



**US Army Corps  
of Engineers**®  
Wilmington District



# **Fairmont, NC Flood Risk Management Planning Assistance to States**

**Robeson County, North Carolina**



**Prepared by:  
U.S. Army Corps of Engineers, Wilmington District  
for the  
Town of Fairmont, NC**

**September 2025**

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# 1. Introduction

This report is authorized under Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended. Efforts under this authorization are conducted through the Planning Assistance to States (PAS) program. The objective of the PAS program is to support states and local communities in their planning for the development, utilization, and conservation of water related resources.

This effort originated from a request for assistance on floodplain-related issues from the Town of Fairmont, NC to the U.S. Army Corps of Engineers (USACE) – Wilmington District in June of 2022. After follow-on coordination and field investigations, Section 22 of the Water Resources Development Act of 1974, as amended, was identified as an appropriate avenue to obtain USACE assistance. A scope of work was developed by the Wilmington District in coordination with the Town. The scope of work and resulting study are intended to provide technical analysis and insight which may inform future flood risk management strategies pursued by the Town of Fairmont. Under the PAS program, the scope of this report is restricted to a conceptual level of design; consequently, it does not include detailed design for project construction. The report does not include a qualitative or quantitative assessment of environmental conditions and impacts related to implementing any of the recommendations within this report. Furthermore, this report does not make any decisions or supersede any environmental-related requirements that may be necessary under any of the recommendations contained within this document. The Town of Fairmont, NC shall comply with all applicable environmental laws and regulations prior to implementation of any recommendations in this report.

This hydrology and hydraulics (H&H) report serves as documentation of the engineering evaluation process for the USACE Fairmont, NC Flood Risk Management Study. There has been historical documentation of overland flooding within the Town limits along Old Field Swamp and Pittman Mill Branch and damage to multiple bridges restricting transportation routes. The Town of Fairmont received nearly 1,500 individual assistance flood damage claims following Hurricane Matthew in 2016. Problems from flooding include impacts to sanitary systems and ponded water that is slow to drain from developed areas. The purpose of this H&H analysis was to inventory existing flood risk management infrastructure such as culverts and engineered channels, document existing physical conditions related to vegetative cover, material integrity, debris, and sedimentation and investigate potential stormwater drainage improvements within the Town. The USACE, Wilmington District conducted this analysis for the Town under the PAS program.

## 2. Basin Description

The Town of Fairmont is located within a subbasin of the larger Lumber River basin. The Town is in Robeson County about 40 miles southwest of Fayetteville, NC. The “Town of Fairmont-Old Field Swamp” United States Geological Survey (USGS) Hydrologic Unit Code 12 (HUC12) 030402031203 encompasses the entirety of rainfall-runoff that is formed within the Town of Fairmont. The Town of Fairmont-Old Field Swamp HUC12 is about 23 square miles and drains north to south. The HUC12 basin has an average width of 3 miles and average length of 8 miles. A map of the Town of Fairmont-Old Field Swamp HUC12 basin is shown in Figure 1. The city limits of Fairmont, NC cover approximately 3 square miles in area and is located near the outlet of the Town of Fairmont-Old Field Swamp HUC12. The headwaters of Old Field Swamp begin just north of Interstate 95 and flow for about 7 miles until it intersects with Pittman Mill Branch. Turkey Branch and multiple unnamed tributaries converge with Old Field Swamp upstream of the Town. Old Field Swamp flows to Hog Swamp, which drains to the Lumber River. Pittman Mill Branch accepts stormwater drainage to the west of town and flows east through the Town and then converges with Old Field Swamp and continues for about 1.5 miles until the outlet of the Town of Fairmont-Old Field Swamp HUC12 is reached.

### 2.1 Climatology

The climate of Fairmont is classified by the National Weather Service as humid-subtropical climate zone. The NOAA climate station Lumberton Regional Airport is located about 11 miles north of Fairmont. Figure 2 provides a monthly climate summary of temperature and precipitation based on a period of record from 1991 to 2020. The region has relatively mild winters with a mean temperature of 43.8 °F. The summers are hot and humid with a mean temperature of 81 °F.

The mean annual precipitation is 50.83 inches. The historic flood producing storms are related to localized severe summer thunderstorms and with tropical systems in the summer and fall months. The historic highest 24-hour rainfall total was 15.01 inches during Hurricane Florence on September 16, 2018.

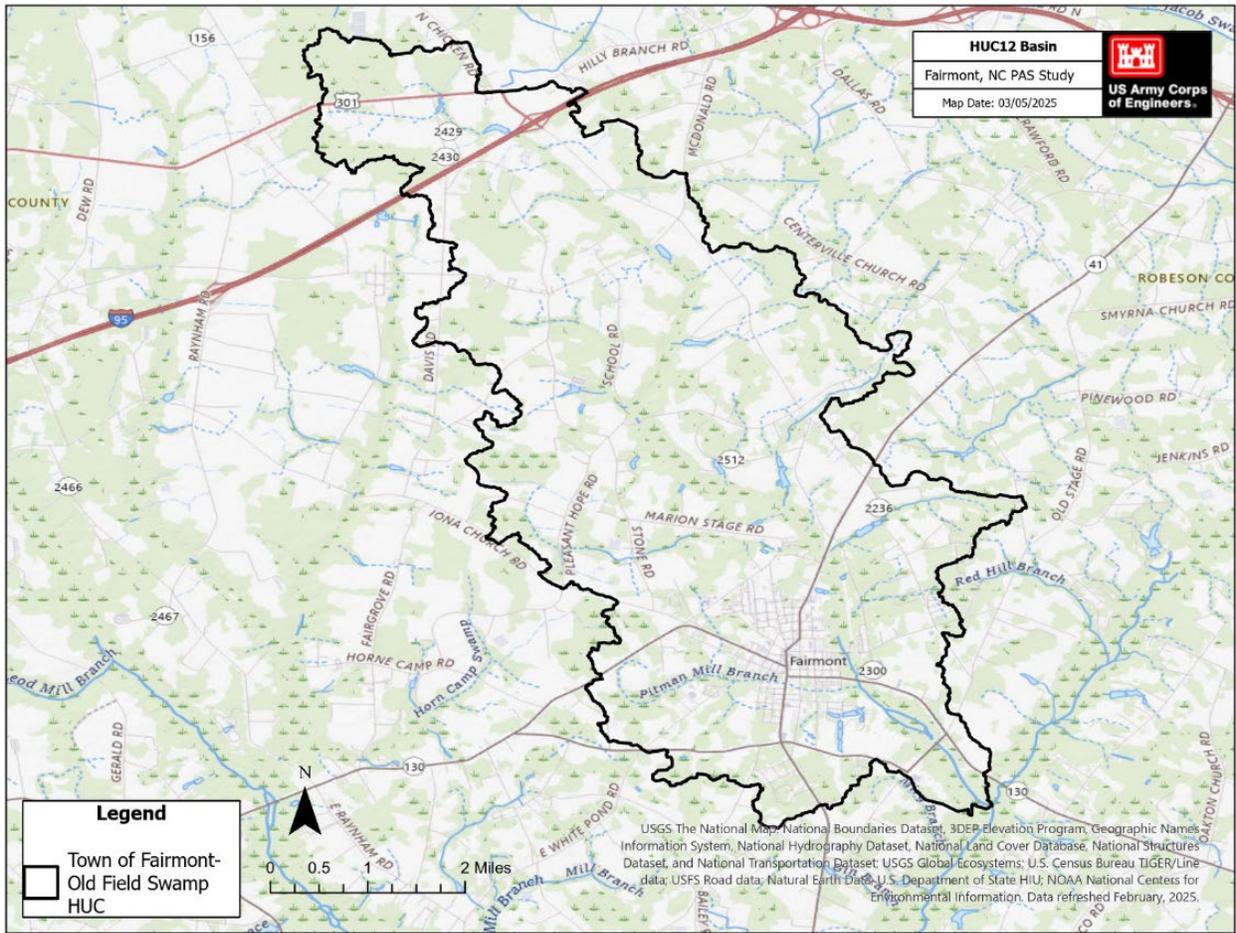


Figure 1: Town of Fairmont-Old Field Swamp HUC12 Basin

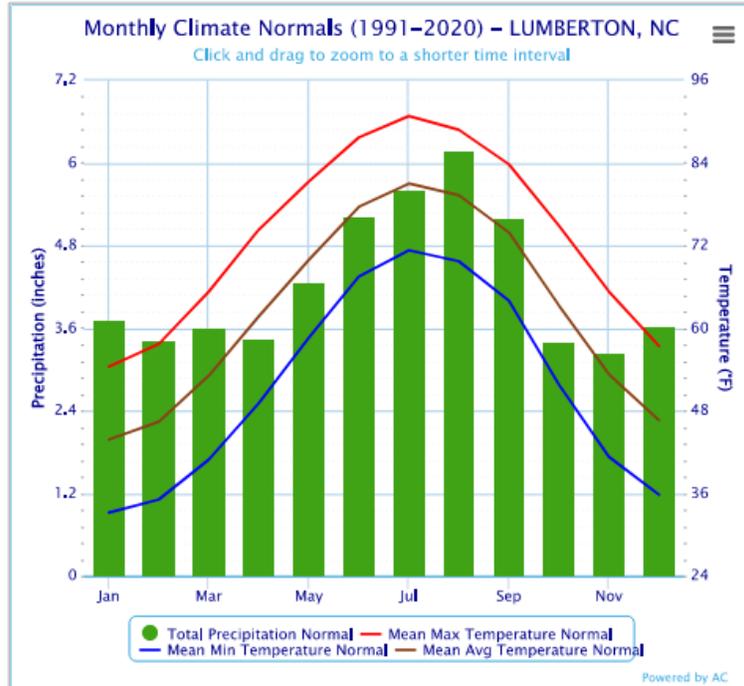


Figure 2: Monthly Climate Summary

Source: <https://www.weather.gov/wrh/Climate?wfo=ilm>

## 2.2 Topography

The Town of Fairmont-Old Field Swamp HUC12 basin lies within the Coastal plain physiographic province. The topography in this region varies from rolling sandhills at its western boundary to almost level land as it approaches the Atlantic Ocean, its larger portion being gently rolling in character. The stream valleys are relatively wide, with large areas subject to overflow. Elevations within the watershed range from 85 ft at the confluence with Hog Swamp to 170 ft along the upper boundary of the watershed. Figure 3 shows a map of LiDAR elevation data of the watershed.



## 2.3 Geology

The geology surrounding the Town of Fairmont can be characterized by the presence of clay with varying amounts of fine-grained and cross-banded sand, shelly medium-to-coarse-grained sand, sandy marl, and limestone. Soil codes and spatial coverage from the comprehensive 1985 Geologic Map of North Carolina in the vicinity of Fairmont is shown in Figure 4. The *Kb* soil type is Kalmia loamy sands and *Tpy* is Transylvania silty loam. There is a mix of hydraulic soil types in the study area. Soils along Pittman Mill are predominately Group A (low runoff potential) while soils along Old Field Swamp are both Group A and Group C (moderately high runoff potential). A map of the hydrologic soils group within the watershed is provided in Figure 5 and was used to define the subbasin Curve Numbers (CN) in the rainfall runoff model HEC-HMS.

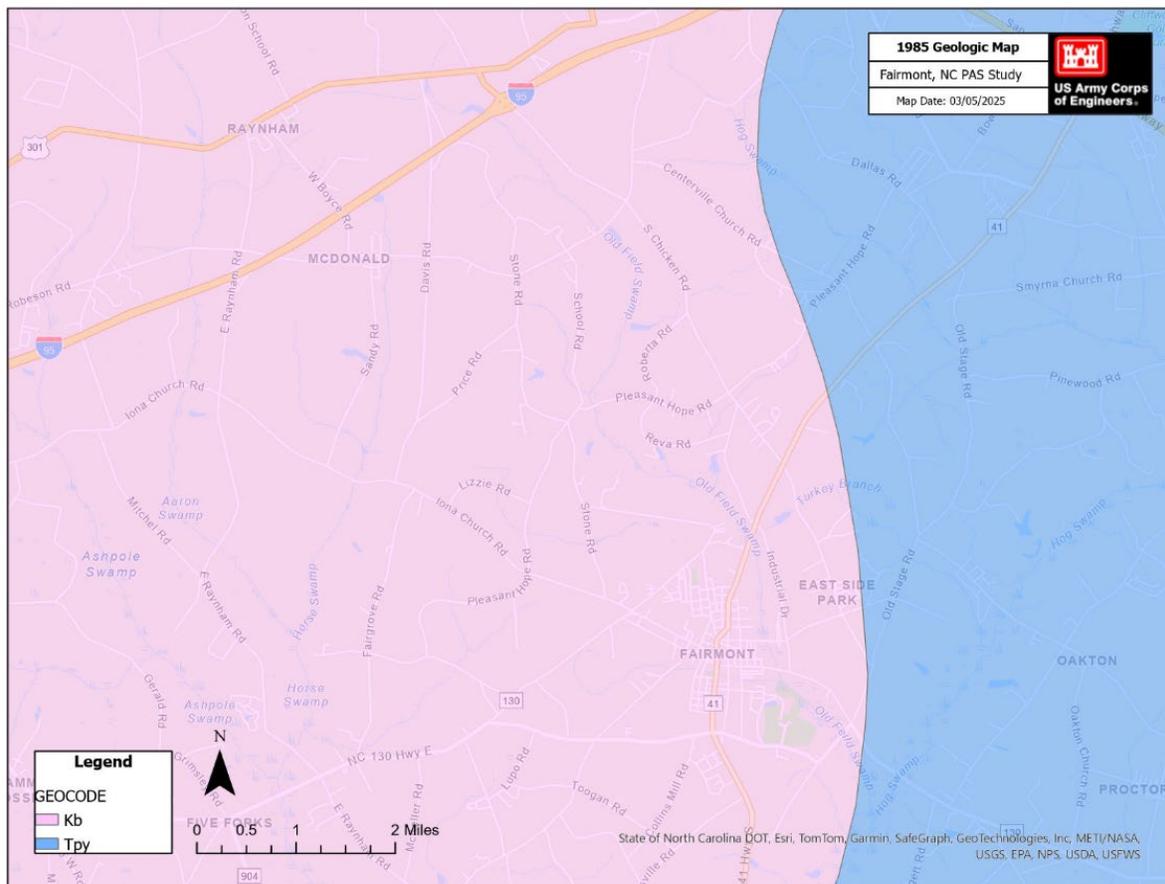


Figure 4: 1985 Geologic Map of North Carolina – Fairmont, NC

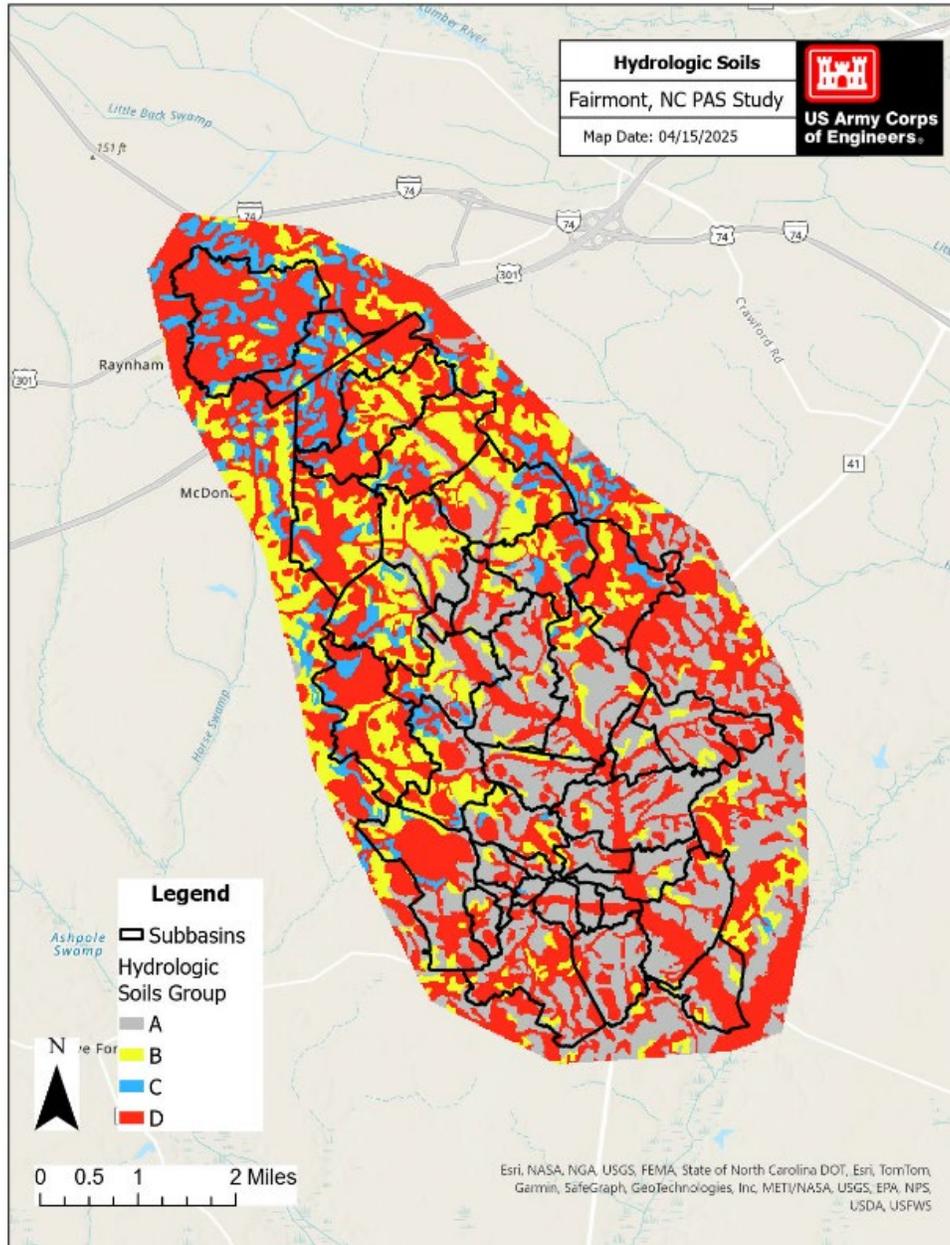


Figure 5: Hydrologic Soil Groups

## 2.4 Land Cover

The most current (2021) National Land Cover Database (NLCD) for the Town of Fairmont-Old Field Swamp HUC12 is shown in Figure 6. Review of the dataset revealed a mixture of agricultural land (row crops), forested areas, woody wetlands, residential areas, business districts, open spaces and grasslands, and transportation infrastructure. Impervious surfaces within the city limits make up roughly 15-percent of the total area. Percentages of select land cover type over the Town of Fairmont-Old Field Swamp HUC12 are listed in Table 1.

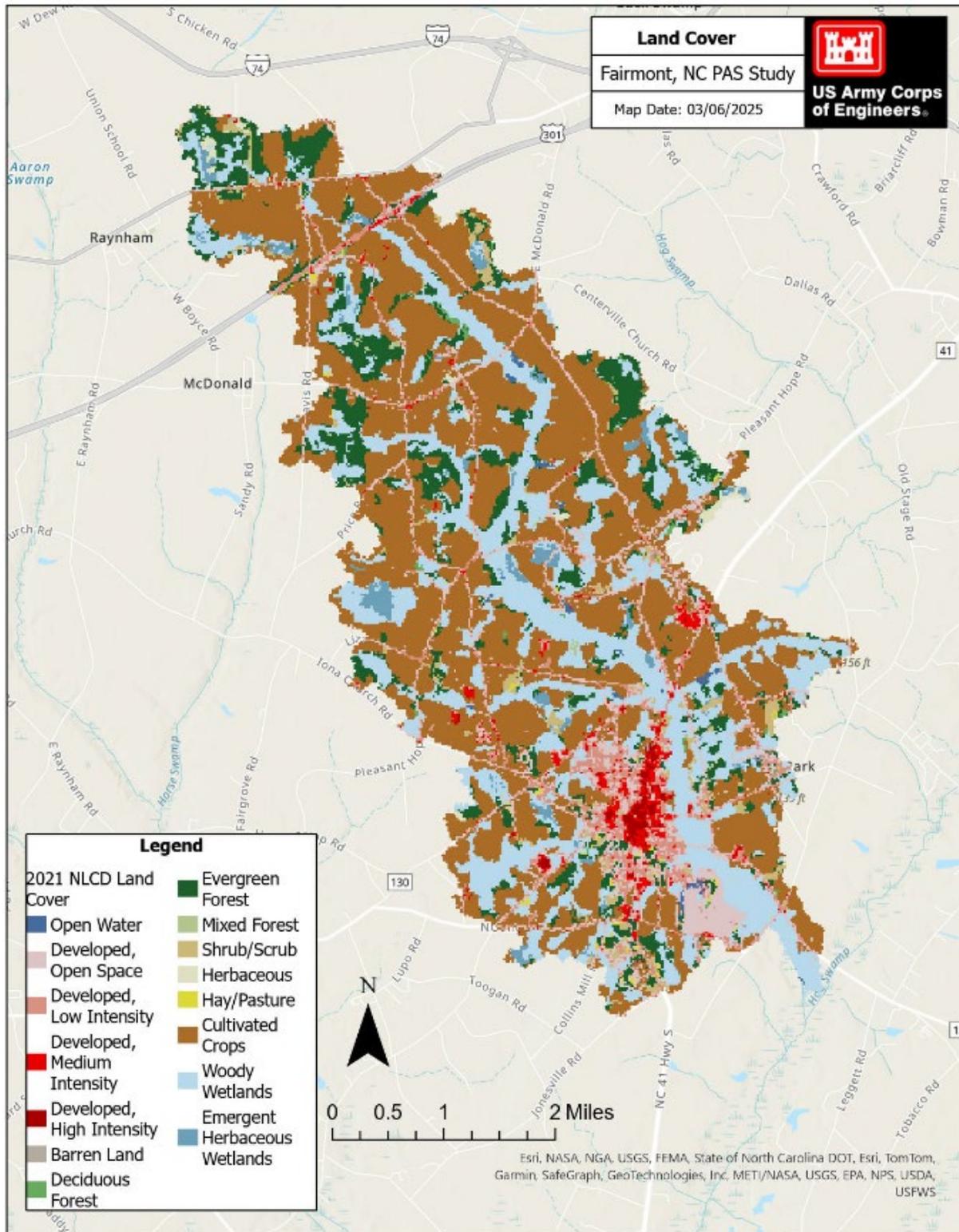


Figure 6: 2021 NLCD for Town of Fairmont-Old Field Swamp HUC12

*Table 1: NLCD 2021 Land Cover Type*

<u>Land Cover Type</u>	<u>Percent of Total Basin Area</u>
Open Water	0.3
Developed, Open Space	7.4
Developed, Low Intensity	4.9
Developed, Medium Intensity	1.7
Developed, High Intensity	0.5
Barren Land	0.0
Deciduous Forest	0.4
Evergreen Forest	10.4
Mixed Forest	0.2
Shrub/Scrub	1.9
Grassland/Herbaceous	0.5
Pasture/Hay	0.3
Cultivated Crops	46.3
Woody Wetlands	23.5
Emergent Herbaceous Wetlands	1.8

## 2.5 Streamflow and Channel Characteristics

There are no active streamflow gages and no available streamflow records within the Town of Fairmont-Old Field Swamp watershed. Stream flows used for evaluating the drainage system were calculated using hydrologic modeling and synthetic storms from statistical precipitation data.

An estimate of monthly flows was calculated by using the ratio of watershed areas from a nearby USGS streamflow station with similar watershed characteristics. The USGS station Big Shoe Hill Creek near Laurinburg, NC (02132320) is about 25 miles northwest of Fairmont with a period of record of 1987 to 2025. The Big Shoe Hill Creek station has a watershed area of 83.3 sq mi and Town of Fairmont-Old Field Swamp has an area 23 sq mi for a ratio area of 0.276. Estimated monthly mean, minimum and maximum flow for Old Field Swamp at the confluence with Hog Swamp based on the ratio of watershed areas is provided in Table 2.

*Table 2: Estimates of Old Field Swamp Monthly Flow*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	35.3	36.4	34.8	28.2	18.8	17.4	16.6	17.4	24.0	22.1	24.0	29.5
Minimum	17.9	16.2	15.2	15.1	8.8	4.6	1.9	2.9	4.0	8.6	8.2	9.6
Maximum	84.1	97.5	90.2	63.1	48.0	47.7	55.4	58.8	157.2	62.5	80.6	106.0

In 1968, a channel clearing and snagging, and channel enlargement project was carried out along Old Field Swamp, in and downstream of Fairmont, and Pittman Mill Branch. In 1981, USACE Charleston District reported project deterioration of Old Field Swamp to pre-project conditions. Pittman Mill, however, was noted to be in excellent condition due to proper maintenance.

## 2.6 FEMA Flood Insurance Studies

The effective FEMA Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS) for Robeson County were published January 19, 2005, Study Number 37155CV000C. The FIRMs and FIS includes Old Field Swamp and Pittman Mill Branch. The FIRMS include the Zone AE (detailed analysis) 1% AEP (100-Year) base flood elevations for Pittman Mill Branch and portions of Old Field Swamp in a limited detailed study with an approximate base flood elevation only.

Flood hazard information for Robeson County is readily available online via North Carolina's Flood Risk Information System (FRIS), the link is provided below. Information available from FRIS includes flood hazard mapping, risk assessments, geospatial data along with computer models used in developing the FIRMs.

NC Flood Risk Information System: <https://fris.nc.gov/>

## 3. Field Survey

As a sub-consultant to GeoDynamics, Joyner Keeny performed the field survey of the Town of Fairmont and surrounding areas from July 22, 2024 through August 30, 2024 as part of an effort to capture data for select stormwater drainage structures, bridges, ditch and channel dimensions, and document typical conditions. The surveyed data included drainage structure location, material type, and dimensions. Tropical Storm Debby, occurring the week of August 5, 2024, caused a delay in the acquisition of survey data.

The products of this survey effort were processed in GIS format. An electronic copy of the survey data was made available to the Town of Fairmont in March of 2025. Figure 7 shows the locations of select drainage structures that were part of the physical survey. Figure 8 shows the locations of segments where ground surface elevations were surveyed. These cross sections were analyzed for consistency in cross sectional channel geometry and longitudinal channel bottom slopes along the ditch and canal alignments.

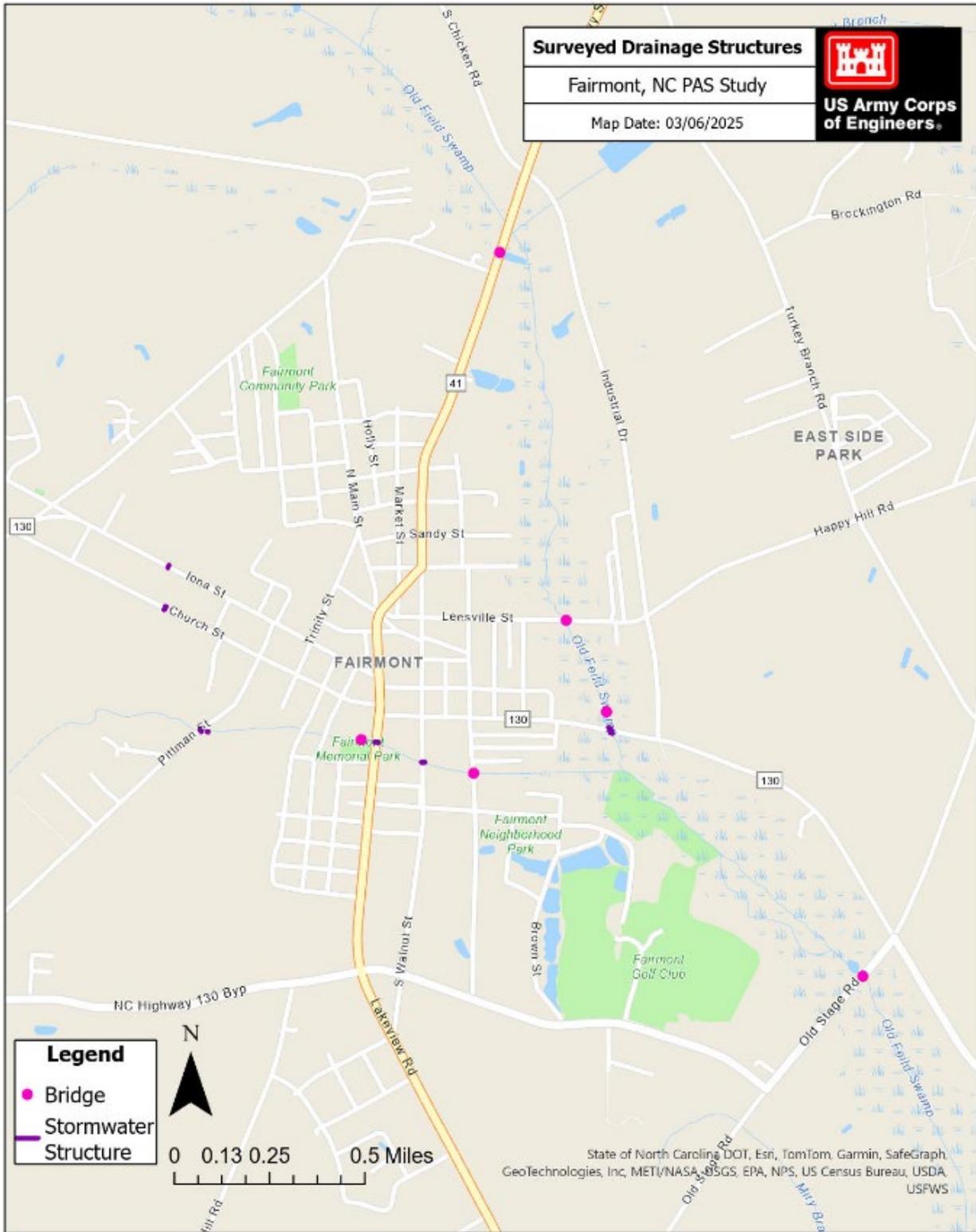


Figure 7: USACE Surveyed Stormwater Structure Locations

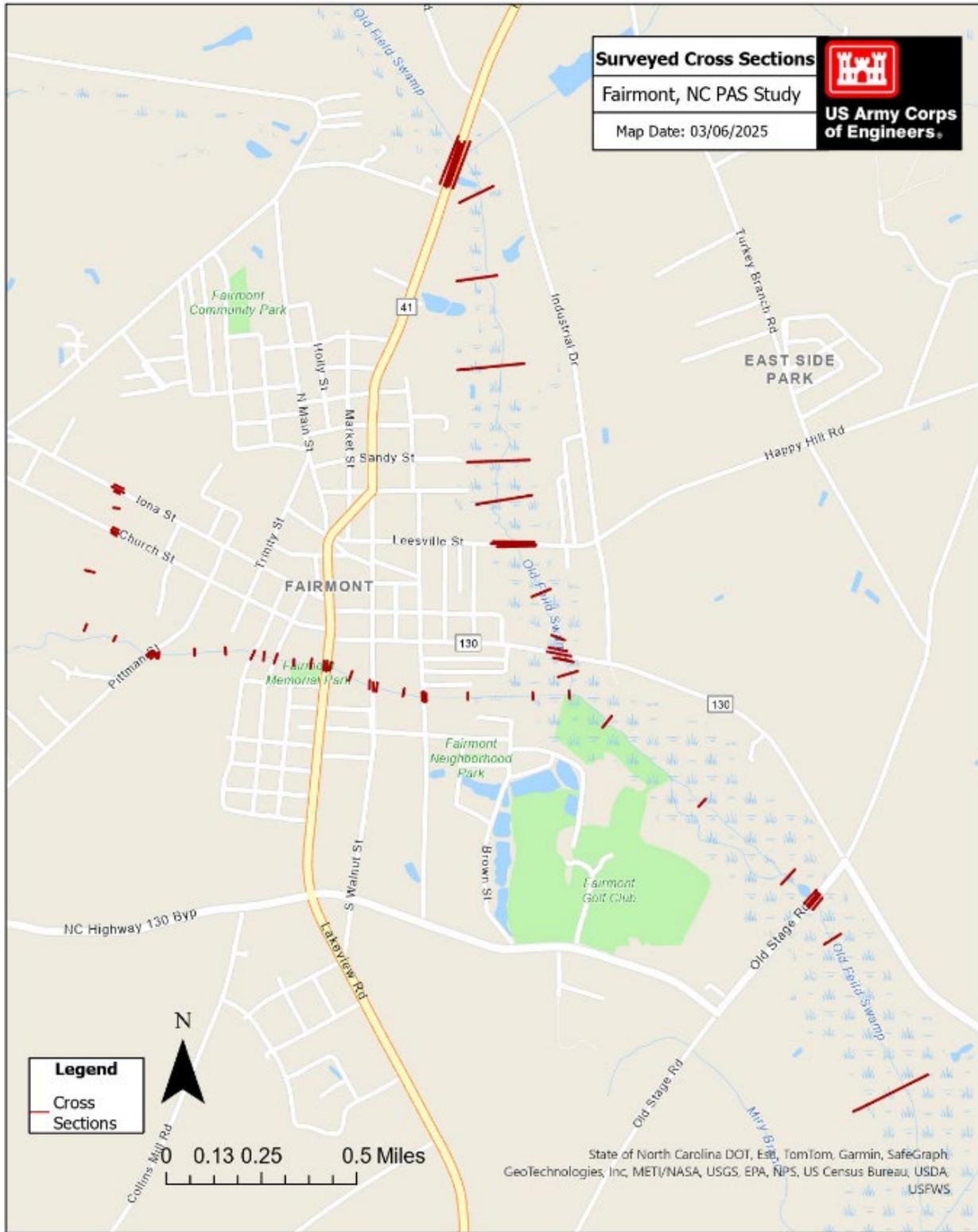


Figure 8: USACE Surveyed Cross Section Locations

## 4. Hydrologic Analysis

A hydrologic computer model of the Old Field Swamp watershed was developed using the USACE Hydrologic Engineering Center, Hydrologic Modeling System (HEC-HMS) software, version 4.12 Beta 4. The HEC-HMS model was developed to simulate precipitation over a watershed, calculate losses such as infiltration and determine the resulting runoff from the watershed. The watershed runoff results from the HEC-HMS model were used as inflow for the HEC-RAS model that was used to evaluate the drainage capacity and flood levels along Pittman Mill Branch and Old Field Swamp.

### 4.1 Topographic Data

State of North Carolina Quality Level 2 (QL2) LiDAR was used to generate a raster digital elevation model (DEM) of the study watershed. Raster resolution was downscaled to a 3-ft by 3-ft cell spacing to work with the Town of Fairmont-Old Field Swamp watershed. The LiDAR elevation dataset was available from the North Carolina Spatial Data Download website. <https://sdd.nc.gov/>

The modeling and associated spatial files were developed in the North American Datum (NAD 1983), State Plane North Carolina FIPS 3200 (US Feet). Projection was Lambert Conformal Conic. All elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD88) unless otherwise noted.

### 4.2 Precipitation Data

The HEC-HMS model of Old Field Swamp was used to develop runoff hydrographs of synthetic storms based on statistical precipitation data. The precipitation data was based on the NOAA Atlas 14 Point Precipitation Frequency Estimates, the website link is below. Synthetic rainfall events were developed to assess the watershed's response for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5% and 0.2% annual exceedance probabilities (AEPs), also known as the 2-, 5-, 10-, 25-, 50-, 100-, 200- and 500-year storm events, respectively. The selected storm duration was 24 hours.

Areal Reduction factors applied to the NOAA ATLAS 14-point precipitation values were based on a 2021 Nuclear Regulatory Commission report for application of point precipitation-frequency estimate to watersheds. This reference was recommended by USACE Risk Management Center for basins within the southeast United States if the study area lacks specific areal reduction factor studies. The HEC-HMS meteorology precipitation method used the Frequency Storm with a 24-hour duration and 5-minute intensity. The 24-hour storm rainfall depths are provided in Table 3.

NOAA Atlas 14 Precipitation: <https://hdsc.nws.noaa.gov/pfds/>

Table 3: NOAA Atlas 14 24-Hour Precipitation

Annual Exceedance Probability	50%	20%	10%	4%	2%	1%	0.5%	0.2%
Return Period (yrs)	2	5	10	25	50	100	200	500
Precipitation (in)	3.39	4.63	5.56	6.85	7.90	9.03	10.3	12.3

### 4.3 HEC-HMS Model Development

Due to the flat terrain within the watershed, GIS tools within HEC-HMS were not used to process the DEM and build the hydrologic model. Instead, the HEC-HMS was created manually using ArcGIS Pro-based polygons for subbasin and reach elements and were imported into the HEC-HMS model to visually represent the watershed area, using the confluence of Old Field Swamp with Hog Swamp as the watershed outlet. Subbasin and reach characteristics were also calculated manually. A total of 40 subbasins were delineated within the 22.83 square mile watershed area and were used to determine flow rates upstream of culverts and bridges and at tributaries entering Pittman Mill Branch and Old Field Swamp. Figure 9 includes a map of the watershed and subbasin delineation and Table 4 includes a summary of properties of the 40 subbasins.

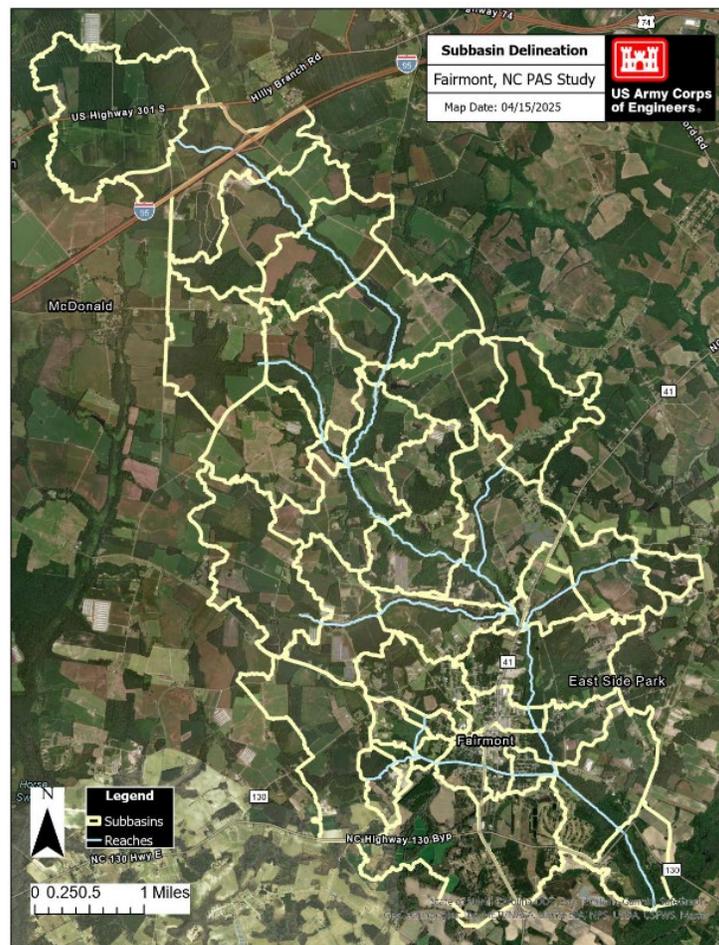


Figure 9: Town of Fairmont - Old Field Swamp Watershed Delineation

Table 4: Subbasin Properties

Subbasin	Area (sq mi)	Curve Number
PMB-S09	1.08772	66.116
PMB-S08	0.181631	55.71
PMB-S07	0.073616	53.557
PMB-S06	1.006598	61.367
PMB-S05	0.071783	49.024
PMB-S04	0.181968	53.763
PMB-S03	0.115257	57.161
PMB-S02	0.601522	56.562
PMB-S01	0.119105	55.725
PMBT-S03	0.522761	62.342
PMBT-S02	0.086562	55.177
PMBT-S01	0.166015	57.419
OFS-S17	1.518498	70.741
OFS-S16	0.457342	72.808
OFS-S15	0.660671	71.243
OFS-S14	0.942448	69.306
OFS-S13	0.825836	68.001
OFS-S12	0.932583	65.675
OFS-S11	0.670468	68.107
OFS-S10	0.38598	54.129
OFS-S09	0.649356	62.636
OFS-S08	0.999044	56.587
OFS-S07	1.055355	60.722
OFS-S06	0.060903	56.845
OFS-S05	0.96896	53.051
OFS-S04	0.215015	61.894
OFS-S03	0.384111	57.77
OFS-S02	0.84004	59.433
OFS-S01	0.469175	62.155
OFST1-S04	0.914783	69.072
OFST1-S03	0.820645	67.931
OFST1-S02	0.738309	62.631
OFST1-S01	0.092189	58.182
OFST2-S03	1.078165	70.14
OFST2-S02	0.686136	67.926
OFST2-S01	0.471167	55.277
OFST3-S01	0.774788	67.05
TB-S03	0.173983	56.372
TB-S02	0.541156	59.761
TB-S01	0.289019	55.245

## 4.4 Watershed Modeling Parameters

For the HEC-HMS model the Soil Conservation Service (SCS) Curve Number methodology contained within Natural Resources Conservation Service (NRCS) Technical Report (TR)-55 was used to estimate for losses from a precipitation event occurring over the watershed (USDA, 1986). The SCS Loss Method based on the Curve Number parameter was selected because of its widespread use in rural and agricultural watersheds similar to the Old Field Swamp watershed. A Curve Number grid over the watershed was calculated using 2021 NLCD dataset and the NRCS hydrologic soil group. The percent of imperious area for each subbasin is accounted for in the Curve Number and Initial Abstraction losses were set to zero. Because of the short duration of the 24-hour storm and the lack of calibration data, baseflow was not included as a subbasin parameter. A map of the curve number classification within the watershed is included in Figure 10.

After the precipitation losses have been accounted for, the excess precipitation is transformed into surface runoff calculated at the downstream outlet for each subbasin. The HEC-HMS model used Clark Unit Hydrograph transformation method. The time of concentration ( $T_c$ ) calculation was based on the Papadakis and Kazan method for small rural watersheds, see Figure 11 (Papadakis and Kazan, 1987). The  $T_c$  was calculated using the subbasin geometric parameters calculated in HEC-HMS and is summarized in Table 5. The storage coefficient ( $R$ ) for each subbasin was calculated using the equation presented in the HEC-HMS user's manual and is also summarized in Table 5.

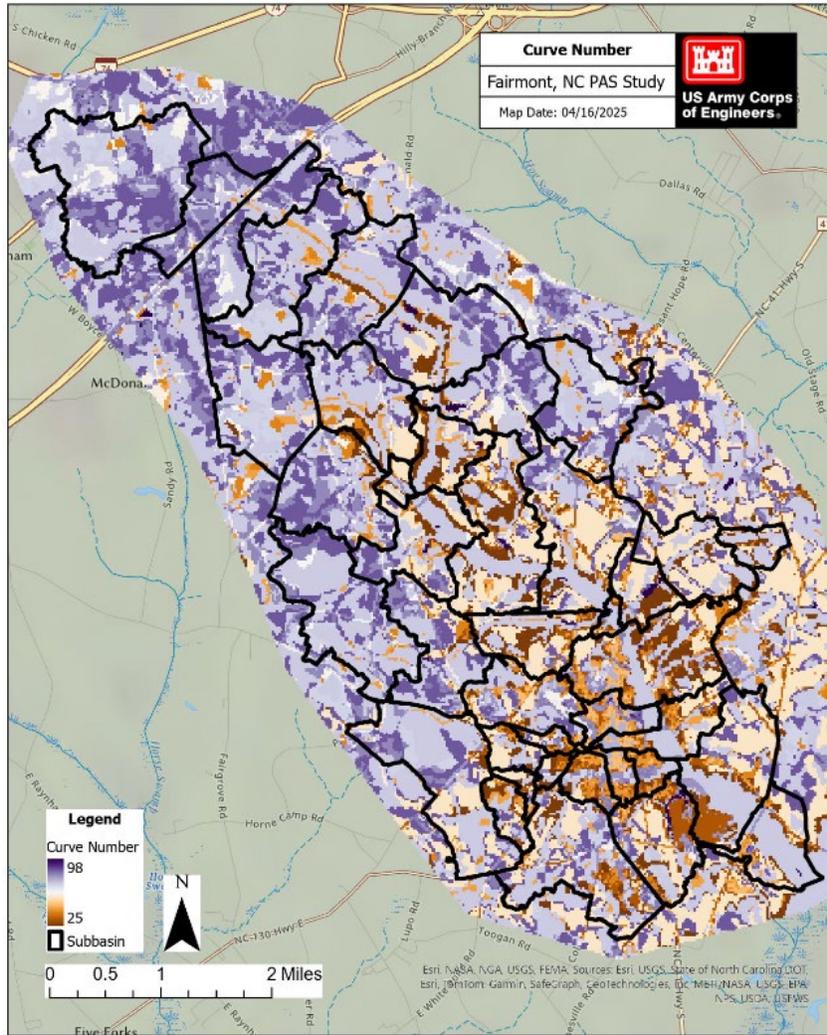


Figure 10: Town of Fairmont – Old Field Swamp Basin Curve Numbers

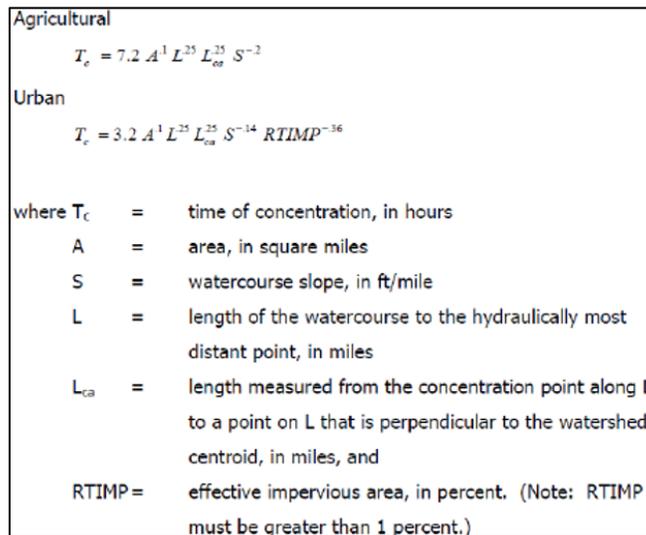


Figure 11: Time of Concentration in Small Rural Watersheds

Table 5: Parameter Transformation

Subbasin	Time Concentration (hr)	Storage Coefficient (hr)
PMB-S09	4.9389	11.03687
PMB-S08	2.1296	4.7589
PMB-S07	1.4197	3.1726
PMB-S06	4.32848	9.6728
PMB-S05	1.23526	2.7604
PMB-S04	1.5045	3.3622
PMB-S03	1.5587	3.4832
PMB-S02	4.0876	9.1346
PMB-S01	1.66478	3.7203
PMBT-S03	2.4378	5.4478
PMBT-S02	1.31924	2.9481
PMBT-S01	2.0206	4.5155
OFS-S17	6.0314	13.478
OFS-S16	3.08464	6.8932
OFS-S15	4.38906	9.8082
OFS-S14	3.83474	8.56947
OFS-S13	3.2285	7.2147
OFS-S12	3.53288	7.8949
OFS-S11	3.6292	8.1101
OFS-S10	3.03732	6.7875
OFS-S09	3.1857	7.119
OFS-S08	3.9972	8.9324
OFS-S07	4.1006	9.1637
OFS-S06	1.2546	2.8037
OFS-S05	2.7692	6.1883
OFS-S04	2.56542	5.7329
OFS-S03	1.9972	4.4632
OFS-S02	3.1641	7.0708
OFS-S01	2.91148	6.5063
OFST1-S04	4.2952	9.5985
OFST1-S03	3.1679	7.0793
OFST1-S02	3.5796	7.9993
OFST1-S01	1.4901	3.33
OFST2-S03	7.08188	15.826
OFST2-S02	3.4386	7.6842
OFST2-S01	3.416	7.6336
OFST3-S01	3.9591	8.8474
TB-S03	2.31218	5.167
TB-S02	2.08546	4.6604
TB-S01	2.397	5.3566

Junctions within the HEC-HMS model are typically locations of subbasin or tributary inflow. The routing reaches between the junctions account for the flood wave timing and attenuation flowing downstream. Routing reach flow in the HEC-HMS model used both the Modified Puls and the normal depth methods. The Modified Puls method was used where reach storage-discharge information from existing HEC-RAS detailed study FEMA models was readily available. For model reaches without existing HEC-RAS model, the normal depth method was used assuming a trapezoidal channel and channel slope estimated from the DEM.

## 4.5 Meteorological Model

The HMS model used a Hypothetical Storm design. Temporal Storm patterns for all frequencies were based on the NOAA ATLAS 14 24-hour duration, 2nd Quartile, 50-percentile curve. This curve was considered an average representation of storm patterns in the absence of calibration data within the study areas. A constant Areal reduction factor of 0.97 was applied to all storm frequency point depth values prior to insertion into the model. All hypothetical storm simulations used a 15-minute computational time interval over a 5-day period.

## 4.6 HEC-HMS Model Calibration

Calibration of hydrologic models such as HEC-HMS typically involve entering precipitation data from multiple observed storm events and then adjusting the model parameters until the resulting model runoff flow rate and timing match the observed flow at a USGS streamflow gage. The Town of Fairmont – Old Field Swamp study watershed does not contain streamflow gages that could be used for model calibration.

Instead, a USGS gage located close to the Fairmont study area with similar characteristics was used: Big Shoe Heel Creek NR Laurinburg, NC – 02132320. The gage captures a drainage area of 83.3 square miles and has a period of record from 1987 to 2025.

An HEC-HMS model was created for the Big Shoe Heel Creek gage watershed and calibrated to 2016 Hurricane Matthew and 2018 Hurricane Florence. The same subbasin parameter methods used in the Fairmont HMS model were used. Upon completion of calibrating to these individual events, an averaged calibration factor was developed for the Curve Number, Time of Concentration, and Storage Coefficient subbasin parameters. The Town of Fairmont-Old Field Swamp HMS model used an averaged calibration factor across both events to adjust the calculated watershed parameters.

The USGS publishes regional regression equations for streams in North Carolina including the rural coastal plain region that includes the Town of Fairmont-Old Field Swamp watershed. The link to the USGS website with information on the regression analysis is provided below. The regression equations are used to calculate the peak flow for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5% and 0.2% AEP in units of cubic feet per

second (cfs). A comparison of the HEC-HMS model results and the USGS regression equation results for the 22.83 square mile Town of Fairmont-Old Field Swamp watershed are provided in Table 6 below. The larger percent difference in the higher frequency storm events (50% AEP) is likely attributed to storage capacity of the swamps not being fully accounted for in the multiple watersheds used in the regression analysis.

USGS Regression Equations: <https://streamstats.usgs.gov/nss/>

*Table 6: Comparison of HEC-HMS Model Results and USGS Regression Equations*

Annual Exceedance Probability	50%	20%	10%	4%	2%	1%	0.5%	0.2%
HMS Model (cfs)	309	719	1125	1794	2390	3085	3888	5055
USGS Regression Equation (cfs)	498	949	1340	1881	2391	2898	3438	4178
Percent Difference	46.84	27.58	17.44	4.73	0.04	6.25	12.29	19.00

## 5. Hydraulic Analysis

The hydraulic analysis of Old Field Swamp watershed was performed using the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) software, version 6.6. The HEC-RAS model was used to route flood flow along stream channels using the watershed runoff developed from the HEC-HMS model. The HEC-RAS model was used to calculate the peak flood elevations and to evaluate the flow capacity of the stream channel and at bridges and culverts.

### 5.1 HEC-RAS MODEL DEVELOPMENT

Two hydraulic models were developed for the study area, one consisting of just Pittman Mill Branch and the other consisting of Old Field Swamp, Turkey Branch, and two tributaries. Both models were built upon their respective existing FEMA model. FEMA used the HEC-RAS models to prepare the Flood Insurance Rate Maps of Robeson County. FEMA Old Field Swamp model was a Limited Detail Study and FEMA Pittman Mill Branch was a Detailed Study. A FEMA detailed study requires field surveys of the stream channel and of the bridge and culvert geometries and includes results for the 10%, 2%, 1% and 0.2% AEP floods. A limited detailed study does not require the field surveys and is limited to only the 1% AEP flood.

### 5.2 HEC-RAS Model Updates

The entire Pittman Mill Branch reach was included in the USACE survey. In addition, a tributary canal to Pittman Mill Branch (“PMBT”) was also surveyed between the confluence with Pittman Mill Branch and Iona Street. Only the lower portion of Old Field Swamp was included in the USACE survey.

All natural cross sections captured in the USACE survey have been incorporated into the two HEC-RAS models. USACE spot elevation surveys either replaced existing FEMA cross section data or new cross sections were created. Overbank terrain for all cross sections was obtained using the terrain developed using QL2 LiDAR. Occasionally, the bottom of channel elevation in the FEMA model was not consistent with the bottom of channel elevation in the USACE survey, therefore certain FEMA cross sections were edited to match the USACE survey data.

Manning’s n values and ineffective flow areas used for replaced and new cross sections were based on the FEMA model values. In areas where debris buildup was noted, the Manning’s n value was altered to represent current conditions.

Existing bridges and culverts were modified to match the survey data obtained by USACE. Inlet and outlet elevation, culvert diameter, bridge pier dimensions and deck/roadway elevation data were either verified or changed. Bridges and culverts which did not exist in the FEMA models were added to the existing conditions models according to USACE survey.

Steady flow data was input into the models based on calibrated flows derived from the HMS model and downstream boundary conditions were set. HEC-RAS inflows are shown in Table 7 and Table 8. The Old Field Swamp model used a normal depth slope downstream boundary condition of 0.002 ft/ft. The Pittman Mill Branch model’s downstream boundary condition was based upon the water surface elevation at the confluence of Pittman Mill and Old Field Swamp.

*Table 7: Pittman Mill Branch HEC-RAS Model Inflows*

River	Station	0.2% AEP	0.5% AEP	1% AEP	2% AEP	4% AEP	10% AEP	20% AEP	50% AEP
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
Pittman Mill Branch	8183.217	293.5	233.1	190.3	153.2	120.3	82.0	57.0	27.9
Pittman Mill Branch	6741.497	539.3	425.7	345.7	276.4	215.5	144.9	99.3	46.7
Pittman Mill Branch	5879	778.8	613.7	497.7	397.3	308.8	206.6	140.7	65.3
Pittman Mill Branch	3571	811.0	647.5	524.2	418.8	325.7	217.1	147.3	67.7
Pittman Mill Branch	2131	839.8	671.8	543.7	434.8	337.9	225.0	152.5	69.8
Pittman Mill Branch	14.048	964.0	768.0	620.2	494.3	382.8	253.6	170.8	77.1
PMBT	2230	163.1	129.0	104.9	84.0	65.5	44.0	30.1	14.1
PMBT	1633	190.9	150.5	122.0	97.3	75.5	50.4	34.1	15.7

Table 8: Old Field Swamp HEC-RAS Model Inflows

River	Station	0.2% AEP (cfs)	0.5% AEP (cfs)	1% AEP (cfs)	2% AEP (cfs)	4% AEP (cfs)	10% AEP (cfs)	20% AEP (cfs)	50% AEP (cfs)
Old Field Swamp	50963	464.6	375.4	312.3	255.8	205.8	146.2	104.3	56.6
Old Field Swamp	49119	638.3	515.6	428.7	350.9	282.3	199.4	142.9	76.8
Old Field Swamp	45810	890.1	717.5	595.2	486	389.8	272.5	194.6	101.7
Old Field Swamp	41749	1112.9	894.5	739.6	602.2	479.6	331.1	235.1	120.3
Old Field Swamp	35926	1338.2	1070.7	880.5	713.3	563.4	384.5	268	132.7
Old Field Swamp	34948	1512.1	1208.8	992.2	802.9	632.2	430.2	298.2	145.9
Old Field Swamp	30153	2237.6	1777.7	1451	1165.8	909.5	612.6	417.1	194.1
Old Field Swamp	26254	2387.4	1892.4	1541.1	1234.8	960.1	642.5	434.4	200.7
Old Field Swamp	21480	2571.3	2029.6	1646.5	1313.4	1015.7	672.8	450.8	205.5
Old Field Swamp	17647	3442.6	2709.4	2191.5	1740.5	1340.8	878.8	585.5	261.9
Old Field Swamp	16338	3657.8	2867.5	2311.1	1827.7	1400.7	910.8	602.4	266.2
Old Field Swamp	12294	3821.1	2984.1	2396.7	1888.2	1440.3	930.1	610.7	266.4
Old Field Swamp	11022	3864	3016.4	2420.5	1905.4	1452.3	936.3	613.5	267.4
Old Field Swamp	9317	3929.5	3062.6	2455	1929.7	1467.9	944.1	617.2	268.2
Old Field Swamp	8659	4827.5	3726.8	2967.7	2312.3	1743.8	1105.1	714	302.8
Old Field Swamp	4637	4980.8	3836.3	3050.2	2366.5	1780.4	1123.7	721.9	307.4
Tributary	8193	240.6	193.7	160.3	130.9	104.6	73.5	52.6	27.7
Tributary	2141	667.9	531.7	436.6	353.7	278	190.8	134.8	68.6
Tributary 2	11675	208.6	168.2	139.4	114.1	91.4	64.5	46.5	24.8
Tributary 2	7407	386.7	310.1	256.4	209	165	115.8	83	43.6
Turkey Branch	6950	48.6	37.6	30	23.5	17.8	11.3	7.3	2.9
Turkey Branch	3240	216.8	169.6	136.4	107.9	82.8	54.1	35.8	15.6

### 5.3 HEC-RAS Model Validation and Sensitivity

There were no stream gages or water level observations available for calibration of the HEC-RAS model. Sensitivity analyses were performed to understand the accuracy and uncertainty of the HEC-RAS models. Two physical parameters, Manning’s n and downstream boundary conditions were tested. It was determined that changing these physical parameters of the model had minimal effects on the model results, meaning the models were stable. Tables 9, 10, and 11 display how the parameters that were altered in the sensitivity analyses. Because the most downstream end of the Pittman Mill Branch model was near a location of concern, the boundary condition was changed from known water surface elevation to a normal depth of 0.002 when the downstream end of Pittman Mill was analyzed.

*Table 9: Pittman Mill & Old Field Swamp – Manning’s N Sensitivity Analysis*

<b>Ex Cond N Value</b>	<b>Low N Value</b>	<b>High N Value</b>
0.05	0.045	0.06
0.055	0.05	0.065
0.06	0.055	0.07
0.065	0.06	0.075
0.10	0.095	0.11
0.11	0.105	0.12
0.125	0.12	0.135

*Table 10: Pittman Mill – Downstream Boundary Condition Sensitivity Analysis*

<b>Flow (cfs)</b>	<b>Ex Cond Known WS Elv (ft)</b>	<b>Sens Analysis Known WS Elv (ft)</b>
964	95.32	93.32
768	94.52	92.52
620.2	93.98	91.98
494.3	93.36	91.36
382.8	92.82	90.82
253.6	92.20	90.20
170.8	91.57	89.57
77.1	90.52	88.52

*Table 11: Old Field Swamp – Downstream Boundary Condition Sensitivity Analysis*

<b>Ex Cond Normal Depth</b>	<b>Sens Analysis Normal Depth</b>
0.002	0.005

## 6. Flood Risk Management Recommendations

As discussed in Section 1 of this report, the scope of this report is restricted to a conceptual level of design; consequently, it does not include detailed design for project construction. Additionally, the report does not include a qualitative or quantitative assessment of environmental conditions and impacts related to implementing any of the recommendations within this report. Furthermore, this report does not make any decisions or supersede any environmental-related requirements that may be necessary under any of the recommendations contained within this document. The Town of Fairmont, NC shall comply with all applicable environmental laws and regulations prior to implementation of any recommendations in this report.

The HEC-RAS model was utilized to pinpoint specific causes of flooding and determine what type of solutions may be implemented. The Pittman Mill Branch model, and the Old Field Swamp model were analyzed separately, starting at the most downstream end of the stream. The recommendations documented below were implemented in various versions of a proposed conditions model for both Pittman Mill Branch and Old Field Swamp and compared to the Existing Conditions model.

### 6.1 Maintenance

#### 6.1.1 Debris Removal

A few bridges and culverts are badly blocked with debris such as fallen tree branches and overgrown vegetation, restricting the channel's flow and making the flooding issues in the Town of Fairmont and surrounding areas worse. Clogged culverts can have a bottleneck effect on a channel and cause flooding upstream of the concerned area worse. Blocked or clogged bridges and culverts are listed below with images succeeding. Clearing the debris will allow the channel to freely flow through the culverts and beneath the bridge, maximizing the area for water flow. The following locations are recommended for debris removal. Figures 12-17 document the current conditions. It is recommended that the culverts and bridges are continuously monitored and properly maintained throughout the year.

- Pittman Mill Branch Tributary - Double Barrel CMP Culvert at Church St
- Pittman Mill Branch - Pedestrian Bridge located East of Park Avenue
- Old Field Swamp – NC 41
- Old Field Swamp – NC130



*Figure 12: Pittman Mill Branch Tributary – Church St. Culverts Upstream*



*Figure 13: Pittman Mill Branch Tributary – Church St. Culverts Downstream*



*Figure 14: Pittman Mill Branch - East of Park Ave Pedestrian Bridge*

The HEC-RAS model indicated that clearing the debris blocking the culvert on Church Street would reduce the flood levels of the 25-year event by about 3 feet along Pittman Mill Branch Tributary between Church and Iona Street. Figure 15 below shows the water surface profile before and after debris clearing in this area.

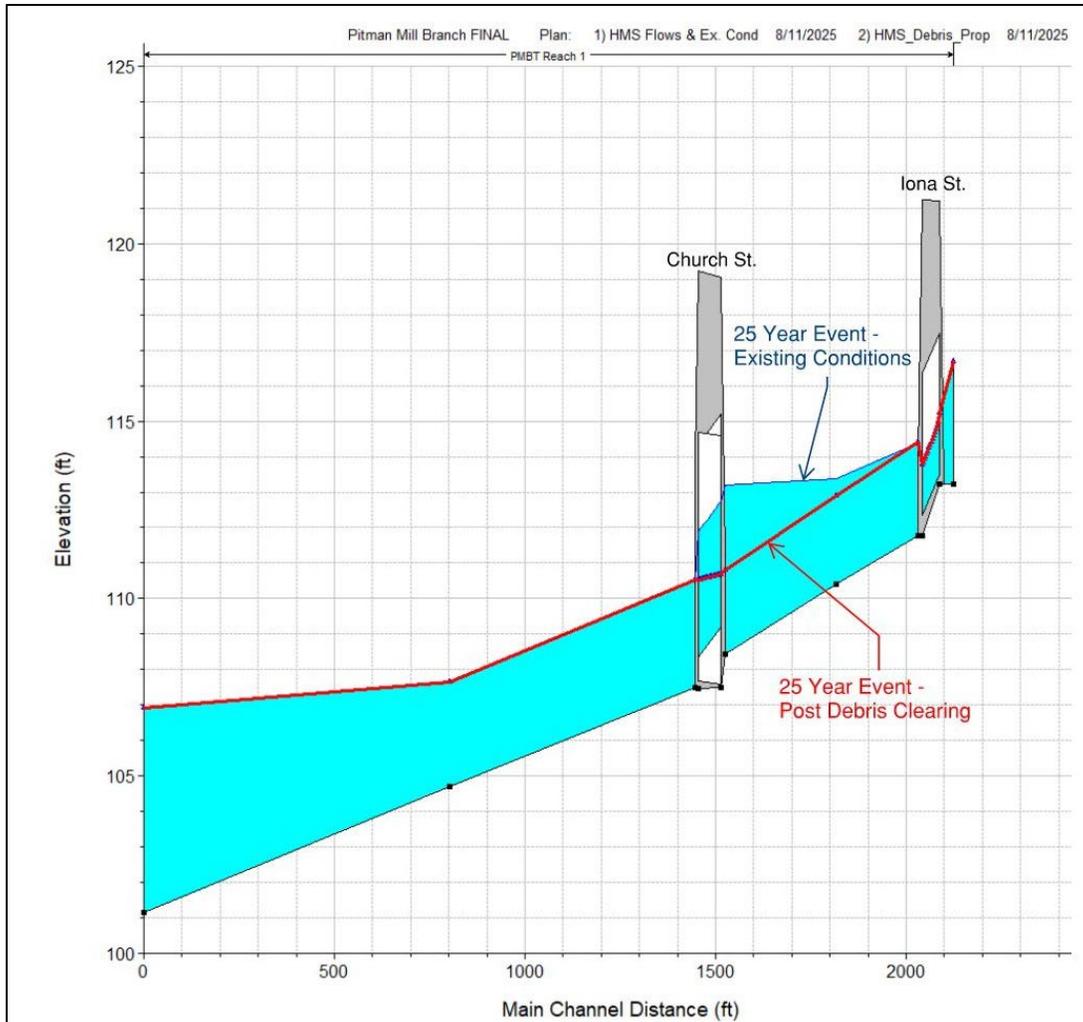


Figure 15: Church St. Debris Clearing Water Surface Profile

Another location where debris removal should be prioritized is at NC Highway 130. Surveys revealed a potential guard rail laying across the channel, shown in Figure 16. This large structure has potential to create a significant blockage in culverts or bridges along Old Field Swamp and should be removed immediately, if not done so already. The bridge crossing at NC41 is mildly clogged with debris, see Figure 17. Although mild, debris like this will collect additional debris and block the drainage system. It is recommended the debris be removed at the NC41 bridge structure along Old Field Swamp.



*Figure 16: Old Field Swamp - NC 130*



*Figure 17: Old Field Swamp – NC41*

### 6.1.2 Channel Clearing

Over time, sediment deposits can build up along the banks and bottom of a channel and narrow the channel area and restrict the flow of water. This is called shoaling. There are a few areas along Pittman Mill Branch where clearing the shoals that have built up will help mitigate flooding concerns. The following locations are recommended for channel clearing along Pittman Mill Branch.

- Pittman Mill Branch - Just downstream of Morro Street

- Pittman Mill Branch - Just upstream of Walnut Street
- Old Field Swamp – Leesville Street bridge

The HEC-RAS model was used to evaluate the benefits of channel clearing along Pittman Mill Branch without culvert upgrades. Figure 18 shows the sediment buildup which has occurred just downstream of Morro Street. Clearing the sediment resulted the velocity of the water changing from 6.17 ft/s to 3.72 ft/s. Although not critical, another location recommended for sediment clearing is just upstream of Walnut Street. Existing conditions are shown in Figure 19.



*Figure 18: Pittman Mill Branch - Downstream of Morro Street*



*Figure 19: Pittman Mill Branch Upstream of Walnut St*

The bridge across Old Field Swamp at Leesville Street has accumulated sediment along the left bank, shown in Figure 20. Clearing the sediment will discourage debris from clogging the flow area beneath the bridge and reduce the 25-year event water surface elevation upstream the bridge crossing by about 0.5 feet.



*Figure 20: Old Field Swamp – Bridge at Leesville Street*

### 6.1.3. Vegetation Management

In addition to debris removal in and around bridges and culverts, the channel should be kept clear of vegetation. This includes both the channel bottom and banks as well as vegetation above the channel, such as very low overhanging trees. Establishing a routine vegetation management plan will reduce the plant growth in and around the channel, reducing the “Manning’s n value” and allowing water to flow more freely. Figures 21 and 22 below demonstrate conditions that would be considered detrimental to the channel and the flow of water.



*Figure 21: Pittman Mill Branch – Examples of Channel Vegetation*



*Figure 22: Pittman Mill Branch – Examples of Overhanging Trees*

The Manning's n value was changed from 0.5 - 0.65 in the existing conditions model to 0.03 in a proposed conditions model demonstrating the effects of vegetation maintenance along the entirety of Pittman Mill Branch. The HEC-RAS model demonstrated that the 50-year event water surface elevation decreases by about 1.5 feet at the upper end of the channel to 0.5 feet at the lower end of the channel when compared to the effects of debris clearing alone. Pittman Mill Tributary displays similar results, showing up to 1.5 feet in water surface elevation decrease for the 50-year flood event. Figures 23 and 24 display the water surface profile comparison between debris clearing alone and debris clearing with vegetation management along Pittman Mill Branch and Pittman Mill Branch Tributary.

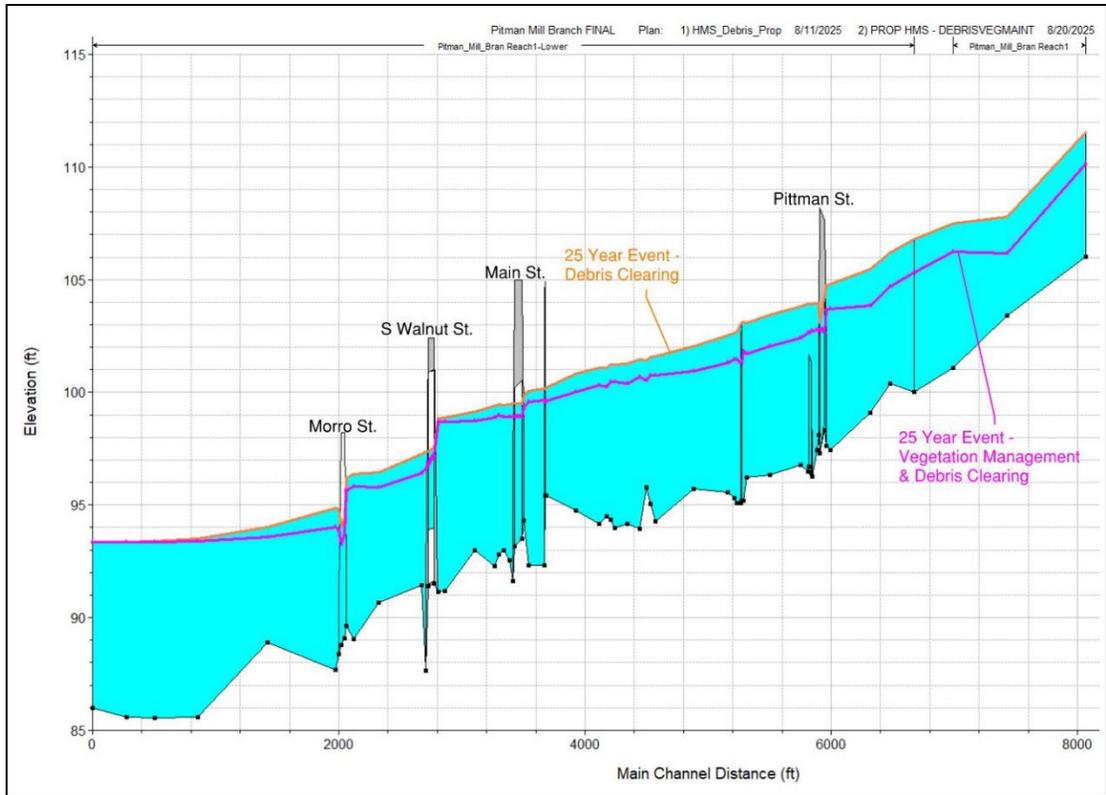


Figure 23: Pittman Mill Branch - Vegetation Management Water Surface Profile

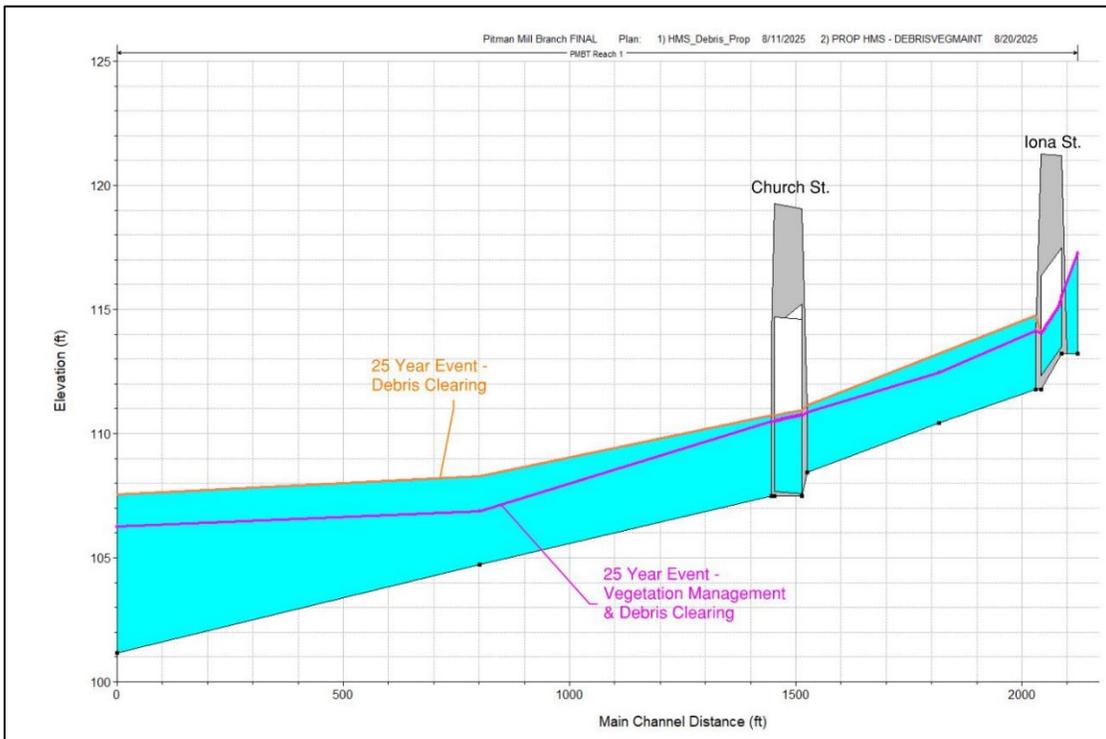


Figure 24: Pittman Mill Branch Tributary - Vegetation Management Water Surface Profile

## 6.2 Culvert Sizing

The North Carolina Department of Transportation (NCDOT) *Guidelines for Drainage Studies and Hydraulic Design* defines the design storm frequency for bridges and culverts across various types of roads. Table 12 shows that culverts and bridges across a major arterial should be designed for a 50-year storm. Culverts and bridges across minor arterials, collectors, and local roads should be designed for a 25-year storm. The design manual also states that “routes functionally classified as Major Arterials (Interstates and primary routes), a minimum freeboard of 1.5 feet is recommended”.

Table 12: NCDOT Culvert Design Frequency

Roadway Classification	Bridges, Culverts and Cross Pipes	FREQUENCY (years)		
		Storm Drain System		Ditches
		On Grade	At Sags (without relief)	
Major Arterials (e.g., Interstates, US, NC Routes)	50 *	10	50	10
Minor Arterials, Collectors, and Local Roads	25	10	25	10
Temporary / Detours	10	-	-	10

### 6.2.1 Major Arterials

HEC-RAS was used to model the existing conditions at bridges and culverts. Within the study area, there are three major arterial stream crossings – one located at Main Street along Pittman Mill Branch, one at NC-130 along Old Field Swamp, and the other at NC-41 along Old Field Swamp. The model indicated that both bridges and culvert allow at least 1.5 feet of freeboard for the 50-year storm, indicating they are sized appropriately.

### 6.2.2 Secondary Roads

There are numerous secondary roads within the study area, a few of which have culvert crossings that do not meet NCDOT design standards. NCDOT design standards indicate that secondary road crossings should be sized to accommodate a 25-year flood event. The 25-year event overtops the 72” single barrel corrugated metal pipe culvert

crossing Old Field Swamp at McDonald Road (SR2422) by about 2.25 ft. The HEC-RAS model was used to evaluate a culvert replacement at McDonald Road. The preliminary design evaluation indicated that a 10 ft by 8 ft (width x height) box culvert would be more efficient and meet NCDOT design requirements. This design assumes a concrete headwall to stabilize the roadway embankment and prevent failure of the roadway. The culvert inverts would be buried 1 ft below grade to meet NCDOT requirements. The depth of cover for the new culverts would be about 2 ft. Additional hydraulic analysis is required for final design and evaluation of changes to FEMA flood zone elevations.

The HEC-RAS model indicated that the single 6 ft x 3.5 ft corrugated metal pipe arch culvert crossing Tributary One on School Road (SR2424) also does not accommodate the 25-year flood event. The culvert is overtopped by about 1.15 ft. Preliminary design evaluation demonstrated a 10 ft by 5 ft box culvert would be more efficient and meet NCDOT design requirements. A 10 ft by 5 ft box culvert provides about 1 ft of freeboard for a 25-year storm event. This design assumes a concrete headwall to stabilize the roadway embankment and prevent failure of the roadway. The culvert inverts would be buried 1 ft below grade to meet NCDOT requirements. The depth of cover for the new culverts would be about 2 ft. Additional hydraulic analysis is required for final design and evaluation of changes to FEMA flood zone elevations.

The 5 ft by 4 ft box culvert at Iona Street (SR2435) currently meets the NCDOT 25-year flood event design standard, however the channel velocities through this section of the channel reach as high as 9 ft/s. Velocities this high can cause the channel to erode and lead to unwanted sediment in the channel. A 7 ft by 8 ft box culvert would reduce the velocities to about 4.5 ft/s. This design assumes a concrete headwall to stabilize the roadway embankment and prevent failure of the roadway. The culvert inverts would be buried 1 ft below grade to meet NCDOT requirements. The depth of cover for the new culverts would be about 2 ft. Additional hydraulic analysis is required for final design and evaluation of changes to FEMA flood zone elevations.

The double barrel 8 ft x 7 ft box culvert at Walnut Street (SR2238) currently meets the NCDOT 25-year flood event design standard, however the channel velocities through this section of the channel reach as high as 7.5 ft/s. Velocities this high can cause the channel to erode and lead to unwanted sediment in the channel. Instead of the two smaller box culverts, one large 10 ft x 15 ft box culvert would reduce the velocities to about 4 ft/s. This design assumes a concrete headwall to stabilize the roadway embankment and prevent failure of the roadway. The culvert inverts would be buried 1 ft below grade to meet NCDOT requirements. The depth of cover for the new culverts would be about 2 ft. Additional hydraulic analysis is required for final design and evaluation of changes to FEMA flood zone elevations.

The bridge at Morro Street (SR2318) currently meets the NCDOT 25-year flood event design standard. However, since the bridge is the most downstream structure along

Pittman Mill Branch it is recommended that the bridge be upgraded to a larger culvert that can accommodate a larger flood event. The HEC-RAS model shows that a double barrel 7 ft by 8 ft box culvert would decrease the 25-year flood levels between Morro Street and Walnut Street by about 0.25 feet. This design assumes a concrete headwall to stabilize the roadway embankment and prevent failure of the roadway. The culvert inverts would be buried 1 ft below grade to meet NCDOT requirements. The depth of cover for the new culverts would be about 2 ft. Additional hydraulic analysis is required for final design and evaluation of changes to FEMA flood zone elevations. In addition, it is recommended that the two utility pipes which run underneath the bridge, shown in Figure 25, be relocated. The pipe obstructs the flow area and creates an area for debris to get caught and clog the opening.



*Figure 25: Morro Street Bridge with Utility Pipes*

### 6.2.3 Other Bridge Crossings

NCDOT standards recommend any temporary roads or detours be able to accommodate a 10-year flood event. The HEC-RAS model indicated the small pedestrian crossing just east of Pittman Street is overtopped by about 1.5 feet during a 10-year flood event. This bridge is currently heavily damaged and is unusable for pedestrians. It is strongly recommended the bridge be completely removed because the bridge currently acts as a blockage in the drainage system. Additionally, the bridge collects large quantities of debris and blocks the river flow in this area as seen in Figures 26 and 27.



*Figure 26: Pittman Mill Branch - East of Pittman St Culvert Upstream*



*Figure 27: Pittman Mill Branch - East of Pittman St Culvert Downstream*

Removal of the pedestrian bridge would have the largest influence on small storms, like a 2-year event. The HEC-RAS model indicated that the flood levels for a 2-year storm would decrease by about 0.5 feet between upper Pittman Mill branch and the pedestrian bridge located east of Pittman Street. These changes can be seen in the water surface profile derived from the HEC-RAS model in Figure 28. As the intensity of the rain events increase, removal of this bridge will have smaller effects on the severity of flooding upstream bridge, but the removal would still provide benefits.

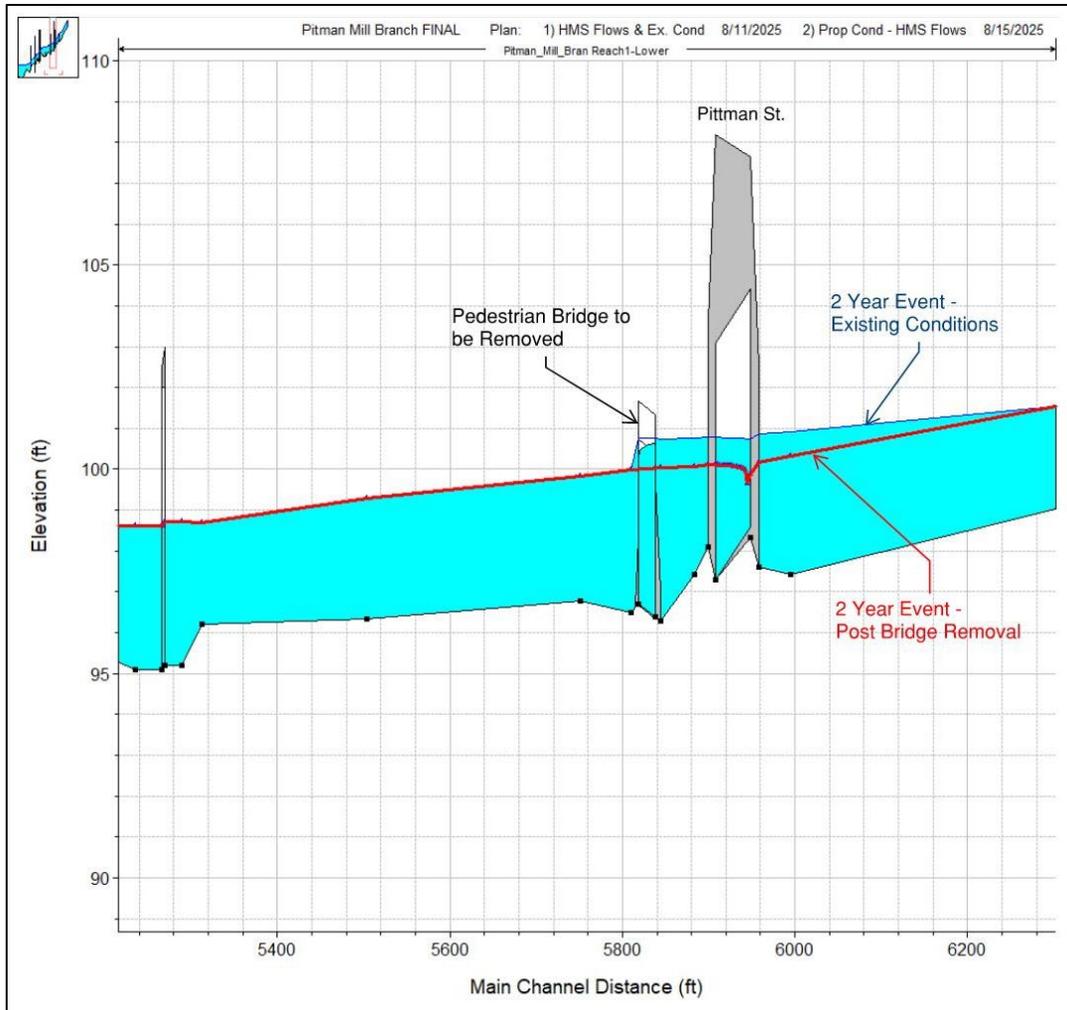


Figure 28: Pedestrian Bridge Removal Water Surface Profile

It is recommended that a second timber bridge 200 ft upstream of NC Hwy 130 (BUS) along Old Field Swamp should be investigated for removal. The bridge does not appear to be currently in use and is in poor condition. The structure includes multiple timber piers that tend to collect debris and is a major restriction to flow. The adjacent earthen bridge embankments also block significant amount of flow in the channel overbanks (floodway). Figure 29 shows the subject timber bridge. The model results indicate that removal of this timber bridge lowers the upstream water levels by 6 ft at the timber bridge and up to 2 ft upstream of Leesville Street for the 100-Year event, shown in Figure 30. Upstream water levels are lowered by approximately 1.0 ft for the 10-Year event. Current ownership and usage of the bridge was not identified, bridge removal should be investigated.



Figure 29: Old Field Swamp - Timber Bridge North of NC-130 (BUS)

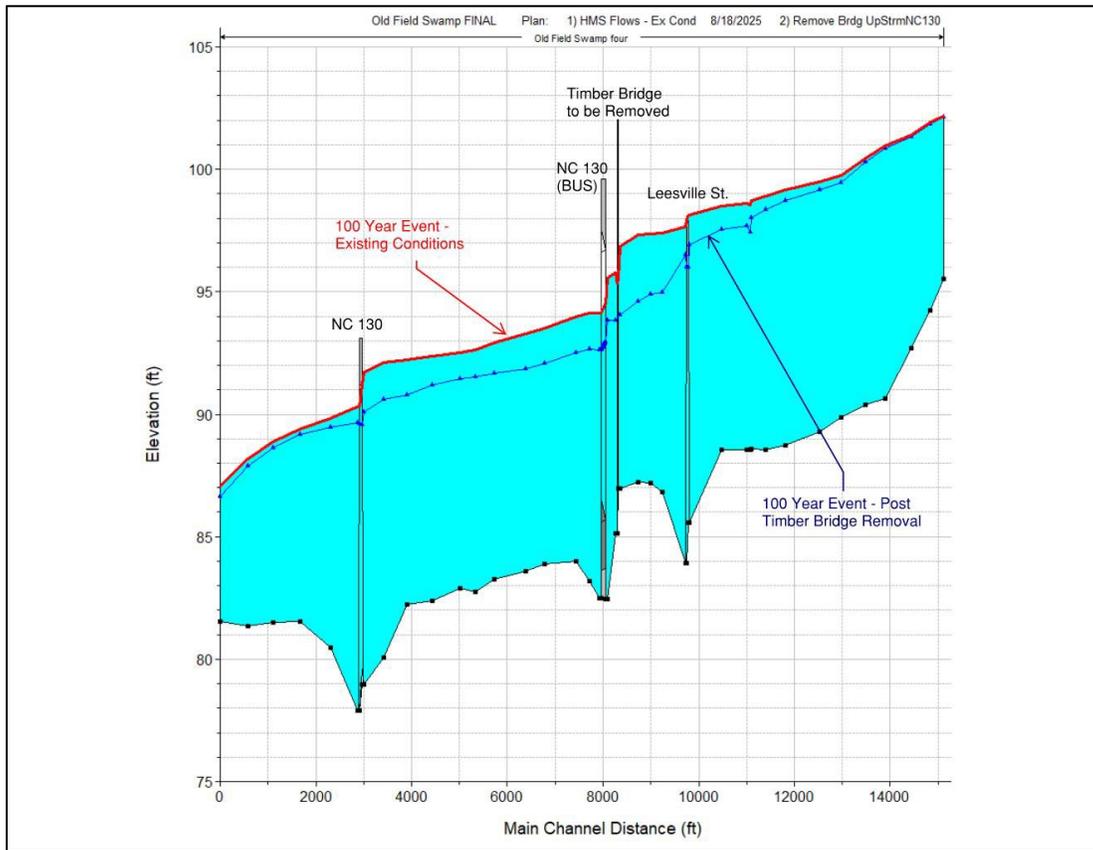
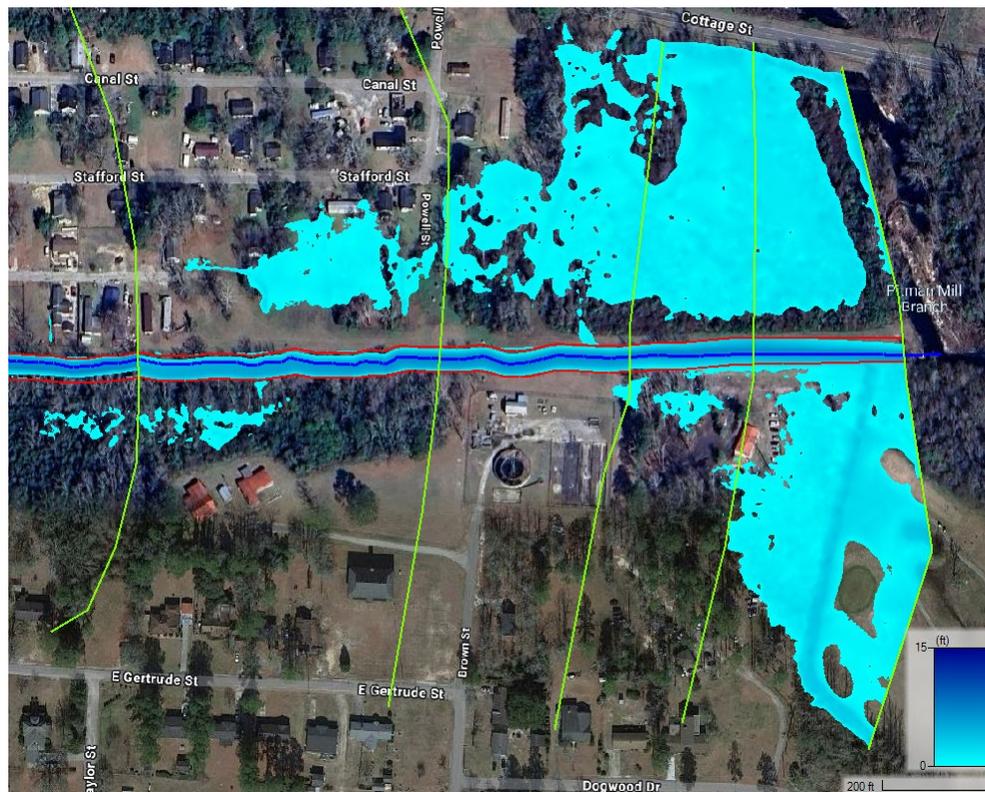


Figure 30: Timber Bridge Removal Water Surface Profile

## 6.3 Bench Cuts

Residential area flooding at the downstream end of Pittman Mill Branch is a reoccurring issue. The HEC-RAS model shows that an event as small as a 10-year event creates flooding outside of the streambank. This section of the channel approaches a bank full stage between the 5 and 10-year flood events. Larger storms produce flooding which inundates a residential area near Stafford Street and Marvin Street. Figure 29 displays the flood extents at the downstream end of Pittman Mill during a 100-year event, assuming no improvements have been made to the culverts or channel. The channel does not provide enough flow capacity, so the water extends into the floodplain.

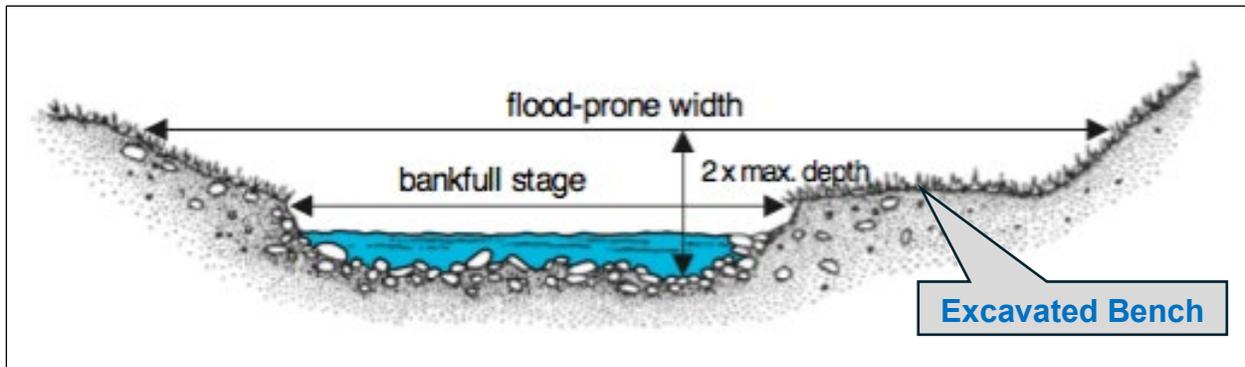


*Figure 31: Pittman Mill Branch - Existing Conditions - 100-year Event Inundation*

To help mitigate the floodwater inundation at the residential area along the downstream end of Pittman Mill Branch, one potential method involves an excavated bench cut to increase the flow capacity adjacent to the main channel. Constructing a bench cut would require excavation of material from the streambank and floodplain immediately adjacent to the main channel. HEC-RAS was used to conduct a concept level design of a bench cut and evaluate the effects a streambank excavation would have on the flood levels.

Guidelines for evaluating bench excavations along Pittman Mill Branch were obtained from “Stream Restoration: A Natural Channel Design Handbook” (Doll, et al, 2003). For this concept level design many assumptions were made, and additional hydraulic analysis will be required. A bank full elevation of 88 ft was assumed, which is near the 1-year flood event. An example of a bench cut on the right streambank is provided in Figure 30.

A bench cut that is 50 feet wide and runs from the confluence of Pittmann Mill and Old Field Swamp upstream approximately 770 feet on the left side of the channel would provide enough flow area to prevent a 100-year storm from inundating the residential area. The bottom elevation of the bench-cut used in the HEC-RAS model is approximately 88 ft. Figures 31 and 32 compare the depth and extents of the 100-year event floodwaters with a 25-foot-wide bench cut and a 50-foot-wide bench cut.



*Figure 32: Stream Entrenchment Ratio and Bankfull Bench*  
(Source: NC State Extension)

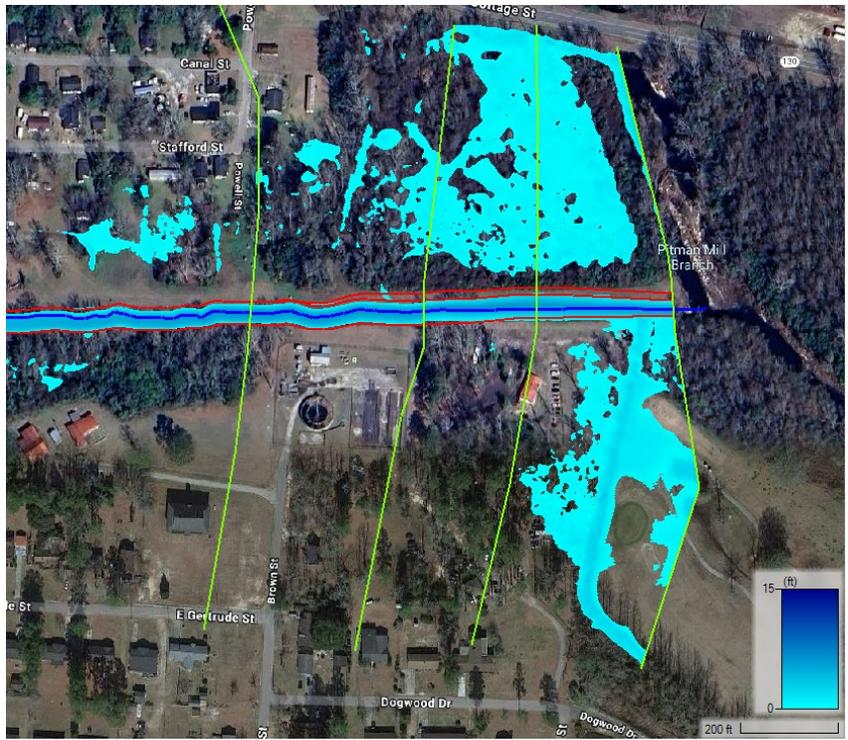


Figure 33: Pittman Mill Branch – 25 ft Bench Cut Inundation

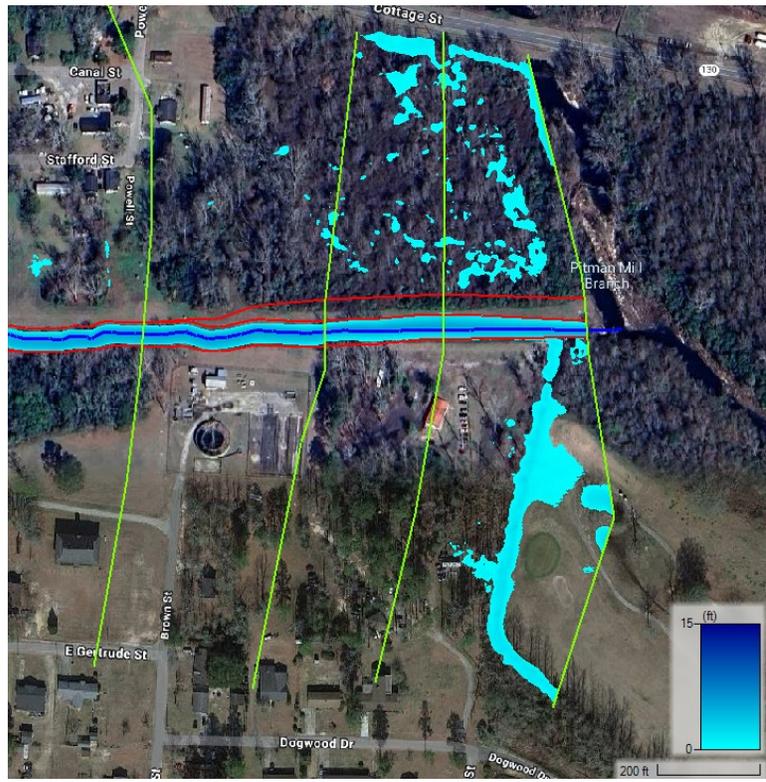


Figure 34: Pittman Mill Branch – 50 ft Bench Cut Inundation

## 6.4 Historical USACE Channelization Project

In 1968, The Army Corps of Engineers – Charleston District designed and constructed a flood control project along Pittman Mill Branch and Old Field Swamp. The project consisted of widening both Pittman Mill and Old Field Swamp. Pittman Mill was designed and constructed to a trapezoidal shaped channel with a bottom width of 16 feet and side slopes of 2:1 and 1:1 with spoils on each bank. Old Field Swamp was designed and constructed to a trapezoidal channel with bottom widths ranging from 50 feet to 80 feet and side slopes of 2:1. The project was designed for the 10-year flood. The maintenance manual for this project can be referenced in *Appendix B*.

In 1981 the Army Corps of Engineers – Charleston District conducted a reconnaissance project on the effectiveness of the earlier constructed project. It noted signs of deterioration which involved sloughing, vegetation overgrowth, and beaver dams along Old Field Swamp. It noted, however, that Pittman Mill Branch was in excellent condition due to appropriate maintenance measures. The objective of the report was to develop measures to restore the initial project to design capacity and develop permanent maintenance access. The project resulted in an 80-foot-wide channel excavation along Old Field Swamp downstream of the confluence with Pittman Mill Branch and a 6-foot-wide pilot channel in Hog Swamp, just downstream Old Field Swamp. The reconnaissance report can be referenced in *Appendix C*.

Survey data revealed that the Old Field Swamp channel bottom has changed significantly since the construction of the original flood control project in 1968. A map of the Old Field Swamp cross sections is shown in Figure 33. Figures 34-37 show various cross sections along Old Field Swamp compared to the original design of the channel project. Figures 34-36 show erosion while Figure 37 shows sediment deposition.

The survey data shows signs of erosion of the lower portion of Old Field Swamp. The channel bottom elevations are 3-5 feet below the original channel bottom design. Due to the erosion, the channel has additional flood carrying capacity in this section. However, sediment is likely a concern in Hog Swamp and may be a cause of some of the flooding issues. This study did not include Hog Swamp in its study extents, so additional analyses could be beneficial in this area.

Survey data as shown in Figure 37 indicates sediment has accumulated in Old Field Swamp just downstream of the confluence with Pittman Mill Branch. The sediment reduces the flow area in this section contributing to flooding upstream. The model was used to evaluate returning the 2,500 ft section of Old Mill Swamp downstream of the confluence with Pittman Mill to the original 1968 project design width and footprint. The model results showed a decrease of approximately 1.0 ft in the area of NC Hwy 130 and the confluence with Pittman Mill Branch for the both the 10-Year and 100-Year events.

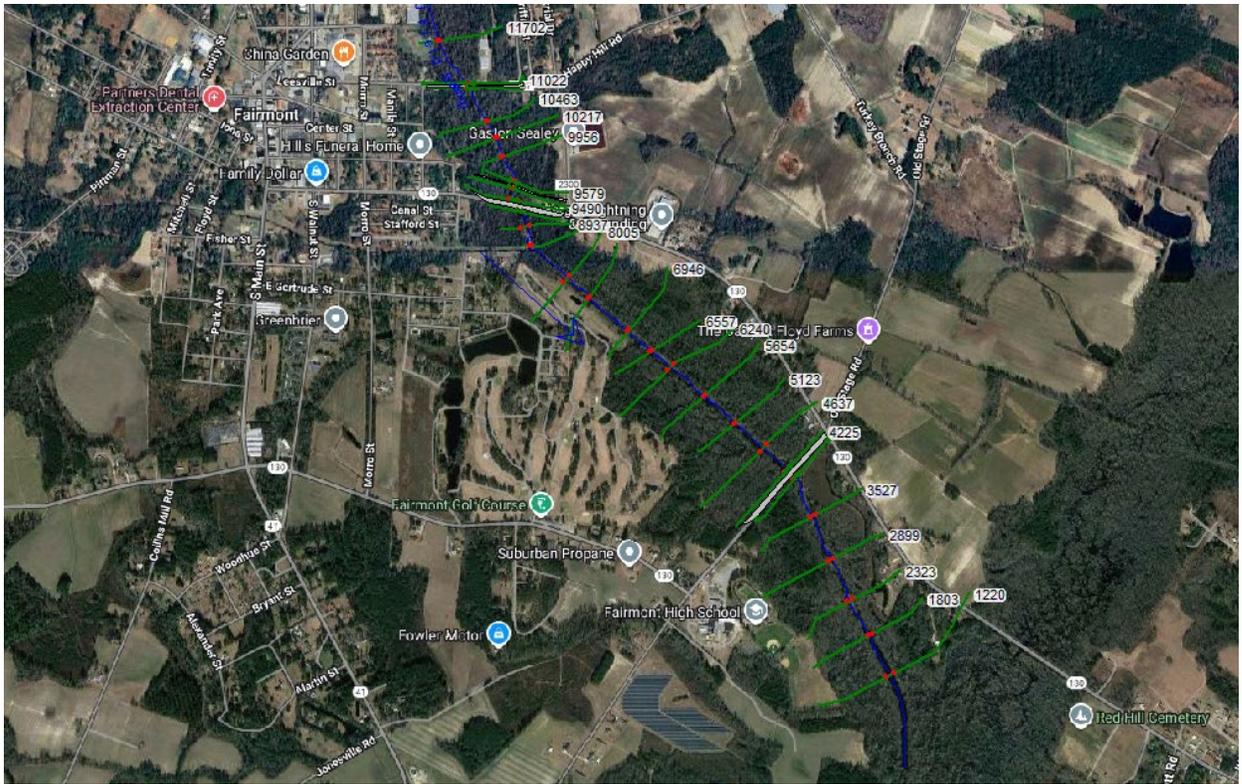


Figure 35: Old Field Swamp Cross Section Map

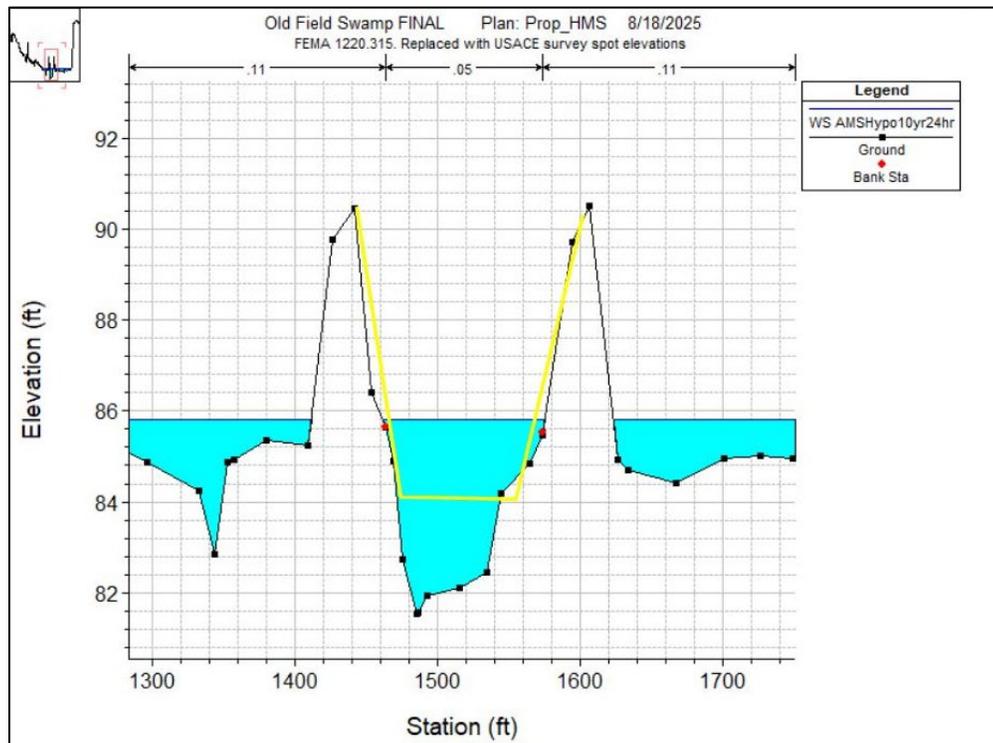


Figure 36: Erosion - Cross Section 1220

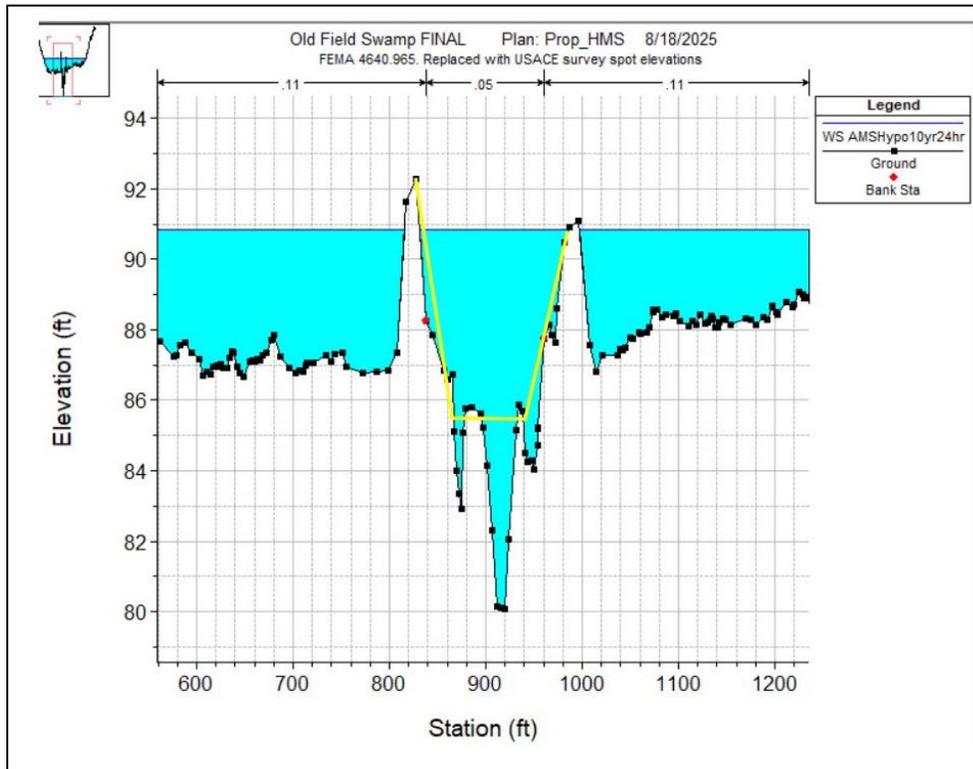


Figure 37: Erosion - Cross Section 4637

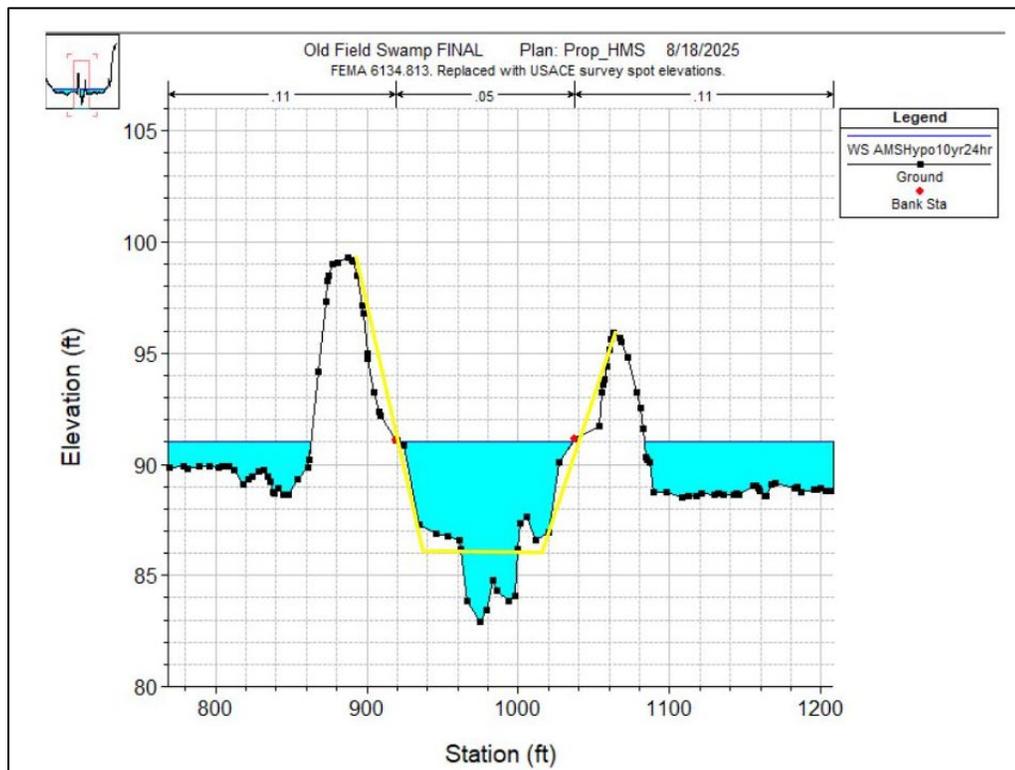


Figure 38: Erosion - Cross Section 6240

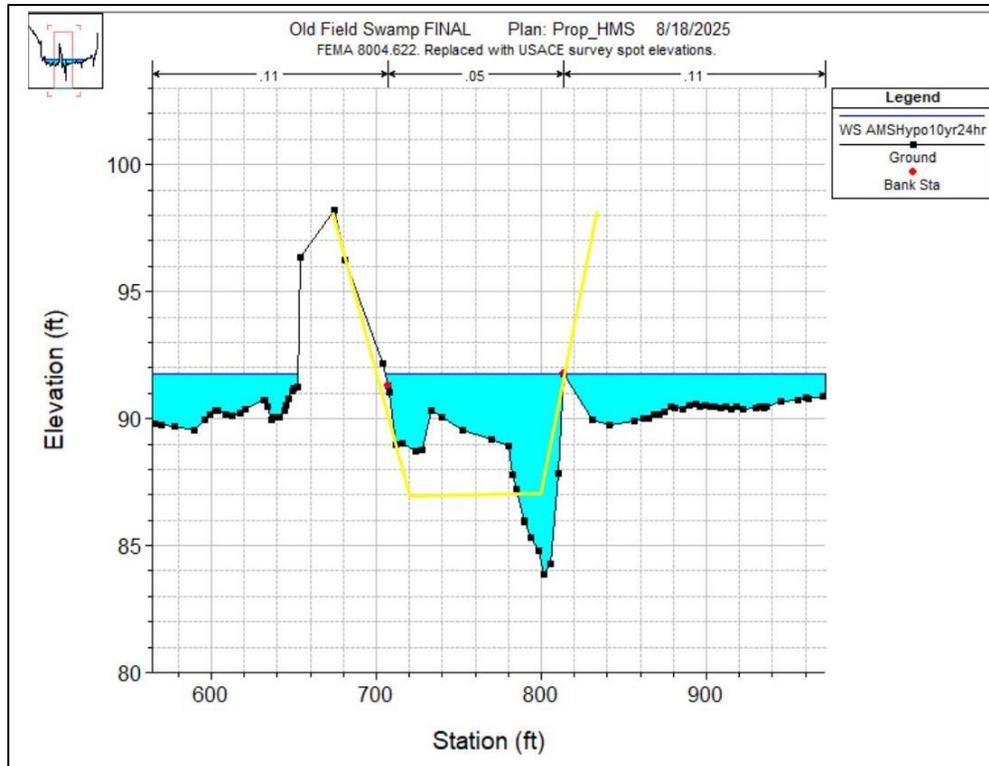


Figure 39: Sediment Accumulation - Cross Section 8005

## 7. Summary and Conclusions

This report presents the results of the Fairmont, NC Flood Risk Management Study prepared by the US Army Corps of Engineers, Wilmington District for the Town of Fairmont, NC. The purpose of this hydrology and hydraulics (H&H) analysis was to analyze the existing drainage system of the Old Mill Swamp watershed and evaluate potential drainage improvements which may inform future flood risk management strategies by the Town and Robeson County. The study limits included the main channel of Old Field Swamp, three small tributaries and Pittman Mill Branch.

Phase one of the study included collecting data on the watershed characteristics and a topographic survey of bridges, culverts and stream cross sections. The second phase included developing the hydrologic computer model HEC-HMS to calculate rainfall runoff from the Old Field Swamp watershed and developing the hydraulic model HEC-RAS to evaluate the flow capacity and peak water levels of the drainage system. The third phase included evaluating drainage improvements with the models.

One of the primary drainage problems for Old Field Swamp and Pittman Mill Branch was heavy vegetation, debris and sediment along the channels reducing the drainage capacity. An annual maintenance program to remove vegetation, debris and sediment along established drainage channels is highly recommended. Focus should also be placed on maintaining the flow area at existing bridges and culverts. The H&H analysis

indicated that increased maintenance would reduce the 25-Year flood levels by 1.0 to 3.0 ft along Pittman Mill Branch and 1.0 ft along Old Field Swamp. The time for floodwaters to recede would also significantly decrease.

High priority bridge and culvert upgrades were also identified, see Table 13 for recommendation summary. The collapsed pedestrian bridge east of Pittman Steet is a significant blockage to drainage and removal is highly recommended. A timber bridge upstream of NC Hwy 130 is a significant restriction to drainage. This bridge is in poor condition and should be investigated for removal. The existing Old Field Swamp culvert pipe at McDonald Road is a significant restriction to drainage and should be replaced with a 10 ft x 8 ft box culvert. The culvert at School Road is also a significant restriction and replacement with a 10 ft x 8 ft box culvert is recommended.

The residential areas along the lower reach of Pittman Mill Branch experiences frequent flooding because of limited channel capacity. It is recommended that a stream restoration project to include bench cuts into the adjacent streambank to increase flow capacity be investigated.

The topographic survey of the Old Field Swamp channel indicates sediment accumulation and reduction of flow capacity that is negatively impacting Pittman Mill Branch. Removal of sediment along this 2,500 ft section of Old Field Swamp is recommended. Drainage along the Hog Swamp channel was not included in this analysis but further investigation of sedimentation and impacts of decrease drainage capacity is recommended.

*Table 13: Summary of Recommendations*

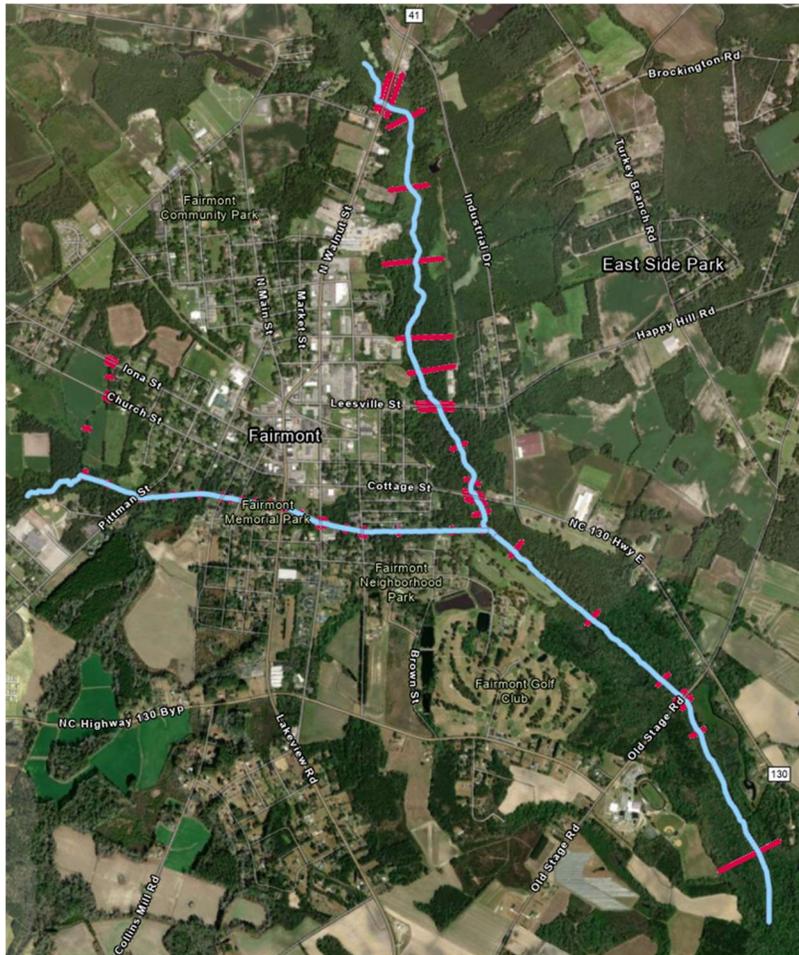
No	Project	Location	Waterway	Proposed Project	Priority	Notes
1	Maintenance	System Wide	System Wide	Clear Debris and Vegetation	Higher	Establish annual maintenance program of drainage system
2	Bridge Removal	East of Pittman Rd.	Pittman Mill Branch	No Replacement	Higher	Remove collapsed pedestrian bridge
3	Bridge Removal	North of NC Hwy 130	Old Field Swamp	No Replacement	Higher	Investigate removal of timber bridge in poor condition.
4	Culvert Upgrade	McDonald Rd.	Old Field Swamp	10 ft x 8 ft RCBC	Higher	Upgrade existing 72" CMP
5	Culvert Upgrade	School Rd.	Old Field Swamp Tributary	10 ft x 5 ft RCBC	Higher	Upgrade existing 6 ft x 3.5 ft Arch CMP
6	Bench Cut	East of Morro St.	Pittman Mill Branch	770 ft Bench Cut Excavation	Higher	Stream restoration with bench cut
7	Clear and Snag	Downstream Cottage St	Old Field Swamp	Estimated 2,500 ft Section	Higher	Remove sediment to return project channel template to original design.
8	Culvert Upgrade	Iona St.	Pittman Mill Tributary	7 ft x 8 ft RCBC	Lower	Upgrade existing 5 ft x 4 ft RCBC
9	Culvert Upgrade	Walnut St.	Pittman Mill Branch	10 ft 15 ft RCBC	Lower	Upgrade existing 8 ft x 7 ft RCBC
10	Culvert Upgrade	Morro St.	Pittman Mill Branch	2 - 7 ft x 8 ft RCBC	Lower	Replace existing bridge

## 8. References

- Doll, B.A., G.L. Grabow, K.R. Hall, J. Halley, W.A. Harman, G.D. Jennings and D.E. Wise, 2003. *Stream Restoration: A Natural Channel Design Handbook*. NC Stream Restoration Institute, NC State University. 128 pp.  
<https://www.bae.ncsu.edu/programs/extension/wqg/srp/guidebook.html>
- U.S. Department of Agriculture (USDA), 1986. *Urban Hydrology for Small Watersheds*. Natural Resources Conservation Service, Technical Release 55, (210-VI-TR-55). July 1986.
- North Carolina Department of Transportation (NCDOT) 2022. *Guidelines for Drainage Studies and Hydraulic Design*. Hydraulics Unit. August 2022
- Papadakis, K.N. and Kazan, M.N., 1987. *Time of concentration in small rural watersheds*. In: *Proceedings of the ASCE Engineering Hydrology Symposium*. Williamsburg, VA: ASCE, 633–638.
- U.S. Army Corps of Engineers (USACE), 2025. *Hydrologic Modeling System HEC-RAS User's Manual Version 6.6*
- U.S. Army Corps of Engineers (USACE), 2024. *Hydrologic Modeling System HEC-HMS User's Manual Version 4.12*

**Appendix A**  
Fairmont FPMS Surveyors Report

Report of Survey  
on  
**Topographic Survey**  
**Flood Plain Management Study**  
Fairmont, Robeson County, North Carolina

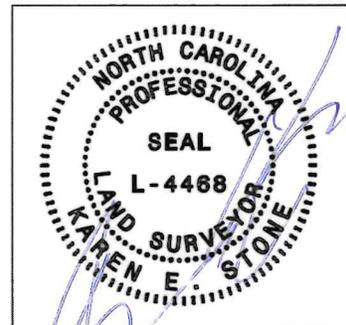


18 September 2024

**PROJECT IDENTIFICATION**

- GENERAL DESCRIPTION: The work consists of surveying cross sections and hydraulic structures for specified areas along Pittman Mill Branch, a Pittman Mill Branch Tributary, and Old Field Swamp in and around Fairmont, North Carolina.
- LOCATION OF PROJECT: In Fairmont, North Carolina, Robeson County.
- CLIENT: U.S. Army Corps of Engineers – Wilmington District  
69 Darlington Avenue  
  
Wilmington, NC 28402-1890
- DATES OF PROJECT: 08July2024 thru 18Sep2024 (extended to due to Tropical Storm Debby, and to accommodate GIS processing delay)
- TYPE OF PROJECT: Flood Study
- PRIME CONTRACTOR: **GeoDynamics, LLC**  
N.C. Firm License # F-1306  
310A Greenfield Drive  
Newport, NC 28570  
252-247-5785 (office)  
www.geodynamicsgroup.com
- SUB-CONSULTANT: **Joyner Keeny, PLLC**  
N.C. Firm License # P-0551  
1051 North Winstead Avenue  
Rocky Mount, NC 27804  
252-977-3124 (office)  
www.joynerkeeney.com

*NOTE: As a sub-consultant to GeoDynamics, Joyner Keeny performed all the field and office work on this boundary survey. GeoDynamics performed the contractor administration services*



*Sep. 18, 2024*

## **Contents**

Written Description of Workflow: page 4

Observations and Atypical Conditions: page 6

Atmospheric Conditions page 12

Equipment used page 15

## **Appendices**

U-Smart Submittals Appendix A

Field Notes Appendix B

Equipment Calibration Report Appendix C

## **WRITTEN DESCRIPTION of WORKFLOW**

### **05 July 2024**

Received Notice to Proceed

### **08 July 2024 through 13 July 2024**

Commenced of project planning and coordination including researching published control monuments within 2000 linear feet of the work area, planning of control layout, preparing worksheets and field maps for crews, and arranging travel for staff. A Esri Field Maps application was set up to permit the crews to shoot geotagged photographs and to serve as a checklist to ensure that the correct photographs and data was acquired.

### **15 July 2024 through 18 July 2024**

A Professional Land Surveyor (PLS) was assigned team lead and was sent with with a helper mobilized to the Fairmont Flood Study site and walked down to further assess site conditions. Control layout plan as modified based on the site conditions and seventeen control points were set in the vicinity of the Pittman Mill Branch Tributary cross sections and a portion of the Pittman Mill Branch cross sections. Thirteen control points had four (4) three minuet observations. Four (4) control points had two (2) three-minute observations and will have two observations remaining. Crews tied into two nearby NGS monuments. As the project commenced, the PLS notified property owners that Joyner Keeny would be surveying on their property as per NC regulations.

The North Carolina VRS system had unknown issues during a period on 16 July 2024 and 16 July 2024 and there was ongoing difficulty locking on to signal.

### **22 July 2024 through 26 July 2024**

One crew consisting of a party chief and helper mobilized to the Fairmont Flood Study site a began shooting cross sections, acquiring culvert information and water elevations, and taking the required photos beginning at cross section PMBT-001 along Iona Street through PMBT-007, then from PMB-001 along Pitman Mill Branch to PMB-009 completing 16 small, moderately open cross sections.

PMBT-004 and PMBT-008 were both in tall corn fields. PMBT-004 was acquired with some difficulty, but the decision was made to skip PMBT-008 until 2 crews were on site. There we multiple rain delays throughout the week.

There were frequent, daily rain delays during this week.

### **29 July 2024 through 02 Aug 2024**

The team lead continued setting control points and performing GPS observations. An additional 24 rebars (40 control points total) with caps have been set and redundant observations have been performed on each. Data was sent to the office the day prior to leaving the site for processing. A 5<sup>th</sup> observation was performed for points found to not 95% confidence interval criteria and the largest outlier of the prior observations were thrown out, focusing on removing outliers performed during the period

A second crew continued shooting cross sections, acquiring culvert information and water elevations, and taking the required photos beginning for cross section PMBT-010 through PMB-029 along Pitman Mill Branch completing 20 small, moderately open cross sections this week (36 completed total). It was observed that a structure at cross section PMB-007 has been washed out since the date that data on that cross section was acquired (photo to follow separately).

There was a work stoppage due to a thunderstorm that began at approximately 3:00 p.m. on Monday, July 29<sup>th</sup>. The streams were significantly swollen throughout the week. Temperatures ranged from a low of 74 degrees Fahrenheit on Monday to 92 degrees Fahrenheit on Friday with barometric pressure hovering between 29.90 and 29.98 throughout the week.

#### **05 Aug 2024 through 09 Aug 2024**

Joyner Keeny crews did not work on the Fairmont NC flood study during the week of 05 Aug 2024 due to forecasts for heavy rain and wind conditions due to Tropical Storm Debby. Field data acquired to date was reviewed and processed using Trimble Business Center, check data collector files against physical notes paying special attention to rod-heights. Data was adjusted to the processed GPS control points. Coverage was checked by importing data into AutoDesk.

#### **12 Aug 2024 through 16 Aug 2024**

Joyner Keeny crews did not work on cross sections for the Fairmont NC flood study during the week of 12 Aug 2024 due to concerns over elevated water levels due to Tropical Storm Debby. The team lead was sent on Thursday, 15 Aug 2024 to ensure work can be safely resumed the week of 19 Aug 2024.

#### **19 Aug 2024 through 23 Aug 2024**

Joyner Keeny crews continued cross section / structure data acquisition on Fairmont NC flood study completing cross sections OFS-012 through OFS-025, as well as PMBT-008 which was skipped due to the need for additional help while working within the corn field. A foot bridge at cross section OFS-013 was determined to be too hazardous to walk across. Crews obtain what data they could for this bridge and took extra photographs. Photos for USMART data base entries were shot. Weather was mild, ranging from 67 degrees F to 87 degrees F with no rain delays.

#### **26 Aug 2024 through 30 Aug 2024**

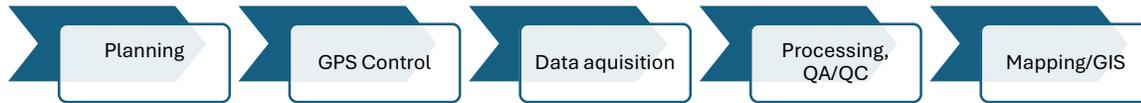
Joyner Keeny crews continued cross section / structure data acquisition on Fairmont NC flood study completing field work on the remaining cross sections and structures. The remaining U-Smart Photos were also taken. Barring any re-visits, field work is complete. Office components such as data computations, QC-QC, U-Smart Reporting & GIS setup remain.

Temperatures ranged from the high 60's in the mornings to the high 80's and high 90's in the afternoons with no rain delays.

#### **1 Sept 2024 through 4 Sept 2024**

Joyner Keeny worked continued work on processing field data and preparing U-Smart entries. U-Smart entries and anticipated were submitted for review and approved on Tuesday, 10 Sept 2024. Joyner Keeny worked on finishing final data review and began working on deliverables.

## **GENERAL QA / QC WORKFLOW**



The qa/qc process consists of planning field work in the office prior to commencing work. A professional surveyor was chosen to serve as team lead and was assigned to setting and observing any control points that were to be used. The control was processed and reviewed in-office by a second PLS. Cross Sections were acquired using robotic total stations and adjusted to the processed GPS control points. If items were found to be lacking, the crews were sent back to acquire missing or insufficient data if needed. Add crews reported to the project manager at the beginning of the work, each Wednesday afternoon, in the morning they were scheduled to return to the office to ensure to final issued needed to be addressed prior to returning.

## **OBSERVATIONS AND ATYPICAL CONDITIONS**

### **PMBT-002**

The Box Culvert located at PMBT-002 was found to consist of a standard box culvert with concrete wingwall on the upstream end but had a 6.3' long 72" CMP butted up to the downstream end with sandbag type slope stabilization which appeared to be concrete.



PMBT-006

The pipe culverts located at PMBT-003 were found to have substantial debris and vegetation along at the upstream and downstream end. The slope stabilization appears to be the sandbag style stabilization similar to that found at PMBT-002.



PMB-004

The pipe culverts located at PMB-004 is a rock wall that appears to be crumbling with significant vegetation in the channel at both ends. Aerial Sanitary Sewer pipes run near the culvert openings at both ends.



PMB-007

The earthen cover over culvert at PMB-007 was washed away after a minor storm event after its initial cross sections but prior to Tropical Storm Debby. The crews shot the exposed area, which is reflected in the cross section. Supplemental photos were taken of this area.



The bridge at PMB-015 is a minor foot bridge only. Water surface elevation was observed at the upstream face of bridge.



PMB-021

The box culvert at PMB-021 has a concrete floor with a channel cut through the northern culvert section. Adequate data was provided to obtain elevations for both the upper and lower sections of the northern culvert floor, with the lower elevation being reported in the stormwater feature class.



OFS-013

The bridge at OFS-013 appeared to be in decay and unstable. Crews did not walk on this bridge. Top chord, bottom chord, and deck elevations were interpolated based on deck and seat elevations at the two ends of the bridge. Piles were located horizontally from the ground.



## Atmospheric Conditions

The following data reflects the atmospheric conditions for the dates Joyner Keeny performed field work for the Fairmont, NC flood study taken from <https://www.wunderground.com/> for nearby Lumberton, NC. More specific temperature and pressure readings taken in conjunction with water surface elevation data acquisition are noted in field notes.

Day	Temp. (°F)			Dew Point (°F)			Humidity (%)			Wind Speed (mph)			Pressure (in)			Precip. (in)
	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	
Jul 21	88	81.2	74	75	72.1	70	91	74.2	59	9	5.1	0	29.9	29.9	29.8	0.00
22	89	76.9	72	76	72.7	70	97	87.4	63	15	7.2	0	29.9	29.8	29.8	1.61
23	92	81.2	74	76	73.8	72	97	79.8	54	16	6.7	0	29.9	29.9	29.8	0.10
24	91	78.7	73	78	73.9	71	96	86.0	59	18	9.2	0	30.0	30.0	29.9	0.65
25	86	77.4	75	76	73.8	73	97	89.0	69	16	7.2	0	30.0	29.9	29.9	0.08
26	79	76.4	74	75	73.1	72	97	89.9	78	10	4.1	0	29.9	29.9	29.8	1.06
27	87	77.7	72	73	69.4	64	94	77.7	48	13	7.5	0	29.9	29.9	29.8	0.11

Time	Temp. (°F)			Dew Point (°F)			Humidity (%)			Wind Speed (mph)			Pressure (in)			Precip.(in)
	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	
Jul 28	88	77.6	67	68	63.2	55	97	65.4	36	9	2.7	0	30.0	30.0	29.9	0.00
29	79	73.0	70	72	69.2	65	97	88.0	64	12	4.0	0	30.0	29.9	29.9	0.00
30	91	80.9	71	77	73.0	68	93	77.6	61	12	4.2	0	29.9	29.9	29.8	0.60
31	90	81.1	72	75	72.8	70	97	76.8	57	10	4.9	0	29.9	29.9	29.8	0.00
1	96	85.3	75	78	75.3	73	96	74.0	49	10	4.0	0	29.9	29.9	29.9	0.00
2	95	82.6	77	80	75.4	71	94	79.8	58	24	8.5	0	29.9	29.8	29.8	0.00
3	92	79.5	72	77	73.0	69	97	81.2	62	24	10.9	0	29.9	29.8	29.8	0.21

Time	Tempe. (°F)			Dew Point (°F)			Humidity (%)			Wind Speed (mph)			Pressure (in)			Precip.(in)
Aug	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Total
18	90	79.0	72	76	71.2	66	94	77.6	59	25	7.8	0	29.8	29.7	29.6	0.00
19	90	78.2	72	74	71.0	67	97	80.6	46	8	4.4	0	29.7	29.7	29.6	0.00
20	86	77.6	71	72	67.9	65	96	73.0	55	13	6.4	0	29.9	29.8	29.7	0.00
21	82	72.8	65	65	58.8	55	90	63.3	44	13	8.4	5	30.0	30.0	29.9	0.00
22	81	70.5	59	59	55.4	52	87	61.3	36	12	6.6	0	30.1	30.1	30.0	0.00
23	80	70.2	61	61	57.5	55	90	65.6	45	12	7.1	0	30.1	30.1	30.1	0.00
24	84	73.2	62	68	63.0	58	90	71.6	56	12	7.2	5	30.1	30.1	30.0	0.00

Time	Temp. (°F)			Dew Point (°F)			Humidity (%)			Wind Speed (mph)			Pressure (in)			Precip. (in)
Aug	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Total
25	89	77.4	66	68	65.6	61	93	68.8	48	13	7.5	0	30.1	30.1	30.0	0.00
26	90	77.2	69	72	68.9	65	96	78.0	45	8	3.7	0	30.1	30.0	30.0	0.00
27	92	77.3	69	74	70.4	68	100	82.1	45	6	1.4	0	30.0	30.0	29.9	0.00
28	95	81.9	70	76	72.1	69	97	75.2	44	9	3.0	0	30.0	29.9	29.9	0.00
29	96	84.5	74	77	73.6	70	97	72.8	43	9	3.9	0	30.0	30.0	29.9	0.00
30	95	81.1	74	76	73.1	70	97	79.1	49	18	4.9	0	30.0	30.0	29.9	0.00
31	87	51.7	0	75	46.8	0	97	58.1	0	7	1.9	0	30.0	29.9	29.8	0.00

## Equipment Used

### GPS Unit:

- Trimble R12 with Trimble (S/N: 6239F00263)

### Robotic Total Stations:

- Trimble S5 (S/N: 37020754)
- Trimble S9 (S/N: 38320093)

### Data Collectors:

- Trimble SCS 5 (S/N: JAJ224010047)
- Trimble SCS 5 (S/N: JAJ222410092)
- Trimble SCS 5 (S/N: JAJ222410183)

### Boat

- 12' Plastic Creek Boat

### Tablets

- (2) Samsung Tab Active 4 with Esri FieldMaps

**Appendix B**  
1968 Old Field Swamp & Mill Branch  
Maintenance Manual

*By...*

MAINTENANCE MANUAL  
FOR  
SMALL FLOOD CONTROL PROJECT  
ON

OLD FIELD SWAMP & MILL BRANCH  
ROBESON COUNTY, NORTH CAROLINA



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

DECEMBER 1968

SERIAL NO. 21

TABLE OF CONTENTS

- I. INTRODUCTION
- II. LOCAL COOPERATION
- III. GENERAL PROCEDURES
- IV. SPECIFIC MAINTENANCE INSTRUCTIONS

LIST OF ATTACHMENTS

- A. (1) Letters from the Board of Commissioners of the Town of Fairmont, the Robeson County Board of Commissioners, and the Department of Water Resources of the State of North Carolina.
- (2) Resolution of the Board of Commissioners of the Town of Fairmont, Robeson County, North Carolina, dated 7 September 1965.
- (3) Letter from the Town of Fairmont, Robeson County, North Carolina.
- (4) Resolution of the Board of Commissioners of the Town of Fairmont, Robeson County, North Carolina, dated 8 May 1967.
- (5) Certificate from the Mayor, City of Fairmont, Robeson County, North Carolina.
- B. Title 33 - Part 208 - Flood Control Regulations
- C. Instructions and Sample Forms for Submission of Semiannual Reports

MAPS

- 1. GENERAL PLAN Sheet 1 of 3
  - 2. PROFILES Sheet 2 of 3
  - 3. CROSS SECTIONS Sheet 3 of 3
-

MAINTENANCE MANUAL  
FOR  
SMALL FLOOD CONTROL REPORT  
ON  
OLD FIELD SWAMP AND MILL BRANCH  
ROBESON COUNTY, NORTH CAROLINA

I. INTRODUCTION

A. Authorization

Authority for preparation of this report is contained in Section 208 of the 1954 Flood Control Act.

B. Location

Old Field Swamp is located in Robeson County, North Carolina, and flows along the eastern town limits of Fairmont. Mill Branch is a tributary of Old Field Swamp and flows through Fairmont. Old Field Swamp outlets into Hog Swamp about 1.5 miles southeast of Fairmont.

C. Protection Provided

The project will reduce flooding in the Old Field Swamp and Mill Branch area, resulting in improvements in agricultural conditions and decreases in damages to business establishments, residential property, and roads. It will not eliminate flooding and this fact should be published annually in order that the public will be appropriately informed. However, it does provide an adequate outlet for drainage works to be accomplished by local interests and lands that were formerly unusable may be put to some use.

D. Construction History

Funds for preparation of plans, specifications, and construction were allotted on 16 June 1967. On 26 September 1967 a contract was let to E. L. McLamb & Son, Little River, South Carolina, for clearing a right-of-way, excavating a canal, constructing and installing project signs and seeding the spoil banks. This work was completed by August 1968.

## II. Local Cooperation

### A. Local interests are required to:

(1) Provide, without cost to the United States, all lands, easements, rights-of-way, utility relocations and alterations, and highway bridge construction and alterations necessary for project construction.

(2) Hold and save the United States free from damages due to the construction works, and adjust all claims concerning water rights.

(3) Maintain and operate the project after completion, without cost to the United States, in accordance with regulations prescribed by the Secretary of the Army.

(4) Prescribe and enforce regulations to prevent obstructions or encroachments on the channel and rights-of-way necessary to proper functioning of the project.

(5) Annually notify affected interest that the improvement will not provide complete flood protection.

(6) Prevent the use of lands in the flood plain below the elevation of present development for permanent-type structures after channel improvement.

B. (1) Letters from the Board of Commissioners of the Town of Fairmont, the Robeson County Board of Commissioners, and the Department of Water Resources of the State of North Carolina, dated 20 August, 8 September, and 10 September 1965 respectively, requesting the assistance of the Corps of Engineers in helping with the flood control problem along Old Field Swamp and Mill Branch. Copies of the letters are inclosed in Attachment A.

(2) A resolution adopted on 7 September 1965 by the Board of Commissioners of the Town of Fairmont, Robeson County, North Carolina, was furnished the District Engineer, U.S. Army Engineer District, Charleston, South Carolina, requesting whatever assistance it can in an effort to remedy the flood control problem. A copy of the resolution is inclosed in Attachment A.

(3) A letter dated 2 March 1967 from the Town of Fairmont, Robeson County, North Carolina, was furnished the District Engineer, U.S. Army Engineer District, Charleston, South Carolina, agreeing to accept the responsibilities as outlined to the Board of Commissioners of the Town of Fairmont in connection with the development of the project. A copy of the letter is inclosed in Attachment A.

(4) A resolution adopted on 8 May 1967 by the Board of Commissioners of the Town of Fairmont, Robeson County, North Carolina, was furnished the District Engineer, U. S. Army Engineer District, Charleston, South Carolina, stating that no permanent type structures shall hereafter be permitted below the elevation of the present development in the flood plain of Old Field Swamp and Pittman Mill Branch. A copy of the resolution is inclosed in Attachment A.

(5) A certificate dated 22 August 1967 by the Mayor, City of Fairmont, Robeson County, North Carolina, was furnished the District Engineer, U. S. Army Engineer District, Charleston, South Carolina, agreeing to fulfill all terms required of local cooperation for the project. A copy of the certificate is inclosed in Attachment A.

### III. GENERAL PROCEDURES

A. Section 208.10, Title 33 of the Code of Federal Regulations contains regulations for the operation and maintenance of local flood protection works approved by the Secretary of the Army in accordance with authorities contained in Section 3 of the Flood Control Act of 22 June 1936, as amended and supplemented (a copy of Section 208.10 is included as Attachment B).

B. The purpose of this manual is to assist the responsible authorities in carrying out their obligations through provision of information and advice regarding the maintenance requirements of the project in accordance with approved regulations.

C. The following general regulations are prescribed to govern the maintenance of the Old Field Swamp and Mill Branch Small Flood Control Project.

(1) The improved channels shall be continuously maintained in such a manner as to obtain maximum flood control and drainage benefits.

(2) The Board of Commissioners of the Town of Fairmont, Robeson County, North Carolina, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent" who shall be responsible for the continuing maintenance of the project.

(3) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering the inspection and maintenance of the project. The report should cover such items as number of inspections made, the conditions of the channels, maintenance needed, and maintenance work done since the last report.

(4) The District Engineer or his authorized representative shall have access at all times to all portions of the project area.

(5) Maintenance measures which the District Engineer deems necessary shall be promptly taken.

(6) Instructions and sample forms for submission of semi-annual inspection and maintenance reports for the project are attached (Attachment C). Forms for the reports will be furnished by the District Engineer to the Board of Commissioners when requested.

#### IV. SPECIFIC MAINTENANCE INSTRUCTIONS

Periodic inspections of the improved channels shall be made by the Superintendent to ascertain whether or not:

A. The channel is clear of debris, weeds, and wild growth.

B. The channel is being restricted by the deposition of waste material, the building of unauthorized structures, or other encroachments.

C. Sloughing of banks has occurred.

D. The capacity of the channel is being reduced by the formation of shoals.

Inspections shall be made immediately following winds of near hurricane force; immediately following each high water period; and otherwise at intervals not exceeding 90 days and, also, at such intermediate times as may be necessary to insure the unrestricted flow of the creek. Immediate steps shall be taken to remedy any adverse conditions disclosed by such inspections.

ATTACHMENT A

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COMMISSIONERS:

J. H. McCOLLUM  
J. WILTON LEWIS  
G. H. FLOYD  
LARRY MARTIN

# TOWN of FAIRMONT

*Biggest Tobacco Market in the Border Belt*

GILBERT A. LEWIS  
JUDGE OF RECORDERS COURT  
DAVID M. & W. EARL BRITT  
ATTORNEYS  
WILLIAM A. HOUGH  
SOLICITOR RECORDERS COURT  
C. D. PITTMAN  
CHIEF OF POLICE

NORTH CAROLINA

20 August 1965

Lt. Col. Robert E. Rich  
District Engineer  
U.S. Army Engineer District, Charleston  
P.O. Box 905  
Charleston, S. C. 29402

Dear Col. Rich:

The Town of Fairmont has a flood control problem for which we would like to get the assistance of the Corps of Engineers. Old Field Swamp and Mill Branch flow through the Town of Fairmont and, when in flood stage, cause considerable damage. These watersheds quite naturally cover agricultural areas both above and below the Town of Fairmont and the problem of flooding in these sections will be discussed with the County Commissioners and abutting land owners to try to enlist their cooperation in sponsoring a study of the flood control situation.

Presently our town is involved in preparing a development plan in cooperation with the North Carolina Department of Conservation & Development and control of floods on these two streams will contribute materially to the development of the town.

On behalf of the Board of Commissioners of the Town of Fairmont this is to request that the Corps of Engineers give us flood control assistance in these two watersheds.

Sincerely yours,



P. L. FISHER, Mayor

PLF:F  
c.c.: Mr. George Pickett  
N. C. Dept. of Water Resources  
Old Health Building  
Raleigh, N. C.

COMMISSIONERS

V. J. Griffin, Chairman  
Fairmont, N. C.  
J. A. Singleton, Jr.  
Red Springs, N. C.  
D. D. McColl  
St. Pauls, N. C.  
Tracy W. Sampson  
Pembroke, N. C.

Robeson County Manager's Office

W. PAUL GRAHAM, County Manager  
Lumberton, North Carolina

September 8, 1965

COMMISSIONERS

George L. Pate  
Rowland, N. C.  
M. Carr Gibson  
Lumberton, N. C.  
D. G. Kinlaw, Clerk to Board  
Lumberton, N. C.  
Dickson McLean, Jr., Co. Attorney  
Lumberton, N. C.

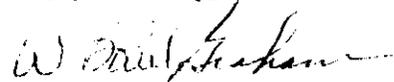
Lt. Col. Robert E. Rich  
District Corps of Engineers  
Post Office Box 905  
Charleston  
South Carolina

Dear Col. Rich:

There is a flood control problem in the Town of Fairmont with Old Field Swamp and Mill Brook Stream which flows through the town. Considerable damage has been caused by the flood from these two streams.

The Robeson County Board of Commissioners respectfully request the Corps of Engineers to lend flood control assistance to the town of Fairmont. Any Assistance that you will be able to render in order to correct this problem will be appreciated.

Respectfully,



W. Paul Graham  
County Manager

WPG:jsi

STATE OF NORTH CAROLINA  
DEPARTMENT OF WATER RESOURCES

DAN K. MOORE, GOVERNOR  
P. D. DAVIS  
WAYNE MABRY  
J. AARON PREVOST



J. R. TOWNSEND, CHAIRMAN  
C. H. PRUDEN, JR.  
S. VERNON STEVENS, JR.  
GLENN M. TUCKER

WALTER E. FULLER, DIRECTOR  
P. O. BOX 9392  
RALEIGH, N. C. 27603  
TELEPHONE 829-3003

OFFICE OF THE DIRECTOR

September 10, 1965

Lt. Colonel Robert E. Rich  
District Engineer  
U. S. Army Engineer District, Charleston  
P. O. Box 905  
Charleston, South Carolina 29402

Dear Colonel Rich:

I am enclosing a copy of a resolution from the Town of Fairmont, North Carolina, asking that a flood control study be made of Old Field Swamp and Mill Branch in order to provide flood protection in the Town of Fairmont.

I will appreciate your investigating this matter and informing me if this study can be made under the authority of Section 205. In the event you find that the necessary protection would exceed the authority of adequate flood control protection under Section 205, I will write to Congressman Lennon asking that he obtain a Congressional authorization for a flood control study.

I will appreciate your informing me of the result of your investigation.

Sincerely,

A handwritten signature in cursive script that reads "Walter E. Fuller".  
Walter E. Fuller

WHEREAS the Town of Fairmont is situate such that it is drained by the watersheds of Old Field Swamp and Mill Branch, the said Old Field Swamp running north and east of the town and Mill Branch running approximately through the center of the Town and emptying into Old Field Swamp east of the Town; and

whereas both of these streams frequently overflow and, when in flood stage inundate several blocks of low-income homes; and

Whereas the Town of Fairmont does not have sufficient funds with which to cope with a problem of this magnitude without some outside assistance;

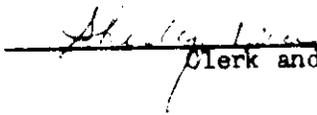
THEREFORE, BE IT RESOLVED by the Board of Commissioners of the Town of Fairmont that the North Carolina Department of Water Resources be requested to assist in a study of the problems created by the overflow of these two streams and to give whatever assistance it can in an effort to remedy the problem.

I, Shirley Price, Clerk and Treasurer of the Town of Fairmont, do hereby certify that the above resolution was adopted at a ~~regular~~ meeting of the Board of Commissioners of the Town of Fairmont on ~~7 Sept~~ ~~1964~~ upon motion of Commissioner J. H. McCollum, seconded by Commissioner Worth Stephens, and passed by the following vote:

Ayes: Commissioners McCollum, Stephens, Floyd and Lewis.

Noes: None.

Witness my hand and the official seal of the Town of Fairmont  
this 7 ~~August~~ ~~1965~~ Sept. 1965.

  
Clerk and Treasurer

P. L. FISHER, MAYOR

~~J. E. BRISTOW~~, CLERK & TREASURER

COMMISSIONERS:

J. H. McCOLLUM  
G. H. FLOYD  
WORTH STEPHENS  
PATRICK R. FLOYD, III

# TOWN of FAIRMONT

*Biggest Tobacco Market in the Border Belt*

NORTH CAROLINA

March 2, 1967

W. CURTIS MCGIRT  
JUDGE OF RECORDERS COURT  
DAVID M. & W. EARL BRITT  
ATTORNEYS  
WILLIAM A. HOUGH  
SOLICITOR RECORDERS COURT  
C. D. PITTMAN  
CHIEF OF POLICE

Col. Robert E. Rich  
Corps of Engineers  
P. O. Box 905  
Charleston, S. C.

Re: Mill Branch & Old Field Swamp  
Flood Control Project

Dear Sir:

This is to advise that the Board of Commissioners of The Town of Fairmont, decided in a meeting on this 2 March 1967 to accept the responsibilities as outlined by the representatives from your office for the above project.

We would appreciate your proceeding with this project application as soon as possible.

Yours truly,

TOWN OF FAIRMONT



P. L. Fisher,  
Mayor

PLF/s

Summary of Meeting with Mayor and Commissioners  
Town of Fairmont, North Carolina  
on 2 March 1967

PURPOSE: To present the Report on Mill Branch and Old Field Swamp.

PRESENT: E. L. Shull and J. F. Murphree from the Corps of Engineers,  
Charleston District. P. L. Fisher, Mayor of Fairmont.  
McCollum, Stevens, G. H. Floyd, and P. R. Floyd; Commissioners.  
W. Earl Britt, Town Lawyer.

SUMMARY OF MEETING: Murphree presented the report on the project with  
emphasis on channel dimensions, right-of-way widths, benefits  
and b/c ratio.

Shull emphasized local responsibilities to include;  
(1) Securing all easements and rights-of-way (2) Maintenance  
of completed channel and (3) Holding the Government  
free of all damages.

The Town Council voted to accept its responsibilities  
and to request that the application be processed without  
delay.

  
J. F. Murphree

  
E. L. Shull

6 March 1967

RESOLUTION OF THE BOARD OF COMMISSIONERS OF THE TOWN OF FAIRMONT ADOPTED  
AT A REGULAR MEETING OF SAID BOARD HELD IN THE TOWN OFFICE IN FAIRMONT,  
N. C. ON 8 May 1967 at 5:00 P.M.

"WHEREAS for many years there has been a flood control and drainage  
problem within the Town of Fairmont on Pittman Mill Branch and Old Field Swamp;  
and

Whereas the Corps of Engineers Department of the Army, Charleston  
District, has conducted a survey of the said Old Field Swamp and Pittman Mill  
Branch and proposed a flood control and drainage project for said areas; and

Whereas certain lands in the flood plain of Pittman Mill Branch and  
Old Field Swamp will still be subject to possible periodic flooding even after  
the work proposed by the Corps of Engineers has been completed; and

Whereas it would be detrimental to the health and general welfare  
of the citizens of the Town of Fairmont, and particularly those citizens living  
in and near said flood plain area for permanent type structures to be built  
within the flood plain below the elevation of present development; and,

Whereas the members of the Board of Commissioners of the Town of  
Fairmont are of the opinion that such structures should be prohibited in said  
area;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COMMISSIONERS OF  
THE TOWN OF FAIRMONT that no permanent type structures shall hereafter be  
permitted below the elevation of the present development in the flood plain  
of Old Field Swamp and Pittman Mill Branch, as said area is shown on the  
map of same prepared by the Office of the Corps of Engineers, Department of  
the Army, Charleston District, which said map is on file in the office of the  
Town Clerk of the Town of Fairmont."

Commissioner Patrick Floyd III moved the adoption of the  
foregoing resolution. The motion was seconded by Commissioner J. J. Johnson  
, and, after some discussion the resolution was adopted by the  
following vote:

Ayes: Commissioners Floyd, Johnson, Stephens, & Ashley

Noes: None.

I, Shirley Price, Town Clerk of the Town of Fairmont, do hereby certify  
that the foregoing Resolution was duly adopted at a meeting of the Board of Com-  
missioners of the Town of Fairmont held in the Town Office at 5:00 P.M. on 8 May  
1967.

Witness my hand and the seal of the Town of Fairmont, this 8 May 1967.

Shirley Price  
Town Clerk

C E R T I F I C A T E

I, P. L. Fisher, Mayor, City of Fairmont, North Carolina, Robeson County, do hereby certify that the said City of Fairmont has valid perpetual easements to the rights-of-way required for the Old Field - Mill Branch Clearing and Snagging and Channel Improvement Project, as authorized by the Chief of Engineers on 16 June 1967, including the right of egress and ingress thereto for the purposes of executing the authorized work, also that said municipality has legal authority and is financially able to fulfill all terms required of local cooperation for the aforesaid project.

Dated at Fairmont, North Carolina, this the 22 day of August 1967.

P. L. Fisher

WITNESS:

H. W. King  
W. M. Boyce

ATTACHMENT B

TITLE 33 - NAVIGATION AND NAVIGABLE WATERS

CHAPTER II - CORPS OF ENGINEERS - DEPARTMENT OF THE ARMY

PART 208 - FLOOD CONTROL REGULATIONS

MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Authority: The provisions of this Part 208 issued under sec. 7,58 Stat. 890; 33 U.S.C. 709, unless otherwise noted.

208.10 LOCAL FLOOD PROTECTION WORKS; MAINTENANCE AND OPERATION OF STRUCTURES AND FACILITIES.

(a) General.

(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible

under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(b) Levees

(1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of

the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

- occurring; (ii) Wave wash or scouring action is not
- overtopped; (iii) No low reaches of levee exist which may be
- the structure. (iv) No other conditions exist which might endanger

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) Flood walls

(1) Maintenance. Periodic inspections shall be made by the Superintendent to be certain that:

- (i) No seepage, saturated areas, or sand boils are occurring;
- (ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;
- (iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;
- (iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;
- (v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;
- (vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;
- (vii) No bank caving conditions exist riverward of the wall which might endanger its stability;
- (viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major

high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) Operation. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) Drainage structures

(1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed

until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) Closure structures

(1) Maintenance. Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

- (i) No parts are missing;
- (ii) Metal parts are adequately covered with paint;
- (iii) All movable parts are in satisfactory working order;
- (iv) Proper closure can be made promptly when necessary;
- (v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) Operation. Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods

to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) Pumping plants

(1) Maintenance. Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) Operation. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected,

oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) Channels and floodways

(1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) Operation. Both banks of the channel shall be patrolled during periods of highwater, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes

and walls, drainage outlets, or other flood control structures repaired.

(h) Miscellaneous facilities

(1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.

ATTACHMENT C

INSPECTION AND MAINTENANCE REPORTS  
OF OLD FIELD SWAMP AND MILL BRANCH

GENERAL

1. Reports shall be submitted on or about 1 January and 1 July of each year to:

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

2. Inspections shall be made (a) immediately following winds of near hurricane force; (b) immediately following each high water period; and (c) otherwise at intervals not exceeding 90 days and, also, at such intermediate times as may be necessary to insure the unrestricted flow of the creek.

3. This form shall be used as a check list in making each inspection and the conditions requiring maintenance work shall be inserted in the appropriate spaces. On the form on which the condition requiring maintenance was first reported, there shall be inserted explanatory information describing the methods employed to correct the condition; or, in the event the inspection form is submitted prior to corrective action being taken, information shall be inserted regarding arrangements that have been made to have conditions corrected.

4. Maintenance shall be performed as required to insure unrestricted flow of the creek.

5. If spaces provided for the insertions are insufficient, the information should be continued on plain sheets and attached to the report.

6. Additional forms may be obtained as needed by requesting them from the District Engineer (see address in paragraph 1 above).

ATTACHMENT C

INSPECTION AND MAINTENANCE REPORT OF OLD FIELD SWAMP AND MILL BRANCH

INSPECTION AND MAINTENANCE REPORT

Name of Channel: \_\_\_\_\_

Type of Inspection: Check below the type of inspection made.

( ) Following high winds  
Date of inspection: \_\_\_\_\_

( ) Following high water  
Date of inspection: \_\_\_\_\_

( ) Routine  
Date of inspection: \_\_\_\_\_

Condition of Channel: (1) If the channel shows evidence of any of the following conditions, describe briefly the approximate location, degree of obstruction, type of maintenance action taken, etc.

(a) Bank caving: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(b) Excessive growth of grass and weeds: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(c) Accumulation of trash, drift, or debris: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INSPECTION AND MAINTENANCE REPORT OF OLD FIELD SWAMP AND MILL BRANCH (Cont'd)

INSPECTION AND MAINTENANCE REPORT (Cont'd)

(d) Downed trees in channel: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(e) Other damaging conditions: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2) Give general condition of channel:

( ) Good ( ) Fair ( ) Poor

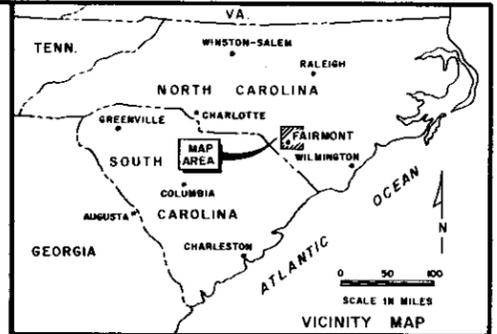
(3) Remarks: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signed \_\_\_\_\_

Title \_\_\_\_\_

ATTACHMENT C



**NOTES.**  
 1. SEE SHEET 2 FOR PROFILES.  
 2. SEE SHEET 3 FOR SECTIONS

**LEGEND**

Proposed Channel

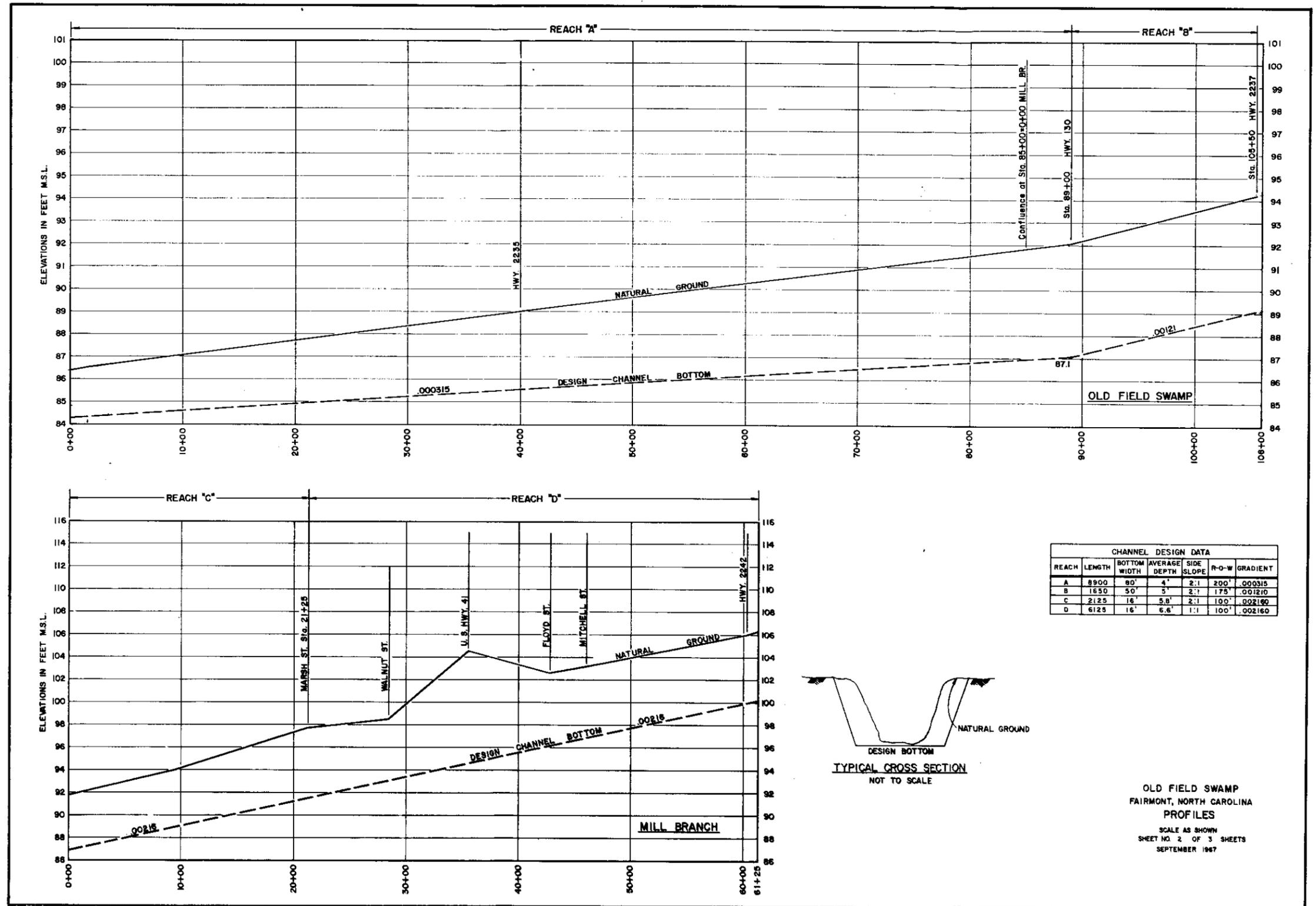


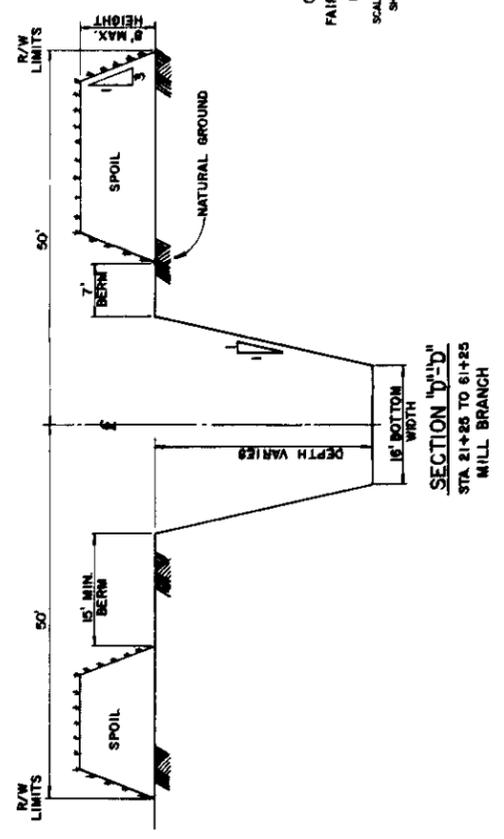
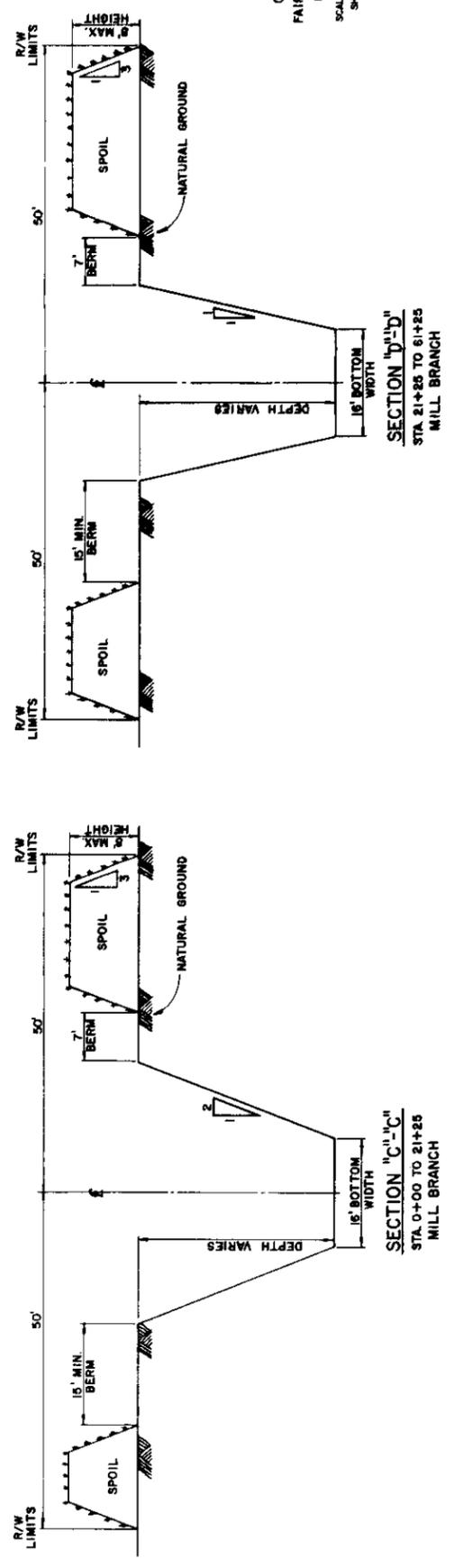
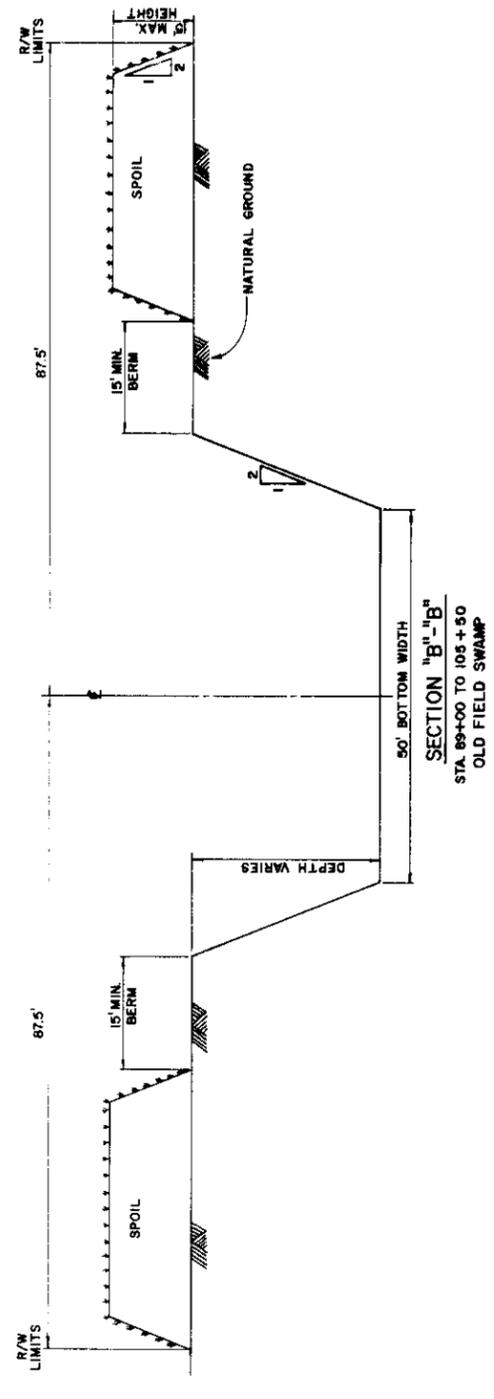
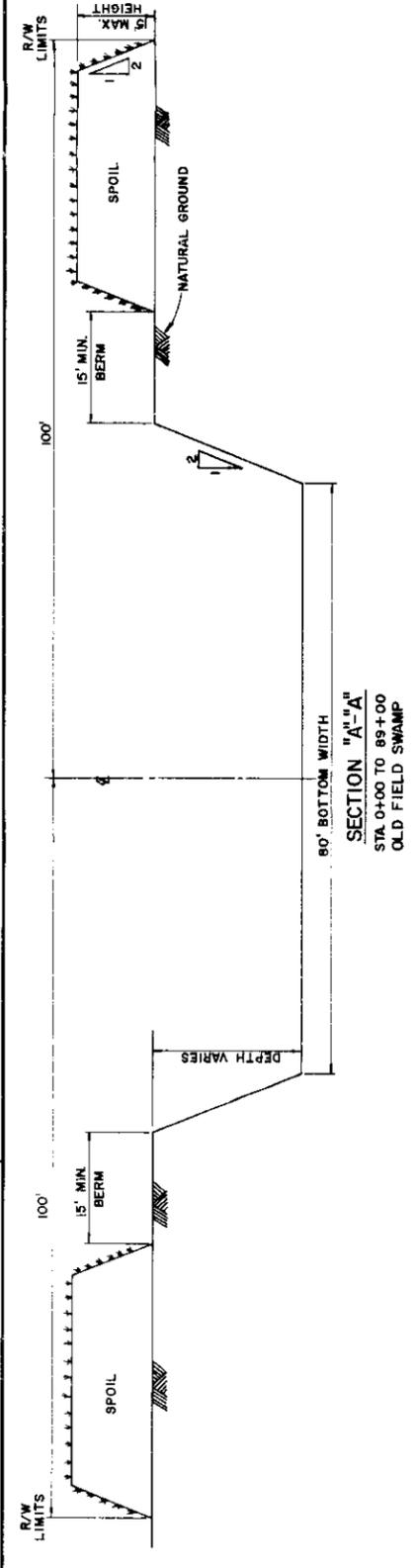
**OLD FIELD SWAMP  
 FAIRMONT, NORTH CAROLINA  
 GENERAL MAP**

SCALE AS SHOWN  
 SHEET NO. 1 OF 3 SHEETS

U.S. ARMY ENGINEER DISTRICT, CHARLESTON, S.C. SEPTEMBER 1967

SUBMITTED: <i>H.B. Sutherland</i> <small>CHIEF PROJECT          PLANNING BRANCH</small>	RECOMMENDED: <i>J.P. [unclear]</i> <small>CHIEF ENGINEERING          DIVISION</small>	APPROVED: <i>[Signature]</i> <small>COLONEL, CORPS OF ENGINEERS          DISTRICT ENGINEER</small>
DRAWN BY: <i>J.A.S.</i>	CHECKED BY: <i>J.A.S.</i>	FILE NO. 10003





- NOTES:
1. SECTIONS SHOWN ARE FACING DOWN STREAM.
  2. SPOIL AREA WIDTHS VARY DEPENDING UPON DEPTH OF CUT.
  3. PROVIDE A 100' LONG TRANSITION ZONE AT CHANGES IN CHANNEL WIDTH OR A CHANGE IN SIDE SLOPES. TRANSITION SHALL BE UPSTREAM OF INFLOW POINT.
  4. SEE SPECIFICATIONS FOR TREATMENT OF SPOIL BANKS.

OLD FIELD SWAMP  
FAIRMONT, NORTH CAROLINA  
CROSS SECTIONS  
SCALE: HORIZ. 1"=10' VERT. 1"=2'  
SHEET NO. 3 OF 3 SHEETS  
SEPTEMBER 1987

**Appendix C**  
1981 Old Field Swamp, Fairmont NC Recon Report

OLD FIELD SWAMP, TOWN OF FAIRMONT, ROBESON COUNTY, N.C.

SECTION 208 RECONNAISSANCE REPORT

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SAWEN-PP

20 May 1981

SUBJECT: Old Field Swamp, Town of Fairmont, Robeson County, N.C.;  
Section 208 Reconnaissance Report on Project Rectification

Division Engineer, South Atlantic  
ATTN: SADPD-P

#### AUTHORITY

1. A Reconnaissance Report on the current effectiveness of this earlier constructed project for flood damage reductions, and to determine appropriate measures to restore proper functioning of the project, has been prepared under the authority of Section 208 of the 1954 Flood Control Act, as amended. In compliance with ER 1105-2-50, South Atlantic Division was notified of study initiation by letter from SAWEN-P dated 8 January 1981, subject: "Old Field Swamp, Fairmont, North Carolina, Section 208 Study." This study was requested on 24 November 1980 by the Mayor of Fairmont, N.C., during a visit to the project by the Wilmington District Engineer.

#### PRIOR STUDIES AND WORK

2. The Charleston District prepared a Section 208 Report on Old Field Swamp, dated 5 May 1967. The recommended project provided for clearing and snagging and channel enlargement along 10,550 feet of Old Field Swamp, in and downstream from Fairmont, with bottom widths of 80 feet and 50 feet; and 6,125 feet of Mill Branch, a tributary through Fairmont, with a bottom width of 16 feet. Side slopes were 2 horizontal to 1 vertical on both streams, except for the upper 4,000 feet of Mill Branch where side slopes of 1 horizontal to 1 vertical were used. The benefit to cost ratio was 1.1 to 1.

3. Funds for preparing plans and specifications and for construction of the project were allotted on 16 June 1967 following project approval. A construction contract was awarded in September 1967 and the project work was completed in August 1968. A maintenance manual, dated December 1968, was prepared and provided local interests.

4. In 1979, the local project sponsor indicated that project disposal berms were not adequately shaped to provide access for maintenance equipment and that this represented a design deficiency which prevented them from properly maintaining the completed project. As a result of this, a condition report on Old Field Swamp, dated 19 September 1980, was prepared by Charleston District in response to a 10 July 1979 request from Congressman Charlie Rose, on behalf of the local sponsor. The study was limited to a comparison of existing project conditions to as-built conditions, and to a determination of whether or not adequate access was provided for maintenance

purposes. The report concluded that an adequate berm (15 feet wide, each side) had been provided on Old Field Swamp for maintenance access; and had the sponsor implemented a continuous maintenance program, adequate maintenance access could have been maintained.

#### BASIN AND STUDY AREA DESCRIPTION

5. Location. Old Field Swamp lies within the upper coastal plain region of North Carolina in southeastern Robeson County at the town of Fairmont. It is within the Pee Dee River Basin, but it flows into Hog Swamp and then Ashpole Swamp before reaching Lumber River. The Lumber River becomes the Little Pee Dee River at the North Carolina-South Carolina line. Fairmont is located about 8 miles north of the State line.

6. Topography. The topography in the project area, Fairmont and immediate vicinity, is rolling to flat with stream swamp flood plains being about 80 to 100 feet above mean sea level in elevation. Steep, fairly sharp escarpments generally mark the "break" from swamp to upland. Upland levels vary from about 100 to 125 feet above mean sea level, and the majority of the upland is cleared for agriculture. The stream swamps are entirely wooded. The unimproved streams are poorly defined and even low flows spread out over the swamp floor.

7. Drainage Areas. According to the U.S. Geological Survey publication, "Drainage Areas at Selected Sites on Streams in North Carolina," Raleigh, N.C., revised 1965, the Old Field Swamp drainage area at its mouth (confluence with Hog Swamp) is 22 square miles. The drainage area of Hog Swamp, some 4 miles downstream from its confluence with Old Field Swamp, is 65 square miles.

8. Soils. Upland soils are sands and sandy loams. Alluvium in the stream swamps consists of organic material mixed with the sands and silts.

9. Rainfall and Climate. Lumberton, 11 miles north of Fairmont, has an average annual rainfall of 45.5 inches. The average annual temperature is 63° F (source: Weather and Climate in N.C., NCSU Bulletin 396, Raleigh, NC, 1964).

10. Population and Development. The 1980 population of Fairmont, according to an interview on 8 May 1981 with local officials, is estimated around 3,000. The Fairmont High School was built in 1970 and is within a short distance of the Old Field Swamp project. Agriculture, primarily tobacco, continues to provide the economic base for Fairmont.

11. Flood History. While flooding and flood producing storms in the 1970s, since project provision, have not generally been severe, the potential for flood damages is essentially as great now as before the 1968 project was provided. This is because shrubs, trees, debris, and aquatic weeds block the channel to such an extent that flood stage reductions are no longer possible. Discharge values at the mouth of Old Field Swamp for several flood frequencies were computed in the 1967 report and are: 2 year, about

300 cubic feet per second (c.f.s.); 10 year, about 1,000 c.f.s.; 20 year, about 1,500 c.f.s.; and 100 year, about 4,100 c.f.s.

#### PROBLEMS UNDER INVESTIGATION

12. The primary problem investigated during this study was the failure of the earlier constructed project to provide the design level of flood protection, and to develop the most cost effective measures to rectify this situation. Flooding has occurred in the town of Fairmont during the 1960s and 1970s, affecting a majority of the 75 homes and businesses within the flood plain of Old Field Swamp and its tributary, Mill Branch.

13. Sanitation and health problems also result from the existing condition of the Old Field Swamp channel. The channel bottom along the project varies from 1 foot to 4 feet below the design bottom. The existing bottom at the lower end of the project is about 3 feet below the design grade, resulting in a ponding condition. Sewage treatment plant effluent enters the stream at the confluence of Old Field Swamp and Mill Branch, and algae bloom and aquatic weed growth is prevalent in this nutrient enriched reach.

14. Causes of Project Deterioration. A combination of factors over the years seem to have reduced the flood carrying capacity of the Old Field Swamp portion of the project to preproject conditions. The Mill Branch portion of the project is in excellent condition due to proper maintenance. The factors causing the reduced carrying capacity of Old Field Swamp are: (a) the 15-foot berms left adjacent to the channel for maintenance access have in many areas sloughed into the channel; (b) the berms were cleared areas that have become overgrown with shrubs and trees thereby limiting machine access for sediment removal from the channel; (c) no pipes were placed from the wet wooded areas in back of the spoil into the channel, thus creating deep ditches perpendicular to the channel. The existence of these ditches further limits continuous maintenance access to the channel. Also erosion of these ditches contributes to the sediment accumulating in the main channel; (d) chemical control of vegetation, tree sprouts, and aquatic vegetation has been curtailed significantly since the project was completed; and (e) beaver dams in and just downstream from the project severely reduce its capacity and essentially eliminate drainage.

#### STUDY OBJECTIVES

15. The study objectives are to develop measures to restore the initial project to design capacity, and to develop conditions so that permanent access is assured for future maintenance.

#### PLAN FORMULATION

16. The necessary element in any plan to assure positive drainage must be an unobstructed channel outlet with a continuous slope downward from the protected area. Another element must be a practical degree of

maintainability so that local interests may reasonably meet their responsibilities for maintenance and operation of the project.

### INVESTIGATIONS

17. Field surveys of the area downstream from the project were conducted to determine if adequate grade could be obtained to assure a positive low flow drainage outlet. Interviews were held with local officials and citizens to determine existing damage patterns and the history of maintenance difficulties. The Robeson County representative of the Soil Conservation Service, U.S. Department of Agriculture, also provided valuable information on design and maintenance history of several similar projects in the county.

### DESIGN CRITERIA

18. The initial project design was selected based on maximum net benefits. The channel which met this criterion contained within its banks the 10 year flood (a flood that, on the average, has a 10 percent chance of occurring during any year). The 10-year design channel would give flood protection from the 30-year flood ( a flood that, on the average, has a 3-1/3 percent chance of occurring during any year) and smaller floods if the project was now functioning as designed and constructed. A larger channel, to contain the 25-year flood (a flood that, on the average, has a 4 percent chance of occurring during any year), was considered but it would have required more right-of-way through town and was not economically justified.

19. The design criteria for measures to rectify existing conditions and restore the initial project to design performance consist of the minimum work necessary to:

- a. Achieve a positive drainage outlet.
- b. Eliminate ponding.
- c. Provide access for sustained maintenance on the east bank and within the initial channel.
- d. Minimize adverse environmental effects.
- e. Improve health and social conditions.

### PROJECT PLAN

20. The plan developed to meet the objectives is as follows:

- a. The physical changes that need to be made consist of excavating a 6-foot-wide pilot channel on Hog Swamp, the receiving stream for Old Field Swamp, beginning about 6,000 feet downstream from the confluence. Surveys of Hog Swamp consisting of partial valley cross sections across the wooded swamp revealed the absence of a main channel, but did determine the low and normal ground elevations along the swamp floor. Adequate slope (2 ft/mi) is available, and the pilot channel could be

brought upstream to tie into the 80-foot channel at bottom elevation about 80.5 ft. m.s.l. (existing bottom elevation is about 81.5 feet at the lower end of the 80-foot channel). The pilot channel, 6 feet wide and 2 feet deep, would be excavated upstream to a point near the end of the Old Field Swamp portion of the project at State Road 130.

b. It would be necessary to clear vegetation from the east bank along 9,131 feet of Old Field Swamp on the berm and spoil. Then a small bulldozer would spread a 2-foot thick layer of old spoil on the berm and reshape a 20-foot-wide travelway for machine access. The pilot channel would be excavated by dragline or backhoe and material placed on the old spoil pile. No disturbance of vegetation would occur on the west bank so that stream shade would be preserved. When the pilot channel had drained the remainder of the 80-foot-bottom channel, it would be dry enough to permit access. The willows and other vegetation then could be removed and burned by the local sponsor. Pipes would be placed under the travelway and spoil piles.

c. The 6,000 feet of work on Hog Swamp would be done by clearing about 35 feet of the hardwood saplings growing there. A dragline or backhoe would be used to dig the 6-foot pilot channel, and spoil would be placed on the east side to form a travelway and discontinuous spoil banks. Pipes may be necessary to permit lateral drainage. Channel alignment would be selected to avoid having to cut large trees.

#### **HYDROLOGY AND HYDRAULICS**

21. No change has occurred in the hydrologic regime since the 1967 report. The hydraulic conditions stated in the 1967 report will be restored by the measures recommended in this report, and the channels will again have capacity to convey 10-year design peak discharges within banks.

#### **ESTIMATES OF PROJECT FIRST COSTS**

22. The estimated first costs of the pilot channel project, based on April 1981 price levels, are shown in Table 1.

TABLE 1

Project First Costs

<u>Item</u>	<u>Amount</u>
<u>Federal Project Construction</u>	
Clearing - 12 acres @ \$1,000. . . . .	\$12,000
Travelway Shaping - bulldozer/12 days @ \$400. . . . .	5,000
Excavation - Old Field Swamp/7,000 cu yds @ \$3. . . . .	21,000
Excavation - Hog Swamp/4,600 cu yds @ \$4. . . . .	18,000
Grassing - travelway and spoil, Old Field Swamp 7 acres @ \$6000. . . . .	4,000
Corrugated metal pipe, 18" dia/1200 ft @ \$12/ft	14,400
Subtotal. . . . .	\$74,400
Contingencies . . . . .	7,600
Engineering and Design. . . . .	3,000
Supervision and Administration. . . . .	3,000
Total Construction Costs. . . . .	\$88,000
<u>Other</u>	
Real Estate, Easements, etc.	1,000
Total Project First Costs	\$89,000

23. Annual charges were computed for a 30-year amortization period at 7-3/8 percent interest rate. A summary of annual charges is shown in Table 2.

TABLE 2

Annual Charges

<u>Item</u>	<u>Interest/Amortization</u>	<u>Total</u>
Pilot Channel - Construction	\$7,360	\$7,360
Pilot Channel - Other	80	80
Maintenance - Total Project	-	5,000
Total Annual Charges		\$12,440

**MAINTENANCE**

24. Anticipated maintenance work to be done by local sponsors after project rectification by pilot channel and travelway clearing and construction, is expected to consist of annual mowing of grassed travelway; excavation of shoals and debris from the main channel and pilot channel annually; control of aquatic weeds probably by chemicals, as needed; and control of shrub growth such as willows and other species that grow within the channel on channel banks or on the travelway. Equipment to mow and excavate may be owned by Fairmont, or could be rented as needed. Some chemicals that have been registered with the Environmental Protection Agency (EPA) as not being harmful if used in the intended environment are shown below.

<u>Product</u>	<u>Registered for Ditch Banks</u>	<u>Registered for Aquatic Weeds</u>	<u>Intended Use</u>
Dimethylene 2,4D	Yes	No	Shrubs on banks
Weed R 64	?	Yes	Water hyacinth
Diquat	?	Yes	Aquatic Weeds
Round Up	No	Yes	Brush killer
Fenac	Yes	Yes	Aquatic weeds and some shrubs

This information on registration and intended use was obtained from Mr. Dick Monford, EPA Herbicides Branch, Washington, D.C., FTS: 557-7070. Mr. Monford stressed that the effectiveness of these chemicals for use in Old Field Swamp would have to be determined from N.C. State University or other sources, or by trial and error. Other more appropriate chemicals may also be registered and available.

25. Beavers are within the project area, and it will be the responsibility of the sponsors to prevent beaver dams being constructed which will interfere with the proper functioning of the project. Relocation or extermination may be required. The N.C. Wildlife Resources Commission, which may have been involved in beaver restocking efforts, may provide assistance in addressing this problem.

#### ESTIMATES OF BENEFITS

26. According to the May 1967 report on the initial project, flood stage reduction benefits were estimated at \$7,390. Measures recommended as the currently proposed project would restore the level of protection originally afforded by the initial project. Current benefits were updated from May 1967 to April 1981, using a factor (3.26) derived from the Engineering News Record Building Cost Index Values for these months (1059 and 3452, respectively). Current annual benefits are estimated at \$24,090.

27. Benefit-to-Cost Ratio. The average annual benefits are \$24,090 and the annual costs (charges) are \$12,440. The ratio of benefits to costs for the currently recommended improvement is 1.9.

#### COST APPORTIONMENT

28. All benefits result from the reduction of flood damages. Therefore, construction costs are Federal costs. Other costs, consisting of real estate easements, etc., and maintenance are to be borne by the local sponsor, which is the town of Fairmont.

#### SOCIAL CONSIDERATIONS

29. The measures considered here to reduce the flooding and associated damages would not involve changes in the community social structure. A majority of the work would occur on existing project right-of-way on Old Field Swamp, and the work on Hog Swamp would only require easements to improve drainage. No removal of lands from tax rolls would result where easements are required.

30. Community cohesion and property values would not be significantly disturbed, nor would public services and facilities, manmade resources, and agricultural activities. Employment, community growth, and regional growth would not be adversely affected. In fact, benefits would likely accrue in some of these areas.

#### ENVIRONMENTAL ASSESSMENT

31. a. Description of Proposed Action. In accordance with Section 208 of the 1954 Flood Control Act, the Corps of Engineers is proposing to rectify problems which have developed on the Old Field Swamp project which was constructed in 1968. Work would consist of clearing 9,131 feet of the existing spoil bank, constructing a maintenance access travelway along this reach by reshaping existing spoil, and excavating a pilot channel with 6-foot bottom width, 2 feet deep, 2 to 1 side slopes within the bottom of the existing 80-foot bottom width channel. The pilot channel, with the same dimensions, would be extended 6,000 feet along Hog Swamp, downstream from the lower end of the Old Field Swamp project. Clearing widths would be about 35 feet. About 7 acres would be cleared of sapling, shrub, and briar growth along Old Field Swamp. About 5 acres would be cleared of saplings, predominantly red maple, black gum, sweet gum, and ash, along Hog Swamp. Channel alignment would vary along Hog Swamp so as to avoid removal of any large trees.

b. Environmental Setting. The environmental setting consists of a disturbed area of existing project right-of-way and cutover timberland.

c. Significant Resources.

(1) Wetlands. The work along Old Field Swamp would not be in wetlands since old spoil material occupies the work area. The Hog Swamp portion would be in wetlands even though there is no discernible main channel along the swamp floor. The wooded swamps constitute a majority of the woodland in the immediate project area. Forest species present are black gum (Nyssa sylvatica), red maple (Acer rubrum), ash (Fraxinus sp.), bald cypress (Taxodium distichum), and willow (Itea virginica). These cutover wetlands support a wide assemblage of wildlife.

(2) Endangered Species. At present, no species listed as endangered or threatened have been documented as occurring in the project impact area.

(3) Game Species. The fish population is minimal or absent in the project area due to absence of a main channel on Hog Swamp and due to low water quality on Old Field Swamp. Beavers are present and some waterfowl are found in the beaver ponds constructed in the project area. Rabbit, squirrel, and quail are found in the uplands on the swamp perimeter.

(4) Cultural Resources. It is not known if cultural resources exist in the project area. The prehistoric archaeological record of the area is unknown. Surveys would be conducted prior to construction, but the already highly disturbed area along Old Field Swamp and the swampy nature

of Hog Swamp make it unlikely that cultural or archaeological resources are present.

(5) Scenic Values. The existing condition of stagnant, algae-ridden water in the swamp detracts from the scenic value of the project area. Reestablishing a properly functioning project will improve scenic value.

d. Environmental Impact of the Proposed Action. Implementation of the proposed project will alleviate the flood problem of Fairmont, and improve health conditions by removing stagnant water and mosquito habitat, and restoring drainage and flood flow capacity.

Construction of the pilot channel will create some short-term turbidity.

Beaver dams would be destroyed, and the beavers would be trapped and either relocated or exterminated as part of the maintenance program.

Loss of shrub and sapling growth (7 acres on Old Field Swamp and 5 acres on Hog Swamp) will reduce this habitat by a minor amount.

Game species would be unaffected by the proposed action.

A temporary increase in noise level during construction is unavoidable.

e. Impact on Significant Resources. Since the project involves only minor channel modification and no significant tree removal, impacts to significant resources will be minor. The functions and productivity of the project area wetlands should be unaffected.

f. Environmental Effects of Alternatives. The no action alternative will result in adverse environmental impacts, since stagnant water will continue to pond close to the town. Larger channels would result in more significant impacts on forest and wetland resources, but such channels would not be appropriate to address the existing need.

g. Relationship of Plans to Environmental Requirements. Determination of degree of compliance with the various Federal, State and local policies would be determined prior to completing the final report.

h. Section 404(b) Analysis Results. No Section 404(b) work has been done at this time. If this draft report is approved, the Section 404(b) activities would be accomplished. The North Carolina Section 401 certificate would be requested and obtained before final report preparation.

i. Irreversible and Irretrievable Commitment of Resources. The project, as presently planned, should not involve any irreversible or irretrievable commitments of the natural resources of the project area. Energy and labor required to implement the proposed project are irretrievable.

j. Assessment Findings. This environmental assessment revealed that the long-term effects of construction would be small, that disruption of

fish and wildlife resources would be short lived and small, and that there would be no significant adverse impacts to cultural resources, air and water quality, or other environmental elements. For these reasons, it was determined that no Environmental Impact Statement (EIS) was required.

k. Recipients of the Assessment. If this draft report is approved, the report and assessment and 404(b) public notice will be circulated for review and comment to all concerned agencies and the public for 30 days.

#### **SUMMARY OF PUBLIC INVOLVEMENT**

32. Congressman Rose called and conducted a public meeting in Fairmont on 3 July 1979 to discuss drainage problems there stemming from the Old Field Swamp and Mill Branch flood control project. A request was made for the Corps to conduct a brief study of the project to determine whether or not there were design deficiencies in the original project. Congressman Rose also requested a study to determine what action needs to be taken so that the situation can be resolved as soon as possible.

33. On 16 November 1979 Corps representatives met in Fairmont with town officials to discuss the condition of the Old Field Swamp project. Local officials indicated that the placement of excavated material during construction prevented access to the project for maintenance operations. Adequate maintenance had been provided on Mill Branch. Substantial flooding occurred in Fairmont in the fall of 1979, mostly in the Mill Branch headwaters. The Corps representatives advised that funds had been requested to investigate maintenance problems. The condition report was completed on 19 September 1980, shortly after responsibility for this project was transferred to Wilmington District.

34. The Wilmington District Engineer visited Fairmont on 24 November 1980 and reviewed the Old Field Swamp situation with the Mayor and other town officials. The District Engineer agreed to conduct a limited reconnaissance study to determine if there is a further Federal interest in project rectification.

#### **COORDINATION WITH OTHER AGENCIES**

35. This study has been informally coordinated with the Soil Conservation Service, U.S. Department of Agriculture, and the Office of Water Resources of the N.C. Department of Natural Resources and Community Development. If a final study is authorized, the study will be coordinated with all interested State and Federal agencies.

#### **POLICY CRITERIA ON CORRECTION OF PROJECT DEFICIENCIES IN COMPLETED PROJECTS**

36. Policy criteria are contained within SADEN-G letter of 10 April 1981, subject: "Correction of Project Deficiencies in Completed Projects that are Operated and Maintained by Local Interests," and the inclosed letter and policy summary from DAEN-CWR-R, dated 31 March 1981, same subject. Paragraph 7 of the policy summary lists five conditions which must be met if the work to correct a design or construction deficiency may be recommended for accomplishment under existing project authority

without further Congressional authorization. The measures recommended for accomplishment to rectify the current situation meet all of the prescribed conditions:

a. Work is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner.

b. Work is not required because of changed conditions. No increased development or change in the hydrologic regime has occurred which affects the project.

c. The work is generally limited to the existing project features. The scope or function of the authorized project are not changed.

d. The work is justified by health, safety, and economic considerations.

e. The work is not required because of inadequate local maintenance. The berms, which may have been adequate immediately after construction, soon sloughed and grew heavy shrub cover. Chemical control of vegetation, by 2,4,5-T and other chemicals, had been planned for use by the local sponsor at the time of project acceptance. This option was closed a few months after project completion by the U.S. Environmental Protection Agency's prohibiting the use of 2,4,5-T in 1970. Many other chemicals, at about the same time, were listed as questionable. The combination of rapidly changing physical conditions along the stream, and the prohibition of chemical use, resulted in an impossible to maintain condition. Hand labor used one summer in the mid 70's for channel maintenance resulted in very high labor costs and slow production. The results of this work were not evident in March 1981. "Maintainability," except for a short period following construction, seems to have been missing from the initial project.

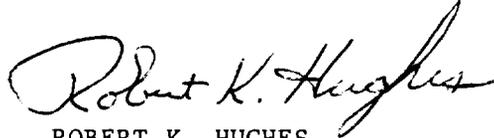
#### CONCLUSIONS

37. It is concluded that there is a Federal interest in rectification of the Old Field Swamp project. It is further concluded that a flood problem exists in Fairmont approximately as severe as prior to construction of the initial project, and that returns are not being received of Federal and local investment. The work as described in this report is needed to restore the integrity of the initial project. The recommended project measures are sound from engineering, economic, social, and environmental standpoints, and meet the criteria for project provision. The preparation of a final report is warranted. A cost estimate for preparing the final report is shown as Exhibit A. Work sequence diagrams for FY 82 are shown as Exhibit B. It is estimated that the final report could be completed in five months.

#### RECOMMENDATIONS

38. The District Engineer recommends that this report be approved, and that funds in the amount of \$10,000 be provided to complete the environmental assessment; to comply with the requirements of Section 404(b); to coordinate the draft report, environmental assessment, and

404(b) public notice; and prepare the final report for rectification of the small flood control project on Old Field Swamp, Fairmont, Robeson County, North Carolina, to be accomplished under authority of Section 208 of the 1954 Flood Control Act, as amended.

A handwritten signature in cursive script that reads "Robert K. Hughes". The signature is written in black ink and is positioned above the typed name and title.

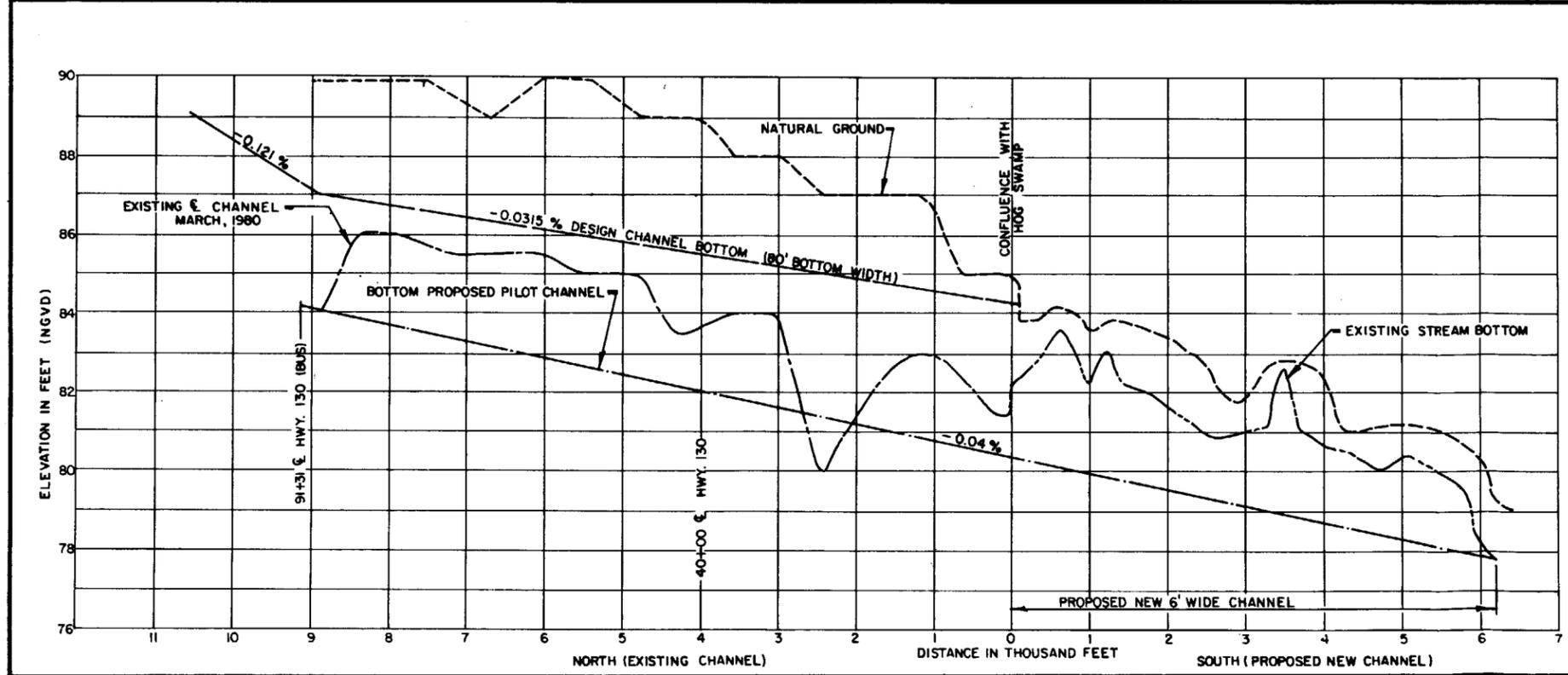
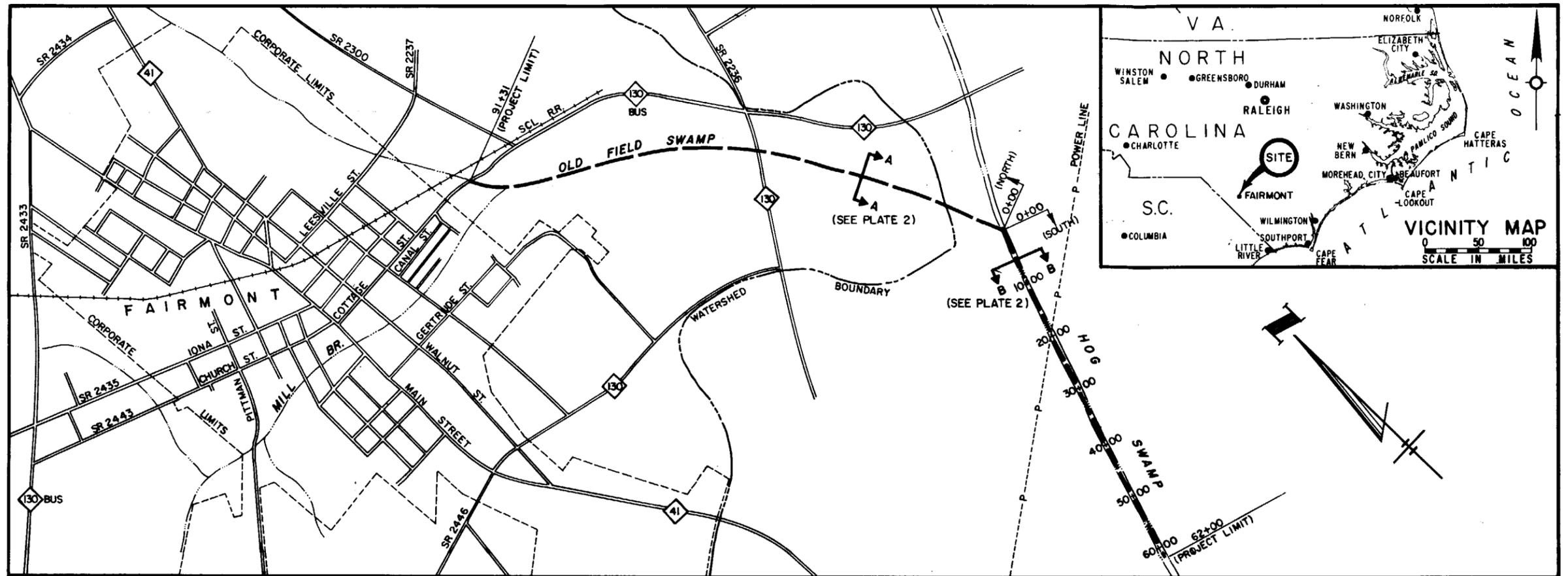
ROBERT K. HUGHES  
Colonel, Corps of Engineers  
District Engineer

STUDY COST ESTIMATE

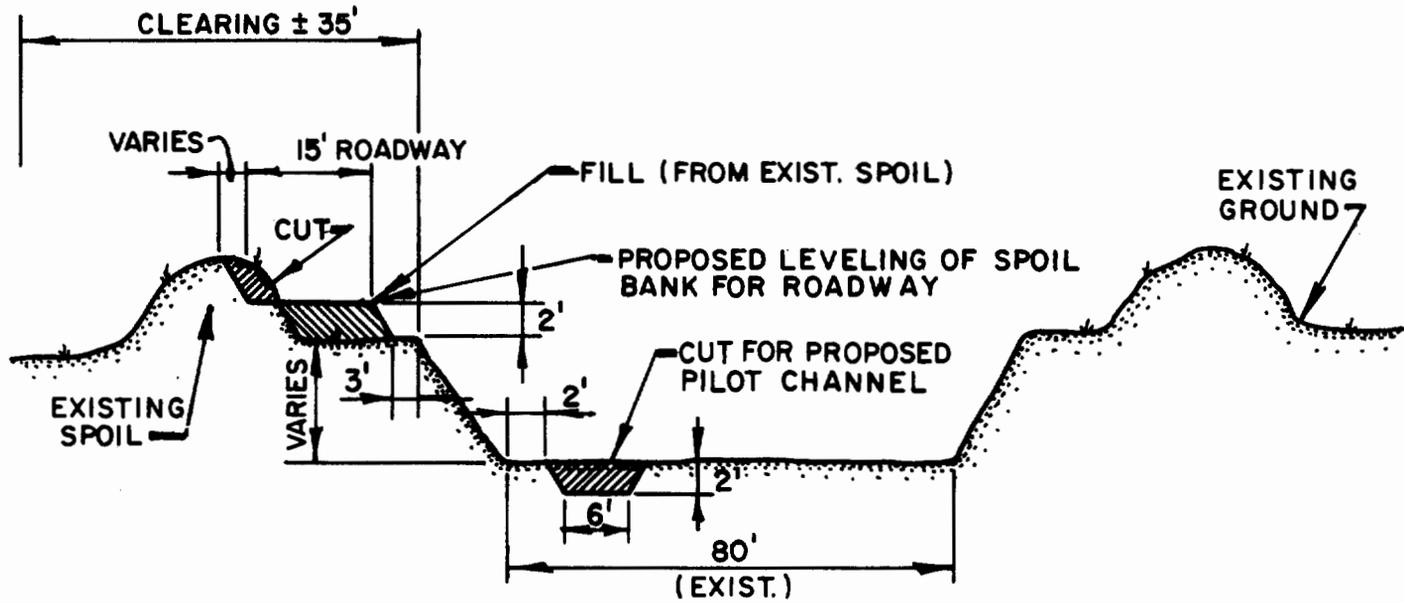
OLD FIELD SWAMP, NORTH CAROLINA

<u>Task Description</u>	<u>Stage 1</u>	<u>Stages 2 &amp; 3</u>	<u>Total</u>
Prepare Reconnaissance Report	\$5,000		\$ 5,000
Public Involvement		\$ 500	500
Environmental Studies		4,500	4,500
Fish and Wildlife Studies		1,000	1,000
Design and Cost Estimates		500	500
Study Management		1,000	1,000
Report Preparation		2,000	2,000
Supervision & Administration	<u>          </u>	<u>500</u>	<u>500</u>
	\$5,000	\$10,000	\$15,000

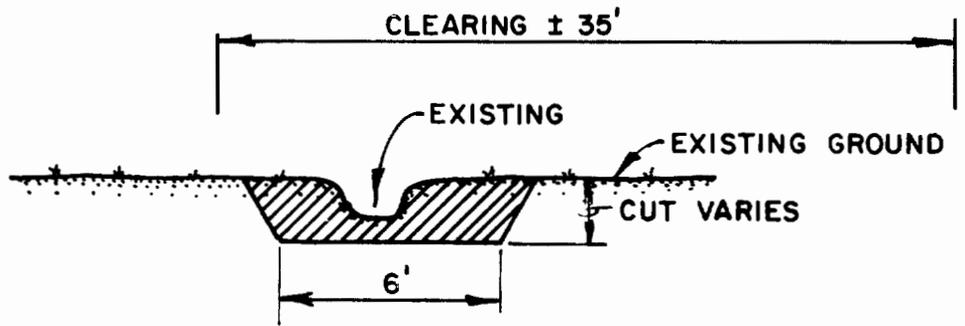
EXHIBIT A



OLD FIELD SWAMP  
 FAIRMONT, ROBESON COUNTY, NORTH CAROLINA  
**STUDY AREA PLAN  
 AND PROFILES**  
 1000 0 1000 2000 3000  
 SCALE IN FEET  
 U.S. ARMY ENGINEER DISTRICT, WILMINGTON, N.C. 7 APRIL 1981  
 DRAWN BY: WHW  
 CHECKED BY: WRC, RAP



**SECTION A-A**  
NOT TO SCALE



**SECTION B-B**  
NOT TO SCALE

NOTE: SIDE SLOPES ON PROPOSED CHANNEL CUTS TO BE 2H TO 1V

OLD FIELD SWAMP  
FAIRMONT, ROBESON COUNTY, NORTH CAROLINA

## SECTIONS

U.S. ARMY ENGINEER DISTRICT, WILMINGTON, N.C. 7 APR 1941

DRAWN BY: WHW  
CHECKED BY: WRC, RAP

PLATE :

EXPENDITURES SCHEDULE FOR FY 82 - \$ 10,000 STUDY/PROJECT NAME OLD FIELD SWAMP, NC SECTION 208

