FLOODS
ON
RICHLAND CREEK
AND
TRIBUTARY STREAMS
IN VICINITY OF
WAYNESVILLE
AND
HAZELWOOD
NORTH CAROLINA

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

FLOODS
ON
RICHLAND CREEK
AND
TRIBUTARY STREAMS
IN VICINITY OF
WAYNESVILLE AND HAZELWOOD
NORTH CAROLINA

Report No. 0–6801

KNOXVILLE, TENNESSEE
MARCH 1970

CONTENTS

CONTENTS (Continued)

TABLES

TABLES (Continued)

PLATES

FIGURES

FOREWORD

Tennessee Valley Authority
Division of Water Control Planning

FOREWORD

This report relates to the flood situation along Richland Creek, Raccoon Creek, Camp and Browning Branches, and Allen Creek in the vicinity of Waynesville and Hazelwood, North Carolina. It has been prepared at the request of the town of Waynesville through the North Carolina Department of Water and Air Resources to aid (1) in the solution of local flood problems and (2) in the best utilization of land subject to overflow. Data assembled by TVA on rainfall, runoff, historical and current flood heights, and other technical information bearing upon the occurrence and magnitude of floods in localities throughout the region provide the basis for this report.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of the two towns in arriving at solutions to minimize vulnerability to flood damages. This might involve (1) the construction of flood protection works, (2) local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, or (3) a combination of the two approaches.

The report covers three significant phases of the Waynesville and Hazelwood flood problem. The first brings together a record of the largest known floods of the past on Richland Creek, Raccoon Creek, Camp and Browning Branches, and Allen Creek. The second treats of Regional Floods. These are derived from consideration of the largest floods known to have occurred in the same general geographical region as the four streams and generally within 60 miles of Waynesville and Hazelwood. The third develops the Maximum Probable Floods for these streams. Floods of this magnitude on most streams are considerably larger than any that have occurred in the past. They are the floods of infrequent occurrence that are considered in planning protective works, the failure of which might be disastrous.

The report contains maps, profiles, and cross sections which indicate the extent of flooding that has been experienced and that might occur

in the future in the vicinity of Waynesville and Hazelwood. This should be useful in planning future developments in the flood plains. Structures or building floor levels may be planned either high enough to avoid flood damage or at lower elevations with recognition of the chance and hazards of flooding that are being taken.

I.

SUMMARY

OF

FLOOD SITUATION

I.

SUMMARY OF FLOOD SITUATION

Waynesville and Hazelwood, North Carolina, are located in the valley of Richland Creek about 7 miles above its confluence with the Pigeon River. Raccoon Creek, a tributary with a drainage area of 8.9 square miles, flows into Richland Creek 1.6 miles downstream from the lower limits of Waynesville. Camp Branch and its tributary Browning Branch flow through a portion of Waynesville and join Richland Creek in Hazelwood. Camp Branch has a drainage area of 5.0 square miles. Allen Creek, a tributary with a drainage area of 16.9 square miles, joins Richland Creek at the upper limits of Waynesville.

This investigation covers Richland Creek from the U. S. Highway 19 bridge at Mile 3.8 to Mile 10.0, Raccoon Creek from the mouth to Mile 1.9, Camp and Browning Branches from the mouth to Mile 2.5, and Allen Creek from the mouth to Mile 1.8.

Much of the residential, commercial, and industrial development of Waynesville and Hazelwood is located on the flood plains of Richland Creek and its tributaries. Portions of this land have been inundated by floods of the past, and a substantially greater area is within reach of the greater floods of the future.

Records of streamflow on Richland Creek are limited to a nine-month period of staff gage records in 1944 and 1945, and no records have been maintained on Raccoon Creek or Camp Branch. Since August 1949 the U. S. Geological Survey has maintained a recording gage on Allen Creek 1.2 miles above the upper limit of this study. Longer records of stages and discharges are available on streams with watersheds adjoining that of Richland Creek. The Geological Survey has maintained a gage on Jonathans Creek near Cove Creek, about 9 miles north of Waynesville, since May 1930 and has maintained gages on Scott Creek at or near Sylva, 15 miles southwest of Waynesville, since May 1928.

In compiling a record of the early floods on the streams, it has been necessary to interview residents along the streams who have knowledge of past floods and to conduct research in newspaper files and historical documents. From these investigations and from studies of possible future floods

on the streams in the vicinity of Waynesville and Hazelwood, the flood situation, both past and future, has been developed. The following paragraphs summarize the significant findings with regard to the flood situation which are discussed in more detail in succeeding sections of the report.

* * *

THE GREATEST FLOOD known to have occurred in recent years on the streams in the vicinity of Waynesville and Hazelwood was on August 30, 1940. During such a flood there is considerable overflow with high velocities along the streams.

* * *

OTHER LARGE FLOODS on streams in the vicinity of Waynesville and Hazelwood occurred in January 1957, January 1959, and March 1965.

* * *

REGIONAL FLOODS on Richland Creek, Raccoon Creek, Camp Branch, and Allen Creek in the vicinity of Waynesville and Hazelwood are based upon floods experienced on streams within 60 miles of the towns, a number of which are larger than any known floods on the four streams. This indicates that greater floods than those experienced so far may reasonably be expected in the future. Based upon the magnitude of floods that have occurred on neighboring streams, a Regional Flood may occur on Richland Creek that would be from 3 to 13 feet higher than the March 26, 1965, flood in the vicinity of Waynesville and Hazelwood. On Raccoon Creek a Regional Flood would be 4 to 14 feet higher than the February 2, 1969, flood. On Camp and Browning Branches a Regional Flood would average about 7 feet higher than the low-water profile, but would range from about 4 feet to 10 feet higher. A Regional Flood on Allen Creek would average about 6 feet higher than the 1965 flood and would range from 4 to 12 feet higher.

* * *

MAXIMUM PROBABLE FLOOD determinations indicate that floods could occur on Richland Creek that would exceed the March 26, 1965, flood in the vicinity of Waynesville and Hazelwood by 6 to 20 feet. On Raccoon Creek the Maximum Probable Flood would be 6 to 18 feet higher than the February 1969 flood, averaging about 11 feet higher. The Maximum Probable Flood on Camp and Browning Branches would be higher than the low-water profile by 6 to 12 feet,

averaging about 9 feet higher. On Allen Creek the Maximum Probable Flood would average about 8 feet higher than the 1965 flood, ranging from 5 to 14 feet higher.

* * *

FLOOD DAMAGES that would result from a recurrence of floods as large as that of 1940 on the streams in the vicinity of Waynesville and Hazelwood would be greater than in 1940 because of the increased development on the flood plains, particularly along Richland Creek. Historical floods on Raccoon Creek, Camp Branch, and Allen Creek have not caused great damage, but extensive damages would be caused along all four streams by the Regional and Maximum Probable Floods because of their greater depths and velocities.

* * *

MOST FREQUENT FLOOD OCCURRENCES on the streams in the vicinity of Waynesville and Hazelwood have resulted from general heavy rainfall in winter and spring months, December through March, and in the month of August. However, large floods may occur any time.

* * *

VELOCITIES OF WATER during the March 26, 1965, flood ranged up to 12 feet per second in the channel and 3 feet per second on the flood plain of Richland Creek. Along Raccoon Creek, velocities during the February 2, 1969, flood were up to 7 feet per second in the channel and 2 feet per second on the flood plain. During the 1965 flood on Allen Creek, channel and flood-plain velocities ranged up to 9 and 2 feet per second, respectively. On Camp and Browning Branches, velocities during the 1965 flood were probably about the same as the velocities on Allen Creek. During a Maximum Probable Flood, velocities in the channel would range up to 22 feet per second on Richland Creek, 15 feet per second on Raccoon Creek, 28 feet per second on Camp and Browning Branches, and 16 feet per second on Allen Creek. On the flood plain the corresponding figures would be 7, 5, 8, and 4 feet per second, extremely dangerous to life and property.

* * *

DURATION OF FLOODS is relatively short on all streams in the vicinity of Waynesville and Hazelwood. During a Maximum Probable Flood on Richland

Creek, the stream would rise 17 feet in 5 hours with a maximum rate of rise of 4 feet per hour, remaining out of banks for about 36 hours. On Raccoon Creek the Maximum Probable Flood would rise 13 feet in 3 hours with a maximum rate of rise of 5 feet per hour, and the stream would remain out of banks for 11 hours. Camp Branch would rise 8 feet in 3 hours with a maximum rate of rise of 4 feet per hour during a Maximum Probable Flood. It would remain out of banks for 7 hours. On Allen Creek the Maximum Probable Flood would rise 12 feet in 4 hours with a maximum rate of rise of 5 feet per hour, and the stream would remain out of banks for 16 hours.

* * *

HAZARDOUS CONDITIONS would occur during large future floods as a result of the rapidly rising streams, high velocities, and deep flows.

* * *

FUTURE FLOOD HEIGHTS that would be reached if floods of the magnitude of the Regional and Maximum Probable occurred in the vicinity of Waynesville and Hazelwood are shown in Table 1. The table compares these flood crests with the crest of the March 26, 1965, flood at each location on Richland Creek and Allen Creek, and with the crest of the February 2, 1969, flood on Raccoon Creek. On Camp Branch, the height of the Regional and Maximum Probable Floods above low water is shown.

TABLE 1

RELATIVE FLOOD HEIGHTS

Flood	Location	Mile above Mouth	Estimated Peak Discharge cfs	Above 1965 or 1969 Flood feet
	Richland Creek			
March 26, 1965	Depot Street	6.61	4,700	0.0
Regional			18,000	6.7
Maximum Probable			40,000	9.4
March 26, 1965	U. S. Highway 23, business	9.26	1,800	0.0
Regional			8,600	7.1
Maximum Probable			20,000	10.9
	Raccoon Creek			
February 2, 1969	U. S. Highway 23, business	0.52	900	0.0
Regional			10,800	14.2
Maximum Probable			17,000	16.4
	Camp Branch			
September 1969 (low water)	U. S. Highway 23, business	0.74	-	0.0
Regional			8,200	8.0
Maximum Probable			11,000	8.7
	Allen Creek			
March 26, 1965	U. S. Highway 23, business	0.28	1,600	0.0
Regional			14,500	7.0
Maximum Probable			25,000	7.6

II.

THE WATERSHED AND REGION

II.

THE WATERSHED AND REGION

Waynesville and its adjoining community of Hazelwood are located on Richland Creek 6 to 9 miles upstream from the mouth. Waynesville is the county seat of Haywood County. Richland Creek is joined by Allen Creek and Camp Branch within the area contained by the two towns. Browning Branch is a tributary of Camp Branch. Raccoon Creek joins Richland Creek 1.6 miles below the downstream corporate limit of Waynesville. Richland Creek, the largest tributary of the Pigeon River, flows in a generally northeasterly direction to join that stream two miles downstream from Clyde, North Carolina. Pigeon River is a part of the drainage system of the French Broad River which joins Holston River to form the Tennessee River at Knoxville, Tennessee. This section of the report includes a brief history of the region and descriptions of the streams and watersheds covered by this report.

Settlement

The land which constitutes Haywood County was considered Cherokee Indian land until 1783 when the North Carolina General Assembly declared it open to settlement by the white man. The territory was first considered a part of Burke and Rutherford Counties. In 1792 Buncombe County was formed including all the land in North Carolina lying west of the Blue Ridge. By 1800 there was the beginning of a town along Richland and Raccoon Creeks with the name of Mount Prospect.

Haywood County was formed by Act of the North Carolina General Assembly in 1808. Mount Prospect, soon to be renamed Waynesville, was the county seat. At its inception the county contained all of what is now the counties of Haywood, Jackson, Macon, Swain, Graham, Cherokee, and Clay. The present boundaries of the county date from the formation of Jackson County in 1851.

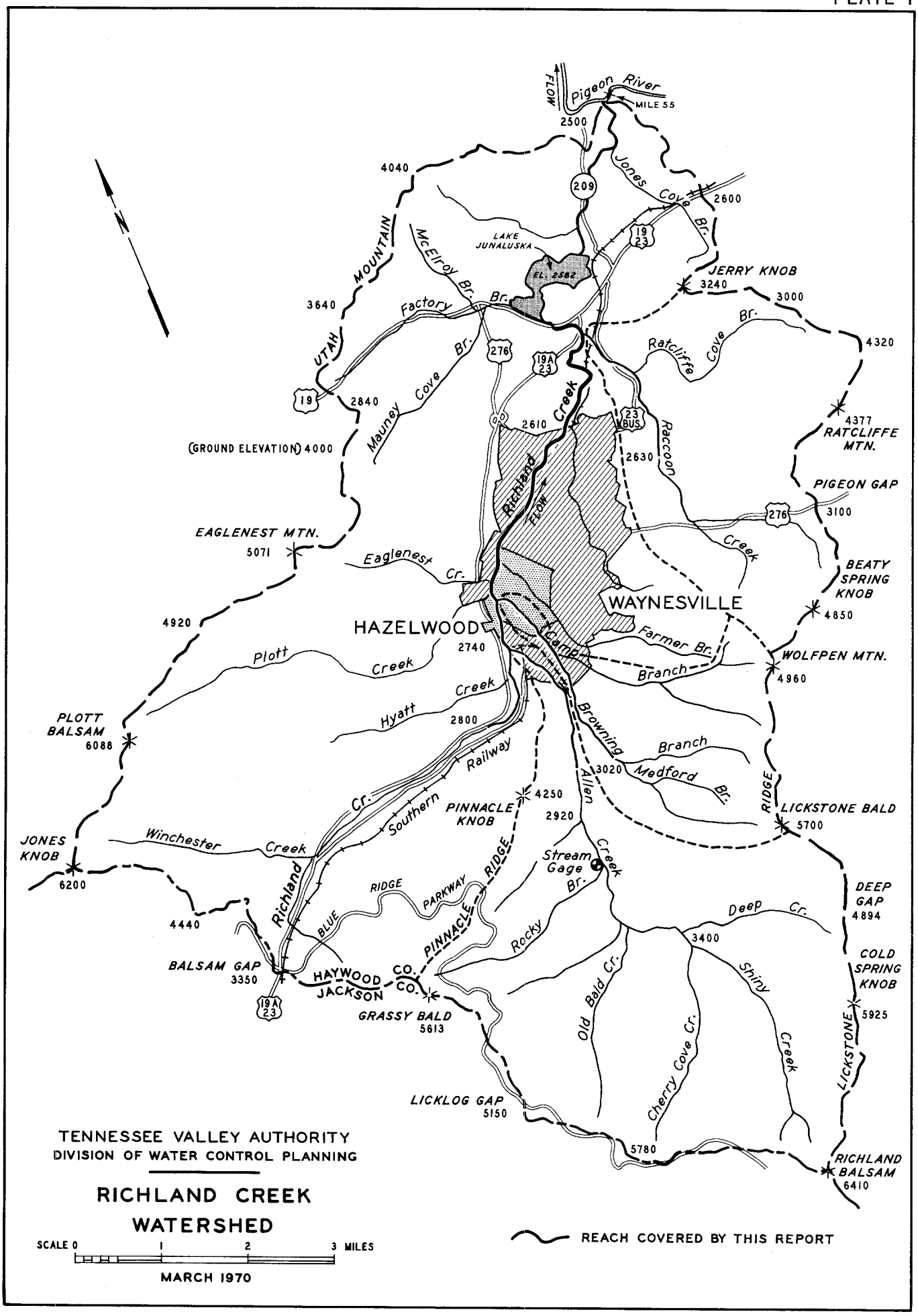
Haywood County takes its name from John Haywood, an early Treasurer of North Carolina. Waynesville was named for General Anthony Wayne of Revolutionary War fame. Waynesville was incorporated in 1871

with a population of less than 200. Hazelwood was incorporated in 1905. The 1960 Census gives a population of 6,159 for Waynesville, 1,925 for Hazelwood, and 39,711 for Haywood County.

The early development of Haywood and its neighboring counties was hampered by poor transportation and communication. The first markets for produce of the area were through Asheville, North Carolina, and Greenville, South Carolina, over primitive wagon roads. Railroad service came to Asheville from the east in 1880. A rail line being built from Asheville westward to Murphy reached Haywood County at Canton in January 1882 and was completed to Waynesville later that same year. By 1891 rail service was available from the county to the west through Murphy and to the north, south, and east through Asheville.

With the coming of good rail transportation, lumber operators were quick to move into the county to tap its lush forests. W. H. Cole built a sawmill at the site of Hazelwood in 1893. He was the town's first mayor and was active in much of its early development. The Unagusta Manufacturing Company was organized in 1904 and started the furniture-making industry in the Waynesville and Hazelwood area. The Sharp and Byron Tannery began operations about 1890. This became the Junaluska Leather Company in 1899, a part of the England-Walton tannery operations, and is now the A. C. Lawrence Leather Company, a division of Swift and Company.

The greatest impetus to the development of Haywood County came in 1906 when construction was begun on the plant of the Champion Paper and Fibre Company at Canton. In a relatively short time this company was giving employment to 2,000 persons. Dependable electric power service was made available in 1905 from a dam and powerhouse on Pigeon River at Hepco, 20 miles north of Waynesville. This plant operated until 1929, when the Carolina Power and Light Company completed its large hydroelectric development on the Pigeon River at Waterville, now called Walters Dam and Powerhouse. The Dayton Tire and Rubber Company, now Dayco Corporation, began operations at their Waynesville plant in 1941. Additions to the plant and product line have been made over the years, and the firm now employs some 2,000 persons. The Wellco Shoe Corporation, makers of casual footwear and users of some of the products of the Dayco plant, began operations in 1941 also and have made



TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

RICHLAND CREEK WATERSHED

SCALE 0 1 2 3 MILES

MARCH 1970

REACH COVERED BY THIS REPORT

HD-1311

several expansions, as well. Plants which produce furniture, textiles, paper products, fertilizer, chemicals, and other items give a wide diversification to the industrial development of Waynesville and Hazelwood today.

Tourism has been a part of the Waynesville scene from its earliest days. The White Sulphur Springs Hotel was opened in 1878, before the coming of the railroad. Other hotels followed as the section became one of the centers in the "summer boarder" boom which affected the Western North Carolina mountain area up to the time of World War I. The Lake Junaluska Assembly area of the United Methodist Church, begun in 1913, brings many persons to its summer sessions. Excellent highways, developed under the Interstate and Appalachian Highway programs, now bring thousands of tourists to Waynesville and Haywood County each year.

Richland Creek and Its Valley

Richland Creek drains an area of 68.4 square miles, all within Haywood County. The watershed is roughly fan-shaped, 14 miles long by 10 miles at the widest point. It is bounded at the head by the high ridge which separates Haywood County from Jackson County, at the west by Plott Balsam, Eaglenest Mountain, Hard Ridge, and Utah Mountain and on the east by Lickstone Ridge, Ratcliffe Mountain, and Jerry Knob. Along the county line elevations average much over 5,000 feet and range from 3,350 feet at Balsam Gap to 6,410 feet at Richland Balsam at the southern corner of the basin. Jones Knob, at the northwest corner of the watershed, is at elevation 6,200 feet. The east and west basin divides maintain elevations mostly 4,000 to 5,000 feet from the county line to points opposite the Waynesville and Hazelwood developments, distances of 5 to 6 miles, then drop off along the lower basin to an elevation of 2,500 feet at the confluence of Richland Creek and Pigeon River. Raccoon Creek, Allen Creek, and Plott Creek are the largest tributaries of Richland Creek. All join the stream in the Waynesville-Hazelwood vicinity, Plott Creek on the left bank, the other two on the right bank. The two towns lie on flat to rolling land along Richland Creek and lower Allen Creek, at elevations near 2,600 to 2,800 feet. Camp, Browning, Farmer, and Shelton Branches drain portions of the Waynesville and Hazelwood areas. Camp and Browning Branches combine to drain an area east of Allen Creek. Farmer Branch flows through the Hazelwood business district and enters Richland Creek at Mile 7.7.

Shelton Branch follows a course east of the principal Waynesville business district and joins Richland Creek at the lower corporate limit, Mile 5.8.

This investigation covers Richland Creek from the head of Lake Junaluska at Mile 3.8 to Mile 10.0. Above the mouth of Hyatt Creek, Mile 9.2, the stream is called Brendles Creek in some historical and newspaper accounts, but the name Richland Creek is generally accepted as now applying to the stream all the way to the head at Balsam Gap. In the reach covered, the stream falls from elevation 2,793 to 2,562 feet at an average rate of 37 feet per mile. The flood plain is 1,100 feet wide at the mouth of Raccoon Creek, Mile 4.2, but otherwise 300 to 600 feet wide over the lower end of the study reach from Lake Junaluska to the Southern Railway bridge at Mile 5.1. At the lower corporate limit of Waynesville, Mile 5.8, the flood plain is 1,000 feet wide and is 1,000 to 1,500 feet wide through the commercially developed area in the vicinity of U. S. Highway 276 and Depot Street. At Smathers Street bridge, Mile 6.8, the flood plain narrows to 500 feet, then widens again to 1,000 to 1,800 feet in the reach extending to the mouth of Camp Branch in Hazelwood, Mile 8.2. Flood-plain widths are mostly 500 feet to 900 feet through the rest of the Richland Creek reach up to Mile 10.0.

Richland Creek is within or follows the corporate limits of Waynesville or Hazelwood from Mile 5.8 to 8.85. In the rather involved corporate limit relationship between the two towns, Waynesville now surrounds Hazelwood except for a distance of about one-half mile in the vicinity of Hyatt and Allen Streets. Thus, the stream is wholly within the Waynesville corporate limits from Mile 5.8 to 7.6, within the Hazelwood limits from Mile 8.1 to 8.5, serves as the boundary between the two towns from Mile 7.6 to 8.1 and Mile 8.5 to 8.7, and follows the west boundary of Waynesville from Mile 8.7 to 8.85.

Pertinent drainage areas of Richland Creek are shown in Table 2.

TABLE 2

DRAINAGE AREAS IN WATERSHED OF RICHLAND CREEK

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Richland Creek	Mouth	0.0	68.4
	U. S. Highway 19	3.80	58.0
	Above Raccoon Creek	4.20	48.2
	Depot Street	6.61	44.5
	Above Camp Branch	8.22	30.6
	Above Allen Creek	8.85	13.4
	U. S. Highway 23, business	9.26	10.9
	Upper limit of study	10.00	10.4
Raccoon Creek	Mouth	0.0	8.90
	U. S. Highway 23, business	0.52	8.74
	Francis Farm Road	0.82	4.64
	Sunnyside Road (Upper limit of study)	1.91	3.81
Camp and Browning Branches	Mouth	0.0	4.98
	U. S. Highway 23, business	0.74	4.76
	Camp Creek Road	1.30	2.75
	Browning Branch Road (Upper limit of study)	2.53	1.95
Allen Creek	Mouth	0.0	16.9
	U. S. Highway 23, business	0.28	16.9
	Secondary Route 1149	0.84	16.6
	Upper limit of study	1.78	16.4
	USGS stream gage	3.00	14.4

Raccoon Creek and Its Valley

Raccoon Creek drains the area east of Waynesville and has a watershed that is roughly fan-shaped. The stream has its head on the slopes

of Wolfpen Mountain and Beaty Spring Knob; and its principal tributary, Ratcliffe Cove Branch, rises on Ratcliffe Mountain on the eastern basin divide. The western divide is formed by the high ridge which is part of Wolfpen Mountain and the lower ridge which is near the eastern corporate limit of Waynesville. Elevations are 4, 960 feet at the peak of Wolfpen Mountain, 4, 850 feet at Beaty Spring Knob, and 4, 377 feet at Ratcliffe Mountain. Pigeon Gap and Clyde Gap, on the eastern basin divide, are at elevations 3, 100 and 3, 000, respectively.

Valley floor elevations in the Raccoon Creek basin are 2, 600 to 2, 700 feet. In the 1. 91-mile reach covered by this investigation, the stream falls from elevation 2, 624 to 2, 563 feet at a rate of 32 feet per mile. The flood plain is relatively narrow, averaging about 400 feet in width. It is less than 200 feet wide at U. S. Highway 23, business, Mile 0. 5, but widens to 700 feet just upstream.

Table 2 lists drainage areas in the Raccoon Creek watershed.

Camp and Browning Branches and Their Valleys

The watershed which is drained by Camp and Browning Branches contains 4. 98 square miles and is shaped like an elongated triangle $4\frac{1}{2}$ miles long by $2\frac{1}{2}$ miles wide at the upper end. The streams head against Lickstone Ridge, where the elevation ranges from 4, 900 to 5, 700 feet. Browning Branch drops steeply to a valley floor which is common with Allen Creek for major floods. Camp Branch drains the northern portion of the watershed and joins Browning Branch at the intersection of Browning Road and Putnam Street in Waynesville, then the combined streams flow northwestward through Hazelwood to join Richland Creek at Mile 8. 2. There is some confusion as to which name applies to the stream below their confluence, but local usage favors the use of the name Camp Branch for the reach. This investigation covers Camp Branch over the lower 1. 0 mile, then Browning Branch to Medford Branch, a total distance of 2. 5 miles.

For the reach covered, the stream falls from 3, 003 to 2, 698 feet at an average rate of 120 feet per mile. For the 1. 0-mile reach of Camp Branch the rate of fall is 74 feet per mile. For the portion of Browning Branch above Mile 2. 0 the rate of fall is a steep 250 feet per mile. Below Mile 0. 3 the flood plain is common with that of Richland Creek. Between Mile 0. 3 and

2.1 it is common with the flood plain of Allen Creek, and the width ranges from 900 to 3,000 feet. Above Mile 2.1 the flood plain of Browning Branch is 200 to 600 feet wide.

From the mouth to Mile 0.7, Camp Branch is in the corporate limits of Hazelwood. From Mile 0.7 to 1.6 the Camp Branch-Browning Branch reach is in Waynesville.

Table 2 lists drainage areas which are pertinent to the Camp and Browning Branch drainages.

Allen Creek and Its Valley

Allen Creek drains an area of 16.9 square miles in the shape of an oval 4 miles across and 5 miles long with a narrow appendage extending 2 miles northward to the mouth. The upper watershed is rimmed by high ridges, Lickstone Ridge at the east, the Haywood-Jackson county line at the south and west, and Pinnacle Ridge at the northwest. Along the county line, elevations range from 5,150 feet at Licklog Gap to 6,410 feet at Richland Balsam at the southern tip of the watershed. Along Pinnacle Ridge the elevations range from 5,613 feet at Grassy Bald to 4,250 feet at Pinnacle Knob, then drop sharply to 2,800 feet at the Richland Creek flood plain. Along Lickstone Ridge, elevations are 4,894 feet at Deep Gap, 5,925 feet at Cold Spring Knob, and 5,700 feet at Lickstone Bald. From Lickstone Bald the divide between Allen Creek and Browning Branch drops gradually to 3,000 feet near Micaville Church.

Allen Creek is formed by the junction of Shiny Creek and Cherry Cove Creek, which fall steeply from the ridges at the south and east. The stream follows a northward course to its junction with Richland Creek at Mile 8.85.

This investigation covers Allen Creek from the mouth to Micaville Church, a distance of 1.8 miles. Above this reach the watershed is about 95 percent forested and constitutes most of the area which provides the water supply for Waynesville and Hazelwood. In the study reach the Allen Creek basin is only one-quarter to one-half mile wide. The stream falls from elevation 2,905 to 2,733 feet, an average fall of 97 feet per mile. Above Mile 1.4 the Allen Creek flood plain is about 1,000 feet wide. Below Mile 1.4 the flood plain is common with that of Camp and Browning Branches and has been previously described.

Allen Creek is within the Waynesville corporate limits from Mile 0.7 to Mile 0.2 and forms the corporate boundary line from Mile 0.2 to the mouth.

Drainage areas pertinent to Allen Creek are given in Table 2.

III.

THE FLOOD PLAINS

III.

THE FLOOD PLAINS

Along the streams covered by this report, there are many manmade features which may be affected by floods or which may have an effect upon the height of floodwaters. This section of the report discusses the industrial, commercial, and residential developments in the flood plains, the highways and railroads that parallel the streams or cross the flood plains, and the bridges spanning the streams.

1. RICHLAND CREEK

Developments in the Flood Plain

Plate 4 shows the flood plain of Richland Creek for the reach covered by this investigation. Waynesville and Hazelwood together occupy both banks of the stream for some three miles of its course. The principal business district of Waynesville is on high ground above the stream, but a growing commercial development is located on the flood plain. The Hazelwood business district is adjacent to the Richland Creek flood plain but is expanding into the flood-plain area. Residential developments of both towns are in the flood plain and there are important industries located on the flood plain.

Dual-lane U. S. Highway 19A&23 crosses Richland Creek at Mile 4.1 and bypasses the Waynesville-Hazelwood area on a route which lies west of the towns. The location follows the edge of the left-bank flood plain from Mile 8.0 to the upper end of the study reach, at Mile 10.0. A Maximum Probable Flood would overtop the roadway at the creek crossing at Mile 4.1 and at Mile 10, but elsewhere the location is above flood heights. The previous location of the highway, now designated U. S. Highway 23, business, passes through Waynesville and Hazelwood, crosses Richland Creek at Hyatt Creek Road, Mile 9.26, and joins U. S. Highway 19A&23 at an interchange on the left-bank flood plain. Originally the U. S. Highway routing followed the right-bank flood plain upstream from Mile 9.2. That road is now designated Secondary Road 1243. At the creek crossing, the

highway is 4 feet below the Regional Flood level. U. S. Highway 276 crosses the Richland Creek flood plain at a bridge and fill at Mile 6.2. The roadway would be overtopped by 4 feet in a Regional Flood and 7 feet in a Maximum Probable Flood.

The Southern Railway follows Richland Creek through Waynesville and Hazelwood. The location is on the right-bank flood plain except for a short distance near Mile 5. Much of the roadbed below Mile 7.4 would be overtopped by a Regional Flood, with depths up to 6 feet. During a Maximum Probable Flood, more of the track would be flooded, the depths of flooding reaching 11 feet.

The Dayco Southern Division of the Dayco Corporation occupies the right-bank flood plain of Richland Creek from the mouth of Allen Creek to Hyatt Creek Road, a distance of some 0.4 mile. The lowest manufacturing buildings in the upstream end of the property have floors 2 feet below the Regional Flood and 6 feet below the Maximum Probable Flood.

The Unagusta Manufacturing Corporation has its furniture plant just downstream from the Dayco property. The manufacturing facilities are located on the high side of the property along the railroad and are above the elevation of a Maximum Probable Flood on Richland Creek. Lumber storage is on lower ground and would be affected by large floods on Richland Creek. The floor of a new office building at the upstream end of the property is at the level of a Regional Flood and is 3 feet below a Maximum Probable Flood.

The A. C. Lawrence Leather Company, a subsidiary of Swift and Company, has its plant on the right-bank flood plain just upstream from Main Street in Hazelwood. A Regional Flood would affect most of the storage buildings, and a Maximum Probable Flood would enter the main tannery buildings to a depth of about 2 feet.

The Giles Chemical Company, producers of pharmaceutical chemicals, is located on the right bank of Richland Creek just downstream from the Smathers Street bridge in Waynesville. A Regional Flood would be 5 feet over the plant floor, and a Maximum Probable Flood would be 5 feet higher.

Business developments are located on the flood plain of Richland Creek in the vicinity of Main and McClure streets in Hazelwood and along the

one-mile reach between Smathers Street bridge and the lower corporate limit of Waynesville. Residences are in the flood plain, particularly in the reach from Russ Avenue, U. S. Highway 276, to the upper corporate limit of Hazelwood, Mile 6.1 to 8.6. Recent years have seen increased development of both businesses and homes in these areas. A new shopping center complex on the left-bank flood plain just downstream from U. S. Highway 276, opened in 1969, has seven stores at this time, and more stores and other facilities are planned for the development. The Regional and Maximum Probable Floods would be about 3 feet and 7 feet, respectively, over the floor level of the existing stores. The following tabulation lists some of the other developments in Waynesville and Hazelwood which are subject to flooding by Richland Creek:

Identification	Effective Creek Mile	Floor Elev. feet	Flood Elevations	
			Regional feet	Maximum Probable feet
Norris Concrete Materials	5.95	2618.5	2620.0	2624.4
Ready-Mix Concrete	6.06	2618.2	2623.2	2627.0
Haywood Building Supply	6.54	2634.4	2638.4	2642.0
National Guard Armory	6.58	2636.4	2640.2	2644.0
Haywood Grocery Company	6.60	2642.2	2641.4	2645.0
Burgin's Super Market	6.60	2638.2	2641.4	2645.0
FCX Supply	6.66	2639.2	2644.4	2648.0
CP&L Substation	6.81	2645.0*	2650.2	2654.5
CP&L Substation	7.83	2688.8*	2689.8	2692.6
Eaglenest Grocery	7.98	2695.3	2698.2	2700.4
Cities Service Bulk Plant	8.05	2699.2	2700.8	2703.4

*Elevation of base of transformers.

In Waynesville on the left-bank flood plain just upstream from U. S. Highway 276, about 45 houses on Lee, Rogers, Henry, Liner, and Harris Streets would be flooded by either a Regional or a Maximum Probable Flood. On the right bank in the vicinity of Killian and Boyd Streets there are 47 houses that are similarly vulnerable to flood damage. On the left bank, along Smathers Street and Sulphur Springs Road, there are 105 houses. About 60 of these would be surrounded or entered in a Regional Flood and 90 would be affected in a Maximum Probable Flood. In the Main, McClure,

Pine Oak, and Georgia Street section, on the right bank in Hazelwood, there are about 50 houses that would have water over the floor level in a Regional Flood. About 65 would be flooded in a Maximum Probable Flood. On the left bank upstream from the Main Street bridge along Hyatt Street, a Regional Flood would enter 10 houses and a Maximum Probable Flood would flood 20 houses. On Robinson Street 9 houses are in the range of a Maximum Probable Flood. Between Hyatt Creek Road and the upper limit of the investigation 12 houses are in low-lying locations on the flood plain of Richland Creek. A Regional Flood on Richland Creek would affect a total of about 270 houses, of which 190 are in Waynesville and 70 in Hazelwood. A Maximum Probable Flood would affect more than 300 houses in the Waynesville-Hazelwood section.

Bridges across Richland Creek

Twelve highway or street bridges, two railroad bridges, and one private bridge cross Richland Creek in the reach covered by this investigation. Table 3 lists pertinent elevations for the bridges and shows their relation to the crest of the flood of March 26, 1965, and the Regional Flood. Plate 5 shows the relation of the floor and underclearance of the bridges to the flood profiles for the reach. Figures 1 and 2 show photographs of some of the bridges on Richland Creek.

The March 1965 flood did not overtop any of the bridges, but both approaches to the Boyd Street Bridge at Mile 7.23 were flooded. A Regional Flood would overtop all of the bridges except the railroad bridge at Mile 4.94, Howell Mill Road, and Main Street. The approaches to the Main Street bridge would be flooded, however. A Maximum Probable Flood would overtop all of the bridges by depths ranging from 3 to 11 feet.

The channel constrictions due to the bridges and their approach fills resulted in little heading up during the March 1965 flood. During a Regional Flood, heading up of one foot or more would occur at four bridges, with 2 feet at U. S. Highway 19 at Mile 3.81, 1 foot at the railroad bridge at Mile 4.94, 3 feet at Howell Mill Road at Mile 4.96, and 2 feet at U. S. Highway 276 at Mile 6.16. Heading up would exceed 1 foot at nine of the bridges during a Maximum Probable Flood, as can be seen on the profile on Plate 5. The greatest heading up would be almost 9 feet at the railroad bridge at Mile 4.94.

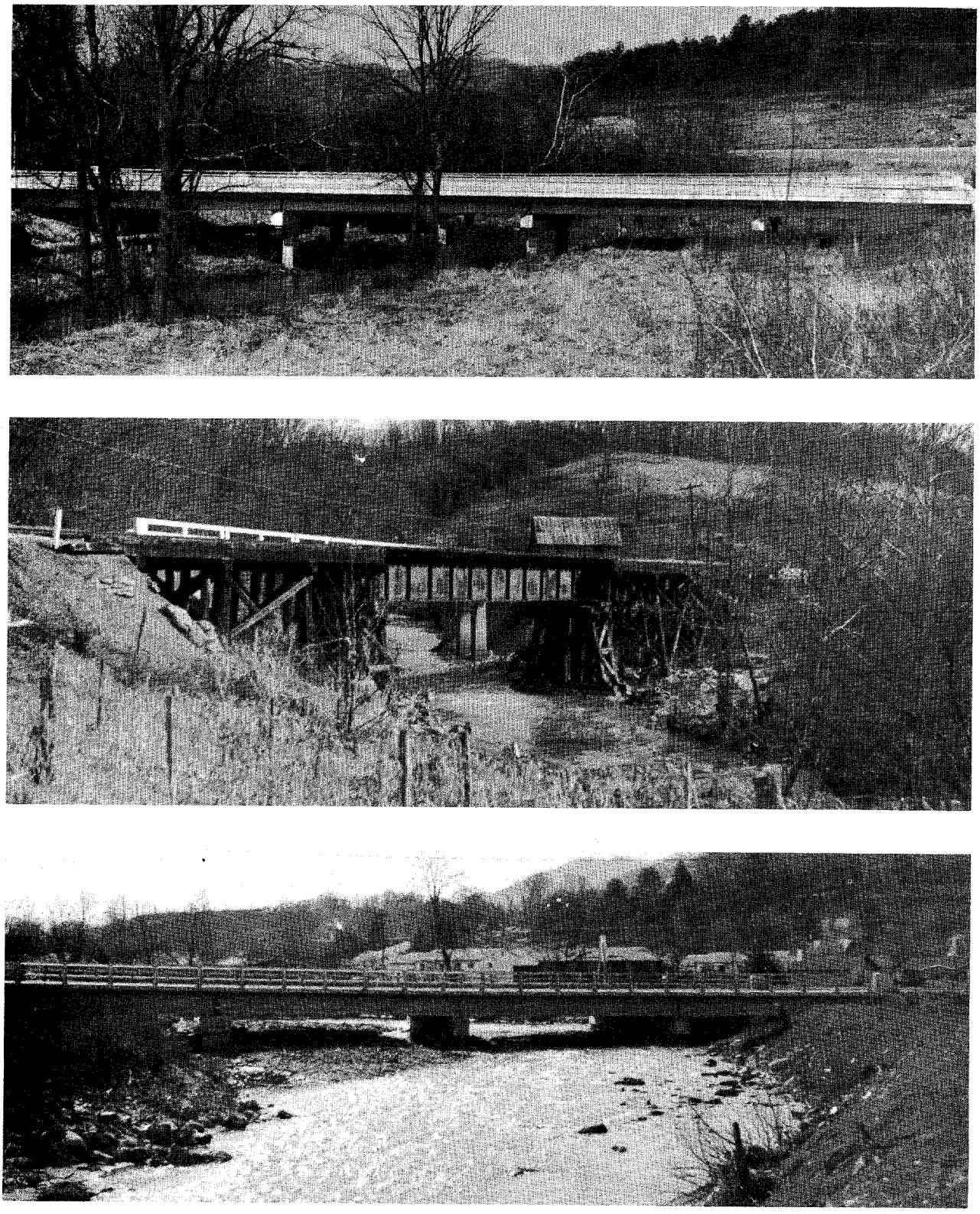


Figure 1.--RICHLAND CREEK BRIDGES NORTH OF CENTRAL WAYNESVILLE

Top view shows upstream side of northbound bridge on U. S. Highways 19A & 23, at Mile 4.15. Piers and railings of the southbound bridge can be seen just downstream. Middle view is downstream side of Southern Railway bridge at Mile 4.94. Piers and part of the handrail for the Howell Mill Road bridge can be seen just upstream from bridge. Bottom view is downstream side of U. S. Highway 276 bridge at Mile 6.16.

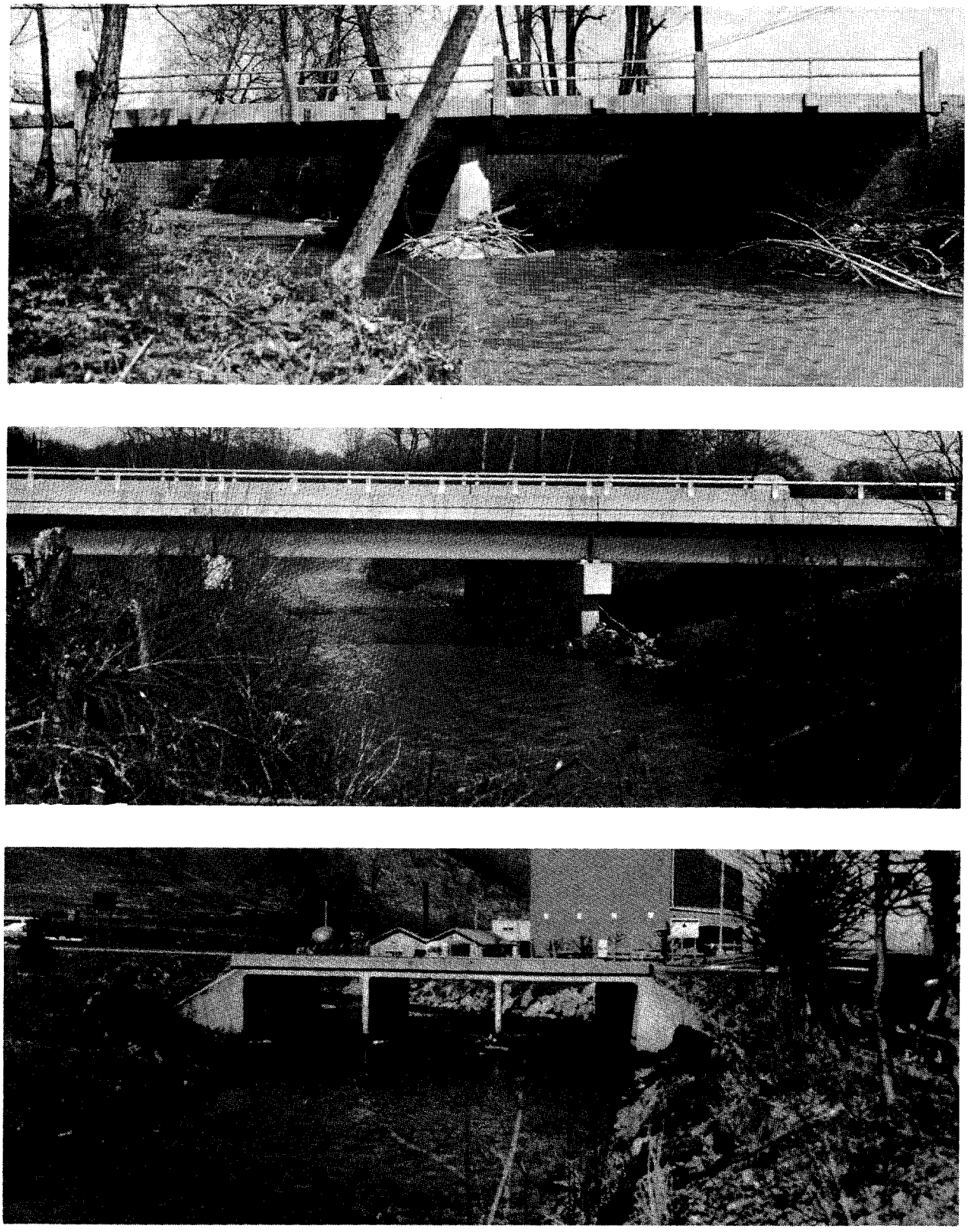


Figure 2.--RICHLAND CREEK BRIDGES AT WAYNESVILLE AND HAZELWOOD

Top view is upstream side of the Depot Street bridge in Waynesville, at Mile 6.61. Middle view is upstream side of McClure Street bridge in Hazelwood at Mile 7.97. Bottom view is upstream side of the Hyatt Creek Road (U. S. Highway 23, business) bridge at Mile 9.26. Buildings of the Dayco Corporation can be seen in background.

TABLE 3

BRIDGES ACROSS RICHLAND CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Mar. 1965 Flood Crest Elev. feet	Underclearance Elev. feet	Above 1965 Flood feet	Below 1965 Flood feet
3.79	U.S. Highway 19, south	2561.5	2571.1	2578.6	2566.4	2567.1	0.7	
3.81	U.S. Highway 19, north	2561.5	2573.2	2579.6	2566.6	2569.5	2.9	
4.13	U.S. Highway 19A & 23, south	2562.1	2577.7	2581.7	2571.2	2574.2	3.0	
4.15	U.S. Highway 19A & 23, north	2562.7	2578.2	2582.4	2571.5	2574.7	3.2	
4.94	Southern Railway	2579.6	2603.1*	2594.7	2587.8	2595.5	7.7	
4.96	Howell Mill Road	2580.7	2601.5	2598.3	2588.4	2598.0	9.6	
5.10	Southern Railway	2585.7	2600.0*	2602.5	2593.2	2597.3	4.1	
6.16	U.S. Highway 276	2616.0	2625.3	2629.4	2622.2	2621.5		0.7
6.61	Depot Street	2629.4	2640.9	2643.2	2636.5	2637.8	1.3	
6.79	Smathers Street	2636.3	2646.2	2649.8	2642.5	2642.8	0.3	
7.23	Boyd Street	2654.9	2663.4	2664.1	2660.8	2659.7		1.1
7.97	McClure Avenue	2685.2	2696.4	2697.9	2691.4	2692.8	1.4	
8.20	Main Street	2697.8	2707.1	2706.9	2701.5	2704.1	2.6	
9.26	U.S. Highway 23, business	2754.8	2763.6	2766.4	2759.7	2761.6	1.9	
9.82	Private road	2785.2	2789.9	2794.2	2789.5	2789.0		0.5

*Top of rail.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. With the exception of the bridges, there are no significant obstructions to flows in the Richland Creek reach included in this study.

2. RACCOON CREEK

Developments in the Flood Plain

Plate 4 shows the flood plain of Raccoon Creek for the reach covered by this investigation. The Southern Railway crosses the stream and flood plain at Mile 0.16. U. S. Highway 23, business, is on the right-bank flood plain from Mile 0.1 to Mile 0.5, crosses Raccoon Creek at that point, then follows the left-bank flood plain to Mile 1.3. A Regional Flood would not overtop the railway, but it would be over the highway from Mile 0.2 to Mile 0.6. A Maximum Probable Flood would overtop the railway and would be over the highway upstream to Mile 0.6. Secondary roads which cross the flood plain, Howell Mill Road at Mile 0.26, Francis Farm Road at Mile 0.82, Ratcliffe Cove Road at Mile 1.40, and Sunnyside Road at Mile 1.91, would all be overtopped by a Regional Flood.

Most of the flood plain of Raccoon Creek is used for agricultural purposes. Farm buildings and houses are located back from the flood plain, but there are business developments located along U. S. Highway 23, business, which are subject to flood damage. An Esso bulk oil plant and service station and a plumbing shop would have water 3 to 5 feet over the main floors during a Regional Flood. Flooding depths would be 8 to 10 feet during a Maximum Probable Flood. At a fruit and vegetable packing plant, the depth of water over the main floor would be 3 feet during a Regional Flood and 6 feet during a Maximum Probable Flood.

The Biltmore Dairy Bar and the Kent Mobile Home Sales office are above the Regional Flood level, but both would be flooded to a depth of 2 feet during a Maximum Probable Flood. The Haywood County Health Center and the Haywood County Welfare Department would be surrounded by water during a Maximum Probable Flood, but the floors of the two buildings are a few inches above the flood level.

Bridges across Raccoon Creek

One railway bridge, one highway bridge, four secondary road bridges, and one private bridge cross Raccoon Creek in the reach investigated. Table 4 lists pertinent elevations for the bridges and shows their relation to the crest of the flood of February 2, 1969, and the Regional Flood. Plate 5 shows the relation of the floor and underclearance of the bridges to the flood profiles for the reach. Figure 3 shows photographs of some of the bridges.

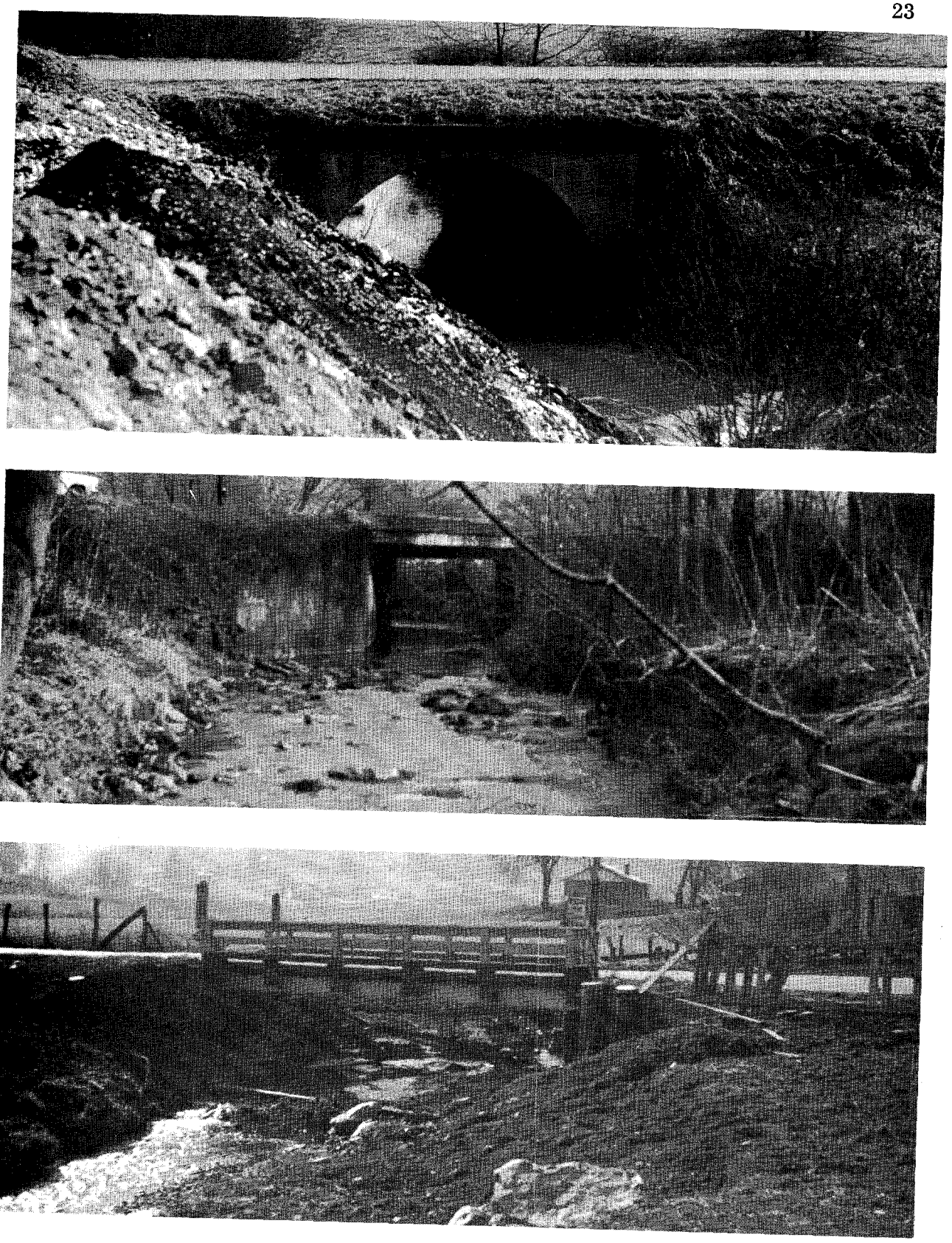


Figure 3.--RACCOON CREEK BRIDGES

Top view shows downstream side of the arch culvert on Howell Mill Road at Mile 0.26. Middle view is downstream side of the bridge on U. S. Highway 23, business, at Mile 0.52. Bottom view shows downstream side of the Ratcliffe Road bridge at Mile 1.40.

TABLE 4

BRIDGES ACROSS RACCOON CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Feb. 1969 Flood Crest Elev. feet	Underclearance Elev. feet	Above 1969 Flood feet	Below 1969 Flood feet
0.16	Southern Railway	2568.7	2588.0*	2585.5	2573.9	2585.4	11.5	
0.26	Howell Mill Road	2571.6	2582.5	2588.9	2575.6	2579.0	3.4	
0.52	U.S. Highway 23, business	2578.5	2591.5	2598.2	2584.0	2588.4	4.4	
0.82	Francis Farm Road	2587.4	2594.6	2601.5	2592.4	2593.0	0.6	
1.40	Ratcliffe Cove Road	2604.6	2611.6	2614.1	2608.9	2609.6	0.7	
1.42	Private road	2604.8	2609.8	2614.8	2609.7	2608.8		0.9
1.91	Sunnyside Road	2624.5	2629.2	2632.4	2628.6	2627.4		1.2

*Top of rail.

The minor flood of February 1969 was above the underclearance of just two bridges, the private bridge at Mile 1.42 and Sunnyside Road at Mile 1.91. A Regional Flood would overtop all of the bridges except the railway bridge at Mile 0.16, and a Maximum Probable Flood would be 3 feet over it.

U. S. Highway 23, business, crosses Raccoon Creek in a naturally constricted section, and the approach fills further constrict the section so that during a Regional Flood heading up of 4 feet would occur. As the depth of flooding over the highway increases, the heading up would decrease so that during a Maximum Probable Flood it would be 1.3 feet. No heading up of importance would occur at any of the other bridges on Raccoon Creek.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. With the exception of the bridges, there are no significant obstructions to flows in the Raccoon Creek reach included in this study.

3. CAMP AND BROWNING BRANCHES AND ALLEN CREEK

Developments in the Flood Plain

Plate 4 shows the flood plains of Camp Branch, Browning Branch, and Allen Creek for the reaches which are covered by this investigation. In large floods overflow from the streams merges, as Plate 4 shows, and accordingly, the three streams are considered together in this section of the report. The land in the flood plains is highly developed, mostly in residences, but there are business and industrial developments in the lower portion.

The Southern Railway and U. S. Highway 23, business, both cross the combined flood plain. The railway crosses Camp Branch at Mile 0.25 and Allen Creek at Mile 0.16, and is in the flood plain of the two streams from Main Street in the Hazelwood business district to Balsam Road, a distance of 5,000 feet. The roadbed is on a low fill which ranges from 1 or 2 feet to about 6 feet in height above the flood plain. A Maximum Probable Flood would overtop the railway the full width of the flood plain, by 5 feet at the Camp Branch bridge and 4 feet at the Allen Creek bridge. A Regional Flood would be 4 feet and 2 feet over the bridges at Camp Branch and Allen Creek, and would be over the tracks most of the flood-plain width.

U. S. Highway 23, business, follows Balsam Road, crossing Camp Branch at Mile 0.74 and Allen Creek at Mile 0.28. The highway is in the flood plain from Brook Street to the Southern Railway crossing, a distance of 4,000 feet. The susceptibility to flooding is similar to that of the railway. A Maximum Probable Flood would overtop all the highway, with a 2-foot depth at Camp Branch and a 1-foot depth at Allen Creek. A Regional Flood would also overtop both bridges and most of the highway.

Allen Creek Road, the principal highway running lengthwise through the developed area, is on the right-bank flood plain of Allen Creek from the upper end of the study reach to its junction with Balsam Road. It is subject to overflow by large floods on either Allen Creek or Browning Branch.

The Dayco Corporation and the Unagusta Manufacturing Company, in the flood plain of Richland Creek, are also subject to flooding by Allen Creek. Flood waters overtopping the Southern Railway would probably not enter the main plant floors but would flow through the grounds at both plants.

At the Unagusta plant a new office building located on the right bank of Allen Creek would be flooded to a depth of 9 feet during a Regional Flood and 12 feet during a Maximum Probable Flood on that stream. The building is also subject to flooding by Richland Creek. At the A. C. Lawrence Leather Company plant, buildings located near the Southern Railway and out of reach of floods on Richland Creek would be affected by large floods on Camp Branch. A Maximum Probable Flood would enter the tanning building and be almost 5 feet deep in the office. A Regional Flood would be 3.5 feet deep in the office.

The textile plant of the Royle and Pilkington Company, manufacturers of fabrics for the furniture industry, is located at Welch Street and Balsam Road, on the left-bank flood plain of Camp Branch. Water would be 3 feet deep in the plant during a Regional Flood and 4 feet deep during a Maximum Probable Flood.

The business developments are concentrated mostly along Balsam Road, U. S. Highway 23, business. Some of the developments in the central business district of Hazelwood are subject to flooding by Camp Branch. The following tabulation lists some of the developments in the flood plains of Camp Branch, Browning Branch, and Allen Creek which are subject to flooding.

Identification	Effective Creek Mile	Floor Elev. feet	Flood Elevations	
			Regional feet	Maximum Probable feet
CAMP BRANCH				
Lowe's Hardware	0.16	2711.5	2715.8	2716.8
Smoky Mountain Fertilizer Co.	0.48	2738.4	2740.2	2741.0
N. Carolina Hwy. Maintenance Department, motor repair shop	0.53	2741.4	2744.1	2744.9
N. Carolina Prison Camp, mess hall	0.58	2746.4	2748.0	2748.8
Scotch Bargain Center	0.65	2750.8	2753.3	2754.1
Cline Bradley Company	0.66	2752.4	2754.2	2755.0
B&P Motor Lines	0.68	2754.2	2755.7	2756.5
First Union National Bank	0.74	2756.9	2760.3	2761.0
Waynesville Country Club	0.90	2771.1	2772.4	2773.2

Identification	Effective Creek Mile	Floor Elev. feet	Flood Elevations Regional feet	Flood Elevations Maximum Probable feet
		ALLEN CREEK		
Little Boy Hamburger	0.21	2765.8	2768.1	2769.6
Waynewood Grocery	0.28	2769.0	2773.7	2774.3
Clyde's Restaurant	0.33	2773.7	2777.6	2778.2
Frady Grocery	0.65	2800.0	2805.2	2806.2
Early's Grocery	0.73	2807.2	2812.4	2813.7
Allens Creek Baptist Church	0.80	2814.7	2818.6	2820.2

In Hazelwood 15 houses on Railroad and Robinson Streets would be surrounded or flooded by a Regional Flood on Camp Branch. Some of these are subject to floods on Richland Creek also. About 100 houses in Hazelwood in the area between the Southern Railway and Balsam Road would be flooded by a Maximum Probable Flood and surrounded or flooded by a Regional Flood. Of these, 35 are located on the left-bank flood plain of Camp Branch, on Welch, Beech, and Scates Streets, and 65 are on the right bank on Richland, Church, and South Balsam and their connecting streets.

In the Waynesville corporate limit, about 30 houses in the Chelsea, Swan, and Epsom Street section would be flooded by either a Regional or a Maximum Probable Flood on Camp Branch. In the flood plain which is common to Allen Creek and Camp and Browning Branches, there are 240 houses, 225 of which are within the Waynesville corporate limit. All would be surrounded or flooded in a Maximum Probable Flood and most would be affected by a Regional Flood. Upstream from the common flood plain there are about 75 houses along Allen Creek which would be affected by a Regional Flood and 20 houses along Browning Branch which are subject to damage of some kind in a severe flood. In the area which would be directly affected by a Regional Flood or a Maximum Probable Flood on Camp Branch, Browning Branch, and Allen Creek, there are about 480 residences, 115 located in Hazelwood, 250 in Waynesville, and 110 in the reaches covered which are upstream from the Waynesville corporate limit.

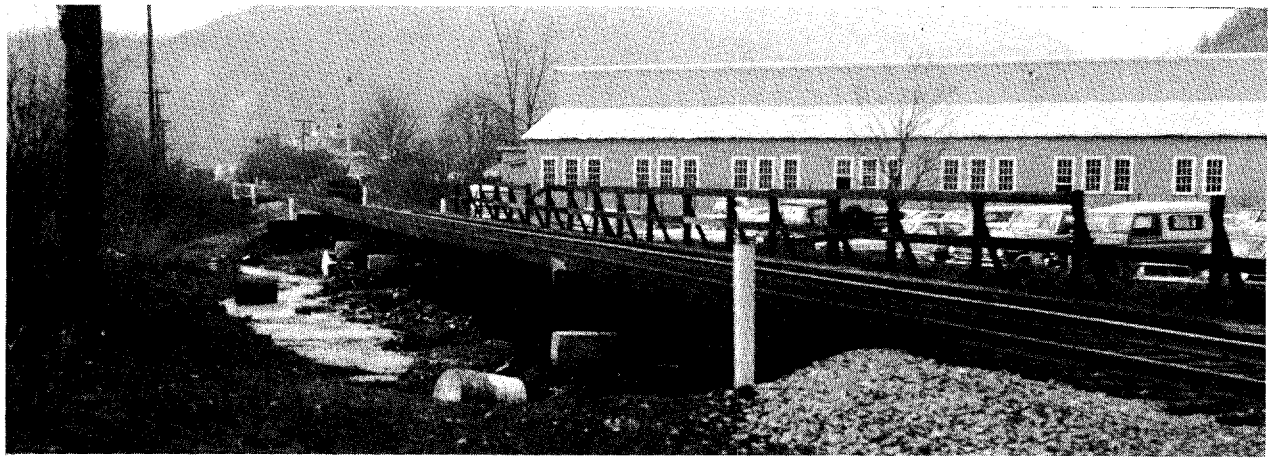
Bridges across the Streams

One highway bridge, one railway bridge, three street or secondary road bridges, two private road bridges, and one footbridge cross Camp Branch in the reach covered by this investigation. Crossing Browning Branch are five street or secondary road bridges or culverts and eleven private road bridges or culverts. Table 5 lists pertinent elevations for the bridges and culverts and shows their relation to the crest of a flood at bankfull stage and the Regional Flood. Plate 7 shows the relation of the floor and underclearance of the bridges or the top of the arch of the culverts to the flood profiles for the reaches on Camp and Browning Branches. Figure 4 shows photographs of some of the bridges on Camp Branch, and Figure 5 shows photographs of one of the bridges and one of the culverts on Browning Branch.

A Regional Flood would overtop all of the bridges and culverts on the two streams. Since most of the structures are low with small, if any, approach fills, they offer little obstruction to flood flows and there is negligible heading up except at the railway bridge at Mile 0.25 on Camp Branch, where heading up of slightly more than 2 feet would occur during a Regional or Maximum Probable Flood.

Crossing Allen Creek are three streets or secondary roads, one highway, one railway, and three private roads. Table 6 lists the pertinent elevations for the bridges and shows the relation to the crest of the March 26, 1965, flood and the Regional Flood. Plate 7 shows the relation of the floor and underclearance at the bridges to the flood profiles for the reach. Figures 6 and 7 show photographs of some of the bridges on Allen Creek.

As on Camp and Browning Branches, the bridges and their approach fills on Allen Creek result in negligible heading up during floods except at the railway bridge at Mile 0.16. During a Regional Flood, the constricted section at that bridge would cause heading up of 4 feet. As the depth of overflow increases, the heading up would decrease and would amount to 3 feet during a Maximum Probable Flood.



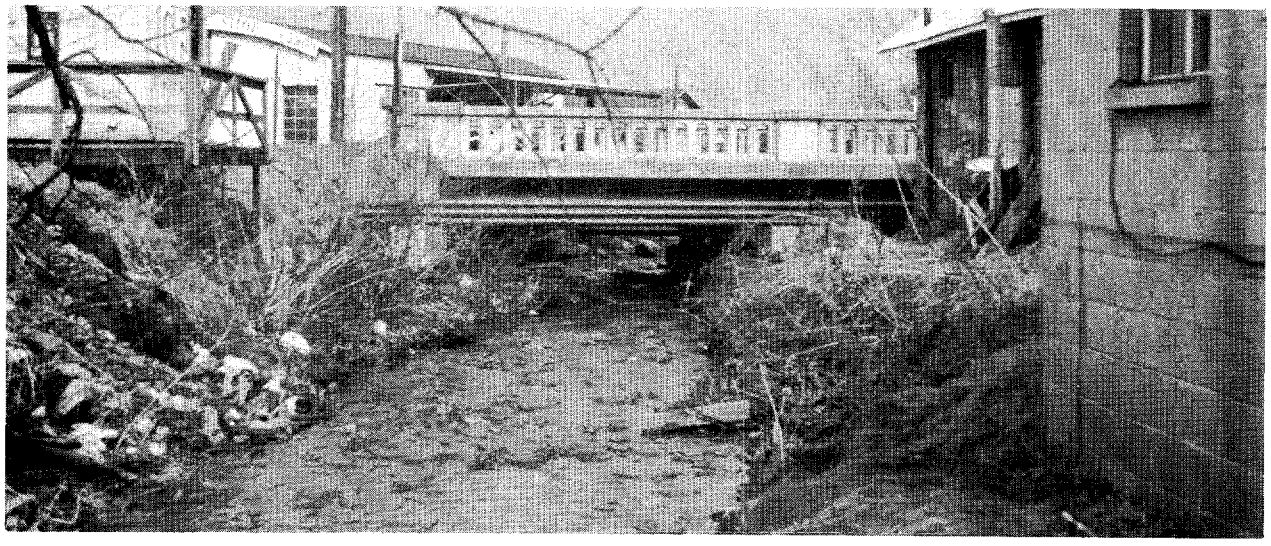


Figure 4.--CAMP BRANCH BRIDGES

Top view is upstream side of the Southern Railway bridge at Mile 0.25, and shows the A. C. Lawrence Leather Company building in background. Middle view is downstream side of the Beech Street bridge at Mile 0.52. Bottom view is the upstream side of the South Main Street (U. S. Highway 23, business) bridge at Mile 0.74.

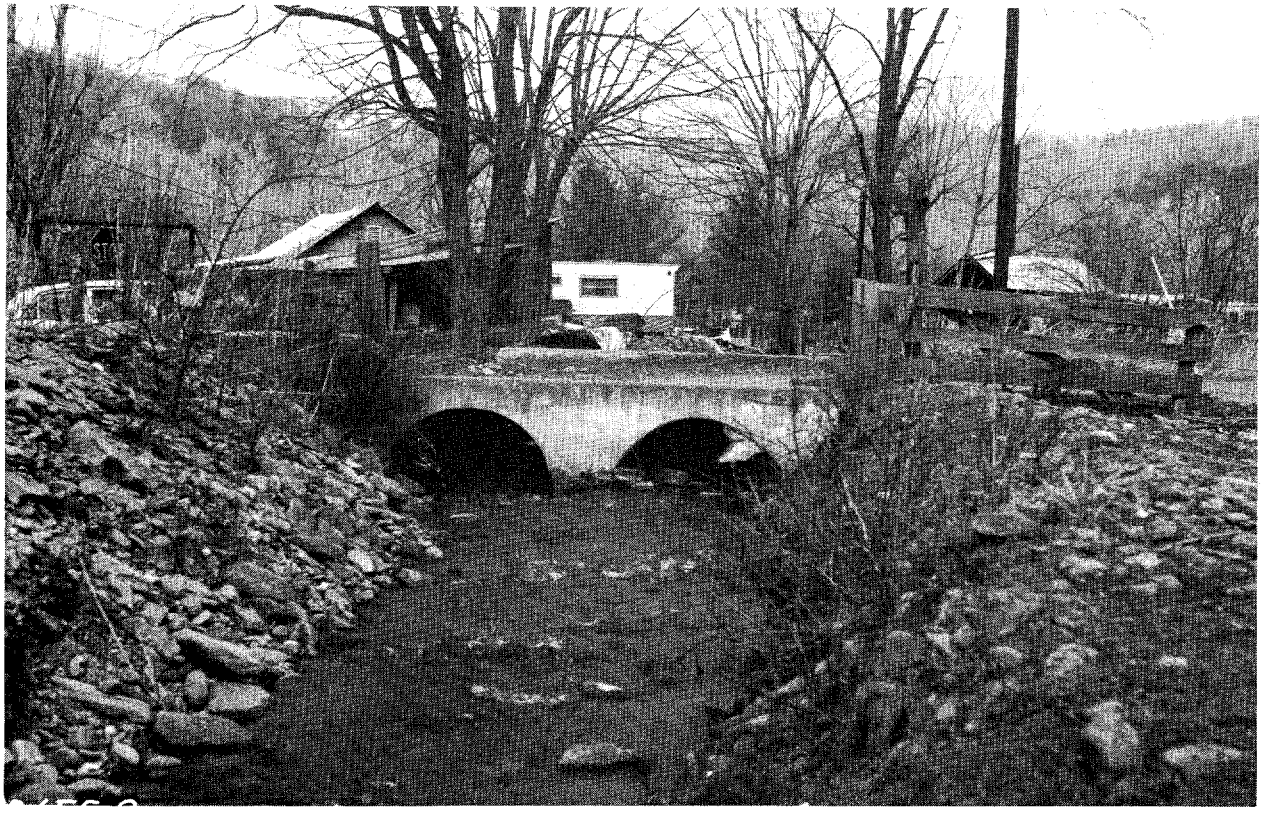


Figure 5.--BROWNING BRANCH BRIDGES

Upper view shows the upstream side of the Camp Branch Road bridge at Mile 1.30, in Waynesville. Lower view is upstream side of the bridge on Secondary Route 1141 at Mile 1.99.

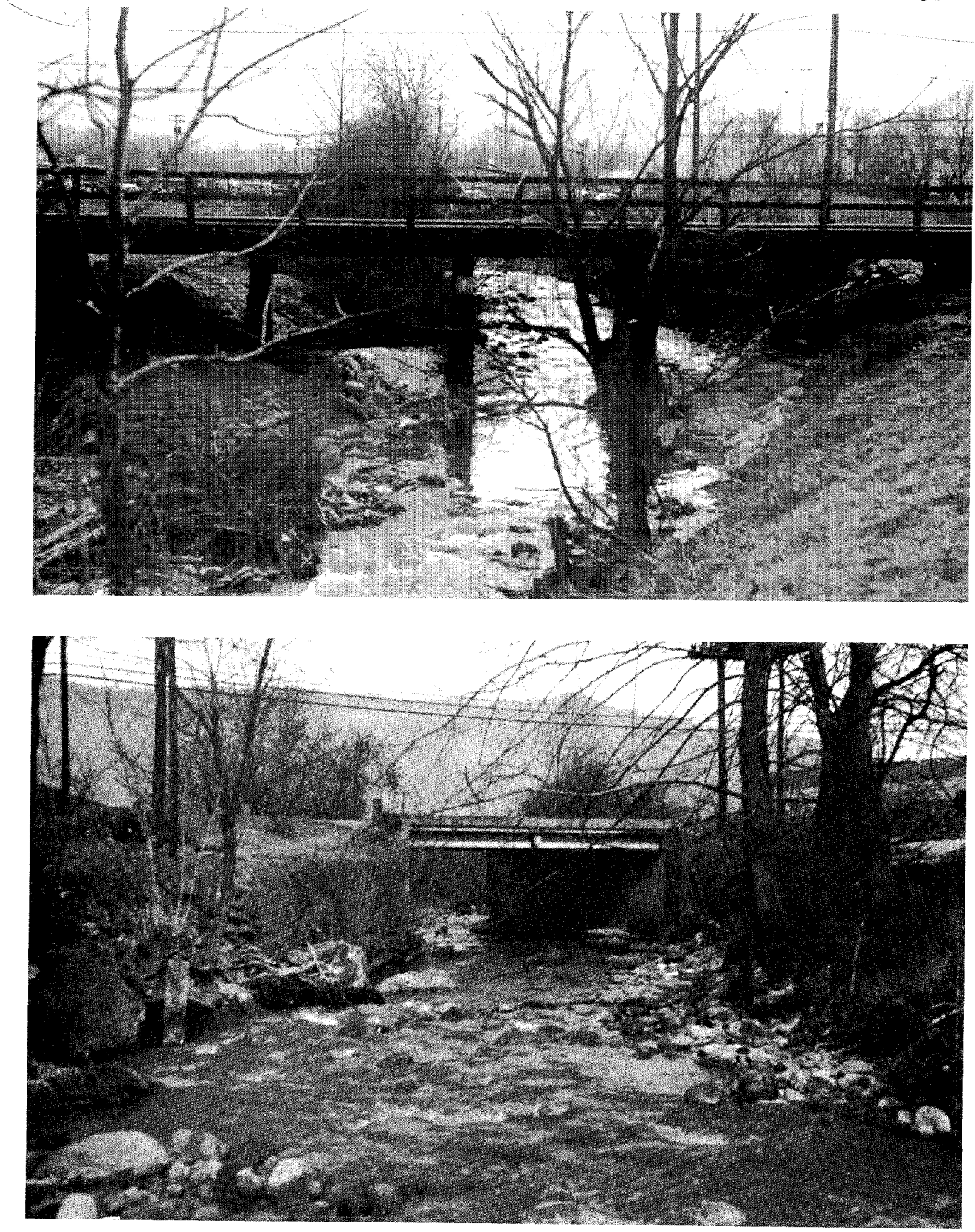


Figure 6.--BRIDGES NEAR MOUTH OF ALLEN CREEK

Upper view is the Southern Railway bridge at Mile 0.16 in Waynesville. Lower view is the upstream side of the South Main Street (U. S. Highway 23, business) bridge in Waynesville, at Mile 0.28.

Figure 7.--ALLEN CREEK BRIDGES IN SOUTHERN WAYNESVILLE

Upper view shows upstream side of Hendricks Street bridge at Mile 0.53, in Waynesville. Lower view is the upstream side of bridge on Secondary Route 1149, in Waynesville, at Mile 0.84.

TABLE 5

BRIDGES ACROSS CAMP AND BROWNING BRANCHES

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Bankfull Elev. feet	Underclearance Elev. feet	Underclearance Above Bankfull Stage feet	Underclearance Below Bankfull Stage feet
			Camp Branch					
0.22	Private road	2711.3	2717.9	2720.3	2716.0	2716.8	0.8	
0.25	Southern Railway	2714.4	2720.8*	2724.7	2718.3	2718.4	0.1	
0.43	Scates Street	2730.6	2734.9	2736.2	2733.3	2733.6	0.3	
0.52	Beech Street	2736.2	2740.3	2743.5	2740.2	2739.0		1.2
0.64	Private road	2742.8	2745.0	2752.6	2746.2	2744.0		2.2
0.74	U.S. Highway 23, business	2752.3	2758.5	2760.3	2756.4	2756.4	0	
0.79	Chelsea Road	2756.0	2760.3	2764.1	2760.3	2759.2		1.1
0.88	Footbridge	2763.1	2767.3	2770.9	2766.4	2766.6	0.2	
1.19	Polk Street	2788.0	2791.8	2794.6	2790.2	2791.7	1.5	
1.25	Private road	2791.3	2793.8	2800.2	2793.8	2792.8		1.0
1.30	Camp Branch Road	2797.7	2801.1	2805.2	2801.1	2799.4		1.7
1.80	Buchanan Drive	2844.0	2846.6	2852.0	2846.6	2845.3		1.3
1.99	Secondary Route 1141	2869.1	2872.1	2875.9	2871.9	2872.0	0.1	
2.04	Private road	2881.4	2885.0	2887.6	2883.5	2884.2	0.7	
2.16	Private road	2906.1	2910.0	2915.6	2910.0	2908.2		1.8
2.24	Private road	2925.8	2930.5	2934.2	2930.5	2930.3		0.2
2.26	Private road	2933.3	2936.8	2938.8	2936.8	2935.6		1.2
2.30	Private road	2939.3	2943.5	2949.1	2943.5	2942.5		1.0
2.33	Private road	2946.6	2951.1	2957.3	2951.1	2950.9		0.2
2.34	Private road	2951.6	2956.2	2960.0	2956.2	2956.1		0.1
2.39	Private road	2962.0	2964.7	2973.7	2964.7	2963.8		0.9
2.40	Private road	2964.0	2967.5	2976.4	2967.5	2966.7		0.8
2.41	Private road	2971.4	2975.7	2979.2	2975.7	2975.2		0.5
2.53	Browning Branch Road	3002.7	3008.0	3012.0	3006.8	3006.0		0.8

*Top of rail.

Browning Branch

TABLE 6

BRIDGES ACROSS ALLEN CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Mar. 1965 Flood Crest Elev. feet	Underclearance Elev. feet	Above 1965 Flood feet	Below 1965 Flood feet
0.16	Southern Railway	2747.0	2762.4*	2764.8	2752.8	2760.0	7.2	
0.28	U.S. Highway 23, business	2761.3	2772.8	2773.7	2768.0	2770.2	2.2	
0.53	Hendricks Street	2788.1	2792.6	2794.6	2791.2	2790.2		1.0
0.73	Private road	2803.9	2809.9	2812.3	2808.5	2808.4		0.1
0.84	Secondary Route 1149	2812.0	2820.0	2822.1	2817.2	2817.9	0.7	
1.44	Rogers Road	2868.7	2877.2	2878.2	2872.0	2874.9	2.9	
1.66	Private road	2891.8	2899.7	2902.2	2895.5	2898.2	2.7	
1.78	Private road	2904.7	2912.8	2915.9	2909.5	2912.0	2.5	

*Top of rail.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. With the exception of the bridges, there are no significant obstructions to flows in the reaches of Camp and Browning Branches and Allen Creek which are included in this study.

IV.

PAST FLOODS

IV.

PAST FLOODS[1]

This section of the report is a history of floods which have occurred on Richland Creek and its tributaries, Raccoon Creek, Camp and Browning Branches, and Allen Creek, in the vicinity of Waynesville and Hazelwood in Haywood County, North Carolina. The portion of Richland Creek considered extends from Mile 3.8 at Lake Junaluska upstream to Mile 10.0, a distance of 6.2 river miles. The investigation on Raccoon Creek covers the reach from the mouth to Sunnyside Road at Mile 1.9. Camp and Browning Branches are considered as one stream which is covered from the mouth upstream to Browning Branch Road at Mile 2.5. The investigation on Allen Creek covers the 1.8 miles from its mouth to a private bridge near Micadale Church.

Records of stages and discharges on Richland Creek are limited to a nine-month period of staff gage records in 1944 and 1945. No records have been maintained on Raccoon Creek or Camp Branch, but a stream gage has been maintained on Allen Creek since 1949. Longer records are also available from gaging stations on Jonathans Creek and Scott Creek, the watersheds of which adjoin the Richland Creek watershed. These records were used to establish the probable dates and frequency of flooding on the streams covered by this report. Following the floods of January 31, 1957, January 21, 1959, and March 26, 1965, flood marks were located in some reaches of the streams included; and in connection with this report, investigations have been made to supplement the flood information on Richland Creek and its tributaries in the vicinity of Waynesville and Hazelwood.

This section of the report discusses the flood history of those streams.

---

1. Prepared by Hydraulic Data Branch

Flood Records

The only records of streamflow on Richland Creek are those from a staff gage at the Depot Street bridge maintained by the U. S. Geological Survey from October 1, 1944, to July 15, 1945. There were no floods during that short period. No records of streamflow have been maintained on Raccoon Creek or Camp Branch, but the Geological Survey has maintained a recording gage on Allen Creek at Mile 3.0, above the upper limits of this study, since August 19, 1949. They have also maintained records on other streams near Waynesville and Hazelwood, and these are useful in a study of this nature.

The nearest stream gage with longer records is that on Jonathans Creek near Cove Creek, North Carolina, 9 miles north of Waynesville. The watershed of Jonathans Creek adjoins the Richland Creek watershed on the northwest side. Records are available on Jonathans Creek since May 24, 1930.

The watershed of Scott Creek adjoins the Richland Creek watershed on the southwest side, and stream gages have been maintained on Scott Creek in the vicinity of Sylva, North Carolina, 15 miles southwest of Waynesville, since May 16, 1928.

Information on floods on Richland Creek and its tributaries was obtained from these gage records, from interviews with local residents, and from a search of newspaper files. Following the flood of January 31, 1957, high-water marks were established along Richland Creek from Mile 6.2 to Mile 9.2, and following the floods of January 21, 1959, and March 26, 1965, marks were established along Richland Creek from Mile 4.2 to Mile 9.2, and along Allen Creek from the mouth to Mile 1.8. Enough marks for the flood of February 2, 1969, were located along Raccoon Creek to develop the profile for that flood.

Flood Stages and Discharges

Table 7 lists the peak stages and discharges for the known floods exceeding the bankfull stage of 3 feet at the U. S. Geological Survey gaging station on Allen Creek near Hazelwood, North Carolina. The table also lists the dates of probable large floods during the period from 1867 to 1930, and the estimated stages and discharges for floods from 1930 to 1949 based upon correlations between flood stages on Allen Creek and those on Jonathans Creek and Scott Creek.

TABLE 7

ALLEN CREEK NEAR HAZELWOOD, NORTH CAROLINA

FLOODS ABOVE BANKFULL STAGE

All gage heights are referred to the U. S. Geological Survey gaging station located at Mile 3.00 near Hazelwood, North Carolina. Drainage area = 14.4 square miles. Bankfull stage is 3 feet.

Date of Crest	Stage feet	Discharge cfs	Date of Crest	Stage feet	Discharge cfs
March 6, 1867	(a)		July 19, 1949	3.36 (c)	900
June 15, 1876	(a)		December 20, 1951	3.37	909
March 1886	(a)		February 21, 1953	3.43	951
August 28, 1893	(a)		January 31, 1957	3.90	1,320
February 28, 1902	(a)		January 21, 1959	4.07	1,470
March 27, 1913	(a)		December 12, 1961	3.50	1,000
March 4, 1917	(a)		March 6, 1963	3.23	778
April 2, 1920	(a)		March 12, 1963	3.28	808
January 21, 1922	(a)		March 5, 1964	3.16	736
June 29, 1928	(a)		April 7, 1964	3.69	1,090
August 16, 1928	(a)		August 30, 1964	3.23	778
December 28, 1932	3.0 (b)	640	October 4, 1964	3.49	953
January 19, 1936	3.2 (b)	760	March 26, 1965	4.13	1,450
February 4, 1936	3.3	820	February 13, 1966	3.22	772
March 26, 1936	3.4	890	March 7, 1967	3.13	718
April 6, 1936	3.3	820	July 7, 1967	3.62	1,040
January 3, 1937	3.1 (b)	700	March 12, 1968	3.65	1,060
February 3, 1939	3.1 (b)	700			
August 13, 1940	3.7 (b)	1,100			
August 30, 1940	7.0 (c)	6,000			
January 7, 1946	3.0 (b)	640			
February 10, 1946	3.5 (b)	960			
January 20, 1947	3.4 (b)	890			
November 28, 1948	3.2 (b)	760			
June 16, 1949	3.53 (c)	1,030			

(a) Stage unknown. Flood history investigations indicate that large floods occurred at this time.

(b) Stage estimated upon basis of correlations with stages on Jonathans Creek near Cove Creek and Scott Creek above Sylva.

(c) Stage based upon high-water mark.

Listed in Table 8 are the highest five floods on Allen Creek in order of magnitude since the gage was established in 1949. The greatest of these, that of March 26, 1965, was exceeded by the flood of August 30, 1940, by almost 3 feet. On Richland Creek the August 30, 1940, flood exceeded the March 26, 1965, flood by 2 to 3 feet and is the highest known flood on the creek. No data are available concerning the 1940 flood on Raccoon Creek and Camp Branch, but it is probably the highest flood on those two streams also.

TABLE 8

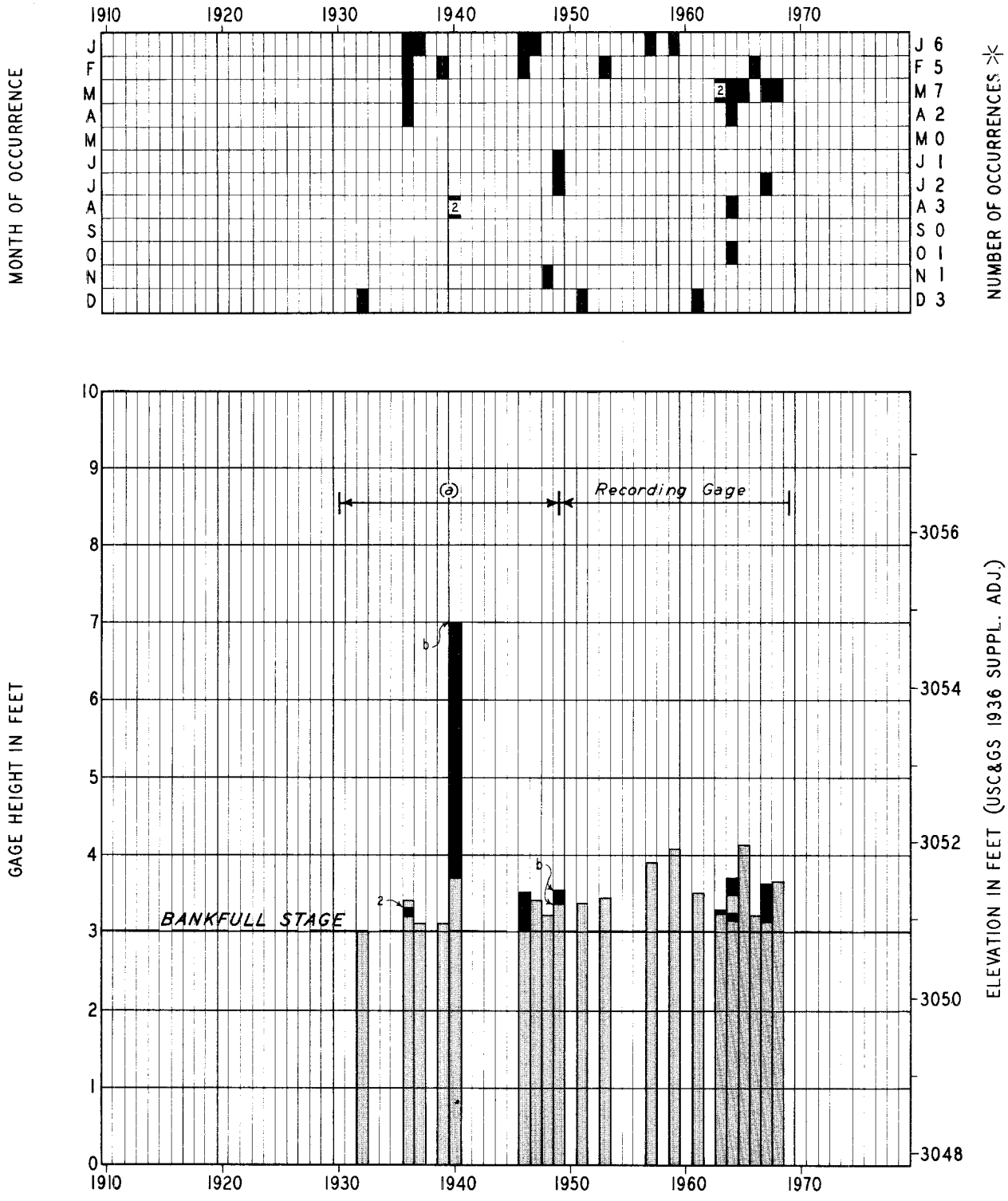
HIGHEST FIVE FLOODS IN ORDER OF MAGNITUDE

ALLEN CREEK NEAR HAZELWOOD, NORTH CAROLINA

Order No.	Date of Crest	Stage feet	Discharge cfs
1	March 26, 1965	4.13	1,450
2	January 21, 1959	4.07	1,470
3	January 31, 1957	3.90	1,320
4	April 7, 1964	3.69	1,090
5	March 12, 1968	3.65	1,060

Flood Occurrences

Plate 2 shows the crest stages and months of occurrence of the floods listed in Table 7 since 1930 which have exceeded the stage of 3 feet on Allen Creek at the stream gage near Hazelwood, North Carolina. Table 9 shows the monthly distribution of the 31 floods exceeding that stage during the period of record through October 1969. The record shows that floods have occurred most frequently in the winter and spring months, December through April, and in the month of August. A longer period of record would probably show floods occurring in every month of the year. The investigation indicates that floods have occurred with about the same frequency on Richland Creek, Raccoon Creek, and Camp Branch as on Allen Creek.



✳ Number of occurrences during the period May 1930 through October 1969.

(a) Stage estimated upon basis of correlations with stages on Jonathans Creek near Cove Creek and Scott Creek above Sylva.

(b) Stage based upon high water marks. Stream gage at River Mile 3.00

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

FLOODS ABOVE BANKFULL STAGE

ALLEN CREEK
NEAR
HAZELWOOD, N.C.
MARCH 1970

HD-1311

TABLE 9

MONTHLY FLOOD DISTRIBUTION

ALLEN CREEK NEAR HAZELWOOD, NORTH CAROLINA

Month	Number of Occurrences*	Month	Number of Occurrences*
Janaury	6	July	2
February	5	August	3
March	7	September	0
April	2	October	1
May	0	November	1
June	1	December	3
		Total	31

*Number of occurrences May 1930 through October 1969.

Duration and Rate of Rise

Small watersheds such as that of Richland Creek and its tributaries experience floods that are characterized by very rapid rates of rise and short duration.

Velocities

In the Richland Creek reach investigated, velocities in the channel during such floods as that of March 26, 1965, would range up to 12 feet per second, and in the overbank areas velocities would range up to 3 feet per second. Along Raccoon Creek in the reach investigated, velocities during floods such as that of February 2, 1969, would range up to 7 feet per second in the channel and 2 feet per second in the overbank areas. Velocities in the channel of Allen Creek during floods such as that of March 1965 would range up to 9 feet per second, and velocities in the overbank areas would range up to 2 feet per second. Velocities in the channel and overbank areas of Camp Branch would be about the same as those for Allen Creek, but higher velocities would occur in the steep upper reaches of Browning Branch. During larger floods on the four streams, velocities would be greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 4 shows the approximate areas along Richland Creek and Allen Creek in the vicinity of Waynesville and Hazelwood that were inundated

by the flood of March 26, 1965, and the approximate area along Raccoon Creek that was inundated by the flood of February 2, 1969. No historical flood data are available for Camp and Browning Branches. Plate 4 also shows the approximate areas along all streams that would be inundated by the Maximum Probable Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the map because the contour interval of the map does not permit precise plotting of the flooded area boundaries. The contour interval of Plate 4 is 40 feet.

Plate 5 shows the high-water profile on Richland Creek for the flood of March 26, 1965, and the high-water profile on Raccoon Creek for the flood of February 2, 1969. Also shown are the profiles for the Regional and Maximum Probable Floods discussed in Sections V and VI of this report.

Plate 7 shows the profiles on Allen Creek for the flood of March 26, 1965, and the Regional and Maximum Probable Floods. Also shown on Plate 7 are the Regional and Maximum Probable Flood profiles on Camp and Browning Branches. The streambed, low-water, and top-of-bank profiles are shown, but there is no historical flood profile.

Plate 6 shows typical cross sections of Richland Creek and Raccoon Creek, and Plate 8 shows typical cross sections of Camp and Browning Branches and Allen Creek in the reaches investigated. The locations of the sections are shown on the map and profiles, Plates 4, 5, and 7. The cross sections show the elevation and extent of overflow of the March 26, 1965, flood or the February 2, 1969, flood and the Regional and Maximum Probable Floods.

Flood Descriptions

Following are descriptions of known large floods that have occurred on streams in the vicinity of Waynesville and Hazelwood. These are based upon newspaper accounts, historical records, and investigations by TVA engineers.

August 13, 1940

The first of two great floods on streams in western North Carolina during August 1940 occurred on this date. Rainfall associated

with a hurricane which had moved inland over Georgia and South Carolina on August 11 totaled more than 16 inches at Beech Gap on the divide between the Pigeon and Tuckasagee River basins about 14 miles south of Waynesville. The average rainfall over the Richland Creek watershed was about 6 inches, and all of the streams in the vicinity of Waynesville and Hazelwood went out of banks. Two high-water marks on Richland Creek indicate that the flood was about 1 foot higher than that of March 1965.

August 30, 1940

The second great flood of August 1940 resulted from a local intense storm centered over eastern Tennessee and western North Carolina. At the recording rain gage at Haywood Gap, 13 miles south of Waynesville, almost 12 inches of rain were recorded in a period of 30 hours, and rainfall over the Richland Creek watershed averaged about 7 inches. The resulting floods on the streams in the vicinity of Waynesville and Hazelwood are the highest known. On Richland Creek and Allen Creek the flood of August 30, 1940, exceeded the flood of March 1965 by 2 to 3 feet.

The "Asheville Citizen" for August 31, 1940, contained the following description of the flood in Waynesville:

> Six hundred people are homeless tonight as a result of the most disastrous flood in the history of this mountain town.
>
> Homes in this area were washed away and water stood four feet deep in the Main street at Hazelwood. The Unagusta Furniture plant at Hazelwood was flooded and water stood two feet deep in many business houses.
>
> A four-room house of Dewey Buchanan was washed from its foundation and about 200 yeards down the creek. Buchanan, his wife and a 11-year daughter had to swim and wade to safety.
>
> Heroic work on the part of Waynesville and Hazelwood police officers accounted for the saving of several persons who were marooned by the high waters. Some of the homeless are being cared for in the Waynesville police and fire departments.
>
> While the damage tonight could not be estimated, it is certain to run into many thousands of dollars. Loss to the England-Walton Leather company alone is placed at $8,000, the Unagusta company $9,000, and many other firms suffered losses.

> The storm reached its crest at 3 a.m., Friday and the railway station was under three feet of water. All highways were flooded but the water has gone down considerably. Communication with the outside was interrupted for 12 hours.

January 31, 1957

An unusual series of storms occurred over the Tennessee River Basin between January 20 and February 10, 1957, producing rainfall totals that in many places exceeded previous records for a similar period. During the 3-week period, 10 to 25 inches of rain fell over the eastern half of the Tennessee Valley.

Rainfall over the Richland Creek watershed averaged almost 4 inches during the 10-day period ending at 6 p.m. January 30. During the next 24 hours rainfall over the watershed averaged more than 5 inches, and all streams in the vicinity of Waynesville and Hazelwood rose rapidly. Allen Creek reached a stage of 3.90 feet, the highest since the gage was installed in 1949.

Richland Creek was out of its banks on the morning of January 31, threatening private dwellings in the vicinity of Border Street and Boyd Avenue, but no property damage was sustained. Farther downstream the creek flooded the wide, flat plain above Lake Junaluska. The flood gates of the lake were opened January 31, and the county road and lowlands directly below the dam were flooded to an average depth of 6 inches. The lake was reported to have risen 18 inches in four hours with the flood gates open.

January 21, 1959

On this date rainfall in the Waynesville vicinity averaged about 3 inches, most of which fell in a 6-hour period. Allen Creek reached a stage of 4.06 feet, 0.16 foot higher than the previous highest stage. An investigation of the flood in the Hazelwood and Waynesville reach at Richland Creek showed that January 1959 flood heights were about the same to a little higher than the January 1957 flood. Damage from the flood was minor and was confined mainly to cleanup work. The boiler room of the Waynesville Laundry and a nearby house were flooded. Water was up in the yards of houses on Lee Street but did not enter any of them.

April 7, 1964

During the four days from April 3 to April 6, 1964, rainfall in the vicinity of Waynesville averaged about 1.2 inches, so that the ground was fairly well saturated when a rainfall averaging about 3.8 inches occurred in a period of 14 hours on April 7. In Waynesville, Richland Creek was out of banks for a few hours on the morning of April 7 and around two houses which are situated next to the creek on low ground near the Boyd Avenue bridge. It also overflowed the low fields below Waynesville; however, no damage was noted. Elsewhere Richland Creek flowed bankfull during this high water.

March 26, 1965

Rainfall which started early in the morning of March 24 and continued until about 9 a.m. March 26 averaged more than 5 inches over the Richland Creek watershed. The flood which resulted on Richland Creek and its tributaries was the greatest since that of August 30, 1940. It exceeded the flood of January 1959 by 0.2 to 0.5 foot on Richland Creek through Hazelwood and Waynesville.

The creek overflowed both approaches to the Main Street bridge, stopping traffic for a short time and leaving a large amount of debris that had to be cleared away after the flood. On Plott Creek, which enters Richland Creek at Mile 8.1, two goats and a purebred calf were drowned in the flood. In this vicinity, construction of the Waynesville bypass road has effected minor changes in the natural drainage pattern of feeder streams.

Floodwaters were 0.4 foot deep in a house on Oak Street and threatened several others in the vicinity, causing some families to leave.

The backyards of a number of houses on the left bank of the creek between Mile 8.0 and 7.0 were badly washed. At Mile 7.2 an occupant of a small frame dwelling situated low on the right bank was awakened early in the morning by the floodwaters pouring through the house. Mud marks on the inside of this house measure 0.8 foot above the floor. Downstream in the vicinity of Smathers Street bridge, the flood entered two left-bank dwellings to depths of 0.5 foot and threatened the Carolina Power & Light Company's Waynesville substation. On the right bank the driveways to a coalyard and bulk oil distribution point were badly washed.

Left-bank overflow from Mile 6.3 to 6.0 fingered out through a residential neighborhood of new houses, washing lawns and streets. None of these houses has a basement. The water flowed beneath several, damaging at least one heating plant. At lower Border Street, water was over the main floor in two houses.

Below Waynesville, Richland Creek spread out extensively in the bottoms along the left bank. Damage was confined to erosion and silting of the land. Just below Lake Junaluska the flood broke some 400 feet of pavement on the blacktop road below the dam.

Raccoon Creek inundated a bulk oil company and carried away a 1,000-gallon empty tank and some drums, which were retrieved after the waters subsided.

Allen Creek reached a crest stage of 4.13 feet at 8:15 a.m. March 26. It is the highest stage recorded since the gage was installed in 1949, but it exceeded the January 1959 flood by just 0.06 foot. At several points the banks of the creek were badly scoured, but otherwise there was little damage along the creek.

Figure 8 shows two photographs of the March 1965 flood on Richland Creek in Waynesville.

Figure 8.--FLOOD OF MARCH 26, 1965, ON RICHLAND CREEK

Upper view shows Lee Street, opposite Mile 6.1 on left bank of Richland Creek, at 9:55 a.m. The water overflowed the bank just above this point and surrounded a number of houses in this section. Lower view shows Giles Chemical Company on right bank at Mile 6.8, as seen by looking downstream from the Smathers Street bridge at Mile 6.8. The picture was taken about 8:45 a.m., the approximate time of the flood crest.

V.

REGIONAL FLOODS

V.

REGIONAL FLOODS[1]

This section of the report relates particularly to floods on streams whose watersheds are comparable with those of Richland Creek and its tributaries.

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Waynesville and Hazelwood, North Carolina. Heavy storms similar to those causing these floods could occur over the watersheds of Richland Creek and its tributaries. In this event, floods would result on these streams comparable in magnitude with those experienced on neighboring streams. Floods of this size are designated as Regional Floods. It is therefore desirable, in connection with any determination of future floods which may occur on Richland Creek, Raccoon Creek, Camp and Browning Branches, and Allen Creek, to consider floods that have occurred in the region on watersheds with similar topography, watershed cover, and physical characteristics.

Maximum Known Floods in the Region

Table 10 lists the maximum known floods experienced on watersheds comparable with those of Richland Creek and its tributaries and within about 60 miles of Waynesville and Hazelwood. Streams which differ significantly in watershed characteristics have not been included. This limits the streams considered to those which have their headwaters in the Southern Appalachian Mountains.

Floods caused by the decadent tropical hurricanes of July 1916 and mid-August 1940 were not included in the determination of the Regional Floods on Richland Creek and its tributaries. These streams are outside the area affected by hurricane movement. During a hurricane, moist air moving from the Gulf and Atlantic coast is forced upward by the gradually sloping ground rising to the crest of the Tennessee Valley Divide. As a result of this orographic influence, the heaviest rainfall occurs on the south and east slopes of the Divide, and the area affected within the Tennessee Valley is confined to a relatively narrow spillover area immediately beyond the crest.

---

1. Prepared by Hydraulic Data Branch.

TABLE 10

MAXIMUM KNOWN FLOOD DISCHARGES ON STREAMS

IN THE REGION OF WAYNESVILLE AND HAZELWOOD, NORTH CAROLINA

No.	Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per sq. mi. cfs
1	Tuckasegee River	at Tuckasegee, N. C.	143	August 30, 1940	40,800	285
2	Pigeon River	at Canton, N. C.	133	August 30, 1940	31,600	238
3	Swannanoa River	at Biltmore, N. C.	130	April 1791	40,000	308
4	Valley River	at Tomotla, N. C.	104	September 1898	20,000	192
5	Cullasaja River	at Cullasaja, N. C.	86.5	October 4, 1964	16,900	195
6	Sandymush Creek	nr. Alexander, N. C.	79.5	August 30, 1940	20,000	252
7	East Fork Pigeon River	nr. Canton, N. C.	51.5	February 13, 1966	12,100	235
8	Deep Creek	at Bryson City, N. C.	43.9	May 1840	20,000	456
9	Caney Fork	above Cowarts, N. C.	39.4	August 30, 1940	21,700	551
10	West Fork Pigeon River	at Lake Logan Dam, N. C.	32.8	August 30, 1940	14,900	454
11	Hominy Creek	above Candler, N. C.	28.9	August 30, 1940	12,400	429
12	North Fork Swannanoa River	nr. Black Mountain, N. C.	23.8	June 16, 1949	16,500	693
13	Wolf Creek	nr. Tuckasegee, N. C.	14.1	August 30, 1940	14,500	1,030
14	West Fork Pigeon River	at Spruce, nr. Waynesville, N. C.	12.2	August 30, 1940	16,500	1,350
15	West Fork Little Pigeon River	below Trout Branch, Sevier County, Tenn.	7.60	September 1, 1951	8,500	1,120
16	Pilkey Creek	at Fontana Reservoir, N. C.	3.87	July 5, 1943	4,520	1,170
17	Alum Cave Creek	nr. mouth, Sevier County, Tenn.	1.95	September 1, 1951	5,800	2,970
18	Cove Creek	nr. Suttontown, N. C.	1.81	June 30, 1956	3,100	1,710

The earliest flood of record in the Waynesville and Hazelwood region occurred in April 1791. Although very little information is available about this flood, it is the greatest known flood on the Swannanoa River. In May 1840 a storm which caused large floods on the Tuckasegee River and Deep Creek occurred in the region.

One of the most severe recent storms in the vicinity of Waynesville and Hazelwood was that of August 29-30, 1940. This storm was a fairly local meteorological disturbance centered in the Little Tennessee and French Broad basins, the heaviest rainfall occurring over the headwaters of the Tuckasegee and Cullasaja Rivers. The rain fell in a period of 20 to 28 hours and totaled 10.2 inches on the Tuckasegee River watershed above Tuckasegee, 10.7 inches on the Wolf Creek watershed, and 10.0 inches on the Cullasaja River watershed above Cullasaja. This storm occurred only $2\frac{1}{2}$ weeks after a tropical hurricane had brought heavy rains over much of the area, creating wet ground conditions which may have contributed to the severe flooding.

The storm of June 14-16, 1949, was part of a widespread disturbance that produced floods of considerable magnitude throughout much of the southeastern part of the Tennessee Valley. Rainfall of 8.50 inches during a 21-hour period near Black Mountain, North Carolina, produced a flood on the North Fork Swannanoa River which was exceeded only by the great flood of July 1916.

On September 1, 1951, an intense thunderstorm in the Great Smoky Mountains National Park caused severe flooding in the West Fork Little Pigeon River watershed above Gatlinburg, Tennessee. Total storm rainfall of 4.0 inches in a 2-hour period was measured at the U. S. Weather Bureau gage on Mount Le Conte.

On June 30, 1956, an intense thunderstorm occurred over the upper reaches of Cove Creek watershed near Suttontown, North Carolina. Rain and hail fell for about an hour over an area of approximately one square mile. Rainfall catches in the area measured up to 3 inches, but approximations made from peak-discharge data indicated maximum rainfall amounts of 10 to 12 inches. This storm caused severe flooding on the upper reaches of Cove Creek and its tributaries with substantial damage to roads, farm property, and crops.

The floods listed in Table 10 have occurred on watersheds in the region of Waynesville and Hazelwood that have similar physical characteristics. This indicates that floods of like magnitude, modified to take into account differences in watershed characteristics, could occur in the future on Richland Creek and its tributaries.

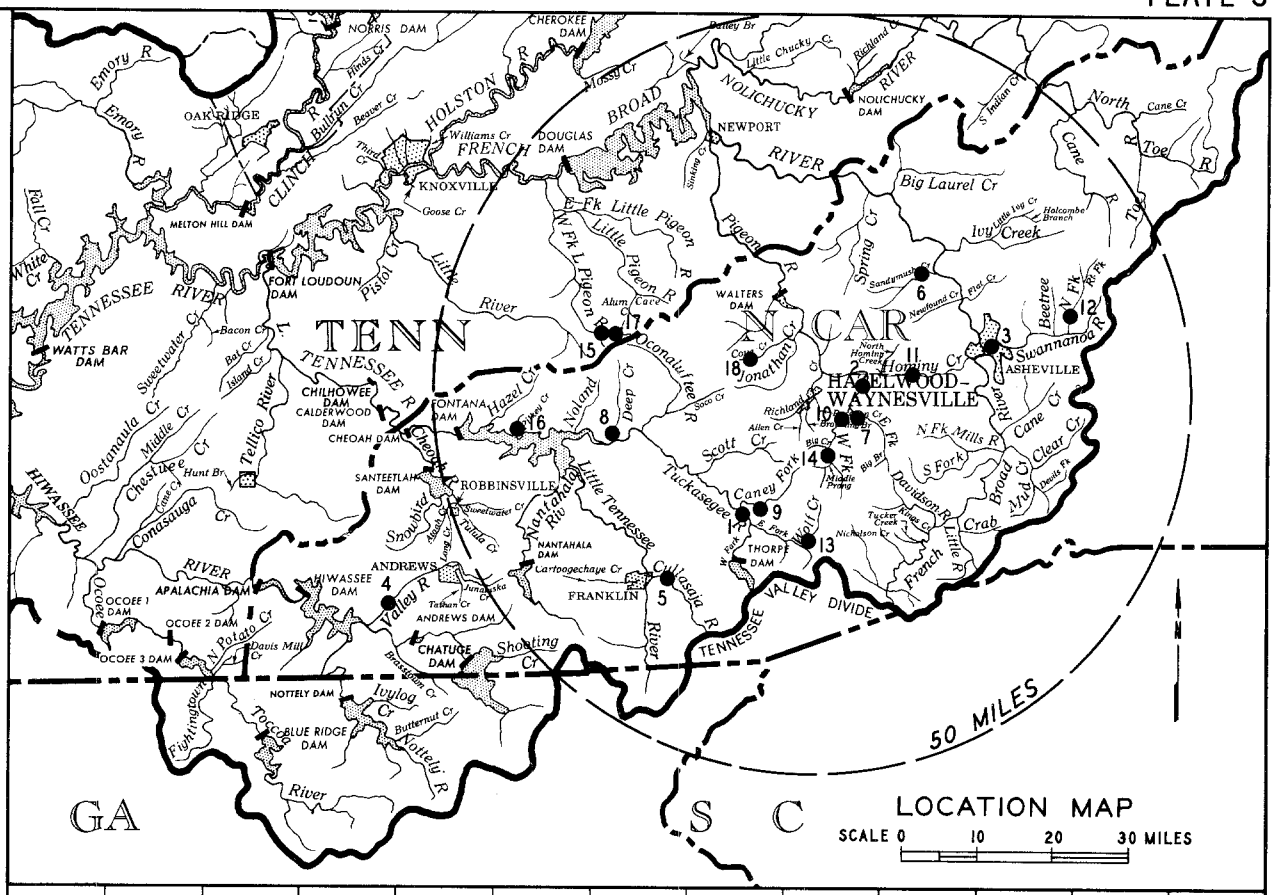
Determination of Regional Floods

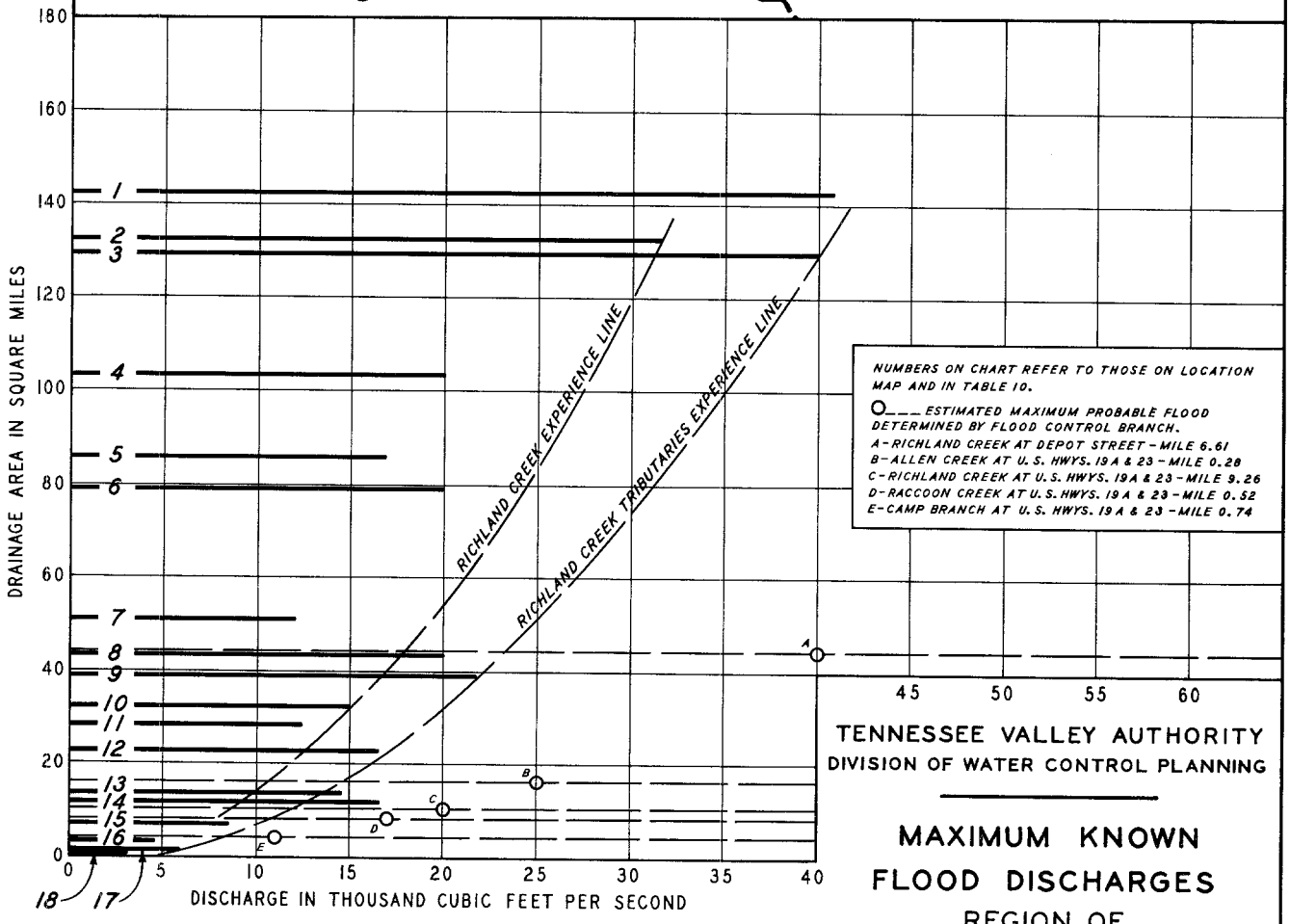
Plate 3 is a diagram of the discharges listed in Table 10 together with a map showing the locations of these discharge measurements. The most significant discharges listed in the table occurred during the late August 1940 flood. This flood resulted from general thunderstorm activity with intense rainfall over a localized area. Undoubtedly storms of this type occur quite often in the mountain regions, but because of the limited size and remoteness of the area affected, very little damage is sustained and the storm is not recorded. Other storms of this type include the storms of June 1949, September 1951, and June 1956.

Although severe flooding in the region of Waynesville and Hazelwood would be more likely to occur from intense local storms, floods can also result from the cyclonic type storm which produces heavy rainfall over a wide area. These storms usually continue for a period of several days and can occur during any part of the year; however, they are more likely to be experienced in the winter or early spring. These storms often fall on frozen ground or melting snow which contributes to the runoff.

An important stream characteristic which must be considered in determining future floods on the Richland Creek watershed is the slope. This includes not only the slope of the main stream but also that of the tributaries. The main stream slope of Richland Creek is considerably flatter than most of the streams listed in Table 10. Therefore, discharges computed upon a per-square-mile basis for Richland Creek would be less than for some of its neighboring streams from a similar storm. The tributaries of Richland Creek studied in this report have slopes similar to those streams listed in Table 10, and from similar storms the discharges upon a per-square-mile basis would be similar. For this reason the experience line shown on Plate 3 for Richland Creek has been shifted to the left.

PLATE 3





TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

MAXIMUM KNOWN FLOOD DISCHARGES
REGION OF WAYNESVILLE AND HAZELWOOD, N.C.

MARCH 1970

Figure 9.--FLOOD HEIGHTS AT RICHLAND CREEK SHOPPING CENTER

This shopping center extends between Miles 5.95 and 6.10, on left bank downstream from U.S. Highway 276. The upper view shows the downstream end, while the lower view was taken at the upstream end. At each location the flood height of March 26, 1965, was 2.4 feet lower than the floor level, represented by the base of the rod. Arrows show the Regional and Maximum Probable Flood heights.

Figure 10.--FLOOD HEIGHTS IN VICINITY OF DEPOT STREET

Upper view shows a department store and super market at Mile 6.60 of Richland Creek. The floor is 2.0 feet higher than the March 1965 flood level. Lower view shows a farm supply store at Mile 6.66, where the floor is 1.0 foot above the same flood. Arrows show heights of the Regional and Maximum Probable Floods.

Figure 11.--FLOOD HEIGHTS AT DAYCO CORPORATION, MILE 9.16

The view is across Richland Creek from U.S. Highways 19A & 23 at mouth of Hyatt Creek. The near corner of the building was 1.6 feet above the 1965 flood; Regional and Maximum Probable Flood heights are shown.

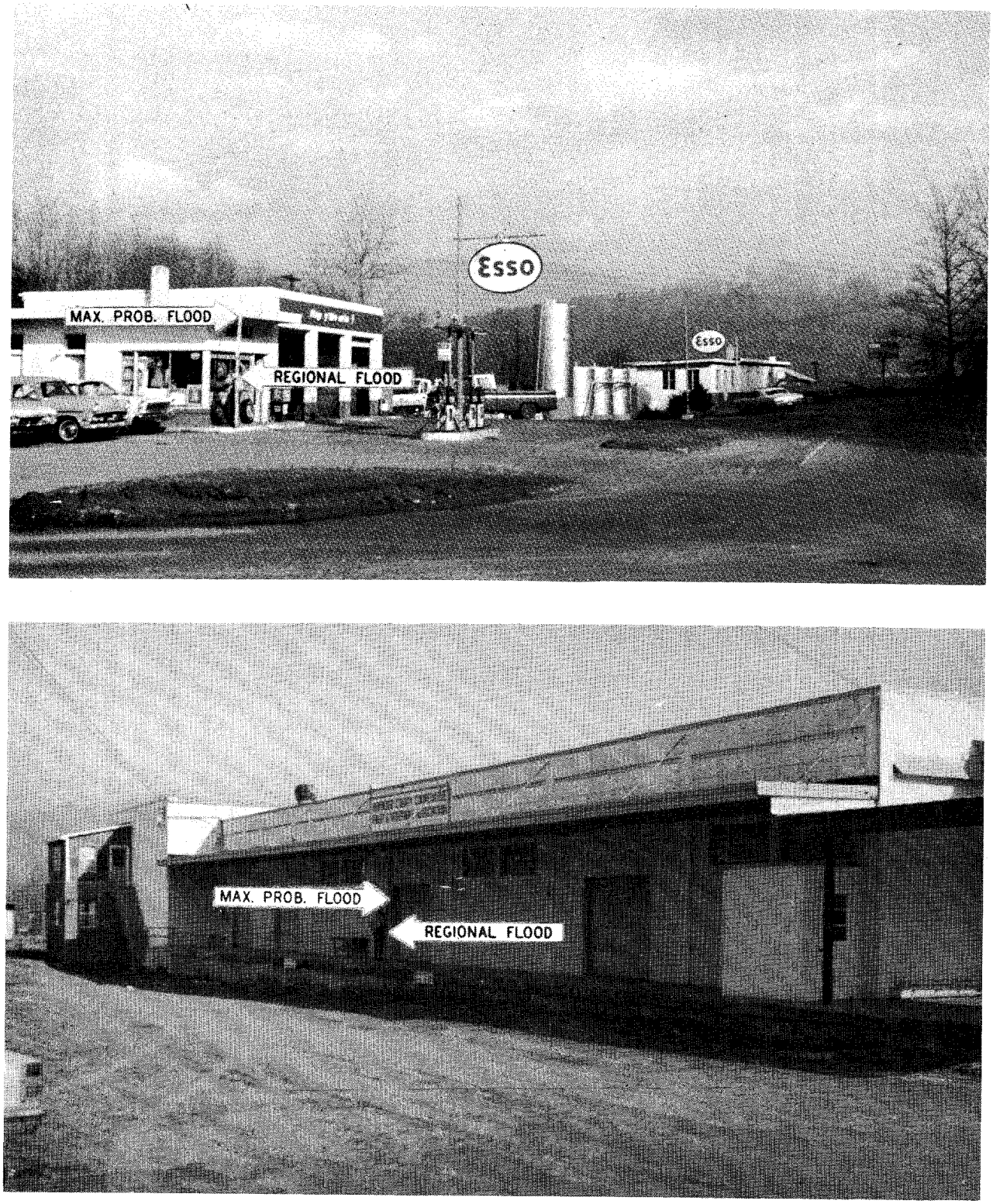


Figure 12.--FLOOD HEIGHTS ALONG LOWER RACCOON CREEK

Upper view shows service station at intersection of U. S. Highway 23, business, and Howell Mill Road, at Mile 0.24. The flood of February 2, 1969, was 7.9 feet lower than the station floor. Lower view shows the Haywood County Cooperative Fruit & Vegetable Association warehouse on left bank at Mile 0.72, where the 1969 flood was 7.8 feet lower than the floor. Arrows show the Regional and Maximum Probable Flood heights.

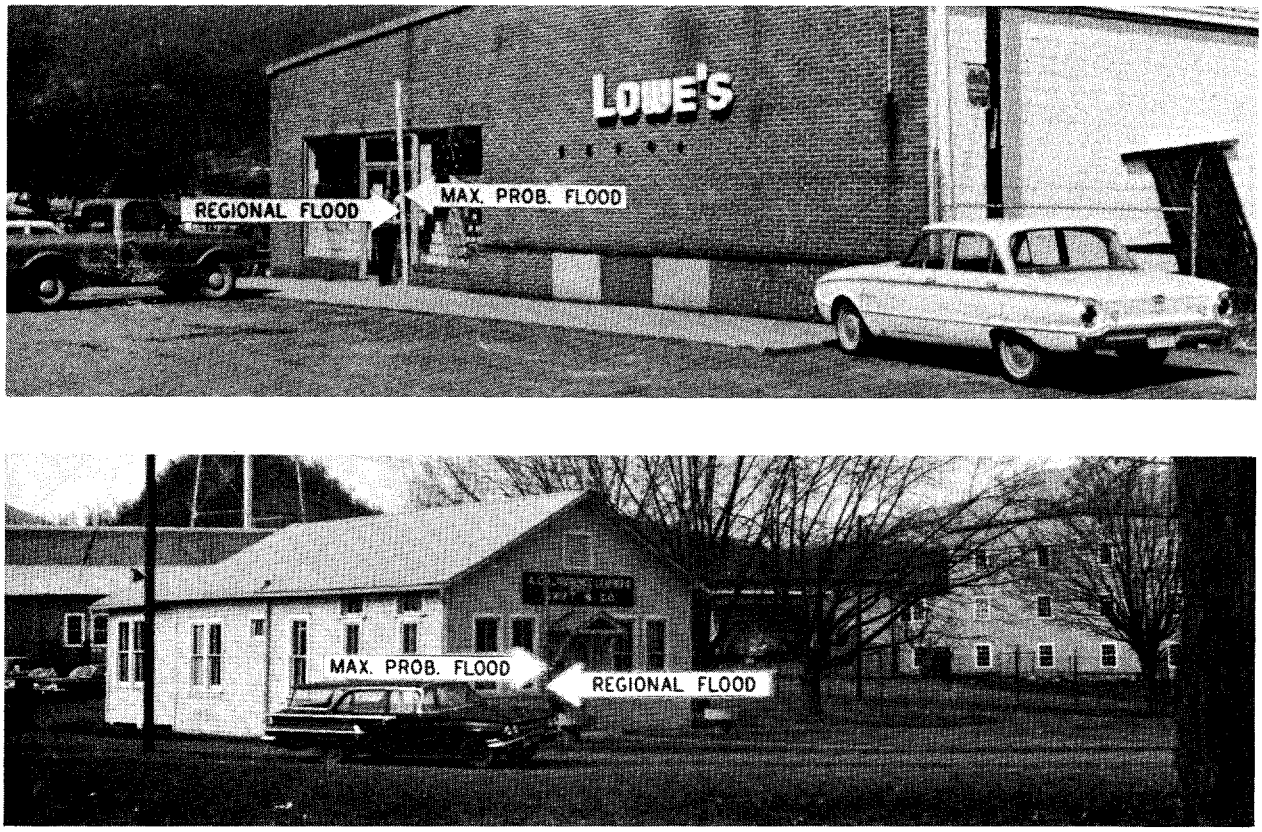


Figure 13.--FLOOD HEIGHTS ALONG CAMP BRANCH

Hardware store in upper view, at Mile 0.16, was 9.0 feet above the March 1965 flood, but the flood of August 30, 1940, reached about floor level. This is opposite Richland Creek Mile 8.22, and the Regional and Maximum Probable Floods on that creek would be respectively 3.5 and 0.5 feet below the floor. Lower view shows A. C. Lawrence Leather Co. at Mile 0.23. Most of the buildings are in the Richland Creek flood plain with floors about 1 foot above the Regional Flood and 2 feet below the Maximum Probable Flood. Arrows show the heights of these floods on Camp Branch.

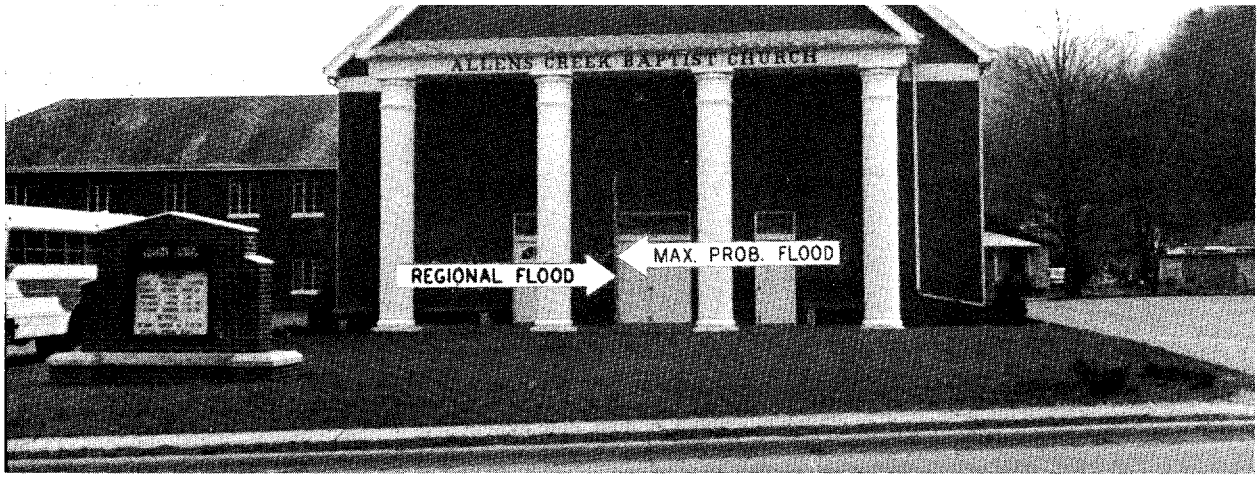


Figure 14.--FLOOD HEIGHTS ALONG ALLEN CREEK

The March 1965 flood was 0.7 foot below the floor. Arrows show the Regional and Maximum Probable Flood heights.

Based upon the maximum flood discharges experienced in the region, it is reasonable to expect future floods on Richland Creek, Raccoon Creek, Camp Branch, and Allen Creek to be in the order of those given in Table 11. These discharges take into account the differences in slope as well as other watershed characteristics of the various watersheds. For the purposes of this report, floods of these magnitudes are called Regional Floods.

TABLE 11

REGIONAL FLOOD PEAK DISCHARGES

Stream	Location	Mile above Mouth	Drainage Area sq. mi.	Discharge cfs
Richland Creek	U.S. Highway 19	3.80	58.0	21,000
	Depot Street	6.61	44.5	18,000
	U.S. Highway 23, business	9.26	10.9	8,600
Raccoon Creek	U.S. Highway 23, business	0.52	8.74	10,800
Camp Branch	U.S. Highway 23, business	0.74	4.76	8,200
Allen Creek	U.S. Highway 23, business	0.28	16.8	14,500

The profiles of the Regional Floods on Richland Creek and Raccoon Creek are shown on Plate 5. Such a flood on Richland Creek would be 3 to 13 feet higher than the March 26, 1965, flood, averaging about 6 feet higher through Waynesville and Hazelwood. A Regional Flood may occur on Raccoon Creek in the reach investigated that would be from 4 to 14 feet higher than the February 2, 1969, flood, averaging about 8 feet higher. The Regional Flood profiles on Camp and Browning Branches and Allen Creek are shown on Plate 7. In the reach investigated on Camp and Browning Branches, a Regional Flood may occur that would be 4 to 10 feet higher than the low-water profile, averaging 7 feet higher. On Allen Creek a Regional Flood may occur that would average about 6 feet higher than the March 1965 flood, ranging from 4 to 12 feet higher as shown on Plate 7. Figures 9 to 14 show the height that would be reached by the Regional Flood at several locations along the streams in the vicinity of Waynesville and Hazelwood.

VI.

MAXIMUM PROBABLE FLOODS

VI.

MAXIMUM PROBABLE FLOODS[1]

This section discusses the Maximum Probable Floods on the streams involved in this study and some of the hazards of great floods. Floods of the magnitude of the Maximum Probable are the kind considered in planning construction and operation of protective works, the failure of which might be disastrous. They represent reasonable upper limits of expected flooding.

Drainage areas of the streams involved in this study are as follows:

Stream	Mile above Mouth		Drainage Area	
	From	To	Downstream Limit	Upstream Limit
			sq. mi.	sq. mi.
Richland Creek	3.8	10.0	58.0	10.4
Raccoon Creek	0	1.91	8.90	3.81
Camp and Browning Branches	0	2.53	4.98	1.95
Allen Creek	0	1.78	16.9	16.4

Extreme floods on these streams are most likely to result from either of two types of storms--intense periods of rainfall during winter storms of fairly long duration, or short-duration storms of the thunderstorm or hurricane type usually occurring during summer or early fall. Infiltration and other losses are generally low in winter and high in summer.

---

1. Prepared by Flood Control Branch.

DETERMINATION OF FLOOD DISCHARGES

In determining the Maximum Probable Floods on the streams involved in this study, consideration was given to great storms and floods that have already occurred on these watersheds and to those which have occurred elsewhere but could have occurred in this area. This procedure provides information about possible floods and storms additional to that which can be gained from the short-term local hydrologic records alone.

The greatest known flood on Allen Creek where formal records have been kept since 1949 was that of March 26, 1965, when the peak discharge equaled 1,450 cubic feet per second. The greatest known flood on Richland Creek in the vicinity of Waynesville and Hazelwood for which data are available is also that of March 1965. The peak discharge is estimated to have been 4,700 cubic feet per second at Mile 6.7 between Depot and Smathers Streets, and 1,800 cubic feet per second at U. S. Highway 23, business, at Mile 9.3. The March 1965 flood peak on Allen Creek at U. S. Highway 23, business, at Mile 0.3 was estimated to be 1,600 cubic feet per second. There is not enough information available from which to make an accurate estimate of the peak discharges for the March 1965 flood on Raccoon Creek or Camp Branch. A minor flood on Raccoon Creek on February 2, 1969, had an estimated peak discharge of 900 cubic feet per second at U. S. Highway 23, business, at Mile 0.5. The record is short, and the recorded floods were not outstanding events; thus it is reasonable to expect that greater floods will occur on all four streams.

Maximum Probable Storms

Observed storms are meteorologically transposable to the area of Waynesville and Hazelwood from within a broad region extending generally from the Atlantic Ocean to the Appalachian Divide and from Florida through Pennsylvania. The moisture source for storms in this region is the warm, moist air flowing northward from the tropical Atlantic Ocean. In general the moisture potential for a given region decreases with its increased distance from the moisture source. It is further decreased when mountain barriers lie between the moisture source and the watershed. Transposition of storms from within the broad region includes adjustments for the particular meteorological conditions to be expected in the area of Waynesville and Hazelwood.

Table 12 lists known rainfall depths for several large storms transposable to this area.

TABLE 12

SELECTED MAXIMUM OBSERVED STORMS TRANSPOSABLE TO THE REGION OF WAYNESVILLE AND HAZELWOOD, NORTH CAROLINA

Date	Location	Drainage Area sq. mi.	Rainfall Duration hours	Rainfall Depth inches
July 1916	North Carolina	10	6	8.0
		60	6	7.5
September 1940	New Jersey	Point	3	11.3
		10	3	10.7
		60	6	18.2
October 1941	Florida	10	6	12.9
		60	6	11.1
July 1960	Georgia	Point	3	12.5
June 1961	North Carolina	3.49	2.5	8.5

Storms for computing Maximum Probable Floods for Waynesville and Hazelwood were developed from storm data similar to that given in Table 12. The procedures used are reported in Hydrometeorological Report No. 45, "Probable Maximum and TVA Precipitation for Tennessee River Basins Up to 3000 Square Miles in Area and Durations to 72 Hours," which was prepared for TVA by the U. S. Weather Bureau and published in May 1969. The following rainstorms were adopted for computing the Maximum Probable Floods.

Location	Drainage Area sq. mi.	Rainfall Duration hours	Rainfall Depth inches
Richland Creek			
Upper limit	10.4	6	18.4
Lower limit	58.0	6	14.9

Location	Drainage Area sq. mi.	Rainfall Duration hours	Rainfall Depth inches
Raccoon Creek			
Upper limit	3.81	3	14.4
Lower limit	8.90	3	13.9
Camp and Browning Branches			
Upper limit	1.95	3	15.2
Lower limit	4.98	3	15.2
Allen Creek			
Upper limit	16.4	3	14.0
Lower limit	16.9	3	14.0

From a meteorological standpoint, storms 1.6 times greater than these can occur.

Maximum Probable Flood Discharges

The peak discharges expected to result from an occurrence of the maximum probable storm were computed by using average runoff conditions. Table 13 lists the peak discharges at selected locations on the streams included in this study.

TABLE 13

MAXIMUM PROBABLE FLOOD PEAK DISCHARGES

Location	Mile above Mouth	Drainage Area sq. mi.	Discharge cfs
Richland Creek			
Lower limit	3.80	58.0	45,000
Depot Street	6.61	44.5	40,000
U. S. Highway 23, business	9.26	10.9	20,000
Upper limit	10.00	10.4	19,000
Raccoon Creek			
Mouth	0.0	8.90	18,000
U. S. Highway 23, business	0.52	8.74	17,000
Upper limit	1.91	3.81	10,000

TABLE 13 (Continued)

Location	Mile above Mouth	Drainage Area sq. mi.	Discharge cfs
Camp and Browning Branches			
Mouth	0.0	4.98	12,000
U. S. Highway 23, business	0.74	4.76	11,000
Upper limit	2.53	1.95	7,000
Allen Creek			
Mouth	0.0	16.9	26,000
U. S. Highway 23, business	0.28	16.8	25,000
Upper limit	1.78	16.4	24,000

Maximum Recorded Floods

As a guide in determining their reasonableness, the computed Maximum Probable Floods were compared with maximum observed floods on other streams. Factors such as the meteorology of the region and flood-producing characteristics of the watershed were given consideration in determining whether peak discharges on other streams were comparable. Table 14 lists peak discharges for observed floods on several streams approximately the size of those discussed in this report, some of which equal or approach the adopted Maximum Probable Flood rates if allowance is made for the size of a watershed. For comparison, the discharges of the March 26, 1965, flood on Allen Creek and Richland Creek are listed.

TABLE 14

SELECTED MAXIMUM OBSERVED FLOODS

APPLICABLE TO WAYNESVILLE AND HAZELWOOD, NORTH CAROLINA

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per sq. mi. cfs
Big Creek	Sunburst, N. C.	1.32	1940	12,900	9,800
Big Creek	Sunburst, N. C.	1.69	1940	12,400	7,340
N. F. Catawba River	Asheford, N. C.	5.2	1940	15,000	2,880

TABLE 14 (Continued)

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per sq. mi. cfs
W. F. Pigeon River	Spruce, N. C.	8.4	1940	16,400	1,950
Swannanoa River	Black Mtn., N. C.	11.2	1916	17,000	1,520
Steels Creek	Tablerock, N. C.	16	1940	24,000	1,500
Elk River	Elkville, N. C.	50	1940	70,000	1,400
Wilson Creek	Adako, N. C.	66	1940	99,000	1,500
Linville River	Branch, N. C.	67	1940	39,500	590
Allen Creek	Hazelwood, N. C.	14.4	1965	1,450	101
Richland Creek	Waynesville, N. C.	44.5	1965	4,700	105

Frequency

It is not possible to assign a probability of occurrence or frequency to the Maximum Probable Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible Larger Floods

Floods larger than the Maximum Probable are hydrologically possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. The consideration of floods of this magnitude is of greater importance in some problems than in others but should not be overlooked in the study of any problem.

HAZARDS OF GREAT FLOODS

The amount and extent of damage caused by any flood depend in general upon how much area is flooded, the height of flooding, the velocity of flow, the rate of rise, and the duration of flooding.

Areas Flooded and Heights of Flooding

The areas flooded by the Maximum Probable Flood and the flood of March 1965 or February 1969 are shown on Plate 4. Depths of flow can be estimated from the crest profiles which are shown on Plates 5 and 7.

The profiles for the four streams were computed by using stream characteristics for selected reaches as determined from available observed flood profiles, topographic maps, and valley cross sections which were surveyed in 1969. The elevations shown on Plates 5 and 7 and the overflow areas shown on Plate 4 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data. More precision would require costly surveys not warranted by this study.

The profiles of the Maximum Probable Flood depend in part upon the degree of destruction or clogging of various bridges during the floods. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand and that no clogging would occur.

The Maximum Probable Flood profile on Richland Creek is from about 6 to 20 feet higher than the March 1965 flood profile, the maximum difference occurring at Mile 5.0 above the Howell Mill Road bridge.

On Raccoon Creek the Maximum Probable Flood is from 6 to 18 feet higher than the February 1969 flood profile. The maximum difference occurs at Mile 0.3, also above a bridge on Howell Mill Road. The Maximum Probable Flood profile on Allen Creek is 5 to 14 feet higher than the March 1965 flood profile, the maximum difference occurring above the Southern Railway bridge near the mouth of the creek. On Camp and Browning Branches the Maximum Probable Flood is 6 to 12 feet higher than the low-water profile. The maximum difference occurs above the Southern Railway bridge one-fourth mile above the mouth of Camp Branch.

Figures 9 to 14 on pages 51 to 54 show the heights that would be reached by the Maximum Probable Flood at several locations along the streams included in this report.

Velocities, Rates of Rise, and Duration

Water velocities in the streams during a flood depend largely upon the size and shape of the cross section, the condition of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream.

During the Maximum Probable Flood, the range of velocities in the main channel and in the overflow plain of the four streams of this study would be as shown in Table 15.

TABLE 15

MAXIMUM PROBABLE FLOOD VELOCITIES

	Feet per Second			
	Main Channel		Overflow Plain	
	From	To	From	To
Richland Creek	7	22	2	7
Raccoon Creek	4	15	2	5
Camp and Browning Branches	6	28	2	8
Allen Creek	7	16	1	4

The total rise above low water to the crest stage, the maximum rate of rise, and the duration above bankfull stage of the Maximum Probable Flood on each of these four streams would be as shown in Table 16.

These rapid rates and high stream velocities in combination with deep, long-duration flooding would create a hazardous situation in developed areas.

TABLE 16

MAXIMUM PROBABLE FLOODS--RATE OF RISE AND DURATION

Stream	Location	Total Rise above Low Water	Maximum Rate of Rise	Duration above Bankfull Stage
Richland Creek	Above Depot Street, Mile 6.7	17 feet in 5 hours	4 feet in 1 hour	36 hours
	Above Main Street, Mile 8.2	12 feet in 5 hours	3 feet in 1 hour	32 hours
Raccoon Creek	Below Ratcliffe Cove Road, Mile 1.3	13 feet in 3 hours	5 feet in 1 hour	11 hours
Camp Branch	Above U. S. Highway 23, business, Mile 0.8	8 feet in 3 hours	4 feet in 1 hour	7 hours
Allen Creek	Above Secondary Route 1149, Mile 0.9	12 feet in 4 hours	5 feet in 1 hour	16 hours

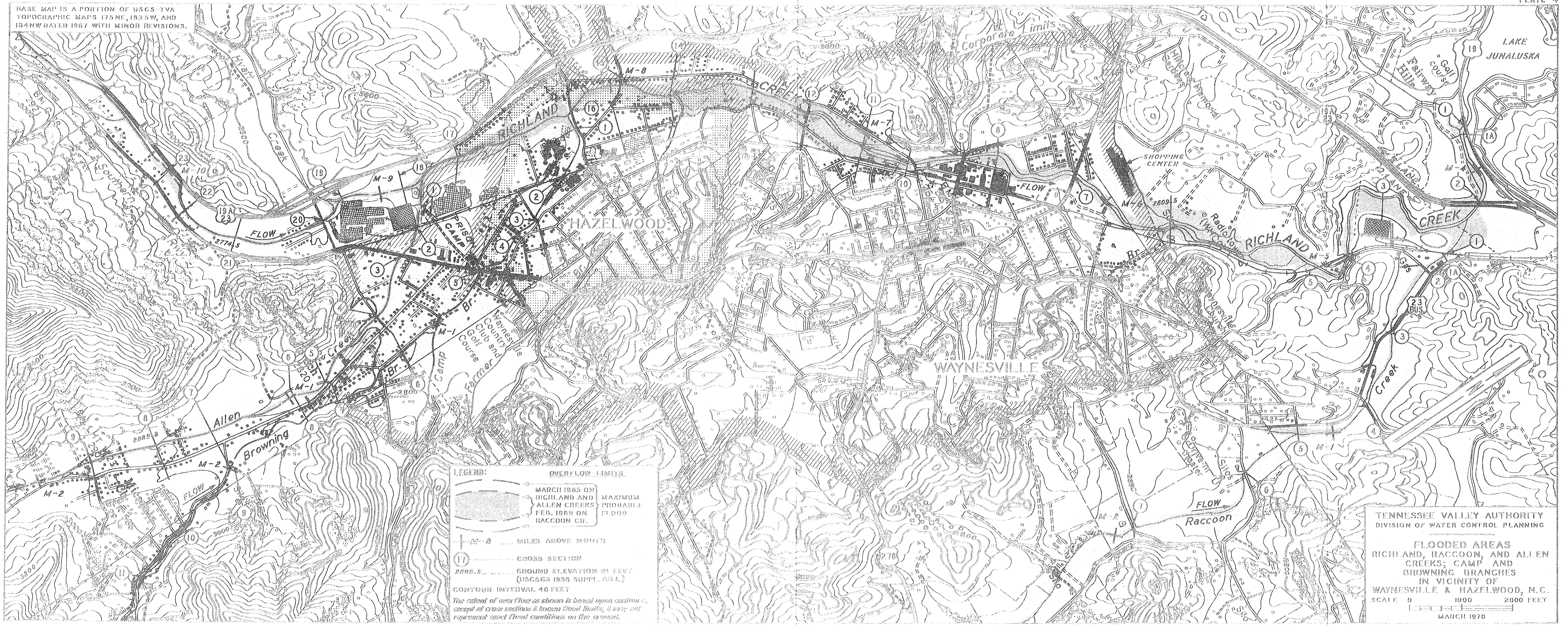
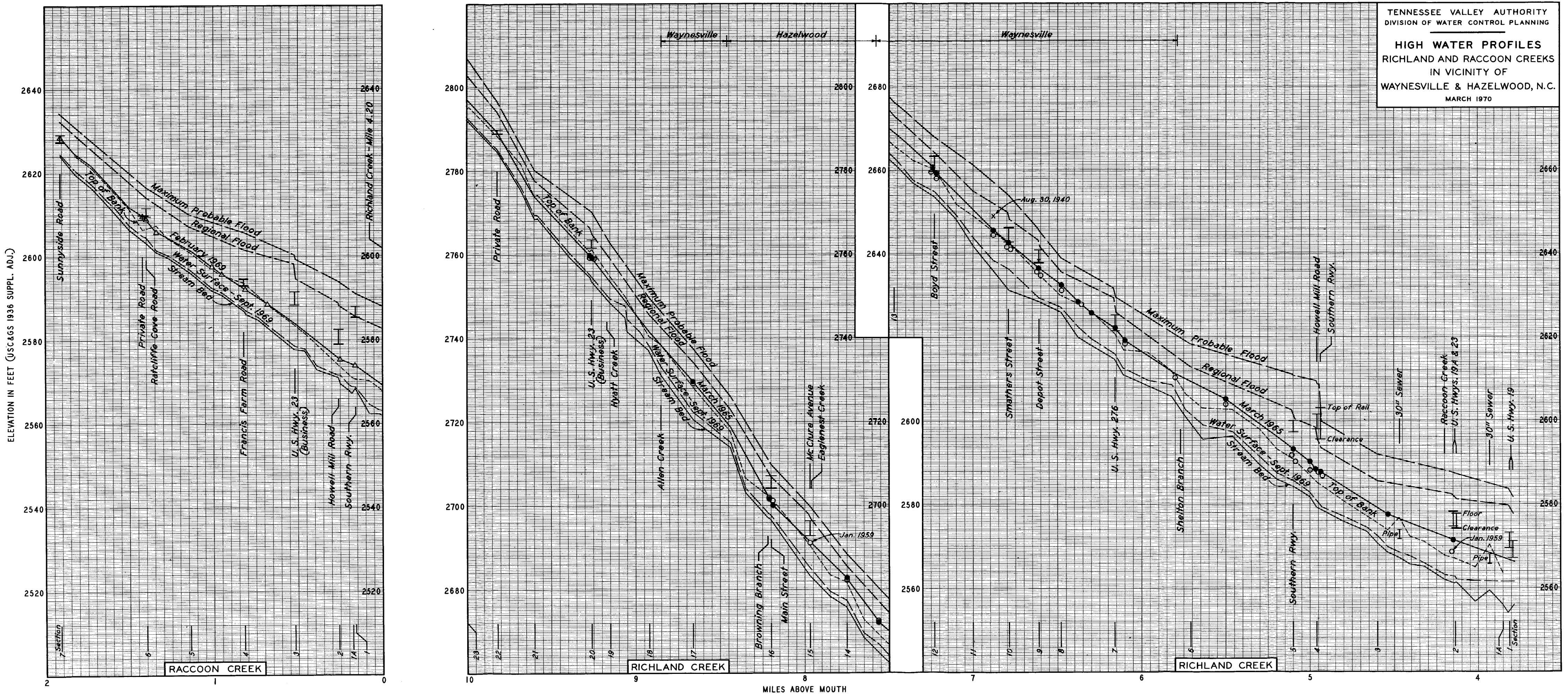

BASE MAP IS A PORTION OF USGS-TVA TOPOGRAPHIC MAPS 175 NE, 183 SW, AND 184 NW DATED 1967 WITH MINOR REVISIONS.
LEGEND:
OVERFLOW LIMITS
MARCH 1965 ON RICHLAND AND ALLEN CREEKS FEB. 1969 ON RACCOON CR.
MAXIMUM PROBABLE FLOOD
M-8 MILES ABOVE MOUTH
17 CROSS SECTION
2809.5 GROUND ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)
CONTOUR INTERVAL 40 FEET
The extent of overflow as shown is based upon contours, except at cross sections & known flood limits, it may not represent exact flood conditions on the ground.
HAZELWOOD
WAYNESVILLE
RICHLAND
CREEK
Allen
Browning
Camp
Farmer
Br.
Raccoon
Creek
FLOW
PRISON CAMP
Waynesville Country Club and Golf Course
SHOPPING CENTER
Corporate Limits
LAKE JUNALUSKA
Fairway Hills
Golf course
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
FLOODED AREAS
RICHLAND, RACCOON, AND ALLEN CREEKS; CAMP AND BROWNING BRANCHES
IN VICINITY OF
WAYNESVILLE & HAZELWOOD, N.C.
SCALE 0 1000 2000 FEET
MARCH 1970

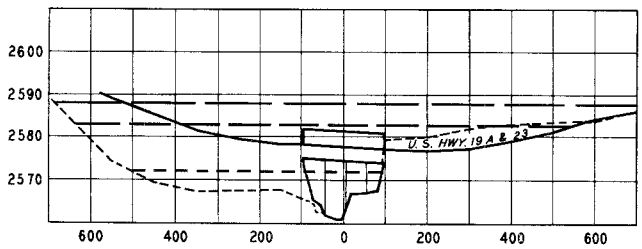
PLATE 5

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

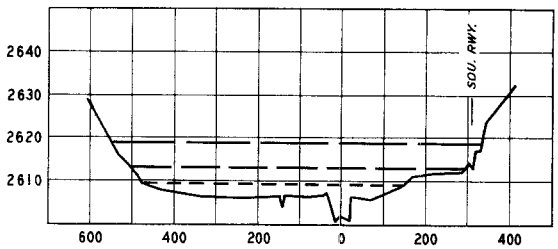
HIGH WATER PROFILES
RICHLAND AND RACCOON CREEKS
IN VICINITY OF
WAYNESVILLE & HAZELWOOD, N.C.
MARCH 1970



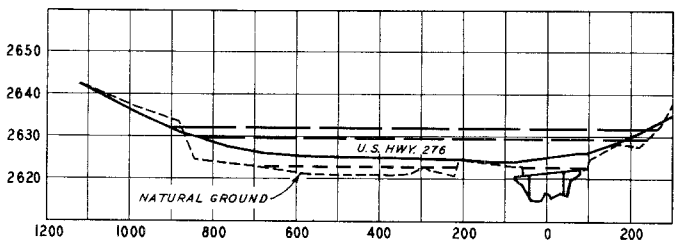
HD-1311



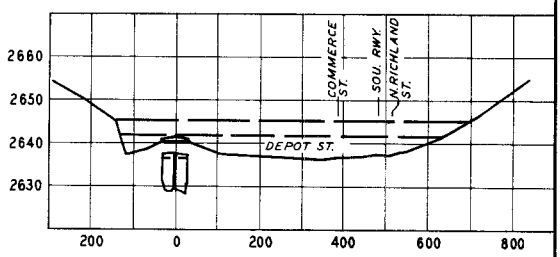
SECTION 2- MILE 4.14



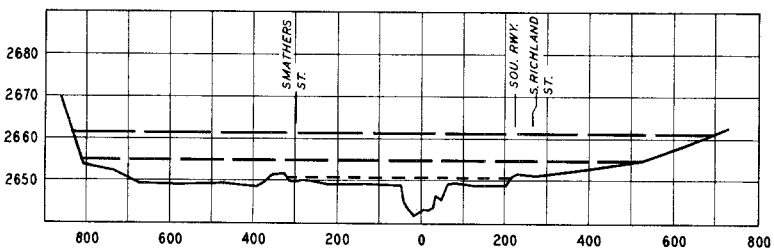
SECTION 6-MILE 5.71



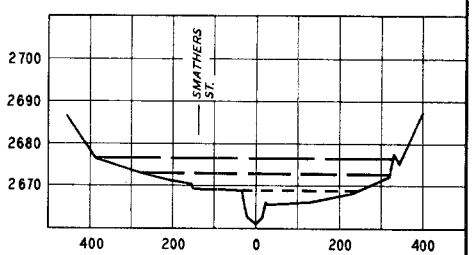
SECTION 7-MILE 6.16



SECTION 9-MILE 6.61

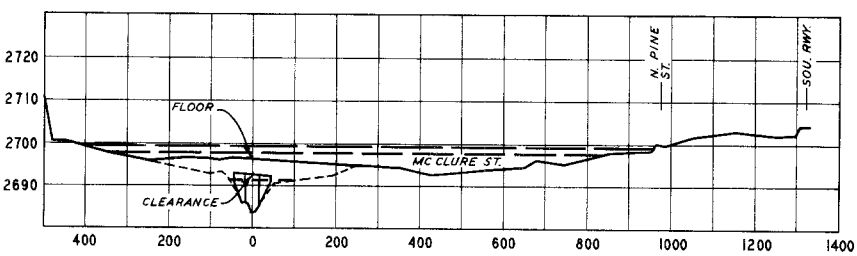


SECTION 11-MILE 7.00

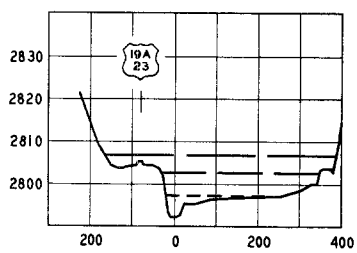


SECTION 13-MILE 7.47

ELEVATION IN FEET (USC & GS 1936 SUPPL. ADJ.)

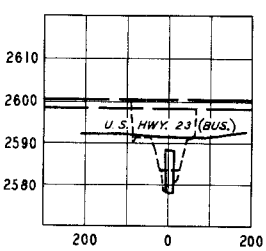


SECTION 15-MILE 7.97

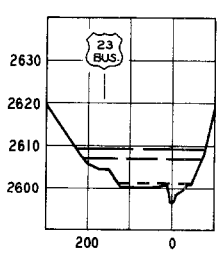


SECTION 23 - MILE 10.00

RICHLAND CREEK
15 sections not shown



SECTION 3-MILE 0.52



SECTION 5-MILE 1.14

RACCOON CREEK
5 sections not shown

Sections taken looking downstream

LEGEND:
- Maximum Probable Flood
- Regional Flood
- March 1965 on Richland Creek
  February 1969 on Raccoon Creek

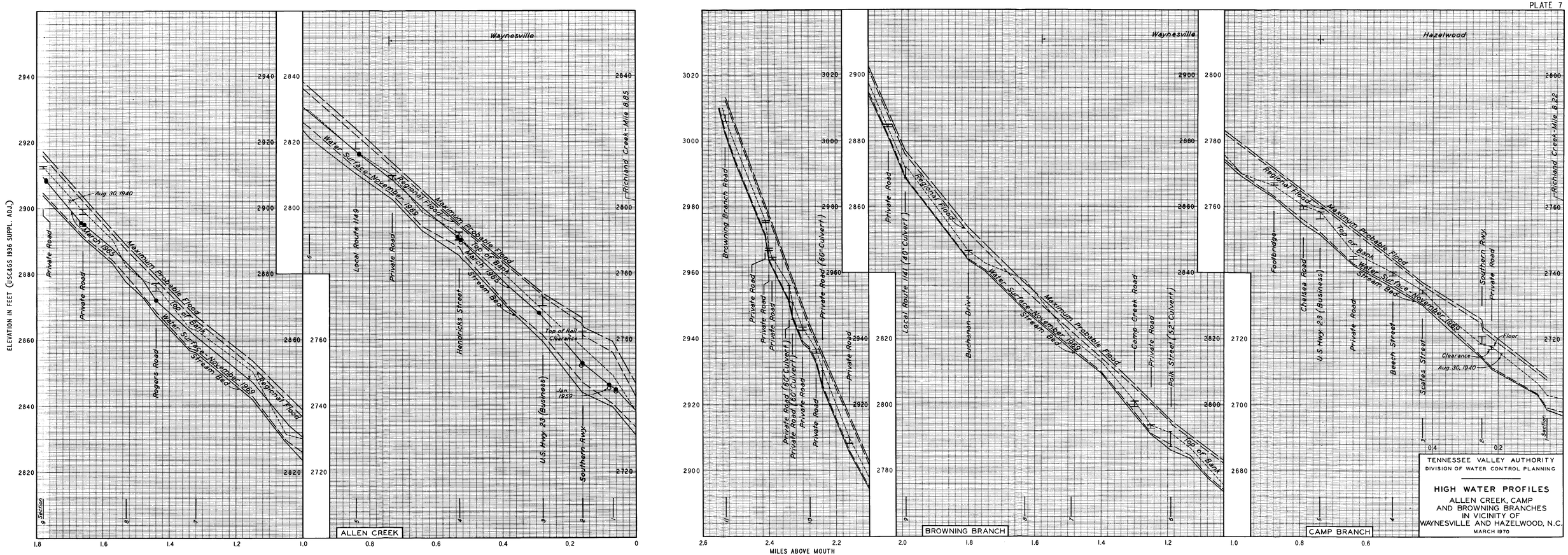
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

CROSS SECTIONS
RICHLAND AND RACCOON CREEKS IN VICINITY OF WAYNESVILLE AND HAZELWOOD, N.C.

MARCH 1970

HORIZONTAL DISTANCE IN FEET

PLATE 7



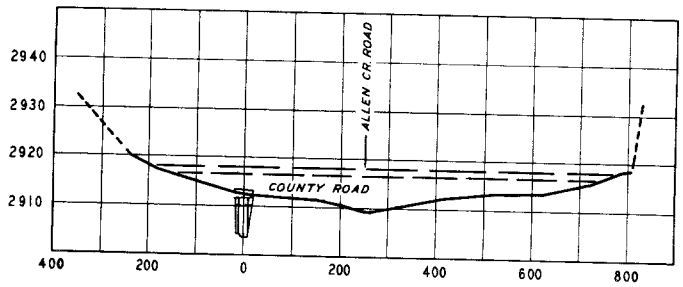
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

HIGH WATER PROFILES

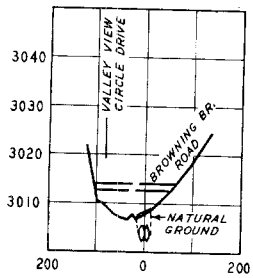
ALLEN CREEK, CAMP
AND BROWNING BRANCHES
IN VICINITY OF
WAYNESVILLE AND HAZELWOOD, N.C.

MARCH 1970

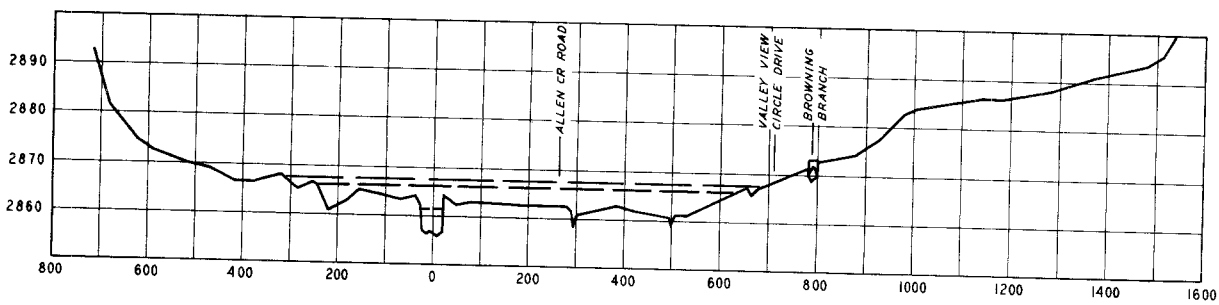
HD-1311



ALLEN CREEK
SECTION 9- MILE 1.78



BROWNING BRANCH
SECTION 11- MILE 2.53



ALLEN CREEK
SECTION 7 - MILE 1.32

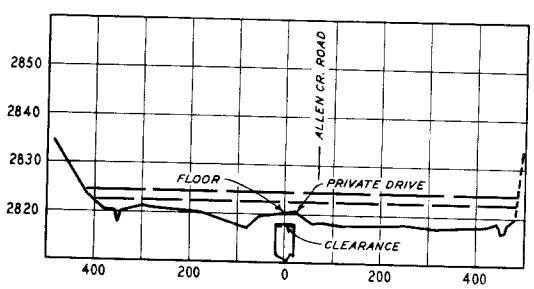
ELEVATION IN FEET (USC&GS 1936 GEN. ADJ.)

LEGEND:

——— ——— Maximum Probable Flood

——— — ——— Regional Flood

- - - - - - - March 1965



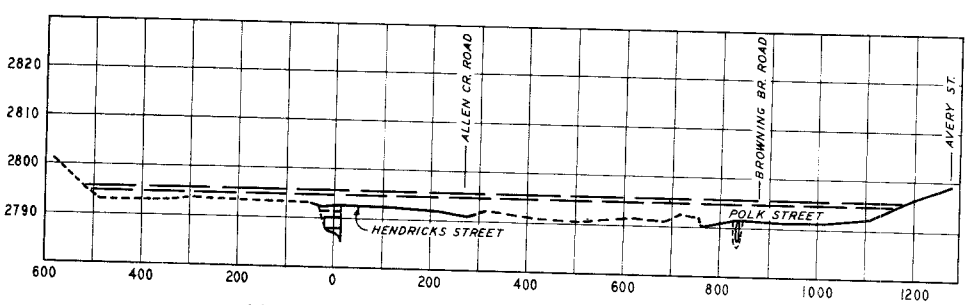
ALLEN CREEK
SECTION 5- MILE 0.84

Sections taken looking downstream

4 sections on Allen Creek not shown

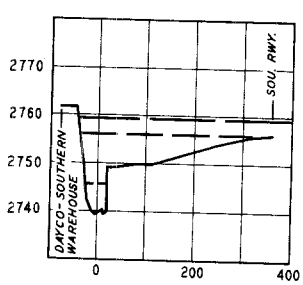
7 sections on Camp and Browning Branches not shown

BROWNING BRANCH
SECTION 7- MILE 1.49

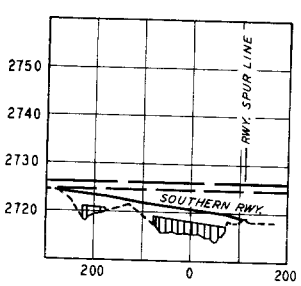


ALLEN CREEK
SECTION 4- MILE 0.53

BROWNING BRANCH
SECTION 6- MILE 1.19



ALLEN CREEK
SECTION 1 - MILE 0.07



CAMP BRANCH
SECTION 2- MILE 0.25

HORIZONTAL DISTANCE IN FEET

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

CROSS SECTIONS
ALLEN CREEK, CAMP AND BROWNING BRANCHES IN VICINITY OF WAYNESVILLE AND HAZELWOOD, N.C.

MARCH 1970