UNIT 5

Understanding and Using NFIP Data

The understanding of those who provide information and of those who have to act responsibly in using that information is often very much misunderstood.

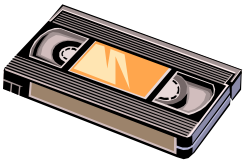
Old Proverb

Overview

The information and data provided by the National Flood Insurance Program is vital for administering floodplain regulations. Determining the location of a proposed development in relation to the floodplain, the base flood elevation, and floodway boundary at the site are the important first steps in processing a floodplain development permit. This unit expands upon the discussion of Flood Insurance Study reports and maps presented in Unit 4, and demonstrates how to use the various data provided in the Flood Insurance Study.

Contents

Equipment and Materials for Completing This Unit



1. Videotape *How to Use NFIP Flood Information* (approx. 18 min.)
2. Video cassette player
3. *Flood Insurance Study: City of Kinston, North Carolina, Lenoir County* report, Flood Boundary and Floodway Maps, and Flood Insurance Rate Maps
4. *Flood Insurance Study: Village of Bald Head Island, North Carolina, Brunswick County* report and Flood Insurance Rate Map
5. Engineer's scale

References

Federal Emergency Management Agency

1995 *Managing Floodplain Development in Approximate Zone A Areas: A Guide for Obtaining and Developing Base (100-Year) Flood Elevations*. Includes the computer program *QUICK-2: Computation of Water Surface Elevations in Open Channels*, Version 1.0. FEMA 265.

1995 *How to Use a Floodmap to Determine Flood Risk for a Property: A Guide for Interested Private Citizens, Property Owners, Community Officials, Lending Institutions, and Insurance Agents*. FEMA 258.

Publications

Most FEMA publications are available free by contacting:

FEMA Publications
P.O. Box 2012
Jessup, MD 20794-2012

or by calling 1-800-480-2520
or fax 301-497-6378

Many NFIP-related publications are also quickly available through the Map Service Center at (800) 358-9616.

Flood Insurance Studies and Maps

Additional copies of your community's Flood Insurance Study, FIRM, and Floodway Map can be ordered by calling **1-800-358-9616**. The toll-free map distribution center number is staffed from 8:00 a.m. to 8:00 p.m., eastern time, Monday through Friday. Requests may be faxed to 1-800-358-9620, or write:

Map Service Center
P.O. Box 1038
Jessup, MD 20794-1038

Maps are provided at no charge to local government officials. The FIS text and floodway maps must be specifically requested, or only the FIRMs will be sent.

Engineering Data

Copies of the computer modeling developed for a Flood Insurance Study are available for a fee through the ESDP Libraries at the FEMA technical evaluation contractors. For further information, please contact the state NFIP office or FEMA regional engineers.

A. Introduction

Floodplain information, including maps showing areas subject to flooding, provide the technical basis for implementation of local floodplain management programs. The local administrator is required to understand, be able to use, and explain the use of these data to others.

In most instances the information being used by the community is that provided in a Flood Insurance Study (FIS) report prepared for the community by the Federal Emergency Management Agency (FEMA). The FIS is a summary of the detailed engineering analysis of the flood hazards in a community. The engineering report itself is very lengthy and is not published. The data is maintained in the ESDP libraries at FEMA's technical evaluation contractors. The purpose of the FIS is to delineate flood hazard areas and establish flood elevations, thereby serving as a basis for providing flood insurance and regulating floodplain development. The FIS also contains other information and data that may be needed by the administrator and other local officials.

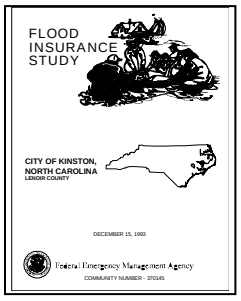
The FIS data provide the basis for preparation of the flood maps—FIRMs and FBFMs. The local administrator should know which maps to use; the map features; and how to use maps to locate development sites, flood boundaries, flood insurance zones, and to determine flood elevations. This understanding should also include being able to relate information on the maps to that found on computed flood profiles, tables, and figures contained in the FIS report. Base flood and other elevation data can be determined from use of the profiles and tables.

This unit is designed to develop and/or test your knowledge and skills in utilizing the floodplain data provided to the community. In practice, they are utilized whenever a development permit application is received.

Included in the course materials are Flood Insurance Study reports and maps for the City of Kinston (riverine) and the Village of Bald Head Island (coastal). These communities were chosen because they have examples of the types of flood hazards most communities in North Carolina face. *Locate the same information in your community's FIS (if one is completed) and see how it pertains to your situation. The outline and content are similar for all Flood Insurance Studies.*

The next section discusses the content of the Flood Insurance Study report and how to use the report data.

B. Flood Insurance Study Report



The Flood Insurance Studies for the City of Kinston and Village of Bald Head Island, North Carolina, are included in the course and referenced throughout the following discussion on using floodplain data.

Each Flood Insurance Study report cover has an outline map of North Carolina. Note that the location of the community is pinpointed on the outline map. The date of the FIS and the community number (discussed in Unit 4) are also indicated on the cover page.

Report Contents

Section 1 of any Flood Insurance Study report provides an introduction stating the purpose of the FIS, authority and acknowledgments, and coordination. Section 2 provides background information on the community, its flood problems, which areas were studied, and what flood protection measures are in effect.

Section 3 discusses the engineering methods used. Section 3.1 covers *hydrologic analyses*—how much water will flow through the floodplain during peak floods. Section 3.2 describes the *hydraulic analysis*—where the water will go. Development of this information was described in Unit 4.

Section 4 of the FIS report discusses how the flood map was prepared from the flood data for floodplain management applications. Section 4.1 covers mapping the floodplain boundaries. Section 4.2, if included, describes the floodway study and mapping. Section 4 also includes the Floodway Data Table. How to interpret and use these and other data will be covered later in this unit.

Section 5 of the FIS report covers data related to flood insurance, some of which is not used by the local administrator. This may be further subdivided into 5.1, Reach Determinations; 5.2, Flood Hazard Factors; 5.3, Flood Insurance Zones; and 5.4, Flood Insurance Rate Map Descriptions.

Section 6, Other Studies; Section 7, Location of Data; and Section 8, Bibliography and References are self-explanatory. Most riverine Flood Insurance Studies include flood profiles as an exhibit at the end of the document. Coastal studies include a map of transect locations and a table

with stillwater and base flood elevations along each transect. A map index and floodplain maps are included as separate exhibits.

Understanding Report Data

In the City of Kinston Flood Insurance Study report, turn to Table 1, *Summary of Discharges*, in Section 3 on page 8 of the FIS. An excerpt from that table is shown below as Table 5-1.

Table 5-1. City Of Kinston, NC, Flood Discharges (excerpt)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. mi.)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
NEUSE RIVER					
USGS gage at Kinston	2,690.0	19,000	27,900	33,300	54,000
SOUTHWEST CREEK					
At mouth	67.5	2,520	4,610	5,800	9,410
Below Mill Branch	61.0	2,370	4,360	5,500	8,940
Above Mill Branch	56.7	2,270	4,190	5,280	8,610
Below Strawberry Branch	54.9	2,230	4,120	5,190	8,470
Above Strawberry Branch	50.8	2,130	3,940	4,980	8,130
At NC Highway 58	49.5	2,100	3,890	4,910	8,030

Table 1 in the report summarizes the peak amount of water discharge for various flood frequencies at locations within the study area. The hydrologic study procedures for arriving at these amounts were discussed in Unit 4. The sizes of the drainage areas contributing to the water runoff producing the floods are also shown in the table. The 100-year flood discharge for Southwest Creek at NC Highway 58 is 4,910 cubic feet per second (cfs). This means that 4,910 cubic feet of water will pass this point each second during the peak of the base or 100-year flood.

Those administering the local ordinance may never have a need for these data. They are, however, important in the subsequent calculations of flood elevations as part of the hydraulic engineering study.

The Floodway Data table in Section 4 of the Kinston report presents data from the hydraulic analysis (Table 3, following page 11 in the FIS). The first page of the table is reproduced here as Table 5-2. To interpret the floodway data, follow these steps:

1. All numbers shown in the table are those calculated at each floodplain cross section. The first two columns (*Flooding Source*) identify the cross sections used in the FIS and their distance from some reference

point, usually the mouth of a river or the point where a stream reaches a river or other stream. The locations of these cross sections are shown on the accompanying flood maps.

2. The next three columns (*Floodway*) provide data on the floodway at each cross section. At cross section B, on the Neuse River, the floodway is 740 feet wide. This information is useful for double-checking the width of the floodway portrayed on the FIRM or FBFM. The cross-sectional area of the floodway below the elevation of the base flood at this location is 9,330 square feet. The floodway area data is used to determine the velocity of water flow. The average or mean velocity of the base flood in the floodway is 4.0 feet per second (which is considered to be hazardous).

FLOODWAY WIDTH

The floodway width is usually not symmetrical on both sides of the stream; it is dependent on the topography.

Similar data are provided at each of the other cross sections.

Table 5-2. City of Kinston, NC, Floodway Data

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Neuse River								
A	434,100	2,500	12,830	2.6	31.2	31.2	31.8	0.6
B	451,850	740	9,330	4.0	35.5	35.5	36.2	0.7
C	454,480	1,265	18,520	1.8	36.5	36.5	37.1	0.6
D	466,150	2,000	21,885	1.5	37.4	37.4	38.3	0.9
E	475,390	2,100	37,475	0.9	38.1	38.1	39.1	1.0
Southwest Creek								
A	16,040	600/550[2]	2,981	1.9	32.4	32.4	33.1	0.7
B	17,060	600/560[2]	3,975	1.4	33.0	33.0	33.6	0.6
C	18,790	550/190[2]	5,418	1.0	34.6	34.6	35.0	0.4
D	21,060	550	5,650	0.9	34.9	34.9	35.4	0.5
E	23,230	350	2,284	2.3	35.7	35.7	36.2	0.5
F	24,120	1,430	20,669	0.3	39.8	39.8	39.9	0.1
G	25,600	735	8,895	0.6	39.9	39.9	40.0	0.1
H	26,350	640	7,056	0.7	39.9	39.9	40.0	0.1
I	27,445	1,280	1,690	3.1	40.2	40.2	40.2	0.0
J	30,900	700	4,327	1.1	44.1	44.1	44.8	0.7
K	33,400	720	6,031	0.8	44.8	44.8	45.5	0.7
L	36,410	800	3,458	1.4	45.9	45.9	46.6	0.7
M	38,530	1,030	4,634	1.1	47.0	47.0	47.9	0.9

[1] Feet above mouth
[2] Total width/width within extraterritorial limits

3. Three of the last four columns *provide base floodwater surface elevations*. The administrator's main concern should be with the first one, the regulatory flood elevation. The others summarize the increases in the water surface at each cross section from confining

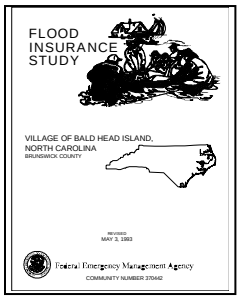
flood flows within the floodway. Notice that at no cross section is the increase more than 1.0 foot, in accordance with NFIP standards.

Now refer to Table 4, Flood Insurance Zone Data, pages 21-22 in the City of Kinston FIS report. Each flood insurance zone is affiliated with a stream reach. That is why there are two reaches for Jerico Run Tributary. The map panels that show the floodplain areas for each are listed in the second column of the table. The average elevation difference (in feet) between the 100-year and the other calculated flood levels are shown in the next three columns.

The flood hazard factors (FHF) for each stream reach are shown in the sixth column of Table 4. The FHF is a measure of the elevation difference between the 10- and the 100-year floods, rounded to the nearest 0.5 foot. An elevation difference of 1.0 foot has a FHF of 010. A difference of 1.5 feet would result in a FHF of 015, 2.0 of 020, etc. In the table the 4.0-foot elevation difference for the Neuse River results in a FHF of 040, a 1.4-foot difference for Reach 1 of Jerico Run Tributary results in a FHF of 015.

The flood insurance zone in the next column of Table 4 is a factor of the FHF. The non-zero part of the FHF is multiplied by *two* to produce the zone number. For example, a FHF of 040 results in an A8 Zone, a FHF of 015 (treated as being 1.5) results in an A3 Zone, etc. However, it should be noted that FHFs are no longer used in determining flood insurance rates for AE, A1-A30, AH, AO, and A Zones. The new format maps also do not contain numbered A Zones, such as A1-A30, instead using the designation AE.

To obtain the BFE (listed as "varies" in the last column of Table 4 in the City of Kinston FIS), use the floodway data table or the FIRM.



Turn now to the Flood Insurance Study report for Bald Head Island, Table 2, *Summary of Stillwater Elevations,* which is found on page 7 and is also inserted below as Table 5-3. This table shows the storm-surge stillwater elevations for the 10-, 50-, 100- and 500-year flood events and the maximum wave crest elevations for the 100-year flood at locations along the coast. At Southshore from Oyster Catcher Court Extended to Cape Fear, the 100-year surge stillwater elevation would reach 10.1 ft., and the wave crest elevation would be 11.9 ft. NGVD. The latter is the regulatory BFE (the second set of numbers in the third column under *Elevation*).

Transect Data in the Bald Head Island report (Table 4 on page 14) is similar to *Flood Insurance Zone Data* in the Kinston report. The data in the table can be used with Figure 4-15 in Unit 4 of this document and with the FIRM. For example, along transect 18 (shown in Figure 4-15) there are both VE and AE Zones (shown in Table 4 and on the FIRM). The VE Zones have BFEs ranging from 18 to 13 ft and AE Zones having base flood elevations of 12 and 10 ft. NGVD. The applicable BFE is shown on the FIRM in parentheses below the zone designation.

Table 5-3. Village of Bald Head Island, NC, Summary of Stillwater Elevations

FLOODING SOURCE AND LOCATION	ELEVATION (feet NGVD)[1]			
	10-YEAR	50-YEAR	100-YEAR	500-YEAR
ATLANTIC OCEAN				
West shore from Bald Head Creek to Horsemint Trail Extended	5.8	8.7	10.1/10.65[2]	13.3
West shore from Horsemint Trail extended to Oyster Catcher Court Extended	5.8	8.7	10.1/11.0[2]	13.3
Southshore from Oyster Catcher Court Extended to Cape Fear	5.8	8.7	10.1/11.9[2]	13.3
East shore, north of Cape Fear	5.8	8.7	8.9/10.7[2]	13.3

[1] National Geodetic Vertical Datum of 1929
[2] Includes wave setup

Relating Report Data to Maps and Profiles

Unit 4 described the data that are developed and used in preparing a Flood Insurance Study report for a community. Each set of data is used for calculations needed to produce additional data for the FIS. The data contained in the FIS report is consistent with that found on the accompanying profiles and maps.

For example, the base flood water surface elevations at each identified cross section can be found in the floodway data table, read from the flood profiles, and interpolated from the flood maps. Within the limits of map accuracy, one should obtain the same answer regardless of which source is used.

In the same way, the distances between cross sections, or their distance from some reference, can be found using any or all of the above data sources. Again, the answers should be approximately the same.

The elevations of the computed profiles contained in the FIS report are used with ground elevation data to determine the limits of the various zones shown on the flood maps. Again, flood elevations can be determined at any location along the studied stream using either the flood profiles or the flood maps. *All the data fit one another.* If obvious mistakes are found, please advise the FEMA regional office.

Just a reminder—due to the limited detail and large scale of the base maps used for most FIRMs (i.e., USGS quads) much interpolation between contour lines is done in mapping the floodplain boundaries. This is why there are so many discrepancies when actual ground elevations are surveyed. The FIRMs are just the best available graphic representations of the BFEs. The BFE takes precedence if there is a discrepancy between the surveyed ground location of the BFE and the boundary of the SFHA shown on the maps. Again, only FEMA can correct or revise the maps, so most discrepancies should result in a Letter of Map Amendment (LOMA) application (see Unit 9). However, the local administrator should use ground survey information, when available, for regulating floodplain development. This works both ways. If property not shown in the SFHA is *below* BFE, it must be regulated as a floodplain area.

Reading and using flood profiles, the last set of data contained in a Flood Insurance Study report, is the subject of Part C of this unit.

Please complete Learning Check # 1 before proceeding.

Learning Check #1

These questions are based on the City of Kinston Flood Insurance Study report.

1. What is the width of the floodway for Briery Run at cross section D? _____

2. What would be the base flood elevation the community would use at this location?
   _____

3. How much did the base flood elevation increase at cross section M on Southwest Creek by confining the base flood within the floodway boundaries? _____

4. Why is this increase no more than 1 foot at any cross section in the table?
   _____
   _____

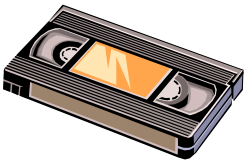
The following questions are based on the Village of Bald Head Island Flood Insurance Study.

5. Which transect would be used to determine flood elevations along the shoreline of the Atlantic Ocean north of Cape Fear? _____

6. What would be the 100-year stillwater elevation along this portion of the shore?
   _____ The wave crest elevation? _____

C. Reading and Using Flood Profiles

Before proceeding, this is a good time to view the third video segment, *How to use NFIP Flood Information*. It is about 18 minutes in length. The tape segment is part of a series produced by the Commonwealth of Pennsylvania. There are some references to Pennsylvania agencies and governmental units but they should not detract from its usefulness to North Carolina communities. It will introduce material contained in subsequent sections of this unit. Do not rewind the tape, unless you want to review the material.



As discussed in Unit 4, a flood profile is a plot, on a graph, of computed flood elevations at and between the floodplain cross sections. They can be used to determine elevations that floods of various frequencies would reach at any location along the studied stream. They also contain other useful information such as bridge, streambed, stream crossing, and cross section location data.

Profile Features

Usually, four flood levels are shown on the flood profile fold-out sheets: the 10-, 50-, 100-, and 500-year floods. Only the 100-, and 500-year floods are used for compliance with NFIP standards, but the others are useful for other floodplain management applications, such as septic system design and location, bridge and culvert design, and urban stormwater management.

In addition to the profiles, these sheets contain a plot of the stream bed, the locations of the cross sections used in the FIS (a letter within a hexagon), and stream crossings (depicted as a large “I” to indicate the top deck and low-steel elevation of the bridge). The data are plotted on a grid to facilitate their interpretation. With few exceptions, the large grid squares are one inch long in both the horizontal and vertical direction and are divided into ten squares in both directions. This greatly aids in making measurements.

Refer to the profile shown in Figure 5-1. The bottom or X-axis shows the distance along the river or stream. To be consistent with other data in the FIS report, distance is measured above the mouth of the river or its confluence with another river. The left side or Y-axis shows elevation, almost always referenced to NGVD.

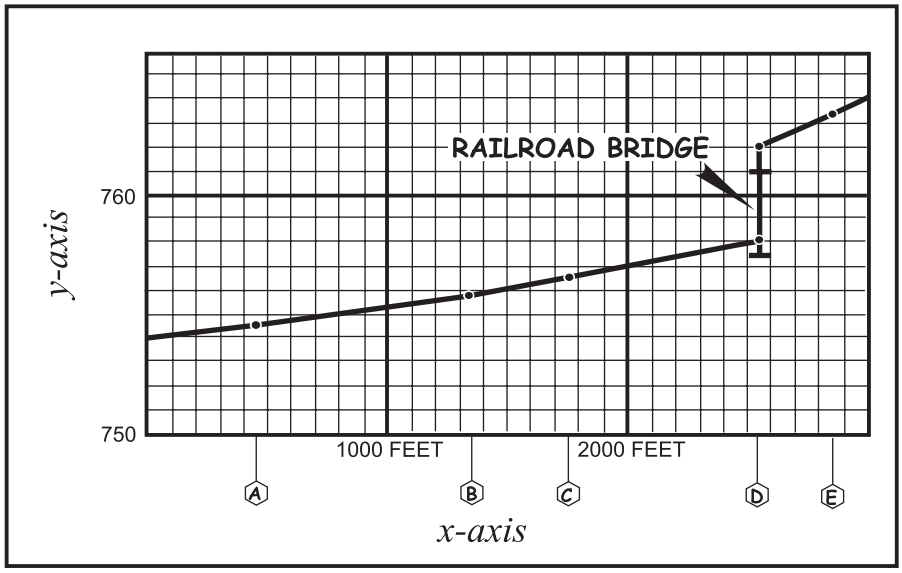


Figure 5-1. Typical Stream Profile

The profile in Figure 5-1 has the following data plotted:

Table 5-4. Stream Profile Data		
Cross section	Feet above mouth	Flood elevation
A	450	754.6
B	1,340	755.8
C	1,760	756.6
D	2,550	758.0 (downstream) 762.0 (upstream)
E	2,850	763.4

When floodwaters reach a bridge or culvert at a stream crossing, several things can happen. All the floodwater can flow through the culvert or under the bridge without backing up or ponding upstream of the crossing. In this instance, the stream profile would not have an appreciable change at the culvert or bridge. If the bridge or culvert is not of adequate size to handle the flood flow, then water can pond upstream. Depending on the elevation of the floodwater relative to the elevation of the top of the roadway, it may or may not flow over the roadway. In the example shown in Figure 5-1, the railroad crossing of the stream does not have an adequate opening to handle the floodwater, causing it to back up. It continues to do so until it is able to flow over the railway embankment. At cross-section D, representing the railroad bridge, the flood elevation *below* (downstream) of the bridge would be 758.0, and the flood elevation *above* (upstream) of the bridge would be 762.0. In these instances, when reviewing or providing the BFE for a development site, pay particular

attention to whether the site is upstream or downstream of the stream crossing in order to determine the applicable BFE.

Locating Development Sites

Because the information contained on flood profile sheets is used to establish building locations and flood elevations and to resolve discrepancies between map and ground data, it is important to be able to locate the development site with respect to the flood profile. This can be done by measuring on the ground, or from the flood map, the distance from some feature shown on the profile sheet, such as a bridge crossing, the mouth of a stream, or from a cross section location shown on the map. Once the site location is marked on the profile sheet, the flood elevations can be determined using the plotted profiles.

Determining Flood Elevations

Use the profile shown in Figure 5-1 to find the flood elevation at a point 250 feet upstream of the railroad bridge by following these steps.

1. Check the horizontal scale at the bottom of the profile. Here each horizontal square (each line on the X-axis) represents 100 feet along the stream. Each vertical square (each line on the Y-axis) represents one foot of elevation.

2. Two hundred and fifty feet upstream of the railroad bridge would be equivalent to two and a half squares to the right of the "I" symbol for the bridge. Mark a vertical line to intersect the profile, as shown in Figure 5-2. At this point, draw a straight line to the left edge of the profile.

3. Read the flood elevation off the left edge of the profile. In this example, it is 3.2 squares above 760 feet, so the flood elevation would be 763.2 (see Figure 5-2). *Note: When profiles are plotted to this scale, always estimate elevations to 1/10th of a foot.*

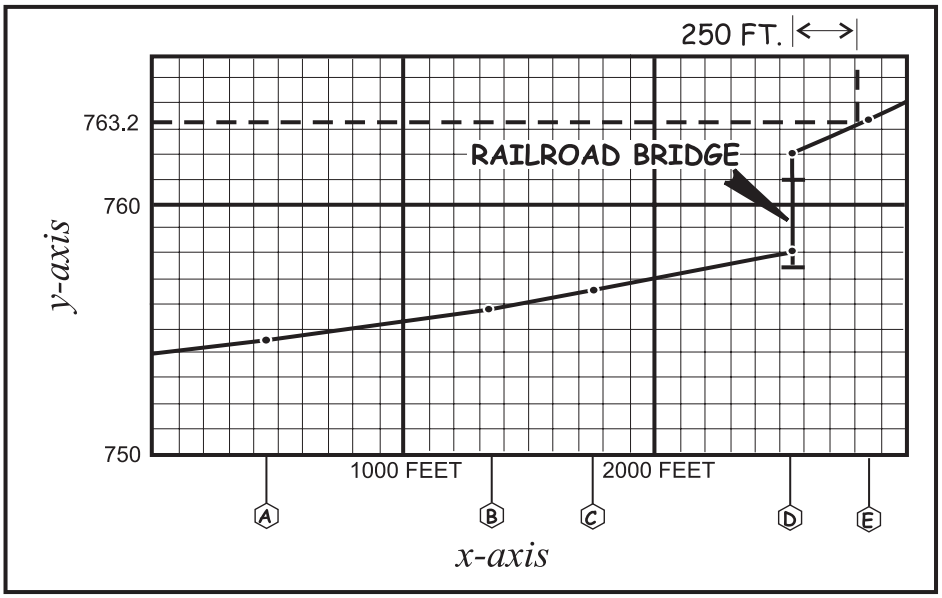


Figure 5-2. Reading a Profile

As discussed in Unit 4, instead of using surveyed cross sections, coastal survey data are called *transects.* Figure 2 on page 9 of Bald Head Island's FIS report shows where transects were surveyed. Transect data are shown in Table 3, starting on page 10. Table 4 on page 14 of the Bald Head Island report shows the 10- and 100-year stillwater and base flood elevations. As depicted in Figure 3 of the Bald Head Island report (also reproduced as Figure 4-17 in this text), the base flood elevation decreases with increasing distance from the shoreline. Although not contained in the North Carolina reports, many older coastal FIS reports contain Coastal Profiles for transects. Current FIS reports do not. BFEs for coastal areas are therefore obtained directly from the FIRM.

Because the elevation determinations for riverine or coastal floodplains are typically used to establish flood elevations for construction in special flood hazard areas and for other purposes, accuracy is very important. For this reason, the administrator should have another employee check the determinations before using them in the permit application process. This is also a good way for the other employee to gain proficiency reading maps and profiles.

Complete the following Learning Check to check proficiency in understanding and reading flood profiles.

Learning Check #2

These questions are based on the City of Kinston Flood Insurance Study report.

1. Using the flood profiles in the report, what is the "100-year" flood elevation for the Neuse River at cross section D? _____

2. What BFE is obtained from using the floodway data table? _____

3. An "I" symbol is plotted at station 5600 feet above mouth on Briery Run flood profiles. What does this symbol represent? _____
   _____
   _____

4. Using the flood profiles, determine the 100-year flood elevation on Southwest Creek for a site 1400 feet upstream of the Southern Railway bridge. _____

5. How far is this site from cross section D? _____

6. A developer proposes to place a structure 100 feet downstream cross section D on Jerrico Run. Using the flood profiles, tell the developer how much higher the structure would have to be elevated above the base flood level to be protected to the 500-year flood level. _____
   _____
   _____

7. During the 100-year flood, floodwater would flow over State Highway 58 where it crosses Briery Run. What would be the BFE for a development site along the roadway above (upstream of) the stream crossing? _____ Along the other side of the roadway below (downstream of) the stream crossing? _____

D. Relating Flood Insurance Study Data to Maps

As previously mentioned, there is a direct correlation between the information contained on flood profiles (and in other parts of the FIS report) to that which is depicted on the various NFIP flood maps. In other words, elevation data shown on the flood profiles is directly related to the BFEs shown on the flood maps.

Flood profiles and some types of floodplain maps show the location of surveyed cross sections. Flood elevations have been computed at each of these locations. As discussed in Unit 4, in most instances the ground elevation data is not shown on FIRMs. Using ground elevation data shown on a topographic map, a determination is made as to where the flood elevation would intersect the ground at a particular cross section. These points are plotted on the map and connected using other topographic data between the cross sections. Floodplain boundary lines are drawn connecting the points (refer to Figure 4-13). Base flood elevation markers (i.e., wavy lines extending across the floodplain) are shown on the map to facilitate determination of the BFE and to serve as a check for the elevations read from the flood profiles. The local administrator *should not* use the BFE lines on the FIRM to establish the BFE at a development site.

Within the limits of map accuracy, the user should obtain the same elevation whether the map or profile is used. As will be discussed later, *the flood profiles should always be used to determine flood elevations along rivers and streams*. In a like manner, the floodway width data contained in the floodway data table of the FIS report can be scaled on the flood map. For example, the floodway width at a particular cross section could be measured on the map. The distances should be approximately the same. Some of the data from this table is also plotted on the flood profile sheets, such as the base floodwater surface elevations and distances between cross sections. If any obvious mistakes or discrepancies between the tables, profiles and maps are encountered, contact the FEMA regional office.

E. Reading and Using Flood Maps

Attention can now be devoted to examining the various flood maps prepared for the community as part of the Flood Insurance Study. Depending on when studies were initiated the community may have received one or two types of floodmaps. A Flood Hazard Boundary Map was issued for most communities prior to preparation of an FIS. The FBFM shows only SFHAs and has no BFEs. As part of an FIS, a Flood Insurance Rate Map is always issued, and a Flood Boundary and Floodway Map if floodways are designated. Since 1987, the FIRM and FBFM have usually been combined into one map.

Which Maps to Use

During the mid-1980s, FEMA started combining the data contained on the FIRM and the FBFM maps into a new version of the FIRM. Most communities in North Carolina still have the FBFM map and the older FIRMs. Some still have the FHBM which was the first set of maps prepared to define approximate flood boundaries until more detailed studies could be carried out or justified. These were "converted" to FIRMs by letter without doing a detailed study. In those cases, the FHBM was reprinted and relabeled as a FIRM, without a detailed study.

In administering the local ordinance, local officials need to be able to use the following maps, depending on the status of the maps in the community:

- Flood Hazard Boundary Map
- Flood Boundary and Floodway Map (FBFM)
- Old format Flood Insurance Rate Map (FIRM)
- New format FIRM
- Digital FIRM

The administrator should be aware of the effective date(s) of the respective maps as these dates have important floodplain management and flood insurance implications. These implications are mentioned in various units of this course.

General Map Features

Map Index

Many communities, including all North Carolina counties, are geographically too large to fit on one map panel at a usable scale. The maps for these communities are, therefore, divided into two or more "panels" with unique panel numbers. Whenever a community requires more than one panel, a "Map Index" for both the FIRM and FBFM (and FHBM) is prepared (see Figure 5-3a).

The map index shows the entire community boundary, highlighting prominent features within the community, including major highways, railroads, and streams. The map index shows how the community is divided into the various panels. The map index also depicts the following:

Title Block. Includes the community name, county name, community identification number, and panel numbers. It is located at the lower right hand corner of the map when unfolded.

Community Identification Number. The community number consists of six digits, in which the first two digits are the same for all communities in a state. Hyde County's community identification (CID) number is 370133 (Figure 5-3). This block is different for countywide FIRMs.

Panels Printed. FEMA prints only those panels having flood hazard areas; printed panel numbers are indicated on the title block (see Figure 5-3a).

Panels Not Printed. Panels that have no flood hazard areas (or floodways on a set of FBFMs) are indicated by an asterisk, "*" (see Figure 5-3b). Sometimes the entire panel is in one flood zone and is not printed. The flood zone for that panel is noted directly on the map index.

Map Index Date. The date shown on the title block reflects the most recent map revision. As changes occur within a community which result in a change in flood elevations or floodplain delineation, FEMA republishes *only the map index and those map panels* affected. Any revised panels are given a new map effective date, indicating when they were officially revised, and a suffix letter after the panel number to

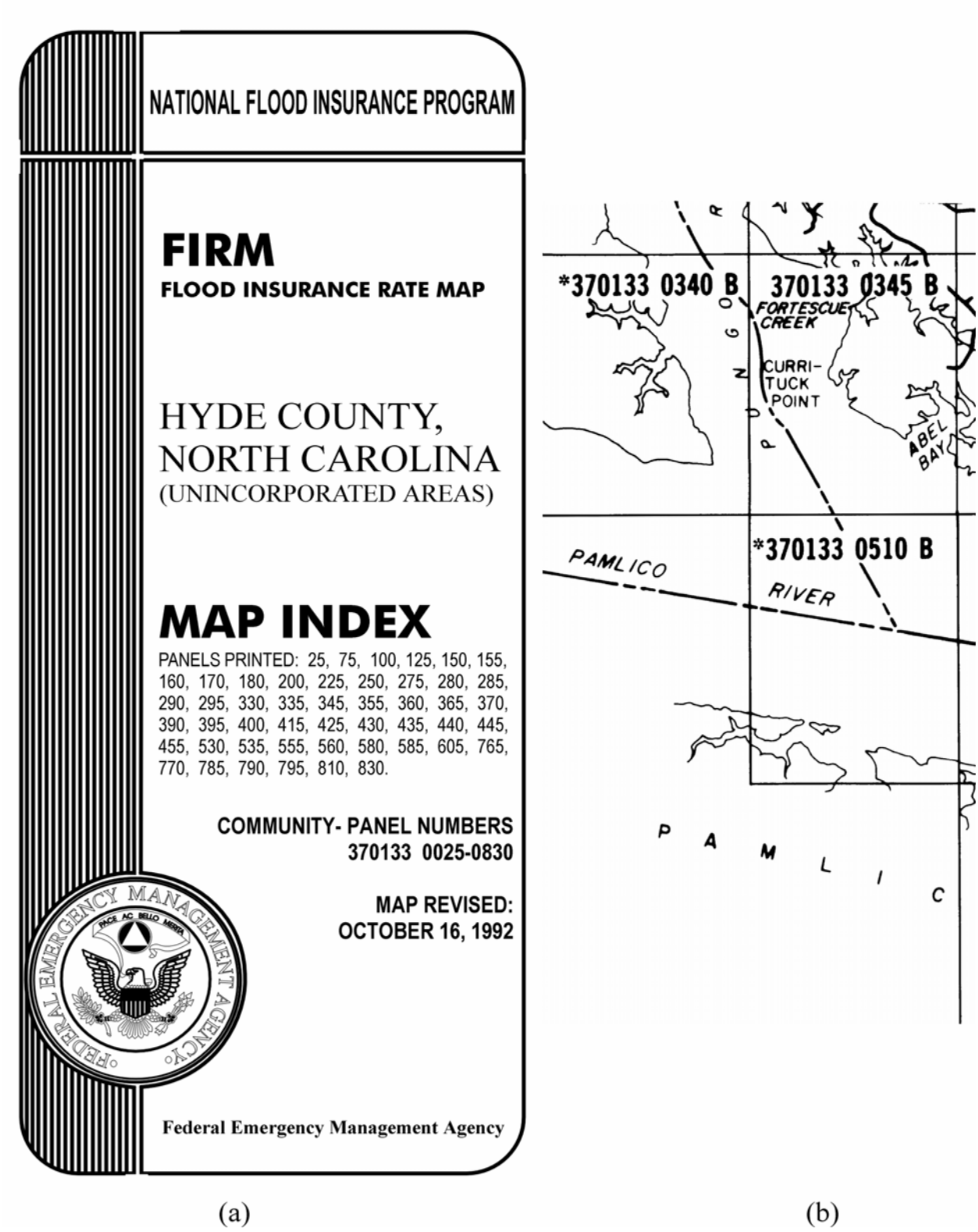


Figure 5-3. FIRM Map Index

indicate that the panel has been revised. The panel suffix letter is changed (to B, C, etc.) with each revision. A given community could have two or more map panel effective dates. The map index shows the current effective map date for all the FIRM panels *or* that of the most recently revised panel.

Map Panel Numbers. Each map panel is assigned a four-digit number which follows the community identification number. The panel numbers for Hyde County are 0025–0830. Panel numbers are based on a standard grid system and frequently occur in increments of 10 or 25. Thus, there are only 48 panels for Hyde County, not 830.

Flood Hazard Boundary Maps (FHBM)

The FHBM was initially prepared to provide information to use for floodplain management and flood insurance purposes. Where detailed Flood Insurance Studies have not been prepared or cannot be justified, they are still in use. As discussed in Unit 4, they may have been converted to Flood Insurance Rate Maps without a detailed study. They are to be used for floodplain management, in conjunction with other local studies and other available data. An FHBM title block, map key, and map for Franklin County are shown in Figures 5-4 and 5-5.

Title Block. Includes the community name, county name, community identification number, and the panel number (Figure 5-4). Franklin County's Community Number is 370337. The title block for Panel 6 is shown. The "A" after the panel number indicates this is the original panel and has not been revised.

Map Dates. The effective date of the map panel is found on the title block. Further information on initial identification of flood hazard areas and date of map revisions will appear in the map legend.

Approximate 100-year Flood Zone. Designated by a blue or gray shaded area and labeled Zone A.

Map Scale. The map scale for the panel shown in Figure 5-5 is one inch equals 2,000 feet (found on "Key to Symbols," Figure 5-4).

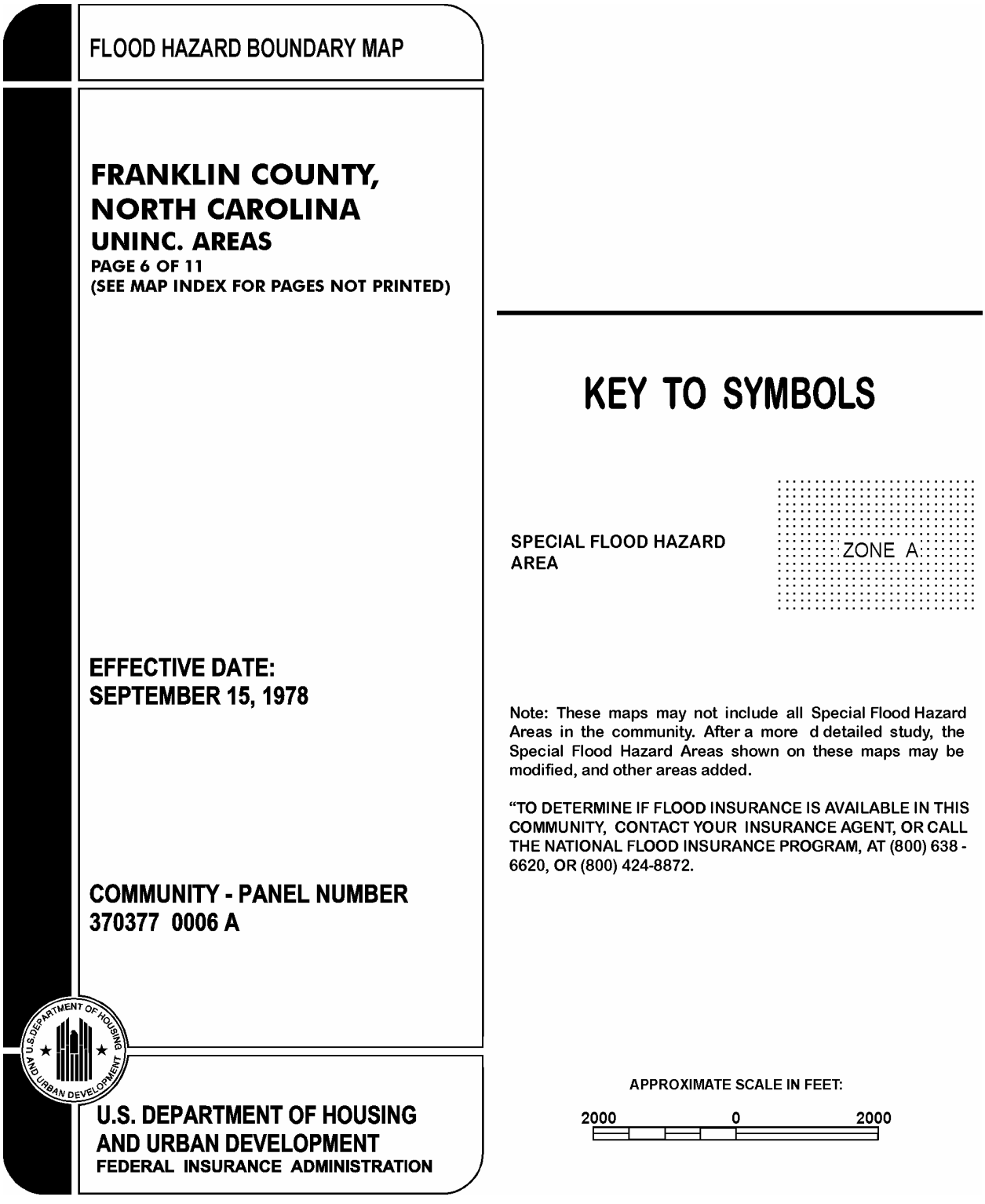


Figure 5-4. Title Block and Key to FHBM

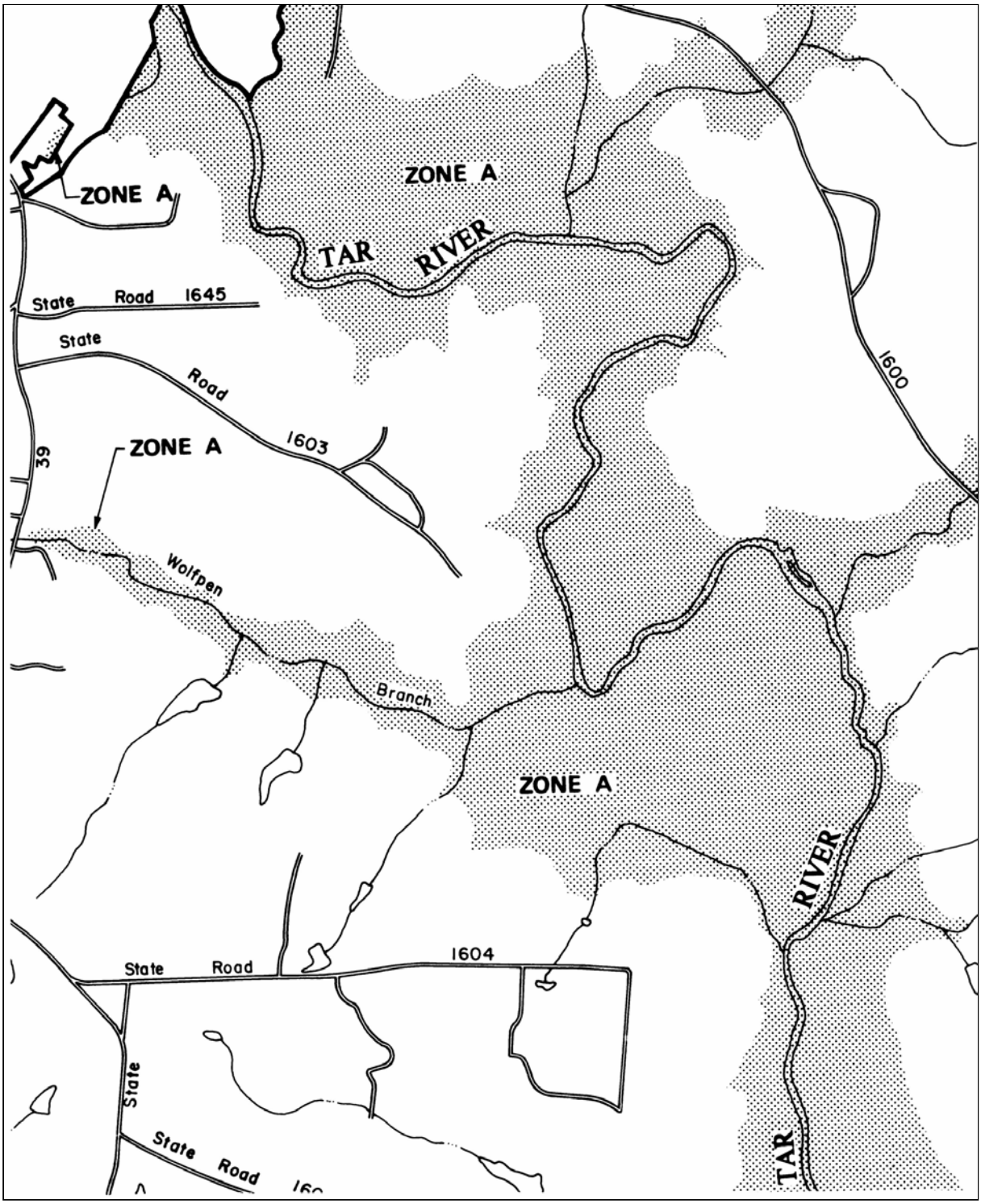


Figure 5-5. Flood Hazard Boundary Map (FHBM)

Flood Insurance Rate Map (FIRM)—Old Format

The Flood Insurance Rate Map (Figures 5-6 and 5-7) is used mainly by lenders, insurance agents, real estate agents, appraisers, property owners, and private citizens to determine:

- Whether a specific property is located within the floodplain
- The flood insurance zone that applies to the property
- The approximate base flood elevation (BFE) at the site

Title Block. Includes the community name and county name, community identification number, and the panel number (see Figure 5-6).

Map Dates. The effective date of the map panel appears on the title block. Other dates that may be listed in the map key (or legend) include:

- Initial Identification—date when the flood hazards in the mapped community were first identified [FHBM], and any revisions prior to issuance of a FIRM.

- Flood Insurance Rate Map Effective—date the community was converted to the regular program of the NFIP which normally corresponds to the date of the initial FIRM.

- Flood Insurance Rate Map Revision—dates of subsequent revisions to the FIRM, if any, and a brief description of the reasons for the revisions.

Map Scale. Shown on the "Key to Map." Different scales may have been used for a single community with more than one map panel.

100-Year Floodplain. Denoted by dark-shaded areas (Insurance Zones A, A1–A30, AE, AO, AH, V, V1–V30, VE). In Figure 5-7, most of the floodplain is designated Zone A13.

500-Year Floodplain. Designated by the lighter-shaded areas (Insurance Zone B). Newer studies include a shaded Zone X. No 500-year flood elevations are shown on the map, but are contained in the FIS.

Base Flood Elevation (BFE). The water surface elevation of the base flood (100-year flood) at that point of the stream, denoted in whole numbers by wavy lines running across the floodplain; or, where the BFE is

uniform within a zone, denoted in parentheses below the zone designation. Symbols are shown in Figure 5-6. Coastal AE and A1-A30 Zones within the area of 100-year tidal flooding, as well as AH Zones and some lake A Zones, have the base flood elevation noted in parentheses beneath the zone designations (refer to Figure 4-17). BFEs in riverine A Zones are indicated by a squiggly line across the floodplain, with the BFE at that point shown as a whole number.

Zone Break Line (or *Gutter Line).* The thin white line separates different flood insurance rate zones within the 100-year floodplain. Symbol shown in Figure 5-6. Can you find the zone break line shown in Figure 5-7?

Approximate Floodplain Areas. 100-year floodplain areas using approximate methods. No base flood elevations are shown in approximate floodplain areas. These areas are classified as "unnumbered" A Zones. None are shown in Figure 5-7. Refer back to Figure 4-19 for an example.

Elevation Reference Marks. Benchmarks with known, recorded elevations, which are used by surveyors to determine unknown elevations at nearby locations. None are shown in Figure 5-7. Symbol shown in Figure 5-6. Refer to Figure 4-11 for examples.

Coastal Barrier Resource System Units. Designated by diagonal line patterns (three of them) that overlay other designations. An example is shown later in this unit.

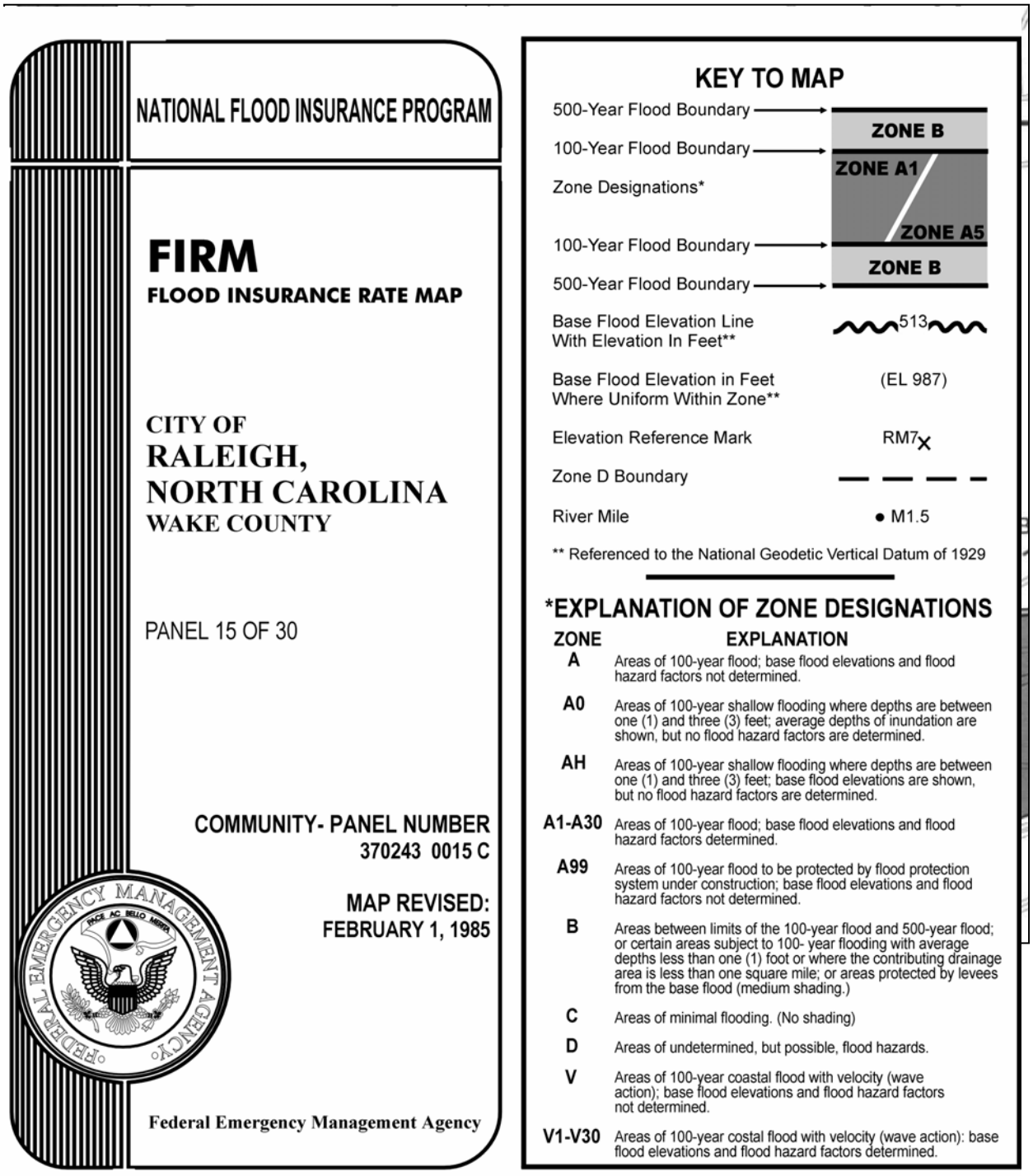


Figure 5-6. Title Block and Key to Old Format FIRM

Figure 5-7. Old Format FIRM

Flood Boundary and Floodway Map (FBFM)

The Flood Boundary and Floodway Map (Figures 5-8 and 5-9) is used by community officials for administration of floodplain management ordinances. The same area is shown in Figures 5-7 and 5-9 to facilitate comparison of features on the FIRM and FBFM maps.

The FBFM shows how the floodplain is divided into floodway and flood fringe where streams are studied in detail. The FBFM also shows general floodplain areas where floodplains have been studied by approximate methods. If a map panel area does not include any detailed study streams or floodways, a FBFM will not be printed; only a FIRM panel will be printed. The FBFM shows the location of stream cross sections which can be used in conjunction with the floodway data table (e.g., Table 5-2) to make a more exact determination of the base flood elevation (BFE) for a site. *Note that no BFEs or flood zone names are shown on the FBFM.*

The 100-year floodplain (detailed study stream reaches) has been divided into two flood regulatory areas, the floodway and the flood fringe.

Title Block. Includes the community name, county name, panel number, community number, and the map date (see Figure 5-8). *Caution!* The FBFM panel numbers may be different from the FIRM panel numbers. The FIRM and FBFM panels shown in Figures 5-6 and 5-8, for the same floodplain area, have different panel numbers.

Map Scale. Shown on the map key (Figure 5-8). *Caution*! The FBFM may have a different scale than the FIRM for that particular community.

Floodway. The non-shaded areas adjacent to and including a stream or channel between the heavy dashed lines. No further development is permitted in the floodway if it will result in a measurable increase in the BFE.

Flood Fringe (Floodway Fringe). Shaded areas outside of the floodway but still within the 100-year floodplain. The flood fringe may be developed in the future provided all new structures are elevated or floodproofed to the BFE. Areas of 100-year tidal flooding have the flood elevation noted in parentheses beneath the zone designations.

500-Year Floodplain. Lighter shaded areas adjacent to, but outside of the 100-year floodplain.

Approximate Floodplain Areas. 100-year floodplain areas determined using approximate methods. The limits of the approximate floodplain on

the FBFM are shown as dashed lines outside of the detailed study areas (not to be confused with the dashed lines marking the floodway boundaries).

Cross-Section Line. These lines represent the location of the surveyed cross sections used in the computer model of the stream for calculating 100-year flood elevations. They are individually labeled with a letter or letter combination put in a hexagon at either end of the cross section. These labels are also used on the profiles and floodway data tables. These cross sections can thereby be used to relate a specific point on the FBFM to the flood profile and floodway data table. Can you find three cross-section lines on Figure 5-9?

Elevation Reference Marks. Benchmarks with known, recorded elevations, which are used by surveyors to determine unknown elevations at nearby locations. None are shown on Figure 5-9. Symbol is shown in Figure 5-8.

Note that FBFMs are not automatically sent out by the Map Service Center when flood maps are requested. They must be specifically requested. They are always sent when an FIS is requested. All communities should request one or more copies of their FIS.

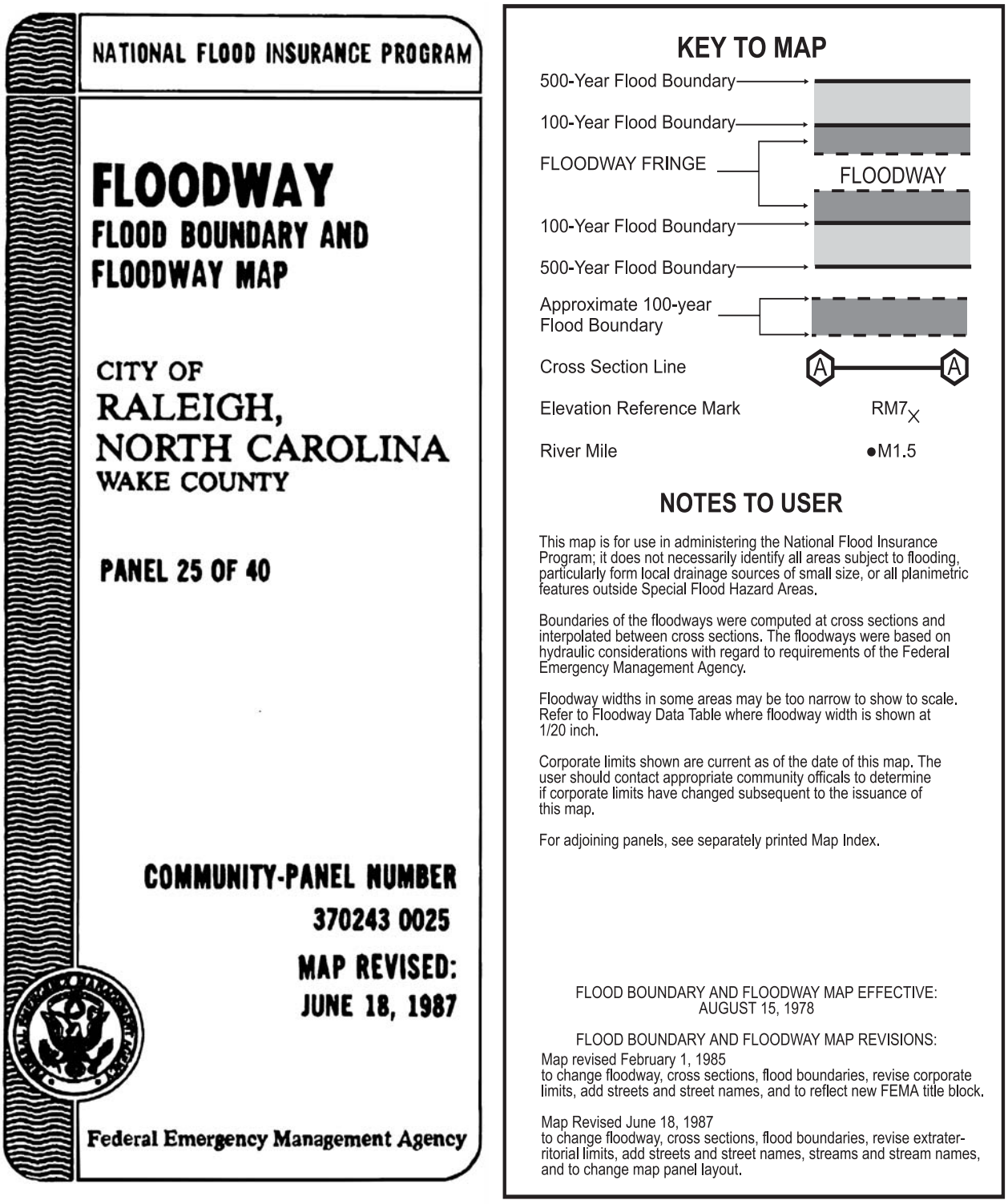


Figure 5-8. Title Block and Key to FBFM

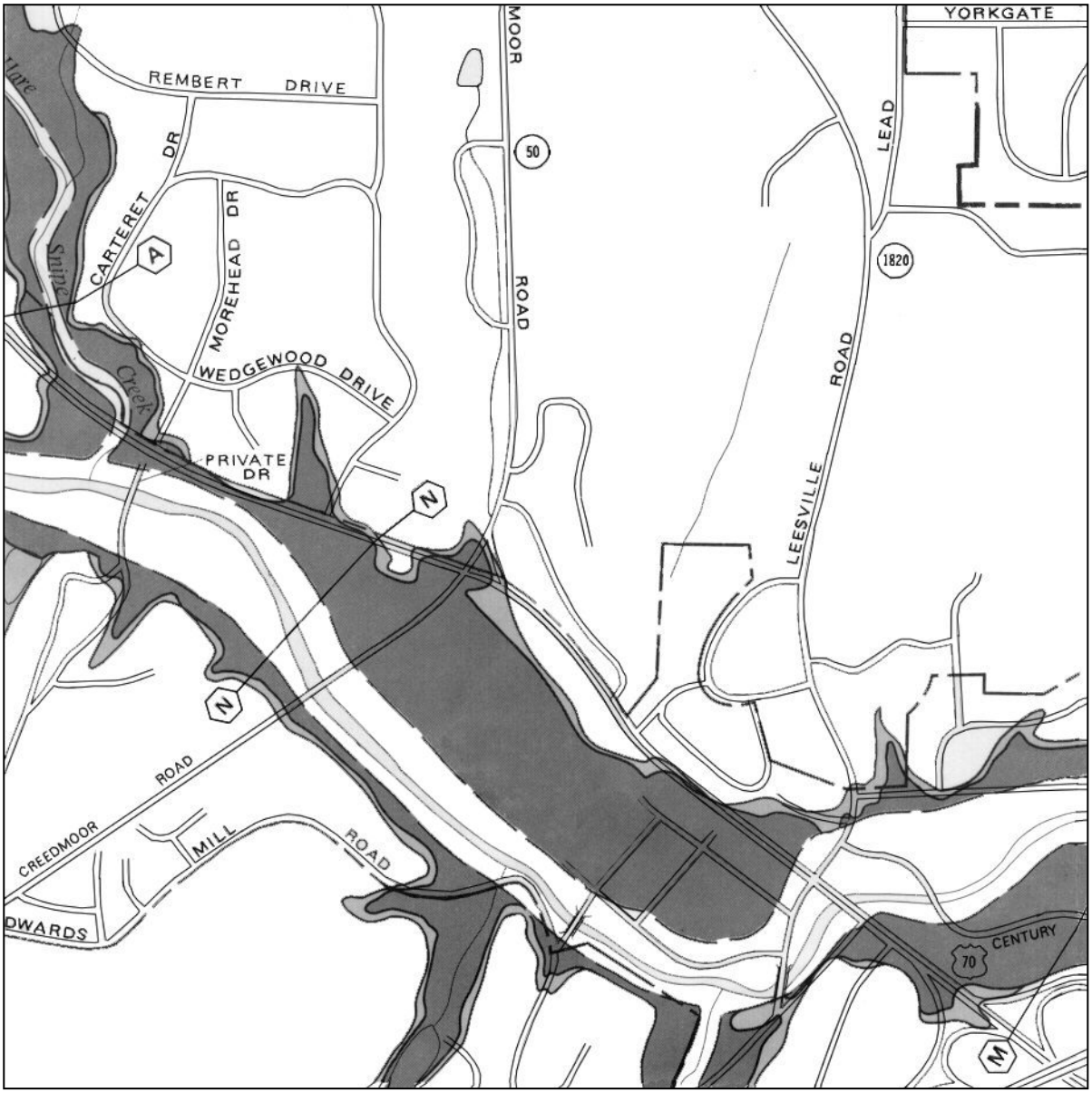


Figure 5-9. Flood Boundary and Floodway Map (FBFM)

Flood Insurance Rate Map (FIRM)—New Format

Generally since 1989, new FIRMs (Figures 5-10 and 5-11) combine the data that was shown separately on the old format FBFMs and FIRMs. Therefore, the new FIRMs are used by community officials and local administrators for floodplain management purposes, by lenders to determine the need for flood insurance, by insurance agents to rate policy applications, and by land surveyors, appraisers, engineers, etc.

Title Block. See Figure 5-10. Includes the community name, county name (Hoke), community identification number (370397), and the panel number (0090 B). "B" means the panel has been revised once.

Map Dates. Several dates may be listed, including:

- Initial Identification—date of first Flood Hazard Boundary Map.

- Flood Insurance Rate Map Effective—date community was converted to the Regular Phase of the NFIP which normally corresponds to the date of initial FIRM if no revisions have been made. The date of conversion to the Regular Phase is also the date that determines whether structures are pre-FIRM or post-FIRM.

- Flood Insurance Rate Map Revision—date of subsequent revisions to the FIRM (March 2, 1989 for Panel 90).

100-Year Floodplain. Designated by the dark shaded areas (Insurance Zones A, AE, A99, AO, AH, V, VE, and V99). Coastal AE and A1-A30 Zones within the areas of 100-year tidal flooding, as well as AH or lake AE Zones, have the flood elevation noted in parentheses beneath the zone designations. An example of a lake zone is shown later in this unit.

Floodway. The crosshatched areas adjacent to a stream. No further development is permitted in the floodway if it will result in a measurable increase in the BFE.

Base Flood Elevation. The water surface elevation of the base flood at that point of the stream or within a zone (denoted in whole numbers). Several "wavy" BFE lines are shown in Figure 5-11.

Zone Break Line (or *Gutter Line)*. Thin white lines separate different flood insurance rate zones within the 100-year floodplain on new format FIRMs. Symbol shown in Figure 5-10. These are shown as *black lines* on *digital* FIRMs. Can you find the zone break line shown in Figure 11?

Approximate Floodplain Areas. 100-year floodplain areas determined using approximate methods. No base flood elevations will be shown in approximate floodplain areas. These areas are classified as unnumbered A Zones. Such an area is shown in Figure 5-11 above a zone break line. That is usually labeled "Limit of Detailed Study."

Elevation Reference Marks. Benchmarks with known, recorded elevations, which are used by surveyors to determine unknown elevations at nearby locations. There is a reference mark in Figure 5-11. Can you find it?

Cross-Section Line. These lines with hexagonal labels represent the surveyed cross sections used in the computer model of the stream in calculating 100-year flood elevations. These cross sections can be used to relate a specific point on the FIRM to the flood profile and/or floodway data table. There are a number of cross-section lines shown in Figure 5-11.

500-Year Floodplain. Designated by a light-shaded area. In old format, the 500-year floodplain was designated as Zone B. It is designated as a *shaded* Zone X on the new FIRMs.

Minimally Floodprone Areas. Designated as *unshaded* Zone X. These zones correspond to the Zone C on the old FIRM format.

Coastal Barrier Resource System Units. Designated by diagonal line patterns (three of them) that overlay other designations. An example is shown later in this unit.

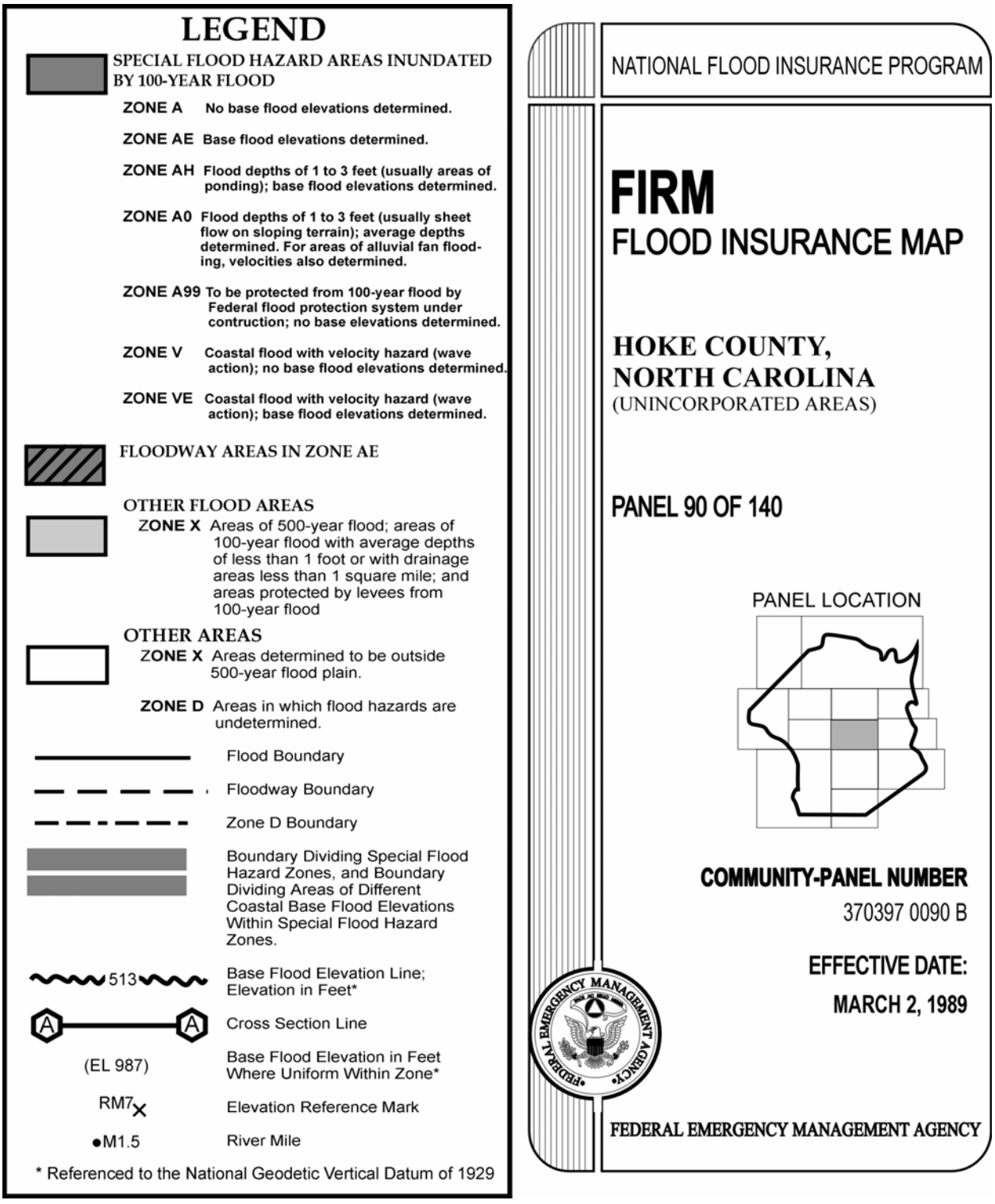


Figure 5-10. Title Block and Legend of New Format FIRM

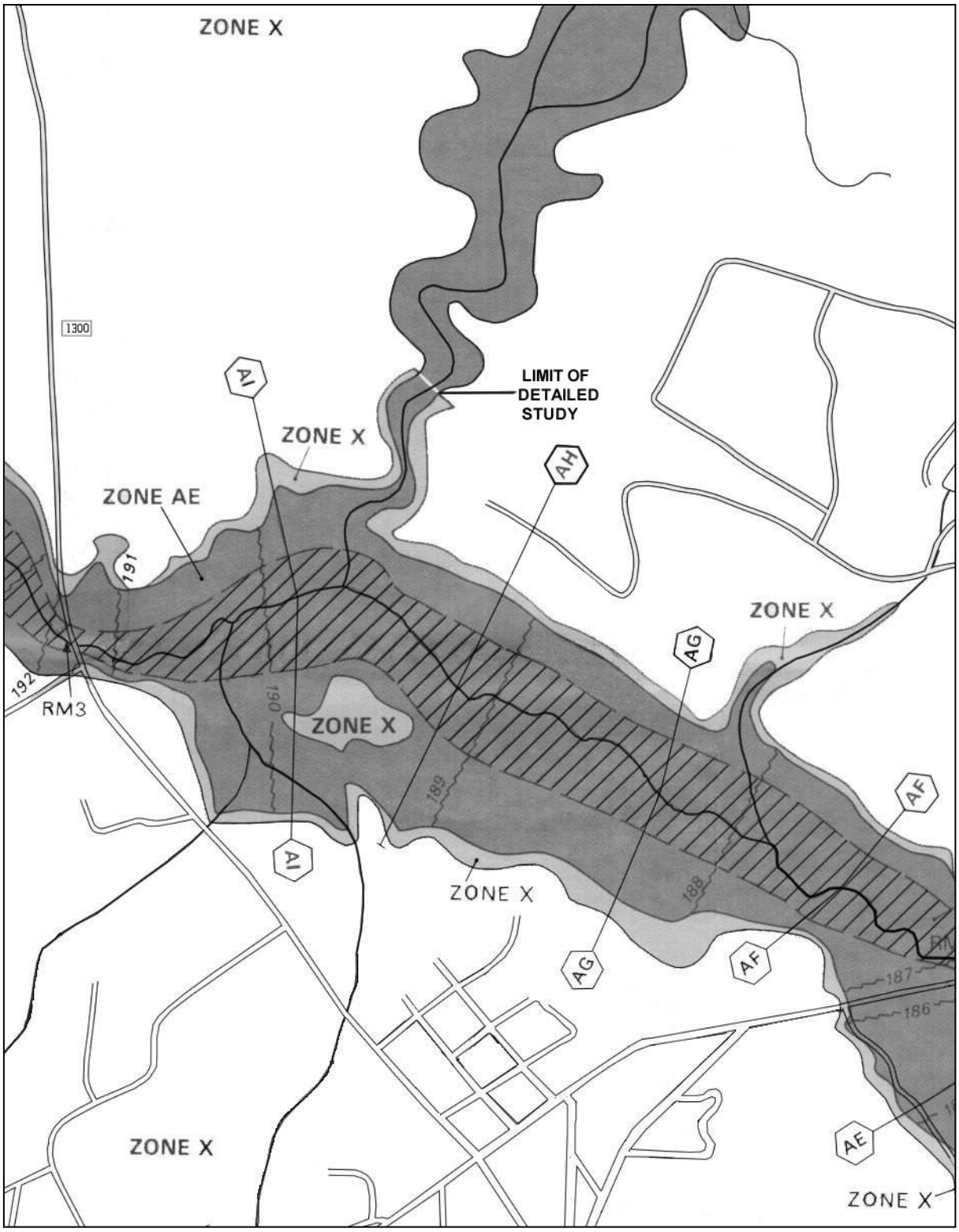


Figure 5-11. New Format FIRM

Countywide FIRMS

Countywide FIRM maps show flood information for all geographic areas of the county, including unincorporated areas and other jurisdictions such as villages, towns, cities, etc. Previously, maps were prepared for each separate jurisdiction, i.e., county FIRMs only showed the flood hazards identified in the unincorporated areas of the county and did not show any flood information inside the corporate limits of a municipality. Now all the identified flood hazard areas within the boundaries of the county are shown on one set of countywide maps.

Title Block. Figure 5-12 shows the title block of a countywide FIRM panel for Richmond County. A list of communities in the county is included on the title block for each panel, along with a panel location map. The community identification numbers (CIDs) in this example are 370200 for the City of Hamlet, 370201 for the City of Rockingham, and 370348 for the unincorporated areas of Richmond County. The CID for a municipality applies to the area within the corporate limits and also to the area of extraterritorial jurisdiction (ETJ). If an unincorporated county area is annexed or included in the ETJ, all references to that area must subsequently use the municipality's CID.

Map Number. Each countywide map panel is identified on the title block by a number starting with a *five-digit* code unique to the county, followed by the letter "C" which stands for "countywide" mapping. It ends with a four-digit panel number, plus a suffix letter if the panel has been revised. In Figure 5-13, the code for Richmond County maps is 37153C; note that this is *not* the same as the community identification number for unincorporated Richmond County. The map number in this example ends with a suffix C, indicating that this may be the third revision of FIRMs for one or more municipalities and/or the unincorporated county. The initial countywide FIRM often has a "C" suffix, used as a convenient starting point for each of the new panels.

Map Effective Date. The effective date for a particular panel is shown on the title block. The date of the initial FIRM for each community is shown on the FIRM index map (not illustrated here). The initial FIRM date is used to determine whether a structure is pre- or post-FIRM for insurance rating purposes.

Legend. The legend for a countywide FIRM (Figure 5-12) is the same as for a new format FIRM.

Figure 5-13 shows a portion of the countywide FIRM for Richmond County indicating the corporate limits and ETJ of the City of Rockingham, as well as unincorporated county areas. Note the

community identification number (370201) for the City of Rockingham and unincorporated Richmond County below the name on the map segment.

Flood Boundaries and Flood Risk Areas

As discussed earlier, flood boundaries are shown on flood maps to define the limit of flooding on the ground for that particular flood event. All areas within those boundaries are subject to that degree of flood risk. They also usually establish the area of jurisdiction for application of the local floodplain management ordinance. NFIP standards require a community to regulate *at least* all areas denoted as the 100-year floodplain, including floodways. For floodplain management purposes, many communities also designate and regulate locally identified floodprone areas and/or 500-year floodplain areas beyond the SFHA. The types of flood boundaries and flood risk areas shown on the flood maps depend on the type of map used.

- FHBMs show "approximate 100-year flood zones."
- FIRMs (old format) show the 100- and 500-year and approximate floodplain areas, COBRA zones, BFEs, and flood zones.
- FBFMs show the floodway, flood fringe, the 500-year floodplain, approximate floodplain areas, and cross sections.
- FIRMs (new format) show the floodway, the 100- and 500-year and approximate floodplain areas, COBRA zones, BFEs, flood zones, and cross sections.
- DFIRMS show the floodway, the 100- and 500-year and approximate floodplain areas, COBRA zones, BFEs, flood zones, and cross sections.

How to use these maps for floodplain management purposes will be demonstrated later in this unit.

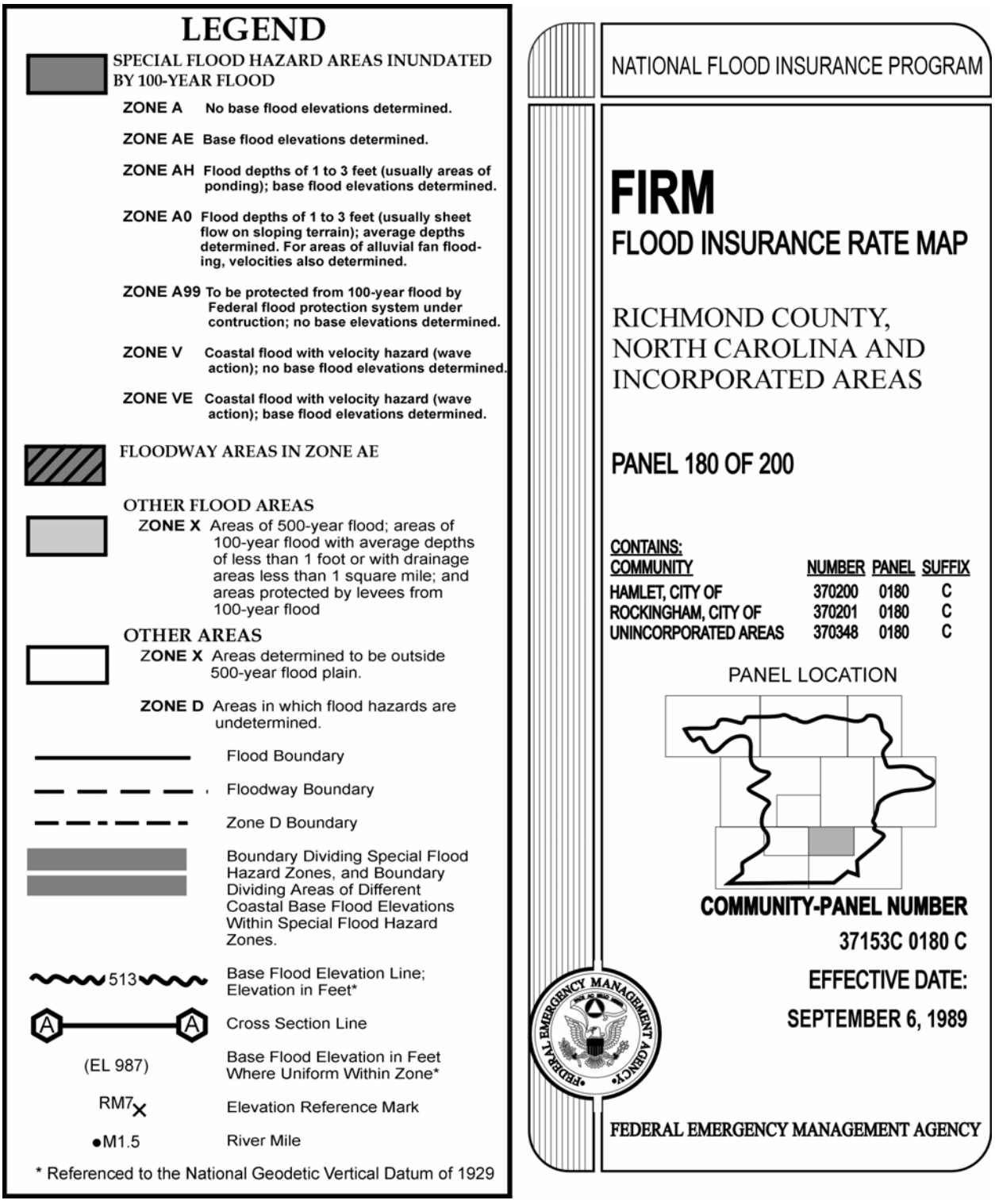


Figure 5-12. Title Block and Legend of Countywide FIRM Panel

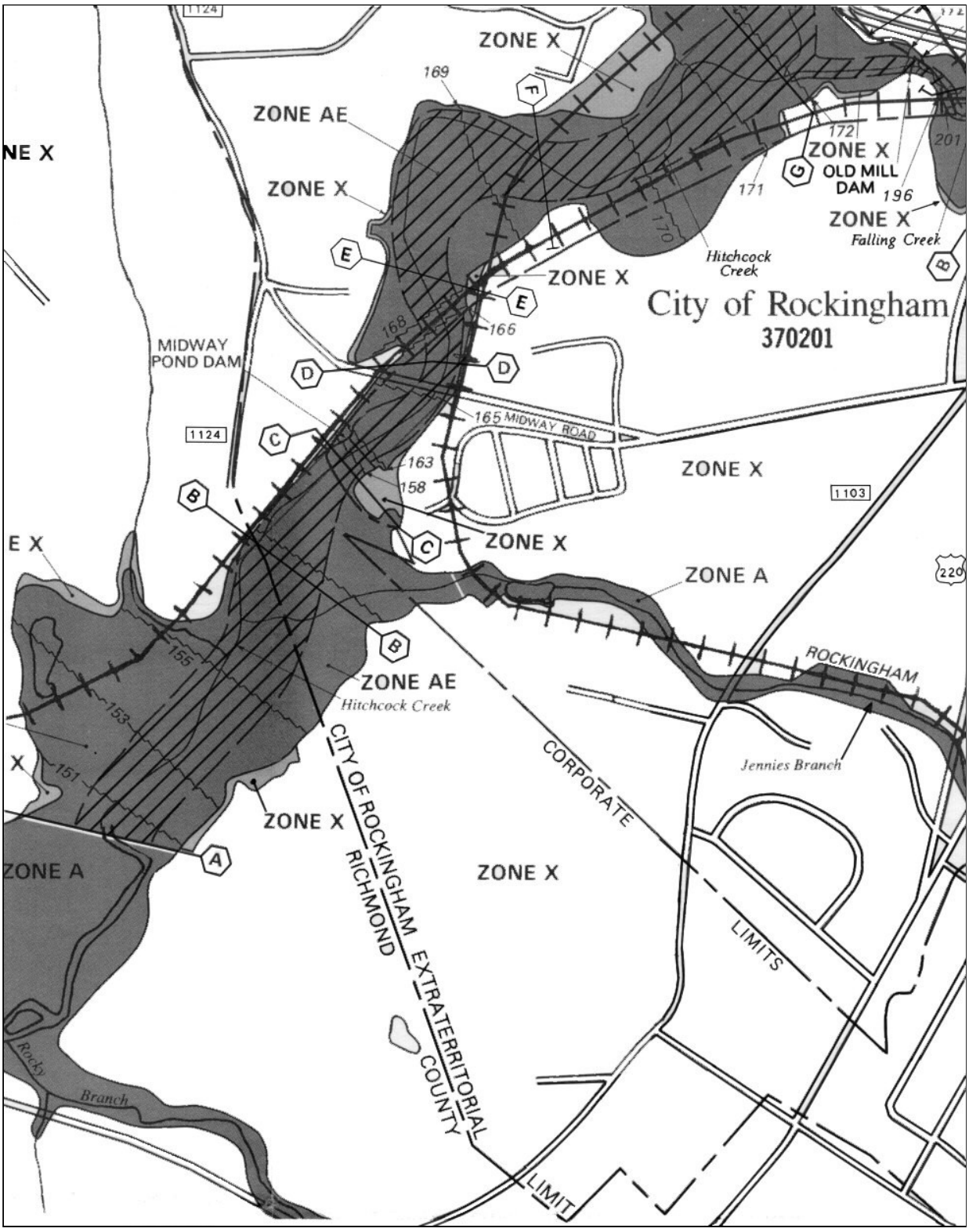


Figure 5-13. Countywide FIRM

Flood Insurance Zones

Flood risk areas are divided into zones on the FIRM. The zones that appear on a particular map will depend on local conditions and the date when the map was issued. Table 5-5 summarizes zone terminology.

Table 5-5. Flood Insurance Rate Map Zones

Zone A	The 100-year or base floodplain. There are seven types of A Zones: **A** Mapped by approximate method, i.e., base flood elevation (BFE) not provided. Often called unnumbered A Zone or approximate A Zone. **A# (A1-A30)** Numbered A Zones (e.g., A7 or A14) where the FIRM shows a BFE in relation to NGVD (old FIRM format). **AE** BFEs are provided. AE Zone delineations are used on new FIRMs instead of A# Zones. **AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths are determined. For areas of alluvial fan flooding, velocities are also determined. **AH** Flood depths of 1 to 3 feet (usually areas of ponding); with BFEs. **AR** SFHAs that result from decertification of a flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection. **A99** To be protected from 100-year flood by a federal flood protection system under construction; no BFEs determined.
Zone B	Areas of 500-year flood; areas subject to the 100-year flood with average depths of less than 1 foot or with contributing drainage area less than 1 square mile; and areas protected by levees from the base flood.
Zone C	Area of minimal flood hazard, outside the 500-year floodplain. B and C Zones may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain.
Zone D	Area of undetermined but possible flood hazard.
Zone V	Coastal flood with velocity hazard (wave action). Zones V, V#, and VE correspond to the A Zone designations.
Zone X	Newer FIRMs show Zones B and C as Zone X. *Shaded* X Zones are equivalent to B Zones and *unshaded* X Zones match C Zones.

Development Sites and Flood Maps

- A developer visits the office of the local administrator to discuss the permits required for a proposed development, or
- A development permit application is received by the local administrator.

It is time to get out the community's flood maps.

The maps to be used are the community's official floodplain maps (referenced in and included as part of the floodplain management ordinance). These maps are used to determine if the proposed development, or any part of it, is located within the flood hazard area or a locally designated floodprone area and therefore subject to the provisions of the local floodplain management ordinance.

To locate the development site on the map, follow these steps:

1. If the community has more than one map panel, use the map index to determine which panel to use.

2. Locate the site on the index using map landmarks, such as highways, streets, and streams.

3. Locate the map panel for the area containing the site. If there is an asterisk on the panel number, either no flood hazard has been identified in that area or it is entirely one flood zone and the panel was not printed. Be sure the map panel is the most recent one by comparing its suffix letter with the suffix letter for that panel on the current map index. Remember, in many communities different panels will have different effective dates due to revisions that do not affect the whole community.

4. Locate the site as accurately as possible on the map. Use a detailed street or road map as well as the tax appraiser's plat map to correctly identify the property boundaries, if necessary. Obtain the distance on the ground between the site and one or more identifiable points (centerline of a road or street, a bridge, or some other feature on the map). Locate these identifiable points on the flood map. Using the map scale and the measured ground distance from these points, plot the site on the map. *(The video,* "How to Use NFIP Flood Information," *viewed earlier, explained this process in more detail. If necessary, go back and review this segment*.) The degree of difficulty

in locating the site on the map will largely depend on the administrator's familiarity with the properties in the community and with the scale of the flood maps. Note: Most people experience difficulty accurately locating property on a large-scale rural FIRM panel, so don't feel alone if this gives you trouble.

If the site is within the mapped flood boundary, it is subject to the provisions of the local ordinance. If the site is clearly outside the flood boundary, no floodplain regulations apply unless the site adjoins the SFHA and surveyed ground elevations are *below* BFE. In this instance, the site would be within the floodplain.

If it cannot be determined whether the site is in or out of the floodplain, then additional information and/or investigations will be needed. In this instance, ground elevation and lowest floor elevations of any structures will be needed for the site, so the applicant will have to hire a surveyor. A field visit by the local administrator or designee and measurements on the ground may also be required. The actual site elevations are compared to the base flood elevation, read from the FIS flood profiles, for that location.

For coastal, lake, reservoir, and shallow flooding studies, the same procedures apply. In these instances the BFE is printed in parentheses below the flood zone designation for that location and can be used without any interpretation.

If the site is near the floodway boundary, the same process as described above will need to be used to determine if any portion of the site is within the floodway. In this instance, measuring from identifiable land features located on both the ground and the map will be required. As before, scaling these distances on the map will help determine location of the site in relation to the floodway boundary. Because the floodway boundary *is not* based on a flood elevation, measuring in the field and on the map is the *only* way to locate the site in relation to the floodway. If the site is at a surveyed cross-section, floodway width data from the floodway data table may be used to supplement the field and map measurements. Remember the width listed in the table is the distance from the floodway line on one side of the stream to the floodway line on the other side of the stream. This is very important if the stream channel is the community boundary, so only about half of the floodway is shown on the community's FIRM. If the width measured on the map at that site is not comparable to that shown in the table, the table data are to be used. If there is a significant difference, contact the FEMA regional office for an interpretation. The proportional width of the floodway from the center of the stream can be used to determine the floodway boundary on the ground.

If any portion of the building site, proposed grading, fill, bridge, or other obstruction is determined to be within the floodway, then the floodway provisions of the ordinance also apply.

The local administrator has the ultimate responsibility for determining if a proposed development, or any part, is located in a coastal high hazard area (Zone V). This determination can be made by scaling on the FIRM from one or more identifiable features (streets, roads, etc.) to the zone boundary, and then by measuring the scaled distances from these features on the ground to establish the boundary location. *If any part of the proposed building construction is located in a V Zone, then the entire building must meet the V-zone requirements.*

Determining Stream Distance

New Term

Stream distance

Flood profile sheets in the Flood Insurance Study are used to calculate flood elevations at the development site. The scale on a flood profile is expressed in terms of **stream distance** in either feet or miles above the mouth of the stream or other reference. Once a site has been located on the flood map (as described above), the next step is to determine the site's position relative to the flood profile. Figure 5-14 illustrates this procedure. In the example, a site, marked by an "x," is located between cross sections C and D.

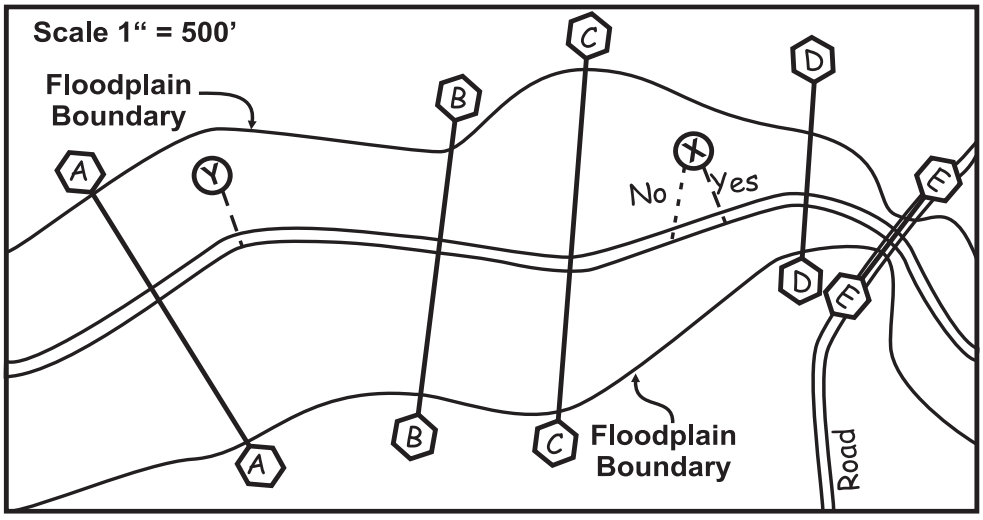
Find the letter designation for the nearest upstream and downstream cross sections on the Flood Boundary and Floodway Map (FBFM) or the new format Flood Insurance Rate Map (FIRM). Locate these same cross-section letters on one of the flood profiles in the FIS. To determine the site's location relative to the profile, use one of the two procedures outlined below, depending on whether the distance is expressed in feet or miles.

Draw a line from the site *perpendicular* to the center of the stream, as is shown in the Figure 5-14. (Another line has also been drawn from the site to the centerline of the stream at another location. Notice it is not perpendicular to the stream and must not be used in these calculations.) From the point where the perpendicular line intersects the center of the stream, measure the distance to the nearest cross section—scale the distance along the center of the stream, following all bends and curves. *(It would be worthwhile to measure distances to both cross sections to check accuracy.)* In this instance, the site is about 500 feet upstream of cross section C and 250 feet downstream of cross section D. (As stated in Unit

4, the cross-section lettering system starts downstream, usually with the letter "A" and goes upstream. Cross section A is downstream of cross section B; B is upstream of A, etc.) In the same manner, site "y" can be located in relation to the flood profile. It is about 600 feet downstream of cross section B and 300 feet upstream of cross section A. Keep these numbers in mind. They will be used shortly.

Figure 5-14. Measuring Stream Distance from Site to Cross Section

Where flood profiles are plotted using a scale in miles, it will be necessary to convert flood map measurements from feet to miles. One mile equals 5,280 feet. Making this conversion, site "x" shown on Figure 5-14 is located about 0.1 mile (rounded) upstream of cross section C (500 divided



by 5280). It would be located about 0.05 miles (rounded) downstream of cross section D (250 divided by 5280). Site "y" is located about 0.11 mile downstream of cross section B and about 0.06 miles upstream of cross section A. Keep these numbers in mind, also.

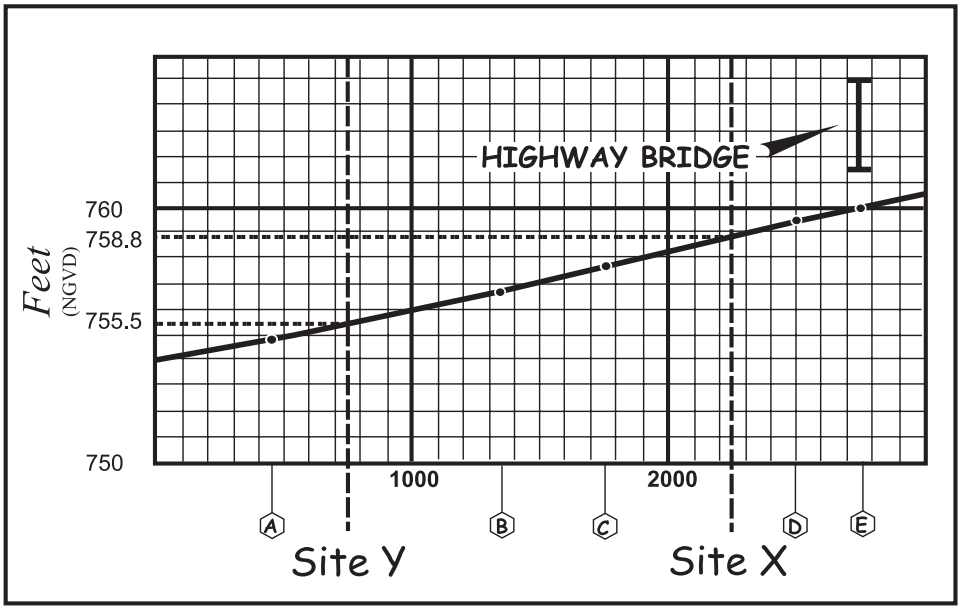
Flood Elevations from Map Data

To obtain flood elevations for a development site, the measurements of site distance (in feet or miles) from stream cross sections are transferred to a flood profile sheet. For example, for site "x" on Figure 5-15, measure 500 feet upstream (to the right) of cross section C on the grid. (This distance was determined from Figure 5-14.) Draw a vertical line on the grid until it intersects the plotted profile. Read the flood elevation for this site at the left edge of the grid as 758.8 feet (NGVD). If the distance is measured 250 feet downstream (to the left) of cross section D on the grid, the same vertical line would be drawn on the grid. Measuring from both

directions on the flood map and on the flood profile is a check for accuracy in obtaining data from these sources. Likewise, the flood elevation for site "y" can be determined by plotting the location on the flood profile, measured from cross sections upstream and downstream of the site. The flood elevation for site "y" would be 755.5 feet (NGVD).

Figure 5-15. Typical Flood Profile—Stream Distance in Feet

Figure 5-16 illustrates how to transfer the converted measurements made from Figure 5-14 when flood profiles are plotted in stream miles. For site "x" on the figure, measure 0.1 mile upstream (to the right) of cross section C. Again, draw a vertical line on the grid until it intersects the plotted profile. Read the flood elevation for this site at the left edge of the grid as 758.8 feet (NGVD). If the distance is measured 0.05 miles downstream of cross section D on the grid, the same vertical line would be drawn. As



before, the flood elevation for site "y" can be determined by plotting the location on the flood profile, measured in miles from cross sections upstream and downstream of the site. A flood elevation of 755.5 feet (NGVD), as before, should be obtained.

The horizontal scale depicted in Figure 5-16 (1 inch = 0.1 mile) is rarely found in FIS flood profiles. It is used here as a learning exercise. Typically, the scales used in plotting computed flood profiles are 1 inch = 0.5 mile or 1 inch = l mile.

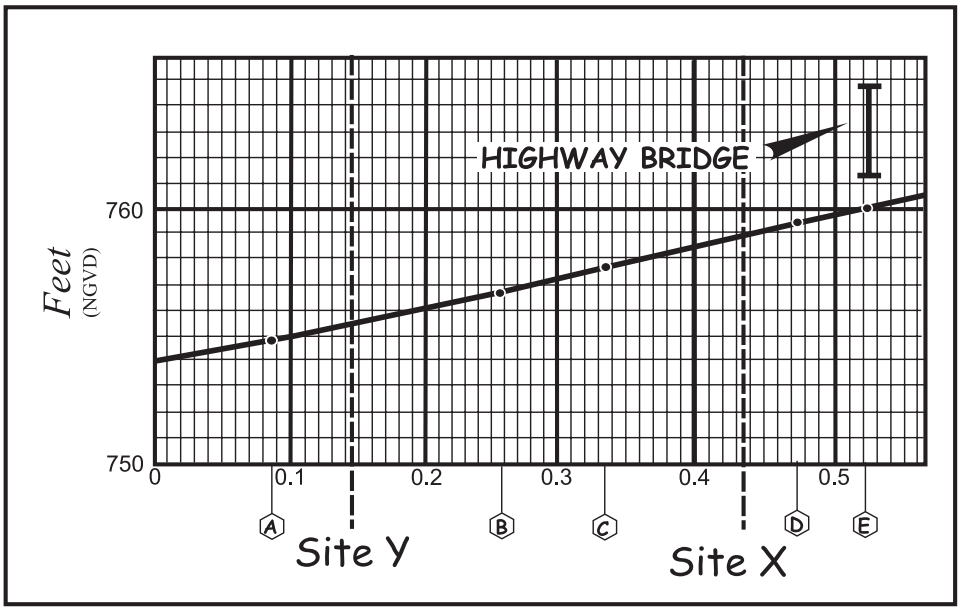
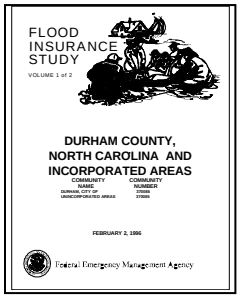


Figure 5-16. Typical Flood Profile—Stream Distance in Miles

The flood profiles in the Flood Insurance Study should always be used to determine BFE instead of interpolating between base flood elevation lines on the FIRM. The profiles will provide a more accurate estimate of the elevation because there may not be a straight-line relationship between "even-foot" base flood elevations shown on FIRMs. Remember that it is the elevations computed at surveyed cross sections that are connected with straight lines to produce the flood profiles.

Additional Flood Elevation Data from the Flood Insurance Study



Where studies have been carried out for lakes and reservoirs, information on BFEs are contained in Section 3 of the FIS. As an example, Table 4, *Summary of Stillwater Elevations*, from the Durham County FIS is reproduced below as Table 5-6. Note that the BFE 262.5 is rounded to one-tenth of a foot in the table, but is shown in parentheses in *whole* numbers on the FIRM (see Figure 5-17). *Use the BFE from the table, not the FIRM.*

Table 5-6. Durham County, NC, Summary of Stillwater Elevations				
FLOODING SOURCE AND LOCATION	ELEVATION (ft. NGVD[1])			
	10-YEAR	50-YEAR	100-YEAR	500-YEAR
FALLS LAKE (NEUSE RIVER) Entire shoreline	256.9	260.7	262.5	266.0

[1] National Geodetic Vertical Datum of 1929

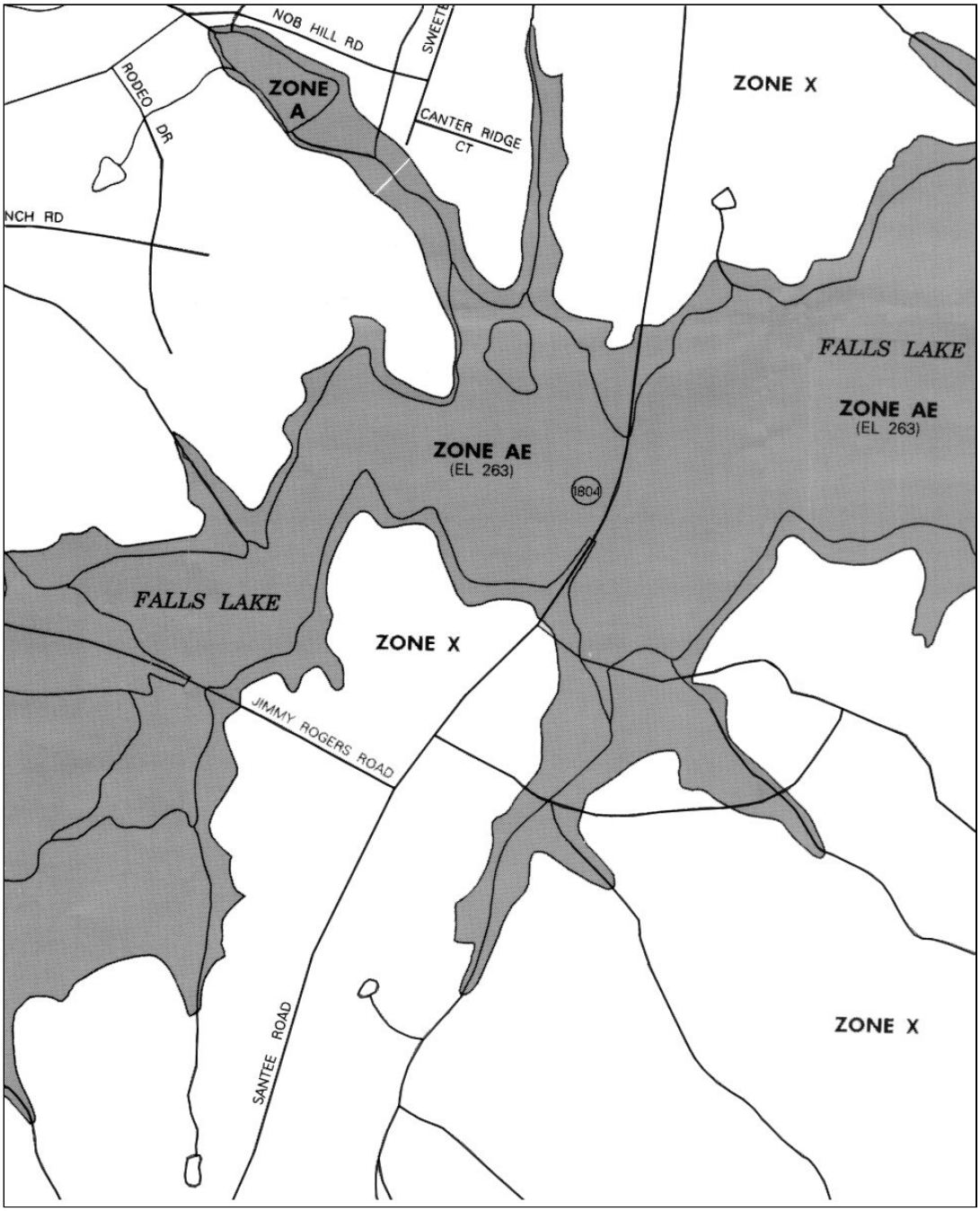


Figure 5-17. FIRM with Stillwater Elevations

Additional BFEs from Map Data

For coastal A# and AE Zones, use the BFE printed in parentheses below the flood zone designation (see Figure 4-17). That BFE applies throughout the flood zone. *No interpolation is necessary*. The same holds true for AO and AH Zones with depths or whole number BFEs (see Figure 4-18).

There are a number of exercises in Learning Check # 3 to evaluate knowledge and skill in using maps and profiles to determine flood boundaries and elevations at development sites.

Learning Check #3

The following questions are based on the Kinston Flood Insurance Study.

1. Using the Flood Boundary and Floodway Map (Panel 15 of 20) and the engineer's scale:

   a. How many feet does one inch on the map represent? _____

   b. What is the width of the floodway at cross section D on the Neuse River? _____

   c. What is the floodway width at this cross section according to the floodway data table in the FIS report? _____

2. Using the Flood Boundary and Floodway Map (Panel 5 of 20) and the engineer's scale:

   a. What is the distance between cross sections G and H on Briery Run? _____

   b. What is the distance according to the floodway data table in the report? _____ _____

   c. How far above Rouse Road does the detailed study on Briery Run extend? _____

3. Refer to the FIRM, Community-Panel Number 370145 0005C. List the different zones shown on the map. _____

4. Of the two types of maps provided with the Kinston FIS, Flood Boundary and Floodway Map and Flood Insurance Rate Map, which type should be used for administration of the local floodplain management ordinance? _____

5. A developer requests the base flood elevation for a site along Trenton Highway. Using the Flood Boundary and Floodway Map Index, which map panel should be used to locate the development site? _____

6. The development site is located on the east side of Trenton Highway where it intersects with Baker Road. This site is between cross sections ____ and ____ . What is the distance

to the nearest cross section? _____ How far is the site from the floodway for Southwest Creek? _____

7. What is the designation of the nearest elevation reference mark? _____
   Where can information regarding this reference mark be found? _____
   _____
   What is the elevation of the reference mark? _____
   How far is it from Baker Road? _____

8. Using the distance scaled in question 6 and the flood profiles in the report, what is the base flood elevation at the development site? _____

9. Using the FIRM that contains this site, what base flood elevation do you believe an insurance agent would assign to this site?
   _____
   _____
   _____

10. A development site is located 200 feet west of Rouse Road (measured perpendicular to the road) and 100 feet from Taylors Branch (measured perpendicular to the stream). Which of the following should be used to determine the base flood elevation for location of the lowest floor of a residence to be built on the site?

    a. The base flood elevation line shown on the FIRM

    b. The floodway data table shown in the Flood Insurance Study report

    c. The flood profiles shown in the Flood Insurance Study report

11. What would be the BFE for this site? _____

Special Map Features

Six map features deserve special attention. They are:

- Stream or river floodways
- Coastal high hazard areas
- Coastal Barrier Resource System
- Ponding areas
- Shallow flooding areas
- Lake flood zones

Stream or river floodways and coastal high hazard areas are extremely hazardous for human occupancy because of water depths and velocities. These hazards have been quantified by the Flood Insurance Study for the community, and floodways are designated on the flood maps.

The floodway has already been discussed a number of times. In coastal studies, those coastal high hazard areas subject to flooding *and* wave action of three feet or more (discussed in Unit 4) are designated as V or VE Zones. *The number in parentheses after or below the zone designation is the base flood elevation*. Refer to the FIRM for the Village of Bald Head Island. Find "Cape Fear" in the lower right corner. Directly above it is Zone VE (EL 16). "EL 16" is the base flood elevation in this area. Unlike the floodway where no development is permitted that would cause any further increase in the level of the base flood, development is permitted in coastal high hazard areas, if certain construction standards are met, including elevation (see Unit 6).

Undeveloped portions of coastal barrier islands in the Coastal Barrier Resources System and other areas (e.g., coastal mainland, along the shore of the Great Lakes, along bays, inlets, or estuaries) have been identified and included on applicable map panels. Otherwise Protected Areas (OPA) are also shown. These are primarily open space areas owned by federal or state governments or private conservation organizations. This system was established by Congress via the Coastal Barrier Resources Act of 1982 and the Coastal Barrier Improvement Act of 1990. These areas are identified because, as required by the above acts, no new flood insurance coverage may be provided after specified dates for new or substantially improved structures in any unit in the system. In addition, any other federal programs that may have the effect of encouraging development in

these identified areas are restricted by the acts. This includes limitations on funding for permanent reconstruction after a disaster.

An example of an identified undeveloped coastal barrier is shown on the FIRM in Figure 5-18. In this instance, identification was made for one area in 1983 and another in 1990. The FIRM for the Village of Bald Head Island also illustrates an identified unit of the Coastal Barrier Resource System, colloquially referred to as a "COBRA zone." For more information, refer to the *COBRA Zone Fact Sheet* in Appendix G.

The next two special map features may represent the opposite end of flood hazards. The development of shallow flooding studies was discussed in Unit 4. Shallow flooding occurs where a clearly defined channel does not exist and represents an average depth of flooding of one to three feet in an area. Water may collect or "pond" in depressions or, in the case of coastal areas, wave run-up may collect or pond behind a dune or obstruction. In steeper areas or on flat plains, water may spread out and run over the land surface as "sheet flow." In either instance, a base flood depth (i.e., in feet above the ground) may be determined.

An example of a shallow flooding area, marked "Zone AO (depth 2')," is shown on Figure 4-18. This area is not subject to the moving water of a riverine flood or the large waves of the coastal floodplain. However, it is subject to flooding by storm surge washing over the top of the dunes or from intense rainfall being trapped between the dunes.

Most lakes have a round-number BFE shown in parentheses below the flood zone (see Figure 5-17). The actual BFE is obtained from Section 3 of the FIS as discussed earlier. However, many long lakes, especially reservoirs have a higher BFE at the upstream end than at the outfall. These types of lakes and reservoirs have BFEs shown with the conventional squiggle lines, and these long lakes also appear on the stream profiles.

For communities without any flood maps, please see Appendix G.

Please complete Learning Check # 4 and the Unit Learning Exercise before proceeding.

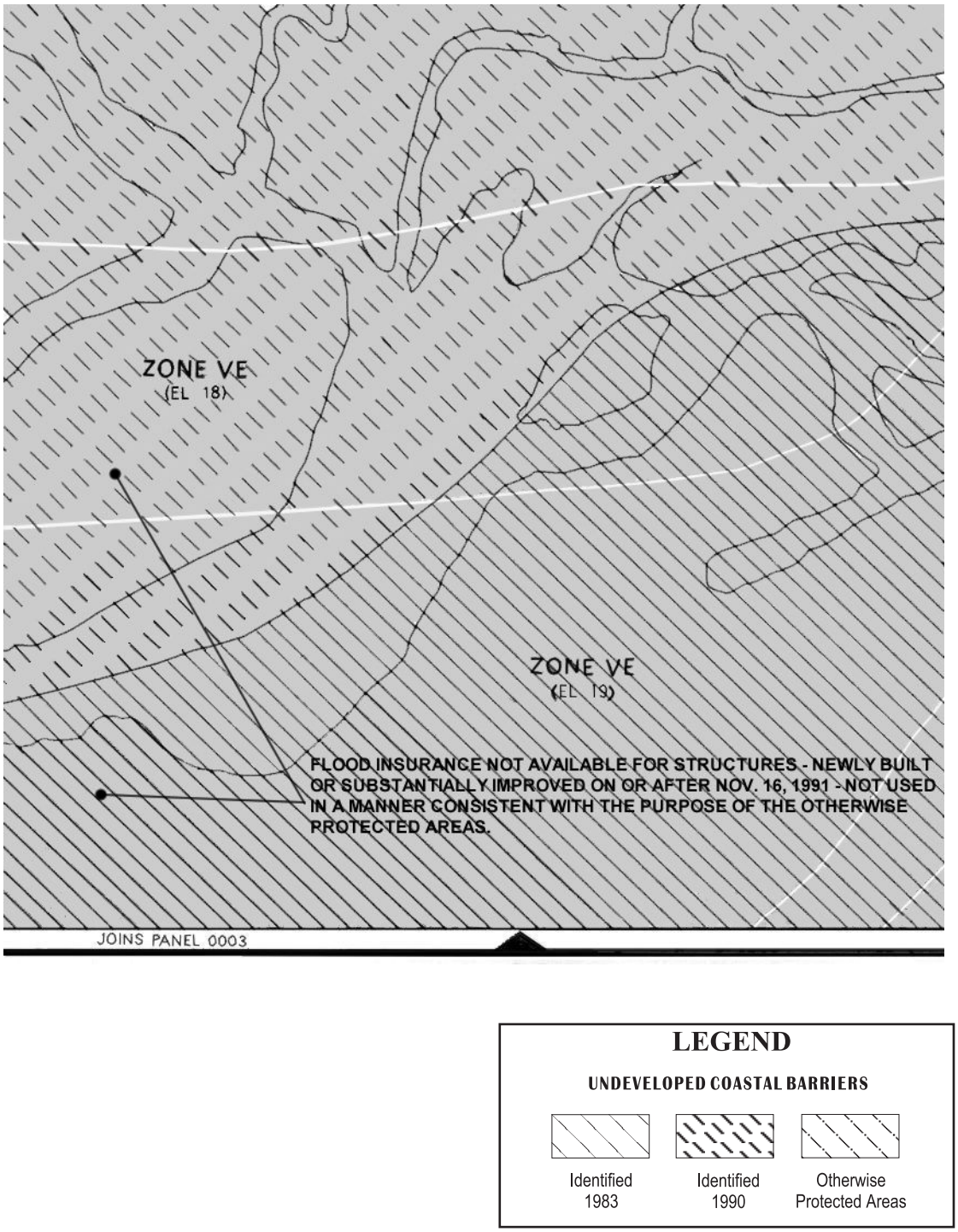


Figure 5-18. Identified Undeveloped Coastal Barrier

Learning Check #4

The following questions, except #7, are based on the Bald Head Island Flood Insurance Study.

1. In coastal studies what is the difference between a VE Zone and an AE Zone? _____
   _____

2. What is the highest wave crest elevation shown on the FIRM? _____

3. In what zone is Starrush Trail located? _____ . Is it in a coastal high hazard area? _____ .

4. In what zone is Nightshade Court located? _____ . Is it in a coastal high hazard area? _____ .

5. Does the FIRM show any identified undeveloped coastal barriers? _____
   _____

6. Within these identified coastal barriers, on or after what date is flood insurance not available for newly built or substantially improved structures? _____

7. In Figure 4-19 of this course text, what is the base flood depth for Zone AO? _____

   What is an AO Zone? _____

Unit Learning Exercise

Purpose: To assess your understanding of the material covered in this unit.

Materials Needed:

1. *Flood Insurance Study*, City of Kinston
2. *Flood Insurance Study*, Village of Bald Head Island
3. Flood Boundary Floodway Maps, City of Kinston
4. Flood Insurance Rate Maps, City of Kinston
5. Flood Insurance Rate Map, Village of Bald Head Island
6. Engineer's scale

Note: All items are provided in the course materials.

Directions: Using the Unit 5 text and the Flood Insurance Studies materials, answer the following questions.

1. What is the best map to use to determine if a property:

   a. is in the Special Flood Hazard Area (SFHA)? _____

   b. in Kinston is in a floodway? _____

2. What is the effective date of:

   a. Kinston's FBFMs? _____

   b. Bald Head Island's FIRM? _____

3. What FIRM panel should be used to determine if a property on Neuse Road in Kinston is in the floodplain?

   _____

4. What Floodway Map panel should be used to determine if a property on Rouse Road in Kinston is in a floodway?

   _____

5. Which of the engineer's scales would you use with Kinston's Floodway Maps?

   Circle one: 20 40 60 80 100 120

6. Where is the boundary between Zone A8 on the Neuse River and Zone A6 on Southwest Creek?

   _____

7. A property is located at the west intersection of E New Bern Road and Franklin Street.

   a. What FIRM zone is this property in? _____

   b. The property is in which of the following? (Check those that apply)

   — floodway

   — 100-year floodplain

   — 500-year floodplain

   — above the 500-year floodplain

   c. What is the base flood elevation (BFE) at this site? _____

8. 416 Brunswick Boulevard is located 1100 feet south of West New Bern Road.

   a. How far back from the boulevard is the floodway boundary at this address?
   _____

   b. What body of water is the source of the flooding here?
   _____

   c. What is the number of the nearest elevation reference mark?
   _____

   d. What is the elevation at this reference mark?

_____

e. What is the BFE at 416 Brunswick Boulevard?

_____

9. A person purchased a 400' x 400' corner lot on the north side of Stallings Road at the intersection with Lynn Drive in Kinston.

   The new owner knows that Adkin Branch runs through the lot. The owner needs to know the following about the flood hazard:

   a. What is the BFE of the stream at the lot's western border, according to the profile?

      _____

   b. What cross section runs through the lot? _____

   c. At this cross section what is the:

      regulatory flood elevation? _____

      width of the floodway? _____

      elevation of the 10-year flood? _____

      elevation of the 500-year flood? _____

   d. What is the approximate mean floodway velocity at the western edge of the lot?

      _____

   e. At the middle of the lot, how far from Stallings Road is the floodway boundary?

      _____

   f. What is the nearest elevation reference mark to this lot?

      _____

   g. What is the description of the location of this reference mark?

      _____

   h. What is the elevation of this elevation reference mark?

      _____

10. What is Bald Head Island's community number? _____

11. If you measured a distance on the ground as 1,000 feet, how many inches would it be on Bald Head Island's FIRM?

    _____

12. Sabal Palm Trail is located in the Village of Bald Head Island.

    a. What FIRM zone is it in? _____

    b. The site is in which of the following? (Check those that apply)

    — 100-year floodplain

    — Coastal High Hazard Area

    — above the 500-year floodplain

    — identified undeveloped coastal barrier

    c. What is the BFE at this site? _____

13. An undeveloped lot is on Brown Pelican Trail in the Village. The owner wishes to build a residence on the lot.

    a. What FIRM zone(s) is the lot in? _____

    b. What is the BFE at this site? _____

    c. What are the numbers of the two closest transects to the site? _____

    d. Is the site in a coastal high hazard area? _____

    e. Is the wave height of the base flood more or less than 3 feet at the site? _____

14. An out-of-state couple is looking at some properties on North Bald Head Wynd, west of Muscadine Wynd, in the Village of Bald Head Island. They are concerned about possible coastal storm flooding. They want to know the following:

    a. What is the 100-year flood elevation in this area? _____

    b. What FIRM zone represents the SFHA? _____

c. At the intersection of North Bald Head Wynd and Stede Bonnet Wynd, how far is it to the boundary of the protected coastal barrier? _____

Answers to Learning Checks and Unit Learning Exercise

Answers to Learning Check #1

These questions are based on the City of Kinston Flood Insurance Study report.

1. What is the width of the floodway for Briery Run at cross section D*?* ***175 feet***

2. What would be the base flood elevation the community would use at this location?
   49.5 feet (NGVD)

3. How much did the base flood elevation increase at cross section M on Southwest Creek by confining the base flood within the floodway boundaries? ***0.9 feet***

4. Why is this increase no more than 1 foot at any cross section in the table?
   This is the maximum permissible increase under NFIP floodplain management criteria.

The following questions are based on the Village of Bald Head Island Flood Insurance Study.

5. Which transect would be used to determine flood elevations along the shoreline of the Atlantic Ocean north of Cape Fear? ***20 (page 12)***

6. What would be the 100-year stillwater elevation along this portion of the shore?
   10.7 (NGVD) The wave crest elevation? ***16.4 (NGVD)***

Answers to Learning Check #2

These questions are based on the City of Kinston Flood Insurance Study report.

1. Using the flood profiles in the report, what is the "100-year" flood elevation for the Neuse River at cross section D? ***37.5 feet (NGVD)***

2. What BFE is obtained from using the floodway data table? ***37.4 (NGVD)***

3. An "I" symbol is plotted at station 5600 feet above mouth on Briery Run flood profiles. What does this symbol represent? ***It is Secondary Road 1732 (Wallace Road) crossing the stream. The top of the "I" is the elevation of the bridge deck or top of rail. The bottom of the "I" is the elevation of the top of the waterway opening.***

4. Using the flood profiles, determine the 100-year flood elevation on Southwest Creek for a site 1400 feet upstream of the Southern Railway bridge. ***about 34.8 feet (NGVD)***

5. How far is this site from cross section D? ***about 1100 feet***

6. A developer proposes to place a structure 100 feet downstream of cross section D on Jerrico Run. Using the flood profiles, tell the developer how much higher the structure would have to be elevated above the base flood level to be protected to the 500-year flood level. ***100-year elevation is about 44.9 ft. (NGVD). 500-year elevation is about 46.1 ft. (NGVD). Raising the structure 1.2 feet would provide this much added protection.***

7. During the 100-year flood, floodwater would flow over State Highway 58 where it crosses Briery Run. What would be the BFE for a development site along the roadway above (upstream of) the stream crossing? ***53.2 feet (NGVD)*** Along the other side of the roadway below (downstream of) the stream crossing? ***52.5 feet (NGVD)***

Answers to Learning Check #3

The following questions are based on the Kinston Flood Insurance Study.

1. Using the Flood Boundary and Floodway Map (Panel 15 of 20) and the engineer's scale:

   a. How many feet does one inch on the map represent***?*** ***800***

   b. What is the width of the floodway at cross section D on the Neuse River***?*** ***about 2000 feet***

   c. What is the floodway width at this cross-section according to the floodway data table in the FIS report? ***2000 feet***

2. Using the Flood Boundary and Floodway Map (Panel 5 of 20) and the engineer's scale:

   a. What is the distance between cross sections G and H on Briery Run? ***about 1860 ft.***

   b. What is the distance according to the floodway table in the report? ***23,310-21,430=1880 feet***

   c. How far above Rouse Road does the detailed study on Briery Run extend? ***About 1000 feet, measured along the stream***

3. Refer to the FIRM, Community-Panel Number 370145 0005C. List the different zones shown on the map. ***Zones A, A4, A5, B, and C***

4. Of the two types of maps provided with the Kinston FIS, Flood Boundary and Floodway Map and Flood Insurance Rate Map, which type should be used for administration of the local floodplain management ordinance? ***Flood Boundary and Floodway Map***

5. A developer requests the base flood elevation for a site along Trenton Highway. Using the Flood Boundary and Floodway Map Index, which map panel should be used to locate the development site? ***370145 0020***

6. The development site is located on the east side of Trenton Highway where it intersects with Baker Road. This site is between cross sections ***L*** and ***M***. What is the distance to the nearest cross section? ***about 200 feet*** How far is the site from the floodway for Southwest Creek? ***about 620 feet***

7. What is the designation of the nearest elevation reference mark? ***RM 45***
   Where can information regarding this reference mark be found?
   Panel number 370145 0015
   What is the elevation of the reference mark? ***45.20 feet (NGVD)***
   How far is it from Baker Road? ***According to the description of the location, it is 600 feet southeast.***

8. Using the distance scaled in question 6 and the flood profiles in the report, what is the base flood elevation at the development site? ***about 46.8 feet (NGVD)***

9. Using the FIRM that contains this site, what base flood elevation do you believe an insurance agent would assign to this site***?*** ***It lies between elevation lines 46 and 47 in Zone A6. It lies very close to elevation line 47, so that elevation would likely be assigned. However, the profiles,*** **not** ***the FIRM elevation lines, should always be used by the administrator to determine elevations.***

10. A development site is located 200 feet west of Rouse Road (measured perpendicular to the road) and 100 feet from Taylors Branch (measured perpendicular to the stream). Which of the following should be used to determine the base flood elevation for location of the lowest floor of a residence to be built on the site?

    a. The base flood elevation line shown on the FIRM
    b. The floodway data table shown in the Flood Insurance Study report
    c. The flood profiles shown in the Flood Insurance Study report

    All three sources provide base flood elevation data for this site. A base flood elevation line (elevation 73) runs through the site. Cross section D also runs through the site; therefore, the base flood elevation can be read from the floodway data table found on

page 15 of the Kinston FIS. It is 73.5 feet (NGVD). Using the flood profiles shown in the FIS, an elevation of approximately 73.5 could be determined. Where a surveyed cross section runs through a development site not covering a large area, it is acceptable to use the floodway data table to obtain the BFE. The table shows the computed elevation at that site. In all other instances, the flood profiles shown in the FIS should be used.

11. What would be the BFE for this site? ***73.5 feet (NGVD)***

Answers to Learning Check #4

The following questions, except #7, are based on the Bald Head Island Flood Insurance Study.

1. In coastal studies what is the difference between a V Zone and an A Zone? ***V Zone has wave heights greater than 3 feet; A Zone less than 3 feet (Figure 3, FIS report, page 13).***

2. What is the highest wave crest elevation shown on the FIRM? ***EL 19***

3. In what zone is Starrush Trail located? **VE (EL 13)** Is it in a coastal high hazard area? ***Yes***

4. In what zone is Nightshade Court located? ***AE (EL 10)*** Is it in a coastal high hazard area? ***No***

5. Does the FIRM show any identified undeveloped coastal barriers? ***Yes, along the northeast portion of the village.***

6. Within these identified coastal barriers, on or after what date is flood insurance not available for newly built or substantially improved structures? ***November 16, 1991***

7. In Figure 4-19 of this course text, what is the base flood depth for Zone AO? ***2 feet***

   What is an AO Zone? ***Usually areas of ponding with flood depths of 1-3 feet***

Answers to Unit Learning Exercise

1. What is the best map to use to determine if a property:

   a. is in the Special Flood Hazard Area (SFHA)? ***FIRM***

   b. in Kinston is in a floodway? ***Flood Boundary and Floodway Map***

2. What is the effective date of:

   a. Kinston's FBFMs? ***June 15, 1982***

   b. Bald Head Island's FIRM*?* ***May 15, 1986 (see map legend)***

3. What FIRM panel should be used to determine if a property on Neuse Road in Kinston is in the floodplain? ***370145 0020***

4. What Floodway Map panel should be used to determine if a property on Rouse Road in Kinston is in a floodway? ***370145 0005***

5. Which of the engineer's scales would you use with Kinston's Floodway Maps?

   Circle one: 10 20 30 ***40*** 50 60

   (The scale of the map is 1 inch = 800 feet. Therefore use the 40 scale and double the amount read.)

6. Where is the boundary between Zone 8 on the Neuse River and Zone A6 on Southwest Creek? ***Neuse River Road***

7. A property is located at the west intersection of E New Bern Road and Franklin Street:

   a. What FIRM zone is this property in? ***A8***

   b. The property is in which of the following? (Check those that apply)

   — floodway

   X 100-year floodplain

   — 500-year floodplain

   — above the 500-year floodplain

c. What is the BFE at this site? ***about 35.6 (NGVD), 600 feet measured along the Neuse River above cross section B***

8. 416 Brunswick Boulevard is located 1100 feet south of West New Bern Road.

   a. How far back from the boulevard is the floodway boundary at this address?
      about 450 feet

   b. What body of water is the source of the flooding here?
      Neuse River

   c. What is the number of the nearest elevation reference mark?
      20

   d. What is the elevation at this reference mark?
      40.955 feet (NGVD)

   e. What is the base flood elevation at 416 Brunswick Boulevard?
      about 38.6 feet (NGVD) located 1600 feet, measured along the Neuse River, above cross section E

9. A person purchased a 400' x 400' corner lot on the north side of Stallings Road at the intersection with Lynn Drive in Kinston.

   The new owner knows that Adkin Branch runs through the lot. The owner needs to know the following about the flood hazard:

   a. What is the BFE of the stream at the lot's western border according to the profile?
      about 60.9 (300 feet above cross section Y)

   b. What cross section runs through the lot? ***Y***

   c. At this cross section what is the:

      regulatory flood elevation? ***60.8 (NGVD) (using floodway data table)***

      width of the floodway? ***160 feet (using floodway data table)***

      elevation of the 10-year flood? ***about 57.8 (NGVD) (using flood profile)***

      elevation of the 500-year flood? ***about 61.8 (NGVD) (using flood profile)***

   d. What is the approximate mean floodway velocity at the western edge of the lot?
      1.6 feet per second (use average of sections Y and Z)

e. At the middle of the lot, how far from Stallings Road is the floodway boundary?
about 150 feet

f. What is the nearest elevation reference mark to this lot? ***RM 10***

g. What is the description of the location of this reference mark?
"X" chiseled on top of left downstream end of culvert on Heritage Street over Adkin Branch

h. What is the elevation of this elevation reference mark?
59.63 (NGVD)

10. What is Bald Head Island's community number? ***370442***

11. If you measured a distance on the ground as 1,000 feet, how many inches would it be on Bald Head Island's FIRM? ***1 inch***

12. Sabal Palm Trail is located in the Village of Bald Head Island.

a. What FIRM zone is it in? ***AE***

b. The site is in which of the following? (Check those that apply)

X 100-year floodplain

— Coastal High Hazard Area

— above the 500-year floodplain

— identified undeveloped coastal barrier

c. What is the BFE at this site? ***10 (in parentheses below the zone designation)***

13. An undeveloped lot is on Brown Pelican Trail in the Village. The owner wishes to build a residence on the lot.

a. What FIRM zone(s) is the lot in? ***AE or X (depending on location)***

b. What is the BFE at this site? ***12 (in parentheses below Zone AE designation)***

c. What are the numbers of the two closest transects to the site? ***18 & 19***

d. Is the site in a coastal high hazard area? ***No***

e. Is the wave height of the base flood more or less than 3 feet at the site? ***Less***

14. An out of state couple is looking at some properties on North Bald Head Wynd, west of Muscadine Wynd, in the Village of Bald Head Island. They are concerned about possible coastal storm flooding. They want to know the following:

    a. What is the 100-year flood elevation in this area?
    10 feet for some areas but mostly 11 feet

    b. What FIRM zone represents the special flood hazard area? ***AE***

    c. At the intersection of North Bald Head Wynd and Stede Bonnet Wynd, how far is it to the boundary of the protected coastal barrier? ***about 400 feet***