

# Guidance for Flood Risk Analysis and Mapping

## **Flood Insurance Rate Map (FIRM) Graphics**

December 2020



**FEMA**

Requirements for the Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) Program are specified separately by statute, regulation, or FEMA policy (primarily the Standards for Flood Risk Analysis and Mapping). This document provides guidance to support the requirements and recommends approaches for effective and efficient implementation. The guidance, context, and other information in this document is not required unless it is codified separately in the aforementioned statute, regulation, or policy. Alternate approaches that comply with all requirements are acceptable.

For more information, please visit the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage ([www.fema.gov/flood-maps/guidance-partners/guidelines-standards](http://www.fema.gov/flood-maps/guidance-partners/guidelines-standards)). Copies of the Standards for Flood Risk Analysis and Mapping policy, related guidance, technical references, and other information about the guidelines and standards development process are all available here. You can also search directly by document title at [www.fema.gov/multimedia-library](http://www.fema.gov/multimedia-library).

## Table of Revisions

The following summary of changes details revisions to this document subsequent to its most recent version in November 2019.

<b>Affected Section or Subsection</b>	<b>Date</b>	<b>Description</b>
Section 1	December 2020	Added section for Automated Map Production
Sections 6.7 and 6.8	December 2020	Added evaluation lines for 2D modeling

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## 1.0 Automated Map Production (AMP)

To support greater automation within the Risk MAP Program, FEMA is developing a tool within the Mapping Information Platform (MIP) called Automated Map Production (AMP). AMP will automate FIRM panel creation, replacing previous practices of manual cartography. The goal of AMP is to eliminate the need for manual edits or adjustments to labels on the FIRM panels and FIRM index.

AMP will read the data in a submitted FIRM database and use a series of cartographic algorithms, with established rules of hierarchy, to autogenerate FIRM panels and indexes that comply with FEMA requirements through all study stages (e.g. draft, preliminary, and final). However, AMP will not change the engineering analysis or alter the FIRM database (i.e. geodatabase; shapefiles). AMP will not fix errors in the submitted FIRM database (e.g. topology). It will continue to be the responsibility of the FIRM database producer to perform quality assurance / quality control (QA/QC) to make sure the submitted data meets all Risk MAP standards. Producers will also be expected to visually review the auto generated AMP panels to determine if they meet expectations or require changes. If updates are needed, the producer will edit the FIRM database and then resubmit to the MIP as usual to begin the process over, to include required DVT submittals.

As AMP is introduced into the Risk MAP study lifecycle, producers need to understand how it will impact the information in this document. While the mission of AMP is to replicate the FIRM panel and FIRM index requirements as known today, there will be changes to the output panels that do not directly align with the guidance and direction in this and other Risk MAP documents. AMP panels will have slight variations from what producers and users have seen since the beginning of Risk MAP. FEMA will develop a best practice document to summarize these changes. Because AMP will be enhanced through future agile development cycles, changes will likely occur more frequently than the annual Guidelines and Standards (G&S) cycle. Therefore, the best practice model will be the most efficient way to provide up-to-date information on changes. Future edits to this document will be made to align the information between this and the AMP best practice document.

## 2.0 FIRM Graphics Overview

This document contains guidance for the development and submission of Flood Insurance Rate Map (FIRM) panels. The graphic format for the FIRM panels can be found in the [FIRM Panel Technical Reference, Format for FIRMs](#), Guidelines and Standards for Flood Risk Analysis and Mapping. The [FIRM Panel Technical Reference](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

## 3.0 FIRM Database Linkages

The [FIRM Database Technical Reference, Preparing Flood Insurance Rate Map Databases](#), Guidelines and Standards for Flood Risk Analysis and Mapping, provides the standards and schema for the FIRM Database which should be the source the components of the FIRM panels per Standard ID (SID) 507. Exceptions would be map elements that are unique to a Flood Risk Project that are not stored in the FIRM Database. Examples of items that are shown on the FIRM panel but are not explicitly included in the FIRM Database include the following:

- Levee system seclusion area outlines

- Various notes, including:
  - Levee system notes
  - Provisionally Accredited Levee (PAL) notes
  - Levee system seclusion notes
  - “Too steep” cross section notes
  - Coincident features notes
  - Range and Township notes
  - Breakout panel notes

The [FIRM Database Technical Reference](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

## **4.0 Map Body**

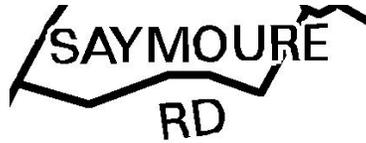
The map body includes all of the base map information and flood hazard information contained within the FIRM panel neatline.

### **4.1 Halos**

White halos around FIRM panel labels are used to ensure the readability of the annotation. They are required on FIRM panels that use an orthophoto base map and on panels that use a vector base map when overprinting occurs, or the label is otherwise not clearly visible. Also, when adding labels inside floodplain areas on vector base maps, it is advisable to use white halos to enable the labels to be more clearly seen. White halos may be used in other cases at the discretion of the Mapping Partner. The specifications for halo sizes are provided in the [FIRM Panel Technical Reference](#).

### **4.2 Overprinting**

Overprinting should be avoided, but if it becomes necessary, the Mapping Partner should choose to overprint base map features that are of least importance to the theme of the map. Overprinting of any base feature that is within the flooding area should be avoided. Text may be placed outside the panel neatline but within the FIRM panel border and leadered into the body of the map panel as necessary. Any text placed around the outside of the map body must not overprint other text. Where a text overprint cannot be avoided within the map body, the hierarchies listed in Tables 1, 2, and 3 below should be followed, and all text should be haloed. Cross section and coastal transect lines and labels, Base Flood Elevation (BFE) labels, flood zone and floodway boundaries and labels must not be overprinted and are listed in Tables 1, 2, and 3 for completeness only.



**Figure 1: Example of Acceptable Overprint**

### 4.3 Hierarchy for Labels and Map Features

When features are coincident with each other, only the highest priority feature should be shown. The following tables illustrate the order of priority (rank) of the various items depicted in the map body. These lists should be used as a guideline to resolve overprinting issues for labels and map features.

**Table 1: Overprinting Hierarchy for Labels**

Rank	Item
1	Cross Section and Coastal Transect Labels
2	BFE Labels
3	Flood Zone Labels
4	Special Notes
5	Jurisdiction Labels
6	All Other Labels
7	Base Map Labels

**Table 2: Overprinting Hierarchy for Standard Map Elements**

Rank	Item
1	Cross Sections and Coastal Transects
2	BFE Lines
3	Jurisdiction Lines
4	Levees and General Structures
5	Flood Hazard Lines
6	Profile Baselines
7	Water Lines and Areas
8	U.S. Public Land Survey System (PLSS) Lines
9	Transportation Features
10	Flood Hazard Areas
11	Ortho Imagery

**Table 3: Overprinting Hierarchy for Boundaries**

Rank	Item
1	Jurisdiction Boundary
2	Flood Insurance Risk Boundary
3	Other Boundaries
4	Base Map Features

## 5.0 Base Maps

Base maps form the backdrop against which flood hazard information is viewed. Base map features are employed by map users to identify properties and structures relative to the floodplains. The Guidance Document No. 1, Guidance for Flood Risk Analysis and Mapping: [Base Map and FIRM Panel Layout Guidance](#) document provides information on the base map types, contents, and sources of base map data that are suitable for use as FIRM base maps. The [Base Map and FIRM Panel Layout Guidance](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

The sections below contain guidance for the presentation of base map information on FIRM panels. Note that base map types should not be mixed within a study (i.e. both raster and vector) without approval of the FEMA Project Officer.

### 5.1 Transportation Features

In addition to primary roads, as defined by the MAF/TIGER data, and the roads shown and labeled on a Flood Profile, as many named roads as possible should be labeled inside of and within 1 inch of an SFHA. Communities can provide road labels beyond the minimum labels required. If provided, community-supplied labels should be shown on the FIRM provided they do not render the map unreadable due to excessive clutter. See Tables 2, 3, and 4 above for overprint hierarchies of labels and map features.

Depicted road labels should match the primary name stored in the FIRM Database. Road name labels should be placed parallel to road centerlines shown on vector-based FIRMs, but not on the road feature itself to obscure it. On orthophoto-based FIRMs, the road labels may be placed either parallel to or on top of the image of the road. Additional road name labels should be added as necessary for clarity. To avoid unnecessary clutter on the map, the road prefix, qualifier, or suffix may be abbreviated. For example, “West Highland Drive,” may be labeled as “W Highland Dr.” Highway route shields may also be used in place of the full highway name. A mix of spelled out and abbreviated road labels is acceptable. If space is limited, a label may be placed over a transportation feature as long as the feature is still recognizable, and the label is haloed. The application of curved labels, also known as splining, may be used as necessary. Road name labels may be leadered into the feature as necessary. If space is limited and leadering is not an option, the use of a numbered road key is acceptable.

If a label is larger than a transportation feature, the feature does not need to be labeled. However, it may be labeled with a leader to the feature if it is a primary road or falls in or within 1 inch of the SFHA.

Only railroads that are shown on a Flood Profile are required to be labeled. The label ‘RAILROAD’ should be placed along the feature when feasible, or leadered if space is limited.

Airports and runways do not need to be labeled.

### 5.2 Hydrographic Features

Hydrographic features include streams, rivers, lakes, ponds, and open bodies of water contained in the S\_Wtr\_Ar and S\_Wtr\_Ln layers of the FIRM Database.

As shown in Table 3 above, Overprinting Hierarchy for Standard Map Elements, profile baselines take precedence over hydrographic features. More information about the graphic representation of profile baselines is contained below in the Flood Hazard Features section of this document.

Line representations of hydrographic features are optional on ortho-based FIRM panels. They may be shown at the request of the FEMA Project Officer. However, if shown, care must be taken to ensure they do not overlap the profile baseline.

On vector-based FIRMs, both the river shorelines and the profile baseline usually can be shown without overlapping on wide rivers and streams. However, on narrower streams or where the hydrographic feature is represented by a stream centerline, care should be taken to make sure the profile baseline is clearly displayed.

Hydrographic features within an identified floodplain should be labeled at least once on each FIRM panel on which they fall. Stream labels should be placed parallel to the feature. The application of curved labels, also known as splining, is allowed. Additional stream name labels may be added for streams that traverse entire FIRM panels, or as necessary for clarity. When streams continue onto adjoining panels, stream labels should be placed at or near panel edges. Large hydrographic features, such as oceans and lakes, may be labeled using larger font sizes and/or more than once on individual FIRM panels as necessary for clarity.

### **5.3 Hydraulic Structures**

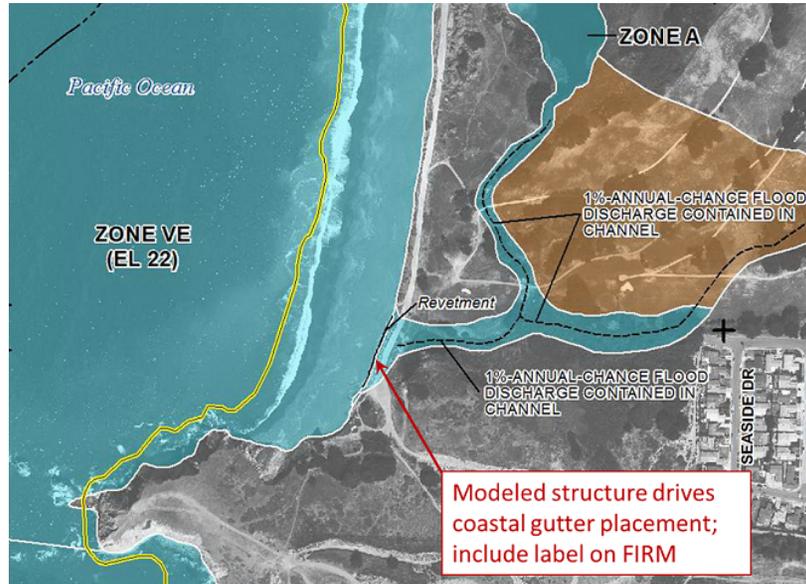
Hydraulic structures such as dams, weirs, culverts, bridges, and floodwalls, should be labeled on the FIRM panel only if they are shown on the Flood Profile. The labels should be placed near the structure and leadered in as appropriate. Risk MAP SID 316 requires that the label name match what is shown on the Flood Profile; follow the specifications provided in the [FIRM Database Technical Reference](#). This may mean that the primary attribute of the structure is labeled on the FIRM using the S\_Gen\_Struct feature class STRUCT\_NM field, where appropriate, or the STRUCT\_TYP field with a possible supplemental FIRM label pulled from STRUC\_DESC.

Where the proper name of a structure is available, (i.e., “Hoover Dam”) that attribute would be indicated in the STRUCT\_NM field and would be placed on the FIRM as the primary label of the structure. The “DAM” attribute would be present in the STRUCT\_TYP field, but it is not necessary to place an additional “Dam” label on the FIRM.

Where the STRUCT\_TYP attribute in the FIRM Database indicates a 1 percent-ANNUAL-DISCHARGE-, 0.2 percent -ANNUAL-DISCHARGE-, or FLOODWAY CONTAINED IN STRUCTURE value, that attribute would be placed on the FIRM as the primary label of the structure. In this case, the actual structure “type” would not necessarily be immediately apparent to the user only based on FIRM symbology; this information may be added as a secondary label of the structure. In this case, the Mapping Partner may add the structure type information to the STRUC\_DESC field in the FIRM Database and may add this label (i.e., culvert, channel) as an additional structure label on the FIRM. The Mapping Partner should work with the FEMA Project Officer, and/or FEMA Region and Flood Risk Project team to determine whether to include these secondary structure type labels on the FIRM, or to have the user refer to the FIRM Database for the actual structure type attribute.

Coastal structures that are part of detailed coastal modeling should be labeled on the FIRM, just as riverine hydraulic structures that are included in the modeling (and thus are included on the riverine

Flood Profile) must be labeled on the FIRM. While all hydraulic (or coastal) structures may not be labeled on the FIRM, all relevant structures are likely symbolized on the FIRM via the S\_GEN\_STRUCT feature class. In order to include all relevant information for coastal floodplain mapping on the printed FIRM, a best practice is to label all coastal structures that are included in the detailed coastal modeling. This is particularly important where modeled coastal structures directly influence the shape and location of coastal gutters/zone breaks. All other (non-modeled) coastal structures could be symbolized on the FIRM, but not necessarily labeled.



A feature would be indicated as a coastal structure via the primary key-foreign key database relationship between records in the S\_GEN\_STRUCT and L\_CST\_STRUCT STRUCT\_ID fields, as well as the S\_GEN\_STRUCT CST\_STRUCT field. The STRUCT\_DESC field may be used to further define the coastal structure if the STRUCT\_TYP and STRUCT\_NM fields do not allow for sufficient information.

#### 5.4 Political Entities and Boundaries

Political entities should be depicted and labeled as described below. The Mapping Partner should use leader lines as appropriate to reduce clutter. Large area features may be labeled using larger font sizes and/or more than once on individual FIRM panels (as necessary for clarity).

Political entities (incorporated areas, unincorporated areas, Extraterritorial Jurisdiction (ETJ) areas, "Areas Not Included [ANI]," etc.) should be labeled near the center of the jurisdiction, if possible. For incorporated communities, the community type should be followed by the name of the community (e.g., City of Smithville), and the Community Identification Number (CID) placed immediately under the community name. For unincorporated county areas, the county name should be shown with "Unincorporated Areas" beneath it, and the county CID should be placed immediately under that label.

When ETJ areas are significant for the purposes of the National Flood Insurance Program, they should be shown on the FIRM with the ETJ area labeled with the community name, followed by the words "Extraterritorial Jurisdiction", and the CID number of the community exercising its ETJ

authority. See Guidance Document No. 30, Guidance for Flood Risk Analysis and Mapping: Extraterritorial Jurisdiction Mapping and Distribution Guidance for additional guidance on the depiction of ETJs. The Extraterritorial Jurisdiction Mapping and Distribution Guidance is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

Any area shown as an ANI should be labeled with the entity's name and the notation "Area Not Included." Vector data, including flood information and base map information, should not be depicted for areas defined as an ANI, regardless of why the area is not included. For orthophoto-based FIRMs, the raster orthophoto base map should be shown in the ANI.

All Tribal lands are mapped on a case-by-case basis. Military and Tribal lands should be labeled with the official name at least once.

State and National Park and Forest labels are not required. If parks or forest boundaries are present in the S\_Pol\_Ar layer of the FIRM Database, they should be labeled. The political area in which the park or forest resides will be used for the beginning of the political label along with the community's CID. An additional line will be added to the political label to describe these areas generically as a park, forest, etc. (see example below). This community name and CID will also appear in the title block of the FIRM panel to represent the park area if the community is not already listed. No specific park or forest information will appear in the title block. In crowded or segmented areas, the political area label(s) can be leadered or made smaller.

**Flood County**  
**Unincorporated Areas**  
**123456**  
**State Park**

When boundaries of different types are coincident with each other or with base map features, the Mapping Partner should show only one. Priorities are defined in the Hierarchies for Labels and Map Features tables shown in Tables 1, 2, and 3 above.

## **5.5 Horizontal Reference Grids**

Even though the FIRM Database will ultimately be delivered to the Map Service Center (MSC) in the Geographic Coordinate System (GCS), the FIRM panels will be prepared using a local projection (e.g., Universal Transverse Mercator [UTM] or State Plane). For the purposes of this discussion, the projection used for preparation of the FIRM panels is also shown on the FIRM panels as the primary horizontal reference grid.

A primary horizontal reference grid and secondary horizontal reference grid ticks are placed on the FIRM panels to orient map readers to real-world coordinates. In addition, the latitude and longitude in degrees, minutes, and seconds are shown at each of the four corners of the map panel, and the UTM reference grid (or grid ticks) is included on the FIRM.

When PLSS features are present, they serve as the primary horizontal reference grid. The primary projection used for FIRM panel production is then shown with both tick marks and crosshairs and

serves as the secondary horizontal reference grid for the FIRM. If additional projection information is desired to be shown, it is depicted only as tick marks along the panel edges.

If PLSS features are not present and the primary reference grid is UTM, then a secondary grid is optional. Other reference grids (e.g., State Plane) may be used as the primary reference grid. If UTM is not the primary reference grid, then it is used as the secondary reference grid (shown as grid ticks) and included on the FIRM. Reference grids or grid ticks should be shown extending to the FIRM neatline.

The secondary grid ticks are shown as ticks along the FIRM panel edge.

The grid interval shown on the FIRM should not vary between panels within the same FIRM, even if the panels are shown at different scales. Generally, a UTM grid interval of 1,000 meters and a State Plane grid interval of 5,000 feet should be used.

## **5.6 U.S. Public Land Survey System**

U.S. PLSS features (i.e., section lines with range and township information) are shown on a FIRM if they are available in digital format and/or were shown on a previous FIRM. They may also be added at the request of a community or FEMA Project Officer. Gridlines, range, township, and section lines should be terminated at the panel neatline and at the political boundaries of the subject community.

Township lines should be labeled at the left and right edges of the panel along both sides of the line. Range lines should be labeled at the top and bottom edges of the panel along both sides of the line. If a panel does not contain any township and range lines, a township and range information note should be placed in an area of the map body void of flood risk data, or in the map fringe just below the bottom neatline.

Section numbers should be placed in the center of the section, parallel to the horizontal neatlines of the panel. If the section is too small to fit the section number without crowding relevant data, the section number may be omitted. Land Grants and other specially designated areas should also be labeled.

If the subject community uses a PLSS grid, the primary grid shown on the FIRM is the PLSS. The secondary grid ticks should be the same as the coordinate system used for preparation of the FIRM panels. When the FIRM panels are prepared using the UTM coordinate system, UTM grid ticks are shown as cross hairs within the body of the map; State Plane grid ticks may also be shown along the edges of the panel but are not required. When the FIRM panels are prepared using the State Plane coordinate system, both UTM and State Plane grid ticks are shown along the edges of the panel.

## **5.7 Breakout Panels**

If a printed panel falls within the area of a smaller-scale panel that is also printed, a breakout note is placed on the smaller-scale panel in the center of the area represented by the larger-scale panel

(the breakout panel area). The note specifies the larger-scale panel map number and scale. It does not include the suffix (to avoid unnecessary future updates).

## **5.8 Other Base Map Features**

In special cases, at the request of the FEMA Project Officer, additional landforms may be added to the FIRM.

## **6.0 Flood Hazard Features**

This subsection provides guidance for showing floodplains, flood zone boundaries, floodways, flood insurance risk zone labels, limit lines, and other items needed to depict hydrologic and hydraulic analyses such as profile baselines, cross sections, BFEs, and coastal transects.

### **6.1 Floodplains and SFHA/Flood Zone Boundaries**

A transparency setting of 70 percent is recommended for all flood insurance risk zones. Slight transparency adjustments of all flood insurance risk zones for a Flood Map Project using a single factor may be made so that flood hazard features can be clearly seen.

Each flood risk zone is bounded by a graphically depicted flood zone boundary line. The seaward side of a coastal flood risk zone does not require a boundary to be shown graphically and is coded as an “Other Boundary.” Lines coded as “Other Boundary” are not graphically depicted on the FIRM panel. Lines coded as “Limit Lines” are addressed in Section 5.5, “Limit Lines,” below.

Where a flood zone designation change occurs along a main stem or backwater area or within a coastal area (for example, AE to A, AE to AH, VE to AE), place a white SFHA/Flood Zone Boundary per the flood hazard line specifications in Table 7 of the FIRM Panel Technical Reference. Features formerly known as “Limit of Detailed Study” or “Limit of Floodway” are now coded as “SFHA/Flood Zone Boundary” in the FIRM Database and are displayed on the FIRM as a plain white line. Other flood hazard features delineating flood zone designation changes such as Zone Breaks, Coastal Gutters, or Limits of Coastal Inundation are also coded as “SFHA/Flood Zone Boundary” in the FIRM Database and are also displayed on the FIRM as a plain white line. Do not label these types lines with any “Limit” label.

Examples of various scenarios of flood zone designation changes are shown in the following Figures.

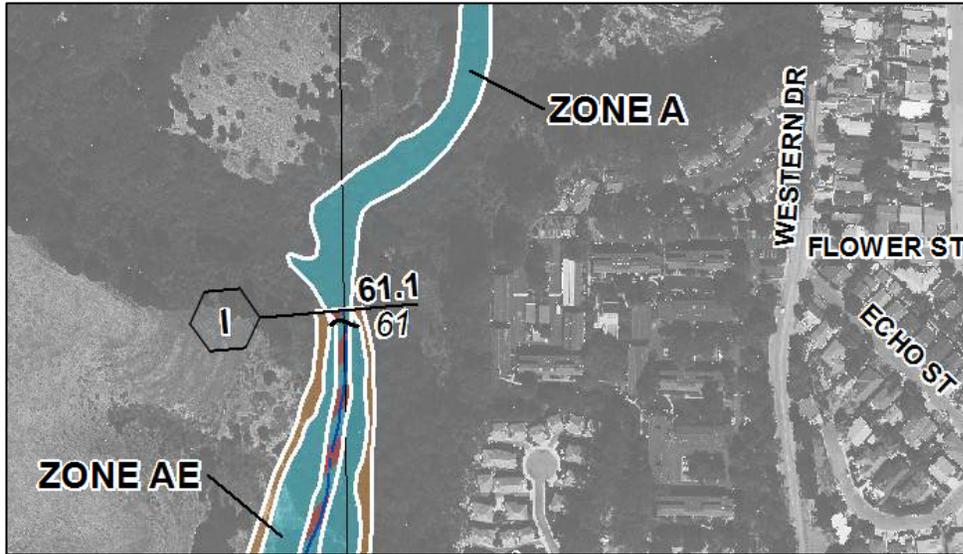


Figure 2: SFHA/Flood Zone Designation Change, Main Stem

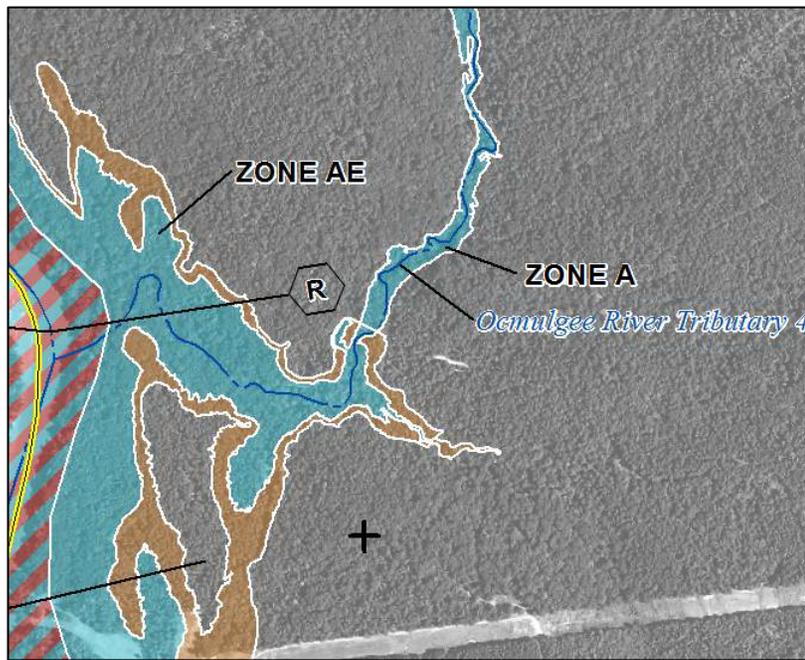


Figure 3: SFHA/Flood Zone Designation Change, Backwater or Tributary

Note how in Figure 3, the plain white SFHA/Flood Zone Boundary line separating the Zone AE from the Zone A represents what may have formerly been labeled “Limit of Detailed Study.”

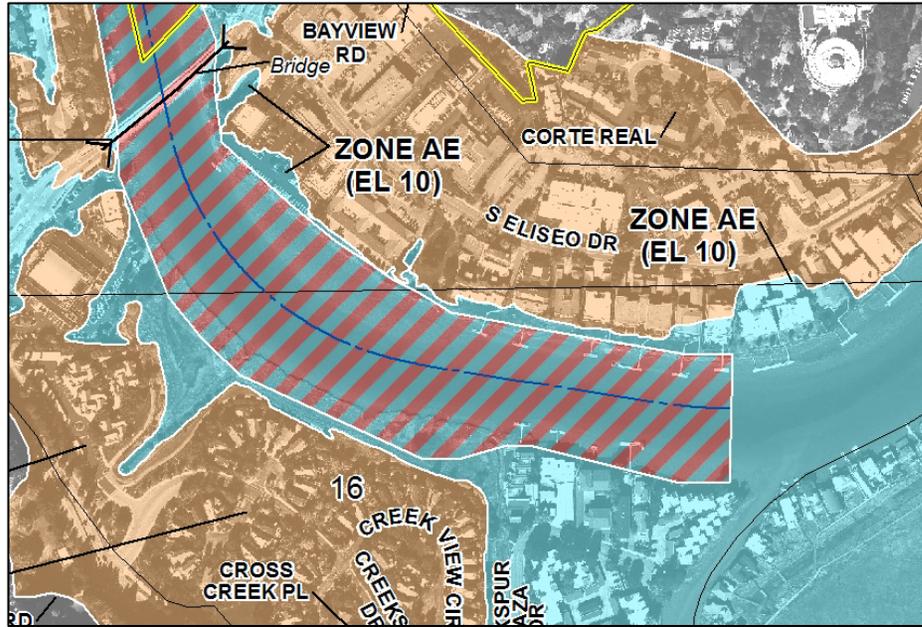


Figure 4: SFHA/Flood Zone Designation Change, Floodway

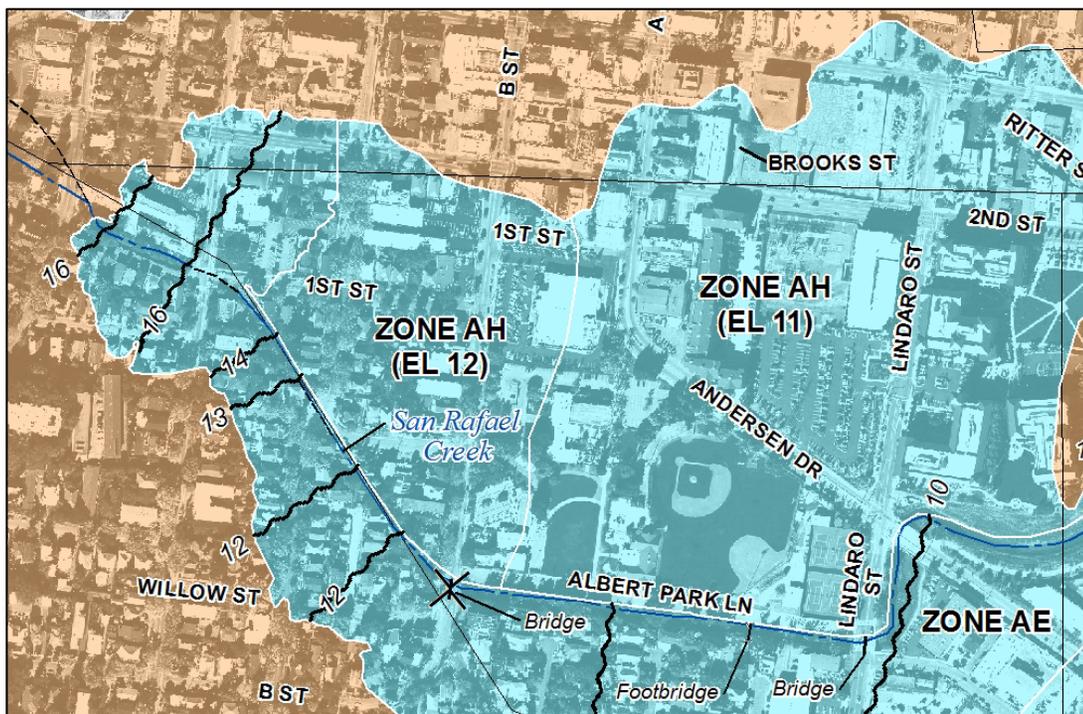
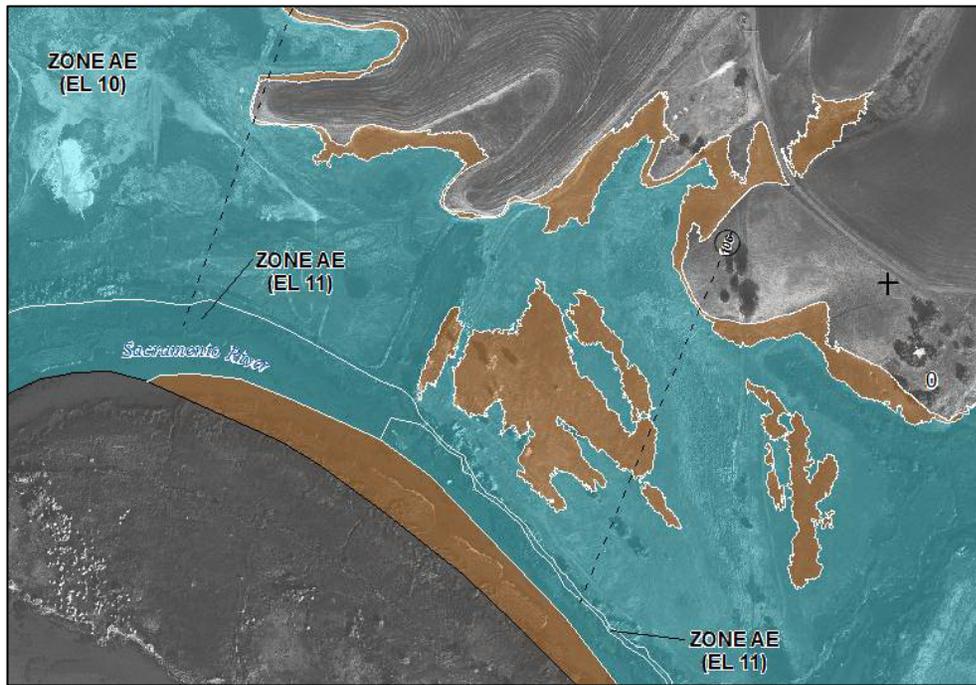
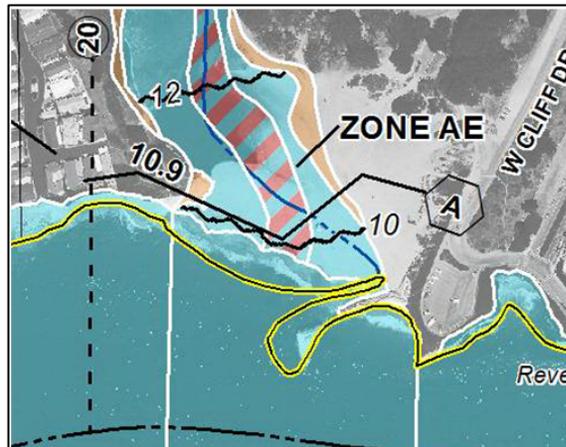


Figure 5: SFHA/Flood Zone Designation Change, Riverine Floodplain (Zone Breaks)



**Figure 6: SFHA/Flood Zone Designation Change, Coastal Floodplain (Coastal Gutters)**



**Figure 7: SFHA/Flood Zone Designation Change, Limit of Coastal Inundation**

Where a shaded Zone X is truncated (not rounded at its terminus), use a standard SFHA/Flood Zone Boundary feature. Do not label these lines.



**Figure 8: SFHA/Flood Zone Designation, Truncated Shaded Zone X**

Although the Flood Insurance Study (FIS) Report Technical Reference, Preparing FIS Reports, Guidelines and Standards for Flood Risk Analysis and Mapping, does not provide specifications for Limit labeling on Flood Profiles, Flood Profiles may display Limit labels that correspond to some of the above types of SFHA/Flood Zone Boundaries (i.e., Limit of Detailed Study locations) on the FIRM. Refer to the FIS Report Technical Reference for information on how Flood Profile information corresponds to the Limit of Coastal Inundation on the FIRM. The FIS Report Technical Reference is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

## 6.2 Floodways

Regulatory floodways are shown on the FIRM with a standard floodway symbol. The following floodways will use the standard floodway symbol in conjunction with a note identifying the type of floodway as shown in the FIRM Panel Technical Reference:

- Riverine Floodway Shown in Coastal Zone
- Riverine Floodway in Combined Riverine and Coastal Zone
- Administrative Floodway
- State Encroachment Areas
- Community Encroachment Area
- Flowage Easement Area

For areas where the above floodway areas are symbolized (and notated) on the FIRM directly adjacent to areas of a Regulatory floodway, such as with Flowage Easement Areas, also place the note identifying the portions of Regulatory floodway so that each separate area floodway type is clear to the map user.

Specific designations of floodways will use a unique Special Floodway symbol. The following Special Floodway types will use the Special Floodway symbol and notes shown in the [FIRM Panel Technical Reference](#):

- Colorado River Floodway
- Density Fringe Area
- Area of Special Consideration

### **6.3 Flood Hazard Information Based on Future-Conditions Analyses**

At the request of community officials and with the approval of the FEMA Project Officer, future-conditions 1-percent-annual-chance floodplains may be shown on the FIRM and referenced in the accompanying FIS report for informational purposes. The future-conditions flood insurance risk zone is shown as a shaded Zone X area and labeled as “Zone X (Future).”

### **6.4 Zone Labels**

All zone areas except Zone X (shaded and unshaded) should be labeled at least once with the applicable flood zone and, if appropriate, with the static elevation or depth. This includes Zone D areas. Zone labels should be repeated as necessary for clarity in large or complicated areas. Open water areas do not need to be labeled.

In the 1-percent-annual-chance floodplains, the floodway fringe areas should not be considered separate areas requiring labels. One zone label is sufficient for both the regulatory floodway and the floodway fringe.

In SFHAs with assigned static elevations, depths, or velocities, the static BFE, depth, or velocity value should be placed under the zone label. Additional guidance on static BFEs is provided in Guidance Document No. 31, Guidance for Flood Risk Analysis and Mapping: [Mapping Base Flood Elevations on Flood Insurance Rate Maps Guidance](#). The [Mapping Base Flood Elevations on Flood Insurance Rate Maps Guidance](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

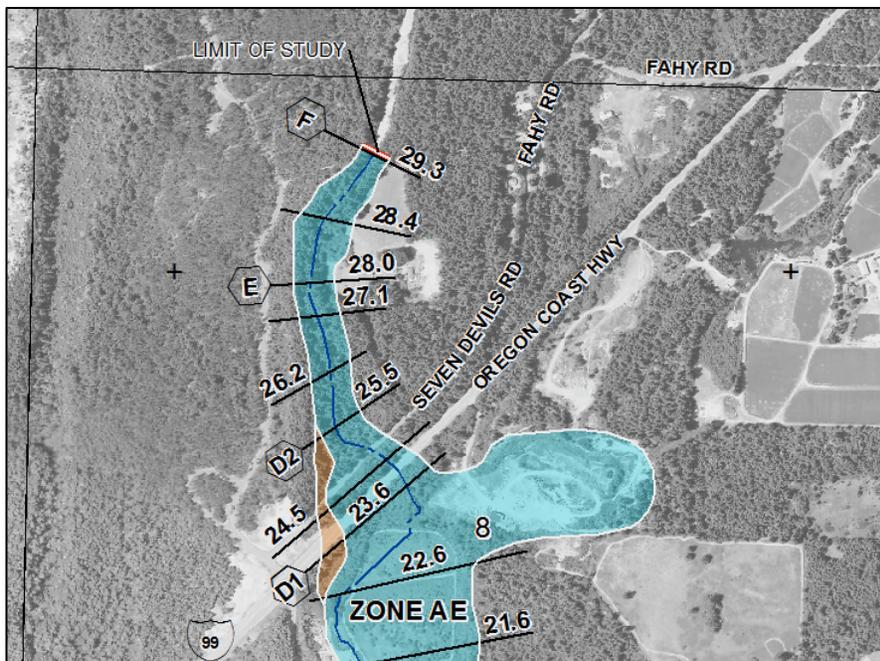
Shaded Zone X areas should be labeled where they represent future-conditions using the specifications found in the [FIRM Panel Technical Reference](#).

Areas behind levee systems are labeled with the appropriate levee system note, indicating whether the levee system is Accredited or Provisionally Accredited for the level of flood hazard reduction afforded by the levee system. The specifications for the levee system notes can be found in the [FIRM Panel Technical Reference](#).

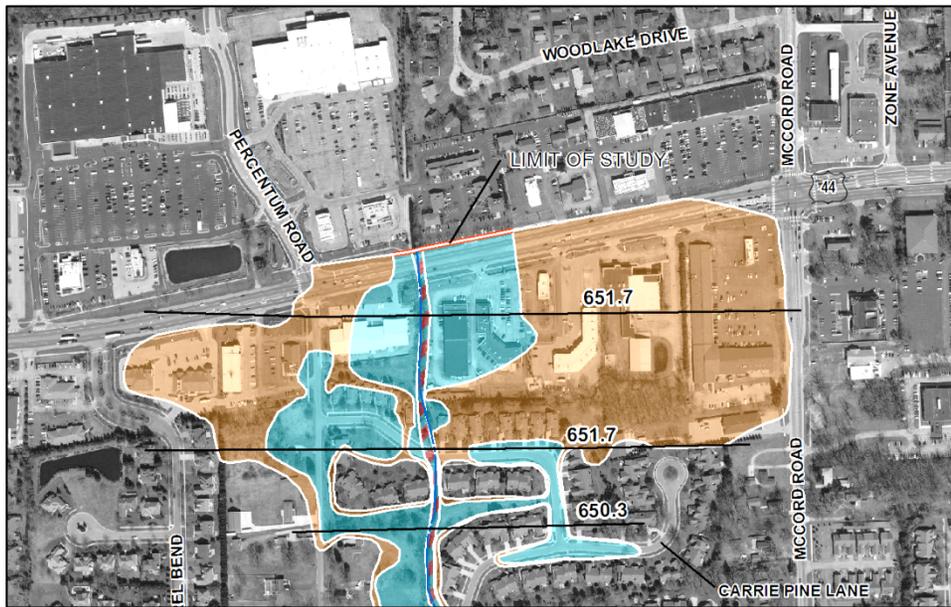
## 6.5 Limit Lines

The following information clarifies the use of Limit of Study lines on the printed FIRM. For information on how to display features formerly coded as “Limit of Detailed Study” or “Limit of Floodway,” please refer to Section 5.1, “Floodplains and SFHA/Flood Zone Boundaries.”

A Limit of Study line is used to indicate the terminus of a 1-percent-annual-chance floodplain where the SFHA is abruptly truncated and no floodplain follows. Where a Limit of Study occurs, place a red and white line per the Limit of Study feature specifications in Table 7 of the FIRM Panel Technical Reference. Label every Limit of Study line per the Limit of Study label specifications shown in Table 7 of the FIRM Panel Technical Reference. Two different Limit of Study examples are shown below.



**Figure 9: Limit of Study, Example #1**



**Figure 10: Limit of Study, Example #2**

In Figure 10, note how the Limit of Study line applies only to the SFHA (1-percent-annual-chance) boundary. The terminus of the 0.2-percent-annual-chance boundary is indicated by the white SFHA/Flood Zone Boundary lines.

Although the [FIS Technical Reference](#) does not currently provide specifications for Limit of Study labeling on Flood Profiles, Flood Profiles may display corresponding Limit labels.

## 6.6 Profile Baselines

Profile baselines that represent the modeled flood flow and accurately reflect the distance between cross sections in the hydraulic model are included in the FIRM for all studied streams with flood profiles or otherwise established BFEs. The profile baseline allows users to more easily reference information in the hydraulic model and the flood profile. The specifications for the symbolization and labeling of the profile baseline can be found in the [FIRM Panel Technical Reference](#). As noted above in Table 2 and in the section on hydrographic features, the profile baseline takes precedence over other hydrographic features along the same flooding source.

## 6.7 Cross Sections and Evaluation Lines

Cross sections are shown on the FIRM panels and provide a spatial reference to the cross sections in the hydraulic model and on the flood profiles. Evaluation lines are shown on the FIRM panels to help characterize the two-dimensional water surface and to provide a spatial reference on the flood profiles (where applicable) and a summary for the Floodway Data Table. Additional guidance on cross section placement is provided in Guidance Document No. 52 [Guidance for Flood Risk Analysis and Mapping: General Hydraulics Considerations Guidance](#). Additional guidance on evaluation line placement is provided in Guidance Document No. 79 [Guidance for Flood Risk Analysis and Mapping: Floodway Analysis and Mapping](#).

Alphabetical labeling of cross sections or evaluation lines is the preferred method. However, at the request of a community and with the approval of the FEMA Project Officer, cross sections/evaluation lines may be labeled numerically instead of using letters. Along a single stream within a study, only one labeling method should be used. The typical numbering sequence is from the downstream to the upstream limit of study, using the stream distance value at that location divided by 100.

Lettered or numbered cross section/evaluation lines are labeled on the map with a hexagon at one end of the line. Hexagons should be oriented so that the letter or number can be clearly read and is not upside down. If necessary, the hexagon may be detached from the end of the cross section/evaluation line and situated closer to the feature. In especially crowded areas, the hexagon may be reduced in size at the Mapping Partner's discretion.

All cross sections/evaluation lines are labeled with the regulatory Water Surface Elevation (WSEL) value, rounded to the nearest tenth of a foot. The WSEL value should be placed parallel to and above the line. If overprints cannot be avoided, leadering of the WSEL value is an acceptable option.

Cross section lines should cross the entire floodplain (past the limits of the 1-percent-annual-chance floodplain, whenever possible). Evaluation lines should also cross the entire floodplain, as possible, but may not always be past the limits of the 1-percent-annual-chance floodplain if based on a water surface contour. If a lettered or numbered line cannot exit either side of the floodplain on the panel, the hexagon should be placed in the middle or on top of the line and haloed to block out the line. All graphic adjustments to cross sections should remain separate from modeled cross section locations that are stored in the FIRM Database.

If "MAPPED" but unlettered cross sections cannot be shown on the FIRM because of crowding due to steep terrain, a note shall be placed referring the user to the profiles in the FIS report. The wording of the note can be found in the [FIRM Panel Technical Reference](#). Only one such note is needed per FIRM panel.

In the event that a cross section/evaluation line contains multiple elevations (e.g., the cross section spans a levee system), the cross section shall be segmented and each segment labeled with its corresponding WSEL value and, when it is lettered, a hexagon.

New cross sections/evaluation lines inserted between existing lettered cross sections/evaluation lines may be numbered with an alphanumeric sequence to avoid re-lettering cross sections upstream (i.e., cross sections A1 and A2 might be inserted between existing cross sections A and B). This scenario is likely to occur only when a portion of a stream is restudied.

## **6.8 Base Flood Elevations (BFEs)**

The term "BFE" includes cross section and evaluation line WSEL values (features and attributes present in S\_XS that may be labeled using the WSEL\_REG field), as well as individual BFE lines (features and attributes present in S\_BFE that may be labeled using the WSEL field).

The use of individual BFE lines (in S\_BFE) is only required in limited cases. BFE lines are used to augment the WSELs shown on the cross sections/evaluation lines, in areas where these lines are not mapped. Examples include a riverine AE zone without a flood profile in the FIS report, areas studied with two-dimensional modeling without floodway, certain ponding areas, SFHA polygons isolated by a FIRM panel boundary, and backwater areas adjacent to streams with flood profiles. Additional guidance on BFE placement is provided in the [Mapping Base Flood Elevations on Flood Insurance Rate Maps Guidance](#) document.

To avoid overcrowding of the BFE and cross section/evaluation lines, when a stream is so steep that there are more than four cross sections, evaluation lines and / or BFE lines per 1 inch of map panel distance, the Mapping Partner should determine the best elevation increments to retain clear labeling.

If the water surface elevation is not adequately captured by the published BFEs and evaluation line elevations on the FIRM, an insert will be added to the FIS to better convey the results of 2D modeling. One option is the annotated grid, where water surface elevations are published at set locations throughout the modeled 2D area. A special note such as “Refer to FIS Report Insert for BFE information for this area” on the FIRM should be placed. Additional guidance on FIS report insert is provided in the [Flood Profiles Guidance](#) document

Static BFEs should be shown centered under the zone labels (e.g., in areas of ponding, lacustrine, or coastal areas).

The preferred unit for static elevations, depth, and velocity is feet. Metric values, where required such as in Puerto Rico and other studies, are also acceptable.

## **6.9 Coastal Transects**

Transect lines are delineated and labeled on the FIRM to identify the physical location of the wave transects described in the Flood Insurance Study (FIS) report. The transect delineation on the FIRM also helps users determine which wave transect analysis may influence or directly affect their property or area of interest. The wave effects mapped for any transect begin at the shoreline and end at the limits of 1-percent-annual-chance flood hazards, even though the actual transect line on the FIRM may extend farther seaward and landward of the coastal flood hazard areas. Transect lines should not be truncated for mapping purposes but should reflect the full extent of coastal modeling.

Coastal transect numbers are placed in a circle on one end of the transect line. Number placement should be uniform across transect lines. If the end of the line cannot be labeled due to space limitations, a haloed label may be placed in the middle of the transect line. If necessary, the circle may be detached from the end of the coastal transect and situated close to the feature. Transect numbers should be oriented so that the number can be clearly read and is not upside down. Transect numbering should generally proceed consecutively from north to south or west to east along a shoreline. New coastal transects inserted between existing transects may be numbered with an alphanumeric sequence to avoid re-numbering transects on unrevised panels (i.e., Transects 5A and 5B might be inserted between existing Transects 5 and 6).

## **6.10 Limit of Moderate Wave Action (LiMWA)**

The inland limit of the area affected by waves greater than 1.5 feet is called the LiMWA. The LiMWA should be shown on FIRMs as an informational layer, when identified, using the guidance for delineation set forth in other FEMA guidance.

At the request of the FEMA Project Officer, the symbology of the LiMWA line on the FIRM may be modified to give it some directionality so it is easily understood which side of the line has the higher wave hazards. An example of a LiMWA line with the hatches pointing towards the V-zones is provided in other FEMA guidance.

## **7.0 Map Collar Information**

The Map collar information includes the Map Legend, Notes to Users, Map Scale Box, Panel Locator Diagram, and FIRM title block. Details of each are provided below.

### **7.1 Map Legend**

The map legend contains those items that are needed to assist the map user in interpreting map symbols, flood hazard screens, linework, flood hazard zone information, and other regulatory information that is depicted on the FIRM panel. Planimetric data (such as roads and railroads) are not included in the FIRM legend.

The FIRM legend elements are standardized and do not vary. However, the symbology shown in the map legend varies depending on whether the FIRM uses an orthophoto or vector base map.

If the need arises, and with the approval of the FEMA Project Officer, customized legend elements may be added to the legend shown in the FIS report.

### **7.2 Notes to Users**

The Notes to Users section of the FIRM provides map users with contact information regarding how to obtain additional information, available related products, and flood insurance availability. The Notes to Users section also provides information about levee systems, and levee system seclusion, if applicable.

Using standardized notes, users are referred to the accompanying FIS report for general information about specific items on the FIRM, background and reference information about sources of data used to prepare the FIRM, and sources of additional information pertinent to specific items on the FIRM. Websites listed in Notes to Users should be black and not underlined.

The following customized notes are added to the Notes to Users section as applicable.

#### **7.2.1. Base Map Source Note**

The base map source note included in the Notes to Users should be customized to reflect the source(s) and date(s) of the base map data used to produce the FIRM.

### 7.2.2. Local Vertical Control Monuments

The assigned Mapping Partner may find it necessary to add special, flood risk project-specific notes if a community requests a reference to local vertical monuments. The monuments will not appear on the map, but the Notes to Users section provides information on where those monuments can be obtained.

### 7.2.3. Levee System Notes

If the FIRM panel contains a levee system, the applicable levee system note will be added to the Notes to Users. The specifications for Accredited, Provisionally Accredited, and Non-Accredited levee system notes, as well as the specifications for levee system seclusion notes, can be found in the [FIRM Panel Technical Reference](#).

### 7.2.4. LiMWA Note and Legend

If the FIRM panel includes a LiMWA line, the Notes to Users section will include the LiMWA note and legend. The specifications for the LiMWA note and legend can be found in the [FIRM Panel Technical Reference](#).

### 7.2.5. CBRS Legend

The U.S. Fish and Wildlife Service (FWS) is the authoritative source for Coastal Barrier Resource System (CBRS) data. CBRS data is not to be displayed on FIRM panels. However, the following Note to Users should be included on all FIRM Panels in communities identified by the FWS as potentially containing CBRS areas: Coastal Barrier Resources System (CBRS) areas and “otherwise protected areas” (OPAs) are no longer shown on this map panel, but still may be present in this community. Current information on these areas is provided by the U.S. Fish & Wildlife Service (FWS). National Flood Insurance Program (NFIP) flood policies are not available within CBRS areas for structures that are built or substantially improved on or after the dates indicated by FWS. Users should reference the most up-to-date information provided by FWS to determine NFIP insurance eligibility. The official maps and additional information regarding CBRS areas are provided on the FWS website at: [www.fws.gov/cbra](http://www.fws.gov/cbra).

### 7.2.6. Custom Notes

At the request of a Cooperating Technical Partner (CTP) or Mapping Partner and with the approval of the FEMA Project Officer, custom notes may be added to the Notes to Users. An example is shown below in Figure 4.

Only coastal structures that are certified to provide protection from the 1-percent-chance annual flood are shown on this panel. However, all structures taken into consideration for the purpose of coastal flood hazard analysis and mapping are present in the DFIRM database in S Gen Struct.

**Figure 11: Custom Notes to Users Example**

Guidance Document No. 24, Guidance for Flood Risk Analysis and Mapping: [Vertical Datum Conversions Guidance](#) provides additional examples of a custom note that would be added to the

Notes to Users for a community-based datum conversion. The [Vertical Datum Conversions Guidance](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.

### **7.2.7. State Seal or Cooperating Technical Partner Logo**

Small areas for State Seals or CTP logos have been reserved at the bottom of the Notes to Users for use as needed. Logo box placeholders do not need to be shown if no additional logos are included on the map.

### **7.2.8. Map Scale Box**

The Scale Box contains the north arrow, scale bar, and information about the map projections and horizontal and vertical datums used for the Flood Risk Project. The specifications for the Scale Box are provided in the [FIRM Panel Technical Reference](#). The Scale Box should be centered in the Panel Locator box.

Even though the FIRM Database will ultimately be delivered to the MSC in the GCS, the FIRM panels will be prepared using a local projection (e.g., UTM or State Plane). The projection information included in the Map Scale Box should reflect the projection used for preparation of the FIRM panels, not the GCS used for delivery of the FIRM Database.

The [Vertical Datum Conversions Guidance](#) document provides an example of a customized Map Projection note that would be used for a community-based datum conversion.

## **7.3 Panel Locator Diagram**

Panel Locator Diagrams serve as a reference to orient the map user to the entire community or county and to adjacent panels. The specifications for the Panel Locator Diagram are provided in the [FIRM Panel Technical Reference](#). The following guidelines should be followed when preparing a Panel Locator Diagram, which should be shown on every FIRM panel, unless a community or county has only one printed panel:

- The diagram size may vary with the size of the community and the space constraints of the diagram.
- The diagram should center on the FIRM panel on which the locator lies and at a minimum will show all adjacent panels with their panel numbers; the Mapping Partner may choose to show more panels as long as the diagram remains readable. The panel numbers in the Panel Locator Diagram do not need to be haloed.
- A diagram inset will show the area of detail within the county; if the entire county can fit in the Panel Locator Diagram, no diagram inset needs to be included.

## **7.4 FIRM Title Block**

The FIRM title block contains those items that identify the community and provide panel-specific information, including the map number and effective date of the FIRM panel. The following title block elements are standard and occur in every FIRM panel title block. The specifications for the elements in the FIRM title block are provided in the [FIRM Panel Technical Reference](#).

### 7.4.1. Community Identification

The community identification information varies slightly depending on the type of study.

- Single jurisdiction FIRMs for incorporated communities list the community type (e.g., city, town, or village), community name, and full State name. Single jurisdiction FIRMs for incorporated communities also include the name of the county, except for jurisdictions that are officially classified as “Independent.”
- Single jurisdiction FIRMs for unincorporated areas of counties list the county name and full State name followed by “(Unincorporated Areas).”
- Countywide FIRMs list the county name and full State name followed by either “And Incorporated Areas” if the countywide FIRM includes both unincorporated and incorporated areas, or “All Jurisdictions” if the countywide FIRM includes flood hazard information for entire counties in which no separate county government exists; all land is administered by community agencies.
- ETJ designators are not listed in the FIRM title block. The community exercising its ETJ authority is listed one time when an ETJ area falls on a FIRM panel. See the [Extraterritorial Jurisdiction Mapping and Distribution Guidance](#) document for additional guidance on the depiction of ETJs.
- The [Vertical Datum Conversion Guidance](#) document provides an example of a customized community listing in a FIRM title block that notes that would be used for a community-based datum conversion.

### 7.4.2. FIRM Panel Number and Highest Number in the Series

Below the community identification information, the FIRM title block lists the FIRM panel number and the highest FIRM panel number in the series. The highest number listed should agree with the highest FIRM panel number listed on the Map Index and in the FIRM Database S\_FIRM\_Pan layer. If the community can be shown on a single FIRM panel, “Only Panel Printed” is used instead of the FIRM panel number.

### 7.4.3. Listing of Communities Shown on FIRM Panel

Below the FIRM panel number is a listing of all of the communities shown on the FIRM panel. An example is shown below. This listing includes the community name, CID number, FIRM panel number, and map suffix. Communities are listed in alphabetical order. The community name is followed by the community type, if applicable (i.e., Coastland, City of). Parks and forests should not be included in the listing of communities shown on the FIRM panel.

COMMUNITY	NUMBER	PANEL	SUFFIX
CONTRA COSTA COUNTY	060025	0280	G
LAFAYETTE, CITY OF	065037	0280	G
MARTINEZ, CITY OF	065044	0280	G
PLEASANT HILL, CITY OF	060034	0280	G

Note that the following guidance should be applied to the FIRM title block listing of communities:

- If the community name is long enough to require more than one line, “OF” should never be on a line by itself. If a second line is required, the complete community title (“CITY OF,” “TOWN OF,” etc.) should be placed on it. This keeps the proper name and the general title complete on each of the two lines.
- When more than one line in a community name is required, the subsequent lines in the name should be indented one or two spaces, for a visual aid in reading the name.
- A community’s CID, panel number, and suffix should be placed on the last line of the jurisdiction to which they belong, so users can read an entire community name, then view its community number and FIRM panel information to the right.

#### **7.4.4. Version Number**

Below the community listing is the version number. The version number indicates the version of the Guidelines and Standards under which a product was produced. More information on the version number is provided at [www.fema.gov/guidelines-standards-maintenance](http://www.fema.gov/guidelines-standards-maintenance).

#### **7.4.5. Map Number**

Below the version number is the map number. The map number is an 11-digit number that includes the CID for single jurisdiction FIRMs or county Federal Information Processing System code plus “C” for countywide FIRMs, the FIRM panel number, and the map suffix.

The map suffix is used to track published editions of each FIRM panel. All panels within a flood risk project may not have the same map suffix if they were not all updated at the same time.

#### **7.4.6. Effective Date**

Below the map number is the effective date of the FIRM panel. It is listed as “Effective Date” when first published and “Map Revised” for subsequent revisions. No effective date or map revised date should be shown on preliminary or revised preliminary title blocks.

Several items may be added to the FIRM panel title block as applicable. These include the following.

#### **7.4.7. Date Stamp**

When FIRM panels are sent to communities for review at the preliminary or other stages, the title blocks are stamped “Preliminary” or “Revised Preliminary” or “Proof Copy” with the date they are sent. The specifications for the date stamp can be found in the [FIRM Panel Technical Reference](#).

#### **7.4.8. Notice to User Note**

If a FIRM panel is reissued to make a correction, a Notice to Users note is added to the title block per the guidance contained in Guidance Document No. 18, Guidance for Flood Risk Analysis and Mapping: [Notice-to-User Revisions Guidance](#). The [Notice-to-User Revisions Guidance](#) is accessible through the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage.