

Strategies to Improve Community Acceptance of Flood Engineering Studies and Maps

Final Report



The Association of State Floodplain Managers, Inc.
www.floods.org

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Strategies to Improve Community Acceptance of Flood Engineering Studies and Maps

Introduction

Among other things, the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs) define:

1. where the mandatory flood insurance purchase requirement applies, and
2. where participating communities are required to regulate development.

In the more populated areas of the country, FIRMs were modernized as part of Flood Map Modernization¹ and republished. Flood inundation maps were reviewed, converted into a geospatial format, and updated where most needed. When completed, FEMA will have modernized mapping for 50 percent of the U.S. land area containing over 90 percent of the U.S. population. Converting its inventory of flood inundation mapping into a geospatial format greatly enhances the usefulness of the maps for disaster preparedness, community growth and infrastructure planning, and informing the public of areas that likely will have dangerous flooding. Due in part to the large number of communities in which maps were modernized the republished FIRMs are generating a significant number of appeals, protests, lawsuits and Congressional inquiries. In response, FEMA requested this evaluation of the flood inundation mapping process and assistance in developing strategies to improve community acceptance of the flood inundation maps developed by FEMA for communities.

This report identifies contributing factors and provides observations and suggested strategies for improving community acceptance of the FEMA flood hazard mapping.

Background on Flood Engineering Studies and Mapping

Floods are the nation's most common and costly natural disaster. To reduce the ever-growing expense to the federal government related to flooding, Congress established the National Flood Insurance Program (NFIP) in 1968. The objective was to provide flood insurance for existing development and map flood inundation areas so that new development would not be constructed at risk. The NFIP guarantees that flood insurance will be available in communities that agree to adopt land-use regulations so that new development is reasonably protected from flood damages. The NFIP flood inundation mapping has designated zones² that are used to determine where flood insurance is required, determine the insurance rate and determine the level of regulation required for development and redevelopment.

Maps depicting flood hazard areas are not only the foundation of the National Flood Insurance Program, but are also the basis of floodplain management at the State and local levels of government. In many

¹ In 2003, Congress appropriated funds for this initiative with annual funding of approximately \$200 million for Fiscal Years 2004 – 2008.

² A, AE, AO, VE, X, and E zones.

U.S. communities, building permits are required only within the mapped floodplain. If an area is not mapped as a flood hazard area, communities often have insufficient basis to enforce building codes and/or to regulate new development even if that area is known locally to be flood-prone.

Most importantly, without adequate floodplain mapping people do not have the necessary information regarding where it is dangerous to build a home or business. Too often, people fail to recognize that the small stream that flows past their new house can become a destructive, raging torrent of water. It is far preferable for people to know that their chosen construction site is in the floodplain before building their home rather than after. When flooded, not only can the damages be extensive but structures rehabilitated after a flood are prone to residual mold that can pose a health risk to the inhabitants. On-site waste disposal systems can be damaged and water supply wells contaminated. Priceless possessions like photographs and family heirlooms damaged by muddy flood waters often cannot be restored or replaced. Psychological disorders may result from the stress caused directly by the disaster (e.g. the injury or death of family members or loss of property, financial assets, or employment), as well as from the disruption of the local social fabric and community life.

Research has documented increases in Post-Traumatic Stress Disorder (PTSD) cases of 15 to 20 percent after natural disasters³. A study carried out eight months after Hurricane Katrina determined that over 30 percent of disaster victims displayed symptoms of a mood or anxiety disorder⁴.

Generating Flood Elevations and Mapping Flood Inundation Areas

Soon after creation of the National Flood Insurance Program in 1968, the Federal government began publishing Flood Hazard Boundary Maps (FHBM). FHBMs were developed using "approximate study techniques" that had no engineering models behind them. FHBMs were intended to provide an early warning for local officials that flooding could occur in their communities, however, they did not provide predicted flood water surface elevations. The original plan anticipated that engineering models would eventually be developed for these approximately-mapped streams. These floodplain engineering studies (called detailed Flood Insurance Studies) provide predicted water surface elevations that could be used to develop more accurate floodplain maps than the NFIP called Flood Insurance Rate Maps (FIRMs). The initial intent was to replace the approximate mapping (FHBMs) with elevation-based mapping (FIRMs) within five years. Detailed Flood Insurance Studies (FIS) and FIRMs were produced throughout the 1970s for many communities across the country. However, the majority of existing flood mapping is still based upon approximate studies with no established flood elevations.

Interagency Agreements

The first NFIP FISs were prepared under interagency agreements for the U.S. Department of Housing and Urban Development (and later FEMA) by Federal agencies with engineering expertise in floodplain mapping—primarily the U.S. Army Corps of Engineers, U.S. Geological Survey, and the U.S. Soil Conservation Service (now NRCS). FEMA continues to work closely with other Federal agencies both in developing flood inundation mapping and in community risk reduction.

³ Ohl, Christopher A. and Tapsell, Sue. *Flooding and human health - The dangers posed are not always obvious*. *BMJ* 321: 1167 doi: 10.1136/bmj.321.7270.1167 (Published 11 November 2000)

⁴Wang, P.S., et al. *Mental health service use among Hurricane Katrina survivors in the eight months after the disaster*. *Psychiatric Services*, Nov 2007;58(11): 1403-11.

Engineering Contractors

Later, private engineering companies were awarded contracts to conduct floodplain hydrologic and hydraulic engineering studies, prepare the maps and assist FEMA in program management. Today about two-thirds of all flood hazard maps are produced by private engineering companies under contract with FEMA.

Flood Map Funding

Throughout its history, FEMA flood hazard mapping has been funded through direct Congressional appropriations, fees derived from the sale of flood insurance policies, and cost sharing with State and local governments via direct funding of flood studies or in-kind contributions. For several decades, federal funding for flood mapping consisted only of fees derived from flood insurance policies. Funding was not adequate to develop flood hazard maps for communities with flood hazards not yet mapped or to upgrade approximate studies to detailed studies. In addition, due to the manual cartographic processes used at the time, the initial mapping developed did not match the topographic data used to prepare the work maps and, in turn, the local terrain.

Due to the fact that a FEMA-produced map of areas subject to flooding is one of the basic and essential tools for flood insurance, floodplain management and flood hazard mitigation, Congress provided funding to FEMA to implement a Flood Map Modernization Plan developed to address these problems.

Flood Map Modernization was a plan to upgrade the 100,000-panel flood hazard map inventory that entailed:

- Conversion of maps to a digital format for approximately 14,000 communities (74,500 map panels), which included resolving community-identified map maintenance needs for 16,500 map panels);
- Conduction of flood engineering updates and production of digital flood maps for approximately 3,300 communities with inadequate floodplain mapping (17,500 map panels); and Development of digital flood maps for approximately 2,700 flood-prone communities without flood maps (13,700 map panels). (bulleting in this list and numbers in next--consistency?)

Community adoption of updated mapping

In addition to identifying where the mandatory flood insurance purchase requirement applies, the FEMA-designated flood hazard area identifies where communities are required to manage new development via an adopted floodplain ordinance. According to FEMA's Multiyear Flood Hazard Identification Plan, "A key objective of the Federal Emergency Management Agency (FEMA) Flood Map Modernization (Map Mod) effort is to increase local involvement in, and ownership of, the flood mapping process." In establishing projected flood elevations for land use purposes with respect to any community pursuant to section 4102 of the National Flood Insurance Act, FEMA is required to:

- notify local governments of the intent and nature of the proposed flood study (44 CFR s 66.5),
- publish proposed Base Flood Elevations and notify the community of the results of the study when preliminary maps are completed,⁵ and

⁵ FEMA is required to publish the proposed flood elevations in a prominent local newspaper at least twice during the 10-day period following the notification of the community chief executive officer. Property owners have 90 days from the second newspaper publication to appeal the proposed flood elevations. 44 CFR s 67.4, 67.5.

- publish final Base Flood Elevations when appeals and/or comments have been processed and the maps are finalized⁶.

FEMA has established a formal process for officially providing a community with a new flood hazard map and addressing concerns a community may have regarding it. If communities have concerns regarding the new maps, there are two options available to them:

Appeal—An appeal is a formal objection to proposed base flood elevations (BFEs) or proposed modified BFEs. It is FEMA policy that due process requiring public noticing occur when the BFE is changed by a foot. A formal objection must be submitted by a community official or an owner or lessee of real property within the community through community officials during the statutory 90-day appeal period. An appeal must be based on data that show the proposed or proposed modified BFEs are scientifically or technically incorrect.

Comment—A comment (formerly referred to as a protest) is an objection to or comment on any information (other than proposed BFEs or base flood depths) shown on an NFIP map that is submitted by community officials or interested citizens through those community officials during the 90-day appeal period.

In addition to these two avenues, communities can both file a lawsuit and contact their Congressional delegation.

Analysis of Contentious Mapping Projects

FEMA received a significant number of appeals, comments, lawsuits and Congressional inquiries during the appeals process. FEMA compiled a contentious mapping projects list (CMPL) with information supplied by its regional office staff. The dates of the appeals or comments included in the listing were from December 28, 2004 to February 11, 2009. The listing included 50 contentious appeals. In 36 of them, the community had contacted its Congressional delegation. This listing provided information on the reasons for the appeal, whether it was an appeal or protest, appeal resolution, and whether a CTP was involved. For this evaluation, the FEMA contentious mapping projects list was supplemented with cases that were highlighted in news reports (e.g. NBC News March 13, 2010 segment on Los Angeles County), identified by FEMA staff (e.g. Finney County, Kansas) or highlighted in personal contacts with floodplain managers (e.g. Dane County, Wisconsin).

For this assessment, ASFPM grouped the appeals in categories, conducted telephone interviews, reviewed information on community webpages, attended ASFPM chapter meetings, identified best practices and compared a sampling of the maps produced against best available topographic datasets. ASFPM also conducted an engineering evaluation of the floodplain modeling developed for selected projects.

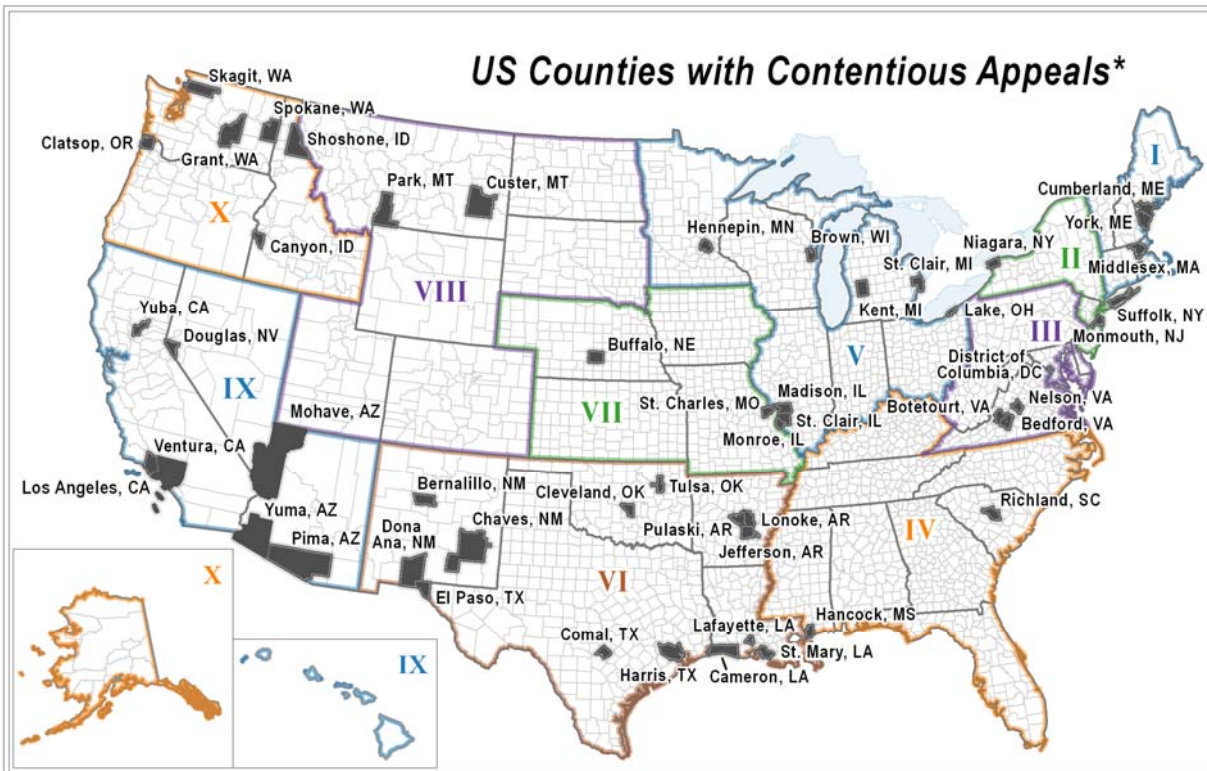
The objectives of this evaluation were to:

1. Evaluate the appeals process and provide options for addressing contentious appeals.
2. Recommend ways to improve the quality and effectiveness of FEMA's communications with State and local officials prior to and during the floodplain study and mapping process.
3. Identify and recommend specific and reasonable actions for FEMA to undertake to reduce the number of contentious appeals.

⁶ Final flood elevations must be published in the Federal Register and copies sent to the community executive officer, all individual appellants, and the State coordinating agency.

4. Recommend performance measures to evaluate whether appeals and disputes have been reduced through FEMA's actions. Note: The actions recommended should provide transparency and a process such that the parties involved (FEMA and appellant) are satisfied with the outcome.
5. Recommend implementation activities.

Below is a map showing the geographic distribution of the contentious mapping projects included in this evaluation followed by a summary of the issues identified.



Map 1. Counties in which there were contentious appeals and comments

*Appeals for this evaluation include appeals, comments/protests and lawsuits.

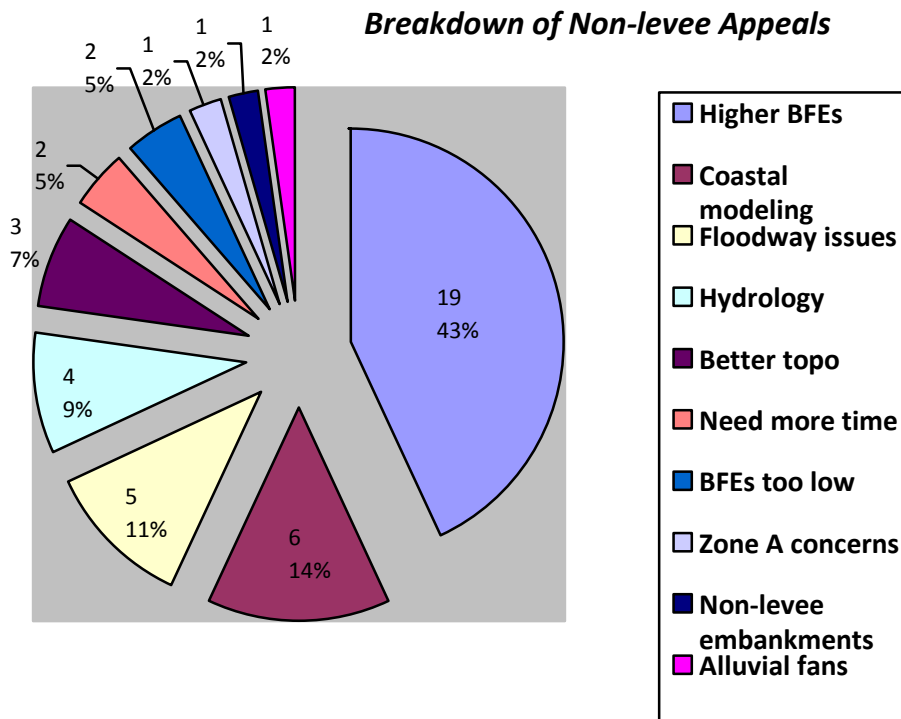
Levees

Levees were the only reason for the appeal in 11 (22 percent) cases. In an additional eight cases, levees were *one of several* reasons identified as a reason for the appeal. The primary issue identified associated with levees was the need expressed by communities for more time to obtain the information required to certify their levees. Most of the communities thought their levees were adequate, and the mapping of areas protected by these levees as being within the Special Flood Hazard Area came as a surprise. Communities found the process of levee certification complicated and frequently unrealizable. In instances where levees were identified as inadequate, communities wanted time to enhance them so that they could be accredited. In the opinion of these communities the mapping of areas protected by levees as being in the Special Flood Hazard Area makes these areas, which the community is targeting for development, less desirable and therefore stigmatized.

Non-levee issues

Of the 50 cases evaluated, 38 (76 percent) of them involved reasons for the appeal or comment that were in part or not at all levee-related. The non-levee reasons identified were:

Increased BFEs/area of inundation – Nineteen contentious mapping projects were due to increased BFEs and/or areas mapped as flood prone. In Finney County, Kansas, for example, Garden City, a community of 30,000 people, 1,800 houses were added to the SFHA. In Los Angeles, 500 houses were added. In both cases, the areas were mapped as Zone As with no published BFEs. Therefore, the communities could not file appeals. The communities expressed concern that if the modeling was not good enough to set BFEs, it should not have been good enough to require those homeowners to purchase flood insurance. The first case led to a lawsuit and the second to a network news investigation. Both communities also contacted their Congressional delegations.



Coastal modeling – Appeals were submitted by a number of parishes on the Gulf Coast that objected to the coastal modeling used in their studies. Also significant in these cases is that the State of Louisiana, seeking relief from the V zone mapping, joined the appeal and contacted its Congressional delegation. FEMA created a project team charged with conducting a more extensive coastal modeling study to ensure a consistent, peer-reviewed methodology for the Gulf Coast. The websites that have been developed for Louisiana and Mississippi provide extensive background material on the restudy effort and the status of new mapping being developed.

Floodway issues – The floodway is considered to be the most hazardous portion of the floodplain and consequently has the most restrictive development regulations. Floodway redelineation often results in an enlarged floodway, and the concern raised most by communities pertains to impacts on future development in the floodway. This ranges from general disagreement with the delineation of the floodway, as in Comal County, Texas; to impacts on an already planned development project (Richland County, South Carolina); to concerns about future development and land use in a now-enlarged floodway, as in the case of Alewife Brook in Cambridge, Massachusetts (Middlesex County).

Hydrology – In floodplain modeling the hydrology is often the most difficult and uncertain part of the flood modeling process. Accuracy is often in the range of +/- 50 percent. Therefore it is the most likely part of the study to be challenged. However, since an appeal must be based on data that show the proposed BFEs are scientifically or technically incorrect, if a community submits a technically superior study that identifies errors and those diverging data do not change the results by more than 50 percent, FEMA is within its criteria to deny the appeal. Hydrology was the primary reason identified in four of the cases reviewed.

Better topographic mapping available – In some instances, floodplain maps were developed from coarse topographic data. Some communities had improved topographic mapping that had been developed for other purposes or, otherwise, quickly contracted for new topographic data.

Need more time – Communities felt the focus was on getting the maps completed quickly and meeting the metrics. In one case, FEMA informed the communities that it wanted their State to be the first to be completely modernized. The hydrologic and hydraulic modeling associated with flood inundation mapping is very complex. Communities felt the 90-day appeal period was not enough time for its engineer to review a study and then provide “superior” technical information for the mapping project.

BFEs too low (houses recently flooded not included in mapped SFHA) – In the City of St. Louis Park, Hennepin County, Minnesota, the proposed 100-year floodplain boundary would remove most of the flood-prone homes upstream of 34th Street from that floodplain, even though there have been past flooding issues in this area. The community hired an engineering firm to evaluate the modeling. This modeling was a leveraged stormwater engineering study. Several errors associated with the hydrology were identified, however, since the difference between the initial study and the modified study was within the acceptable error (50 percent), FEMA denied the appeal.

Zone A concerns – Implementing floodplain zoning requirements in areas without BFEs is difficult for communities. As one example, Nelson County, Virginia felt that the cost of deriving a BFE for a development site in the A Zone SFHAs was prohibitive (\$10,000 per site). The community also could not understand why it was not allowed to use the rudimentary flood heights from the U.S. Army Corps of Engineers studies, which are the basis of the A Zones.

Non-levee embankments – Levee issues are a major contributing reason in appeals, but not to be underestimated are instances where areas behind embankments have not been included in the floodplain. A case in Pima County, Arizona provides a good example. The Town of Marana there disagreed with how areas behind highway and railroad embankments (all non-levees) were mapped. The town conducted a 2-D hydraulic study to redelineate the Special Flood Hazard Area.

Alluvial fans – Alluvial fans are mapped with techniques that focus on historic stream channels instead of simply hydraulic conveyance. This can substantially increase the width of the floodplain.

Need for increased communication with communities – The variety of reasons for appeals identified points to a general need for increased communication with communities. The ubiquitous nature of this reason is why it is not represented in the chart above. Outreach and education on issues of scientific technique and processes is complex, but the recurrence of this underlying issue in appeals makes it critical to address.

Steps FEMA has taken to improve community acceptance of the flood engineering studies and maps.

FEMA has developed flood hazard mapping guidance documents, quality standards, and procedural memoranda. In addition, FEMA has established engineering project management procedures and increased its engineering contractor capacity. FEMA has also worked with stakeholders to involve appropriate entities in flood hazard mapping. As Map Modernization progressed, FEMA modified its procedures to improve its mapping processes and increased collaboration with State and local governments as part of the mapping process.

When Flood Map Modernization approached the halfway point in its funding, FEMA performed a mid-program evaluation that considered input from Congress, the U.S. Government Accountability Office (GAO), the Department of Homeland Security's Inspector General and other stakeholders.

From the beginning of the initiative in 2003, Flood Map Modernization focused on creating a digital flood layer for all communities at risk of flooding. However, stakeholders felt that simply digitizing existing maps would not result in reliable products. They expressed a preference for FEMA to focus on developing flood maps that meet certain quality standards.

With the mid-course adjustment, the Flood Map Modernization Program's objectives were modified to:

1. producing new digital products,
2. providing new, updated, or validated engineering analyses, and
3. integrating the 2005 Floodplain Boundary Standard into the digital maps.

The following table shows that, with the adjusted course, a heavier emphasis was placed on engineering analysis and compliance with the Floodplain Boundary Standard. In order to meet a reasonable metric with available funding, there was a decrease in the total land area being mapped and the percentage of the U.S. population receiving a digital map product.

Criteria	Original Course	Adjusted Course
Percentage of mapped stream and coastal miles meeting 2005 Floodplain Boundary Standard	57%	75%
Percentage of mapped stream and coastal miles with new, updated, or validated engineering analysis	22%	30%
Percentage of population covered by maps with new, updated, or validated engineering analysis	15%	40%
Percentage of land area of continental United States covered by digital flood maps	100%	65%
Percentage of U.S. population covered by digital flood maps	100%	92%

Under FEMA's new Risk MAP program, FEMA has incorporated some lessons learned from Map Modernization. At the time of the writing of this publication only pilot projects have been conducted, but Risk MAP shows promise in its approach to reducing contentious appeals. However, it is acknowledged that with the focus on coastal areas in Risk MAP there may be a new set of appeals due to issues unique to that particular topography.

Recommended Strategies, Actions and Evaluation Measures for Enhancing Steps Taken

The remainder of the document identifies six thematic areas where strategies, actions, and evaluation measures for improving acceptance of flood maps and reducing the number of contentious appeals are encouraged. The first three are areas where FEMA has taken positive steps to improve community acceptance of FEMA developed flood hazard mapping. FEMA is encouraged to continue with these efforts and some suggested enhancements are provided in the first three strategies that follow.

#1: Partnering with States and Authorities for oversight and QA/QC

The Federal government recognizes that States and authorities/basin commissions have a long history of generating data on flood elevations (see (ii) in sidebar). In addition, a number of States and authorities/basin commissions have higher standards for floodplain mapping (e.g. No Adverse Impact floodways, future conditions mapping). Some of these States and authorities have statutory requirements to review floodplain engineering studies.

These entities often have engineers on staff responsible for reviewing engineering studies and mapping within their jurisdictions to ensure those studies meet the State or local standards. Some examples include:

- The Illinois Office of Water Resources has been in existence since 1913 and its website highlights that 75 percent of its staff are engineers.
- The Tennessee Valley Authority (TVA) developed some of the first flood hazard maps beginning in the 1950s. TVA established the concept of identifying the most hazardous portions of a floodplain as the “floodway.”
- The State of New Jersey has been mapping floodplains based on 125 percent of the Q_{100}^7 since the late 1970s. The State produced half of the initial Flood Hazard Boundary maps developed by FEMA in the 1970s, along with a full set of maps based on 125 percent of the Q_{100} . The FIRMs are used for determining where flood insurance is required, while the New Jersey floodplain maps are used for siting new development in non-coastal areas.
- A 1965 Wisconsin State law requires communities to implement floodplain zoning provided the State “assures the accuracy of the mapping.” Therefore, all flood engineering studies in Wisconsin are reviewed and approved by Wisconsin Department of Natural Resources engineers.
- A 1972 Montana law requires the State to ensure floodplain maps are based upon “reasonable hydrologic certainty.”

44 CFR 9.7 (c) Floodplain determination.

(1) In search for flood hazard information, FEMA shall follow the sequence below:

- (i) (Use a FEMA map.)*
- (ii) If a detailed map is not available ... and if data on flood elevations, floodways, or coastal high hazard areas are needed ... the Regional Director shall seek assistance from ... other Federal agencies, States and authorities/basin commissions. ...*
- (iv) If the sources listed do not have the information necessary ... the Regional Director shall seek the services of a Federal or other engineer experienced in this type of work.*

⁷ The flow associated with the 100 year (1 per cent chance) flood event.

The Federal government has enlisted the services of States/authorities for flood engineering studies since the NFIP was established. FEMA substantially increased the amount of State/authority involvement under Flood Map Modernization.

Involving States/authorities can be broken down into the following areas:

1. Map production including hydrology, hydraulic, mapping and outreach;
2. Program management including oversight, needs assessment (Coordinated Needs Management Strategy), and
3. QA/QC and map maintenance.

Flood Map Production

In developing the Flood Map Modernization Plan, FEMA conceptualized the Cooperating Technical Partners (CTP) initiative to increase involvement in map production through formalized Federal-State-regional-local partnerships. The intent was to facilitate and capitalize on these State, regional, and local efforts and coordinate them with FEMA's flood mapping efforts in a consistent way rather than on an ad hoc basis.

Today there are more than 200 CTPs. Most CTP Task Agreements are collaborative efforts to maximize the extent, accuracy, and utility of flood studies to best meet local and Federal needs while minimizing costs. This cost-shared approach to funding flood mapping activities allows FEMA and other Federal agencies, States, regional and local governments to leverage their available resources, and maximize output. State, regional and local governments are funding approximately 60 percent and FEMA approximately 40 percent of the cost of joint flood mapping projects nationally. Thus, for every \$1 invested by FEMA, \$2.50 worth of updated flood mapping is being produced.

Flood Mapping Coordination and Oversight

Recognizing existing water-related authorities, FEMA provided funds to State and regional agencies and to federally-recognized tribes to assist with flood hazard map needs assessment, coordination and oversight. This mapping support included a variety of administration and management activities including but not limited to: assessing mapping needs, developing State implementation plans, reviewing hydrologic and hydraulic studies prepared for flood map revisions, coordinating with other agencies and local communities, and developing an inventory of base maps and topographic mapping.

When this funding was initially established, it was included as part of the Community Assistance Program—State Support Services Element (CAP-SSSE) program and was called CAP-MAP. However, the 25 percent cost share required under CAP-SSSE made it difficult for States to accept the funding. To enable more State involvement, FEMA established a separate funding stream called Map Modernization Management Support (MMMS) that did not require a cost share. In addition, FEMA increased the available funding to an average of \$100,000 per State – sufficient to support a full-time position. These changes substantially increased State involvement and successfully built State capability to assist in the process of creating new or revised flood hazard maps. Attachment 1 is a listing of States participating in MMMS that have designated State floodplain mapping coordinators.

Flood Mapping Independent QA/QC

FEMA Quality Assurance/Quality Control (QA/QC) processes call for independent QA/QC at several points in the mapping process.

Community Rating System (CRS) Assessment – 2007

The independent review of flood studies is one of the activities included under FEMA’s Community Rating System (CRS). In 2007, at the request of the CRS Task Force, ASFPM reviewed State floodplain management programs to determine which States qualify for CRS credits for independent review of flood studies. ASFPM identified six states that have a long history (25 to 40 years) of conducting technical reviews of flood engineering studies to assure compliance with higher State floodplain mapping standards. The findings are summarized in Table 1.

States under the Public Trust Doctrine have authorities associated with the navigable waters of the State that they cannot abdicate. The primary issue is how they have exercised those authorities. While specific provisions identified in State statutes help solidify and clarify State authorities, the true test is that the State issues an approval letter for the activity.

As an example, ASFPM’s *Floodplain Management 2003* identifies thirteen States that carry out an engineering study review. In order to determine the extent of the State review, ASFPM interviewed State representatives and requested copies of review checklists and sample approval letters issued. These items identified the elements of the study reviewed and helped determine if the review was adequate to qualify as independent QA/QC.

Table 1. Technical Review of Flood Studies

State	Hydrology#	Hydraulics#	Floodplain Mapping#	Year Technical Review Began
New Jersey	X		X	1962
Michigan	X	X	X	1968
Wisconsin	X	X	X	1968
Illinois	X	X	X	1975
Minnesota	X	X	X	1980
Indiana	X	X	X	1982

Contentious Mapping Project Assessment – 2011

To determine if additional States have taken on independent QA/QC under flood map modernization, ASFPM reviewed Mapping Activity Statements (MAS) to determine the extent of State/authority involvement in map production and program management. Map 2 below highlights States that have engineering and/or mapping QA/QC responsibility under Map Mod.

Strategy: Continue to support State/authority capability that has been developed under Flood Map Modernization. Increase efforts to leverage the expertise of States/authorities in the review of Flood Insurance Studies. Many have legislative authorities and long histories of reviewing and approving flood studies. When the maps are provided to communities, these States/authorities can attest to the adequacy of the study.

Best Practices

Indiana and Minnesota - The U.S. Army Corps of Engineers, the U.S. Geological Survey, and the Natural Resources Conservation Service have signed a Memorandum of Understanding (MOU) with the State of Indiana associated with the review and approval of flood discharge frequency determinations. The MOU includes a specific timeframe for reviewing discharge frequency determinations and a process for resolving disputes, and has been in place nearly 35 years.

Minnesota has a similar, less formal agreement with these agencies associated with the review and approval of flood discharge determinations that also has been in place since the 1970s.

New Jersey – has developed its own floodplain maps in non-coastal areas, based upon Q_{100} plus 25%, in an attempt to address future conditions. FEMA's FIRMs are used for flood insurance. The New Jersey floodplain maps are used by communities for siting new development. New Jersey engineering staff review and approve any Qs used in New Jersey.

Rationale: The financial downturn has significantly impacted State budgets. FEMA funding to States and authorities has helped State floodplain management programs avoid staff reductions. In some cases, it has actually prompted increased State program staffing levels. Reductions in funding could result in staff terminations that may be difficult, if not impossible, to restore.

Recommended Actions:

1. Continue to fund State Floodplain Mapping Coordinators – FEMA provided sufficient funding to support on average one position per State. Coordinators have been designated in 34 States. These coordinators have become familiar with the mapping processes and the flood hazard mapping needs in their State/region.
2. Continue to provide funding opportunities to States/authorities to develop the Coordinated Needs Management Strategy (CNMS) for their States/jurisdictions.
3. Continue to partner with qualified and interested States/authorities in the QA/QC of engineering studies that establish or modify BFEs (FISs, Physical Map Revisions (PMRs) and Letters of Map Change (LOMCs)).

Evaluation Measures: The number of States/authorities with State and/or locally funded floodplain/water management engineers with MOUs associated with program management, map production and QA/QC or map maintenance including:

1. Oversight and coordination (related to Map Modernization MMMS funding),
2. Development of the CNMS, and
3. QA/QC of FISs, PMRs, and LOMCs.

#2: Increasing consultation with local officials

42 U.S.C. 4107. Consultation with local officials; scope

“In carrying out its responsibilities the Director shall establish procedures assuring adequate consultation with the appropriate elected officials ... Such consultation shall include, but not be limited to, fully informing local officials at the commencement of any flood elevation study or investigation ... the nature and purpose of the study, the areas involved, the manner in which the study is to be undertaken, the general principles to be applied, and the use to be made of the data obtained. The Director shall encourage local officials to disseminate information concerning such study widely within the community, so that interested persons will have an opportunity to bring all relevant facts and technical data concerning the local flood hazard to the attention of the agency during the course of the study.”

The initial contact with a community used to be called the “scoping meeting.” The concept was to meet with local officials to discuss their mapping needs and establish the scope of the project. Recently, FEMA has changed the term to “discovery meeting.” This term more properly describes the intent of the meeting, which is to gather information that can help provide reasonable flood hazard mapping for the community.

In addition to the initial scoping/discovery meeting, routine contacts are critical throughout the mapping process.

If the community has digitized their FIRMs, these data can be used for the digital versions of the community existing flood hazard mapping. These data can then be used to identify changes to the community’s flood hazard area as a result of new FIRMs which is one of the new products being provided to communities under RiskMAP.

Strategy 1: Ensure the FIRMs developed for a community are within established tolerances of the community’s geospatial framework.

Recommended Actions:

1. If digitizing existing FIRMs is necessary, the x and y coordinates of the points used to georeference the FIRM should be bundled with the DFIRMs. These points (tics) can then be used to evaluate how well the DFIRMs correlate with the community’s framework geospatial data sets and base aerial photography.
2. Conduct a spot check of converted DFIRMs against U.S. Geological Survey Digital Raster Graphic quadrangles. In this assessment, the National Flood Hazard Layer was compared to USGS 7.5-minute quadrangles for a sampling of communities in each of the regions. For the most part the DFIRMs looked reasonable when compared to the quadrangles. However, this review identified errors warranting attention. In two of the cases it was apparent that there had been no attempt to check topography. Issues such as these severely undermine community confidence in the DFIRMs.

Best Practice:

Mohave County, Arizona - The community digitized its FIRMs several years ago and had been using these maps for community planning. The community was comfortable with how well the digitized FIRMs matched other community geospatial data and base aerial photography.

When the preliminary FIRMs were provided to the community, it was apparent that FEMA had also digitized the floodplain boundaries from the existing FIRMs. Because the hard copy FIRMs have no horizontal control, neither exactly represents the hard copy FIRMs. As a result, the floodplain boundaries on the preliminary Digital Flood Insurance Rate Maps (DFIRMs) did not match the community's digitized floodplain boundaries.

Community involved in editing floodplain boundaries:

The community initially was frustrated with having to justify changes to the preliminary DFIRMs when comparisons to its aerial photography identified obvious errors. FEMA ultimately provided the geospatial preliminary linework to the community for it to edit directly.

Rationale: Digitizing existing FIRMs and republishing with a new date implies as level of map currency that is unwarranted and inappropriate. Using automated flood engineering modeling tools is preferred over digitizing existing FIRMs when republishing community FIRMs. These automated tools have reduced the costs to the extent that costs associated with the two methods are comparable.

However, some digitizing of FIRMs may continue (without republishing with a new date) in order to get all existing hardcopy FIRMs into a geospatial format. Digitized FIRMs have some error introduced during the digitizing process. The points used to georeference FIRMs are generally road intersections. By bundling these points with the digital FIRMs these points can be compared to the road intersections on the community base maps. This improves community confidence in the mapping by allowing the community to confirm that any offsets in the linework were not caused by incorrect data projection procedures.

Spot-checking DFIRMs against U.S.G.S. topographic quadrangle maps helps ensure that there are no instances of water flowing uphill and that the DFIRMs pass the common sense test.

Strategy 2: Continue to encourage communities to be actively involved in the mapping process to the extent they are capable. Establish milestones that prompt consultation with local officials.

Current FEMA guidance concerning Risk MAP¹⁰ has to some extent addressed this issue. First, the guidance for discovery meetings encourages significant contact with communities at the start of a project to ensure the best data is being used and all issues are addressed. With two to three additional meetings, communities have more opportunity to be involved.

¹⁰ Risk Mapping Assessment and Planning – a FEMA initiative to improve community understanding of risks associated with flooding.

Recommended Actions:

1. Contact the community at least quarterly with a status update, an offer to meet with them to discuss the project, and to answer any questions they may have.
2. Create a formal, active role for the community in the mapping process beyond attending the discovery meeting and receiving appeals.

Rationale: Asking the community to be actively involved in the mapping process can significantly improve the quality of the mapping and increase community ownership in the flood hazard mapping produced. FEMA has developed a well-documented mapping process. FEMA should establish milestones in the process that would require consultation with local officials.

The guidance for Risk MAP includes the following: Discovery and Charter. These lay out the extent of the study and clearly define the following items.

1. **Streams to be mapped:** Care should be taken to ensure the community understands which streams will be mapped, with particular attention to new streams to be added to its flood hazard maps.
2. **Hydrology to be used:** Due in part to the very limited number of stream gauges in the United States, hydrologic modeling has a high degree of uncertainty. Common accuracies mentioned in the field are in the range of 30 to 50 percent.
3. **Floodway meetings:** The State of Minnesota highlighted the fact that, historically, FEMA and the State would meet with communities when new maps were produced to discuss the proposed floodway boundaries. (The floodway is the portion of the floodplain with the most restrictive development standards.)

Evaluation Measures: Establishment of processes to obtain confirmation from local officials regarding:

1. Streams to be studied,
2. Hydrology to be used, and
3. Floodway delineation.

Best Practices:

South Carolina – The South Carolina Department of Natural Resources has been successful in building a consortium among local, State and Federal governments to acquire topographic information or leverage locally-licensed data as the foundation for new flood maps. In some instances counties have provided their parcel and building footprint data, in addition to the topographic data, to improve flood map quality. These partnerships with local governments make the acquisition and processing affordable as the costs are split among consortium members. These new topographic data are then placed in the public domain and made available to the public.

Wisconsin – The Wisconsin Land Information Program provided \$250,000 in grant funding to counties to develop data to support flood map modernization. The funding could be used for bridge surveys and/or topographic data development. Most of the five recipients of these \$50,000 grants used the funding to survey bridges needed for detailed studies.

#3: Calibrating engineering models to historic flooding

A common concern raised by communities and impacted property owners was that the areas mapped as flood hazard areas have never flooded. In one case on the contentious appeals list, the FEMA Regional Office indicated the community was “objecting to FEMA remapping because they had not been provided reasons for remapping.” One way to address this issue is to use high water mark information and/or remote sensing technology to document the extent of inundation associated with flood events. Highlighting discrepancies between high water marks and existing Special Flood Hazard Areas mapping would help reinforce the need to remap an area.

High Water Marks - Floodplain engineering studies are efforts to simulate flood events using mathematical engineering models. To ensure their accuracy, model results need to be correlated to past flood events’ high water marks. This is referred to as “calibrating” the model.

Historic Flood Photographs - Flood photographs can help reinforce the fact that a community is flood-prone. A common theme for contentious appeals is “but that area has never flooded.” Karl Christians, Conservation District Specialist for the State of Montana, told of a public hearing in which people were disputing the mapping and stating that common refrain. An elderly gentleman in the back of the room then piped up, “Don’t you folks read the paper?” He was holding up a copy of a local newspaper from 1952 with photographs showing the area in question under water.

When interviewing community officials regarding comments on the Flood Insurance Rate Maps for Dane County, Wisconsin, the county staff developing the Hazard Mitigation Plan indicated that in general, the maps were good. The exceptions were a couple of lakes in the northern part of the county. The buildings around these lakes are mapped as being out of the floodplain, yet when the maps were published, many were standing in several feet of water and had been for months.



Figure 1. Fish Lake, Dane County - May 2009

Strategy: Implement continuous quality improvement mechanisms for flood engineering studies that incorporate past flood event high water marks.

Rationale: The use of past flood event records helps link flood hazard maps to actual events that have caused flood damages, and establishes an underpinning of credibility that cannot be easily disputed. That link to historic flooding is usually the true test for residents.

Recommended Actions:

1. Calibrate flood modeling against historic high water marks.
2. Archive high water marks collected after disasters such that the HWMs are available for future flood hazard mapping projects.
3. Update flood hazard mapping after flood events where the maps prove themselves to be inadequate.
4. As part of the release of new maps, proactively develop materials and information to show relationship of changed BFEs, floodways and historical events. This will show the community how the historical event was used in the analysis and encourage more buy-in of the mapping products.

Evaluation Measures:

1. Miles of stream with published BFEs developed with hydraulic modeling that has been calibrated against past flood events, and
2. Miles of stream with documented high water marks.

Best Practices

Direct mailing:

The State of Indiana – Due to a complaint to the governor early in Flood Map Modernization, the Indiana floodplain management program was directed to attempt to contact all impacted property owners when preliminary FIRMs were produced. For the first 24 counties for which preliminary FIRMs have been developed, 50,315 land owners received direct mailings at a cost of \$38,240. These direct mailings have substantially increased the attendance at public meetings associated with the new preliminary FIRMs.

The Commonwealth of Virginia – In 2007, the Commonwealth passed legislation that “requires the government to notify homeowners when FEMA changes floodplain maps in ways that affect their homes, empowering those homeowners to make informed decisions about flood insurance”.

Out-as-Shown:

Johnson County, Kansas – For homes that appeared close to the floodplain, detailed field surveys were conducted that were then provided to FEMA. Letters were then mailed in the spring of 2009 to all homes judged to be on or near the new floodplains. The letters provided the community’s assessment of those homes’ status. The community pointed out that it does not provide official status determinations, and any information it has provided is always subject to correction. FEMA reviewed this information and provided a LOMC for the affected properties.

Recommended New Strategies, Actions and Evaluation Measures.

The first three strategies highlighted steps FEMA has taken to involve States and authorities in the mapping process, increase community involvement and validate the engineering modeling used to generate the flood hazard mapping. These next three sections detail some new strategies that have not been implemented by FEMA or are not in widespread use.

#4: Evaluate impact of mapping on existing development

The National Flood Insurance Program includes specific procedures for publishing Base Flood Elevations that includes due process for people impacted. FEMA publishes two notices of the proposed base flood elevations in the local newspaper within a 10-day period. The 90-day review period begins once the second notice is published.

In a number of the contentious appeals, homeowners were surprised when they received letters from their lenders indicating they were in a Special Flood Hazard Area after the final maps were published. The lenders indicated that residents were to purchase flood insurance or it would be purchased for them, with the premium added to the monthly mortgage payment. When property owners receive notice in this fashion, it is too late to make adjustments to the mapping if it is warranted. The property owner may be facing at a minimum several hundred and potentially several thousand dollars worth of additional annual costs to address what they perceive is an error in the mapping. Mailing notices to all property owners potentially impacted by the new flood hazard mapping helps ensure property owners are engaged early enough in the process to provide comments.

Communities in Johnson County, Kansas took it one step further. For homes that appeared close to the floodplain, detailed field surveys were conducted that were then provided to FEMA. FEMA was able to use detailed survey

data to verify homes identified as being out of the floodplain. Letters were then mailed in the spring of 2009 to all homes judged to be on or near the new floodplains. The letters provided the community's assessment of a home's status.

Strategy: Evaluate the impact of mapping Special Flood Hazard Areas on existing development.

Rationale: Conducting elevation surveys for individual houses and creating an inventory of buildings with associated elevation certificates provides homeowners with information to address mandatory flood insurance purchase requirements.

Recommended Actions:

1. Mandate, as a condition of having a certified levee or perhaps even as a condition of NFIP participation, that a community with a levee that is either accredited or not provide an annual information notice to owners protected by that levee that identifies its status, condition, protection level and whether the property is in an identified levee failure zone. This will get people living in such areas used to the idea that there is levee risk and facilitate better buy-in of new mapping products.
2. In all Risk MAP projects that include a levee that has the possibility of being decertified, include detailed risk assessment data about what is at risk and also map or provide flood inundation area information.
3. Encourage communities to provide notice to impacted properties in their utility bill or via direct mailing.
4. Encourage communities to develop elevation certificates for properties potentially impacted.

Assessing the Impact:

In Nebraska's Large Area Mapping Project, the floodplain mapping program sent survey crews to mapped communities to identify and generate elevation certificates for structures that would be included in the mapped floodplain.

Evaluation Measures:

1. Number of communities in which direct mailings were provided to impacted property owners.
2. Number of communities in which elevation certificates were generated for impacted properties.

#5: Publish Limited Detail Study flood elevations

FEMA has indicated it will implement procedures such that, eventually, all new flood insurance studies and associated maps will have an associated engineering model-derived elevation. All maps will be based on either a “Detailed Study” or “Limited Detail Study.” FEMA provides communities with Limited Detail Study elevations to use as best available data with their floodplain zoning ordinances. However, FEMA does not publish LDS elevations. Therefore, LDS elevations are not officially Base Flood Elevations and FEMA does not provide communities the opportunity to appeal LDS elevations.

For unnumbered A Zones, FEMA feels an appeal cannot be filed because there are no new or revised published BFEs. Communities can file a comment only.

Section 4104 states that *“In establishing projected flood elevations for land use purposes with respect to any community pursuant to section 4102 of this title, the Director shall first propose such determinations by publication for comment in the Federal Register, by direct notification to the chief executive officer of the community, and by publication in a prominent local newspaper.”*



Best Practices:

North Carolina and South Carolina provide communities with the opportunity to appeal elevations from Limited Detail Studies as well as BFEs established using Detailed Study

In a lawsuit associated with one case, the appellant indicated that there was nothing in the regulations differentiating flood elevation determinations based on a limited detail study from those developed using detailed engineering studies.

Strategy: Increase comfort level and acceptance of FIRMs by providing due process for all flood hazard mapping developed for communities.

Rationale: It is counterintuitive for detailed study flood elevations to be appealable while the less rigorously-developed LDS flood elevations are not. In one case, LDS modeling was used to extend the SFHA to include 1,800 homes. It caused great angst within the community that such a large number of homes were impacted and yet the community did not have appeal status. The community opted to file a lawsuit. In addition, communities frustrated by not being allowed to appeal will often contact their Congressional delegation.

Recommended Action: Allow elevations established using Limited Detail Studies to be officially appealable by communities.

Evaluation measure: Miles of stream with published flood elevations for which people have been provided due process.

#6: Map flood hazards before there is a risk

Flood inundation mapping assists communities in guiding the construction of not only individual homes and buildings but also commercial and industrial buildings, community infrastructure, and critical facilities (e.g. emergency facilities, assisted care units, emergency shelter centers, transportation routes and public utilities).

In much of the U.S., building permits are required only in mapped floodplains. While FEMA has developed flood hazard mapping for much of the nation, there are still large areas of the country for which no flood inundation maps have been developed. According to FEMA's Flood Map Modernization Mid-Course Adjustment summary, there are 13,700 map panels needed for communities that had not been mapped, and an estimated 60,000 stream miles presently do not have flood inundation mapping or flood elevations where development is anticipated.

The United States' population is one of the fastest growing in the world. Between the year 2000 and 2050, it is anticipated that it will increase from 281 million to 460 million people and housing units will increase from 116 million to 200 million units. The nation's landmass is large enough—about three percent is currently urbanized—to accommodate this growth. However, social scientists indicate a new landscape may emerge, one that resembles the network of smaller towns characteristic of 19th-century America.

An August 2010 *Smithsonian Magazine* article predicts rural and small-town communities will increase in population and economic importance in the next several decades. The article makes the case that:

“For the better part of the 20th century, rural and small-town communities declined in percentage of population and in economic importance. In 1940, 43 percent of Americans lived in rural areas; today it's less than 20 percent. But population and cost pressures are destined to resurrect the hinterlands. The Internet has broken the traditional isolation of rural communities, and as mass communication improves, the migration of technology companies, business services and manufacturing firms to the heartland is likely to accelerate.”

Best Practice: Nebraska is an example of a State working to map flood inundation in rural areas. Nebraska has passed State floodplain management legislation and has developed a large-area floodplain mapping program that is mapping rural Nebraska in a cost-effective manner. Its goal is to develop flood inundation mapping and anticipated flood elevations for all 40 of the counties in the State that do not have county-wide flood hazard mapping, 31 of which have no flood hazard mapping.

Strategy: Develop flood hazard mapping for areas with development potential that have not yet been mapped.

Rationale: Per Section 4102 the Director of FEMA is authorized to develop criteria for land management and use designed to encourage, where necessary, the adoption of adequate State and local measures which, to the maximum extent feasible, will:

- (1) *Constrict the development of land which is exposed to flood damage where appropriate,*
- (2) *Guide the development of proposed construction away from locations which are threatened by flood hazards [emphasis added], ...*

Most of the contentious mapping projects were associated with increased BFEs and increased areas of inundation that included existing development. Mapping flood hazards in areas not yet developed helps make people purchasing land aware of potential flood hazards and helps prevent inappropriate monetary and personal investments in these areas. People will not have inappropriate or unrealistic expectations regarding the use of flood-prone property. While a landowner may be disappointed that development in certain areas may be limited, mapping areas already developed as being in the floodplain can prompt mandatory purchase requirements that people often resent. Mapping flood hazard boundaries before there is a risk helps avoid significant monetary and personal investments by homeowners after the fact.

Recommended Action: Identify and publish information with respect to all floodplain areas in the United States, including coastal areas, that have special flood hazards. Priorities can be based on:

1. Incorporated communities with flooding sources that have not been mapped.
2. Extraterritorial jurisdiction areas and/or planned growth areas associated with incorporated communities that have not been mapped.
3. Unincorporated areas with existing development at risk.
4. Unincorporated areas, with significant developments proposed, that have not been mapped.

Evaluation measure: Miles of stream, with development that meets a certain population threshold, that have SFHA maps.

Glossary

One percent annual chance floodplain

The boundary of a flood that has a one percent chance of being equaled or exceeded in any given year. Also known as the 100-year floodplain.

One percent annual chance water-surface elevation

The height of a flood having a one percent chance of being equaled or exceeded in any given flood year (also known as the 100-year flood or the base flood).

100-year flood

The flood having a one percent chance of being equaled or exceeded in any given year; also known as the base flood. The one percent annual chance flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on an NFIP map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

100-year floodplain

The boundary of the flood that has a one percent chance of being equaled or exceeded in any given year. Officially termed the one percent annual chance floodplain.

500-year floodplain

The boundary of the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. Officially termed the 0.2 percent annual chance floodplain.

Base flood

The flood having a one percent chance of being equaled or exceeded in any given year; also known as the 100-year flood. The base flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a Special Flood Hazard Area shown on an NFIP map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

Base Flood Elevation (BFE)

The elevation of a flood having a one percent chance of being equaled or exceeded in any given year.

Cooperating Technical Partner (CTP) Program

The Cooperating Technical Partners (CTP) Program is an innovative approach to creating partnerships between FEMA and participating National Flood Insurance Program (NFIP) communities, regional agencies, and State agencies that have the interest and capability to become more active participants in the FEMA Flood Hazard Mapping Program.

Cross section

A line developed from topographic information across a floodplain at which a computation of flood flow has been made to establish a potential flood elevation. Cross sections are shown on the Flood Boundary Floodway Map, Flood Insurance Rate Map, and/or Flood Profiles of a Flood Insurance Study.

Cubic feet per second (cfs)

Typical unit used to express the rate of flow of surface water in open channels. One cubic foot is approximately equal to 7.5 gallons per second.

Depth

Maximum depth of water in the cross section as measured below the water surface elevation.

Detailed Study

A flood hazard study that, at a minimum, results in the delineation of the floodplain boundaries for the one percent annual chance (100-year) flood and the determination of base flood elevations or flood depths.

Digital Flood Insurance Rate Map (DFIRM)

A Flood Insurance Rate Map (FIRM) that has been prepared as a digital product, which may involve converting an existing manually produced FIRM to digital format, or creating a product from new digital data sources using a Geographic Information System environment. The DFIRM product allows for the creation of interactive, multi-hazard digital maps. Linkages are built into an associated database to allow users options to access the engineering backup material used to develop the DFIRM, such as hydrologic and hydraulic models, flood profiles, floodway data tables, digital elevation models, and structure-specific data, such as digital elevation certificates and digital photographs of bridges and culverts.

Discharge

The volume of water that passes a given location within a given period of time. Usually expressed in cubic feet per second (cfs).

Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency, a formerly independent agency that became part of the Department of Homeland Security in March 2003, is tasked with responding to, planning for, recovering from and mitigating against disasters. The agency's mission is: to lead America to prepare for, prevent, respond to and recover from disasters with a vision of "A Nation Prepared."

Flood (also Flooding)

A general and temporary condition of partial or complete inundation of normally dry land areas. For flood insurance claim purposes, two or more structures must be inundated before flood damage will be covered.

Flood Insurance Rate Map (FIRM)

The insurance and floodplain management map produced by FEMA that identifies, based on detailed or approximate analyses, the areas subject to flooding during a one percent annual chance (100-year) flood event in a community. Flood insurance risk zones, which are used to compute actuarial flood insurance rates, also are shown. In areas studied by detailed analyses, the FIRM shows BFEs to reflect the elevations of the one percent annual chance flood. For many communities, when detailed analyses are performed, the FIRM also may show areas inundated by 0.2 percent annual chance (500-year) flood and regulatory floodway areas.

Flood Insurance Study (FIS)

The examination, evaluation, and determination of flood hazards performed for a community. This

report contains the information found during the study of the community's flooding sources including study methodology, source data, discharges, water surface elevations, flood profiles, and references.

Flood profile

A cross-sectional drawing showing the contiguous cross sections along a stream, with ground elevations and potential flood elevations plotted.

Floodplain management

The operation of a program of corrective and preventative measures for mitigating flood damage, including, but not limited to, emergency preparedness plans, flood-control works, and floodplain management regulations.

Floodway

Channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood discharge can be conveyed without increasing the elevation of the 100-year flood by more than a specified amount (one foot in most states).

Letter of Map Amendment (LOMA)

An official determination by FEMA that a property has been inadvertently included in a Special Flood Hazard Area (SFHA) as shown on an effective FIRM and is not subject to inundation by the 1-percent-annual-chance flood. Generally, the property is located on natural high ground at or above the BFE or on fill placed prior to the effective date of the first FIRM map designating the property as within an SFHA.

Letter of Map Revision (LOMR)

A letter issued by FEMA to revise the FIRM and/or FIS report for a community to change BFEs, floodplain and floodway boundary delineations, and coastal hazard areas.

Limited Detail Study

The method of Special Flood Hazard Area (SFHA) identification that can be used if a Triangular Irregular Network (TIN) of Light Radar Detection and Ranging (LiDAR) data (or other digital elevation data) with break lines is available. Cross sections and road data are obtained from these data. Openings of structures and Manning's "n" values may be estimated with limited field inspections. No new field survey is taken. A GIS-based tool may be used to create cross section and structure data for the HEC-RAS program to determine the one percent annual chance water surface elevations. Because the 1-percent-annual-chance water-surface elevations are determined using approximate hydrologic and hydraulic methods with topographic and structural data, BFEs will not be shown on the FIRM, but will be provided to the community and may be used as 'best available data' for floodplain management regulatory purposes.

National Flood Insurance Program (NFIP)

Federal insurance program under which flood-prone areas are identified and flood insurance is made available to residents of participating communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage.

Orthophotograph

Aerial photographs that have been rectified to produce an accurate image of the Earth by removing tilt and relief displacements that occurred when the photo was taken. An orthophotograph has the same scale throughout and can be used as a base map for the DFIRM.

Redelineation

This method of Special Flood Hazard Area (SFHA) identification can only be used for previously studied streams. Using this method, the SFHA boundary is redefined using the effective water surface elevations superimposed on updated topography. No changes are made to the currently effective model. This case involves situations for which new topographic data exists for a study reach or entire county. The new topographic data is more recent and of higher quality than the topographic data originally used in the effective study. When the original hydraulic model is not available digitally but the model is correct, the effective FEMA profile forms the basis of the redelineation. The appropriate vertical datum conversion is applied, and the revised flood boundaries are mapped on the new topographic source. In this case, the BFEs will be republished on the DFIRM. The deliverable will be digital flood boundaries that match best available topographic data, recreated flood profiles, and floodway data tables meeting FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners.

Special Flood Hazard Area (SFHA)

The area delineated on a National Flood Insurance Program map as being subject to inundation by the base flood. SFHAs are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with a community; floodplain topographic surveys; and hydrologic and hydraulic analyses.

Attachment 1 – State Floodplain Mapping Coordinators

State Floodplain Mapping Coordinator Contact Information, December 2010

State	State Flood Mapping Coordinator	Phone Number	Email Address
AL	Leslie Durham	334.353.5506	Leslie.Durham@adeca.alabama.gov
AR	Alvin Simmons	501.682.3981	Alvin.Simmons@arkansas.gov
CO	Dawn Gladwell	303.866.3921	Dawn.Gladwell@state.co.us
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GA	Collis Brown	404.657.6233	Collis.Brown@dnr.state.ga.us
ID	Barbara McEvoy	208.287.4926	Barbara.Mcevoy@idwr.idaho.gov
IL	Sally McConkey	217.333.5482	sally@sws.uiuc.edu
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MS	Steve Champlin	601.961.5506	Stephen_Champlin@deq.state.ms.us
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NC	John Dorman	919.715.8000	John.Dorman@ncmail.net
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OR	Mark Darienzo	503.373.0050 ext. 269	Mark.Darienzo@state.or.us
OR	Christine Valentine	503.373.0050 ext 250	Christine.Valentine@state.or.us
SC	Ronnie Catoe	803.734.1411	catoer@dnr.sc.gov
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TN	Joe Chapman	704.643.0108	jchapman@watershedconcepts.com
UT	John Crofts	801.538.3332	jcrofts@utah.gov
VT	Gretchen Alexander	802.241.4596	Gretchen.Alexander@state.vt.us
WA	Jerry Franklin	360.407.7470	Jfra461@ecy.wa.gov
WI	Amanda Schwoegler	608.267.2795	Amanda.Schwoegler@wisconsin.gov
WY	Shawn Lanning	307.766.6281	Sql55@uwyo.edu

Attachment 2 – Contentious Mapping Projects List

<u>County</u>	<u>State</u>	<u>Reason For Appeal</u>	<u>Resolution</u>
Region I			
Middlesex	MA	The H&H for Alewife Brook came into question, particularly for a site called Cambridge Discovery Park. In particular, the floodway for this brook was larger than shown in the previous effective FBFM, so the community and developer of the property raised concerns regarding the accuracy of the new study and the potential impacts the revised floodway could have on the future use and development of the site.	The 04/11/2008 meeting held with S E A, Dewberry, and FEMA led to the BSC Group's subsequent appeal of 09/10/2008. This appeal was resolved by letter dated 03/12/2009. BSC Group followed up with a letter received on 04/27/2009, and this appeal was further resolved by letter dated 07/15/2009. However, the State NFIP Coordinator raised concerns on 08/07/2009 regarding the appeal resolution and the 07/15/2009 letter was rescinded on 09/16/2009. BSC Group followed with a letter dated 11/10/2009 and Dewberry provided responses to the RMC on 11/25/2009. Further, a CLOMR (10-01-0436R) was initiated on 12/07/2009 for the site in question.
Region II			
Monmouth	NJ	Communities were not given adequate lead time for de-accreditation of levee. Preliminary map was released shortly thereafter. Economic hardship area.	Resolution letter sent.
Suffolk	NY	Areas with significant increase in SFHA. Very wealthy area, some to pay significant amounts of insurance through 3rd party lenders. Technical issues that were insubstantial. Volume of insubstantial appeals.	Pending.
Niagara	NY	Unfair SFHA areas like islands, economic hardship areas.	Pending.
Region III			
District of Columbia	--	Protest - FEMA should make appeal period longer for Washington DC and should have provided extensive public outreach and stakeholder involvement. Against showing impacts from de-accredited Potomac Park Levee because of impact to new African-American History Museum.	Custom comment period added to appeal period. LFD rescinded. Custom 2-year plan to build levee and get certification of existing berm instituted.
Nelson	VA	On August 30, 2007 FEMA Region staff attended the Outreach/ Final Meeting (not required because there are no new studies or BFEs) in Nelson County. The surveyors and county officials expressed frustration that there would be no new studies with this map update. They felt the burden of deriving a BFE for (continued) development in the A Zone SFHAs was cost prohibitive and gave a typical cost of \$10,000. They also asked	Remap.

		why they could not use the rudimentary flood heights from the Army Corps of Engineer studies that are the basis of the A Zones.	
Bedford	VA	Lake Vista modeling, Ivy Lake BFE discrepancies, Swan Lake top of dam elevation survey needed, Spring Lake top of dam elevation survey needed, issues with other ponds and Smith Mountain Lake based on VGIN topo.	Re-map, fixes.
Region IV			
Hancock	MS	City perceived the BFEs were unrealistically high and would inhibit economic recovery.	Minor adjustments to Coastal BFE gutters and VE-AE Zone boundary, based on detailed transect data submitted by the City.
Richland	SC	Floodway delineation would restrict planned development project.	Appeal denied, but lawsuit challenged FEMA protocols.
Region V			
Lake	OH	Appeal of BFEs on Wasson Ditch/Heisley Creek within City. Are providing revised detailed H&H analysis, flood hazard delineations and profiles along with digital data to support appeal. Full appeal data received on 02/08/2008.	--
Brown	WI	Community resistance to accepting the coastal mapping BFEs and the techniques backing them up.	LFDs were issued on 2/18/2009 with R5's approval.
Hennepin	MN	The proposed 100-year floodplain boundary would remove most of the flood-prone homes upstream of 34 th Street from the floodplain even though there have been past flooding issues in this area.	Revised Prelim (08-05-2032S).
St. Clair	IL	Zone AR – levees.	BFE notice on hold due to Congressional pressure to wait until Missouri counties are issued preliminary.
Monroe	IL	Zone AR – levees.	BFE notice on hold due to Congressional pressure to wait until Missouri counties are issued preliminary.
Madison	IL	Zone AR – levees.	BFE notice on hold due to Congressional pressure to wait until Missouri counties are issued preliminary.
Kent	MI	Levee was de-accredited, but H&H about 30 years old. New study was performed.	Levee will still be de-accredited.
St. Clair	MI	Increased SFHA and BFEs.	FEMA R5 funded USACE to update the Anchor Bay BFEs.
Region VI			
Pulaski	AR	Levee issues.	About to release 10 revised preliminary panels.
Jefferson	AR	Levee issues.	--
Lonoke	AR	7 earmarked panels - County -- corrections from a previous study	--

		completed.	
Harris	TX	Ranged from providing technical data, challenge of model and delineation of flood boundary, disagreement with being placed in floodplain, to objection to FEMA remapping without reasons being provided for that remapping.	Every panel of this study was revised due to appeals. Revised Preliminary was distributed.
Comal	TX	Disagreement with delineation of floodplain, floodway and elevations	Appeal period ended 12/11/2007; the city submitted an appeal and the mapping was revised. LFD set for 3/2/2009.
El Paso	TX	Levee issues.	County will have revised preliminaries.
Chaves	NM	Disagreement with delineation of flood boundaries not reflecting LOMR information.	Flood boundaries were revised; LOMR was included as approved.
Dona Ana	NM	Levee and alluvial fan issues.	Rio Grande was remodeled and remapped with different process to show the unprotected areas; community is awaiting detailed information on the alluvial fan study.
Bernalillo	NM	Community could not certify a portion of the levee along the Rio Grande; wanted to stall the entire study until it could get reconstructed.	De-certified levee was shown to be not providing protection.
Tulsa (County, City of Tulsa)	OK	Appealed delineation of floodplain, extended backwater of tributaries, problems with people not filing LOMRs and wanting recent study to be incorporated into the study beyond the time frame of incorporation. Also had levee issues.	Revised panels -- second appeal was initiated.
Tulsa (City of Jenks)	OK	Requested better definition of the FEMA Guidance for mapping of areas protected by levee system.	Historic appeal - FEMA floodway mapping policy regarding landside toe was better-defined due to this appeal. If the 100-year flood does not touch the levee, it will not apply.
Cleveland	OK	Disagreed with preliminary - wanted new LiDAR and new contour data included.	--
Lafayette	LA	Disagreed with preliminary, BFEs, coastal and LiDAR.	Requested all back-up data and stop to any further study statewide. Requested a re-study of the entire coastal surge analysis.
St. Mary	LA	Disagreed with preliminary, BFEs, coastal and LiDAR.	Requested all back-up data and stop to any further study statewide. Requested a re-study of the entire coastal surge analysis.
Cameron	LA	Disagreed with preliminary, BFEs, coastal and LiDAR.	Requested all back-up data and stop to any further study statewide. Requested a re-study of the entire coastal surge analysis.
Region VII			
Finney	KS	Including two drainage ditches as flooding sources in Garden City added areas to the SFHA that included 1800 homes. Public notices had not been properly sent to communities. No BFEs were established, therefore community	FEMA withdrew Letter of Final Determination. Since maps no longer proposed, lawsuit dismissed. Community wants to restart study process.

		could not file an appeal. Community filed a lawsuit.	
Buffalo	NE	Survey data was wrong in new detailed study.	New survey data, hydraulic analysis, and mapping was provided and used in the map.
St. Charles	MO	A levee was erroneously shown as being accredited.	Modeled the without-levee scenario and mapped as de-accredited.
Region VIII			
Custer	MT	Complicated with- and without-levee flow paths resulted in high BFE discrepancies (3-4 feet) along gutters that separate flow paths. Community has asked that these be reevaluated and the Region and contractor agreed that a cross-section can be reoriented.	Revised preliminary and letter.
Park	MT	City protested based on more up-to-date topographic information that was collected after the USACE H&H analysis and prior to issuance of preliminary DFIRM by IDIQ.	Never made it to protest since the city communicated their intent to appeal prior to 90-day appeal period start.
Region IX			
Los Angeles	CA	A portion of the Park Mesa Heights neighborhood north of a RR embankment was added to the SFHA. Topographic data available when mapping was developed showed that area should not have been included. Concerns of residents were not addressed initially.	FEMA issued a LOMR that changed the newly added area north of the railroad embankment from a Zone A to a shaded Zone X. The FEMA Regional Office has received funding to conduct a detailed study for the area.
Yuba	CA	Three levee segments along the Lower Feather River basin were certified/accredited, and the community requested to revise the SFHA on the effective FIRM panels.	FEMA proposed a hybrid hydraulic model and revised BFEs on the Lower Feather River and other tributaries to account for the certified/accredited levee segments.
Ventura	CA	Camarillo and Moorpark submitted appeals, which were lacking adequate data. Both communities were sent an AD request. The study involves complicated engineering analyses. The communities wanted the modeling to be redone using 2-D analysis, instead of HEC-RAS. Camarillo ended up dropping the appeal. The Moorpark appeal was resolved.	A 316-PMR was processed to incorporate the revised analysis. The study results were incorporated into the countywide DFIRM.
Douglas	NV	Douglas County disagreed with the hydrologic analyses completed (primarily for Buckeye Creek and Buckbrush Wash). The 100-year discharges had increased significantly, resulting in approximately 5000 acres (continued) being added to the SFHA. County hired engineering firm to conduct a new hydrologic study in order	A response letter was provided stating "preliminary FIS and FIRM continue to be the most accurate depiction of the existing flood hazards" and indicating the submitted appeal does not demonstrate more reasonable results than the FEMA study. Douglas County started ongoing litigation in order to prevent the new DFIRMs from becoming effective (the LFD went out on 7/20/09, and the maps are now

		to protest the NHC results.	effective).
Mohave	AZ	The community had digitized its FIRMs several years ago and was using these maps for community planning. FEMA also digitized FIRMs that did not match.	FEMA eventually provided the geospatial preliminary linework to the community for it to edit directly.
Pima	AZ	The Town of Marana disagreed with how non-levee embankments (CAP canal, highway and railroad embankments) were treated and conducted a 2-D hydraulic study to redelineate the SFHA due to Tortolita alluvial fan flooding.	FEMA worked with the community and its study contractor to review/revise the study to comply with FEMA Guidelines and Specifications. The study was accepted and incorporated into the countywide DFIRM.
Yuma	AZ	Levee issues, request by county for additional flood hazard maps for washes on 25 panels, dam not recognized, floodway issues, and roads incorrectly named.	Some levees accredited, additional flood hazard maps for washes added, dam added, floodways corrected, errors in decertified levees corrected to reflect actual field conditions. According to community, "being given the opportunity to see the technical data and knowing that our comments were being considered made it possible for Yuma to stand behind the end product."
Region X			
Spokane	WA	City claimed dry wells and infiltration rates were not accounted for properly in the hydrology for the Chester Creek re-study and that discharges, even though they were greatly reduced from the effective, were still not low enough.	Revised Prelim using reduced flows. BFEs changed upstream and downstream of wells (increases and decreases), and floodplain shrank downstream of wells.
Grant	WA	As a result of a new study, the floodway through the Town of Wilson Creek expanded. The Town claims that certain properties are now in the floodway and will lose value, and that certain undeveloped areas in the Town can never be developed.	Proof copies of DFIRM including a "Special Flood Risk Zone" between the effective floodway and the new floodway, as approved by RX and FEMA HQ.
Skagit	WA	City (and its engineering contractor) claims "serious flaws" in the hydrology, 2-D modeling, and resulting flood elevations and depths. Appeal resolution ongoing.	N/A
Canyon	ID	City (and its engineering contractor) claims basalt substrate leads to high infiltration and lower discharges entering the system; also claims that carrying capacity of NY Canal upstream of city is higher than what was assumed for study and lower flows will ultimately enter Caldwell through Indian Creek. (continued) Resolution ongoing.	Revised prelims for the 13 affected panels were issued 12/31/2009, showing the reduced base flood discharge and BFEs for Indian Creek.
Shoshone	ID	City of Wallace and Shoshone County claimed that a flood control structure (channelization) was not completely	Draft maps sent to communities showing flood control structure. The Region also entered into a PAL agreement with the City and County. The

		incorporated into the maps.	structure was shown on the revised FIRMs with the PAL note.
Clatsop	OR	Three separate letters were submitted with appeals: first the City claimed that the language within Section 4.1 of the FIS required redelineation of the FP boundaries with 2-foot contour data. Another appeal claims that their levees should be certified Warrenton Diking District No 1. The third letter referred to the change in BFE and the city's concern that they had not been given an opportunity to review those changes.	Information regarding the revisions that occurred as part of the Map Mod study can be found in Section 10; information in preceding sections, including the reference in Section 4.1, applies to previous map revisions. Based on data available in the levee inventory from the USACE, FEMA Region X confirmed that there are no levees eligible for re-accreditation within Clatsop County and Incorporated Areas. The city was notified of the change in BFEs again in the 2/2008 revised BFE notification (101/155) letter which informed the community CEO of the appeal period. **Despite the "appeal resolution" the City has since been to FEMA HQ to discuss.**