NFHL Web Map Service (WMS)

Add Flood Hazard Map Layers to Your GIS Applications

Purpose and Appropriate Use

FEMA provides access to the National Flood Hazard Layer (NFHL)[1] and related data through a WMS. You can use the service to add web-based digital flood hazard maps to business applications. You also can look up attribute information for data portrayed on the maps.

FEMA publishes new Flood Insurance Rate Maps (FIRMs) in the form of paper maps, digital map images, and digital geospatial flood hazard data like those in the NFHL. When used appropriately, these representations are equivalent to one another and represent official FEMA designations of Special Flood Hazard Areas (SFHAs), base flood elevations (BFEs), insurance risk zones, and other regulatory information.

If you plan to use the map images provided by the WMS for official purposes, ensure that imagery and other map information displayed with the flood data meet FEMA's standards for map accuracy[2].

What is a WMS?

A WMS creates map images from a database of map information and delivers the images over the Internet. A WMS also can retrieve attribute information for the data portrayed in the image.

The image files generated by a WMS contain information about the location on the Earth's surface portrayed by the image. To create custom maps, a computer mapping program uses this location information to register WMS map images to other map information. For example, you can use Geographic Information System (GIS) software to overlay map images from a WMS on your map data.

Computer programs request the images or attribute information using URLs defined by the WMS specification. The FEMA service complies with version 1.1.1 of the WMS specification. The specification, developed by the Open Geospatial Consortium, Inc.,® is available at http://www.opengeospatial.org/standards/wms.

To use a WMS you need web-based mapping or GIS software, or software that you develop, that displays WMS images and a high-speed Internet connection.

Viewing Flood Hazard Data in Your GIS Using the "NFHL" WMS

FEMA's WMS named "NFHL" portrays the full range of NFHL map features. Areas of high flood hazard are symbolized in red (see Figure 1). The symbols were designed to be legible when overlaid on imagery.

Figure 1. Portion of a map image returned by the NFHL WMS. Only a few of the available map layers are shown. The image is for an area in Pittsburgh, Pennsylvania.

Computer mapping programs have different means for accessing a WMS. Some only require you to enter a URL while others require you to provide additional software. See the documentation for your software to learn how to add a WMS.

Regardless of how your software works, you will need one or more of the following URLs to access the NFHL WMS. The service responds to the GetCapabilities, GetMap, and GetFeatureInfo requests defined by the WMS specification. Many software applications only need the GetCapabiltiies URL to access a WMS.

The "NFHL" service:

- Responds to GetCapabilities requests through the URL:

  http://hazards.fema.gov/wmsconnector/wmsconnector/Servlet/NFHL?REQUEST=GetCapabilities&SERVICE=WMS

- Responds to GetMap requests through the URL:

  http://hazards.fema.gov/wmsconnector/wmsconnector/Servlet/NFHL?VERSION=1.1.1&REQUEST=GetMap&*[the WMS GetMap parameters that describe a particular map]*

[1] The National Flood Hazard Layer is a computer database that contains the digital flood hazard information from FEMA's Flood Map Modernization program. These map data include Digital Flood Insurance Rate Map databases and later changes made by Letters of Map Revision. They do not include changes identified by property description. Maps that have not been modernized are not available in the NFHL, but can be viewed and ordered from FEMA's Map Service Center at http://msc.fema.gov.

[2] A base map shows the location of roads and railroads, streams and lakes, boundaries, structures, and other features. When used with flood hazard data for official purposes, base maps must have a horizontal radial accuracy ($Accuracy_r$) better than or equal to 38 feet (11.58 meters) as measured using the National Standard for Spatial Data Accuracy. (This measure is equal to maps of scales larger than or equal to 1:12,000 under the old National Map Accuracy Standard.)

- Responds to GetFeatureInfo requests [3] through the URL:

  http://hazards.fema.gov/wmsconnector/wmsconnector/Servlet/NFHL?VERSION=1.1.1&REQUEST=GetFeatureInfo&*[the WMS GetFeatureInfo parameters that describe a particular map, and the layer(s) and the location on the map for which attribute information is requested]*

NFHL Data Are Organized as Map Layers

The NFHL WMS makes information available as map layers. Each layer displays a theme of data, such as flood hazard areas, floodways, cross sections, and coastal transects. Each layer has a name, a title, a set of map symbols, and a range of map scales for which the service provides a map image. View the list of layer titles and associated map symbols at http://tinyurl.com/5h5d6z.

The service also provides reference information that complements the DFIRM data in the NFHL. For areas for which flood hazard data are not available from the NFHL, a map layer portraying an older set of flood hazard data, named the "Q3" data, might be available. Another layer displays the approximate locations of places described in Letters of Map Amendment (LOMAs) and Letters of Map Revision Based on Fill (LOMR-Fs) and their case numbers. The service also provides map layers that display flood data and flood map availability and a version of the national FIRM panel scheme.

Accessing Commonly-Used Layers

Five information themes are of common interest to users: flood hazard zones, cross sections, communities, FIRMs, and LOMRs (see Figure 2). These themes are available using the layers listed below.

- Flood hazard zones: The layers titled "Flood Hazard Zones (Detailed)" and "Flood Hazards Zone Boundaries" show insurance risk zones with red (high hazard), pink (medium-to-low hazard), and gray (undetermined hazard) line patterns and outlines. Areas of low hazard are not shaded.
- Cross sections: When used with the Flood Insurance Study for the community, cross sections are the basis for calculating a BFE. The layer titled "Cross Sections" shows cross section lines and labels in orange.
- Communities: The layers titled "Jurisdiction Names" and "Jurisdiction Boundaries" show the names and boundaries with brown text and line symbols. If you use both layers and see a name but no boundary, the entire WMS image is within the community.

Figure 2. Map image of commonly used layers from the NFHL WMS overlaid in 3-d on imagery and terrain data in Google Earth.™ [4] The area is the same shown in Figure 1.

- FIRMs: The layer titled "DFIRM Panels (detailed)" shows the 11-character number and boundaries of FIRM panels in light blue. If you see a number but no boundary, the entire WMS image is within the panel.
- LOMRs: The layer titled "LOMR's" shows the case number and boundaries of effective LOMRs in dark blue. If you see a number but no boundary, the entire WMS image is within the LOMR.

All of these layers display information at map scales of 1:32,000 and larger. Some also display information at smaller map scales.

Sources of Additional Information

FEMA web site for the NFHL WMS: See the MSC web site at http://msc.fema.gov. In the area for NFHL-related services, follow the link "Use Web Map Service in your own GIS application."

Questions or comments about the NFHL WMS: Direct them to MIPhelp@mapmodteam.com. Please include the words "NFHL WMS" in the subject of your message. Note that FEMA cannot answer questions about using the WMS in a brand of software.

To view and buy flood maps and data: See the MSC web site at http://msc.fema.gov.

For information and resources associated with using or requesting changes to FEMA Flood Maps: See the Flood Hazard Mapping web site at http://www.fema.gov/plan/prevent/fhm/index.shtm.

For general information about flood risk, flood insurance, and the National Flood Insurance Program: See the FloodSmart web site at http://www.floodsmart.gov.

[3] The GetFeatureInfo function returns table, attribute, and value information for layers identified in the URL. Find specifications for the tables, attributes, and values in the DFIRM database specifications. See section L7, "Database Table Structure for Preliminary and Final Digital Flood Insurance Rate Map Databases," in Appendix L, "Guidance for Preparing Draft Digital Data and DFIRM Databases," of *Guidelines and Specifications for Flood Hazard Mapping Partners*. Appendix L is available through http://www.fema.gov/library/viewRecord.do?id=2206. A WMS layer has one corresponding DFIRM database table.

[4] Names of products are provided for descriptive purposes only and do not represent an endorsement by the United States Government.

"NFHL" WMS			
Layer Title	Description	Map Scale Ranges [5]	
		Upper	Lower
DFIRM Flood Hazard and Related			
Floodways	Mapped regulatory floodways	1:300,000	
Floodways (linear)	Floodways contained in structures	1:300,000	
Limit of Floodway	Floodway limits labeled on Flood Insurance Rate Maps (FIRMs)	1:32,000	
Flood Hazard Zones (General)	Flood hazards shaded by annual chance of flooding	1:300,000	
Flood Hazard Zones (General-med) [6]	Flood hazards shaded by annual chance of flooding	1:300,000	1:32,001
Flood Hazard Zones (General-lrg) [7]	Flood hazards shaded by annual chance of flooding. Transparency set at 50 percent.	1:32,000	
Flood Hazard Zones (linear)	Flood hazard events contained in a structure	1:300,000	
Flood Hazard Zones (Detailed)	Flood hazards shaded by flood insurance risk zone	1:32,000	
Flood Hazards Zone Boundaries	Flood hazard zone boundaries shown or labeled on FIRMs	1:32,000	
CBRS and OPA Units	Coastal Barrier Resource System (CBRS) and Otherwise Protected Area (OPA) units	1:300,000	
Base Flood Elevation	Base Flood Elevation (BFE) lines symbolized by vertical datum and labeled with the BFE	1:32,000	
Cross Sections	Cross section lines labeled with their identifier	1:32,000	
Coastal Transects	Coastal transect lines labeled with their identifier	1:32,000	
General Structures	Hydraulic structures, levees, channels, and other structures that impact flood risk	1:32,000	
Q3 Flood Hazard			
Q3 Flood Hazards (red) [8]	Older portrayal of areas with 1-percent-annual-chance flood hazards	1:300,000	
Q3 Flood Hazards	Older portrayal of areas with 1-percent-annual-chance flood hazards	1:300,000	

"NFHL" WMS			
Layer Title	Description	Map Scale Ranges [5]	
		Upper	Lower
Community			
Jurisdiction Boundaries	Symbolized community and other boundaries	1:300,000	
Jurisdiction Names	Names of communities and other jurisdictions	1:32,000	
Jurisdiction Names 2	Secondary names of communities and other jurisdictions	1:32,000	
FIRM, LOMR, and LOMA/LOMR-F			
DFIRM Panels (detailed)	FIRM panel boundaries and numbers from Digital Flood Insurance Rate Map (DFIRM) databases	1:300,000	
LOMR's	Effective Letter of Map Revision (LOMR) boundaries and case numbers for which data are available in the NFHL	1:300,000	
LOMA and LOMR-F	Approximate locations of recent Letters of Map Amendment (LOMAs) and Letters of Map Revision Based on Fill (LOMR-Fs) and their case numbers	1:300,000	
Flood Map Panels (national) [9]	National Flood Insurance Program (NFIP) map panel boundaries and numbers.	1:300,000	1:32,001
Base Map and Reference			
Bench Marks	Bench marks labeled with their permanent identifier	1:32,000	
River Distance Markers	River marks labeled with their river mark number	1:32,000	
Streets (from DFIRM)	Roads, railroads, and airports and names	1:32,000	
Streams	Streams and names	1:32,000	
Water Bodies	Water bodies and names	1:32,000	
PLSS	Public Land Survey System (PLSS) township and section lines	1:300,000	
USGS Quads	U.S. Geological Survey (USGS) 7½-minute topographic map boundaries and names	1:300,000	
Watershed (HUC)	Hydrologic unit boundaries at the subbasin level and 8-digit hydrologic unit codes (HUCs)	1:25,000,000	

[5] Labels for many layers display at map scales of 1:32,000 and larger only.
[6] Same as Flood Hazard Zones (General) except for the scale range.
[7] Same as Flood Hazard Zones (General) except for the scale range.
[8] Recommended. Same as Q3 Flood Hazards except for symbology.
[9] Maps available from the MSC. Due to different maintenance schedules, this layer might not match the DFIRM Panels (detailed) layer.

"NFHL" WMS			
Layer Title	Description	Map Scale Ranges [5]	
		Upper	Lower
Status Information			
Flood Data Availability	County-based status map of DFIRM database, partial DFIRM database, or Q3 data coverage. (Data for these areas are available in the NFHL.)		1:300,001
Preliminary Maps Issued	County-based status map of areas for which FEMA issued preliminary maps. These areas show DFIRM database coverage that will next appear in the NFHL. (These counties currently might have Q3 data.)		1:300,001
DFIRM Data Availability [10]	Community-based status map of DFIRM database coverage available in the NFHL.	1:1,000,000	
Flood Map Availability [11]	Status map of NFIP map availability from the MSC.	1:1,000,000	
Mask Layers (used with other layers)			
No DFIRM mask	Backdrop used to symbolize area for which there are no DFIRM data	1:300,000	
Flood hazard zone (mask)	Backdrop of areas covered by a zone designation other than "area not included"	1:300,000	

NFHL WMS "Tips and Tricks"

■ *My application has an option of identifying a background color (a color that my application makes transparent). Which color should I choose?*

"White," red-green-blue (RGB) code 255,255,255.

■ *Instead of an image, the WMS returns the message "Requested image is too big and cannot be created." What should I do?*

The maximum image size is 1024-by-1024 pixels. Change the WIDTH and HEIGHT parameters in your GetMap URL to request an image of 1024-by-1024 pixels or smaller. It you cannot control these parameters directly:

- Make your map window smaller until an image appears.
- If you need a large map window, see if your application will tile the WMS images. In this approach, the application requests multiple smaller images from the WMS and tiles them to fill a large area. One drawback of this approach is that labels for features that span tiles will be repeated for each tile. (For example, the name of a community that spans three tiles will be repeated on each tile.)

■ *The whole image is covered by purple solid or vertical striped shading. How do I turn this off?*

Turn off the layer "DFIRM Data Availability" (for solid shading) and "Flood Map Availability" (for striped shading).

■ *I would like to see through the image when I overlay it on other maps. What are my options?*

Options include:

- Use the image "as is." Most area shading uses a weave pattern that you can see through if the color "white" is set to be transparent.
- If your application permits it, make the image transparent. If you would like some layers to be transparent and not others, add the WMS to your application twice. In one instance of the WMS, only turn on the layers to be transparent and set the transparency parameter. In the other instance, only turn on the layers to be solid.

■ *Why are there two "Q3 Flood Hazards" layers?*

"Q3 Flood Hazards (red)" is easier to see over imagery, has the color of similar DFIRM flood hazard data, and is recommended. "Q3 Flood Hazards" was retained for backwards compatibility with existing applications. They show the same information.

■ *Why are there three layers for "Flood Hazard Zones (General)"? Should they be used together?*

The three layers allow for flexibility in map display. The layer shows all "A" (A, AE, AH, etc.) and "V" (V and VE) zones in one symbol; the "Shaded X" zone in another symbol; and the "D" zone in a third symbol. If you want to show this generalized information throughout the scale range, use "Flood Hazard Zones (General)." If you want to show generalized zone information at medium map scales, but detailed zone information (i.e., distinguish between zones A, AE, AO, V, VE, etc.) at large map scales, use "Flood Hazard Zones (General-med)" and "Flood Hazard Zones (Detailed)" together. Do not use all three layers together.

■ *When should I use the Mask Layers?*

Use the Mask Layers with one or more of the "Flood Hazard Zones" layers (general or detailed) to distinguish where there are no flood hazard data in the NFHL. When sequenced in the drawing order (from top to bottom) "Flood Hazard Zones" (general or detailed), "Flood hazard zone (mask)", and "No DFIRM mask," the display shows zones A, V, Shaded X, and D in red, pink , and gray; Zone X and open water in white, and areas for which there are no data (including flood hazard areas coded as "area not included") in yellow. If an area has overlapping polygons coded as "area not included" and as one of the zone designations, it will be shaded with the zone designation.

[10] Created for a particular application. Not useful to most applications.
[11] Created for a particular application. Not useful to most applications.