



Attachment 2

Evaluation of FEMA Map Service Center Products & Tools

Moving to Digital Flood Hazard Information Issues and Recommendations for **The Limited Distribution of Paper Flood Insurance Rate Maps**

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Review of FEMA Digital Products and Tools

A review of the tools and data that FEMA provides on the Map Service Center (MSC) to replace the printed maps is an important part in establishing how easy the transition will be for users to move to the digital products.

Initially a topical review asked novice users to comment on:

- the MSC and each product's instructions
- design—does the product do what the user expected?
- how easy products are to customize
- if products were too difficult to learn to use in a short period of time

Both a technical reviewer and a novice (casual) user completed this review. Little additional instruction was given to either reviewer outside the MSC Web site address and the "*Moving to Digital Flood Hazard Information*" flier as a guide.

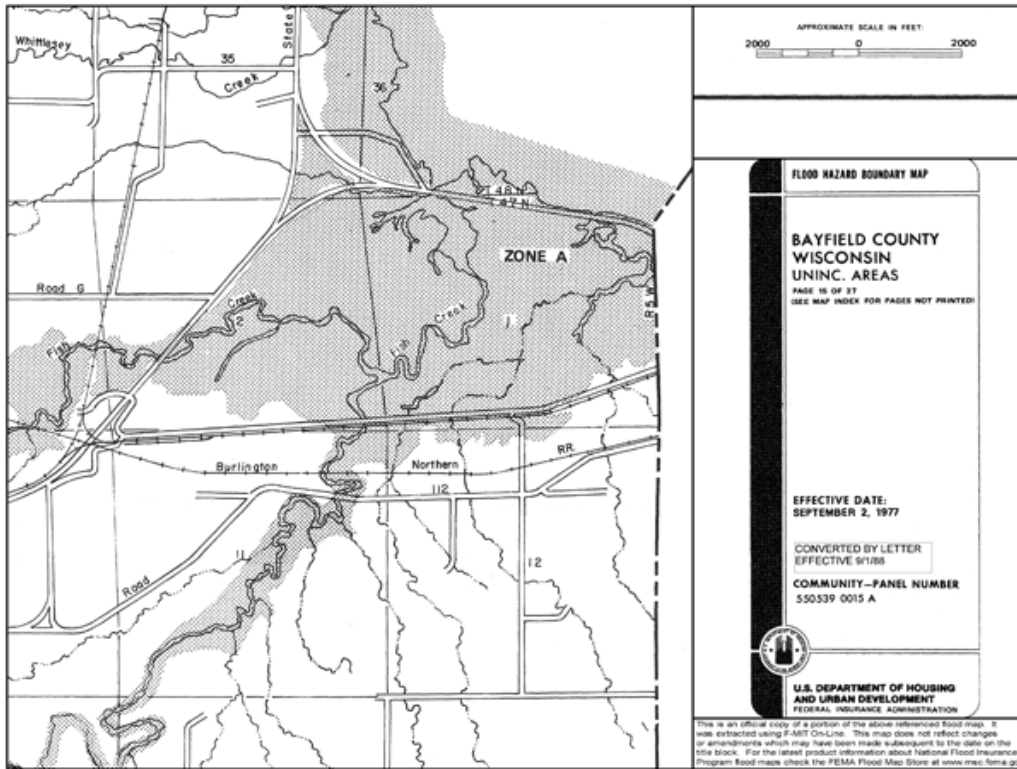
A.1 FEMA Data Products

A.1.1 FIRM Scans

There are actually 2 varieties of FIRM "scans" available. One version are truly scans of printed FIRM maps. But for areas that have digital (GIS) data, they are actually digitally rendered maps from the GIS data. This isn't mentioned in the help, and may cause confusion with non-experienced users as the FIRMette tutorial shows only old variety.

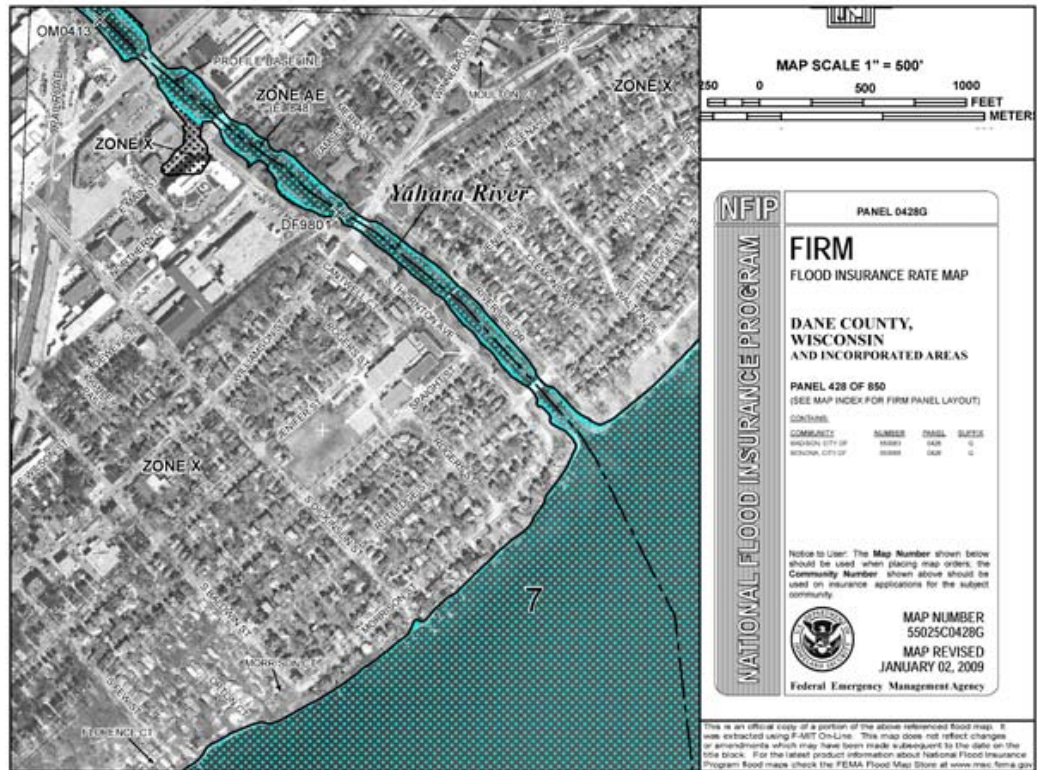
The scans are done at 400dpi, but as bitmaps (on/off pixels) so that some detail is lost. Where the printed lines and text are not completely black, the scan ends up speckled; this should not be too noticeable when printed at scale.

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The rendered FIRMs are also 400dpi, and because of the rendering, the text and linework look crisp. Since the air photo background is rendered at only 72dpi, background detail is lost, though it's clear enough to display important locational information.

[FM55025C04 28G.png]



A.1.2 DFIRM, NFHL Data

DFIRM is the first level of GIS data—essentially the printed data digitized. NFHL has updates (Letter of Map Revision, LOMRs) applied and there does not seem to be a way to remove the LOMRs. These appear to be referenced interchangeably on the Map Service Center site, and only the product table in the "Moving to Digital Flood Hazard Information" flier mentions the DFIRM and NFHL data as separate products. They appear to be the same data when downloaded or viewed in the online MapViewer.

Data are provided in a variety of formats. Most are easily used.

Vector formats include ESRI interchange files, ESRI shapefiles, and MapInfo interchange files. ESRI interchange files seem redundant, as the shapefiles work just as well and don't require importing, though labels may be easier to apply from the interchange files. MapInfo interchange files are only suitable for MapInfo, though other software can import them. MapInfo could also probably import the shapefiles, and since it's own interchange format presumably requires an import, the MapInfo interchange files are also a bit redundant. The shapefiles are used by the MapViewer Desktop application. A shapefile-only option would be nice, but this option was not quickly found.

The data are also provided in rendered image formats through Web Map Services (WMS). The Google Earth kmz files use this format and will be discussed below. WMS layers in QGIS—an open source GIS program, (<http://www.qgis.org/>) that can view WMS data layers—were tested and but did not work.

A.1.3 Accessing Data from the MSC

The most obvious access point on the front page of the MSC is the *Product Search* sidebar. An address or map ID (if you know it) can be searched. A search can be executed for either Flood Maps (FIRMs) OR DFIRMs, but not both at the same time. Search results appear in a new window, though the results layout is different. The FIRM results have a useful button to view a map, but the purchase button for each item is odd; it expands the results table to show checkboxes with the purchase options and expands it for all items. The DFIRM results however have checkboxes for each item right away, but there is no view button.

The screenshot shows the FEMA Map Service Center interface. At the top, there is a blue header with the FEMA logo and the text 'Map Service Center'. Below the header is a navigation bar with links: 'Product Catalog | Map Search | Quick Order | Digital Post Office | Help'. A breadcrumb trail reads 'Home > Map Search Results'. The main content area is titled 'Map Search Results' and features a section for 'FEMA Issued Flood Maps'. Below this is a table with the following data:

Map Item ID	Description	Effective Date	Show LOMC	View	Buy
55025C0409G	DANE COUNTY UNINC & INC AREAS	01/02/2009	<input type="checkbox"/>		

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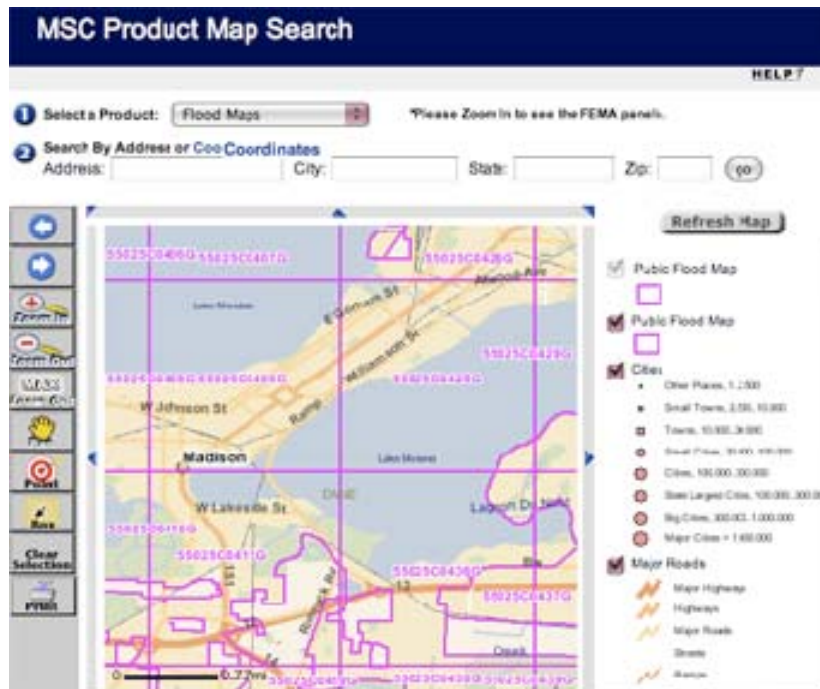
Map Search Results

DFIRM Databases

DFIRM ID	Description	Effective Date	On-Line	CD	CD with Basemaps
55025C	DANE COUNTY UNINC & INC AREAS	06/17/2003			
			\$10.00	\$10.00	

[search results firm.png] [search results dfirm.png]

Another method that's not as obvious is the *Map Search menu item* at the top of the page. This opens a Web map where a search by address, lat/long coordinate (i.e., from a GPS), or a browse can be done. Errors occur regularly if the map size is not greater than 0. This is fixed with a simple reload.



[map search.png]

While nice for those more visually inclined, it's not clear how to select FIRM or DFIRM maps. The process of elimination pointed to the "Point" and "Box" tools. These then bring up the same search results window as the Product Search.

The *Map Search* has a few layout glitches. Plus, a layer bug that displays the flood map outlines twice in the layer panel when turned on.



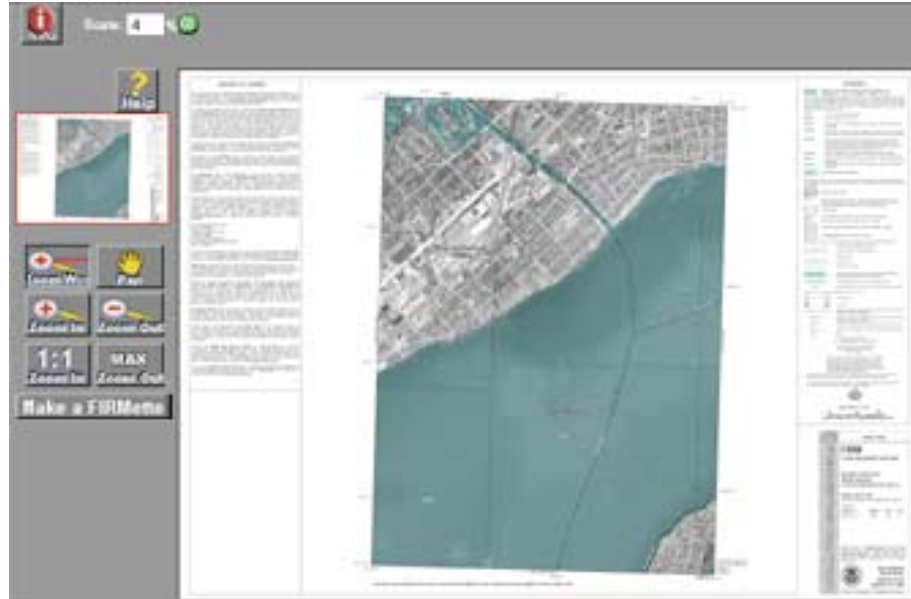
[zoomed in-legend glitch.png]

A.2 FEMA Tools

A.2.1 FIRMette Web

Novice user: User could not find this application on the Web site.

Technical user: Clicking the View button in the FIRMette search results opens (yet another) new window to create a FIRMette. The window has some layout issues in that the browser scrollbars indicate that there is much more to the page when there really isn't. This is frustrating to the user.



[firmette-1.png]

The whole FIRMette interface is very slow; most actions require "Retrieving Data..." with slow progress bars. Making the FIRMette is mostly straightforward, however, clicking the "Follow instructions..." button requires the user to click the button to get some instructions, that resulted in exiting the "Make FIRMette" mode after another long wait.

FIRMette Web tool also doesn't quite position the scalebar block correctly.

[firmette-2.png]



The resulting PDF and PNG images work as expected, but the TIFF image for old printed

Overall Notes:

- Windows only
- Slow
- Maps cropped when printed

A.2.3 MapViewer Web

Novice user: There wasn't any problem using this tool. Most of the layers worked fine. The e-z print tool did not work, while the standard print button created a PDF that worked fine. Zooming also worked fine. The info tools seemed to work though it opened in a new window. The ability to change symbols, if needed, is recommended.

Technical user: There are not handy links in the search results, but the tool has a much more consistent design than the FIRM map search. Unfortunately, the map is huge and even on a large screen requires scrolling at every reload to see the whole map. The legend will also grow to the right depending on the amount of text in the legend items that could result in layout issues.

The Identify tool doesn't function no matter what is clicked on the map. The e-z identify tool does work though it was slow. It was also noted that the globe is spinning the wrong direction while processing the request. The identify-DFIRM-and-Print returned an "invalid HTTP request" error every time though this was not consistent on all machines.

The save feature is nice, just remember what the purpose is for the .wmc file (it looks like a standard "Web map context" file, which could possibly be used by other OGC-aware software).

The print feature has some problems; it reloads the map image zoomed-in slightly, but the PDF is generated at the view when the print tool is clicked. Unfortunately there isn't any previous zoom tool.



[view before print.png]

[view after print.png]

The orthophoto, topo map, and relief layers would be nice for reference and enhancement, but they appear to be on "top" of everything else and are only slightly transparent. Therefore, they overwhelm the other information.



[same area as test firmette, with ortho.png]

Despite the constant reloads for every action, the MapViewer is quite usable.

Overall Notes:

- Many reloads
- Several Tools do not work
- Very usable but needs more work

A.2.4 MapViewer Desktop

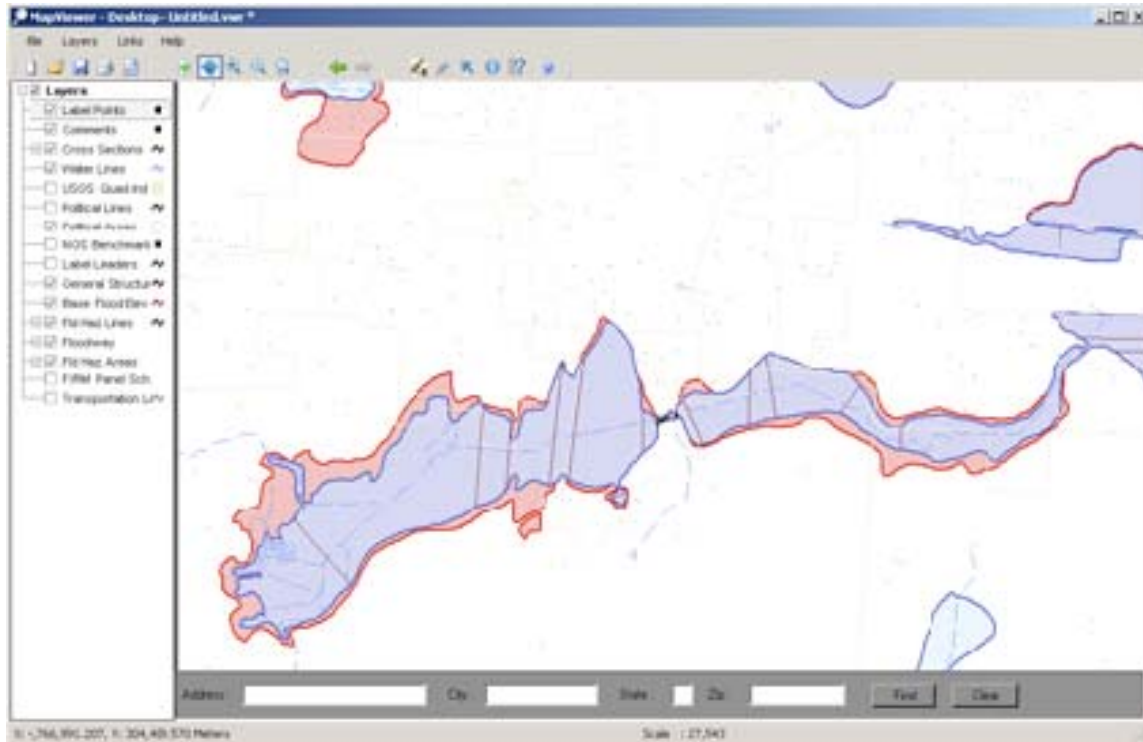
Novice user: The user got started with this but quickly got lost and could not load the DFIRM data.

Technical user: This one does not start very intuitively. A session begins in a window with two radio buttons—"Open DFIRM Database" and "Return to a Previous Session" (which is dimmed at the first run of the program). Make a choice, then click the OK button. If opening a DFIRM database, then the program asks to locate the database, though it doesn't really make it clear what is a database. After trying every folder level in a downloaded DFIRM, it appears to be the folder holding the shapefiles. The help screenshot highlights the folder, but it doesn't reveal it explicitly.



[MapViewer-1.png]

The program has predefined default symbols for the DFIRM layers, but once loaded, the symbols can be customized.



[MapViewer-3.png]

The MapViewer Desktop exports only JPEG and BMP images. This is divergent from all the other FIRM/DFIRM programs and Web interfaces. The image is essentially a 72dpi screenshot of the map. This may not be very useful for some users. Map, legend, and north arrow images are exported separately, so they can be placed easily in a page layout program.

There are two problems other than low resolution: the north arrow option caused an error in tests and the legend BMP image is unreadable by Photoshop.

Overall Notes:

- Need better information on how to open a Database
- Need to make projection information more obvious
- No raster data
- Exporting capabilities are weak
- Very usable but needs more work

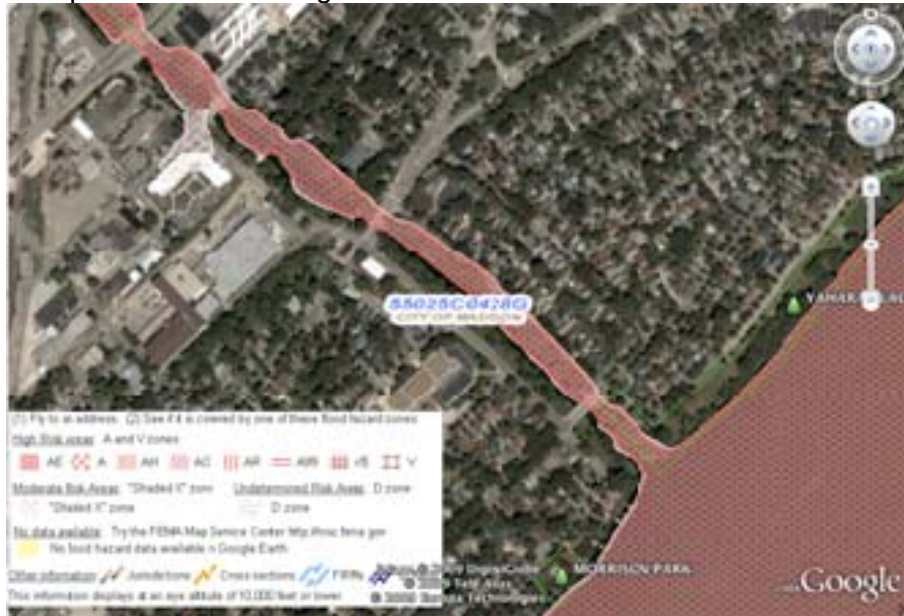
A.2.5 Google Earth kmz

Novice user: Could not find the right information and was intimidated at the idea of mapping on Google Earth.

Technical user: These were easy and fun to use, though they are not official so they can only be used to explore FIRM data. The orthophoto imagery is complete and layered correctly so it doesn't cover FIRM data.

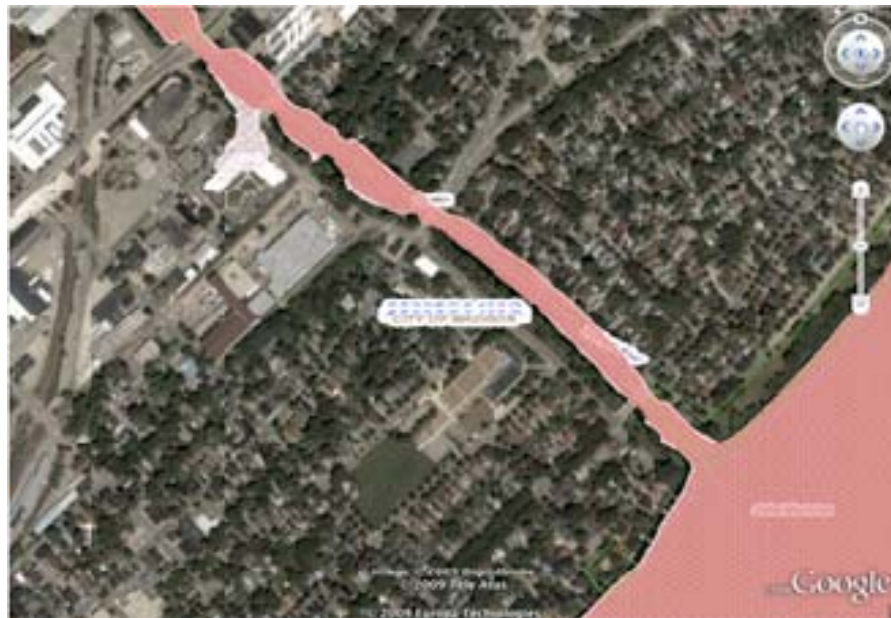
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The Stay Dry and Flood Smart kmz displays the basic flood zone information. The large legend overlay permanently covers one corner of the map display and obscures a great deal of the visible map area on an average monitor size.



[stay dry ge sample.png]

The NFHL kmz displays all the data available in the MapViewer, without the frustrating legend overlay.



[FEMA_NFHL ge sample.png]

Labels for areas draw in the same layer as their areas, so other area's lines and patterns often cover labels. Also, areas that cover the whole view will have their labels drawn in the center of the view. This can cause overlapping labels. Both problems are understandable, considering that the process uses WMS (Web Mapping Service) layers, which have no

understanding of other kmz layers preventing the software from avoiding label collisions and ordering.

Since the kmz layers are simply WMS layer combinations, the user could create and share custom kmz layers if they are trained. There are two such "custom combinations" in the kmz.

Overall Notes:

- Simple application
- Has labeling conflicts
- Potential for users to share their own layers

A.3 Practical Test of FEMA Digital Tools and Data

Digital products may work for most cases, but for individuals and communities that need paper maps, how will a floodplain administrator, planner, or building code officer acquire the flood hazard map that is needed and print it? A set of tasks were developed that will help test how the user will acquire or use the MSC product or tool needed to acquire the data/information, print a map, and make it available.

Situations in which survey/interview respondents identified the need for a paper map include:

- A. Planning meetings
- B. Citizen requests/building permits
- C. Disaster response
- D. Enforcement audits

Two US cities were reviewed utilizing the steps needed to create acceptable products applying only the data and tools provided by FEMA. Performance of the assigned tasks was tracked, as were costs involved and the time needed to produce the desired product. The two cities reviewed are Iowa City, IA and City of Elbridge, NY. The case studies are as follows:

A.3.1 Iowa City, IA

- A. Planning meeting
 1. New development east of an existing neighborhood that includes Normandy Dr., Eastmoor Dr., Park Place. Area is south of Iowa River.
 2. Print a paper map showing this area to display at a public hearing and planning meeting
 3. Look up area using FEMA Panel 19103C0195E or by streets
 4. Maps requested for the meeting
 - i. Full size FIRM panel plot with aerial photography
 - ii. Individual 11"x17" maps for attendees
- B. Citizen Request/Building permit
 1. Home improvement project: 700 Normandy Drive, Iowa City, IA 52246
 2. Lookup address
 3. Print maps for property
- C. Disaster Response
 1. Iowa River flooding between I-80 south city boundary

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2. Print a series of maps
 3. Maps requested
 - i. Map showing extent of flooding
 - ii. 8.5" x 11"
- D. Enforcement audit
1. Print map panels for entire city to be used while driving around city examining buildings for code violations

Iowa City, IA - Practical

A. Planning Meeting

Using the Web site Address Search tool, searching by street only without an address number, does not return any results regardless of using all variations of abbreviated and non-abbreviated street type; the user must have an exact address. Using the map panel search works assuming the planner knows the map panel ID. The map panel does include LOMRs

It was discovered that this FIRM is a true scan of original paper FIRM and does not include orthophotos. This doesn't fit requirements of using orthos for the study. There are not any LOMRs applied to them for this area. An official FIRMette was created with Web interface but orthos or LOMRs were unable to be included. Printing Sizes: FIRMette could be printed double size for 11"x17" with reasonable quality (200dpi).



Map search time: 10 minutes for someone that is unfamiliar with the city.
Total Time: 15 minutes

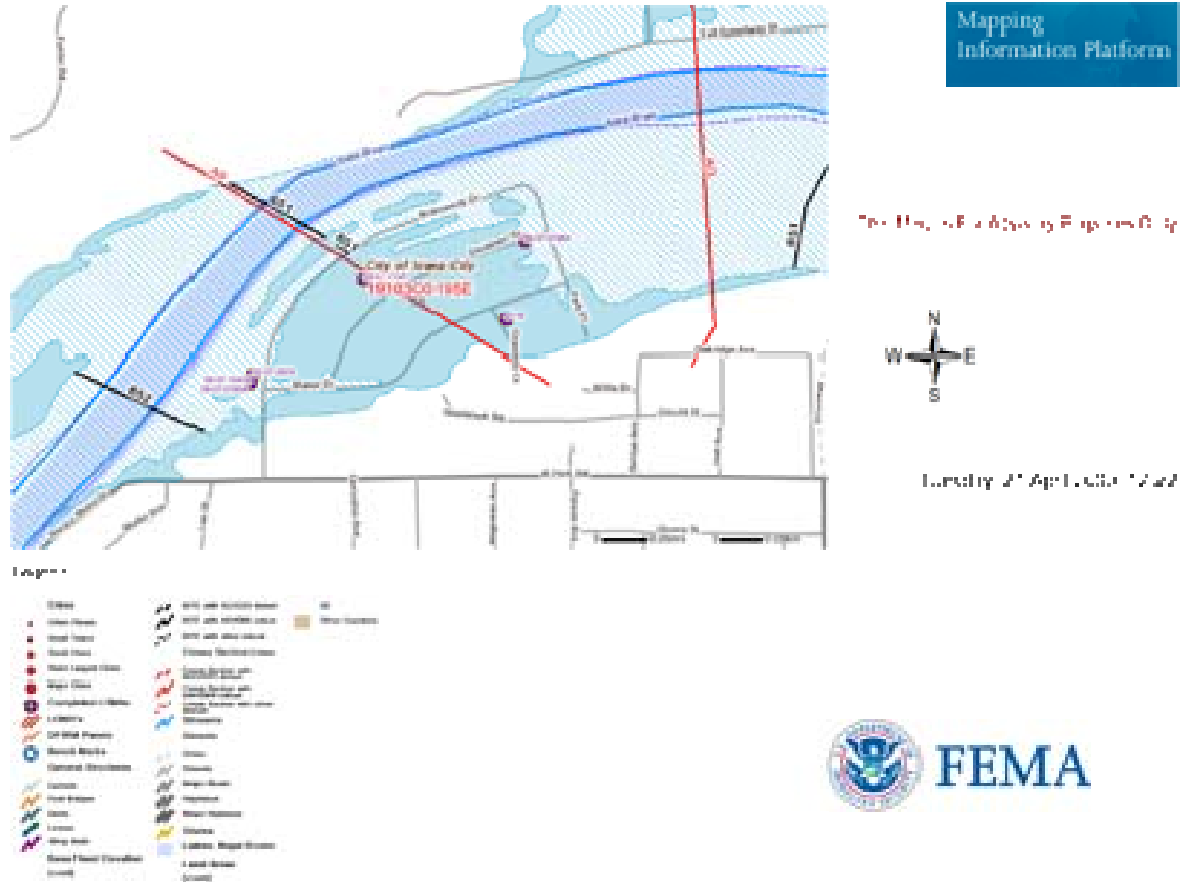
Google Earth included digital and updated data in this area. These orthos are Google's. Printing Sizes: Could print view, but only at letter size (that is oriented incorrectly), at low-medium resolution (hi-resolution available only with Pro version of Google Earth).
Total Time: 5-10 minutes

WMS will not work for this task since only a screen resolution (72dpi) is supported.

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NFHL Map Viewer Web – This product also supports map output at screen resolution and only for letter size maps. Another issue using this tool is that the orthophoto image overlay makes it difficult to see the other information on the map.

To achieve exactly what is specified for this task was impossible due to the lack of required data.



Partial successes:

Without the ortho underlay requirement, full size and 11"x17" prints could be printed:

- Used the MSC
- Total Time: less than 30 minutes (search, order, format, and print—not including download time)
- Purchase FIRM (download): \$2.50
- Other Requirements: Photoshop or similar image manipulation software, large-format printer
- Print one map 36"x26" (cost approximately \$8.00)
- Print multiple 11"x17" pdf's (cost approximately \$0.30 each)

With ortho underlay:

- Google Earth
- Total Time: less than 15minutes
- Print 8.5"x5.5" @ 72dpi (due to rotation problem, screen resolution)
- Printing (cost: \$0.20 each map)

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- NFHL Map Viewer Web
- Total Time: less than 15 minutes
- Print 8.5"x11" @ 72dpi
- Printing (cost: \$0.20 each map)

B. Citizen Request/Build Permit

- Web search & FIRMette Tool

Total Time: 10 minutes (search, view map, make FIRMette, download PDF, and print)

Scale: unchangeable

Size: 8.5"x11"

Cost: \$0.20 each map

Note: The user may not realize that the FIRM (true) scans don't include LOMRs. All LOMRs are listed in the search results and available as PDF downloads (24 in this case). If the LOMRs are needed, they would need to be downloaded and interpreted by the user or submitted with a building permit. Searched address not marked on final map.

- NFHL Map Viewer Web

Total Time: 10 minutes (open map viewer, search, print to PDF, Print PDF)

Scale: User able to zoom in for more detail

Size: 8.5"x11"

Cost: \$0.20 each map

Note: Searched address not marked on final map

- Google Earth Stay Dry and Flood Smart

Total Time: 5 minutes

(search/zoom to neighborhood scale, mark address on map, and print)

Scale: User able to zoom in for more detail

Print: View is low resolution, ~1/2 letter size, and legend did not print

Notes: User needs to move the view some to allow for legend overlay in Stay Dry tool.



C. Disaster Response – Using DFIRM

DFIRM Search - Search box on main page only works for FIRM searching by panel ID. Can't use for DFIRM search by panel ID, must use drill-down search in "What are you looking for?" > "DFIRM Databases" to select state-county-community/city.

NFHL MapViewer Desktop - The default styling may need adjustment; but the design needed could be created. There isn't a way to setup a multi-page layout; the user must zoom to desired level, then pan-and-print, pan-and-print, etc. In the final maps, the legend covers more than 1/2 of every page.

DFIRM doesn't have a scale-dependent layout, yet layers have scale-dependent styling and visibility. Print retains view extents, not scale, so view is rescaled to fit page, with the styling and layer visibility of the new scale.

Total Time: 25 minutes for first map not including download time (remaining maps would be faster)

Number of Maps: Depends on scale used: 1" = 1 mile is 1 page. 1"=2640' is 4 maps, 1"=660' is 16 maps.

Size: 8.5"x11"

Cost: \$0.20 each map

Notes: With MapViewer's limited exporting, large format maps cannot be created.

D. Enforcement Audit

The Map Search tool is used to select a group of panels to get search results. Nine panels were used for this sample. Users may need LOMRs for this task. Download and print PDFs for each LOMR for each panel, (tedious but downloads quick, prints 1-2 letter pages for each LOMR.)

Further requirements: image editing/viewing applications (i.e. Photoshop,) large-format printer.

Total Time: 1-2 hours

Print Maps: \$72.00

Print LOMR's: \$3.60

A.3.2 City of Elbridge, NY

- A. Planning meeting
 - 1. Print a paper map showing the Town of Elbridge (that includes city of Elbridge) to display at a public hearing and planning meeting
 - 2. Maps requested for the meeting
 - i. Full-size FIRM panel plot with aerial photography
- B. Citizen Request/Building permit
 - 1. Home improvement project: 6 Elbridge St, Jordon, NY 13080 (Jordan is in Town of Elbridge)
 - 2. Lookup address
 - 3. Print maps for property
- C. Disaster Response
 - 1. Flooding of river through City of Jordan
 - 2. Print a series of maps

3. Maps requested
 - i. Map showing extent of flooding
 - ii. 8.5" x 11"
- D. Enforcement audit
 1. Print map panels for entire Town to be used while driving around city examining buildings for code violations

City of Elbridge, NY – Practical

A. Planning Meeting

The Web site Address Search tool was tried again but again. A real address was needed and so the panel ID was used. The same problem was encountered where FIRM scans are true scans. There wasn't any ortho for them.

The area needed covers multiple FIRMs (one unprinted and it is assumed unavailable.) Town boundaries were missing on MapSearch, so a Delorme atlas needed to be consulted to determine which FIRMs were needed. Multiple full-size plots require Photoshop or other graphics software and a large format plotter.

Total maps: 12 panels (not including the 1unprinted FIRM)
Total time: 2-3 hours
Cost: \$96.00

DFIRM data does not exist, so both NFHL Viewer and Google Earth are not options.

B. Citizen Request/Building Permit

FIRMette Web and Desktop are the only tools that will function here since the FIRM is the only data available.

Total Time: 10 minutes (search, view map, make FIRMette, download PDF, and print)
Scale: unchangeable.
Size: 8.5"x11"
Cost: \$0.20 each map

Note: Again, the user may not realize that the FIRM (true) scans don't include LOMRs. All LOMRs are listed in the search results and available as PDF downloads (24 in this case). If the LOMRs are needed, they would require to be downloaded and interpreted by the user or submitted with a building permit. Searched address was not marked on final map.

No DFIRM data exists so both NFHL Viewer and Google Earth are not options.

C. Disaster Response

There are not any DFIRM data available to complete this task as requested. One map panel would have covered the area needed possibly.

D. Enforcement Audit

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We used the Map Search tool was used so a group of panels could be selected to get search results. Nine panels were used in this study.

Further requirements: image editing/viewing applications (i.e. Photoshop,) large-format printer.

Total Time: 1-2 hours depending on download and computer speed

Print Maps: \$96.00