

FEMA DFIRM Base Map Development in Harris County, Texas

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Abstract

Thirty-five communities within Harris County, Texas are being included in an update of Flood Insurance Rate Maps for over 1,700 square miles of roadways, streams, parks, railroads, and political boundaries. Data from each of the 35 communities, the local area council, Texas Department of Transportation, USGS, TIGER, appraisal district, and a private mapping company was received in ArcView 3.2, ArcGIS 8.2, AutoCAD, Microstation, and hardcopy formats. The coordination, digitizing, review, rectification, and publication of this map for the communities to FEMA specifications was successfully completed in 14 months.

Introduction

In June 2001, Tropical Storm Allison inundated Harris County, Texas with five-day rainfall amounts exceeding 38 inches in some areas. Allison was responsible for 22 fatalities, 95,000 damaged vehicles, 73,000 flooded structures, 30,000 stranded residents and over \$5 billion in damages. The Harris County Flood Control District (HCFCD) and the Federal Emergency Management Agency (FEMA) joined forces to help the flood damaged community recover and created the Tropical Storm Allison Recovery Project (TSARP). This disaster effort will provide the ability to recover data promptly, and produce the Digital Flood Insurance Rate Maps (DFIRMs) efficiently.

This paper describes the development and design of the digital flood insurance rate map for Harris County, Texas. This base map is a part of FEMA's Map Modernization initiative and will provide improved efficiency when updating and final map production. There were two major factors in the production of the DFIRM base map for Harris County, data standards and data management.

There are several layers of information necessary for DFIRM production however the foundation for these maps is the basemap information, which includes over

1,700 square miles including 14,270 miles of roadways, 2,600 miles of streams, 560 parks covering 52,000 acres, 1,500 miles of railroads, and political boundaries. The Base Map encompassed all of Harris County as well as a two-mile buffer outside of the county limits. Not only are the aeral extents extreme in this project, but there are 35 communities directly affected by this mapping effort therefore coordination is essential. (Figure 1)

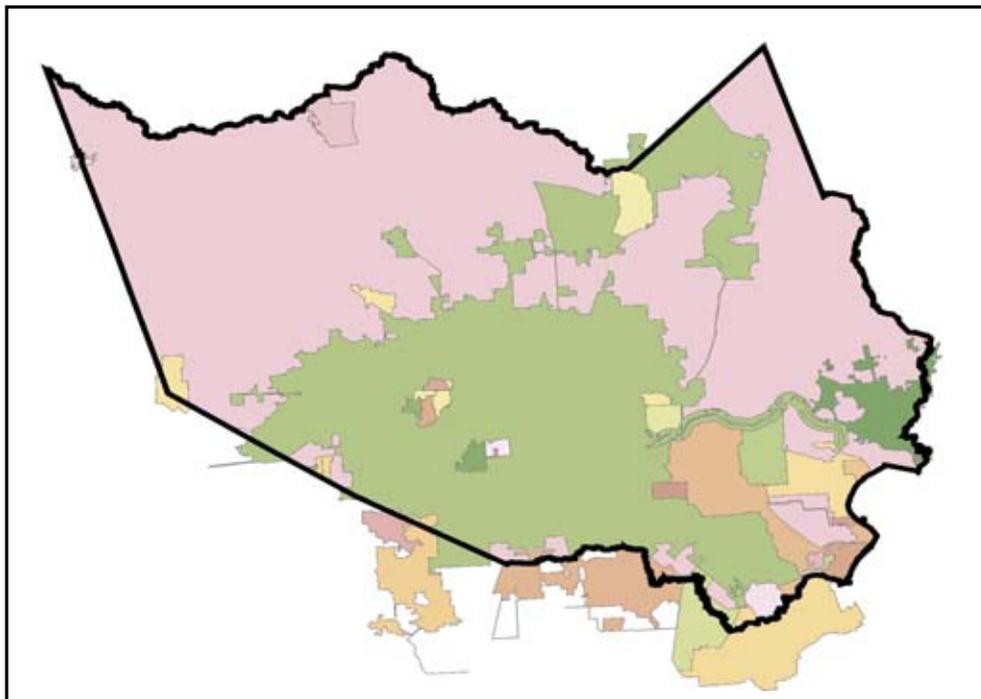


Figure 1 – 35 Communities in Harris County, Texas

Data Management

At the beginning of this project, all 35 communities received written notification about the upcoming project as well as a request for information related to street centerlines, parks, and corporate limits within their prospective communities.

These data sets depended entirely on the technical capabilities of each city.

Therefore, a variety of formats were submitted for review and incorporation into the base map. These formats included hard copy faxes, hand-annotated blue-lines, AutoCAD drawings, and spatially referenced shapefiles. Many of the submissions faxed over lacked clarity and were difficult to inspect. Most cities that submitted electronic formats lacked the correct projection system defined by the project scope. Therefore, all electronic submission had to be converted into the project defined projection system and then overlaid on the existing base map and aeriels. Submitted data provided by each city or incorporated area was integrated into the base map.

Differences in the submissions posed major problems when it came to delineating corporate limits. These problems were by far the most time consuming and required many meetings and discussions between cities as to who actually

encompassed what area. Adjacent communities would often both claim the same area as theirs and orphan another area. (Figure 2) Different individuals within a city often disagreed as to the location or name of a feature. Many times several interactions with the city and multiple staff were necessary before sufficient responses were received. Draft versions with all updates were submitted to each individual city for their review of their prospective map. They reviewed the locations and names of all features shown and submitted comments back to BGE for secondary updates into the TSARP base map. This street information was updated with previously submitted information from the cities to update over 60,000 arcs. Most cities provided useful comments back, however the quality and accuracy of some information was suspect



Figure 2 – Disputed Areas



Figure 3 – Road Rectification Example

Data Standards

Data standards for the DFIRM base map were established by FEMA as a part of the Map Modernization program. These specific details included how the data base structure was to be established and many other required items that are necessary to facilitate electronic DFIRM production. A detailed description of these specifications can be found in the Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix L. Although these standards were established to encourage to one type of data set, some specifications did not directly relate to items in Harris County, Texas. Most of these items were directly related to the designations in the database. Many descriptions that were considered required, simply did not apply. Other instances included attributes that needed to be added to the DFIRM specifications. Feature classes such as creeks, sloughs, tollways, farm to market roads, and high occupancy vehicle lanes (HOV) were added.

The proposed basemap originated from a street center line coverage provided by

the Houston-Galveston Area Council (HGAC), this coverage is know as the STAR*Map. Unfortunately, the STAR*Map did not meet the minimum FEMA specifications, as stated in Guidelines and Specifications for Flood Hazard Mapping Partners; Appendix L. Therefore this map was rectified to the January 1999 aerials. (Figure 3) Approximately, 70,000 arcs were moved, deleted, or added. These digital rasters images were processed on a 0.5 meter resolution, and claimed an accuracy of +/-10 feet. Incidentally these aerial photographs determined the overall projection system for the project, which was State Plane, NAD83, Texas South Central. This aerial photography was used to rectify roadways, railroads, parks, and airports. Other major submissions included the data provide by the City Houston, and HCFCD. (Figure 4)

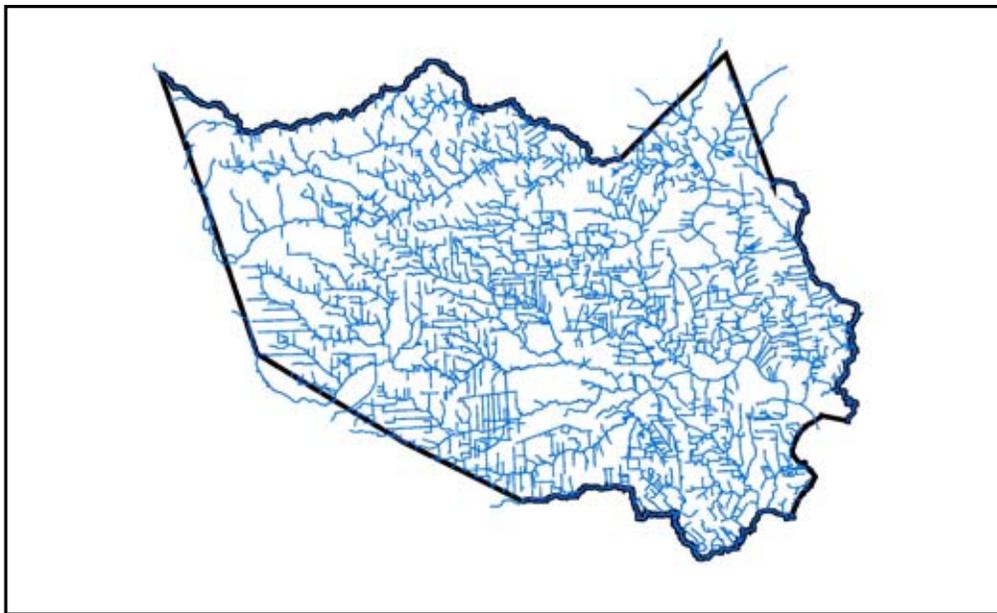


Figure 4 – Channel Assessment Program

The official published map will be a hard copy formatted to a typical FEMA FIRM paneling scheme. The DFIRM database will allow Map Modernization to incorporate the data into a seamless, electronic version of this county, adjacent counties, and the entire United States. The Harris County Flood Control District will publish the maps via the internet through an ArcIMS server. An internet user will be able to receive a view of the basemap, new special Flood Hazard Areas (floodplains), previous floodplains, and aerial photographs. (Figure 5)

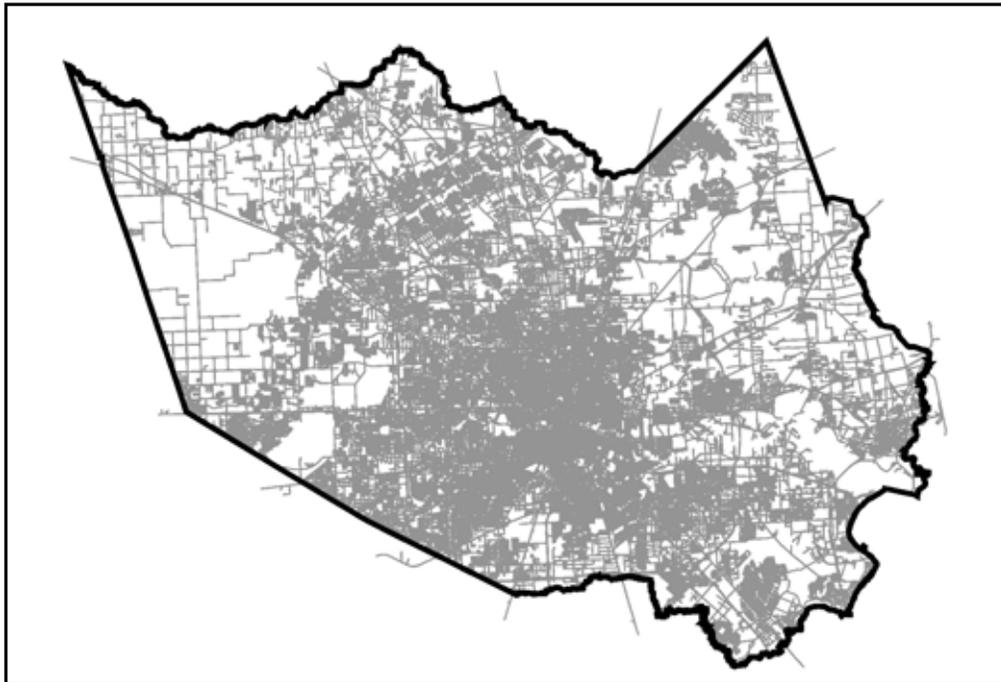


Figure 5 – Harris County, Texas Street Coverage - STAR*Map

Conclusion

The overall success of this project relied heavily on BGE's data management abilities, maintenance of data standards, superior reviews and updates to the final basemap product. The time constraints placed on this effort were intense but not unreasonable however there were many unexpected database and software obstacles to overcome. Many innovative solutions came out of this effort and numerous suggestions were made to FEMA so that they may improve their overall DFIRM database structure and usability for the future. As a result of these efforts, Harris County, Texas has one of the most accurate basemap products in the United States. That combined with an entire re-study of floodplains places this community as an exemplary model for future Map Modernization efforts.

References

Guidelines and Specifications for Flood Hazard Mapping Partners; Appendix L.

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