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Water Elevation Technologies

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Analysis of Costs Associated with Obtaining
Elevation Certificates for Low-Income Households
in San Marcos, Texas

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1. Introduction

One of nature's more frequently occurring disasters is flooding. Due to climate change, urbanization and many other factors, flooding is a natural disaster that we are likely to see more of in the future (Oak Ridge National Laboratory and the U.S. Department of Energy). Flooding and its effects can be widespread and damaging.

San Marcos, Texas has a history of floods. Many of the city's lowest-lying areas are residential areas housing low-income residents. The cost of obtaining the elevation survey required before a flood insurance policy can be issued can put the cost of flood insurance out of the reach of many residents. Therefore, the city of San Marcos is looking to develop a Community Development Block Grant (CDBG) application to assist residents in obtaining flood insurance.

GIS was selected as the tool of choice for this project because it allows decision makers to visualize where flooding is likely or has occurred in the past, and where it overlaps with low-income residents. The intent of the project is to provide an estimate of the number of flood-prone, low-income properties falling in or near the floodplain.

2. Data

Joan Hickey with the City of San Marcos originally provided all data files, and all data created is derived from these files. The specifics of the data created are described in the “methods” section.

The following files delineate areas that are believed to be prone to flooding, or have demonstrated a tendency to flood regularly:

- FEMA Floodway (Floodway.shp) – polygon shapefile
- Flood Plain Cross Sections (Elevlines.shp) – polyline shapefile
- 100-year flood plain (Flood_100yr.shp) – polygon shapefile
- 500-year flood plain (Flood_500yr.shp) – polygon shapefile

The following data files relate to the flood of October 1998, which impacted areas well outside the established floodplains and caused significant damage to a number of properties:

- Areas inundated during the 1998 flood (gpsfm98.dwg) – CADD file
- Outlines of parcels damaged in 1998 (FloodDamage98.shp) – polygon shapefile

The following data files relate to existing flood insurance policies and previous flood insurance claims:

- Active flood insurance policies as of 30 April 2006 (485505 Active Policies 043006.xls) – Microsoft Excel spreadsheet
- Flood insurance claims, 1979-2006 (485505 Historical Claims 043006.xls) – Microsoft Excel spreadsheet
- Information about certain properties with multiple claims (485505 Additional Data 043006.xls) – Microsoft Excel spreadsheet
- Existing elevation certificates (Elevation_Certificates.shp) – point shapefile

The following data file relates to a flood in July 2002. It was not used in the project:

- Gauge elevations, Blanco River July 2002 (Blanco River.xls) – Microsoft Excel spreadsheet

The following data files were used in mapping, but not in analysis:

- Address points (AddressPoints.shp) – polygon shapefile
- Building footprints (Building.shp) – polygon shapefile
- City Limit (CityLimit2006_07.shp) – polygon shapefile
- Extraterritorial Jurisdiction (ETJ2006_07.shp) – polygon shapefile
- Major creeks (Major_Creeks.shp) – polyline shapefile
- Railroads (GISMGR_Railroad.shp) – polyline shapefile

- San Marcos River and bodies of water (GISMGR_River.shp) – polygon shapefile
- Street centerlines (Centerlines.shp) – polyline shapefile

The following data files were used in determining low-income areas:

- Parcels (Parcels.shp) – polygon shapefile
- Property tax appraisals – Microsoft Excel spreadsheet

Property tax appraisal values were used as a substitute for income data, because it provided specific economic data in a small geographic area. Much of the rest of the data was remapped to work at the parcel level in order to match with this data.

The data was used “as is,” except to modify address fields to exactly match each other. For the most part, this involved changing addresses from all-capitals to mixed case or *vice versa*. The modified files are included in the metadata and CD-ROM of data.

3. Methods

The first step taken was to modify addresses to match exactly, as described in the previous section. This produced one layer, Elevation_Cerititicate2.shp.

Once the tabular data about previous claims could be joined to geographic data, layers containing information about those claims could be created. Those layers include parcels with paid insurance (Parcels_with_Paid_Insurance.shp,) claims made following the flood of 1998 (Flood_Claims_98.shp,) sites with multiple claims in 1998 (Multiple_Claims_98.shp,) sites with multiple claims over the entire period for which data was provided (Sites_With_Multiple_Claims.shp,) current policies (Active Policies.lyr,) and past flood insurance claims (Historic Claims.lyr.)

Since the shapefile provided depicting parcels damaged in 1998 did not line up with the parcel data on which the other data was based, parcels in the parcel layer were manually selected and exported into a layer (Parcels_with_Damage-1998.shp.) This new layer only depicts which parcels were damaged, and does not contain any of the attributes of the FloodDamage98.shp layer provided by the City of San Marcos. A CADD file depicting the extent of areas inundated by the 1998 flood outside the 100-year floodplain was also digitized into a shapefile (1998_outside_floodplain.shp.)

Spatial joins between existing layers were used to produce sets of parcels partially or entirely within floodplains. Those layers are Parcels in 500-yr floodplain.lyr,

Parcels_in_100-Year_Floodplain.shp, and Parcels_in_Floodway.shp. In addition, parcels in the 500-year floodplain and/or damaged in 1998 were highlighted in Parcels_in_1998_or_500-year.shp.

As stated in the previous section, tax-assessed parcel value was used as a substitute for income value due to its lower granularity. To that end, tax assessment data was joined with parcel data and three layers were produced as a result. Three thresholds were used for property value. Total assessed value of \$15,000 or less (Low Income \$15,000.lyr,) \$30,000 or less (Low Income \$30,000.lyr,) and \$45,000 or less (Low Income \$45,000.lyr.)

4. Results

Of the 13,568 parcels entirely or partially within the city limits or ETJ of San Marcos...

- 74 have elevation certificates.
- 324 parcels have active flood insurance policies. Of those 324...
 - 280 lie within the 500-year floodplain.
 - 93 have a total assessed value of less than \$30,000.
- 632 parcels are in the 500-year floodplain and have a total assessed value of less than \$30,000.
- 479 parcels are in the 100-year floodplain and have a total assessed value of less than \$30,000.

There have been 267 flood insurance claims in San Marcos since 1979. 84 claims were filed for the flood of 1998. 34 addresses had more than one claim.

One San Marcos surveyor stated the cost of an elevation survey ranged from \$500 to \$1,000, depending on the complexity of the work to be done. Using the numbers above, providing elevation certificates for houses in the 500-year floodplain to properties with an assessed value of \$30,000 or less would range from \$316,000 to \$632,000; for the 100-year flood plain with the same value, potential costs would range from \$239,500 to \$479,000.

5. Discussion

Our project was designed to give an analysis, rather than answer a question. Our results were an overview of the data the City of San Marcos possessed and do analysis based on the insurance and income data they provided. Our results showed a significant area of the floodplains that were low income and without flood insurance. There are also results showing where multiple claims historically have occurred. This shows that there is a large part of the parcels in the floodplain that do not have flood insurance. There is also a significant part of these parcels that are in the low-income category. Since there was not an initial hypothesis we could not base results off of it. Our project was based largely on analysis and showing the analysis in different ways, not answering a real question. It was noted that there were probably going to be areas in the low elevations that would be poorer due to a lower land value. More parcels with higher land value might have been expected since many of them like to live near the rivers for the view and access to the water, but there were not as many as anticipated.

Our methodology was pretty sound; the only differences that would most likely be made are the further editing of some files to make a more precise analysis. The majority of our flood data, especially the insurance claims only go through 2004. As that is rather current information, having the claims through 2006 for further analysis would enhance the accuracy of the results. An improvement on our project, providing there was more time to work on it would be a more detailed analysis of the insurance claims. Being able to break them down by the amount the insurance companies paid the filers would give a more accurate assessment to the amount of damage in a 'worst case' flood event.

Again with a more updated list of those who have insurance and elevations certificates to allow the city to properly apply for funding more accurately.

6. Conclusions

Time considerations prevented the group from doing all of the possible permutations of flood danger and income level, but the data prepared provides a basis for the estimation of costs in the future.

7. References

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