

# Guidance on Flood Mapping to Inform Community-Driven Buyout Projects

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### 1. Background

Communities facing severe and/or chronic flood risks are potential candidates for residential buyouts, which aim to relocate residents out of high-risk areas. The decision to relocate is not an easy one. Residents must decide whether to stay in their homes and risk future flooding or abandon their homes and move away from their existing social and community networks to reduce future flood exposure. It is thus important that residents and community groups have access to quantitative data about past flood events to make informed decisions about buyouts. This guidance document presents a method for mapping historical flood impacts to identify candidate neighborhoods for targeted and effective residential home buyouts. It is intended to be used by community groups and their partners to inform local decision-making regarding flood mitigation.

This document is organized as follows. Section 2 describes the data sets and sources that are used in the mapping effort. Section 3 outlines the methods for aggregating and mapping the data. Section 4 discusses the potential uses and limitations of the approach. Section 5 contains links to the data sources.

### 2. Data Requirements

The following data sources can be used to map historical flood damages and associated factors in the community of interest: (a) severe repetitive loss properties (SRLP), (b) National Flood Insurance Program (NFIP) claims, (c) individual assistance (IA) grants, (d) socioeconomic data, and (d) digital elevation data. Each of these data sets is described in more detail below. Appendix A displays the data fields for the SRLP, NFIP, and IA data sets in tabular form.

#### *a. Severe Repetitive Loss Properties*

According to the National Flood Insurance Reform Act of 2004, a SRLP is “a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.” SRLP data is available by contacting the Natural Resources Defense Council, which obtained the data from the Federal Emergency Management Agency (FEMA) as part of a public records request. The data covers the entire U.S. and is provided at the zip code level. The data set excludes properties without flood insurance policies and properties that have incurred flood-related damage on fewer occasions or at lower cost than the given thresholds.

#### *b. National Flood Insurance Program Claims*

The NFIP was created following passage of the National Flood Insurance Act of 1968. As part of the NFIP, the federal government establishes flood insurance rates, engages in risk studies for communities, and sets floodplain management criteria. Local communities must then adopt floodplain management standards within their boundaries to qualify for the NFIP. Flood insurance is sold to homeowners by FEMA directly or through private insurance companies. Following a flood event, homeowners must file claims with the NFIP or their insurance provider.

Redacted data for over two million NFIP claims dating back to 1978 is available through the OpenFEMA platform [1]. This data set covers the entire U.S. and is provided at the Census tract level. The claims data does not capture the cost of flood damages for properties without NFIP flood insurance policies.

#### *c. Individual Assistance*

FEMA provides IA, in the form of disaster assistance grants, to individuals and families whose homes, vehicles, personal property, businesses, or inventory have sustained damage due to a disaster. The IA data set is available on the OpenFEMA platform [2] and includes claims made for large disasters since 2017. The IA data is provided at the Census block level, which allows for a more localized picture of claim distribution in areas that have recently experienced a disaster.

#### *d. Socioeconomic Data*

Socioeconomic data can be used to identify potential environmental justice issues within a community. In addition, some federal disaster funding sources are targeted at low- or moderate-income residents, so quantifying the income status of homeowners in neighborhoods that are candidates for buyouts could enable the community to leverage these funding opportunities. Socioeconomic data, including population characteristics and income, is provided by the U.S. Census Bureau and can be aggregated at the same level as each of the flood loss data sets (i.e., zip code [3], Census tract [4], and Census block [5]). The data covers the entire U.S.

#### *e. Digital Elevation Data*

Elevation data can be used to identify low-lying areas that may be more prone to flooding. Digital elevation data at approximately 10-meter resolution is available from the U.S. Geological Survey's National Map [6]. The data set covers the entire U.S.

### **3. Aggregation and Mapping Methods**

To generate maps, the flood damage data sets are first processed in Python (freeware). The results can then be mapped using a geographic information system (GIS) software. The specific details of each of these steps are described below.

#### *a. Data Aggregation*

The SRLP, NFIP, and IA data are all provided as individual entries for each property, with associated geographic identifiers (i.e., zip code, Census tract, and Census block). For mapping purposes, this data needs to be aggregated and summarized by geographic unit. This can be accomplished using the Python script located here: <https://thrivingearthexchange.org/wp-content/uploads/2019/03/floodDamageAggregation.pdf>. Detailed comments are provided in the script to facilitate its use. In brief, after the flood data sets are loaded into the program, the sum or average of each variable is calculated for each geographic unit. The outputs of the script are saved as text files for use within the GIS platform.

#### *b. Mapping*

Mapping of flood damage data can be accomplished using one of several GIS platforms, such as ArcGIS (proprietary) or QGIS (freeware). Outputs from the Python script (in text format) can be loaded directly into the GIS platform, along with the Census data (in shapefile format). The flood damage data can then be joined with the geographic units from the Census data for mapping. Socioeconomic and elevation

data can also be incorporated. Someone with experience using GIS software should be consulted to develop the desired maps.

Some example maps for Port Arthur, Texas, created using the IA data at the Census block level, are shown in Figure 1. These maps summarize (a) the total number of claims per Census block, (b) the average gross income of residents, (c) the average reported water level of flooding (in feet), and (d) the percent of applicants with flood insurance. The IA data provide the highest-resolution information and capture local variability better than the SRLP data at the zip code level and NFIP data at the Census tract level.

#### **4. Uses and Limitations**

The flood damage, socioeconomic, and elevation maps developed using the guidance in this report provide an initial picture of the distribution of historical flood impacts and can be used to identify neighborhoods that might be targeted for residential home buyouts. These could include neighborhoods with a high magnitude or frequency of past flood losses, areas with higher social vulnerability due to factors such as income, race/ethnicity, age, or gender, and areas at relatively low elevation that may be more prone to flooding. Once target areas are identified, additional local-level information should be collected, including information about substantially damaged properties, elevation certificates, and local post-flood damage assessments.

Outputs from this mapping approach should not be used to coerce residents into moving but rather to provide residents with the information needed to make informed decisions about whether to participate in buyout and relocation programs. Sustained engagement with community leaders and residents is essential to understand residents' attitudes toward buyouts and gauge interest in neighborhood-scale relocation programs.

After a community has decided to pursue a buyout program, it is necessary to identify appropriate sources of funding. Some potential sources include the FEMA Hazard Mitigation Grant Program or the U.S. Housing and Urban Development Community Development Block Grant Program for Disaster Recovery. As mentioned previously, these programs often set aside funds for low- and moderate-income households, which can be leveraged when appropriate.

#### **5. Data Sources**

[1] Federal Emergency Management Agency. (2019). FIMA NFIP Redacted Claims Data Set. Available: <https://www.fema.gov/media-library/assets/documents/180374>. Accessed 14 June 2019.

[2] Federal Emergency Management Agency. (2018). OpenFEMA Dataset: Individual Assistance Housing Registrants Large Disasters - V1. Available: <https://www.fema.gov/openfema-dataset-individual-assistance-housing-registrants-large-disasters-v1>. Accessed 5 July 2019.

[3] U.S. Census Bureau. (2017). TIGER/Line with Selected Demographic and Economic Data: Zip Code Tabulation Area. Available: <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-data.html>. Accessed 17 October 2019.

[4] U.S. Census Bureau. (2017). TIGER/Line with Selected Demographic and Economic Data: Census Tract State Files. Available: <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-data.html>. Accessed 17 October 2019.

[5] U.S. Census Bureau. (2018). Census Block Tabulation Areas. Available: <https://www2.census.gov/geo/tiger/TIGER2018/TABBLOCK/>. Accessed 17 October 2019.

[6] U.S. Geological Survey. (2019). The National Map Viewer. Available: <https://viewer.nationalmap.gov/advanced-viewer/>. Accessed 10 July 2019.



## Appendix A: Flood Damage Data Fields

### *a. Severe Repetitive Loss Properties*

<b>Name</b>	<b>Description</b>
<b>State Name</b>	State Name
<b>Community Name</b>	Community Name
<b>Comm Nbr</b>	Community Identification Number
<b>Insured?</b>	YES/NO - Currently Insured
<b>Mitigated?</b>	Typically Yes if mitigation measures, unlocatable, or Historic Building
<b>NOTSPECSW</b>	Updated as - Unable to locate
<b>NOBLDGSW</b>	No building on property
<b>FLOODPRSW</b>	Flood Protection Provided
<b>GT100SW</b>	Updated as - All losses greater than 100 year
<b>UNABLIDSW</b>	Updated as - Unable to identify cause of flooding
<b>BOX_1_SW</b>	Code Section 1.) of Mitigation Action Codes
<b>BOX_2_SW</b>	Code Section 2.) of Mitigation Action Codes
<b>BOX_3_SW</b>	Code Section 3.) of Mitigation Action Codes
<b>BOX_4_SW</b>	Code Section 3.) of Mitigation Action Codes
<b>HISTBLDGSW</b>	Updated as - Historic Building
<b>Dt of Loss</b>	Date of Loss
<b>Occupancy</b>	Occupancy Type
<b>Zone</b>	Flood Zone
<b>Post FIRM</b>	YES/NO - Is this a Post FIRM structure?
<b>Building Payment</b>	Building Payment
<b>Contents Payment</b>	Contents Payment
<b>Building Value</b>	RCV that is determined and reported by the claims adjuster at the time of adjustment
<b>Tot Building Payment</b>	Total of Building Claim Payments
<b>Tot Contents Payment</b>	Total of Contents Claim Payments
<b>Losses</b>	Total Number of Losses

<b>Total Paid</b>	Total of ALL Payments
<b>Average Pay</b>	Average of ALL Payments
<b>Data Type</b>	Indicates the type of properties included on report (Mitigated/non-mitigated)
<b>As of Date</b>	As of Date for data on report
<b>County Name</b>	County Name
<b>SRL Indicator</b>	See SRL Indicator Descriptions Tab

*b. National Flood Insurance Program Claims*

<b>Name</b>	<b>Description</b>
<b>agriculturestructureindicator</b>	Indicator of whether a building is an agricultural structure
<b>asofdate</b>	The effective date of the data
<b>basefloodelevation</b>	Base Flood Elevation (BFE) for which there is a 1% chance per year of flooding
<b>basementenclosurecrawlspacetype</b>	Basement code
<b>reportedcity</b>	City of the insured property
<b>condominiumindicator</b>	Indicator of what type of condominium property is being insured
<b>policycount</b>	Insured units in an active status
<b>countycode</b>	FIPS code for the primary County
<b>crsdiscount</b>	Community Rating System (CRS) Classification Credit Percentage
<b>dateofloss</b>	Date on which water first entered the insured building;
<b>elevatedbuildingindicator</b>	Indicator of whether or not a building meets the NFIP definition of an elevated building
<b>elevationcertificateindicator</b>	Indicates if a policy has been rated with elevation certificate
<b>elevationdifference</b>	Difference between elevation of lowest floor and base flood elevation (BFE)
<b>censustract</b>	US Census Bureau defined census Tracts
<b>floodzone</b>	Flood zone derived from the Flood Insurance Rate Map (FIRM)
<b>houseworship</b>	Indicator of whether a building is a house of worship
<b>latitude</b>	Approximate latitude of the insured building
<b>locationofcontents</b>	Code that indicates where within the structure the contents are located
<b>longitude</b>	Approximate longitude of the insured building
<b>lowestadjacentgrade</b>	Lowest natural grade adjacent to the insured structure prior to excavating or filling

<b>lowestfloorelevation</b>	Building's lowest floor elevation
<b>numberoffloorsintheinsuredbuilding</b>	Code that indicates the number of floors in the insured building
<b>nonprofitindicator</b>	Indicator of whether a building is a nonprofit
<b>obstructiontype</b>	Type of obstruction in the enclosure
<b>occupancytype</b>	Code indicating the use and occupancy type of the insured structure
<b>originalconstructiondate</b>	The original date of the construction of the building
<b>originalnbdate</b>	The original date of the flood policy
<b>amountpaidonbuildingclaim</b>	Dollar amount paid on the building claim
<b>amountpaidoncontentsclaim</b>	Dollar amount paid on the contents claim
<b>amountpaidonincreasedcostofcomplianceclaim</b>	Dollar amount paid on the Increased Cost of Compliance (ICC) claim
<b>postfirmconstructionindicator</b>	Indicator of whether construction was started before or after publication of the FIRM
<b>ratemethod</b>	Indicates policy rating method
<b>smallbusinessindicatorbuilding</b>	Indicator of whether the insured represents a small business
<b>state</b>	The two-character alpha abbreviation of the state
<b>totalbuildinginsurancecoverage</b>	Total Insurance Amount in dollars on the building
<b>totalcontentsinsurancecoverage</b>	Total Insurance Amount in dollars on the contents
<b>yearoffloss</b>	Year of Loss = Year in which the flood loss occurred
<b>reportedzip</b>	5 digit Postal Zip Code of the insured property
<b>primaryresidence</b>	Indicator of whether a building is a primary residence

*c. Individual Assistance*

<b>Name</b>	<b>Description</b>
<b>id</b>	System generated unique identifier
<b>disasterNumber</b>	Unique FEMA numerical identifier for each disaster declaration
<b>damagedCity</b>	Damaged Dwelling City
<b>damagedStateAbbreviation</b>	Damaged Dwelling State Abbreviation
<b>damagedZipCode</b>	Damaged Dwelling Zip Code
<b>householdComposition</b>	Number of individuals living in household at time of damage
<b>grossIncome</b>	Self-reported Gross Income

<b>specialNeeds</b>	Applicant requires special accommodations to use FEMA assistance
<b>ownRent</b>	Applicant is Owner or Renter of Dwelling
<b>residenceType</b>	Damaged Dwelling Residence Type
<b>homeOwnersInsurance</b>	Does the applicant have Home Owner's Insurance?
<b>floodInsurance</b>	Does the applicant have flood insurance?
<b>inspected</b>	Has the applicant been inspected by FEMA?
<b>rpfvl</b>	Real property damage amount observed by FEMA
<b>habitabilityRepairsRequired</b>	Are repairs required to make the dwelling habitable?
<b>destroyed</b>	Is structure permanently uninhabitable?
<b>waterLevel</b>	Total depth of water in damaged dwelling
<b>floodDamage</b>	Was damage caused by flooding?
<b>foundationDamage</b>	Has the damaged dwelling's foundation been damaged?
<b>foundationDamageAmount</b>	Foundation damage amount observed by FEMA
<b>roofDamage</b>	Has the damage dwelling's roof been damaged?
<b>roofDamageAmount</b>	Roof damage amount observed by FEMA
<b>tsaEligible</b>	Is applicant eligible for Temporary Sheltering Assistance?
<b>tsaCheckedIn</b>	Has applicant checked in to FEMA provided Temporary Sheltering Assistance facility?
<b>rentalAssistanceEligible</b>	Is applicant eligible for FEMA rental assistance?
<b>rentalAssistanceAmount</b>	Amount of Rental Assistance in dollars
<b>repairAssistanceEligible</b>	Is applicant eligible for FEMA assistance to repair the damaged dwelling?
<b>repairAmount</b>	Amount of Repair Assistance in dollars
<b>replacementAssistanceEligible</b>	Is applicant eligible for FEMA assistance to replace the damaged dwelling?
<b>replacementAmount</b>	Amount of Replacement Assistance in dollars
<b>sbaEligible</b>	Is applicant eligible for a Small Business Association loan?
<b>renterDamageLevel</b>	Level of Damage: Moderate, Major, Destroyed
<b>rentalAssistanceEndDate</b>	Final Month applicant received Rental Assistance
<b>rentalResourceCity</b>	Rental Resource City
<b>rentalResourceStateAbbreviation</b>	Rental Resource State Abbreviation

<b>rentalResourceZipCode</b>	Rental Resource Zip Code
<b>primaryResidence</b>	Is the applicant's damaged dwelling his/her primary residence?
<b>personalPropertyEligible</b>	Is the applicant eligible for FEMA's Other Needs Assistance to cover damaged personal property?
<b>ppfvl</b>	FEMA Verified Loss captured during inspection of personal property
<b>censusBlockId</b>	Address-based 15-character code
<b>censusYear</b>	Census period used to obtain Census Block ID