

## Guidance for Local Communities on Completing a Substantial Damage Vulnerability Analysis

### I. What is a Local Substantial Damage Vulnerability Analysis?

An SD vulnerability analysis seeks to identify structures that are vulnerable to SD within a community's regulatory floodplain. Communities can use a vulnerability analysis to:

- Pinpoint areas to prioritize for SD assessments after damaging events
- Identify priority structures for mitigation grants
- Obtain Community Rating System (CRS) points for a Substantial Damage Management Plan

The Vulnerability Analysis includes methods for identifying areas vulnerable to substantial damage. For both simplified and complex methods, communities can use the information generated from a Vulnerability Analysis as part of an SD Plan or to create a Substantial Damage Vulnerability Analysis Report. Both of which are tools communities can use to increase safety and resiliency. A summary of the methods is provided:

The **simplified method** involves gathering information most communities already have, including data on structures, flood risk, and historical damage. This information is then used to identify areas with many structures that are potentially at risk of being substantially damaged. *(Recommended for communities who have limited resources or lack digital data.)*

**Complex methods** can be used in communities with access to computer software, such as Geographical Information Systems (GIS). In these cases, multiple options are available. *(Recommended for communities with GIS capabilities and/or interest in CRS credit.)*

### II. Use of this Document

**This document is designed for communities that need to identify which areas and/or structures are most vulnerable to SD.** This document may be provided to communities along with the local SD plan template during community floodplain management program audit processes or in other instances as appropriate.

<sup>1</sup> (FEMA CAP-SSSE Tiered State Framework (TSF) Playbook v4.1, pg. 37-38)

### III. Purpose & Introduction

#### Purpose

This document provides communities with methodology options they can use to identify structures that are vulnerable to SD within their Special Flood Hazard Areas (SFHA) and any other community regulated flood-prone areas (regulatory floodplain).

#### What is a Substantial Damage Vulnerability Analysis?

An SD vulnerability analysis seeks to identify structures that are vulnerable to SD within a community's SFHA. This involves compiling information about the structures within a community's regulatory floodplain and using that information to assess the potential damage that could occur due to natural disasters or other events that cause damage (damage events).

The FEMA Community Rating System (CRS) program also requires an SD vulnerability analysis to be conducted as part of an SD plan to earn CRS credit. If completing a vulnerability analysis for CRS credit purposes, then the community should also refer to the FEMA *Developing a Substantial Damage Management Plan guidance document (2021)*<sup>1</sup>.

#### Use of this Document

The methodology used by a community to conduct an SD vulnerability analysis is dependent on their available data and resources. This guidance document will focus on a methodology for communities that do not participate in CRS, have limited access to data and resources, and wish to determine which structures within their regulatory floodplain are most at risk of SD due to flood events. However, it also addresses additional methodologies that can be used by CRS communities or communities with extensive data, software, and staff resources.

### IV. Background

#### National Flood Insurance Program SD Requirements

Under the National Flood Insurance Program (NFIP), participating communities are responsible for regulating all development and assessing damages that occur to all structures within the regulatory floodplain. Communities are required to conduct SD assessments after disasters or any event which causes damage to a structure (damage event).

A structure in the regulatory floodplain is considered **substantially damaged** if it has been damaged such that the cost to repair the damage and return the structure to its pre-damage condition is equal to or greater than 50% of the pre-damage market value of the structure.

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<sup>1</sup> Available online at: [https://crsresources.org/files/500/developing\\_subst\\_damage\\_mgmt\\_plan.pdf](https://crsresources.org/files/500/developing_subst_damage_mgmt_plan.pdf)

The source of the damage event is not limited to floods – a structure in the regulatory floodplain can also be considered substantially damaged due to windstorms, wildfires, earthquakes, hurricanes, and other causes.

### Post-Disaster SD Requirements

After an event, NFIP participating communities are required to assess damaged structures within the regulatory floodplain and determine whether they are substantially damaged. These SD determinations must happen after every event, not just large events that rise to the level of a State Declared Disaster (SDD) or Presidentially Declared Disaster (PDD). Understanding what structures within a community's regulatory floodplain are at risk of SD will support and benefit community SD assessment activities.

If a structure is substantially damaged, then it will have to be repaired in such a way that it is brought into compliance with the current floodplain regulations. This may trigger significant changes to the location, design, elevation, and construction of the structure. These requirements can have financial and other impacts on property owners.

### SD Vulnerability Analyses Mitigate Risk

To reduce flooding impacts, structures vulnerable to SD can be identified prior to a damage event. These at-risk structures can be prioritized for mitigation actions (such as elevating, retrofitting, relocating, or acquiring a structure for demolition) to reduce or remove their risk of future damages.

Understanding where these structures are located is the first step towards being able to mitigate the risks to SD structures in a community. Knowledge of the structures at risk of SD will also help prepare communities in advance of a disaster or damage event (e.g., flood). Not all damage events are large enough in magnitude to be considered disasters. This information can also be used to assist communities with post-disaster SD assessment and determination activities.

## V. Methodology Options

Communities have options available to conduct an SD vulnerability analysis and identify structures with SD risk within their regulatory floodplains. The following sections provide methodologies that communities can utilize.

### Selecting the Most Appropriate Methodology

The methodologies in this document are organized from simple to complex based on the level of effort, software and data required. Communities should choose the methodology most appropriate to their situations and available data. Below is a brief description of the data and software requirements for each methodology.

- **Option 1. Simplified Methodology:** Most appropriate for communities with paper structure and hazard data and limited access to Geographic Information Systems (GIS).
- **Option 2. Complex Methodologies:** Most appropriate for communities that have structure and hazard information in digital or GIS format, access to ESRI

ArcGIS software, and other specific datasets. These methodologies also rely on use of external tools, such as FEMA's Substantial Damage Estimator Tool, FEMA's Hazus Program, and FEMA's Flood Assessment Structure Tool (FAST). *Use of these methodologies may earn CRS participating communities CRS credit.*

## **1. Simplified Methodology**

This method is most appropriate for communities that have most of their structure and hazard information in paper format and have limited access to the following:

- Software such as GIS,
- Structure data in electronic/GIS format,
- Flood risk and other hazard data in electronic/GIS format, and
- Staff with the knowledge and capacity to conduct an analysis of the structures in the community at risk of SD.

However, this method can provide value to any communities that do not have SD vulnerability information for the structures within their regulatory floodplain.

### **1.1 Methodology Overview**

Communities can utilize hard copy information to identify the structures that fall within the regulatory floodplain and review hard copy natural hazard data (e.g., Flood Insurance Rate Maps (FIRMs), Flood Insurance Studies (FIS), flood insurance claims data, etc.) to identify structures vulnerable to SD.

### **1.2 Data Requirements**

The data needed and potential sources for that data are provided in Table 1. Communities can proceed with incomplete datasets but the analysis results will reflect these limitations, which should be conveyed to the analysis users.

Table 1. Simplified Methodology SD Vulnerability Analysis Data

<b>Structure Data</b>	
<b>Data Type</b>	<b>Potential Source(s)</b>
Address	Assessor data, community permit files
Construction type (e.g., residential, non-residential)	Assessor data, community permit files
Year built	Assessor data, community permit files
Number of stories	Assessor data, community permit files
Foundation type	Assessor data, community permit files
Basement (Y/N)	Assessor data, Elevation Certificate, community permit files
Building size (sq. ft.)	Assessor data, community permit files
Elevation of lowest floor	Elevation Certificates, LiDAR data, community permit files
Market Value	Adjusted Assessor data, appraisals
Property identification number (e.g., parcel number)	Assessor data, community permit files
<b>Flood Risk and Historic Damage Data</b>	
<b>Data Type</b>	<b>Potential Source(s)</b>
Flood Risk Information (e.g., flood hazard zones, Base Flood Elevations (BFE), etc.)	FEMA Flood Insurance Rate Maps and Flood Insurance Studies; Other local, state, or federal flood studies or mapping information (such as Base Level Engineering (BLE) data); Community Hazard Mitigation Plan.
Historic flood damage information	Flood insurance claims data; Repetitive Loss (RL) or Severe Repetitive Loss (SRL) data; past SD determination records (structure data); High Water Mark (HWM) data; community Natural Hazard Mitigation Plan; TexMesonet Viewer ( <a href="https://www.texmesonet.org/">https://www.texmesonet.org/</a> ); TexasFlood.org Flood Gage Viewer ( <a href="https://map.texasflood.org/">https://map.texasflood.org/</a> ); and community staff knowledge of previously identified flood risks at various flood stages.
Topographic data (e.g., topographic maps, LiDAR data, etc.)	FEMA, state, and local community databases; the Texas Geographic Information Office has LiDAR data available online at: <a href="https://geographic.texas.gov/stratmap/elevation-lidar.html">https://geographic.texas.gov/stratmap/elevation-lidar.html</a> ; USGS has topographic maps available online at: <a href="https://www.usgs.gov/programs/national-geospatial-program/topographic-maps">https://www.usgs.gov/programs/national-geospatial-program/topographic-maps</a> .

Communities may have additional structure data they wish to include to support other analysis or efforts (e.g., FEMA Mitigation Grant Benefit Cost Analysis or CRS Repetitive Loss Areas Analysis). They may also have additional flood hazard data that can be utilized to complete the analysis procedures specified in Section 1.3.

### 1.3 Simplified Methodology Analysis Procedures

#### **Create the Vulnerability Analysis Spreadsheet**

- 1) Create a hard copy or Microsoft (MS) Excel list of the structures within the regulatory floodplain by address.
- 2) Add structure information to the list. Add a new column for each data field that the community has at least partial data for. Table 1 shows a list of Structure Data. Each row represents a new column that can be added to the list. Only add a column if to the data required to populate it is available. However, if only partial data is available for a column, add that information but enter “N/A” for any structures that are missing that data.
- 3) Add a column titled “SD Risk Category (High, Med., Low).”

#### **Identify Flood Risk for Each Structure**

- 4) Access the FEMA floodplain mapping information for the community. This information is available online at <https://msc.fema.gov/portal/advanceSearch>.
- 5) Compile any additional state or local floodplain mapping information for the community.
- 6) Review the floodplain mapping information and add columns to the list to note the flood zone each structure falls in.

#### **Determine SD Vulnerability Utilizing Floodplain Mapping or Topographic Data** **(Optional based on data availability)**

- 7) If the community has detailed floodplain mapping with Base Flood Elevation (BFE) data or High-Water Mark (HWM) data and structure’s lowest floor information, then complete the following steps. If it does not, then skip these steps.
  - a. Add a column titled “Base Flood Elevation” (or “BFE”) or “HWM” depending on the information available and add the BFE or HWM elevation information for each structure.
  - b. Add a column titled “Below/Above the BFE” or “Below/Above the HWM” depending on the data available.
  - c. Add a column titled “BFE Difference” or “HWM Difference” based on the data available.
  - d. Compare each structure’s lowest floor elevation data with the BFE or HWM data. If the structure’s lowest floor elevation is above the BFE or HWM then put “Above” in the “Below/Above the BFE” or “Below/Above the HWM” column and vice versa if it is “Below.” Then enter the difference between the structures lowest floor and BFE or HWM.
  - e. If a structure’s lowest floor is below the BFE or HWM then enter “High” in the “SD Risk Category” column.
  - f. If a structures lowest floor is at (equal to) the BFE or HWM then enter “Med.” in the “SD Risk Category” column.

- 8) If the community does not have detailed floodplain mapping with BFE data, HWM data, or structure lowest floor information, but does have access to topographic data (e.g., LiDAR data) then complete the following steps.
- Review the topography information within the regulatory floodplain and identify any structures that have lower elevations or are in areas of low elevation adjacent to a flooding source.
  - For any structures at low elevations enter “Med.” into the “SD Risk Category” column.

### **Incorporate Community Knowledge of Historic Flooding and Past Events**

- 9) Have staff with knowledge of historic flooding, nuisance flooding, and past damage events review the FEMA floodplain mapping information for the community and complete the following steps.
- Identify any structures that are in areas where structures have experienced damage due to nuisance flooding, historic flood events, or other damage events that have a risk of occurring again.
  - For these structures enter “High” in the “SD Risk Category” column.

### **Assess SD Vulnerability Based on Historic Flood Damage Data (*Only complete if one of steps 7, 8, or 9 were completed*)**

- 10) If the community has access to Flood Insurance Claims data, RL data, SRL data, or past SD determination data for structures within the regulatory floodplain then complete the following steps.
- Review the list of structures that have had a flood insurance claim paid, are on the RL list or the SRL list, or have had past SD determinations.
  - Enter “High” in the “SD Risk Category” column for any of these properties.
  - Do not note anywhere on the list or any document related to the list the address of structures that have had a flood insurance claim, are on the RL or SRL lists, or have had past SD determinations. That information is covered by the 1974 Privacy Act and cannot be disclosed. The community must avoid singling out these structures and conveying which structures had claims or are RL or SRL structures. For any questions about meeting the Privacy Act requirements while completing this work, consult the community attorney.
  - Only complete step 10) if at least one of steps 7), 8), or 9) are completed to ensure individual properties with past flood insurance claims, SD determinations, or RL or SRL designations cannot be identified.

### **Prepare SD Vulnerability Analysis Report and Complete Analysis Process**

- 11) Enter “Low” in the “SD Risk Category” column for any structures that have not been categorized as “Med.” or “High.”
- 12) Prepare a brief written “SD Vulnerability Analysis” report in hard copy, MS Word, or equivalent to accompany the list and ensure it addresses the following topics:
- Date the vulnerability analysis was conducted and staff involved,
  - Data used to complete the vulnerability analysis,
  - Summary of methodology (analysis steps completed),
  - How the list will be maintained and updated, and



- e. How the list should be used (e.g., in support of SD planning efforts and post-disaster SD assessment work).
- 13) Review the draft list and complete an internal Quality Assurance/Quality Control (QA/QC) review.
- 14) Finalize the list and save it electronically if possible.

#### 1.4 Analysis Products

The simplified approach can be used to develop a list or database of structures within the regulatory floodplain that are potentially vulnerable to SD and findings and information that can be incorporated into an SD plan or a “SD Vulnerability Analysis” report.

#### 2. Other Complex Methodologies

Communities can utilize more complex methodologies and tools if they have most of their structure and hazard information in electronic/GIS format and have access to the following:

- Basic GIS software,
- Structure data in GIS format (point data or building footprint data),
- Flood risk and other hazard data in GIS format (floodplain boundaries, BFE, etc.), and
- Staff with the knowledge and capacity to use software tools (e.g., GIS) to conduct a GIS based vulnerability analysis.

Communities can use these additional methodologies even if they do not participate in the CRS program. However, if a community participates in CRS and wishes to obtain CRS credit for their SD Plan, then they can and should use one of the methodologies listed below and review the FEMA CRS guidance for SD vulnerability assessments in the FEMA *Developing a Substantial Damage Management Plan guidance document (2021)*<sup>2</sup>.

The additional methodology options recommended in this guidance are:

##### 1. Repetitive Loss Area Analysis (RLAA)

- a. CRS Developing an RLAA guide (2017) - <https://www.crsresources.org/files/500/rlaa-guide-2017.pdf>
- b. CRS fact sheet on mapping RL areas for CRS - [https://crsresources.org/files/500/mapping\\_repetitive\\_loss\\_areas.pdf](https://crsresources.org/files/500/mapping_repetitive_loss_areas.pdf)

##### 2. FEMA Flood Assessment Structure Tool (FAST)

- a. FEMA FAST Fact Sheet - [https://www.fema.gov/sites/default/files/documents/fema\\_flood-assessment-structure-tool.pdf](https://www.fema.gov/sites/default/files/documents/fema_flood-assessment-structure-tool.pdf)
- b. Live walkthrough videos of the FAST tool - <https://bit.ly/HazusFASTVideo>

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<sup>2</sup> Available online at: [https://crsresources.org/files/500/developing\\_subst\\_damage\\_mgmt\\_plan.pdf](https://crsresources.org/files/500/developing_subst_damage_mgmt_plan.pdf)



- c. Link to download the FAST tool - <https://hazus-support.msc.fema.gov/Updates/061520/FAST.zip>
- 3. FEMA Substantial Damage Estimator (SDE) tool**
  - a. FEMA SDE tool portal - <https://www.fema.gov/emergency-managers/risk-management/building-science/substantial-damage-estimator-tool>
  - b. FEMA SDE tool User Manual - [https://www.fema.gov/sites/default/files/2020-07/sde\\_3.0\\_user\\_manual\\_field\\_workbook\\_0.pdf](https://www.fema.gov/sites/default/files/2020-07/sde_3.0_user_manual_field_workbook_0.pdf)
  - c. Link to download FEMA SDE tool - [https://www.fema.gov/sites/default/files/2020-07/SDE3\\_04062018.zip](https://www.fema.gov/sites/default/files/2020-07/SDE3_04062018.zip)
- 4. FEMA Hazus software**
  - a. FEMA Hazus portal - <https://msc.fema.gov/portal/resources/hazus>
  - b. Hazus Tools and Data User Release Notes (2019) - <https://www.fema.gov/sites/default/files/2020-09/hazus-tools-data-release-notes.pdf>
  - c. Hazus self-guided course materials - <https://bit.ly/HazusCourses>
  - d. Hazus YouTube videos - <https://bit.ly/HazusYouTube>
  - e. Hazus Loss Library - <https://hazards.fema.gov/hll/about>

Each of these complex methodologies uses specialized processes and community-provided data to execute an automated and more complex analysis of the risks structures within the regulatory floodplain are vulnerable to, including SD. After completing an analysis using one of these methodologies, a community can reference the methodology used and then incorporate the findings and information into a community SD Plan or prepare an SD Vulnerability Analysis report.

### 3. Conclusion

Communities can benefit from having information about structures that are vulnerable to SD in both blue sky and post-damage event scenarios. This information can support outreach, mitigation, and SD assessment activities. A community's methodology selection should be informed by the data and resources they have access to. The methods covered in this guidance document present options that will work for all types of communities. For questions or additional information contact the Texas Water Development Board (TWDB) at [flood@twdb.texas.gov](mailto:flood@twdb.texas.gov).