# DEVELOPING TOOLS AND WORKFLOWS FOR SDE DATA

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**Flood Mitigation Program**

*Protecting Lives, Protecting Property* | Floodplain Management, Mapping, and Mitigation

www.dnr.sc.gov/flood

# Substantial Damage

- Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before damage occurred.

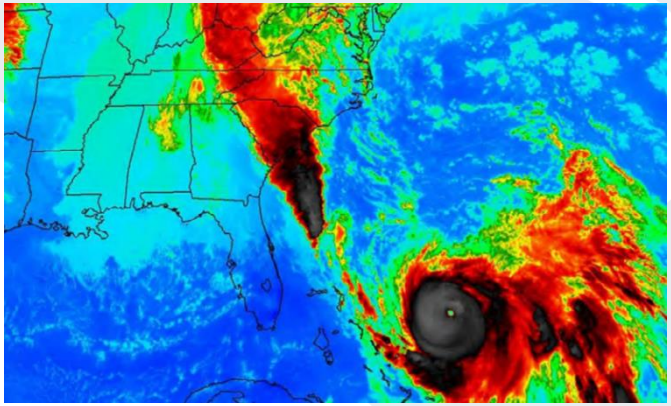
# Substantial Improvement

- Any improvement of a structure, the cost of which equals to exceeds 50 percent of the market value of the structure. Includes structures which have incurred “substantial damage”, regardless of the actual work performed.

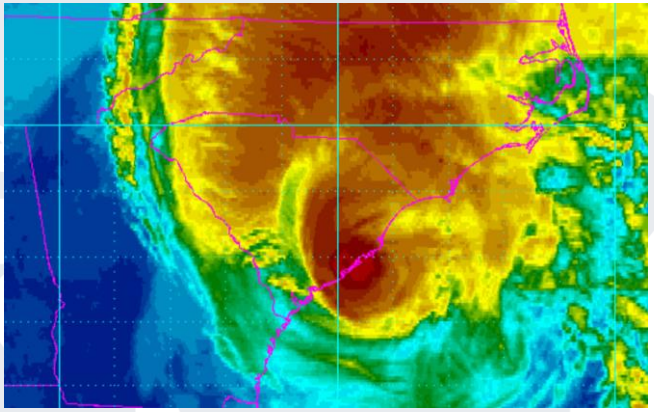
# Cumulative Substantial Improvement

- South Carolina's model ordinance states that permits shall be cumulative for 5 years
- Majority of communities have adopted this higher standard

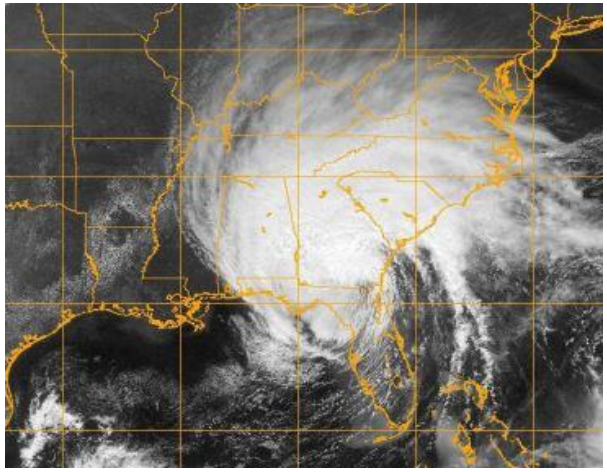
# Five Flood Events in Five Years



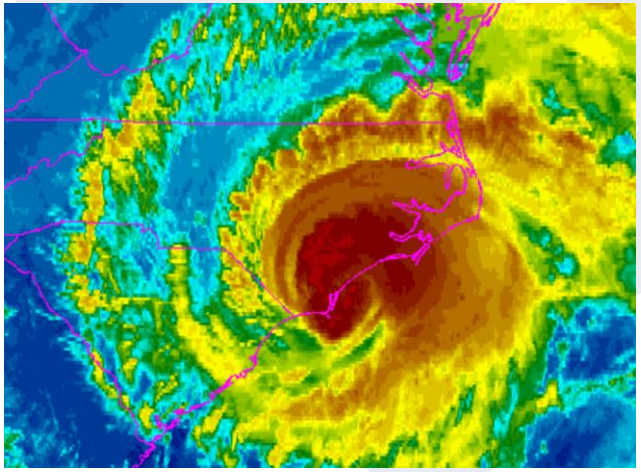
2015 October Flood



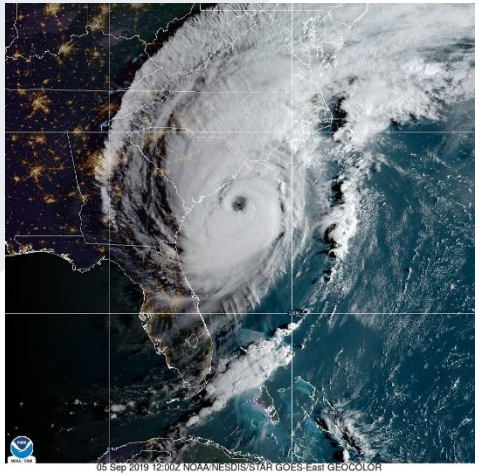
2016 Hurricane Matthew



2017 Hurricane Irma

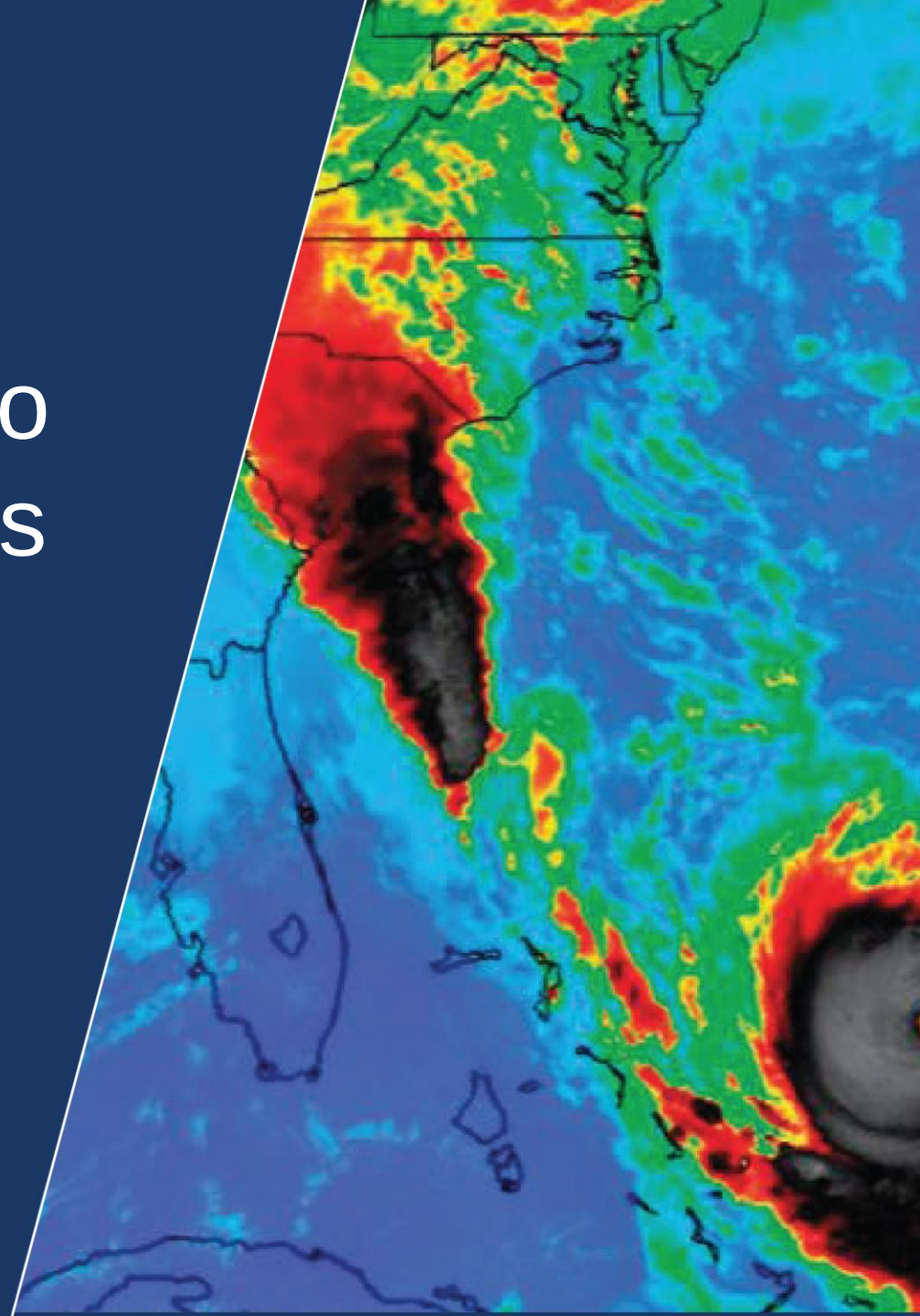


2018 Hurricane Florence




2019 Hurricane Dorian

# State Approach to Conducting SDEs

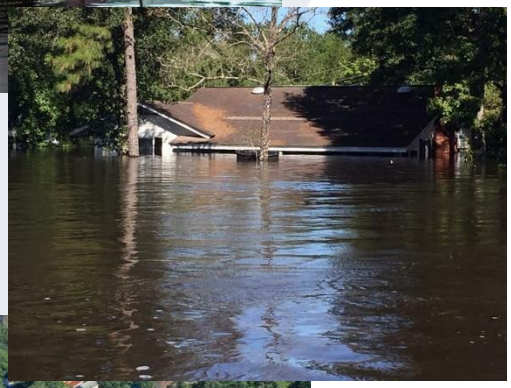


# October 2015 flooding

- HMTAP teams
  - Advantages
    - Covered whole state
    - Compliance with the NFIP
  - Disadvantages
    - Lack of community involvement
    - Slow

# Hurricane Matthew

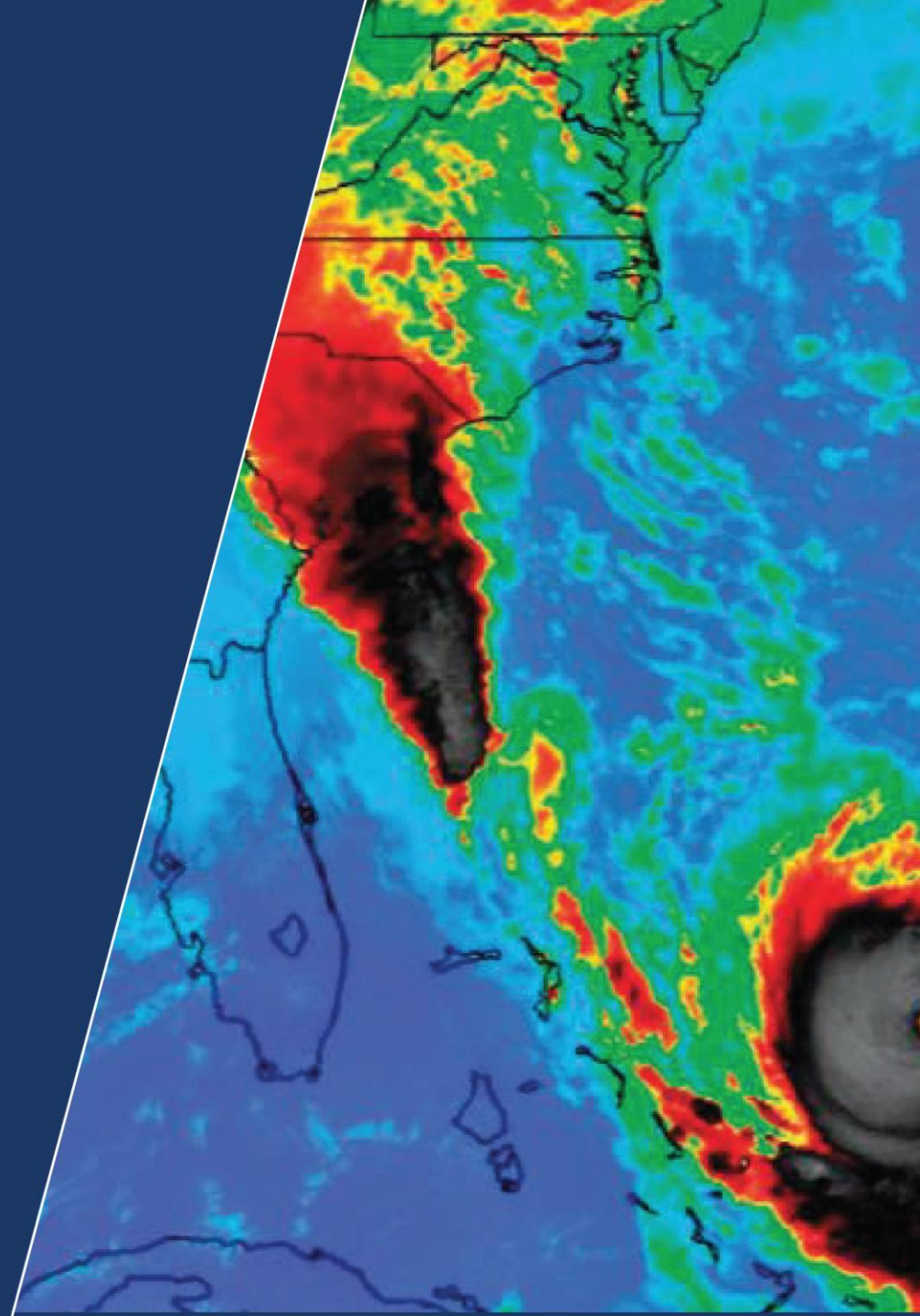
- State Assistance
  - Advantages
    - Consistency
    - More community engagement
  - Disadvantages
    - Lack of manpower
    - Lack of follow up



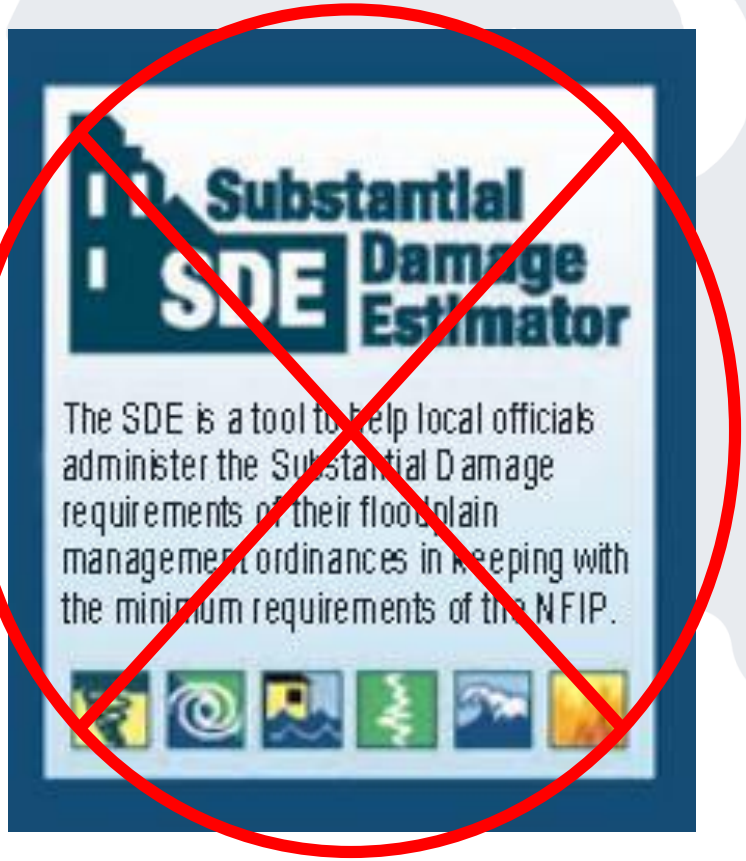
# Hurricane Florence

- Coordinated volunteer approach
  - Advantages
    - Trained local community
    - Moved quickly
  - Disadvantages
    - Managing volunteers
    - **FEMA's SDE software!!!**

# SCDNR's New and Improved SDE Tools



# Updated SDE tool




## NEW SDE tool!

- Data is collected with Collector app and entered into the SDE spreadsheet.
- Spreadsheet based calculator tool that replicates the calculations of the FEMA SDE software.

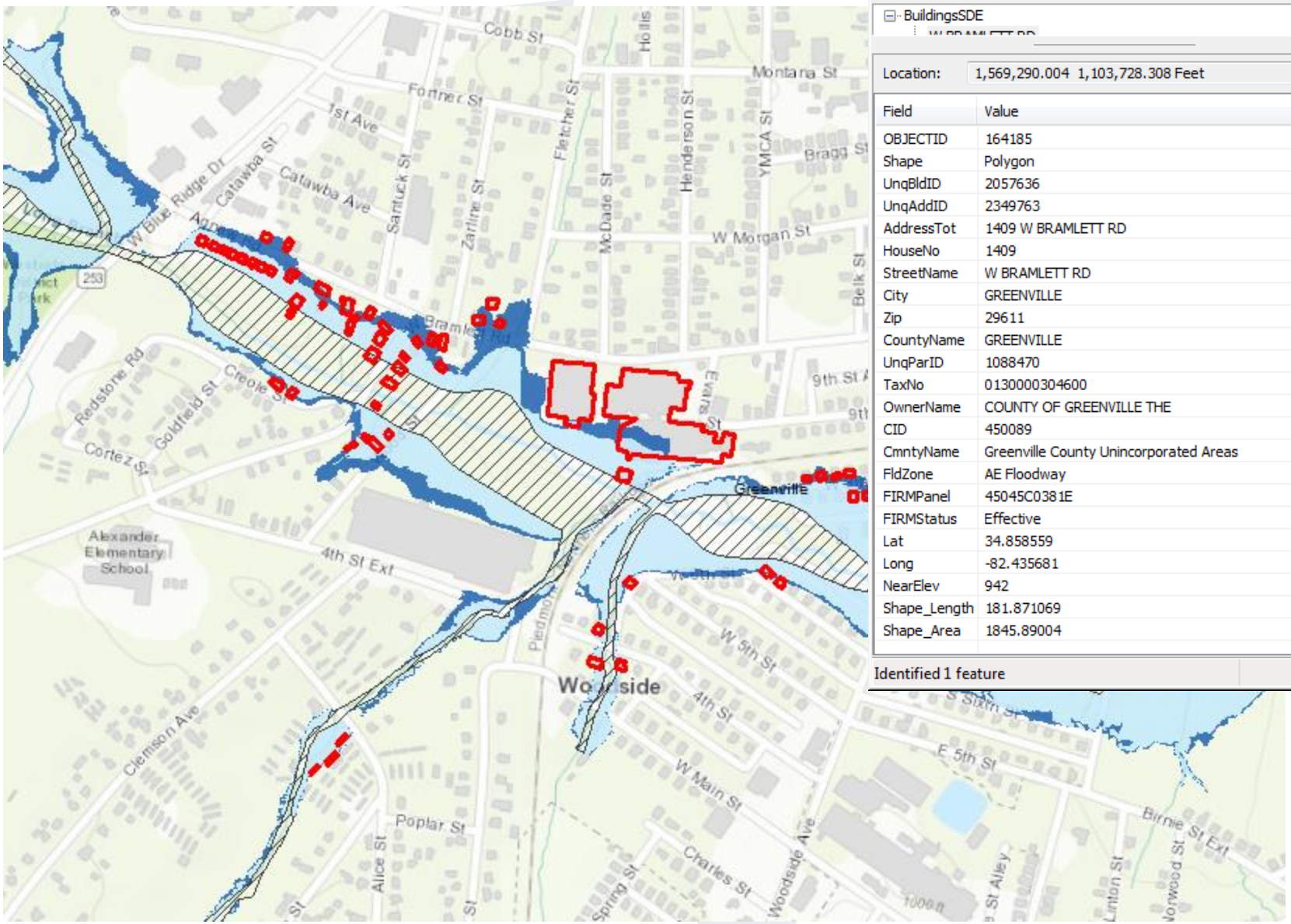
# Updated SDE Tool Development

- Develop support data layer of floodprone buildings with pre-populated information
- Extract/Reverse-Engineer FEMA SDE Logic
- Create spreadsheet calculator and batch tool

# Floodprone Buildings Support Layer

- Can be loaded into Collector to have basic location/information on buildings
  - Help pre-identify the location and number of buildings that may need SDE inspections
  - Can save time with back-end processing
- Use Microsoft building footprints as base
- Attribute buildings on floodprone parcels with basic locator, flood hazard, and elevation

# Example Attribute Buildings - Greenville



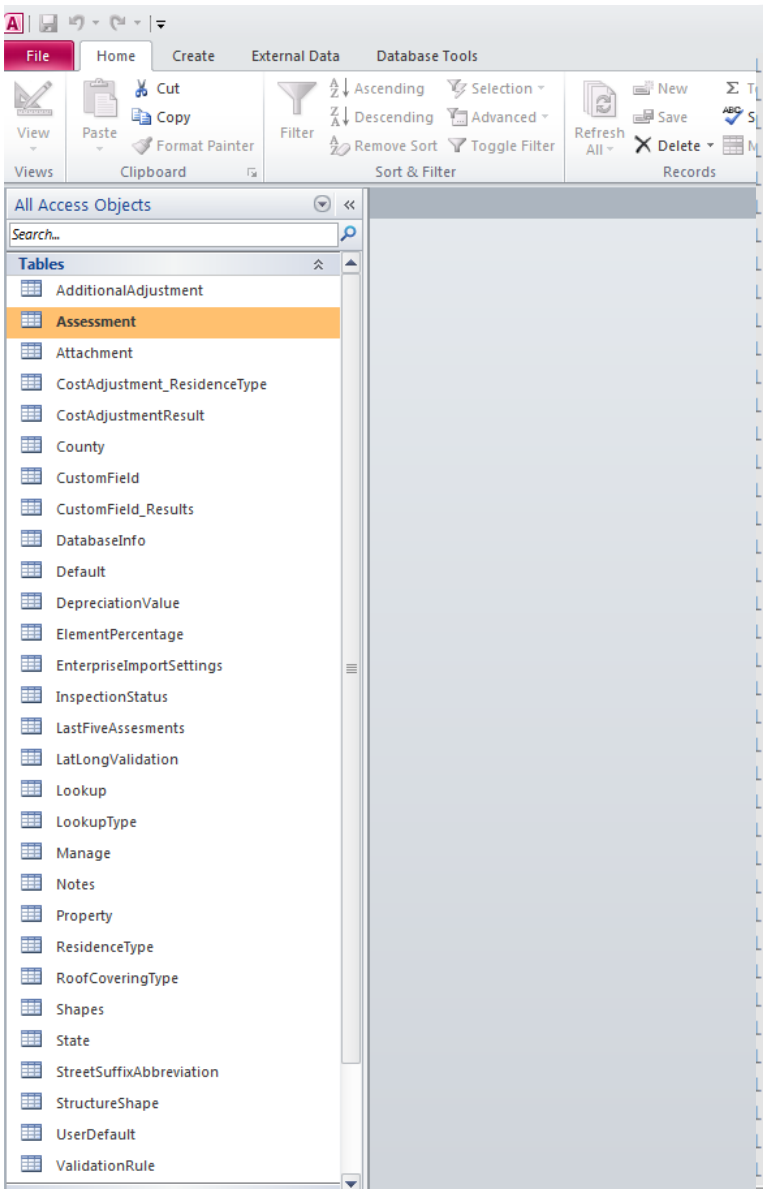
# Reverse Engineer SDE Logic

- Biggest challenge is figuring out % value of each element to total based on combination of inputs
  - 13+/- inputs of building use/type
  - Produces over 23,000 combinations that each result in different values
- Examined FEMA SDE program files to decipher

# Reverse Engineer SDE Logic

- Reads/Writes to Access database and stores percent damage relationships in JSON files
- Converted program data to coded pivot tables in Excel to capture
- Rebuild logic to calculate SDE estimate outside of program

# SDE Access Database and JSON Look-Up Files





```
    "SuperStructureID": 3,
    "RoofCoveringID": 1,
    "ExteriorFinishID": 5,
    "HvacID": 2,
    "StoryID": 3,
    "Element": "Cabinets and Countertops",
    "Percentage": "4.2",
    "FIELD10": ""
  },
  {
    "ResidenceID": 1,
    "FoundationID": 3,
    "SuperStructureID": 3,
    "RoofCoveringID": 1,
    "ExteriorFinishID": 5,
    "HvacID": 2,
    "StoryID": 3,
    "Element": "Floor Finish",
    "Percentage": "12.9",
    "FIELD10": ""
  },
  {
    "ResidenceID": 1,
    "FoundationID": 3,
    "SuperStructureID": 3,
    "RoofCoveringID": 1,
    "ExteriorFinishID": 5,
    "HvacID": 2,
    "StoryID": 3,
    "Element": "Plumbing",
    "Percentage": "10.7",
    "FIELD10": ""
  },
  {
    "ResidenceID": 1,
    "FoundationID": 3,
    "SuperStructureID": 3,
    "RoofCoveringID": 1,
    "ExteriorFinishID": 5,
    "HvacID": 2,
```

# Updated SDE Tool Development

- Started with “interactive” SDE calculator spreadsheet interface
  - User enters essential inputs with “pull-down” menus or manual entry
  - Spreadsheet performs lookups and calculations
  - Great for single calculation
- Added batch function using VBA code to run any number of records
  - Writes data to new columns
  - Provides ability to export to report

# Tool Built-In User Guide Excerpt

## User Guide

### SCDNR Flood Mitigation Data Compilation Tool

The SDE Calculator 1.0 is a calculator spreadsheet model based on the FEMA SDE Application. All input data and methodologies used to produce final determination have been taken from the FEMA SDE Application Version 3.0. This user guide is provided to help users with this model. The user should refer back to the FEMA Substantial Damage Estimator (SDE) User Manual and Field Workbook for any additional information.

The SDE Calculator Workbook includes 2 visible screens that are used to calculate damages for one or multiple properties. Below is a brief explanation on how each worksheet operates.

### Interactive Calculator Mode (Calculator Tab)

The calculator worksheet is an independent and interactive calculator that can be used to calculate damages for individual properties. This work book has 4 parts; General information, structure information, element damages and damage summary.

General Information box is used to put general information about the property and assessment. The information in this box is only informative and would not impact the assessment. This information includes the property address, cause of damage, depth of water above ground and lowest floor and the assessment date.

| GENERAL INFORMATION | | | | |
|---|---|---|---|---|
| *Property Address* | | | *Assessment Date* | |
| | | | | |
| *Inspector/Team* | *Cause of Damage* | *Flood Depth Above Ground* | *Flood Depth Above Floor* | *Flood Duration* |
| | | | | |
| *Comments* | | | | |
| | | | | |

Structure information box represents information about the property. User should choose an option from the dropdown fields to populate the structure information. Cells relevant to damage calculations remain green while all non-relevant cells turn to dark gray. Please refer to the FEMA SDE user manual for detailed explanation on each element type.

| STRUCTURE INFORMATION | |
|---|---|
| Structure Type | Residential |
| Residential Type | Select One |
| Number of Stories | Select One |
| Foundation | Select One |
| Superstructure | Select One |
| Roof Covering | Select One |
| Exterior Finish | Select One |
| Heating and Cooling | Select One |
| Structure Use | Select One |
| Story | 1 Story |
| Sprinkler | No |
| Conveyance | No |
| Depreciation Determination | 4- Average Condition |
| Depreciation Value | 24.2% |
| Total Square Footage | |
| Quality | Average |
| Geographic Adjustment | 1.0 |
| Base Cost ($/sq ft) | $175.00 |

Element damage box represents the field assessment damages. User should enter the estimated percent

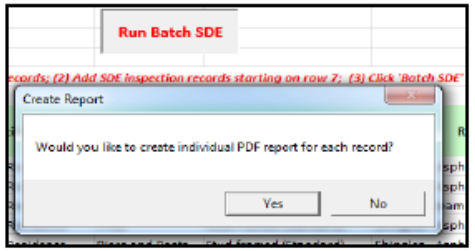
## User Guide

### SCDNR Flood Mitigation Data Compilation Tool

are not perfect and may not represent the actual building outline.

| Total Square Footage | Depreciation Determination | Geographic Adjustment | Base Cost ($/ft) | NonResidential Interior Damage |
|---|---|---|---|---|
| 956 | | | 175 | 0 |
| 1419 | | | 175 | 0 |
| 1672 | | | 175 | 0 |
| 3635 | | | 175 | 0 |
| 3352 | | | 175 | 0 |

User can use the "Run Batch SDE" to calculate damages for all properties. A message will pop up asking the user if they would like to create individual PDF report for each record. This will result in the model to create individual PDF files in the same location where the calculator is stored. The tool will loop through all the rows populated by the user and add resulting SDE calculations in the orange highlighted columns to the right of the main table. If the user elects to create PDF reports, the PDF files are named with the Unique ID as their identifier and stored in the same directory as the spreadsheet tool. The SDE calculation results includes Flagged errors that can help user identify issues with the assessment entry.



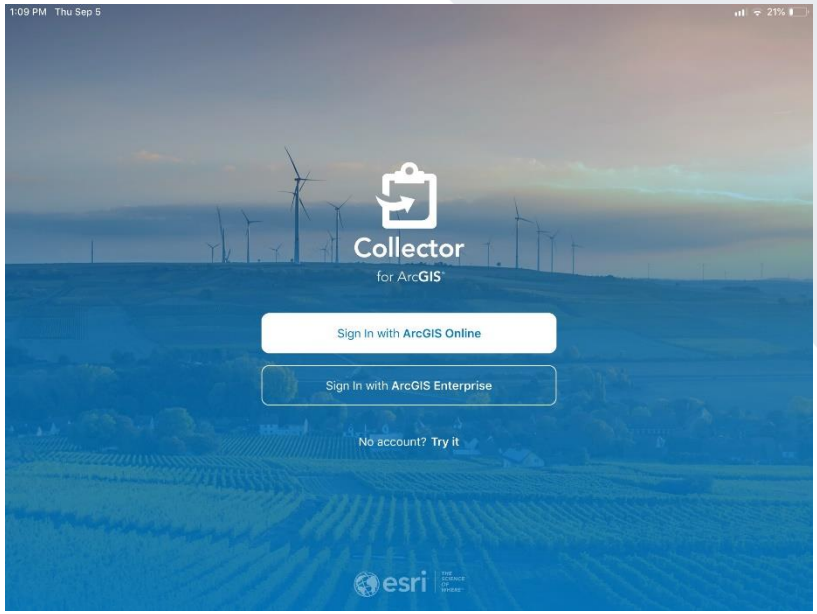

| SDE CALCULATION RESULTS | | | | | | |
|---|---|---|---|---|---|---|
| $ Replacement Cost | $ Computed Damages | Percent Depreciation | Computed Actual Cash Value | Overall Percent Damage | Final Determination | Flagged Error (Y/N) |
| $167,300.00 | $1,611.10 | 24.2 | $126,813.40 | 1.3 | Not Substantially Damaged | N |
| $248,325.00 | $1,427.87 | 24.2 | $188,230.35 | 0.8 | Not Substantially Damaged | N |
| $292,600.00 | $2,750.44 | 24.2 | $221,790.80 | 1.2 | Not Substantially Damaged | Y |
| $636,125.00 | $6,068.63 | 24.2 | $482,182.75 | 1.3 | Not Substantially Damaged | N |
| $586,600.00 | $18,477.90 | 24.2 | $444,642.80 | 4.2 | Not Substantially Damaged | N |

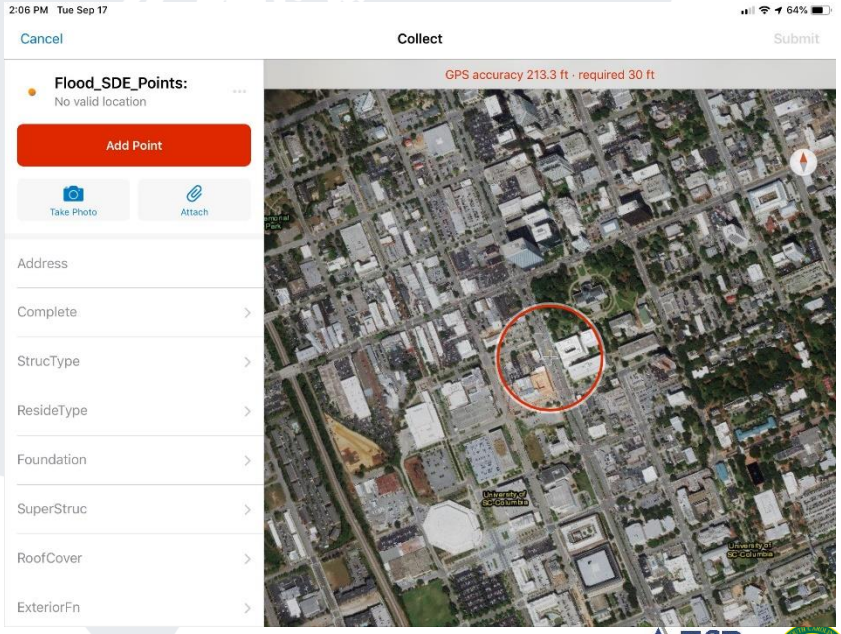
### Troubleshooting

The SDE Calculator model uses macros to calculate the damages. If the Macros are not enabled on this

# Collecting Field data

- FEMA's Residential Damage Inspection Worksheet (google FEMA SDE) OR
- SCDNR's revised version OR
- ArcGIS on-line Collector app



# Calculating the SDE

- Export field data from the ArcGIS Collector app as an Excel spreadsheet
- Import into SDE Calculator Batch mode
- Run Batch mode
  - May need to edit columns in order for it to run
  - Can create individual PDF reports for each record

# SDE Calculator- Batch mode

**SDE Calculator - Batch Mode**

*Version 1.0 (September 2019)*

Run Batch SDE

*To use Batch Spreadheet: (1) Clear any existing/unwanted records; (2) Add SDE inspection records starting on row 7; (3) Click 'Batch SDE' button; (4) review results st*

| Unique ID | Address | Structure Type | Residential Type | Foundation | Superstructure | Roof Covering | Total Square Footage | Depreciation Determination | Geographic Adjustment | Base Cost ($/ft) | NonResidential Interior Damage | $ Replacement Cost | Percent Depreciation | Computed Actual Cash Value | $ Computed Damages | Overall Percent Damage | Final Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | SDE CALCULATION RESULTS |
| 2 | | Yes | Residential | Single Family Re | Piers and Posts | Stud-framed (Standard) | 2158 | | | 175 | | $377,650.00 | 24.2 | $286,258.70 | $7,175.35 | 2.5 | Not Substanti |
| 3 | | Yes | Residential | Single Family Re | Piers and Posts | Stud-framed (Standard) | 2271 | | | 175 | | $397,425.00 | 24.2 | $301,248.15 | $7,551.08 | 2.5 | Not Substanti |
| 4 | | Yes | Residential | Single Family Re | Piers and Posts | Stud-framed (Standard) | 2379 | | | 175 | | $416,325.00 | 24.2 | $315,574.35 | $2,914.28 | 0.9 | Not Substanti |
| 7 | | Yes | Residential | Single Family Re | Piers and Posts | Stud-framed (Standard) | 3054 | | | 175 | | $534,450.00 | 24.2 | $405,113.10 | $0.00 | 0 | Not Substanti |
| 8 | | Yes | Residential | Single Family Re | Piers and Posts | Stud-framed (Standard) | 1482 | | | 175 | | $259,350.00 | 24.2 | $196,587.30 | $3,112.20 | 1.6 | Not Substanti |
| 9 | | Yes | Residential | Single Family Re | Piles | Stud-framed (Standard) | 2545 | | | 175 | | $445,375.00 | 24.2 | $337,594.25 | $6,591.55 | 2 | Not Substanti |
| 10 | | Yes | Residential | Single Family Re | Piles | Stud-framed (Standard) | 2254 | | | 175 | | $394,450.00 | 24.2 | $298,993.10 | $5,837.86 | 2 | Not Substanti |
| 11 | | Yes | | | | | 2284 | | | 175 | | $399,700.00 | 24.2 | $302,972.60 | $4,796.40 | 1.6 | Not Substanti |
| 12 | | Yes | | | | | 1546 | | | 175 | | $270,550.00 | 24.2 | $205,076.90 | $3,246.60 | 1.6 | Not Substanti |
| 13 | | Yes | | | | | 2409 | | | 175 | | $421,575.00 | 24.2 | $319,553.85 | $11,298.21 | 3.5 | Not Substanti |
| 14 | | Yes | | | | | 3189 | | | 175 | | $558,075.00 | 24.2 | $423,020.85 | $12,277.65 | 2.9 | Not Substanti |
| 15 | | Yes | | | | | 2818 | | | 175 | | $493,150.00 | 24.2 | $373,807.70 | $0.00 | 0 | Not Substanti |
| 16 | | Yes | | | | | 1737 | | | 175 | | $303,975.00 | 24.2 | $230,413.05 | $3,647.70 | 1.6 | Not Substanti |
| 18 | | Yes | | | | | 4081 | | | 175 | | $714,175.00 | 24.2 | $541,344.65 | $8,570.10 | 1.6 | Not Substanti |
| 19 | | Yes | | | | | 2604 | | | 175 | | $455,700.00 | 24.2 | $345,420.60 | $0.00 | 0 | Not Substanti |
| 20 | | | | | | | 2829 | | | 175 | | $495,075.00 | 24.2 | $375,266.85 | $0.00 | 0 | Not Substanti |
| 21 | | Yes | | | | | 2823 | | | 175 | | $494,025.00 | 24.2 | $374,470.95 | $0.00 | 0 | Not Substanti |
| 22 | | Yes | | | | | 2930 | | | 175 | | $512,750.00 | 24.2 | $388,664.50 | $40,507.25 | 10.4 | Not Substanti |
| 23 | | Yes | | | | | 2438 | | | 175 | | $426,650.00 | 24.2 | $323,400.70 | $0.00 | 0 | Not Substanti |
| 24 | | Yes | | | | | 1523 | | | 175 | | $266,525.00 | 24.2 | $202,025.95 | $746.27 | 0.4 | Not Substanti |

# SDE Calculator – Individual Report

**Substantial Damage Estimate (SDE) Calculator**

*Version 1.0 (September 2019)*

| GENERAL INFORMATION | | | | |
|---|---|---|---|---|
| *Property Address* | | | *Assessment Date* | |
| | | | | |
| *Inspector/Team* | *Cause of Damage* | *Flood Depth Above Ground* | *Flood Depth Above Floor* | *Flood Duration* |
| | Two or More Stories | Team 2 | 5 | |
| *Comments* | | | | |
| 0 | | | | |

| STRUCTURE INFORMATION | |
|---|---|
| Structure Type | Yes |
| Residential Type | Residential |
| Number of Stories | Heating and/or Cooling |
| Foundation | Single Family Residence |
| Superstructure | Piles |
| Roof Covering | Stud-framed (Standard) |
| Exterior Finish | Shingles - Asphalt, Wood (Standard) |
| Heating and Cooling | Siding or Stucco (Standard) |
| Structure Use | Select One |
| Story | 1 Story |
| Sprinkler | No |
| Conveyance | No |
| Depreciation Determination | 4- Average Condition |
| Depreciation Value | 24.2% |
| Total Square Footage | 1,523 |
| Quality | Average |
| Geographic Adjustment | 1.0 |
| Base Cost ($/sq ft) | $175.00 |
| *Element Percentage Lookup* | Default |

**ELEMENT DAMAGES**

| *Element* | *Percent Damaged (Field Assigned)* | *Element Percentage* | *Element Cost* | *Damage Value* |
|---|---|---|---|---|
| Foundation | Flood and Wind | | | |
| Superstructure | | 24.0 | $63,966 | $0 |
| Roof Covering | 0 | 6.0 | $15,992 | $0 |
| Exterior Finish | 0 | | | |
| Interior Finish | 5 | | | |
| Doors and Windows | 0 | | | |
| Cabinets and Countertops | 0 | | | |
| Floor Finish | 0 | | | |
| Plumbing | 0 | 10.0 | $26,653 | $0 |
| Electrical | 2 | 14.0 | $37,314 | $746 |
| Appliances | 0 | | | |
| Interiors | | | | |
| HVAC | 0 | 16.0 | $42,644 | $0 |
| Skirting / Forms Piers | 0 | | | |
| **Totals** | | **70** | **$186,568** | **$746** |

| DAMAGE SUMMARY | |
|---|---|
| Replacement Cost | **$266,525** |
| Computed Damages | **$746** |
| Computed Actual Cash Value | **$202,026** |
| Repair/Reconstruction % *(Overall %Damaged)* | **0.4%** |
| Final Determination | **Not Substantially Damaged** |
| Error(s) | **Missing Data and/or Defaulting to 'average' Element Percentages. Check Input Values** |

# Long Term Substantial Damage

# Long Term Substantial Damage

- Provide FEMA and SCDNR support and follow up to communities on their substantially damaged properties
- Document compliance on a monthly basis

| CI | COMMUNITY | COUNTY | ADDRESS | PARCEL | S | URE_TY PE | GE_EX T | PERMI T_NU | PERMIT_T YP | PERMIT_STA TUS | OUTCOME | COMMENTS | REV_D T | FLOOD_ZO NE | APPRAS L17 | CLM_BLDG PAY | ClaimID | ALTKEY | Initial Lis | LAT | LONG | ADD_COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E+06 | Smithville | Jones | 10 MENENDEZ ROAD | | YES | | 100% | | | | Not Compliant | Property is considered 100% SD'd and owner would like to demo, but the financing bank is giving some kind of push-back about allowing the demo. | 13-Mar | AE-9 | | $4,015.87 | 99999SF00289413 | | NO - 08/29/18 | #N/A | #N/A | Check address |
| 1E+06 | Smithville | Jones | 103 SOUTH STREET | 987654321 | YES | SF | 55% | | | | In progress | HARB Approved for Demo expires on 4/19/19. No ,change in status, as of 03/13/2019, per FPA | 13-Mar | AE-9 | $6,220.00 | NTD | - | 2120400000 | YES - 04/06/18 | 29.88186 | -81.31388 | |
| 1E+06 | Smithville | Jones | 123 Main St | 987654321 | YES | SF | 61% | 2017-1110 | Demolition | Completed | Compliant - Demolished | | 23-Oct | AE-9 | $6,220.00 | NTD | - | 2159600000 | NO - 08/29/18 | 0 | 0 | Appriasal value is from 2016 |
| 1E+06 | Smithville | Jones | 456 Main St | 987654321 | YES | SF | 54% | 2018-1032 | | | In progress | 2018-1032. In process. 03/13/2019 -- work is completed. FPA is waiting for final EC. | 13-Mar | AE-9 | $77,485.00 | $36,614.61 | 98765443211 | 2130900000 | YES - 04/06/18 | 0 | 0 | Appriasal value is from 2016 |
| 1E+06 | Smithville | Jones | 789 Jones Ave | 987654321 | YES | SF | 54% | | | | Compliant - Elevated | Meets Floodplain Requirements. | 1-Feb | AE-9 | $70,498.00 | NTD | - | 2129000000 | YES - 04/06/18 | 0 | 0 | Appriasal value is from |
| 1E+06 | Smithville | Jones | 321 Jones Ave | 987654321 | YES | SF | 53% | | | | Not Compliant | FPA has no contact information for the owner. No permits have been applied for or issued, and no repairs have been made. No ,change in status, | 13-Mar | AE-9 | $38,234.00 | NTD | - | 1077300000 | NO - 08/29/18 | 0 | 0 | |
| 1E+06 | Smithville | Jones | 654 Smith Dr | 987654321 | YES | SF | 51% | | | | Compliant - Appealed | Meets Floodplain Requirements. | 23-Oct | AE-9 | $38,449.00 | NTD | - | 2186500000 | NO - 08/29/18 | 0 | 0 | Appriasal value is from 2016 |
| 1E+06 | Smithville | Jones | 876 Smith Dr | 987654321 | YES | SF | 60% | 2017-0572 | | | Compliant - Already co | 03/13/2019 - Elevation complete. Inspections found code violation. Has to be fixed before final CO. | 13-Mar | AE-9 | $57,592.00 | NTD | - | 2224200120 | NO - 08/29/18 | 0 | 0 | Appriasal value is from 2016 |
| 1E+06 | Smithville | Jones | 567 Long Rd | 987654321 | YES | MF | 67% | 2018-1345 | Demolition | | Compliant - Demolishe | Unsafe structure. Structures currently have demo permit 2018-1345 | 1-Feb | AE-9 | $97,765.00 | NTD | - | 2066900000 | YES - 04/06/18 | 0 | 0 | Appriasal value is from 2016 |
| 1E+06 | Smithville | Jones | 987 Long Rd | 987654321 | YES | MF | 53% | 2018-1346 | Demolition | | Compliant - Demolishe | Unsafe structure. Structures currently have demo permit 2018-1346 | 1-Feb | AE-9 | $97,765.00 | NTD | - | 2066900000 | YES - 04/06/18 | 0 | 0 | Appriasal value is from 2016 |

| | Count of ADDRESS |
|---|---|
| Compliant - Appealed | 1 |
| Compliant - Demolished | 3 |
| Compliant - Elevated | 1 |
| In progress | 2 |
| Not Compliant | 2 |
| Compliant - Already compli | 1 |
| **Grand Total** | **10** |
| | |
| | |
| | |
| Pending | 4 |
| Compliant | 6 |
| **Compliance** | **60%** |

# Substantial Damage Volunteer Network

# COMMENTS & QUESTIONS

Jessica Artz, CFM
artzj@dnr.sc.gov / 803-734-1012

March 19, 2019

**Flood Mitigation Program**

*Protecting Lives, Protecting Property* | Floodplain Management, Mapping, and Mitigation

www.dnr.sc.gov/flood