After-Action Report and Improvement Plan

Charleston Region, South Carolina Flood Preparedness Pilot

June 2018

Developed with support from the US Department of Homeland Security (DHS) Science and Technology Directorate (S&T) under agreement HSHQDC-16-C-B0016

National Alliance for Public Safety GIS (NAPSG) Foundation
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I. Acknowledgements

Floods are the most common natural disaster in the United States and are only increasing in frequency, magnitude, and cost as a result of ever-changing weather patterns and increasing development. When a flood occurs, first responders and operators must make life and death decisions under considerable time constraints. Understanding the key challenges often faced by flood-prone communities necessitates the engagement of first responders and key stakeholders at the local level. NAPSG Foundation and the DHS Science and Technology Directorate (S&T) are grateful for the invaluable contributions in time and expertise that the following agencies and organizations contributed in the testing of the National Flood Preparedness Guideline. They provided invaluable feedback for the planning, development, design, and conduct of the Charleston Region Flood Preparedness Table-top Exercise conducted on March 7, 2018.

Jurisdiction
City of Charleston, South Carolina
Charleston County, South Carolina
City of North Charleston, South Carolina
Town of Mount Pleasant, South Carolina
State of South Carolina – Emergency Management Division

NAPSG Foundation and DHS S&T appreciate the ongoing commitment by the homeland security/public safety and GIS communities as we work together to solve key challenges around flood disasters.

II. Executive Summary

The problem public safety officials often face when making difficult decisions is not about the availability of data – rather, it is about how data becomes actionable information that changes the outcomes for survivors. For an effective response, the right information must be delivered to the right people at the right time in the right format.

To better understand the key challenges often faced by flood-prone communities, in 2017 NAPSG Foundation worked with first responders across the country to develop a national flood preparedness guideline. The guideline addresses key workflows, including the information needs of first responders, to help Geographic Information Systems (GIS) support staff compile and deliver critical information at the right time to support data-driven decision making.

Following the release of the guideline, NAPSG Foundation partnered with two pilot communities with experience in different types of flooding hazards to test, validate, and refine:

1. The key challenges and priority information needs that were identified in the National Guideline; and
2. A Prototype Toolkit of data, maps, and applications for each phase of a flood disaster, from preparedness through recovery.

III. Flood Preparedness Pilot Overview

MAJOR MILESTONES

Requirements Gathering Session – Charleston County Emergency Operations Center (EOC) – 8500 Palmetto Commerce Pkwy, Ladson, SC 29456 - February 6, 2018 – 8:30am-2:00pm.

Hybrid Functional and Discussion-based (tabletop) Exercise – North Charleston City Hall – 2500 City Hall Lane North Charleston, SC 29406 – March 7, 2018 – 8:30am-4:00pm.

PILOT PLANNING AND CONDUCT TEAM

- Peter O'Rourke, Executive Director, NAPSG Foundation
- David Halstead, Senior Advisor, NAPSG Foundation
- Rebecca Harned, Director National and Federal, NAPSG Foundation
- Paul Doherty, Program Manager, NAPSG Foundation
- Tari Martin, Program Specialist, NAPSG Foundation
- David Runneals, GIS Technician, NAPSG Foundation
- Carla Boyce, Senior Advisor, NAPSG Foundation
- Denis Gusty, Program Manager, US Department of Homeland Security Science and Technology Directorate (DHS S&T)
- Ronald Langhelm, Program Manager, DHS S&T

PARTICIPANTS

Provided below is a list of agencies or organizations and their representatives that participated in the Requirements Gathering Session, and Hybrid Technology and Discussion-Based Tabletop Exercise. Each agency/organization was asked, when possible, to have representation from staff team capable of filling the following roles:

- Decision Maker/Commander
- Operator or Planning Specialist
- Geospatial Staff/Technologist

Participating Jurisdictions and Agencies	
City of Charleston	• Emergency Management • Information Technology • Police Department
Charleston County	• Charleston County Consolidated 9-1-1 Center • Emergency Management • Sheriff
City of North Charleston	• Emergency Management • Fire Department • Police Department • Public Works
Town of Mount Pleasant	• Emergency Management • Fire Department • Police Department
State of South Carolina	• Emergency Management Division

Observing Agencies and Related Efforts	
Agency or Organization	**Related Effort**
ATI	• Alastar
ETI	• Palmetto
Esri	• Flood Preparedness Tool and Emergency Management Deployment Solution

Pilot Project Summary

Below is a summary of the major milestone outcomes from the Requirements Gathering Session and from the Hybrid Technology and Discussion-Based Tabletop Exercise. At the start of the Pilot, each of the jurisdictions and participating agencies completed the Capability and Readiness Assessment Tool (CARAT). The assessment will be completed again after the next phase of the effort when the region moves into full-scale implementation and operationalization to assess changes in maturity over time.

For the complete agendas for each of the engagements, refer to the Pilot File Share Folder. For additional detail on exercise design or scenario for the April TTX, refer to the Flood Preparedness Pilot Tabletop Exercise (SITMAN).

Purpose and Objectives

- Support regional efforts to enhance flood preparedness and readiness by applying innovative technology and data analytics;
- Validate information requirements for decision making in flood preparedness and response;
- Leverage existing technology platforms in pilot communities to develop and implement a suite of prototype GIS-based tools/templates that fulfill priority unmet needs and requirements;
- Test and evaluate the prototype tools/templates through a Tabletop Exercise
    - TTX serves as basis to inform updates and enhancements to the prototype tools/templates;
- Conduct final Drill/Stress Test of the prototype tools/templates – the Drill/Stress Test serves as the engagement for transition of the prototype tools/templates to Region;
- Support technical transition of prototype tools/templates to agencies for long-term hosting, implementation, and maintenance; and
- Inform updates to the National Flood Preparedness Guideline for expanded use across the Nation.

Outcomes

Pilot Project activities focused on achieving the following outcomes:

- Establish a shared understanding of what information is needed to make better decisions in flood preparedness through response and to recovery;
- Have a better understanding of gaps in available data to fulfill information requirements and whether these gaps can be filled through cross-jurisdictional sharing;

- Create a heightened awareness of currently available tools to support planning and operations; and
- Assess how the Flood Situational Awareness Toolkit can support decision making and operations, as well as integrate into existing platforms in the region.

IV. Milestone 1. Requirements Gathering Session

Goals and Objectives

- Confirm core operational information requirements needed by pilot community decision makers for flood preparedness and response;
- Establish baseline understanding of GIS technology, infrastructure, and data sharing and coordination;
- Establish baseline understanding of existing GIS tools for flood planning and response GIS in-use;
- Discuss how data analysis and decision makers employ GIS for flood planning, preparedness, and response activities; and
- Define specific business needs and identify gaps that could be filled through advanced technology.

Background

Charleston Region – Geography and Flood Hazard Exposure

The Charleston County region includes the City of Charleston, City of North Charleston, and town of Mount Pleasant – as well as other municipalities. The Requirements Gathering Session provided an opportunity for decision makers and technologist from the region to come together and discuss their unique and shared challenges for flood events, learn about existing and new technologies, and share best practices.

The greater Charleston region is low and flat and sits at the confluence of the Ashley, Cooper and Wando Rivers at Charleston Harbor on the Atlantic Ocean. The area is subject to both coastal and inland riverine flooding, storm surge, and nuisance flooding from heavy rains and high tides. Bridges that connect the communities are, in many cases, the only way in or out and close to traffic at high winds. In addition to the geographic challenges, the three cities participating from the Charleston Region are three of the top five largest cities by population in South Carolina.

Historic flooding events including excessive rainfall events such hurricanes Irma, Matthew and Hugo, and ongoing flooding from high tides and heavy rains in this closely connected

communities, have necessitated a regional approach to flood preparedness and response. Residents in one jurisdiction often commute through or make up the workforce of another. Decision makers need to quickly and efficiently share information on current flooding, transportation issues, and evacuations, as well as understand the timing of flooding and potential impacts.

Existing Technology

The region and the state have invested in a number of technology solutions, including geographic information systems to map infrastructure, flood hazards and populations at risk to flooding. The participating jurisdictions use a common platform, Esri, deployed within their own organizations. Beyond local instances of GIS, the County has acquired and deployed the Alastar situational awareness viewer through their Consolidated Dispatch Center for use by the region. Also, the State of South Carolina Emergency Management has developed Palmetto for use by State and County Emergency Management agencies.

The timing of the pilot project was such that most of the jurisdictions were not fully familiar with the below systems and their functionality and had not yet gained access or received training. Participants received demonstrations from the City of Charleston on its solutions and workflows, from Esri on Emergency Management Solutions already available through their license, as well as demonstrations from the County on the below applications.

Alastar

The County of Charleston, through their Consolidated Dispatch Center, procured Alastar, an online situational awareness viewer. The application consumes static and live data, including camera feeds and weather and river gauge data with customizable dashboards.

At the time of the Requirements Gathering Session, the system had primarily served to share situational awareness around 9-1-1 Calls for service, with AVL and Camera Feeds and Data Layers for Special Events, and for other Base and Public Safety data layers. Additionally, the system managers had added several state emergency management layers, as well as historic incident data such as road closures and flood extents. The City of Charleston was the only jurisdiction actively sharing base data and live data

such as road closures into the system. Custom dashboards had been developed for the County's Emergency Management Division, EMS, PIO's, among others.

Beyond the web application, the mobile version has been used during flood events to stream real-time video, in order to monitor known flood-prone areas. The system also has been configured to send alerts based on live feeds, e.g., when river gauges hit a specific level.

PALMETTO

South Carolina's Emergency Management Division's Common Operating Picture, Palmetto, is available free to counties in the State. The direction of the system's development and functionality is managed by a steering committee. Counties are able to gain access following training.

The application is pre-loaded with statewide datasets and allows for data and services to be added. During an event, the State Emergency Operations Center generally updates data. Data that is incident related with dynamic information, such as status, is added to the top of the layer list.

The application has a number of other features including: a position log; file library for sharing IAP's, press releases, after action reports and shapefiles; graphical display of county indicators including county closures; OPCON level and EOC activation status; a resource inventory for counties to view and request mutual aid resources; a donations module; and a customizable dashboard to add DOT camera feeds.

V. Milestone 2. Tabletop Exercise

Goal and Objectives

Goal

Validate decision maker information needs and inform enhancements to the prototype Flood Situational Awareness Toolkit Prototype.

Objectives

Reliable, timely, and accessible information when a flood occurs is essential to the first responders who must make life and death decisions under considerable time constraints. The pilot activities aimed to identify the critical information needs at each phase of a flood event through the Requirements Gathering Session. They also focused on developing a prototype situational awareness toolkit that brings this information into an actionable format, as well as testing the prototype and making refinements in a regional tabletop and drill/stress test, respectively. The Pilot Project is an opportunity to collectively:

- Validate decision maker information needs for flood events from the preparedness phase through the recovery phase
- Assess the efficacy of existing and emerging decision making support tools (e.g., dashboards) and identify modifications needed
- Identify data gaps and facilitate cross-jurisdictional information sharing to fill gaps
- Develop specific requirements and functionality needed for improving decision support tools within existing systems
- Develop a prototype situational awareness capability for flooding that supports preparedness, readiness, response, and recovery – and can be integrated with one and/or more existing systems in the region

Exercise Structure

The tabletop exercise was designed to push players to identify information needs and the specific trigger points necessary to take action at each phase of a flood event, from preparedness activities through recovery. Participants and players had the opportunity to discuss the effects of the event, test the sharing of situational awareness information across jurisdictions, agencies or organizations, and systems.

Exercise Assumptions and Guidelines

Participants considered the following exercise ground rules to ensure exercise objectives were met in a reasonable amount of time and that the exercise ran smoothly:

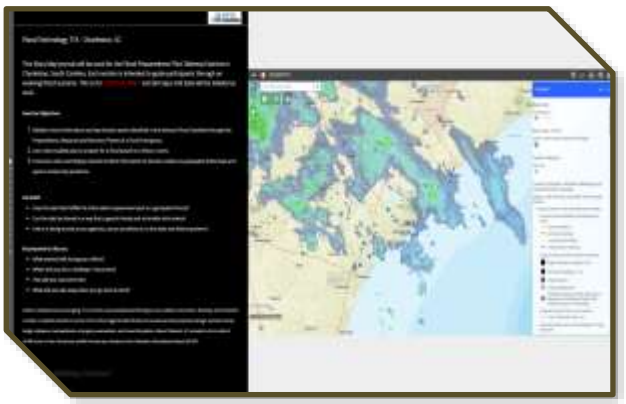
- **No-Fault Environment**
  This exercise provided a no-fault, neutral forum in order to maintain open dialogue and remain open to all perspectives.

- **Not an evaluation or comparison of differing systems currently in place**
  The exercise was not intended to decide which, if any, existing system was better than the others.

- **Not an exercise to test GIS skills**
  The tabletop exercise was not intended to test participants' GIS skills, though part of the exercise focused on specific production and information exchange workflow.

- **Focus your comments and consider time constraints**
  In any exercise, assumptions are necessary to complete discussions in the time allotted. During this exercise, the following assumptions applied:
    - The scenario and likely affects to the communities and surrounding area(s) were plausible, and events occur as they are presented.
    - Participants were asked to "parking lot" certain issues and discussions due to time constraints.

FLOOD TABLETOP EXERCISE SCENARIO



Story Map Briefing - driving scenario and exercise play

The exercise was based on a single historic scenario to frame the discussion. All participants received the injects at the same time via a Story Map Briefing. The Story Map Briefing and Prototype Toolkit was shared with all participants to complete injects and test the Prototype Toolkit. Since this was a technology exercise, the scenario was not the focus of the exercise. The scenario was only intended to provide incident context and drive discussion on information needs throughout a flooding event. This exercise was designed so that any other historic or fictitious event related to a community's flood risk may be substituted with minor modifications.

The exercise scenario was based on historic data from the 2015 South Carolina floods and adapted for this exercise.

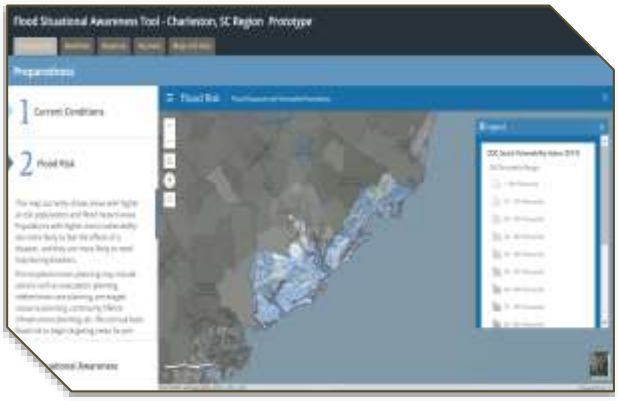
Scenario: Historic rainfall amounts are forecast for the area, averaging 15–20 inches which may cause widespread flooding across Colleton, Dorchester, Berkeley, and Charleston counties. Localized rain may be seen in excess of 25 inches which may trigger flash floods and causing personal property damage, business losses, bridge collapses, road washouts, emergency evacuations, and travel disruptions. Mount Pleasant may record a storm total in excess of 26.0 inches of rain. Greatest rainfall potentials for the area may be as much as:

- 1−Day Rainfall: 11.50"
- 2−Day Rainfall: 14.00+"
- 3−Day Rainfall: 15.90+"
- 4−Day Rainfall: 17.00+"

Outcomes: Gaps and Needs Identified

Preparedness: Information Needs

Need to identify what information and tools are needed to evaluate risk and support pre-scripted mission planning.



Preparedness: Flood Risk

Discussion Points:

- GIS and Operators agree they need to collaborate on a handful of datasets and standards including symbology (Road Closures, Damage Assessments to start).
- Data they do not own but need requires status. Some are coming from the state level (e.g., hospitals).
- Need to build stronger relationships with partners. Different jurisdictions had varying success with the below and should collaborate/share what has worked.
    - Businesses – Need status information
    - Utilities – Need more granular data on outages.
    - Hotel/Motels – Need data on emergency housing.
    - Vulnerable Populations – Non-DHEC facilities, Medicaid recipients (HHS)
    - Fueling Stations

- Interested but hesitant to incorporate crowdsourced data - Citizen reporting GeoForm (used by City of Charleston) is a more acceptable approach.

Action Items: Preparedness – Short-Term

- Identify priority datasets for standardization of schemas and symbology for regional situational awareness.
- Use City of Charleston Citizen Reporting form as basis for building a common citizen reporting template -- agree on key fields and domains, jurisdictions then customize to support workflows.
- Establish and train on process for sharing incident and operational data with Alastar and Palmetto.

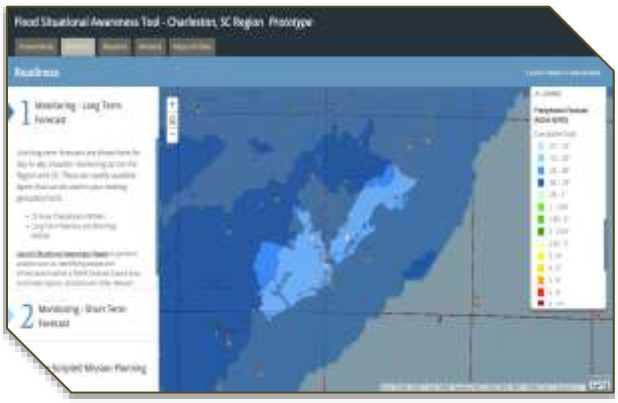
Action Items: Preparedness – Long-Term

- Identify datasets that need status attributes, i.e. hospitals.
- Engage private sector in planning process and begin building partnerships for sharing data.
- Develop approach and SOPs for updating data during an event – Single editable service hosted regionally? Multiple datasets hosted locally and shared? Time stamps? Editor and Contact?
- Work with Alastar and Palmetto to develop custom jurisdictional and regional views, respectively.

READINESS: LONG-TERM AND SHORT-TERM FORECASTING

Need identified for a common view of more actionable data/information across the region for both long-term and short-term forecasting

Discussion Points:



Readiness: Live long-term forecast feeds

- There is a need for more river/tide gauges in and above the county.
- There is a need for more weather stations throughout the county to monitor rainfall.
- Cameras have been deployed in the past to monitor locations prone to flooding – good solution until battery dies.
- DPW has put out stakes with cameras pointing at them to monitor flooding in the past.
- There is a need for more detailed forecasting, i.e., probabilities to assist decision makers with decisions such as school closures, evacuations, shelters, etc.
- Flooding affects each jurisdiction differently – City of Charleston is generally affected first if tidal influence.
- Trigger points have changed from previous historic events – some communities experience nuisance flooding with high tides.
- Would be helpful to build in actions, e.g., Protocol on coastal flood advisories to alert group via email at specific height.
- Forecasted tide is particularly important to law enforcement agencies who are often the ones closing roads.
- State conducts weather calls with counties leading up to and during an event, but there are not enough lines for municipalities to join. Representatives from municipalities can be sent to the State EOC or wait for the tri-county call conducted later.
- There is a need for a place, potentially in Palmetto, for the state to share analysis driving decisions.
- With enough leeway, state can do flood models like HAZUS.

Action Items: Readiness-Long/Short-Term Forecasting – Short-Term

- Incorporate additional live weather feeds identified in the Flood Situational Awareness Tool into decision support tools.
- Add flood forecast feeds such as the National Water Model and NHC Probabilistic Storm Surge feeds to viewers used in the Readiness Phase.
- Build out tiered notification list for river gauge alerts (Alastar).

Action Items: Readiness-Long/Short-Term Forecasting – Long-Term

- Identify avenues for increasing river and tide gauge network.
- Build out additional alerts as triggers are identified – short-term weather hazards warnings, high-tides, etc.
- Based on triggers identified, build actions into plans and geo-spatial viewers.
- Work with state to readily consume HAZUS model run results into local decision support tools.

READINESS: SITUATIONAL AWARENESS

Need to understand the potential impacts of forecasts on the population and infrastructure to set priorities, anticipate resource needs and begin communicating with the public.

Discussion Points:

- Potential impacts could be estimated using the situational awareness widget, provided good data.
- Historic flood extents or modeled data could be used to run initial impact analysis.
- There is a need to know what the other jurisdictions are doing for consistent messaging.

Situational Awareness Widget: Potential Impact Analysis

- Flooding in one jurisdiction impacts other jurisdictions, particularly closures and hazards that affect commute and workforce.
- Understanding the potential severity would assist in estimating resource requirements and where gaps exist.
- Mitigation actions would be taking place to limit impact and the pre-staging of resources.
- Additional data of benefit for the Situational Awareness widget analysis would include citizens who are electricity dependent. There is a need to obtain this information in a more consumable format from HHS that can be filtered opposed to the current excel sheet, which contains all Medicaid recipients.
- The ability to import polygons used in Mass Emergency Notification Systems would be helpful for situational awareness.
- In addition to seeing the population that is/could be impacted, there is a need to see what is available for emergency housing (e.g., hotel status and room availability).

Action Items: Readiness – Situational Awareness – Short-Term

- Identify layers and attributes for Situational Awareness analysis (demographic sub-categories, infrastructure, etc.).
- Add historic flood extents, known flood-prone areas, model results (HAZUS / SLOSH) to decision support tools to ready for analysis such as the Situational Awareness Tool.
- Configure custom dashboard with appropriate data and live feeds for each jurisdiction for blue skies monitoring to allow for operational readiness and swift transition to response.

Action Items: Readiness – Situational Awareness – Long-Term

- As a region, work with HHS on obtaining information such as electricity dependent populations in a more consumable format.
- Identify organizations/agencies that have hotel/motel occupancy levels and broker a regional partnership to obtain information, in a readily consumable format if possible.

READINESS: INITIAL PRIORITIES AND NEEDS

While the type of flooding and the impacts by jurisdiction vary, there is a common need for information that support decisions – such as whether to activate emergency operations centers and to what level; whether to order evacuations, what type and where; whether resources need to be requested; and what information needs to get communicated to the public and by what methods.

Discussion Points:

Readiness: Short-Term Forecast

- Initial evacuation priorities focus on low lying areas, vulnerable population (including nursing homes and homeless), and persistent flood areas.
- The City of Charleston has mapped where the most vulnerable are living in the lowest part of the city and go door to door.
- North Charleston would make request for high-water vehicles.
- The County uses Facebook, Twitter, press releases, the JIC, and press conferences to push out public information.
- The City of North Charleston would issue safety message to First Responders, then ask folks to get off the roads and then conduct a focused notification door-to-door.
- Town of Mount Pleasant would encourage evacuation in high priority areas, implement mitigation strategies, push out information and ready resources.

Action Items: Readiness – Initial Priorities and Needs – Short-Term

- Develop map layers, where gaps exist, of known vulnerable populations and flood prone areas and build into actions based on triggers identified in Preparedness Phase.

Action Items: Readiness – Initial Priorities and Needs – Long-Term

- Develop SOP for sharing areas of priority for evacuation with messaging with regional partners and across situational awareness platforms.

RESPONSE: TRANSPORTATION

Need to have a region-wide approach to sharing road status and lack a consistent schema / approach for interoperability.

Discussion Points:

- Jurisdictions vary on approach to managing road closures with varying degrees of success.
- The City of Charleston currently is only one sending road closures via rest service to Alastar. **Each jurisdiction tested sharing a road closure service with Alastar during the TTX.*
- Current workflow for the remaining jurisdictions is to send via call/radio.
- Challenge exists in getting updates when the road is clear both locally and in the WAZE app.
- The City of North Charleston collects road closures out with windshield surveys. The Fire Service currently handles this task, and perhaps Law Enforcement will be assisting as well soon.

Response: Regional Road Closure Editor

Action Items: Transportation – Short-Term

- Agree upon road closure schema and symbology, taking into consideration the Esri Local Government Data Model which already integrates directly with Waze.
- Agree upon method for hosting/updating/sharing road closures in the region.

Action Items: Transportation – Long-Term

- Establish routine workflows for managing road closures that is scalable during emergencies.
- Work with the state to pull in DOT 511 service into local decision support tools.
- Determine feasibility of partnering with Traffic Services such as the WAZE Connected Citizens Program.

RESPONSE: CITIZEN ENGAGEMENT (INBOUND)

Need for a standardized and reliable/vetted approach to gather and use citizen-generated information during an event towards enhancing situational awareness. This may apply to information shared by citizens through social media, EM-provided information collection forms, 311 systems, and any others.

Inbound Citizen Engagement Application

Discussion Points:

- The City of Charleston hosts a GeoForm on its website, where citizens can self-report. The same form is also used at their Call Center, and in the field for collecting damage reports. *Important to publicize during readiness phase.
- There is a need for both electronic damage self-reporting and to publicize a phone number to call and report damage for the remaining population.
- The citizenry could provide a wealth of information on what is up and open – e.g., grocery stores, pharmacies, hotels, etc.

- ESF 24 – Business and Industry is closely tied to the chamber of commerce. They are not as involved as in the past, but jurisdictions are beginning to engage larger partners – e.g., Boeing, Big Box Stores, etc.

Action Items: Citizen Engagement (Inbound) – Short-Term

- Develop basic schema for citizen form

Action Items: Citizen Engagement (Inbound) – Long-Term

- Agree on approach for local or regional hosting of form and data

RESPONSE: PUBLIC INFORMATION USING A COMMON MAP

Need a common and shared model for a web-based Public Information Map that can be consistently used to share the most critical information with the public.

Discussion Points:

- Desire to leverage data already being generated/collected and shared with the Public in a consistent way.
- Information that should be available to be turned on when needed / relevant in a Public Information Map:
  - Non-Emergency Shelters managed by counties and
  - Points of Distribution
  - Incident Impact Area
  - Public View of Damage Assessments
  - Volunteer Reception Centers / Donation Sites
  - Debris Collection
  - Power Gas and Water Outages
  - Reason for Road Closure

Sample Public Information Map

Action Items: Public Information Map – Short-Term

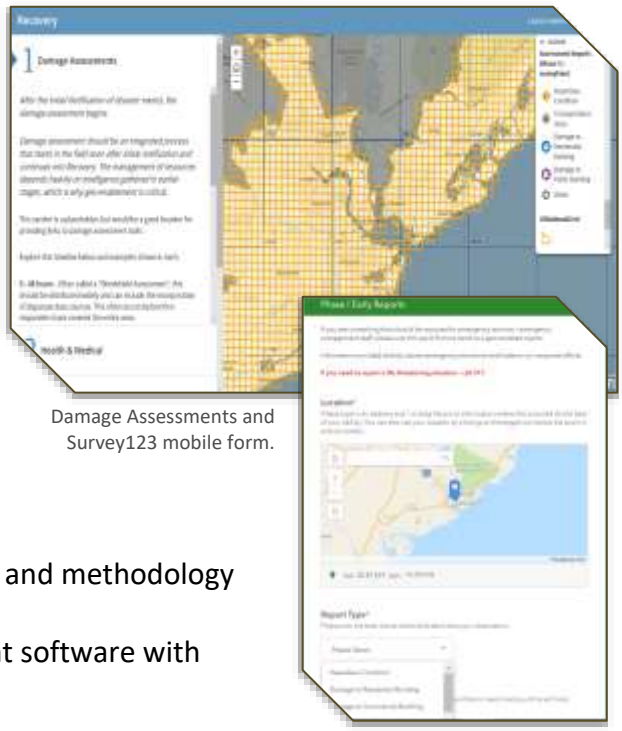
- Identify which data layers currently exist and add to Public Information Map. Create, symbolize feature classes for the remaining – these may be empty.
- Agree on nomenclature for non-emergency shelters.

Action Items: Public Information Map – Long-Term

- Identify power companies that serve the region and broker access to their feeds.
- Identify Public Information Map(s) approach which provides thematic information based on phase of disaster.
- Publicize and promote Volunteer registration portal available in state application.

RECOVERY: MONITORING AND DAMAGE ASSESSMENTS

Need to establish a consistent data schema and solution set for collecting and analyzing damage assessment information across the continuum: from basic windshield assessment to initial damage assessment to formal damage assessment.



Damage Assessments and Survey123 mobile form.

Discussion Points:

- State recommends locals to do it the FEMA way although not currently in geospatial form.
- Each jurisdiction has their own schemas and methodology for collecting damage assessments.
    - Crisis Track – damage assessment software with FEMA forms within the system.

  - iPads with Collector for ArcGIS with schema that matches the state
  - Mobile Esri templates modified for local needs
  - Paper collection with plans to use Crisis Track
- Important for all jurisdictions to do Damage Assessments even if only minorly affected – The City of Charleston missed the declaration threshold by 5 houses in a previous event.
- Jurisdictions are on Charleston County dependent contract for debris.
- The region is often the end of the line with the contractor who has other major contracts.
- Debris sites have been pre-identified.

Action Items: Recovery – Short-Term

- Establish basic damage assessment schema that supports State and Federal requirements and agree on symbology for shared regional view.

Action Items: Recovery – Long-Term

- Agree on approach for sharing local damage assessments to region.
- Formalize methodology for sharing geospatial damage assessments with the state.

VI. Conclusions

Over the course of the Pilot Project, key information requirements through each phase of a flood event were identified. Sources, where they existed, were compiled. Where gaps existed, available national datasets or broadly used schemas were used to create templates as a starting point for regional discussion. Additionally, workflows, maps, and mission focused applications were developed to facilitate cross-jurisdictional information sharing and to transform data into actionable information for decision makers and first responders.

Key Outcomes

At the time of the Pilot Project, multiple situational awareness viewer applications were already in development or in early stages of deployment in the region and in the state. Additionally, each jurisdiction identified facing similar challenges with flood preparedness and were looking to identify solutions. Through the Pilot Project, a number of achievements transpired:

- Emergency Managers, Planners, Technologist, and Operators from across the region came together to discuss challenges, share best practices, lessons learned and ongoing projects of interest.
- GIS staff shared existing database schemas and solutions where each of them were excelling, thereby enhancing the capabilities of the whole region.
- GIS staff has formed a working group to begin addressing harmonizing data schemas and symbology and sharing data.
- GIS staff who were not previously aware of Alastar were able to publish test datasets and make a case for the need of a regional approach on nomenclature.
- Jurisdictions were exposed to the applications available to them and given demonstrations of the current capabilities.
- Key stakeholders and intended users obtained access to the systems, underwent training, and gained a better understanding overall of their unique capabilities and use cases.
- Emergency Managers, Planners, Technologist, and Operators provided real input to enhancements to these applications as information needs and specific capabilities were identified during the tabletop exercise as necessary to provide true actionable information to decision makers.
- Developers of each of the applications and have already begun implementing a number of recommendations.
- More substantial updates to Palmetto have, or will be brought to the steering committee for approval.
- Overall, the Charleston Region was given a unique opportunity to influence the development and course of Palmetto to meet the needs of local emergency managers and geospatial technologists and Alastar to provide enhanced regional situational awareness.

In addition, NAPSG developed the Flood Hazard Situational Toolkit as a part of the Flood Preparedness Pilot. The toolkit was developed over the course of the Pilot Project as key information needs were validated. The toolkit is a suite of resources and should serve to guide the evolution and development of decision support tools in the region. Resources include the following:

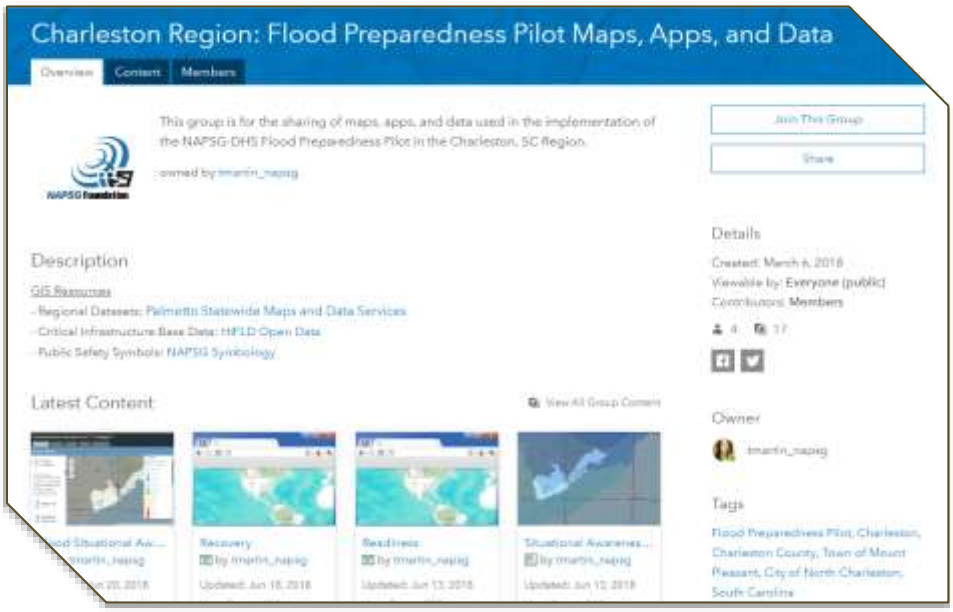
- Base Data and Live Data feeds identified as needed at each phase
- Schemas for key data layers and essential elements of information for a shared consistent regional view
- Templates for maps and apps to easily deploy local and/or regional solutions

- Prototype Application – Step-by-Step guide of information needs; and the data, analytical tools, templates, and applications to produce timely actionable information at each phase

NEXT STEPS AND RECOMMENDED IMPLEMENTATION STRATEGY

The suite of resources is available to all the Charleston Region stakeholders to test, inform enhancements, adapt and/or adopt elements as needed. This includes each of the tools demonstrated during the TTX or added in response to gaps identified. All components have been shared in a public ArcGIS Online group and will serve to inform the national core information model for Flood Preparedness. Each of the stakeholders are encouraged to go through the toolkit and take any components needed to fill their specific gaps.
The following are recommendations for addressing gaps identified in the Pilot Project and building on the great momentum in the region:

- After Action Report core stakeholder review and feedback – NAPSG Foundation will compile any feedback and update the report as needed.
- Final After Action Report release to broad stakeholder group – Recommend stakeholders address short-term action items as applicable to each jurisdiction and as a region whenever possible.
- Newly formed Regional GIS Working Group – Identify (5-7) priority datasets to agree on schema, symbology and SOP for updating during an incident.
- Work with State on customizing regional view in Palmetto application and work with jurisdictions to share locally maintained data to keep data current during blue skies and updated during an emergency.
- Incorporate available viewers into training and exercises.
- Include analytical tools from the Toolkit into decision support tools to turn data into actionable information.
- Develop strategy for addressing long-term action items.



KEY RESOURCE LINKS:

Charleston Region Situational Awareness Toolkit: https://arcg.is/1zSHvX
Charleston Region Flood Preparedness Pilot Maps, Apps, and Data: https://arcg.is/89uTb
Share folder for Charleston Region Agendas and meeting notes: http://arcg.is/1zzXXP