

OGC Disasters Resilience Pilot User Guide

***Connecting Communities During Disasters for Timely
Impact Analysis***

by Esri

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NOTE

This document is a user guide created as a deliverable in an OGC Interoperability Initiative as a user guide to the work of that initiative and is not an official position of the OGC membership. There may be additional valid approaches beyond what is described in this user guide.

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Chapter 1. Introduction

Emergency managers can use this guide to see how they can use the ArcGIS platform to connect geospatial communities so that they and their stakeholders have the right information before and during a disaster. Specifically, it empowers locally focused emergency managers, planning chiefs and local watch officers with critical weather, address, demographic and health data to help them monitor incidents and estimate the impacts of an upcoming disaster, and then respond to changing conditions to ensure enough recovery resources are requested and deployed in targeted impact areas.

ArcGIS, a core part of the Esri geospatial cloud, provides emergency managers and first responders the critical spatial data infrastructure needed to plan for, respond to, and recover from disasters such as hurricanes and floods, acting with confidence and understanding to save lives and property. With this global geospatial infrastructure in place, locally focused emergency managers, planning chiefs and local watch officers

In three basic steps, managers of emergency operations will learn how to:

1. quickly federate the needed data services from a variety of sources (Chapter 3)
2. configure those data services into helpful configurable web and mobile application templates (Chapter 5.1), and
3. analyze data on the fly for decision making as the situation evolves (Chapter 5.2)

With ArcGIS's open platform architecture, these managers can leverage the information coming from a variety of sources and formats – including web services using OGC's open standards - making these data quickly accessible, prioritized and filtered into the critical reporting tools that help decision makers respond effectively.

1.1. Hurricane Preparation One Week Before Disaster

A Texas State EOC Manager who wants to quickly curate & federate web services (Esri REST, OGC) (data like: Weather status, Flood Prediction Zones, Households/Addresses, and other Local Lifelines), to do impact analysis to support resource requests from federal government and to know where to pre-position critical resources like water, food and electrical generators.

1.2. Hurricane-Based Flooding Impact Analysis During the Event

As the flooding continues to increase, a local watch officer is monitoring the real-time flood inundation reports from first responders and the public against the forecasted inundation maps to see where the flooding levels are right now, and whether new incidents and new impacts to vulnerable populations are occurring in his area. After reporting them to his Operations and Planning Section Chiefs, they determine what kinds of new or additional resources might be needed to support their jurisdiction.

Chapter 2. Simple Architecture

The architecture for this pilot involves two key cataloging applications, ArcGIS Portal and ArcGIS Hub, and three key Clients, ArcGIS Pro (Desktop), ArcGIS Web AppBuilder and ArcGIS Online Web Map Viewer, as shown below in Figure 1.

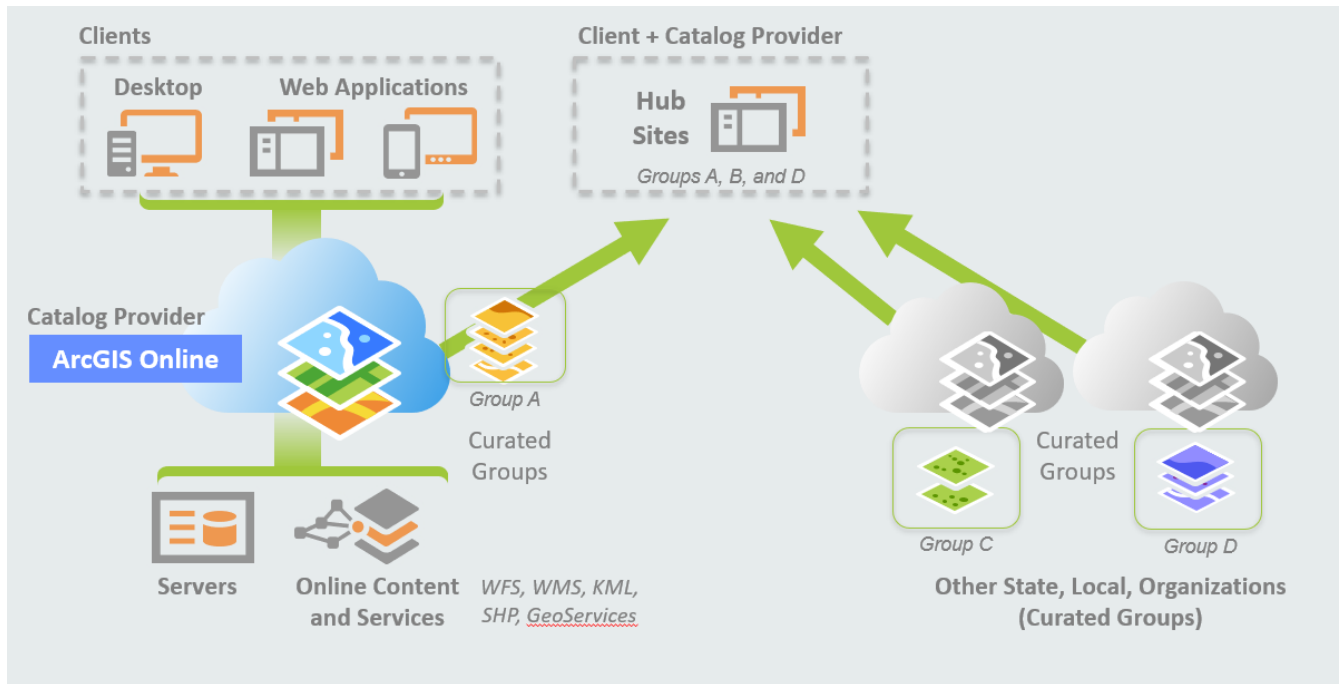


Figure 1. ArcGIS Simple Architecture

Chapter 3. General Use Cases by User Activity

This pilot focuses on the role of a State Emergency Operations Center Manager one week prior to projected landfall of a major hurricane. In this scenario, the manager anticipates flooding in certain jurisdictions across the state. The State level Manager will likely become the Incident Commander and coordinate with many other local and state emergency management roles - e.g., planning and operations section chiefs, local incident watch officers - who will need a common operating picture on the evolving disaster and related incidents in local zones.

The authoritative data federated by the Incident Commander serves as the foundation for the common operating picture among his or her stakeholders, including the public.

Below, the Commander can quickly see how to federate this foundational data, most of which may already exist and simply needs to be registered. Other key datasets may need to be published or re-published for operational purposes.

3.1. Registration of data

As a State Emergency Manager, or supporting staff, when you prepare for an upcoming flooding event, you may be sent or find authoritative data about key community lifelines, such as updated health care facility information or new flood forecasts, that will be useful for estimating resources needed or designating a distribution center. These data may come from a variety of stakeholders – local officials, state officials, federal agencies, universities, non-profits like the Red Cross, individual volunteer groups, social media, and private companies.

There are three approaches to registration in ArcGIS. First, a manager can use her organizational ArcGIS Online or Enterprise Portal account to register individual items to a public data group. Second, she can federate existing groups of data curated by other organizations within ArcGIS Online ecosystem. Third, she can use APIs or other tools to sync third party catalog items into ArcGIS online or Enterprise portal groups.

These data or content groups can then be quickly shared into your ArcGIS Hub Site for your stakeholders to explore and discover.

3.1.1. Option One: Adding specific datasets and services (layers, maps, apps)

In the example below, managers will see how to navigate to your Portal homepage and add two separate US Army Corps of Engineers Levee layers to a data group. One layer contains Floodwalls and the other Embankments.

Step 1: Go to your Content tab and begin to Add Item. See Figure below.

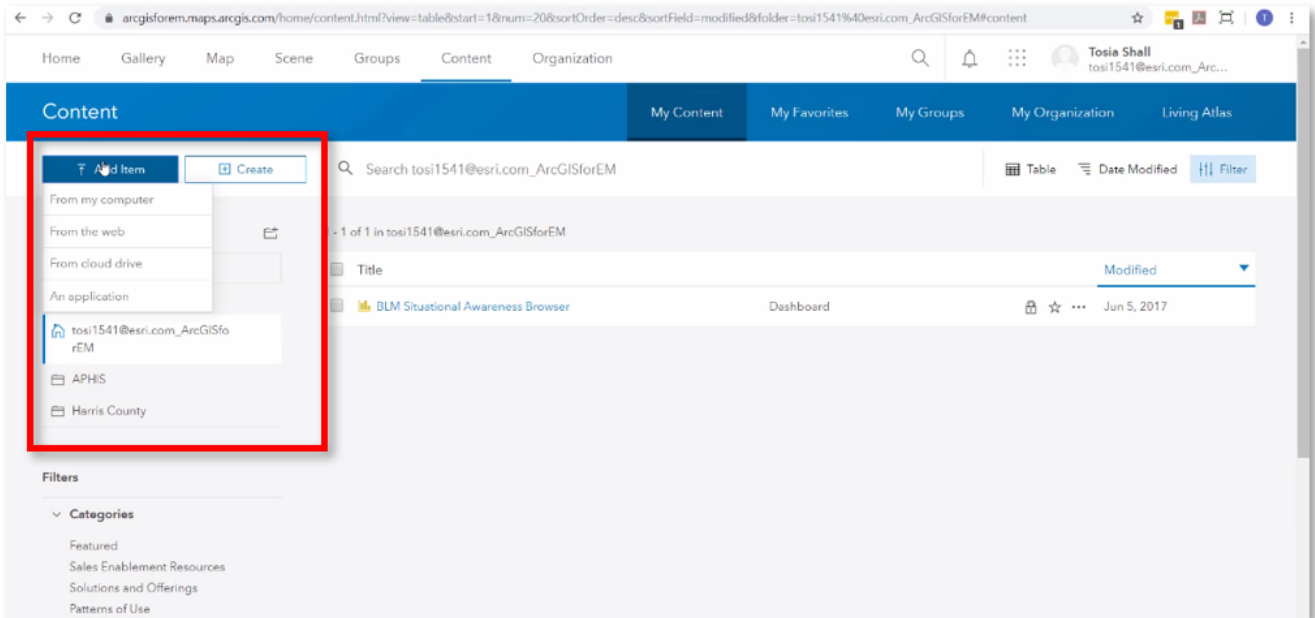


Figure 2. Add Data - Step 1

Step 2: Drop down to From the Web. See Figure below.

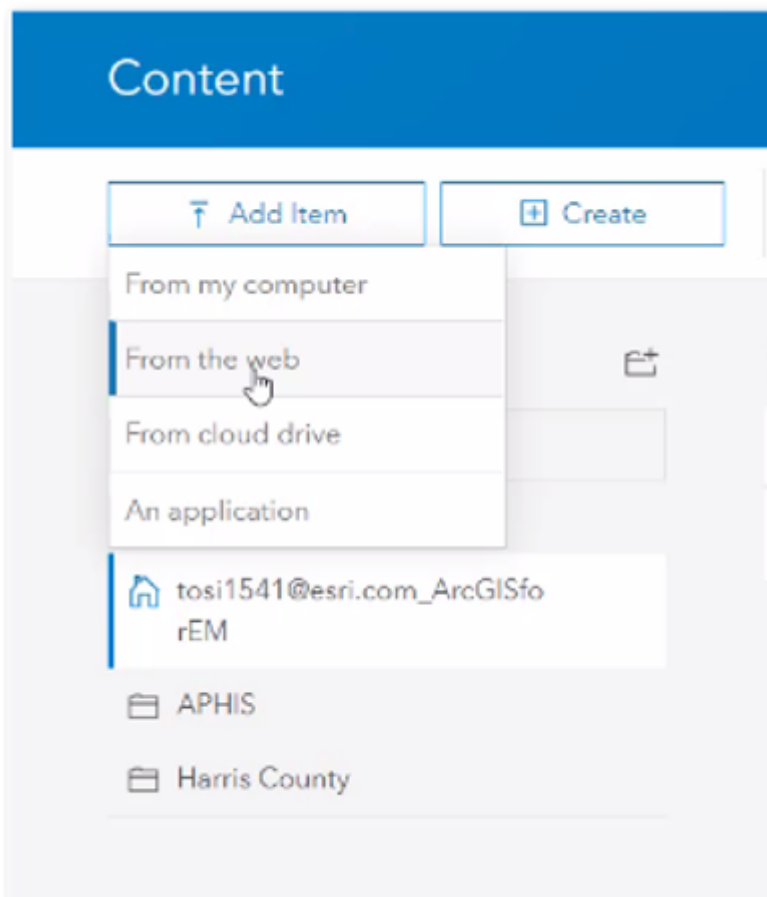


Figure 3. Add Data - Step 2

Step 3: Insert the URL to the service. Give the layer a title, tags and publish. See Figure below.

Add an item from the web

☐ ArcGIS Server web service
 ☐ KML

☐ WMS (OGC)
 ☒ WFS (OGC)

☐ WMTS (OGC)
 ☐ Document

URL:

Title:

Categories:

[+ Assign Category](#)

Tags:

Layer:

Figure 4. Add Data - Step 3

Step 4: On the item detail page, share out the newly added item to the Hub group. These new data will be added to your Flood event Hub site dynamically and stay updated as those publishers modify or add new data to their groups. Repeat steps for each layer, such as the embankments line layer.

Your changes are automatically saved.

To add this item to a Hub Site, simply share the Open Data Group to your selected groups in the Groups Manager of the site. This step is shown below in the Option Two section.

3.1.2. Option Two: Registering Curated ArcGIS Data Groups to your Hub Site

From the Groups Manager tab, a manager can select groups that contain the public data he wants to be accessible through your site. The groups are managed in ArcGIS Online that he or other organizations have made available for Open Data. The items in those groups could be OGC services or any of the many of the supported OGC file types.

You can search groups to add to your site by scrolling through all available open data groups.

Step 1. Within the Hub admin app, navigate to the Groups Manager tab on your site. See Figure

below.

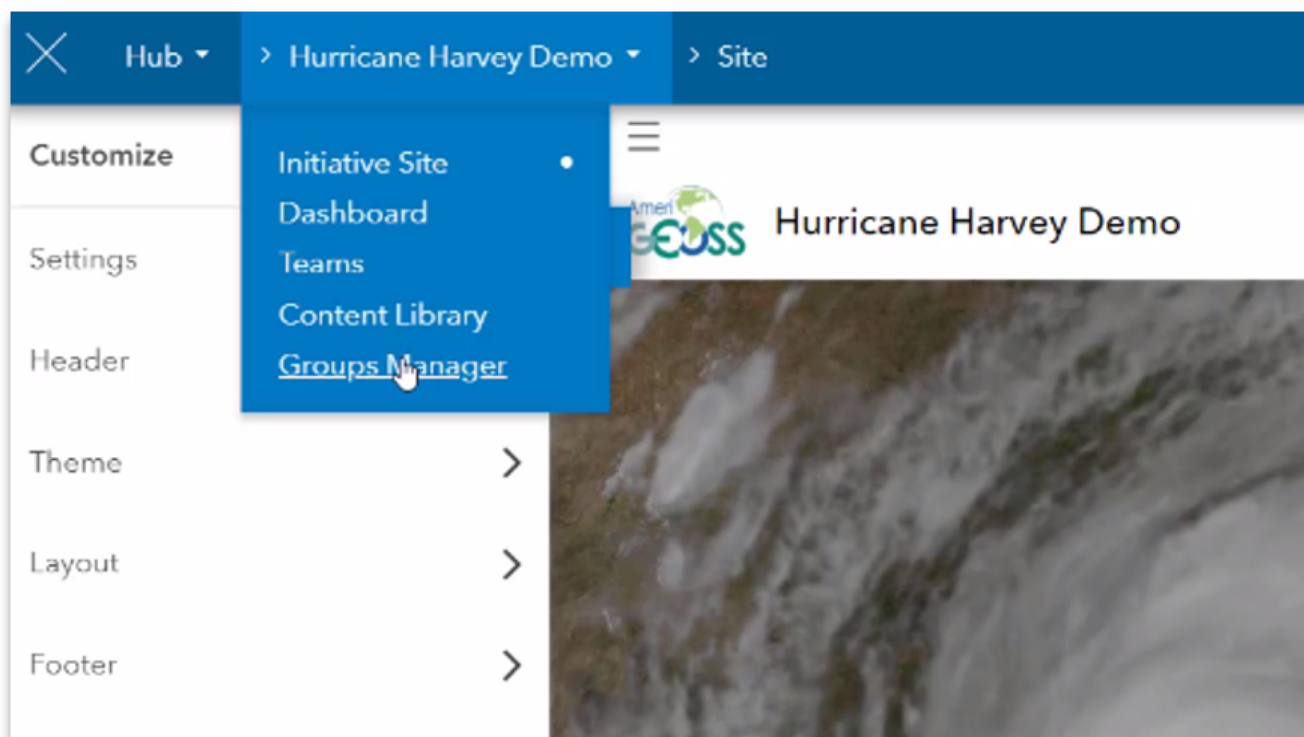


Figure 5. Register Groups - Step 1

Step 2. The Groups Manager interface is where he begins to access different data and apps from various groups. See Figure below.

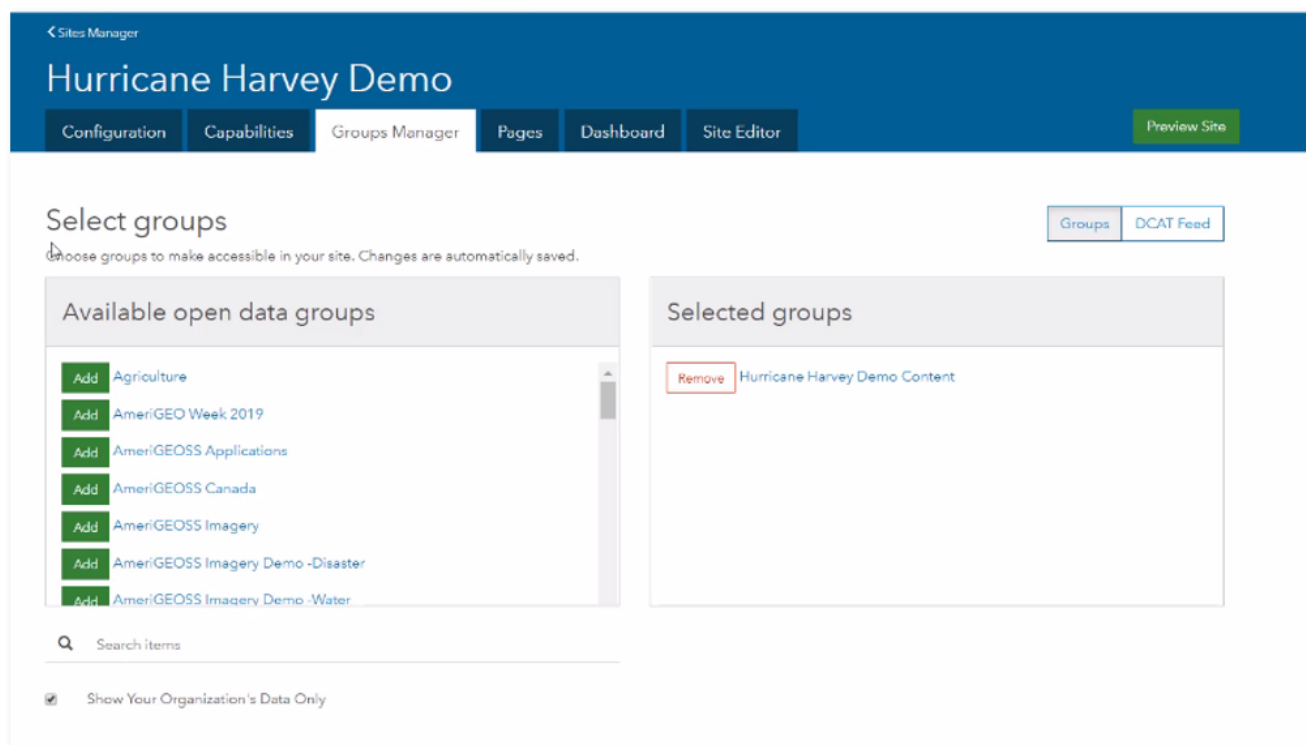


Figure 6. Register Groups - Step 2

Step 3. Before beginning your search uncheck 'Show Your Organization's Data Only'. See Figure below.

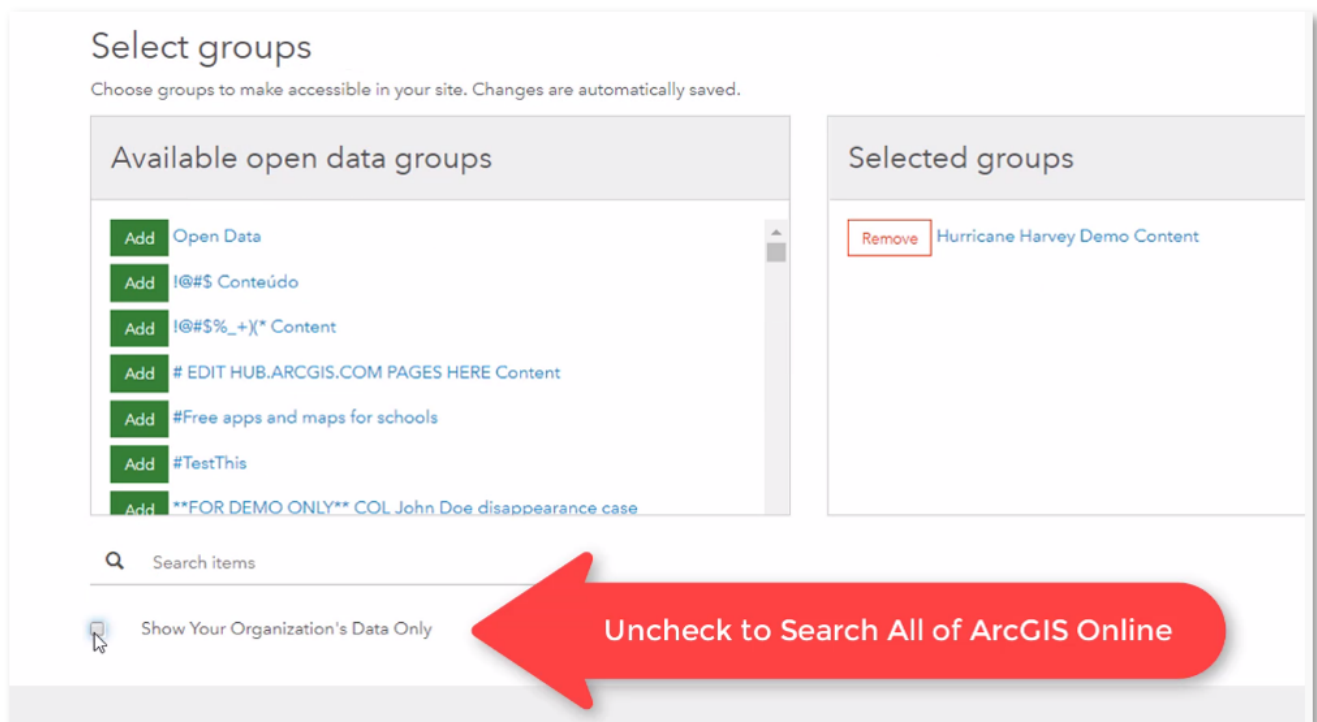


Figure 7. Register Groups - Step 3

Step 4. Simply add data groups already managed by different authoritative organizations in ArcGIS Online - like the state of Texas, Arlington County, US Geological Survey, or NASA's Disaster Program. These trusted organizations have curated data and applications just for your event or types of events and are easy to add to your specific website. Search for groups, such as 'Harris County', 'HIFLD', 'USGS', 'NASA Disaster'. Once he adds a group, any supported public item from that group will be available on your site. If he does not want an item to be part of Hub, he can simply make the item private. See Figure below.

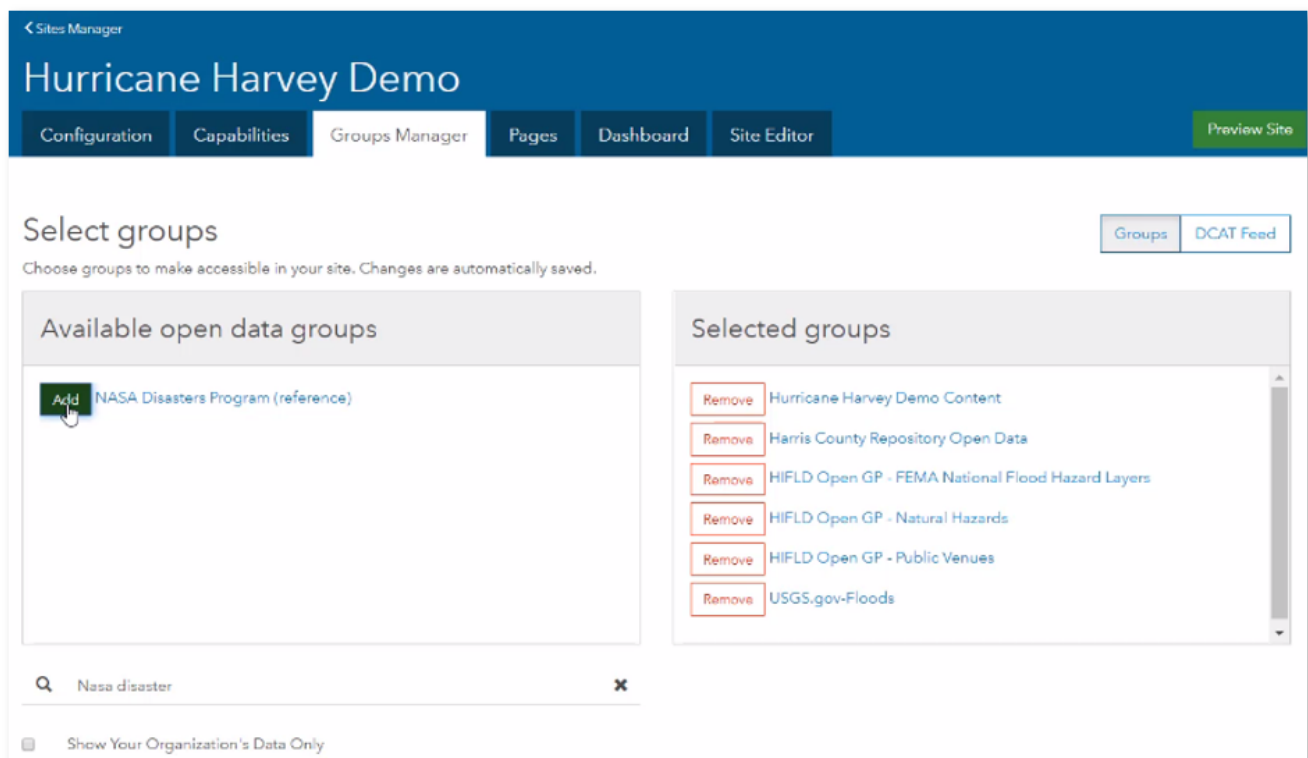


Figure 8. Register Groups - Step 4

Step 5. For any of your selected groups, one can view the group details and content. See Figures below.

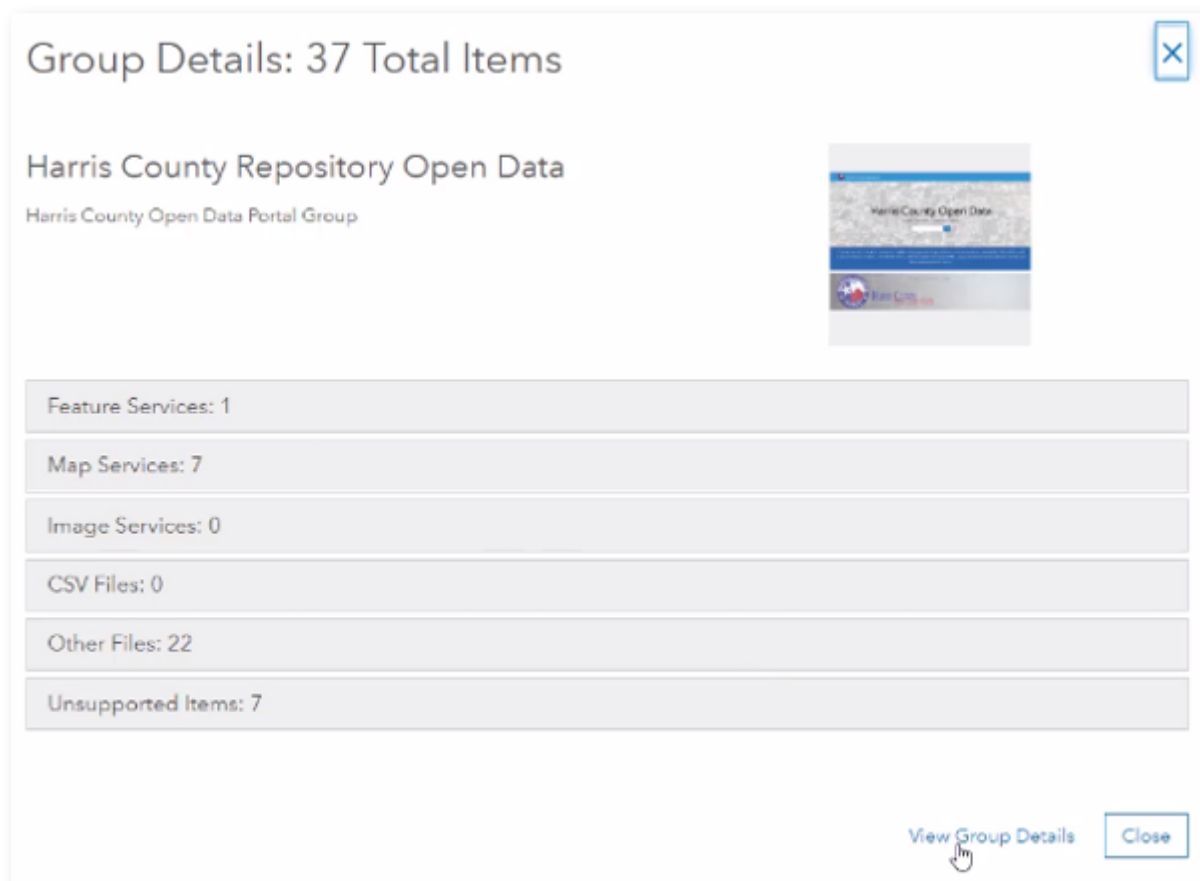


Figure 9. Register Groups - Step 5

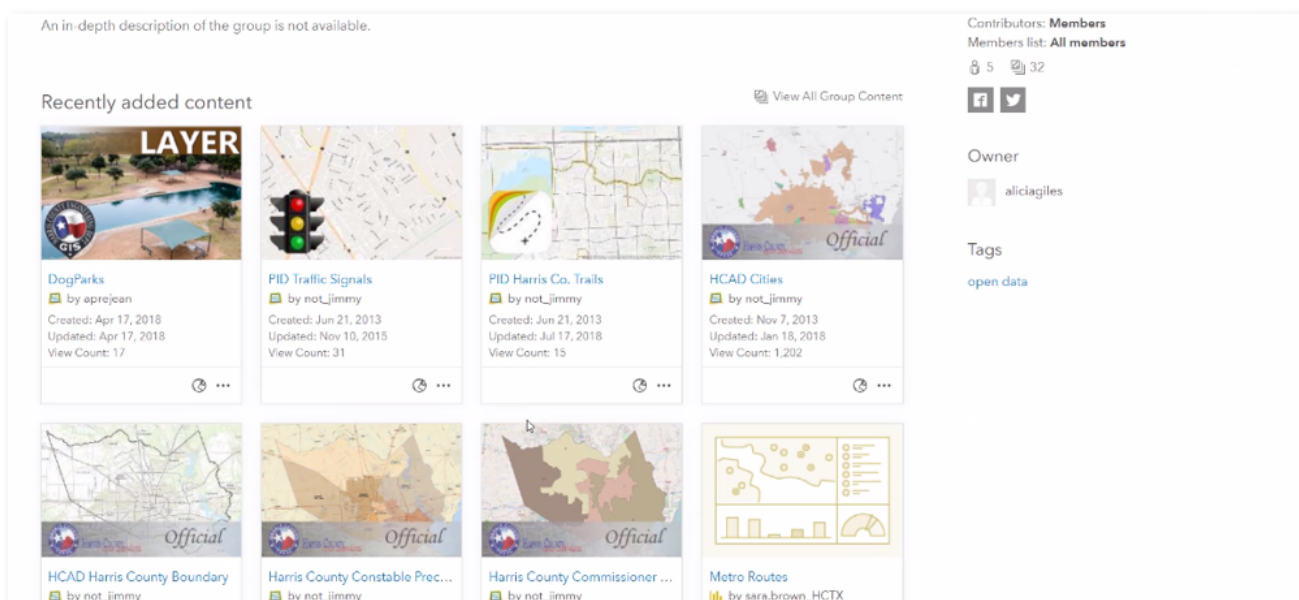


Figure 10. Register Groups - Step 5b

3.1.3. Option Three: Automatically Registering Catalogs into ArcGIS Groups

A manager can also instruct development staff to use the ArcGIS REST API, Python API for ArcGIS, or [Geoportal Server](<https://github.com/Esri/geoportal-server/wiki/Portal-for-ArcGIS-Integration>) to

automate the registration of items from third party catalogs or sources. A demonstration of this approach is not part of the scope of this pilot.

For details on how to use the ArcGIS APIs, see <https://developers.arcgis.com>.

3.2. Publication of data

Data that needs to be published or re-published for the specific scenarios is addressed in Chapter 5.

Types of Data Services

ArcGIS supports many of the OGC services as shown here: <http://www.opengeospatial.org/resource/products/compliant>

3.3. Discovering of data

For the purposes of this Pilot, an Emergency Management Director, or Incident Commander, would provide stakeholders the ability to discover data in ArcGIS by searching or browsing content in the Hub Site.

Search for Keywords

Step 1. Click Search on the home page to open the search box. See Figure below.

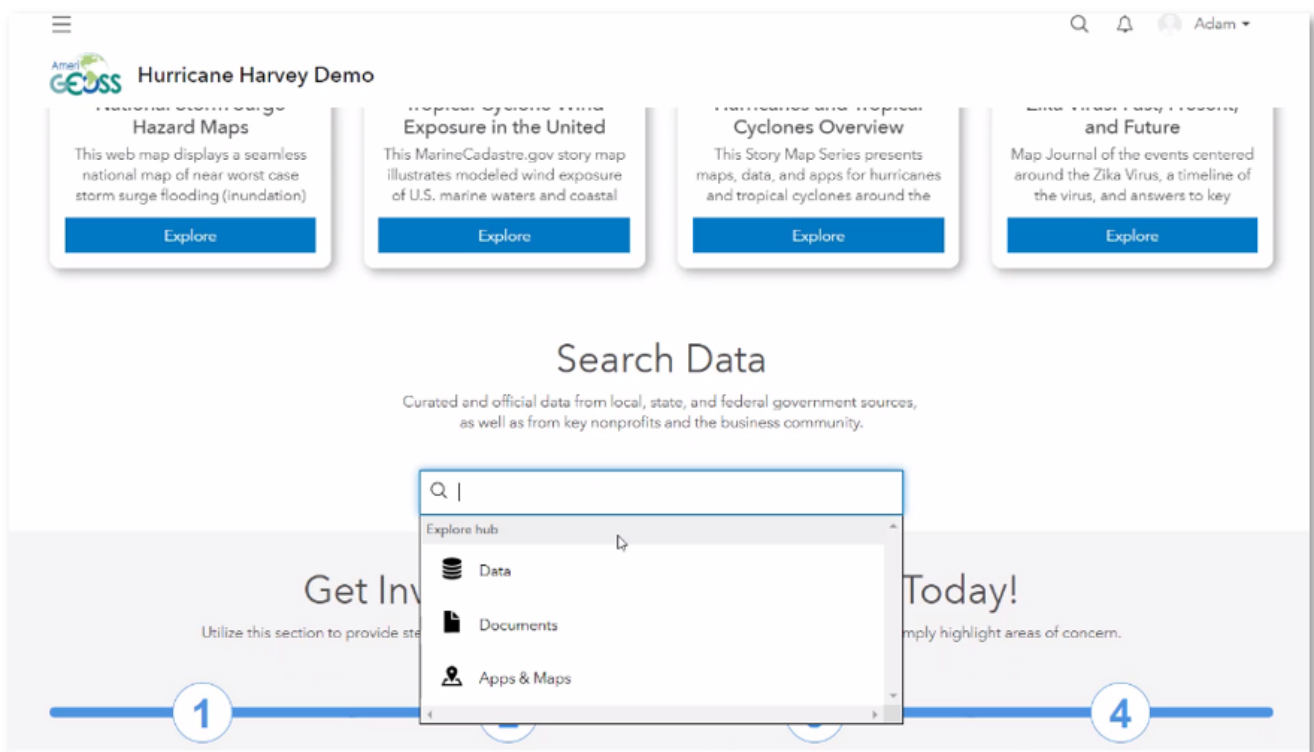


Figure 11. Discover Data - Step 1

Step 2. Type your keyword or words or select Data, Documents or Apps & Maps and click Enter or the magnifier icon in the search box to see a list of results and sources in the lower portion of the page. See Figure below.

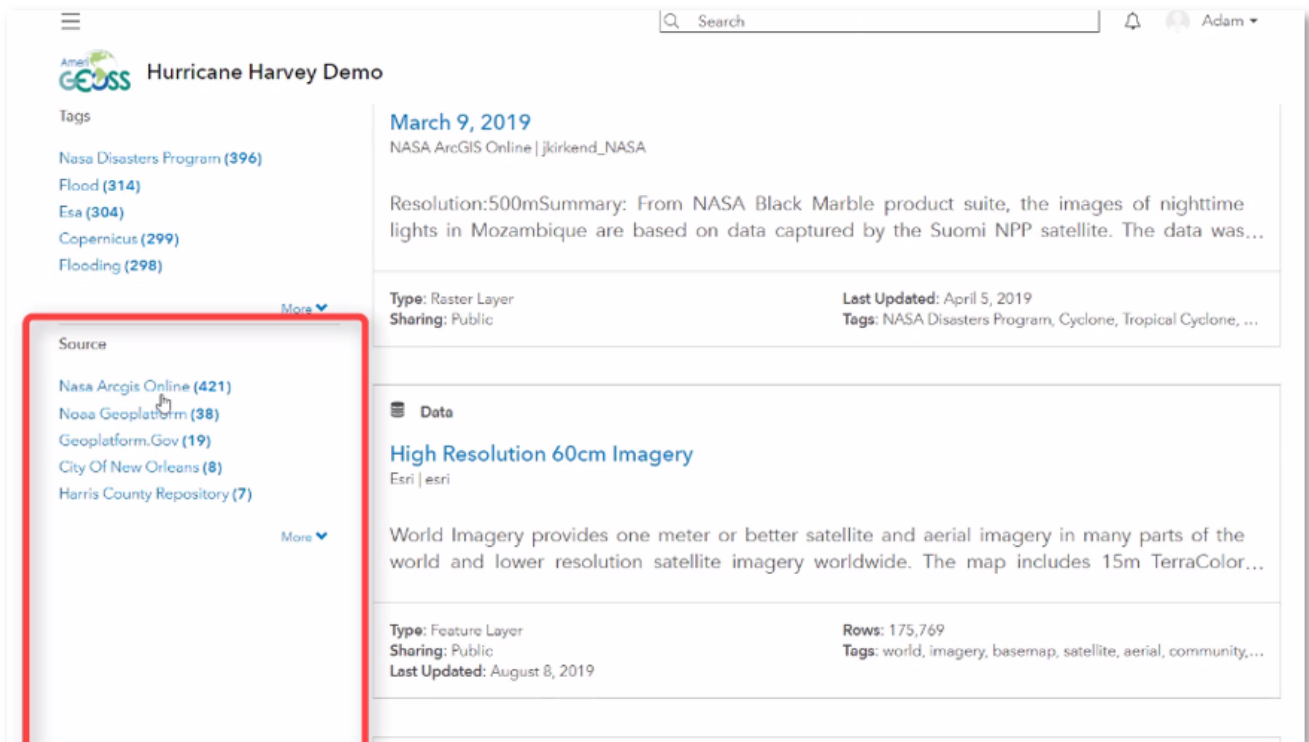


Figure 12. Discover Data - Step 2

Step 3. You can narrow by selecting a facet, such as a Data Source. For example, if let's Department of Urban Housing and Development. See Figure below.

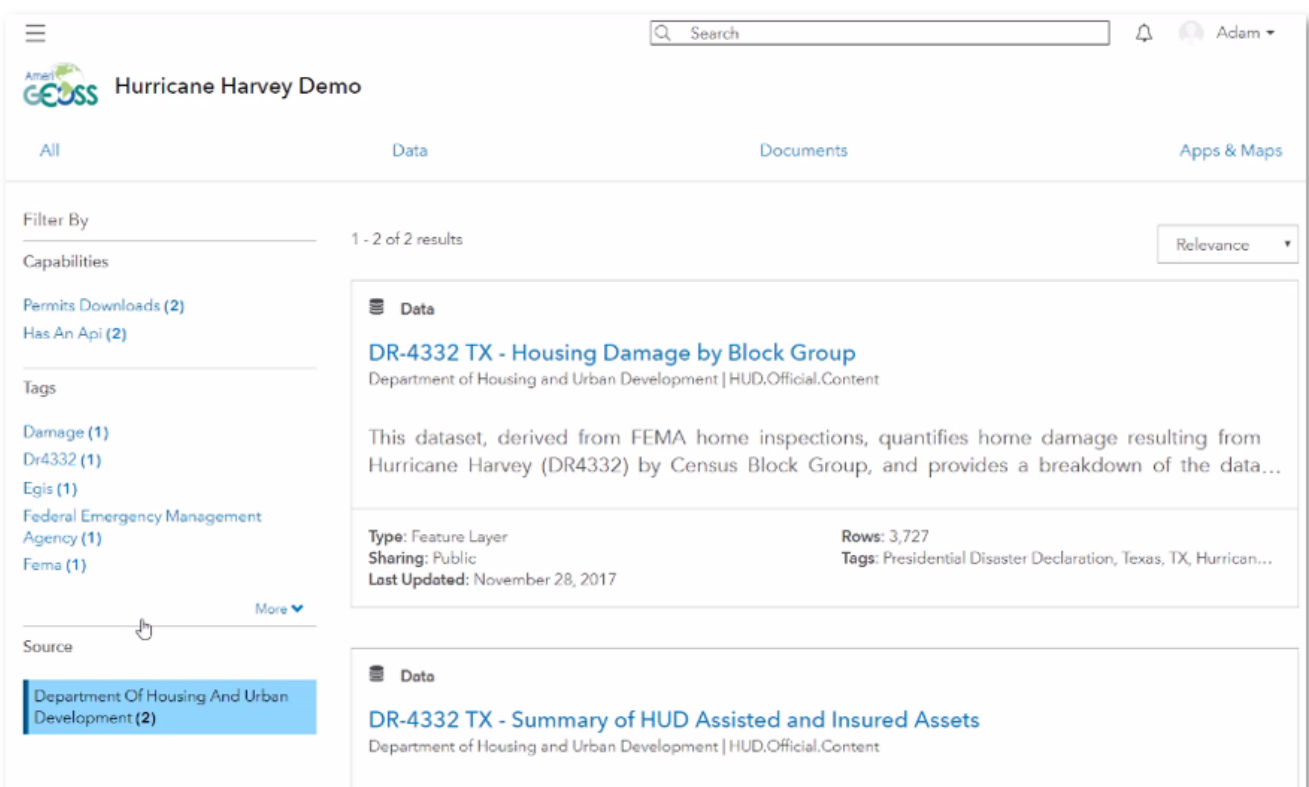


Figure 13. Discover Data - Step 3

Step 4. Select the resulting data you want, for example, Housing Damage by Block Group. See Figure below.

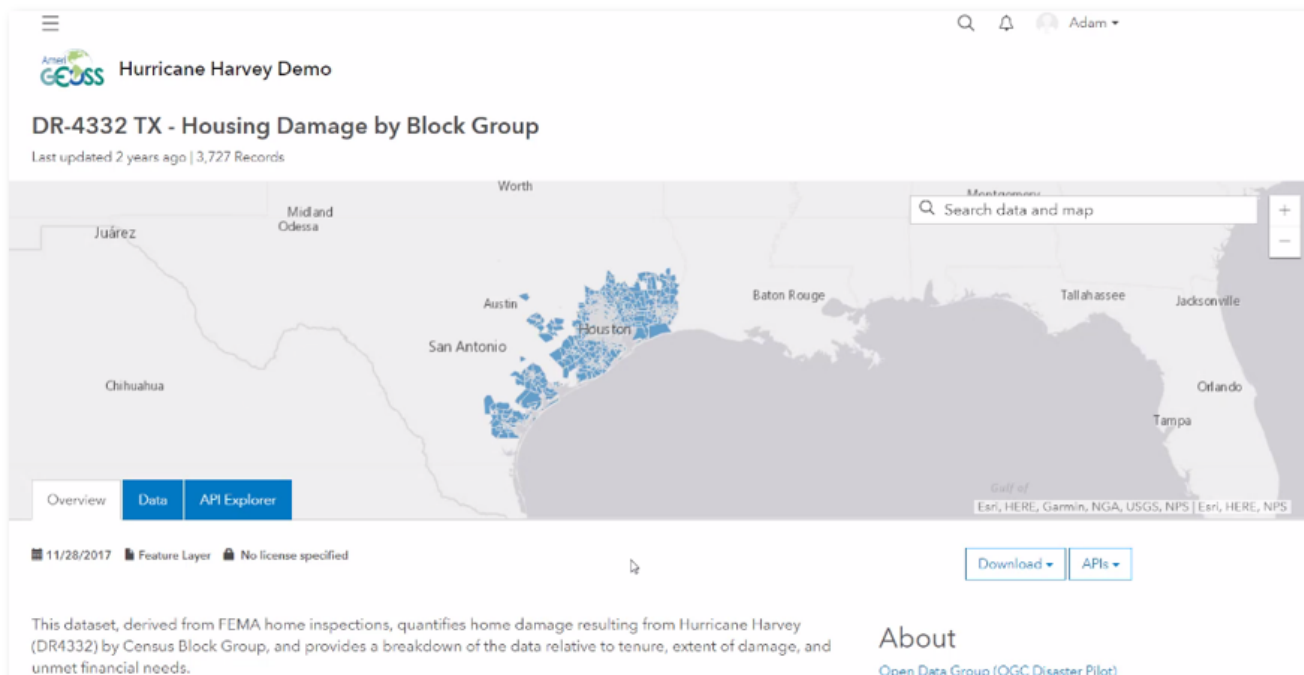


Figure 14. Discover Data - Step 4

Step 5. You can explore the data further by browsing attributes. By selecting certain attributes, the smart map preview at the top of the page will change to visualize that attribute. See Figures below.

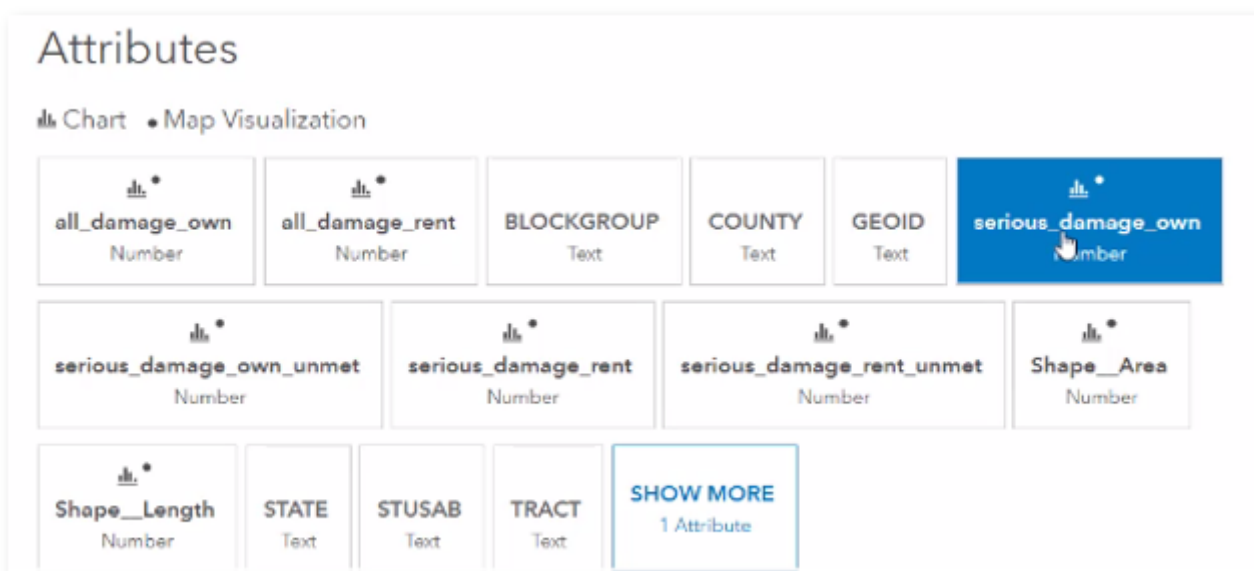


Figure 15. Discover Data - Step 5

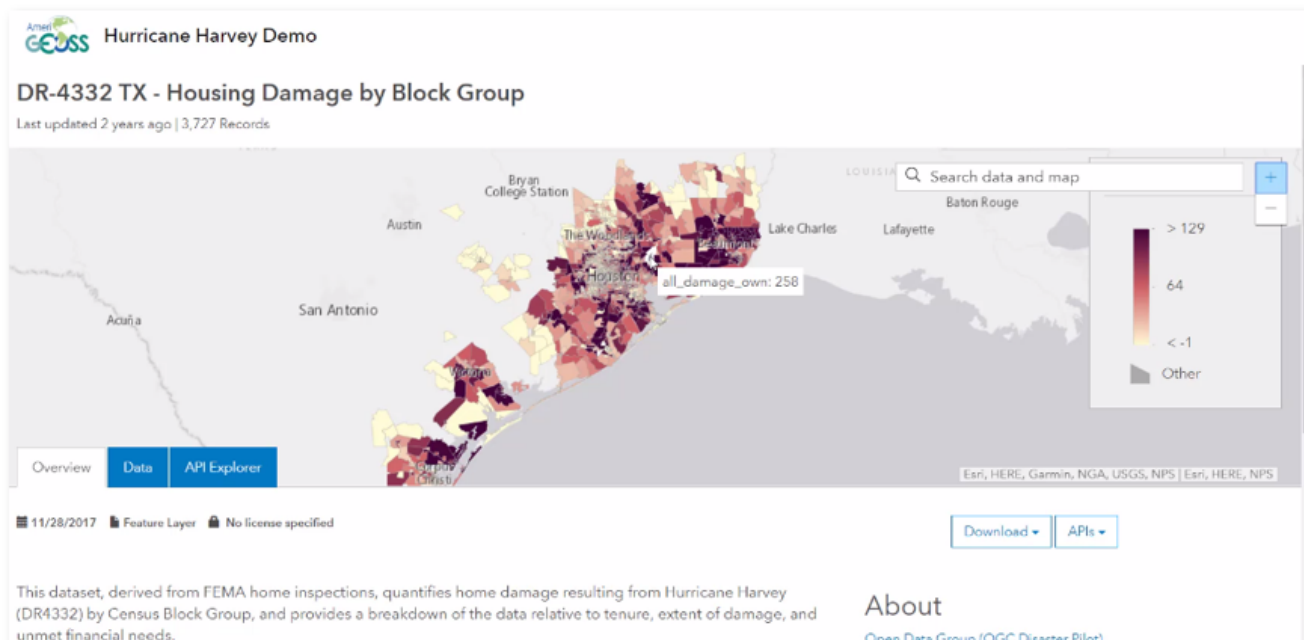


Figure 16. Discover Data - Step 5b

The example above shows how an manager can enable data discovery with all relevant stakeholders through a Hub Site.

As a State Emergency manager or designated staff, discovering the authoritative data for registration or republication into your Hub site for your particular community or disaster could happen through the

- exchange of URLs through existing relationships with the public safety community (HIFLD, DHS CONOPS, FEMA)
- searching in existing catalogs such as Geoplatform.gov, Data.gov, ArcGIS Online or the ArcGIS Living Atlas of the World.

See how to register these data as groups or items in the section above.

3.4. Downloading of data

Data presented in the Hub Site can be downloaded from the dataset page in standard formats (csv, geojson, shp, kml) by clicking the download button underneath the map in the top right corner. See Figure below.

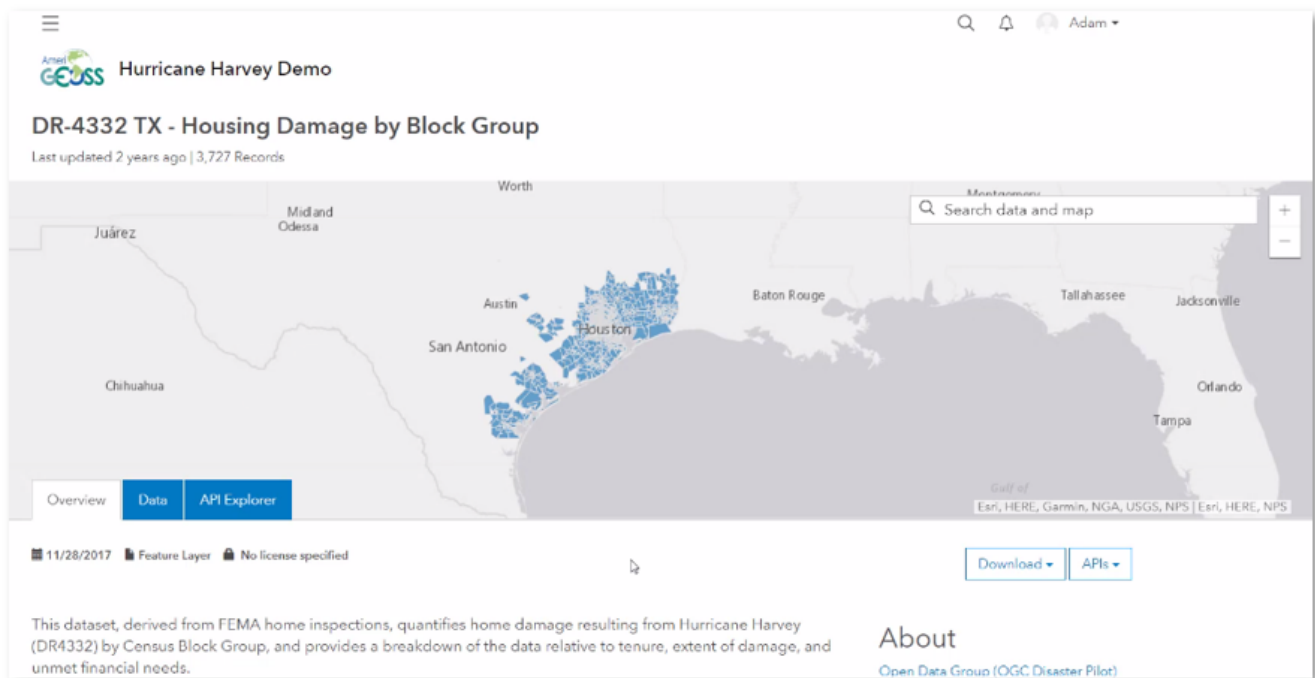


Figure 17. Discover Data - Downloads

3.5. Data Integration

See Chapter 5

3.6. Republication of data

Web services provided by third parties may not be demand-ready for the high spikes in interest by all the emergency manager's stakeholders, or provided in a format that enables all the kinds of analysis needed. In addition, to enable configurable web apps and web analytics on the fly, RESTful, JSON based APIs are commonly preferred, per the W3C and OGC's recommendations for Best Practices for Data on the Web (#24). Therefore, data managers may want to have staff republish 3rd party data in OGC or Esri web service formats, hosted in the demand-scalable ArcGIS Online platform using this following method in ArcGIS Pro.

In this Pilot example, the WFS service from a National Government database is re-published and hosted to ArcGIS Online. As part of the common operational picture, Emergency Operations Managers may want to get levee data from the US Army Corps of Engineers (USACE) on floodwalls, encroachments and embankments for Houston, TX, currently provided as an OGC Web Feature Service (WFS v2.0). The following guide shows the steps for clipping and re-publishing an area of interest in ArcGIS Pro.

Step 1: From the USACE Levees website (<https://levees.sec.usace.army.mil>), copy the mapserver URL to paste into the server connection in ArcGIS Pro. See Figure below.

Web GIS Services

The National Levee Database's core mapping data can be used in GIS desktop and web apps via the Web-GIS Service URLs below. Use these services to add NLD data to your maps, change layers styles and export selected features.

The NLD's WMS and WFS services use the "ows_" metadata reference in lieu of "wms_" and "wfs_", which allows a single endpoint to support both mapping and feature services. The URL provided below can be used for adding both WMS and WFS services to your GIS client.

<https://levees.sec.usace.army.mil/mapserver/public/ows>

Select and copy the link above

The NLD's ESRI feature and mapping services provided below can be used for adding to your ESRI compatible GIS client.

https://ags01.sec.usace.army.mil/server/rest/services/NLD2_PUBLIC/MapServer

Select and copy the ESRI mapping service link above

https://ags01.sec.usace.army.mil/server/rest/services/NLD2_PUBLIC/FeatureServer

Select and copy the ESRI feature service link above

Downloads

User Guide - NLD Web-GIS services (pdf)



Figure 18. Republish Data - Step 1

Step 2: In ArcGIS Pro, connect to the WFS Service

1. Open an ArcGIS Pro project, open the Catalog panel and view the "Project" tab.
2. Right-click on the "Servers" folder and choose "New WFS Server Connection".
 1. If the Servers folder is not shown, choose the "Insert" tab in the ribbon, and then click the "Connections" button and choose "New WFS Server".
3. In the Add WFS Server Connection window, enter the service URL in the "Server URL" input box and click the "OK" button. (<https://levees.sec.usace.army.mil/mapserver/public/ows>) See Figures below.

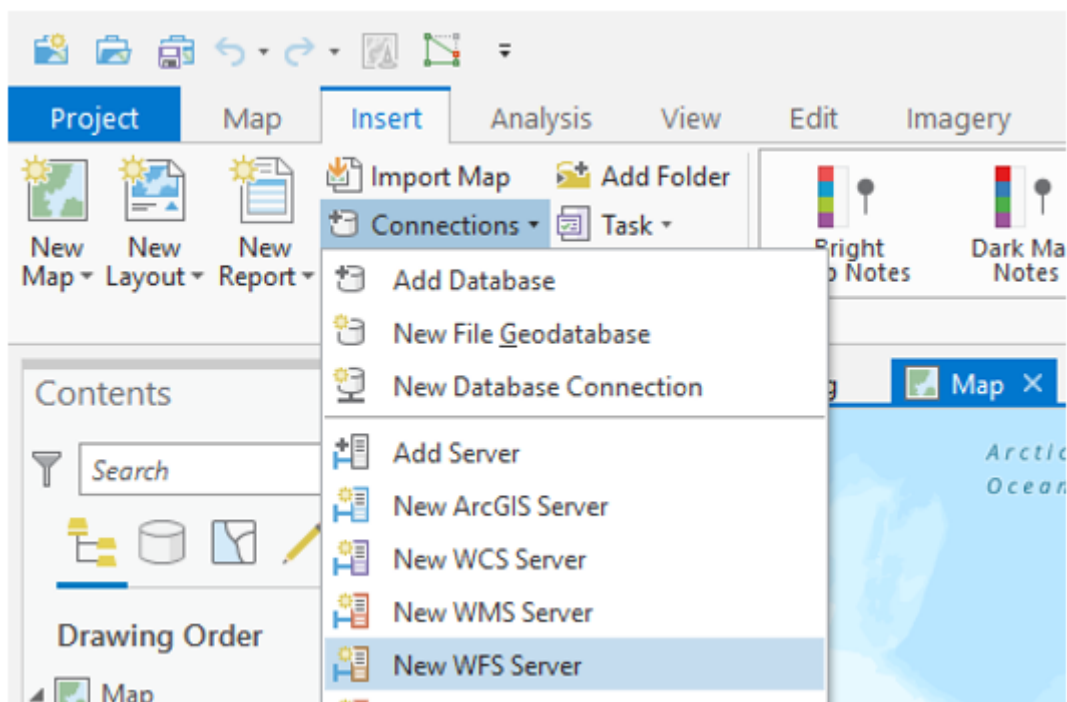


Figure 19. Republish Data - Step 2

 The 'Add WFS Server Connection' dialog box is shown. It contains the following fields and options:

- Server URL:** A text box containing the URL `https://levees.sec.usace.army.mil/mapserver/public/ows`.
- Examples:** Two example URLs are listed: `http://gisserver.example.com/arcgis/services/SampleWorldCities/MapServer/WFSServer?` and `http://gisserver.example.com:8080/geoserver/ows?`.
- Version:** A dropdown menu set to 'Default version'.
- Custom request parameters:** A section header with a right-pointing arrow.
- Authentication (Optional):** A group box containing:
 - User Name:** An empty text box.
 - Password:** An empty text box.
 - Two radio buttons: 'Save Username / Password to Windows Credential Manager' (selected) and 'Save Username / Password to connection file'.
- Buttons:** 'OK' and 'Cancel' buttons at the bottom right.

Figure 20. Republish Data - Step 2b

In the Catalog panel, Project tab, a new item called “WFS on... wfs” should now be available in the Serves folder. See Figure below.

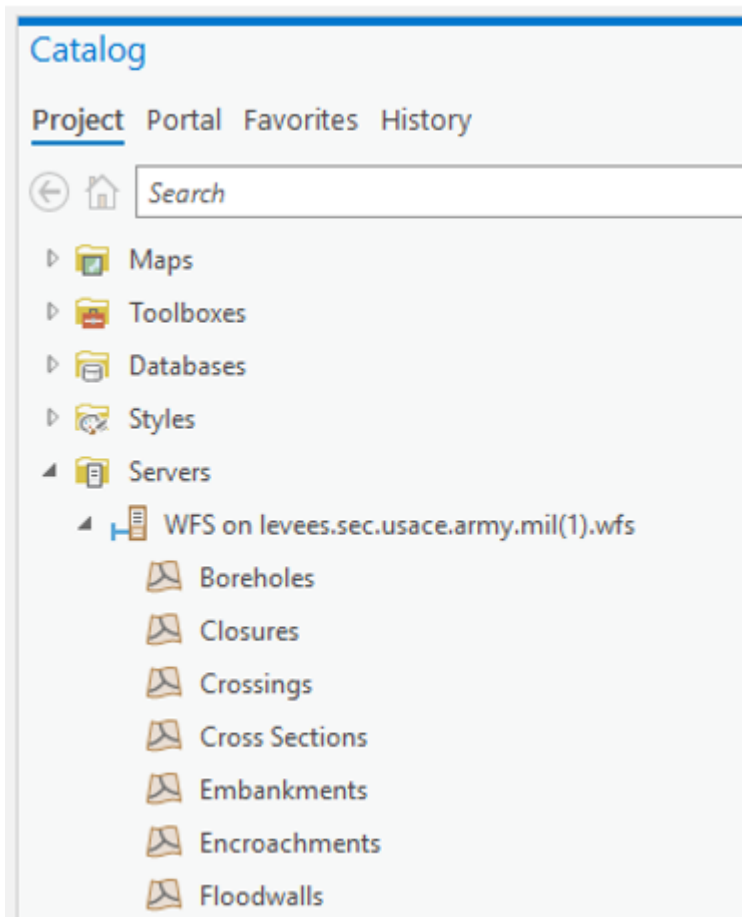


Figure 21. Republish Data - Step 2c

Step 3: View the WFS Layers in a Map

1. In an ArcGIS Pro project, open the Catalog panel or click the Add Data button in the “Map” tab of the ribbon, and then navigate to the Servers folder.
2. From the Catalog panel, Project tab:
 - a. To add to your current map, select one or more layers from the WFS service. Drag and drop the layer(s) into the map or Contents panel. Alternatively, right-click a layer or layer group and choose “Add to Current Map”.
 - b. To create a new map with layers from the WFS service, right-click the layer(s) and choose “Add to New Map”.
3. From the Add Data window:
 1. To add layers to your current map, first open WFS item and then select one or more layers and click the “OK” button. See Figure below.

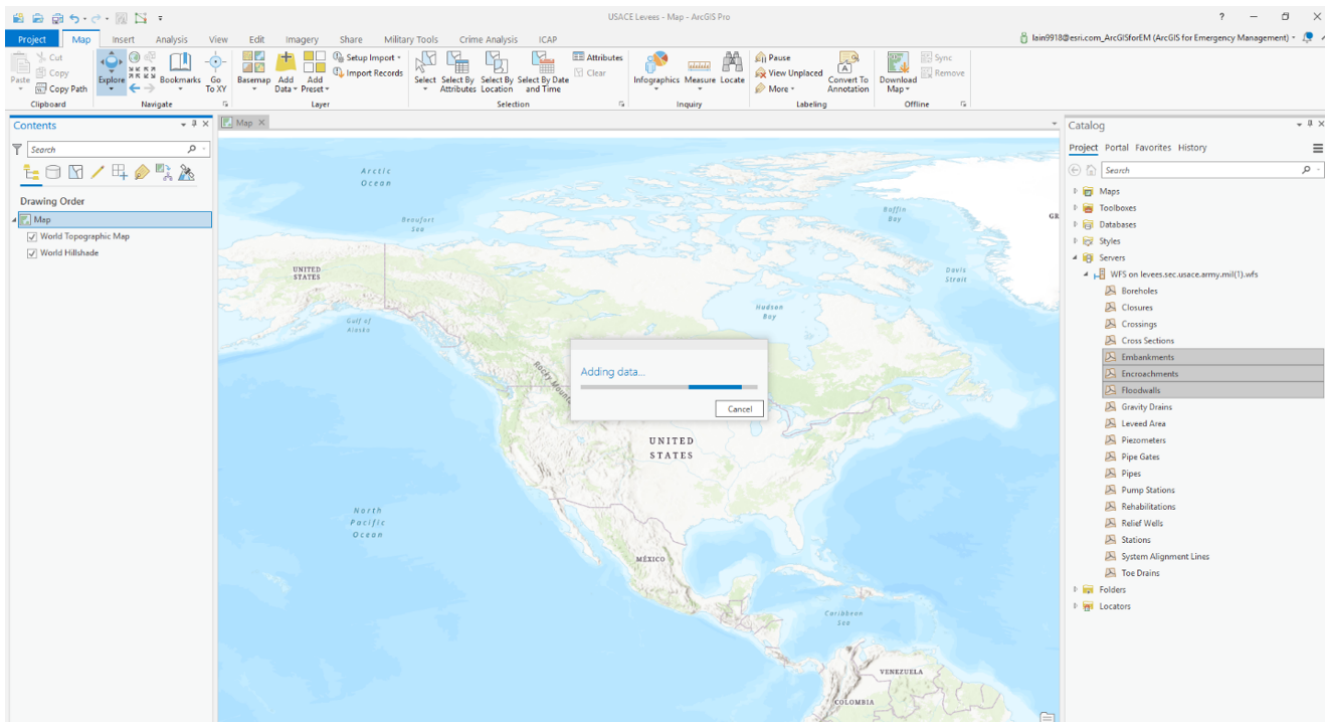


Figure 22. Republish Data - Step 3

If the layers are not displayed in the correct location, or if features appear to be missing, this is likely due to the default WFS layer settings. In the map contents panel, right-click a WFS layer and go the WFS section. Check on “Swap x/y coordinates” and set the maximum features returned to a higher value. See Figure below.

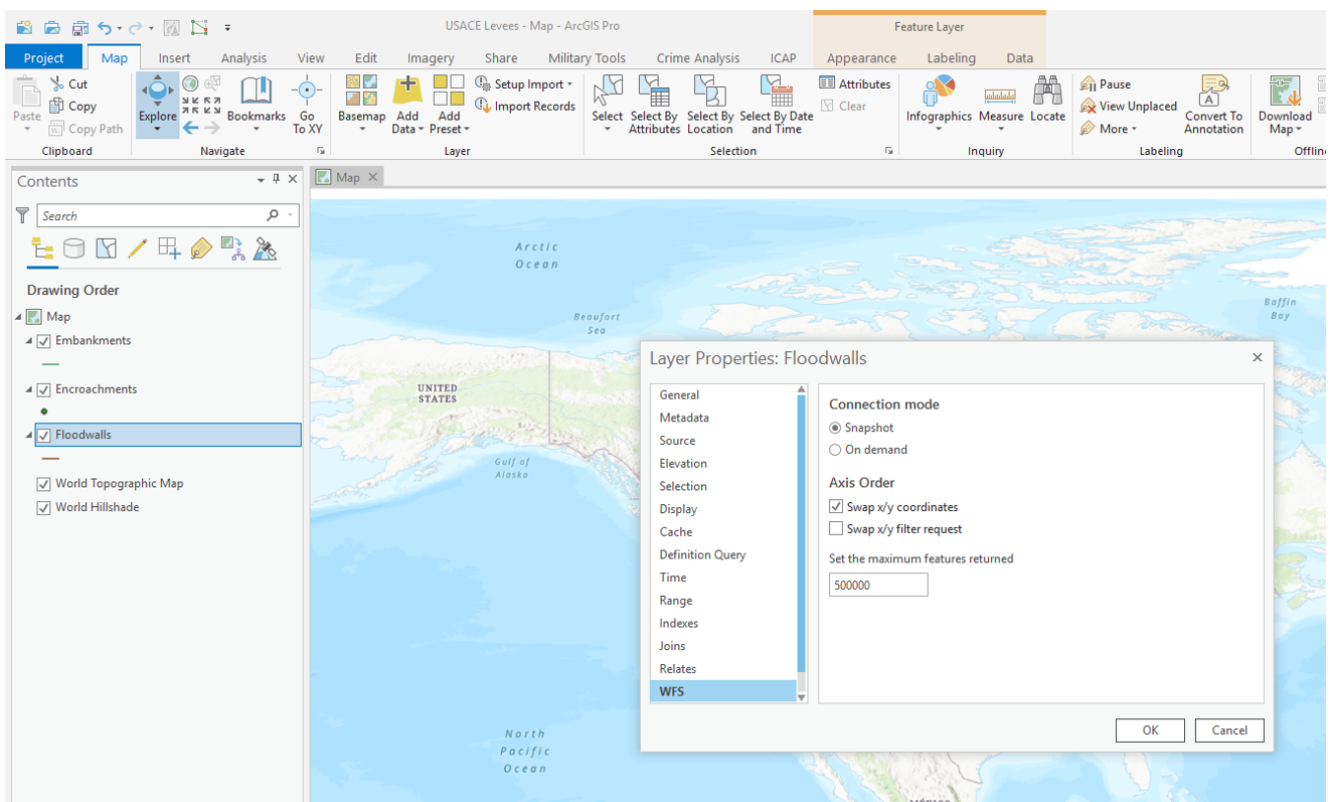


Figure 23. Republish Data - Step 3b

Step 4: Clipping the desired area before sharing

The URL to the connected web map service has National level data for the entire country. However,

an incident manager may only want the portion relevant to Houston, TX and the surrounding areas. In order to achieve this focused area, he can use the select polygon and analysis “Clip” tools.

In the map tab choose “select” > “rectangle” and select all features in the area of interest. See Figure below.

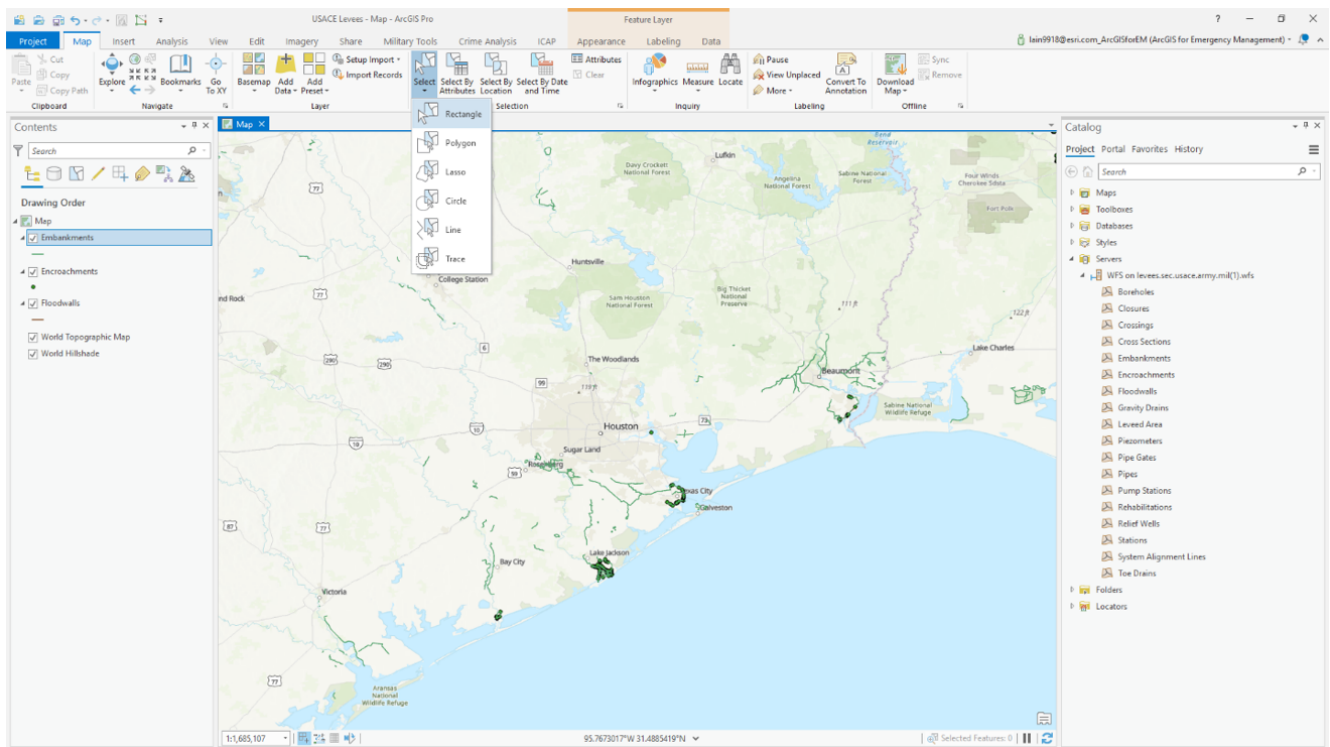


Figure 24. Republish Data - Step 4

Next to clip out information that you do not need select the analysis tab and select “Clip”. In the geoprocessing pane select the input and clip feature classes (example, encroachments), enter in a unique name for the output feature class (example, Embankments_Clip) and and hit run. See Figure below.

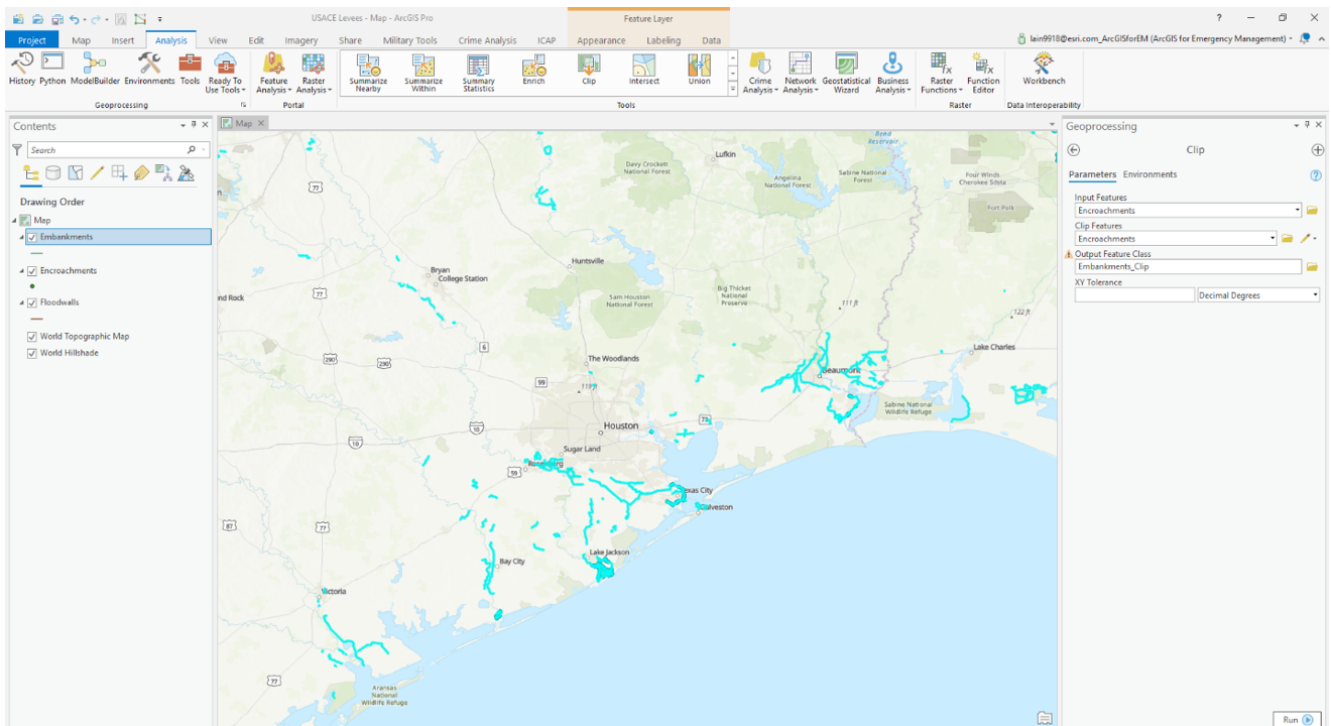


Figure 25. Republish Data - Step 4b

Follow this workflow for all three feature layers, encroachments, embankments and floodwalls. The result should be six layers in your contents pane. Embankments, Embankments_Clip, Encroachments, Encroachments_Clip, Floodwalls and Floodwalls_Clip.

Delete the original layers – Embankments, Encroachments and Floodwalls

Next, select all three clip layers – Embankments_Clip, Encroachments_Clip and Floodwalls_Clip and right click to group. See Figure below.

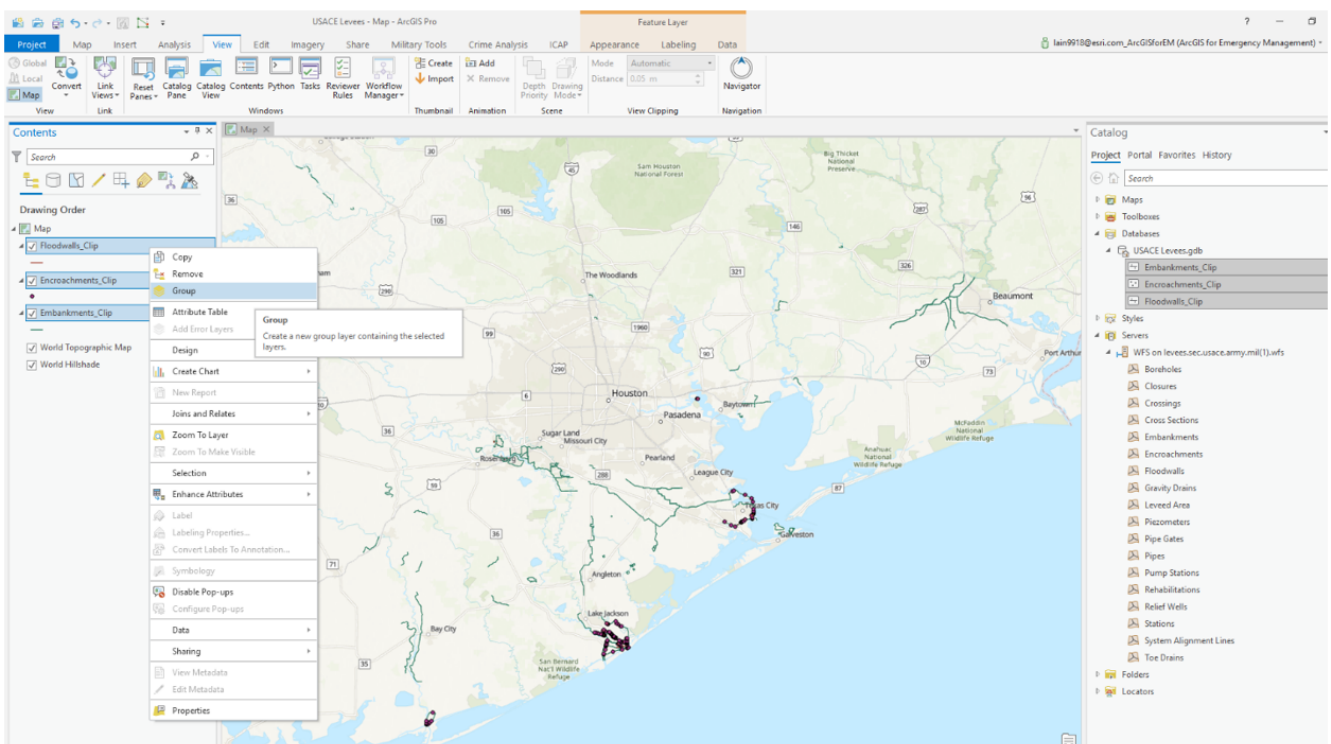


Figure 26. Republish Data - Step 4c

Step 5: Publish as a hosted feature service and WFS See Figure below.

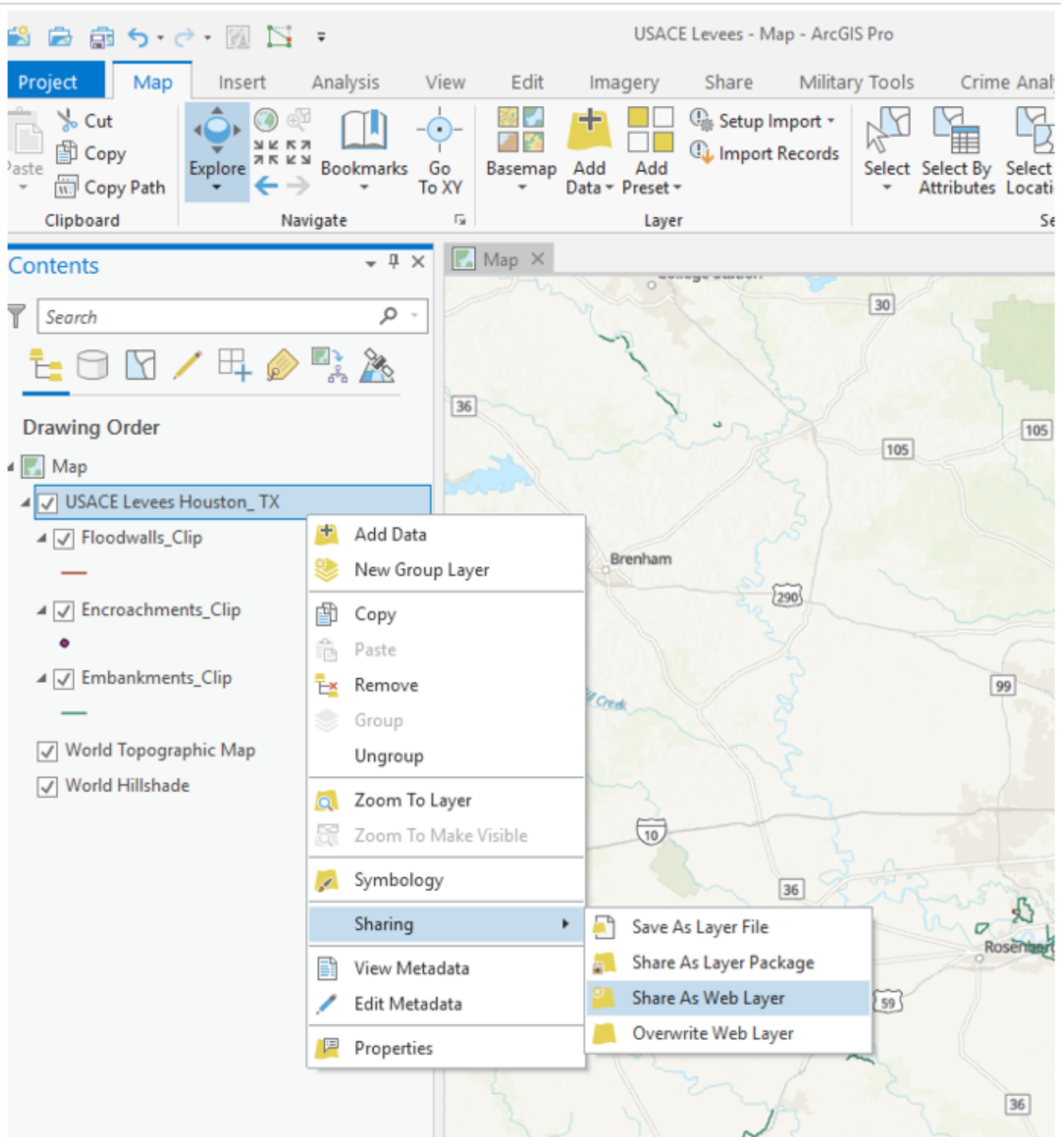


Figure 27. Republish Data - Step 5

3.7. Displaying of the data with proper symbology

Data can be displayed using pre-defined symbology sets from the hosting server.

Chapter 4. Special Topics

This section describes special topics, issues, and considerations related to the Use Case.

4.1. The Right Data for the Right People at the Right Time

Within a disaster response scenario, there are a myriad of decisions that must get made by a number of people - emergency managers, victims in harms way and their families, first responders, and policy makers.

This pilot focuses on the Emergency Manager, or Incident Commander, at the state level, as well as the locally focused emergency managers, planning chiefs and local watch officers and their need to understand local situations and the expected and evolving impacts of their area of interest.

First, state emergency managers need to share a broad array of foundational baseline data, or a common operating picture, about their communities - including probable flood areas from FEMA, community shelters from local governments, household addresses and more. Being able to share this information broadly to others coming to help - such as neighboring localities, federal agencies and volunteer groups - is key to enabling effective communication and cooperation.

However, with the inundation of information, Esri has found that emergency managers also need focused solutions in the form of configurable web applications, to help answer specific questions at specific times, that focus on a subset of this foundational data.

Applications such as the Public Information and Flooding Dashboard focusses on the question - Where is the storm now? and will it likely be in the next few days?

Applications such as the Situational Awareness Viewer helps answer the question - what are the localized impacts in this particular area of interest around a local incident or group of incidents?

Chapter 5. Scenarios and Tools

Demonstration

5.1. Hurricane Preparation One Week Before Disaster

Texas State EOC Manager needs to quickly curate & federate web services (Esri REST, OGC) to provide a common operation picture for public and third party stakeholders, as well as to do short-term impact analysis to support resource requests to the state, federal governments and non profits.

5.1.1. Audience

Primary

- State Emergency Managers
- County / Local Emergency Managers
- Incident Commanders

Secondary

- Citizens in the projected path of hurricane
- National and local business owners
- Non-profit first responders

5.1.2. Publication of data

- State of Texas Address Database, Texas Natural Resources Information System (TNRIS): <https://tnris.org/stratmap/address-points> | <https://www.arcgis.com/home/item.html?id=967a909d2328454e996e036713acee3f>
- Health Solutions Research Vulnerability Index by ZipCode – <https://www.arcgis.com/home/item.html?id=440a2e53048a4986b4f3bebe725e2884>
 - As WFS:
- Active Hurricanes: <https://www.arcgis.com/home/item.html?id=adfe292a67f8471a9d8230ef93294414>
- Active Hurricane, Cyclones and Typhoons: <https://www.arcgis.com/home/item.html?id=248e7b5827a34b248647afb012c58787>
- Live Stream Gauges: <https://www.arcgis.com/home/item.html?id=704fcc5841f340cab8b6e9f47bc684d7>
- National Water Model (Hourly Anomaly Forecast): <https://livefeeds2.arcgis.com/arcgis/rest/services/NFIE>
- National Water Model (10 Day Anomaly Forecast): <https://livefeeds2.arcgis.com/arcgis/rest/services/NFIE>

- National Weather Service Precipitation Forecast (Cumulative Total): <https://arcgisforem.maps.arcgis.com/home/item.html?id=f9e9283b9c9741d09aad633f68758bf6>

Other relevant data is available in the Esri Living Atlas: <https://livingatlas.arcgis.com>

5.1.2.1. In-situ Data

- NOAA: Recent GOES Weather Satellite Imagery
- NOAA: Recent NEXRAD Weather Radar Imagery

5.1.2.2. Remote Sensing Data

See In-situ Data

5.1.3. Registration of data

The registration of ArcGIS Data Groups into the event-based Hub Site included:

- HIFLD (Public Health): <https://www.arcgis.com/home/group.html?id=2900322cc0b14948a74dca886b7d7cfc>
- HIFLD (Education): <https://www.arcgis.com/home/group.html?id=f16c582f00184cb094affff556fe57ee>
- Harris County: <https://www.arcgis.com/home/group.html?id=9ab62bed53f348d58bec9c27e985d894>
- NASA Disasters Program (reference): <https://www.arcgis.com/home/group.html?id=556d1e1bd0ad489a96736ee633f57ce2>
- NOAA Weather: <https://www.arcgis.com/home/group.html?id=346669a541e9433a8433bd267991539f>

5.1.3.1. Key Data Items Registered (for Pilot demonstration)

Federal Data

- FEMA 100 Year Flood zones: <https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer>
- USACE Levee: <https://levees.sec.usace.army.mil/mapserver/public/ows?SERVICE=WFS&REQUEST=GetCapabilities&VERSION=2.0.0>
- HIFLD Open Layers (348)
 - Geoplatform Hub Site: <https://hifld-geoplatform.opendata.arcgis.com>
 - Hospitals: <https://www.arcgis.com/home/item.html?id=a2817bf9632a43f5ad1c6b0c153b0fab>
- CDC Social Vulnerability Data: <https://www.arcgis.com/home/item.html?id=62b3e305b730423782c64b9696242c5e>

Local Data

- Harris County

- Harris County Hub Site: <http://geo-harriscounty.opendata.arcgis.com/>
- Facilities Layer: <https://www.arcgis.com/home/item.html?id=69988d188e424843a0a5cefdd7daa8b6>
- State of Texas Address Points (2017), Texas Natural Resources Information System (TNRIS): <https://tnris.org/stratmap/address-points>

Third Party

- Health Solutions Research - Vulnerability Index – based on Census data - Zipcode level - with population counts of specific health vulnerabilities (language fluency, critical conditions, mental health issues) <https://www.arcgis.com/home/item.html?id=440a2e53048a4986b4f3bebe725e2884>
 - Reference the WFS in the group: <https://www.arcgis.com/home/group.html?id=09d69303783441d3968b100408900341#overview>
- Iowa State Mesonet IEM WMS Service for historical NEXRAD data (to visualize the radar for Harvey 2017-08-17 timespan): <https://arcgisforem.maps.arcgis.com/home/item.html?id=e5905be0a0fe4c52adb13d368459f6e7>

5.1.4. Discovering of data

This pilot and the guidebook below shows how emergency managers can create a Hub Site for the purpose of enabling data discovery with all relevant stakeholders (See Primary and secondary audiences). For a State Emergency manager, discovering the data for registration or republication into his or her site for their disaster could happen through the exchange of URLs through existing relationships with the public safety community (HIFLD, DHS CONOPS, FEMA) or searching in catalogs such as Geoplatform.gov, Data.gov, ArcGIS Online or the ArcGIS Living Atlas of the World. See how to register this data as groups or items in General Use Case (Chapter 3).

5.1.5. Downloading of data

See General Use Case (Chapter 3)

5.1.6. Data Integration

Data integration for this Pilot is only performed as preparation of the HAND Model-Generated Depth Polygons using the Texas Digital Elevation Model (10-m).

Additional integrations were done to create the derived layers listed above under Published Data, but detailed descriptions are not included in the scope of this pilot.

5.1.7. Republication of data

For this scenario, we republished Texas Address Data (2017) from <https://data.tnris.org/collection/c56ff69b-efe7-46e7-89c7-43e655188382>, which was provided as a downloadable File Geodatabase (.fgdb), as a hosted Esri Feature Service to enable on the fly analysis.

In addition, see General Use Case (Section D3) for relevant instruction.

5.1.8. Displaying of the data with proper symbology

5.1.9. Guide to Implementation

5.1.9.1. Federate Relevant Data from all Contributing Sectors

State emergency managers may start disaster preparations with a foundational baseline of data about their communities - flood prediction areas, community shelters, household addresses and more. Being able to share this information broadly to others coming to help - such as neighboring localities, federal agencies and volunteer groups - will be key to enabling effective cooperation.

By managing the foundational baseline of data in ArcGIS Servers or using ArcGIS Online, managers can quickly create an event-specific website backed by the content shared through Groups in ArcGIS Online.

However, managers prepare for an upcoming flooding event, they may be sent or find additional authoritative data about key community lifelines that will be useful for planning purposes, like updated health care facility information or new flood forecasts. These data may come from a variety of stakeholders - local officials, state officials, federal agencies, universities, non-profits like the Red Cross, individual volunteer groups, social media, and private companies.

We'll show managers how they can use ArcGIS Online Hub sites to quickly add pre-curated data groups from other organizations with a few clicks.

For more information on how to prepare data for a Hub site, please see ArcGIS Hub documentation "Data" section at visit <https://doc.arcgis.com/en/hub>

Create a Site

Step 1. Sign in to ArcGIS Hub and navigate to the Overview page. See figure directly below for an illustration.

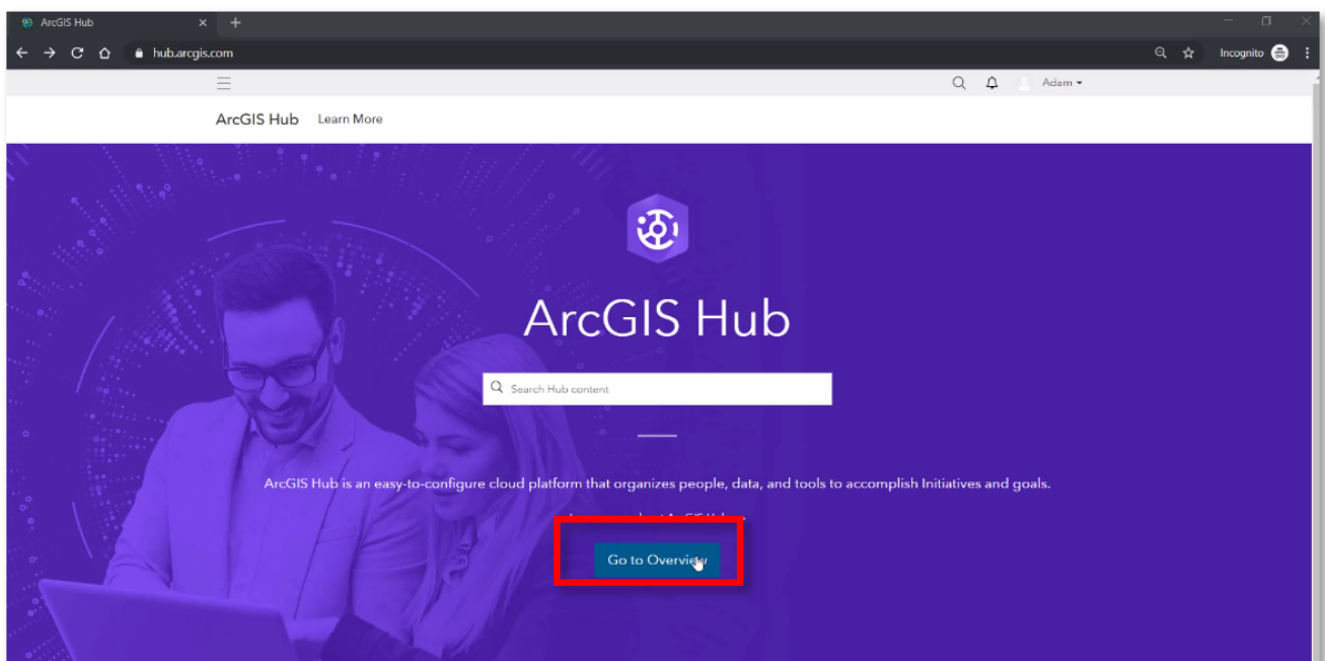


Figure 28. Create a Site - Step 1

Step 2. Click on New and choose site. See figure directly below for an illustration.

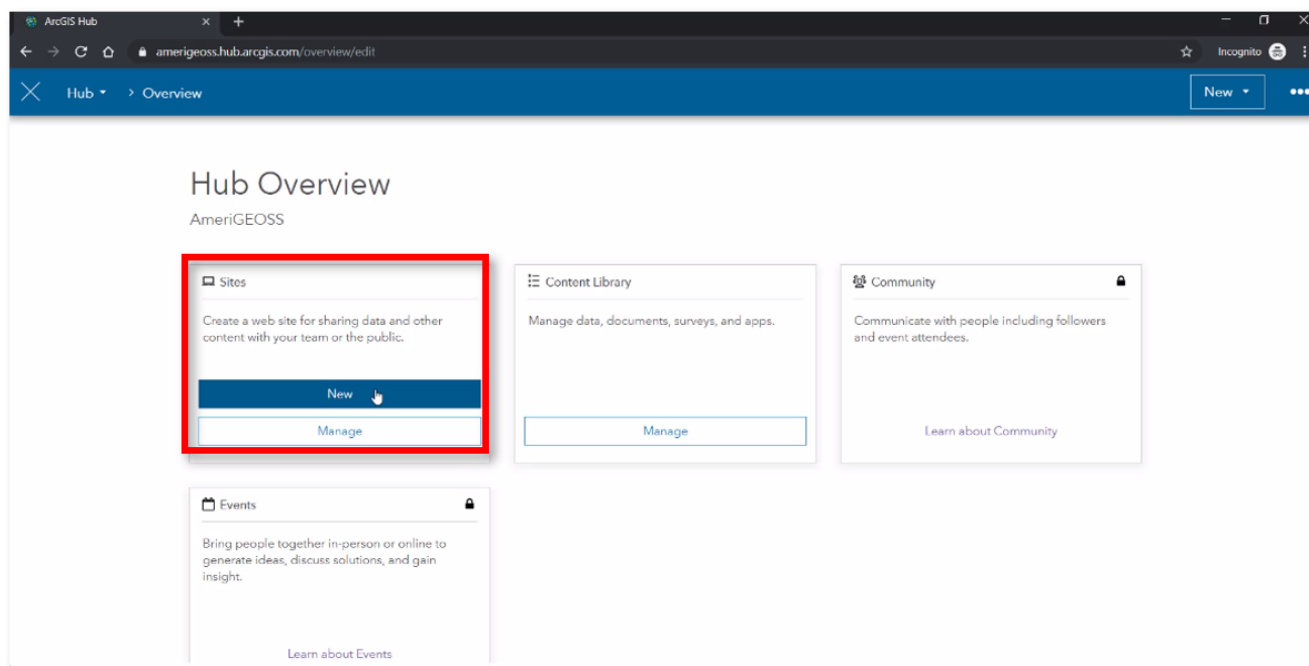


Figure 29. Create a Site - Step 2

Step 3. Provide a name for the site. See figure directly below for an illustration.

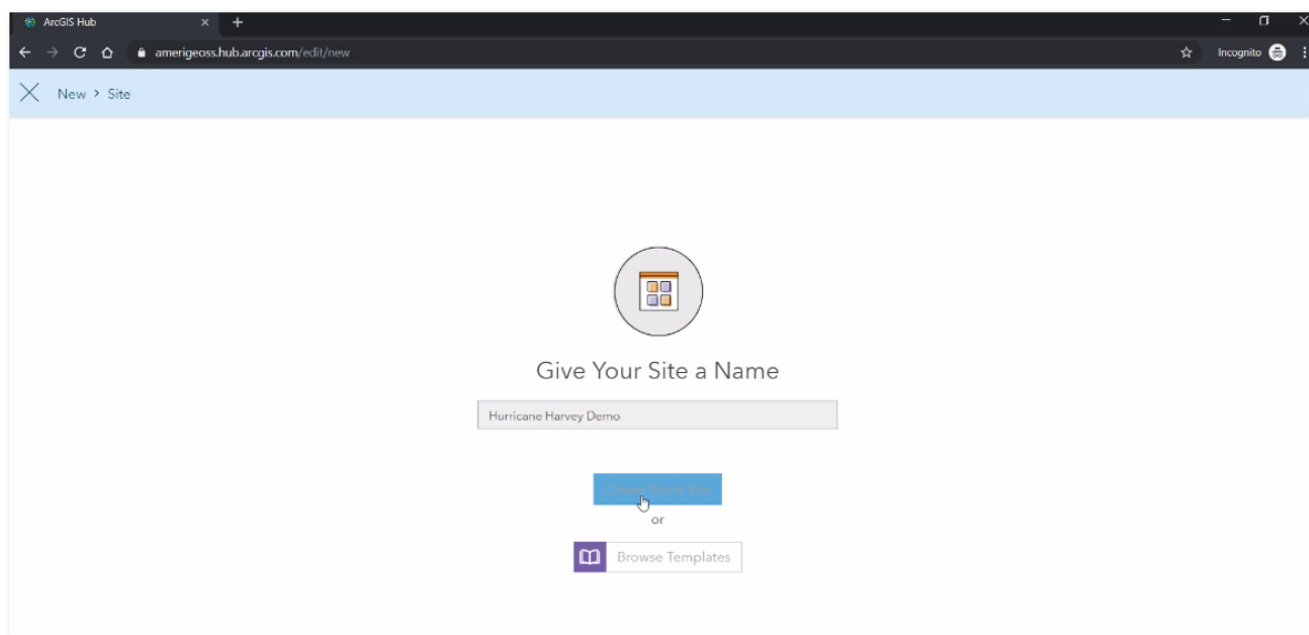


Figure 30. Create a Site - Step 3

Step 4. Once site is created, configure its settings or begin by adding cards to the site's layout. See figure directly below for an illustration.

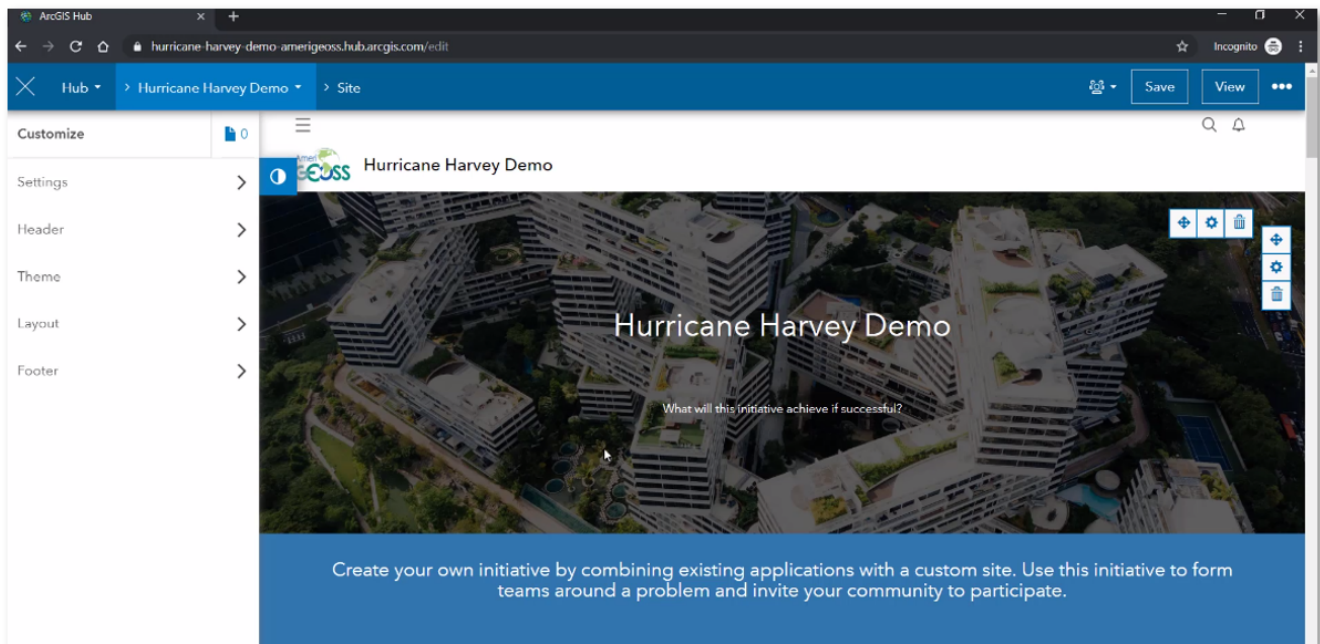


Figure 31. Create a Site - Step 4

Configure the Site

Each site has its own settings that can be configured to personalize how the site works and displays on the web. Settings include basic information like a site title, description, and URL. They also include more advanced options like custom domain configuration and site capabilities. Settings can be modified at anytime.

Step 1. Click Settings on the Customize panel. See figure directly below for an illustration.

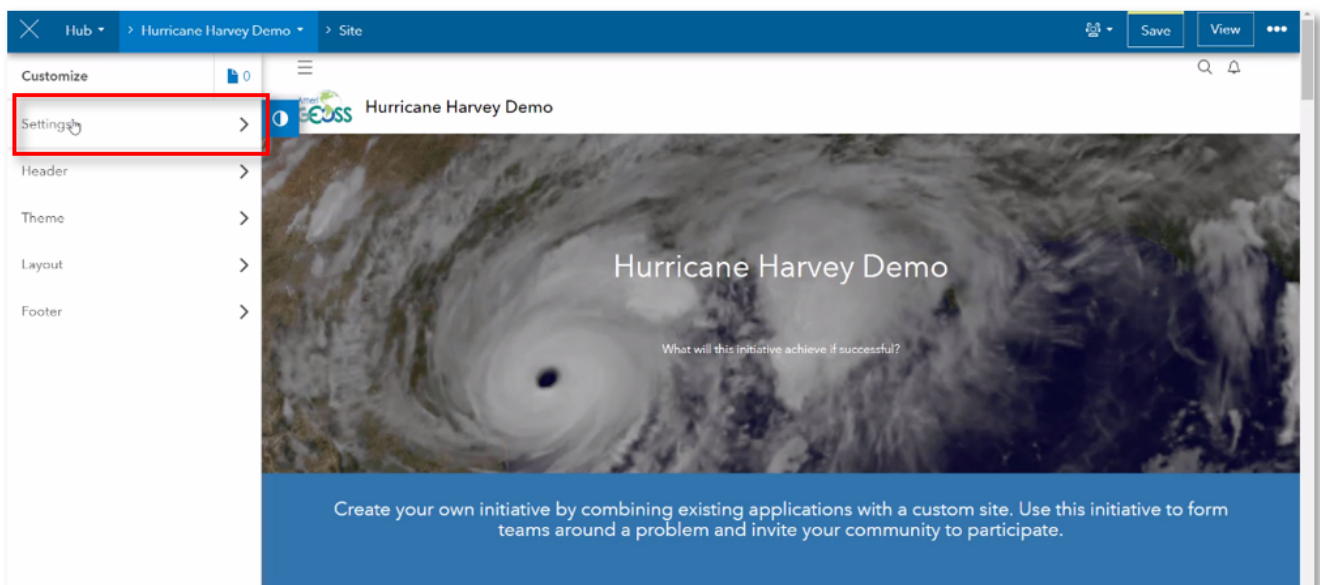


Figure 32. Configure the Site - Step 1

Step 2. Enter a title in the Site Title field or change an existing title to something new. Enter a Site URL. The site's URL is the web address that will appear at the top of the browser page.

Step 3. Provide some background info on the site in the About Site field. Provide an optional favicon by pasting an image URL in the Custom Favicon field.

Step 4. Click Capabilities at the top of the Customize panel to open the Capabilities menu. View available capabilities. Standard options are provided under options and beta capabilities are listed under Beta. See figure directly below for an illustration.

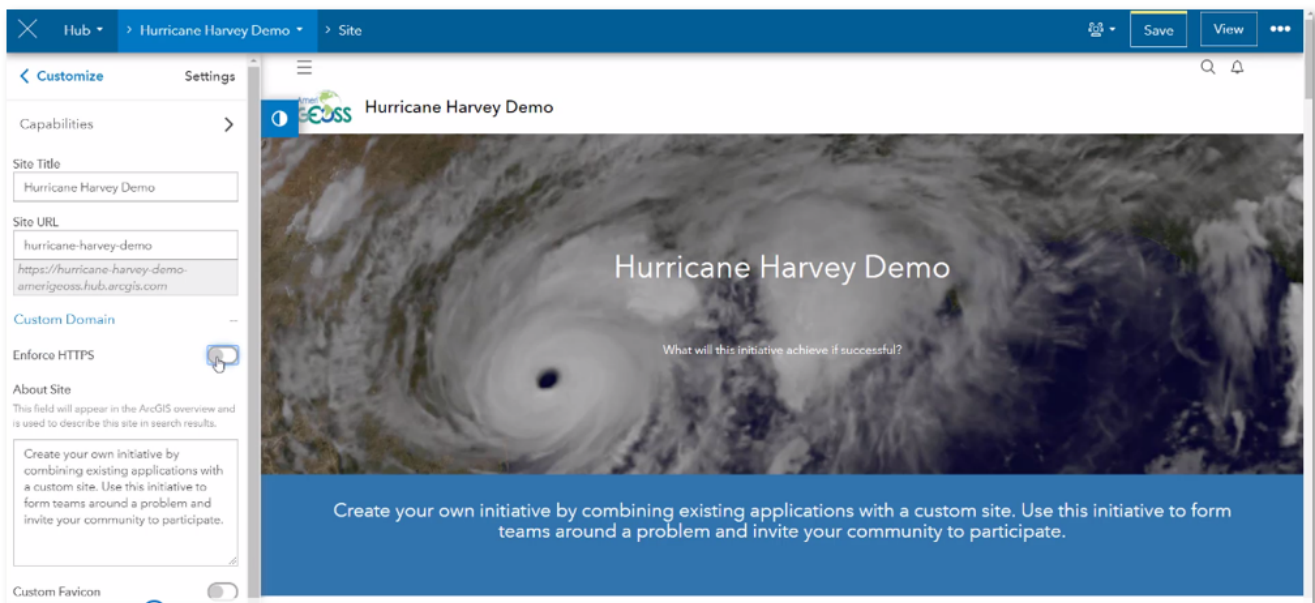


Figure 33. Configure the Site - Step 4

Step 5. Click the toggle button to enable or disable a capability. See figure directly below for an illustration.

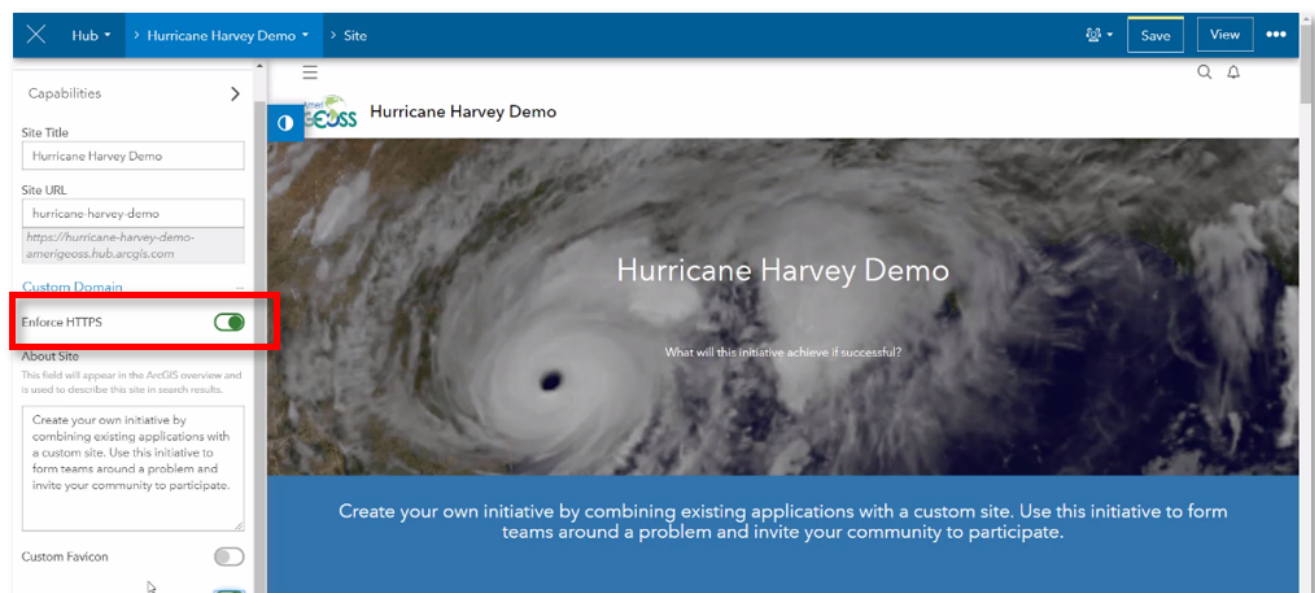


Figure 34. Configure the Site - Step 5

Step 6. Save in the edit navigation bar to apply the changes to the site.

Step 7. Other Site Capabilities to consider:

The figure directly below illustrates the Google Analytics setting.

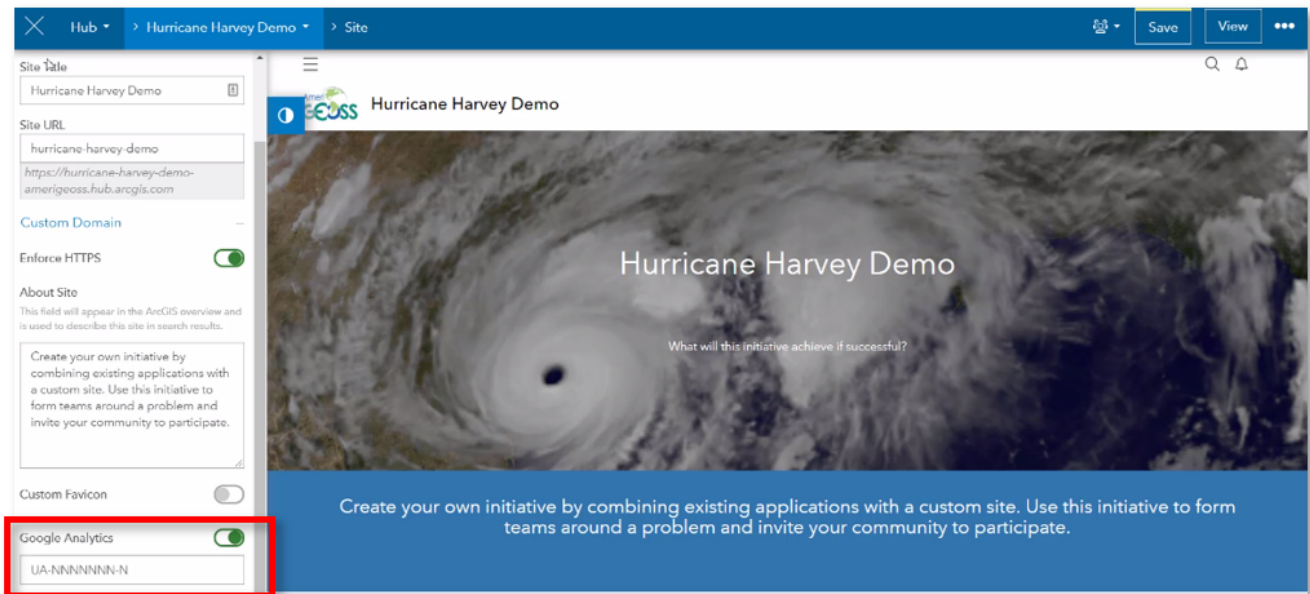


Figure 35. Configure the Site - Google Analytics

1. Google Analytics
2. Geohash visualization
3. Document iFrames
4. API Explorer
5. App Page
6. Private item Views
7. Search route and API
8. Local projections
9. Comments
10. Global navigation

Design the Site

Time is scarce, so with ArcGIS Hub sites, emergency managers can use simple, drag-and-drop functionality to get the core messages across and showcase the most timely resources in gallery of application or dataset cards. Hub sites make it easy for users to navigate and search for relevant data and applications.

After configuring and adding data groups to the Site, emergency managers or their staff can use the Site Editor to begin designing the site. The Site Editor is a full-page editor that provides a default site template that he can modify to fit the preferred branding and data, or completely remove to start from scratch.

Design the layout of the site by using drag-and-drop cards, setting an overall theme, and customizing the header and footer with markdown or custom HTML.

Below are some suggested steps to get started:

Step 1. Adjust the overall banner and look by giving your site a brand. By selecting the gear settings

wheel. You can adjust layout, text and background images. See figure directly below for an illustration.

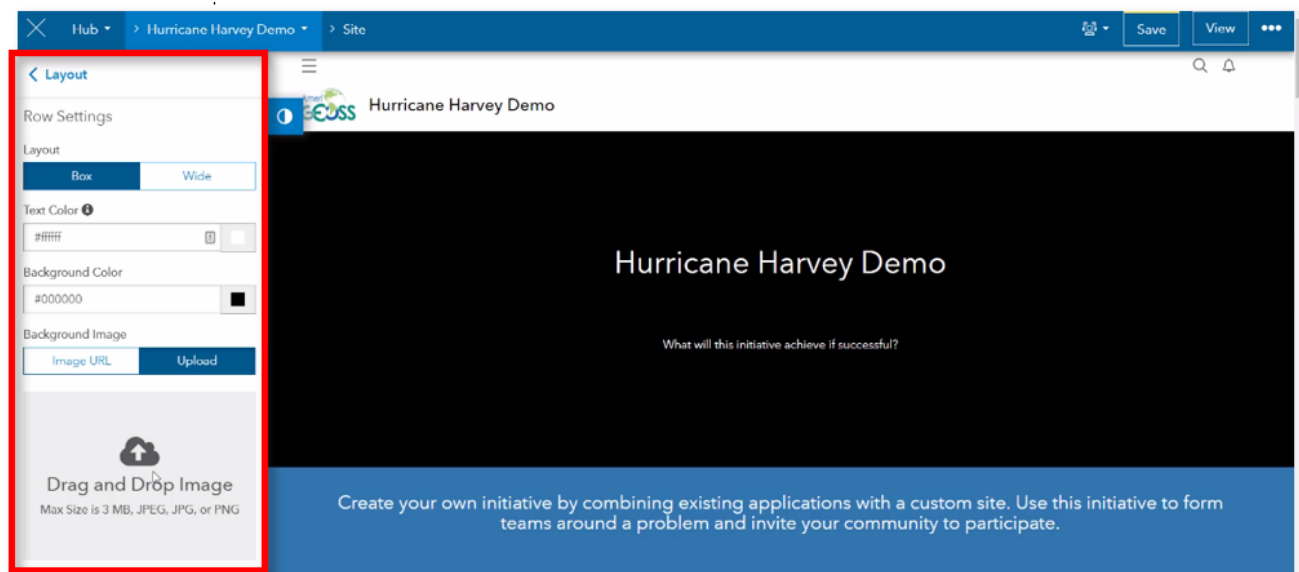


Figure 36. Design the Site - Step 1

Step 2. Drag and drop an image or navigate to the image that you would like as your banner. See figure directly below for an illustration.

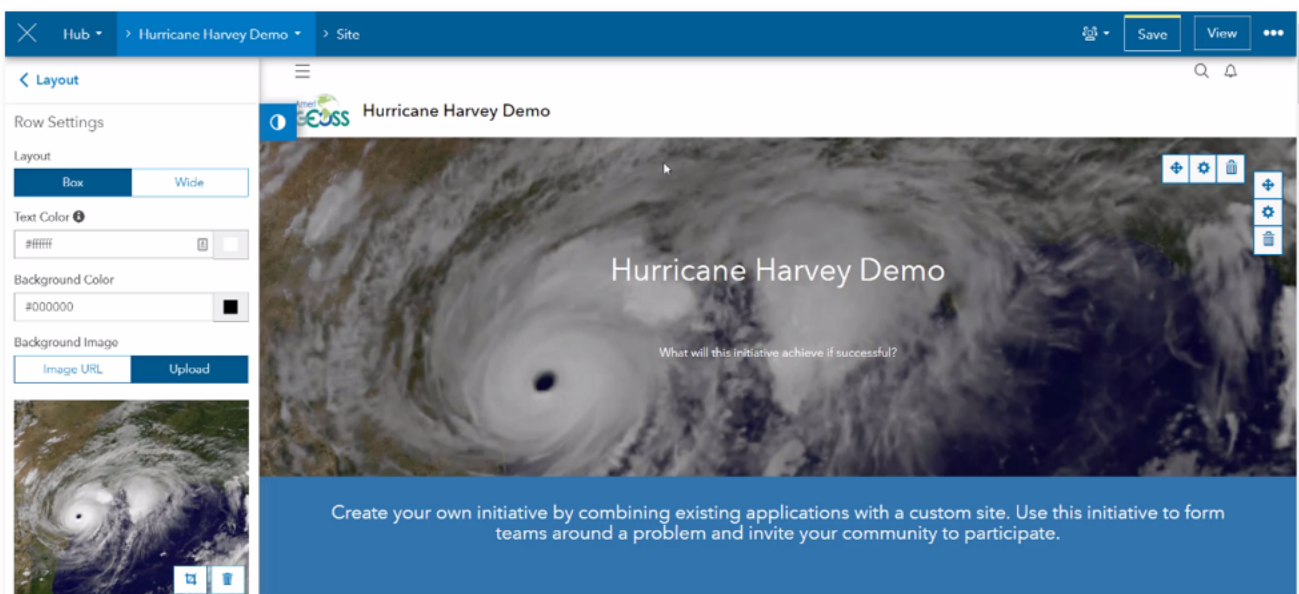


Figure 37. Design the Site - Step 2

Step 3. There are other layout options to add to your site such as a gallery. See figure directly below for an illustration.

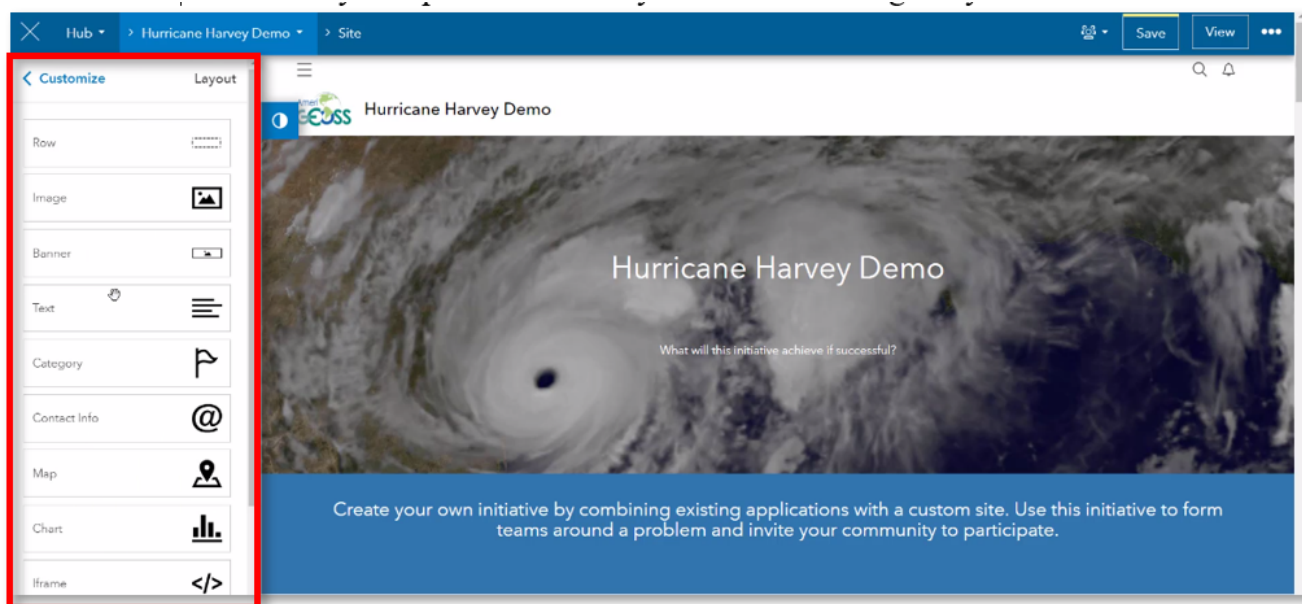


Figure 38. Design the Site - Step 3

Step 4. Drag and drop the Gallery layout option on your site. See figure directly below for an illustration.

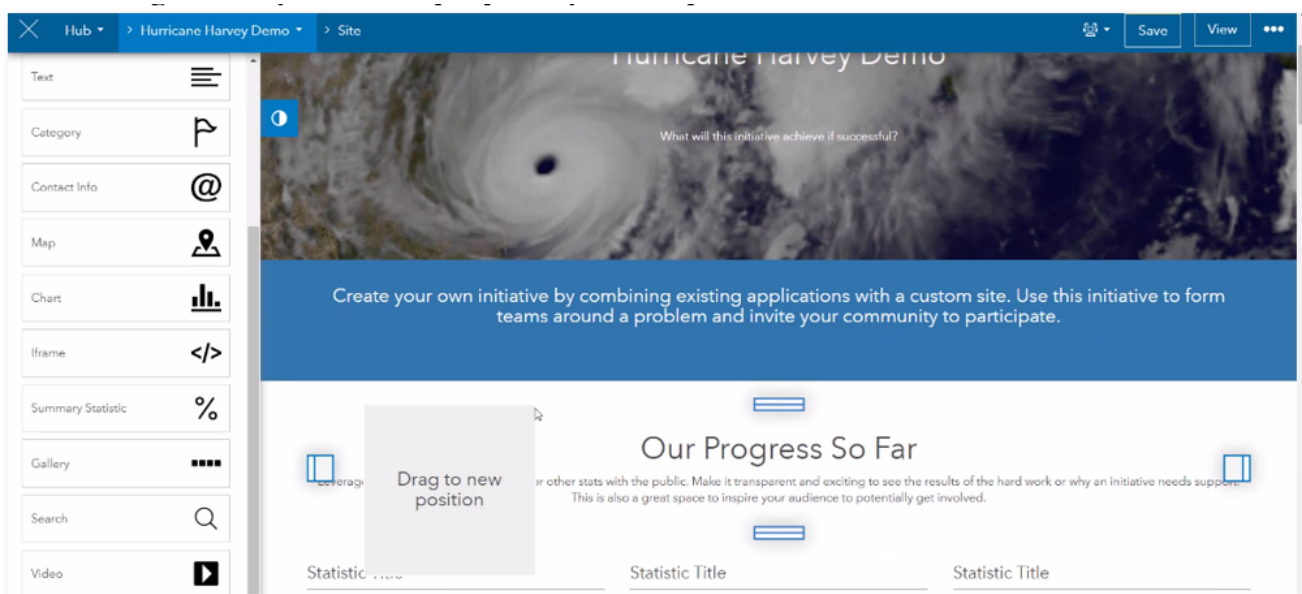


Figure 39. Design the Site - Step 4

Step 5. Modify the Gallery options to meet your needs. See figure directly below for an illustration.

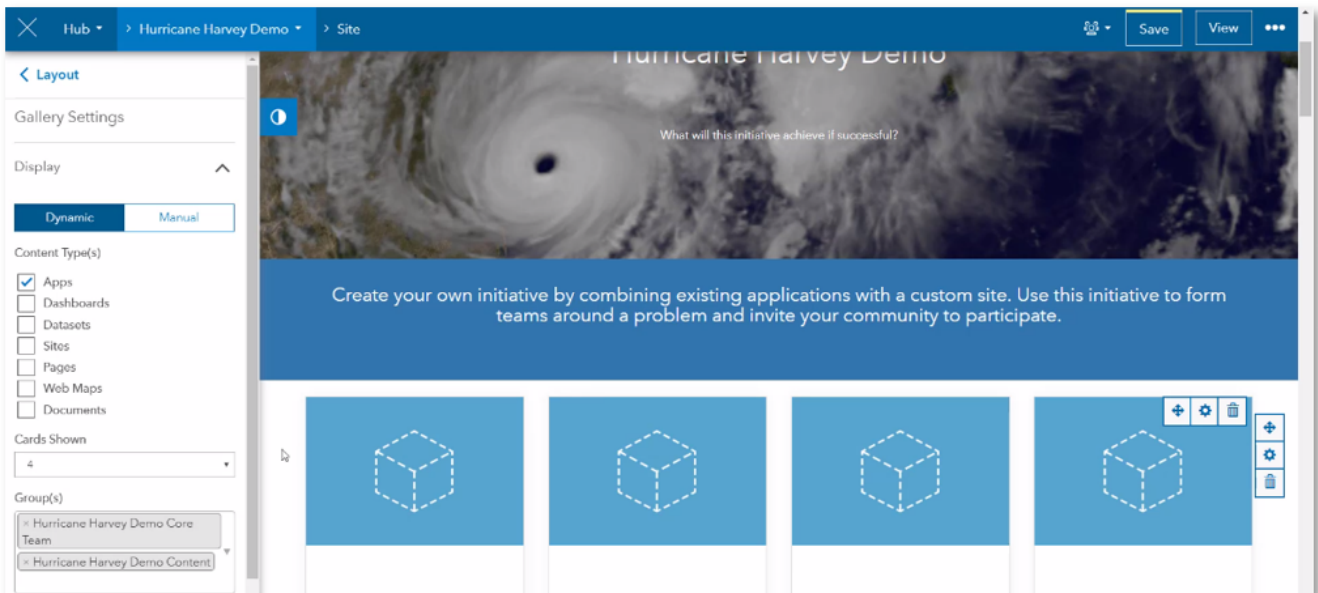


Figure 40. Design the Site - Step 5

Step 6. Add in specific group content to highlight featured apps. See figure directly below for an illustration.

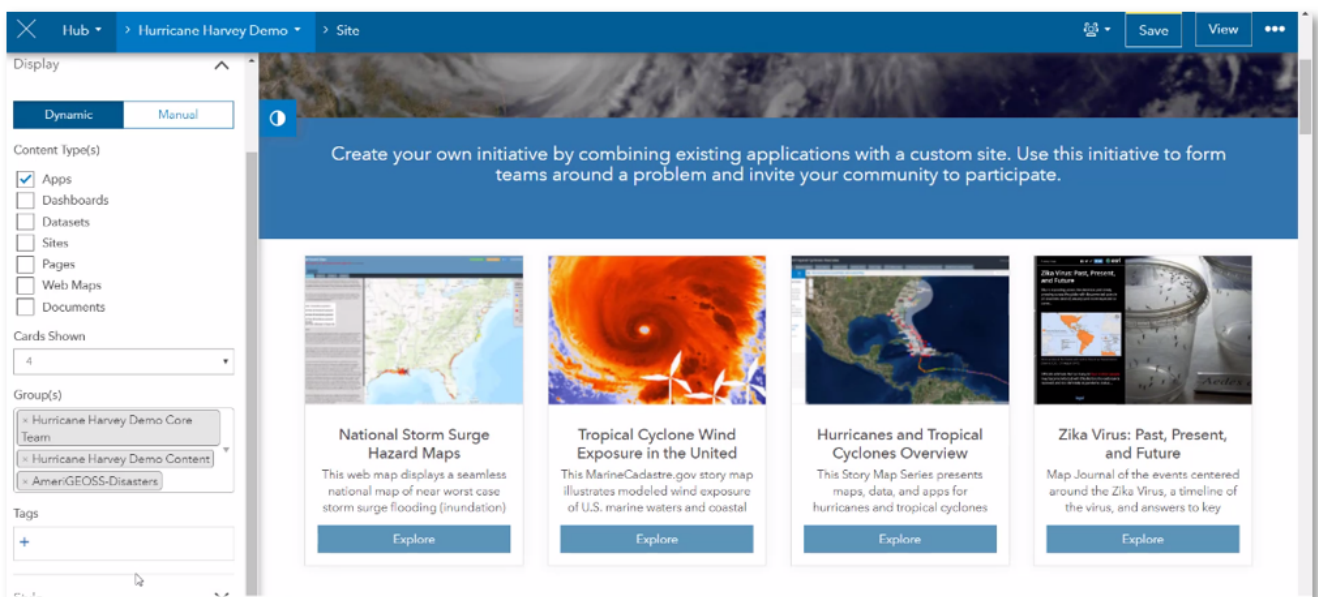


Figure 41. Design the Site - Step 6

Step 7. Modify the appearance of the gallery by making the necessary adjustments to the Gallery options. See figure directly below for an illustration.

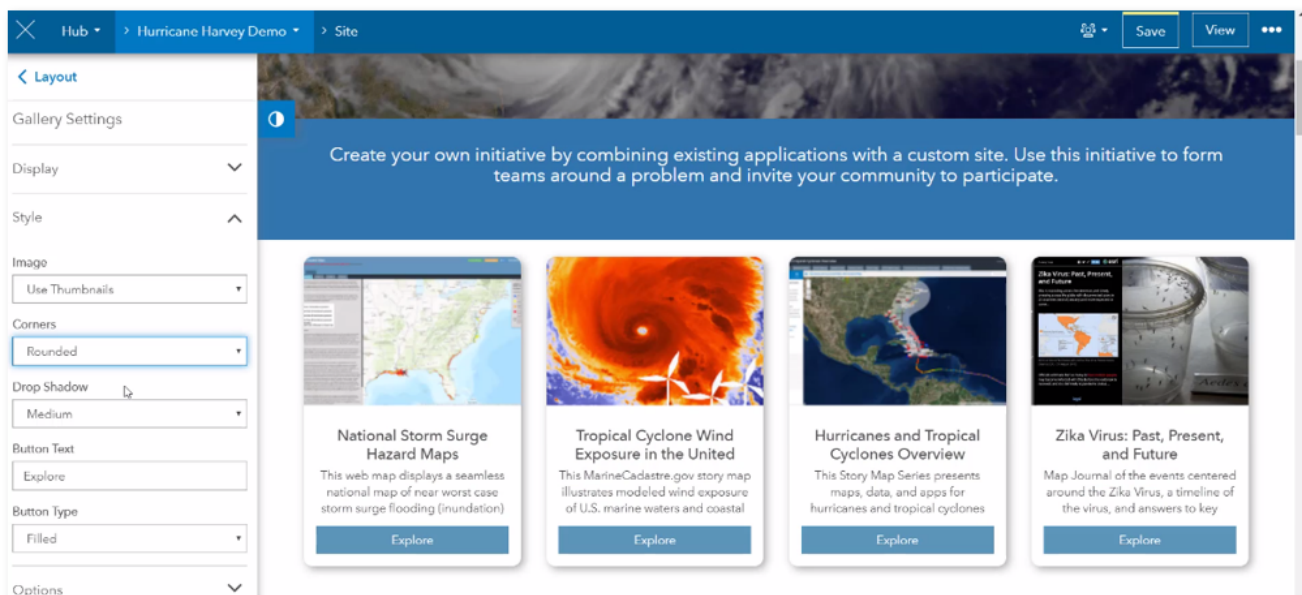


Figure 42. Design the Site - Step 7

Be sure to save your progress before viewing the site. See figure directly below for an illustration.

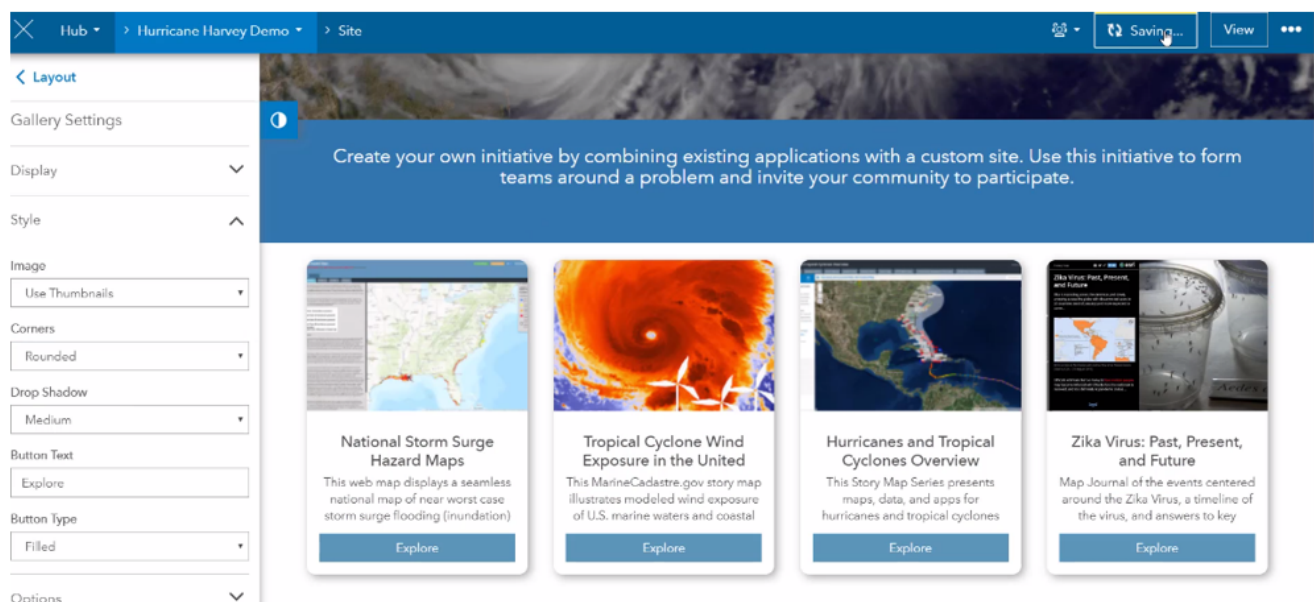


Figure 43. Design the Site - Step 7b

5.1.9.2. Configure Maps and Apps for Public Awareness

Once an emergency manager has aggregated data from trusted sources into the ArcGIS Online groups and added them to a Hub Site, local emergency managers, planning chiefs or watch officers need to answer pressing questions:

- Where is flooding going to be?
- What will the impact on the community be, especially the most vulnerable populations?
- What resources should we request from the state or federal government or non-profits, such as water, food or special medical resources?

Using ArcGIS Online, managers can quickly configure maps and apps to answer these questions. In

this pilot, managers can see how to identify how many and where the most vulnerable populations, hospitals and schools will be affected.

In the examples below, a manager or designated staff can pull some of the federated content into a map, and then populate one of the configurable apps designed specifically for disaster response meant to narrow down on the impact question.

Getting Started Creating Maps & Adding Data

Step 1. General Outline to creating a web map. See figure directly below for an illustration.

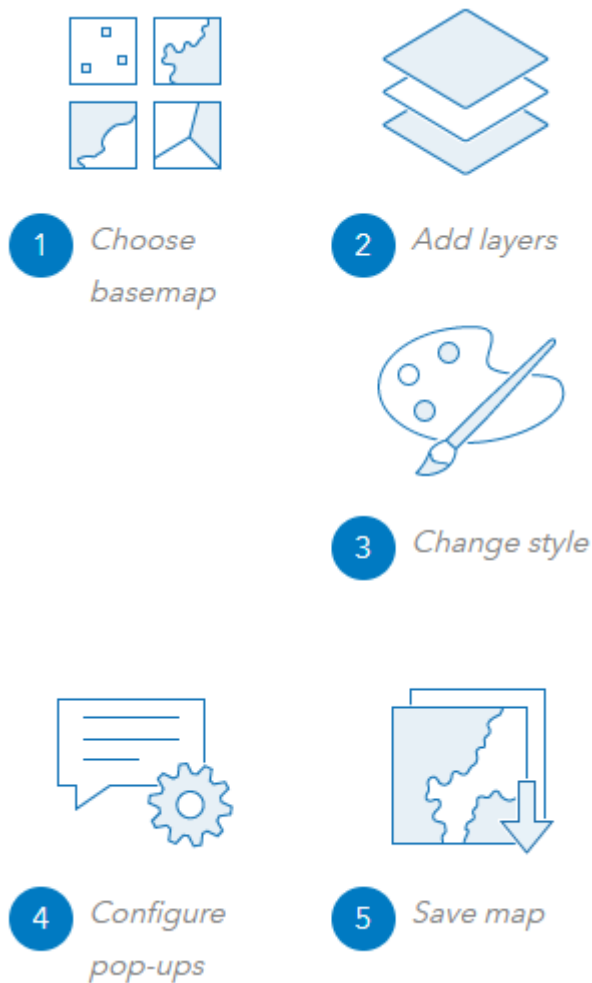


Figure 44. Creating a Map - Step 1

Step 2. Navigate to your ArcGIS Online Organization or Enterprise to log in. Enter your credentials and click on the 'Map' tab to open a blank web map. Now that you have the web map open, you can begin configuring your map for your Situational Awareness application. See figure directly below for an illustration.

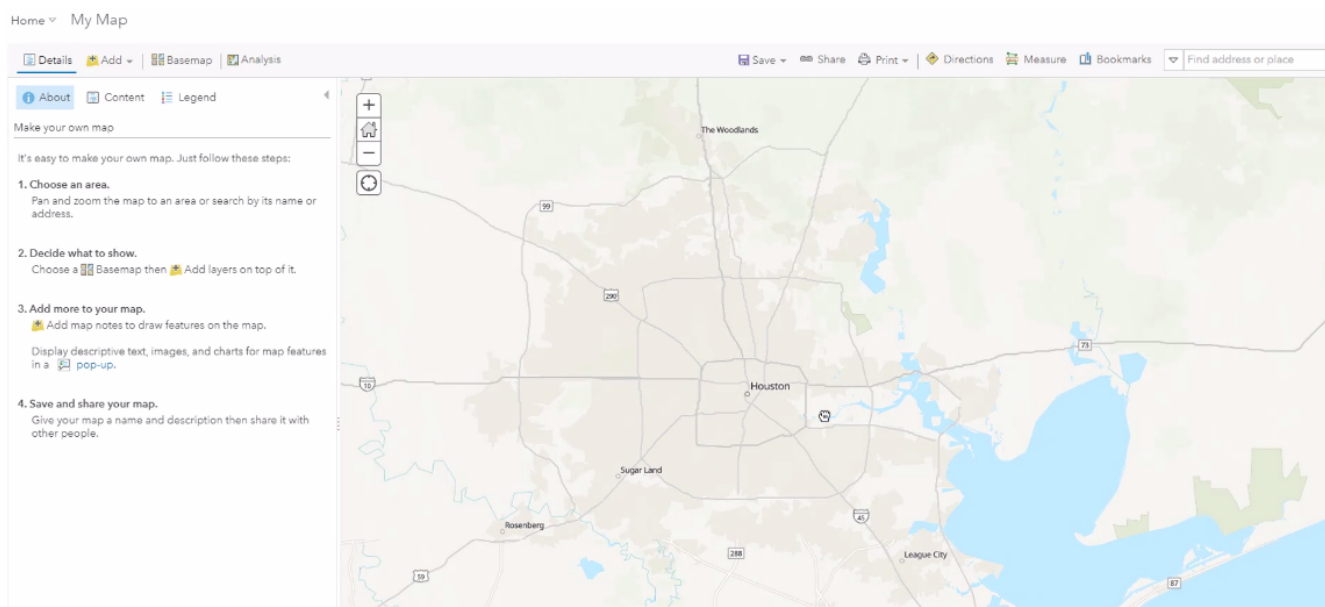


Figure 45. Creating a Map - Step 2

Step 3. Search for map layers Layers are the contents of your story. They can include topics related to people, Earth, life, and imagery. You can add one layer or multiple layers. By bringing together multiple layers, or data sources, into a single map, you can help tell a more interesting story. Be careful, however, that you don't add too many things to one map and make it hard to read. In addition, it may help your audience understand your map if you add some features that are not part of an existing layer. Navigate to the 'Add Data' button to start searching for layers within your groups and ArcGIS Online, including the ArcGIS Living Atlas. See figure directly below for an illustration.

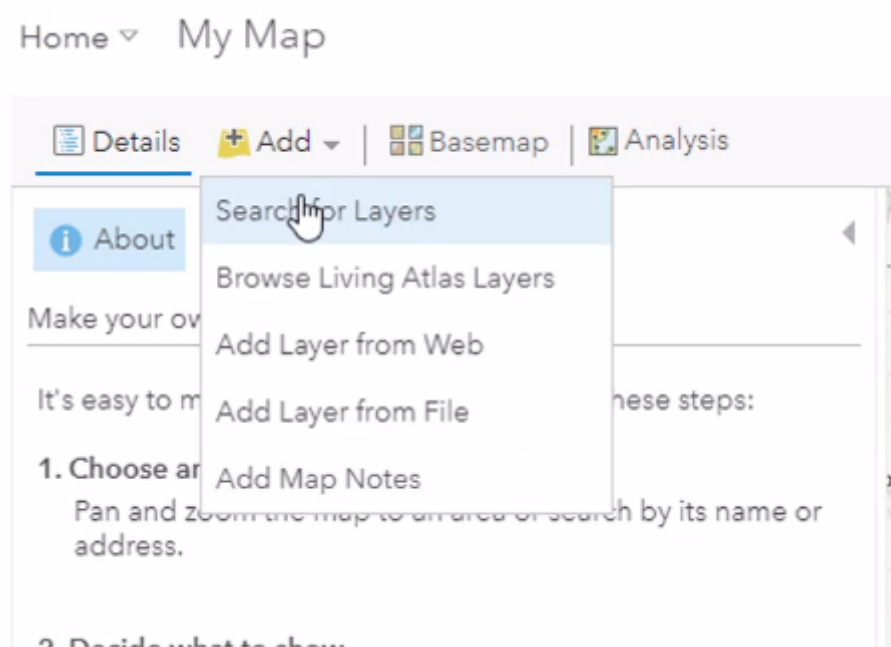


Figure 46. Creating a Map - Step 3

Search for layers published to the ArcGIS Online Community. You'll find many useful live web services, for example, for this application, we'll add –

- FEMA 100-Year Flood Zones
- USACE Levees: <https://levees.sec.usace.army.mil/mapserver/public/ows?SERVICE=WFS&>

REQUEST=GetCapabilities&VERSION=2.0.0

- HIFLD Hospitals: <https://www.arcgis.com/home/item.html?id=a2817bf9632a43f5ad1c6b0c153b0fab>
- CDC Social Vulnerability Data: <https://www.arcgis.com/home/item.html?id=62b3e305b730423782c64b9696242c5e>
- Local Harris County Facilities Layer: <https://www.arcgis.com/home/item.html?id=69988d188e424843a0a5cefdd7daa8b6>
- State of Texas Address Database

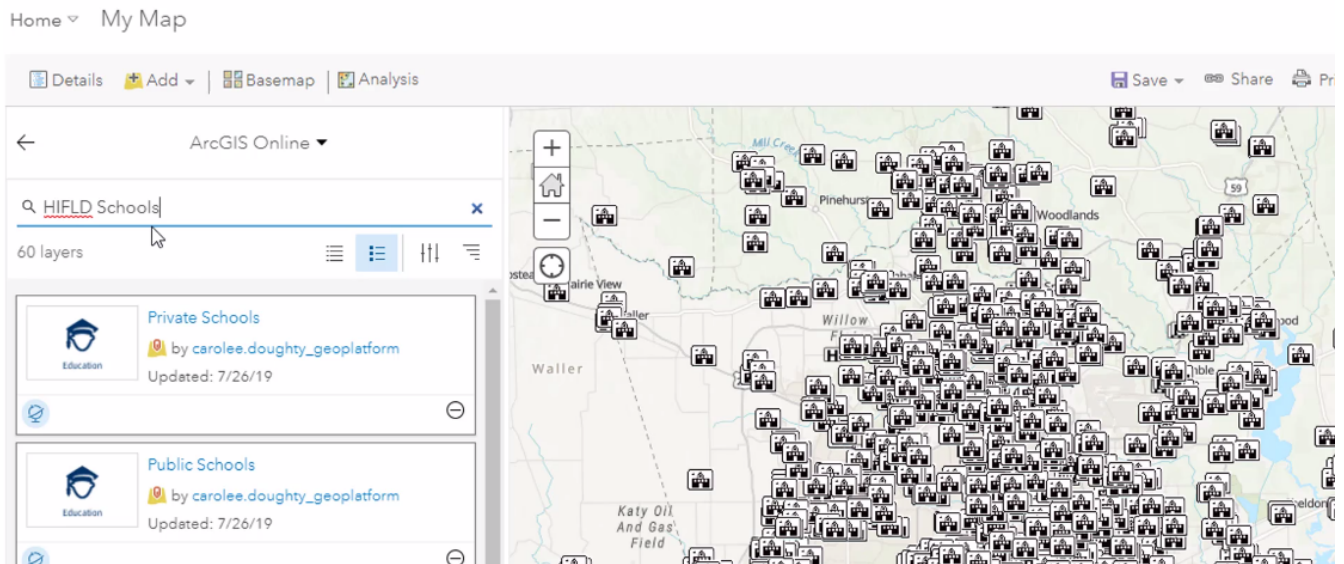


Figure 47. Creating a Map - Step 3b

Style your Map and Layers

This step is highly dependent on the specific audience, data layers chosen and scenario, but below are a few steps to tailor the maps for use in our configurable Situational Awareness App.

Select the layer options per each layer. There are many options to choose from to further refine the look and feel of your layers.

Rename Layers: One can rename this local layer from Harris County to something more recognizable. Rename the layer to “Harris County Community Facilities (Local)”, as shown in the figures directly below.

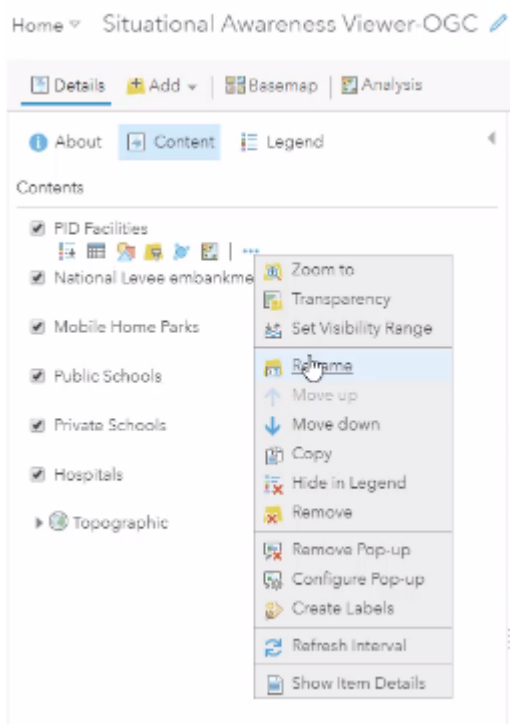


Figure 48. Style a Map - Rename Layers 1

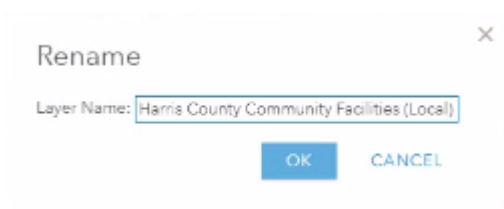


Figure 49. Style a Map - Rename Layers 2

Adjust Point Symbolology: Another way to further refine the layers look and feel is to adjust the symbology of the layer. This can be done if the service provider allows it. First, navigate to the Style options for the layer. There are several ways to modify the symbology according to the data you want to display. For point data, there are two options: change the symbology by location and an attribute or a heat map. The location-attribute option allows you to visualize unique values per facility. While the Heat Map option displays the density of the points.

For the Harris Facilities layer, we will change the symbol to one of the facilities symbols in the 'Government' shape style options. See figure directly below for an illustration.

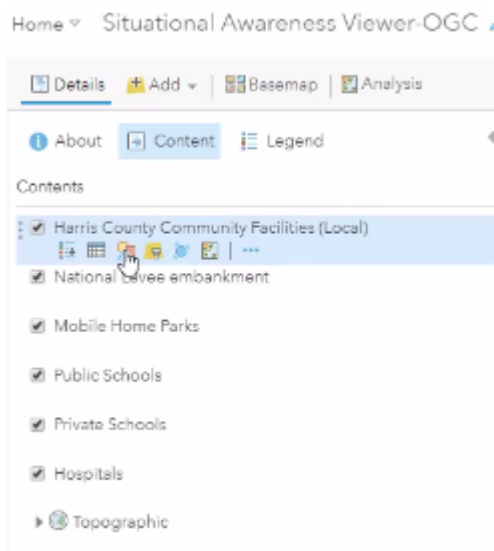


Figure 50. Style a Map - Adjust Point Symbology 1

The figure directly below shows the final Harris layer with the changed symbology. ArcGIS applications will adopt the provided symbology by registered web services that do not allow for symbolization.

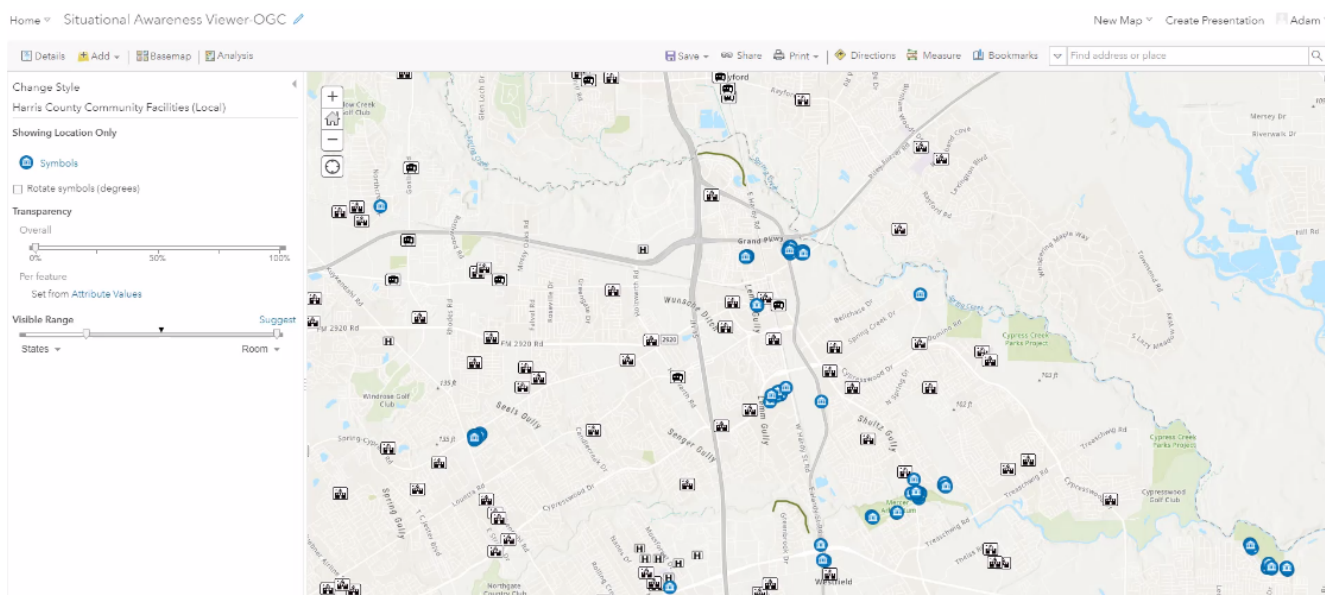


Figure 51. Style a Map - Adjust Point Symbology 2

Adjust Visibility: Next, add the TX address point data to your map and adjust the visibility range. This is a best practice when you have lots of data points in the map viewer. The visibility range changes the visual extent at which the data will render, improving browser performance.

Texas point address data shown at all visibility ranges.

After the visibility range is adjusted you will only see the data as the user zooms in, as shown in the figure below.

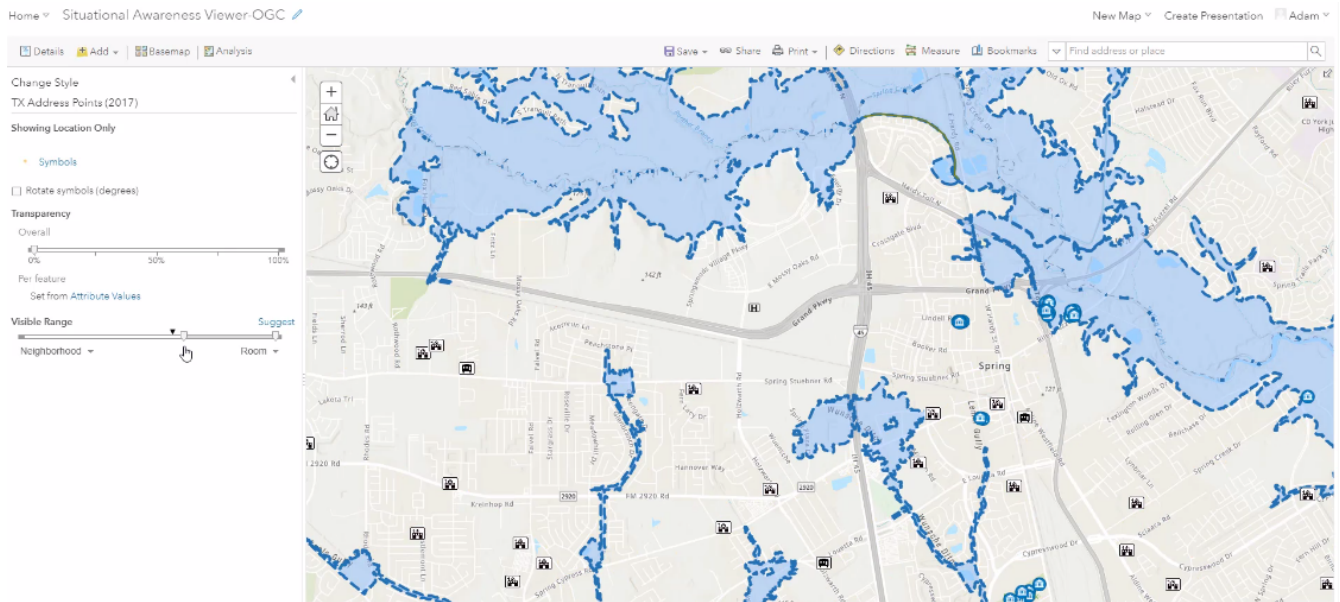


Figure 52. Style a Map - Adjust Visibility

*Adjust Area Symbology: Style the TX Zipcode Health Risk layer. Navigate to the Style option for the layer.

Since this layer is at the zipcode level you will get other options for symbology. One is Counts and Amounts (Color), Counts and Amounts (Size) and Location. As an example, symbolize this layer by the attribute for 'Diabetes' and Counts and Amounts(Color). See figure directly below for an illustration.

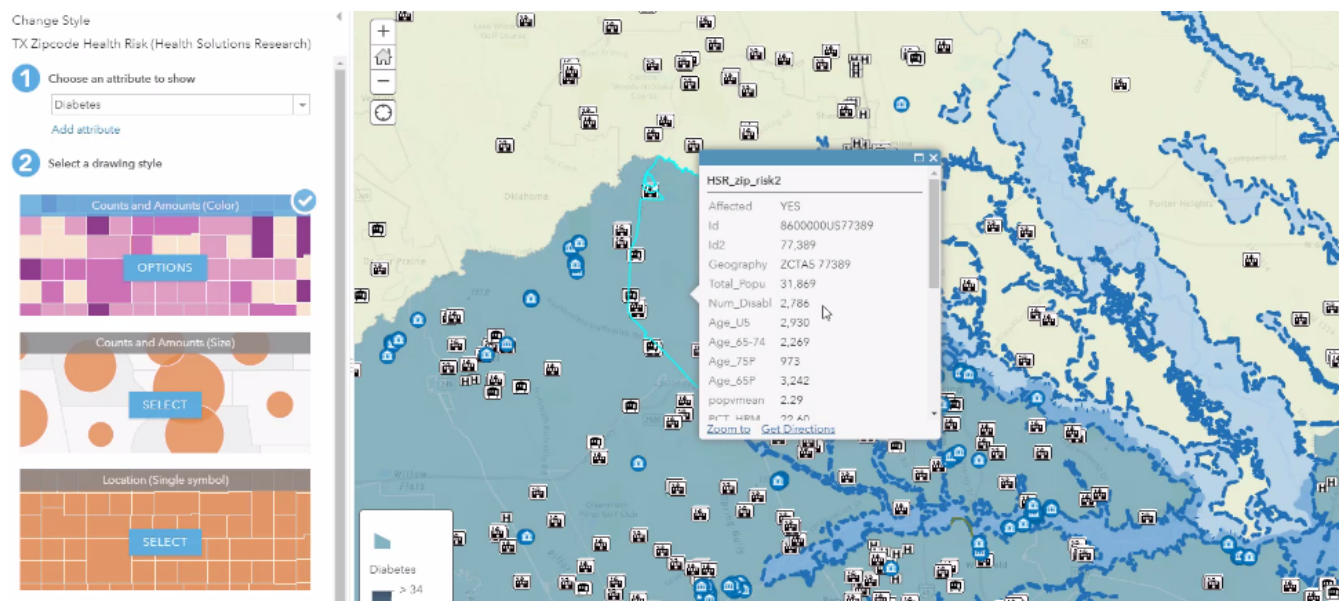


Figure 53. Style a Map - Adjust Area Symbology

Save your web map.

Your web map should look like the one in the figure below.

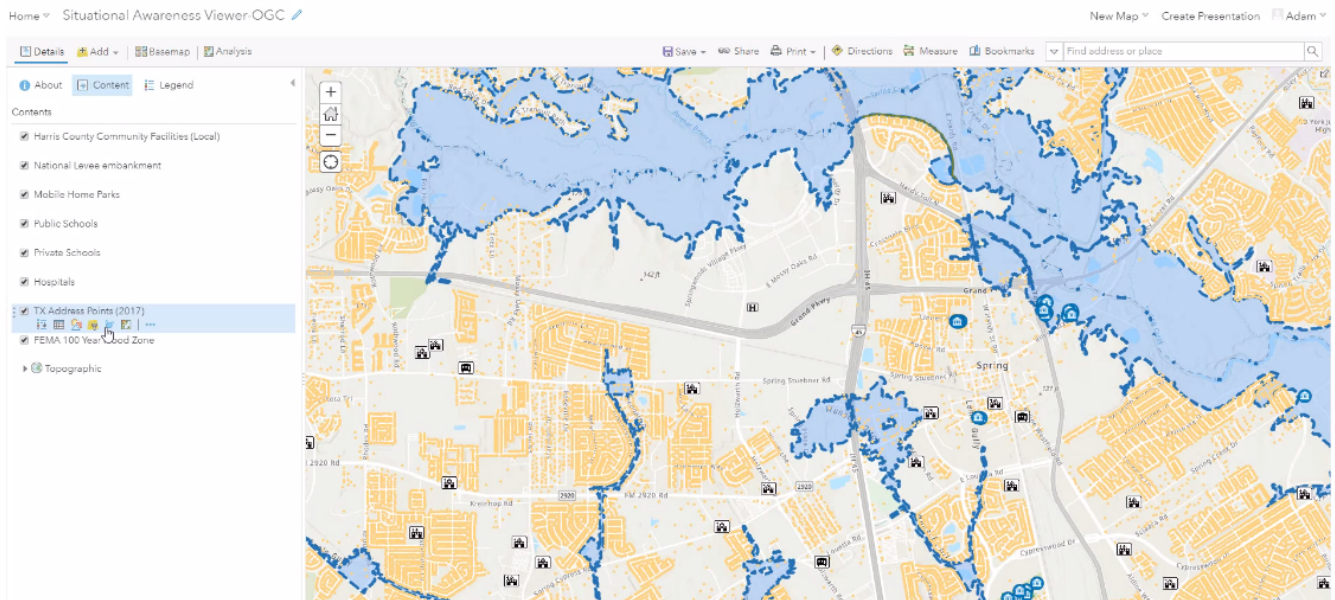


Figure 54. Style a Map - Final Example

Configure a Web App for Situational Awareness

Next, you want to your maps and deploy them in configurable applications tailored specifically for disasters hurricane and flooding, which add a some built-in to create quick insights for specific purposes. In this pilot we focussed on the Situational Awareness application configuration using Web AppBuilder and the Situational Awareness widget.

This configuration allows you as an Incident Commander or Plannign Chief to target specific areas of impact to do quick impact analysis.

Step 1. Navigate to your 'My Content'. Click on 'Create' and drop down to 'Using the Web AppBuilder'.

Step 2. Fill in the Web App details: Title, Tags, Folder...etc.

Step 3. A blank web appbuilder screen will populate after you've entered in the App details. The opening screen is where you will determine the Theme, Map and Widgets.

Step 4. Next, select the data and web map to include in the Situational Awareness App. Navigate to the web map created in the previous section, as shown in the figure below.

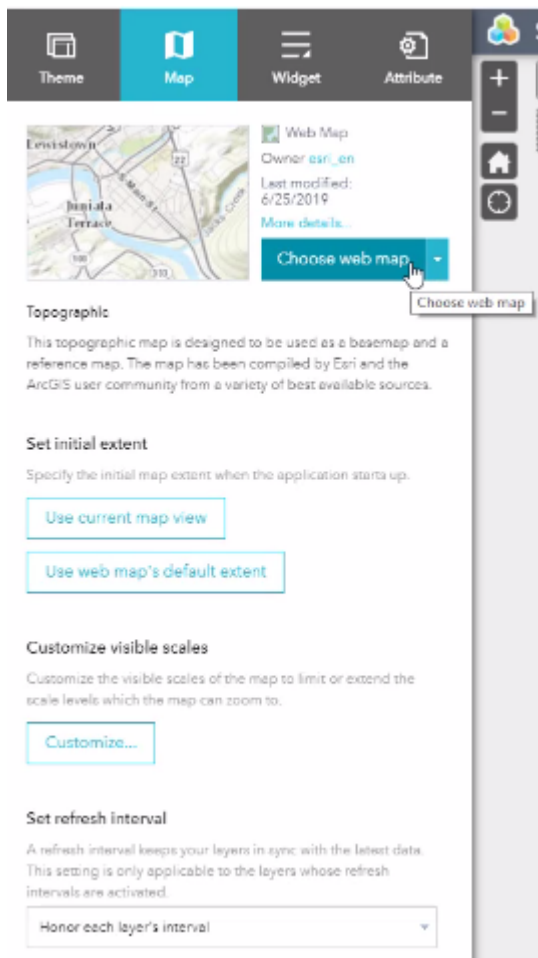


Figure 55. Configure a Web App - Step 4

Step 5. After selecting the map from the previous step - e.g., the “Situational Awareness OGC” map, it will populate the web app. See figures directly below for an illustration.

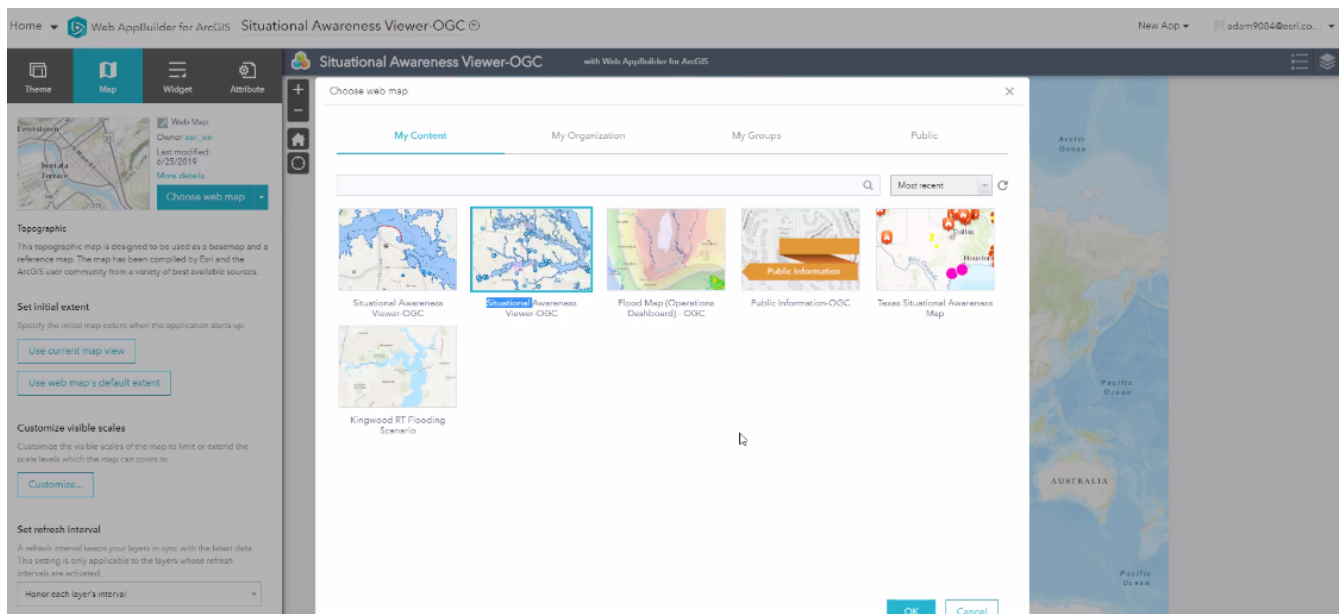


Figure 56. Configure a Web App - Step 5

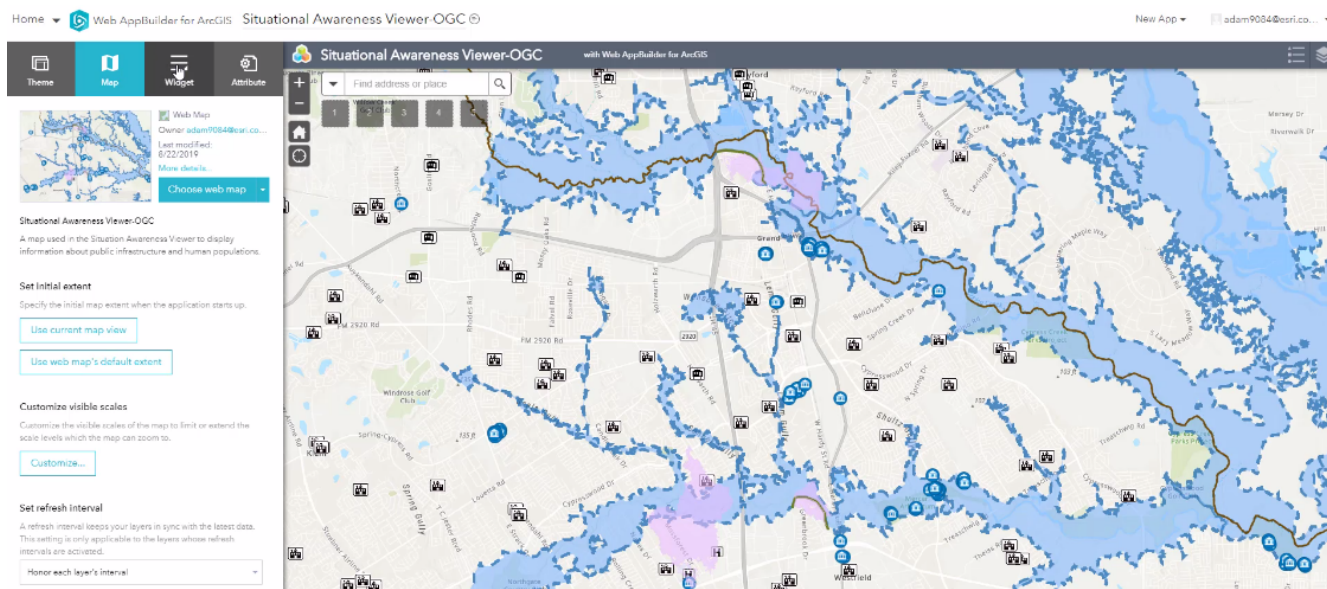


Figure 57. Configure a Web App - Step 5b

Step 6. Set the widgets in the Header and begin to add another widget. See figure directly below for an illustration.

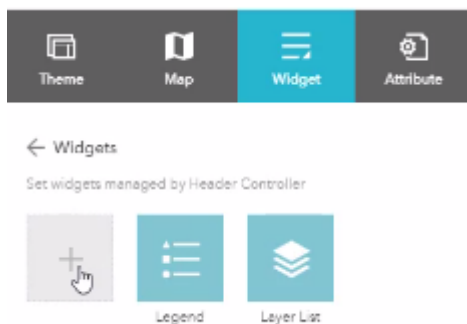


Figure 58. Configure a Web App - Step 6

Step 7. There are several options of widgets to choose from, as shown in the figure below.

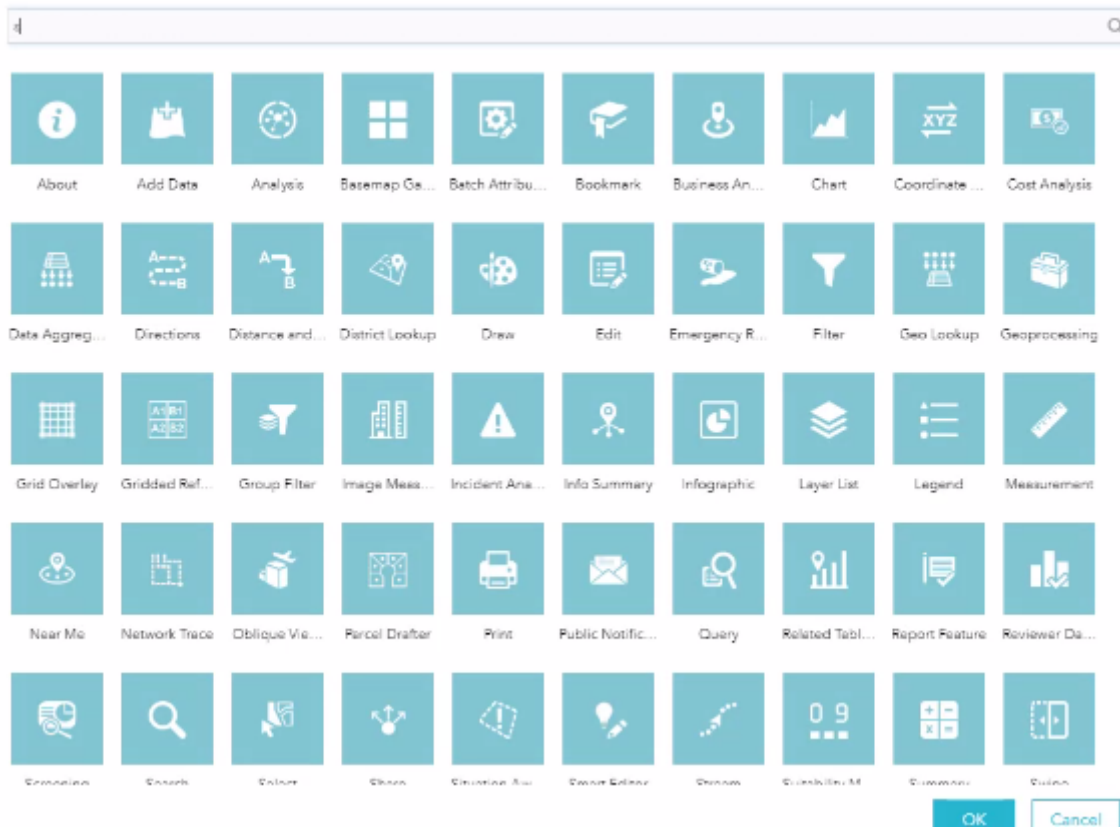



Figure 59. Configure a Web App - Step 7

Step 8. Search for the Situational Awareness Widget.

Step 9. Begin to Configure the Situational Awareness Widget.

Step 10. Start by adding your data layers, as shown in the figure below.

 Situation Awareness

[Change widget icon](#) [Learn more about this widget](#)

Analysis

Output

[+ Add Tab](#)

Layer	Analysis Type	Label	Actions
RT_08-28-2017-7pm_(demo)	Closest Feature		

RT_08-28-2017-7pm_(demo)

RT_08-28-2017-6pm_(demo)

USACE Levees WFS - embankments_line

Mobile Home Parks

EPA Emergency Response (ER) Risk Management Plan (RMP) Facilities

Harris County Community Facilities (Local)

Public Schools

Private Schools

Address Points

Local Incidents

Police Stations

Label:

Buffer label:

Buffer Distance

Distance:

0

Maximum buffer distance:

100

Maximum distance:

80

Visibility management

☐ Draw geodesic shapes

☒ Display summary features

Weather options are no longer available for this widget.

OK

Cancel

Figure 60. Configure a Web App - Step 10

Step 11. Choose Public Schools data layer with the Analysis Type as Summary, as shown in the figure below.

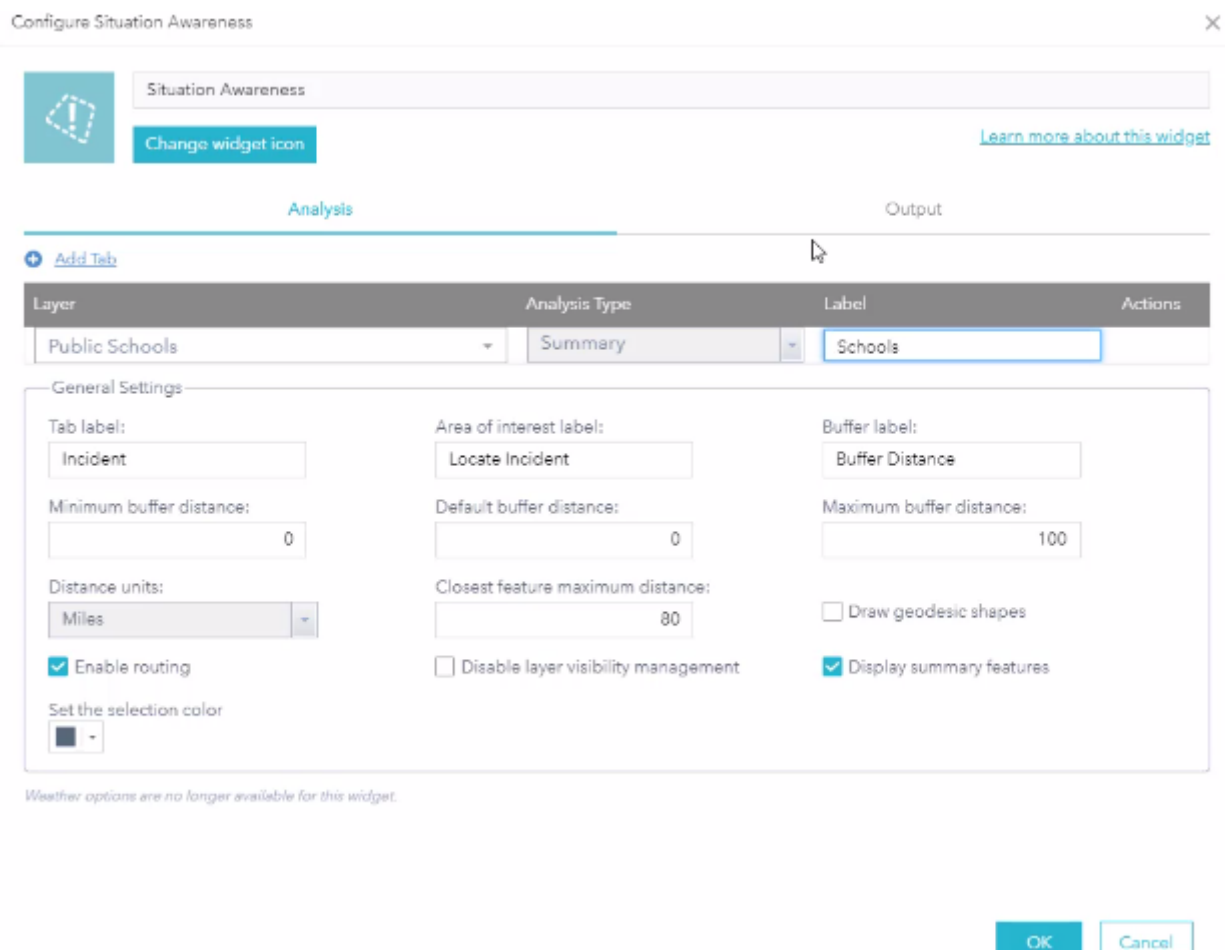


Figure 61. Configure a Web App - Step 11

Step 12. Select the Pencil under the Actions category for the layer to configure the attributes that will be summarized. Select the 'Enrollment' and 'FT_Teacher' attribute, as shown in the figure below.

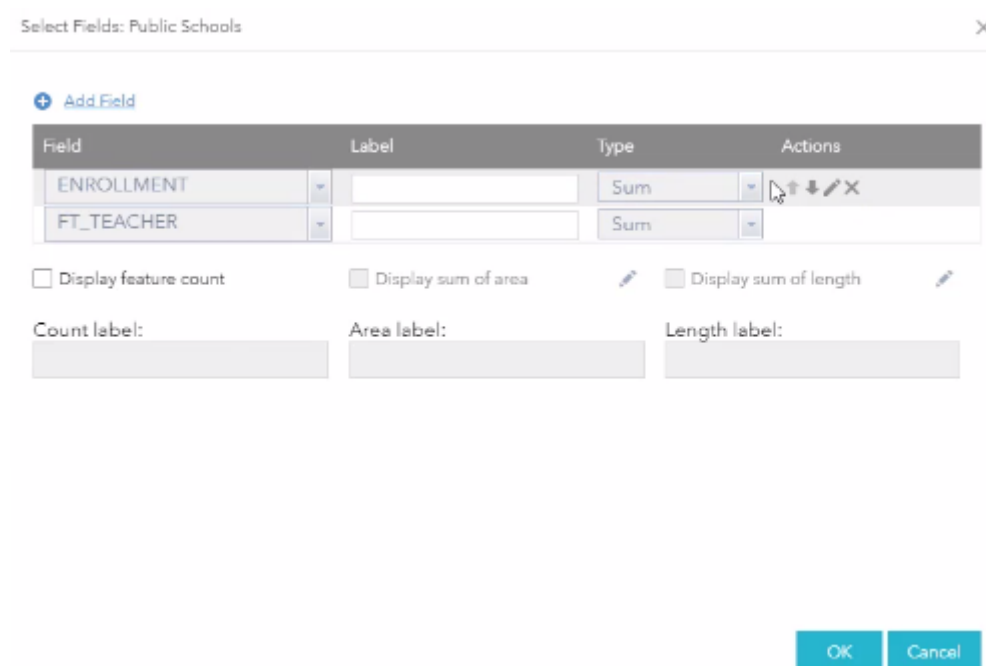


Figure 62. Configure a Web App - Step 12

Step 13. Add another layer to the widget. Choose the "EPA Emergency Responses (ER) Risk

Management Layer. Choose the Analysis Type as Proximity and rename the layer to Hazardous Facilities.

Step 14. Set the default buffer for analysis to 0.25 miles

Step 15. Click OK and Save the application.

Configure an Operations Dashboard for a Weather Forecast Common Operational Picture

For this application, the same general steps apply from two section above: create a map and then configure the application. However, instead of creating an applicaiton using Web AppBuilder from the Content page, create an App "Using Operations Dashboard," as shown in the figure below.

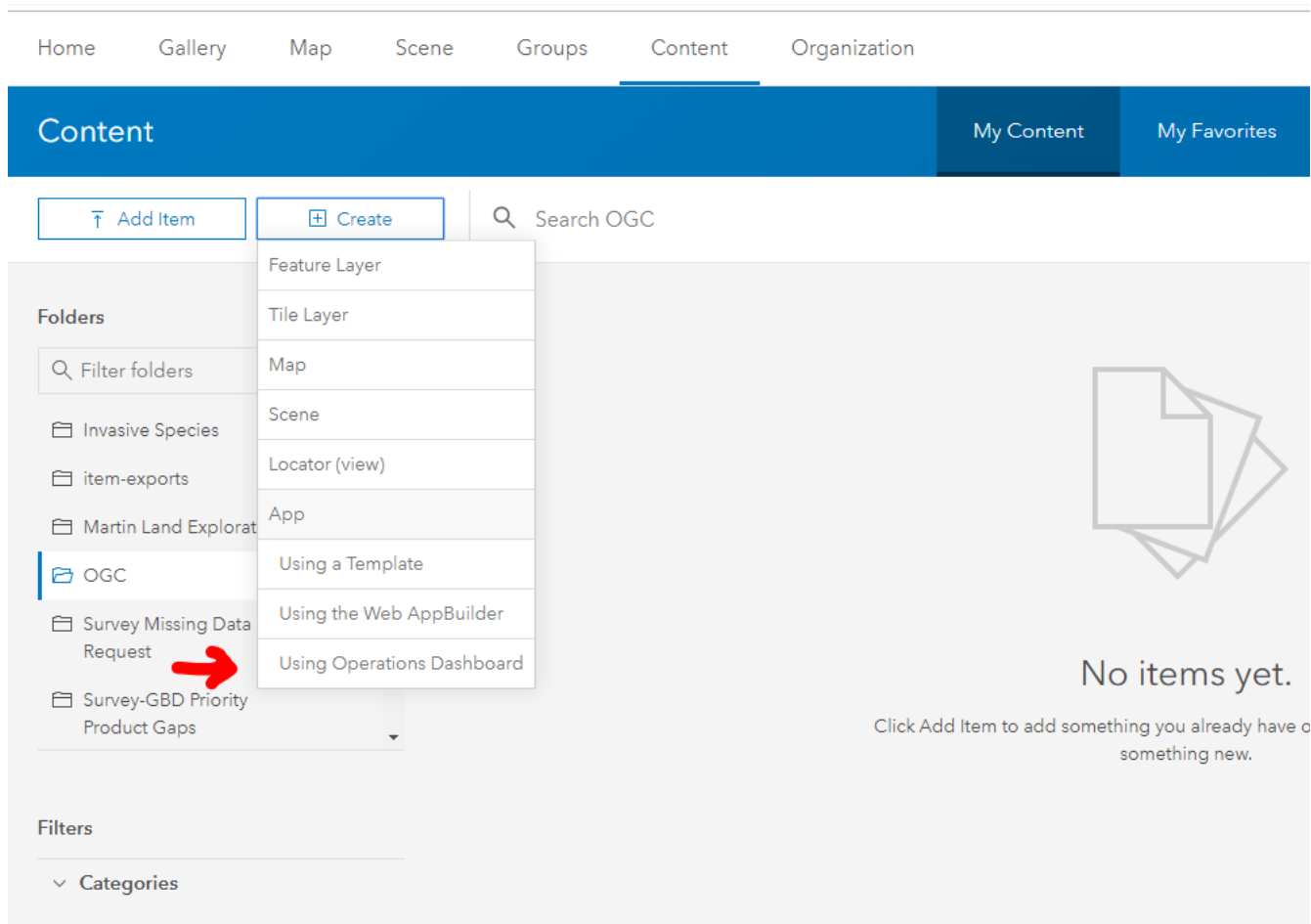


Figure 63. Configure a Ops Dashboard - Starting

This application will focus on live weather related data services from NOAA and Esri Living Atlas, derived from the National Weather Service.

It helps answer the questions: Where is flooding now and likely going to be? See an illustration of a configuration of app in the figure below.

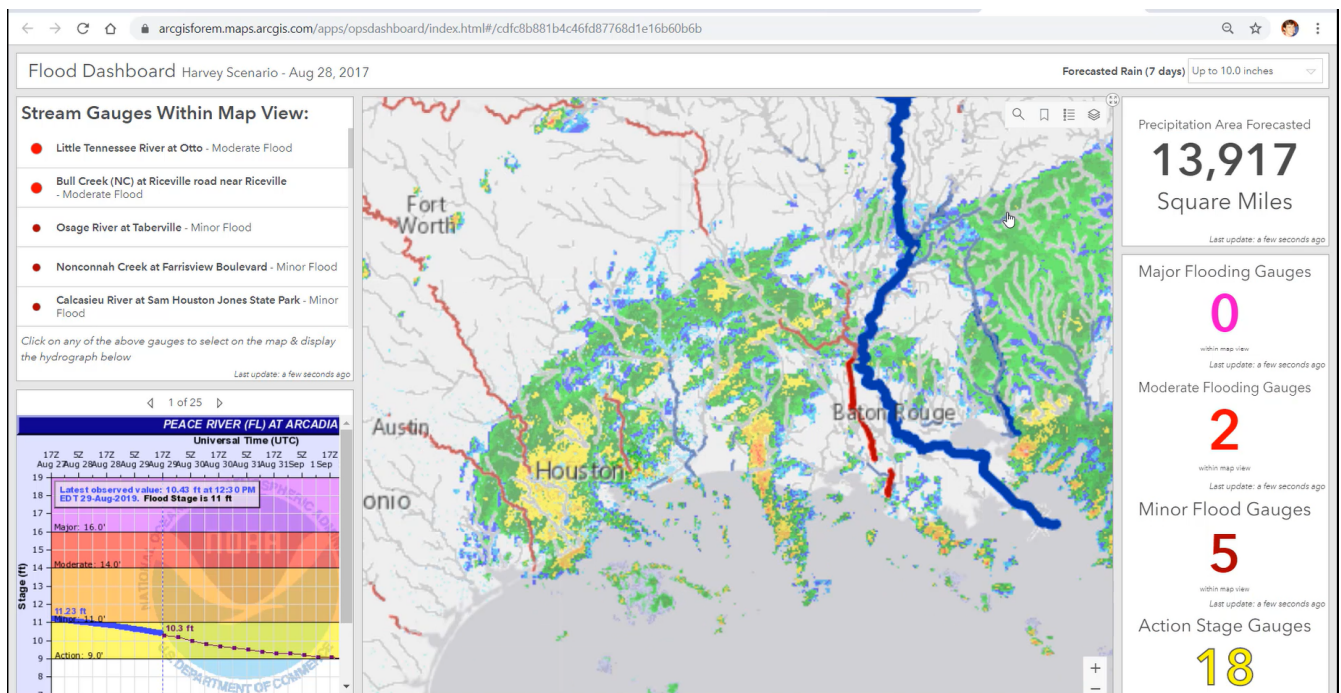


Figure 64. Configure a Ops Dashboard - Final Example

5.2. Hurricane-Based Flooding Impact Analysis During the Event

As the flooding continues to increase, a local watch officer is monitoring the real-time flood inundation reports from first responders and the public against the forecasted inundation maps to see where the flooding levels are right now, and whether new incidents and new impacts to vulnerable populations are occurring in his area. After reporting them to his Operations and Planning Section Chiefs, they determine what kinds of new or additional resources might be needed to support their jurisdiction.

5.2.1. Audience

Primary

- Watch Officer (County / Local Emergency Management staff): Officers who monitor the current situation in his or her jurisdiction; if an incident occurs, it is my job to immediately assess the situation and its impact on the jurisdiction.

Secondary

- Incident Commander
- Planning Section Chief
- Operations Section Chief (County / Local Emergency Managers)
- Volunteer first responders

5.2.2. Publication of data

The scenario builds on much of the same data listed in the first scenario. In addition, real-time

polygon layers are generated and saved from the Pin2Flood Map.

5.2.2.1. Model Data

- Digital Elevation Model (10-m) for State of Texas
- Height Above Nearest Drainage (HAND) Model-Generated Depth Polygons (contributed to this pilot, but provided outside the scope of this pilot): https://flood.arcgis.com/arcgis/rest/services/NFIE/NWM_Flood_Inundation_Polygons/MapServer/0
- National Water Model Predicted Flow

Additional models may have been used to create derived layers published in the Living Atlas listed above in Section 5.1.2, and referenced in the Flood Dashboard but are not detailed out here in the scope of this pilot.

5.2.3. Guide to Implementation

This scenario leverages the Situational Awareness map and application configured in the sections above, adding new flood reports from the field. The new flood areas weren't fully predicted by the FEMA Flood zone, which the manager's previous plans were based upon.

The newly reported flood area implicates a new hospital, more homes and businesses, as well as an increased number elderly. The new flooded area in this pilot also is a surprise to EOC managers, based on the failure of an USACE-certified embankment wall, that was locally constructed around a neighborhood.

The newly impacted people and areas will need to be reported to the Incident Commander and Planning Section Chief

5.2.3.1. Look for Real Time flood reports from the field using the Pin2Flood App

- Instruct first responders and field reporters to use the Pin2Flood Application in the Living Atlas
- Drop pin in Field view of app: <https://livingatlas.arcgis.com/labs/flood/field/>
- Save new reported flood zones in the EOC view of app to ArcGIS Online organization: <https://livingatlas.arcgis.com/labs/flood/dist/eoc/>
- Add new reported flood zones into the Situational Awareness Map powering the configured Situational Awareness application

5.2.3.2. Add New Areas to Impact Analysis

Within the Situational Awareness application configured in the previous scenario:

- Run Impact Analytics on existing FEMA flood areas with no buffer
- Click on new flood areas and select "Add Location" to see additional impacts on configured layers
- Based on TX Address Layer (2017), there are more addresses impacted
- Based on the CDC Social Vulnerability metrics using Census data as the census tract level, there are more census tracts impacted and likely more people who are elderly

Chapter 6. Conclusion and Way Forward

During this pilot, Esri identified a few areas for further investigation and consideration.

List of issues spotted:

- ArcGIS Web AppBuilder, built with ArcGIS API for Javascript 3.x, only provides read-only display support of WFS 2.0, and does not natively support analytics on WFS 2.0, forcing use of ArcGIS Pro to either re-host the WFS or do direct analysis on WFS in Pro, a client that does support direct analysis.
- While data Catalog export from ArcGIS Online is available through the ArcGIS REST API and from ArcGIS Hub through the DCAT standard (a World Wide Web Consortium standard), neither currently support export through a CSW file (OGC).
- While registering items from a CSW data catalog into ArcGIS Online groups is possible through the ArcGIS REST API and Geoportal Server, progress towards a user interface could be made to help streamline this capability for data managers.

In the next phase of the OGC Disasters Pilot, in addition to investigating and plans to address the issues above, we plan to focus on the "After Event" phases of a Hurricane and Flooding Disaster. With that focus, we plan to look towards the east coast, learning from the devastating long-term damage that Hurricane Florence havocked in East coast to create a playbook for leveraging the ArcGIS open platform.