Exercise: Exploring Historic Pittsburgh

What's in a Map? A Crash Course in GIS for the Humanities and Fine Arts
UMass Libraries Workshop – November 4, 2019
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The goal of this exercise is to introduce you to GIS mapping software through the ArcGIS Online platform. This is a web-based mapping platform that allows users to search for spatial data, create their own maps, and share them with the world. We will explore the historic downtown area of Pittsburgh and map a few of the most important historical landmarks.

All UMass students, staff, and faculty have access to Esri products like ArcGIS Online through our university-wide site license. If you are hooked on GIS by the end of this workshop and want to continue practicing on your own computer, you can find out how to download the desktop software and request a license by filling out this form: https://www.geo.umass.edu/arcgis.

In this exercise you will learn how to:

1. Look for spatial data online
2. Access ArcGIS Online with your UMass credentials
3. Create a Web Map in ArcGIS Online
4. Look for existing GIS data in Living Atlas and add it to your map
5. Add a layer using existing spatial data
6. Create an empty layer and add your own data
7. Take measurements on the map
8. Export a simple map as an image or PDF

Step 1: Look for Spatial Data Online

The easiest way to get started mapping is to look for spatial data that already exists somewhere on the web. For historical data, a great resource is the National Register of Historic Places.

1. Search on Google for "pittsburgh national register of historic places". One of the top hits should be a Wikipedia page - go ahead and open it (https://en.wikipedia.org/wiki/National_Register_of_Historic_Places_listings_in_Pittsburgh,_Pennsylvania). Take a moment to look at the Wikipedia page. The page lists the addresses, photos, and (most importantly) the coordinates for all of the points in Pittsburgh.

2. Now let's explore the spatial data on this page. Above the table to the right are several options for accessing the data.

    a. Click "Map all coordinates using OpenStreetMap" to explore the points in a web map viewer. Try panning, zooming, and clicking different points. Does clicking the point do anything?

    b. Click "Download coordinates as KML" to download a file to your local harddrive.

> **What is a KML file?**
> KML stands for Keyhole Markup Language. It is an XML-based file developed by Google Earth. KML files can be opened in Google Earth and some GIS software, including ArcGIS Online.
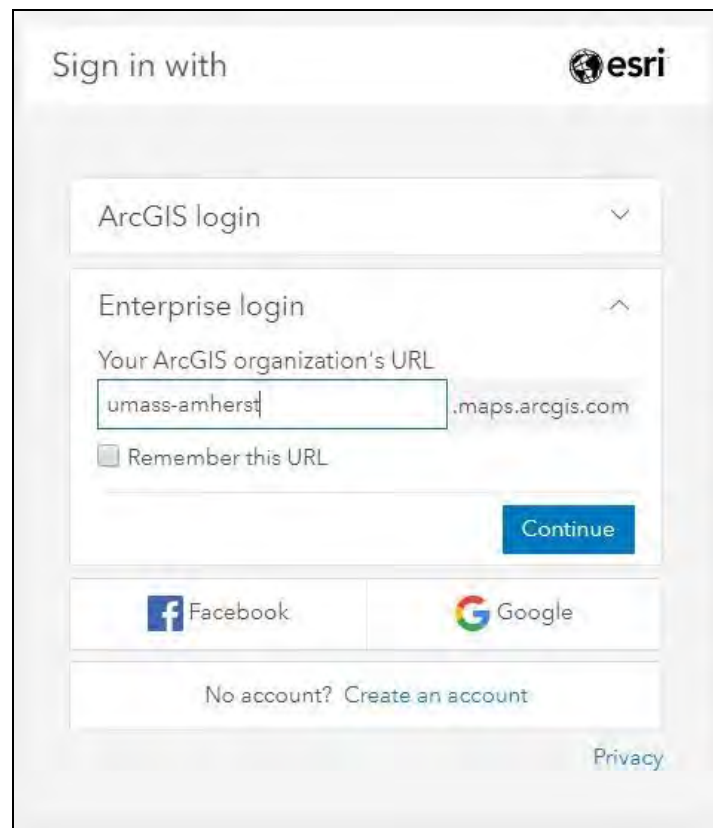
    c. Find the file in your Downloads folder (or wherever you saved it). Double-click the filename to automatically launch Google Earth and see how the data displays in that software program. Try panning and zooming here. How does it compare to the OpenStreetMap viewer? Is one easier to explore? Easier to read?
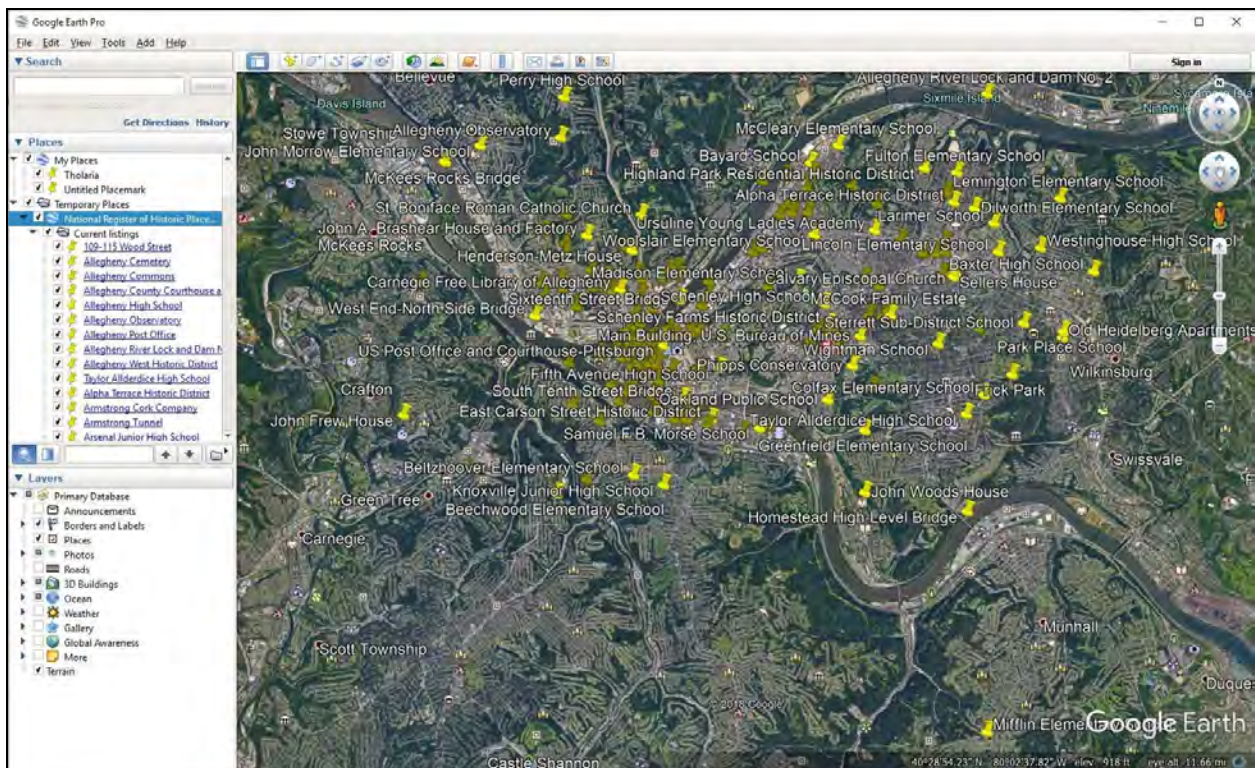
Step 2: Access ArcGIS Online with your UMass credentials

In the above step, we found a spatial dataset online and opened it in Google Earth. Google Earth is a great platform for looking at spatial data and doing some basic analyses, like measuring distance and area. But we can do even more with GIS software. Let's explore some of those options with the ArcGIS Online platform.

1. Open a web browser and navigate to the ArcGIS Online homepage: https://www.arcgis.com/home/index.html

2. Click "Sign In" in the top right corner of your screen.

3. Make sure that "Enterprise login" is selected, and enter your ArcGIS organization's URL: **umass-amherst**. Do not enter a username and password on this screen or you will not gain access to the UMass system.


4. Click "Continue".

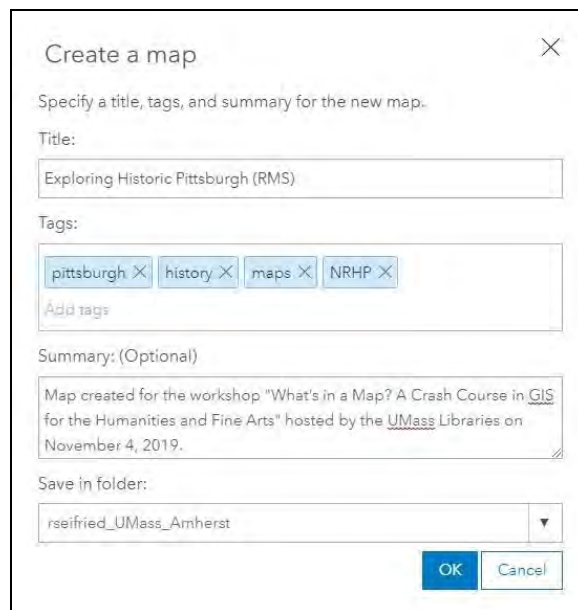5. Enter your UMass credentials to login and be taken to the UMass ArcGIS Online homepage.

Step 3: Create a Web Map in ArcGIS Online

This is the part of the exercise where we familiarize ourselves with the ArcGIS Online platform and make our very first map!

1. At the top of the screen is the menu bar. Click "Content" to go to your private space, where any maps, layers, and apps you create will be stored.
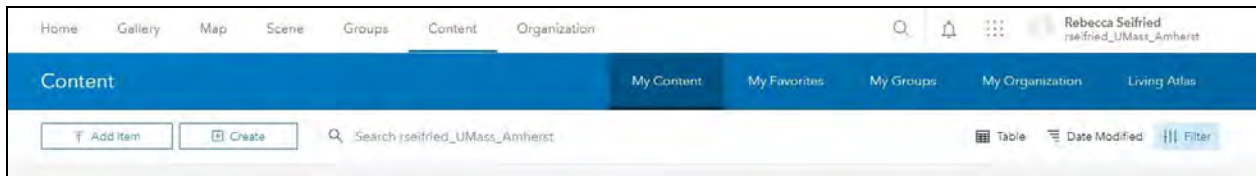
2. Click the "Create" button in the top left corner, then select "Map".

3. Fill out the fields in the popup window. This information is essentially the basic metadata about the map. If you decide to share the map, this information will ensure that your map is discoverable when people search ArcGIS Online, and it will also help you remember what the map is about!

What is metadata?
Metadata is "data about data". It tells other people who use your data what it's about, who made it, how it was made, when it was made and/or modified, and where any source information came from. Good, descriptive metadata helps people find your data, re-use it, and cite it properly.
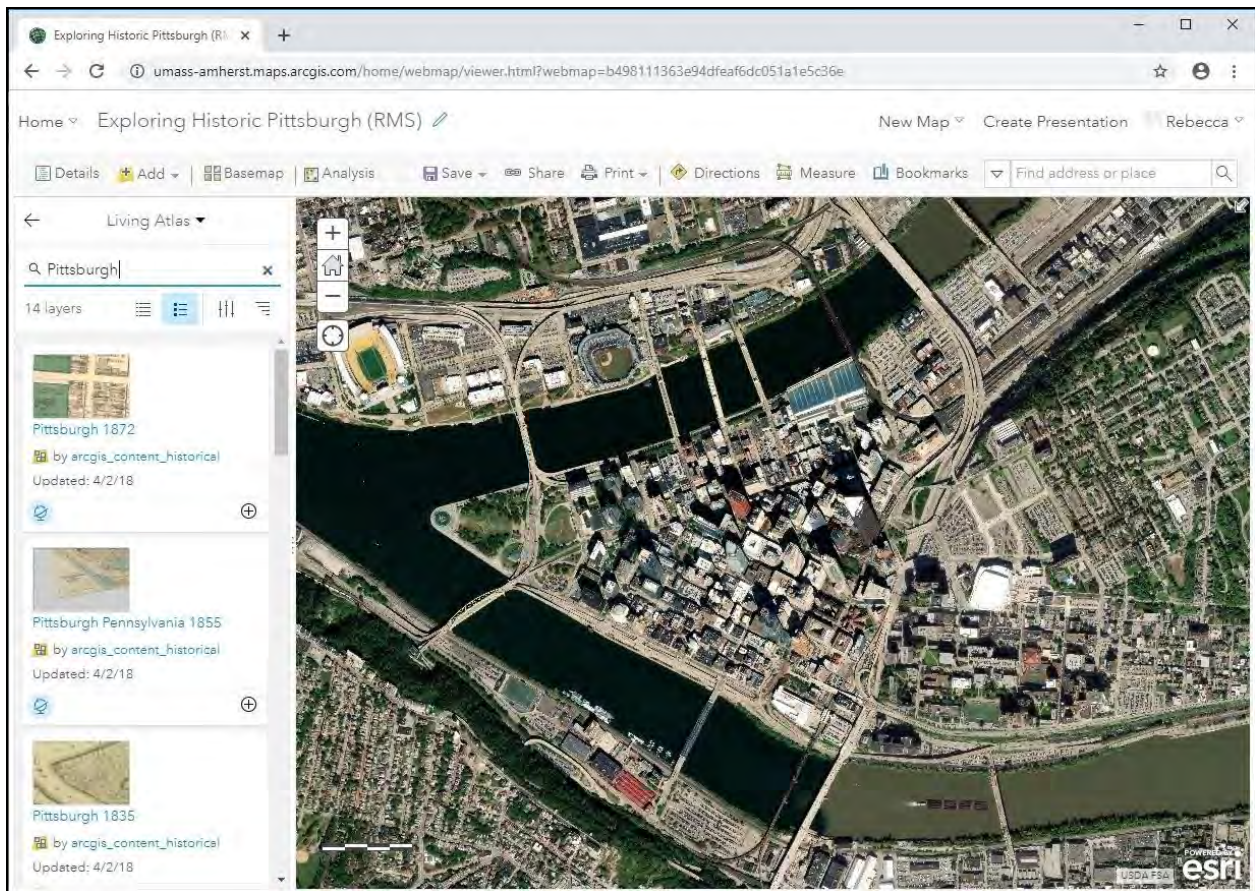
4. A new web map is generated, automatically centering on the UMass campus. Take a moment to familiarize yourself with the menu items and buttons.

    a. Check the "About" tab to see the summary you provided in the popup.

    b. Go back to the "Content" tab and look at the items in your map. Currently there is only one item, the topographic base layer. Change this to a different image by clicking "Basemap" in the menu. Try a few options, then select the "Imagery" basemap.

Step 4: Look for Existing GIS Data in Living Atlas and Add it to Your Map

Now that we have a Web Map in ArcGIS Online, we can begin adding data. Let's start by looking for existing datasets in Living Atlas of the World, a searchable collection of maps, apps, and data layers published by other Esri users.

1. In the menu bar, click "Add" and then "Browse Living Atlas Layers."

2. In the search box, type in "Pittsburgh" then hit the Enter key to search.

3. You should see about a dozen layers. Add the following layers by clicking the small plus sign in the bottom right corner of each item:

   Pittsburgh 1967 aerial
   Pittsburgh 1939 aerial
   Pittsburgh 1872
   Pittsburgh 1835
   Pittsburgh 1796

4. Reorder the layers by clicking on the three dots to the left of the layer name, then dragging the layer up and down. The earliest image should be on the bottom, and the latest on top.

   a. Try turning the layers on and off. How does the order of the layers (top to bottom) affect their visibility?.

   b. Compare different layers to each other – what are some of the major changes you see in terms of natural features, building footprints, bridges, roads, and large public buildings?
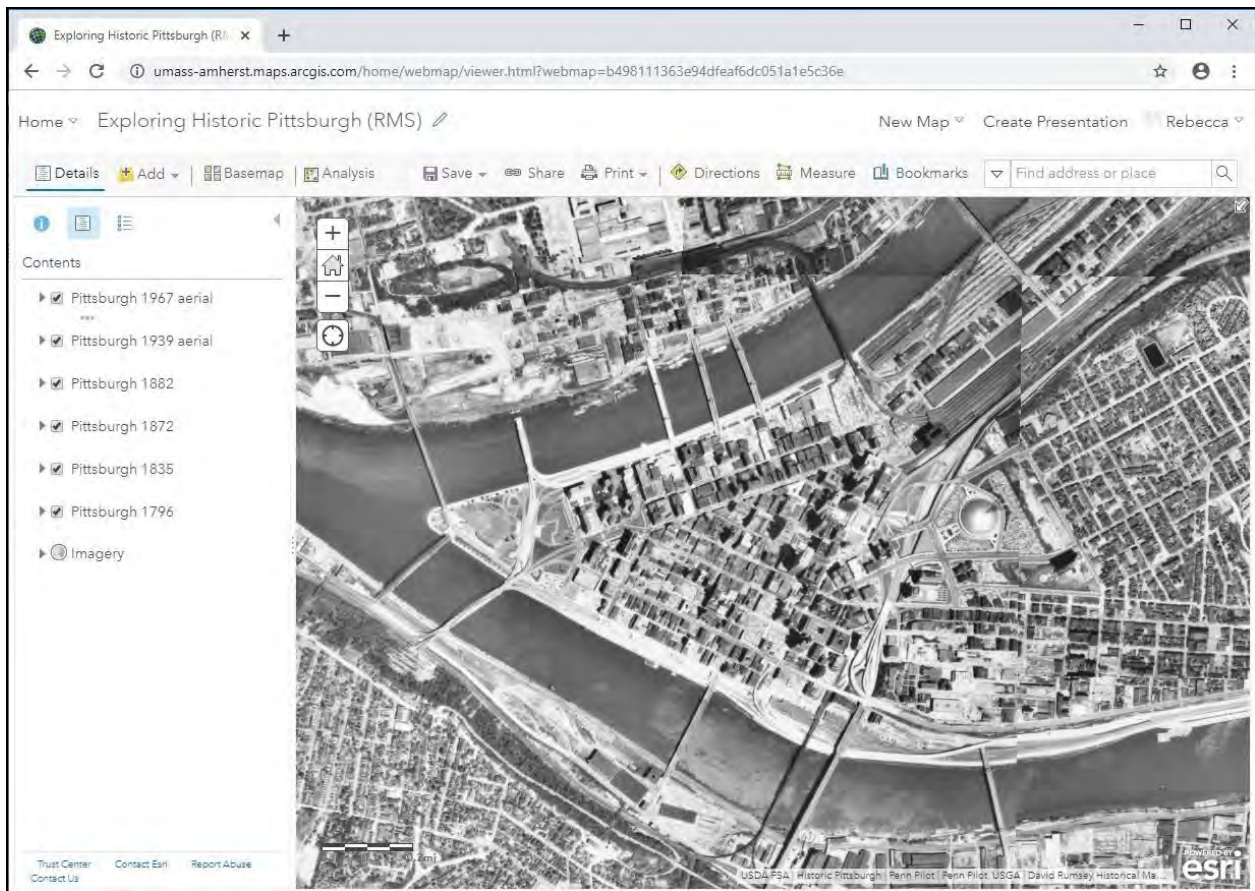
## Step 5: Add a Layer Using Existing Spatial Data

Now let's import the spatial data from the KML file you found for the National Register of Historic Places in Pittsburgh and compare this to the historical maps and aerials we added from the Living Atlas.

1. Go back to the Wikipedia page and find the box where you can "Download coordinates as KML." Right-click and select "Copy link address…"

2. Return to your ArcGIS Online session. In the menu bar, click "Add" and then "Add Layer from Web."

   a. In the drop-down menu, select "A KML File."

   b. In the URL box, paste the link address you just copied.

   c. Click "Add Layer."

3. ArcGIS Online automatically imported the spatial data from the KML file we found on the Wikipedia page. Try panning and zooming. How does it compare to the OpenStreetMap viewer and Google Earth? What happens when you click on one of the points?
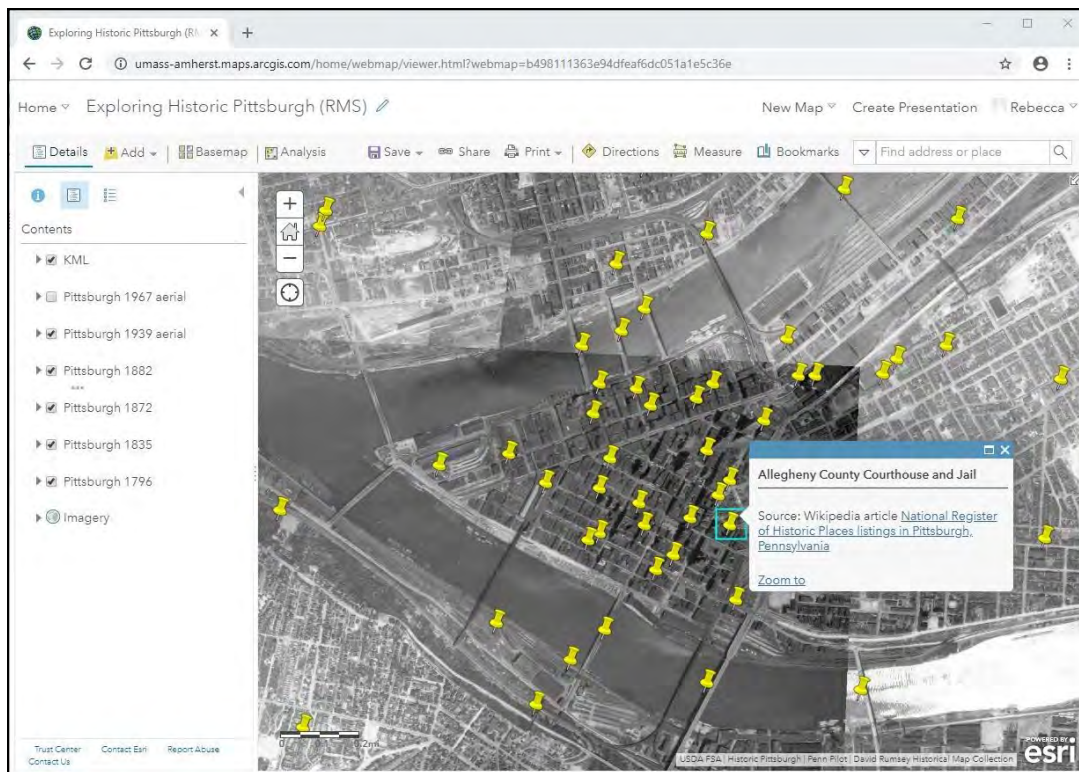
4. Zoom into the downtown area and explore some of the historic places. Refer back to the Wikipedia page to find out when the places were built, and see if you can find them in any of the maps or aerials.

   a. Can you see any features in the historical maps or aerials that are missing from the National Register of Historic Places?

   b. Turn off all the layers except for "KML" and "Pittsburgh 1796." Look for the forts that were drawn on this historical map. Are any of these registered in the NRHP?
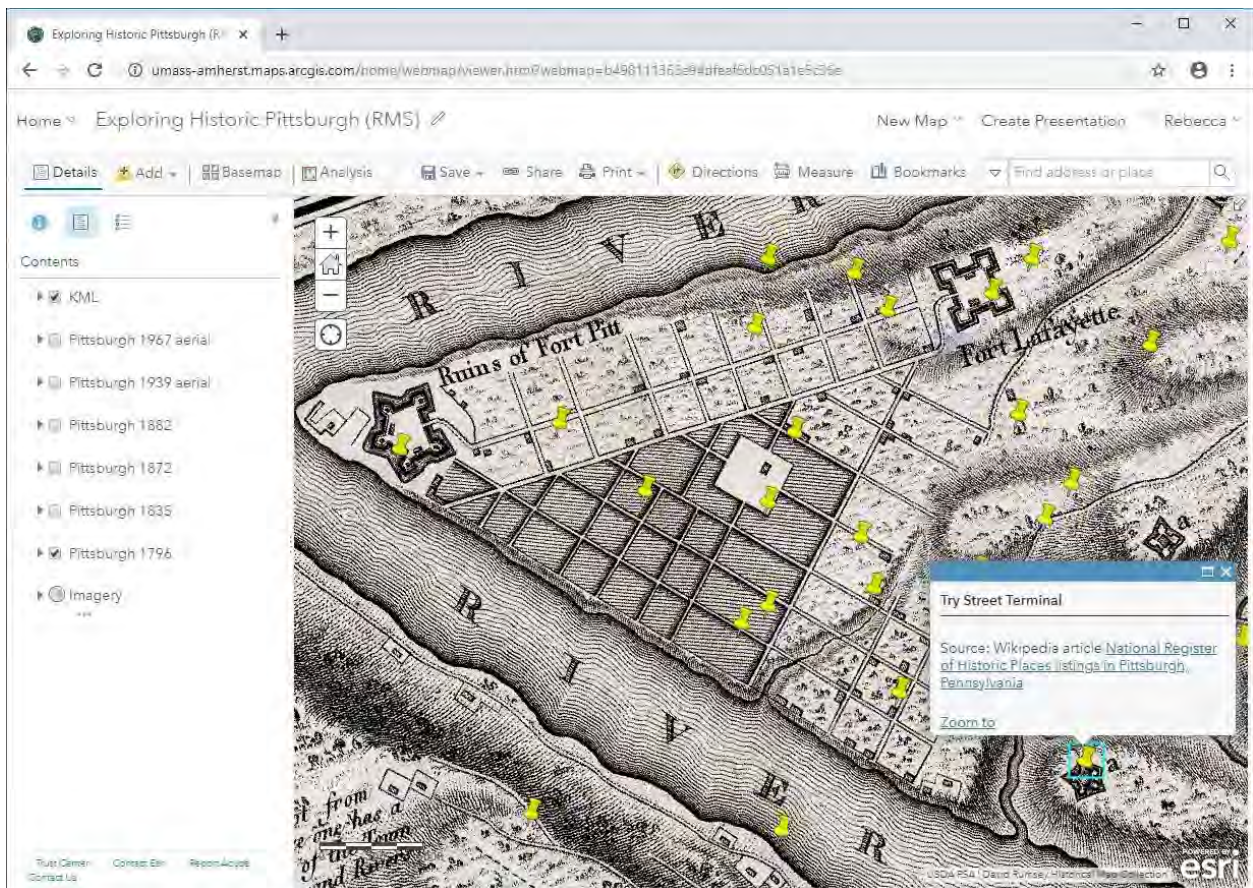

5. Before moving to the next step, click "Save" (then "Save" again) in the Menu. This makes sure that all the layers you've added to your map will load again the next time you open the map!

Step 6: Create an Empty Layer and Add Your Own Data

In the last step, we found out that there were historical features in Pittsburgh that have since been destroyed. What if we want to make a map that shows where these features used to be? Let's create our own empty layer and digitize these points from the 1796 historical map.

1. Return to your Content screen by clicking "Home" in the top left corner, then "Content." This will take you back to your personal workspace. You should see the Web Map you just created. If you have never used ArcGIS Online before, this will be the only file in your Content workspace.

2. Create a new feature layer by clicking "Create" then "Feature Layer."

   a. In the popup window, you will see a variety of templates designed for different fields that rely heavily on mapping technology. For this map, we just want to design our own simple point file, so select "Build a layer," then "Points." Click "Create."

   b. Leave "Point layer" checked and click "Next."

   c. In the next box, we are asked to pan to where the points will be located. Zoom and pan so that the map is centered on downtown Pittsburgh.
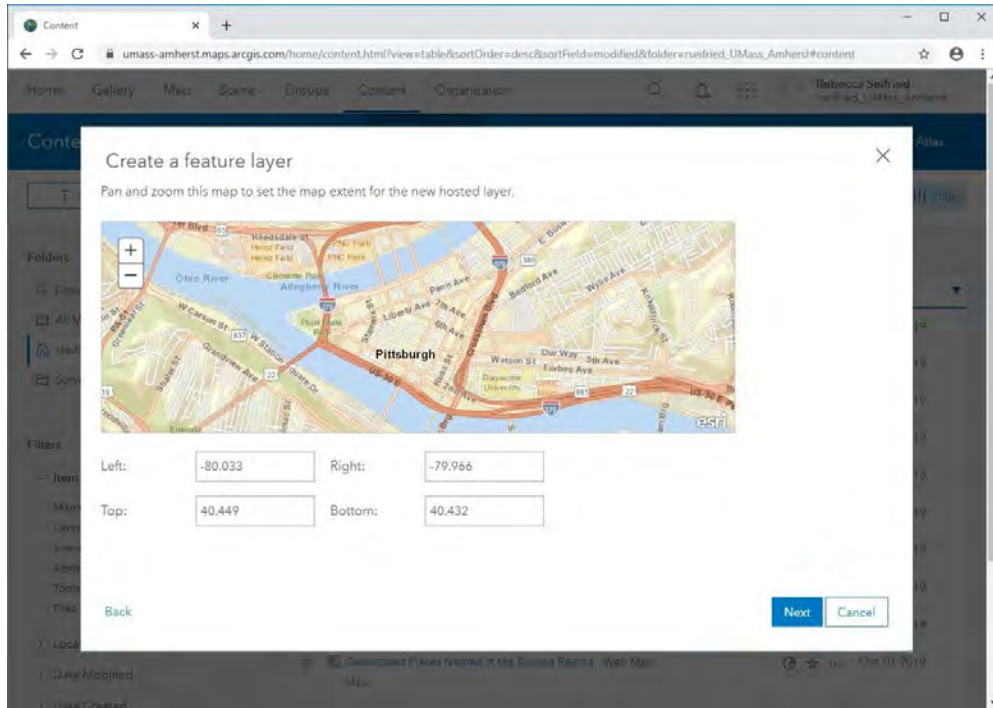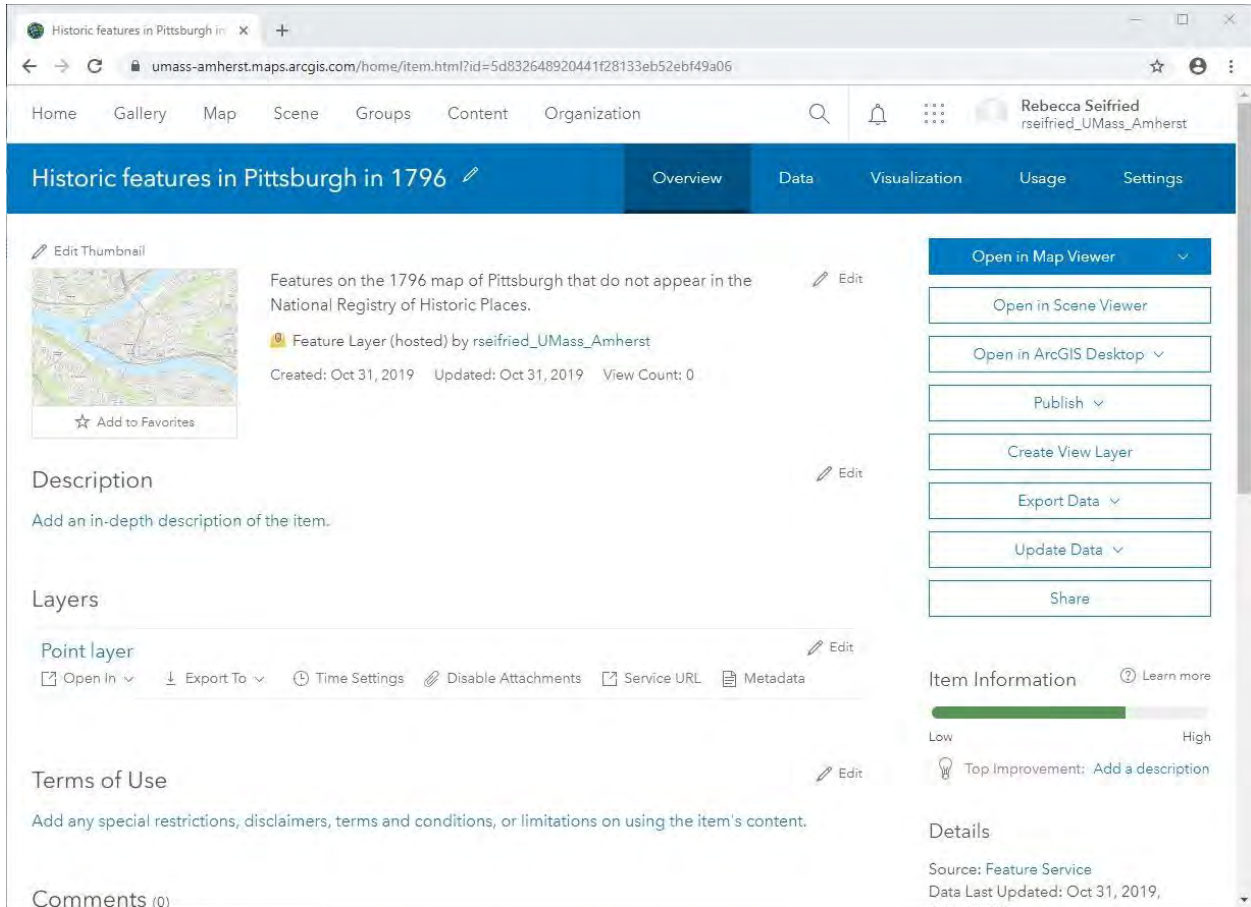
d. Click "Next."

e. Fill out the fields in the popup window. As with the Web Map, this is the basic metadata about our new feature layer.
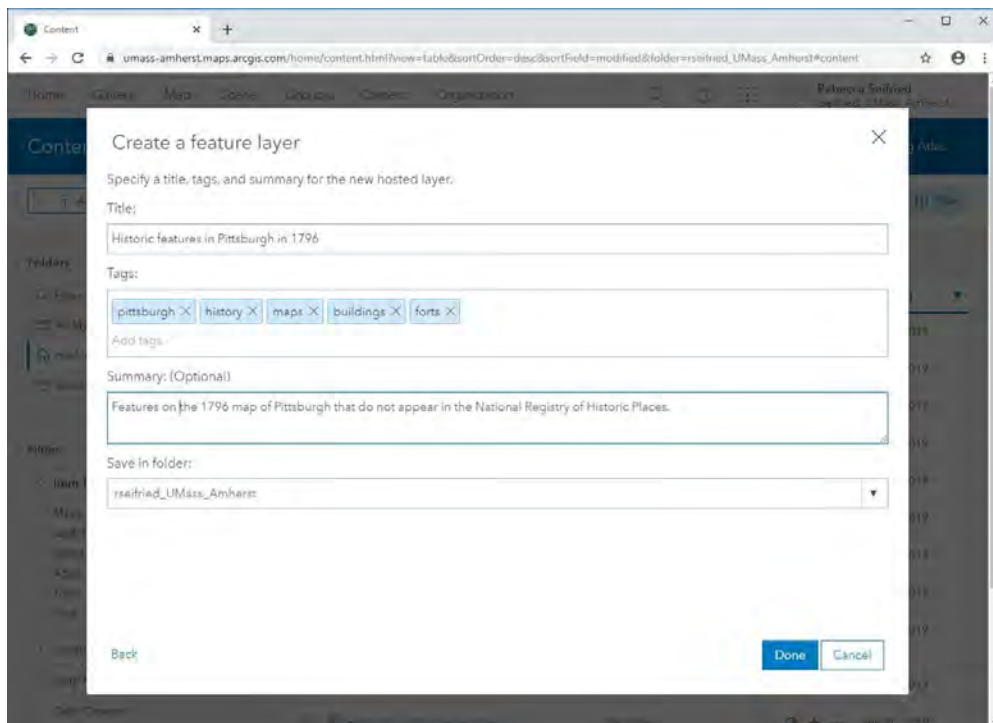
f. Click "Done." The feature layer is generated and we are taken to the Overview page, where we can edit the layer's metadata.
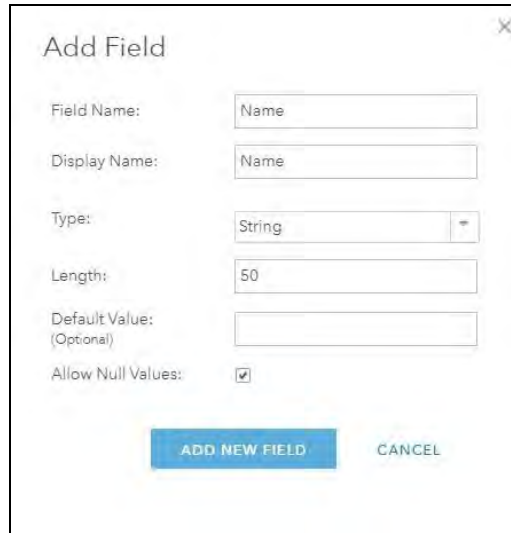

3. Return to your Content workspace and find the Web Map we created earlier. Click the map name to open the Overview page, then click "Open in Map Viewer."

   a. Make sure only the "KML" and "Pittsburgh 1796" layers are turned on.

4. Add the layer we just created by clicking "Add", then "Search for Layers." This pulls up all the layers in your Content workspace. Click the plus sign next to your new layer to add it to the map. Click the left-arrow in the upper left corner to return to the content panel.

5. The feature layer you just created has no data - it's an empty layer! Let's explore the table associated with the layer by clicking the "Show Table" icon just below the layer name.
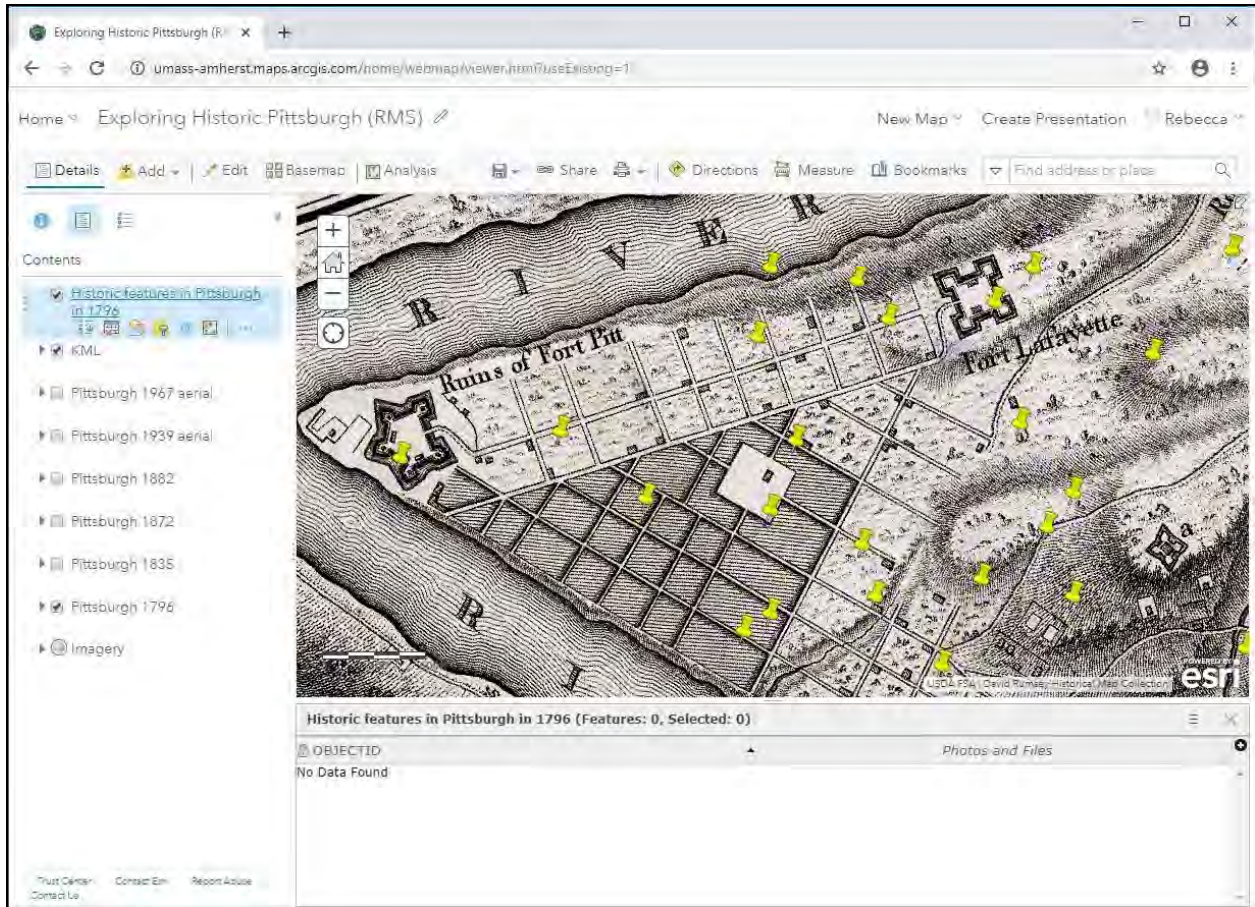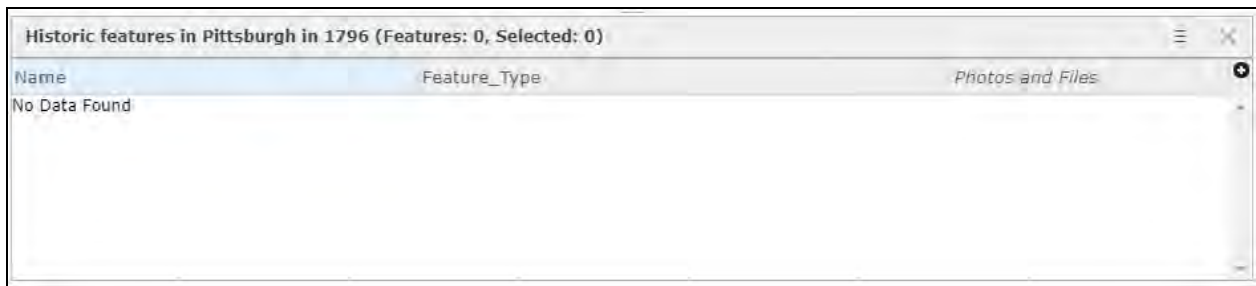
a. There are two fields in the table: OBJECTID, and Photos and Files.

b. Add a new field by clicking the "hamburger" icon in the top right corner of the table, then "Add Field."

c. Make a new text (string) field called "Name" with a length of 50 characters. When you are ready, click "Add New Field."
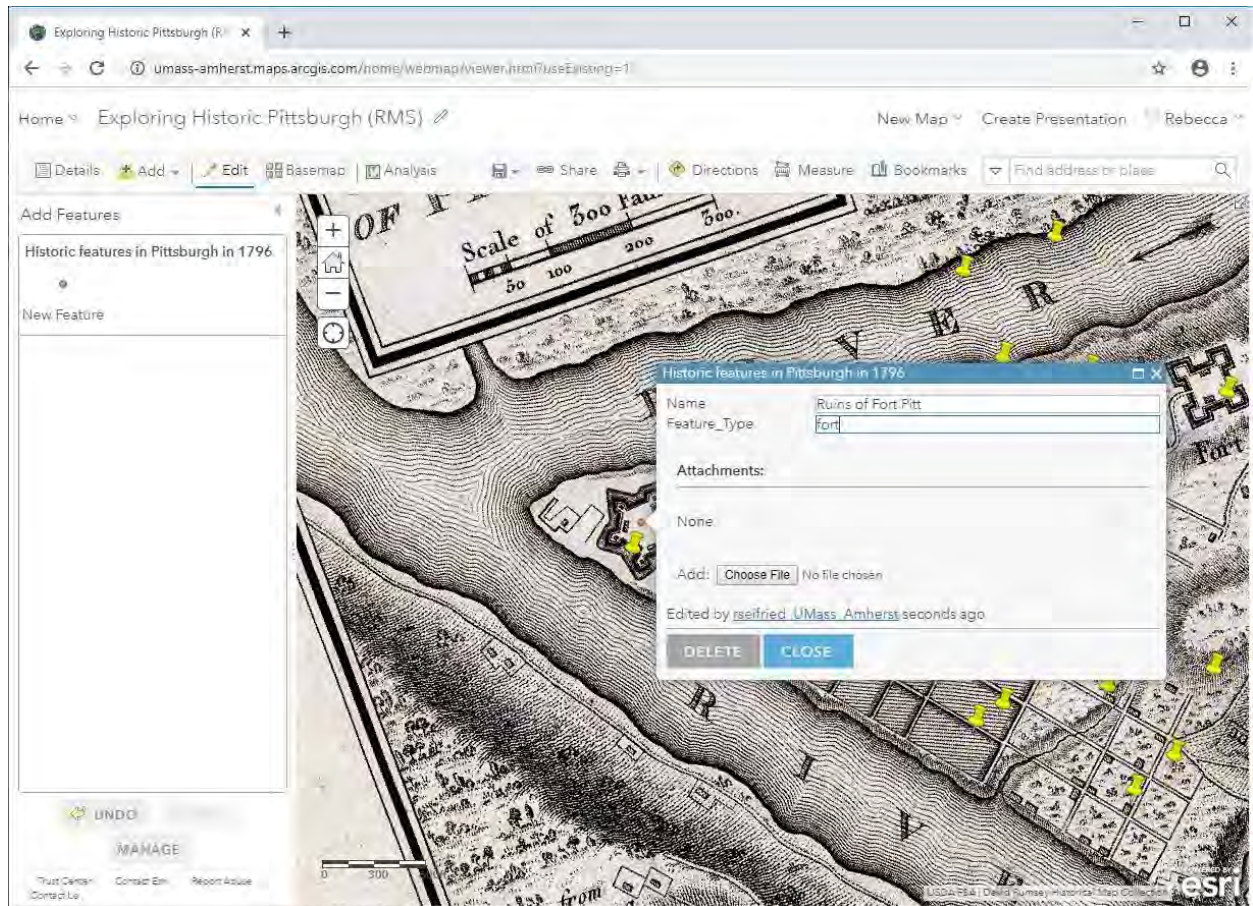
d. Repeat this step, making a new text (string) field called "Feature_Type" and a length of 50 characters.

e. The table should now look like this:

6. Now it's time to start adding points! Click the "Edit" button in the menu to bring up the "Add Features" menu. Select "New Feature."

   a. Click once on the map to add a new point.

   b. Fill out the fields in the popup window that appears.

c. Pan and zoom around the map, adding points on any historical features that you can see in this map that are not represented in the National Registry of Historic Places KML file. (You can digitize anything you want - not just forts!)

d. As you digitize, think about the categories of "Feature_Type." Try to use just a few categories (e.g. fort, industrial, natural).

e. When you are finished, click "Save."

7. Now let's change the way your points are displayed. Click the "Change Style" icon below the layer name.
   a. Step 1 is to choose an attribute to show. Currently this is set to "Show location only." Every feature is displayed the same way.
   b. Step 2 allows you to change the way these points are displayed. Click "Options" under "Location (Single Symbol)", then click "Symbols."
   c. Explore the different symbol options and pick one you like! Make the symbol bigger by adjusting the symbol size at the bottom of the popup.

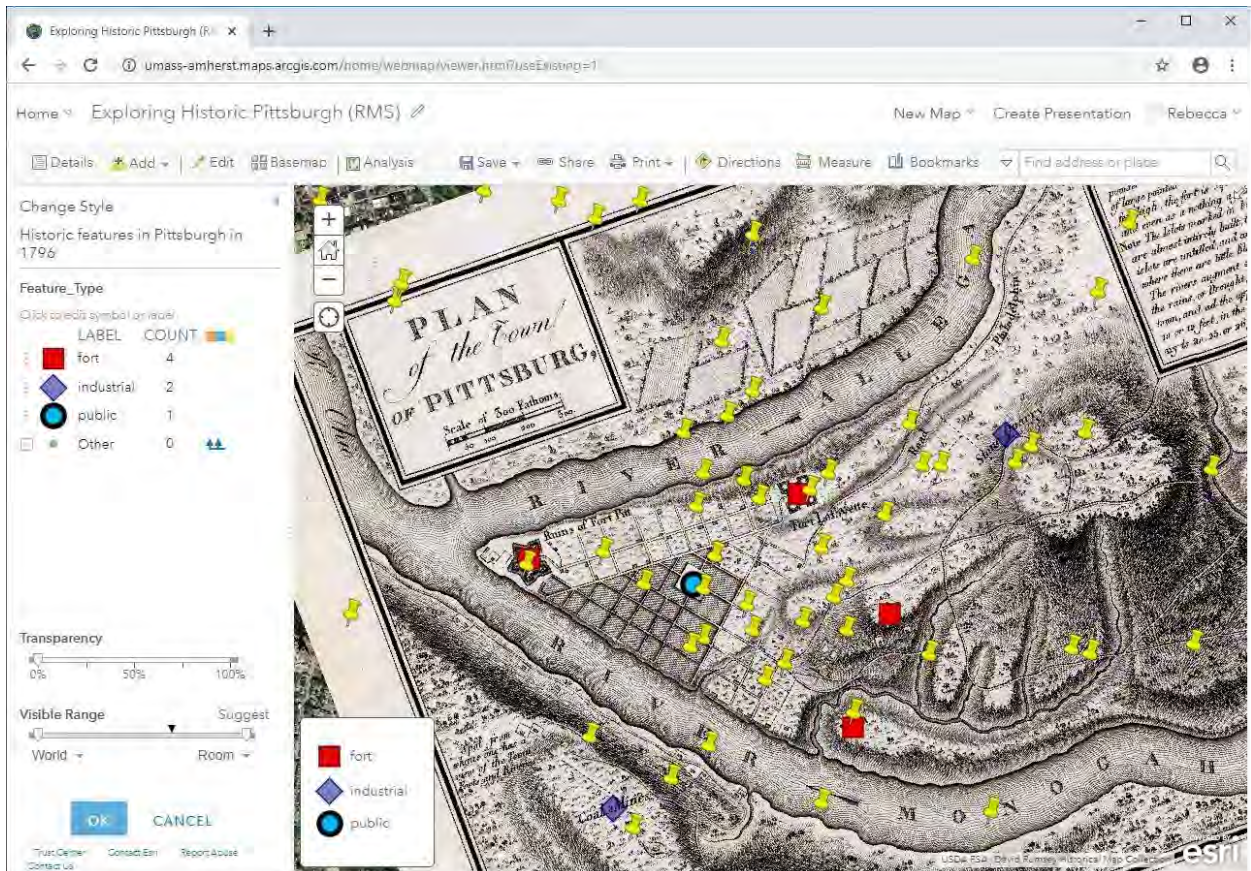*Exercise: Exploring Historic Pittsburgh*
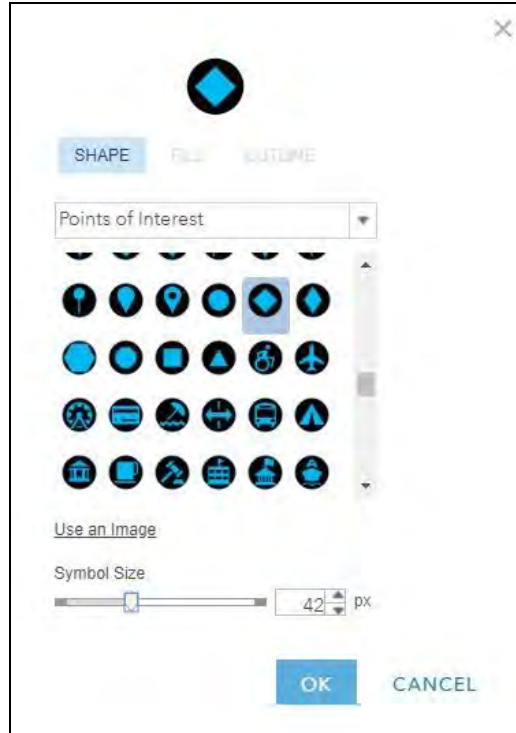
d. Click "OK" to preview how that symbol looks on your map.
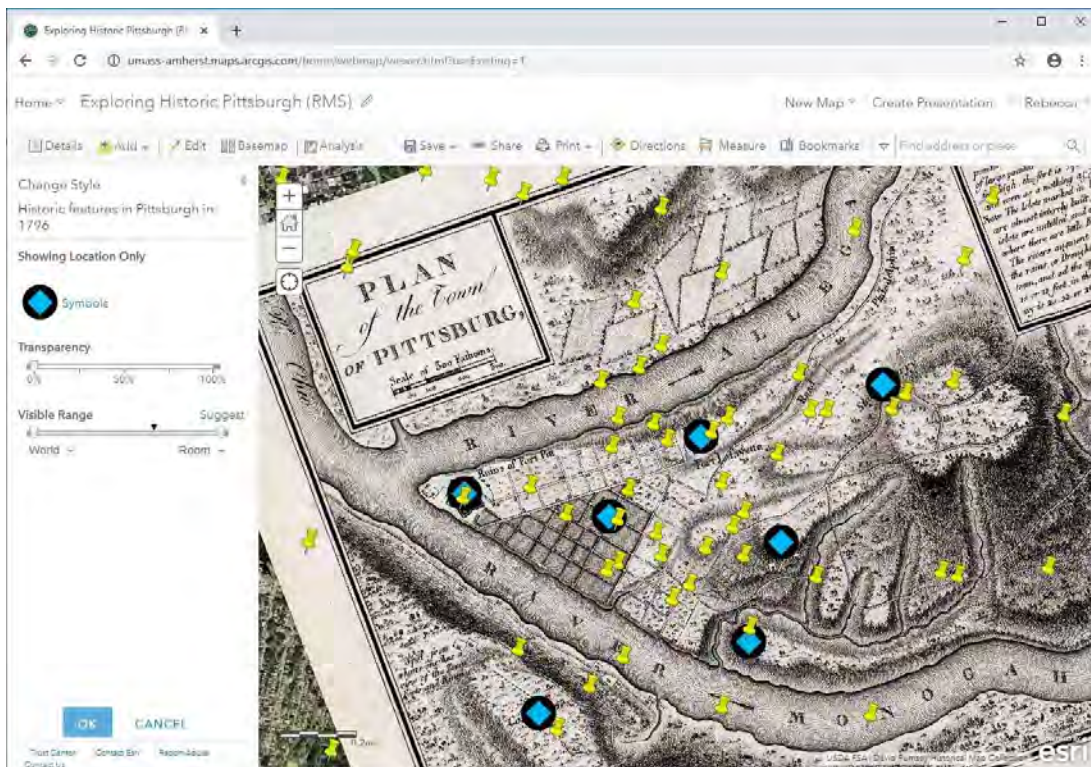
e. Click "OK" to exit.

f. Now let's try displaying symbols based on "Feature_Type." Click "Options" under "Types (Unique symbols)."

g. The categories you defined while digitizing the points should auto-populate. Select individual symbols to change the way they look.

h. Click "OK" and then "Done" to save your symbology.

Want more practice digitizing features?
Try making a new feature layer for a different map layer or aerial image. How has the built infrastructure of Pittsburgh changed since the 1800s? Are there any buildings or bridges you can see in the 1939 image that no longer exist? What about in 1967? What has changed since the 1967 photo was taken?

Step 7: Take Measurements on the Map

You now have two sets of features to explore spatially - the group of historical features from the NRHP, and the features you digitized manually from the 1796 historical map. Let's look at three basic types of measurement: area, distance, and location.

1. Click "Measure" in the menu bar and select the first icon, "Area." Change the units of measurement to your favorite system.

2. In the map, start clicking to draw a polygon around an area you want to measure, such as the extent of the city in a historical map. Double-click to set the polygon.

3. Turn off all the map layers and measure the extent of the city on the modern base imagery. How much did Pittsburgh grow between 1796 and 2019?
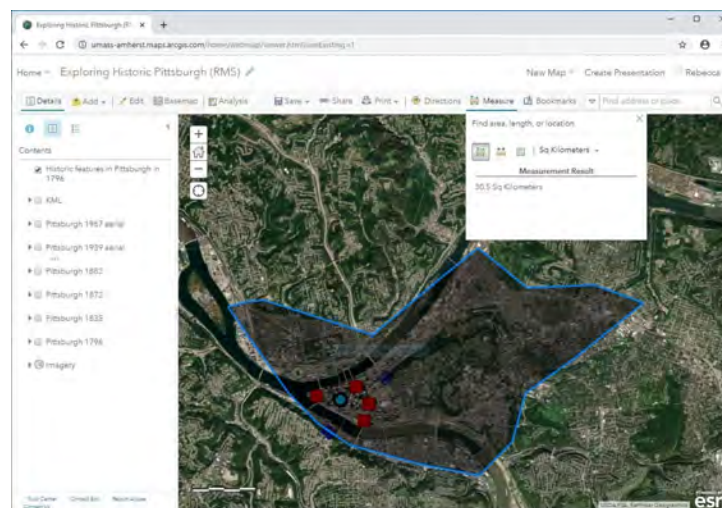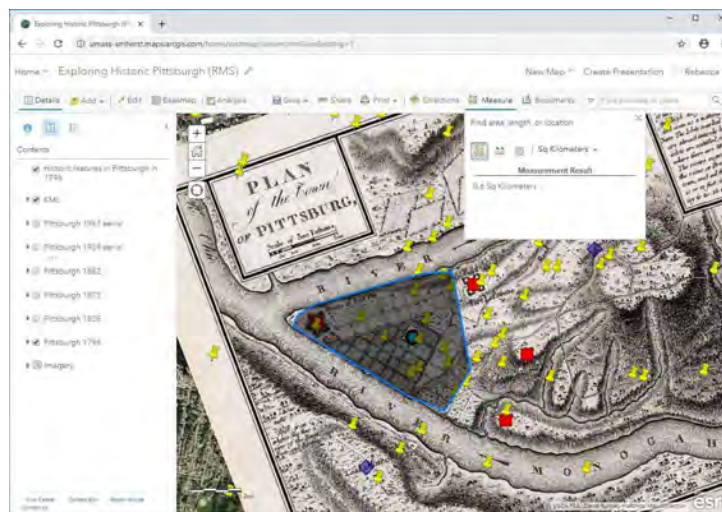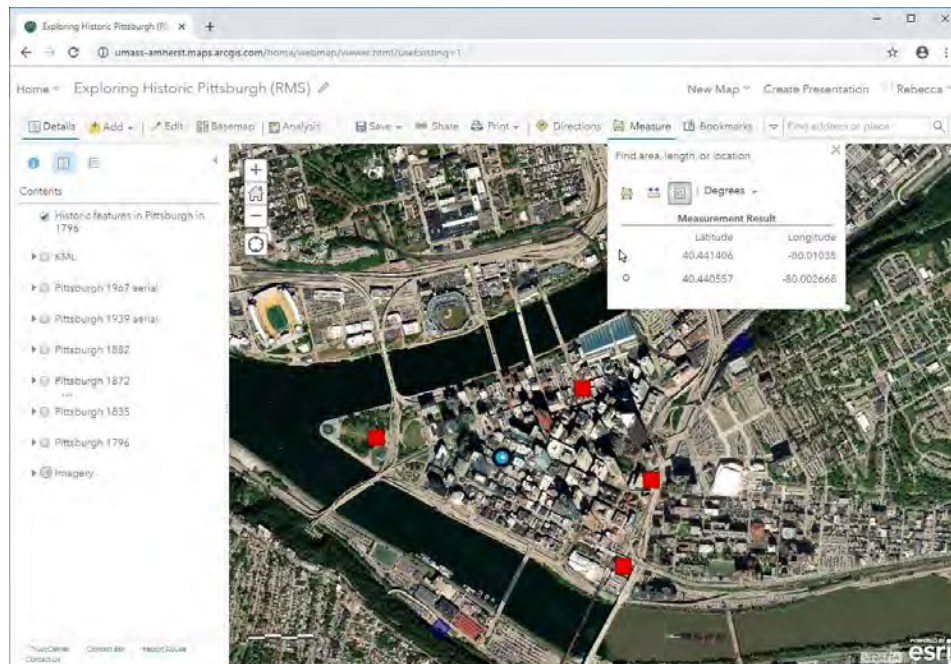
4. Now try using the distance tool to measure the distance between different features on the map. How far apart were the historical forts?
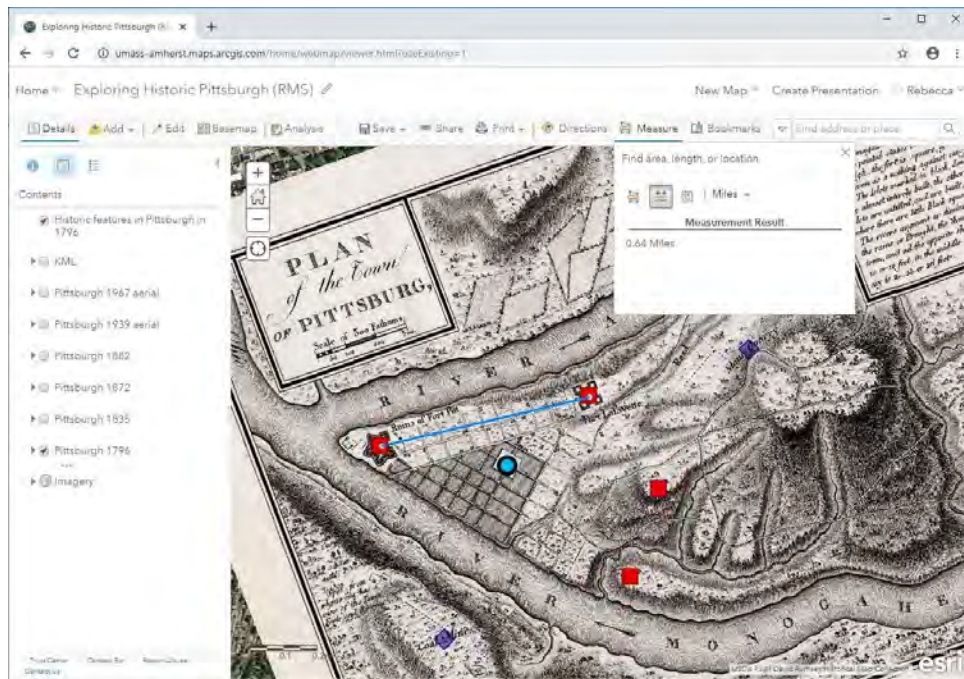
5. Last but not least, use the location tool to find the latitude and longitude of a point of interest.

Step 8: Export a Simple Map as an Image or PDF

We've reached the end of the workshop! Before you save and close your web map for good, let's export a copy of the map you created.

1. Pan and zoom the map so that it is centered on downtown Pittsburgh. Turn off any layers that you do not want to appear in the map.

2. Click "Print" in the menu, then "Map with Legend." A basic map opens in a new window with all of the most important mapping elements. Can you find these features?

> Title
> Legend
> Description (summary)
> Scale bar
> Data credits
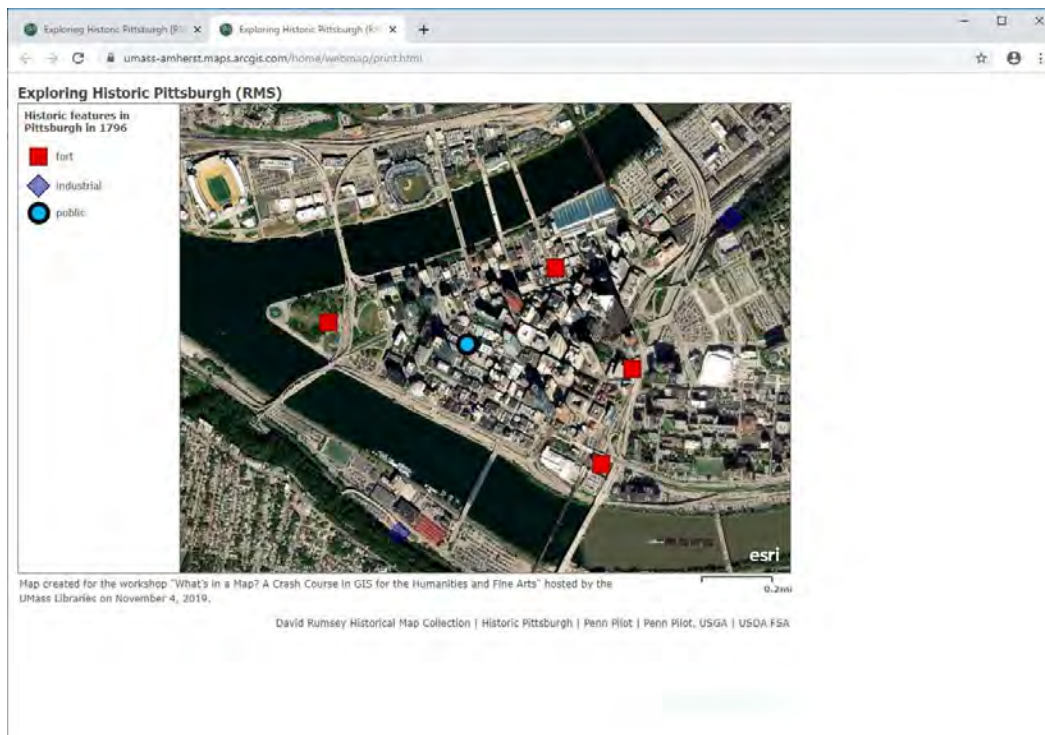
   a. Right click on the image to save a copy or print.
3. Close this window and return to your map. Make sure to click "Save," then close your browser.

4. Give yourself a pat on the back – you did a great job!