Geography 222

Laboratory 4

Introduction

The following lab will introduce you to the power of buffers and overlay tools for conducting spatial analysis projects.

Simply put, a buffer is a polygon created around a feature. An overlay is the combination of two data layers used to identify which features (points, lines, or polygons) are over top of the other features. Overlays can be visual or topological. A topological overlay combines the spatial, and attribute, data of two (or more) layers to create another map layer.

In today's laboratory you will learn how to conduct:

- Point, Line, and Polygon buffers

- Intersect, and Erase overlays

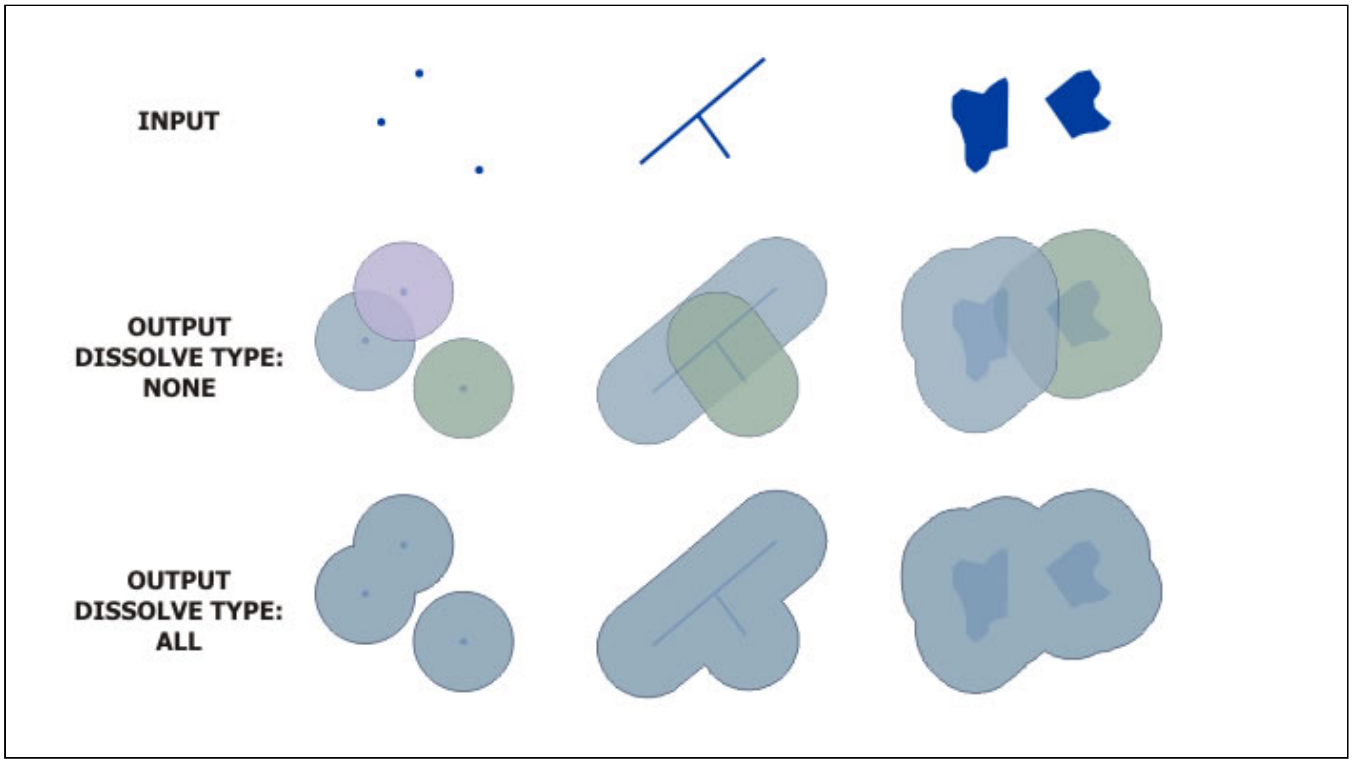
Exercise

Buffers

Polygons generated from buffers are used to determine spatial proximity. You generate them when the analysis calls for identifying areas or zones surrounding geographic features (points, lines, or polygons). Polygons are the only features that can have a buffer *outside or inside* the feature.

The buffer geoprocessing tool will generate a new feature class (i.e., new file), consisting of polygons (one or more), surrounding one or a set of existing features. They can be dissolved (no overlap) or undissolved (overlapping).

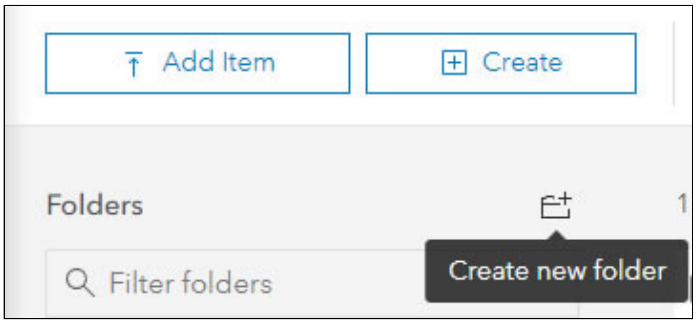
Examples of buffer analysis questions include: identifying all homes within 1 km of a grocery store (point), identifying all invasive plant species within 1 km of a river (line), or all crimes within 1 km of a census tract (polygon).

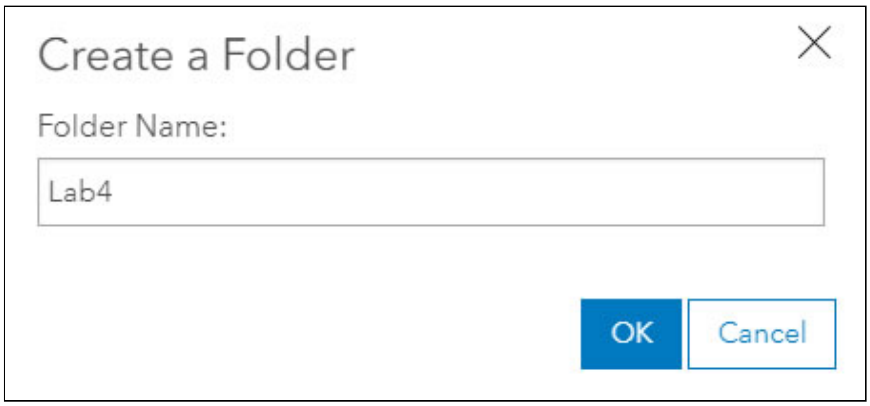


Source: http://pro.arcgis.com/en/pro-app/tool-reference/analysis/buffer.htm

Let's use ArcGIS Online to explore buffer creation.

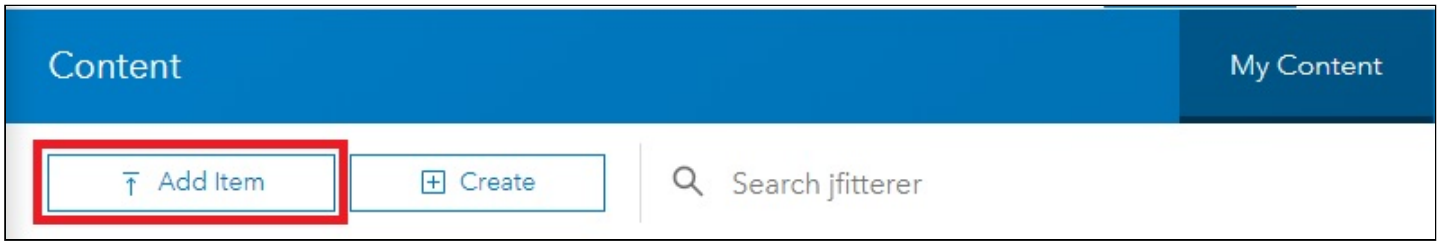
1. Login to ArcGIS Online
2. Download the Lab Data to your Lab 4 folder
3. In ArcGIS Online go to the Content tab and select "Create New Folder"

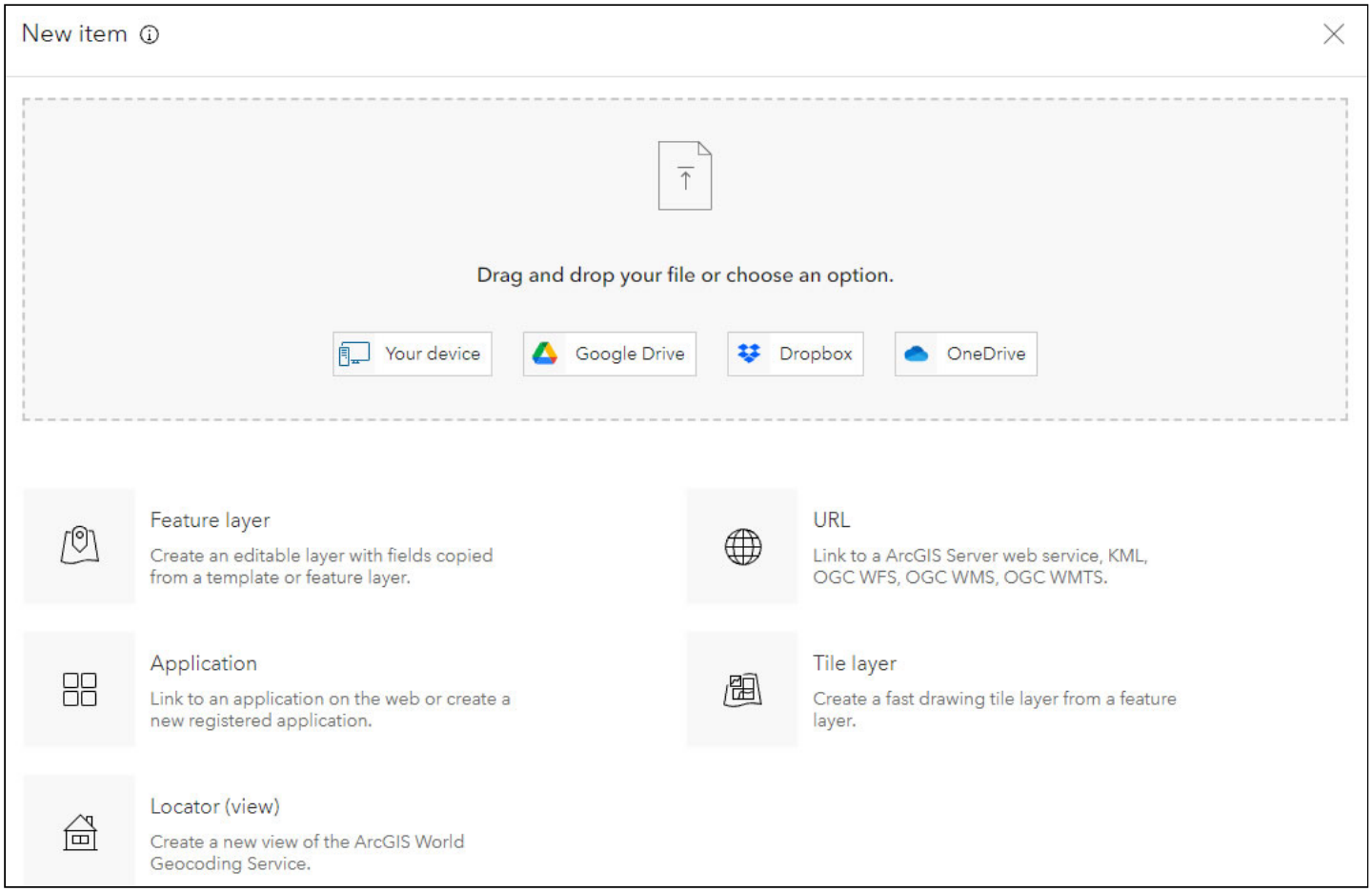


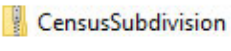


- Press **OK**

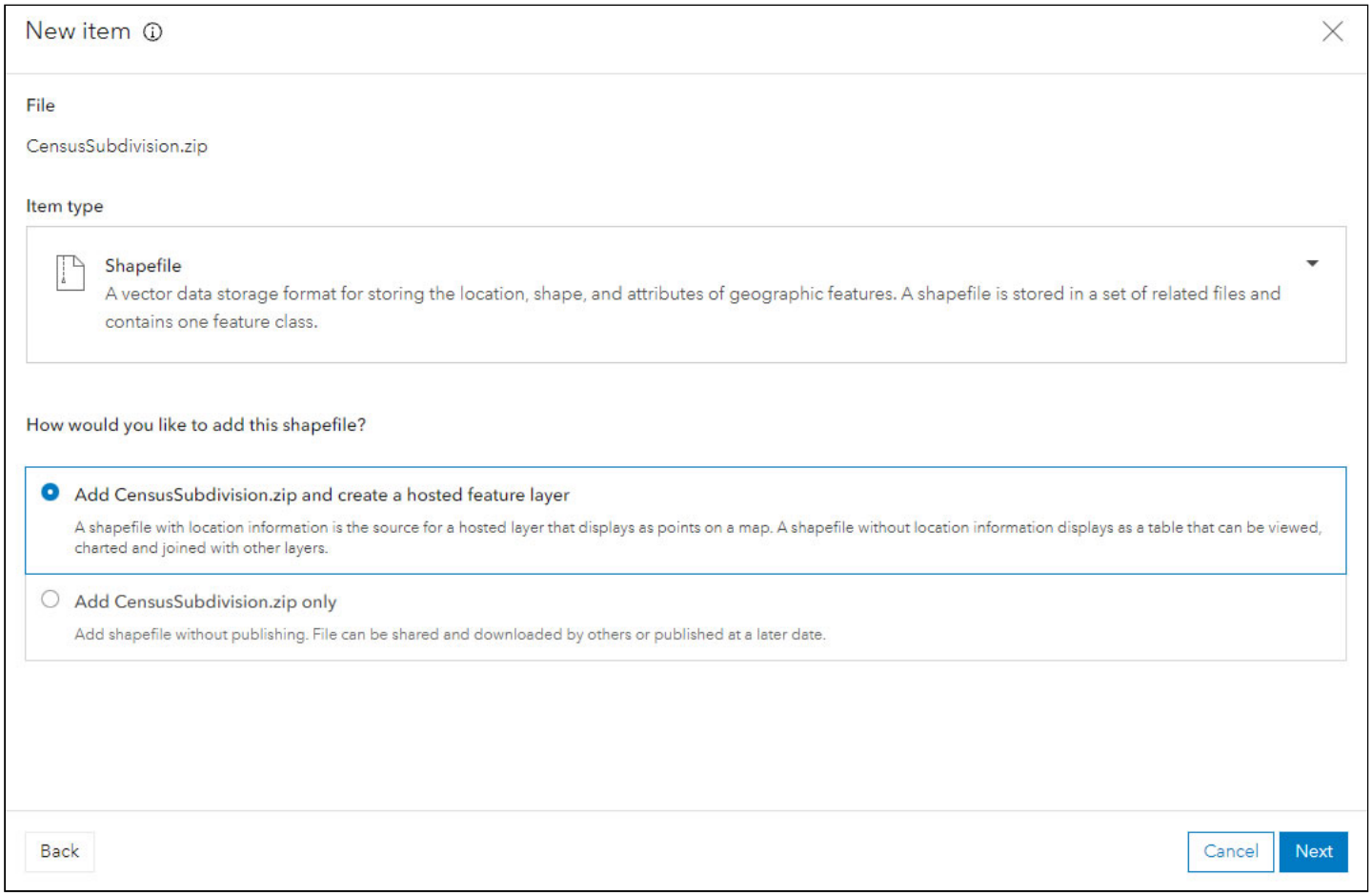
From the **Lab4** folder, select **Add Item** → From your computer



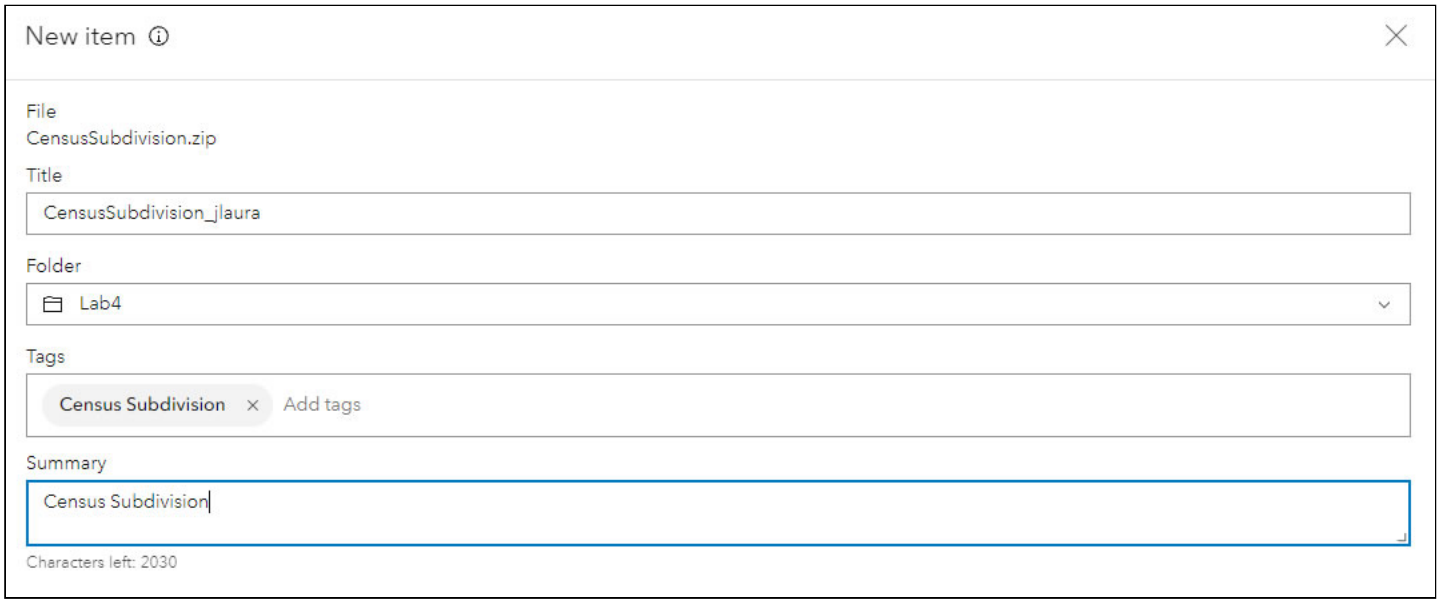


- Drag and drop the **CensusSubdivision** layer into the **Add Item** box 

- Add the Feature as a **hosted feature layer** → press **Next**



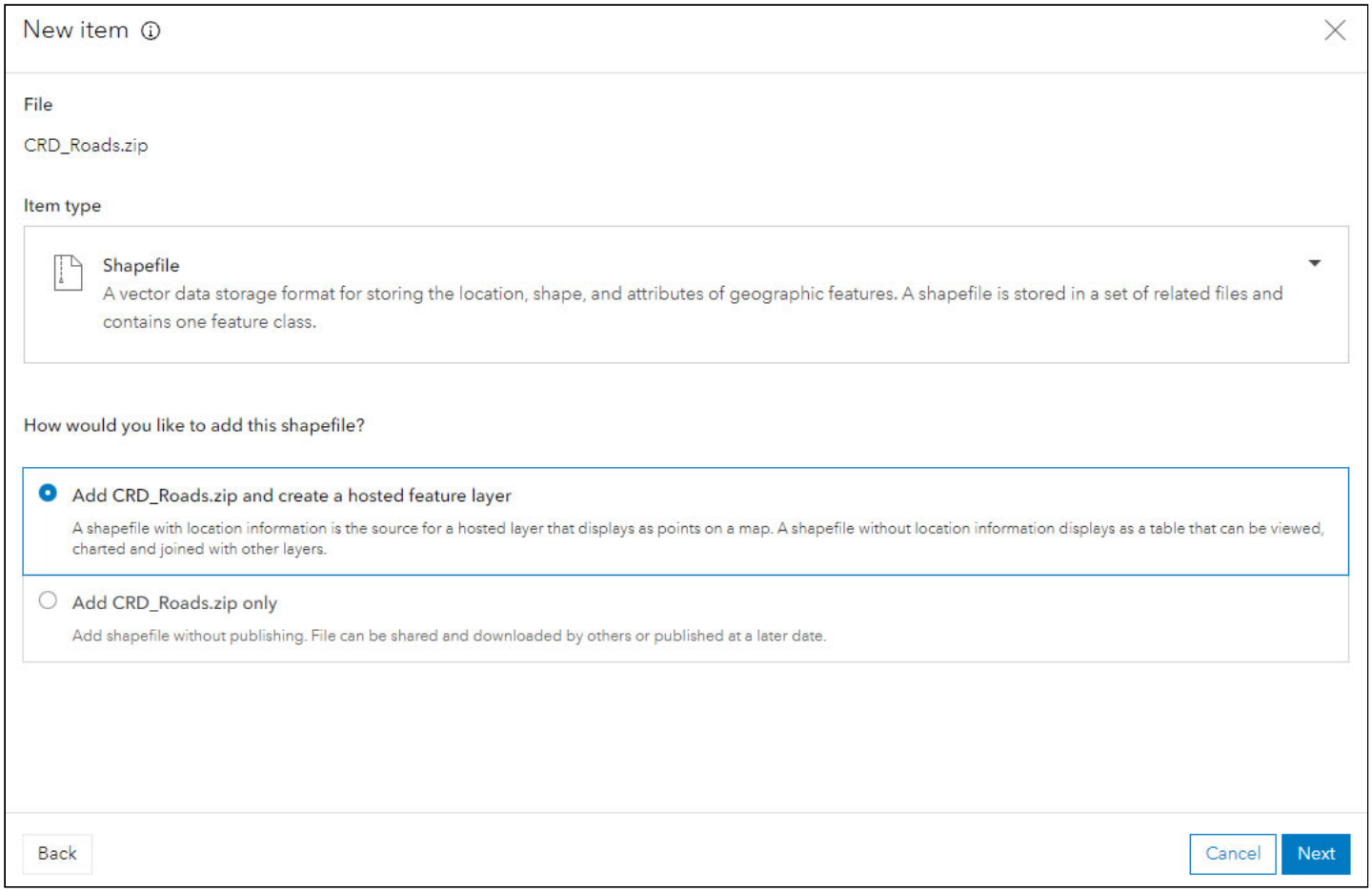
- Change the file name to include your netlink ID and add tags and summary as set below:



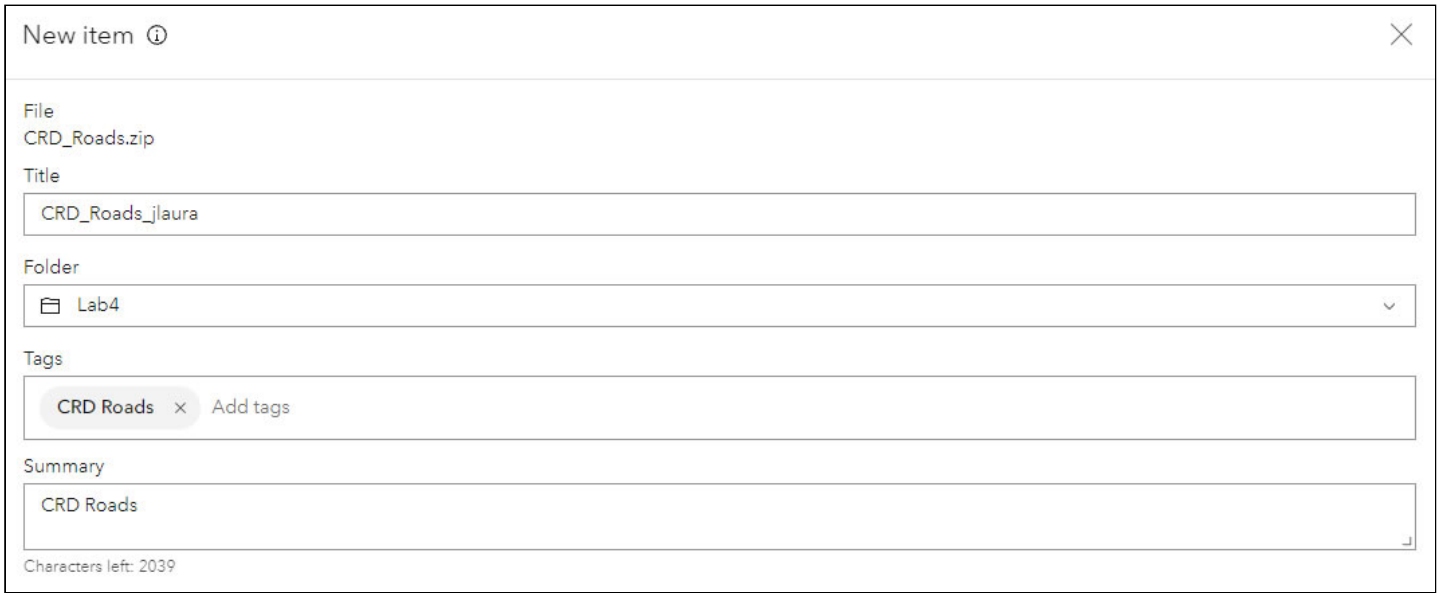
- Press **Save**

4. Go back to the **Content** tab → select the **Lab4** folder → **Add Item**

- Drag and drop the CRD_Roads.zip layer
- Choose: **Add "CRD_Roads.zip" and create a feature hosted layer** → Next



- Change the file name to include your netlink ID and add tags and summary as set below:

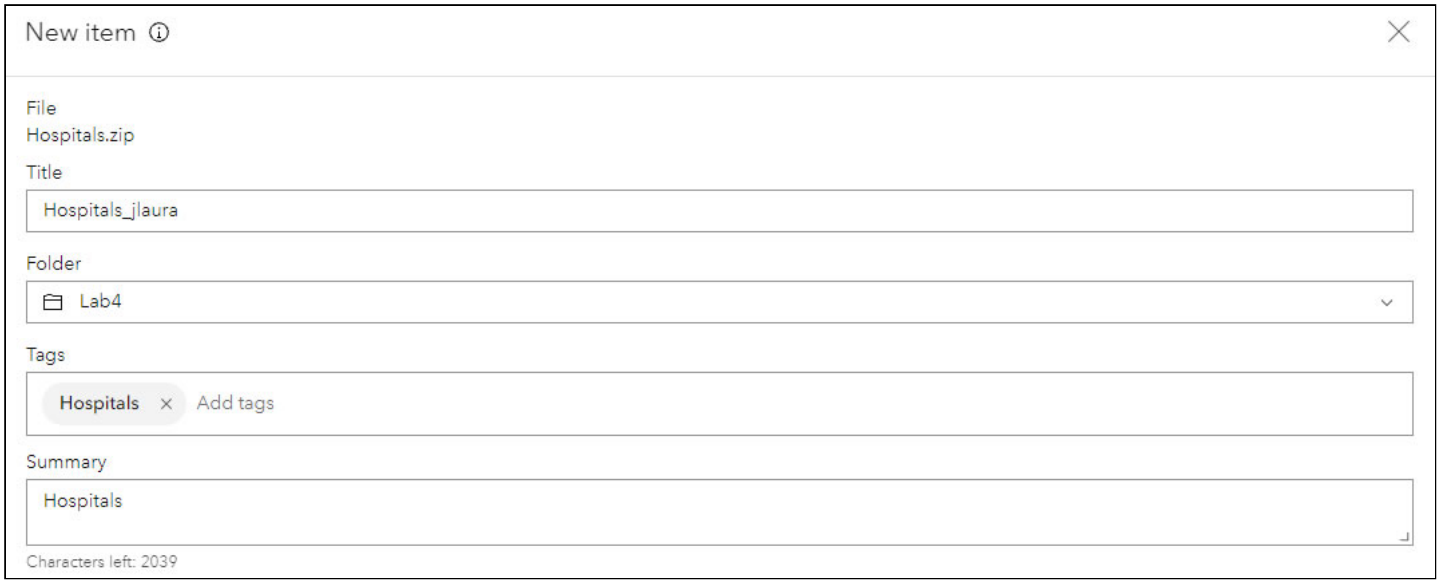


- Press Save

5. Go back to the **Content** tab → select the **Lab4** folder → **Add Item**

- Drag and drop the Hospital.zip layer
- Choose: **Add "Hospital.zip" and create a feature hosted layer** → Next

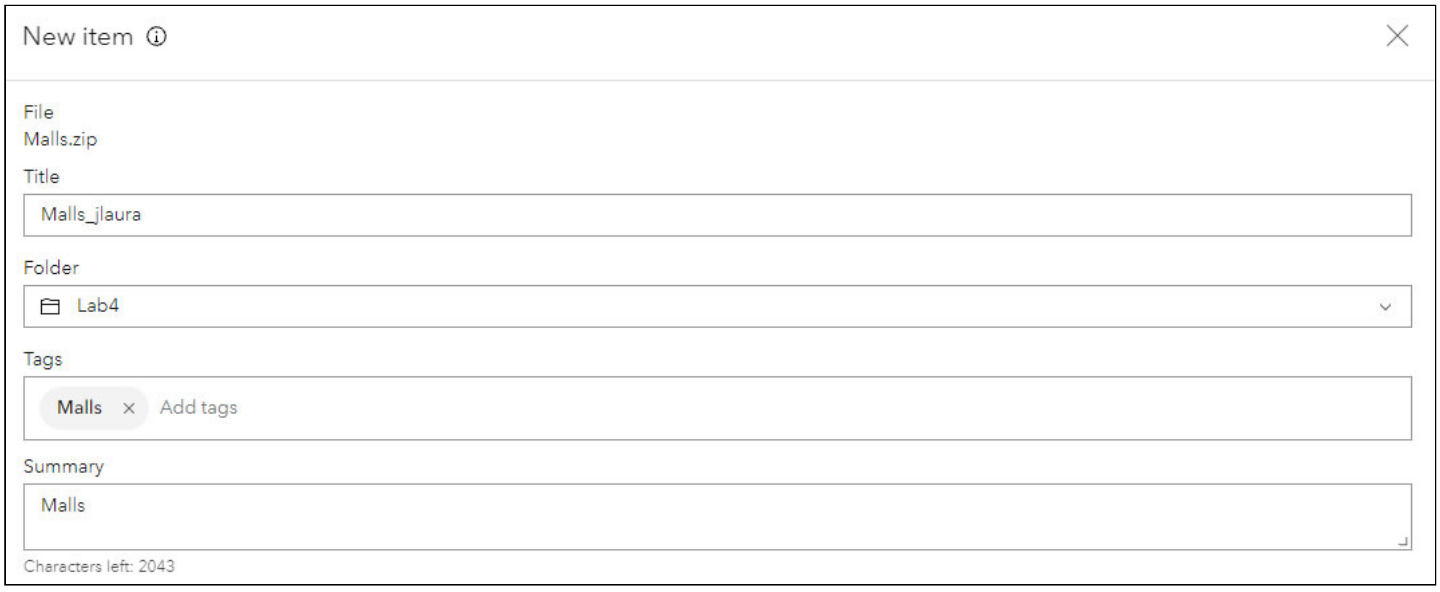
- Set the summary and tags as:



- Press **Save**

6. Go back to the **Content** tab → select the **Lab4** folder → **Add Item**

- Drag and drop the **Malls.zip** layer
- Choose: **Add "Malls.zip" and create a feature hosted layer** → Next
- Set the summary and tags as:

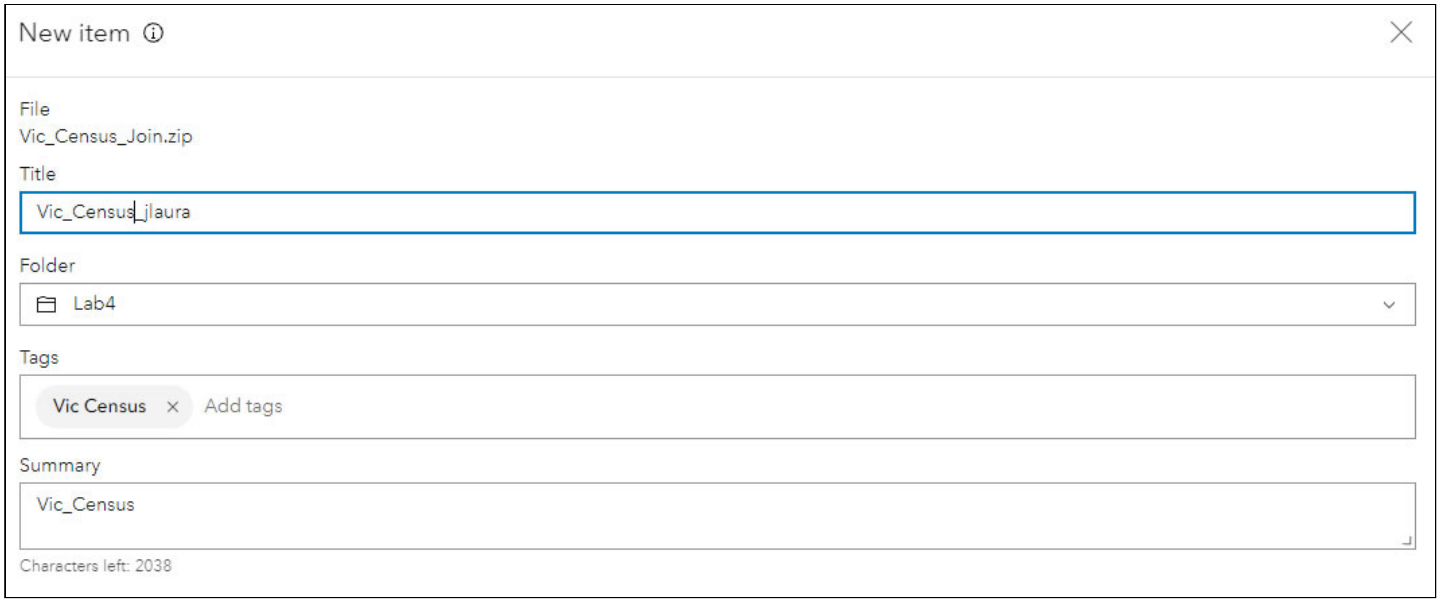


- Press **Save**

7. Go back to the **Content** tab → select the **Lab4** folder → **Add Item** → From your computer

- Drag and drop the **Vic_Census_Join.zip** layer

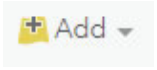
- Choose: **Add "Vic_Census_Join.zip" and create a feature hosted layer** → Next
- Set the summary and tags as:



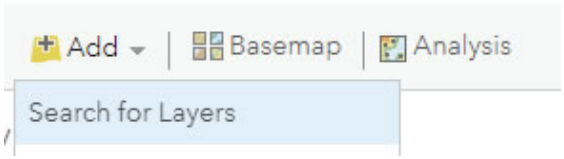
- Press **Save**

8. Once you have added the Census Tracts, use the Open in Map Viewer button to create an active map.

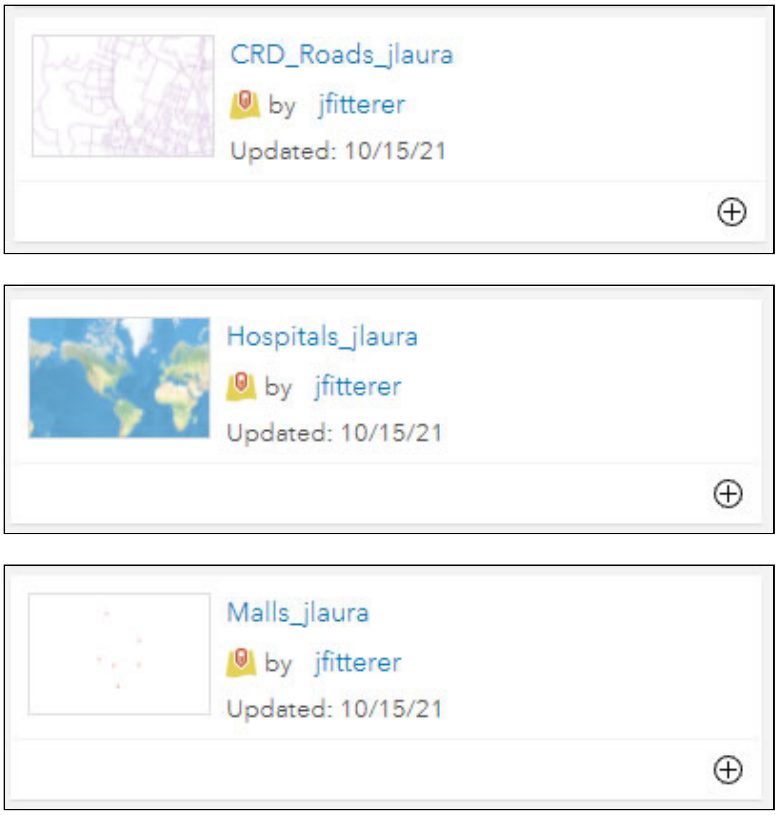
- Set symbology to "show location only" and press Done

9. From the details menu, go to **Add** data 

and **search for layers**



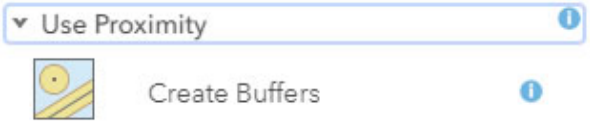
to add to the map:



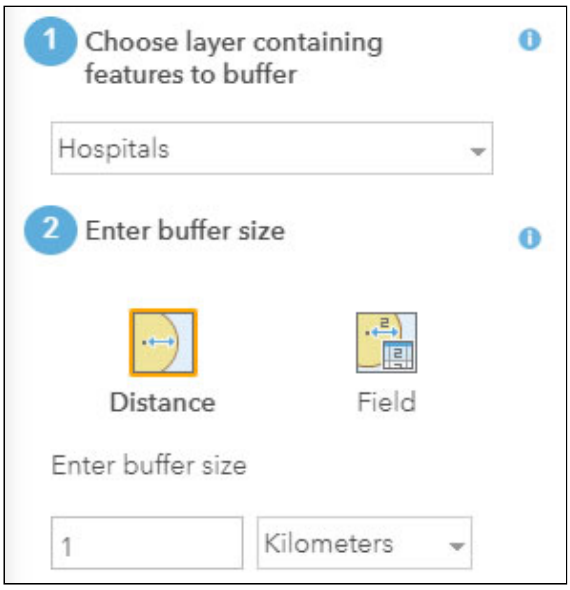
Point Buffer

HYPOTHETICAL SITUATION: The Capital Regional District (CRD) has commissioned a study to reduce noise levels around each hospital. They propose creating a one kilometre 'quiet' zone around all hospitals and they need to know the area (m^2) that will be affected for each hospital.

1. Open the **Analysis** menu, and select the **Create Buffers** tool

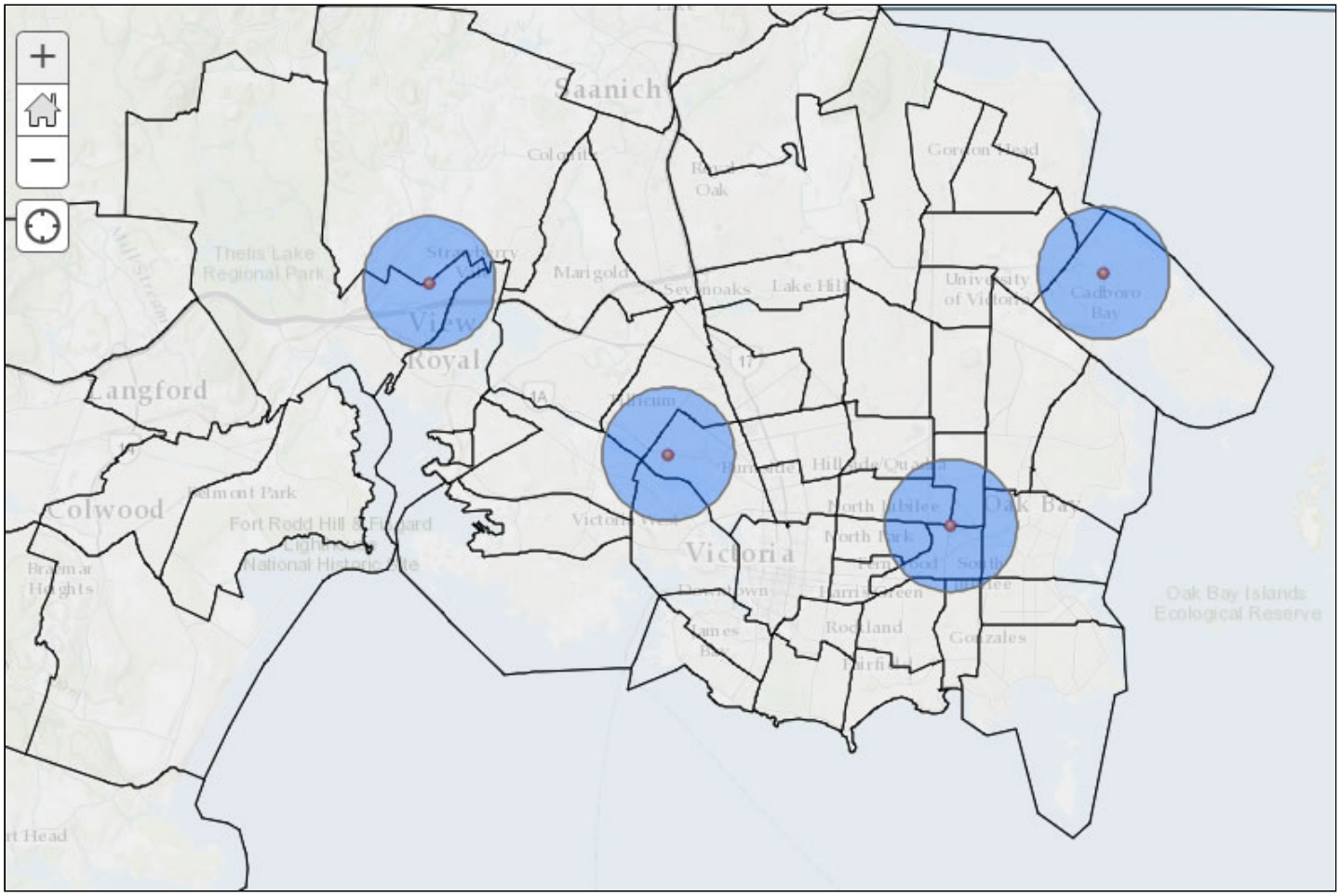


2. Enter the buffer size: 1 kilometer

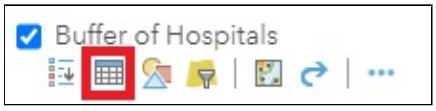


- Uncheck 

Press **Run Analysis**

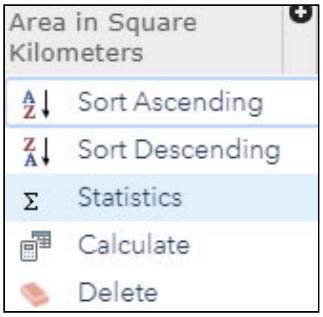


2. Open the Buffer of Hospitals Attribute Table

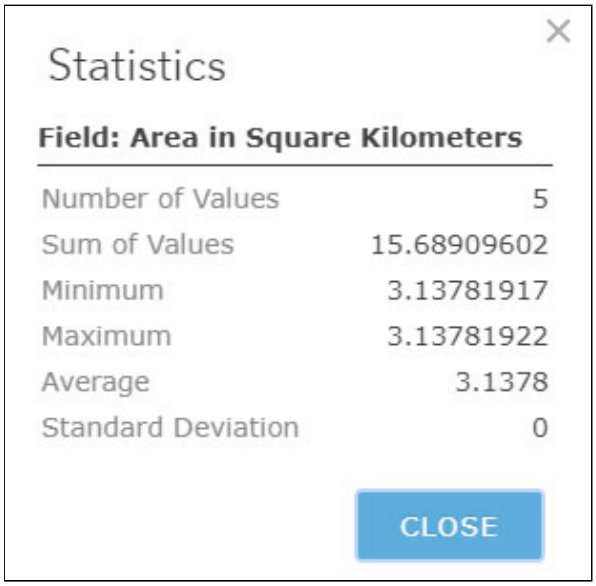


3. Scroll to the "**Area in Square Kilometers**" column

4. Calculate Statistics:



5. Read the sum of the statistics to get the **Total Area**:

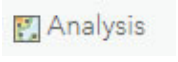


The total area is: 15.69km^2

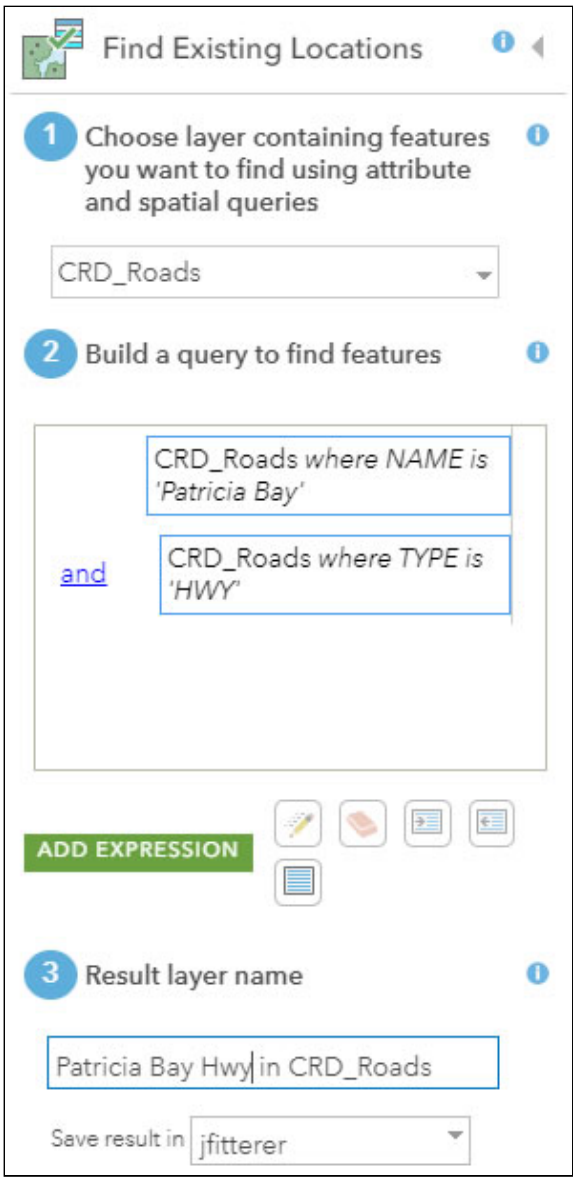
Line Buffer

HYPOTHETICAL SITUATION: The CRD is proposing a 100 meter no garbage zone around the Patricia Bay highway and they need to know how much land will be affected by this new policy (km^2).

Before you can begin to create the new buffer, you have to select 'Patricia Bay' from CRD_Roads layer (if you need a refresher on attribute queries, revisit Lab 3).

1. Select the Analysis  button

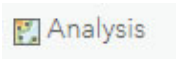
2. Navigate to the "**Find Existing Locations**" and enter the following query:



- Uncheck 

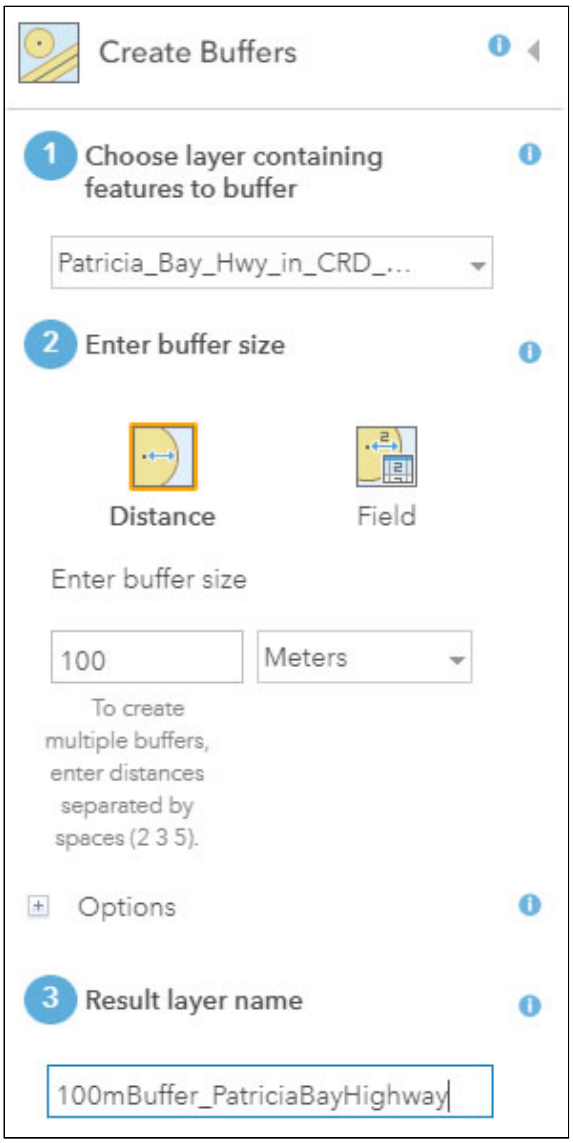
- Press **Run Analysis**

With the highway selected, you will create a 100m no garbage zone.

3. Select the Analysis 

button → Use Proximity → Create Buffers → set the parameters as follows:

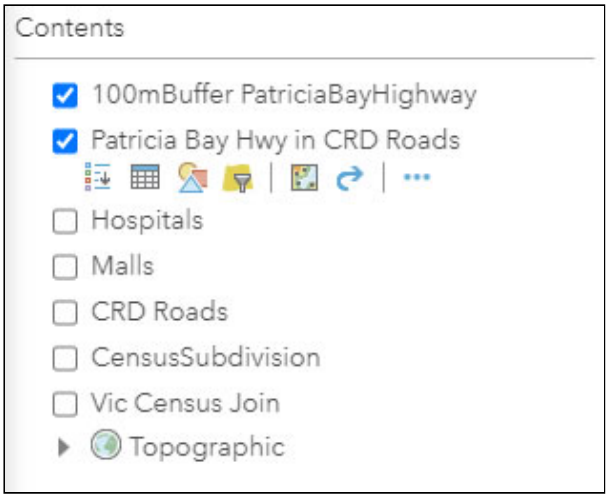
Choosing the Patricia Bay highway from the drop down, you can create the 100m buffer around the road.



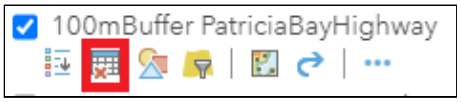
- Uncheck 

- Press **Run Analysis**

If you uncheck the other layers, you will will notice that the buffer created overlapping polygons.



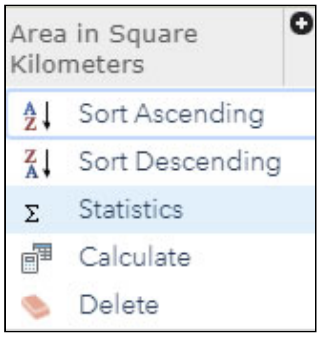
Also, if you open the layer's attribute table



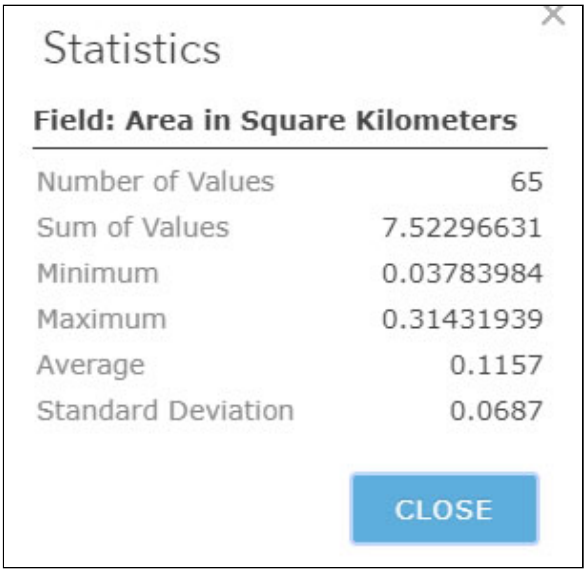
You will see the **Area in Square kilometers** column:

Area in Square Kilometers
0.04
0.04
0.04
0.05

- Right click → choose statistics:

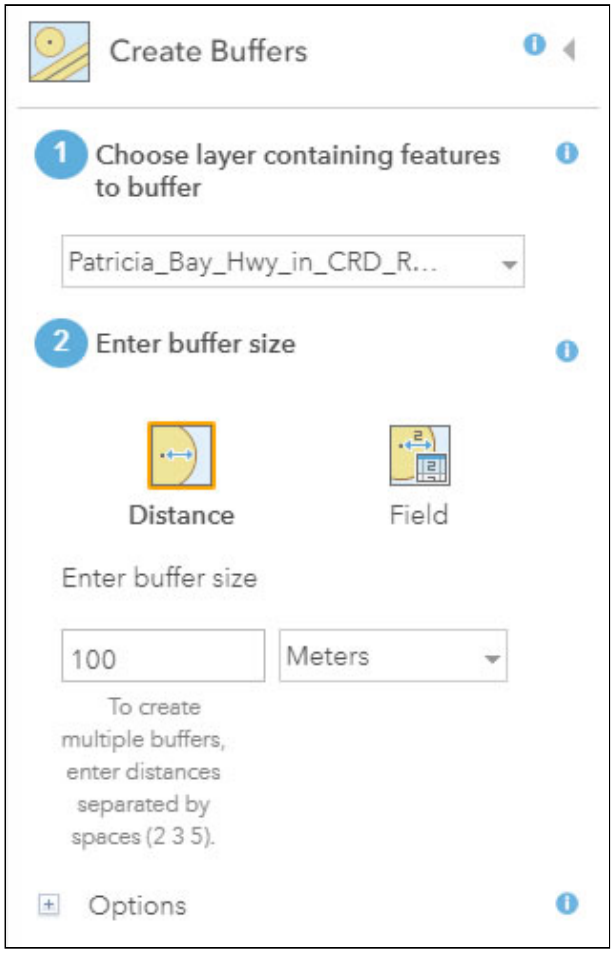


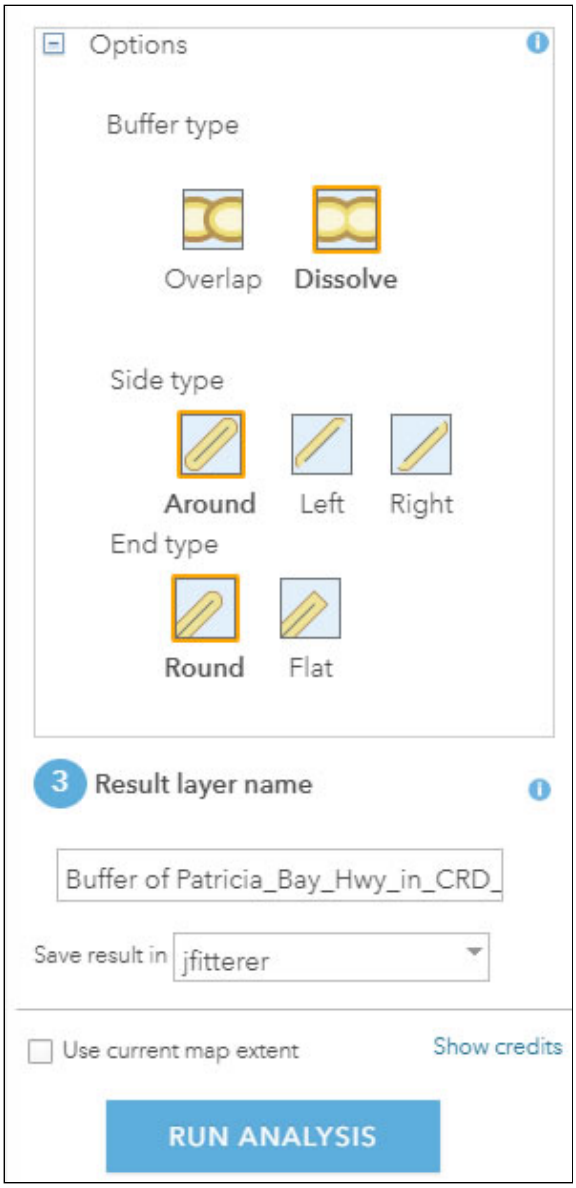
Read the **Sum of the Values** to get the total area (7.53km^2)



Now you will want to create a dissolved buffer around the road:

4. Select the Analysis button → Use Proximity → Create Buffers → set the parameters as follows:





- Press **Run Analysis**

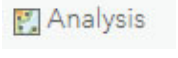
5. Open the **Attribute Table** for the **Dissolved 100m Buffer for the Patricia Bay Highway**

View the dissolved area:

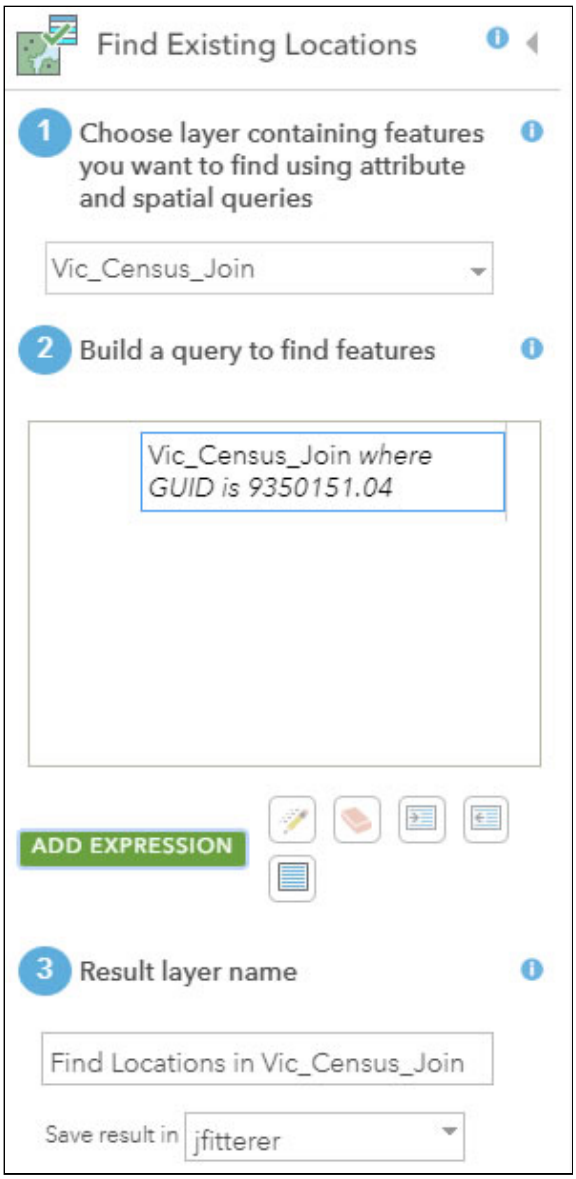
Buffer of Patricia Bay Hwy in CRD Roads (Features: 1, Selected: 0)	
Buffer distance in Meters	Area in Square Kilometers
100.00	5.52

Polygon Buffer

HYPOTHETICAL SITUATION: The Langford Association is considering a 'parking-free' zone around the downtown core to encourage people to shop there. Census tract 9350151.04 has been chosen, and they are contemplating a 250m zone outside that region. They need to know how much area km^2 will be affected.

1. Select the Analysis  button

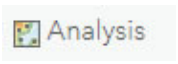
2. Navigate to the "**Find Existing Locations**" and enter the following query:



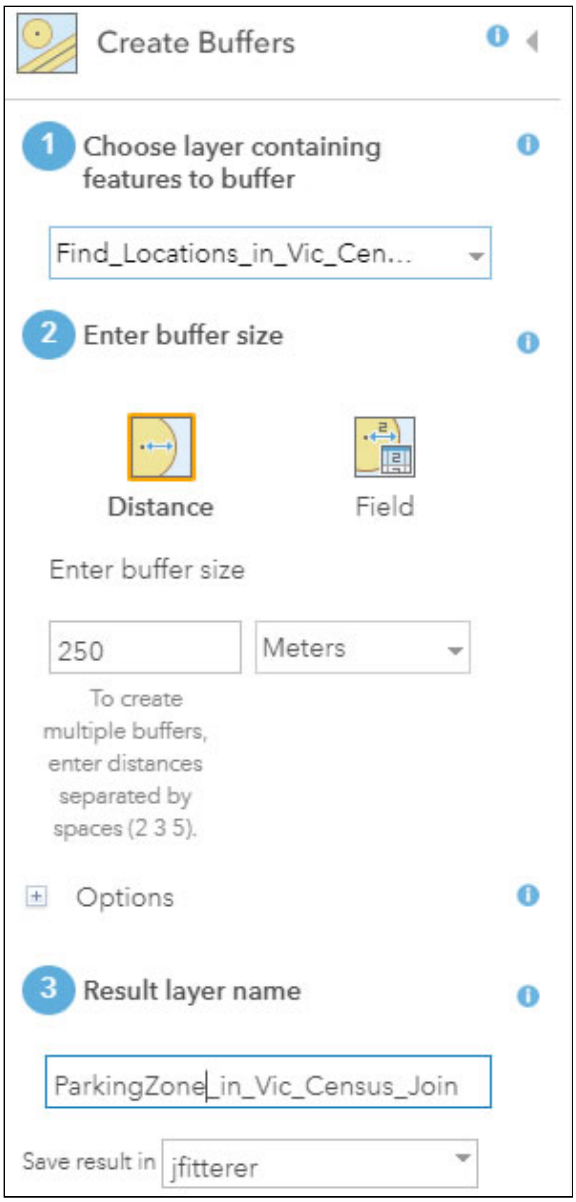
- Uncheck 

- Press **Run** Analysis

Now that the Langford census tract has been selected you can create the 250m parking-free zone.

1. Select the Analysis 

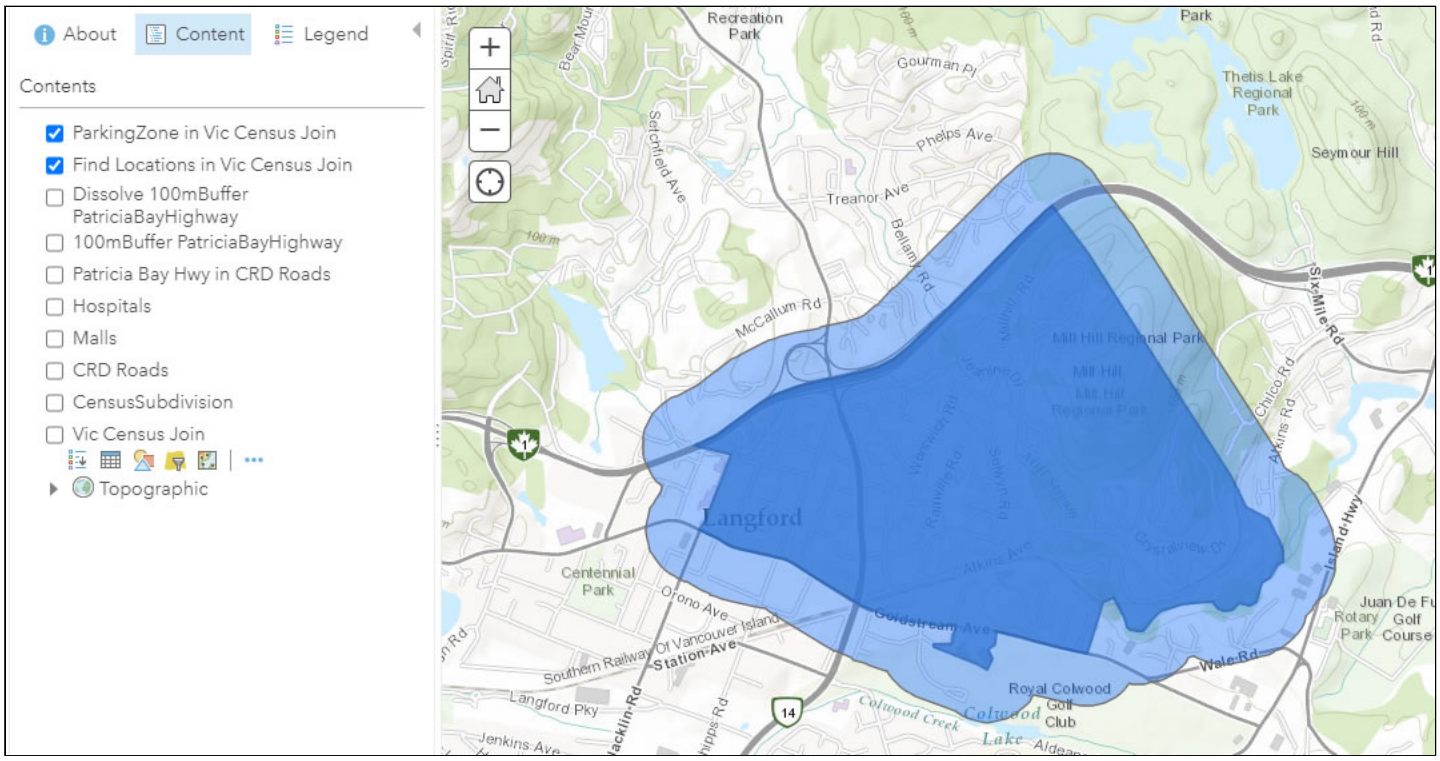
button → Use Proximity → Create Buffers → set the parameters as follows:



- Uncheck 

- Press **Run Analysis**

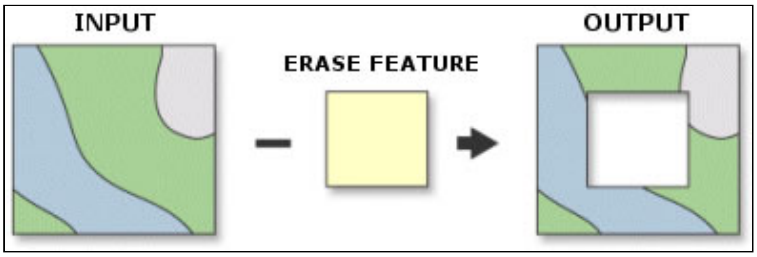
This will create a polygon that expands 250m around the 9350151.04 census tract

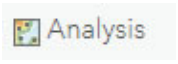


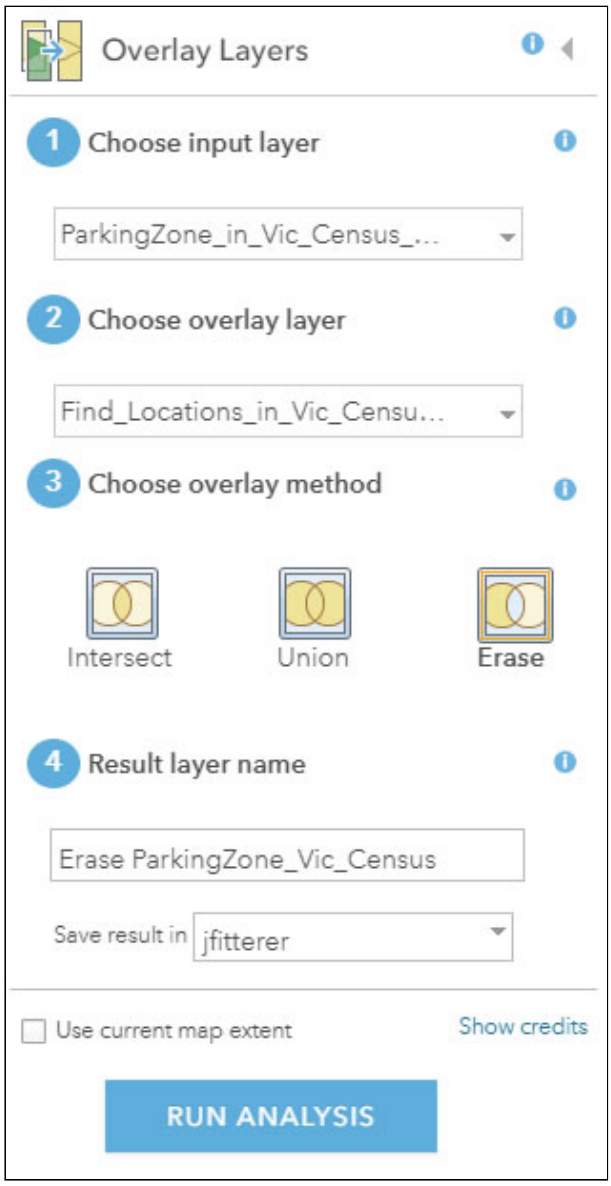
Overlay Types

Now you will need to remove the Langford census tract area from the buffer using the **Erase** Overlay tool.

The Erase tool "creates a feature class by overlaying the input features with the polygons of the erase features. Only those portions of the input features falling outside the erase features outside boundaries are copied to the output feature class" *https://pro.arcgis.com/en/pro-app/tool-reference/analysis/an-overview-of-the-overlay-toolset.htm*

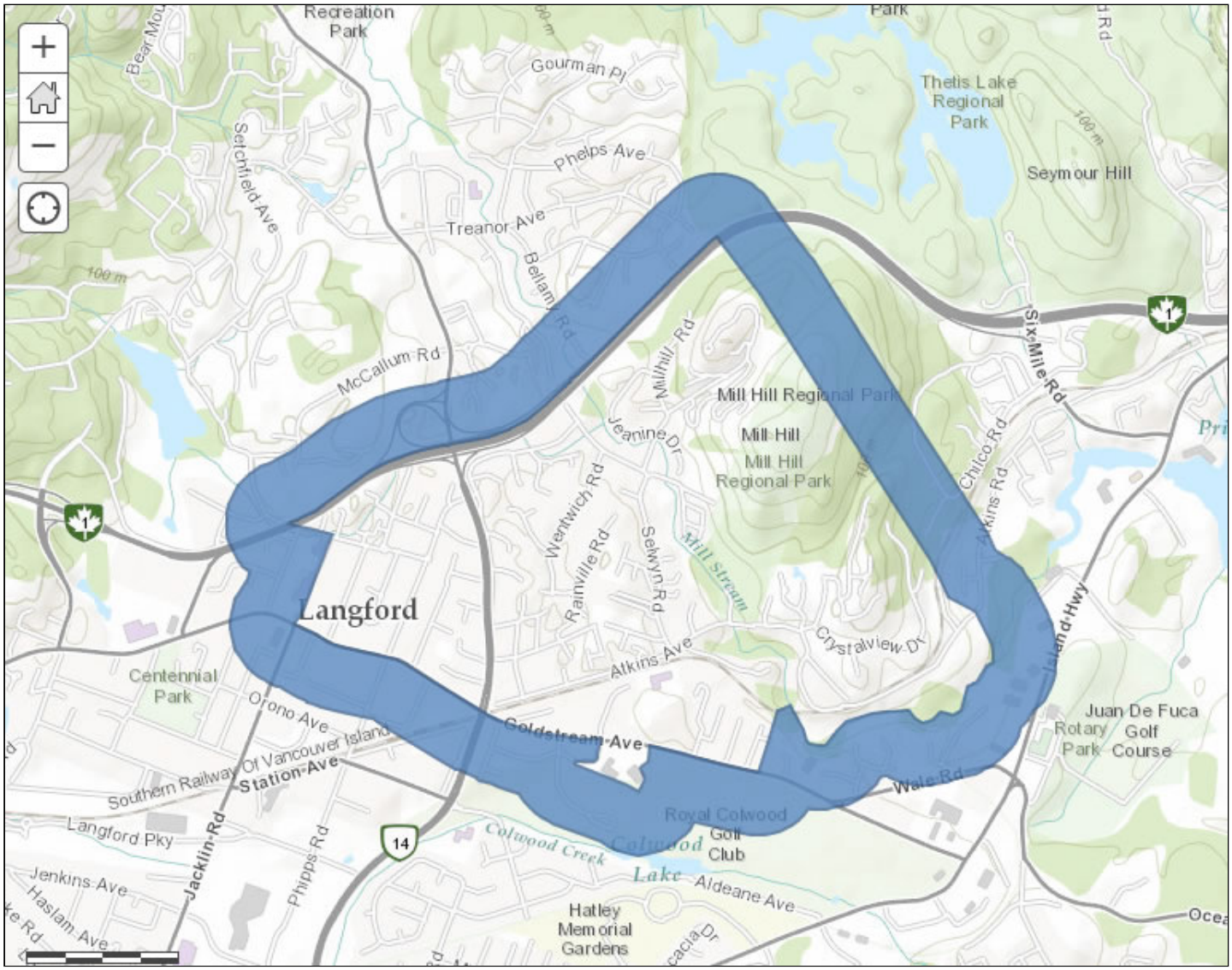


1. Select the Analysis  button → Manage Data → Overlay Layers → set the parameters as follows:



- Press **Run Analysis**

2. You are left with the erased feature, which is the 250m buffer around the Langford census tract.

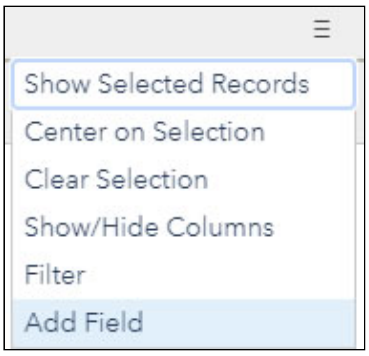


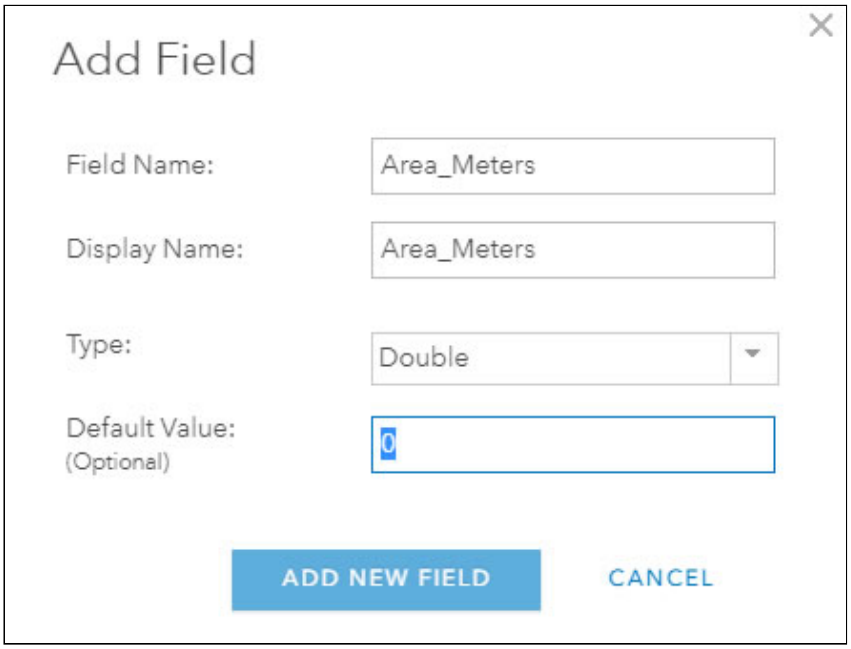
3. Now you can open the **EraseParkingZone Vic Census** layer to view the total area

Area in Square Kilometers
2.21

What happens if you want to know the Square Area of the polygon in meters or another unit?

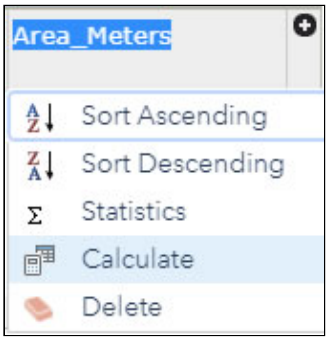
1. First you will create a new **Area** column, by using the **Add Field** to the attribute table.



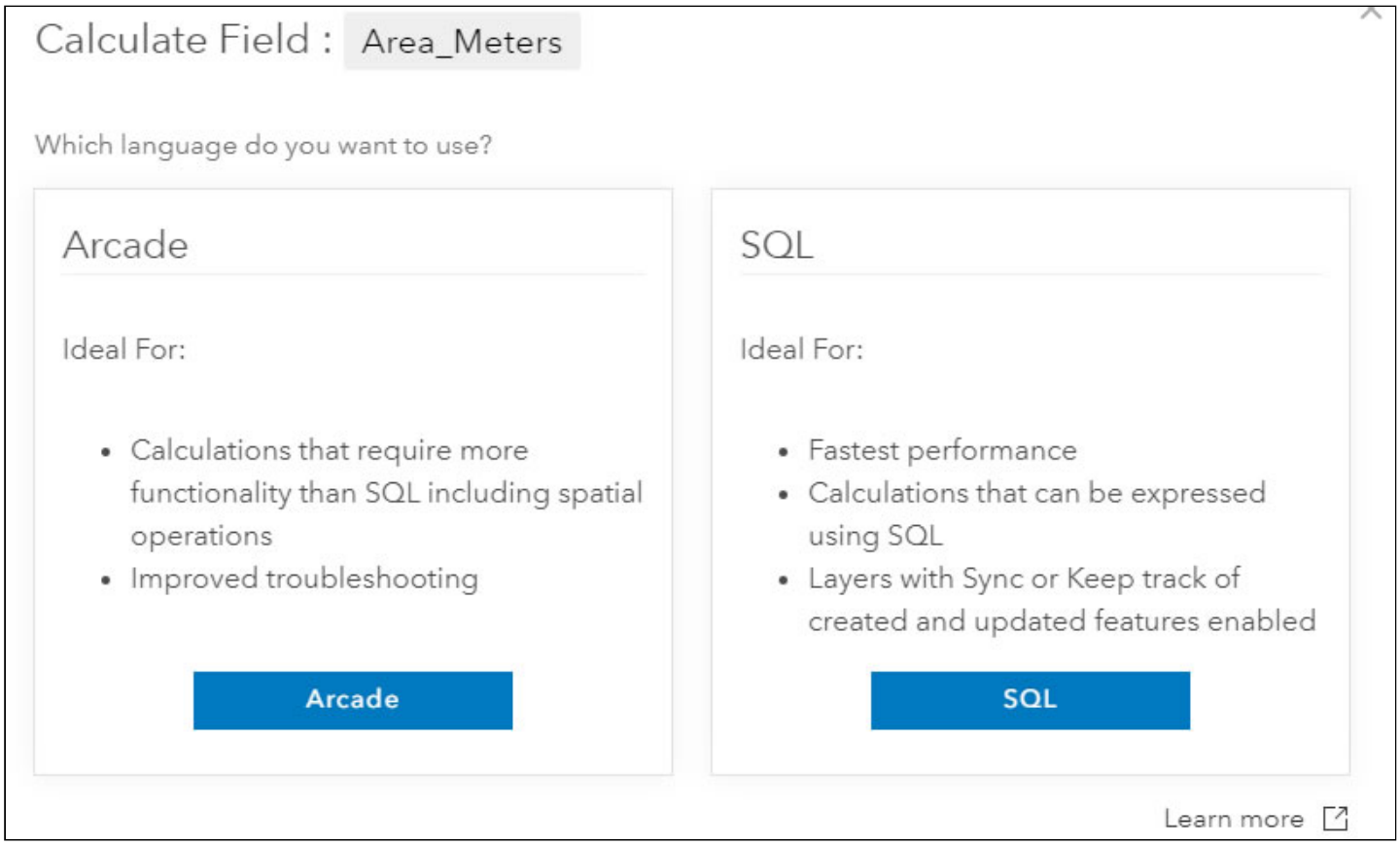


- Press "Add New Field"

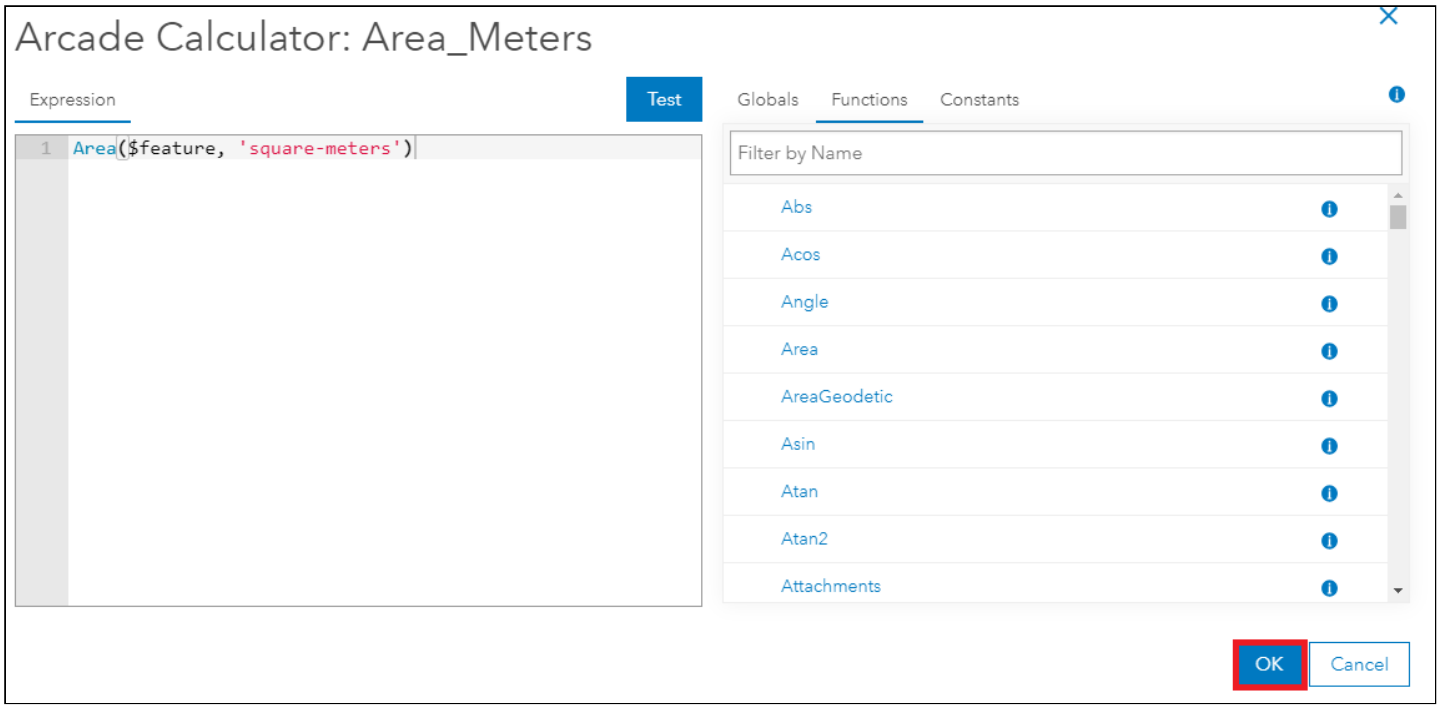
3. In the **Attribute Table** scroll to the new **Area_Meters** column and use the drop down to calculate the Area.



- Choose the **Arcade**



- Select "**Functions**" and choose **AreaGeodetic**
- **AreaGeodetic($feature, 'square-meters')**
- Press **OK**



Intersect

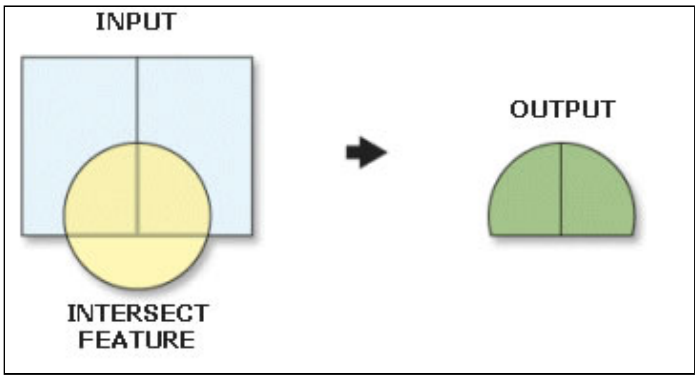
Intersect computes an intersection of the input layers. Features or portions of features which overlap in all feature classes/layers will be written to the output feature class. The input and overlay layers can be points, lines or polygon geometry.

If the inputs have different geometry types (line on polygon, point on line, etc), the output geometry type will default to the same as the Input features with the lowest dimension geometry. For example, if one of more of the inputs are points, the default output will be a point; if one or more of the inputs are lines, then the output will be a line; if all outputs are polygon, then the output will be polygon.

Use intersect when you want a resulting layer that:

A. has the combined attribute data of the features in the input and overlay layers, and

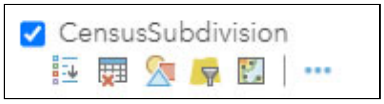
B. only contains features that fall within the spatial extent of the overlap.

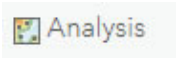


Source: http://pro.arcgis.com/en/pro-app/tool-reference/analysis/an-overview-of-the-overlay-toolset.htm

Let's revisit the example above but this time you want to isolate the malls within the Victoria census subdivision. The resulting output will only contain the malls within the Victoria region.

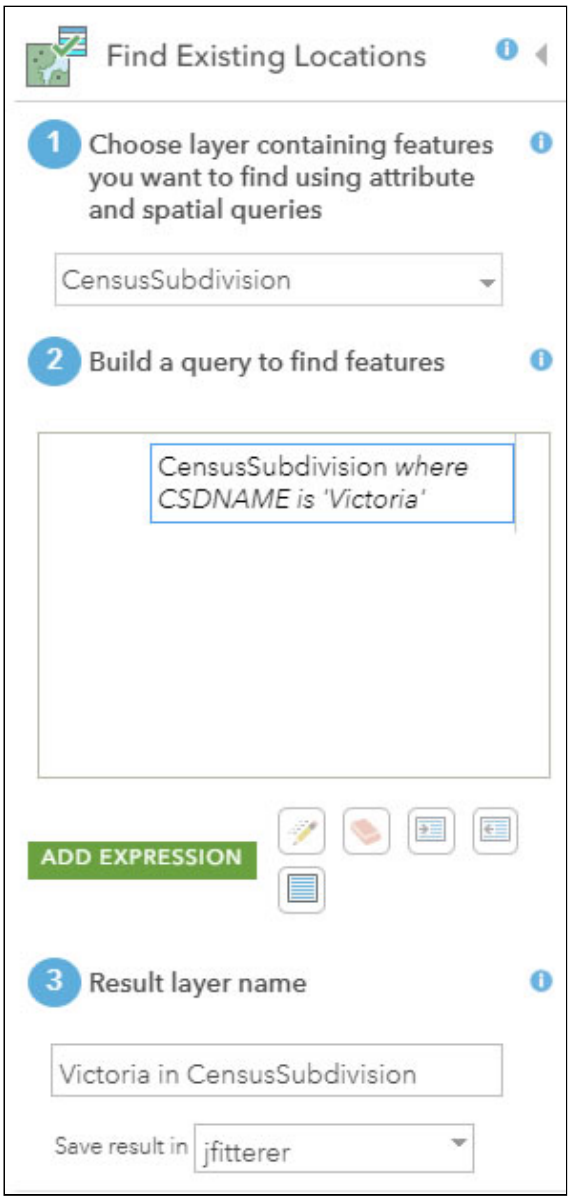
1. Turn the **CensusSubdivision** layer on in the content menu to identify the **Victoria** region from the **CensusSubdivision** layer

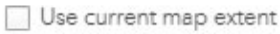


2. To identify the **Victoria** region from the **CensusSubdivision** file, select the Analysis 

button → Find Existing Locations → set the parameters as follows:

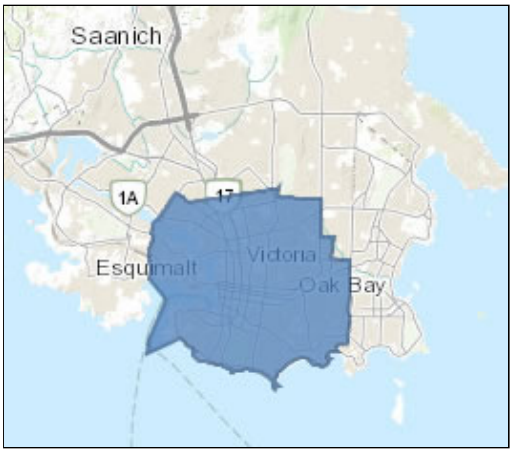
Note, that you have to use the unique value options to search for the Victoria title from the CSDName column when creating the query.

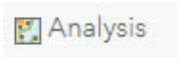


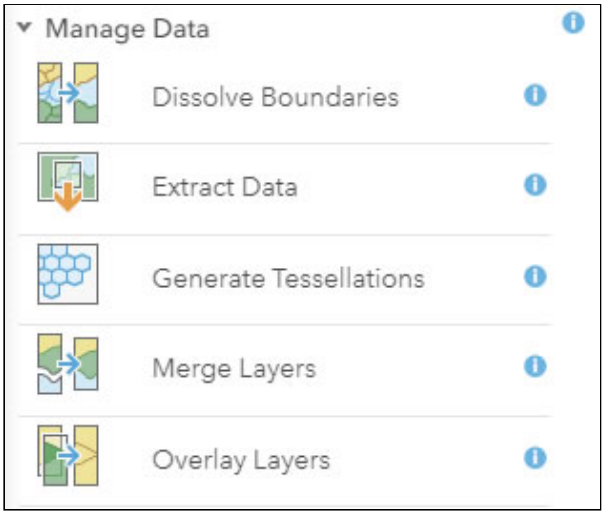
- Uncheck 

- Press **Run Analysis**

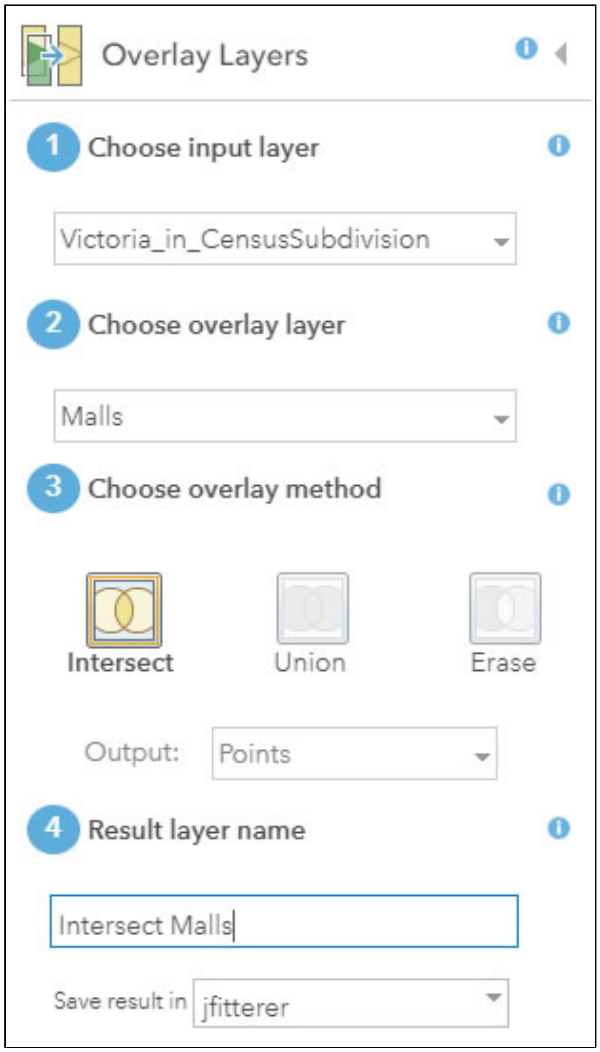
The output region will be the Victoria Census Area:



3. To run the intersect, go to the Analysis  button → Manage Data → Overlay Layers

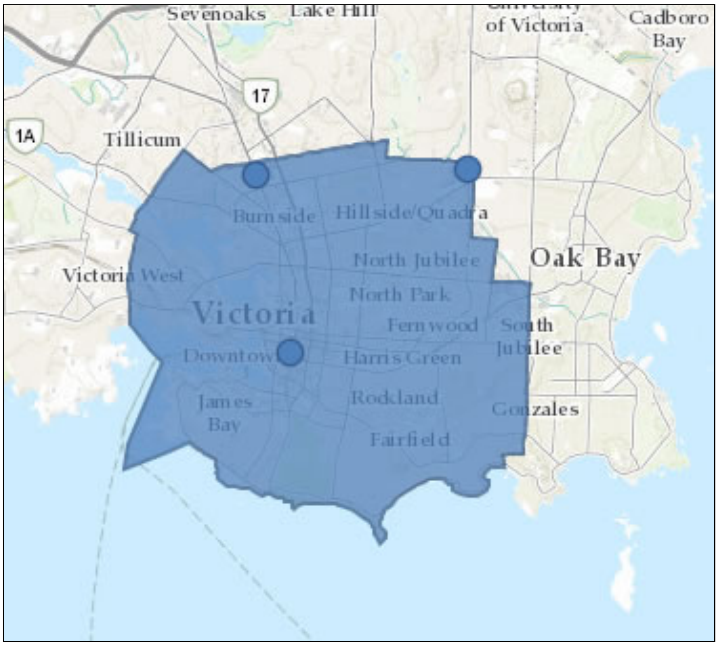


- Set the parameters as follows:



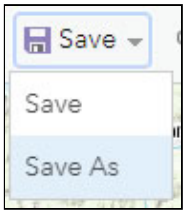
- Uncheck 

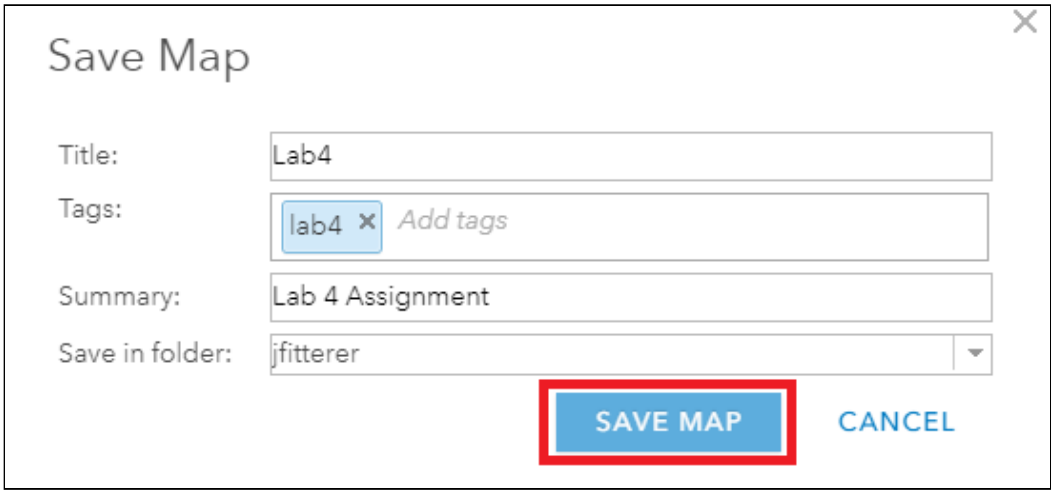
- Press **Run Analysis**



Now you have identified the malls within the Victoria census region.

If you would like to save the map, select Save from the dropdown menu and then select Save As





Assignment