Spatial Analysis with ArcGIS Pro

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Welcome! The workshop will start shortly.

Download the slides here:

https://tinyurl.com/ProAnalysis

Spatial Analysis with ArcGIS Pro

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https://tinyurl.com/ProAnalysis

What We'll Cover

01	02	03	04	05
Intro/GIS as a problem-solving tool	**Planning a spatial analysis workflow**	**Map Creation & Analysis**	**Sharing & Collaboration**	**Resources**

1. Introduction

The Map and Data Library

- Data collections
- Workshops and training
- In-person and virtual support

Robarts Library

7th Floor

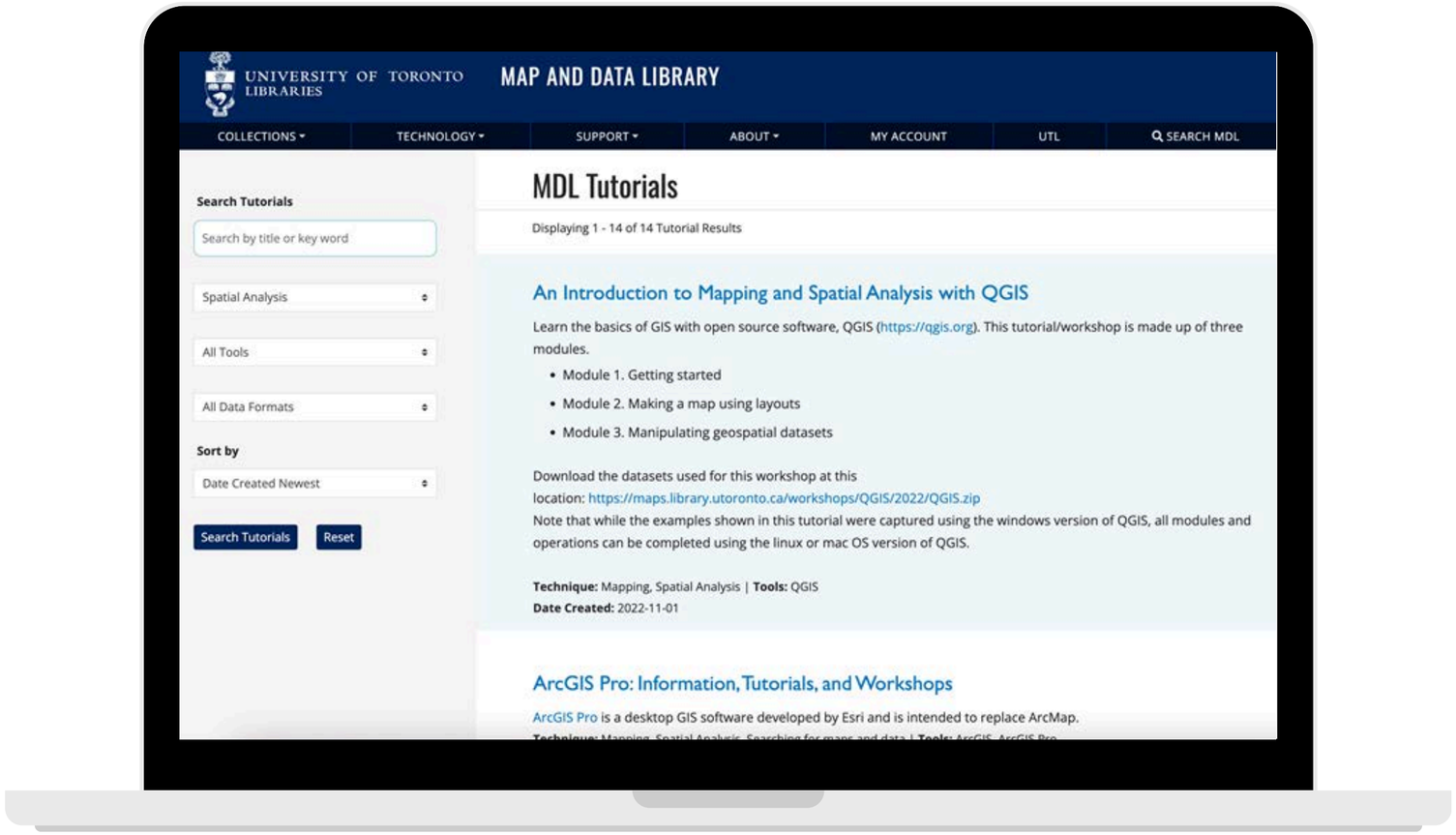
Open 11am - 5pm weekdays by appointment

https://mdl.library.utoronto.ca/

1. Introduction

MDL: Tutorials and Workshops

https://mdl.library.utoronto.ca/support/tutorials



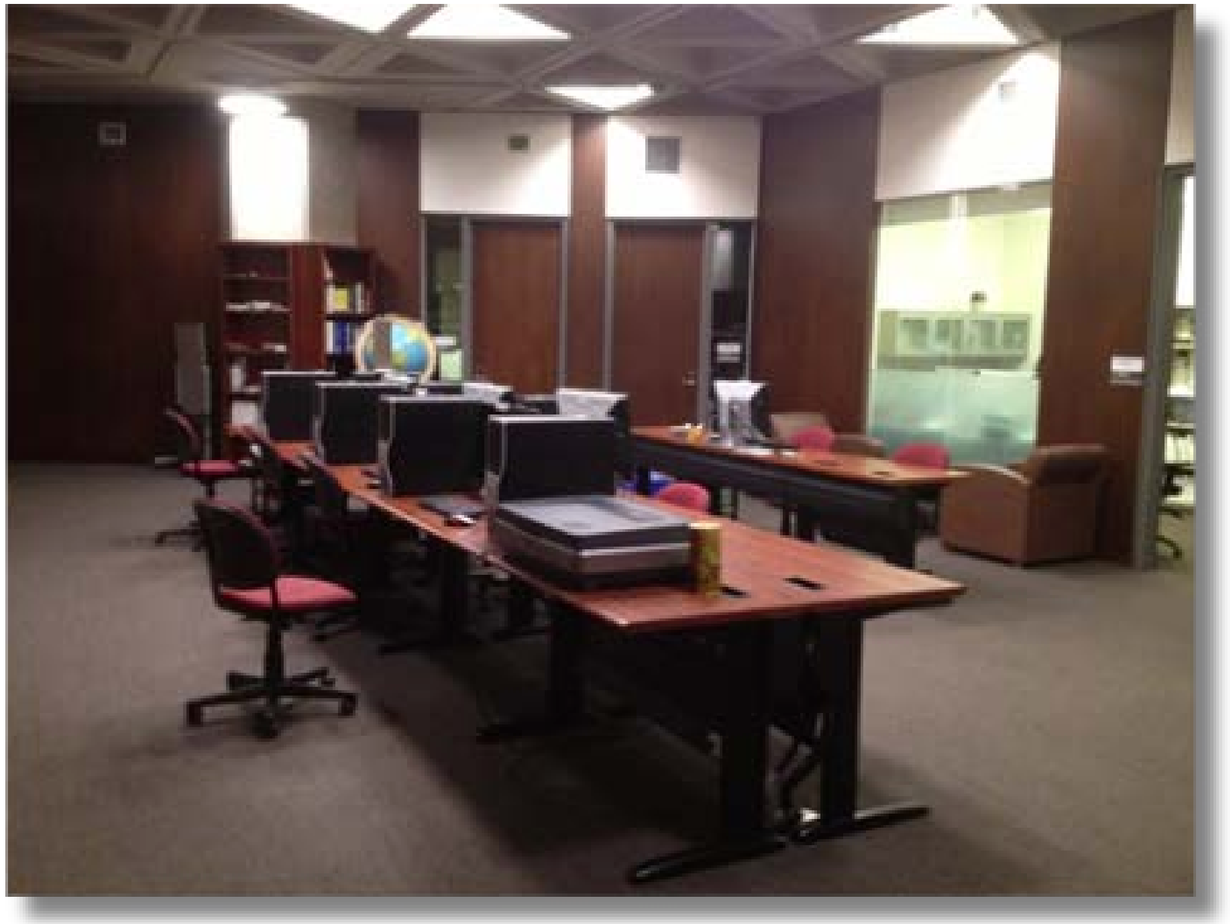
Map and Data Library: Getting Help

Virtual support:

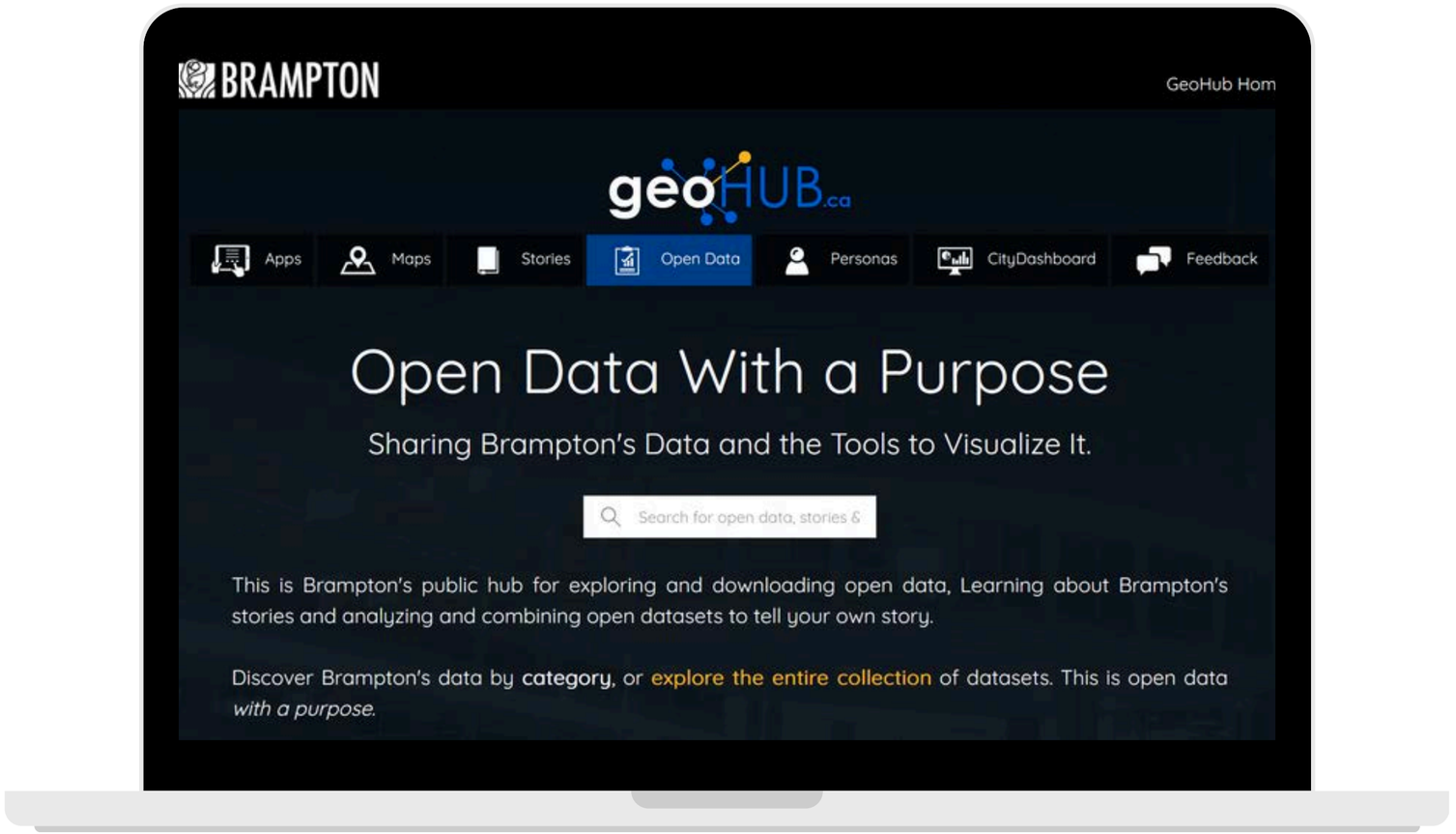
- Email us to get started
  mdl@library.utoronto.ca

In-person support:

- Reference Area:
  Robarts, 7th Floor
  Monday-Friday, 11am-5pm
  (by appointment)



1. Introduction
Open Data



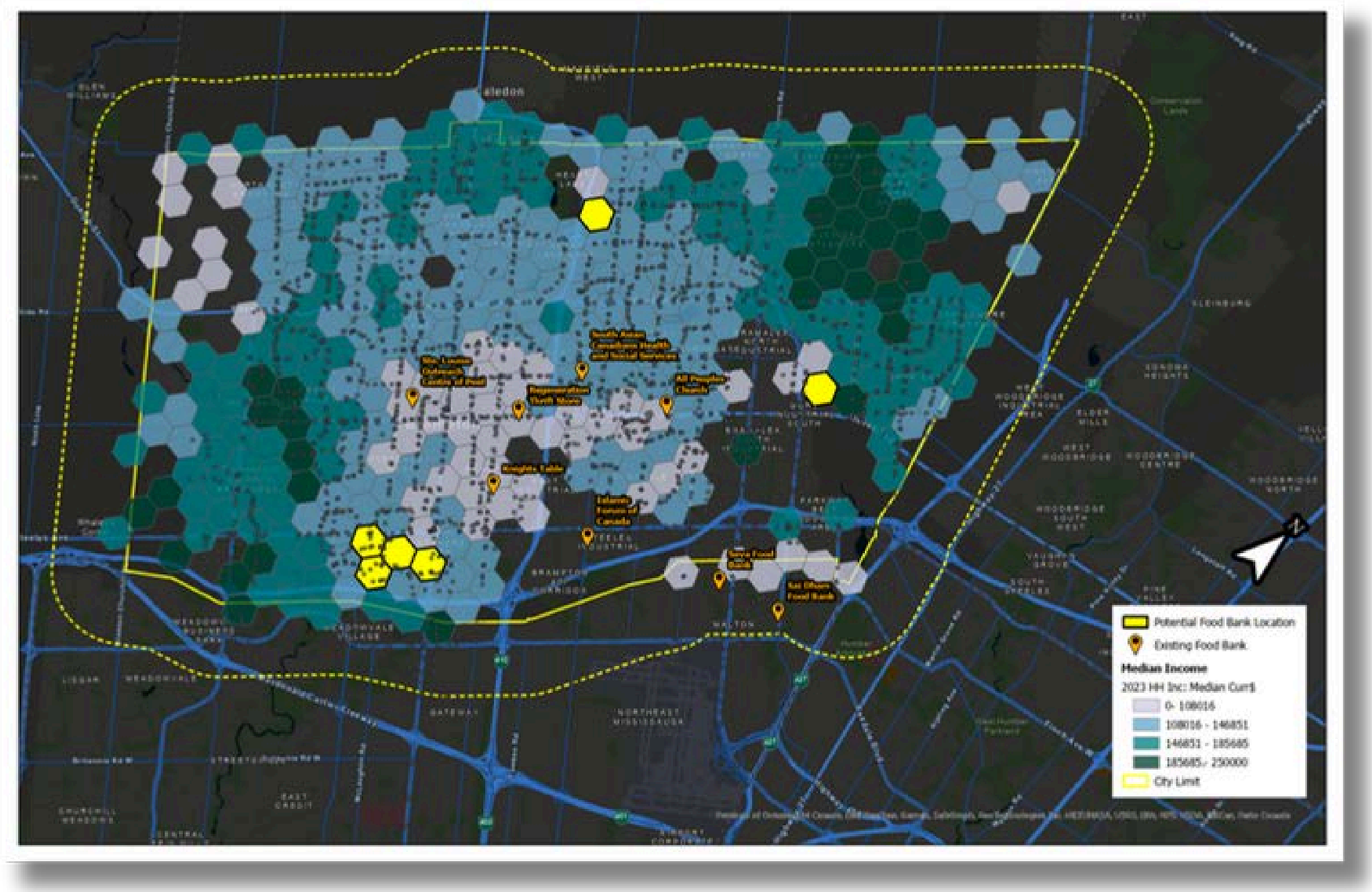
1. Introduction

Spatial Problem Solving Example: Public Health

- Identify health trends by location
- Find locations to implement new services for those at risk
- Track infectious diseases
- Study how demographic factors affect the health of communities
- Report on cases of a virus

1. Introduction

- This is the map we'll create.



Photograph by Bill Bradzo CC by SA 2.0

1. Introduction

Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

- What are the criteria to determine the best locations?
  - Income level?
  - Population density?
  - Existing resources?
  - Transportation network?
  - Land use?
  - Community needs?

Photograph by Bill Bradzo CC by SA 2.0

Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

- What **spatial** and/or **statistical data** will we need to locate or create?
    - Road network?
    - Demographic data from the Canadian Census?
    - Existing services?
    - Health statistics?

Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

- What tools/software will be used?
  - ArcGIS Online?
  - ArcGIS Pro?
  - QGIS?

Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

- How will the results be shared?
  - Reports?
  - Interactive web maps?
  - Dashboards?
  - Presentations?
  - Posters?

1. Introduction

Designing a GIS project

Find and assess spatial data

- MDL Website, Open Data, ArcGIS Online/Living Atlas, etc.
- Create your own data if needed.
- Assess data quality, software compatibility, completeness, licensing.

Map creation, symbolization & analysis

- Style, Labels, Filters, etc.
- Use analysis tools to gain insights.

Sharing & collaboration

- Results can be shared as digital data, printed as map layouts, or uploaded to ArcGIS Online and shared as interactive web maps.

2. ArcGIS Pro

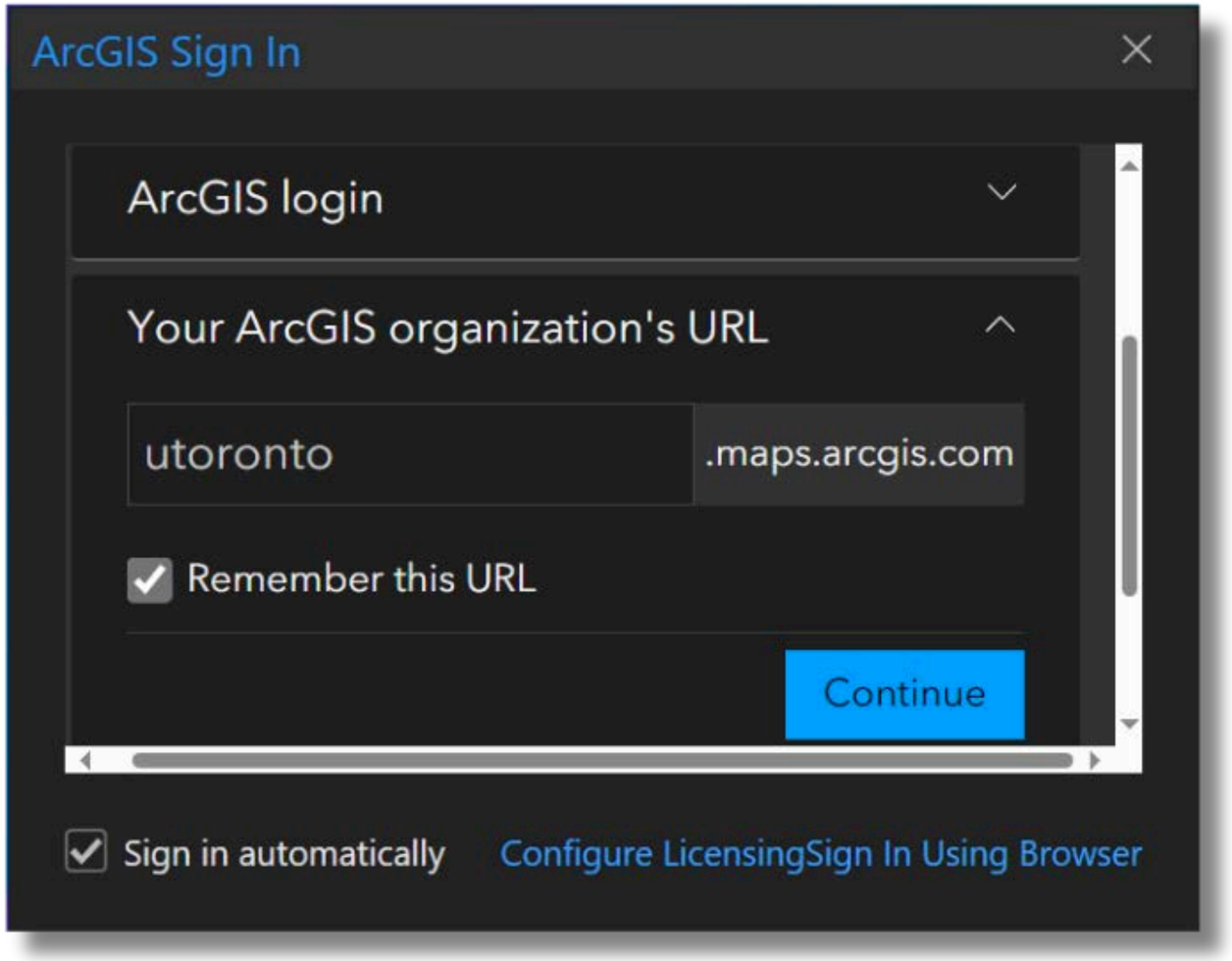
Professional desktop GIS application

Create/analyze/share maps and data

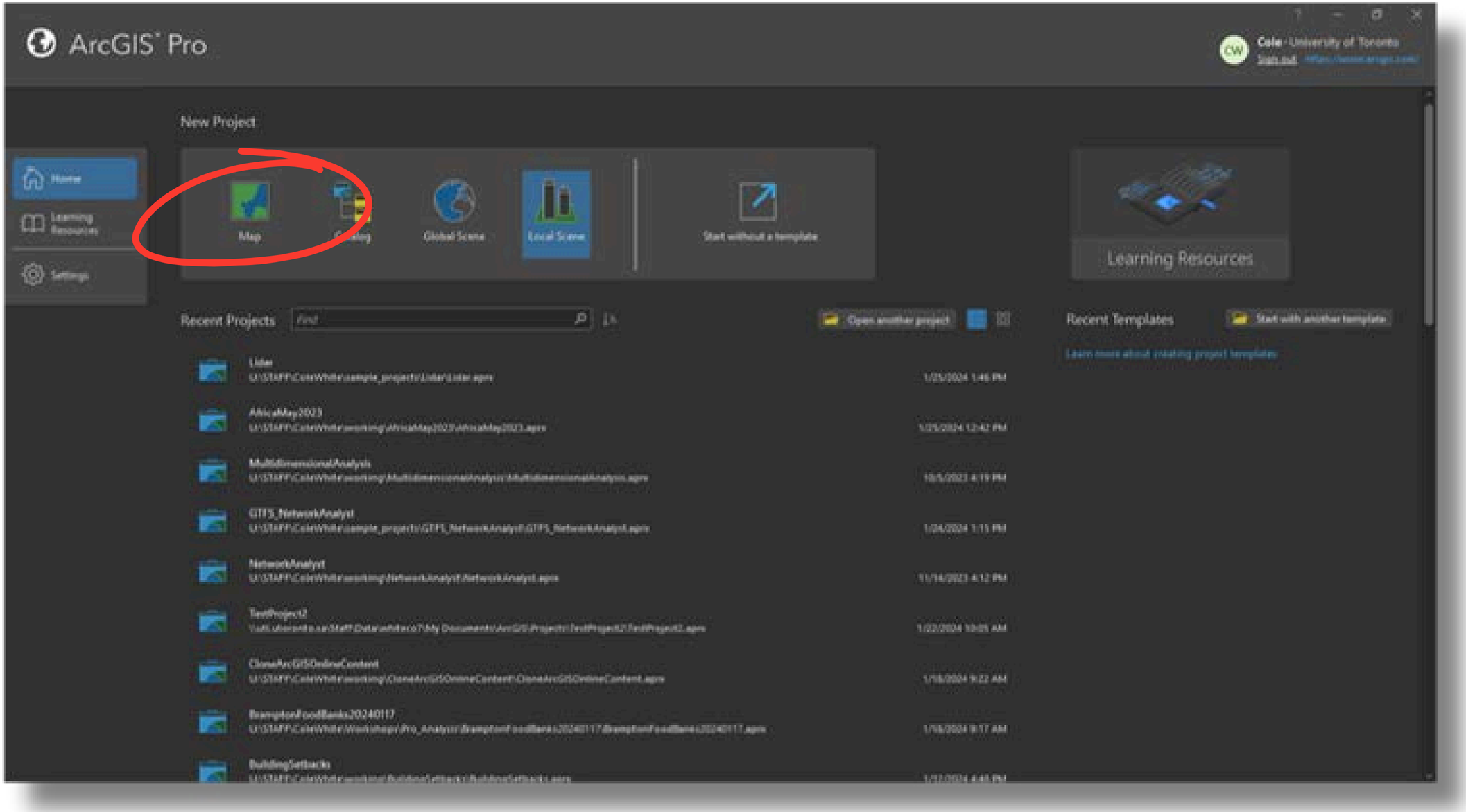
Modern user interface

2. ArcGIS Pro

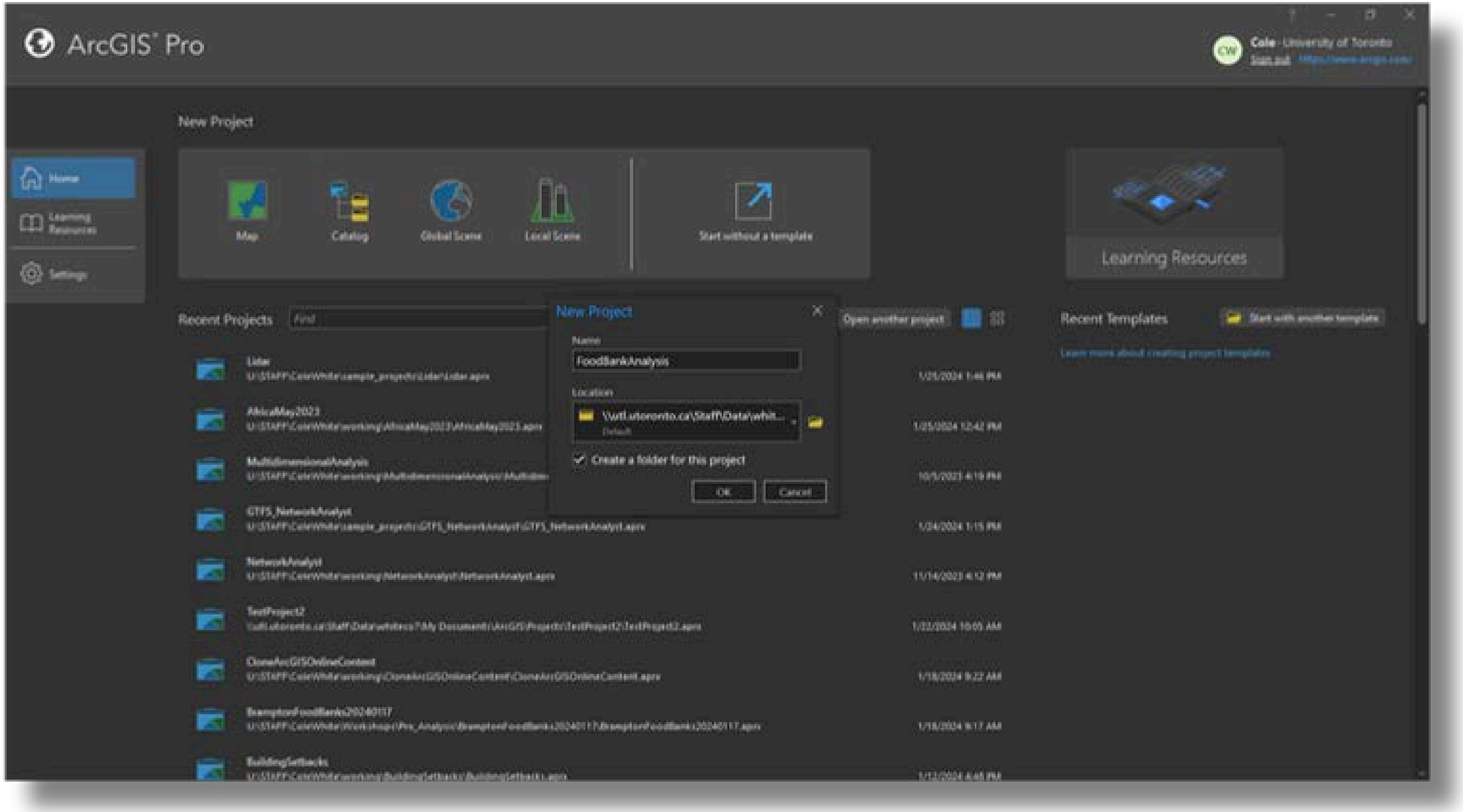
Logging In



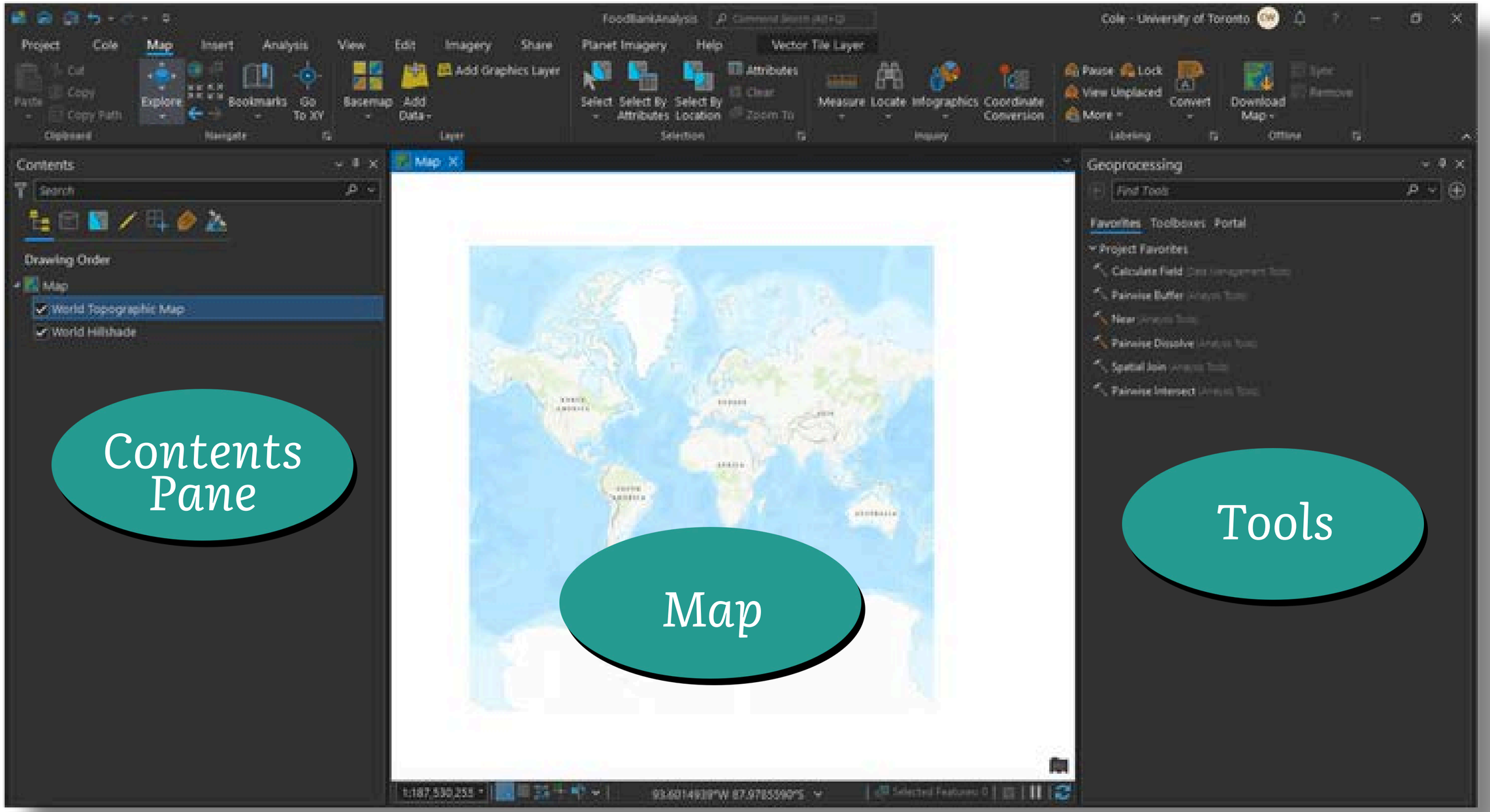
Creating a new Project



Creating a new Project

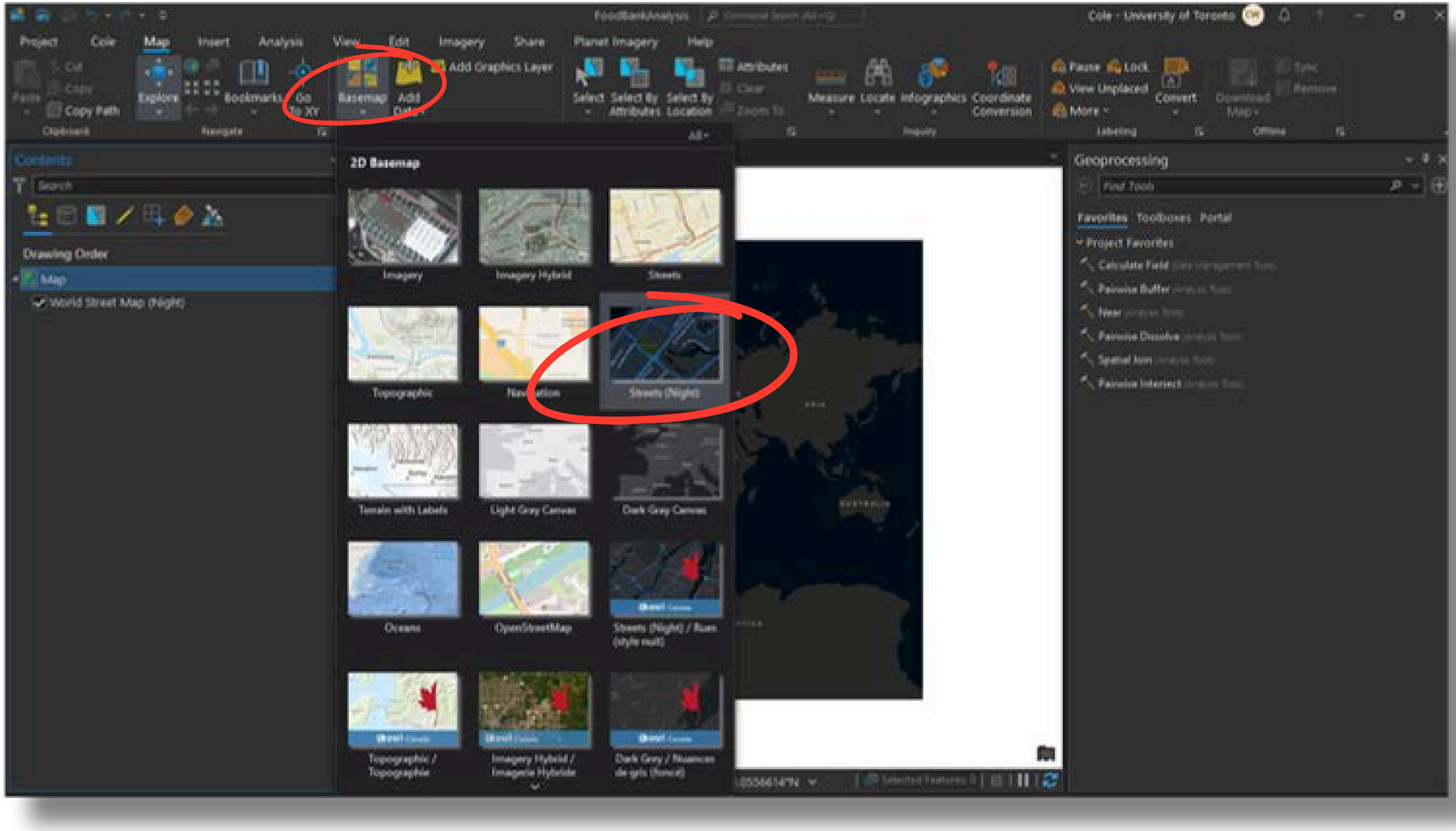


2. ArcGIS Pro



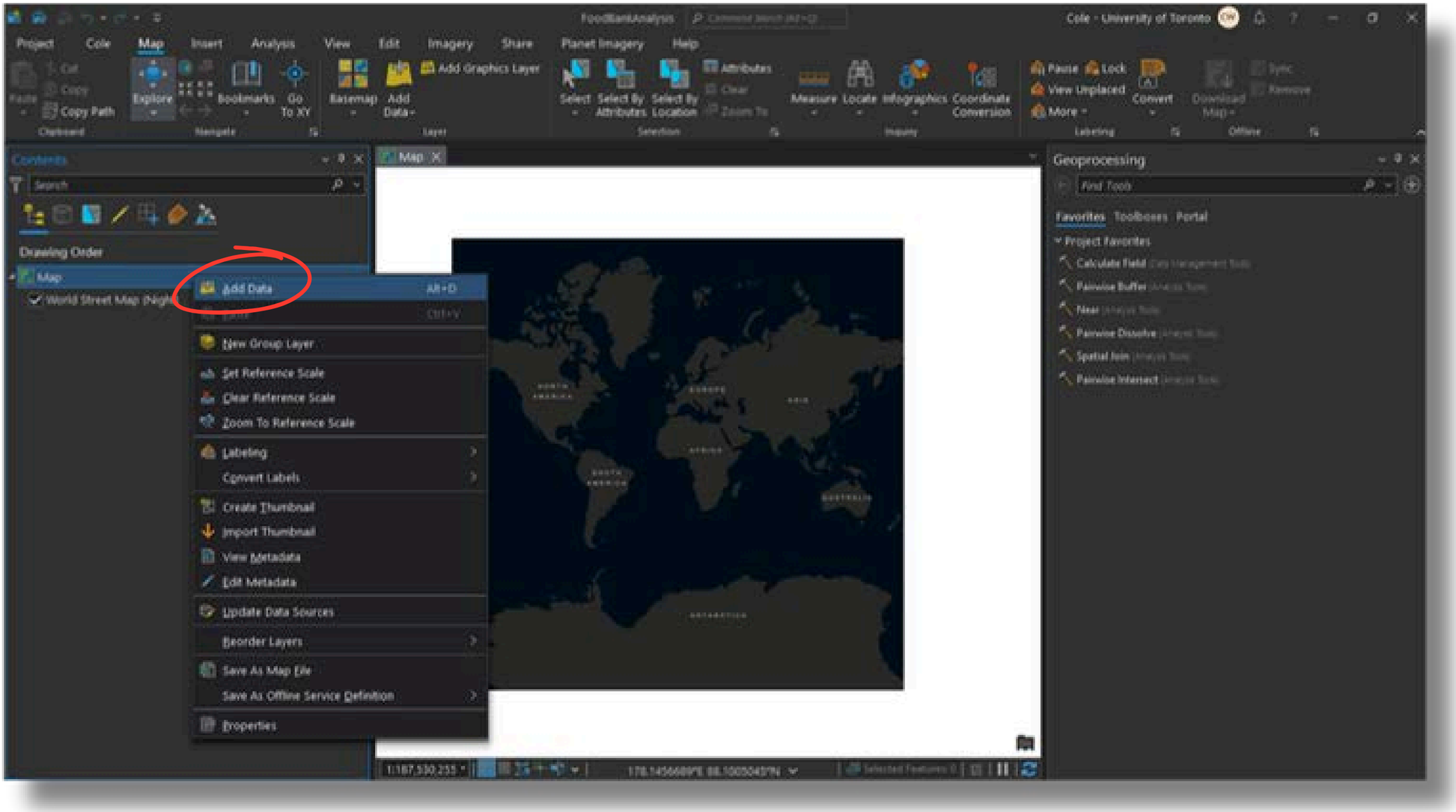
2. ArcGIS Pro

- Change the **Basemap**.



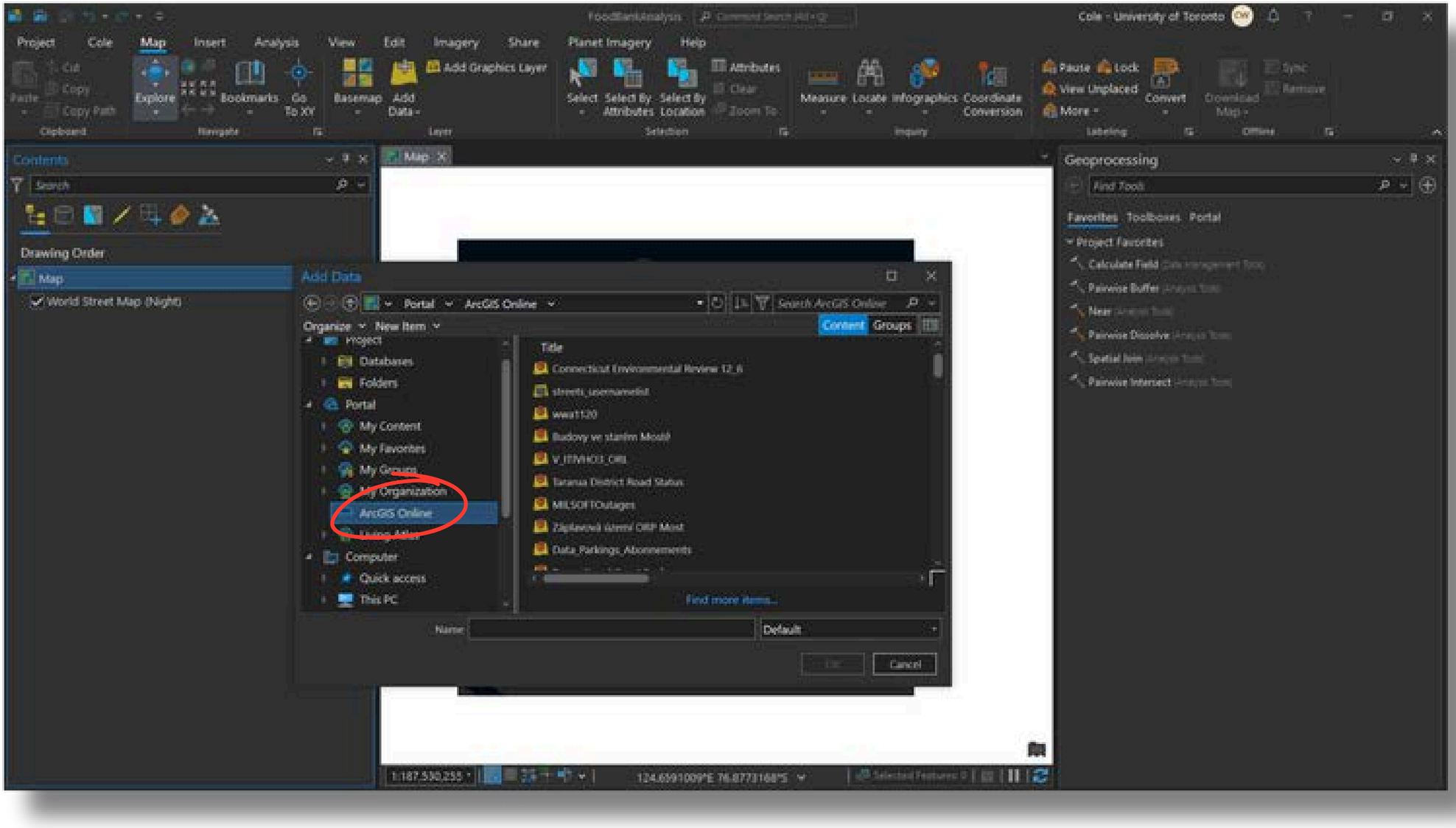
2. ArcGIS Pro

- Add Data.



2. ArcGIS Pro

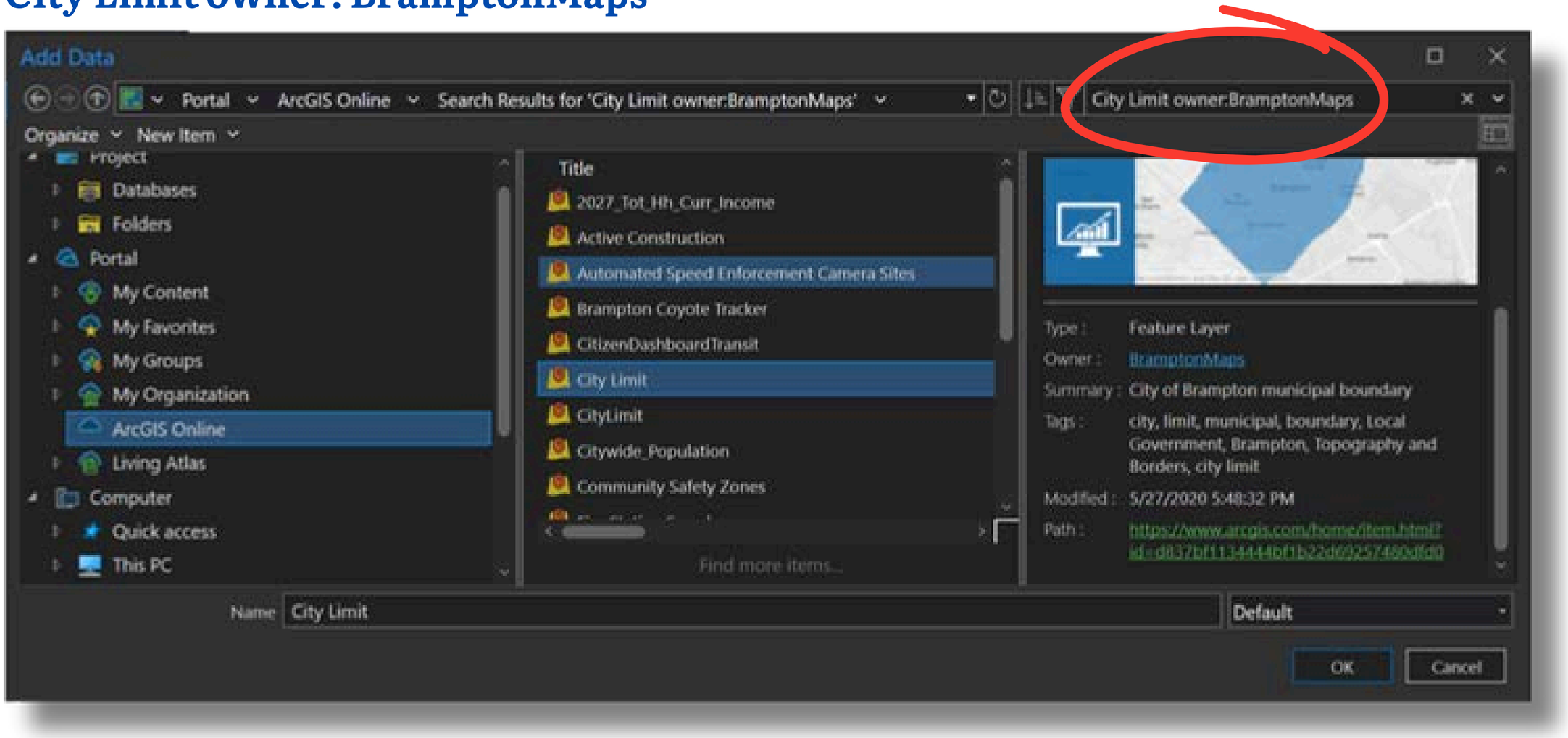
- Choose **ArcGIS Online.**



2. ArcGIS Pro

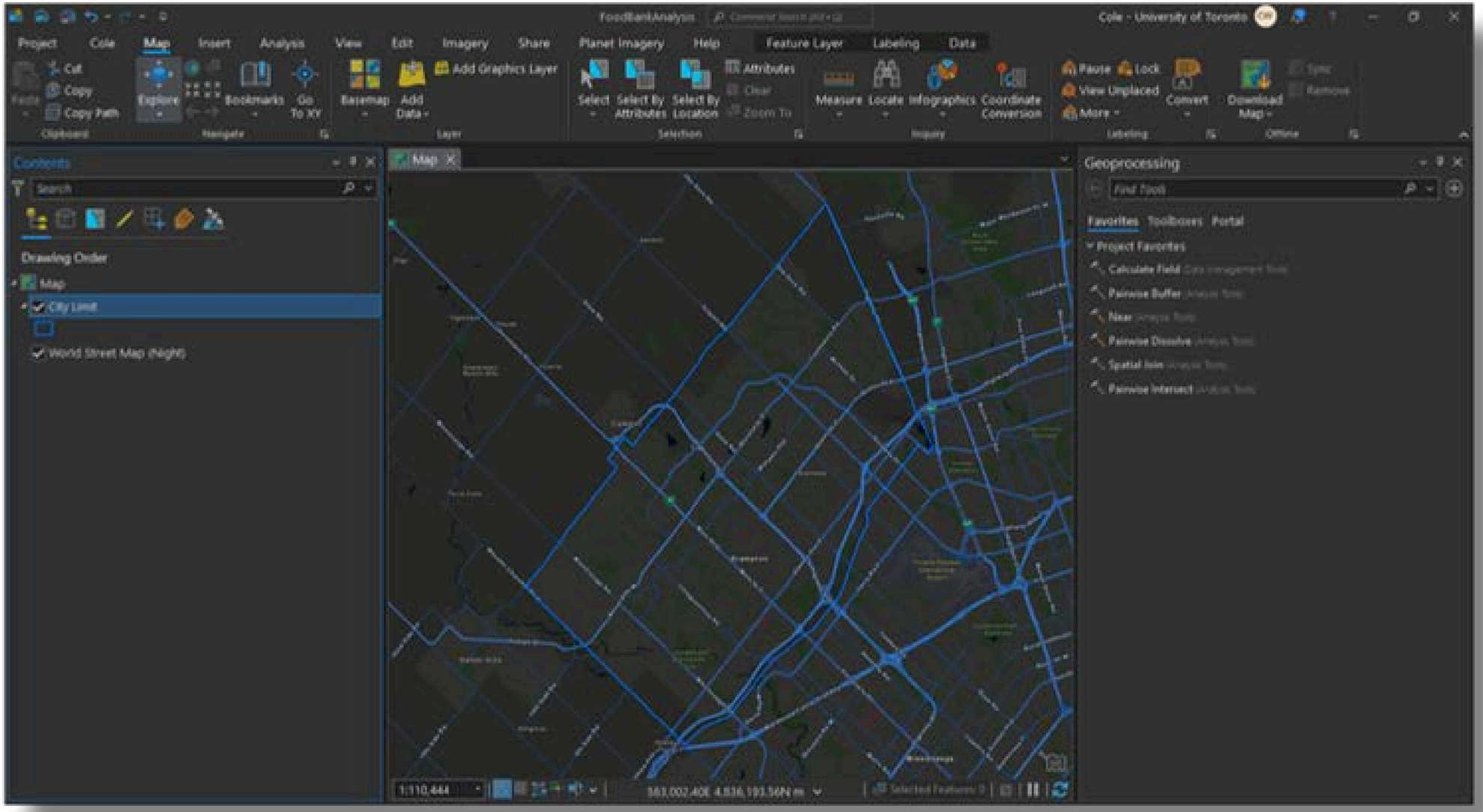
- Search for:

City Limit owner: BramptonMaps



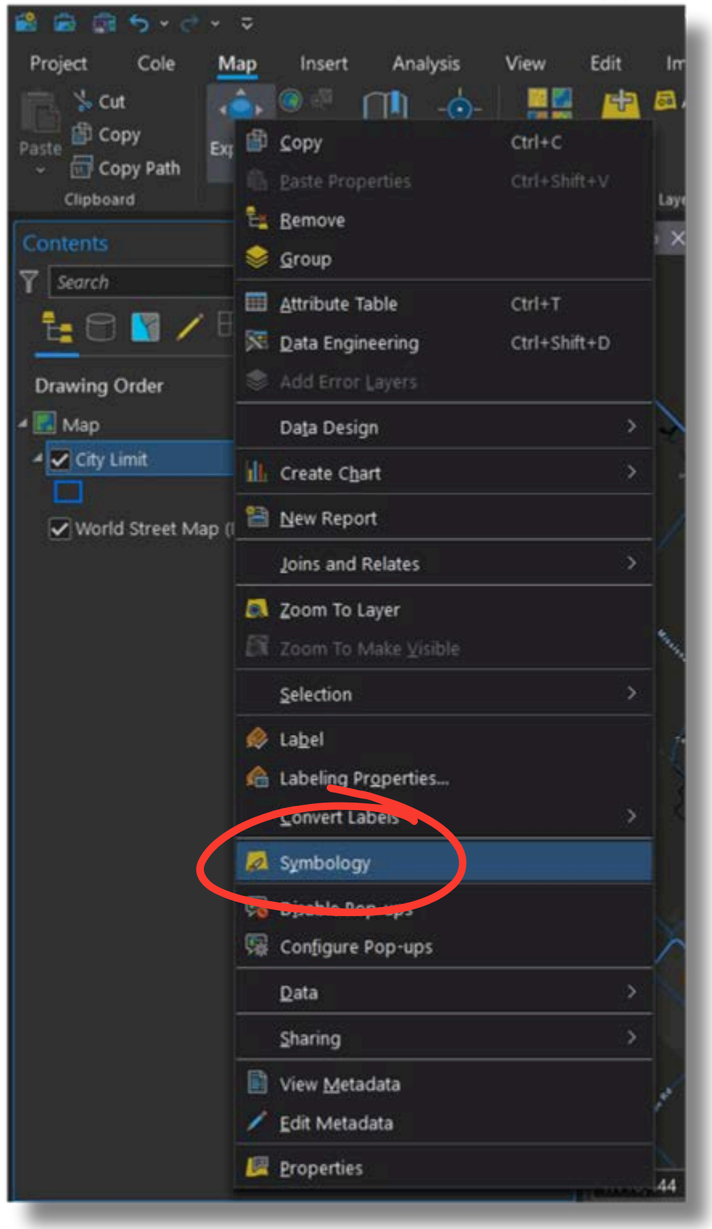
2. ArcGIS Pro

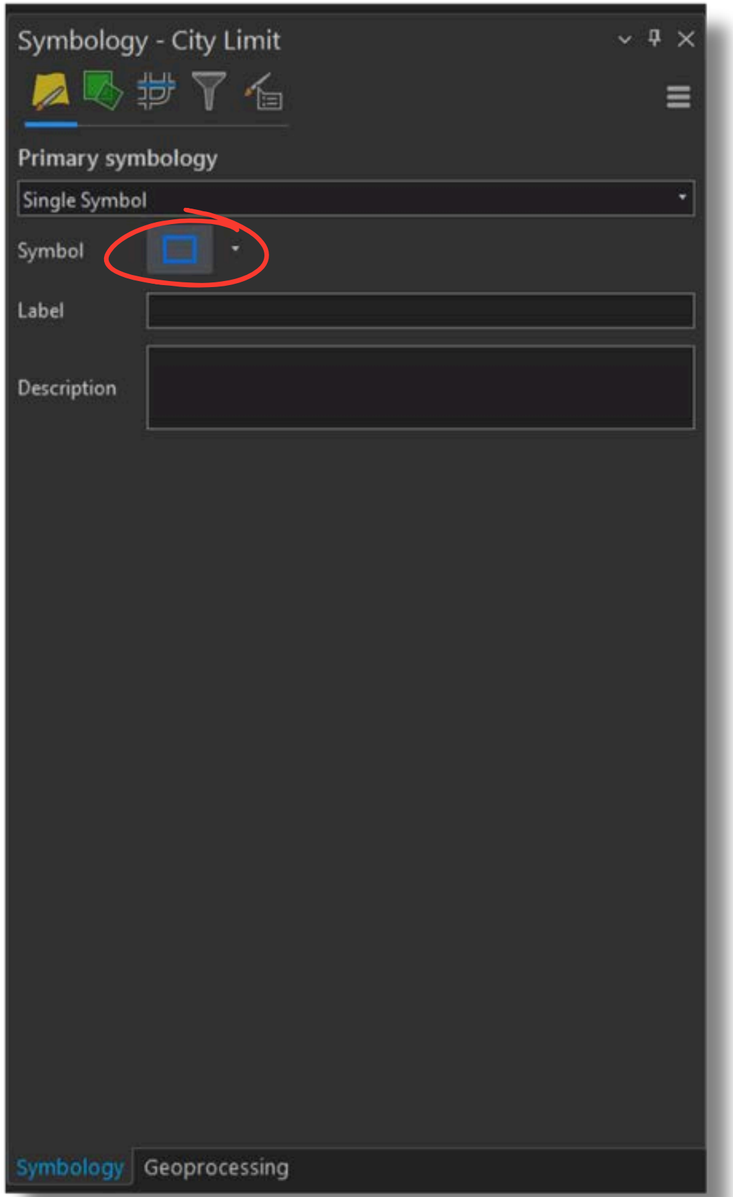
- Click **OK.** The layer is added to the map.

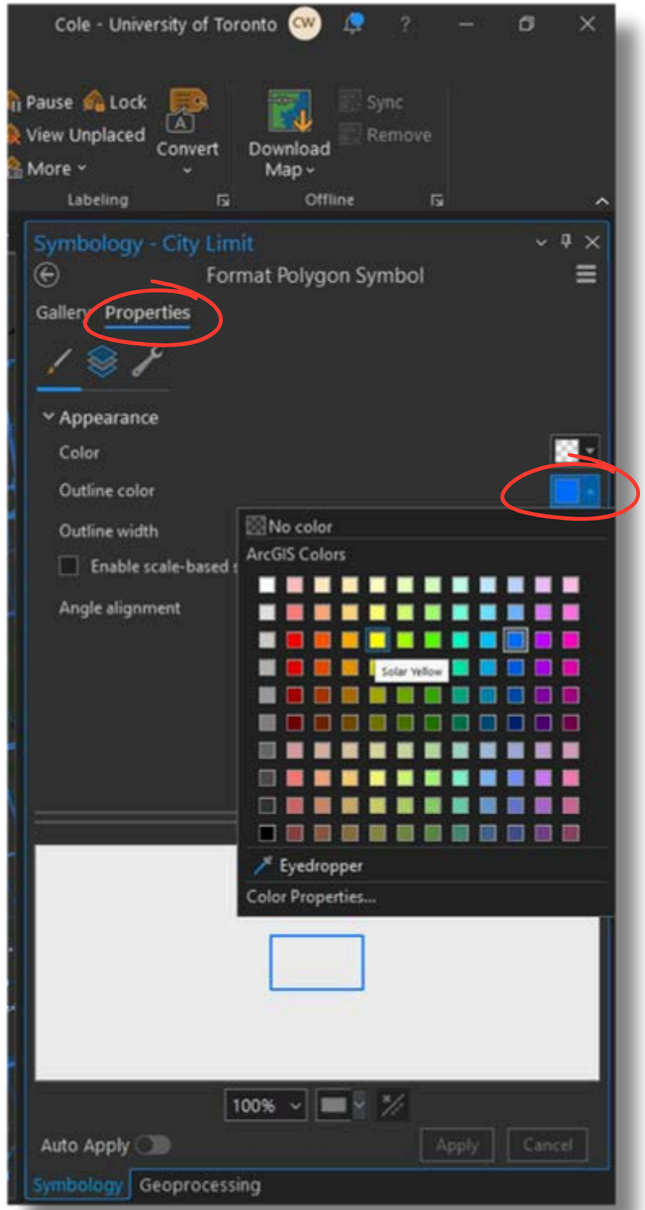


2. ArcGIS Pro

- Adjust the symbology.

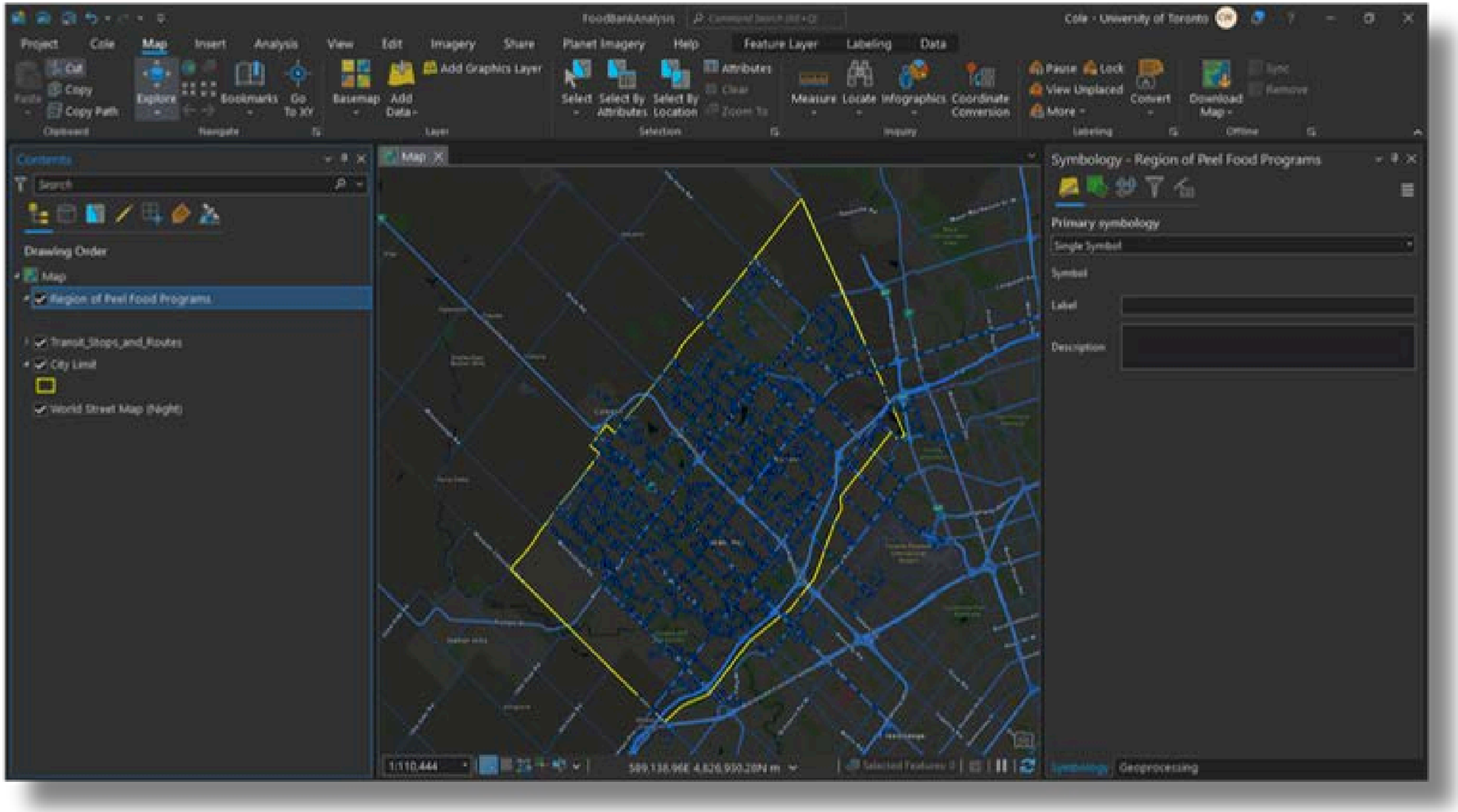






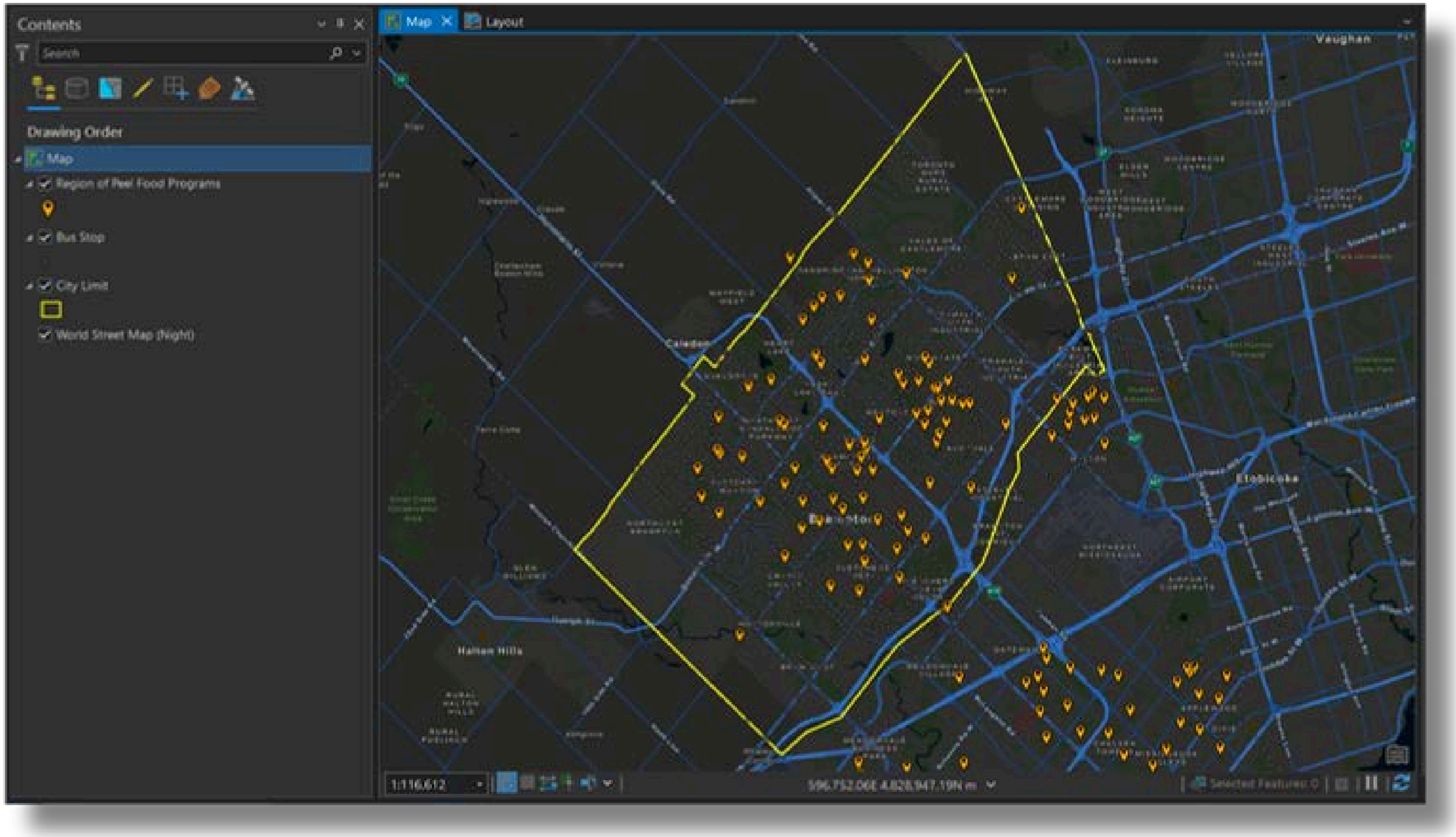
2. ArcGIS Pro

- Add the following layers (also by searching and using the owner: BramptonMaps flag):
  - **Transit_Stops_and_Routes**
  - **Region of Peel Food Programs**



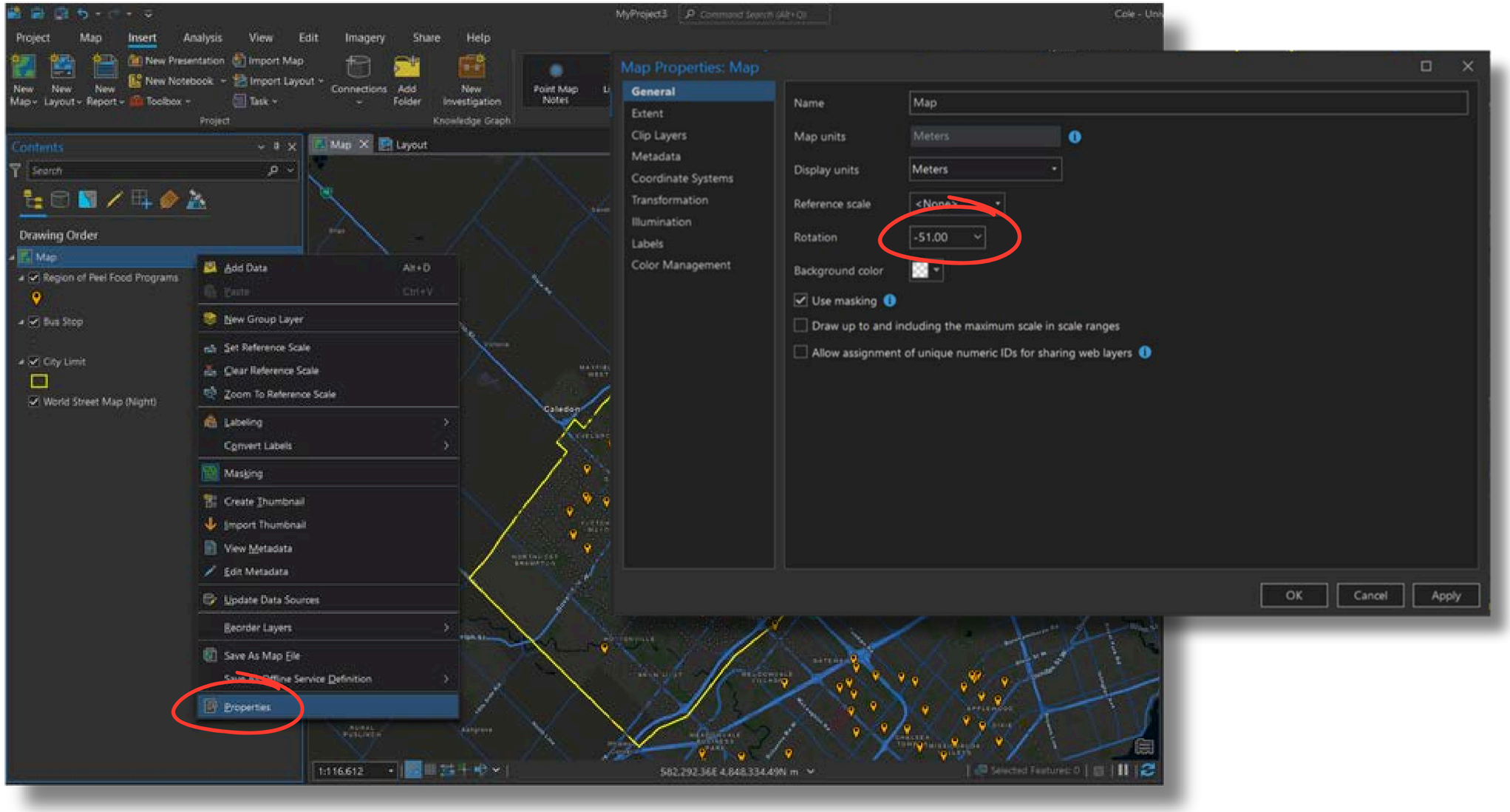
2. ArcGIS Pro

- Customize the **symbology** for each layer.



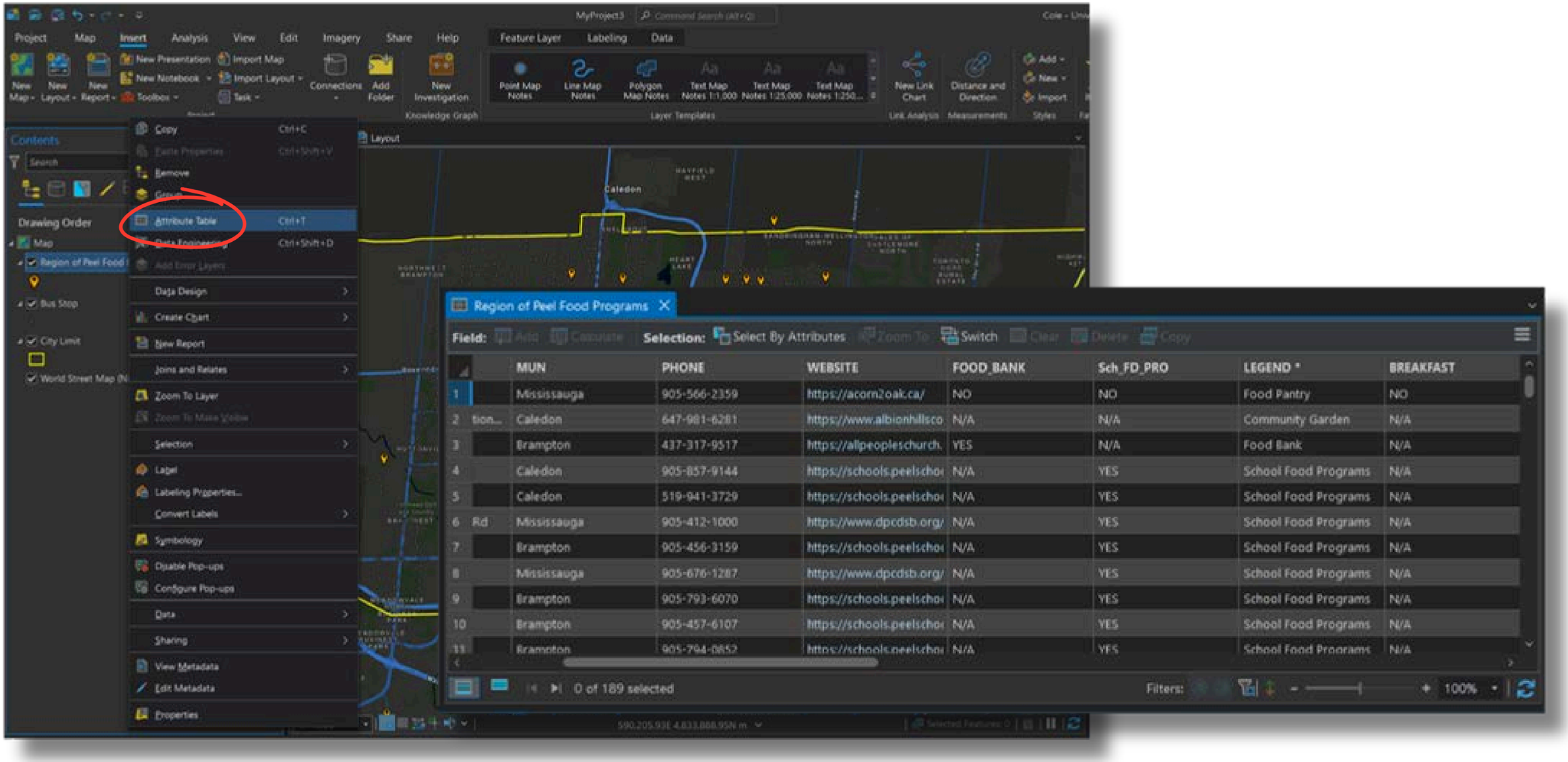
2. ArcGIS Pro

- Open the **Map Properties**
- Set the map rotation to **-51**



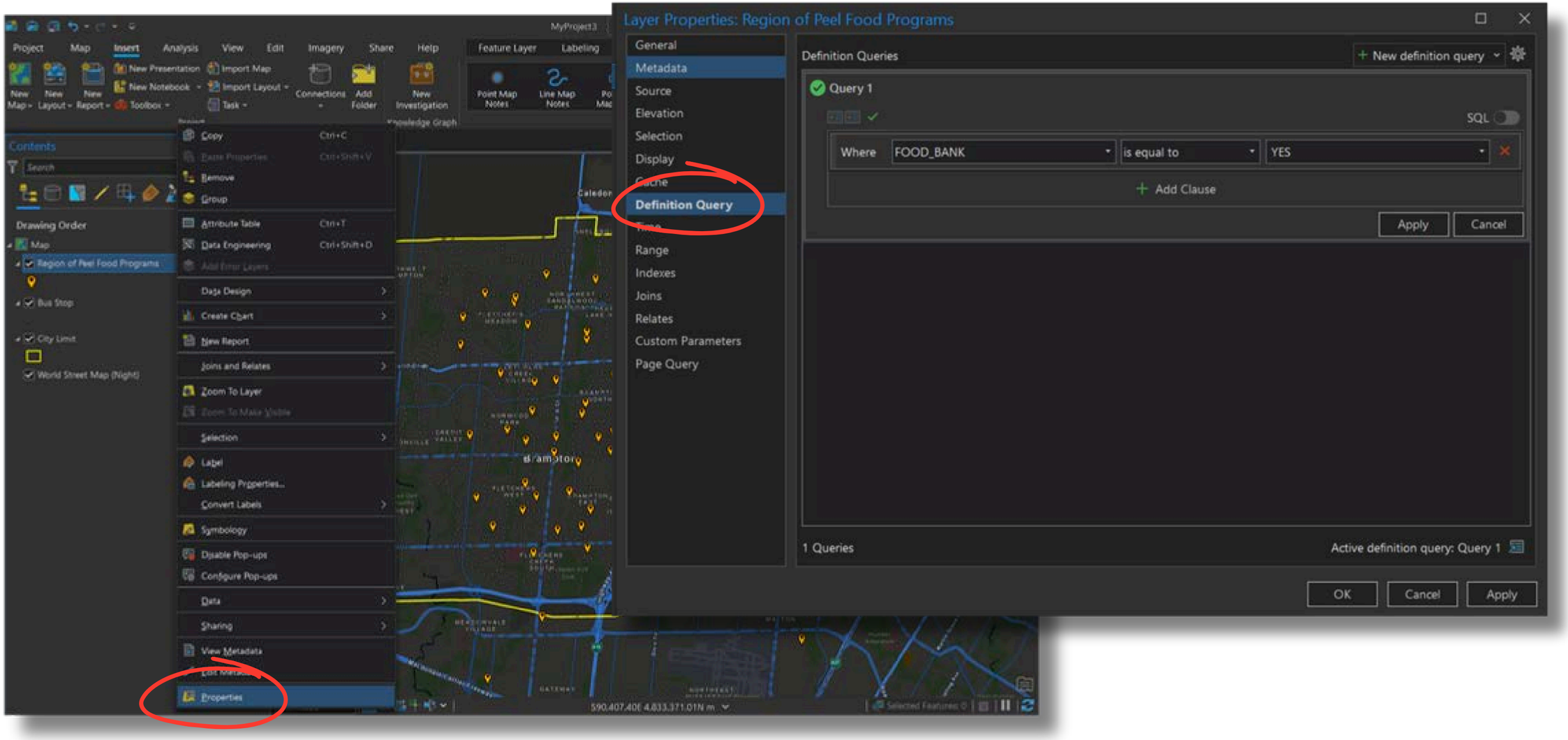
2. ArcGIS Pro

- Review the **Attribute Table** of the Region of Peel Food Programs layer.



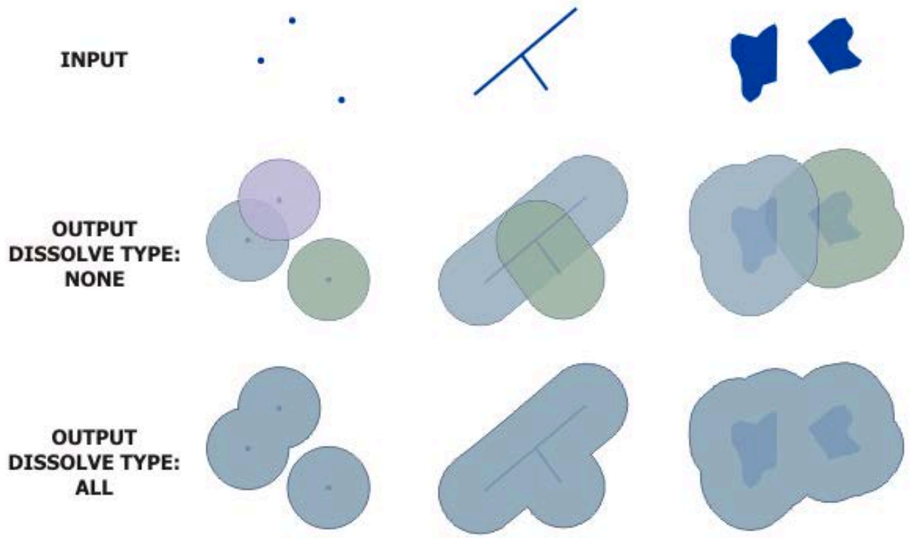
2. ArcGIS Pro

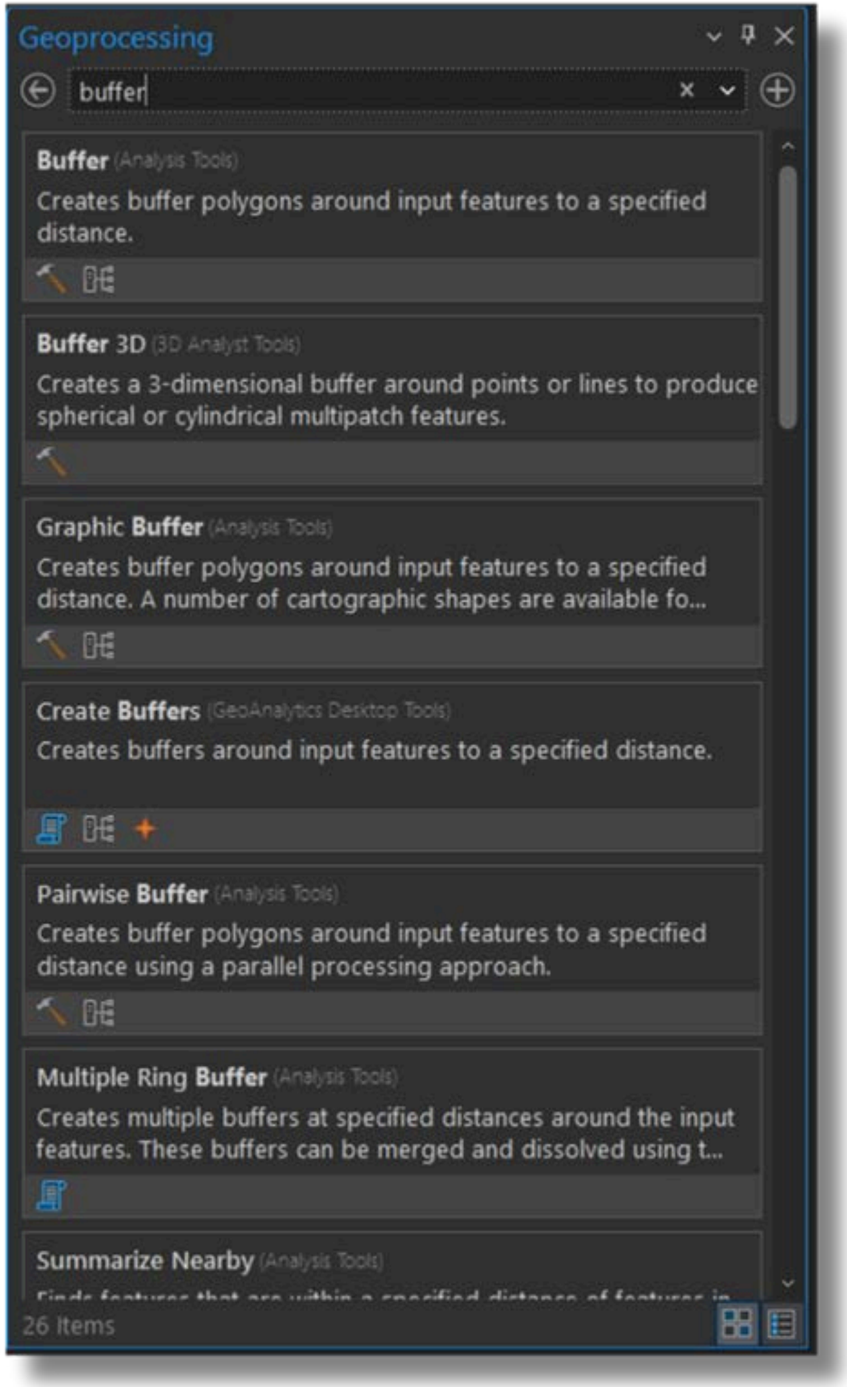
- **Filter** the Food Programs layer using a Definition Query.
- Build the expression: **FOOD_BANK is equal to YES.**



2. ArcGIS Pro

- Create a 2km buffer around the City Limit (this will be our study area).
- From the **Geoprocessing** pane, search for and open the **Buffer** tool.

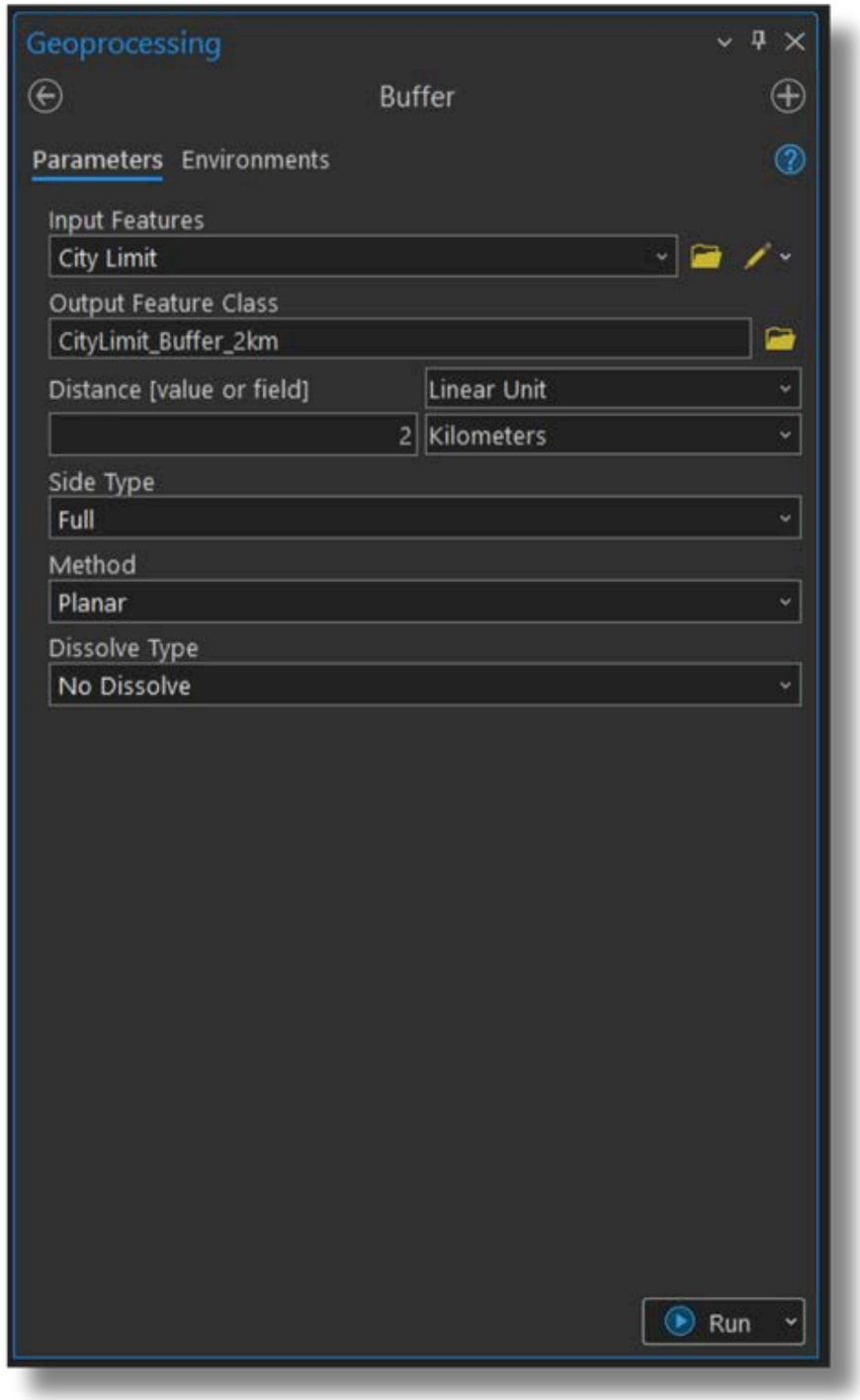




More info about buffering:
https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm

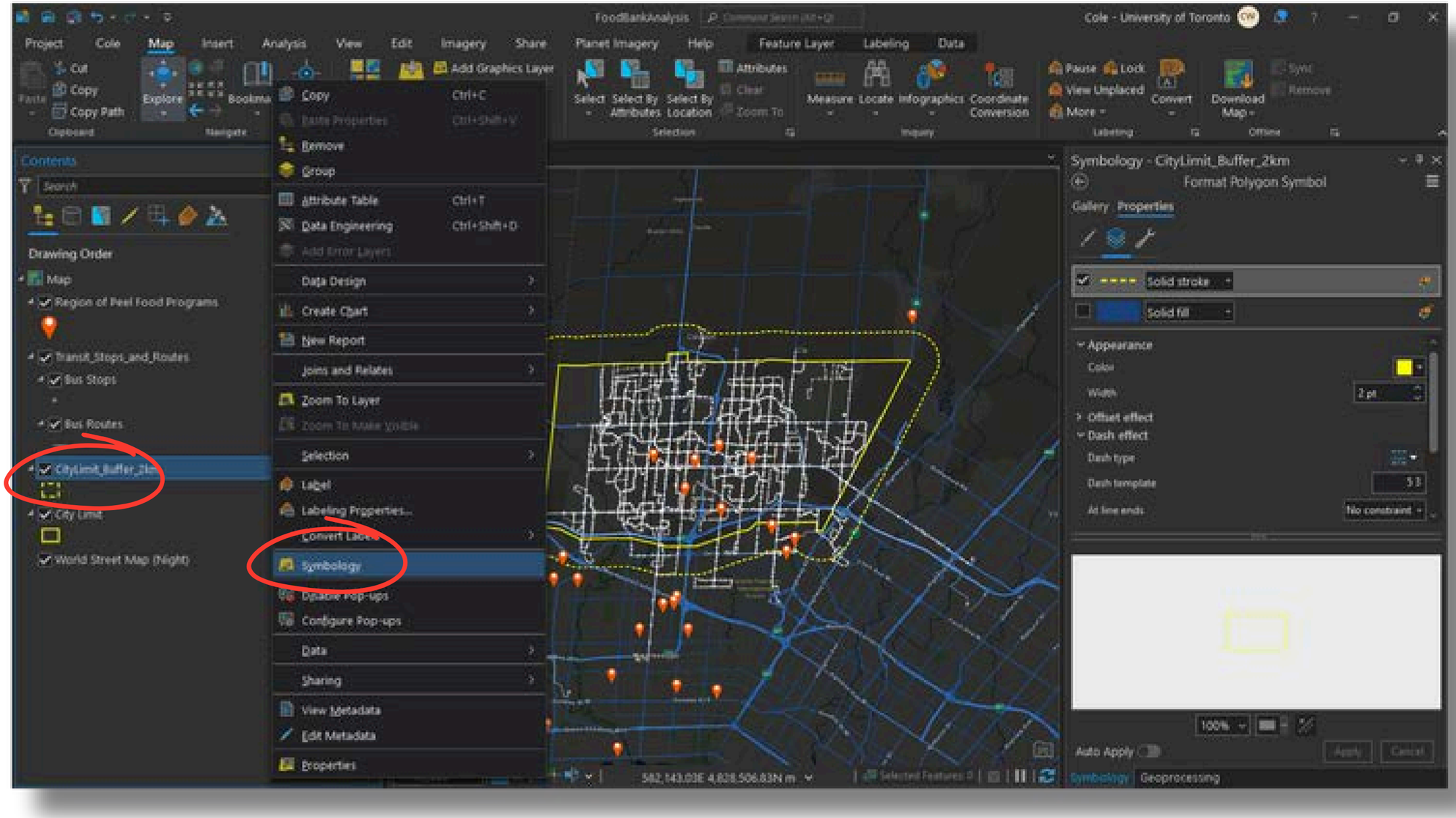
2. ArcGIS Pro

- Select the **City Limit** layer for the **Input Features** parameter.
- Give the output feature class a descriptive name.
- Specify **2** for the **Distance** value and **Kilometers** for the **Unit.**
- The other parameters can be left at the default values.
- Click **Run.**



2. ArcGIS Pro

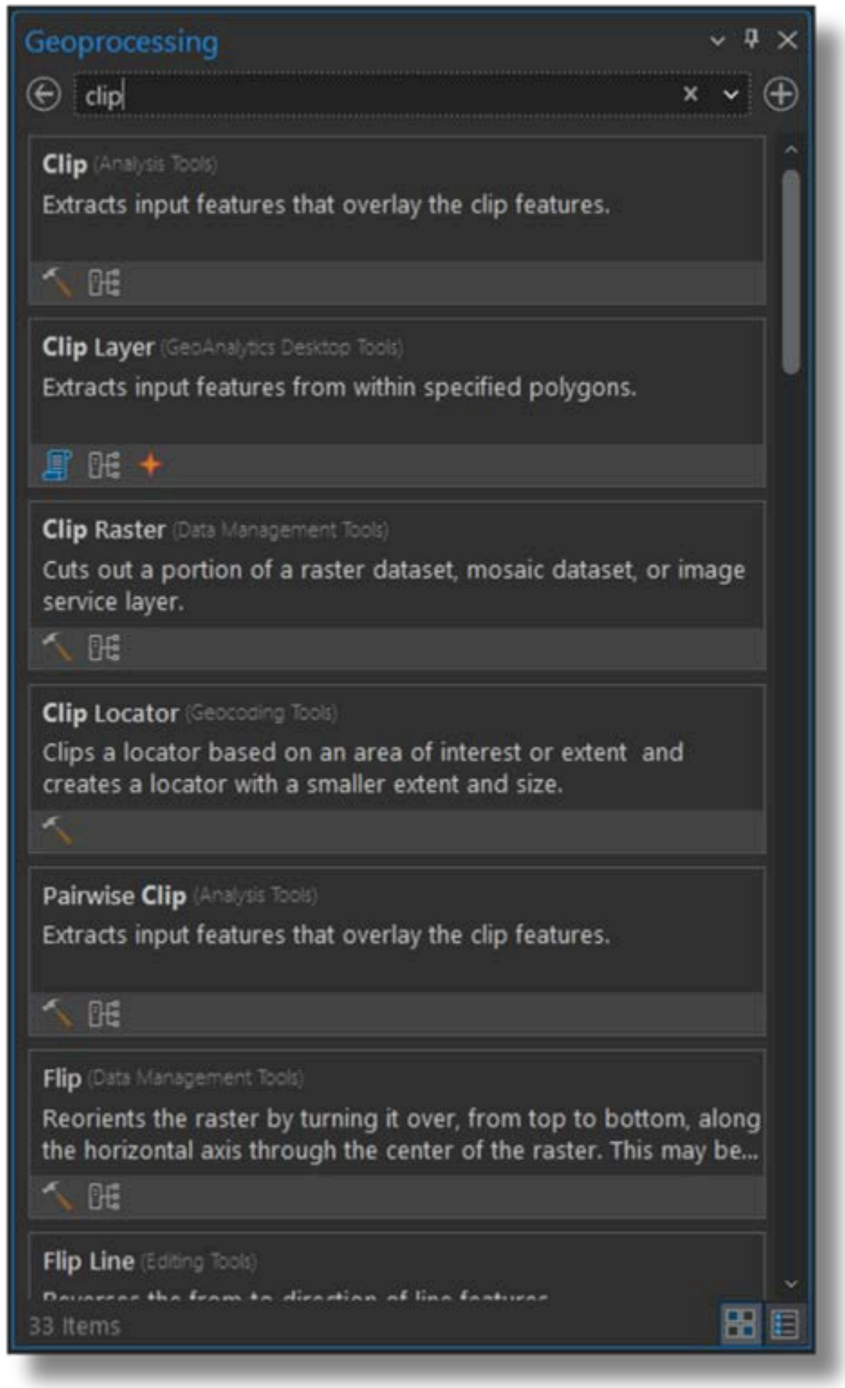
- Adjust the symbology of the new buffered layer.



2. ArcGIS Pro

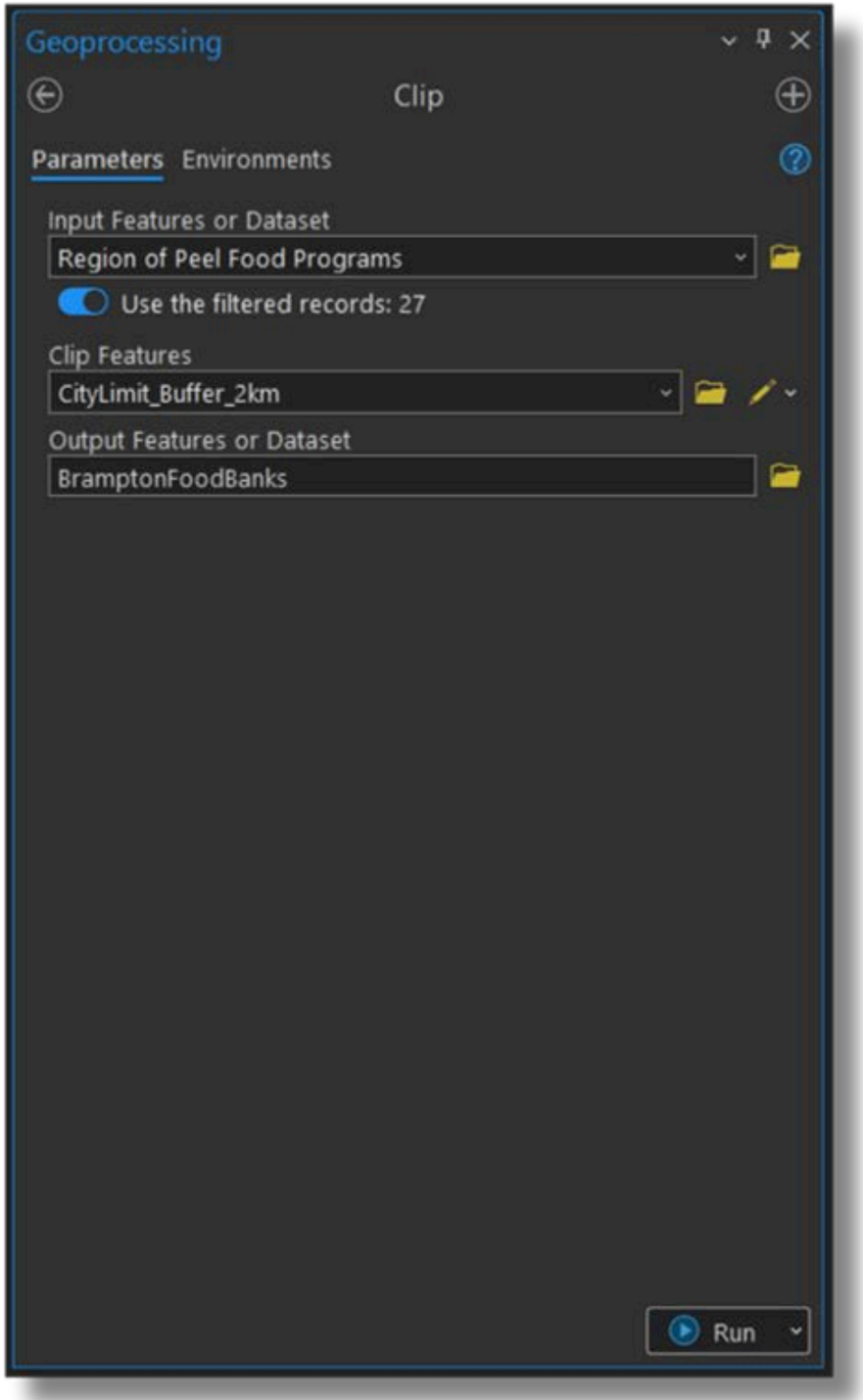
- Create a layer containing only food banks within the study area.

- In the **Geoprocessing** pane, search for and open the **Clip** tool.



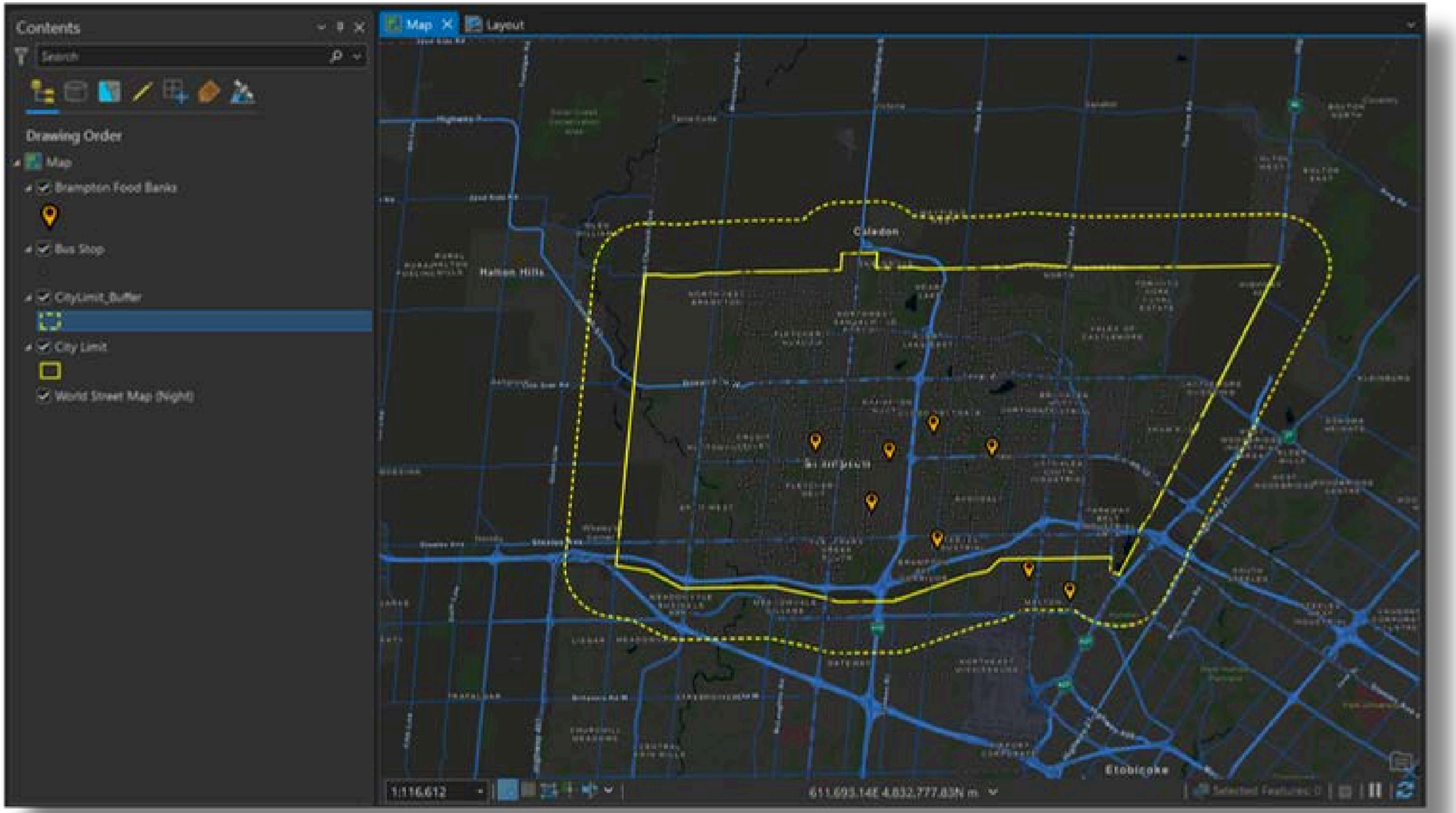
2. ArcGIS Pro

- Specify the **Region of Peel Food Programs** as the **Input Features or Dataset.**
- Leave ‘Use the filtered records’ toggled **on.**
- Select the buffer layer as the **Clip Features.**
- Give the output a descriptive name.
- Click Run.



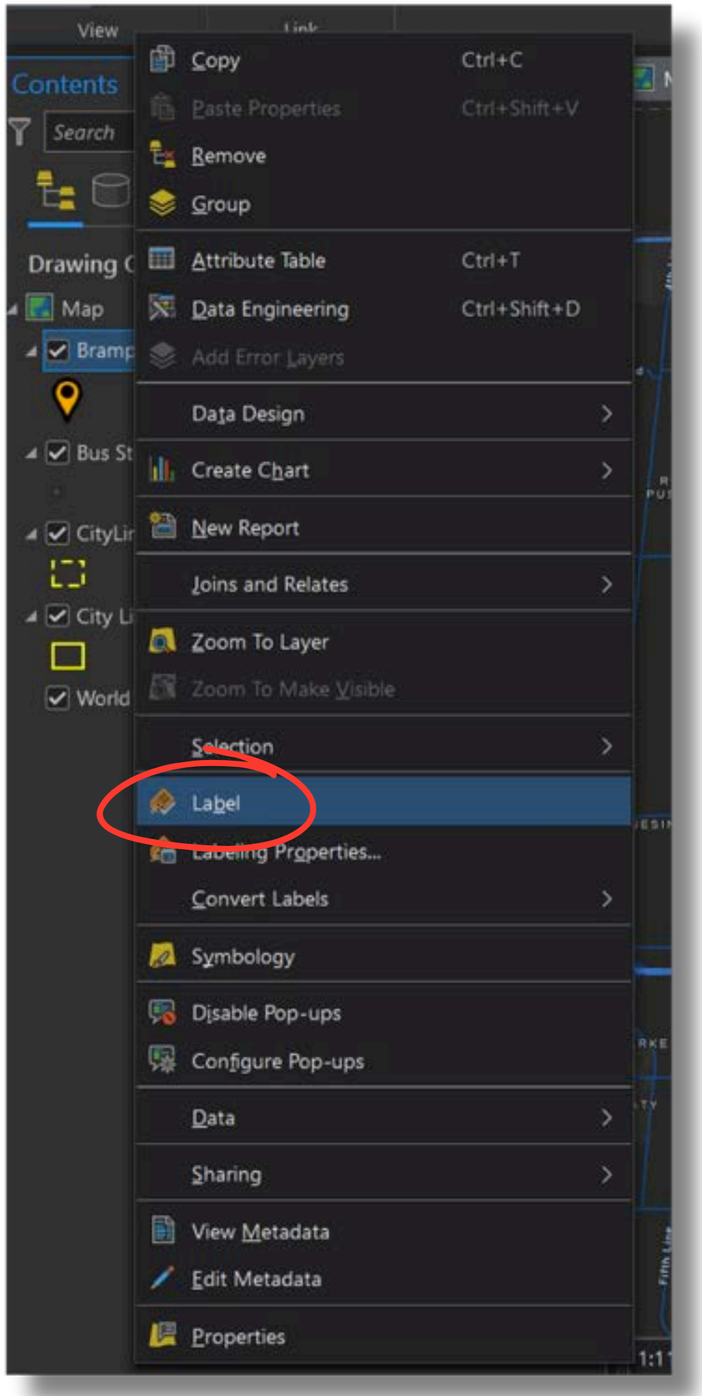
2. ArcGIS Pro

- Remove the original Region of Peel Food Programs layer.



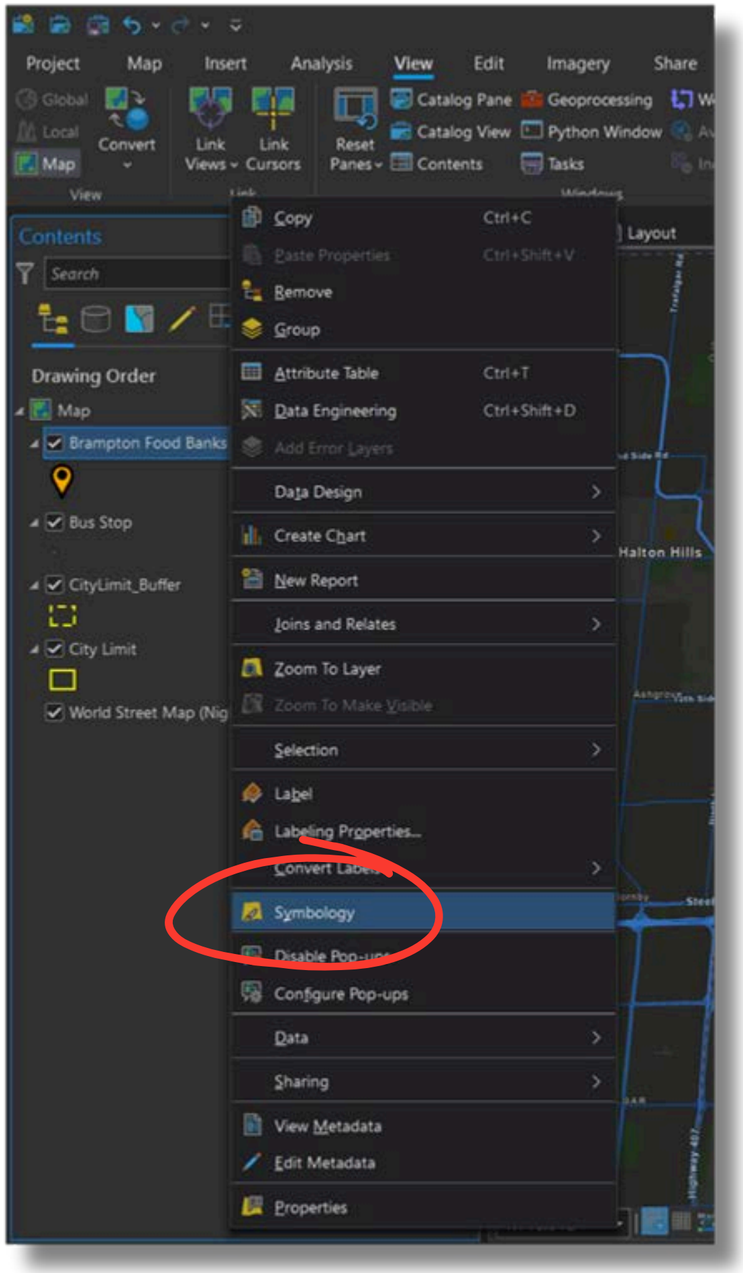
2. ArcGIS Pro

- Create labels for the existing food bank locations
- Right-click the BramptonFoodBanks layer and click the **Label** menu item to enable labels.



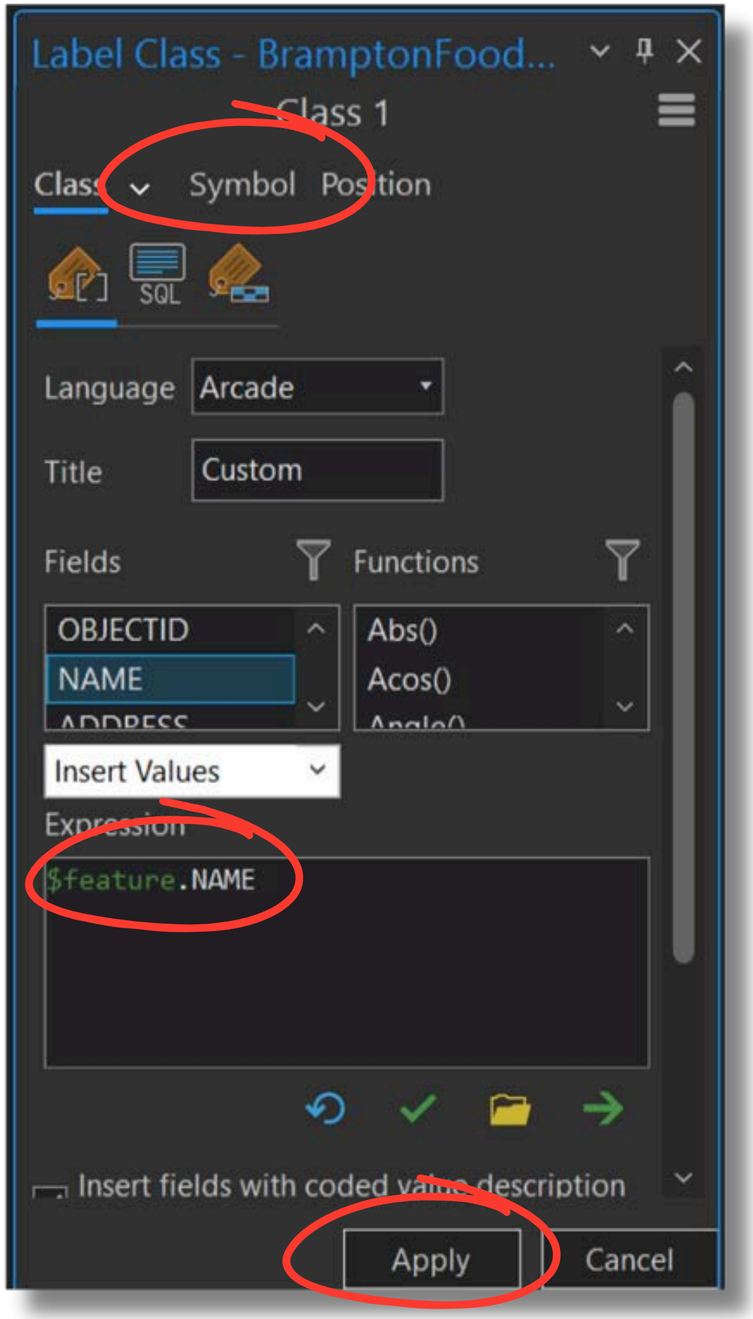
2. ArcGIS Pro

- Right-click the BramptonFoodBanks layer again.
- Click the **Labeling Properties** item in the contextual menu.



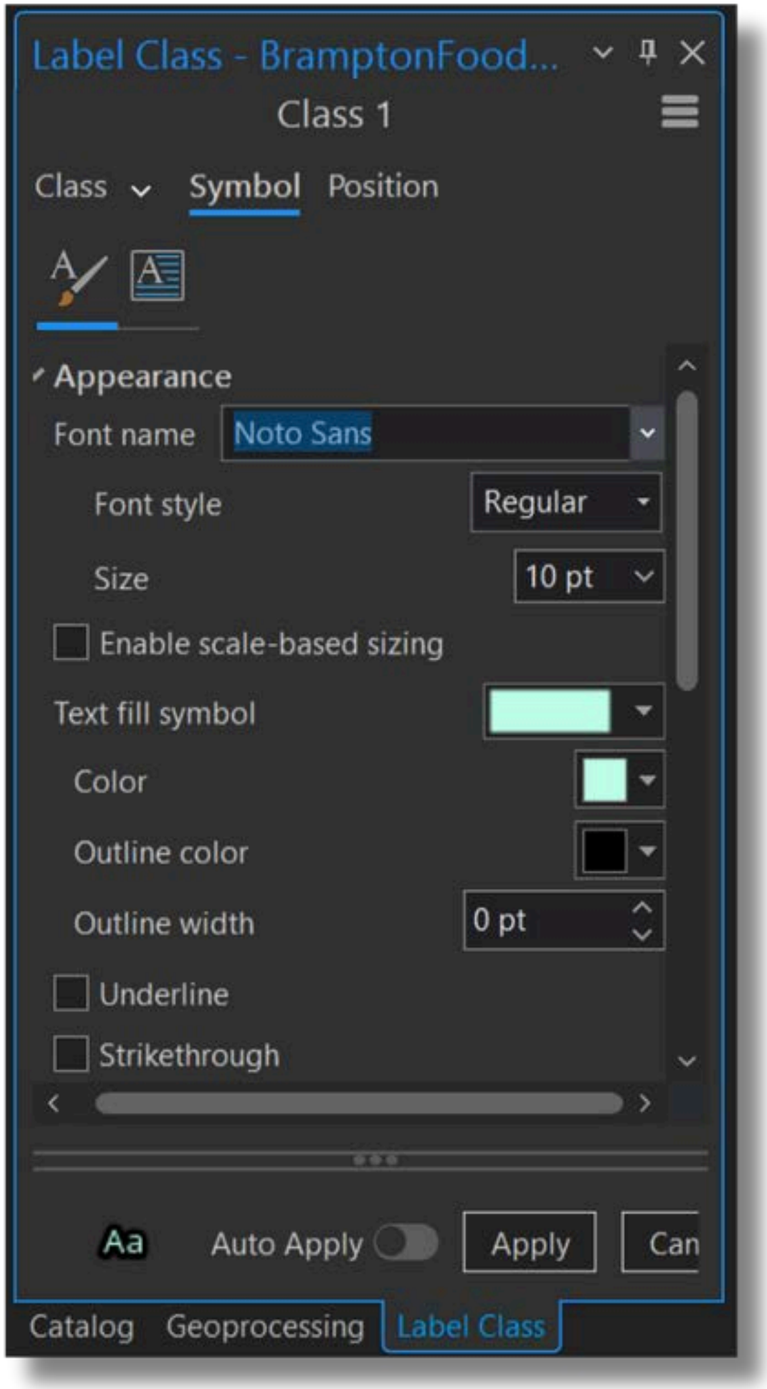
2. ArcGIS Pro

- Select **NAME** as the label field if it isn't already
- The Expression box should contain text reading **$feature.NAME**
- Click **Apply.**
- Next, click the **Symbol** tab to customize the label's appearance.



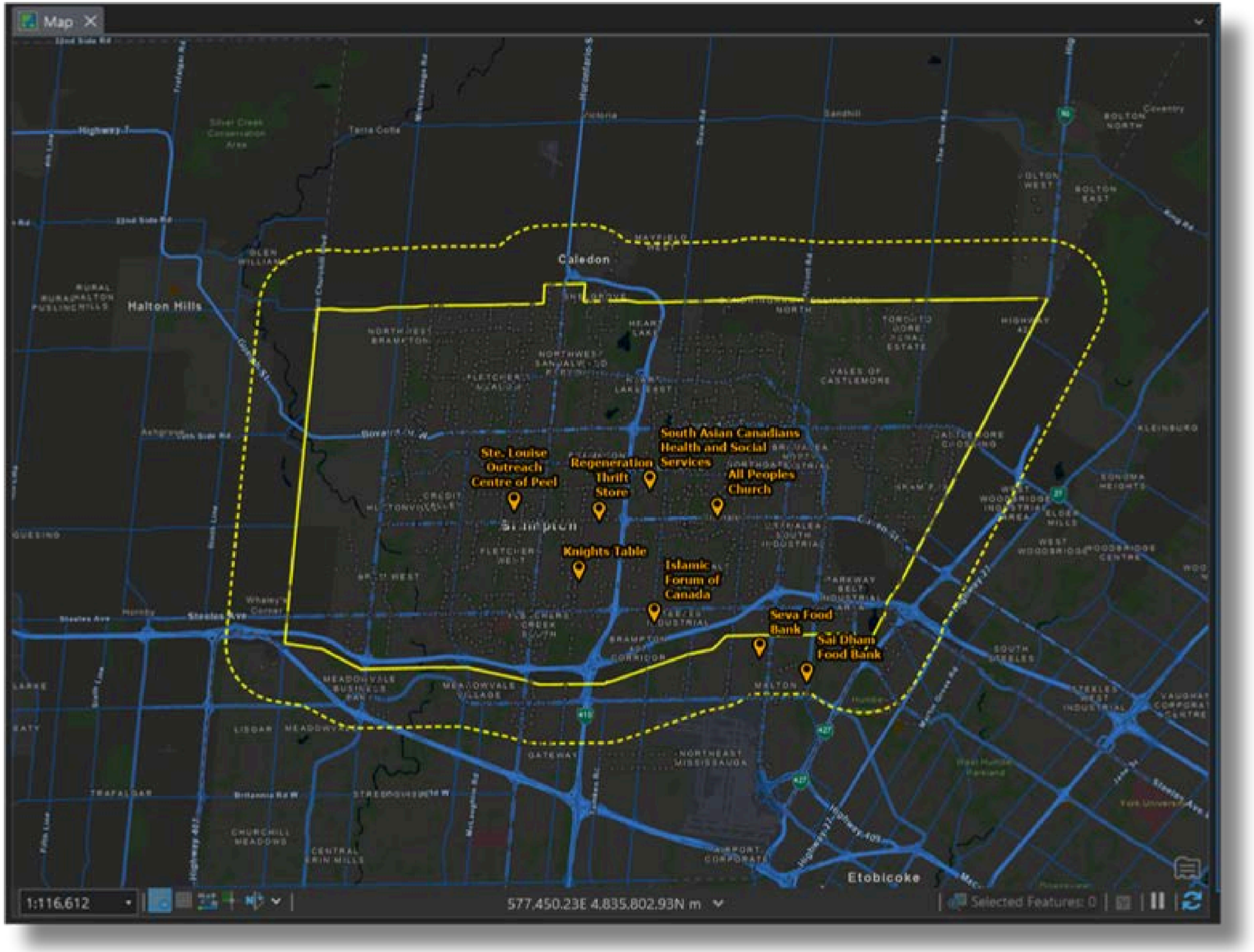
2. ArcGIS Pro

- Adjust the label font, size, and colour.
- Click Apply.



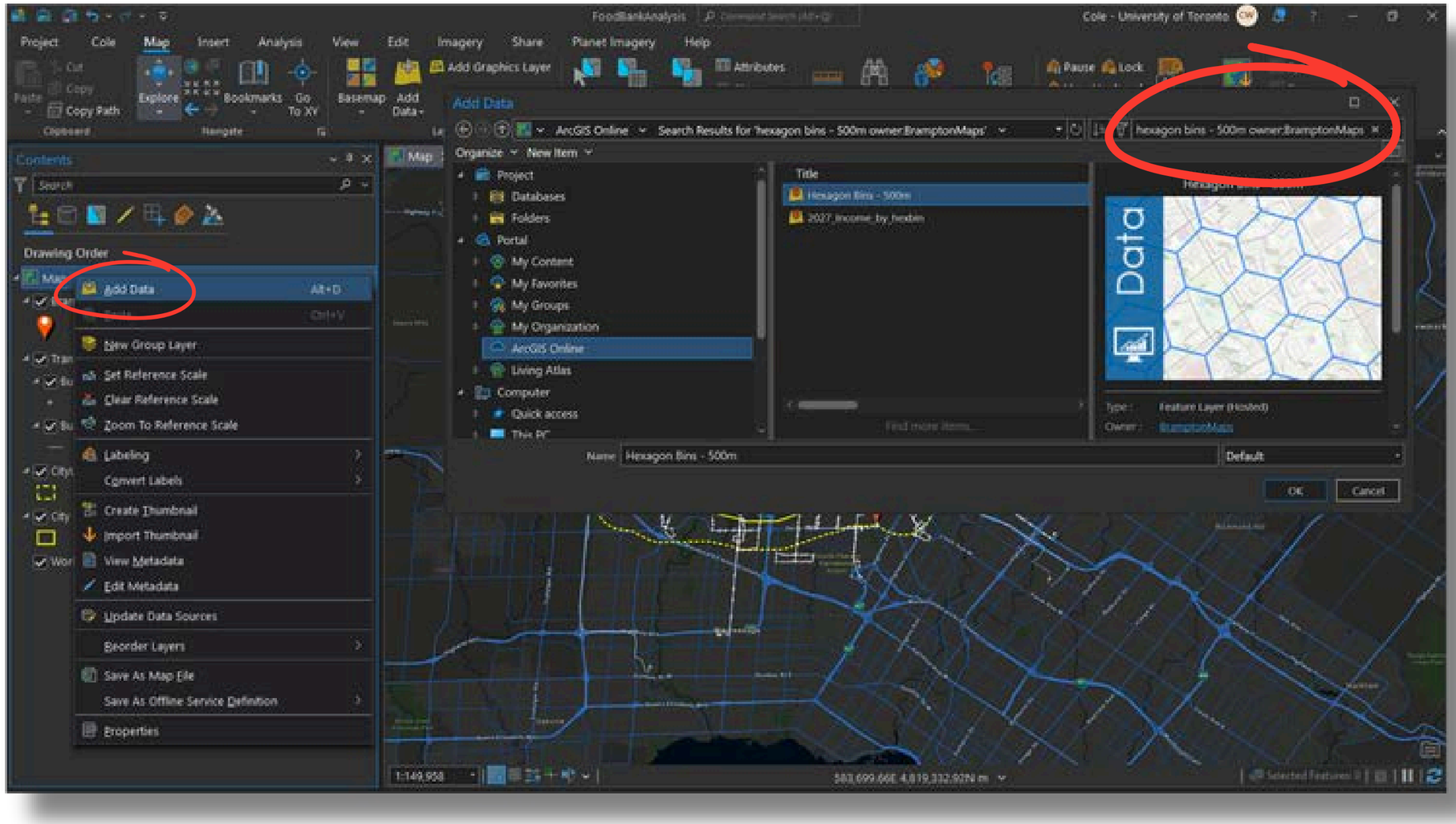
2. ArcGIS Pro

- Labels will now appear for each point.



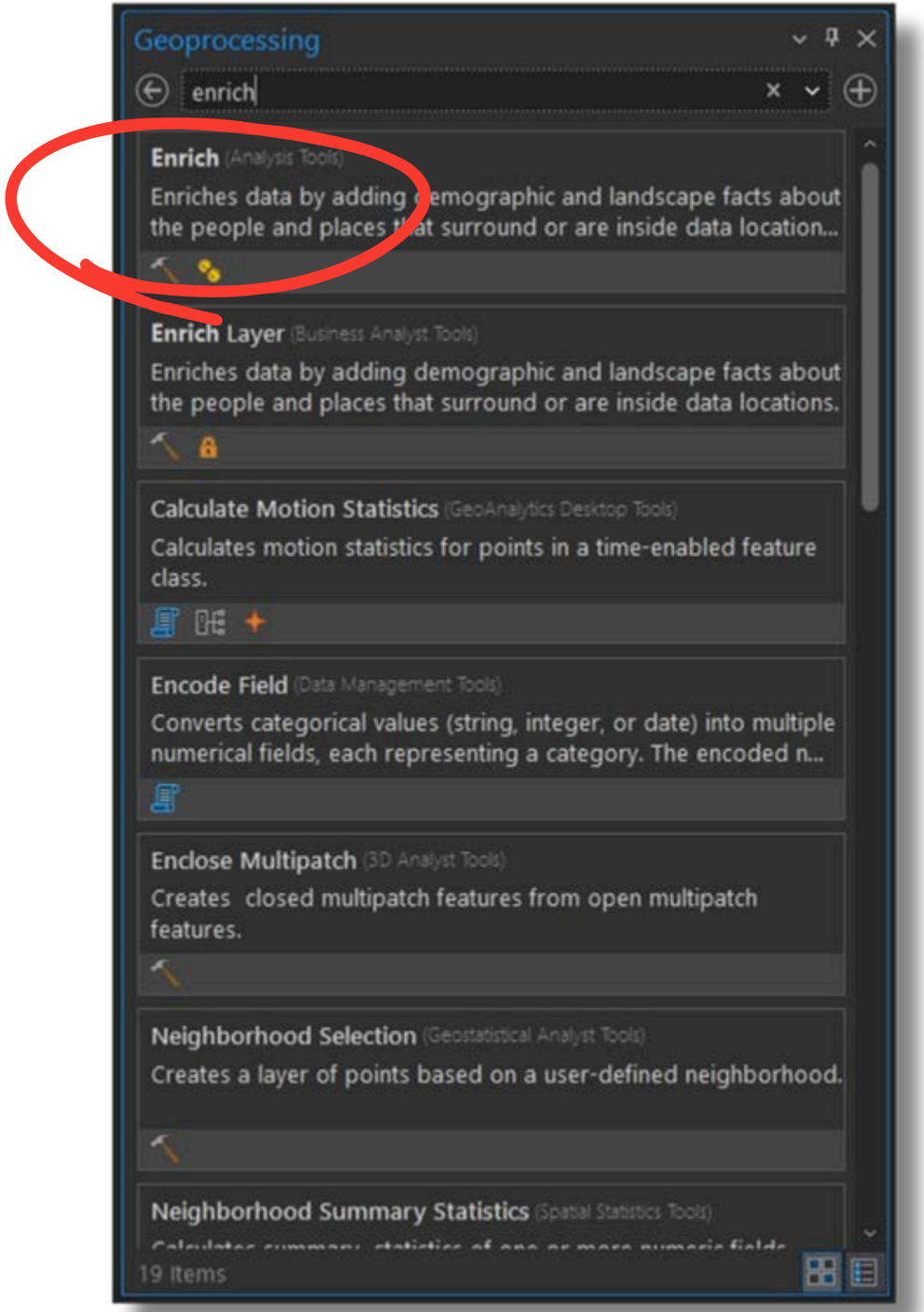
2. ArcGIS Online

- Analyze income within the study area.
- Add Data
- Search for and select **Hexagon Bins - 500m owner:BramptonMaps** within ArcGIS Online. Click OK.



2. ArcGIS Pro

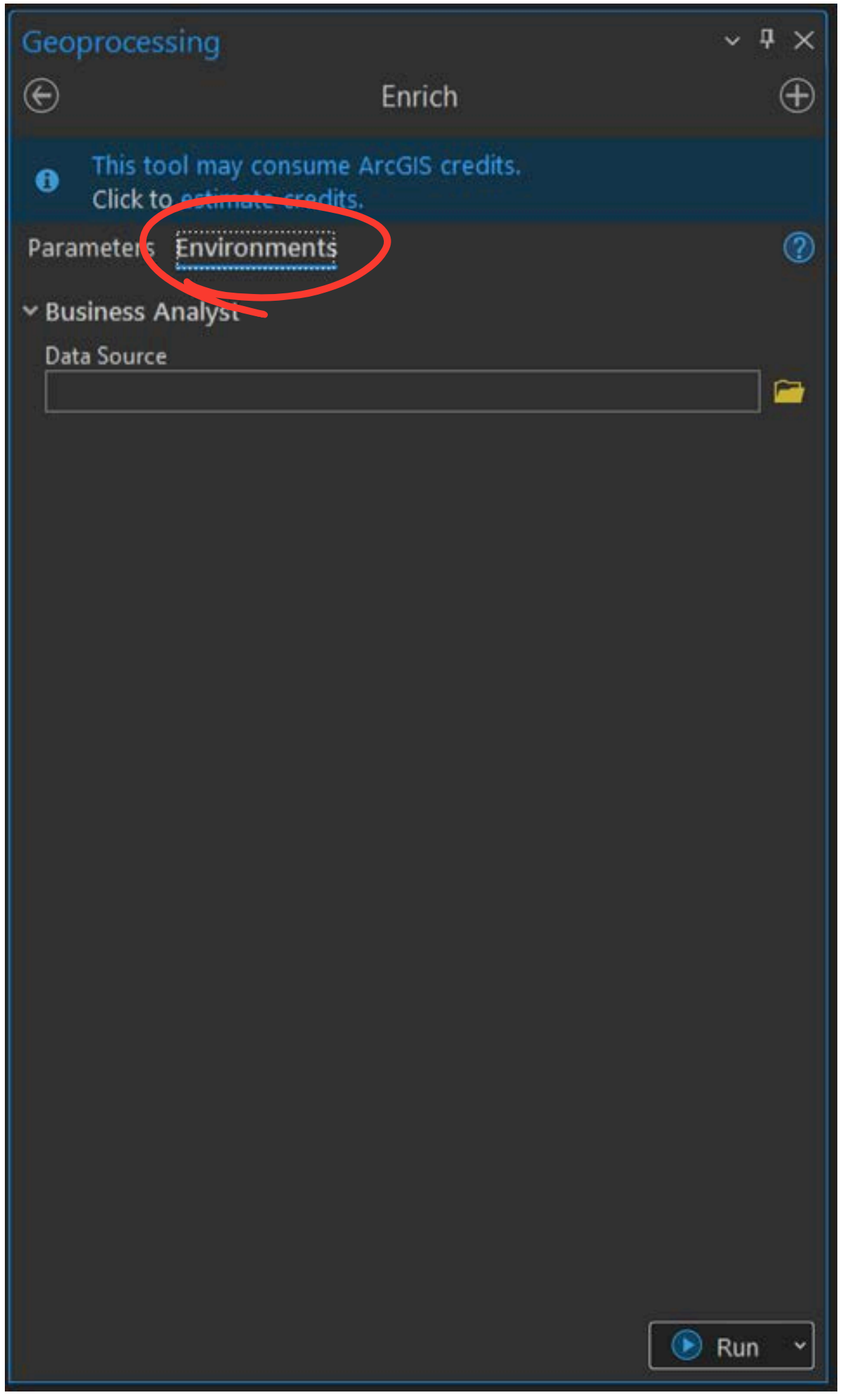
- In the **Geoprocessing** pane, search for and open the **Enrich** tool.



2. ArcGIS Pro

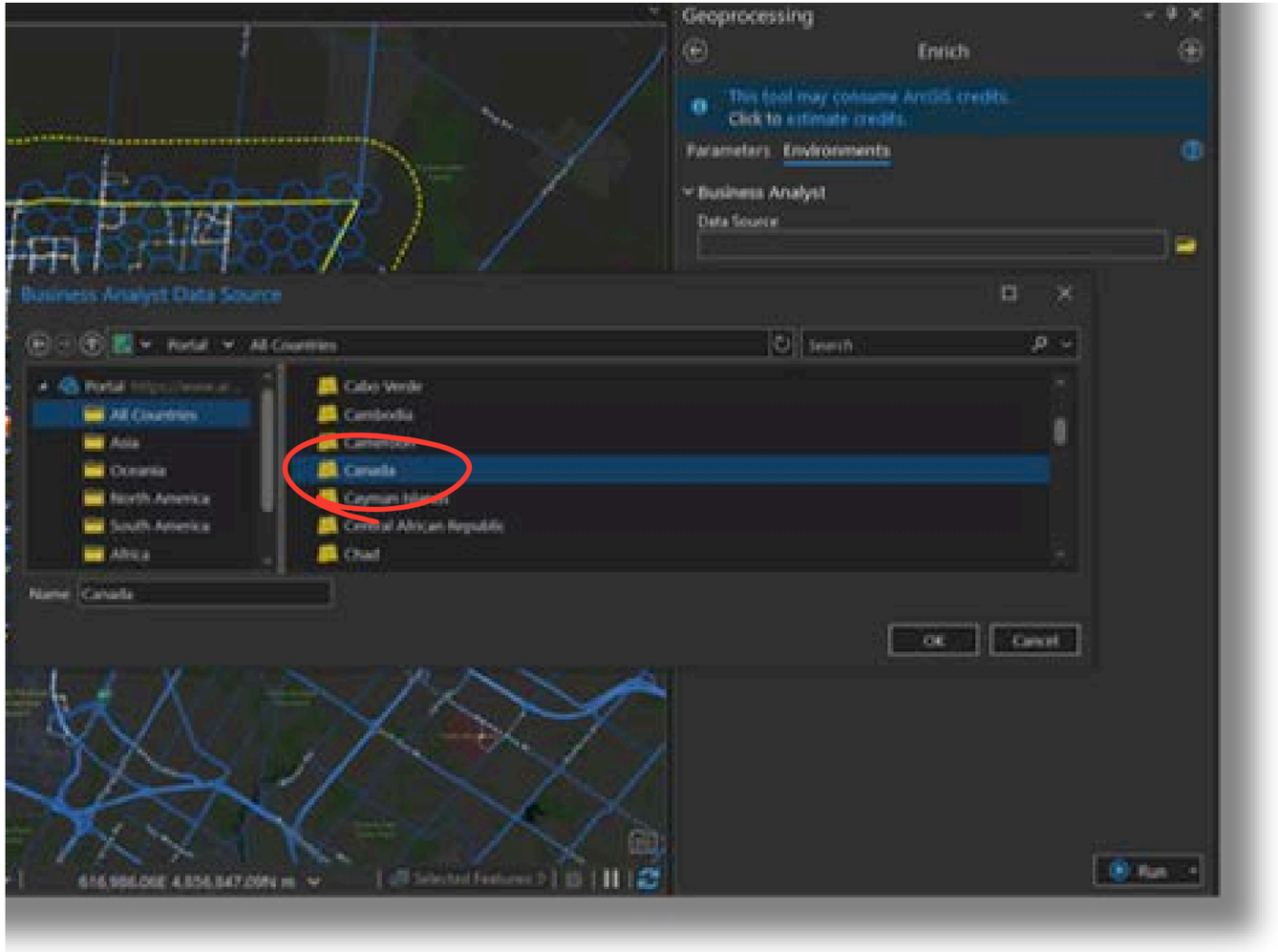
- The Enrich tool defaults to United States locations. Change this by clicking on the **Environments** tab.

- Click the **folder icon** to the left of the Data Source box.



2. ArcGIS Pro

- Find and select Canada. Click OK.

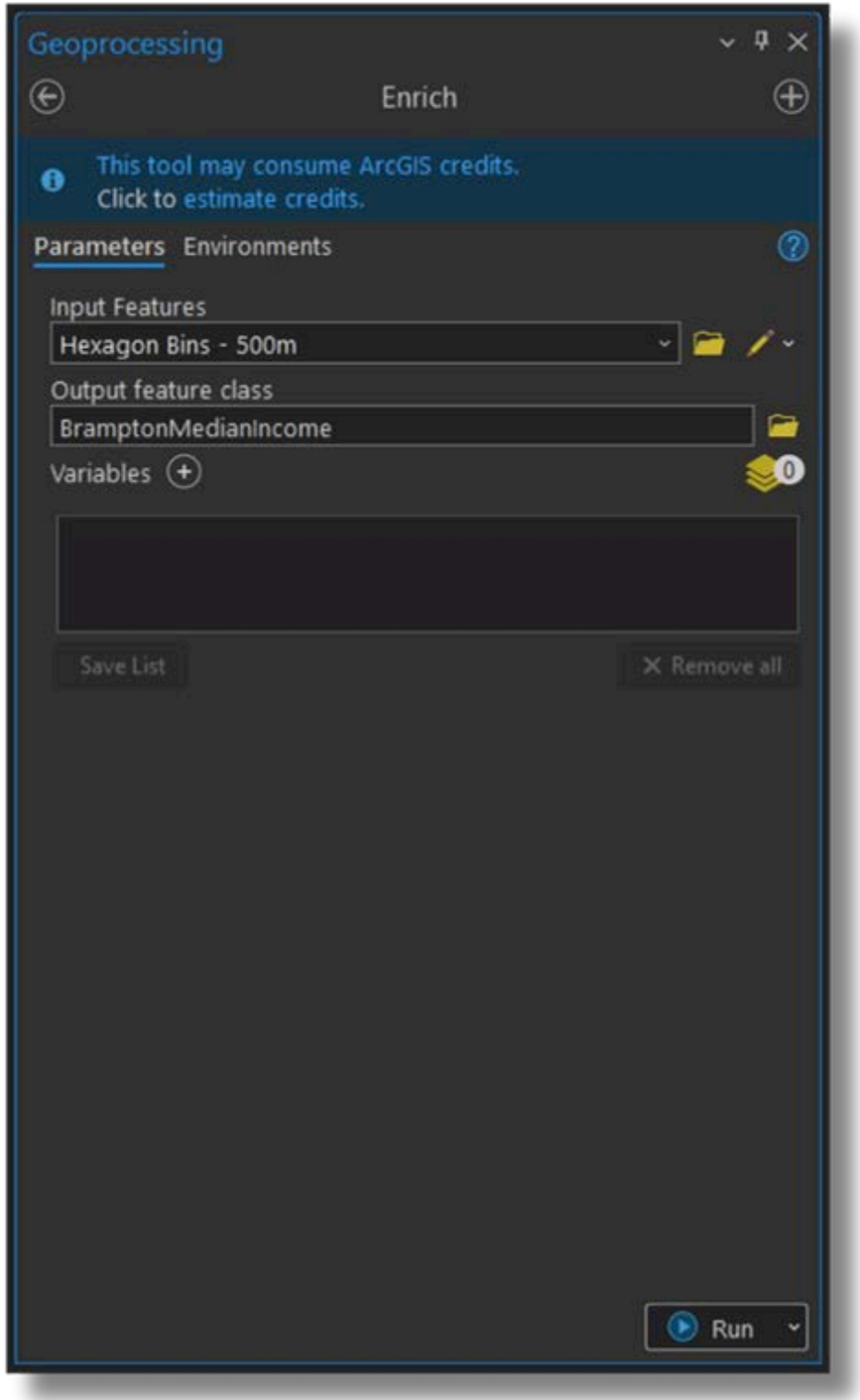


2. ArcGIS Pro

- In the **Parameters** tab of the **Enrich** tool, specify the following:

- **Input Features:** Select the **Hexagon Bins - 500m** layer

- **Output feature class:** Enter **BramptonMedianIncome** or another descriptive name.

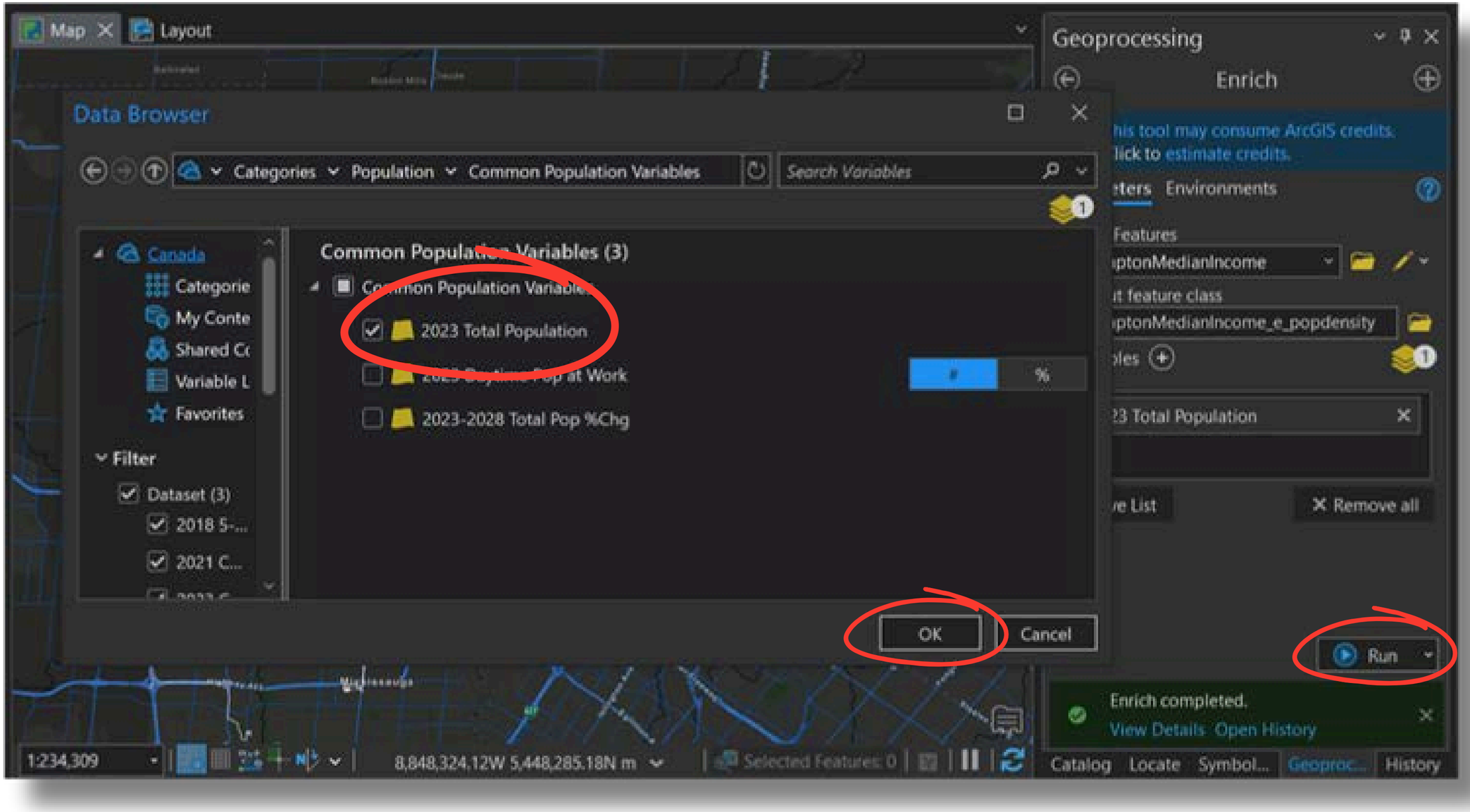


2. ArcGIS Pro

- Click the **+** button next to the word Variables.
- Navigate to Income > **Common Income Variables.**
- Check the box next to **2023 HH Inc. Median Curr$.**

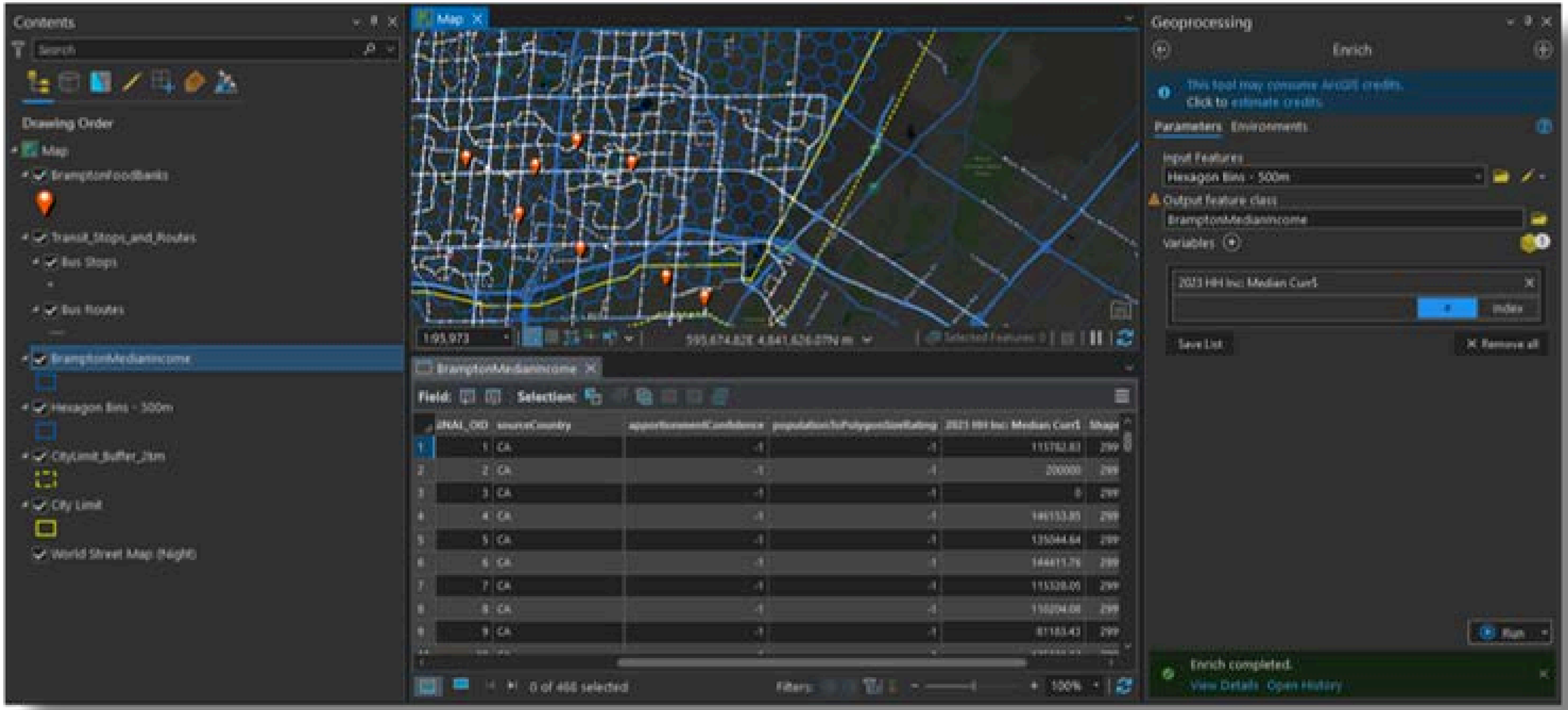
2. ArcGIS Pro

- Navigate to **Population** > **Common Population Variables.**
- Check the box next to **2023 Total Population.**
- Click **OK.** Click **Run.**



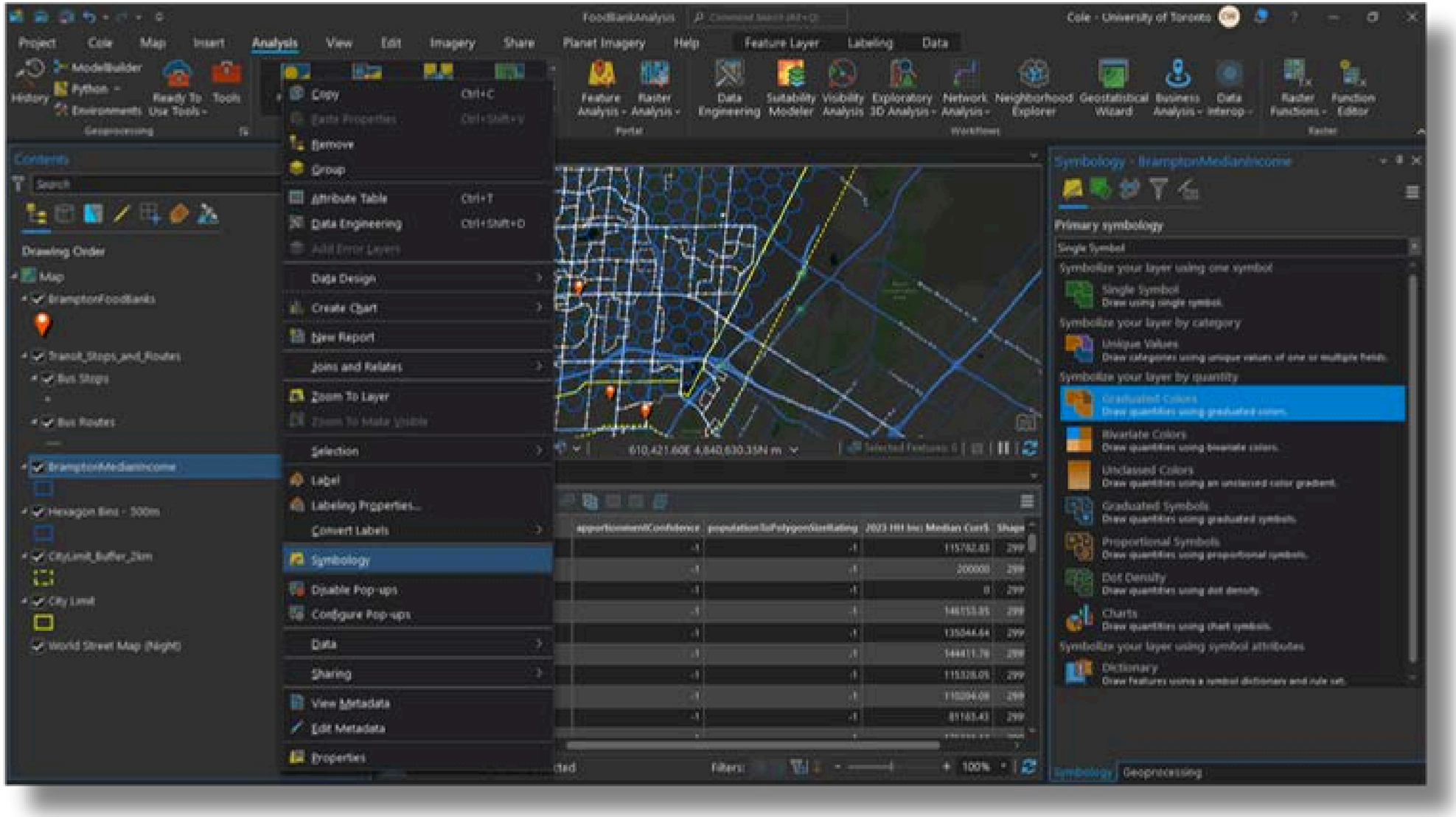
2. ArcGIS Pro

- Review the **Attribute Table** of the new layer created by the **Enrich** tool.
- The layer now includes median household income values and population counts for each feature.



2. ArcGIS Pro

- Open the **Symbology** pane for the BramptonMedianIncome layer
- From the Primary Symbology dropdown, choose **Graduated Colors.**

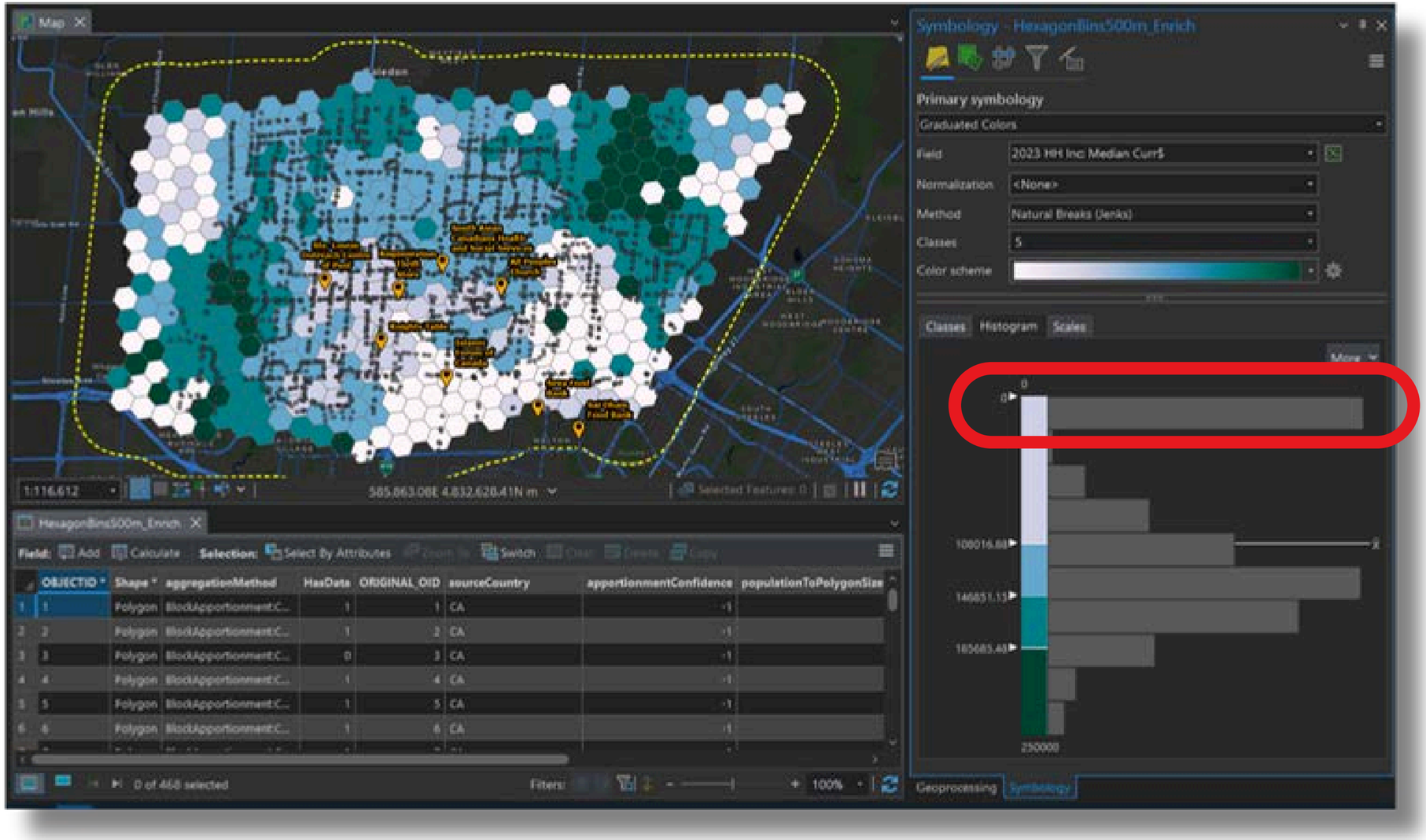


2. ArcGIS Pro

- Select **2023 HH Inc: Median Curr$** for the Field
- Input 5 for the number of classes
- Choose a colour ramp
- *Note: you may wish to experiment with the classification method, number of classes, and color scheme to see how the same data may be visualized in different ways.*

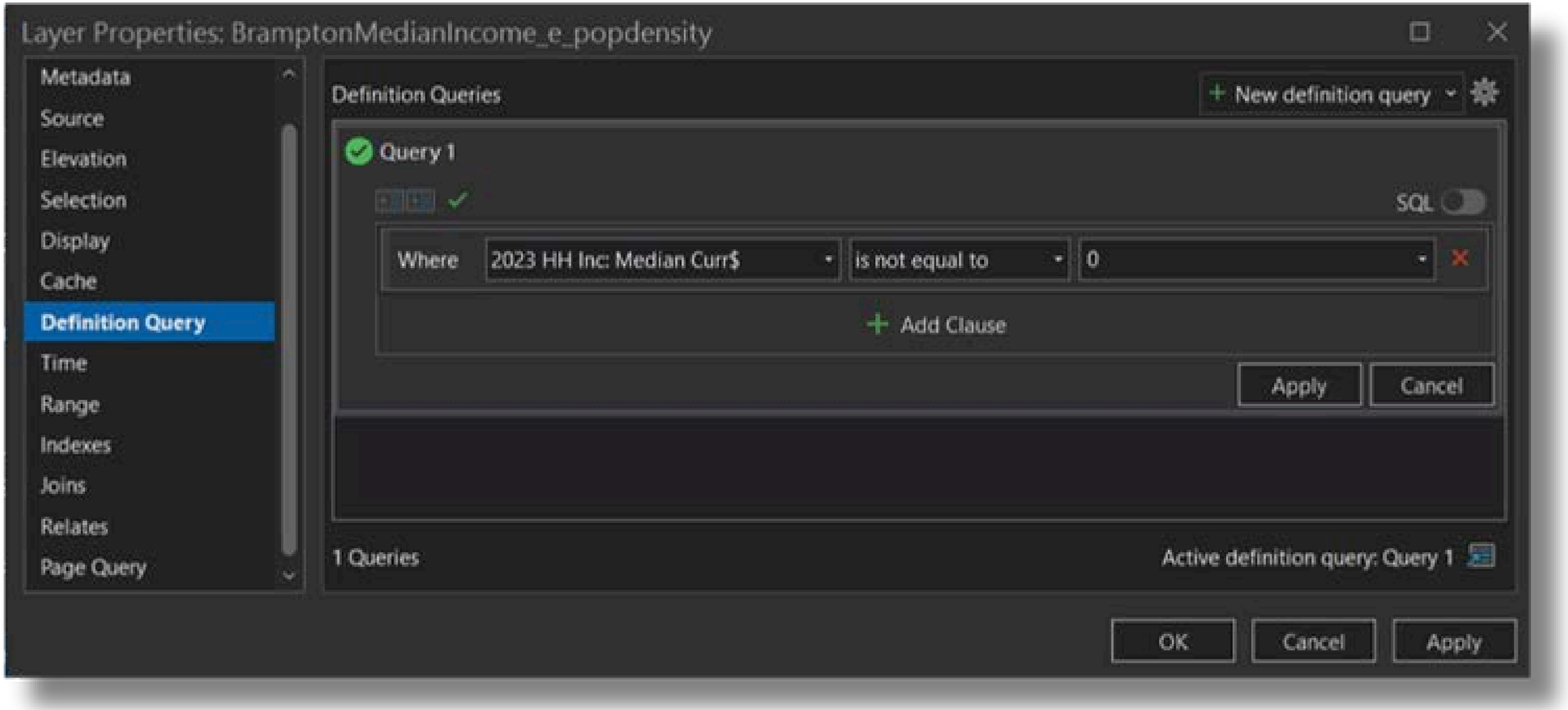
2. ArcGIS Pro

- Click on the **Histogram** tab of the Symbology pane.
- Note the high number of zeros for the Median Income field.
- This is because some features had no data returned by the Enrich Layer function.



2. ArcGIS Pro

- Add a **Definition Query** to the Median Income layer to filter out the zeros.
- Build the expression: **2023 HH Inc: Median Curr$ is not equal to 0**
- Click **Apply**. Click **OK**.

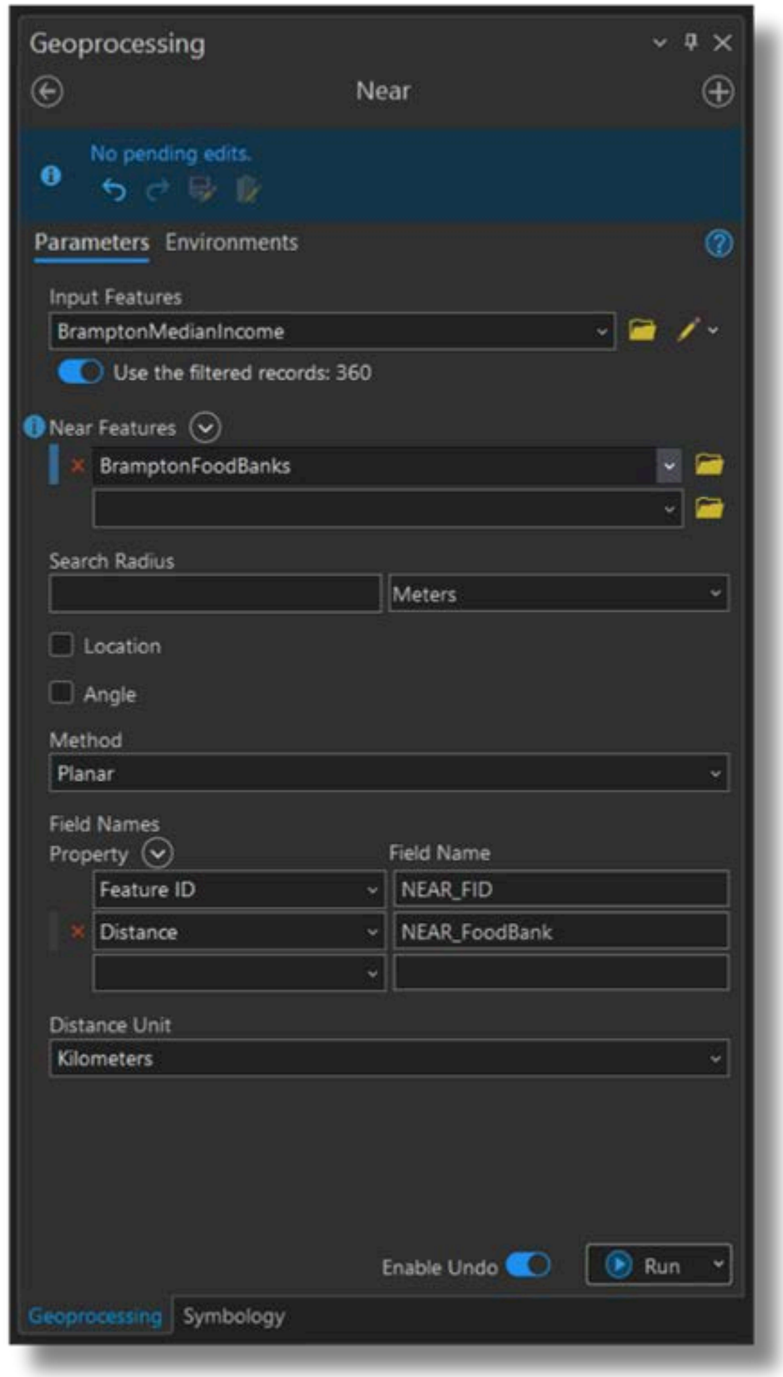


2. ArcGIS Pro

- Remove the original Hexagon grid layer. The map should look something like this.

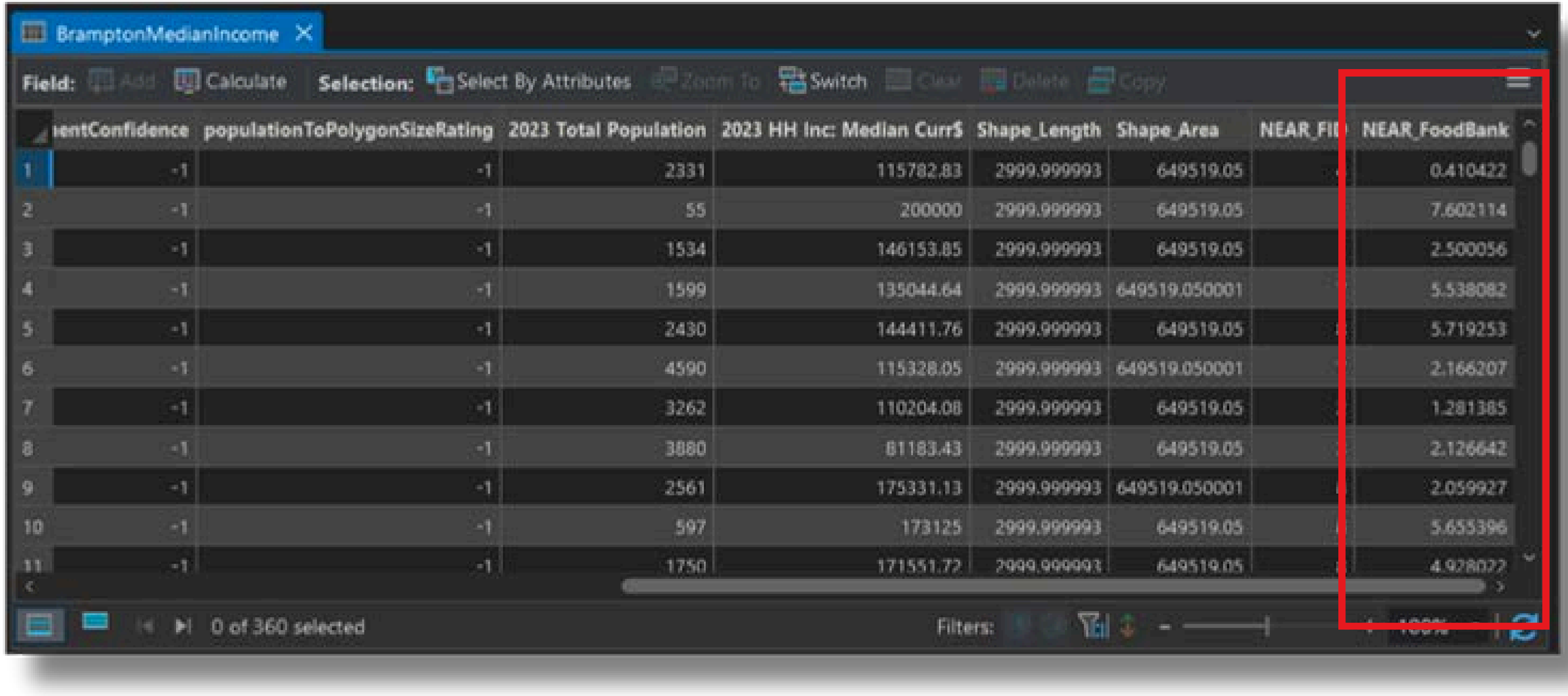
2. ArcGIS Pro

- How far is each area from a food bank?
- Open the **Near** geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Food Banks layer for the **Near Features**.
- Distance Unit = **Kilometres**.
- Distance Field Name = **NEAR_FoodBank**
- Click **Run**.



2. ArcGIS Pro

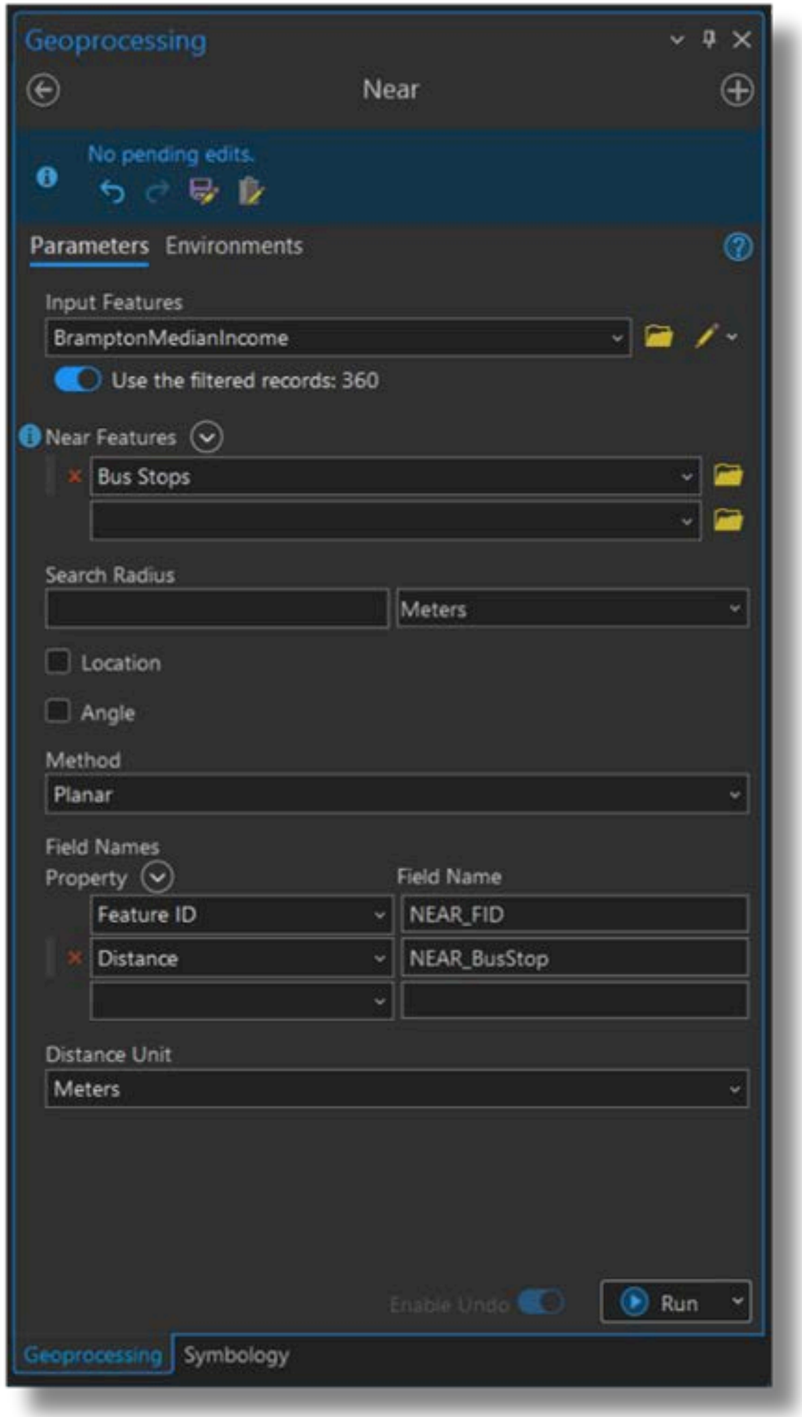
- The layer's Attribute Table now contains a field called **NEAR_FoodBank.**
- The attribute values in the NEAR_FoodBank field represent how far each area is from a food bank, in kilometres.



	ientConfidence	populationToPolygonSizeRating	2023 Total Population	2023 HH Inc: Median Curr$	Shape_Length	Shape_Area	NEAR_FID	NEAR_FoodBank
1	-1	-1	2331	115782.83	2999.999993	649519.05		0.410422
2	-1	-1	55	200000	2999.999993	649519.05		7.602114
3	-1	-1	1534	146153.85	2999.999993	649519.05		2.500056
4	-1	-1	1599	135044.64	2999.999993	649519.050001		5.538082
5	-1	-1	2430	144411.76	2999.999993	649519.05		5.719253
6	-1	-1	4590	115328.05	2999.999993	649519.050001		2.166207
7	-1	-1	3262	110204.08	2999.999993	649519.05		1.281385
8	-1	-1	3880	81183.43	2999.999993	649519.05		2.126642
9	-1	-1	2561	175331.13	2999.999993	649519.050001		2.059927
10	-1	-1	597	173125	2999.999993	649519.05		5.655396
11	-1	-1	1750	171551.72	2999.999993	649519.05		4.928027

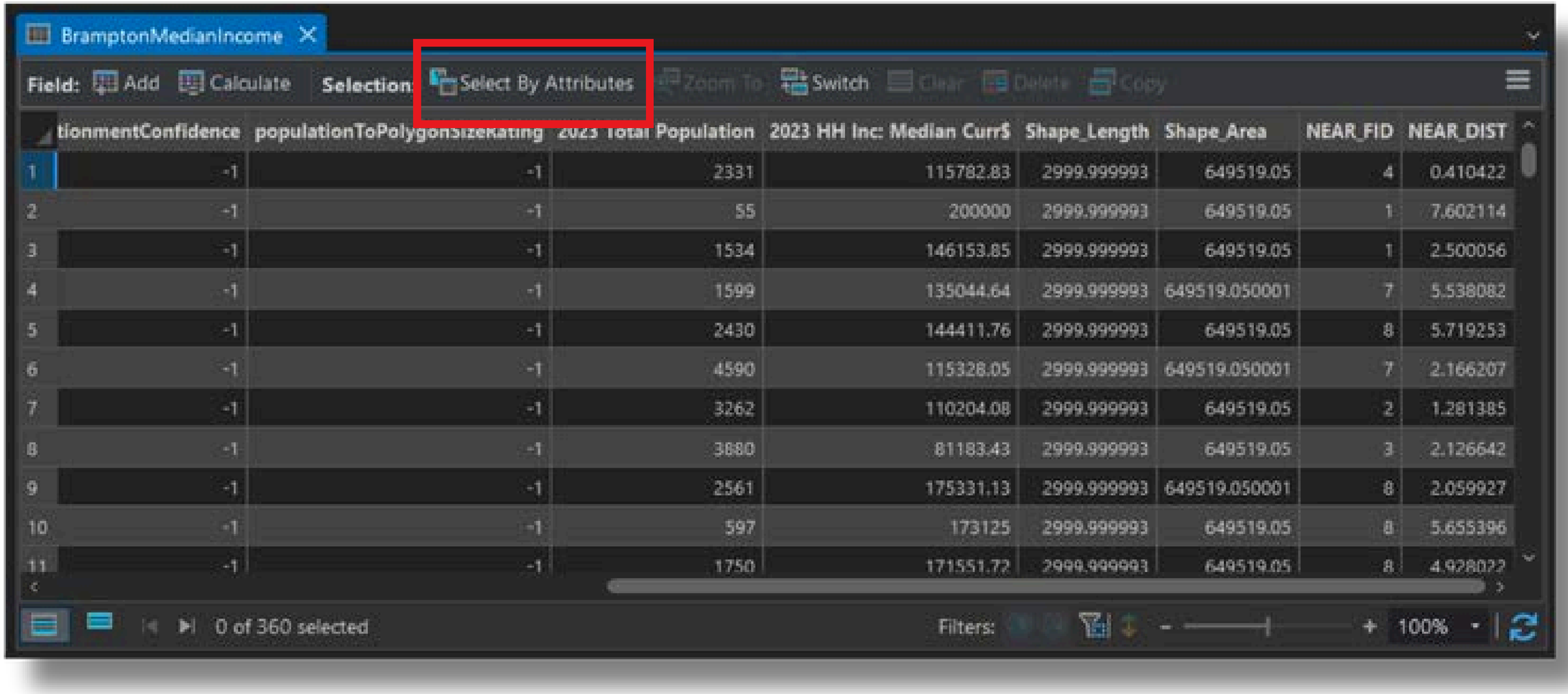
2. ArcGIS Pro

- How far is each area from a bus stop?
- Open the **Near** geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Bus Stops layer for the **Near Features**.
- Distance Unit = **Metres**.
- Distance Field Name = **NEAR_BusStop**
- Click **Run**.



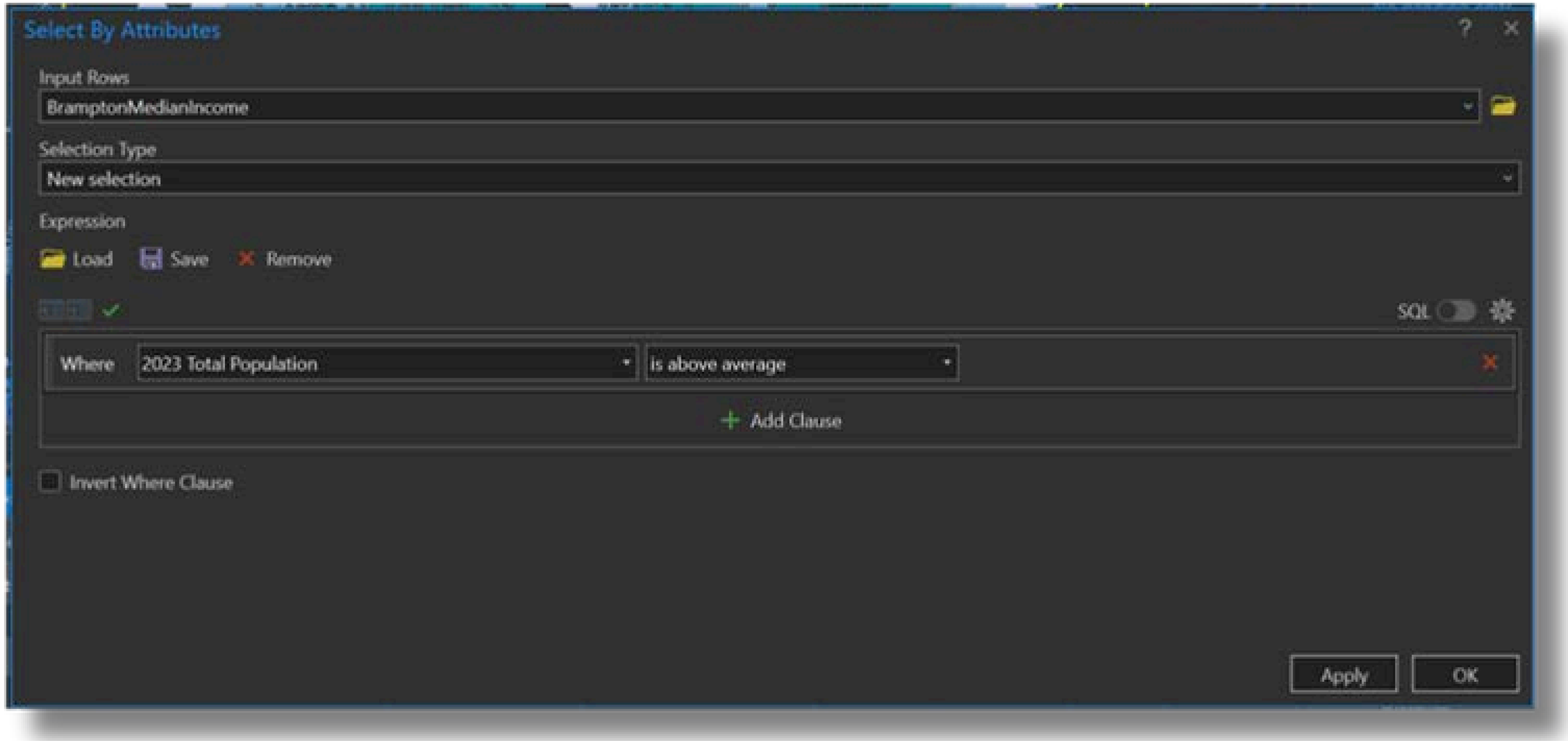
2. ArcGIS Pro

- Use the information in the attribute table to select some potential locations.
- Click the **Select by Attributes** button.



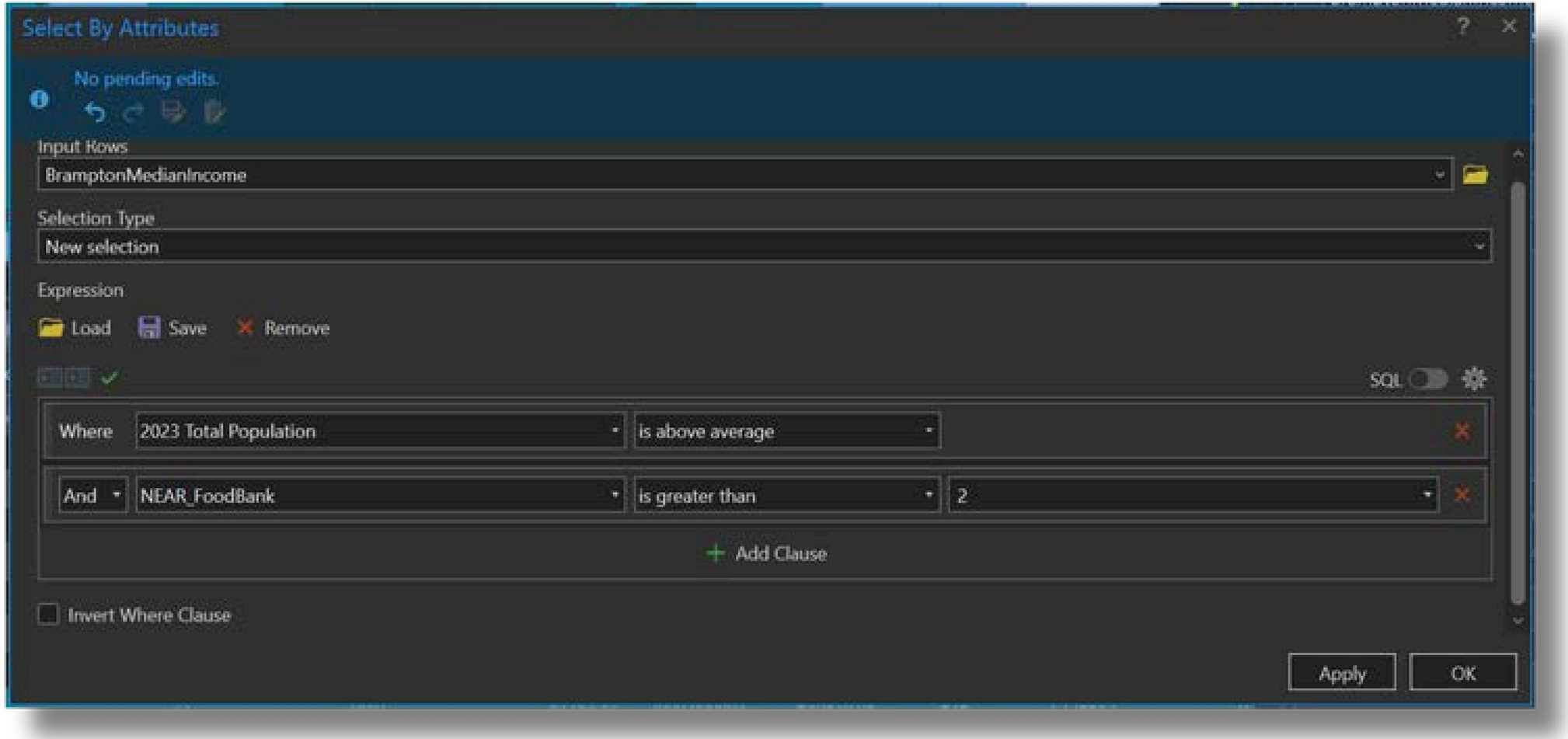
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - **Densely populated**



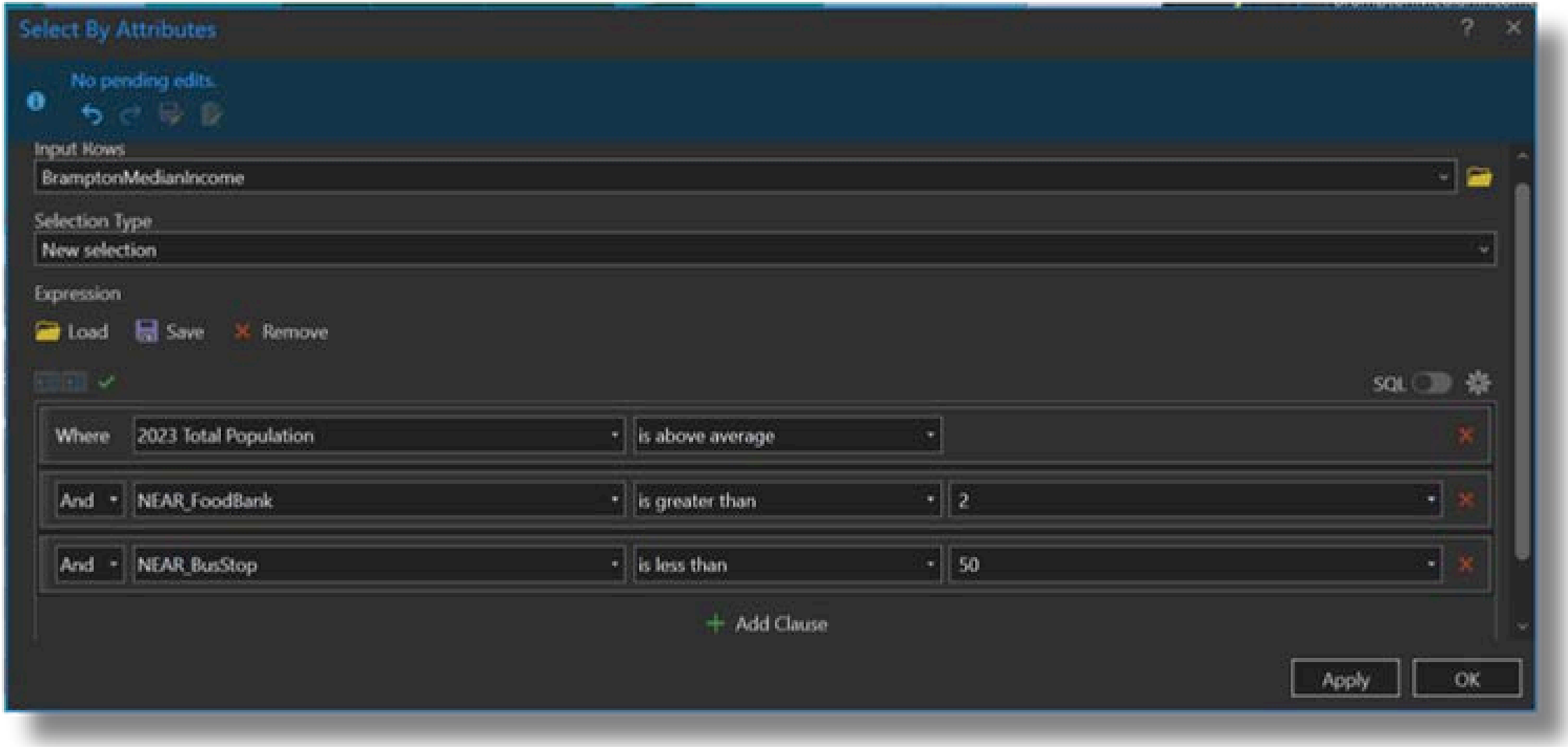
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - **More than 2km from an existing food bank**



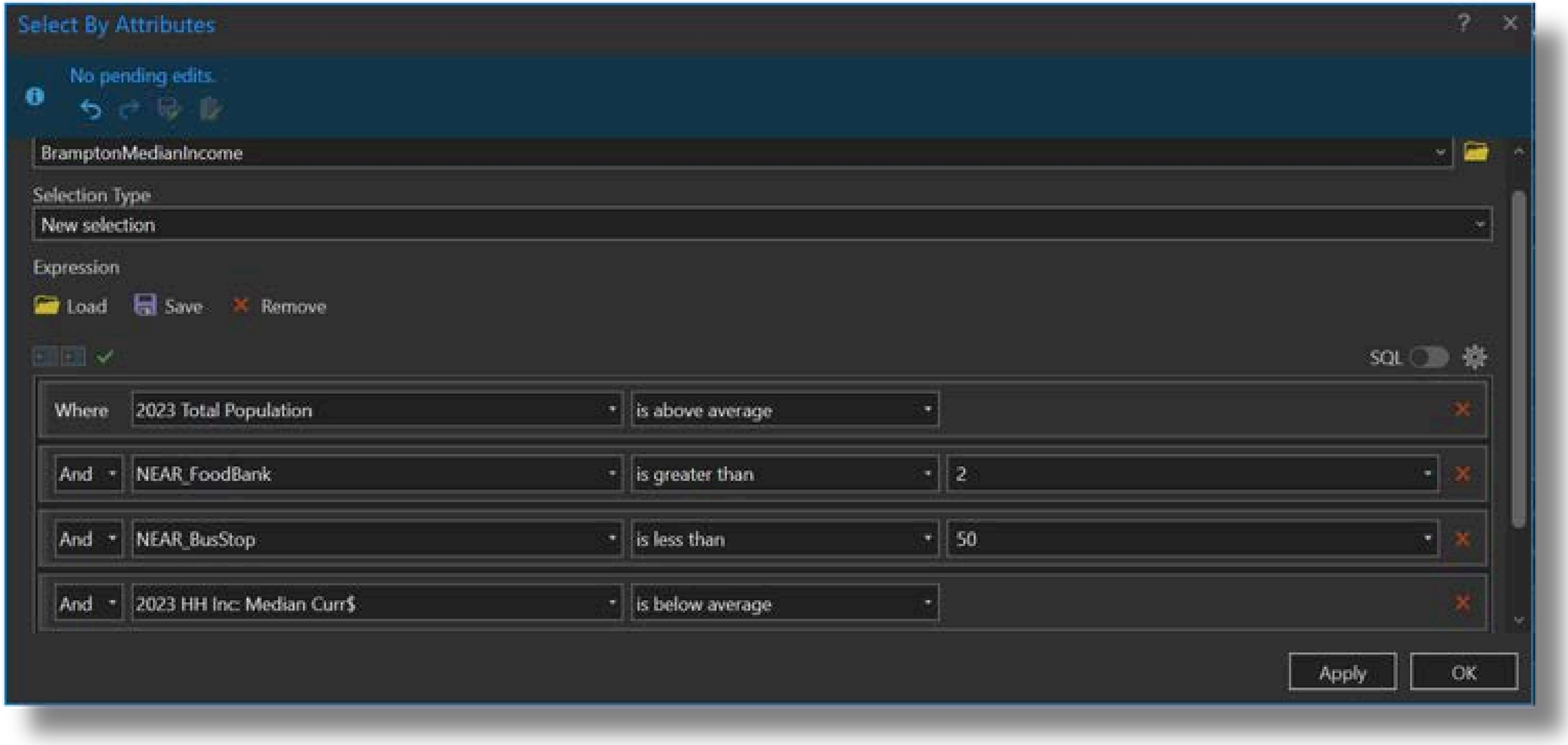
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - More than 3km from an existing food bank
  - **Within 50 metres of a bus stop**



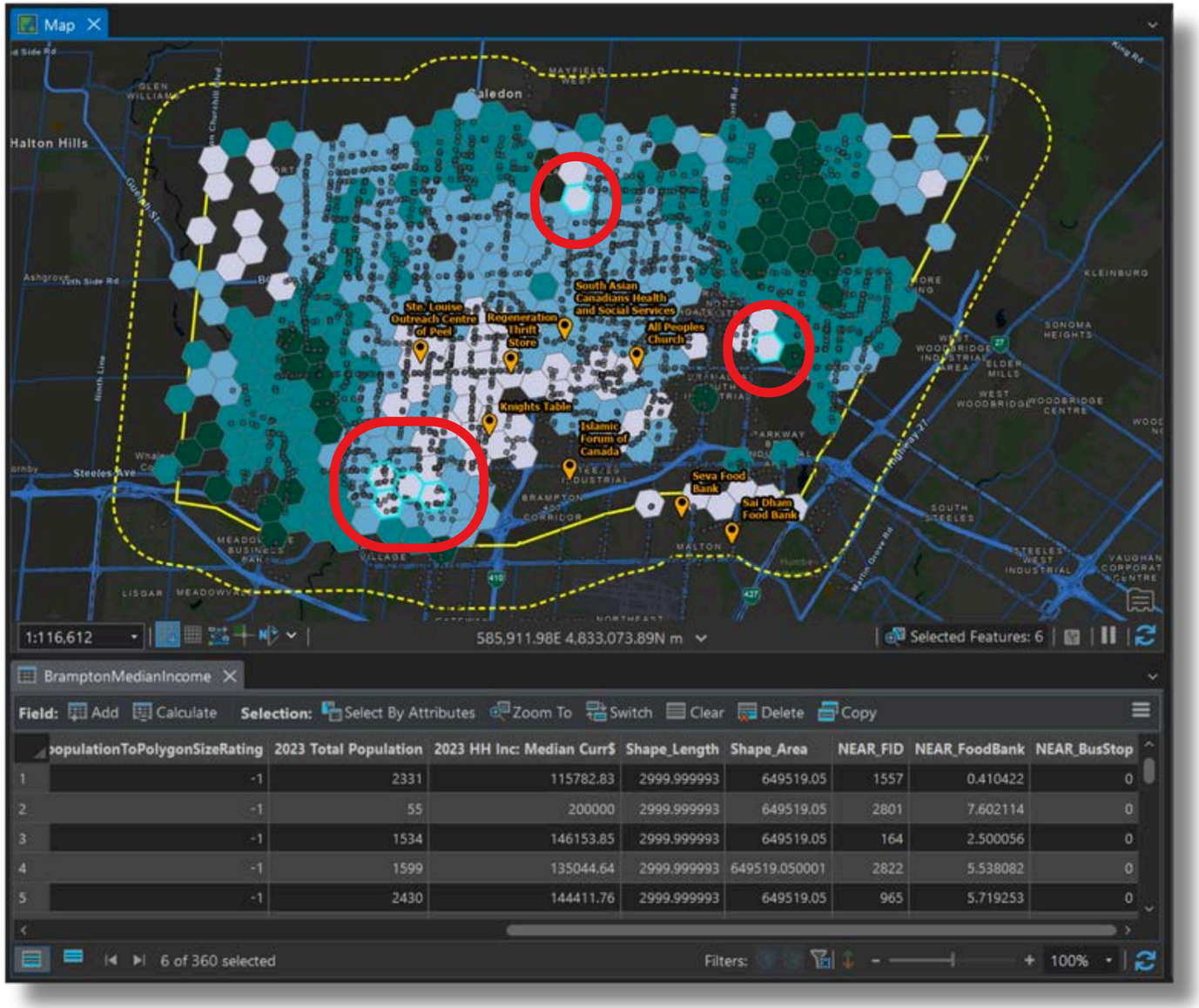
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - More than 3km from an existing food bank
  - Within 50 metres of a bus stop
  - **Relatively low-income**

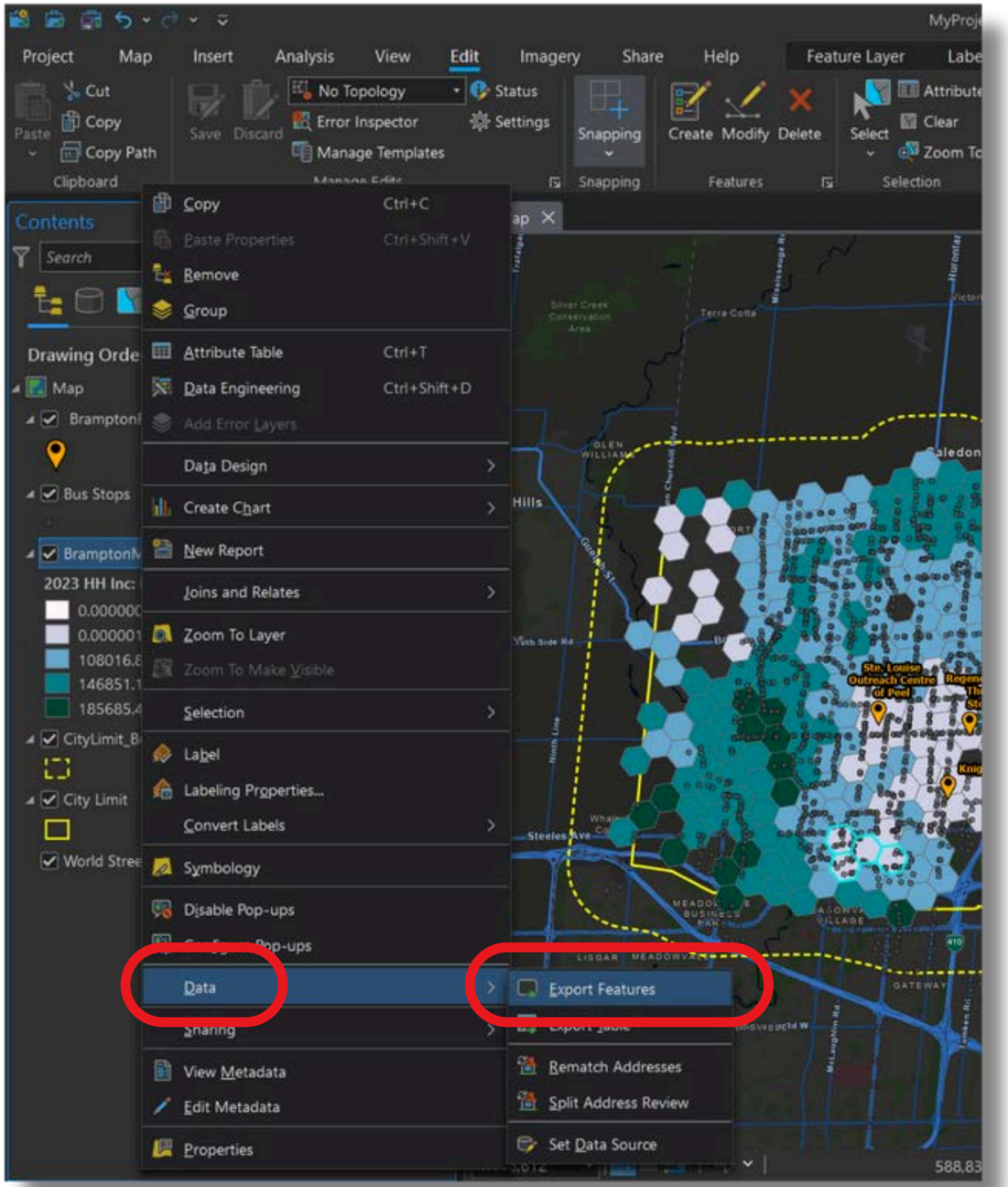


2. ArcGIS Pro

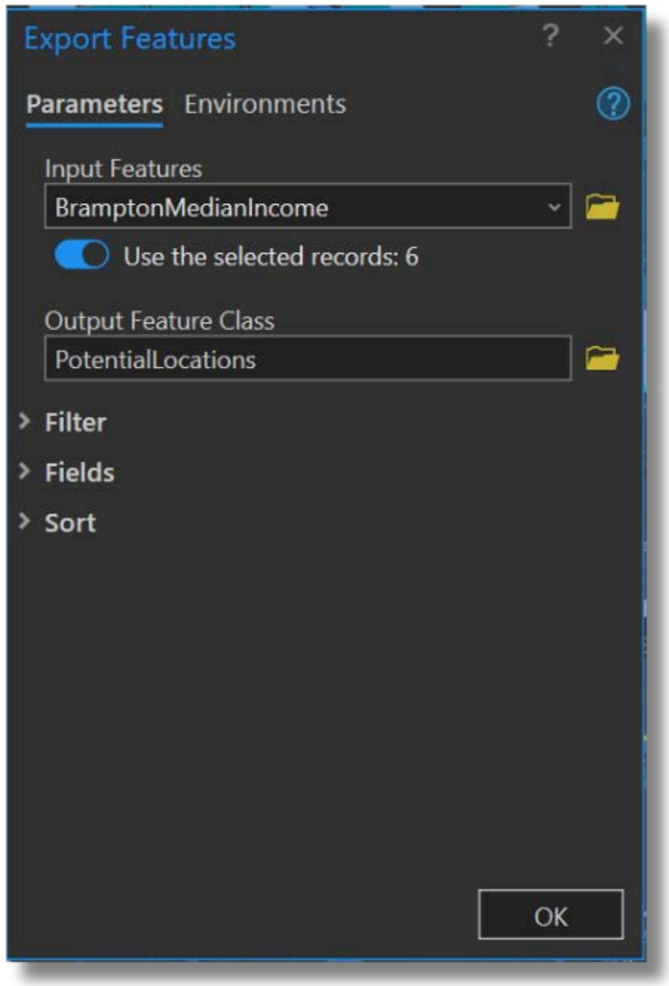
- Click OK.
- Results will be something like this:



2. ArcGIS Pro



- Export the selection to create a new layer.



2. ArcGIS Pro

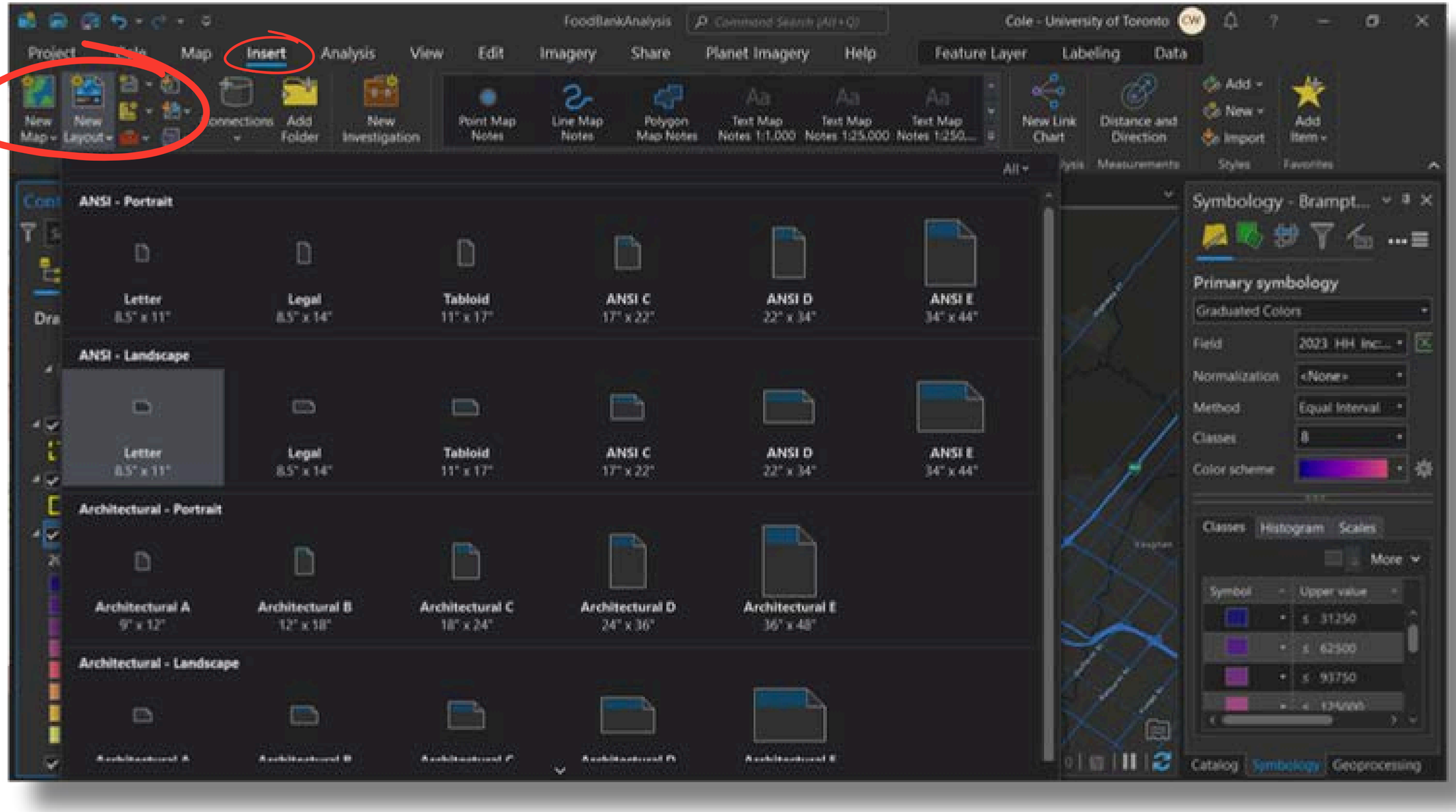
- Result:

- Based on the result, where would the best locations be to establish new food banks in Brampton, Ontario?

- What could be done to make this analysis better?

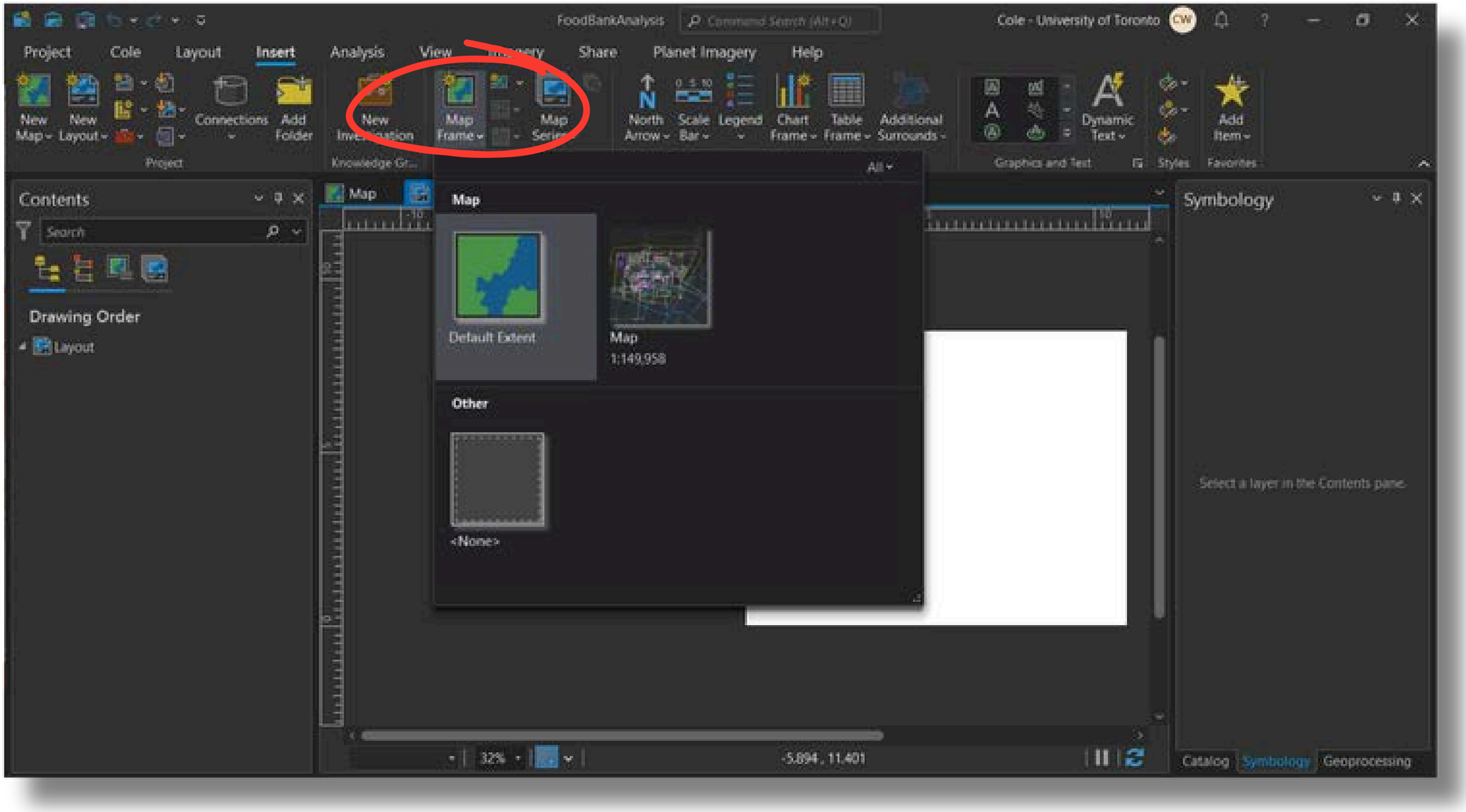
2. ArcGIS Pro - Next Steps - Layouts

- Next steps: Create a map **Layout** by choosing New Layout from the Insert tab



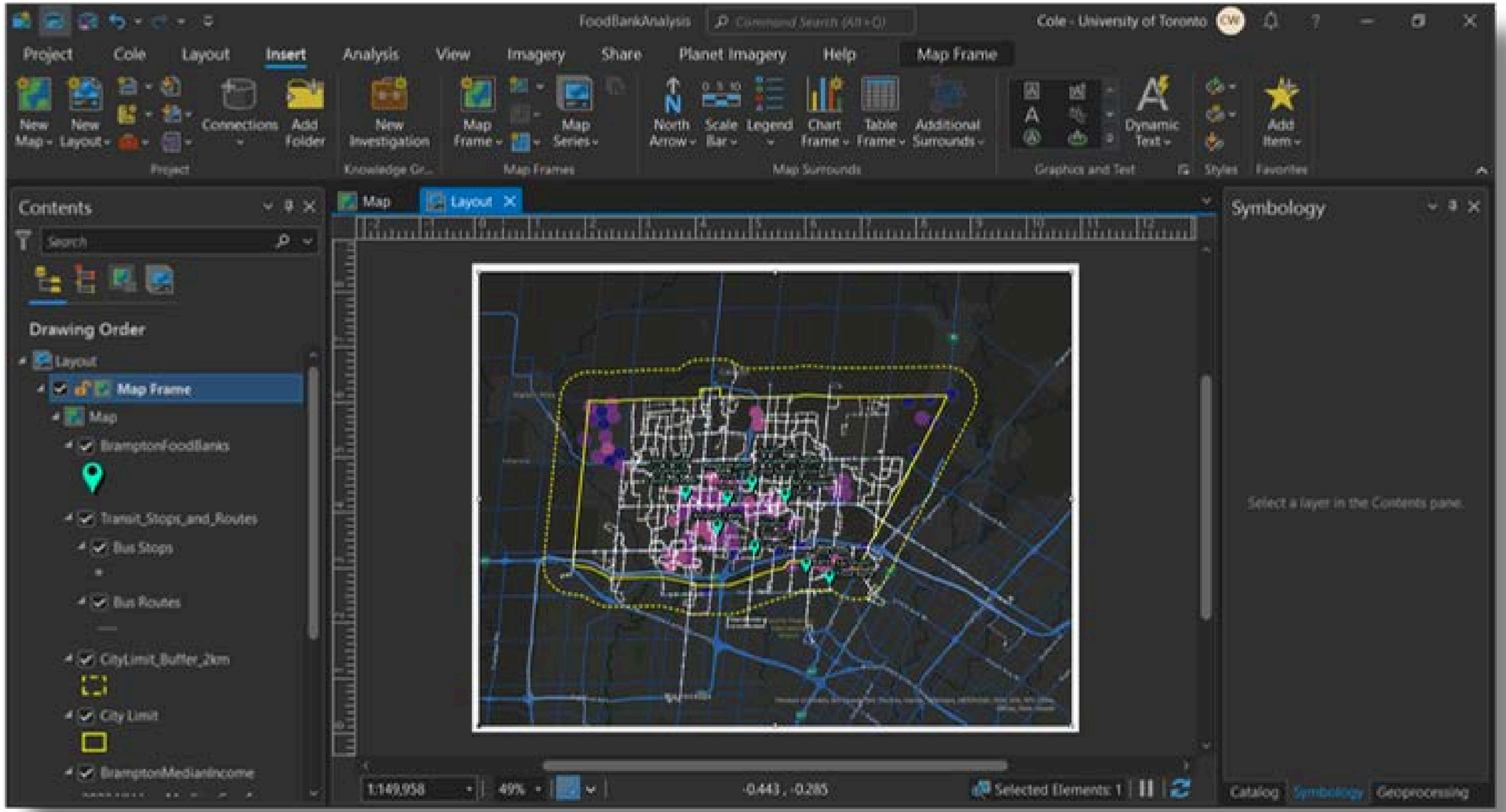
2. ArcGIS Pro - Next Steps - Layouts

- Click the **Map Frame** button and click the **Map** button



2. ArcGIS Pro - Next Steps - Layouts

- Hold down the left mouse button and drag to place the Map Frame within the Layout.
- **Title text, north arrows, scale bars**, and **legends** can be added at this point.



Resources: Further Reading

Learn ArcGIS Pro

- Map and Data Library Tutorials
  https://mdl.library.utoronto.ca/taxonomy/term/70

- Esri Training: Getting Started With Spatial Analysis
  https://www.esri.com/training/catalog/5bca58f8f77b99238f845e1c/getting-started-with-spatial-analysis/

- Esri Training: Exploring Spatial Relationships
  https://www.esri.com/training/catalog/60d1fa75b588b75ae084c42c/exploring-spatial-relationships/

- Layouts in ArcGIS Pro
  https://pro.arcgis.com/en/pro-app/latest/help/layouts/layouts-in-arcgis-pro.htm

Other Resources

- Esri Education Blog: How to find, evaluate, and use geospatial data in a GIS
  https://community.esri.com/t5/education-blog/how-to-find-evaluate-and-use-geospatial-data-in-a/ba-p/1366056

- GIS for Urban Planning (Official Esri website)
  https://www.esri.com/en-us/industries/urban-community-planning/overview

Resources: Finding Data

Spatial Data

MDL Geospatial Data Collection
https://mdl.library.utoronto.ca/collections/geospatial-data

Scholars GeoPortal
https://geo1.scholarsportal.info

Natural Earth Data
https://www.naturalearthdata.com/

Open Street Map
https://www.openstreetmap.org

City of Toronto Open Data
https://open.toronto.ca/

Ontario GeoHub
https://geohub.lio.gov.on.ca/

Toronto and Region Conservation Authority Open Data
https://data.trca.ca/

GIS at NASA
https://www.earthdata.nasa.gov/learn/gis

ArcGIS Hub
https://hub.arcgis.com/search

Other Data and Media

MDL Numeric Data Collection
https://mdl.library.utoronto.ca/collections/numeric-data

Wikimedia Commons
https://commons.wikimedia.org/wiki/Main_Page

Creative Commons Search Portal
https://search.creativecommons.org/

Freesound
https://freesound.org/

Open Culture
(see the Free Art & Images and Free Music sections)
https://www.openculture.com/

Burst by Shopify
https://www.shopify.com/stock-photos

GitHub: Awesome Public Datasets
https://github.com/awesomedata/awesome-public-datasets

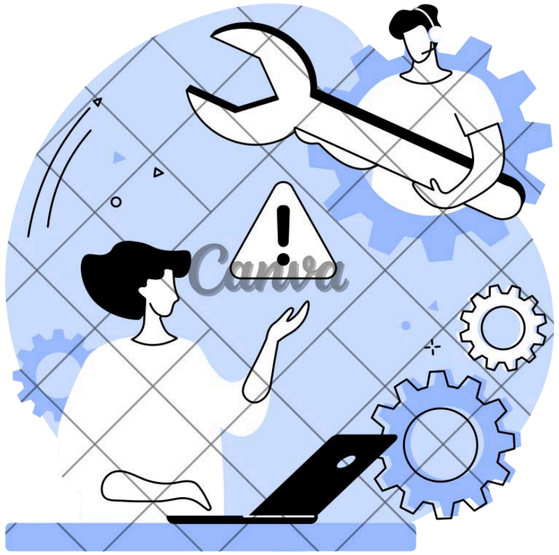
Internet Archive (Archive.Org)
https://archive.org/

Resources: Troubleshooting

Esri community discussion boards
https://community.esri.com/

GIS StackExchange
https://gis.stackexchange.com/

Contact the Map and Data Library
https://mdl.library.utoronto.ca/about/contact-form



Thank you!

Download the slides here:

https://tinyurl.com/ProAnalysis