

GIS Training II

Generating and Managing Spatial Data Exercise



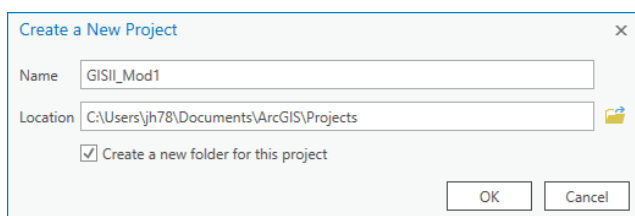
*** Files needed for exercise: ExerciseData.gdb (*RI_FarmersMarkets_Mar2020_add*, *RI_FarmersMarkets_Mar2019*, *RI_bg_2017_ACS2015*), and the Census Geocoder 2018 locator (*Census_Geocoder_2018.loc*, *Census_Geocoder_2018.lox*)

Goals: The goals of this exercise are to use batch geocoding to update locations of farmers markets in Rhode Island and visualize a 1-mile distance from the farmers markets.

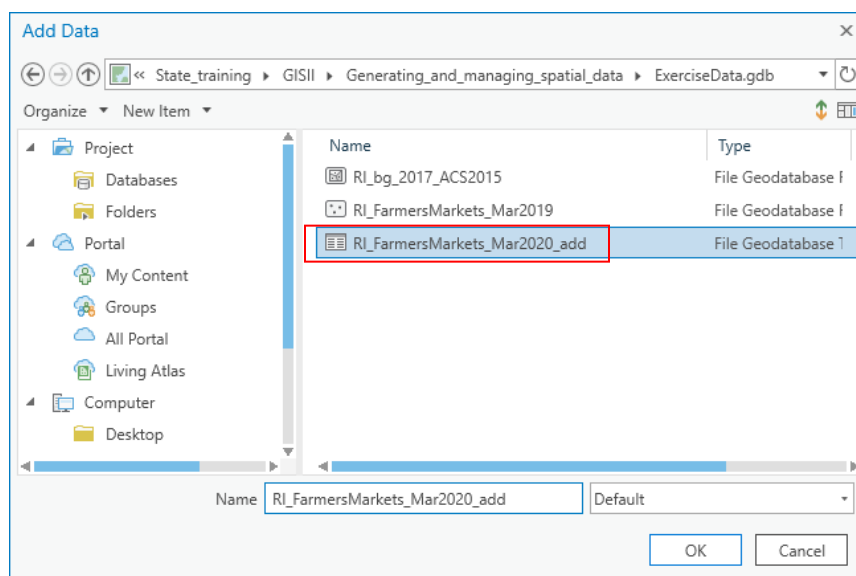
Skills: After completing this exercise, you will be able to use both the batch geocoder tool and the interactive matching tool to geocode a table of addresses in ArcGIS Pro. You will also know how to use common geoprocessing tools such as Merge and Buffer.

Preparing the address table and address locator

1. Create a new ArcGIS Pro map project.



2. On the map tab, click the **Add Data** button and browse to the exercise data geodatabase. Add the table, *RI_FarmersMarkets_Mar2020_add*. This table lists the addresses of new Farmers Markets in Rhode Island not present in the Mar2019 dataset. These data are actually simulated for the purposes of the exercise but are sourced from the USDA National Farmers Market Directory <https://www.ams.usda.gov/local-food-directories/farmersmarkets> as of Feb 26, 2020.



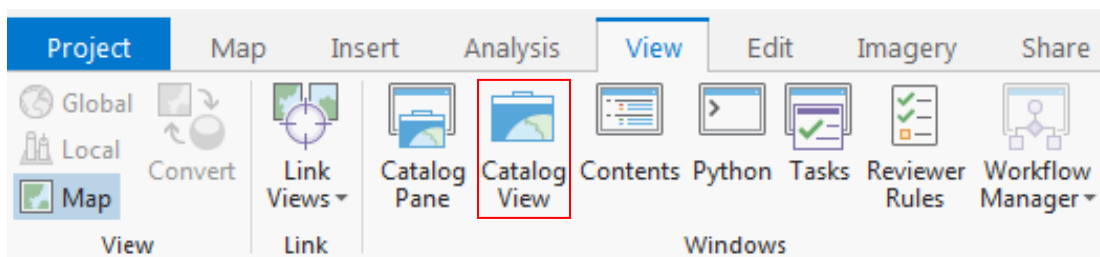
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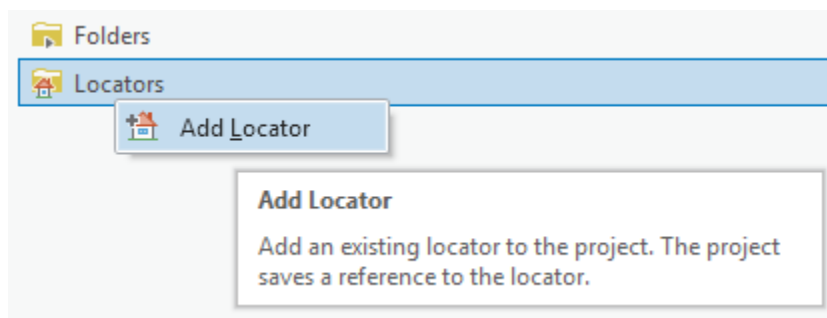
- Right click *RI_FarmersMarkets_Mar2020_add* in the **Contents** pane and **Open** the attribute table. You can see the market name and additional attributes for 8 farmers markets. Check that all the necessary address components are present: address, city, state, and zip.

OBJECTID	FMID	MarketName	Street	City	County	State	Zip	Season1Date
1	1019466	Armory Farmers Market	85 Parade Street	Providence	Providence	Rhode Island	02909	<Null>
2	1019467	Broad St. Farmers Mar...	807 Broad St	Providence	Providence	Rhode Island	02907	06/15/2019 to 10/26/
3	1019468	Brown University Farm...	Thayer St	Providence	Providence	Rhode Island	02912	09/04/2019 to 10/30/
4	1019465	Central Falls Farmers...	559 Dexter St, Central F...	Central Falls	Providence	Rhode Island	02863	<Null>
5	1019470	Neutaconkanut Farme...	675 Plainfield St, Provi...	Providence	Providence	Rhode Island	02909	07/01/2019 to 10/28/
6	1019469	Slater Park Farmers Ma...	375 Newport Ave, Paw...	Pawtucket	Providence	Rhode Island	02860	07/03/2019 to 10/30/
7	1019743	Weaver Library Farmer...	41 Grove Avenue	East Providence	Providence	Rhode Island	02914	06/25/2020 to 09/10/
8	1019471	Woonsocket Farmers...	450 Clinton St, Woonso...	Woonsocket	Providence	Rhode Island	02895	07/02/2019 to 10/29/

- After checking the address table, we can add the address locator to our project. Click on the **View** tab in the ribbon (top of the screen), then click on **Catalog View**.



- At the bottom of the list, right click on **Locators** and choose **Add Locator**. Navigate to the data folder and select *Census_Geocoder_2018.loc*. The address locator should now be listed under Locators. CEHI built this address locator based on 2018 TIGER/Line road data published by the US Census.



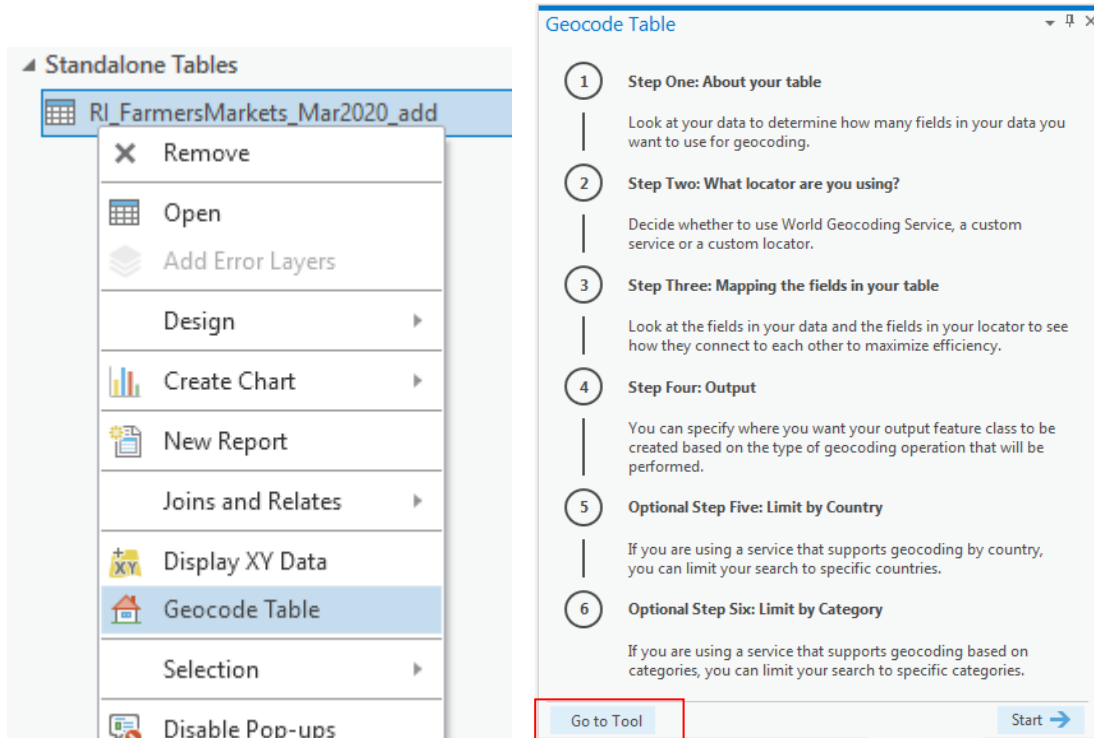
Name	Type
ArcGIS World Geocoding Service	Locator
Census_Geocoder_2018	Locator
XY provider	Locator

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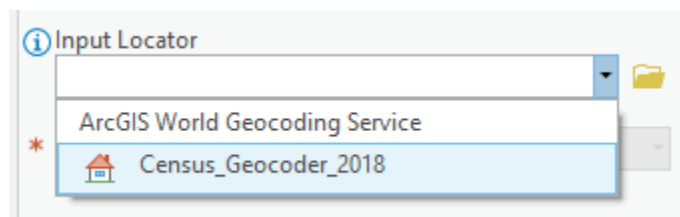


Batch Geocoding

1. Switch back to the main **Map** view. In your **Contents** pane, right click on *RI_FarmersMarkets_Mar2020_add* and choose **Geocode Table**.



2. ArcGIS Pro provides a guided flow to walk you through the batch geocoding process. However, we will skip directly to the tool. Click on **Go to Tool** in the bottom left of the pane.
3. In the Geocode Table pane, the **Input Table** should be *RI_FarmersMarkets_Mar2020_add*. Under the **Input Locator** dropdown menu, you will see two locators available: *ArcGIS World Geocoding Service* and *Census_Geocoder_2018*. The *ArcGIS World Geocoding Service* is an online service that requires spending credits (obtained from spending real currency) so you may need to think twice before you use it, especially if you want to geocode any confidential data. Select the locally stored *Census_Geocoder_2018* for this exercise.



4. You will now need to specify the fields used for geocoding, as well as the path of the output feature class. Double check that Address and ZIP have been correctly selected by the locator; adjust if necessary. (This locator was built to only use address and zip though others may include additional fields such as city and state.) Designate the **Output** file name and location by clicking

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on the yellow folder. Name the file *RI_FarmersMarkets_Mar2020_add_result* and save it in your exercise data geodatabase for this module. Click **Run** to start the process.

The screenshot shows the 'Geocode Table' dialog box in ArcGIS. The 'Input Table' field is set to 'RI_FarmersMarkets_Mar2020_add'. The 'Input Locator' is set to 'Census_Geocoder_2018'. The 'Input Address Fields' are set to 'Multiple Field', and the 'Locator Field' is set to 'Data Field'. The 'Street or Intersection' is set to 'Street', and the 'ZIP Code' is set to 'Zip'. The 'Output' field is set to '_Mod1.gdb\RI_FarmersMarkets_Mar2020_add_result'. The 'Add output to map after completion' checkbox is checked. A 'Run' button is located at the bottom right of the dialog.

5. Wait for the automated geocoding process to complete, then a result window will appear. You should see similar numbers as the screenshot displayed below. Click **Yes** to begin the interactive rematch process.

The screenshot shows the 'Geocoding Completed' dialog box. It displays the following statistics: 6 Matched (75.00%), 2 Unmatched (25.00%), and 0 Tied (0.00%). The average speed is 1154 records/hour. The dialog asks 'Start rematch process?' and has 'Yes' and 'No' buttons at the bottom right.

Category	Count	Percentage
Matched	6	75.00%
Unmatched	2	25.00%
Tied	0	0.00%

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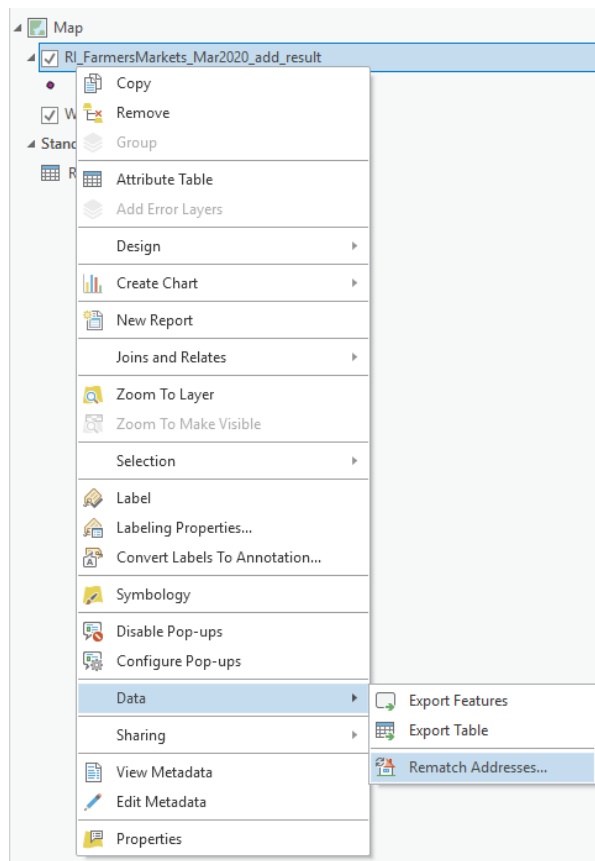


Interactive Geocoding

1. If the batch geocoding process was successful, the resulting feature class should be added to your **Contents** pane with new points on the map in Rhode Island. You can use the basemap or add *RI_bg_2017_ACS2015* as reference. **Open** the attribute table to see the new fields that the geocoding process has added.

ObjectID	Shape	Status	Score	Match_type	Match_addr	Addr_type	AddNum	AddNumFrom	AddNumTo	Side	StPreDir
1	Point	M	100	A	85 Parade St, 02909	StreetAddress	85	61	91	R	
2	Point	M	100	A	807 Broad St, 02907	StreetAddress	807	801	813	R	
3	Point	U	0	A							
4	Point	M	100	A	559 Dexter St, 02863	StreetAddress	559	505	573	R	
5	Point	M	100	A	675 Plainfield St, 02909	StreetAddress	675	665	699	R	
6	Point	U	0	A							
7	Point	M	100	A	41 Grove Ave, 02914	StreetAddress	41	7	99	R	
8	Point	M	100	A	450 Clinton St, 02895	StreetAddress	450	300	498	L	

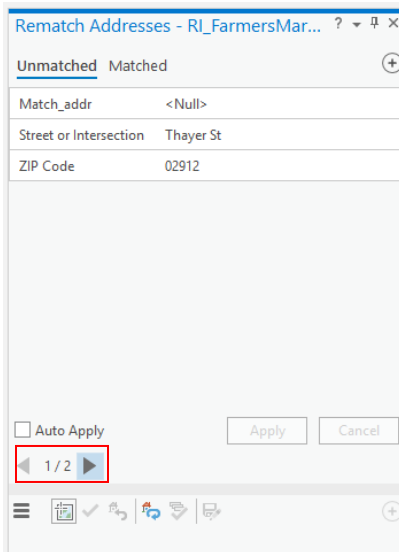
2. There are still addresses remaining that were not matched to a geocoded location. We can find matches for them interactively. If the rematch address pane is not open, right click on the newly added geocoded points and under **Data** sub-menu, click on **Rematch Addresses...** The Rematch Address pane will appear on the right hand side.



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- The rematch process is designed for finding appropriate candidates for any *Unmatched* records and for making decisions for any *Tied* records. In the **Rematch Address** pane, you will find the pane dissected into two. The top part shows the input info for the current record while the bottom part lists potential candidates (if any) for a match. Use the arrows at the bottom of the input section to click through different records. It also informs you that we have 2 unmatched records.



- Switch to unmatched address 2 – “375 Newport Ave, Pawtucket, RI 02861”. No candidates are listed but notice the address includes redundant information. Click on the **Street or Intersection** input and remove “Pawtucket, RI 02861”. Edit the **ZIP Code** from “02860” to “02861”. Press **enter** then click **Apply**.

Match_addr	<Null>
Street or Intersection	375 Newport Ave
ZIP Code	02861

- You should now see two candidates listed in the pane and their labeled respective points displayed in the map. Candidate A is now a perfect match so click the **green check mark** to confirm the match. ArcGIS Pro will add the point and automatically display the next unmatched address. The total number of unmatched records in the queue will decrease from 2 to 1.

Address	Type	Score
A 375 Newport Ave, 02861	StreetAddress	100
B 376 Newport Ave, 02861	StreetAddress	79

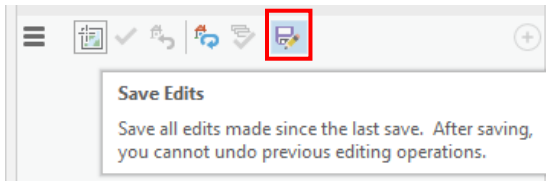
- Typically, you would continue to review the other unmatched addresses. You can also review the Matched addresses and un-match any false positives. For now, let's move on.

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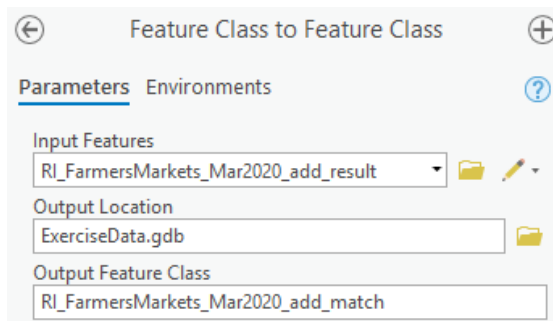


Exporting and projecting matched records

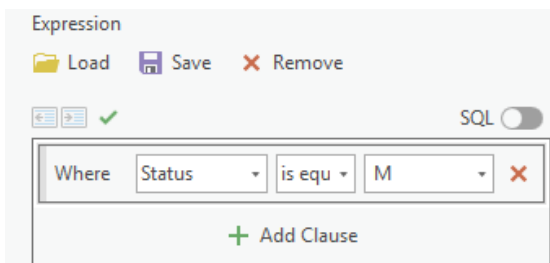
1. At the top of the candidates sections, click the **save** icon. Note this is different than the save project button. Select **Yes** to confirm saving all edits. Close the rematch pane.



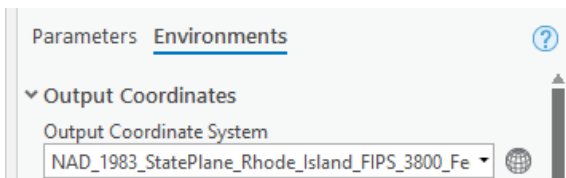
2. It is possible that not all addresses are matched to a point. It's best practice to export just the matched features to a clean new feature class.
3. Right click *RI_FarmersMarkets_Mar2020_add_result* in **Contents** and select Data>Export Features. For Output Location, click the yellow folder and select the exercise data geodatabase. Name the Output Feature Class *RI_FarmersMarkets_Mar2020_add_match*.



4. Take advantage of the **Expression** field to select and export only the matched records. Click the **+ New expression** button, and use the dropdowns to create: Where *Status is equal to M*.



5. Use the **Environments** settings to both export and project the data. Under **Output Coordinate System**, select *NAD 1983 StatePlane Rhode Island FIPS 2800 (US Feet)*. **Run** the tool.



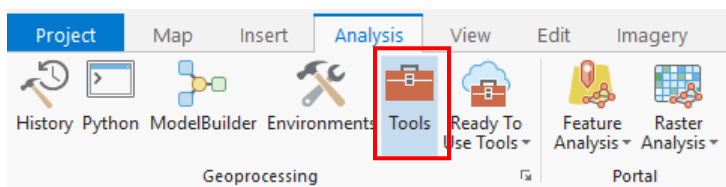
6. The new feature class will be added to your map. Open the attribute to check its contents. It should only contain the 7 matched records. Remove the geocoding results layer from the map.

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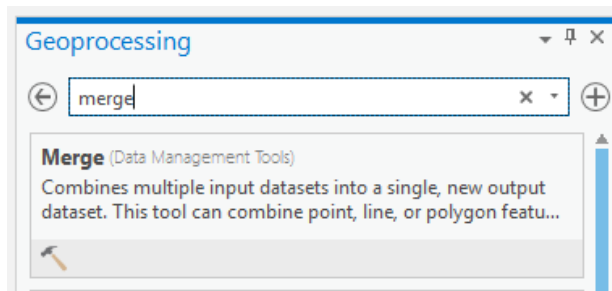


Merging with other datasets

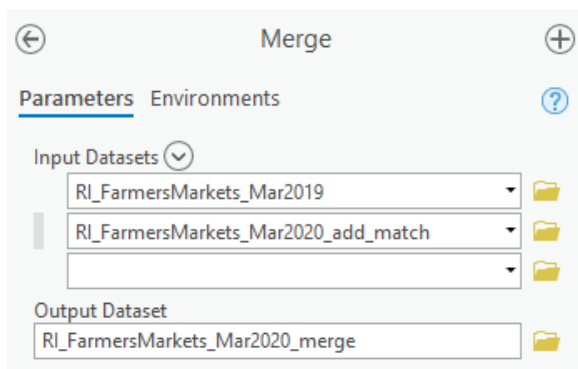
1. Use **Add Data** to add the existing farmers markets dataset (*RI_FarmersMarkets_Mar2019*).
2. After geocoding the new farmer markets, we can combine it with the previous farmers markets to create one feature class for future use. A feature class is a collection of features with the same type of geometry: point, line, polygon, or annotation.
3. Whenever performing analysis or operations across multiple feature classes, it is best practice for all data to be in the same coordinate system. Double check that both layers are in the same projected coordinate system. Right click a layer in contents and select **Properties**. Under the **Source** menu, scroll down to **Spatial Reference**.
4. Now we are ready to merge. Under the **Analysis** tab, select the **Tools** icon. The Geoprocessing



5. In the search box, type “Merge” and select the first result **Merge**.



6. Use the dropdowns to select the farmers markets from each year – be sure to select the matched records, not any of the previous results or tables. Click the yellow folder to save the output file in the exercise data geodatabase. **Run** the tool.



7. After the tool completes, the new merged feature class is added to your **Contents**. Open the attribute table to view the total 35 farmers markets in Rhode Island as of March 2020. Turn off or remove the previous layers to clearly view the merged dataset on the map.

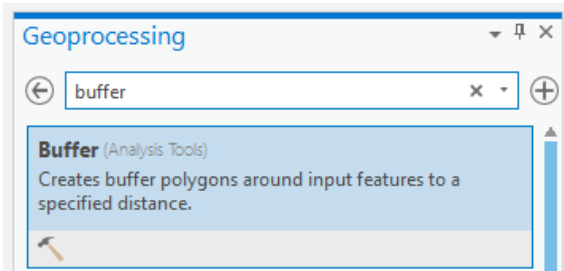
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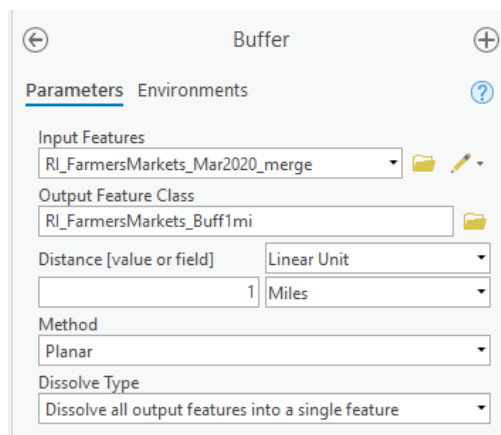
Generating a buffer

1. Press the back button on the Geoprocessing pane or click the **Tools** icon again.
2. Search for “Buffer” this time and select the first result **Buffer**.



Note: The Buffer tool creates polygons that cover a given distance from a point, line, or polygon features.

3. Run the tool using the following parameters:
 - a. Your **input features** will be: *RI_FarmersMarkets_Mar2020_merge*
 - b. Save your **output feature class** in the *Exercise_data.gdb*: *RI_FarmersMarkets_Buff1mi*
 - c. Your **buffer distance value** will be a linear unit of 1 mile – this is an approximation of the distance that can be covered walking for 20 mins at a rate of 3 miles per hour.
 - d. Keep the **Method** as Planar. Do you know why?
 - e. You will choose to “**Dissolve all output features into a single feature.**” Consider when you might choose a different option.

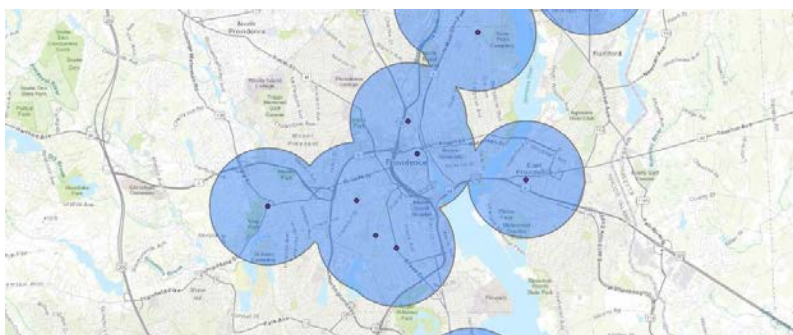


Planar vs Geodesic buffers:

Planar buffers measure distance in a two-dimensional Cartesian plane, where straight-line or Euclidean distances are calculated between two points on a flat surface. Planar buffers are more appropriate for two-dimensional flat maps that are concentrated in a relatively small area.

Geodesic buffers account for the actual shape of the earth by measuring distance with curved lines. Geodesic buffers may appear unusual on a flat map and are more appropriate for three-dimensional maps that cover multiple time zones or large areas.

4. Zoom in and take a look at the buffers are added to your map and Contents. What areas are within walking distance to a farmers market? What areas are not?



Note: by dissolving all output features into a single feature, the resultant polygons do not display overlapping buffer outlines and instead show the buffer areas as a single polygon.

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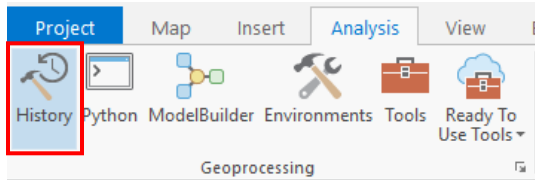
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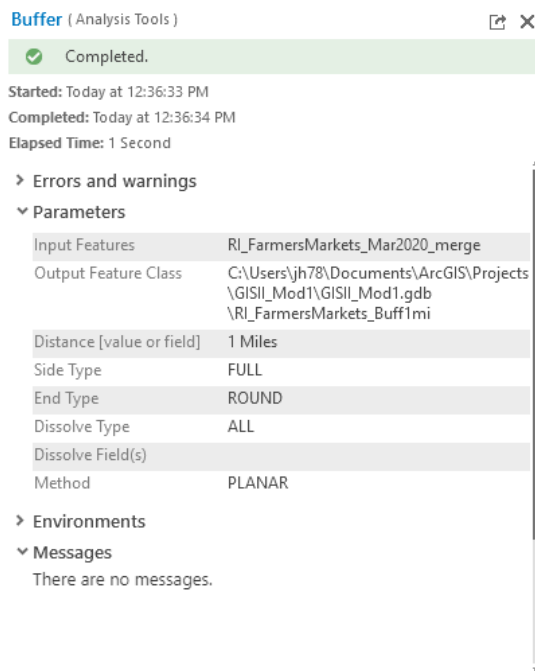
Inspecting geoprocessing history

1. After using all these tools, it is a good time for us to review every operation we have done. Under the **Analysis** tab, select the **History** icon. The History pane will appear on the right.

(Note: the **History** pane was added in Ver 2.5 and was previously found in the **Catalog** pane.)



2. A list of the geoprocessing tasks we've run are listed. However over one of these to review your input parameters, output location, error messages, etc.



3. These logs are a good way to document your process. However, storing the results will increase the file size of the project and sometimes, failed processes can clutter up your log. In these cases, it may be useful to right click a history item and **Remove** it from the History.

