

Exercise 23: Vector Geoprocessing using ModelBuilder

This exercise will explain how to create a model using ArcGIS ModelBuilder. Here, we will specifically focus on the analysis of vector data. You will produce a simple model that summarizes the area of palustrine wetlands that may be impacted by a proposed highway. Once the model is produced, you will create a new tool in ArcToolbox that can be used by other analysts. ModelBuilder offers an intuitive and graphical means to build a multipart process that does not rely on coding or scripting.

Topics covered in this exercise include:

1. Implement ArcGIS ModelBuilder to work through a multipart process
2. Create a ModelBuilder tool containing vector geoprocessing functions
3. Create a new toolbox
4. Create an ArcToolbox tool from a ModelBuilder process

Step 1. Open a Map Project

First, we need to download and open the **Exercise_23.aprx** file.

- Download the **Exercise_23** data from <https://www.wvview.org/>. All lab materials are available on the course webpage and linked to the exercise. You will need to extract the compressed files and save it to the location of your choosing.
- Open ArcGIS Pro. This can be done by navigating to All Apps followed by the ArcGIS Folder. Within the ArcGIS Folder, select ArcGIS Pro. Note that you can also use a Task Bar or Desktop shortcut if they are available on your machine.
- After ArcGIS Pro launches, select "Open another project."



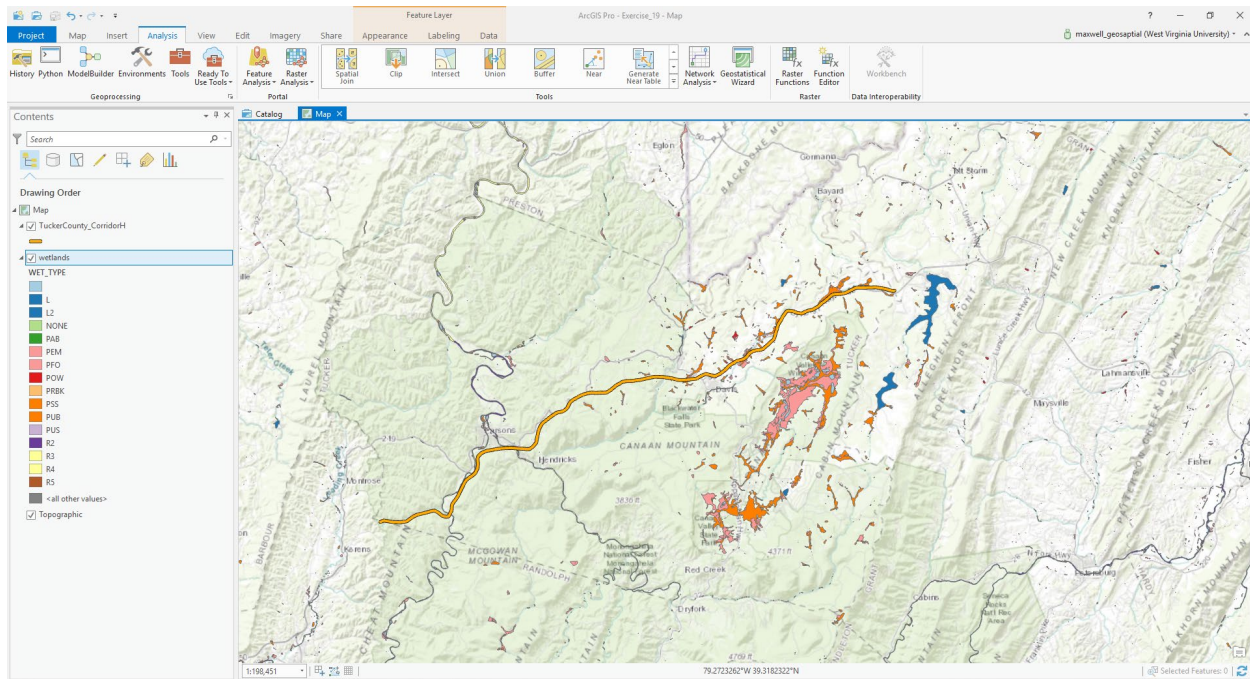
- Navigate to the directory that houses the material for this course. The project files are in the **Exercise_23** folder where it was saved on your local machine.
- Select **Exercise_23.aprx**. Click OK to open the project.
- If necessary, navigate to the WV map.

Note: If you'd prefer, you can also just click on the **Exercise_23.aprx** file within the uncompressed folder directly to launch ArcGIS Pro.

This project contains a single map that contains two data layers.

TuckerCounty_CorridorH: line feature representing a proposed highway route

wetlands: polygon features representing wetland extents from the National Wetland Inventory (NWI)



Step 2. Create a New Toolbox

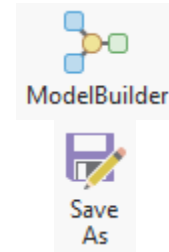
Before you begin the analysis, you will need to create a new toolbox in which to save your model. You will do so using ArcCatalog.

- In ArcGIS Pro, navigate to the View Tab then select Catalog View. This will open the Catalog View if it is not already open.
- In the Catalog View, double-click on Toolboxes. This will open a list of available toolboxes.
- Right-click in the toolbox space within the Catalog View then select New Toolbox. Provide a name to save the new toolbox.

Note: Each project has a default toolbox associated with it. You can use this toolbox. Here, we are having you create a new toolbox so that you know how to do so. Tools, such as models, must be saved inside of toolboxes.

Step 3. Creating the Model

- ❑ Return to ArcGIS Pro. You will not need to use ArcCatalog again in this lab, so you can close it if you'd like.
- ❑ Navigate to the Analysis Tab then select ModelBuilder under the Geoprocessing area. This will open the ModelBuilder window.
- ❑ In the ModelBuilder Tab, click on the Save As button.
- ❑ Navigate to the toolbox you just created and save the model in the toolbox as **wetland_tool**.

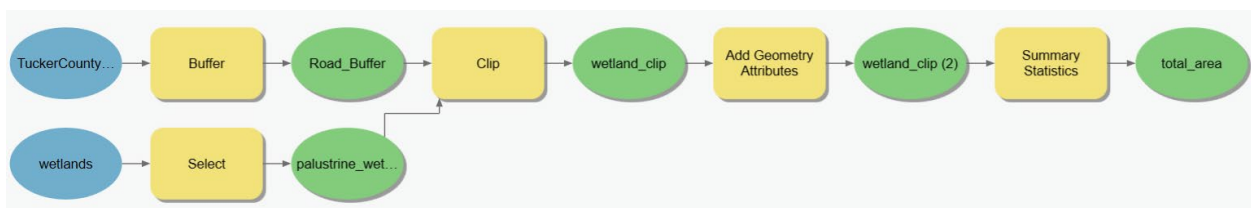


In this exercise, you will specifically focus on impacts to palustrine wetlands. So, impacted wetlands will be those that are within 1 km of the proposed highway and are palustrine.

Here are the required steps:

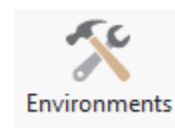
1. Buffer the proposed highway using a 1 km buffer distance.
2. Select any wetlands that are palustrine and extract them from the larger dataset.
3. Clip the palustrine wetland using the road buffer.
4. Calculate the area of the wetland within a new field.
5. Summarize the field to obtain the total area impacted.

This section will guide you in creating the model. Once your model is complete, it should look like the model presented below.

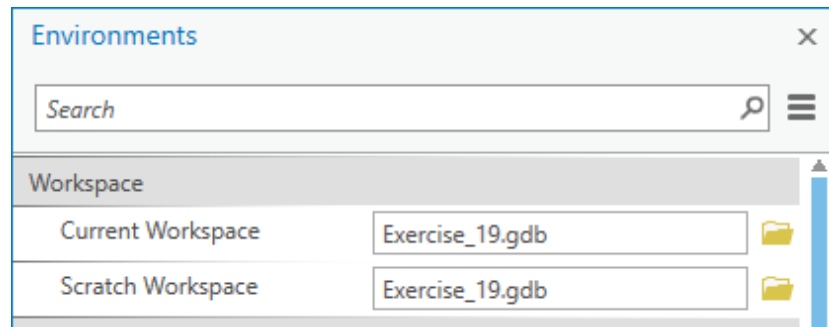


First, change the environment settings for the ModelBuilder so that the outputs are automatically saved to the **Exercise_23.gdb** geodatabase in the **Exercise_23** folder.

- ❑ In the ModelBuilder Tab and in the Model area, select the Environments button.
- ❑ Set the Current Workspace and the Scratch Workspace to the **Exercise_23.gdb** geodatabase.



- Click OK to save these environment settings.



Note: Environment settings changed within ModelBuilder are only honored by operations performed within the model, not by all operations performed within the project.

- Add the two input layers to the model by dragging them from the Contents Pane to the model area.

There are many options for adding tools to the model.

- Right-click on the Tools button under ModelBuilder. This will open the Geoprocessing Pane. In the Geoprocessing Pane, click on Toolboxes to view ArcToolbox. Tools can be added by dragging them from ArcToolbox to the model area.
- Add the following tools to the model.
 1. **Buffer Tool** (This can be found in the Proximity subtoolbox of the Analysis Toolbox.)
 2. **Select Tool** (This can be found in the Extract subtoolbox of the Analysis Toolbox.)
 3. **Clip Tool** (This can be found in the Extract subtoolbox of the Analysis Toolbox.)
 4. **Add Geometry Attributes Tool** (This can be found in the Features subtoolbox of the Data Management Toolbox.)
 5. **Summary Statistics Tool** (This can be found in the Statistics subtoolbox of the Analysis Toolbox.)

You will now need to specify the settings for each tool. The outputs will automatically save to the **Exercise_23.gdb** geodatabase, as this was defined as the working directory. To edit the settings for each tool, click on each tool to open up the wizard. Once you have specified the desired settings, click OK to accept the changes. Note that links between inputs and tools and tools and outputs will be created as you change the settings.

- Specify the settings for all tools.

Buffer

- Input Features = **TuckerCounty_CorridorH**
- Output Feature Class = **Road_Buffer**
- Linear Units = Kilometers
- Distance = 1
- You do not need to change any other settings.

Select

- Input Features = **wetlands**
- Output Feature Class = **palustrine_wetlands**
- Clause
 - Field = WET_TYPE
 - Operator = "Begins With"
 - Values = P

Note: This will extract all records in which the wetland type begins with the letter P. This will be all of the palustrine wetlands.

Clip

- Input Features = **palustrine_wetlands**
- Clip Features = **Road_Buffer**
- Output Feature Class = **wetland_clip**
- You do not need to change any of the other settings.

Add Geometry Attributes

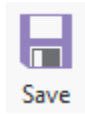
- Input Features = **wetland_clip**
- Geometry Properties = Area
- Area Units = Acres
- Coordinate System = Current map [Map] (should be NAD 1983 UTM Zone 17 North)
- You do not need to change any of the other settings.

Summary Statistics

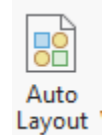
- Input Table = **wetland_clip(2)**
- Output Table = **total_area**
- Statistics Fields
 - Field = "POLY_AREA"
 - Statistic Type = "SUM"
- You do not need to change any of the other settings.

You should now have a completed model that looks like the one shown above.

- Save your model by clicking on the Save button in the Model area of the ModelBuilder Tab.



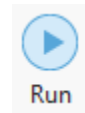
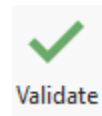
Note: You can make your model graphic a little neater by using the Auto Layout button. This can be used to make the graphic more orderly. **Blue** indicates inputs, **yellow** indicates tools or processes, and **green** indicates outputs.



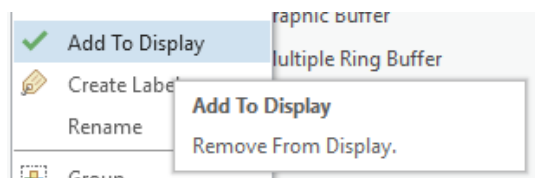
Step 4. Execute the Model

Now that you have a complete model, it can be executed. Before you execute the model it is generally a good idea to validate the model.

- Click on the Validate Tool in the Run area of the ModelBuilder Tab to validate the model. If no issues are flagged, no issues were detected.
- You can now run your model. Do this by clicking the Run Button in the Run area of the ModelBuilder Tab.



- Once the model executes, no layers will be added to your map. You will need to add the **wetland_clip(2)** and the **total_area** outputs to the map to answer the questions below. To do this, right-click on the output model graphic then select Add to Display.



Use the results to answer the following questions.

Question 1. What is the name of the attribute column that holds your calculated total area measurement in the **total_area** table?

Question 2. What is the total acreage of wetlands impacted by the road construction?

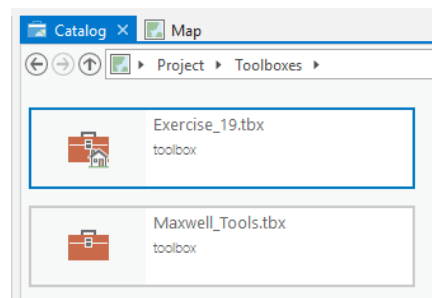
Question 3. What is the name of the attribute column that holds your calculated area for each wetland in the **wetland_clip(2)** layer?

Question 4. What is the largest acreage of a single wetland impacted by the road construction?

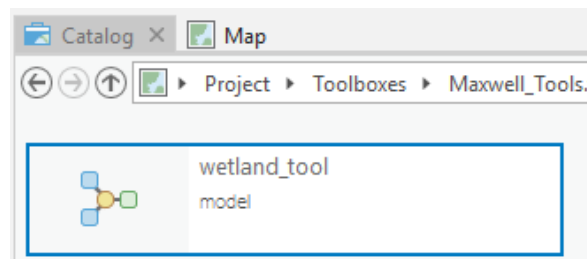
Step 5. Creating a Tool from a Model

Models can be used like other tools made available in ArcToolbox. However, this does require some additional work. Let's start by adding your new toolbox that contains the model you just created.

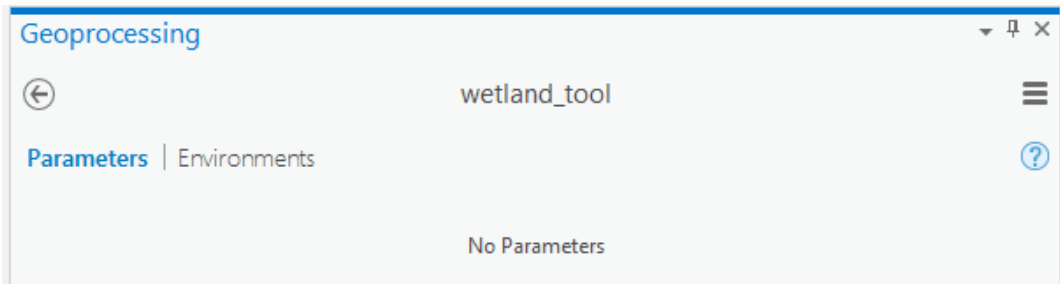
- Save your model again by clicking on the Save button in the Model area of the ModelBuilder Tab.
- Close the ModelBuilder window.
- Navigate to the Catalog Tab.
- In the Catalog Pane, right-click in the Toolboxes area.
- Select Add Toolbox.
- Navigate to the **Exercise_23** folder. Click on your toolbox followed by OK to add it.
- Back on the Catalog Tab, double-click in the Toolbox area. You should now see your toolbox in the list.



- If you double-click on the added toolbox, the contents will be displayed. It should just contain your model.

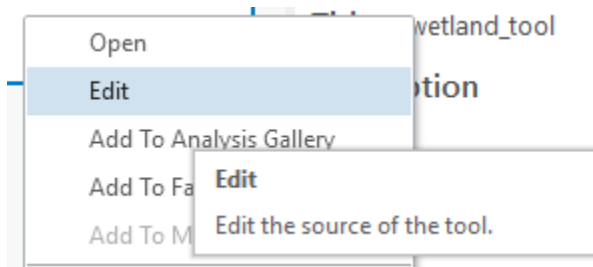


- Double-click on the model to open it as a tool. Note that it opens in the Geoprocessing Pane. However, it only says No Parameters.



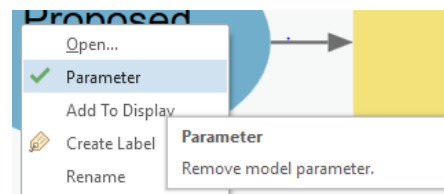
Why can't you specify any settings? This is because you did not specify any user-defined parameters. You will need to do so if you want someone to use your model as a tool and not interact with it directly. We will now guide you through that process.

- ❑ Close the Geoprocessing Pane.
- ❑ Back in the Contents Pane, right-click on the model then select Edit. This will open the model so that it can be edited using ModelBuilder.



You will begin by setting the input highway as a parameter and giving it a more meaningful name.

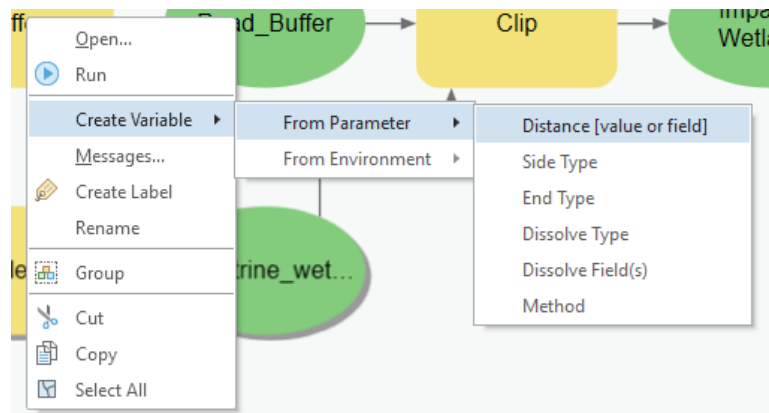
- ❑ Right-click on the blue circle that says **TuckerCounty_CooridorH**.
- ❑ Select Parameter.
- ❑ Next, select Rename and change the name to "Proposed Highway." Do not include the quotes here or in any of the steps below.



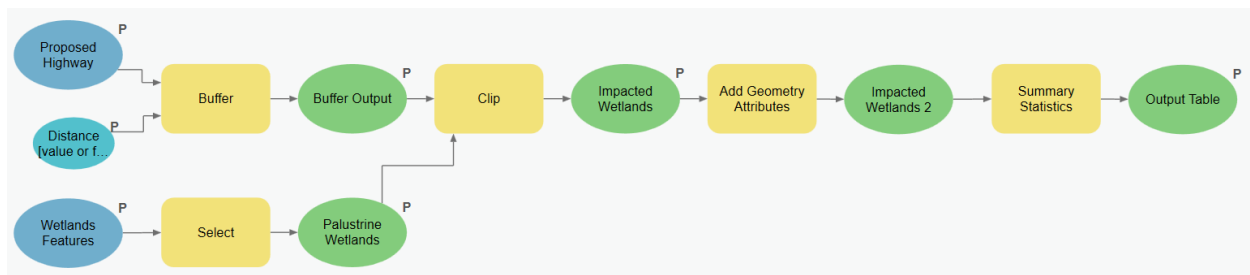
- Using similar methods, define the **wetlands** input as a parameter and change the name to "Wetlands Features" and set it as a parameter.
- Using similar methods, change the **wetland_clip(2)** output name to "Impacted Wetlands 2." Do not define it as a parameter.
- Change the name of the final output, total area, to "Output Table" and make it a parameter.
- Change the name of the buffer output to "Buffer Output" and make it a parameter.
- Change the name of the select output to "Palustrine Wetlands" and make it a parameter.

This tool would be much more robust if you could change the buffer distance. Luckily, you can specify this as a user-defined parameter also.

- Right-click on the **Buffer Tool** in the model. Select Create Variable followed by From Parameter. Select Distance [value or field].



- Right-click on this new variable then select Parameter to add it as a user-defined parameter.

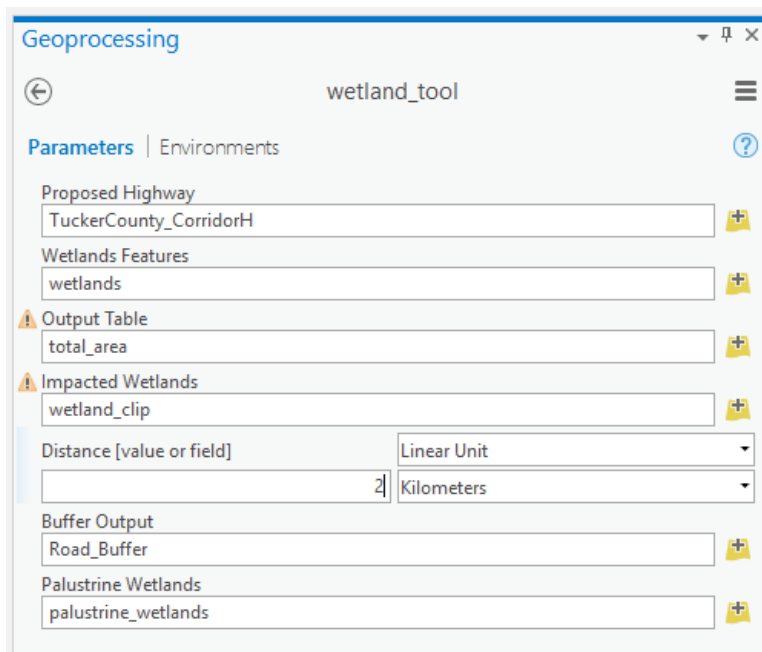


- Click Save in the Model area of the ModelBuilder Tab to save these changes.
- Close the model.

- Return to the Catalog Tab. Double-click on Toolboxes followed by your toolbox.
- Double-click on your model to open it in the Geoprocessing Pane.

Now, your model has parameters that can be specified by the user. So, the end-user can use this like any other ArcToolbox tool. They do not need to interact with the model directly.

- Change the distance to 2 kilometers and re-execute the tool. You will also need to rename the outputs.



Note: If you do not change the names of the outputs the original outputs will be overwritten. That is why there are warning symbols next to these parameters. If the outputs are loaded into your map, the tool will fail as the files cannot be overwritten.

Use the results to answer the following questions.

Question 5. What is the largest acreage of a single wetland impacted by the road construction using a buffer distance of 2 kilometers? (2 Points)

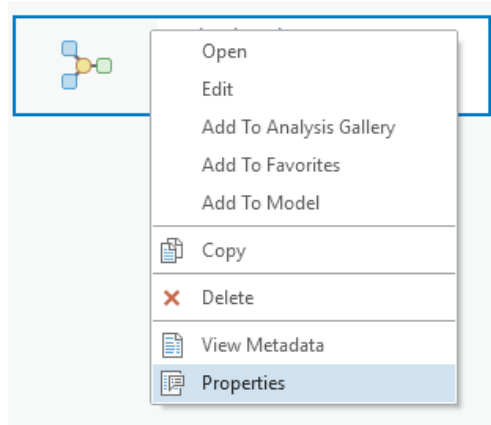
Question 6. What is the total acreage of wetlands impacted by the road construction using a buffer distance of 2 kilometers? (2 Points)

Question 7. What is the difference in total acreage between the area of impact defined using the 2 kilometer buffer vs. using the 1 km buffer? (2 Points)

Step 6. Rename Tool

You can give the tool a more meaningful name using the Properties Button in the Model area under the ModelBuilder Tab. Alternatively, this can be done within the Catalog Pane. Here, we will demonstrate the Catalog Pane.

- Navigate to the Catalog Pane followed by Toolboxes.
- Right-click on the model within your new toolbox. Select Properties.



From this menu, you can give the tool a more descriptive name by changing the label.

- Change the label to rename the tool.

Question 8. What did you name the tool? (2 Points)

You will have to select Save from the Model area under the ModelBuilder Tab to complete the label change.

END OF EXERCISE