Introduction to ModelBuilder

In this Chapter you will learn

- How to create a new toolbox and add this toolbox to the ArcToolbox window in ArcMap
- How to create a model and run it
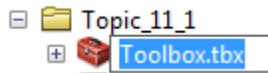
1. ModelBuilder

Model builder is a convenient way to quickly and visually automate GIS processes. The model builder tools are built into ArcGIS so everyone using this software, regardless of whether you are using a Basic, Standard or Advanced license, should be able to build a model. Models are created and saved in a toolbox, so we will start this chapter by creating a new toolbox and developing a model.
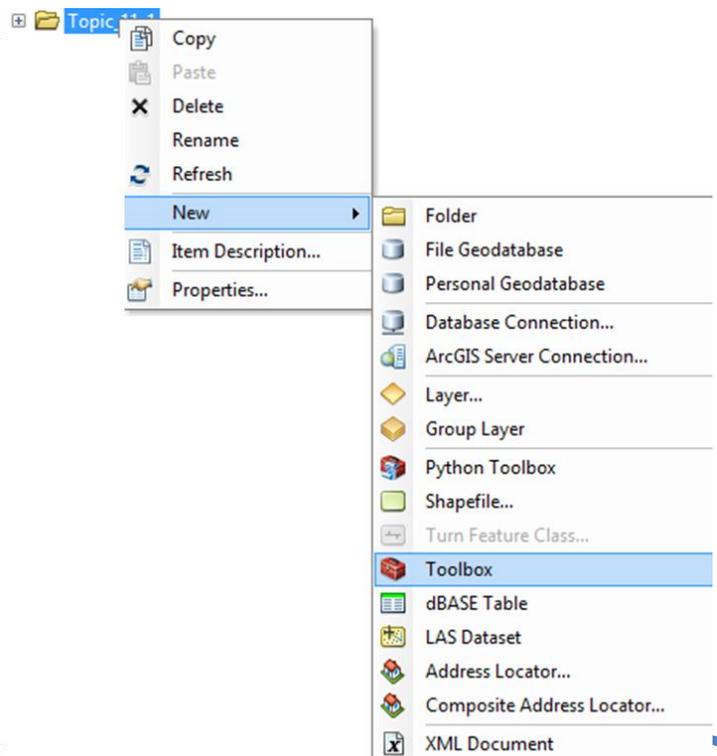
VIDEO

11.1 Create a model to select features

Exercise 1 – Creating a new toolbox and adding it to ArcMap

1. Start a blank map document in ArcMap and open ArcToolbox. *(Hint: click on the ArcToolbox button 🗔 on the Standard Toolbar)*

2. Open the ArcCatalog window inside ArcMap. Browse to the Topic11_1 Folder. Right-Click on this folder and choose New > Toolbox as shown on the right.

3. A new toolbox should appear as shown below

    Topic_11_1
    Toolbox.tbx

4. Change the name from "Toolbox.tbx" to "ModelBuilder_Tools.tbx"

5. Click on your new toolbox in ArcCatalog and then drag it to an empty space inside ArcToolbox. Your new toolbox should now appear in ArcToolbox.
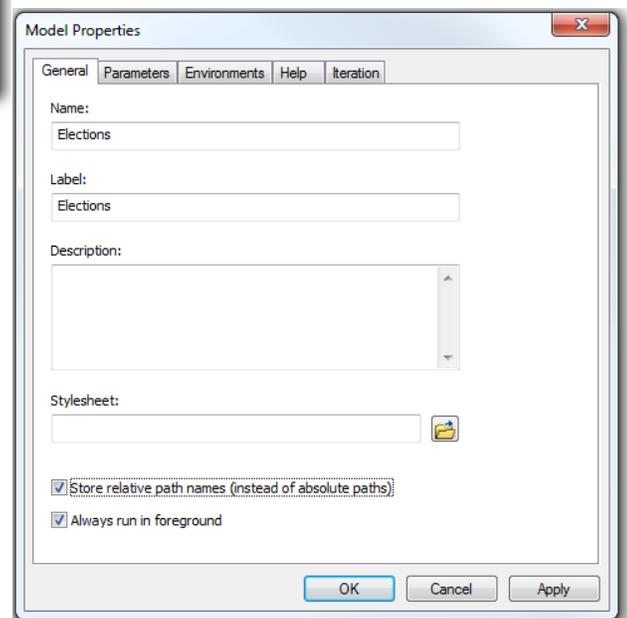
Context menu:
- Copy
- Paste
- Delete
- Rename
- Refresh
- New ▸
  - Folder
  - File Geodatabase
  - Personal Geodatabase
  - Database Connection...
  - ArcGIS Server Connection...
  - Layer...
  - Group Layer
  - Python Toolbox
  - Shapefile...
  - Turn Feature Class...
  - Toolbox
  - dBASE Table
  - LAS Dataset
  - Address Locator...
  - Composite Address Locator...
  - XML Document
- Item Description...
- Properties...

Topic_11_1

6. Leave ArcMap open for the next exercise

Exercise 2 – Creating a new model in ModelBuilder

1. Make sure you have completed exercise 1 in this tutorial.

2. Right-click on the "ModelBuilder_Tools" toolbox in ArcToolbox and choose New > Model as shown on the right.

3. Your new model should now be visible on your screen.

4. Click on Model > Model Properties as shown below.
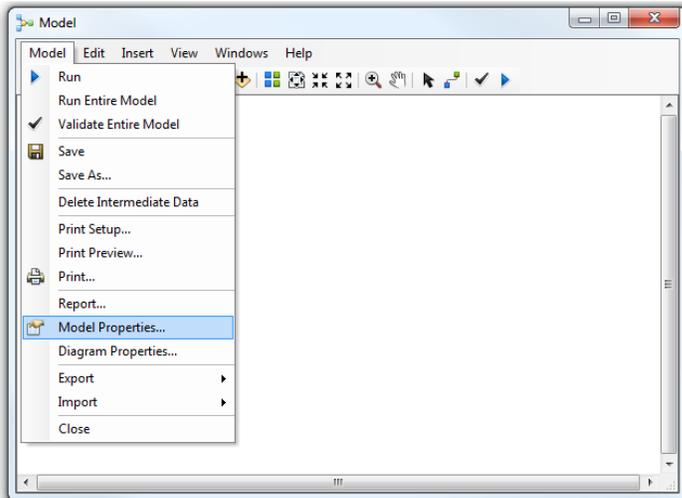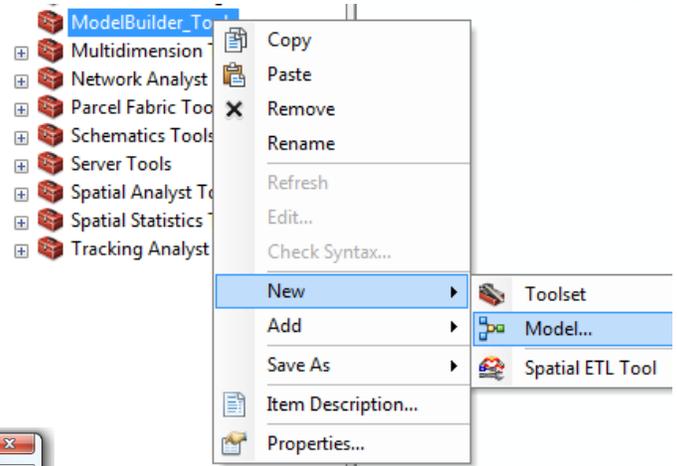
5. Name your model "Elections" and set your Label to "Elections" as well. Make sure the check box in front of "Store relative path names (instead of absolute paths)" is checked. This way, if your ever decide to move the Topic11_1 folder to a different drive then the model should still work.

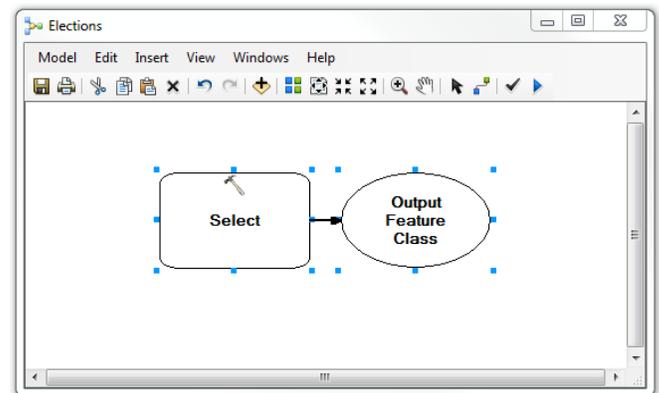6. Click OK

7. Leave your map open for the next exercise

Exercise 3 – Creating a model that selects and exports features

1. This exercise assumes that you have completed exercises 1 and 2 above.

2. In ArcMap, add the "County_Elections" shapefile from the Topic11_1 folder to your map

3. Open the attribute table for the County_Elections layer and note that it contains 13 precincts and 3 commissioner districts. In this exercise we will separate out this data and create one shapefile with only the precincts and one shapefile with only the commissioner districts. We do this by first selecting all the features with TYPE = PRECINCT and exporting that to a new shapefile called "Precinct" and then selecting all the features with TYPE = COMM_DIS and exporting those selected features to a shapefile called Commisioner_Districts.

Table

County_Elections

FID	Shape	PRECINCTS	COM_DIS	TYPE
0	Polygon ZM	LETHA		PRECINCT
1	Polygon ZM	BRICK		PRECINCT
2	Polygon ZM	CENTRAL EMMETT		PRECINCT
3	Polygon ZM	EMERSON		PRECINCT
4	Polygon ZM	OLA		PRECINCT
5	Polygon ZM	HANNA		PRECINCT
6	Polygon ZM	BUTTEVIEW		PRECINCT
7	Polygon ZM	SWEET-MONTOUR		PRECINCT
8	Polygon ZM	LINCOLN		PRECINCT
9	Polygon ZM	BENCH		PRECINCT
10	Polygon ZM	NORTH EMMETT		PRECINCT
11	Polygon ZM	SOUTH EMMETT		PRECINCT
12	Polygon ZM	WEST EMMETT		PRECINCT
13	Polygon ZM		DISTRICT I	COMM_DIS
14	Polygon ZM		DISTRICT II	COMM_DIS
15	Polygon ZM		DISTRICT III	COMM_DIS

0   (0 out of 16 Selected)

County_Elections

4. Close the attribute table and open the search window (*Hint: Click on the Search button on the standard toolbar)*

5. Do a search for "Select" and then click and drag the "Select (Analysis)" tool onto your model window. Your model should now look like the one shown on the right.

6. Double click on the "Select" tool inside your model so you can set the parameters for this tool.

Elections

Model   Edit   Insert   View   Windows   Help

Select → Output Feature Class

7. The Select tool in ModelBuilder makes a selection and then automatically exports this selection to a new shapefile. Follow the instructions at the top of the next page to populate the select tool parameters to select all the precincts and save those features to a new shapefile called "Precincts" in your Topic11_1 folder.
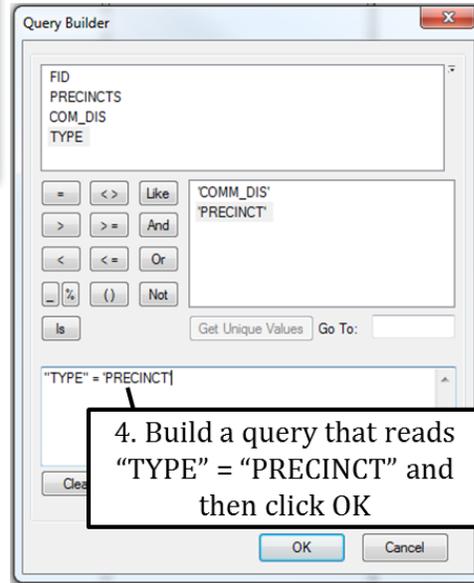
1. Click on this drop-down button and choose "County_Elections". If you want to use a layer that is not already in ArcMap click on the folder icon next to it.
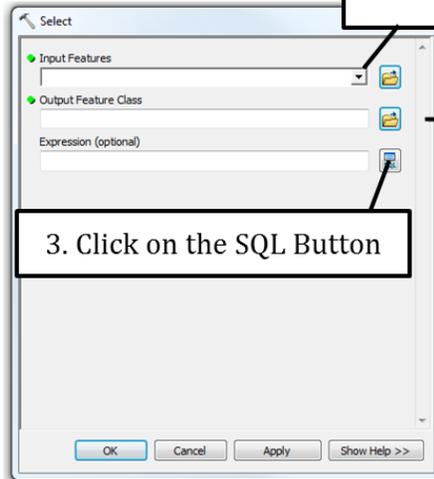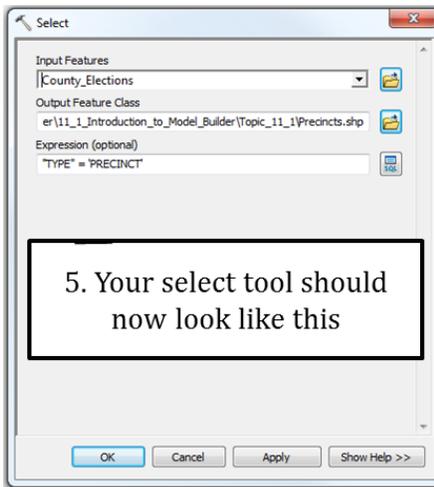
2. Click on the folder icon. Call the output feature class "Precincts" and save it in the Topic11_1 folder

3. Click on the SQL Button

Select

Input Features

Output Feature Class

Expression (optional)

OK   Cancel   Apply   Show Help >>

Query Builder

FID
PRECINCTS
COM_DIS
TYPE

= | < > | Like | 'COMM_DIS'
> | > = | And | 'PRECINCT'
< | < = | Or
_ % | ( ) | Not
Is | Get Unique Values Go To:

"TYPE" = 'PRECINCT'

4. Build a query that reads "TYPE" = "PRECINCT" and then click OK

OK   Cancel

Select

Input Features
County_Elections

Output Feature Class
er\11_1_Introduction_to_Model_Builder\Topic_11_1\Precincts.shp

Expression (optional)
"TYPE" = 'PRECINCT'

5. Your select tool should now look like this

OK   Cancel   Apply   Show Help >>

8. Next we need to set up another "Select tool" so we can select all the commissioners districts and export those to a new shapefile called "Commissioner_Districts". We could repeat steps 5 through 7 above, this time selecting all the TYPE = COMM_DIS and naming the output file "Commisioner_Districts" or we can copy and paste the select tool we have already set up and make some small modifications.

9. Follow the instructions on the top of the next page to finish your model.

1. Click on this Select tool and then draw a box around the Select tool, including the input and output layer.

5. Click on the "Auto Layout" button to straighten out the tools in the model window

2. You should see those blue handles around the whole select tool

3. Click CTRL + C on your keyboard to copy the tool

4. Click CTRL + V on your keyboard to paste the tool

6. Double click on the "Select (2)" tool to set its parameters

7. Click on the folder icon. Call the output layer "Commissioner_Districts" and save it in the "Topic11_1" folder

8. Click on the SQL Button. Set the query to "TYPE" = 'COMM_DIS'

Select

Input Features
County_Elections

Output Feature Class
xduction_to_Model_Builder\Topic_11_1\Commissioner_Districts.shp

Expression (optional)
"TYPE" = 'COMM_DIS'

9. Click OK

OK   Cancel   Apply   Show Help >>

10. Click on the Full Extent button to center your model inside the model window:

Full Extent

11. Validate the model by clicking the "Validate Entire Model" button:
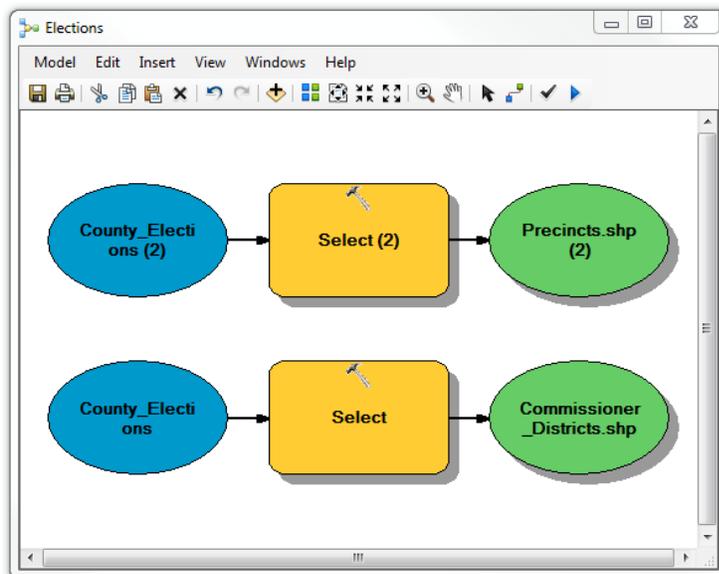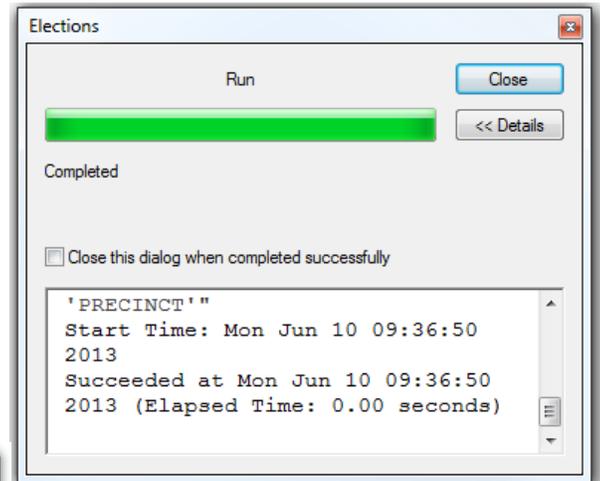

Validate Entire Model
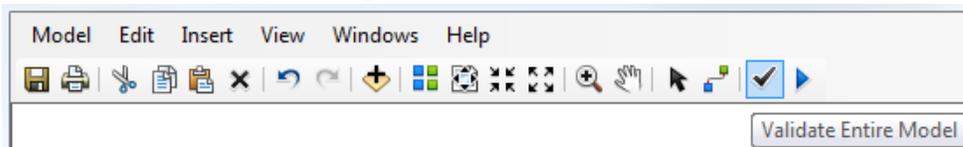
12. Run the model by click in the "Run" button:
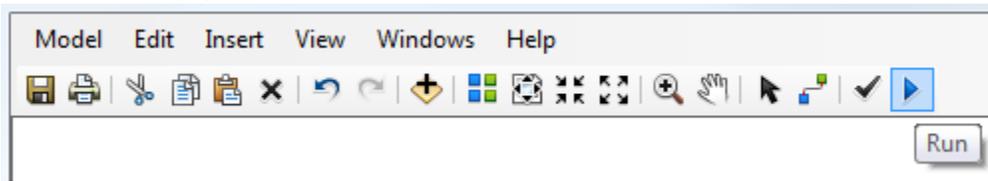
13. Once your model has completed running add the new "Precinct" and "Commissioner_District" shapefiles to your map.

14. Open the attribute table for both new layers and verify that the Precinct layer only contains precincts, and the Commissioner_Districts layer only contains commissioner districts.

15. Note that the tools and variables (the input and output layers for the tools) now have a shadow below them.

16. Click on the Run tool again. Note that you get an error message that states that "All processes have already been run".

17. Click on the "Validate Entire Model" button and notice that the shadows disappear. Now you can run the model again. Note that every time you run this model you will create new Precinct and Commisioner_Districts shapefiles that overwrite the old ones.

There are a number of reasons to build models using ModelBuilder:

- You can start automating processes that you may need to repeat frequently. For example, in the next exercise we will create a customized parcel layer that someone may need to re-create once a month. Once set up, the model can be re-used and run monthly.

- A model in ModelBuilder shows exactly which tools have been used and how those tools have been set up. In other words, it is a great way to document exactly how you did an analysis which may be a really helpful resource when someone has questions, or you yourself need to revisit this analysis at a future date.

- You can set up all your geoprocessing at once. This is a real benefit when you are building a more complex model that involves many steps and many layers. This way, you can really concentrate on what you are trying to accomplish and then set up the whole process at once.

11.1 Using ModelBuilder to Create a Parcel Extract

Exercise 4 – Using ModelBuilder to create a customized parcel data extract

In this exercise you will build a model that makes it easy to join a table containing CAMA data to a parcels layer and then export this data to a "ParcelExtract" layer . This model may be helpful if you need to create this extract periodically, for example for people outside your office that request (or buy) this data monthly, quarterly or annually.
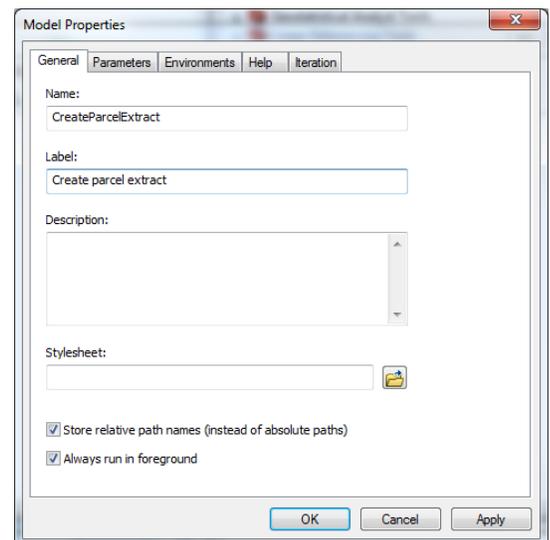
1. Open a new blank map document in ArcGIS. Add the Parcel, ParcelExtract and pcparsum.dbf table to your map.

2. Open the attribute table for the ParcelExtract layer. This layer represents the last time you created a parcel extract and shows you all the attributes you may want to include in your extract. Let's assume you decide that you do not want to give away (or sell) all those attribute fields. In the next few steps we will delete the fields that you do not want to include in your extract.

3. In the Search window in ArcMap do a search for "Delete Fields". Then open the "Delete Field (Data Management)" tool. In this tutorial we will assume that you only want to keep the PARCEL, PS_CARE_OF, PS_MAIL_NM, PS_PROP_AD and PS_PROP_ZP fields. Click on the "Select All" button in the Delete Field dialog box, and then only uncheck the fields you want to keep as shown on the right.
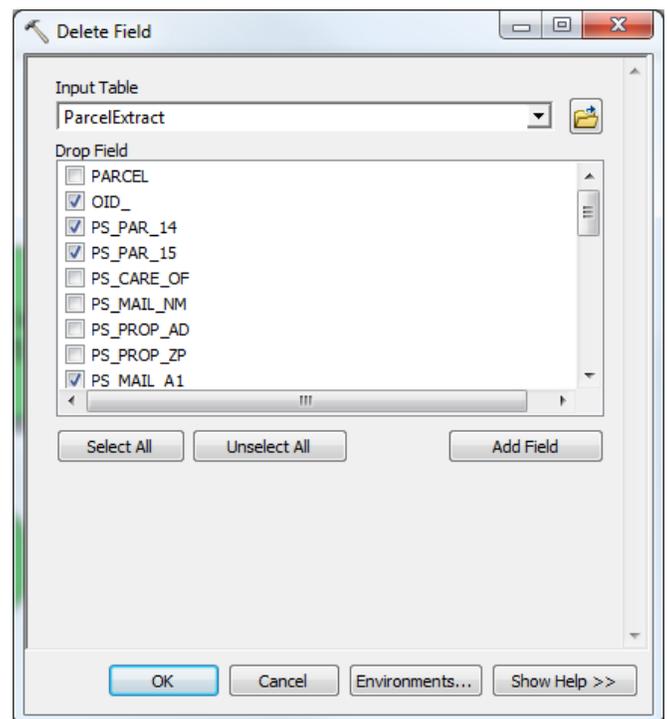
4. Your ParcelExtract shapefile should now look like the one below:

	FID	Shape *	PARCEL	PS_CARE_OF	PS_MAIL_NM	PS_PROP_AD	PS_PROP_ZP
►	0	Polygon ZM	R1808500170	V	BOLIN, ROBERT B	4449 COUNCIL-CUPRUM RD	0
	1	Polygon ZM	R1808500180	V	ARBOGAST, JUDY		0
	2	Polygon ZM	R1808500190	V	ARBOGAST, JUDY L		0
	3	Polygon ZM	R1808500200	V	ARBOGAST, JUDY L	4457 COUNCIL-CUPRUM RD	0
	4	Polygon ZM	R1808500210	V	HOEFNER, LINDA A		0
	5	Polygon ZM	R1808500220	V	PACK, KAREN K FAMILY TRUST		0
	6	Polygon ZM	R1808500230	V	PACK, KAREN K FAMILY TRUST	4461 COUNCIL-CUPRUM RD	0

1 (0 out of 19 Selected)

ParcelExtract

5. Next we will build a model that replaces the existing features in the ParcelExtract layer with new information from the Parcels shapefile and pcparsum table. The model will do the following things (in order):

   a. Delete all the features from the ParcelExtract shapefile (they are old and need to be replaced!)

   b. Copy all the parcels from the Parcels shapefile into the ParcelExtract shapefile (now we have the shapes, but not yet the attributes)

   c. Join the pcparsum table to the ParcelExtract shapefile

   d. Field calculate the PS_CARE_OF, PS_MAIL_NM, PS_PROP_AD and PS_PROP_ZP attribute fields

   e. Unjoin the pcparsum table. Now you have finished the new extract.

   f. Make a copy of your new extract and store it with a new name (for example with the date if you would like to archive those extracts).

6. Open ArcToolbox and add the ModelBuilder_Tools.tbx toolbox you created in exercise 1 of this tutorial to the ArcToolbox window.

7. Right-click on your ModelBuilder_Tools toolbox and click New > Model

8. Open the properties for this new model. Then click on Model > Model Properties. Name your model "CreateParcelExtract", label it as "Create parcel extract" and check the box in front of "Store relative path names (instead of absolute paths) as shown on the right.

9. Let's start with the first step where we delete all the features from the ParcelExtract layer. Do a search for "delete features" and add the "Delete Features (Data Management) tool to your ModelBuilder window.

Model Properties

General | Parameters | Environments | Help | Iteration

Name:
CreateParcelExtract

Label:
Create parcel extract

Description:

Stylesheet:

☑ Store relative path names (instead of absolute paths)
☑ Always run in foreground

OK | Cancel | Apply

10. Drag the ParcelExtract layer to the ModelBuilder window as well, and use the "Connect" button to set the ParcelExtract as the "Input Features" into the Delete Features tool. Your model should now look like the one on the right.
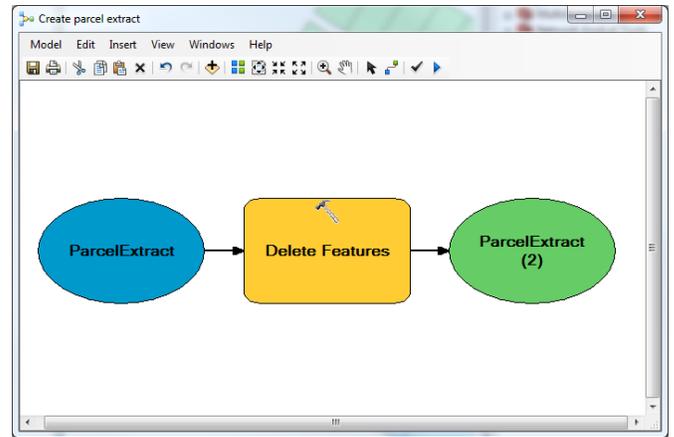
11. In the next step we need to copy the features from the Parcels layer into the ParcelExtract layer. Do a search for "Append" and drag the "Append (Data Management)" tool to your model window.

12. Drag the Parcel layer from your table of contents onto the model builder window. Click on the connect button and then click on the blue circle representing the Parcel layer. Connect the parcel layer to the Append tool and set it to "Input Datasets". Then click on the green "ParcelExtract(2)" symbol with the connect tool followed by the Append tool to make this ParcelExtract layer the "Target Dataset".
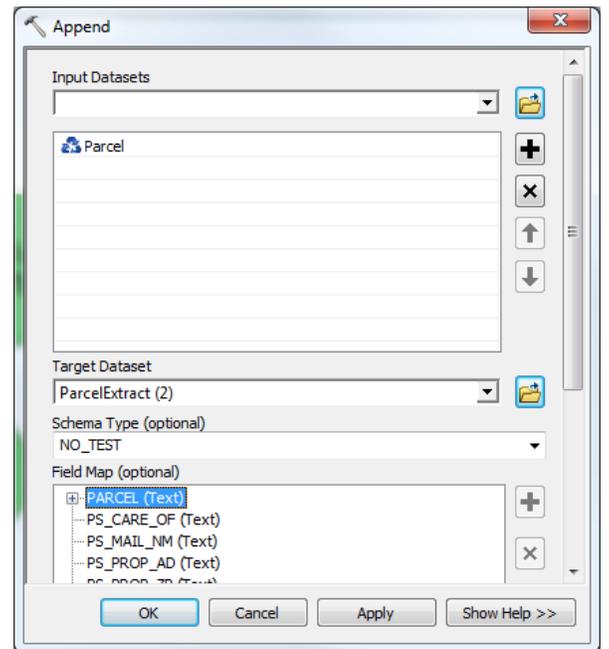
13. Double-click with the on the Append tool to look at its parameters. Change the Schema Type to "NO_TEST" as shown on the right.

14. Click on the "Auto Layout" button, followed by the "Full Extent" button. Your model should now match the model below.
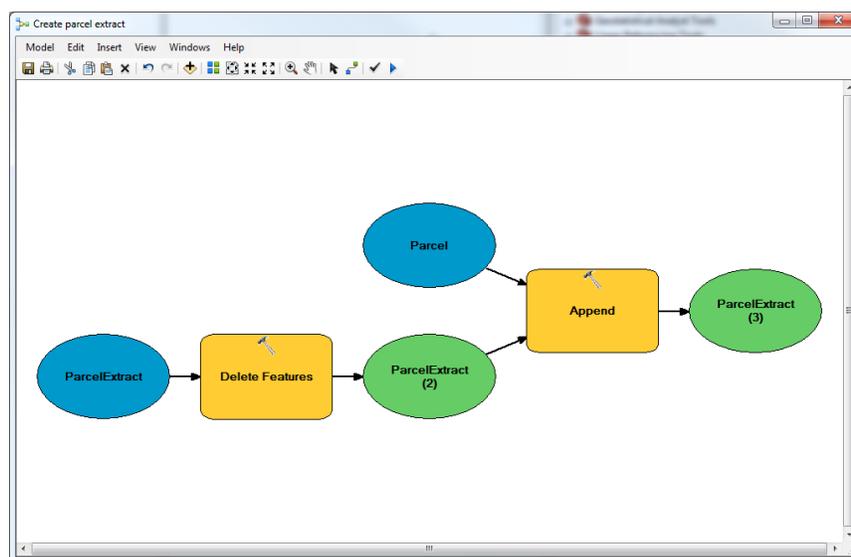
15. The next step in our workflow is to join the pcparsum table to the ParcelExtract layer. Do a search for "Join" and drag the "Add Join" tool to your modelbuilder window. Using the "Connect" button make the ParcelExtract(3) the "Layer Name or Table View".

16. Double-click with on the "Add Join" tool and match its parameters to the dialog box shown on the right. The Input Join Field is "PARCEL", the Join Table is "pcparsum" (hint: use the dropdown button and select this table) and the Output Join Field is "PS_PAR_14". Click OK.
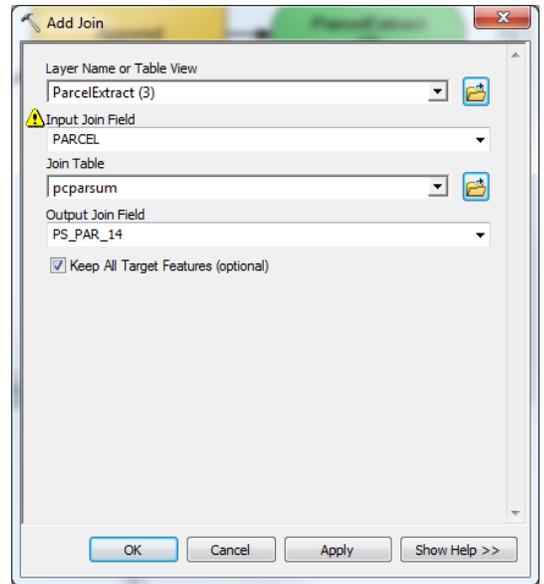
17. The next step in our process is to field calculate all the attribute fields in the ParcelExtract layer that we want to include in our extract. In our example we need to calculate four fields: PS_CARE_OF, PS_MAIL_NM, PS_PROP_AD and PS_PROP_ZP

18. Do a search for "Calculate Field" and drag four copies of this tool to your model window. Use the Connect button to set ParcelExtract(5) as the "Input Table" to each of the four copies of the "Calculate Field" tool. After clicking the "Auto Layout" button, followed by the "Full Extent" button. Your model should now match the model below.
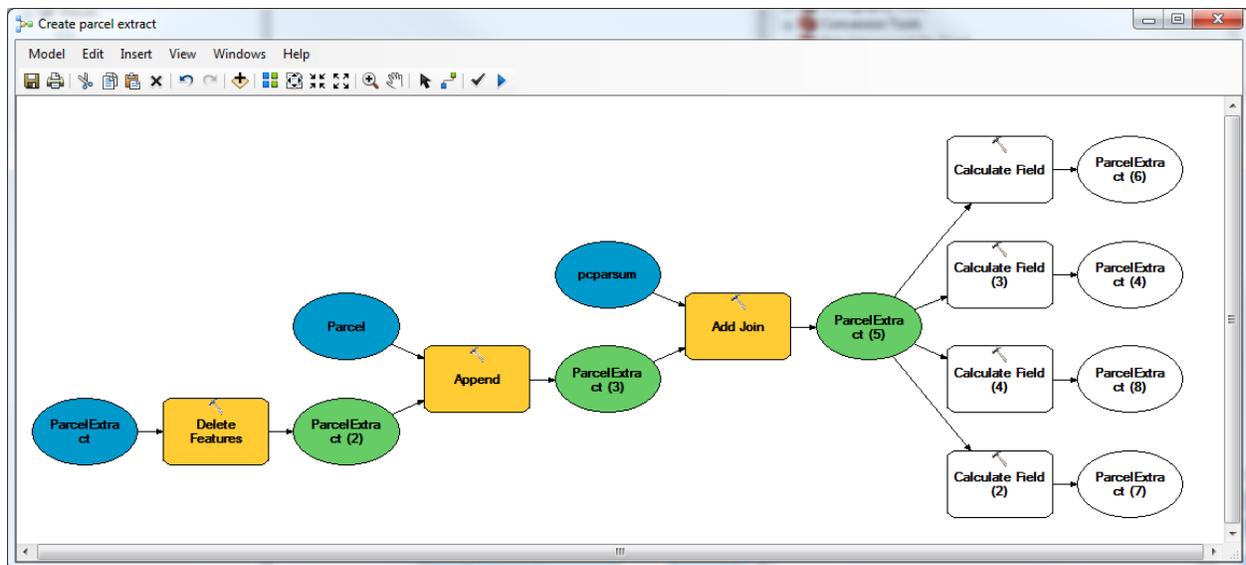
19. Double-click with [cursor icon] on one of the "Calculate Field" tools to open its dialog box. Follow the instructions below to set up the calculation.
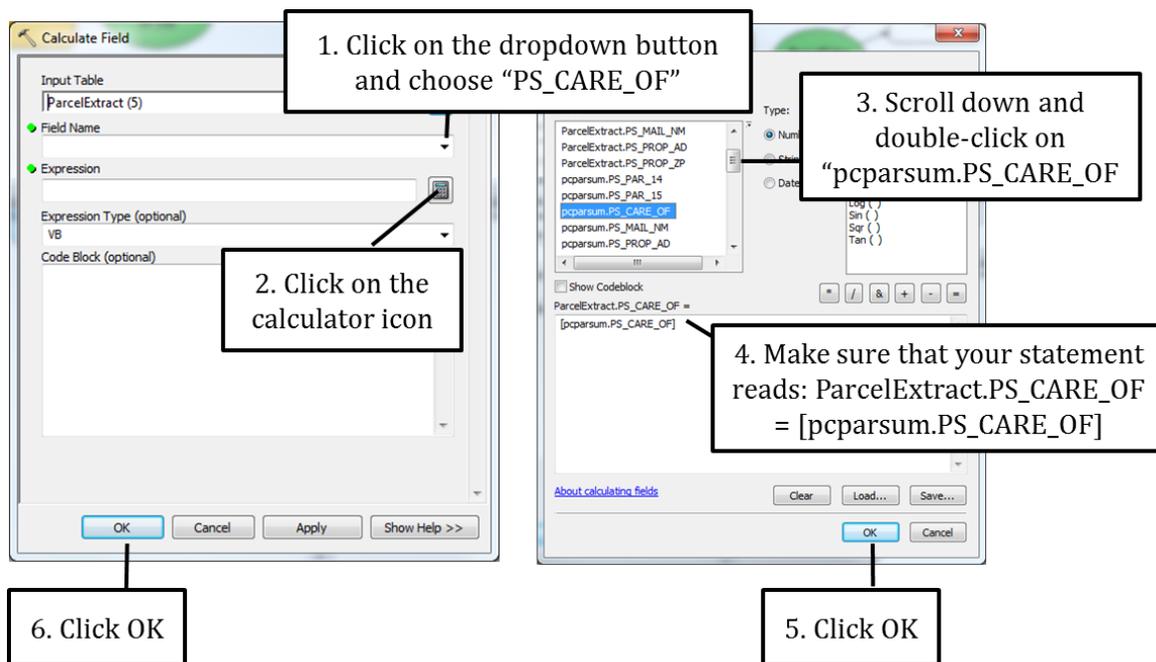
1. Click on the dropdown button and choose "PS_CARE_OF"

2. Click on the calculator icon

3. Scroll down and double-click on "pcparsum.PS_CARE_OF

4. Make sure that your statement reads: ParcelExtract.PS_CARE_OF = [pcparsum.PS_CARE_OF]

5. Click OK

6. Click OK

20. Repeat step 19 to set up the remaining three Field Calculators to compute the PS_MAIL_NM, PS_PROP_AD and PS_PROP_ZP to match the fields with the same name in the pcparsum table. For reference the three remaining field calculator dialog boxes are shown below.
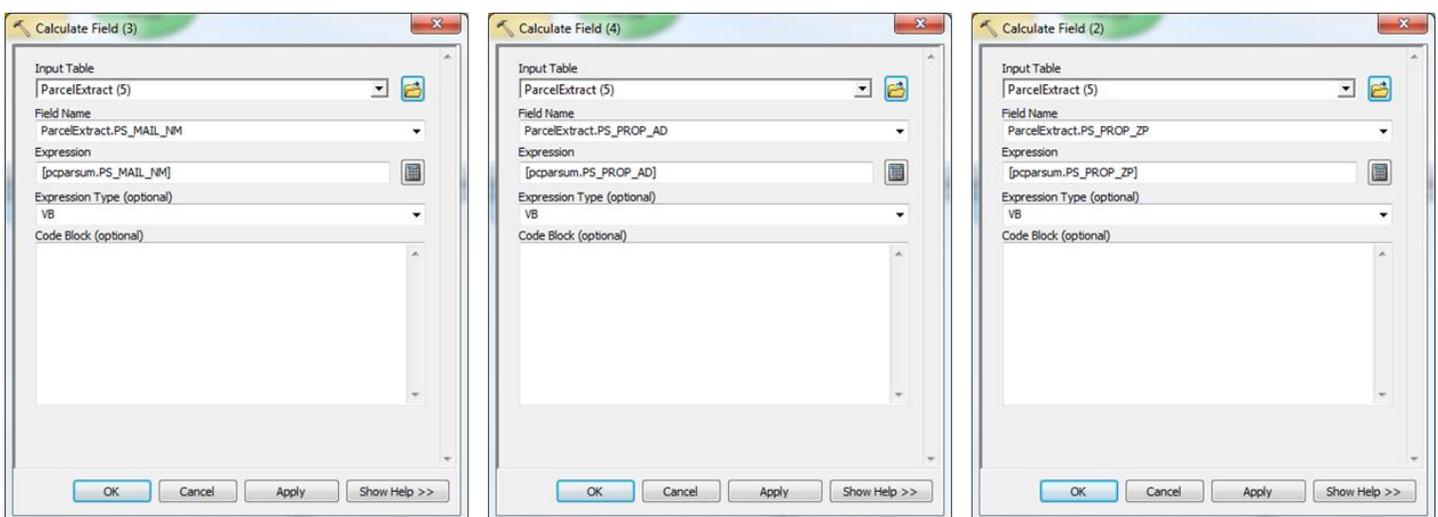
21. The last step in our process is to unjoin the pcparsum table from the ParcelExtract layer. Do a search on "remove join" and add the "Remove Join" tool to your model window. Use the "Connect" button to connect "ParcelExtract (9) to the Remove Join tool as it "Layer Name of Table View".

22. Open the Remove Join tool and populate the dialog box as shown on the right.

23. Click OK

24. To make sure that all four Calculate Fields are executed before the join is removed we will make the execution of all Field Calculate tools a precondition of the "Remove Join" tool. In other words, we will not allow the "Remove Join" to run until all preconditions (i.e. the execution of all calculate field tools) are met.

25. Click on the "Connect" button and click on ParcelExtract(8). Then click on the "Remove Join" tool and choose "Precondition" as shown on the right. There should now be a blue dotted line on your model window as shown on the right.

26. Also create preconditions for the remaining two Calculate Field tools. Your final model should look like this:
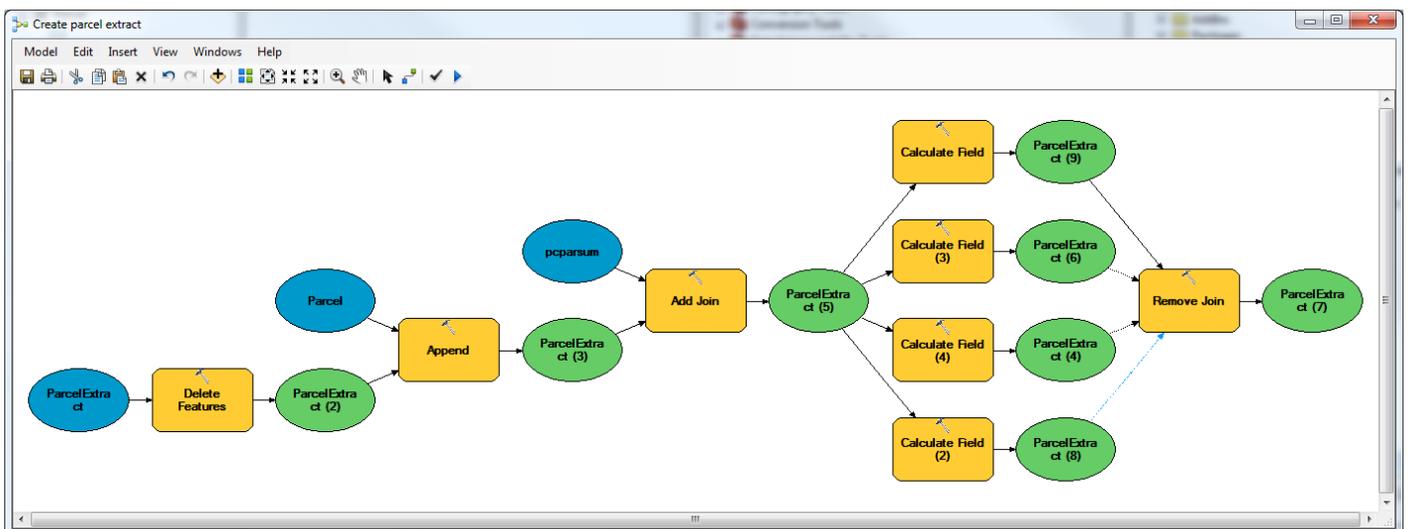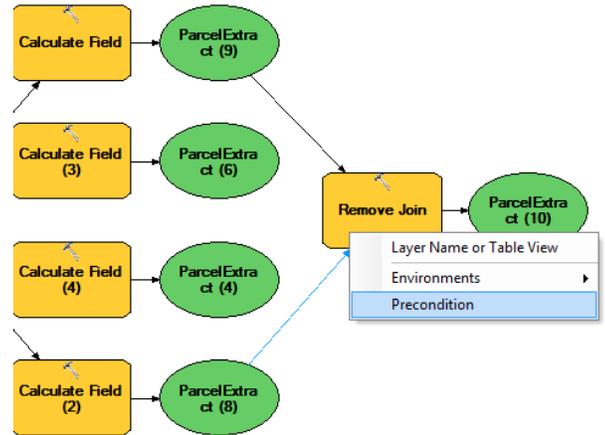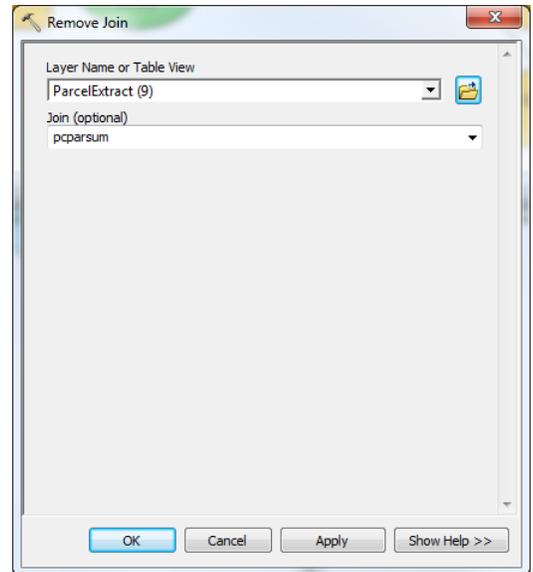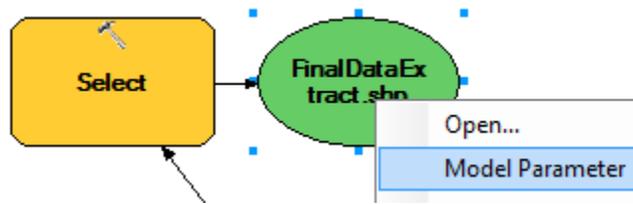
27. Click on Model > Save

28. Click on the "Validate" button, and then on the "Run" button to test your model.

29. Zoom to your ParcelExtract layer and note that new parcels have been added to your extract. Also open the attribute table and note that it now contains the information from the pcparsum table.

30. Click again on the "Validate" button to reset your model, save your model and then close it.

31. A different way to run your model is by double clicking on "Create parcel extract" in your ModelBuilder_Toolbox as shown on the right.

32. You will now see a "Create parcel extract" dialog box with the words "This tool has no parameters". Click OK to run the tool again.

33. Let's tweak your model to add some parameters. For example, it may be helpful to be able to allow users to pick the Parcels layer that will be copied into the parcels extract. Right-click on the "Create parcel extract" model in the ModelBuilder_Toolbox and choose "Edit".

34. Right-click on the blue Parcel symbol and choose "Model Parameter". Note the letter "P" that is added to your model window.

35. Validate your model, save your model and then close your mode.

36. Run the model by double-clicking on "Create parcel extract" in your ModelBuilder_Toolbox. Note that you now have the option to select a different parcel layer for your model.

37. Finally, we will add one more tool to your model that copies the final DataExtract into a new layer with a name that a user can specify.

38. Right-click on your model and choose "Edit" to open your model window.

39. Do a search for "Select" and add the "Select (Analysis)" tool to your map. Use the "Connect" button to set the final ParcelExtract layer (i.e. the one to the right of the "Remove Join" tool) as the "Input Features".

40. Double-click with the ![cursor] on the Select tool and populate as shown on the right where the Output
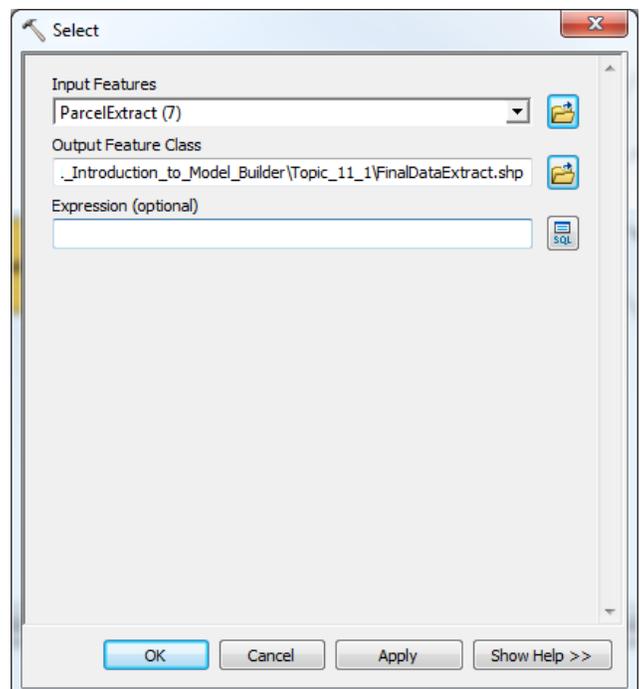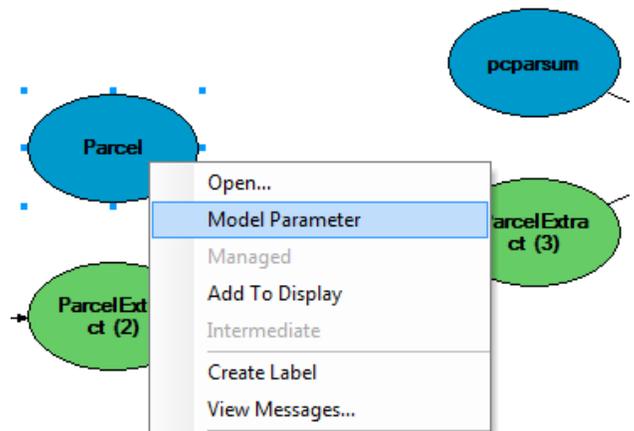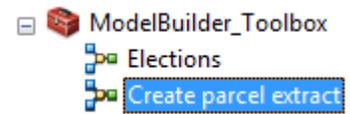
Feature Class is called "FinalDataExtract" and stored in the Topic11_1 folder. Click OK.

41. Right-click on the green "FinalDataExtract" symbol and choose "Model Parameter" as shown below.

42. Validate your model, save your model and close your model.

43. Start your model from your ModelBuilder_Toolbox. Note that you can now set your parcel input layer, as well as the name and location of your FinalDataExtract. Click on the folder icon to the right of "FinalDataExtract.shp" and save this shapefile as "Extract_072413". Run the model and verify that the new layer you created has been added to your map.