Sept 17, 2019

Create your own geoprocessing tools!

Trevor Laureys
Director – GIS & Data Analysis
Indiana State Dept. of Agriculture

October 30, 2018

Automated Report Generation using ArcGIS Pro, ArcPy MapSeries Module and Python

farmers
ently.

LAST YEAR WE COVERED ARCPY.MP

Meg Leader
Director of Soil Health
INFA State Coordinator

Trevor Laureys
Program Manager Data Analytics

Over 73,000 Region 5 Modeled practices since 2013!

Conservation Project Tracking

Indiana has a unique situation

Tracking ALL ICP cost-shared practices since 2013

ICP Conservation Database includes

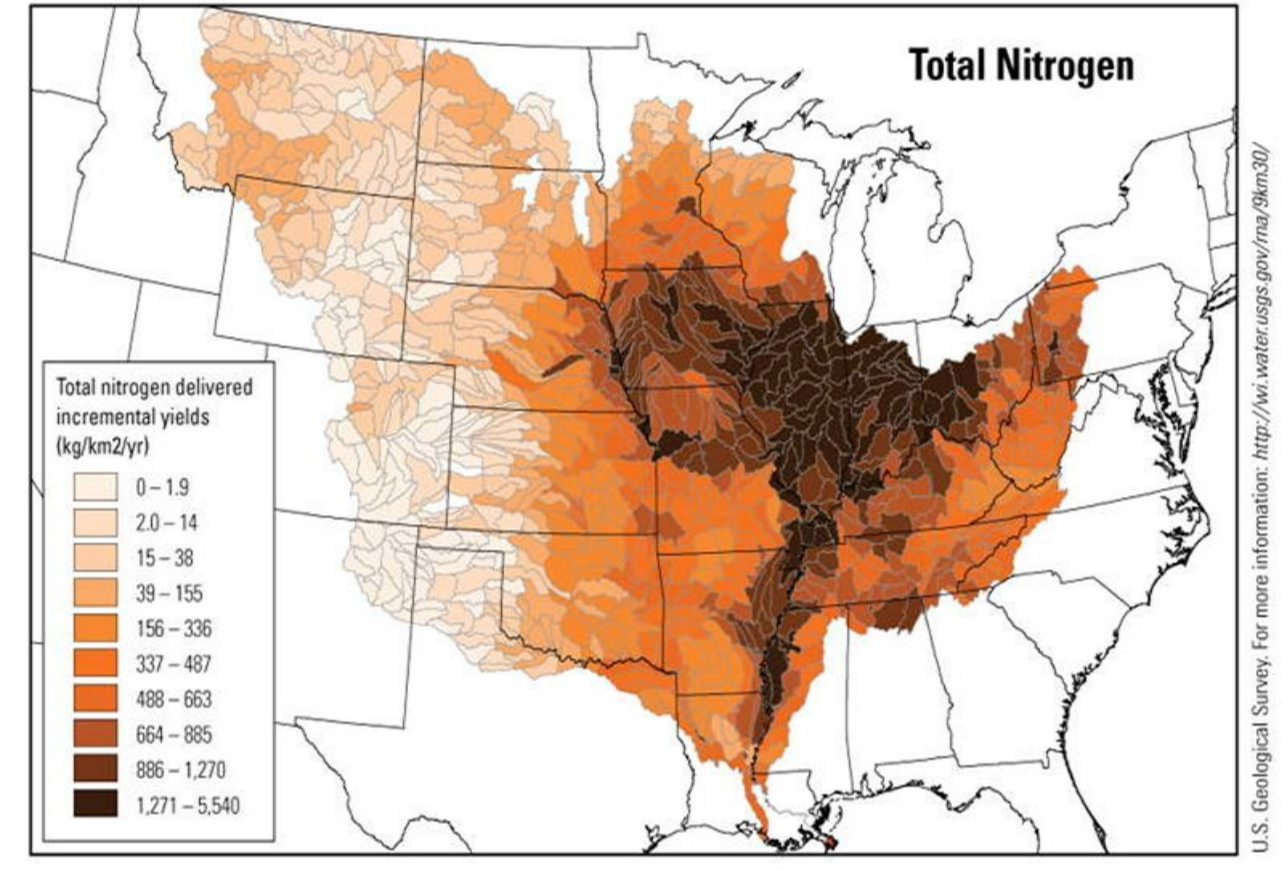
- NRCS Applied Conservation Practices/Agronomic
- SWCD Applied Conservation Practices
- ISDA-DSC & CWI Applied Conservation Practices
- DNR-LARE Applied Conservation Practices
- IDEM-319 Applied Conservation Practices

ONLY state with a comprehensive data sharing agreement with our federal partners

Tracking progress -

Key Regulatory Challenge:

Water Quality as it relates to Nutrients and Non-point Source Runoff



Tracking allows the ICP to monitor the success of cost-share programs in various geographic regions

All conservation data is stored in points geodatabase

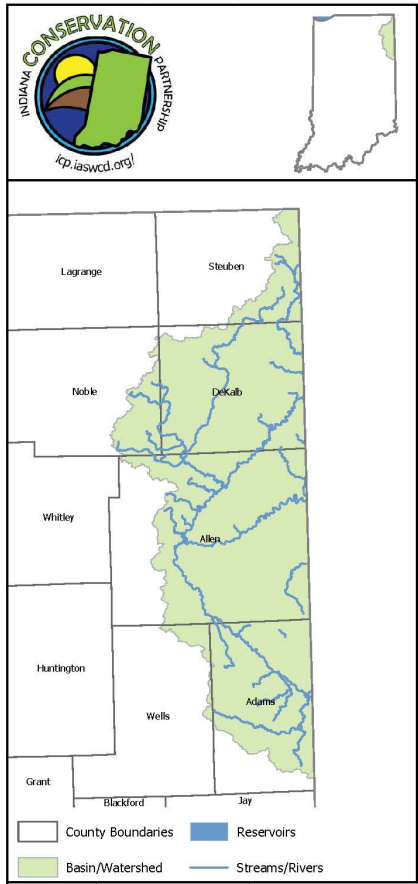
Some parameters tracked include

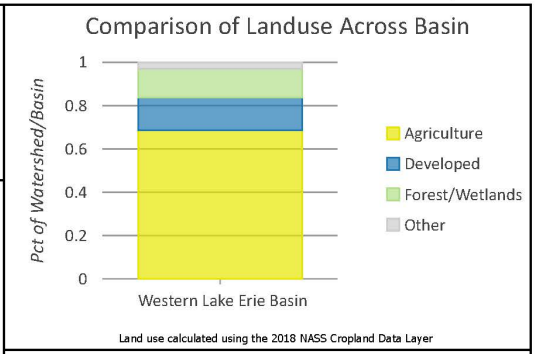
- Practice Name
- Load Reductions
- UTM XY
- Applied Date
- Program
- Size

We can defend the work we do as conservationists as well as the work of private landowners

Western Lake Erie Basin Nutrient and Sediment Load Reductions

Accomplished By Private Landowners and the Indiana Conservation Partnership

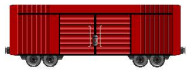




Land use calculated using the 2018 NASS Cropland Data Layer

Sediment Reduced: 106,342,230 lbs.

Enough to fill 532 freight cars!



x532

Phosphorus Reduced: 67,515 lbs.

Enough to fill 68 truck beds (8' bed)!

x68

Nitrogen Reduced: 136,815 lbs.

Enough to fill 137 truck beds (8' bed)!

x137

Practices do not include the many unassisted practices designed and installed by private landowners without ICP assistance.
Nutrient estimates only consider sediment bound N and P, not dissolved components.
Load reductions are calculated using the EPA's Region 5 Load Reduction Model.

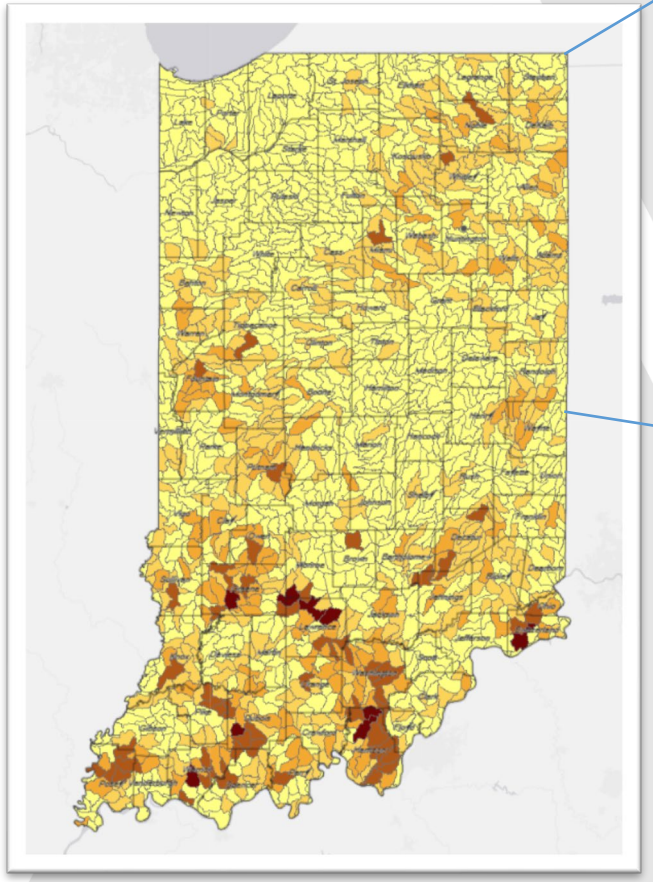
Calendar Year	Practices Installed	Active Practices	Sediment Reduction (lbs)	Phosphorus Reduction (lbs)	Nitrogen Reduction (lbs)
2013	733	733	102,000,275	58,720	119,310
2014	471	573	69,349,650	39,730	81,345
2015	823	1,007	105,006,120	62,315	126,495
2016	888	1,117	109,751,505	65,650	133,150
2017	1,197	1,446	134,319,580	79,755	161,370
2018	1,177	1,631	106,342,230	67,515	136,815
13-18	**5,289**		**626,769,355**	**373,685**	**758,490**

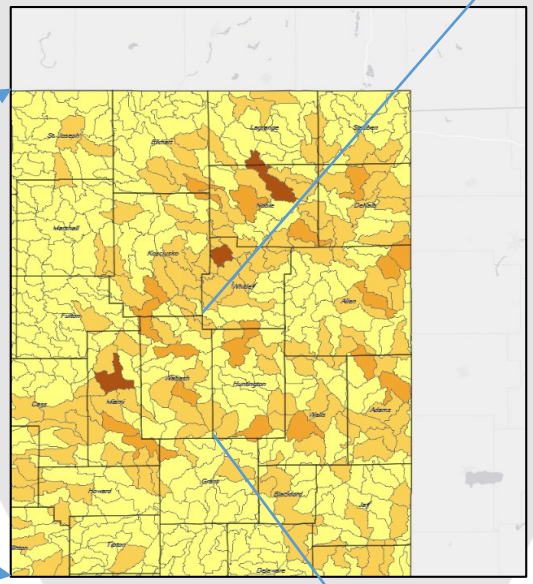
The "practices installed" column indicates the number of newly installed best management practices within a given calendar year, while the "active practices" column indicates the number of best management practices that are actively reducing sediment, nitrogen, and phosphorus loading regardless of the year of installation. Load reduction calculations have been rounded to the multiple of 5.

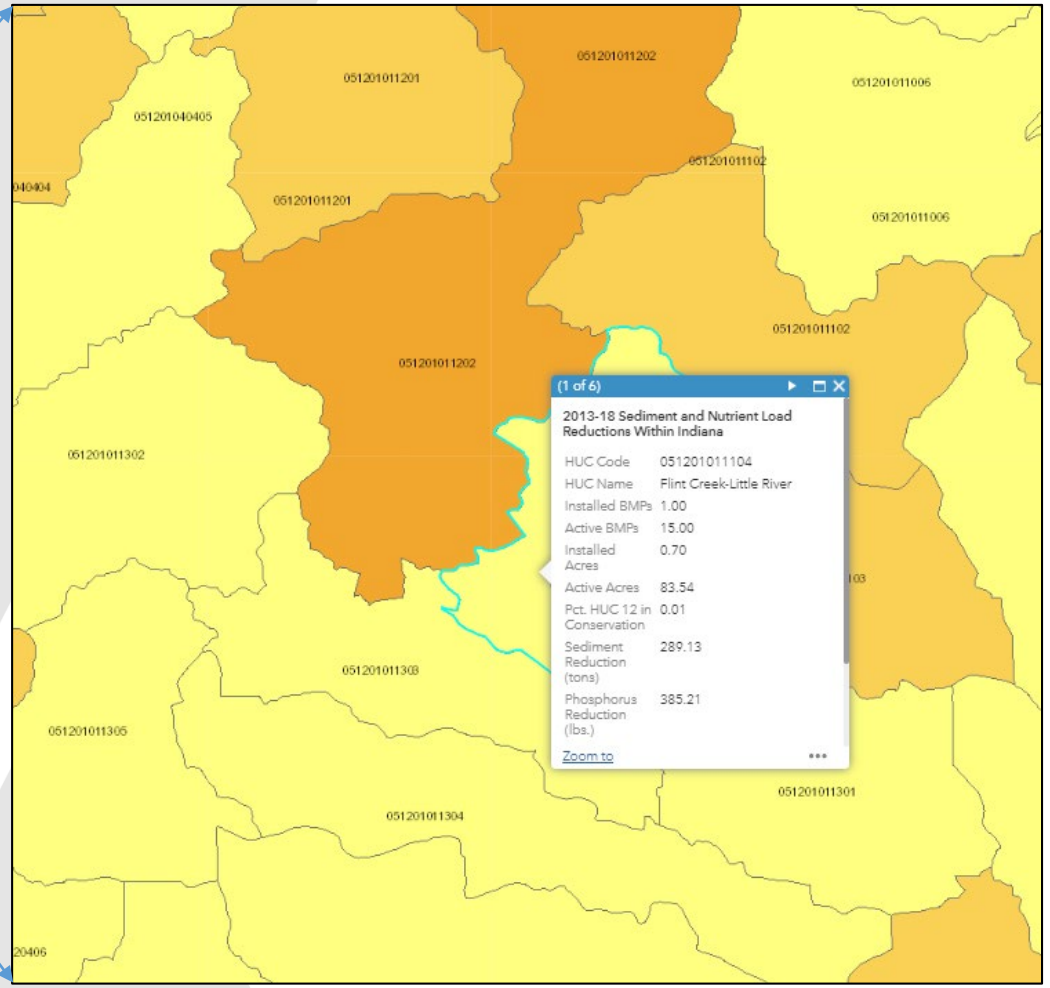
For more information visit: http://www.in.gov/isda/2991.htm or contact ISDANutrientReduction@isda.in.gov
Last updated: 3/8/2019

Data provided by: Indiana State Department of Agriculture, Indiana Department of Natural Resources, Indiana Department of Environmental Managment, Indiana Soil and Water Conservation Districts, and the USDA Natural Resource Conservation Service.

A WHOLE LOT OF DATA







INDIANA
STATE DEPARTMENT OF AGRICULTURE

“Geoprocessing is a framework and set of tools for processing geographic and related data.”

- Sir Esri Websitington

Geoprocessing Tools

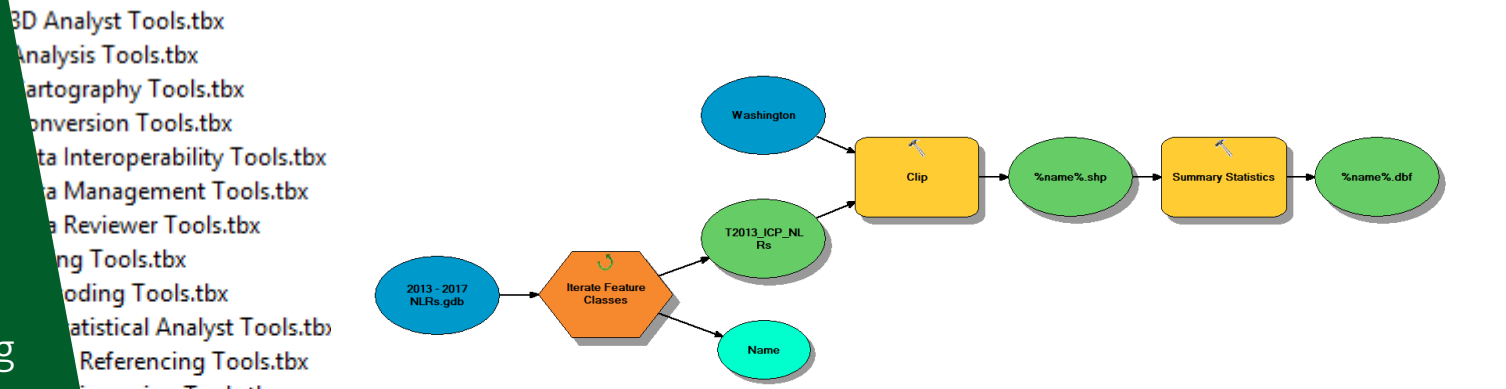
I'll cover how we can create custom geoprocessing tools using:

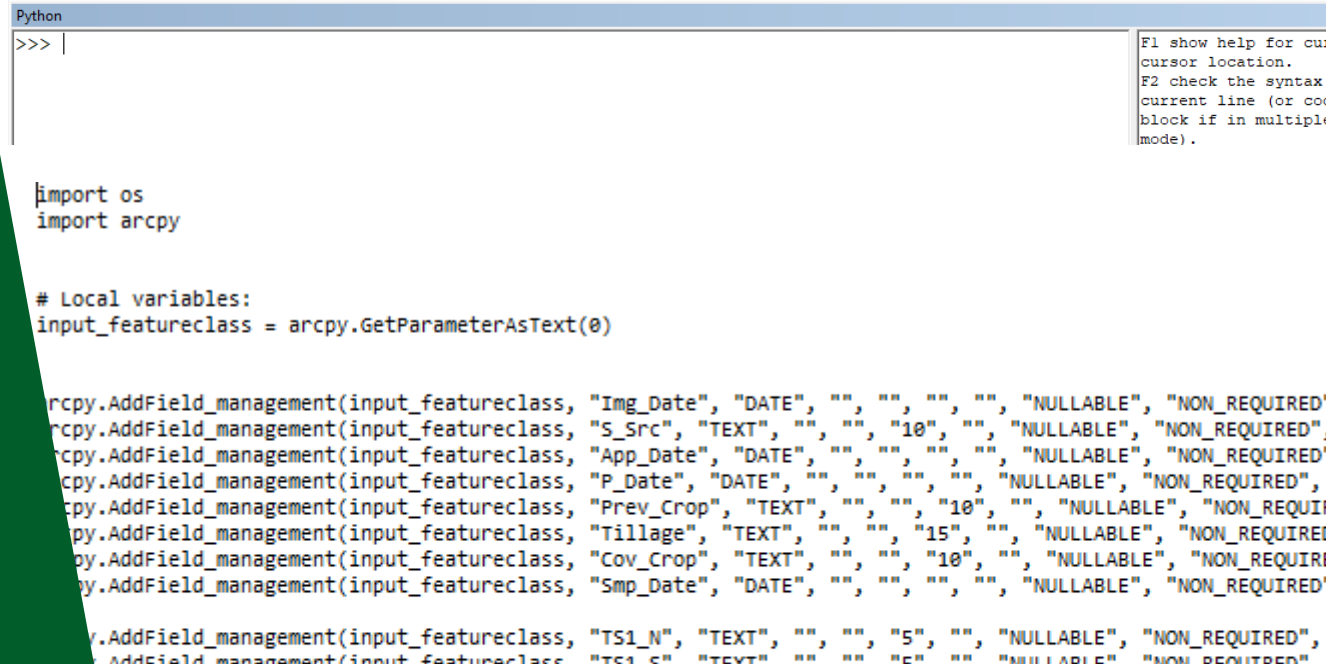
>Model Builder Method
>Python Method

May touch on:
>Command Line
>ArcToolBox Basics

DISCLAIMER: This is geared towards novice users who have some GIS experience, but may not have ventured outside the normal toolboxes.

Some of you may be experts, and may not benefit from this presentation.





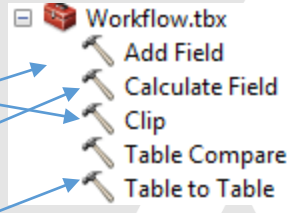
Why create your own tools?

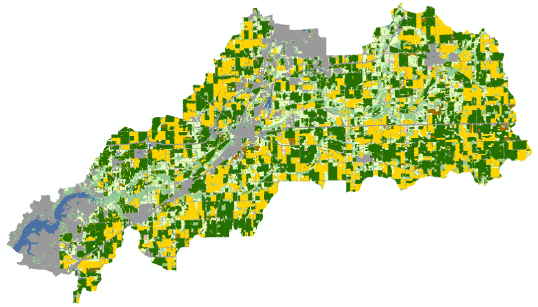
- Create toolboxes for workflows that one must do repetitively
- Creating tools for users who aren’t familiar with the software
- Skip UI for certain tools and save time!
- Insert persuasion.txt

Model Builder Approach

Simple example workflow from Trev's life: Cropping & land histories for different watersheds/political boundaries

Arctoolbox workflow
Export feature
Locate CDL Raster
Raster Clip + UI
Add Field + UI
Calculate Field + UI
Table to table + UI



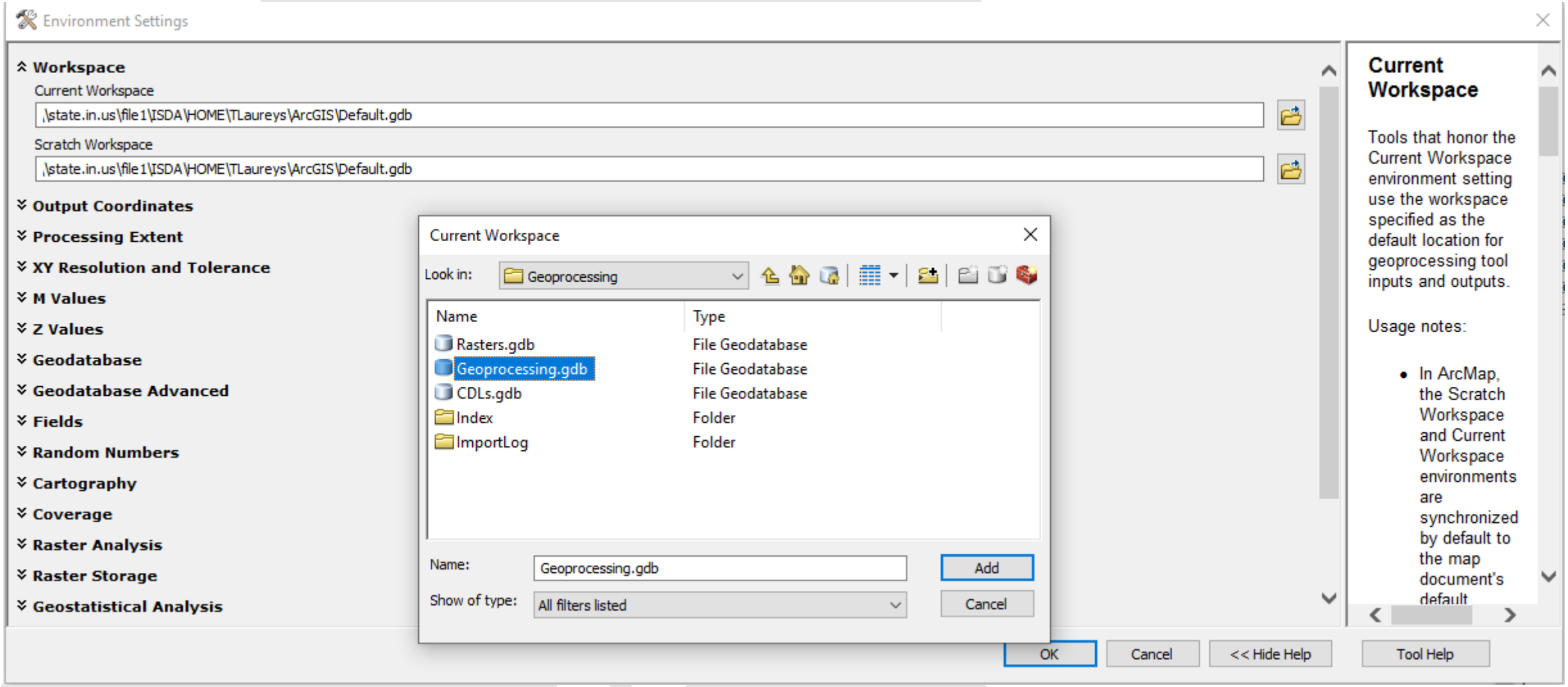


CDL_2018

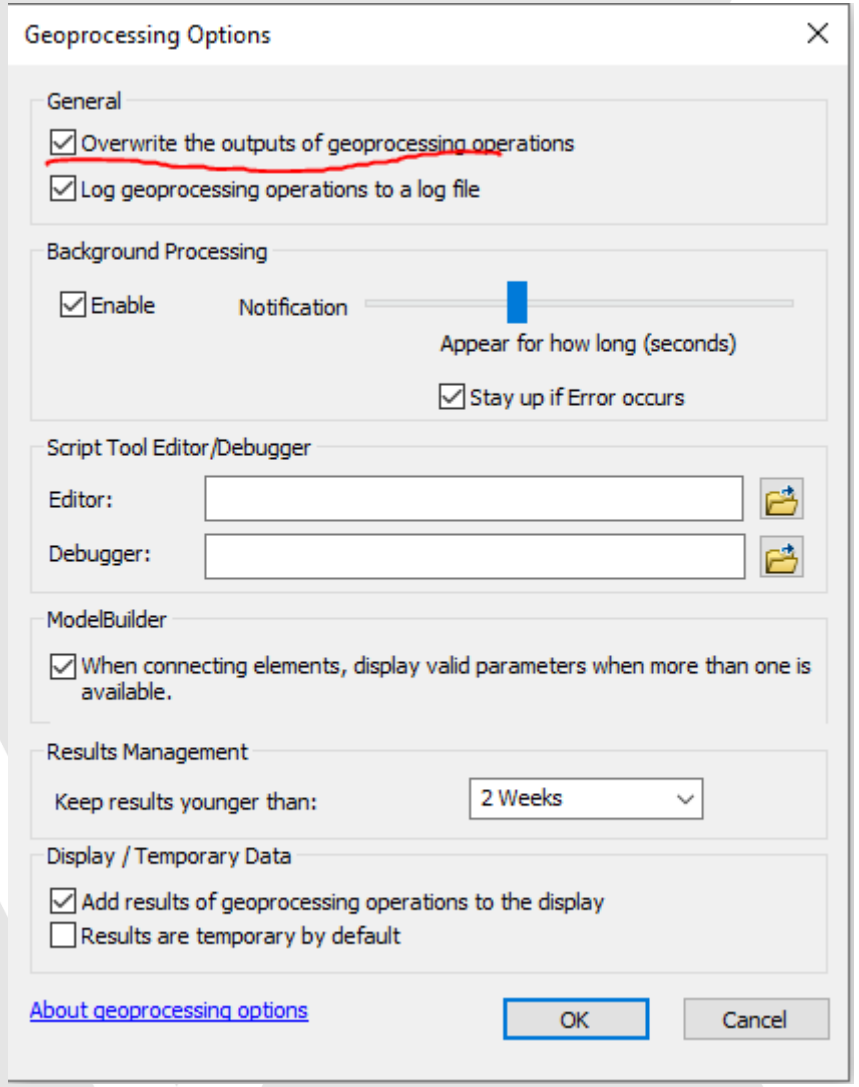
OID	VALUE	CLASS_NAME	RED	GREEN	BLUE	OPACITY	Count	Acres
0	1	Corn	1	0.827451	0	1	142062	31593.736428
1	5	Soybeans	0.14902	0.439216	0	1	203058	45158.880852
2	13	Pop or Orn Corn	0.866667	0.647059	0.047059	1	43	9.562942
3	24	Winter Wheat	0.647059	0.439216	0	1	3312	736.568928
4	26	Dbl Crop WinWht/Soybeans	0.439216	0.439216	0	1	1063	236.404822
5	27	Rye	0.678431	0	0.486275	1	1	0.222394
6	28	Oats	0.627451	0.34902	0.537255	1	19	4.225486
7	36	Alfalfa	1	0.647059	0.886275	1	3245	721.66853
8	37	Other Hay/Non Alfalfa	0.647059	0.94902	0.54902	1	3249	722.558106
9	44	Other Crops	0	0.686275	0.298039	1	2	0.444788
10	54	Tomatoes	0.94902	0.639216	0.466667	1	330	73.39002
11	56	Hops	0	0.686275	0.298039	1	1	0.222394
12	58	Clover/Wildflowers	0.909804	0.74902	1	1	12	2.668728
13	59	Sod/Grass Seed	0.686275	1	0.866667	1	63	14.010822
14	61	Fallow/Idle Cropland	0.74902	0.74902	0.466667	1	104	23.128976
15	111	Open Water	0.298039	0.439216	0.639216	1	11200	2490.8128
16	121	Developed/Open Space	0.607843	0.607843	0.607843	1	58708	13056.306952
17	122	Developed/Low Intensity	0.607843	0.607843	0.607843	1	42018	9344.551092
18	123	Developed/Med Intensity	0.607843	0.607843	0.607843	1	12675	2818.84395
19	124	Developed/High Intensity	0.607843	0.607843	0.607843	1	3911	869.782934
20	131	Barren	0.8	0.74902	0.639216	1	175	38.91895
21	141	Deciduous Forest	0.576471	0.8	0.576471	1	55234	12283.710196
22	142	Evergreen Forest	0.576471	0.8	0.576471	1	17	3.780698
23	143	Mixed Forest	0.576471	0.8	0.576471	1	3	0.667182
24	152	Shrubland	0.776471	0.839216	0.619608	1	534	118.758396
25	176	Grass/Pasture	0.909804	1	0.74902	1	87551	19470.817094
26	190	Woody Wetlands	0.498039	0.698039	0.698039	1	376	83.620144
27	195	Herbaceous Wetlands	0.498039	0.698039	0.698039	1	870	193.48278
28	216	Peppers	1	0.4	0.4	1	9	2.001546
29	229	Pumpkins	1	0.4	0.4	1	281	62.492714

Multiplied by # of Years of interest going back ~10 years

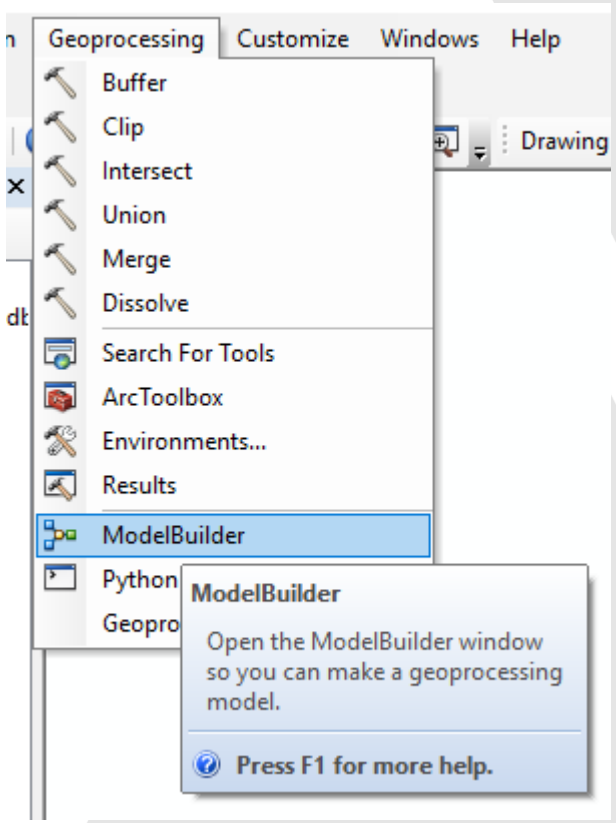
Model Builder Approach cont.



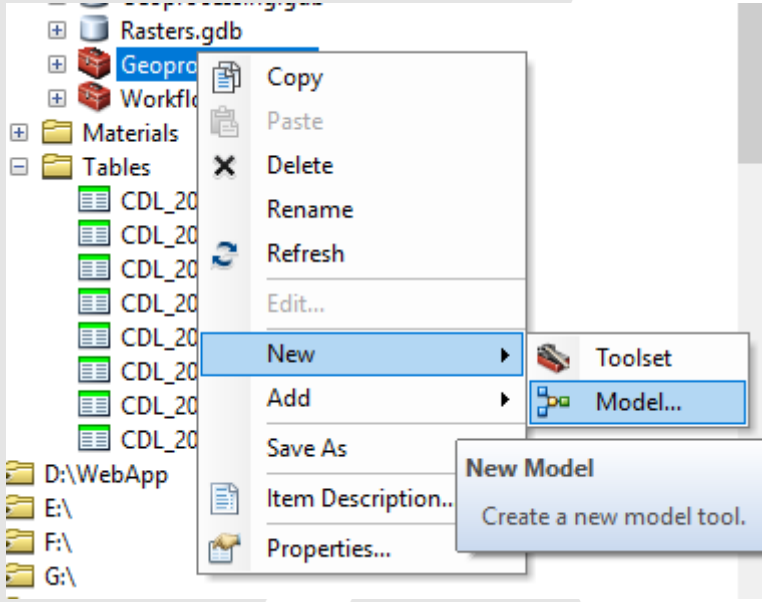
Model Builder Approach cont.

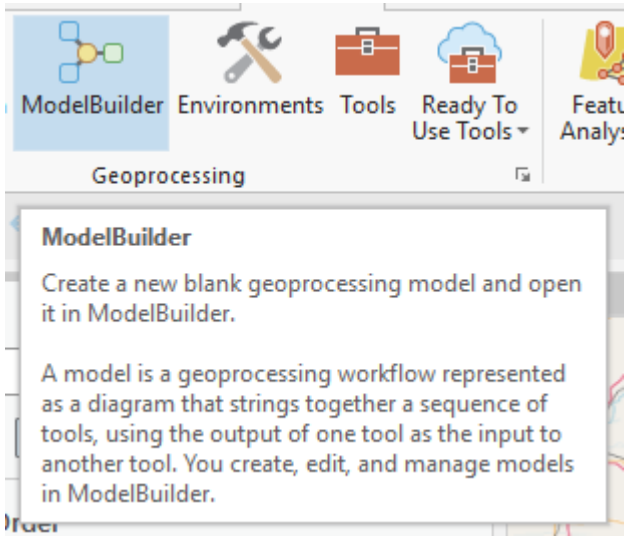


Model Builder Approach cont.



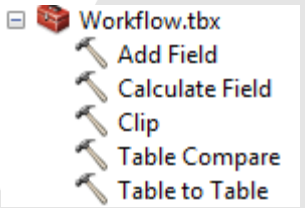
Geoprocessing>ModelBuilder

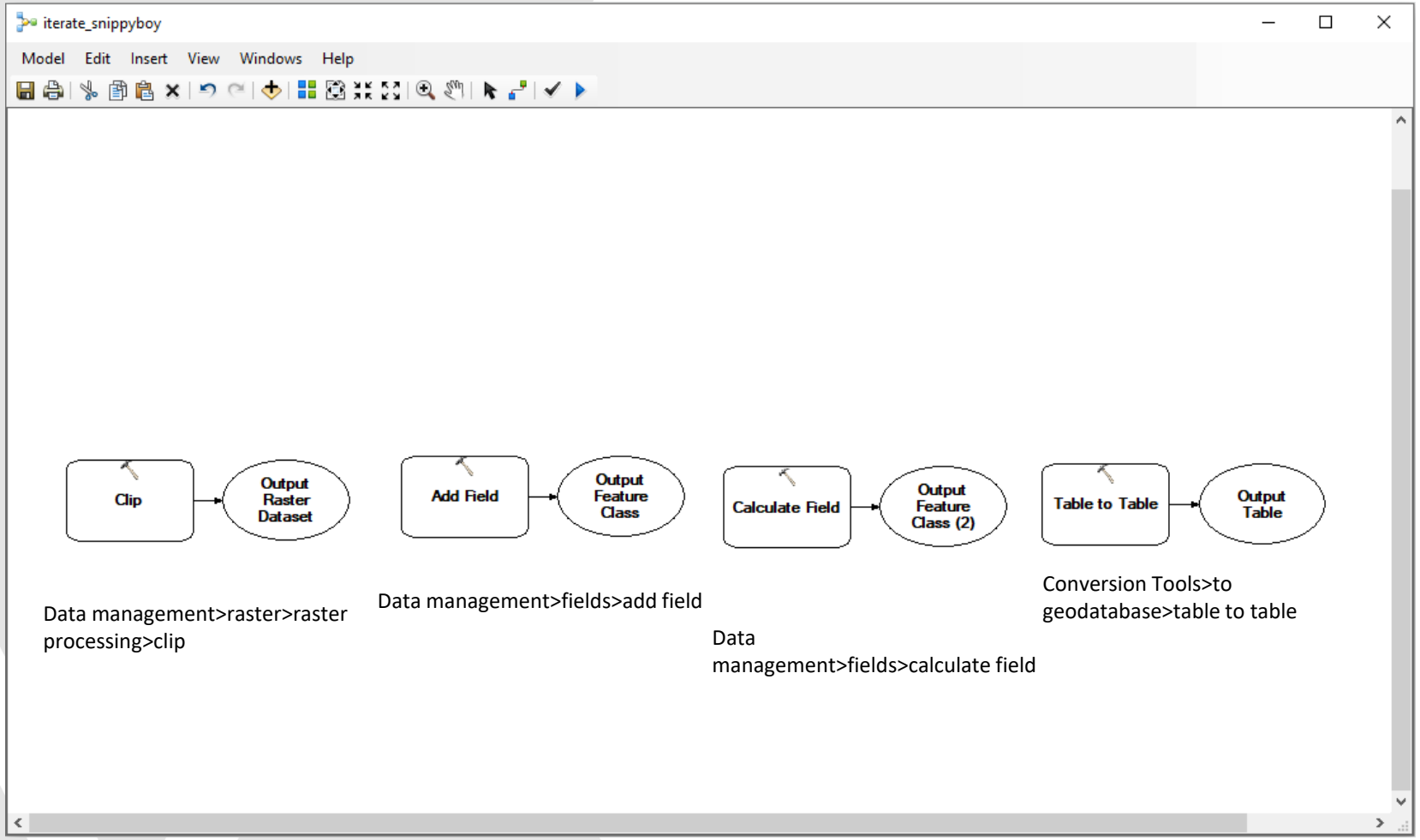




Analysis Tab>ModelBuilder

Model Builder Approach cont.





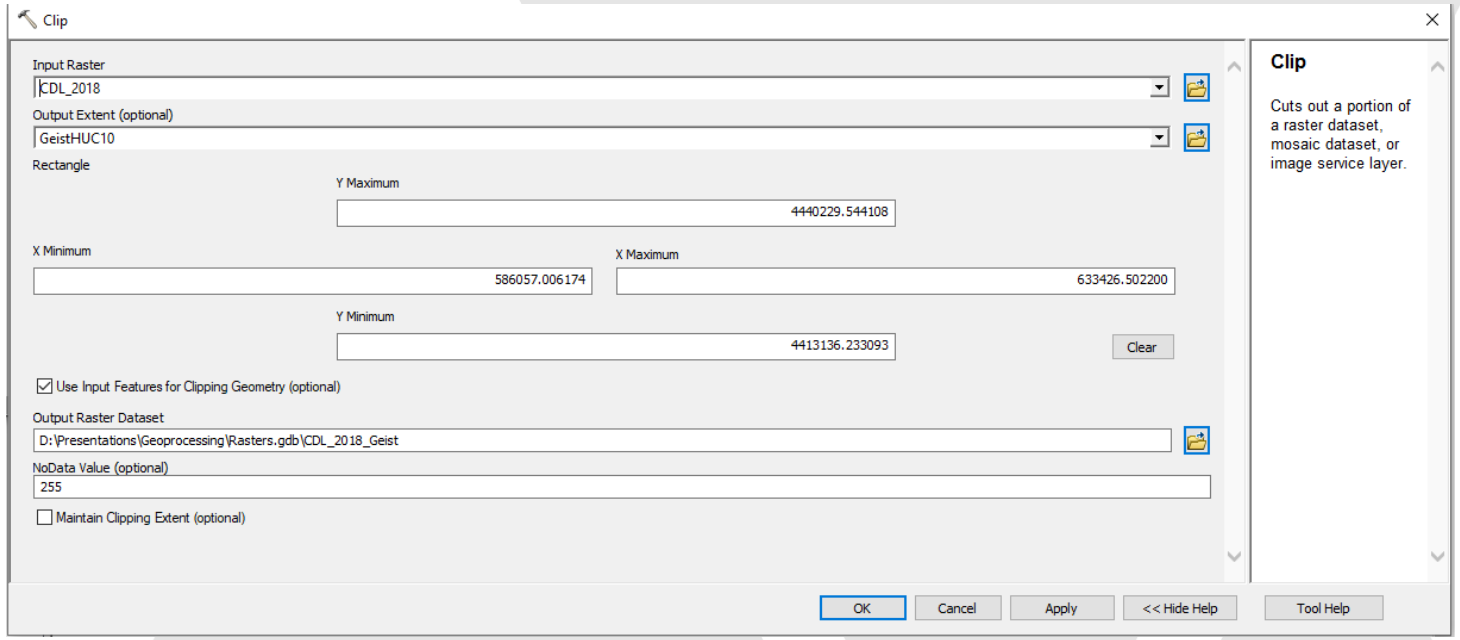
Data management>raster>raster processing>clip

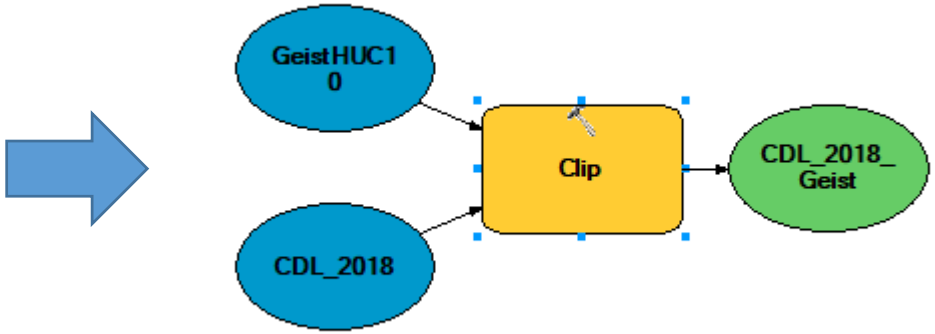
Data management>fields>add field

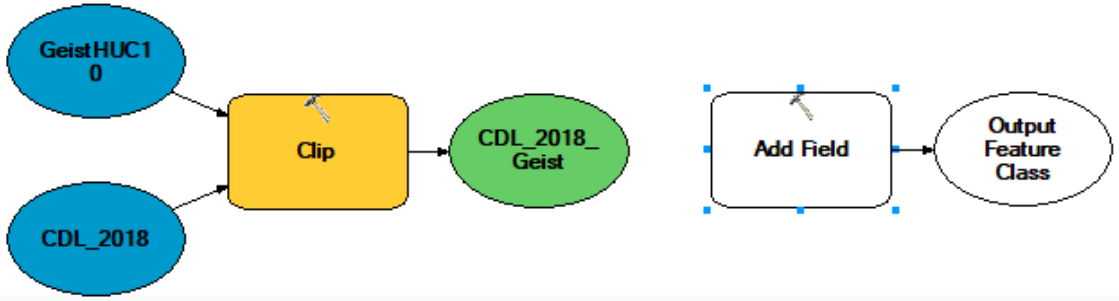
Data management>fields>calculate field

Conversion Tools>to geodatabase>table to table

Model Builder Approach cont.







Add Field

Input Table

Output Feature Class (2)
CDL_2018_Geist
Output Table
CDL_2018
GeistHUC10
CDL_2018
GeistHUC10
CDL_2018

Field IsRequired (optional)

Field Domain (optional)

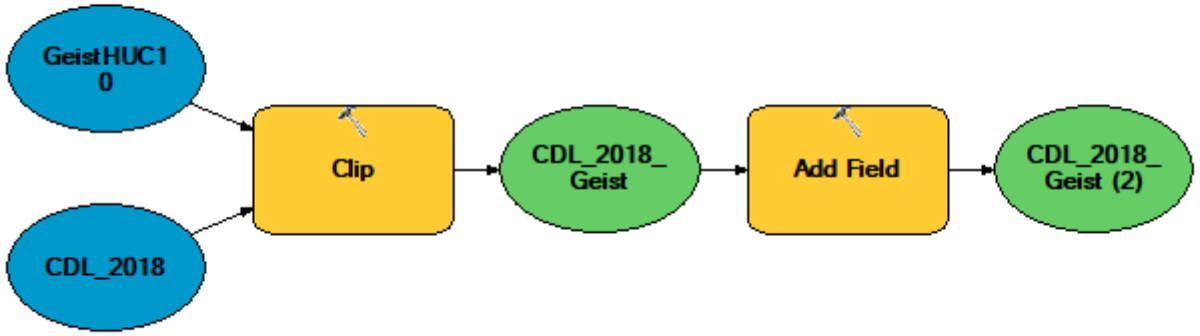
Input Table

The input table to which the specified field will be added. The field will be added to the existing input table and will not create a new output table.

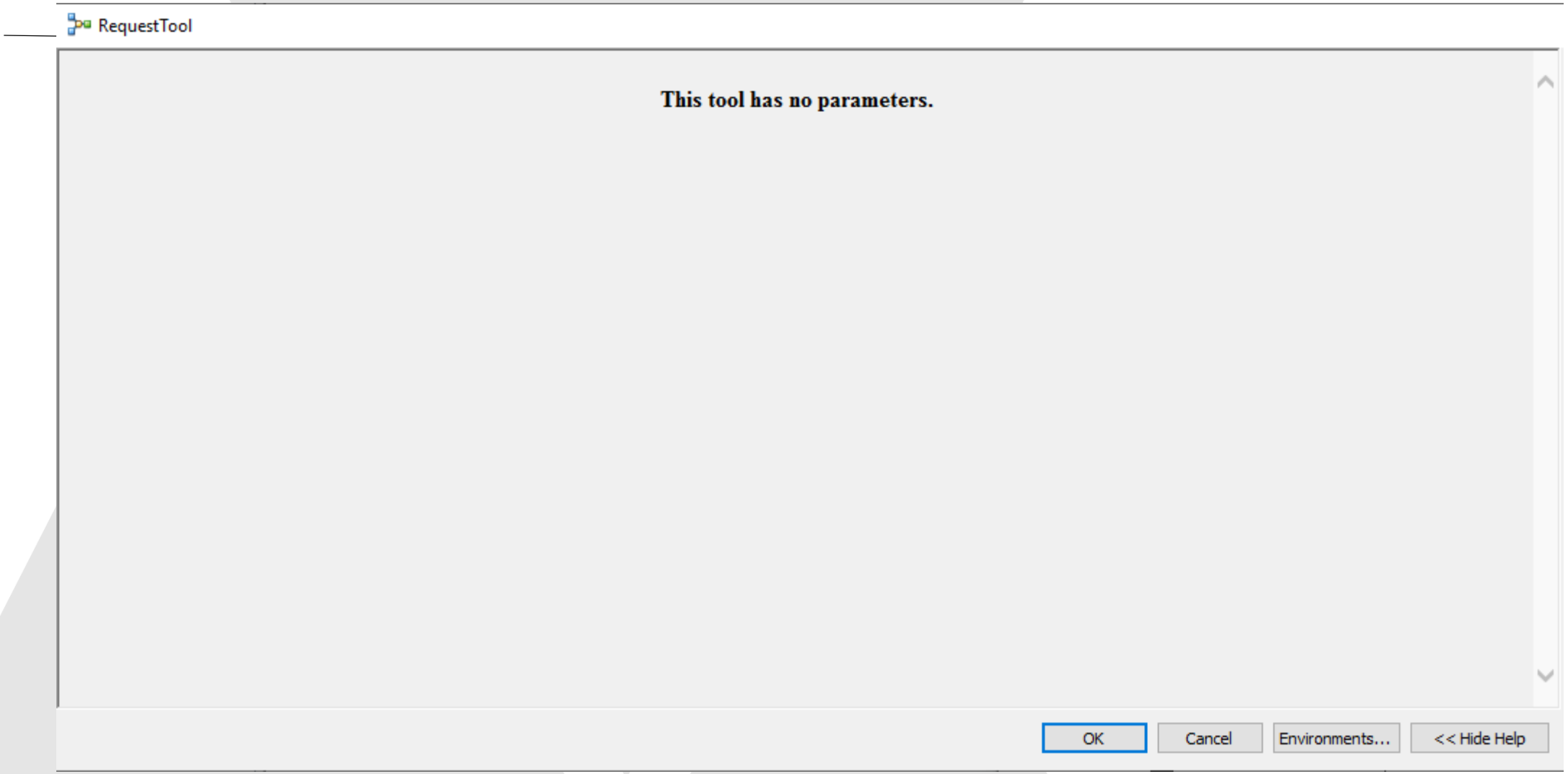
Fields can be added to feature classes in geodatabases, shapefiles, stand-alone tables, rasters with attribute tables, and layers.

OK | Cancel | Apply | << Hide Help | Tool Help

Model Builder Approach cont.



Model Builder Approach cont.



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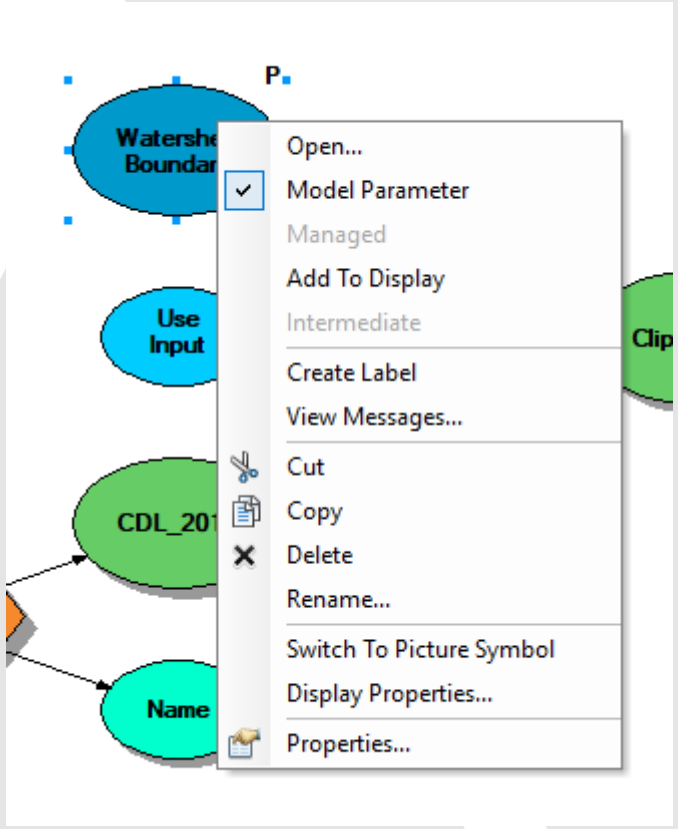
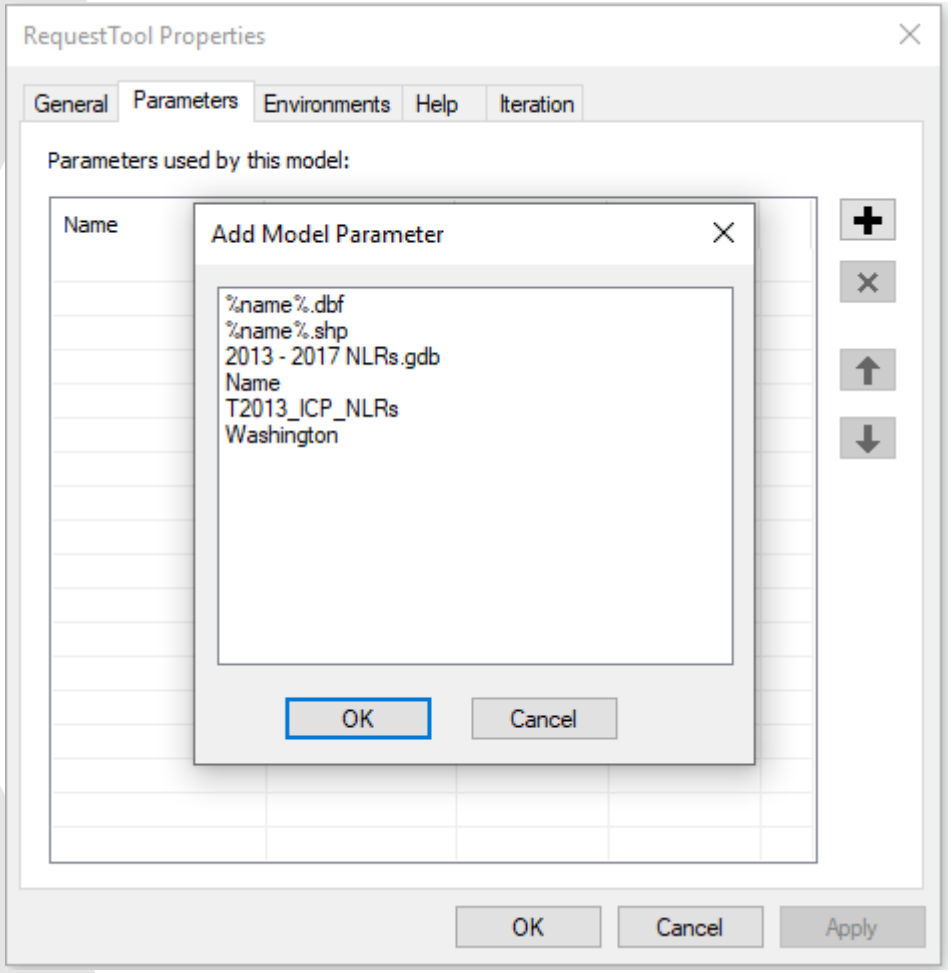
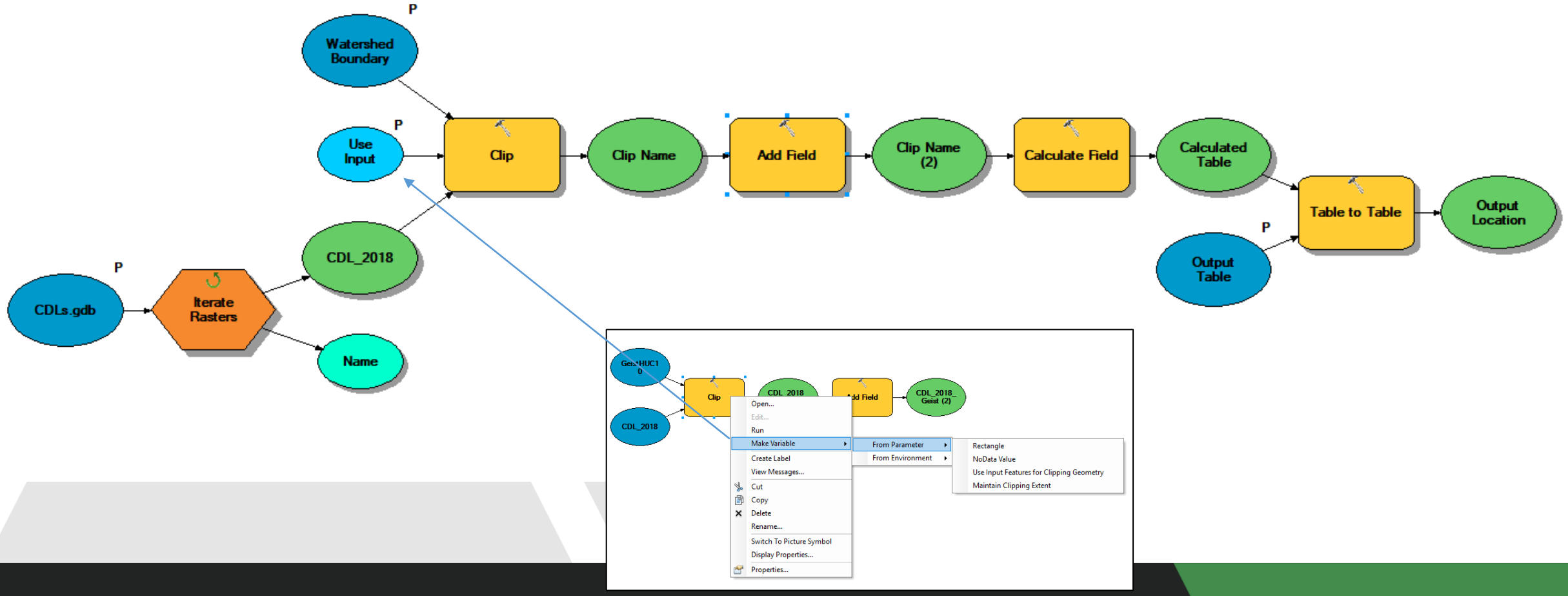
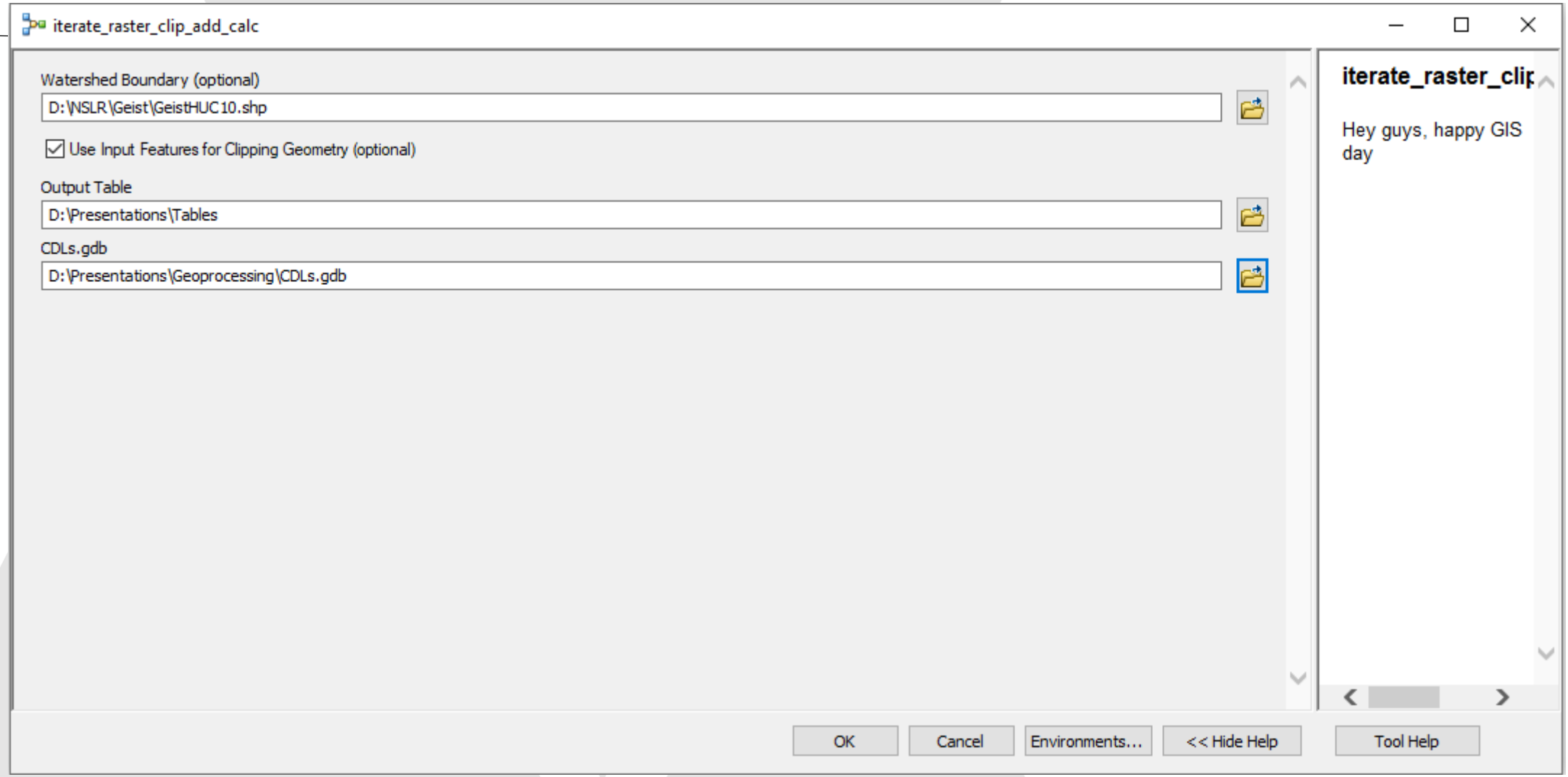




Model Builder Approach cont.



Model Builder Approach cont.



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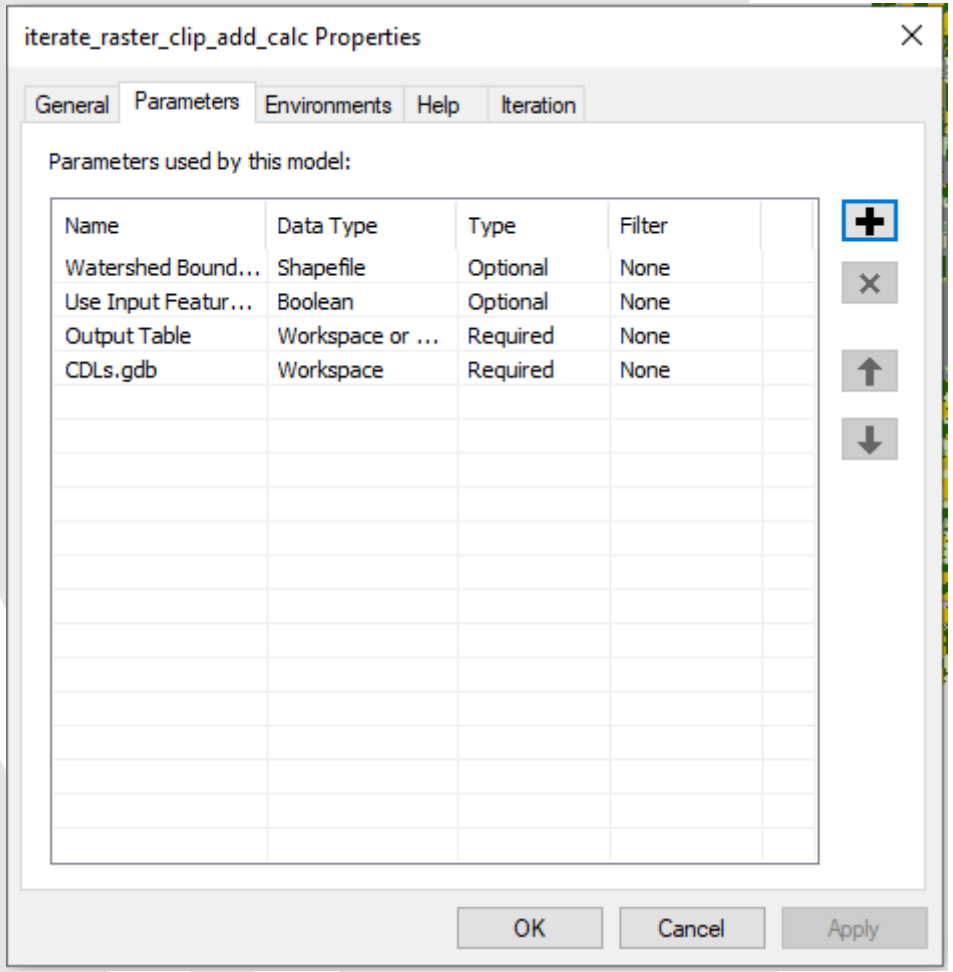
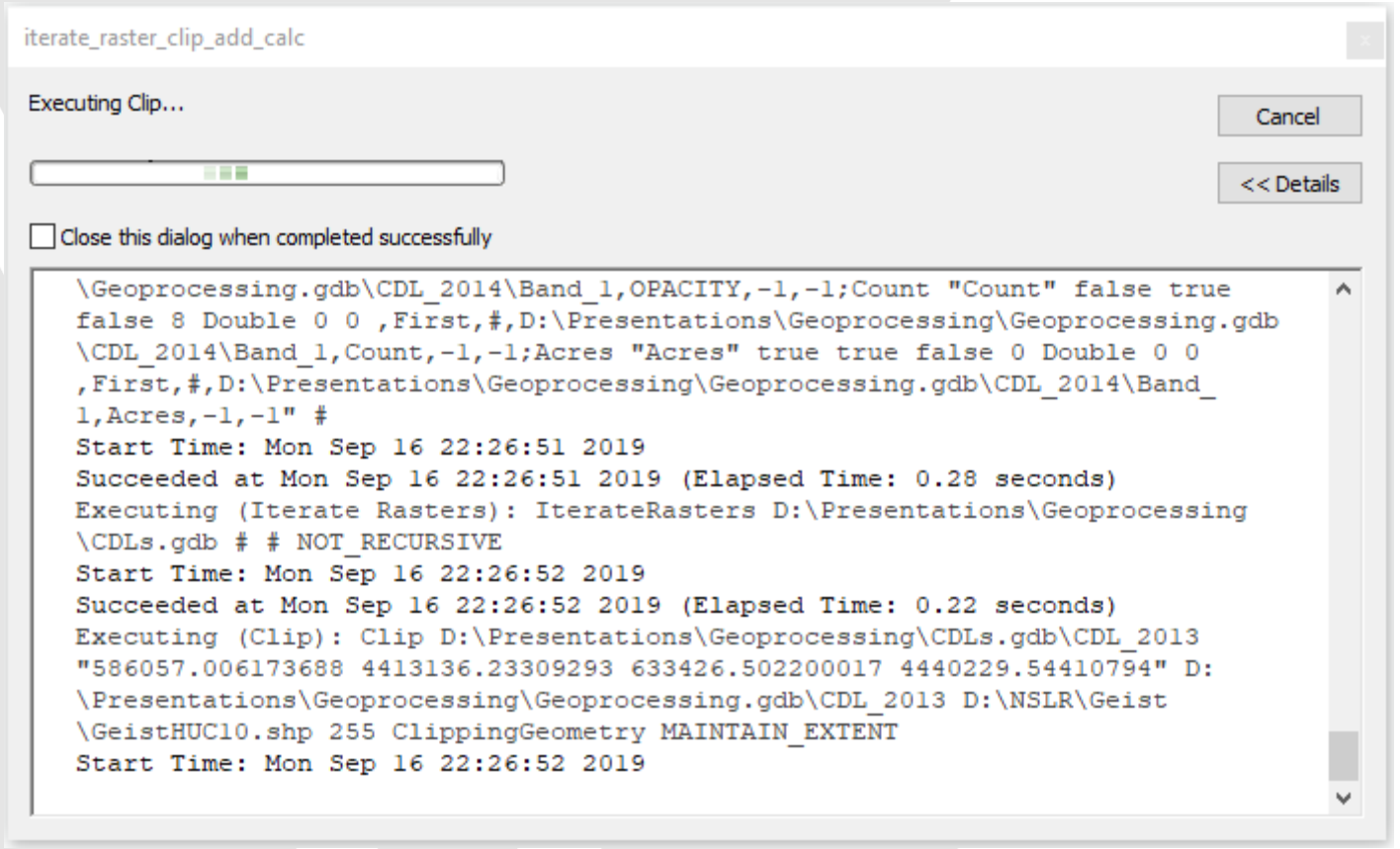
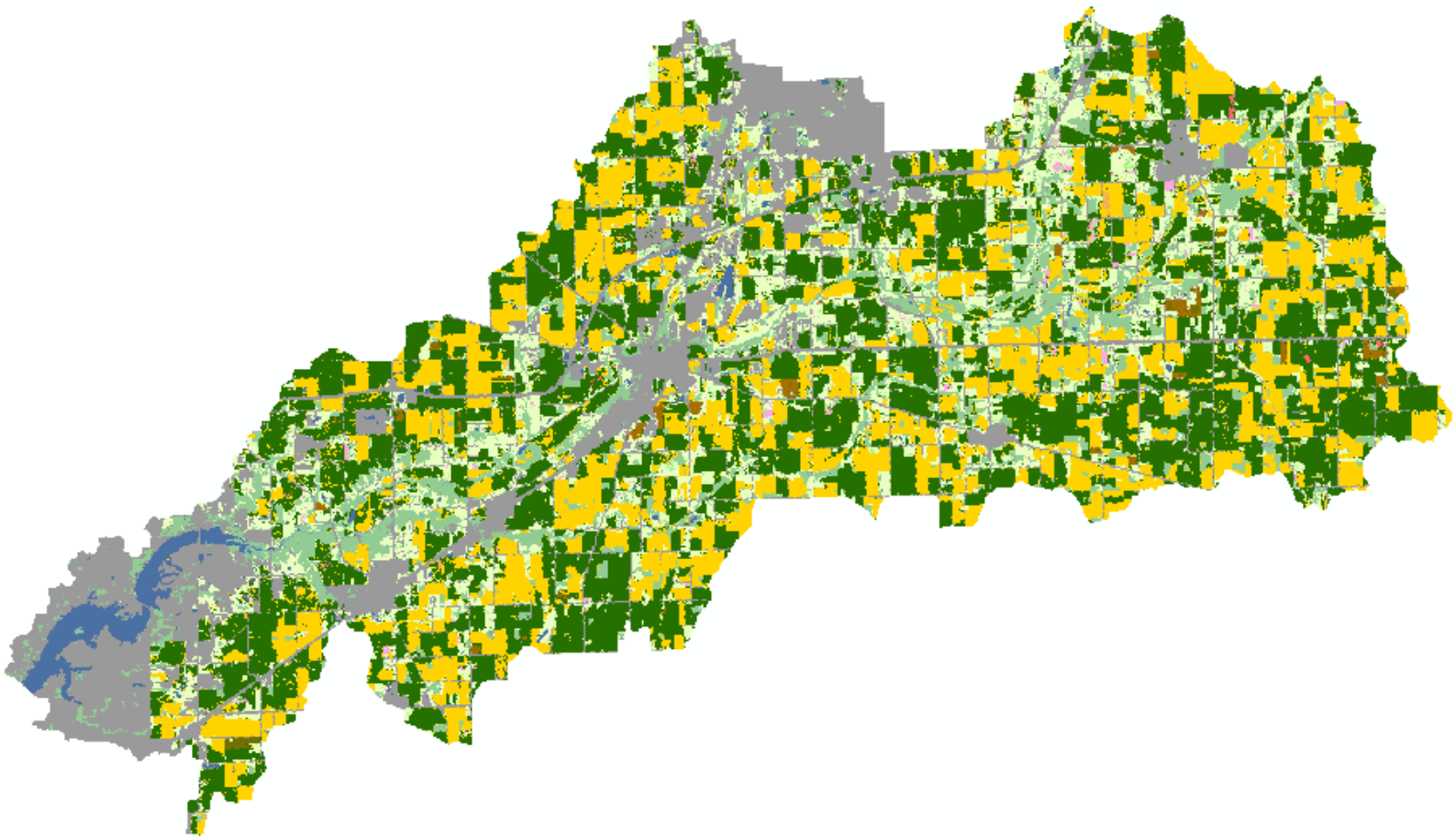
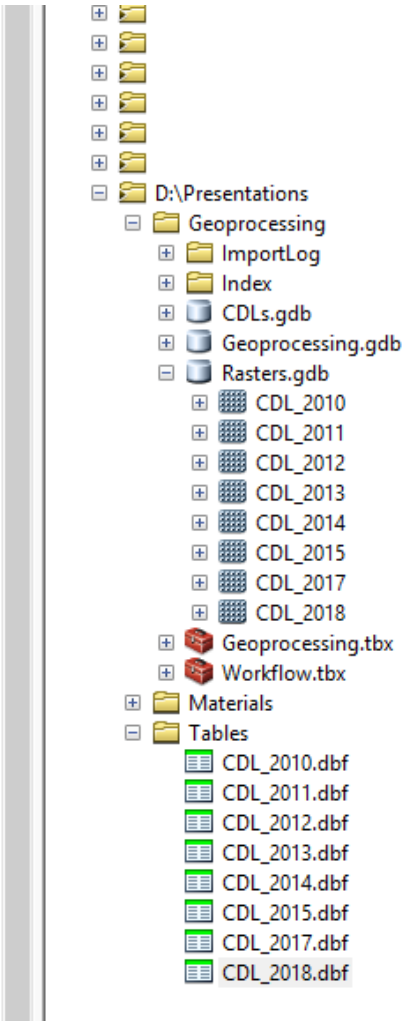


Model Builder Approach cont.



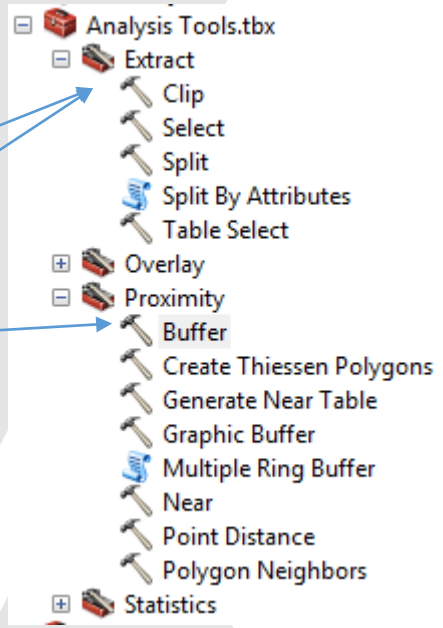
Model Builder Approach cont.

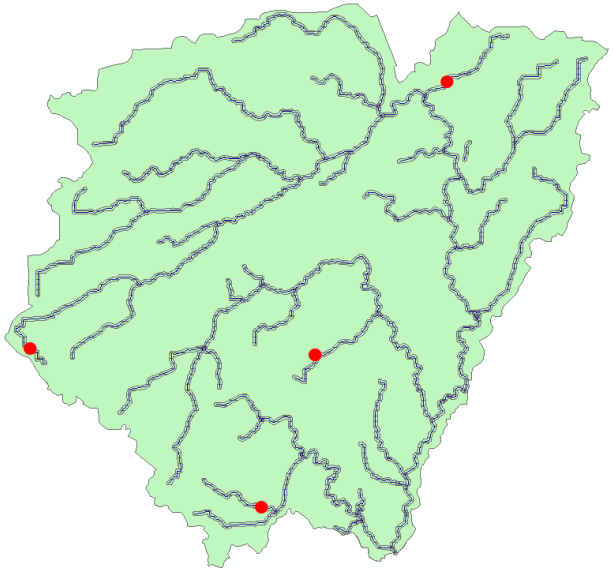




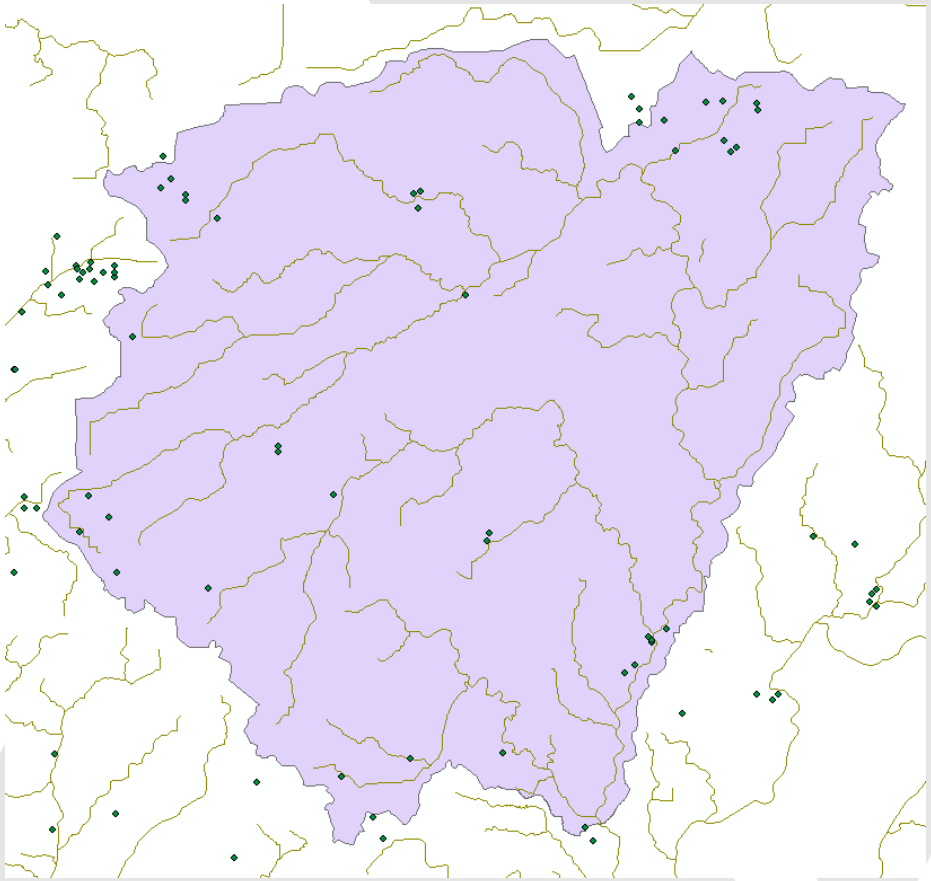
Python Script Approach

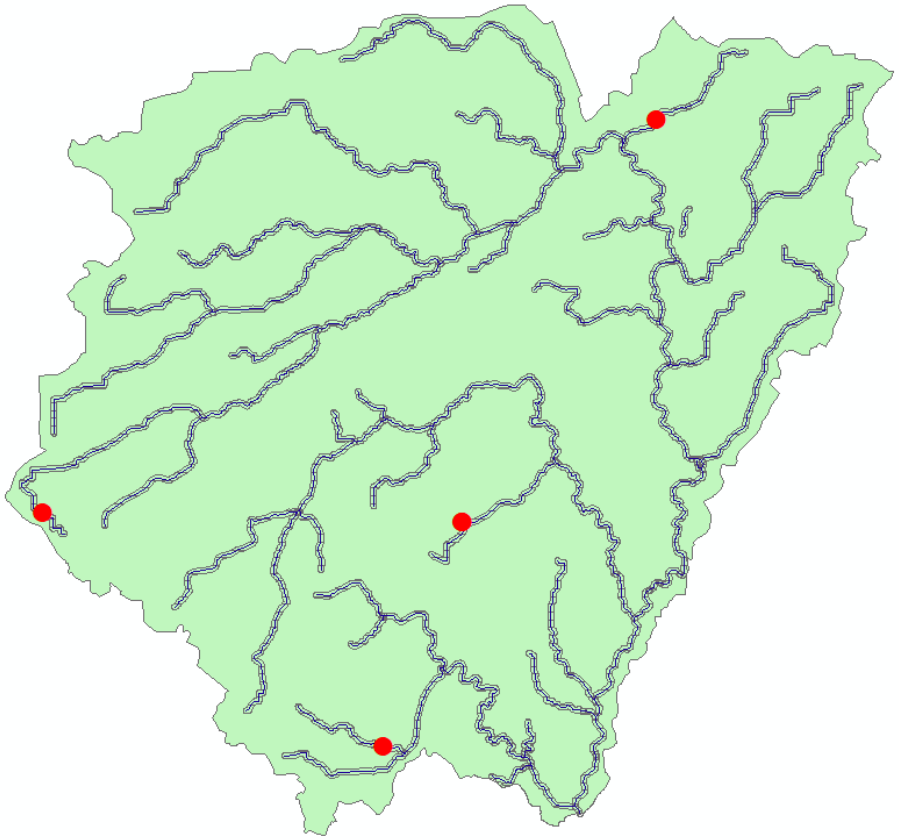
Arctoolbox workflow
Export feature
Locate NHD Stream Data
Clip
Buffer
Clip





Python Script Approach

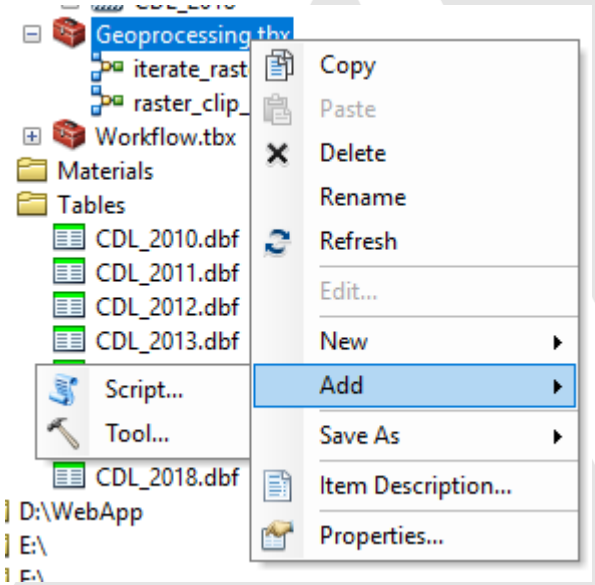


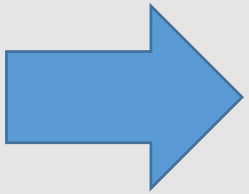


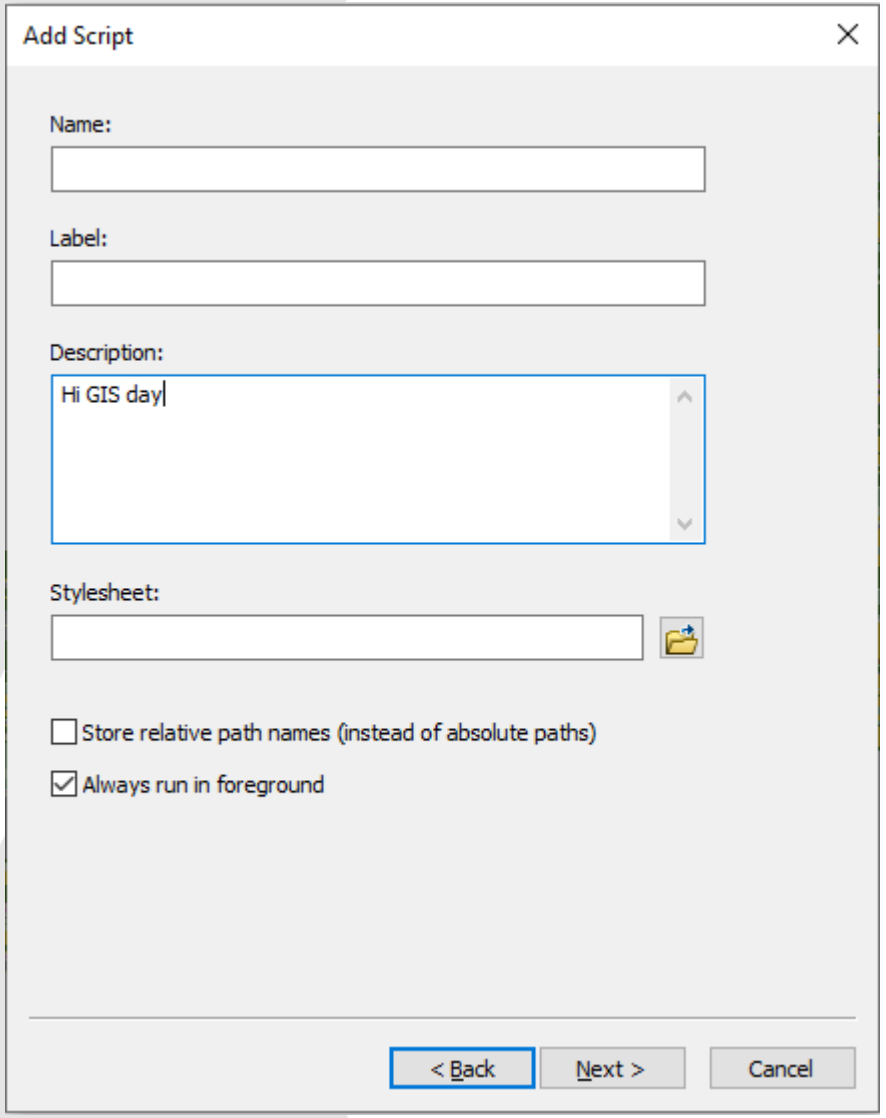
Python Script Approach

```
import arcpy

#set parameters
Clip_Boundary = arcpy.GetParameterAsText(0)
CY_Practices = arcpy.GetParameterAsText(1)
Distance__value_or_field_ = arcpy.GetParameterAsText(2)
Stream_Clip_Name = arcpy.GetParameterAsText(3)
Stream_Buffer_Name = arcpy.GetParameterAsText(4)

# variables:
NHDFlowline_shp = "D:\\NHD\\NHDFlowline.shp"
RiparianPractices = "D:\\Presentations\\Geoprocessing\\Geoprocessing.gdb\\RiparianPractices"

# Process: Clip, buffer, clip
arcpy.Clip_analysis(NHDFlowline_shp, Clip_Boundary, Stream_Clip_Name, "")

arcpy.AddMessage("Clipping by watershed")

arcpy.Buffer_analysis(Stream_Clip_Name, Stream_Buffer_Name, Distance__value_or_field_, "FULL", "ROUND", "NONE", "", "PLANAR")

arcpy.AddMessage("Buffering streams")

arcpy.Clip_analysis(CY_Practices, Stream_Buffer_Name, RiparianPractices, "")

arcpy.AddMessage("Clipping practices")
```

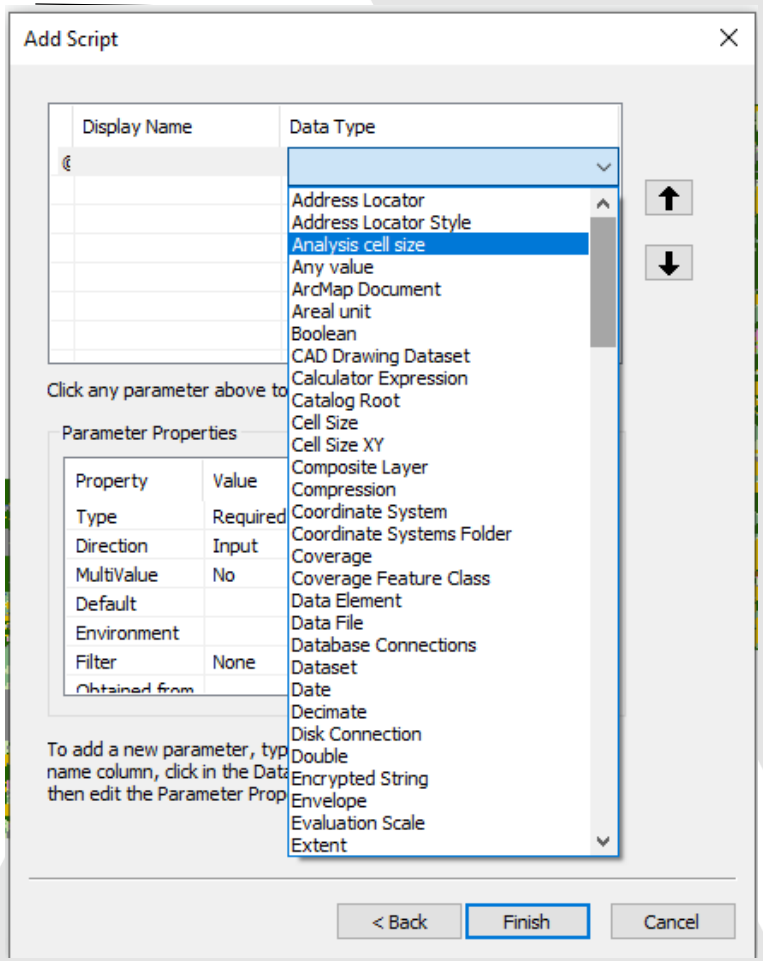
Python Script Approach

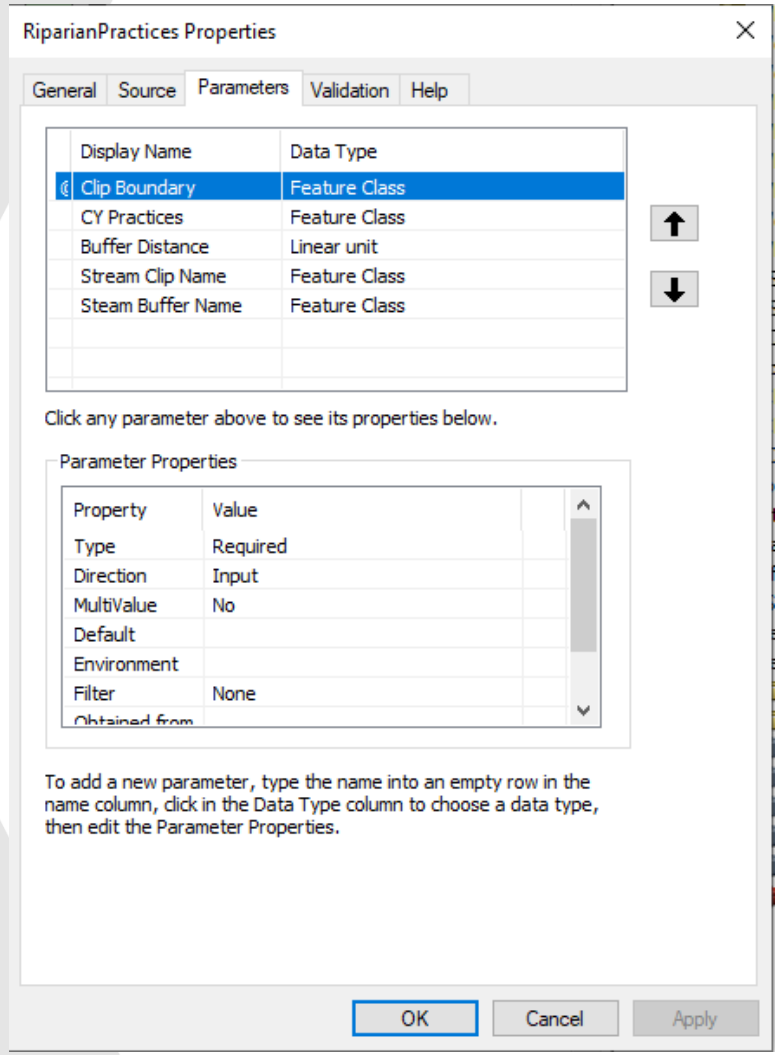






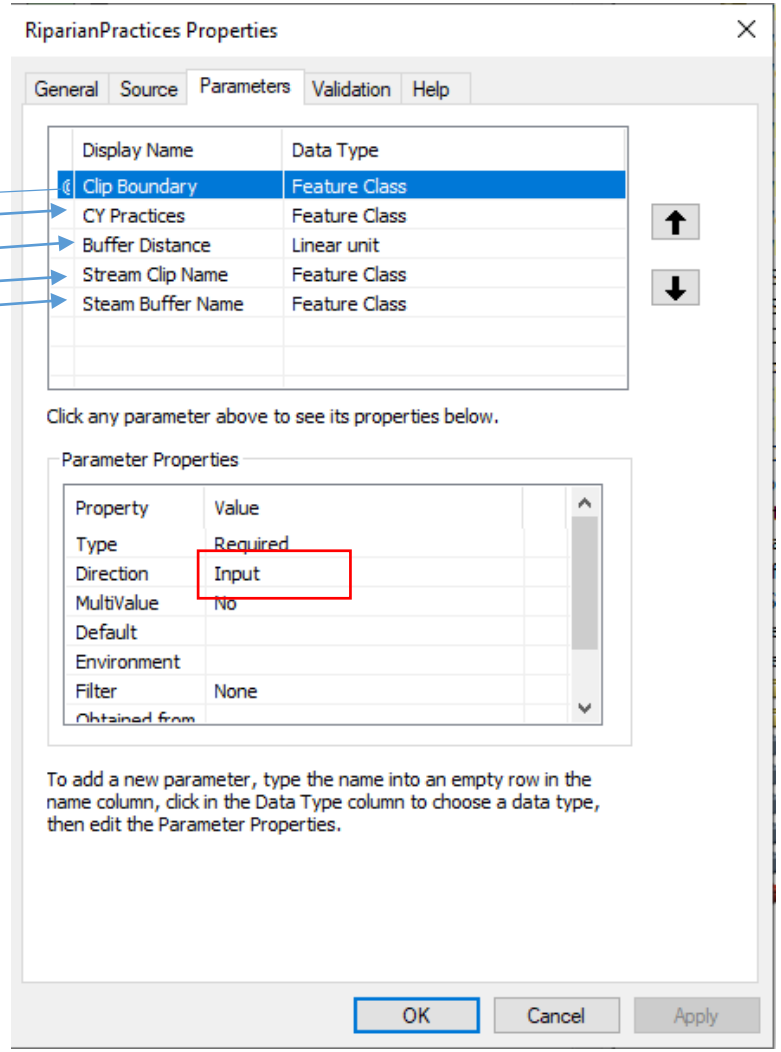
Python Script Approach



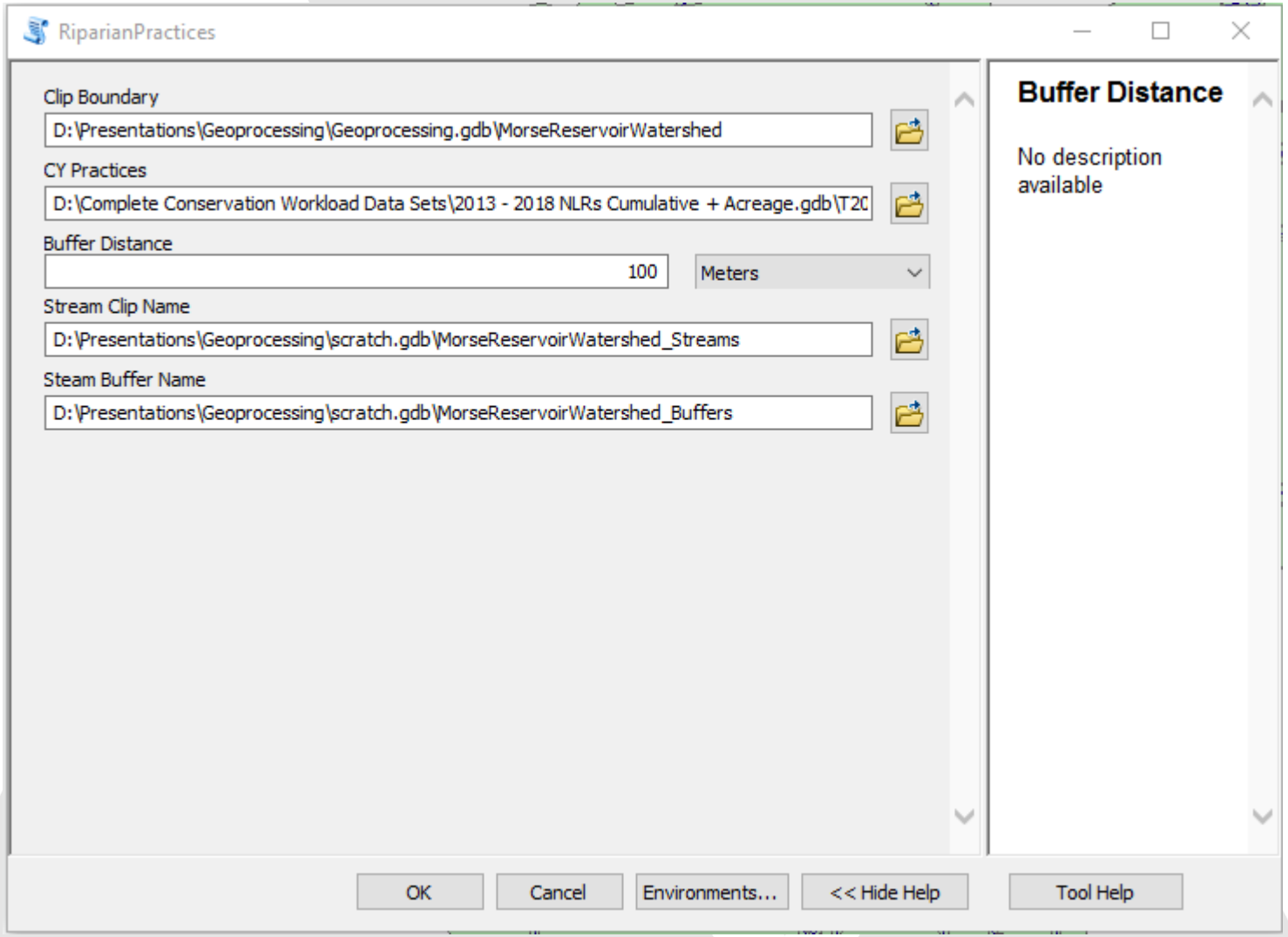


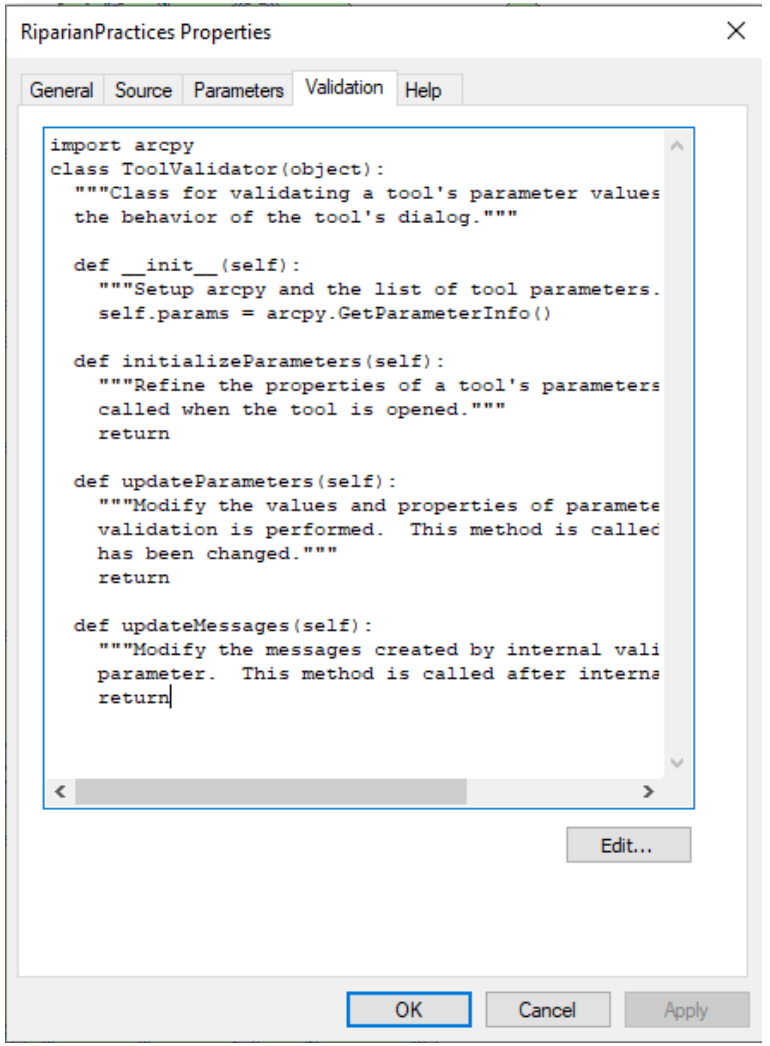
Python Script Approach

```
import arcpy

#set parameters
Clip_Boundary = arcpy.GetParameterAsText(0)
CY_Practices = arcpy.GetParameterAsText(1)
Distance__value_or_field_ = arcpy.GetParameterAsText(2)
Stream_Clip_Name = arcpy.GetParameterAsText(3)
Stream_Buffer_Name = arcpy.GetParameterAsText(4)

# variables:
NHDFlowline_shp = "D:\\NHD\\NHDFlowline.shp"
RiparianPractices = "D:\\Presentations\\Geoprocessing\\Geoprocessing.gdb\\RiparianPractices"

# Process: Clip, buffer, clip
arcpy.Clip_analysis(NHDFlowline_shp, Clip_Boundary, Stream_Clip_Name, "")

arcpy.AddMessage("Clipping by watershed")

arcpy.Buffer_analysis(Stream_Clip_Name, Stream_Buffer_Name, Distance__value_or_field_, "FULL", "ROUND", "NONE", "",

arcpy.AddMessage("Buffering streams")

arcpy.Clip_analysis(CY_Practices, Stream_Buffer_Name, RiparianPractices, "")

arcpy.AddMessage("Clipping practices")
```

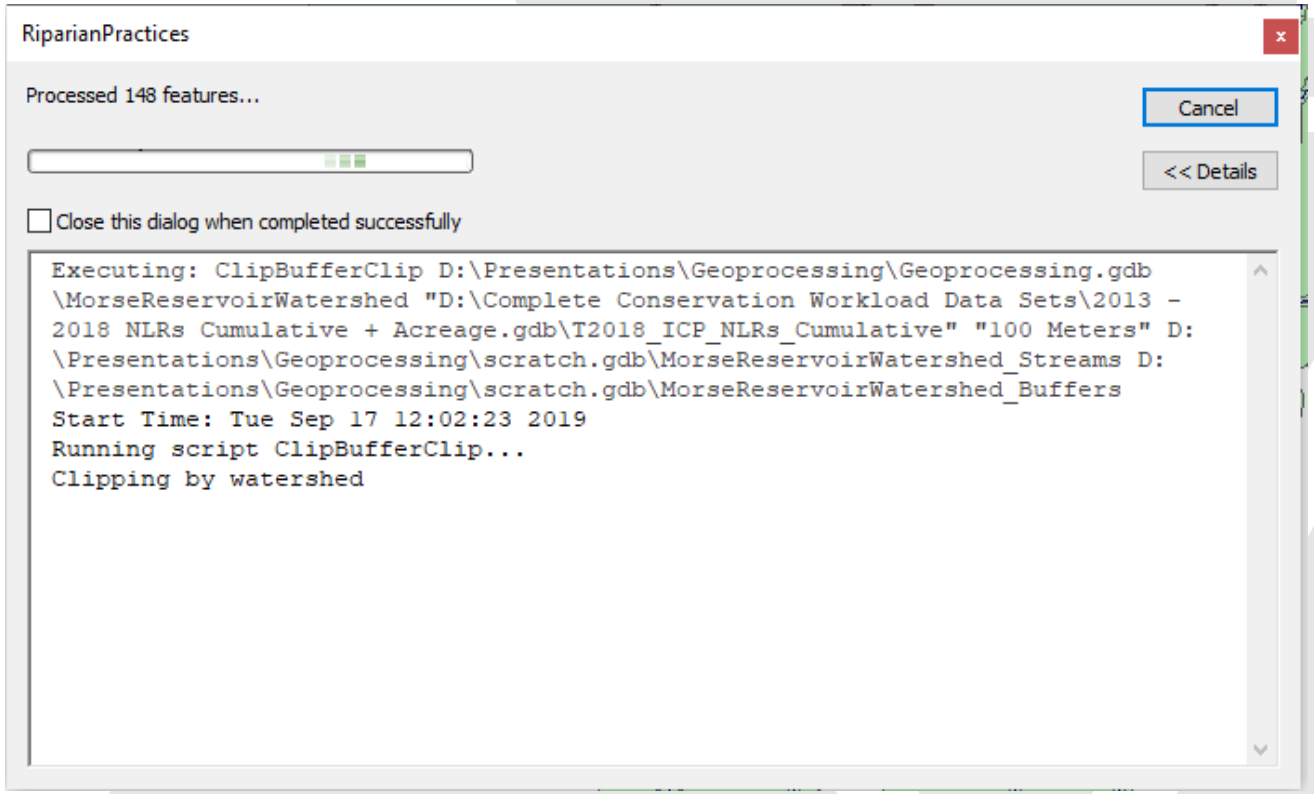


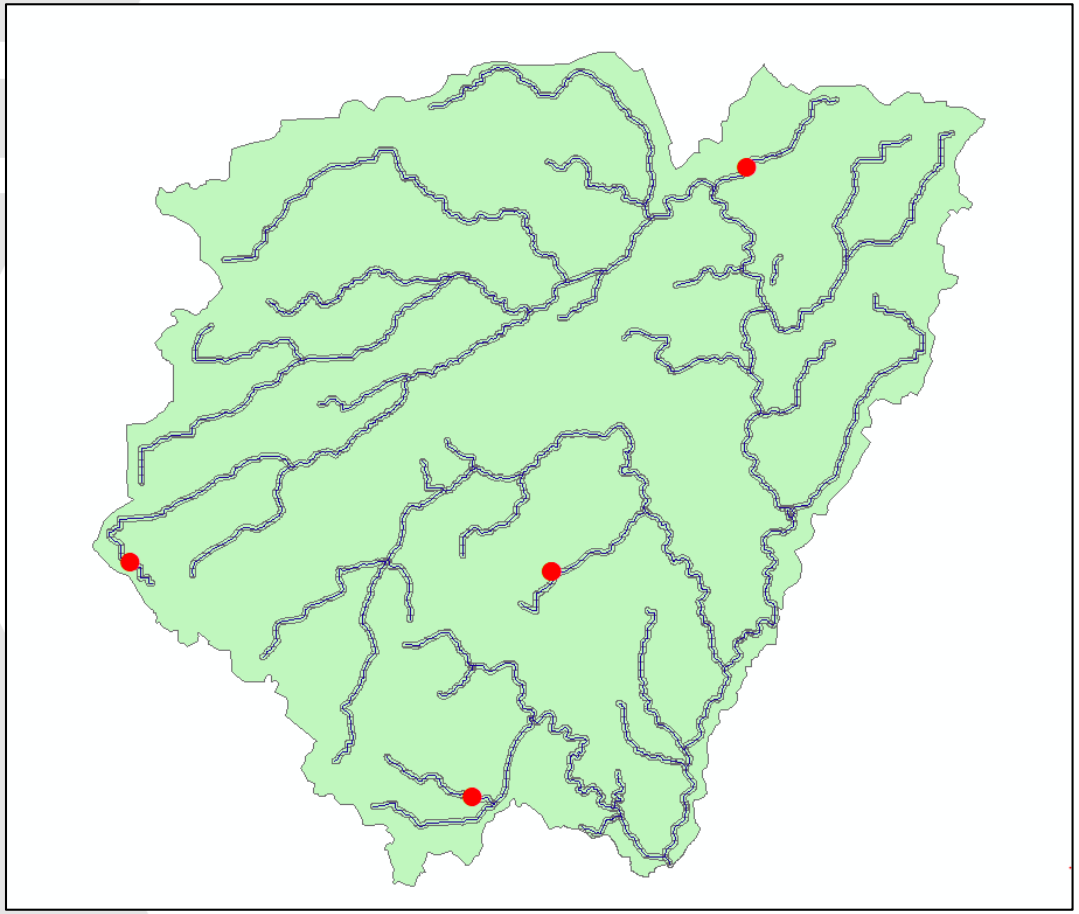
Python Script Approach





Python Script Approach





GIS

What my friends think I do

What my mom thinks I do

What society thinks I do

What my clients think I do

What I think I do

What I really do

INDIANA
STATE DEPARTMENT OF AGRICULTURE

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