MODELBUILDER

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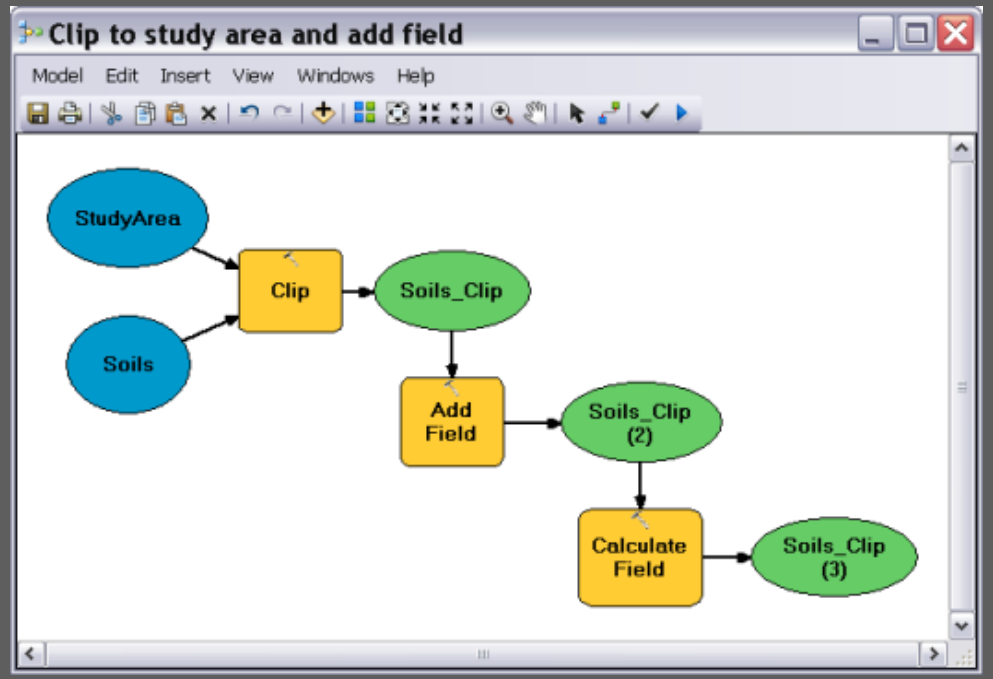
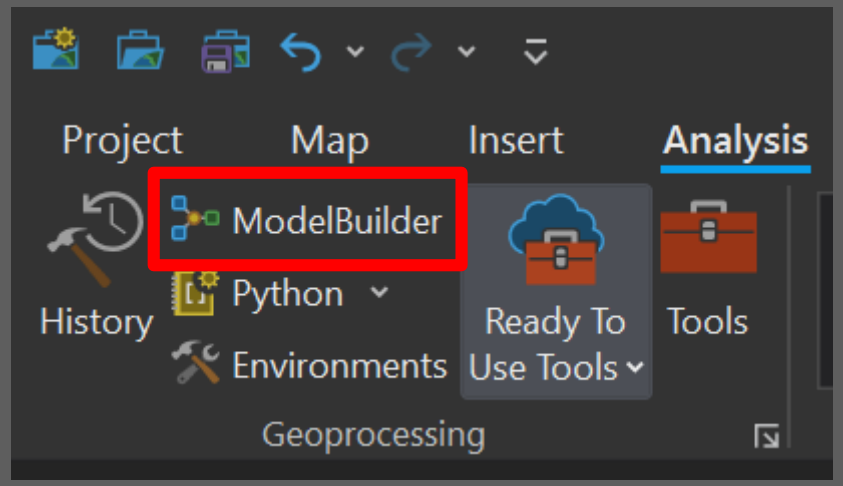
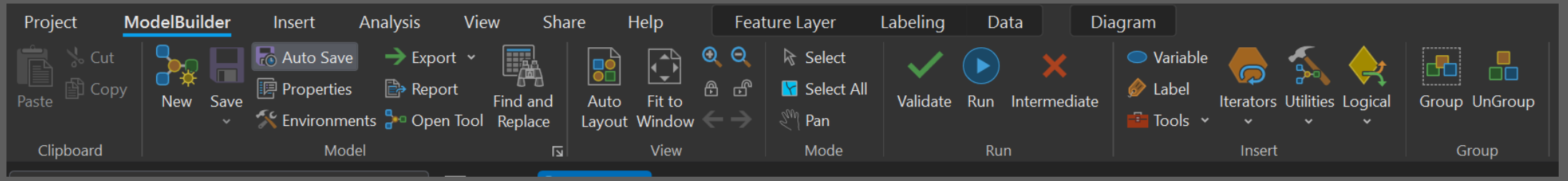
WHAT IS MODELBUILDER?

- ModelBuilder is an application you use to create, edit, and manage models.
- A model is a custom tool that string together sequences of geoprocessing tools/workflows.
- Visual programming language.

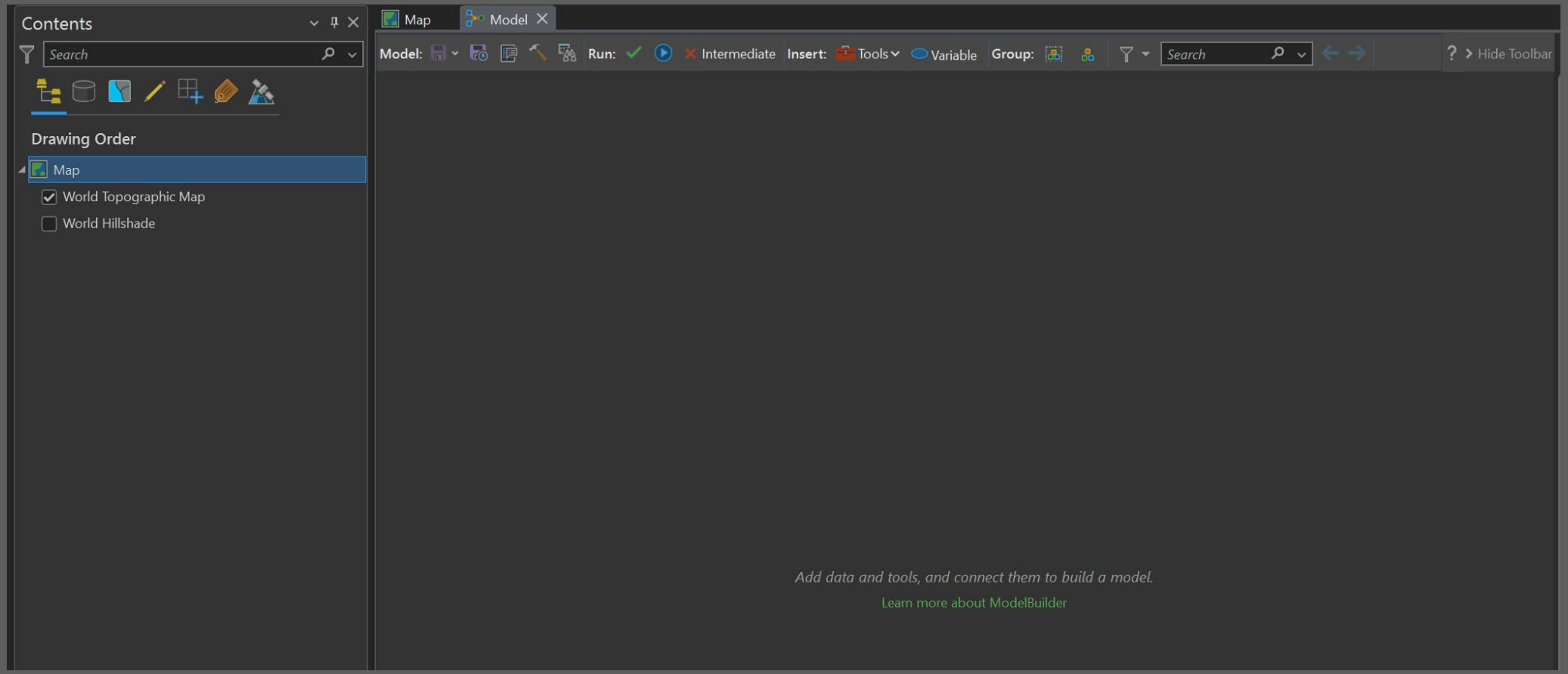


WHERE TO FIND IT?



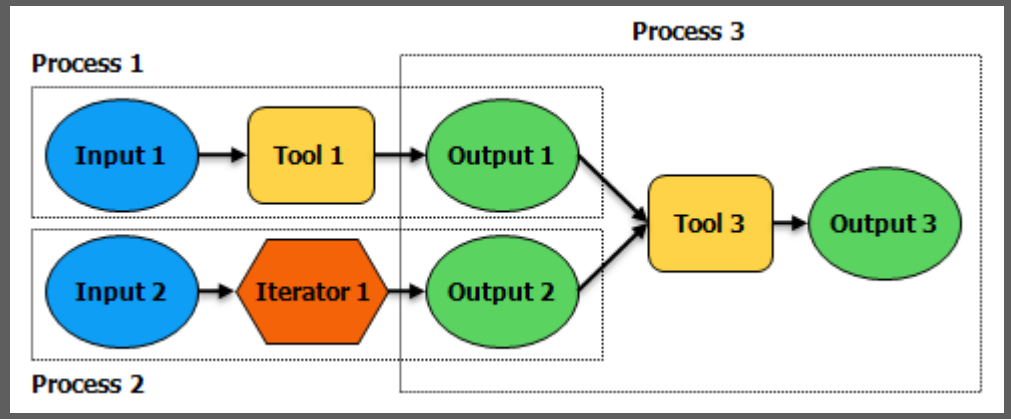


MODEL CANVAS



MODEL PROCESS

- A model process consists of a tool and all variables connected to it. Connector lines indicate the sequence of processing.
- Processes can be chained together to create a larger process.



PROCESS STATES

- Not Ready-To-Run
- Ready-To-Run
- Running
- Has Been Run

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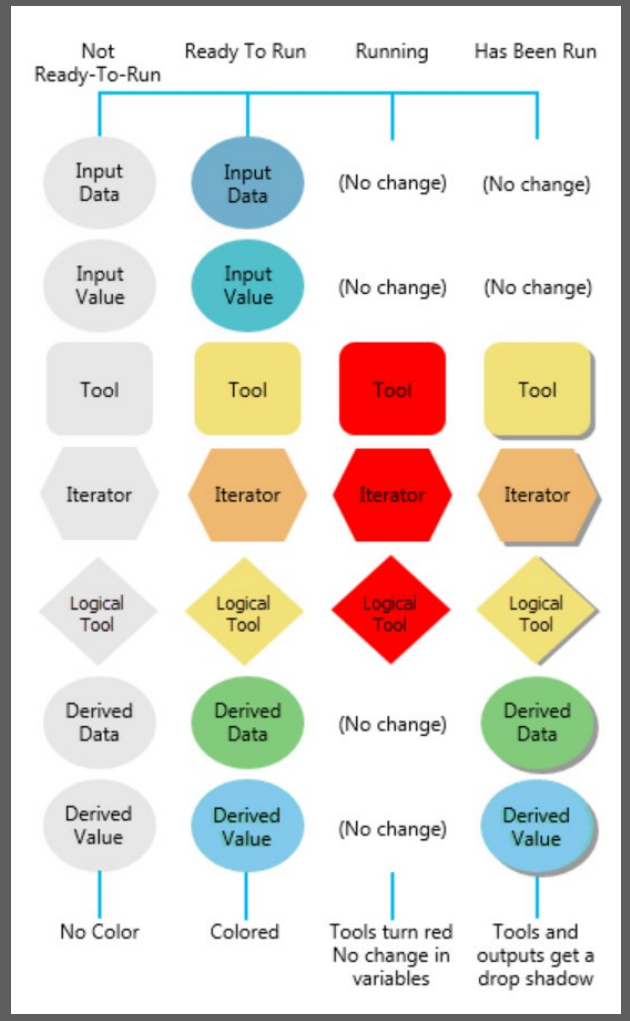
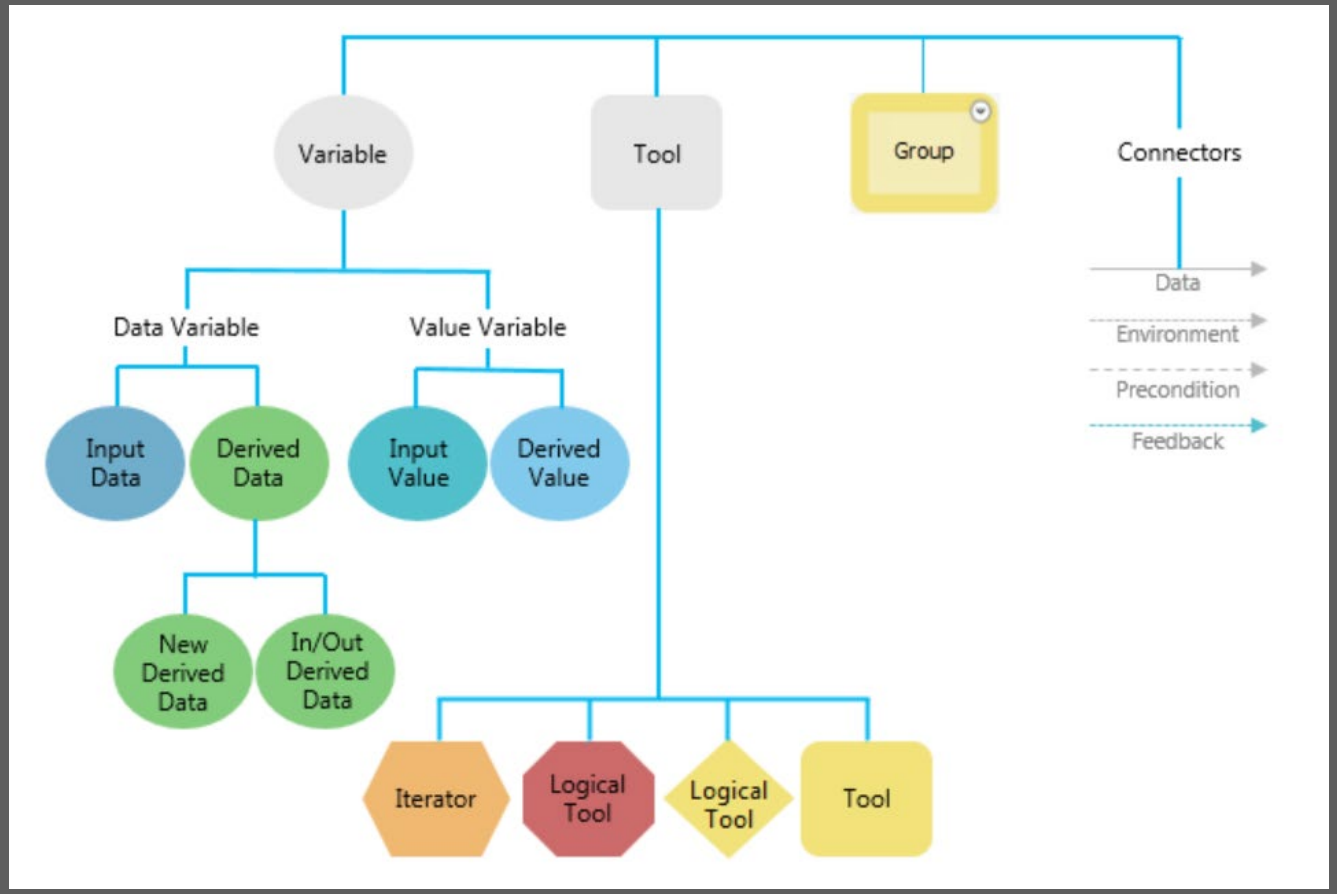


MODEL ELEMENTS

- Tools – Geoprocessing tools are the basic building blocks of workflows in a model.
- Variables – Elements in a model that hold a value or a reference to data stored on disk.
  - Types of variables: Data and Values
- Groups – Visual categories that include other elements in the model.
- Connectors – Connect data and values to tools. The connector arrows show the direction of processing.
  - Types of connectors: Data, Environment, Precondition, Feedback

MODEL ELEMENTS



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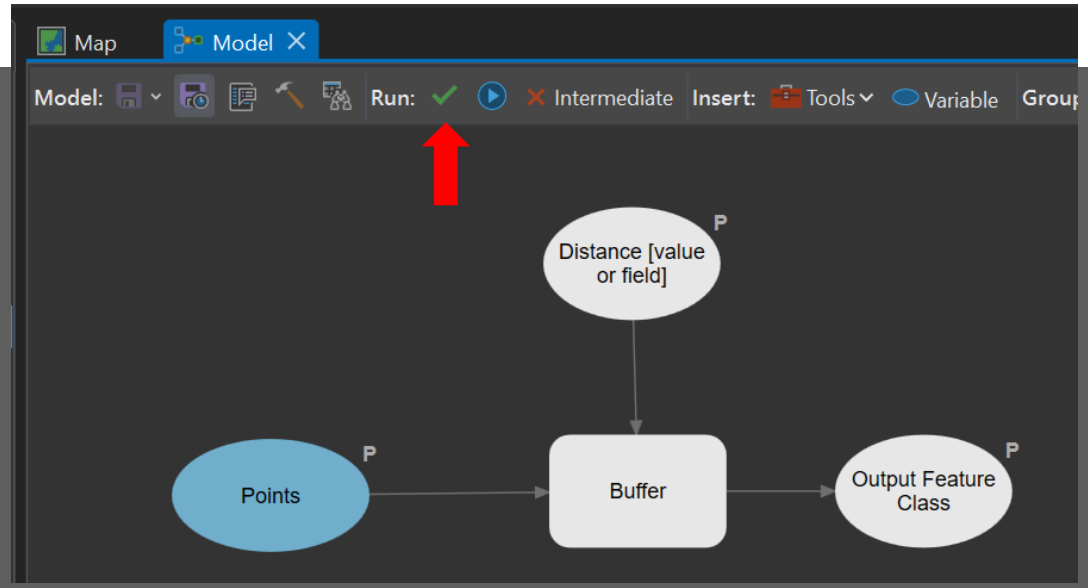
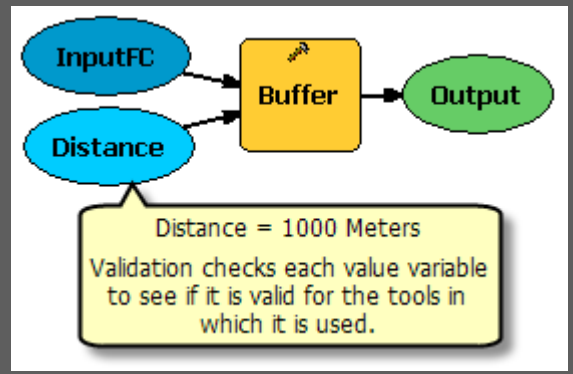
MODEL VALIDATION

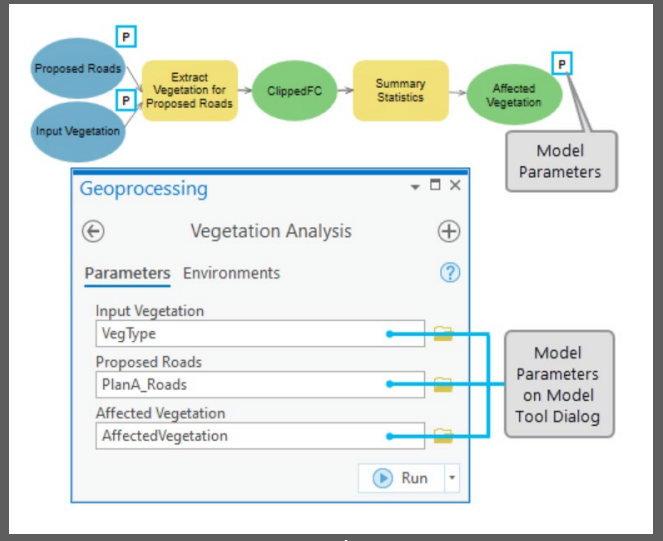
- Model validation refers to the process of making sure all model variables (data or values) are valid.
- Data variables reference data on disk and the descriptive information, not the actual data.
- Value variables contain actual data.
- No color = Not Ready-to-Run





MODEL PARAMETERS

- Model parameters are the parameters that appear on the model tool dialog box.
- Any variable in the model can be made a model parameter.
- Parameters can be set to Required, Optional and Derived types



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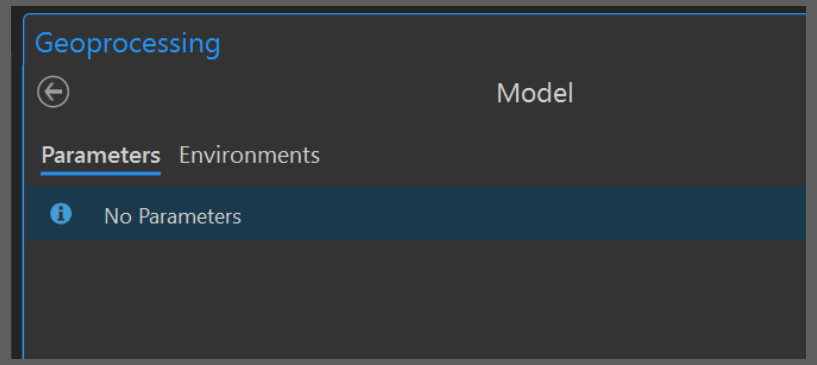


WORKSPACE ENVIRONMENTS

- Current Workspace – Default location for geoprocessing tool inputs and outputs
- Package Workspace – Location of a folder with contents of the geoprocessing package or service.
- Scratch Folder – Location of a folder to write file-based data, such as shapefiles, text files, and layer files
- Scratch GDB – Location of a file geodatabase to write temporary data
- Scratch Workspace – default workspace for the output datasets. This workspace is intended for output data you do not want to maintain.
- In addition to above workspaces, model output can be written to memory. These data are temporary and will be automatically cleared when the application closes.

ENVIRONMENT SETTINGS

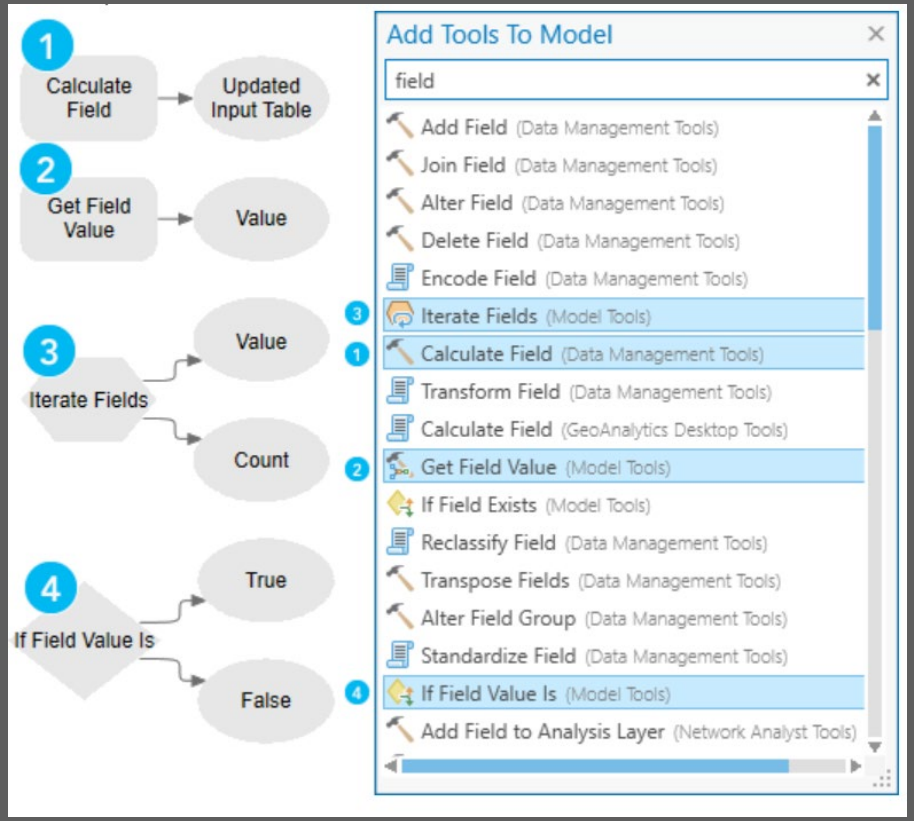
- Project level – applied to any tool when it is executed in the current project.
- Model level – settings are specified and saved with a model and override project level settings.
- Model process level – settings are applied to a single run of a tool, saved with the model, and override project-level and model-level settings.

INTERMEDIATE DATA

- Temporary output data that is created as a middle step to connect to other processes that will create the final output.
- These data are often (but not always) of no use once the model has finished running.
- Intermediate data will not be automatically deleted when the model is executed from the ModelBuilder window in order to maintain a model's has-been-run process state. Intermediate data can be manually deleted by clicking **Intermediate** button within ModelBuilder to prevent the cluttering of the workspace with data that is not needed.
- These data are written to memory, but can be saved to a specific location if needed.
- * Writing data to memory is often significantly faster than writing to an output format. However, data written to the imemory workspace is temporary and will be deleted when the application is closed.

HOW TO…?

- Add Data to a Model
  - Drag datasets (feature classes, tables, rasters) into ModelBuilder from the Catalog pane
  - Drag map layer from Contents pane to ModelBuilder
- Add Tools to a Model
  - Drag a tool from Geoprocessing or History pane. Or right click a tool and click Add to Model
  - Add model-specific tools by clicking Iterators, Utilities, or Logical buttons
- Connect Data and Tools
  - By specifying input parameters in model
  - Interactive connector



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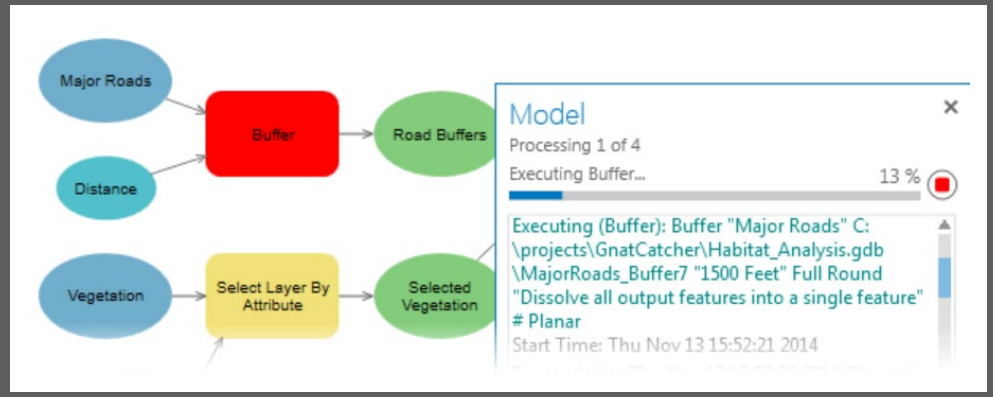
HOW TO…?

- Validate Model
- Run Models
  - Run single tool
  - Run a sequence of tools
  - Run Entire model
- Save a Model
- Document a Model
  - Tool and variable description can be edited from Item Description window



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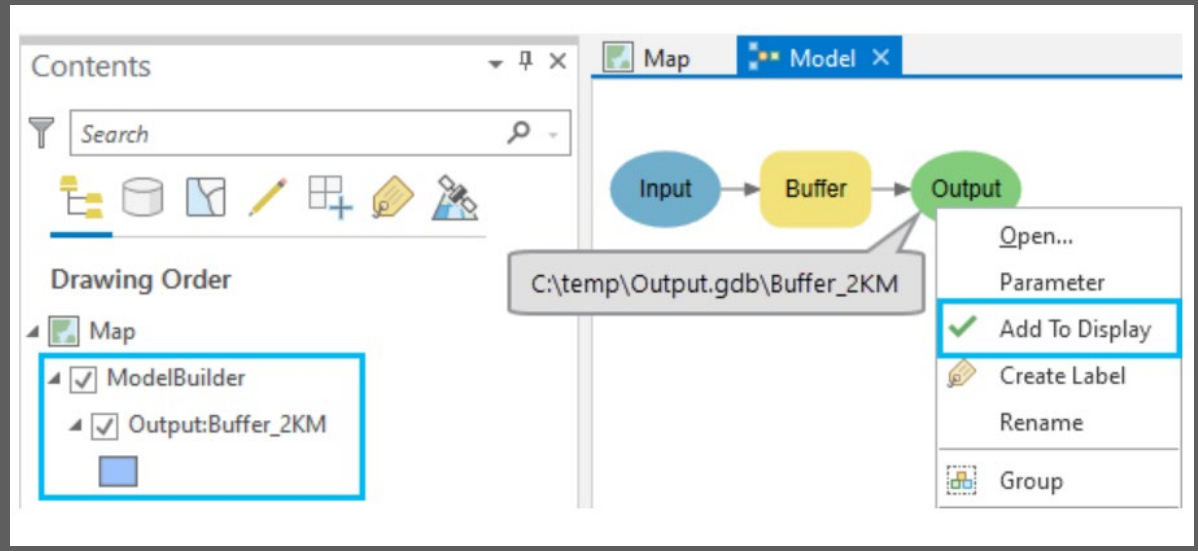
DISPLAYING MODEL DATA

- Model inputs and outputs can be automatically added to Contents pane after model execution using 'Add To Display' option.
- Data symbology can be predefined using a layer file
  - Using a layer symbology file
  - Using the Apply Symbology From Layer tool



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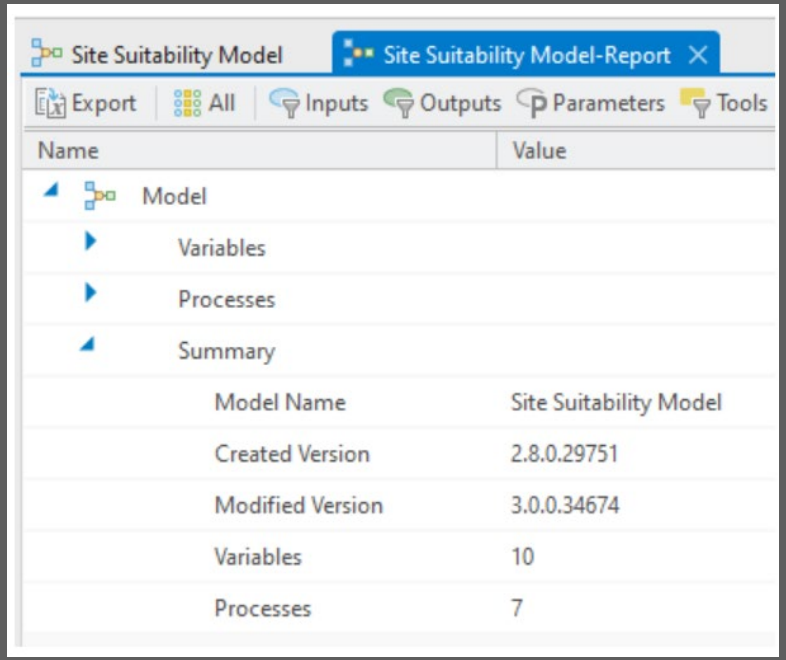
MODELBUILDER REPORT

- Shows all the variables and tools in a model along with each element's value and other properties
- Filter the report to show a subset of variables and processes
- Models and model reports can be edited and updated at the same time using the Auto Sync option



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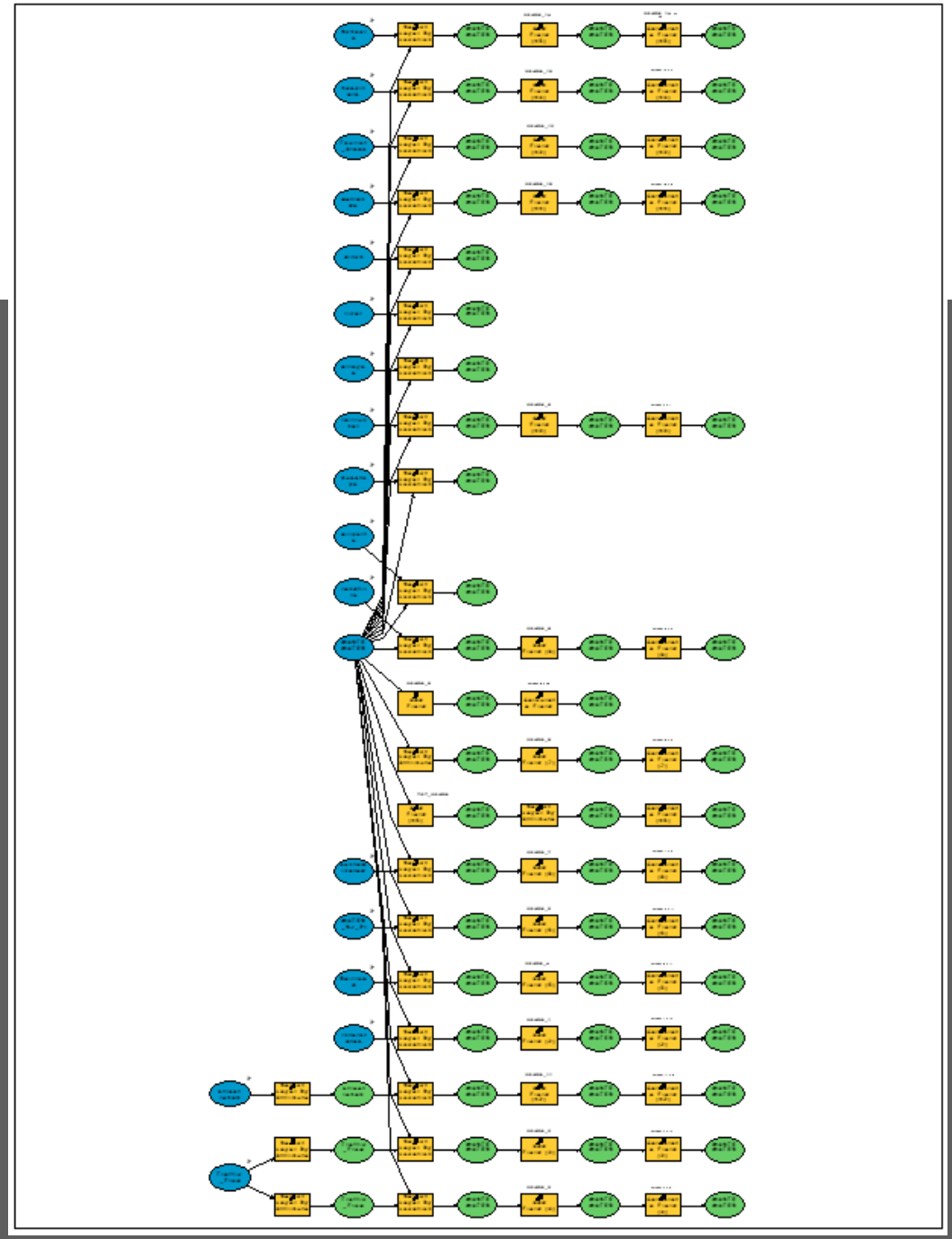
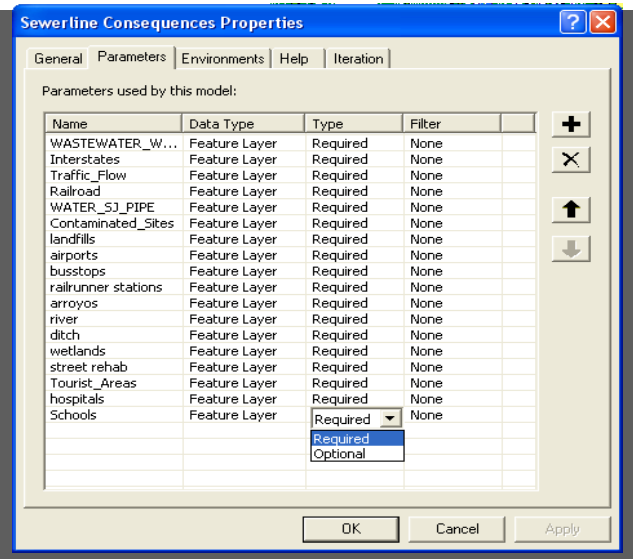
MODEL EXAMPLE

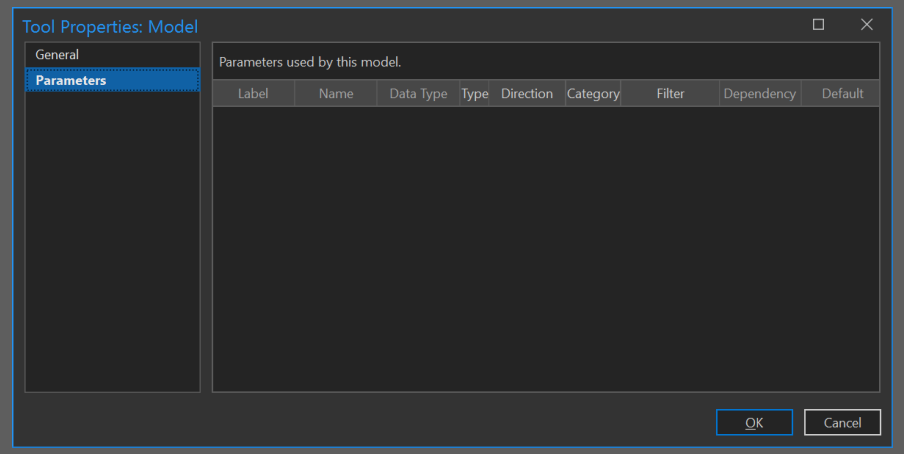
Failure Assessment Modeling to Prioritize Small Diameter Sewer Pipe Renewal



MODEL EXAMPLE

1. Calculating the Consequences of Small Diameter Sewer Failure based on the geographic location;
2. Calculating the Probability of Small Diameter Sewer Failure based on the year installed and material used;
3. Calculating the Sewer Line Failure Risk based on the Consequences and Probability.



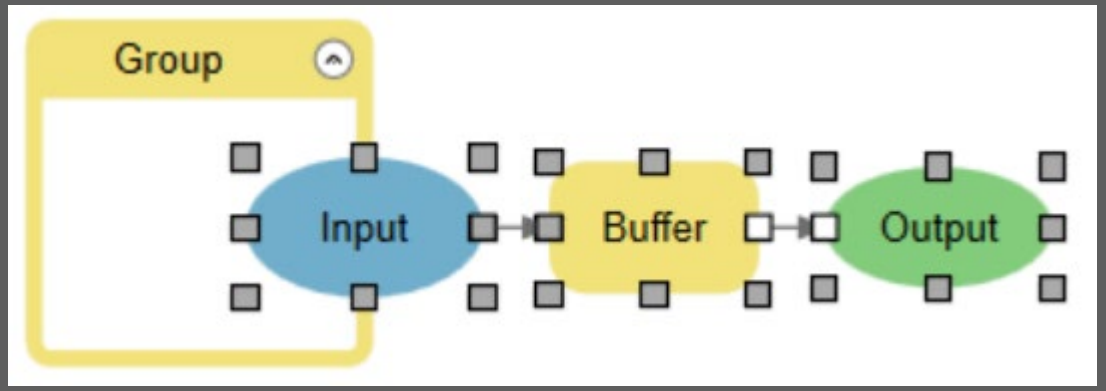


ADVANCED TECHNIQUES

Want to create complex models?

GROUPING

- Allows to assemble processes into logical units
- Groups can be collapsed to represent several processes as a single process, or expanded to edit the processes within the group



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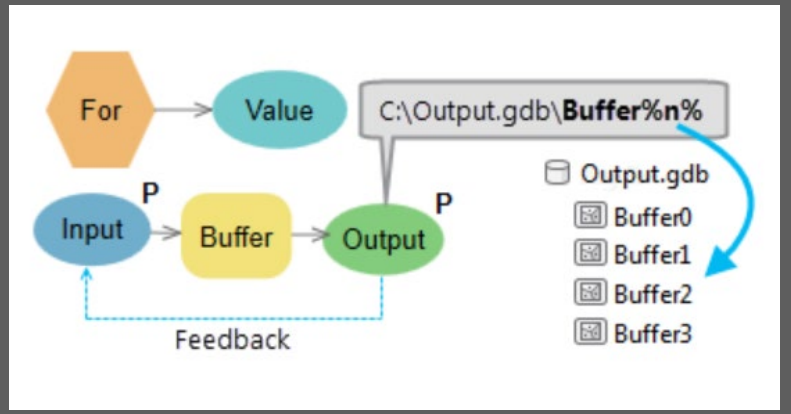
INLINE VARIABLE SUBSTITUTION

- Contents of a variable can be used as a substitute for another variable by enclosing the substituting variable in percent signs (%).
- Types
  - Model Variables
    - Example: %variable_name%
  - System Variables
    - Example: %n% - iteration counter, %t% - time,…
  - Workspace environments
    - Example: %scratchGDB%, %scratchFolder%,…



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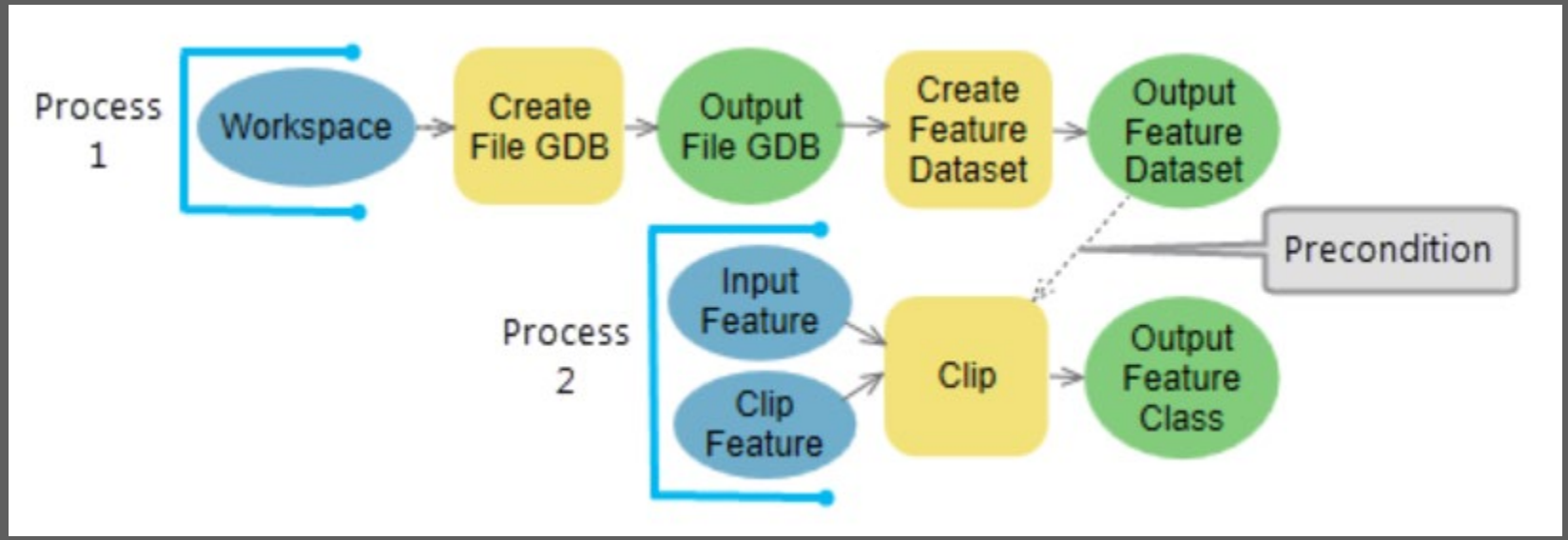
PRECONDITIONS

- Preconditions can be used to explicitly control the order of operations in a model.
- For example, a process can be made to run after another process by making the output of the first process a precondition to the second process.
- Any variable can be made a precondition to tool execution, and any tool can have more than one precondition.



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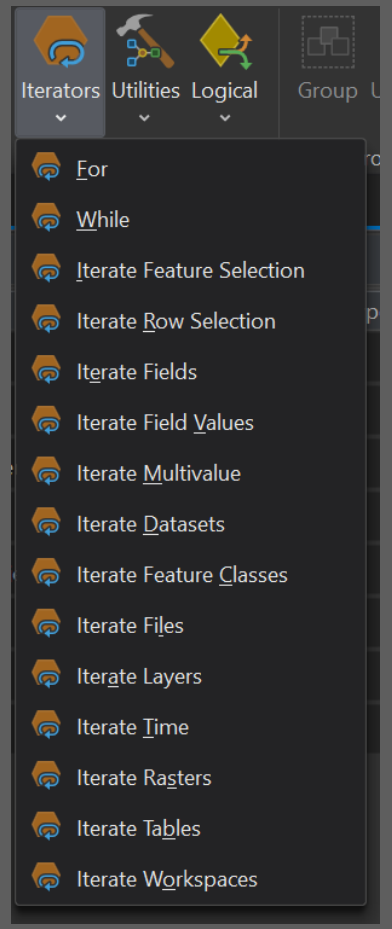
ITERATION

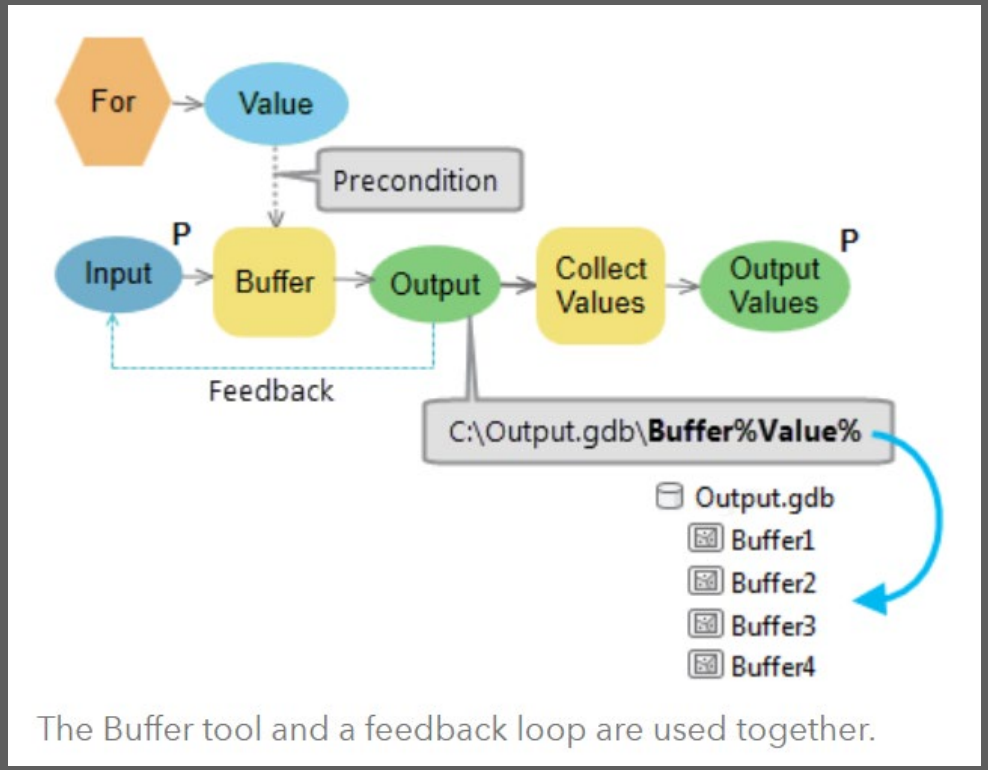
- Repeat a process with some degree of automation.
- Iteration can be applied for entire model or a single tool/process
- Only one iterator can be used per model



https://pro.arcgis.com/en/pro-app/latest/help/analysis/geoprocessing/modelbuilder/iterators-for-looping.htm

FEEDBACK IN ITERATION

- The output of a process can be used as an input to a previous process.
- Feedback loop can be set using:
  - Variable properties
  - Connect tool



The Buffer tool and a feedback loop are used together.

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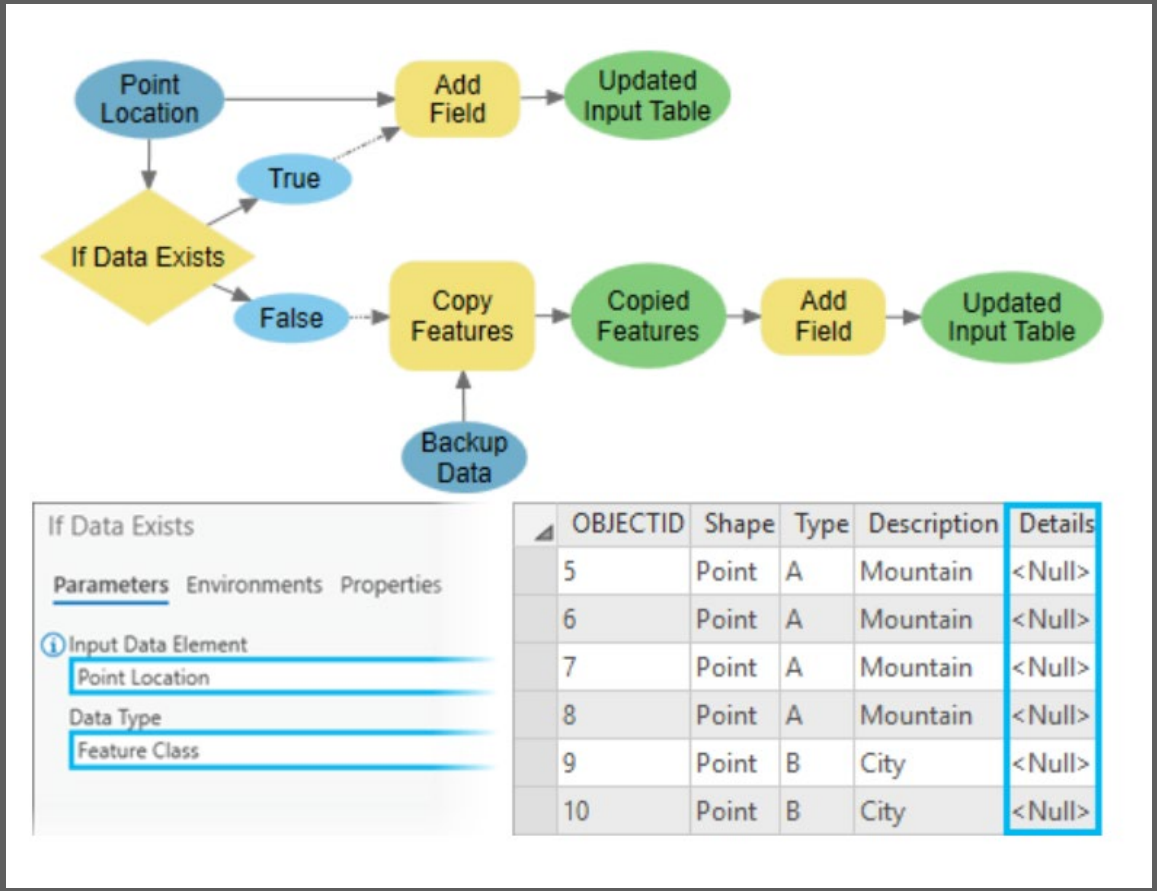
UTILITIES

- Calculate Value
- Collect Values
- Get Field Value
- Parse Path
- Select Data

https://pro.arcgis.com/en/pro-app/latest/help/analysis/geoprocessing/modelbuilder/utility-tools.htm

IF-THEN-ELSE



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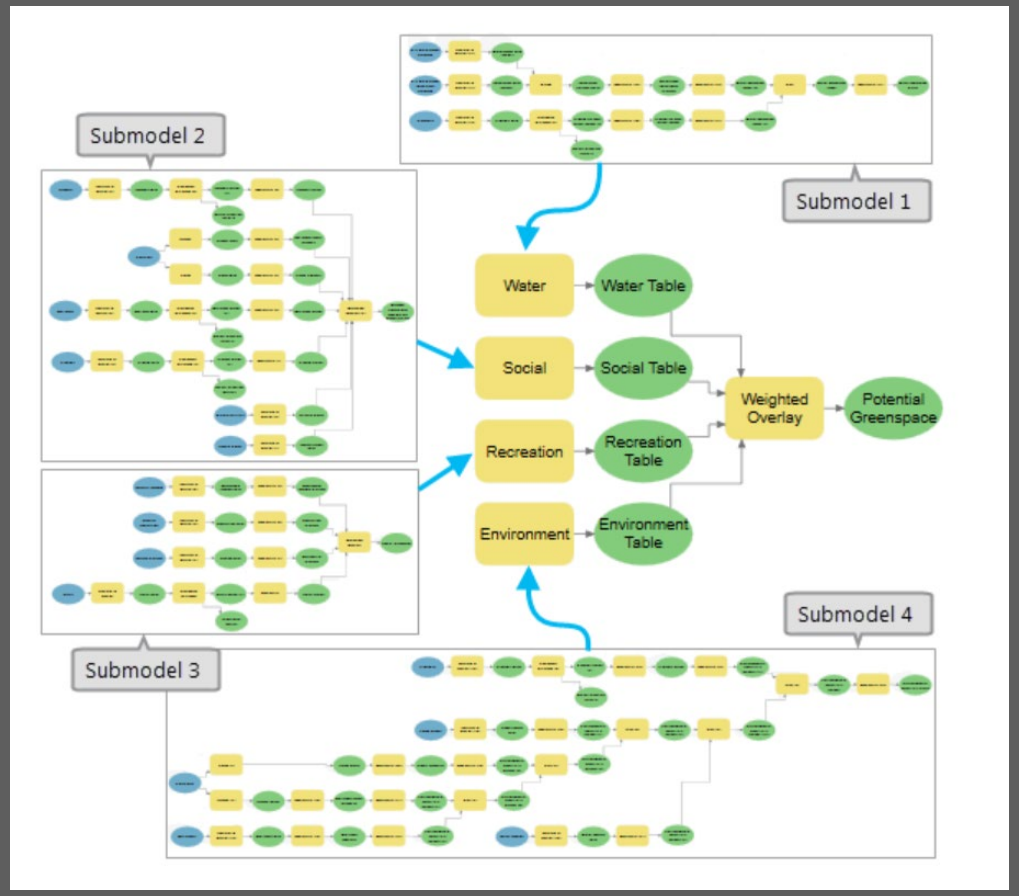
MODEL WITHIN A MODEL



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