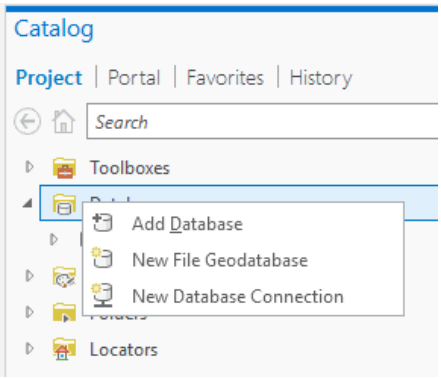
Lab 6: Advanced Editing and Topology

What You'll Learn: Creating, validating, and editing topology.

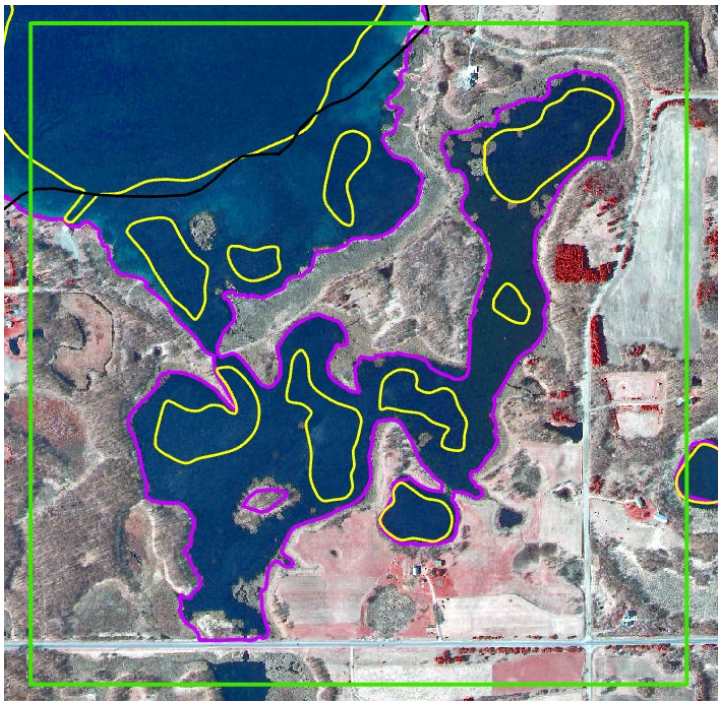
Data: The several data layers are in the Lab4 subdirectory, all in the UTM, NAD83(2011) zone 15 coordinate system, for a portion of Big Marine Lake, in Washington County, Minnesota:
BigMarSum.img, a summer infrared image, with a 1-meter cell size,
RectSpring.img, a spring infrared image with 1 meter cell size,
The following in the geodatabase Lab6AP.gdb in the Lab4 directory:
NWILakes, MNDOTLakes, different renditions of lake boundaries, and
SouthBayArea, a polyline feature class, in the SB Feature Data Set, and
ExamShore, a polyline layer showing examples of the upland/lake boundary.

Background: Multi-temporal images are commonly used for updating information.



Start ArcGIS Pro, add a Map, load the RectSpring image from Lab6, add the Lab6/Lab6AP.gdb to your databases via the Catalog Panel (right click on Databases, then Add Database; see figure at right).

Also add the NWI, MNDOT, DNR lakes, and SouthBayArea feature classes from the Lab6AP.gdb, and zoom to the SouthBayArea extent.



Symbolize each layer similar to that in the figure on the left.
Note how the various lakes boundaries are different. While the DNR data (purple) comes closest, it still includes the emergent lake plants in upland, but we want them included with the lake for our intended use. We need to digitize a new lake boundary layer.

We will digitize the upland and lake boundaries for the SouthBayArea portion of Big Marine Lake, based primarily on the RectSpring image.

We will digitize the emergent wetland vegetation and the floating wetland vegetation from the lake area using both the RectSpring image and the BigMarSum image.

We will create topology, including rules about inclusion and overlap, and validate this topology.

There are examples and maps lower down for guidance on distinguishing vegetation types. First you need to create topology.

Understanding and Defining Topology
As noted in the readings, topology specifies the spatial relationships, or constraints, within features in a layer and between features in different layers.

You enforce topological relationships by first creating a list of topology rules, validating them against data, and editing the topological errors found by the validation.

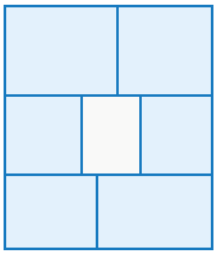
There are many possible rules for polygon topology, described at the ArcGIS Pro webpage
http://pro.arcgis.com/en/pro-app/help/editing/geodatabase-topology-rules-for-polygon-features.htm

You set up a topology by specifying rules, and then specifying the layers that participate in that rule. Some rules require only one layer, some have two participants, and some more than two.

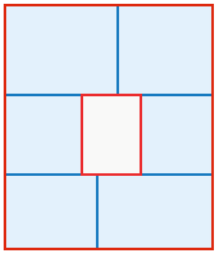
One commonly applied rule is a layer "Must not have gaps." This applies to only the single participating layer and implies that there can be no slivers or uncovered pieces.

Here is an example of a layer with an error in the "Must not have gaps" rule:

Layer:



Error, after validation.

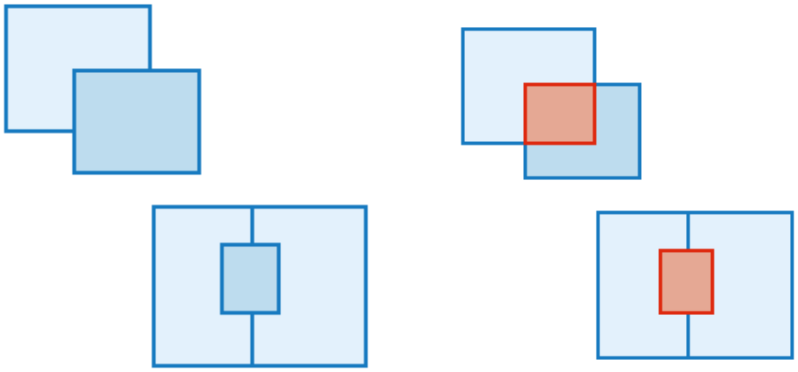


ArcGIS shows the red line around the interior gap.
It also shows a red line around the outside of the layer for this rule, which technically is a gap (to the outside world), but isn't what we interpret as a real error, so we call it a faux error.

Another common topological rule in ArcGIS Pro specifies that features in one layer cannot overlap with features in another layer. You would use this "Cannot

overlap" rule to prevent features in a 'buildings' layer from overlapping with features in a 'lakes' layer. There are a few buildings built in lakes, but very few, so almost all data sets would be the result of errors.

The figure below shows "Cannot overlap" errors where the dark blue features, in one layer, partially cover light blue features in another layer. The errors are flagged after validating the topology, as shown below, lower right.



There are subtle differences in some of the names and actions of the rules, for example between a rule named:

Must be covered by

and one named

Must be covered by Feature Class of

You should read the documentation carefully for each topological rule and make sure you are using them correctly.

There are similar, but fewer and simpler, rules for point and line topology which we won't discuss here. If you understand and master the polygon tools you shouldn't have trouble with point and line topologies.

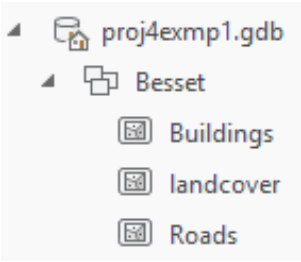
An Example Topology

We'll show an example of topology creation for a set of layers. You're not required to do these steps as you will not be turning in any maps or data from this example.
However, you may want to execute the commands as the instructions for your work later will refer to the information covered in this example.

We've included a geodatabase named Besset.gdb for an area in southern France (gdb is in the Lab 4 directory)

Besset:

As shown in previous labs, I first created a geodatabase, then a feature dataset with the geodatabase named Besset, then added three polygon feature classes; Buildings, Roads, and Landcover.



I assigned the most accurate local coordinate system, selecting Projected - National Grids – France – RGF 1993 CC43 when specifying the coordinate system for the feature data set.

I want to create a data layer that shows the urban area and the surrounding rural land. I want to digitize the building footprints into the buildings layer, the urban boundary and surrounding rural area into the landcover layer, and the main roads into the roads layer.

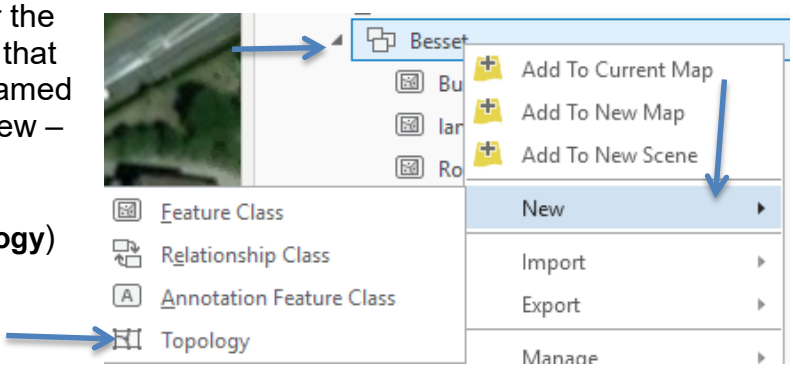
I want to restrict the buildings to be contained within the landcover layer polygons – that is, the buildings cannot straddle the urban to rural polygons, nor extend outside the landcover layer.

I want there to be no slivers or gaps between the landcover polygons.

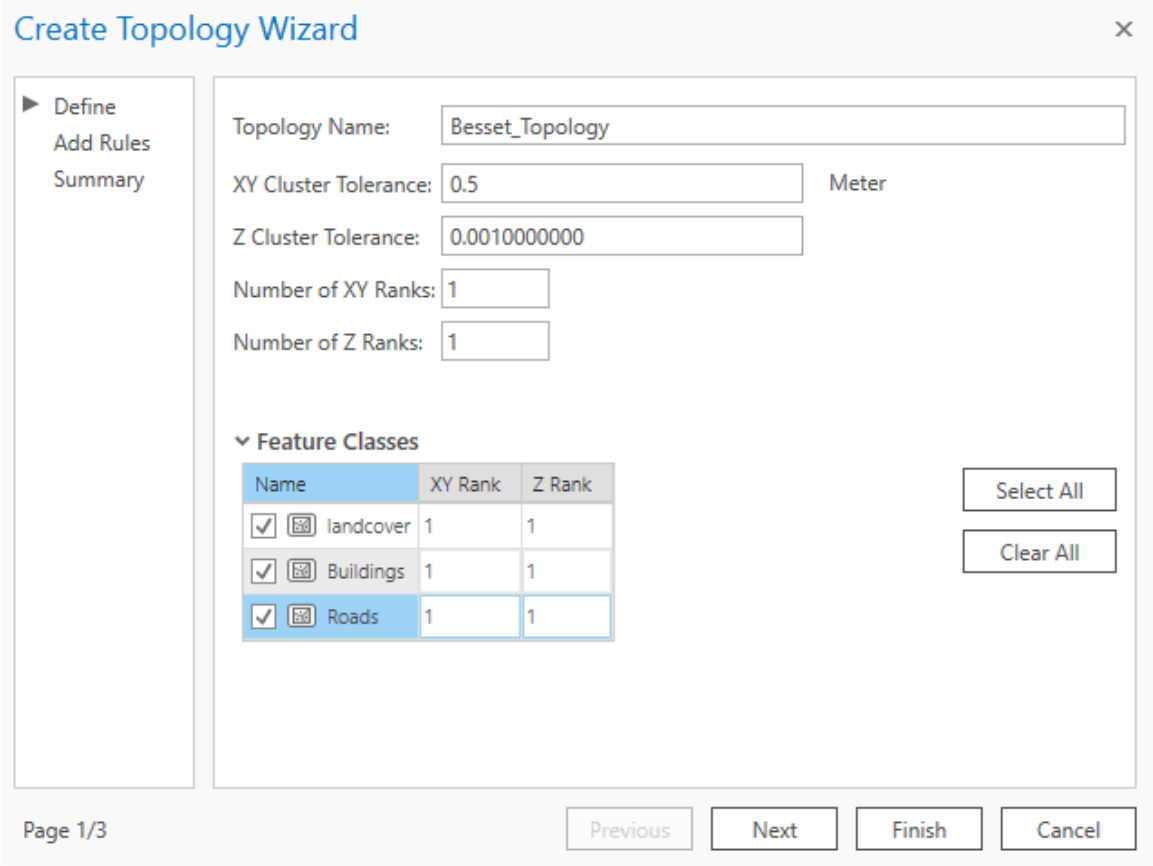
I want there to be no slivers or gaps between the landcover polygons and road polygons where they meet, and roads and landcover must not overlap.

I need to create a topology for the Feature Data Set (FDS). I do that by right clicking on the FDS named Besset, then left clicking on New – Topology:

(**Video: Create Example Topology**)



This opens the Topology Wizard, by which you define a new topology:

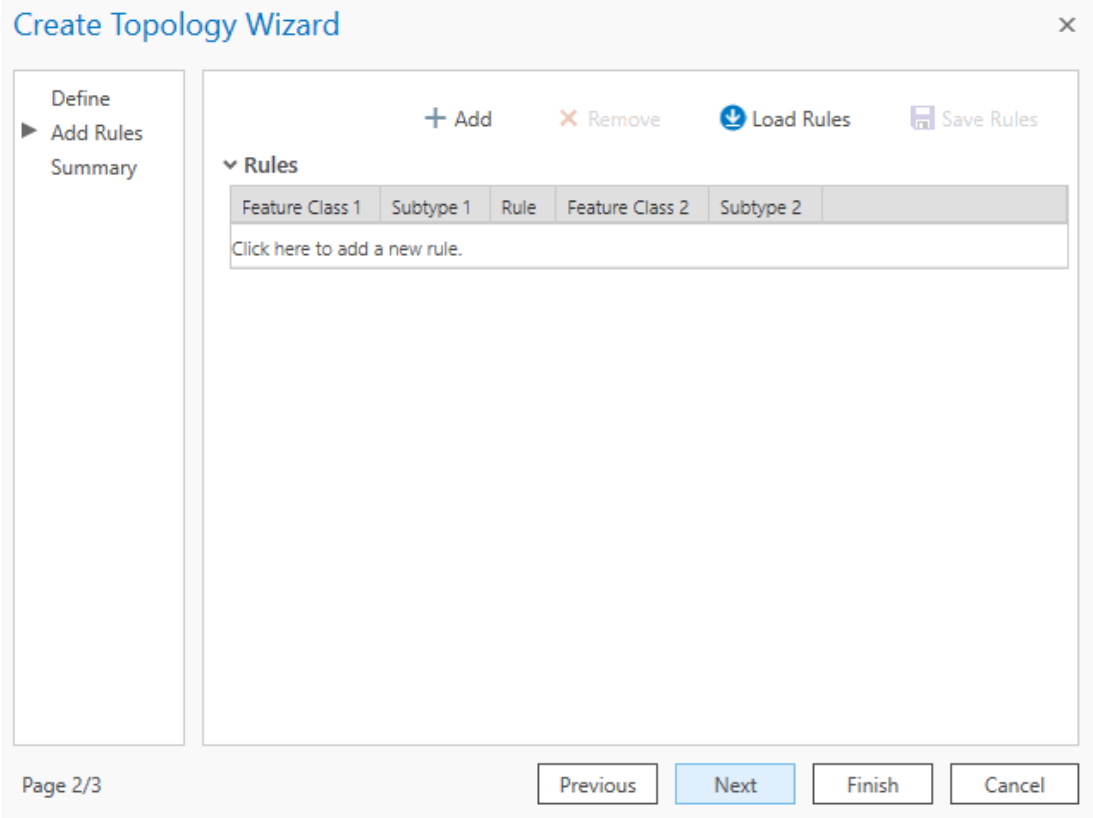


You set cluster tolerances (also called fuzzy tolerances in the textbook), the number of Ranks, and the participating feature classes.

Ranks indicate which layer features should remain stationary, and which should be moved in the event an error less than the cluster tolerance is discovered; features of lower rank will be moved to features of higher rank (e.g., 3 will move to 1).

In my case, I modified the XY cluster tolerance to 0.25 meters, kept all ranks equal, and clicked on all three feature classes to participate in the topology, then clicked on the Next button.

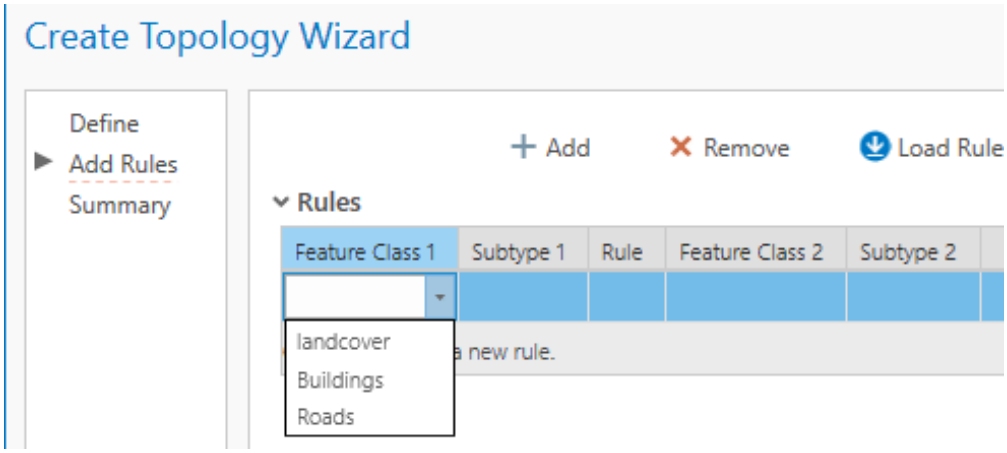
This displays a rules panel (see figure below).



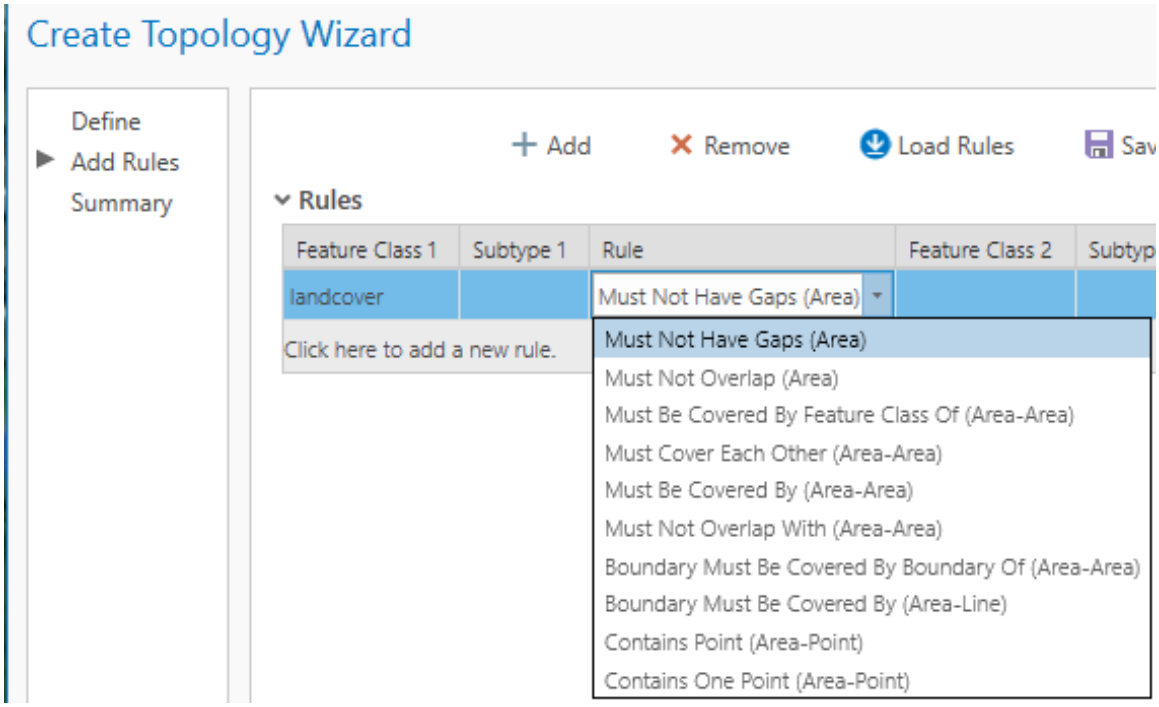
First you click on the +Add button near the top-left of the entry panel, this will add a row for the rule. Then you can click in a row box to display a drop down of choices.

Starting with Feature class 1, the dropdown lets me specify the feature class.

I'll choose landcover here to enter the rule that prohibits gaps.



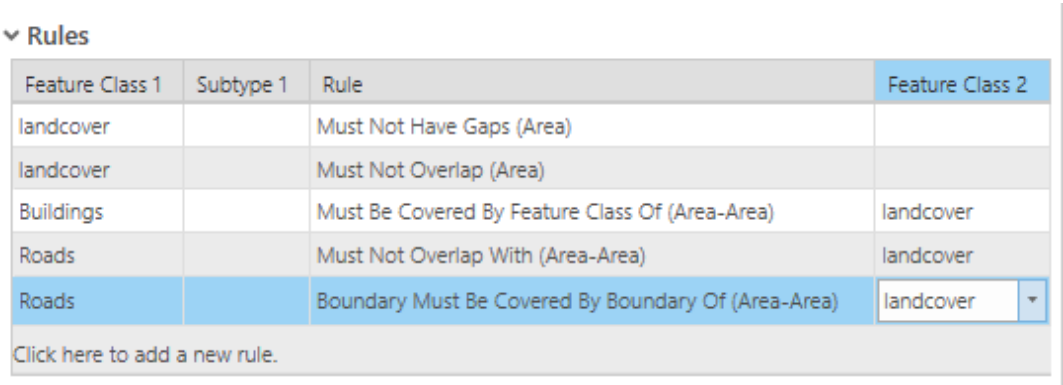
Next, I click on the Rule box to reveal a dropdown containing selectable rules:



Here, I'll select the 'Must Not Have Gaps' rule.

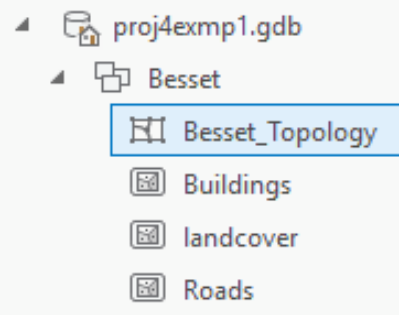
I ignore the Subtype 1 column, it doesn't apply here.

I add rules for each of my conditions:



- Landcover polygons must not overlap each other
- Buildings must be contained within landcover polygons (not extending across urban boundary)
- Roads must not overlap with landcover, they must meet at the bounding edge.

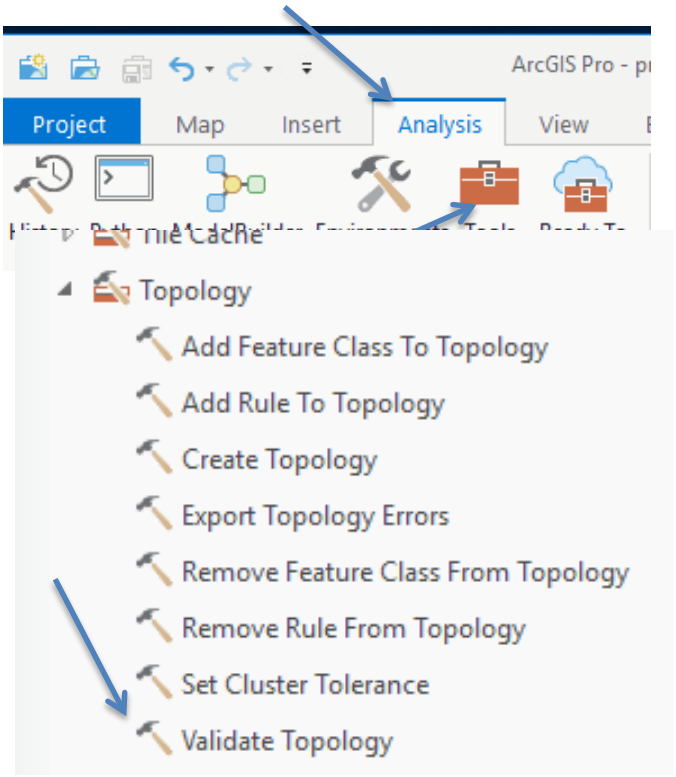
When I click on finish it adds the rules and then adds the new topology to my Feature Data Set:



I then digitized a set of features for each of the 'Buildings', 'Landcover', and 'Roads' layers. I set the snapping as shown in previous labs, but added a few errors on purpose to show how to validate topology.

A building overlaps a road and I've inserted gaps and overlaps in the roads and landcover layers. At first these errors aren't visible, as they are small.

We need to validate the topology, which finds and highlights errors. We do this through the Analysis tab, then clicking on the Tools icon (toolbox, see right).



This should open the geoprocessing panel on the far right of the main window. Select Toolboxes, then open the Data Management toolbox, and then the Topology toolbox, and you'll find the ***Validate Topology*** tool near the bottom of the list:

Double clicking on the tool opens a simple window with one entry - the input topology.

I specify the Besset topology, contained in the Feature Data Set I created.

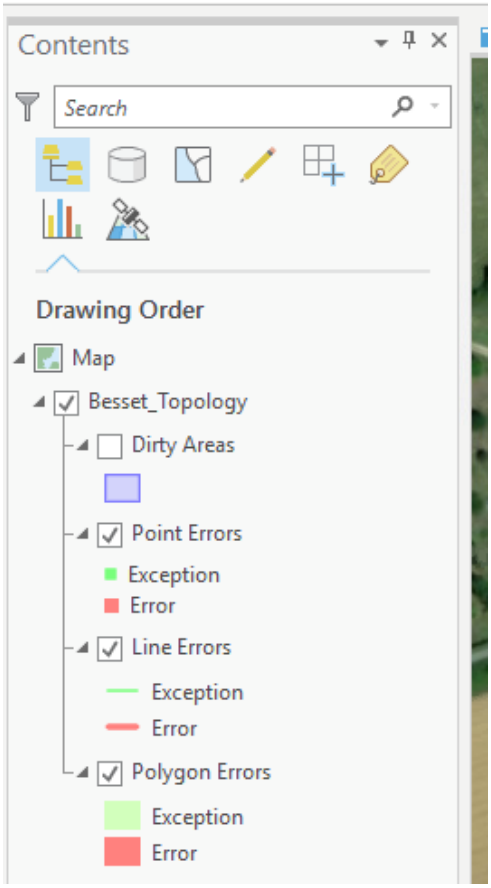
On clicking Run at the bottom right this should validate the topology, creating an error table and highlighting errors in red (see the figure below).

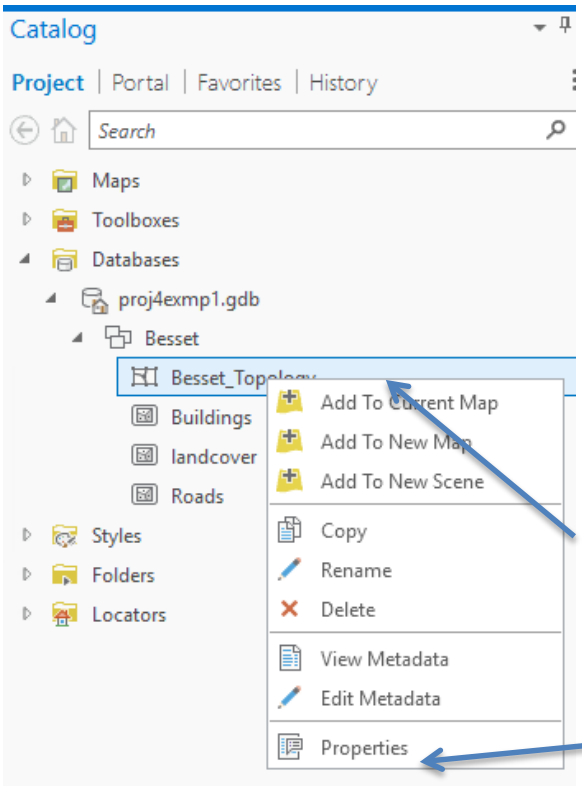
(**Video Validate Topology**)

This also shows the errors in the topology entry for the Table of Contents, displayed on the left side of the main ArcGIS Pro window:

“Dirty Areas” are areas that have been edited since the last validation; they are not clicked for display here.

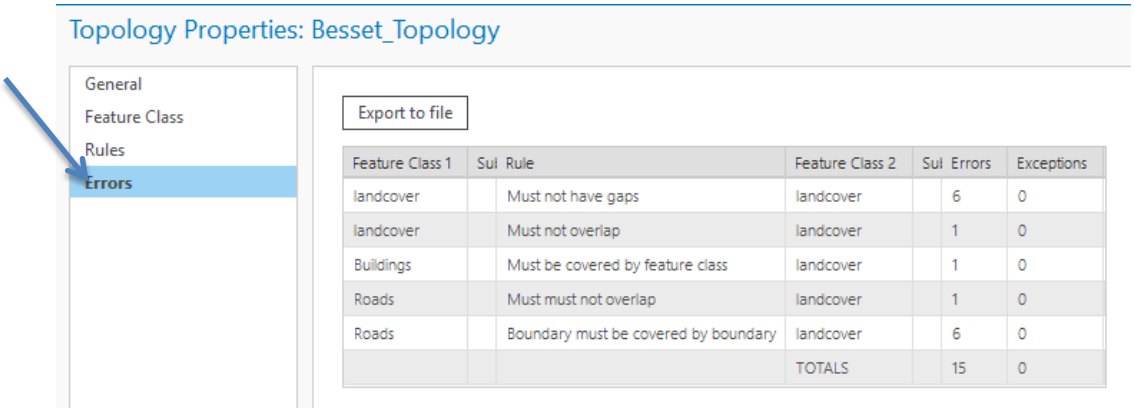
Pinks indicate errors. Green indicate exceptions; features specified as allowed to violate given topology rules.





I can view an error summary by right clicking on the topology entry in the Catalog pane at the right side of the main ArcGIS Pro window (may have to activate the Catalog pane first by clicking on its tab at the lower right to bring it to the front).

Then click on ‘Properties’, then ‘Errors’.

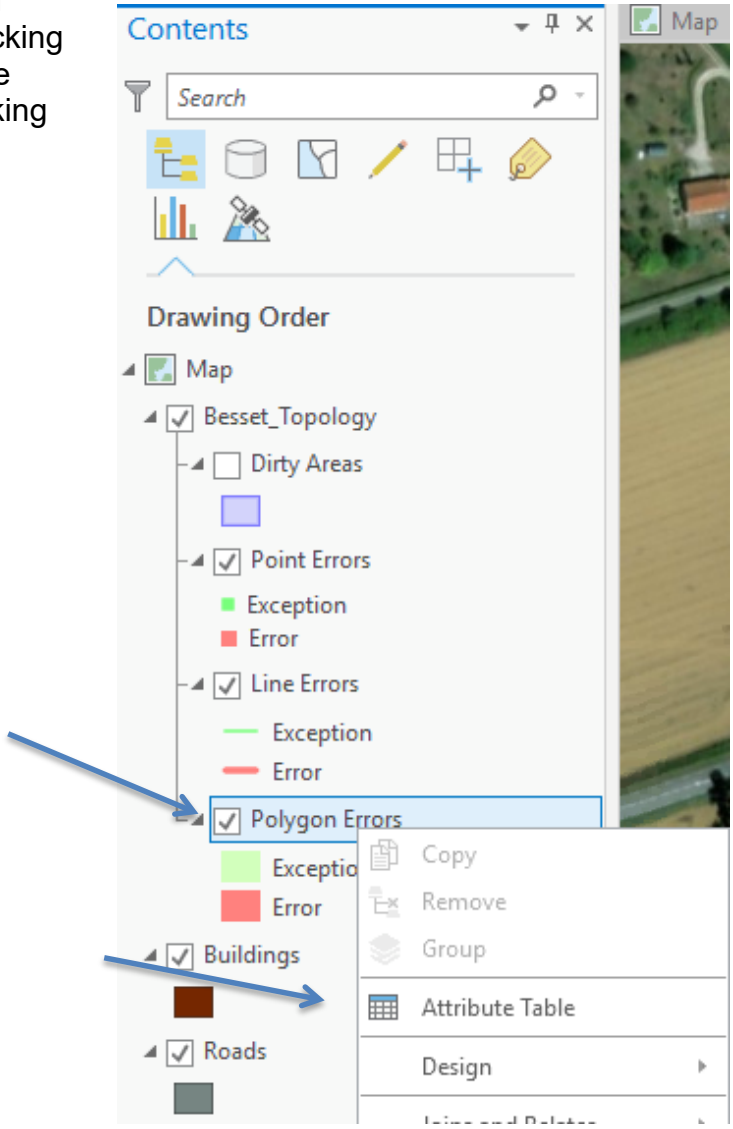


Feature Class 1	Sul	Rule	Feature Class 2	Sul	Errors	Exceptions
landcover		Must not have gaps	landcover		6	0
landcover		Must not overlap	landcover		1	0
Buildings		Must be covered by feature class	landcover		1	0
Roads		Must must not overlap	landcover		1	0
Roads		Boundary must be covered by boundary	landcover		6	0
			TOTALS		15	0

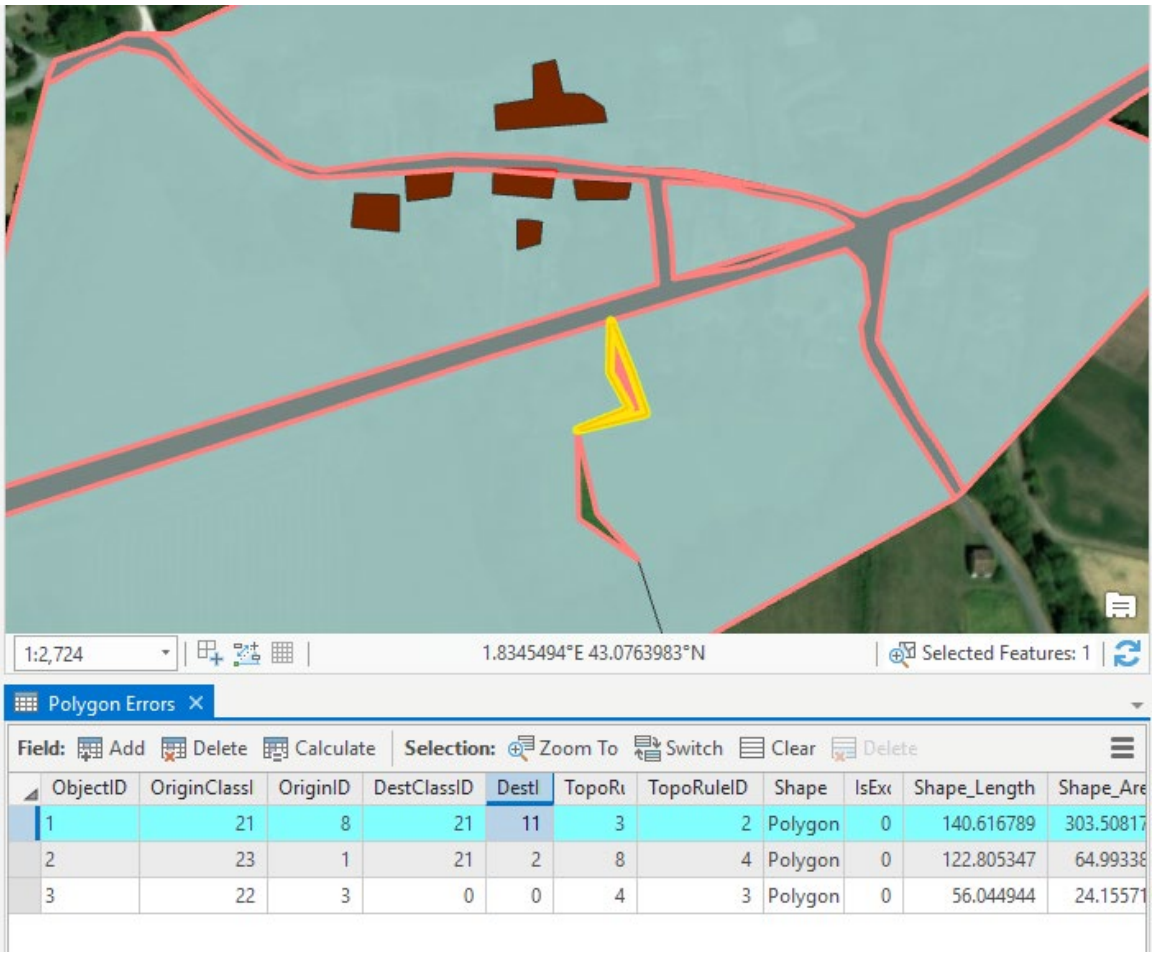
Inspect the displayed table above. It shows 6 errors in landcover for the rule “Must not have gaps,” 1 error for landcover “Must not overlap,” and various other errors.

Each time you validate a topology it creates a table with entries for each layer that is participating in the topology.

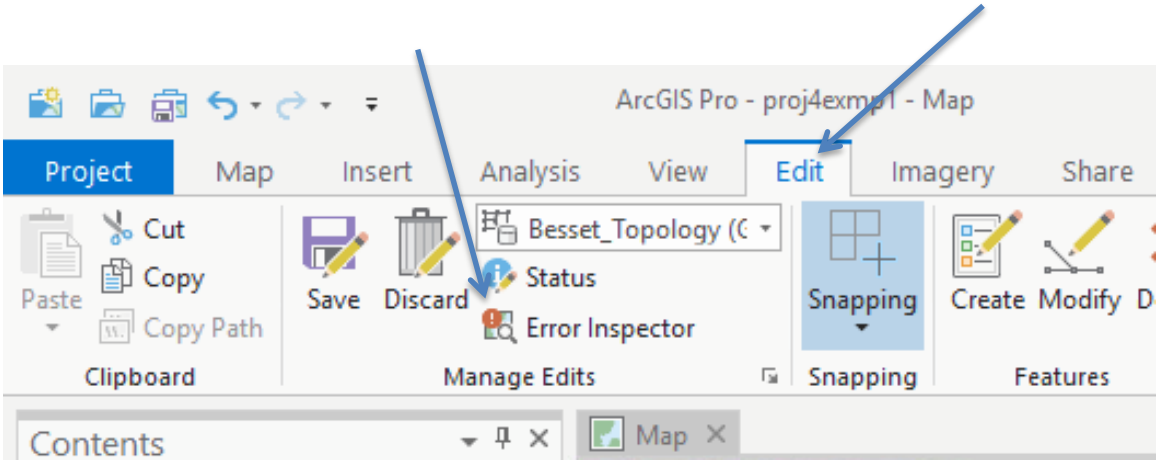
You can display the table of individual errors by right clicking in the ‘Topology’ entry in the Table of Contents, and clicking on ‘Attribute Table’:



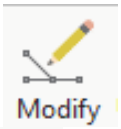
This should display the error table in a panel below the map. You can highlight an individual error in the selection color on the map by clicking on a row in the table:



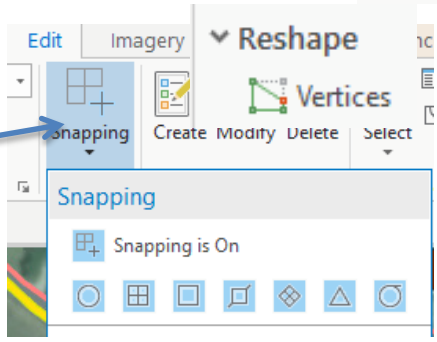
You can also display the error table by activating the Edit tab along the top of the main window, then clicking on the Error Inspector icon:



Once you've identified an error, you proceed to fix it.



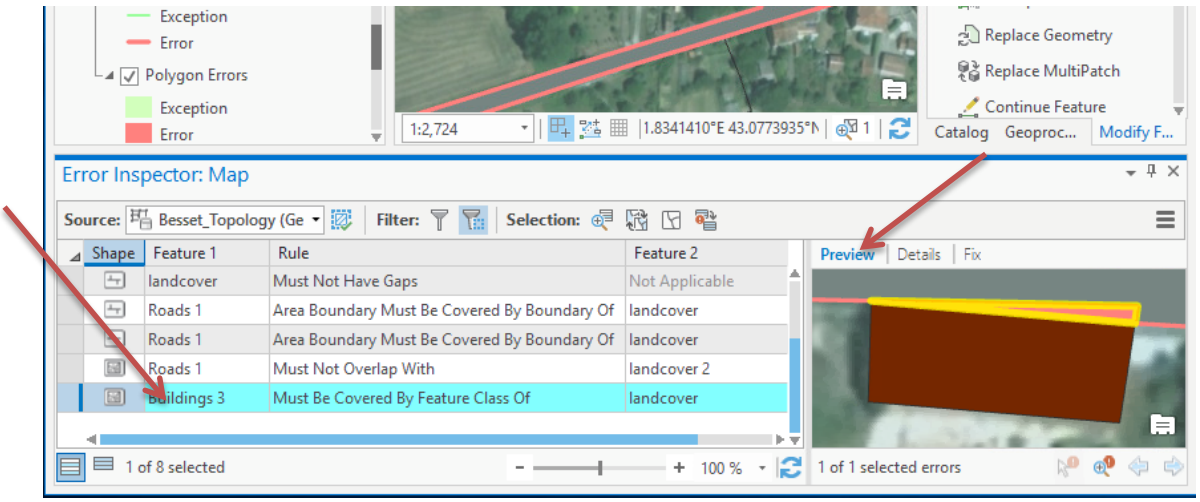
For some errors, such as the one highlighted in the figures above, I need to move the edges to fix the overlap. I simply activate the Modify features edit tool, activate snapping, choose the Reshape – vertices tool from the list of tools in the edit panel on the right-hand side of the main window – and manually edit the offending edges that overlap, bringing the edges into alignment. I may have to adjust the transparency on the layer if some interpretation from the image is required.



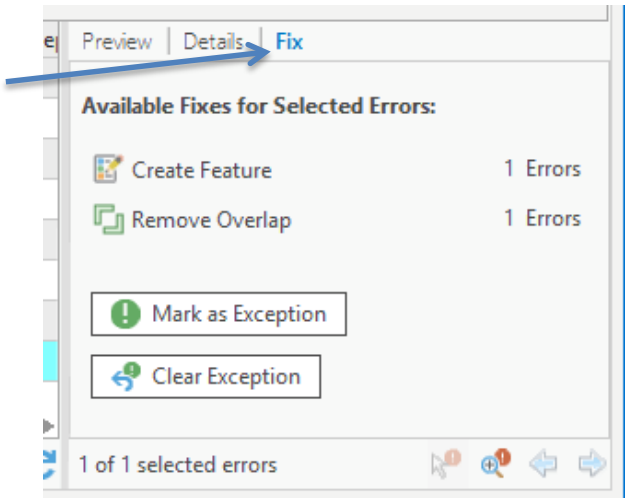
I can then validate the topology again via the Toolbox tool. I confirm that I've fixed the error by noting that it doesn't show up on the map of topological errors.

It's sometimes quicker to use suggested "Fixes" shown with the Error Inspector tool.

You might have noticed that when you activated the Error Inspector it showed a small submap window to the lower right of the main window. Click on an error and then 'Preview' in the submap, this submap window will zoom to an error:



You can then click on Fix in the submap window and it will display a set of actions, including suggested fixes, if any.



Here, a house extends outside the landcover area which violates the rules.

An appropriate fix in this case might be to remove the overlap; the second suggested fix, shown ->:

Clicking on this fix removes the error.

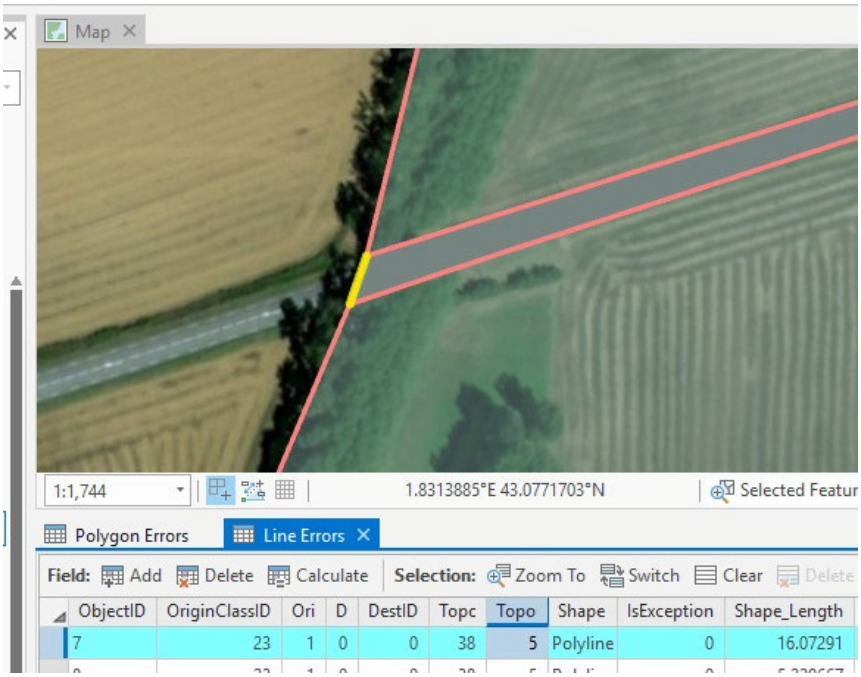
Alternatively, I could Mark this as an 'Exception' (an allowable violation of the rules) or select the Modify Features tool in the main editing window and edit it manually.

Note that all the errors listed in the table aren't "real" errors. For example, I have a rule that says the roads boundary must be covered by the landcover boundary. This rule is to prevent gaps at the edges of the roads.

However, at the edge of my study area the Roads and Landcover polygons end, so there the Road boundaries are not covered by Landcover polygons. It shows as an error when it is just an edge effect:

I could fix this several ways, either by marking it as an exception (preferred), or extending the landcover around the edge (although this wouldn't be exactly accurate). Often these faux errors are just noted and ignored.

After editing, I make sure to save my edits.



Map you will hand in:

Digitizing Lake, vegetation, and upland features

Your task is to create three (or 4) layers for the SouthBay Area on Big Marine Lake:

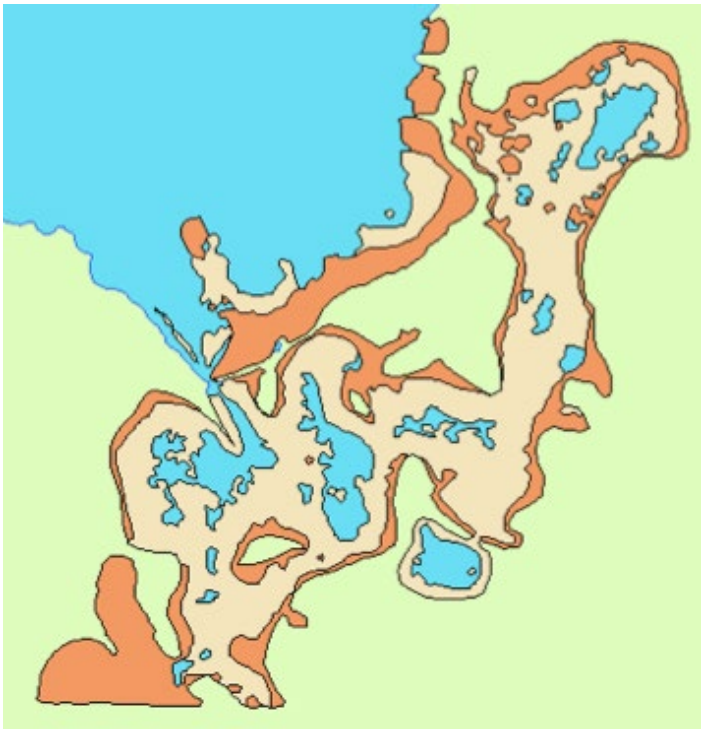
- Uplands
- Lake
- An aquatic vegetation layer split into emergent and floating vegetation (defined by a unique coded value in the table) OR two separate layers, one for the Floating Vegetation and the other for Emergent Vegetation)

As noted earlier, the polyline feature class SouthBayArea defines our working area, so only digitize your new data in that area.

We will draw our upland/lake boundary based primarily on the RectSpring image, but this boundary will be represented in two feature classes (layers); the Uplands and the Lakes.

We will digitize the emergent wetland vegetation and the floating wetland vegetation from the lake area, using both the RectSpring image and the BigMarSum image.

You'll have to interpret the shoreline for the upland/lake boundary to digitize the Lake and Upland layers.
You'll also need to split the emergent vegetation from the floating vegetation on the lake. There is substantial marshland that is considered part of the lake, and not land, along some sections. You will have to do your best job of identifying the land/water boundary, which is difficult because of similar appearing upland and lake vegetation near shore.



Here, we'll consider wetlands part of the lake, that is, we'll include all patches of wetland vegetation in the lake when digitizing the upland/wetland boundary.
Some wetland grasses grow both in shallow water and upland wet soils, while others like cattails are rooted but grow out of the water, so the boundary is at times difficult to distinguish. We've provided the map on the right to give you the approximate

boundaries with uplands in green, lake in blue, emergent wetland vegetation in brown, and floating plants in tan.

Note that the lake polygon extends to the areas shown as wetland vegetation, but they are displayed on top of the lake layer.

The two examples (below) illustrate how the various classes appear on the images. The examples are of the north shore of the eastern lobe of Big Marine Lake. An approximation of the land/water boundary is shown in yellow. The Rectspring image is shown first. Note the water is dark blue, and cattails/wetland grasses show as dark grey. Roads are also grey, but uniform in color and straight-sided, so shape and texture set them apart.

Upland grasses are white, to pinks, to red, so the boundary (in yellow) between upland and lowland is somewhat obvious for most of this stretch.

There is a near-shore area of upland labeled ‘A’ on the images. This is a bit more complicated and subjective to delineate because the marsh cattails, wetland grasses, and the upland grass are shades of grey, so it isn’t obvious where the land/water boundary should be. In addition, there are small patches of cattail and water embedded in upland polygon ‘A’ which we include as part of the upland polygon because we can’t spend all day digitizing.

The summer image (2nd image shown at right) helps because the various shades of light red/ pink are upland grass, while the emergent wetland cattails are blue/black to very dark red. Floating vegetation is

also white/pink/light red, but their texture and location (areas that are water in spring, vegetation in summer) gives them away.

There is no floating vegetation in the lake in the spring (upper) image.

You will also create topology including rules about inclusion and overlap, and validate this topology.

We are not going to give you specific instructions on each of the steps for digitizing or topology creation. We will give examples and hints of how you might want to proceed, and we will demonstrate a few new tools, but we have covered most the tools you need in the section above and in previous labs.

One good strategy is to:

- use the spring image, aided by the summer image, to digitize the upland and lake boundaries
- then use the spring image to digitize the emergent vegetation polygons
- use the summer image to digitize the floating wetland vegetation

A few things to keep in mind:

You NEVER, EVER, EVER want to digitize complicated lines twice. It is o.k. for simple, long, straight lines with only a few vertices, but a nightmare for most curving natural features. For example, don't digitize the Upland polygons and then trace over the same lines to digitize the Lakes polygons. You'll just waste way too much time you could be spending with your friends or calling your parents. Plus, it will make you miserable when it comes time to validate and fix your topology.

Use other tools like *split*, *merge*, or *conversion*, so that you don't spend a lot of time retracing the same path.

Digitize at a "goldilocks" scale, not too small, nor too large, to get sufficient detail. Since we're interested to about two meters, you should set your snapping at about that or a little less and digitize most of your lines at a scale of about 1:3,000, zooming in or out from about half to double that as needed.

Save your Edits FREQUENTLY *(remember save Edits, Then Save the Project; in that order).*

Toggle back and forth between the spring and summer image by clicking the top on "off" in the Table of Contents pane. Sometimes it is much easier to see a boundary in one image than another.

The Process:

Start by creating a new geodatabase, named something like a new BML_digit_xyz, where *xyz* are your initials.

You should create a Feature Data Set with the UTM North American zone 15N NAD83(2011) coordinates.

You should create empty polygon feature classes *(lab 3 pp. 2/3)* in this new feature data set into which you will digitize new features. A straightforward way is to create layers for

1) Lakes
2) Uplands
3) WetVeg

The WetVeg feature class will hold vegetation polygons in two categories, 1) emergent aquatic vegetation (plants that stand up out of the water, most commonly cattails), and 2) floating aquatic vegetation.
Accordingly, you'll need to create a type variable in the table for that layer.

You need to create a topology within the feature data set and add rules to enforce the following conditions:

1) Upland and Lake areas do not overlap
2) There are no gaps between Upland and Lake areas
3) The emergent vegetation and floating vegetation layers do not overlap
4) The wetland vegetation layers are contained within the lakes layer
5) All layers are contained within the study area defined by the SouthBayArea polyline

Review the topology rules described in the "Understanding and Defining Topology" in the first part of this exercise, read the description of rules in the cited URL, and create a topology in your feature data set that includes the necessary rules.

You want to look at the "Must Not Overlap With" rule for the Lake/Uplands boundary overlap

The "Area Boundary Must Be Covered By Boundary Of" for the Lakes/Uplands boundary gaps

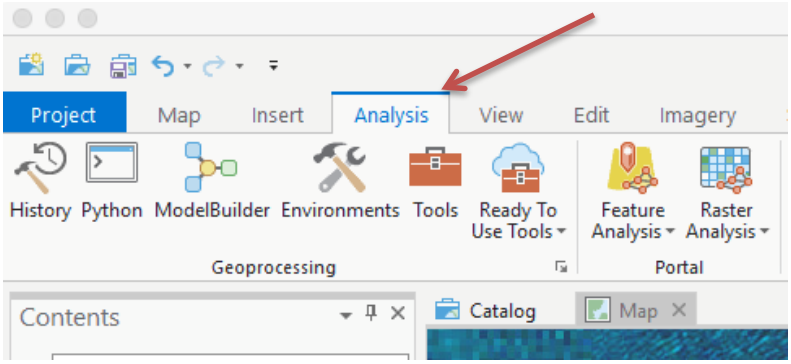
"Must Not Overlap" for the wetland vegetation polygons (different from must not overlap WITH)

and the "Must be Covered By" to make sure all the wetland vegetation polygons are within the Lake, and that all the layers are inside the SouthBayArea boundary.

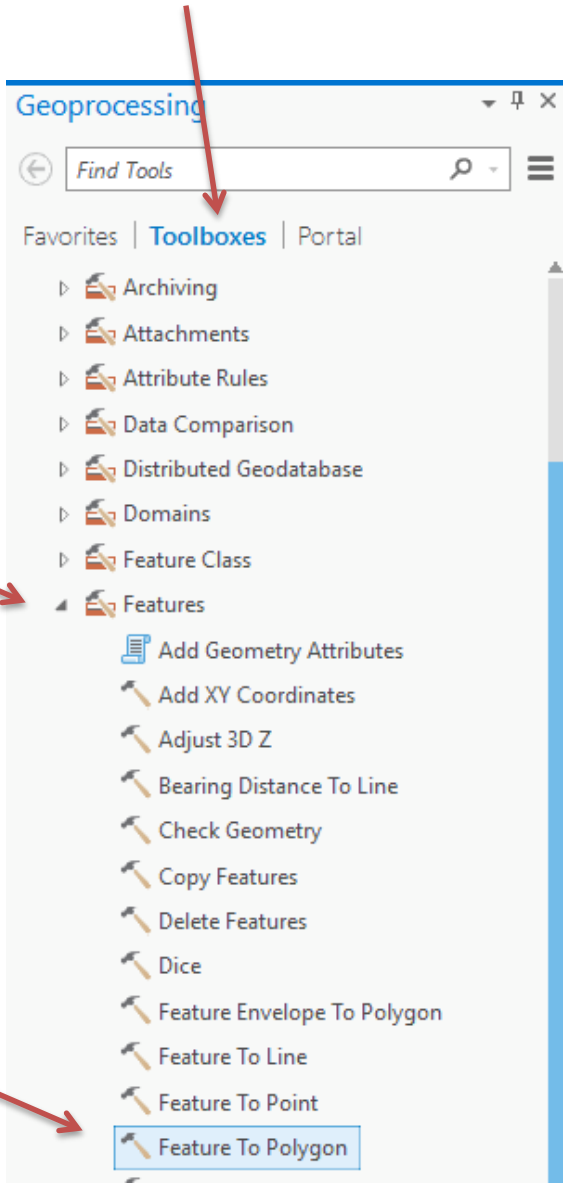
Note that there is no layer that allows us to enforce condition 5, “All layers are contained within the study area defined by the SouthBayArea polyline.”

The “Must be Covered By” rule requires the bounding feature to be a polygon. Luckily, you can convert the SouthBayArea polyline feature to a polygon.

Activate the Analysis tab along the top main window



Then select the Toolboxes menu in the Geoprocessing pane on the right hand side of the main window



Then open the Features Toolbox

And select the Features to Polygon tool

Specify the SouthBayArea layer as input and something like SouthBayPolys as output, storing it in your geodatabase with you other layers. This should create a polygon feature class you can use in your topology.

<u>Example Topology Rules</u>

Below is a partial table containing some of the rules for one topology specification that meets our needs. It still needs a few more rules to be complete, but provides some direction if you don't know where to start.

Feature Class 1	Sul	Rule	Feature Class 2
Lakes		Must Not Overlap With (Area-Area)	Uplands
Lakes		Boundary Must Be Covered By Boundary Of (Area-Area)	Uplands
Lakes		Must Be Covered By (Area-Area)	SouthBayPoly
WetVeg		Must Be Covered By (Area-Area)	Lakes

- The first two rules make sure that the Lakes neither overlap with Uplands, nor are there gaps along the edges they share ("Boundary Must Be Covered By Boundary Of").

- The third rule tests that the lakes are within the study area.

- The fourth rule tests that the wetland vegetation polygons are within the Lakes.

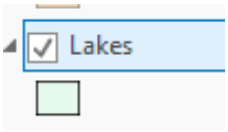
Note that these rules don't include all of our requirements (e.g., that the Uplands must be inside the study area, or that the wetland vegetation polygons don't overlap with each other).

Note that when you validate topology from a completed set of rules, you will likely still have rules for some of the outer edges. The particular issue is the *"must not have gaps between uplands and the lake".* There is no rule that will exactly provide this. We use a *"boundary must be covered by"* rule, but this rule will by definition be broken on the study area boundary, so you'll get the "faux" errors when you validate the topology, as mentioned before. You could provide exceptions for those errors, but no need to create exceptions here.

New Techniques That Should Help

Cross hatch fills. You will be digitizing several layers and will want to display some of them at the same time to visually check while digitizing. For example, you'll want to display both the Upland and Lake layers at the same time, with perhaps the SouthBayPoly in the background. We've shown transparent fills, but these are sometimes sub-optimal when shown two and three layers deep, so cross hatch fills can sometimes help. Unfortunately, you can't pick them from most standard sets, and creating them is a bit hidden.
(**Video: Cross Hatch and Transparent Fills**)

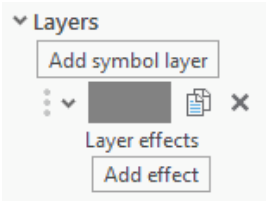
Start by clicking on the color patch for a layer in the Table of Contents on the left side of the main window, here Lakes:



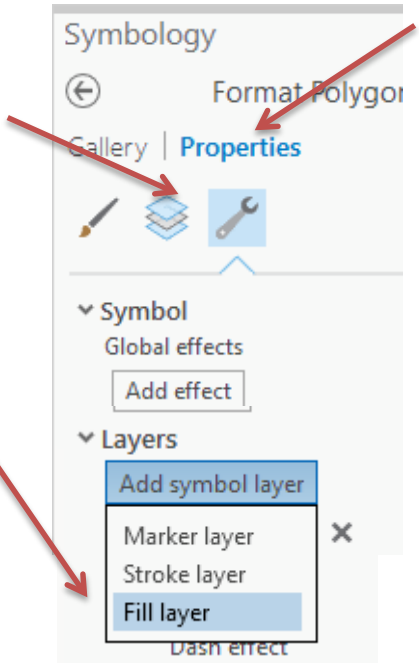
The right panel should switch to the Symbology tools. Select 'Properties', then the wrench (labeled Structure if you hover over it):

Then click on Layers – Add symbol layer, and select Fill layer.

This will display a patch, usually dark, in the 'Layers' section.



Click Apply at the bottom of the Symbology panel, it should change the appearance of your feature class.

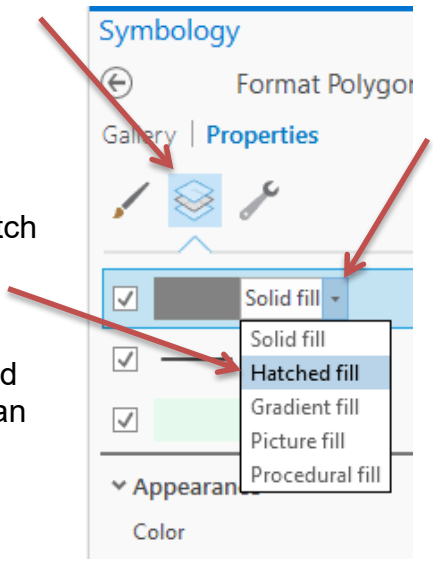


Now click to activate the layer stack in the main Symbology pane, then click to the right of the new symbol layer to reveal a drop-down list.

Select ‘Hatched fill’ and Apply.

This should change the fill to northeast pointing hatch lines.

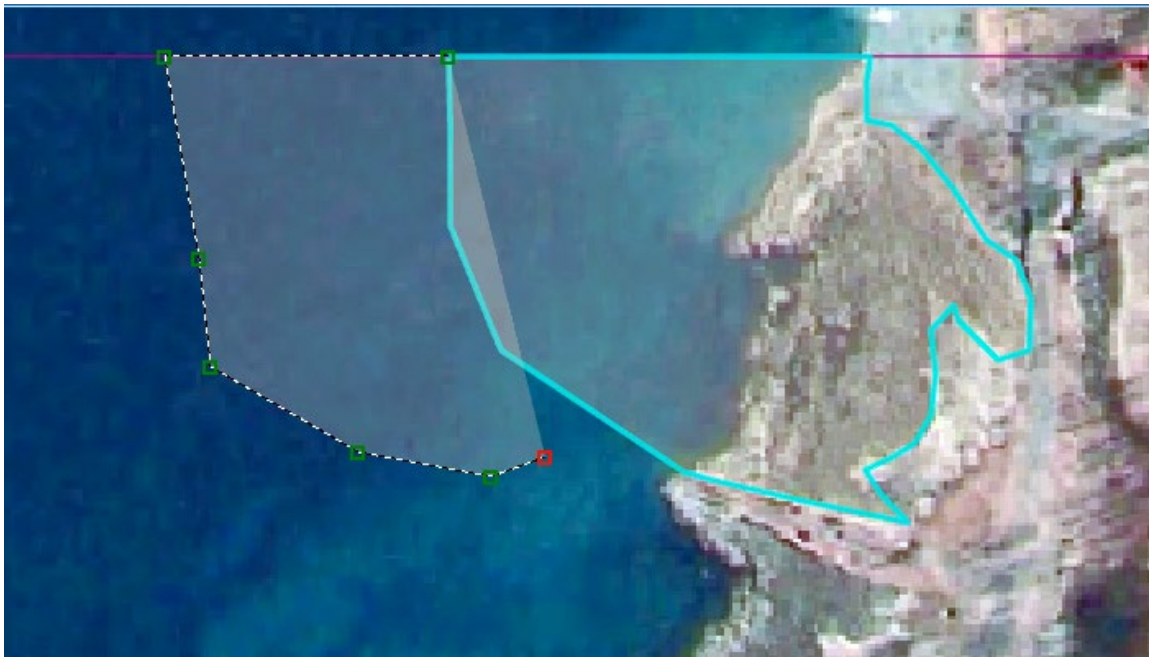
Notice there are options to alter the color, line width, and hatch angle (not shown here). You would want to make the Uplands layer different, so you can distinguish the two.



Digitizing in Pieces, then Merging

When creating large complex polygons, it may be useful to digitize them a section at a time, to contain errors and allow frequent saves. One approach, as described last week, is to

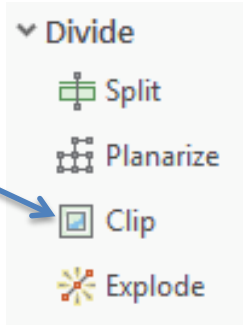
- first digitize a new polygon that is a portion of the target feature, then
- add to the polygon with the auto complete tool (in the Create panel)



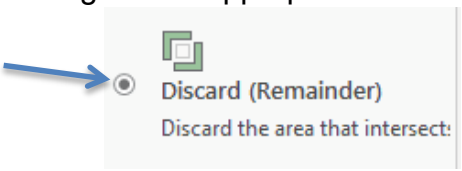
Remember that you must merge these separate parts of the lake by selecting both and then use the Edit→Merge (lab 3).

Clip digitizing for Islands. You must digitize islands both in the lake and near shore, as shown in the example map. Perhaps the easiest way to digitize and island is:

- First digitize the lake, covering the islands.
- Set the lake fill semi-transparent (Symbology panel, properties, then display, set transparency something like 40 – 50%; *lab 3 pp 10/11*)
- Then digitize an Upland polygon that outlines an island polygon.
- Select the island polygon
- From the main Edit-Modify menu, select the Clip option (see figure)



- Specify the Discard (Remainder) option by clicking on the appropriate radio button in the window that appears



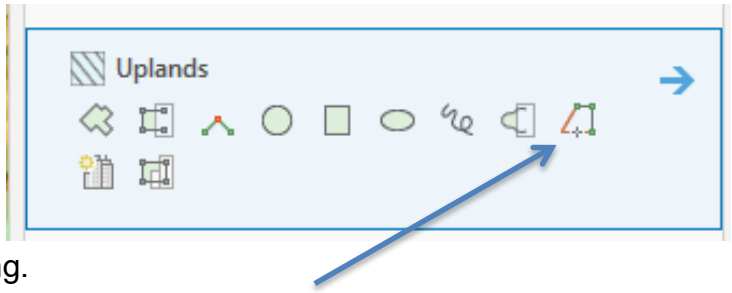
- This clips out the lake portion behind the island and the island still remains, filling the hole.

(See the Lab 4 video, **ClipDigitizing**)

Tracing and Existing Edge.

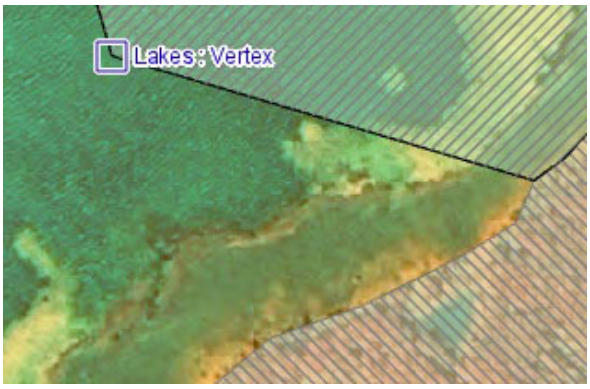
When we say you never want to digitize the same line twice, that means if there are lots of vertices you don't want to have to match each one while digitizing adjoining edges. However, how do you make sure edges match across features in different layers? You may have discovered that the autocomplete polygon tool does not work across different layers. You can't autocomplete a lake polygon on the edge of an upland polygon.

There is a 'Trace' tool that automatically traces an edge for you, saving much time while digitizing. It is found toward the right-hand side of the 'Create Features Panel', the tools that display on the right side of the main window when you are editing.



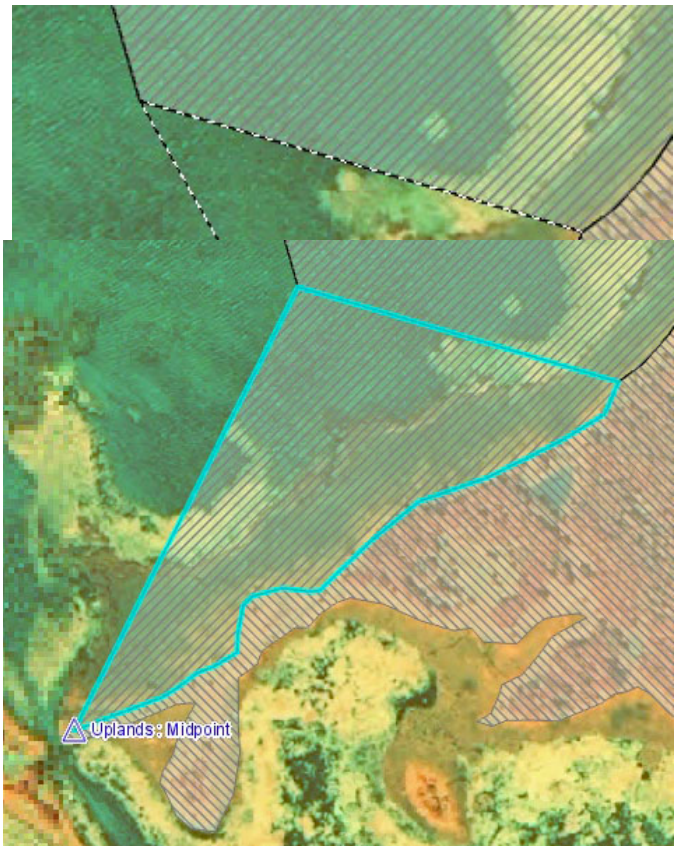
It is perhaps more easily understood by viewing the **Trace video**, but we'll summarize here also.

You first activate the tool for a layer. Then locate an edge vertex with your cursor (indicated by a square and title, as shown at right). Click on the vertex.



Note that you can follow edges from the layer your digitizing, other layers, or both.

While NOT depressing any mouse buttons, move the cursor to a point further along the edge(s) of polygon(s), and notice a dotted outline, and vertexes identified as you move further down the edge (see at right).
When you get to a convenient stopping place, hover over a vertex or midpoint on the edge and click. This should automatically create a polygon following the edge (see right).

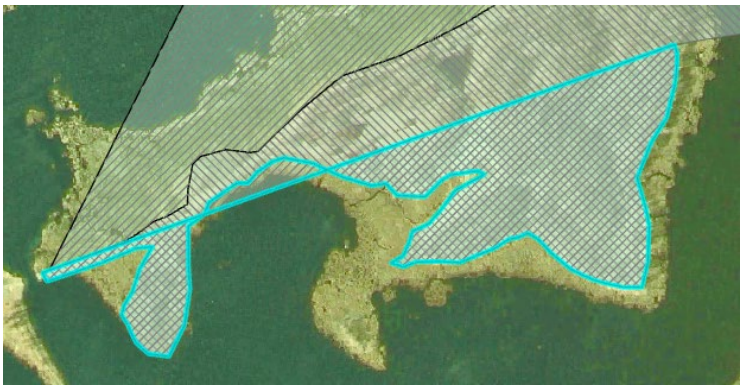


You can then merge this polygon to the existing lake polygon adjacent to your starting point, and then trace the next piece.

You should note that it is easy to create “crazy” polygons, that are ill formed and will cause all sorts of problems, as the example shown below.

The polygon boundary crosses over itself multiple times and this won’t do.

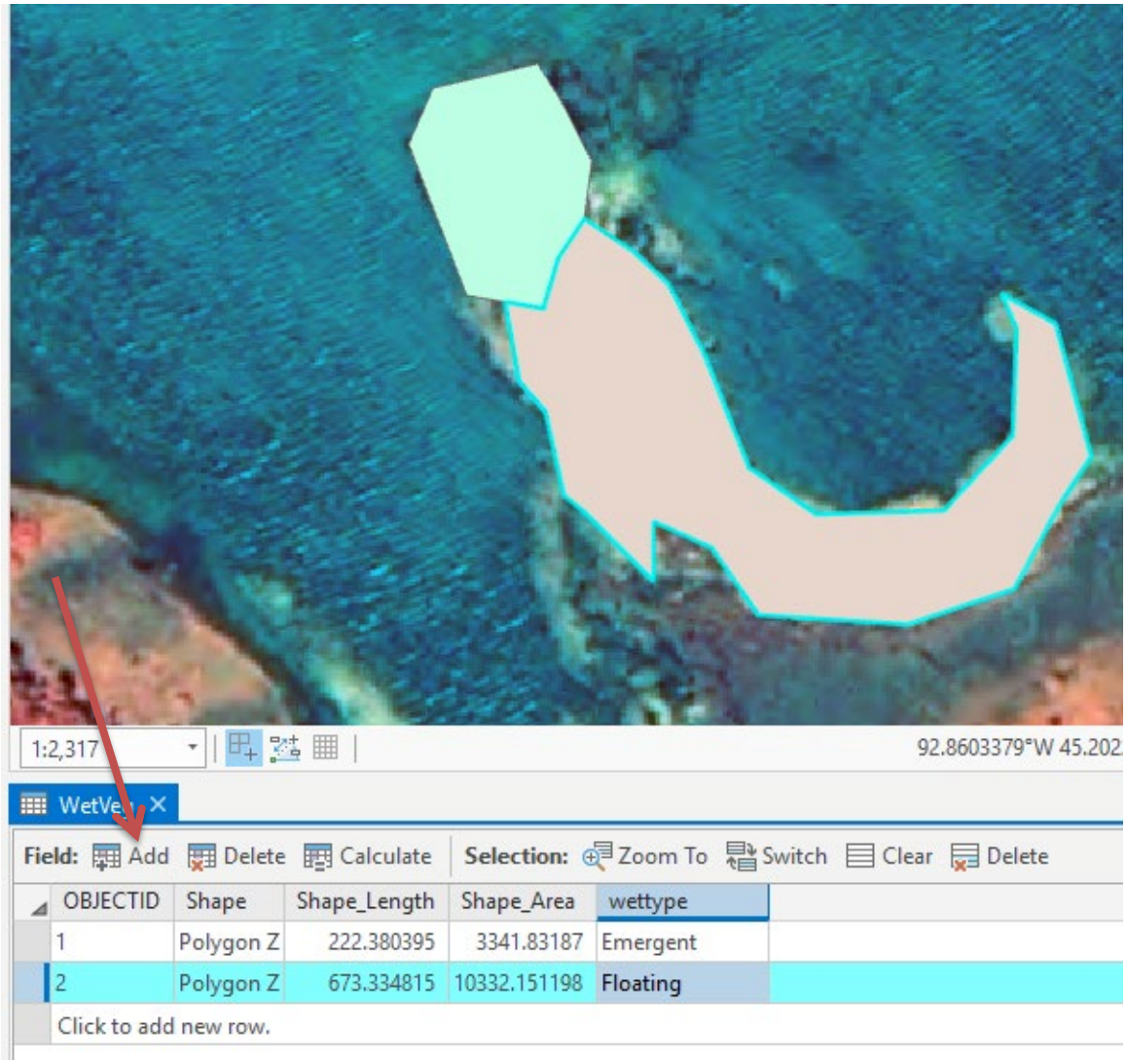
You avoid this by tracing longer or shorter edges and inspecting your polygon as you trace it to make sure it doesn’t overlap itself.



You’ll have to add a column to your ‘Wetlands Vegetation’ table to hold the code for the two types.

As illustrated below, you do this by displaying the table (right click in the TOC on the layer name, then Attribute table), then the Field: Add tool.

You may then select individual rows/polygons and type the code for wetland type in the column. Here I used a text variable, and specify “Emergent” and “Floating,” but you could use numbers in a numeric column, e.g. 1 and 2.



(See the **Video AddAttribute**)

<u>An alternative approach to consider:</u>
When you are trying to ensure digitized data layers adhere to topological rules, one approach is to create one layer that covers the entire study area and then “carefully” cut it apart, moving pieces to the appropriate final layers.

This approach cannot be applied to every topological editing situation, but it would work for this lab (Lab 4).

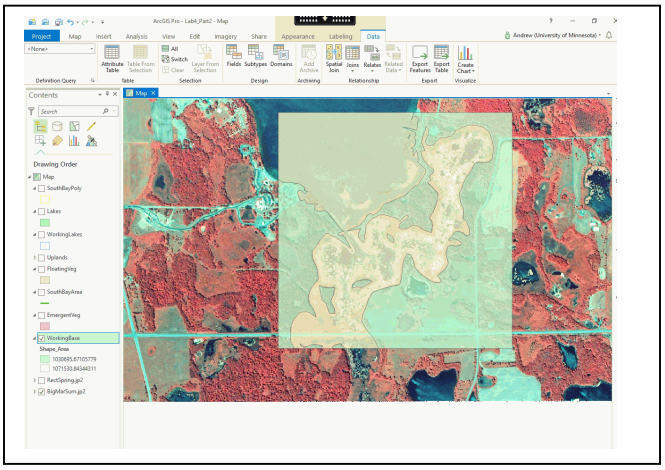
To use the approach, follow the above step to create a polygon layer from the polyline layer SouthBayArea *(pp. 19).* The previous instructions named this polygon layer SouthBayPolys.

Step 1: Create empty polygon layers for Lakes, Uplands, Emergent Veg and Floating Vegetation. *(**Note**: the previous approach used a Wetlands as one polygon layer and had Emergent and Floating Vegetation as attributes, this approach uses separate Emergent Veg and Floating Vegetation polygon layers)*

Step 2: Create empty working polygon layers; WorkingBase and WorkingLakes.

Step 3: Select all polygons in SouthBayPolys and Copy/Paste (Paste Special) in to Working Area and make WorkingBase somewhat transparent.

Step 4: Select the one big polygon in WorkingBase (in Edit) and draw a CUT LINE at the EDGE of the UPLANDS and WATER (this margin could be open or have emergent or floating on top). CUT out the non-upland polygons and paste them into WorkingLakes. Cut out the uplands and paste them into Upland layer. Remember, to Cut you have to have the "subject" selected.



When you select the polygons right click and CUT, then select the PASTE in the upper left and choose PASTE SPECIAL, then choose the correct layer you want to paste into.

Step 5: Repeat the process for CUTTING the WorkingLakes into Lakes, EmergentVeg and FloatingVeg.

HINT: *It will be easiest if you 1st cut out open water and paste it into Lakes, then the FloatingVeg and finally everything that is left goes to EmergentVeg.*

Step 6: Set up and apply your topological rules and there SHOULD BE (if you were careful) NO ERRORS. If there are, fix them as described earlier.

Simple Overall Instructions Summary

Digitize the Upland, Lake, and Wetland Vegetation layers. Check them against your created topology to make sure they conform to our requirements.

Create a Layout that contains all your layers and your validated topology, showing that you've removed all the errors, except for the "faux" errors along the outer boundary.

Turn the map in, looking something like: