Basic GIS Work Book

For ArcMap 10.2

What is GIS

What is ArcGIS

- License levels

Data view

- Tool Bars
- Data frame
- Table of Contents
- Data
- Basemaps
- Symbology
- Tables
- Windows

ArcCatalog

- Folder Connections

Editing

- Edit data
- Create Data

Analysis

- Tools
- Buffer

Layout view

- Insert elements
- Index map
- Grids
- Export

Topic: Installing Class Data
Problem:

Solution:

Data used: USB Stick , CD or Zip file

License: Basic

All the data you need for this class is in one folder. Transfer the Folder **BasicClass** to **C:\Student\.** If the student folder doesn't exist then create on first.

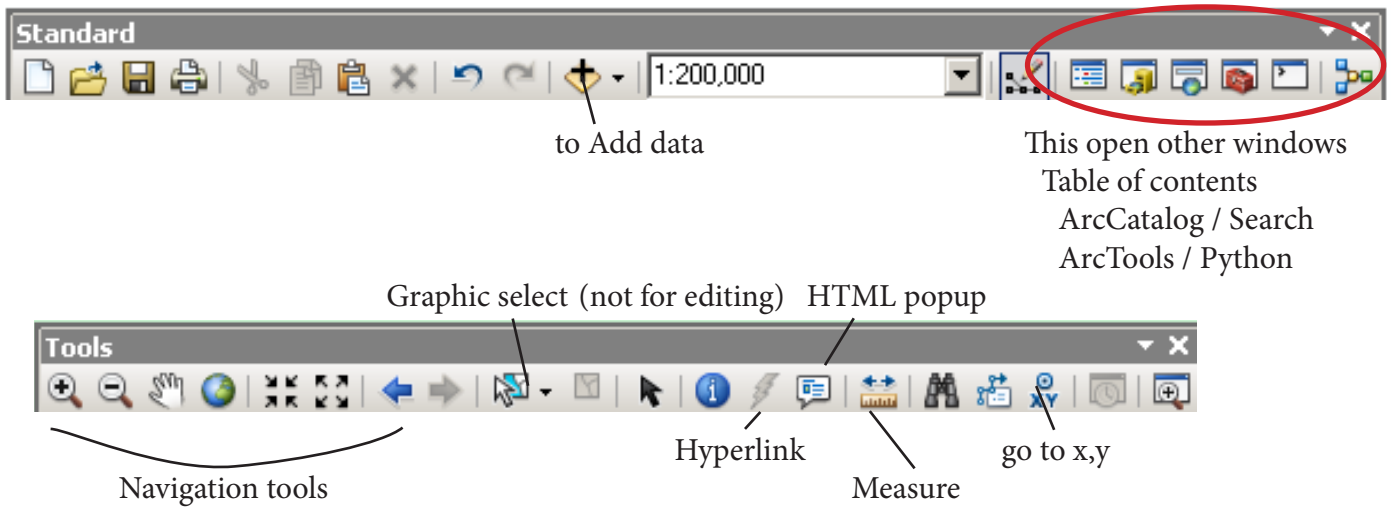
Topic: ArcMap
Problem: So many windows buttons and tool bars

Solution: Explore ArcMap

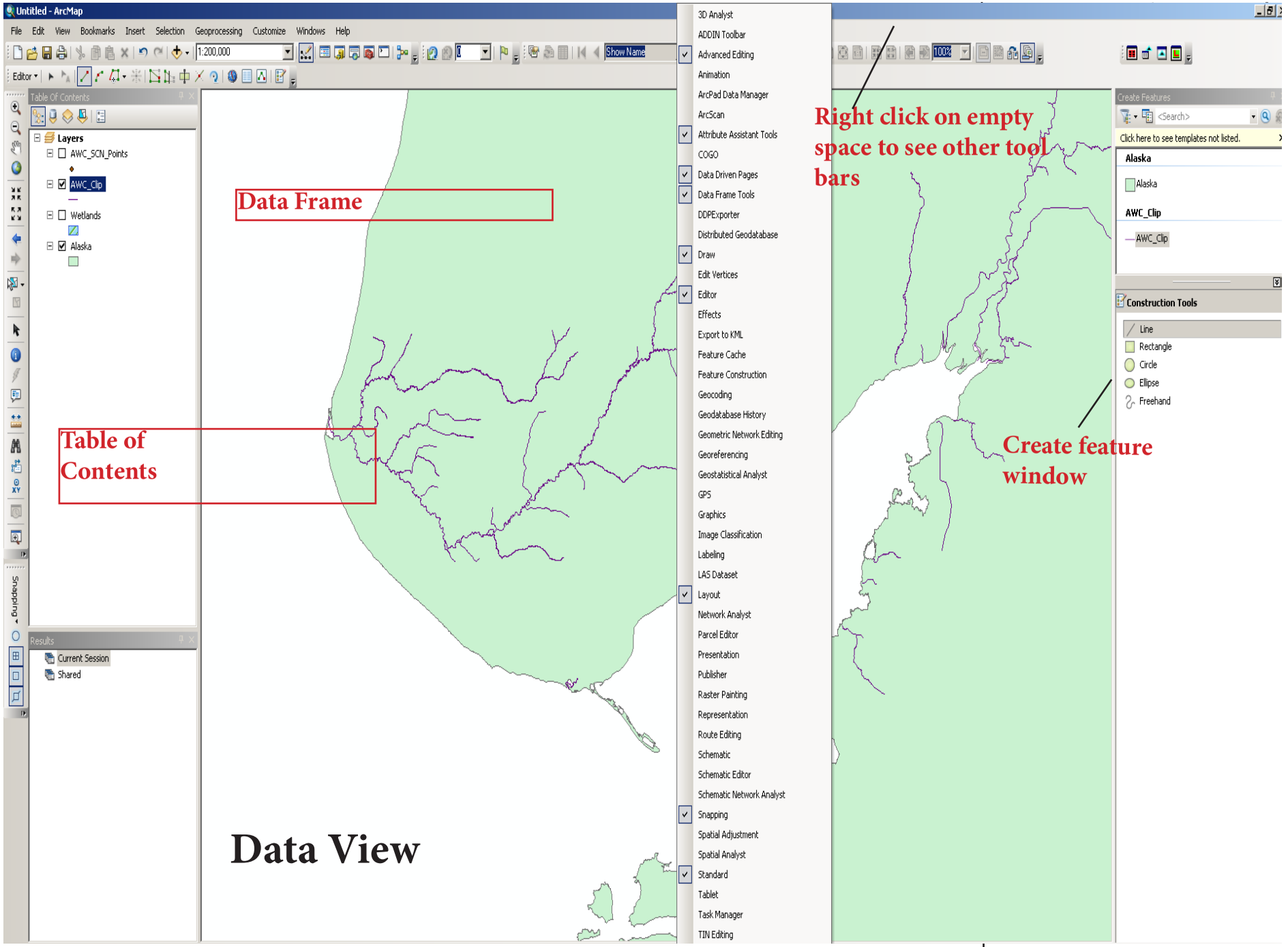
Data used:

License: Basic

First we will review some of the main tool bars



The drawing tool bar is good for adding graphics or text to either the editing view or layout view


Untitled - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
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Layers
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AWC_Clip
Wetlands
Alaska
Results
Current Session
Shared
Data Frame
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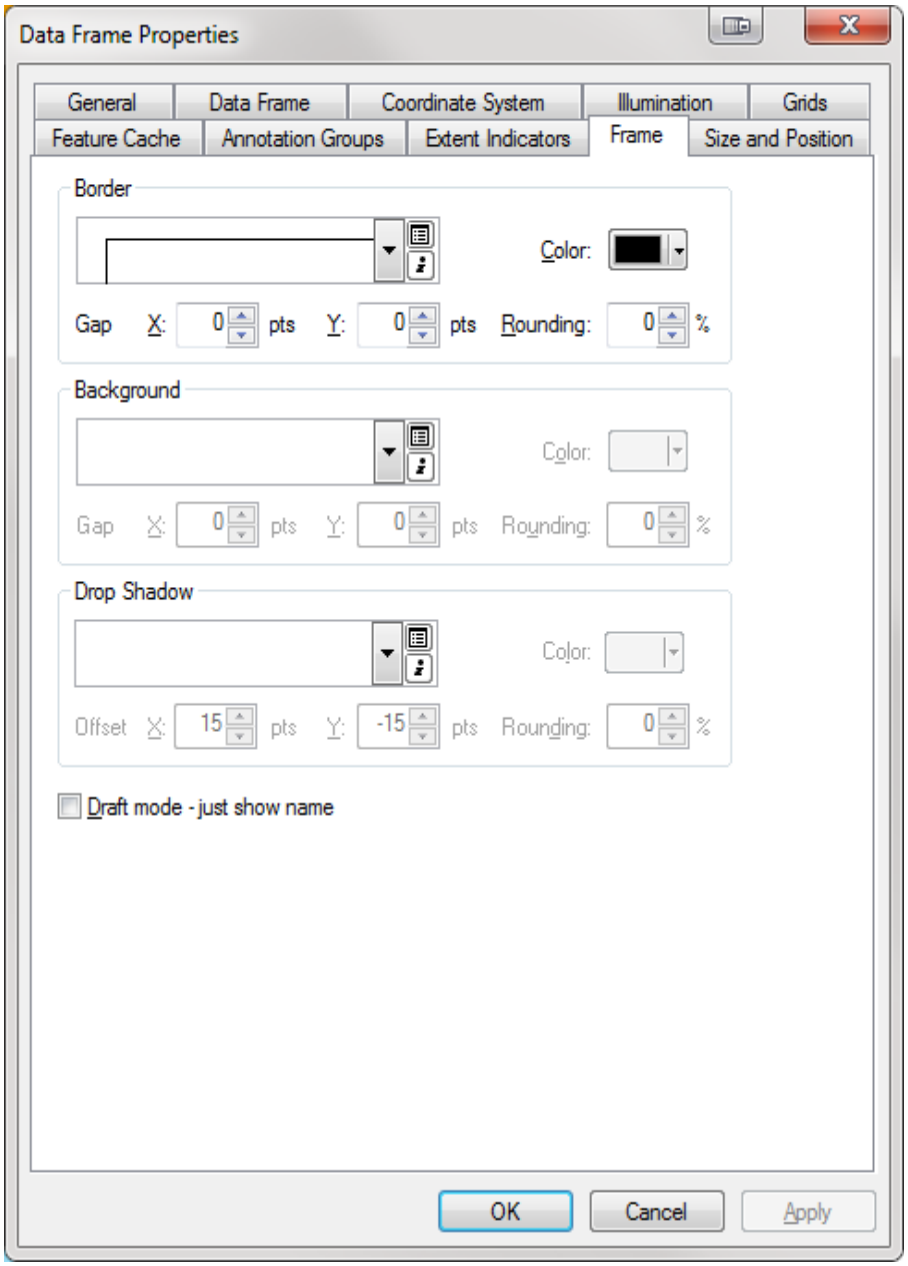
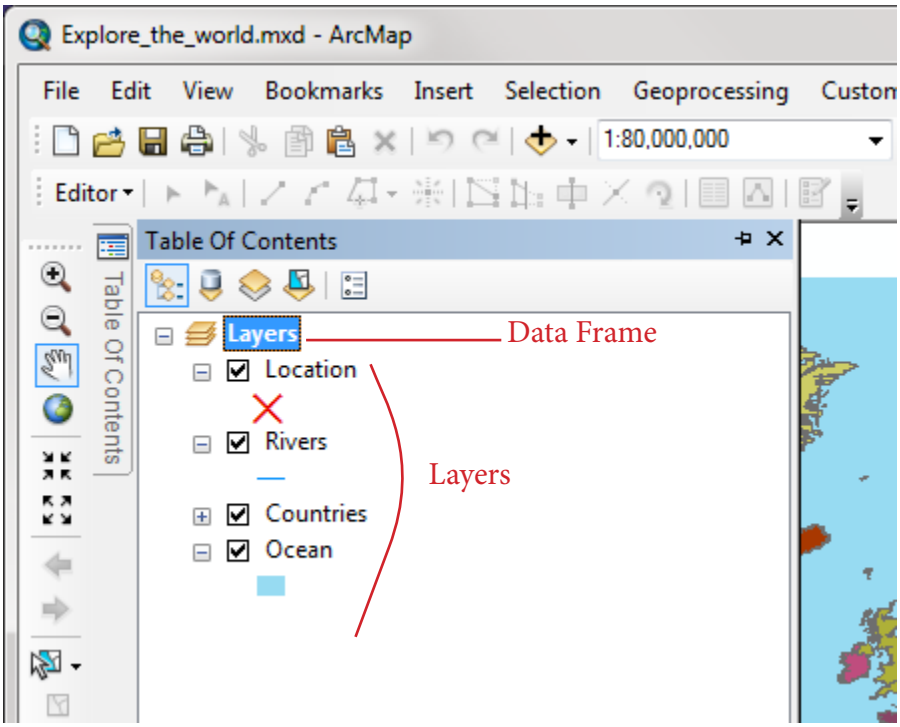
Export to KML
Feature Cache
Feature Construction
Geocoding
Geodatabase History
Geometric Network Editing
Georeferencing
Geostatistical Analyst
GPS
Graphics
Image Classification
Labeling
LAS Dataset
Layout
Network Analyst
Parcel Editor
Presentation
Publisher
Raster Painting
Representation
Route Editing
Schematic
Schematic Editor
Schematic Network Analyst
Snapping
Spatial Adjustment
Spatial Analyst
Standard
Tablet
Task Manager
TIN Editing
Right click on empty space to see other tool bars
Create Features
Click here to see templates not listed.
Alaska
AWC_Clip
Construction Tools
Line
Rectangle
Circle
Ellipse
Freehand
Create feature window



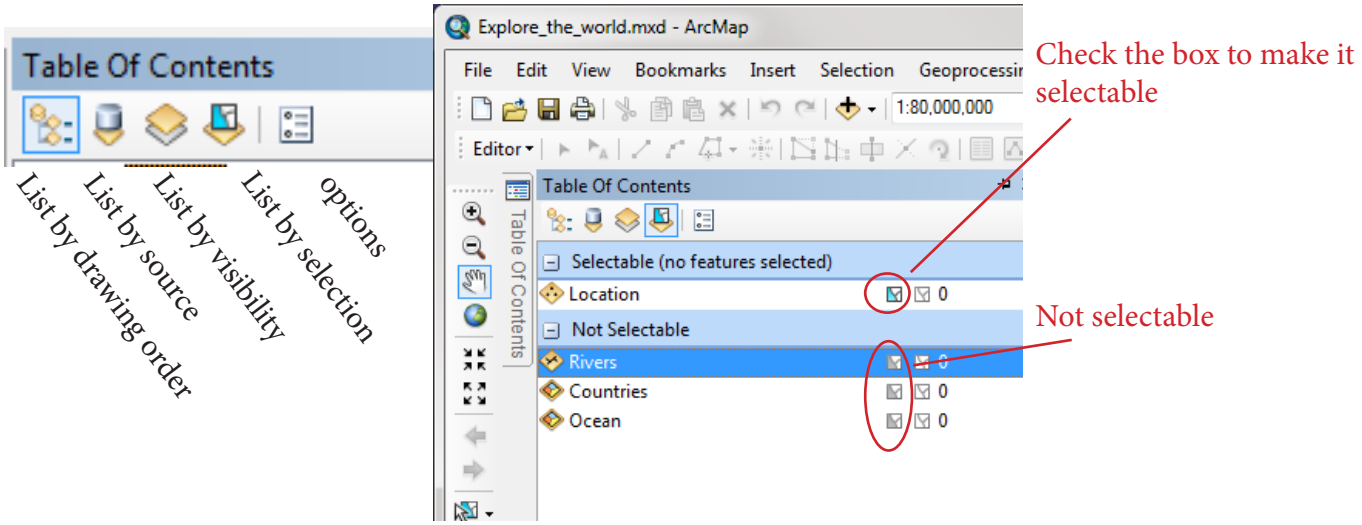
In the data frame properties you can change its appearance, the coordinate system and add graticules .

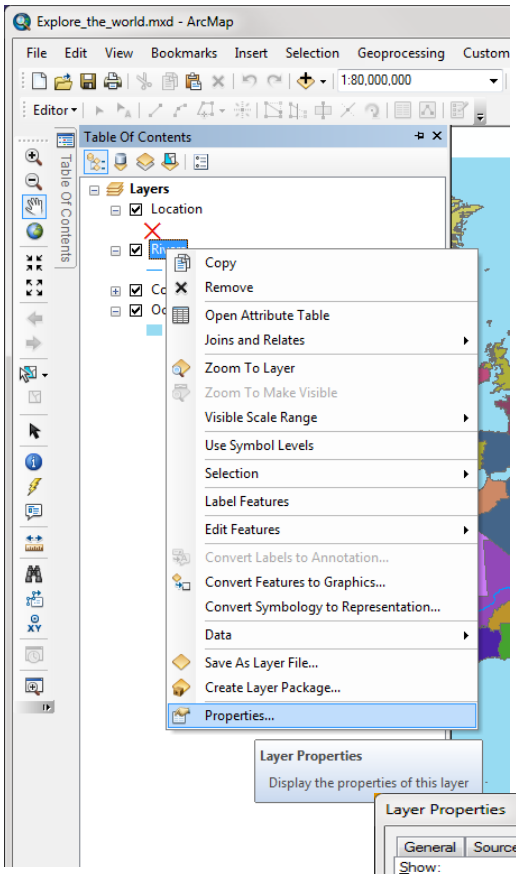
In the general tab

Table of Contents: TOC



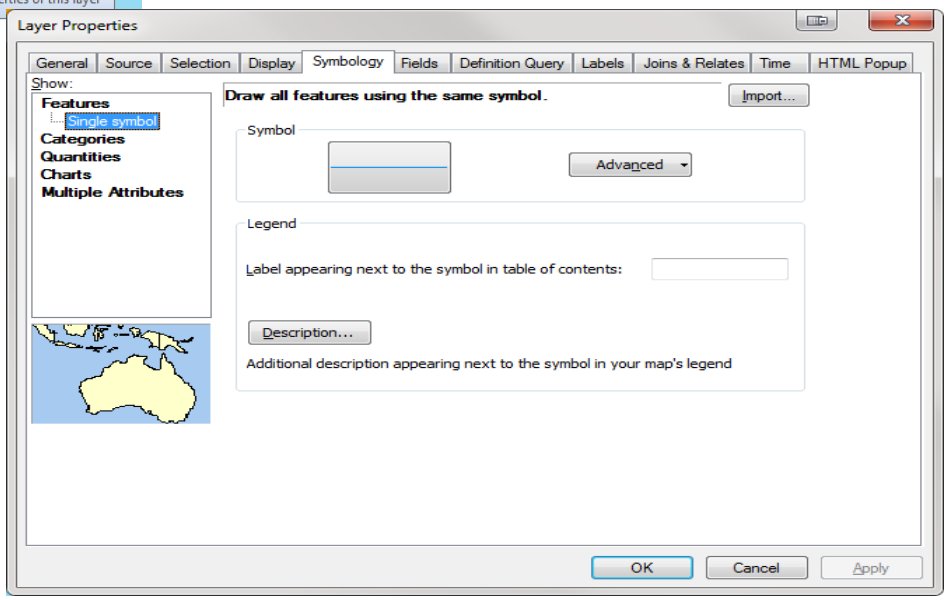
Change the view of the TOC

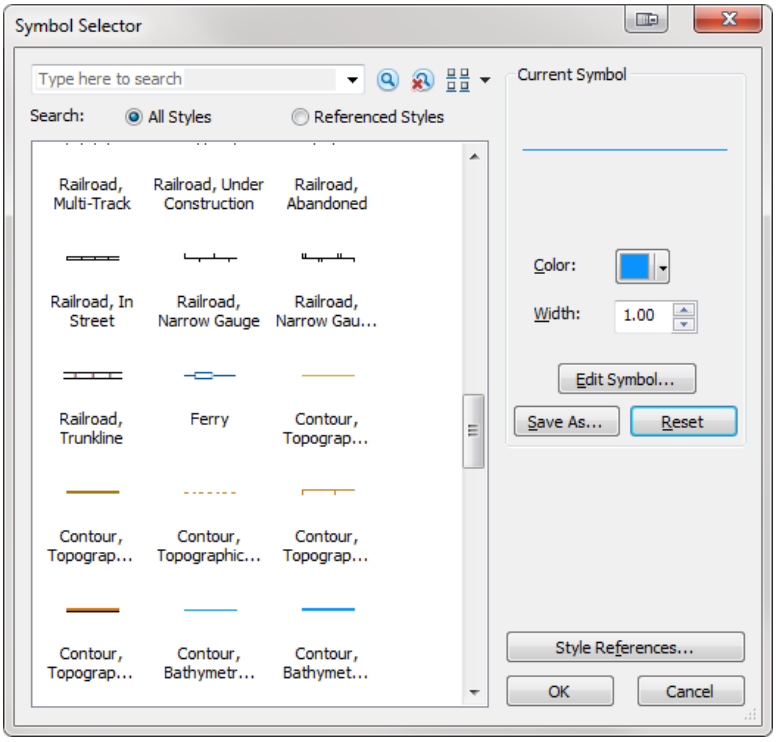




By right-clicking on the layer you can access its table and properties.

In the properties window you can change the symbology of the layer. You can also view or change the source, set transparencies or set scale limits.

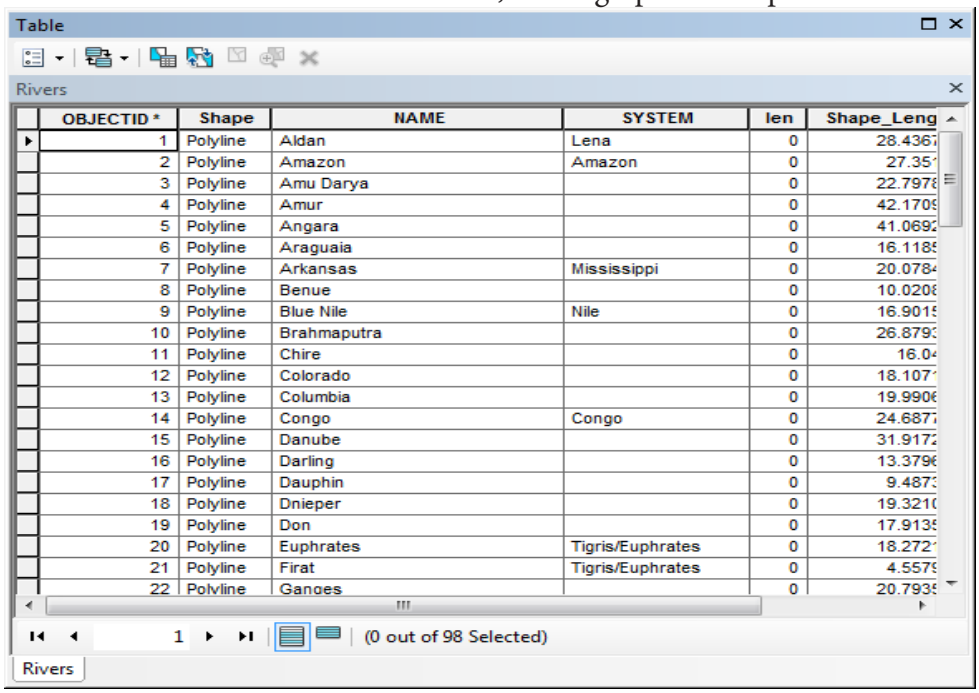




Symbology can be set by selecting from the library of symbols

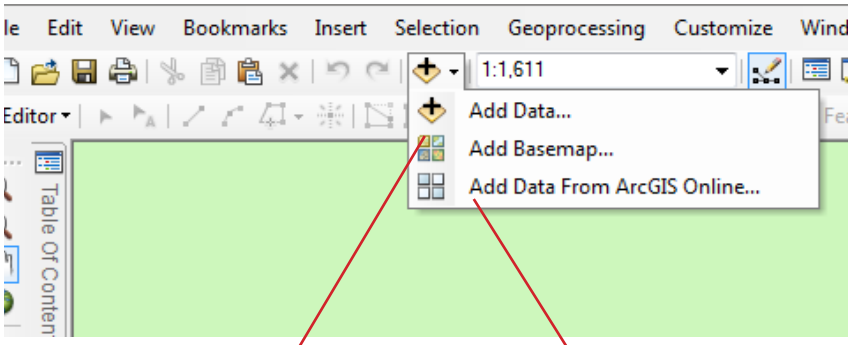
or by selecting on the edit symbol button and customizing your own

In the table, you can view and edit attributes. You can also sort and calculate values as well as add and delete fields, create graphs and reports.



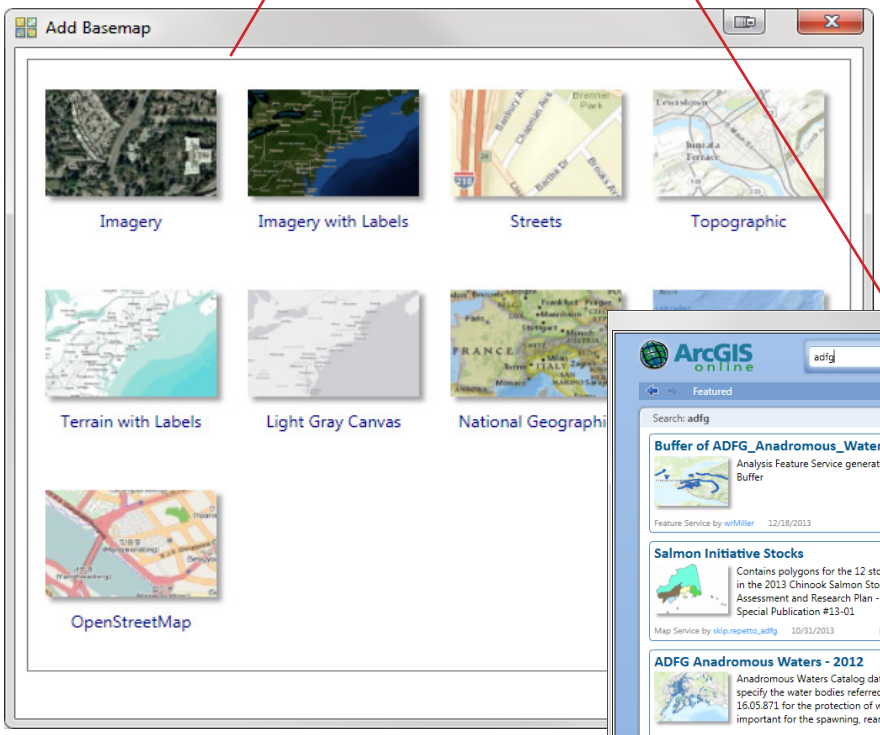
OBJECTID *	Shape	NAME	SYSTEM	len	Shape_Leng
1	Polyline	Aldan	Lena	0	28.4367
2	Polyline	Amazon	Amazon	0	27.351
3	Polyline	Amu Darya		0	22.7978
4	Polyline	Amur		0	42.1709
5	Polyline	Angara		0	41.0692
6	Polyline	Araguaia		0	16.1185
7	Polyline	Arkansas	Mississippi	0	20.0784
8	Polyline	Benue		0	10.0208
9	Polyline	Blue Nile	Nile	0	16.9015
10	Polyline	Brahmaputra		0	26.8793
11	Polyline	Chire		0	16.04
12	Polyline	Colorado		0	18.1071
13	Polyline	Columbia		0	19.9906
14	Polyline	Congo	Congo	0	24.6877
15	Polyline	Danube		0	31.9172
16	Polyline	Darling		0	13.3796
17	Polyline	Dauphin		0	9.4873
18	Polyline	Dnieper		0	19.3210
19	Polyline	Don		0	17.9135
20	Polyline	Euphrates	Tigris/Euphrates	0	18.2721
21	Polyline	Firat	Tigris/Euphrates	0	4.5575
22	Polyline	Ganges		0	20.7935

Add Basemaps



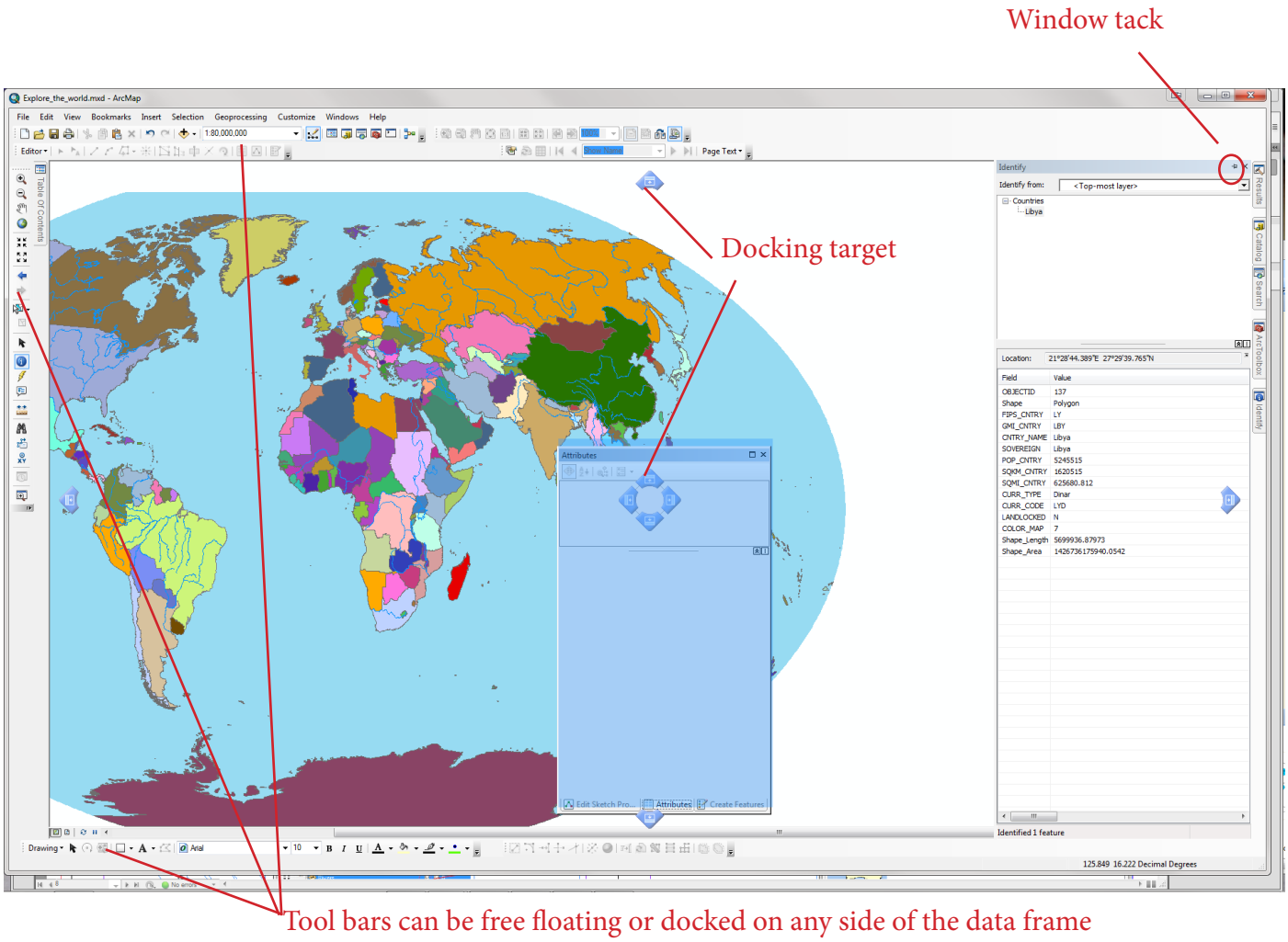
Next to the **add data** button there is a black down arrow, if you click on that you will see more options.

The **add basemap** button will give you a set selection of base maps from ESRI

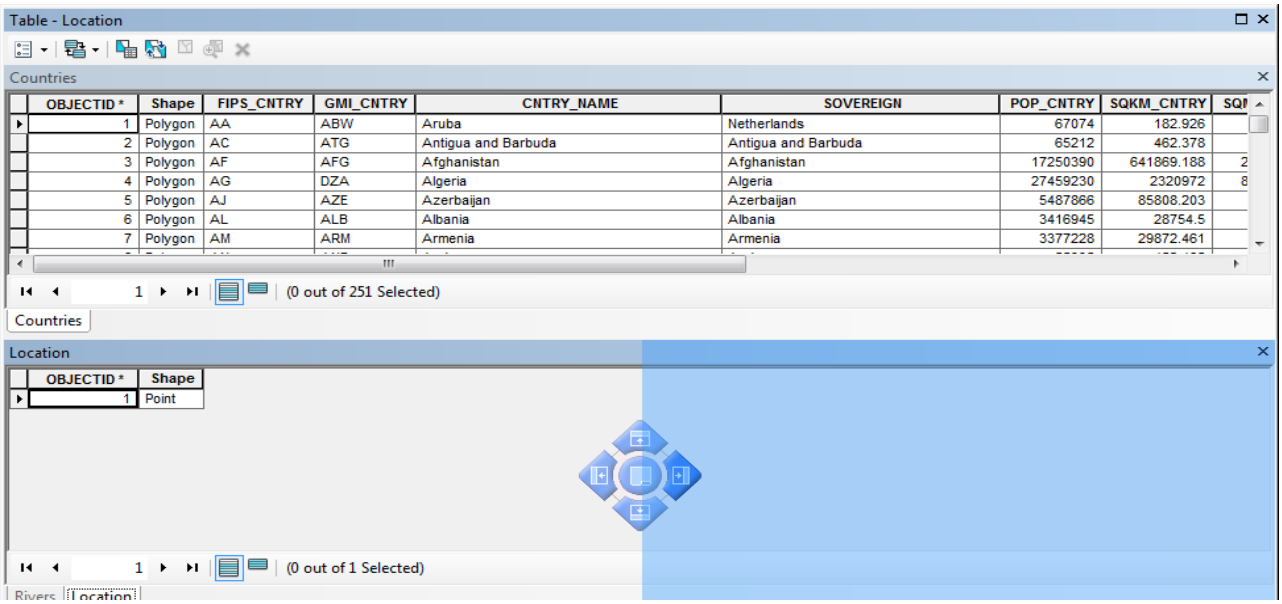


Add Data from ArcGIS Online will open a window that allows you to search for all layers available to the public contributed by the public.

Arrange tool bars and windows



Tables can also be docked



Topic: ArcCatalog
Problem: Finding all the windows in ArcCatalog

Solution: All the windows can be re-sized, opened and closed. Explore ArcCatalog and familiarize yourself with all the windows and buttons

Data used: None

License: Basic

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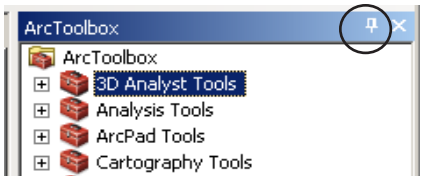
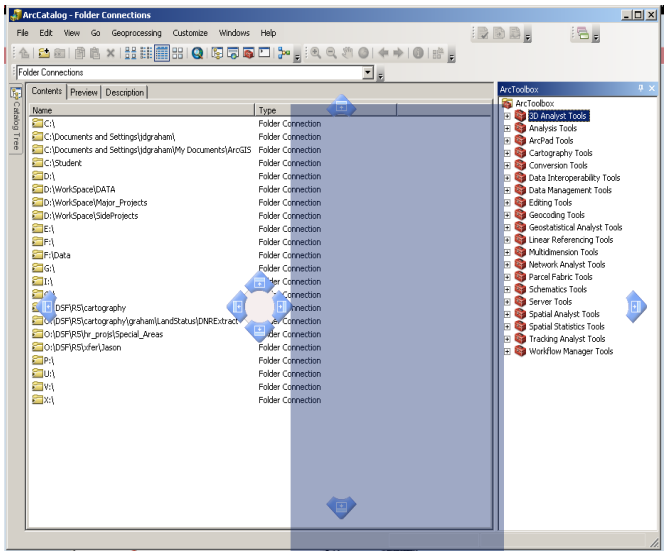
1 Take turns opening and closing windows, you can open them by clicking on the icons on the tool bar.

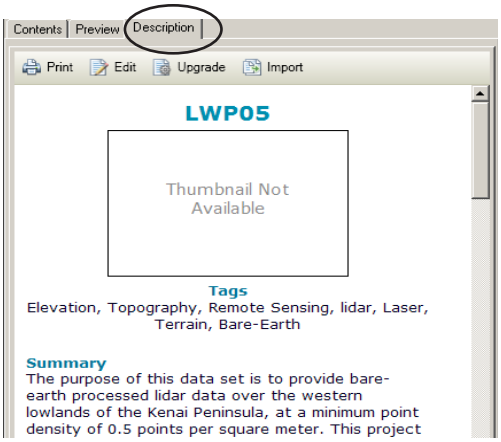
2 Alternatively instead of closing the window you can click on the thumb tack To reduce the window to the side of the frame



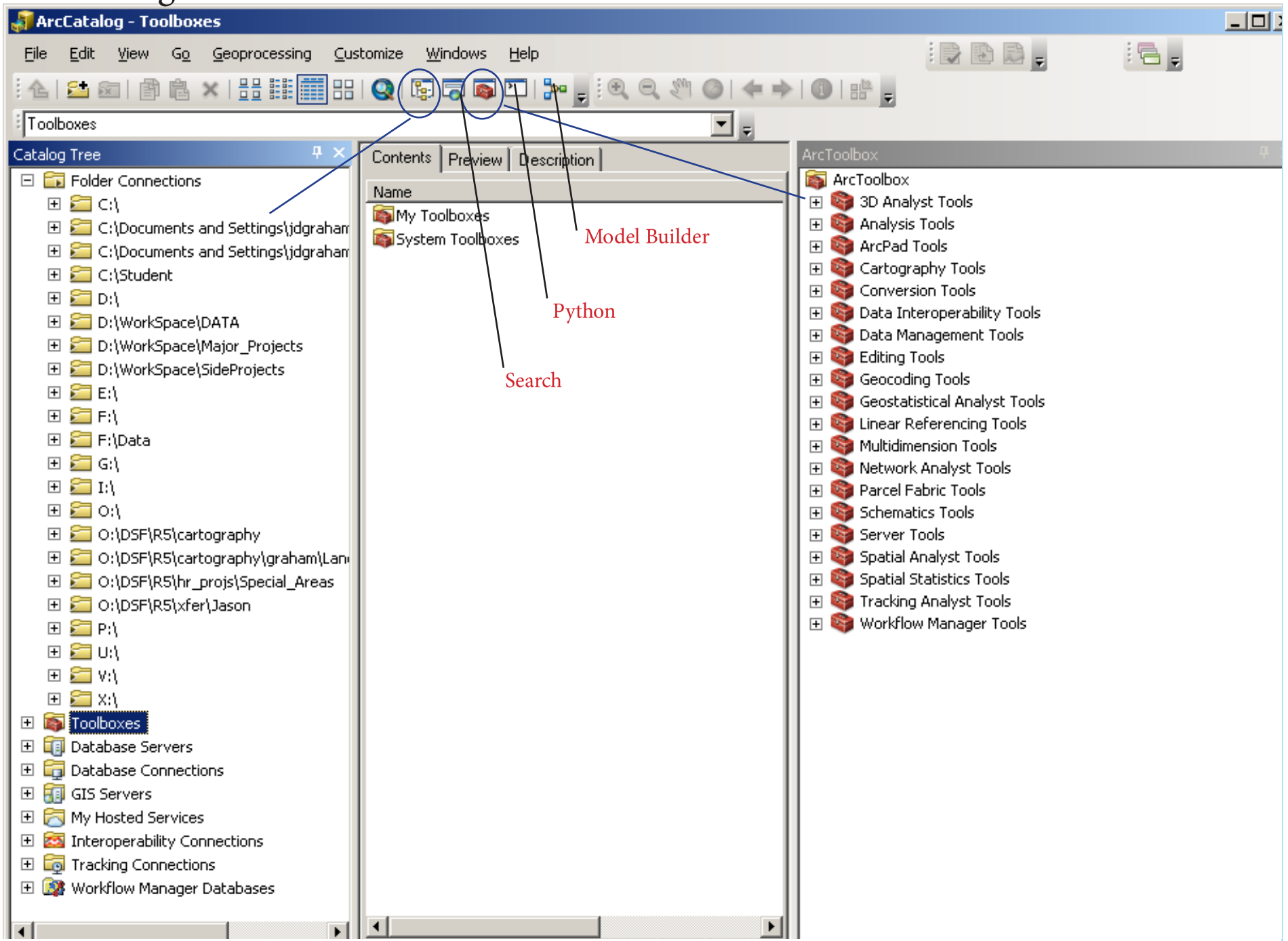
3 You can also click and drag the windows around the frame and doc them elsewhere or within other windows



4 Access the metadata by highlighting the item in the catalog tree and select the description tab.



ArcCatalog

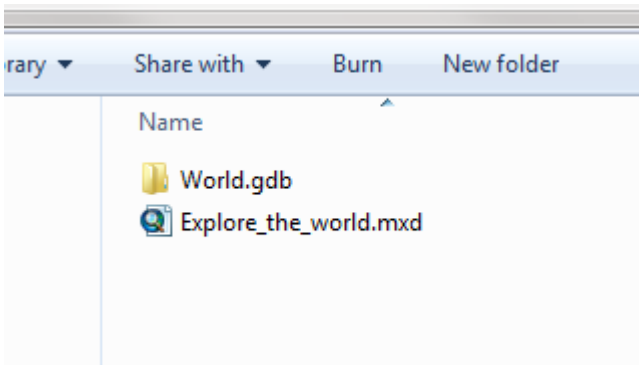

ArcCatalog - Toolboxes
File Edit View Go Geoprocessing Customize Windows Help
Toolboxes
Catalog Tree
Folder Connections
C:\
C:\Documents and Settings\jdgraham
C:\Documents and Settings\jdgraham
C:\Student
D:\
D:\WorkSpace\DATA
D:\WorkSpace\Major_Projects
D:\WorkSpace\SideProjects
E:\
F:\
F:\Data
G:\
I:\
O:\
O:\DSF\R5\cartography
O:\DSF\R5\cartography\graham\Lan
O:\DSF\R5\hr_projs\Special_Areas
O:\DSF\R5\xfer\Jason
P:\
U:\
V:\
X:\
Toolboxes
Database Servers
Database Connections
GIS Servers
My Hosted Services
Interoperability Connections
Tracking Connections
Workflow Manager Databases
Contents
Preview
Description
Name
My Toolboxes
System Toolboxes
Model Builder
Python
Search
ArcToolbox
ArcToolbox
3D Analyst Tools
Analysis Tools
ArcPad Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Editing Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Parcel Fabric Tools
Schematics Tools
Server Tools
Spatial Analyst Tools
Spatial Statistics Tools
Tracking Analyst Tools
Workflow Manager Tools

Topic: Explore_the_world.mxd
Problem: Try out arc map on your own

Solution:

Data used: Explore_the_world.mxd

License: Basic



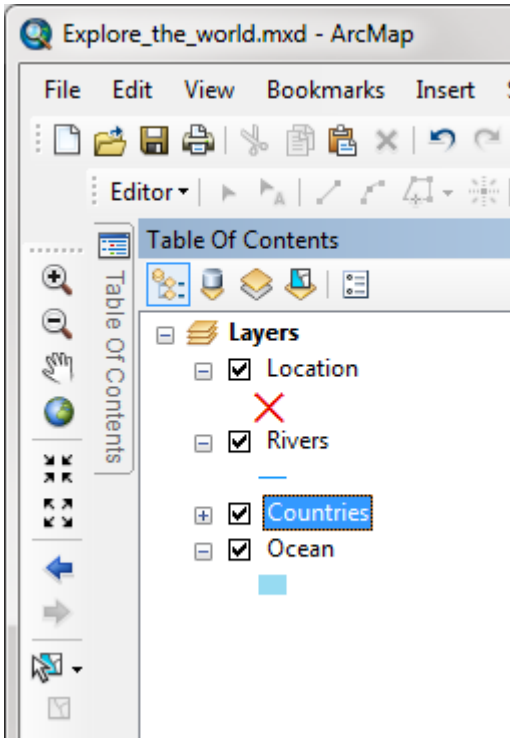
Navigate to the folder you installed the data to \GIS-CLass\Data\BasicClass\BigPicture and double click on the Explore_the_worls.mxd to open the ArcMap project

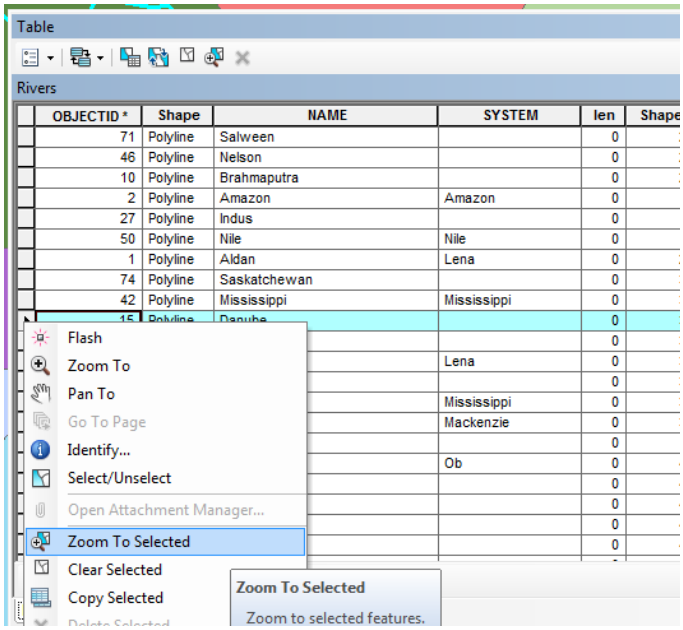
Open the table of contents and examine the data.

How many are selectable?

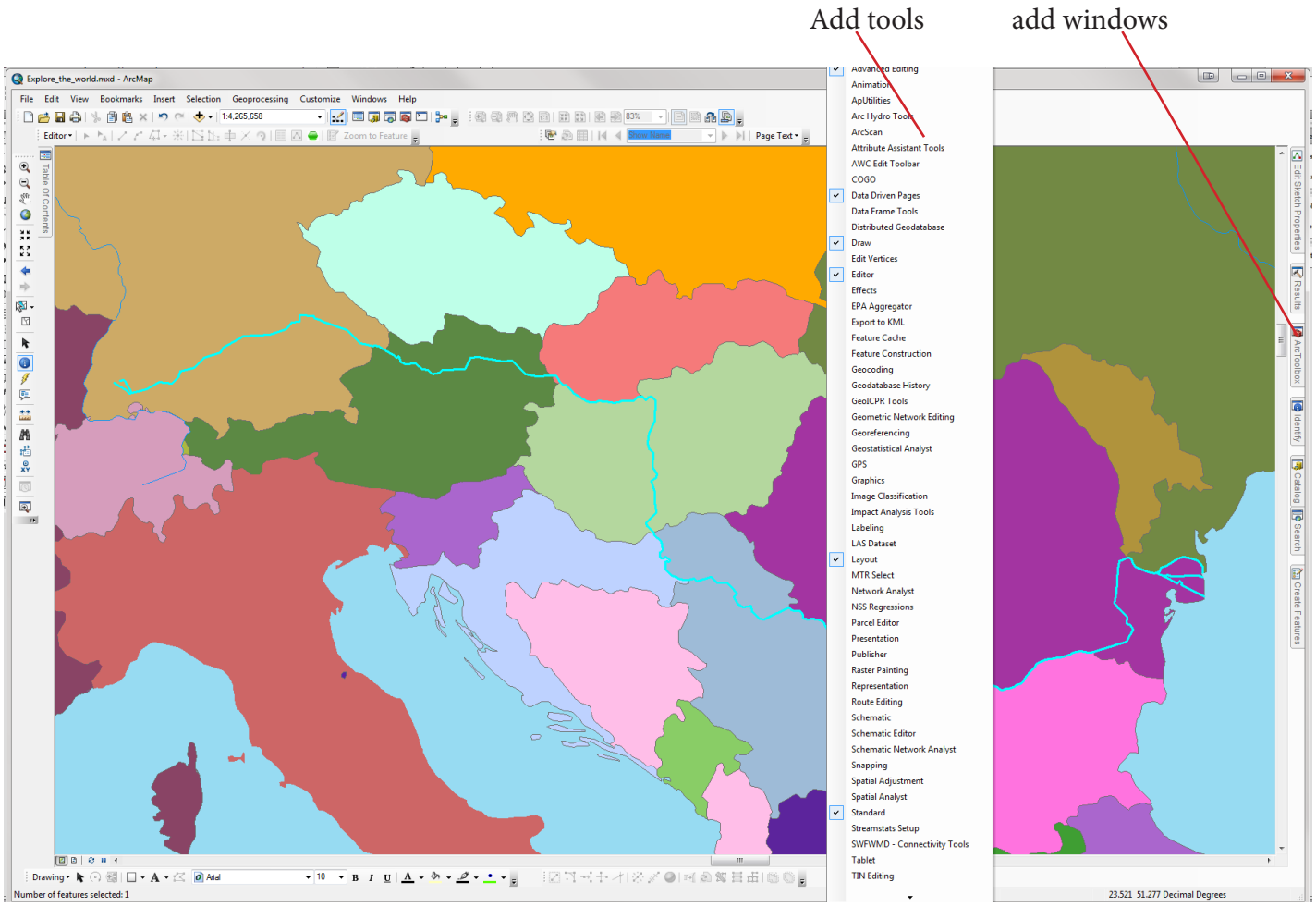
What country is the x on?

Zoom to the Danube River





Add some tool bars and windows to your view, try to arrange them in a functional way, regularly tool bars include: Editor, advanced editing, layout, Draw, and Tools.



Zoom to the previous extent and measure the distance between the tip of Taiwan to the red x

What projection/coordinate system is the data frame in?

Topic: Editing
Problem: Learn how to create and edit points, lines and polygons

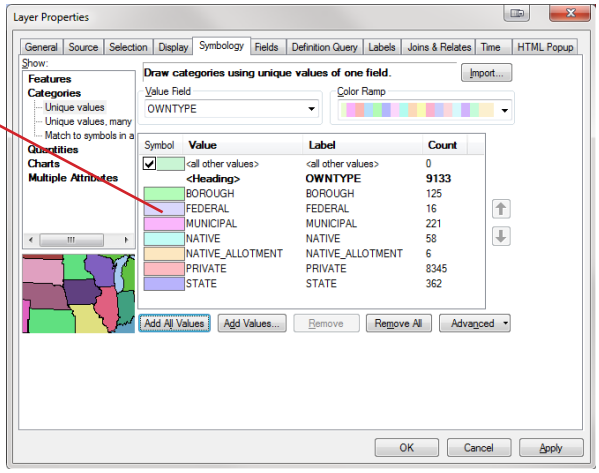
Solution:

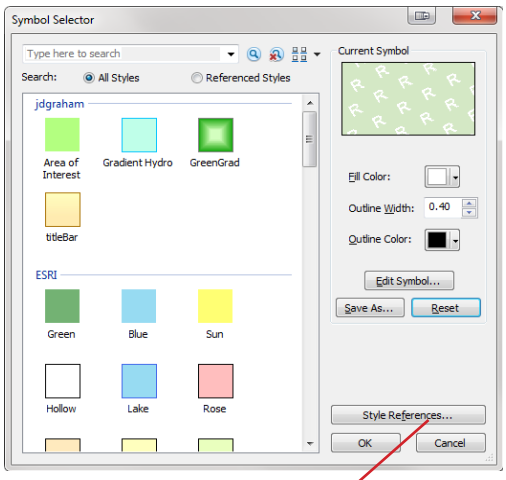
Data used: From Editng.gdb: Roads, Parcels, Facilities_Albers

License: Basic

Open a new arc map and add the Three layers to your map. Save the project as Editing.mxd. Open the layer properties for the parcels layer and go to the **Symbology** tab. Select Categories and in the **Value Field** pull down, select **OWNTYPE** and then on the row of buttons below click **Add All Values**

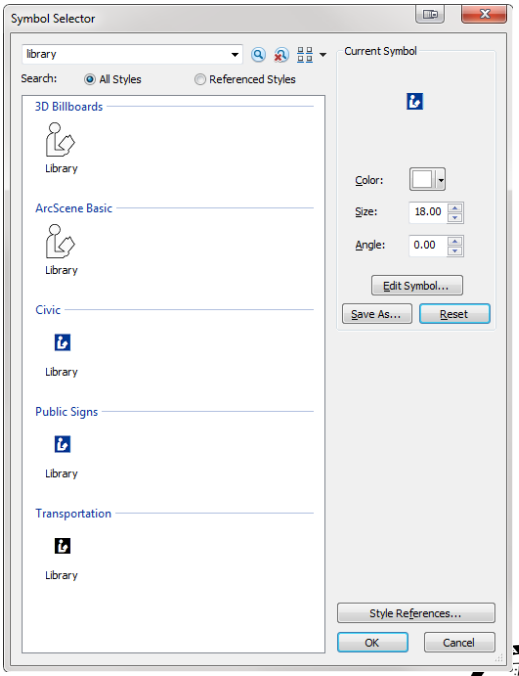
1 Right click on a symbol and select Properties for Selected Symbol, change its color





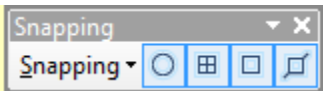
2 Click on Style References and check out some of the other styles available, check the box next to one to bring in.

3 Do the same for the facilities layer, set the value field to Category, select the symbol for Library, In the symbol selector window search for Library and choose a new symbol, Change some of the other symbols



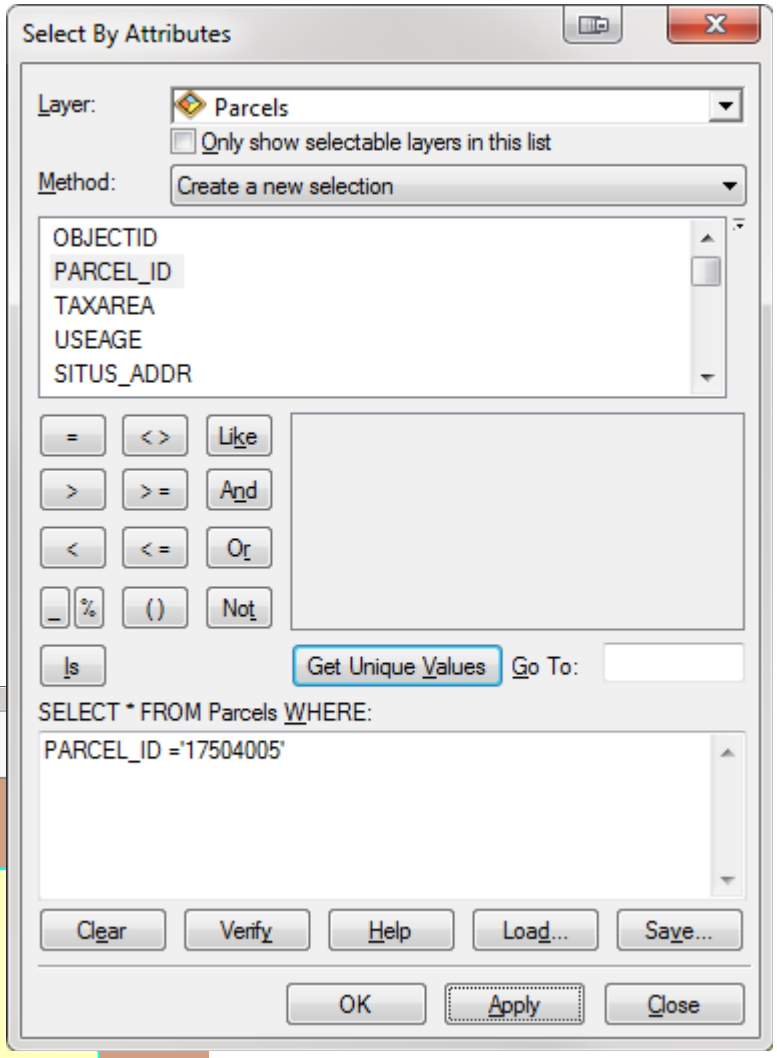
Change the data frame view to **Data View**, find the Edit tool bar
Click on the **Editor** button and select start editing and select the **Parcels** layer

Click on the **Editor** button and select **snapping**, and open the **snapping tool** bar

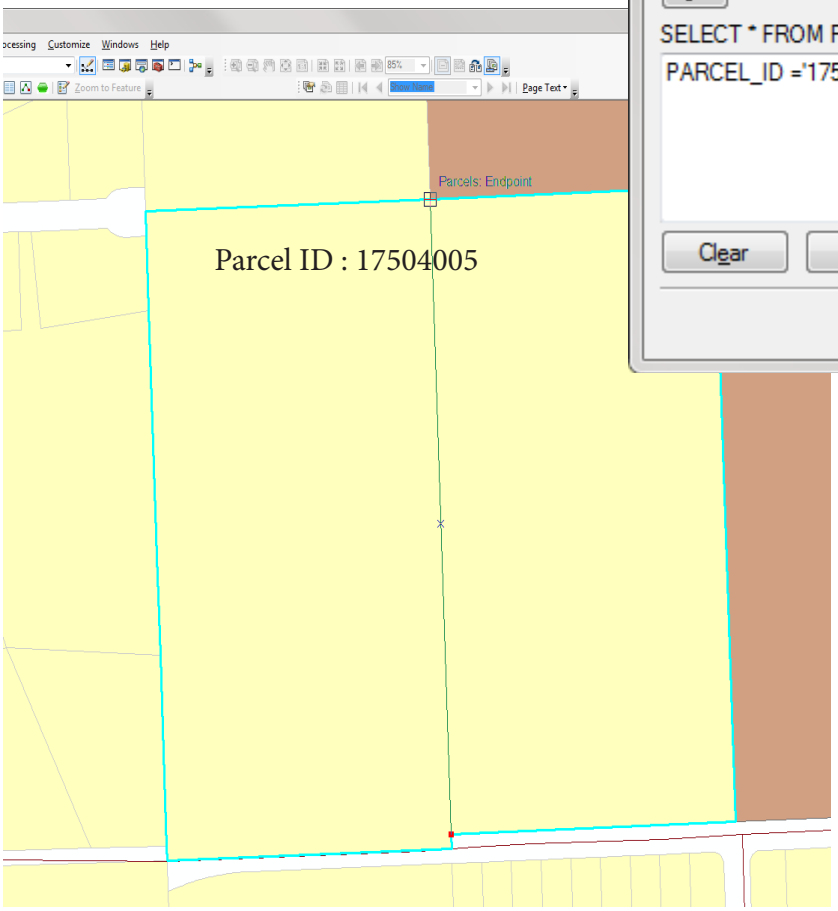


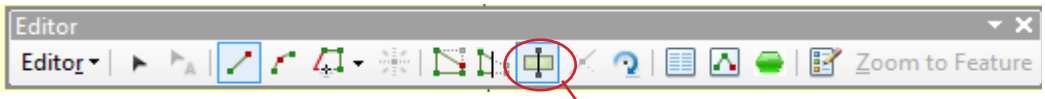
Select all the buttons to enable snapping

On the main toolbar select **Selection** and **Select by attribute** and follow this example

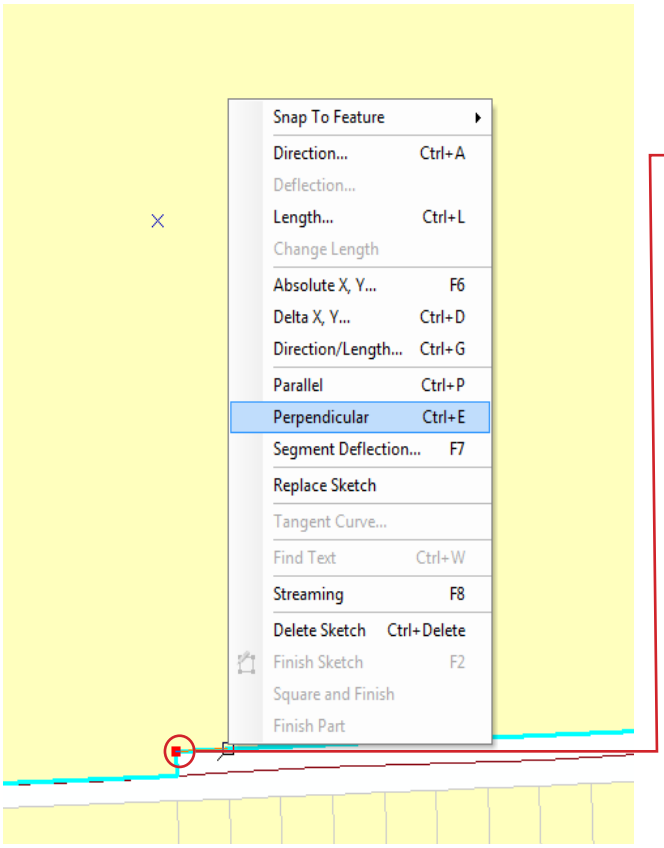


Under **Selection** again, select **zoom to selected**

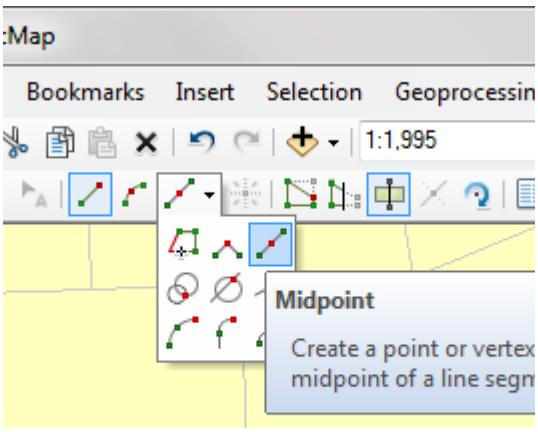


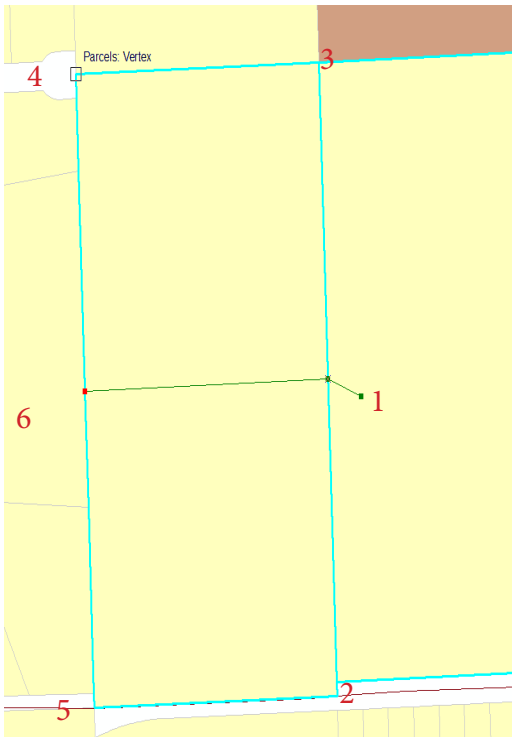


From the Editor tool bar select the Cut Polygon Tool.



We are going to divide this parcel, the first step is to click on the center point on the bottom of the parcel. Follow the line to the right, then right-click and select Perpendicular. Next, double click on the center of the top of the parcels, this will split the parcel in two



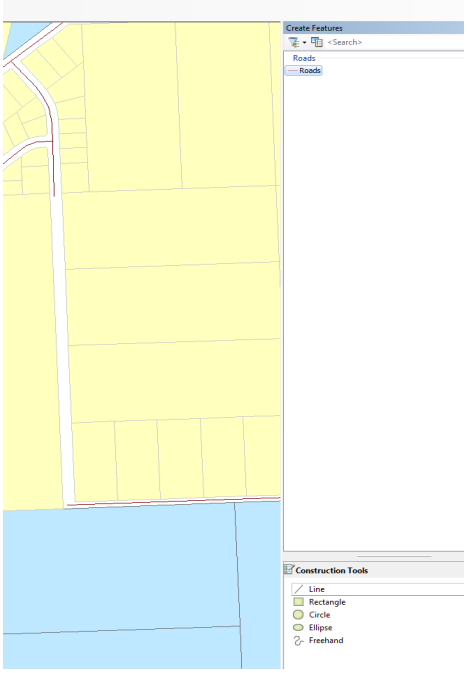


Now we will split in half the parcel on the left. With only that parcel highlighted, select the **split polygon tool** again, click in the space out side of the polygon to the right, then click on the **midpoint tool** as seen above. Now click on the four corners and double click outside of the polygon to the left, as the points are numbered to the left.

Right click on the northern parcel and select **Attributes**, in the **Owner** field, change the name to **John Smith**

Save your edits and stop editing

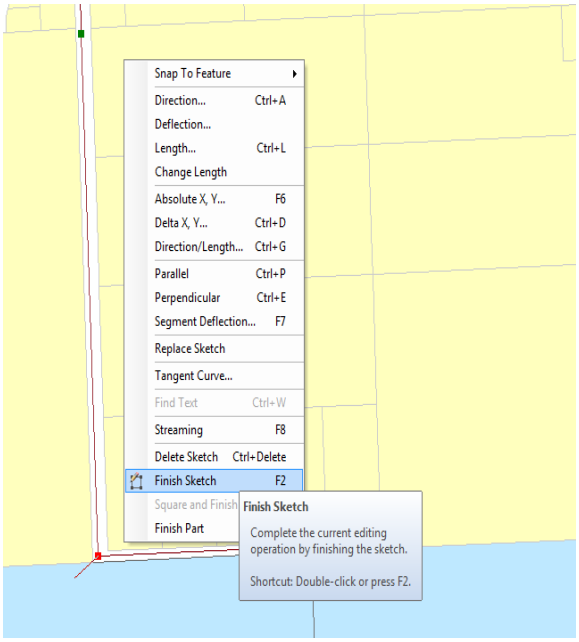
Now find Parcel ID **17903056** the same way as before. Notice a road seems to be missing. We are going to add a new arc here. Start an **Editing** session with the roads layer



Open the **Create Features** window, select the **Roads** layer and then select the **Line** feature below.

Make sure roads are the only selectable layer.

Now snap to the existing road and connect the north section to the south section.



Click on the upper road then the lower road then right click and select finish sketch. To join the two road segments, select the new segment, hold the shift key, and select the segment to the north. Now click on the Editor button and select Merge, this will create one continuous arc. Try adding a few more roads in the area.

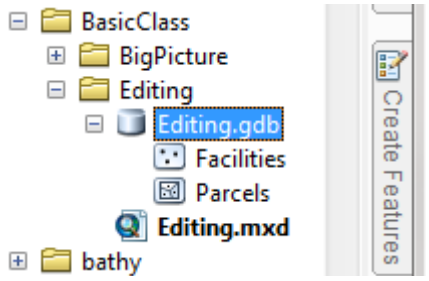
Save your edits and stop editing

Topic: Creating data
Problem: Creating new data and adding it to a database

Solution:

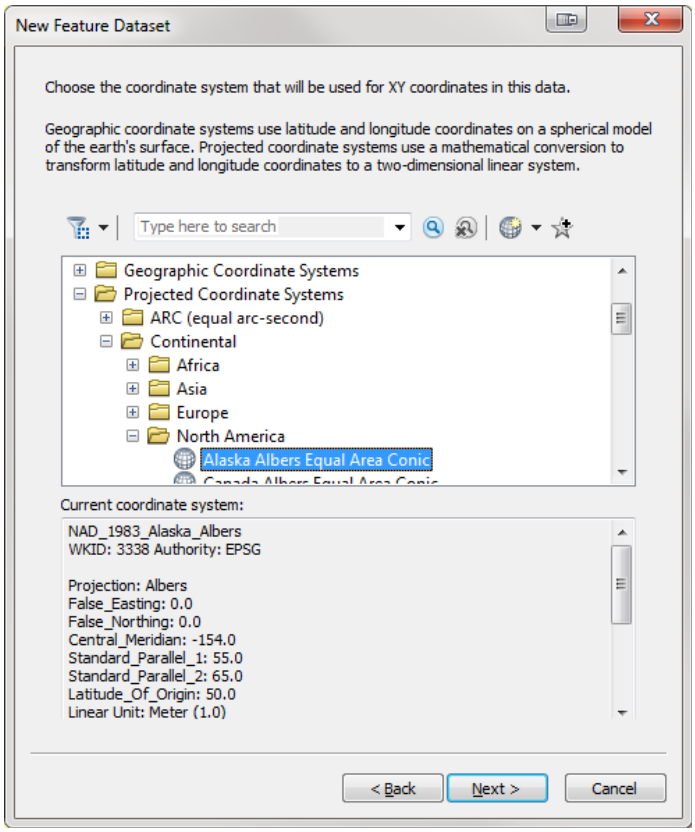
Data used: Parcels,Roads, NHD_Area., Facilities_Albers from Editing.gdb

License: Basic



Open the **ArcCatalog** window in **ArcMap** and locate the **Editing.gdb**

Right-click on the .gdb and select **New/Feature Dataset**. Name it **New_Data** and set the projection to **Alaskan Albers**. Leave the rest as default. Right-Click on the new dataset and add a new **Feature Class**

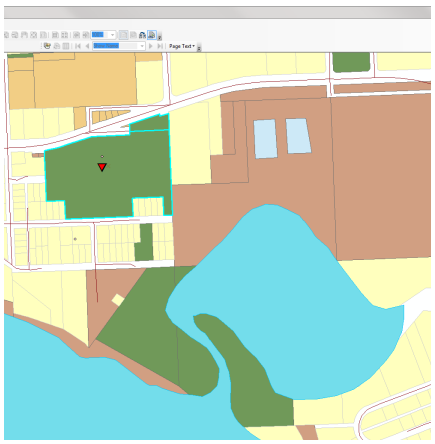


Name the new Feature Class **New_Parcels**, and set type as Polygon, click next. Next then add a new field named **NAME** and set data type to **Text**.

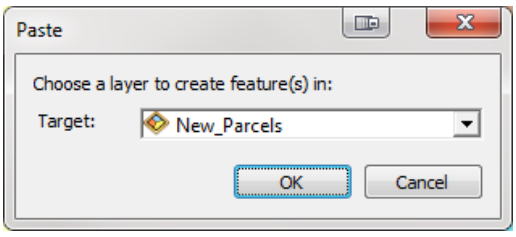
When finished the new layer will automatically come into the open project.

Start an Editing session for **New_Parcels**. Zoom to the Alaska Islands & Ocean visitor center and select the two parcels

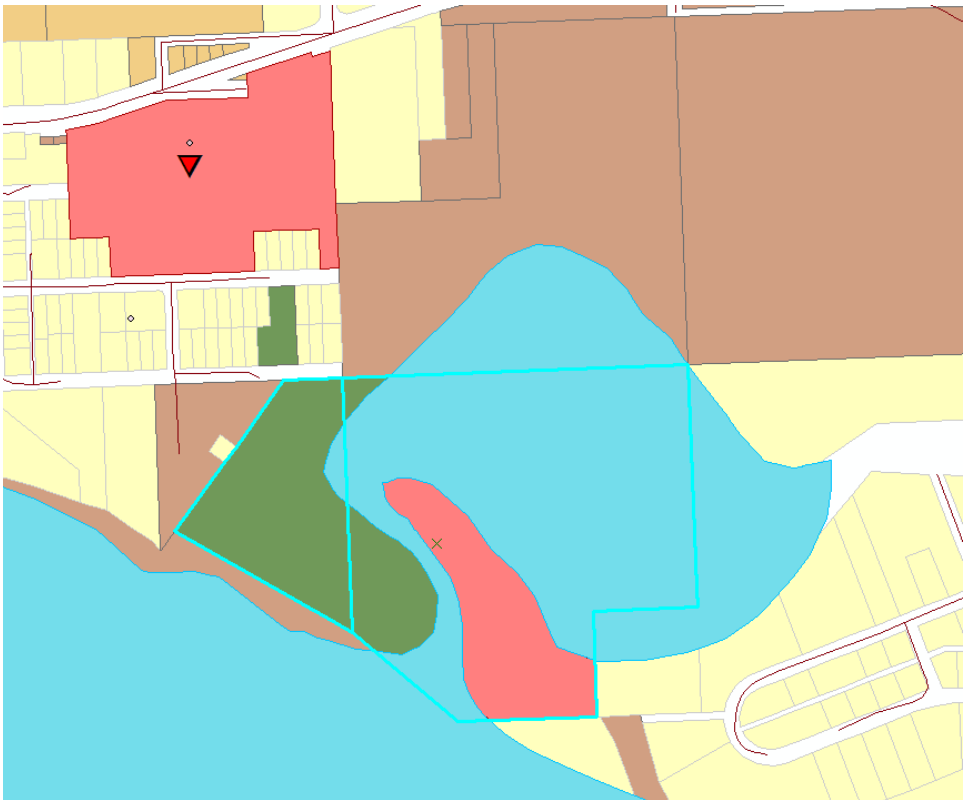
If you dont know where it is, use the facilities layer



Select copy and paste and be sure to select the target as **New_Parcels** then merge the parcels



Trace tool



I want to add this other three parcels associated with the rebut not the portion under the water. For this we will use the trace tool.

Open the **Create Feature** window and select the **New_Parcels** layer, now select on the **Trace** tool. To draw a new parcel click on the edge of the parcel, trace around, then double click when you reach the beginning point. Trace the selected parcels and exclude the hydrography.

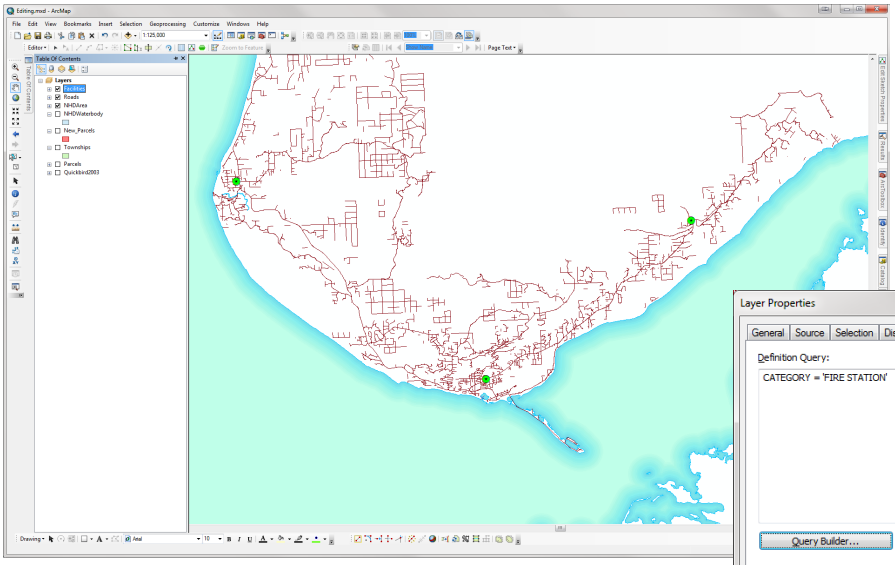
Save and stop editing

Topic: Analysis
Problem: Determining proximity and distribution of fire stations

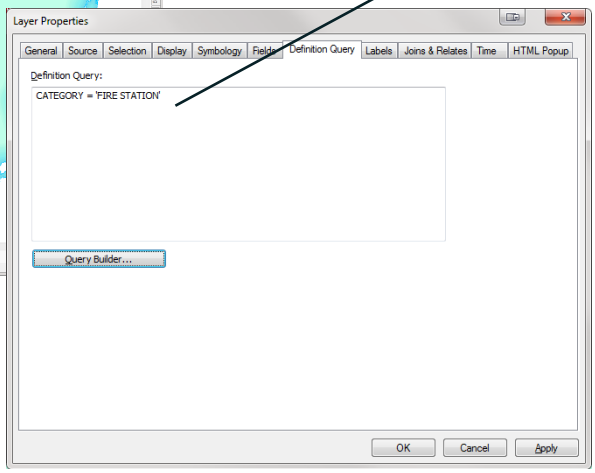
Solution: Buffer and multi buffer

Data used: Facilities, Parcels, Roads, Editing.gdb

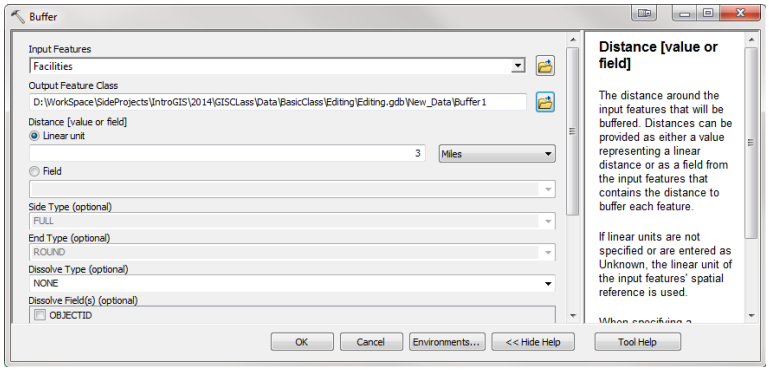
License: Basic



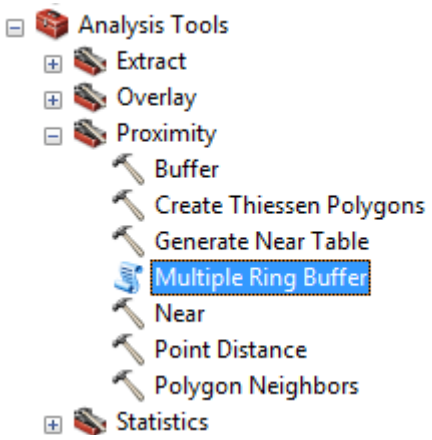
Turn off the **Parcels** layer and zoom to the full extent of the **Facilities** layers. We are only working with the Firestations so use a definition query in the layers properties, as below.



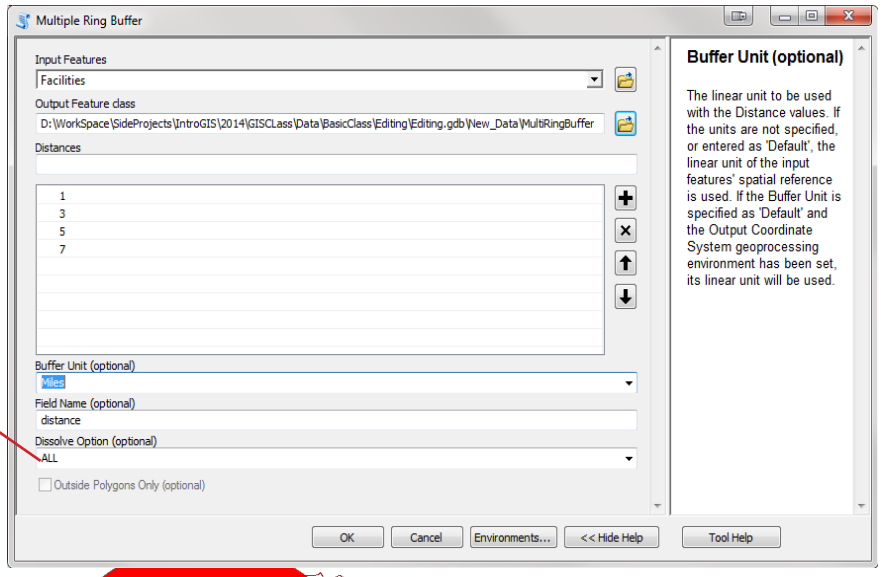
First we will use the geoprocessing tool from the tool bar. Select Geoprocessing from the tool bar then Buffer, use the Facilities layer and be sure to save it to your New_Data dataset, buffer to 3 miles and click OK.



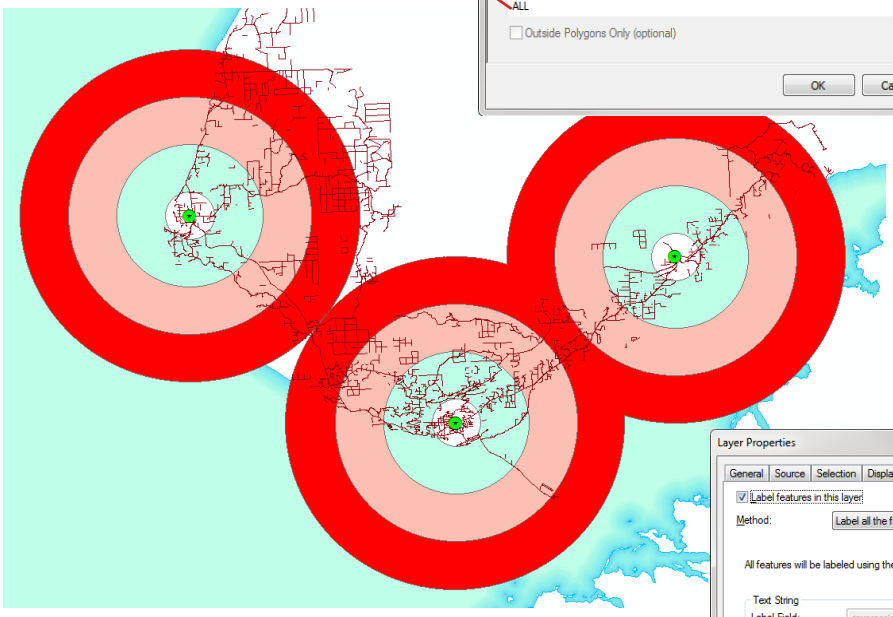
With this analysis we can only see 3 miles out from the Fire station, what if we want to see at more intervals? Create More Buffers?



Now we can use multi ring buffer. Open the **ArcToolbar** window, go to Analysis tools/ Proximity/ Multiple Ring Buffer and enter the wizard as below

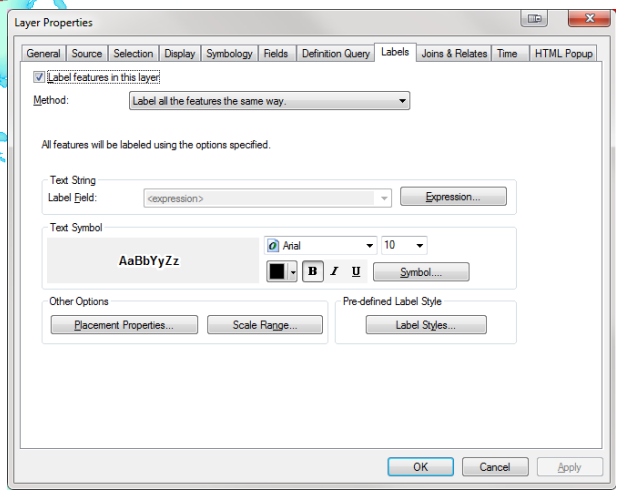


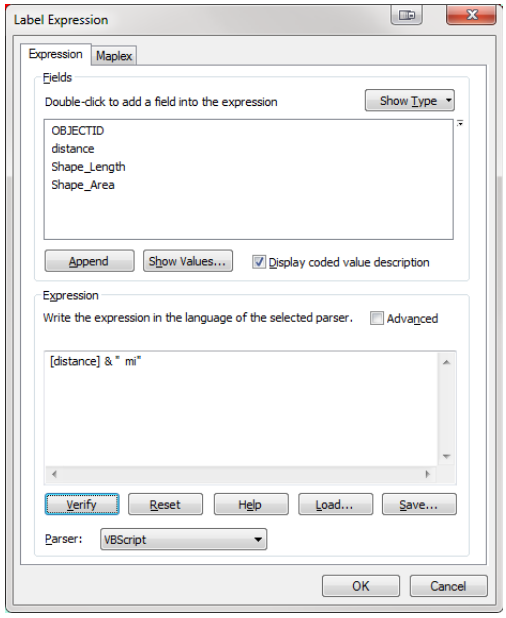
Be sure to select **ALL** rather then **NONE** under dissolve, this will give us rings rather than circles



Multiple rings should give us a better idea for response times of the fire trucks.

To add labels to the rings go to the layer **Properties** window





Under **Labels** select **Expression** and enter as it is on the left. click OK

Make the text and add a white halo so it shows up better. You can find it in Symbol/ Edit Symbol/ Mask

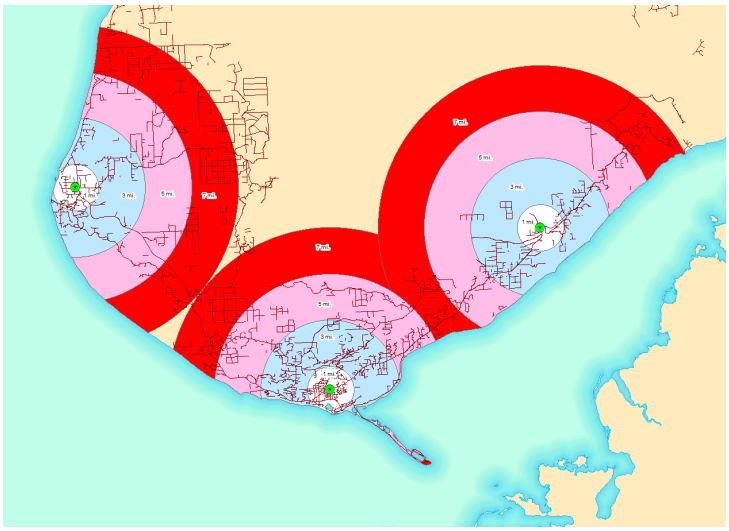
Topic: Clipping
Problem: Sometimes layers over lap and need to be clipped to match the edges

Solution: The Clipping tool will automate this process

Data used: FH_Multi_Buffer, Alaska_Clipped, addressPoints in Editing.gdb

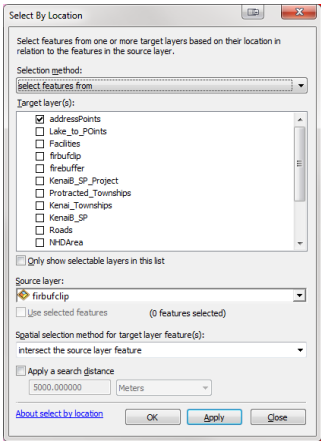
License: Basic

From the **ArcTools** Windows select the **Clip tool**. Follow the wizard to clip the buffer you created to the Alaska_Clipped layer. This will create a new layer, so you will need to remove the old one. Change the symbology and add labels to the new layer

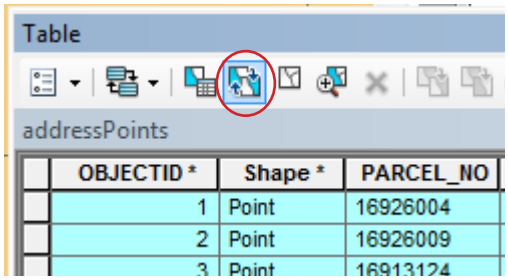


You could accomplish the same task with the erase tool by erasing the NHD_Area from the buffer layer. However, the Erase tool is only available to the Advanced license.

Now with the addressPoints layer on we will try to find the houses that are farthest away. First, we will select the points outside the buffer area using the **Select by Location** window

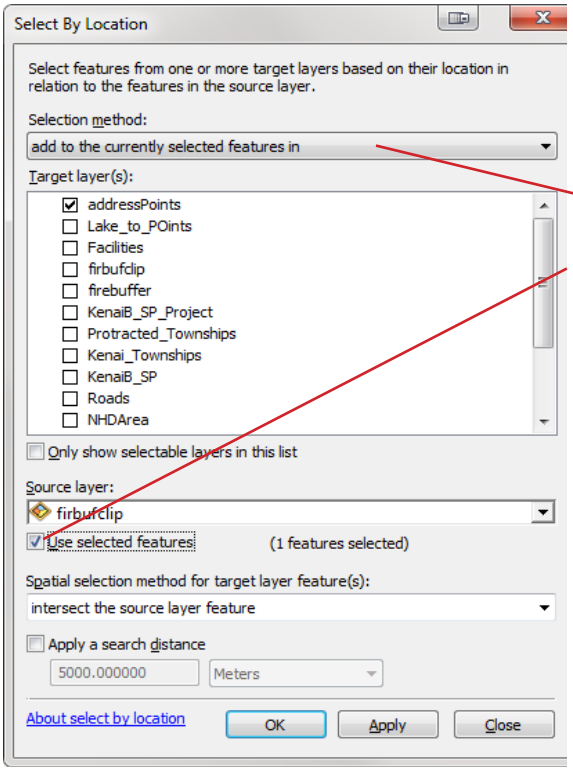


Select from the address-Points layer those points that intersect your clipped buffer layer



Open the attribute table for Addresspts and select the **Switch Selection** button
now just the addressPoints out side the buffered areas should be selected.

Next, use the **Select Features** tool and select the 7 mile ring of the buffer layer. Be sure to hold down the **Shift key** or you will lose your other selection.

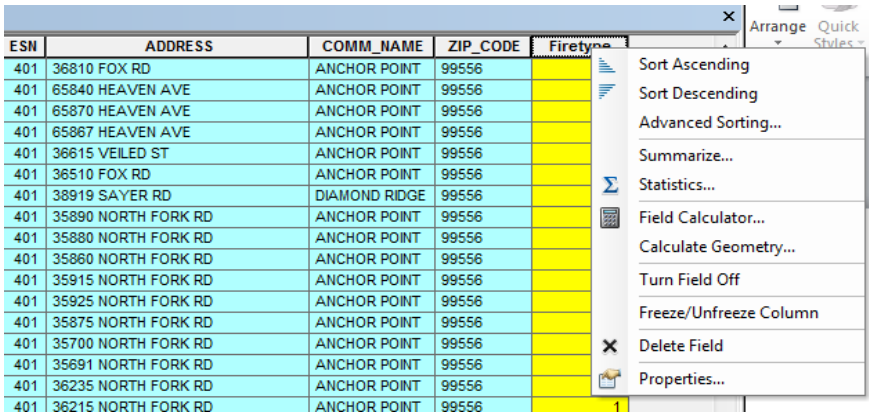


Now go back to the **Select by Location** and perform the same selection except:

select **Add to the selections**

and select **Use Selected features**

In the attribute table change the view to see only the selected records. Add a new field and call it FireType, type = short integer. and use the **Field Calculator** to set the selected records to 1.



Topic: Finding anadromous water bodies
Problem: Sorting through the data to find what you need

Solution: Using various methods to select out and manipulate wanted data

Data used: SwtPoints, SwtArcs, NHD_Lakes, StudyArea From AWCClass.gdb

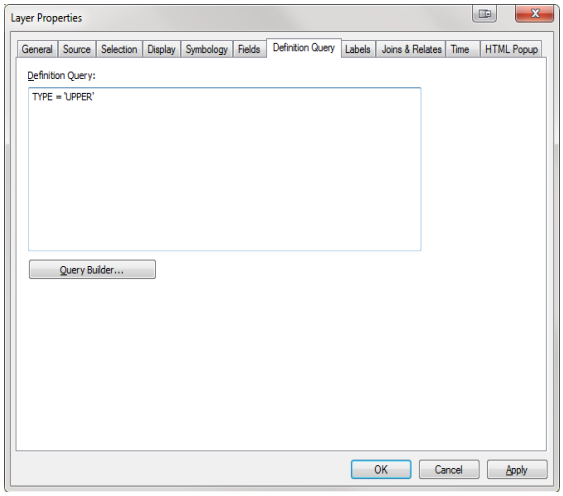
License: Basic

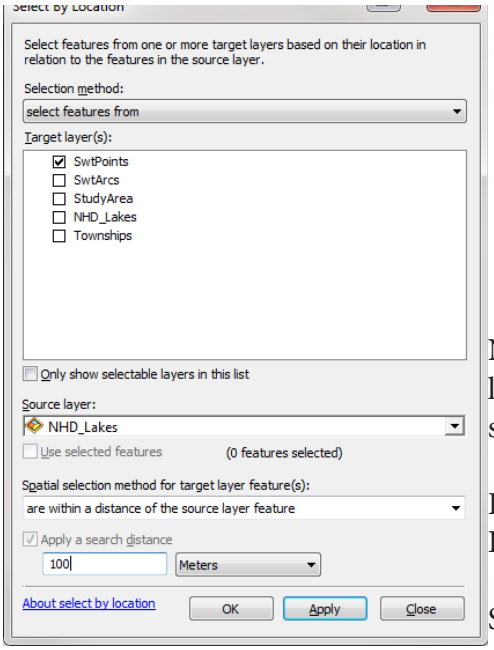
Start a new project and add the listed layers. Examine the data , SwtPoints and SwtArcs are layers from the Anadromous Waters Catalog(AWC) for a portion of the Southwest region. The arcs are the portions of stream with known anadromous fish, the points indicate the upper and lower extents as well as mid points that depict life stage changes.

NHD_Lakes is a clipped portion from the National Hydrographic Dataset(NHD), the hydrographic standard used by the department. The Study area is clipped from the Hydrographic Units , a part of NHD that depicts watershed boundaries.

For this project we are tasked with investigating lakes to possibly add to the AWC catalog.

We want to find lakes that are connected to anadromous streams and create a GPS point for the mouth of each lake. Create a definition query on the SWTPoints layer. Open the layer properties and navigate to the Definition query tab, use the SQL statement **TYPE = 'UPPER'** Also create one for NHD_Lakes, use the SQL statement **Shape_Area > 0.00005**





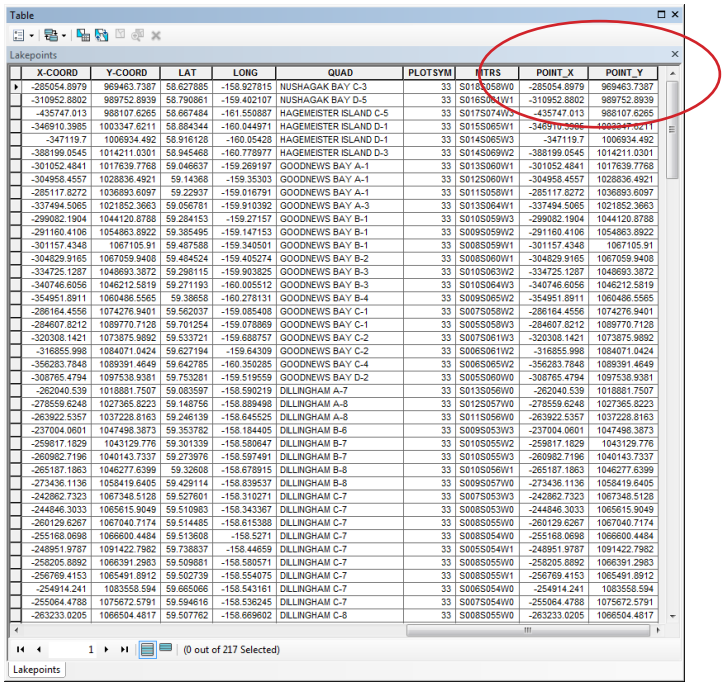
Now use the **Select by Location** window to Select from the SWT_Points layer that are within distance of the source layer and apply a 100 meter search distance, how many more lakes did that add?

Right-click on the SWTPoints layer in the TOC and select Data / Export Data.

Save it to your AWCClass.gdb and turn off the NHD_Lakes layer.

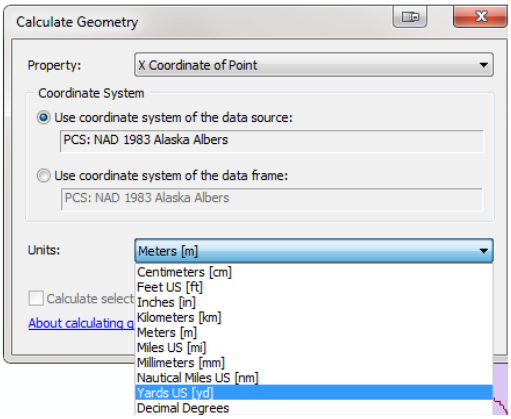
Now, for our operations plan we are going to need a lat. long of where to start investigating each lake. Most likely that should be the outlet of the lakes, the lowest point.

For the first one we will use geoprocessing tools.
Under data management tools/ Features, find **Add X/Y coordinates**. Run the tool for your lake points layer, then open the attribute table



Now you can see two new columns, they are in meters but we prefer to use Decimal Degrees(DD)

Right click on the X and Y fields and select calculate geometry and select Decimal Degrees in the drop down box



Now all the points should have a lat. long in decimal degrees

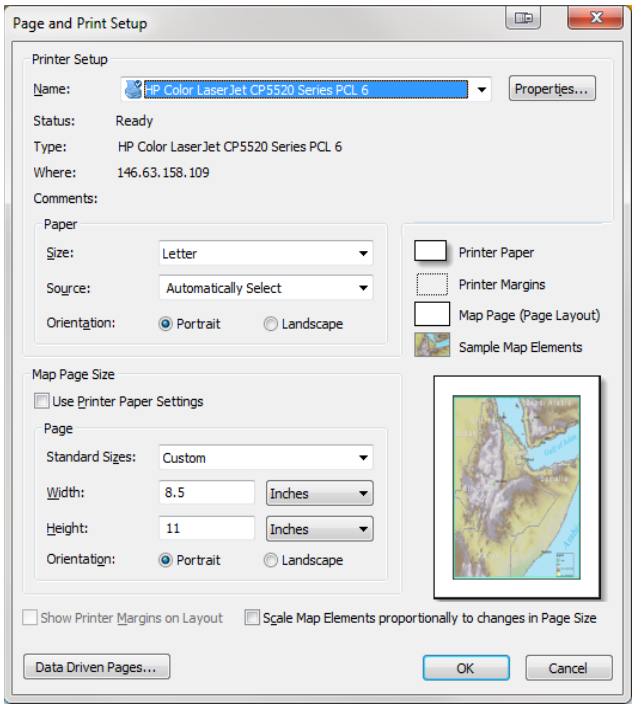
MTRS	POINT_X	POINT_Y
S018S058W0	-158.927815	58.627885
S016S061W1	-159.402107	58.790861
S017S074W3	-161.550887	58.667484
S015S065W1	-160.044971	58.884344
S014S065W3	-160.05428	58.916128
S014S069W2	-160.778977	58.945468
S013S060W1	-159.269197	59.046637
S012S060W1	-159.35303	59.14368
S011S058W1	-159.016791	59.22937
S013S064W1	-159.910392	59.056781
S010S059W3	-159.27157	59.284153
S009S059W2	-159.147153	59.385495
S008S059W1	-159.340501	59.487588
S008S060W1	-159.405274	59.484524

Topic: Layout View
Problem: Exploring the Layout view

Solution:

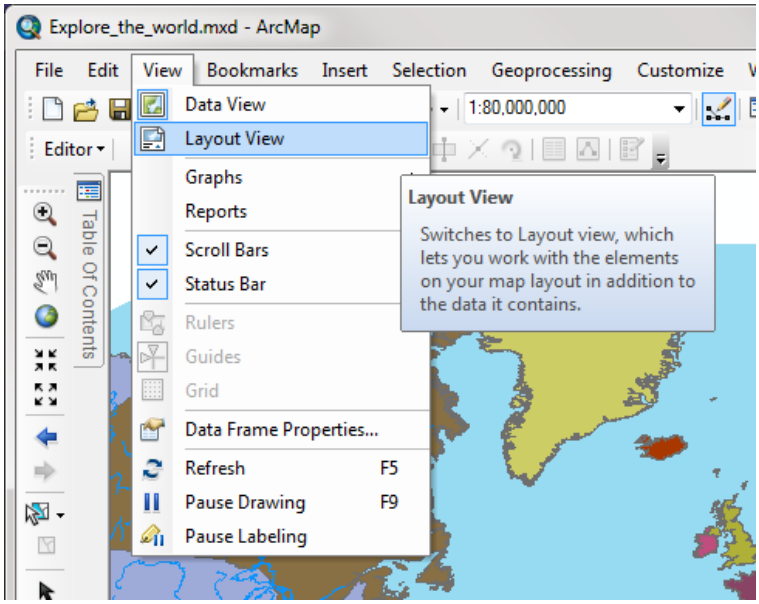
Data used:

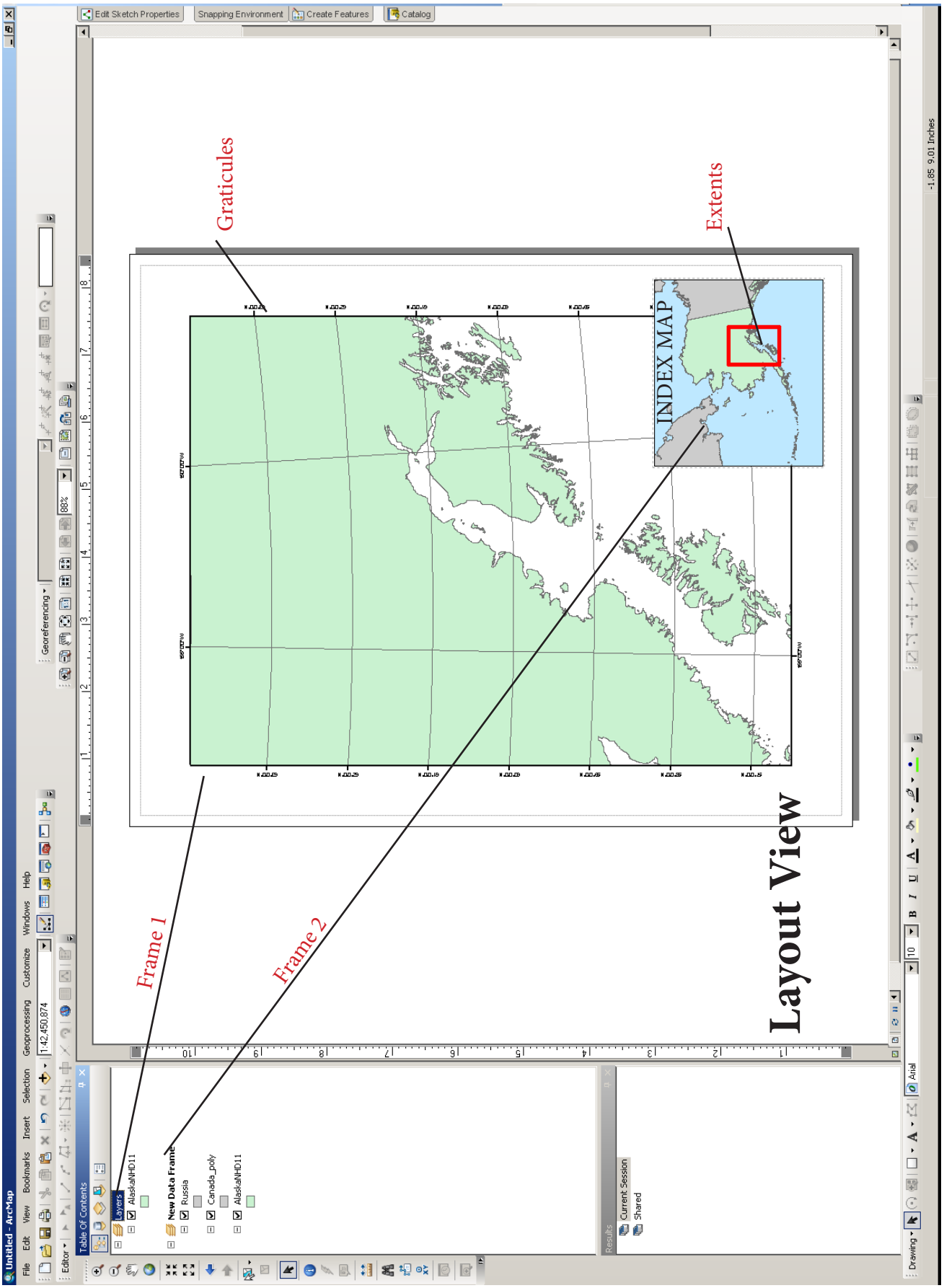
License: Basic



On the standard tool bar, click on **File** then select **Page and Print Setup**. If you are creating a map to be printed, this is where you set the size and orientation of the page

On the same tool bar, click on View then select Layout

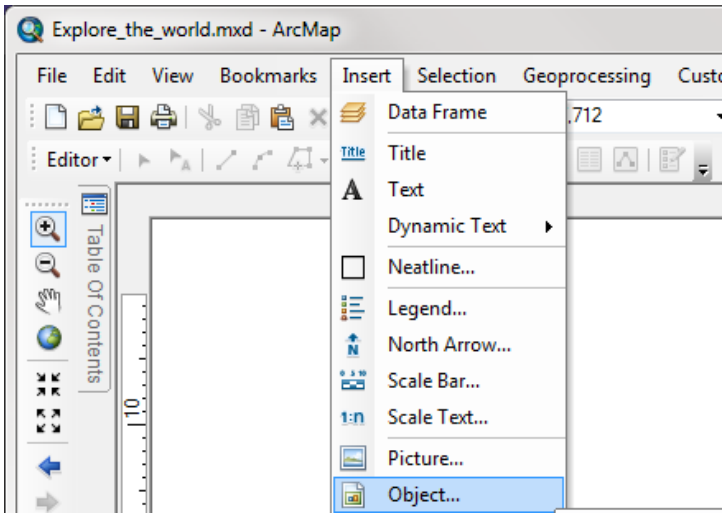



Graticules
Extents
INDEX MAP
Frame 1
Frame 2
Layout View

Insert elements in the layout view

The **Insert** tab on the standard tool bar give you the option to add the basic elements of a map to your layout.

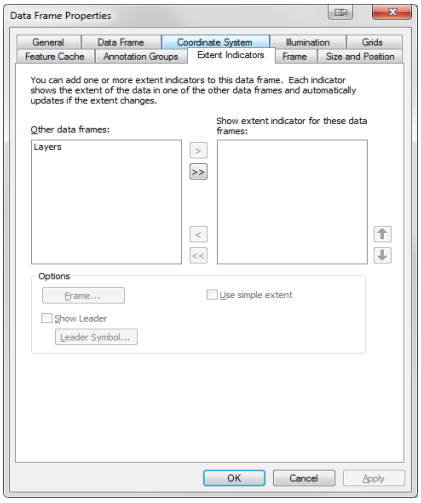
Title
Legend
Scale bar
North Arrow
Etc.

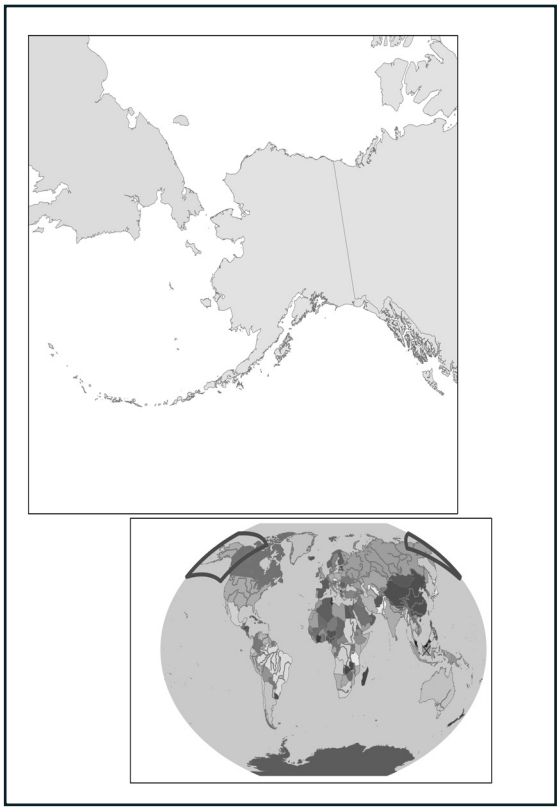


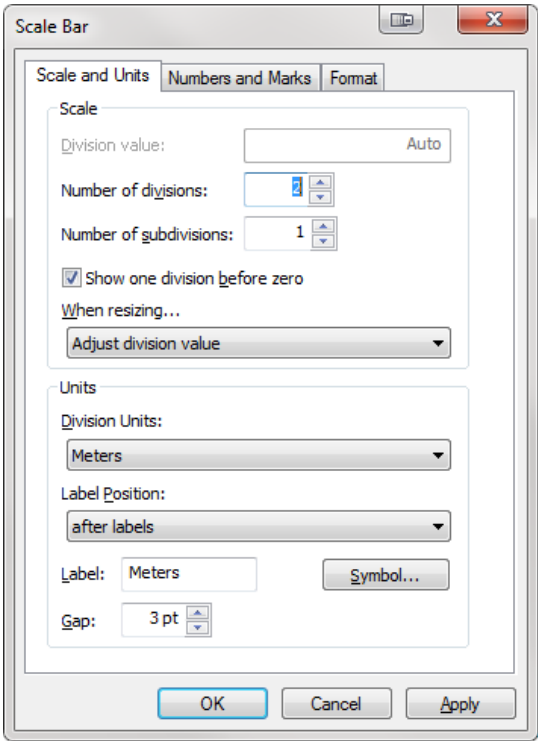
An index map can be created by inserting a second data frame. The new data frame can have a different extent and coordinate system.

In the Extent Indicators tab in the data frame properties window, you can connect the two data frames in order to see the extent of one in the other.

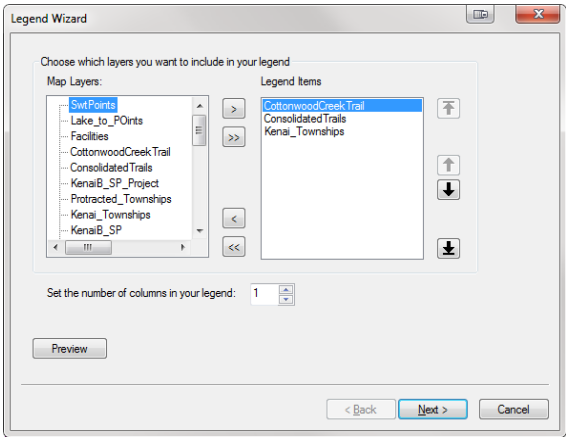
Close the project don't save







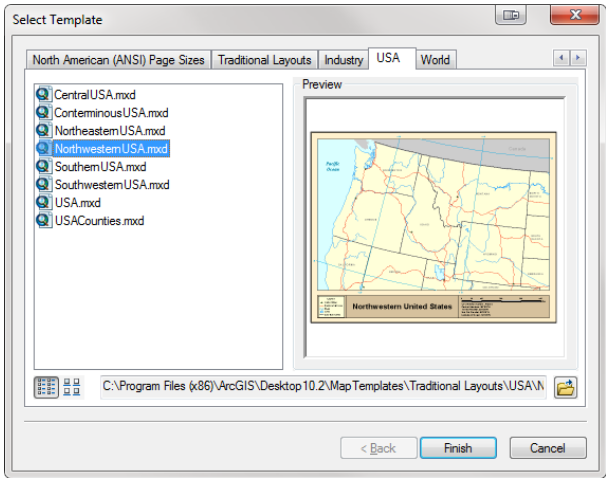
All of the Elements have Wizards that allow you to customize them.



The layout tool bar only works in Layout view

Navigation tools

change the focus to the data frame
So that you can edit in layout view



You can also use templates to easily create an organized layout

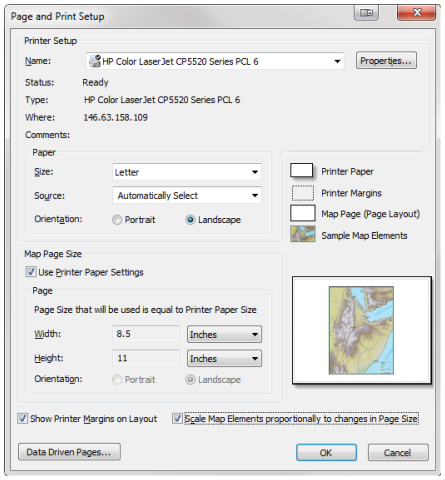
Topic: Layout: make a map
Problem:

Solution: Once you have all your data looking the way you want, switch to layout view to make a final product. The map can then be saved into various digital formats or be printed

Data used: Facilities, Parcels_Albers, Roads , FH_Multi_Buffer, Alaska_Clipped, NHDArea, SwtArcs, NHD-Waterbody

License:

Basic



Start a new project with the data listed above.

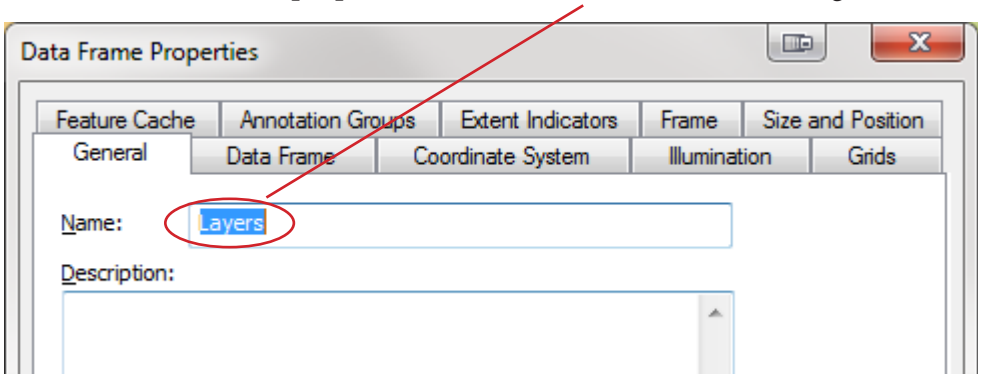
Open the File/ Page and printer setup

Change the layout to landscape

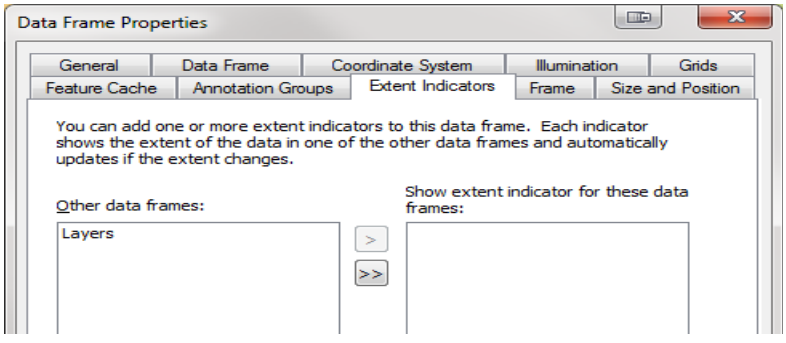
Insert the map elements(scale bar, North Arrow, Title) and a new Data frame

Add the Alaska layer to the new data frame

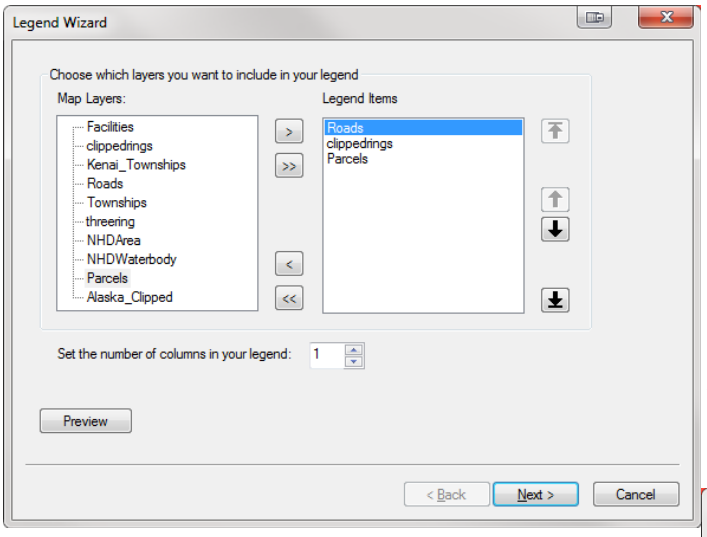
Go into the properties of the new data frame and change the name to “Inset”



Next, go to the **Extent Indicator** tab and move the Layers data frame into the box on the right. You can keep the defaults or go into the **Options** button and change the extents appearance.

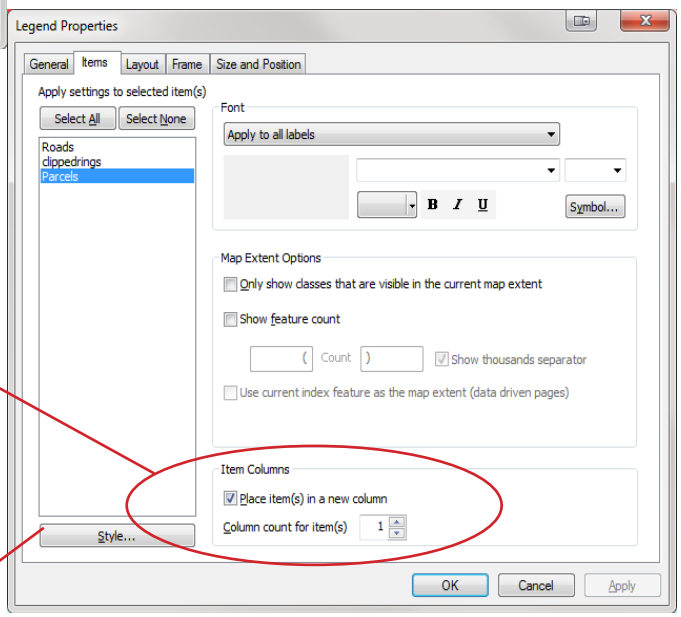


With the original data frame activated, insert the legend. Just include the Clipped rings layer, the parcels and the roads

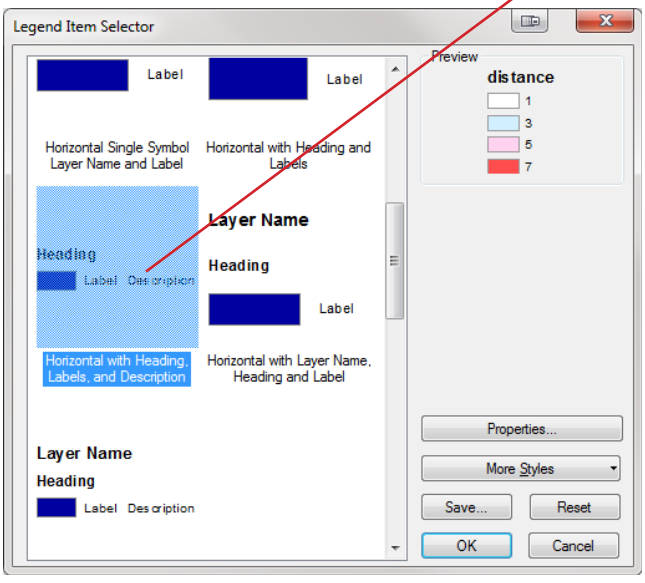


Follow the wizard and add a border and background. Finish the wizard and look at the legend.. Changes made in the table of contents will reflect in the legend unless you convert it into graphics

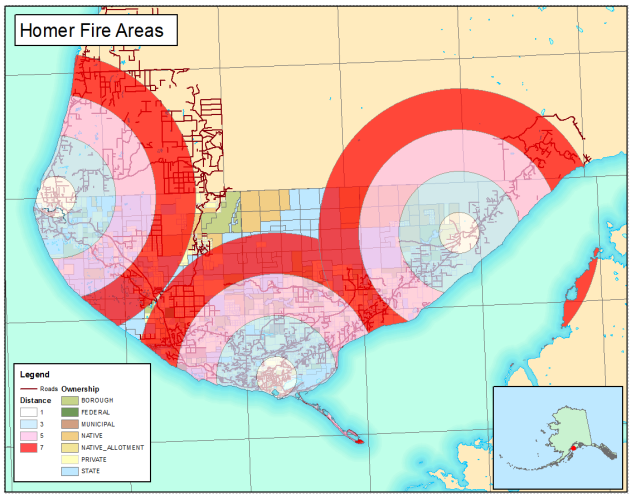
Double click on the legend to open it's properties. Go to the Items tab select the parcels layer and place it in a second column



Next, for the clipped rings and parcel layers change the style to Heading



How does your map look?



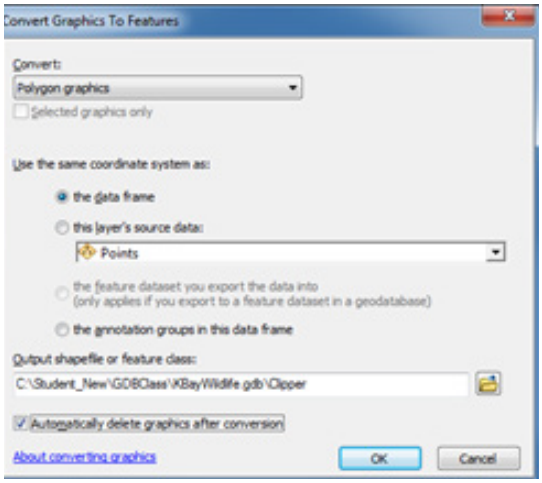
Topic: Converting graphics into Feature Classes
Problem: Clipping Data

Solution:

Data used: \BasicClass\Editing\Editing.gdb Parcels

License: Basic

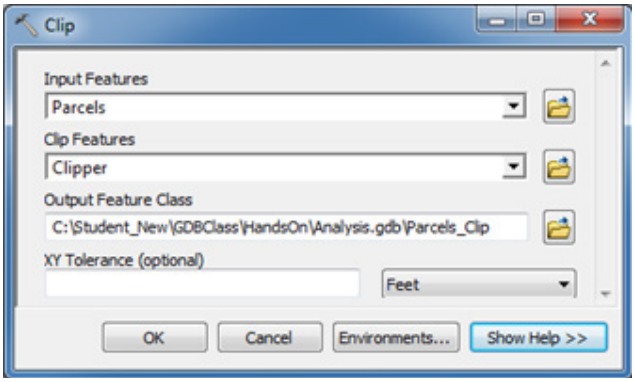
Polygons: Will create a polygon to use as a clipping feature



1. Add Parcels layer to ArcMap. With the Rectangle tool from the Draw toolbar draw a rectangle smaller that the Parcels area.

2. To convert the graphic into a feature, right-click the Data Frame name in the TOC & select "convert Graphics to Features". Name the new feature Clipper. Also, check the "Automatically delet graphics after conversion" box at bottom. Add to map.

3. Got to Geoprocessing tab on the menu & choose Clip. Add Parcels as Input Feature and Clipper as Clip Features. Then OK. You've created your own custom clipping shape.

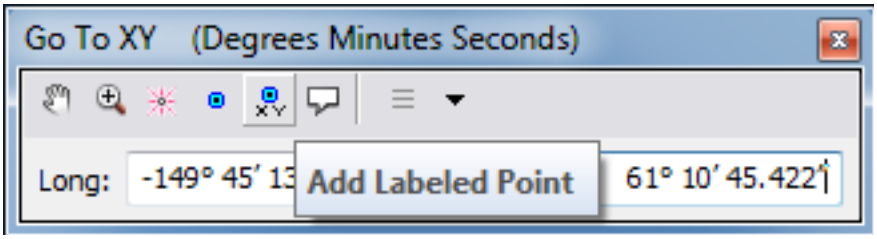


Points: Will add points and coordinates to label on a map

1. Using **GO TO XY** tool – You can type in an XY coordinates to locate them; then make coordinates into a feature class.

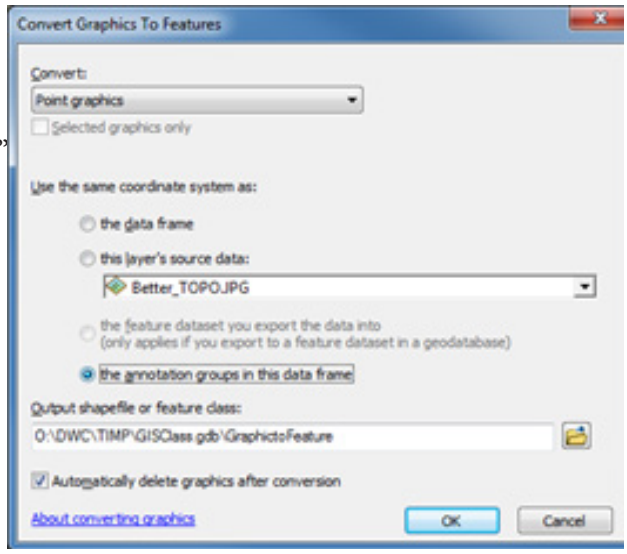
2. Type in the following coordinates: (can usually drop the °, ‘, “ signs & uses spaces)

a. 61° 10’ 45.422”, -149° 45’ 13.384”
b. 61° 08’ 14.793”, -149° 47’ 22.596”
c. 61° 08’ 28.468”, -149° 44’ 37.016”



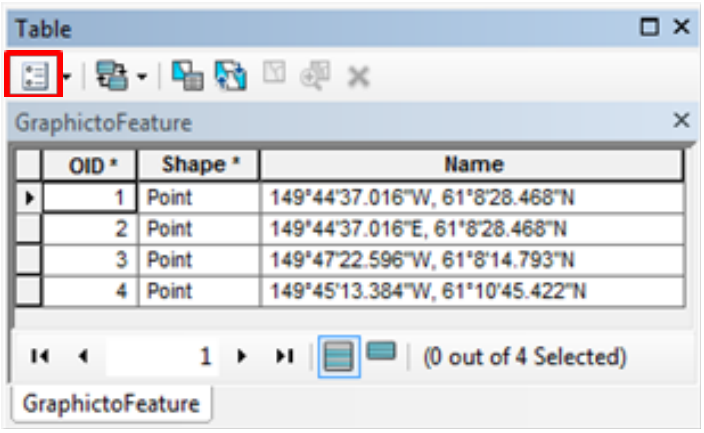
3. If properly entered, points should appea
r on screen in position. These are only a graphic.

4. To convert the graphics into a feature, right-click the Data Frame name and select “Convert Graphics to Features”

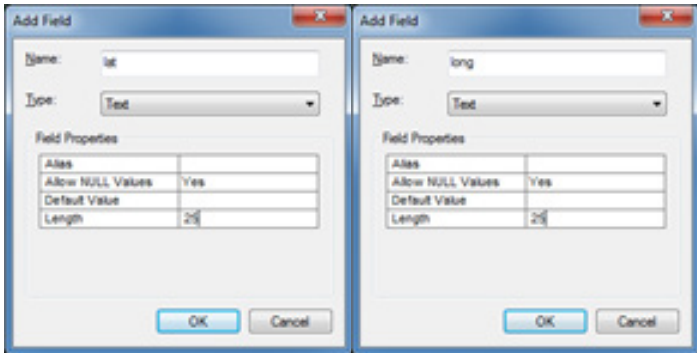


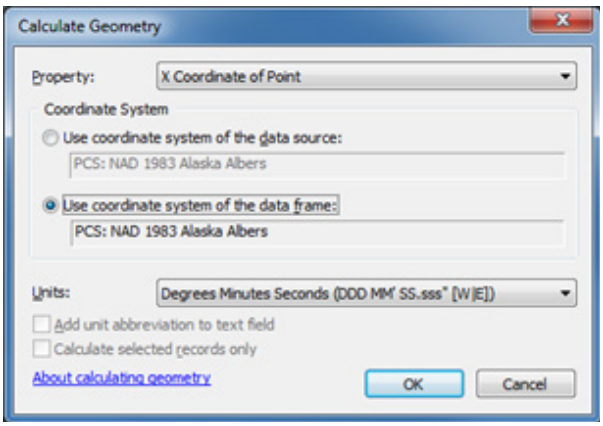
5. Can save as shapefile or into a geodatabase and add to map.

6. Open the new feature’s table. You’ll see the coordinates aren’t user-friendly for labeling/manipulation



a. Click **Table Options** icon & choose **Add Field**; fill in as below; one **lat**, one l**ong**





7. Right-click on the column header, choose **Calculate Geometry**…

Turn on labels for this layer and use the new lat & long to lable points, if desired.

Data Sources

http://www.asgdc.state.ak.us/

http://www.alaskamapped.org/

http://nationalmap.gov/

http://nhd.usgs.gov/data.html

http://www2.borough.kenai.ak.us/GISDept/

https://github.com/

http://gis.stackexchange.com/questions

Resources
http://www.esri.com/training/main

esri
http://www.esri.com/

ArcGIS Desktop Free Trial
Http://www.esri.com/software/arcgis/arcgis-for-desktop/free-trial