

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



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







General eature Cache	Data Frame Annotation	Groups	dinate (Extent	Bystem	Illuminati Frame	on Size	Grids and Position
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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.

Layer Properties	×					
General Source Selection	on Display Symbology Fields Definition Query Labels Joins & Relates Time HTML Popup Draw all features using the same symbol.					
Categories Quantities Charts Multiple Attributes	Symbol Advanced •					
Multiple Attributes Legend Label appearing next to the symbol in table of contents: Description Additional description appearing next to the symbol in your map's legend						
	OK Cancel Apply					

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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.

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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	
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17	Polyline	Dauphin		0	9.4873	
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Add Basemaps





Arrange tool bars and windows



Tool bars can be free floating or docked on any side of the data frame

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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

- 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

4 Access the metadata by

description tab.

catalog tree and select the

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



ArcToolbox

+

🛐 ArcToolbox

💱 3D Analyst Tools



ArcCatalog		
ቭ ArcCatalog - Toolboxes		
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 Interoperability Connections 		
🗉 🚺 Tracking Connections		
🕂 🎇 Workflow Manager Databases		

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

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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**





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

Editor Editor -	👻 💌 🔝 📥 📴 Zoom to Feature
Click on the Editor button and select snapping , and open the snapping tool bar	Select By Attributes
Snapping ▼ × Snapping ▼ ○ 田 □ □	Layer: Parcels Only show selectable layers in this list Mathedu
Select all the buttons to enable snapping	OBJECTID PARCEL_ID TAXAREA USEAGE SITUS_ADDR
On the main toolbar select Selection and Select by attribute and follow this example	$= \langle \rangle \underline{lke} \rangle \rangle = \underline{And} \langle \langle = \underline{Or} \rangle \rangle$
Under Selection again, select zoom to selected	Is Get Unique Values Go To:
scesing Customice Windows Help ✓ 🗶 🗇 🕼 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🔅 📄 H 🔅 🖗 🖗 🔊 V 📄 🖗 🖗 🖉 V V V V V V V V V V V V V V V V V V V	SELECT * FROM Parcels <u>W</u> HERE: PARCEL_ID ='17504005'
Parcel ID : 17504005	Clear Verify Help Load Save OK Apply Close

Editor - | 🕨 🛌 | 🖊 🐔 🖧 - 🎼 | 🖾 🎠 🛑 🔨 💁 | 🧾 🛆 👄 | 📝 Zoom to Feature



Editor

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



Make sure roads are the only selectable layer.

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

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

Now snap to the existing road and connect the

	Snap To Feature	•		
	Direction	Ctrl+A		
	Deflection			
	Length	Ctrl+L		
	Change Length			
	Absolute X, Y	F6		
	Delta X, Y	Ctrl+D		
	Direction/Length.	Ctrl+G		
	Parallel	Ctrl+P		
	Perpendicular	Ctrl+E		
	Segment Deflection	on F7		
	Replace Sketch			
	Tangent Curve			
	Find Text	Ctrl+W		
	Streaming	F8		
	Delete Sketch C	trl+Delete		
们	Finish Sketch	F2		
	Square and Finish	Finish Sketc	n	
	Finish Part	Complete t	he current ed	liting
		operation b	y finishing th	ie sketch.
		Shortcut: D	ouble-click o	r press F2.

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

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**

Choose the coordinate system that will be used for XY coordinates in this data.

transform latitude and longitude coordinates to a two-dimensional linear system.

Canada Albers Equal Area Co

Geographic coordinate systems use latitude and longitude coordinates on a spherical model of the earth's surface. Projected coordinate systems use a mathematical conversion to

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Cancel

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

New Feature Dataset

Type here to search

Current coordinate system:

NAD_1983_Alaska_Albers WKID: 3338 Authority: EPSG

Projection: Albers False_Easting: 0.0

False_Northing: 0.0 Central_Meridian: -154.0 Standard_Parallel_1: 55.0 Standard_Parallel_2: 65.0 Latitude_Of_Origin: 50.0 Linear Unit: Meter (1.0)

🗉 🚞 Geographic Coordinate Systems

Projected Coordinate Systems

North America

 Image: Construction of the second s

Paste	
Choose a la	ayer to create feature(s) in:
Target:	🗞 New_Parcels 📃
	OK Cancel

Next >

< <u>B</u>ack





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

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



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Facilities		- 🖻	liciuj
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D: \WorkSpace \SideProjects \IntroGIS \2014 \GISCLass \	Data\BasicClass\Editing\Editing.gdb\New_Data\Buffer I	· 🖻 📋	input features that will be
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ide Type (optional)			buffer each feature.
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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?





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





Table Image: Second sec	Open the attribute table for Addresspts and select the Switch Selection button now just the addressPoints out side the buffered areas should be selected.
Select By Location	buffer layer. Be sure to hold down the Shift key or you will lose your other selection.
relation to the features in the source layer. Selection method: add to the currently selected features in Taroet layer(s):	Now go back to the Select by Location and perform the same selection except:
	select Add to the selections and select Use Selected features
Protracted_IoWnships Kenail_SP Roads NHDArea Qnly show selectable layers in this list	
Source layer: firbut Clip Use selected features (1 features selected) Spatial selection method for target layer feature(s): intersect the source layer feature	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.
Apply a search distance 5000.00000 Meters About select by location OK Apply Glose	

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401	65867 HEAVEN AVE	ANCHOR POINT	99556			Advanced Sorting
401	36615 VEILED ST	ANCHOR POINT	99556			Summarize
401	36510 FOX RD	ANCHOR POINT	99556		5	Statistics
401	38919 SAYER RD	DIAMOND RIDGE	99556		4	
401	35890 NORTH FORK RD	ANCHOR POINT	99556		F	Field Calculator
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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 proporties 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**

select by Location
Select features from one or more target layers based on their location in relation to the features in the source layer.
Selection method:
select features from
Target layer(s):
SwtPoints SwtArcs StudyArea NFD_Lakes Townships
Only show selectable layers in this list
Source layer:
NHD_Lakes
Use selected features (0 features selected)
Spatial selection method for target layer feature(s):
are within a distance of the source layer feature 🔹
✓ Apply a search distance 100 Meters
About select by location OK Apply Glose

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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

Calculate Geometry	ý	×
Property:	X Coordinate of Point	•
Coordinate Syste	:m	
Our Use coordinate	e system of the data source:	
PCS: NAD 19	983 Alaska Albers	
PCS: NAD 19	993tem of the data frame: 983 Alaska Albers Meters [m]	
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	Decimal Degrees	2

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

			×
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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	
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Topic: Layout View **Problem:** Exploring the Layout view

Solution:

Data used:

License: Basic

Printer Setup			
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Status: Read	dy		
Type: HP (Color LaserJet CP	5520 Series PCL 6	
Where: 146.	63.158.109		
Comments:			
Paper			
<u>S</u> ize:	Letter	•	Printer Paper
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onentad <u>o</u> n	• For d arc		278 E
		_	
Show Printer Mar	gins on Layout	Scale Map Elements	proportionally to changes in Page Size

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







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.

Q Explore_the_world.mxd - Arcl	Мар		
File Edit View Bookmark	s Inse	ert Selection	Geoprocessing Custo
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S 00 1	三	Legend	
Onte :	Ť.	North Arrow	
	0.5 W	Scale Bar	
53 <u>2</u>	1:n	Scale Text	
-		Picture	
-		Object	



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

	customize them.
ale and Units Numbers and Marks Format	
Scale	
Division value: Auto	
Number of di <u>v</u> isions:	Legend Wizard
Number of subdivisions: 1	Map Layers:
	SwtPoints
Show one division before zero	Facilities
When resizing	···· Consolidated Trails
Adjust division value 🔻	···· KenaiB_SP_Project ···· Protracted_Townships
Lipita	···· Kenai_Townships ···· KenaiB SP
	<
Division Units:	Cat the strends of advance is usual and
Meters	Set the number of columns in your legend.
Label Position:	Preview
after labels	
Label: Meters Symbol	
Gap: 3 pt 👗	

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

Map Layers:	Legend Items	
SwtPoints	CottonwoodCreekTrail ConsolidatedTrails	Ŧ
Facilities	>> Kenai_Townships	
CottonwoodCreek Trail		
KenaiB_SP_Project		
Protracted_Townships		
Kenai_Townships	<	
< III +	<<	Ŧ
Set the number of columns in your l	egend: 1 🚔	
Preview		

The layout tool bar only works in Layout view





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

rinter Setup			
lame:	HP Color Laser Je	t CP5520 Series PCL 6	 Properties
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ype:	HP Color LaserJet CP	5520 Series PCL 6	
Vhere:	146.63.158.109		
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onentation	OPortait	Carloscape	Sample Map Elements
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	0.5	incres -	Star -
Height:	11	Inches 🔹	
Orientation:	O Portrait	② Landscape	
Show Printer	Margins on Layout	Scale Map Elements	proportionally to changes in Page Size

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"

Data Frame Prope	erties					×
Feature Cache	Annotation Gro	pups	Extent Indicators	Frame	Size	and Position
General	Data Frame	Co	ordinate System	Illuminat	tion	Grids
Name:	ayers					
Description:						
				*		

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.

General	Data Frame	Coord	dinate System	Illuminat	tion	Grids
Feature Cache	Annotation Gro	oups	Extent Indicators	Frame	Size	and Position
updates if the	e extent changes.	one or tr	ne other data fram	es anu aut	omatica	ally
updates if the	e extent of the data in e extent changes. rames:	one or tr	Show extent i frames:	ndicator fo	omatica r these	ally data



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



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.

Parcels				J 🔁
Clip Features				
Clipper				• 🖻
Output Feature O	lass			
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XY Tolerance (opt	ional)			
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OK	Cancel	Environ	ments S	how Help >>

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Convert:	
Polygon graphics	
Selected graphics only	
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the gata frame	
🔿 this Jayer's source data:	
🚸 Points	•
 the feature dataset you export the data into (only applies if you export to a feature dataset in a geodatabase) 	
the annotation groups in this data frame	
Qutput shapefile or feature class:	
C:\Student_New\GDBClass\KBayWildlife.gdb\Clipper	2
Automatically delete graphics after conversion	
About converting graphics	Cancel

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.





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

×

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



Convert Graphics To Features

- 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.

Convers	
Point graphics *	
Selected graphics only	
Use the same coordinate system as:	
🗇 the gata frame	
O this jayer's source data:	
Better_TOPOJPG	-
 the feature dataset you export the data into (only applies if you export to a feature dataset in a geodatabase) 	
the annotation groups in this data frame	
Qutput shapefile or feature class:	
0:\DWC\TIMP\GISClass.gdb\GraphictoFeature	
Automatically delete graphics after conversion	
that covering graphics	Cancel

🔁 • | 🍢 🏹 🖸 🖑 🗙

Shape *

6.	Open the new feature's table.	You'll see the coordinates
are	n't user-friendly for labeling/	nanipulation

Name

149°44'37.016"W, 61°8'28.468"N

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

Name:	let .			Name:	long		
Dos:	Text		-	Tes:	Text		•
Field Pro	petes			Field Pro	petes		
Ales				Ales			
Allow	NULL Values	Yes		Allow	NULL Values	Yes	
Defeu	t Value	1000		Defaul	Value	1000	
Lengt	1	26		Length		24	

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.

4	Point 149°45'13.384"W, 61°10'45.422"N
•	1 🕨 н 📄 📟 (0 out of 4 Select
aphictoFe	ture
Calculate Geo	metry 📒
	wanter date
Property:	X Coordnate of Point
Property: Coordinate	X Coordinate of Point System
Property: Coordinate	X Coordinate of Point System dinate system of the gata source:
Coordinate	X Coordinate of Point System dinate system of the gata source: AD 1983 Alaska Albers
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Table *=

GraphictoFeature

OID *

1 Point 2 Point

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

