Data Acquisition and Getting Data into GIS

4

Section I: Introduction to the Acquisition Method

Data entry process is the most important step and the most time-consuming part of the GIS operation. User should always be aware in advance at what type of data is needed for the project and where to locate or obtain it. Reliable and accurate data is essential for carrying meaningful GIS project. GIS users can rely on many sources of GIS data and some of the data is already available in different format or it can be created. Some of the most common source of GIS projects are hard copy maps. The maps can be digitized or scanned and integrated into GIS as a digital data. There are also huge digital spatial data, available from various organizations and commercial sources. They are processed data of different types and ready to use. Some of the data is free, you can download it, copy it, and borrow it. You can even convert it from one format to another.

Data is also available in tabular format. It can then be integrated into GIS one of two ways. Tabular data that has fields with a coordinate system can be integrated directly. Data that lack the coordinate system can be joined or linked into GIS, then the data can be converted into a layer (Discussed later). Reports containing relative and important data for a specific project can be translated into useful data by manual entry or scanning them. Then stored as an associated ingredient of the database. Reports can be any valuable information that can be turned into GIS layers, such as classification or even explanation for a certain type of data. Field Data is considered a primary data that a user can collect and integrate into GIS as a database. User can use GPS to register the location in term of X, Y coordinates and altitude of the observation locations image below. The data that is gathered in the field can be joined to the GPS file and integrated directly into GIS.

Images are also major source of GIS data. Imagery can be placed directly into the GIS database. Remote sensing is collecting data of a landscape from above, such as an aircraft that has cameras and electronic sensors.

Remote Sensing has several advantages that are important in GIS. Satellite imagery is very consistent regarding data quality and the condition of collection. They cover a very large area and provide a permanent record that can be verified and used for a long time. This will allow keeping records that show the changes that took place due to a certain activities.

This chapter will provide the following exercises:

1. Integrate flat file data into ArcMap
2. GPS Data Integration into ArcMap
3. Data Integration from the Internet
4. Add Data from ArcGIS Online
5. On Screen Digitizing

Electronic Supplementary Material: The online version of this chapter (https://doi.org/10.1007/978-3-319-61158-7_4) contains supplementary material, which is available to authorized users.

W. Bajjali, *ArcGIS for Environmental and Water Issues*, Springer Textbooks in Earth Sciences, Geography and Environment,
https://doi.org/10.1007/978-3-319-61158-7_4

Field collection using GPS

Table 4.1 Coordinate in latitude and longitude

Proposed site	Longitude			Latitude		
WWTP	Degree	Minute	Second	Degree	Minute	Second
1	91	40	42	46	27	11
2	92	8	50	46	40	15
3	92	2	6	46	28	16

Integrate Flat File Data into ArcGIS

Scenario 1: You are a professional working for the city of Superior, WI. Your supervisor gave you a word report that has a table containing three proposed locations of a Waste Water Treatment Plant (WWTP) in Douglas County (Table 4.1). The coordinate is in degree, minute, and seconds (DMS) and your duty is to do the following:

1. Use the Excel software to convert the DMS into Decimal Degree (DD)
2. Save the file as text (tab delimited) (".txt") or (comma delimited) (*.csv).
3. Integrate the text file into ArcMap
4. Convert the file into shapefile.

Convert Degree, Minute, Second into Decimal Degree Using Excel

1. Highlight the data in Table 4.1/copy it (Ctrl C)
2. Open Excel and place your cursor on A1 paste (Ctrl V) (or type the table in Excel)
3. Type "Longitude" in cell I2 and "Latitude" in cell J2
4. Place your cursor in cell I3 and type "=" then "-" ,open a bracket move your cursor to B3 cell type "+" and type "/" and type 60, type "+" and move your cursor to D3 cell and type "/" and type 3600, close the bracket and enter

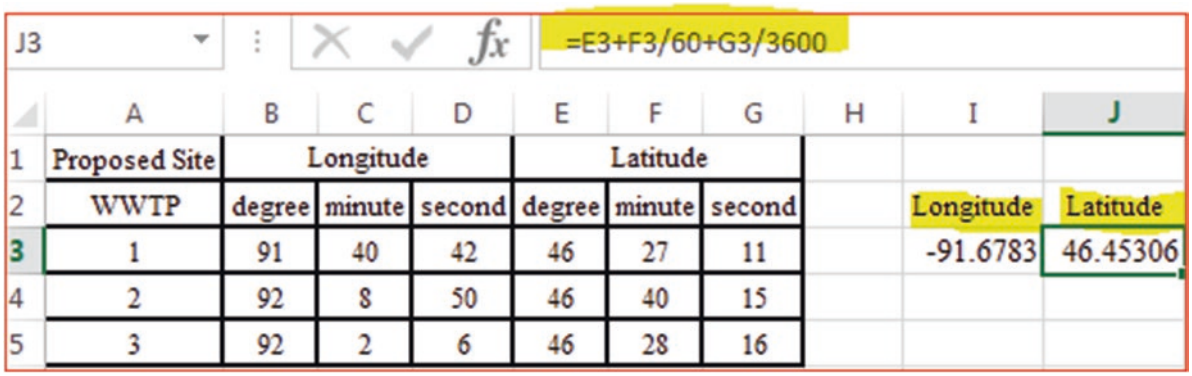
=-(B3+C3/60+D3/3600) this is DMS longitude formula

$$-\left(D+\frac{M}{60}+\frac{S}{3600}\right)=-\left(91+\frac{40}{60}+\frac{42}{3600}\right)=-91.6783$$

Note: the sign '−' means west such as the location of USA (North hemisphere and second quarter)

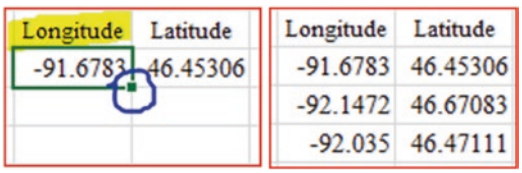
5. Repeat these steps for the latitude coordinates using the same formula but without the '−' sign and the bracket =E3+F3/60+G3/3600 this is DMS latitude formula

$$D + \frac{M}{60} + \frac{S}{3600} = 46 + \frac{27}{60} + \frac{11}{3600} = 46.45306$$



	A	B	C	D	E	F	G	H	I	J
1	Proposed Site	Longitude			Latitude					
2	WWTP	degree	minute	second	degree	minute	second		Longitude	Latitude
3	1	91	40	42	46	27	11		-91.6783	46.45306
4	2	92	8	50	46	40	15			
5	3	92	2	6	46	28	16			

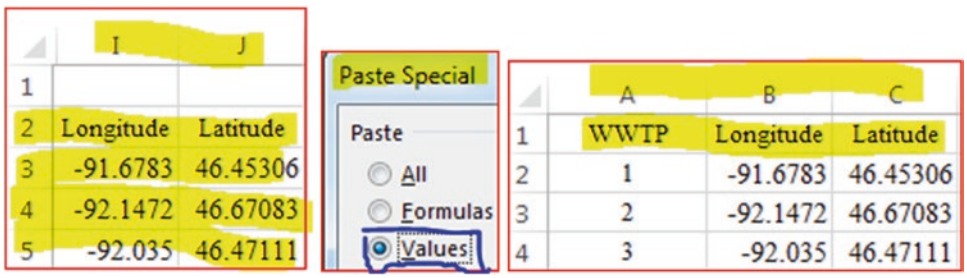
6. Highlight the cell I3, the calculated longitude (−91.6783), and drag down the dot in the bottom right corner of the cell to the row of the last coordinate in the table
7. Repeat these steps for the latitude coordinates



Longitude	Latitude
-91.6783	46.45306

Longitude	Latitude
-91.6783	46.45306
-92.1472	46.67083
-92.035	46.47111

8. Highlight I3:J5 cells of the calculated longitude-latitude and copy (Ctrl C),
9. Then, R-click the cell I3 and select "Paste Special" and select "Values".
10. Then delete Row1 and the B, C, D, E, F, G, and H columns and remove the border of column A



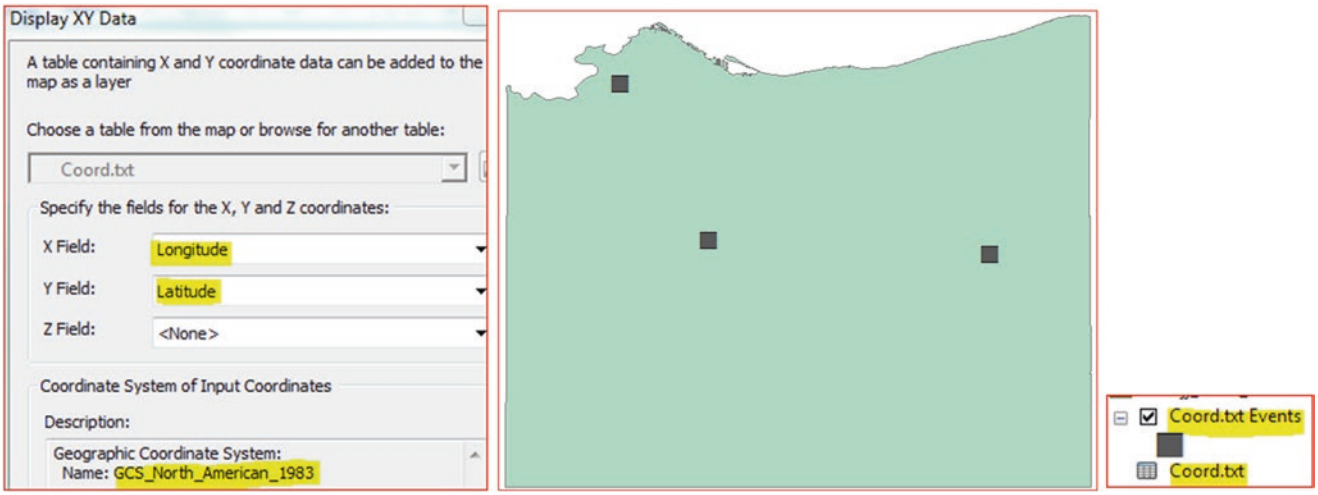
	I	J
1		
2	Longitude	Latitude
3	-91.6783	46.45306
4	-92.1472	46.67083
5	-92.035	46.47111

	A	B	C
1	WWTP	Longitude	Latitude
2	1	-91.6783	46.45306
3	2	-92.1472	46.67083
4	3	-92.035	46.47111

11. Click File menu/Save As/browse to \\Result folder, change Save as type to Text (Tab delimited) (*.txt) and call the file **Coord.txt**

Integrate the Data Table into GIS

12. Launch ArcMap.
13. Click on Add Data browse to \\Ch04\Data\Q1 folder, highlight Douglas and click Add.
14. Click on Add Data again and browse to \\Result folder, highlight **Coord.txt** (created in the earlier step) and Add.
    Note: You can also access the file in "TabDelimited" folder in Chap. 4
15. In the TOC/r-click the **Coord.txt** and go to Display XY Data.
16. Make sure the X field is the Longitude, the Y field is Latitude, and the Geographic Coordinate System is GCS_North_American_1983
17. Click OK/OK



Result: Three features added into ArcMap and a layer called Coord.txt Event added to the TOC.

Note: XY event data sources are commonly used to draw point data originating from a data source that is not spatially enabled. In this respect, XY event data sources are a powerful way to integrate simple point data into your map. The Coord.txt Event can be converted into a spatial data source such as a feature class in geodatabase or shapefile.

18. R-click on the **Coord.txt Events**/Data/Export Data
19. Save it in \\Result folder and call it **WWTP.shp**
20. Click OK to add the **WWTP.shp** to the TOC
21. In the TOC/R-click on the **Coord.txt Events** and click remove

Global Positioning System and GIS

The Global Positioning System (GPS) plays a key role around the world as part of the global information infrastructure and takes serious responsibility to provide the best possible service to civil and commercial users worldwide. This is as true in times of conflict as it is in times of peace. GPS is a worldwide radio-navigation system formed from a constellation of around 30 satellites and their ground stations. GPS uses these "man-made stars" as reference points to calculate positions accurately to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter. GPS is used in GIS extensively and the captured data can be integrated directly into GIS.

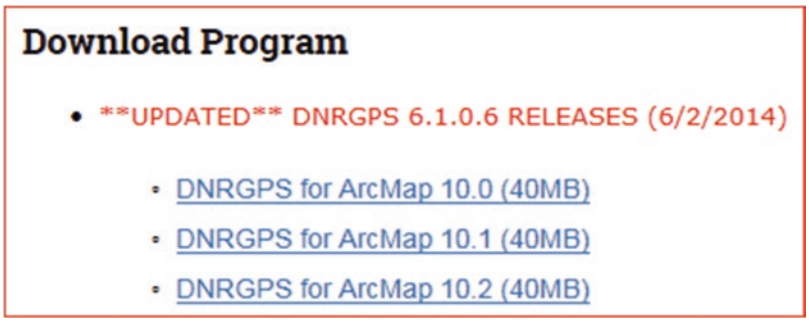
GPS Data Integration into ArcMap

If you use your GPS in the field to capture waypoints data such as well locations, or track a creek, you can get those features into ArcMap for further analysis directly. The two simplest ways for integrating GPS data into ArcMap is using either ArcGIS Explorer or the Desktop DNR Garmin Extension if you have Garmin GPS.

GPS Data Integration Using DNR Garmin Extension

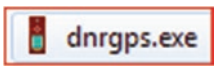
Department of Natural Resources (DNR) provides an extension that will give the GPS user the ability to directly transfer data between Garmin GPS handheld receivers and ArcGIS software packages. Using this extension a user can use point features in a shapefile format and upload them to the GIS as Waypoints. The extension and documents can be downloaded free of charge from the following web page:

http://www.dnr.state.mn.us/mis/gis/DNRGPS/DNRGPS.html



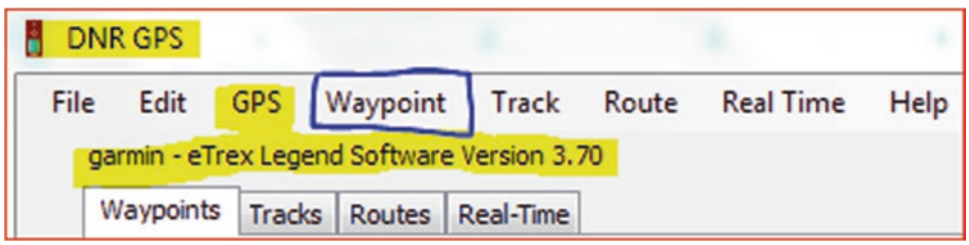
Download GPS Data and Integrate the Waypoints into ArcMap

Scenario 2: You are a researcher working for Douglas County and you have been asked to capture some GPS location at the territory of UWS campus to build a culvert to drain the surface runoff. You used the Garmin GPS and captured 12 locations. At your office, you connected your GPS to your desktop and downloaded the captured GPS waypoints.

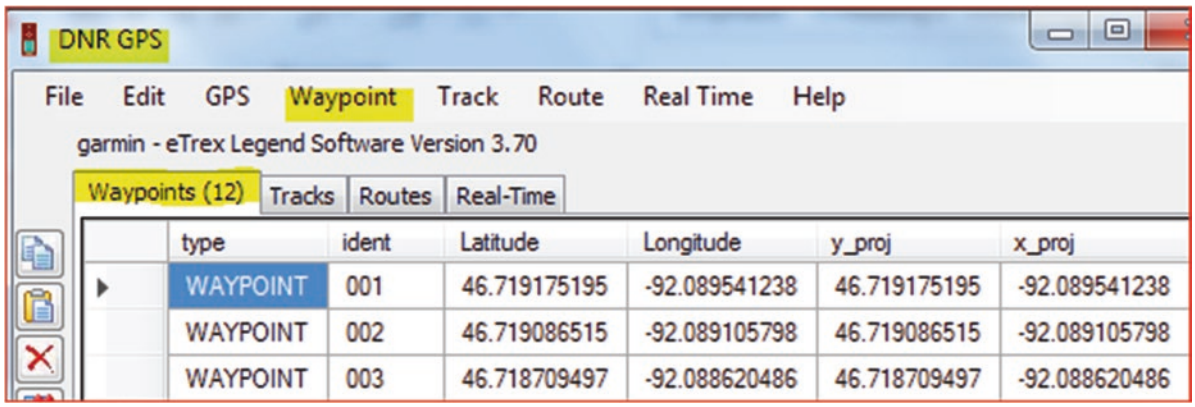
1. Click the DNRGPS for ArcMap 10.2 (40MB) and download the program in a "GPS" folder
2. Unzip the "**dnrgps_6_1_0_6_for_ArcMap_10_2.zip**" in new folder called "**DNRGPS**"
3. Connect your GPS to your PC or Laptop to where you want to download your GPS data and switch on your GPS Garmin device (**DNRGPS program in Ch04**)
4. Open the "**DNRGPS**" in \\Ch04 folder and D-click **dnrgps.exe** 

5. Click Run to excecute the program
6. The DNR GPS program opens, if the program doesn't recognize your GPS device, click GPS menu and point Find GPS

Result: The GPS device will be recognized and its name (garmin-e trex Legend) will be displayed on top

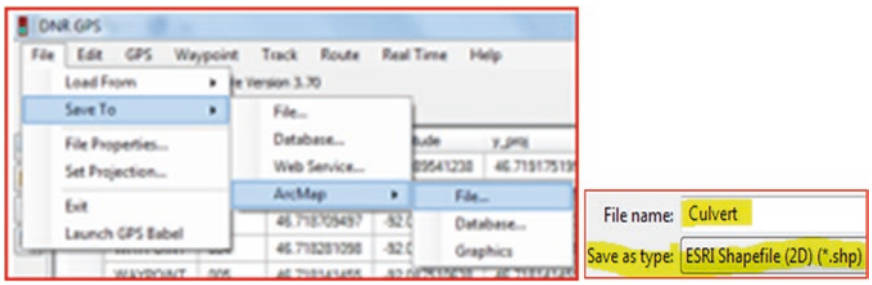


7. Click Waypoint menu and point to Download
8. 12-Waypoints will be downloaded

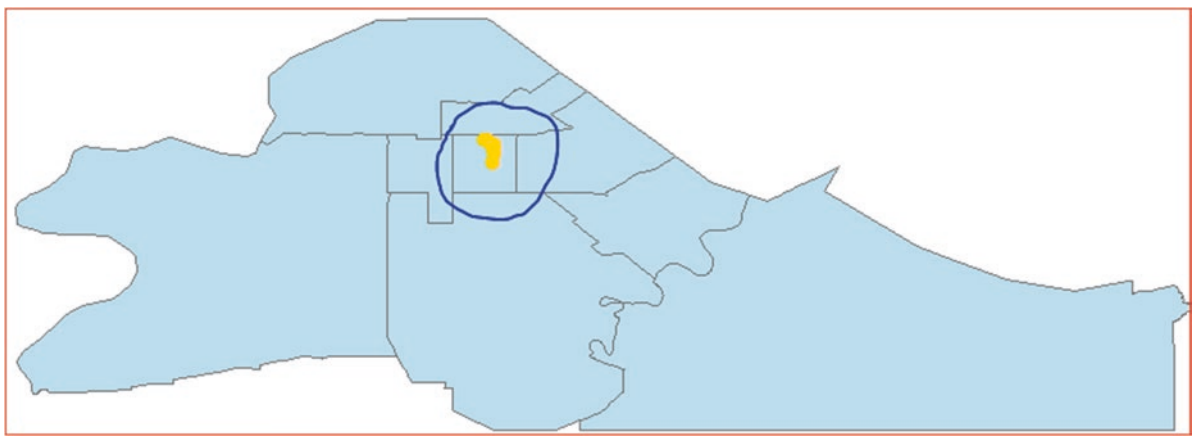


Save the downloaded Waypoints as Shapefile

9. In the DNR GPS/click File menu/Save To/ArcMap/File
   a. File Name: Culvert
   b. Save as type: ESRI Shapefile (2D) (*.shp)
10. Click Save



11. Make ArcMap active
12. Click Insert menu and Add data frame and call it “GPS”
13. Click Add Data browse to \\Data\Q1 folder and add Tract.shp
14. Click Add Data browse to \\Result folder and add Culvert.shp
    Note: You can also access Culvert.shp in the “Culvert” folder in Chap. 4



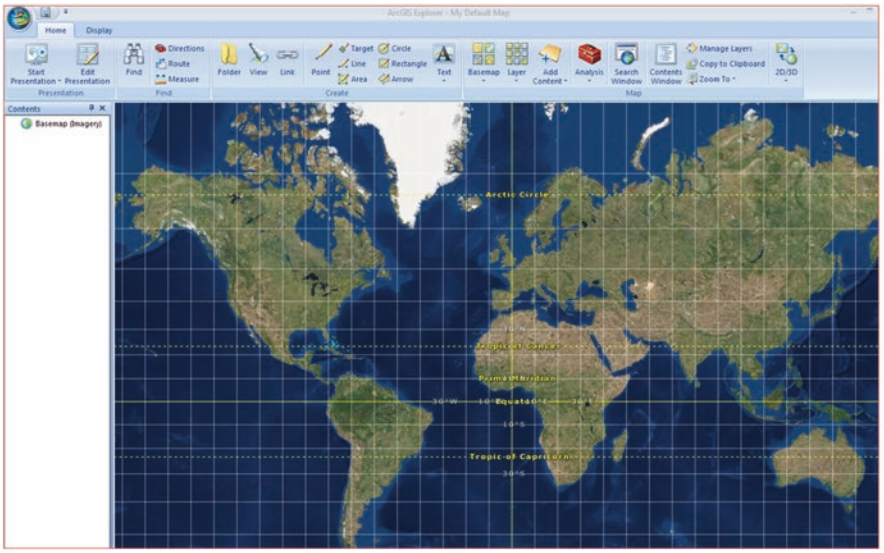
15. Save your map as GPS.mxd and exit ArcMap

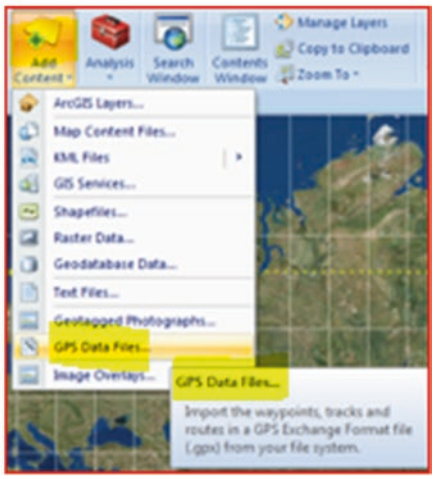
Add GPS Data to ArcMap Using ArcGIS Explorer Desktop

The majority of GPS devices can export the collected waypoints as an exchange format (GPX). A format just about all GPS devices support.

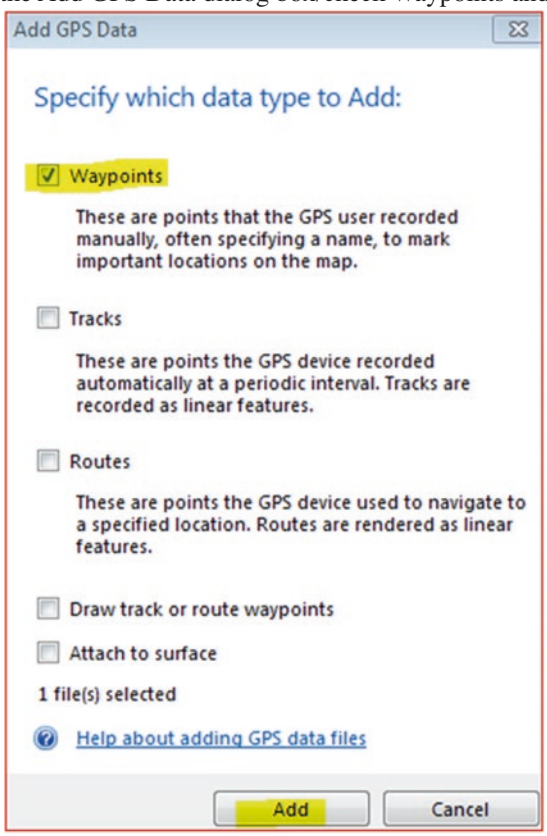
16. Launch ArcGIS Explorer Desktop
17. Click Add Content 

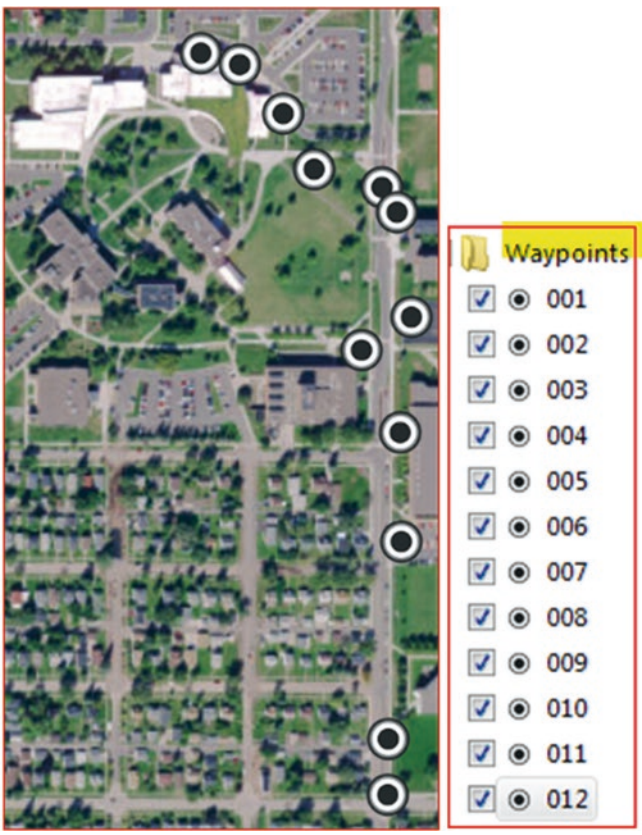
button/GPS Data Files
18. Browse to \\Data\Q1 folder highlight "**Waypoint.gpx**" and click Open





19. In the Add GPS Data dialog box/check Waypoints and click ADD



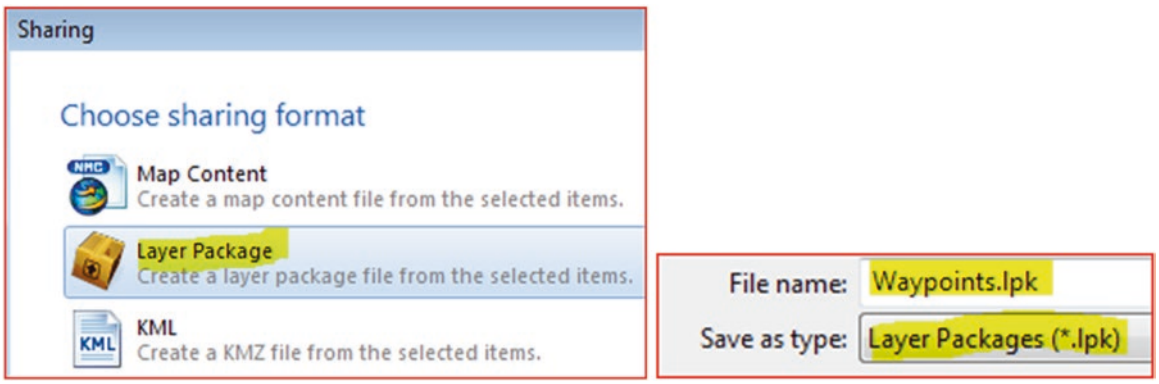


Result: the GPX file (waypoints) is added to TOC and displayed in ArcGIS Explorer Desktop with all the 12 symbols.

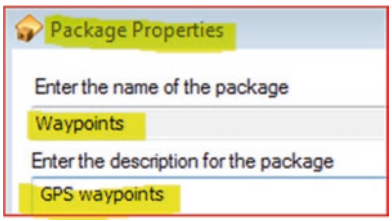
Save the Waypoints Layer as a Layer Package (LPK)

ArcMap support the Layer Package (LPK) and once it shared it will capture the symbols of the Waypoints for display in ArcMap.

20. In TOC/r-click the Waypoints layer and choose Share.
21. In the Sharing dialog box/highlight "Layer Package"/Next
22. Browse to \\Ch04\Output folder and save it as Waypoints.lpk

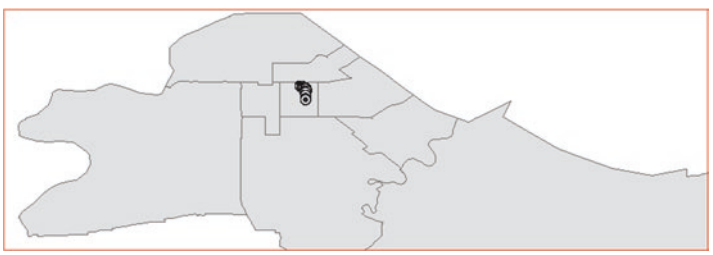


23. In the Package Properties dialog box enter "Waypoints" as the name of the package
24. Enter the description for the package "GPS waypoints" and Click OK
25. Close ArcGIS Explorer Desktop



Integrate LPK into ArcMap

26. Launch ArcMap/click Add Data and browse to \\Data\Q1 folder and add Tract.shp
27. In Ch04/open the folder "**Output**" and d-click the "**Waypoints.lpk**"



Result: The Waypoints displayed in ArcMap

Data Integration from the Internet

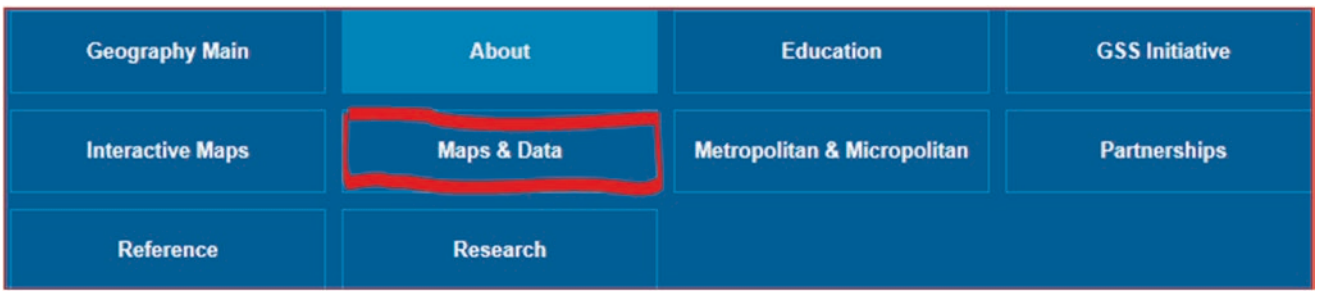
There are large sets of data available in either raster or vector format, which can be downloaded for free from the internet or ESRI. The data can be downloaded and integrated directly into ArcGIS and then can be used for analysis.

Note: If you have difficulty downloading the data, they will be available for you in chapter 4 folder of "Download".

Scenario 3: You have been asked to download the census tract of Wisconsin lakes and rivers in digital format for Douglas County, Wisconsin from the US Census Bureau web page.

1. Go to "www.census.gov" web page
2. Click "**Geography Map, Products**" tab

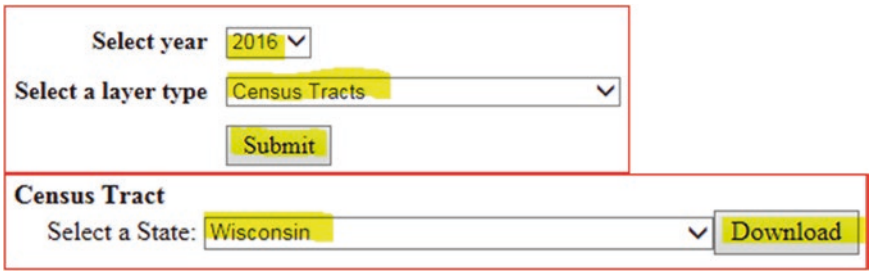
3. Click Map & Data



4. Click Map & Data
5. Under Geographic Data, click on **TIGER Products**
6. Click on Tiger/Line Shapefile—New 2016 Shapefiles
7. Click on **2016** and then click on **Download** DSA
8. Then click on Web interface.

First Download the Census Tract

9. Select year "**2016**" Select a layer type "**Census Tracts**"
10. Click Submit
11. Select **Wisconsin** as the State and click **Download**
12. Click **Save As**
13. Save the file in the \\Download folder.



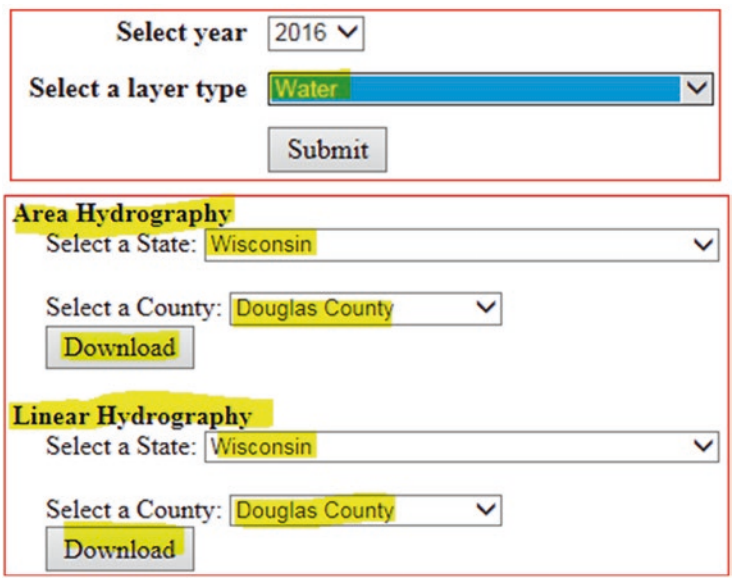
Result: The "**tl_2016_55_tract.zip**" is downloaded, now use any free software (PeaZip or 7-Zip file manager) from the internet to unzip the downloaded file.

14. R-click the "**tl_2016_55_tract.zip**" and unzip it in a folder called "**Tract**"

Second Download the Water Files

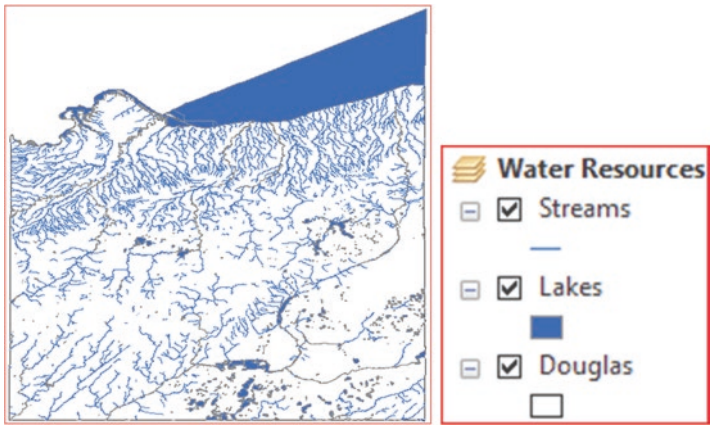
You will now download the Hydrography for Douglas County, Wisconsin

15. Select year "**2016**" Select a layer type "**Water**"
16. Click Submit
17. Area Hydrography/Select a State **Wisconsin**/Select a County Douglas County and click **Download**
18. Click **Save As** in **\\Download** folder as **tl_2016_55031_areawater.zip**
19. R-click the "**tl_2016_55031_areawater.zip**" and unzip it in a folder called "**Lake**"
20. Linear Hydrography/Select a State **Wisconsin**/Select a County Douglas County and click **Download**
21. Click **Save As** in **\\Download** folder as **tl_2016_55031_linearwater.zip**
22. R-click the "**tl_2016_55031_linearwater.zip**" and unzip it in a folder called "**Stream**"



Integrate Downloaded Data into ArcMap

23. Click Insert menu/Data Frame and call it "Water Resources"
24. Add Data/browse to \\Data\Q2 folder and add **Douglas.shp**, **Lakes.shp**, and **Streams.shp**
25. Make the Douglas layer hollow, and change the streams and lakes symbols to blue



Aerial Photography and Satellite Images

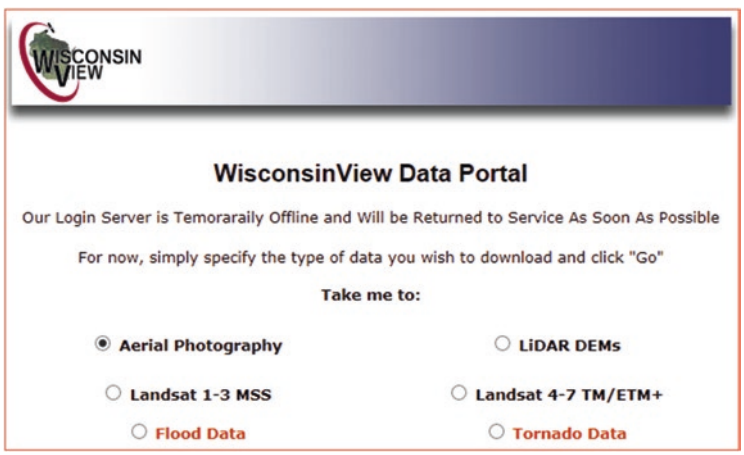
Remotely sensed imagery is used extensively in conjunction with GIS technology to answer many questions about the environment in which we live. The advancement of the technology and wealth of image of various resolutions have changed the way geographic analyses are done. Images of aerial photographs and remote sensing are easily integrated into GIS. The process of integration is straightforward; images may be scanned or downloaded from the internet. The images then can be used as a background in the GIS project or can be used to be a source of obtaining vector features from the image. There are many web pages in the internet that offer free images from all over the USA.

The following web page will be used to download data from Wisconsin:
http://relief.ersc.wisc.edu/wisconsinview/form.php

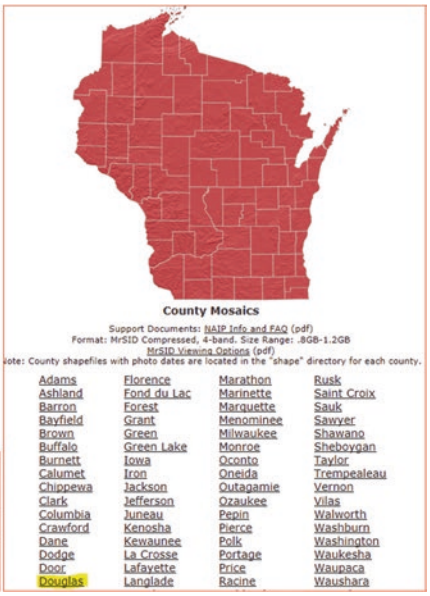
The web page "WisconsinView" provides access to photographs, images, and related data regarding Wisconsin. Photographs from the National Agriculture Imagery Program; Department of Natural Resources Digital Orthophotos; and Landsat MSS, TM, and ETM+ imagery. Tornado data for Wisconsin is also provided. This web page requires you to register, which is free.

Download Image from the Internet

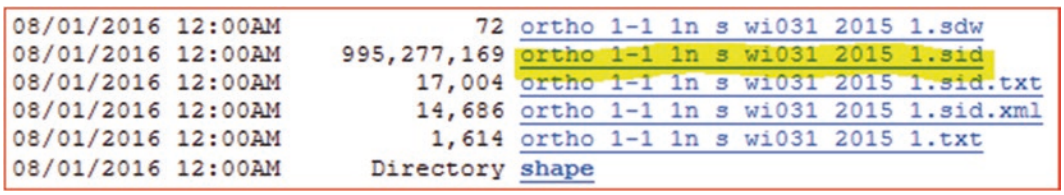
1. Go to the internet and type in http://relief.ersc.wisc.edu/wisconsinview/form.php



2. First enter your email address to set up your account or if you have already done this just sign in
3. Click **Aerial Photography/**then click GO.
4. Highlight the NAIP County Mosaics and year "2015" and check "UTM Version"
5. Scroll down and click on "Douglas".



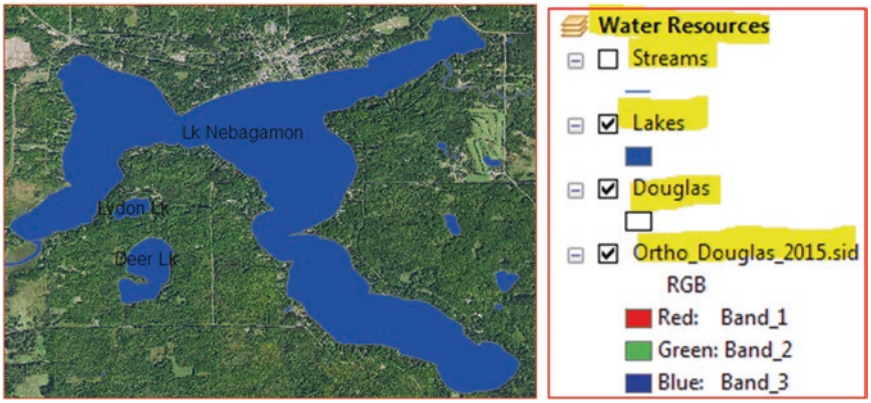
6. Scroll down and click on "**ortho 1-1 1n s wi031 2015 1.sid**"
7. Save as in \\Ch04\Download\Ortho folder



8. Make sure that the Water Resources data frame is active in ArcMap
9. Add Data and browse to \\Data\Q2 folder and add "Ortho_Douglas_2015_1.sid"

Result: the "Ortho_Douglas_2015_1.sid" is added to ArcMap and aligned correctly with the three layers (Douglas, Lakes, and Streams) in the Water Resources data frame. The ortho image is the raster file that downloaded in the previous step.

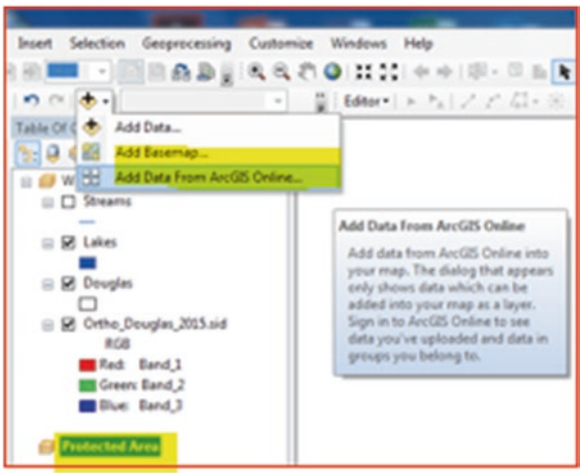
10. Zoom in around Lake Nebagamon in east central Douglas County



Add Data from ArcGIS Online

ArcGIS online contains set of database online of different GIS data sources. ArcGIS allows users to connect to any source desired and use it in ArcMap.

1. Insert Data Frame and call it “Protected Area”.
2. Click on the arrow of the Add Data icon and click on Add Data from ArcGIS Online
3. The ArcGIS Online window will pop-up. Search for the USA Protected Area and click the search symbol.



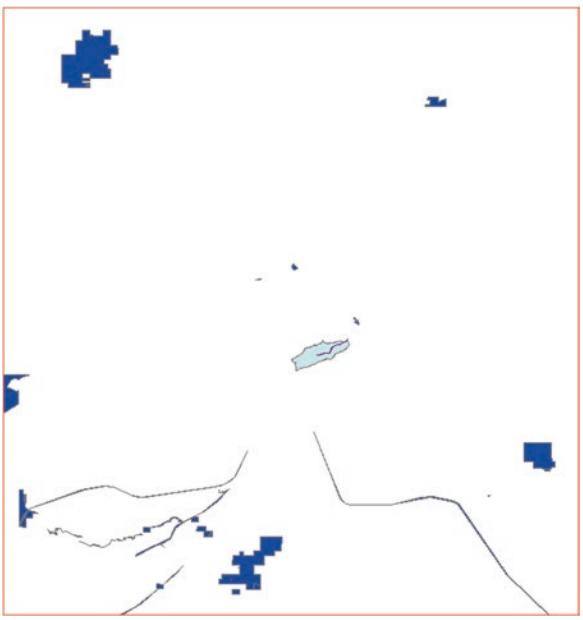
4. Click “Protected USA” and click Add.

Result: The areas of concern in the USA is displayed.

5. Add Data browse to \\Data\Q3 folder and add NewtonCreek and Watershed_Newton layers
6. R-click Watershed_Newton and Zoom To Layer

Result: The Watershed_Newton and NewtonCreek displayed. The Newton Creek baseflow is treated wastewater from Murphy Oil that eventually discharge in Hug Island. The area was highly contaminated by hydrocarbon and was considered an area of concern.

7. In the Tools toolbar click Fixed Zoom Out  button several time



Result: Various Areas of Concern are displayed in Douglas County, where the Newton Creek was one of the sites

8. Explore other areas of concern in the USA
9. Close ArcMap and save your document as **AreaConcern.mxd** in \\Result folder

Section II: Introduction to Feature Creating

This section discusses several ways to create GIS data. GIS features can be created by converting features from existing data or creating a new data by drawing geographic features (point, line, and polygon) and adding an attribute table. Traditionally, most geographic features in GIS have been digitized from a preexisting map, scanned map, aerial photograph, or satellite photographs. Digitizing means simply capturing an analog signal in digital form or the process of tracing map features for conversion into a digital format. Digitizer allows users to transform spatial data of various types into digital format. Digitizing is a time consuming and costly process.

In this section we are going to discuss an example on screen digitizing. ArcGIS offers digitizing capability on the screen to digitize using a base layer such as an aerial photo, remote sensing imagery, or a scanned hardcopy map for visual perspective. Screen digitizing has become the most popular manual digitizing method. The feature types that can be digitized are point, line, or polygon. The features you decide to create should be identified and given a layer name prior to digitizing. The layers can be traced using the mouse and the advantage of this type of digitizing is the ease of zooming in and out for detail tracing. During the process you can use full array of editing functions such as delete, copy, move, add, and other functions.

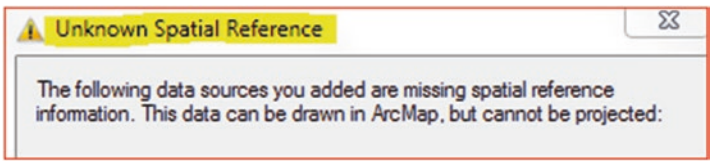
Creating a GIS Layer from Existing Feature

This lesson shows you how you can create a new layer from an existing layer. By doing this step, the new layer will inherit the attribute table and the coordinate system from the original layer.

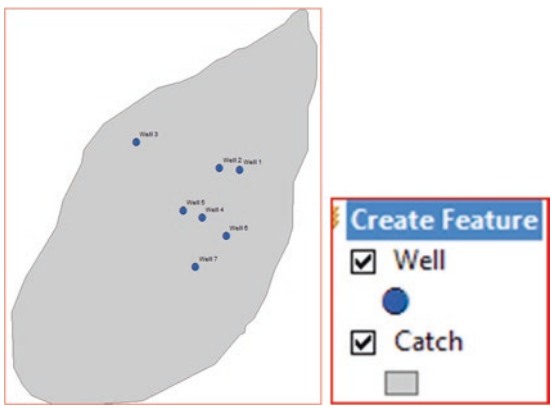
Scenario 4: You are a hydrogeologist and you would like to study the quality of water in the southern catchment area of the Nuaimeh region in Jordan. You have decided to create a new well layer from the southern wells in the catchment area.

GIS Approach

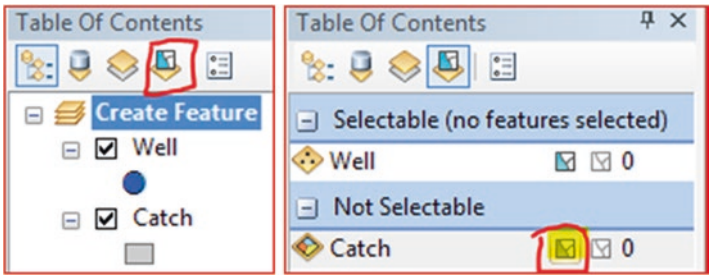
1. Start ArcMap and call the Layers data frame "Create Feature".
2. Click Add Data button and browse to \\Data\Q4 and highlight the **Catch.shp** and **Well.Shp** layers and click Add.
3. A dialog box display stating "Unknown Spatial Reference" (we will learn about spatial reference in Chap. 5) will appear.
4. Click Ok to display both files in ArcMap.



5. In TOC/click on the Well symbol, select circle 2, size 10, and blue color.
6. In TOC/R-click on the **Well** layer and click Label Features.



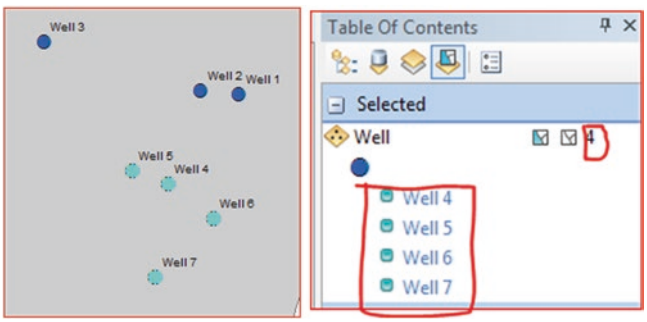
7. Go to the TOC/click "**List By Selection**"  button.
8. Next, click on the **Catch** to make it "Not Selectable".



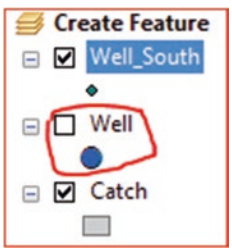
Note: This step is to select number of wells features located inside the catchment area

9. Click the drop down arrow for Select Feature tool  and click on the "**Select Feature By Rectangle**".
10. Click inside ArcMap and draw a rectangle around the wells 4, 5, 6, and 7.

Result: The 4-wells will be selected and they will be seen in the TOC



11. In the TOC/click on the "**List By Drawing Order**"  button.
12. In the TOC/r-click on the Well layer/click Data/Export Data/browse to \\Result folder and call it **Well_South.shp** and click Save.
13. A box will appear asking if you want to add the new file to the TOC/click Yes.
14. In TOC/click the **Well.shp** to uncheck it.



Add New Features to the Existing Layer

This lesson shows you how you can create new features in the existing layer. By doing this step, the new features will be added as new records in the well attribute table and will be displayed in ArcMap.

Scenario 5: The hydrogeological investigation showed that in the southern part of the catchment area there is a good aquifer. You have been asked to drill another four wells close to each other to generate a well-field that can be used for water supply.

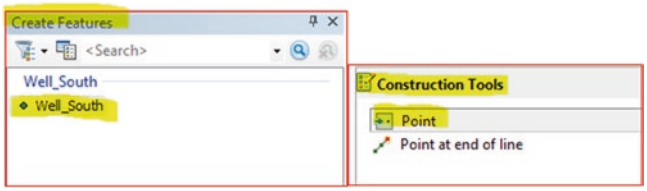
1. Click Insert menu/Data Frame and rename the New Data Frame "**New Wells**"
2. Drag Catch layer from Create Feature data frame and place it in New Wells data frame. Repeat and drag the Well-South also to the New Wells data frame
3. Add Data and browse to \\Data\Q4 folder highlight "Study_Area.shp"/click Add/OK

Result: The catchment area, southern wells, and the proposed study area are displayed in the data view in ArcMap.

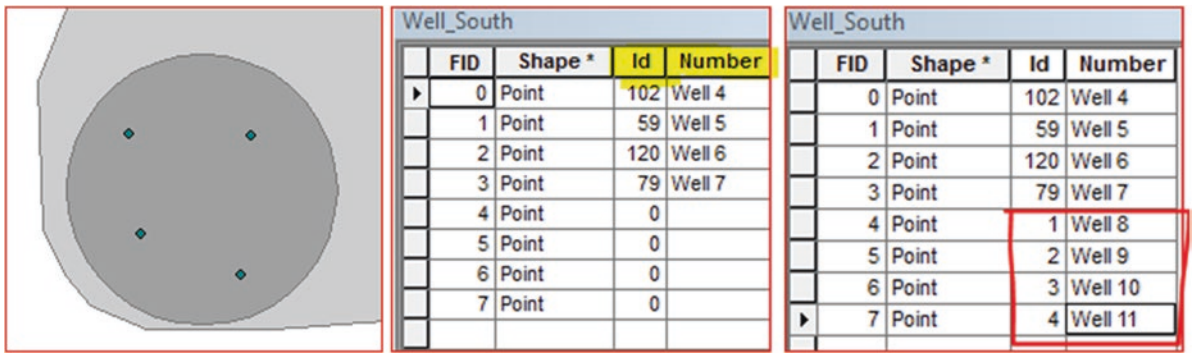
Now, you will create new four point features representing groundwater wells within the designated study area.

4. R-click on the Well_South.shp/click Edit Features/click on Start Editing.
5. The Create Feature dialog box will appear in ArcMap in the right side/click on it.

6. Click on "**Well_South.shp**" under Create Features



7. Next click on "**Point**" under the Construction tools in the Create Features Window.
8. Place a point in the Study Area by clicking on the map. Click three different places to create the three locations needed (see image below).
9. R-click "**Well_South.shp**" in the TOC/click on the Attribute Table to open it.
10. In the "Id" field type 1, 2, 3, and 4. Then under the number field in the attribute table type Well 8, Well 9, Well 10, and Well 11.



11. Once these changes have been made, close the attribute table.
12. In the Editor Toolbar click the Editor drop down arrow and click the Stop Editing

13. A box will appear asking if you want to save the edits, click Yes.

Result: The 4-new wells are now part of the Well_South layer

14. Save your map as Nuaimeh.mxd and exit ArcMap.

Digitizing on Screen

On-screen digitizing is a process in which a map is created using another map. This map could be an image, a scanned picture, or a previously digitized map. This technique is used to trace features to create new layers. This practice is similar to the traditional tablet digitizing, but rather than using a classical digitizer and a puck, the user creates layers on the computer screen with the mouse and referenced information as a background. On-screen digitizing may also be used in an editing session where the user can update or add new features. The accuracy of the digitized features cannot in any way be higher than the original base image. For accurate tracing, during digitizing, the user should zoom in for better viewing. Nevertheless, this does not mean the new captured feature will be more closely match the real world coordinate.

In this exercise you are going to use a geometrically corrected aerial photograph (orthoimage) as backdrop to capture and create new data. You will digitize on screen points (trees), sidewalk (lines), and building (polygons) from the campus of the university of Wisconsin-Superior (UWS).

Scenario 6: You are a GIS technician working for UWS and you have been asked to use an aerial photograph as a backdrop to digitize all the features on the campus in order to create an up-to-date map of campus.

Create New Polygon Shapefile

This step will allow you to add the background image and use it to trace the building in the campus of UWS.

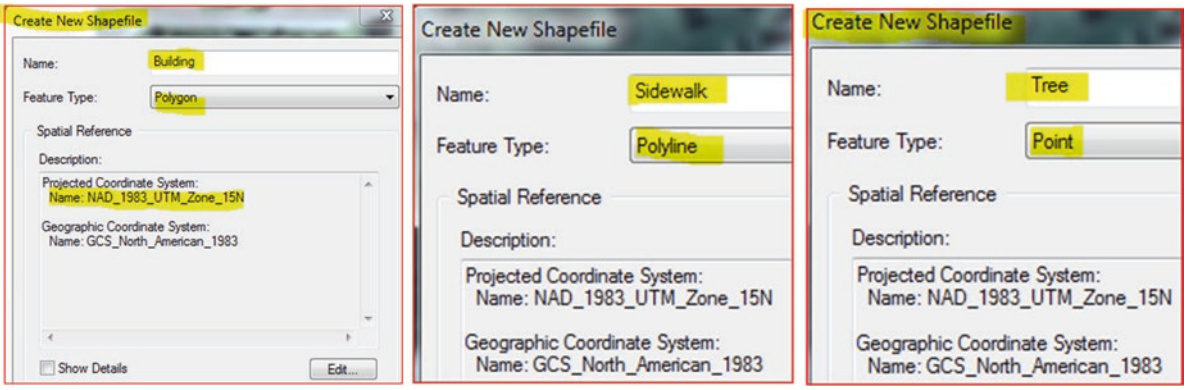
1. Start ArcMap and rename the Layer Data Frame "**Digitizing**"
2. Click on Add Data and browse to \\Data\Q5\Image folder highlight **UWS_UTM15.tif** and click Add

Result: the **UWS_UTM15.tif** is added to ArcMap and in the image you can see buildings (polygons), line (sidewalk) and points (trees).

3. Click Catalog window on the right hand side of the screen and browse to \\Data\Q5\folder/R-click Campus folder/New/Shapefile.
4. Name the new shapefile Building and make the feature type a Polygon
5. Click on Edit/click Add Coordinate System drop-down arrow click Import browse to \\Q5\Image\select **UWS_UTM15.tif** and click Add/OK

Result: the new **Building.shp** is added to the TOC.

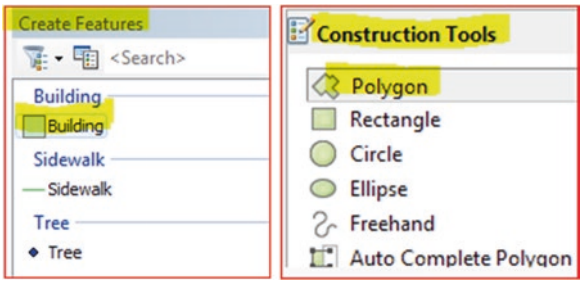
6. Repeat the step above, but make a line shapefile and name it **Sidewalk** and then create a point shapefile and name it **Tree**.



Create the Polygon Shapefile

Now you are going to start digitizing (beginning with the buildings). In order to start digitizing, you have to be in editing mode. Therefore, you have to use the Editor Toolbar and start editing.

7. In the TOC/R-click on the **Buildings** layer, click on **Edit Features** and then click on **Start Editing**.
8. Click on the **Create Features** window and then click on **Buildings**, and then "**Polygon**" under **Construction Tools**.
9. Zoom in to the lower right building in the image (the corners are labeled from 1 to 9)

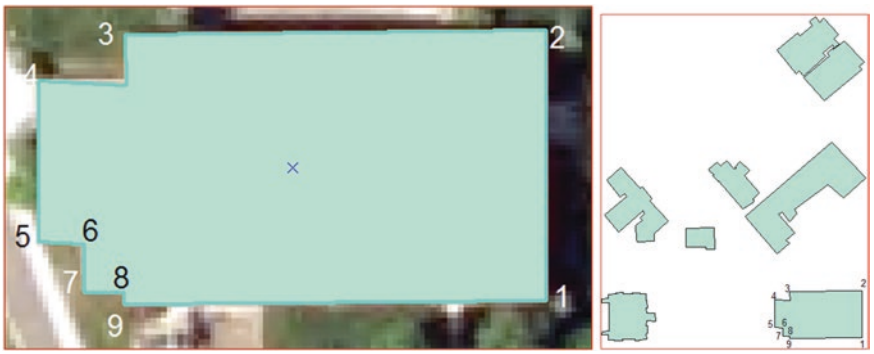


10. Position the crosshair cursor on the lower right corner of the building (No 1) to place a vertex and then move your pointer up to the north (No 2), then click again. You now have created two vertices with a straight line connecting them to define the eastern boundary of the building.

11. Mover your pointer and click a series of vertices along the perimeter of the building one at a time to form the polygon and double-click to place the last vertex or click F2.

Note: if you make a mistake and want to cancel the vertex that you added, you can delete it by pressing the Undo button

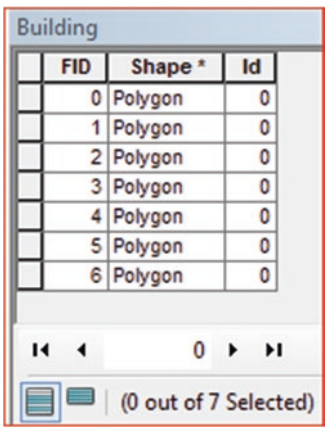
12. Continue digitizing for each of the buildings in the image.



Result: the buildings in the images are digitized now

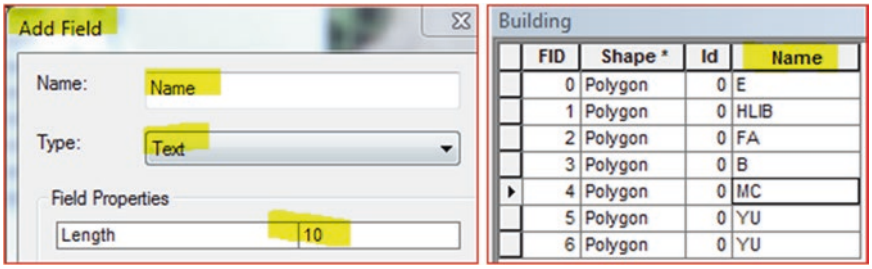
Update the Attribute Table of the Building

13. Open the attribute table of the Building layer
14. Highlight the first record and type 1, 2, 3,... under the "Id" field
15. In the Editor Toolbar click the Editor drop down arrow and click the Stop Editing



Note: The Building attribute table has 3-fields: FID, Shape*, and Id. A new field will be added to accommodate the name of the building.

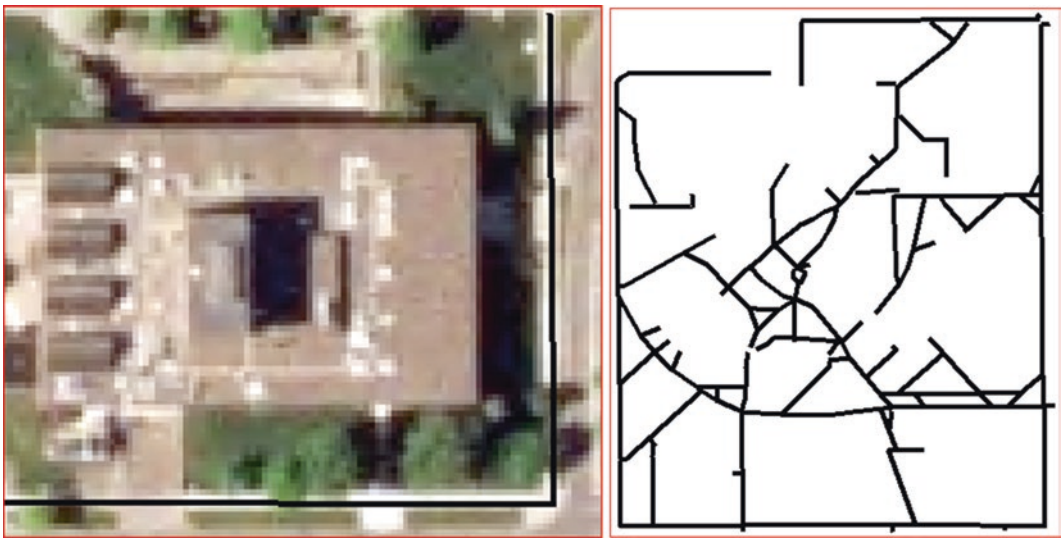
15. Click Table Options/Add Field
16. Name: Name
17. Type: Text
18. Length 10
19. OK
20. In the TOC/R-click on the **Buildings** layer, click on **Edit Features** and then click on **Start Editing**.
21. Populate the field "Name" as seen below



Create New Line Shapefile

You are now ready to begin digitizing the "Sidewalk"

20. Zoom In on the area south-east of the image, and you will see a sidewalk there.
21. In the Create Features window, click on the Sidewalk, and in the Construction Tools below, click on the line tool.
22. Using the aerial photo as a guide, digitize the new line by clicking the map each place you want to add a vertex
23. Continue clicking on the Sidewalk as you go along it to completely digitize it. Once you are done right click and click on Finish Sketch.



24. Continue digitizing for each of the Sidewalks in the image.

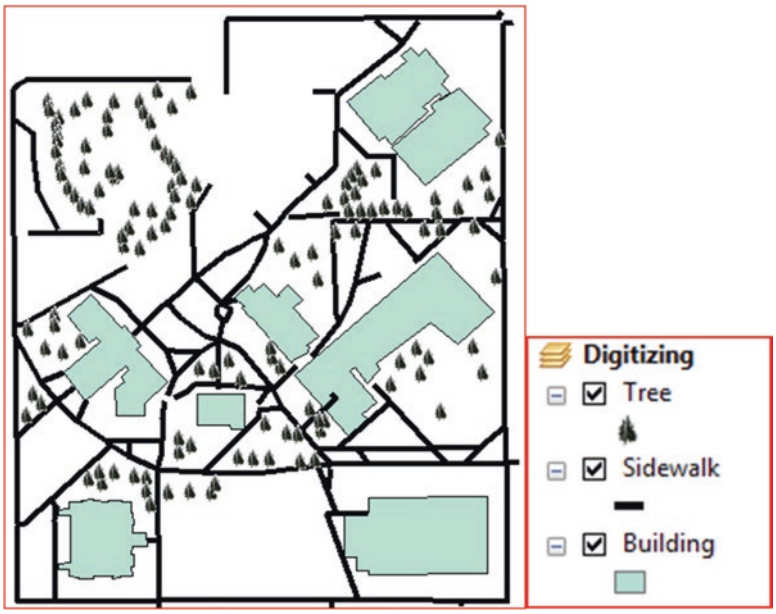
Create New Point Shapefile

Now we will digitize the tree layer. Begin by changing the symbol for the tree layer.

25. Double click on the symbol for the tree layer and then search "Tree" in the search bar. Then click on the desired tree symbol.

26. Now you will start digitizing by clicking on the Create Features window, and then clicking on "Trees" and then "Point" in the Construction Tools below.
27. Find a tree on the image background and click on it to digitize that point.
28. Repeat this process for the entire area of interest until you digitize all of the trees

29. With the Buildings, Sidewalk and Trees layers digitized, ArcMap will appear as follows for the area of interest. Note: Final digitizing of the Buildings, Sidewalk and Trees are in \Q6\Digitized folder



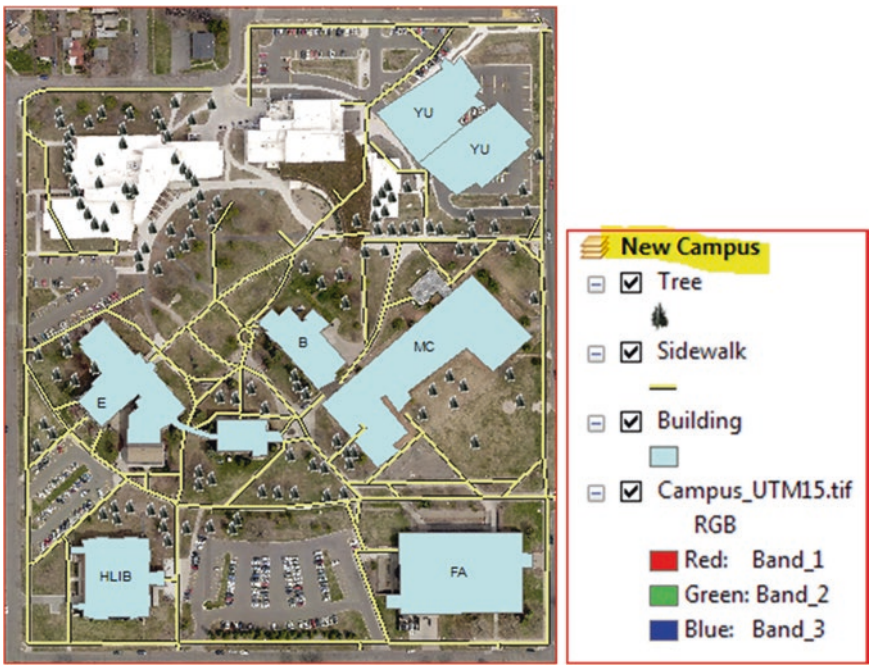
Update the Digitized Map

Overtime, some features will be removed, others will be modified, and new features will be added. To make these changes, sometimes you need to use an up-to-date image to update the features.

Scenario 7: The campus in 2010 modified, some building such as McCaskill Hall (MC) has been removed, Erlanson Hall (E) extended. And Yellowjacket Union (YU) student center modified and moved to another location. Two new buildings were added to the campus: Swenson Hall and the Greenhouse (GH). Your duty is to use an up-to-date image and perform all the changes.

GIS Approach

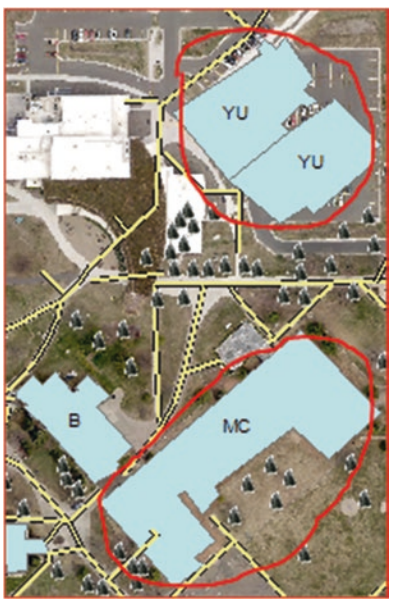
1. Insert Data Frame and call it **New Campus**
2. Click Add Data and browse to \\Data\Q6\Image highlight Campus_UTM15.tif and click Add
3. Click Add Data and browse to \\Data\Q6\Digitized and add Building.shp, Sidewalk.shp, and Tree.shp
4. R-click Building/and check Label Features
5. Change the symbol of the trees by choosing the Tree Symbol and make it size 10
6. Change the Sidewalk symbol by choosing "Expressway Ramp" and with a width of 2



Result: The image with the buildings, sidewalks, and trees that was digitized in the previous steps is displayed.

Remove the Non-existing Buildings from the New Image

The first step is to remove the buildings that do not exist anymore such as the McCaskill Hall (MC) and the Yellowjacket Union (YU) student center that has been destroyed and constructed at another location.



7. In TOC/R-click Building layer/Edit Features/Start Editing
8. In the Start Editing dialog box/highlight Building/click Continue
9. Zoom in around the YU building (you notice that the building does not exist in the new image, and a parking lot replaced it)

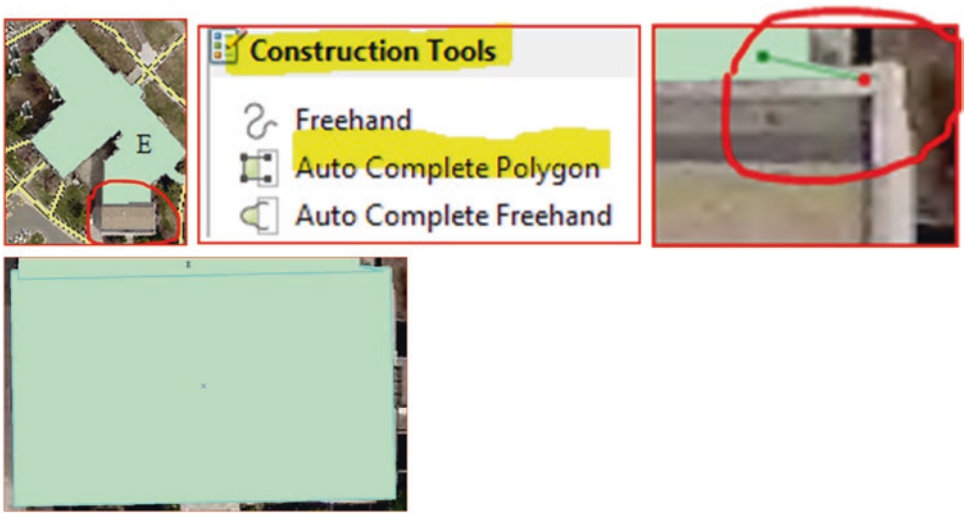
10. Click on the Edit Tool  in the Editor Toolbar, then click on one of the YU building, click Shift and click on the second building (now both buildings are selected)

11. Click "Delete" on the Keyboard (Both of the YU buildings will disappear, and you will see that a parking lot replaced the buildings)
12. Zoom in around the MC building, you notice that the building does not exist in the new image and is replaced by Oexemann Greenhouse (GH)
13. Click on the Edit Tool  in the Editor Toolbar, then click on MC building to select it and click "Delete" on the Keyboard (now the MC building is deleted)

Modify the E Building

The previous digitizing missed the southern part of Erlanson Hall (E) and your duty is to digitize it using the "Auto Complete Polygon" tool

14. Zoom in around the southern part of E Building.
15. Click on the **Create Features** window and then click on Buildings, and then Auto Complete Polygon under Construction Tools.
16. Click inside the E building first, then click on the upper right corner of the non-digitized building on the image, then on the lower right corner, then on the upper left corner and then Double-click inside the digitized E building to finish digitizing



Next, you have to continue digitizing the Swenson Hall (SW) and Greenhouse (GH) buildings that have erected after the MC was building removed. You have to digitize them in order to have them added to the attribute table of the Building layer. After you finish digitizing the building, update the Tree and Sidewalk layers as seen in the image. Your final drawing should be like the one seen below