

Applied Geomorphology

Lab 6: GPS Surveying

Introduction

In this lab you will use hand-held GPS receiver units to map a running trail on campus. In addition, you will take waypoints for the corners of the Life Sciences Building. You will then download the data using the “All Topo” application, and generate a hard copy map. To accomplish this task you will need to know how to:

1. Set the GPS to a specific map datum and coordinate system. For this project we are using NAD27 datum, UTM coordinates in zone 16. To set the map datum and coordinate system follow the below steps:
 - a. Go to the main menu page (the page that contains many icons) and select the “setup” option.
 - b. Select “units” option.
 - c. For position format select “UTM UPS”. By selecting UTM coordinates you are configuring the GPS to output coordinates that correspond to the UTM grid marked on all modern USGS topographic maps. Units for the coordinates are meters.
 - d. Set the “map datum” to “NAD27 CONUS” (North American 1927 datum for continental U.S.). This datum matches the published USGS Springhill 1:24,000 quadrangle that contains the USA campus area.
2. Store waypoints on the GPS with sufficient frequency that the distribution will accurately delineate the assigned trail. You will also need to be able to judge whether or not the GPS is receiving high-resolution data from satellites before saving a waypoint. Your instructor will demonstrate the setup and saving waypoint steps on the GPS receiver at the start of the lab session on campus. The goal is to accurately delineate the running trail that circles 3 Mile creek on campus. Each waypoint will be displayed on a final hard copy map.
3. Downloading the stored waypoints to an aerial base map of the campus. We will be using “All Topo GPS” application to download the waypoints to a text file. The text file will be edited and then imported into an Excel spreadsheet.
4. The GIS application ArcMap (9.3) will be used to generate the waypoint position map overlain on top of the campus aerial at a scale of 1:5,000. The map will have a title, graphical scale, North arrow and UTM grid.

Traverse

We will meet initially in 335 to go over operation of the GPS and to designate groups. After that we will walk to the trailhead and walk through the trail so that everyone knows exactly what is to be mapped. We will collect a few waypoints along the way. When you know where the end of

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the traverse is located, I will turn you loose to work in groups.

Download Waypoints from Receiver using All Topo GPS Tool

Begin by connecting the GPS cable to the receiver and a computer serial port. Make sure AllTopo is installed on the computer (all of the workstations in LSCB137 will have it installed). Turn on the GPS receiver. Start AllTopo by double-clicking on the “AllTop” icon on the desktop. It is helpful to have the Springhill quadrangle loaded into the main window for reference, but not necessary.

1. Select the menu option “Tools” > “GPS Tool”. Under the “GPS Setup” tab make sure “Garmin” is selected, and that the serial port is “COM1” for the lab workstations (The communications port may vary for different computers). Clicking on the “Test Link” should return a message from the receiver verifying that communications are working. Seek help from your instructor if this doesn’t work.

2. Select the “Coordinate List” tab, and then choose “Load coordinates from GPS receiver” button. On the pop-up window select the “Waypoint List” option, and then you should see a list of waypoints similar to **Figure 1**. You can use the mouse + <ctrl> or <shift> keys to control which waypoints are selected (blue highlight).

3. Write the selected waypoints to a file by clicking on the “Save selected Coordinates to Waypoint File”. Save the file to “c:\ArcGIS_Data\GY301\GPS_Project\waypoints.txt”.

Edit Waypoint Text File For Excel

1. Load the “waypoints.txt” file into “Notepad” or any other standard text editor. The original text file should be changed from the below format:

```
; Start ATMGPS 9/21/2009
6:42:35 PM
<+>
<@ GetDef>
<Line 2 Blue> ; Line width, color
<Symbol M=2 W=1> ; Symbol (set W=-1) to turn off
```

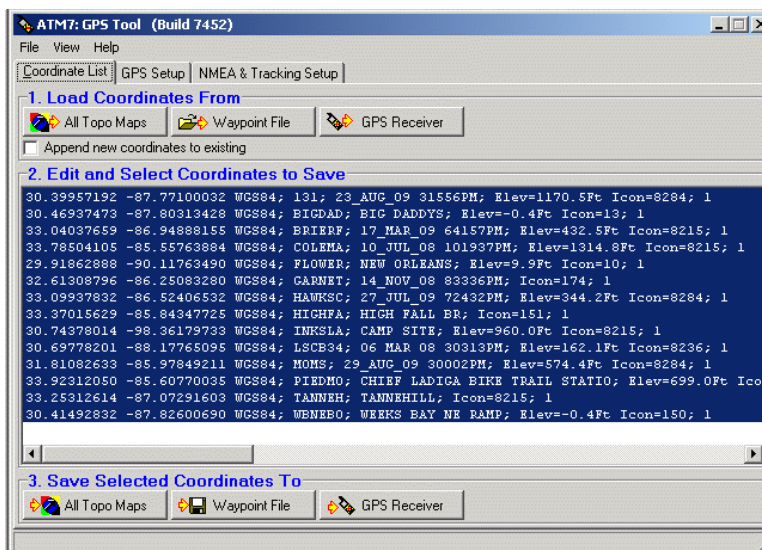


Figure 1: Waypoint list in All Topo GPS tool.

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```
30.6991513 -88.177415; ST01; 06 MAR 08 30313PM; Elev=121.2Ft Icon=1
30.6975651 -88.177621; ST02; 06 MAR 08 30313PM; Elev=162.1Ft Icon=1
.
.
.
.
<->
; End ATMGPS 9/21/2009 6:42:35 PM
```

to the below format

```
"Latitude", "Longitude", "Point", "Elev"
30.6991513, -88.177415, "ST01", 165.4
30.6975651, -88.177621, "ST02", 162.1
.
.
.
.
```

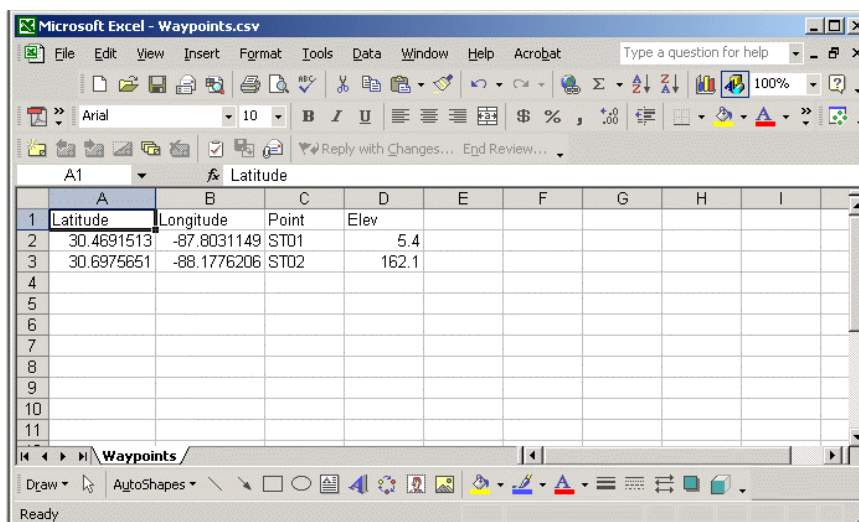
The above format should be saved to “Waypoints.csv” - this file will be imported into Excel.

Load CSV file into Excel and save as a Spreadsheet file

1. Start “Excel” from the desktop and select “File” > “Open” from the menu. Change the file type to “.csv” so that you can select “waypoints.csv” in the file open window. The file should appear like

Figure 2. This file can now be used by ArcMap to plot the waypoint positions. Save the file to

“C:\ArcGIS_Data\GY301\GPS_Project\waypoints_group1.xls” with the “File” > “Save As” menu option (make sure the file type is “.xls”).



	A	B	C	D	E	F	G	H	I
1	Latitude	Longitude	Point	Elev					
2	30.6991513	-88.177415	ST01	165.4					
3	30.6975651	-88.177621	ST02	162.1					
4									
5									
6									
7									
8									
9									
10									
11									

Figure 2: Waypoint spreadsheet format.

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Create Final Map with ArcMap 9.3

1. Start “ArcMap” from the desktop. In the opening window dialog select a “New empty map”. Right-Click on “Layers” in the left features window, and then select “properties”. Modify the dialog to appear as in **Figure 3**.

2. Use the “Add Data” button to add the aerial to the ArcMap project (yellow diamond with black plus sign). The aerial file is “05401737.tif”, a georeferenced raster file. Adding this file will set the coordinate system to UTM NAD27 (matching the GPS receiver settings). Load the file from “C:\ArcGIS_Data\GY301\GPS_Project\” folder. Say “yes” if ArcMap asks if it should generate “pyramids” to speed raster processing.

3. Post your GPS waypoints by selecting “Tools” > “Add XY Data” in ArcMap. Setup the ensuing window dialog as in **Figure 4**. Ignore any warnings regarding a missing object ID. Select the coordinate system from “Geographic Coordinates” > “North America” > “North Am. Datum 1927”.

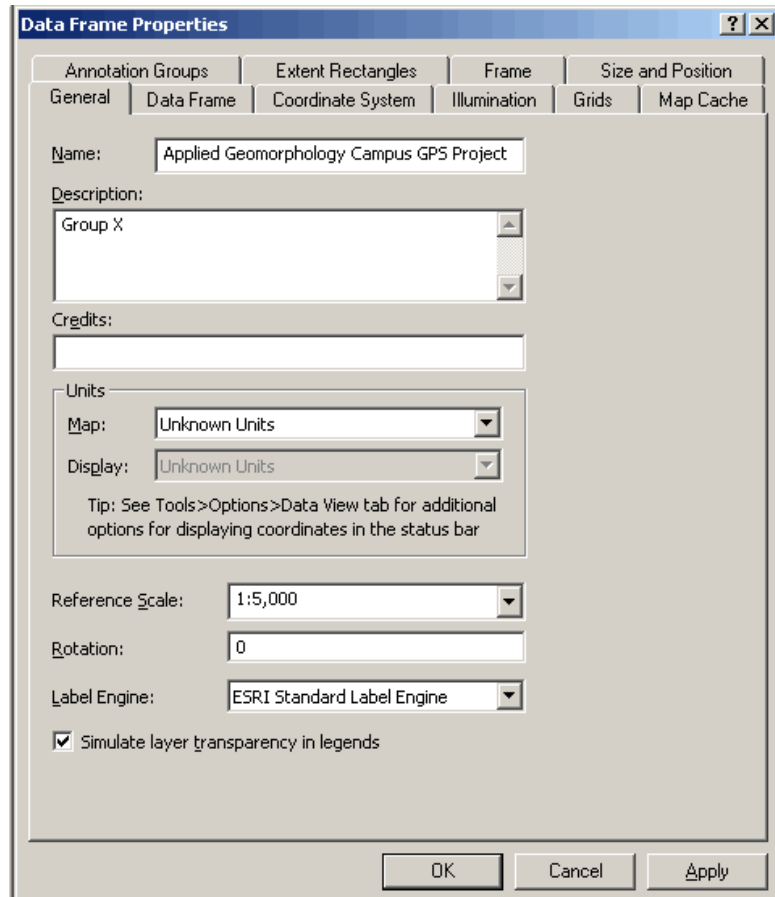


Figure 3: Layer properties window settings.

4. You should now see the waypoints posted on the campus aerial. Right-click on the waypoint symbol in the left features window to change the size and color (8 points, red color). If you can’t see the waypoints seek help from your instructor.

5. Right-Click on the current waypoints feature name and select “properties” and the “General” tab to change the name to “GPS Waypoints”. Use the same method to change the campus aerial feature layer to “Campus Aerial (2006)”. Right-click on the waypoints layer and select “zoom to

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layer” to center the map window around the GPS waypoints.

6. Right-click on the waypoints layer name again and select “Properties” and then the “labels” tab. Set the label properties to 8 points and a red color as in **Figure 5**. You should now be able to see labels on the map next to the waypoint markers.

7. The map is ready to layout for printing. Select “File” > “Page Setup” from menu, and select the “HP 2600 laser” printer in landscape orientation. See the other settings in **Figure 6**.

8. Select the “View” > “Layout” option from the main menu. You will now see a page margin with a re-sizable frame around the map. Re-size the frame to approximate the position in **Figure 7**. Right-click on the map frame and select “properties” and then the data frame tab. Set the scale of the map to “fixed scale” at 1:5,000.

9. Use the “Insert” menu to add the title, scale bar, north arrow, legend (do not include the aerial), scale text (1:5000) and graphical scale.

10. Add your group number and persons in your group to the lower right with the text tool. Save the ArcMap project file to “C:\ArcGIS_Data\GY301\GPS_project\GPS_project_group1.mxd”. (Substitute “group2” if you are in group 2, etc.).

11. Add a UTM grid to the map by right-clicking on the map frame, and then selecting “properties”. Select the “grid” tab, and then the “new grid” button. Choose “measured grid” and name the grid “UTM”. Next select the “Grids and Labels” appearance option, and set the x and y spacing to 100 meters. Allow the default options for the rest of the dialog. You will have to re-size the map frame to allow for the UTM labels.

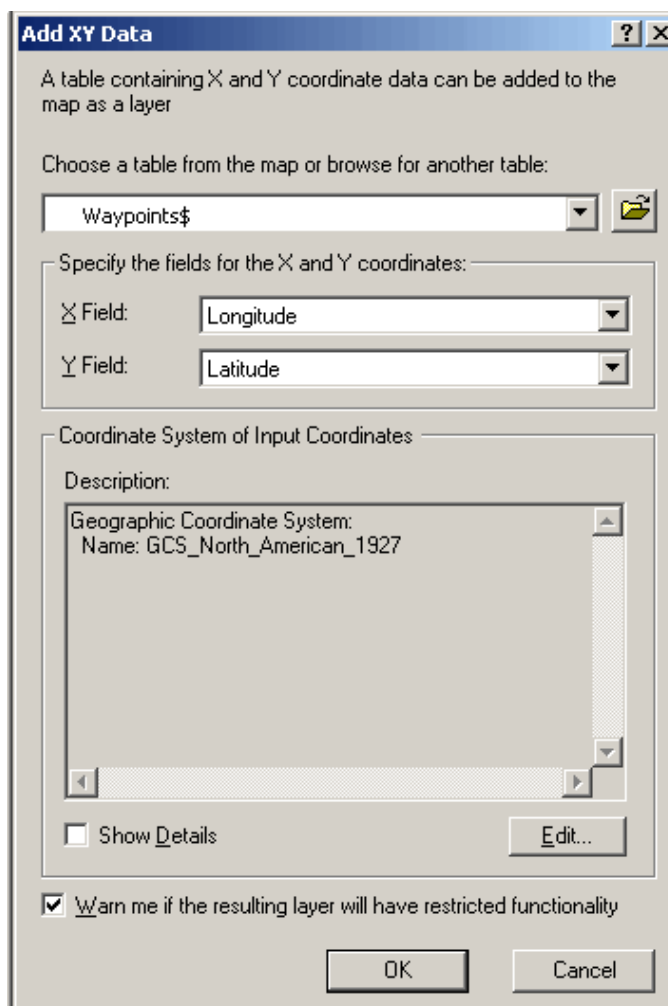


Figure 4: Add XY data window dialog setup.

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12. Select “File” > “Print” to setup the printing of the map. Make sure that the active printer is the “HP 2600 Laser” , and then select “OK”.

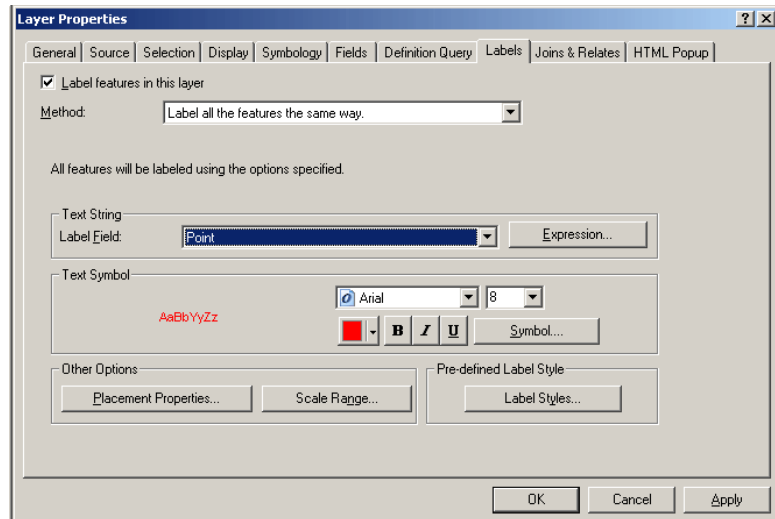


Figure 6: ArcMap waypoint labels dialog.

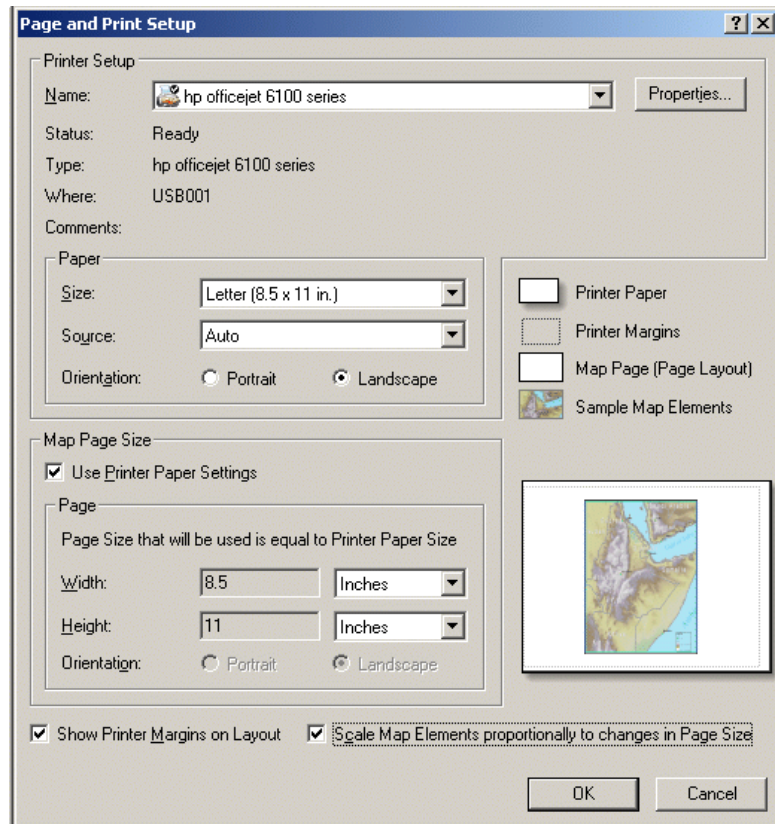


Figure 5: Page setup in ArcMap.

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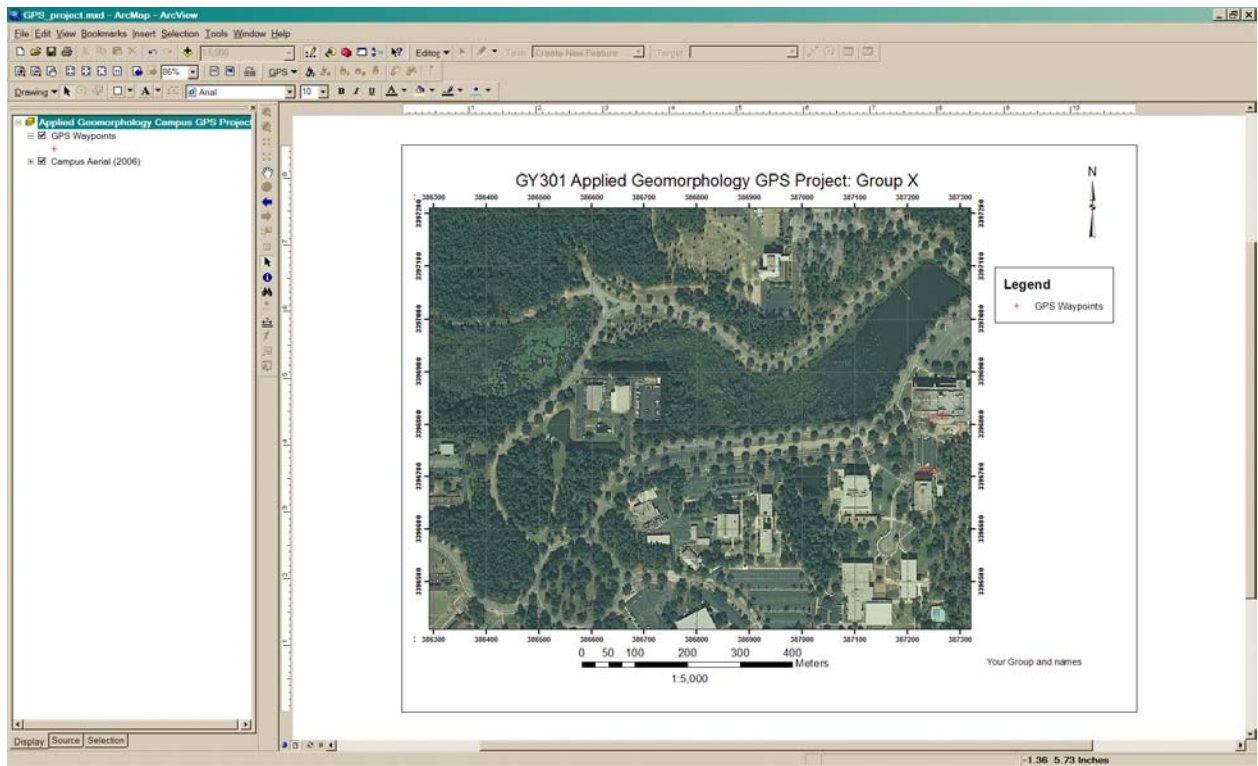


Figure 7: Layout of final map.