WMS 11.2 Tutorial

Projections / Coordinate Systems

Working with map projections in WMS

Objectives

Learn how to work with projections in WMS, and how to combine data from different coordinate systems into the same WMS project.

Prerequisite Tutorials

- Introduction to WMS

Required Components

- WMS Core

Time

- 15–25 minutes

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1 Introduction

Coordinate systems and map projections provide information for locating data on the earth (georeferencing). There are two types of coordinate systems: geographic and projected.

A geographic coordinate system uses a three dimensional sphere to locate data on the Earth. Data in a geographic coordinate system is referenced using latitude and longitude. Latitude and longitude are angles measured from the Earth's center to a point on the Earth's surface.

A projected coordinate system is two dimensional based on a sphere or spheroid. Unlike a geographic coordinate system, projected coordinate systems have constant lengths, angles, and areas across the two dimensions.[1]

A PRJ file is a text file containing information describing the type coordinate system and other relevant data to position the related data on the Earth. This tutorial provides an overview of working with projected data in WMS through the following steps:

1. Importing a TIFF file and assigning a projection.
2. Learning about the Display Projection.
3. Importing a CAD file and assigning a different projection.
4. Learning about “Project on the fly”.
5. Importing a shapefile with an associated projection.
6. Importing elevation data and edit points.
7. Creating a coverage.

[1] Information summarized from ESRI: http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=projection_basics_the_gis_professional_needs_to_know

2 Getting Started

To begin the tutorial, do the following:

8. Launch WMS.
9. Select *File* | **New** to restore program settings to the default state.

3 Importing an Image

Start by importing an image of an area where the model will be built. The image was downloaded from the state of Massachusetts.

1. Click the **Open** button to bring up the *Open* dialog.
2. Navigate to the *Projections\Projections* folder.
3. Select "q233914.tif" and click **Open** to import the image and close the *Open* dialog.
4. Move the mouse around in the Graphics Window.

Notice that the lower right corner of the image is at x=233,000 and y=914,000 (which is where the file name "q233914" comes from). This image came with a TFW file (TIFF world file); the world file gives the location and size of the pixels in the image file.

No PRJ file was included with this image, so while WMS is able to read the world file and position the image at the correct coordinates, WMS is not able to georeference the location of the image. The projection of the image must be specified in order to georeferenced the image.

3.1 Setting the Projection

To set the projection in WMS:

1. Right-click " q233914.tif" in the Project Explorer and select *Projection* | **Projection…** to bring up the *Projection* dialog.
2. In the *Horizontal* section, select the **Global projection** radio button to bring up the *Horizontal Projection* dialog.

This dialog is used to select a projection and can also be used to export or import PRJ files.

3. Enter "1983 Meters Massachusetts" in the *Filter strings* edit field.
4. Select the "NAD1983 StatePlane Massachusetts FIPS 2001 (Meters)" item from the list.
5. Click **OK** to exit the *Horizontal Projection* dialog.
6. Click **OK** to exit the *Projection* dialog.
7. Click **OK** at the warning that explains that a projection will be added to the file.
8. Click **Save** from the *Save As* dialog to save the new TIFF file.
9. Click **OK** if a warning dialog appears stating the display projection must be set.
10. If the *Display Projection* appears, click **OK**.

Projection data has now been added to the TIFF file. Any time this TIFF file is imported into WMS (or any GIS application), it will use the set projection.

> Any time the projection is set on an image, a new image will be exported from GMS with the projection information stored in that image.

11. Move the mouse around the Graphics Window.

Notice that the coordinates are the same as before but now the latitude and longitude are displayed as the mouse moves

When data which includes projection data is imported WMS, it will set the display projection. The display projection can be changed to any supported projection, though some projections are not compatible. For example, data in State Plane, Massachusetts Mainland will not display in the Philippines Grid.

3.2 Setting Transparency

The transparency of the image must now be changed so that the other data brought into the project will be easier to see.

To do this:

1. Right-click on "q233814_exported.tif" in the Project Explorer and select **Transparency…** to bring up the *Layer Transparency* dialog.
2. Use the slider to set *Transparency* to "60%".
3. Click **OK** to exit the *Layer Transparency* dialog.

The project should appear similar to Figure 1.

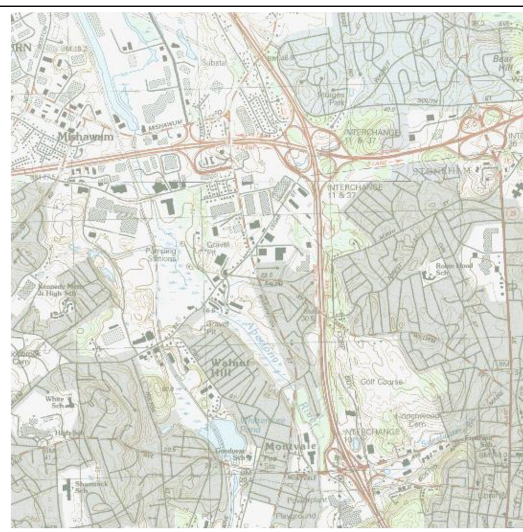

Figure 1 Map image with 60% transparency applied

4 Importing a CAD File

To import a CAD file with the roads in the study area, do the following:

1. Select the **Open** button to bring up the *Open* dialog.

2. Select “roads.dwg” and click the **Open** button to import the file and close the *Open* dialog.

3. In the Project Explorer, right-click on “ roads.dwg” and select **Zoom to Extants**.

After importing the CAD file, the Graphics Window should appear as in Figure 2.

Figure 2 Imported CAD data

Notice that the background image has disappeared. By moving the mouse around in the Graphics Window, the displayed coordinates vary from (-71.15, 42.46) to (-71.09, 42.52), and the latitude/longitude values have changed.

Because there was no PRJ file associated with this CAD file, the data is drawn at the coordinates specified in the file. A projection for the CAD data must be specified so that it will be drawn in the correct location. This particular file has coordinates in latitude/longitude.

To set the projection:

4. Right-click on “ roads.dwg” in the Project Explorer and select *Projection* | **Projection** to bring up the *Projection* dialog.

5. In the *Horizontal* section, select *Global projection* and click the **Set Projection…** button to bring up the *Horizontal Projection* dialog.

Instead of searching the tree for the correct projection, enter the EPSG code to assign a geographic projection to the CAD data.

6. Select the **EPSG code** button to open the *Projection from EPSG code* dialog

7. Enter “4269” as the *New EPSG code*.

8. Click **OK** to exit the *Projection from EPSG code* dialog.

9. Click **OK** to exit the *Horizonatal Projection* dialog.

10. Click **OK** to exit the *Projection* dialog.

11. Click **OK** at the warning that explains that a projection will be added to the file.

12. Right-click on “ roads.dwg” in the Project Explorer and select **Zoom to Extents**.

The image should now be visible behind the CAD data (Figure 3). Even though the CAD data is in a different projection from the display projection, it is positioned in the correct location. The CAD data is "projected on the fly", which involves transforming the coordinates of the CAD data from latitude and longitude to State Plane meters.

Items with a projection different from the display projection are "projected on the fly" so that they are positioned correctly.

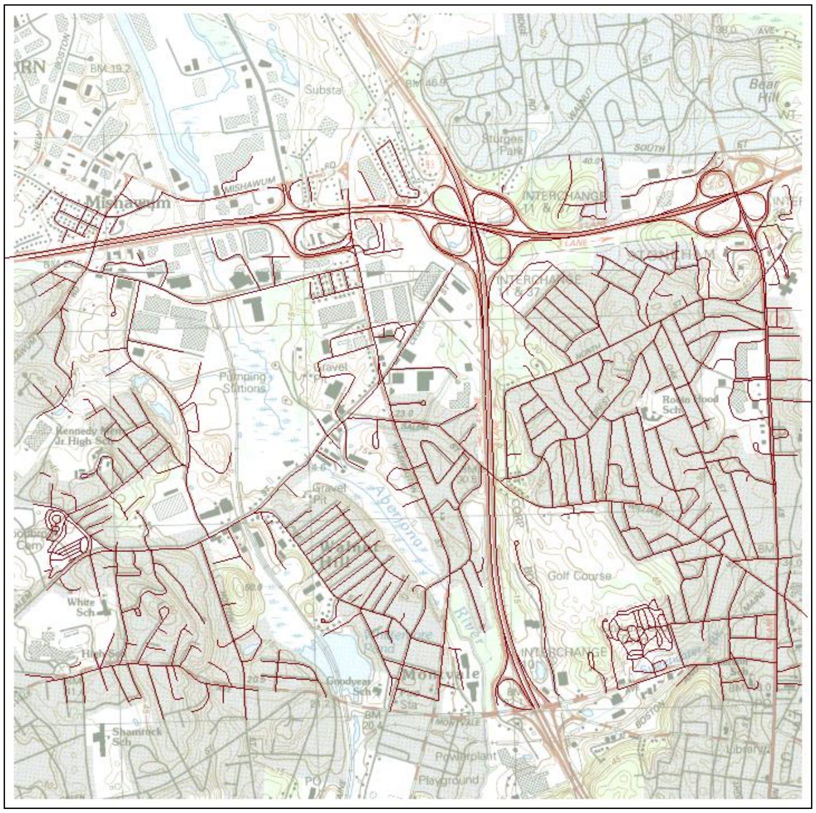

Figure 3 CAD correctly positioned after specifying the projection

If the CAD file had initially had an associated PRJ file, then the data would have already been correctly positioned in the current display projection.

When opening the *Horizontal Projection* dialog, notice that a list of recently used projections is shown. This can be useful when assigning the same projections to multiple objects. Likewise, frequently used projections can be saved by right-clicking on the projection and selecting **Add to Favorites** which will then show the projection under the favorite projections folder.

5 Importing a Shapefile

A shapefile of the Aberjona River will now be imported. This shapefile uses a different projection than the display projection.

To import the shapefile:

1. Click the **Open** button to bring up the *Open* dialog.
2. Select "AberjonaRiver_Clip.shp" and click **Open** to import the file and close the *Open* dialog.

The Graphics Window should appear as in Figure 4.

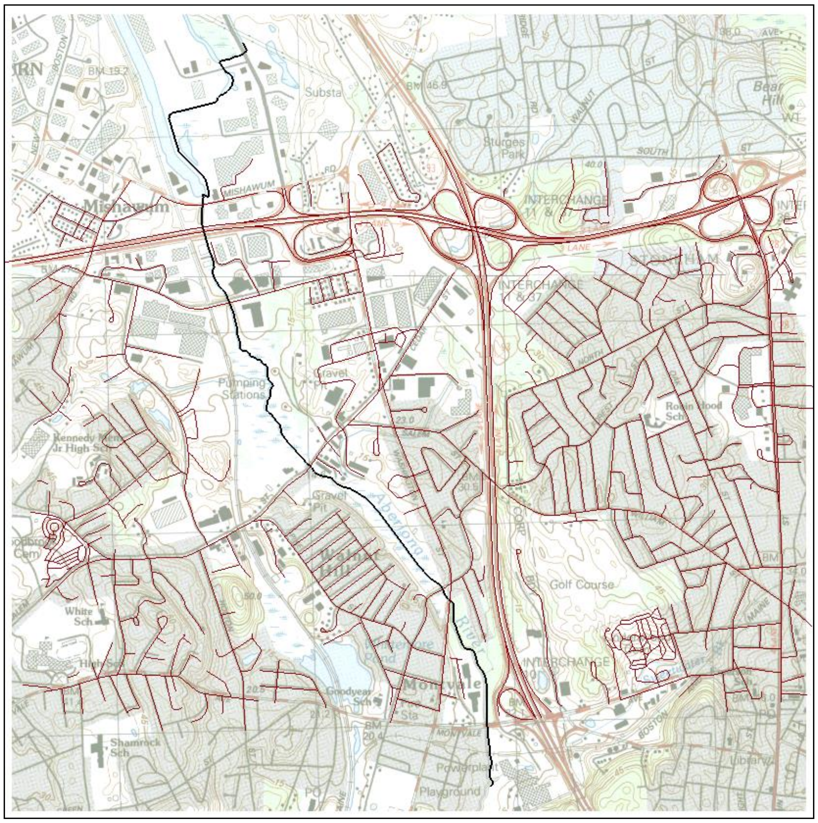

Figure 4 Aberjona River shapefile

3. Right-click on " AberjonaRiver_Clip.shp" in the Project Explorer and select *Projection* | **Projection…** to bring up the *Projection* dialog.

Note the projection is "NAD_1983_UTM_Zone_18N", which was imported from the PRJ file associated with the shapefile. This allowed WMS to place the shapefile in the correct location.

4. Select **Cancel** to exit the *Projection* dialog.

If a file is imported imnto WMS, and the file has an associated PRJ, then the projection is imported with the file.

6 Importing Elevation Data

Next to import surface elevations into the project from a text file by doing the following:

1. Select the **Open** button to bring up the *Open* dialog.
2. Select "elev.txt" and click **Open** to close the *Open* dialog and open the *Text Import Wizard – Step 1 of 2* dialog.
3. Below the *File import options* section, turn on *Heading row*.
4. Click the **Next >** button to bring up the *Text Import Wizard – Step 2 of 2* dialog.
5. Select "2D scatter points" for the *WMS data type*.

6. Click the **Finish** button to close the *Text Import Wizard – Step 2 of 2* dialog.

To set the projection to make the scatter set display correctly, do the following

7. Right-click on " elev" in the Project Explorer and select *Projection* | **Projection** to bring up the *Projection* dialog.
8. In the *Horizontal* section, select *Global projection* and click on the **Set Projection…** button to bring up the *Horizontal Projection* dialog.
9. Click the **.prj file** button to bring up the *Open* dialog.
10. Browse to the *Projections\Projections* directory and select "elev.prj".
11. Click **Open** to close the *Open* dialog.
12. Click **OK** to close the *Horizontal Projection* dialog.
13. Click **OK** to close the *Projection* dialog.
14. Select " elev" in the Project Explorer and click the **Frame** macro.

The Graphics Window should appear similar to Figure 5.

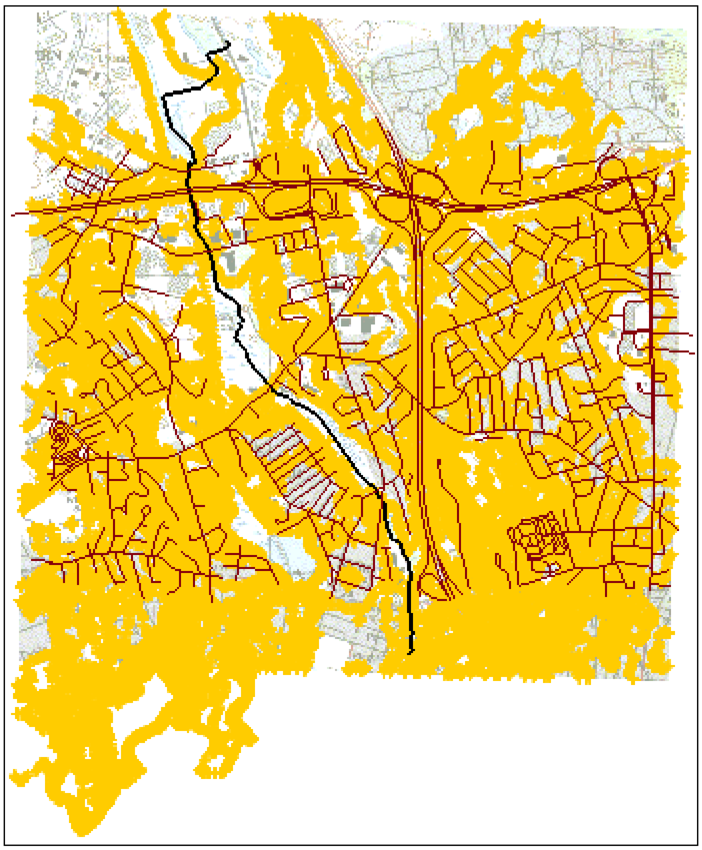

Figure 5 Imported elevation data

6.1 Editing the Scatter Points

The elevations that are in the project can be edited as follows:

1. Select " elev" in the Project Explorer to make it active.

2. Using the **Select Scatter Point** tool, select one of the scatter points in the Graphics Window by clicking on it.
3. Press the *Delete* key to delete the selected point. A prompt appears that explains that the projection of the “elev” scatter set does not match the display projection. In order to edit the points, the scatter set’s projection must be the same as the display projection.
4. Select **Yes** at the prompt to change the display projection to match that of the “elev” scatter set projection.
5. **Frame** the project.
6. Press the *Delete* key again to delete the selected point.

> An item in a project can be edited only if its projection matches the display projection.

7 Creating a Coverage

A coverage can be created by doing the following:

1. Right-click on “ Coverages” in the Project Explorer and select **New Coverage…** to bring up a *Properties* dialog.
2. Click **OK** to accept the default settings and exit the *Properties* dialog.
3. Right-click on “ new coverage” and select *Projection* | **Projection…** to bring up the *Projection* dialog.
4. Notice that the projection for this coverage is the same as the Display Projection. Click **OK** to exit the *Projection* dialog.

> When a new item is created in a WMS project, the projection of the new item will be set to match the Display Projection.

8 Conclusion

This concludes the “WMS Projections / Coordinates Systems” tutorial. The following items were discussed in the tutorial:

- WMS supports many different projections.
- WMS has a user-defined display projection.
- An item’s projection can be specified in WMS and the file will be overwritten.
- All georeferenced data in a WMS project is drawn in the display projection; this requires “Projecting on the fly”.
- Newly created items in a WMS project are assigned the display projection by default.
- To edit an item in a WMS project, the item’s projection must match the display projection.