WMS 11.4 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	Required Components	Time
• Introduction to WMS	• WMS Core	• 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 of 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.

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[1] Information summarized from ESRI: https://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:

1. Launch WMS.

2. If WMS is already running, from the *Menu* bar, select the *File | **New*** menu item or press the **Ctrl-N** keys to ensure that the program settings are restored to their default state.

3. A dialog may appear asking to save changes. Click the **Don't Save** button to clear all data.

## 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. From the *Macro* bar, click the **Open** macro to bring up the *Open* dialog.

2. Navigate to the *Projections\Projections* folder.

3. Select the "q233914.tif" file and click the **Open** button to import the image and close the *Open* dialog.

4. Move the mouse around in the Graphics Window.

Hover the cursor over the lower right corner of the image and notice in the *Cursor Coordinates* bar that 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. In the Project Explorer*,* right-click " q233914.tif" and select the *Projection | **Projection…*** context menu item 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. In the *Filter strings* edit field, enter "1983 Meters Massachusetts".

4. From the list of projections, select the "NAD 1983 StatePlane Massachusetts FIPS 2001 (Meters)" item.

5. Click the **OK** button to exit the *Horizontal Projection* dialog.

6. Click the **OK** button to exit the *Projection* dialog. A warning dialog appears.

7. At the warning dialog that explains that a projection will be added to the file, click the **OK** button. The *Save As* dialog appears.

8. In the *Save As* dialog, click the **Save** button to save the new TIFF file.

9. If a warning dialog appears stating the display projection must be set, click the **OK** button.

10. If the *Display Projection* dialog appears, click the **OK** button to accept the default.

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 in the *Cursor Coordinates* bar.

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. In the Project Explorer, right-click on " q233814_exported.tif" and select the **Transparency…** context menu item to bring up the *Layer Transparency* dialog.

2. Using the slider, set the *Transparency* to "60%".

3. Click the **OK** button to exit the *Layer Transparency* dialog.

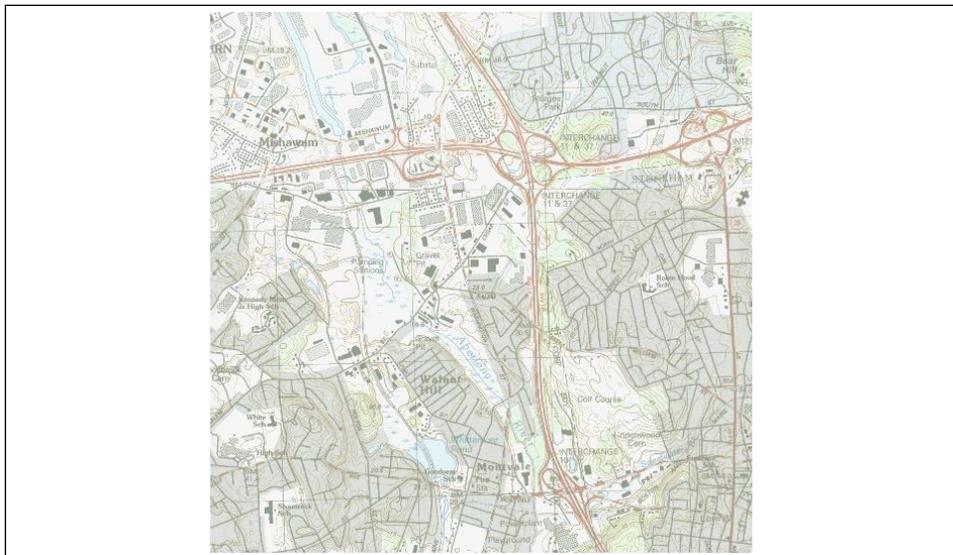The project should appear similar to   Figure 1.

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** 📂 macro to bring up the *Open* dialog.

2. Select the "roads.dwg" file 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 the **Zoom to Extants** conext menu item.

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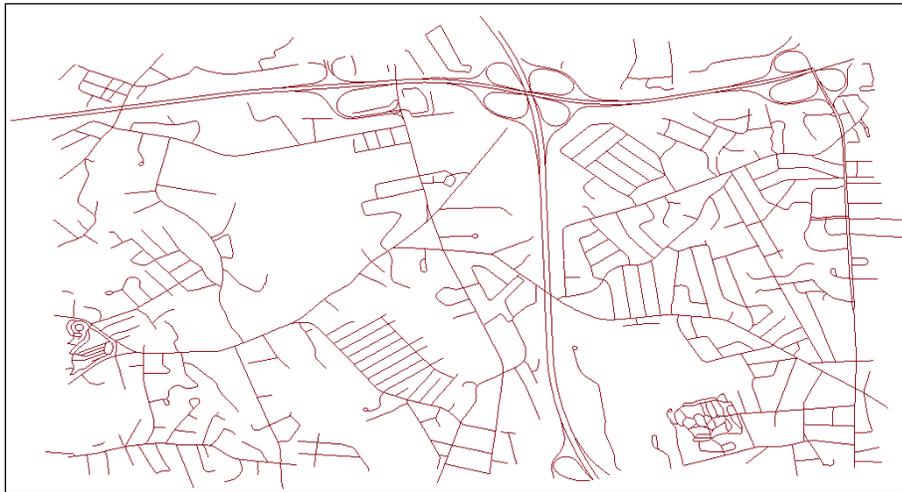

Figure 2:   Imported CAD data

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. In the Project Explorer*,* right-click on "🗋 roads.dwg" and select the *Projection | **Projection*** context menu item to bring up the *Projection* dialog.

5. In the *Horizontal* section, select the *Global projection* radio button*.*

6. Click the **Set Projection…** button to bring up the *Horizontal Projection* dialog.

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

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

8. For the *New EPSG code,* enter "4269".

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

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

11. Click the **OK** button to exit the *Projection* dialog. A projection warning will appear.

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

13. In the *Project Explorer*, right-click on "🗏 roads.dwg" and select the **Zoom to Extents** context menu item.

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.
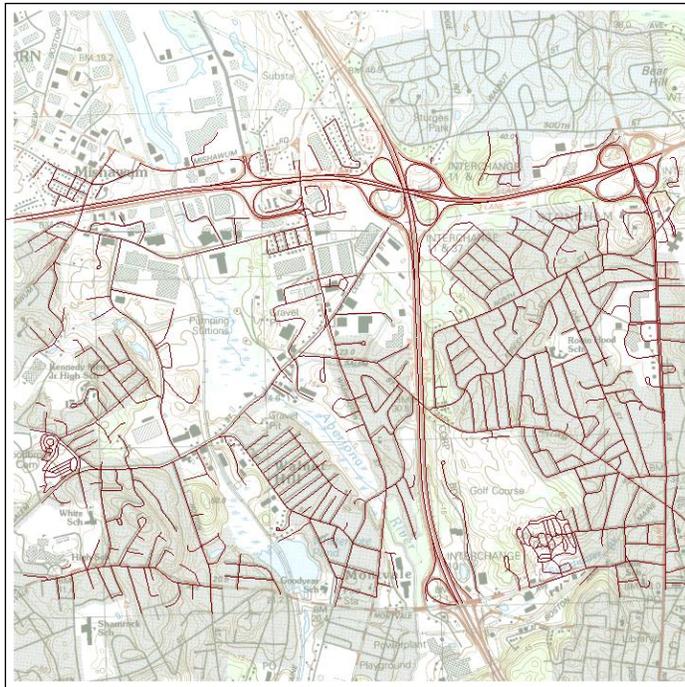

Figure 3:   CAD correctly positioned after specifying the projection

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. From the *Macro* bar, click the **Open** 📂 macro to bring up the *Open* dialog.

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

The Graphics Window should appear as in   Figure 4.

Figure 4:   Aberjona River shapefile

3. In the Project Explorer, right-click on "⬒ AberjonaRiver_Clip.shp" and select the *Projection* | **Projection** context menu item 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. Click the **Cancel** button to exit the *Projection* dialog.

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

6   Importing Elevation Data

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

1. From the *Macro* bar, click the **Open** 📂 macro to bring up the *Open* dialog.

2. Select the "elev.txt" file and click the **Open** button to close the *Open* dialog and open the *File Import Wizard – Step 1 of 2* dialog.

3. Below the *File import options* section, turn on the *Heading row* checkbox.

4. Click the **Next >** button to bring up the *File Import Wizard – Step 2 of 2* dialog.

5.   For the *WMS data type,* select the "2D scatter points" drop-down menu item.

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

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

7.   In the Project Explorer, right-click on "⊞ elev" and select *Projection |* **Projection** to bring up the *Projection* dialog.

8.   In the *Horizontal* section, select the *Global projection* radio button*.*

9.   Click the **Set Projection…** button to bring up the *Horizontal Projection* dialog.

10. For the *Add projection from* option, click the **.prj file** button to bring up the *Open* dialog.

11. Browse to the *Projections\Projections* directory and select the "elev.prj" file.

12. Click the **Open** button to close the *Open* dialog.

13. Click the **OK** button to close the *Horizontal Projection* dialog.

14. Click the **OK** button to close the *Projection* dialog.

15. In the Project Explorer, select "⊞ elev".

16. From the *Macro* bar, 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. In the Project Explorer, select " elev" to make it active.

2. Using the **Select Scatter Point** tool from the *Dynamic* toolbar, select one of the scatter points in the *Graphics Window* by clicking on it.

3. Press the **Delete** key to delete the selected point.

4. If a prompt asking if you are sure you want to clear the item appears, click the **OK** button.

A prompt appears that explains that the projection of the "elev" scatter set does not match the display projection. To edit the points, the scatter set's projection must be the same as the display projection.

5. Select the **Yes** button at the prompt to change the display projection to match that of the "elev" scatter set projection.

6. Click the **Frame** macro to zoom to the extents of the project.

7. Press the **Delete** key again to delete the selected point.

8. If a prompt asking if you are sure you want to clear the item appears, click the **OK** button.

> 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. In the Project Explorer, right-click on the " Coverages" map data and select the **New Coverage…** context menu item to bring up a *Properties* dialog.

2. Click the **OK** button 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 the **OK** button 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 to the display projection by default.

- To edit an item in a WMS project, the item's projection must match the display projection.