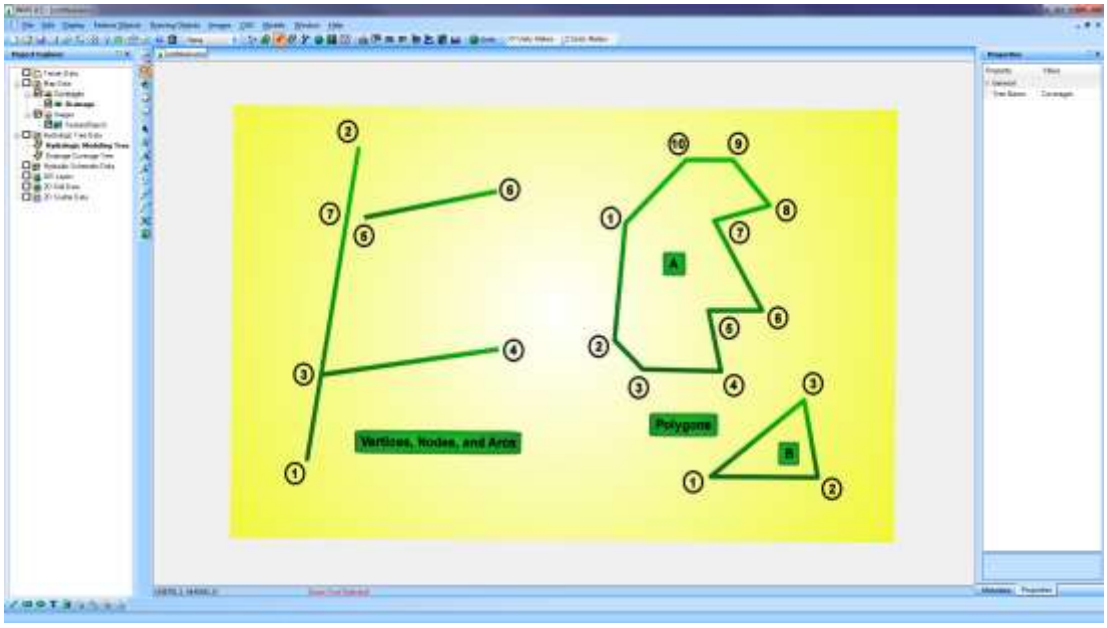
WMS

v. 10.0

WMS 10.0 Tutorial

Introduction – Basic Feature Objects

Learn about feature objects, create, edit, and manage them in WMS, and import and use GIS data



Objectives

Define the term "Feature Objects". Create, edit, and manage feature objects and coverages in WMS. Import GIS data and convert the data to feature objects in the map module. Use images to create feature objects from scratch.

Prerequisite Tutorials

- None

Required Components

- Data
- Map

Time

- 30-60 minutes

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1 Introduction

Feature objects are points, lines, and polygons organized in coverages by different attribute sets such as drainage features, land use, soils, time travel paths, cross sections, etc. The primary coverage in WMS is the drainage coverage, which holds drainage boundary polygons, stream lines, and outlet nodes. Most of the other coverages are secondary to the drainage coverage and are used to “map” other hydrologic parameters such as travel time or curve numbers. Feature objects are equivalent to GIS vector data, therefore, importing from GIS databases is one important way to create coverages in WMS. Another important method for creating feature object coverages is to digitize directly from the screen, using a georeferenced image in the background as a guide. In this exercise users will experiment with both methods, with the main focus being the use of the various tools and assigning attributes.

2 Objectives

This exercise will teach the basics for creating and importing feature objects and managing different coverages. This includes the following:

1. Creating and editing feature objects
2. Defining feature object attributes
3. Creating coverages and specifying attribute sets
4. Using shapefiles
5. Using images to create feature objects
6. Managing multiple coverages

3 Creating and Editing Feature Objects

The Terrain Data, Drainage, and Map modules are where the feature objects are created and manipulated. All feature objects are made from a set of points and the lines connecting the points. There are three main types of feature objects: points, arcs, and polygons. The following steps will teach users how to create and edit the different types of feature objects.

1. Close all instances of WMS.
2. Open WMS.
3. Switch to the **Map** module.
4. Select *File* | **Open**.
5. In the *Open* dialog, locate the "feature" folder in the files for this tutorial. If needed, download the tutorial files from www.aquaveo.com.
6. Locate and open "FeatureObjects.jpg".

The image will show up in the Main Graphics Window. This is just a picture of feature objects that users will use to trace and create feature objects. Do not be confused that it already "looks" like the feature objects are created.

3.1 Creating Feature Arcs

1. Find the portion of the image labeled Vertices, Nodes, and Arcs.
2. Choose the **Create Feature Arc** tool.
3. Single-click on the image near the point labeled 1.
4. Double-click on the image near point 2 to end the arc.

While creating a feature arc, users can press Esc to cancel, Backspace to back up one vertex, Enter or single-click to make a vertex, and double-click to end the arc. When WMS creates an arc, each end is a node and all points in the middle are vertices.

5. Single-click at point 3, directly on top of the newly created arc.
6. Double-click at point 4 to end the arc.

Notice how WMS automatically links the new arc to the existing arc and creates a node at the point of intersection.

7. Single-click at point 5.
8. Double-click at point 6.

3.2 Inserting Vertices and Snapping Arcs

Oftentimes, users will have two arcs very close to each other that should share a common node, but do not. WMS has an option to snap these nodes together.

1. Choose the **Create Feature Vertex** tool.
2. Single-click on the arc where it is labeled 7.

A vertex is inserted here just as if the user had clicked here when creating the arc originally. Users must create a vertex at this location so that the arc can be "snapped" to this location.

3. Choose the **Select Feature Point/Node** tool.
4. Right-click on the node labeled 5 and select **Clean** on the pop-up menu.
5. A *Clean Options* dialog box should pop up. Make sure the *Snap selected nodes* option is checked.
6. Select **OK.**

At the bottom of the WMS screen, notice the help script prompting the user to select a snapping point.

7. Select the newly created vertex (labeled 7).

WMS snaps the two arcs together and changes the vertex at point 7 to a node.

3.3 Deleting a Portion of an Arc

Now that the main arc has two nodes along its length, users can delete the center portion only.

1. Choose the **Select Feature Arc** tool.
2. Select the portion of the arc between nodes 3 and 7—it will highlight once it has been clicked on.
3. Press the *Delete* key, or right-click and select 'Delete', to delete the arc.
4. If asked to confirm deleting the Arc, select **OK** .

Users can also create arcs between two existing nodes. Practice this by reforming the arc that was just deleted.

5. Choose the **Create Feature Arc** tool.
6. Click on the node labeled 3.
7. Click on the node labeled 7 to re-form the arc.

3.4 Converting Vertices to Nodes

WMS uses vertices and nodes for different purposes. For example nodes can have attributes while vertices simply define the shape or position of the arc. Sometimes users will need to change a vertex to a node or a node to a vertex.

1. Choose the **Create Feature Vertex** tool.
2. Double-click on the arc somewhere between nodes 3 and 7. A dot should appear, indicating the new vertex.
3. Choose the **Select Feature Vertex** tool.
4. Right-click on the new vertex and select **Vertex → Node** on the pop-up menu.

The user should now see a red node at this location. Effectively, the arc is now broken in half. It is also possible to define attributes (e.g. a drainage outlet) at this location.

3.5 Converting Nodes to Vertices

Just as users can change vertices to nodes, they can change nodes to vertices. It is not necessary in most cases to do this, but can leave the project with a "cleaner" representation of its feature arcs. For example, users now have to manage and assign attributes to one arc instead of two because converting a vertex to a node merges two arcs together.

1. Choose the **Select Feature Point/Node** tool.
2. Right-click on the node which was just converted in step 3.4 and select **Node → Vertex** on the pop-up menu.

The node has been changed back to a vertex.

3.6 Building Polygons

Find the portion of the image labeled Polygons.

1. Choose the **Create Feature Arc** tool.
2. Single-click at the point labeled 1 on polygon A.
3. Single-click on points 2 through 10.
4. Single-click on point 1 again to end.
5. Trace polygon B in the same manner.

The user should now have two closed loops made out of the arcs just created. They are not polygons at this time – they are still just arcs.

6. Right-click on the "Drainage" coverage in the Project Explorer and select **Build Polygon** on the pop-up menu.
7. A window should pop up, indicating that no arcs are selected.
8. Select **OK** to use all the arcs.

The two polygons should now be drawn with a thick line instead of the thinner arc lines. Polygons are built from their constituent arcs and it is during the build polygon function that the appropriate topology is established.

3.7 Assigning Attributes

Each of the nodes, arcs, and polygons users created were created with default properties or attributes. WMS allows users to change the attributes of feature objects.

1. Choose the **Select Feature Arc** tool.
2. While holding the SHIFT key down, select (multi-select) all 5 arc sections in the Vertices, Nodes, and Arcs portion of the image.
3. Select *Feature Objects* **| Attributes**

A *Feature Arc Type* dialog will come up allowing the user to choose whether they want the arcs to have the Generic, Stream, Pipe, Lake, or Ridge attribute.

4. Select the "Stream" option.
5. Select **OK.**

The arcs should now be colored blue. Each arc portion should have a small blue arrow on it. These arrows show the way the newly created stream flows. The original direction in which the user created the arc determines the way the stream flows now. Stream arcs should always be created from downstream to upstream. Users should also be able to see that the lower node on the arc looks different now. WMS has automatically changed it to a drainage outlet instead of a generic node.

6. Choose the **Select Feature Point/Node** tool.
7. Double-click on the lower node (now an outlet).

A dialog comes up showing that the node now has the Drainage outlet attribute. For any feature object (point, line, arc) users can select and then choose the Attributes command from the *Feature Objects* menu, or double-click to bring up the attributes dialog.

8. Select **OK.**

Just as users can change the attributes of arcs and nodes, they can change the attributes of polygons.

9. Choose the **Select Feature Polygon** tool.
10. Double-click anywhere inside Polygon A in the polygons portion of the image.
11. In the *Drainage Feature Polygon Type* dialog, select the "Drainage boundary" type.
12. Select **OK**.

Polygon A should now be drawn in a thick colored line.

13. Double-click anywhere inside Polygon B.
14. Select the *Lake/Reservoir* type.
15. Select **OK.**

Polygon B should now be drawn in light blue.

4 Using Shapefiles to Create Feature Objects

One of the most important features of WMS is the ability to automatically create feature objects using shapefiles.

1. Select *File* | **New**.
2. Select **No** when asked to save changes.

Users will import shapefile data differently depending on whether the computer they are working on has ArcView installed on it or not. For this exercise, the two ways are basically equivalent. However, with ArcView installed, users have access to more data types and display options.

4.1 Importing a Shapefile and Mapping to Feature Objects

1. Right-click on "GIS Data" in the Project Explorer and select **Add Shapefile data.**
2. In the *Select shapefile* dialog, locate and open "streams.shp".

In order for the shapefile to work correctly, "streams.dbf" and "streams.shx" must be located in the same directory as "streams.shp." This is true for all shapefiles.

3. Make sure the **GIS** module is selected.
4. Choose the **Select Shapes** tool.
5. Draw a box around all the shapes to select them all. Draw a box by holding down the left mouse button and moving a box across the screen to select all the shapes.
6. Select *Mapping* **| Shapes → Feature Objects.**

The window which pops up is the *GIS to Feature Objects Wizard*. It is used to map shapefile data to feature objects in WMS.

7. Choose **Next.**

The spreadsheet that is presented shows each shapefile attribute in capitalized letters. In this file, users should see *DRAINTYPE*, *LENGTH*, *SLOPE*, etc. Underneath each attribute is a dropdown box containing the WMS attributes a user can choose to map the shapefile attributes to.

8. The *DRAINTYPE* attribute should be mapped to "Drainage Arc type".
9. The *LENGTH* attribute should be mapped to "Stream length".
10. The *SLOPE* attribute should be mapped to "Stream slope".
11. The *DMANNINGS* attribute should not be mapped ("Not mapped").

This attribute cannot be mapped because there is not a corresponding WMS attribute available to map it to.

12. The *BASINID* attribute should be mapped to "Stream basin id".

Scroll through the mapping spreadsheet to see the value that is assigned to each attribute for each shape.

13. Click **Next.**
14. Click **Finish.**
15. Toggle off the "streams.shp" shapefile in the Project Explorer to see result of mapping the shapefile to WMS feature objects.

Users have now imported a shapefile containing streams and basins, converted all the shapes to WMS feature objects, and mapped data from the original shapefile to WMS attributes.

5 Creating Feature Objects Using Background Images

Another important feature of WMS is the ability to create feature objects using background images as guides. For instance, users may have a soil use map they want to read into WMS. The following procedure explains how this is done.

5.1 The Project Explorer

First, users will need to create a new coverage by utilizing the Project Explorer on the left hand side of the WMS main window.

The Project Explorer displays and allows users to manage the current coverages and data in WMS.

1. Select *File* | **New** .
2. Select **No** if a prompt appears asking to save changes.

In the Project Explorer, there is a folder entitled Map Data. Users should also see the default coverage listed (always a Drainage coverage when beginning a new project) in the Coverages folder. From the Project Explorer, users can manage the default coverage, make new coverages, delete coverages, edit coverage properties, and change the active coverage.

3. Right-click on the existing coverage in the Project Explorer, named "Drainage".

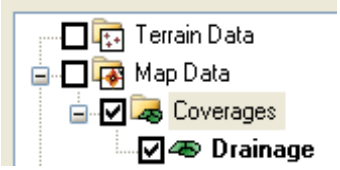

Figure 1 Drainage in Project Explorer

4. Select **Rename.**
5. Enter "PracticeDrainage" for the new coverage name.
6. Right-click on the "Coverages" folder.
7. Select **New Coverage.** A *Properties* dialog will appear.
8. From the *Coverage type* dropdown box, select "Soil Type".
9. Notice that the coverage name in the field below is automatically changed to "Soil Type".
10. Select **OK**.
11. Click on the "PracticeDrainage" coverage.

This coverage shows up in color and bold, while the "Soil Type" drainage is in gray and regular font. This means that the "PracticeDrainage" coverage is the active coverage.

12. Select the "Soil Type" coverage to make it active.
13. Uncheck the box next to the "PracticeDrainage" coverage.

14. Now the "PracticeDrainage" coverage is not visible. Turn this coverage back on to make it visible again.

5.2 Reading in Images

Now that users have added a soil type coverage, they can read in the soils image.

Select *File* | **Open** .

In the *Open* dialog, locate and open "soils.img".

5.3 Manually Digitizing Feature Objects

1. Choose the **Create Feature Arc** tool.
2. Make sure that the "Soil Type" coverage is selected.
3. Starting anywhere on the border of the large orange area, outline the entire region, labeled D, with an arc.

Users can be as accurate as they like. If preferred, users can even zoom in to get a closer view of the image. Users will have to end the arc by double-clicking in order to be able to select any other tools, such as zoom, pan, or show all. After zooming to the preferred location, just pick up where the project left off. Remember that when clicking near an existing vertex or arc, WMS will automatically snap the new arc to the existing one.

4. Outline all the other soil type polygons similarly, without creating arcs on top of previously defined borders.

NOTE: When outlining the other regions, simply start somewhere on the previously created arc and proceed around a border without re-drawing where another border has already been defined by arcs.

5. Right-click on the "Soil Type" coverage and select **Build Polygon**.
6. Select **OK** to use all the arcs.

Check to make sure that each soil use polygon is completely outlined. If one or more polygons do not build correctly, check to be sure that the arcs surrounding the polygons are completely closed.

5.4 Assigning Feature Polygon Attributes

Now that users have created the soil use polygons, they will need to assign the soil use attributes to the correct polygons.

1. Choose the **Select Feature Polygon** tool.
2. Double-click on the yellow polygon labeled B.

The *Soil type mapping* dialog should come up automatically. Just as in the first part of the exercise, double-clicking on a feature object brings up a dialog allowing the user to select or edit its attributes. Since users are now using a "Soil Type" coverage, the automatic attribute for a polygon is Soil Type.

3. Choose the **Add soil ID to list** button.

4. Choose the **Add soil ID to list** button three more times, so that there are four soil types in the list box.

Users will now assign soil types to the WMS Soil IDs.

5. Under *Soil type properties*, notice the drop-down buttons used to assign relationships to the Soil IDs.
   a) *Soil ID 1* should be assigned to Soil "Type A".
   b) *Soil ID 2* should be assigned to Soil "Type B".
   c) *Soil ID 3* should be assigned to Soil "Type C".
   d) *Soil ID 4* should be assigned to Soil "Type D".
6. Since the polygon clicked on originally is Type B, select "Soil ID 2" from the *WMS soil ID list* and choose the **Apply** button.
7. Double-click on the polygon labeled A.
8. Select "Soil ID 1" from the *WMS soil ID list* and choose **Apply.**
9. Similarly, assign Soil ID 3 to all the polygons labeled C and Soil ID 4 to all the polygons labeled D.
10. Make sure each polygon has the proper Soil ID assigned by double-clicking on each and checking the soil type in the *Selected Soil Properties* box.

6 More Feature Objects from Images

WMS handles land use images the same as it does soil type images. Users will now read in a land use image, digitize polygons, and assign land uses. Users need the land use image (and the resulting land use polygons) to be on its own coverage, so they will need to create a land use coverage.

1. Right-click on the "Coverages" folder in the Project Explorer.
2. Select **New Coverage.** A *Properties* dialog will appear.
3. From the *Coverage type* dropdown box, select "Land Use".
4. Select **OK**.

Usually users would open the land use image and digitize the land use polygons independently. Here, users will open a completed file. To use the completed file, complete the following steps:

5. Select *File* **| Open** **.**
6. In the *Open* dialog, locate and open "luse.map".

If the user were digitizing the image manually, they would complete the following steps:

1. Select *Images* **| Import.** In order to access this *Images* menu, be sure the **GIS** module is selected.
2. Open "luse.img".

As outlined in Parts 5.3 and 5.4, users would trace all the land use polygons with arc segments (while in the Map module), build polygons, and then map the land use IDs to the correct polygons.

7 Display Options

WMS has many display options to help users tailor the look of a project to their needs. Users can change options such as polygon colors, presence of nodes and vertices, and legends using the **Display Options** command.

1. Right-click on the "Soil Type" coverage and select **Display Options** on the pop-up menu.
2. On the *Map* tab, check the *Color Fill Polygons* box.
3. Uncheck the *Points/Nodes* and *Vertices* boxes.
4. Choose the **Soil Type Display Options** button at the bottom of the spreadsheet. The *Soil Type Display Options* dialog will appear.
5. Select the first "Soil ID" listed in the list box and click on the color square to the right.
6. Choose a new color from the color palette.
7. Change the colors of the other soil groups uses if desired.
8. Select **OK** to close the *Soil Type Display Options* dialog.
9. Check the *Soil Type Legend* box.
10. Select **OK** once again to exit the *Display Options* dialog.

Users can continue to explore the display options if they wish. If users wanted to assign new colors to the land uses, they would need to make the land use coverage active before going back into the *Display Options* dialog or switch to "Land Use" in the coverage type combobox.

7.1 Managing Coverages

Using the Project Explorer, users can choose to hide and/or show coverages and designate which coverage is the active coverage

1. From the Project Explorer, toggle off the check boxes for the "PracticeDrainage" and the "Soil Type" coverages.
2. Click on the land use coverage so it will be active.

Now only the land use coverage will be visible on the screen. The other coverages still exist; they simply will not show on the screen until their visibility is turned back on.

8 Conclusion

In this exercise users should have learned the basics for creating and importing feature objects and managing different coverages. Both these concepts are central to an understanding of WMS. Users should now be able to:

1. Create and edit feature objects
2. Set feature object attributes
3. Create coverages and specify coverage attribute sets
4. Import shapefiles
5. Use images to create feature objects
6. Manage multiple coverages