

Mantra ArcGIS Data Management Practical – Exercise 1.
Build Geodatabase from input datasets.

Contents of Exercise 1: Build Geodatabase from input datasets.

In this first exercise we spend time in ArcGIS setting up a work environment and a Geodatabase in which all work within ArcGIS will be carried out. Attention is paid to choice of name for file and variables/fields within geospatial datasets.

Part 1: Explore project datasets.

Part 2: Create new Geodatabase.

Part 3: Load data into Geodatabase.

Part 4: Add data from Geodatabase to ArcMap project

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Part 1: Explore project datasets.

1. As part of this practical you should have been provided with a zip archive called **Mantra_ArcGIS_datasets.zip**.

Extract the contents of the **Mantra_ArcGIS_datasets.zip** to a folder on your computer which both you and ArcGIS are able to write to. After extracting the contents of the zip file there should be a new folder called **Mantra** present. This folder contains all of the geospatial datasets that we will be using during this practical. It should also be the location where you save any data that you create during the practical.

Learning Point: Filenames and ArcGIS.

The software behind ArcGIS has evolved from command-line based terminal applications to the GUI based ArcMap, ArcCatalog etc utilities that we use today. Unfortunately some of the functionality provided through the ArcGIS GUI applications still rely on the old applications which were developed for much older versions of Windows™ and as such assume that filenames conform to certain conventions. For this reason ArcGIS cannot always cope with spaces in file or folder names. As a general rule you should therefore avoid extracting the contents of the **Mantra_ArcGIS_datasets.zip** to any path which contains spaces as part of the path. An example of such a path would be the windows **My Documents** folder.

2. Once you have extracted the contents of the **Mantra_ArcGIS_datasets.zip** archive to a folder start ArcCatalog.

ArcCatalog can be started from the ArcGIS program group in the windows start menu.

Learning Point: Metadata.

Metadata is data about data. By extension geospatial metadata is data about geospatial data. It has two main purposes – it provides a record of how a particular geospatial dataset has been created (and maybe from what other geospatial dataset it has been derived) and it provides a bibliographic record to facilitate the discovery and sharing of that geospatial dataset by others.

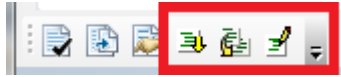
There are a number of different geospatial metadata standards in use today. Within the UK the Gemini metadata standard should be used. Each of the geospatial datasets to be used in this practical have had a Gemini metadata record created for them. Before we go any further we need to make sure that ArcCatalog is displaying the metadata correctly. The ArcGIS software is written by ESRI – an American software vendor - and by default ArcCatalog assumes that metadata records are to be created and viewed using American metadata standards.

To allow ArcGIS to handle UK metadata records we need to have installed an extension provided by ESRIUK known as the Productivity Suite. To check this is installed go to Customize >> Extensions... and check that there is an item called ProductivitySuite and that this is ticked.

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If the ProductivitySuite item is not listed then you will need to install the Productivity Suite Extension before going any further.

Having confirmed that the ProductivitySuite is installed, go to **Customize >> Toolbars** and make sure that the **Metadata** item is ticked. The Metadata toolbar will be added to the ArcCatalog interface:

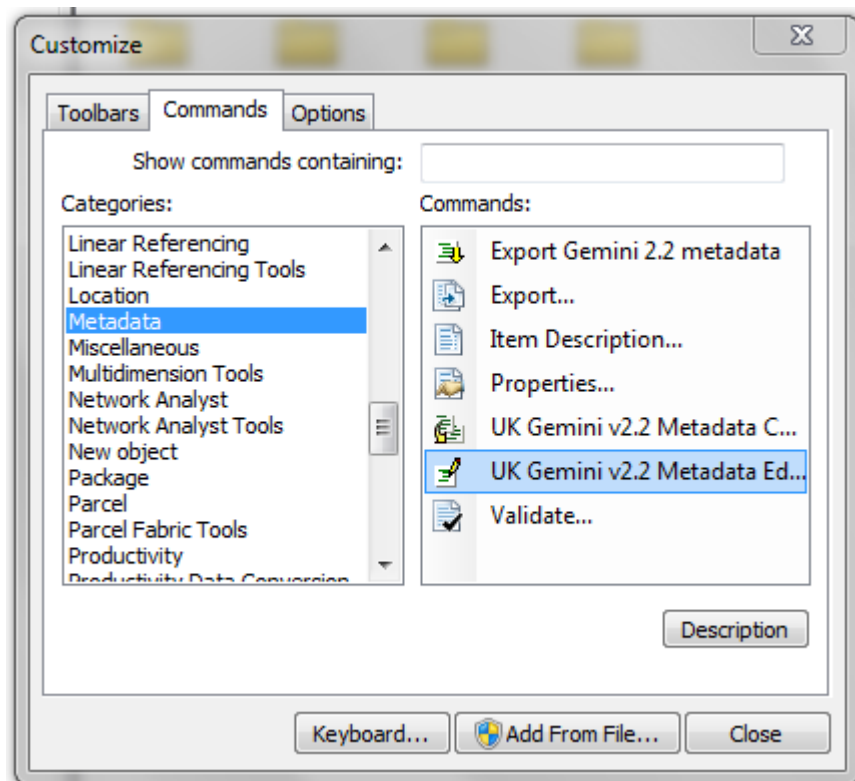


The toolbar consists of a set of 6 buttons. The 3 highlighted rightmost buttons are buttons provided by the ProductivitySuite specifically for editing UK Gemini metadata. If you only have 3 buttons shown like this:



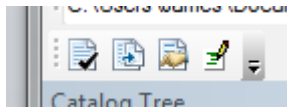
then you'll need to add the additional buttons manually. To do this from the ArcCatalog menubar go to

Customize >> Customize Mode...
On the Customize dialog:



click on the Commands tab, then click on the Metadata items in the Categories list. Left-click on the UK Gemini v2.2 Metadata Editor Command so that it is highlighted, hold down the mouse button and drag the button over to the Metadata toolbar in ArcCatalog and then close the Customize dialogue. You should see this:

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The new button at the far right being the UK Gemini v2.2 Metadata Editor that we'll use in Exercise 4 to create a new metadata record covering the new geospatial data we create during this practical.

Finally we need to change a setting in ArcCatalog so that metadata records are shown styled using the Gemini metadata style. To do this, go to:

Customize >> ArcCatalog Options...
Click on the Metadata tab
Set the Metadata Style dropdown to **UK_Gemini_2.2**
Click Apply, OK.

Before going any further ensure that (which we've just done above):

→ **ProductivitySuite is installed, ArcCatalog Metadata toolbar is visible and UKGemini metadata records can be viewed.**

→ **Ensure that ArcCatalog is not hiding filename extensions.**

To ensure this:

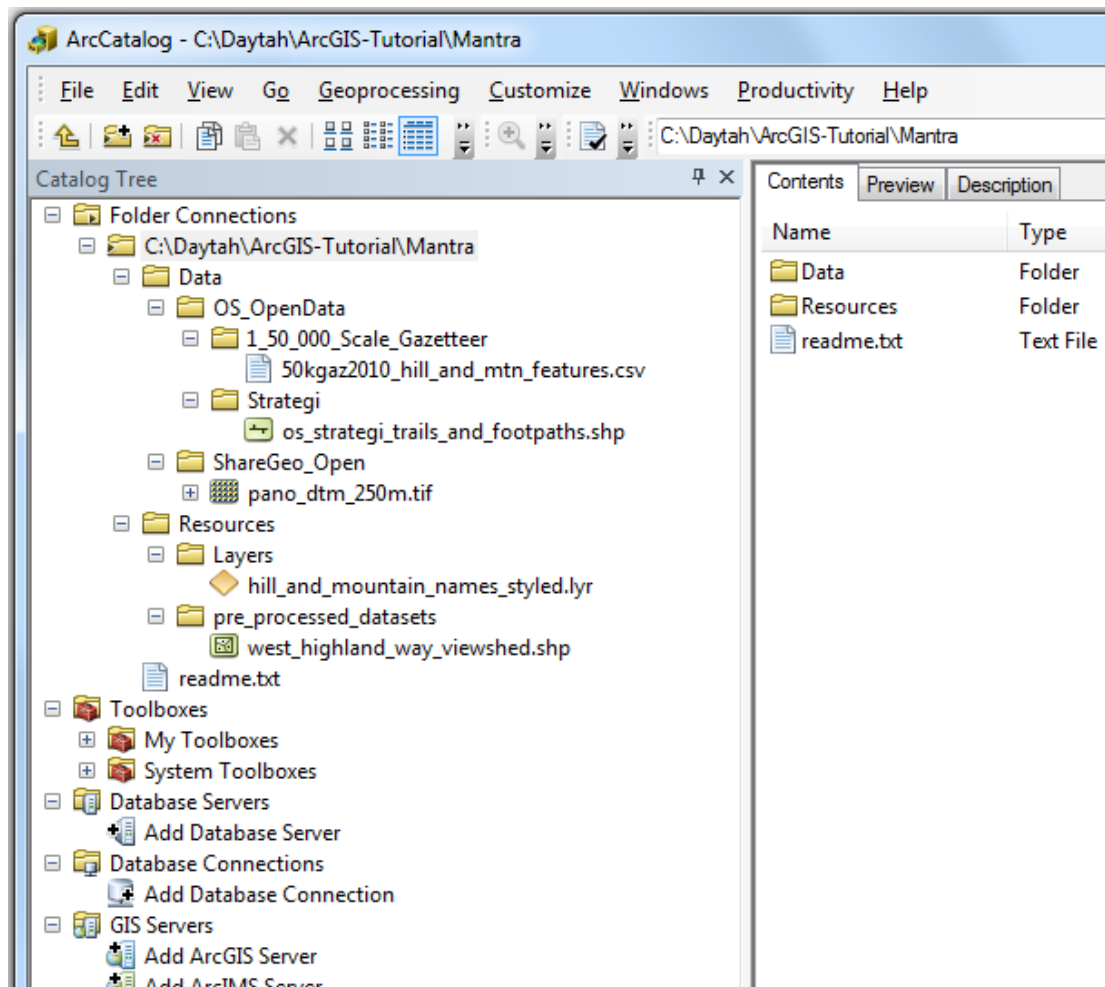
Go to Customize >> ArcCatalog Options. On the General tab ensure that the Hide file extensions checkbox at the bottom of the dialogue is not ticked.

Use the Connect to Folder command in the File Menu to navigate to the location of the "Mantra" folder that you extracted in the previous step. You will now see the Mantra folder listed in the Folder Connections branch of ArcCatalog Catalog Tree on the left.

If you've never used ArcCatalog before it can be thought of as a Windows Explorer for geospatial datasets. Another handy analogy is to think of ArcCatalog as a Map Chest which allows you to browse geospatial datasets.

Expanding the Mantra folder fully within the ArcCatalog Catalog tree you should have something like the following in the left-hand side window.

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Below the *Data* folder are the **OS_OpenData** and **ShareGeo_Open** folders. These contain different types of geospatial data that will be used during the practical as we go along.

There is also a folder called **Resources**. This contains supporting data and other resources which can be used during the course of the practical.

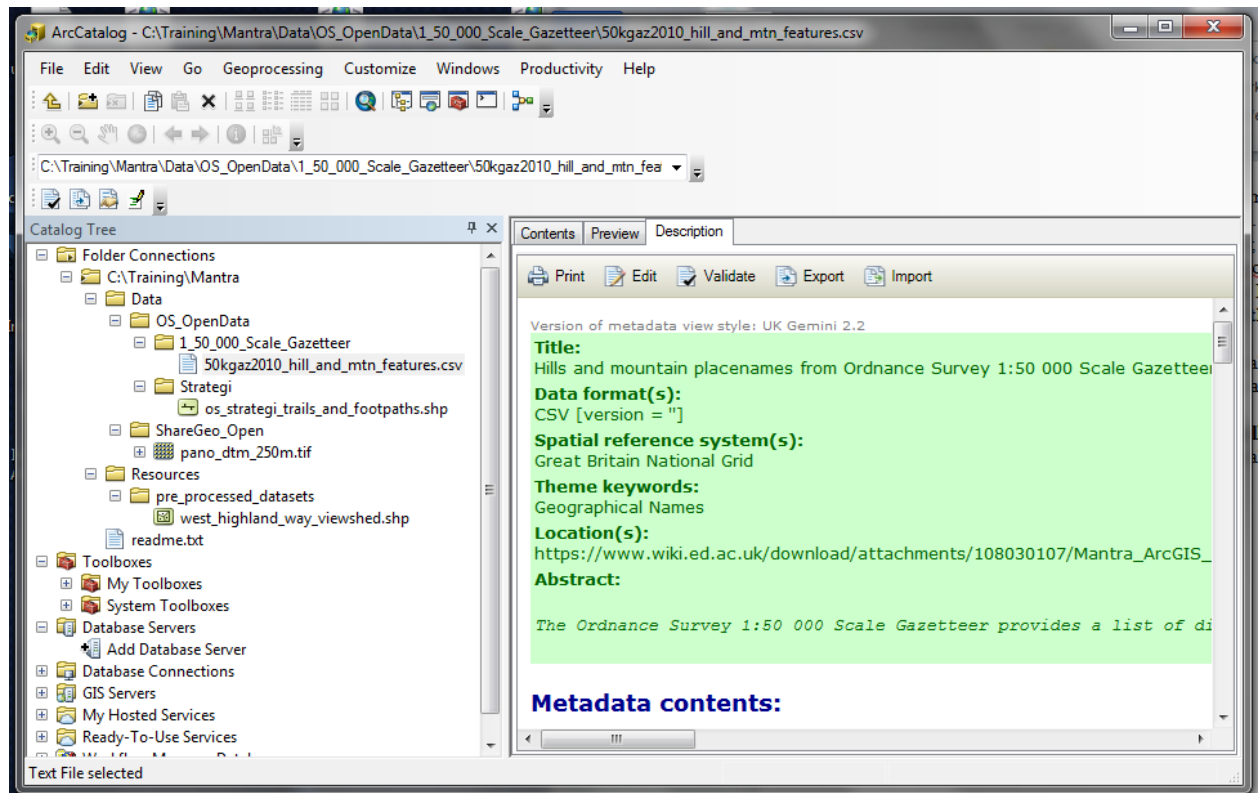
3. Before we go any further let's spend some time exploring the contents of the datasets that we have been provided with. Clicking on any of **50kgaz2010_hill_and_mtn_features.txt**; **os_strategi_trails_and_footpaths.shp** or **pano_dtm_250m.tif** within the ArcCatalog Catalog tree so that the item is selected and then using the **Contents**; **Preview** or **Description** tabs at the right of ArcCatalog will allow you to explore the contents of the datasets.

Pay particular attention to the Description tab. This tab allows you to view any geospatial metadata record that has been associated with the geospatial dataset.

For example click on the **50kgaz2010_hill_and_mtn_features.txt** item so that it is selected and then click on the Metadata tab. You should see something like the following:

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Part 2: Create new Geodatabase.

Let's create a new file geodatabase and then load our geospatial datasets into this.

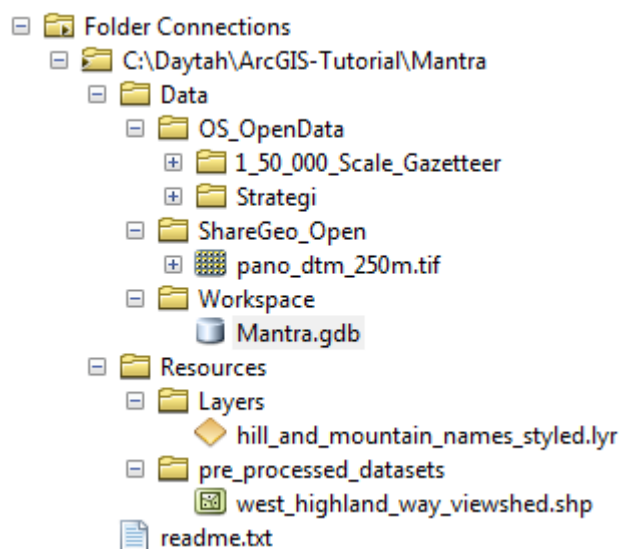
Learning Point: The Geodatabase.

ArcGIS can use different type of Geodatabases. A Personal Geodatabase stores all data in a Microsoft Access database whereas a File Geodatabase stores all data in a local file structure. There is one important difference between the Personal Geodatabase and the File Geodatabase. A Personal Geodatabase may contain up to 2GB of data whereas a File Geodatabase can contain up to 1TB of data. When using geographical information data volumes often become large quickly and it is recommended that you always create a File Geodatabase.

Within the ArcCatalog Catalog Tree click the **Data** folder in the top level of the Mantra dataset so that it is highlighted, right-click and from the pop-up menu select **New > Folder**.

Give the folder the name **Workspace**. Click the **Workspace** folder so that it is selected and from the ArcCatalog menu bar select **File > New > File Geodatabase** and give the File Geodatabase the name **Mantra.gdb**.

When done if you press the **F5** key on your keyboard to refresh the ArcCatalog Catalog tree, you should have something like this:



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Part 3: Load data into Geodatabase.

Now that the Geodatabase is in place let's populate it with our datasets. First we'll create a new point [featureclass](#) based on the records held in the **50kgaz2010_hill_and_mtn_features.csv** file. After which we'll add in the other 2 datasets. We will not load the pano_dtm_250m.tif dataset into the Geodatabase.

Let's create a **hill_and_mountain_names** point featureclass within **Mantra.gdb** geodatabase from **50kgaz2010_hill_and_mtn_features.csv** delimited text file. To do this:

In the ArcCatalog Catalog Tree click on the **50kgaz2010_hill_and_mtn_features.csv** item so that it is selected, right-click, and then from the pop-up menu select **Create Feature Class > From XY Table...**

Doing so will bring up the **Create Feature Class From XY Table** dialogue.

The **50kgaz2010_hill_and_mtn_features.csv** contains a set of records. Each record contains a placename, various information about the placename plus the location of that placename as a British national grid Easting and Northing.

Set the **X Field:** to **EAST**
Set the **Y Field:** to **NORTH**

When we create a new featureclass within the geodatabase we need to specify the coordinate system applied to this. Click the **Coordinate System of Input Coordinates...** button. The **Spatial Reference Properties** dialogue will be shown. Double-click:

Projected Coordinate Systems > National Grids > Europe

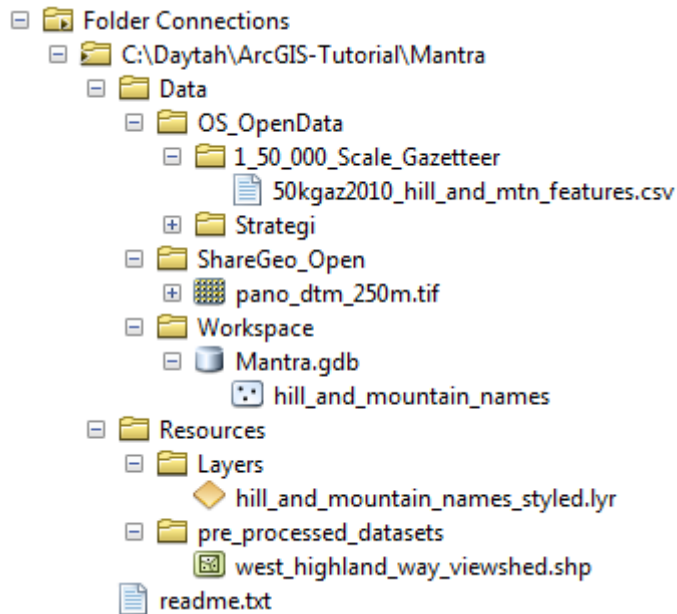
Click on the **British National Grid** items so it is selected and click OK.

This will take you back to the Create Feature Class from XY Table dialogue, on which under **Output**, click the yellow folder button. This will open up the **Saving Data** dialogue. Ensure that Save as type is set to **File and Personal Geodatabase feature classes** and then navigate to the location of the geodatabase that we just created in our workspace. Double-click the Mantra.gdb Geodatabase icon and then enter **hill_and_mountain_names** for the name of the file to be created. Then click **Save**

ArcGIS will return you to the **Create Feature Class From XY Table**, on which you should click the **OK** button. When done if you press the **F5** key on your keyboard to refresh the ArcCatalog Catalog tree, and then expand the contents of the Geodatabase our new featureclass will be listed within the geodatabase like so:

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Again the ArcCatalog Preview tab at right can be used to explore the contents of this geodatabase featureclass.

Learning Point: Fieldnames.

Click on the **hill_and_mountain_names** item in the geodatabase so that it is selected, ensure that the Preview tab is visible and then set the Preview dropdown to Table rather than Geography. Doing so will allow us to view the contents of the dataset as a table. Unfortunately the column headings used in the table are from the supplied text file, and are not very meaningful. ArcGIS will allow us to provide aliases for the attribute names which will be used when the data is used within ArcMap. To set an alias on an attribute right-click on the **hill_and_mountain_names** item in the geodatabase and select Properties from the pop-up menu. This will bring up the **Feature Class Properties** dialogue. Click the **Fields** tab.

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Feature Class Properties

General Editor Tracking XY Coordinate System Domain, Resolution and Tolerance

Fields Indexes Subtypes Feature Extent Relationships Representations

Field Name	Data Type
OBJECTID	Object ID
SEQ	Long Integer
KM_REF	Text
DEF_NAME	Text
TILE_REF	Text
LAT_DEG	Text
LAT_MIN	Double
LONG_DEG	Double
LONG_MIN	Double
NORTH	Double
EAST	Long Integer
GMT	Text
CO_CODE	Text

Click any field to see its properties.

Field Properties

Alias	Placename	
Allow NULL values	Yes	
Default Value		
Length	255	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply

Click on the button to the left of **DEF_NAME** to select this entire row so that it is selected, then under Field Properties at the bottom section give the field the alias Placename. If you want you can do something similar for **NORTH** and **EAST**. Appropriate aliases might be Northing and Easting. After you have finished assigning alias' click OK to close the Feature Class Properties dialogue.

Note:

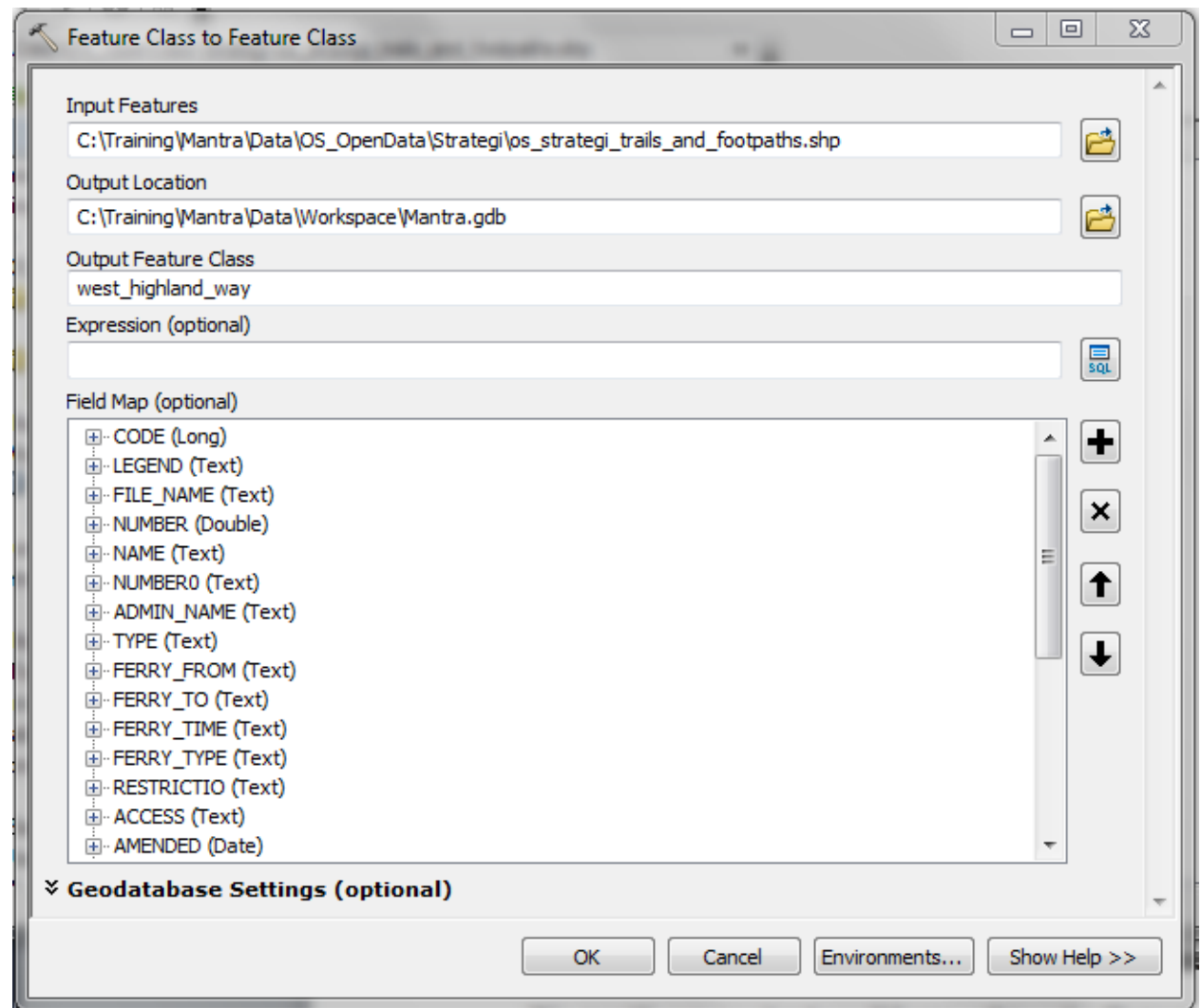
If you look in the **Mantra\Data\OS_OpenData\1_50_000_Scale_Gazetteer** folder there is a PDF file **50k_Gazetteer_Tech_Spec.pdf** which provides a full description of this dataset and which might help you if you want to assign aliases to some of the other attributes.

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Let's now create a **west_highland_way** polyline featureclass within the **Mantra.gdb** geodatabase from the **os_strategi_trails_and_footpath.shp** Shapefile.

Right-click on the **os_strategi_trails_and_footpath.shp** item in the ArcCatalog Catalog Tree, and select **Export > To Geodatabase (single)...**

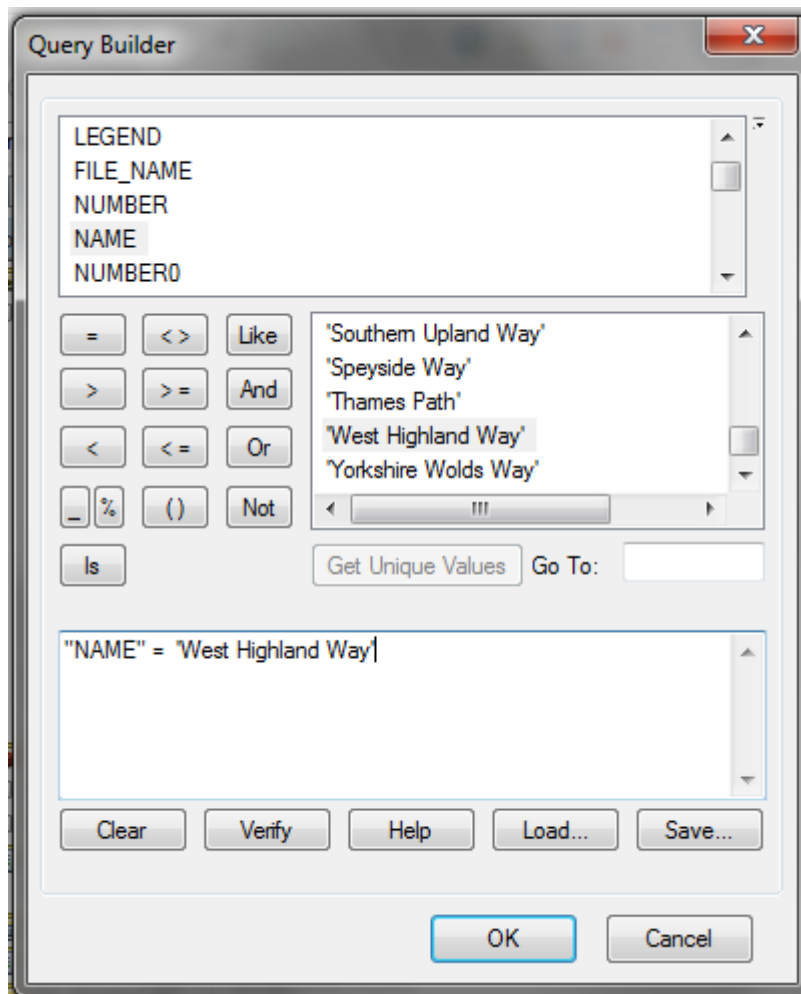
Doing so will bring up the **Feature Class to Feature Class** dialogue. Clicking the **Show Help >>** button will display ArcGIS contextual Help for this tool. The dialogue should be completed like so:



We specify our geodatabase (Mantra.gdb) as the **Output Location** and provide a new name for the **Output Feature Class** of **west_highland_way**.

The **os_strategi_trails_and_footpath.shp** Shapefile contains features for across the UK. However we only need features that correspond to the West Highland Way long distance footpath in the Scottish Highlands. During the import process we can restrict the features that are brought in to the geodatabase from the Shapefile using the optional **Expression** parameter. Clicking the SQL button next to the Expression text box brings up the Query Builder dialogue which allows us to build up a query string through which we limit the features imported based on their attributes.

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The Scrollable window at the top of the dialogue lists all of the fields available in the dataset that we want to make selections from. Clicking on the name of a field so that it is selected and then clicking the **Get Unique Values** button will list all of the unique values that appear within a specific field.

In the **Query Builder** dialogue we specify that we want to import only those features that have a **NAME** attribute with value of **West Highland Way**. So we enter the following query:

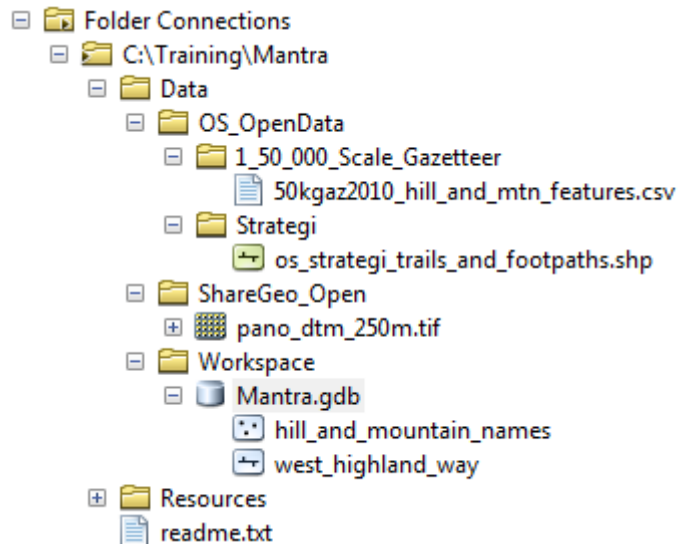
“NAME” = ‘West Highland Way’

Note: choice of quote mark is significant. Double-quotes should be used for field names, single-quotes for textual values to search for within that field.

Clicking **OK** having entered this in the **Query Builder** dialogue followed by **OK** on the **Feature Class to Feature Class** dialogue will load the data. When done if you press the **F5** key on your keyboard to refresh the ArcCatalog Catalog tree, the geodatabase should now contain both a **hill_and_mountain_names** item and a **west_highland_way** item.

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Part of our criteria for the selection of the fieldwork sites is that the site is visible from the footpath. This visibility factor will be captured as a viewshed. A viewshed is a region of visibility observable from one or more observation points. In our case the viewshed will be the region of visibility of the landscape which is observable from the route of the West Highland Way long distance footpath. Viewsheds are calculated by comparing locations with an underlying terrain surface held in a Digital Terrain Model (DTM). This calculation can be computationally intensive.

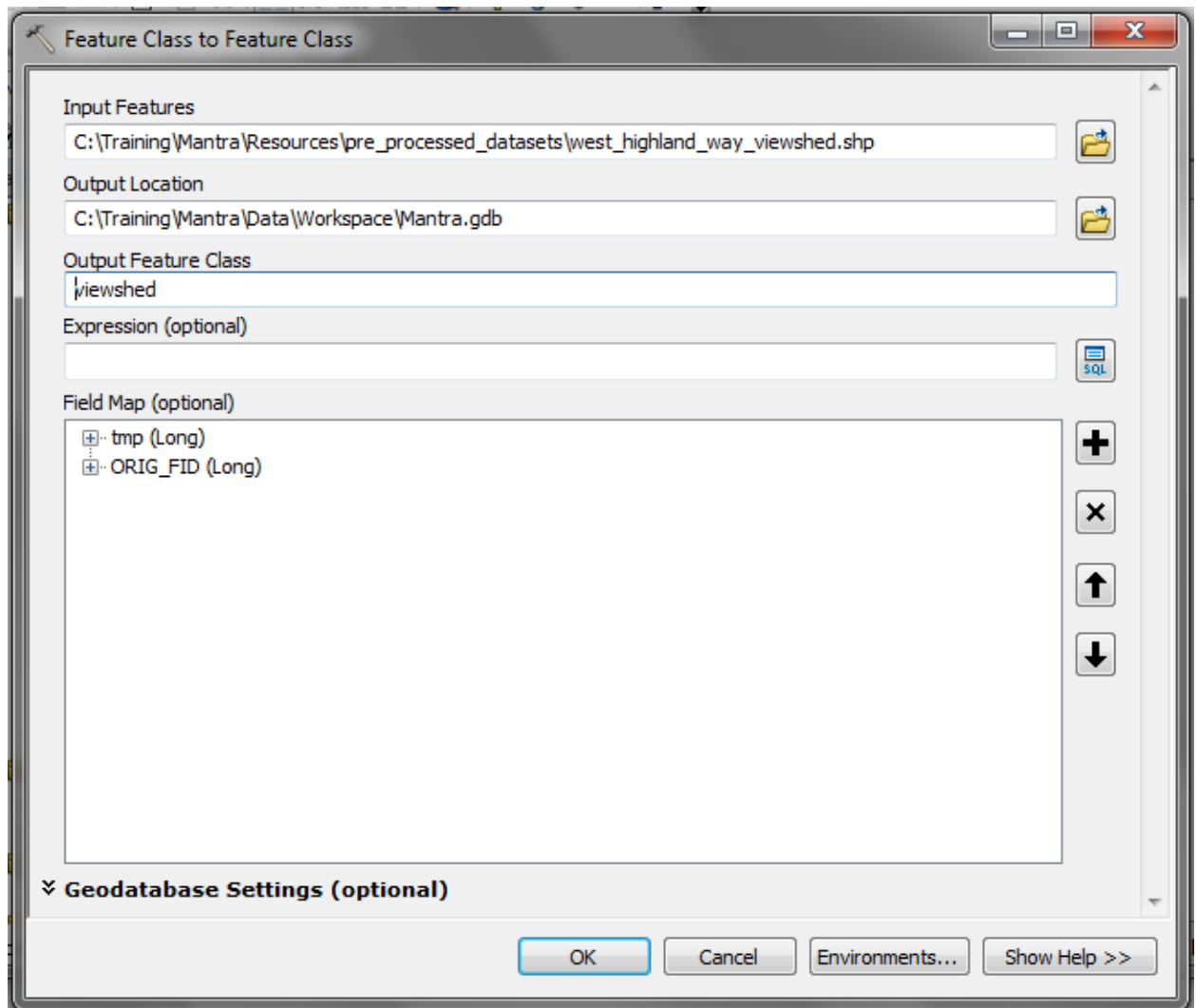
To save time a viewshed corresponding to the West Highland Way has been created for you. This dataset is provided as the `west_highland_way_viewshed.shp` Shapefile in the **Resources\pre_processed_datasets** folder of your Mantra folder. Using the Metadata tab in ArcCatalog will provide you with information about the dataset.

Let's create a **viewshed** polygon featureclass within **Mantra.gdb** geodatabase from **west_highland_way_viewshed** Shapefile.

In ArcCatalog expand the **Resources > pre_processed_datasets** folder and click on the **west_highland_way_viewshed.shp** item so that it is selected, right-click the file and then select **Export > To Geodatabase (single)...**

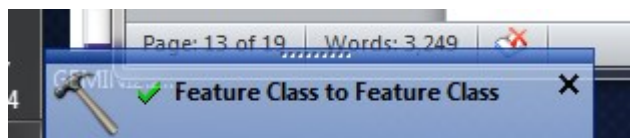
Again this will bring up the **Feature Class to Feature Class** dialogue. All we need to provide is the name of the **Output Feature Class** and the **Output Location**.

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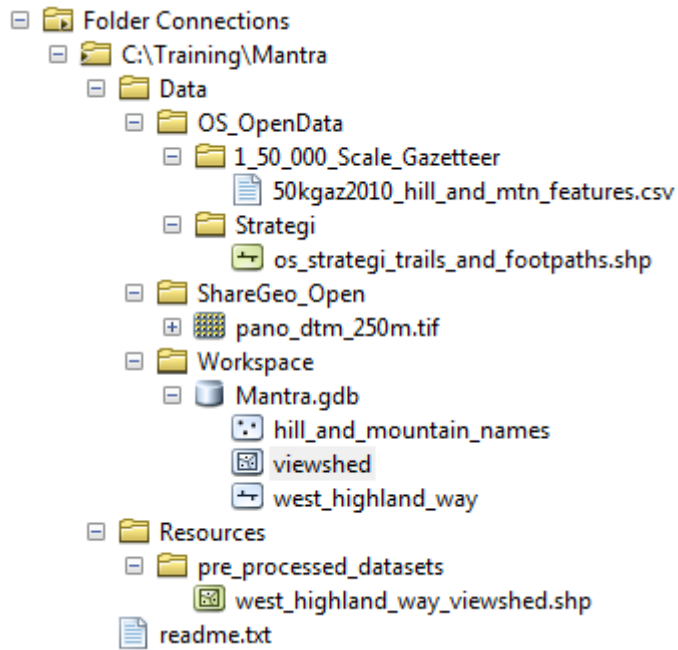
Set Output Location to our geodatabase and Output Feature Class to **viewshed**.

Clicking **OK** will tell ArcGIS to load the data. When it does ArcGIS will display a notification like this:



When done press **F5** on your keyboard to refresh ArcCatalog and check that you have something like the following:

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Great. We've learned how to create a new Geodatabase in which to carry out our research data work within. We've understood the differences between different types of Geodatabase and seen how we add data to the Geodatabase. In the initial exploration of our data we also saw the benefit of geospatial metadata as a mechanism of understanding the contents and source of data. Before we go any further we'll create a new ArcMap project for the purposes of this practical and add to it the datasets from our geodatabase.

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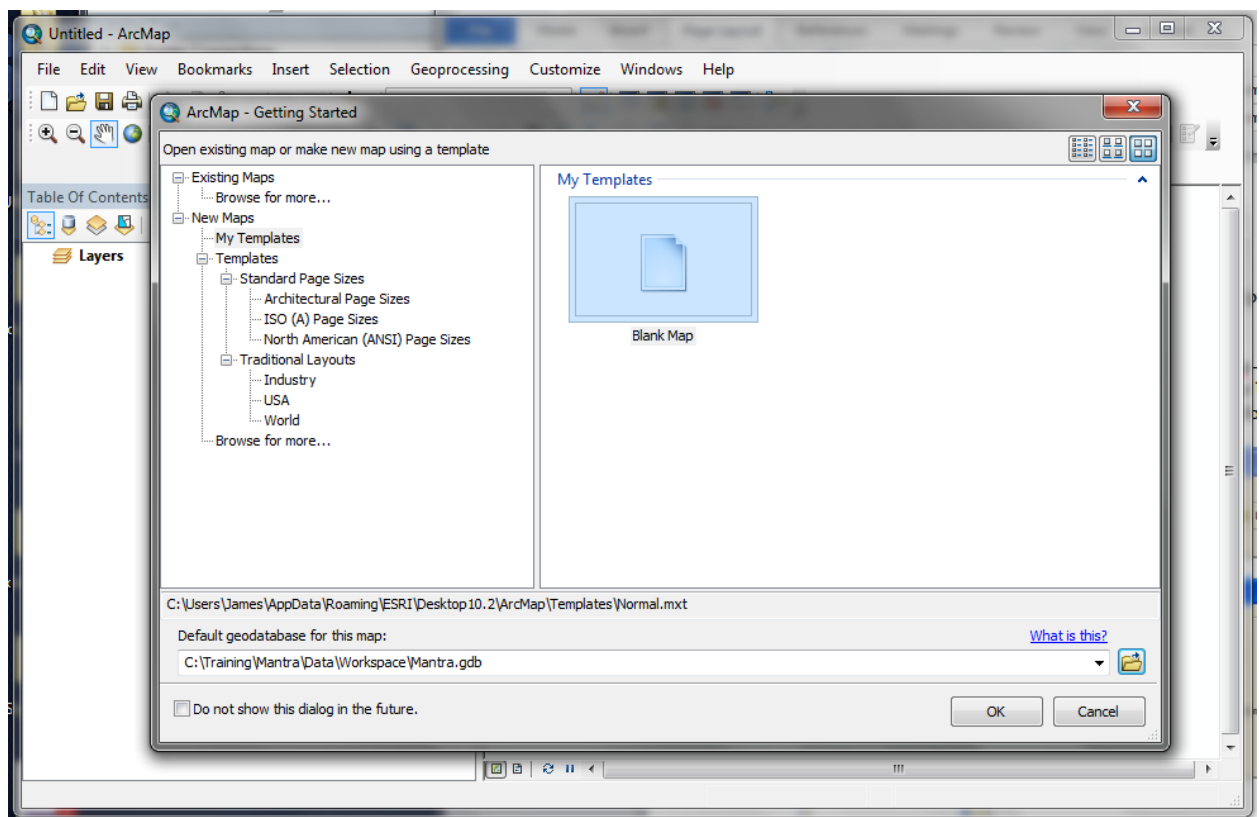
Part 4: Add data from Geodatabase to ArcMap project.

From the ArcCatalog toolbar click on the ArcMap button highlighted below:



Alternatively ArcMap can be started from the ArcGIS program group in the Windows Start menu.

After a short delay ArcMap will open. At the **ArcMap – Getting Started** dialogue select Blank Map for the map template to use and at the bottom of the dialogue set Mantra.gdb as the Default geodatabase for this map before clicking OK.



Learning Point: Absolute and Relative paths in ArcGIS.

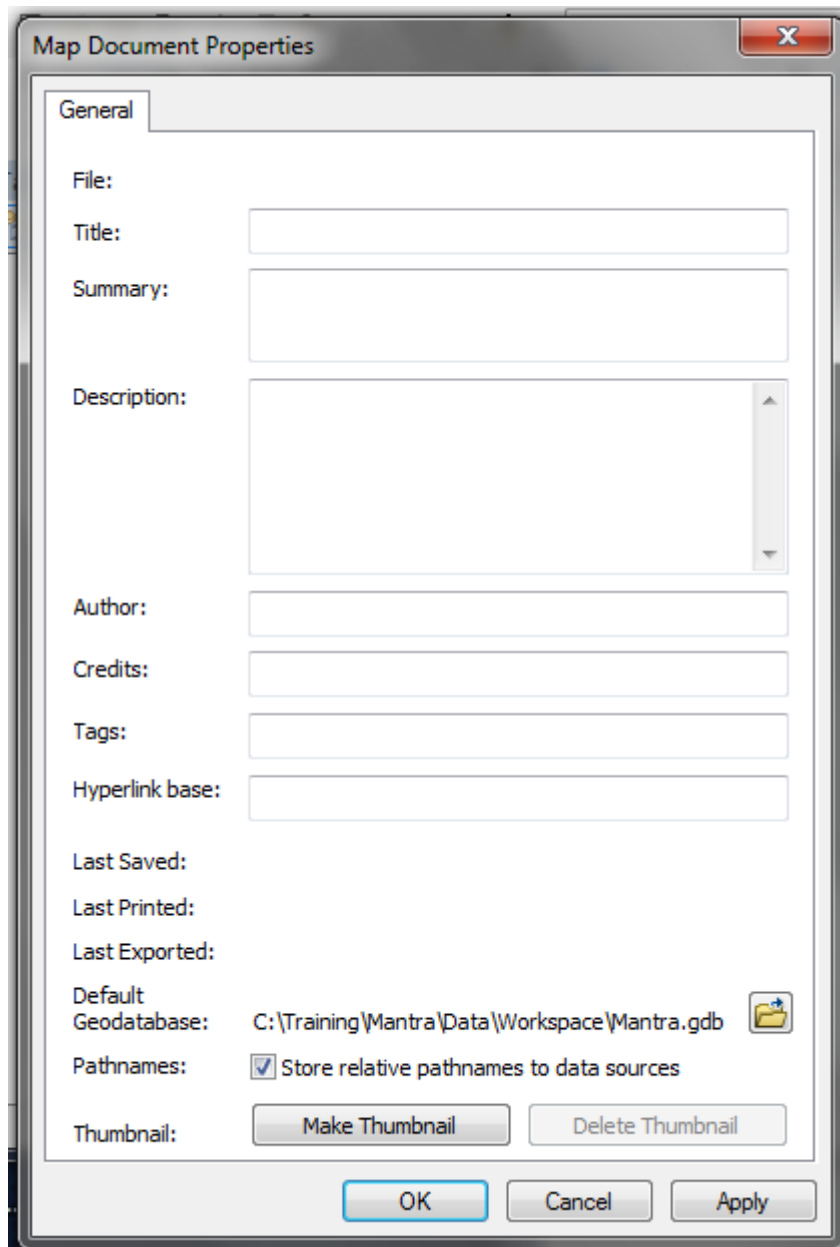
Before we go any further let's set an important property of the ArcMap project held in the .mxd file. Files stored within the local directory structure on your computer are expressed as pathnames. Pathnames can be expressed in absolute or relative terms. An absolute path is a path that points to the same location on one file system regardless of the working directory and is usually written in reference to a root directory such as C:\. A relative path by contrast is a path relative to the working directory of ArcGIS (e.g. same folder, one folder up, or in a folder two down called /mapdata/features). ArcGIS will allow us to use either relative or absolute paths within our ArcMap project. By default relative paths are used.

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This means that the ArcMap project should be able to be transferred between different filesystems (different computers) without problem.

To check whether the ArcMap project is using absolute or relative paths go to **File > Map Document Properties**.

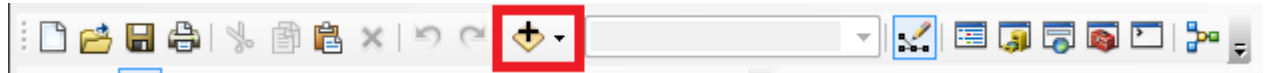
On the **Map Document Properties** dialogue which is displayed ensure that the option under Pathnames: to **Store relative path names to data sources** is ticked and click Apply, followed by OK.



This will return us to ArcMap. Now let's add the data from our geodatabase to ArcMap. Either use **File > Add Data...**

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Or use the Add Data button on the main ArcMap toolbar, highlighted below:



Navigate to the location of the **Mantra.gdb** geodatabase and add all three items that we just populated the geodatabase with:

That is

hill_and_mountain_names
viewshed
west_highland_way

Notice that each is listed as one of a set of Layers in the tree on the left hand side of the ArcMap window.

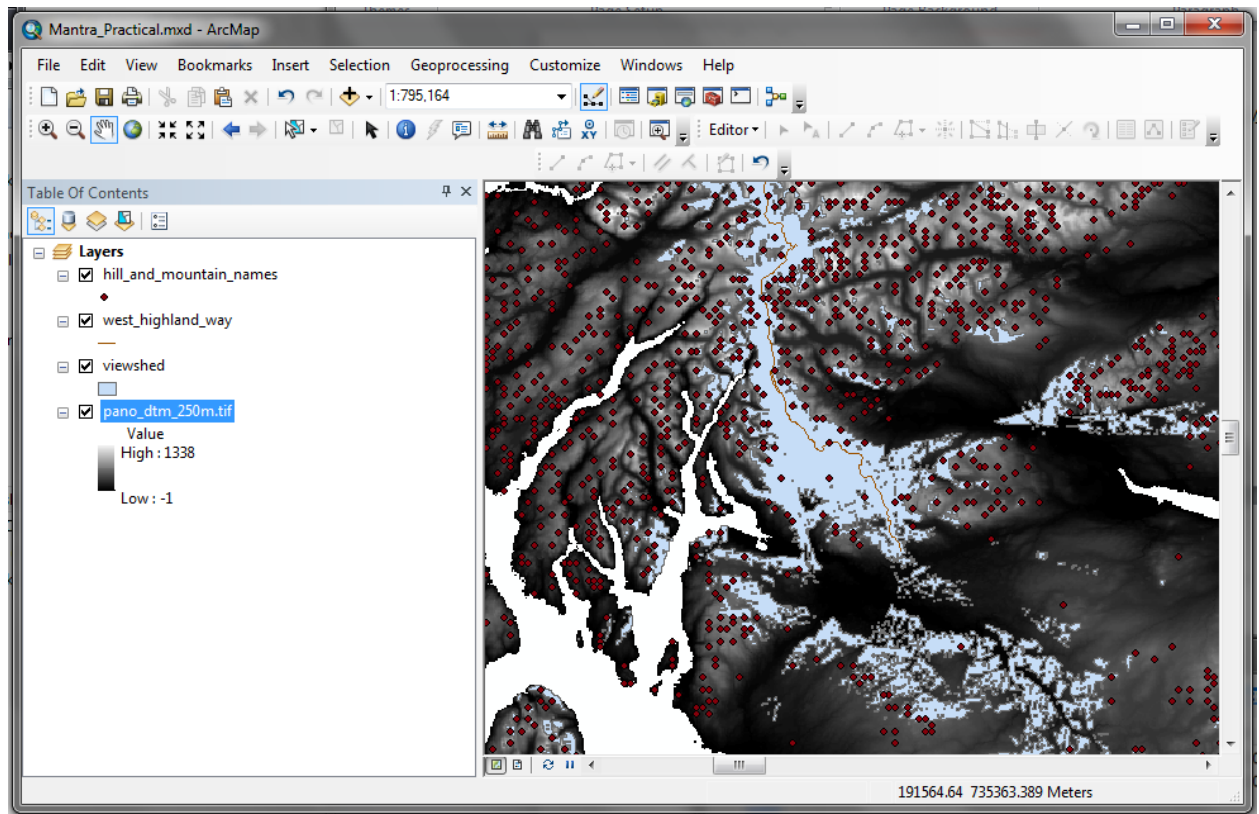
In addition, to give context to the viewshed we can add the Digital Terrain Model which was used to create the viewshed. This is provided for you in the Data\ShareGeo_Open folder as **pano_dtm_250m.tif**. This is a GeoTiff format dataset. Before adding the pano_dtm_250m.tif layer to ArcMap, click on the item so that it is selected in ArcCatalog, right-click and select **Build Pyramids**. The Build Pyramids dialogue will be shown. Just click the **OK** button. Then ensure the pano_dtm_250m.tif item is selected, right-click and select Calculate Statistics. The Calculate Statistics dialogue will be shown. Accept the defaults and click the **OK** button. You can now add the pano_dtm_250m.tif layer to ArcMap.

Having added all of the data the best way to zoom into the extents of the data is to click on the **west_highland_way** layer, right-click and choose **Zoom To Layer**.

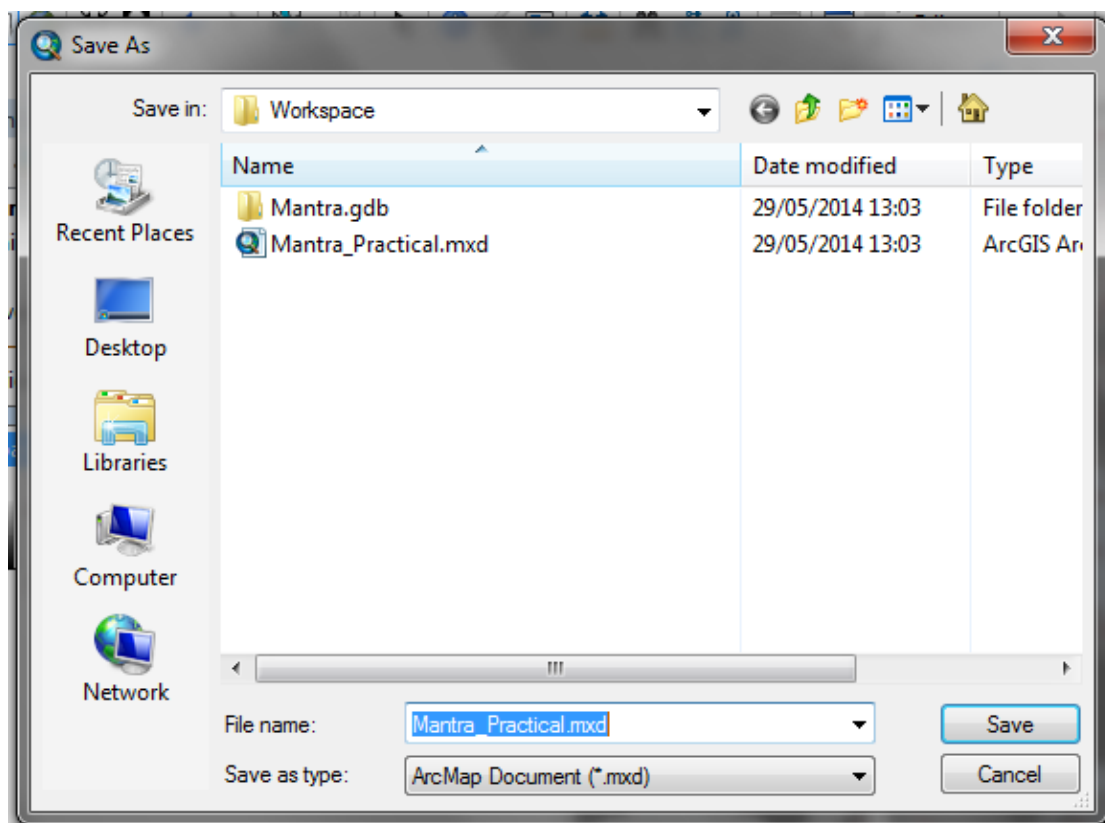
You might at this point want to change how ArcMap displays any of the four layers from the default symbologies. It would be useful to change the symbology of the viewshed layer so that features are shown with a transparent fill (right-click on viewshed, select Properties, select the Symbology tab). That way we can view the underlying terrain described by the **pano_dtm_250m.tif** through the **viewshed** layer.

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Either way we should save our ArcMap project. From the main ArcMap menu bar select **File > Save As...** to save the current ArcMap project.



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Give the project the filename **Mantra_Practical.mxd**, ensure that Save as type is set to **ArcMap Document (*.mxd)** and that you save the file to the Mantra/Data/Workspace folder.