TUTORIAL - Locations & Mapping
Using the ESdat Environmental Database System

For use with ESDAT version 5

ESdat
HELPING YOU DO, WHAT YOU WANT, WITH YOUR DATA

Produced by ESdLS
# Function Tutorial - Locations and Mapping

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Summary

This tutorial:

- examines the use of ESdat to manage and/or create the following data types:
  - location data in either bulk or individual forms (i.e. from a surveyor)
  - vector base maps
  - web based aerial imagery
- uses the *Sample Hydrogeology and Contam* database (and therefore can be used with the demonstration version of ESdat)
- is completed using the Access version of ESdat
- requires approximately 90-120 minutes to complete

Pre-requisites

It is assumed the user has previously completed:

- *Tutorial 2 – Introducing ESdat*
- *Function Tutorial: Importing and Editing Data*

For a full list of the Tutorials available for use with ESdat, please see the [Tutorial List](#).

Key Learning

Following completion of this tutorial, the user will have developed skills in the following:

- Management of geographical coordinate data within ESdat
- Using the ESdat mapping functions to create, display and edit locations
- Exporting data from ESdat to third party software packages
Introduction

As described in *Functional Tutorial: Importing, Editing and Deleting Data*, a Location Code (or LocCode in the Access version) is a unique identifier (or Primary Key).

A Location Code is a unique code used within ESdat to associate a single unique location (e.g. a borehole or surface soil sample) with associated attribute information (such as coordinates and elevation data).

This attribute information associated with a location is stored within a *Data Table* in the project database (called the *Location Data Table*).

By assigning the same (unique) Location Code to any other data imported into ESdat, the attribute information will also be associated with the imported data (e.g. chemistry results are associated with the coordinates of a particular groundwater well).

Other different data types managed by ESdat are stored within specific Data Tables within ESdat. Examples of different data types include groundwater well details, water level data, geological or borehole data.

An example relationship between the Location Table and other information held in Data Tables within ESdat is shown in the figure below. Note the Location Code forms the crucial link (Location Code is abbreviated in the Access version LocCode and to Location_Code in SQL).

Users generally prefer to assign a meaningful Location Code (such as BH01).

In general, data (such as chemistry data or water levels) cannot be imported to ESdat unless a corresponding Location Code (referred to as a Parent Record) has previously been created within ESdat.
However, when necessary, Location Codes can automatically be generated by ESdat during the import process.

By selecting *Create Missing Parent Records* when importing new data, a new Location Code entry will be created if one does not already exist within the database.

All other Location attribute information such as co-ordinates will then need to subsequently be added to that newly created location.

This process is described in detail in the Function Tutorial: *Importing, Editing and Deleting Data*. 
Importing and editing locations and co-ordinates

The following exercise comprise importing some new Location data into a new database. It is assumed readers have completed the previous tutorials describing how to set a new database in ESdat.

For assistance in setting up a new database, refer to http://www.esdat.net/esdathelp/index.html?tutorials.htm

Location data can be imported into ESdat in three ways:

- bulk import (i.e. data supplied from a surveyor); or
- addition of locations directly into the Locations Data View in ESdat
- addition of locations directly onto a map in ESdat

The method of bulk import of data is detailed in the following exercise.

Addition of locations directly to a map is covered later in this tutorial.

The new locations to be added to the new ESdat Site/Project comprises the following:

<table>
<thead>
<tr>
<th>x</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH1 153.556756</td>
<td>-28.86857486</td>
</tr>
<tr>
<td>BH2 153.556892</td>
<td>-28.86848345</td>
</tr>
<tr>
<td>BH3 153.5560937</td>
<td>-28.86837448</td>
</tr>
<tr>
<td>BH4 153.5564424</td>
<td>-28.86842897</td>
</tr>
<tr>
<td>BH5 153.5559023</td>
<td>-28.86846963</td>
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Exercises

Exercise One: Exercise 1: Bulk Import using Import templates

- Click on the Import view type button (located top section of the ESdat window)
- From the Blank Import Templates area (blue area), select Locations to open a Blank Import Template in Excel
- Copy/enter the tabulated data from the previous page into the relevant fields (cells) within the Blank Import Template
- Navigate to the Add Ins tab at the top of the Excel window
- Click the Import button to open the Upload Data dialogue box
- Click Import to import the new data (as shown in the figure below)

Successfully imported cells will shaded light green (as shown above).

- Click Close within the Upload Data dialogue box
- Close the Excel template (don’t save)
- Return to ESdat
- Navigate to the Data Views view type
- Click on the blue Locations data type button (directly below Open Project, top left of the window) to refresh the data
- Confirm that the data imported is present in the database
Exercise 2: Specifying the co-ordinate system

The coordinate system for the data in ESdat is specified in the Project Data Table in the Access Version of ESdat (or the Site Data Table for the SQL version).

- Hover the mouse over the Data Tables button (top right while in Data Views)
- Click on the Project table (Access)

Information about the Project will now be displayed. Note the Coordinate System for this dataset is blank (unless you specified it on project setup).

- Select Edit Mode by clicking on the Allow Editing icon from the far left vertical tool bar (the icon will go red)
- Click within the cell directly below the Column (Field) Heading Coordinate_System and expand the drop down list that appears
- If required, widen the column labelled Coordinate_System, so all values in the drop-down are visibleFrom the drop-down select WGS_84 (these co-ordinates are

![Coordinate_System Drop Down]

latitude/longitude)

- Turn Edit mode off by clicking the Allow Editing icon again (the icon will no longer be red)
Basemaps

Exercise 3: Adding a vector basemap

The following steps describe the method to add a basemap to ESdat (such as an aerial photograph) above which locations (such as boreholes) and associated data can be presented.

- Select the Locations Data-Type button

Note that the new locations are shown together with locations that were already present within the database. A filter must be applied to focus only upon BH1 – BH5.

- Within the Column (Field) labelled LocCode, double click on the cells containing BH1, BH2, BH3, BH4 & BH5

A filter code will be created in the Filter Area.

- Click Apply Filter (directly below the blue Soil/Rock Chemistry button)

The data should now be filtered to only show BH1-BH5, as shown in the figure below.

- Select the Map panel (centre of three grey tabs mid screen)

- Click the Zoom to Selected Layer button (from the far left vertical toolbar)

Locations BH1-BH5 should now be visible.

A basemap layer can be added (imported) to the map window in most common GIS formats using the Add button (located to the top right of the Map area).

Alternatively, a new layer can be directly drawn in ESdat. The following describes the process to draw a new site boundary.

- Click the New button (immediately right of the Add button)

- Save this layer with file name test (save at a convenient location, such the desktop)

(Note: the DXF format is the most versatile for drawing, however MapInfo format files (.mif) can also be created in the same way)

After saving the file, the layer test.DXF will appear in the Map Layers list visible to the right of the map.
The layer test.DXF currently contains no data. The following steps will edit test.DXF.

- Click the *Edit Button* located immediately above the *Map Layers* list to the top right of the map (note – this *Edit Button* is distinct from that used to edit data used in Exercise 2)

Clicking the edit button will open additional point, line and polygon creation and editing buttons, as shown below (hovering over the buttons in ESdat will produce a small popup window with button names):

- **Click Add Polygon**

Clicking at a point on the map will create a single node. Clicking at a second point will create a second node joined to the first by a line. Clicking at a third point will create a polygon and so on.

- **Draw a polygon surrounding the boreholes on the map**

- **Click Save**
Exercise 4: Changing layer display properties

Double clicking on a layer within the Map Layer list will open a dialogue box (an example is shown below). Various options allow editing of layer properties, such as line colour, dashed lines and so on.

- Double click the layer test from the Map Layers (shown below) to open a dialogue box
- Select the Area tab (a polygon corresponds to an area)
- Select the Outline sub-tab
- Change the Color to Red
• Click OK
The outline of the polygon will be shown in red (as shown in the image below).

• Explore the options here and note the changes, prior to closing the dialogue box.

For more information on base maps, see:
http://www.esdat.net/esdathelp/index.html?adding_basemaps.htm
Basemap Coordinate Systems

ESdat has the ability to overlay data and layers in different coordinate systems.

**Imagery Basemaps**

All imagery basemaps (such as aerial photographs or satellite imagery) need to be geo-referenced before viewing in ESdat.

Some imagery formats contain the co-ordinate system within the file (such as ecw format) and others require associated world files (such as tiff format).

If a co-ordinate system isn't specified the imagery will need to be geo-referenced using a (third party) geo-referencing package, or one of the mainstream GIS applications.

Whenever possible ESdat will automatically detect the co-ordinate system, requiring no user action other than adding the layer.

**Vector Basemaps**

A coordinate system can be assigned to vector basemaps (i.e. a basemap comprising lines, such as dxf files) in ESdat.

**Exercise 5: Assigning a coordinate system to a vector basemap**

The following describes the method to assign a coordinate system to a vector basemap:

- Click on the *Map* panel
- Double click on the *test.dxf* layer created previously to open a dialogue box
- Select the *Layer* tab and click *Select*
- A second dialogue box called *Coordinate System* will open, as shown below

  ![Coordinate System Dialogue Box]

- Select *WGS84* (i.e. Latitude/Longitude)
- Click *OK* to close the first and second dialogue boxes
Adding Web Mapping Service Layers and Mapping Features

As the co-ordinate system of the data in ESdat has been assigned, publicly available basemaps provided by WMS (Web Mapping Service) can be viewed through ESdat.

One such publically available WMS service which has global coverage is OpenStreetMap.

For US and Canadian users, Natural Resources Canada and USGS provides WMS coverage for those geographical areas.

Users can also specify their own WMS address (URL) or Web Feature Service address (WMF URL).

Access to corporate WMS layers and WFS, or other publicly available WMS layers and web features is via the View and Manage Map Layers button, shown below:

Exercise 6: Adding Open Street Map data to the map

- Click the View and Manage Map Layers button to open the Layer Library dialogue box (as shown below)

- Click the Open Street Map button

A street map of the local area in the vicinity of locations BH1-BH5 and the polygon test.DXF (which are incidentally in the vicinity of the EScIS offices) will be displayed within the Map panel.

Note that individual map layers can be re-ordered (i.e. moving forward or backward) by clicking and dragging the relevant layer in the layer list to the right of the Map Panel.

- Experiment re-ordering map layers OpenStreetMap and test.DXF
Map Functions

ESdat offers a range of mapping functions, including:

- add or edit locations through a map
- zoom in and out
- move maps
- add base maps and
- change coordinate systems

Buttons for controlling map zoom, panning, selection style or interrogation are included on the toolbar to the left of the map. The buttons include options to:

- Select locations by Rectangle
- Select locations by Circle
- Clear All selections
- Move Map (drag the map within the map extents)
- Zoom to World (zoom out to map extents)
- Zoom to Selected Layer (zoom to the extent of a map layer selected in the map layer list to the immediate right of the map)
- Zoom In
- Zoom Out
- Zoom in/out to Window (click the button then draw a rectangle within the map area)
- Select and Show information (click this button, then click on a point on the map to display information – will only show information for the selected layer).
- Explore these different functions on the example map

At the top right of the Map panel there are three buttons Lock Extent, Labels and To Filter, as shown in the figure below:

The Lock Extent button freezes the current extent (or scale) of a map to the extent of the selected map layer. This is useful if one or more layers within the map extend beyond the users area of interest. For example a group of locations of interest may only occupy a small portion of an underlying dxf file or basemap.
If Lock Extent is not selected and a new data type is incorporated, ESdat will zoom out to the maximum extent of the newly selected data type.

This can be tested by completing the following:

- Manually delete BH5 from the filter text and click Apply Filter (this will remove BH5 from the map)
- Ensure the Location layer is selected from the Map Layer list
- Click Zoom to Selected Layer
- Click Lock Extent
- Add BH5 back into the filter
- Click Apply Filter (adding BH5 to the map)

Note the map view will not zoom out to extend to include BH5.
- Repeat these steps again without locking the extent and note the difference

The Labels button provides options for changing the appearance of data points in a map.
- Click the Labels button and note the options
- Clicking the More Layer Options button reveals further choices for customising the map appearance

- Experiment with the options to see the changes these create on the map.

The To Filter button allows a selection of locations (e.g. select by circle or rectangle) to be added to the ESdat filter.

This button is examined in the Functional Tutorial on Filtering.
Adding and moving ESdat Locations directly on the map

Exercise 7: Adding a Location directly onto the Map.
ESdat allows manual addition of a location to a map, automatically generating coordinates corresponding to the selected location. This is useful when the exact coordinates of a location are not known, but the approximate location is known.

For example, a basemap may be loaded to ESdat (such as a geo-referenced aerial image) and the user is able to determine the position of a location relative to features visible in the aerial image.

Alternatively a location can be created relative to locations already present on a map. In this example a new location (BH6) will be added to the existing 5 locations from the previous exercise (BH1-BH5).

This function can only be used from the Location data type (i.e. when viewing locations).

- Ensure the Location Data Type is selected and locations are filtered to only include BH1-BH5
- Click the Map panel tab to view the locations on the map
- Ensure the Location map layer is selected from the list of map layers (immediate right of the Map area)
- Click Zoom to Selected Layer
- Click on the Add Point button at the top left of the map
- Click a desired point on the map to locate BH6

The Add Coordinates to the Database dialogue box will open.

- Type the name (LocCode) of the new Location: BH6

A Location data entry box will now open, with the coordinates of the newly created location, BH6. These coordinates can be corrected (if more accurate data is available), and other location information can be added here, including addition of comments.

- Once the entry of information is complete, click Add
- Update the filter to include BH6 (as follows):
  
  LocCode In( 'BH1', 'BH2', 'BH3', 'BH4', 'BH5', 'BH6')
• Click Apply Filter

BH6 should now be visible on the map at the nominated location.

• Select the Data panel (click the grey tab labelled Data)

BH6 should now also be visible on the list of locations.

**Exercise 8: Changing the position of an existing location on the map.**

The position (coordinates) of locations can be altered using the map interface.

• Open the Data panel and note the coordinates for BH6

To change the position of an existing location (in this case BH6) on the map:

• Select the Map panel

• Click Move Point button

• Click and hold on location BH6 (on the map) and reposition to a new location (a dashed line should follow your path)

• Release the mouse-button

• Select the Data panel

• Compare the coordinates for BH6 with those noted previously – they should have changed (refreshing of the Data panel may be required by clicking Apply Filter)

More information on locations is available in the Help files:  
Creating labels for locations (data points) on maps

Simple labels can easily be added to locations displayed on a map in ESdat (such as borehole or groundwater well ID). Labels can be manipulated using the ESdat mapping function.

Labels can also be edited to allow presentation of specific data (within the database) associated with the location, such as elevation, groundwater depth, NAPL thickness – whatever pertinent information is required.

Clicking the Labels button located above the map area will open the GIS Layer Options – Simple dialogue box (as shown in the figure below).

It is important to note that the options for labelling, in particular the values available for inclusion as labels are driven by the data type selected.

- Ensure the Locations Data Type is selected and Loc1_Location table is being viewed (in SQL, Sites Data Type and HGSite1_Locations table is being viewed)
- Click the Labels button
- Open the drop down list to the right of the Show Values text

Note the options in the drop down list correspond to the fields of the Loc1_Location table. By selecting different Data Type buttons, different options (table fields) appear in the drop down list.

Selected values presented in the label can be presented as the following:

- Range (i.e. the maximum and minimum are shown, such as max and min water levels)
- Max
- Min
- Count (number of values in the field for that location) or
- Average
Location Codes may be switched off if required so it does not appear as a label. Chemistry results tables and exceedances associated can also be presented on the map. Users should refer to the Analysing Chemistry tutorial for details.
Exports to ArcMap / MapInfo / Google Earth

ESdat can export points and labels to all the above GIS applications.

For Google Earth and MapInfo only Location Codes and simple Result Values can be shown next to a point. ArcMap supports all labels that can be generated in ESdat.

Exercise 9: Exporting to Google Earth

A link to the Google Earth download is provided in the ESdat Google Earth Export dialogue box (i.e. in the dialogue box when the Google Earth external link button at the right of the Data Views view is clicked).

- View the data on the Map Panel (or from the Data Panel if preferred)
- Click the Google Earth export button on the Export Toolbar
- Select either Temporary or Permanent File (Permanent saves the .kml file at a directory location that can be chosen by the user)
- The installation location of GoogleEarth.exe may need to initially be specified (once only)

Google Earth will zoom into the area around the EScIS offices, where locations BH1-BH5 have been randomly placed.

Exercise 10: Exporting to ArcMap / MapInfo

If ArcMap or MapInfo are installed on the computer from which this tutorial is being completed, click the relevant button (shown below) on the Exports toolbar to export data and launch ArcMap or MapInfo.

Further Tutorials

For a list of other tutorials available with ESdat see http://www.esdat.net/esdathelp/index.html?tutorials.htm