British Geological Survey
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Installation and User Guide for the 2010A Open Source Release of BGS·SIGMAmobile

Geoscience Technologies Programme

Open Report OR/10/062

Sigma • MOBILE
System for integrated Geoscience Mapping

BRITISH GEOLOGICAL SURVEY

GEOSCIENCE TECHNOLOGIES PROGRAMME

OPEN REPORT OR/10/062

Installation and User Guide for the 2010A Open Source Release of BGS•SIGMAmobile

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Foreword

The British Geological Survey began developing digital field mapping systems in 1989, however it was apparent that the commercially available hardware was not suitable at that time. In 2001 we revisited the topic under the System for Integrated Geoscience Mapping (SIGMA) programme. By 2003 BGS had developed a PDA (personal digital assistant) field system, which was superseded in 2005 when we began deploying a beta system on rugged Tablet PCs. The Tablet PC system, which we call BGS·SIGMA*mobile* is now used by BGS in mapping projects across the UK as well as overseas. It is now available in Open Source form via the BGS website, www.bgs.ac.uk under an agreement which stipulates that updates and modifications must be supplied to BGS in order to stimulate further developments. Within 10 months of the BGS·SIGMAmobile release in June 2009, 590 licenses were downloaded by users from North America to Africa, India and Australia.

This document has been written to guide users through the installation and use of BGS·SIGMA*mobile* 2010A, which is the second free release. It is envisaged that future releases will be made available from the BGS website incorporating new modules, modifications and upgrades supplied by BGS and external users of the system.

We are happy to receive feedback and modifications emailed to sigma@bgs.ac.uk.

Acknowledgements

BGS·SIGMA*mobile*, formerly known within BGS as MIDAS, has taken several years to develop. During this time, software and hardware specifications have improved significantly while the underpinning data capture concepts and model has largely remained the same. The authors would therefore like to acknowledge the work of all the digital field data capture team over the past five years, in particular Andrew Howard, Russell Lawley, John Laxton, Jon Ford, Bill Hatton and Bruce Napier. Furthermore, the BGS·SIGMA*mobile* system could not have been developed without the comments and feedback of our dedicated teams of field testers including Maxine Akhurst, Helen Burke, Tony Cooper, Andy Farrant, Martin Gillespie, Nick Golledge, Mike Hall, Mat Hardenberg, Holger Kessler, Simon Price, Andreas Scheib, Chris Thomas, Kathryn Goodenough and Andrew Finlayson.

Contents

Foreword ..... **i**

Acknowledgements ..... **i**

Contents ..... **ii**

Introduction ..... **iii**

1 Installation Instructions **1**

1.1 System requirements 1

1.2 installation instructions 1

1.3 Increasing Tablet PC performance 4

1.4 Setting up a project 4

2 Global Positioning System (GPS) **4**

2.1 Projection Setup 4

2.2 GPS Setup Instructions 5

3 Using BGS·SIGMA*mobile* **11**

3.1 Opening the BGS·SIGMA*mobile* GIS 11

3.2 Preparing BGS·SIGMA*mobile* for field use 12

3.3 The BGS·SIGMA*mobile* Graphical User Interface (GUI) 19

3.4 Using the digital field slip 27

3.5 Capturing structured data or more detailed observations 43

3.6 Displaying structural information in BGS·SIGMA*mobile* 62

4 Using the BGS Integrated Tools **65**

4.1 The BGS Compass bearing Tool 65

4.2 The BGS Structure Contour Tool 67

5 Backing-up your data **74**

6 Viewing sketches on the Desktop **74**

7 Troubleshooting **74**

8 Using BGS·SIGMA*mobile* outside the UK **77**

Introduction

This report serves as an installation and introductory user guide to BGS·SIGMA*mobile*, which is an application for digital geoscience field data collection developed within the British Geological Survey's SIGMA (System for Integrated Geoscience Mapping) programme within the Earth & Planetary Observation & Monitoring Team. This document provides installation instructions, followed by a brief guide to using the application. In BGS we provide our field staff with a two-day training course, and while this guide does not replace that, it is hoped that these instructions will provide a basis for successful use of BGS·SIGMA*mobile* in your organisation.

BGS·SIGMA*mobile* is designed to run in the field on rugged Tablet PCs, but can also be used on a laptop or a desktop PC. The system is a heavily customised ArcGIS 9.3.1 (service pack 1) and MSAccess application. The user must have a licensed copy of ArcView ArcGIS and MSAccess 2003, BGS does not supply these. The system will run with MSAccess2007 but the database must be stored as a 2002-2003 .mdb file otherwise it will not be compatible with ArcGIS. It is fully tested on the Windows XP operating system; BGS does not currently use the Windows 7 operating system and therefore no testing of the system on Windows 7 has taken place.

The BGS uses the application on several models of Tablet PC including Itronix GoBooks, Xplore iX104s and GETAC V100's. This guide does not provide instructions to its use on specific hardware platforms.

BGS staff have used the system for mapping in locations including the UK, Ghana, Madagascar, Tajikistan, the Antarctic and the U.S.A. We use it as part of a workflow of other customised BGS-developed systems that enables us to:

1. automatically collate spatial information from our databases,
2. interpret new data from satellite imagery and digital photogrammetry,
3. take our baseline and interpreted data to the field,
4. populate corporate databases with our field data,
5. build 3D digital models and visualisations,
6. output our data in formats such as maps.

Further information on these steps is available from the BGS website at http://www.bgs.ac.uk/research/technologies_epo.html. Only the field system has been supplied in this Open Source agreement so you will need to build/define your own methods for integrating BGS·SIGMA*mobile* into your mapping workflow.

1 Installation Instructions

The entire folder containing BGS·SIGMA*mobile* 2010A and its component parts (as downloaded from the website) should be copied onto each tablet PC that will be used to run the system.

1.1 SYSTEM REQUIREMENTS

BGS·SIGMA*mobile* 2010A has been developed using ESRI's ArcGIS 9.3.1 (service pack 1) software. It is built onto a relational database that has been built in Access 2003. It is important that all users of BGS·SIGMA*mobile* use the above mentioned version of ArcGIS for this release of BGS·SIGMA*mobile* otherwise they may experience problems with some of the functionality. As mentioned previously the database side of the system will also run on MS Access 2007.

BGS has developed several integrated tools that require additional installation. These are the BGS Sketch Tool, the BGS Bearing Tool, the BGS Structure Contour Tool, the BGS GPS Tool, the BGS Précis Tool and the BGS CaptureBySymbol tool.

Please ensure that your tablet PC has been set to UK language and regional settings, and uses the 24hr clock. To check this, open regional and language options from within control panel and check all settings.

IMPORTANT NOTE: The Précis Tool must be installed for the latest version of BGS·SIGMA*mobile* to run.

1.2 INSTALLATION INSTRUCTIONS

1. On your Tablet PC – Control Panel – Add/Remove Programs – Uninstall the following Programs:
    a. BGS GPS TOOL
    b. SKETCH TOOL
    c. STRUCTURE CONTOUR TOOL (or BGS STRUCTURE CONTOUR TOOL)
    d. PRECIS TOOL (or BGS PRECIS TOOL)
    e. BEARING TOOL (or BGS BEARING TOOL)
2. On your Tablet PC – Delete the above five folders from: C:\Program Files\BGS
3. On your Tablet PC in the BGS·SIGMA*mobile* INSTALLATION folder
    a. Install the Tools by double clicking on the InstallAllDotNet.bat – this will install the following BGS custom tools:

    BGS PRECIS TOOL & FIELD REPORT (new to 2010A)

    BGS GPS TOOL v1.6 (new to 2010A)

    BGS SKETCH TOOL

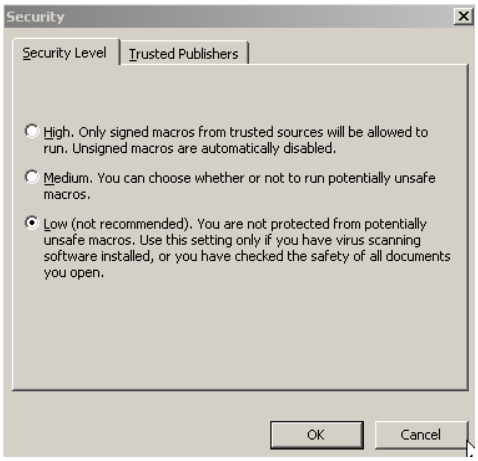
    BGS COMPASS BEARING TOOL

    BGS STRUCTURE CONTOUR TOOL

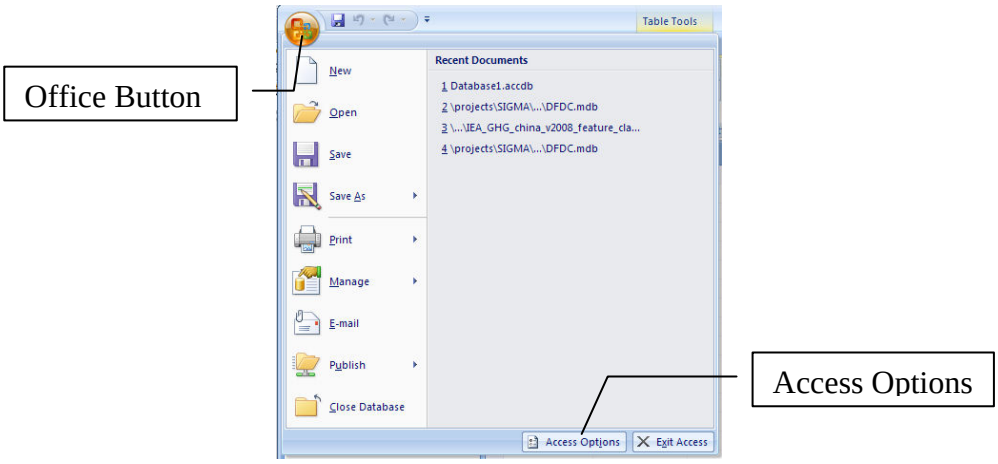
b. If any problems are encountered during the install it is possible that the .Net Framework is not installed. To fix this please visit the Microsoft website and download the latest version.

4. Copy the SIGMA_stylesheet.style found in the Main Project Folder to C:\Program Files\ArcGIS\Styles and rename it SIGMA.style (if there is already a file of this name in the Styles folder delete it before renaming the SIGMA_stylesheet.style file).
5. Install Fonts by either dragging and dropping the BGS Fonts from the FontsV4 folder, found in Installation, to the Fonts Folder in the Control Panel or by opening the Fonts Folder in Control Panel, going to Edit, Install New Font, and navigating to the FontsV4 folder.
6. Set the Microsoft Access macros levels to work with BGS·SIGMA*mobile*. Instructions on how to do this for both Access 2003 and Access 2007 are detailed below. This step will need to be repeated on the tablet PC if a different profile name is used.

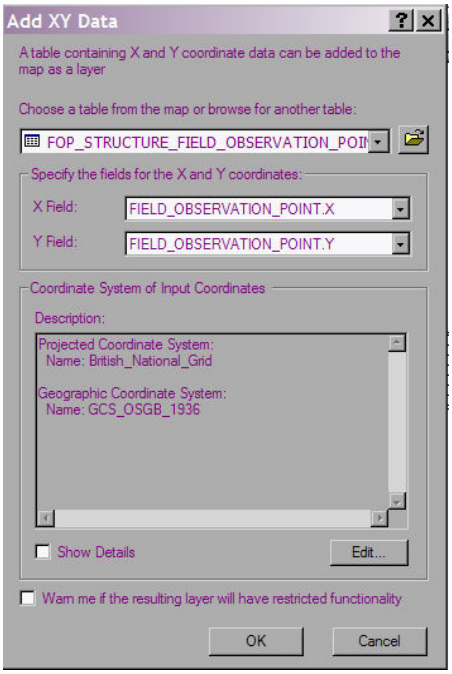
   a. For 2003 – Open MS Access and from the programs menu go to Tools – Macro – Security and set the Security Level to Low.



   b. For 2007 – Open MS Access and from the programs menu select the Office Button and then Access Options. From the pop up window select Trust Centre – Trust Centre Settings – Macro Settings and select Enable All Macros.



7. When you first open BGS·SIGMA*mobile* go to the Tools menu - Extensions, and switch on the Capture by Symbol V0.1. Then go to the Tools menu - Options, click on the Table of Contents tab, and check the box next to Capture.
8. Before you are able to load any data into your Project you must fix the broken link of FOP_STRUCTURE_FIELD_OBSERVATION_POINT Events found under Layers in the Table of Contents of BGS·SIGMA*mobile*.
    a. Click on the red exclamation mark or right-click on the layer and go to Properties – Source - Set Data Source.
    b. The Table name should be listed as: FOP_STRUCTURE_FIELD_OBSERVATION_POINT
    c. The X Field should be: FIELD_OBSERVATION_POINT.X (select by using the drop down arrow)
    d. The Y Field should be: FIELD_OBSERVATION_POINT.Y (select by using the drop down arrow)
    e. Edit the Coordinate System to match the projection you are using for your project – If in the UK, then British National Grid. (Edit – Select – Projected Coordinate Systems – National Grids – British National Grid.prj.)
    f. More information on this topic can be found in Section 3.6 starting on page 63.



9. All 'added data' or Baseline data that you will be using in the field needs to be below the last layer found in BGS·SIGMA*mobile* (National Grid QS). Any added layer that is above the Field Observation Points (except for the automatic GPS layer generation) will cause the Field Observation Points Tools to stop working and the Access database will no longer open or behave as expected.

1.3 INCREASING TABLET PC PERFORMANCE

It is highly recommended that measures are taken to increase the performance of the tablet PCs to ensure the system runs as fast as possible. These measures could include:

1. Reducing the visual effects in windows (Via My Computer> Properties> Performance).
2. Defrag the hard drive on a regular basis (within BGS we do this once a month during the field season). Clear out any temporary files.
3. Stop non-essential services and turn off the desktop wallpaper to save memory.

1.4 SETTING UP A PROJECT

Data can either be added to a blank BGS·SIGMA*mobile*.mxd or if a project GIS is already set up, layers can be dragged or dropped between the project GIS and the empty BGS·SIGMA*mobile* GIS. It is important that the BGS·SIGMA*mobile* layers; GeoPoly, GeoLine, Map Face Note, National Grid QS and TestPointProjection remain in the project for the system to work.

Within BGS, data are located in the BASELINE Data Folder for portability.

NOTE: Wherever possible raster data should be in an optimised file format and stored as an image catalog to reduce the file size and number of rasters displayed at once, therefore reducing the amount of system resources needed to refresh the data within BGS·SIGMA*mobile*. One example of an appropriate file format to use would be ECW which can be generated through the ERMapper software. The use of full resolution tiff files may considerably reduce the speed of the system and therefore the usability so these should only be used in circumstances where they are essential to the work being carried out and where the user is prepared to accept the potential problems that may be caused through lack of system resources.

Update to this note: It was found at BGS that in Arc 9.3.1 ESRI had changed the projection for British National Grid causing all previous tiff imagery to be slow to redraw due to a continual projection on the fly. BGS has rectified this problem by reprojecting our raster imagery but still finds the ECW file format to be the quickest file format to load and pan while using ArcGIS with a Tablet PC. The ECW file format was created in BGS by using ERDAS ERMapper 7.2

2 Global Positioning System (GPS)

2.1 PROJECTION SETUP

For onshore field data collection in the UK, the British National Grid (BNG) projection, which has an OSGB 1936 datum, is used. The DFDC data frame in ArcMap should automatically have this as its projection. If it does not, then it needs to be set using the data frame properties dialogue box, Coordinate System tab.

GPS systems use the world geographic coordinate system (WGS 1984). Since the DFDC data frame in ArcMap and the GPS use different coordinate systems, it is essential that ArcMap knows how to read in the GPS signal and transform it's coordinates into OSGB coordinates that are accurately viewed within ArcMap. To do

this, a file called “TestPointProjection” has been added to the project. This file has a WGS84 projection and forces ArcMap to store the transformation properties required to transform data from a WGS84 projection into BNG (N.B – all the other layers in the data frame should have a BNG projection).

Instructions for using the system in map projections other than BNG are included in Section 8

2.2 GPS SETUP INSTRUCTIONS

To use the GPS tools a system with a GPS receiver and software must be used.

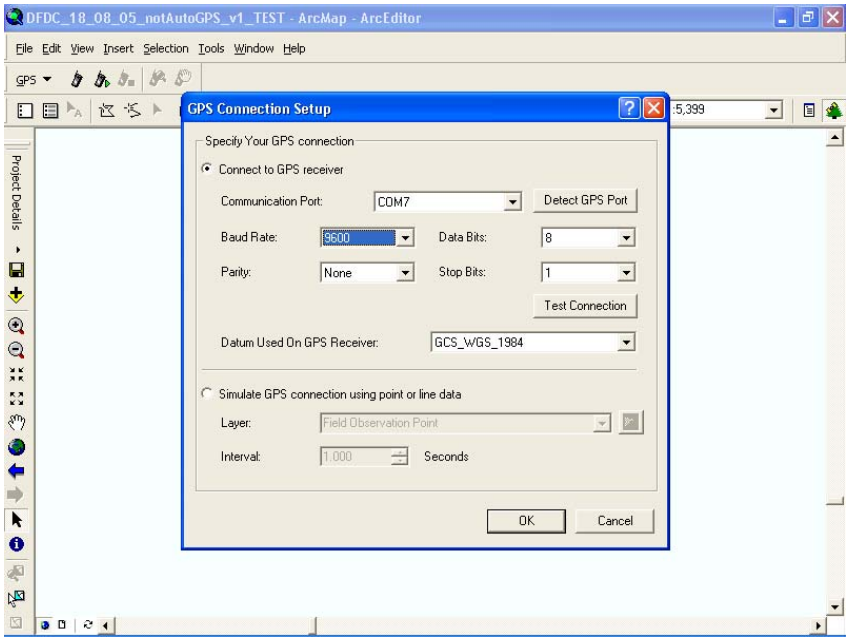
2.2.1 Using the ArcGIS GPS tools

Note that there is an incompatibility issue with the ArcGIS GPS tools and some hardware systems that may cause an increase in computer crashes. If this is the case, the BGS GPS tool can be used instead (see 2.2.2 below).

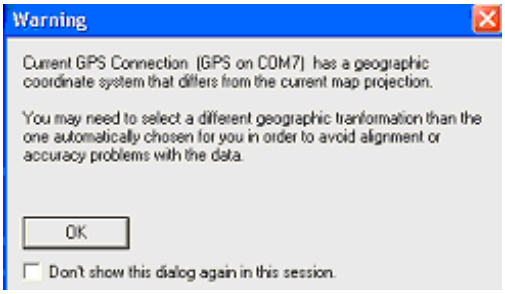
2.2.1.1 CONNECTING TO THE GPS

1. Open BGS·SIGMA*mobile* from within Windows Explorer (or your Desktop shortcut) and use the GPS toolbar (or the GPS drop down on the menu bar) to set up the GPS connection as follows.

2. Click the GPS Connection Setup Option button to open the GPS Connection Setup dialogue box. The datum on the receiver should be set to GCS_WGS_1984. Everything else should stay as default.



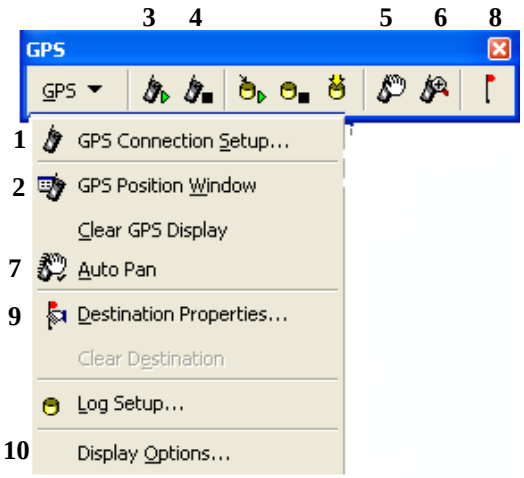
3. Click OK. Then click the Connect to GPS icon on the toolbar . If you get the warning message below, click OK. The error message is because the GPS uses a WGS84 coordinate system whereas the BGS·SIGMA*mobile* data frame is using BNG.



4. You can also see the GPS readings from the toolbar using the GPS position window button.

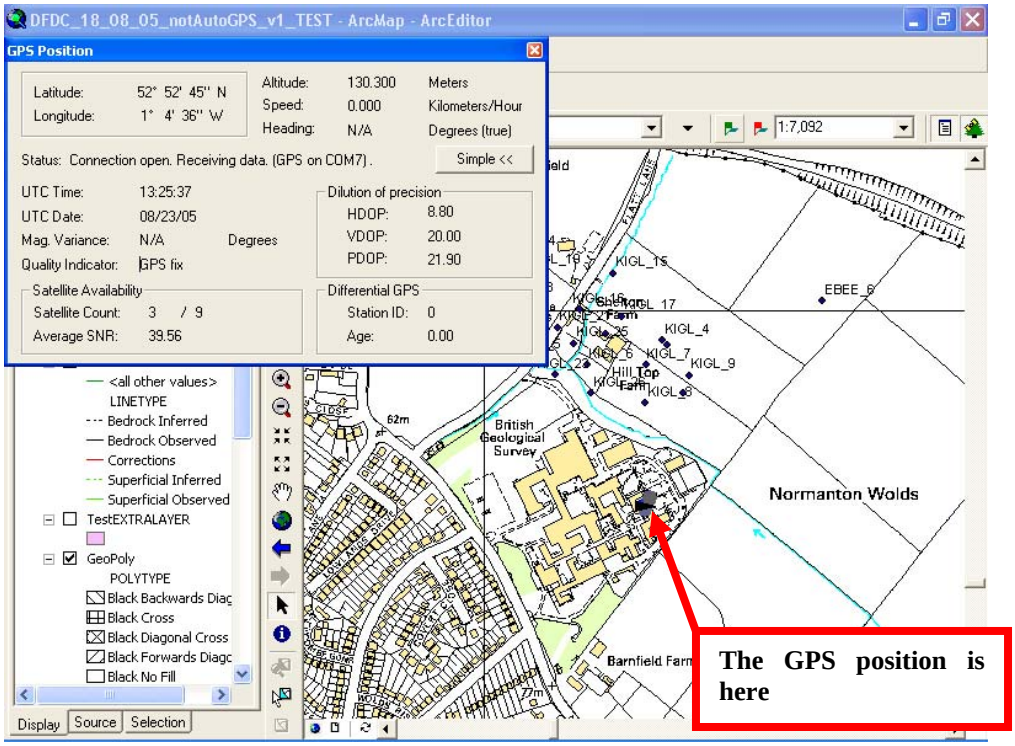
5. You can now use the Display Options within GPS Tools to change how the GPS locator is displayed and whether you want a track log etc.

2.2.1.2 ARCGIS GPS TOOLBAR

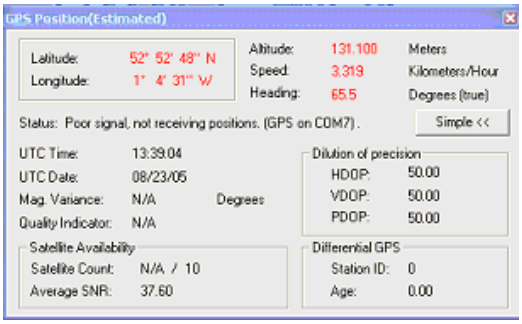


1. ***GPS Connection Setup*** – enables the user to connect to the GPS through the correct COM port and using the correct baud rate.

2. ***GPS Position Window*** – displays useful information about the GPS connection and its current position. In advanced mode it is possible to see the satellite availability as well as time/date and magnetic variances, along with suggested accuracy measurements.



When there is no connection, the GPS window shows an estimated position in red as shown below.



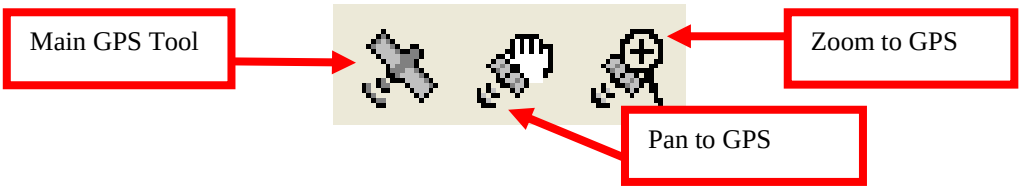
3. ***Open Connection*** – Establishes a connection to the GPS.
4. ***Close connection*** – Closes the connection to the GPS.
5. ***Pan to GPS position***
6. ***Zoom to GPS position***
7. ***Auto pan to GPS position*** – turn on or off depending on whether you want the system to move the map view to the GPS position whilst you are walking.
8. ***Add destination***– Sets the clicked point on the screen as the destination.
9. ***Destination properties*** – Sets the symbol and label for the destination flag and allows the user to show the bearing to the destination from their current location.
10. ***Display options*** – Sets how the GPS symbol is displayed.

2.2.2 Using the BGS GPS tools

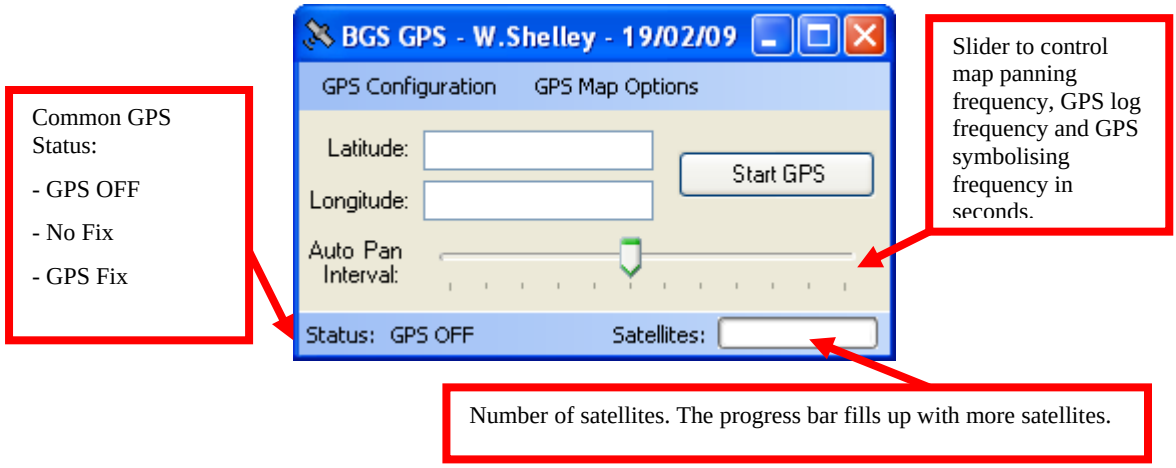
The ArcGIS GPS tool seems to conflict with the GPS on the iX104 tablet PCs causing the software to crash intermittently, therefore BGS wrote a bespoke GPS tool that operates with ArcGIS on any hardware.

2.2.2.1 BGS GPS TOOLBAR

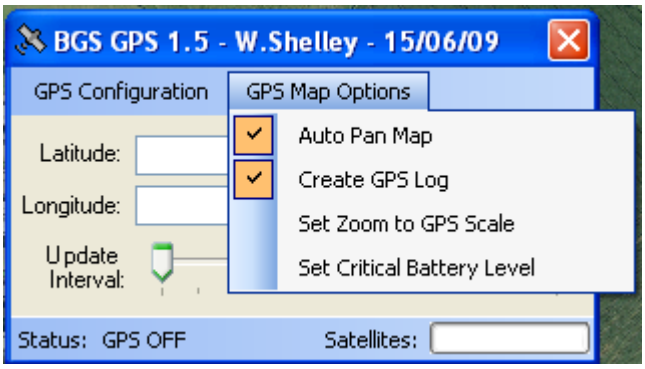
1. If the Toolbar is not visible go to View/Toolbars and select 'BGS GPS Toolbar'



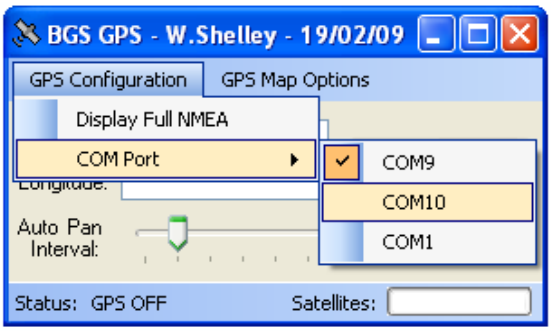
2. Click on the Main GPS Tool and select Start GPS
    a. The GPS tool will then attempt to get a GPS fix
    b. To stop the GPS click the Start GPS button again

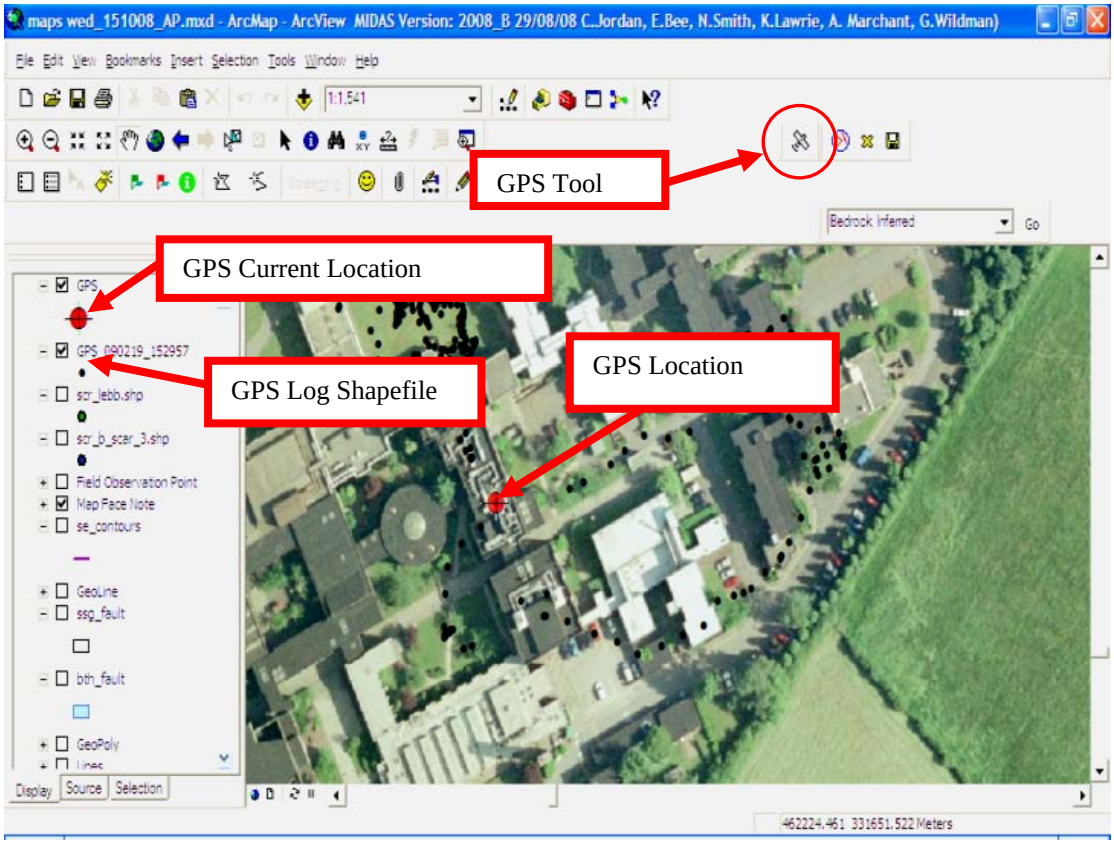


3. Once the GPS has a fix you can pan or zoom to the GPS location using the Pan and Zoom buttons on the Main Toolbar
    a. You can also set the BGS GPS to Automatically Pan by using the Main GPS Tool see the diagram below



4. The first time the BGS GPS Tool is used in BGS·SIGMA*mobile* two shapefiles will be created – these files are created using the same spatial reference as the current data frame (eg. British National Grid)
    a. Current GPS location (Created at DocPath\GPS\GPS.shp)
    b. GPS Log (Created at DocPath\GPS\GPS_Date_Time.shp)
5. The GPS tool will scan all the communications ports that are available to the application. If COM2 is available this will automatically be selected
    a. If you need to change the communication port go to GPS Configuration/COM Port/COM n (see below)

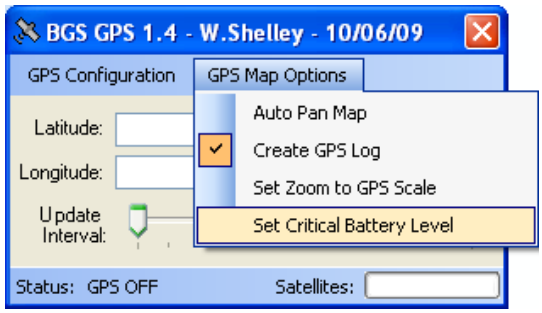




More GPS Settings and Information:

- The GPS shapefile has one point with the current GPS location marked within it. This location is a transformation from the GPS.
- The symbology of GPS shapefile will be automatically set depending on the strength of the GPS signal. Red = No Signal, Yellow = Low Signal, Green = Good Signal.

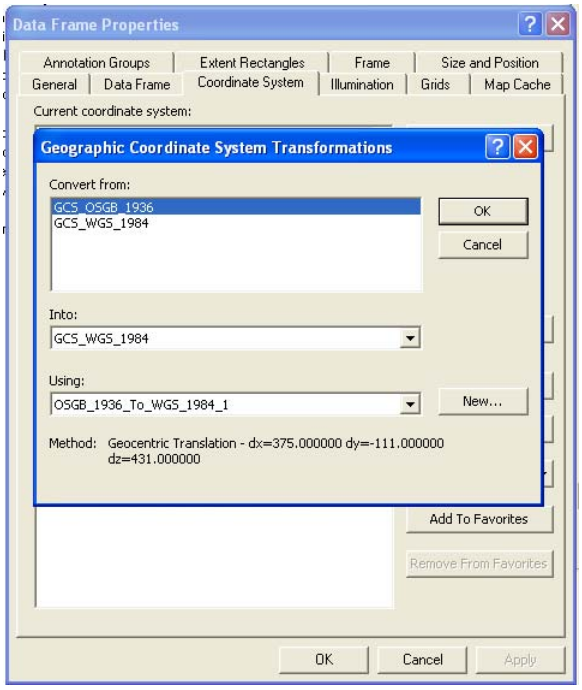
- You can turn the GPS location on/off by tuning the layer on/off in the ArcGIS Layer Table of Contents.
- The GPS log file will have a record for every interval, set using the auto pan interval.
- A column in the GPS log file has the date and time of the GPS point.
- You can turn the GPS log file on/off by turning the layer on/off in the ArcGIS Layer Table of Contents.
- You can alter the critical battery level at which the GPS will turn off (see below). This is recommended to be at least 1% above the system's critical battery level. This setting will persist until the application is removed. The tablet's critical battery level can be changed using ControlPanel > PowerOptions



2.2.3 GPS in ArcMap - trouble shooting

2.2.3.1 INCORRECT POSITIONING

If you think that the GPS position is being shown incorrectly in ArcMap, check the transformation settings in the data frame properties/coordinate system/transformations dialogue. It should appear as displayed in the image below. If this is not correct, then make sure that the TestPointProjection feature class and a feature class with BNG projection have been added to the data frame.



2.2.3.2 A GPS FIX DOES NOT OCCUR AFTER STANDBY/HARD SHUT DOWN IN THE BGS GPS TOOLS

After coming back from Standby or after a battery change the BGS GPS Tools might not find a satellite fix. This might be caused by a corrupt shapefile where the number of features in the shapefile does not match the attributes in the dbf file caused by a system failure during the edit process. Removing the GPS and GPS log layers from the BGS·SIGMA*mobile* Table of Contents, saving the Project, closing the .mxd, renaming the GPS Folder found in the main project area, reloading BGS·SIGMA*mobile*, and starting the BGS GPS Tools again should solve this problem. If this happens please set the Critical Battery Level as defined in More GPS Settings and Information.

3 Using BGS·SIGMA*mobile*

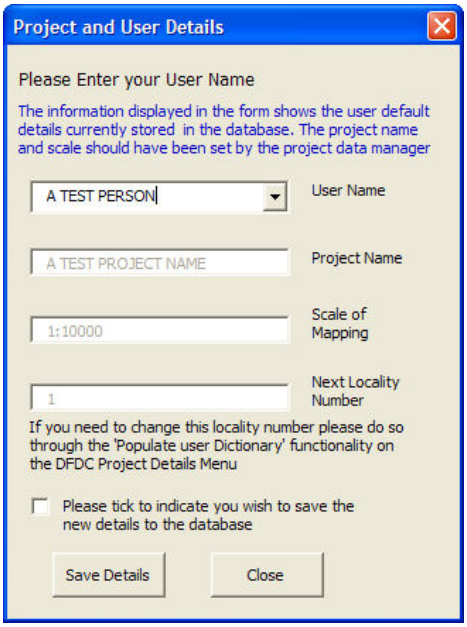
The digital field slip has been developed using ArcGIS 9.3.1 (service pack 1) and a personal geodatabase which uses Access 2003

The digital field slip should be treated in much the same way as a paper field slip, the only difference is that data are captured digitally. On a paper field slip, geologists make notes and observations by drawing lines, polygons, map face comments and points with labels to reference their geological notebook observations. The same is true in the digital field slip. Geological lines or landforms created by BGS staff using the digital field slip are "inked in" using our SIGMA*desktop* on return to the office in much the same way a paper field slip is inked in. External users will need to define their own workflow for making maps from the digital field data collected using BGS·SIGMAmobile.

3.1 OPENING THE BGS·SIGMA*MOBILE* GIS

BGS·SIGMA*mobile* fires code in the background whilst the system is being loaded. For this to work, the application needs to be opened either through a shortcut from the Desktop to the .mxd itself or by double-clicking the .mxd in Windows Explorer. If the application is opened via ArcMap, you will come across an error in the code and will not be able to use the system. This is because ArcMap temporarily looks for the geodatabase in a bin folder rather than to its real location. For ease, and to reduce the risk of this error, you should create a shortcut on the tablet PC's to the BGS·SIGMA*mobile*.mxd.

Once the BGS·SIGMA*mobile* GIS is opened a dialog box will be displayed showing the project and user details which are currently stored in the database. These are default settings, which are added to any data captured during fieldwork so that, in the future, it can always be determined who captured the data, when and for which project. When opening a brand new project the dialog box will show the test user and test project details so it is important that the user changes these details before commencing use of the system. The user name shown in the dialog box can be changed to their own by selecting their name from a list of user names displayed in the dropdown list, checking the save details box and clicking the Save Details button. The project details will need to be changed via the 'populate user dictionary' tool (see section 3.2.1) which can be selected from the DFDC Project Details menu.



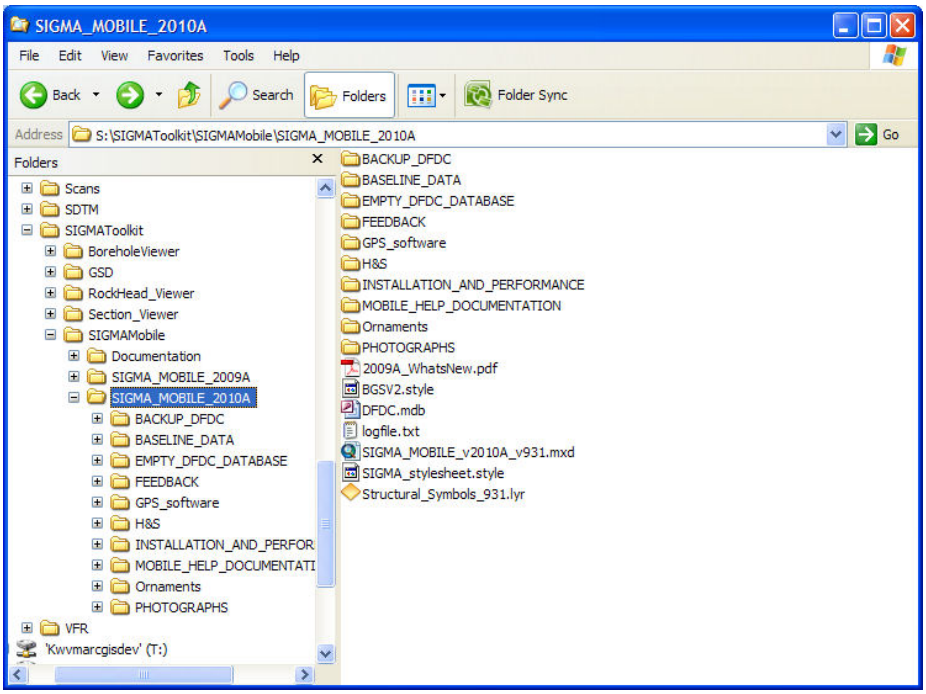
If a valid username does not exist in the dropdown list, or any of the project details are incorrect, the user will have to access the populate user dictionary form from the DFDC Project Details menu and make the appropriate changes here. Within this form there is also the option to change the starting locality number. If, upon opening the GIS, all details in this dialog box are correct then the user may just click on the close button. The process to add new users is described in Section 3.2.1.1.

BGS·SIGMA*mobile* relies on particular layers to store field observations. These will appear in the table of contents when you open the GIS. They should not be renamed or removed, if they are and you use one of the BGS·SIGMA*mobile* tools you will be alerted by a message box saying that the layer cannot be found. The layers which are specific to BGS·SIGMA*mobile* are:

These are all stored in the DFDC.mdb file.

3.2 PREPARING BGS·SIGMA*MOBILE* FOR FIELD USE

To begin a new project, copy the BGS·SIGMA*mobile* folder and subfolders from the zip file to the project workspace.



If a project GIS has been set up, then so long as it has been created in ArcGIS 9 or above, you should open both the project GIS and the BGS·SIGMA*mobile* GIS on your office PC and simply drag and drop the data from the table of contents (TOC) from the project GIS into the TOC of the BGS·SIGMA*mobile* GIS.

The BGS·SIGMA*mobile*.mxd can be renamed to reflect the project or the user. The DFDC database **MUST NOT** be renamed. Alternatively the data can be added directly into BGS·SIGMA*mobile* using the add data button. If you do this, make sure you have created .lyr files through the desktop GIS first in order to save the legend information

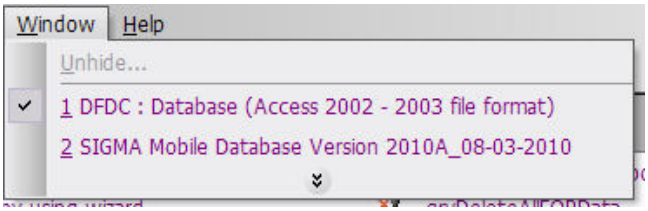
3.2.1 Setting up project details

3.2.1.1 Entering new users to the system

The user names of staff / students that will be using the BGS·SIGMA*mobile* system are used to generate a UUID (unique user ID) for each map face note, line, polygon and observation so it is important that the details of your field staff / students are input to the system so that each entry can be coded correctly.

Entering the information for your staff into the main staff details table in the database is described in the following steps:

1. Open the DFDC.mdb and open the Database window – this can be done by clicking on Window from the main menu and selecting DFDC



2. Open BGS_META_ORACLE_USER which will be shown in the list of tables. This table is used to store all details for a user and is then accessed by other parts of the system to populate the tables used by ArcMap.
3. Details for each user who may use this system should be added to this table. Some of the fields in this table are BGS specific but the essential fields that must be populated are:
    a. USERNAME – this is the code for the person and should be no more than 10 characters long
    b. PERSON_NAME – this is the persons full name and should be no more than 30 characters long

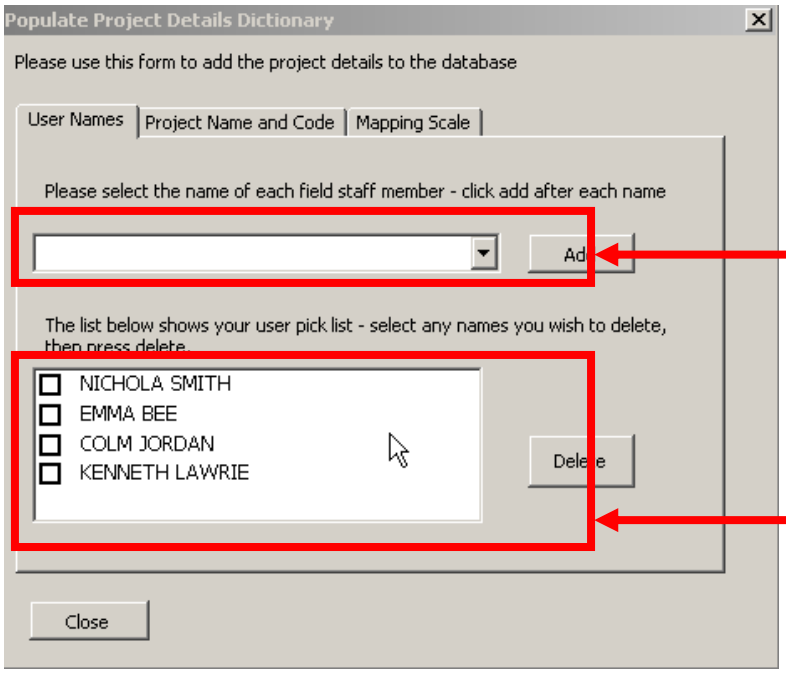
    Other fields can be populated if this is helpful to your organisation but they are not essential to the operation of the BGS·SIGMA*mobile* system.

    If you are creating a single mastercopy database to be used throughout your organisation then it is sensible to add in any user who may potentially use the system regardless of whether they will be using it in the immediate future. Within BGS this table is populated with all current employees.
4. Save the table and close the database.

When you first open the BGS·SIGMA*mobile* GIS, the Project and User Details form will prompt you to check the default details. When setting up the BGS·SIGMA*mobile* GIS for project use, these default details will be incorrect and must be amended. This is done by opening the DFDC Project Details Menu and selecting Populate User Dictionary. The Populate Project Details Dictionary form will appear with four tabs which allow you to select the correct details for your project.

3.2.1.2 USER NAMES

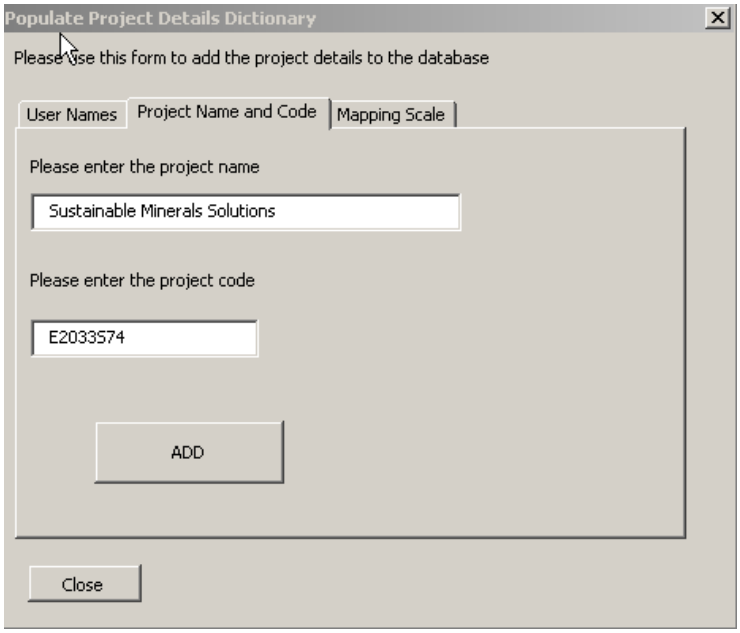
This allows you to take the names of the staff that will be working on a specific project from the BGS_META_ORACLE_USER table and populate the more project specific table within the database (UserDetailsDictionary). This is done for ease of use in the system and means that the drop down list in the Project and User Details form that first appears on opening a project (and is used to set the current user) only lists the staff working on the specific project and not all members of staff listed in the BGS_META_ORACLE_USER table.



This list refers to a list of names and user names in the geodatabase that are stored in the table BGS_META_ORACLE_USER. You can type in a name and it should appear in the list. You can then select it and add it to the list below.

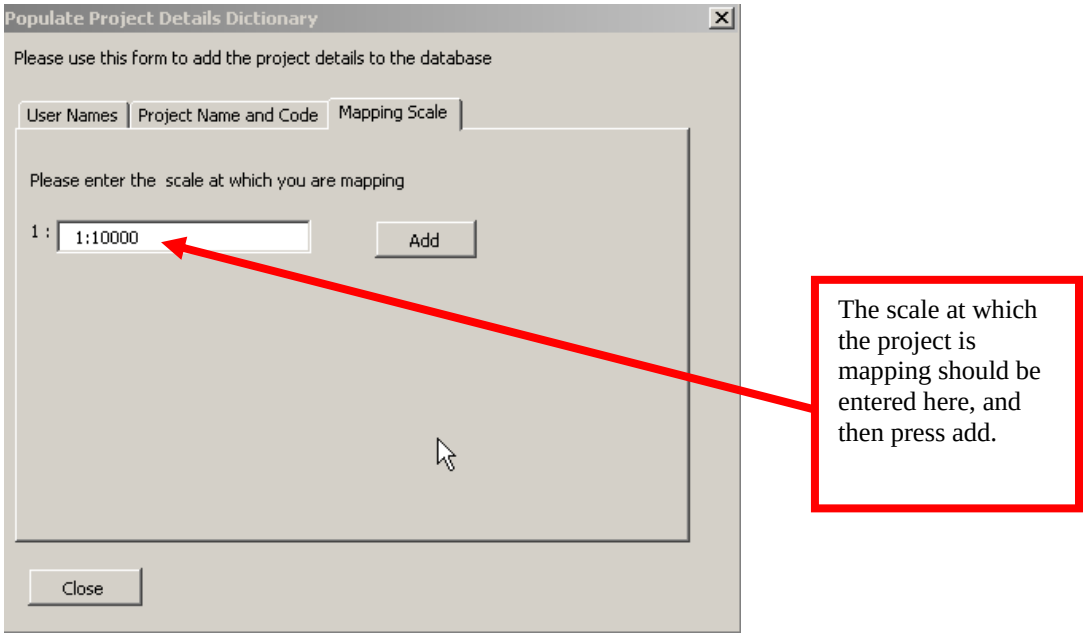
This is the list which appears in the project/user details form (button 16a). The user can add or remove names from that list on this form. To delete a name, select it and click delete on the form.

3.2.1.3 PROJECT NAME AND CODE

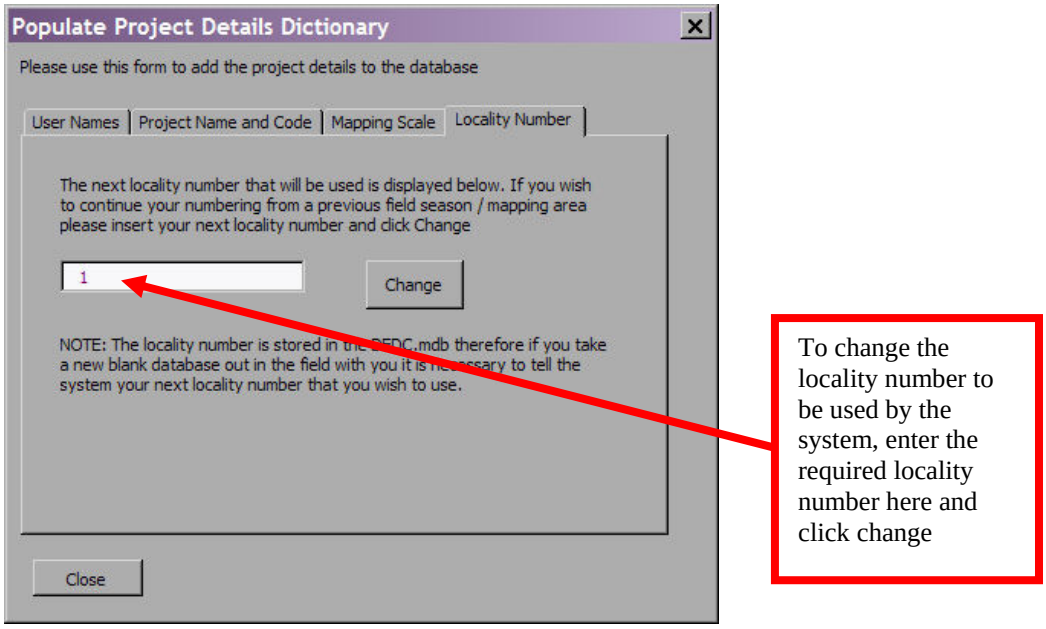


The form shows the project name and code currently set in the database. It is possible to type over these entries to ensure that the correct project code and name appear exactly as required by your organisation. It is necessary to ensure both text boxes are entered before clicking the Add button – if one or other of these are not used within your organisation then an X or similar should be entered.

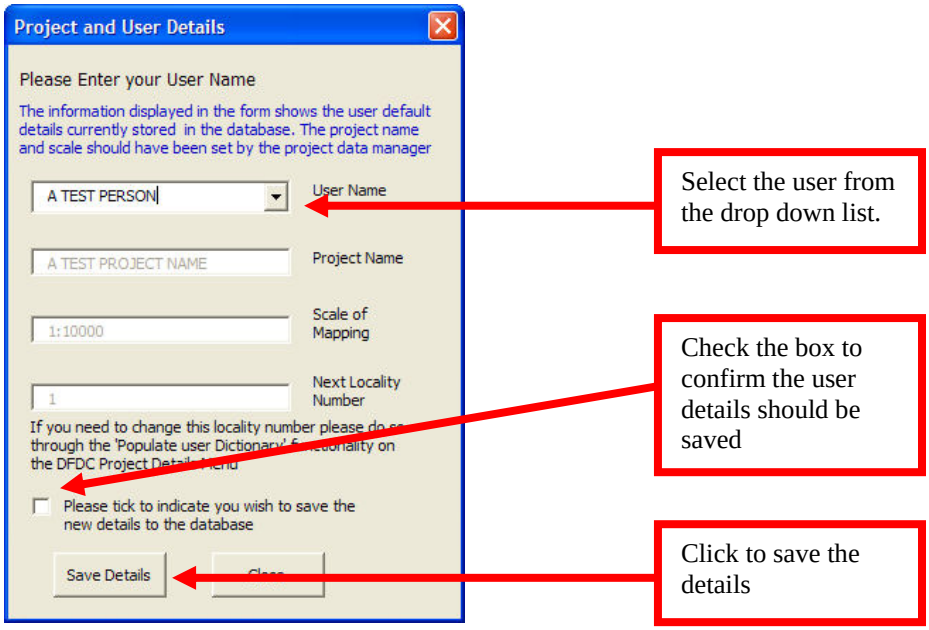
3.2.1.4 MAPPING SCALE



3.2.1.5 LOCALITY NUMBER



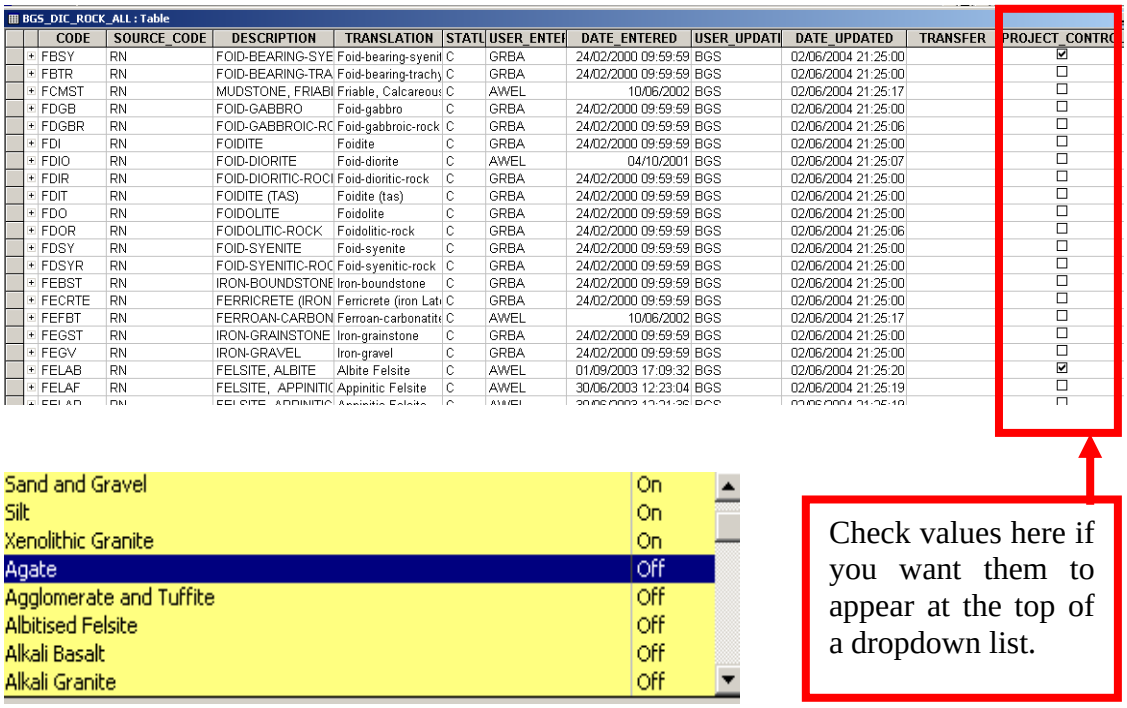
Once these four sections have been populated with information, the user can check that the database is using the correct values by viewing the form that appears after clicking the Project/user details button. This form will also now list all the users set up for the project and it is essential that the current user should select their name from the drop down list, tick the save details checkbox and click the Save Details button.



All of these details are then stored in the database table USER_DETAILS.

3.2.2 Setting-up Project Dictionaries

Within the DFDC.mdb there are several dictionary tables. Some of these, such as BGS_DIC_ROCK_ALL are very extensive and would take up a lot of room in dropdown lists in the field. To reduce the time spent searching through lists to find the right value, the dictionaries have been set up with a project control field because different projects map in different domains and will require different values. The data manager can go through each dictionary to check the project control box beside any dictionary value that they feel will be used within the mapping domain. What this does is force these checked dictionary values into alphabetical order at the top of a dropdown list on the Tablet PC. All other values, i.e. with no project control tick, will be included, in alphabetical order, in the dropdown list, but below the checked values.



BGS_DIC_ROCK_ALL : Table

CODE	SOURCE_CODE	DESCRIPTION	TRANSLATION	STATL	USER_ENTEI	DATE_ENTERED	USER_UPDATI	DATE_UPDATED	TRANSFER	PROJECT_CONTRO
FBSY	RN	FOID-BEARING-SYE	Foid-bearing-syenit	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☑
FBTR	RN	FOID-BEARING-TRA	Foid-bearing-trachy	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FCMST	RN	MUDSTONE, FRIABI	Friable, Calcareous	C	AWEL	10/06/2002	BGS	02/06/2004 21:25:17		☐
FDGB	RN	FOID-GABBRO	Foid-gabbro	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDGBR	RN	FOID-GABBROIC-RC	Foid-gabbroic-rock	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:06		☐
FDI	RN	FOIDITE	Foidite	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDIO	RN	FOID-DIORITE	Foid-diorite	C	AWEL	04/10/2001	BGS	02/06/2004 21:25:07		☐
FDIR	RN	FOID-DIORITIC-ROCI	Foid-dioritic-rock	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDIT	RN	FOIDITE (TAS)	Foidite (tas)	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDO	RN	FOIDOLITE	Foidolite	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDOR	RN	FOIDOLITIC-ROCK	Foidolitic-rock	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:06		☐
FDSY	RN	FOID-SYENITE	Foid-syenite	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FDSYR	RN	FOID-SYENITIC-ROC	Foid-syenitic-rock	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FEBST	RN	IRON-BOUNDSTONE	Iron-boundstone	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FECRTE	RN	FERRICRETE (IRON	Ferricrete (iron Lat	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FEFBT	RN	FERROAN-CARBON	Ferroan-carbonatite	C	AWEL	10/06/2002	BGS	02/06/2004 21:25:17		☐
FEGST	RN	IRON-GRAINSTONE	Iron-grainstone	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FEGV	RN	IRON-GRAVEL	Iron-gravel	C	GRBA	24/02/2000 09:59:59	BGS	02/06/2004 21:25:00		☐
FELAB	RN	FELSITE, ALBITE	Albite Felsite	C	AWEL	01/09/2003 17:09:32	BGS	02/06/2004 21:25:20		☑
FELAF	RN	FELSITE, APPINITIC	Appinitic Felsite	C	AWEL	30/06/2003 12:23:04	BGS	02/06/2004 21:25:19		☐

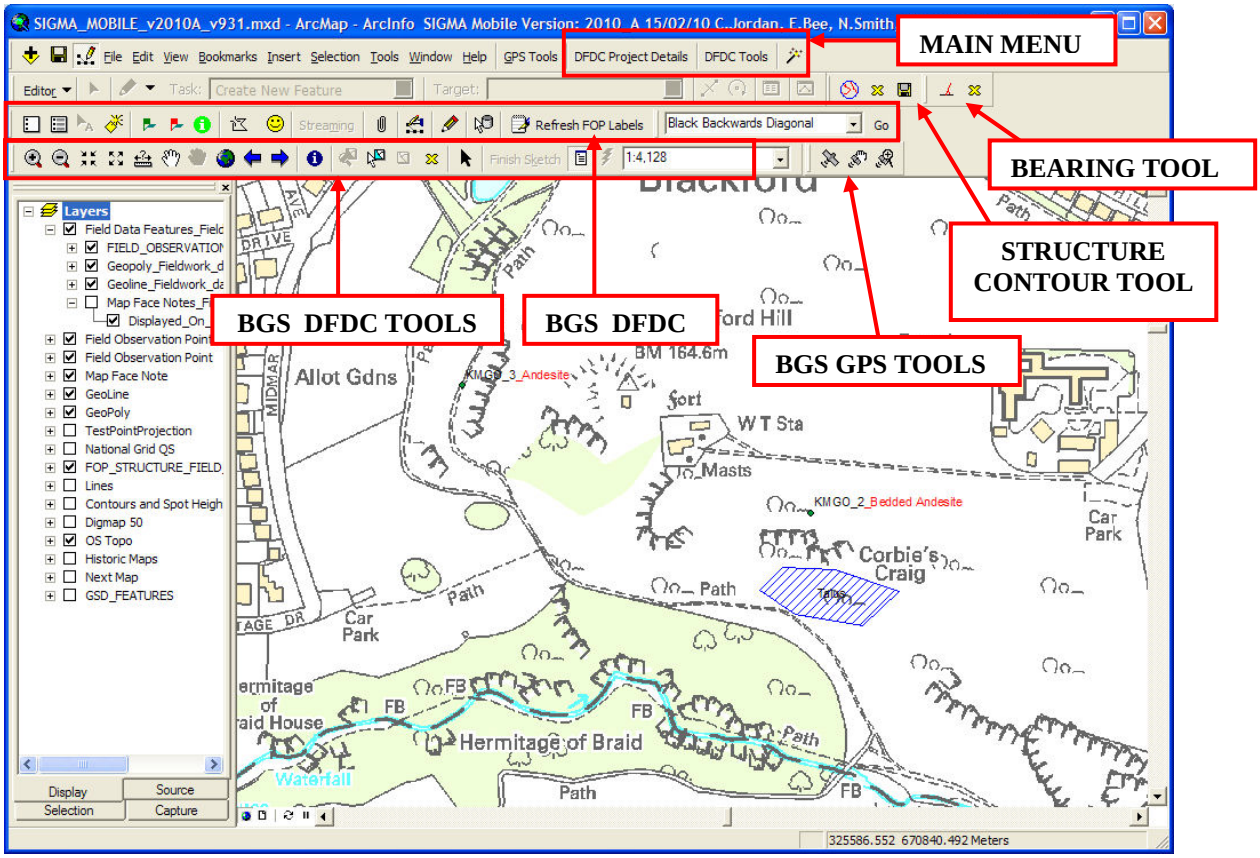
Sand and Gravel	On
Silt	On
Xenolithic Granite	On
Agate	Off
Agglomerate and Tuffite	Off
Albitised Felsite	Off
Alkali Basalt	Off
Alkali Granite	Off

Check values here if you want them to appear at the top of a dropdown list.

This means that all dictionary values will be available in the field, but only some will be listed at the top of the dropdown list

To edit the Dictionaries you will need at least one field observation point, if necessary place a dummy field observation point on the map. In the Database go to the Housekeeping Tab, select View Manipulate Dictionaries, and in the Dictionary Browser select the down arrow and choose the Dictionary you wish to change. You can also double-click on the DFDC.mdb itself in Windows Explorer, select a field observation point, and continue with the steps listed above.

3.3 THE BGS·SIGMA*MOBILE* GRAPHICAL USER INTERFACE (GUI)



The layout of the BGS·SIGMA*mobile* application is shown above.

3.3.1 BGS DFDC Tools Toolbar

This toolbar uses a subset of useful tools that appear on the default ESRI tools toolbar as well as customised DFDC tools developed in BGS. Each tool is outlined below but their best practice use is described in more detail later in this document.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

1. ***Zoom in***
2. ***Zoom out***
3. ***Fixed zoom in*** - Zooms in to the centre of the map in steps.
4. ***Fixed zoom out*** - Zooms out of the centre of the map in steps.
5. ***Measure*** - Allows the user to measure a distance on the map.
6. ***Pan*** - Lets the user move the map centre
7. ***Toggle Auto Pan*** – allows the user to turn the auto pan functionality on or off
8. ***Full Extent*** - Zooms to the full extent of all the data.

9. ***Go back to previous extent***

10. ***Go to next extent***

11. ***Identify*** - brings up the attributes of a feature.

12. ***Zoom to selected features***

13. ***Select features*** - Selects map features that are set as selectable.

14. ***Clear selected features*** - (unselect the selected features)

15. ***Delete selected geofeatures and graphics*** - deletes those selected GeoPolygons, GeoLines, Map Face Notes, Field Observation Points or Graphics.

16. ***Select graphic elements*** - this tool will select graphic elements, but not geofeatures

17. ***Finish Sketch*** - If you are creating a GeoLine or GeoPoly feature and find it difficult to double tap on the tablet to finish drawing, click this button instead and it will finish drawing for you.

18. ***Toggle table of contents*** - Toggle this on or off depending on whether you want to view the table of contents window (TOC) or not.

19. ***Map scale*** - This combo box shows the current map scale. A new scale can be entered here and the map will zoom to the new scale.

3.3.2 BGS DFDC Toolbar

This toolbar displays the customised BGS·SIGMA*mobile* tools that are commonly used whilst mapping in the field. The tools will be outlined in brief in this section and described in more detail in later sections.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

1. ***Add Map Face Note*** - This tool enables the user to enter a map face comment to the digital field slip. (see section 3.4.1)

2. ***Edit Map Face Note*** - This tool enables the user to edit the content of an existing map face comment. (see section 3.4.1)

3. ***Move Map Face Note Tool*** - This tool allows the user to move the position of a map face comment. (see section 3.4.1)

4. ***Copy map face note*** - The user can use this tool to copy a selected mapface note to save them time re-writing it. (see section 3.4.1)

5. ***Add Notebook observation point*** - This button allows the user to add a point to the map face. Once the point is added the notebook application opens. (see section 3.4.2)

6. ***Edit Notebook observation point*** - This button allows the user to edit an existing notebook point on the map face. Once the point is selected the notebook application opens. (see section 3.4.2)

7. ***Précis tool*** - Use this tool to identify on a field observation point and view all the data entered at that point in a précis list within ArcMap. This tool is also available within the DFDC database. (see section 3.4.4)

8. ***Draw GeoPoly*** - The user can use this tool to draw a polygon on the field slip. They can select the colour and the shading of the polygon by changing the selections available in the form activated by button 10. The style in use is written on the button. The project leader must decide what combination of fill style and colour correspond to each type of feature being mapped. This will vary depending upon mapping domain and as such project specific. (see section 3.4.5)

9. ***Change GeoPoly symbology*** - This button allows the user to amend the symbology of a selected geofeature. The symbology is updated to reflect what is visible in the combo boxes. (see section 3.4.5)

10. ***Streaming - Turn on/off streaming*** - Streaming adds vertices as your pointer moves around the screen whilst in editing mode. If you prefer to tap to add vertices, turn this off, else turn it on for streaming. You can set streaming preferences using the editing options button described in 6.s and detailed in section 3.4.8.

11. ***Label a geofeature*** - When a geofeature (GeoPoly or GeoLine) has been selected, the user can use this tool to label it if they so wish. To display these labels on the Map Face, select button 6.n. (see section 3.3.3)

12. ***Edit Tool*** - This allows the user to edit the shape of a GeoPoly or GeoLine by moving the shapes vertices.

13. ***Activates the ink tools*** - see section 3.4.7

14. ***View Old DFDC Databases*** - This button allows the user to view old DFDC projects. (see section 3.4.9)

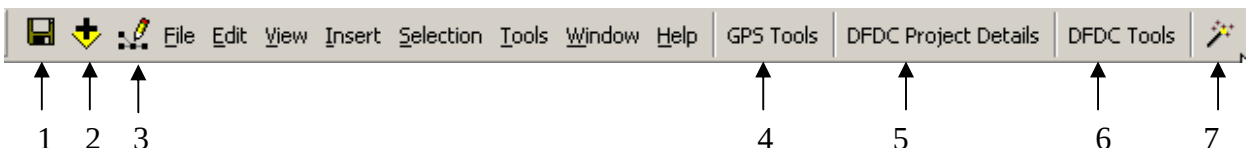
15. ***Refresh FOP Labels*** – refreshes the FOP annotation once a summary label has been entered into the DFDC database. (see section 3.4.3)

16. ***Change style of GeoPoly/GeoLine*** - This combo box shows all of the styles currently in use by the project. Select the style you want from the drop down box, select a feature to convert and click 'Go' (button 17).

17. ***Convert style of GeoPoly/GeoLine*** - Once an appropriate style has been selected from the combo box to the left (16), click 'Go' to convert the selected GeoPoly/GeoLine.

3.3.3 Main Menu

The main menu toolbar includes all menus found in any new ArcMap document, and some addition menus to use within BGS·SIGMA*mobile*.



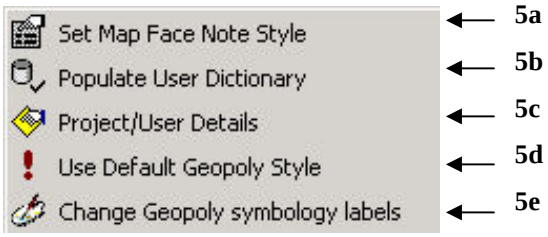
1. ***Save*** - Saves the project

2. ***Add layer*** - lets the user browse to add a new layer into the GIS.

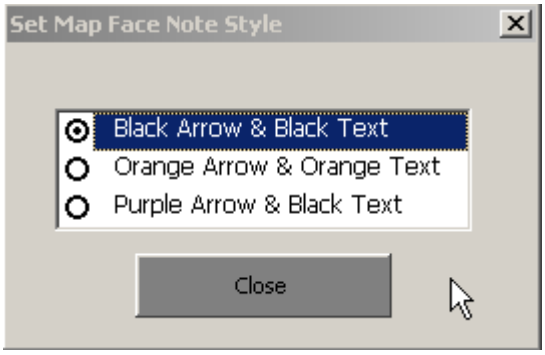
3. ***Launch editor toolbar*** - launches the editor toolbar to allow users more freedom with editing.

4. ***GPS tools*** – ArcGIS GPS Tools (Appendix A). New GPS Tools were created by BGS due to an incompatibility between the ArcGIS Tools and the IX104s - explained in Section 4.

5. ***DFDC project details*** - menu of project/person specific buttons which change default settings.



5.a. ***Set map face note style*** - Use this to change the colour of the text and arrow of future map face note. Each time the project opens, the default is reset to a black arrow and black text. There is a choice of three styles.

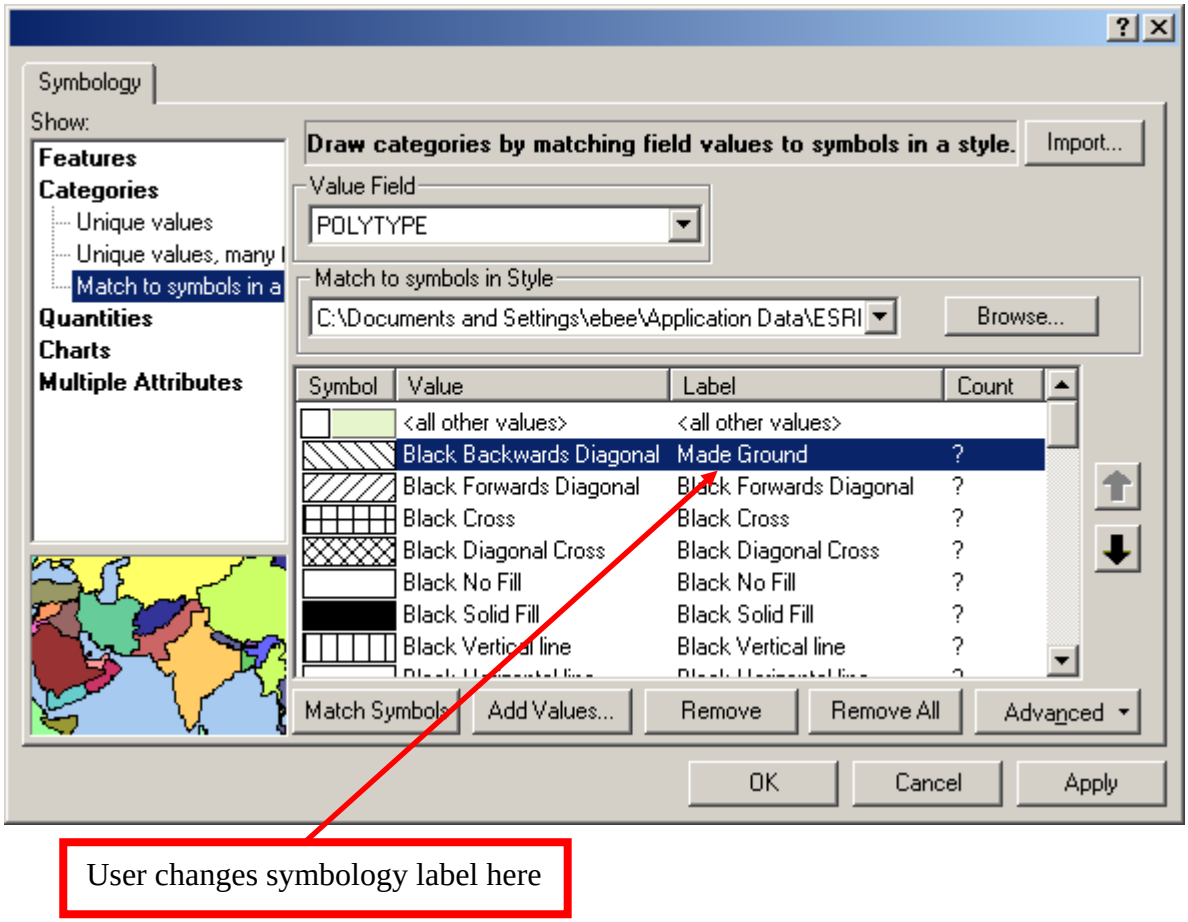


5.b. ***Populate User dictionary*** - This button opens a form in which the user can change the default project details. This should be done by the data manager before going into the field, but in case it isn't, a user can populate the project details here.

5.c. ***Project/User details*** - This button displays the default project name and user details that have been entered into the database. Click this to change the user name, or check to see the details are correct. It is the same form as the one which pops up when the BGS·SIGMA*mobile* application is opened.

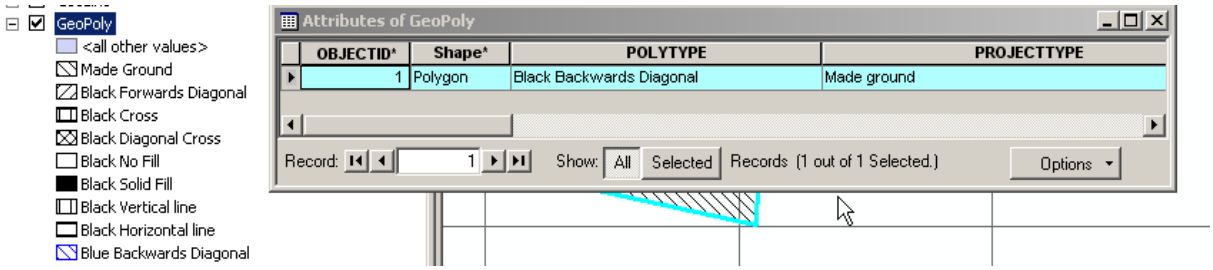
5.d. ***Use default GeoPoly styles*** - By clicking this button, the default fill types and label text for the GeoPoly layer are applied. This removes any project specific customisation of value labels which may have been applied (see 5.e).

5.e. ***Change Geopoly symbology labels*** - This button brings up the symbology window of the GeoPoly layer. A user can enter an alternative label for each polygon fill type into the label section if they so wish. The application colours GeoPolygons based on the value field rather than the label field. The value field therefore, must not be altered. The value fields are also used to construct the drop-down menu boxes for polygon fill-type, so it is important to note that even though you may change the label field, the dropdown menus will not change.

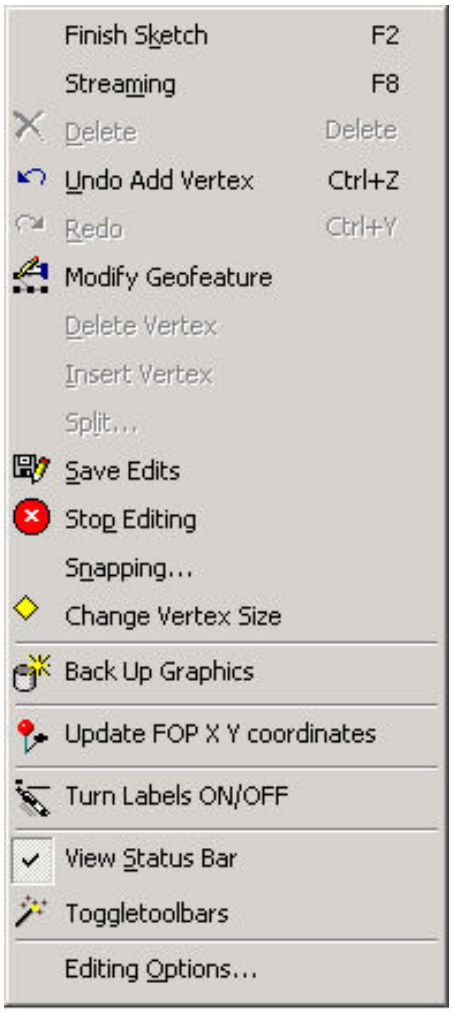


User changes symbology label here

Both the Value text and the label text are stored within the attribute table of the GeoPoly. This is to ensure that project specific fill types can be retrieved with their true meaning at a later date.



6. ***DFDC tools, drop down list of tools*** (see list of buttons 6a – 6r below)



6.a. ***Finish Sketch - If you are creati***ng a GeoLine or GeoPoly feature and find it difficult to double tap on the tablet to finish drawing, click this button instead and it will finish drawing for you.

6.b. ***Turn on/off streaming*** - Streaming adds vertices as your pointer moves around the screen whilst in editing mode. If you prefer to tap to add each vertex, turn this off, or else turn it on for streaming. You can set streaming preferences using the editing options button described in 6.s and detailed in section 3.4.8.

6.c. ***Delete Features*** - This button allows the user to delete selected features.

6.d. ***Undo*** - This button undoes the last action.

6.e. ***Redo*** - This button redoes the previously undone last action.

6.f. ***Modify Geofeature*** - When a GeoLine of GeoPoly is selected, the user can select this tool to automatically start modifying the look of the feature.

6.g. ***Delete Vertex*** - ESRI editing tool that is also accessible by a right click, this option lets the user delete a vertex on a polygon.

6.h. ***Insert Vertex*** - ESRI editing tool that is also accessible by a right click, this option lets the user insert a vertex to a polygon.

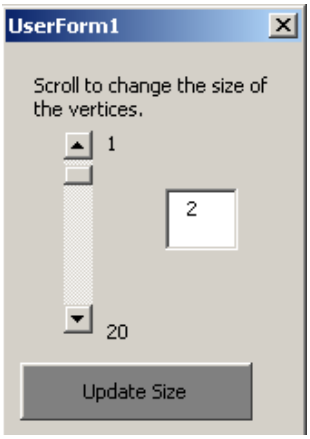
6.i. ***Split*** - ESRI editing tool. This allows the user to split a geoline into two given a specified length.

6.j. ***Save Edits*** - This button allows the user to save any edits without having to stop editing. It is a useful tool to use if the user is making a lot of changes within an editing session.

6.k. ***Stop Editing*** - This button forces the user to stop the edit session. If you have created a feature, it will ask you whether you wish to save your edits.

6.l. ***Snapping*** - Brings up the snapping window where the user can choose the part of the feature, vertex, edge, or endpoint to which they want their new feature to snap by setting the layer snapping properties

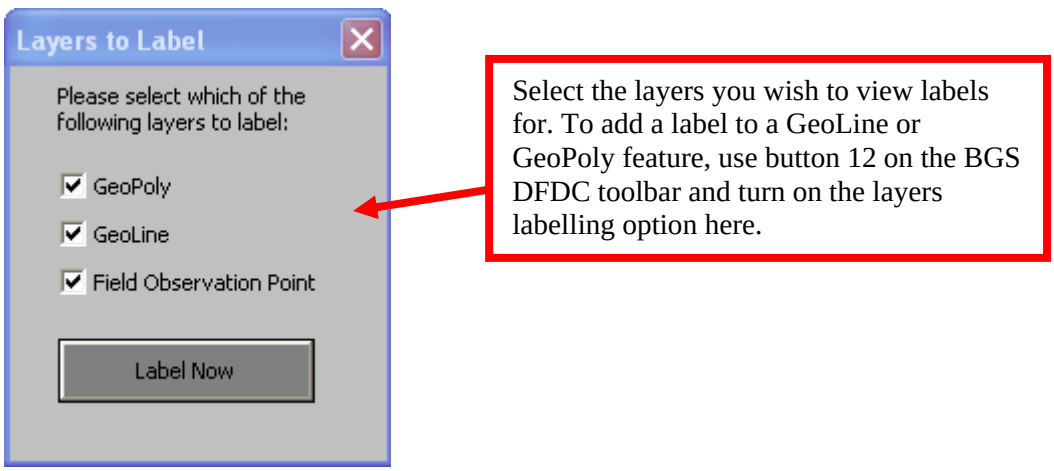
6.m. ***Change vertices size*** - Allows the user to change the size of the vertex editing square to aid drawing.

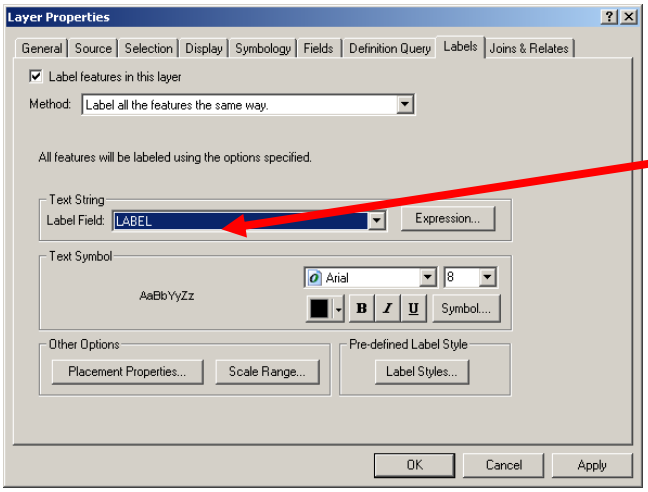


6.n. ***Back Up Graphics*** - Backs up any graphics to the graphics feature class in DFDC.mdb. The graphics are now stored in the database as well as in the map

6.o. ***Update FOP X Y Coordinates*** **–** Updates the X and Y coordinates in the database of any Notebook observation point that has been moved by the user. (see section 3.4.2)

6.p. ***Turn labels on/off*** – If you have entered any labels for the GeoLine or GeoPolys, or want to view the notebook point labels, you can turn labelling on or off here.





If a layer's labels do not appear to correspond to the correct attribute field, right click on the layer and open its properties. Go to the Labels tab and check that the label field is set to LABEL as shown here.

6.q. ***Toggles status bar*** - This button toggles on and off the status bar to create more room on the tablet to view the field slip. The status bar holds information about location and tool messages.

6.r. ***Reset DFDC Toolbars*** - If there are several toolbars displayed in the GIS, click this button to hide all of those except for the main BGS·SIGMA*mobile* toolbars.

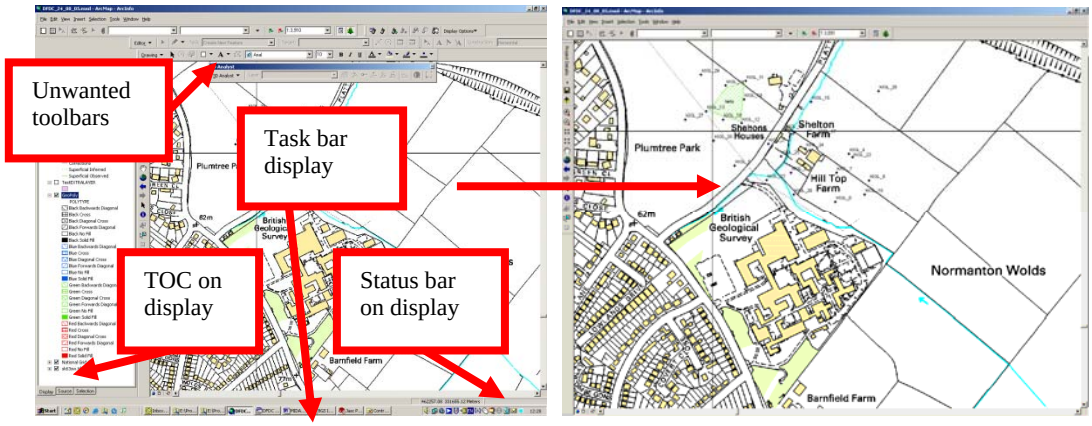
6.s. ***Editing Options*** - This button brings up the editing options form. Settings such as streaming tolerance can be adjusted for user preference here.

7. ***Reset DFDC Toolbars*** - If there are several toolbars displayed in the GIS, click this button to hide all of those except for the main BGS·SIGMA*mobile* toolbars.

3.3.4 Maximising the map display (data view)

In order to maximise the available screen space on the tablet PCs for viewing the digital field slip, a number of buttons have been created within the BGS·SIGMA*mobile* GIS to use as and when required.

- The user can turn off viewing the table of contents by clicking this button (BGS DFDC Tools button 18).
- The status bar can be turned off by clicking this button View Status Bar (main menu button 6.q).
- The toolbars can be reset by clicking this button Reset DFDC Toolbars (main menu button 6.r or 7)
- Finally, the tablets can be set up so that the task bar in Windows is set to auto hide, again creating more space in ArcMap. This is done by right clicking on the task bar, selecting properties and checking auto-hide.



Wasteful use of screen space **Optimal use of screen space**

3.4 USING THE DIGITAL FIELD SLIP

Field mapping can consist of the following types of data recording:

- Pro-forma based recording - structured data which are commonly dictionary constrained.
- Notebook based recording - freeform recording of detailed comments and sketches (e.g. The Red Notebook).
- Map based recording – brief text notes on the map face, geological lines and landforms (e.g. the field slip).

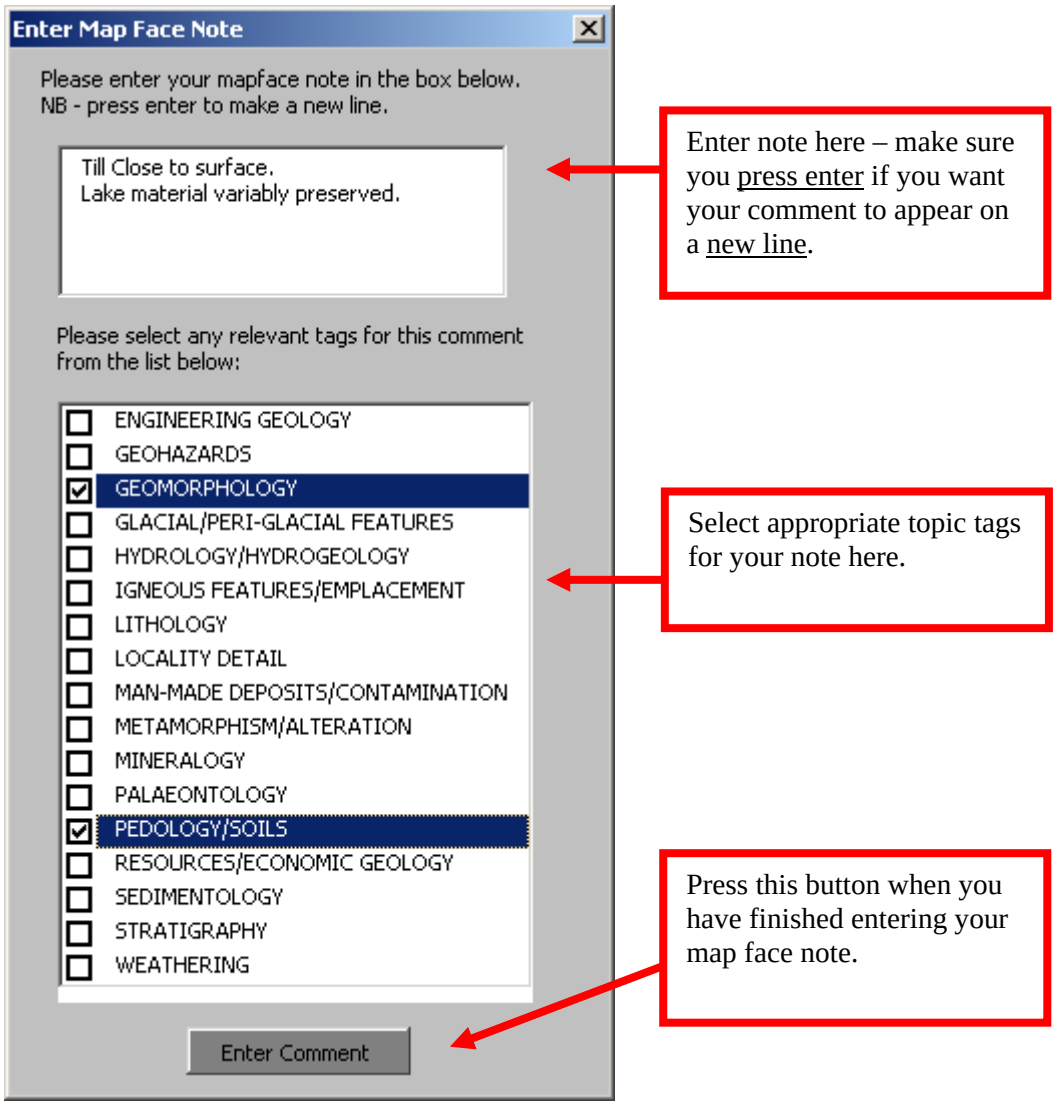
BGS·SIGMA*mobile* has incorporated all of these types of recording into a digital environment. The GIS map acts as the field slip for map based recording of geological line work, landforms and brief text notes. Points that require further detailed comments or structured based recording can be marked on this digital map and expanded upon through the digital notebook.

3.4.1 The Map Face Note

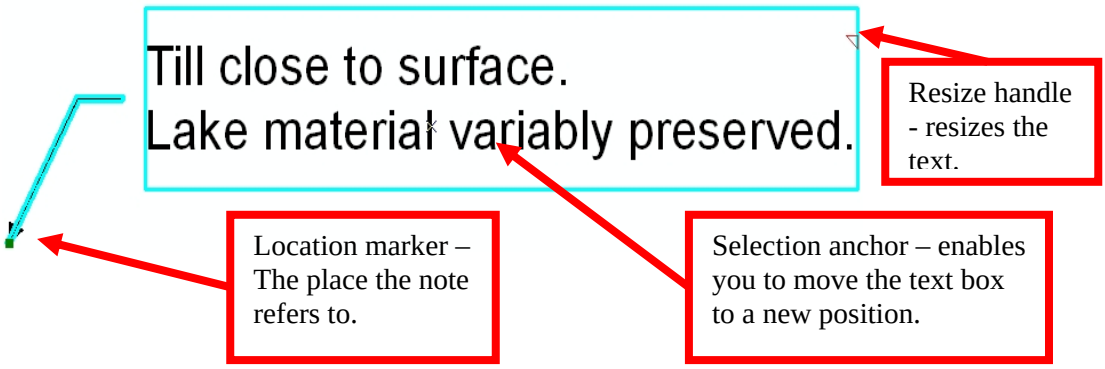
The map face note is designed to replicate the traditional brief comments geologists make on their field slips. These are notes that are viewed on the map whilst conducting fieldwork.

To add a map face note to the GIS, click the “Add Map Face Note” tool and then click on the screen to indicate where your Map Face Note will refer to. There are two clicks involved, the first positions the arrowhead and the second positions the end of the arrow at the start of the text. Once positioned, a menu will appear in which you can add your note and tag your note with a topic to which it refers. More than one topic can be entered.

Simply hover the stylus over the box where the notes are to be added and a tool will appear for you to click on before the handwriting interface appears.



The map face note will now appear in ArcMap. It can be moved around or resized using the edit annotation button .

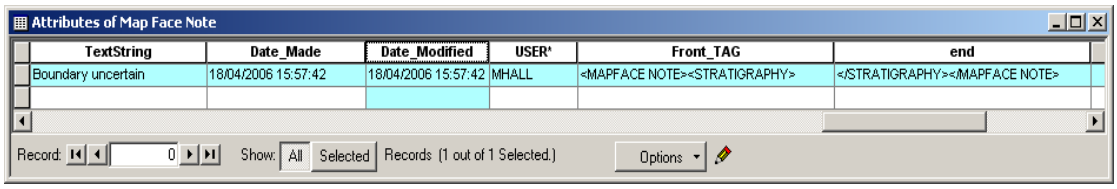


To edit a note you have created you must first select the annotation feature you wish to edit, then click the Edit Map Face Note button . This will open the same form as before, but this time the tags and comments you had entered will be displayed. Change the tags or note if you wish and click save edits. The Edit Annotation button is automatically turned on so that you can now move the annotation if you wish.

When annotation is created or edited, BGS·SIGMA*mobile* automatically stores the username and the date in the annotation attribute fields. The note itself is also stored here. The size of the annotation is set so that it can be viewed and read at the quarter sheet level for 1:10,000 mapping – the size of a normal field slip. The text therefore may appear quite large if you are zoomed far in, or too small if zoomed too far out.

When creating map face notes, it is important to bear in mind that the enter key must be pressed if you want to create a new line within the text. This is true on the tablets even if the hand writing recognition text appears on a new line.

The following QA attributes are stored within the Map face note attribute field:



There are 3 different Map Face Note Styles available: Black Arrow & Black Text, Orange Arrow & Orange Text, and Purple Arrow & Black Text.

There are 2 ways to modify the style. To change the Map Face Note Style for the next map face note go to the DFDC Project Details Menu and choose Set Map Face Note Style (this does not change the previous map face notes).

To change any other map face note styles – right click on Map Face Note in the Table of Contents to open the Attribute Table. Under SymbolID* change the number to reflect the style: Black = 20, Orange = 23, and Purple = 24. To change many records: Select the records, right-click on SymbolID*, Field Calculator, in the SymbolID= box, type 20 (or 23 or 24 depending on the style you are after).

Map Face Note x and y values are automatically updated when the document closes.

3.4.2 The Notebook Point Observation

Notebook points can be added to the digital field slip when more detailed or structured information is required about a certain point. There are two buttons which access the digital notebook shown thus: . The green flag allows the user to add a notebook point observation, whereas the red flag allows a user to edit an existing notebook point observation. To add a Notebook Point Observation select the Green flag and click on the map at the required location – this will add in a Notebook Point Observation and open the Digital Notebook to allow the entry of further detailed information. To edit an existing Notebook Point Observation select the red flag and click on the point on the map that is to be edited – this will then open the Digital Notebook and display the existing details entered for that locality. Notebook points are labelled on the map face with the username and a consecutive number so that the geologist can reference it at any other point.

It is important to be patient with the system when adding or editing a field observation. It takes a small amount of time for the code to be generated to open Access from within ArcMap and transfer and build the relevant forms for data entry.

If you wish to delete a notebook feature then you have to ensure you are editing the layer, have selected the feature and clicked delete. If you do this, please note that the database has been set to cascading so any associated notes in the database will also be deleted. You can use the "Undo" button (6.d on the DFDC Tools Menu - see section 3.3.3 for an overview of this menu) to restore i.e. undelete the data.

To move a Notebook point observation: Go to Editor – Start Editing – OK. Using the 'Select Elements' tool hover the cursor over your new location and write down the coordinate location from the bottom right of your screen. Set the Task on the Editor Toolbar to Modify Feature, Select the Field Observation Point to be moved, right-click and select Move To. Enter the x and y coordinates of your new location. Alternatively it is possible to drag and drop the point to the new location if a specific x and y coordinate location is not required. The new coordinates also need to be updated in the attribute table, to do this select the Update FOP X Y Coordinates option from the DFDC Tools menu (see section 3.3.3 for an overview of this menu).
ArcMap has also been customised so that when it shuts down all X and Y coordinate values are updated within the attribute table in case any feature has been moved within the session and the user has forgotten to update the x and y coordinates manually. However, it is advisable to carry out the update at the time of moving the notebook point in case of any unexpected system shutdown which results in the customised code not running when ArcMap shuts down.

Trouble Shooting: You have made a selection with the 'Edit Notebook observation point' tool and you got the following message: "You have not made a selection." This may be caused by broken links (red exclamation marks) in the Table of Contents (in ArcMap) or the Field Observation Point layer (from either the current DFDC or the old DFDC) is not switched on. Repair the links by clicking on the red exclamation mark and re-setting the source and make sure all Field Observation Point layers are on and visible. This may also happen if there are any layers (shapefiles or feature classes) above the Field Observation Point layers (besides the GPS layers) – move the layers below and the functionality returns.

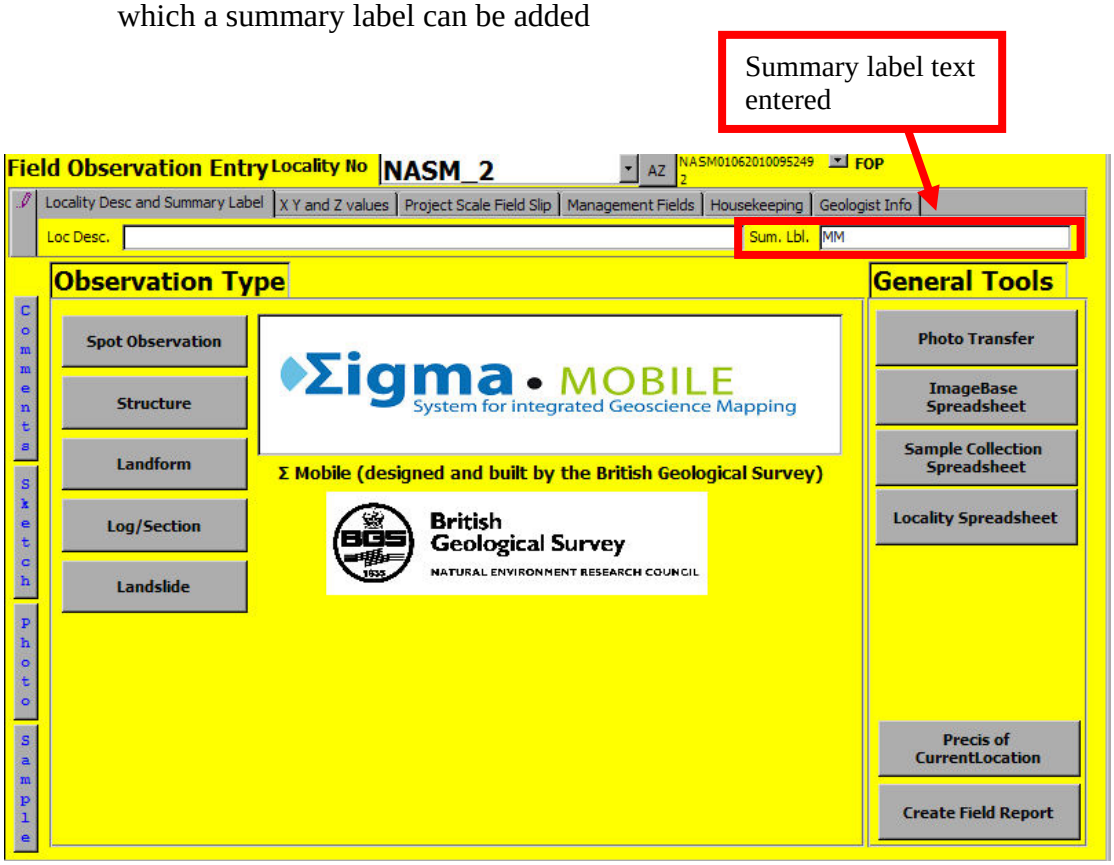
3.4.3 Notebook Point Observation Labels / Annotation

Notebook Point observations are automatically labelled with the user name and locality number but it is also possible to add in a summary label via the digital notebook to summarise the locality on the map. For example, if the lithology is Mercia Mudstone then the geologist may wish to write the summary label MM. The summary label will be displayed in red and can either be displayed as annotation which can be manipulated and moved around within the map view or it can be displayed as a static label that can't be moved by the user. The methods used to create this summary label and manipulate it in the map view are detailed below.

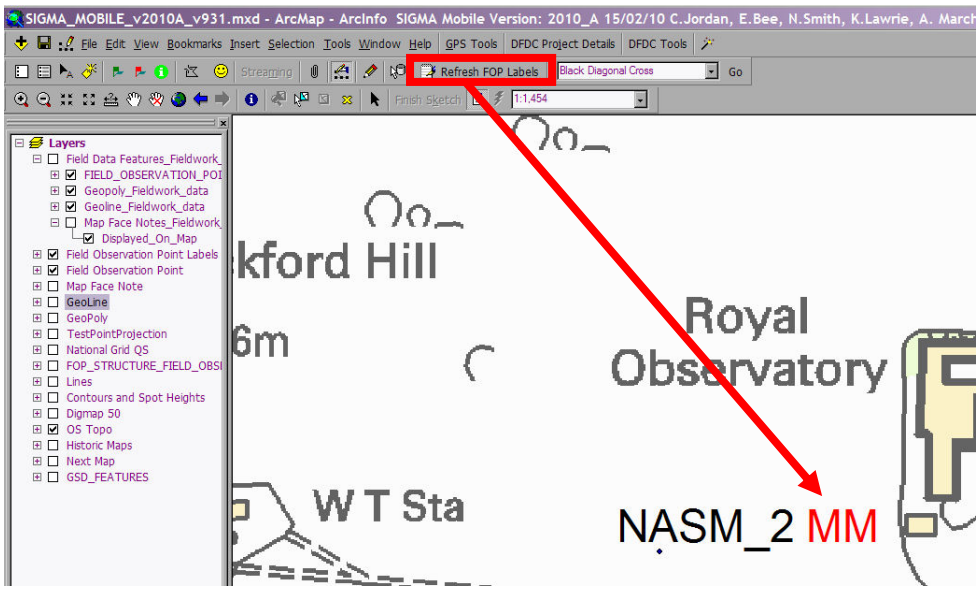
3.4.3.1 SUMMARY LABEL ANNOTATION

This method details the way in which to add a summary label if the user wishes to be able to manipulate and move it within the map view.

1. Once the digital notebook has opened (following the entry of a Notebook Point Observation on the map) the following form will be displayed within which a summary label can be added



2. Once the summary label is entered into the database the map view needs to be updated to display the annotation. This is done by clicking on the Refresh FOP Labels button on the BGS DFDC Toolbar.

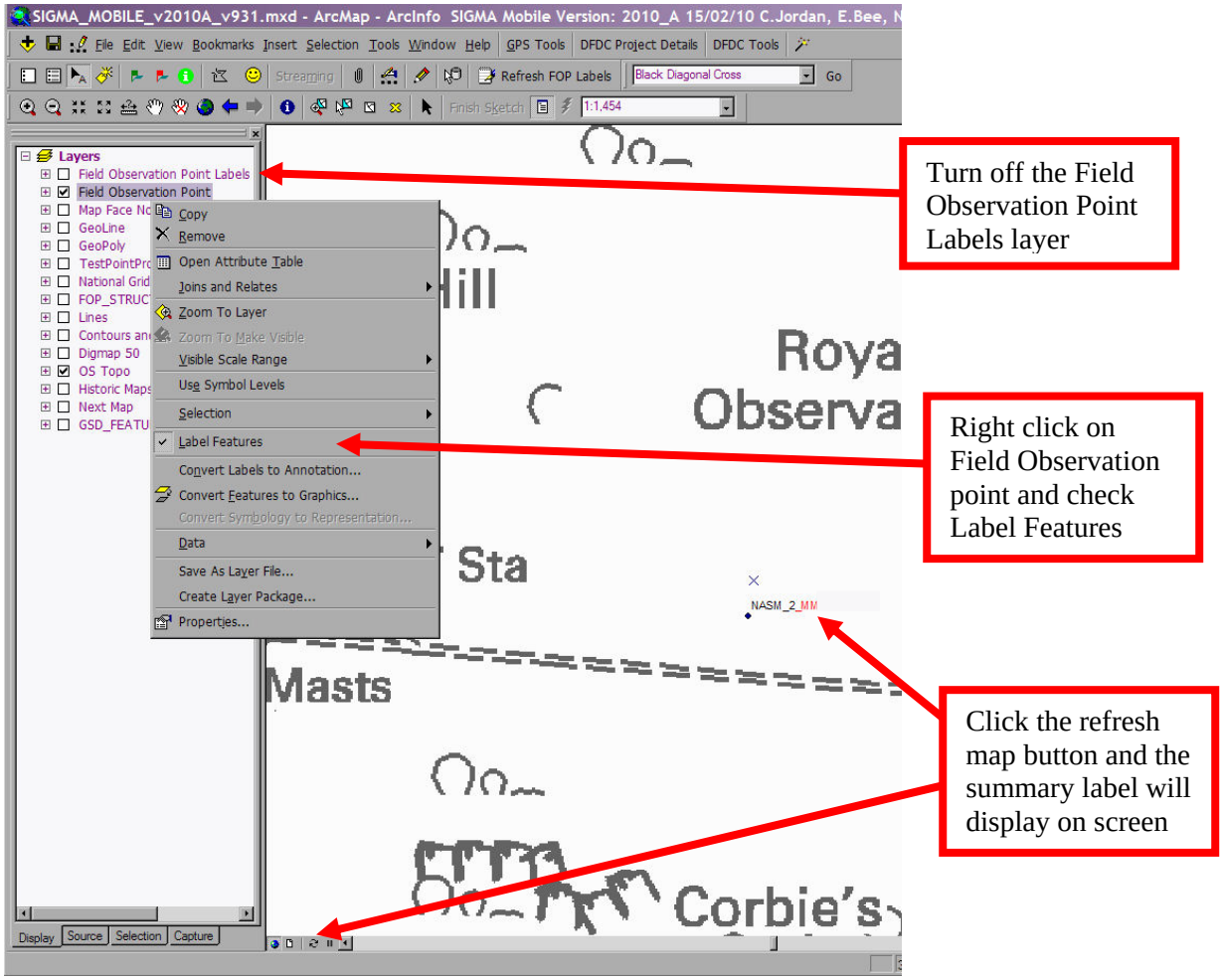


3. Once the summary label is displayed on the map it is now possible to move it if it is not displayed in a suitable place relative to any other data displayed in the map view. This is done by selecting the text using the edit annotation button . Click on this tool and then select the summary label to be moved. Once the summary label is highlighted it is possible to move, resize and rotate the text to a suitable position on the map. It should be noted that unlike the map face notes there is no arrow from the summary label to the notebook observation point to which it refers so it is recommended that the user bears this in mind when moving the summary label.

3.4.3.2 Summary Label Static Labels

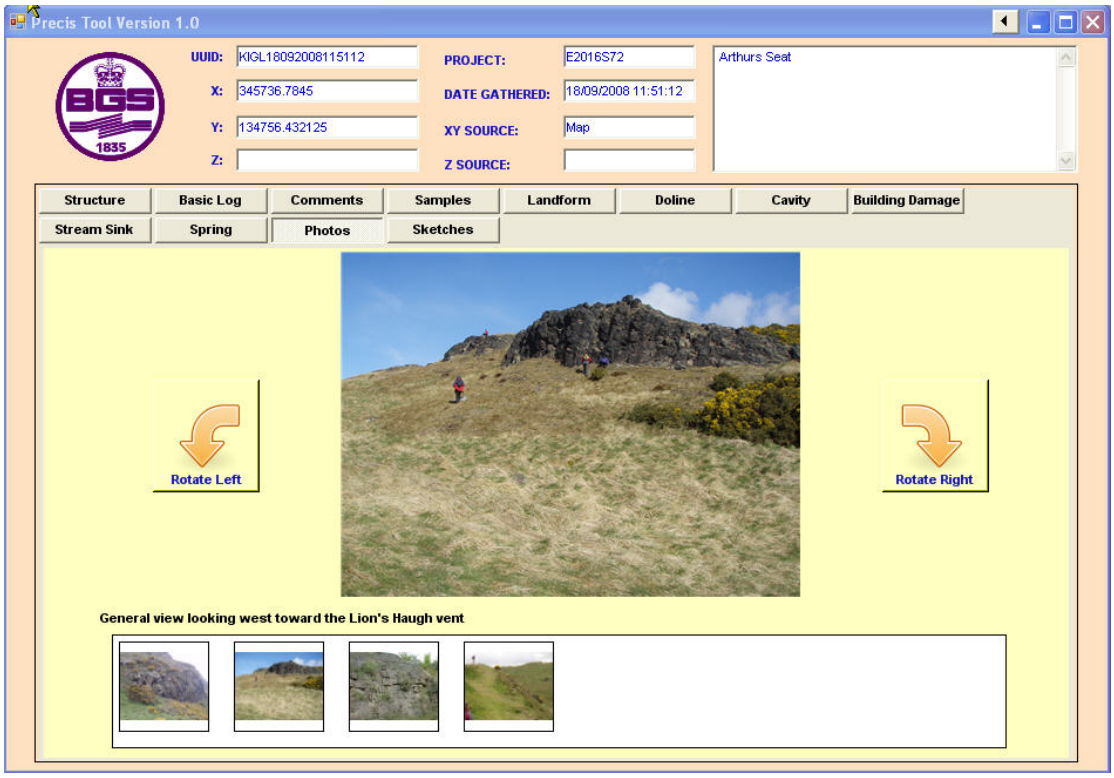
If the user does not require the ability to manipulate the location of the summary labels within the map view then it is possible to simply display the summary labels as standard labels from the Field Observation Point layer in the table of contents.

To turn on these labels either use the Turn Labels On / Off tool on the DFDC Tools menu or alternatively this can be done manually using the following method. Right click on the Field Observation Point layer in the TOC and check Label Features. It will also be necessary to turn off the Field Observation Point Labels layer in the TOC. To view these labels once the summary label is added into the DFDC database then the user must click the standard Refresh Map button at the bottom of the map view.



3.4.4 Reviewing Notebook Data within ArcMap – Précis Tool

The green information button (Précis Tool) shown as button 7 on the BGS_DFDC toolbar enables the user to view the contents contained in the notebook for each field observation point. The Précis Tool can also be accessed through the DFDC database. General Information is displayed at the top of the form with more detailed information contained in tabs below. Photos and Sketches are viewable and selected using the Film Strip view at the bottom of the form and can be individually rotated.

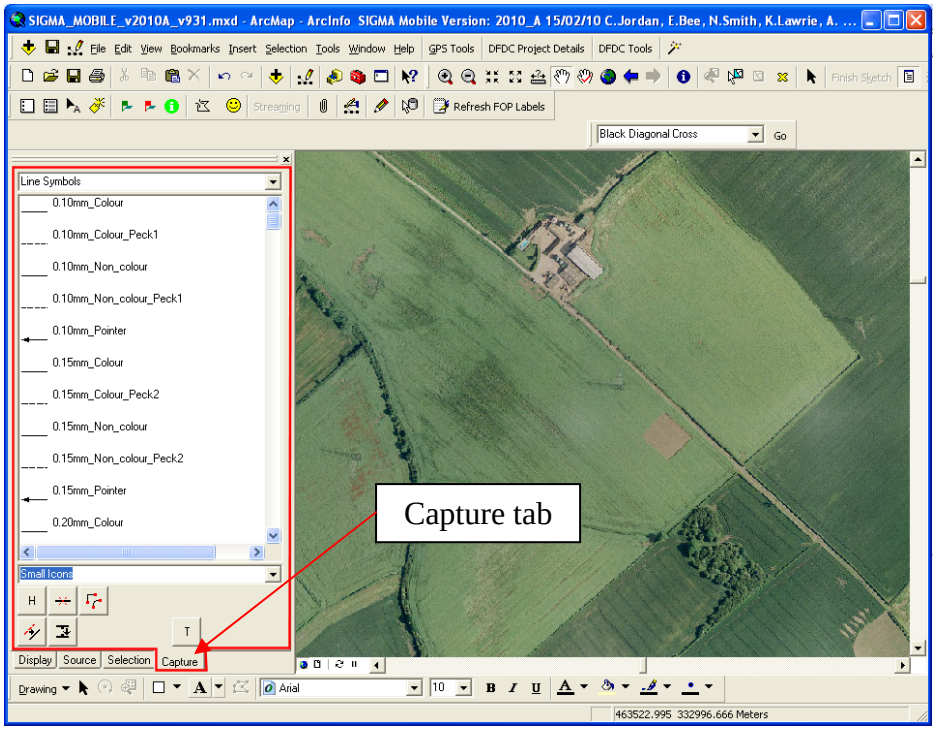


3.4.5 The GeoLine Capture Tool

The GeoLine capture tool has been designed to mark geological linework onto the digital field slip.

BGS·SIGMA*mobile* has an entire toolset for collecting geolines. This toolset is accessed using the 'capture tab' from the table of contents (TOC). All of the BGS SIGMA line types are shown in the drop down box towards the top of the TOC. If you cannot see any SIGMA line types then it is possible that the SIGMA stylesheet has not been loaded correctly. To reload the SIGMA style sheet go to the Tools menu at the top of the screen > Styles > Style Manager > click on the styles button > scroll all the way to the bottom of the list that appears, and select 'Add'. Browse to the location of the SIGMA style sheet and load it in.

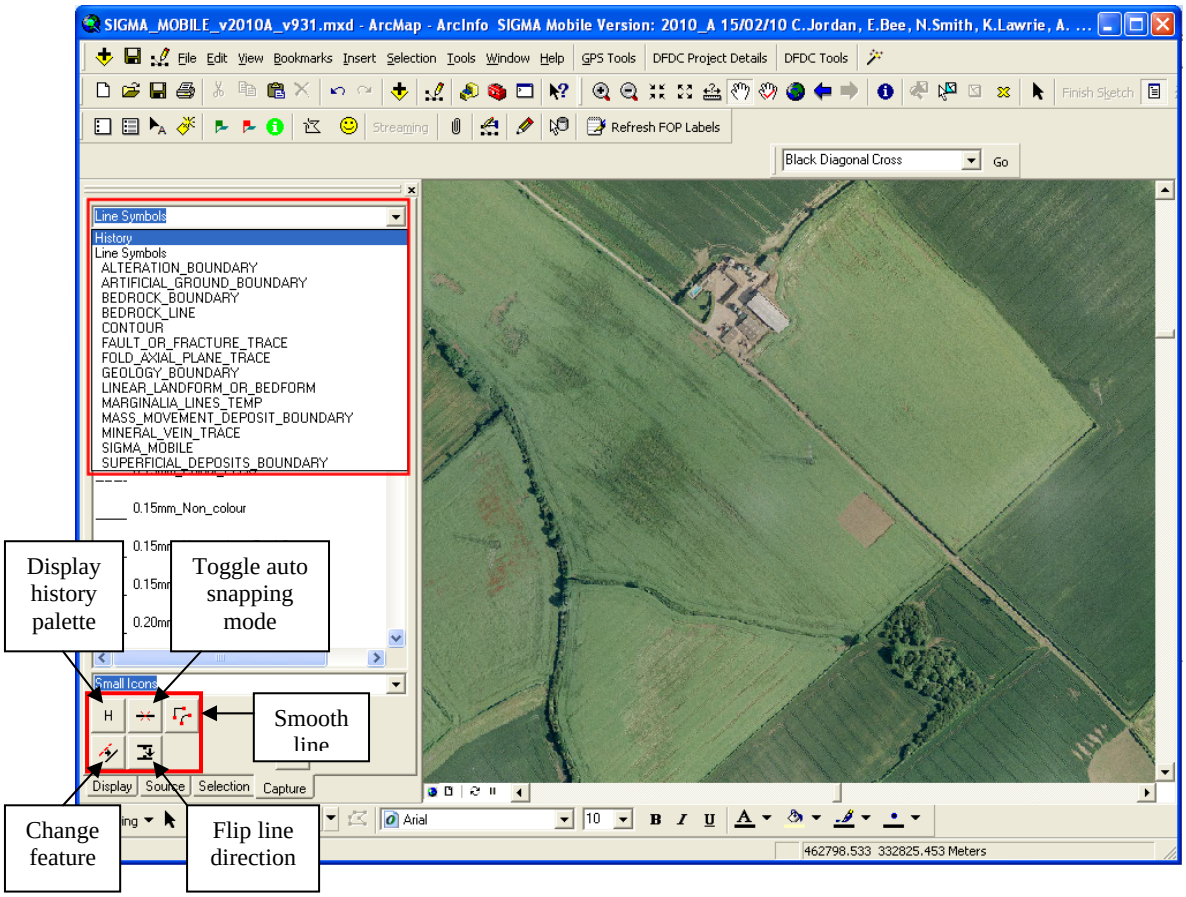
Users outside of BGS may have linestyles specific to their organisation and these can be added into the SIGMA.style using the standard ArcMap Stylesheet tools. Alternatively an organisation may wish to use a stylesheet they have already created, in which case this should be renamed as SIGMA.style and should replace the SIGMA.style file provided with the BGS·SIGMA*mobile* application that has been placed in C:/ProgramFiles/ArcGIS/Styles. The linestyles in BGS·SIGMAmobile are derived from the published BGS map symbols and ornaments document which can be accessed from the downloads section of the BGS website at http://www.bgs.ac.uk/downloads/browse.cfm?sec=1&cat=3.



To draw a line, select the line style you want and simply start drawing on the map. Double click when you are finished.

The new line style is dynamically shown in the GeoLine legend.

There are a number of tools that are associated with the line capture toolset. These are located towards the bottom of the TOC (see figure below for details).



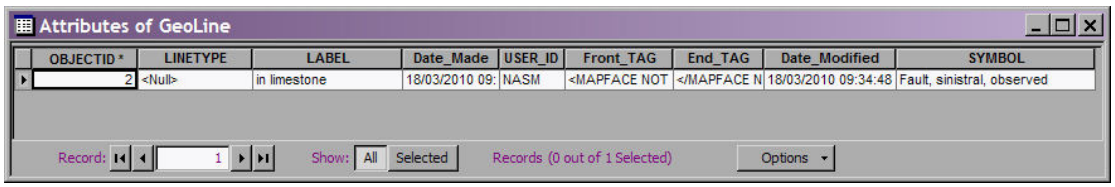
1. **Display history palette.** Displays all the line styles recently used. This can also be accessed by selecting the option ‘History’ on the drop down box at the top of the TOC.
2. **Toggle auto snapping mode.** Switches auto snapping on or off. This allows lines to be automatically snapped to other lines.
3. **Smooth line.** This acts by adding extra vertices to a geoline, making it a smoother curve. Simply click on the button to activate the tool, and then click on the line you wish to smooth.
4. **Change feature.** This changes the line style of a selected line to another style in the SIGMA style sheet. Select the destination line style from the TOC, click on the button to activate the tool, and click on the line you wish to modify.
5. **Flip line direction.** Changes the direction of a geoline. How a line is symbolised depends on the direction in which it has been digitised. So if, for example, the ticks on a fault are on the wrong side, use this tool to flip them. Simply click on the button to activate the tool, and then click on the line you wish to flip.

Streaming can be turned on or off (see section 3.4.8) and vertices can be removed using the edit vertices tool. The size of the editing vertices can be altered from by using the change vertices size button.

To add a label to a GeoLine feature, make sure it is selected and click the button. A comments form with tags will be shown. This form is the same as the add map face note form except the size of label is limited to 50 characters. This means you can tag the label with a topic if required. To view the labels, make sure that the GeoLine layer labelling is set to on using the turn labels on and off button.

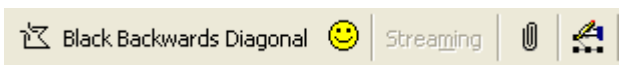
GeoLines, which are your draft field lines, will need to be digitally inked in within the GSD. It is not always possible to determine the geology or geomorphology in the field until several observations with linework have been made. Several GeoLines created in the field may determine just one feature (polygon or line) in the GSD. Hence the need to digitally ink in the data within SIGMA*desktop*. This will also help maintain and differentiate field observations and interpretations from those made in the office.

The attribute table for the GeoLine is shown below.



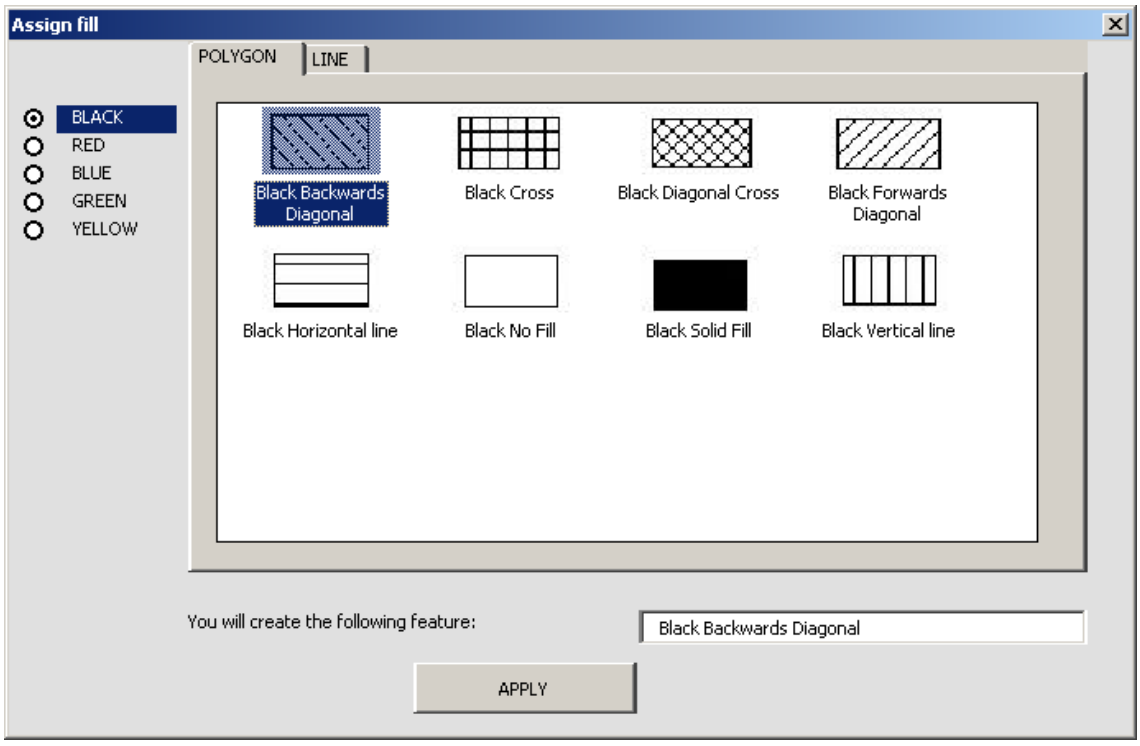
It is also possible to create GeoLines using the graphic ink tools. This is described later in section 3.4.7.

3.4.6 The GeoPoly Tool

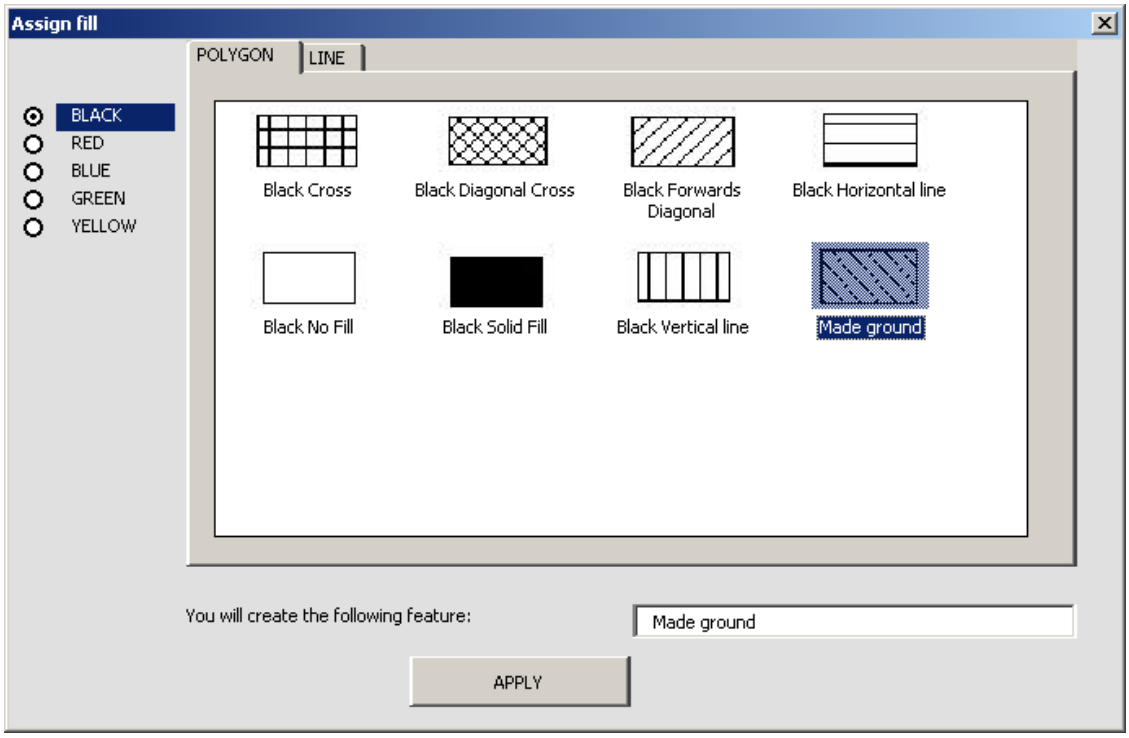


The GeoPoly tool

has been designed to delineate and draw aerial features onto the digital field slip. The user can select the tool and draw the polygon displayed on the tool. The polygon style can be set using the set line style tool . The following menu will appear:

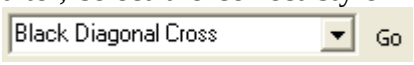


Alternatively, if the project has set project fill styles, the menu may look as follows:



The polygon fill names can be changed via the ‘Change Geopoly symbology labels’ option on the DFDC Project details drop down menu.

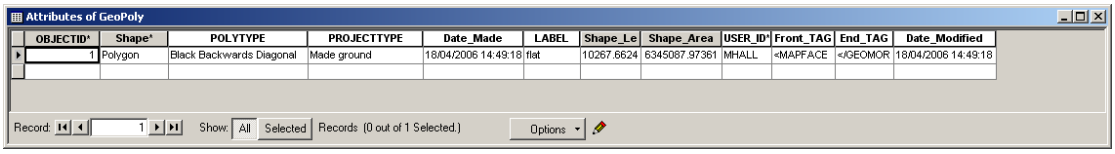
If a GeoPoly has been drawn using the wrong style, select the polygon you want to alter, select the correct style from the drop down menu, and click the ‘Go’ button.



To add a label to the GeoPoly, make sure it is selected and click the button. A comments form with tags will be shown. This form is the same as the add map face note form except the size of label is limited to 50 characters. This means you can tag the label with a topic if required. To view the labels, make sure that the GeoPoly layer labelling is set to on using the turn labels on and off button.

GeoPolygons will need to be digitally inked in within a desktop topological GIS where they are properly attributed. Any structured landform measurements can be made by adding a field observation in the GeoPolygon and entering information through the notebook.

The GeoPoly attribute table is shown below:

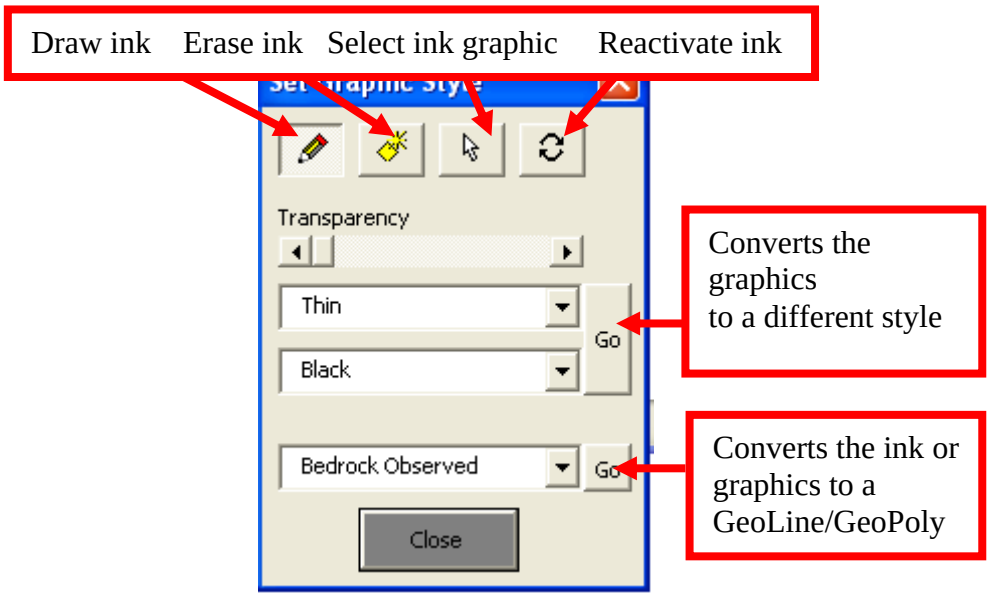


It is also possible to create GeoPolygons using the graphic ink tools. This is described in the following section.

3.4.7 Using the Ink Tools

The BGS·SIGMA*mobile* development team have developed the existing ESRI tablet tools to allow users to draw features like they would with a pencil and rubber. **These tools are included in this release of SIGMA*mobile* but need to be used with care and consideration as the core development of ink tools within ESRI software for use on tablet PCs is still in its infancy.** Errors with these tools are a function of the ESRI core development objects.

These tools can be accessed by clicking the button 13 on the BGS DFDC toolbar. (see section 3.3.2 for an overview of this toolbar)



1. ***Draw ink*** - The draw ink tool, also referred to as the Ink tool, is used to create ink graphics on the map. You can choose from several styles of pen ink from the drop down menus.

2. ***Erase ink*** - The erase tool removes all connected pieces of ink that you touch with your pen, including ink created with the draw ink tool. To erase ink drag the eraser across the ink you want to erase. If you wish to convert ink to shapefile, care should be taken when using the eraser tool. Try not to rub out in the middle of lines, but rub out from the ends.

3. ***Select tool*** - This tool enables the user to select graphics. Use this to select a committed ink graphic in order to re-activate it using the re-activate tool. When you select a graphic the project will automatically change the view to the same scale at which the ink was originally captured, and pan so that the graphic is in the centre of the screen. The ink tools within ArcMap are still fairly primitive, and this action prevents the graphics from randomly disappearing from the map.

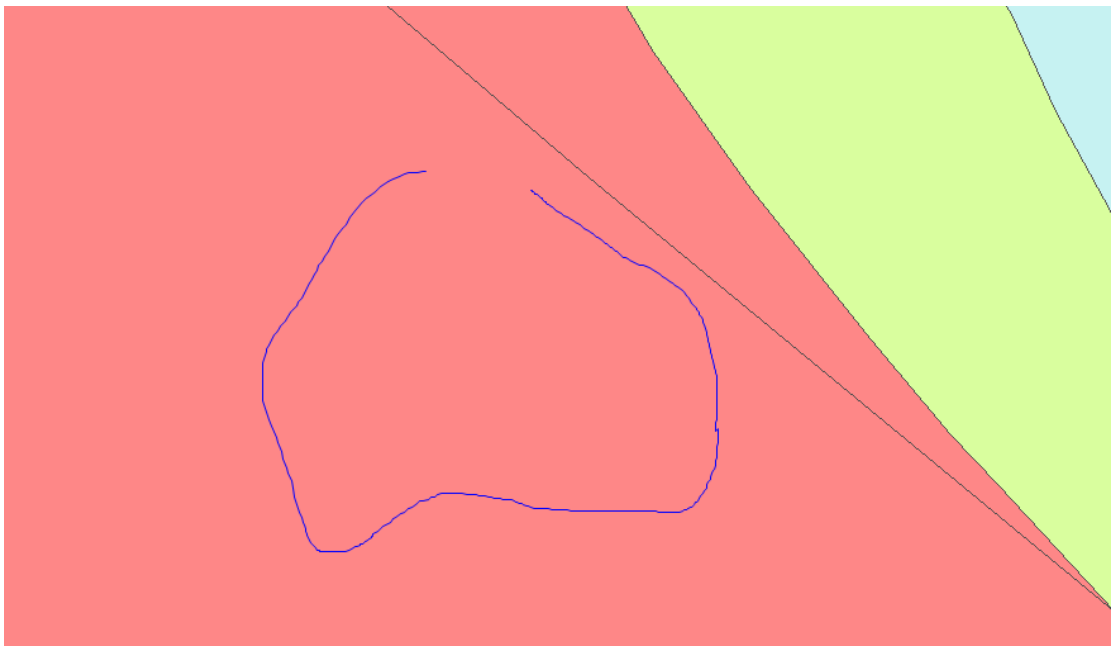
4. ***Reactivate ink graphic*** - The Reactivate Ink button re-creates an ink sketch from a selected ink graphic element. You can reactivate an ink graphic that has been committed as a graphic and use the ink and erase ink tools to alter the graphic before you commit it to shapefile. Once a feature has been committed to shapefile it cannot be re-activated.

5. ***Changes the style of the selected graphic element*** - If you want to change the style of a committed graphic, select the line type from the combo boxes and click 'Go'.

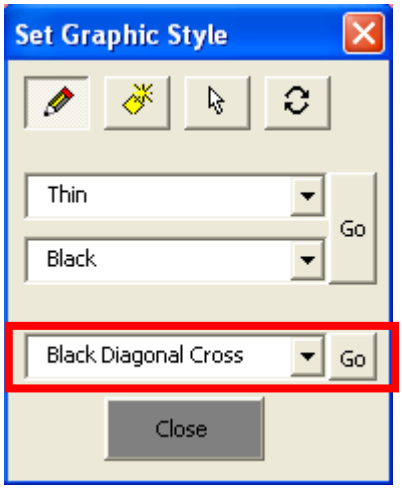
6. ***Convert ink to geoline or geopoly tool*** - Converts ink of selected graphics into a line or polygon geometry (i.e GeoPoly or GeoLine) as defined in the adjacent combo box.

The tools can be used in the following stages:

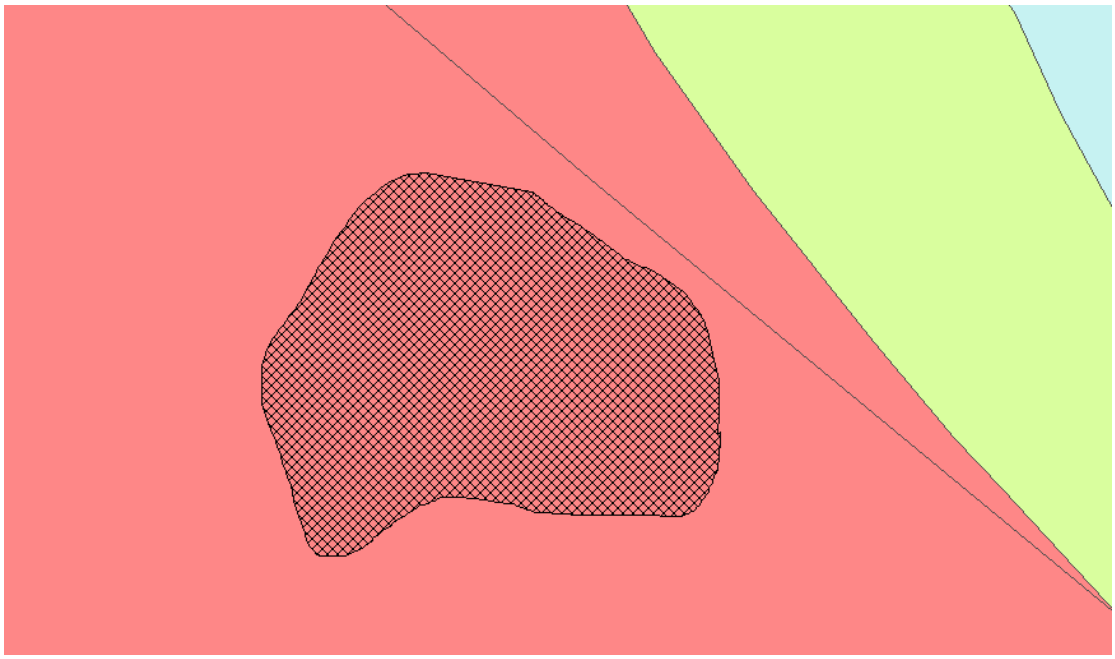
1 – Draw graphic ink on screen



2 – Decide whether you are happy with the ink sketch or whether you want to temporarily store it as a graphic. If you are happy with the ink sketch and want to store it within your GeoPoly or GeoLine layer then select the appropriate GeoLine/GeoPoly style from the drop down box and click 'Go'. If you have selected a polygon style from the drop down box, even though the ink is not a closed feature, it will still convert this to a polygon. You can convert either ink elements or committed graphics in this way.

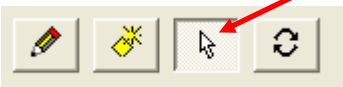


The image below shows that the feature has been turned into a GeoPolygon feature with the attribute made ground.



If you are not ready to convert this feature, you could temporarily commit the ink to a graphic layer in the GIS to re-activate at a later point. To do this, either use a different tool or close the ink tools window. If you do this, your data is not intelligent; it will not have any attributes and will not be transferable into another GIS. In the event of the .mxd corrupting, data captured in this way, without conversion to shapefile is likely to be lost. **Users should therefore only temporarily store data as a graphic, with the view to convert them to shapefile as soon as possible (preferably within the same field day i.e. when you are happy to "commit" the line)**. If you do not do this, it is imperative to keep a regular back up of your .mxd on an external device such as a data stick or another PC.

Should you wish to re-activate a stored ink graphic to make any changes you will need to open the ink tools window from the DFDC toolbar (button 13 as described above). Click the Select graphic / ink tool and then click on the graphic you wish to modify

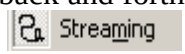


Note: The view will automatically change to the same scale at which the ink was originally captured, and pan so that the graphic is in the centre of the screen. The ink tools within ArcMap are still fairly primitive, and this action prevents the graphics from randomly disappearing from the map. Once the graphic is selected, click on the refresh ink button. The map will refresh and redraw a number of times. Please be patient will this happens, as repeatedly clicking the map may cause BGS·SIGMA*mobile* to crash. This will re-activate the sketch and you can now use the eraser tool with the pen tool to refine your line. Be careful to just rub the edges of the line out rather than the middle because this may affect the conversion

to shapefile. If in doubt, create a new ink line to draw over your edits and use this to convert to shapefile.

Trouble shooting: If the iX104 has been on Stand-by mode you may start to experience the 'invisible ink phenomenon.' This is a known issue and you will have to re-boot your machine for the tool to work correctly again.

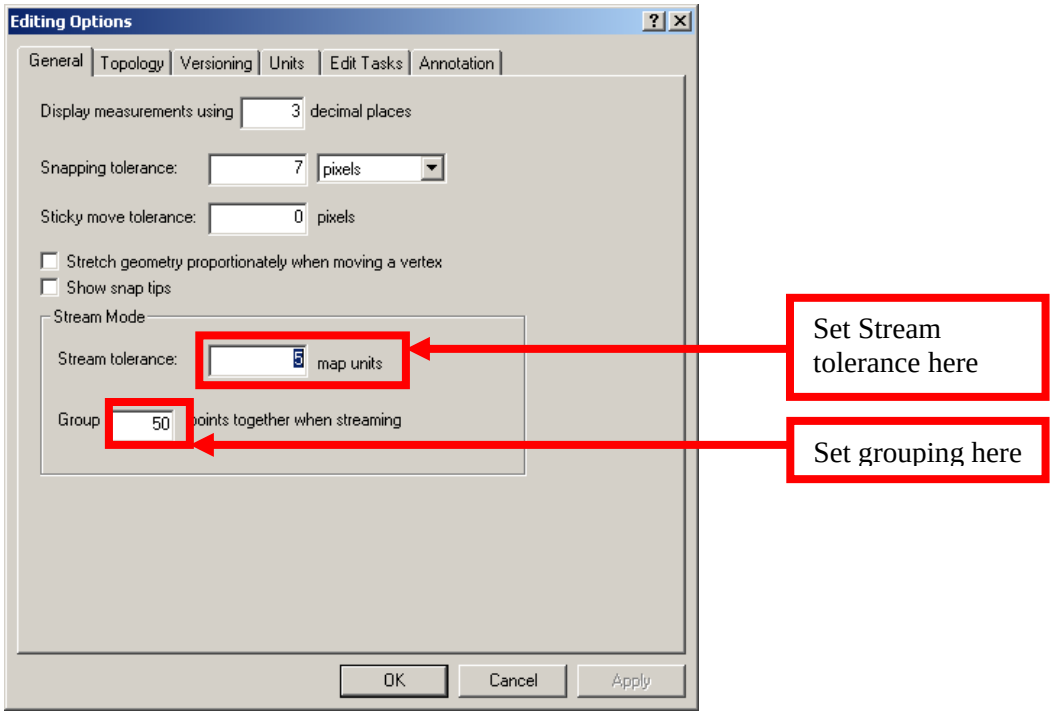
3.4.8 Editing Options (Stream or Point Mode)

GeoLine or GeoPoly Features can be created in two ways; point mode or stream mode (streaming). You can switch back and forth between the two modes as you digitise by clicking the streaming button 

(main menu button 6.b). If you are using a duo-touch Go Book, you are advised to set the screen to touch mode when streaming. The modes can be switched by pressing the hardware buttons 2 and 3 together.

When you start creating a feature on the screen, the default mode is point mode. This enables the user to create a feature on the map using a series of points. The user taps on the screen to create a new point.

Stream mode capture lets the user capture features by allowing ArcMap to automatically add vertices at an interval specified in the stream tolerance section of the editing options. The default stream tolerance is normally zero, although in BGS·SIGMA*mobile* it has been set to five. Each user must enter a tolerance value that suits their requirements. If the tolerance is set to zero, the vertices will join together or overlap each other. The stream tolerance can be changed at any time, even when in the process of creating a feature. The user should adjust these options to their own preferences using the dialog box below, available via the Editing Options Tool (6.s).



The user can also define the number of streaming vertices that they would like to group together. This number tells ArcMap how many vertices to delete when the

Undo button is clicked . For example, if this number is set to 50 the Undo button is clicked whilst the feature is being created, ArcMap deletes the last 50 digitized vertices from the feature. This value is set to 10 as default in the BGS·SIGMA*mobile* GIS.

Sticky move tolerance can also be set here – this determines the minimum number of pixels the pointer must move on the screen before a selected feature is moved. This reduces the risk of moving a feature by accident.

Other ESRI specific editing tools, such as inserting vertices, have been incorporated into the DFDC Tools drop down list. Many of these can be accessed by right-clicking, however, as some users dislike right-clicking on a tablet PC, these tools have been included in the drop down list as well.

3.4.9 Viewing Old DFDC Databases

Button 14 on the DFDC Tools toolbar allows the user to load and view other DFDC databases, for example, from a previous field season or from other field mappers working in the same area. The data from these databases are not actually loaded into your current database (DFDC) but become viewable in one BGS:SIGMA*mobile*.mxd from their separate locations. These data can be both queried and viewed using the BGS·SIGMA*mobile* tools available in your current project but should not be edited. It should also be noted that the précis tool will only work with 2010a databases and will not work with any older versions of the database that have been loaded using this tool.

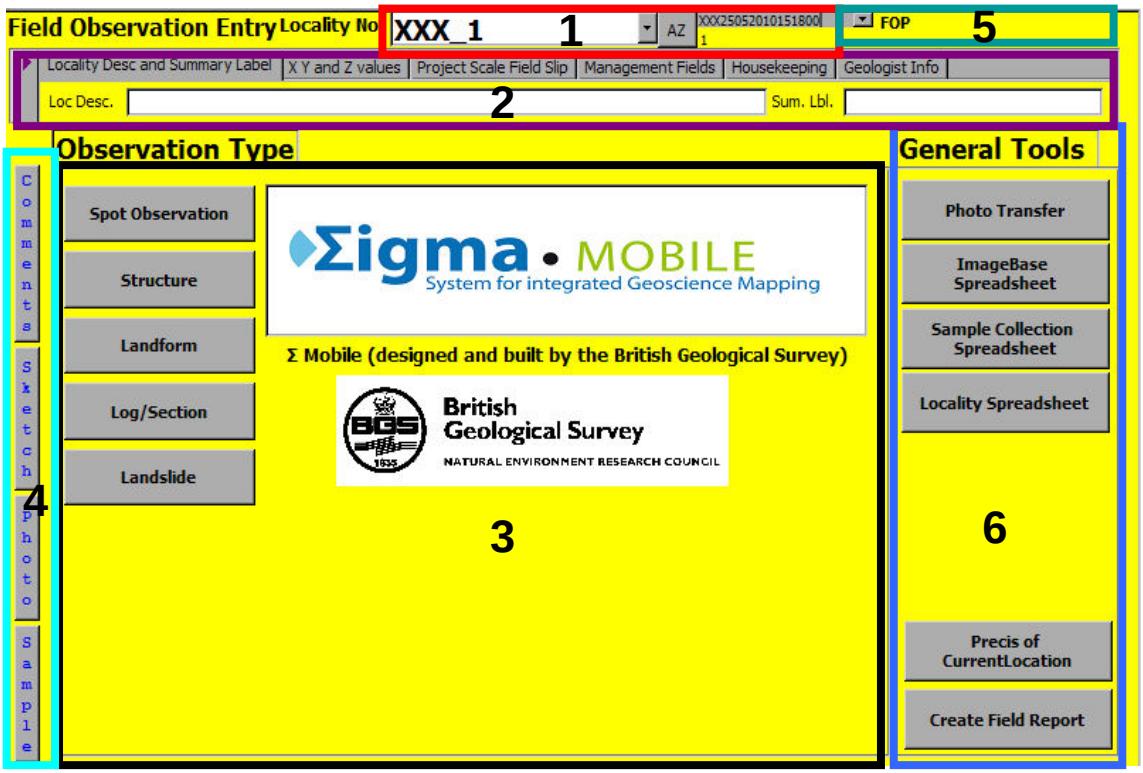
Before uploading any old DFDC projects you must rename the database (this tool will not upload a file called DFDC), a suggested practice might be ProjectName_Field Date_UserID_DFDC.mdb. When the button is clicked, a 'Select Database' dialog box will appear, browse to the database to be used, and click OK. The Project will then take a few seconds to load.

3.5 CAPTURING STRUCTURED DATA OR MORE DETAILED OBSERVATIONS

Structured information is recorded in a set of related tables in Microsoft Access. A Microsoft Access database can hold 20GB of information. Once this limit is reached, it will not store any more. Bear in mind that 20GB is larger than BoGe. It is advisable to use an empty version of the database at the start of each field season, even if mapping in the same geographical area as previous field seasons, as this will reduce the possibility of the database become too large and slowing the system down. The data from previous field seasons can be viewed within BGS:SIGMA*mobile* by uploading them using the View Old DFDC Databases tool from the BGS DFDC Toolbar (see section 3.4.9)

3.5.1 Layout of the Notebook

The notebook application is designed to fit a 12.5cm by 17cm screen in landscape format. It is accessible via the add notebook point button or the edit notebook point button in ArcMap.



1 – Creation of UUID and site label to be displayed on GIS. This is done automatically.

2 – Top level information. Much of this is populated automatically. This is detailed below.

3 – Switch form offering the modules available in BGS·SIGMA*mobile* for data capture

4 – Buttons to add comments, sketches, photos or samples at any point in application.

5 – The user can tell where in the system they are from this message. FOP means you are at the top Field Observation Point level, FOP_SPOT_LITH_2 would tell you that you were in Spot, lithology number 2. The sketch, sample, photo and comment areas rely on knowing where in the notebook they were activated. So if a sketch were now drawn in FOP_SPOT_LITH_2, it would know it was a sketch relating to Spot, lithology number 2.

6 – General Tools, including Photo Transfer, ImageBase Spreadsheet, Sample Collection Spreadsheet, Locality Spreadsheet, Précis of the Current Location and Create Field Report. (see Section 3.5.12 for more information on the General Tools)

TOP LEVEL INFORMATION

Enter location description information here and, if you wish, a summary label to summarise the notebook entry so it can be viewed on the field slip in red ink as described earlier in section 3.4.3

This tab displays the easting and northing of the notebook point you added or are editing. This is generated by ArcMap. A note of caution – if you move a point in ArcMap then you need to make sure the X and Y values in the attribute table reflect the new location of the geometry as described earlier. Section 8 describes how to change the coordinate reference system.

Enter the Z value if known and how you obtained this Z value in the Z source text box in this section. The Z source may be DGPS, DTM (NEXTMAP), DTM (OTHER). This may be a dropdown list in future releases.

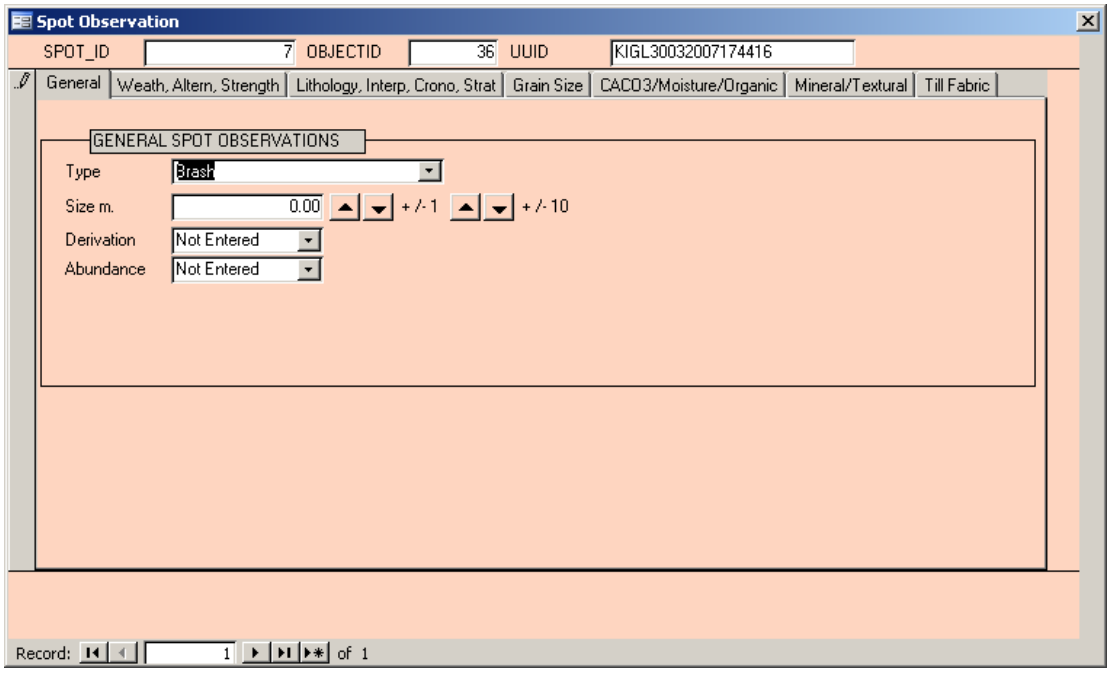
These values were all entered within the GIS. You cannot edit them here, just view them. Enter more information about the XY or Z data source type here if you wish.

Management fields to confirm the date and geologist code are correct. Again you cannot edit these. PFO stands for Primary Field Observation. All data collected in the field will have this value.

The user can perform several tasks from this menu. Dictionaries can be customised (see section 3.5.13 for more detail), Sample numbers can be entered (see section 3.5.11 for more detail, and the main menu in Access can be shown or hidden to create more space on the tablet PC. This latter task is achieved simply by clicking the “Show Menu” button.

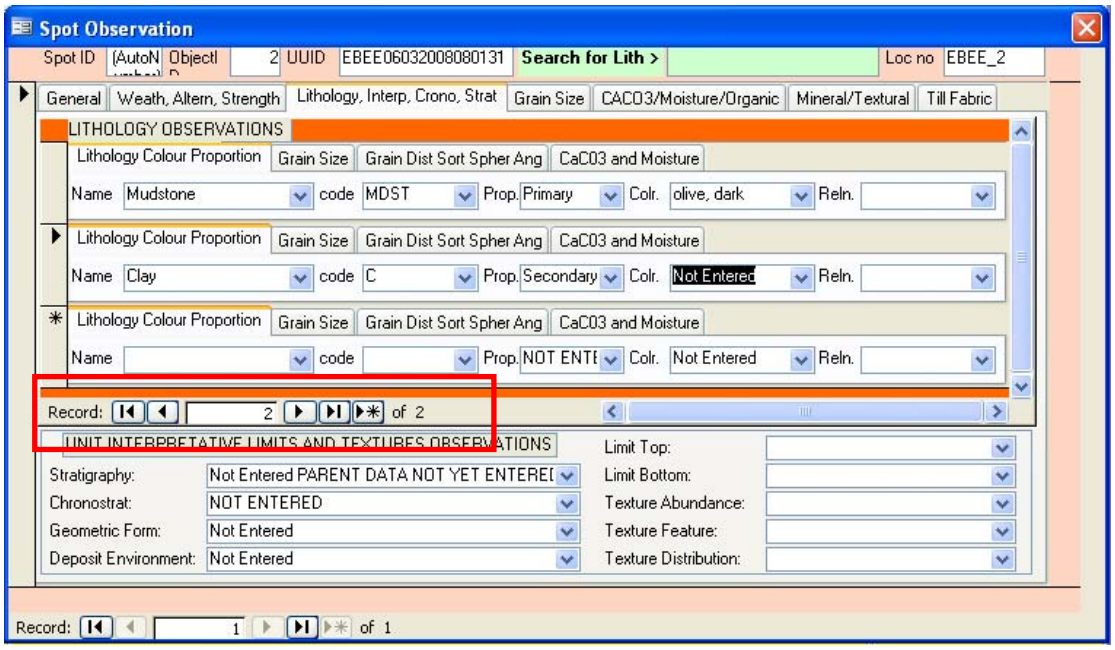
This form stores information important to the geologist. The geologist can enter their Collector codes here. The collector code may differ depending on what type of sample is being made. You can also enter the starting sample number to ensure that the sample is unique and matches your sample labels.

3.5.2 Spot Observations



A spot observation is essentially a two dimensional log (think of a log which only comprises one unit). An example of a spot observation would be brash. The types of measurements you record are dependant on the type of spot observation you are making. The example above shows the measurements you may make for brash.

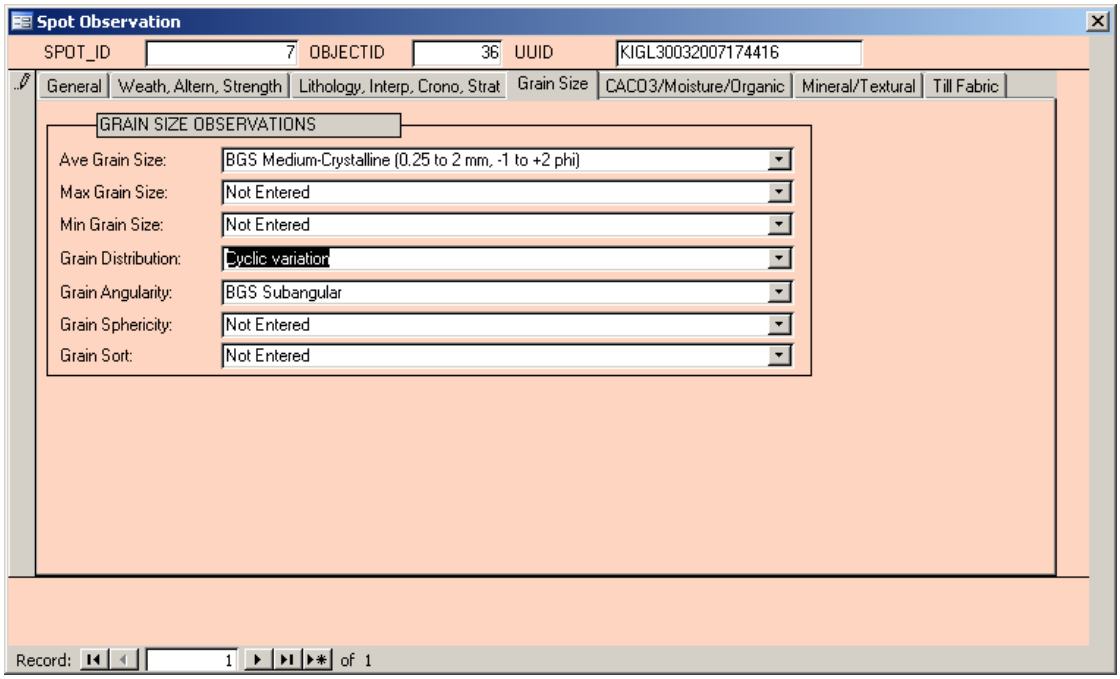
You can take several measurements or make descriptions here about the spot observation by entering through the forms entitled strength, lithology, grain size etc.



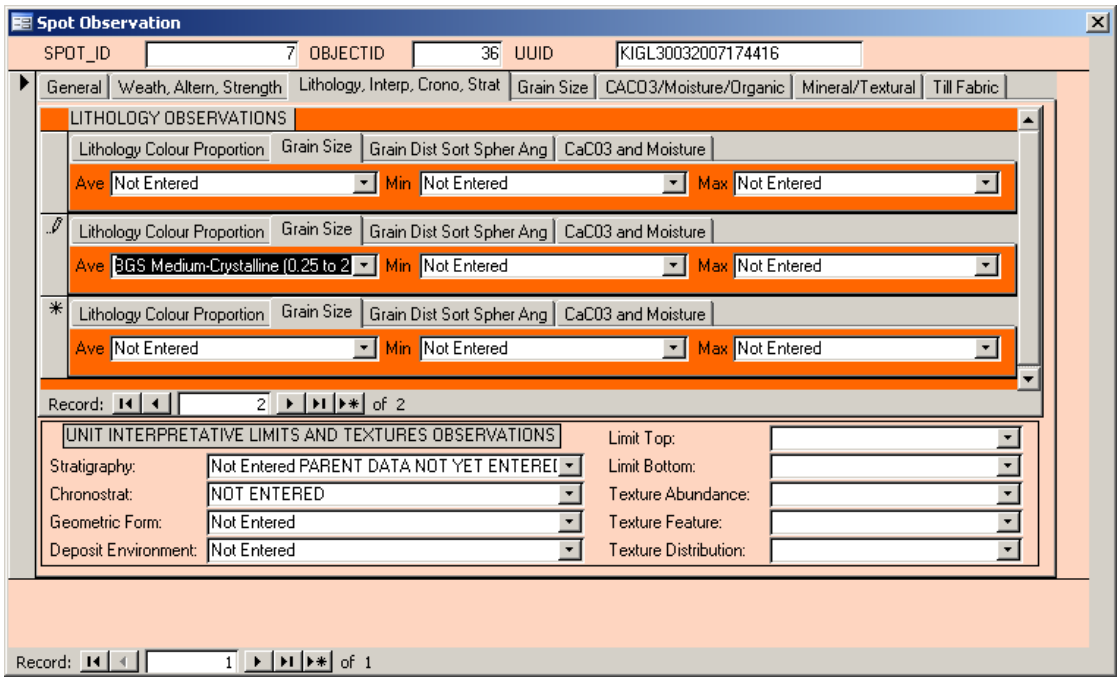
In the above example, the orange area shows that we have entered 2 lithologies for the spot observation. The arrow symbol on the grey column shows that we are currently looking at lithology 2 and any sketch, photo, sample or comment taken now would relate to lithology 2 - clay. To navigate through different lithologies, either use the scroll down list or use the default Access record mover in the lithology section.

The area shown in orange in the diagram above lets the user enter information relating to the lithological distributions within the unit as a whole. The unit thumbnails also store information about the whole unit, whereas the lithology thumbnails just store information about that lithology within the unit.

The system currently gives the user flexibility as to whether they wish to write information (such as grain size, and CaCo3 content) pertaining to the whole unit or just a particularly lithology in the unit. The user must decide in the field, which is more appropriate.

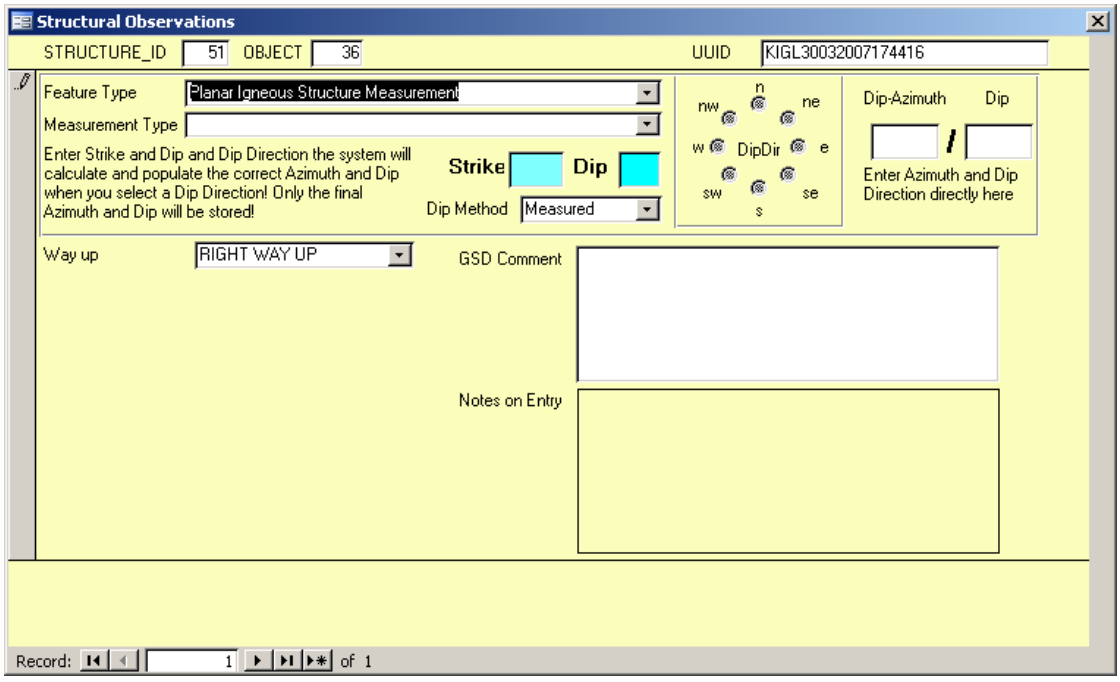


The example above shows how grain size information may be entered about the whole unit.



Whereas this example shows how a user may enter grain size information about the second lithology in the unit.

3.5.3 Structures

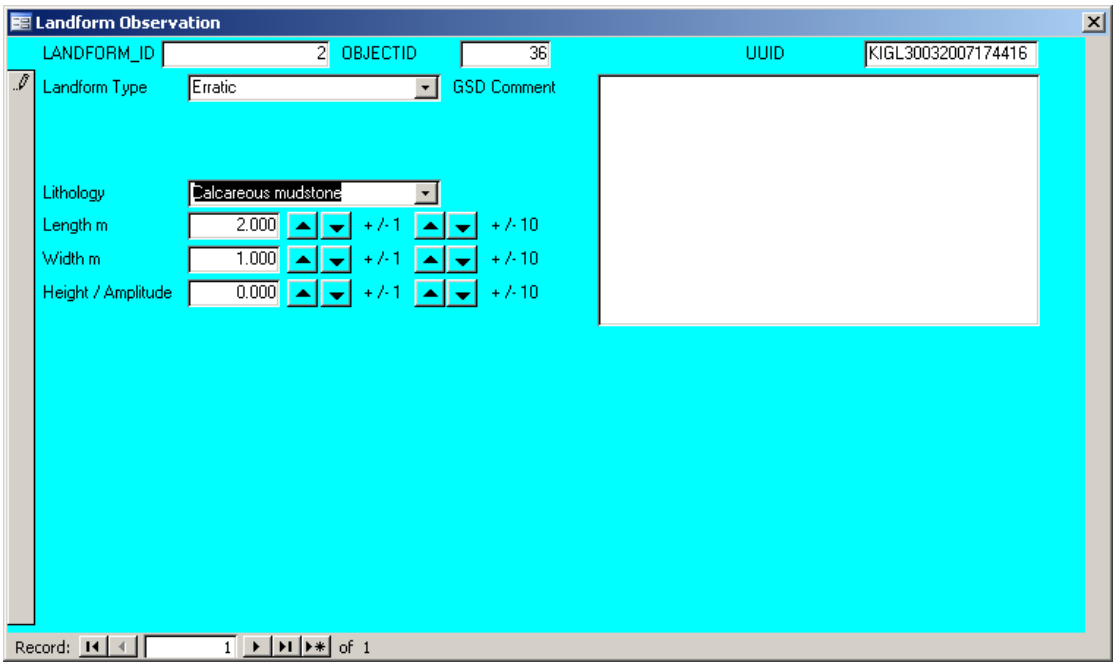


Enter information about structures in this section of the notebook. Again, relevant boxes and dropdown lists for entering data will appear in the form depending on the type of structural measurement being made in the field. Also the GeoLine, GeoPoly or Map Face note tools can be used in the digital field slip to augment your information.

Geologists are given the option of how to record certain structures, such as dip and strike or dip azimuth and dip. If strike and dip are entered, you must tick on the compass to identify the dip direction and the strike/dip figure are converted into dip-

azimuth and dip, which are the two figures recorded in the database This ensures that there is no confusion whether a field geologist used the right hand rule or another.

3.5.4 Glacial Landforms



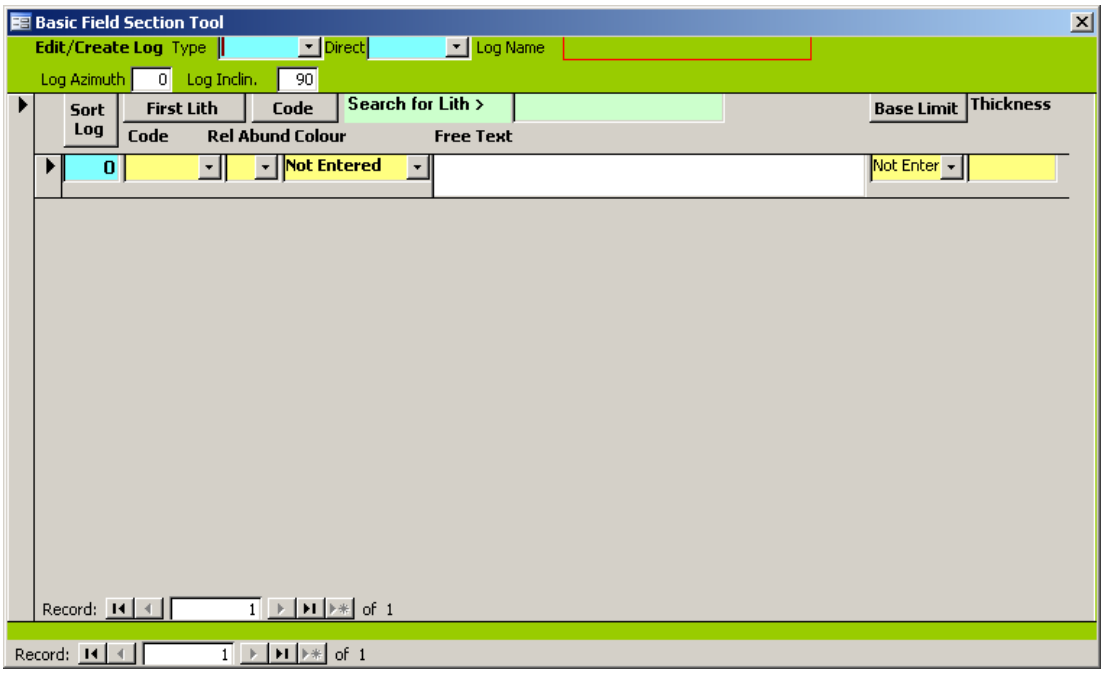
Enter information about glacial landforms in this section of the notebook. Again, the measurements you make in the field are dependant on the landform type being recorded and consequently this is reflected by what boxes appear to enter data into.

When developing the data model, all landforms were considered, but the team only included those landforms that you would actually measure in the field in the system. Other landforms, or the aerial extent of a landform should be recorded using the GeoLine, GeoPoly or Map Face Note tools.

More than one landform can be entered at any one point by pressing the record arrow at the bottom of the Landforms form to navigate to a second record. A record can be deleted using the delete button.

3.5.5 Sections

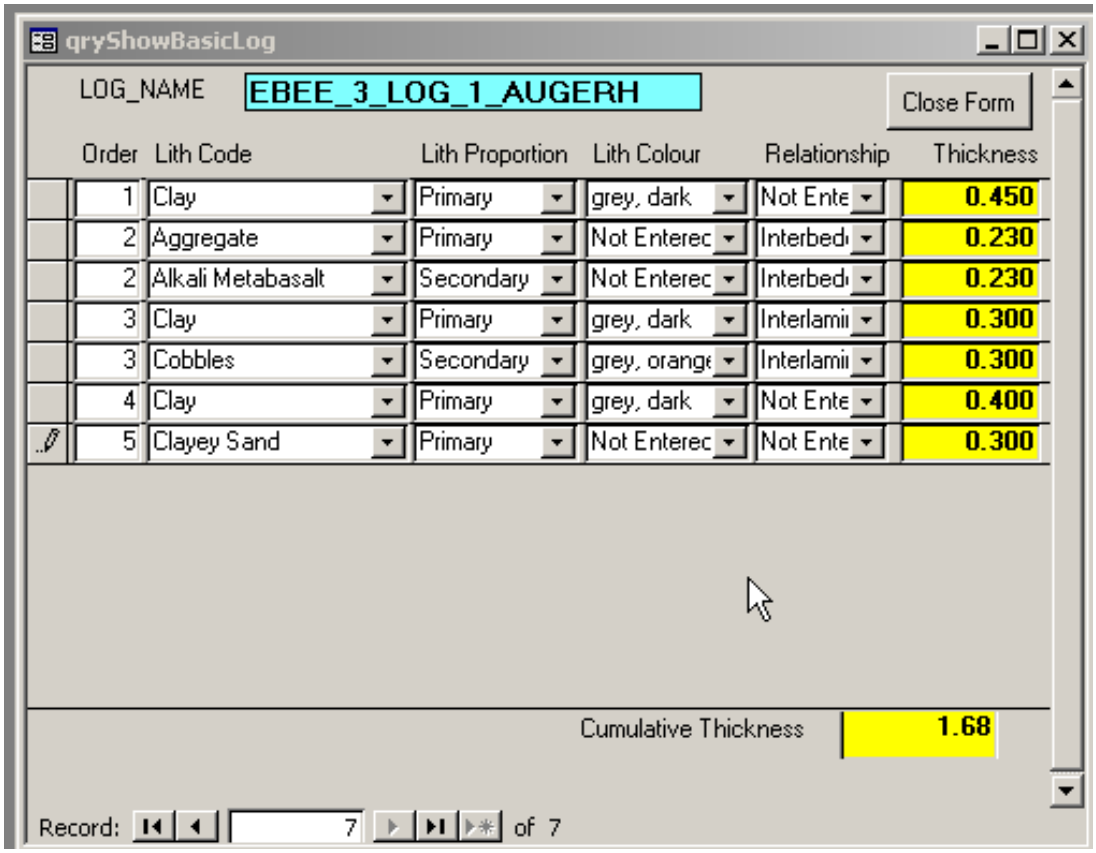
Logs (Augers, sections, quarries etc) can be entered in this section.



By clicking the Sort Log Units button, the order of units can be sorted in the correct order so that the user can sequence through the log from top to bottom correctly using the unit record arrows

For each unit any number of lithologies can be entered, and information, such as grain size, about the unit as a whole, or a lithology within the unit, can be entered in a similar manner as described in the spot observations section.

3.5.5.1 VIEWING THE LOG TOOLS

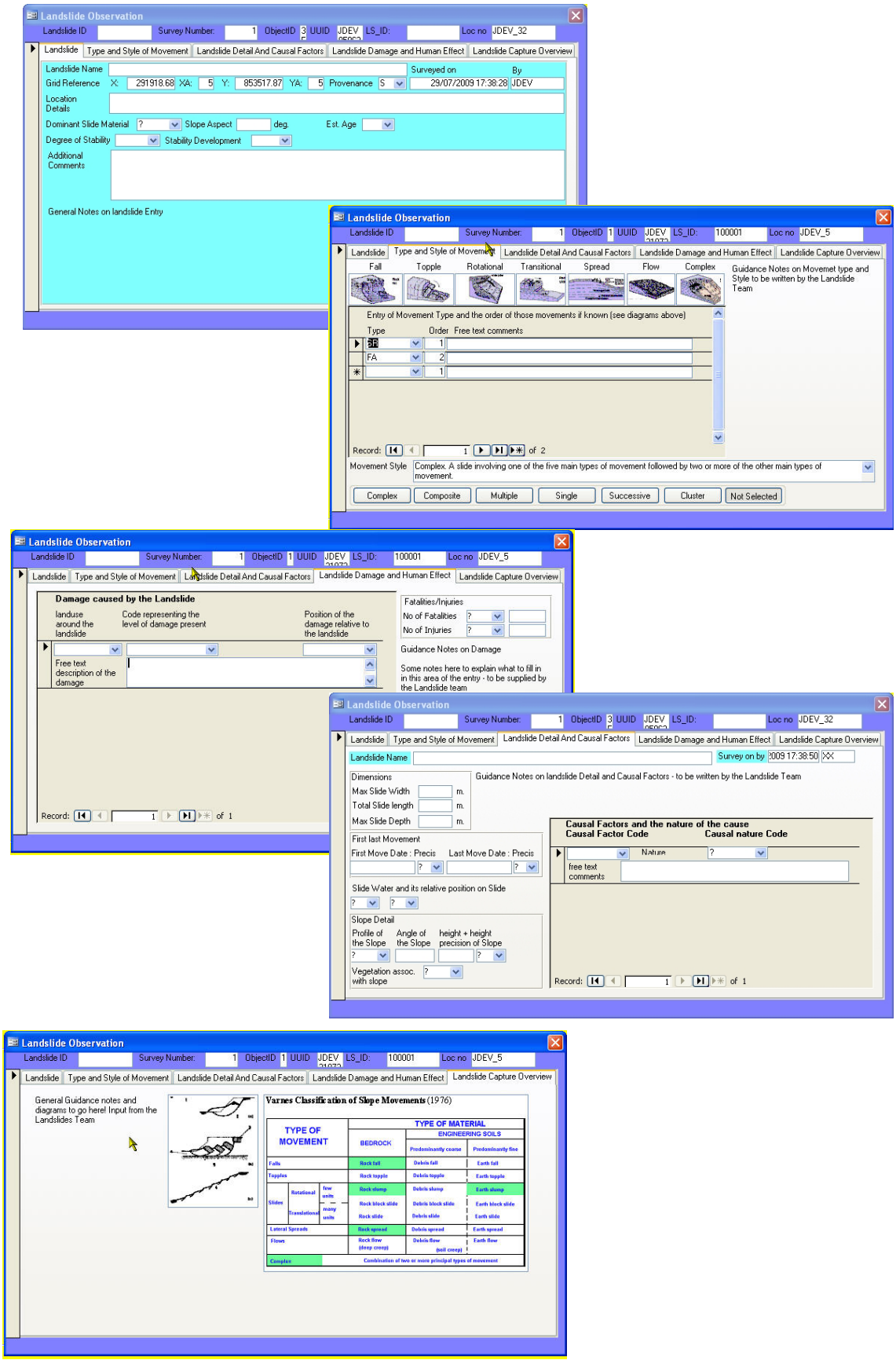


At any point whilst creating units within a log, the user can click the view/edit log button on the screen. When this button is clicked, the form shown above will appear. In the example above, the user has edited the order fields so that they are numeric 1 – n. Where there are two orders of the same number, it signifies that there are two lithologies recorded for one unit. For example, unit 3 above has both Clay and cobbles. The form shows the log from top to bottom and lets the user edit some of the main details about the log.

The log viewer, shown in the image above, lists the thickness of each unit and adds these thicknesses together to give a cumulative thickness. If there are two lithologies within a unit it displays the thickness of the whole unit for both these lithologies. For example, for the unit ordered number 3, there are two lithologies; clay and cobbles. Unit 3 has a thickness of 0.3 metres. This 0.3 metres is written beside both lithologies. However, only one 0.3 metres is included in the cumulative thickness of the log as 0.3 refers to the whole unit not the lithology.

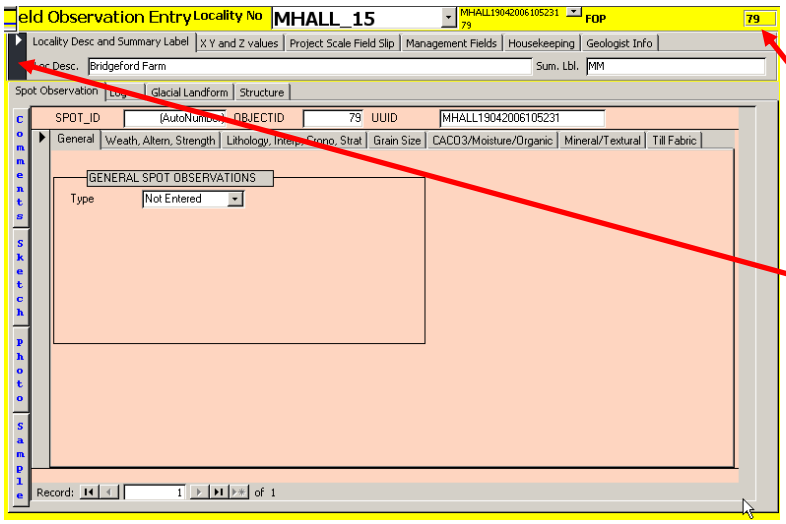
3.5.6 Landslide Observations

This tool is relatively new, having successfully completed one full year of field trials. Comprehensive instructions on the use of these forms are being compiled but a quick guide is included here.

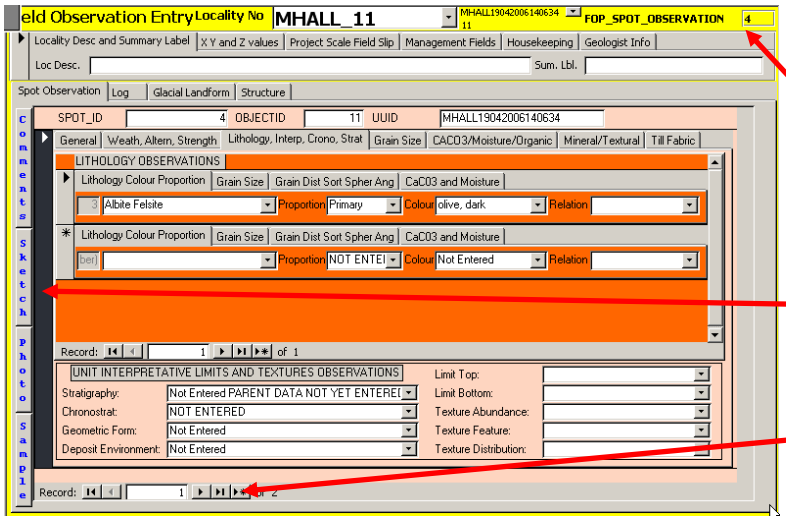


3.5.7 Setting the right location, before entering comments, sketches etc

As noted previously, the user can ensure that they are entering a comment, sketch, photo or samples about the correct thing by ensuring that the black bold text displayed in the top right hand corner of the notebook reads what the user wants to relate the comment, photo, sample or sketch to. The following images show different scenarios depending on which part of the form the user has last used. The black filled columns are a useful guide to this, and if the user clicks within these areas, the text in the top right hand corner of the notebook should change.

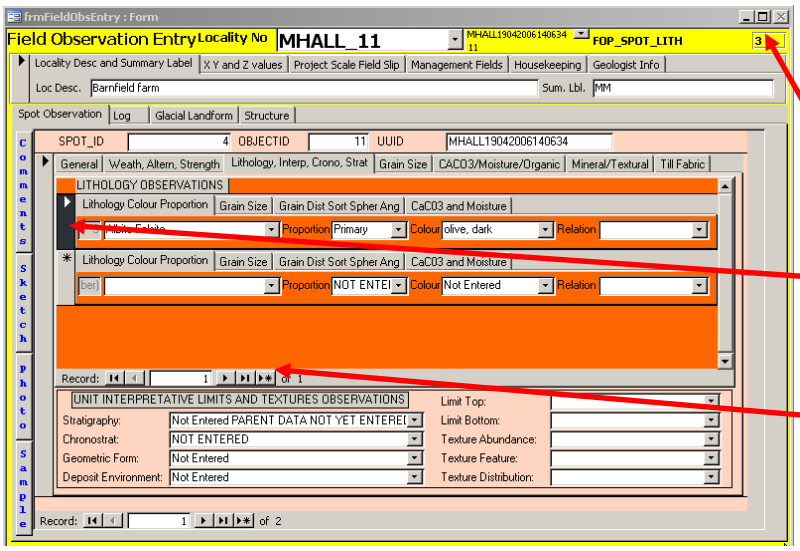


Indicates that the comment will refer to the field observation point (FOP) as a whole

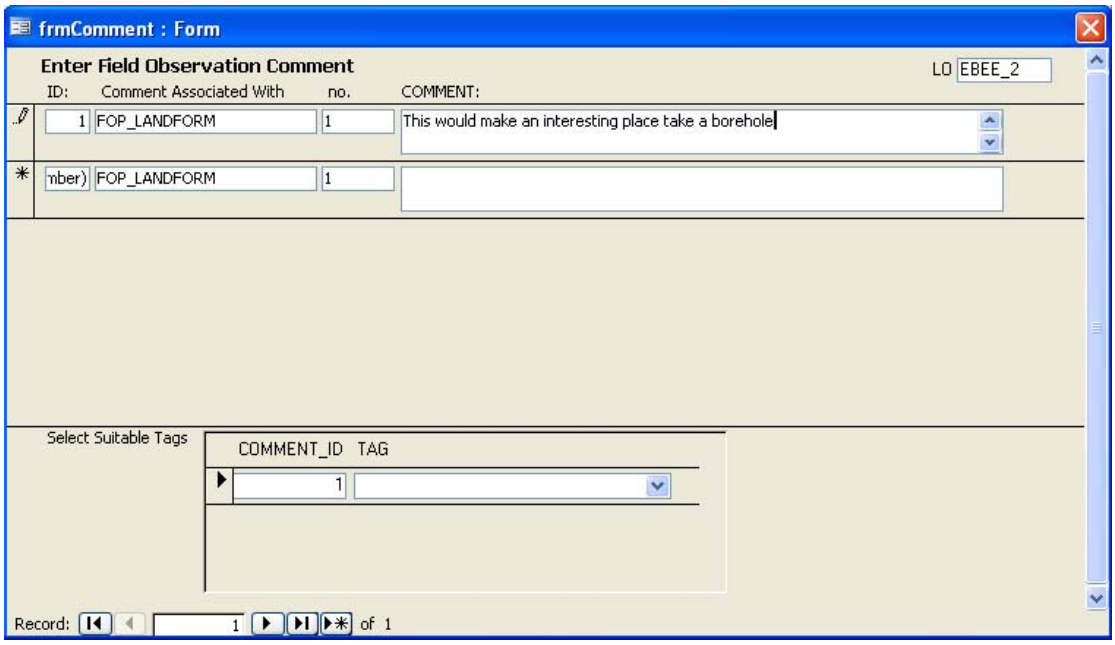


Indicates that the comment will refer to the fourth spot observation recorded in the database.

Indicates that the user is viewing the first of two spot observations at this site.

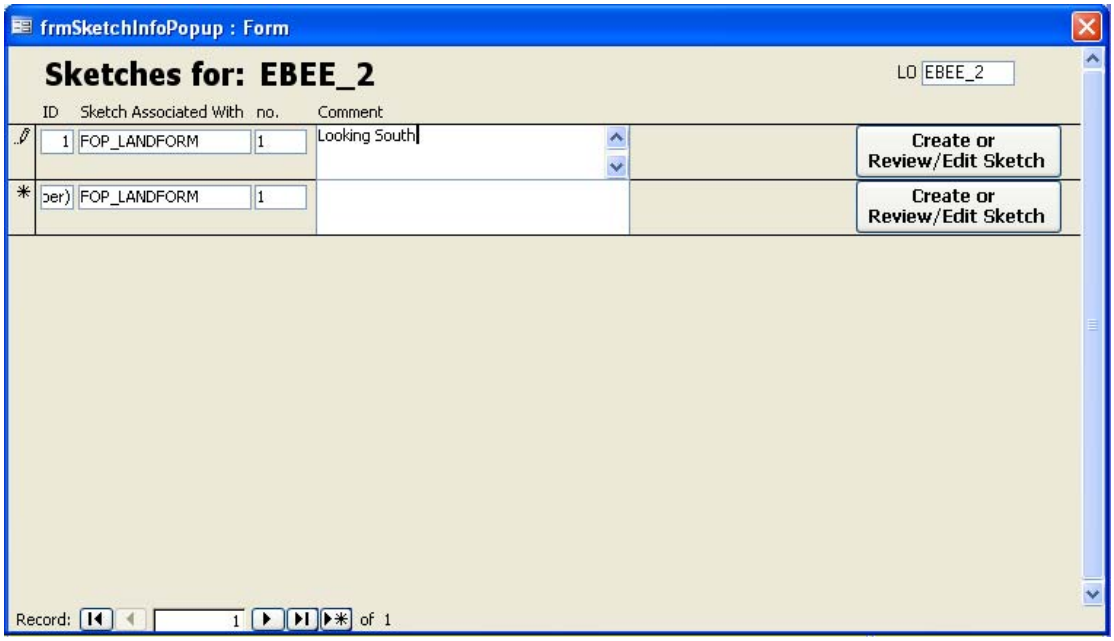


3.5.8 Comments



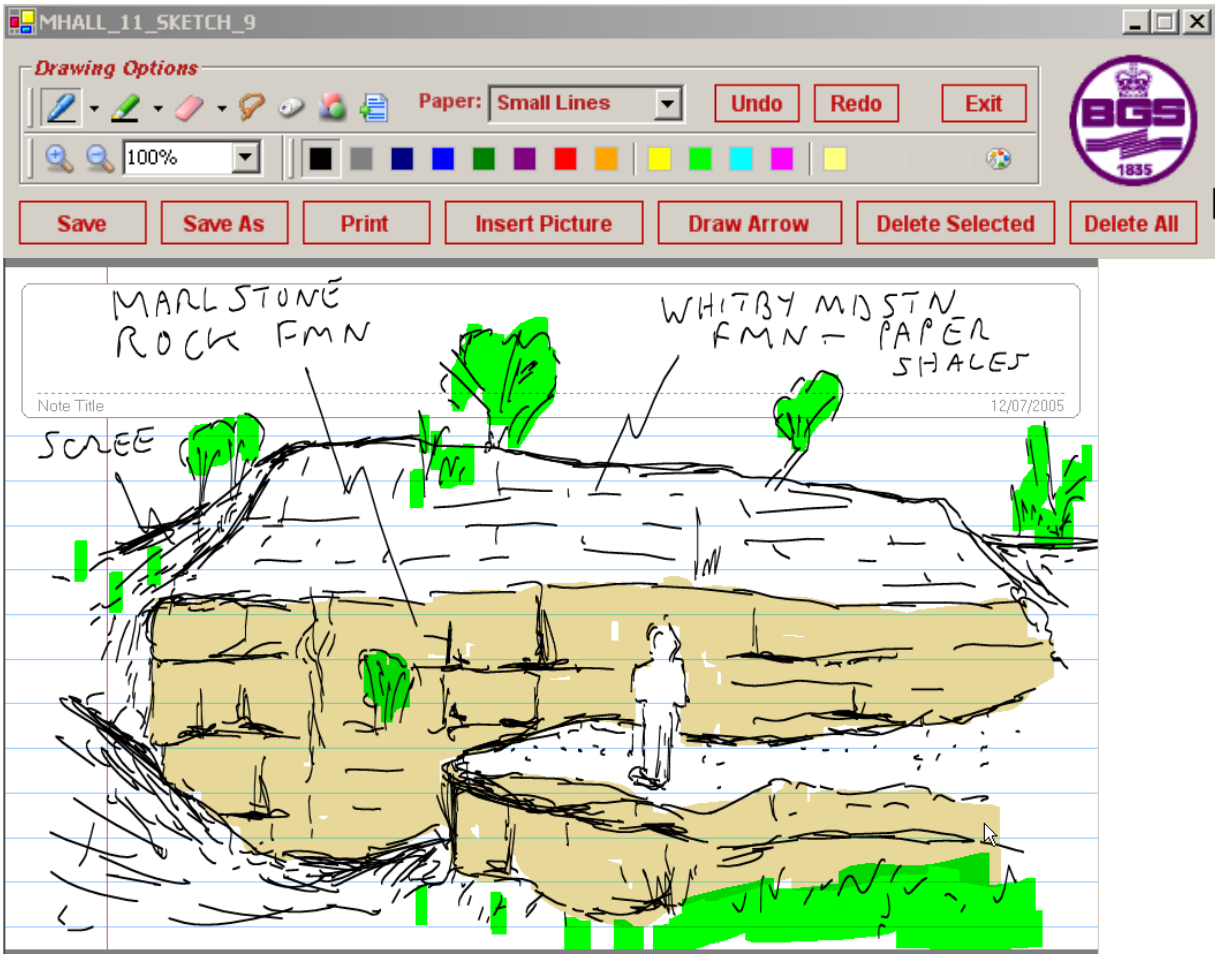
Comments can be made at any point in the system. The position where they were called from is documented automatically. This will be the location the comment button was clicked in and will relate to what was displayed in black bold text in the top right hand location of the notebook as discussed in section 3.5.1. Each comment made should be tagged with an appropriate topic tag. More than one tag can be used for any one comment.

3.5.9 Sketches



Sketches can be added or reviewed from the notebook at any point by clicking the sketch button. The form shown above will appear in which you can add or edit a comment about your sketch. The position where the sketch was called from is documented automatically this will be the location the comment button was clicked in and will relate to what was displayed in black bold text in the top right hand location of the notebook as discussed in section 3.5.1.

Sketches are created using a customised version of Agilix InfiNotes called BGS Sketch Tool. This programme needs to be installed separately from BGS·SIGMA*mobile*. If this is not installed on your tablet, ask a member of the BGS·SIGMA*mobile* team where to locate the installation file. Help instructions can be obtained from the installation file.

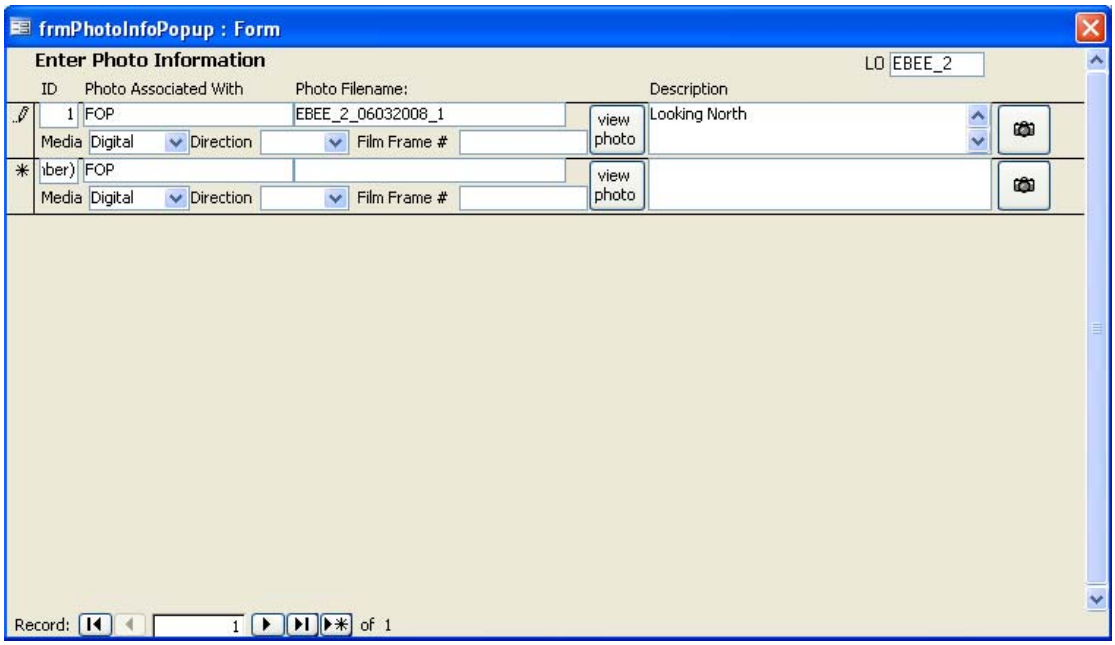


3.5.10 Photos

Metadata about photos taken in the field can be added through the photo forms. The photos will remain on your camera until you upload them to your PC. When you do this, use the Photo Transfer facility on the database start up screen. This is detailed below.

3.5.10.1 PHOTO FORM

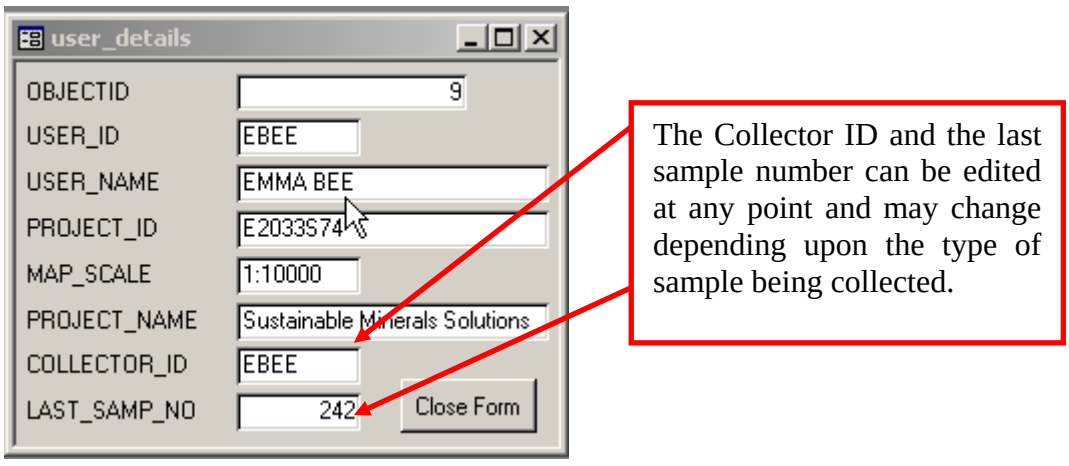
The database requires that you first enter a description of the photo. Once you have entered this you can link to a photo if it is already on your tablet, by clicking the photo button on the form . The system will automatically rename the photos as well as copy the renamed photo to the photographs folder in your BGS·SIGMA*mobile* directory and make the necessary linkages. If you have linked to a photo you can view it by clicking on the 'view photo' button. If your photos are not yet on your PC you can go back and transfer your photos to the BGS·SIGMA*mobile* database at a later date. The new file name assigned to a photograph consists of the LOCALITY NUMBER plus the current date and a number which starts at 1 for each locality. The original file name is also preserved in the Film Frame # field. It is recommended that you transfer your photos as often as possible.



3.5.11 Samples

Before taking samples using the BGS·SIGMA*mobile* system, each geologist must set up their Collector code number in the database on the tablet PC. This is done through the housekeeping section of the notebook.

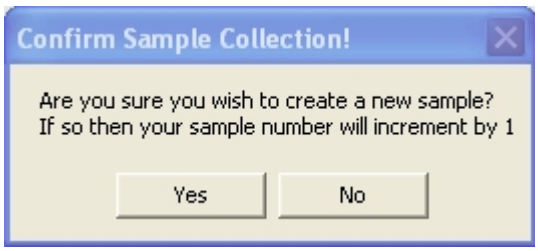
The user should click the "Edit Collector/sample no" button before taking the system out in the field and make the appropriate changes to the form which is displayed below.



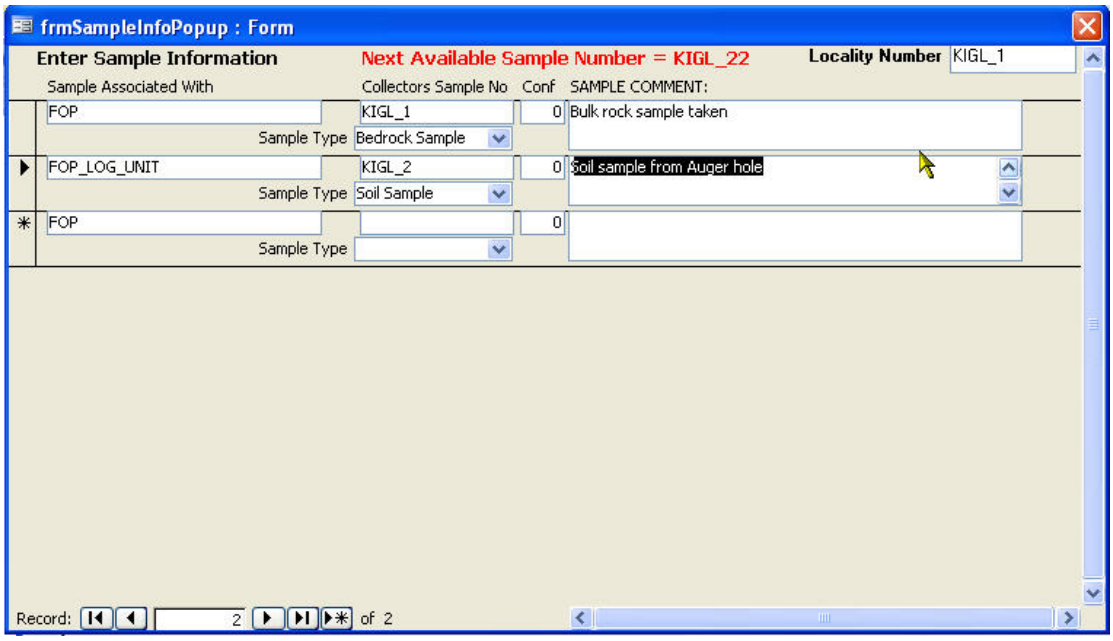
In BGS geologists are issued with sample number books when they joined the organisation. The numbers and ID's written in the above form should reflect the Geologist's user ID and sample number in their relevant sample book.

For information, the user can see the user name, ID, project details and map scale they registered in ArcMap. These should not be edited here unless absolutely necessary.

Once the “sample” button has been clicked you will see this pop up box:



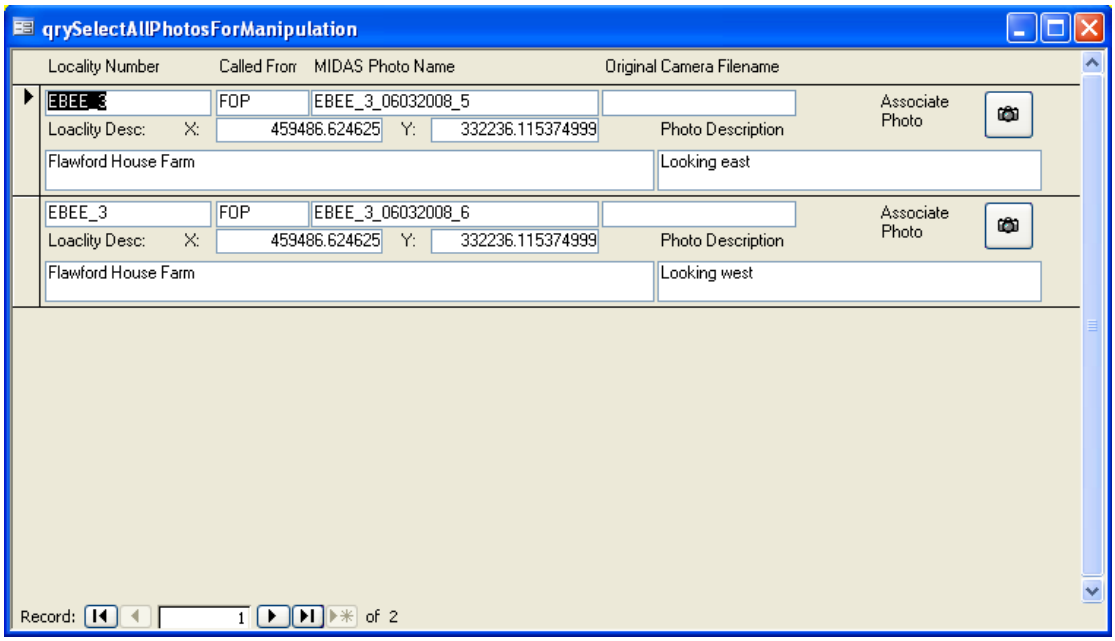
Click Yes to continue to the form and enter in any relevant information and No to move away from the sample form.



3.5.12 General Tools

3.5.12.1 PHOTO TRANSFER

If the photos are not on your tablet you can link the photos to the correct metadata once you have uploaded them to your pc. To link to the photos like this, click on the Photo Transfer button on the opening screen of the database. The form will then display a list of descriptions about the photos taken at that location. Click on the photo button to associate a photo on your PC to the appropriate description. There is no need to rename the photos as the database will do this automatically, as well as copy the renamed photo to the photographs folder in your BGS·SIGMA*mobile* directory.



3.5.12.2 IMAGEBASE SPREADSHEET

This button creates an Excel spreadsheet in the photographs folder of your current working project. It exports the data in a format suitable for the BGS Photographic Department to enter in to their systems. For this to work efficiently you must transfer and describe all of the photos in the database that are to be exported. It is recommended that you do this on a daily basis.

3.5.12.3 SAMPLE COLLECTION SPREADSHEET

This button creates an Excel spreadsheet in the root of your current working project area. It exports the data in a format suitable for the BGS Collections Department to enter in to their systems. For this to work efficiently you must transfer and describe all of the samples in the database that are to be exported. It is recommended that you do this on a daily basis.

3.5.12.4 LOCALITY SPREADSHEET

This button creates an Excel spreadsheet in the root of your current working project area. It exports the basic information on each of the localities where data was collected, for example, x & y coordinates, locality number and locality description and summary label

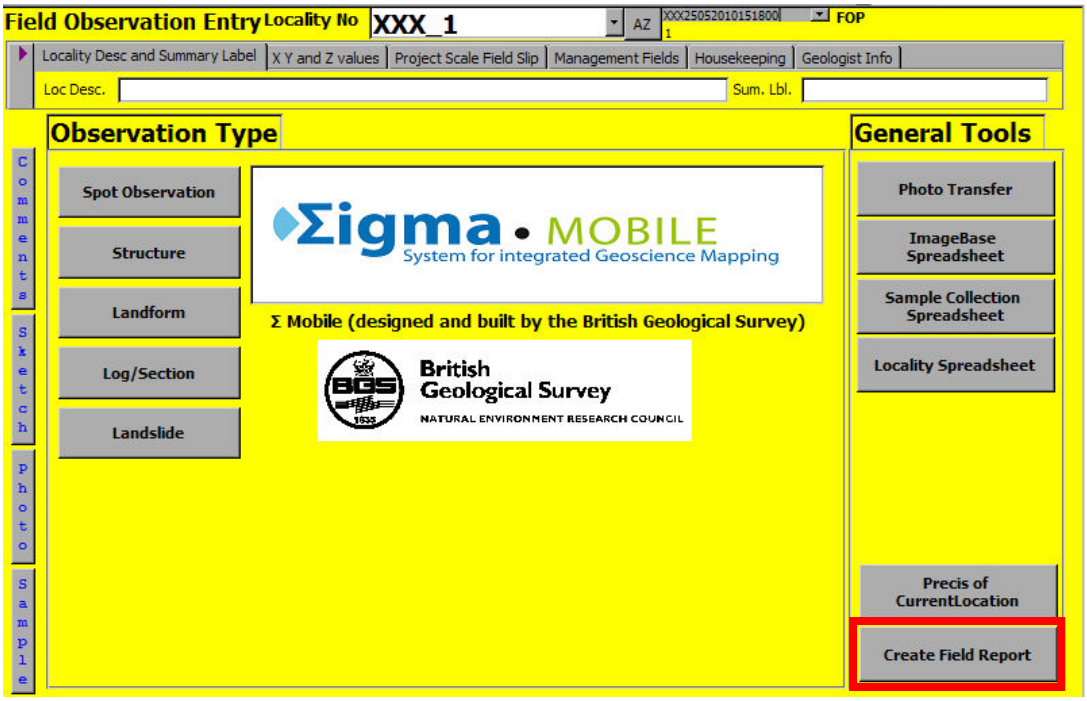
3.5.12.5 PRÉCIS OF CURRENT LOCATION

A specialized Précis Tool can be accessed using the information button in BGS·SIGMA*mobile* and within the Database itself. This tool is described in more detail in section 5.4.3.

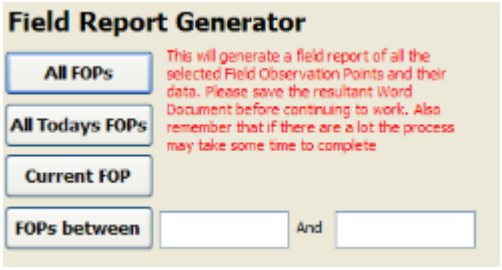
3.5.12.6 FIELD REPORT

The Field Report Tool allows you to generate a report in Microsoft Word of all selected Field Observation Points and their data.

1. Open The DFDC database and select the *Create Field Report* Tool:



2. The following menu will be displayed:



Use the buttons to select which FOPs will be reported on. To select FOPs between two dates first click on the two white boxes and a calendar tool will appear.

3. Microsoft Word will open and a report will be generated. This may take a while if you have selected many FOPs.
4. Save the Word Document before continuing to work.

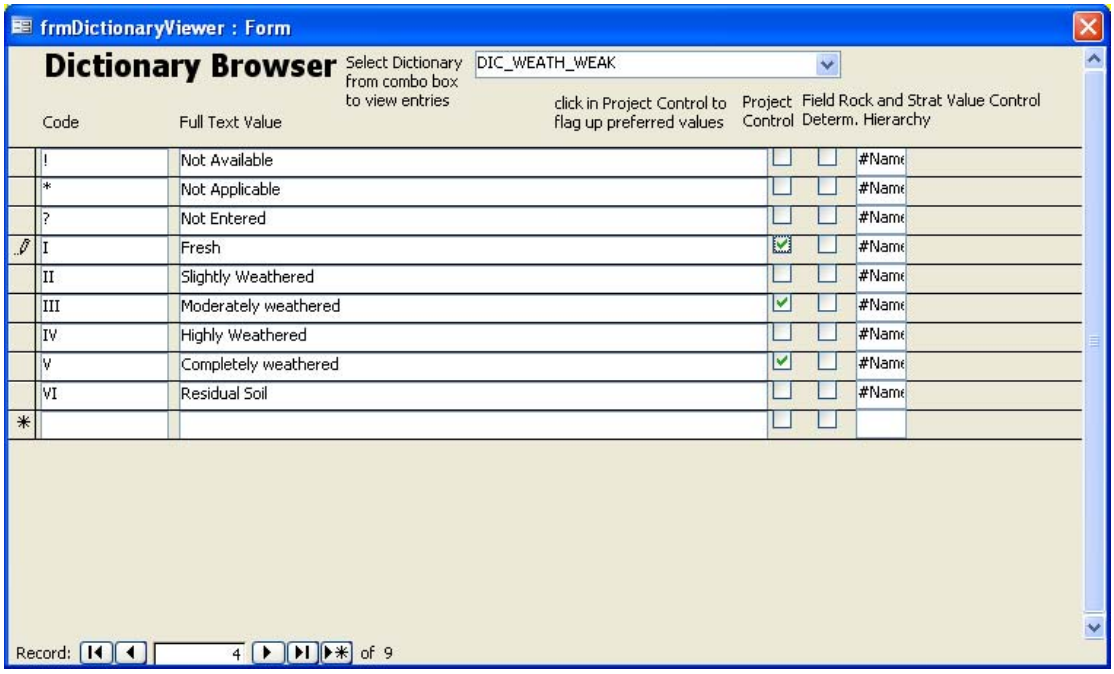
Note: the Table of Conents in the Word Document allows you to hyperlink directly to a Field Observation Point.

3.5.13 Customising project dictionaries in the notebook

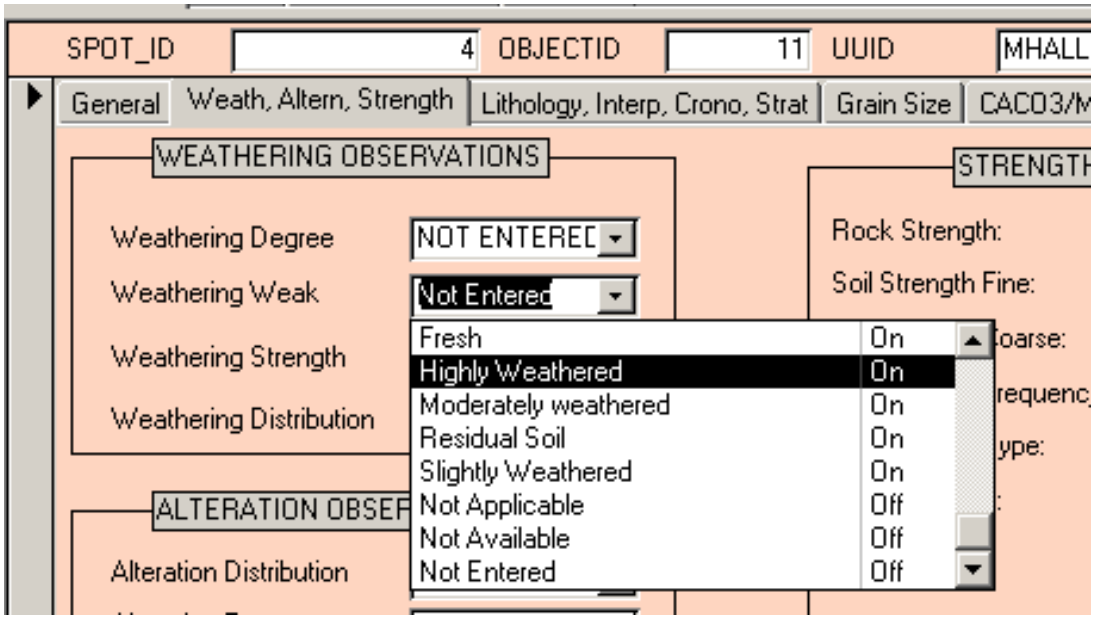
The data manager or user can select the dictionary values a project uses most often so that they appear at the top of a dictionary listing by clicking the view manipulate dictionaries button in the housekeeping section of the notebook, as shown below.

This action will bring the following form to view. The user can then select the appropriate dictionary to customise from the drop down list (combo box) and then

tick or untick values depending on whether the value should be listed at the top of a dictionary list in the system. The example below shows the values for the DIC_WEAT_WEAK dictionary.



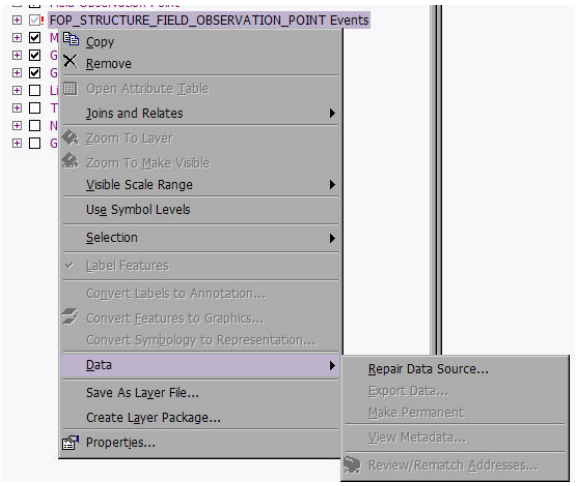
The results of the above customisation can only be seen when the notebook application is re-opened. They can then be seen within the Weathering sections of the notebook (so within Spot or Log). The image below shows that the three values that were ticked in the dictionary browser appear at the top of the drop down list. They are in alphabetical order. The other values are still accessible, but appear below those values where the user had indicated a preference.



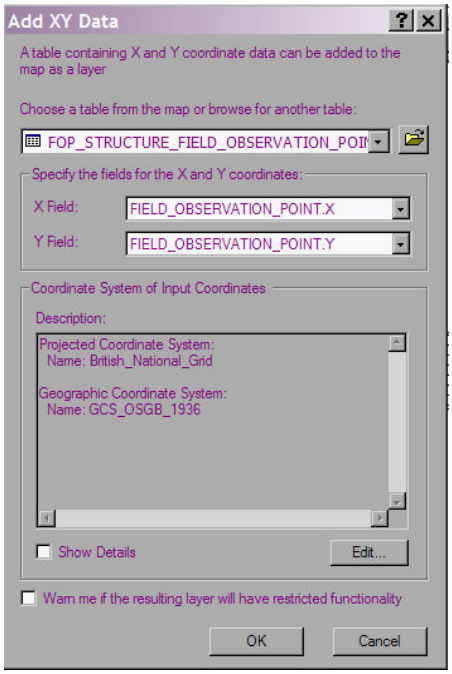
3.6 DISPLAYING STRUCTURAL INFORMATION IN BGS·SIGMA*MOBILE*

It is important to note that the data source to this layer must be repaired otherwise it will cause problems repairing links to any other dataset within the mxd.

It is possible to display structural measurements taken within BGS·SIGMA*mobile* as a separate layer within the GIS and orientate the symbols in their appropriate direction. When you open BGS·SIGMA*mobile* you will see that there is a layer in the Table of Contents (TOC) called "FOP_STRUCTURE_FIELD_OBSERVATION_POINT Events". This layer is an Event theme and is created by joining the tables for the Field Observation Point (to gain the X & Y coordinates) and the FOP_STRUCTURE table. This layer will already be symbolised with the correct symbology but will have a red exclamation mark next to it if it is the first time you have opened the project. To repair the data link right click on the Event theme in the TOC, select Data and choose Repair Data Source.



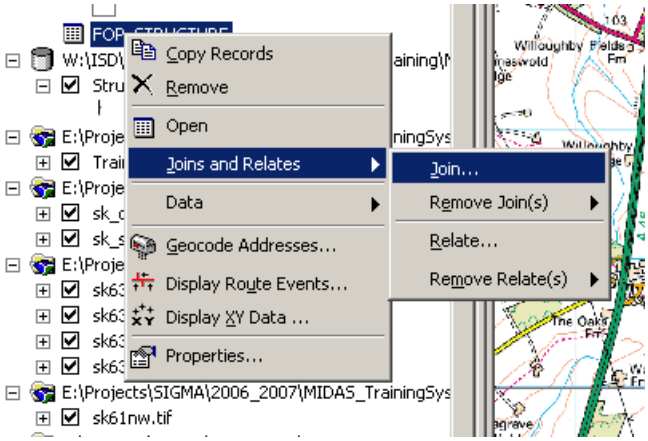
This will open a dialog box which allows the user to redefine the attribute fields required to display the data on the map. The X and Y coordinates should be taken from the FIELD_OBSERVATION_POINT layer as details in the diagram below. The projection should also be set to the projection being used by the map (this will be British National Grid if working in the UK).



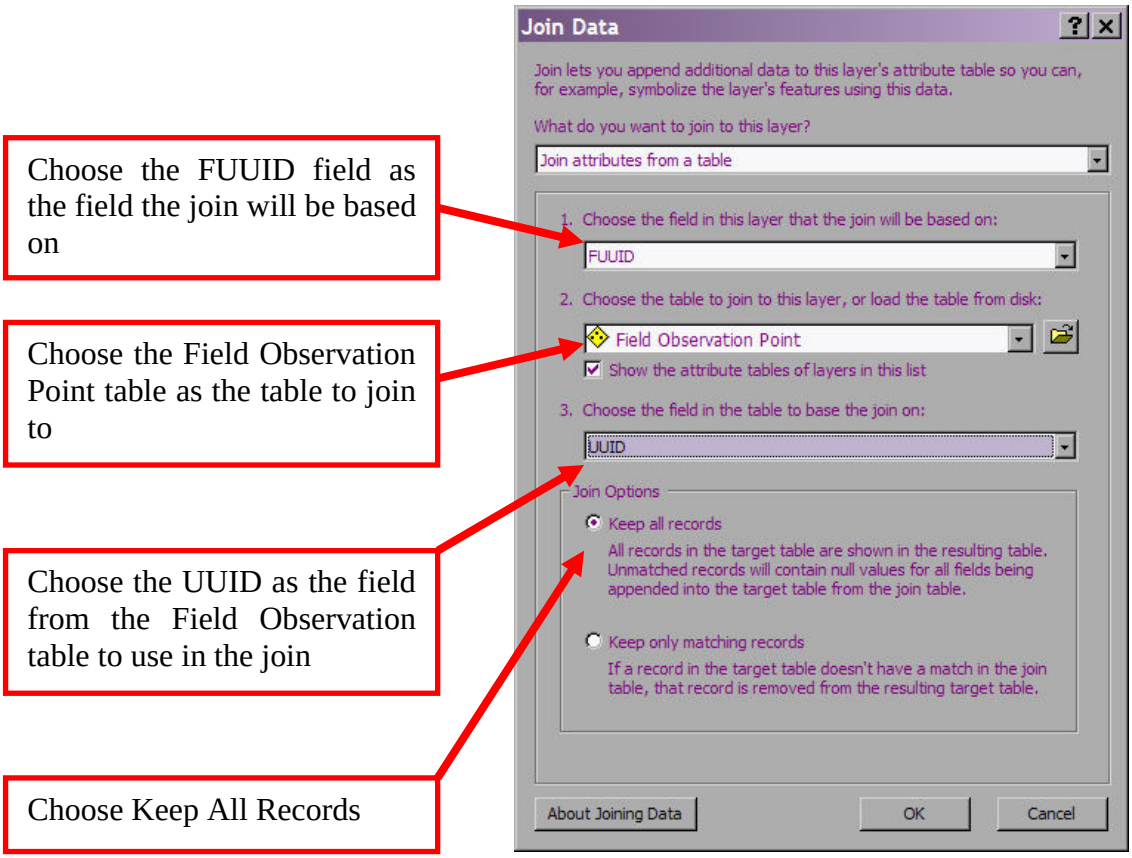
3.6.1 Creating a Structure Event Layer

If for some reason an error occurs in the event theme already set up in within BGS·SIGMA*mobile* follow the instructions below to set-up a replacement event theme :

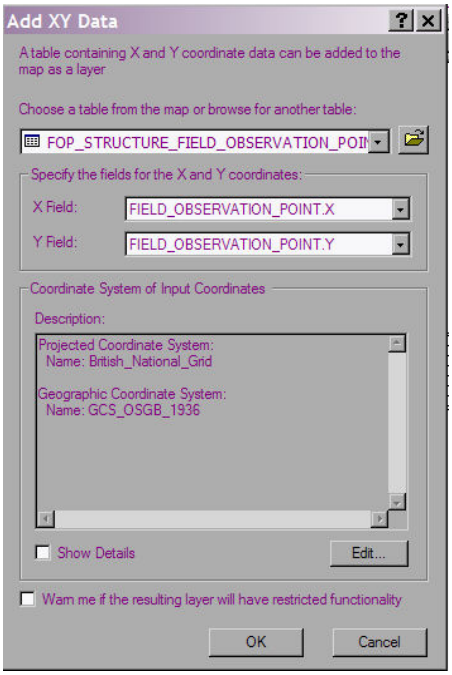
1. Add in the FOP_STRUCTURE table from the DFDC.mdb if it is not already loaded (check under the Source tab of the TOC). It is important that this table is not loaded more than once unless you give each table a different name. Loading two or more tables with the same name (even if they are from different locations) will cause confusion within the system and you are likely to experience errors.
2. Right click on the FOP_STRUCTURE table in the TOC and select Properties and the Joins/Relates Tab. If FOP_STRUCTURE is not joined to FIELD_OBSERVATION_POINT then follow steps 3 and 4 below. If FOP_STRUCTURE is already linked to FIELD_OBSERVATION_POINT then go directly to step 5.
3. Right click on the FOP_STRUCTURE table in the TOC (you may need to select the source tab at the bottom of the TOC if this has not already been done) and select Joins and Relates followed by Join.



4. It is necessary to make a join to the FIELD_OBSERVATION_POINT based on the UUID in order to join the X and Y data to the FOP_STRUCTURE table. In the Join dialog box that opens the following should be set:



5. Once the joins are made an event theme can be generated. To do this, right click on the FOP_STRUCTURE table and click Display XY data. The following menu will appear.



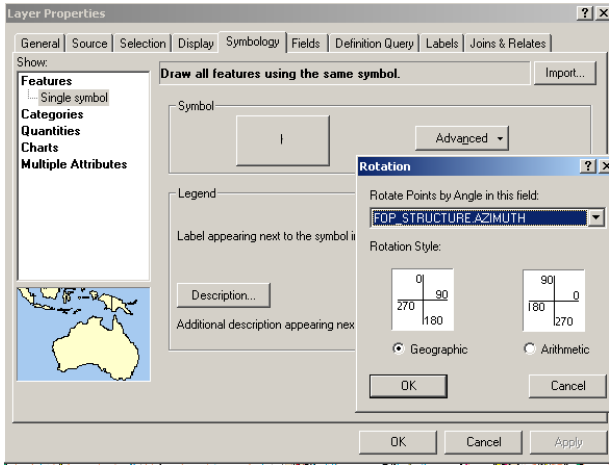
The X and Y attributes need to be assigned in order to display the points in the GIS.

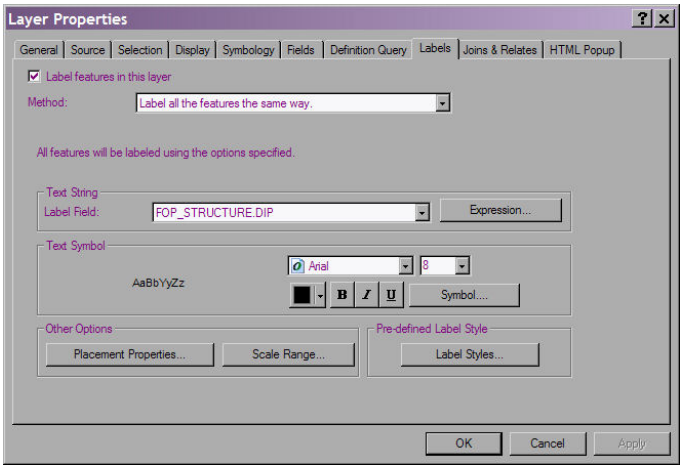
- X value should be the FIELD_OBSERVATION_POIINT.X attribute and the
- Y value should be the FIELD_OBSERVATION_POIINT.Y attribute
- Make sure you set the coordinate system to be British National Grid.

You should now have a layer called FOP_STRUCTURE_FIELD_OBSERVATION_POINT Events.

6. Layer Symbolization:

- Go to Layer Properties for FOP_STRUCTURE_FIELD_OBSERVATION_POINT Events and select Import
- Browse to your Project Folder SIGMA_MOBILE_2010A and select Structural_Symbols_v931.lyr
- Also check within the Symbology Tab that rotation is based upon the azimuth field. (Advanced/Rotation and select: FOP_STRUCTURE_AZIMUTH with the Geographic Rotation Style)
- To Label the Structures go to the Labels tab within Layer Properties – check on Label features in this layer and within Label Field select: FOP_STRUCTURE DIP





Once you have set this up once, it will be saved in your project and structural measurements will automatically appear in the event layers when you create them using the notebook point tool.

4 Using the BGS Integrated Tools

4.1 THE BGS COMPASS BEARING TOOL

The purpose of the tool is to show compass bearings i.e. lines of sight and backsight in ArcMap. The tool is a simple way for the geologist to use a compass to record a bearing to/from features on the landscape, and to draw lines of the same bearings onto the map.

To use the Bearing Tool:

1) Open ArcMap.
2) From the **View** Menu on ArcMap, select **Toolbars** and then click on **Bearing Tool** from the list of toolbars available.

The Bearing Toolbar toolbar will then become visible:

The Bearing Toolbar contains the following two buttons:

Bearing tool

Delete Bearing Graphics

Each of these buttons is described below.

Bearing Tool

After clicking the Bearing tool button, the mouse icon changes to a set of cross-hairs and the tool is ready to use. Single-tap on the screen where you wish to take the bearing from and hover the stylus elsewhere to see a dashed red line appear. The bearing of the line is displayed in the bottom left of the screen.

When you double-tap to finish the line, it becomes a solid line and is annotated with the compass bearing. The compass bearing is always displayed at the terminus of the line (i.e. where you double-tapped).

Delete Bearing Graphics

Clicking the Delete Bearing graphics button will remove the graphics created by the Bearing tool from ArcMap's map display. Note that any other graphics on the map display (that were not created by the Bearing tool) will not be removed.

4.2 THE BGS STRUCTURE CONTOUR TOOL

The purpose of the tool is to calculate Structure Contours to estimate where a geological bed will outcrop. Given the location of an Observation Point where the angle and direction of dip of the bed are known, and assuming the dip is uniform, the tool can calculate an equation for the plane of the bed. From this equation it is then possible to calculate the elevation of the bed at any point. By using a DTM this elevation can be compared with the ground elevation and where the two are equal it can be predicted that the bed will outcrop.

4.2.1 Installation

The Structure Contour Tool should already be installed on the Tablet PC, but if not please follow the instructions below To check if the Tool is installed go to the **View** menu on ArcMap, select **Toolbars** from the view menu and see if there is a toolbar called **Structure Contour Tool**.

You can also use the instructions below to install the tool on your Desktop PC. ArcGIS 9.0 (with Service Pack 3) or above must be installed on the PC for the Structure Contour Tool to work. The system also requires the .net framework version 2.050727 to be installed on the tablet or Desktop machine. Follow the four steps below to install the Structure Contour Tool:

1) Copy the directory **Structure Contour Tool** in the BGS·SIGMA*mobile* folder to any location on your PC;
2) Open this directory and double click on the file **Setup.bat;**
3) Click on the **Yes** button of the first dialog window to update the registry;
4) Click on the **OK** button of the next dialog to complete the installation.

4.2.2 Using the Tool

To use the Structure Contour Tool:

1) Open ArcMap with a project that contains a DTM.
2) Open the Structure Contour Toolbar (from the **View** Menu on ArcMap, select **Toolbars** and then click on **Structure Contour Tool** from the list of toolbars available).

The Structure Contour toolbar will then become visible:

The Structure Contour Toolbar contains the following three buttons:

Calculate Structure Contours

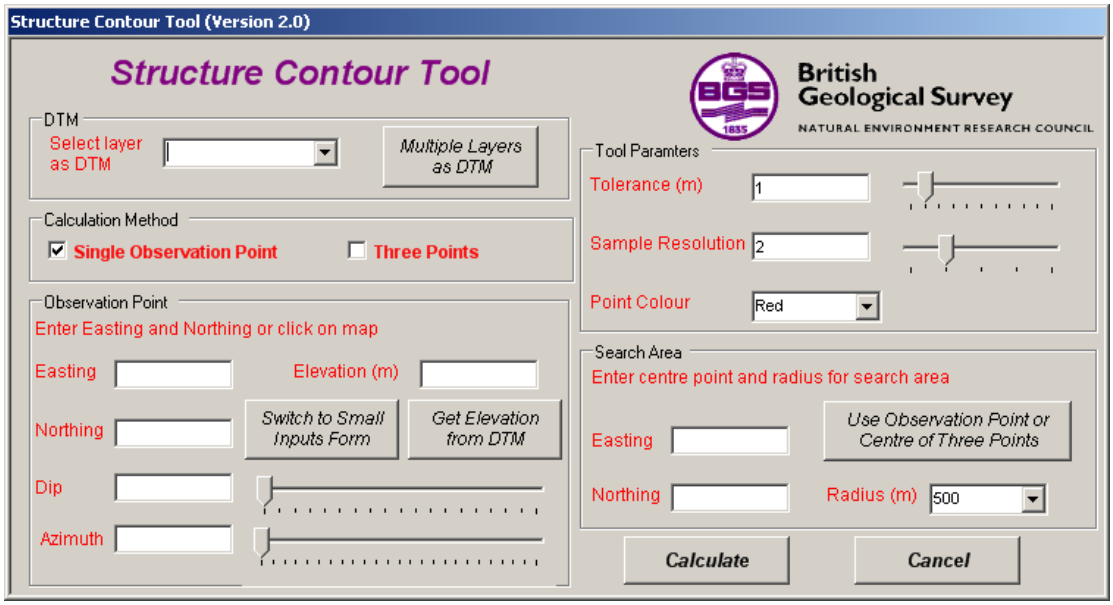
Delete Structure Contours

Save Structure Contours as Shapefile

The functionality of each of these buttons is described in detail below.

4.2.2.1 CALCULATE STRUCTURE CONTOURS

After clicking the Calculate Structure Contours button, the user is presented with the following window:

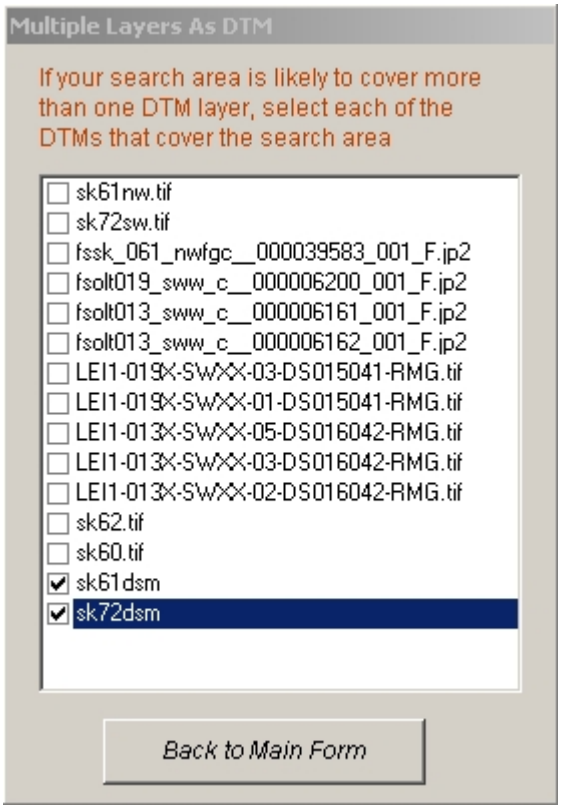


The user is required to enter four types of input: DTM, Observation Point, Tool Parameters and Search Area:

DTM

The DTM input consists of a dropdown menu that lists the raster layers available in the current project (note that this list will therefore also include non-DTM rasters such as OS topographic maps). The user must select the layer to be used to calculate all elevation values by the Structure Contour Tool.

If the Search Area that you are interested in is likely to be covered by more than one DTM, click on the '**Multiple Layers as DTM**' button and you will be presented with the following window:

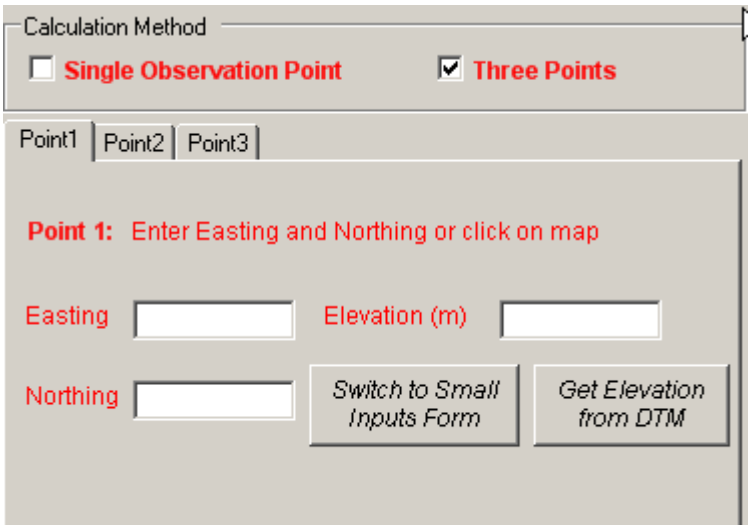


Make sure that all of the DTM layers that cover the Search Area are ticked and then click on the '**Back to Main Form'** button. The value in the DTM Combo box will now be set to: **Multiple DTMs.**

IMPORTANT NOTE: All raster layers are displayed in the '**Multiple Layers as DTM**' window as it is not possible to distinguish DTMs from other raster layers such as OS 50k sheets. Make sure that **only** DTMs are ticked. Otherwise it is possible that the Structure Contour Tool will attempt to get elevation values from a non-DTM raster layer.

Calculation method

There is an option to use just one input point for structure contour calculation or up to three input points where there are known measurements. The user can input measurements for each known observation point as described in the Observation point section below.

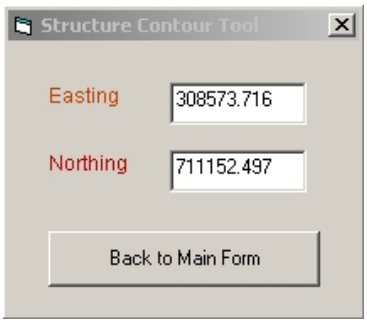


Observation Point

The Observation Point inputs consist of the observed properties of the bed at a known location. They include:

1) **Easting**: The National Grid Coordinate (Easting) of the point.
2) **Northing**: The National Grid Coordinate (Northing) of the point.

Easting and Northing values can be typed in manually or can be entered automatically by clicking on the required location on the map display. As the Inputs window is relatively large and obscures the majority of the map display, the button '**Switch to Small Inputs Form**' has been provided. Clicking this button closes the main inputs form and brings up the following window:



Once this window appears the user simply clicks on the map display to input the coordinates of the structure measurement. When the correct values are entered, click on the '**Back to Main Form**' button to return to the original Inputs window. Note that on returning to the main Inputs window the Easting and Northing values have been populated using those values selected using the smaller window.

3) **Elevation**: The elevation of the point in meters. This value can be typed in manually or populated automatically (after the Easting and Northing have

been entered) by clicking on the **Get Elevation from DTM** button. This button uses the entered Easting and Northing values to query the selected DTM and returns the appropriate elevation Z value.

4) **Dip**: The observed angle of dip of the bed. This will be a value between 0 and 90 degrees and can be typed in manually or populated using the slider to the right of the Dip text box. To move the slider by a factor of one degree, click just to the left or to the right of the slider's pointer and it will move 1 degree in that direction.

5) **Azimuth**: The observed direction of dip of the bed (measured from North in a clockwise direction). This will be a value between 0 and 360 degrees and can be typed in manually or populated using the slider to the right of the Azimuth text box. To move the slider small amounts click just to the left or just to the right of the slider's pointer and it will move 1 degree in that direction.

Tool Parameters

These three input values are parameters that affect how the tool calculates and displays structure contours. Each input is initially given a default value.

The three inputs are:

1. **Tolerance**: At various points in the search area the tool calculates the predicted elevation of the bed and compares it with the ground elevation value from the DTM to see if they are the same. The tolerance value defines how close (in meters) these two values need to be to be declared 'the same'. This value can be typed in manually or populated using the slider to the right of the Tolerance text box. To move the slider small amounts click just to the left or just to the right of the slider's pointer and it will move 1 meter in that direction. A non-integer value (e.g. 0.5) can be entered as the tolerance, but this must be entered manually.

2. **Sample Resolution**: For large search areas the time taken to produce structure contours can be high as calculations are made every 5 meters (the resolution of NEXTMap, from Intermap). To speed up the tool the distance between calculations can be increased. A sample resolution of 2 means calculations will be made every 10 meters, whilst a sample resolution of 3 means calculations will be made every 15 meters and so on. Obviously increasing the sample resolution may decrease the number of points found that form structure contours. This value can be typed in manually or populated using the slider to the right of the Sample Resolution text box. To move the slider small amounts click just to the left or just to the right of the slider's pointer and it will move 1 in that direction.

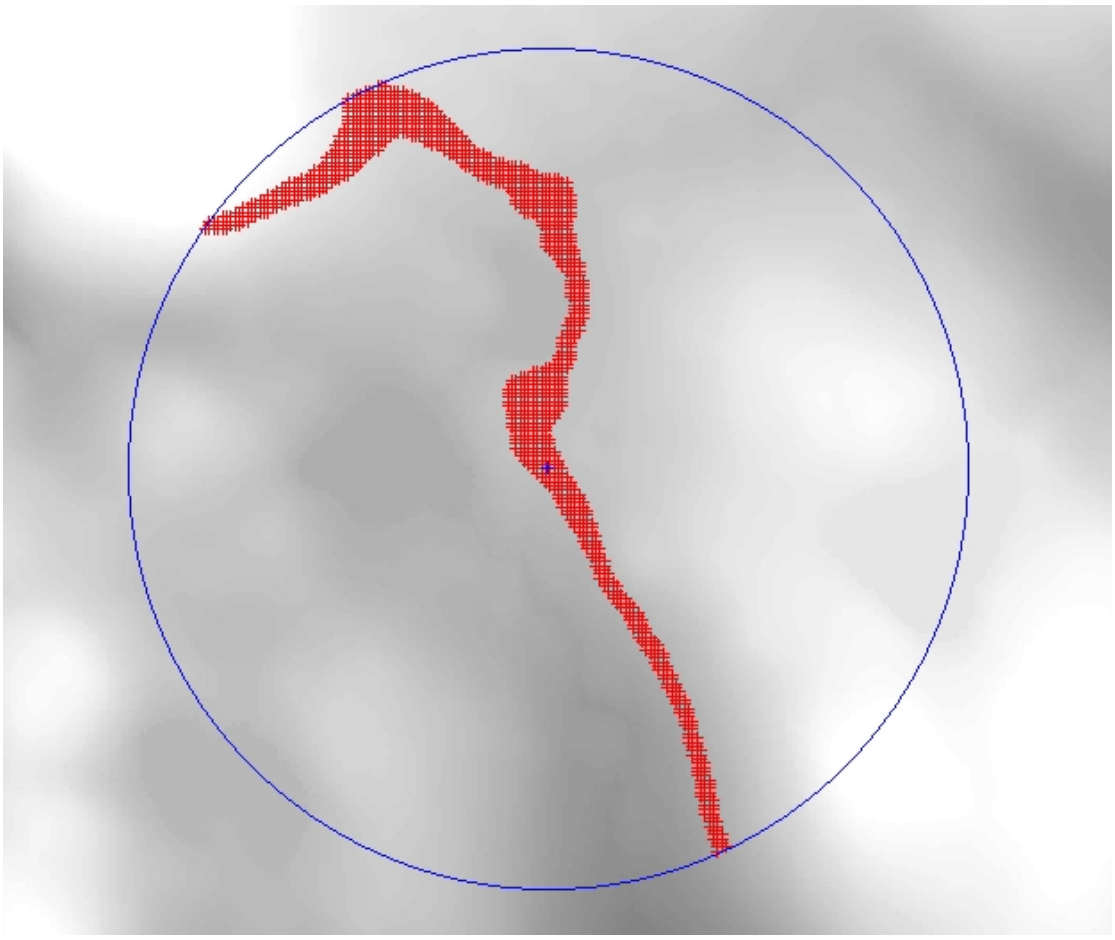
3. **Point Colour**: The colour used to display structure contours on the map display. Select from the pull down list of colours. Through the use of different colours it is possible to display the results of several structure contour calculations on the map display at the same time.

Search Area

These three input values are used to define a circular search area. Only structure contours that fall within this search area will be identified. The three inputs are:

1. **Easting**: The National Grid Coordinate (Easting) of the centre of the search area. This value can be typed in manually or populated automatically as the Easting of the Observation Point by clicking on the **Use Easting and Northing of Observation Point** button.
2. **Northing**: The National Grid Coordinate (Northing) of the centre of the search area. This value can be typed in manually or populated automatically as the Northing of the Observation Point by clicking on the **Use Easting and Northing of Observation Point** button.
3. **Radius**: The radius in meters of the search area. This value can be typed in manually or a value can be selected from the dropdown list.

When all of the inputs have been entered, click on the **Calculate** button to run the tool. The progress of the tool is displayed, and once completed the results are displayed on the map display as graphics. An example result is shown below:



- The blue cross is the location of the Observation Point.
- The blue circle is the search area.
- Each red cross is a location where the estimated bed elevation is within the tolerance value of the ground elevation (forming a structure contour).

Important Notes on the use of the tool:

The Structure Contours are drawn as graphics onto the map display of ArcMap. To make a permanent copy of the results they must be converted into a Shapefile. An additional tool is provided for this purpose and is described below.

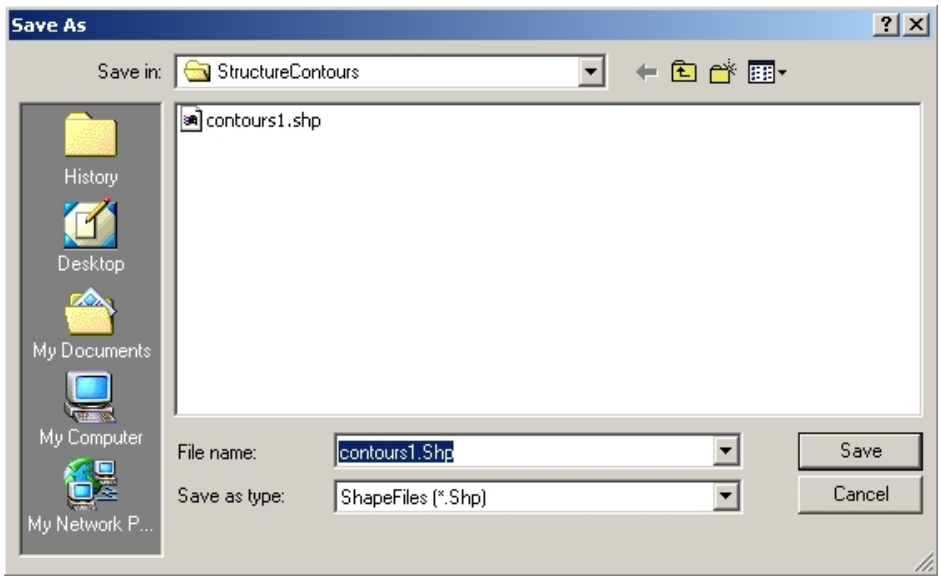
Slider controls have been included on the inputs form to simplify the process of manually entering values on a Tablet PC. The easiest way to enter a precise value using the sliders is to drag the pointer of the slider to roughly the right value (within 1 or 2) and then click just to the left or just to the right of the slider's pointer (causing the value to increment or decrement by 1) until the precise value is displayed.

4.2.2.2 DELETE STRUCTURE CONTOURS

Clicking the Delete Structure Contours button will remove the graphics created by the Structure Contour tool from ArcMap's map display. Note that any other graphics on the map display (that were not created by the Structure Contour tool) will not be removed.

4.2.2.3 SAVE STRUCTURE CONTOURS AS SHAPEFILE

Clicking the save Structure Contours as Shapefile button allows the user to save all the points created by the Structure Contour tool to a Shapefile, which can then be retrieved at a later time. The user is presented with the following dialog:



Navigate to the required directory, enter a filename and then click on the **Save** button to complete the operation.

Note that it is possible to overwrite an existing Shapefile, but not if that Shapefile is currently being used in the active ArcMap project.

4.2.3 Limitations of the Structure Contour Tool

When choosing a DTM or multiple DTMs for the Structure Contour Tool, the user is able to select from all raster layers held in the GIS, as it is not possible to distinguish DTMs from other raster layers such as OS 50k sheets. Make sure that **only** DTMs are selected. Otherwise it is possible that the Structure Contour Tool will attempt to get elevation values from a non-DTM raster layer.

5 Backing-up your data

We recommend that field data are backed-up each evening in the field in case your data becomes corrupted or the system fails. This also ensures that you will never lose more than one day of fieldwork.

Go to your Project area using Windows Explorer and **Copy** and **Paste** your DFDC.mdb file from your main Project Area to the ArchivedCopies Folder. Within the ArchivedCopies Folder rename DFDC.mdb to DFDC_UserID_Date, for example: DFDC_KIGL_08042009.mdb. Note that if the length of the renamed DFDC database is greater than 20 characters the tools to view old datasets in BGS·SIGMA*mobile* will fail due to the concatenation of the feature class names becoming too long.

6 Viewing sketches on the Desktop

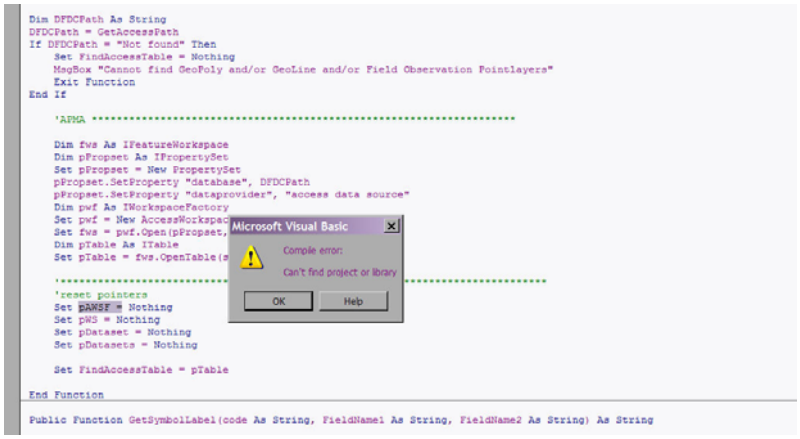
You can use the Précis Tool in BGS·SIGMA*mobile* to view your sketches or you can use the edit tool to edit a geological observation and also edit any associated sketch. The sketch tool on the System works with .ANT files in their native format, but it also saves a JPG file for use in any other programme.

7 Troubleshooting

Most bugs have been error trapped within the system either through the provision of a message box telling you what the problem is and how to alter it or through internal code. However, it is impossible to confirm that you won't encounter any errors. Be patient with the system. There is a lot of code working in the background to reduce the amount of data entry and button pushing you have to do. This takes time to run, so occasionally you might find things don't work as quickly as you may like. Some errors, along with their solutions are listed below.

7.1.1.1 ARCMAP CRASHES OUT TO THE VBA CODE ON FIRST USE

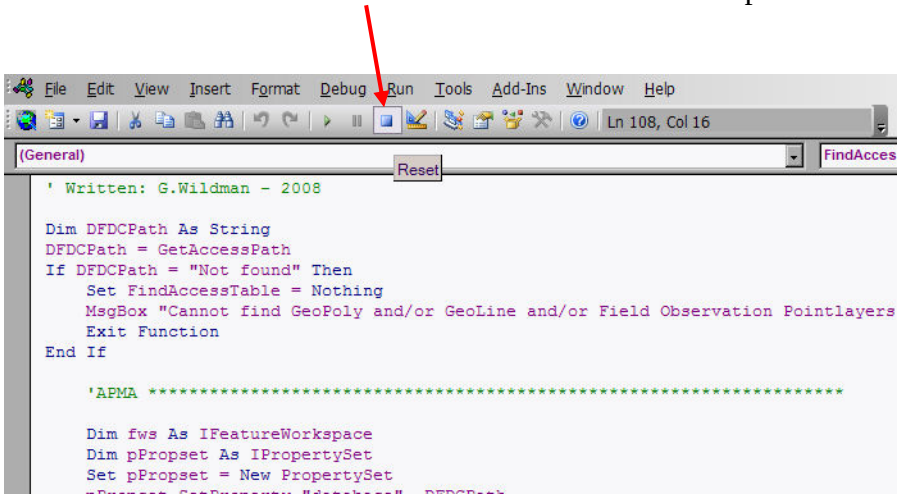
One possible error that may occur on first use of the system is that the system crashes out to the VBA code on first use. This is most likely to be caused by the fact that the PC / Tablet PC running BGS·SIGMA*mobile* does not have all the additional ESRI ArcMap extensions which BGS has access to. These extensions are not used by the BGS·SIGMA*mobile* application but are set up as standard references in ArcMap because the BGS·SIGMA*mobile* application has been developed in an environment where these ESRI extensions are available. If you do encounter a problem on first opening the BGS·SIGMA*mobile* application and it is a problem with the references then you will see something similar to the image below:



Please note that your error message will possibly be different to the one shown above depending on which reference is missing.

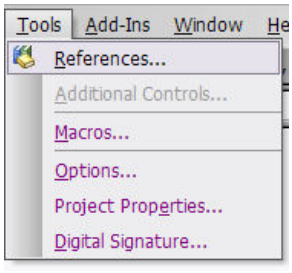
To solve this problem the following steps should be taken

- Click OK on the error message on screen
- Click on the Reset button on the toolbar to stop the code

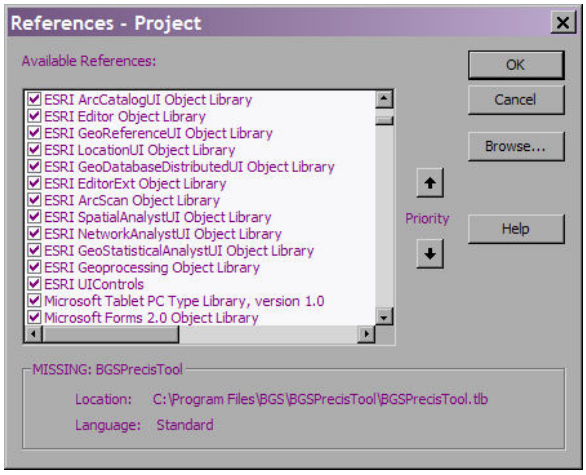


If the Reset Button is not visible turn on the toolbar containing this button by clicking View from the main toolbar followed by Toolbars > Standard

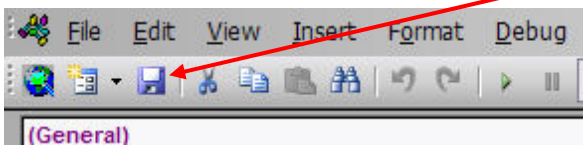
- Select References from the Tools Menu



- This will open the references dialog box. In the list of available references you will see some of the ESRI references marked as MISSING. Where this is the case turn these off by clicking in the check box next to the reference in the list. Click OK



- Save the code and references by clicking the Save button from the standard toolbar



- Close the code window and close ArcMap
- Reopen the BGS·SIGMA*mobile* – the problem should now be solved. If the same error occurs repeat the above steps and ensure that all the MISSING references have been turned off.

7.1.1.2 OTHER COMMON ERRORS

- **Not having the GeoPoly, GeoLine, National grid QS or Field observation point loaded into the GIS** or having them spelt incorrectly. These must be loaded, with the correct layer name spelling as in the Blank BGS·SIGMA*mobile* GIS.
- If whilst you use the BGS·SIGMA*mobile* system **you get asked to enable macros in Access** rather than viewing a data entry form, it is likely that you haven't set the security level to be low in Access. You will need to open the DFDC.mdb in Access 2003 and select Tools > Macro > Security and set the security level to low. This ensures that macros built in the system will work when fired up from ArcGIS.
- **The DFDC.mdb has been renamed**. This should never been renamed as the code between ArcMap and Access relies on knowing the access database filename. It should only be renamed when moving to be used in the SIGMA*desktop* or being backed up, and even then, the database does this automatically through a push of a button.
- **If there is more than one version of the same .mxd open**, or two MXD's pointing to the same geodatabase open, this can cause problems with the code. Only use one .mxd project at a time.
- **If the user has changed a button image using the customize button**, this seems to upset the default path for editing and the editing tools will no longer

work without falling over in the code. If this happens, refresh the code in the VBA editor and go to file, save as and overwrite the project. This resets the correct path.

- **If the database opens with an error**, check to ensure your virtual keyboard doesn't have SHIFT + CTRL highlighted. If this doesn't solve the problem, check to ensure that in Microsoft Access 2003 under tools/macro/security, the security level is set to low.
- **Problem displaying historical maps in correct location**. There is no projection set up in the world files relating to these datasets. For use of the GPS, the GoBook uses 2 projections that are displayed together, when you try to bring in the historical maps or air photos the software does not know how to project it so they may come in the wrong size. The files have .rrd and .aux files so it is possible to use some sample ArcMap code found in the raster samples to create a world file.

8 Using BGS·SIGMA*mobile* outside the UK

When you work overseas you will use a different coordinate system to the British National Grid to conduct your mapping. You will need to update BGS·SIGMA*mobile* (this includes the database and the ArcMap application) to reflect the coordinate system you will be using. The following guidance notes describe how to do this. Please also remember to follow the generic BGS·SIGMA*mobile* installation instructions.

1. Copy a new empty BGS·SIGMA*mobile* to your PC.
2. You will need to create an equivalent NationalGridQS layer for the area of interest (AOI) you are working in. If you have an existing polygon outline or a similar file to the National Grid for the AOI than one of these are ideal, otherwise grabbing, for example, the outline of a country from ESRIdata will also work. The example we will work with is for the country of Ethiopia.
    a. Open a blank ArcMap Project, and set the Layer projection to WGS 1984, UTM37N (for Ethiopia). Browse to your copy of ESRIdata and add in a Country_Outlines.lyr Layer or Shapefile. Open the Attribute Table and Select Ethiopia. In the Table of Contents, right-click on Country Outlines, and export the selected feature (Ethiopia) using the coordinate system of the data frame. Call this Ethiopia_UTM37N.shp or similar and save within the SIGMA*mobile* project. Add the feature to the map.
3. It is essential that the polygon outline or grid of the country has a field name called QS. This should be a text field of maximum 50 characters and should be populated with the name of the map sheet.
    a. Continuing on from 2a, within ArcMap, open the Attribute Table for Ethiopia_UTM37N. Click Options, Add Field, QS, Text, Length – 50. In this case, Editor, Start Editing, and type in 'Ethiopia' into the QS column. Editor, Save Edits, Stop Editing.

i. If you have a file similar to the National Grid for your AOI, then use the Field Calculator to update the QS field based on the sheet names.

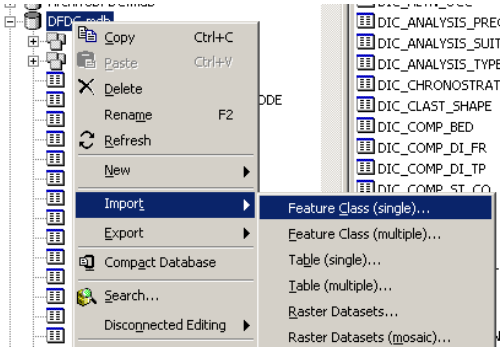
ii. It is best to keep this file as small as possible – so deleting unnecessary fields would be ideal. This can be done using Delete Field (management) in ArcToolbox. Remember that QS is the most important field.

4. Close ArcMap and open ArcCatalog. Browse to your Project Folder (where your blank BGS·SIGMAmobile is stored) and click on DFDC.mdb. Rename NationalGridQS to NationalGridQSBNG.

5. Continuing in ArcCatalog, import Ethiopia_UTM37N into the geodatabase.

    a. Do this by right-clicking on DFDC.mdb and choosing import, feature_class (single).

    b. Input Features: browse to Ethiopia_UTM37N.shp and Output Feature Class: NationalGridQS. OK.

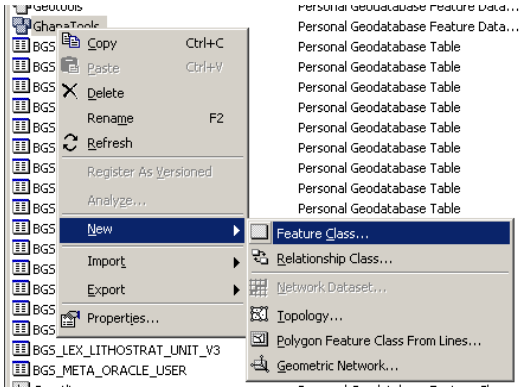


6. Now open the BGS·SIGMAmobile.mxd (note, you may have renamed this).

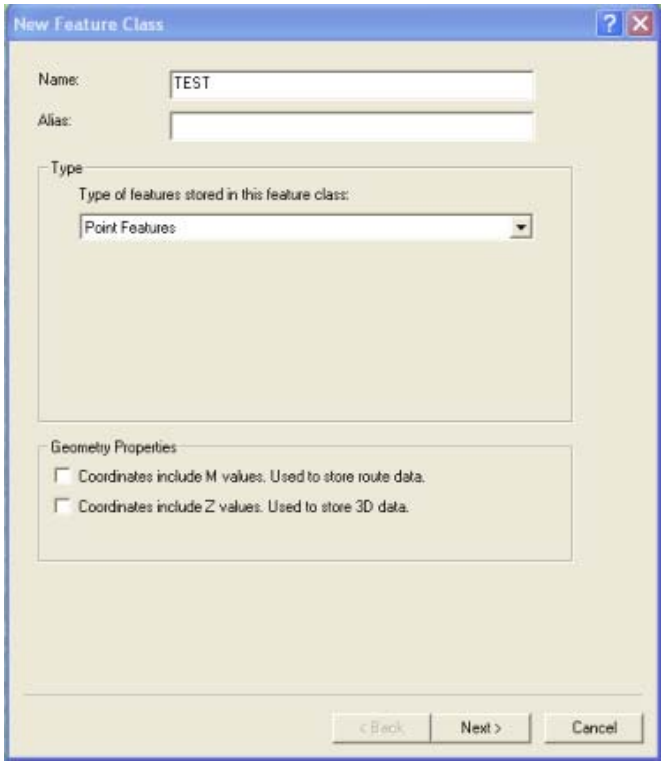
7. You will need to set the coordinate system of the data frame to the appropriate coordinate system for your overseas mapping project by right clicking on "Layers" and selecting properties. You can choose to import the coordinate system from a dataclass or select the appropriate one for your project. (The same as in step 2a)

8. Next you will update the spatial references of some of the Feature Classes in the DFDC. Close the BGS·SIGMAmobile.mxd (save changes) and open ArcCatalog.

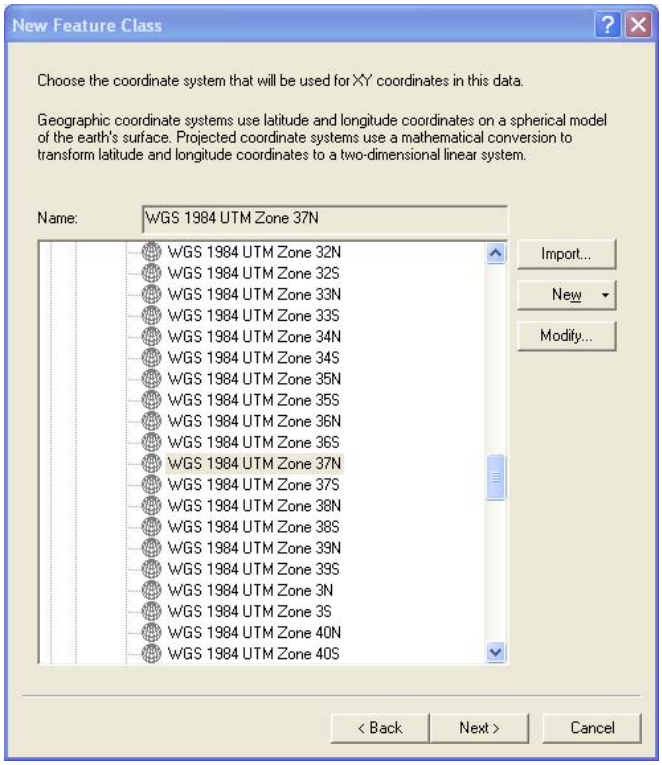
9. In ArcCatalog browse to the DFDC database in your Project Folder. Add a new Feature Class called "TEST" by right-clicking on DFDC.mdb, New - Feature Class. (If there is already a feature class called "TEST" – then name this "TEST2").



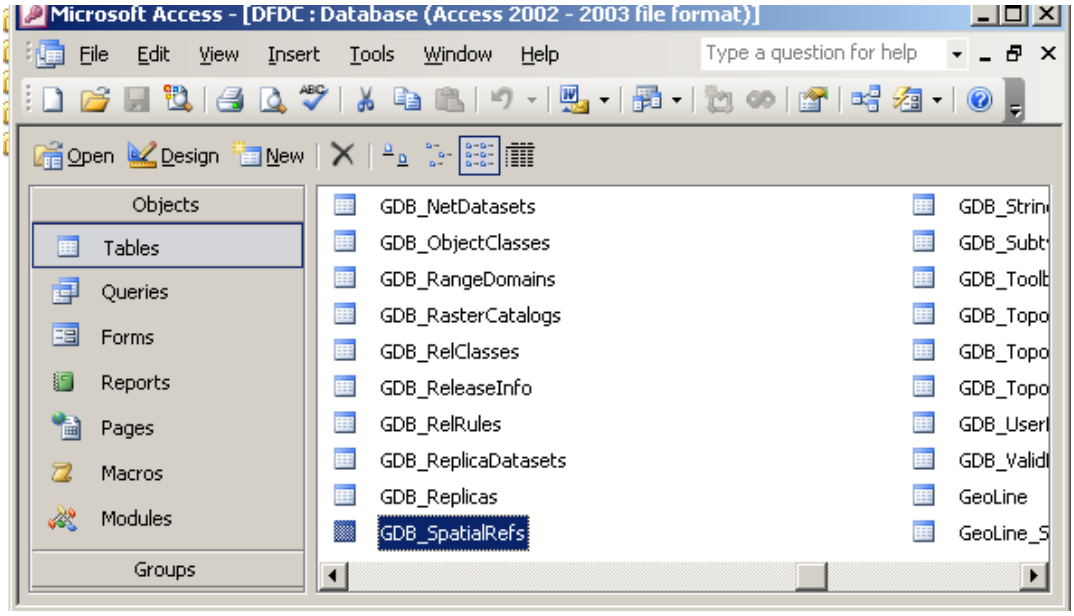
10. In the new window shown below, enter the name “TEST”, and select point features as the type. Click Next.



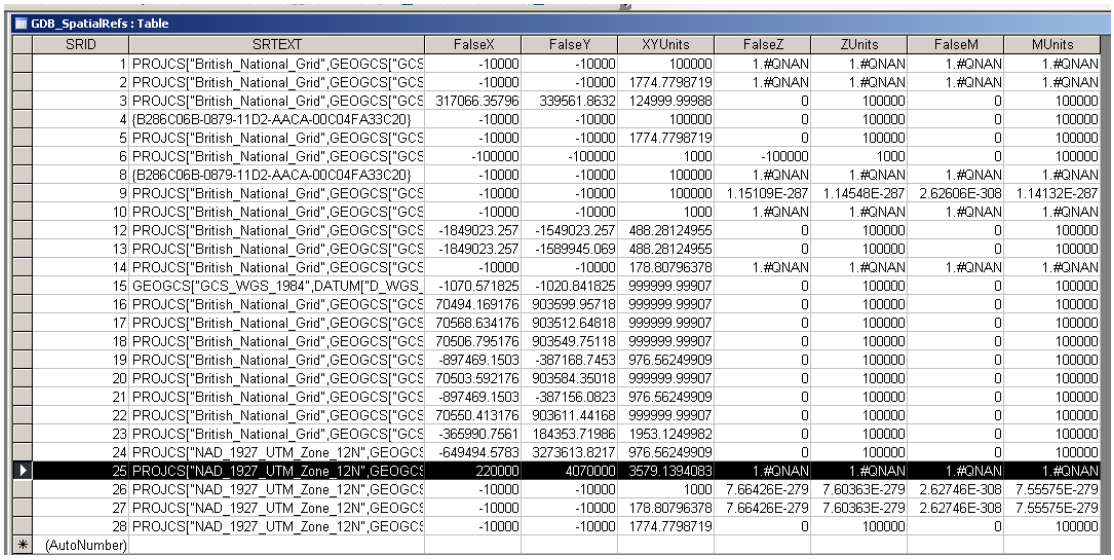
11. Select your coordinate system from the following window. Click Next and Next again to XY tolerance.



12. Click OK and Finish.
13. Within the DFDC we will now need to set the Projection for all of the Feature classes present. These are: FIELD_OBSERVATION_POINT, GeoLine, Geopoly, Graphics, and MapFaceNotes.
    a. To change the projection, double click on the Feature Class in the DFDC.mdb to bring up the Properties dialog box and select the XY Coordinate System tab. Either select or import the projection and click OK.
14. Close ArcCatalog.
15. In Windows Explorer, open the DFDC.mdb in Access 2003. Either you will have to select Window, Unhide, and Tables or select Design View and Tables to view the database tables (you may have to close the Form to see the objects list).
16. In Table view select the table GDB_spatialRefs and open this



17. You should notice that one row in the table will represent the spatial reference system for the "TEST" data class you created. The SRTEXT field should match the coordinate system you will be using overseas.

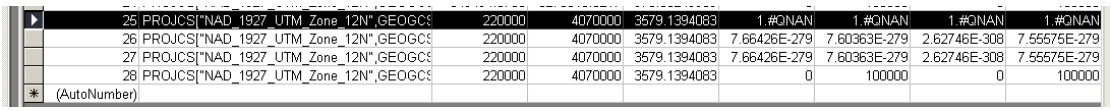


GDB_SpatialRefs : Table

SRID	SRTEXT	FalseX	FalseY	XYUnits	FalseZ	ZUnits	FalseM	MUnits
1	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	100000	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
2	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	1774.7798719	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
3	PROJCS["British_National_Grid",GEOGCS["GCS	317066.35796	339561.8632	124999.99988	0	100000	0	100000
4	{B286C06B-0879-11D2-AACA-00C04FA33C20}	-10000	-10000	100000	0	100000	0	100000
5	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	1774.7798719	0	100000	0	100000
6	PROJCS["British_National_Grid",GEOGCS["GCS	-100000	-100000	1000	-100000	1000	0	100000
8	{B286C06B-0879-11D2-AACA-00C04FA33C20}	-10000	-10000	100000	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
9	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	100000	1.15109E-287	1.14548E-287	2.62606E-308	1.14132E-287
10	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	1000	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
12	PROJCS["British_National_Grid",GEOGCS["GCS	-1849023.257	-1549023.257	488.28124955	0	100000	0	100000
13	PROJCS["British_National_Grid",GEOGCS["GCS	-1849023.257	-1589945.069	488.28124955	0	100000	0	100000
14	PROJCS["British_National_Grid",GEOGCS["GCS	-10000	-10000	178.80796378	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
15	GEOGCS["GCS_WGS_1984",DATUM["D_WGS_	-1070.571825	-1020.841825	999999.99907	0	100000	0	100000
16	PROJCS["British_National_Grid",GEOGCS["GCS	70494.169176	903599.95718	999999.99907	0	100000	0	100000
17	PROJCS["British_National_Grid",GEOGCS["GCS	70568.634176	903512.64818	999999.99907	0	100000	0	100000
18	PROJCS["British_National_Grid",GEOGCS["GCS	70506.795176	903549.75118	999999.99907	0	100000	0	100000
19	PROJCS["British_National_Grid",GEOGCS["GCS	-897469.1503	-387168.7453	976.56249909	0	100000	0	100000
20	PROJCS["British_National_Grid",GEOGCS["GCS	70503.592176	903584.35018	999999.99907	0	100000	0	100000
21	PROJCS["British_National_Grid",GEOGCS["GCS	-897469.1503	-387156.0823	976.56249909	0	100000	0	100000
22	PROJCS["British_National_Grid",GEOGCS["GCS	70550.413176	903611.44168	999999.99907	0	100000	0	100000
23	PROJCS["British_National_Grid",GEOGCS["GCS	-365990.7561	184353.71986	1953.1249982	0	100000	0	100000
24	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	-649494.5783	3273613.8217	976.56249909	0	100000	0	100000
25	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	220000	4070000	3579.1394083	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
26	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	-10000	-10000	1000	7.66426E-279	7.60363E-279	2.62746E-308	7.55575E-279
27	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	-10000	-10000	178.80796378	7.66426E-279	7.60363E-279	2.62746E-308	7.55575E-279
28	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	-10000	-10000	1774.7798719	0	100000	0	100000
(AutoNumber)								

18. The rows after the highlighted row should all have the same coordinate system as the area you will be mapping in, but the FalseX, FalseY, precision and XY Tolerance values will differ to your "Test" dataset. These remaining rows represent the GeoTools, the Field Observation Points, the Map Face Notes, and the Graphics (the Feature Classes that we changed the projection for in step 13a). (Note that in our example it will be any rows called: "PROJCS["WGS_1984_UTMZone_37N"]

19. Replace the FalseX, FalseY, precision and XY Tolerance values in these rows with the values found in your "Test" row.



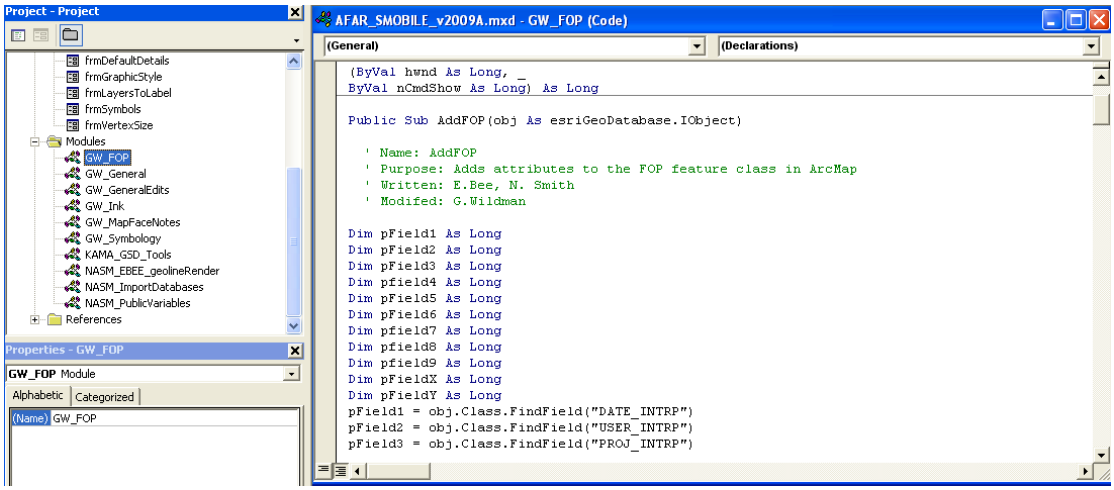
25	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	220000	4070000	3579.1394083	1.#QNAN	1.#QNAN	1.#QNAN	1.#QNAN
26	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	220000	4070000	3579.1394083	7.66426E-279	7.60363E-279	2.62746E-308	7.55575E-279
27	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	220000	4070000	3579.1394083	7.66426E-279	7.60363E-279	2.62746E-308	7.55575E-279
28	PROJCS["NAD_1927_UTM_Zone_12N",GEOGCS	220000	4070000	3579.1394083	0	100000	0	100000
(AutoNumber)								

20. Close the table; save changes and close the database.

21. Open your Project BGS·SIGMAmobile.mxd that you will be using overseas. Try adding a Field Observation Point and add a Sketch, a Mapface note, a Field capture line, and a Geopoly within the QS map area of your project area. If you can do this, you have successfully modified BGS·SIGMAmobile to be used overseas. If not, you may need to check that you have completed the steps above accordingly or seek further support.

22. The last thing you will need to do in order to have a working BGS·SIGMAmobile for overseas use is to change the hard coded reference system from BNG to the reference system you will be using.

    a. To do this, open the Project BGS·SIGMA*mobile*.mxd. Go to Tools/Macros/Visual Basic Editor. Locate the module GW_FOP and double click on it to open the code. In the right hand window, scroll down to the Public Sub AddFOP(obj As esriGeoDatabase.IObject) code.



23. Within this sub there is some code that looks like the following text shown in red:

If pfield7 > -1 Then

obj.value(pfield7) = "BNG"

End If

24. Where it reads “BNG” change this to be UTM37 or the correct text to describe the coordinate system you are using. **Note, you can only insert a word up to 6 characters long.** Click save and close down the Visual Basic Editor.