Fieldmove
User Guide

midland valley

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Introduction

FieldMove is a digital mapping app that has been designed for Apple, Android and Windows tablets. The app has been laid out in a map-centric format, allowing large-screen tablets to be used as a mapping sheet and data collection tool. Once enough data has been collected, the advanced line drawing tools, which include a virtual mouse for precision drawing, can be used to create geological boundaries and fault traces. Simple polygons can also be generated to mark the location of exposures and illustrate the wider distribution of rock types. Both lines and polygons can be modified using the editing functionality in the app.

FieldMove uses the available sensors in a tablet to measure the orientation of planar and linear features with a digital compass clinometer. The data captured can then be analysed using the built-in stereonet. Orientation data can be saved and stored in the app notebook, along with any sketches, field notes or editable photos. The tablet's GPS will geo-reference all saved data and provide real-time positioning updates on your chosen map.

FieldMove integrates the traditional tools used during field work under one platform, reducing the amount of kit required for field mapping. The app supports online maps (via MapBox.com), which can be pre-cached for offline access whilst in the field. It also supports the import of any custom maps that are saved as MBTiles, GeoTIFFs or osgEarth files.

Projects can be exported as a .csv file (comma-separated values, similar to an Excel spreadsheet), a .mve file (for direct import into Midland Valley's Move software) and a Google Earth .kmz file. In addition to this, multiple projects can be merged together within FieldMove, allowing for group work to be combined into one project.

This user-guide contains instructions on the functionality and common workflows used within FieldMove.

Disclaimer

The use of GPS devices, tablets and smartphones as navigation aids

The internal GPS in your device can be used to automatically set location information in the app, which is recorded as latitude and longitude.

Global Positioning System (GPS) devices are commonly used to aid navigation, having grown in popularity over the past decade. Over the last few years, this has extended to tablets, smartphones and digital compasses, which are often equipped with GPS functionality.

GPS is a valuable aid to navigation during fieldwork, however it is important to keep safety at the forefront, and we draw your attention to the advice given by many mountaineering councils:

"Everyone heading into the hills needs to learn how to read a map, and be able to navigate effectively with a paper map and traditional magnetic compass, especially in poor visibility."

FieldMove requires online data transfers for some features, such as accessing online maps and sharing exported files. Accessing these features over data network services may incur costs from your provider. If you use the app and data services on your tablet, you are responsible for any fees that your service provider charges. Your service provider is not the provider of FieldMove.

Midland Valley accepts no liability or loss, resulting from the use or misuse of this product.

Application Layout

This section provides an overview of the general layout of the FieldMove app and briefly describes its tools and features. When a new FieldMove project is opened, the following view is displayed:
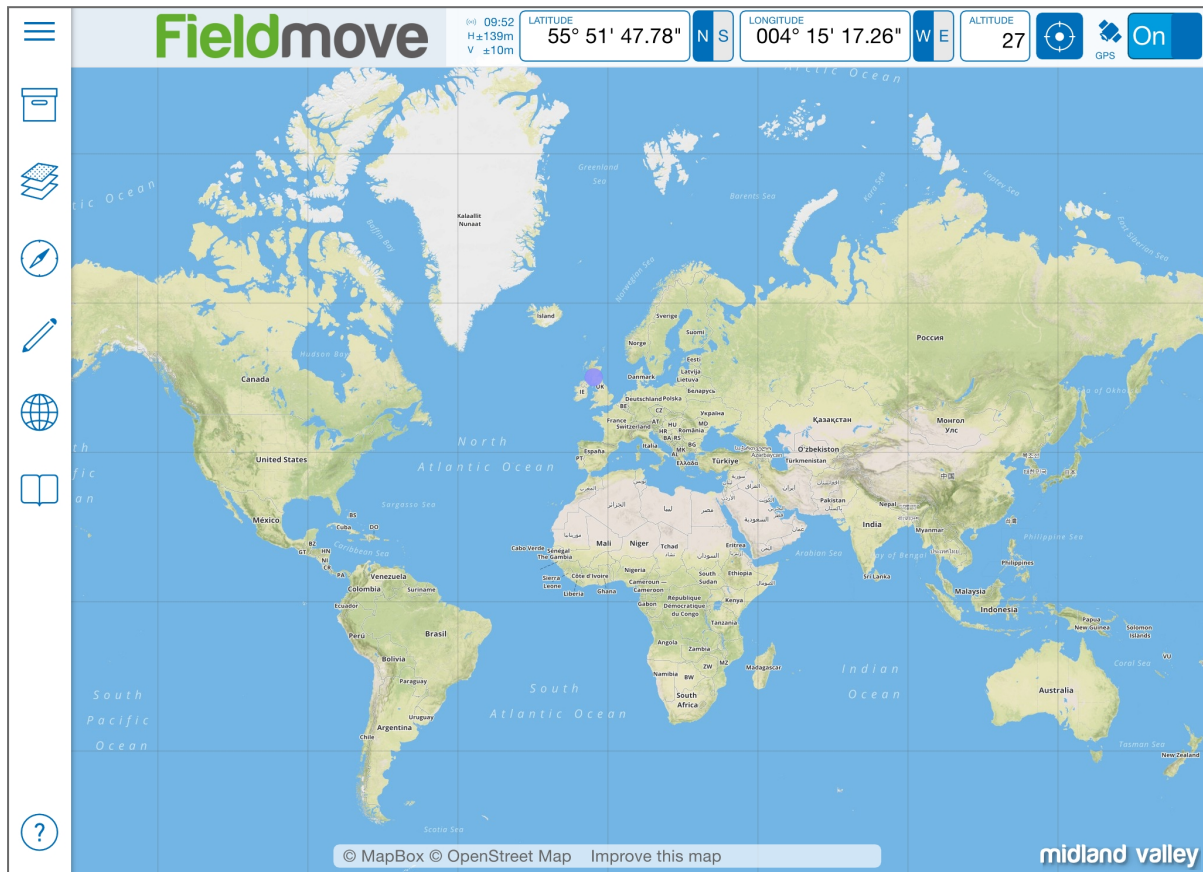

Figure: The default display when a new FieldMove project is opened. Shown is the map view, along with the Location bar (top right) and Side Panel (left).

Location Bar

The **Location Bar** is situated above the map view, on the right hand side. It will display your current location in lat/long format. It is also used to turn the GPS on/off and locate your position within the map view.

Side Panel

The **Side Panel** is located to the left of the map view. It contains access to a number of pages that can be opened on selection. The pages are arranged in an order that reflects the typical workflow that a geologist would adopt when carrying out fieldwork. The **Side Panel** can be expanded by tapping ☰ in the top left.
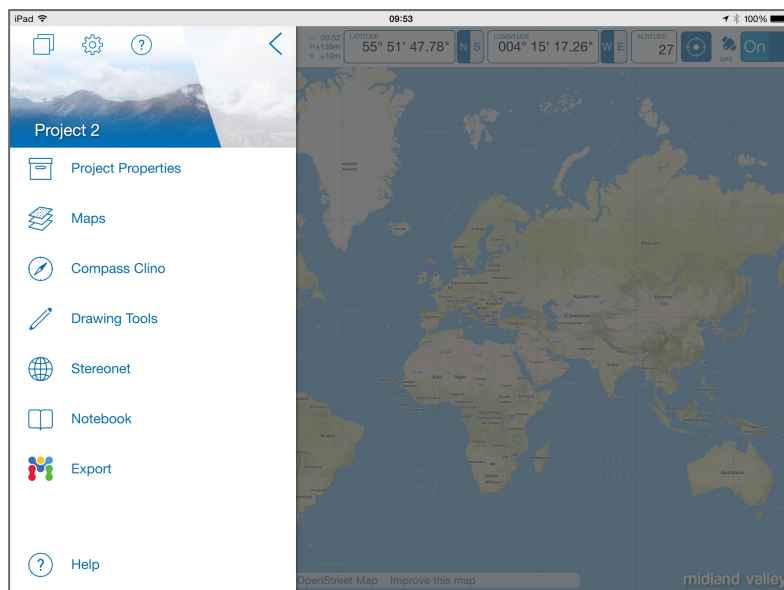
It will list the following pages:

Figure: Expanded Side Panel displaying the pages that can be opened on selection.

🔲 Project Properties

The **Project Properties** page contains details of the active project. This includes the name, creation date, declination, locality naming set-up and a project description. In the **Project Properties** page, you can merge the active project with a second project. The active project can also be exported from here.

🔶 Maps

Use the **Maps** page to import basemaps in MBTile, GeoTIFF or osgEarth format. Alternatively, use the Maps page to switch between satellite, road or terrain maps, which can be accessed providing you have a valid network connection.

🧭 Compass Clino

Use the **Compass Clino** page to take a bearing and record the orientation of planes and lineations. Localities and a stratigraphy, or list of rock units, can also be created on this page.

✏️ Drawing Tools

Use the **Drawing Tools** page to digitize lines and polygons on the map. The line type, thickness, opacity and unit assignment can be set up for each line or polygon. Localities and a stratigraphy, or list of rock units, can also be created on this page.

🌐 Stereonet

Use the **Stereonet** page to plot orientation data as poles and/or planes on an equal area or equal angle stereonet. Data can be filtered by its assigned locality, unit or type.

📖 Notebook

Use the **Notebook** page to create geo-referenced field notes, photos, map screenshots and sketches. The Notebook page will list all saved data (orientation measurements, line and polygon data, notes, photos, stereonet screen captures etc.) by locality. The **Notebook** page also allows for data to be edited, moved and deleted if necessary.

🎨 Export

Use the **Export** page to export the project to various formats, including the .mve file format, which allows data to be imported straight into the Move software for model building and analysis.

Extra options available from the Side Panel include:

⊠ Exit Application

Tap this button to exit FieldMove (Windows tablets only).

⤢ Full Screen Mode

Tap this button to enter into full screen mode (Windows tablets only).

⌖ Exit Full Screen Mode

Tap this button to exit full screen mode. This button will only be available if you are in full screen mode (Windows tablets only).

▢ Project Management

Tap this button to open the **Project Management** window. This page lists all available projects that have been created in FieldMove. Each saved project can be opened from this page, new projects can be created or external projects can be imported.

⚙ Settings

Tap this button to open the **Settings** window. Settings relating to basemaps, units, coordinates, line join distance, compass clino mode, sensors and cache reset can be changed from here.
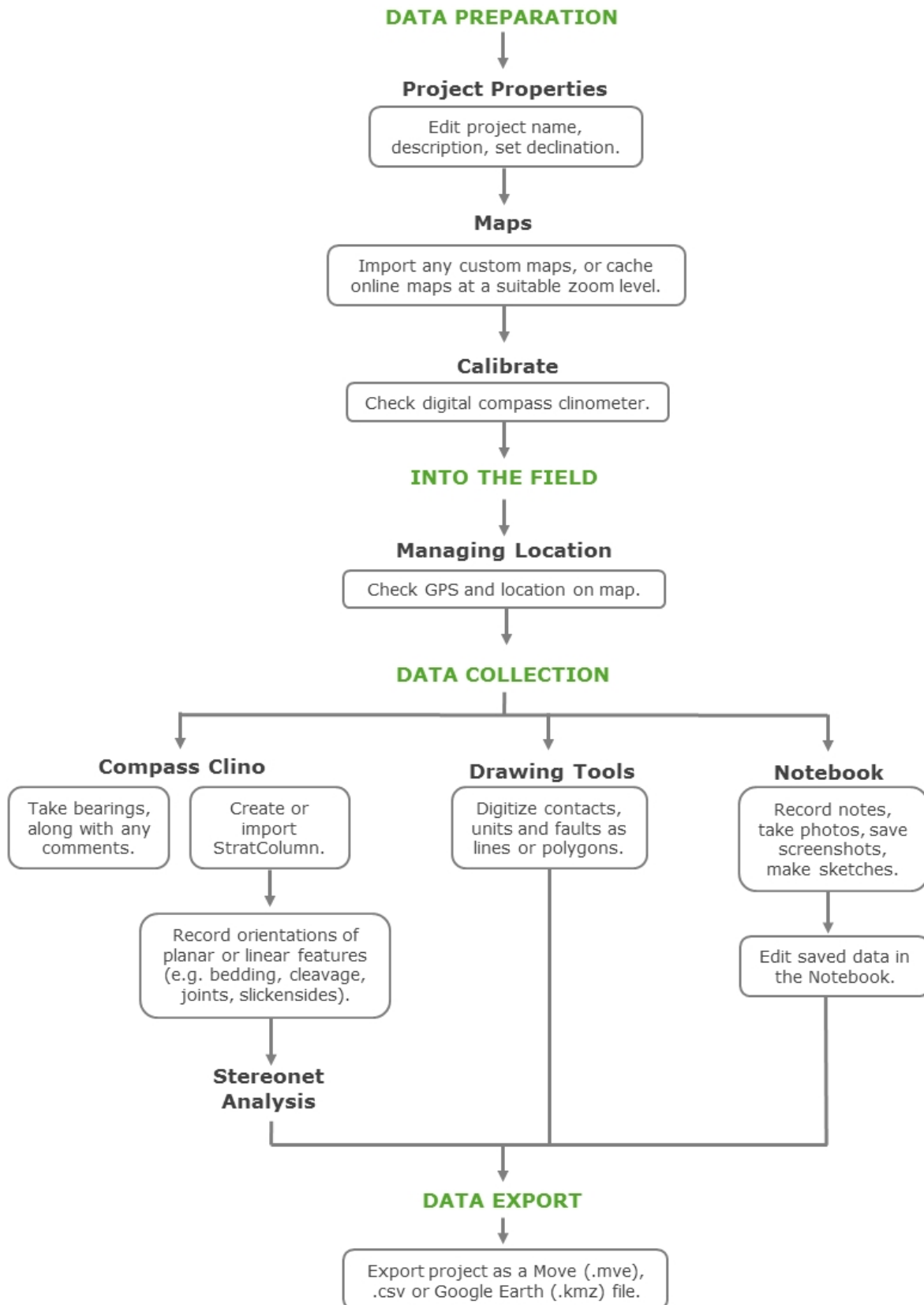
⍰ Help

Tap this button to open the FieldMove help pages.

FieldMove Workflow

Shown below is a suggested workflow for using FieldMove when mapping.

DATA PREPARATION

↓

Project Properties

Edit project name, description, set declination.

↓

Maps

Import any custom maps, or cache online maps at a suitable zoom level.

↓

Calibrate

Check digital compass clinometer.

↓

INTO THE FIELD

↓

Managing Location

Check GPS and location on map.

↓

DATA COLLECTION

Compass Clino

Take bearings, along with any comments.

Create or import StratColumn.

↓

Record orientations of planar or linear features (e.g. bedding, cleavage, joints, slickensides).

↓

Stereonet Analysis

Drawing Tools

Digitize contacts, units and faults as lines or polygons.

Notebook

Record notes, take photos, save screenshots, make sketches.

↓

Edit saved data in the Notebook.

DATA EXPORT

↓

Export project as a Move (.mve), .csv or Google Earth (.kmz) file.

Settings

Prior to going into the field, it is important to check the basic app settings. Expand the **Side Panel** by tapping ☰ , then tap ⚙ to open the **Settings** window.

Note: The header of the **Settings** window will also display the FieldMove version number.
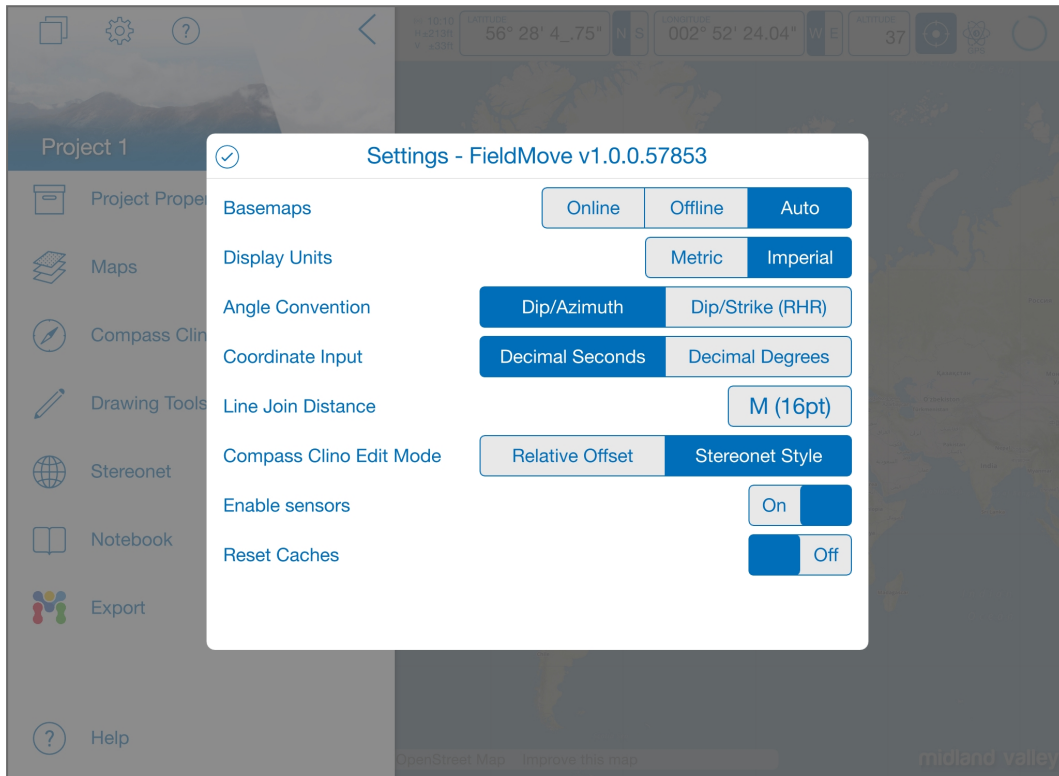
Figure: Settings window.

The selected feature will be highlighted in blue. To apply any changes make sure to tap ✓ before closing the window. The following settings can be adjusted:

Basemaps

This setting determines whether the app uses basemap tiles from the internet (**Online**) or whether it uses those that are already cached on the device (**Offline**). Switching between Online/Offline will cause the map to appear fuzzy until it has re-rendered. The default mode **Auto**, switches between online and offline-cached modes based on its ability to communicate with the basemap tile server.

Display Units

This will determine whether the altitude and scale bar is displayed it in **Metric** (default) or **Imperial** units.

Angle Convention

Choose between displaying planar or linear orientations as **Dip/Azimuth** (default) or **Dip/Strike (RHR)**. Both conventions are saved when the project is exported.

Coordinate Input

Choose to display the lat/long coordinates as degrees, minutes and seconds before the decimal point (**Decimal Seconds**) or just as degrees (**Decimal Degrees**).

Note: FieldMove uses the Lat/Long WGS84 projection system. If a different coordinate system is required, it can be altered once the project is in Move.

Line Join Distance

The **Line Join Distance** defines the extent (in points) at which it is possible to extend or join a line when using the **Drawing Tools**. Values range from 8 to 24 points, in 4 point increments. The higher the value, the greater the distance across which lines will be joined.

Compass Clino Edit Mode

This setting affects the interactive control in the **Compass Clino** page once a measurement has been locked, or if the tablet sensors are disabled/unavailable and orientation measurements need to be entered manually. If **Relative Offset** is selected then edits to the dip and strike/dip azimuth are carried out individually. The dip can be edited by dragging your finger in the direction indicated by the arrows in the blue circle, shown on the clinometer face. Whereas the dip azimuth/strike can be edited by dragging your finger in a circular motion around the edge of the clinometer face.
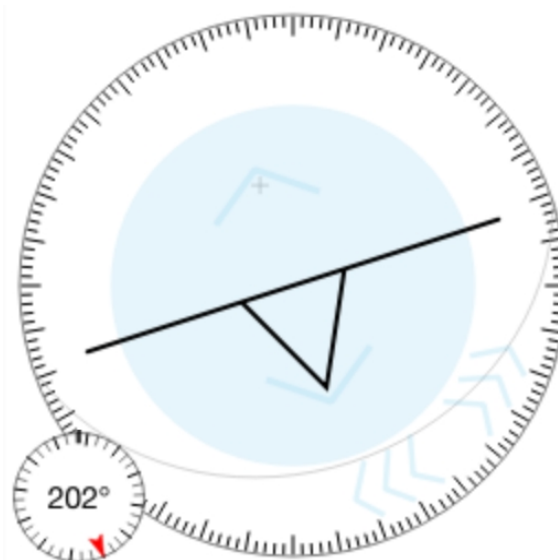

Figure: Locked clinometer face showing the Relative Offset editing mode. The dip and azimuth can be edited individually by following the direction of the blue arrows.

If **Stereonet Style** has been selected, edits to the dip/plunge and strike/azimuth can be made at the same time by dragging the dark blue cross (highlighted by a light blue circle) around the clinometer face. The latter is the equivalent to moving the pole to the plane on a stereonet.
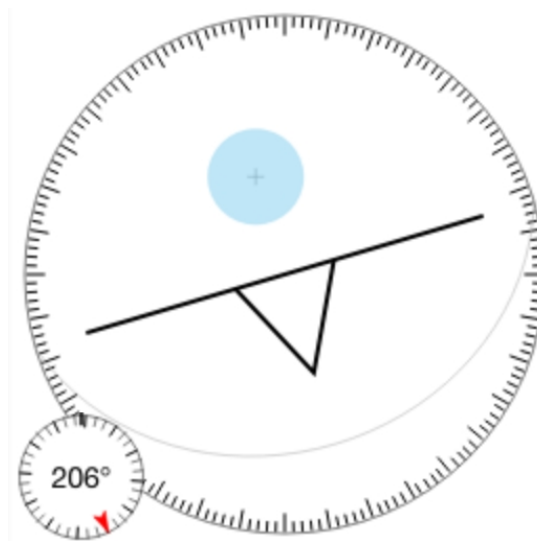

Figure: Locked clinometer face showing the Stereonet Style editing mode. The dip and azimuth can be edited by tapping a moving your finger within the blue circle.

Enable Sensors

The sensors in your tablet are used to take orientation measurements in the **Compass Clino** page. Some tablets may have poorly calibrated or inaccurate sensors; this setting allows them to be turned off. Readings can be taken with a traditional compass clinometer and input manually into FieldMove.

Reset Caches

This is set to off by default. If this setting is turned on, the next time the app is restarted, any cached maps will be cleared. The app has to be terminated and restarted for cached maps to clear.

Use Built-in Image Gallery

This setting is only available on Windows and Android tablets. If activated you can insert an image into the project using a file browser, which will show thumbnails for importable images within the app. If deactivated, files can be picked using the photo gallery on Android tablets, or system file dialogue on Windows tablets.

Digital Compass Calibration

Internal Sensors in your Tablet

FieldMove relies on three hardware sensors within the device, a **magnetometer**, a **gyroscope** and an **accelerometer**. These sensors have been programmed to measure the orientation of planar and linear features in the field. The three sensors are installed as standard in all **Apple** tablets (iPad and iPad mini), but are not always present in **Android** or **Windows** tablets.

These electronic components may vary in quality and are subject to a number of limitations including other internal and external magnetic materials (the hard iron effect). As with a traditional compass-clinometer, always be aware of items which may interfere with the magnetic field. This may come from magnets, ferrous metals, watches, other electronic devices and tablet cases.

In addition to external interference, the quality of the sensors installed in Apple, Android and Windows tablets varies considerably and at the time of writing (June 2015) we have been unable to find an Android or Windows tablet that will produce a reliable reading from both the digital compass and the clinometer. The Apple tablets appear to contain high quality components and the compass readings are generally accurate to ±5 degrees, with very good clinometer accuracy – similar to FieldMove Clino on the iPhone.

No matter what hardware you have, it is still important to know your device and you should compare the output from your tablet with a traditional hand-held compass clinometer before going into the field. Do not attempt this comparison inside. You need to be outside and away from any magnetic or electrical interference. We recommend that you collect data by holding the tablet in a variety of orientations (landscape and portrait mode, at various angles on a planar surface, and with the long edge pointing up and down for linear features). You should obtain closely similar measurements regardless of the orientation of the device. A range of different readings might indicate a faulty sensor, or interference from another magnetic or electrical source. The iPad's in our testing programme appear to record accurate data irrespective of the orientation of the tablet, however some other tablets have a preferred orientation that is the more accurate.

If you have no sensors, poor quality sensors, or the sensors are consistently effected by external interference, we would advise that you input your compass and/or clinometer readings manually – either from a traditional compass-clinometer, or by using the FieldMove Clino app on a smartphone. Even with compass and clinometer manual input you can still access the other functionality inside the application (drawing tools, stereonet, camera and notebook), and the data will be georeferenced correctly via the internal GPS. You can then export your data in a variety of formats and still save a huge amount of time compared to inking in and drawing up maps by hand.

Digital Compass and Sensor Calibration

All iPads will display a black screen with a small red ball that must be rotated within the confines of a graduated circle.
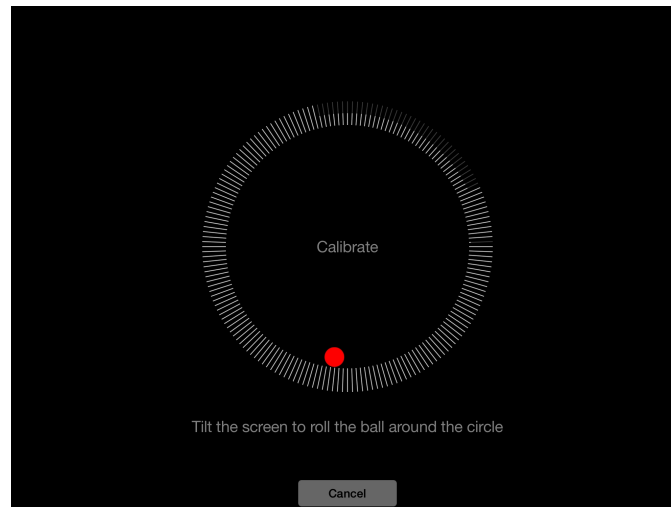
Calibrate

Tilt the screen to roll the ball around the circle

Cancel

Figure: Digital calibration of an iPad.

The compass clinometer within FieldMove will not become active or accurate until this operation has been performed. Both Android and Windows tablets appear to have internal calibration.

Digital Mappers of the Future

New Apple, Android and Windows tablets are regularly released into the marketplace and we will continue to test FieldMove on a variety of these new devices. There is no guarantee that the sensors installed in the latest model will be an improvement over the previous model. However, we will notify users as soon as we find a tablet (or range of tablets) that gives consistently reliable readings. If you are using FieldMove on a tablet and would like to tell us about your own experiences – good and bad, then we would be delighted to hear from you. Contact us at **www.mve.com/contact**

Project Properties

When FieldMove is opened for the first time, a new project called Project 1 will automatically be created. Specifics regarding the name of the project, declination, locality naming and description can be edited from the **Project Properties** page, which can be opened by tapping 🗋 from the **Side Panel**.

Note: If you do not wish to change any of the project properties continue to section '**Maps**'.
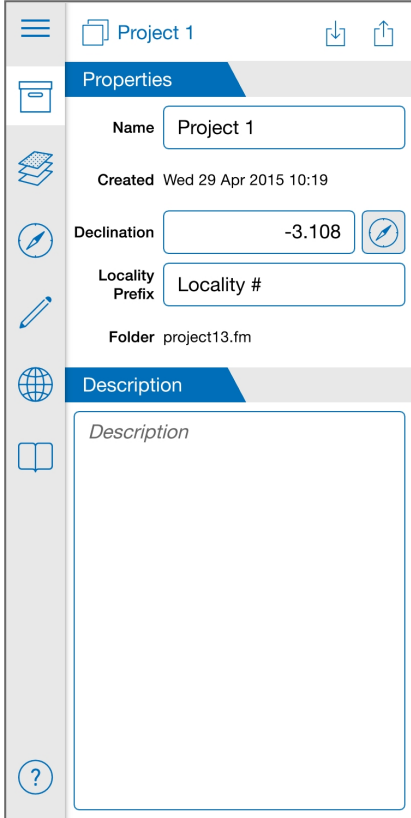
Figure: Project Properties page.

Editing Existing Project Properties

Name

By default the project name is **Project #**. Changing the name of the project will change how the project is referenced in the **Project Management** window. Although this will change the project name, the name of the .fm folder where the project is stored will stay fixed.

Created

This displays the date the project was first created.

Declination

The declination can be set by manually entering the value, or by tapping ⊘ . The declination will not update automatically. Therefore, if data is being collected over a large area, you should return to the **Project Properties** page and update the declination.

Note: All data in FieldMove is stored in true north.

Locality Prefix

By default the name assigned to localities is **Locality #**. Changing the locality prefix will change the default name given to created localities. The hash (#) indicates the position of the number in the name. If it is deleted the localities will no longer be numbered.

Folder

This displays the name of the .fm folder and the location where the active project is stored once the tablet is connected to a computer.

Description

The **Description** box can be tapped to add a detailed description of the project.

Merging Projects

In the **Project Properties** page, it is also possible to merge the active project with a previously created project. To merge two projects together tap ⬇ ; a list of projects saved on the tablet will be presented. Select the desired project to open the **Merge Project** window.

In the **Merge Project** window there is the option to ignore basemaps and/or images during the merge. Keep in mind that importing these will create multiple copies and will require extra storage space. Two projects can then be combined by tapping **Merge**.

When merging the two projects, the stratigraphy and symbol databases will be combined together. If the imported databases contain entries with the same name as those in the active project, the imported data will be assigned to the existing unit or symbol.

Maps

By default FieldMove will open the terrain map view . The display of online maps and import of offline maps is controlled from the **Maps** page, which can be opened by tapping ⧉ from the **Side Panel**.
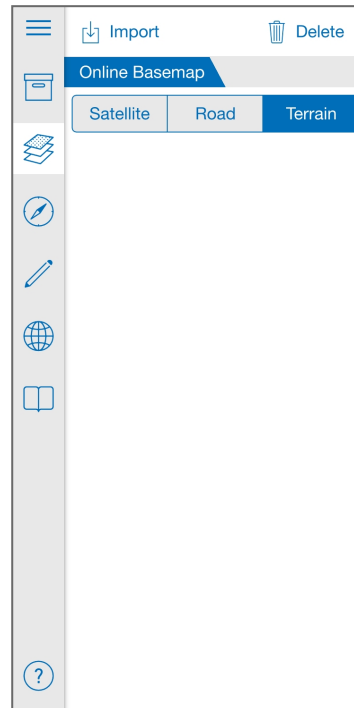

Figure: Maps page showing the online basemap display options. As of yet, no custom (offline) maps have been imported into the project.

Imported (Offline) Maps

Maps, which may contain geological, topographic and geophysical information, can be imported into FieldMove as MBTiles, GeoTIFFs and osgEarth files.

MBTiles

We would recommend importing offline custom basemaps as **MBTiles**. The advantage of this is that the zoom level can be set to a higher level of detail, suitable for mapping. MBTiles also tend to render faster than GeoTIFFs due to the fact that they have been pre-processed to the correct projection and appropriate zoom level for display.

Midland Valley's Move software allows for the conversion of geo-referenced images to MBTiles in a couple of steps. For more information see the help pages within the Move software. Alternatively the following programs also allow for MBTile creation;

- Global mapper (Windows)
- Map Tiler (Windows/Mac OSX/ Linus)
- Arc2Earth plugin for ArcGIS (Windows)

Import Maps into FieldMove

The import of MBTiles, GeoTIFFs and osgEarth files depends on whether the tablet is an iPad or Android/Windows.

iPad Basemap Import

For Apple tablets, a basemap can be inserted into the project folder using iTunes. To do this, connect the iPad to the laptop or desktop computer that contains the saved MBTiles, GeoTIFF or osgEarth file. Then open iTunes, select the tablet from the iTunes toolbar (1), and select **Apps** from the device option panel (2). Scroll down to the list of apps and select FieldMove (3). A list of FieldMove project files will appear in the right-hand column. Click **Add File** (4), navigate to the saved basemap file and click **Open**. Then click **Sync** to update the iPad.
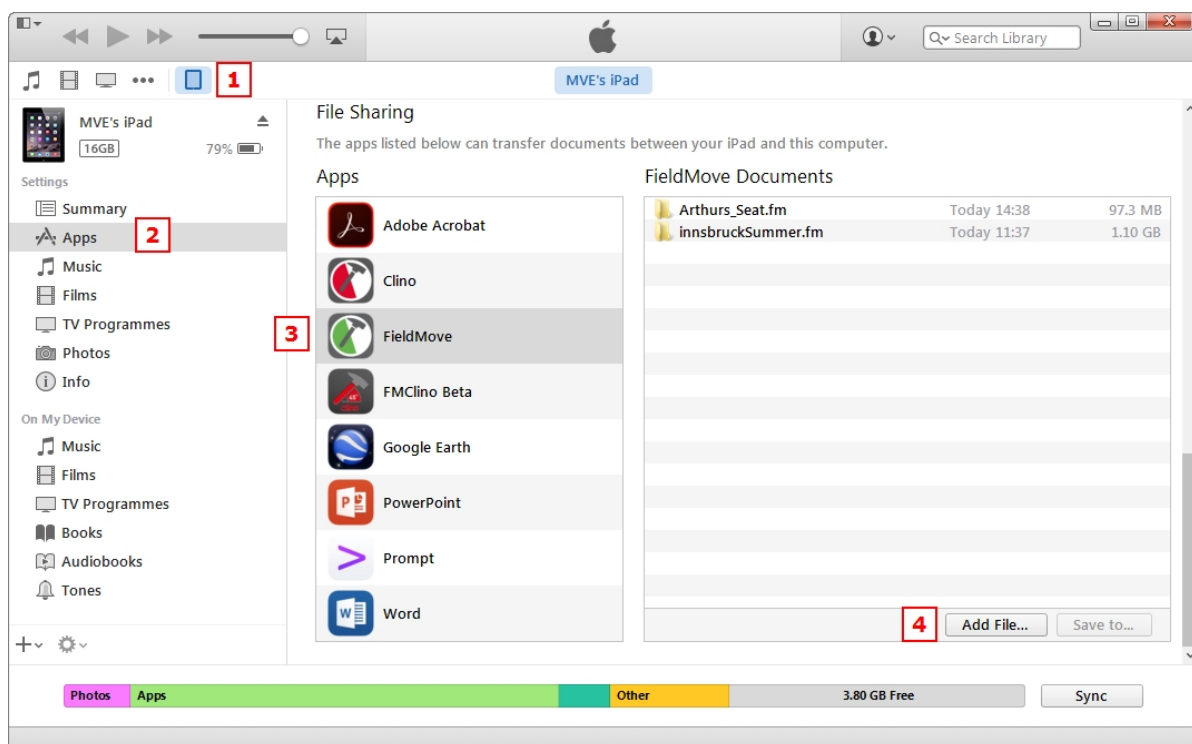
Figure: Import of a basemap via iTunes.

Once the file has been added via iTunes, in the **Maps** page of FieldMove, tap **Import** and select the desired basemap.

Android/Windows Basemap Import

To import a basemap using an Android or Windows tablet, connect the tablet to the laptop or desktop computer that contains the saved MBTiles, GeoTIFF or osgEarth file. Move the basemap from its saved location into the tablets **Internal Storage** > **FieldMove** folder. Then in the **Maps** page of FieldMove, tap **Import** and select the desired basemap.

Viewing Imported Basemaps

Multiple maps can be imported into FieldMove and they will be listed in the **Maps** page, under the heading **Imported Maps**.

To display any of the imported maps, tap ⊗ so that the button changes to ✓ . Multiple maps can be displayed at once. It is also possible to adjust the transparency of the map by tapping ⧠ . The third command ⊕ will centre the view on the selected map.

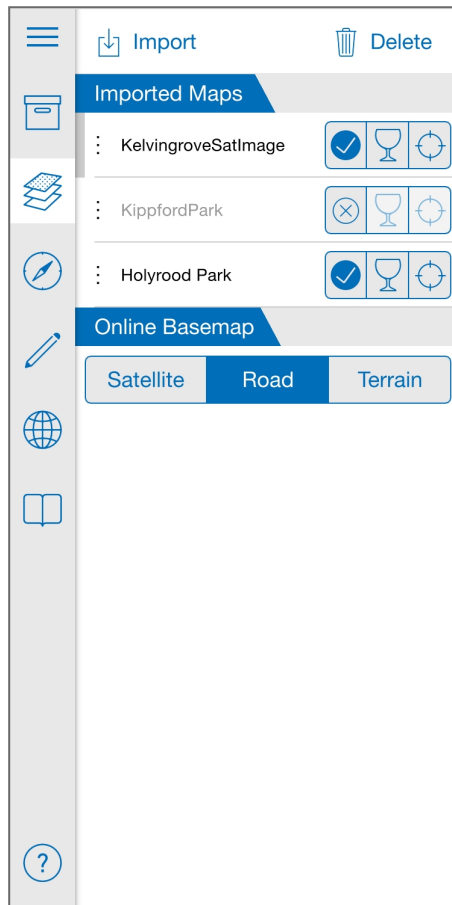The order of imported maps can be adjusted by dragging the map name.

Figure: Maps page listing three maps that have been imported into FieldMove.

Online Basemaps

Online maps can be displayed in three ways: satellite, road and terrain.
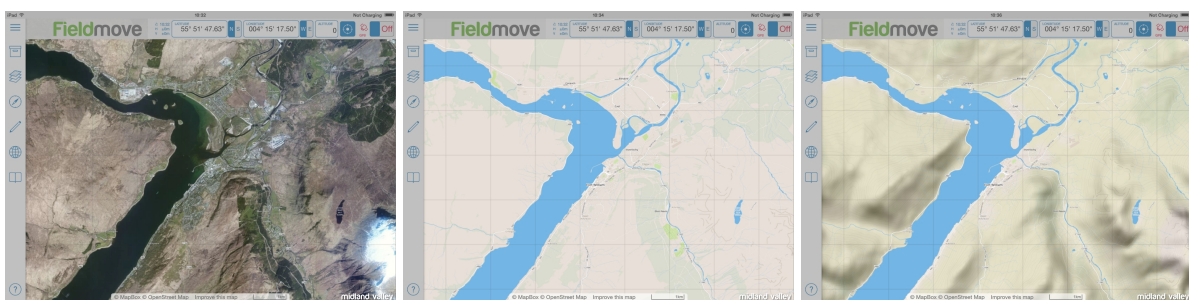
Figure: From left to right - satellite map, road map and terrain map.

Viewing Online Basemaps

To download and display online basemaps, a network connection is required. Online maps are downloaded from MapBox.com and are stored in a cache on the tablet. When zooming in/out of the map view, a blue loading circle will appear next to the map icon ⬚ to indicate that the map is still rendering. When the map has finished loading, the loading circle will disappear and the level of detail seen in the map view is saved to the cache.

Before going into the field (or to an area with no network connection) it is recommended that you zoom into the level of detail that you wish to see whilst mapping. Doing so will automatically store the map at that resolution in the cache. Once the tablet is offline, only the level of detail that is stored can be viewed. Saving to a cache is an automatic process that all tablets use to speed up programmes and apps that require repetitive data storage.

To clear the cache, expand the **Side Panel** by tapping ☰ . Tap ⚙ to open the **Settings** window and turn the **Reset Caches** option to **On**. The next time FieldMove is restarted the cache will be cleared.

Note: After resetting the cache, it may take a few minutes for the online maps to reload.

Imported maps (MBTiles and geoTIFFs) do not require online connectivity. These maps can be zoomed into and out of areas with no network connection and hence caching imported maps is not required. However, if working with osgEarth maps, these should also be cached using the same process as the online basemaps.

Managing Location

Before recording data in the field, it is important to recognise how the location is displayed and updated in FieldMove, and to be aware when data maybe recorded in the wrong place.

Note: Orientation data can be moved if it is saved in the wrong location, see section '**Notebook**'.

Using the GPS

FieldMove uses the tablet's GPS to geo-reference all recorded data and provide real-time positioning updates in the map view. This information is displayed as lat/long coordinates and an altitude reading in the **Location** bar, which is situated above the map view.
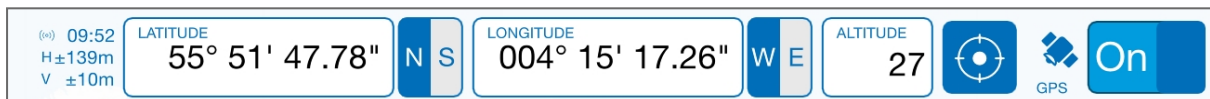
Figure: Location bar with the GPS turned on.

When the GPS is **On**, the map can be centred on your current location by tapping the cross-hair [⊕] . The location will be indicated on the map by a **blue circle** with a transparent halo. The size of the halo indicates the accuracy of the location reading - the smaller the halo the more accurate the reading.

The horizontal and vertical accuracy is also displayed numerically (+/- metres) in the **Location** bar, to the left of the lat/long coordinates. The last updated GPS reading is also given.

Figure: Map view showing the current location as a blue dot, with a transparent halo to mark the location accuracy.

Note: It is important to check the time of the last GPS reading to ensure that the location is continually being monitored.

Keeping the GPS on at all times is battery intensive, so when possible use the **Location** bar to turn the GPS off to preserve the battery life.

When the **GPS** is switched **Off**, the location will be displayed on the map as a **red circle**. This indicates the location at which any measurements will be saved to, if the GPS is not turned back on.

Once the GPS is turned back on, it may take a few seconds to update. In this case the **On/Off** switch will display a rotating loading circle ◯ .

Adjusting Your Location Manually

Current locations can be set manually without using the tablet's GPS. This can be carried out in two different ways:

- Tap on the latitude or longitude box, and type in the degrees/minutes/seconds corrdinates in the lat/long boxes. Upon entering a new value, the GPS will be automatically switched off.
- Alternatively, set your position using the cross-hair dragger, which will appear once you tap on the latitude or longitude box. Tap your finger on the translucent dragger and move it to set your new position. It is also possible to set the location by long tapping on the map. Once the cross-hair is moved it will change from blue to red.

Once the coordinates or position has been set, tap ✅ on the **Location** bar to apply the update.
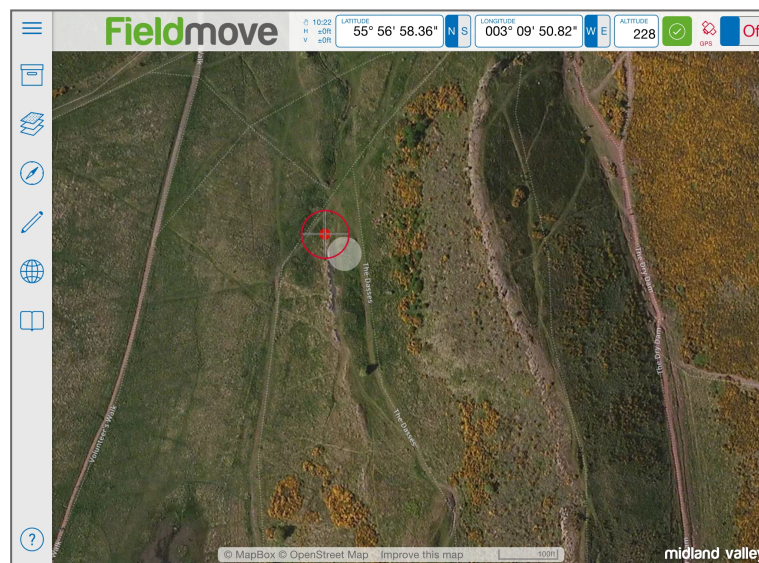

Figure: Map view showing the interactive cross-hair dragger (in red), which can be used to set your location manually.

Troubleshooting

All my data are in the same position, even though I entered different localities in different regions. ALWAYS check that your GPS is on and has been updated recently. Any measurement will be geo-referenced to your last know position. Therefore, if the GPS has accidentally been turned off, or has lost signal the most recent measurement will be positioned at the last GPS reading, which may be some distance from your true location.

Compass Clino

If you do not need to change the details of the project and are using cached online maps, the **Project Properties** and **Maps** pages do not need to be opened. The **Compass Clino** page can be opened immediately to start recording localities and orientation measurements in the field. The **Compass Clino** page can be opened by tapping ✐ from the **Side Panel**.

By default, the **Compass Clino** page will display the digital compass as the active face. The clinometer is displayed as a small inactive face, to the bottom right of the compass. To switch between each face, tap on the inactive face.
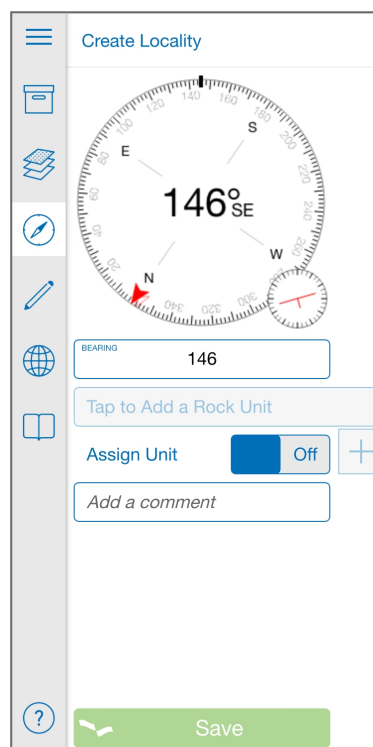
Figure: Compass Clino page showing the compass face as the active face.

Note: Measurements in, and exported from, FieldMove are stored relative to True North. This is calculated using the declination set in the **Project Properties** page.

Locality

When an orientation measurement is saved for the first time, it will automatically be assigned to the default 'Locality 1'. Control and creation of localities is carried out from the top of the **Compass Clino** page. It is a good idea to create new localities when new outcrops are encountered.

To add and change a locality assignment tap **Create Locality**. In the pop-up window, tap **Create Locality** once more. The locality naming is automatic and is controlled from the **Project Properties** page. A new locality is geo-referenced to your current position (providing the GPS is on) and once created, it becomes the active locality and is denoted by a grey vertical bar. Tap ⊘ once happy with the assignment.
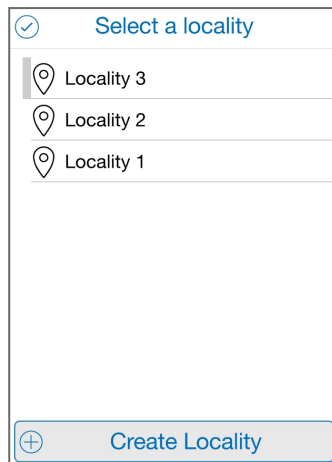
Figure: Select a Locality window, from where the active locality can be selected and new localities can be created.

Once a locality is created, it will be displayed in the map view as a pin icon ⍭ .

Note: Localities can also be created in the **Drawing Tools** page and the location, naming and description of a locality can be edited in the **Notebook** page.

When a measurement, line or polygon is saved, it is not possible to change the locality that these objects are assigned to. Therefore, make sure that the correct locality is labelled at the top of the **Compass Clino** or **Drawing Tools** page before saving.

Compass

The compass face will display a bold red arrow, showing True North, and a red outlined arrow, showing magnetic North. To record a compass bearing, hold the tablet horizontal and look towards your desired position. Give the compass a few seconds to stabilise before tapping on the compass face to lock it. When the compass is locked and you move to face a different orientation, a red bar will appear on the compass showing the deviation from the locked bearing.

Note: The compass works best when the tablet is held horizontal. See section '**Digital Compass Calibration**' for information on sensor consistency in different tablets.

Figure: Compass face locked at a bearing of 153°. Once the compass has been locked, any deviation from the 153° bearing is shown by a red bar.

Once the compass is locked, the bearing will be displayed in the map view as a black line at the centre of a cross-hair. As long as the GPS is on, and has been updated recently, the bearing will be geo-referenced to your current location. If the location needs to be edited, use the cross-hair dragger to move the bearing (see section '**Managing Location**').
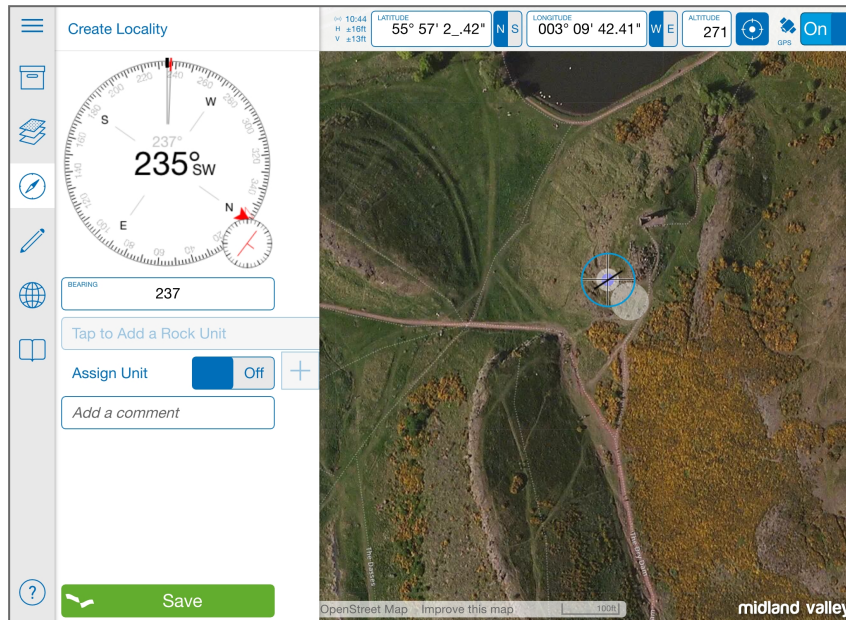

Figure: Map view showing a locked bearing, as indicated by a black line at the centre of a cross-hair. The cross-hair is blue, indicating that the bearing has been geo-referenced to your current position. This has been detected since the GPS is on and is also shown by the blue circle underneath the bearing measurement.

A bearing can also be recorded manually, or overwritten, without using the tablet sensors. To do so, tap on the **BEARING** box and either type in a value or drag the slider to set an orientation. The compass face will automatically update to reflect that bearing. Tap ⊘ to apply the changes.
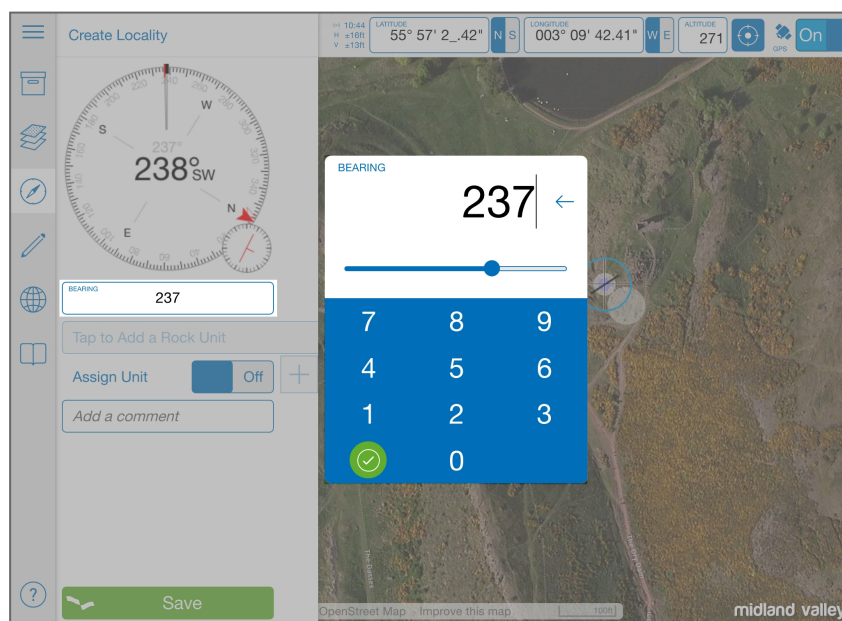
Figure: Bearing box, which can be edited once selected.

When saving a bearing, you can choose to assign a unit to the measurement. This means that a stratigraphy, or list of rock units, will need to be set up. For more information, see sub-section 'Stratigraphy' (below). The bearing can also be saved along with a comment. Tap the **Add a Comment** box to activate the keypad. Tap **Done** once happy with the comment and **Save** to save the measurement. A locked bearing is only saved on the map and in the **Notebook** page once you tap **Save**.

Note: If you do not want to save a bearing, and need to unlock the compass face, tap on the compass face once more.

Clinometer

Tap on the small clinometer face to make this active. This will allow you to measure and record the orientation of planar and linear features. Before a clinometer measurement can be saved, a stratigraphy needs to be set up so that the measurement can be assigned to a rock unit, fault or contact.
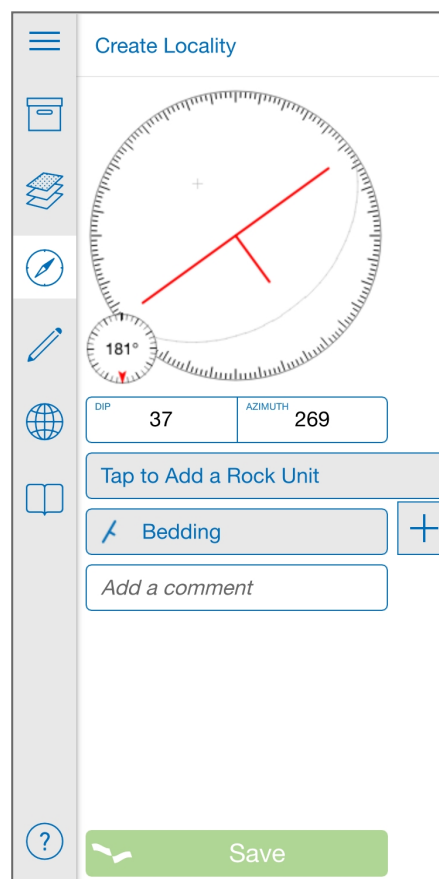
Figure: Compass Clino page, with the clinometer face active.

Stratigraphy

When starting a project for the first time, the **StratColumn** is blank. To create a stratigraphy, or list of rock units, either tap ➕ or tap on the box stating '**Tap to Add a Rock Unit**'. By default, this will add a rock unit called 'Unit 1'. More units can be added by tapping ➕ multiple times and these will be listed as coloured

squares down the right hand side of the **Compass Clino** page. To assign an orientation measurement to the relevant unit, contact or fault, tap on the relevant coloured square so that its name is expanded.
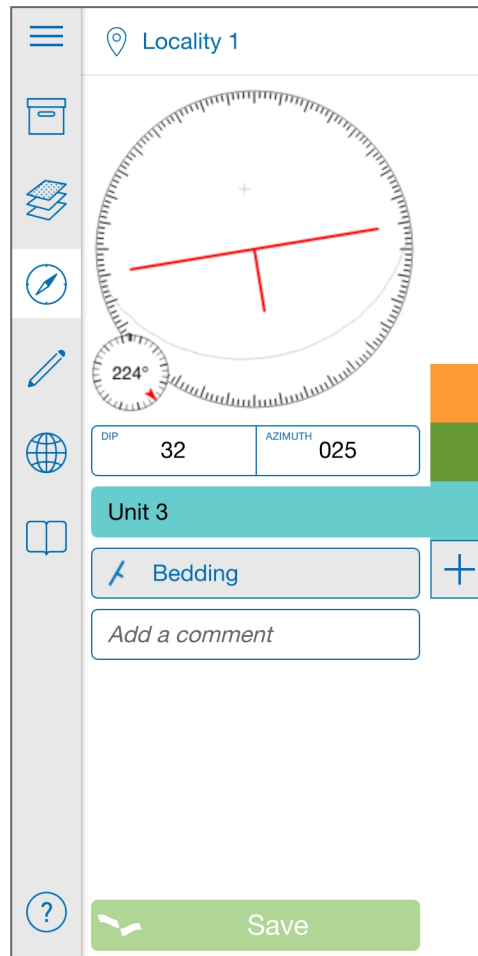

Figure: Rock units displayed to the right of the Compass Clino page as a list of colour squares. By default, the rock units are assigned the name 'Unit #'.

To change the name, assignment or colour of the unit, tap on the unit name to open the **StratColumn**. The name can be changed by tapping on the text box. By default, all entries are assigned as units (U) - i.e. a stratigraphic unit, rock type or lithology - but this can be changed to mark a fault (F) or contact (C). To do this, tap U (the colour of the button may vary) and choose the relevant assignment. The button will change from a U to an F or C to denote the assigned type. To change the colour of each entry, tap 🖉 to open the **Pick a Colour** window, choose a new colour and tap ✓ to apply the updates.
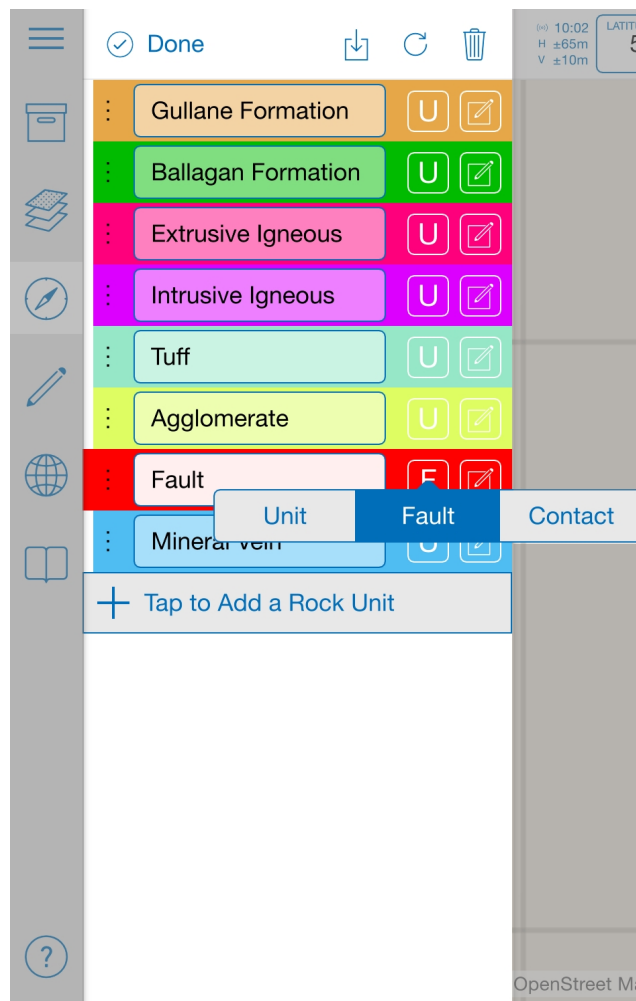
Figure: StratColumn showing a list of user-defined rock units and faults. The assignment of 'Fault' is currently being edited.

Entries can also be re-ordered, refreshed or deleted from the **StratColumn**. To re-order, tap on the three dots to the left of the unit (to make this the active unit) and drag the entry up/down.

Note: The active unit expands further to the left compared to the remaining units.

To delete an entry, tap the three dots to the left of the unit to make this the active unit, and tap 🗑 located at the top right of the page. To refresh the **StratColumn** tap ↻ , this will refresh to show only the units that are assigned to orientation measurements, lines or polygons.

Additionally, a **StratColumn** can be imported into FieldMove by tapping ⬆ . The StratColumn can be imported in three different ways:

- **Default StratColumn** – import a default column of units listed Horizon_01 to Horizon_10.
- **Browse Files** – import a .csv file generated from Move.
- **Other Projects** – import a StratColumn from other projects saved in FieldMove.
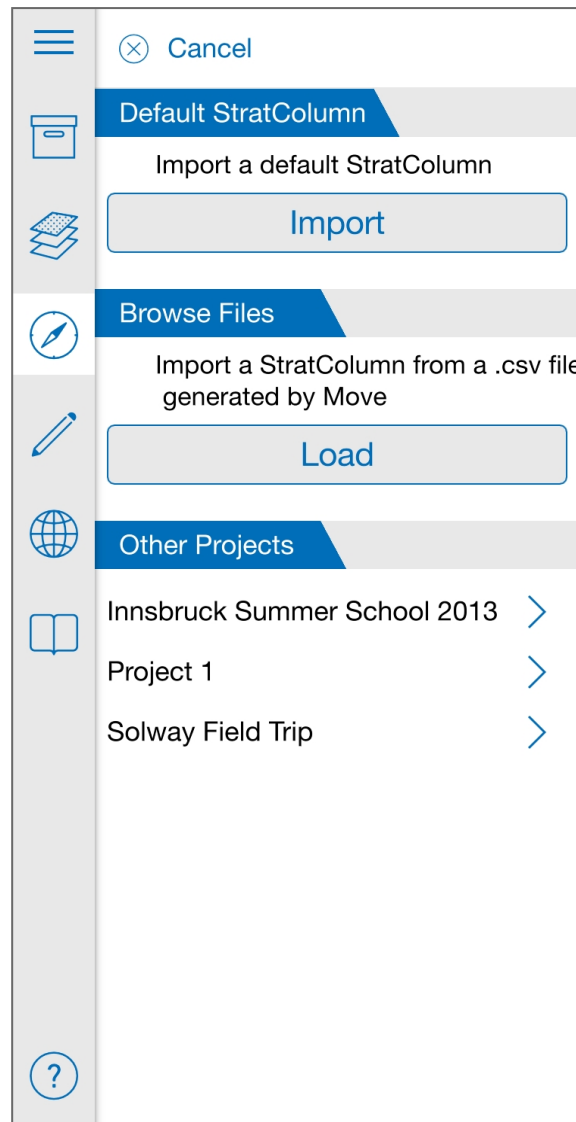
Figure: Import StratColumn options.

Once happy with the **StratColumn** set up, tap **Done** at the top left of the page to return to the **Compass Clino** page.

Symbol Type

As well as assigning a clinometer measurement to a unit in the **StratColumn**, it is also important to ensure that the measurement is assigned to the correct symbol type. By default the clinometer will display a dip symbol to denote a bedding data type. To change this, tap **Bedding**. This is the data type box located below the assigned unit. This will open a new window where a range of planar (cleavage, joint, fault) and linear (lineation, slickenside, mineral and fold axis) symbols can be selected. Switching between a planar or linear symbol will unlock the clinometer, if a measurement was locked beforehand. Switching between symbols in the same category (planar or linear) will not unlock the clinometer.
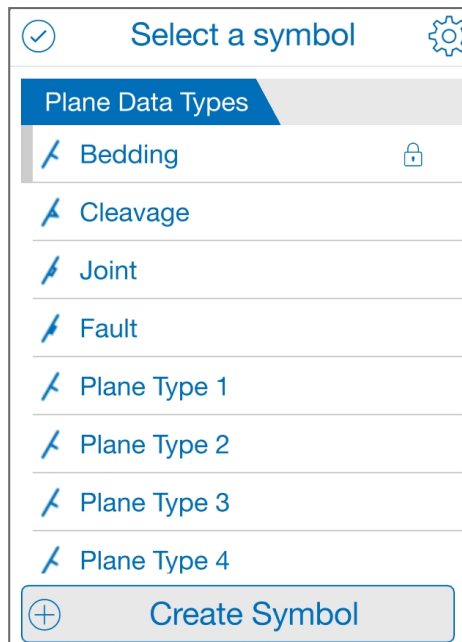
Figure: Select a Symbol window.

New symbols can be added and existing symbols can be edited. To add a new symbol, tap **Create Symbol**. The window will expand to allow you to define a symbol name and icon. Tap **Save** to add the symbol and tap ⊗ to collapse the window. To edit a pre-existing symbol, tap ⚙ . Once the window has been expanded, the relevant symbol can be selected from the data types list on the left (the selected symbol will be denoted by a vertical grey bar to the left of the symbol name). The symbol name and/or icon can be edited or the symbol can be deleted.
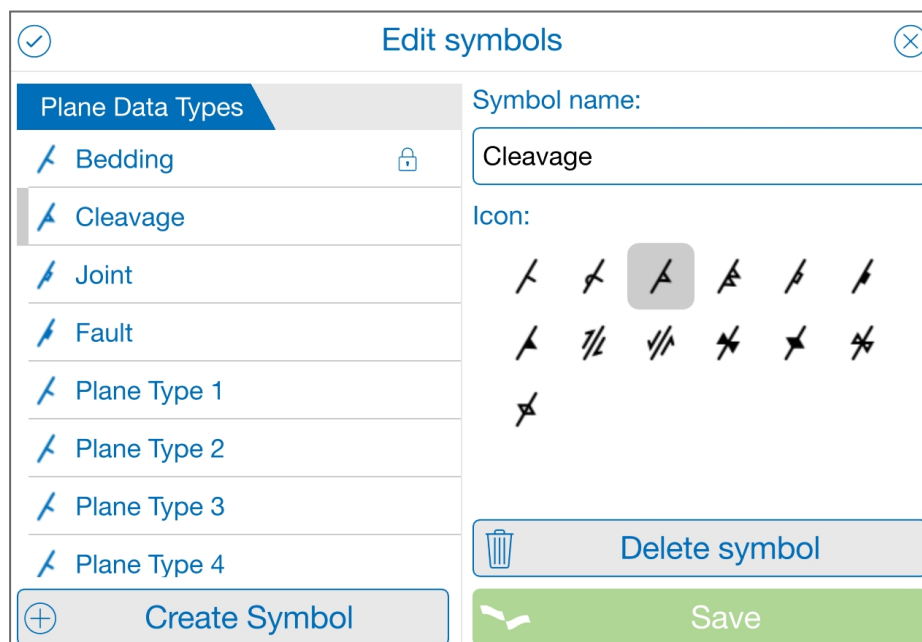

Figure: Edit Symbols window, where the symbol name and icon can be edited.

Note: If a padlock is displayed next to any of the data types, this means that the symbol cannot be deleted.

Taking a Clinometer Measurement

Once the rock unit and symbol assignment is complete, the clinometer can be used to record orientation data. If the assigned symbol type is **Bedding**, the clinometer will display a red dip with a grey great circle and pole to the plane. If the assigned symbol type is **Lineation**, the clinometer will display a red arrow with a grey line showing the horizontal.
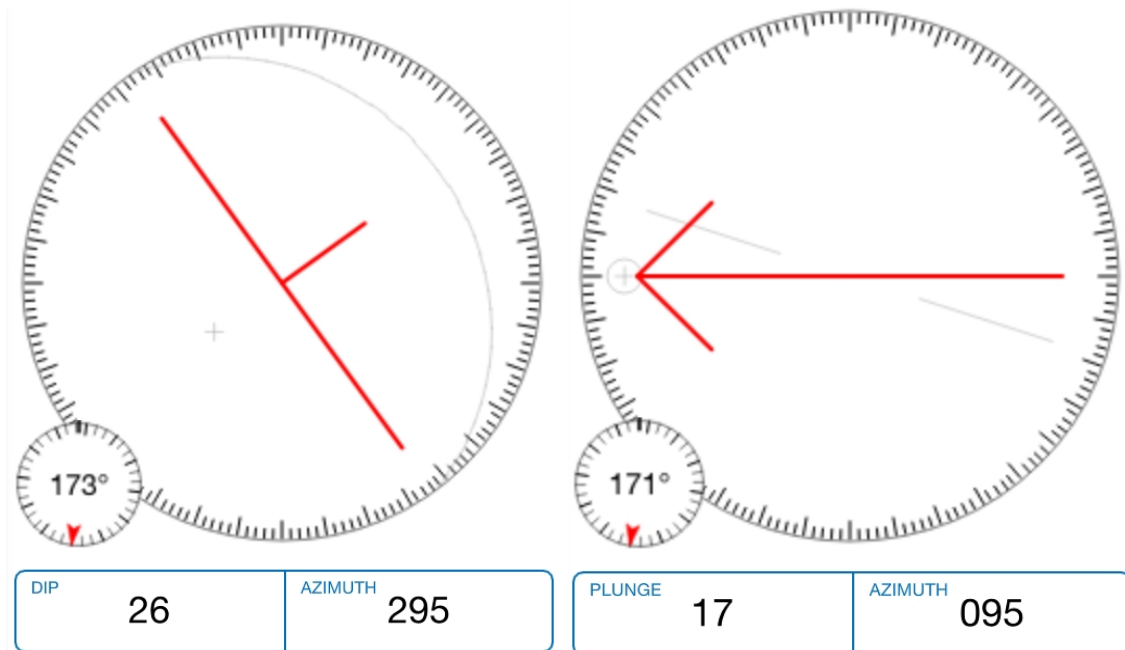

DIP		AZIMUTH	
	26		295

PLUNGE		AZIMUTH	
	17		095

Figure: Recording bedding (left) and lineation (right) measurements.

To record a planar measurement, it is recommended to lie the tablet on the bedding plane, with the long axis of the tablet parallel to the bedding strike. To record a linear measurement, postion the tablet vertically with the long axis parallel to the lineation/vein/fold axis, ideally with the tablet facing you.

Figure: Photos showing the suitable tablet orientation when recording a planar (left) and linear measurement (right).

Tap on the clinometer face to lock the measurement, the dip will change from red (active) to black (locked). It will also be displayed at the centre of a cross-hair in the map view.

Editing Clinometer Measurements

Once the clinometer is locked the display will vary depending on the compass clino edit mode defined in the project settings (see section '**Settings**'.)

If the edit mode is **Relative Offset**, a locked measurement can be edited by adjusting the dip and azimuth on the clinometer face individually. To edit the dip, drag your finger in the direction indicated by the arrows in the blue circle, shown on the clinometer face. To edit the azimuth, drag your finger in a circular motion around the edge of the clinometer face.

If the edit mode is **Stereonet Style**, a locked measurement can be edited by tapping and dragging the cross (highlighted in a blue circle). This represents the pole to the plane.
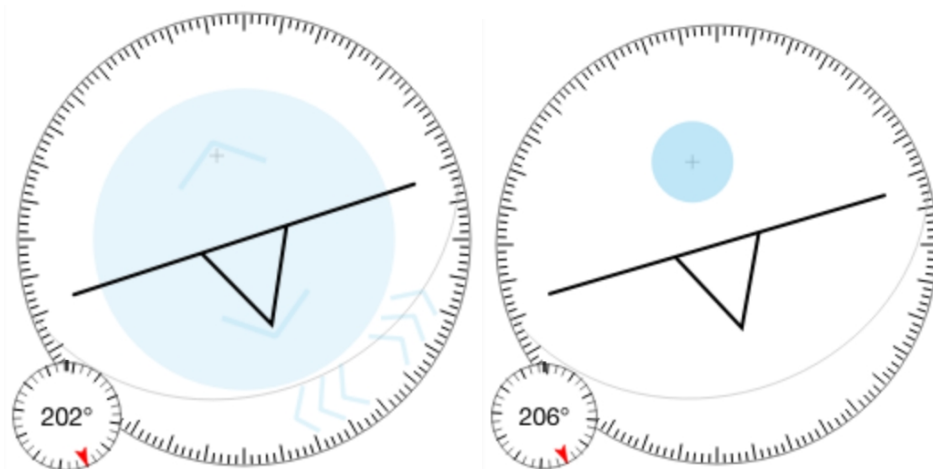

Figure: Relative Offset (left) and Stereonet Style (right) editing modes.

The dip/azimuth can also be manually entered into FieldMove by tapping the **DIP** and **AZIMUTH** boxes below the clinometer face. As with the compass, this will open a new window where the orientation can be typed in or adjusted using the slider.

When the measurement is being edited, the dip symbol will automatically update in the map view. The location of the dip can also be moved using the cross-hair dragger.

Tap **Save** to save the measurement in the **Notebook** page and on the map, along with any added comments.

Note: Orientation measurements cannot be edited once they are saved in the **Notebook** page.

Drawing Tools

The **Drawing Tools** page can be used to create linework and simple polygons on to your chosen basemap. To open the **Drawing Tools** page tap ✏ from the **Side Panel**.

To maximise the map view whilst digitizing, the **Drawing Tools** page can be collapsed to a narrow toolbar by tapping ⟨ . To expand the page tap ⟩ . Both of these buttons are located at the bottom left of the **Drawing Tools** page.
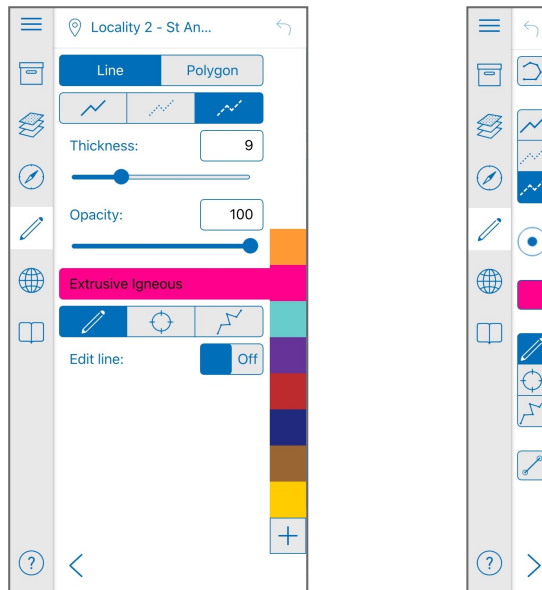

Figure: Expanded (left) and collapsed (right) Drawing Tools page.

Locality

As with the **Compass Clino** page, lines and polygons will be assigned to a locality ID. The active locality is displayed at the top of the expanded **Drawing Tools** page. To change the locality tap on ◎ .

Note: The locality is linked in both the **Drawing Tools** and the **Compass Clino** pages. Changing the locality in one page will update it in the other.

Line Style and Appearance

The appearance of lines and polygons can be customised in the **Drawing Tools** page with the following options:

Style: Solid, dotted or dashed

Thickness: The line thickness is given as a point width and ranges from 2 to 30. To change the thickness either adjust the number in the text box or drag the slider left and right with your finger.

Opacity: The opacity is given in percentage and ranges from 20% to 100%. To change the transparency, either adjust the number in the text box or drag the

slider left and right with your finger. Lines cannot be made fully transparent and the outline of a polygon will remain more opaque than its filled colour.

Stratigraphy: Prior to digitizing a line or polygon must be assigned to a rock unit. The line/polygon colour will match that of the rock unit. To change the rock unit assignment, tap on any of the coloured squares listed to the right of the **Drawing Tools** page.

Note: The **StratColumn** is linked in both the **Drawing Tools** and **Compass Clino** pages. Edits made to the **StratColumn** in either of these pages will be updated in the other.

As with the **Compass Clino** page, the **StratColumn** can be opened by tapping on the active rock unit. The name, colour and assignment can be edited within this page. Please refer to section '**Compass Clino**' for more information.

Drawing Modes

From the **Drawing Tools** page, you can choose from three different drawing modes: **Freehand**, **Virtual Mouse** and **Vector Line**.

Figure: Respective buttons for each line drawing mode. From left to right - Freehand, Virtual Mouse and Vector Line.

Note: When in the **Virtual Mouse** and **Vector Line** drawing modes, it is still possible to pan in the map view.

Freehand: Drag your finger to digitize a line on the map. The map view can be zoomed in/out and panned by separating/pinching your thumb and forefinger together. A new line is created for every stroke on the map.

Virtual Mouse: Lines can be drawn by moving the cross-hair dragger on the map. The cross-hair will show the position of the line, whilst the translucent dragger marks your finger position. This mode allows for precision drawing. To start digitization, tap ✏. Press and move the translucent dragger to digitize the line, then tap ✅ to create it.
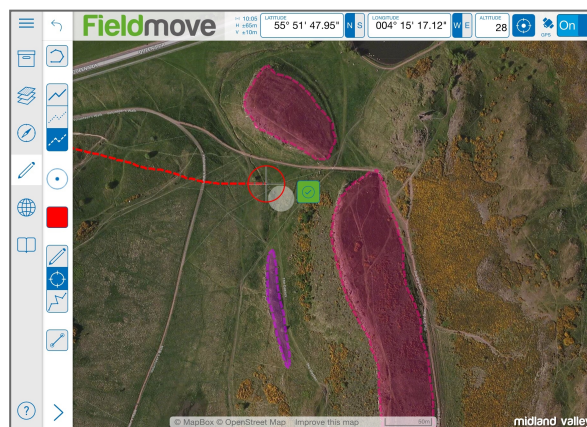

Figure: Map view showing the Virtual Mouse drawing mode. The colour of the cross-hair will reflect the colour of the assigned rock unit.

Vector Line: Lines can be drawn by incrementally adding points one after another using the cross-hair dragger on the map. To start digitization, tap ⊕ to create the first point, then move the translucent dragger on the map. Tap ⊕ to create further points and continue extending the line. The number of points will be displayed to the right of the cross-hair dragger. To finish the line, tap ✓ .
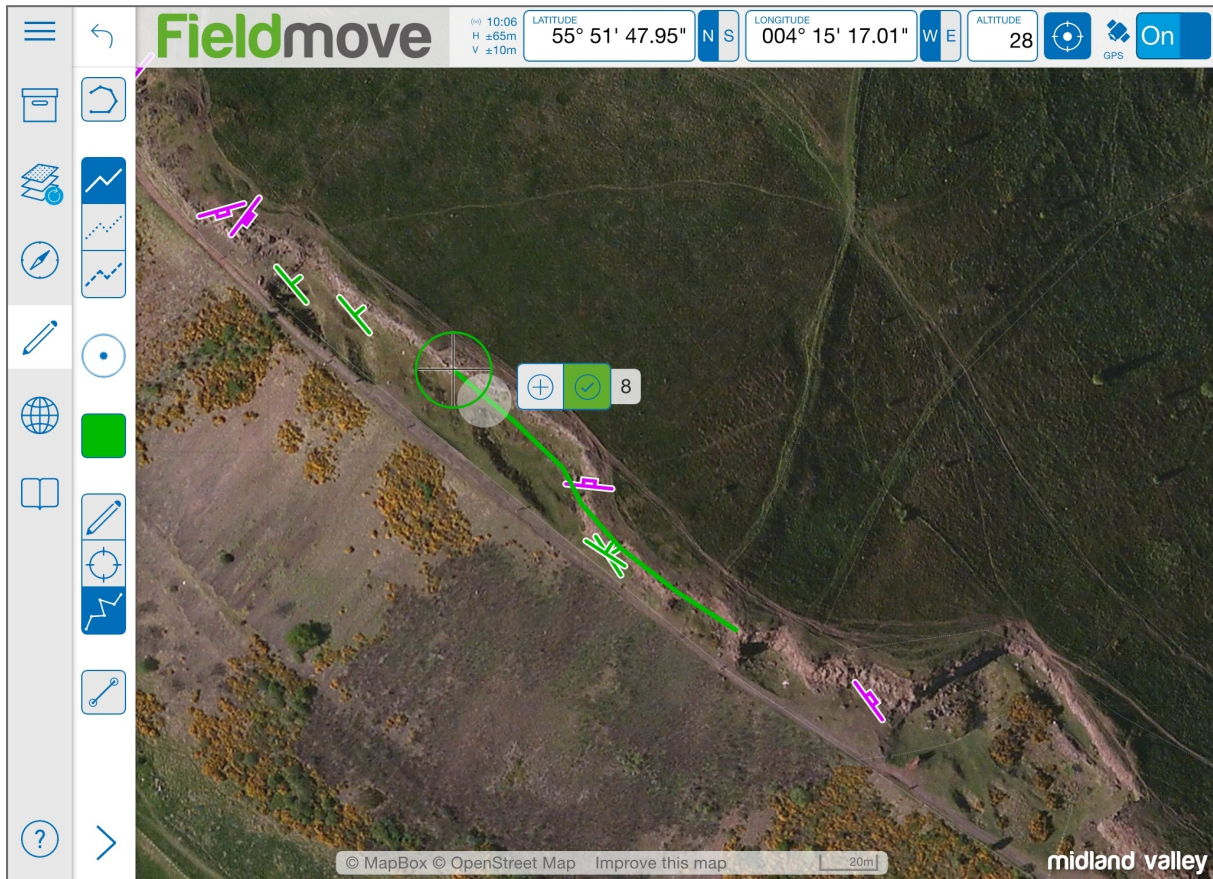

Figure: Map view showing the Vector Line drawing mode.

Note: To undo the creation of any lines/polygons, tap ↶ in the top right of the **Drawing Tools** page. There is no redo command.

Editing Lines

Lines and polygons can be modified by adding, moving or removing points. Lines, can also be split into two. To activate the **Edit** mode in the expanded **Drawing Tools** page, next to **Edit line** turn the slider to **On**. Or if in the collapsed **Drawing Tools** page, tap the icon 🔧 so that it turns blue. It is also possible to activate

the **Edit Line** mode without having the **Drawing Tools** page open. To do this, tap on a line in the map view and tap ⓘ . This will open the expanded **Notebook**

page, where it is possible to tap **Edit**.

Note: When the Edit mode is active, it is not possible to digitize lines or polygons. Therefore, remember to turn this mode off before resuming digitization.

Adding nodes to a line or polygon:

- Tap on an existing line or polygon to select it. It will be highlighted in yellow.
- Turn on the **Edit Line** mode. The nodes on the line will now be highlighted.
- Long tap on the line where a new node is required. The line will change to its original colour to indicate a new point has been added.
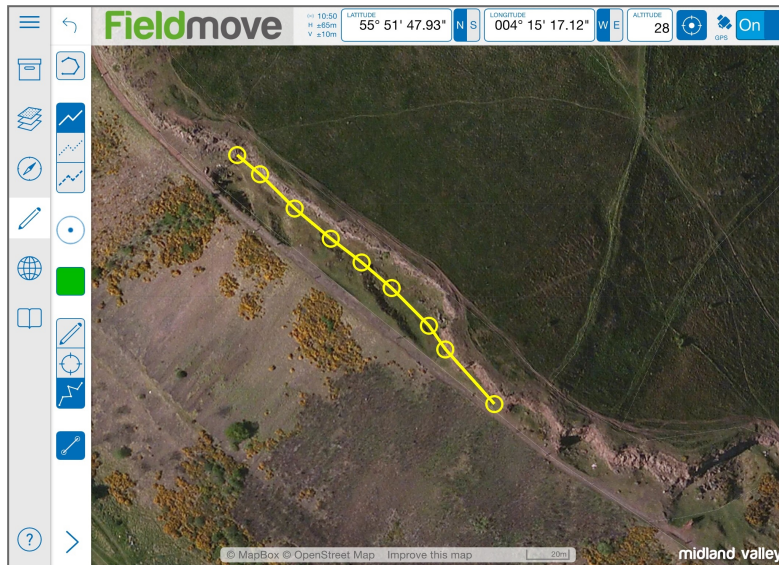

Figure: Map view showing active Edit Line mode and displaying the nodes along a line.

Moving nodes on a line or polygon:

- Tap on an existing line or polygon to select it. It will be highlighted in yellow.
- Turn on the **Edit Line** mode. The points on the line will now be highlighted.
- Tap and drag a node to change its position. The original line will remain highlighted in yellow and the new position of the line will be shown in the original line colour.
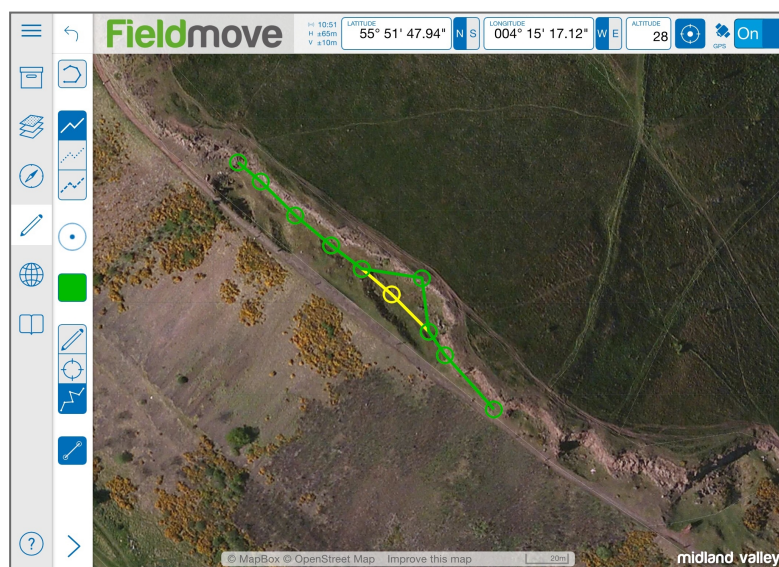

Figure: Map view showing the process of moving a node along a line to a new position. The original line is highlighted yellow and the new location is coloured green.

Removing nodes from a line or polygon:

- Tap on an existing line or polygon to select it. It will be highlighted in yellow.
- Turn on the **Edit Line** mode. The nodes on the line will now be highlighted.
- Long tap on a node and tap 🗑 to delete it.

Splitting a line:

- Tap on an existing line to select it. It will be highlighted in yellow.
- Turn on the **Edit Line** mode. The nodes on the line will now be highlighted.
- Long tap on a nodes and tap ⌐|⌐ to split the line.

Note: It is not possible to split polygons.

Extending and Joining Lines

Lines can be extended and joined together by digitizing a new line from either end of an existing line.

Extending a line:

- Tap on an existing line to select it. It will be highlighted in yellow.
- Draw a new line from the end of the existing line.
- When digitization is ended, the new line will be added to the existing line.

Join a line:

- Tap on an existing line to select it. It will be highlighted in yellow.
- Draw a new line from the end of the first line to the end of the second line.
- The two existing lines, as well as the new line will be merged together.

Notes to consider when extending or joining lines:

- Only lines belonging to the same rock unit can be extended or joined.
- Extending and joining only works in **Freehand** and **Virtual Mouse** modes (not in **Vector Line** mode).
- The **Line Join Distance** can be edited in the **Settings** window. Increasing this distance will make it easier to connect and extend lines, however it will not be as accurate. For more precise drawing, the **Line Join Distance** value should be smaller.
- It is currently not possible to close a line by drawing a new line between it's two end points.

Drawing Polygons

To switch the drawing method from line to polygon tap **Polygon** at the top of the **Drawing Tools** page. Polygons are created in the same way as lines.

Lines and polygons can be edited in the **Notebook** page. For more information, refer to section '**Notebook**'.
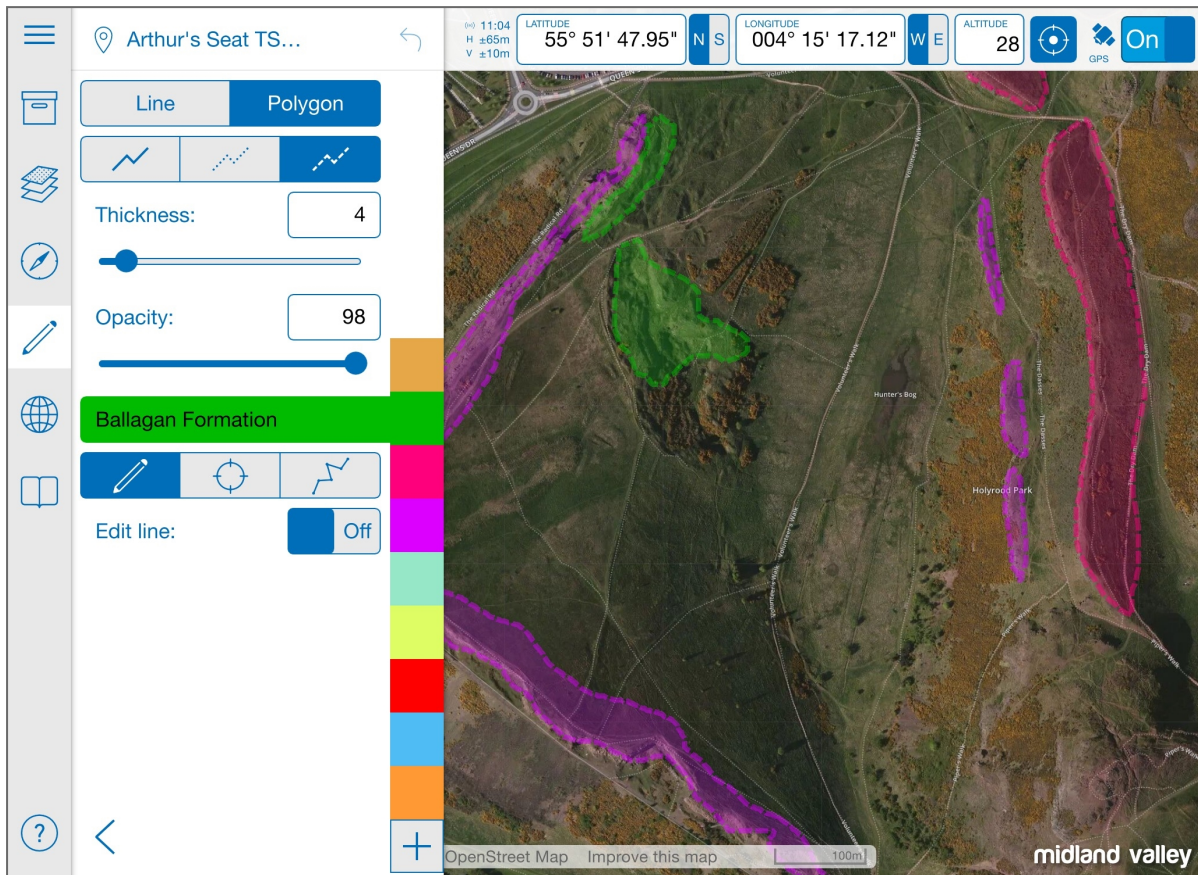

Figure: Digitizing polygons in the field to illustrate the distribution of rock units.

Stereonet

Any planar and linear data saved using the clinometer can be viewed in the **Stereonet** page, allowing you to carry out a first look structural analysis whilst in the field. Structural data is visualized on either an equal area or equal angle stereonet. To access the **Stereonet** page tap ⊕ from the **Side Panel**.
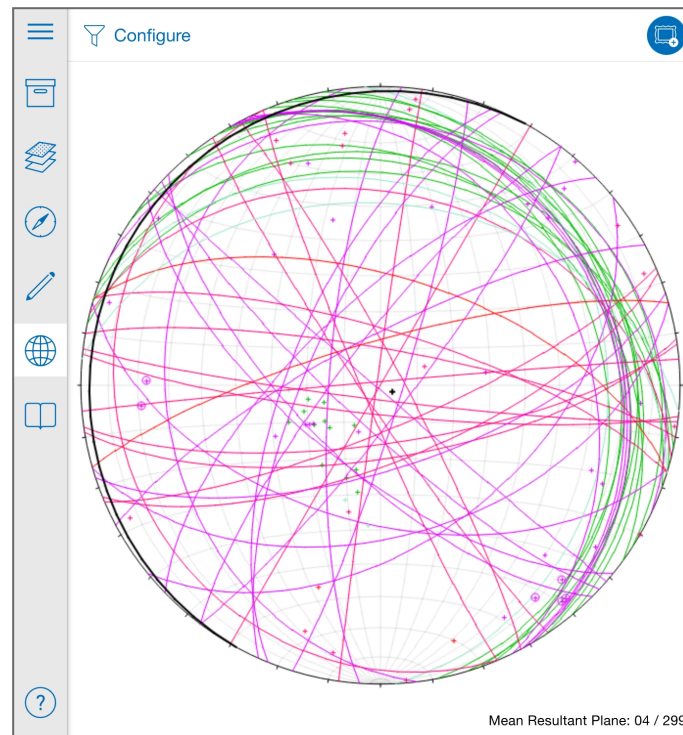

Figure: Stereonet page. By default, the stereonet will plot all planar and linear measurements that have been saved in the Notebook page.

Mean and Temporary plane display

Upon opening the **Stereonet** page, the default view will display the poles and planes of all saved planar and linear data. The **Mean Resultant Plane** is also displayed as a black great circle with the mean dip/azimuth shown in the bottom right corner. To display a **Temporary Plane (and pole)** tap anywhere within the circumference of the stereonet. The dip and azimuth of the temporary plane will be displayed in the bottom left corner. Tap ⊗ to the left of the **Temporary Plane** dip/azimuth reading to remove the plane from view.

Configure and Filter the Stereonet

Filters can be applied to display a subset of the collected data by tapping ▽ Configure located in the top left corner of the **Stereonet** page.

This will expand the page to show two new sections: Stereonet display to the left; filter options to the right.

Figure: Stereonet page expanded to show the configure and filter options.
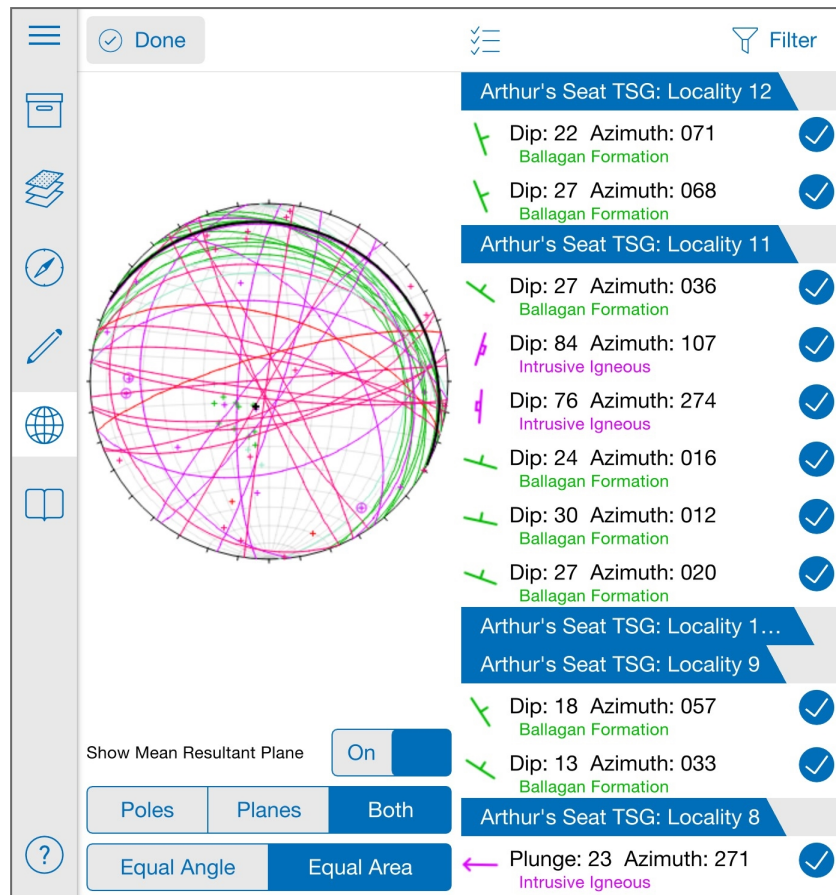
Stereonet Display

The display is controlled by tapping on the desired option. There are three choices:

Show Mean Resultant Plane: Tap **On** to display the plane as a black great circle.

Display of poles and planes: Tap to select whether **Poles**, **Planes** or **Both** are shown on the stereonet.

Type of Stereonet: Tap to select whether the stereonet should be **Equal Angle** (Wulff)or **Equal Area** (Schmidt).

Filters

At the top right of the **Stereonet** page, tap **Filter**. Structural data can then be filtered by four categories: **Data**, **Localities**, **Units** and **Types**.

Tap on each category to change how the data is filtered. To remove any data (or groups of data) from the stereonet, tap ✓ . It will change to ○ to confirm that the data has been removed from view. Tap again to turn the data back on. As a shortcut, tap ≣ to select all, none, or invert the selection of displayed structural data.
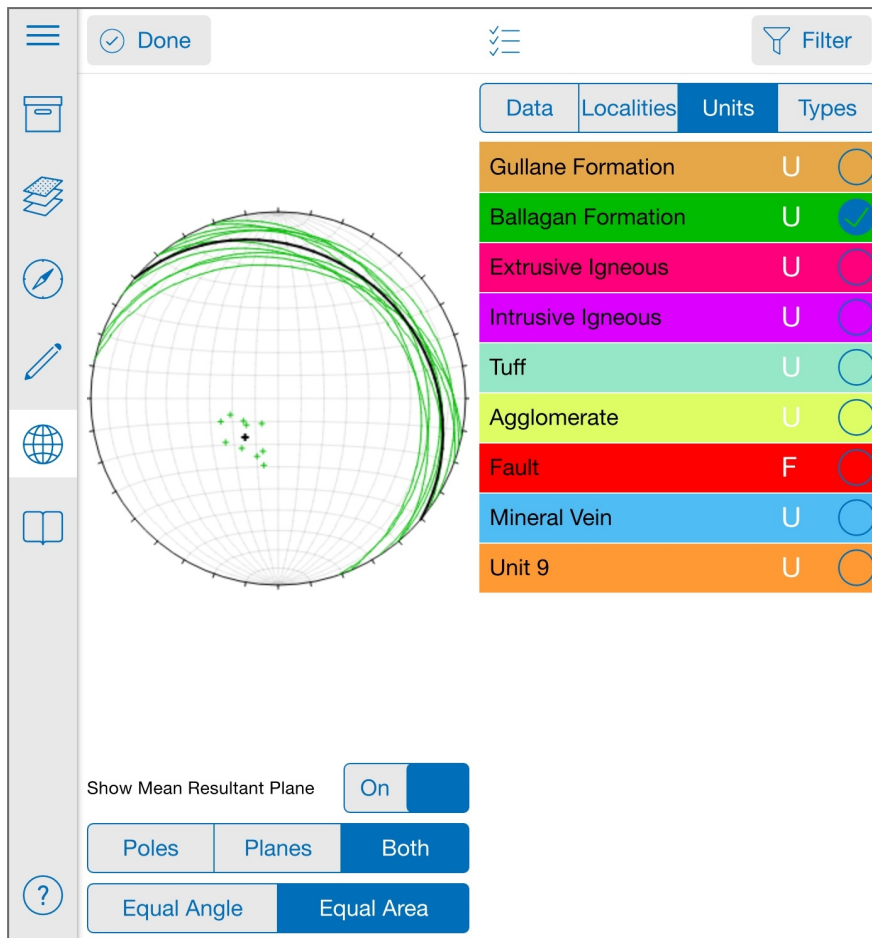
Figure: Stereonet page filtered to only show the measurements recorded for the rock unit 'Ballagan Formation'.

Once the settings and filters have been applied tap ⧩ Done to return to the main stereonet page.

Saving a stereonet.

To take a screenshot of the stereonet tap 🖳 at the top right of the **Stereonet** page. This will open a window where a comment can be saved along with the image. Tap **Save** to add the stereonet image and comment in the **Notebook**. The screenshot will be geo-referenced to your current location and will be displayed in the map view by the following symbol 📷 .

Notebook

The **Notebook** page stores all the data recorded and saved in the **Compass Clino**, **Stereonet** and **Drawing Tools** pages. It will also store any photos, notes, screenshots and sketches taken from within the **Notebook** page and allows for data to be edited and deleted if necessary. To access the **Notebook** tap ▯▯ from the **Side Panel**.

Notebook Entries

In the **Notebook** page all saved data will be listed by locality. The active locality will always be listed first and all data assigned to that locality will be listed in reverse chronological order.

Note: The active locality is that displayed at the top of the **Compass Clino** and **Drawing Tools** pages.
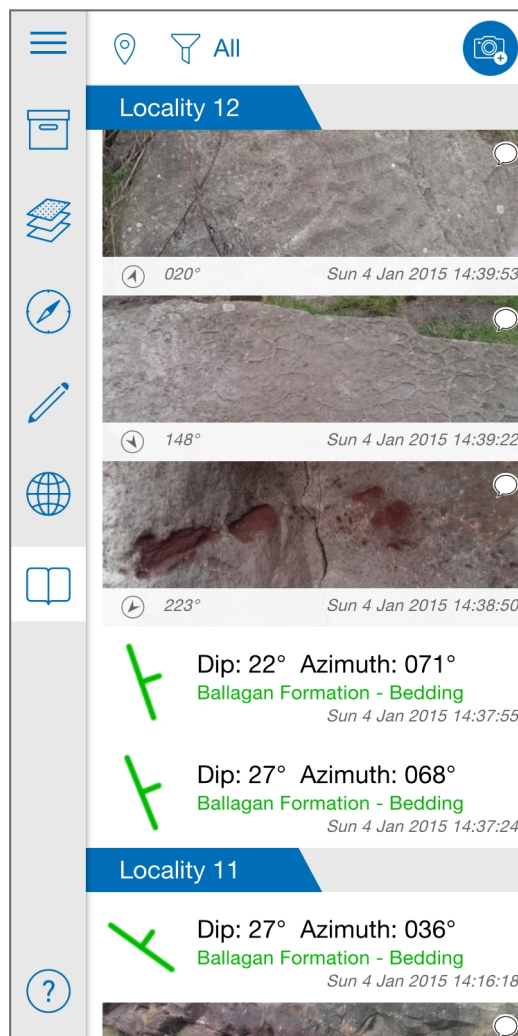

Figure: Notebook page listing all the data that has been saved in the FieldMove project by locality.

Adding Notes, Photos and Screenshots

To add a **Note**, **Photo**, **Screenshot** or **Sketch** tap 📷 in the top right of the **Notebook** page.

Note ✎

Tapping on **Note** will open a text box at the top of the **Notebook** page. The note will be geo-referenced to the current location, as shown by the cross-hair dragger in the map view. To move the note to another location, tap and move the translucent dragger. The cross-hair will change from **blue** to **red** to indicate that the position is not set by the GPS. To add the **Note**, type in the text box and tap **Save**.

Photo and Gallery 📷

Photos can be added to the **Notebook** directly from the tablet camera or by uploading photos stored on the tablet. To add a photo directly from the camera, tap on **Photo**. This will automatically open the camera view. Once the photo is taken a comment can be added, and the viewing direction will automatically be captured. Tap **Save** to store the photo.

Note: The photo will not be stored in the **Notebook**, until you tap **Save**.

To upload a photo already stored on the tablet, tap **Gallery**. The file browser will open and you can navigate to the desired image. Tap on the photo to bring it in to FieldMove. A comment can be added if required. Tap **Save** to store the photo in the **Notebook** page. Photos will be geo-referenced to the current GPS location.

Screenshot 📷

Tapping **Screenshot** will add a snapshot of the current map view, along with a comment if required. Tap **Save** to add the screenshot to the **Notebook** page. Screenshots will be geo-referenced to the current GPS location.

Sketch 📷

Tapping **Sketch** will allow you to make a sketch in a new blank window. This window provides basic 'finger painting' tools allowing you to choose the colour and thickness of lines. Lines and text can be erased by tapping 🗑 and annotations can be added by tapping 𝔸. The text size of the annotations is controlled by the line thickness. To save the sketch to the **Notebook**, at the bottom left of the window, tap ✓.

Data display

The display of notebook entries can be managed using the two buttons at the top of the page:

1) By Locality: Tap ⊚ to show data assigned to a certain locality. This is useful for larger projects. The locality selected will be listed at the top of the **Notebook** page.

2) Filter data: Tap ▽ to filter the **Notebook** page by **Data** only, **Notes** and photos only or by **Lines** only. To filter the data tap on the desired option; the map view will also update to show only the filtered data. Select **All** will display all of the saved data.

Editing data

Tapping on each data entry will expand the **Notebook** page to show the object details. It will also automatically zoom in on the selected data entry in the map view.
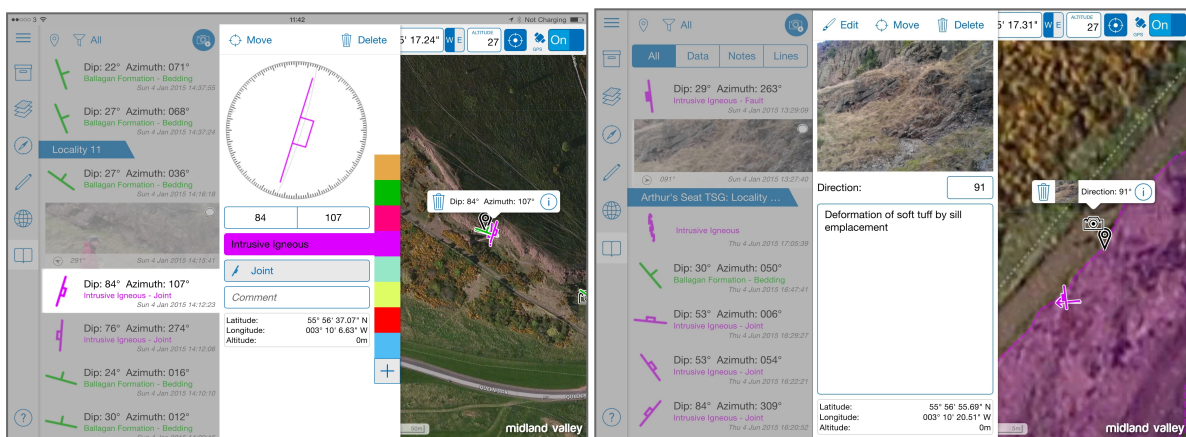
Figure: Expanded Notebook page showing the editing options for the selected joint measurement (left) and photo (right). The selected measurement has also been zoomed into in the map zoom and is highlighted by an information label.

When a photo has been selected, it is possible to annotate and sketch on top of the photo by tapping **Edit**. This will open a new window with the same tools that are available when recording a sketch. Lines and text can be added to the photo. To save the edits, at the bottom left of the window, tap ⊘.

Figure: Photo editing window showing the annotation and digitization over a photo.

Note: If the FieldMove project is exported as an .mve file and imported into Move, the edited photos will be stored within the .mve project and can be viewed in the **Field Image Browser**. The original, unedited images will be saved and stored in a separate folder.

The extended **Notebook** page will allow you to edit certain object properties depending on the data type (see table).

	Structural Data	Photos	Notes	Localities	Lines and Polygons
Measurement	No	N/A	N/A	N/A	N/A
Unit Assignment	Yes	N/A	N/A	N/A	Yes
Data type	Yes	N/A	N/A	N/A	N/A
Comment	Yes	Yes	Yes	Yes	Yes
Location	Yes	Yes	Yes	Yes	No
Facing Direction	N/A	No	N/A	N/A	N/A
Colour	Yes	N/A	N/A	Yes	Yes
Thickness	N/A	N/A	N/A	N/A	Yes
Opacity	N/A	N/A	N/A	N/A	Yes
Style	N/A	N/A	N/A	N/A	Yes

Table: Data types stored in the Notebook, and properties that can be edited. Further information on editing is provided below. N/A indicates that the property does not apply to that data type.

Note: For structural measurements, the data type cannot be converted from planar to linear or vice versa. Data symbols can only be changed to a different symbol of the same data type. It is also not possible to edit the dip/azimuth or plunge/azimuth or the measurement.

Colour

The colour of structural measurements, lines and polygons can be changed by changing the colour of the rock unit it is assigned to. To change the rock unit colour, tap on the object to expand the **Notebook** page, then select the active rock unit to open the **StratColumn** page. In this page, tap 🖊 next to the unit you wish to edit (the colour of the icon may vary). This will open the **Pick a Colour** window where a new colour can be chosen.

The default colour for the locality pins ⑨ is black. To edit this tap on the locality listed in the **Notebook** page and tap 🖊 to the right of the locality name. Once the preferred colour has been chosen, tap ✓ to apply.

Unit Asignment

To change the unit assignment of a structural measurement, line or polygon tap on the data entry to expand the **Notebook** page. To the right of the page, a number of coloured squares are listed, which each represent a rock unit in your **StratColumn**. Tap one of the coloured squares to change the unit assignment.

Moving Data

The location of structural data, notes, photos and localities can be updated. To do this, tap on the data entry in the **Notebook** page, then tap ⊕ Move in the top of the expanded page. The Notebook list will become hidden behind the **Side Panel** to allow for more space on map. A cross-hair dragger will also appear overlying the data point in the map view. Tap and move the translucent dragger to the new location. Once in the correct position, tap ⊕ Done (which will have taken the place of the button ⊕ Move).
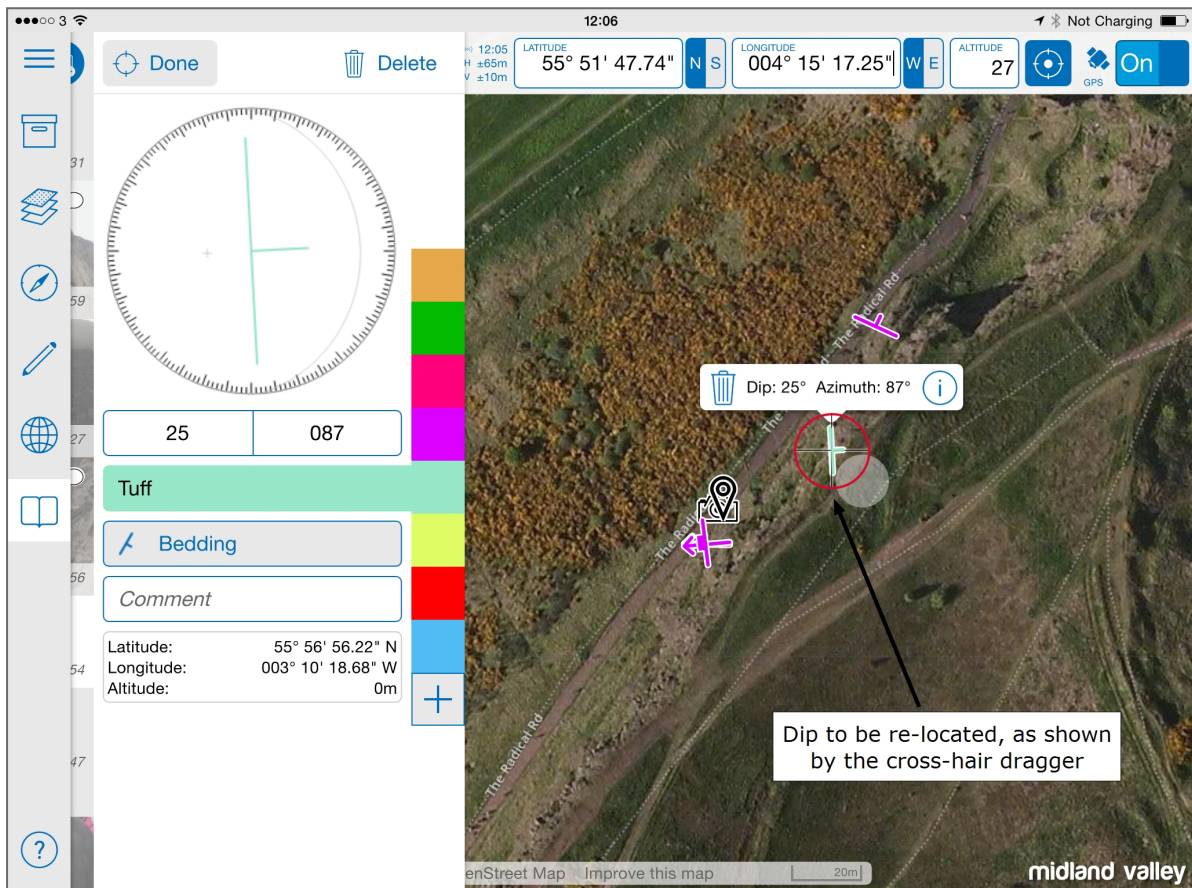
Figure: Moving a dip measurment assigned to the unit 'Tuff'. Once you tap Move, a cross-hair dragger will appear in the map view and can be used to re-locate your data.

Deleting Data

In the expanded **Notebook** page, all data can be deleted by tapping 🗑 Delete in the top right corner. Tap once to activate the button, then tap 🗑 Confirm to apply the deletion. This cannot be undone.

Note: Data can also be selected in the map view and deleted via the object label.

Export

At any point in your work the FieldMove project can be exported so that data can be managed and analysed in external programs. All exported FieldMove project folders will be in the form projectXX.fm

Exporting a Project

A project can be exported through two different routes: i) Tap ≡ to expand the **Side Panel** and tap 👥 . ii) Tap 🔲 to open the **Project Properties** page and tap ⬆ . Data can be exported in three formats:

- Move (.mve);
- Google Earth (.kmz);
- CSV (.csv).

Once the export format has been selected, tap **Export** - a progress circle will appear. The time of export will vary depending on the file format and size of the project. Move and Google Earth files will take longer to export as they are larger zipped files.
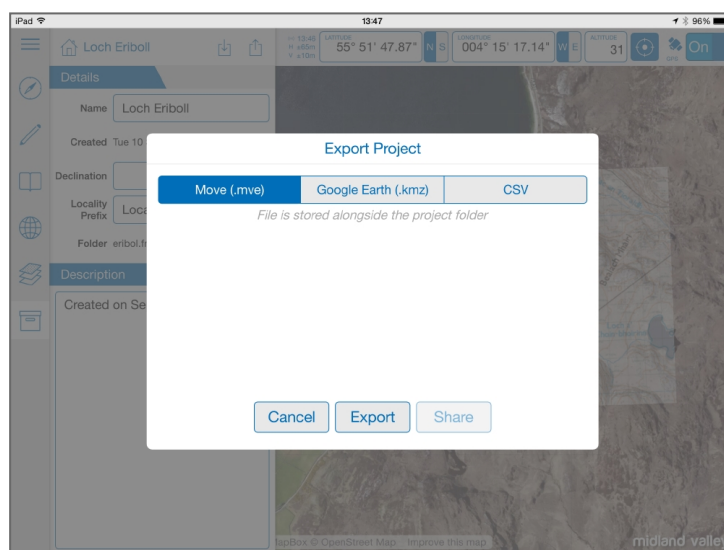
Figure: Export FieldMove project options.

Sharing a Project

Once the project has been exported, the data can be shared through:

- **AirDrop** – Share data wirelessly with another Apple device.
- **Mail** – Email the exported project as an attachment. Be aware that large projects may be too big to attach to an e-mail.
- **Dropbox** (requires network connectivity)– This will let you upload the exported file straight to Dropbox. The first time this is selected, you will be asked to grant permission so that FieldMove can access your

Dropbox. This will be done from the Dropbox app if it is installed, or via a web interface. You can then browse to your Dropbox folder and tap **Choose** when you are ready to upload the file.

- **Open In** – Open exported data in another installed app. For example, the Google Earth (.kmz) export can be directly opened in the **Google Earth** app if installed.

Export Location

The location of exported files will depend on the file type. CSV files will be stored within their project folder, whilst Google Earth or Move exports will be located alongside the FieldMove folder (.fm) as .mve or .kmz files respectively.

The exported files are accessed in different ways depending on whether the tablet is an iPad or Android/Windows.

iPad Export Location

To access the exported project connect the tablet to iTunes on a laptop or desktop PC. Select the tablet from the iTunes toolbar (1) and select **Apps** from the device option panel (2). The device may need to be synced to see these options. Scroll down to the list of apps and select FieldMove (3). A list of associated files will appear in the right-hand column. Select the .mve, .kmz or .file to copy from the device (4) and click **Save to...** (5).

Figure: Export of a FieldMove project via iTunes.

To access the exported data connect the tablet to a laptop or desktop PC. Once the tablet has been recognised, navigate to the tablets internal storage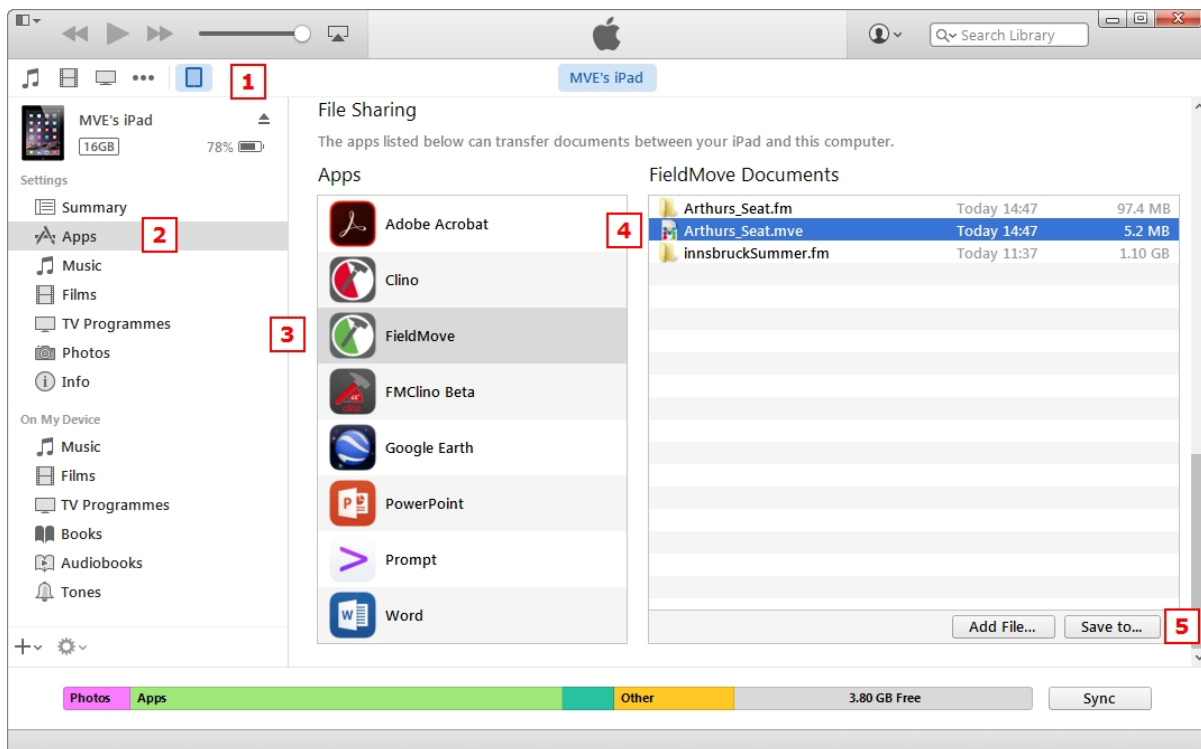 folder. Select and open the folder named FieldMove. A list of all the .fm projects currently available on the tablet will be listed alongside any exported .kmz and .mve files. To transfer these folders to the computers local storage, they can either be copied and pasted to the desired location or simply dragged and dropped.
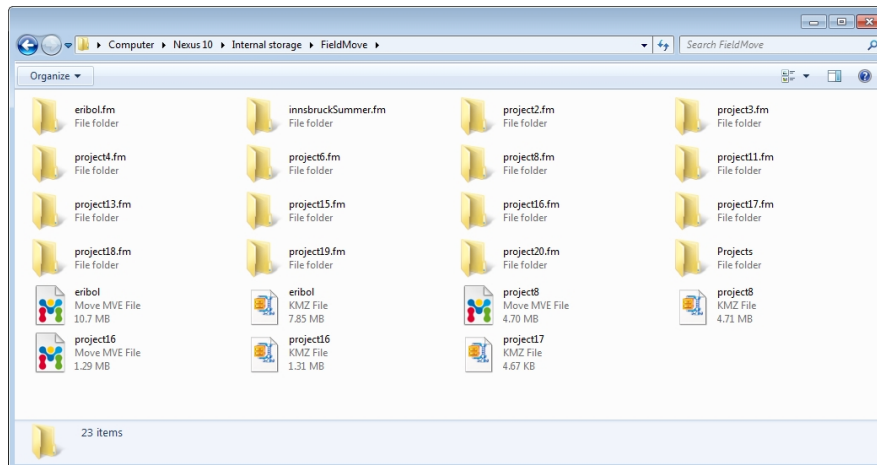
Figure: Windows Explorer showing the location of a number of FieldMove projects.

Viewing Exported Project Files

Each exported file format can be opened, viewed and manipulated in different applications. The information below provides details on each export format.

Move

The .mve export is available so that projects can be imported directly into Midland Valley's Move software. Move is designed for constrained 2D and 3D model building, interpretation and validation. The .mve files can also be viewed in Midland Valleys free 3D visualization software MoveViewer. Bringing projects directly into Move is a great way to start building geological models.

Before importing .mve files into Move, it is advisable to set up the projection system in a new Move document. Doing this avoids UTM calculation issues and misplaced data for larger spanning projects. This process will also flag up any UTM calculation issues on the import summary and is a good check of data location/projection validity.

Note: The **Field Image Browser** in Move can be used to view, edit and annotate photos taken using FieldMove.

CSV

A CSV file stores geo-referenced point data and photo locations in a spreadsheet style layout. When choosing to export as CSV, several files will be output, with each file containing data for a single data type, e.g. line.csv, plane.csv, note.csv.

The first column of each .csv file contains a locailtyID which is assigned to each locality and data point. This can be used to cross reference localities and their associated data.

CSV files do not support photos or screenshots. Instead the geographic location and name of each photo is found within the image.csv file. Photos can be found in the Images folder, which is stored in the .fm folder.

CSV files can be opened and/or imported into many GIS software packages as CSV/ASCII data. They can also be viewed quickly in simple text editors (i.e. Notepad) or spreadsheet software (i.e. MS Excel).

Google Earth

After exporting as .kmz, the file can be opened directly in Google Earth or in Move (once the file has been unzipped).

Note: .kmz files do not preserve the line style for line data. The line data will only be displayed as solid. The thickness of the line however will be preserved.

Troubleshooting

When I open my exported .kmz project into Google Earth I can only see some of my data. In the top left of the Google Earth screen a time stamp bar shows the range of information displayed that is set between specific dates. You may need to alter this so that the extent range covers the time period when the data was collected.

Project Management

The **Project Management** window stores all projects created in FieldMove in order of their creation date. It is also the location where projects can be switched, or where new projects can be created or imported. To open the **Project Management** window, expand the **Side Panel** by tapping ≡ then tap ⧉ .

Note: The **Project Management** window can also be opened by expanding the **Project Properties** page and tapping ⧉ .

Figure: Project Management window showing three FieldMove projects.

The selected project is highlighted by a yellow header. It will display the most recent photo added to the project, if present.

The **Project Management** window contains the following commands:

⊕ Create Project

Tap to open a new project. The project will become the active project and will take you to a blank map view. This new project will be listed at the top of the **Project Management** window.

▭ Import Project (Android and Windows tablets only)

Tap to import any .fm folders that has been saved on the tablet, but are not listed in the **Project Management** window. This opens a file browser, which can be used to navigate to the desired project. This workflow can be adopted when sharing a project across multiple tablets.

Note: On iOS tablets, projects are imported into FieldMove via iTunes. To do this connect your tablet to a pc, open iTunes and select the tablet from the iTunes toolbar. Then click Apps and, scroll down to open the FieldMove app. Click and drag the .fm folder from your pc into FieldMove documents list. It may be necessary to sync iTunes to insert the project into FieldMove.

⚙ Settings

Tap to open the **Settings** window. See section '**Settings**' for more information on the available options.

Switching Projects

When multiple projects have been saved in FieldMove, it is possible to switch between these projects in the **Project Management** window. To switch to a different project, tap **Load Project**.

Deleting Projects

Projects can only be deleted from in the **Project Management** window. To delete a project, select the desired project so it is highlighted by a yellow header and tap 🗑 .

A warning will pop-up. Select **Yes** to confirm the deletion. This project will be removed from the device.

Note: It is not possible to delete all projects from FieldMove. The application must have at least one project saved.

Operating Systems

All figures in the User Guide have been taken from an iPad. Thus, the UI will vary slightly if you are using FieldMove on an Android or Windows tablet.

As well as differences between the import and export of files, which are mentioned throughout the User Guide, we also want to make you aware of the following variations when using FieldMove on an Android or Windows tablet.

License Screen (Android)

When opening FieldMove for the first time, you must be connected to the internet. This is so the tablet can communicate with the Google Play Store and retrieve the license. If you are not connected to the internet, you will receive the following message at the base of the start-up screen.

> Retry   FieldMove was unable to connect to Google Play. Please make sure the device is connected to the internet and try again.
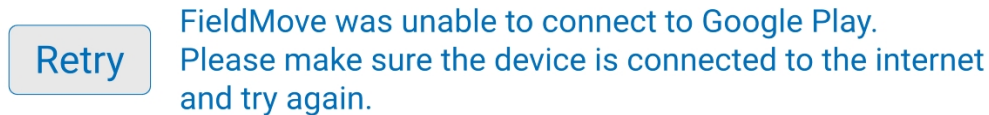
Figure: Warning message when FieldMove is opened for the first time without internet connection.

License Screen (Windows)

The license screen is shown the very first time the app is run after a new install on Windows. You must enter the license key (including dashes) that you received by email when purchasing the software into the text box provided, then tap **Submit Key**. This will contact the MVE license server, and activate the software. The app will open to show the default map view, and the license screen should not be shown on your tablet again.
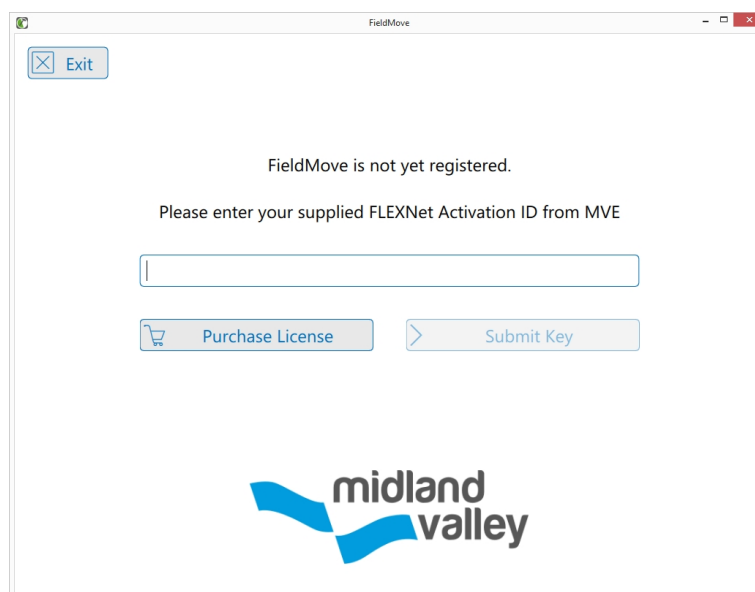
Figure: Windows Licensing.

If the user does not have a license, the **Purchase License** button will open a link to the MVE website in their default web browser, where the user can go through the payment process.

If the user can't get a license for whatever reason, they can quit the app, either by closing the window, or tapping **Exit** from the top left of the window.

Update Available Dialog

When FieldMove is opened on a Windows tablet, it will check to see if there is a new version available. If so, the **Updated FieldMove Available** window will pop up over the main view.

The window will show the current version the user currently has, the number of the new one available, and any update notes.

If you tap **Get New Version**, it will open a link to download the new version using your default web browser.

If you tap **Remind Me Later**, it will hide the window, and prevent it from appearing automatically on start-up for one whole day.

You can also dismiss the window by tapping ✓ in the title bar, which will hide the window, but not prevent it appearing the next time that the app is started.

If you have dismissed the **Update FieldMove Available** window, but want to access it again, you can do so from a button that will appear in the **Settings** window, which only appears when updates are available.

Figure: Update FieldMove Available window.

Frequently Asked Questions

This section contains a list of common questions that have been complied from previous user enquiries.

What does a tablet need to be able to take compass clinometer measurements?

A tablet must have an **accelerometer**, **gyroscope** and **magnetometer** (sometimes called a geomagnetic sensor) to be able to take measurements.

Make sure you check the hardware specifications before using your tablet as a measuring device.

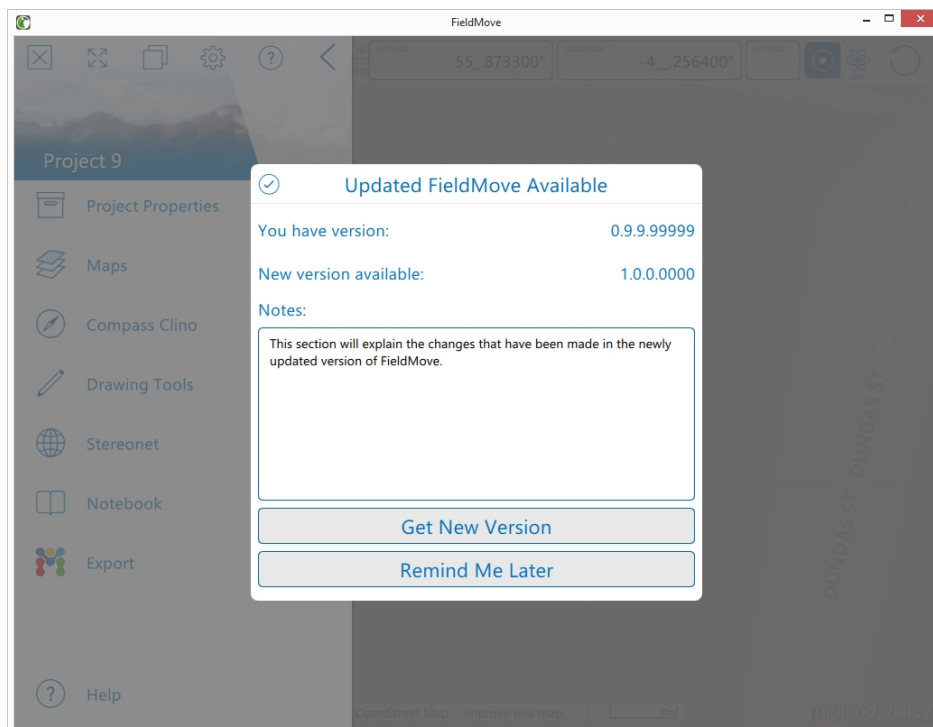## How do I take a bearing?

To take a bearing, tap ⊘ to open the **Compass Clino** page. If the compass is inactive tap on the small compass face to the left. To take a bearing, hold the tablet horizontal and tap the compass face to lock the bearing. Deviations from this bearing will be displayed by a red bar. To stop tracking the bearing, tap the compass face again. Bearings can be saved by tapping **Save**.

Refer to section '**Compass Clino'** for more information.

How do I take bedding measurements?

Bedding measurements, along with other planar or linear readings are recorded in the **Compass Clino** page. If required, activate the clinometer by tapping on the small clinometer face.

For the measurement to be saved, it has to be assigned to a rock unit. To set up a stratigraphy, or list of rock units, refer to section **'Compass Clino'**. Then ensure that **Bedding** is selected as the active data type.

To record a measurement, place the tablet parallel to the surface. When the device is active, the clinometer face will display a red dip symbol. To lock the reading, tap the clinometer face; the dip symbol will change from **red** to **black**. Once the reading is locked, check the location reading and associated properties, add an optional comment, then tap **Save**. All measurements will be stored in the **Notebook**.

Refer to section '**Compass Clino**' for more information.

My measurements won't save, why?

To save a planar or linear measurement they need to be assigned to a rock unit that is listed in the **StratColumn**.The workflow for setting up **StratColumn** is described in section '**Compass Clino**'.

How do I load a basemap?

To use an image as a basemap in FieldMove it has to be geo-referenced, and in the file format **GeoTIFF** (.tiff), **MBTile**s (.mbtile) or **Earth Files** (.earth).

We recommend importing **MBTiles** via **iTunes**, as the **zoom level** can be set for higher detail whilst working in the field. GeoTIFFs can be converted to MBTiles in Move.

Basemaps are imported from the **Maps** page. Once the page is open, tap ⬆ and select the desired map. It will be listed in the **Maps** page. Tap ⊗ to display the map.

For more information on loading basemaps refer to section '**Maps**'.

How do I take a geo-referenced photo?

From the **Notebook** page tap 📷 and select **Photo** from the drop-down list. This will automatically open the camera. Geo-referenced notes can be added to the photo once the image has been captured.

Refer to the **Notebook** section for more detailed information.

How do I create a geo-referenced note?

From the **Notebook** page, tap 📷 and select **Notes**. Once the note has been saved it will be automatically geo-referenced. Details on its location can be viewed by selecting the note from within the **Notebook** page.

Refer to section '**Notebook**' for more information.

How do I change the project name?

The project name is edited in the **Project Properties** page. It is important to note that the exported project folder will still have the name 'projectXX.fm'. However, the folder name can be renamed once transferred onto a computer.

Refer to section '**Project Properties**' for more information.

How do I change a locality name?

Locality names and positions can be changed from within the **Notebook** page. To change the name tap on the locality title, and change the text in the expanded **Notebook** page.

Refer to sections '**Notebook**' and '**Project Properties**' for more information.

How do I view and edit saved data?

All saved data is listed in the **Notebook** page. Select a data entry to view the object details and make any apropriate edits. Data can be filtered in the Notebook

page, and the map view will update appropriately.

Refer to section '**Notebook**' for more information.

How do I delete data?

To delete individual measurements (e.g. dips, lines) select the data in the map view. This will display a data label in the map view, tap 🗑 to activate the deletion, then tap 🗑 Confirm to confirm the delete. Data can also be deleted by selecting it from within the **Notebook** page. This will expand the page from where you can tap **Delete** in the top right corner.

To delete rock units in the **StratColumn** tap on the active rock unit from within the **Compass Clino** or **Drawing Tool** pages. Tap 🗑 from the top right corner to delete the active rock unit. To delete a different rock unit tap on the three dots to the left of the unit name, to make this the active unit, then tap 🗑 .

To delete a whole project, navigate to the **Project Management** page. Listed under the project title is the 🗑 button which, when tapped, will delete the project.

Refer to sections '**Compass Clino**', '**Notebook**' or **Project Management** sections for more information.

Does FieldMove support other coordinate systems?

At present, FieldMove only operates using a **Lat/Long** and **WGS84 projection** system. This is the standard web Mercator projection.

When the project is imported into **Move**, the coordinate system can be changed. We recommend that before the FieldMove project is imported, a blank document is set up with the correct coordinate system, as this will avoid UTM calculation issues.

How accurate are elevation readings?

We have not tested the accuracy of altitude readings on tablets containing barometers. We would advise that you project your data onto a DEM once in **Move**, rather than relying on the altitude readings from the tablet.

How do I use FieldMove offline?

FieldMove requires online connectivity for the basic maps (satellite, road and terrain views). If you disable online connectivity, the map view will still work but will only display maps that have been cached previously. A basic grid will be shown in places where there is no cached data.

Any basemaps that have been imported will display when there is no connectivity.

Refer to section '**Maps**' for more information.

How do I clear the cache?

To clear the cache, expand the **Side Panel** by tapping ☰ . Tap ⚙ to open the **Settings** page and turn the **Reset Caches** option to **On**. The app must then be completely restarted for the cache to reset. When opening FieldMove after the cache has been reset, it may take a few minutes for the Online Maps to load. See the '**Maps**' section for more information.

How do I export a project?

The project can be exported through two routes:

1) From within the **Project Properties** page, tap ⬆ at the top of the page to export the project.

2) Expand the **Side Panel** and tap 🔵 to export.

Data can be exported in CSV, Move and Google Earth file formats.

Refer to section '**Export**' for more information.

Why might my project not be loading into Move?

One of the main reasons this has occurred in the past is due to the inclusions of non Ascii characters such as é, £ or % in file titles.. If it does occur try renaming the file and upload again.

Glossary

Accelerometer	An electromechanical device that measures acceleration forces. With respect to FieldMove, it measures the acceleration due to gravity (G-Force). When tilted, the accelerometer can work out the angle of the device (e.g. Dip).
Barometer	A barometer is a device that measures atmospheric pressure. It is used in FieldMove (as well as many other apps) to help detect the altitude level. Tablets that contain a barometer will give more accurate altitude readings.
Bearing	The direction in which you are heading given by the orientation on the compass.
Cache Data	Whilst viewing maps online, the map view and zoom level are stored locally in an area called 'cache'. If the user then works offline, the maps stored in the cache can be viewed. However if the user wants to zoom at a different level, or a different area whilst offline, it will not be possible.
Comments	These are linked to specific measurements, for example describing in detail the surface where a dip measurement has been taken from.
CSV	Comma Separated Values file. Files exported in this format can be opened in programs designed for spreadsheets such as Microsoft Excel.
Data Type	Defined as planar and linear data. The user can assign measurements to specific data types such as bedding, cleavage or mineral lineation.
Declination	The angular deviation of the compass from true north. The value can be adjusted in the Project Properties page.
.earth	Earth files are small XML text files that point to a web based server. Many geological surveys and companies have user generated maps based on web servers which allow users to stream and cache maps onto the device for viewing.
.fm folder	The file type used for storing FieldMove projects.
Geo-referenced	An object which contains information about its location. If an image is geo-referenced then it carries information about its geographical position. Images that are brought into FieldMove as basemaps must be geo-referenced.
GeoTIFF	A commonly used GIS format. GeoTIFFs can be imported directly but many tablets struggle to reproject and render this data. Using Move to convert the GeoTIFF to an MBTile file before importing to FieldMove will reduce the file size and speed up the app in the field.
GPS	Global Positioning System. This is used to gather information from satellites about your location.
Gryoscope	A device that helps to indicate orientation by using the earth's gravity by measuring the angular rotational velocity.
.kmz	Keyhole Markup Language file. Files exported in this format can be opened straight into Google Earth.
Line Join Distance	The line join distance defines the extent (in points) at which it is possible to extend or join a line when using the drawing tools . The higher the value, the greater the distance across which lines will be joined.
Locality	Localities are a way of grouping data and are user definable. For example, localities can be applied to an outcrop or for a new day in the field.

Magnetometer	Provides the orientation with relation to the Earth's magnetic field.
Maps	Geographical images. FieldMove provides online maps for terrain, satellite and road views. Map overlays can beimported as MBTile files or GeoTIFF files.
MBTiles	This a web format that cuts data into a number of tiles depending on zoom level. Move can directly export MBTiles from a geo-referenced image to load onto a tablet.
Mean Resulatant Plane	The average plane for all the selected data, displayed as a great circle on the stereonet.
.mve	A Move file. Files exported in this format can be opened straight into Midland Vallye' s Move software.
Notes	Notes are geo-referenced descriptions, such as a sample location or notable change in vegetation. This is akin to the notes taken in a field notebook while mapping.
osgEarth files	This file type uses an XML based file format called an Earth File to specify how source data turns into an OSG scene graph.
Pixel Width	The width measured by individual pixels. This measurement is used to alter the width of the lines and polygons in the Drawing Tools page.
Project	A project is a set of localities, structural data, notes and images related to a specific mapping area. When exporting data it is the whole project that is exported.
Projection	A projected coordinate system, is always based on a geographical coordinate system, but is defined on a flat two dimensional surface. Across the two dimensions, it has constant lengths, angles and areas.
Relative Offset	Refers to the editing mode in the Compass Clino page. Edits made to the dip and strike or dip azimuth are carried out individually.
Stereonet Style	Refers to the editing mode in the Compass Clino page. Edits made to the dip/plunge and strike/azimuth can be made at the same time.
StratColumn	User defined list of rock units that is used to assign a colour to structural measurements or line objects i.e. to define a rock type or a fault. On export this information is recorded as an attribute.

Our Experience

Figure: Collecting data on Arthur's Seat.

Hardware

Battery can last for a full field day (~8 hours with the GPS on, but with other apps and data streaming turned off). Larger tablets with heavy batteries tend to have a good battery life in the field but this must be considered against the tablets weight. This is highly dependent on the tablet, and we recommend experimenting with your device to get the best out of usage time. Older tablets may suffer from reduced battery life. Lithium batteries tend to falsely report a low battery in cold conditions and so keeping the device from being exposed will help reduce this problem.

When your tablet is locked, the GPS will become inactive and will not drain the battery.

There are plenty of tough cases and waterproof pockets on the market that to protect the tablet such as LifeProof, Idry, Aquapac etc.

Preparation

A common hindrance to successful digital geological mapping is a lack of advance preparation before leaving for the field. In addition to collation of digital basemaps, elevation models, and existing geological maps, the most important aspect of preparation is to practice using the software and hardware tools. As with any compass, orienteering, and basic mapping skill, advance practice ensures that the mapping device is not the focus of the user's attention, leaving the field

mapper to focus on 3D spatial analysis of rock units. We find that these issues are relatively easy to overcome with advance planning and training, giving an appreciation of the potential benefits of digital field mapping.

We recommend testing and calibrating the tablet against a compass before going to the field. See our guide on **Digital Compass Calibration**.

Things to watch out for when mapping with a tablet

1. Make sure that you **lock** your device **when traversing**. This will ensure that you don't end up with 'ghost' readings while you're en route to the next outcrop.

2. Check that the **GPS location has updated** to your current location, **before saving** a reading. Look at the time stamp (to the left of the the lat / long readings) and check that the lat/long coordinates have updated for the current location. If you are still unsure if the GPS has placed you correctly check your position on the map.

3. Make sure that your device has **enough storage space** for a day's data collection. We recommend that, at the end of each day, you copy your files from your device to your PC and back these up. You can then delete the project from your device and start a new project, to free up memory. To put a project back onto your device, simply paste it from its saved location on your PC into the FieldMove app folder through iTunes.

4. At the start of the day, **check** your device's **calibration** before taking a reading. Make sure that you are away from buildings, cables, vehicles and jewellery and compare the readings from your device with a traditional compass-clinometer.

5. Take care to check that you have assigned the **correct rock unit and structure type** before tapping the **Save** button. It is very easy to collect incorrectly classified data. The rock unit and symbol assignment can be edited in the **Notebook** page.

Closing remarks

We find that digital mapping tools improve the 3D spatial interpretation process by facilitating more analysis and less data management than traditional techniques, especially in the "field office" during the evenings. With a digital mapping workflow, data organisation largely occurs in the field upon data collection, transcription from paper to digital format is unnecessary, and data backup can be as simple as copying digital files to external hard drives. Digital mapping allows more time in the evenings for problem solving, targeting areas of uncertainty, and formulating effective field plans.

System Requirements

FieldMove has been built on Qt, which is the same development platform used by Move. The application will run on Apple (iPad and iPad mini), Android and Windows tablets, but it cannot be used on smartphone devices. For more information on how FieldMove runs on iPads, Android and Windows tablets please refer to the **Digital Compass Calibration** section. We **strongly** advise that users read this section to understand some limitations of FieldMove on specific tablets.

Minimum iPad tablet requirements

- iOS 8 and above running on iPad 2, iPad 3, iPad 4, iPad Air, iPad Air 2, iPad Mini, iPad Mini 2, iPad Mini 3.

Note: WiFi and Cellular model is required for GPS sensors.

We recommend at least an iPad 4, iPad Air or iPad Mini 2 or better for ideal performance.

Minimum Android tablet requirements

- A tablet running Android 4.0 (Ice Cream Sandwich) and above.

Tablets must have a magnetometer, gyroscope and accelerometer for the orientation readings to work.

Minimum Windows tablet model requirements

- Windows 7 or above (32 or 64 bit)
- 1GB RAM
- 512MB free hard disk space
- DirectX 9 or DirectX 11 compatible graphics
- Magnetometer, gyroscope and accelerometer.

Recommended:

- Multi-Point Touch Screen
- 9-axis orientation sensors (Accelerometer, Gyroscope, Magnetometer)
- GPS (compatible with Windows Location Services)
- Intel HD Graphics series, GeForce 500M series or above, or AMD Mobility Radeon 5000 series or above.

About Midland Valley

Midland Valley is a world leader in the field of structural geology and the development of software modelling tools using structural validation, restoration and forward modelling, to provide best practice workflows and reduce risk and uncertainty. Our structural modelling software, Move, is the validation technology of choice for Oil, Gas and Mining companies, in addition to being used by Geological Surveys and a variety of Geotechnical organisations worldwide.

About Move™

Move provides workflows for digital field mapping, cross-section construction, 3D model building, kinematic restoration and validation, geomechanical modelling, fracture modelling, stress analysis and sediment modelling. The software helps the user to go beyond static models, which may be little more than an artist's impression or a computer animation. By addressing time development of structure and checking evolutionary feasibility, users are three times more likely to produce the correct result.

Find out more about the Move suite by visiting our website at **www.mve.com** where you can contact us for more information, pricing details or for details about our software evaluation license.