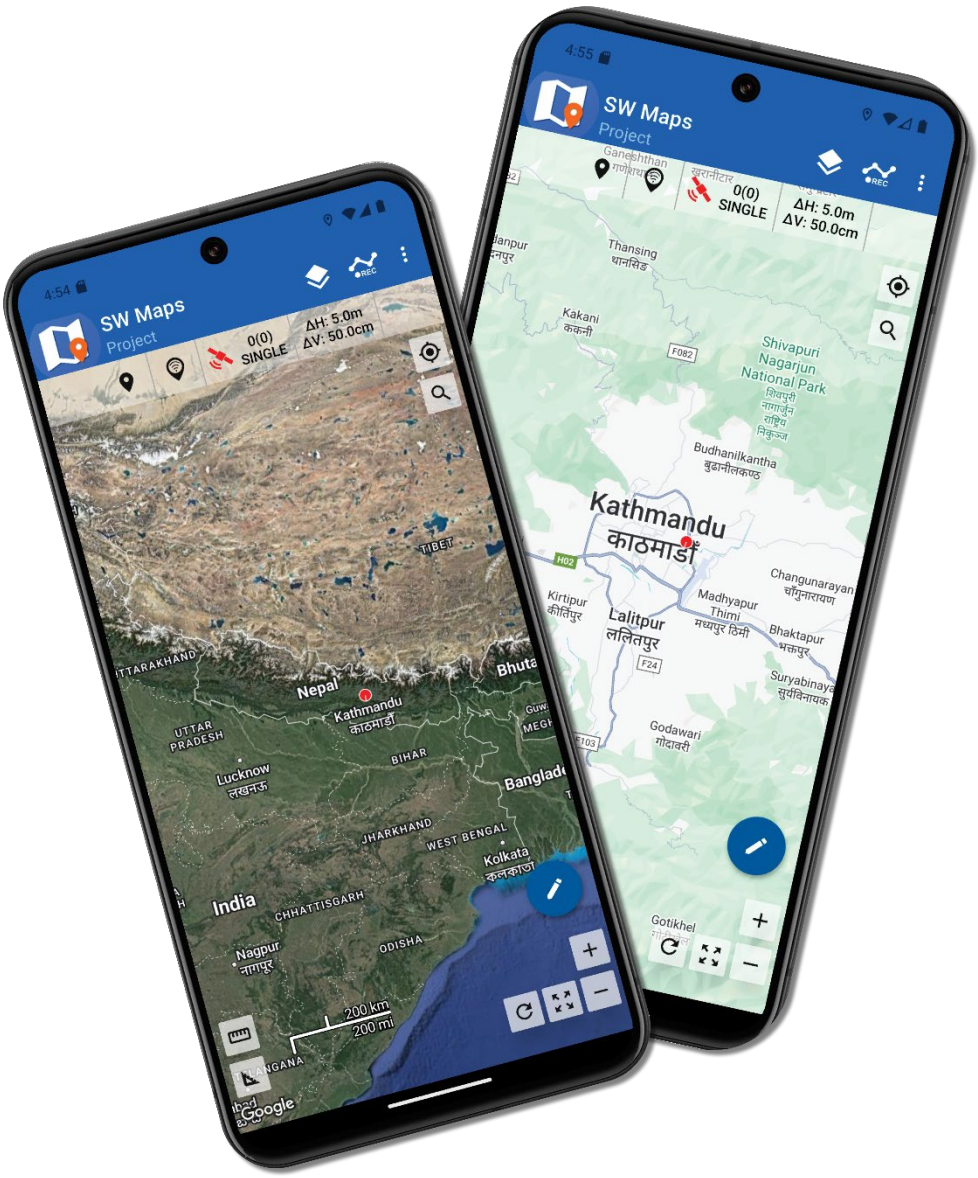
SW Maps

Android App Version 3.0.0
User Manual



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About This Manual

The purpose of this manual is to serve as a reference document for users of SW Maps.

- Chapter 1 is a general introduction to SW Maps and its features.
- Chapter 2 contains the system requirements for running SW Maps.
- Chapter 3 contains information on installing SW Maps.
- Chapter 4 contains a brief description of the main user interface of SW Maps.
- Chapter 5 contains information on the SW Maps data folder.
- Chapter 6 explains the SW Maps project creation and deletion.
- Chapter 7 explains the project settings sidebar and changing coordinate systems.
- Chapter 8 deals with project attributes.
- Chapter 9 provides detailed information on layers, including layer attributes and styling.
- Chapters 10, 11 and 12 deal with recording features, tracks, and photos respectively.
- Chapter 13 describes the various file formats used by SW Maps.
- Chapter 14 contains information on sharing and exporting projects in various formats, and importing projects shared using the SW Maps swmz format.
- Chapter 15 deals with templates, including their creation, installation, and use.
- Chapter 16 has instructions for connecting and using external GPS/GNSS instruments and NTRIP client.
- Chapter 17 contains the instructions for viewing additional GPS information and satellite skyplot.
- Chapter 18 describes the stakeout tool to locate the data points on the ground.
- Chapter 19 describes the various settings that are available on the app.
- Chapter 20 explains the miscellaneous tools and utilities in SW Maps.

1 Introduction

SW Maps is a GIS app for collecting, presenting, and sharing geographic information, for phones and tablets.

Features

- Online Base maps: Google Maps or Open Street Map
- Support for multiple MBTiles and KML overlays.
- Shapefile, GeoJSON and GeoPackage layers, with attribute categorized styling
- Define multiple number of feature layers, each with a set of custom attributes
  Feature Types: Point, Line, Polygon
  Attribute Types: Text, Numeric, Drop-Down Options, Checklist, Photos, Audio and Video
- Add multiple online WMTS, TMS, XYZ or WMS layers and cache tiles for offline use.
- Record GPS tracks, with distance measurement.
- Draw features on map and export as KMZ, Shapefiles, GeoJSON or GeoPackage.
- Label features based on attribute values.
- Import feature layers from templates or existing projects. Export layers as a template to create another project.
- Share or export collected data as KMZ (with embedded photographs) or as shapefiles, GeoJSON, GeoPackage (GPKG), XLS/ODS spreadsheets or csv files.
- Share templates or projects with other users.
- Connect to external high-accuracy GNSS receivers through Bluetooth or USB Serial for high accuracy surveying using DGPS, RTK or PPP. Also record data from external receiver for post processing.
- Stake out features on the ground using precise GNSS receivers.

2 Requirements

SW Maps is currently available for devices running Android 5.0 and above. Google Play Services is required and will be updated if necessary.

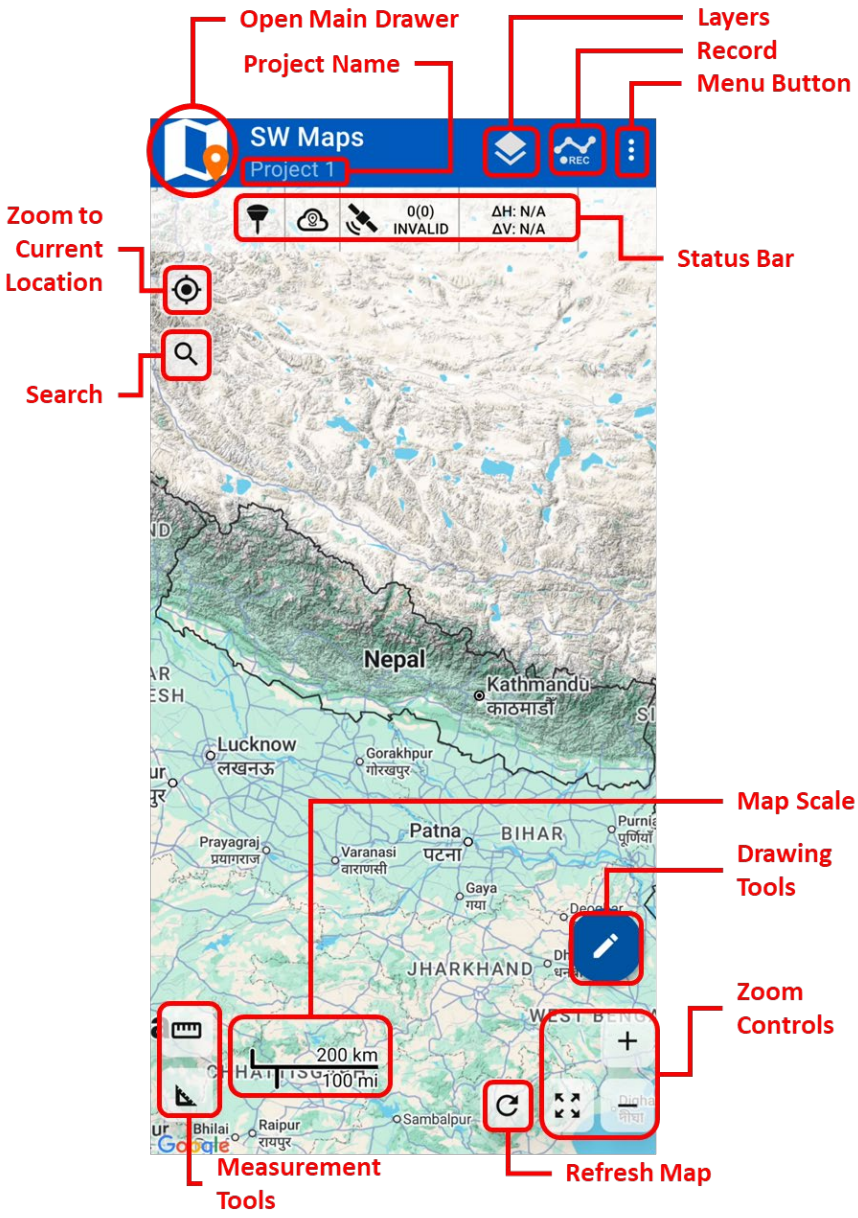
3 Installation

SW Maps for Android is available from the Google Play Store.

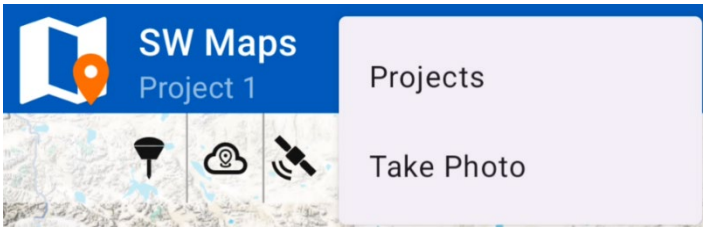
4 Getting Started

4.1 The SW Maps User Interface

The SW Maps user interface has the following components.

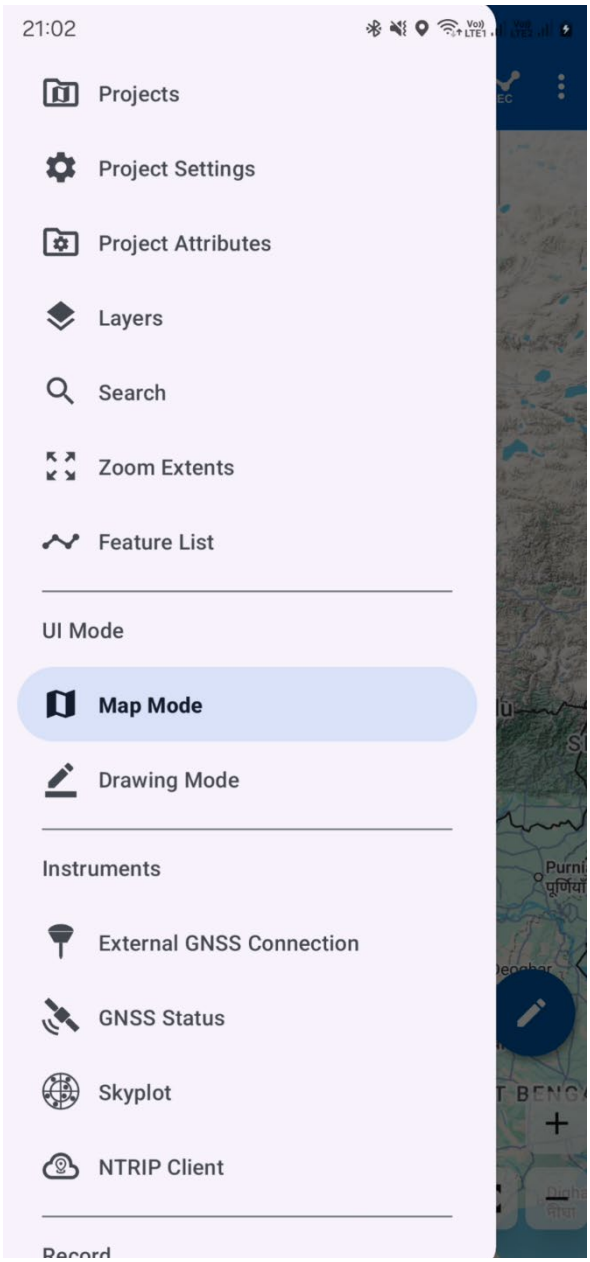


Pressing the Menu Button will reveal more common actions.



4.2 The Navigation Drawer

Swiping the app screen from left to right will open the Navigation Drawer, which can be used to access all the features of SW Maps. The navigation drawer contains a scrollable list of actions.



The navigation drawer has the following items available for selection.

1. Project
   Opens the **Projects** sidebar for creating, opening, or deleting projects.
2. Project Settings
   Opens the project settings sidebar where you can change project specific settings, like the coordinate system.
3. Project Attributes
   Opens the **Project Attributes** sidebar, which allows creating and removing global attributes for the current project and allows editing the values.
4. Layers
   Opens the **Layers** sidebar for adding, editing, and deleting layers.
5. Search
   Opens the search bar, which can search for recorded/drawn features and imported geometries on the map.
6. Zoom Extents
   Zooms the map to the extent of the current project.
7. Feature List
   Opens the list of features in the currently open project.
8. UI Mode
   It allows you to switch the interface between the Google Map view and a drawing mode suitable for fine drawing.
9. Instruments
   a. External GNSS Connection
      Press this button to connect to external GNSS receivers using Bluetooth or USB.
   b. GNSS Status
      Opens a sidebar showing detailed GNSS status.
   c. Skyplot
      Shows the GNSS satellite skyplot.
   d. NTRIP Client
      Allows connecting to an NTRIP client for GNSS corrections, that are sent to the receiver.
10. Record
    a. Feature
       Opens the **Record Feature** sidebar for recording features.
    b. Track
       Opens the **Record Track** sidebar for recording tracks.
    c. Photo
       Loads the camera application for quickly taking a photo.
11. Import
    a. Import Project
       Import a project from the device storage.
    b. Import Template
       Import a template from the device storage.
    c. Import CSV

Import points from a CSV file into a layer in the current project.

12. Share/Export Project
    a. Upload to FTP
       Upload the project to an FTP server.
    b. Share Project
       Share the current project in different formats.
    c. Export Project
       Export the current project in different formats.

13. Templates
    a. Share Template
       Share the project as a template.
    b. Export Template
       Export the project as a template.

14. Other
    a. Compass
       Opens a compass to show the current bearing.
    b. Settings
       Opens the app settings.
    c. About
       Shows the about dialog with app version and developer contact information

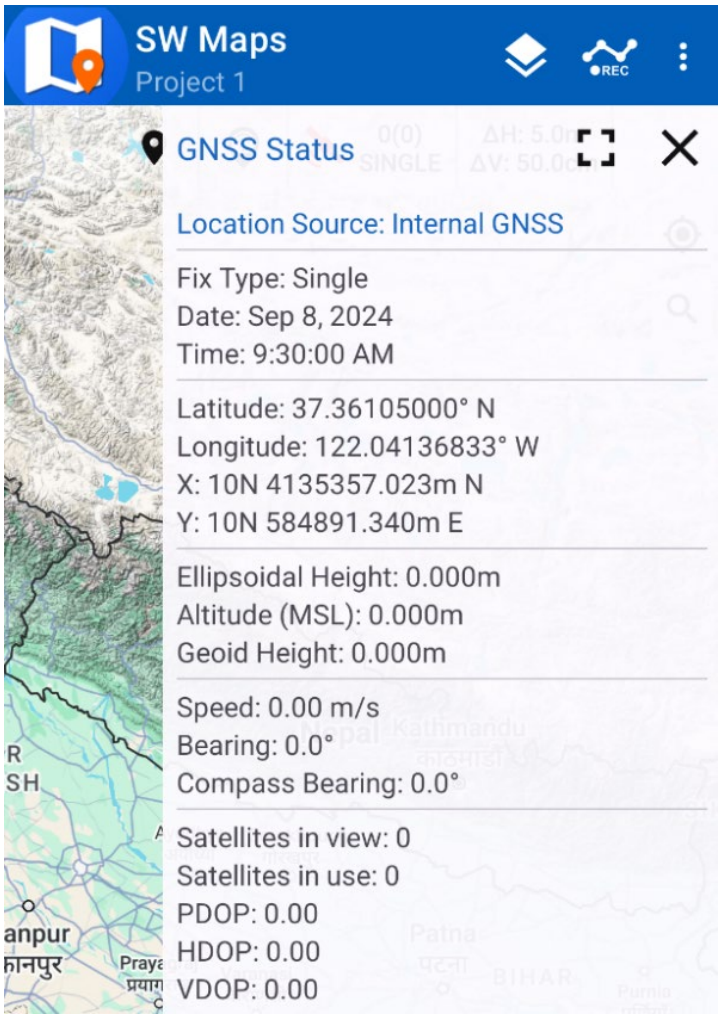
4.3 Button Symbols Used in SW Maps

SW Maps uses different button icons to symbolize the actions performed by the button. Commonly used icons, along with their description, are shown below.

Symbol	Description
	Used for buttons that are used to add items, such as layers and projects.
	Used for buttons which delete items such as layers, attribute definitions, features, tracks, and photos.
	Used for buttons which change some settings or show additional options.
	Used for buttons which allow editing a value.
	Close button of sidebars.
	**Record Point** button when recording features.
	For Sharing items.
	For data exports.
	Refresh buttons.
	Used in buttons next to textboxes that save or update a value.
	Save buttons.
	Label fields
	Delete actions
	Enter and exit full screen display for sidebars
	Zoom in, zoom out and zoom to extents

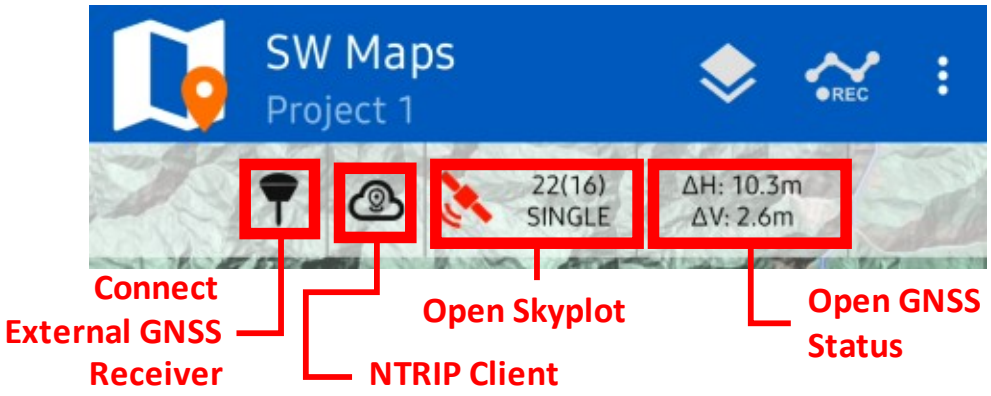
4.4 Sidebars

Most of the actions that are performed within SW Maps are done through various sidebars. The sidebars appear on the right side of the screen.



4.5 Location Status Bar

The location status bar shows the status of the app and the user's location. You can also use the location status bar to quickly access different parts of the app.



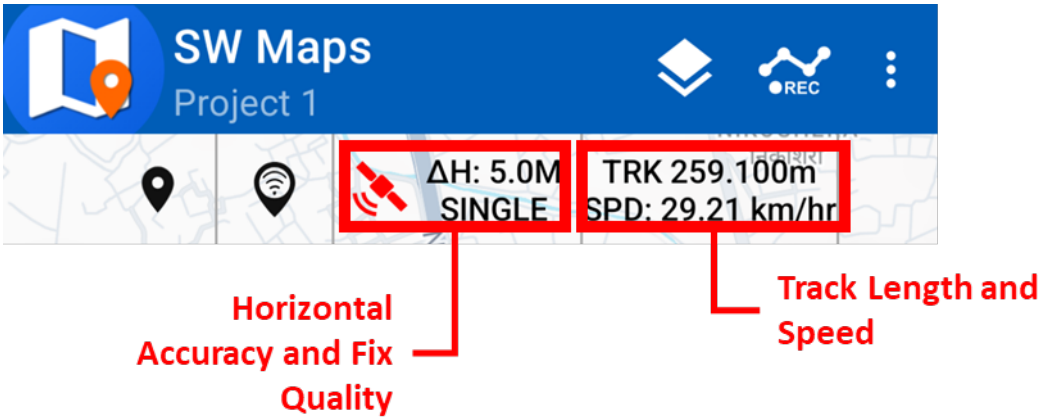
The leftmost button shows the status of the external GNSS connection. Press this button to open the External GNSS connection sidebar.

The second button shows the NTRIP status. It is green when the NTRIP client is connected, orange if the client is connected but the age of differential is high.

The third button shows the number of satellites and the current fix status. Tap on it to open the GNSS Skyplot.

The rightmost button shows the current estimated location accuracy. Tapping it opens the GNSS Status sidebar.

The buttons on the status bar can change based on context. For example, when recording a track, the current track length and speed is shown.



Tapping on the track length and speed opens the **Record Track** sidebar, where you can stop recording the track.

5 The SW Maps Folder

All the data files used by SW Maps, including projects, photos taken, external layers and templates are stored in the SW Maps folder. The location of the folder depends on the Android version.

- For Android 10 and earlier, the SW_Maps folder can be found in the root of the primary device storage (Internal storage)
- For Android 11 and later, the folder has been moved to the Android/media/np.com.softwel.swmaps/files folder due to storage restrictions. The folder is accessible through a computer and file manager apps installed in the device.

When run for the first time, SW Maps will create the following folders inside the SW_Maps folder.

- **Projects** Contains all project database files.
- **Maps** Contains all external layers. Copy your data to one of the subfolders of this folder.
    - mbtiles: For MBTiles files
    - kml: For KML file
    - shapefiles: For shapefiles. Copy the shp, shx, dbf and prj files here.
    - geopackage: For GeoPackage (gpkg) files
    - geojson: For GeoJSON files
- **Photos** contain all the photos taken using the app (for version 2.x and earlier).
- **Templates** contain templates that can be used by the app to create projects. Copy the template files here.
- **Export** contains all the data exported using SW Maps
- **Geoids** contain geoid models that can be used by SW Maps for computing the orthometric height. Copy the geoid grid files in GTX format here.
- **RawData** contains the raw GNSS data recorded from instruments connected via Bluetooth or USB.
- **Temp** contains temporary files.
- **Import** contains CSV and other data files to be imported into the app.
- **Cache** contains a cache of online maps.

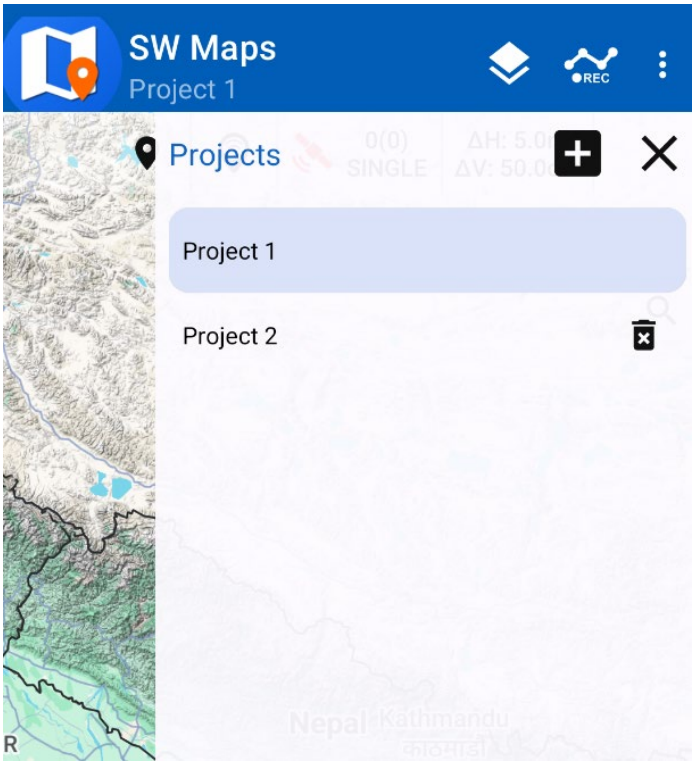
6 Project

SW Maps stores all recorded data and layer definitions in a project database. Projects can be created or opened using the “Projects” Sidebar, which can be opened using the menu or the navigation drawer.

SW Maps will prompt you to create a new project when opened for the first time and whenever no projects are available. The last used project is opened at each startup.

6.1 The Projects Sidebar

The **Projects** sidebar can be opened using the **Projects** button on the navigation drawer.

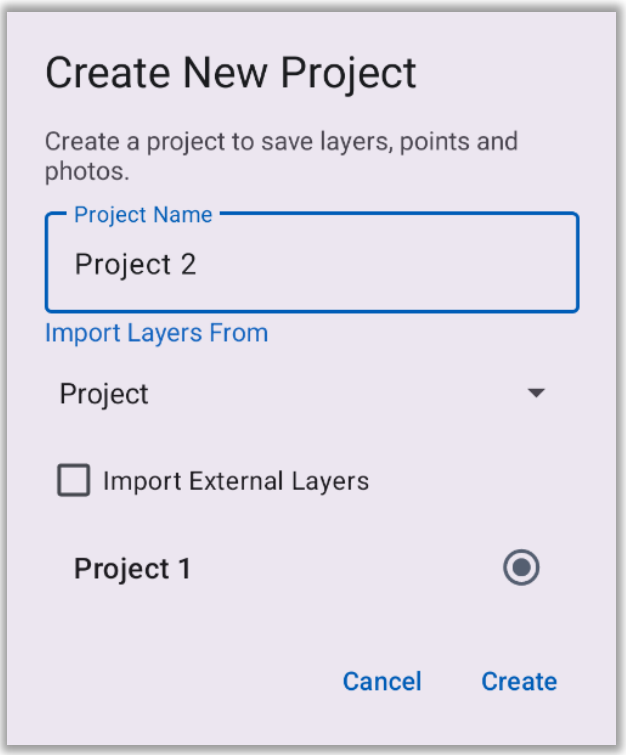


The sidebar shows a list of projects that are currently on the device. Yoo may create a project by clicking the button. You may also delete projects by clicking the button next to the project. Note that the currently open project cannot be deleted.

6.2 Creating Projects

To create a project, follow the steps below.

1. Press the ➕ button to open the **Create Project** dialog.
2. Enter the name of the new project.
3. When creating projects, feature layers and attributes can be imported from other projects or templates by selecting the appropriate option in the Layers drop-down.
    - To import from templates, select the **Template** option.
    - To import from another project, select the **Project** option.
    - To create a blank project, select the **Do Not Import** option.
4. If importing from a template or an existing project, the dialog will also show the list of available projects or templates. Select the project or template to load. You can also choose whether to import the external layers added to the project.
5. Press the **Create** button to create the new project.



6.3 Deleting Projects

To delete a project, select the project in the list and then press the Delete icon 🗑 beside the project's name on the list. Note that you may not delete the currently active project.

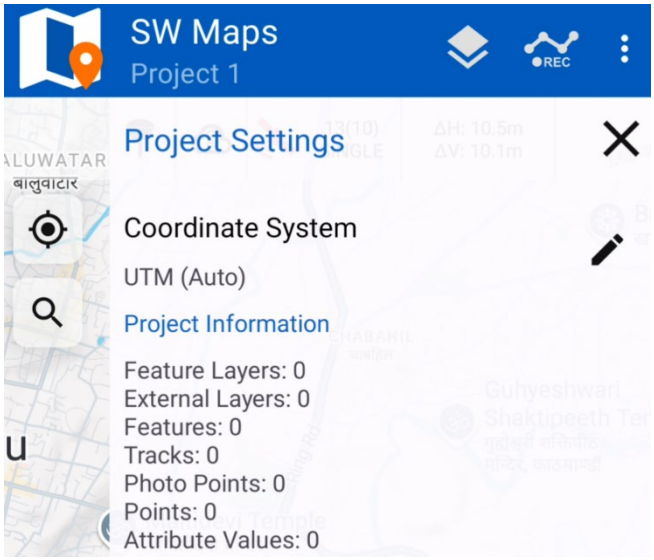
7 Project Settings

7.1 Project Coordinate System

SW Maps lets you define the projected coordinate system for a project. The defined coordinate system is used for the following.

1. The display of X and Y values in various screens around the app.
2. The stakeout tools.
3. Import of CSV files.
4. Manual entry of coordinates.
5. Export in Spreadsheet and CSV formats.

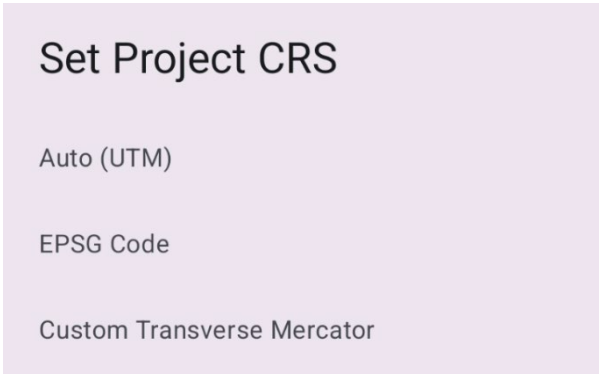
To define the project coordinate system, open the **Project Settings** sidebar from the navigation drawer.



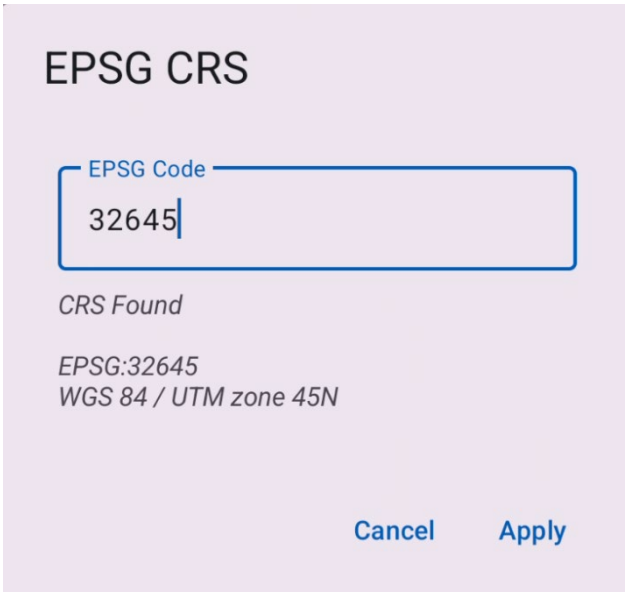
7.1.1 Changing the Project Coordinate System

By default, the project coordinate system is set to **UTM (Auto)**. This uses the Universal Transverse Mercator system to display the X and Y values, and the zone is calculated automatically based on the point's location.

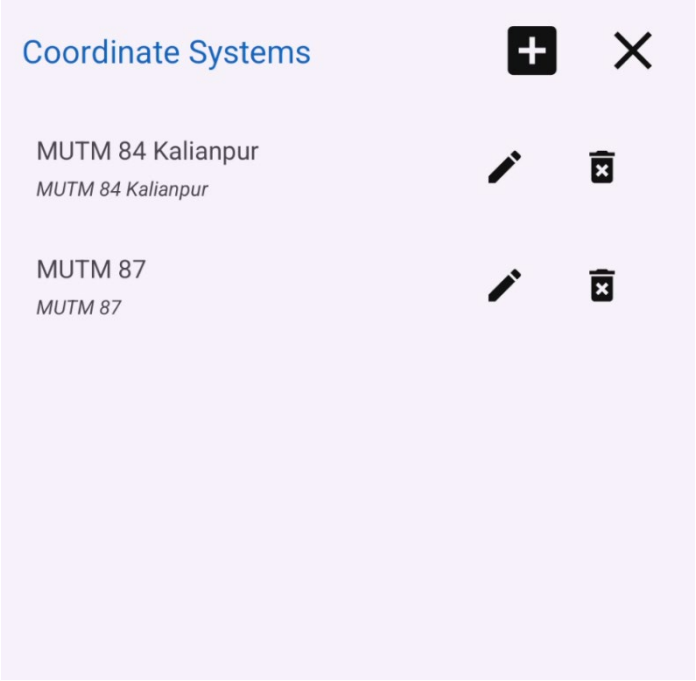
To change the coordinate system, press the ✎ button. You will have the option to choose between **Auto (UTM), EPSG Code** and **Custom Transverse Mercator**.



Using the **EPSG Code** option will let you enter an EPSG code and set the project's coordinate system to it.

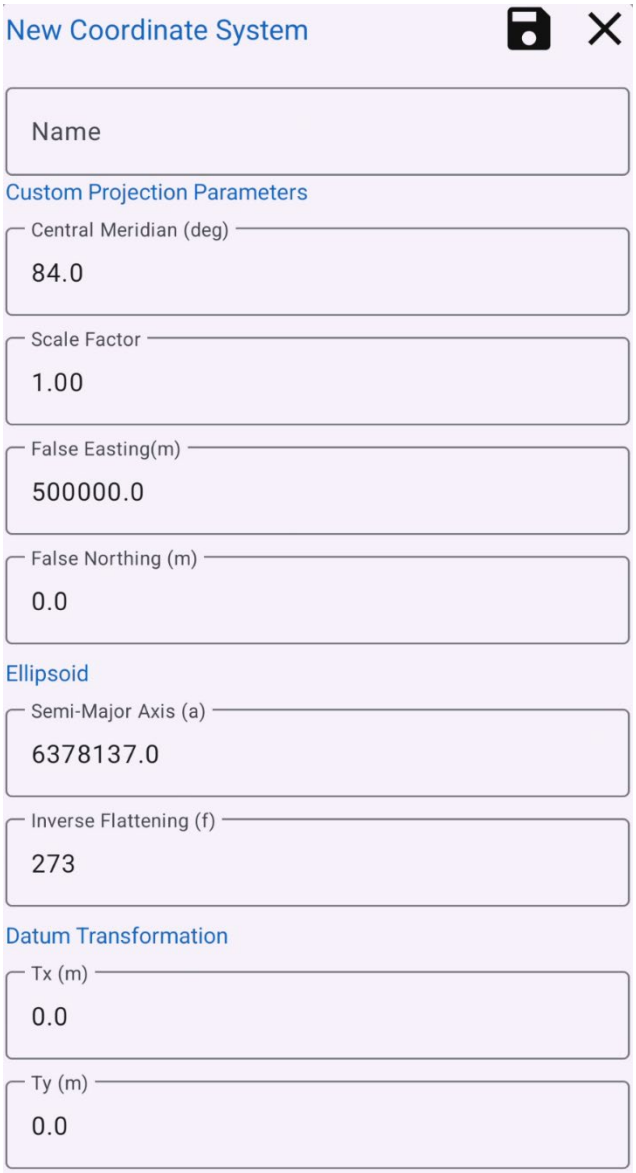


Selecting **Custom Transverse Mercator** will let you define your own Transverse Mercator projection and select from a list of user defined projections.



7.1.2 Adding a Custom Transverse Mercator Projection

To add a custom Transverse Mercator projection, press the ➕ button on the list of Coordinate Systems. This opens a screen where you are required to enter the name of the new system and several parameters of your custom projection, including Ellipsoid, Datum Transform parameters (to WGS84) and projection parameters.

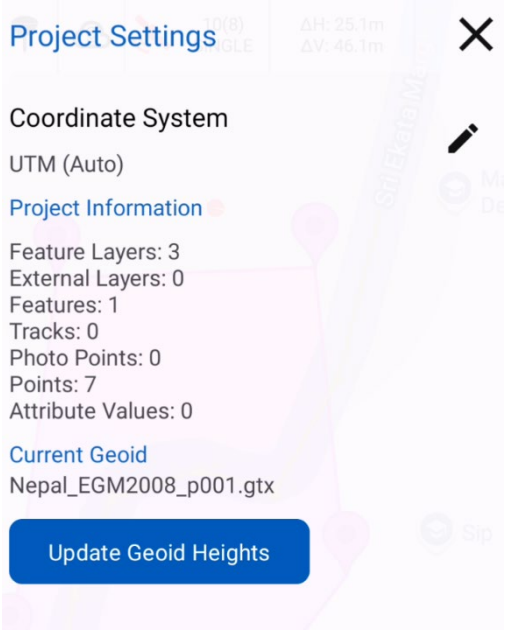


Once defined, you can use this system as the project coordinate system.

You can also add a Nepal Modified-UTM system to SW Maps in a similar way.

7.2 Project Statistics

The Project Settings sidebar also shows the project statistics, with the number of layers, features and points in a project.



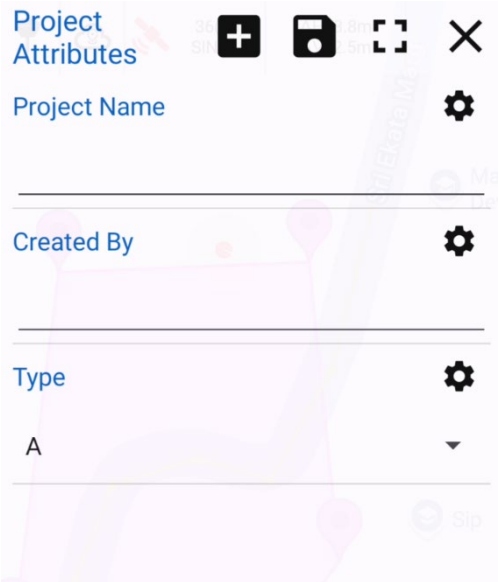
7.3 Updating Geoid Heights

When a geoid file is loaded into SW Maps, you can use the Project Settings sidebar to update all the geoid heights recorded in the project using the new geoid file, by pressing the **Update Geoid Heights** button.

8 Project Attributes

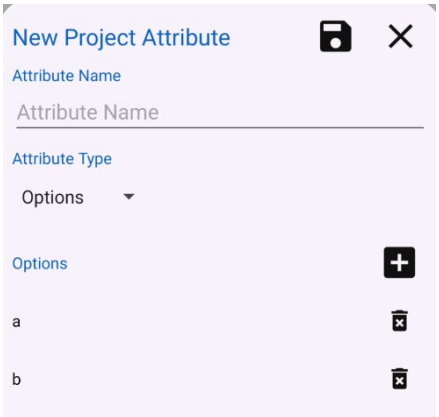
The **Project Attributes** sidebar allows defining a set of attributes applicable to the whole project. The project attributes feature is useful especially when used in combination with templates, to describe the project itself.

The **Project Attributes** sidebar may be opened from the left navigation drawer.



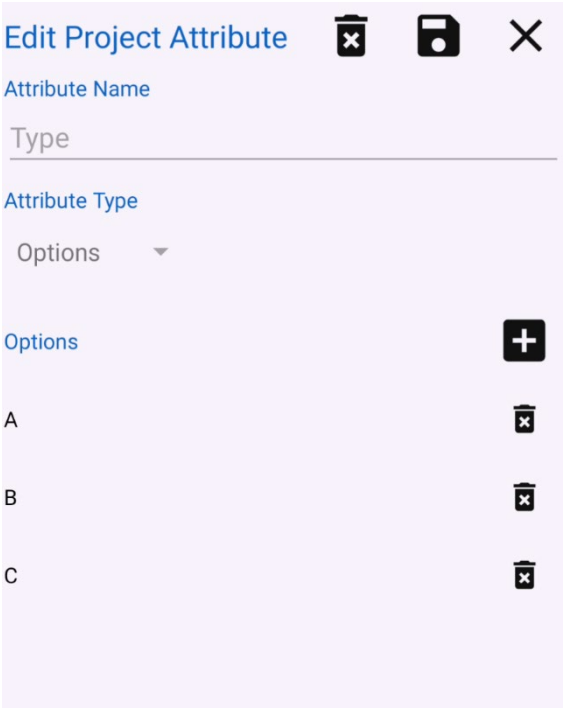
8.1 Creating Project Attributes

Press the + button on the top of the Project Attributes sidebar. Then enter the attribute name and data type. For the Options data type, also enter a list of choices.



8.2 Editing and Deleting Project Attributes

To edit or delete a project attribute, press the ⚙ button next to it. This will open the **Edit Project Attribute** sheet. You can edit the project attribute and tap the save button to edit it or tap the **Delete** button to delete it.



It is not possible to edit the attribute name or data type. An alternative is to delete the attribute and create a new attribute. The choices for Options type attributes may be added or removed.

8.3 Entering and Saving Project Attribute Values

The value of a project attribute can be entered in the **Project Attribute** sidebar. To save the entered values, press the **Save** 💾 button.

9 Layers

Layers are references to data sources which are symbolized over the map.

SW Maps supports different types of layers as overlays over the basemap.

1. User Data Layers: These layers contain data that the user records using a GNSS receiver or draws on the map.
2. External File Layers: These layers are loaded from file(s) stored on the user's device, such as shapefiles, GeoPackage or KML files.
3. External Online Layers: These are layers that are streamed from an online source (WMS/XYZ)

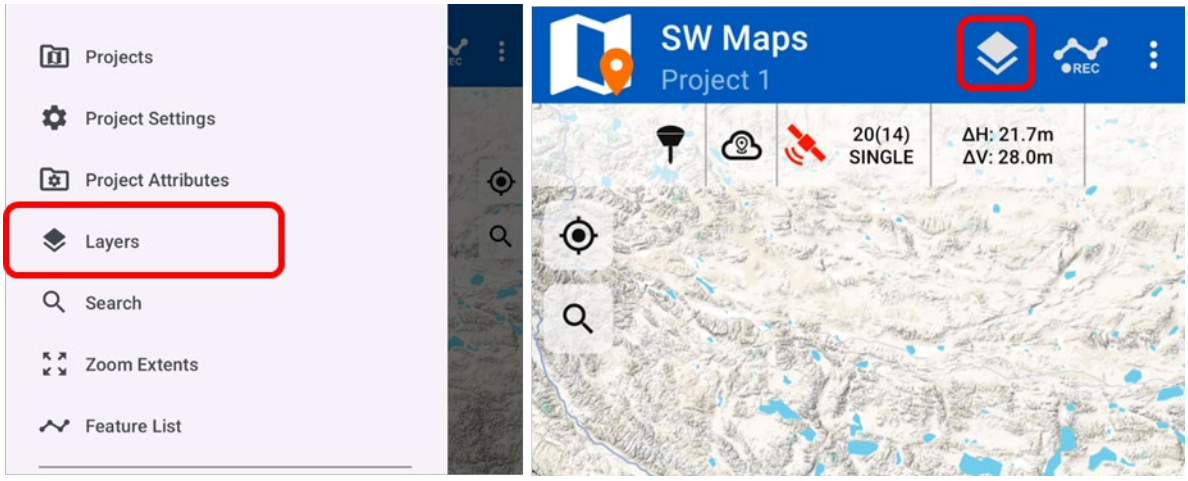
Each layer needs to have a layer name. Shapefiles, GeoPackage, GeoJSON and user data layers also require symbol information.

9.1 The Layers Sidebar

The Layers Sidebar allows you to add, remove and edit the layers that are part of the current project. It also allows you to toggle the visibility of the layers and change the background map type.

The Layers Sidebar can be opened using the following two ways.

1. Using the Layer button on the top menu
2. From the left navigation drawer.



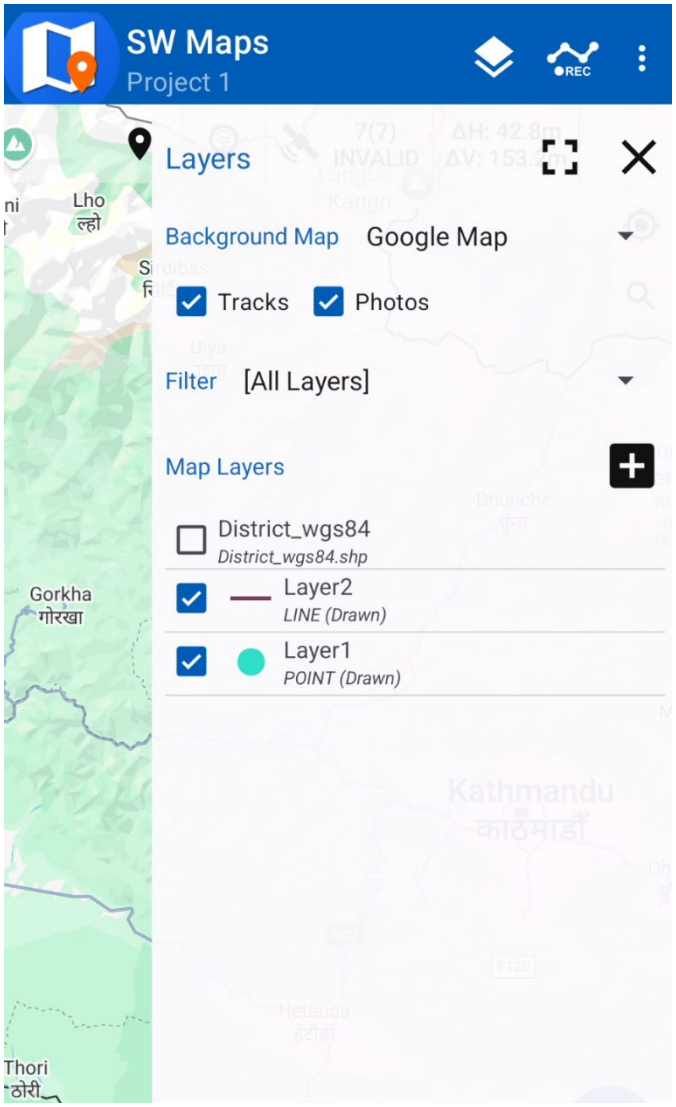
The Layers Sidebar has the following settings available.

1. Background Map
   Online maps can be displayed in the background. Only one background map can be active at a time.

2. Tracks
   This checkbox allows toggling the visibility of recorded tracks.

3. Photos
   This checkbox allows toggling the visibility of photo markers on the map.

4. Layer List
   This list shows all layers defined in the currently open project. To select a layer, simply tap on the respective list item. Selecting a layer reveals actions that can be applied to the layer.



9.2 Background Maps

SW Maps supports different types of background maps. The background maps serve as the bottom layer of the map view, being a basemap to all the data loaded on the map.

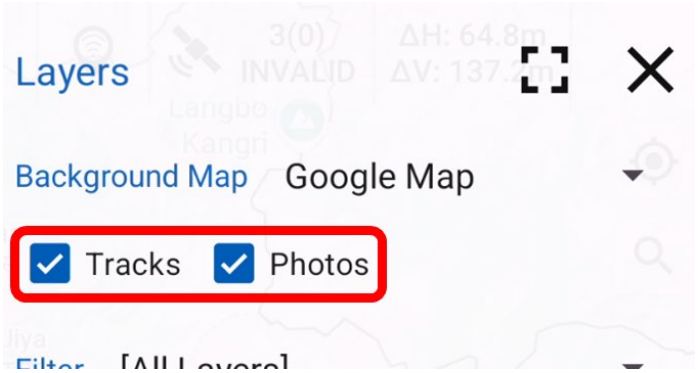
The following background maps are supported by SW Maps.

1. None
2. Google Maps
3. Google Satellite
4. Google Hybrid
5. Google Terrain
6. OpenStreetMap

The Google layers are only supported in Map mode. In Drawing Mode, OpenStreetMap can be used.

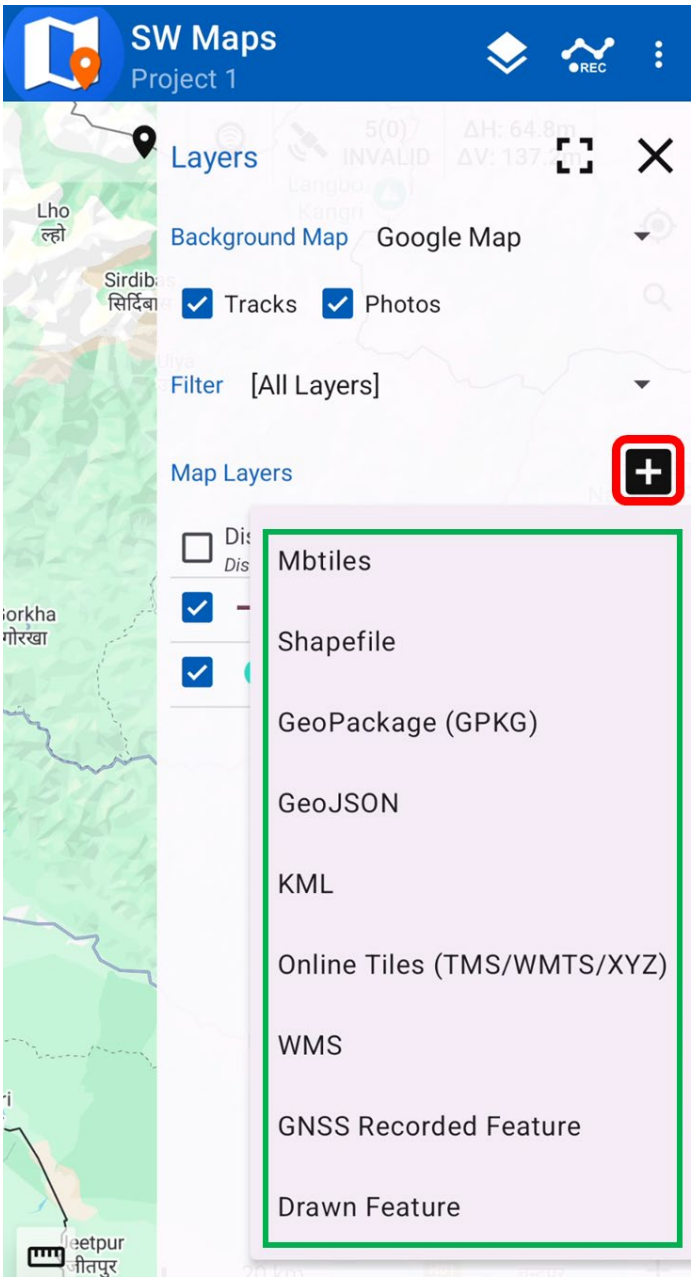
9.3 Tracks and Photos

The tracks and photo points recorded on the map are in their own pre-defined layers. The visibility of these layers can be toggled by using the respective checkboxes.



9.4 Adding Layers

To add layers, press the ⊞ button. In the menu that follows, select the desired layer type.



The following types of layers can be added.

9.4.1 MBTiles

SW Maps supports adding offline map tiles stored as MBTiles files, as a layer. Mbtiles is an open format for storing tiled map data.

Copy MBTiles to the Maps/mbtiles folder in the SW_Maps folder of the device.

To add an MBTiles layer, select **Mbtiles** in the dropdown menu of the ➕ button. In the dialog that follows, enter the layer name, and select the file from the list of available files.

9.4.2 Shapefile

To add Shapefiles to SW Maps, copy the shapefile along with supporting files (shp, shx, dbf and prj files are required) to the Maps/shapefile folder in the SW_Maps folder of the device.

To add a shapefile layer, follow the following steps:

1. Press the ➕ button and select **Shapefile** in the dropdown menu.
2. In the **Add Shapefile Layer** dialog, enter the layer name and select the file from the list of available files.

Note: For best performance, transform the Shapefile to the WGS84 Geographic (EPSG:4326) coordinate system. Other coordinate systems may not be supported and require transformation so will have poor performance.

9.4.3 KML

KML files must be copied to the Maps/kml folder in the SW_Maps folder of the device.

To add a KML layer, select **KML** in the dropdown menu of the ➕ button. In the dialog that follows, enter the layer name, and select the file from the list of available files.

Note: KMZ files are supported but may not work in all cases.

9.4.4 GeoJSON

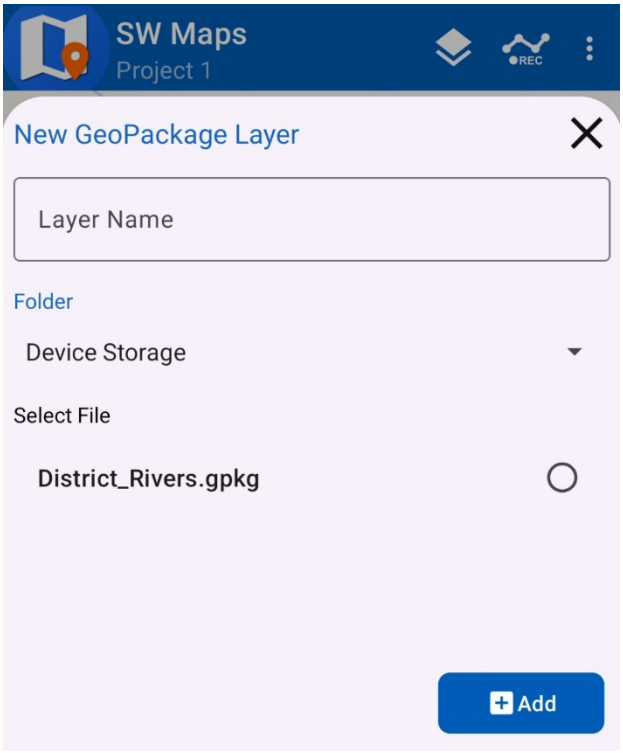
GeoJSON layers can be added in the same way as shapefiles. Copy the GeoJSON file to the Maps/geojson folder in the SW_Maps folder of the device.

9.4.5 GeoPackage

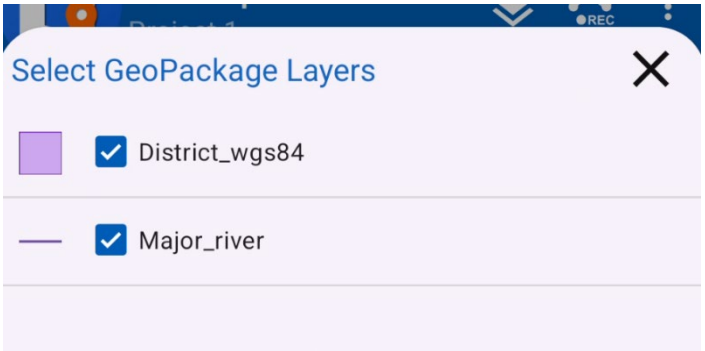
To add a GeoPackage to SW Maps, Copy the GeoPackage file (gpkg) to the Maps/geopackage folder in the SW_Maps folder of the device.

To add a geopackage layer, follow the following steps:

1. Press the ⊞ button and select **GeoPackage (GPKG)** in the dropdown menu.
2. In the **Add GeoPackage Layer** screen, enter the layer name and select the file from the list of available files. Press **Add** to add layer.



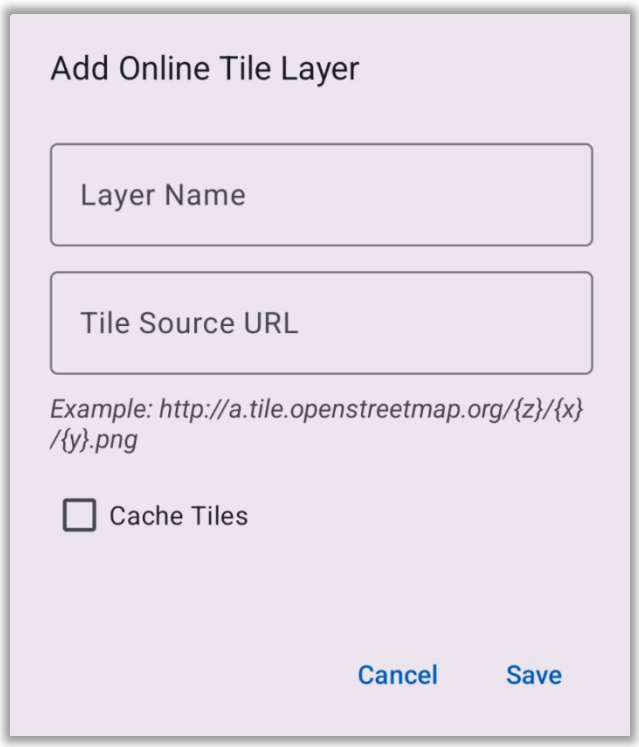
3. In the next dialog, select the GeoPackage layers that you wish to import. You may also change the symbol of the layer here. Press the X icon to close the screen and import.



9.4.6 Online Tiles (TMS/WMTS/XYZ)

To load tiles from an online tile server, follow the steps below.

1. Press the ➕ button and select **Online Tiles (TMS/WMTS/XYZ)** in the dropdown menu. This opens the **Add Online Tile Layer** dialog.

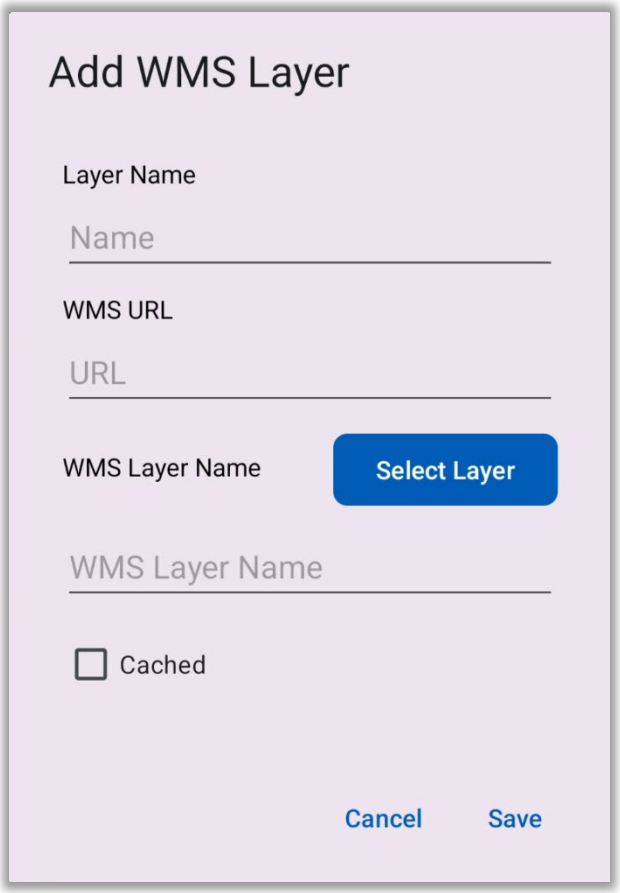


2. Enter the layer name.
3. Enter the tile source URL. Use the following placeholders in the tile URL.
    a. **{x}** Tile X coordinate
    b. **{y}** Tile Y coordinate
    c. **{z}** Tile Zoom Level
    d. **{-y}** Inverted Tile Y coordinate
    e. **{q}** Tile Quad-Key
4. Check the **Cache Tiles** checkbox if you want to cache the tiles that are loaded. Caching saves the loaded tiles on your device and allows online tile layers to be used when the device is offline.
5. Press **Save**.

9.4.7 WMS

To load a WMS layer from an online source, follow the steps below.

1. Press the ➕ button and select **WMS** in the dropdown menu. This opens the **Add WMS Layer** dialog.

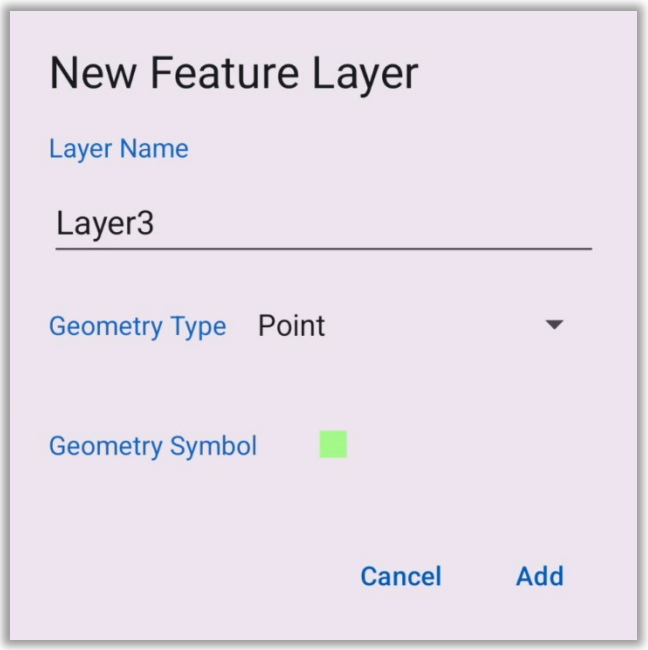


2. Enter the Layer Name
3. Enter the WMS source URL.
4. Enter the name of the WMS source layer. Alternatively, press the **Select Layer** button to get the list of layers from the WMS server using the *getCapabilities* API.
5. Check the **Cache Tiles** checkbox if you want to cache the tiles that are loaded. Caching saves the loaded tiles on your device and allows online tile layers to be used when the device is offline.
6. Press **Save.**

9.4.8 GNSS Recorded Features

All the spatial data (points, lines & polygons) recorded by SW Maps must be associated to a layer.

To add a feature layer whose data is collected using GPS/GNSS, follow the following steps.



1. Press the ⊞ button and select **GNSS Recorded Feature** in the dropdown menu.

2. In the **New Feature Layer** dialog, enter the layer name and select the required geometry type (Point, Line or Polygon)

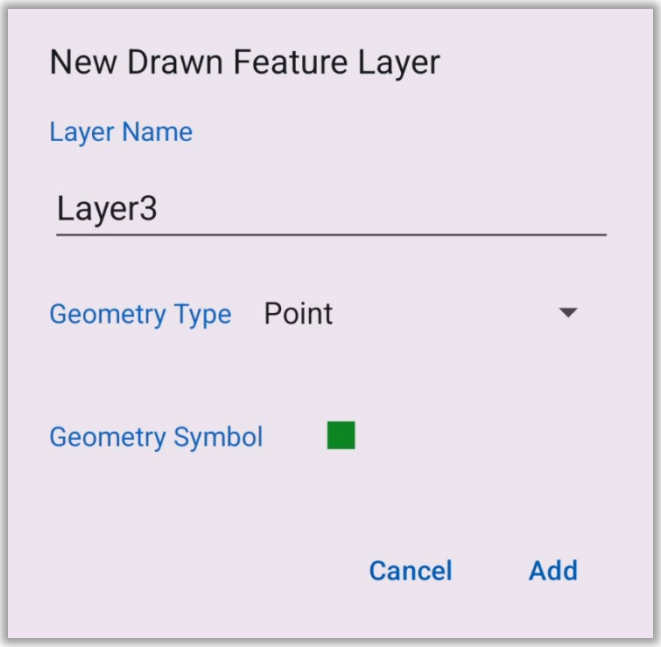
3. Assign a geometry symbol by tapping the geometry symbol button. The symbol dialogs allow you to select colors, line width and point shapes, and are different for each geometry type.

4. Press **Add.**

9.4.9 Drawn Feature Layer

To add a feature layer whose features are added by drawing on the map, follow the following steps.

1. Press the ⊞ button and select **Drawn Feature** in the dropdown menu.

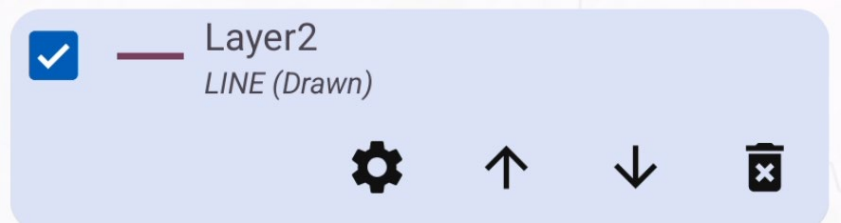


2. In the **New Drawn Feature Layer** dialog, enter the layer name and select the required geometry type (Point, Line or Polygon)
3. Assign a geometry symbol by tapping the geometry symbol button. The symbol dialogs allow you to select colors, line width and point shapes, and are different for each geometry type.
4. Press **Add.**

Note: The app allows features in a Drawn Feature layer to be recorded using GNSS but features in GNSS Recorded Feature layers may not be drawn.

9.5 Layer Actions

In the layer list, several actions may be performed by selecting a layer.

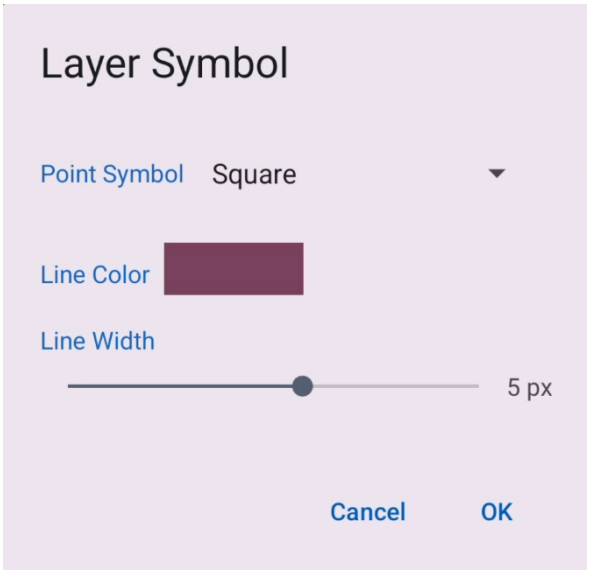


1. Delete
   This button will delete the selected layer.
2. Layer Settings
   This button opens additional settings for the layer.
3. Move Layer Up ↑
   Press this button to move the layer up.
4. Move Layer Down ↓
   Press this button to move the layer down.

9.6 Feature Layer Settings and Attributes

9.6.1 Changing Layer Symbol

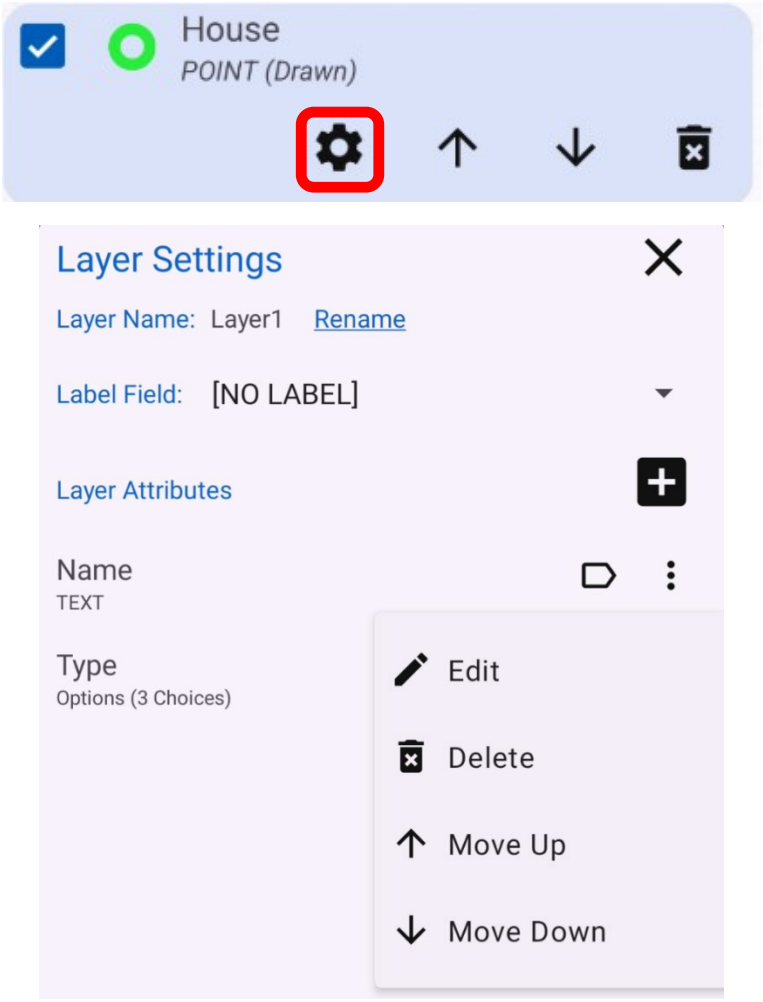
For feature layers, the current layer symbol is shown next to the layer name. You can change the layer symbol by tapping on the symbol icon.



This opens the **Layer Symbol** dialog. Change layer style here and press **OK** to save.

9.6.2 Layer Settings

Feature layer settings can be changed by using the **Layer Settings** screen, which can be accessed from the **Layers** sidebar. First, select the layer to be modified. Then press the settings ⚙ button on the layer.



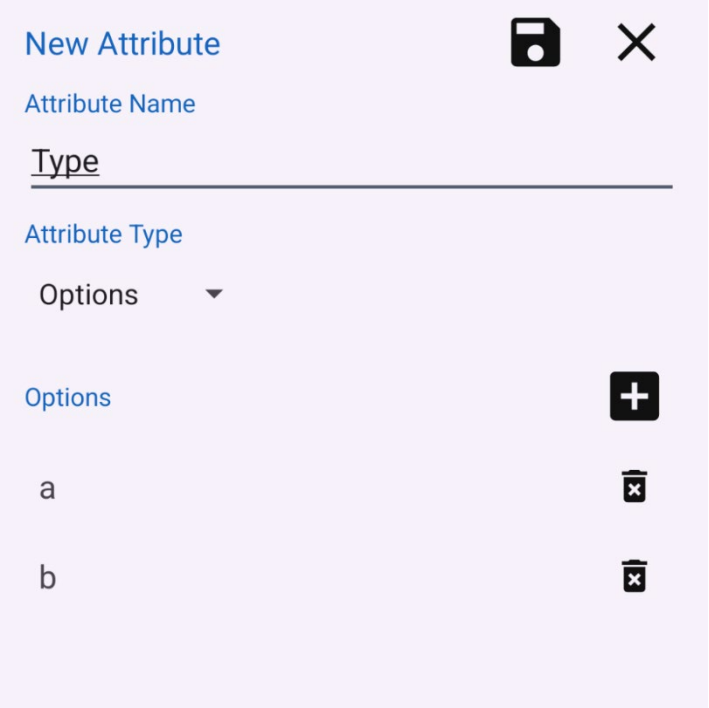
In the **Layer Settings** screen, you can rename the layer, add/remove layer attributes and set the labeling attribute for the layer. The screen shows a list of all the attributes for the selected layer.

- To rename a layer, press the **Rename** link next to the layer name.
- To assign a label, select the label field in the **Label Field** drop-down. Alternatively, press the label button 🏷 next to the attribute in the Attributes list. *Only supported with Text, Numeric and Options type attributes.*
- You can reorder, edit or delete the layer attributes by pressing the menu button next to it.

9.6.3 Defining Layer Attributes

To add a layer attribute, follow the steps below in the **Layer Settings** screen.

1. Press the Add button . The following dialog will appear.



2. Enter the attribute name.

3. Select the attribute data type from one of the following options.
   - Text: Use this type to save text.
   - Numeric: Use this type to save numeric data.
   - Options: Use this type to select a value from a list of choices.
   - Checklist: Use this type to select multiple values from a list of choices.
   - Photo: Use this type to save a photo.
   - Video: Use this attribute type to save a video
   - Audio: Use this attribute type to save an audio recording.

4. If the **Options** or **Checklist** data type is selected, press the button to add choices. At least one choice must be present.

5. Press the **Save** button on the top to create the attribute.

9.7 Imported Layers

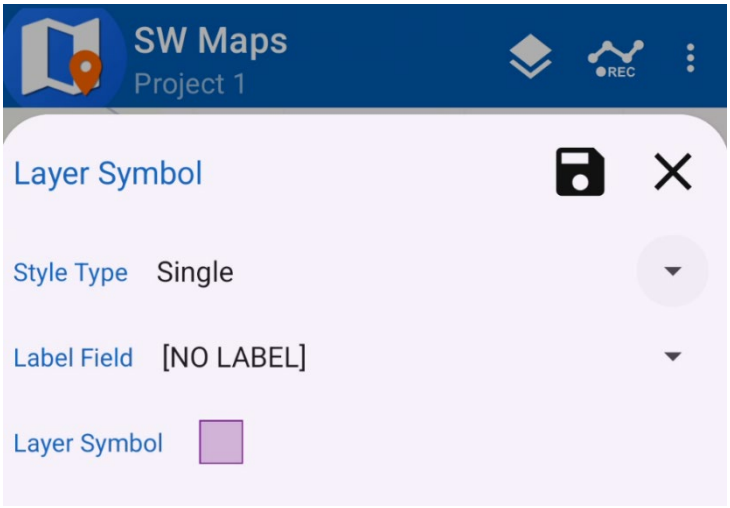
9.7.1 Styling Imported Layers

To change the layer style for an imported Shapefile, GeoPackage or GeoJSON layer, select the layer on the **Layers** sidebar and press the ⚙ button on the selected layer in the layer list.

For Shapefiles and GeoJSON, the following dialog is shown. It can be used to set shapefile symbols. The following options are available.

1. Single
   Use this to apply the same symbol to all the items in the shapefile.

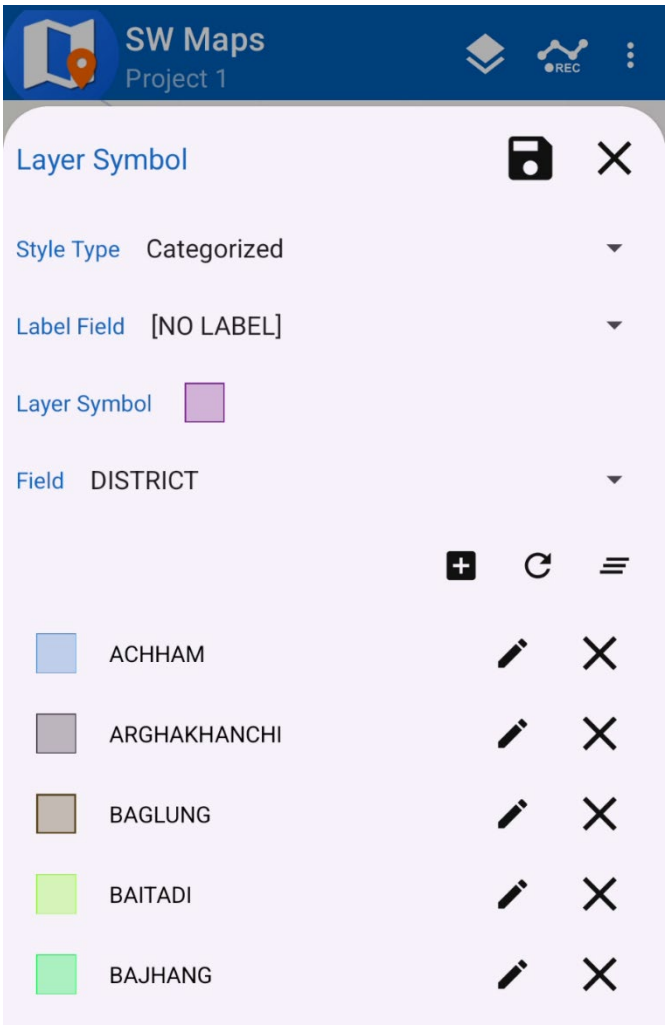
2. Categorized
   Use this option to categorize the shapefile entities based on their attribute values and apply a different symbol to each category.



For GeoPackage layers, a different dialog is shown with the list of all layers contained within the GeoPackage. In this dialog, you may select the active layers, and change the layer style by pressing the current layer symbol next to the layer name.

To apply categorized symbols, follow the steps below.

1. Select **Categorized** in the dropdown at the top of the **Shapefile Symbol** dialog.
2. Set a default symbol in the **Layer Style** box.
3. Select the field based on which the symbol will be set in the **Field** dropdown which lists all the attribute fields of the shapefile.
4. Press the ⊞ button to add an empty item to the list of attribute values. The value can be edited by pressing the ✎ button beside it. The value can be deleted using the ✕ button.
5. Press **OK** to set the shapefile symbol.



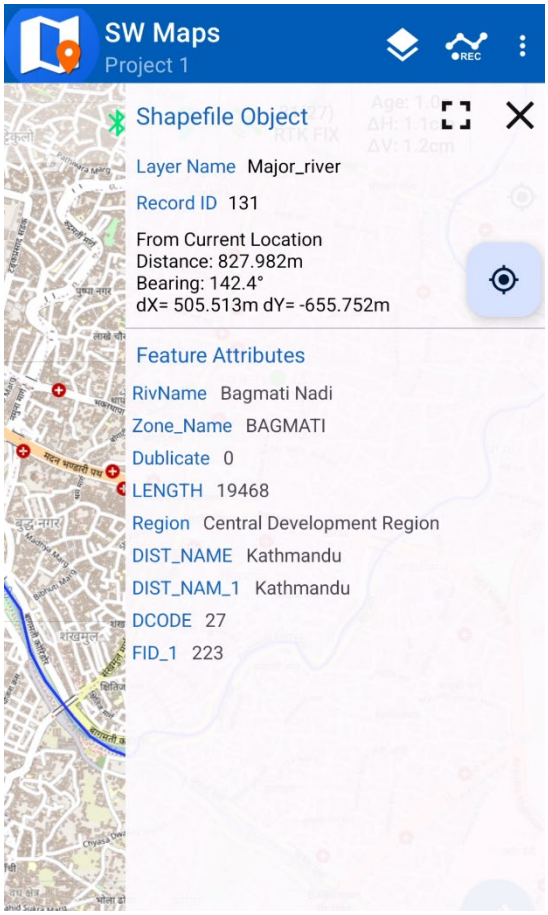
Pressing the ⟳ button will fill up the list with all the values of the selected field present in the shapefile and assign random symbols.

To change the symbol for an attribute value, tap its current symbol shown on the list.

Pressing the ≡ button will clear all the listed values.

9.7.2 Viewing Feature Attributes

You can tap on any imported feature on the map to show the attributes of the feature. You can also open the stake out tool from here to locate the feature.



9.8 Loading Layers from External SD Card

File based external layers (MBTiles, KML, Shapefiles, GeoJSON, GeoPackage) can be loaded from external SD card. However, Android does not allow writing to external SD cards. So, the following folders need to be created manually.

1. **SW_Maps/Maps/mbtiles** for Mbtiles
2. **SW_Maps/Maps/kml** for KML files
3. **SW_Maps/Maps/shapefiles** for shapefiles.
4. **SW_Maps/Maps/geopackage** for GeoPackage (GPKG).
5. **SW_Maps/Maps/geojson** for GeoJSON.

Then when adding the files as layers, select the path of your external SD card on the dropdown above the list of files.

Note: This feature may not be supported in some devices on Android versions newer than 5.0.

10 Features

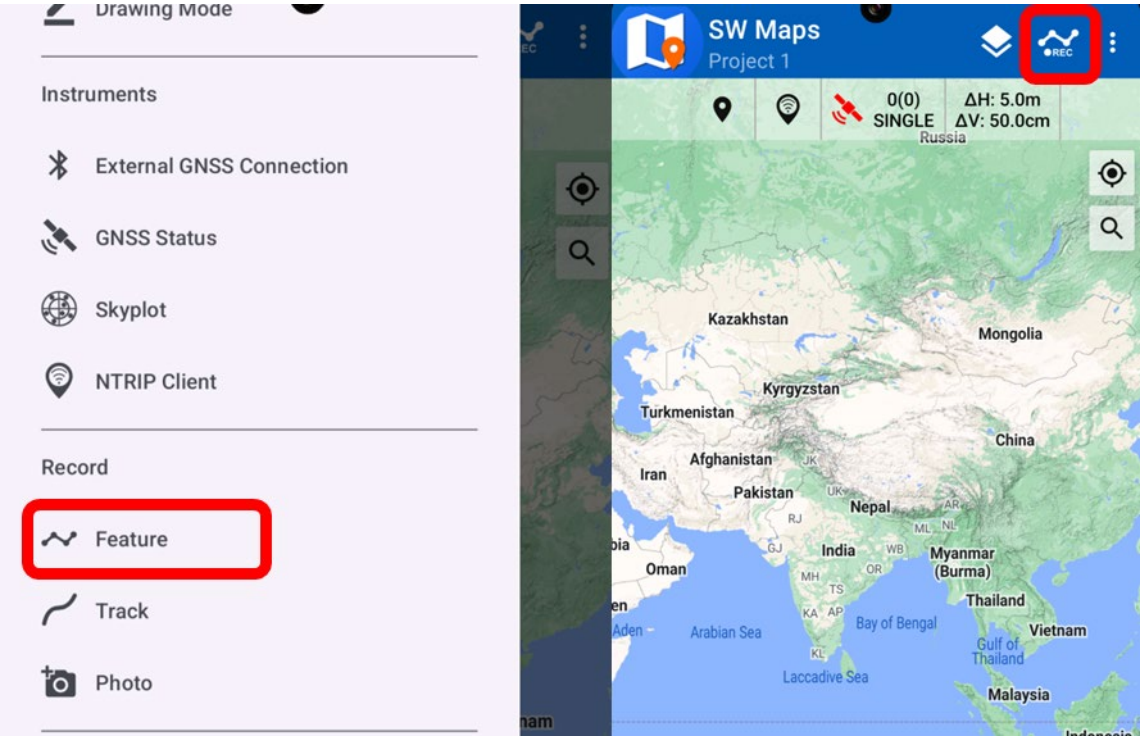
Features are entities comprising of geometry (points, lines, or polygons) and attributes associated with them. In SW Maps, recorded features must be associated with one layer, and are displayed on the map itself.

Features are displayed on the map with their own layer symbol, and a point id. Elevation of the point is also displayed alongside the marker. The appearance of elevation on the marker can be toggled via the application preferences.

Features can be interacted with by tapping on their point markers.

10.1 The Record Feature Sidebar

The **Record Feature** sidebar allows you to record new features, append points to existing features and assign values to feature attributes. To open the **Record Feature** sidebar, press the **Record Feature** entry in the **Record** menu. Alternatively, press the **Feature** item under the **Record** entry in the navigation drawer.

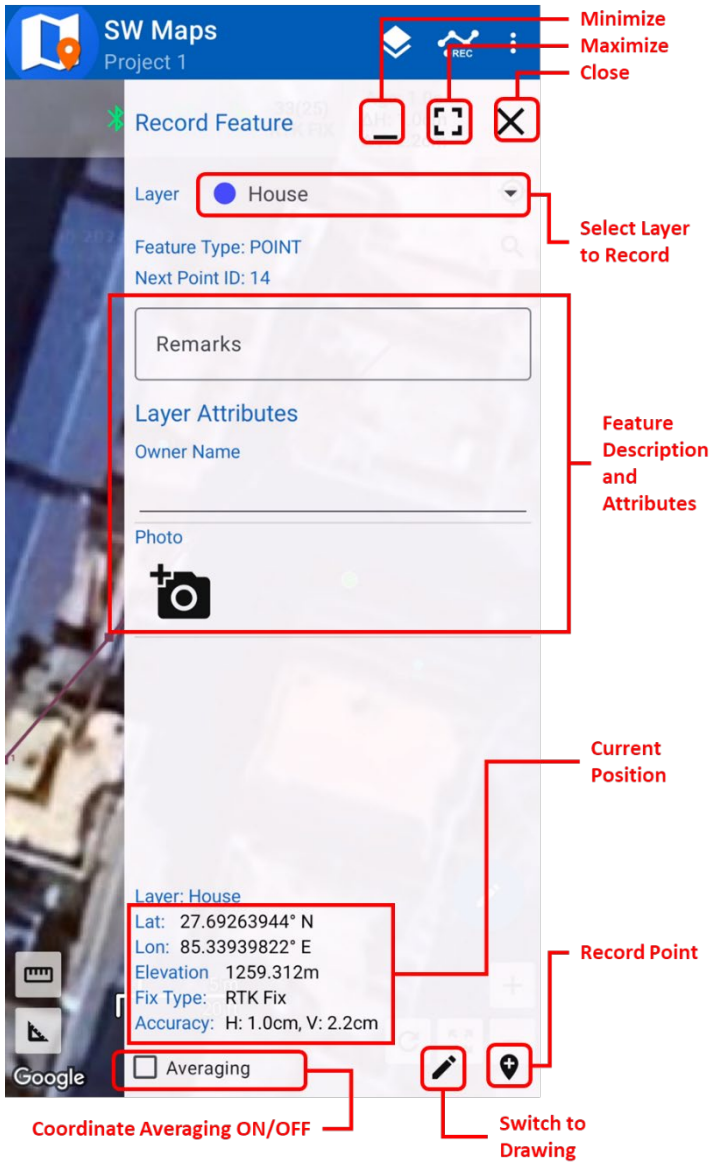


10.2 Record Features using GNSS Receiver

To record a feature using the internal or external GPS/GNSS receiver, follow the steps below.

1. Open the **Record Feature** sidebar.
2. Select the feature layer from the dropdown.
3. For new Line and Polygon features, check the **New** option and enter a unique ID. To append points to existing Lines and Polygons, check the **Existing** option and select the feature ID from the dropdown.
4. Enter a description and fill up attribute values. The description and attributed values may be changed later. *Photo, audio, and video attributes may only be recorded after the point is saved.*
5. Press the **Record** button.

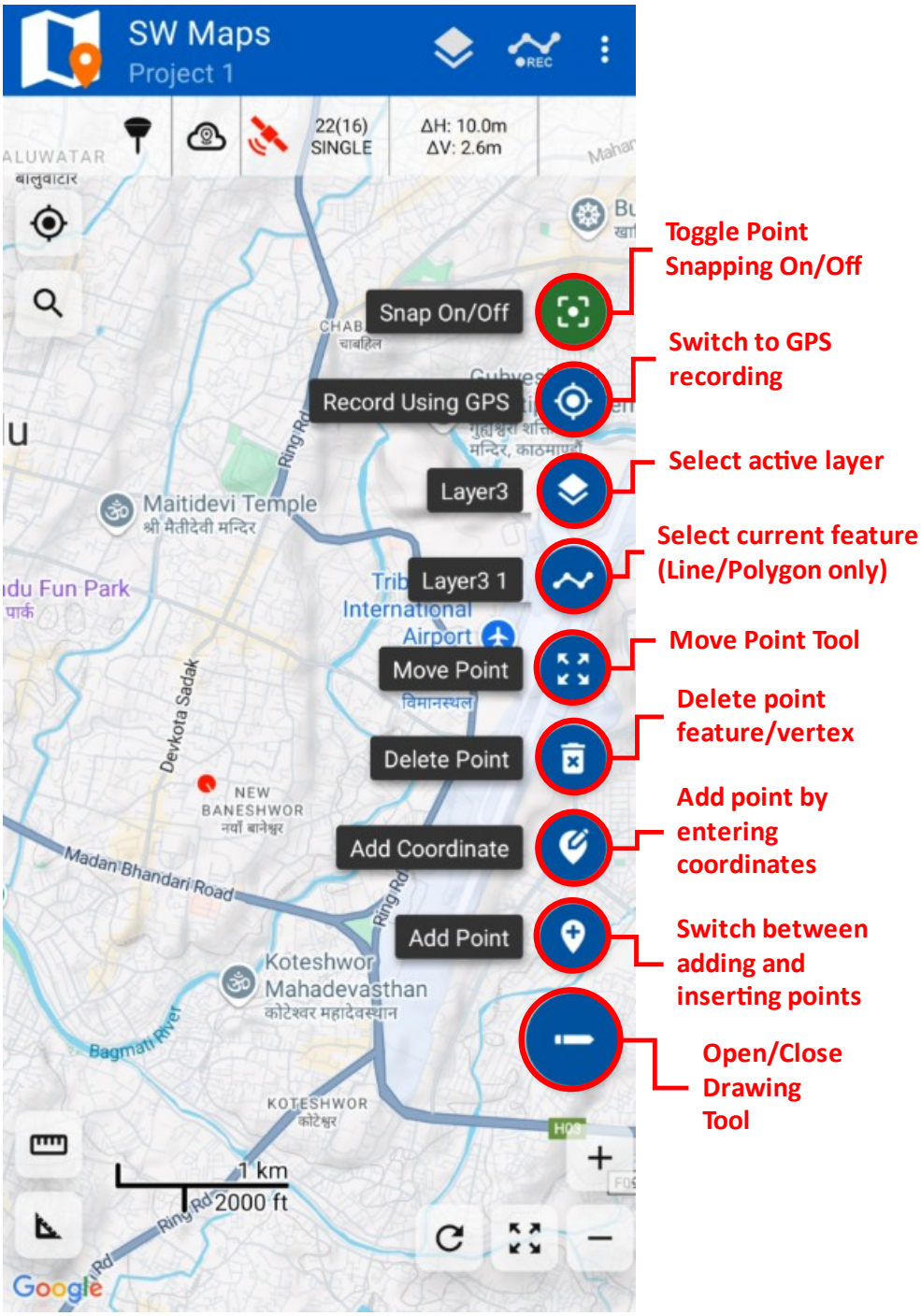
If the current layer is a drawn layer, you may quickly switch to drawing the feature by pressing the button.



10.3 The Drawing Tool

In SW Maps, the drawing of features is carried out using the drawing tool. The drawing tool can be accessed by pressing the blue button with ✎ icon on the bottom right corner of the screen.

The drawing tool can only be opened if the project has at least one drawn layer. If there are no drawn layers, the app will ask you to create one.



10.3.1 Drawing New Features

To draw features, follow the steps below.

1. Open the drawing tool.
2. Select the active layer.
3. If the layer is a point layer, you may add a point now by pressing the add point button (which turns green) and then tapping anywhere on the map.
4. For line and polygon layers, the current feature must also be selected. Press the **Select Current Feature** button on the drawing tool to open a list of features, where you can select an existing feature or create a new one. You can also tap on a feature on the map to select it.
5. For line and polygon layers, the **Add** button has two modes. The **Add** mode will add the new point after the last point on the feature, whereas **Insert** lets you insert point between two points.

10.3.2 Deleting Points

To delete points, press the Delete Point button on the drawing tool, and tap on the point on the map. You can only delete points on the currently selected layer.

For point features, it deletes the feature itself, whereas for line and polygon features only the selected vertex is deleted unless it is the last vertex remaining on the line/polygon.

10.3.3 Snapping

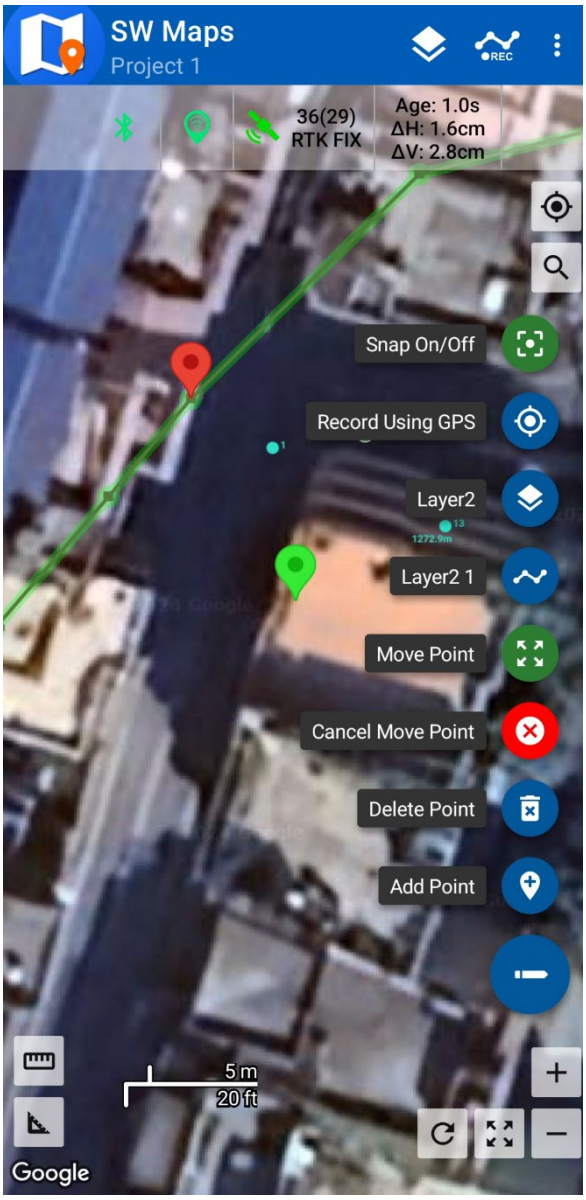
If another marker is pressed when adding or inserting a point, the new point will snap to the point that was pressed. The two points are now linked and may be moved together at the same time. To stop points from being linked, turn off the **Snap** option in the drawing tool.

10.3.4 Switch to GNSS Recording

If you wish to add points to the selected feature using the device location instead, press the **Record using GPS** button to switch to the **Record Feature** sidebar.

10.3.5 Moving Points

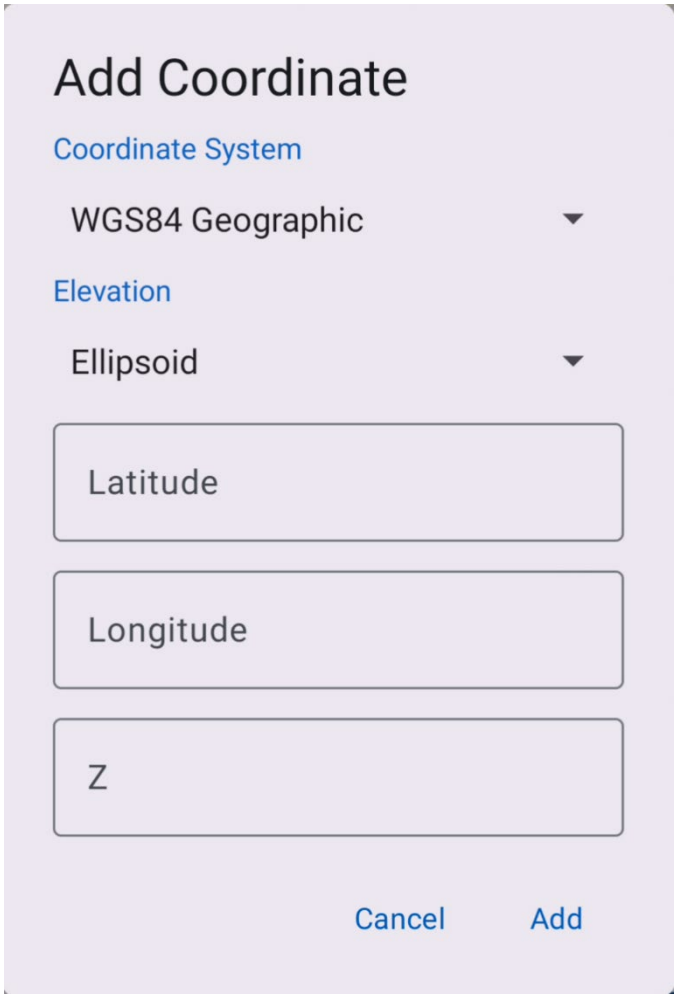
Drawn points on the map may also be moved around by using the move tool. To move a point, first select the layer of the feature to edit. Then, click on the **Move Point** tool to activate it. After that, tap on the point to move, which creates two markers on the map.



The red marker is locked to the vertex to be moved, whereas the green marker is fixed at the center of the map. You can now move the map to change the position of the green marker. Pressing **Move Point** will move the marked vertex to the location of the green marker. To cancel the operation, press the **Cancel Move Point** button.

10.3.6 Adding Points by Coordinates

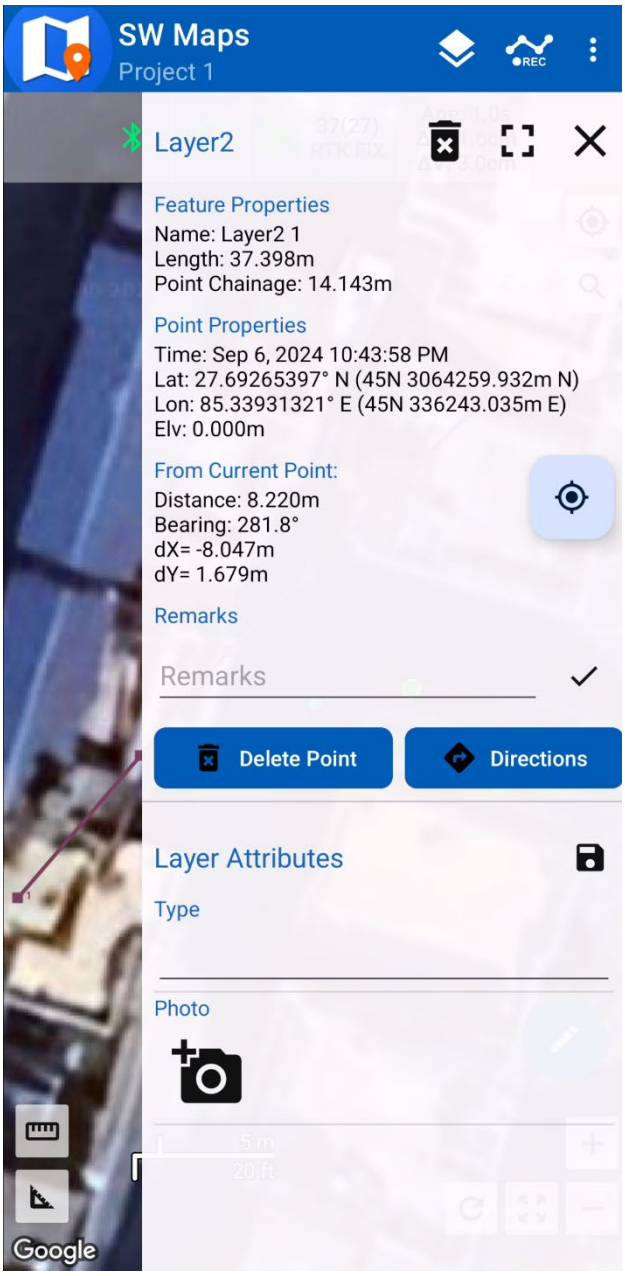
Drawn points may be added by entering co-ordinates. To add a point, press the **Add Coordinate** button in the drawing tool. This opens the **Add Coordinate** dialog.



The co-ordinate system can be selected between WGS84 Geographic and the project coordinate system. The elevation datum reference defaults to Ellipsoid by default but can be changed to Geoid if a Geoid data file is loaded.

10.4 Viewing Feature Properties

To view the properties and attribute values of a previously recorded point feature, press the point marker on the map. For lines and polygons, press one of its vertices. This will show the feature properties in a sidebar, including co-ordinates of the marker, length of lines, area, and perimeter of polygon features.



The feature properties sidebar also shows the relative location of the selected point or vertex from the current location. This allows you to locate the points on the field. From here, you can also enter the stakeout view to locate features, or offsets from line features.

10.5 Editing and Deleting Features

Features can also be edited or deleted using the feature properties sidebar.

To edit feature attributes, enter the new values in the attribute list and press the Save button.

To edit the item description, type in the new description in the descriptions box, then press the ✓ button beside it.

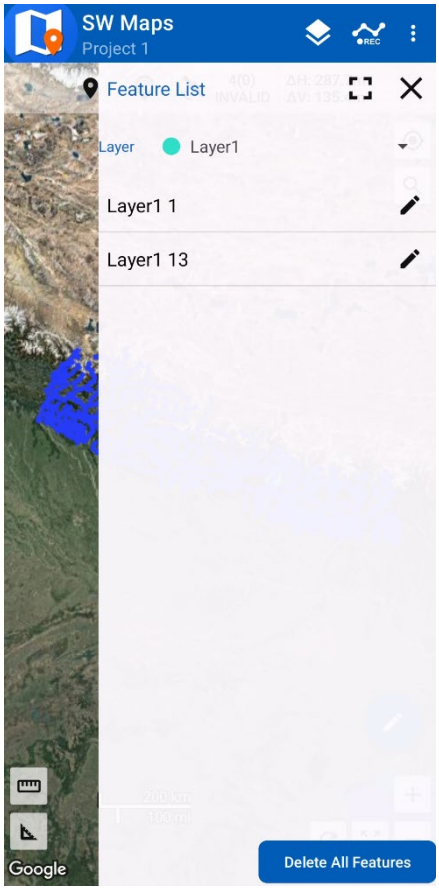
To delete the selected point from the line or polygon feature, press the **Delete Point** button.

To delete the whole feature, press the **Delete** button.

Press the **Directions** button to open the selected point in Google Maps and get turn-by-turn navigation to the point.

10.6 Feature List

A list of all the features can be found by opening the **Feature List** sidebar from the left navigation drawer. Clicking the button next to a feature will open its properties. From the feature list you can also delete all the features in the selected layer.

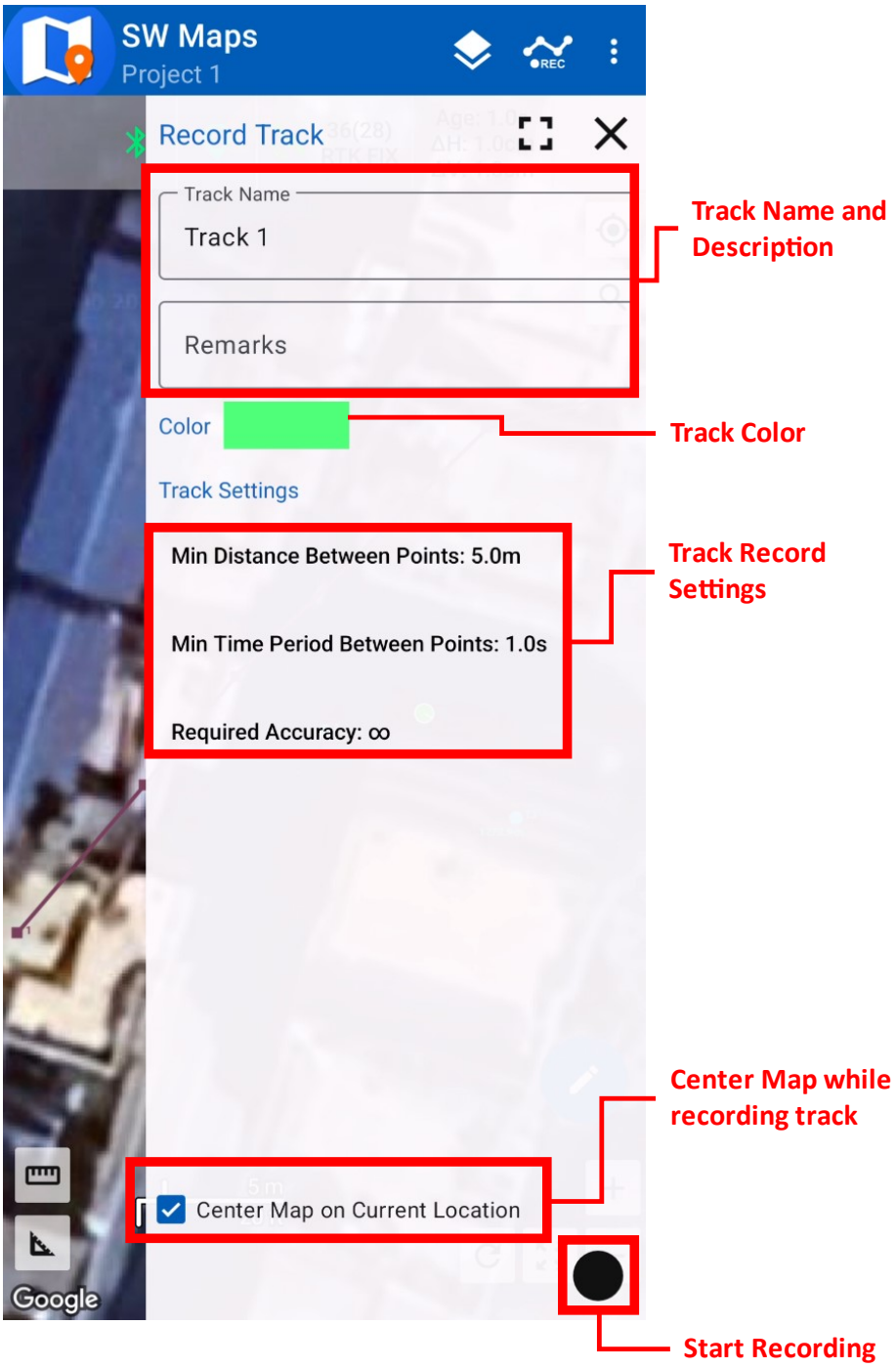


11 Tracks

11.1 Recording Tracks

To record tracks, press the **Record Track** entry in the **Record** menu. Alternatively, press the **Track** item under the **Record** entry in the navigation drawer.

This opens the **Record Track** sidebar.



This sidebar has the following options:

1. **Track Name**
   Enter a unique name of the new track here.
2. **Remarks**
   Enter an optional description for the new track.
3. **Color**
   Select the track color used to show the track on the map.
4. **Minimum Distance between Points**
   Select the minimum distance between two corresponding track points. Points are not recorded unless distance from the previous point exceeds this value.
5. **Minimum Time Period between Points**
   Select the minimum time between the recording of two consecutive points.
6. **Required Accuracy**
   Select the minimum required GPS accuracy to record point. If location accuracy is below this value, the location is not recorded.
7. **Center Map on Current Location**
   If checked, the map is kept centered on the current location.

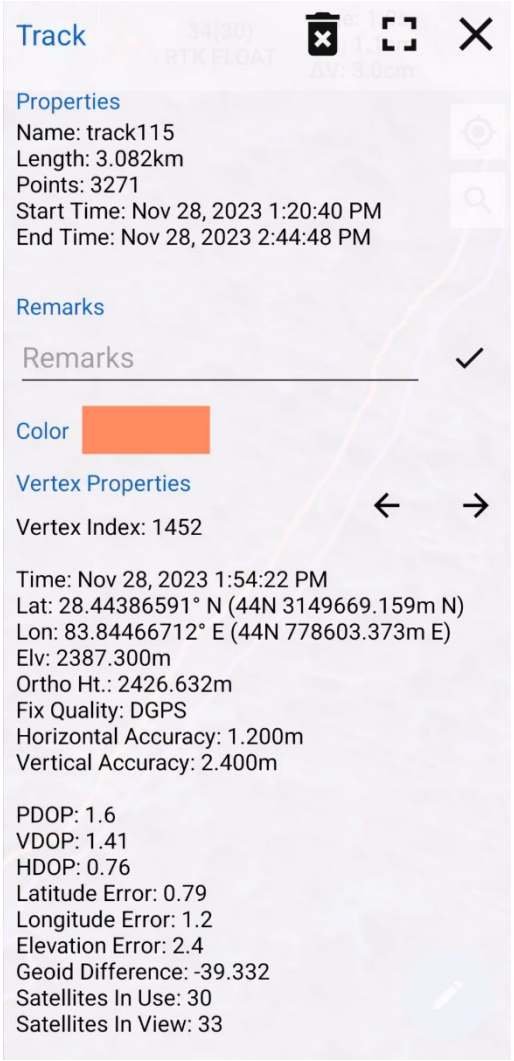
To start recording a track, press the **Record** button ● . The record button is then replaced by track recorder status, the **Pause** ❙❙ button and the **Stop** ■ button.

Press the ❙❙ button to pause recording track. Press the ▶ button to resume recording.

Press the **Stop** ■ button to stop recording and save the track.

11.2 Editing and Deleting Tracks

Tapping the track line on the map will display the track properties, including track length, number of points, description, and color.



To edit the track remarks, enter the new description in the textbox and press the ✓ button beside it.

To change the track color, press the colored box beside the label reading **Color.**

To delete the track, press the **Delete** 🗑 button.

You can also view the properties of each point recorded on the track. The first point shown is the vertex closest to the tapped point on the track. You can use the arrow button to go through the track vertex properties.

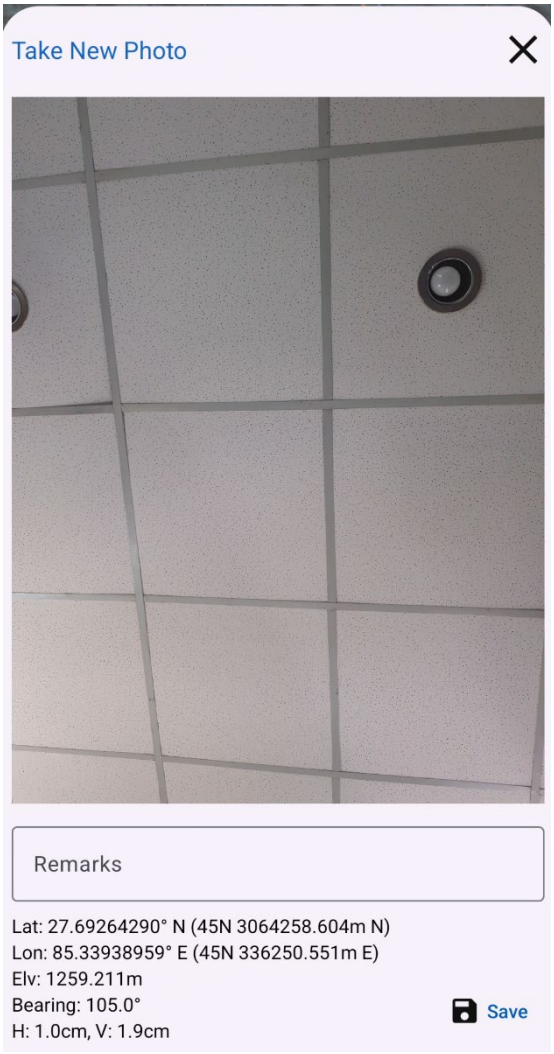
12 Photos

SW Maps also allows you to quickly take photos and save them with a location obtained from the GPS on the device. The photos appear on the map as icons and can be viewed by pressing the icon.

12.1 Taking Photos

To take a photo, follow the steps below.

1. Press the **Photo** button, under the **Record** group in the navigation drawer. Alternatively, press the **Take Photo** menu item. In tablets, the **Take Photo** menu may appear as a button on the action bar with the icon.
2. The default camera app is then launched automatically. Take a photo using it.
3. A screen will appear, showing the recently taken photo, with an empty textbox labelled **Description** and the photo location.
4. Enter an optional description and press **Save** to save the photo.

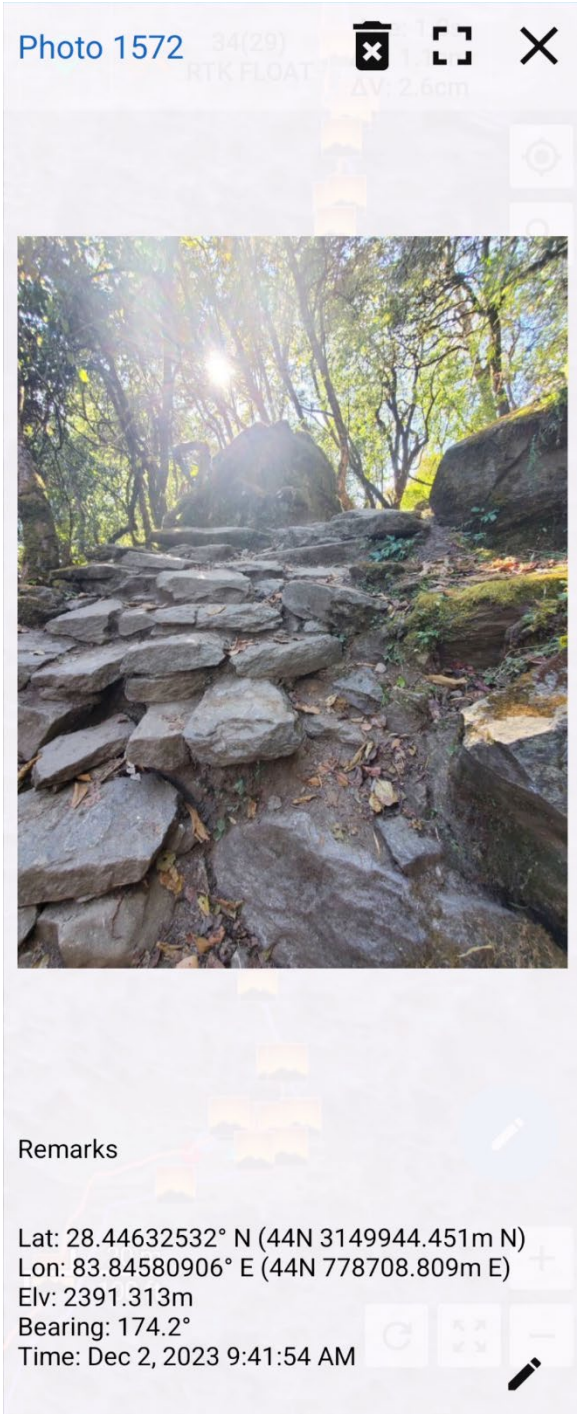


12.2 Viewing and Deleting Photos

Photos taken using SW maps are shown as markers on the map. To view the photo, tap on the marker. This will load a sidebar showing the photo and its description.

Tap the photo thumbnail to open the photo in your default photo viewer app.

To delete the photo, press the **Delete** button.



13 File Formats

SW Maps uses additional file formats for storing project data and for sharing projects and templates with other SW Maps users. These file formats are associated with SW Maps upon installation and will open automatically with SW Maps when opened from a file browser.

The file formats associated with SW Maps are described in the following sections.

13.1 The swm2 File Format

Files with extension “swm2” are used by SW Maps to store project data. These files are SQLite databases containing information on all layers and attributes defined in the project, as well as all the data recorded in the project. However, these files do not include photos.

All the projects listed in the **Projects** sidebar are present as swm2 files in the SW_Maps/Projects/ folder.

Opening a swm2file using SW Maps will install the project to the SW_Maps/Projects/ folder and open it.

13.2 The swmz File Format

The swmz file format is the preferred file format for sharing projects with other SW Maps users. These files are created from existing projects by exporting the projects or sharing them. This is also the file format used by SW Maps when uploading projects to servers.

The swmz file is a zip archive, containing the project data in a swm2 file, and all the photos associated with the project. Opening a swmz file using SW Maps will extract it, install the project to the SW_Maps/ Projects/ folder and copy all the photos into the relevant folders. It will then open the project.

The swmz file does not contain any external layer files referenced by the project, but it includes the references to these files. These files will have to be copied manually and should be present when installing the project on another device.

13.3 The swmt and swmr File Format

The swmt and swmr file format is the SW Maps template file. It is an SQLite database containing all the feature layers and their attribute definitions which is copied into projects when the template is used to create one.

Installed templates can be found as swmt or swmr files in the SW_Maps/Templates folder.

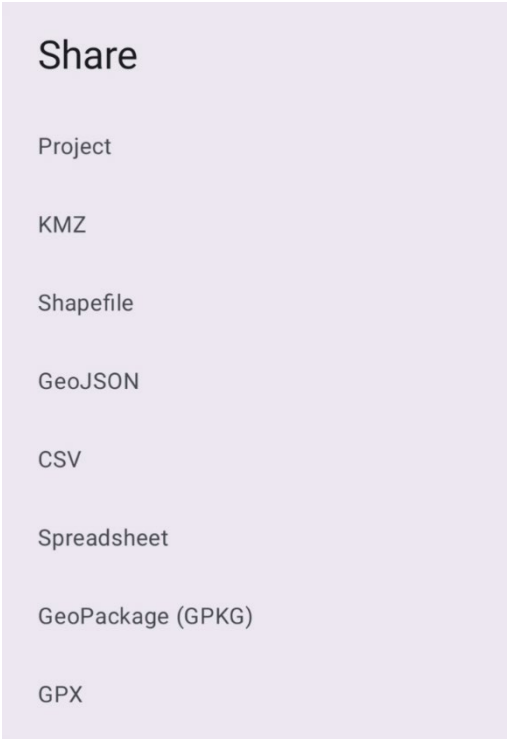
Templates having the swmr extension are read-only. Projects created using a read-only template does not allow adding or removing feature layers and attributes.

14 Sharing, Exporting and Importing Projects

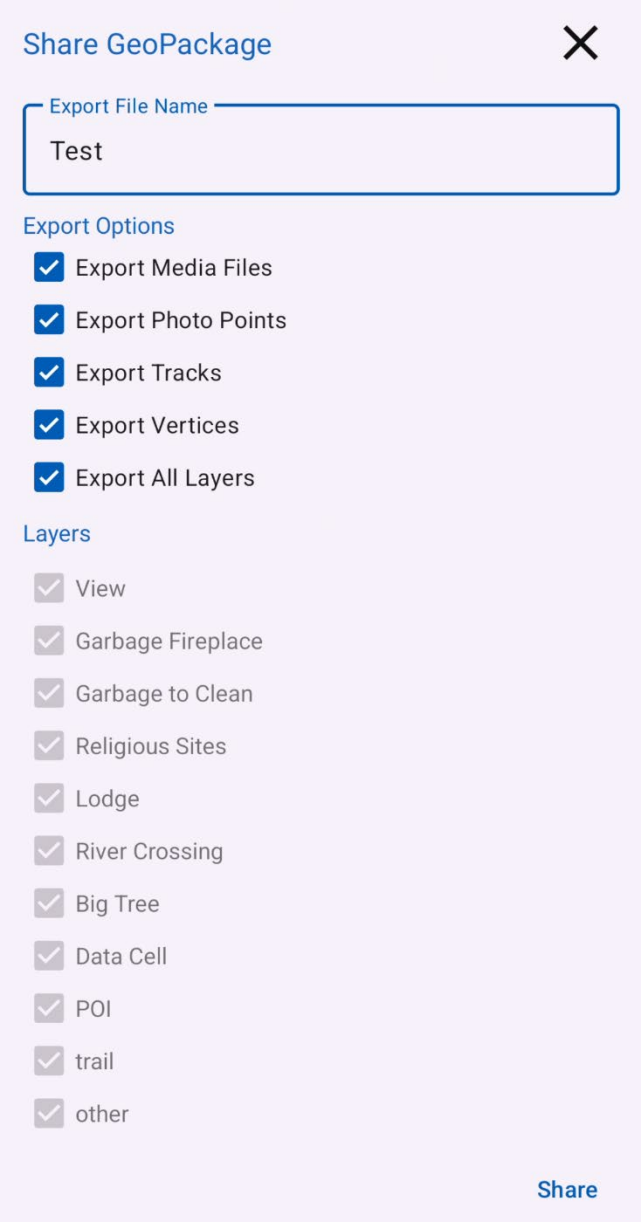
SW maps supports exporting and sharing of project data in KMZ, Shapefile or the SW Maps SWMZ format. Projects can also be shared or exported as templates, containing all the layer and attribute definitions but no data.

14.1 Sharing Projects

To share a project, Press the **Share** button, present under the **Share/Export Project** group in the navigation drawer. A dialog will appear which will allow you to choose different formats for sharing the project.



Pressing any one of the three options will open a screen with export settings. You can change the export file name and choose whether to export various elements and layers of the project.



Once you press **Share**, a dialog is shown with a list of available applications to share the exported files with.

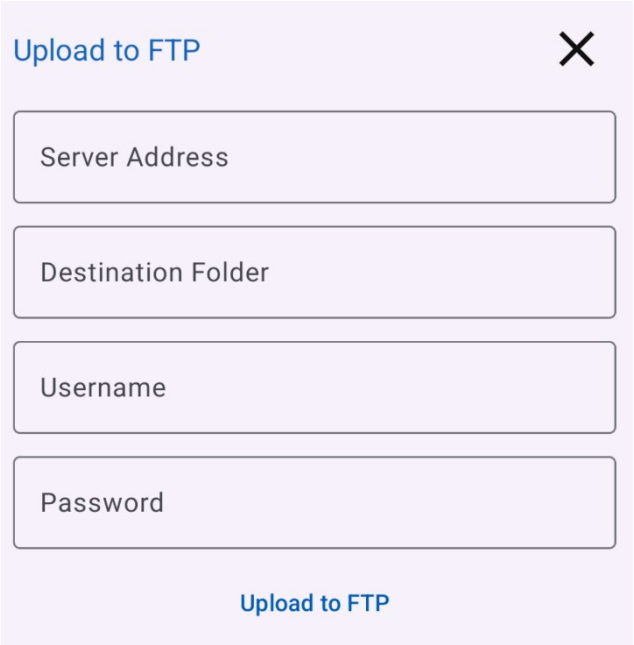
14.2 Exporting Projects

To export a project, press the **Export** button, present under the **Share/Export Project** group in the navigation drawer. A dialog will appear which will allow you to choose between exporting the project in different formats.

The files will be exported with the name of the project in the SW_Maps/Export folder.

14.3 Uploading to FTP Servers

SW Maps also supports uploading projects directly to FTP servers as a swmz file. To upload to FTP servers, press the **Upload To FTP** button, present under the **Share/Export Project** group in the navigation drawer, which will open the following dialog.



Then, fill up the following details.

1. **Server Address:**
   The address of the ftp server. *Example: ftp://swmaps.softwel.com.np*
2. **Destination Folder**
   The subfolder in the FTP server where the uploaded files are to be stored.
3. **Username**
   The FTP username.
4. **Password**
   The FTP user password.

Then, press the **Upload to FTP** button in the dialog to begin the upload.

14.4 Importing Projects

You can use the **Import Project** tool from the left drawer to import projects.

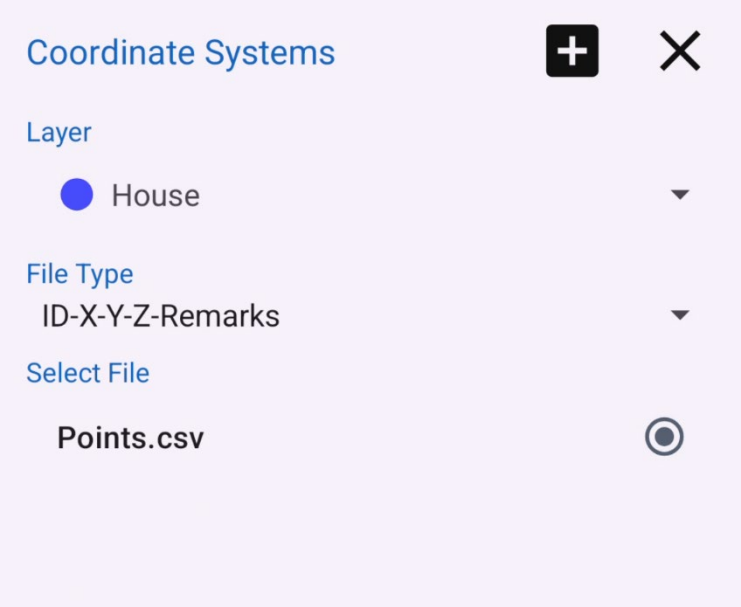
The drawer will let you select the following types of files.

1. SWMAPS: Project Database file for SW Maps version 1.x
2. SWM2: Project database file for SW Maps version 2.0 and above
3. SWMZ: SW Maps project file containing the project database and all media files.

The application automatically imports the select file and installs it as a project. Installed projects are listed in the **Projects** sidebar and can be used as if they were created in the same device.

14.5 Importing Point Data from CSV Files

You can import points from CSV files into drawn point layers in SW Maps. To do so, select the **Import CSV** tool in the left drawer to open a dialog box.



The CSV file must be copied to the SW_Maps/Imports folder and must follow one of the following two header formats.

1. ID-X-Y-Z-Remarks
2. Lat-Lon-Alt

To use the ID-X-Y-Z-Remarks format, the project must have a coordinate system defined. Lat-Lon-Alt uses geographic coordinates in the WGS84 geographic system (EPSG:4326).

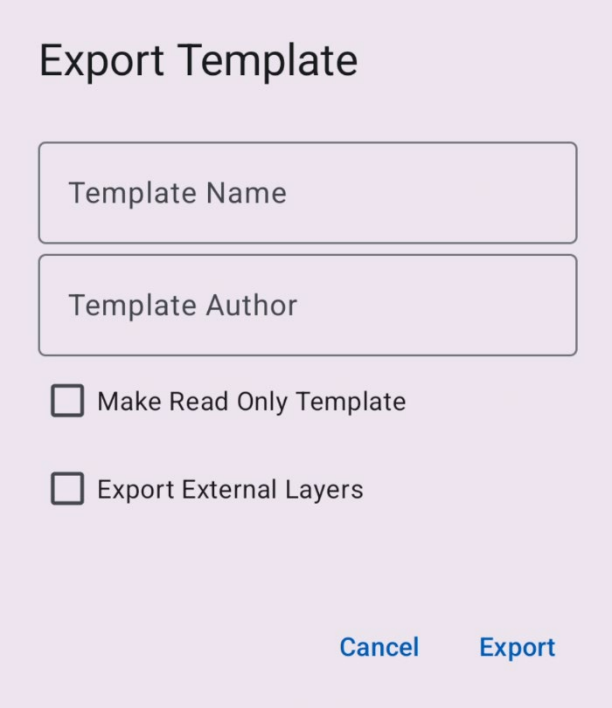
15 Project Templates

Project Templates contain a predefined set of feature layers and attribute definitions which can be used when creating projects. Templates can be created from existing projects and shared with other users.

15.1 Creating a Template

Templates are created from existing projects. To create a template, create a project with all the required feature layers and attributes. Then follow the steps below.

1. Open the navigation drawer and press the **Export Template** button under the **Templates** group to export the project as a template in the SW_Maps/Templates folder.
   Alternatively, press the **Share Template** button to share the project directly through other applications.
2. In the dialog that follows, enter the name of the template file and press **Export** or **Share**.
3. You can also choose to make a read-only template file, or export the external layers defined in the project with the template.



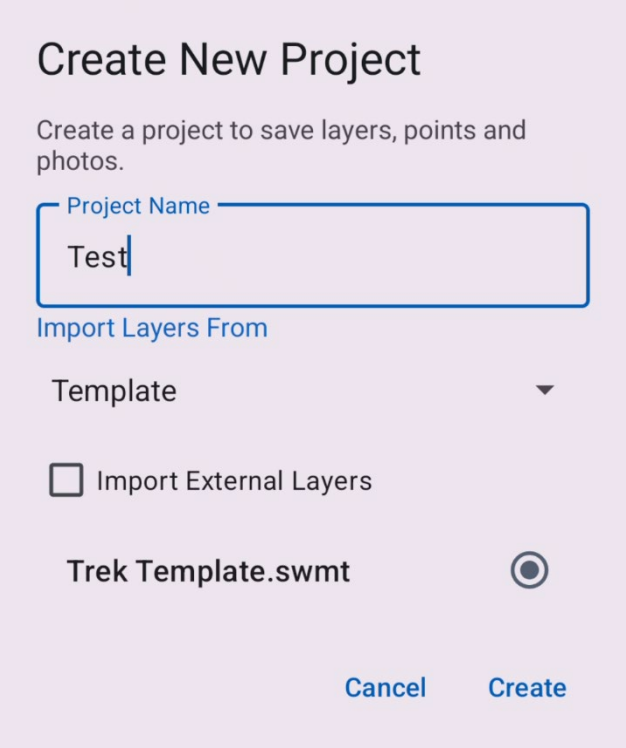
15.2 Importing a Template

To import a template into SW Maps, copy the template swmt file into the SW_Maps/Templates folder of your device storage. You can also use the **Import Template** tool from the navigation drawer to select a template file from the device storage.

15.3 Creating Projects using a Template

To create projects using an installed template, follow the following steps.

1. Press the **Projects** entry in the navigation drawer to open the **Projects** sidebar.
2. In the **Projects** sidebar, press the button.
3. Enter the new project name in the **New Project** dialog. For the **Import Layers From** option, choose **Template.**



4. The list of templates installed on the device is shown. Select the template to use to create the project.
5. Select **Import External Layers** if you would like to import external layers from the template into the new project.
6. Press **Create** to create the new project.

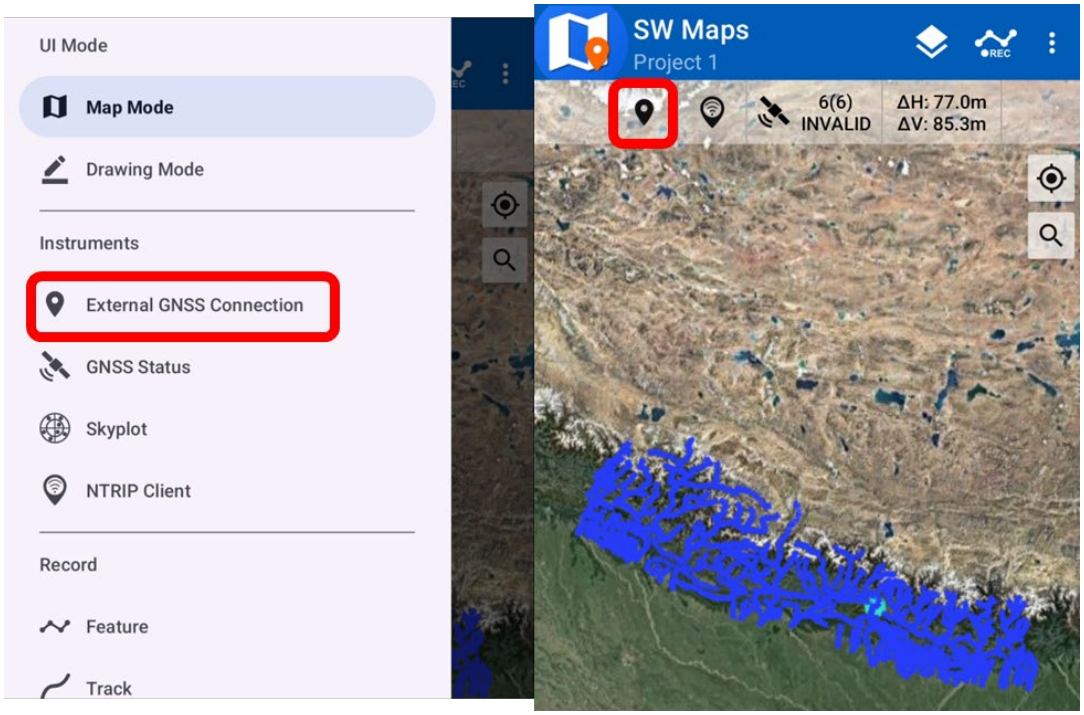
Note: You can also use another project installed in the device as a template. To do so, select **Project** in the **Import Layer From** dropdown.

16 External GNSS Connection

SW Maps supports connecting external GNSS receivers over Bluetooth Serial, Bluetooth Low Energy (BLE) and USB Serial. It also has a built-in NTRIP client, which allows it to be used for high accuracy location data collection.

16.1 Connecting an External GNSS Receiver

To connect an external GNSS receiver, open the left navigation drawer and tap on **External GNSS Connection**. Alternatively, you can also use the leftmost button on the location status bar.

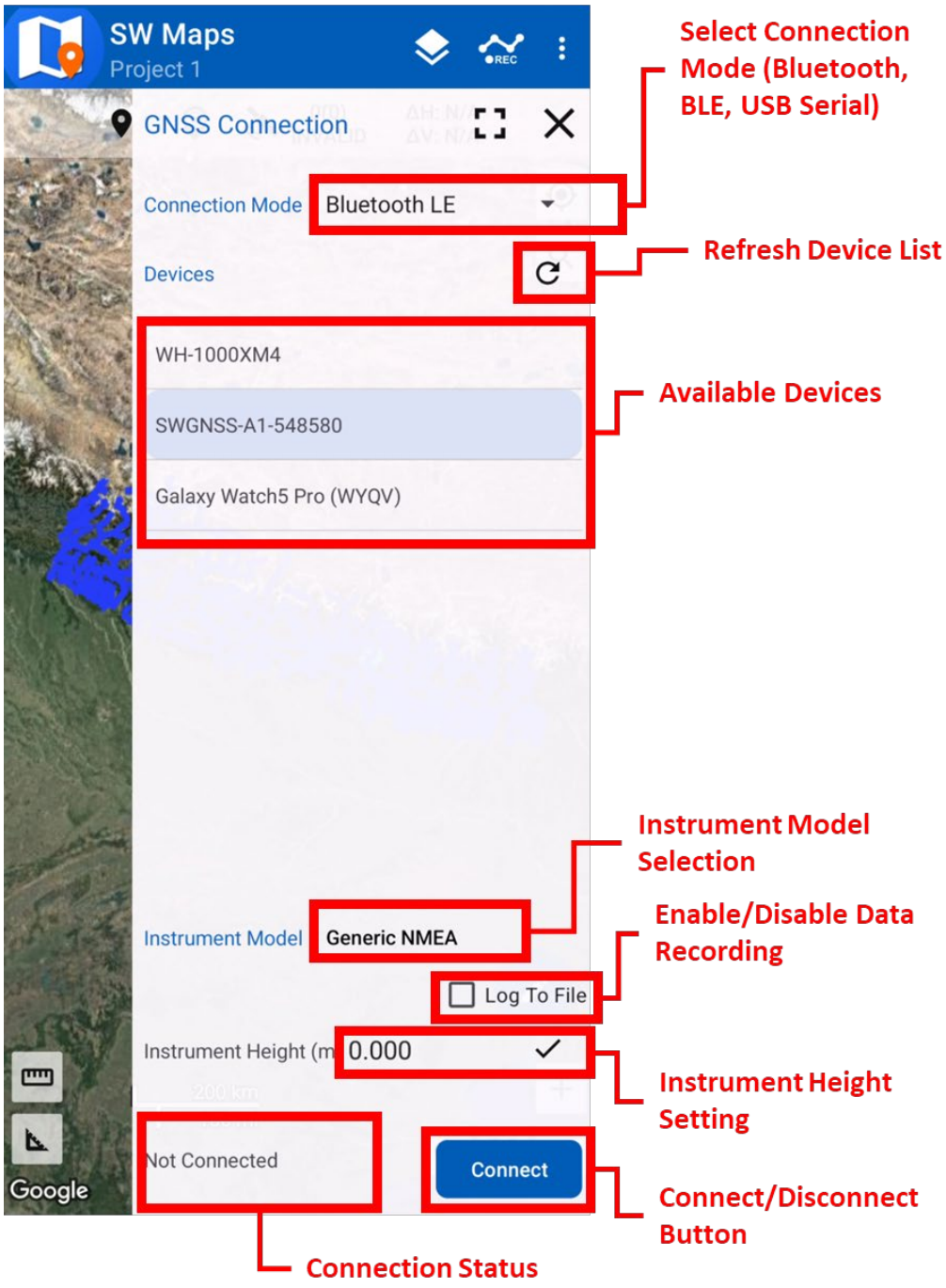


This opens the **GNSS Connection** sidebar, which allows you to connect to external GNSS receivers.

To connect a GNSS receiver, follow the steps below.

1. Open the **GNSS Connection** sidebar.
2. Select the connection mode of the receiver. The choices are Bluetooth, Bluetooth LE, and USB Serial.
3. Select the device to connect to from the list of available devices. For Bluetooth devices you must pair the Android device with the receiver beforehand. Once paired, you can press the refresh button to list the paired devices again. The app can automatically scan for Bluetooth LE devices using the refresh button.

4. Select the instrument model. SW Maps supports several different types of GNSS instruments. If your instrument is not supported, try using the Generic NMEA option, or contact your GNSS receiver manufacturer.
5. Enter the instrument height. The height can be changed at any time by entering the new height and pressing the ✓ button beside it.
6. Press the **Connect** button.



SW Maps obtains the position and satellite skyplot from the external GNSS receiver using standard NMEA-0183 sentences. The receiver must be configured to output the required NMEA messages. The following messages are required.

1. GGA
2. GSA
3. GSV
4. RMC
5. GST

Once the instrument is connected a notification is displayed showing the current position as obtained from the external GPS.

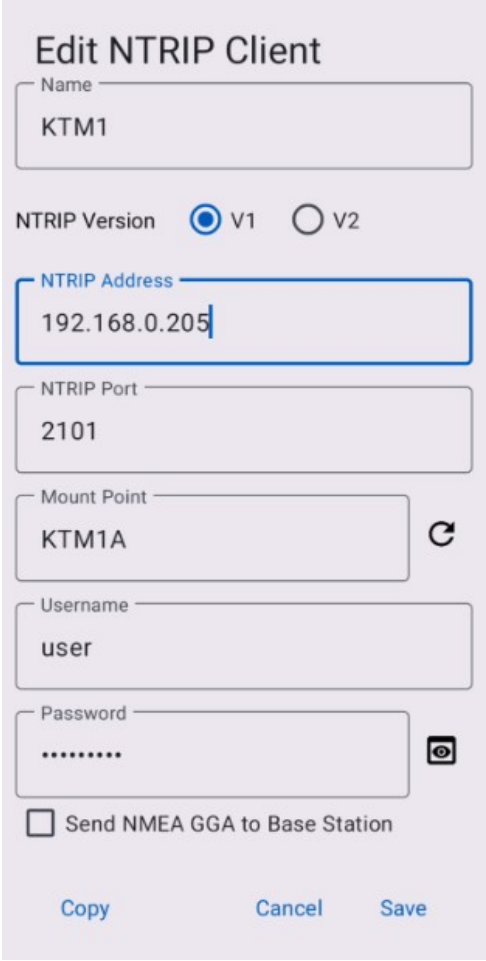
16.2 Mock Locations

If mock locations are allowed on the device, SW Maps sets the location of the device to the location obtained from the external receiver. This allows the use of an external GNSS receiver in other apps that use the location of the device.

The settings for enabling mock location can usually be found under **Developer Options** in android settings. The instructions for enabling **Developer Options** and **Mock Locations** are device specific. You must set SW Maps as the **Mock Location Provider** app in the developer options.

16.3 NTRIP Client

SW Maps can function as an NTRIP client to pass GNSS corrections from a remote base station to the connected external GNSS receiver. To open the NTRIP client, press **NTRIP Client** on the left navigation drawer.



The NTRIP Client sidebar shows a list of saved NTRIP connections. To add a connection, press the + button. You can also edit and delete saved connections here or create a copy of the connection settings.

When adding a connection, enable **Send NMEA GGA to Base Station** if you are connecting to a VRS or a NEAR stream.

The **Apply Base Antenna PCO** option is useful if your base station is transmitting an antenna model, but the rover connected to SW Maps is not able to apply the base station antenna phase center offset.

Press the **Connect** button to connect to the NTRIP caster. Press **Disconnect** once connected to disconnect. The NTRIP caster is automatically disconnected if the external GNSS receiver is disconnected.

17 GNSS Status and Skyplot

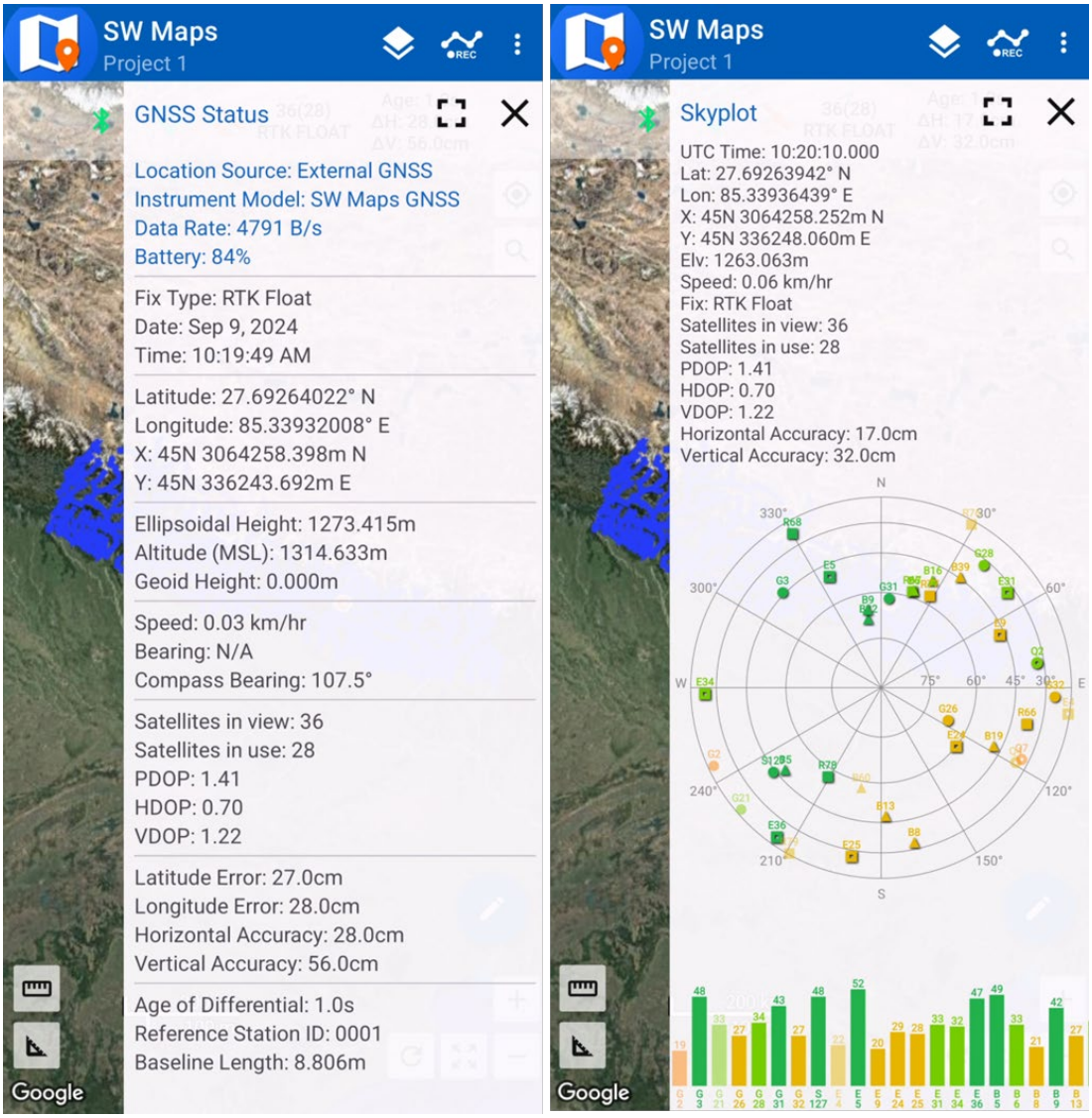
17.1 Viewing GNSS Status

To view GNSS status, open the navigation drawer and press the **GNSS Status** button.

The GNSS Status sidebar shows detailed information on the current GNSS position, including coordinates, satellites in view/use, estimated horizontal and vertical accuracy and DOP.

17.2 Viewing Satellite Skyplot

To view the satellite skyplot, open the navigation drawer and press the **Skyplot** button. The skyplot view shows all visible satellites and their signal to noise ratio (SNR) along with basic GNSS information. The SNR plots can be scrolled horizontally.

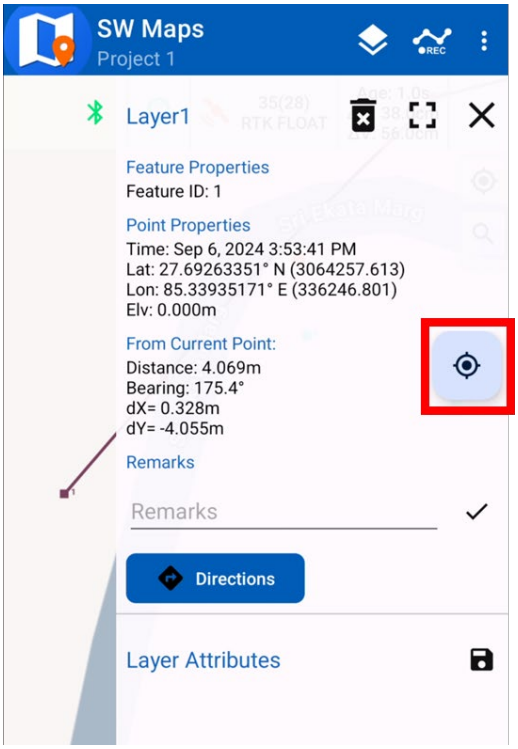


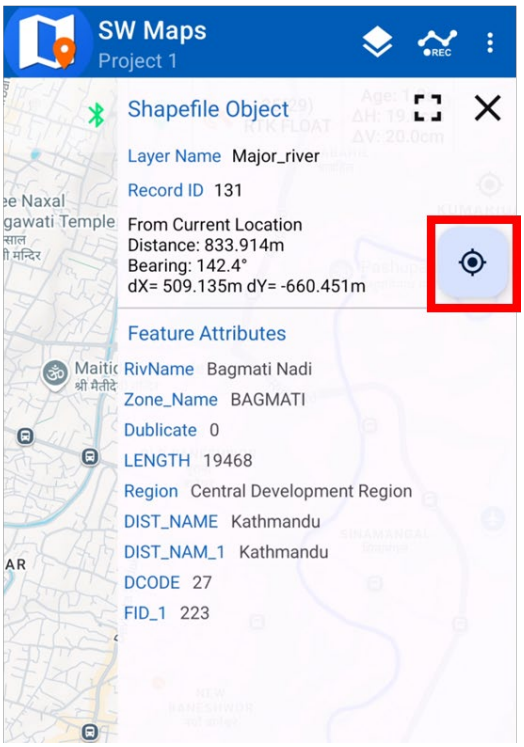
18 Feature Stakeout Tool

The feature stakeout tool lets you locate the features from the map on the ground using a high accuracy GNSS receiver. You can stake out points, lines and polygons that are in feature layers, or imported vector layers such as shapefiles or Geopackage.

18.1 Opening the Stakeout Tool

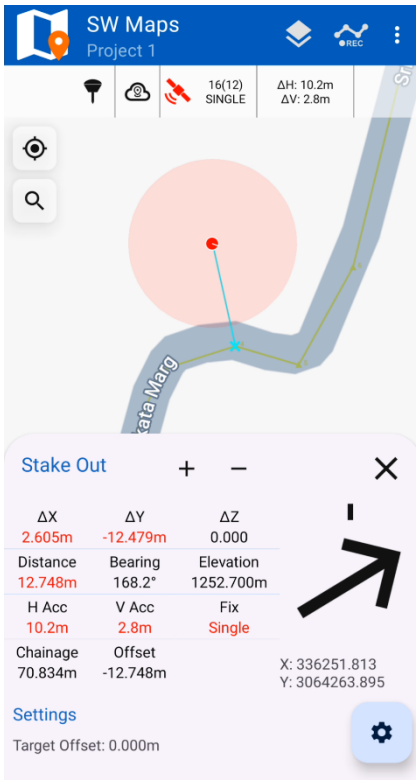
To open the stakeout tool, first open the properties sidebar of the feature to stake out. You can do so by tapping the feature on the map. Then, press the button to open the stakeout tool.





18.2 Using the Stakeout Tool

Pressing the button closes the feature properties and loads the stakeout tool. In the stakeout mode, the map is centered at the current location, with a line drawn between the point currently being located and the current location.

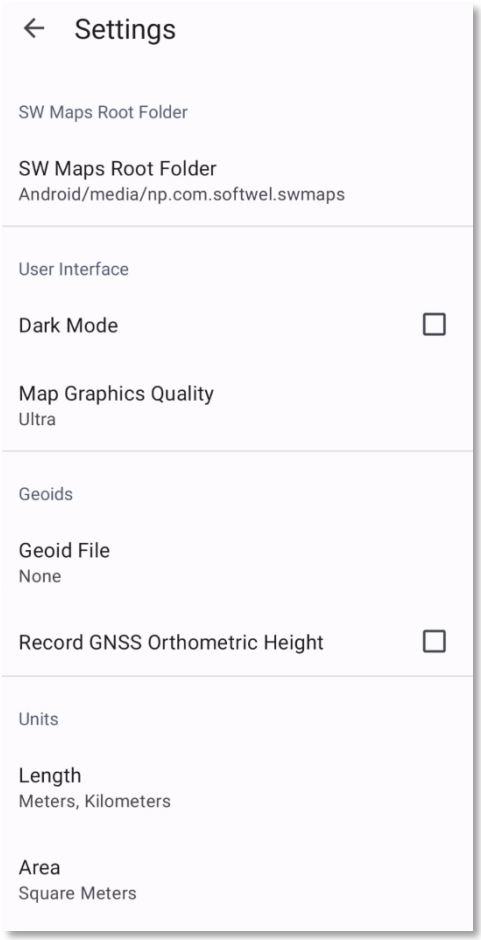


The arrow uses the compass on the device to point to the selected line or point. You can use the + and – buttons to zoom in and out.

For lines, pressing the button lets you set the target distance and offset of the point to be located. This can be used to locate points at a certain offset from the line. Use a negative value for offsets to the left side, and positive value for offsets to the right. You can also set an angle to the offset.

19 App Settings

The app settings can be accessed through the **Settings** menu on the left navigation drawer.



The settings screen also shows the SW Maps Root Folder that is currently being used.

The following settings can be changed.

1. User Interface
    a. Dark Mode: Enable or disable dark mode UI.
    b. Map Graphics Quality: Increase or decrease the quality of rendering of map elements. Lower quality results in better performance.
2. Geoids
    a. Geoid File: Select the Geoid file to be used by SW Maps. Geoids must be in binary GTX format and copied to the SW_Maps/Geoids folder.
    b. Record GNSS Orthometric Height: Enable this option to record the Orthometric (MSL) height reported by the GNSS receiver if a geoid file is not available.
3. Units
    a. Length: The unit of length used to show the length of lines and tracks, as well as perimeter of polygons.
    b. Area: The unit used in displaying area of polygons.

c. Elevation: The unit used in displaying elevation.
d. Latitude/Longitude: Sets the format in which Latitude/Longitude is displayed.
e. Speed: The unit used for displaying speed.
f. Show UTM Coordinates: Check this option to show UTM coordinates alongside latitude and longitude.

2. Display
    a. Show Elevation in Points: Checking this option will show elevation in point markers on the map.
    b. Show Point Numbers: Disabling this option will hide point numbers from the map.
    c. Show Chainage in Tracks: Checking this option will display Chainage markers on tracks.
    d. Point Marker Size: Change the size of point markers shown on the map.
    e. Chainage Interval: Set the interval at which chainage markers are drawn.
    f. Chainage Marker Size: Select the size of the chainage markers shown on the map.
    g. Label Size: Change the size of line and polygon labels.

3. Features
    a. Minimum Fix Quality
    Set the minimum fix quality with which points may be recorded. This is useful to prevent low accuracy points from being recorded.

    b. Prompt Editing Attributes After Recording Feature
    When enabled, the app will ask you whether you wish to record attributes once a feature is recorded.

    c. Vibrate On Record
    Vibrates the device when a point is recorded.

4. Compress Photos
    Enables photo compression, to reduce the disk space and project size.

20 App Utilities

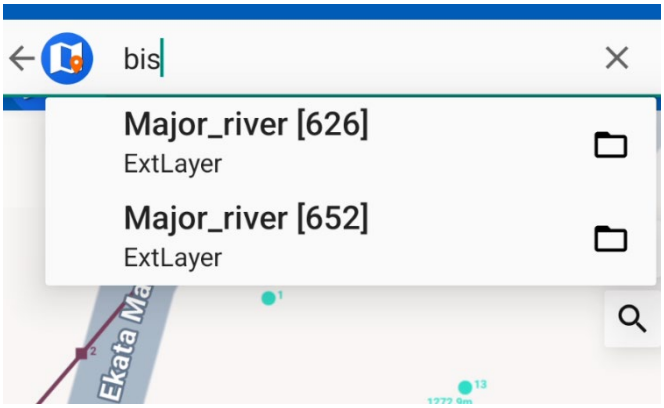
SW Maps provides several useful tools and utilities.

20.1 Compass

To open the **Compass** sidebar, tap **Compass** on the left navigation drawer. The compass sidebar functions as a virtual compass, showing the current bearing.

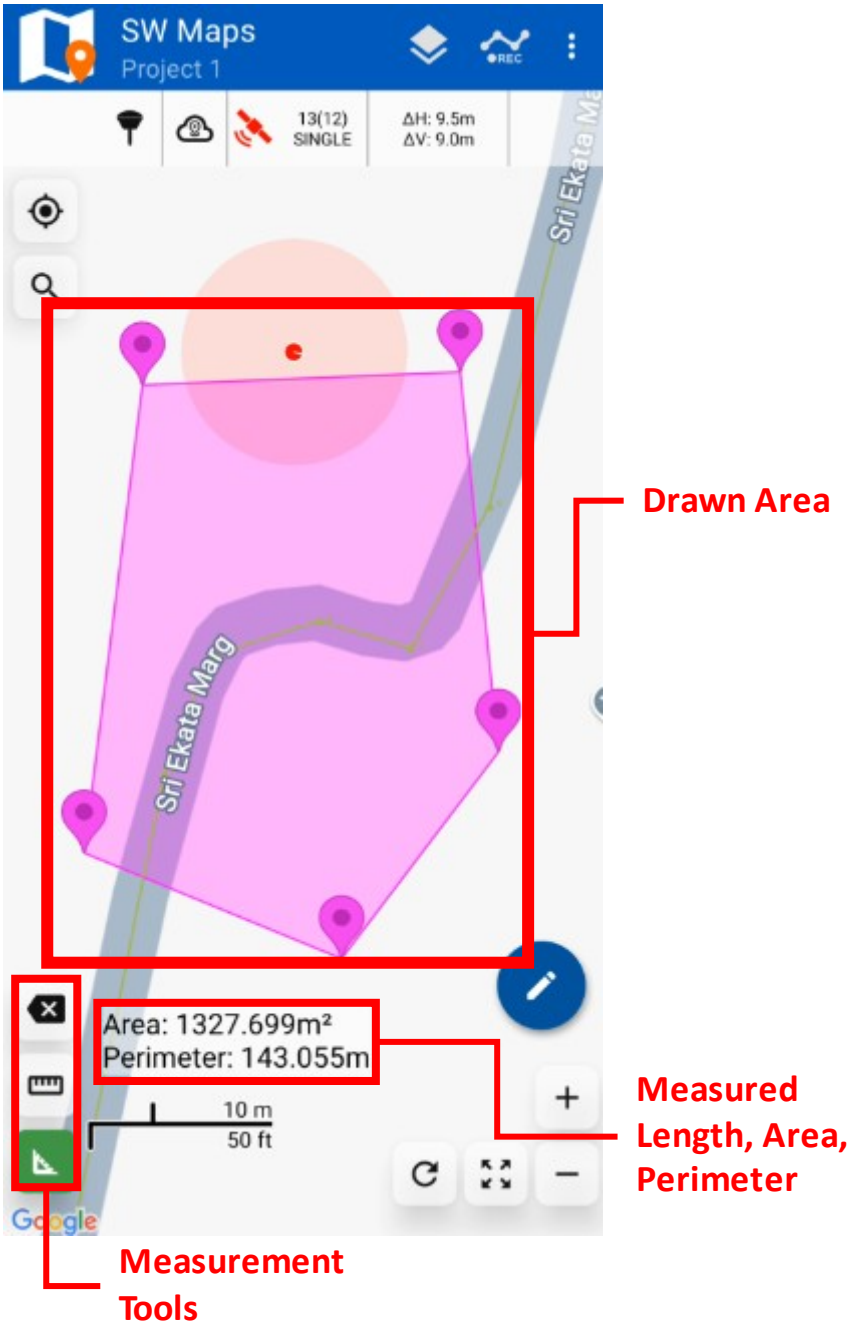
20.2 Search

The Search tool lets you search for any data on the current project. You can search for recorded or drawn features, tracks, photos as well as Shapefile/GeoPackage/GeoJSON features. You can enable search from the button on the top right, or from the navigation drawer. Clicking on a searched feature will open its properties.



20.3 Measurement Tools

SW Maps has length and area measurement tools that can be enabled from the bottom left corner of the map.



To start a measurement, press the **Measure Line** or **Measure Area** tool on the bottom left corner of the map. Then, draw the line or polygon to measure. The drawn points can snap to map features and can also be dragged by long-pressing them on the map.

You can remove the last added point by pressing the **Erase** button.

The length, area and perimeter are shown using the units set from the app settings.