

[DRAFT] SOP for using mobile devices as GPS data recorders

Connecting to the Bad Elf™ Bluetooth GPS (on Android devices)

Before collecting any data, many tablets will need to connect to an external GPS device. We will be using the Bad Elf™ receiver, but there are others on the market.

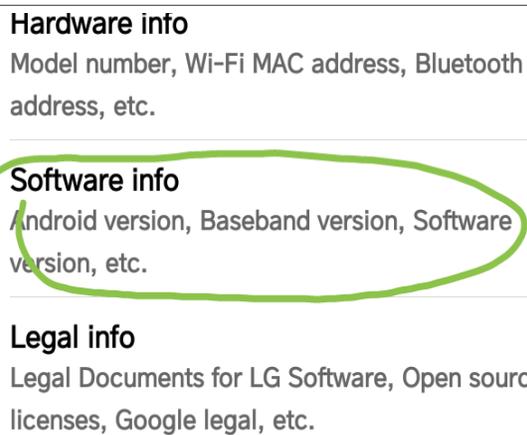
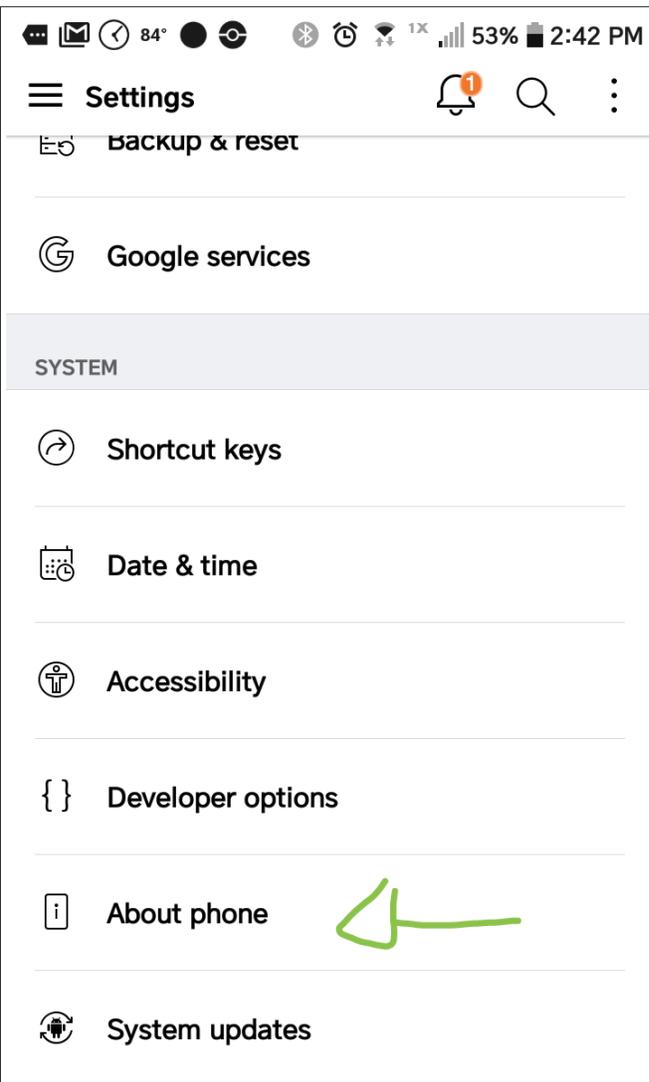
All modern smartphones are equipped with an onboard GPS. These will typically have a horizontal accuracy of 4-6m in good conditions.

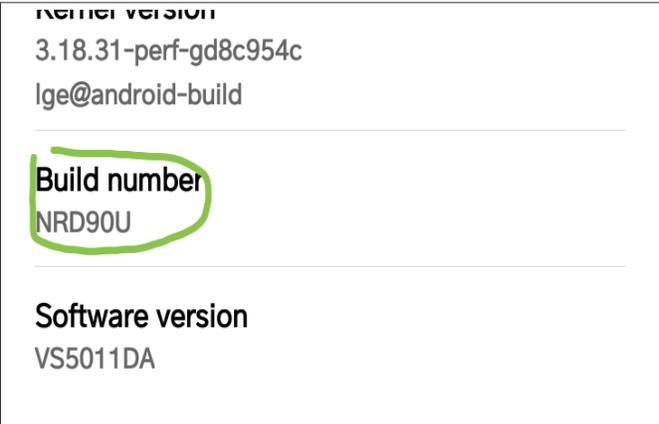
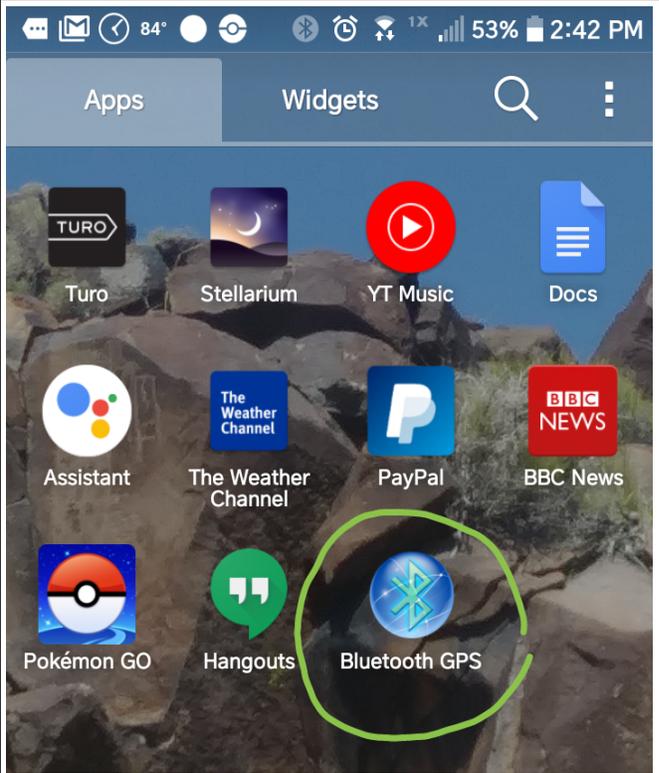
You may also want to connect an external GPS to smartphone or tablet that already has an onboard GPS in order to improve accuracy.

Because the companion app for the Bad Elf™ receiver is written to run natively on iOS only, Android users will have to go through a few extra steps.

First, you will need to activate developer tools in order to bypass the onboard GPS. Go to your settings menu, and click “About phone.”

Scroll down and click “Software info”



<p>Rapidly click “Build number” 7-10 times.</p> <p>Once you are successful, you will receive a notification “you are now a developer!”</p> <p>Next, pair the Bad Elf™ via bluetooth with your smart device. It should pair, but will <i>not</i> say “connected” quite yet.</p>	 <p>Build number NRD90U</p> <p>Software version VS5011DA</p>
<p>To fully connect to the bluetooth GPS receiver, you will need to manage the connection through an app.</p> <p>For iOS, this will be the Bad Elf app. As that app is not yet available for Android, we will need to use a third party app. “Bluetooth GPS” is recommended. Install it from the Play Store.</p> <p>Next, launch the “Bluetooth GPS” app.</p>	 <p>Apps Widgets</p> <p>Turo Stellarium YT Music Docs</p> <p>Assistant The Weather Channel PayPal BBC News</p> <p>Pokémon GO Hangouts Bluetooth GPS</p>

“Bluetooth GPS” can connect to the Bad Elf™ GPS. Do so by selecting it from the drop down menu under “Select paired GPS device...”

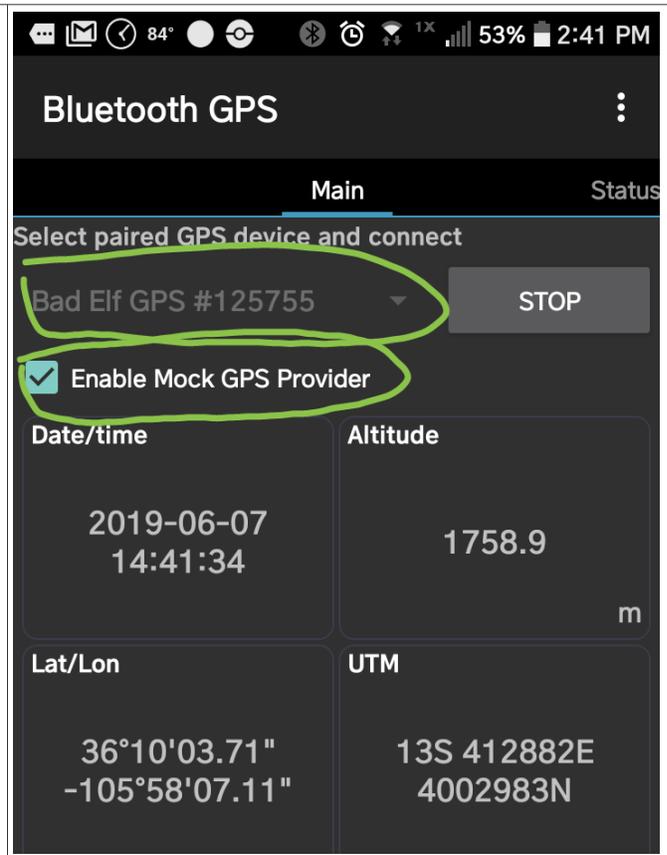
If the GPS receiver does not appear on this menu, you will need to pair with it first.

Once you have selected the Bad Elf GPS, check the box for “Enable Mock GPS Provider.”

Click the “Connect” or “Start” button to the right.

You can verify you are receiving GPS data from the Bad Elf using the telemetry boxes. The altitude and position will appear if you are connected. If connection has failed or if you need to reconnect, these fields will be blank.

If the connection is successful, “Bluetooth GPS” can now be left to run in the background. It will feed the receiver's telemetry to other apps, including Avenza.



Getting started with Avenza: opening and importing a GeoPDF map

“Avenza Maps” is a mid-range GPS/GIS app developed for mobile platforms, and is compatible with Android, iOS, and Windows Mobile.

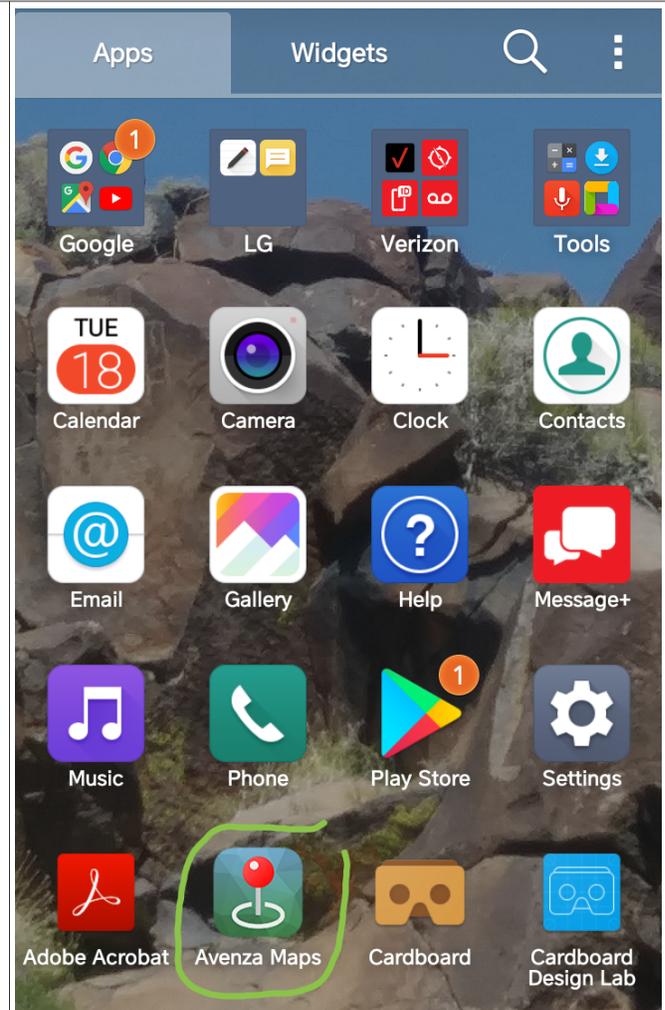
Because of the many features this app has to offer, it is gaining enthusiasm among archaeologists as an affordable alternative to expensive professional grade GPS units.

On devices with onboard GPS, Avenza will work without an external receiver. It is only as accurate as device or receiver it is used with, and that accuracy can approach high-end commercial units (such as Trimble Geo7X/GeoXH with ArcPad or TerraSync) when used with a receiver like the Bad Elf™ GNSS Surveyor.

Avenza is available in standard in professional versions. At the time of the writing of these instructions, we are included to use the free standard edition.

Avenza standard edition handles two primary data types: background files (georeferenced pdf's) and layer files (e.g. .kml/.kmz). We will use both.

Begin by opening Avenza Maps.



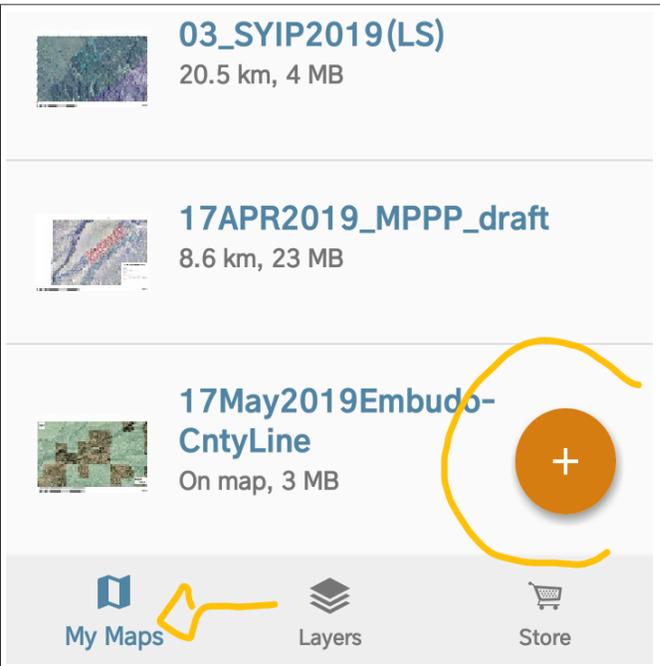
To start using Avenza, we will need a map covering the area to be visited.

We prepare custom in-house using ESRI's ArcMap, and export them as georeferenced .pdf's (geoPDF).

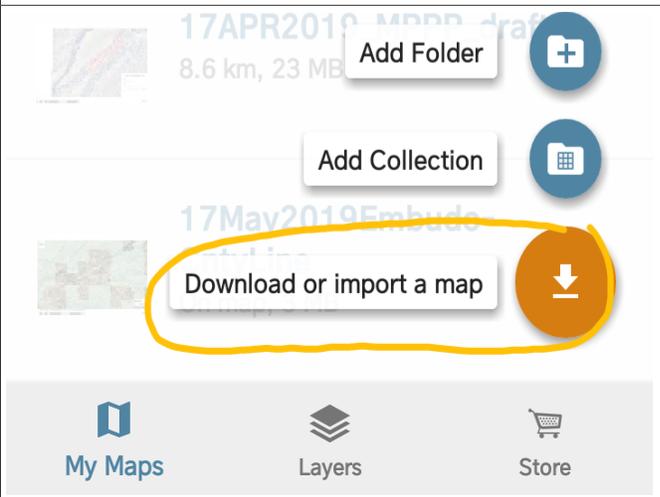
First, make sure the geoPDF map has been loaded onto your device storage.

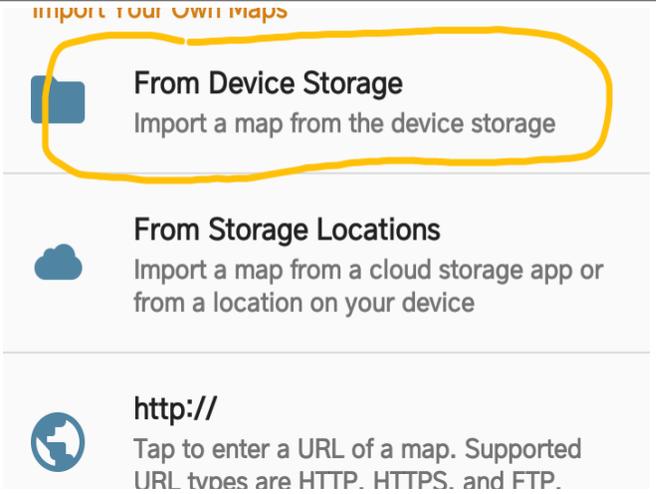
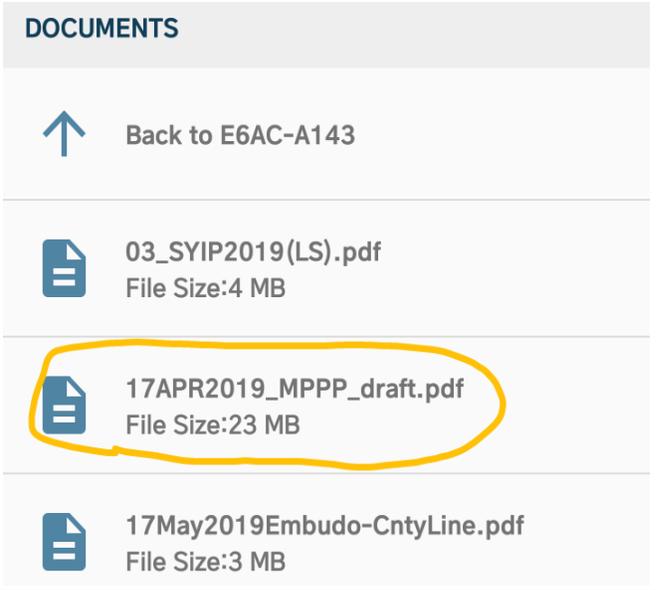
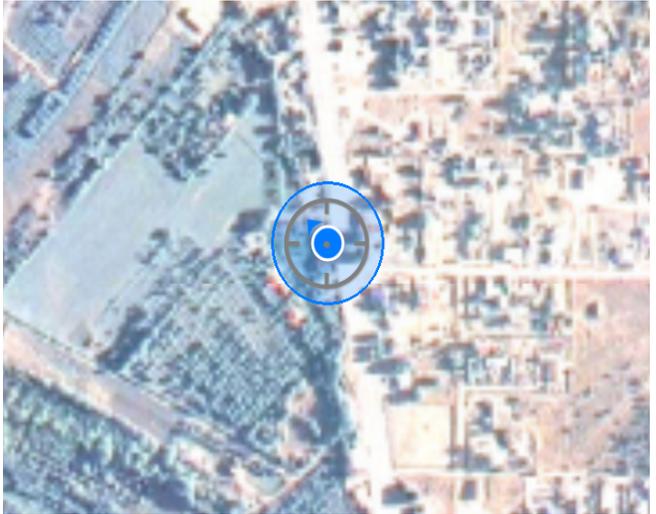
To add, make sure you are on the "My Maps" tab.

Click the "+" sign in the lower right of the screen.



Click the "Download or import a map" button.

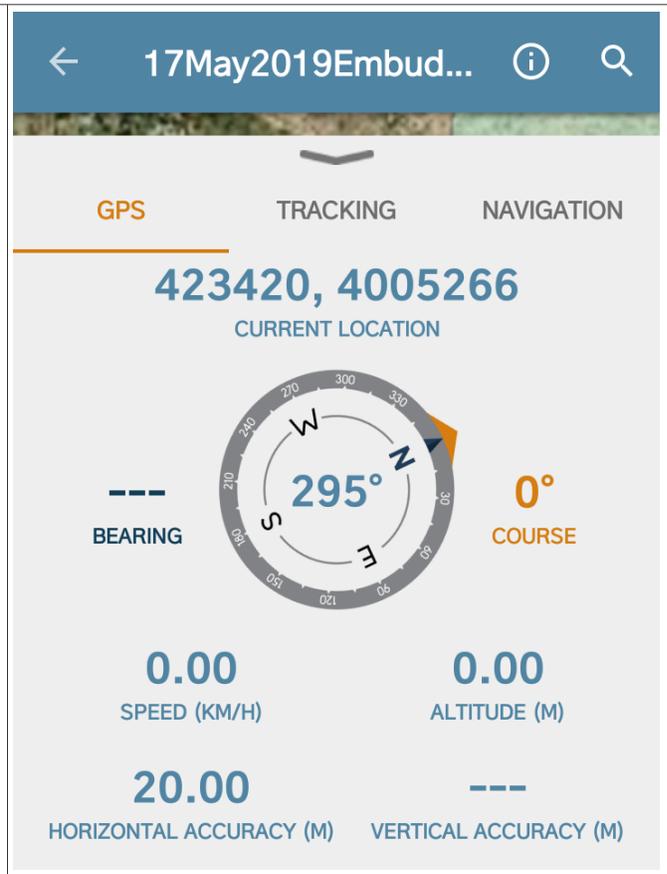


<p>Scroll until you see “From Device Storage” and click here.</p>	 <p>Import Your Own Maps</p> <ul style="list-style-type: none">From Device Storage Import a map from the device storageFrom Storage Locations Import a map from a cloud storage app or from a location on your devicehttp:// Tap to enter a URL of a map. Supported URL types are HTTP, HTTPS, and FTP.
<p>Navigate to the location on your device where the geoPDF map is stored.</p> <p>Select the map file you wish to import.</p> <p>If there are multiple .pdf maps and you are unsure which one to use, contact the Project Archaeologist.</p>	 <p>DOCUMENTS</p> <ul style="list-style-type: none">Back to E6AC-A14303_SYIP2019(LS).pdf File Size:4 MB17APR2019_MPPP_draft.pdf File Size:23 MB17May2019Embudo-CntyLine.pdf File Size:3 MB
<p>The map will take several seconds to import. Avenza will need to “process” the map to position it in its spatial reference frame.</p> <p>If successful, the map will appear in the list among my Maps. If it appears inactive, remove another map first.</p> <p>Once added, click on the map.</p> <p>Your position will appear as a dot on the map. The cross hairs can be aligned to your position.</p>	 <p>An aerial satellite-style map showing a city area. A blue location marker with a white dot in the center is overlaid on the map. The marker has a circular crosshair design around it.</p>

The bar at the bottom of the screen can be expanded to show additional information.

The “current location” will correspond with the position of the cross hairs. This should be set to UTM NAD83. If it is not, contact the Project Archaeologist.

You will also notice a compass, and fields for altitude and GPS accuracy.



Using Avenza part I: importing map layer data

With the georeferenced area map now loaded, it is time to begin addressing data.

GIS programs like Avenza store location data in layers. These layers help organize different datasets based on how the user defines them. Using multiple layers can be helpful in separating data of different types, location, or time.

We use separate data layers to a few purposes. One is to import or display previously recorded cultural features that have already been entered into our database. Doing so helps prevent redundant data and re-recording known features.

Another purpose is to collect new data connected to discrete geographic positions. These can be recorded as points, lines, or polygons. We will explore these types later.

Lastly you may want a separate layer to track fieldwork progress, or to help locate your car.

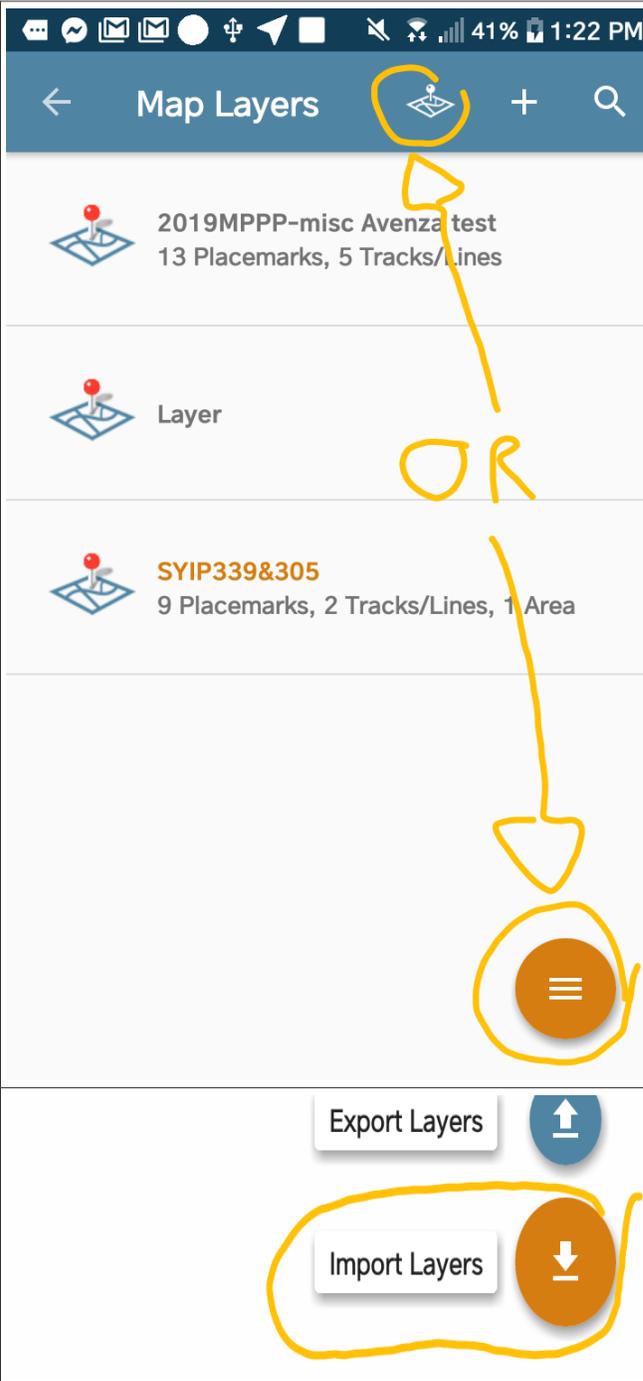
We will store data layers as .kmz files, which is a compressed or “zipped” version of .kml.

To begin adding a data layer, go to the layers tab. Click either the map icon in the upper right, or click the mock-text icon in the lower right.

This will open the export/import menu.

Click on the “Import Layers” option to access .kmz files on your device.

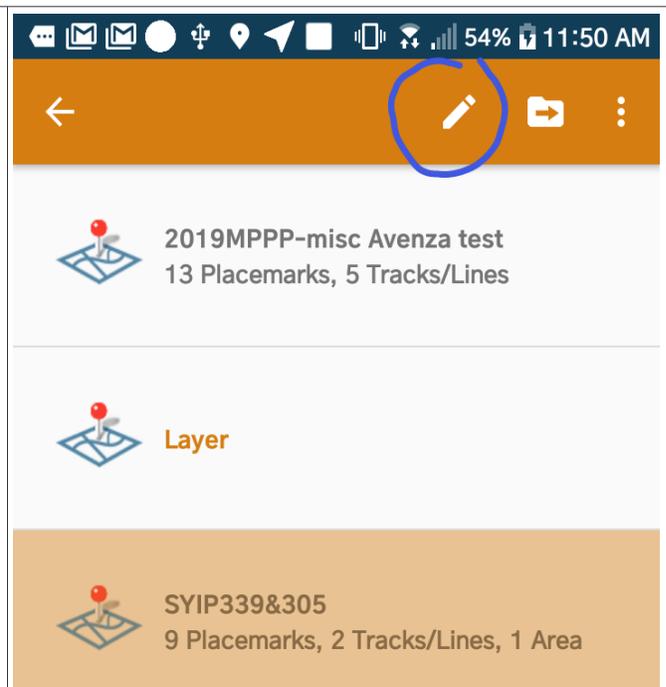
If the layer file is not currently on your device, you will have to download it before proceeding.



Once the layer is imported into Avenza, it is necessary to one or two more things.

First, hold-click the layer, and select the pencil icon in the upper right.

This opens the Edit layer dialog.

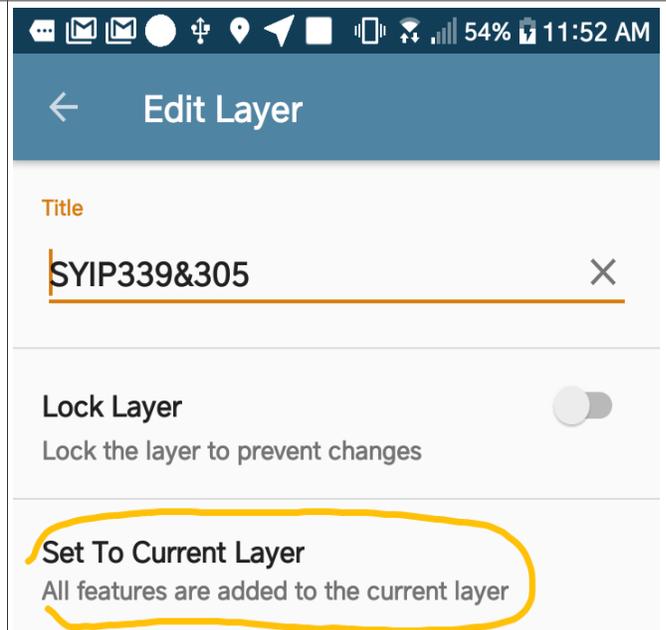


If the layer you just imported is the one for collecting data, you will have to set it as “current.”

In the Edit Layer dialog, click “Set to Current Layer.” now all new information will be recorded into this layer.

You may also want to edit the name of the file to make sense.

For background files and previously recorded data, skip this step.



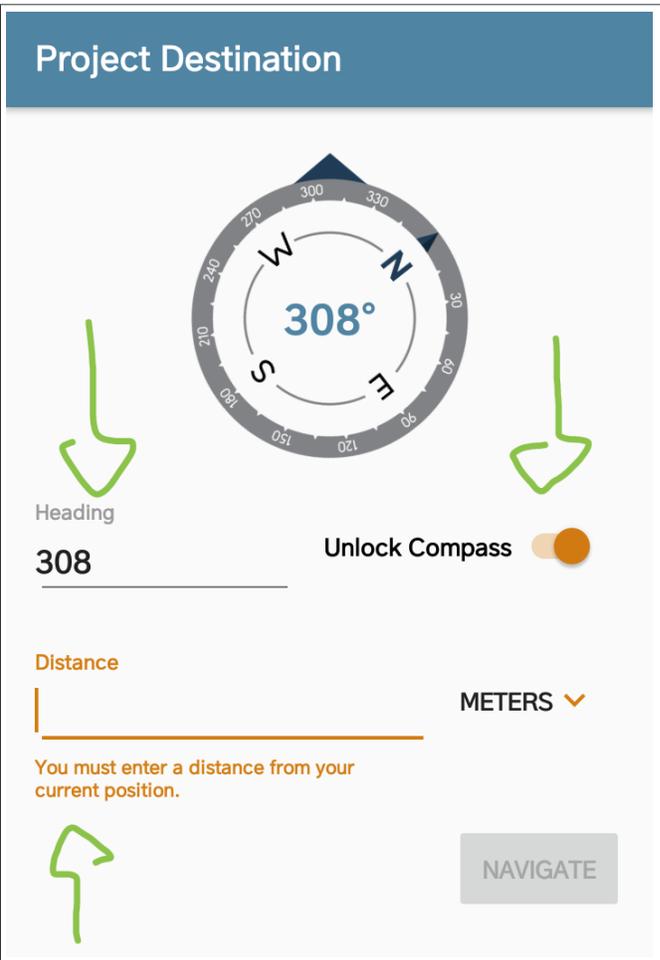
<p>Each layer can contain a couple of different types of data. These are usually stored as single points, poly-lines (lines with multiple vertices), and polygon areas.</p> <p>Symbols are typically set by the defaults defined for the layer in question. New and existing features can also be assigned symbols different from the default.</p>	
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<p><i>Using Avenza part II: navigating</i></p>	
<p>One of the first tasks you may want to do is navigating to a location.</p> <p>Navigating is useful in finding where to begin surveying, determining coverage progress, and relocating your vehicle.</p> <p>Avenza provides three ways to navigate: projecting, placemarks, and destinations. The following will cover all three.</p>	

Projecting is a simple tool. It takes user input to determine the destination based on compass heading and distance.

To project a destination, enter the bearing and distance.

Remember to click “unlock compass.”

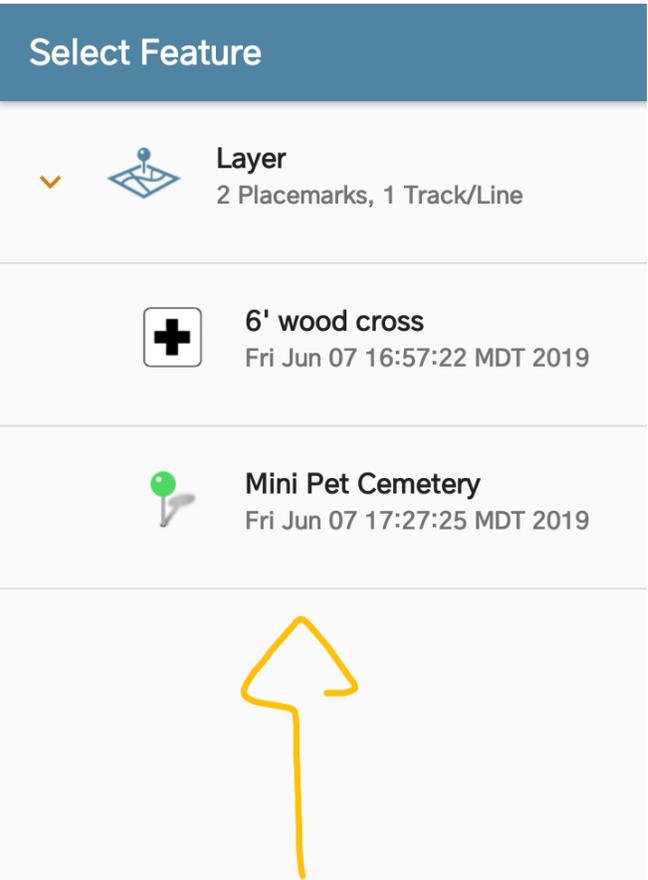
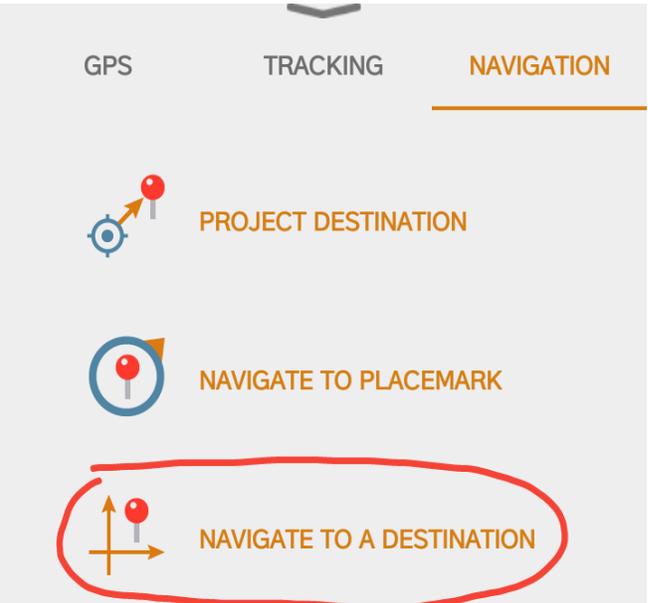


It is even easier to navigate to previously recorded points. Any waypoint in your active map layers will work.

If you have taken a point on a feature, or your car, it will be easy to relocate using this method.

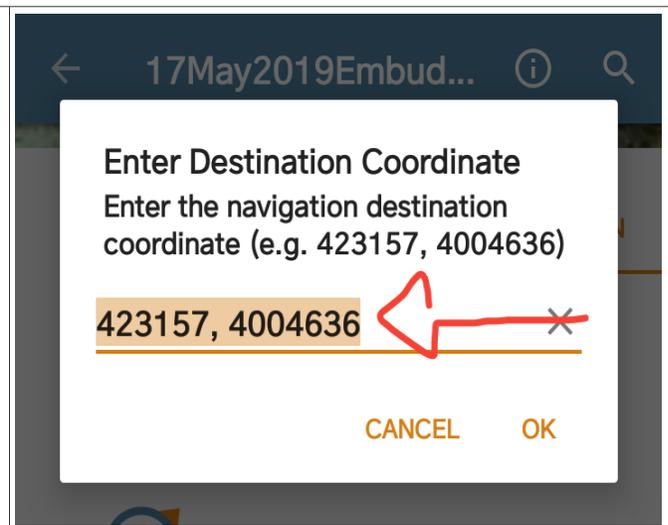
Click on “Navigate to Placemark”



<p>Expand the layer containing the point.</p> <p>Click the desired point from the list of features in this layer.</p> <p>The screen will guide you towards your destination.</p>	 <p>Select Feature</p> <p>▼  Layer 2 Placemarks, 1 Track/Line</p> <p> 6' wood cross Fri Jun 07 16:57:22 MDT 2019</p> <p> Mini Pet Cemetery Fri Jun 07 17:27:25 MDT 2019</p>
<p>Finally, you can navigate to a position simply by directly importing the coordinates.</p> <p>Click “Navigate to a Destination”</p>	 <p>GPS TRACKING NAVIGATION</p> <p> PROJECT DESTINATION</p> <p> NAVIGATE TO PLACEMARK</p> <p> NAVIGATE TO A DESTINATION</p>

A box will open to receive coordinates. MPPP uses UTM NAD83, and *not* lat/long.

In the dialog box, input the desired coordinates as UTM, and press OK.



*Using Avenza part III: collecting data in the field
part IIIa: marking waypoints*

Collecting new data can become one of the more confusing aspects of fieldwork. There are many benefits to collecting data directly in the field.

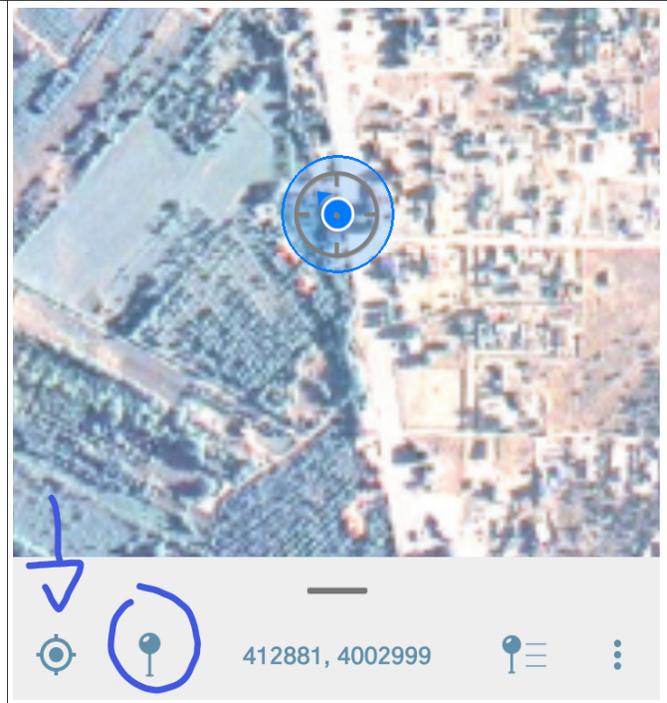
As mentioned, new data can be collected in one of three forms: points, lines, and areas. The following walks through each of these.

Beginning with points, the interface is careful. The pin logo in the lower right will mark a point.

It is important to remember new points will always be added at the cross hairs.

To make sure the cross hairs match your position, click the circular logo in the lower left corner of the screen until it becomes nucleated.

Next, click the map pin to collect the new point.



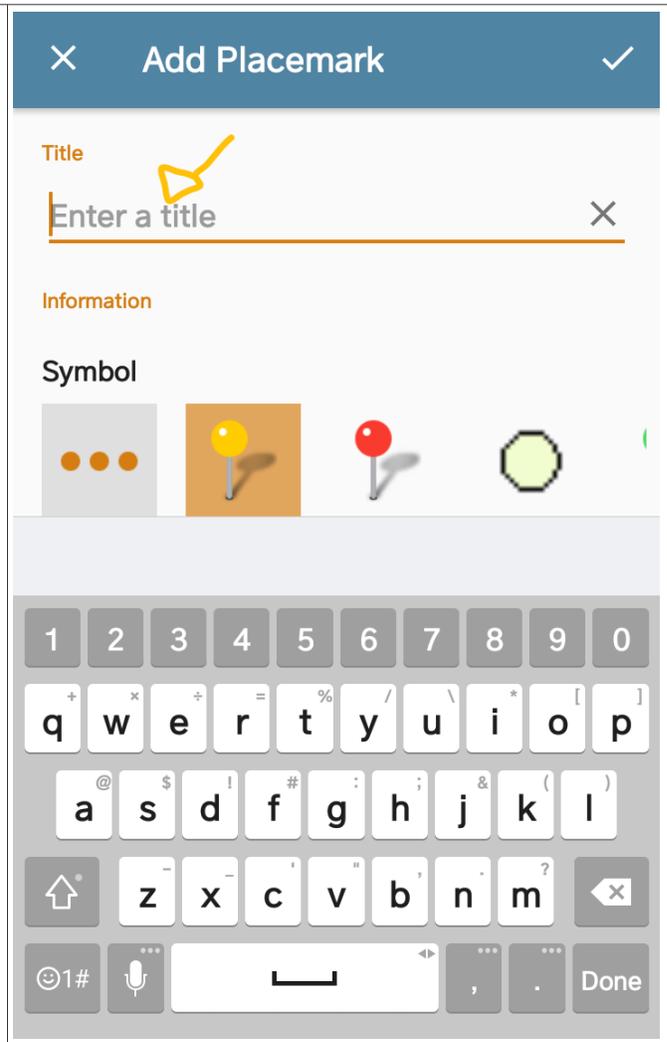
Points (sometimes called *waypoints* or *placemarks*) should each have a unique name.

As of the time of the writing of these instructions, a standard naming scheme has yet to be agreed upon by MPPP members.

Map data will need to contain year, provenience #, and locus name.

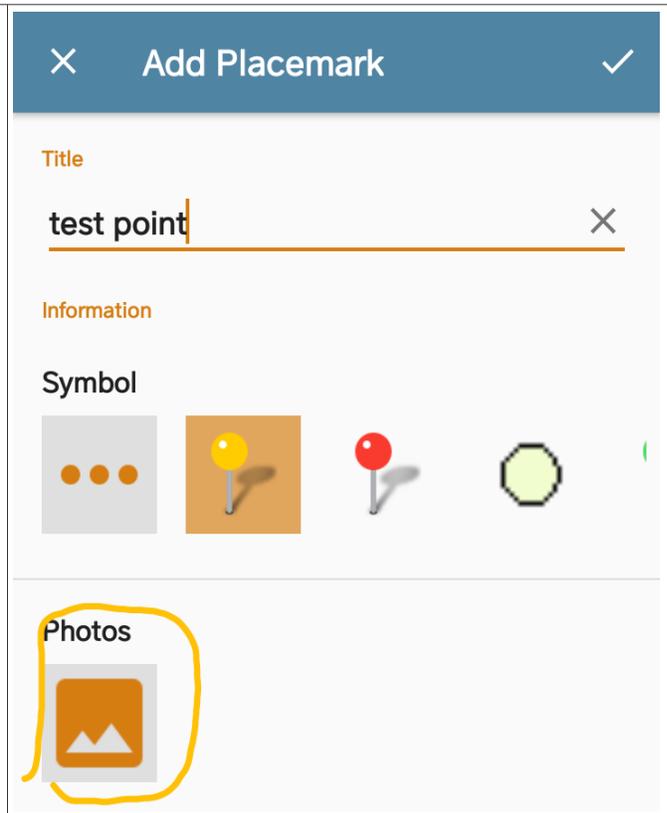
At present, these instructions will assume that year and provenience are included in the layer name. That leaves locus name for the individual mark.

Alternately, during field demonstrations, all three were included in point names. Examples followed the format [year]-[prov]-[locus], for example “2019-309-AU”.



In Avenza, placemarks not only record an exact position, but can also include photos, descriptions, and predefined attributes.

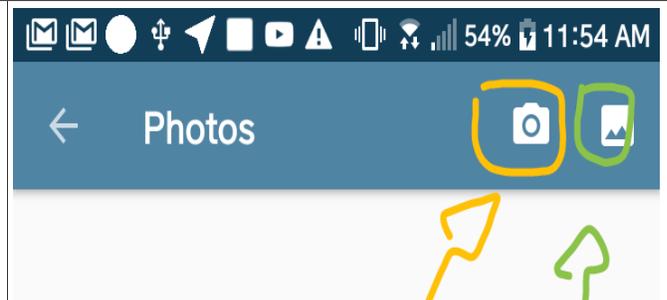
To add photos, click on the photo icon.



There are two ways to add photos: by selecting one from your gallery (picture image at far right green arrow), or taking a new photo using the app (camera icon at yellow arrow).

If using the gallery, navigate to the desired photo and select it.

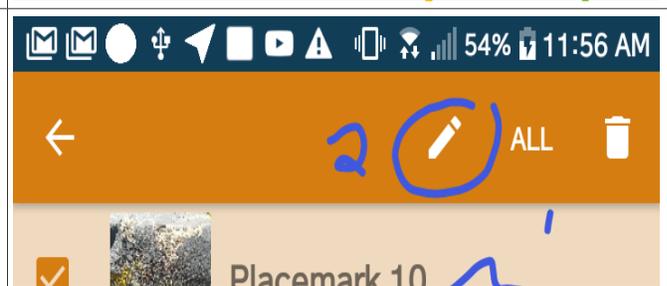
If using the camera, take the picture, review it, and if acceptable click "OK" or "confirm".



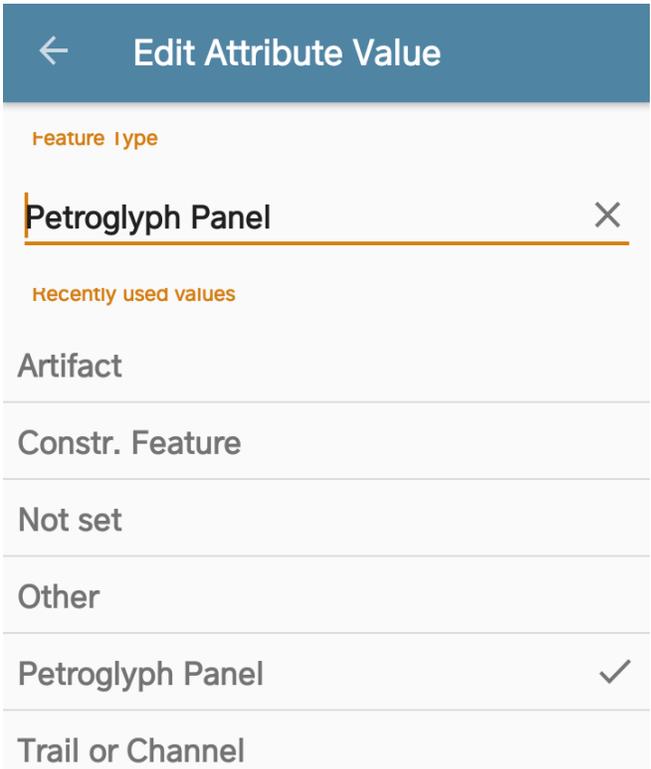
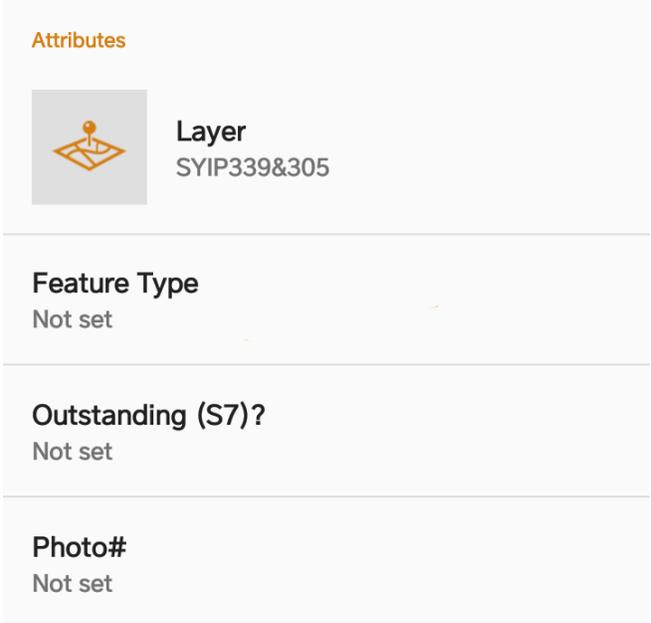
After adding photos, it is recommended to name them.

Hold-click the image, and click the pencil icon.

Good names include locus and panel information, and whether it is an overview or close-up.



<p>All features stored in map layers contain a field for a description.</p> <p>Good descriptions should include information about what the point is marking.</p> <p>If it is a petroglyph panel, describe prominent elements.</p> <p>If it is a constructed feature, describe its shape and construction.</p> <p>If it is an artifact, describe the material and type.</p>	<div data-bbox="841 226 954 252">Information</div> <div data-bbox="841 296 941 327">Symbol</div> <div data-bbox="841 344 1458 470"> </div> <div data-bbox="841 550 935 581">Photos</div> <div data-bbox="841 598 1104 720"> </div> <div data-bbox="841 800 992 833">Description</div> <div data-bbox="1068 829 1274 905"> </div>
<p>Next are the user-defined attributes. These are coded uniquely to each map layer.</p> <p>Make sure to fill out every applicable attribute.</p> <p>There are several different types of attributes, including string (text), boolean (yes/no), integer, and real (decimal number).</p> <p>In the example, the first is a string called “Feature Type.” click this field.</p> <p>(Just above these you will notice the location. This can be edited manually if need be.)</p>	<div data-bbox="841 940 958 972">Location</div> <div data-bbox="841 978 1049 1008">412891, 4002985</div> <div data-bbox="841 1075 911 1104">Time</div> <div data-bbox="841 1110 1052 1140">6/18/19 11:52 AM</div> <div data-bbox="841 1205 940 1230">Attributes</div> <div data-bbox="841 1266 1143 1383">  <div data-bbox="987 1295 1062 1327">Layer</div> <div data-bbox="987 1333 1143 1360">SYIP339&305</div> </div> <div data-bbox="841 1446 1015 1480">Feature Type</div> <div data-bbox="841 1486 928 1514">Not set</div> <div data-bbox="1019 1444 1258 1528"> </div> <div data-bbox="841 1581 1081 1614">Outstanding (S7)?</div> <div data-bbox="841 1621 928 1648">Not set</div> <div data-bbox="841 1715 941 1747">Photo#</div> <div data-bbox="841 1753 928 1780">Not set</div>

<p>“Feature Type” has been set up as a “pick list” of standardized options.</p> <p>Select the appropriate option.</p> <p>Adding new types to an existing layer is discouraged. Instead, select “Other” and describe it in the description field.</p>	
<p>Make sure to fill out all attributes.</p> <p>The example layer also has a field for S7, and for Photo Number.</p> <p>These fields should be filled to match your Photo Data Sheets.</p> <p>If filled out fully and correctly, Avenza map layer data will take the place of the Mapper's Notes.</p>	

Using Avenza part IIIb: collecting data as poly-lines

Avenza is cable of recording multi-vertex lines, or polylines, as tracks.

Tracks are useful in a number of instances. Tracks can be used to record survey transects.

Tracks can also be used to record linear cultural features like walls, trails, and old road alignments.

Begin recording tracks from the map screen.

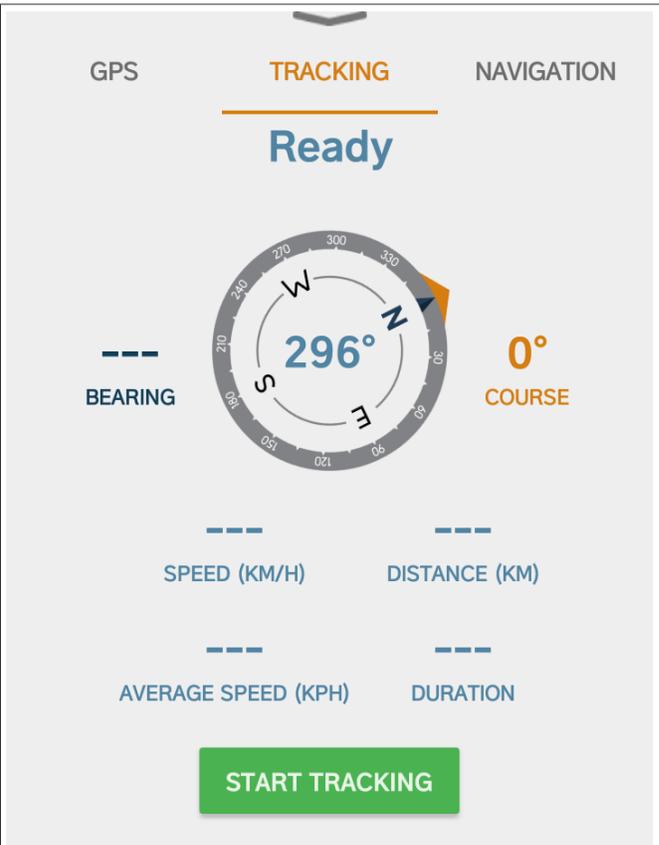
Expand the menu at the bottom of the screen.

Click the middle display marked “Tracking”

position yourself at the start of the line you are recording, and click “Start Tracking”

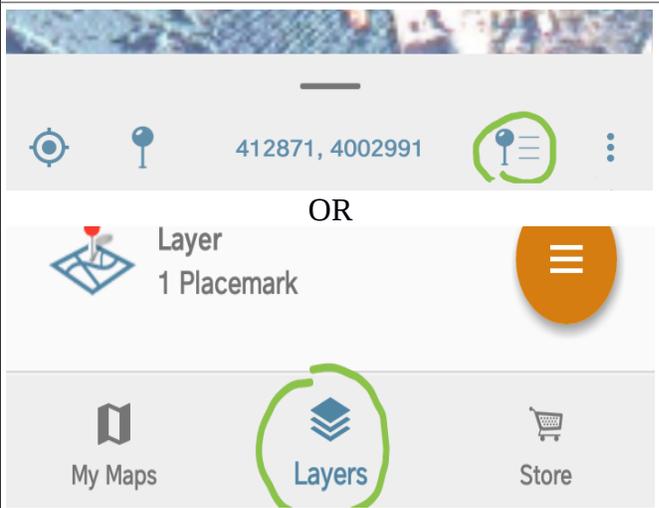
On some displays, the “Start Tracking” button will appear as a green button with a “play” triangle.

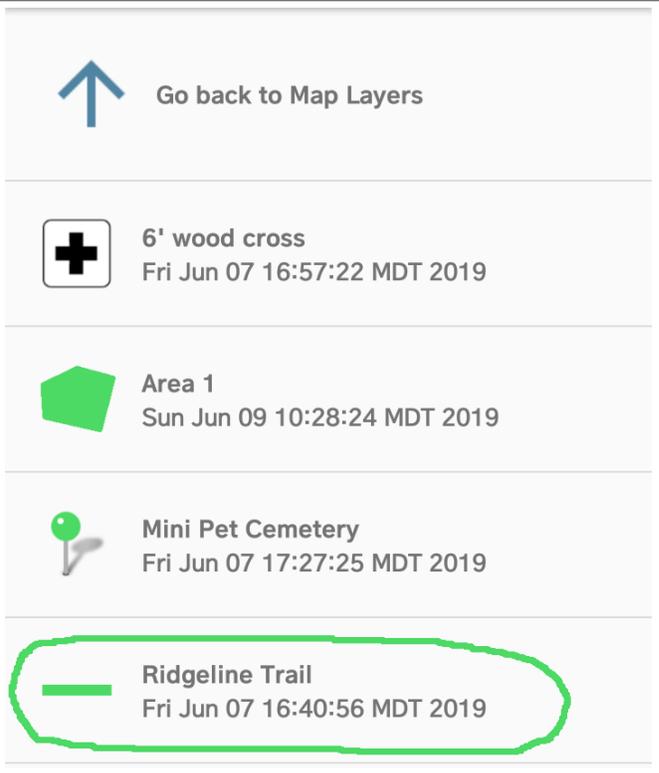
When finished, click “Stop” or the red square.

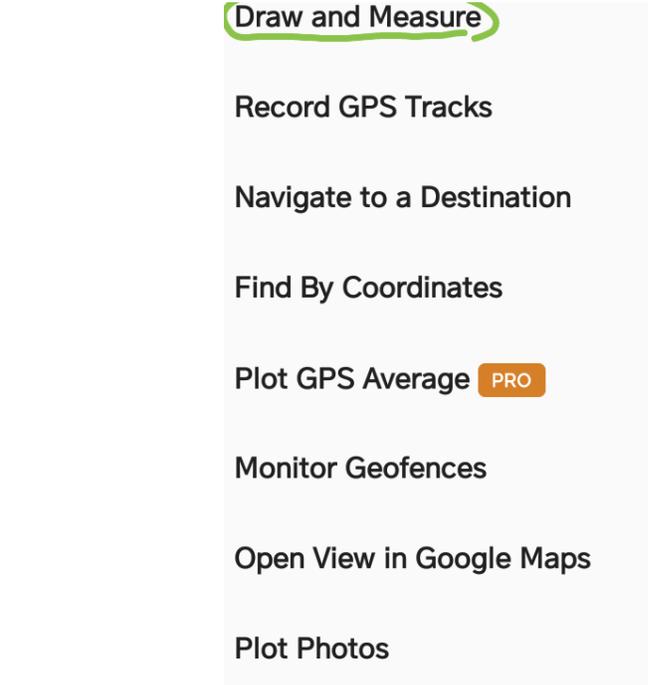


Once recorded, it is highly recommended to name and describe your track.

Go to the layers tab either by clicking the pin-with-mock-text logo in the lower right of the map screen, or by selecting the “Layers” tab from the Avenza home screen.



<p>Once recorded, it is highly recommended to name and describe your track.</p> <p>Go to the layers tab either by clicking the pin-with-mock-text logo in the lower right of the map screen, or by selecting the “Layers” tab from the Avenza home screen.</p> <p>Click to expand your current active layer.</p> <p>Scroll until you see your track/line.</p> <p>Hold-click the track.</p>	
<p>Click the pencil edit icon in the upper right.</p>	
<p>Set a name for the linear feature.</p> <p>If recording a cultural feature, conform to the naming scheme for points.</p> <p>If a survey transect, note it as such.</p>	
<p>You will notice that the track polyline contains all the same attribute fields as the points stored in the same layer.</p> <p>If this line is a cultural feature, fill out all the applicable fields just as if it were a point.</p> <p>If this line is for other purposes such as survey extent, leave these black. In this case, it may be best to record it in a separate layer. Setting up new layers is covered later in “Advanced Usage”.</p>	<p>Feature Type Not set</p> <p>Outstanding (S7)? Not set</p> <p>Photo# Not set</p>

<i>Using Avenza part IIIc: collecting data as circles and polygons</i>	
<p>Avenza is also capable of recording polygon areas. In the Pro version, lines can be converted to areas. In standard, we need to draw them manually. Start by clicking the three dots in the lower right.</p>	
<p>Select "Draw and Measure".</p> <p>Make sure the target icon in the lower left corner is nucleated, locking the crosshairs to your position.</p>	

Areas are drawn by marking vertices.

With the cross hairs locked to your position, tap anywhere on the map to mark the first vertex.

Walk to the next spot, and tap the map again to mark the next vertex.

Continue this procedure until you've encircled the area you are recording.

Next, from the drawing menu at the bottom of the screen, tap the line to switch to area.

You can also draw a circle (the circle icon) if you have either 1 or two points marked, but not with any more than that.



The area will now fill in.

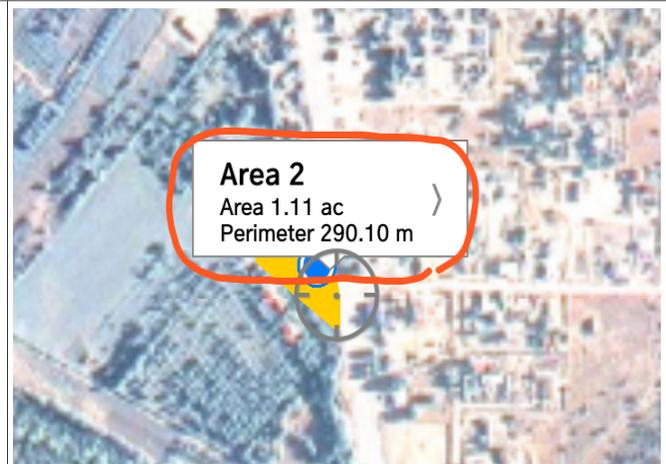
To save, click the checkmark in the lower right corner.

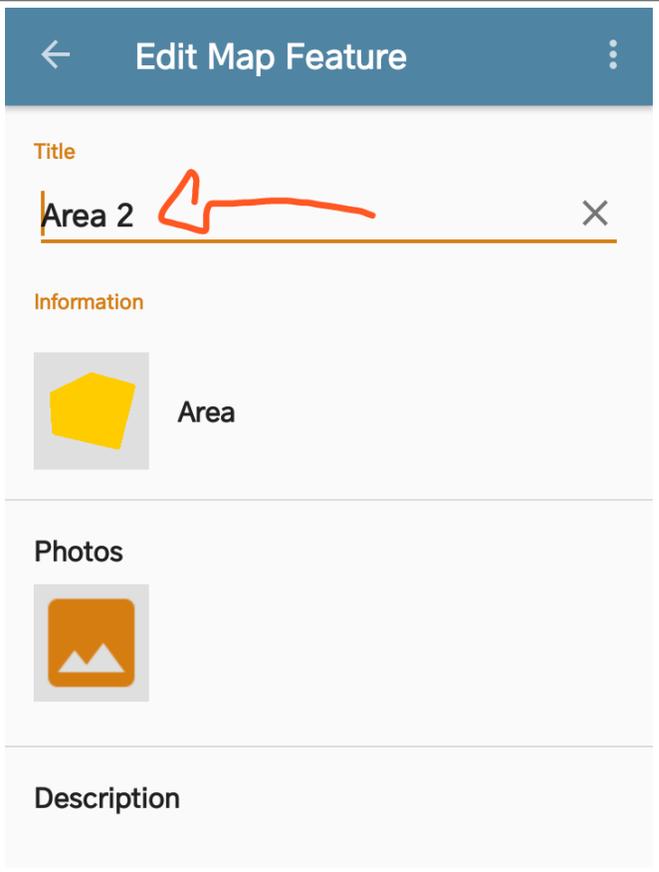


The area will display with a pop-up identifier.

Areas are first assigned generic names, so like with lines, we will need to edit this.

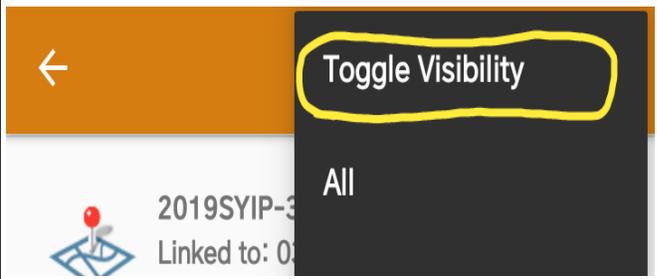
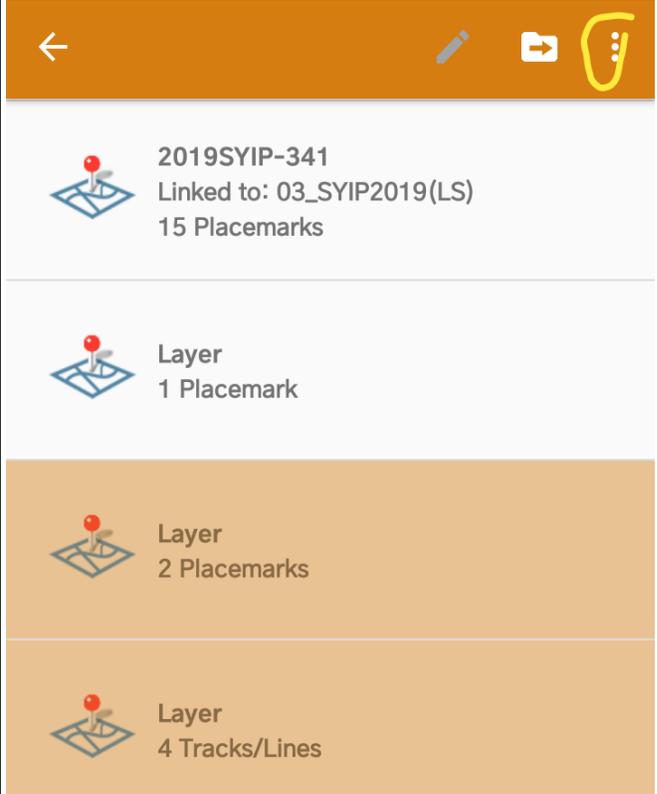
Click the pop-up dialog labeling your area to edit.



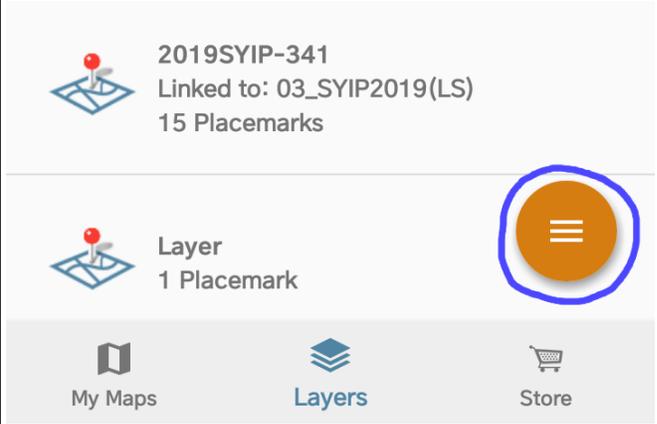
<p>This will bring up a now familiar screen for editing features.</p> <p>Make sure to set a title that clearly defines what kind of area this is.</p> <p>Like with points and lines, you can attach photos from your device's gallery, or take photos from inside the app.</p> <p>Don't forget to write a description.</p> <p>Like lines, polygons can be used to record features of the cultural landscape, or survey coverage, or the extent of an area impacted by erosion or human activity.</p>	
<p>If the area being recorded is a part of of the cultural landscape, it is prudent to fill out all of the relevant attribute fields.</p>	<p>Feature Type Not set</p> <p>Outstanding (S7)? Not set</p> <p>Photo# Not set</p>

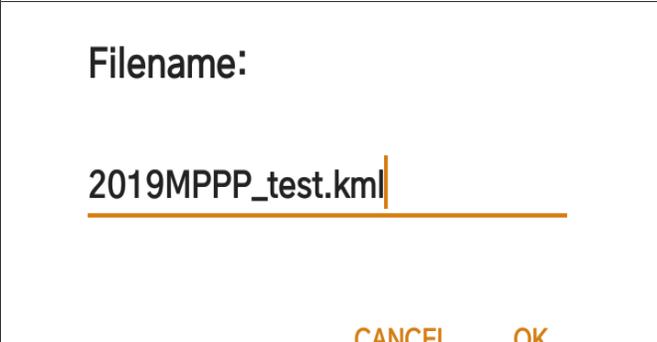
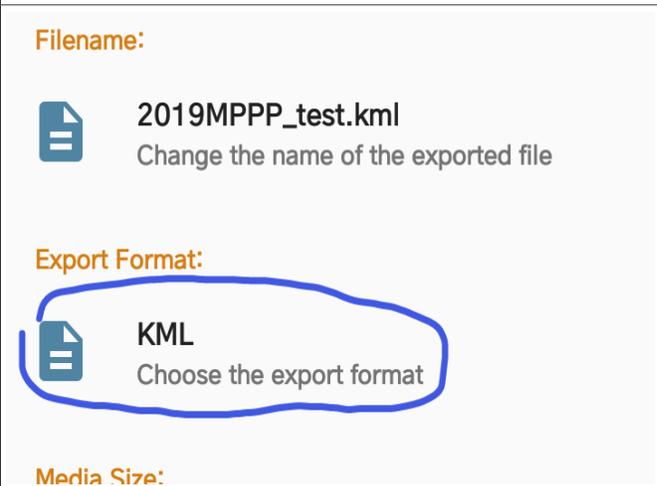
Using Avenza part IV: completing and exporting data

....change visibility...



....export to .kml/.kmz....

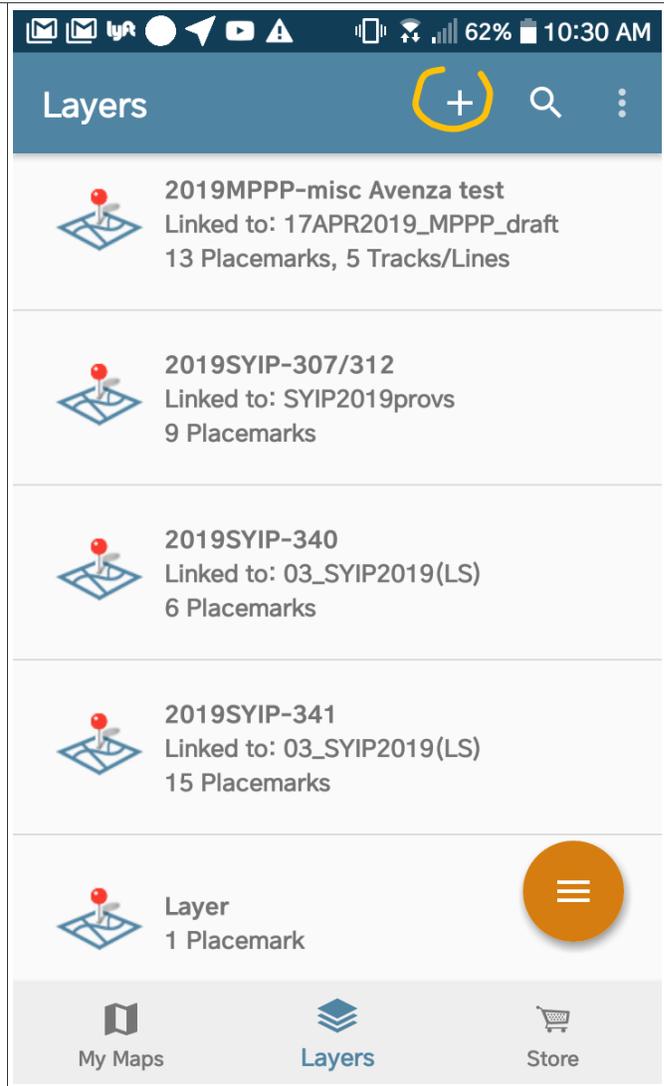


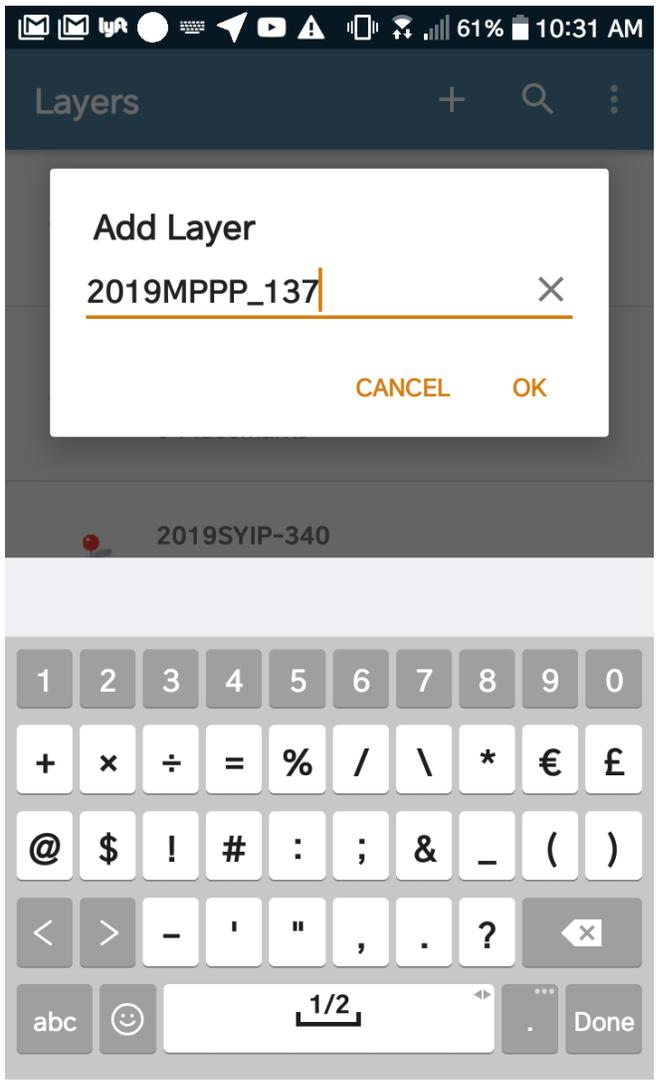
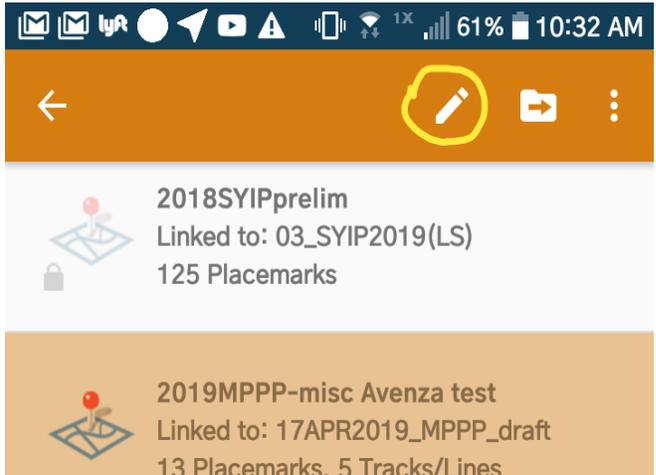
	 <p>Layer 4 Tracks/Lines</p> <p>Export Layers</p> <p>Layer 38 Placemarks</p> <p>Import Layers</p>
	 <p>← Export Layers</p> <p>Filename:</p> <p>All Layers.kml Change the name of the exported file</p> <p>Export Format:</p> <p>KML Choose the export format</p>
	 <p>Filename:</p> <p>2019MPPP_test.kml</p> <p>CANCEL OK</p>
	 <p>Filename:</p> <p>2019MPPP_test.kml Change the name of the exported file</p> <p>Export Format:</p> <p>KML Choose the export format</p> <p>Media Size:</p>

	<p>Export as:</p> <p><input checked="" type="radio"/> KML</p> <p><input type="radio"/> CSV</p> <p><input type="radio"/> GPX</p> <p><input type="radio"/> SHP PRO</p> <p>CANCEL</p>
	<p>Export visible only: <input checked="" type="checkbox"/></p> <hr/> <p> Export Send the file "All Layers.kml" to Email and Storage Locations</p>
	<p> Export Send the file "All Layers.kml" to Email and Storage Locations</p>
	<p>Export</p> <p> Save to Drive  Gmail  Email  WhatsApp</p> <p> Device Storage  Bluetooth</p>

Using Avenza part V: Advanced usage, defining data dictionaries for new layers

....Creating and naming new layer....



	
	
	<p>[INSERT SCREENCAP HERE]</p>

... setting symbology

Placemarks



Set Default Icon

All placemarks on this layer will use the default icon

Tracks and Lines



Set Default Line Style

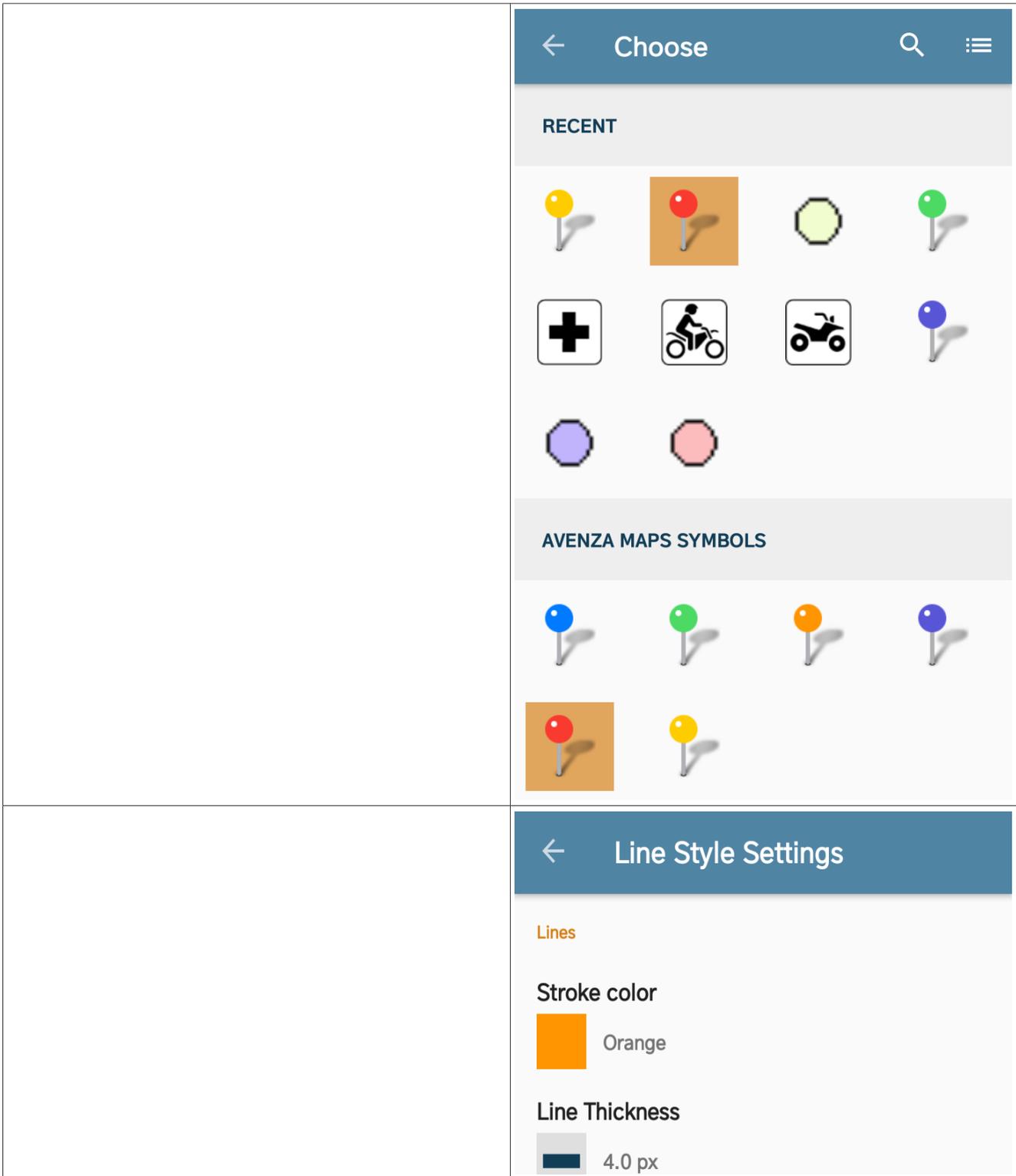
All placemarks on this layer will use the default icon

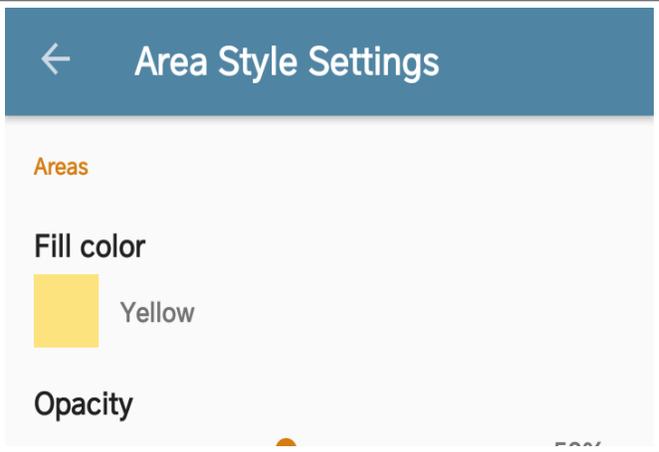
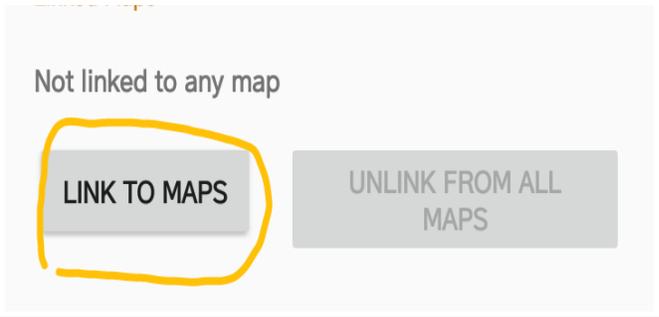
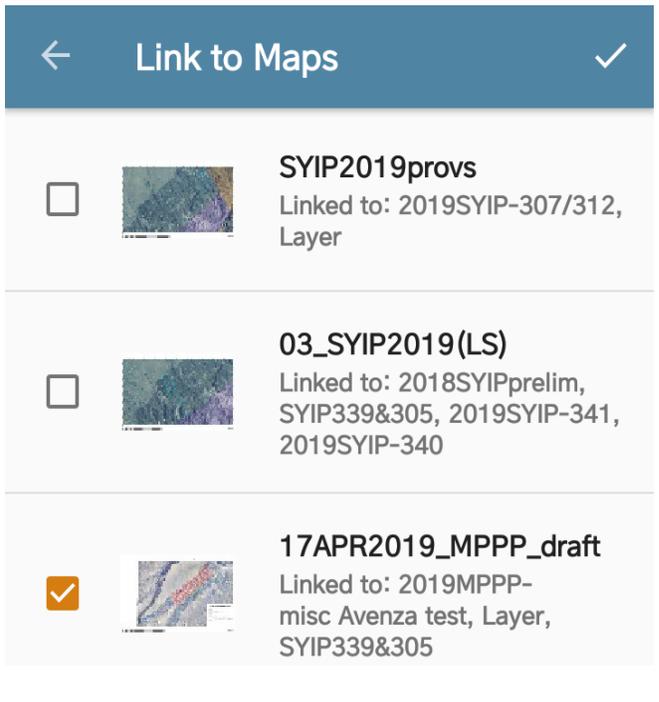
Areas



Set Default Area Style

All placemarks on this layer will use the default icon



	
<p>... linking layer to maps ...</p>	
	

<p>.... Defining attributes...</p>	<p>Attribute schema </p> <p><i>Click the + icon to add a new attribute</i></p>
	<p> Edit Attribute </p> <p>Attribute Name</p> <p><u>New Attribute</u> </p> <p>Attribute Type</p> <p>String Tap to set type</p> <p>Pick List </p> <p><i>Click the + icon to add a new pick list value</i></p>
	<p>Enter Attribute Type</p> <p>String</p> <p>Boolean</p> <p>Real</p> <p>Integer</p>

	<p>Attribute Name</p> <p><u>Outstanding Panel (S7)?</u> ✕</p> <p>Attribute type</p> <p>Boolean Tap to set type</p>
	<p>Attribute Name</p> <p><u>Feature Type</u> ✕</p> <p>Attribute type</p> <p>String Tap to set type</p> <p>Pick List +</p> <p>Artifact</p> <hr/> <p>Constr. Feature</p> <hr/> <p>Other</p> <hr/> <p>Petroglyph Panel</p>
	<p>← Feature Type 🗑️</p> <p>Edit pick list value</p> <p><u>Enter a pick list value</u> ✕</p>

