

# Introduction to QGIS for grapegrowers

Russell Moss

2/26/2019



## Contents

<b>1. Introduction</b> .....	2
2. Getting started .....	2
2.1 Set up snapping.....	2
2.2 Download plugins.....	3
3. Making your vineyard map .....	4
3.1 Set your CRS .....	4
3.2 Go to the area of interest (AOI) .....	5
3.3 Draw the boundaries .....	9
3.4 Insert your blocks.....	12
3.5 Adding color to your map .....	14
3.6 Adding block labels .....	18
3.6.1 Creating “callout” labels .....	21
3.7 Importing vineyard information from Excel.....	24
3.8 Composing the map .....	25
4. Using Avenza Maps .....	29
4.1 Measuring area in Avenza Maps.....	32

# 1. Introduction

Quantum GIS (QGIS) is a free and open source geographic information system software. The main proprietary GIS software on the market is ArcGIS. However, QGIS is rapidly becoming the GIS software of choice for many farmers because it doesn't require a license. The cheapest ArcGIS license is ~\$800/year.

This document is meant to guide you through some of the useful functions of QGIS. While this tutorial will mainly focus on creating vineyard maps, there are many more things that you can do with GIS software. After completing this tutorial, you should have a solid foundation of GIS knowledge from which to further explore the world of geographic information.

## 2. Getting started

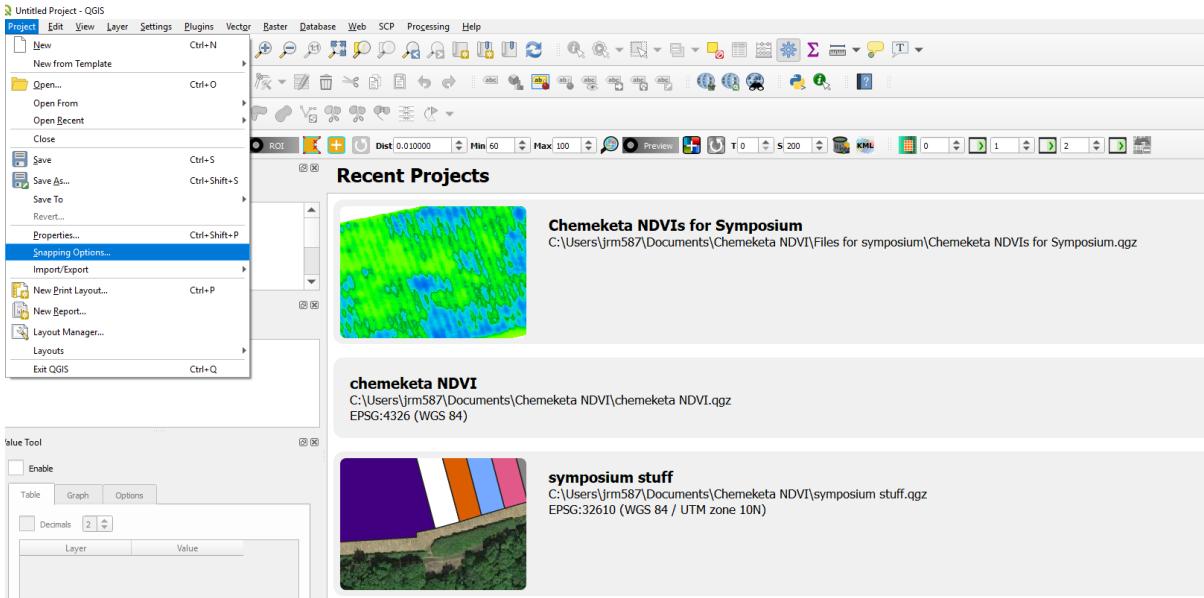
[Start by downloading QGIS \(this is a link\)](#). You can choose between the newest version (3.6 at the time of writing), but this may be a little buggy. QGIS gives you the option of downloading a later version which will be the most stable (3.4 at the time of writing). Either option is fine. Some plugins will only work with specific older versions of QGIS. For the case of this tutorial, version 3.4 and 3.6 will be fine.

Once you have downloaded and installed QGIS, you are going to want to set it up so that you can start creating your vineyard map. The first thing you'll want to do is set up "snapping".

### 2.1 Set up snapping

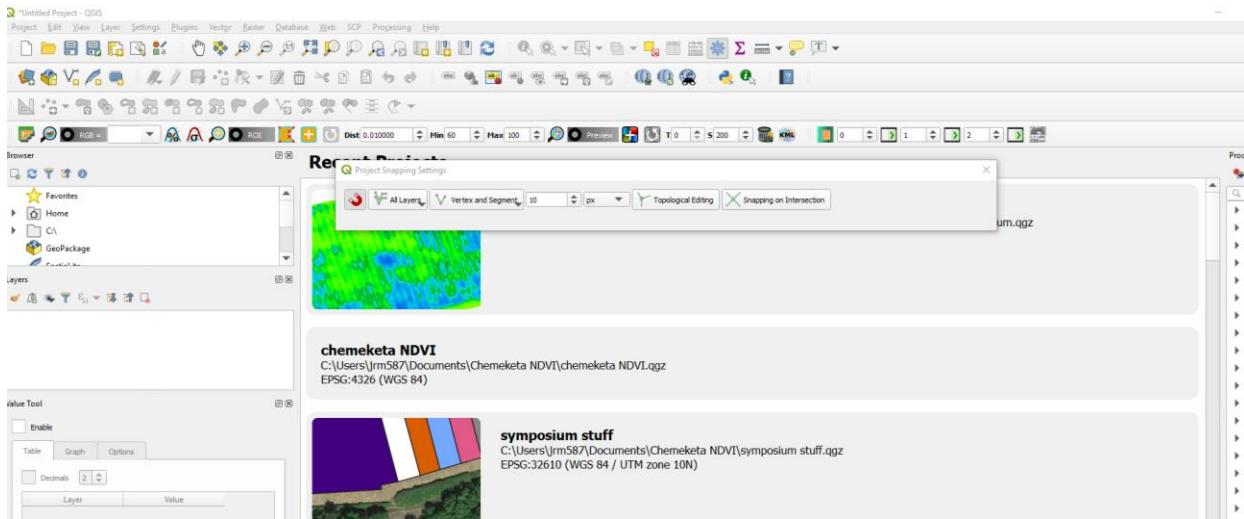
Snapping is a really useful tool when creating maps because your cursor will just snap to existing lines and vertices. This way, you don't have to match up lines yourself.

To set up snapping, go to Project→Snapping Options



In the Snapping Options properties, you will see a magnet icon. Click on that (this turns snapping on). You will then have a few options to choose from. I would set up snapping on "all layers" for this exercise because we want our blocks to line up. I would also choose snapping for "vertex and segment" because you want your lines and your vertices to line

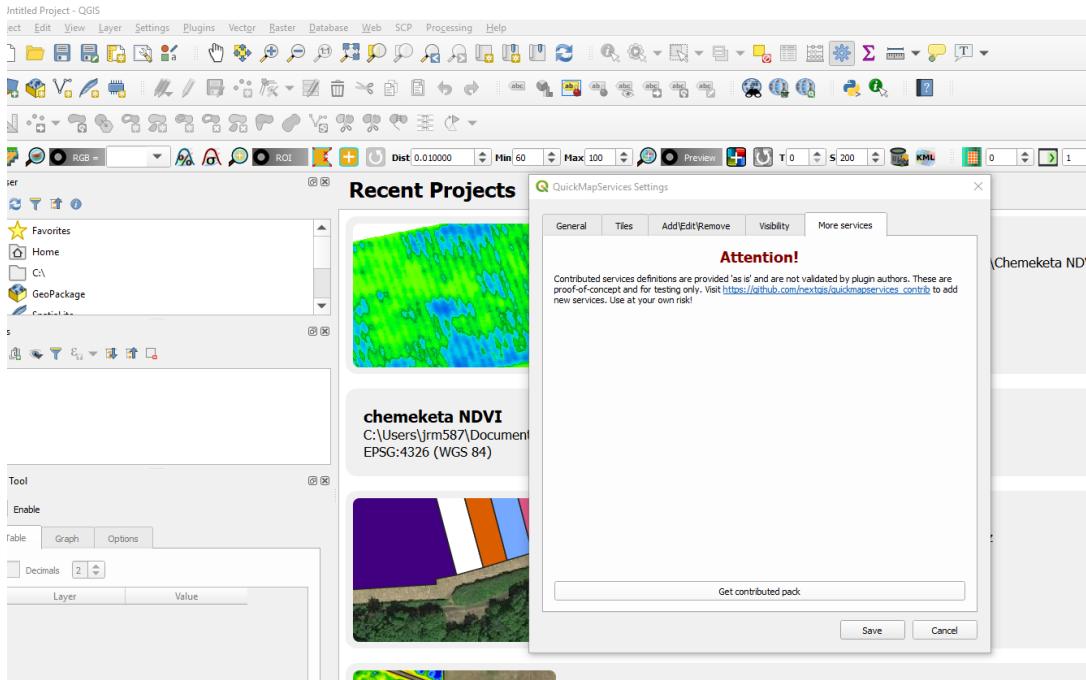
up when you are making a vineyard map. You can choose how far away from a vertex or segment that you need to be before snapping comes into play. You can do this based upon pixels or meters. I normally set it at 10 pixels (10 px) when I'm making vineyard maps, but this is just personal preference.



## 2.2 Download plugins

There are some useful plugins for grapegrowers. The most useful plugin is the Quick Map Services plugin that will provide you with base maps (like Google Earth). To install this plugin go to Plugins→Manage and Install Plugins and search for “QuickMapServices”. Install this plugin.

Once you have installed QuickMap, you may need to download all of the possible base map sources. To do this, you go to the “settings” menu within the QuickMap plugin and you go to the “More Services” tab. In there, you will click on “get contributed pack”. This will download a bunch of base map sources, including Google Earth.



You may also want to download a plugin that will allow you to search for addresses in QGIS, just as you would in Google Earth. For this, you will want to get the GeoCoding plugin. You will search for it and install it the same way that you did

for the QuickMap Services plugin earlier.

Once you have installed the plugins, you can test it out by starting a new project and going into the “Web” menu of QGIS and then going to “QuickMap Services” and you’ll see a dropdown menu of all the possible base maps you can pull into QGIS. Go ahead and go to “Google” and then open the “Google Satellite” map. You should now see a world map on your workspace.

Now go to the Plugins menu and click on “GeoCoding”. Go ahead and enter the Cornell Plant Science building address and see if it gets it right. The address is:

236 Tower Rd. Ithaca, NY 14853

NOTE: this plugin isn’t perfect, but it will get you close to the point that you need so that you can start mapping easily from QGIS.

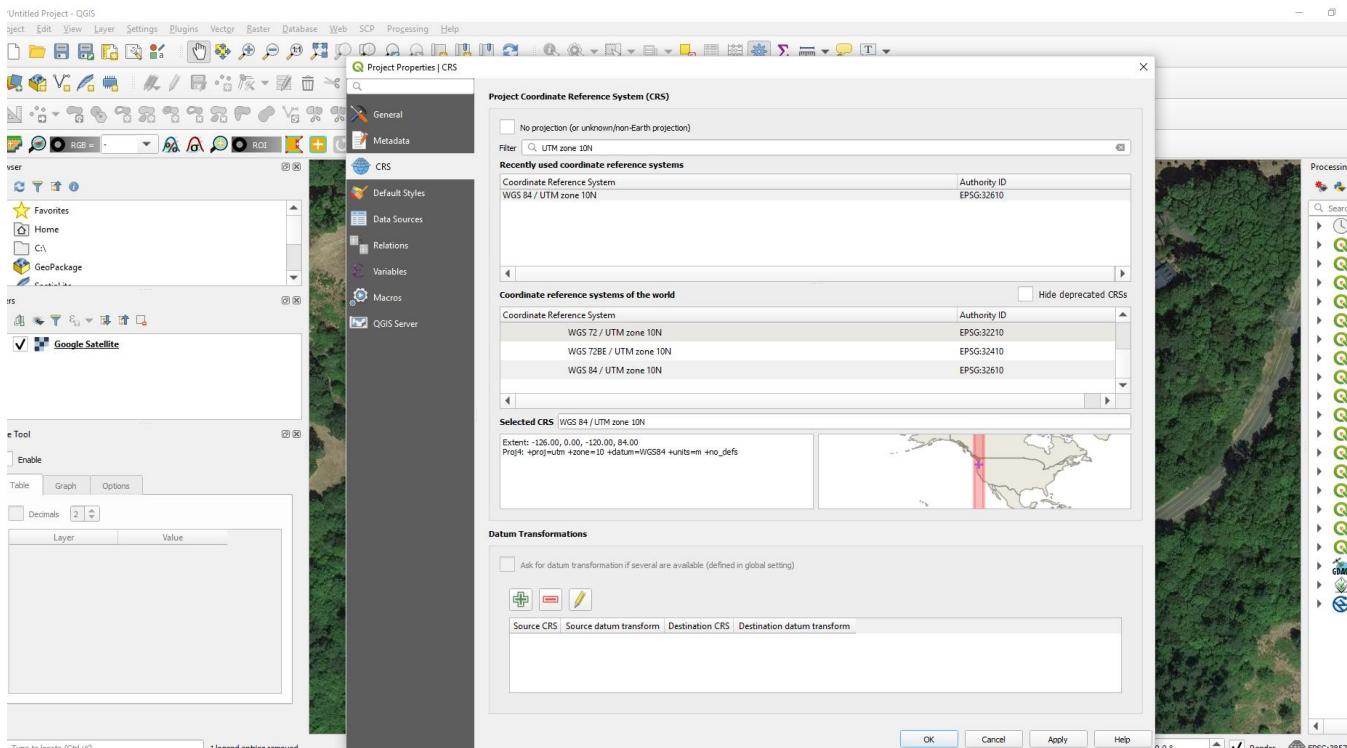
### 3. Making your vineyard map

You’ll want to start a new project by clicking on the blank paper icon or by going to project→New or by hitting “ctl+N”.

#### 3.1 Set your CRS

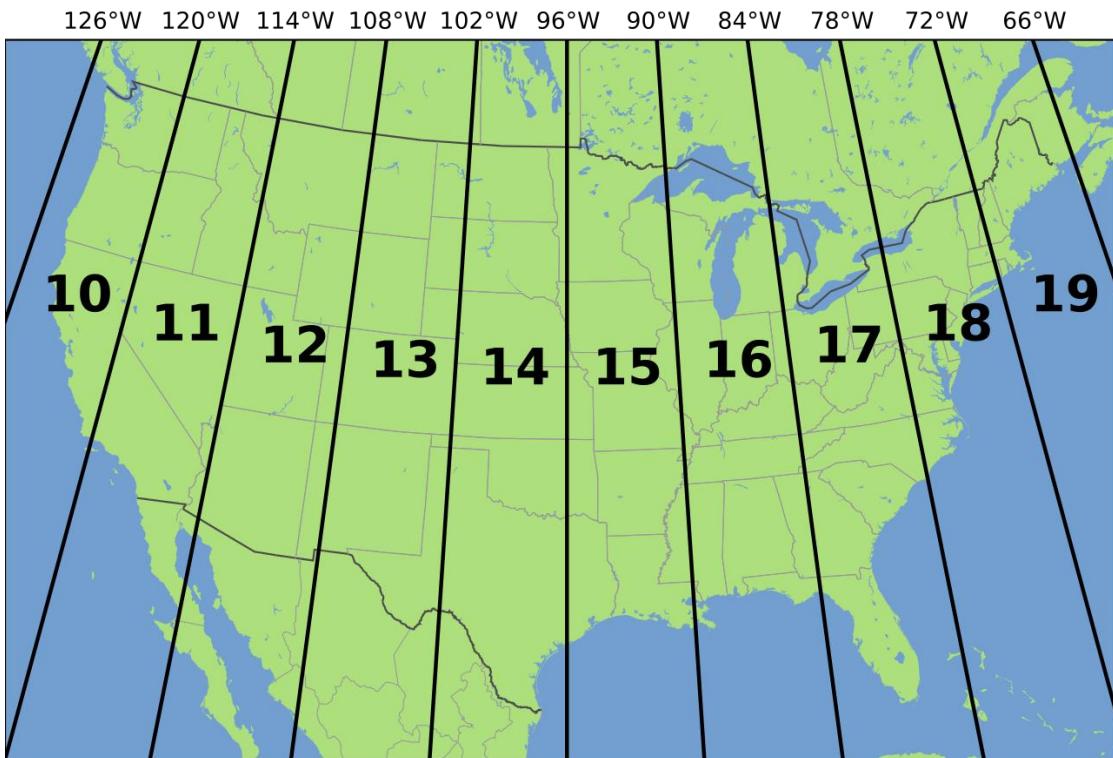
You may want to specify what Coordinate Reference System (CRS) that you are going to use at this point. A CRS defines a specific map projection. Some CRS’s are good for large areas and some are better on smaller areas. QGIS’s default CRS is WGS84. This is a latitude and longitude based CRS that is good for the whole world. There are specific projections that are better used in smaller areas. For this tutorial, I am going to use a UTM (Universal Trans Mercator) projection, but there are even more accurate projections for smaller local areas if you use NAD83 projections.

For this tutorial, we are going to map using a QGS 84/UTM zone 10N projection. You do this by going to Project→Properties→ CRS. Search for “UTM zone 10N”. Click on WGS 84/UTM Zone 10N. QGIS highlights the area that is covered by this projection. You will notice that it covers all the major grapegrowing areas of the West Coast. Once you have selected UTM zone 10N, click “apply” and then “ok”.



Since we are going to be mapping a vineyard in Salem, OR, we may choose to use something like NAD83/Oregon North (ft). This would be a good choice for us because all of the measurements will be in feet and we won't have to convert from meters (we are going to have to make this conversion when we calculate acres from the UTM projection).

If you are mapping in New York, Pennsylvania or Virginia, UTM zones 18 or 17N will be what you will want to use (or a more localized NAD83 projection). The map below will show you where different regions of the US fall within UTM zones.

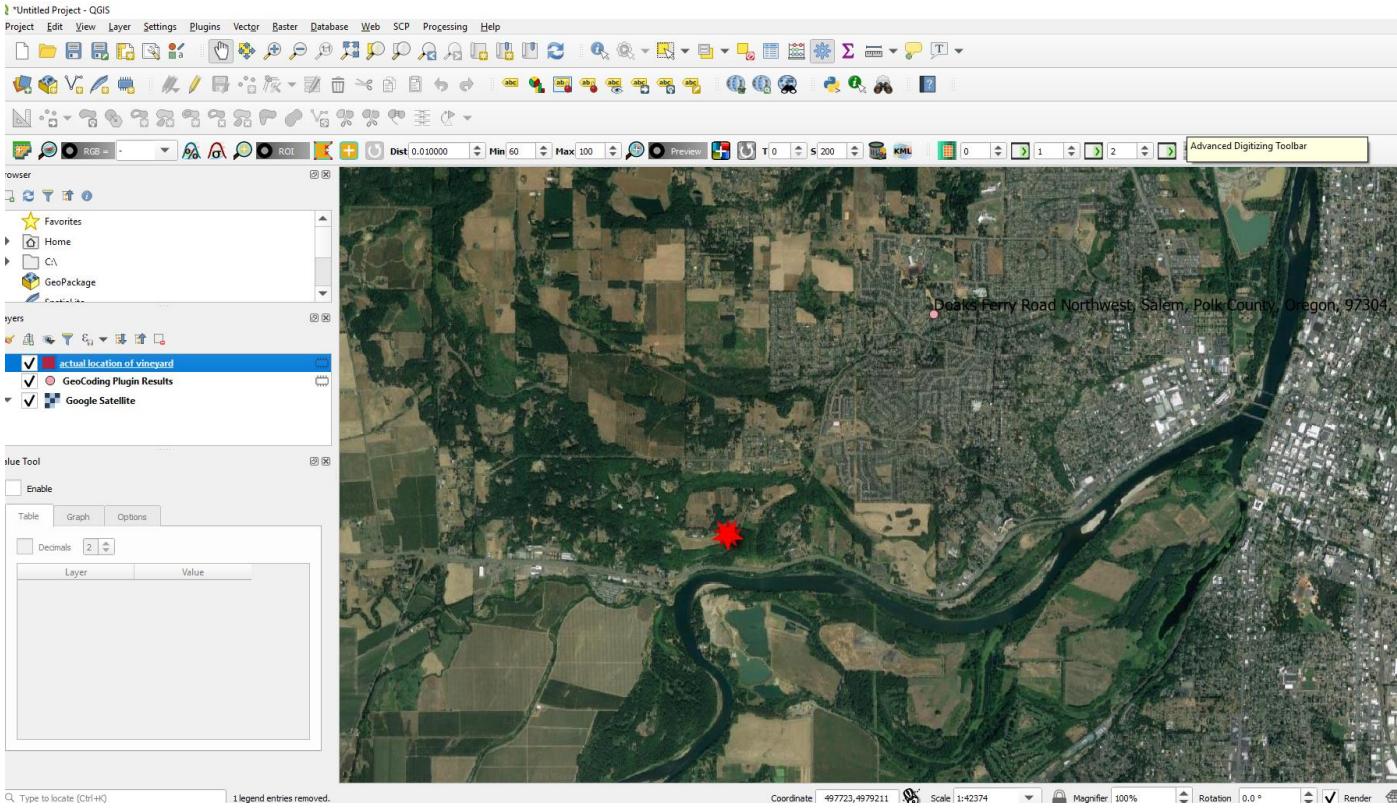


### 3.2 Go to the area of interest (AOI)

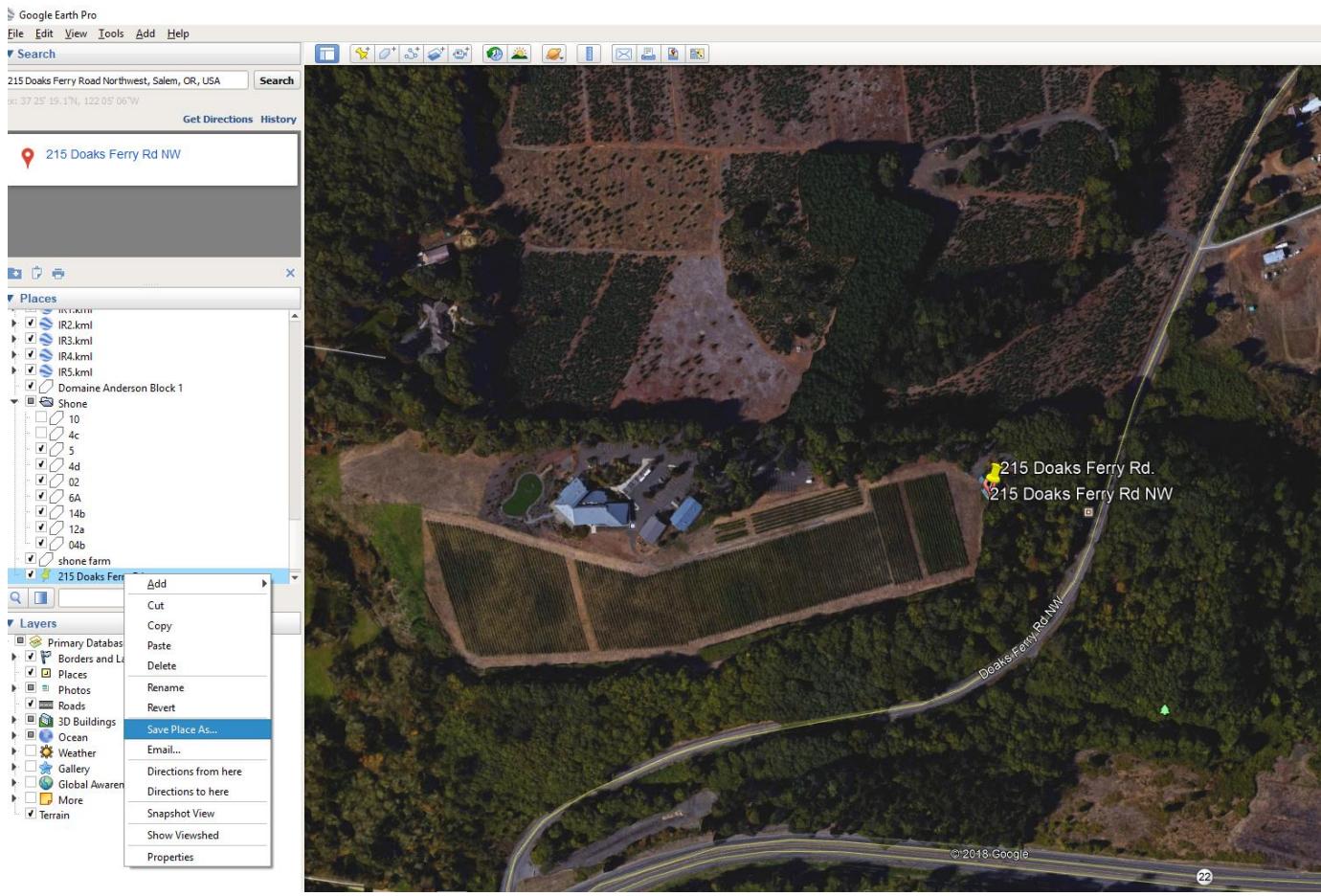
There are a few ways to find your AOI. We could use the GeoCoding plugin. For this tutorial, we are going to find the Chemeketa Community College Vineyard in Salem, OR. The address for the college is:

215 Doaks Ferry Rd NW, Salem, OR 97304

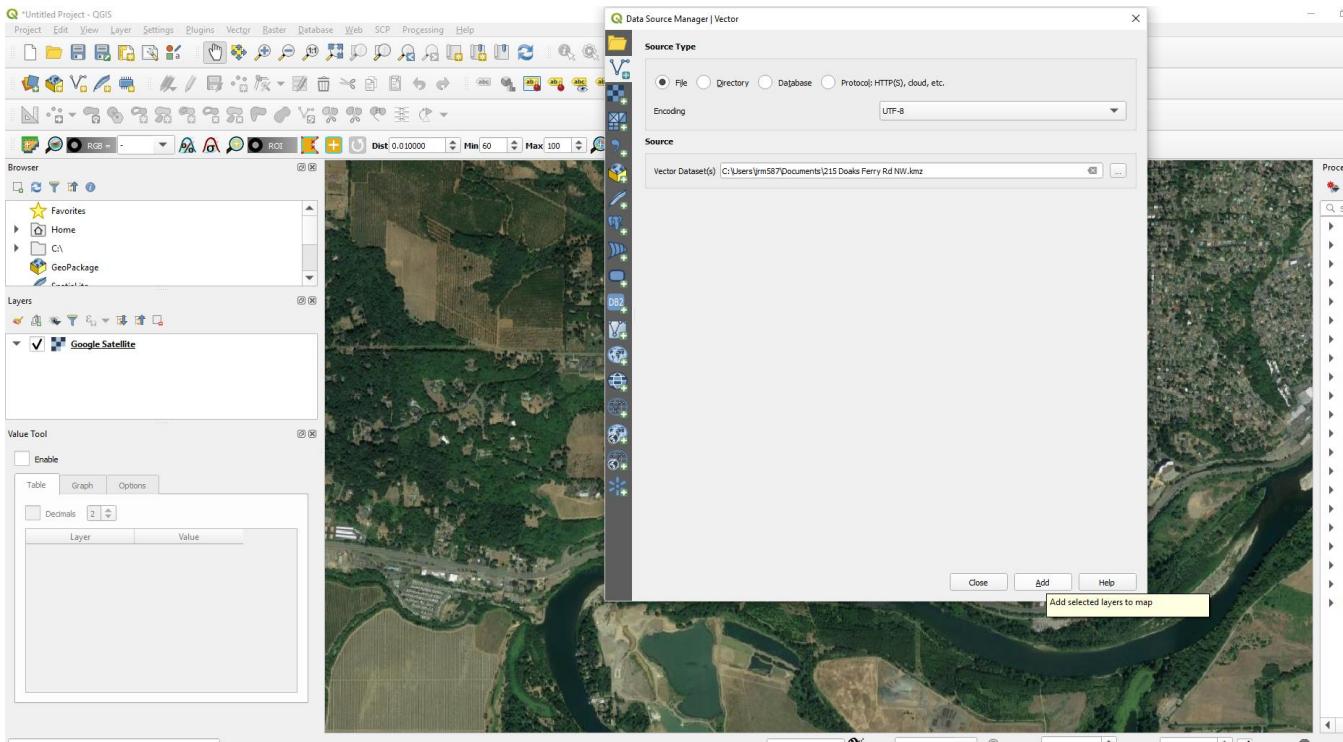
We could search for that address verbatim in the Geocoding plugin. It will ask us to specify from one of two possibilities. Just choose one and then you will need to find the vineyard. In the photo below, you will see where the GeoCoding plugin has taken us and the large red star is where the vineyard actually is:



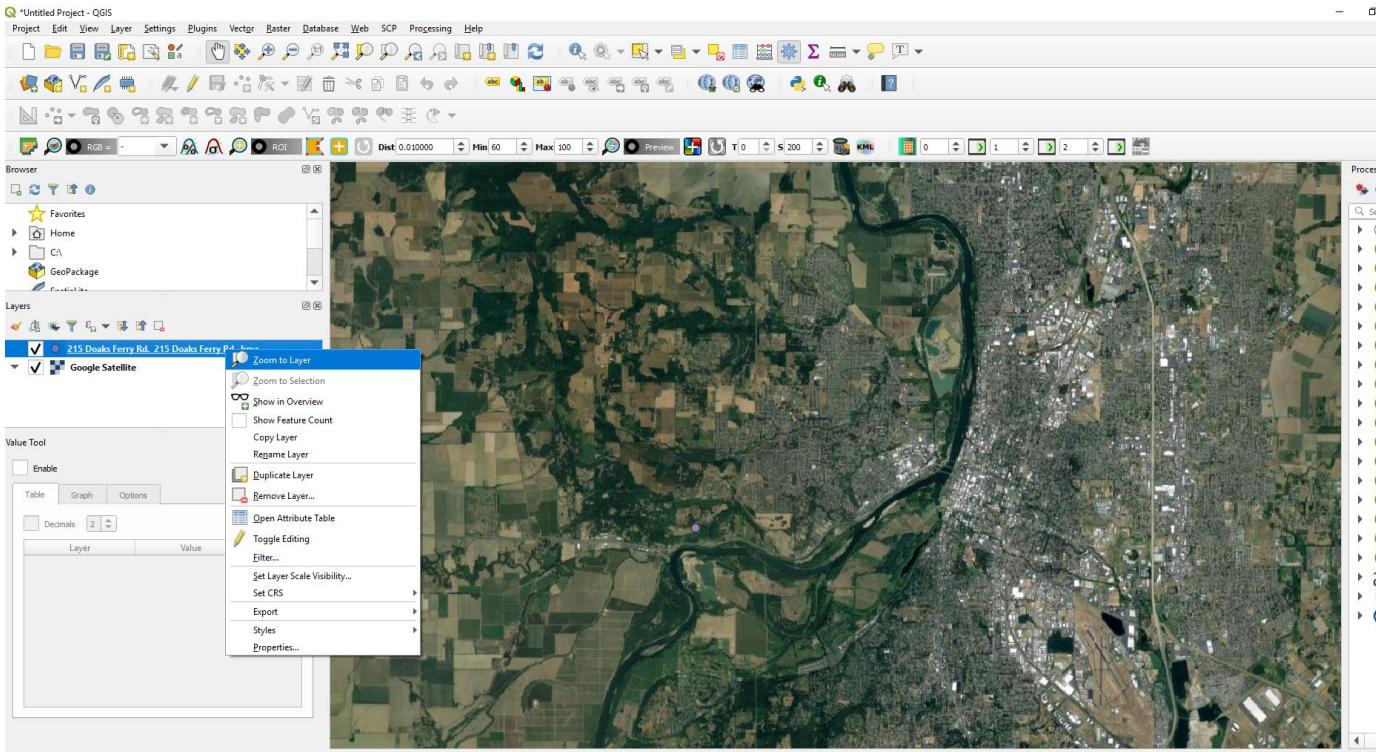
Another way to find your AOI is to start in Google Earth Pro. You will want to download this free software to your computer. In Google Earth Pro you can search for the address or the coordinates of whatever location you are trying to map. In this case, I searched the address of the vineyard (215 Doaks Ferry Rd). Now that you are at the vineyard in Google Earth, you'll want to drop a pin on the location. Do this by clicking on the yellow pin icon. It should drop a pin right on the vineyard, if not, you can drag it to where it should be. Now write a name for the pin. I chose "215 Doaks Ferry Rd" and click "ok". Now find your pin in your "places" drop down menu. Right click on the pin and select "save place as". Save the pin as a .kmz or .kml file (either is fine).



Now, go back to QGIS and open a “vector file” by going to layer→add layer → add vector layer. Where it says “source” click on the three dots and fine your .kmz or .kml file that has the address location. Add this file location and click “add” to add the point on your map.



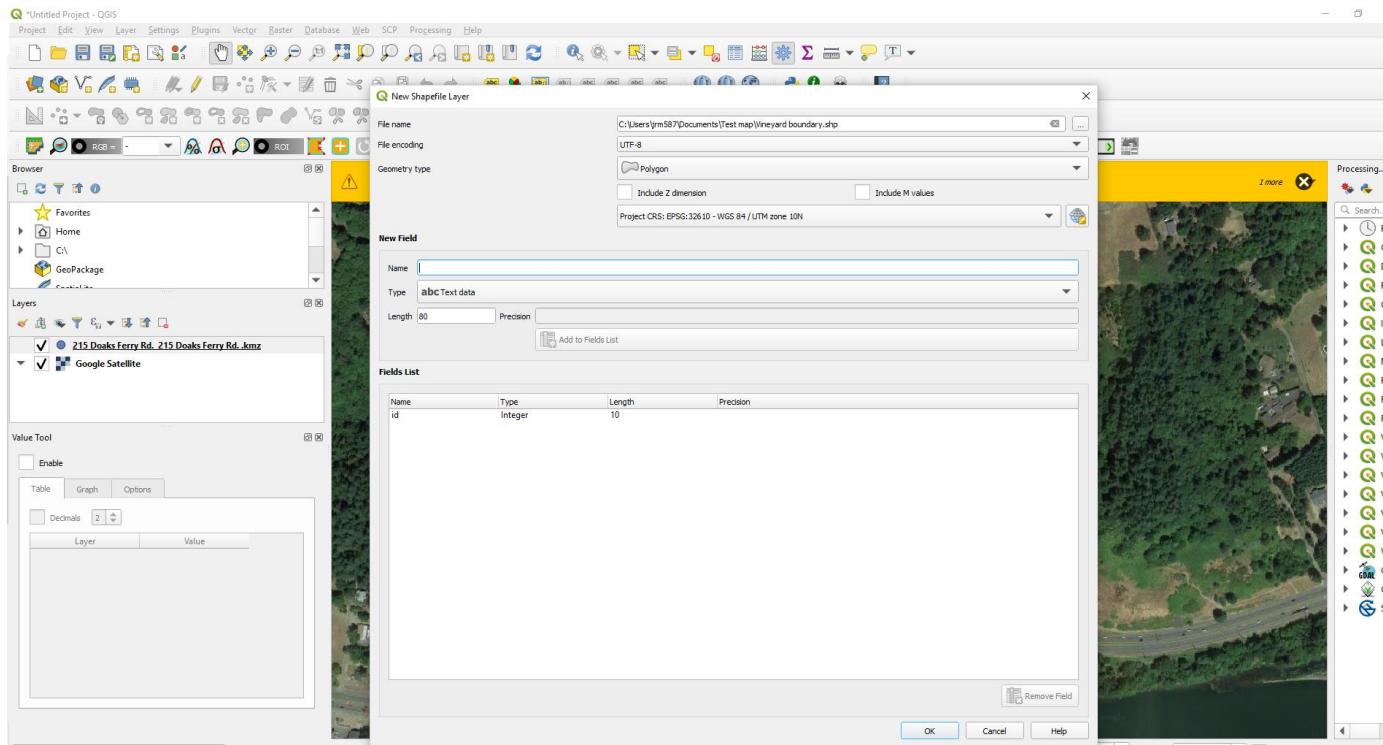
It will now drop the point of your AOI on the map. If you need to zoom to the location, simply right click on the vector layer in the Layers panel and click “zoom to layer”.



### 3.3 Draw the boundaries

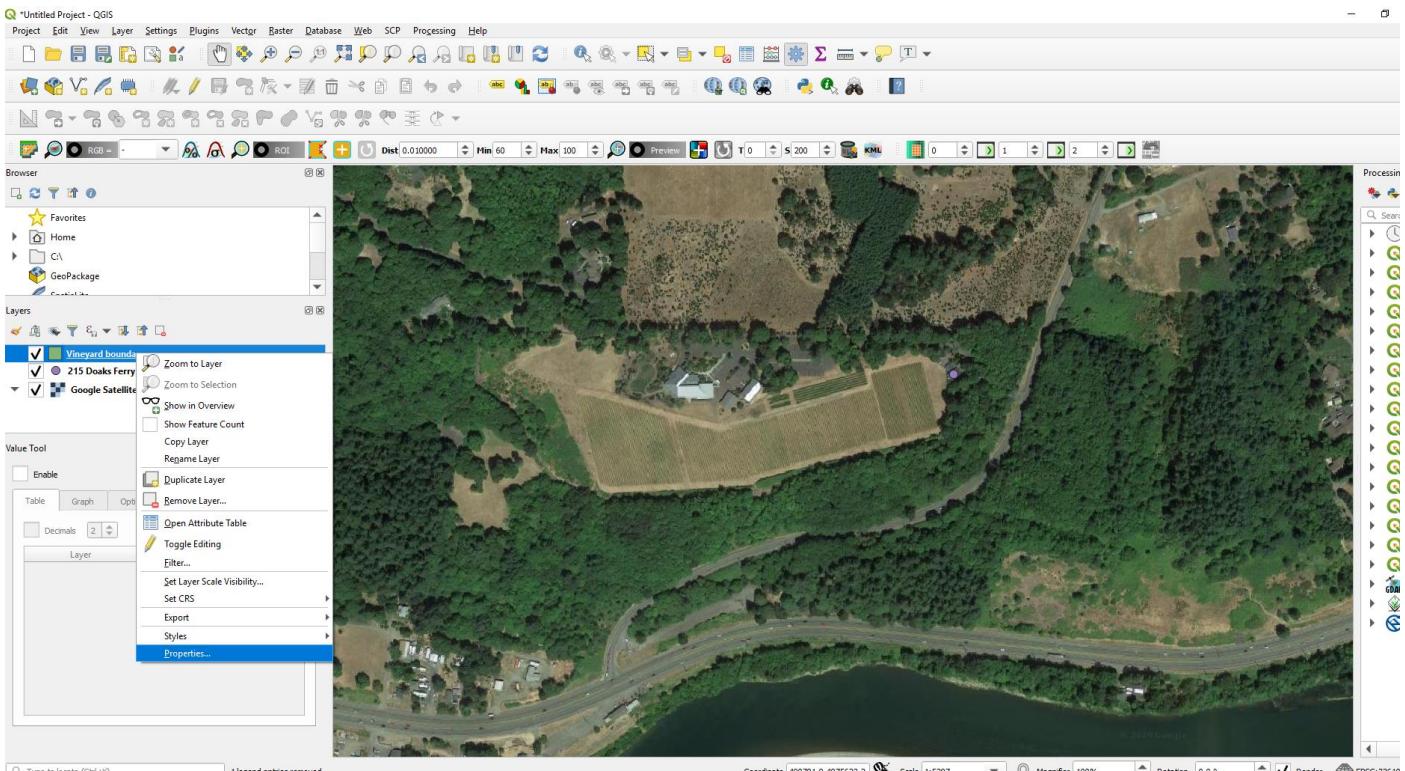
I like to start mapping by drawing the boundaries of the planted area first. This will give the cursor something to snap to when you start filling in the rest of the blocks and will ensure that lines are straight. You can create polygons in QGIS by clicking the “new shapefile layer” icon 

Upon clicking the “new shapefile layer” icon, you will have to specify a file name and where you would like to save it. I created a file called “test map” and will be saving everything for this exercise in that file. I will name this shapefile “vineyard boundary”. You will also need to specify what kind of shape you will be creating. In this case, we will be making polygons around the vineyard, so we select “polygon”. You will also need to select the CRS. Use the project CRS (UTM zone 10). Click “ok” to create the file.

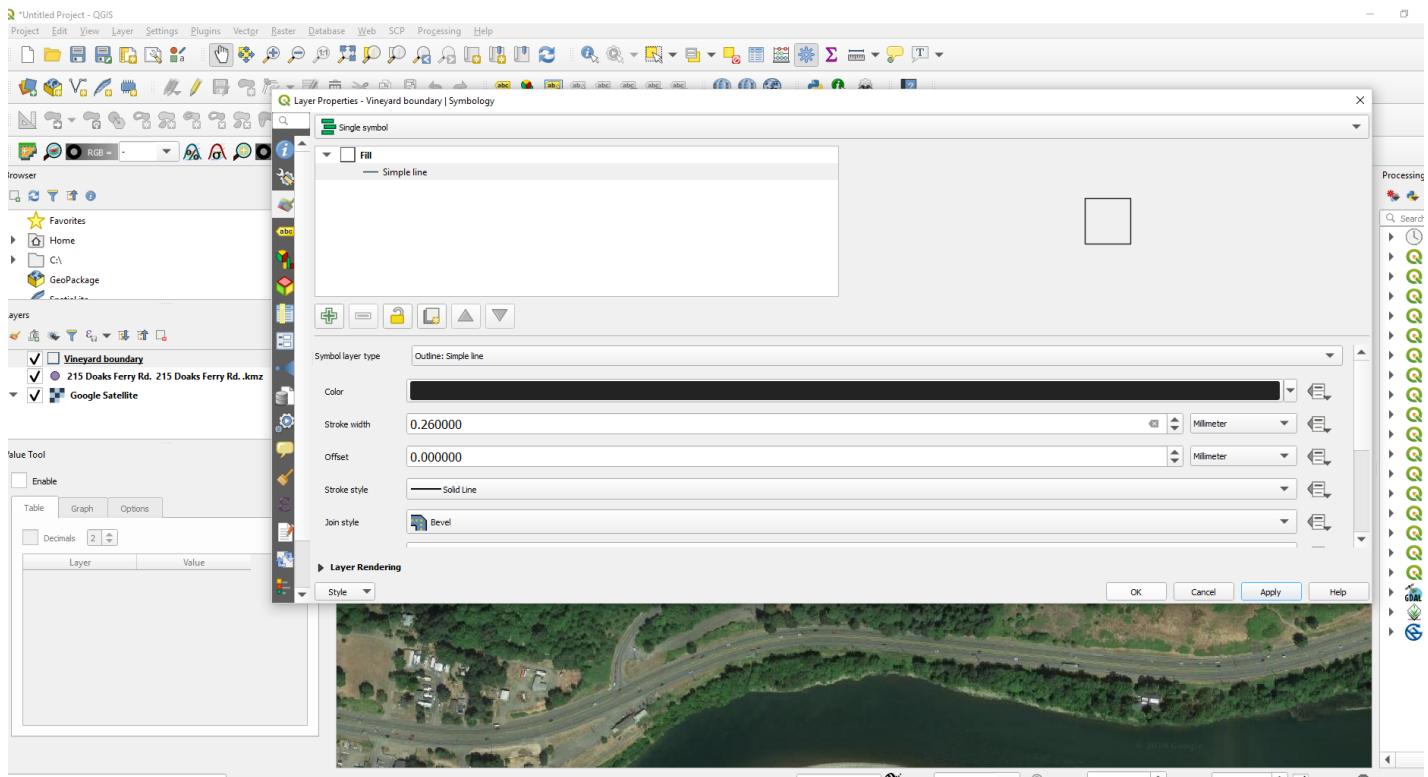


Now you should see the “vineyard boundary” layer load into the layers panel on the left hand side of the screen.

We are going to want to change the style of this layer so that we can see through the middle of it, so we just want the polygon to have a simple line outline. We do this by right clicking on the “Vineyard boundary” layer in the layer panel and clicking on “properties”.

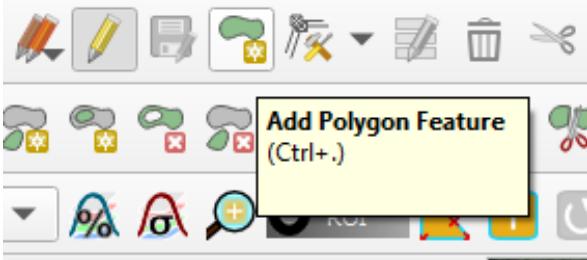


In the layer properties screen, find the paint brush looking icon (symbology) and click on it. At the top of the screen, it will say “fill” and below that it will say “simple fill”. Left click on “simple fill”. Now go down the screen to where it says “symbol layer type” and find/select “outline: simple line.” Click “apply” and “ok” to make this change.

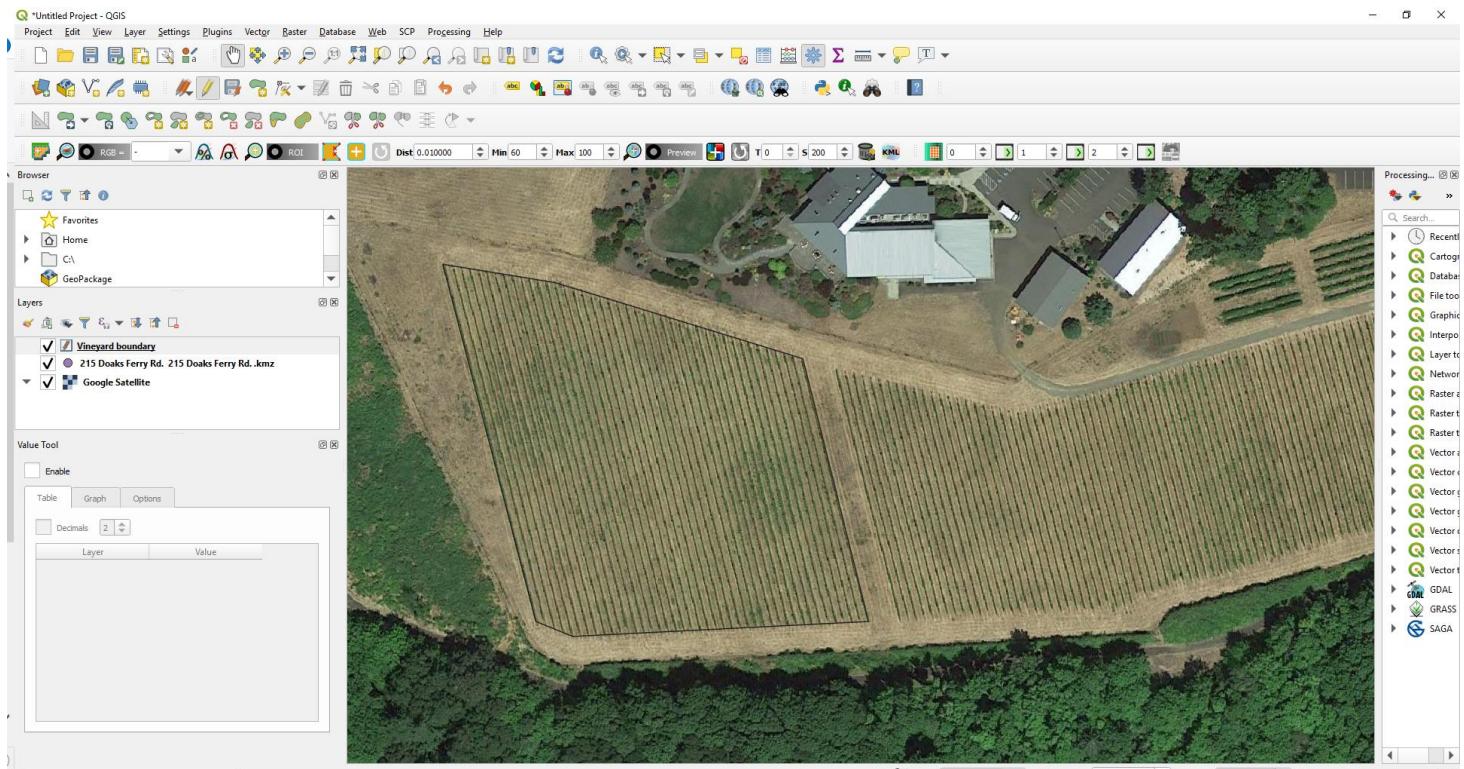


Now you are ready to start making the boundary polygons. Left click on the “vineyard boundary” layer in the layer panel on the left hand of the screen. You should see a pencil icon in the digitizing toolbar at the top of the screen. If you don’t see it, right click on the toolbars at the top of the screen. You will see a checklist of panels and toolbars appear. In this checklist, go to toolbars and make sure the “digitizing toolbar” is checked. Once it is checked, you should see the pencil.

Now click on this pencil and you can edit the layer you have selected. Now select the green blob looking icon that is the “add polygon feature”.



Now a reticle will appear. This is the tool that you will use to start dropping vertices for your polygon. Zoom in on a corner of a block and drop your first point by left clicking on an end assembly. Move around the block dropping vertices every time there is a change in direction in the block boundary. When you have finished dropping points for your polygon, right click and click ok on the next screen that pops up.



You can continue to add polygons to the same layer. Just click on the layer and click the pencil icon and click the “add polygon feature” icon again and continue to add polygons within this single layer. You can have several discontinuous polygons within one layer.

### 3.4 Insert your blocks

Now that you have created the vineyard boundary polygons, it's time to start inserting the blocks. If you don't have a lot of rows, you can easily create blocks simply by counting the rows and making polygons around each block. For the Chemeketa Vineyard we can easily do that. However, if we have blocks that have >40 rows that process becomes pretty tedious. To quickly figure out where blocks start and stop, we just need to know how many rows there are in the block and the row spacing. Let's look at Chemeketa Block 5. We know that this block has 35 rows and the rows are spaced apart by 8ft. So we use the following formula to figure out how far it is from the first row to the last row:

$$\text{Distance from first row to last row} = (\text{number of rows} - 1) \times \text{row spacing}$$

So in the case of block 5, it's going to be 272 feet from the first row until the end of the block.

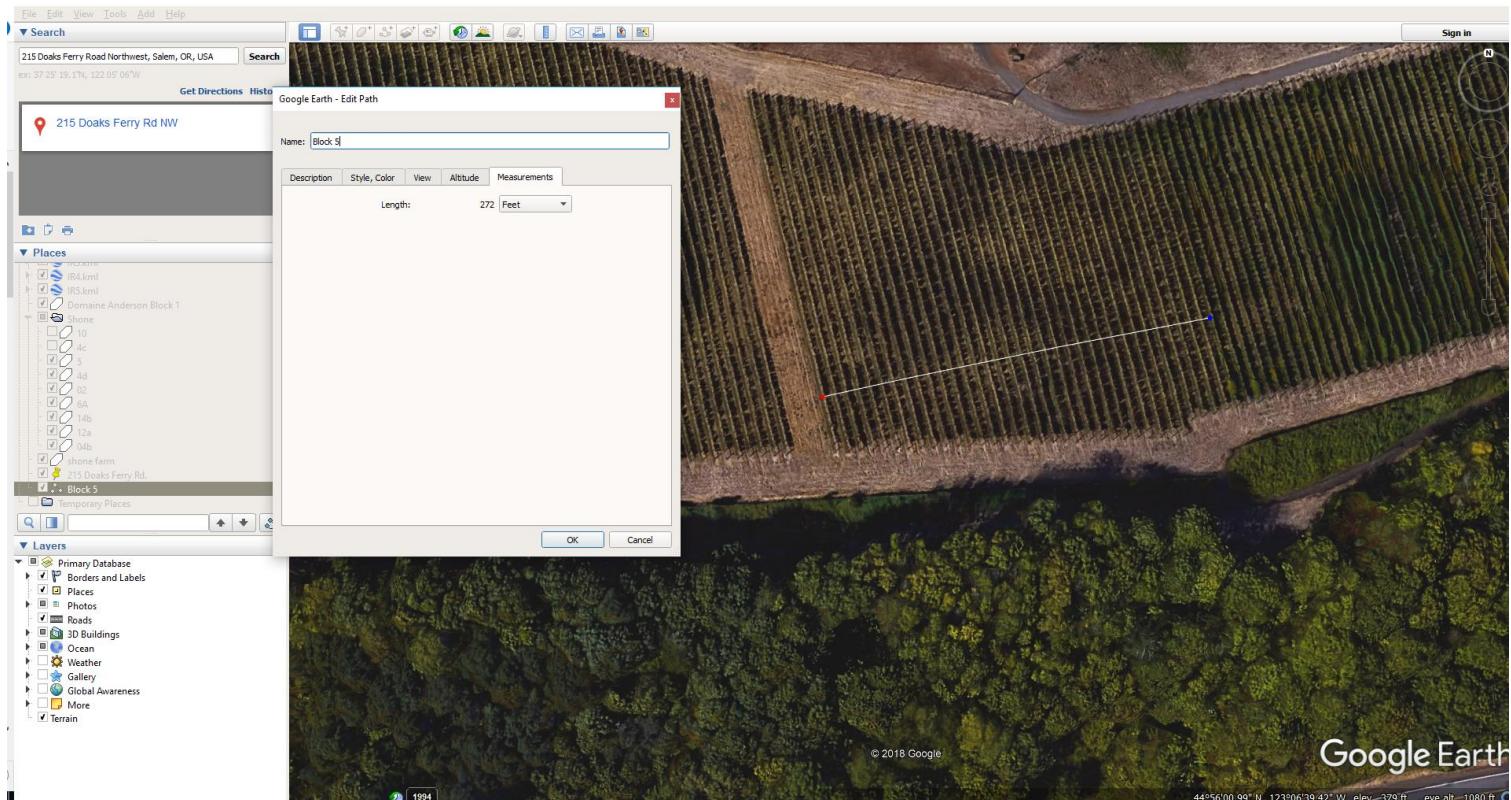
Now that we know the distance from the first row of the block to the last, we can go to Google Earth Pro and draw a line that has that length to figure out where the block ends.

NOTE: you can also do this using the Advanced Digitizing Toolbar in QGIS, but at the time of writing, QGIS was crashing when I tried to use this tool.

Open Google earth. Go to the vineyard. Find the first row of block 5. Hit the "add path" icon



Give your path a title that you will recognize. I will call it "block 5". Click on the "measurements" tab and choose "feet". Keep this box open. Now move the reticle to the first row of block 5 and left click. Move your cursor into the block (anywhere) and left click again, forming a line. Now click on this point and drag it across the rows until you reach 272 feet.

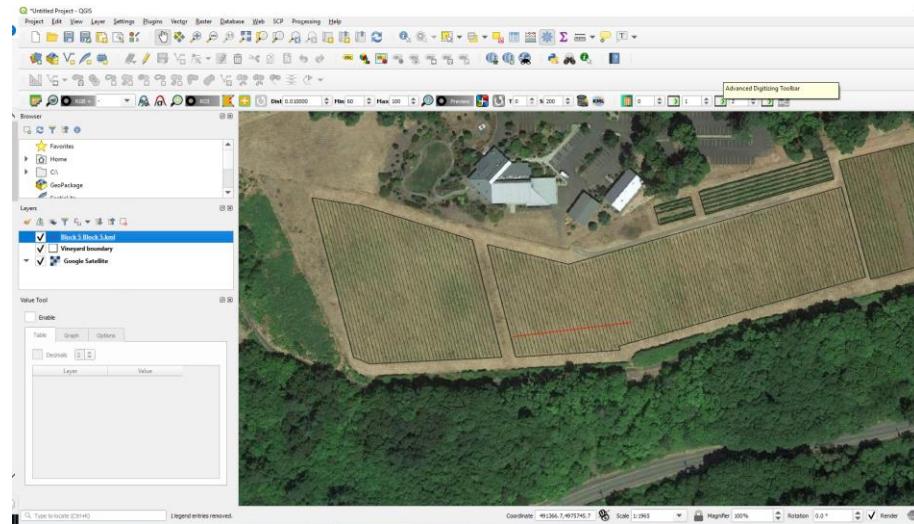


Note: You are going to want to eyeball this line and make sure that it's making ~90° angles as it goes through the rows.

Once you have created the line, click "ok" on the box and it will be saved in your places. Now save this line as a .kml file as you did earlier (right click on the place → save as → save as .kml).

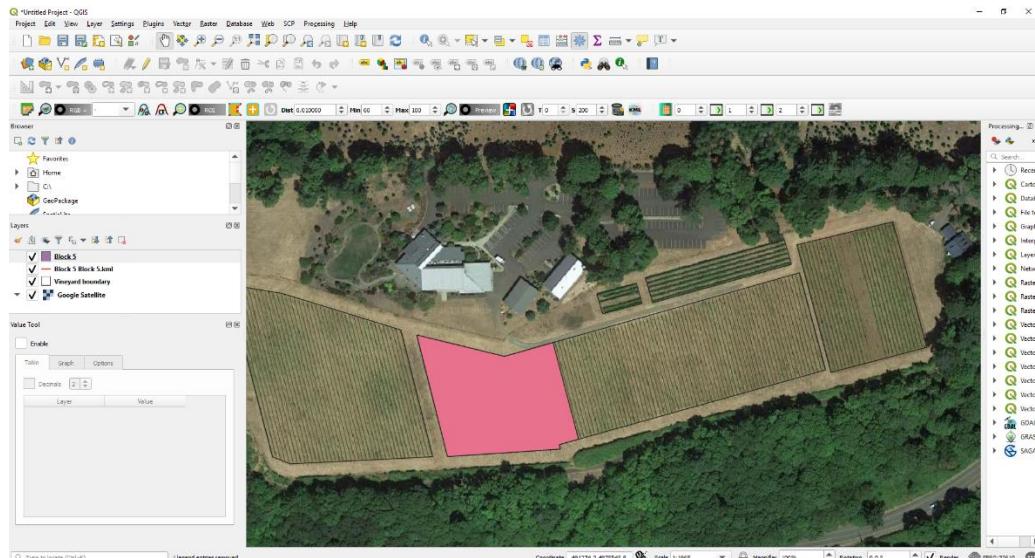
Now open the line that you just drew in QGIS. Do this by going to layers → add layer → add vector layer and find the .kml file and add it.

Now you will see the line overlaying the vineyard.



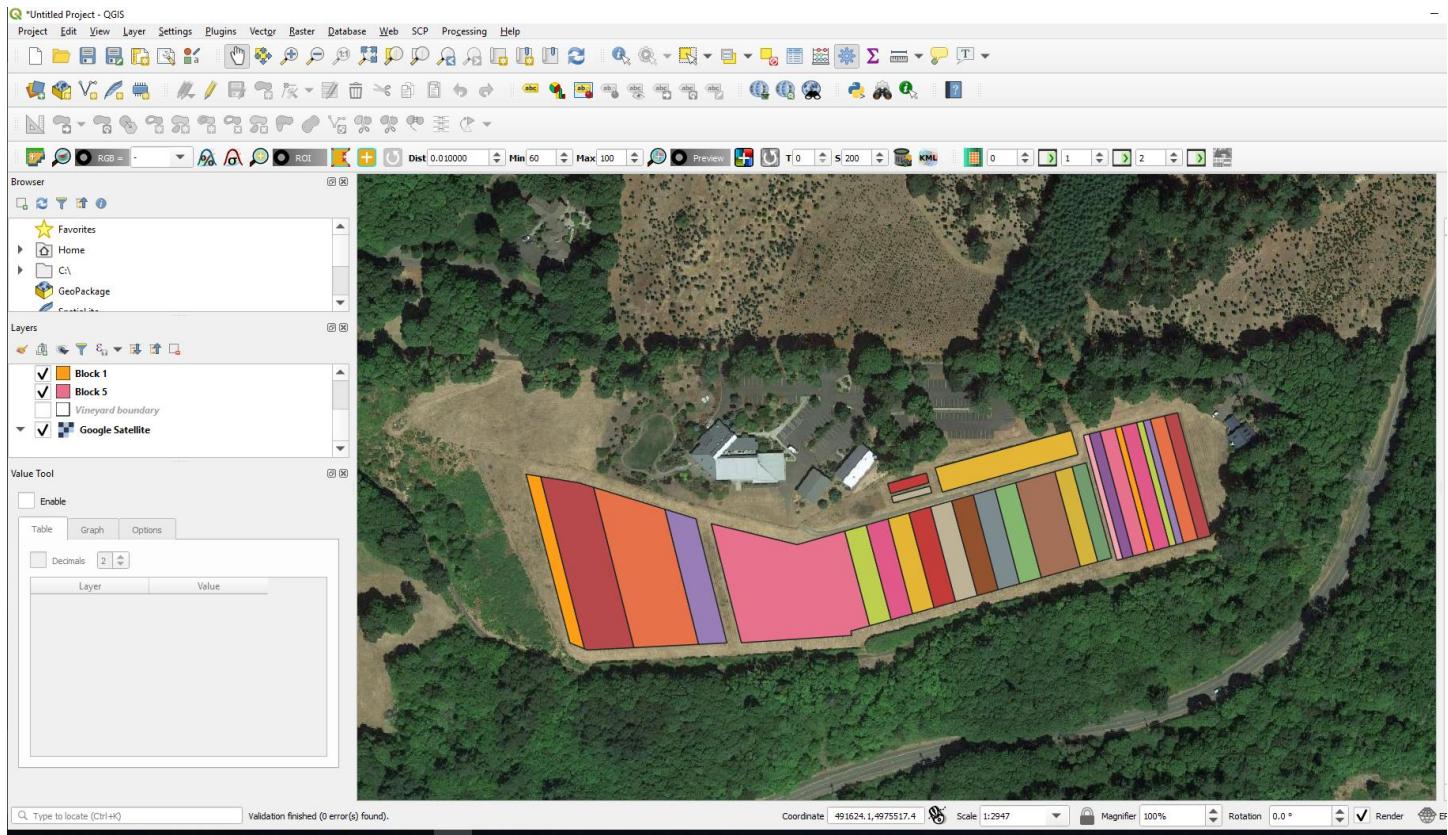
Now we are ready to make the outline for Block 5.

Add a polygon layer like you did previously when you created the vineyard boundary. Name this layer “Block 5”.



Continue with this process for the remainder of the blocks. Remember, you don't have to draw lines in Google Earth every time, you can just count the number of rows in the image to figure out when blocks start and stop, in fact that will be more accurate, just a little tedious.

Now you should have a map that looks like this (with different colors):



Note: You can do all of your blocking in the same layer. I just created each block as a different layer so that we can color them differently.

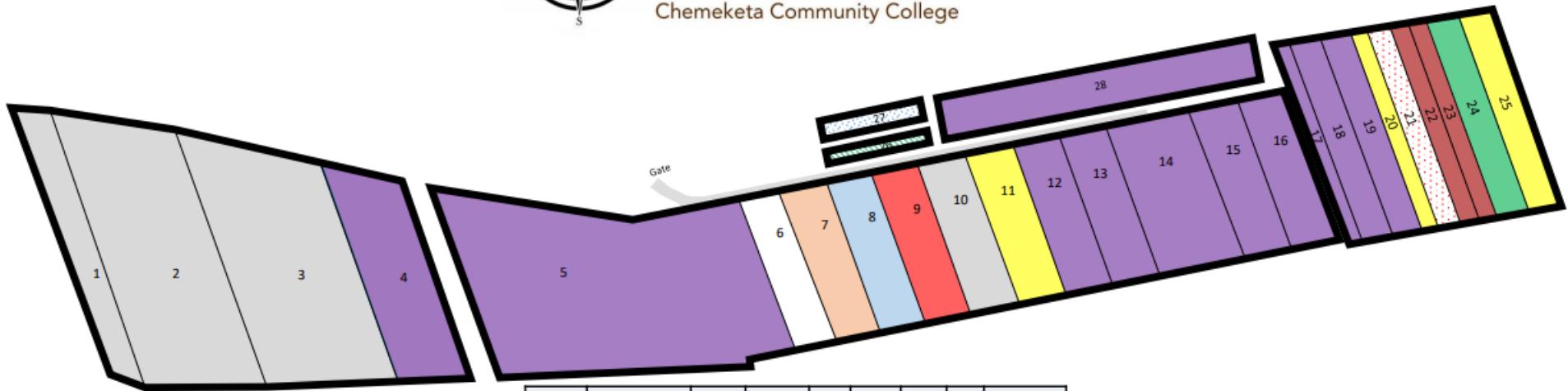
You can now deselect or completely delete the vineyard boundary layer from the layer panel, as you were only using that to keep all of your lines straight.

Now it's time to start coloring the blocks (if you want to).

### 3.5 Adding color to your map

Sometimes it's nice to display map with colors that denote certain varieties or perhaps that delineate between producing, non-producing and development blocks. In this example, we are going to color the blocks to delineate the variety. We are going to try to stick as close to the original color scheme as possible (see map on next page).

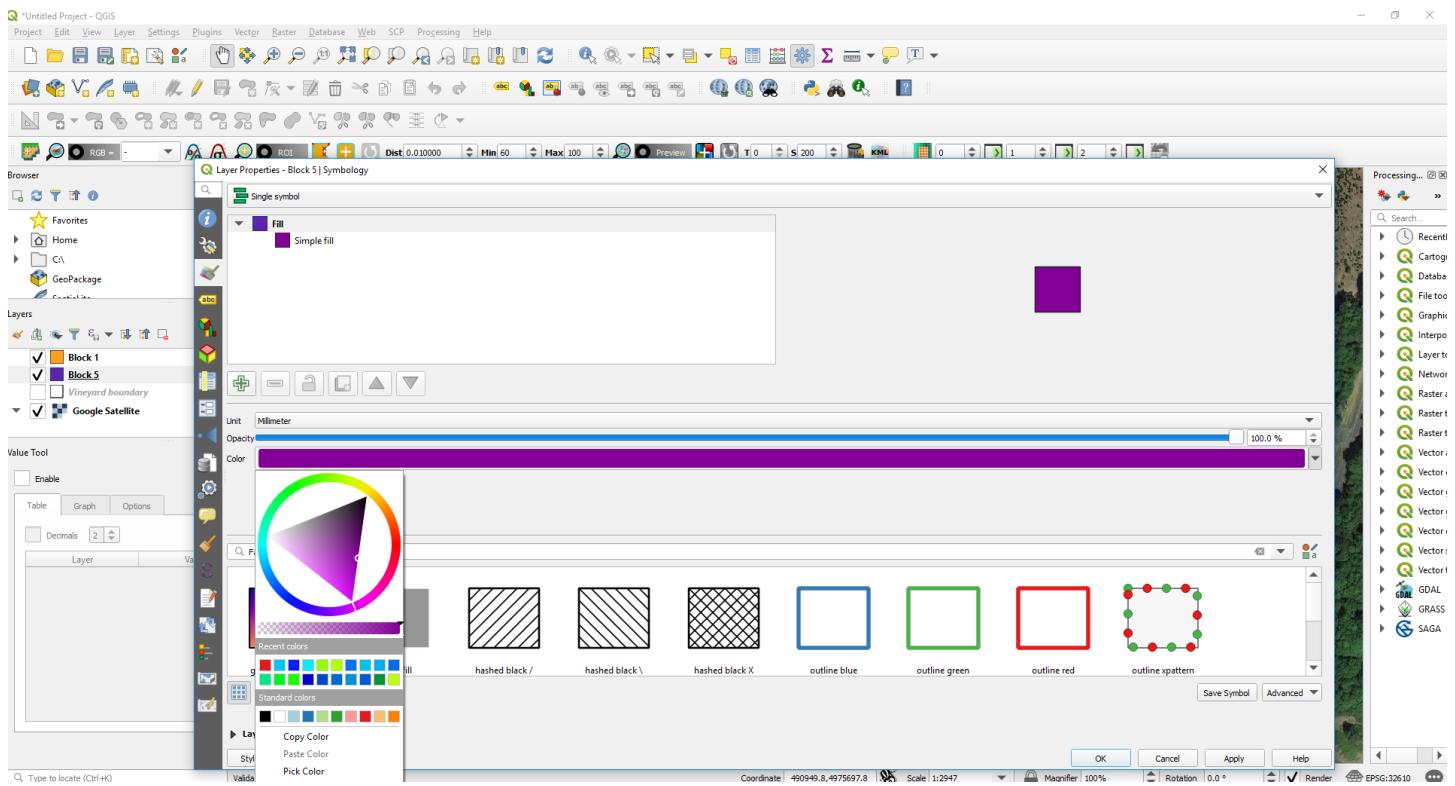
215 Doaks Ferry Rd.  
Salem, OR 97304



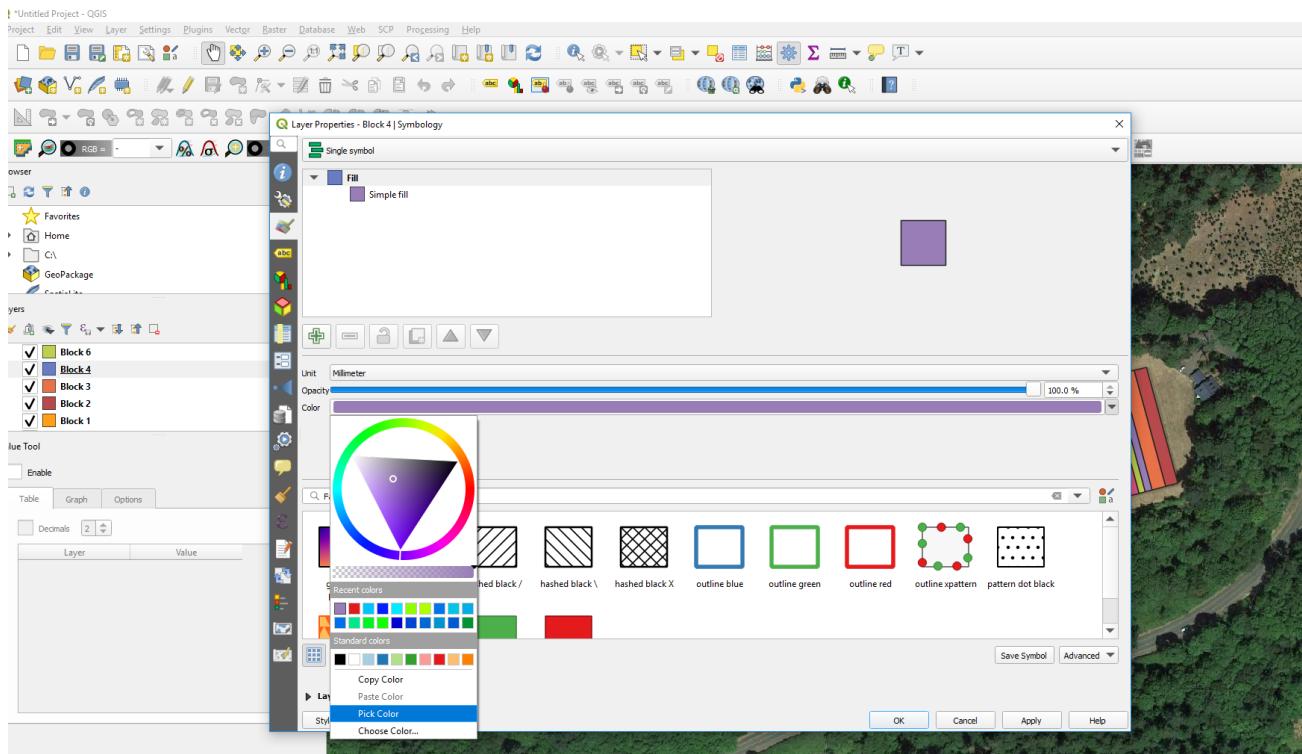
Block	Variety	Clone	Rootstock	Row #	Spacing	# vines	Acres	Year planted
1	Pinot gris	152	101-14	30-33	8x5	294	0.27	2006
2	Pinot gris	152	S04	17-29	8x5	940	0.86	2005
3	Pinot gris	146	101-14	1-16	8x5	1008	0.93	2005
4	Pinot noir	115	101-14	35-43	8x5	498	0.46	2005
5	Pinot noir	115	101-14	1-34	8x5	1089	1.46	2005
6	Pinot blanc	?	3309	1-5	8x4	250	0.18	2001
7	Viognier	1	3309	6-11	8x4	300	0.22	2001
8	Riesling	10	S04	12-17	8x4	300	0.22	2001
9	Gamay noir	284	3309	18-23	8x4	300	0.22	2001
10	Pinot gris	152	SC	24-29	8x4	300	0.22	2001
11	Chardonnay	76	101-14	30-36	8x4	300	0.22	2001
12	Pinot noir	Pom	101-14	37-41	8x4	300	0.22	2001
13	Pinot noir	777	101-14	42-46	8x4	300	0.22	2002
14	Pinot noir	115	3309	47-57	8x4	550	0.4	2002
15	Pinot noir	115	101-14	58-63	8x4	300	0.22	2002
16	Pinot noir	777	RG	64-68	8x4	300	0.22	2003
17	Pinot noir	Wad	3309	69-70	8x3.5	150	0.10	2003
18	Pinot noir	113	S04	71-73	8x3.5	300	0.19	2003
19	Pinot noir	667	101-14	74-77	8x3.5	300	0.19	2003
20	Chardonnay	?	101-14	78-79	8x3.5	150	0.10	2017
21	TBD	TBD	TBD	80-82	TBD	14	TBD	TBD
22	Tempranillo	2	3309	83-84	8x3.5	150	0.10	2003
23	Tempranillo	Duero	101-14	85-86	8x3.5	150	0.10	2003
24	Sauvignon blanc	Musque	101-14	87-90	8x3.5	300	0.19	2003
25	Chardonnay	?	101-14	91-94	8x3.5	300	0.19	2003
26	Rootstocks	See map			9x6	31	0.04	?
27	Table grapes	7	?	-	9x6	45	0.06	?
28	Pinot noir	Pom	3309	-	10x6	300	0.41	?

Total 8.35

To add color to each block, right click on the block in the layer panel and click “properties”. Now find the paint brush icon (symbology) and click on that. Click on “fill” and click on “color” to choose the color for that block. When you have found the right color, click “apply” and “ok” to finish.

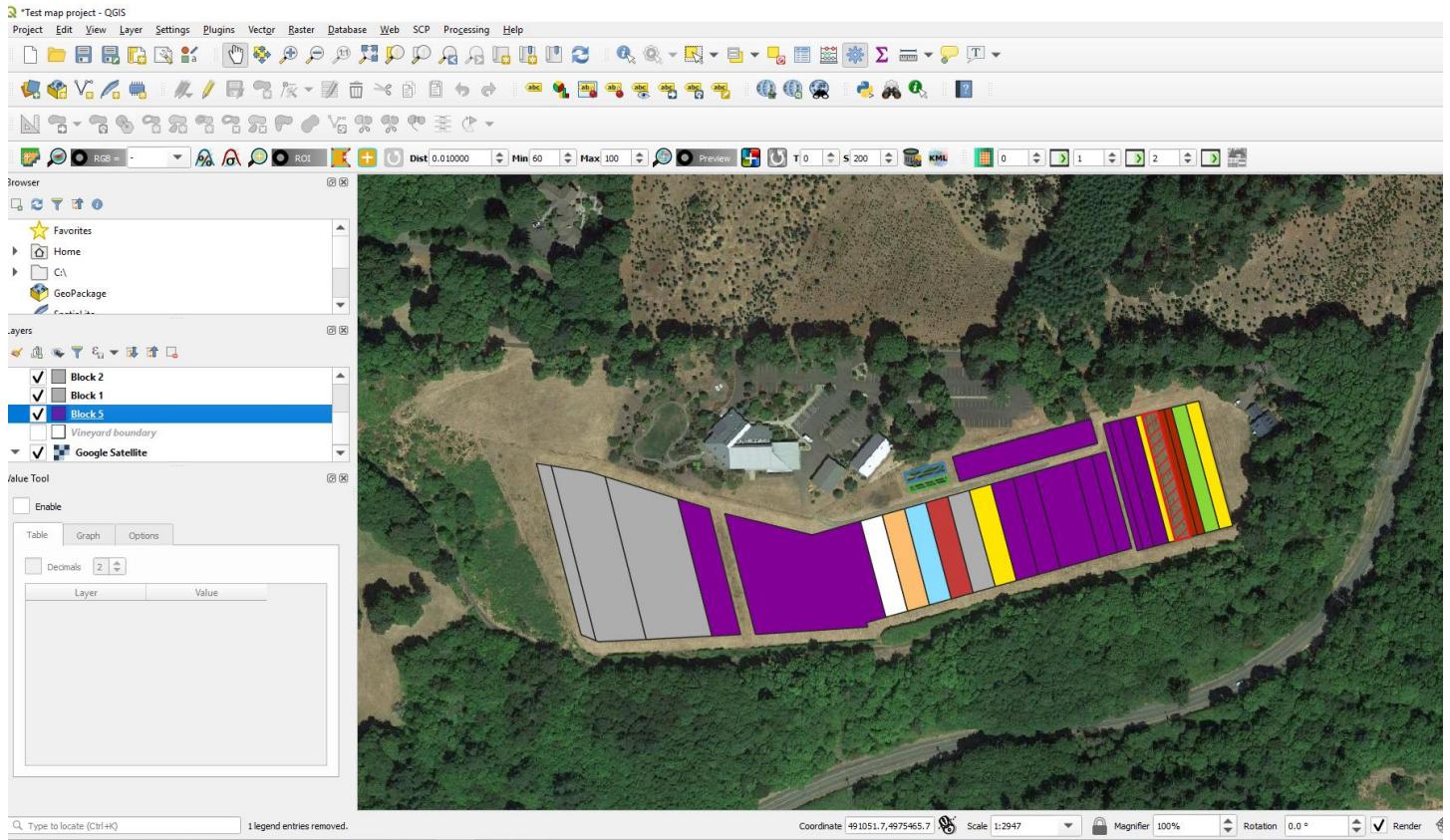


When you want to match colors, you can use an eyedropper function to choose the color of another layer to match. For instance, block 5 and 4 are both Pinot noir, so they are both going to be colored purple in this example. I have already made block 5 the shade of purple that I want to use. So to match the colors, I will go to the symbology tab of the layer properties for the block 4 layer and I will click on “color” again, but instead of choosing a color from the wheel, I will click “pick color”.



Once you click “pick color” you will have an eyedropper tool with which to pick a color to match. Bring the eyedropper over Block 5 and left click to choose an identical color for Block 4. Repeat this step for all over Pinot noir blocks.

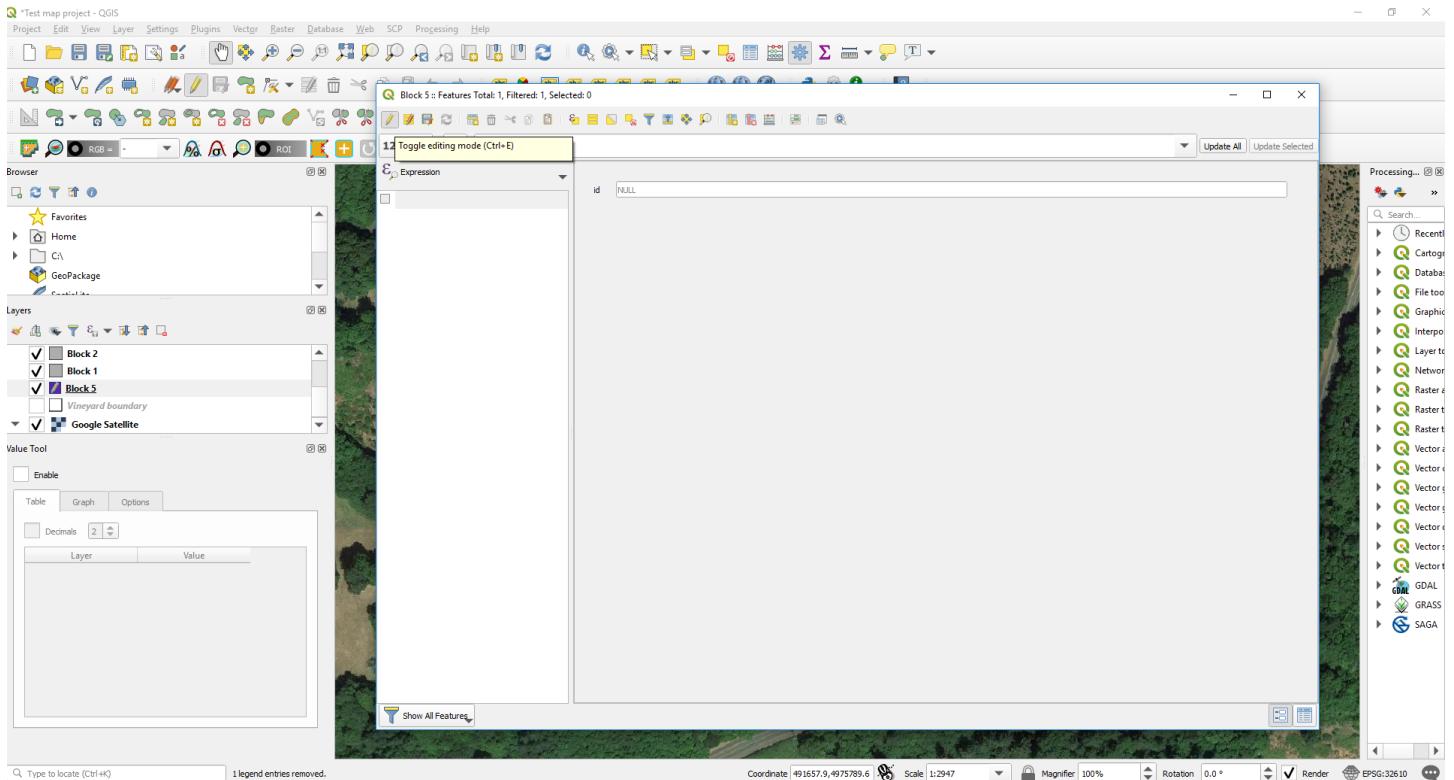
Note: you can fill layers with textures and designs, as well as solid colors. This can be useful for denoting something different from a normal production block. In this example, I chose to use textures for the block that was ripped out (block 21), the rootstock block (block 26) and the miscellaneous table grape block (block 27).



### 3.6 Adding block labels

Now we can start adding key block details and labels to our map. We can do this by right clicking on the block layer in the layers panel and clicking “Open Attribute Table”. An attribute table is where all of the key information for our blocks will be stored.

Once the attribute table is open, you will click the pencil icon (toggle editing mode).



Now that we are in editing mode, we are going to delete the “id” field that just comes standard with every layer because we don’t need it. You can delete a field by clicking on the “delete field” icon 

Choose the field you want to delete and click “ok”.

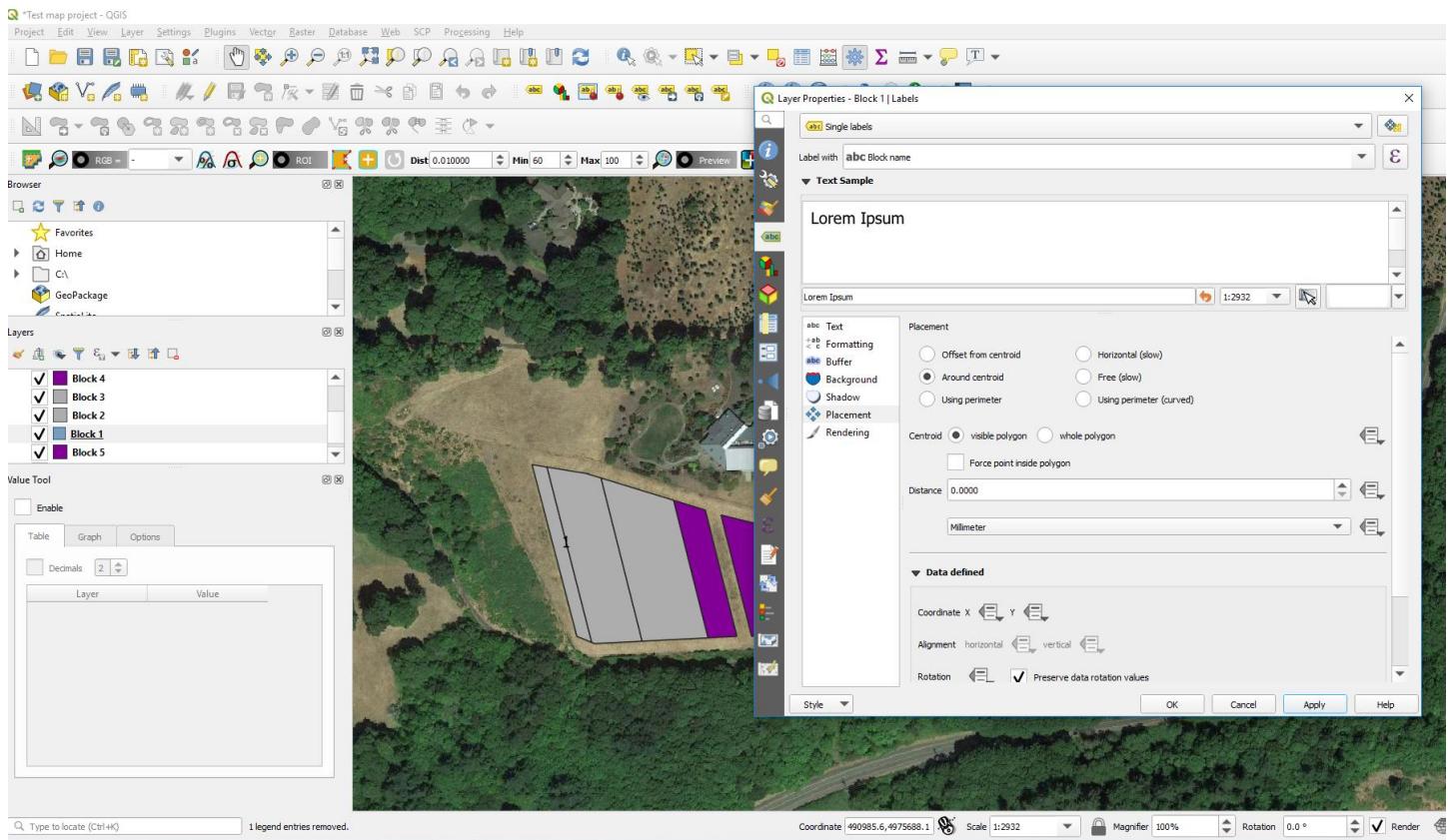
To create a field you click on the “add field” icon 

We are going to add a field called “block name” and it can be a text string with a length of 2. You will see the field appear and you will see “NULL” in the text box. Type in the block name (the number) in that box and hit “update all”. Now the block has been named in QGIS. Now you can unclick the pencil icon and hit “save” before moving on to the next block.

Do this for every block.

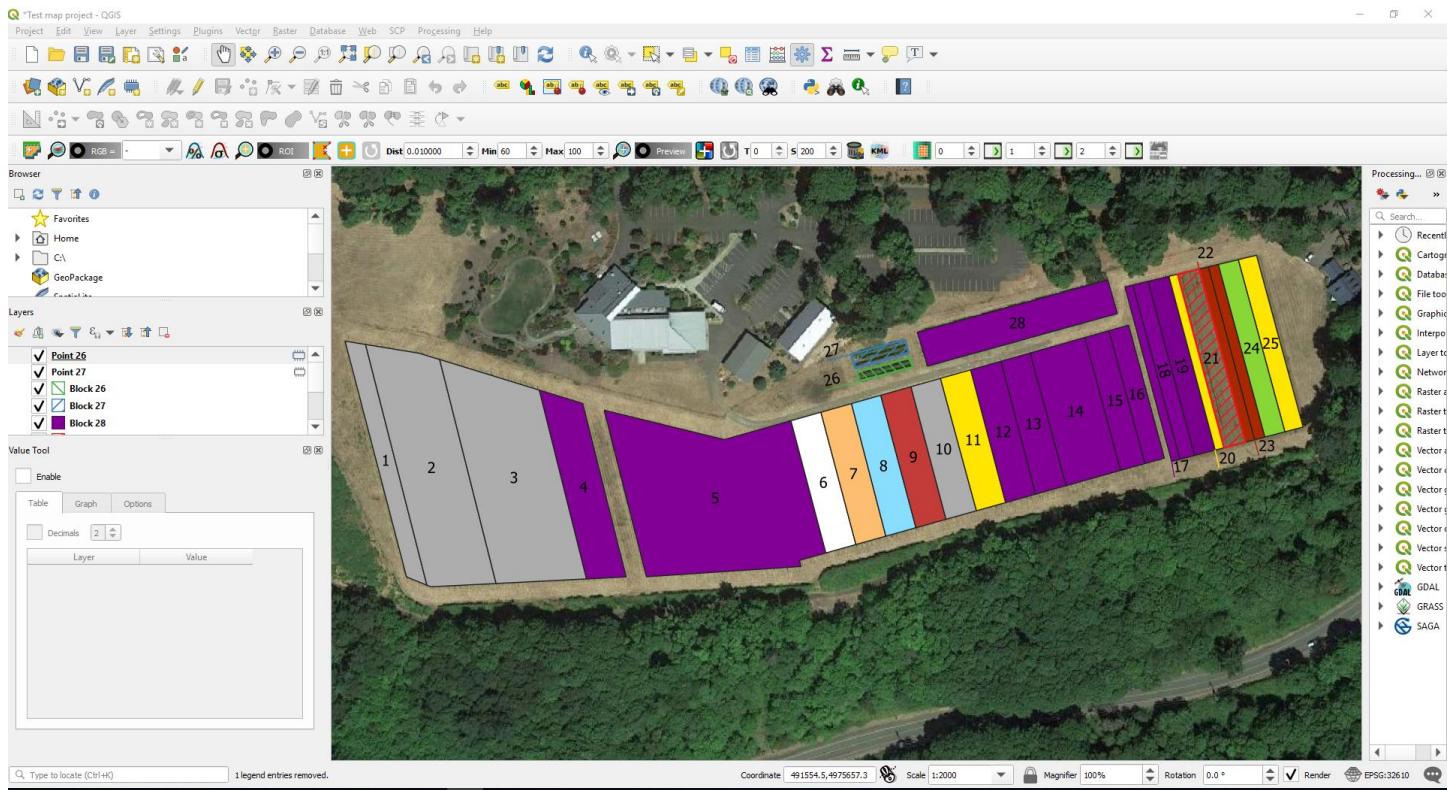
To add labels for each block, right click on the block layer in the layer panel and go to the properties for that layer. Find the labels tab . At the top of the screen, select “single labels”. In the “label with” box, select “block name” (this is the attribute field that you just created). Hit “apply” and you should see the block name appear on the map.

I applied the label for block 1 and the label is going through the line between block 1 and 2.



To correct this, you need to go into the “placement” options of the labels. In there, you will see that the default is “around centroid”. That default is usually fine, but sometimes it gets it wrong. Choose “offset from centroid” and hit “apply” and see where the number ends up. Have a play around in these placement settings if you need to move labels around to get them to look right.

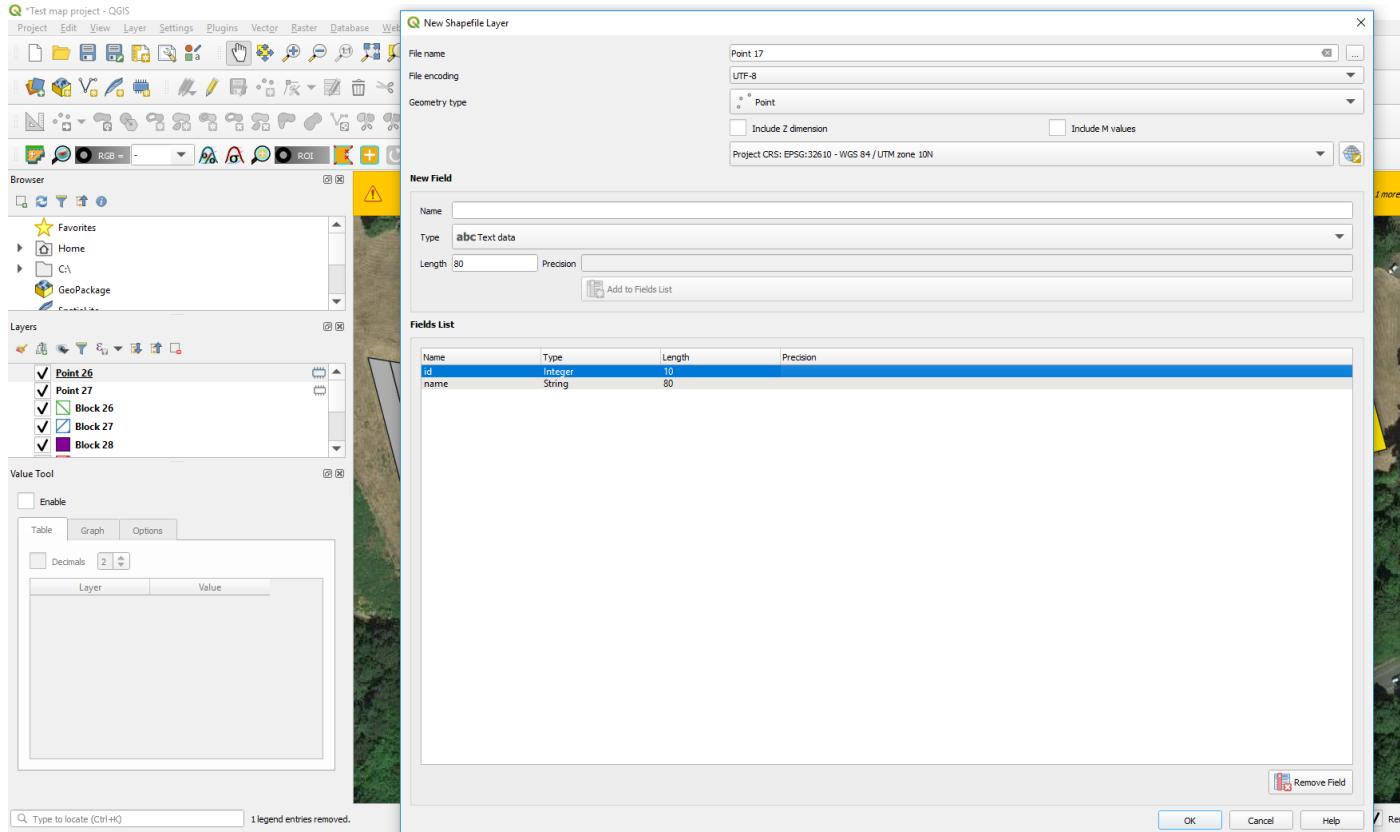
Apply labels to all of your layers.



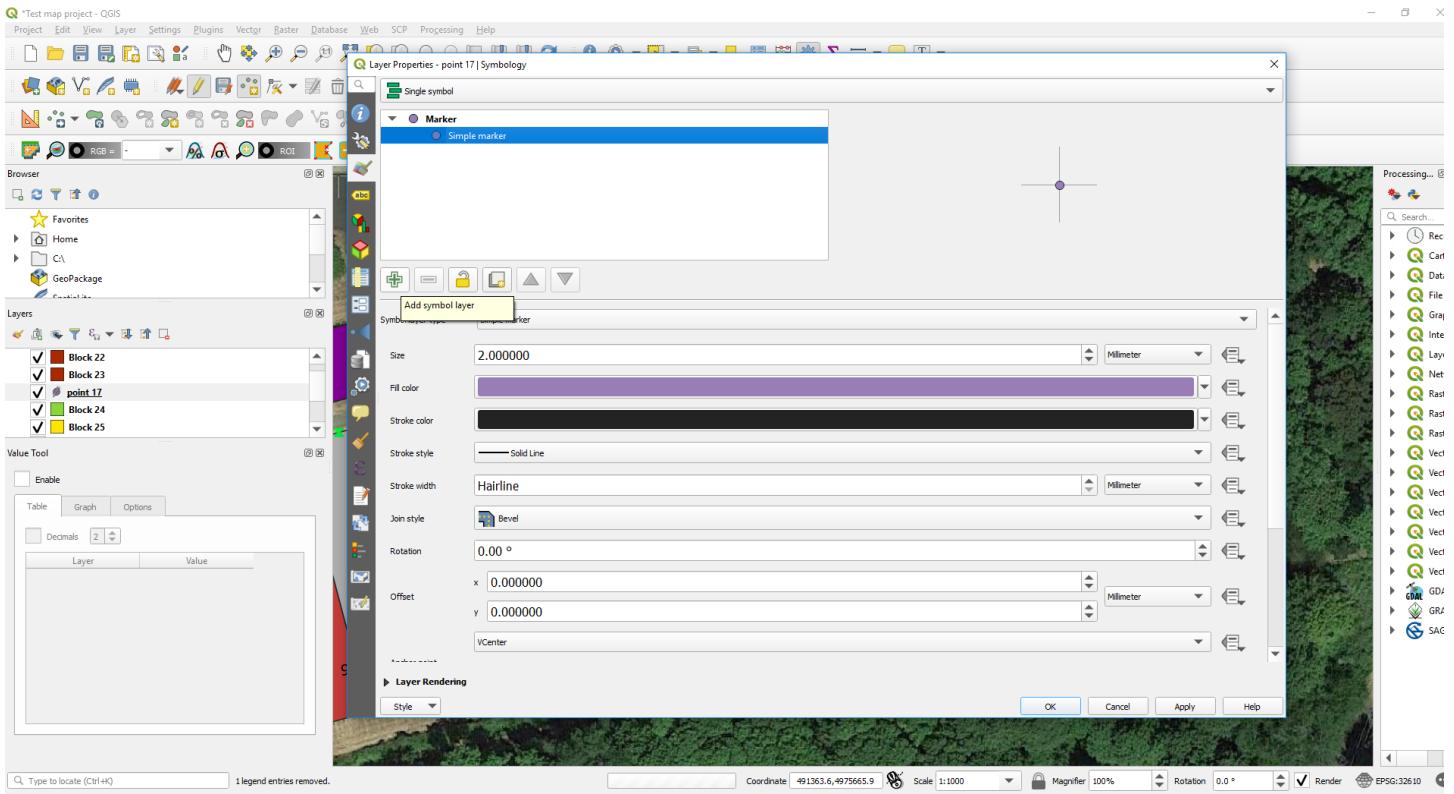
Notice that I used call out labels on some blocks because these blocks are too small to put a label within the polygon. This is a unique situation because the Chemeketa vineyard has such small blocks. However, I will show you how to create callouts, should the need arise for you in the future.

### 3.6.1 Creating “callout” labels

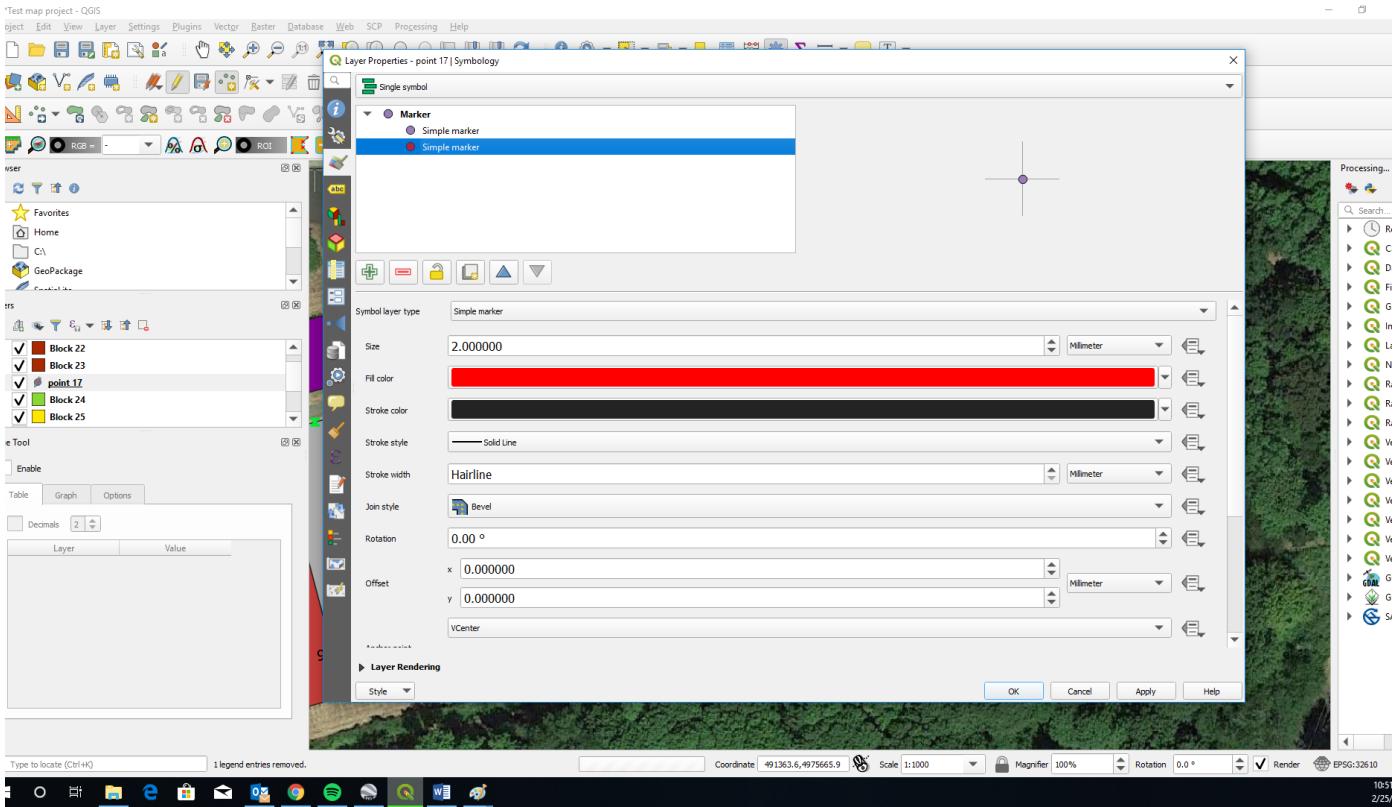
Let's deal with block 17 because that is the thinnest of all the blocks, so it is difficult to fit a legible label within the polygon. To create a callout label, we must create a marker point. We do this by clicking on the “Create new shapfile layer” icon  create a point called “point 17”. Geometry type should be set to “point”. Set your CRS to the project CRS (UTM zone 10) . In “new field” add a field called “name” (this can be text data with the default length of 80). Click on “add to fields list”. Click ok to load this layer in the layer panel.



Now make sure the point 17 layer is highlight in your layers panel (left click it). Now click the “toggle editing mode” pencil and place the point at a vertex of block 17 (I chose the lower left vertex). The attribute table will come up. Now you can input “17” in the “name” field that you created when you first created this point. Click ok. Now open the properties for this layer (right click on the layer → properties). Go to the tab for this layer. Here's where things get slightly tricky.

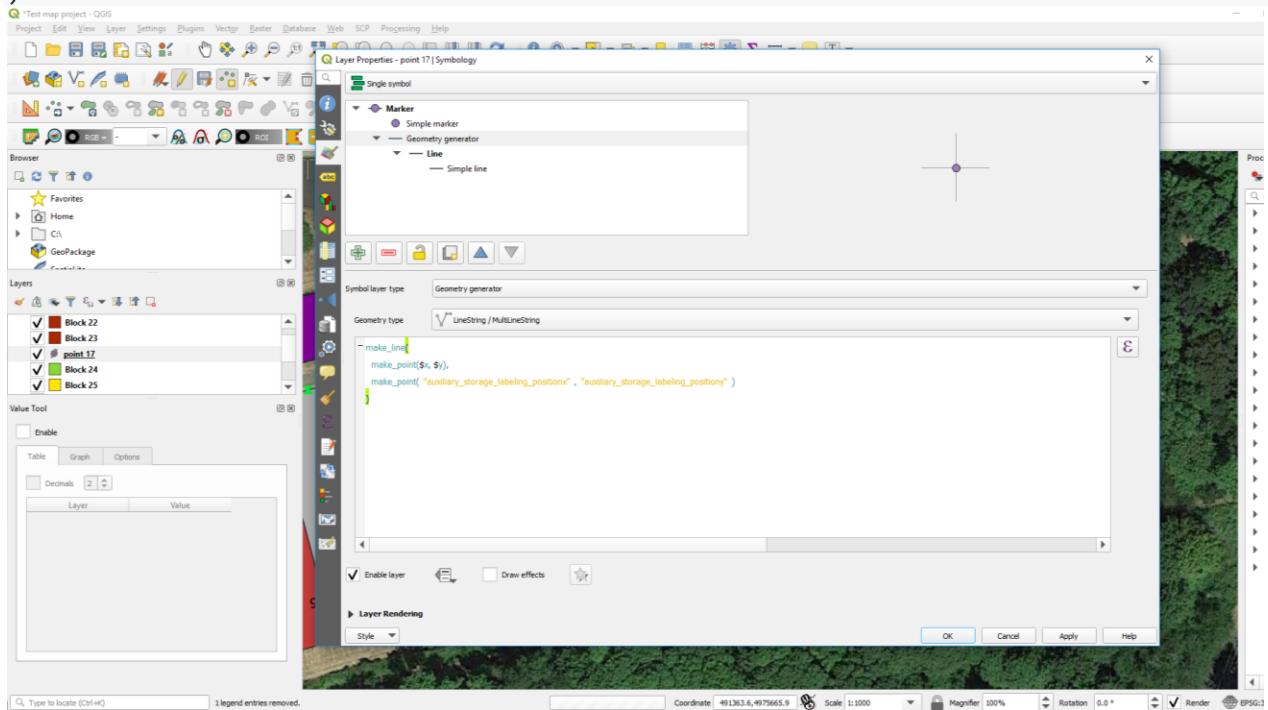


We are going to add a symbol to make the callouts. We do this by clicking on the green plus sign this is the “add symbol layer” icon. When you click this, a new point symbol will appear above the symbol that you just laid down. You want to highlight the new symbol by left clicking on it and then hit the down arrow to make sure point on the map right now is on the top.

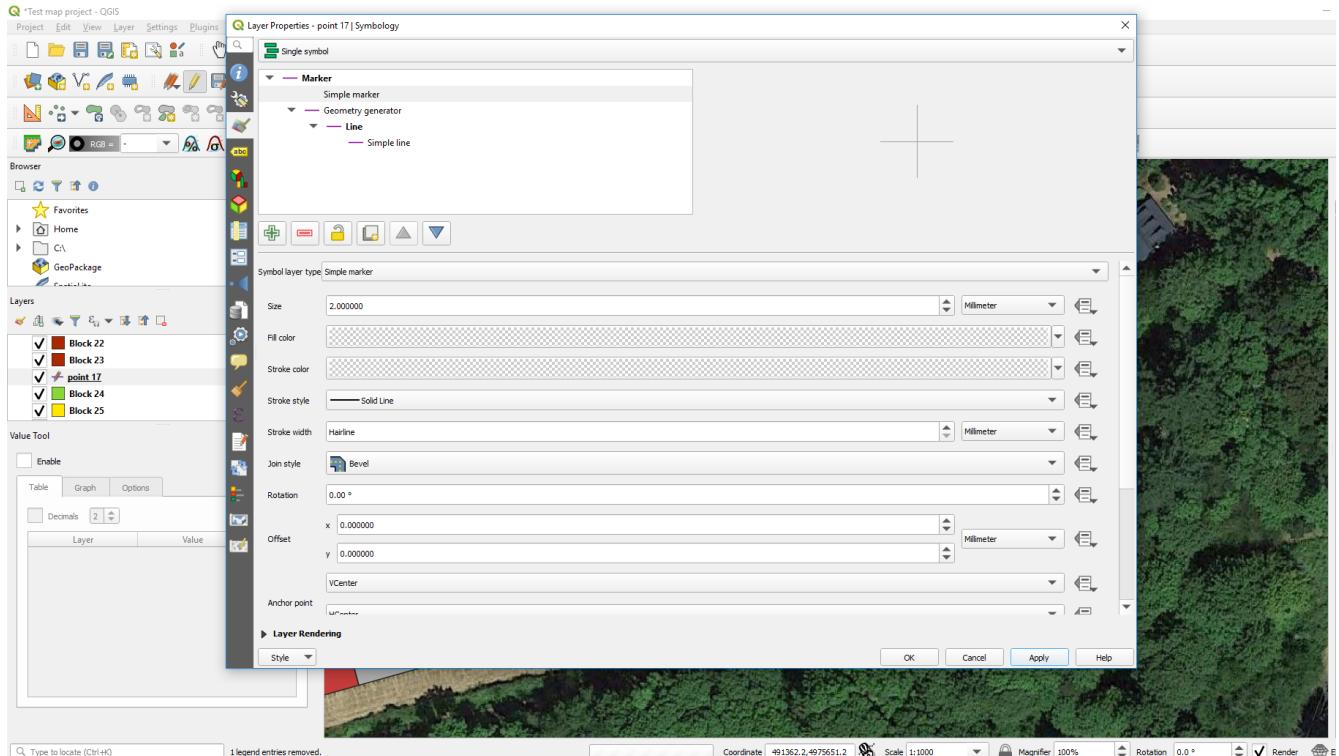


Now click on the new symbol and under “symbol layer type” change this to “geometry generator”. In the “Geometry type” drop down menu, select “LineString/MultiString”. Delete “\$geometry” in the big open field. Now copy and paste the following formula into the open field:

```
make_line(
    make_point($x, $y),
    make_point( "auxiliary_storage_labeling_positionx" , "auxiliary_storage_labeling_positiony" )
)
```



Now click on the line and change the color of the line to the color of the block. Now click on the “simple marker” which is the dot on the canvas in QGIS. Set the fill color and the stroke color of the dot to transparent and hit “apply”.



Now add the label for the marker as you would for the polygons you labelled earlier. Now you will see the label over the vertex that you put the point on. You can move the label by clicking on the “move label” icon  in the “label toolbar”. Once you click on that icon, click the cross on the label and then it will ask you to “select the primary key to use for joining with internal data storage”. Go ahead and choose the block name that you used for the label. Now you can click on the label and drag and drop it around the canvas.

Another really useful tool in the label toolbar is the “rotate label” tool  . Give this a try if you need to rotate your labels to make them look right.

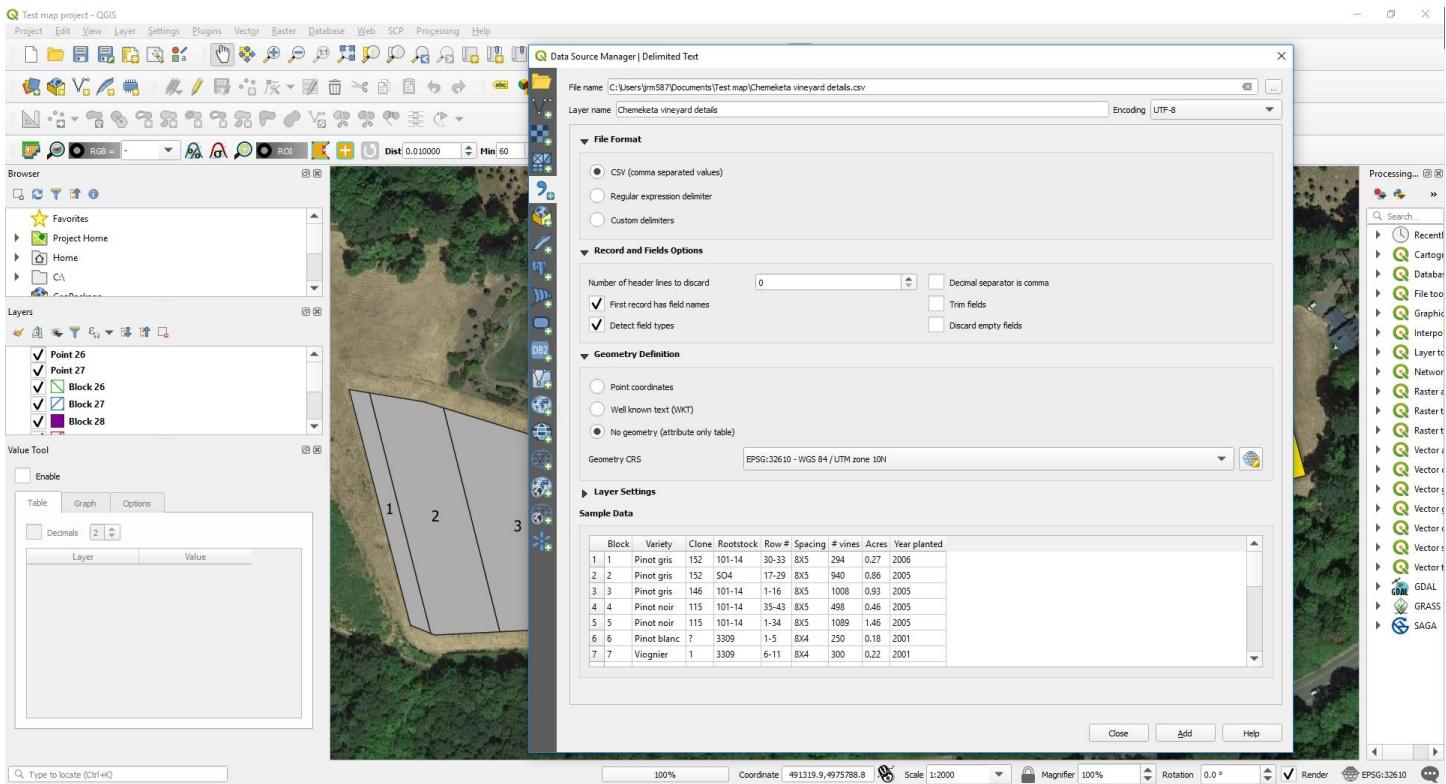
### 3.7 Importing vineyard information from Excel

We can input all of our vineyard information into attribute tables in QGIS and we don’t have to import excel files. However, I find it easiest to do it this way because all of us have excel files with our key block details, so it’s easy to just import these details into QGIS and then use this as a table in our map.

To do this, you will want to create a .csv file in Excel with all of the key block details. This might include:

1. Block name
2. Variety
3. Clone
4. Rootstock
5. Row #
6. Spacing
7. # of vines
8. Acres
9. Year planted

To add this file to your map, just go to layer→add layer→ add delimited text layer. Now flick on the three dots next to the file name field and find your .csv file containing the block details. Under file format, make sure that “CSV” is checked. Undoubtedly the first row of the document contains the names of each column, so make sure that “first record has field names” is checked. In the “geometry definition” field, make sure it’s set to “no geometry”. You can preview your data in the “sample data” field to make sure that it’s going to import correctly.



Hit “add” when you are sure that the .csv data is going to be imported correctly.

If you have a lot of blocks, sometimes you will have to separate the block details into a couple of sections to fit it all on the map. For the Chemeketa vineyard, I created a .csv file that contains blocks 1-16 and another that contains blocks 17 – 27.

### 3.8 Composing the map

Now it's time to put the map all together. You do this by clicking on the “new print layout” icon at the top of the page

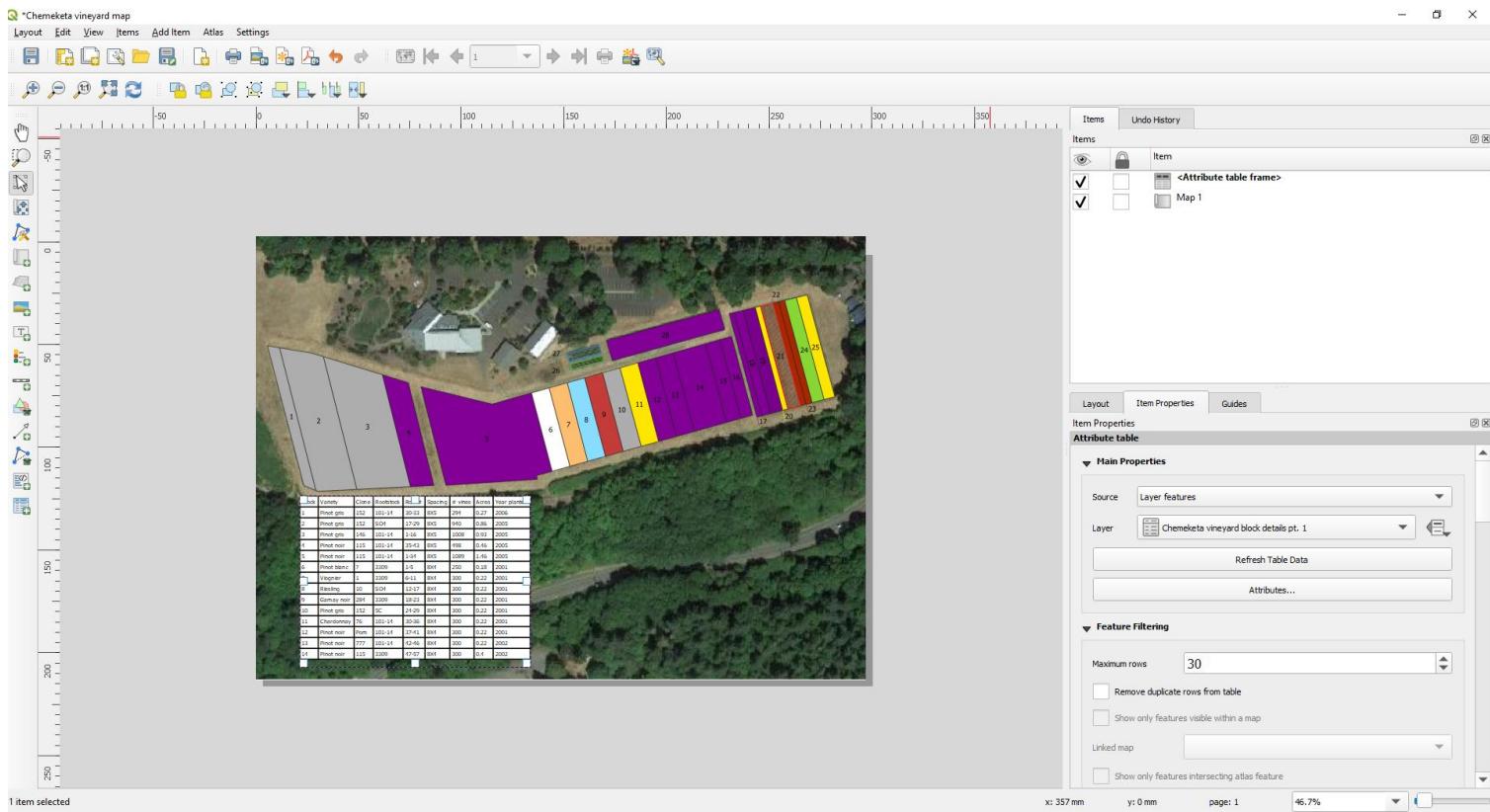


Create a name for your map and click “ok”.

Once you are in the print layout click on “add item” and click “add map”. Click the upper left hand corner of the white canvas and drag and drop your map to whatever dimension that you want. I just did mine for this example across the entire canvas.

Now you may add the attribute tables that you imported (the .csv files). You can click on the “add attribute table” icon on the left of the screen Now draw on the canvas, by clicking and dragging, where you want your table to go.

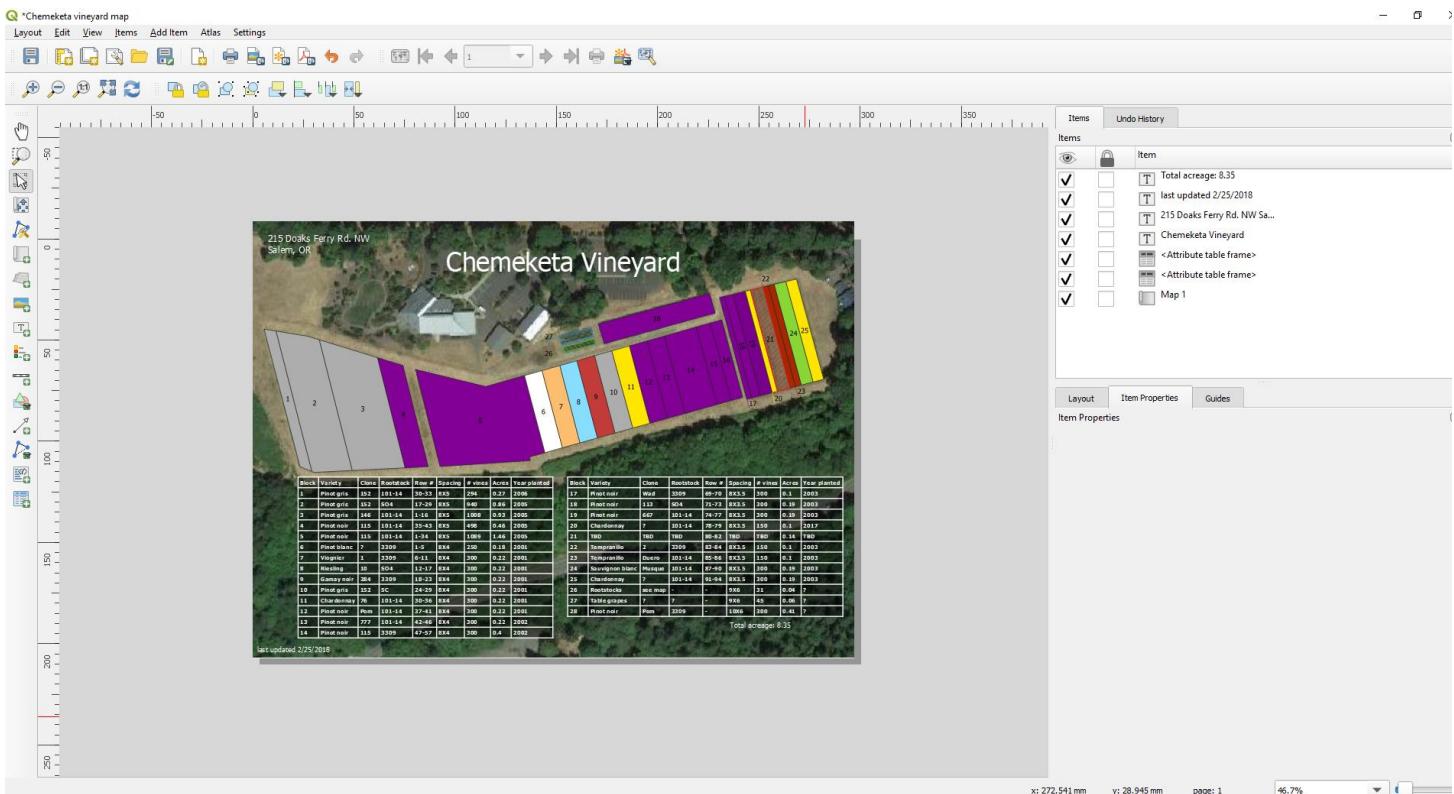
Once you let go of the mouse you will choose “layer” and choose one of the attribute tables that you brought in to QGIS.



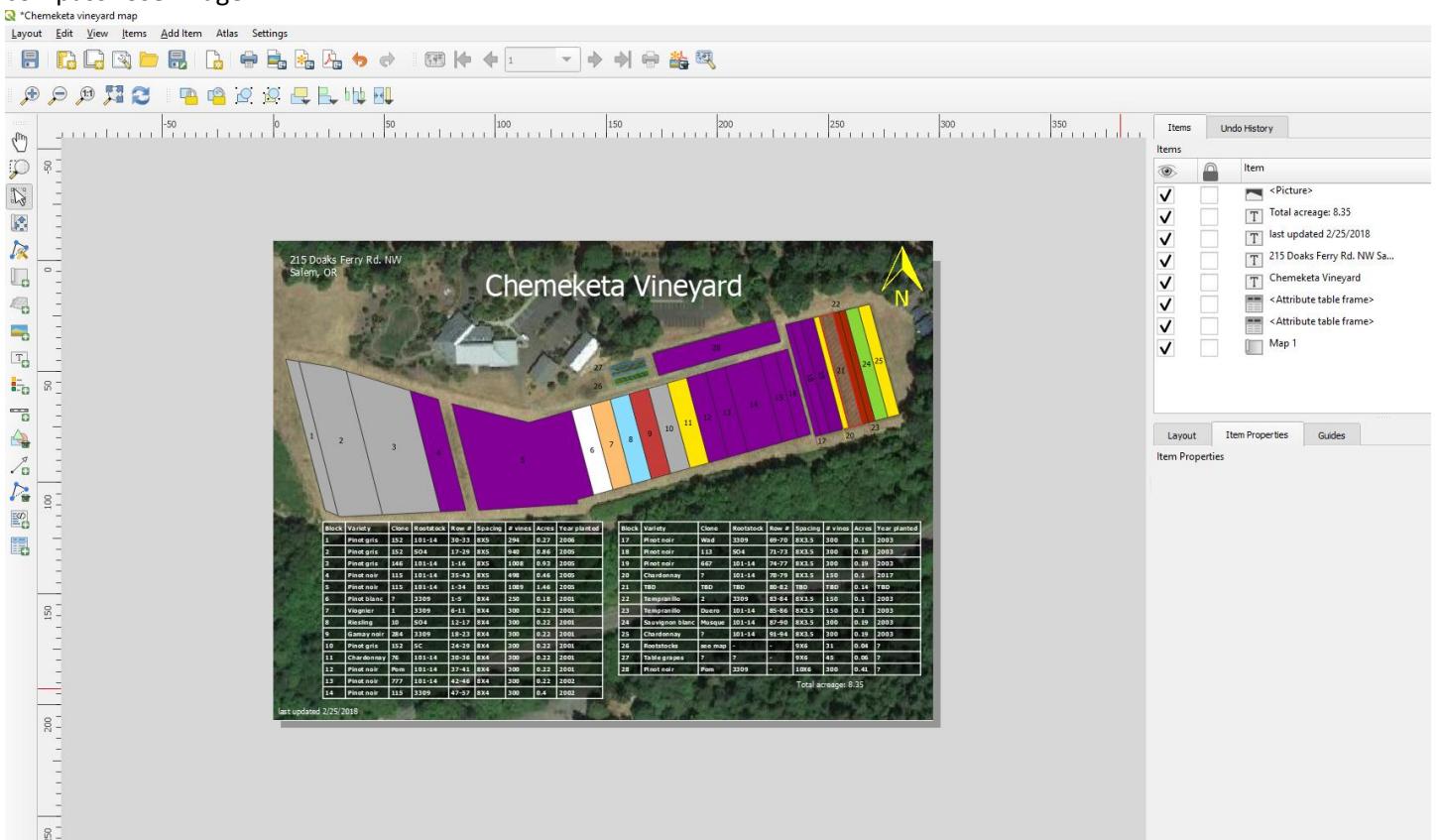
Now do this with both tables.

Have a play around with the formatting of the tables. You can change the font, background color, text color etc.

You can also add labels by going to “add item” and clicking on “add label”. In here you can type out labels like a title for your map. It’s also nice to put something on your map that says when it was last updated, you may also want to include an address so that you can give to map to someone that might not know where the vineyard is.



You can also add a north arrow if you want to. I downloaded a transparent north arrow from Google images and I'll just add it as a picture. You can do that by going to "add items" and then clicking on "add picture" and then find your compass rose image.



You can export this map in many different formats. Click on the “export as image” icon  . Choose the name of the file and then you may choose the type of file you’d like to save your map as. A .tiff file is a georeferenced file that can be uploaded into Avenza maps on your phones and tablets and you can see your approximate location within the map as you walk around the vineyard (the phone GPS can be off by up to 6 meters at times). You can also save your map as a simple non-georeferenced image like in a .jpeg format.

## 4. Using Avenza Maps

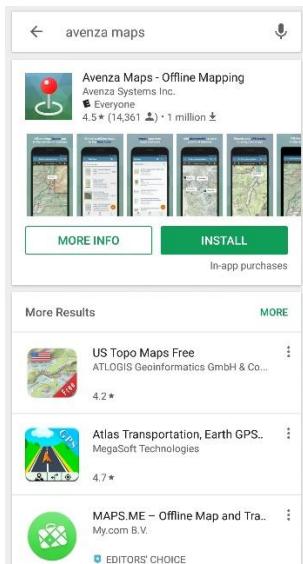
The following are directions for uploading and using Avenza with an Android device. For iOS, see the following link for assistance with uploading maps:

<http://help.avenzamaps.com/customer/en/portal/articles/2936861-importing-a-map-ios->

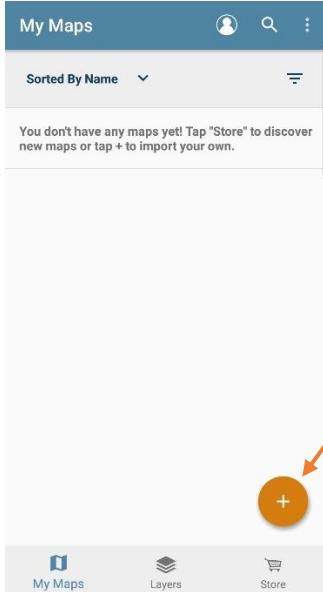
Or view this video in which image upload is covered starting at 1 min 30 sec:

<https://www.youtube.com/watch?v=UAHXcNkJIM>

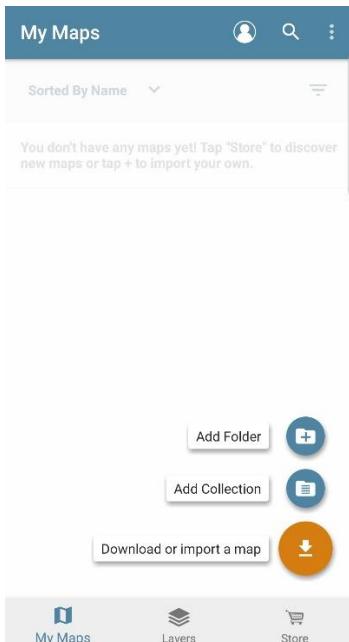
1. Save your .tiff images in a Google Drive folder
2. Go to the app store and download Avenza Maps.



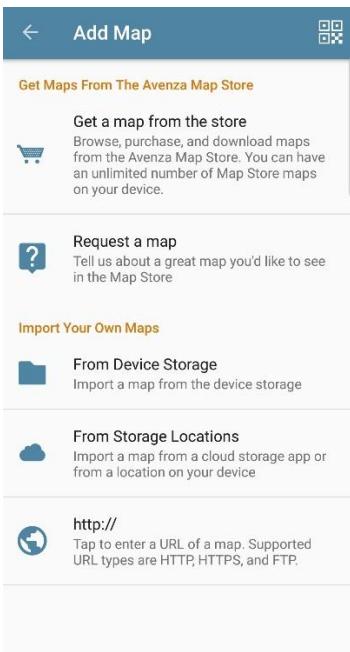
3. Open Avenza Maps and allow the app to have access to your device's location.
4. When you're in Avenza, go to "my maps" and hit the plus sign in the lower right hand corner.



5. Now hit "download or import a map"

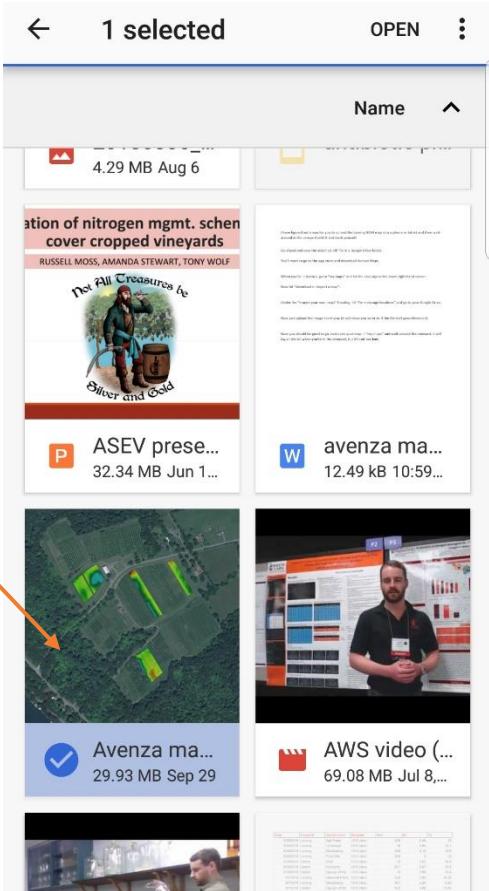


6. Under the “import your own maps” heading, hit “from storage locations”



7. Allow Avenza Maps to access photos, media and files on your device.

8. Go to your google drive and download a map.

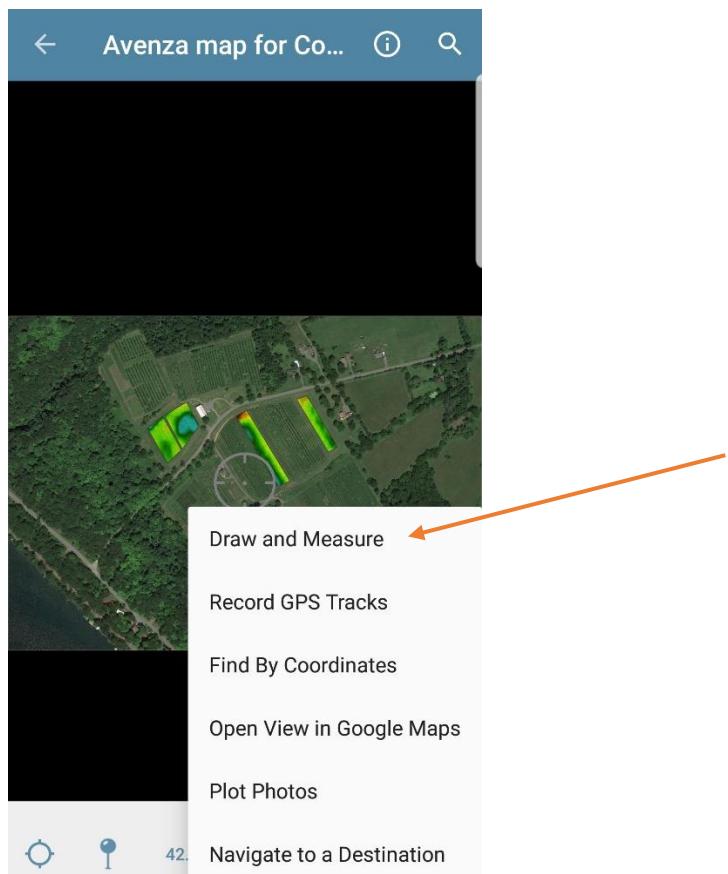


9. Now you should be good to go. Just open your map in “my maps” and walk around the vineyard. It will lag a little bit, but it’s not too bad.

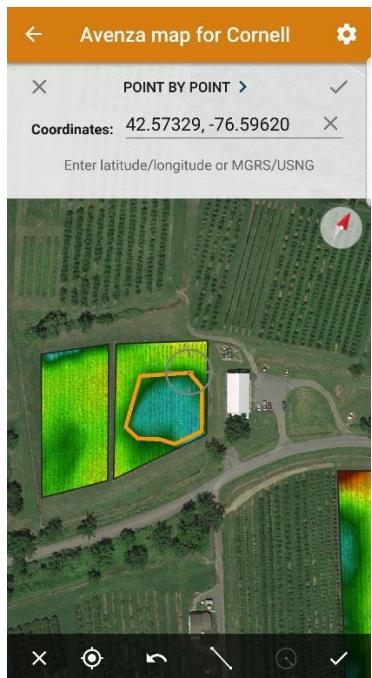
#### 4.1 Measuring area in Avenza Maps

1. Tap on the three dots at the bottom right hand corner of the map.

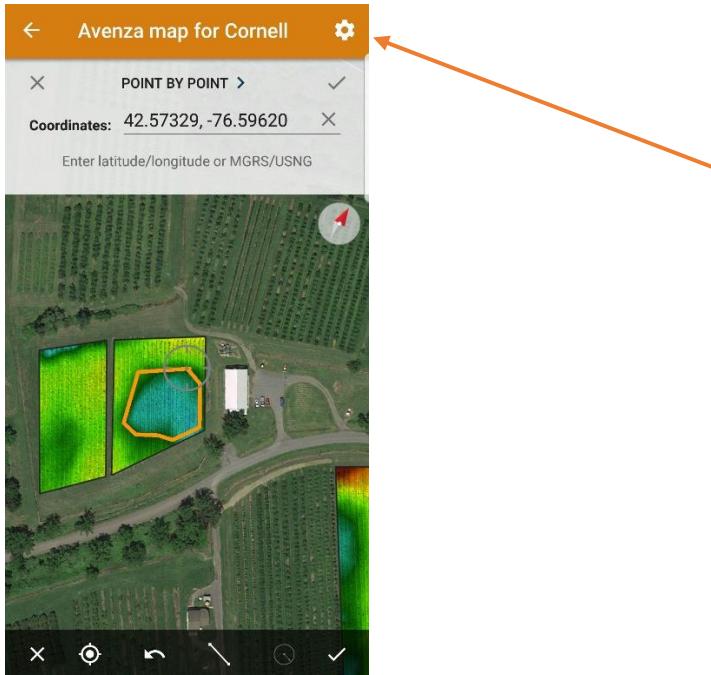
2. Tap “draw and measure”



3. Bring the reticle to the beginning of where you want to start your polygon and tap the screen anywhere. Now drag the screen to elongate the line and tap any time you want the line to change directions. After you've made at least 3 different angles, you can hit the line with two dots at the bottom of the map and it will turn into an area.



4. Now hit the settings wheel at the top right hand corner of the map.



5. Go to “area units” and select acres or hectares ☺ Make sure your polygon doesn’t cross over itself or it won’t save.

6. Now hit the check mark at the lower right hand corner of the map and your polygon will save and the area of the polygon will display.

