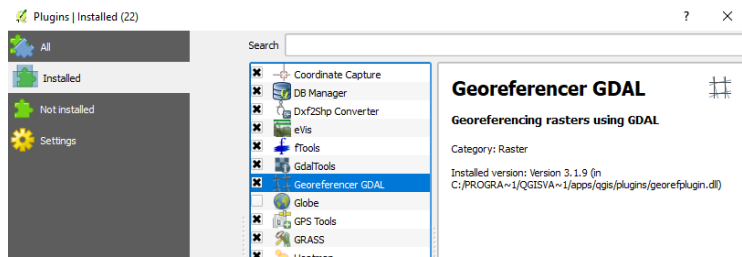
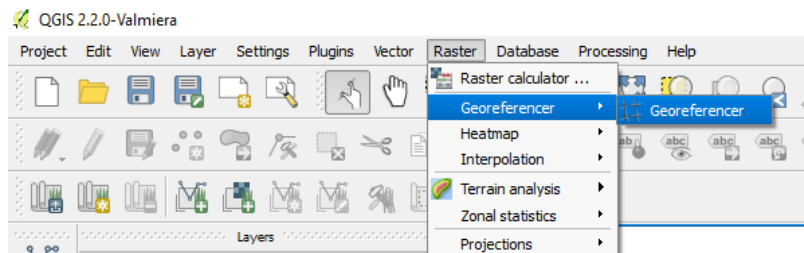


## A) Georeferencing Topo Sheets and Scanned Maps

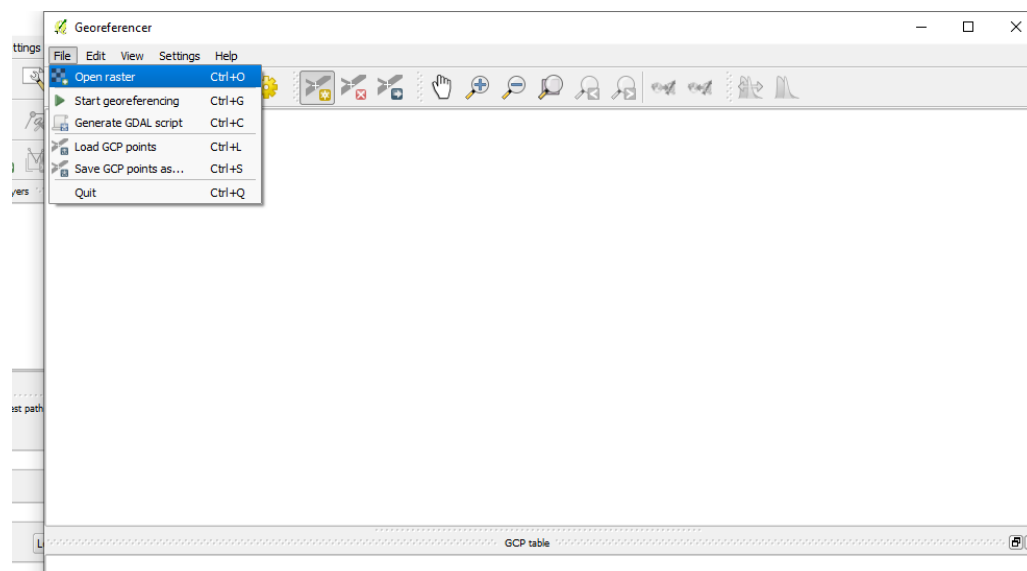
1. Georeferencing requires the Georeferencer GDAL plugin, so if it is not installed first install it.



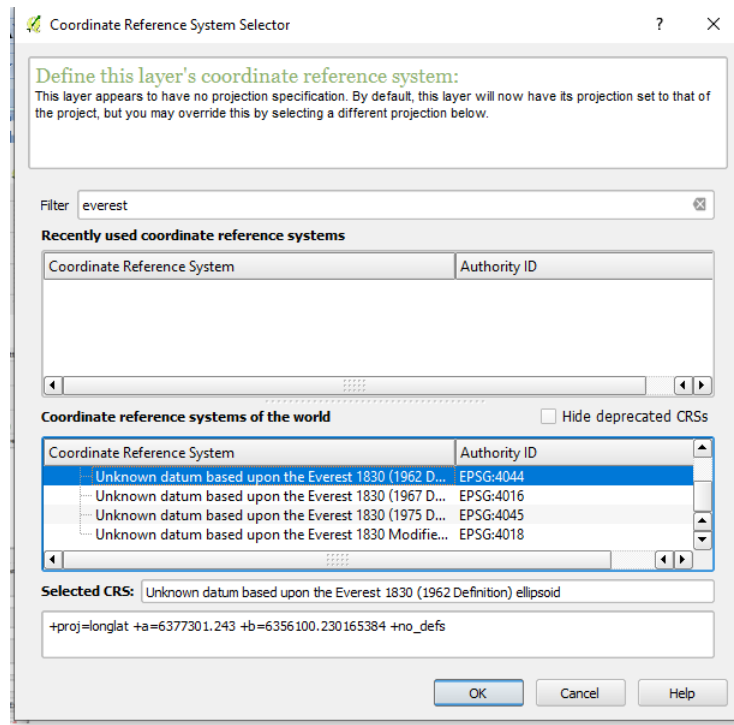
2. Click on Raster → Georeferencer → Georeferencer to open the plugin.



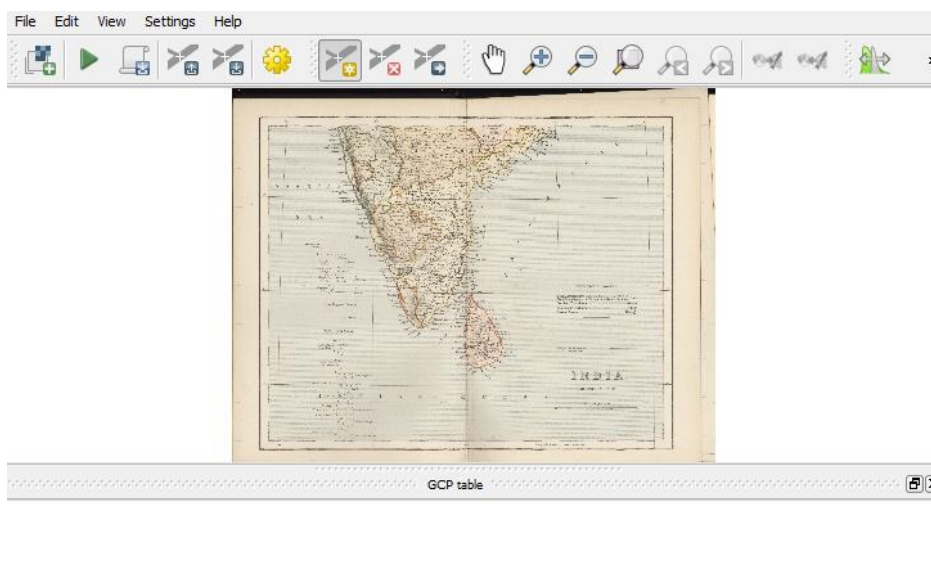
3. The plugin window is divided into 2 sections, in the top section the raster will be displayed and in the bottom section a table showing GCPs will appear.
4. Click on File → Open raster on Georeferencer window. And open Scanned map of South India



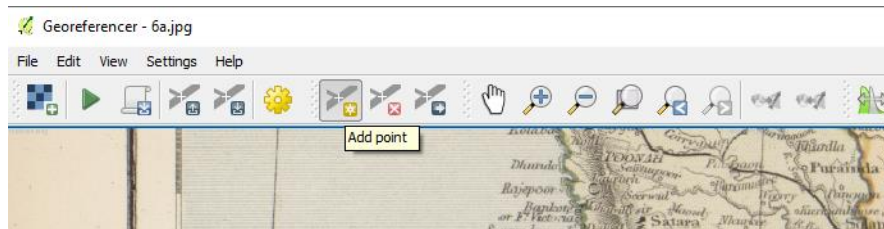
5. If we have collected the ground control points using a GPS device, we would have the WGS84 CRS. If we are geo-referencing a scanned map like this, we can obtain the CRS information from the map itself. Looking at our map image, the coordinates are in Lat/Long. There is no datum information given, so we have to assume an appropriate one.
6. Since it is India and the map is quite old, we can select the Everest 1830 datum.



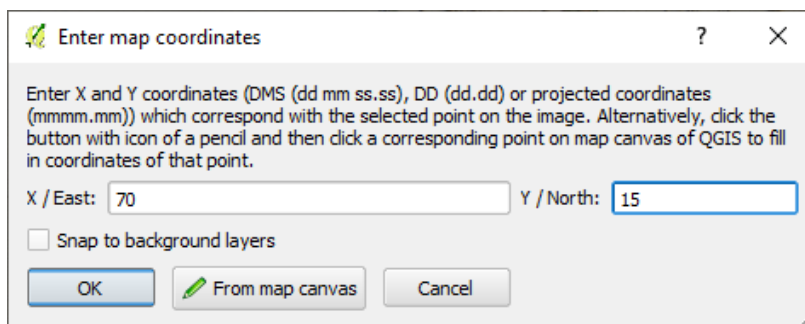
7. We will see the image will be loaded on the top section.



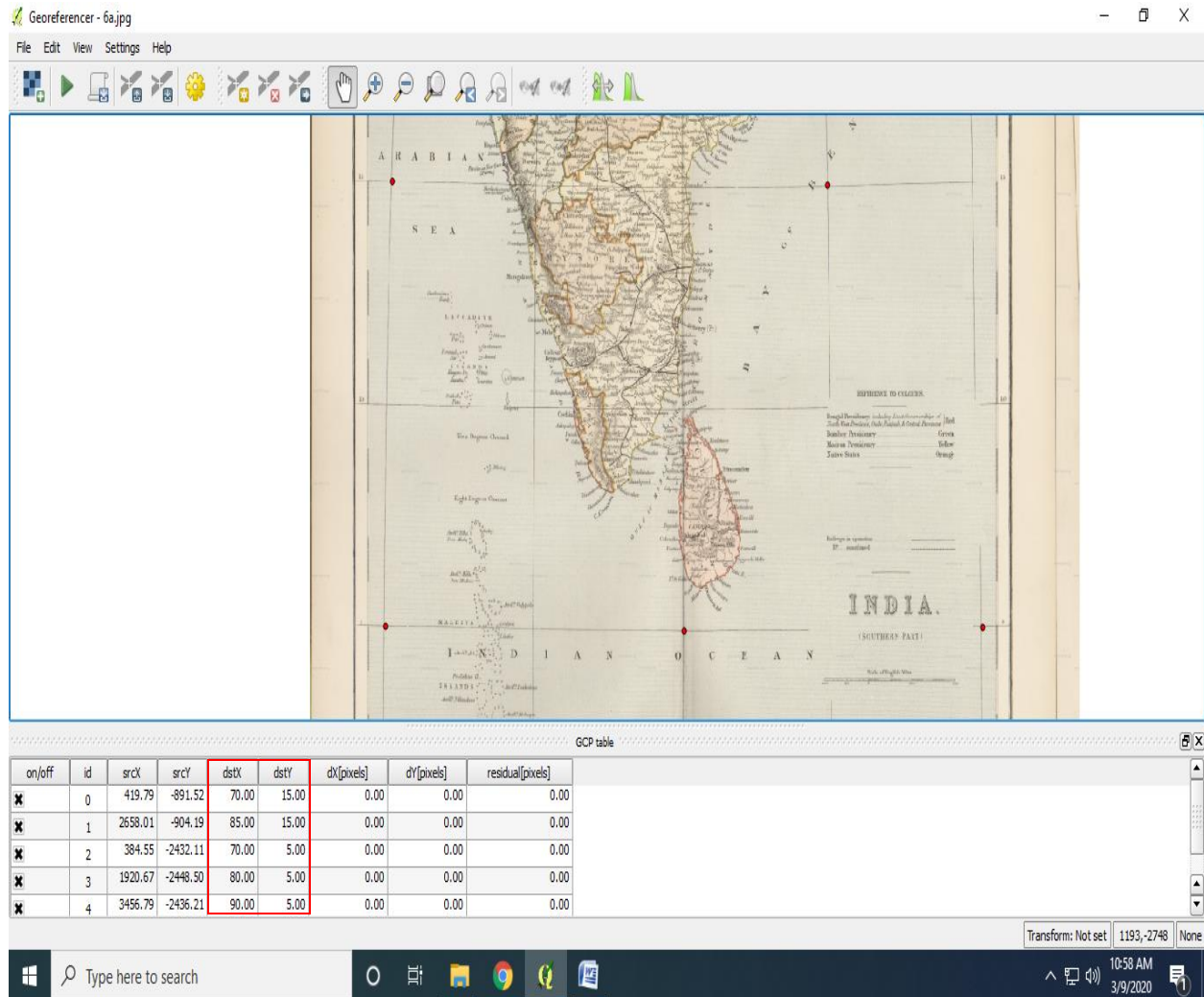
8. We can use the zoom/pan controls in the toolbar to learn more about the map.
9. Now we need to assign coordinates to some points on this map. If we look closely, we will see coordinate grid with markings. Using this grid, you can determine the X and Y coordinates of the points where the grids intersect.
10. Click on Add Point icon on the toolbar.



11. Mouse pointer will be converted into plus sign, keep that plus sign on the intersection of horizontal and vertical lines and enter coordinate values according to scanned map.

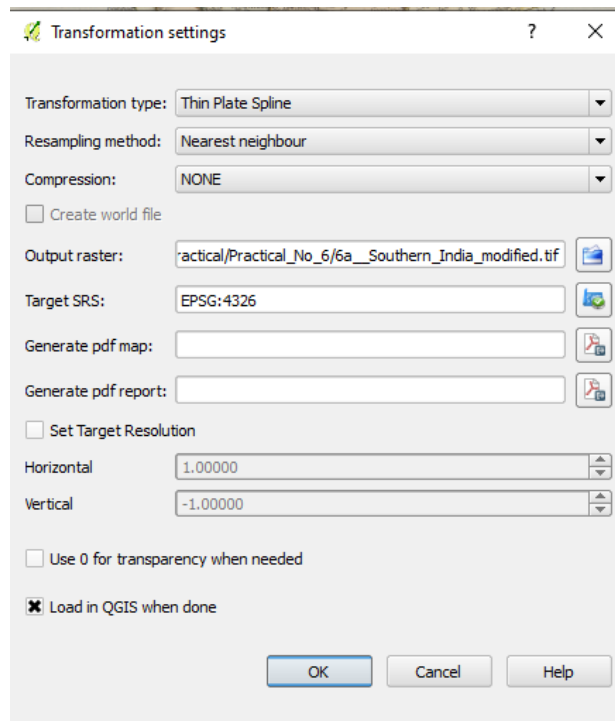


12. Similarly, add at least 4 GCPs as shown below as shown in figure below. The more points we have, the more accurate our image is registered to the target coordinates.
13. The GCP table now has a row with details of our GCP.

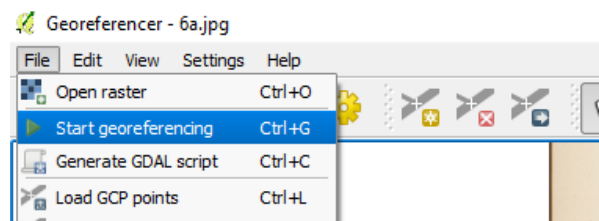


14. Once we have enough points, go to Settings → Transformation settings.

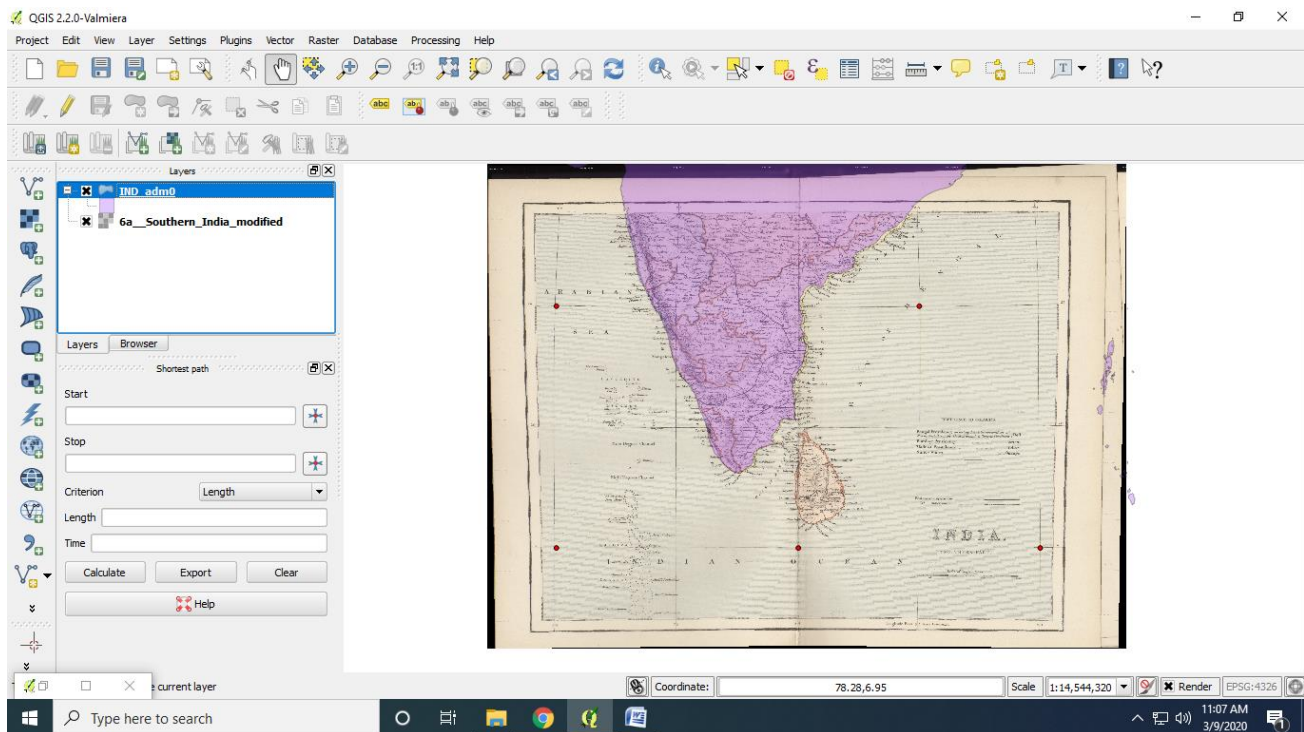
15. In the Transformation settings dialog, choose the Transformation type as "Thin Plate Spline". Select location and name for output raster. Choose EPSG:4326 as the target SRS so the resulting image is in a widely compatible datum. Make sure the Load in QGIS when done option is checked. Click OK.



16. In the Georeferencer window, go to File → Start georeferencing. This will start the process of warping the image using the GCPs and creating the target raster.

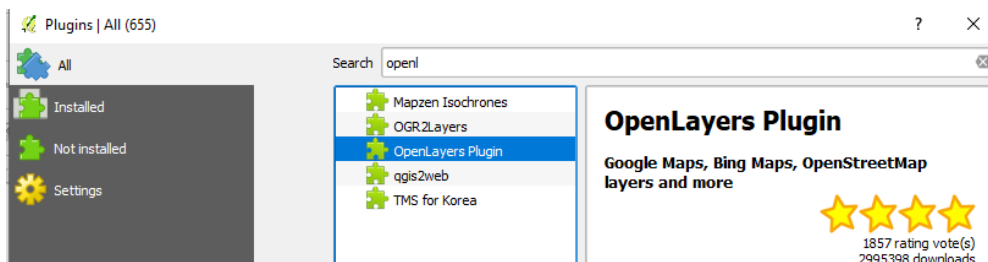


17. Once the process finishes, we will see the georeferenced layer loaded in QGIS.  
18. To verify georeferencing, load the country boundaries i.e. IND\_adm0 by clicking on add vector layer.



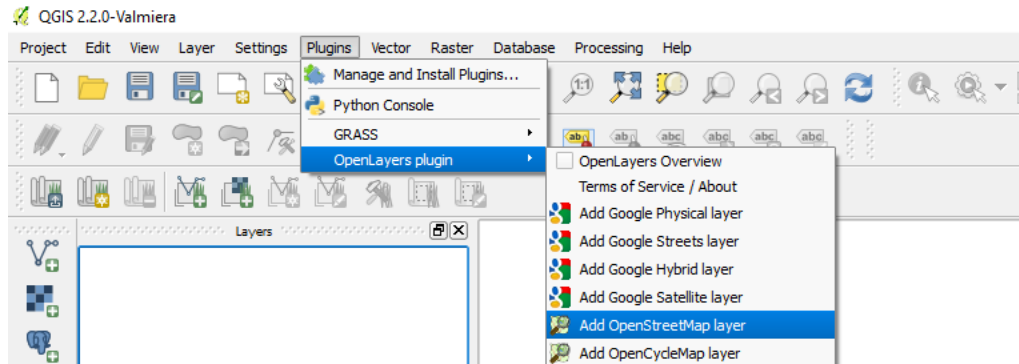
## B) Georeferencing Aerial Imagery

1. Install OpenLayers Plugin if it is not installed.

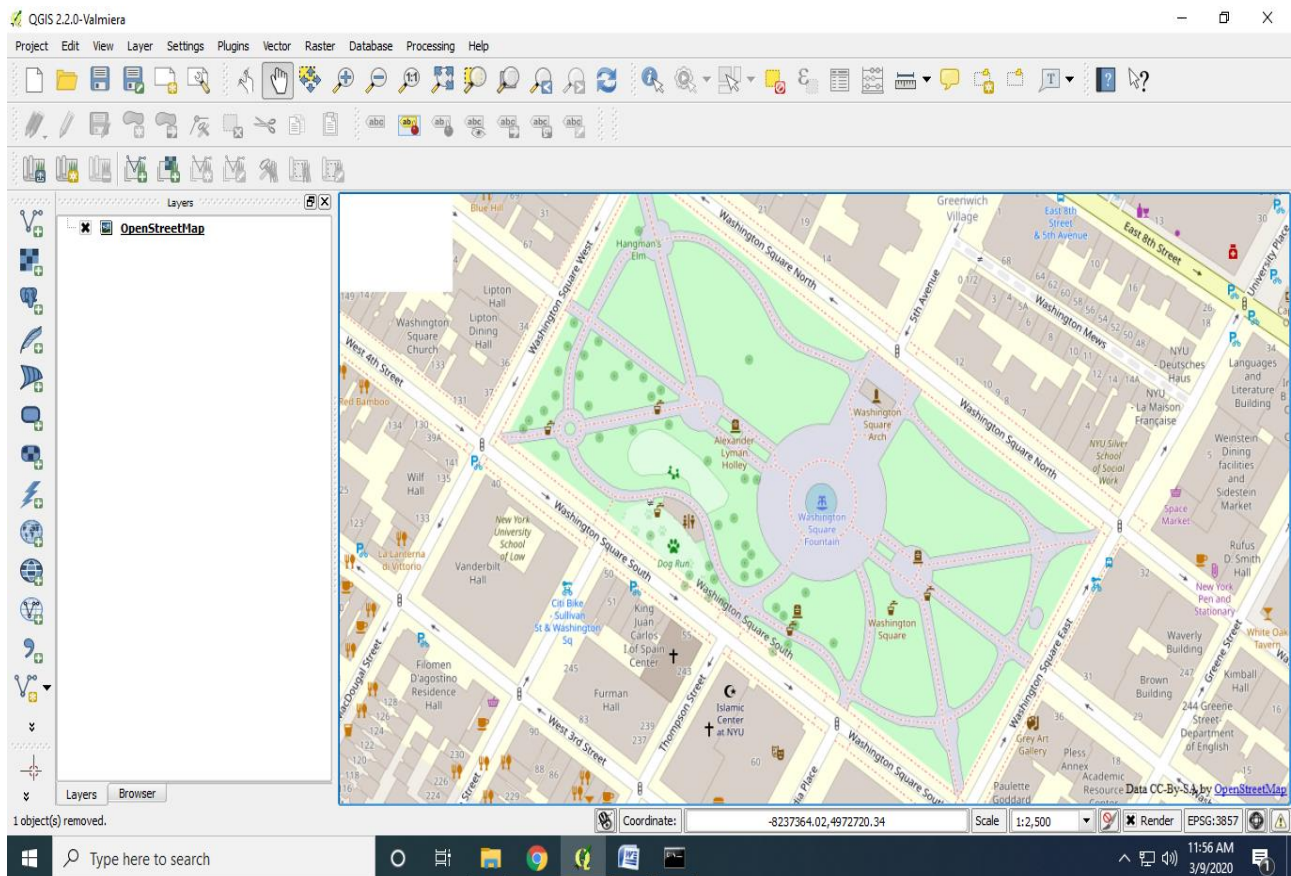


2. Click on Plugins → OpenLayers plugin → Add OpenStreetMap Layer.

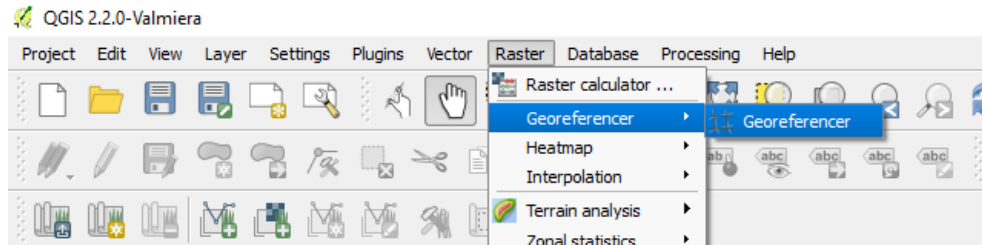




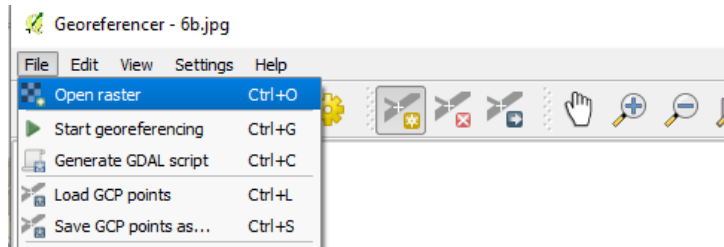
3. In coordinate field at bottom of the screen enter (-8237364,4972720) and scale as 1:2500 and press enter. Also set CRS value as EPSG:3857.



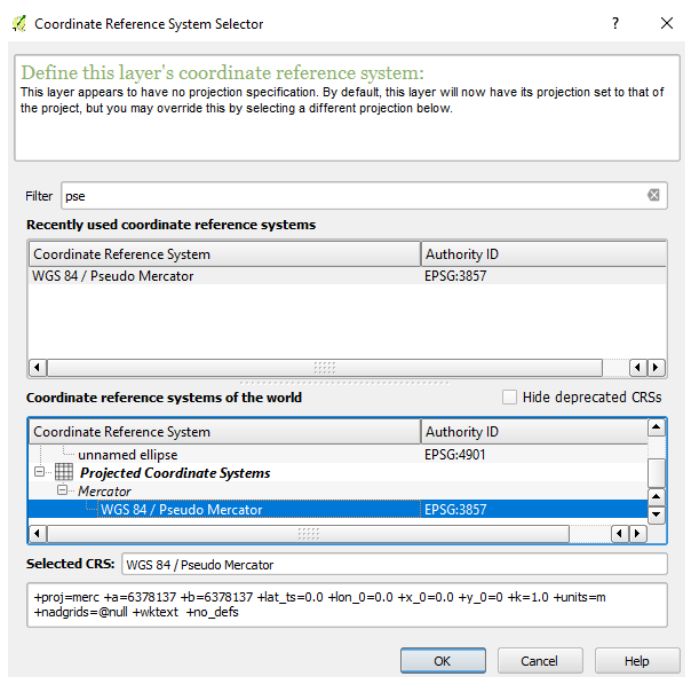
4. Click on Raster → Georeferencer → Georeferencer.



5. On georeferencer window click on File → Open raster open 6b.

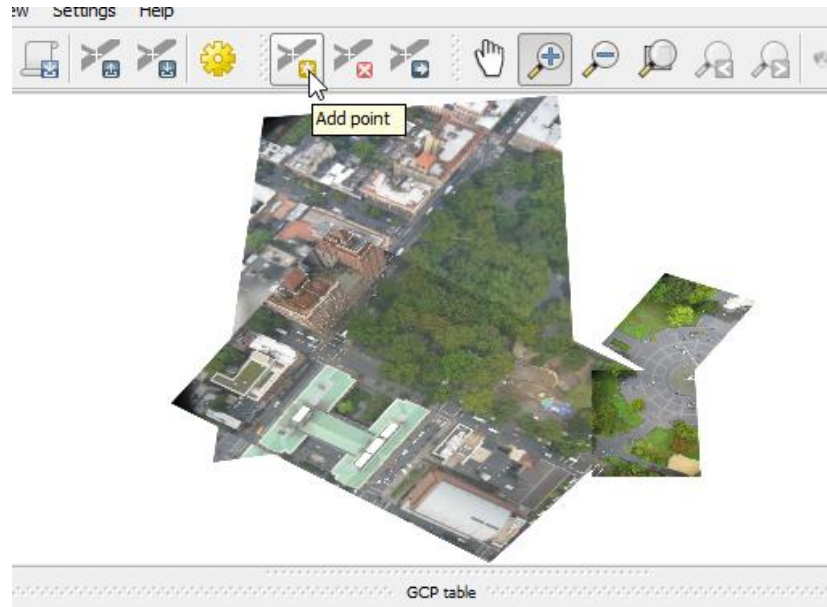


6. Set CRS as EPSG:3857 and click on OK.

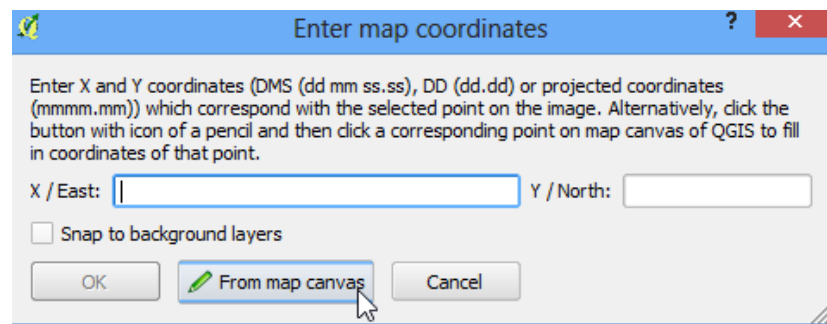


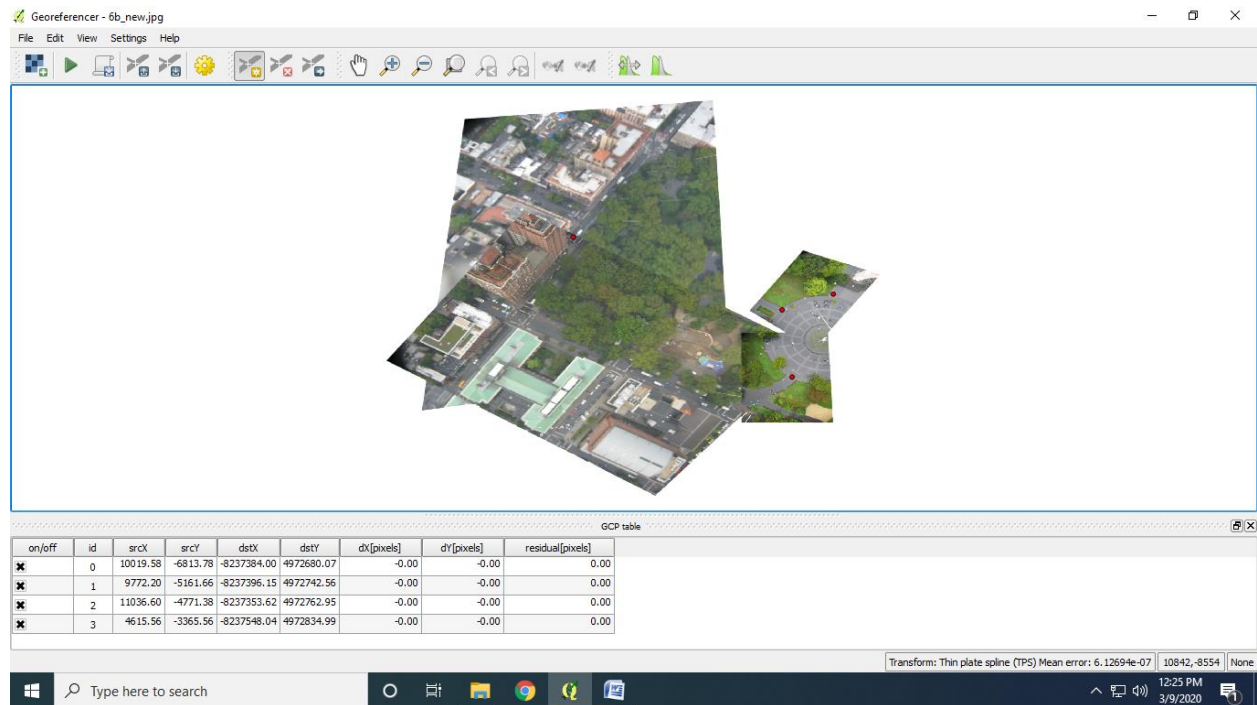


## 7. Click on Add point icon.

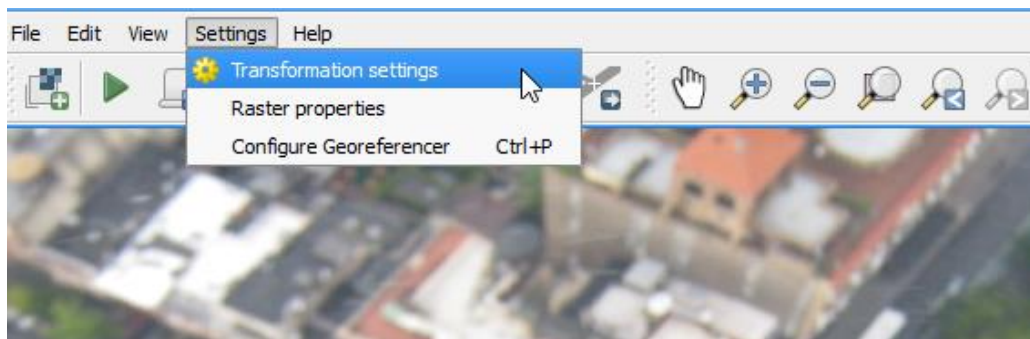


## 8. Mouse pointer is changed into plus sign, now click at any location on image a pop-up asking us to enter map coordinates. Click the button "From map canvas" and select appropriate point from streetmap (Refer below images for selecting 4 corresponding points on Aerial image and Streetmap from main QGIS window).





9. After selecting at least 4 points click on Settings → Transformation settings.



10. In the Transformation settings dialog, choose the Transformation type as "Thin Plate Spline". Select location and name for output raster. Choose EPSG:3857 as the target SRS. Make sure the Load in QGIS when done option is checked. Click OK.

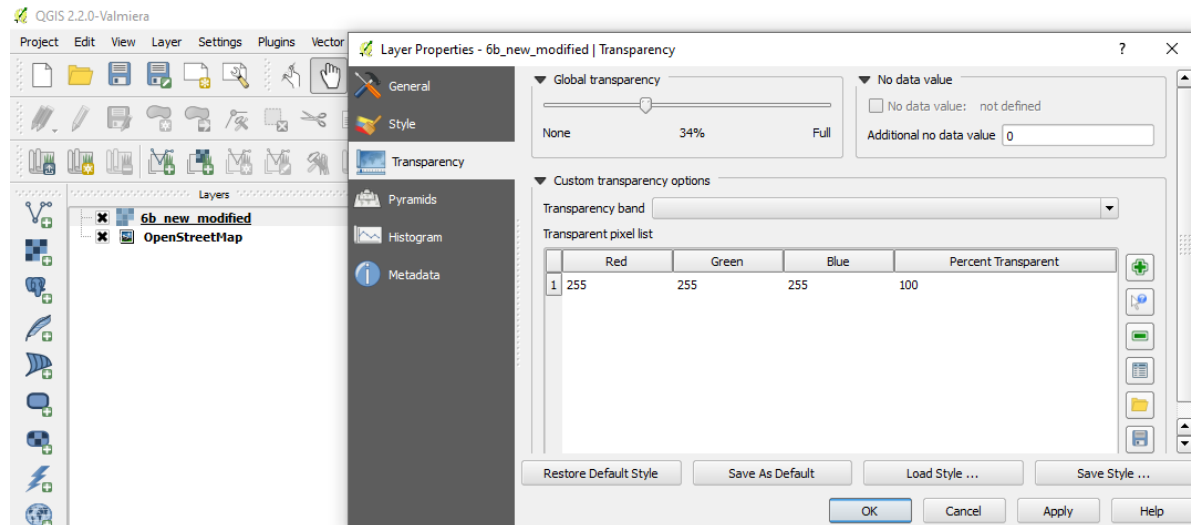
11. On Georeferencer window, go to File → Start georeferencing.

12. The layer is added to main GIS window.

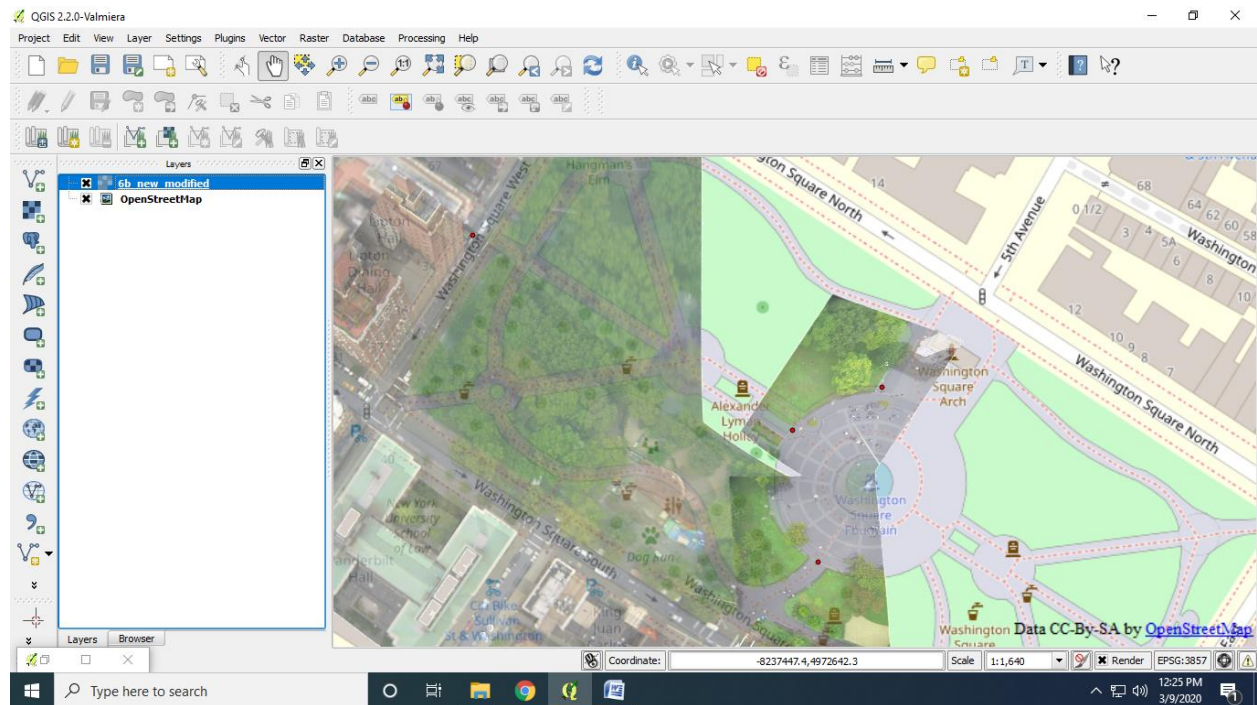


13. Open property window of newly added layer (double click on it from layer pane).

14. Click on Transparency tab. We want to indicate that any black or white pixels in the image are no-data values and should be made transparent. Input "0" as the No data value. Also, in the Custom transparency options, click on the "+" button and add 255 as the transparent pixels for each band and enter 100 as the Percent transparent. Click OK. It require we can change global transparency also.

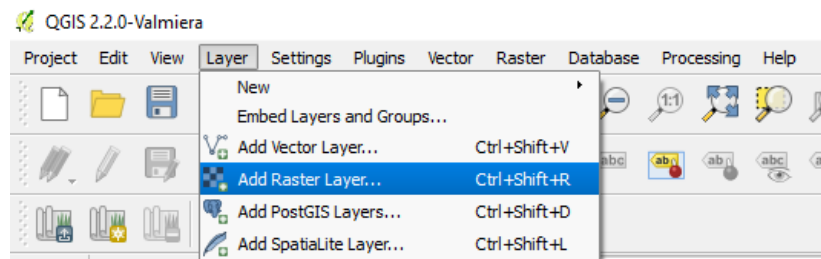


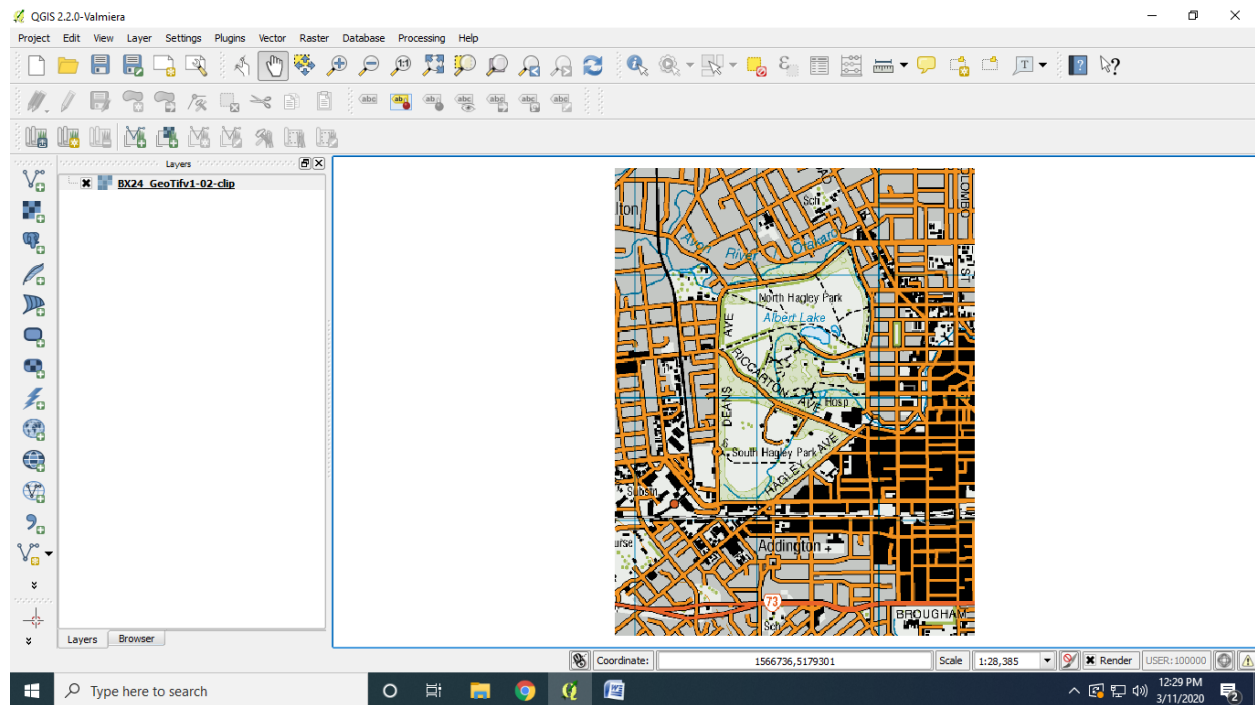
15. Now we will see our georeferenced image nicely overlaid on the base layer.



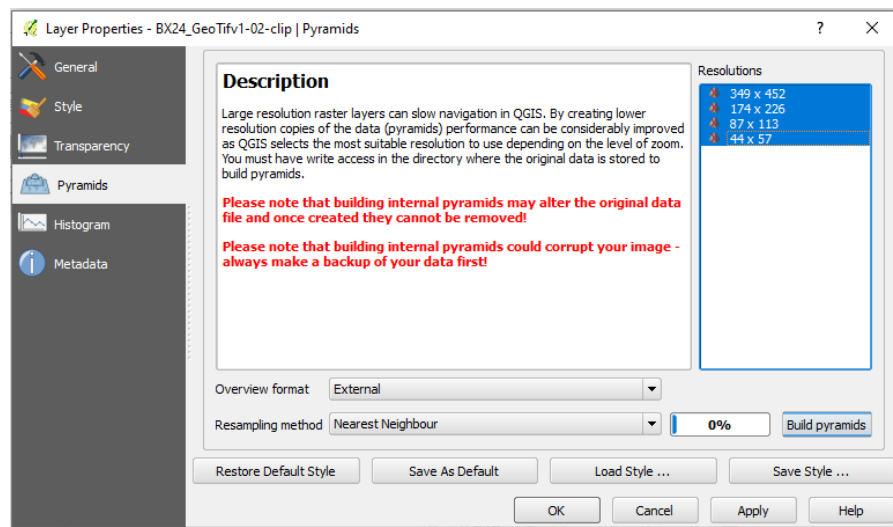
### C) Digitizing Map Data

1. Add raster layer and select BX24\_GeoTifv1-02-clip.tif.



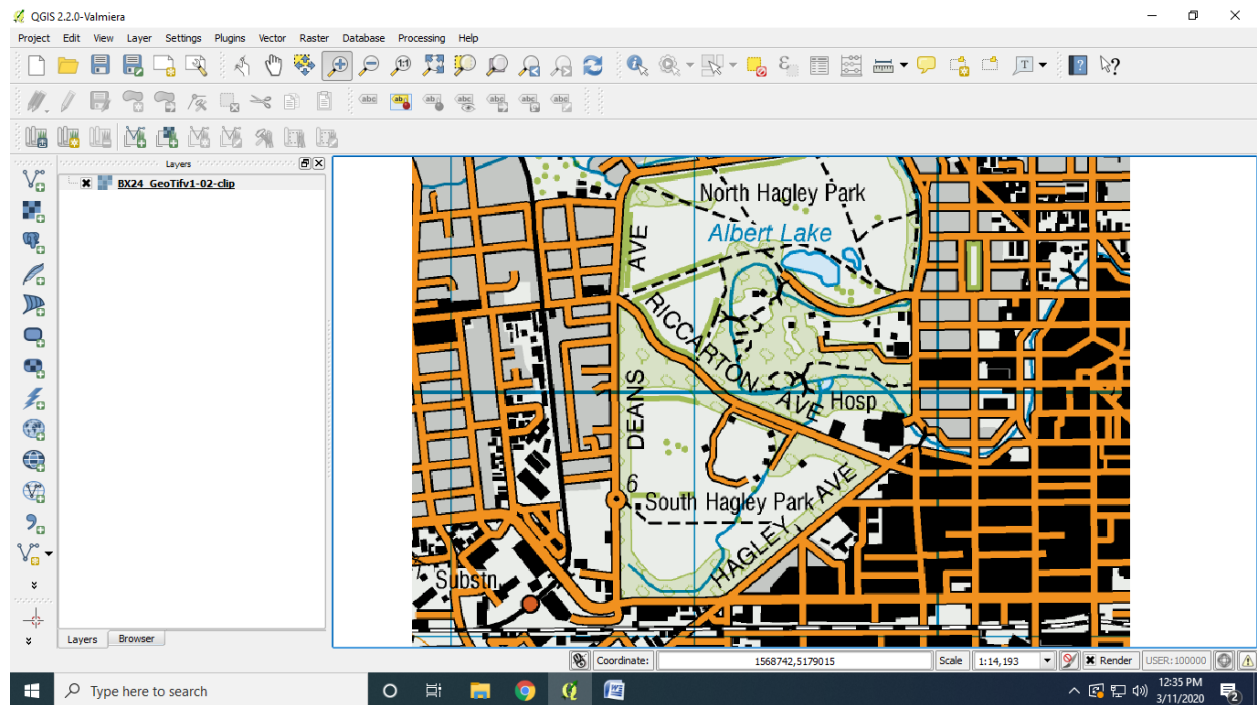


2. Open property window by double clicking on layer from layer pane. Click on Pyramids tab and select all the available resolution then click on Build pyramids button. (Optional Step).

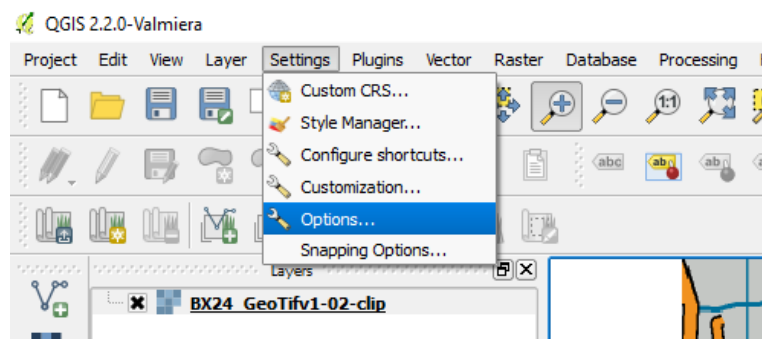


3. Zoom In the image as shown below.



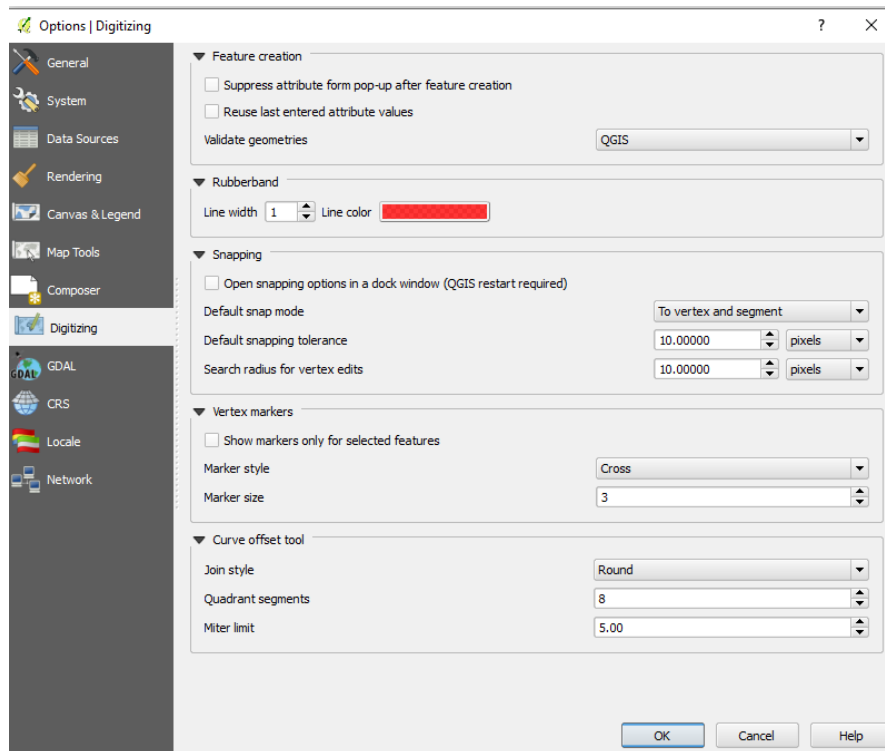


#### 4. Click on Settings → Options...



5. Click on the Digitizing tab in the Options dialog. Set the Default snap mode to "To vertex and segment" ; So that it will snap to the nearest vertex or line segment. Set the Default snapping tolerance and Search radius for vertex edits in "pixels" instead of map units. This will ensure that the snapping distance remains constant independent of zoom level. Depending on our computer screen resolution, we may choose an **appropriate value**. Click on OK.

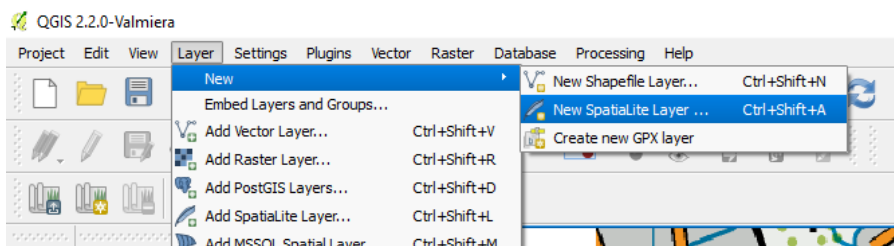




6. Now we are ready for digitization.

7. We will first create a roads layer and digitize the roads around the park area. Select Layer → New → New Spatialite Layer....

8. Spatialite is an open database format similar to ESRI's geodatabase format. Spatialite database is contained within a single file on our hard drive and can contain different types of spatial (point, line, polygon) as well as non-spatial layers. This makes it much easier to move it around instead of a bunch of shapefiles. We are creating a couple of polygon layers and a line layer, so a Spatialite database will be better suited.

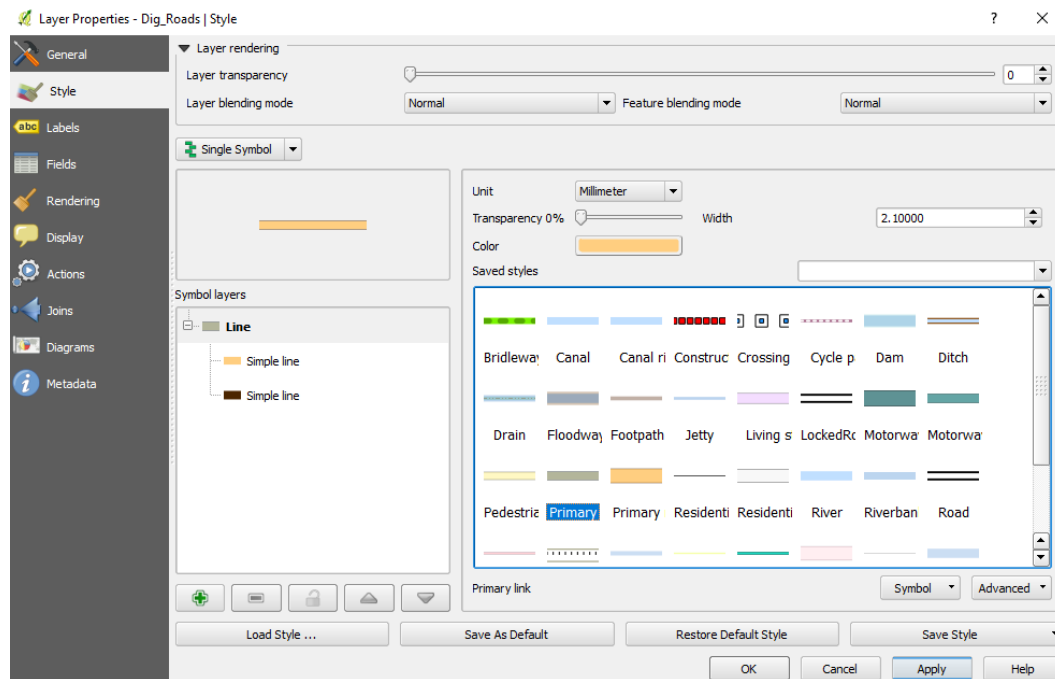


9. Create new database by clicking on ... button. Enter name of layer, select Type as Line, check "Create an auto incrementing primary key". Add attribute Name and click on Add to attributes list button, similarly if require we can add Class attribute. Then click on OK.

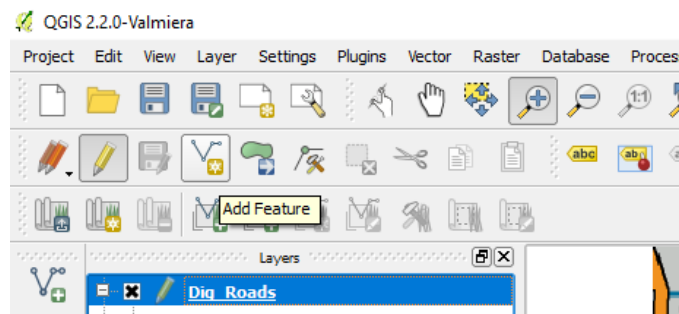
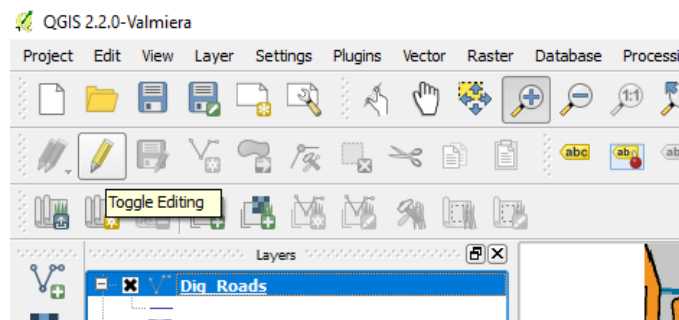
The screenshot shows the 'New Spatialite Layer' dialog box. The 'Database' field is set to 'C:/Users/User/Desktop/GIS\_Practical/Practical\_No\_6/6c.sqlite'. The 'Layer name' field is 'Dig\_Roads'. The 'Geometry column' is 'geometry'. The 'Type' section has 'Line' selected. The 'CRS' is 'EPSG:2193 - NZGD2000 / New Zealand Transverse Mercator 2000'. The 'Create an autoincrementing primary key' checkbox is checked. The 'New attribute' section has 'Name' as the attribute name and 'Text data' as the type. The 'Attributes list' table shows two attributes: 'Name' (text) and 'Class' (text).

Name	Type
Name	text
Class	text

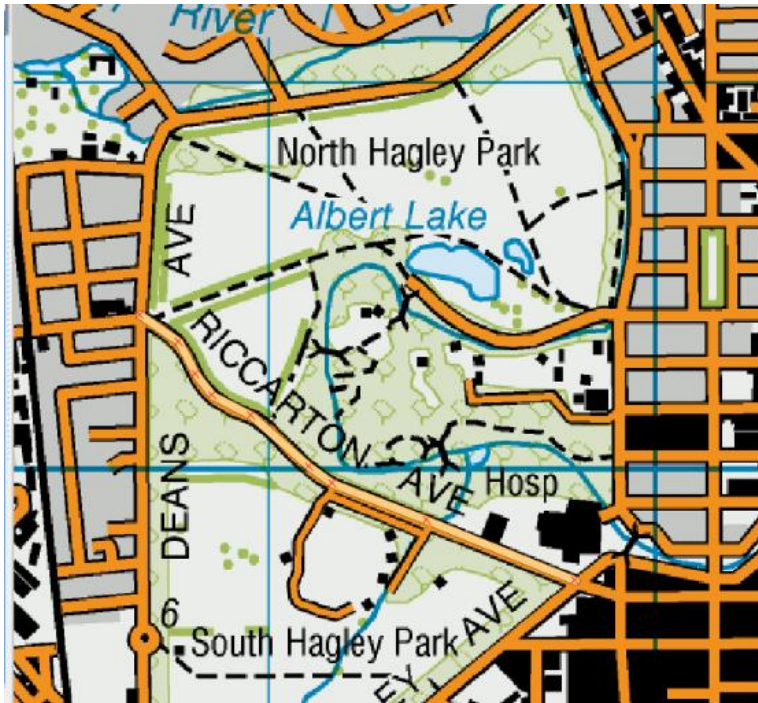
10. Open property window of this layer and select Style tab. Choose a thicker line style such as Primary from the predefined styles and then Click OK.



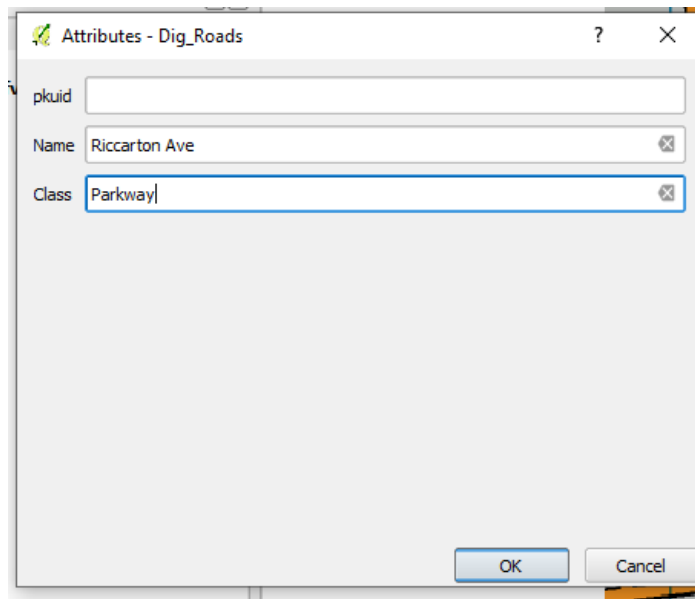
11. Select newly created layer from layer pane, click on Toggle Editing icon and then click on Add feature icon



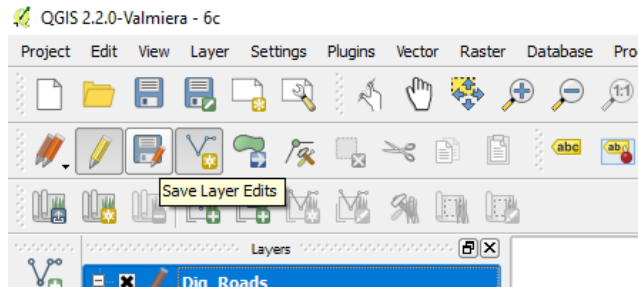
12. Select some points on images as shown and as done with one road right click at the end a new window will open.



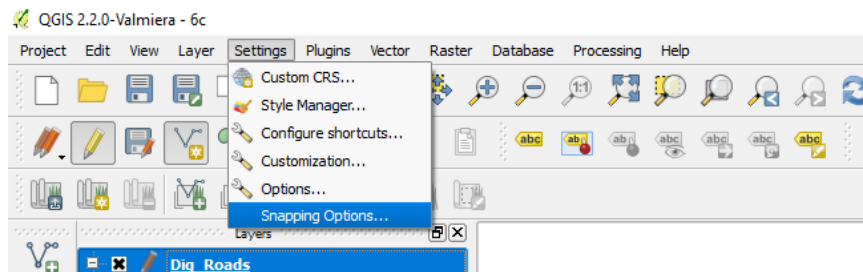
13. Enter Name and class for road and click on OK.



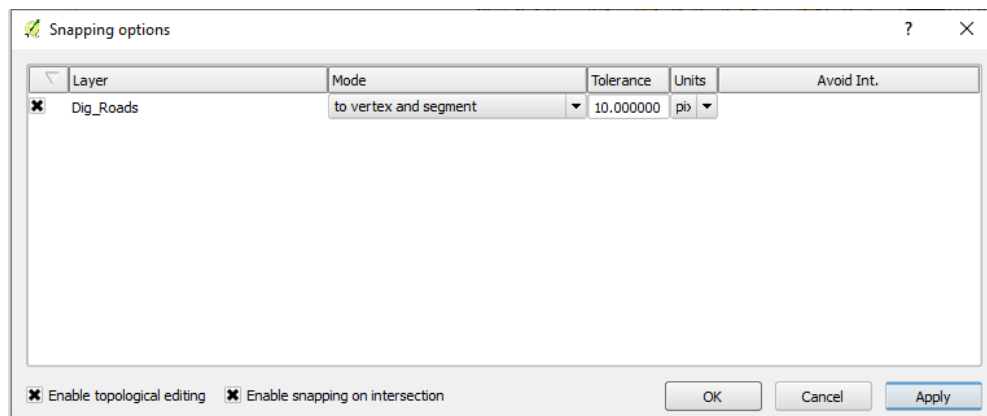
14. Click on Save layer edits icon.



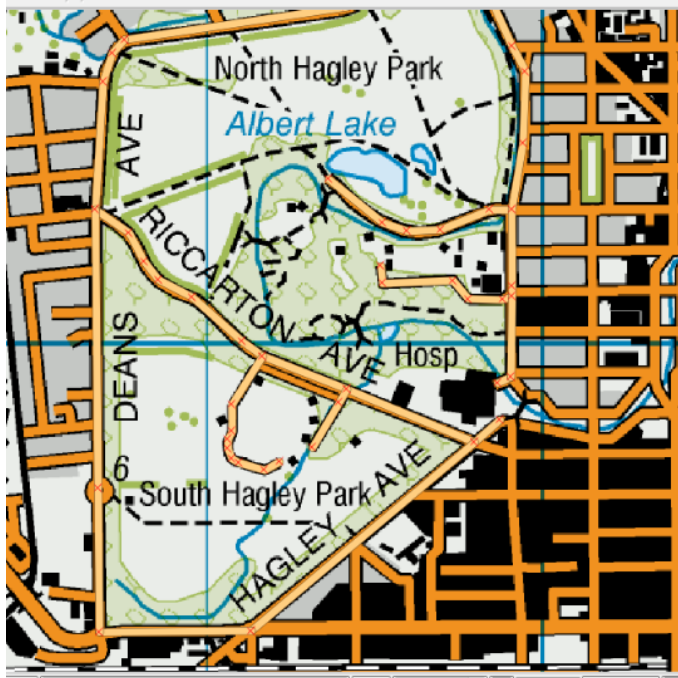
15. Click on Settings → Snapping Options..



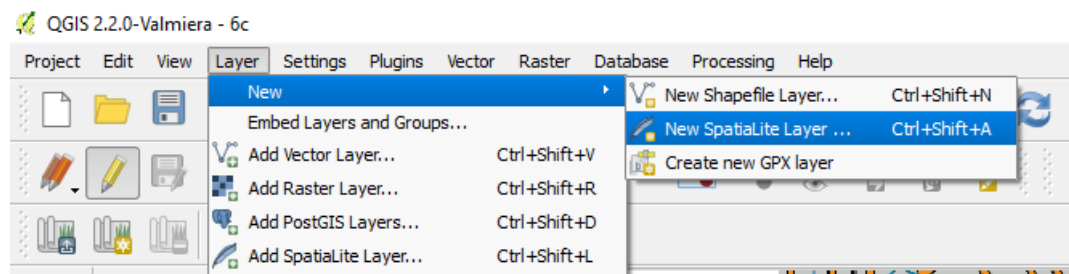
16. In the Snapping Options dialog, check the Enable topological editing. This option will ensure that the common boundaries are maintained correctly in polygon layers. Also check the Enable snapping on intersection which allows us to snap on an intersection of a background layer then click on Apply and Ok button.



17. To add some more roads repeat step number 11, 12, 13 and 14. And create structure as shown below.

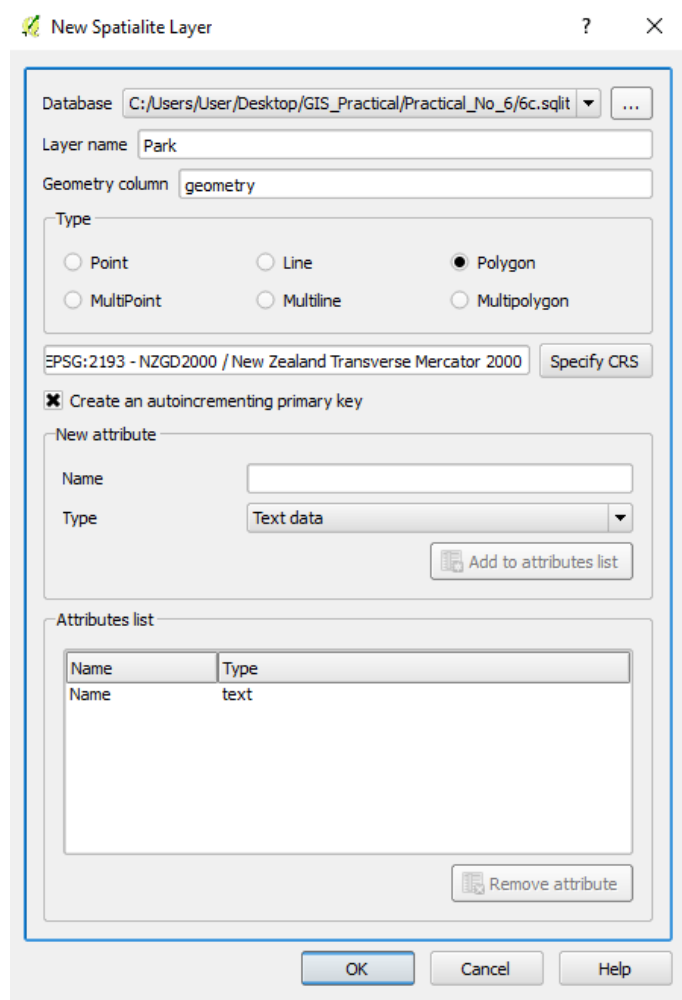


18. To add one more layer for Park again click on Layer → New → New Spatialite Layer...

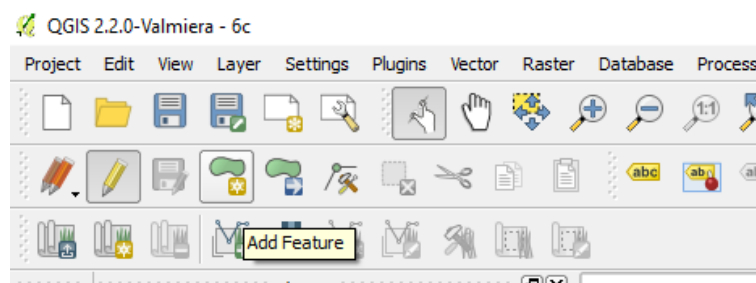


19. Select the same database which we have created earlier. Enter name of layer, select type as Polygon, check "Create an auto incrementing primary key". Add attribute Name and click on Add to attributes list button. Then click on OK.

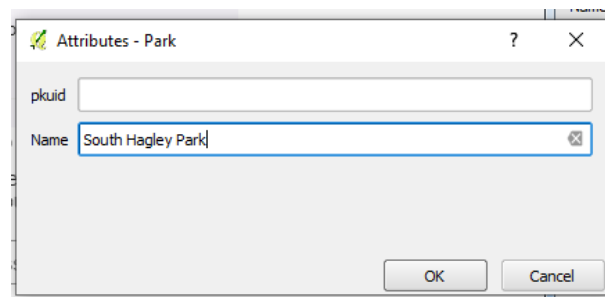
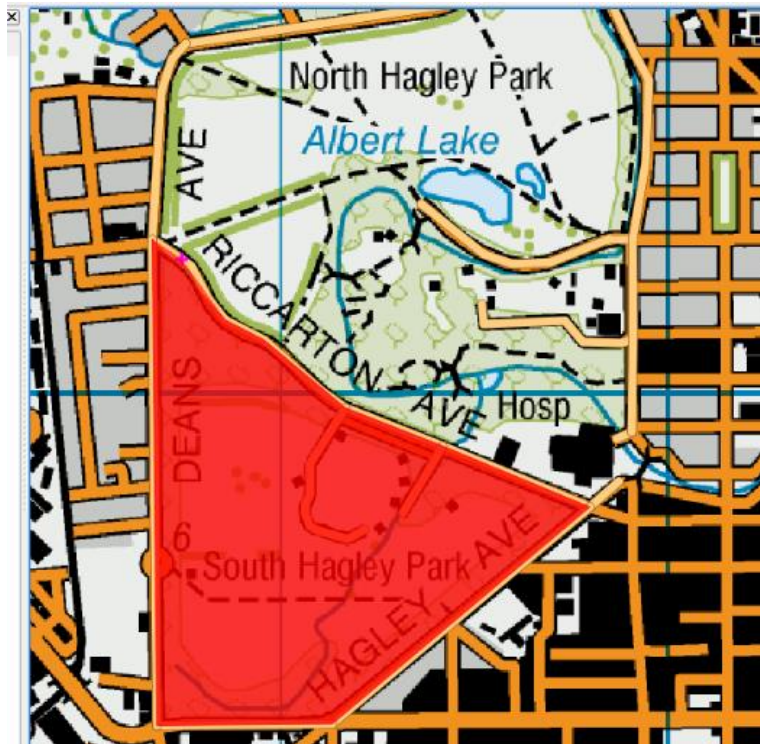




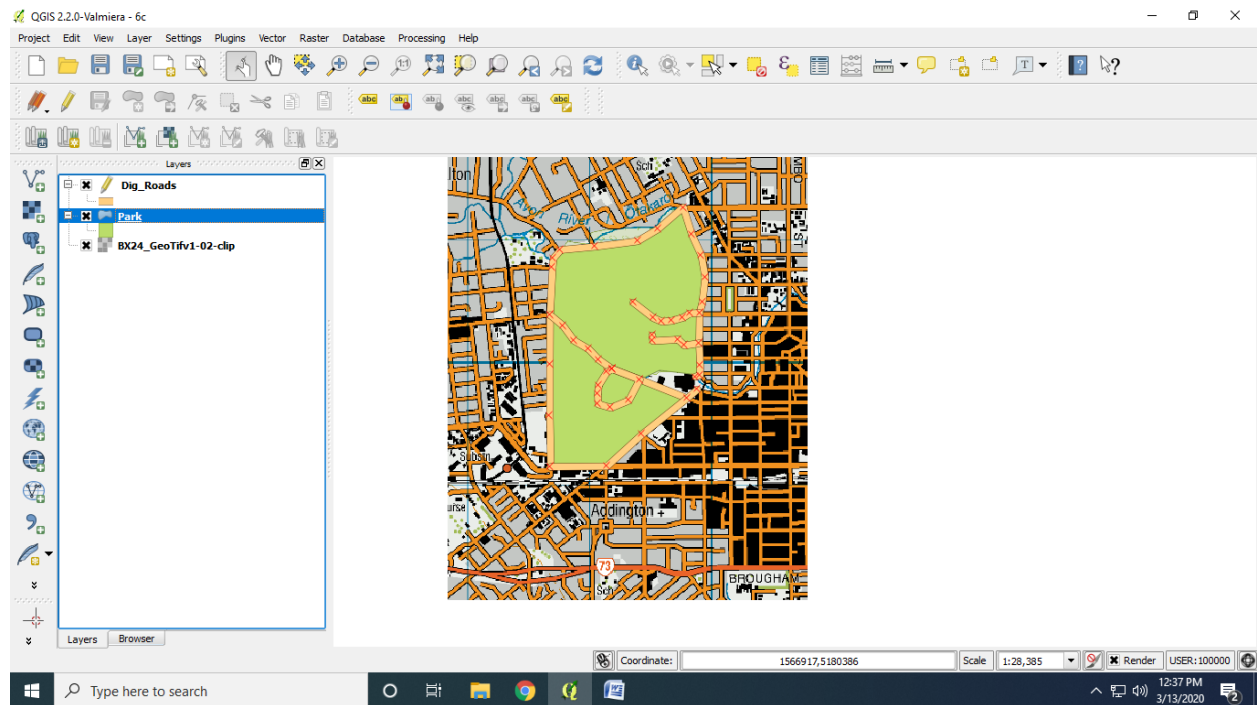
20. Click on Edit toggle button and then Add feature.



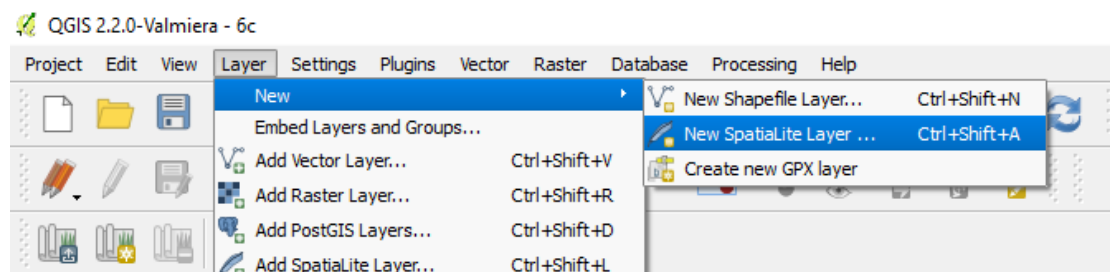
21. Create a polygon for park and at the end right click to open attributes window then enter name for park area.

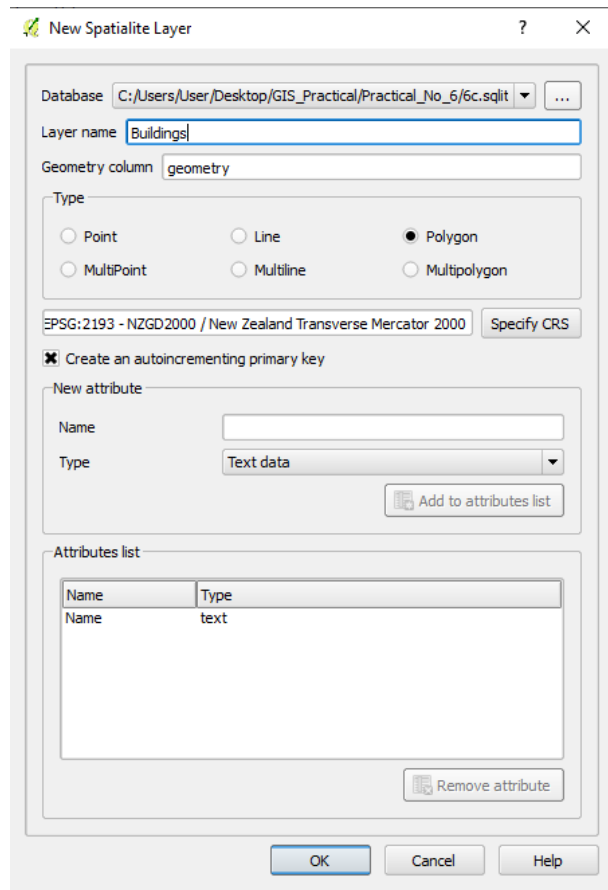


22. Create a structure as shown below. Place Road layer above the Park layer from layer pane.

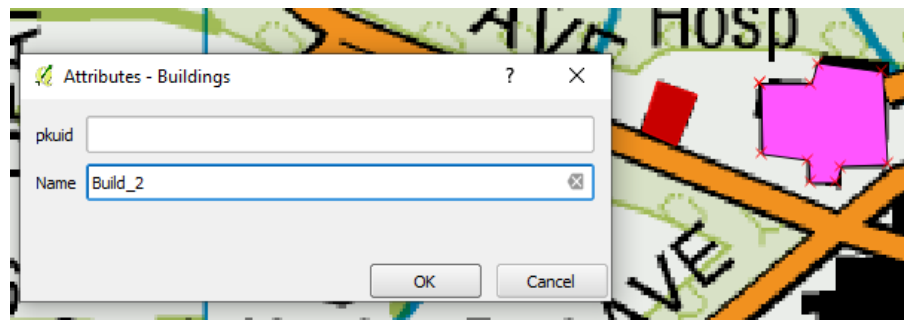


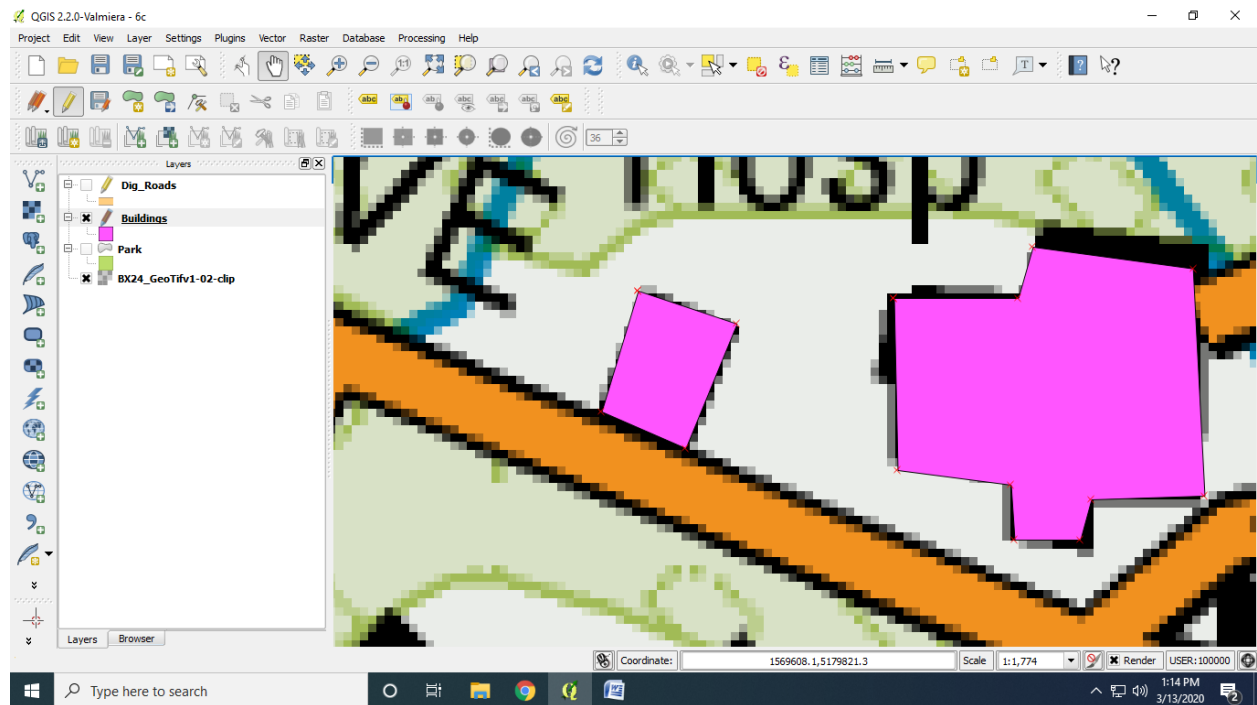
### 23. Create new polygon layer for Buildings.



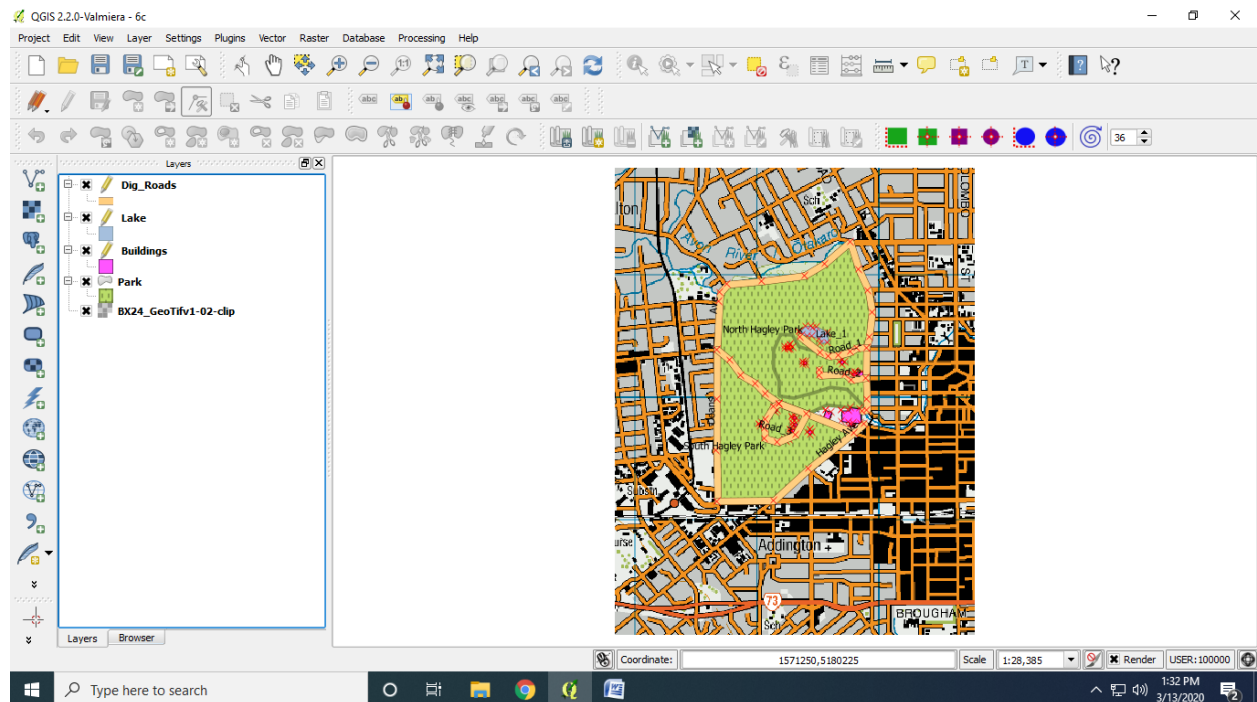


24. For accurate digitization zoom in the image and create polygon for building when done right click to open attributes window enter name of building, similarly add some more buildings based on base layer.





25. If require we can change property of any layer.



26. Uncheck base layer from layer pane. Digitizing map is done. To display label on each object open property window for any one layer at a time, select Labels tab and check Label this layer with and from the dropdown select Name. Click on Apply and ok button.

