PRACTICAL - 1

B. AIM : - Creating and Managing Vector Data:

a) Adding vector layer

b) Setting properties

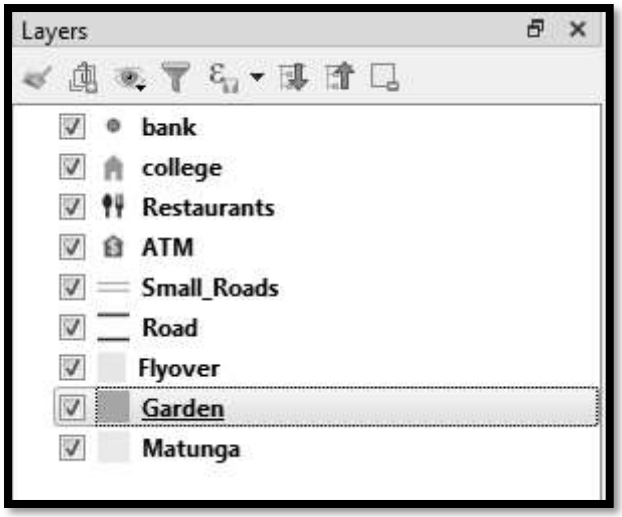
c) Vector Layer Formatting

Procedure:

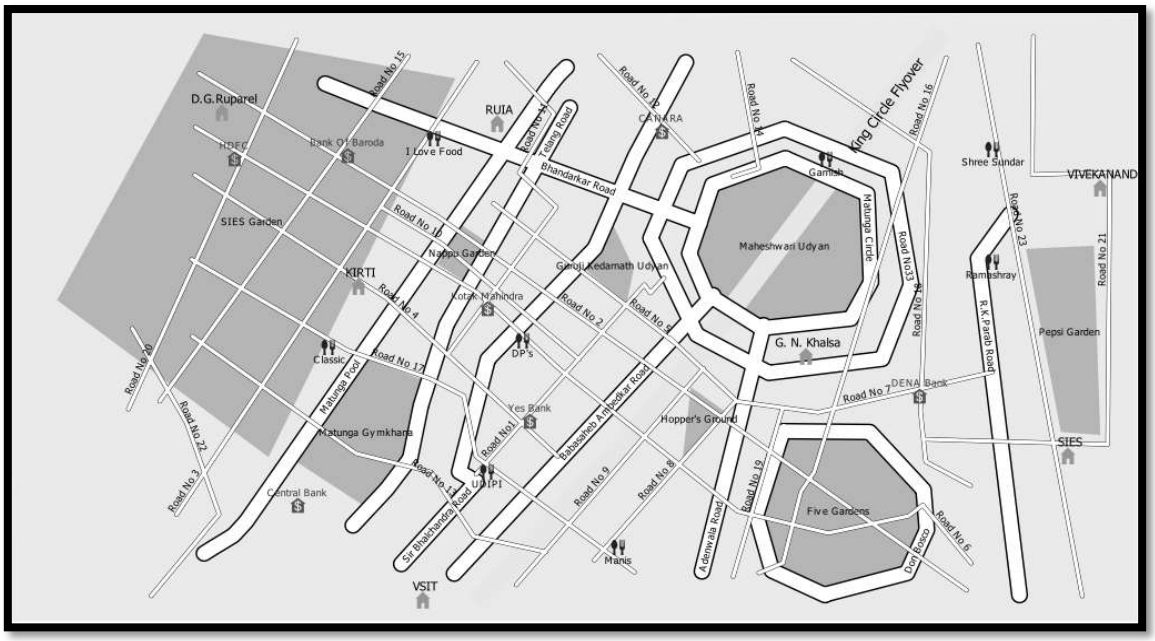
a. Adding vector layers (Polygon, Line, Points)

- Polygon layers (We have taken **2** layers Matunga, Garden)
- Line layers (We have taken **3** layers Small_Roads, Road, Flyover)
- Point layers (We have taken **4** layers bank,college,Restaurants,ATM)

b. Setting properties (Labeling, Symbolism)

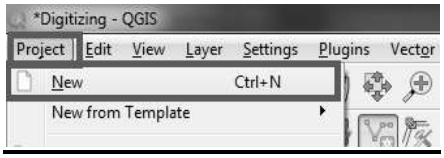


- **Our aim is to create map representing a location and its surrounding as follows:**

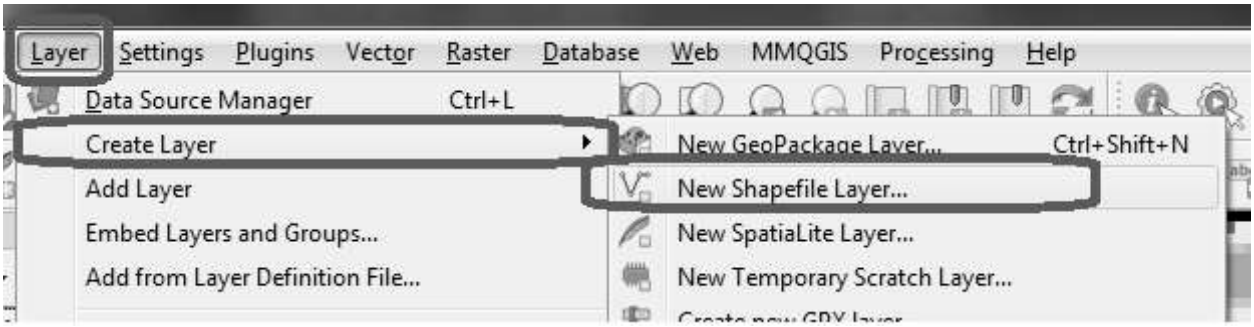


a) Creating Polygon vector layer

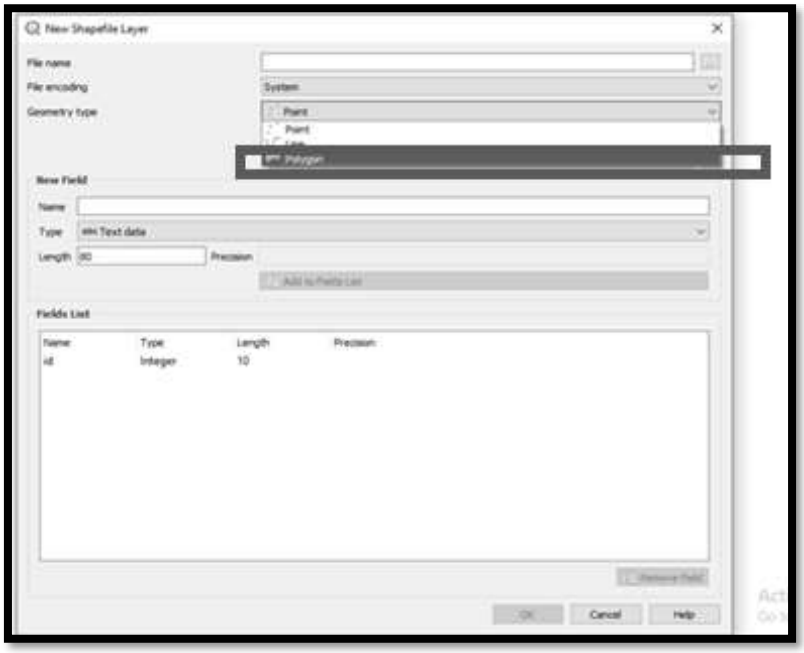
- Select **Project→New**



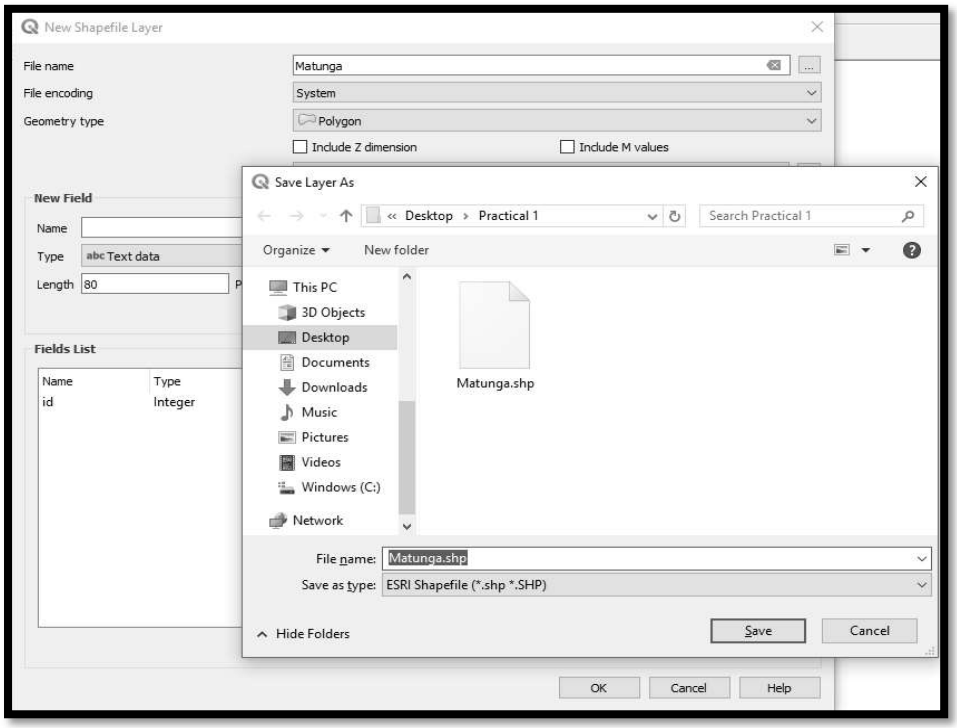
- Select **Layer→Create Layer→New Shapefile Layer**



- Following dialog box will appear on the screen. Select Polygon option from Geometry type.



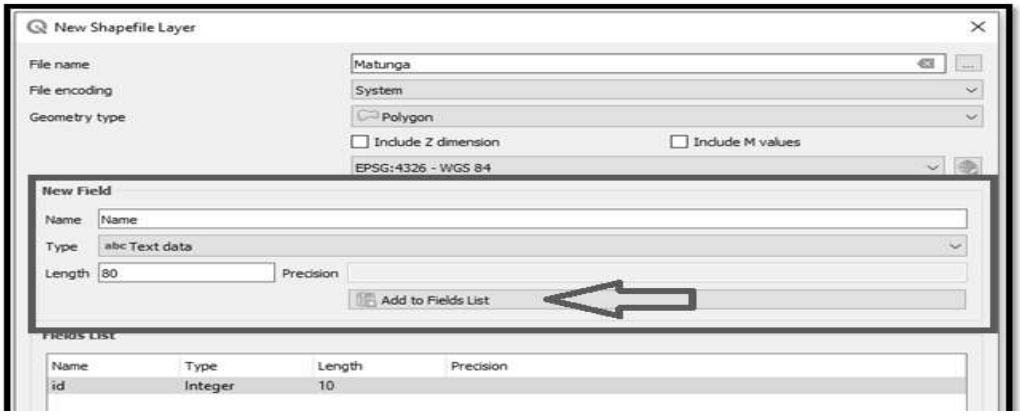
- Fill the appropriate information in each text box.
  - File name :
    - By default the file will be saved in bin folder.
    - To avoid it click on following button to change the location of file.



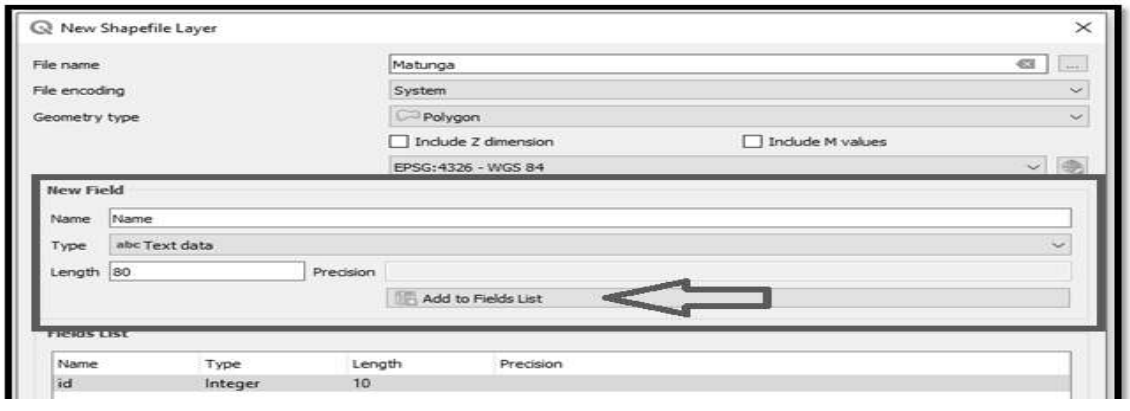
- **Field Panel**
  - Add the **Attribute** you want to show. (**Column Name** for Table)

b. Specify **Type (DataType:**Text Data/Decimal Data/Whole Number/Date**)** of Attribute

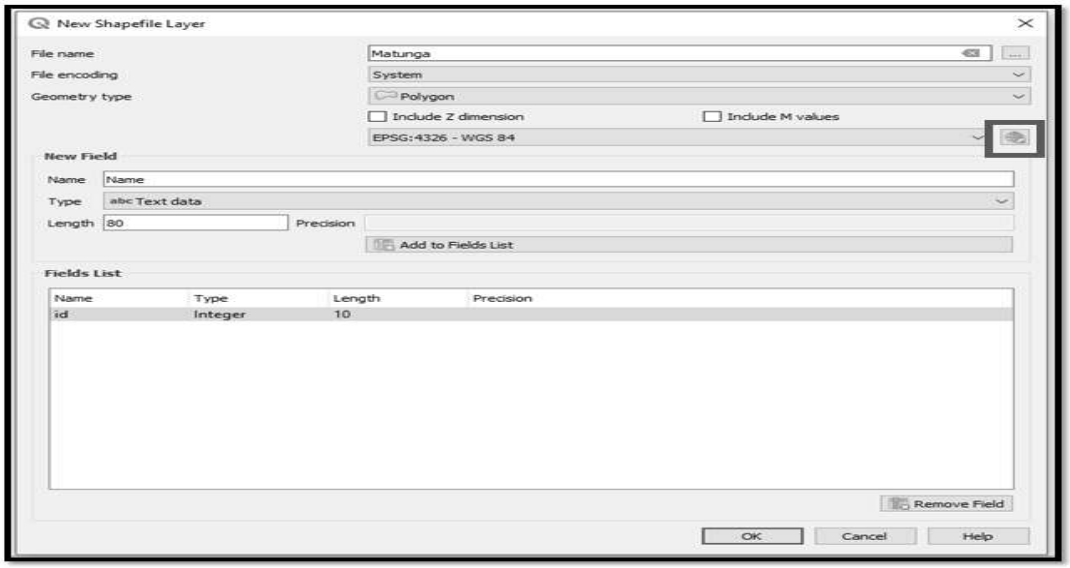
c. Specify the **Length** of the Attribute. Specify **Precision** (If **Data Type** is **Decimal**)



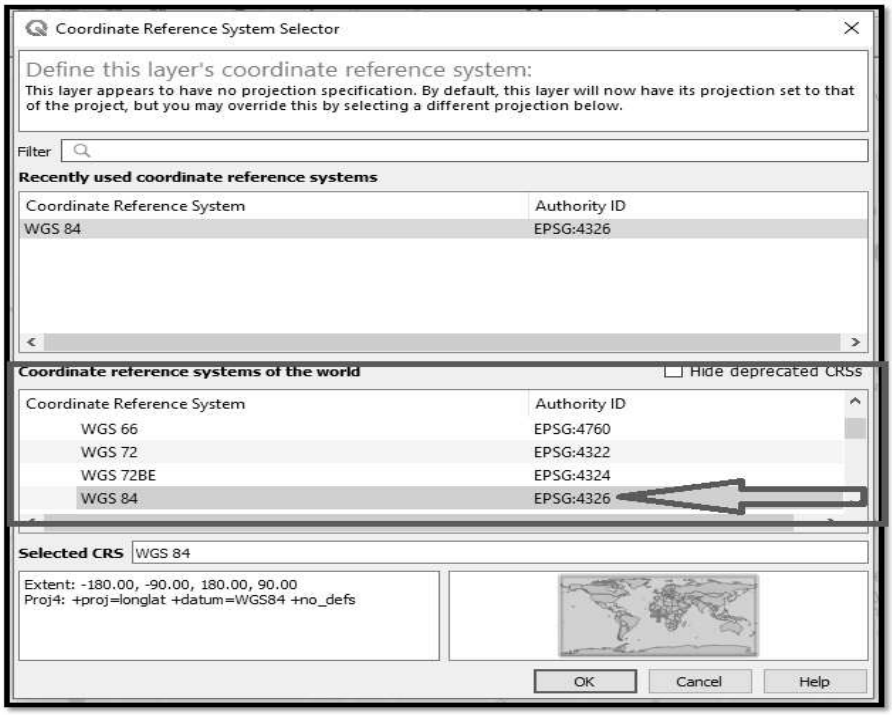
- Click on **Add to Field List** Button**.**
- You can add as many **fields (Column Name)** as you want for the layer.



- Select Geometry Type as follows
  - Click on the following button

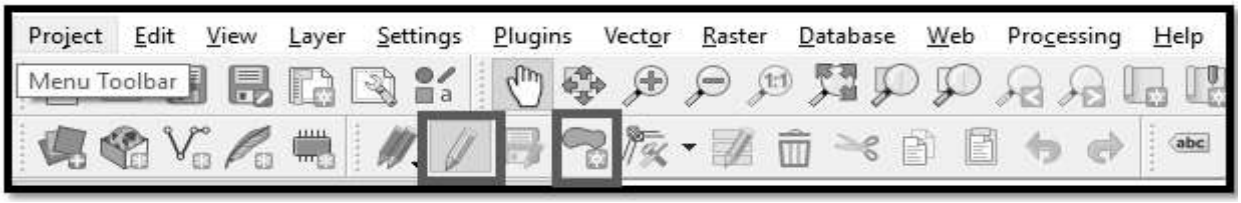


- The CRS dialog box will appear on screen. Click on the WGS84 option and it will be selected as follows. click on **OK**

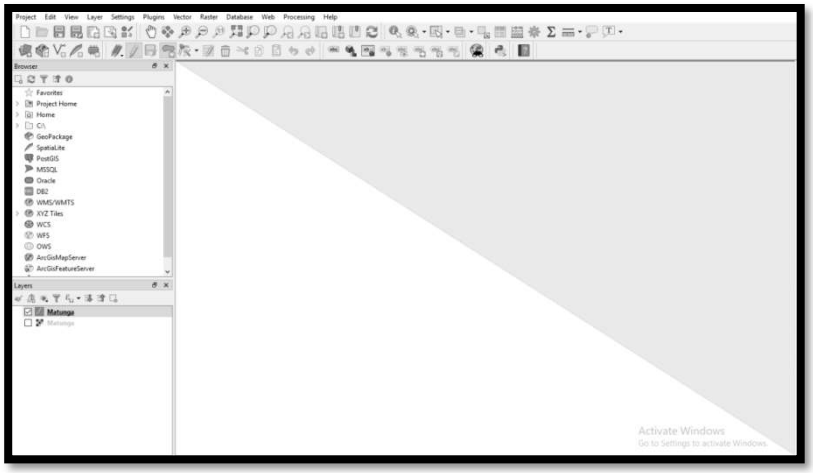


a) Follow the steps to plot **Polygon features.**

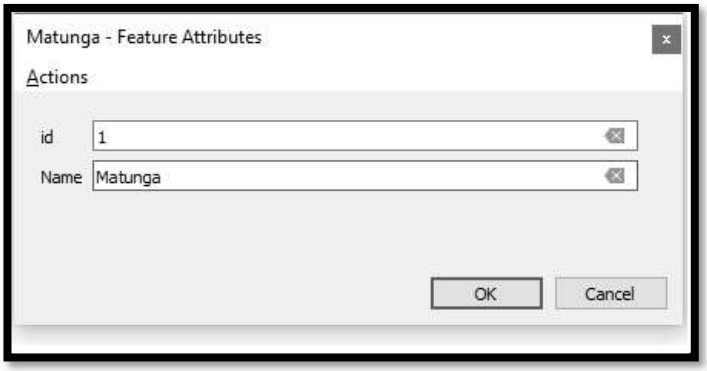
- Select the **Polygon Feature(** In our case it is **Matunga** for **background)** from layer panel



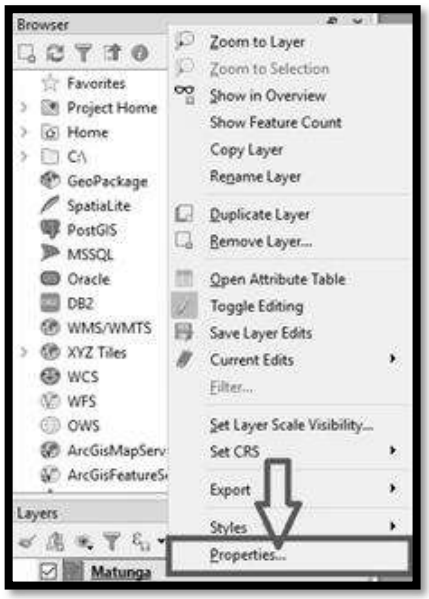
- Click **Toggle Editing Button**  → Click on **Add Polygon**  →Now place the cursor at the location where you want to place the polygon. for **polygon** layer **minimum 3 points** should be selected



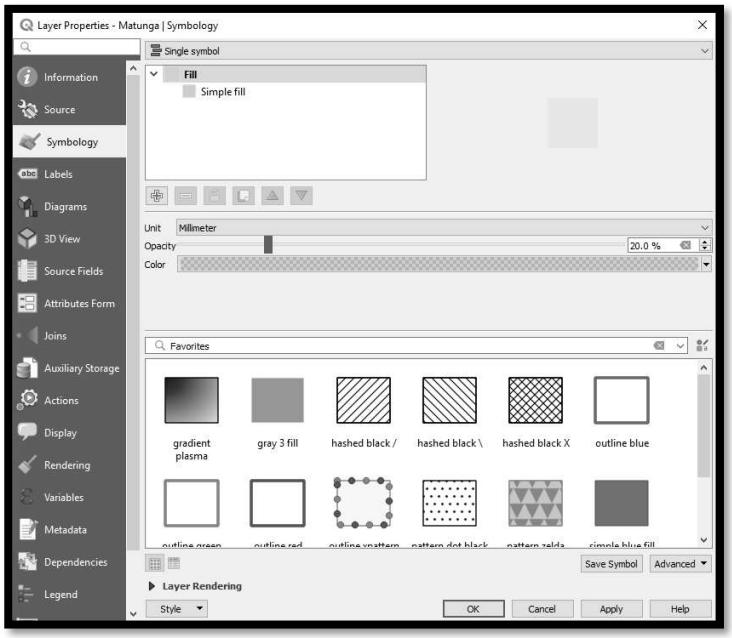
- Save the newly added polygon as follows.



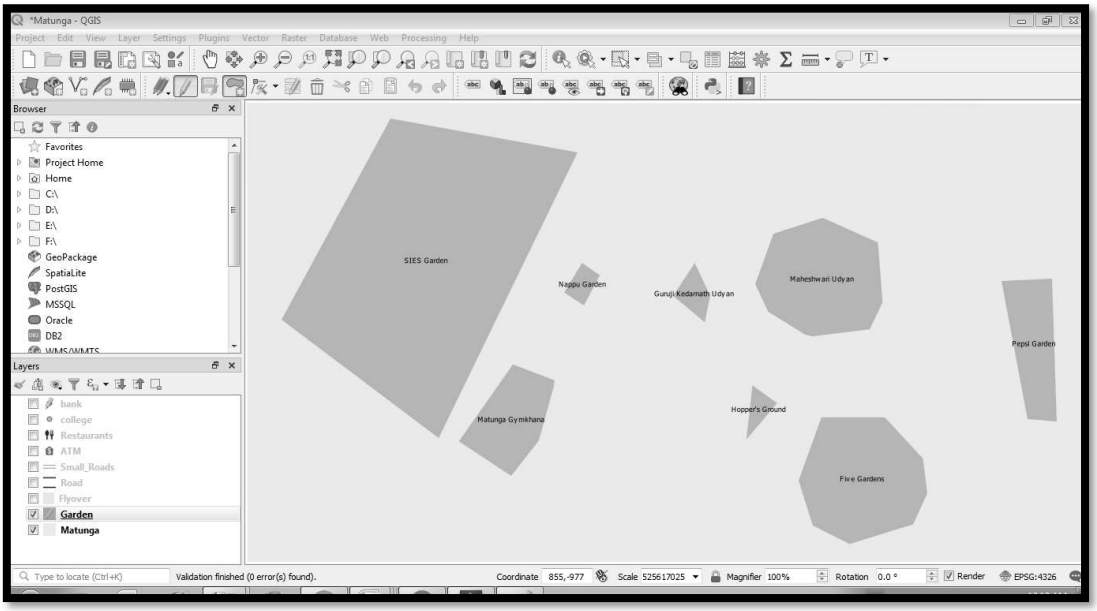
- Set **style** for polygon by using property window(**Right click** on Matunga Layer)



- Following screen will appear on the screen. Select **pattern** as you want and **click** on **OK**.

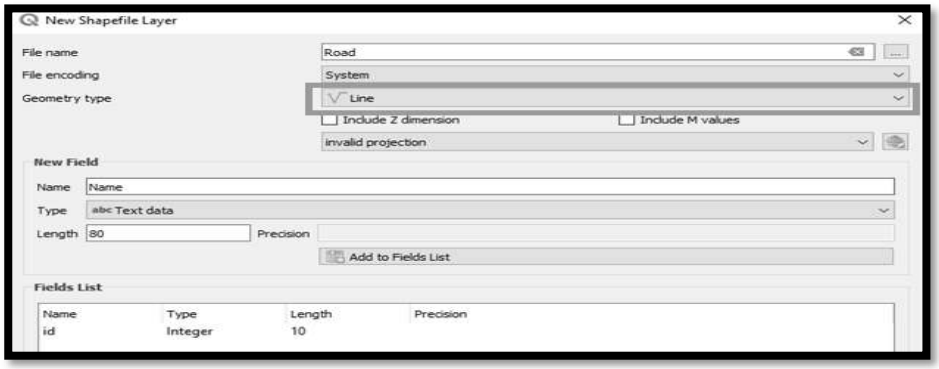


- Same way we can add one more polygon layer for Gardens.



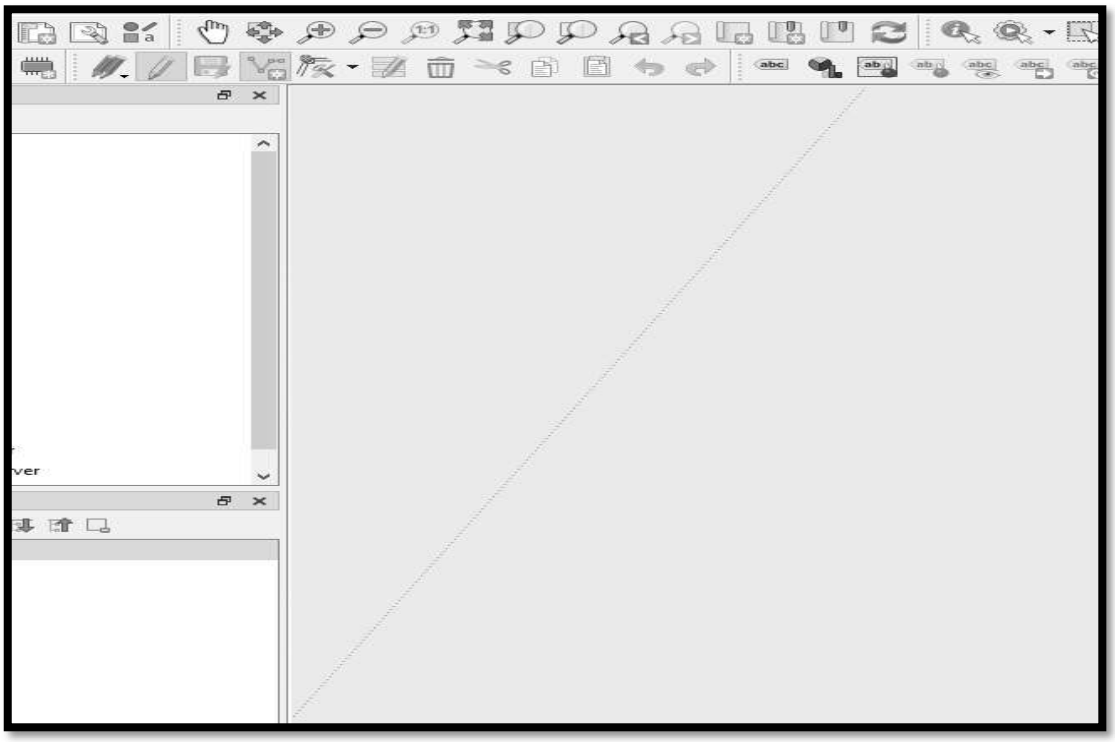
b) Creating Line vector layer

- Repeat the same steps as we have done for polygon layer.
- Select geometry type Line.

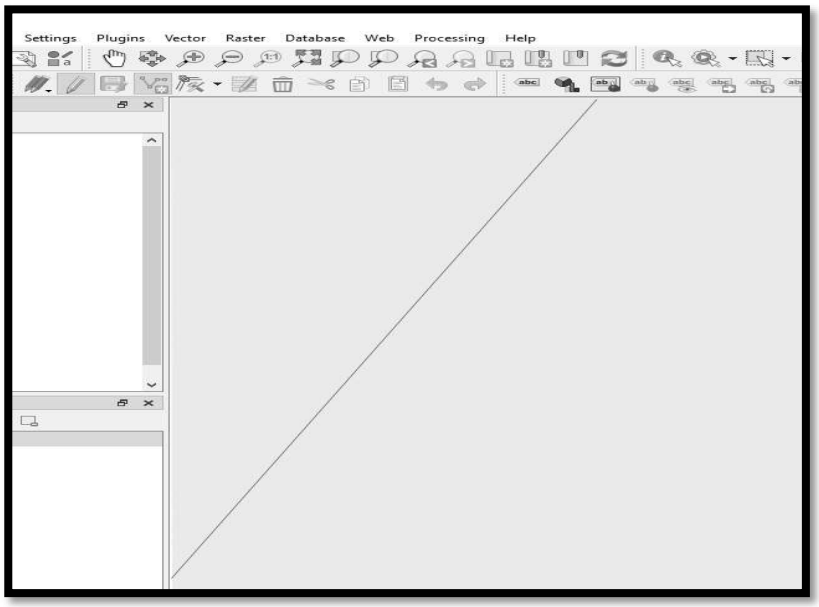


- **Road layer** :
  - To plot road **click** on **Add Line Feature**.

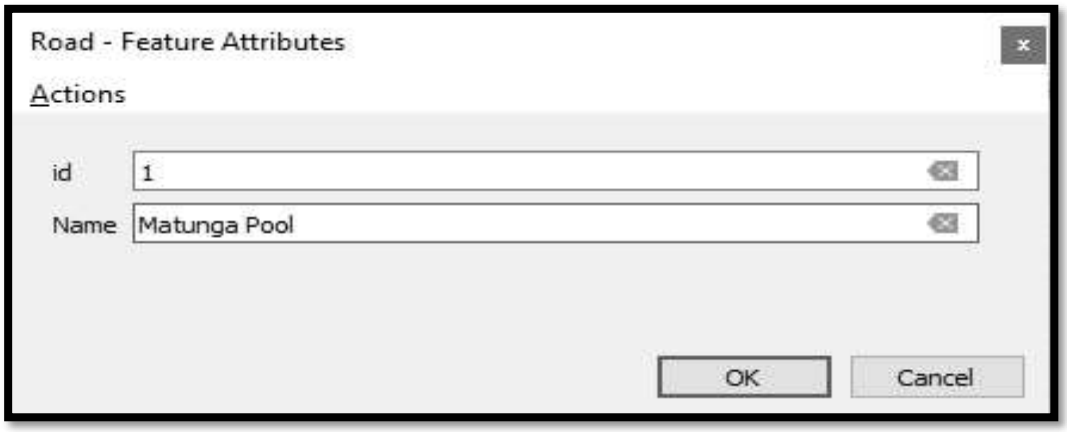
  - Click on the map where you want to draw line.



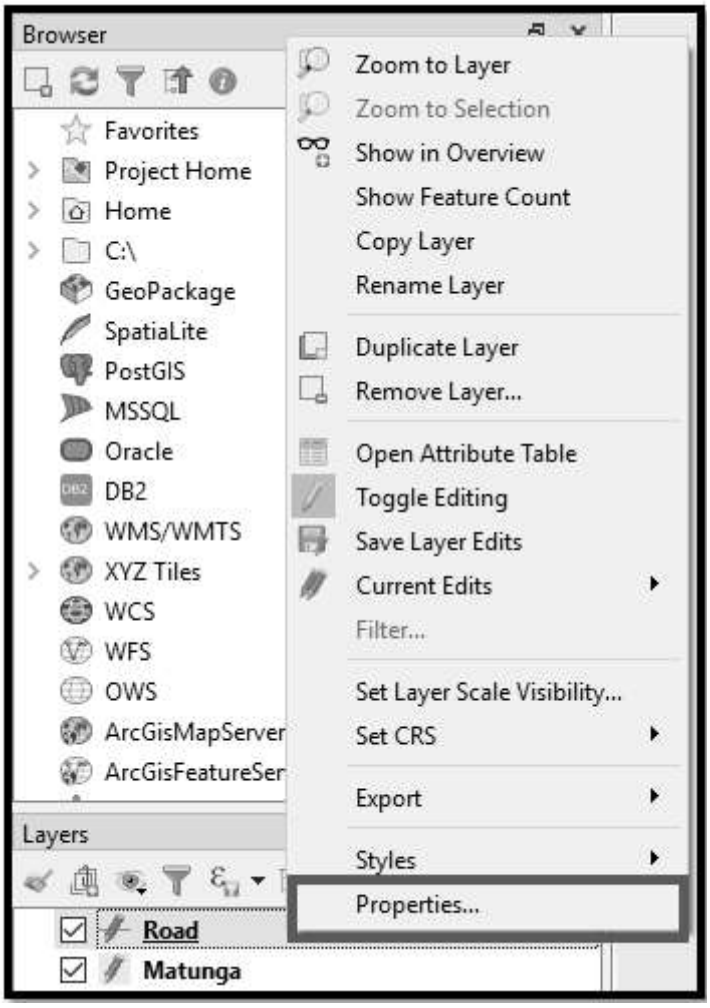
  - Once you are done then **right click** on map (**Dotted line** turn into **solid line**)

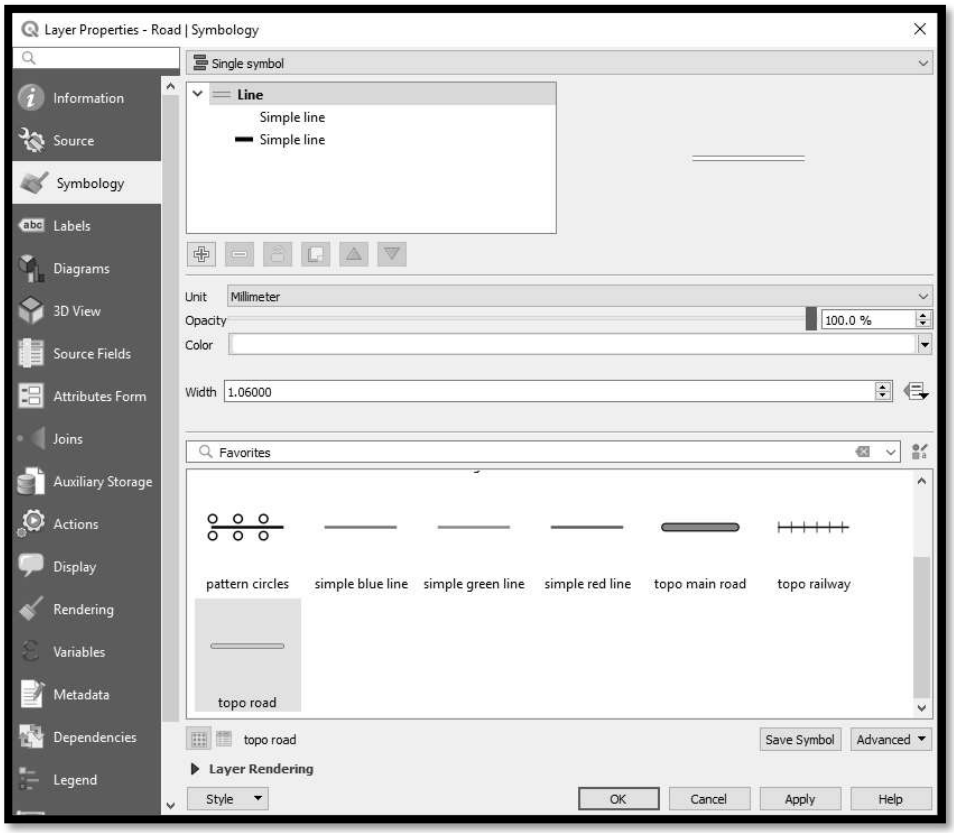


  - **save** your data

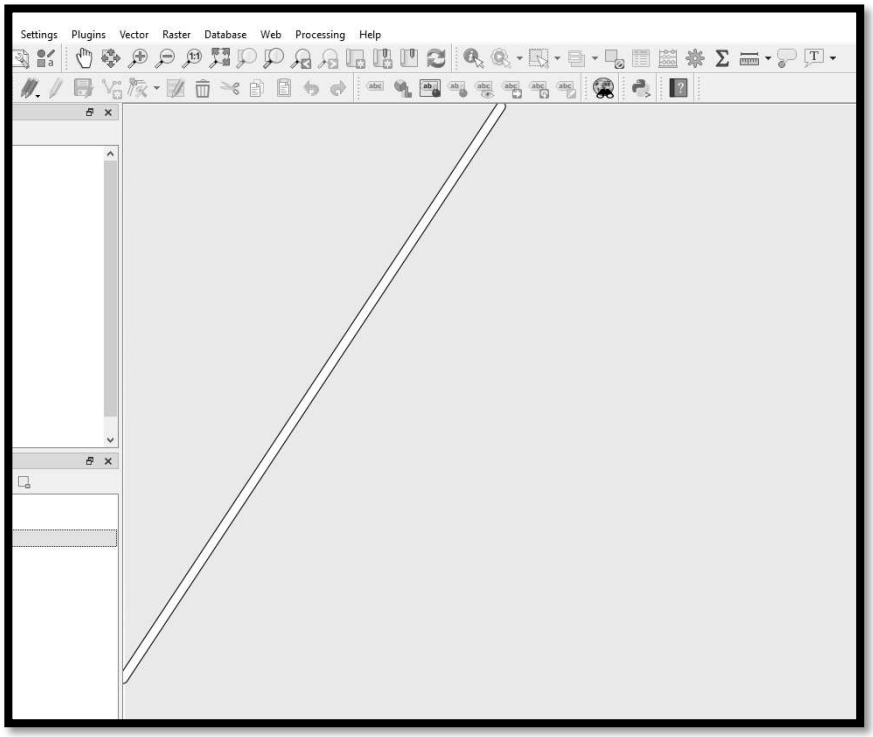


- set **style** for Roads in the same way as we have done for polygon

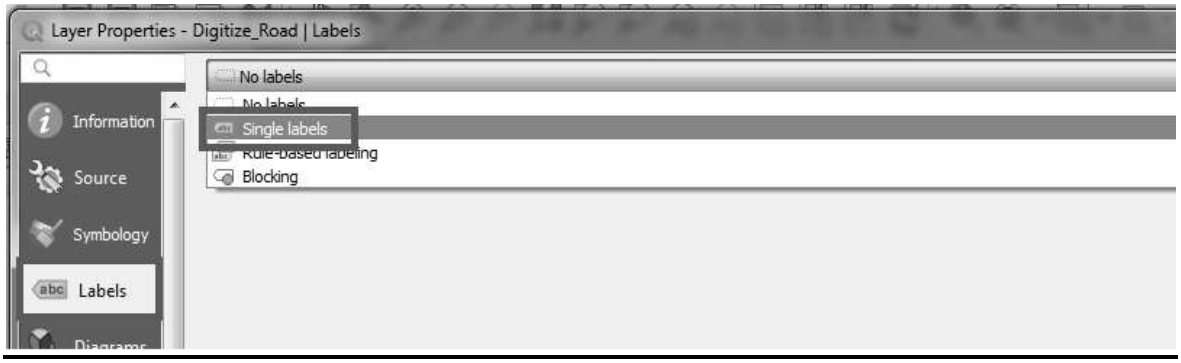




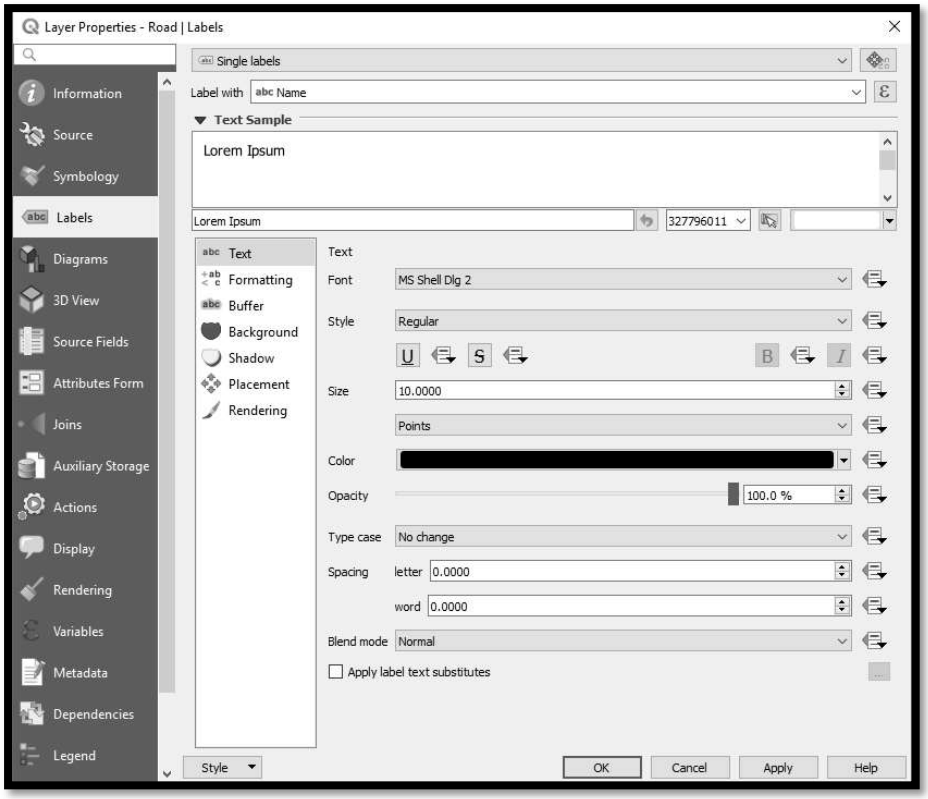
- Road will look as below



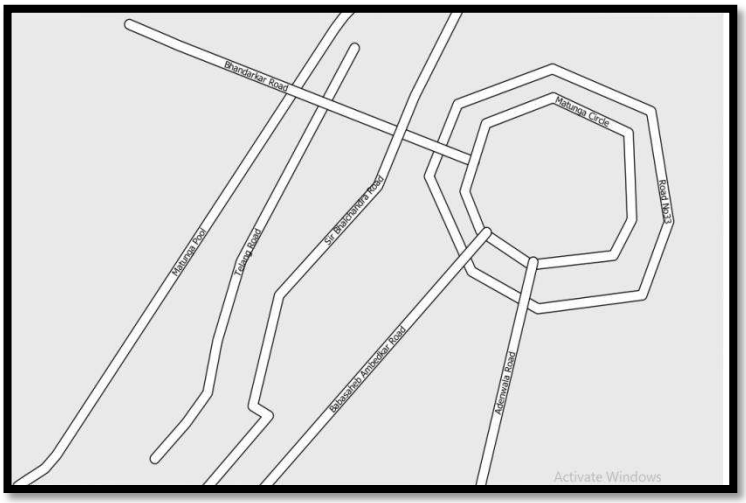
- To label your roads **Right click** on **Road layer** .Go to **properties** window then select label and set single **label property**



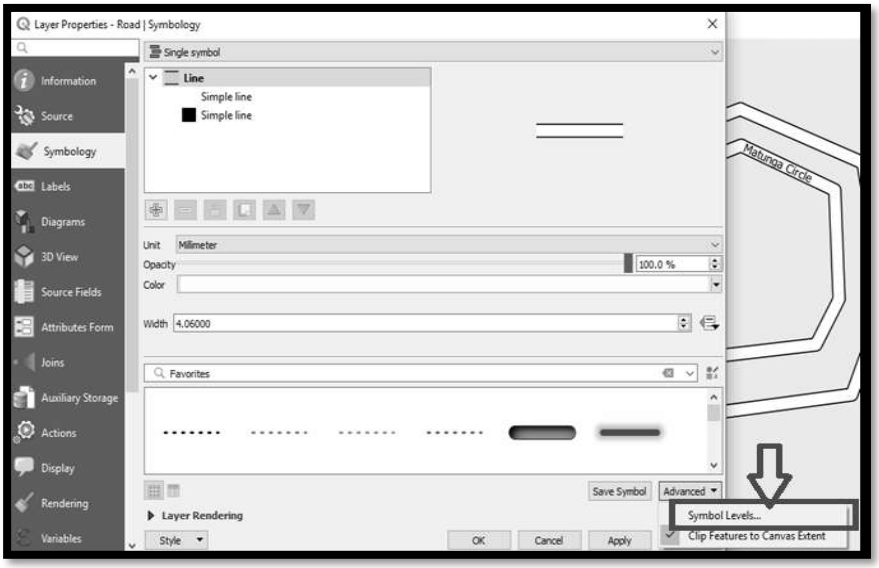
- Following window will appear on the screen



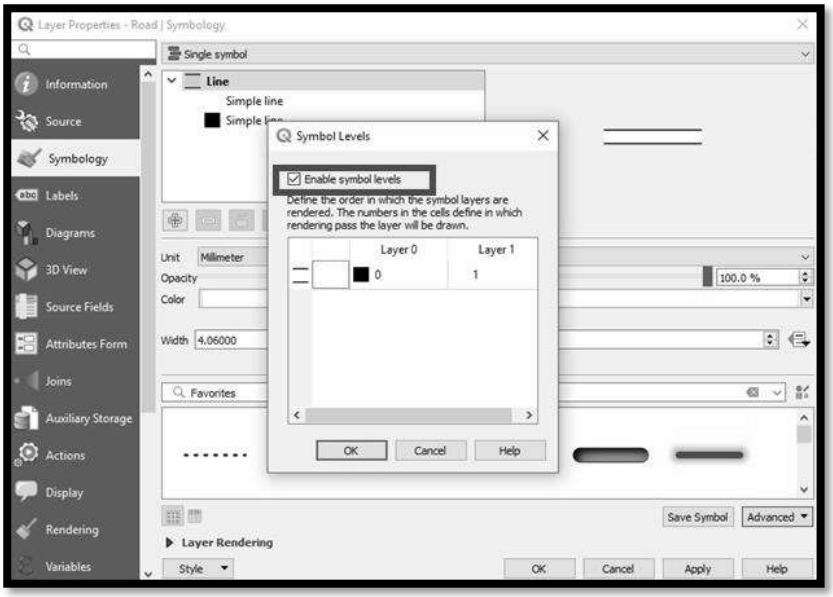
- Roads will look like these



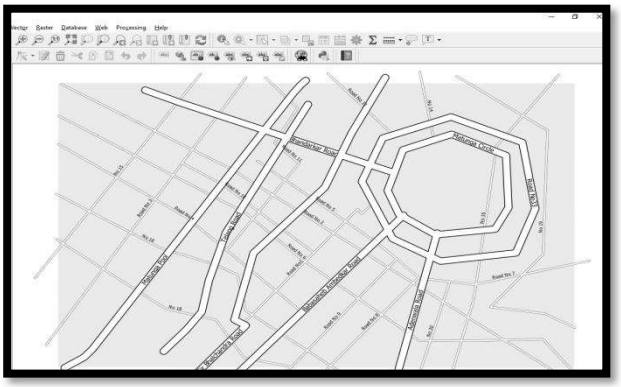
- To merge roads
  - Go to **properties** of road then select **symbology**. Click on **Advanced button** select Symbol levels.



- Check **Enable symbol levels** option

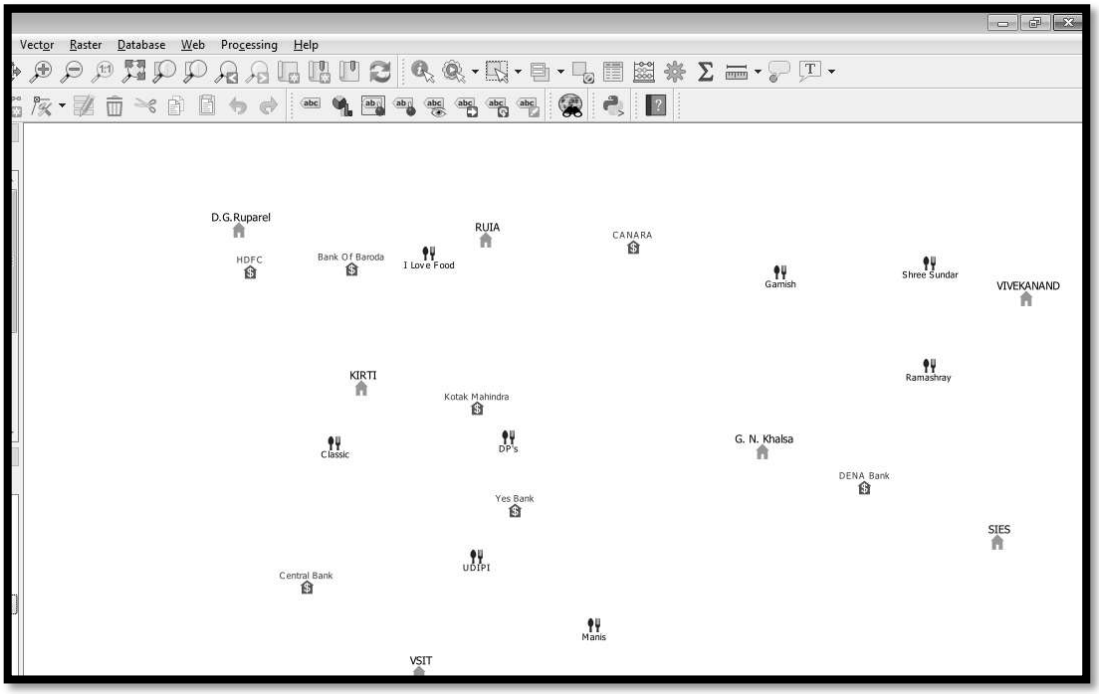


- Click ok & Road will appear as follows

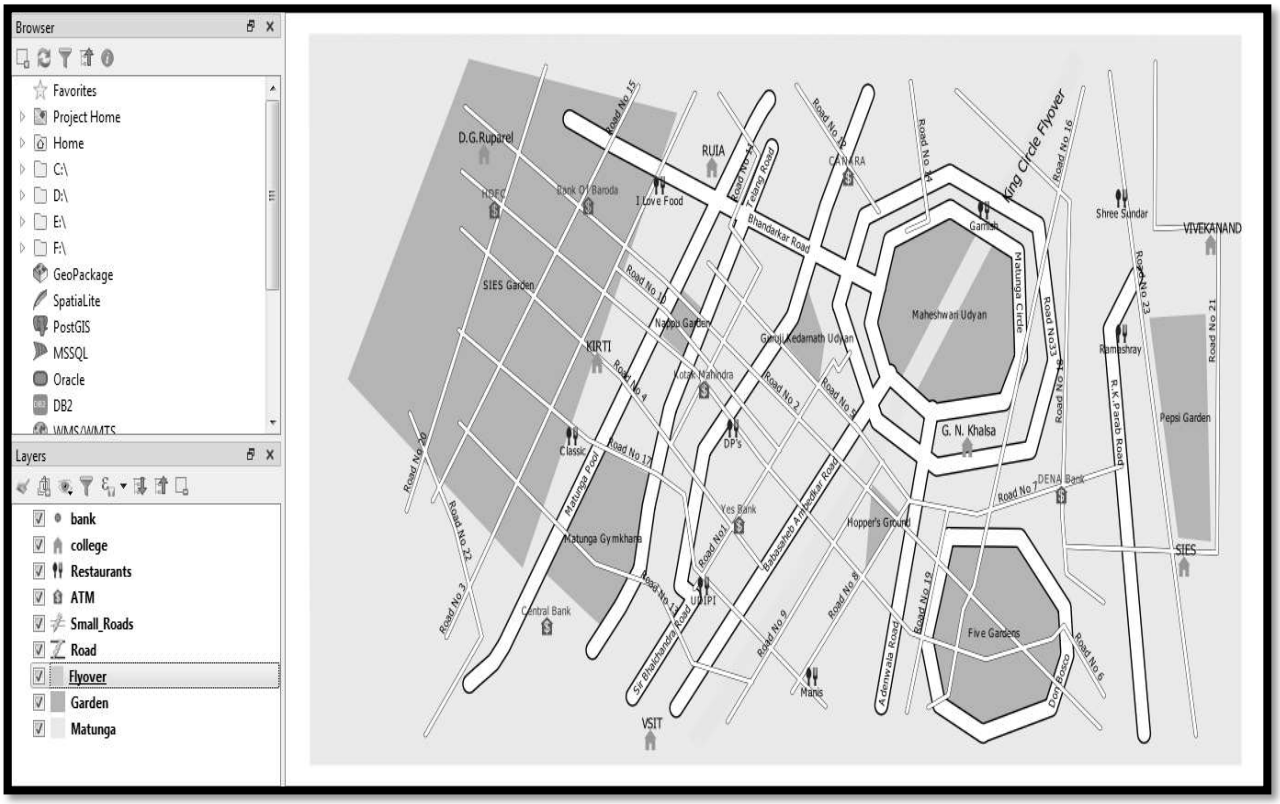


C. Create Point vector layer

- Repeat same steps to add point layers as we have done in previous layers.(For ATM, Restaurants, Banks, Bus Stops etc)

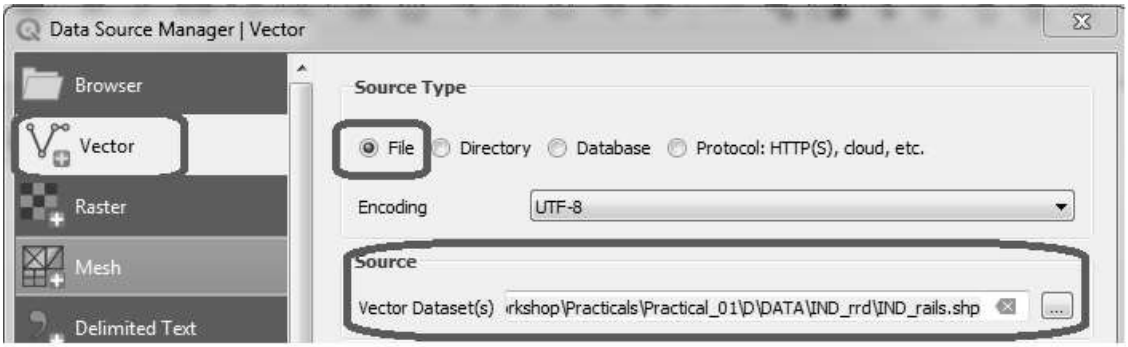


Final output:



d) Calculating line lengths and statistics

- Go to Layer → Add Layer → Add Vector Layer
- Add the following file to project

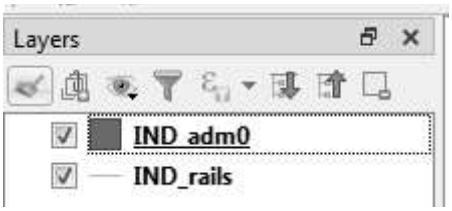


"\GIS_Workshop\Practicals\Practical_01\D\DATA\IND_rrd\IND_rails.shp"
Press "ADD"

- Also add India Administrative Map

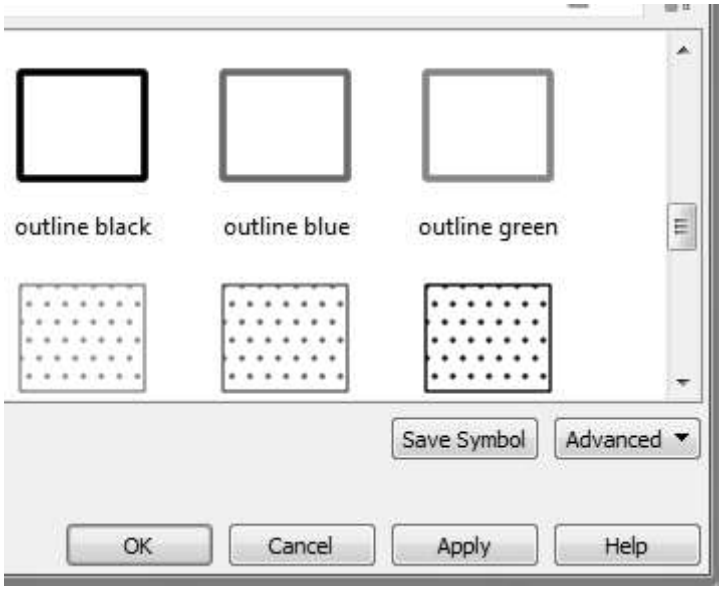
"GIS_Workshop\Practicals\Practical_01\D\DATA\IND_adm\IND_adm0.shp"

- Double Click on IND_adm0



Select 

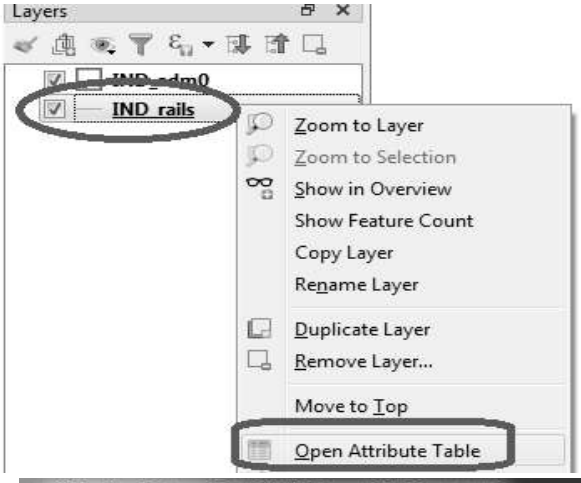
→ Select any outline style from below given options.

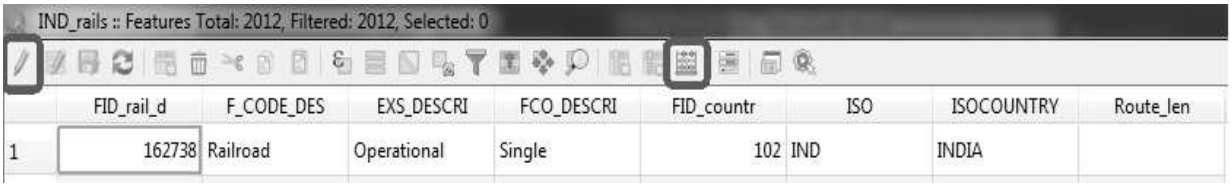


Press OK

- The display window will appear like

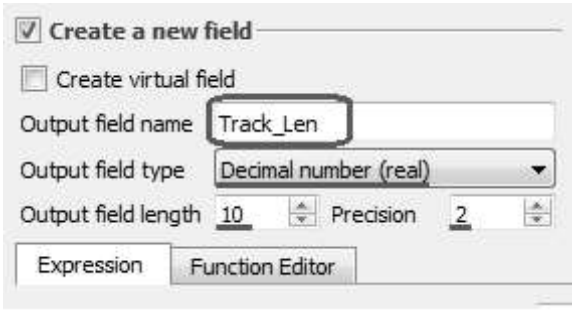
➢ In Layer Pane, Right click on IND_rails → Open Attribute Table



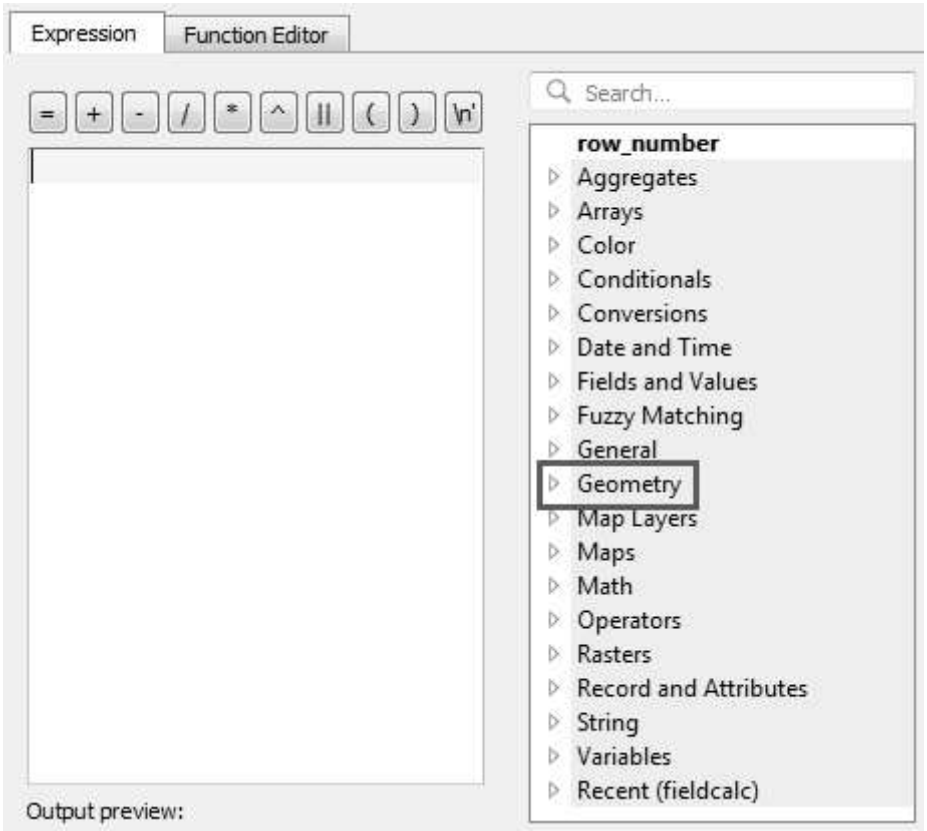


➢ Press Toggle Editing button using  button, on Attribute table window toolbar.

- Press Open Field Calculator using  button.
- Set the output field as “Track_Len”, field type to “Decimal Number”.



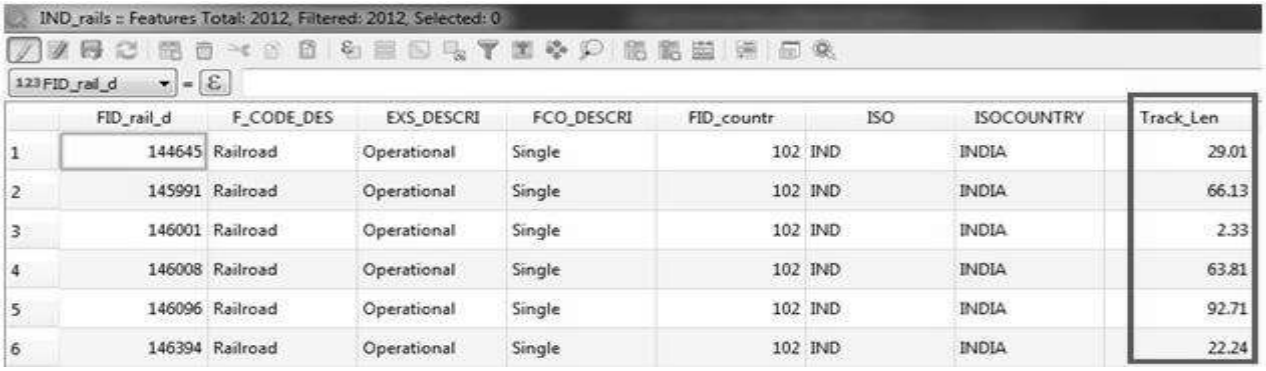
- From Function List search $length or go to Geometry → Select $length



- Set expression as

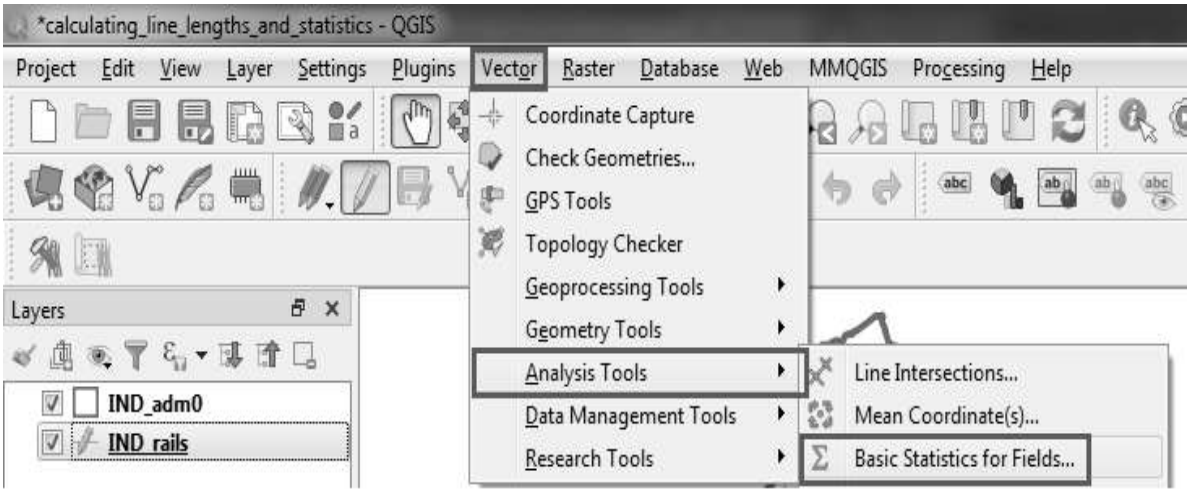
Press “OK”

- A new column is added to the attribute table with value representing the length of track in KM.

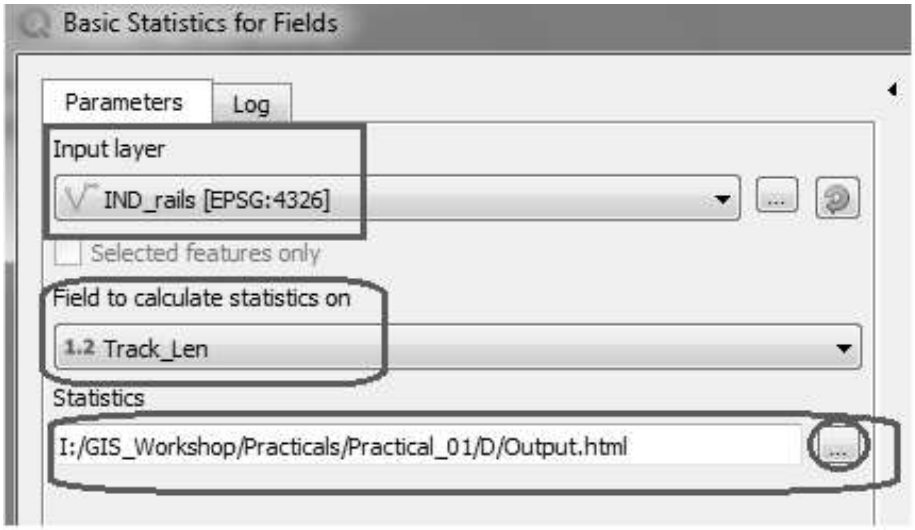


	FID_rail_d	F_CODE_DES	EXS_DESCRI	FCO_DESCRI	FID_countr	ISO	ISOCOUNTRY	Track_Len
1	144645	Railroad	Operational	Single	102	IND	INDIA	29.01
2	145991	Railroad	Operational	Single	102	IND	INDIA	66.13
3	146001	Railroad	Operational	Single	102	IND	INDIA	2.33
4	146008	Railroad	Operational	Single	102	IND	INDIA	63.81
5	146096	Railroad	Operational	Single	102	IND	INDIA	92.71
6	146394	Railroad	Operational	Single	102	IND	INDIA	22.24

- Press CTRL+S or click on Save Edits option on tool bar
- Close the attribute table window.
- For calculating the total length of Railway tracks in India.
- Select Vector→ Analysis Tools→ Basic Statics for Fields

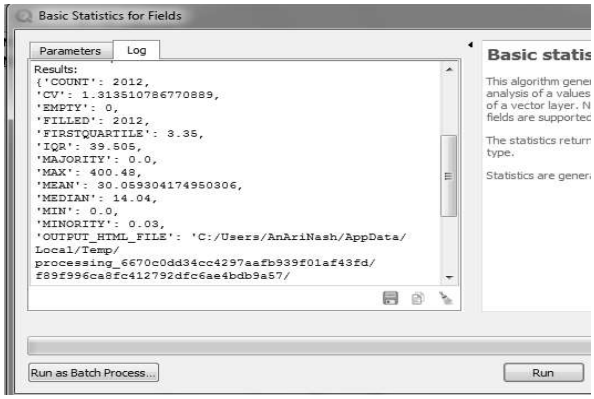


- Select IND_rails layer from input layer. And select Track_Len in "Field to Calculate statistics on"



- Press RUN

- The Result is



- Open the "**output.html**" file to get the field statistics.

  Analyzed field: Track_Len
  Count: 2012
  Unique values: 1608
  NULL (missing) values: 0
  Minimum value: 0.0
  Maximum value: 400.48
  Range: 400.48
  Sum: 60479.320000000014
  Mean value: 30.059304174950306
  Median value: 14.04
  Standard deviation: 39.483220276624444
  Coefficient of Variation: 1.313510786770889
  Minority (rarest occurring value): 0.03
  Majority (most frequently occurring value): 0.0
  First quartile: 3.35
  Third quartile: 42.855000000000004
  Interquartile Range (IQR): 39.505

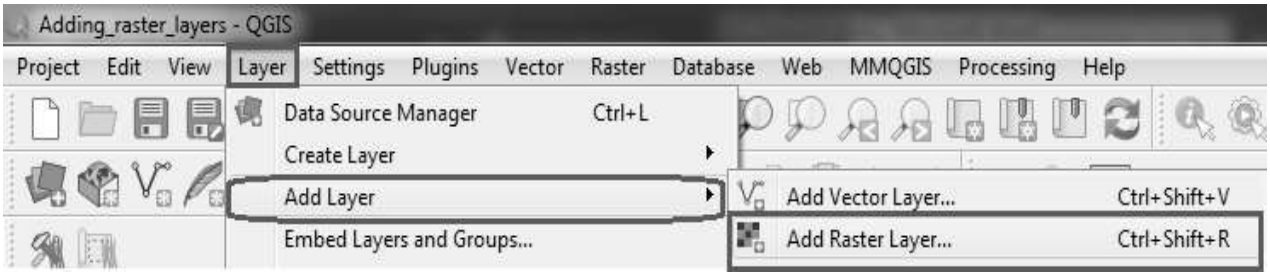
- The above statistics show that the total length of Railway track in India is **60,479.32 KM**.

PRACTICAL - 2

Exploring and Managing Raster data:

a) Adding raster layers

- From menu bar select Layer → Add Layer → Add Raster Layer



- Select Gridded Population of the World (GPW) v3 dataset from Columbia University, Population Density Grid for the entire globe in ASCII format and for the year 1990 and 2000.

"\GIS_Workshop\Practicals\Practical_02\A\Data\gl_gpwv3_pdens_90_ascii_one\glds90ag60.asc"

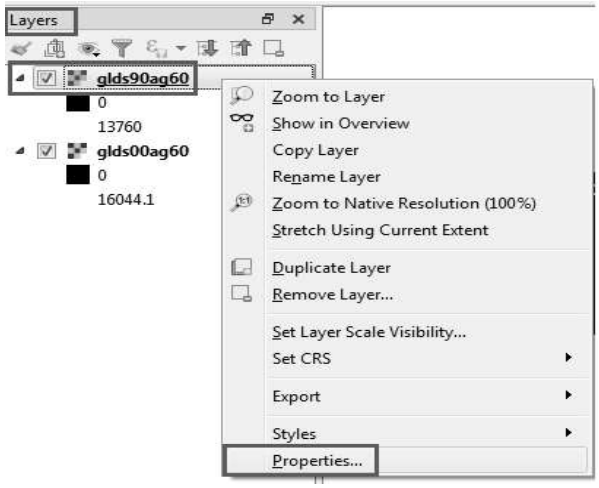
"\GIS_Workshop\Practicals\Practical_02\A\Data\gl_gpwv3_pdens_90_ascii_one\glds00ag60.asc"

- Go to Project → Properties OR Press the Set CRS option on bottom right corner.

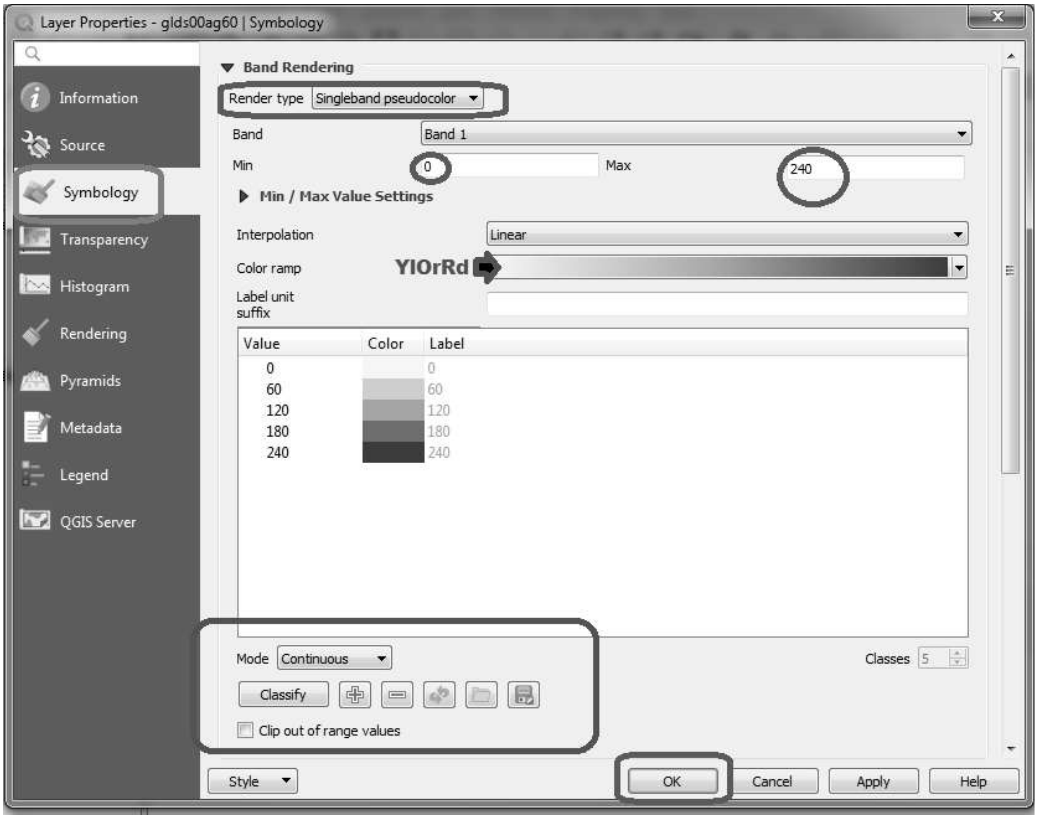
Select WGS 84 EPSG: 4326 and Press OK

b) Raster Styling and Analysis

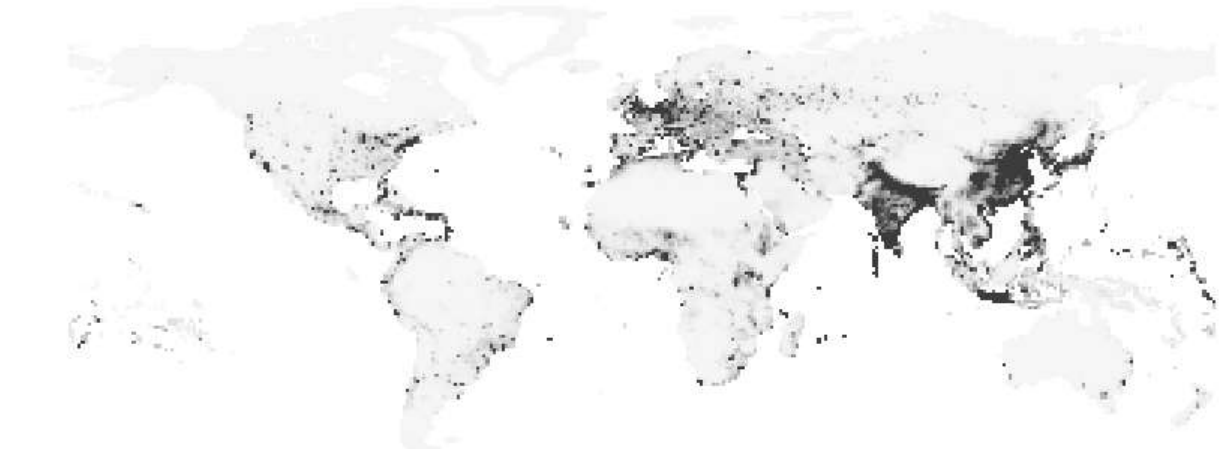
- To start with analysis of population data, convert the pixel from grayscale to Color.
- Select "glds90ag60.asc" Layer form layer Pane → select property OR double click on it.



- Select 

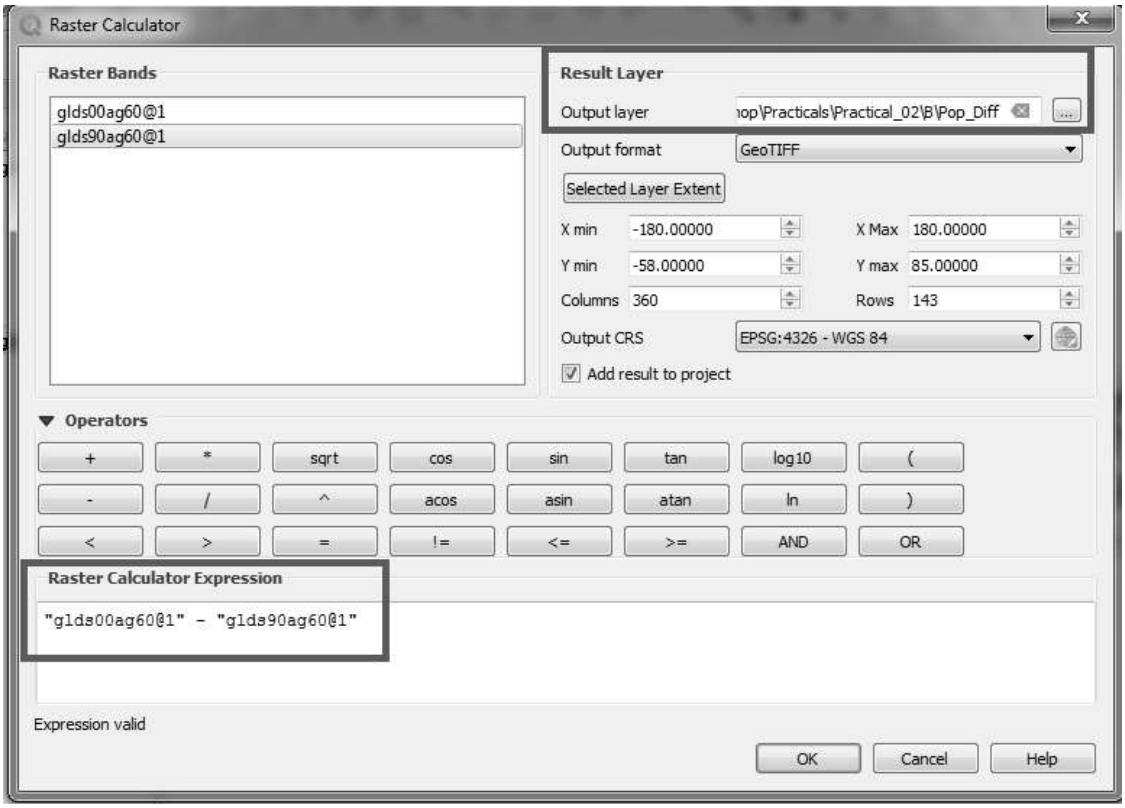


- Press "APPLY"
- Repeat the same for "glds00ag60.asc" Layer



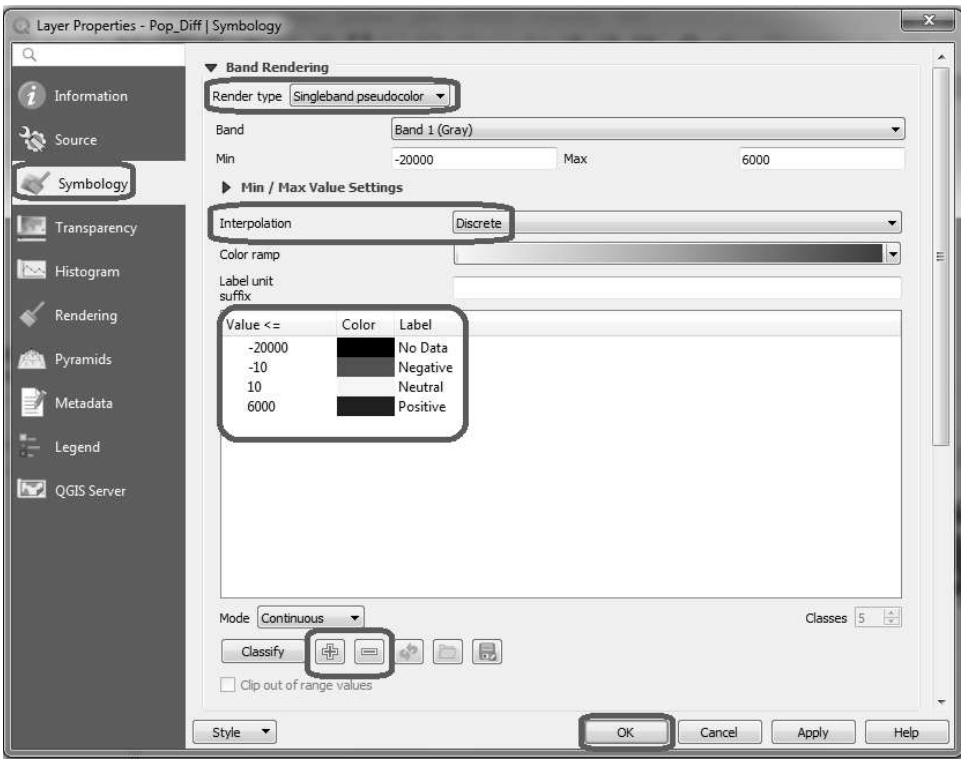
Layer output after applying style.

- The objective this experiment is to analyze raster data, as an example we will find areas with largest population change between 1990 and 2000, by calculating the difference between each pixel values.
- Go to Raster → Raster Calculator



- Put the expression "glds00ag60@1" - "glds90ag60@1"
- Select the output file location & name and Press OK.

- Remove the other two layers i.e. glds00ag60.asc and glds90ag60.asc
- Double click on pop_diff layer.
- Select 



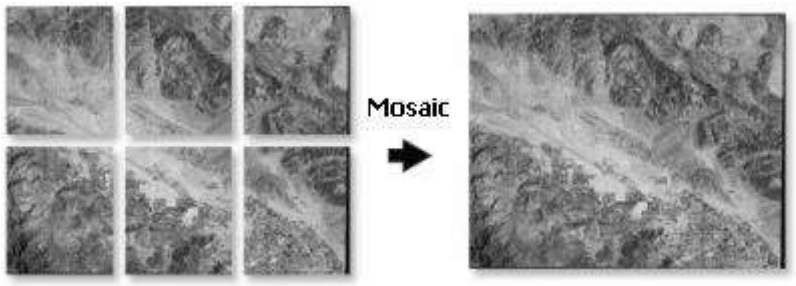
- Set Render Type to "Single band Pseudo color", Interpolation as Discrete, and remove all classification and add as shown in figure above using  button. After all settings press "OK".
- Layer will appear like

- Explore an area of your choice and check the raster band value using  to verify the classification rule.
- The red pixel shows negative changes and blue shows positive changes.

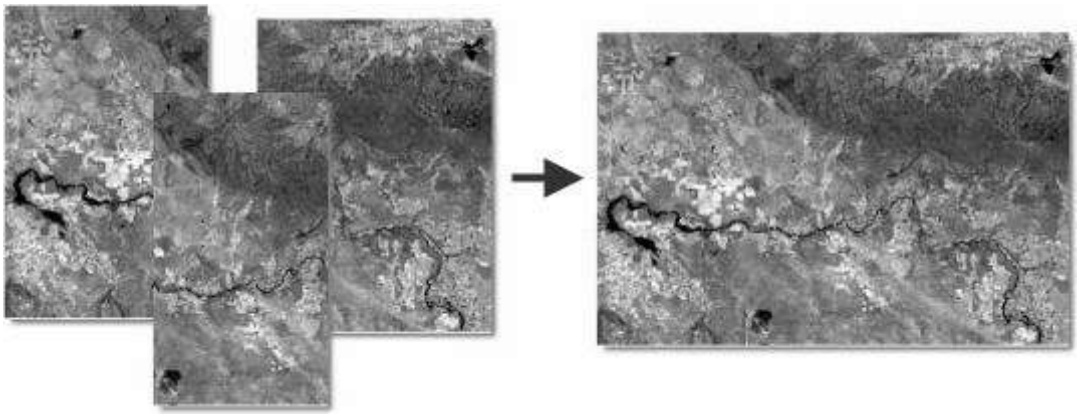
c) Raster Mosaicking and Clipping

A **mosaic** is a combination or merge of two or more images.

In GIS, a single raster dataset can be created from multiple raster datasets by mosaicking them together.

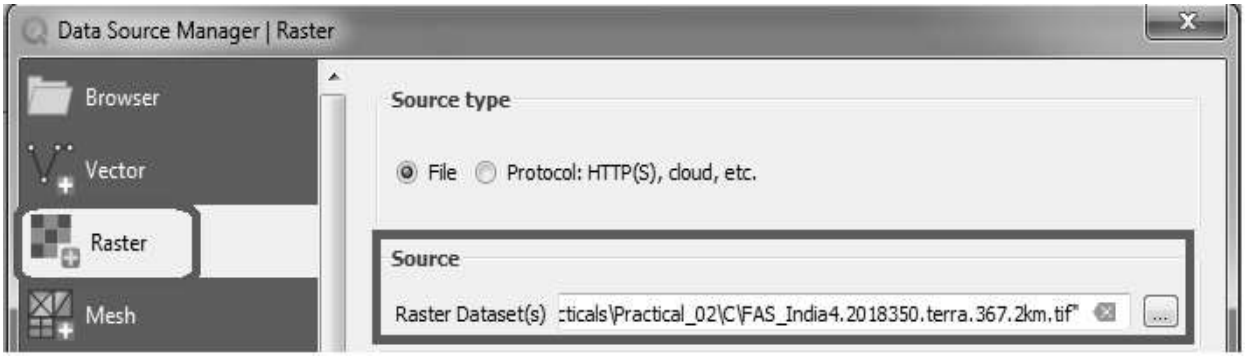


In many cases, there will be some overlap of the raster dataset edges that are being mosaicked together, as shown below.



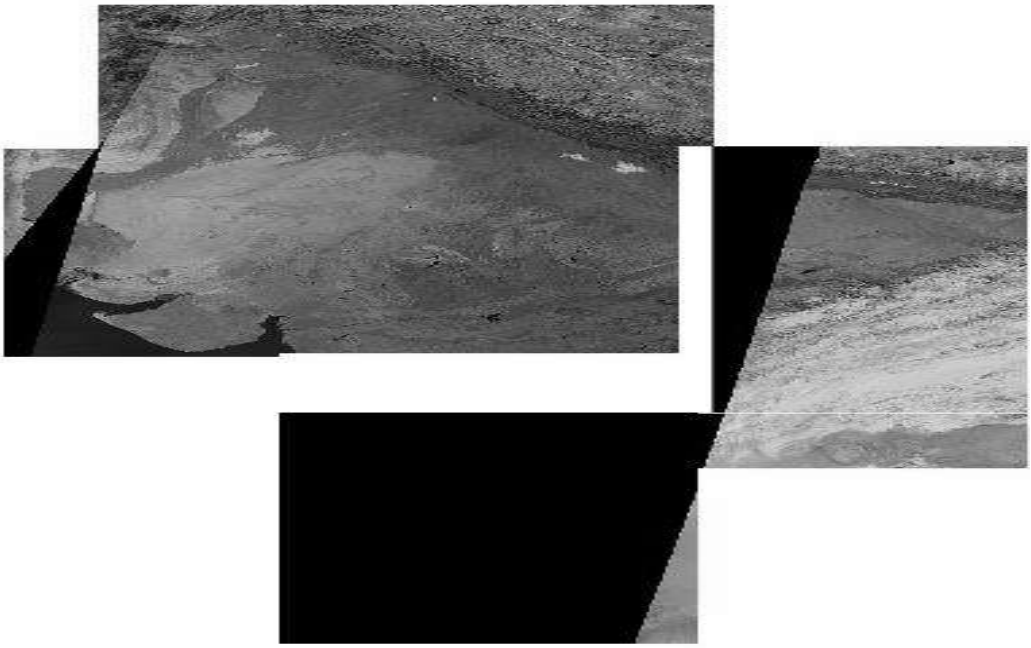
These overlapping areas can be handled in several ways; for example, you can choose to only keep raster data from the first or last dataset, you can blend the overlapping cell values using a weight-based algorithm, you can take the mean of the overlapping cell values, or you can take the minimum or maximum value. When mosaicking discrete data, the First, Minimum, or Maximum options give the most meaningful results. The Blend and Mean options are best suited for continuous data. If any of the input rasters are floating point, the output is floating point. If all the inputs are integer and First, Minimum, or Maximum is used, the output is integer.

- Go to Layer → Add Layer → Add Raster Layer.

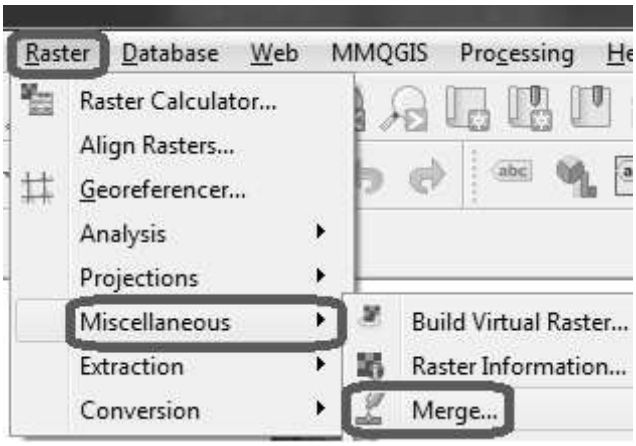


- Select the following "**.tif**" raster images for India from data folder.
  FAS_India1.2018349.terra.367.2km.tif
  FAS_India2.2018349.terra.367.2km.tif
  FAS_India3.2018349.terra.367.2km.tif
  FAS_India4.2018349.terra.367.2km.tif

- Press open
- In data source manager | Raster window click Add.

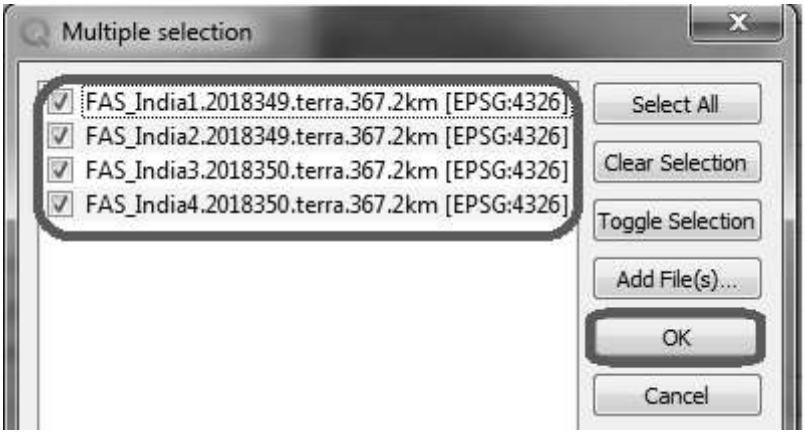


- Go to Raster → Miscellaneous → Merge

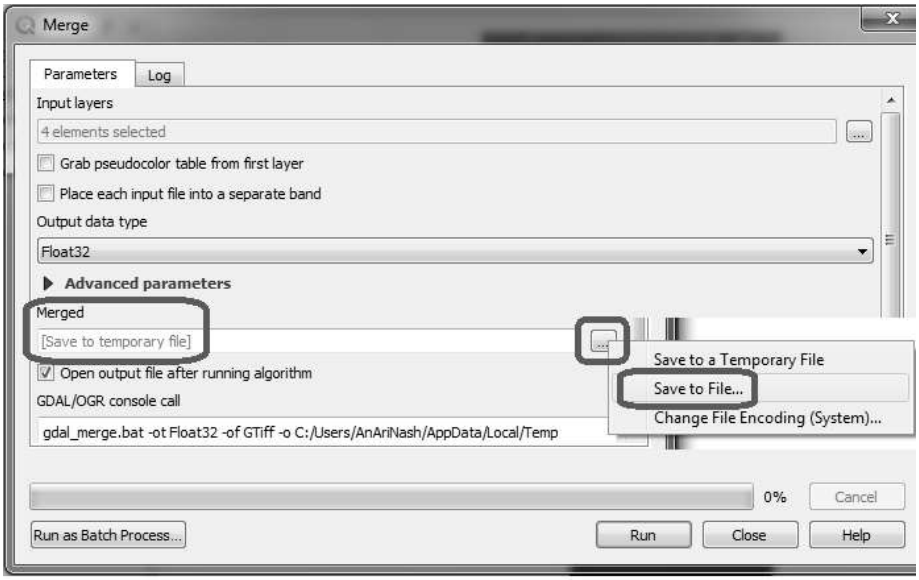


- In the Merge dialog window

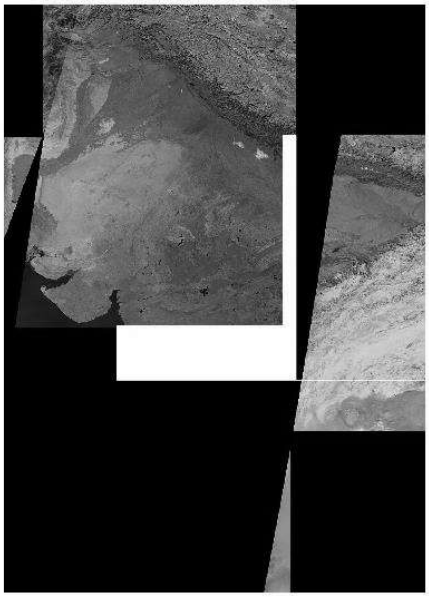
- Select all layers and Press OK.



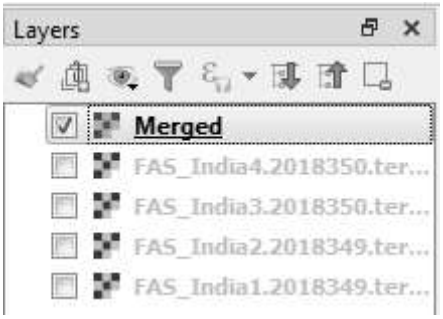
- In Merge dialog window select a file name and location to save merged images.



- Save the file to "GIS_Workshop/Practicals/Practical_02/C/" location with the name as Merge_Files.tif
- Press Run and after completion of operation close the Merge window dialog box.



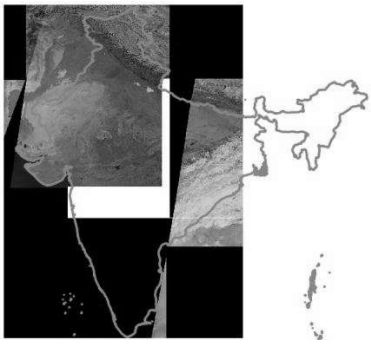
- You can now deselect individual layers from layer pane and only keep the merged raster file.



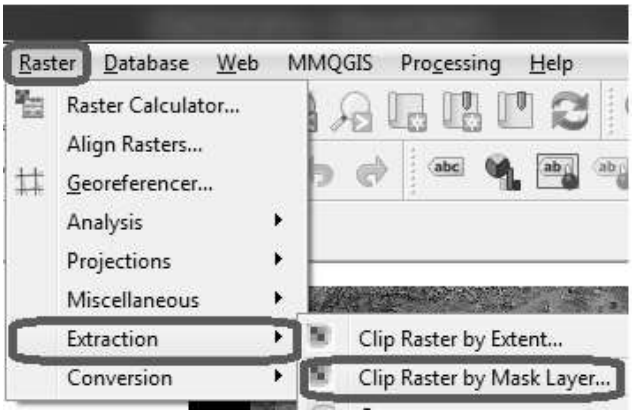
- Go to Layer→ Add Vector Layer → Select \GIS_Workshop\Practicals\Practical_02\C\IndiaAdminBoundry\IND_adm0.shp file.
- From layer properties → select 

→ select any one of the following

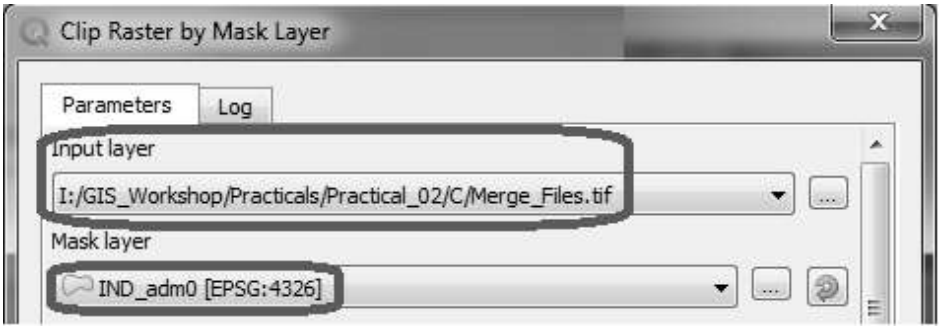
- The result will be



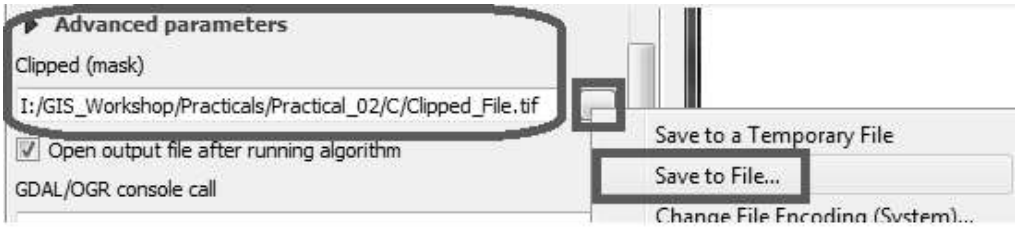
- Go to Raster → Extraction → Clip Raster by Mask Layer



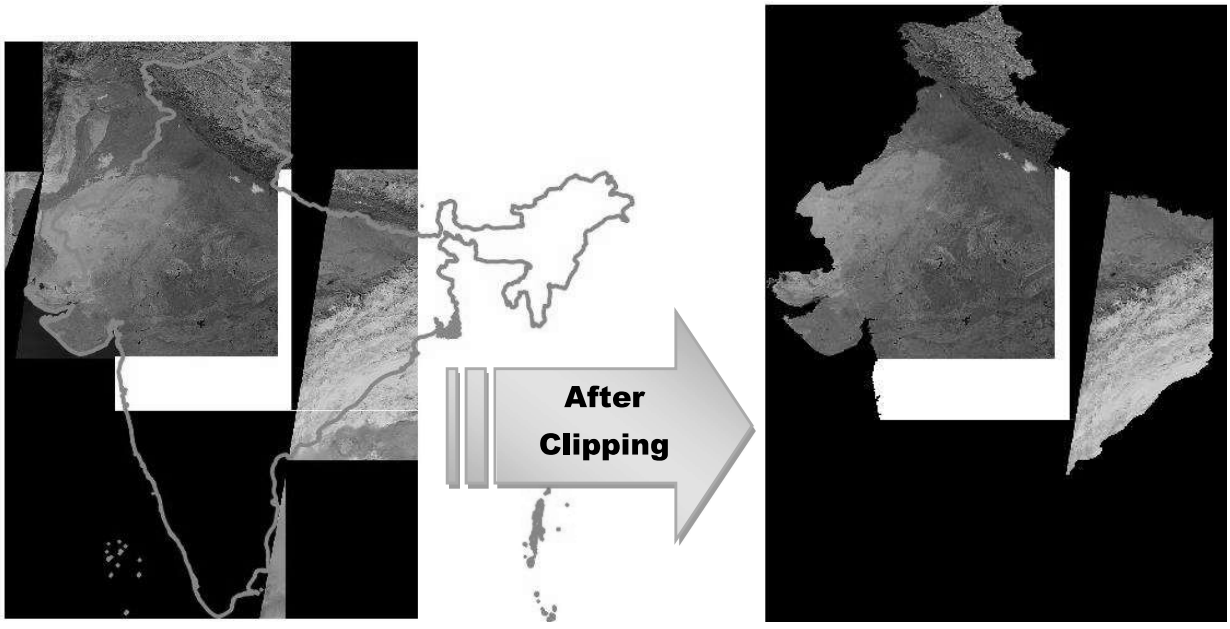
- Select the merge raster image as input and Ind_adm0 as mask layer.



- Select a file name and location for clipped raster as /Practical_02/C/Clipped_File.tif.



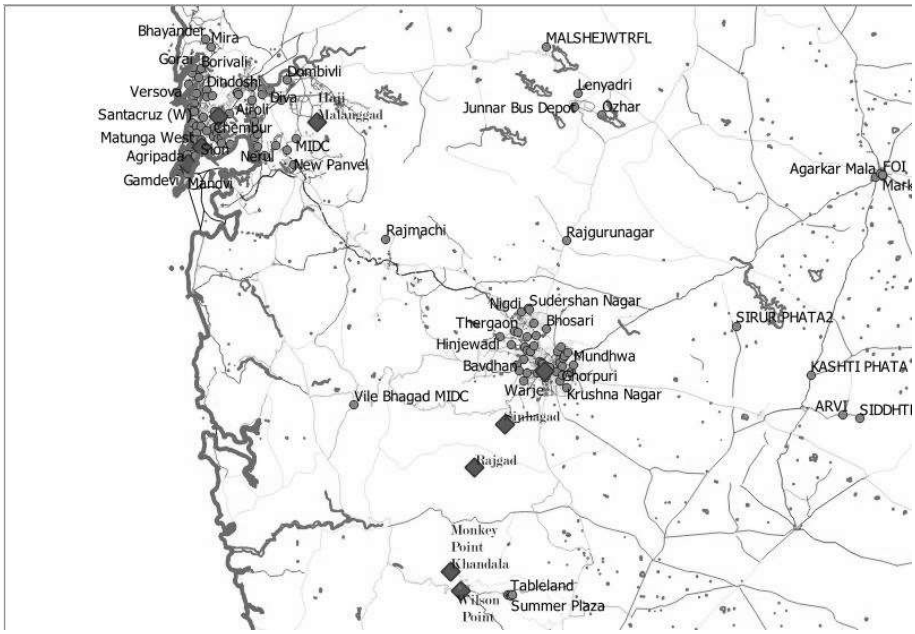
- Press RUN.



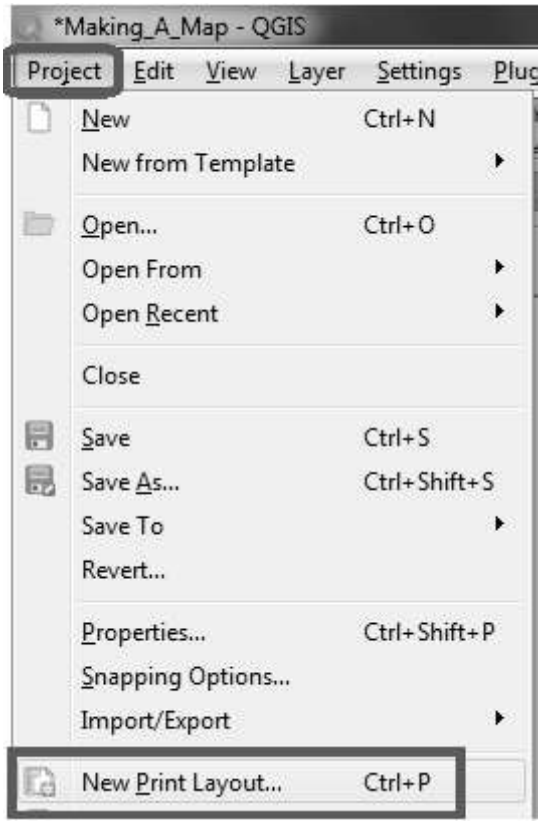
PRACTICAL - 3

a) Making a Map

- Create a new Thematic Map or open and existing one
- Consider the following map as an example map

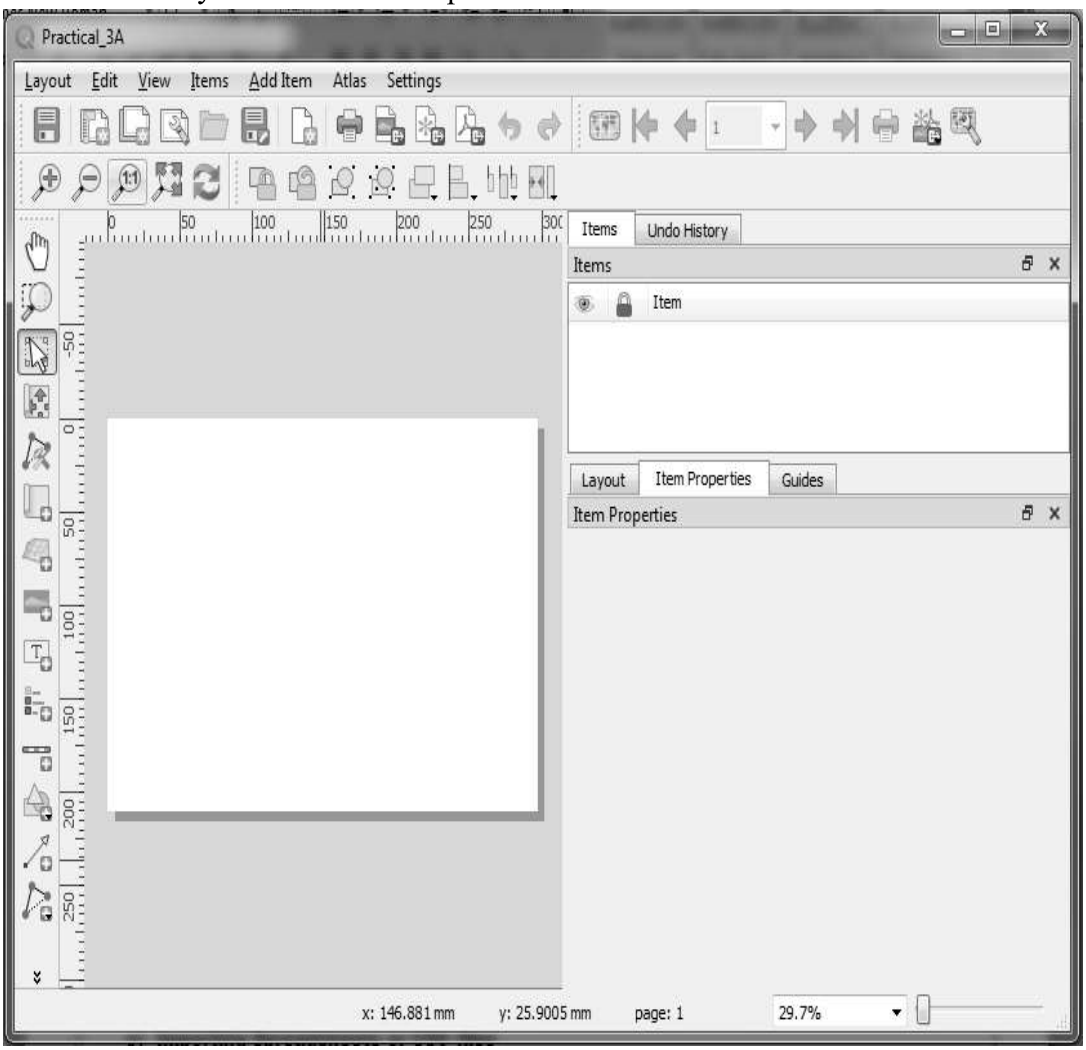


- Go to Project → New PrintLayout

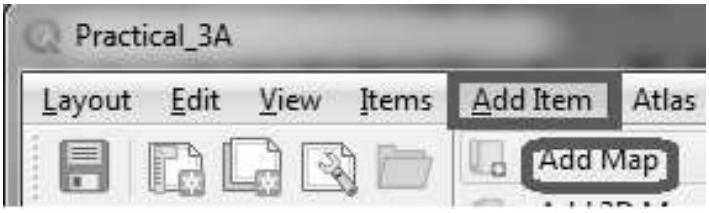


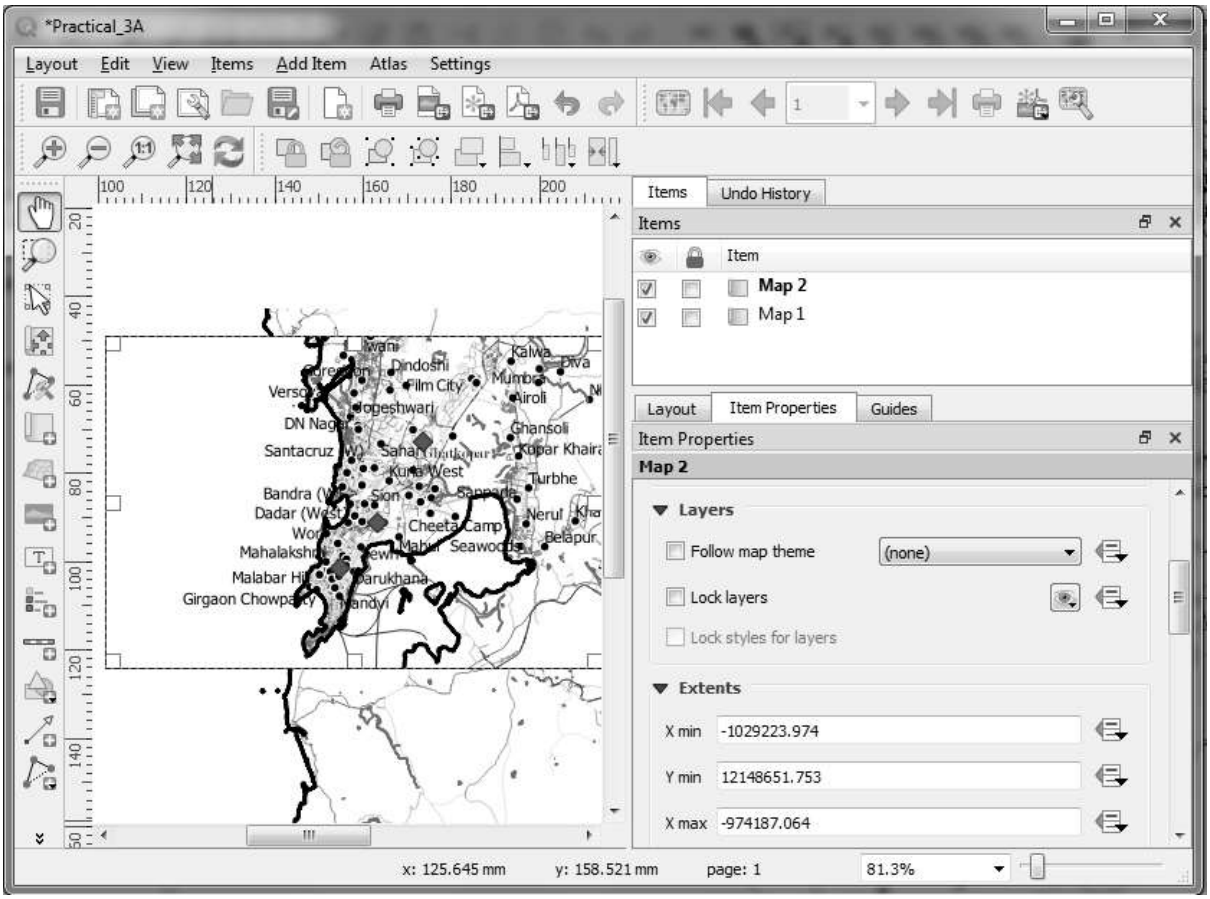
- Insert a suitable title and press “OK”.

- A new Print Layout window will open

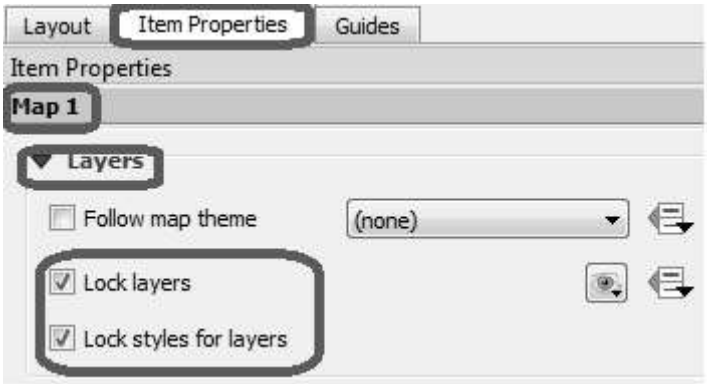


- Select Add Item → Add Map



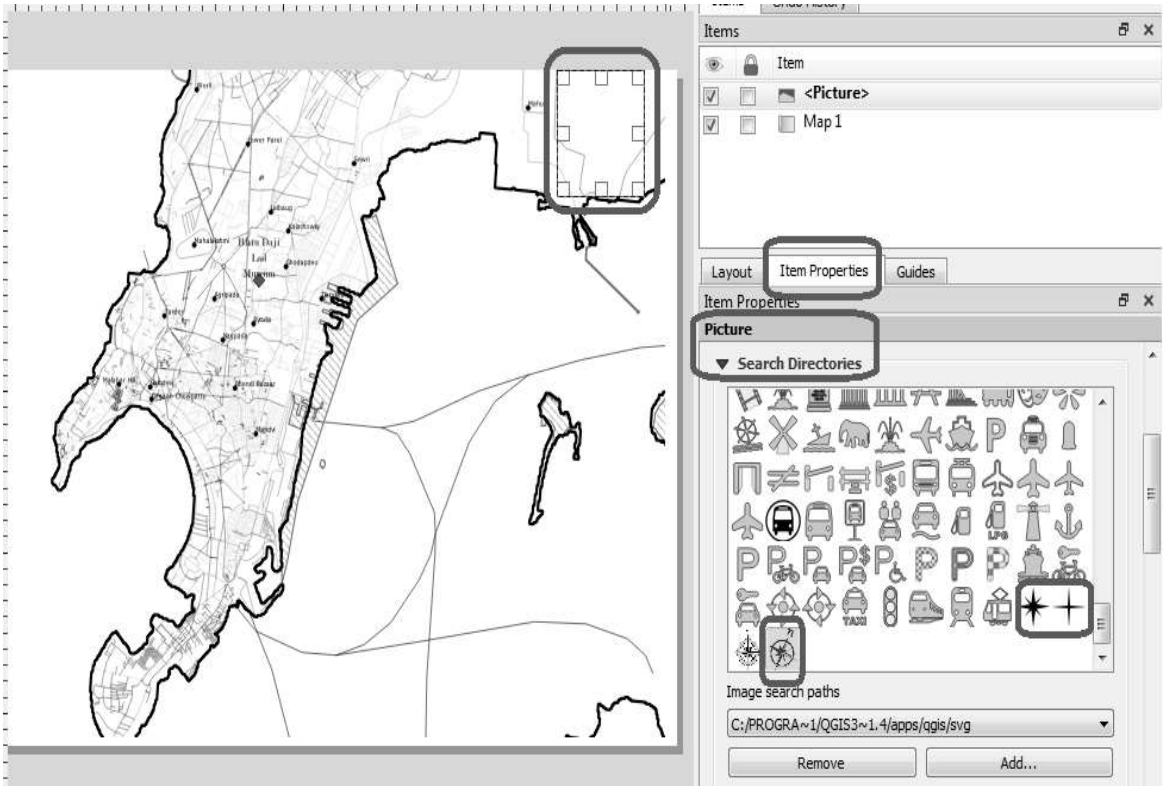


- After adding map go to ItemProperties → Map1→ Layers
  Check on Lock Layers and Lock Styles for Layers

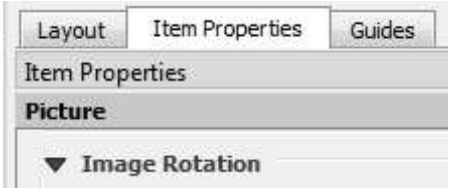


This will ensure that if any change in layers or change their styles, the Print Layout view will not change.

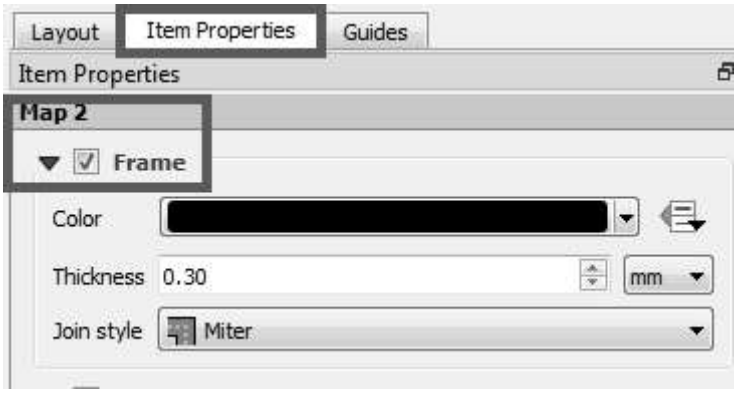
- Go to Add Item → Add Picture → Place a picture box at appropriate location.



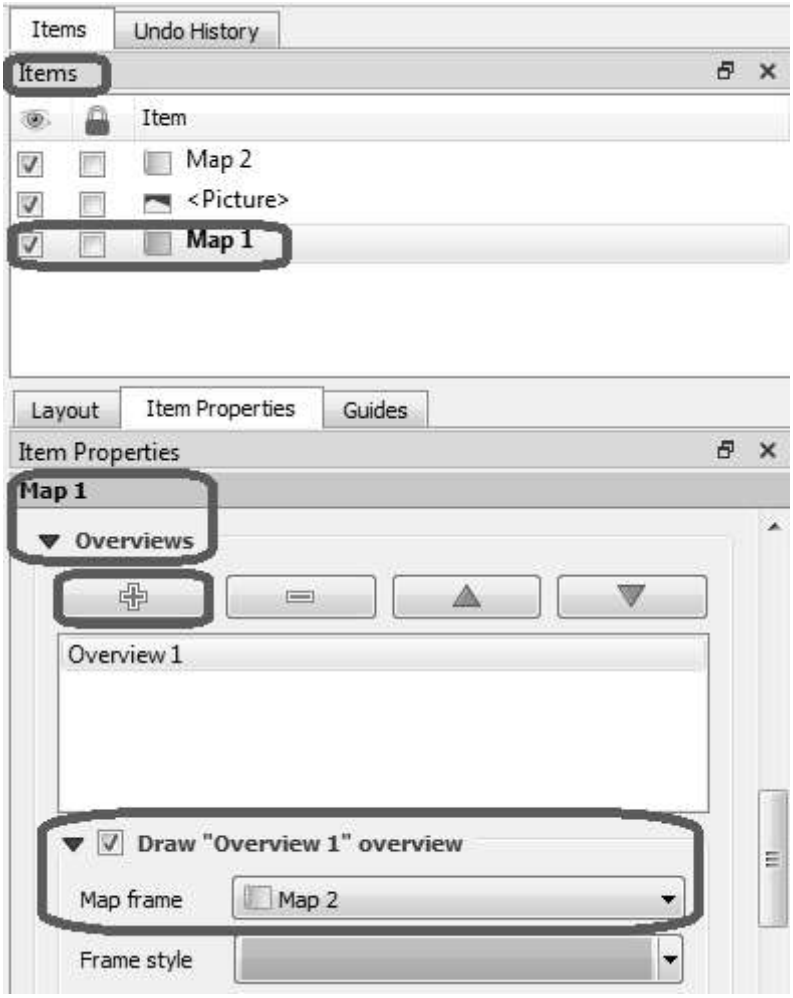
- Also adjust Image Rotation to its appropriate value.
- Item Properties → Image Rotation



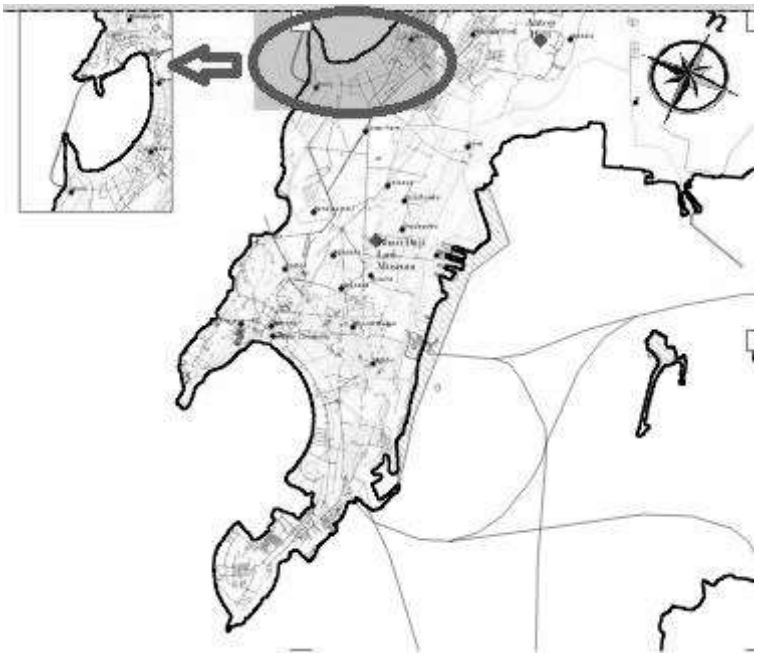
- Add an inset Using Add Item → Add Picture → Select an area to be highlighted on main Map.
- Set a frame for Inset by enabling the check box for Frame.



- To highlight the area shown in Inset
- Select the Picture representing main Map from Items pane.
- In Item Properties → Overviews → using  icon add an overview.
- Select the checkbox Draw Overview
- Name the Picture object representing inset (Map1 in our case).



- The Print Layout will appear like

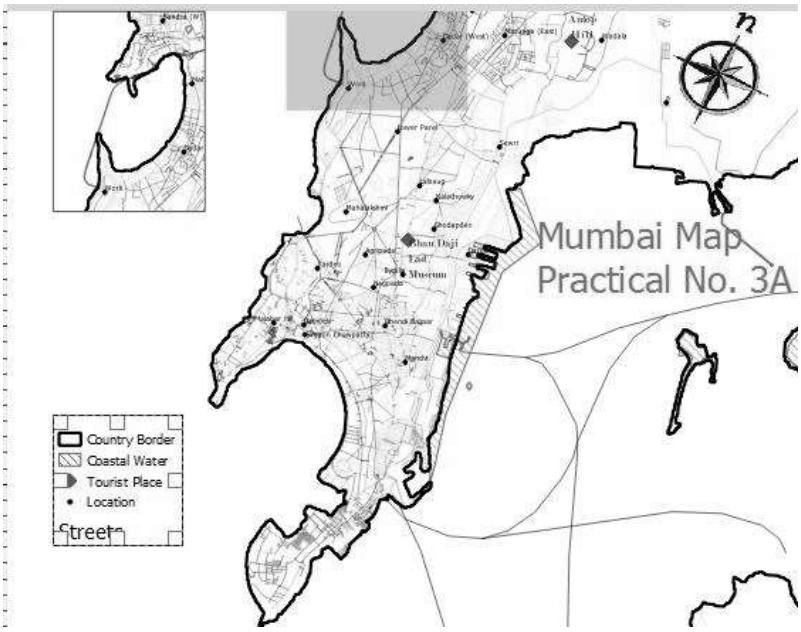


- Add Item → Add Label

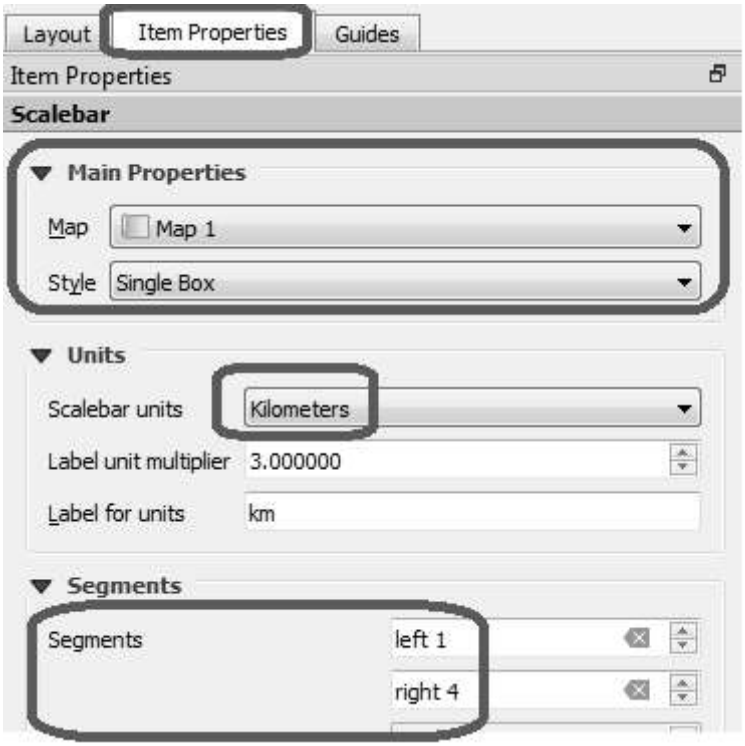
- Change the Label text To “Mumbai Map”, Set appropriate font size and color using Item Properties→ Main Properties.

- Add Item → Add Legend→ Place the legend indicator at appropriate location.
- Uncheck auto update and use suitable legend indicator label.

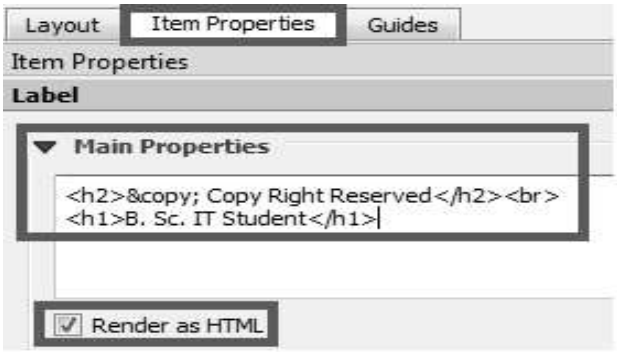
- The Print Layout will appear



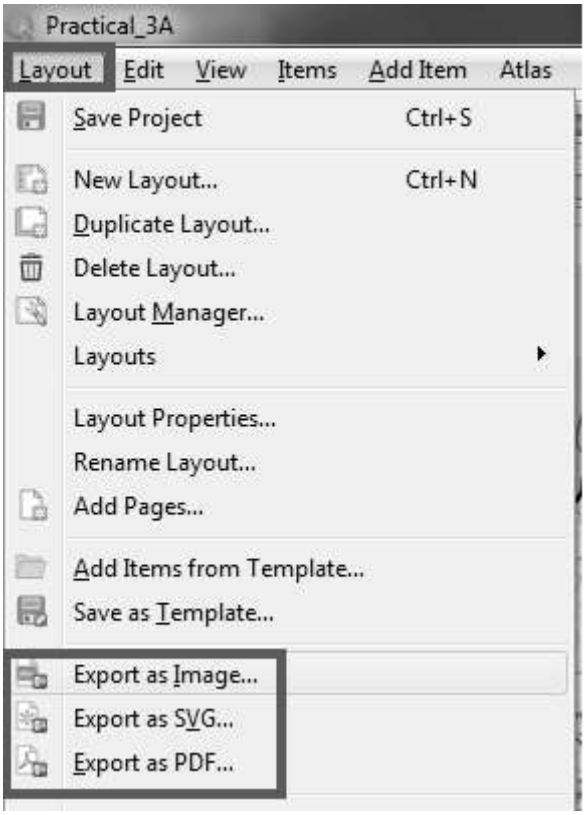
- Add Item → Add Scale Bar



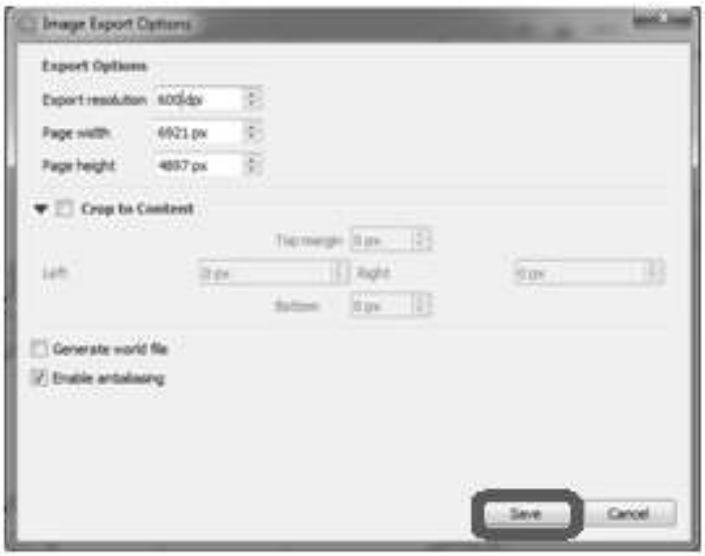
- Add Item → Add Label→Add a Label using HTML rendering



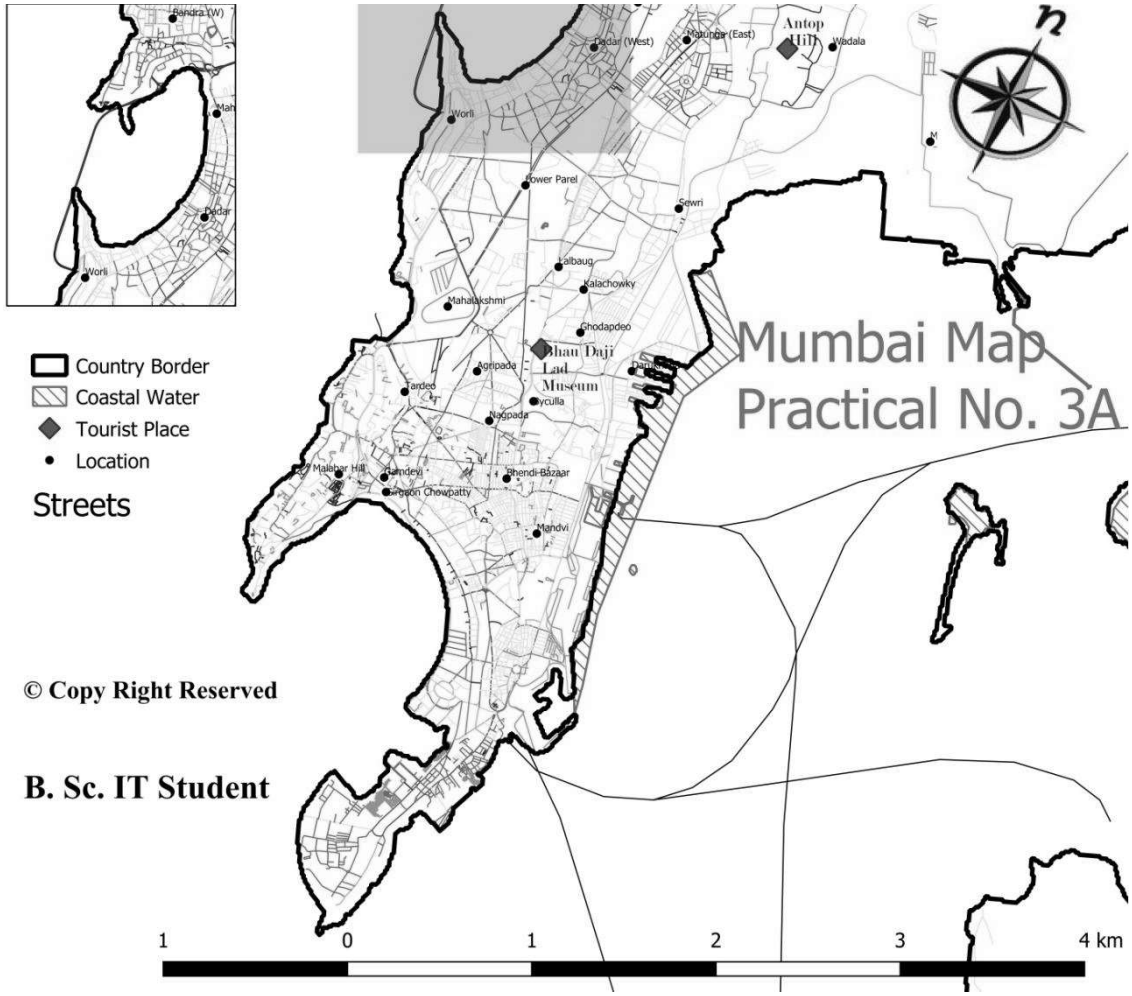
- A Map can be saved in Image or PDF using Layout → Export as Image / Export as PDF



- Save the Map to a location appropriate location as PDF or Image.

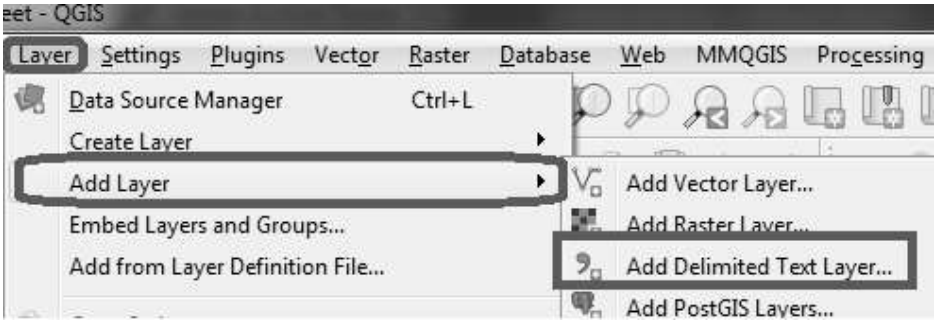


- Open the PDF or Image from location.

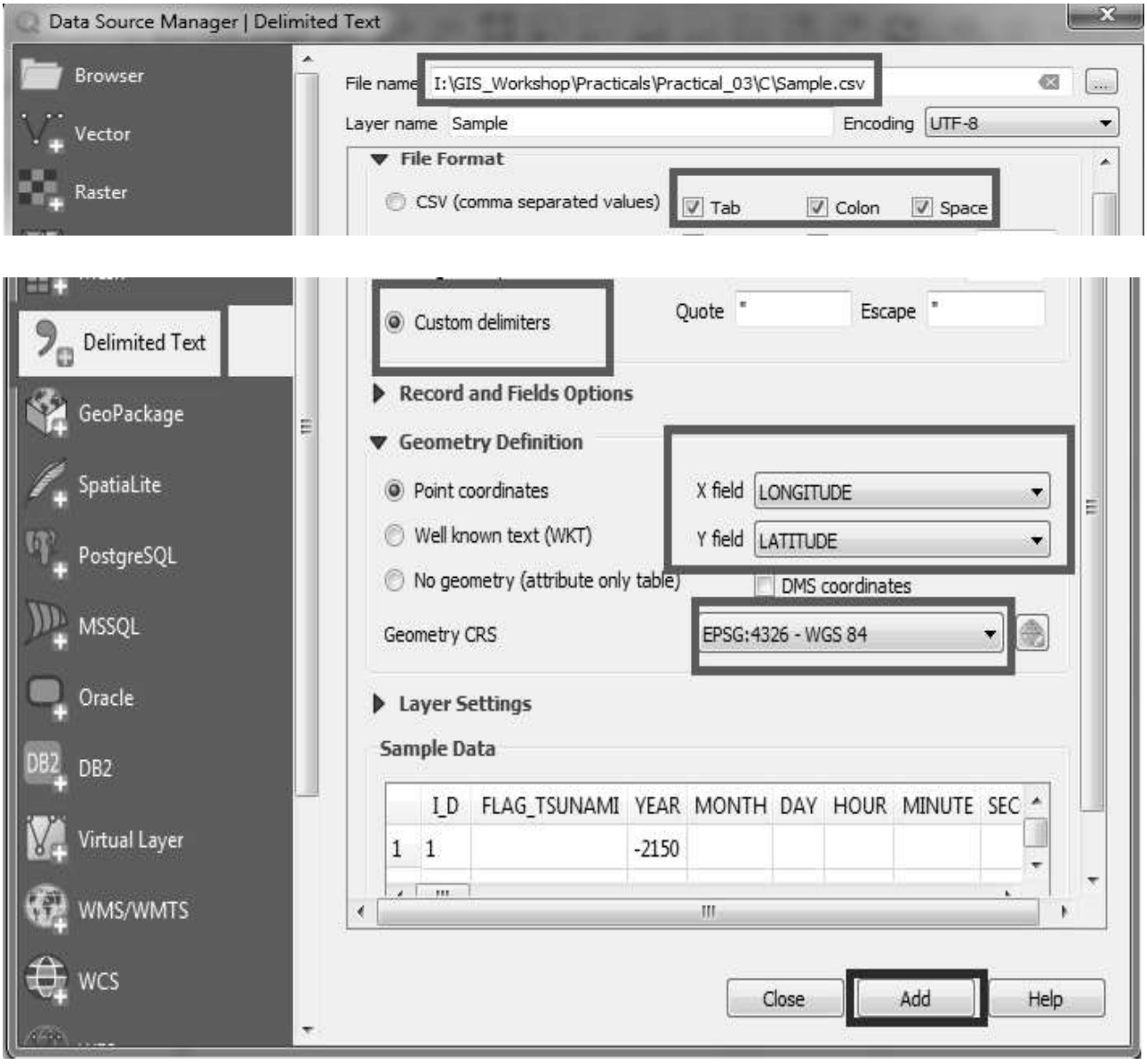


b) Importing Spreadsheets or CSV files

- Many times the GIS data comes in a table or an Excel spreadsheet or a list lat/long coordinates, therefore it has to be imported in a GIS project.
- Sample file for Earthquake data will be used in this practical.
- Go to Layer → Add Layer → Add Delimited text Layer



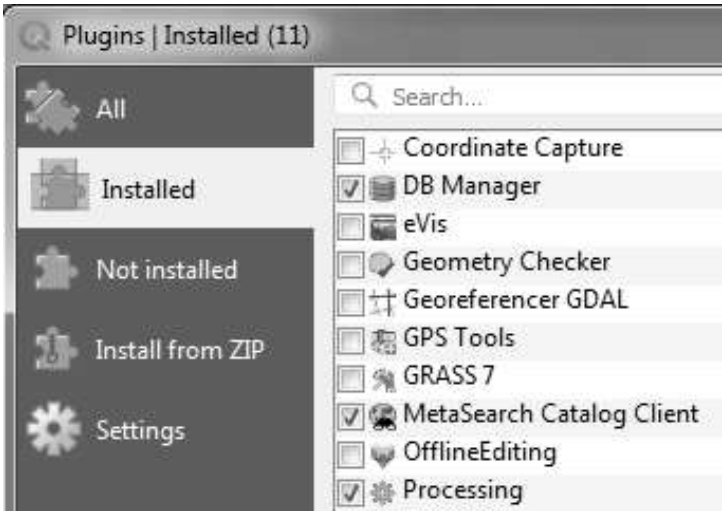
- Data Source Manager | Delimited Text window will appear
- Select the \GIS_Workshop\Practicals\Practical_03\C\Sample.csv file from data folder.



- Press ADD and close the window.
- Output:

c) Using Plugins

- Core plugins are already part of the standard QGIS installation. To use these, just enable them.
- Open QGIS. Click on Plugins → Manage and Install Plugins....



- **To enable a plugin**, check on the checkbox next to Plugin. This will enable the plugin to use it.
- **External plugins** are available in the QGIS Plugins Repository and need to be installed by the users before using them.
- Click on Not Installed or Install from ZIP.
- Once the plugin is downloaded and installed, you will see a confirmation dialog.
- Click on Plugins → <<new Plugin Name>>
- The Plugin if marked **Experimental plugin** can be installed, from Setting→ check on

or

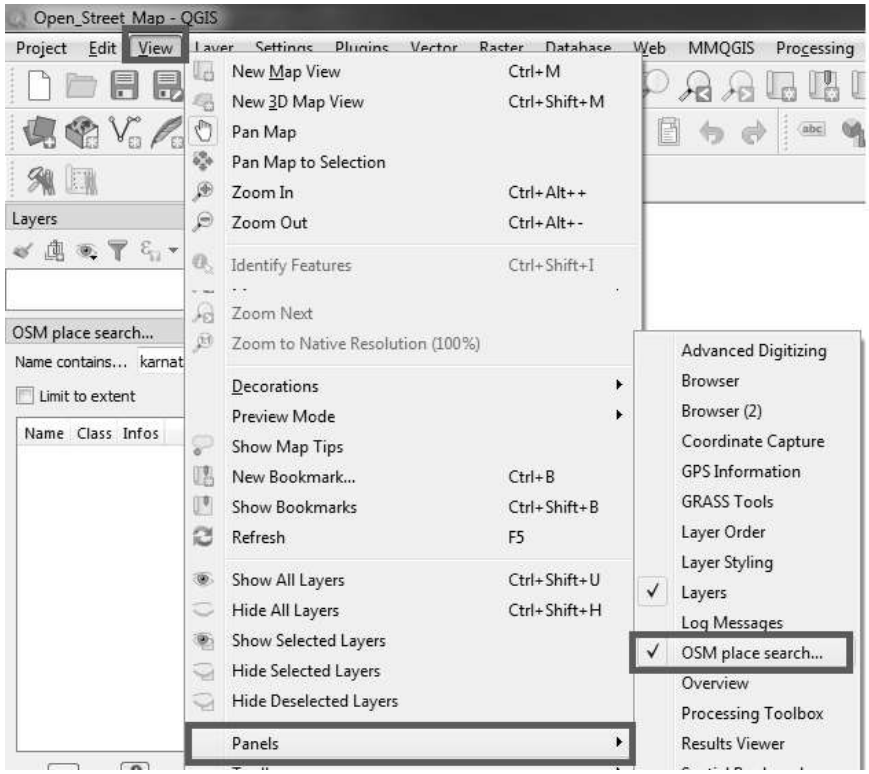
- A 

tab will be added to Plugin Manager Window.
- Click on a plugin name and Click Install.

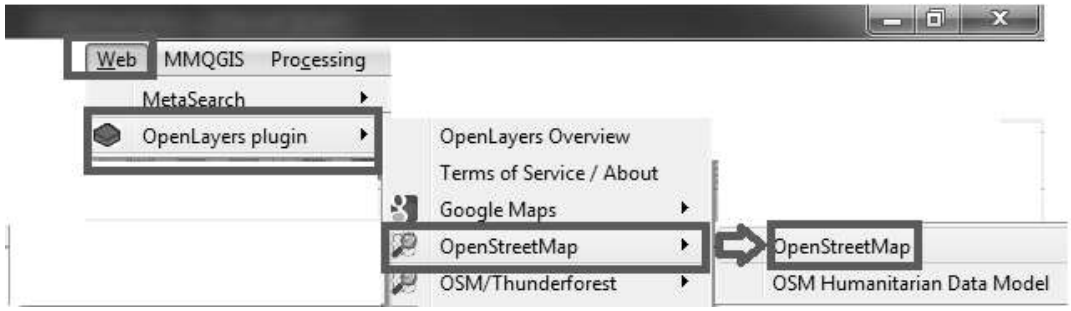
d) Searching and Downloading OpenStreetMap Data

OpenStreetMap (**OSM**) created by Steve Coast in the UK in 2004 is a collaborative project to create a free editable map of the world. Rather than the map itself, the data generated by the project is considered its primary output. The creation and growth of OSM has been motivated by restrictions on use or availability of map information across much of the world, and the advent of inexpensive portable satellite navigation devices.

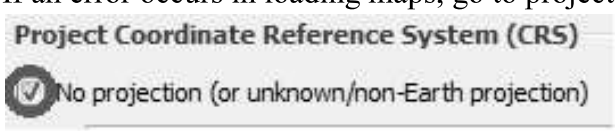
- Add "**Open Layer"** and "**OSM Search"** Plugin from Not Installed option from Plugin Manager Dialog Box.
- The **OSM Place Search** plugin will install itself as a *Panel* in QGIS, if not go to View → Panels → select OSM Place Search.

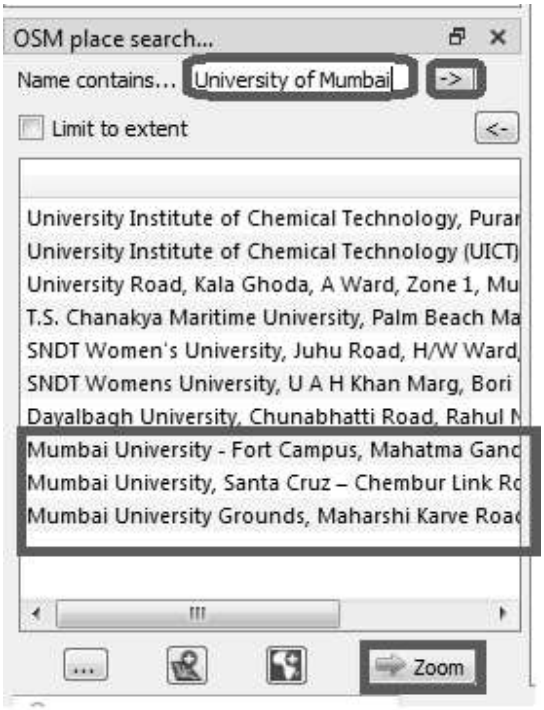


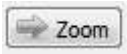
- Go to Web → OpenLayer Plugin and select Open Street Map



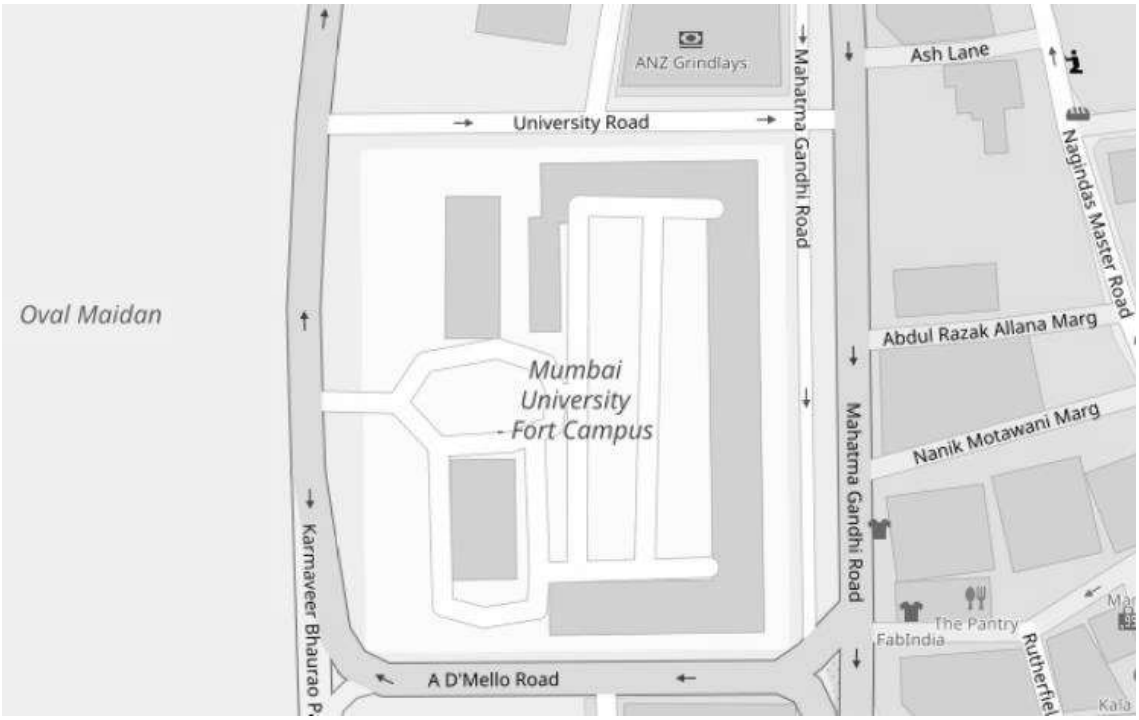
- A World map will appear on screen.
- If an error occurs in loading maps, go to project properties → CRS →





- In OSM Place search Pane → Enter Mumbai or any place name to search
- Double click on the desired place in OSM Place search Panel or Click and press 

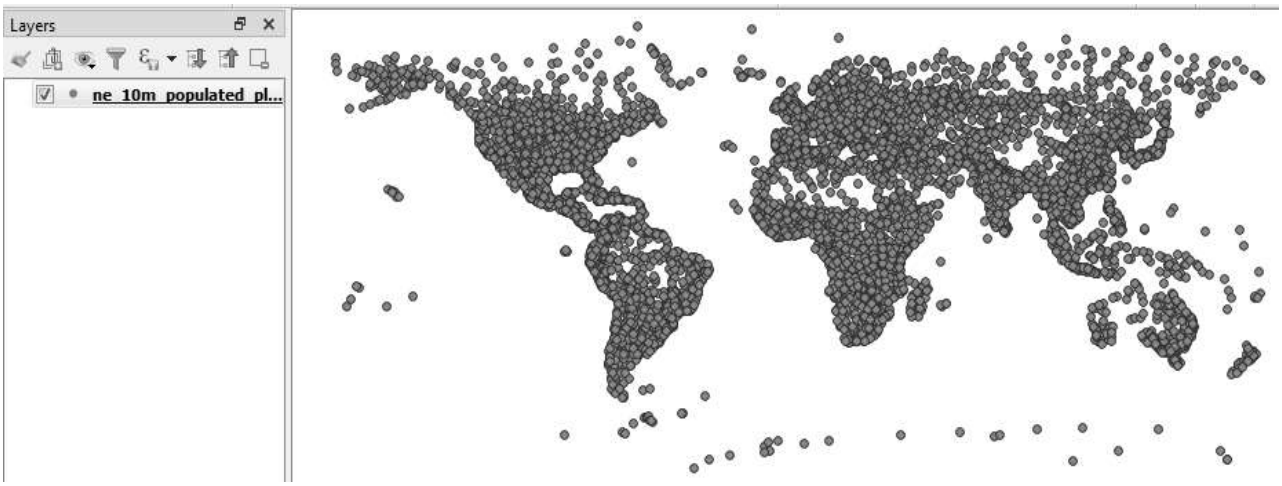
Output:



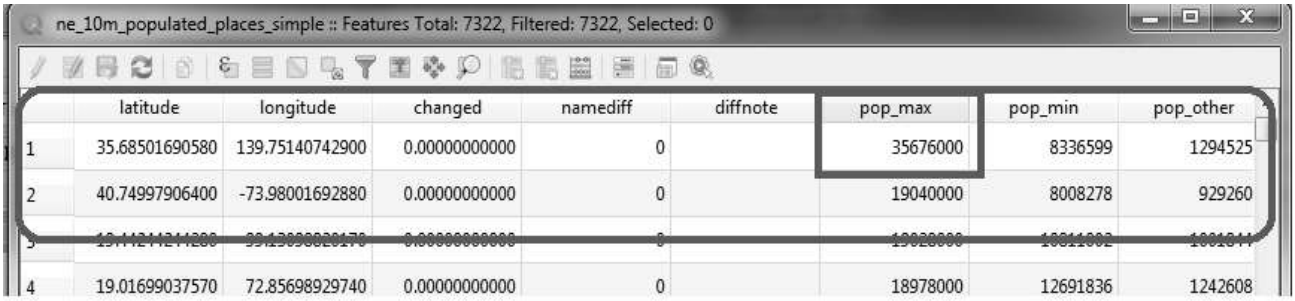
PRACTICAL - 4

A. Working with attributes

- Start a new project.
- Go to Layer → Add Layer → Add Vector Layer
- Select "\GIS_Workshop\Practicals\Practical_04\A\Data\ne_10m_populated_places_simple.zip"

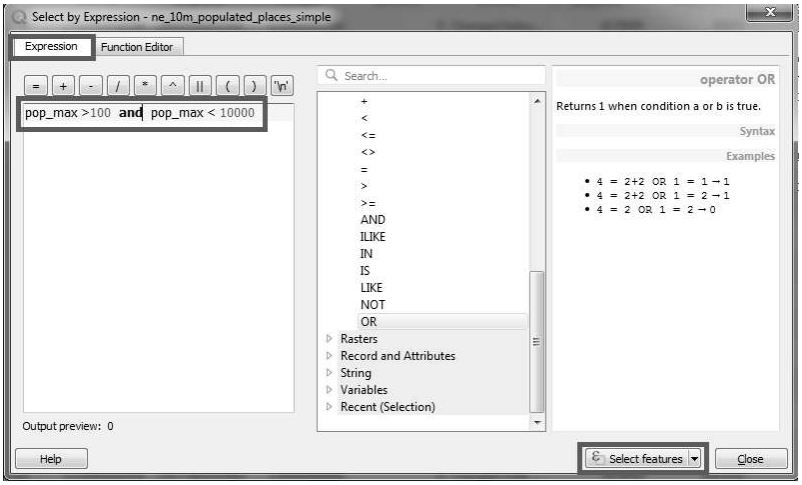


- Right click on Layer in Layer Panel → Open Attribute Table.
- Explore various attributes and their values in the Attribute table.
- To find the Place with maximum population click on "**pop_max"** file



	latitude	longitude	changed	namediff	diffnote	pop_max	pop_min	pop_other
1	35.68501690580	139.75140742900	0.00000000000	0		35676000	8336599	1294525
2	40.74997906400	-73.98001692880	0.00000000000	0		19040000	8008278	929260
3	[illegible]	[illegible]	[illegible]	0		[illegible]	[illegible]	[illegible]
4	19.01699037570	72.85698929740	0.00000000000	0		18978000	12691836	1242608

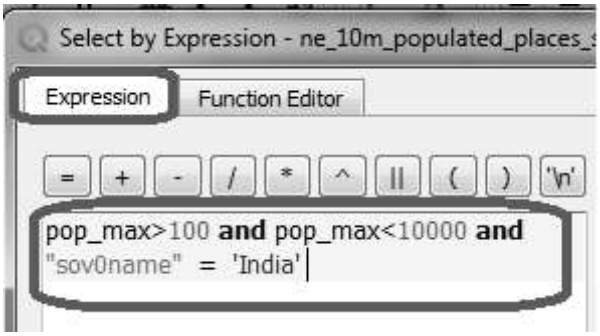
- On clicking the Select feature using expression  button the following window will appear.



- Enter pop_max>100 and pop_max<10000 and click  button to get all the places with population between 100 and 10000.

- The places matching the criteria will appear in different color.

- Different queries can be performed using the dataset.
- Try this

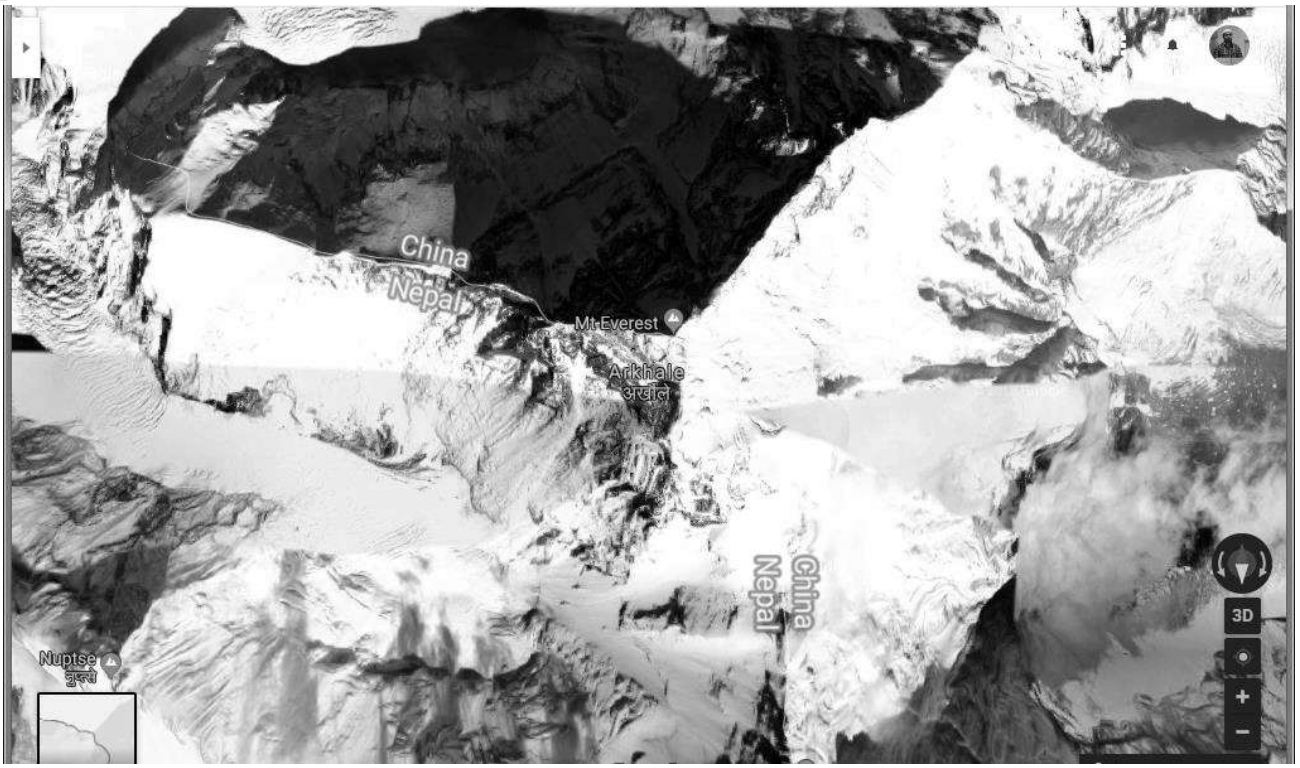


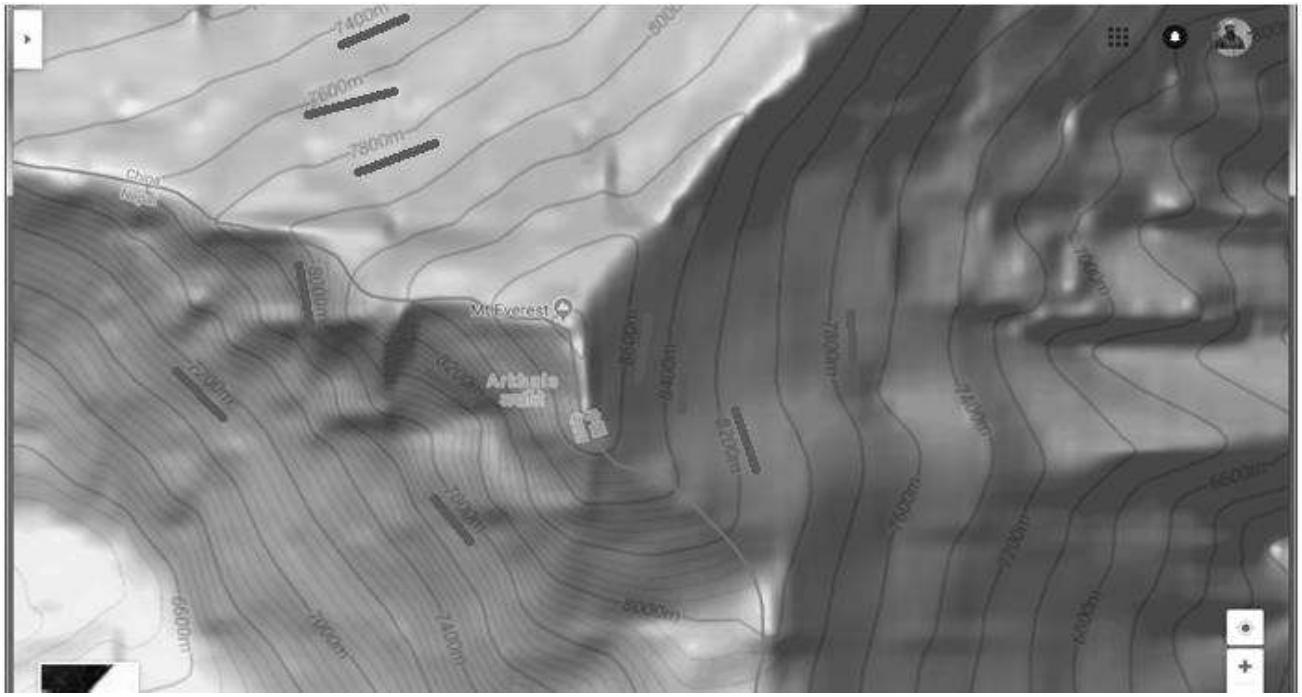
Will give

- Use the deselect button  to deselect the feature to be rendered in original color.

b) Terrain Data and Hill shade analysis

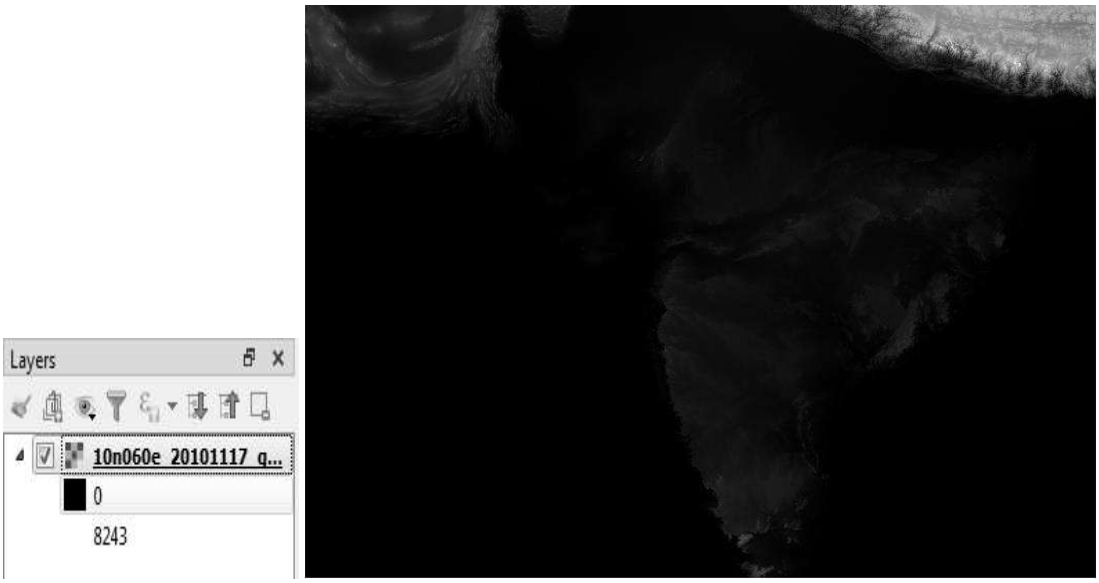
A terrain dataset is a multiresolution, TIN-based surface built from measurements stored as features in a geodatabase. Terrain or elevation data is useful for many GIS Analysis like, to generate various products from elevation data such as contours, hillshade etc.



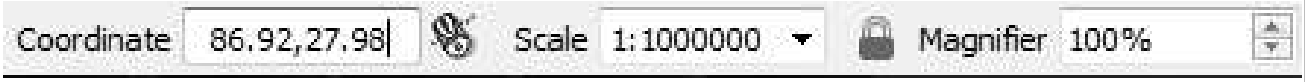


https://www.google.com/maps/@27.9857765,86.9285378,14.75z/data=!5m1!1e4?hl=en-US

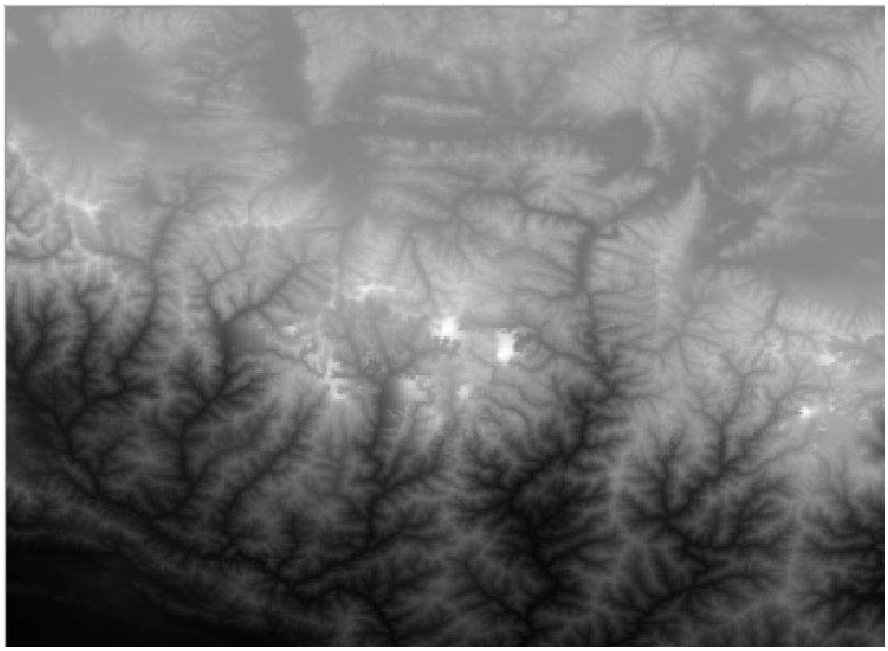
- Go to Layer → Add Raster Layer → select "10n060e_20101117_gmted_mea300.tif", from Data folder



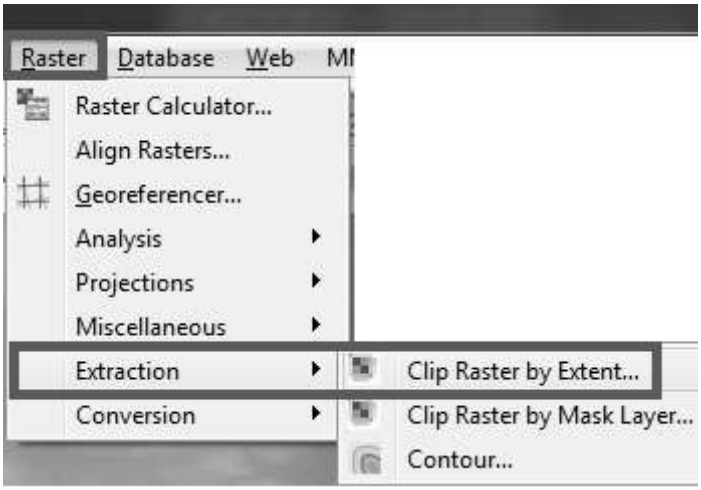
- The Lower altitude regions are shown using dark color and higher using light shade as seen on top region containing Himalaya and Mt Everest.
- Mt. Everest - is located at the coordinates 27.9881° N, 86.9253° E.
- Enter 86.92, 27.98 in the coordinate field, Scale 900000 and Magnifier 100% at the bottom of QGIS.

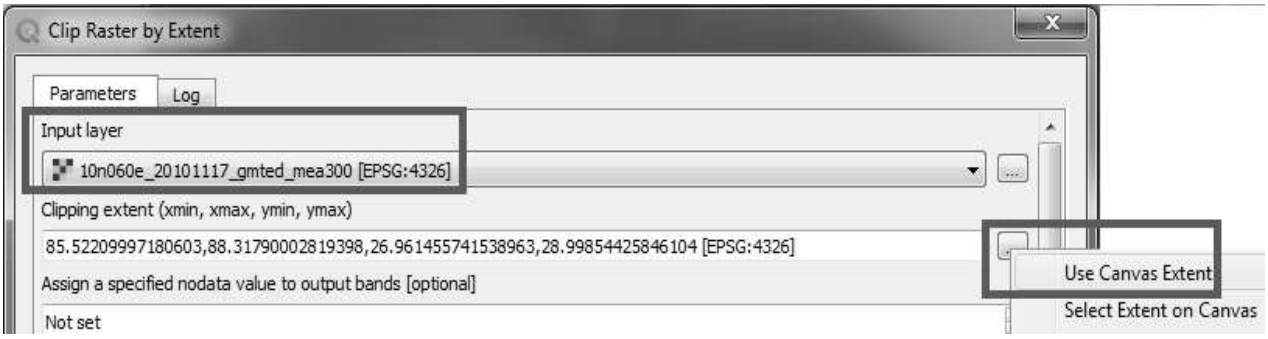


- Press enter the view port will be centered on Himalaya Region.

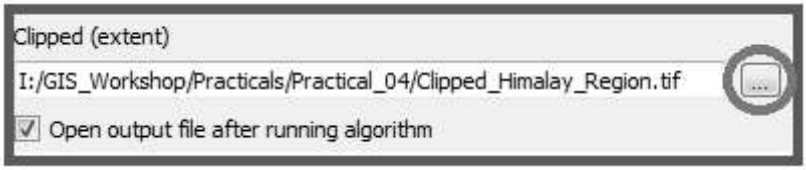


- Crop the raster layer only for the region under study.
- Go to Raster → Extraction→ Clip Raster by Extent

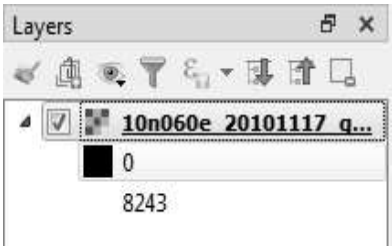




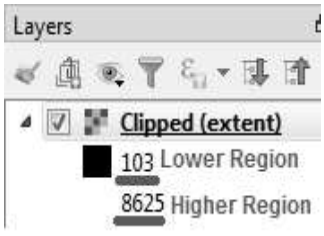
- Select the raster layer *(if project contains multiple layers)*.
- Select the clipping area by selecting the option **Use Canvas Extends** if the visible part of map is to be selected or manually select an area on canvas by using **Select Extent on Canvas**.
- Select the location and file name for storing clipped raster layer.



- Press RUN.
- Deselect the original layer and keep the clipped one.
- The Clipped raster layer is representing altitude are from 103 Meters.

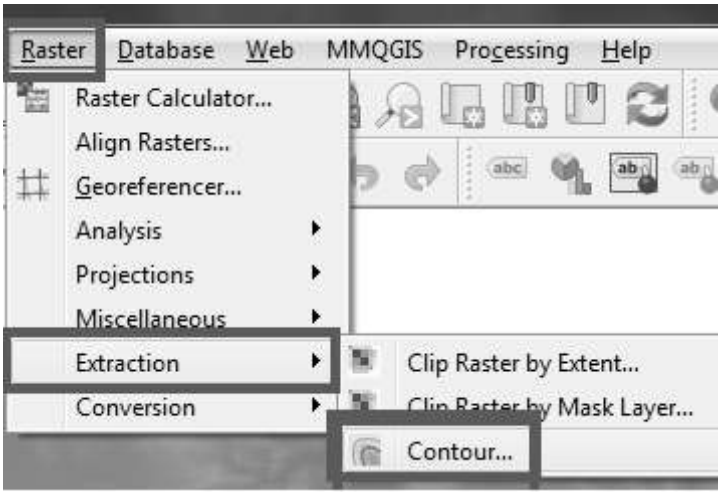


Original Raster

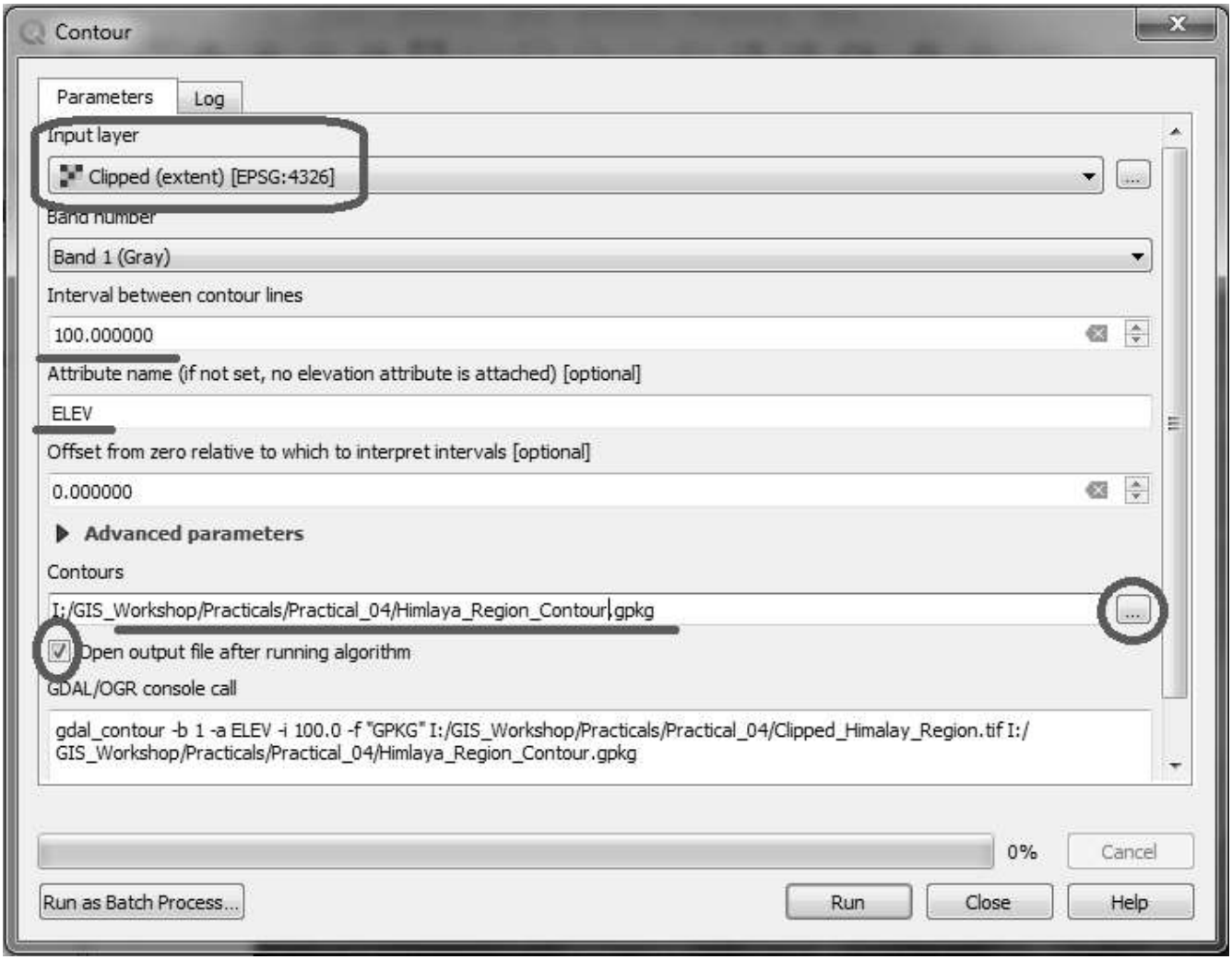


Clipped Raster

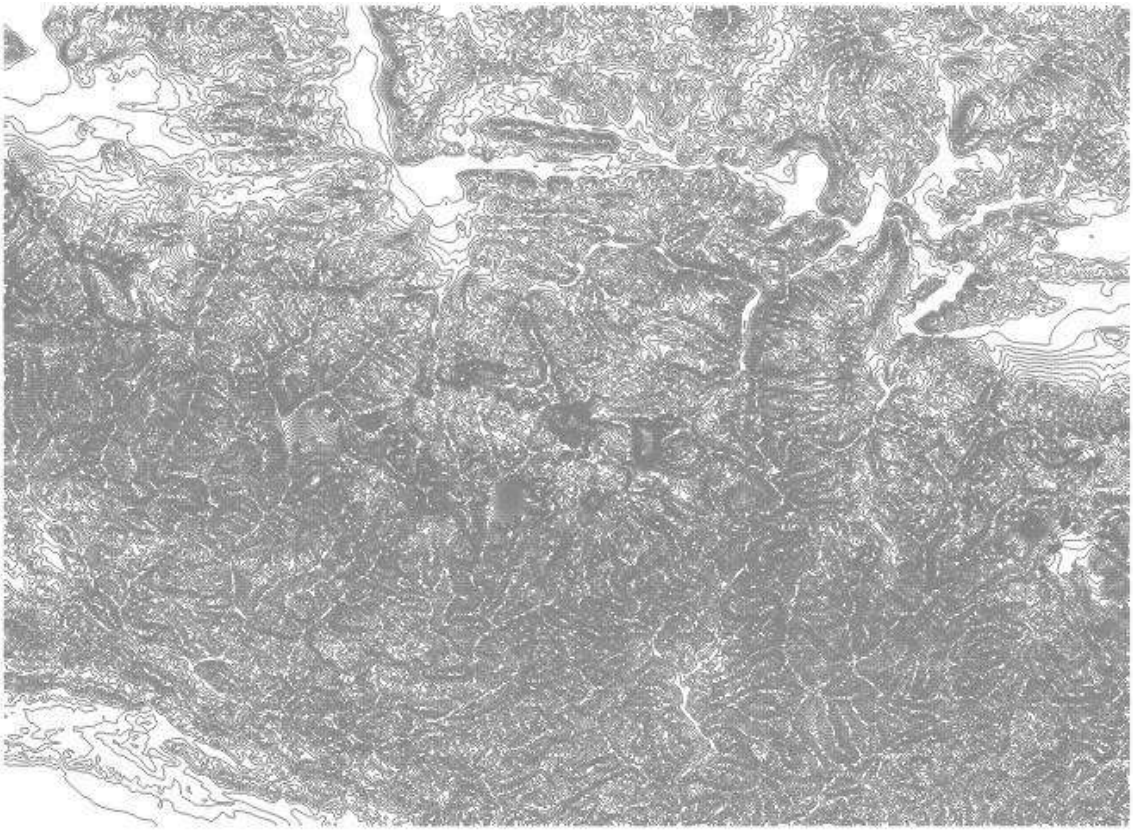
- Counter lines are the lines on a map joining points of equal height above or below sea level. A **contour interval** in surveying is the vertical distance or the difference in the elevation between the two **contour** lines in a topographical map.
- To derive counter lines from given raster.
- Go to Raster → Extraction→ Contour



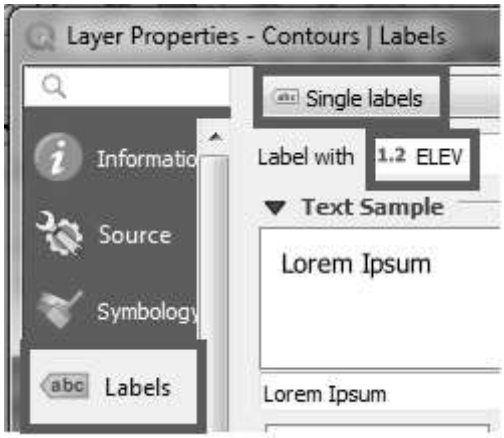
- The Contour configuration window will appear

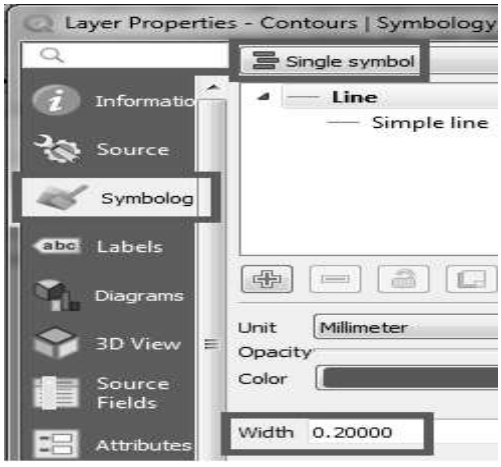


- Select the input raster layer name. Set contour interval 100.00 meters, select the output file name & location and check the option to add output file to project after processing.
- Press “RUN”.
- The contour layer will appear like this



- Label the layer using “ELEV” field and set appropriate symbols for line.

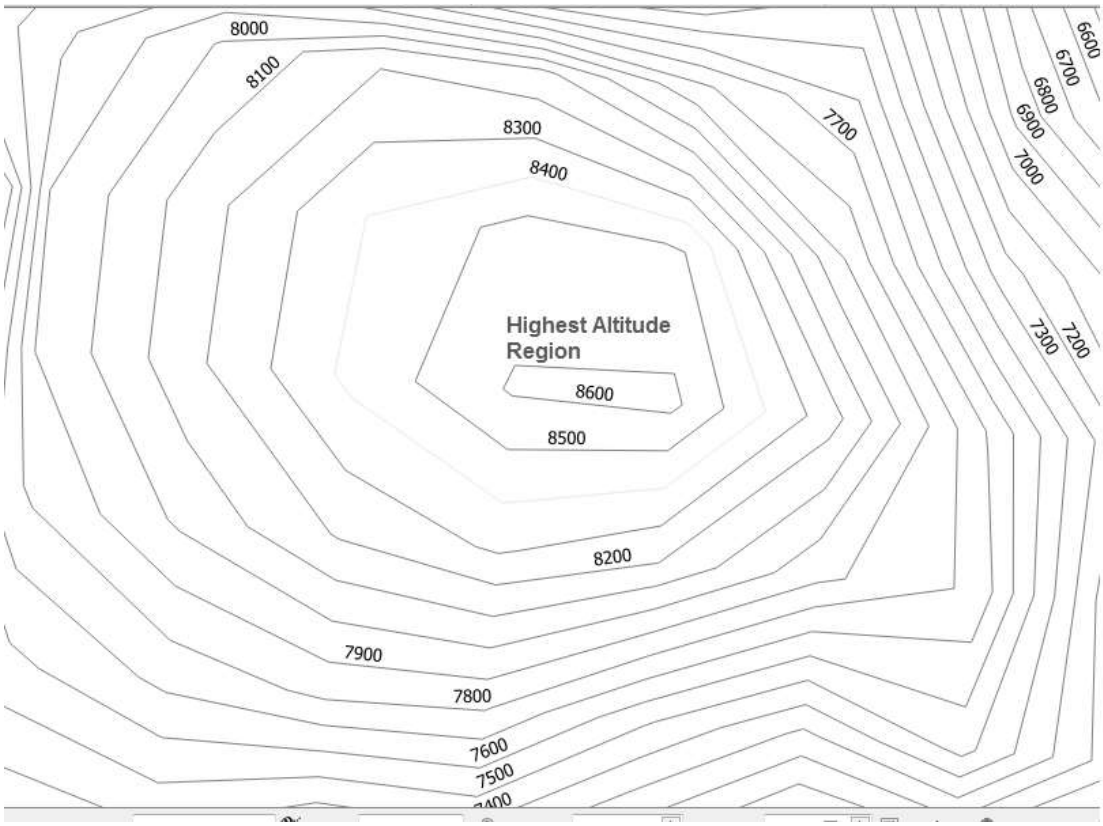




- In the Layer panel right click on Contour Raster Layer and select “**Open Attribute table**”,
- Arrange the table in descending order based on the value of “ELEV” column.
-

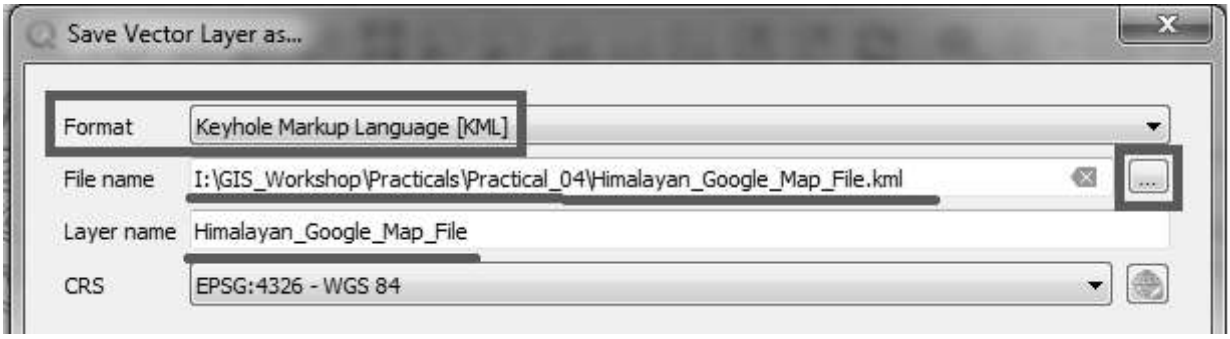
Contours :: Features Total: 4714, Filtered: 4714, Selected: 1

	fid	ID	ELEV
1	1990	1989	8600
2	1989	1988	8500
3	2337	2336	8400
4	2019	2018	8400
5	2336	2335	8300
6	2018	2017	8300
7	2335	2334	8200
8	2017	2016	8200
9	2938	2937	8100
10	2334	2333	8100



Compare the above counter line raster layer with the previous Google map image or visit **https://www.google.com/maps/@27.9857765,86.9285378,14.75z/data=!5m1!1e4?hl=en-US**

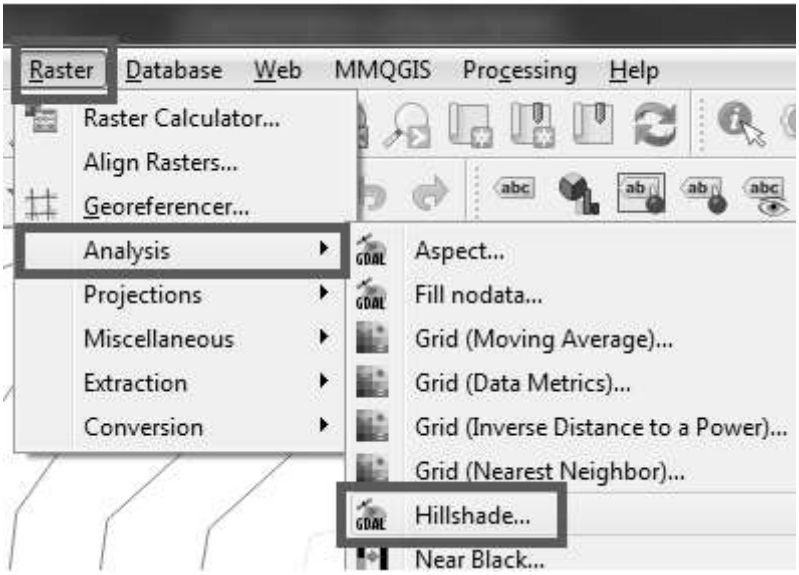
- To verify the above contour files using Google Map
- Make a copy of Contour Layer, Go to Layer →Save As
- Select file format as "Keyhole Markup Language", set file name, location and Layer Name.
- Also set CRS to WGS 84 EPSG:4326



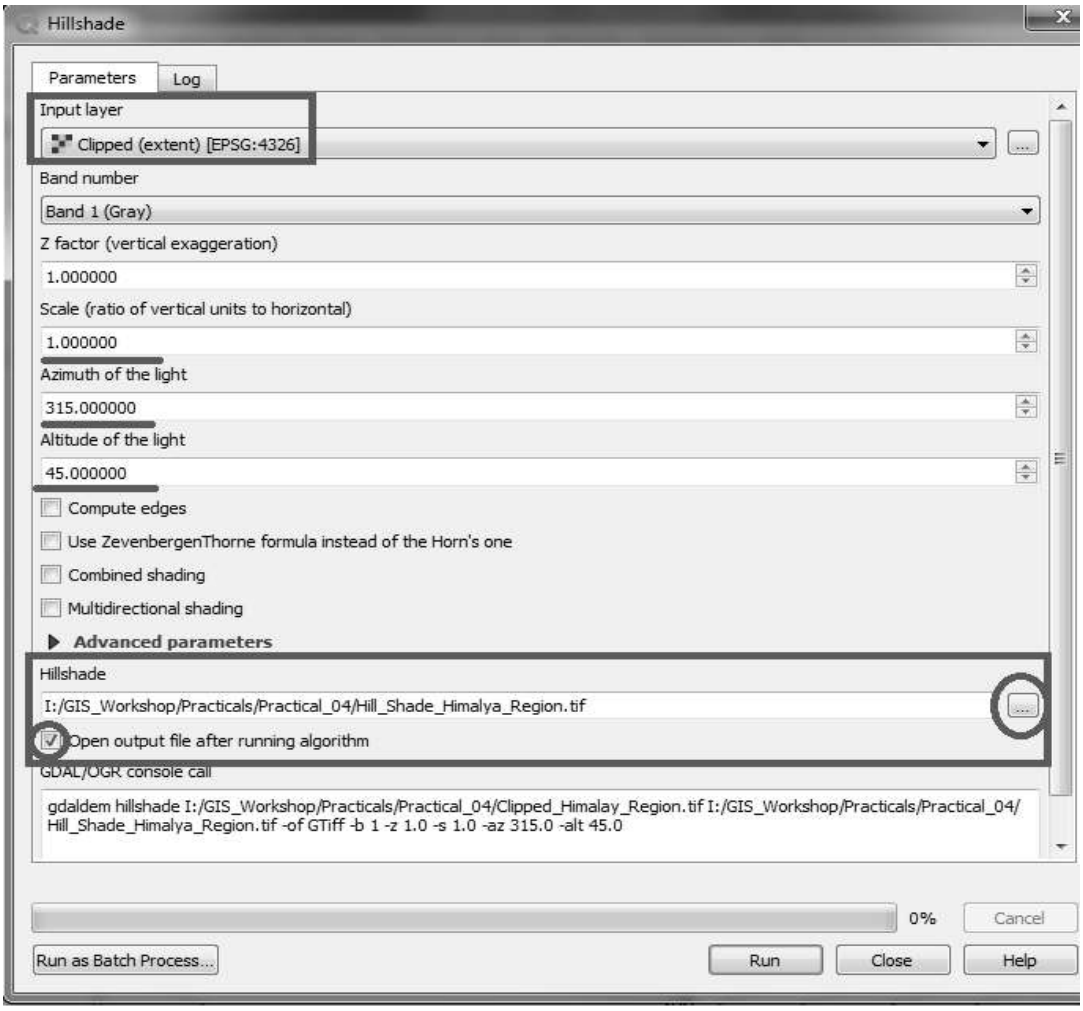
- Go to the stored location on Hard Disk and open the "Himalayan_Google_Map_File.kml" with Google Map.\

A **Hillshade** is a grayscale 3D representation of the surface, showing the topographical shape of hills and mountains using shading (levels of gray) on a map, just to indicate relative slopes, mountain ridges, not absolute height.

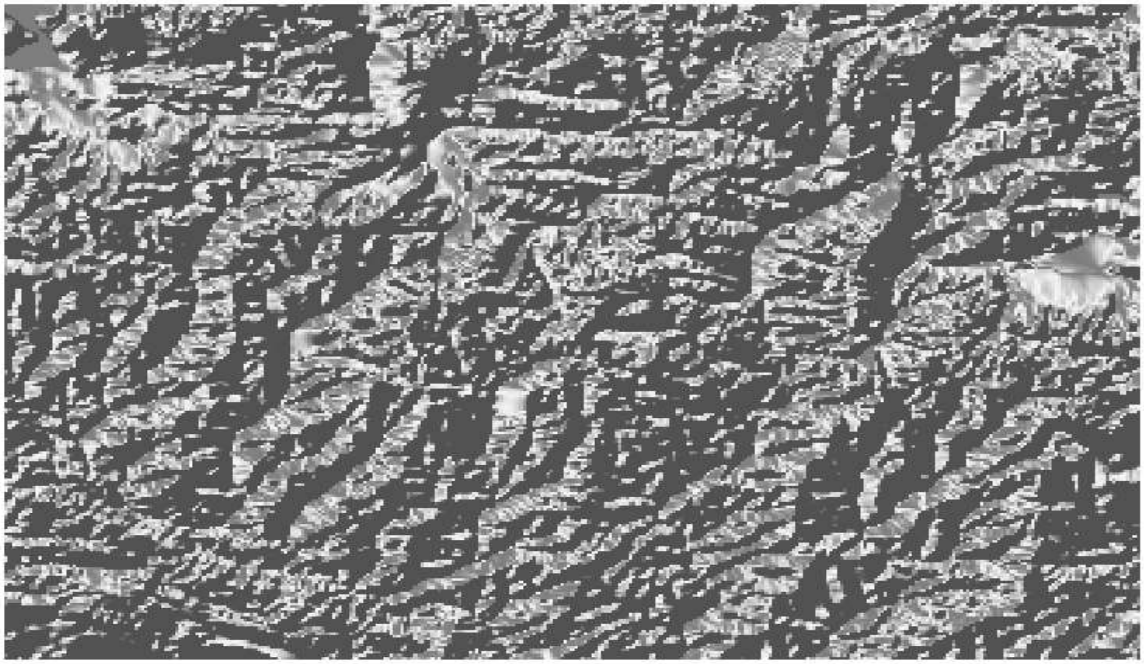
- For Hill Shade surface analysis
- Go to Plugin → Install Georeferencer GADL.
- After successful installation of plugin Go to Raster → Analysis → Hill Shade



- Select the input raster layer, select file name and location for storing Hill Shade output file.



- Press “RUN” and Close the Hill Shape Dialog window.
- After Raster styling the Output will appear like this.

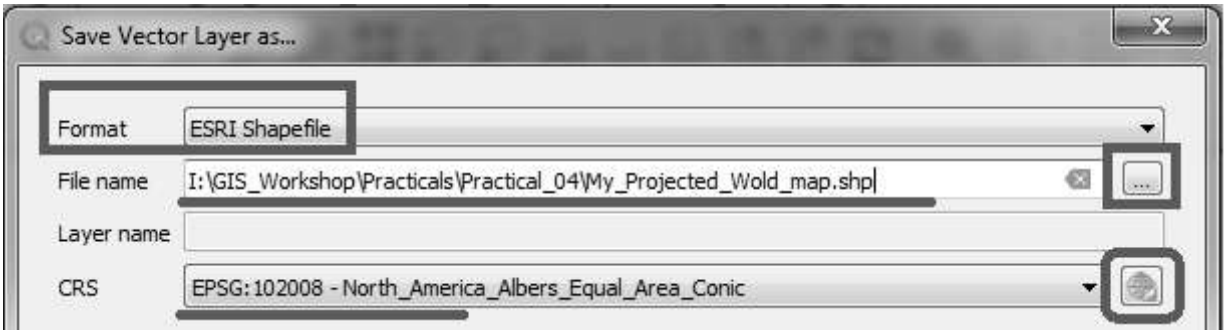


PRACTICAL - 5

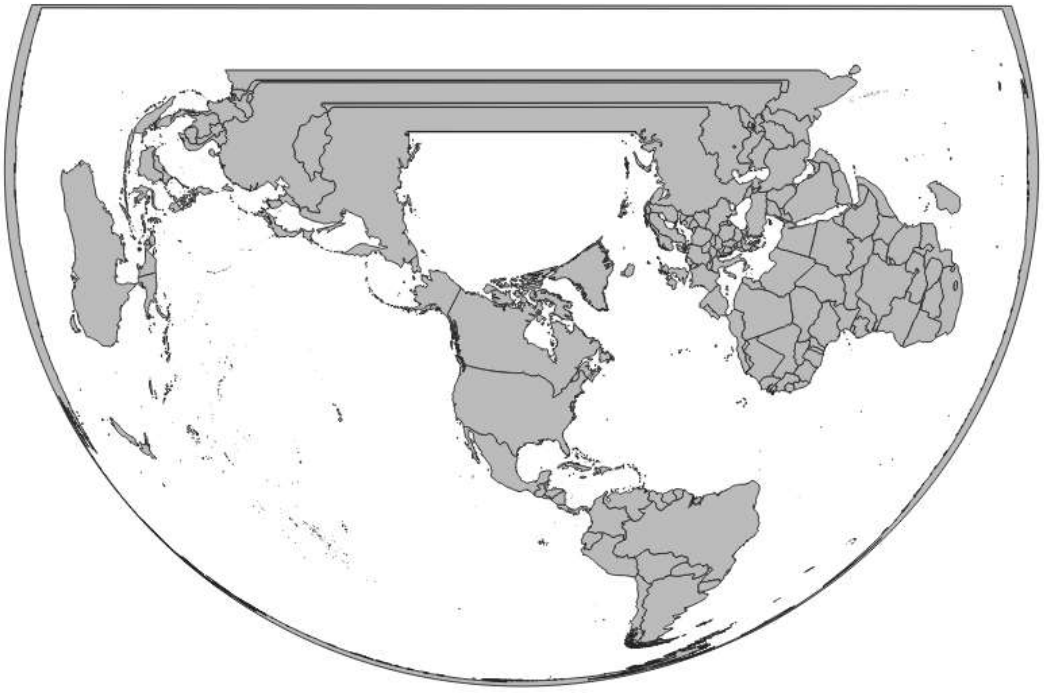
Working with Projections and WMS Data

A **Web Map Service** (**WMS**) is a standard protocol developed by the Open Geospatial Consortium in 1999 for serving georeferenced map images over the Internet. These images are typically produced by a map server from data provided by a GIS database

- Start a new Project.
- Layer → Add Layer →Vector Layer
- Select "ne_10m_admin_0_countries.zip" Layer from data folder.
- Go to Layer → Save As
  Select format as ESRI Shape File
  Select folder location and file name
  Set CRS North_America_Albers_Equal_Area_Conic EPSG: 102008



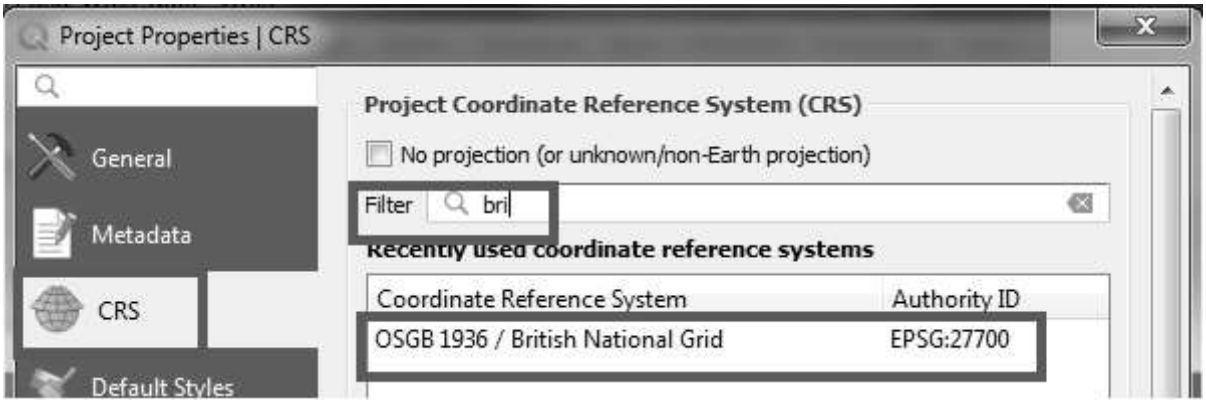
- Press "OK".
- Deselect the original Image and keep the projected layer visible.



- Select Layer → Add Layer → Add Raster Layer → Select MiniScale_(standard)_R17.tif from Location

"GIS_Workshop\Practicals\Practical_05\DATA\minisc_gb\minisc_gb\data\RGB_TIF_compressed\MiniScale_(standard)_R17.tif"

- The Layer appears on a different location than the location where Great Britain is shown on Map.



- Open Layer Properties→CRS → Search bri → select British National Grid EPSG 27700.
- Processing may take some time.
- Locate United Kingdom on Layer; the vector layer exactly coincides by the raster layer covering United Kingdom.