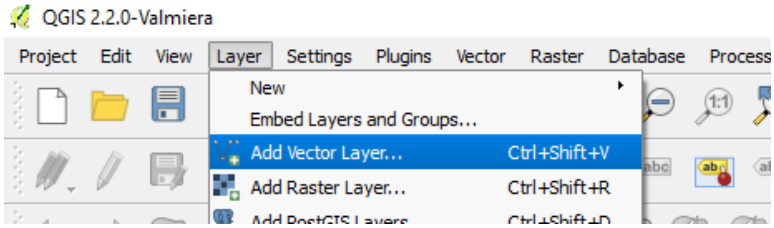
Practical No. 7

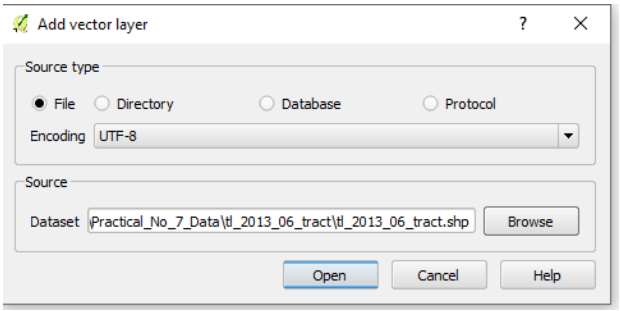
A) Performing table join

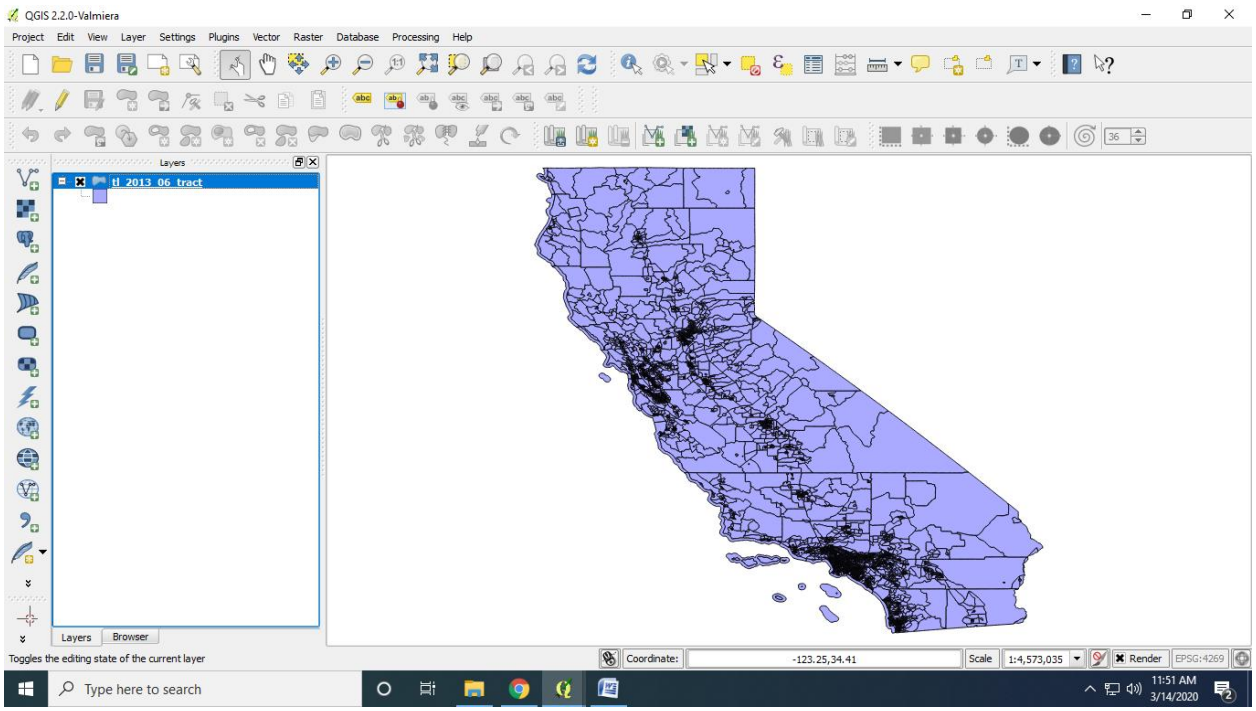
Dataset we are using:

tl_2013_06_tract.zip
ca_tracts_pop.csv

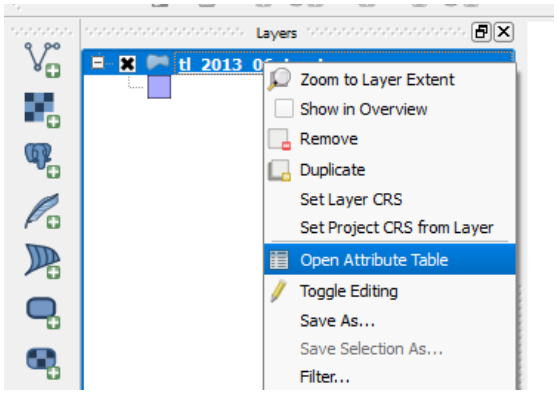
1. Add vector layer “tl_2013_06_tract.shp”



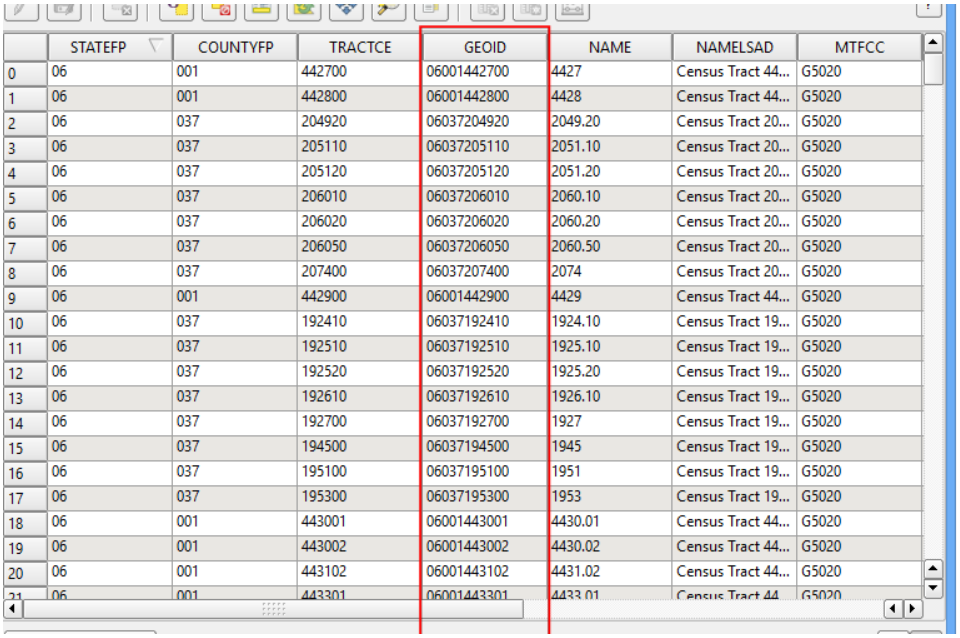




2. Right click on this layer in layer pane and select “Open Attribute Table”

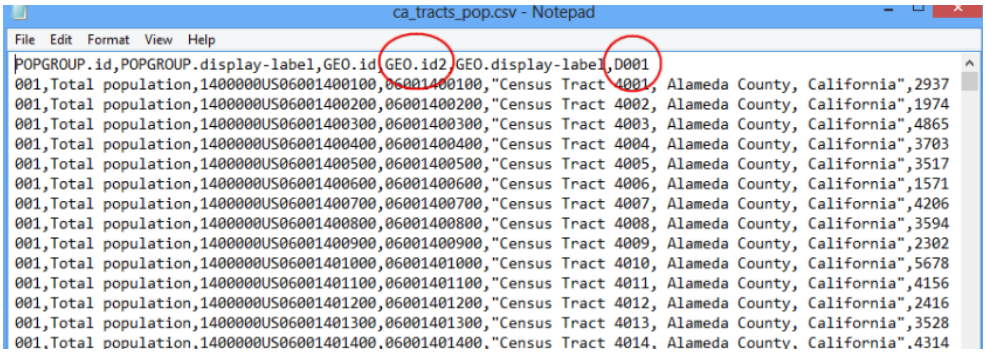


3. Observe the attributes of this shape file, to join table with this shape file we need to have one common column, in this case GEOID is the unique identifier for each tract and it can be used to join any other table containing the same ID.

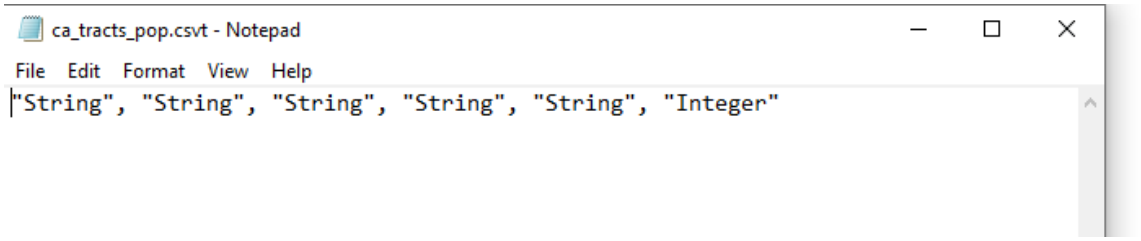


	STATEFP	COUNTYFP	TRACTCE	GEOID	NAME	NAMELSAD	MTFCC
0	06	001	442700	06001442700	4427	Census Tract 44...	G5020
1	06	001	442800	06001442800	4428	Census Tract 44...	G5020
2	06	037	204920	06037204920	2049.20	Census Tract 20...	G5020
3	06	037	205110	06037205110	2051.10	Census Tract 20...	G5020
4	06	037	205120	06037205120	2051.20	Census Tract 20...	G5020
5	06	037	206010	06037206010	2060.10	Census Tract 20...	G5020
6	06	037	206020	06037206020	2060.20	Census Tract 20...	G5020
7	06	037	206050	06037206050	2060.50	Census Tract 20...	G5020
8	06	037	207400	06037207400	2074	Census Tract 20...	G5020
9	06	001	442900	06001442900	4429	Census Tract 44...	G5020
10	06	037	192410	06037192410	1924.10	Census Tract 19...	G5020
11	06	037	192510	06037192510	1925.10	Census Tract 19...	G5020
12	06	037	192520	06037192520	1925.20	Census Tract 19...	G5020
13	06	037	192610	06037192610	1926.10	Census Tract 19...	G5020
14	06	037	192700	06037192700	1927	Census Tract 19...	G5020
15	06	037	194500	06037194500	1945	Census Tract 19...	G5020
16	06	037	195100	06037195100	1951	Census Tract 19...	G5020
17	06	037	195300	06037195300	1953	Census Tract 19...	G5020
18	06	001	443001	06001443001	4430.01	Census Tract 44...	G5020
19	06	001	443002	06001443002	4430.02	Census Tract 44...	G5020
20	06	001	443102	06001443102	4431.02	Census Tract 44...	G5020
21	06	001	443301	06001443301	4433.01	Census Tract 44	G5020

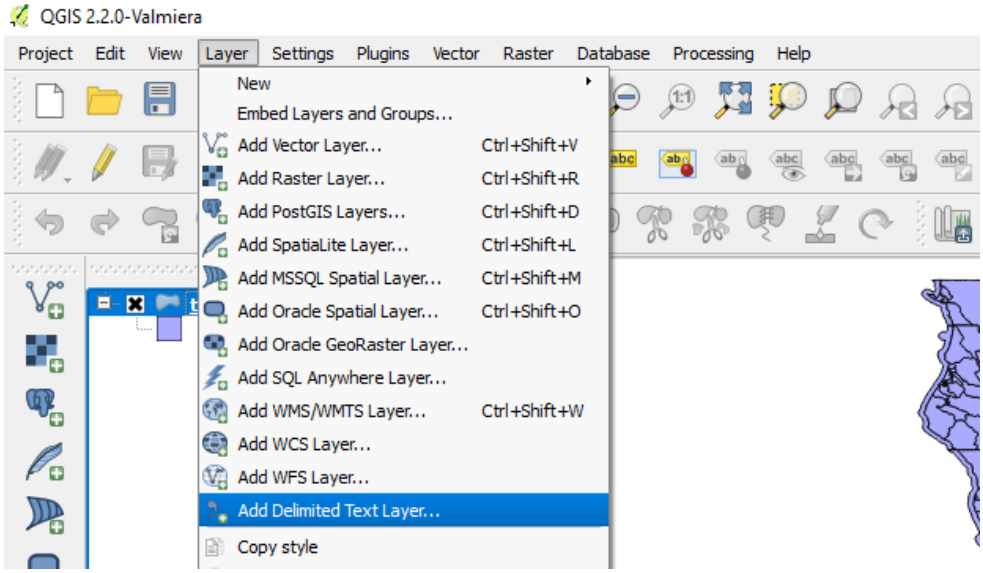
4. Open the .csv file “ca_tracts_pop.csv” with notepad. Each row of this file contains information about tract with unique identifier as we have seen in previous step. Here the same field is named as GEO.id2 in csv. In this csv file D001 column has population value for each census tract.



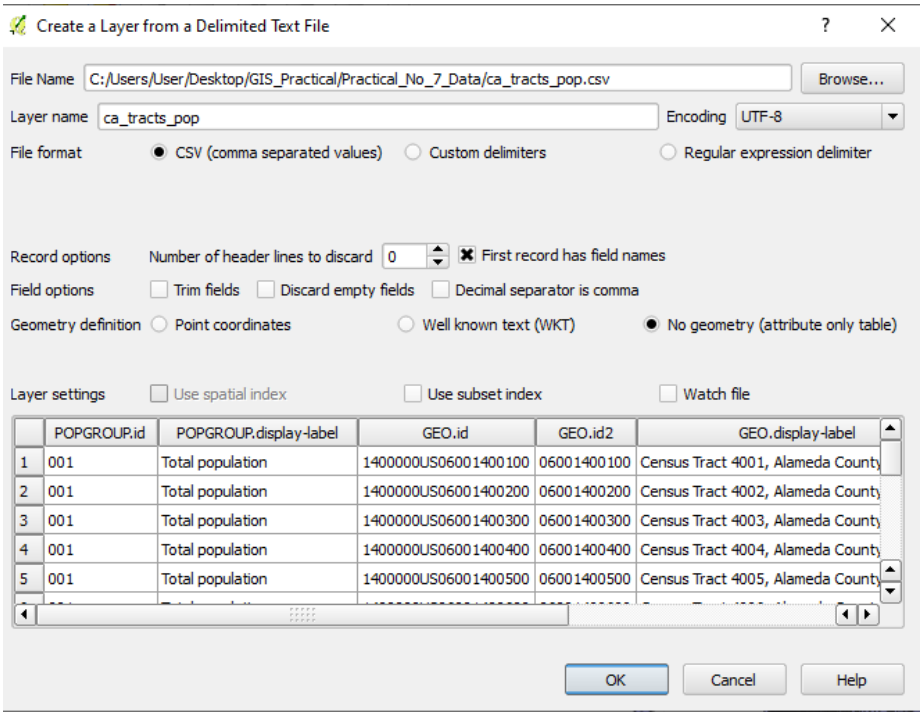
5. We can import the above file directly in QGIS but the default type for each column will be String (text). This is fine for all the columns except D001 which contains Population value and if this is imported as text then it will not allow us to perform any mathematical operations on this column.
6. To tell QGIS to import this column as number we need to create one text file with .csvt extension, this file will be used to specify just the data types of each column as shown below. Save this file as "ca_tracts_pop.csvt" in the same folder.



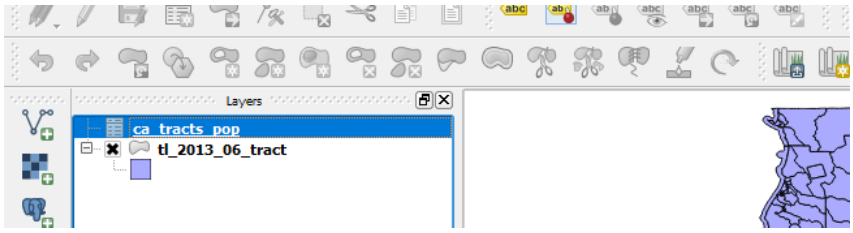
7. Now we are ready to import csv file, go to layer → Add Delimited Text Layer…



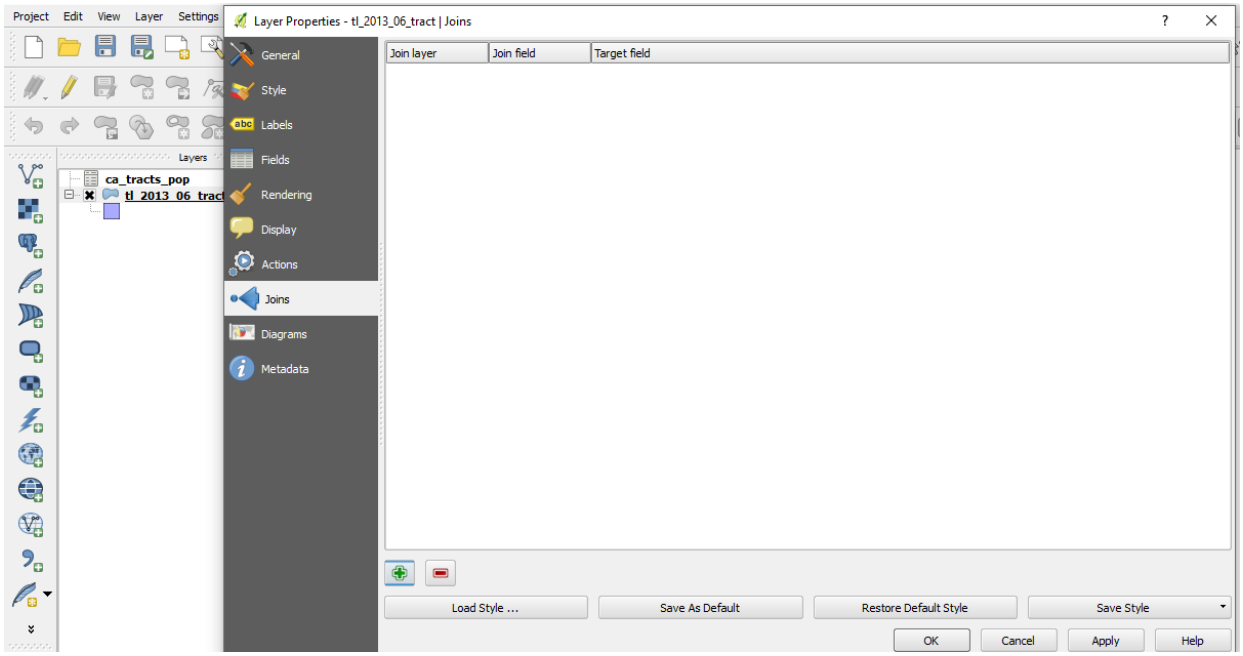
8. Browse to the location where the csv file is stored and select it. Select file format as CSV. Since we are importing this file as table, we need to specify that this file contains no geometry. Select No Geometry option and click on Ok.



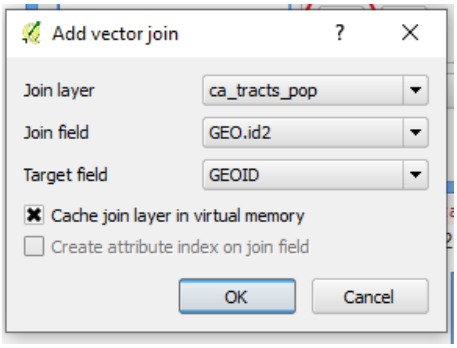
9. The csv is imported as table in QGIS.



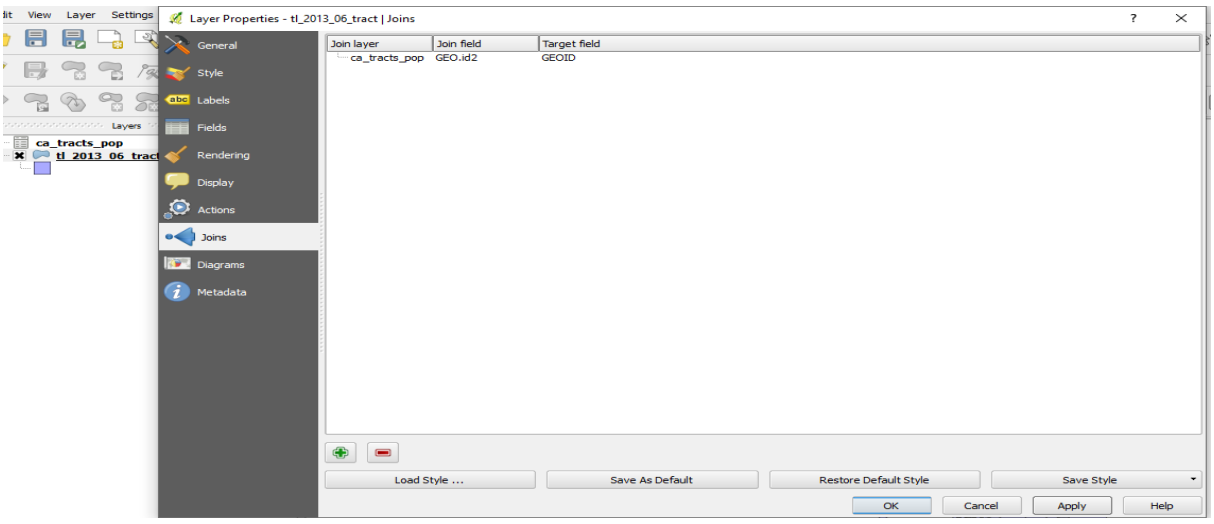
10. Double click on tl_2013_06_tract layer in layer pane to open the Layer Properties window.
11. On layer properties window click on Join tab and click on plus (+) button at the bottom to create new table join.



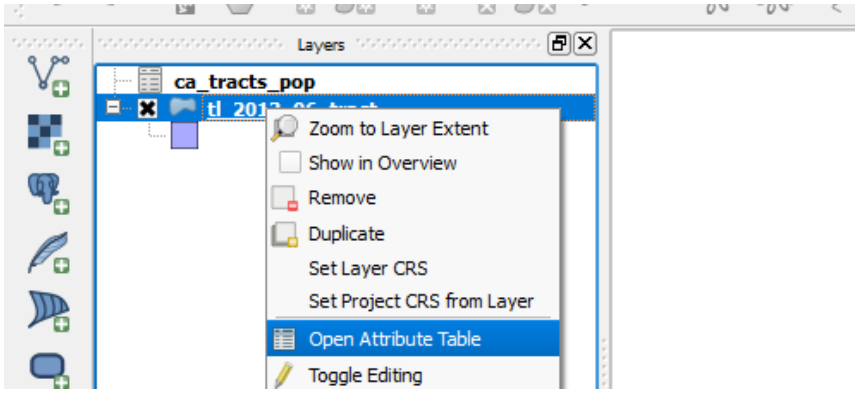
12. In the Add vector join dialog box select ca_tracts_pop as Join layer, select GEO.id2 as Join field and GEOID as Target field. Click Ok.



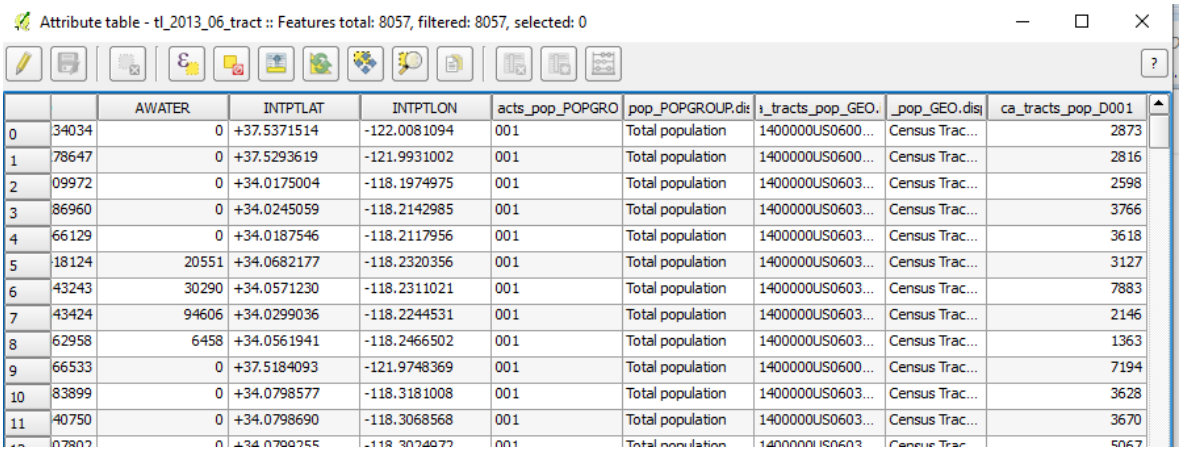
Click on Ok button on Layer properties window and then close it.



13. Now, right click on tl_2013_06_tract and select Open Attribute Table.

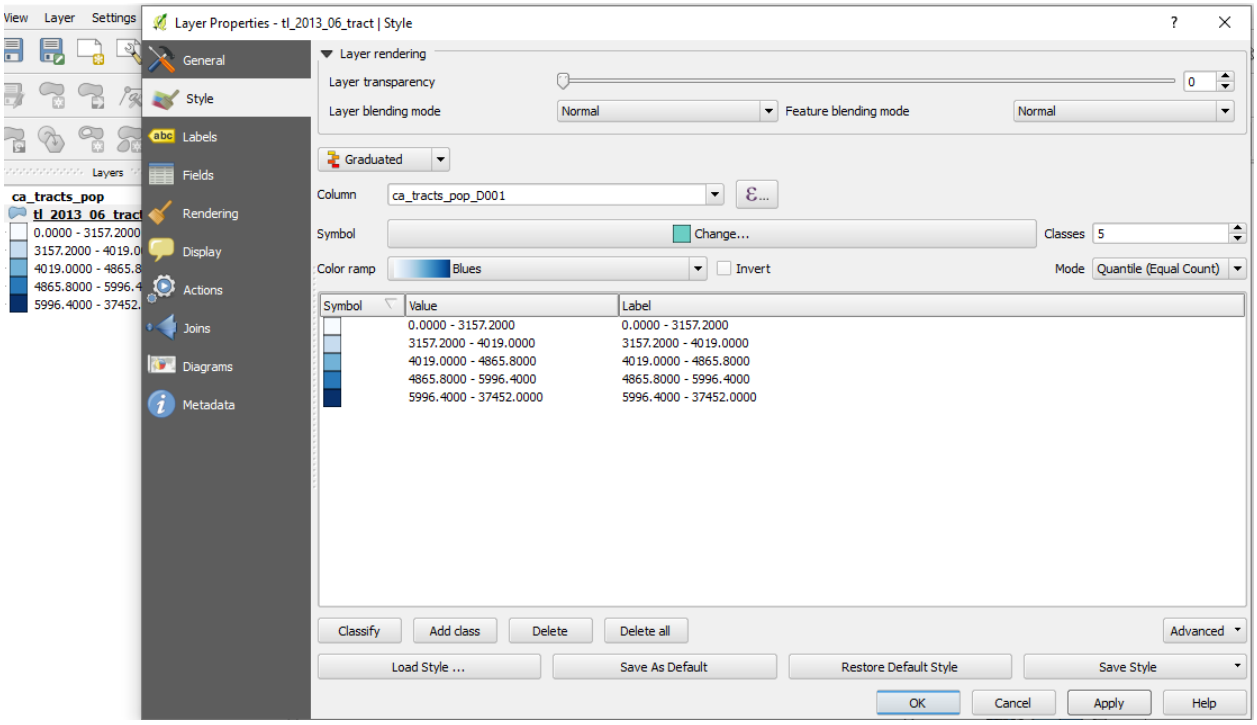


14. We can see new ca_tracts_pop_D001 is added for each feature. Close the attribute table.



		AWATER	INTPTLAT	INTPTLON	acts_pop_POPGRO	pop_POPGROUP.dis	_tracts_pop_GEO.	_pop_GEO.disp	ca_tracts_pop_D001
0	34034	0	+37.5371514	-122.0081094	001	Total population	1400000US0600...	Census Trac...	2873
1	78647	0	+37.5293619	-121.9931002	001	Total population	1400000US0600...	Census Trac...	2816
2	09972	0	+34.0175004	-118.1974975	001	Total population	1400000US0603...	Census Trac...	2598
3	86960	0	+34.0245059	-118.2142985	001	Total population	1400000US0603...	Census Trac...	3766
4	66129	0	+34.0187546	-118.2117956	001	Total population	1400000US0603...	Census Trac...	3618
5	18124	20551	+34.0682177	-118.2320356	001	Total population	1400000US0603...	Census Trac...	3127
6	43243	30290	+34.0571230	-118.2311021	001	Total population	1400000US0603...	Census Trac...	7883
7	43424	94606	+34.0299036	-118.2244531	001	Total population	1400000US0603...	Census Trac...	2146
8	62958	6458	+34.0561941	-118.2466502	001	Total population	1400000US0603...	Census Trac...	1363
9	66533	0	+37.5184093	-121.9748369	001	Total population	1400000US0600...	Census Trac...	7194
10	83899	0	+34.0798577	-118.3181008	001	Total population	1400000US0603...	Census Trac...	3628
11	40750	0	+34.0798690	-118.3068568	001	Total population	1400000US0603...	Census Trac...	3670

15. Double click on the same layer. Click on style tab, select Graduated from the dropdown. We need to assign different color to each census tract based on population count, so select ca_tracts_pop_D001 as the column. Select any color ramp from the drop down. In mode select Quantile (Equal Count). Next click on Classify button, now we can see different color is assigned to various population ranges. Click on Ok.


Layer Properties - tl_2013_06_tract | Style
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ca_tracts_pop_D001
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Label
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0.0000 - 3157.2000
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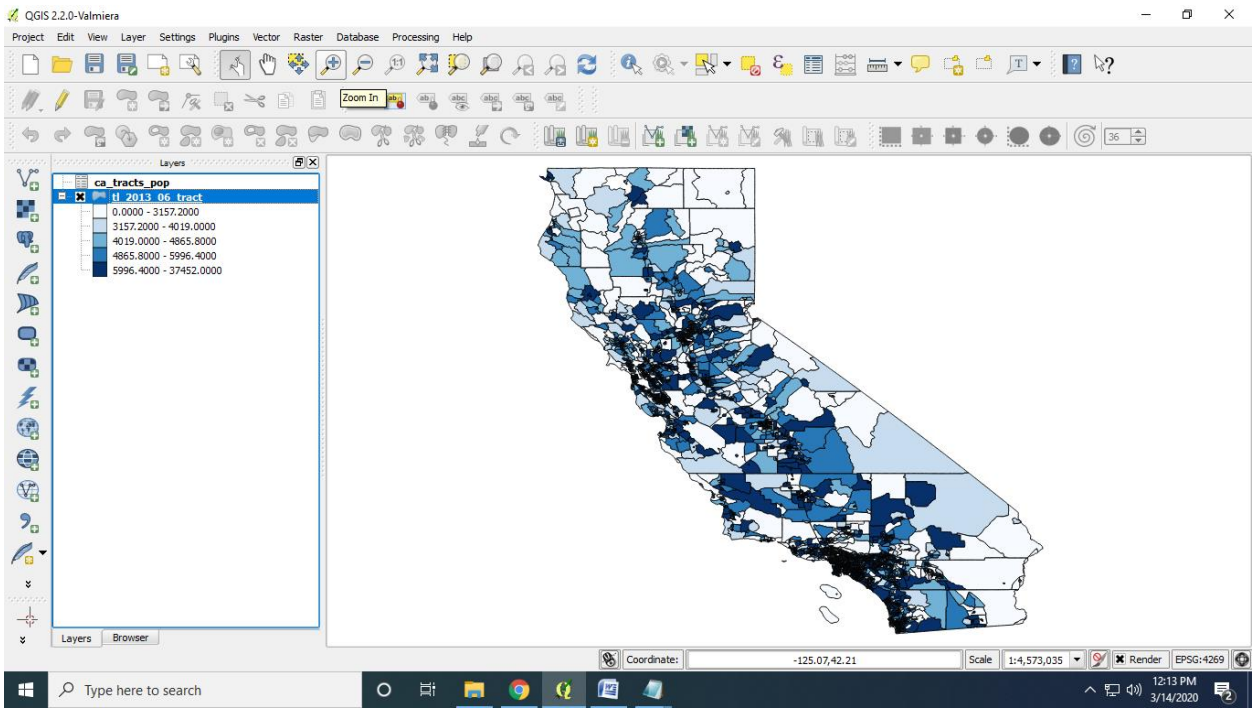
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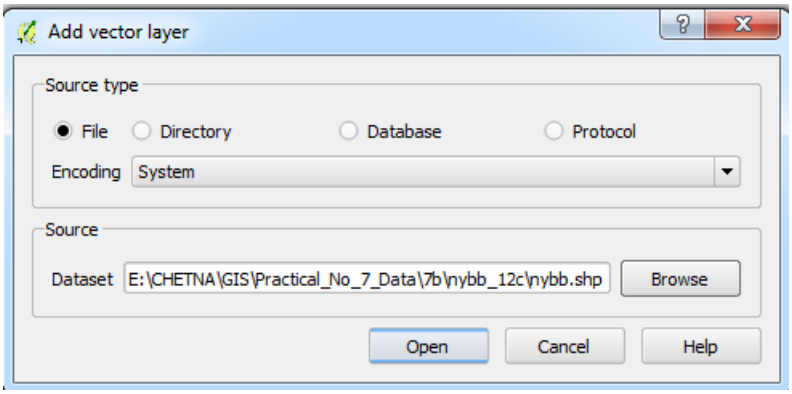
B) Performing Spatial join

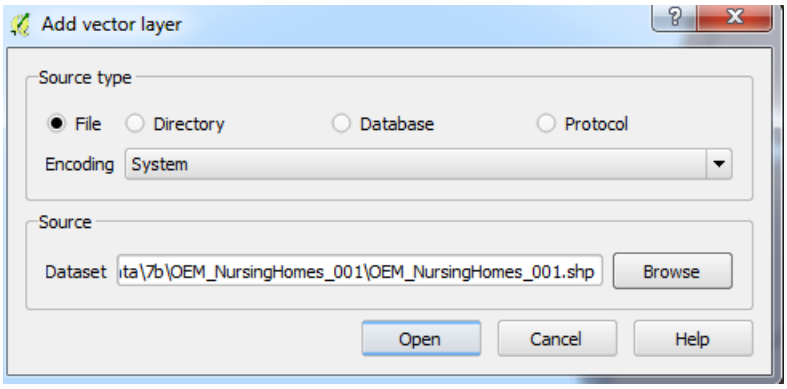
We will use 2 layers - A shape file of borough boundaries of New York city and another shape file of nursing home locations in New York city. We will use spatial join technique to find the total nursing home capacity for each of the boroughs.

Required dataset:

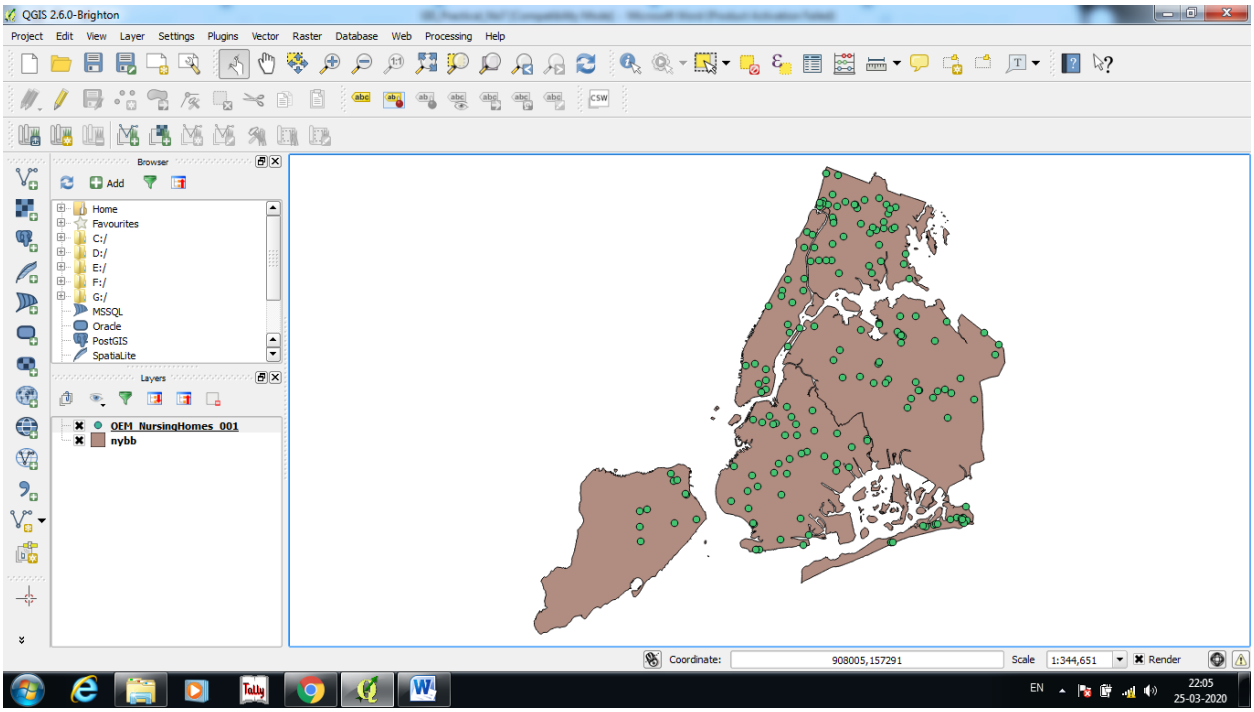
nybb_12c.zip
OEM_NursingHomes_001.zip

1. Add Vector layer “nybb.shp” and “OEM_NursingHomes_001.shp”

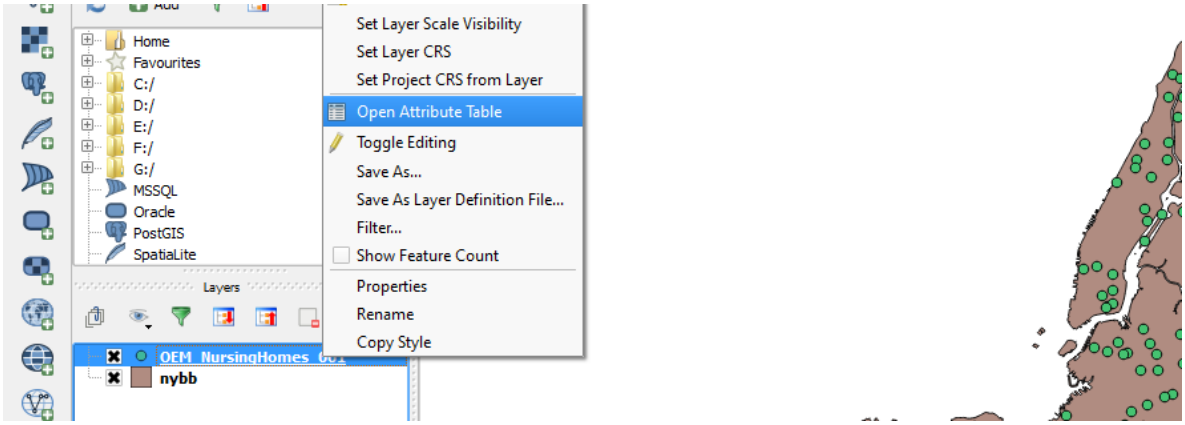




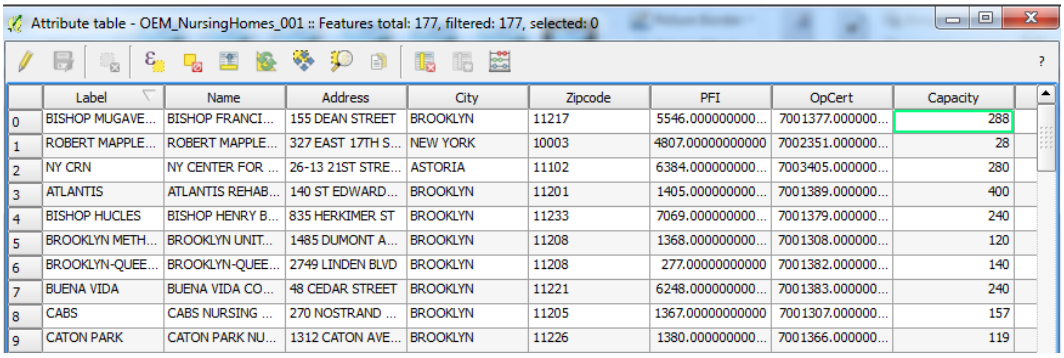
2. Both the files are loaded in QGIS



3. Right click on OEM_NursingHomes_001 from layer pane and click on Open Attribute Table.

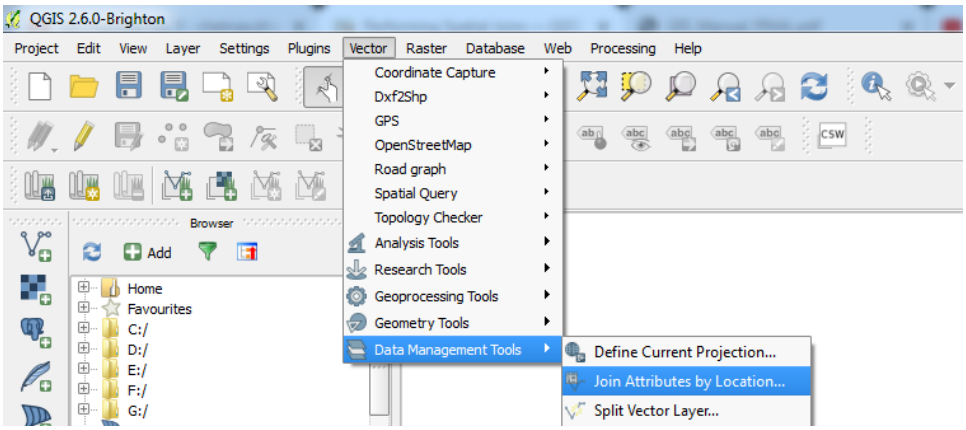


4. Observe the table. Since our task is to calculate total nursing home capacity for each borough, we can use “Capacity” attribute which can be join to the boundaries layer.

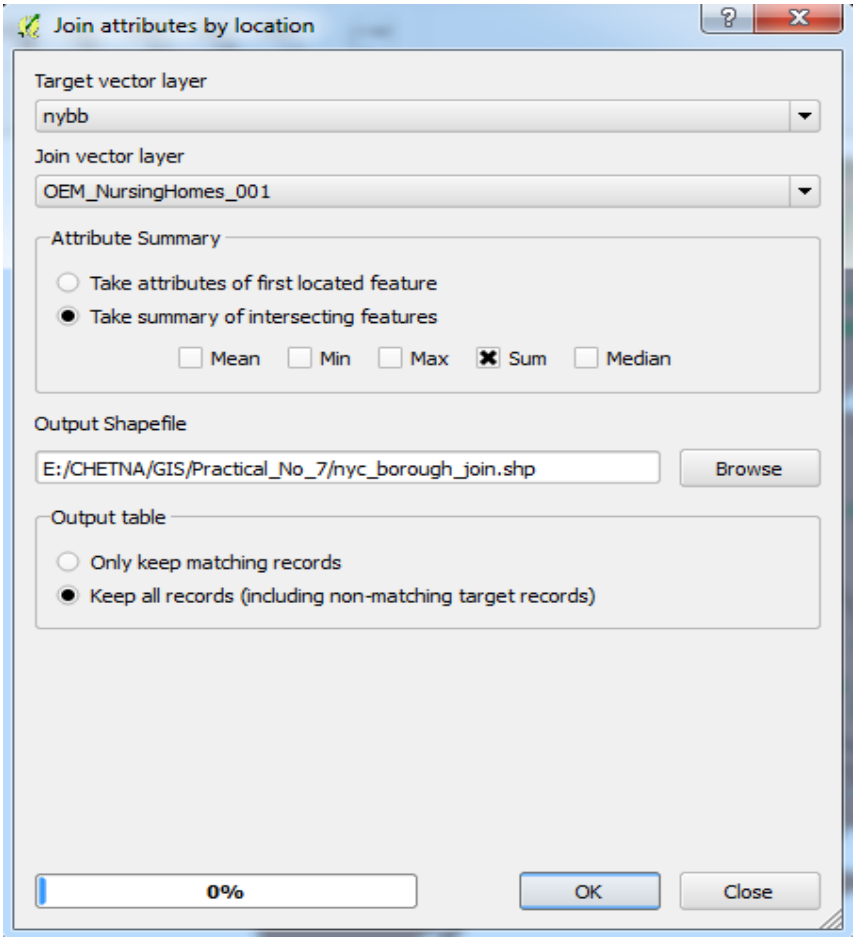


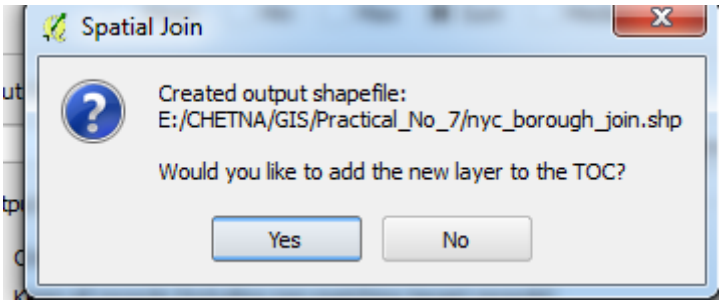
	Label	Name	Address	City	Zipcode	PFI	OpCert	Capacity
0	BISHOP MUGAVE...	BISHOP FRANCI...	155 DEAN STREET	BROOKLYN	11217	5546.000000000...	7001377.000000...	288
1	ROBERT MAPPLE...	ROBERT MAPPLE...	327 EAST 17TH S...	NEW YORK	10003	4807.00000000000	7002351.000000...	28
2	NY CRN	NY CENTER FOR ...	26-13 21ST STRE...	ASTORIA	11102	6384.000000000...	7003405.000000...	280
3	ATLANTIS	ATLANTIS REHAB...	140 ST EDWARD...	BROOKLYN	11201	1405.000000000...	7001389.000000...	400
4	BISHOP HUCLES	BISHOP HENRY B...	835 HERKIMER ST	BROOKLYN	11233	7069.000000000...	7001379.000000...	240
5	BROOKLYN METH...	BROOKLYN UNIT...	1485 DUMONT A...	BROOKLYN	11208	1368.000000000...	7001308.000000...	120
6	BROOKLYN-QUEE...	BROOKLYN-QUEE...	2749 LINDEN BLVD	BROOKLYN	11208	277.00000000000	7001382.000000...	140
7	BUENA VIDA	BUENA VIDA CO...	48 CEDAR STREET	BROOKLYN	11221	6248.000000000...	7001383.000000...	240
8	CABS	CABS NURSING ...	270 NOSTRAND ...	BROOKLYN	11205	1367.00000000000	7001307.000000...	157
9	CATON PARK	CATON PARK NU...	1312 CATON AVE...	BROOKLYN	11226	1380.000000000...	7001366.000000...	119

5. Go to Vector→ Data Management Tool→ Join attributes by location.

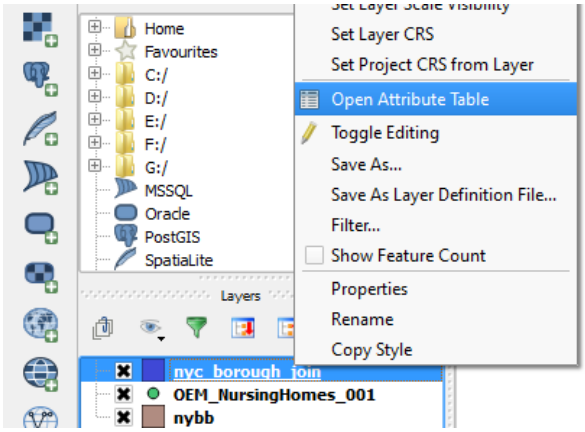


6. The Target vector layer is the one which we want to add the attributes to. In this case, this will be the boroughs boundary “nybb” layer. The Join vector layer will be the nursing homes “OEM_NursingHomes_001” layer. Since we want to sum the capacity of nursing homes, select “Take summary of intersecting features” and choose “Sum”. Browse to the location where we want to save this file and give name as nyc_borough_join.shp. In the Output table select “Keep all records”.

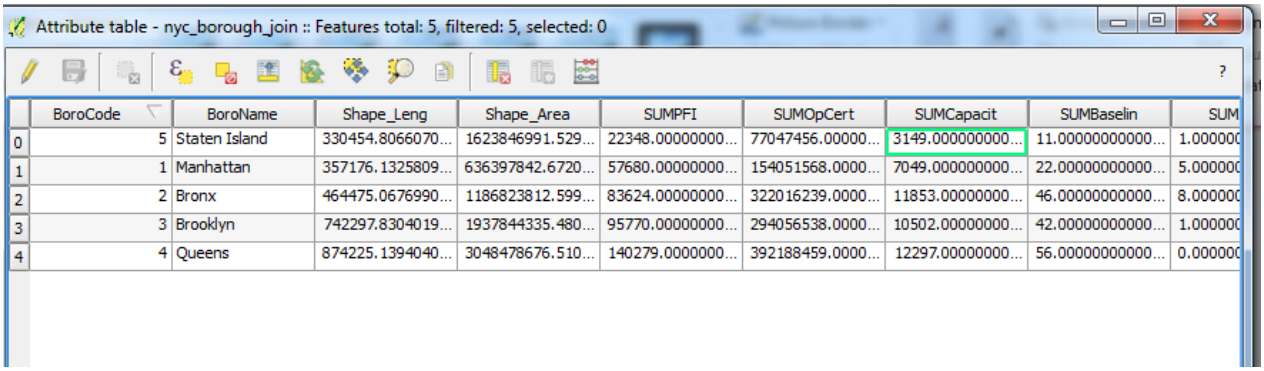




7. Select Yes when asked if you want to add the layer to TOC. The new layer nyc_borough_join would have the features from nybb layer along with spatially joined attributes from OEM_NUrsingHomes_001 layer. Right-click on the newly created layer and select Open Attribute Table.

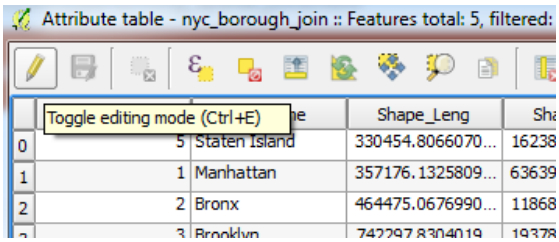


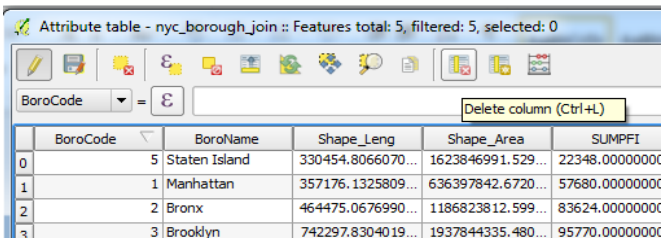
8. In attribute table there is one column SUMCapacit, this is the sum of capacity attribute for nursing homes fall within each borough feature.



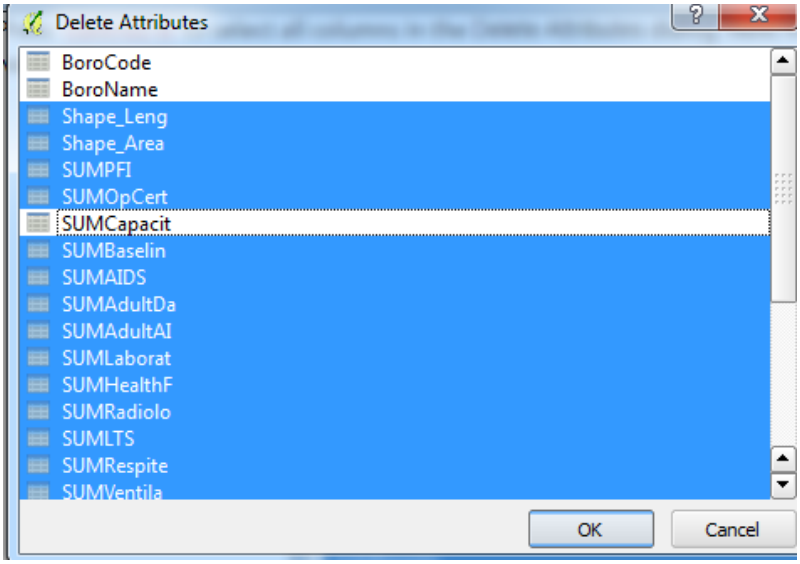
	BoroCode	BoroName	Shape_Leng	Shape_Area	SUMPFI	SUMOpCert	SUMCapacit	SUMBaselin	SUM
0	5	Staten Island	330454.8066070...	1623846991.529...	22348.00000000...	77047456.00000...	3149.000000000...	11.00000000000...	1.000000
1	1	Manhattan	357176.1325809...	636397842.6720...	57680.00000000...	154051568.0000...	7049.000000000...	22.00000000000...	5.000000
2	2	Bronx	464475.0676990...	1186823812.599...	83624.00000000...	322016239.0000...	11853.00000000...	46.00000000000...	8.000000
3	3	Brooklyn	742297.8304019...	1937844335.480...	95770.00000000...	294056538.0000...	10502.00000000...	42.00000000000...	1.000000
4	4	Queens	874225.1394040...	3048478676.510...	140279.0000000...	392188459.0000...	12297.00000000...	56.00000000000...	0.000000

9. This is something for which we are looking, but some extra attributes are also available which are of no use for this project so we will delete those columns. Click on Toggle editing button and then Delete column button.

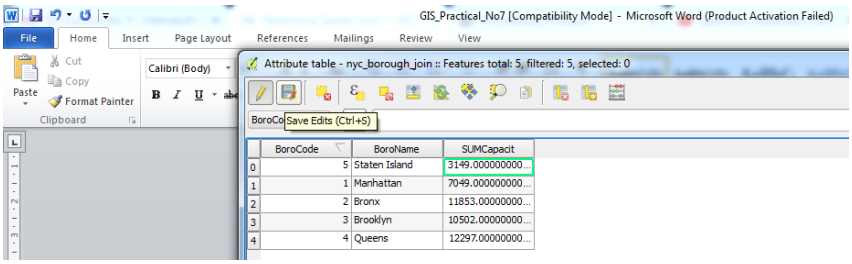




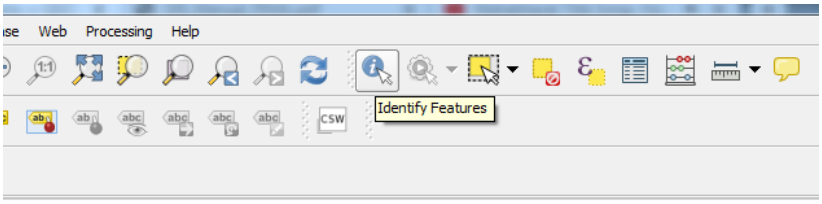
10. Press control key and from the delete attribute window select the columns which we want to delete then click on Ok button.

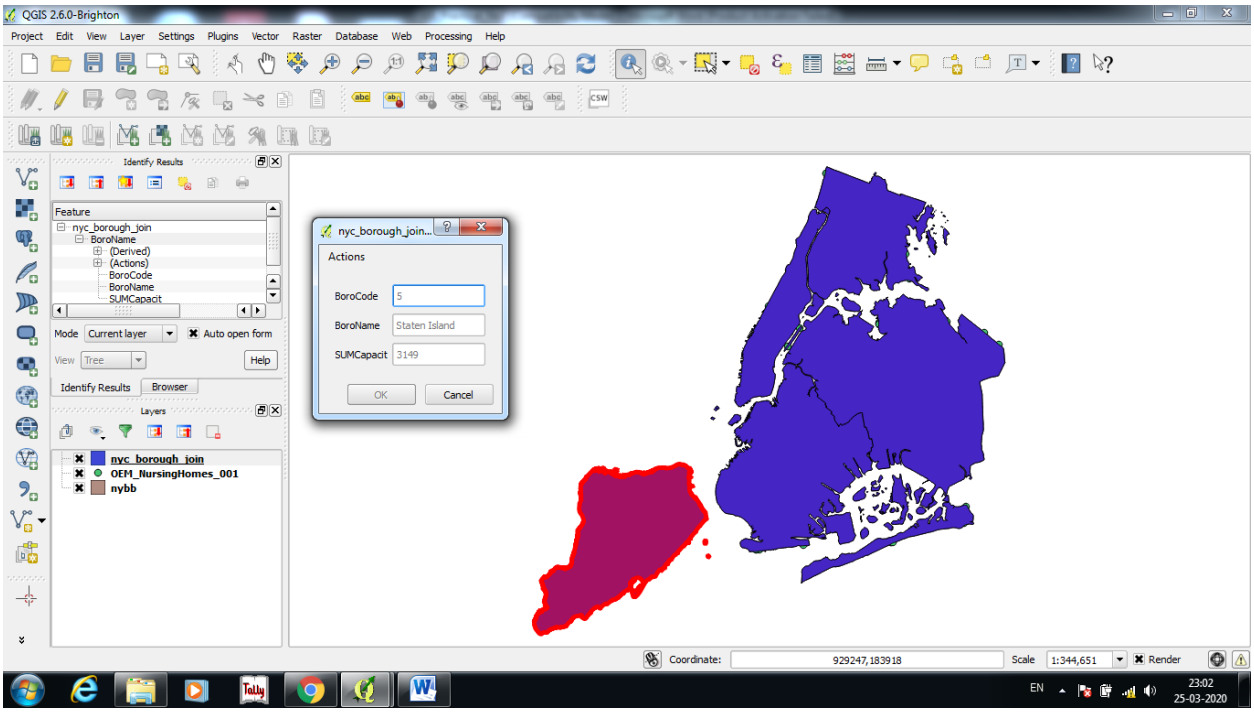


11. In the attribute table window click on save edits button then click on toggle editing button again.



12. Now in QGIS main window, use identify tool to verify that the output file has desired attributes for each feature.




QGIS 2.6.0-Brighton
Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help
Identify Results
Feature
nyc_borough_join
BoroName
(Derived)
(Actions)
BoroCode
BoroName
SUMCapacit
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View Tree
Help
Identify Results
Browser
Layers
nyc_borough_join
OEM_NursingHomes_001
nybb
nyc_borough_join...
Actions
BoroCode 5
BoroName Staten Island
SUMCapacit 3149
OK
Cancel
Coordinate: 929247,183918
Scale 1:344,651
Render
EN
23:02
25-03-2020

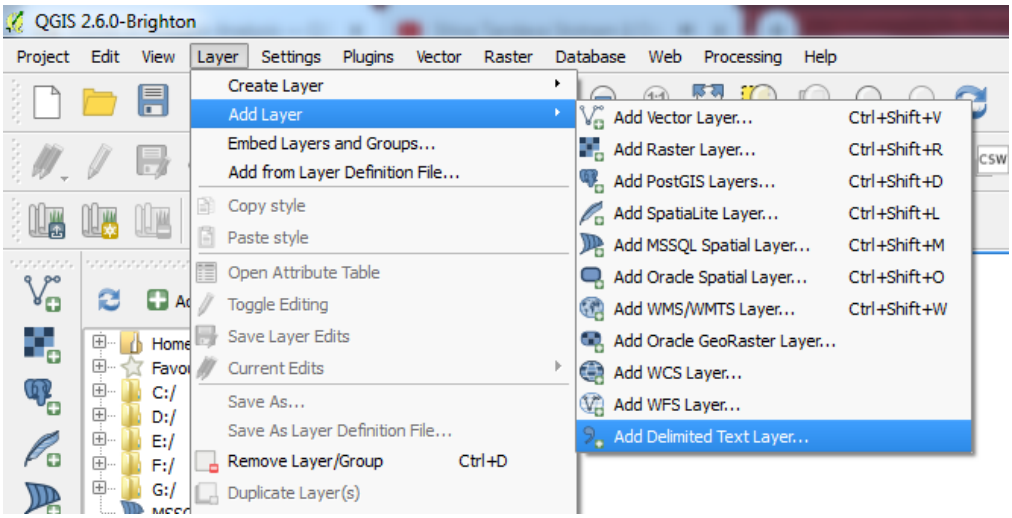
C) Points in polygon analysis

The locations of all known significant earthquakes are given, we will try to find out which country has had the highest number of earthquakes.

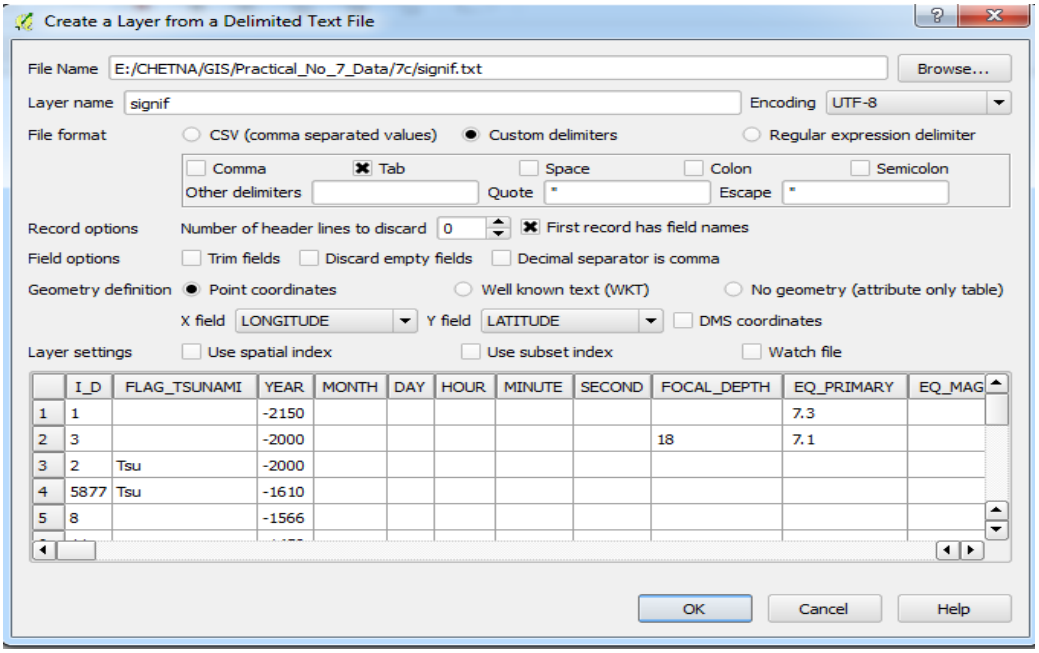
Required dataset:

signif.txt
ne_10m_admin_0_countries.zip

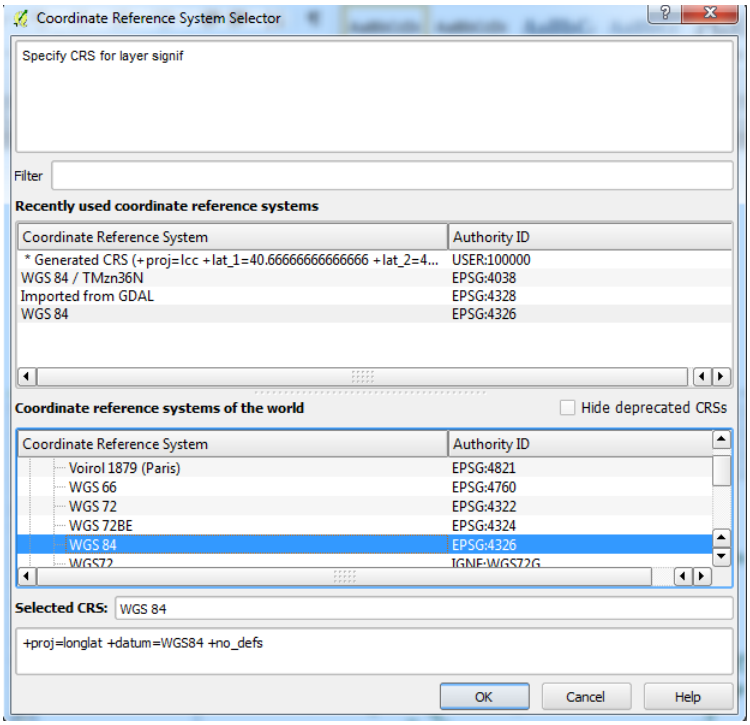
1. Open layer → Add Delimited Text layer and select “signif.txt”.



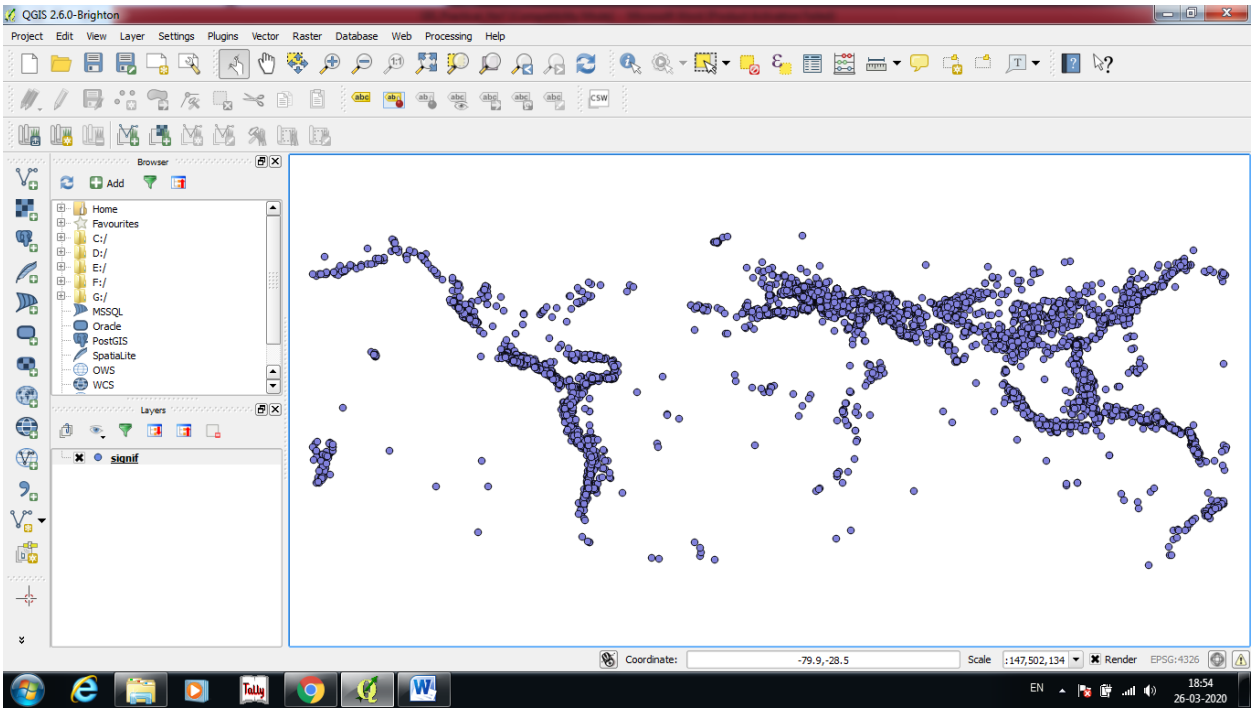
2. Chose Tab as File Format, as this is Tab delimited file. X and Y field will be auto populated. Click Ok. We may see some error message as some rows are not imported, but for this practical we can ignore this error.



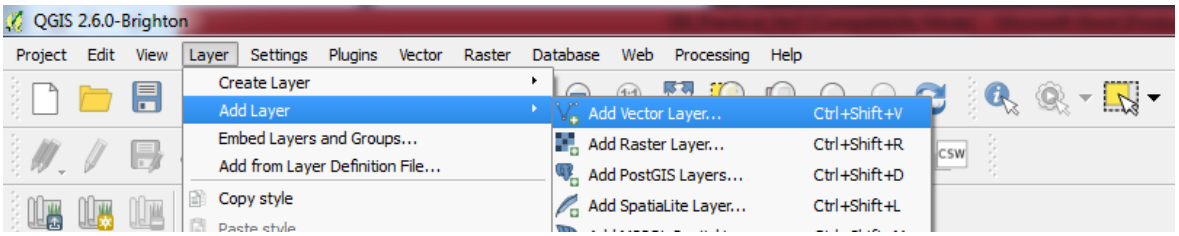
3. Select WGS 84 as CRS.

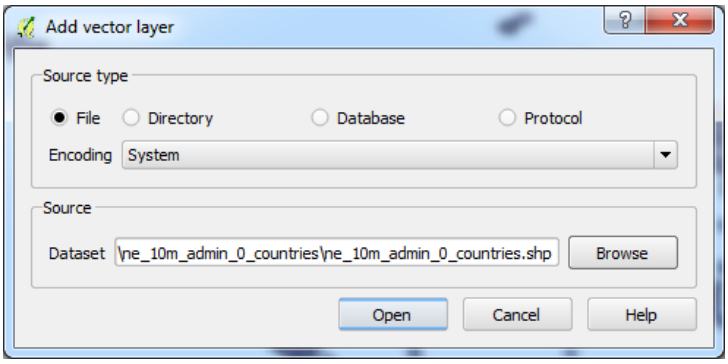


4. The earthquake point layer is loaded in QGIS.

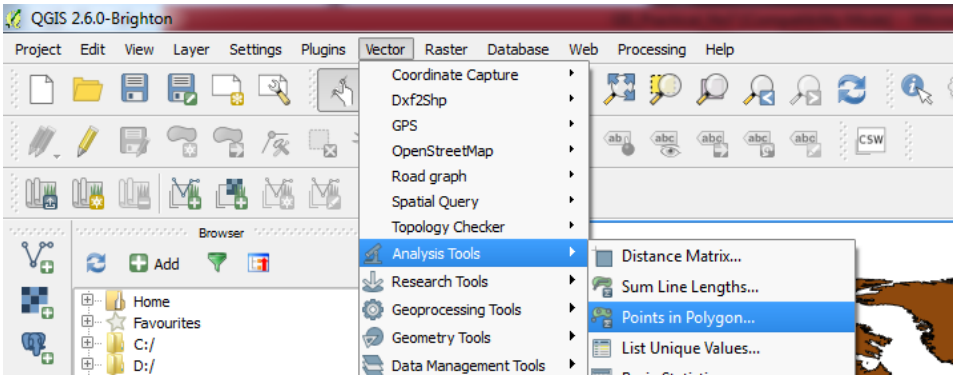


5. Now let's add countries layer. Add vector layer "ne_10m_admin_0_countries.shp".

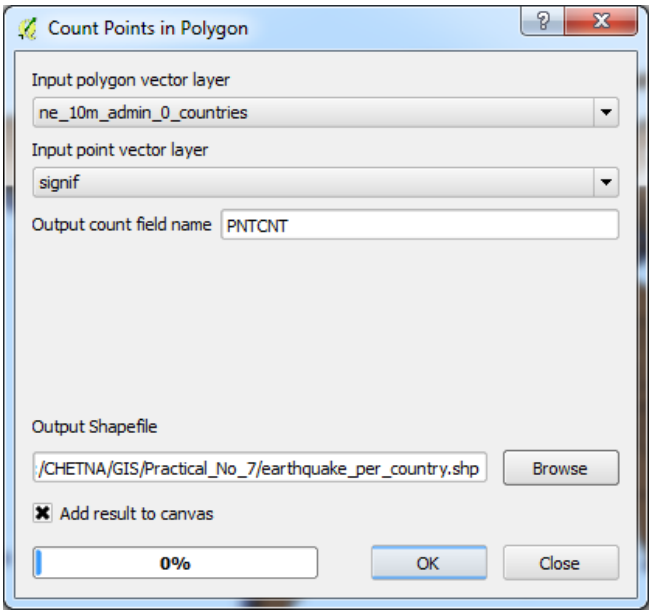




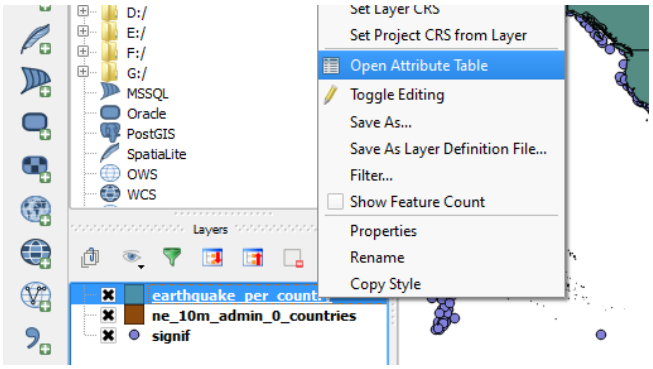
6. Click on Vector → Analysis Tools → Point in Polygon.



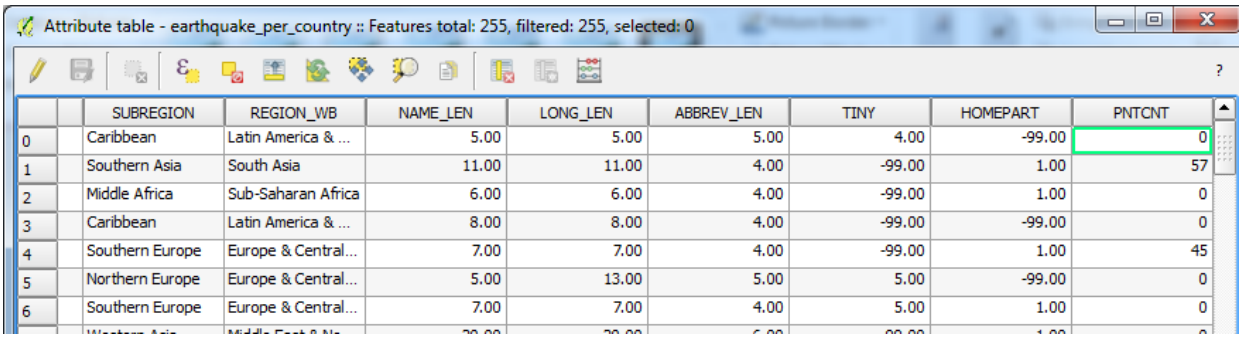
7. Select “ne_10m_admin_0_countries” and “signif” as Input polygon vector layer and Input point vector layer respectively, enter Output count field name as PNTCNT and give name of output file as “earthquake_per_country”. Click Ok. It may take 10-12 minutes for processing and then close it.



8. When asked whether you want to add the layer to TOC, click on Yes.
9. A new layer is added in layer pane. Right click on “earthquake_per_country” layer and click on Open Attribute Table…

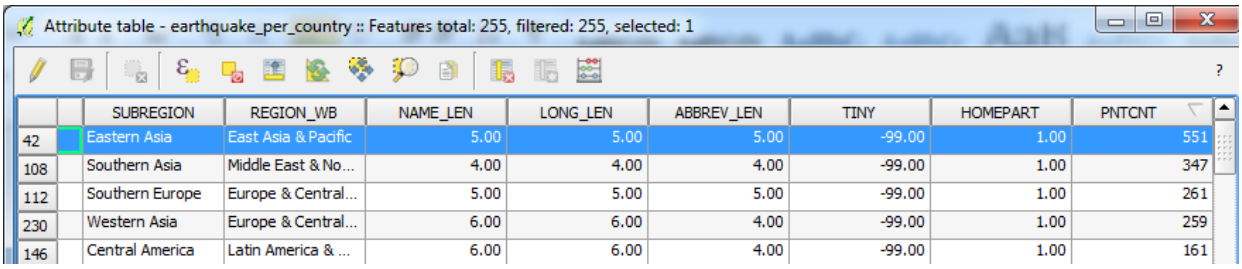


10. In the attribute table we can see a column PNTCNT , this is the count of number of points from earthquakes layer that falls within each polygon.



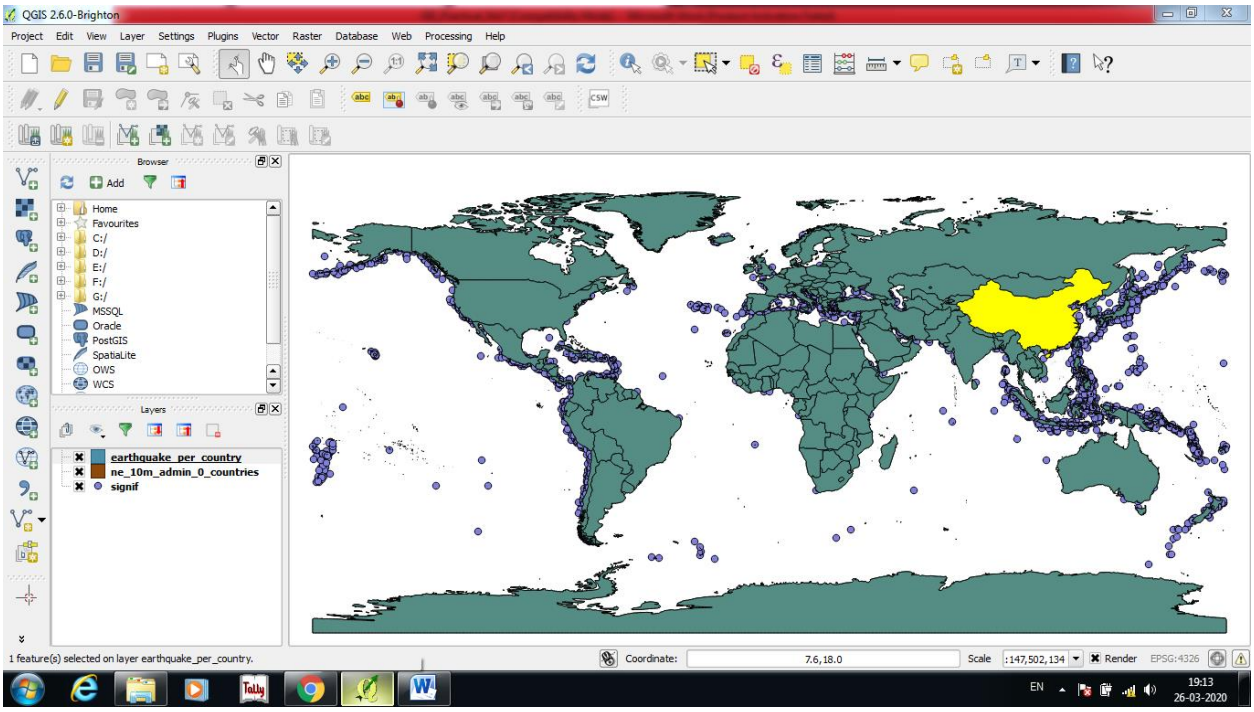
	SUBREGION	REGION_WB	NAME_LEN	LONG_LEN	ABBREV_LEN	TINY	HOMEPART	PNTCNT
0	Caribbean	Latin America & ...	5.00	5.00	5.00	4.00	-99.00	0
1	Southern Asia	South Asia	11.00	11.00	4.00	-99.00	1.00	57
2	Middle Africa	Sub-Saharan Africa	6.00	6.00	4.00	-99.00	1.00	0
3	Caribbean	Latin America & ...	8.00	8.00	4.00	-99.00	-99.00	0
4	Southern Europe	Europe & Central...	7.00	7.00	4.00	-99.00	1.00	45
5	Northern Europe	Europe & Central...	5.00	13.00	5.00	5.00	-99.00	0
6	Southern Europe	Europe & Central...	7.00	7.00	4.00	5.00	1.00	0

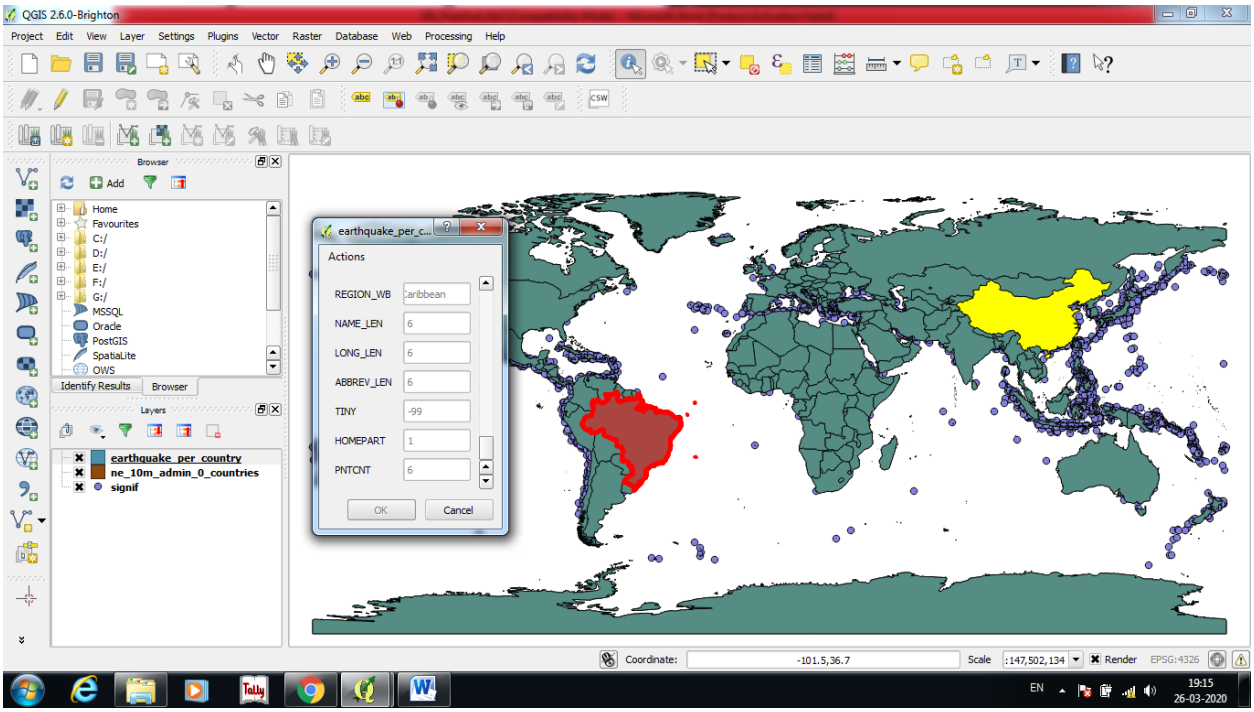
11. We can sort the table by PNTCNT field and the country with highest count will be the answer. Click 2-times on the PNTCNT column to get it sorted in descending order. Click on the first row to select it and close the Attribute Table.



	SUBREGION	REGION_WB	NAME_LEN	LONG_LEN	ABBREV_LEN	TINY	HOMEPART	PNTCNT
42	Eastern Asia	East Asia & Pacific	5.00	5.00	5.00	-99.00	1.00	551
108	Southern Asia	Middle East & No...	4.00	4.00	4.00	-99.00	1.00	347
112	Southern Europe	Europe & Central...	5.00	5.00	5.00	-99.00	1.00	261
230	Western Asia	Europe & Central...	6.00	6.00	4.00	-99.00	1.00	259
146	Central America	Latin America & ...	6.00	6.00	4.00	-99.00	1.00	161

12. In the main QGIS window, we can see one feature is highlighted in yellow. This is the feature linked to the selected row in the attribute table which is having the highest number of points. Click on the Identify tool and click anywhere on layer in canvas to check attribute value at that location.




QGIS 2.6.0-Brighton
Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help
Browser
Add
Home
Favourites
C:/
D:/
E:/
F:/
G:/
MSSQL
Oracle
PostGIS
SpatiaLite
OWS
Identify Results
Browser
Layers
earthquake_per_country
ne_10m_admin_0_countries
signif
earthquake_per_c...
Actions
REGION_WB Caribbean
NAME_LEN 6
LONG_LEN 6
ABBREV_LEN 6
TINY -99
HOMEPART 1
PNTCNT 6
OK
Cancel
Coordinate: -101.5,36.7
Scale 1:147,502,134
Render
EPSG:4326
EN
19:15
26-03-2020

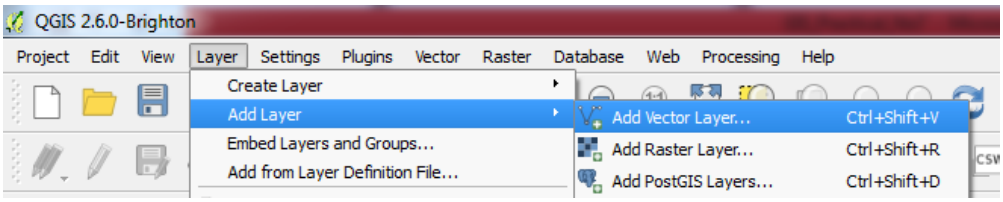
D) Performing Spatial Queries

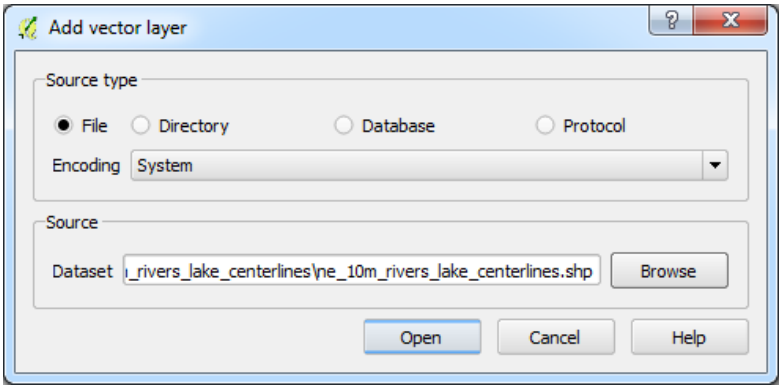
Here we are working on 2 layers, line layer for river and point layer representing cities. The task is to execute spatial query to find all cities which are within 10 km s of river.

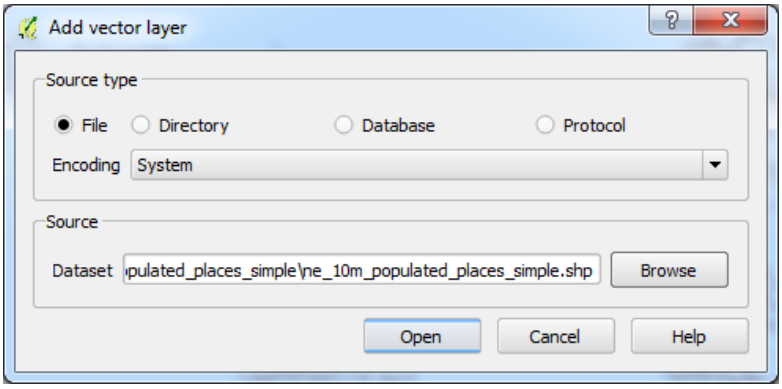
Required dataset:

ne_10m_rivers_lake_centerlines
10m_populated_places_simple

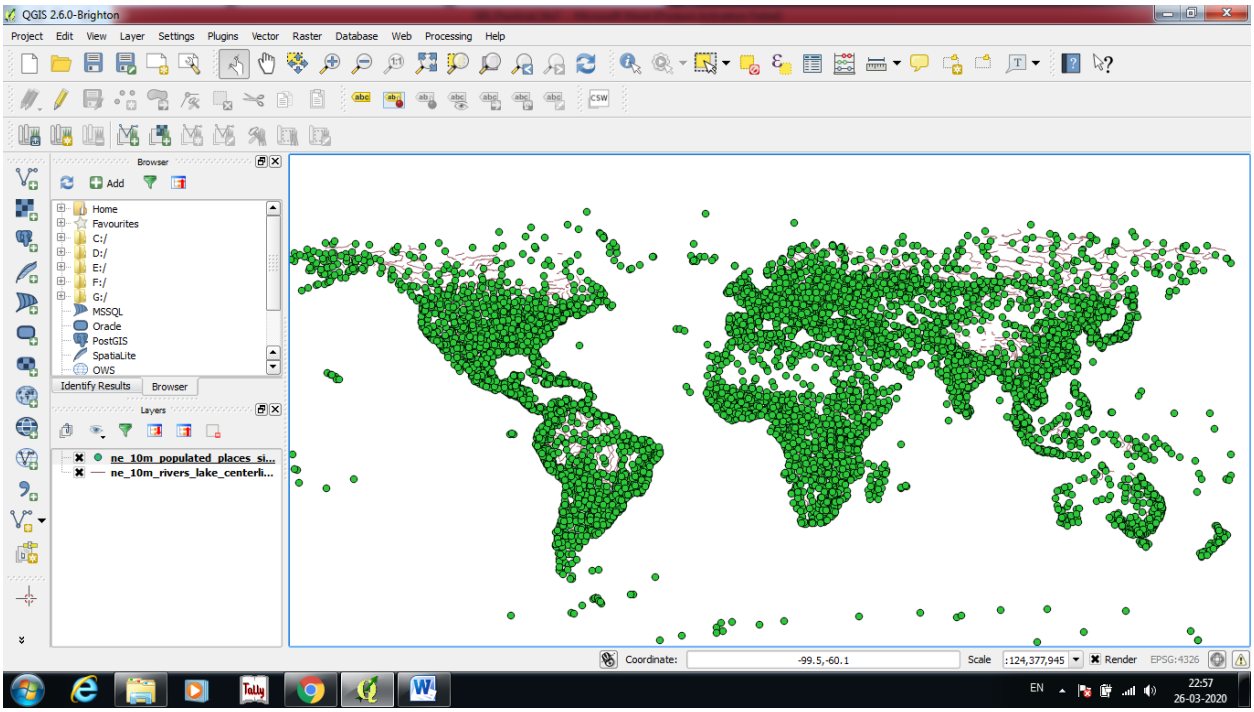
1. Add vector layer and open “ne_10m_rivers_lake_centerlines.shp” and “10m_populated_places_simple.shp” one by one.



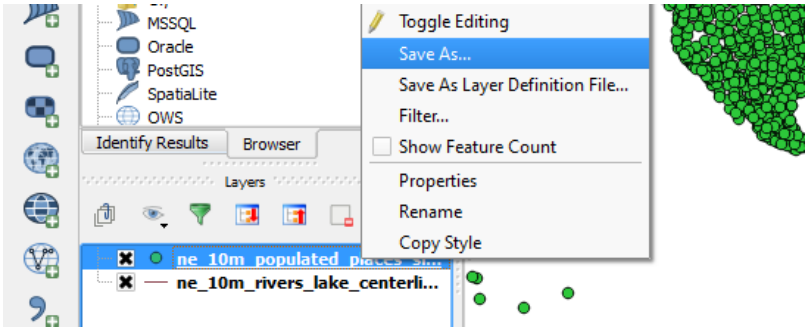




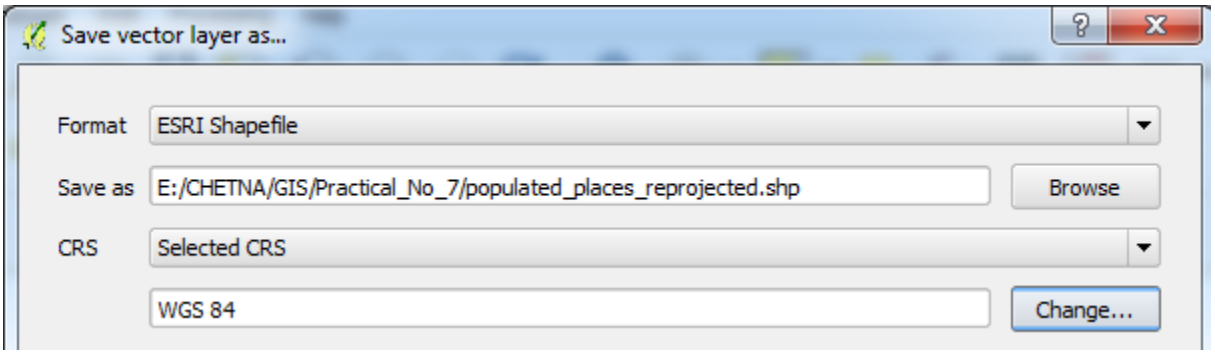
2. Both the layers are loaded in QGIS.

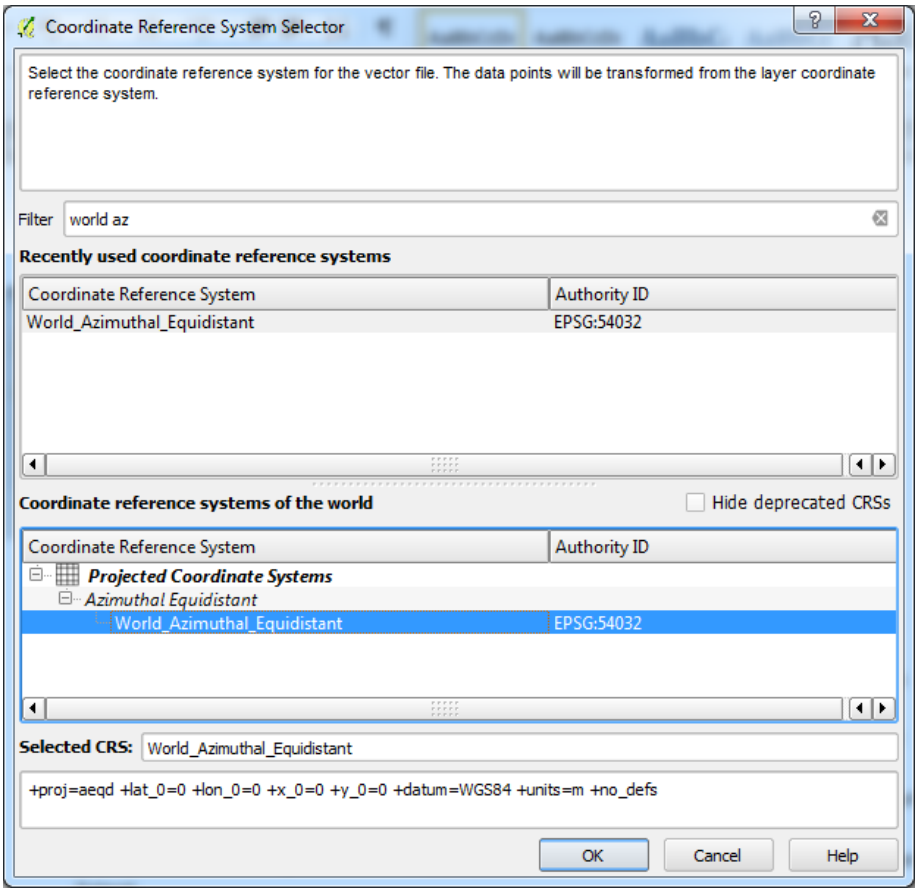


3. We need to create buffers around point and line layers. But the layers which we have loaded are in Geographic CRS with the unit of degrees, this is not suitable here, because we want our analysis to use meters or kms. To do this, we need to re project our layers to the Projected CRS. For that right click on “10m_populated_places_simple” and select Save as…

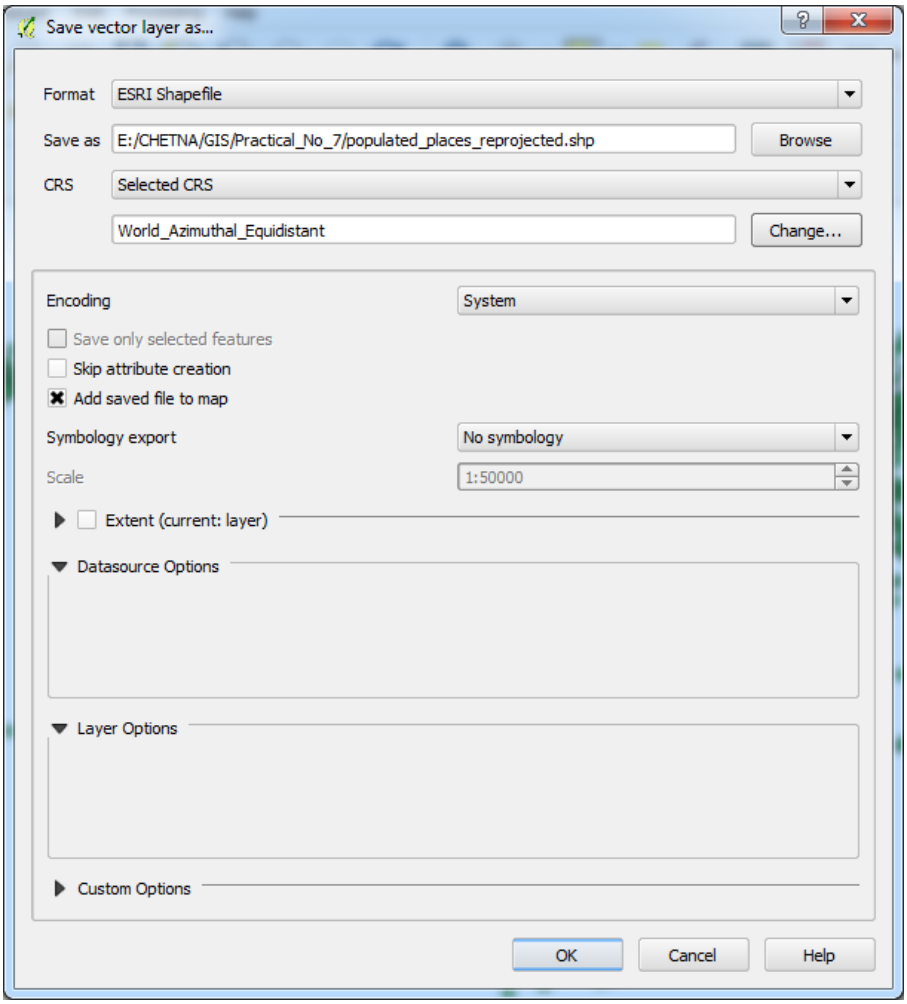


4. On Save vector layer dialog box click on Browse button next to save as and select location for the new layer and give name as “populated_places_reprojected”, then click on Change button next to CRS, now we need to select proper CRS for generating buffers, Azimuthal Equidistance would be the best for this.

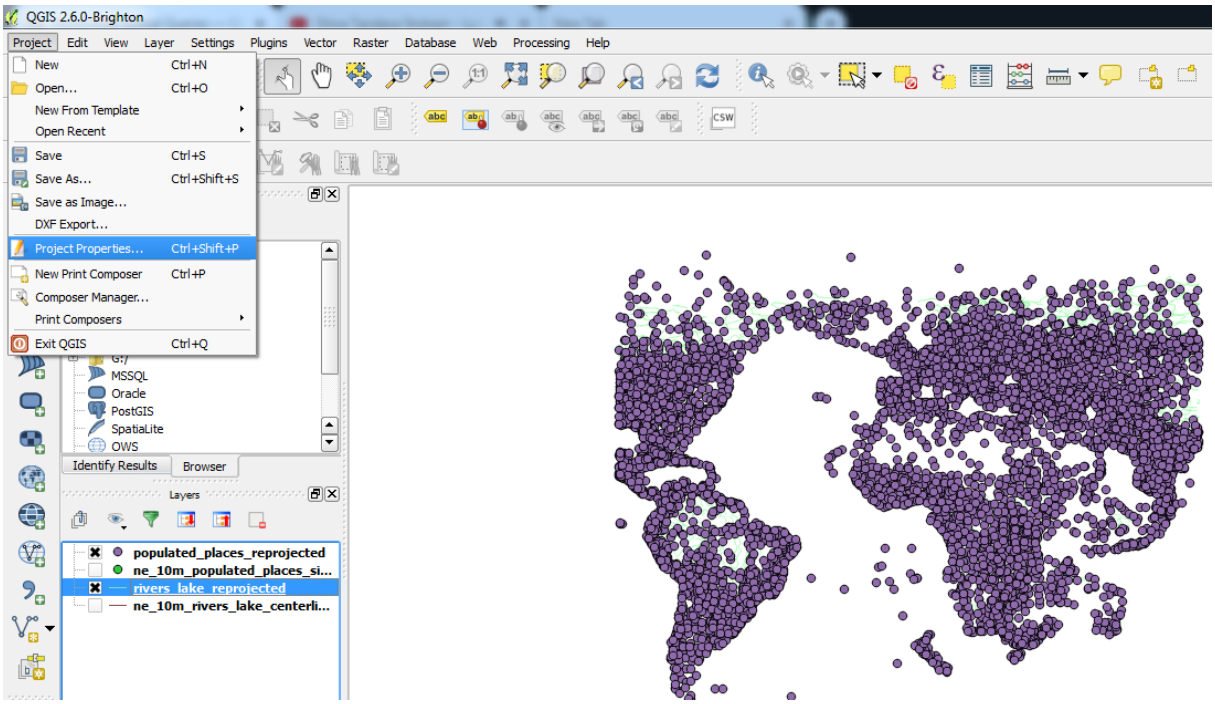




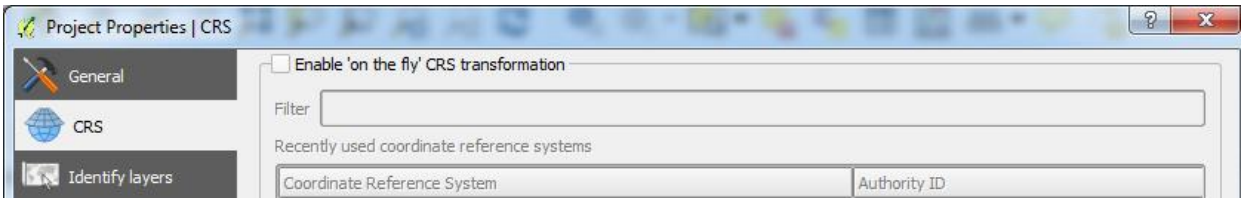
5. Back on Save vector layer dialog box, check the box next to Add saved file to map and click on Ok.



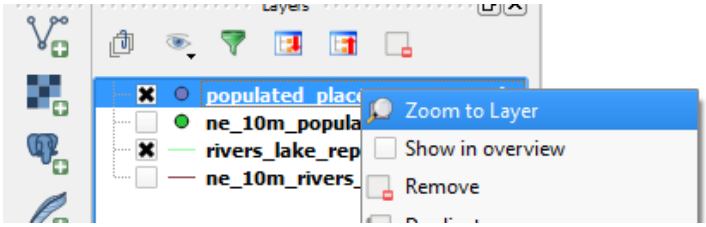
6. Repeat the same procedure for “ne_10m_rivers_lake_centerlines” layer and save new layer as “rivers_lake_reprojected”.
7. Just uncheck the boxes against original layers from layer pane. But still the CRS is not changed because of default setting, so click on Project → Project Properties…



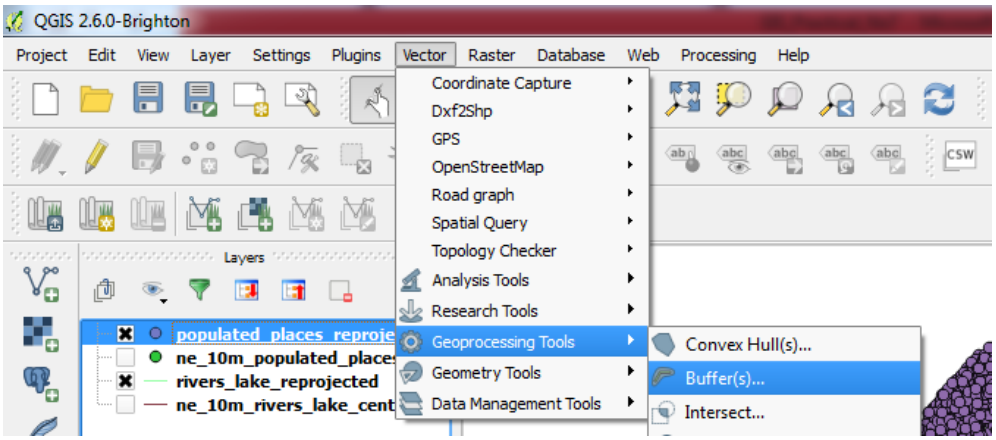
8. On Project Properties window open CRS tab and uncheck “Enable on the fly CRS transformation” then click on Ok.



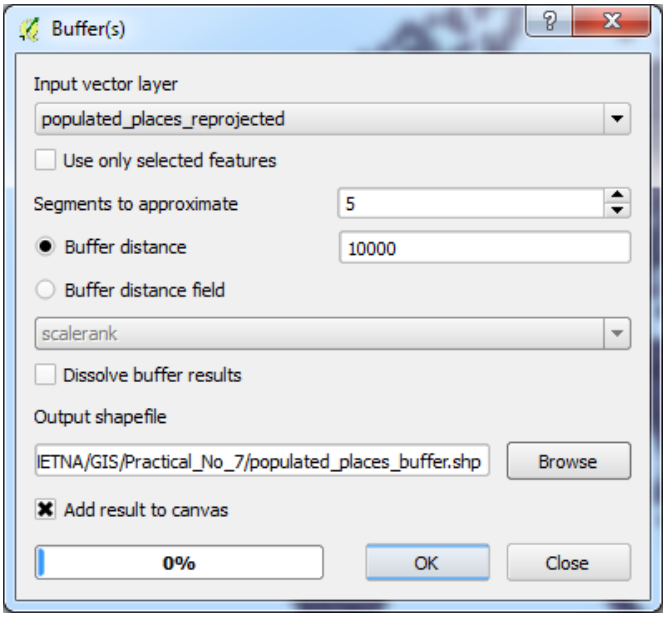
9. In QGIS main window right click on any reprojected layer in layer pane and select Zoom to Layer Extent.



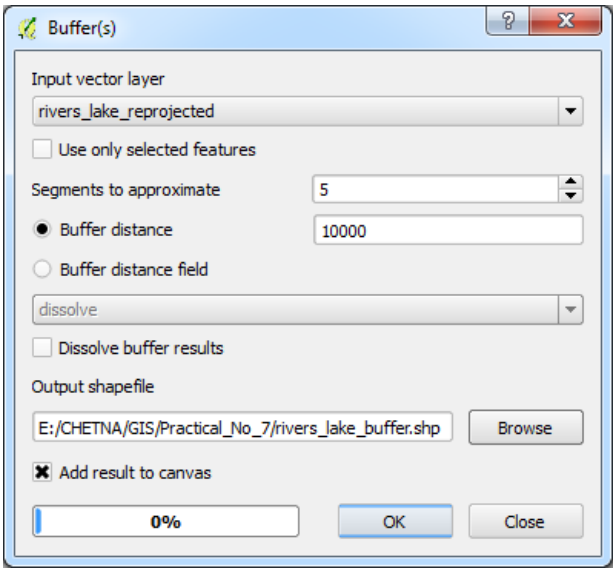
10. Now we are ready to create buffers, click on Vector → Geoprocessing Tools →Buffer.



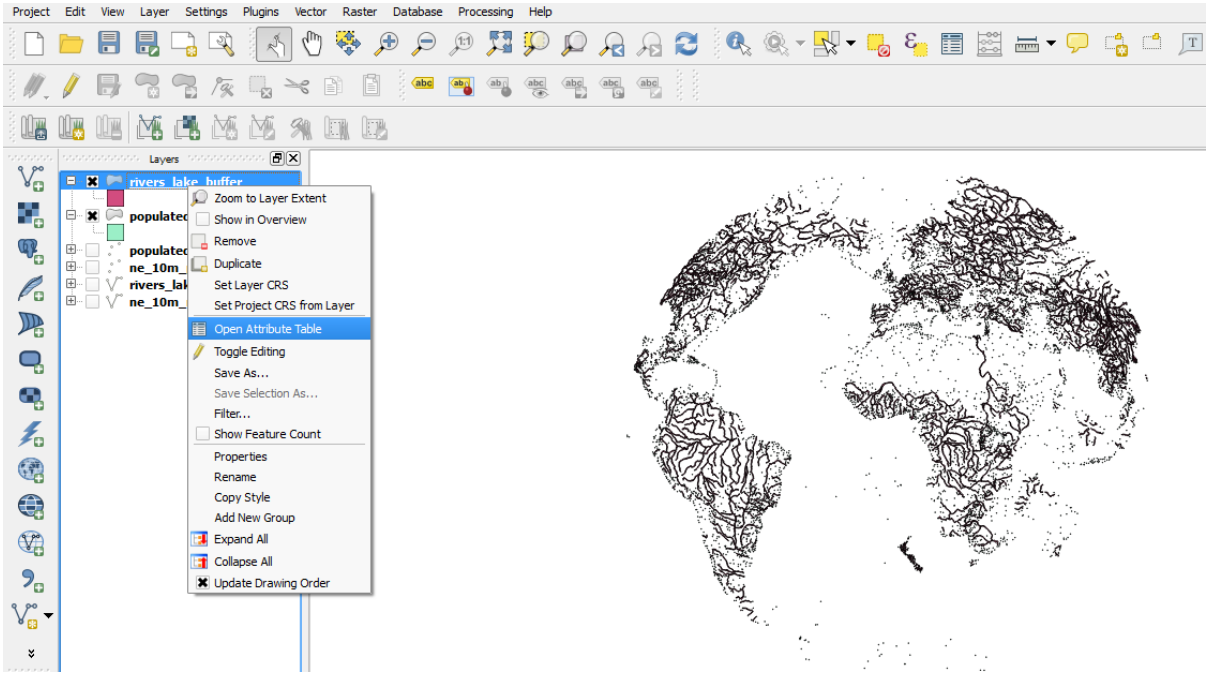
11. In the buffer tool, select populated_places_reprojected layer as input. Enter buffer distance as 10000 (as we want a buffer of 10kms and since CRS units are in meters we need to enter 10000). Enter output file name as populated_places_buffer. Click on Ok.



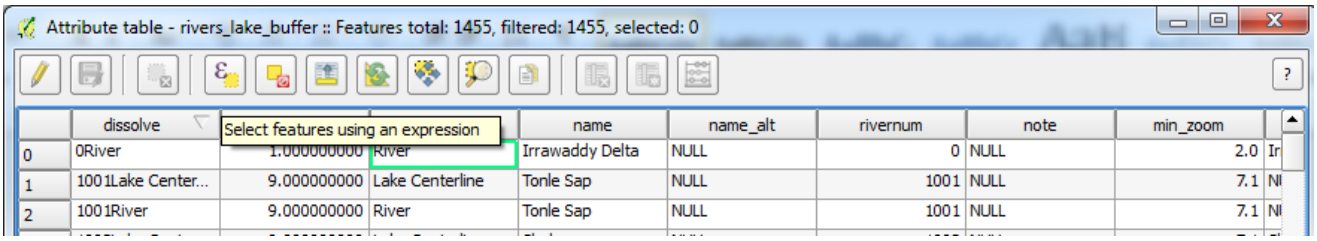
12. When the processing is done, click on Yes to add newly created layer to TOC.
13. Repeat the same procedure for rivers_lake_reprojected layer and give name of output layer as rivers_lake_buffer.



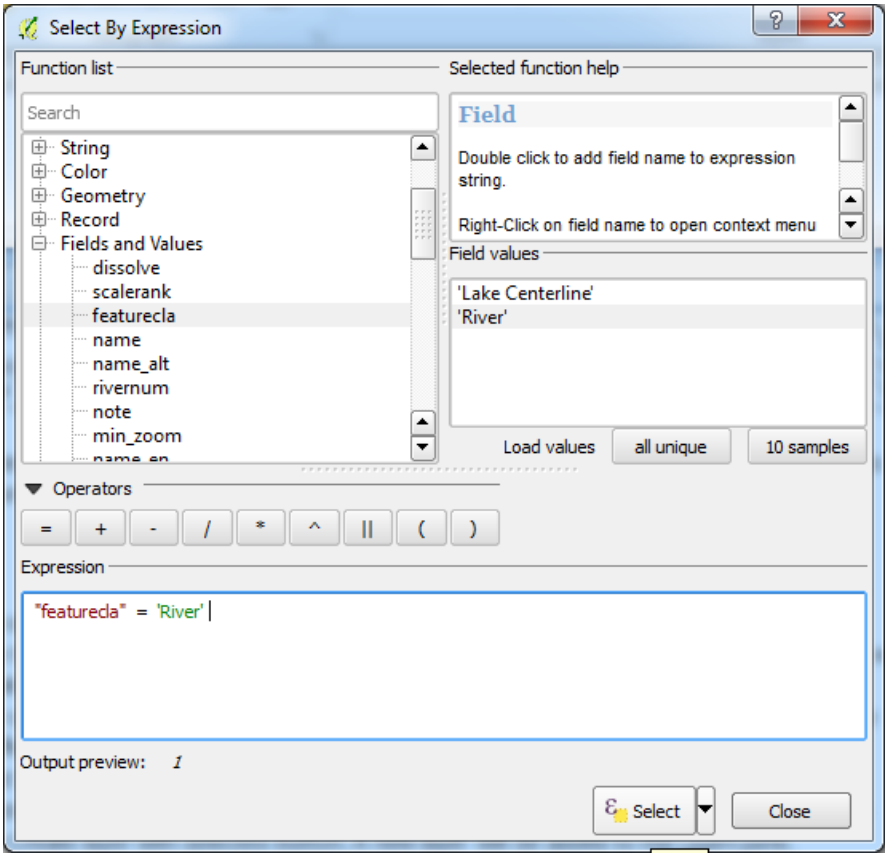
14. Now, rivers_lake_buffer contains features that are rivers as well as lake, but we want only rivers for our analysis, so we will run query to select only river features. Right click on rivers_lake_buffer layer and select Open Attributes Table.

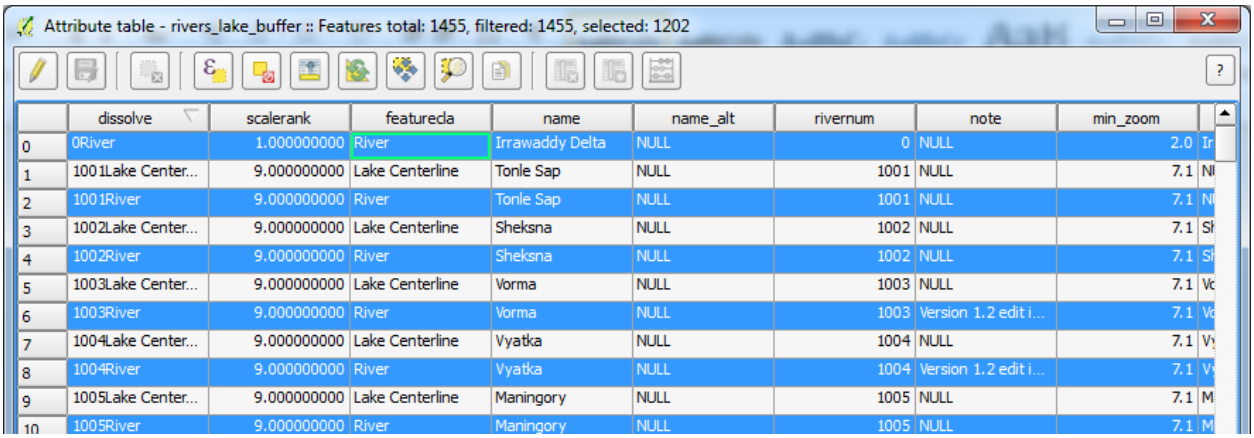


15. We can see the featurecla attribute which contains the information we can use to select the river feature, click on select features using an expression button.

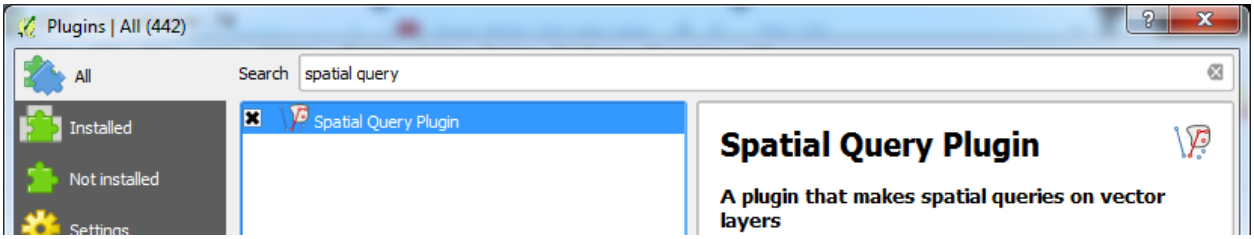


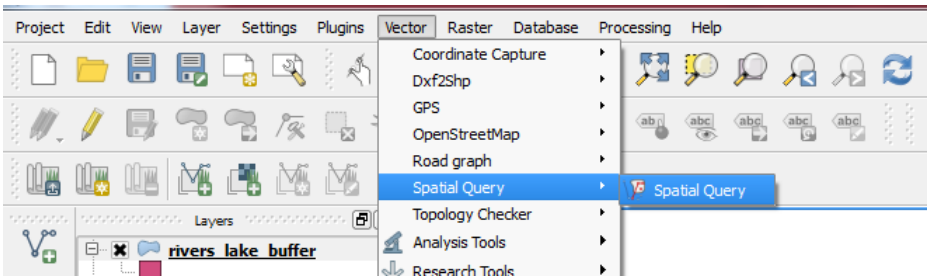
16. Enter the expression "featurecla" = 'River', click on Select button and then click on Close to return back to the main QGIS window.



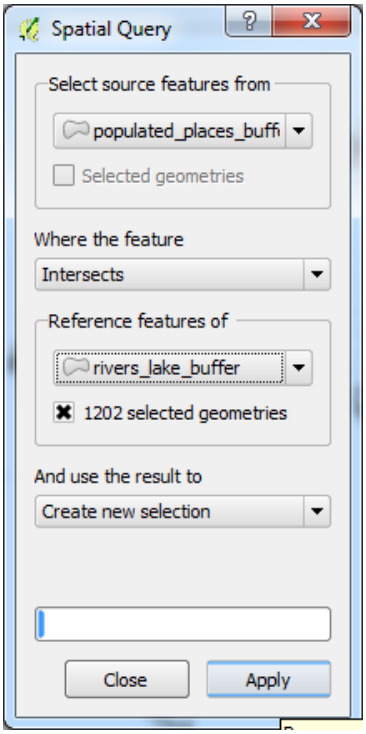


17. We are ready to perform the spatial query. We need to enable the Spatial Query plugin to use this functionality. Once Spatial Query plugin is enabled, go to Vector → Spatial Query → Spatial Query.

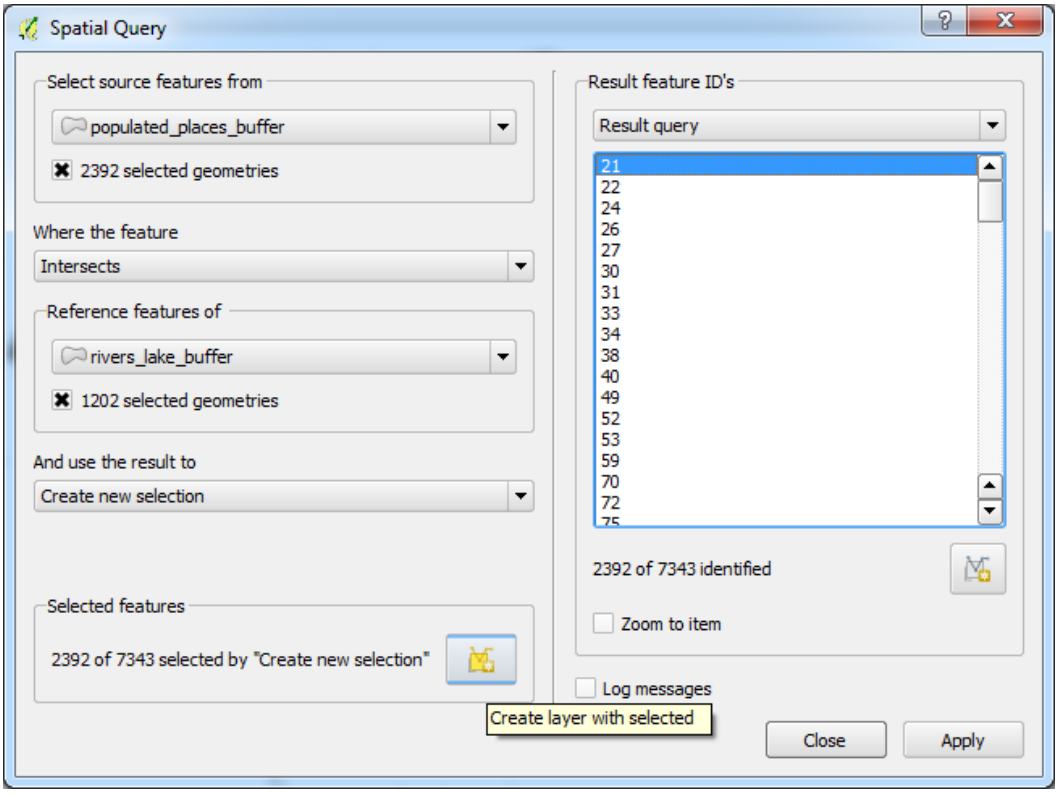




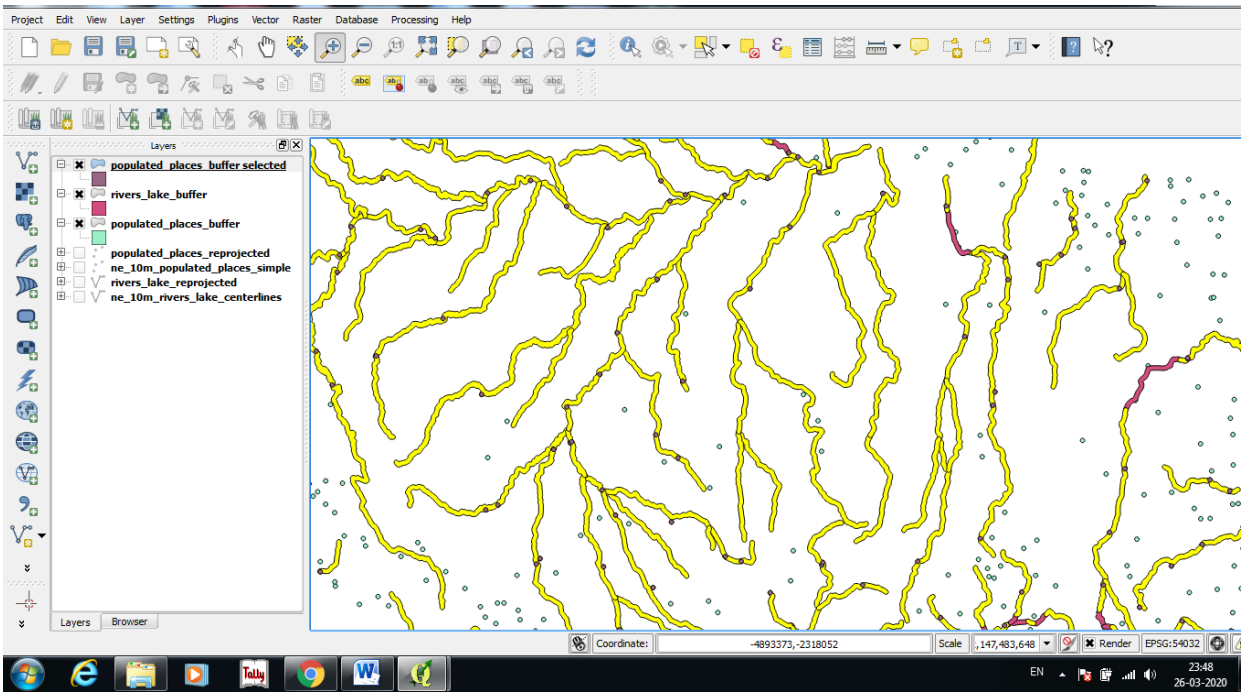
18. For our query, we want to select features from the buffered places which intersect with the buffered river lines. Check the checkbox next to selected geometries. This is to make sure that the query uses only river features that we have selected previously. Click Apply.

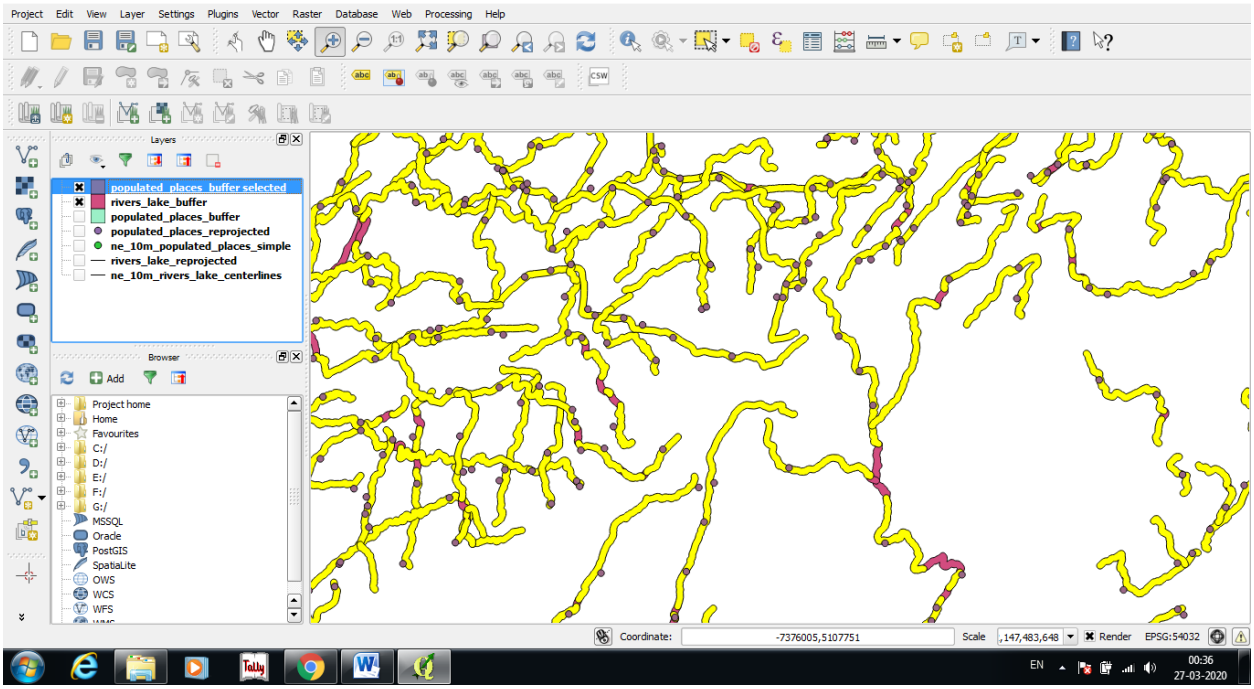


19. Once the query is completed, we will see a new section named Selected features. Click on the Create layer with selected button. A new layer will be added to the Layers pane. Click Close.



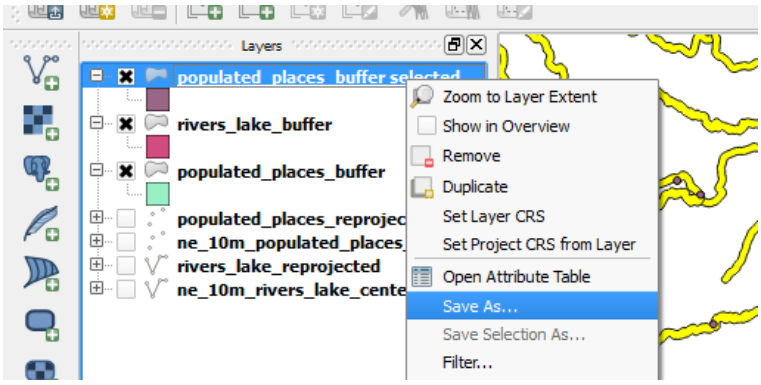
20. Zoom in to any area and compare the results. We will notice that the new layer contains only the features that intersect with river buffers. We can verify this just uncheck populated_places_buffer layer so that the canvas will display cities intersected with river.



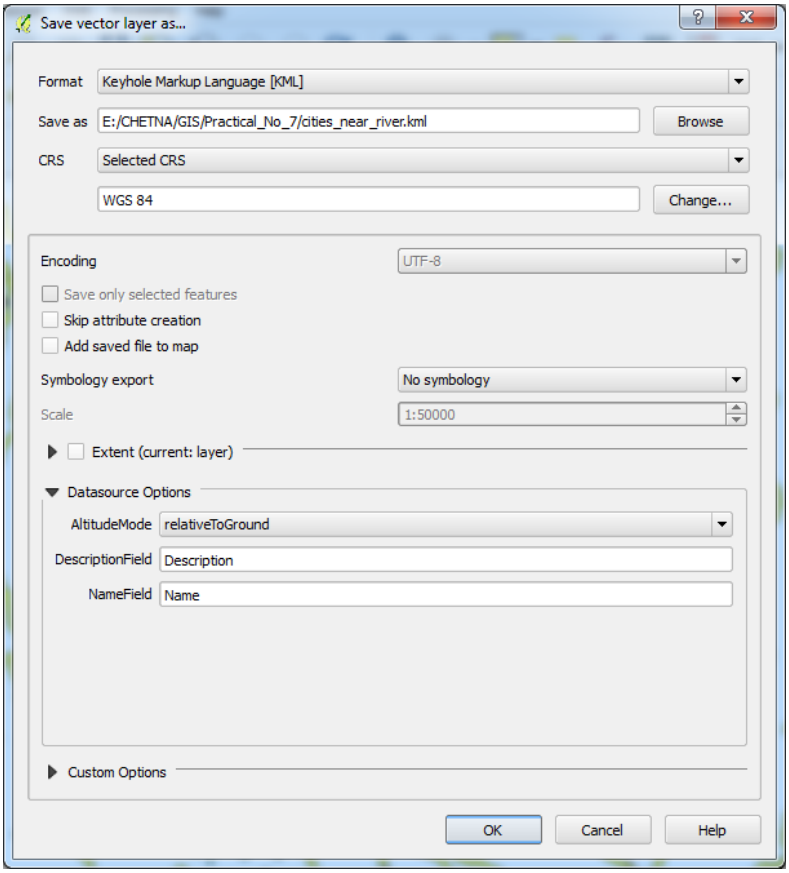


Here, we are done with "Performing Spatial Queries", next steps are for verification only.

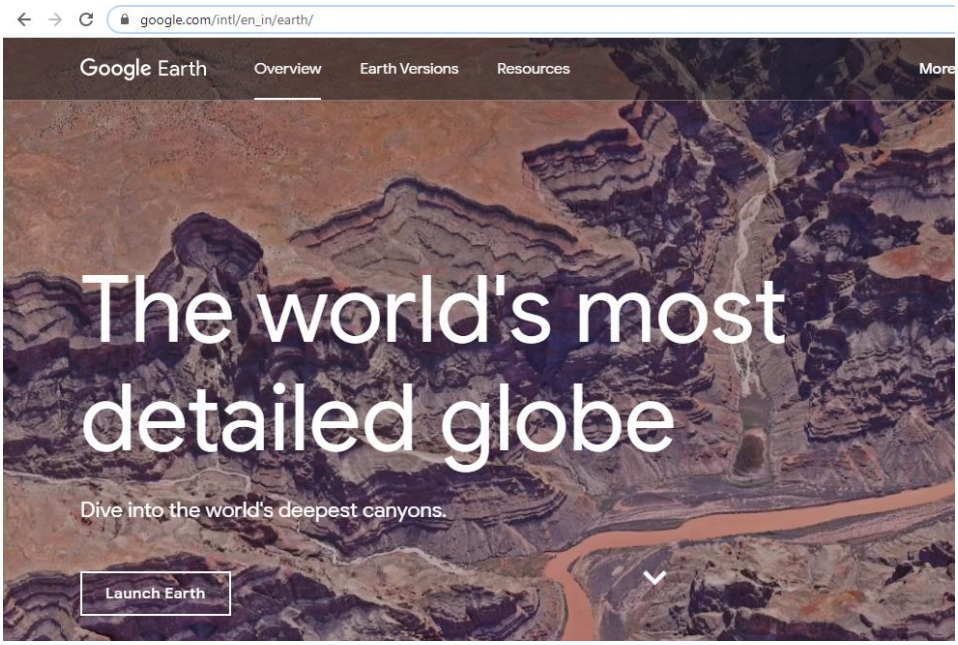
21. We should always verify our results to ensure the analysis is accurate enough. One way to verify the results is to export this layer as a KML file and load it on Google Earth. We can check if the areas we found really are within 10kms of a river. Right-click the layer and Save As....

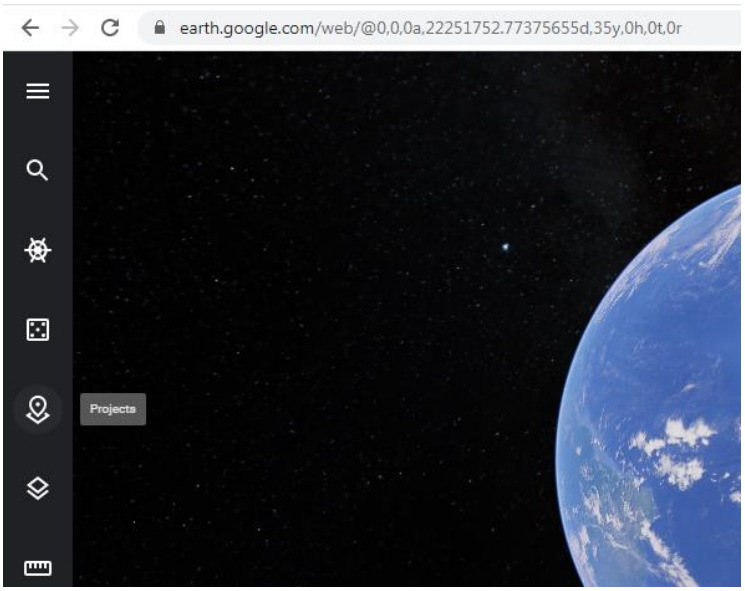


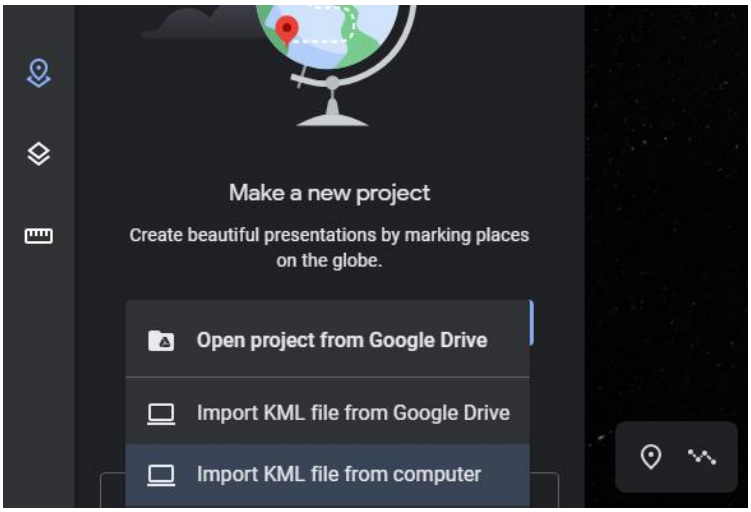
22. In the Save vector layer as window, select format as KML, choose WGS 84 as the CRS. This is because KML format needs the coordinates to be in Geometric CRS. Name KML layer as cities_near_river.kml.

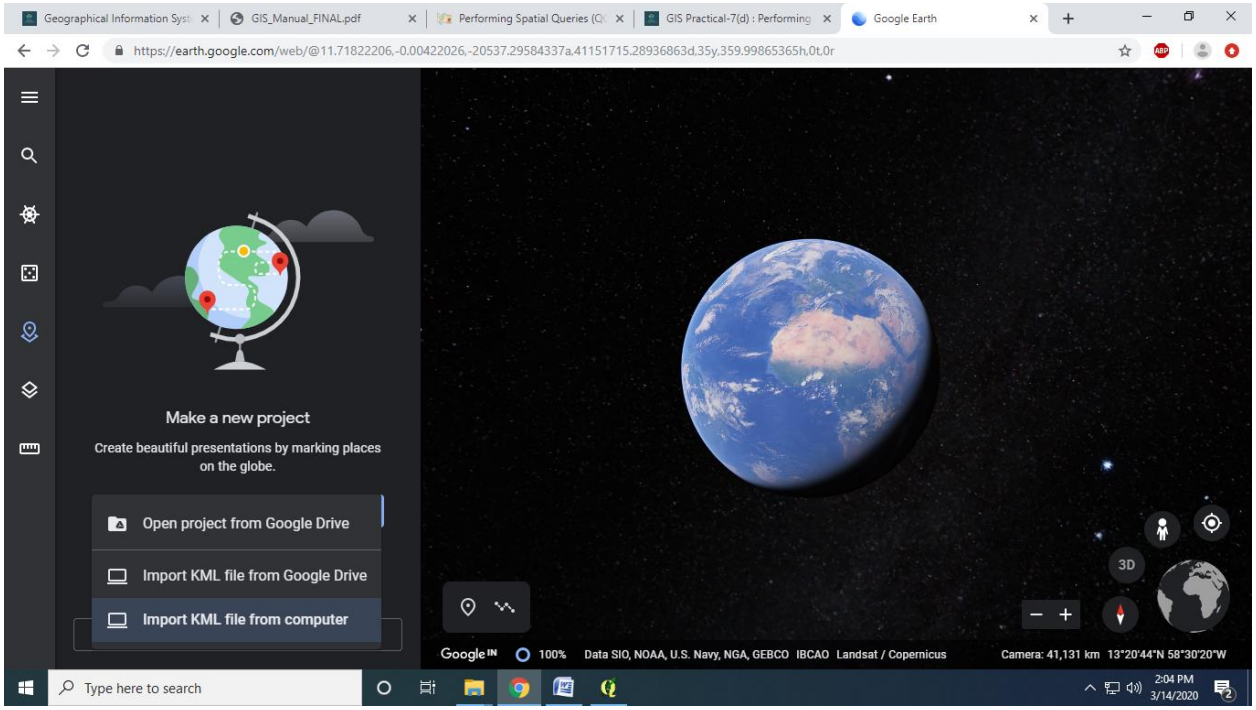


23. Open Google Earth (https://www.google.com/intl/en_in/earth/) then click on "Launch Earth". Click on Projects option and then click on Open. Select Import KML file from computer and open .kml file which we have created to verify that the cities represented by these buffers are actual close to rivers.


google.com/intl/en_in/earth/
Google Earth
Overview
Earth Versions
Resources
More
The world's most detailed globe
Dive into the world's deepest canyons.
Launch Earth


earth.google.com/web/@0,0,0a,22251752.77375655d,35y,0h,0t,0r
Projects


Make a new project
Create beautiful presentations by marking places on the globe.
Open project from Google Drive
Import KML file from Google Drive
Import KML file from computer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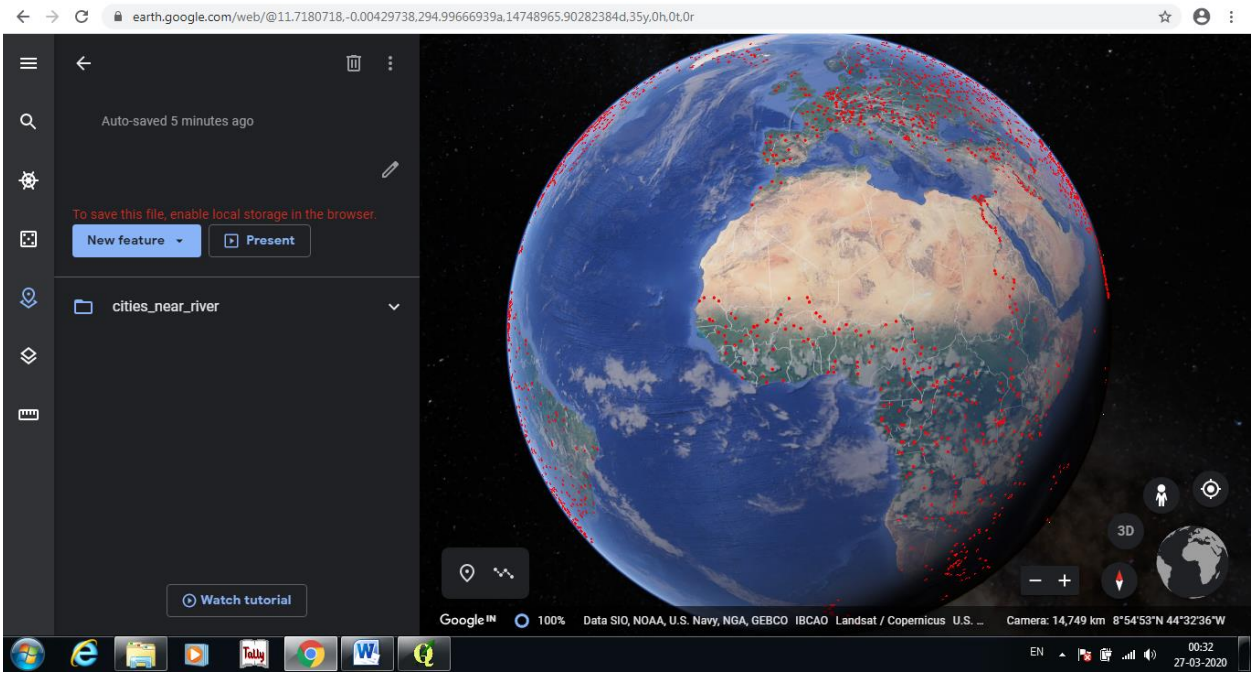
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