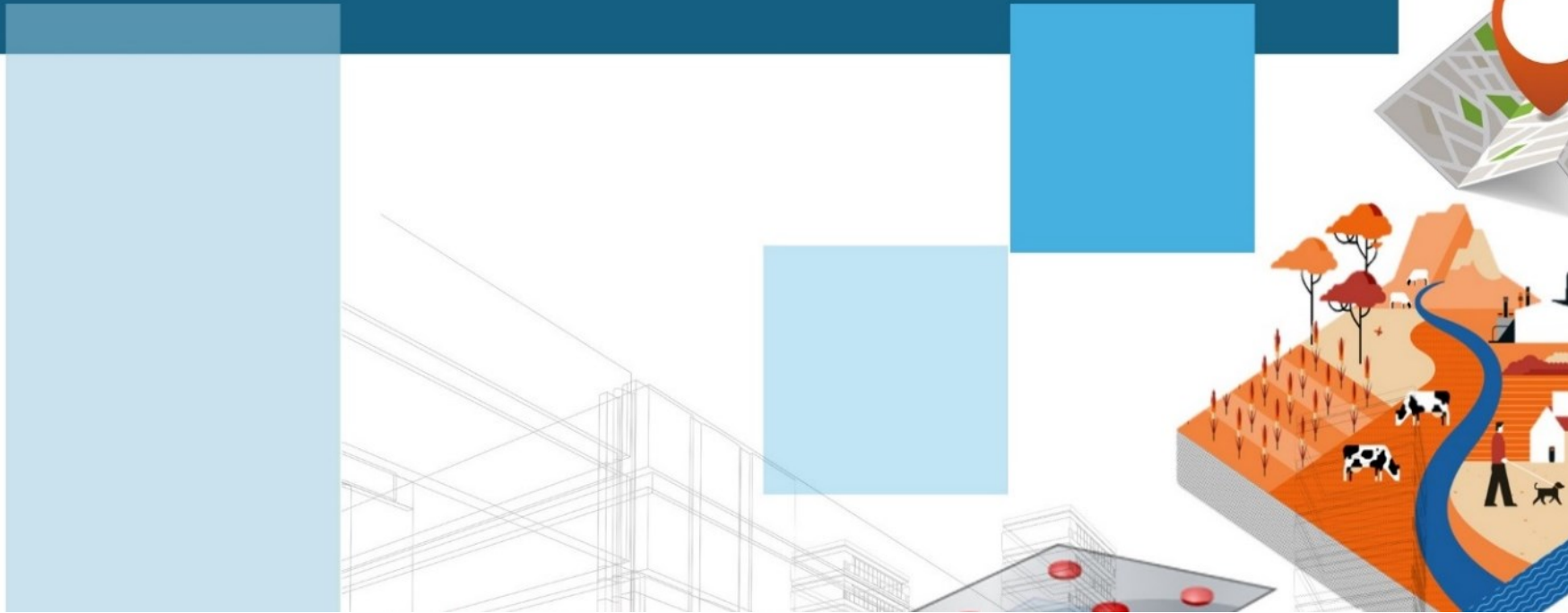


**Teaching & Learning
Step-by-Step Guide:**

Landuse Mix Analysis



Amila Jayasinghe

Achini Premachandra

Samith Madusanka

Teaching & Learning Step by -Step Guide:

Land use Mix Analysis

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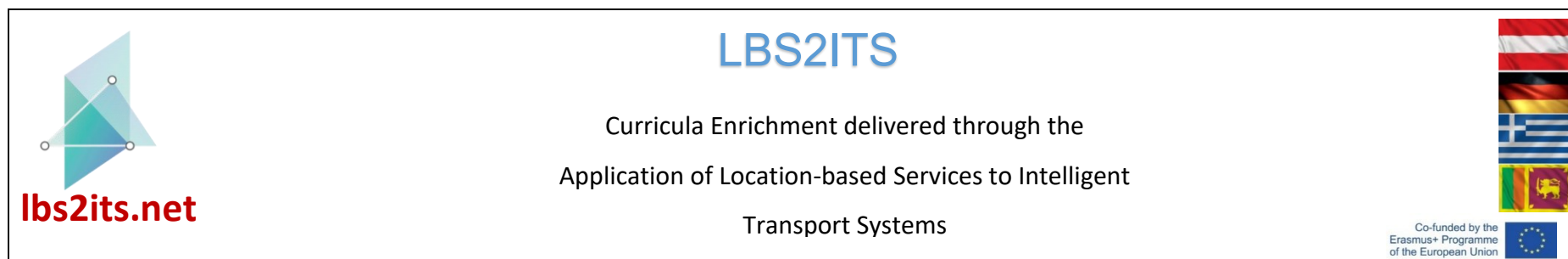
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Publisher

University of Moratuwa

PREFACE

This book serves as open educational material for both undergraduate and postgraduate degree programs, offering a detailed, step-by-step guide to mapping the land use mix of a particular area using GIS technology.

Land use mix analysis delves into the intricate arrangement and diversity of land use within a defined area, often at the scale of a neighborhood or urban region. This analysis meticulously evaluates how various land uses such as residential, commercial, industrial, recreational, and green spaces or Live, Work, and Visit—interact and are distributed spatially. By quantifying the blend and proximity of these land uses, the analysis illuminates the area's spatial structure, functionality, and vibrancy. Whether you are a student aiming to master mobile mapping and geographic information systems, a teacher looking for robust educational tools, or a practitioner in need of refining your technical expertise, this book offers invaluable guidance and support. It ensures that users at all levels gain proficiency in leveraging modern technologies to explore and solve geographic challenges effectively.

This understanding of land use mix is paramount for urban planners, policymakers, and researchers alike. It serves as a cornerstone for fostering sustainable development, enriching livability, nurturing walkable communities, and bolstering social and economic prosperity.

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1. MAPPING PROCESS

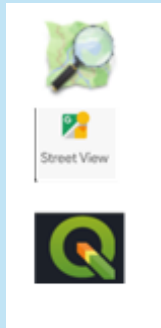
Data preparation	Data Analysis	Mapping data
<u>Data collection</u>  Open Street Map Google Street View Qgis	<u>Process</u>  Categorize buildings. ↓ Convert as points. ↓ Code ↓ Interpolate ↓ Reclass	 Choose the appropriate color ramp. ↓ Rename according to the use
<u>Output</u> Building Layer	<u>Output</u> Raster layer according to the land use mix	<u>Output</u> Landuse Mix Map

Table 1 -Mapping Process

2. REQUIRED TOOLS / SOFTWARE AND EQUIPMENT

QGIS is a free, open-source software that allows users to create, edit, analyze, and visualize geospatial data and maps. Its compatibility with various data formats, plugins, and support for projections make it a versatile tool for geographic information.

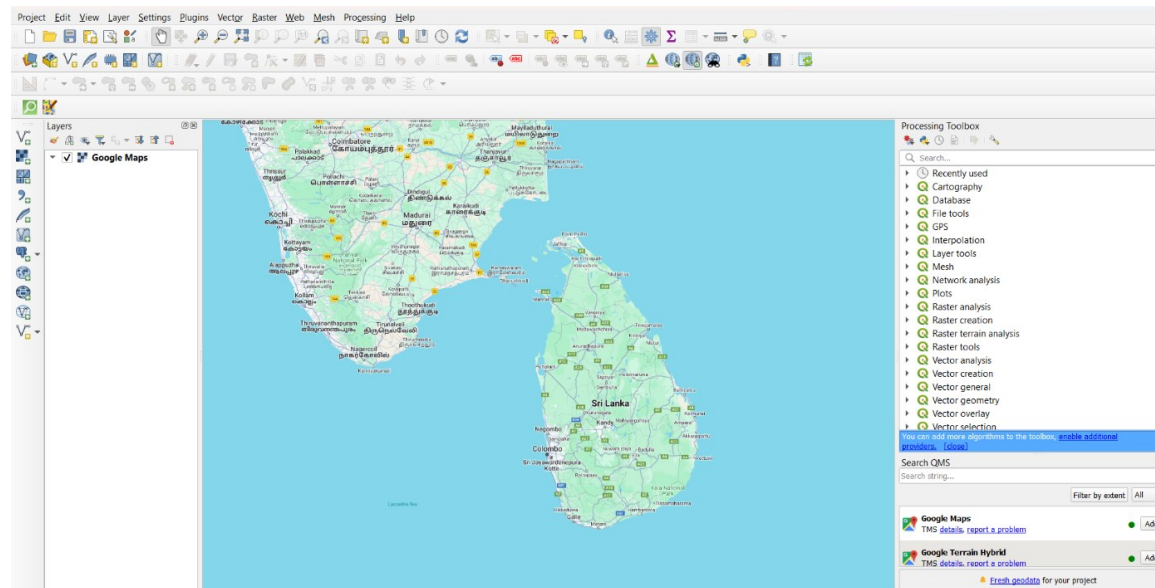


Figure 1 - QGIS Interface

3. STEPS

Land use Mix for Dambulla MC

The completed land use mix map provides a visual representation of the varied land uses found in our research zone. This map serves as a comprehensive overview, allowing us to understand the dynamic landscape and how different land uses interact and coexist within our study area. By visually representing Live, Work, Visit, Live and Work, Live and Visit, Work and Visit, and the live, work, and visit according to the use, the map provides valuable insights into the spatial arrangement and interaction of these elements. Figure 2 shows the final output of this process, the Landuse Mix of the Dambulla municipal council area.

Functional Mix Map of Dambulla MC

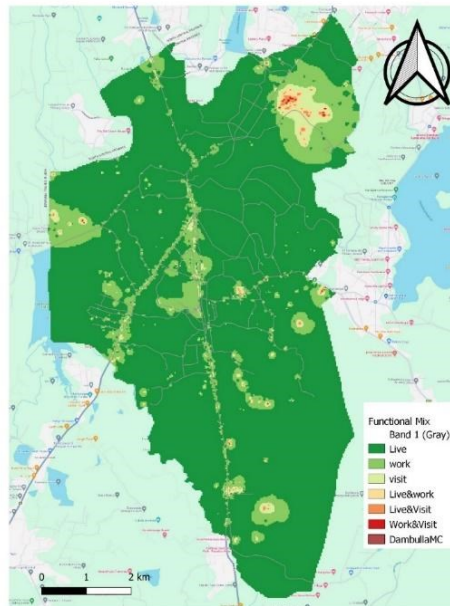


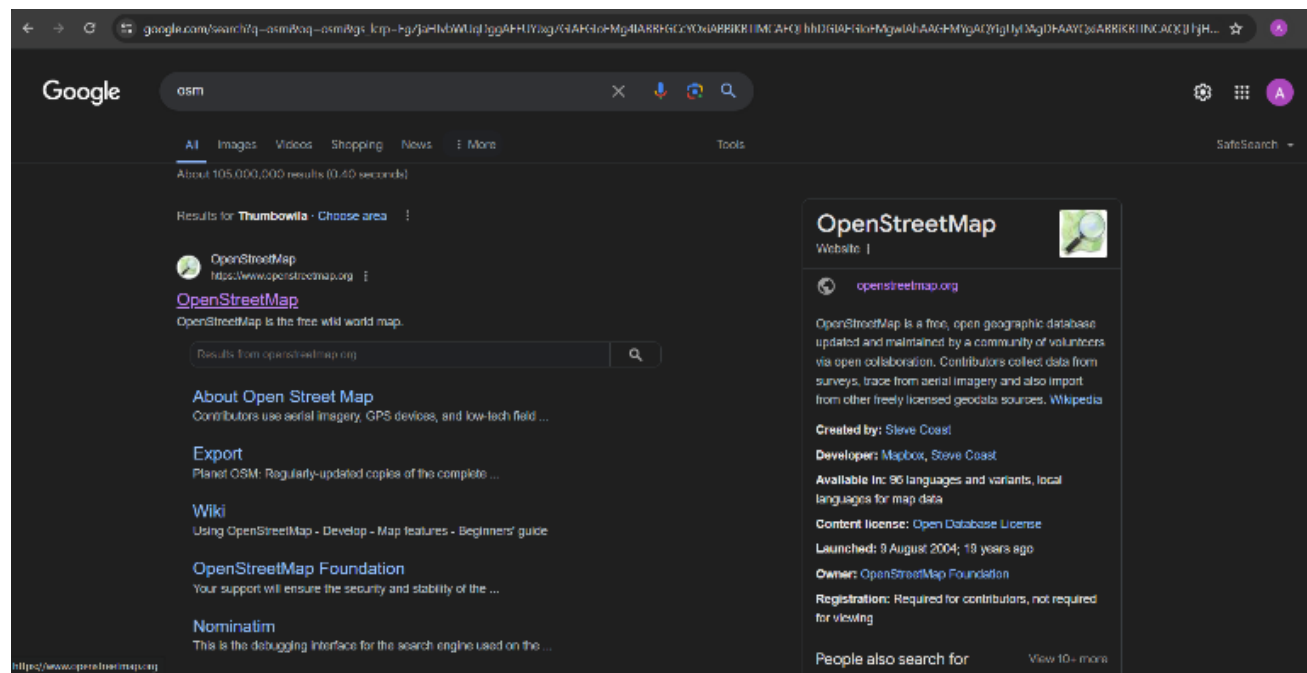
Figure 2 - landuse mix map of Dambulla MC

Step 01

For creating the land mix (Functional Mix) map for an area we have to have a Building layer of that area including land uses. If not, we have to create it Using OpenStreetMap (OSM) which is an Open source software, with data as a base and then digitizing missing buildings using the following steps is one approach to creating a building layer.

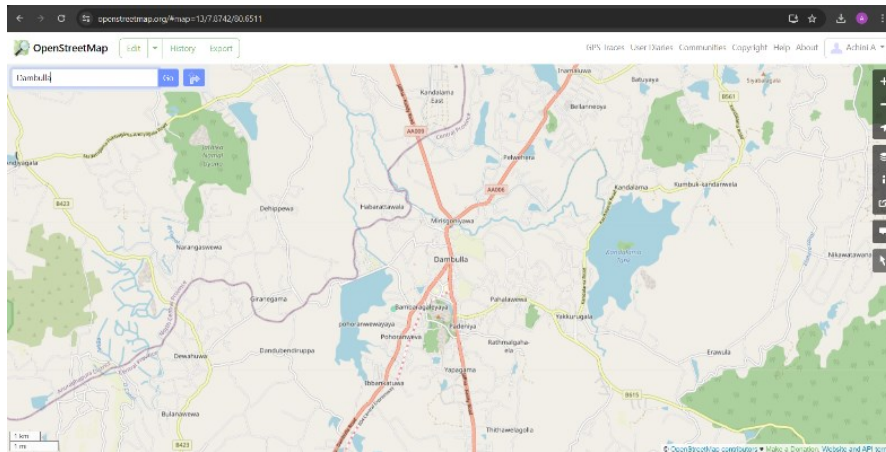
I. Download OSM Data _Access OSM data for the study area by downloading OSM data.

- Go to the OpenStreetMap website (www.openstreetmap.org) >>Sign in



Note - If any building layer is available with the land uses for the study area you can use it.

- Use the provided interface to select the study area or specify a bounding box for the study area.



ii. For digitizing missing buildings, first use the **Edit** tool to digitize buildings.

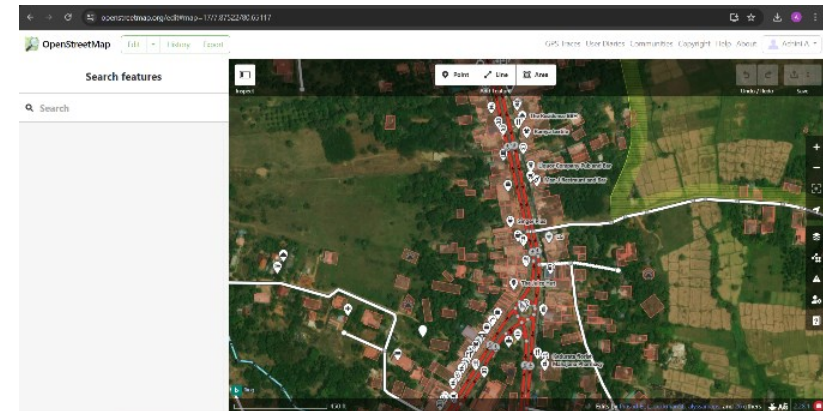
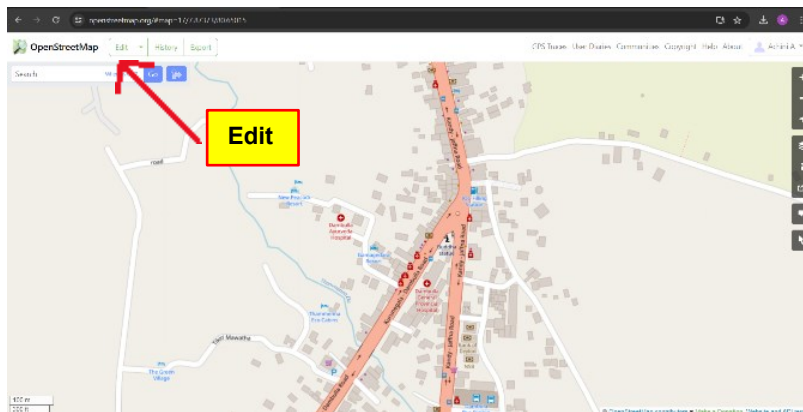
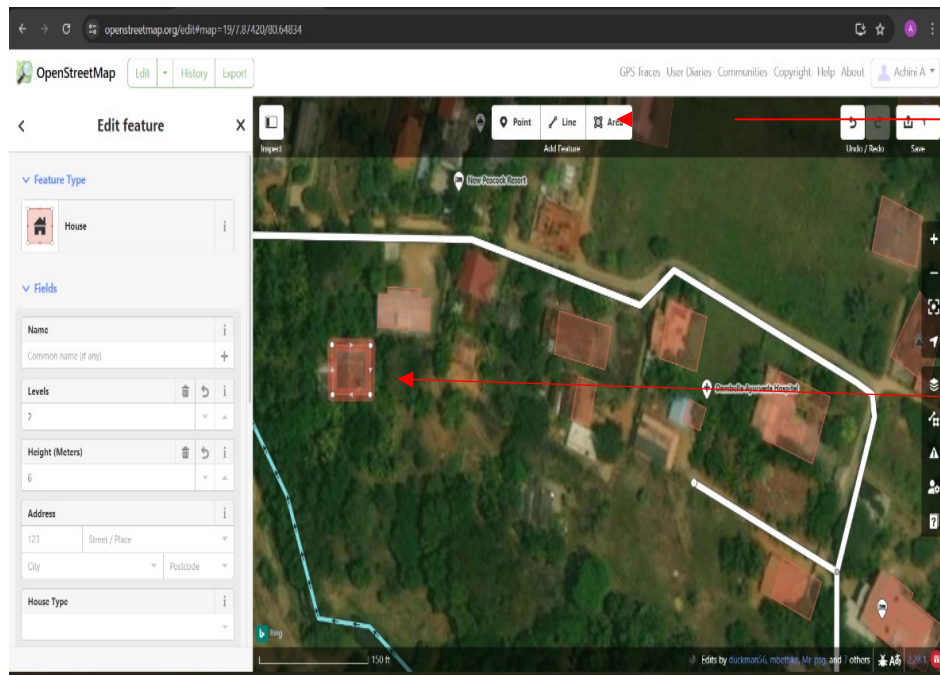


Figure 5- Edit Tool

- Click on 'Area' >> Draw the shape of the building >> save



Step3

Step1

Step2

Now we can download the data

- When exporting the data, automatically download the data.

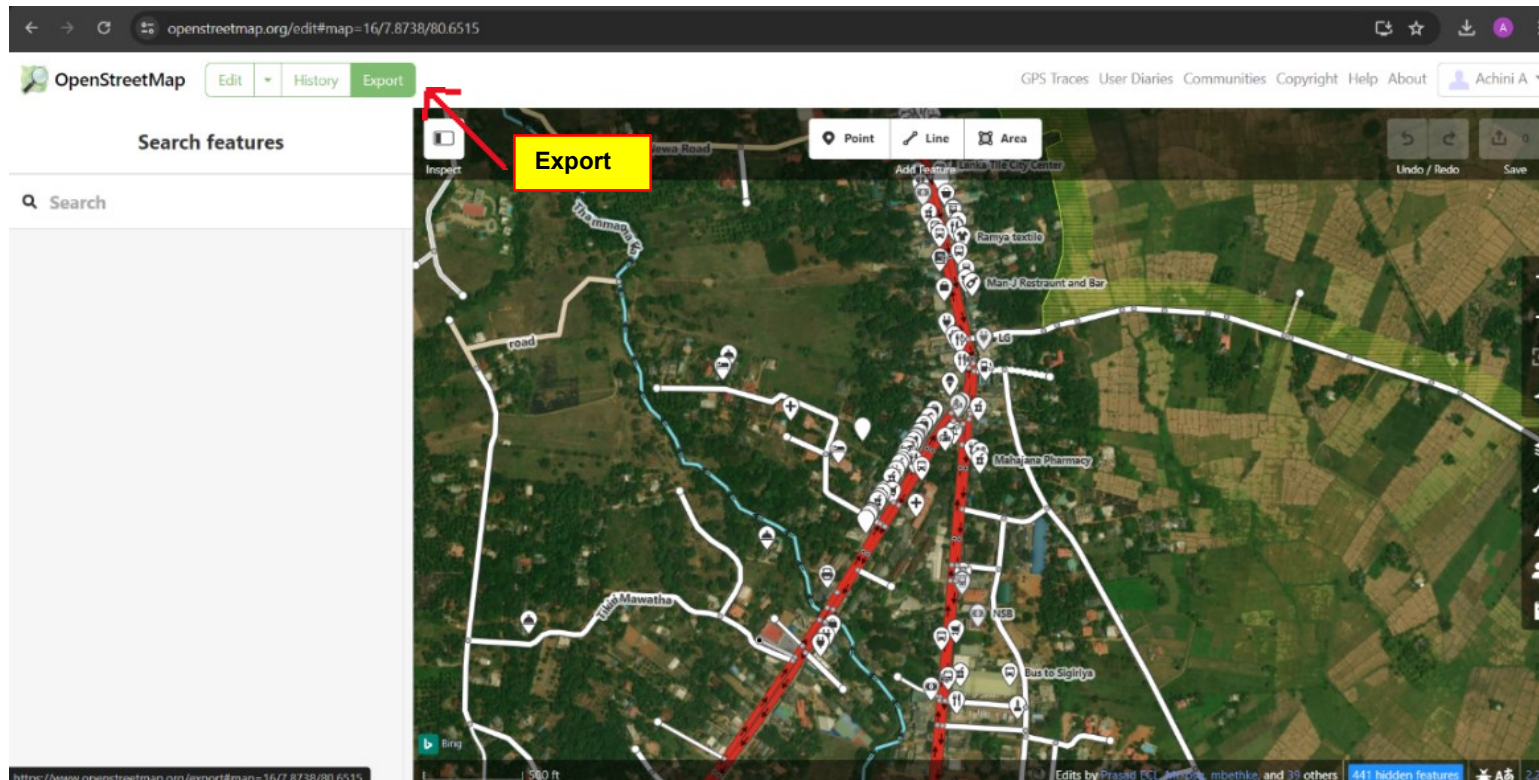


Figure 6 -Export Data

iii. Import the OSM data into QGIS.

- Install QuickOSM Plugin (if not already installed) - Plugins>>Manage and Install plugins.

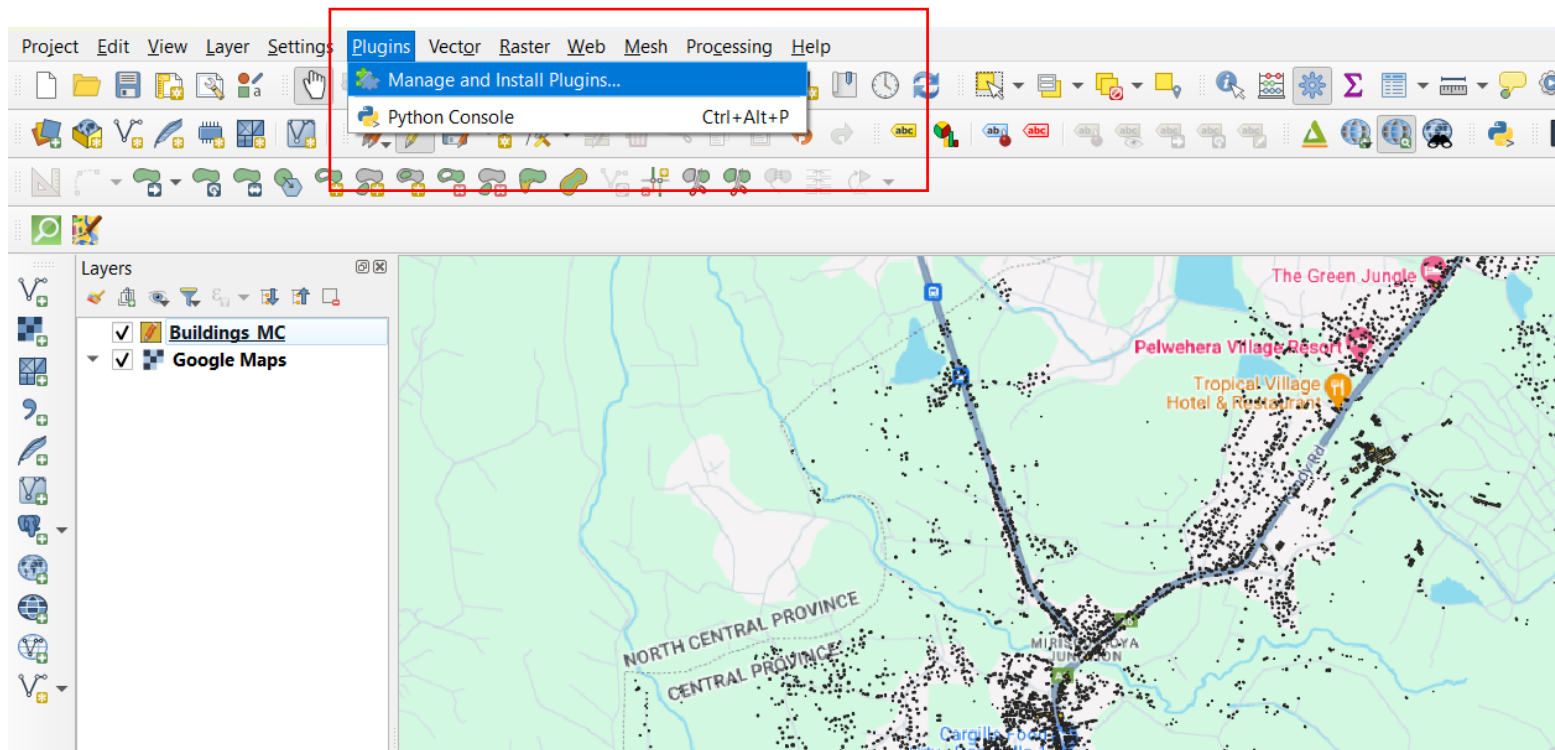


Figure 7 -Install Plugins

- In the Plugins Manager window, search for "QuickOSM" and install it.

Search 'QuickOSM' in the searching box.>> Select the 'QuickOSM' >>Install the plugging.

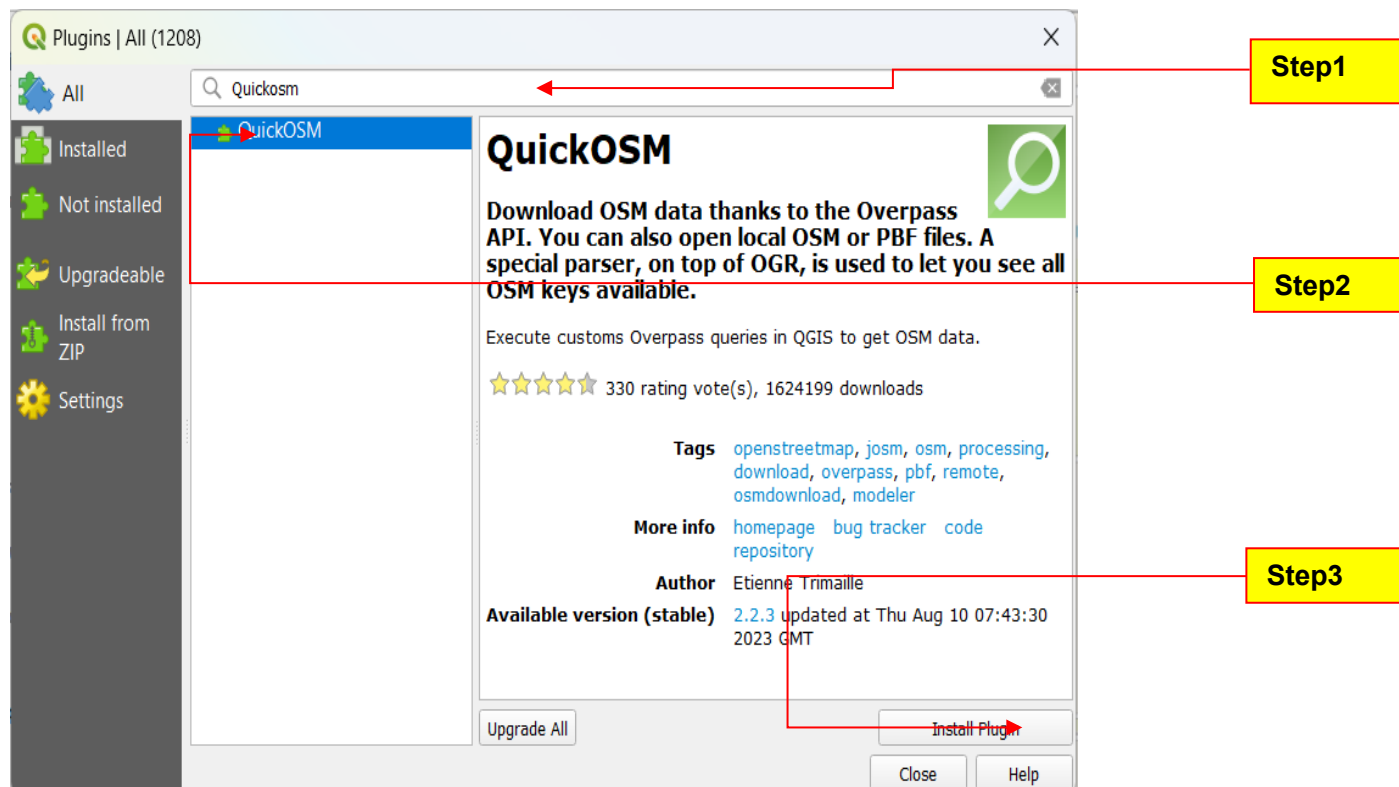


Figure 8 - Install QuickOSM plugin.

- When we install the QuickOSM plugin successfully, it appears as this.

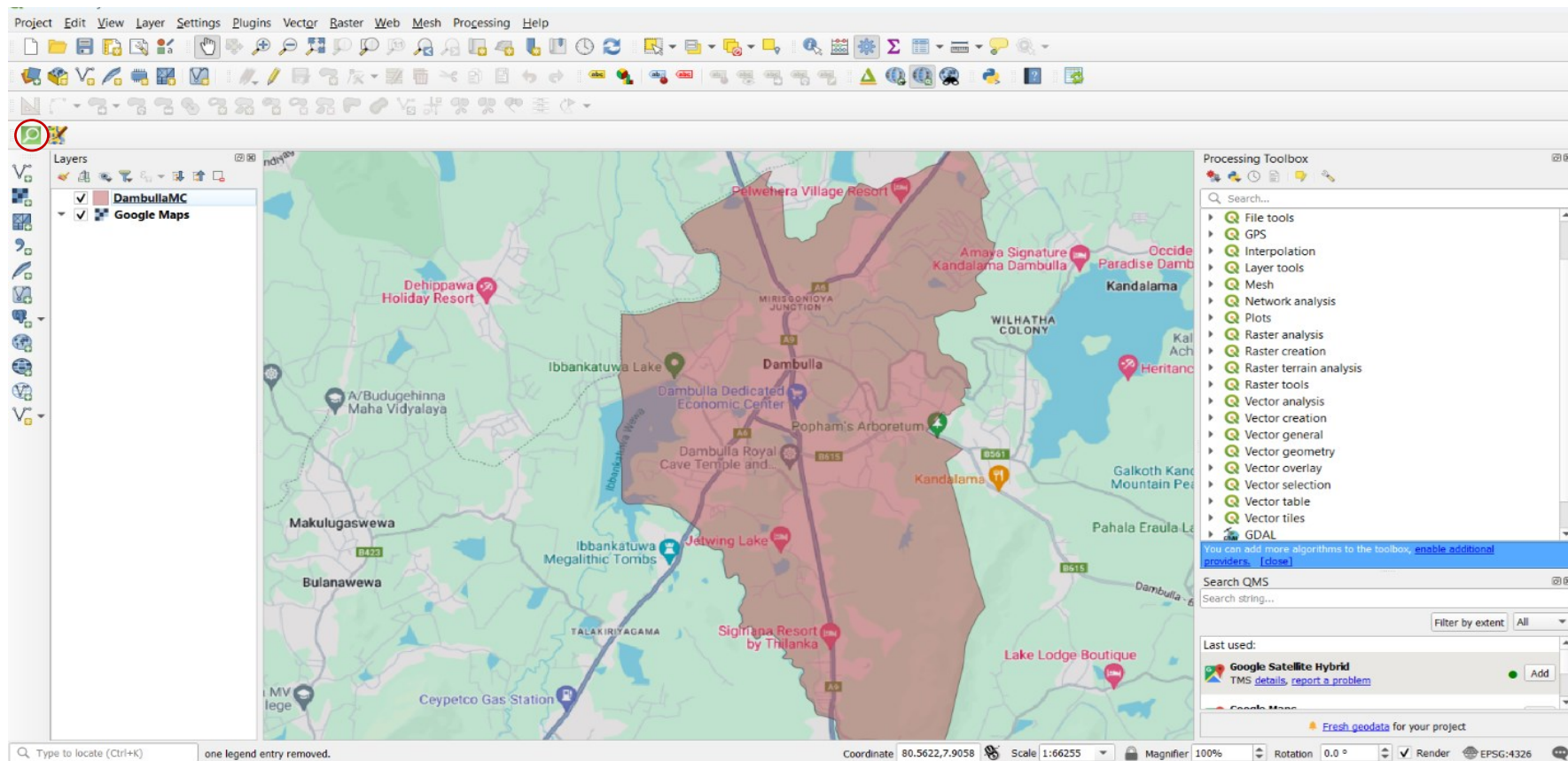


Figure 9 -OSM Plugin

- Now we can import the buildings which we digitize in OSM, to the QGIS using this tool.

Click on the QuickOSM plugin>> choose 'Buildings' in the preset box.

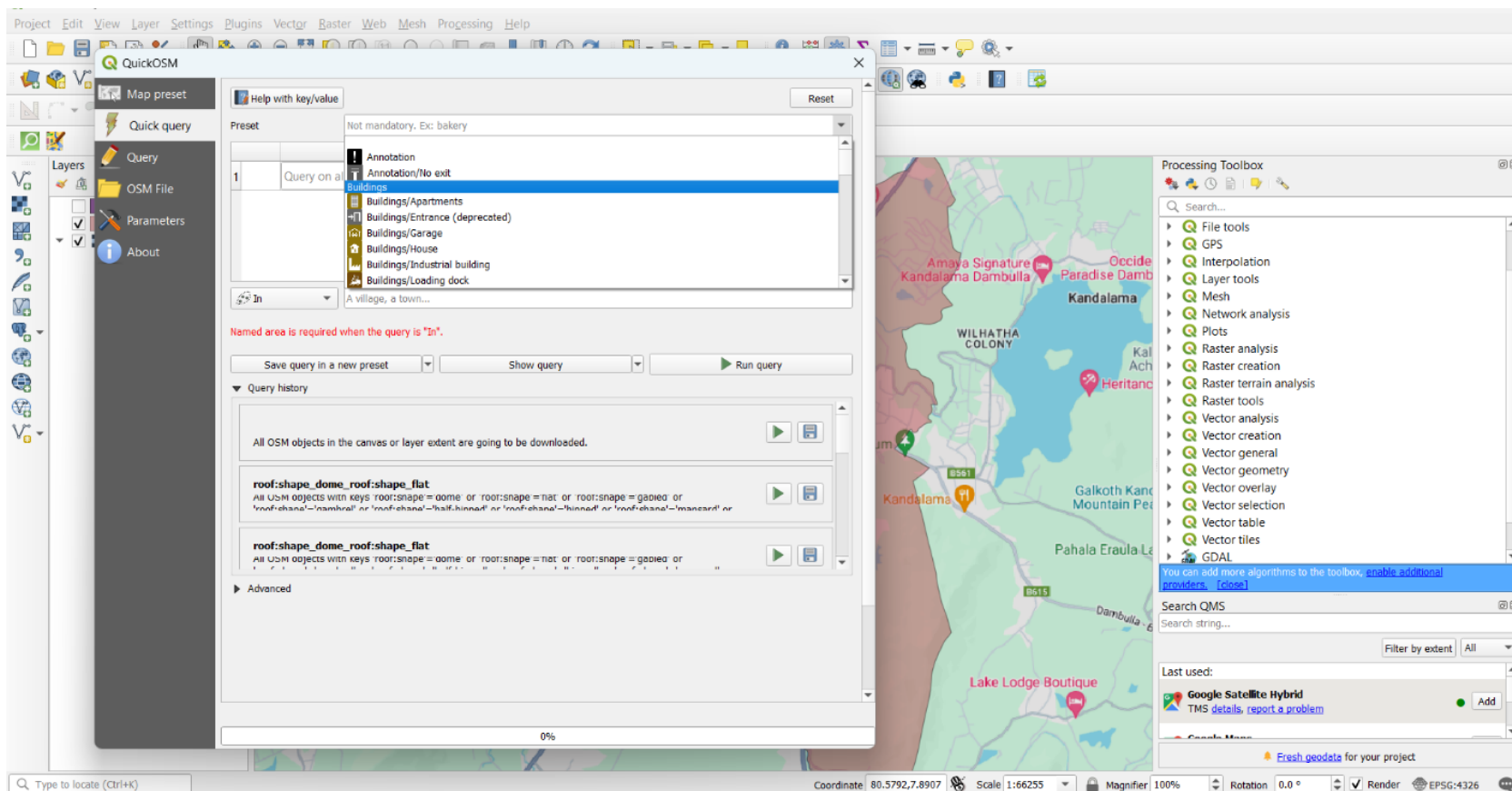


Figure 10- Import Buildings

- Give the 'layer extent' as the spatial extent>>select the study area using the drop bar. (Configure the query parameters according to your requirements.)

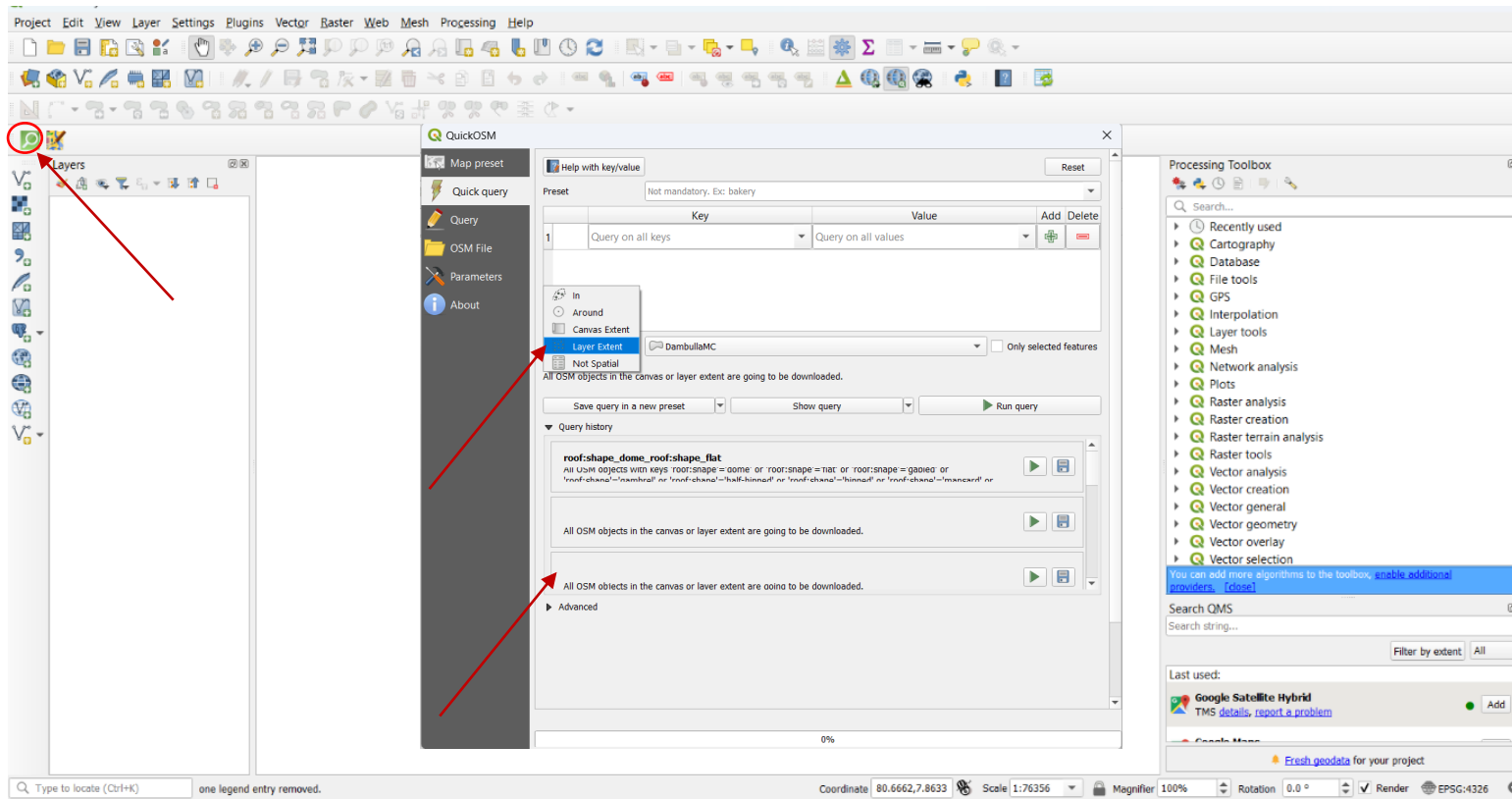


Figure 11 -Layer Extent

- Run the Query- After specifying the query parameters, click on the "Run Query" button to execute the query. QuickOSM will create building data based on the criteria.

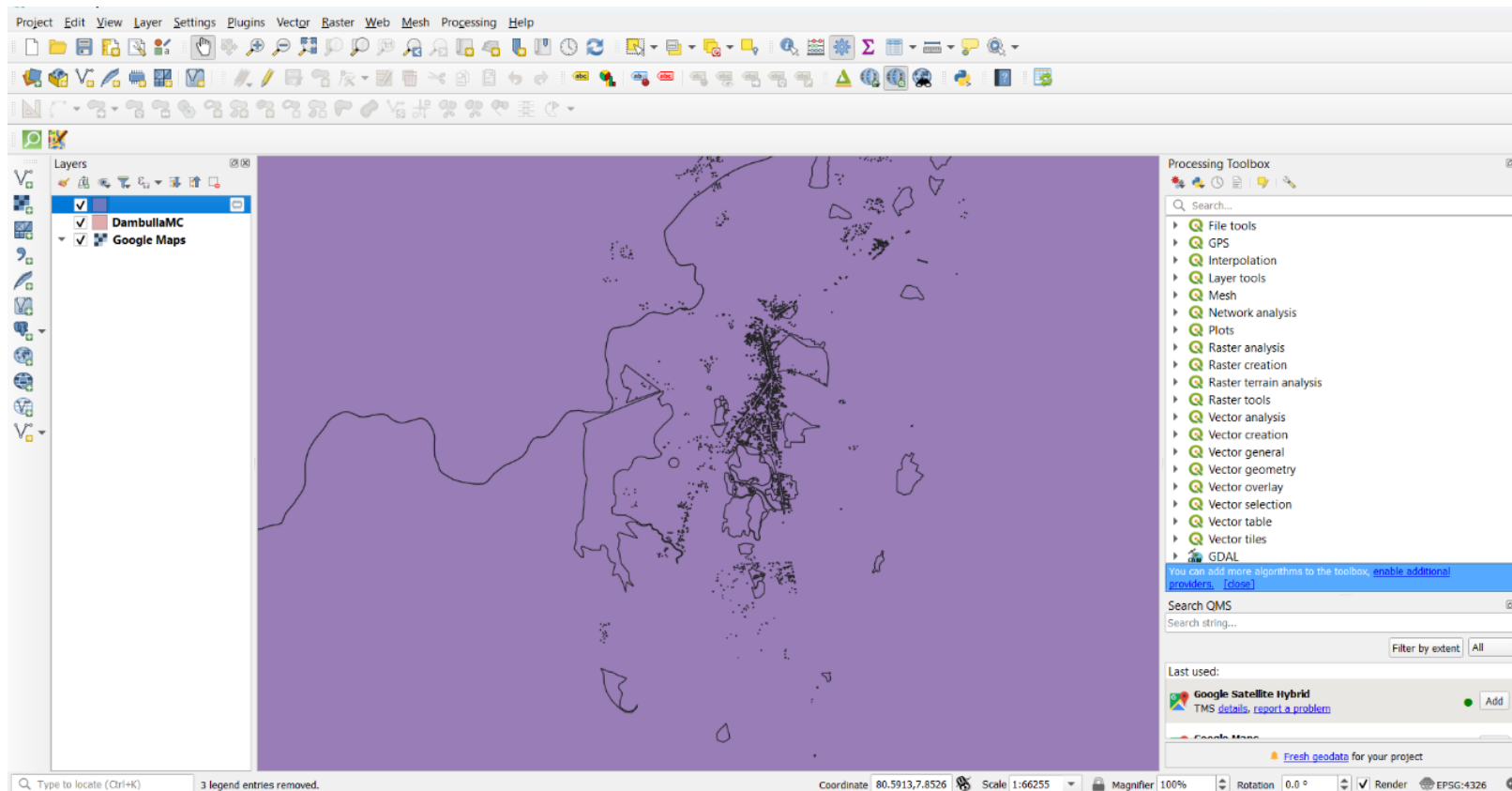


Figure 12 -Imported Building layer from OSM

- Delete unwanted polygons using attributes.

I. **Select the layer>> click on the toggle editing tool**

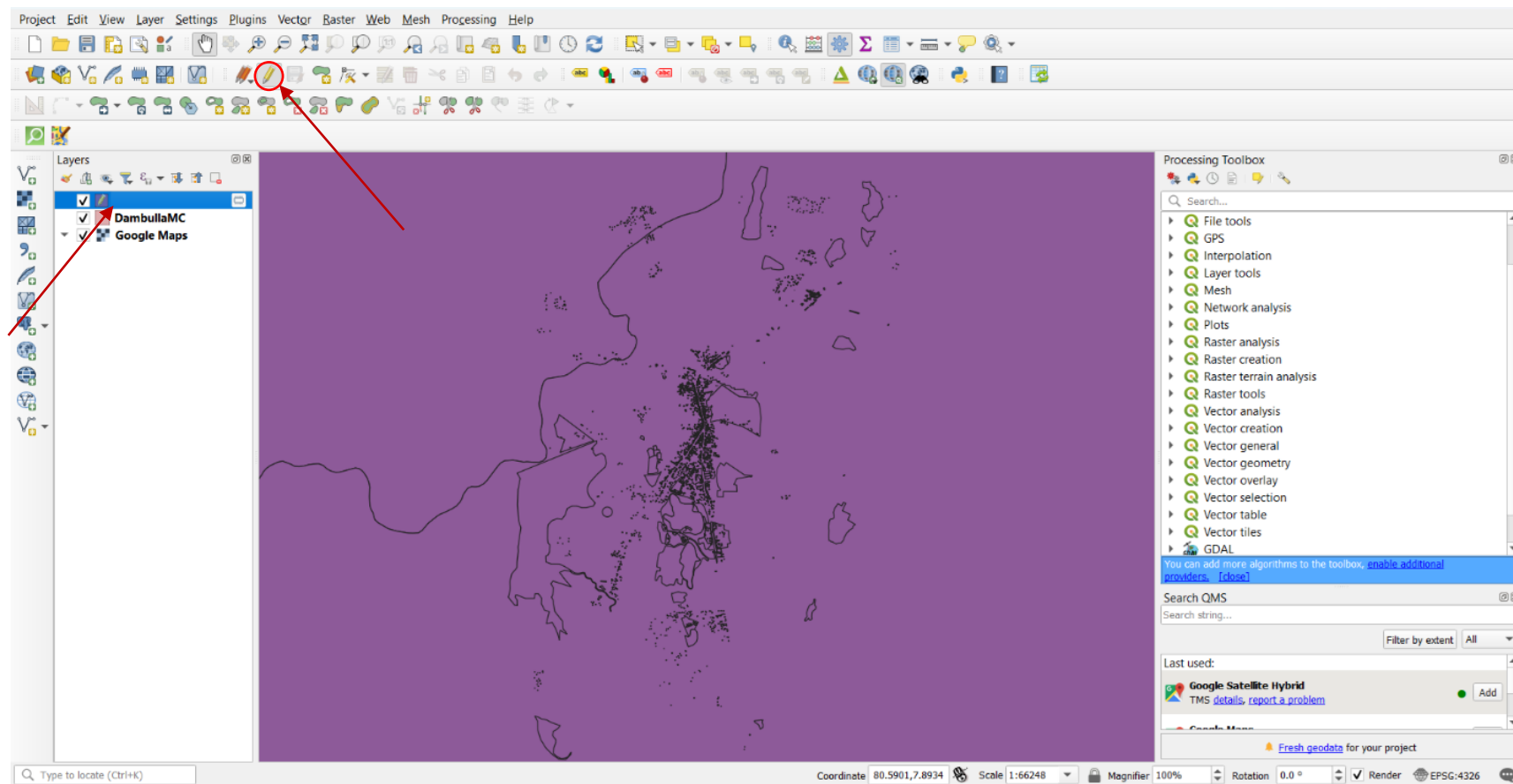


Figure 13 - Deleting.

ii . Open the attribute table by right-clicking on this layer(imported layer from the open street map).

	leisure	height	building:levels	amenity	water	tourism	building	natural	wikipedia	wikidata	type	name:zh-Hant	name:zh-Hans	name:zh	name:uk
19	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
20	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
21	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
22	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
23	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
24	NULL	NULL	NULL	NULL	lake	NULL	NULL	water	NULL	NULL	NULL	NULL	NULL	NULL	NULL
25	NULL	NULL	NULL	NULL	lake	NULL	NULL	water	NULL	NULL	NULL	NULL	NULL	NULL	NULL
26	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
27	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
28	NULL	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
29	park	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
30	park	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
31	NULL	NULL	NULL	NULL	NULL	hotel	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
32	swimming_pool	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
33	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
34	NULL	NULL	2	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
35	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
36	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
37	NULL	NULL	NULL	place_of_worship	NULL	attraction	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
38	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
39	NULL	NULL	2	NULL	NULL	residential	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
40	NULL	NULL	NULL	parking	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
41	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
42	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 14 -Attribute table of Building layer

- When opening the attribute table, we can see a field called 'buildings'. The polygons that are 'NULL' in this column are not buildings and we have to delete them. Select the unwanted polygons by using the 'select by attribute' tool.

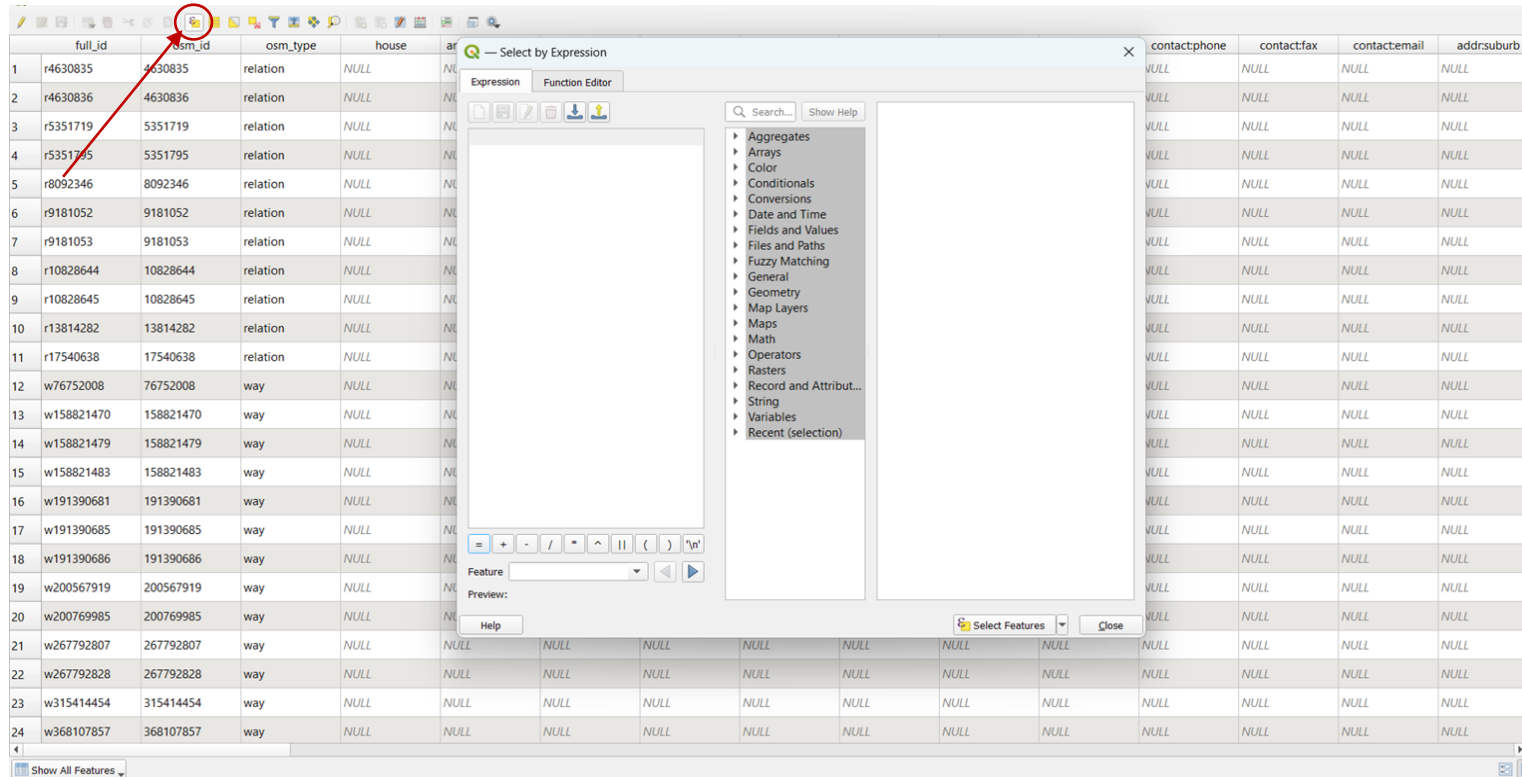


Figure 15 -Select By Expression

- Extract the Fields and Values using the drop bar.

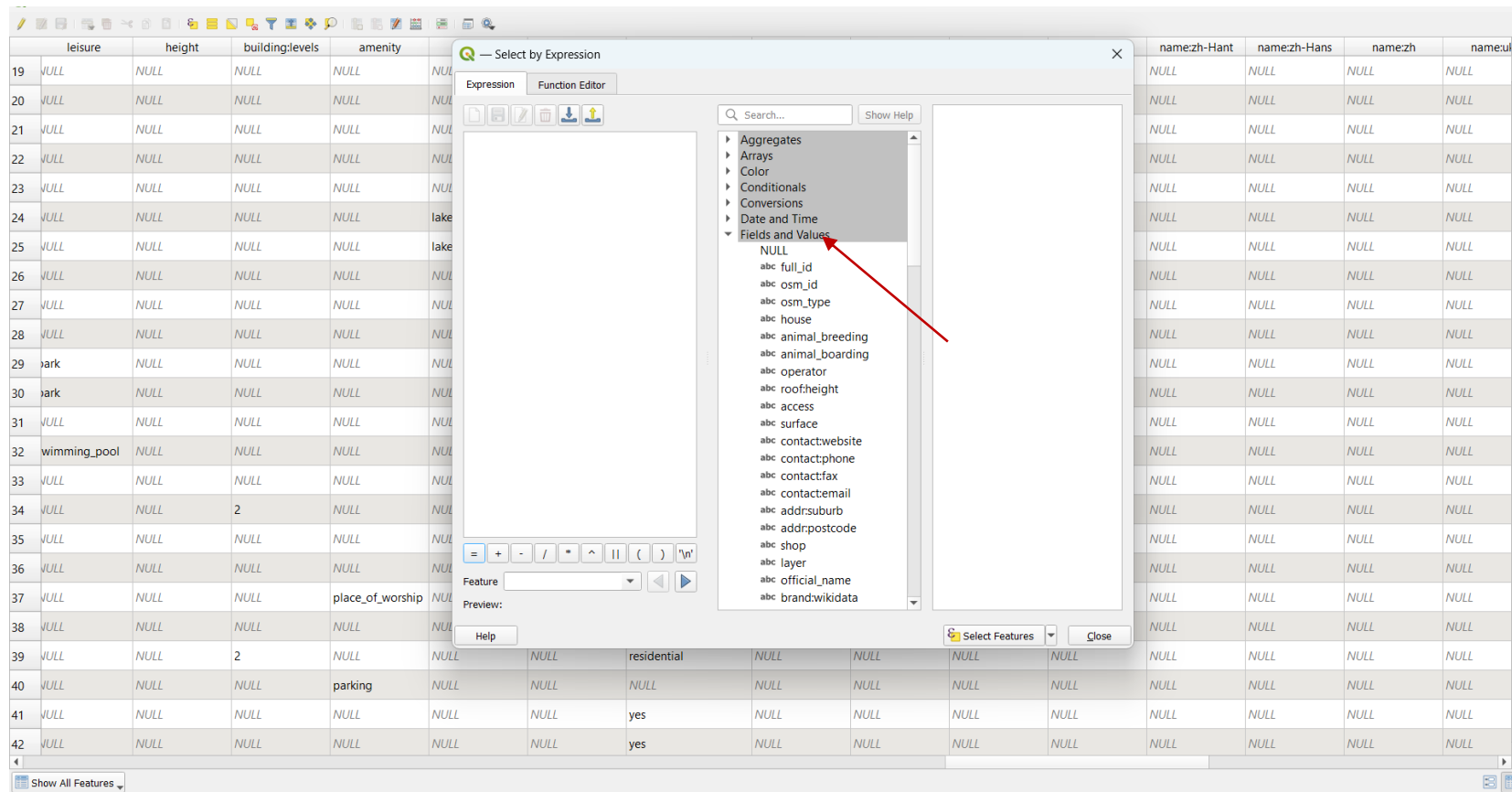


Figure 16 -Select Fields and Values

- Select the buildings>>double click on it. It appears in the vacant space in the left top corner of the window.

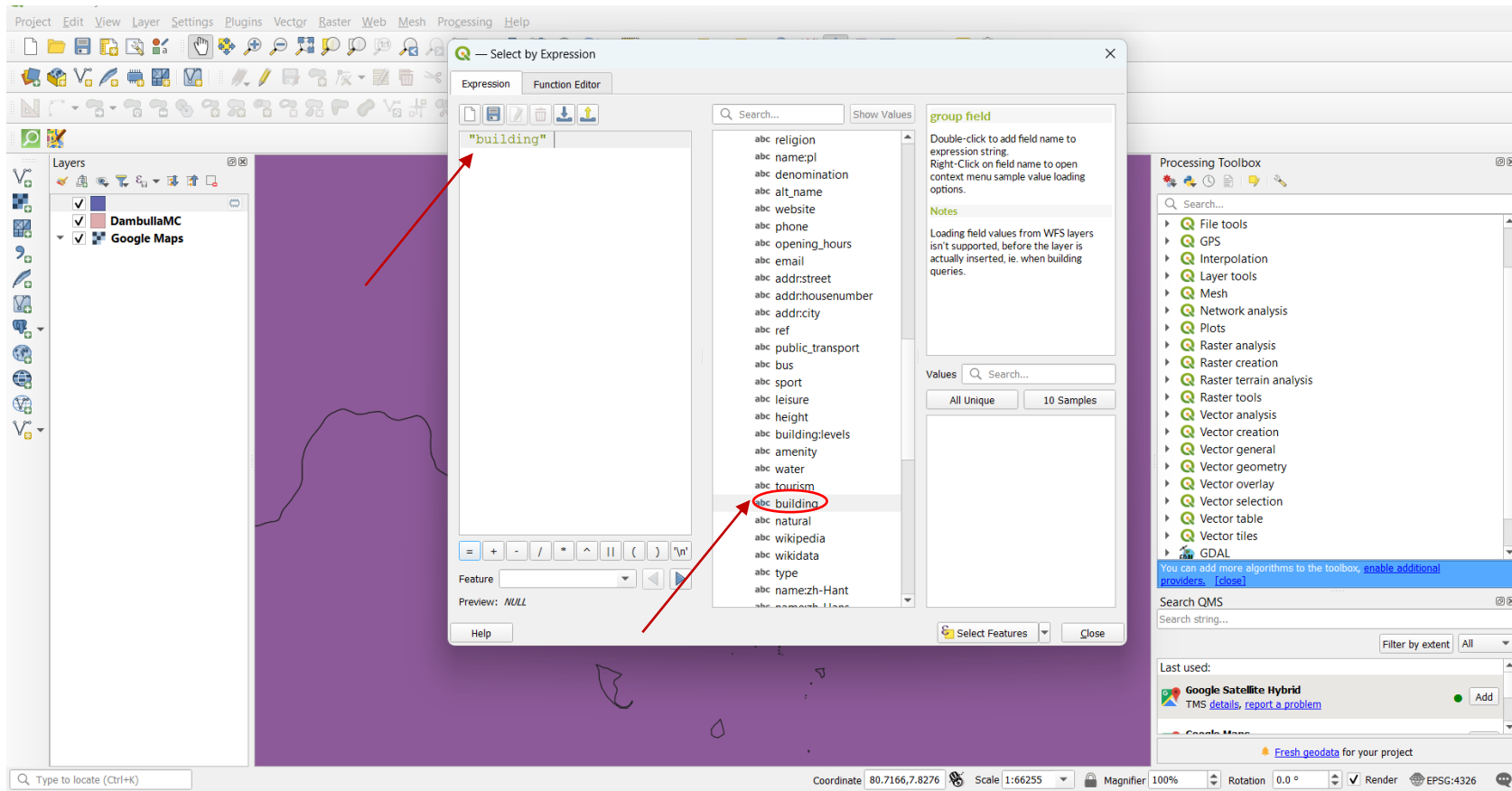


Figure 17 - Select Building

- Type 'is' after the building >>All Unique>>double click on 'NULL'>>Click on select Fetchers>>close

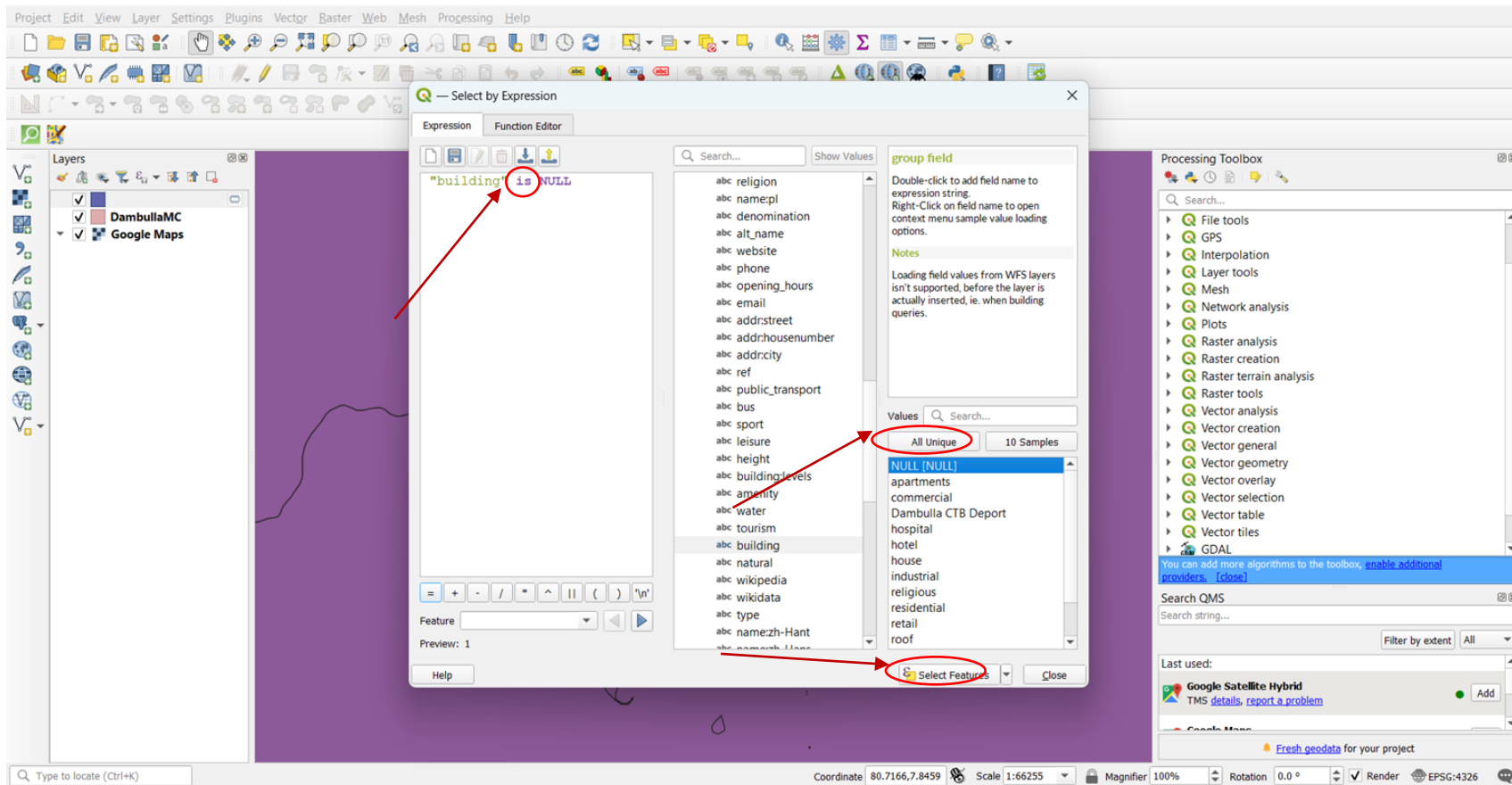


Figure 18 -Select by Attribute

- Delete the selected unwanted polygons that are not buildings using the delete tool.

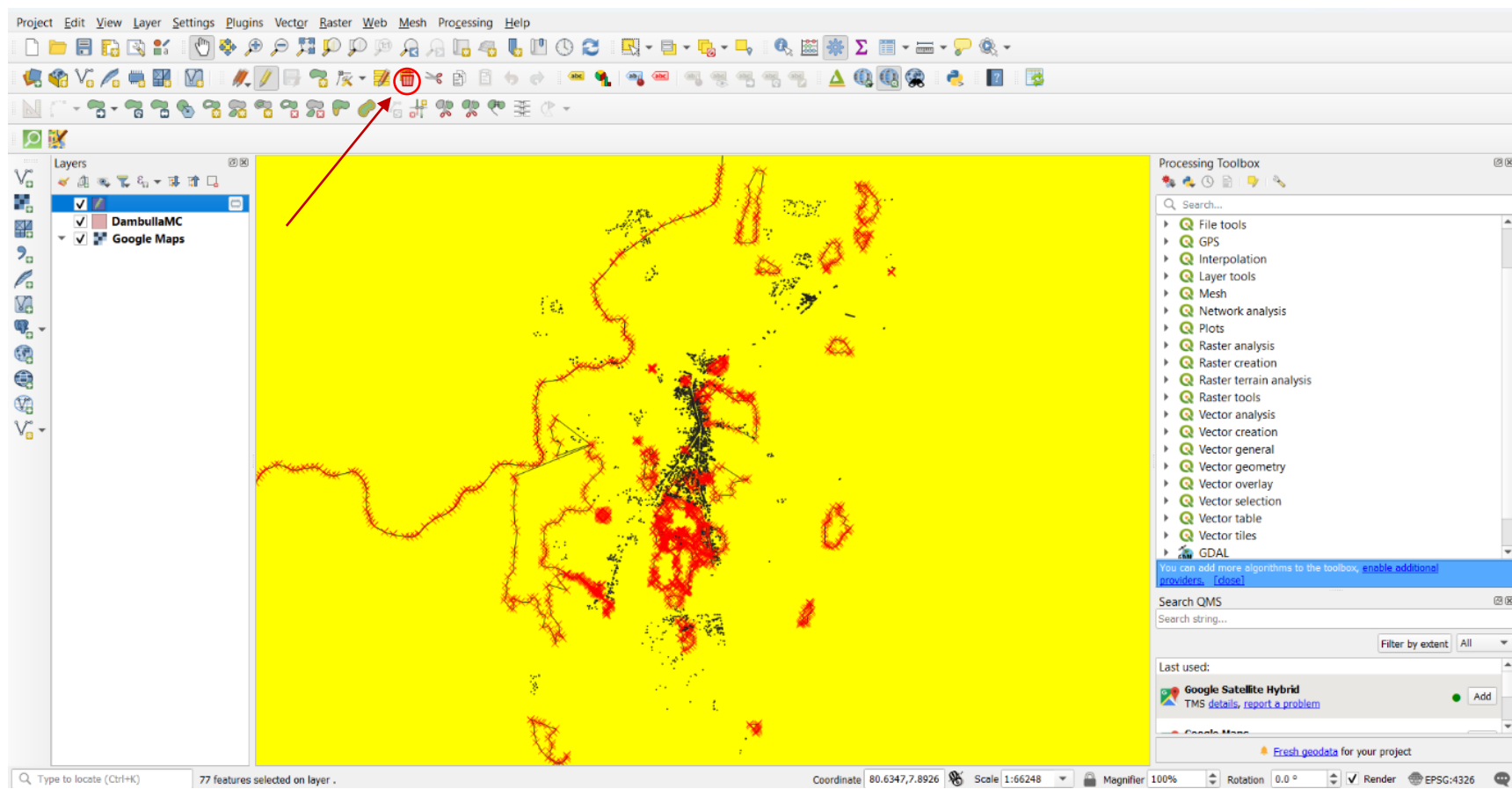


Figure 19 -Delete

- If there are buildings outside of the study area boundary you can delete them.

Select those buildings. By holding the shift key select all buildings that are outside of the boundary of the study area. Then delete them.

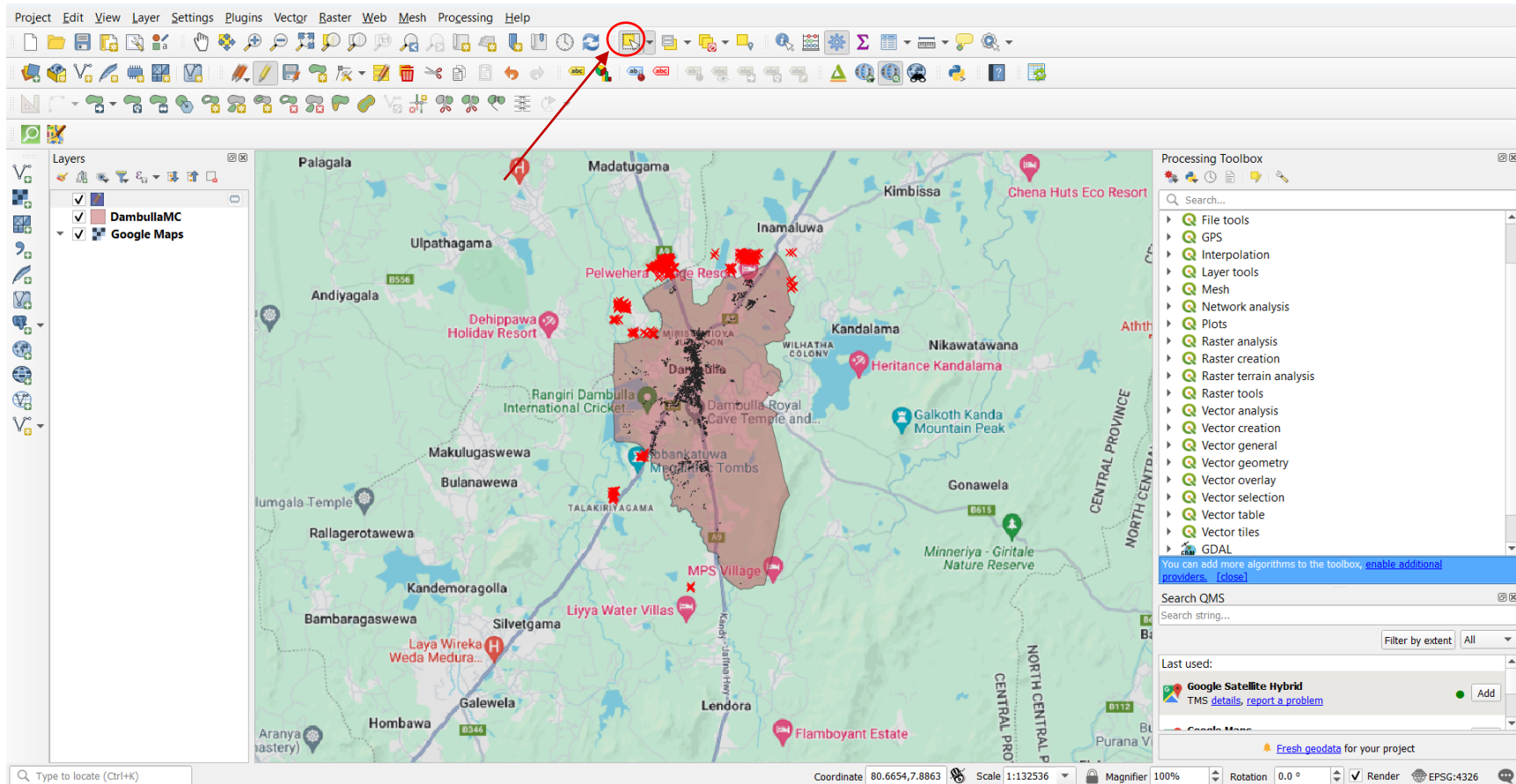


Figure 20 -Delete buildings which are outside of the boundary

- Now we can delete the unwanted columns from the attribute table of the building layer.

Open attribute table>>click on toggle editing>>click on delete field>>select the names of unwanted fields>>OK

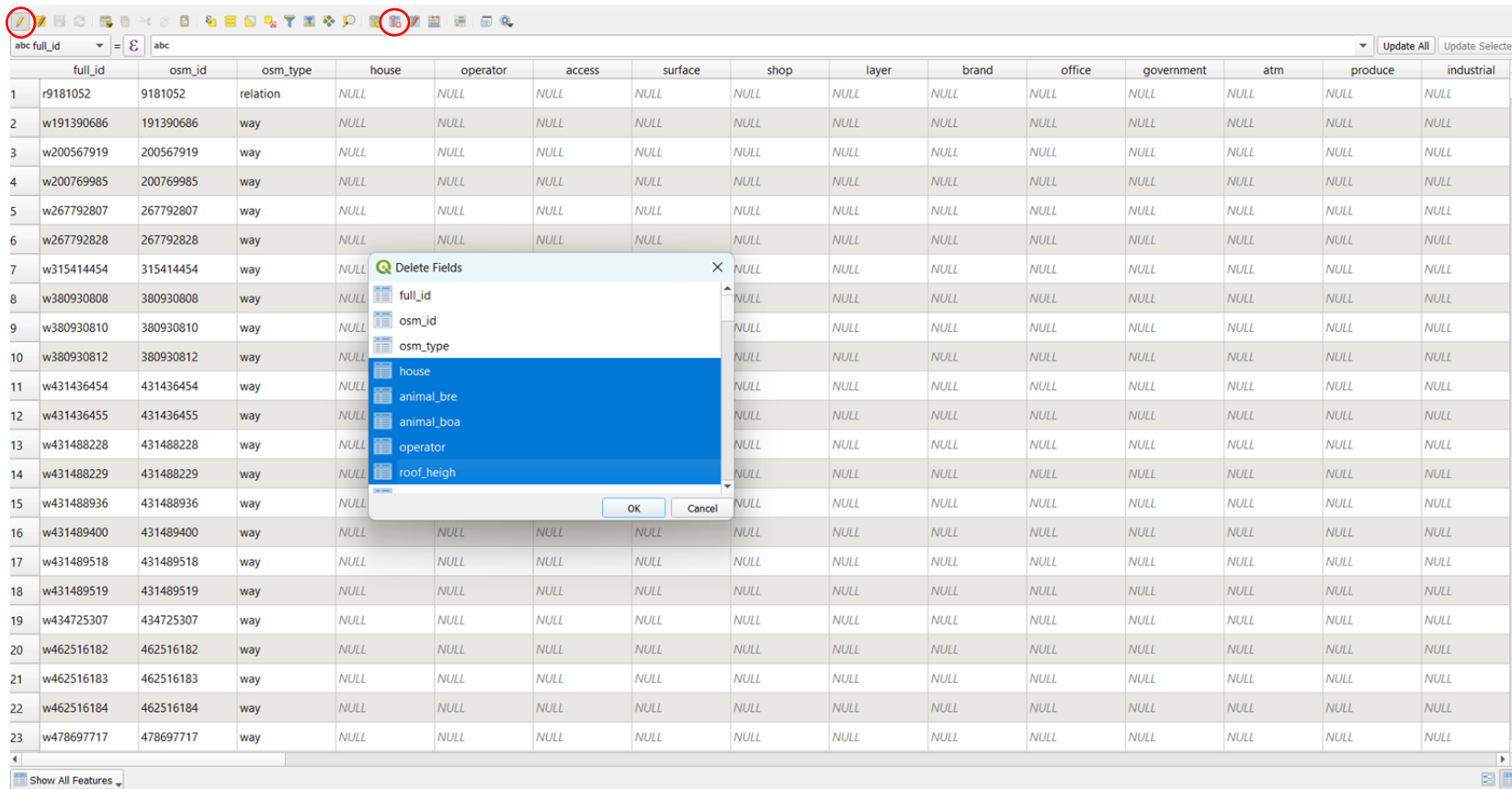


Figure 21 -Select unwanted Columns.

- Save the layer.

Click on toggle editing>>yes. -Now we have the building layer of our study area.

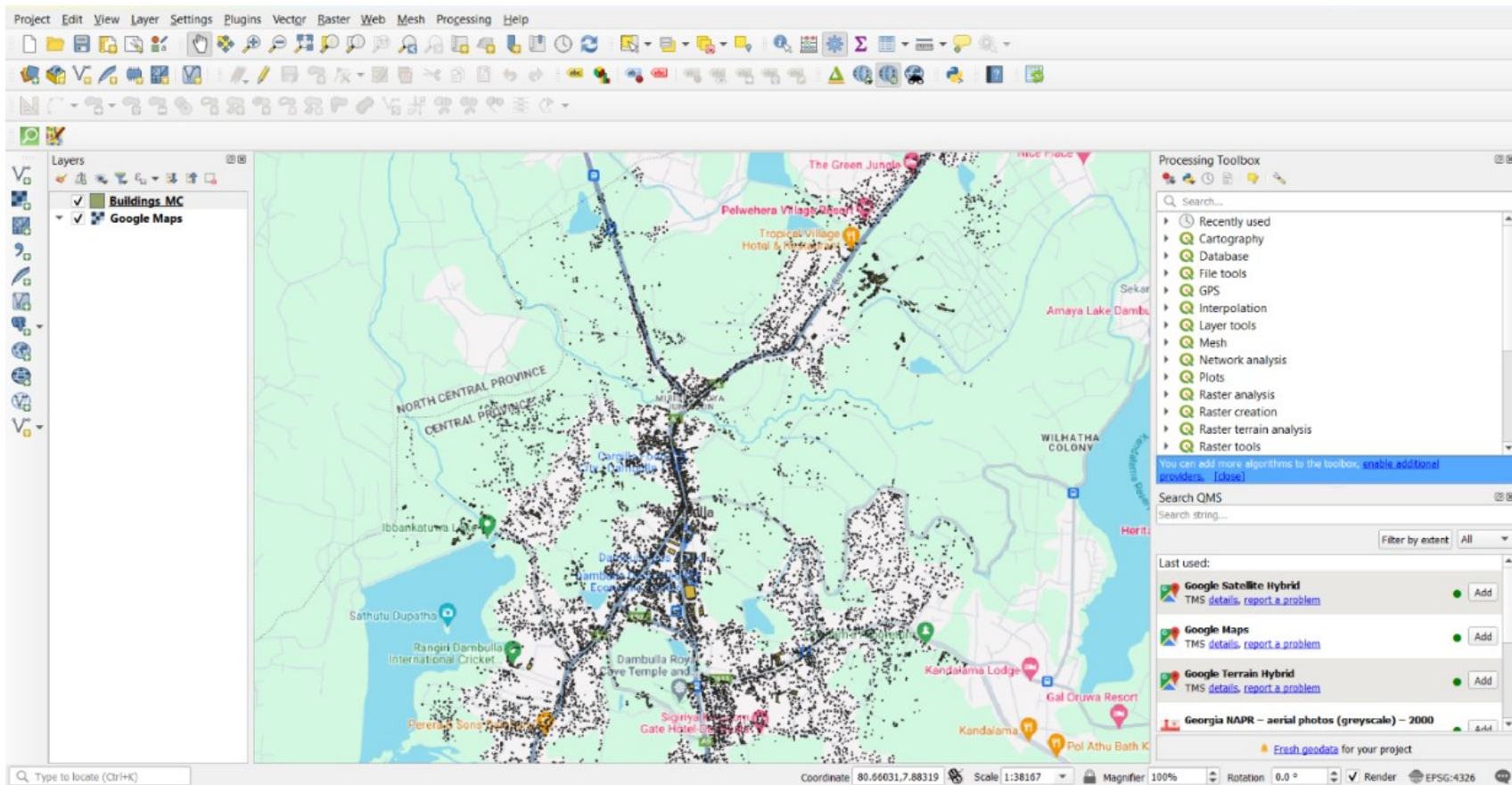
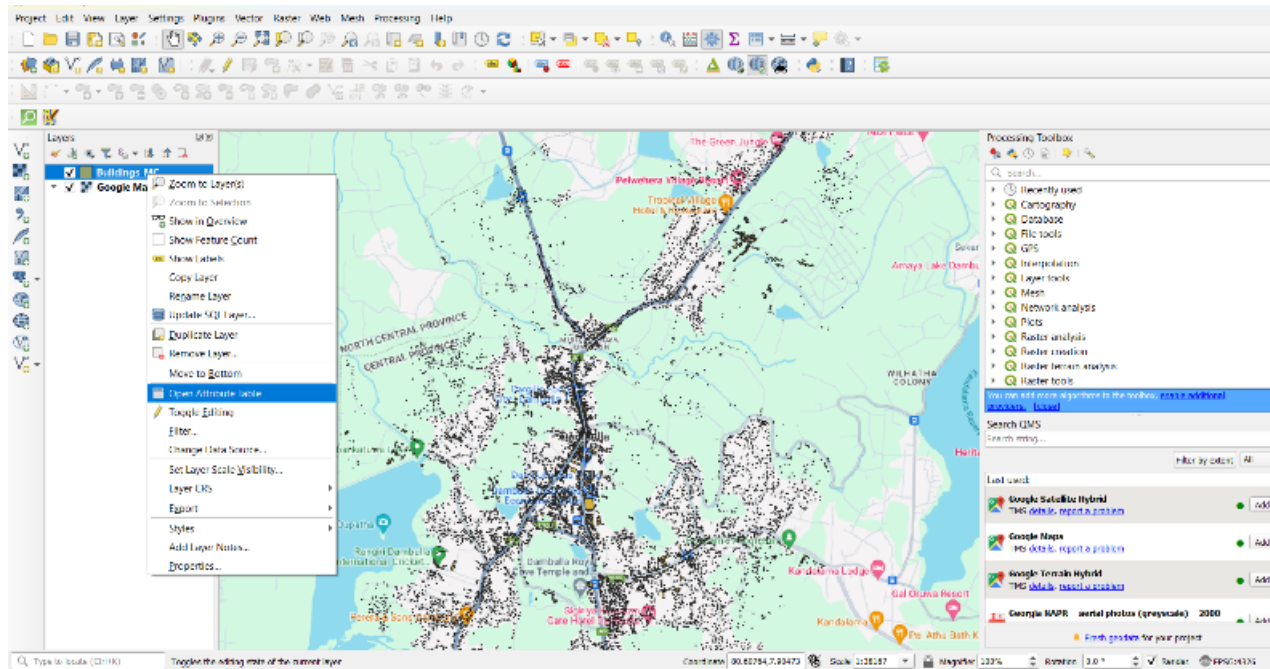


Figure 22 -Building layer

Step 02

We have to have land use for each building for this analysis. For that,

- i. **Open the attribute table of the building layer by right-clicking on the layer.**



	latitude	longitude	area_in_me	confidence	full_plus_
1	7.85619114000...	80.6550586799...	136.384099999...	0.8504	6MV2VM44+F2...
2	7.85206145000...	80.6558336100...	36.782499999...	0.6816	6MV2VM24+R8...
3	7.85110933000...	80.6540884599...	32.872999999...	0.6997	6MV2VM23+CI...
4	7.85085545000...	80.6550881000...	147.866399999...	0.861	6MV2VM24+82...
5	7.85339178000...	80.6546113800...	130.150700000...	0.683	6MV2VM33+9R...
6	7.85503781000...	80.6551788000...	53.100299999...	0.7191	6MV2VM44+23...
7	7.85654983000...	80.6561935799...	134.262499999...	0.8141	6MV2VM44+JF8R
8	7.85304112000...	80.6549067600...	50.855699999...	0.8303	6MV2VM33+6X7J
9	7.85616451000...	80.6544944999...	33.063899999...	0.8186	6MV2VM43+FQ...
10	7.85432756000...	80.6541885599...	29.481200000...	0.7381	6MV2VM33+P...
11	7.85541383000...	80.6554347999...	125.371399999...	0.7582	6MV2VM44+55...
12	7.85055452000...	80.6554593000...	161.790300000...	0.6945	6MV2VM24+65...
13	7.85231165000...	80.6546857999...	81.685500000...	0.7742	6MV2VM23+W...
14	7.85208745000...	80.6563912900...	54.628999999...	0.6915	6MV2VM24+RH...
15	7.85571889000...	80.6556222899...	22.521999999...	0.7201	6MV2VM44+76...
16	7.85402082000...	80.6559043000...	39.333100000...	0.652	6MV2VM34+J92X
17	7.85748841000...	80.6568236300...	46.598900000...	0.73	6MV2VM44+XP...
18	7.85579453000...	80.6551276000...	44.850299999...	0.8067	6MV2VM44+836J
19	7.85470836000...	80.6547734899...	180.310599999...	0.7881	6MV2VM33+V...
20	7.85644683000...	80.6552911600...	119.544200000...	0.7032	6MV2VM44+H4...
21	7.85610235000...	80.6543229499...	93.215800000...	0.6882	6MV2VM43+CP...
22	7.85464722000...	80.6554732000...	18.734800000...	0.6568	6MV2VM34+VS...
23	7.85521685000...	80.6546303599...	38.928600000...	0.7342	6MV2VM43+3VJ
24	7.85518687000...	80.6551910700...	43.941200000...	0.7971	6MV2VM44+33...

- Add a new field for landuse.

Click on toggle editing >>click on New Field>>Name=Landuse, Type= Text>>OK

The screenshot shows the QGIS interface with a table of data. The table has columns: latitude, longitude, area_in_me, confidence, and full_plus. The data is as follows:

	latitude	longitude	area_in_me	confidence	full_plus
1	7.85619114000...	80.6550586799...	136.384099999...	0.8504	6MV2VM44+F2...
2	7.85206145000...	80.6558336100...	36.7824999999...	0.6816	6MV2VM24+R8...
3	7.85110933000...	80.6540884599...	32.8729999999...	0.6997	6MV2VM23+CJ...
4	7.85085545000...	80.6550881000...	147.866399999...	0.861	6MV2VM24+82...
5	7.85339178000...	80.6546113800...	130.150700000...	0.683	6MV2VM33+9R...
6	7.85503781000...	80.6551788000...	53.1002999999...	0.7191	6MV2VM44+23...
7	7.85654983000...	80.6561935799...	134.262499999...	0.8141	6MV2VM44+JF8R
8	7.85304112000...	80.6549067600...	50.8556999999...	0.8303	6MV2VM33+6X7J
9	7.85616451000...	80.6544944999...	33.0638999999...	0.8186	6MV2VM43+FQ...
10	7.85432756000...	80.6541885599...	29.4812000000...	0.7381	6MV2VM33+P...
11	7.85541383000...	80.6554347999...	125.371399999...	0.7582	6MV2VM44+S5...
12	7.85055452000...	80.6554593000...	161.790300000...	0.6945	6MV2VM24+65...
13	7.85231165000...	80.6546857999...	81.6855000000...	0.7742	6MV2VM23+W...
14	7.85208745000...	80.6563912900...	54.6289999999...	0.6915	6MV2VM24+RH...
15	7.85571889000...	80.6556222899...	22.5219999999...	0.7201	6MV2VM44+76...
16	7.85402082000...	80.6559043000...	39.3331000000...	0.652	6MV2VM34+J92X
17	7.85748841000...	80.6568236300...	46.5989000000...	0.73	6MV2VM44+XP...
18	7.85579453000...	80.6551276000...	44.8502999999...	0.8067	6MV2VM44+836J
19	7.85470836000...	80.6547734899...	180.310599999...	0.7881	6MV2VM33+V...
20	7.85644683000...	80.6552911600...	119.544200000...	0.7032	6MV2VM44+H4...
21	7.85610235000...	80.6543229499...	93.2158000000...	0.6882	6MV2VM43+CP...
22	7.85464722000...	80.6554732000...	18.7348000000...	0.6568	6MV2VM34+V5...
23	7.85521685000...	80.6546303599...	38.9286000000...	0.7342	6MV2VM43+3VJ

The 'Add Field' dialog box is open, showing the following fields:

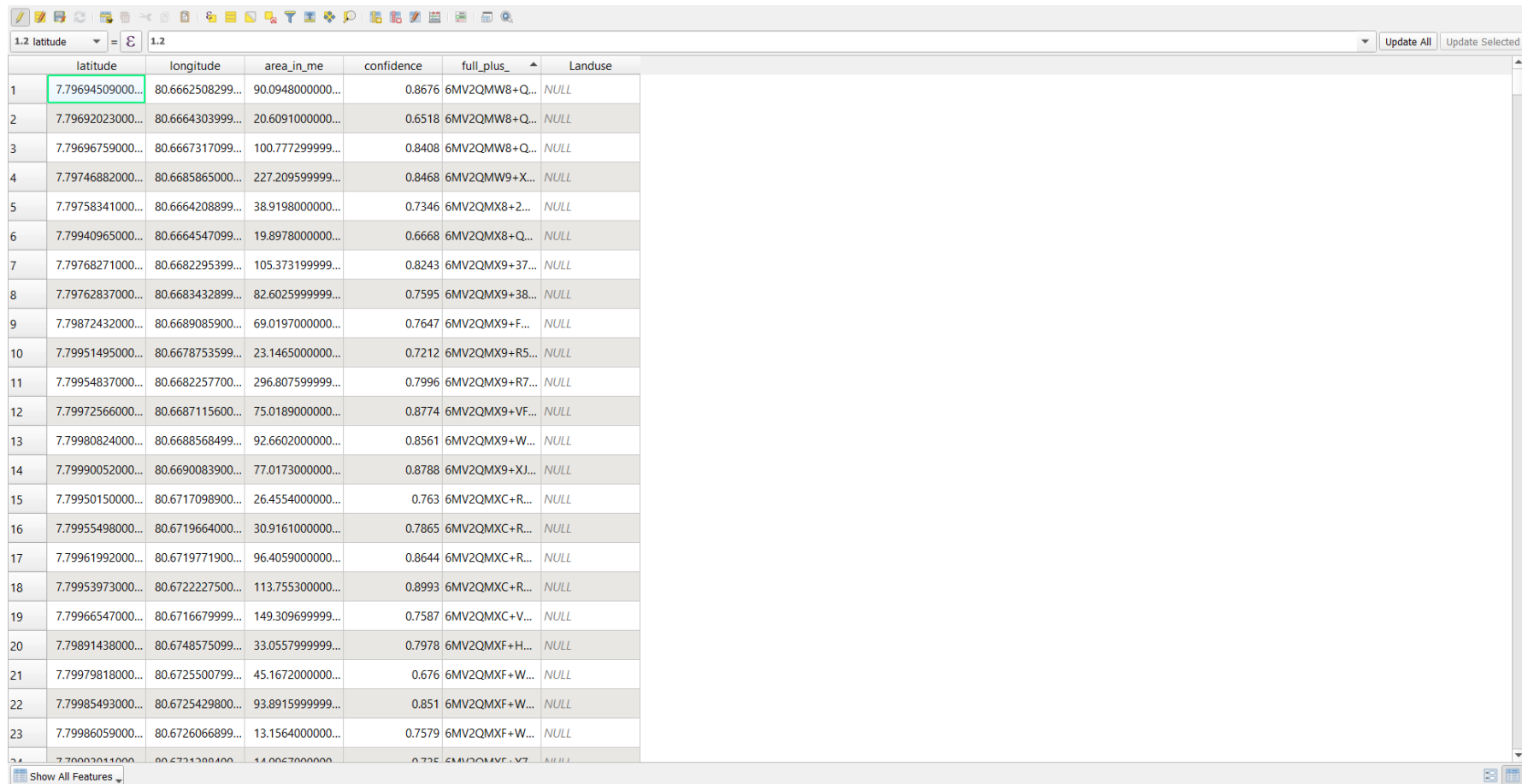
- Name: Landuse
- Comment: (empty)
- Type: Text (string)
- Provider type: string
- Length: 10

Red arrows indicate the steps to add a new field:

- Step 1: Click on the 'Toggle Editing' button (top left).
- Step 2: Click on the 'New Field' button (top right).
- Step 3: Click on the 'Add Field' dialog box.

Figure 25 - Add New Filed

- Now the land use column was added for the attribute table of the building layer.



	latitude	longitude	area_in_me	confidence	full_plus_	Landuse
1	7.79694509000...	80.6662508299...	90.0948000000...	0.8676	6MV2QMW8+Q...	NULL
2	7.79692023000...	80.6664303999...	20.6091000000...	0.6518	6MV2QMW8+Q...	NULL
3	7.79696759000...	80.6667317099...	100.777299999...	0.8408	6MV2QMW8+Q...	NULL
4	7.79746882000...	80.6685865000...	227.209599999...	0.8468	6MV2QMW9+X...	NULL
5	7.79758341000...	80.6664208899...	38.9198000000...	0.7346	6MV2QMX8+Z...	NULL
6	7.79940965000...	80.6664547099...	19.8978000000...	0.6668	6MV2QMX8+Q...	NULL
7	7.79768271000...	80.6682295399...	105.373199999...	0.8243	6MV2QMX9+37...	NULL
8	7.79762837000...	80.6683432899...	82.602599999...	0.7595	6MV2QMX9+38...	NULL
9	7.79872432000...	80.6689085900...	69.0197000000...	0.7647	6MV2QMX9+F...	NULL
10	7.79951495000...	80.6678753599...	23.1465000000...	0.7212	6MV2QMX9+R5...	NULL
11	7.79954837000...	80.6682257700...	296.807599999...	0.7996	6MV2QMX9+R7...	NULL
12	7.79972566000...	80.6687115600...	75.0189000000...	0.8774	6MV2QMX9+VF...	NULL
13	7.79980824000...	80.6688568499...	92.6602000000...	0.8561	6MV2QMX9+W...	NULL
14	7.79990052000...	80.6690083900...	77.0173000000...	0.8788	6MV2QMX9+XJ...	NULL
15	7.79950150000...	80.6717098900...	26.4554000000...	0.763	6MV2QMXC+R...	NULL
16	7.79955498000...	80.6719664000...	30.9161000000...	0.7865	6MV2QMXC+R...	NULL
17	7.79961992000...	80.6719771900...	96.4059000000...	0.8644	6MV2QMXC+R...	NULL
18	7.79953973000...	80.6722227500...	113.755300000...	0.8993	6MV2QMXC+R...	NULL
19	7.79966547000...	80.6716679999...	149.309699999...	0.7587	6MV2QMXC+V...	NULL
20	7.79891438000...	80.6748575099...	33.055799999...	0.7978	6MV2QMXF+H...	NULL
21	7.79979818000...	80.6725500799...	45.1672000000...	0.676	6MV2QMXF+W...	NULL
22	7.79985493000...	80.6725429800...	93.891599999...	0.851	6MV2QMXF+W...	NULL
23	7.79986059000...	80.6726066899...	13.1564000000...	0.7579	6MV2QMXF+W...	NULL

Figure 26 -Add Columns

- Now it should be filled land use column by using observations or Google Street View.

Examples of land uses- are houses, shops, schools, temples, libraries, banks, offices, etc.

Using the following steps, we have to fill the whole land use column according to the land use of each building.

Process- Observe the use of the building that is shown in yellow color in Figure A, by using Google Street View according to Figure When opening the attribute table, That selected building is shown in Figure C. We can fill the land use column according to the observed use of that building in Figure D.

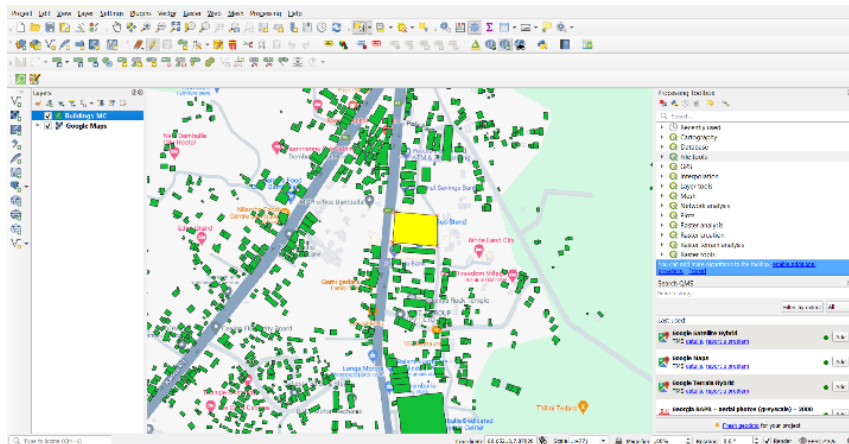


Figure A

Figure 27 - Building Layer

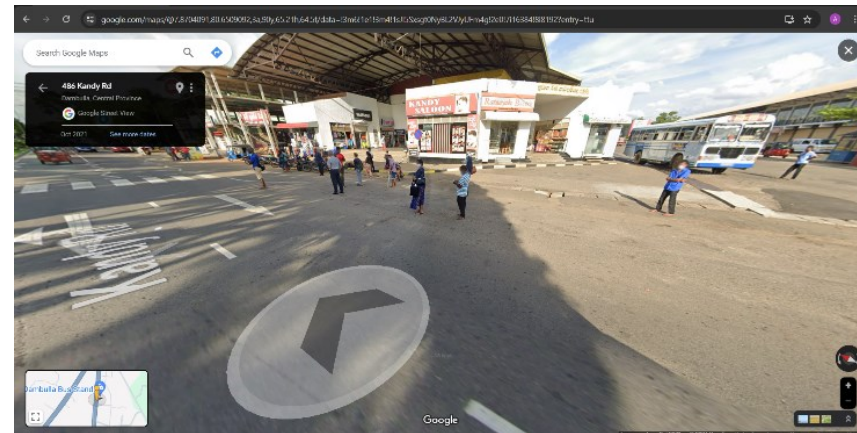


Figure B

Figure 28 - Google Street View

latitude	longitude	area_in_me	confidence	full_plus_	Landuse
7.83861423000...	80.6421047599...	30.6593000000...	0.8142	6MV2RJQR+CRXF	NULL
7.83868425000...	80.6412294999...	50.7978999999...	0.6785	6MV2RJQR+FFH7	NULL
7.83878915000...	80.6417671100...	147.793299999...	0.8023	6MV2RJQR+GP6G	NULL
7.83907121000...	80.6419555699...	216.047899999...	0.9234	6MV2RJQR+JQ...	NULL
7.83935556000...	80.6416414100...	36.2989000000...	0.6516	6MV2RJQR+PM...	NULL
7.83937518000...	80.6417171100...	112.337100000...	0.8094	6MV2RJQR+QM...	NULL
7.83761740000...	80.6438960600...	141.111300000...	0.8634	6MV2RJQV+2HRP	NULL
7.83771960000...	80.6441842600...	104.549499999...	0.8447	6MV2RJQV+3M...	NULL
7.83767883000...	80.6444854100...	88.3717000000...	0.8038	6MV2RJQV+3Q...	NULL
7.83780204000...	80.6435182000...	184.929800000...	0.7773	6MV2RJQV+4CC4	NULL
7.83778426000...	80.6439312499...	86.5071999999...	0.8359	6MV2RJQV+4H79	NULL
7.83780800000...	80.6443931299...	67.7182999999...	0.7093	6MV2RJQV+4QC8	NULL
7.83791213000...	80.6440126400...	51.2794999999...	0.7417	6MV2RJQV+5J6F	NULL
7.83856556000...	80.6444628800...	76.6706999999...	0.7646	6MV2RJQV+CQ...	NULL
7.83874970000...	80.6444643800...	47.9562000000...	0.7301	6MV2RJQV+FQ...	NULL
7.83887737000...	80.6447969700...	193.777999999...	0.8136	6MV2RJQV+H...	NULL
7.83990823000...	80.6441399499...	156.590800000...	0.7978	6MV2RJQV+XM...	NULL
7.83841324000...	80.6469267500...	156.015800000...	0.8798	6MV2RJQW+9Q...	NULL
7.83869095000...	80.6474718999...	76.9827999999...	0.8089	6MV2RJQW+FX...	NULL
7.83909444000...	80.6474411300...	52.4273000000...	0.7837	6MV2RJQW+JXPJ	NULL
7.83913387000...	80.6451152700...	150.251499999...	0.8747	6MV2RJQW+M...	NULL
7.83949775000...	80.6450193900...	138.511200000...	0.7729	6MV2RJQW+Q2...	NULL
7.83951397000...	80.6450860900...	51.4380000000...	0.6834	6MV2RJQW+R2...	NULL

Figure C

Figure 29 -Attribute table of Building layer

latitude	longitude	area_in_me	confidence	full_plus_	Landuse
7.83861423000...	80.6421047599...	30.6593000000...	0.8142	6MV2RJQR+CRXF	NULL
7.83868425000...	80.6412294999...	50.7978999999...	0.6785	6MV2RJQR+FFH7	NULL
7.83878915000...	80.6417671100...	147.793299999...	0.8023	6MV2RJQR+GP6G	NULL
7.83907121000...	80.6419555699...	216.047899999...	0.9234	6MV2RJQR+JQ...	NULL
7.83935556000...	80.6416414100...	36.2989000000...	0.6516	6MV2RJQR+PM...	NULL
7.83937518000...	80.6417171100...	112.337100000...	0.8094	6MV2RJQR+QM...	NULL
7.83761740000...	80.6438960600...	141.111300000...	0.8634	6MV2RJQV+2HRP	NULL
7.83771960000...	80.6441842600...	104.549499999...	0.8447	6MV2RJQV+3M...	NULL
7.83767883000...	80.6444854100...	88.3717000000...	0.8038	6MV2RJQV+3Q...	NULL
7.83780204000...	80.6435182000...	184.929800000...	0.7773	6MV2RJQV+4CC4	Bus stand
7.83778426000...	80.6439312499...	86.5071999999...	0.8359	6MV2RJQV+4H79	NULL
7.83780800000...	80.6443931299...	67.7182999999...	0.7093	6MV2RJQV+4QC8	NULL
7.83791213000...	80.6440126400...	51.2794999999...	0.7417	6MV2RJQV+5J6F	NULL
7.83856556000...	80.6444628800...	76.6706999999...	0.7646	6MV2RJQV+CQ...	NULL
7.83874970000...	80.6444643800...	47.9562000000...	0.7301	6MV2RJQV+FQ...	NULL
7.83887737000...	80.6447969700...	193.777999999...	0.8136	6MV2RJQV+H...	NULL
7.83990823000...	80.6441399499...	156.590800000...	0.7978	6MV2RJQV+XM...	NULL
7.83841324000...	80.6469267500...	156.015800000...	0.8798	6MV2RJQW+9Q...	NULL
7.83869095000...	80.6474718999...	76.9827999999...	0.8089	6MV2RJQW+FX...	NULL
7.83909444000...	80.6474411300...	52.4273000000...	0.7837	6MV2RJQW+JXPJ	NULL
7.83913387000...	80.6451152700...	150.251499999...	0.8747	6MV2RJQW+M...	NULL
7.83949775000...	80.6450193900...	138.511200000...	0.7729	6MV2RJQW+Q2...	NULL
7.83951397000...	80.6450860900...	51.4380000000...	0.6834	6MV2RJQW+R2...	NULL

Figure D

Figure 30 -Attribute table of Building layer.

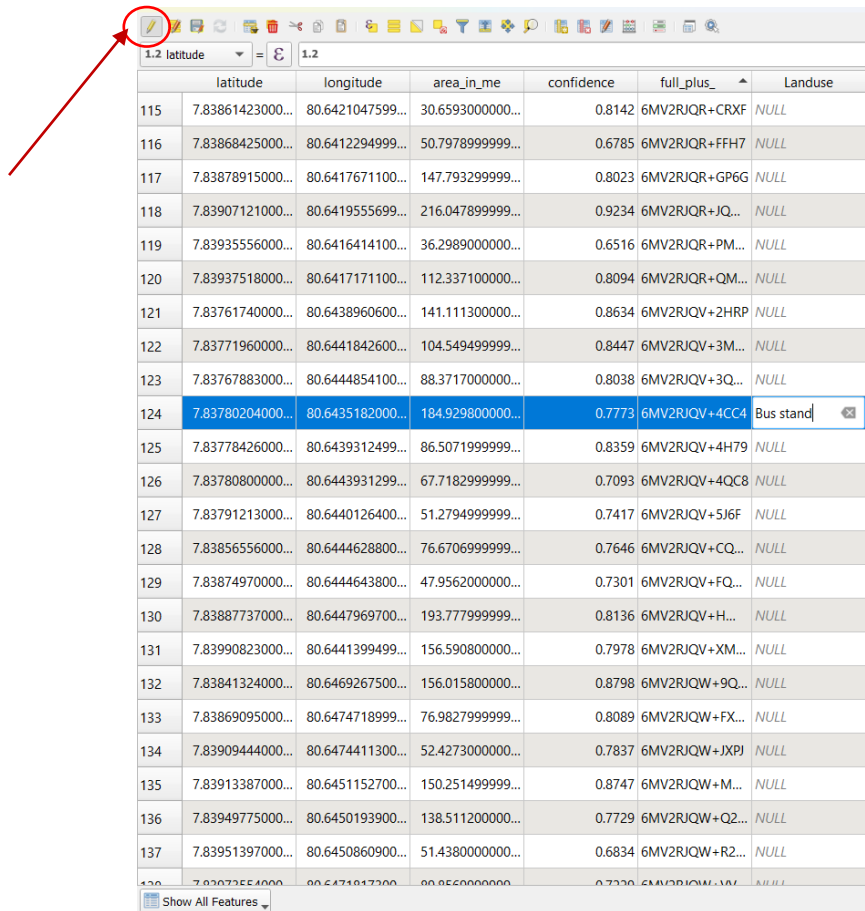


Figure 31 -Fill in the Land use column

- Save the layer by using the toggle editing tool. Click on toggle editing>>ok
- Using the above process, we can fill the Landuse column by using the use of buildings.

This is the attribute table of the building layer within the land use for each building.

Buildings_MC — Features Total: 14333, Filtered: 14327, Selected: 0

	latitude	longitude	area_in_me	confidence	full_plus_	Land_Use
13	7.84295309000...	80.6464940799...	51.3607000000...	0.6997	6MV2RJVW+5H...	Houses
14	7.84496085000...	80.6701122700...	82.9535000000...	0.8121	6MV2RMVC+X2...	Houses
15	7.90230404000...	80.6428897899...	7.2322000000...	0.672	6MV2WJ2V+W5...	Houses
16	7.90715700000...	80.6685230599...	169.580800000...	0.7776	6MV2WM49+V...	Houses
17	7.89671492000...	80.6706302599...	434.917700000...	0.9333	6MV2VMWC+M...	Warehouse
18	7.87873187000...	80.6237491100...	34.8791000000...	0.7804	6MV2VJHF+FFX9	Houses
19	7.90542638000...	80.6695553200...	63.8934000000...	0.7605	6MV2WM49+5...	Houses
20	7.89951357000...	80.6387449500...	37.6246000000...	0.7518	6MV2VJXQ+RF5H	Houses
21	7.84697714000...	80.6653756900...	14.2409000000...	0.6758	6MV2RMW8+Q...	Houses
22	7.89905289000...	80.6722281600...	10.6283999999...	0.7225	6MV2VMXC+JV...	Warehouse
23	7.83840450000...	80.6732793099...	47.3690000000...	0.8062	6MV2RMQF+98...	Houses
24	7.89675290000...	80.6399086499...	79.1808999999...	0.6726	6MV2VJWQ+PX...	Houses
25	7.90114896000...	80.6641178699...	13.8482000000...	0.6751	6MV2WM27+FJ...	Houses
26	7.89546041000...	80.6737475200...	458.944200000...	0.7801	6MV2VMWF+5F...	Warehouse
27	7.84732936000...	80.6672941300...	52.8038000000...	0.6597	6MV2RMW8+W...	Houses
28	7.89574507000...	80.6344825000...	78.1805999999...	0.7887	6MV2VJWM+7...	Houses
29	7.90496262000...	80.6696090199...	101.043099999...	0.8309	6MV2WM39+X...	Hotel & Motel
30	7.91467024000...	80.6792863799...	148.973800000...	0.6509	6MV2WM7H+V...	Houses
31	7.90797795000...	80.6737709599...	173.648599999...	0.886	6MV2WM5F+5...	Hotel & Motel
32	7.89550459000...	80.6341837500...	73.9539999999...	0.7397	6MV2VJWM+6...	Houses
33	7.84641391000...	80.6669702899...	686.567800000...	0.8339	6MV2RMW8+H...	Warehouse
34	7.84914720000...	80.6694107499...	42.8795000000...	0.7164	6MV2RMX9+M...	Houses
35	7.84265138000...	80.6471202099...	113.272900000...	0.9004	6MV2RJVW+3R95	Houses
36	7.90681803000...	80.6673002400...	112.261499999...	0.8036	6MV2WM48+P...	Houses

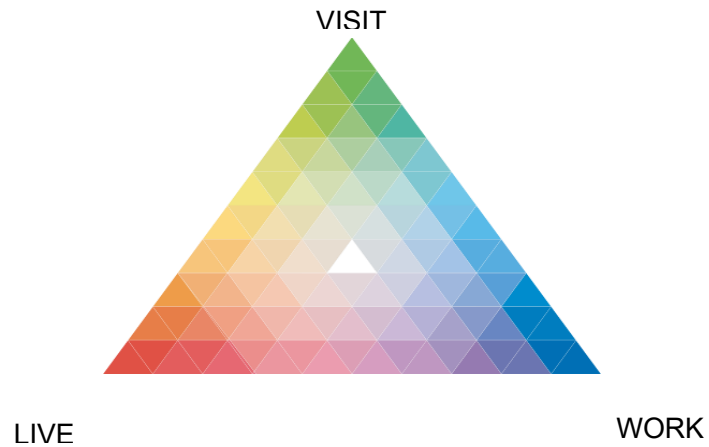
Show All Features

Figure 32 -Attribute table of building layer.

Step 03

Land uses have been categorized into seven different types, Live, Work, Visit, Live Work, Live&Visit, Work &Visit, Live, Work &Visit.

Examples-



Live- Houses, Hotel & Motel

Work- National Schools, Departments, Boards, Authorities, Police Station

Visit- Shops, Restaurants, Sports Clubs, General Hospital, Bus Stands

Work Visit- Animal Clinic, Bank, Child's, Education Centers, Corporate

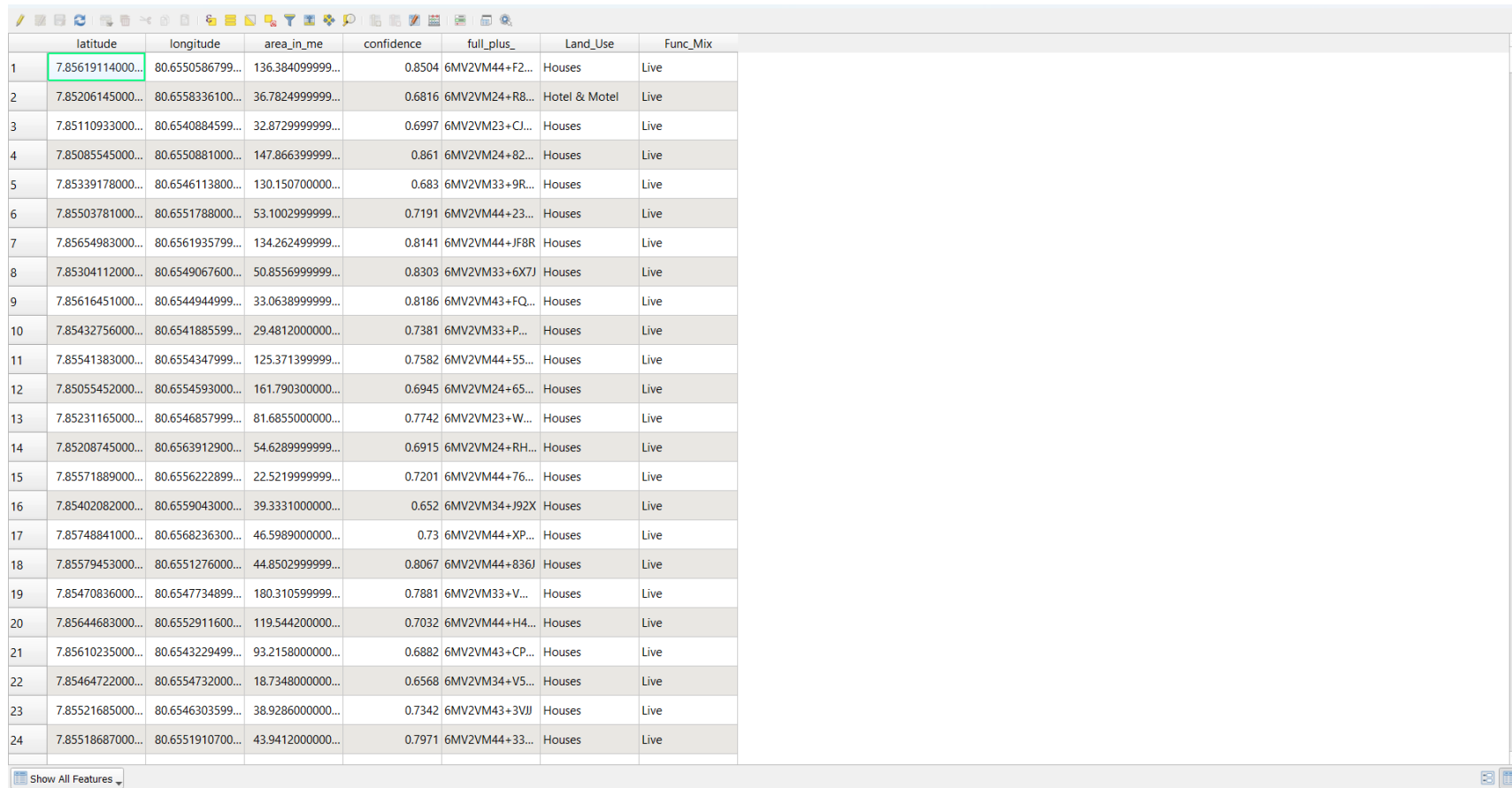
Live&Visit- Transport Workshop + Restaurant + Houses, Shops + Houses

Live&work- Hotels, Hotel & Motel

Live, Work&Visit- Multifunctional transportation hub

Figure 33 -Live, Work, and Visit Triangle

- Add a new field (Step02-ii), in the attribute table of the building layer called Functional mix according to this categorization.



	latitude	longitude	area_in_me	confidence	full_plus_	Land_Use	Func_Mix
1	7.85619114000...	80.6550586799...	136.384099999...	0.8504	6MV2VM44+F2...	Houses	Live
2	7.85206145000...	80.6558336100...	36.782499999...	0.6816	6MV2VM24+R8...	Hotel & Motel	Live
3	7.85110933000...	80.6540884599...	32.872999999...	0.6997	6MV2VM23+CJ...	Houses	Live
4	7.85085545000...	80.6550881000...	147.866399999...	0.861	6MV2VM24+82...	Houses	Live
5	7.85339178000...	80.6546113800...	130.150700000...	0.683	6MV2VM33+9R...	Houses	Live
6	7.85503781000...	80.6551788000...	53.100299999...	0.7191	6MV2VM44+23...	Houses	Live
7	7.85654983000...	80.6561935799...	134.262499999...	0.8141	6MV2VM44+JF8R	Houses	Live
8	7.85304112000...	80.6549067600...	50.855699999...	0.8303	6MV2VM33+6X7J	Houses	Live
9	7.85616451000...	80.6544944999...	33.063899999...	0.8186	6MV2VM43+FQ...	Houses	Live
10	7.85432756000...	80.6541885599...	29.481200000...	0.7381	6MV2VM33+P...	Houses	Live
11	7.85541383000...	80.6554347999...	125.371399999...	0.7582	6MV2VM44+55...	Houses	Live
12	7.85055452000...	80.6554593000...	161.790300000...	0.6945	6MV2VM24+65...	Houses	Live
13	7.85231165000...	80.6546857999...	81.685500000...	0.7742	6MV2VM23+W...	Houses	Live
14	7.85208745000...	80.6563912900...	54.628999999...	0.6915	6MV2VM24+RH...	Houses	Live
15	7.85571889000...	80.6556222899...	22.521999999...	0.7201	6MV2VM44+76...	Houses	Live
16	7.85402082000...	80.6559043000...	39.333100000...	0.652	6MV2VM34+J92X	Houses	Live
17	7.85748841000...	80.6568236300...	46.598900000...	0.73	6MV2VM44+XP...	Houses	Live
18	7.85579453000...	80.6551276000...	44.850299999...	0.8067	6MV2VM44+836J	Houses	Live
19	7.85470836000...	80.6547734899...	180.310599999...	0.7881	6MV2VM33+V...	Houses	Live
20	7.85644683000...	80.6552911600...	119.544200000...	0.7032	6MV2VM44+H4...	Houses	Live
21	7.85610235000...	80.6543229499...	93.215800000...	0.6882	6MV2VM43+CP...	Houses	Live
22	7.85464722000...	80.6554732000...	18.734800000...	0.6568	6MV2VM34+V5...	Houses	Live
23	7.85521685000...	80.6546303599...	38.928600000...	0.7342	6MV2VM43+3VJJ	Houses	Live
24	7.85518687000...	80.6551910700...	43.941200000...	0.7971	6MV2VM44+33...	Houses	Live

Figure 34 -Attribute table of Building layer

Step 04

This approach is to analyze the urbanity level in this area. For that, we have created a raster file by assigning the above categories. To create this raster layer we have to interpolate the building layer of the study area. For interpolation,

We have to convert this building into points. For that, it is used the Processing Toolbox.

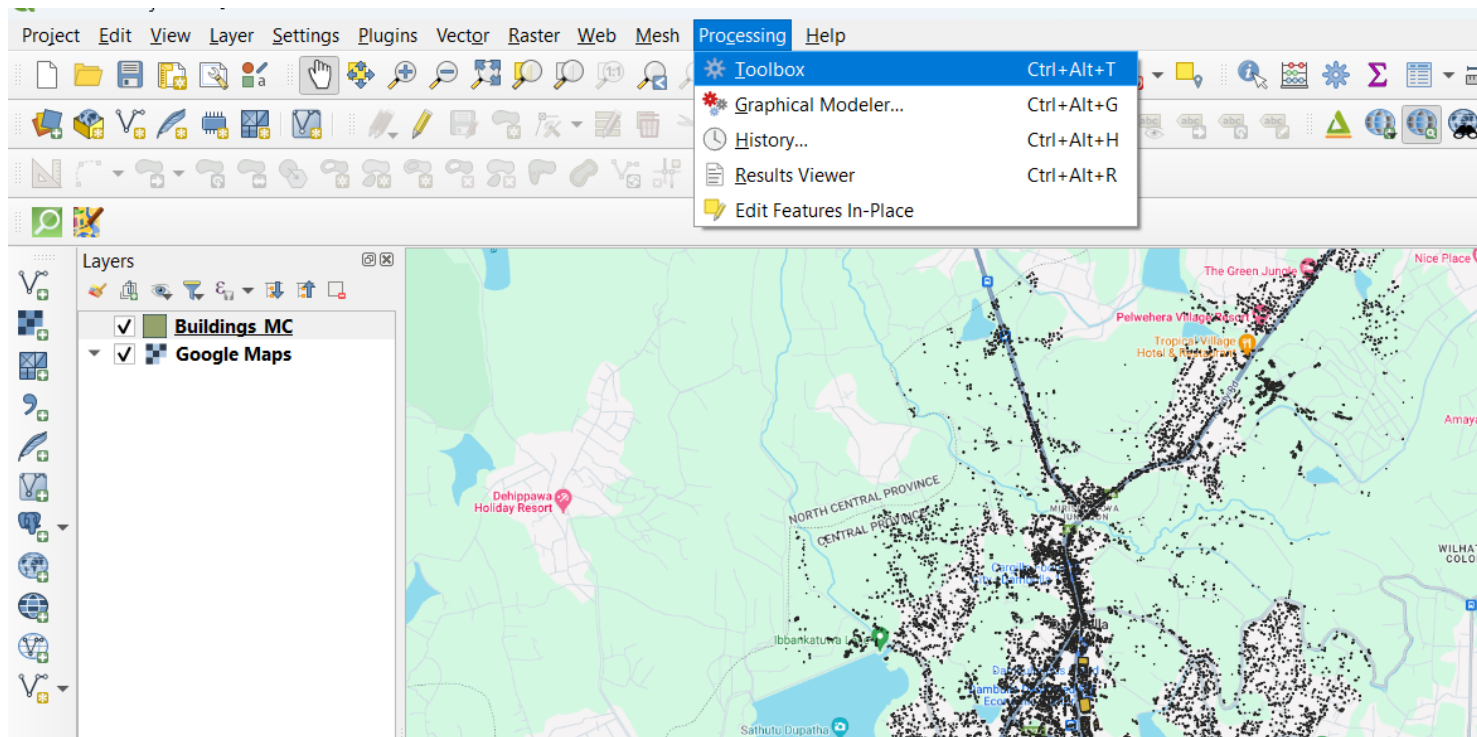


Figure 35 -Processing Tool Box

- Then, Search the "Centroids" Tool in the Processing Toolbox.

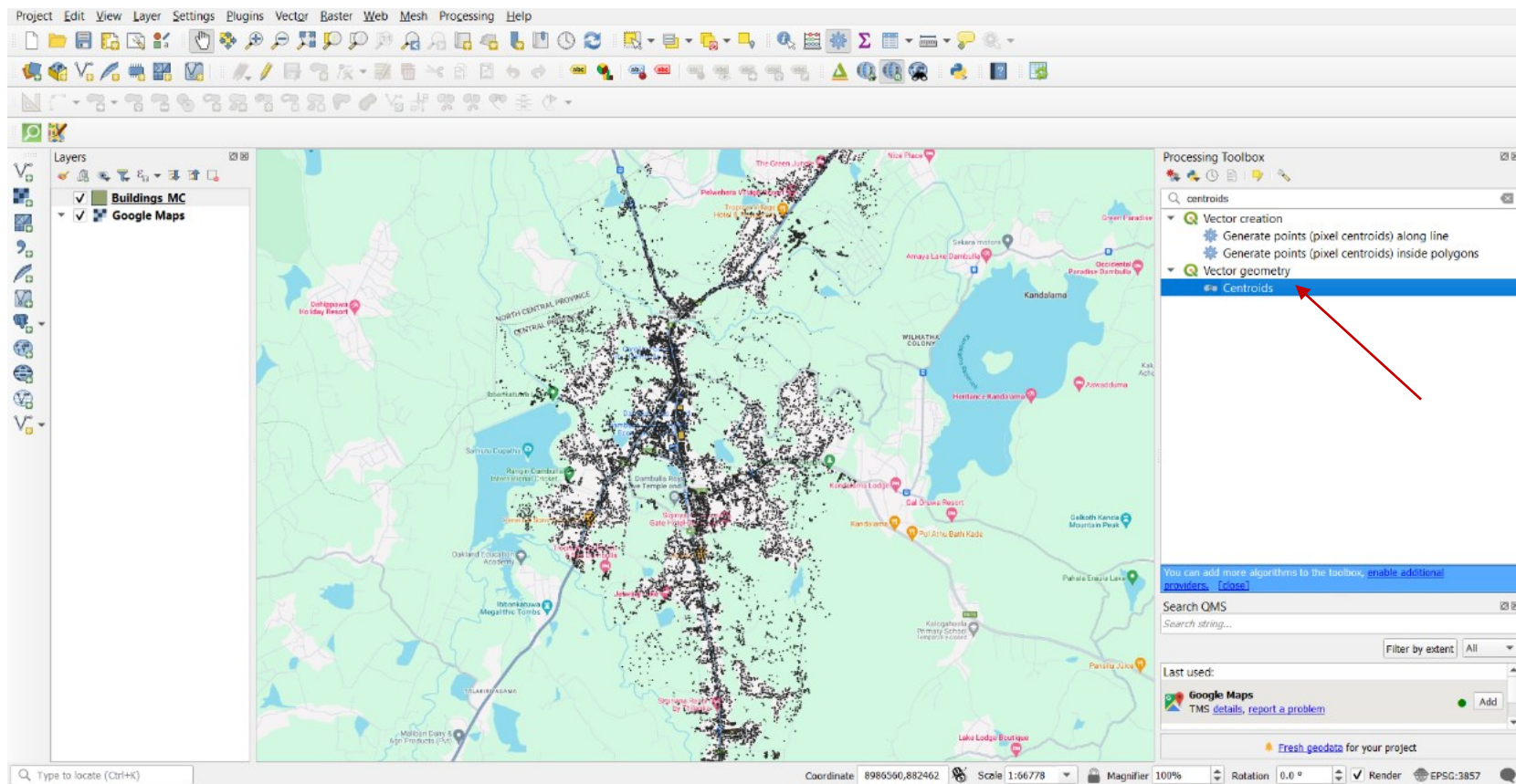


Figure 36 -Select 'Centroids' in the Processing toolbox.

In that window,

- i. Enter the building layer which we created, as the input layer
- ii. Tick on the 'create centroids for each part'
- iii. Give a path for the output layer
- iv. Run the tool

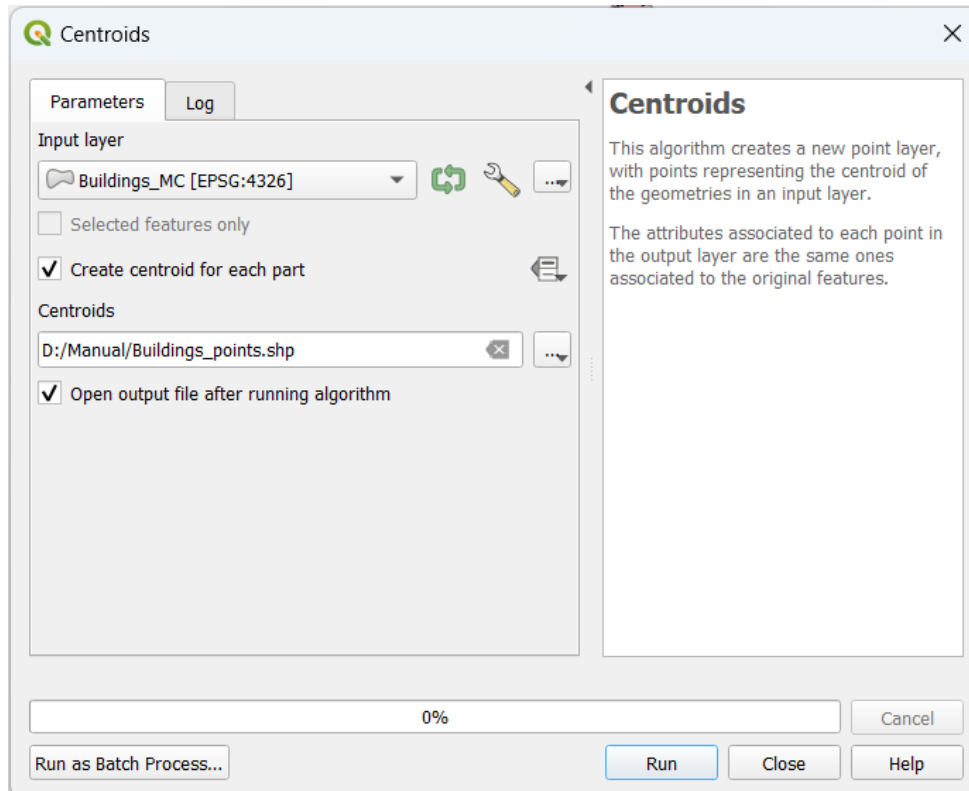


Figure 37 -Centroids

Error:

When running this, this error occurred

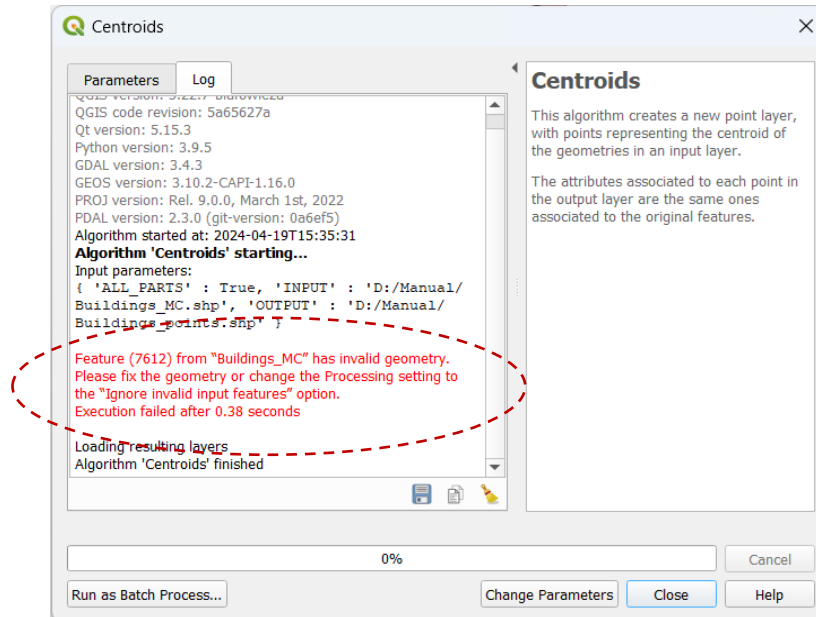


Figure 38 -Centroid error

To solve that, it can be used "Check Validity" tool to identify invalid features. According to the above step, we can search in the processing toolbox "check Validity".

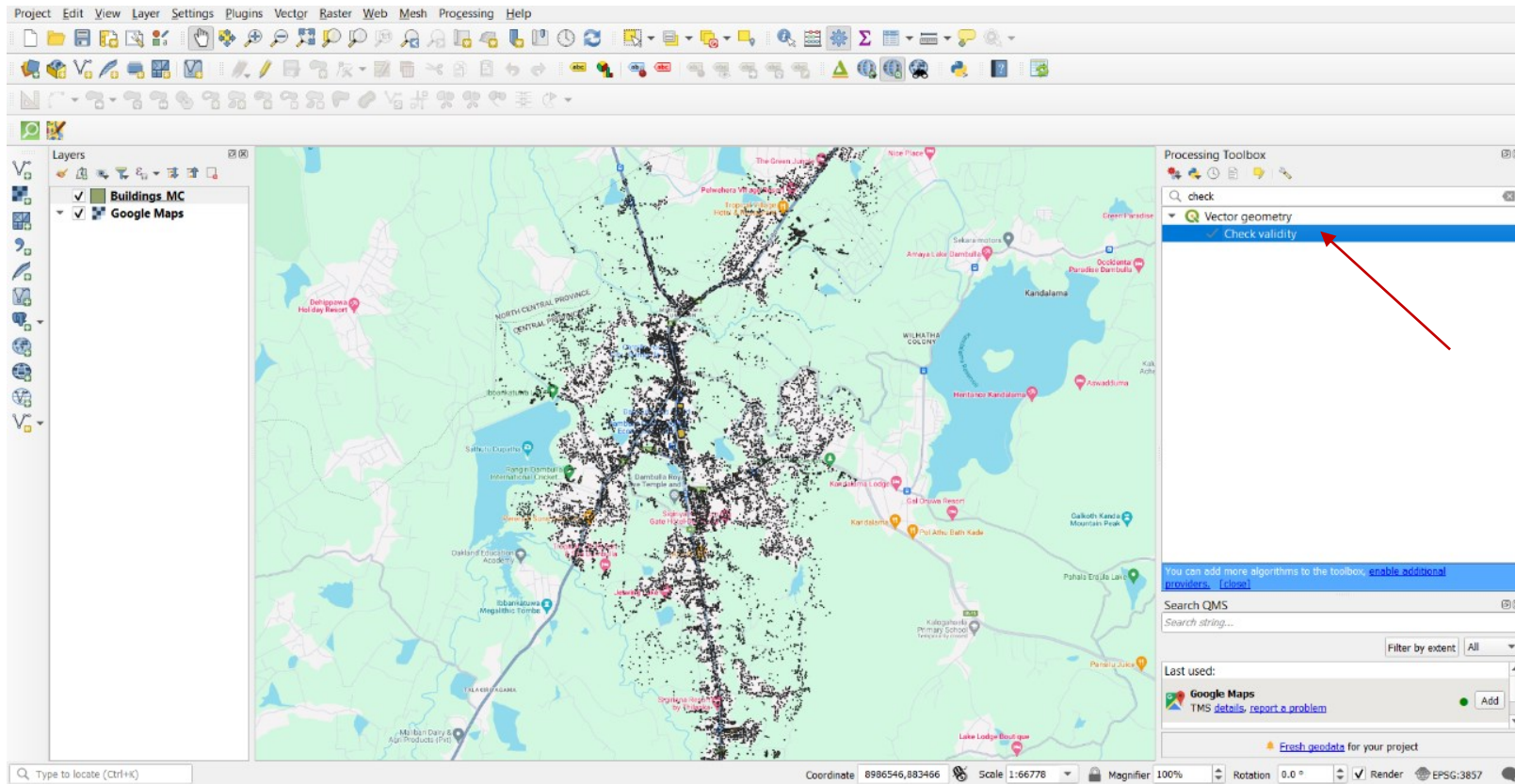


Figure 39 -Select the 'check validity' tool.

Then follow these steps.

i. Enter the building layer as the input layer

ii. Run the tool

it will generate 3 temporary layers.

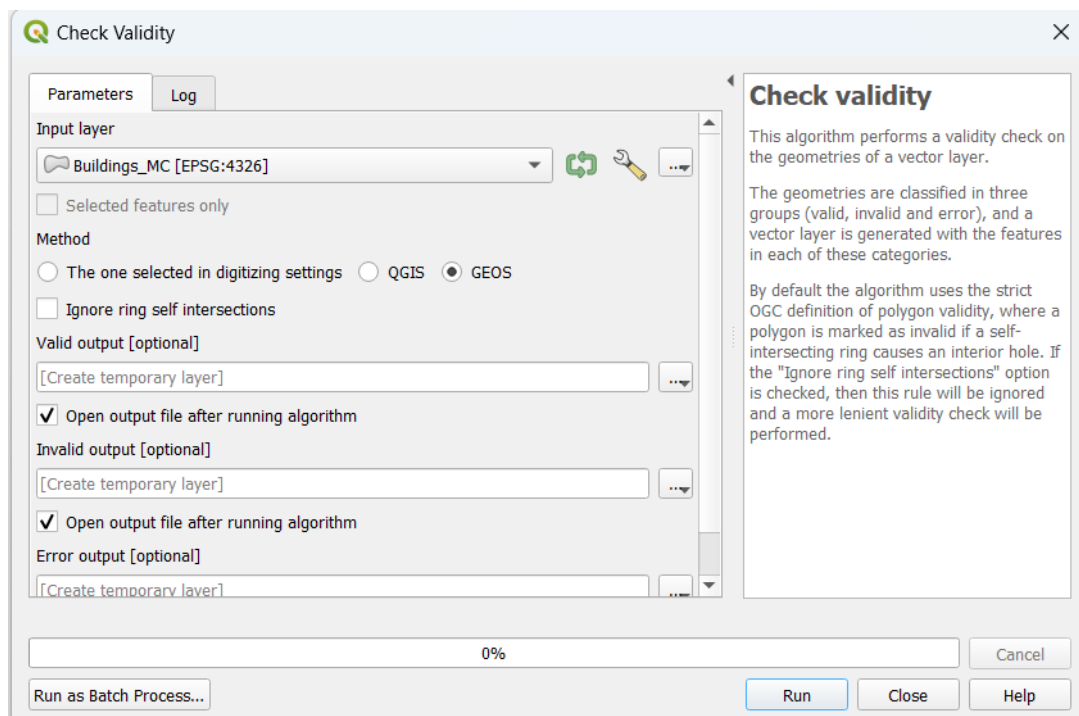


Figure 40 -Check Validity

- Using the "Fix Geometries" tool we can repair the geometry. Search the tool in the processing toolbox,

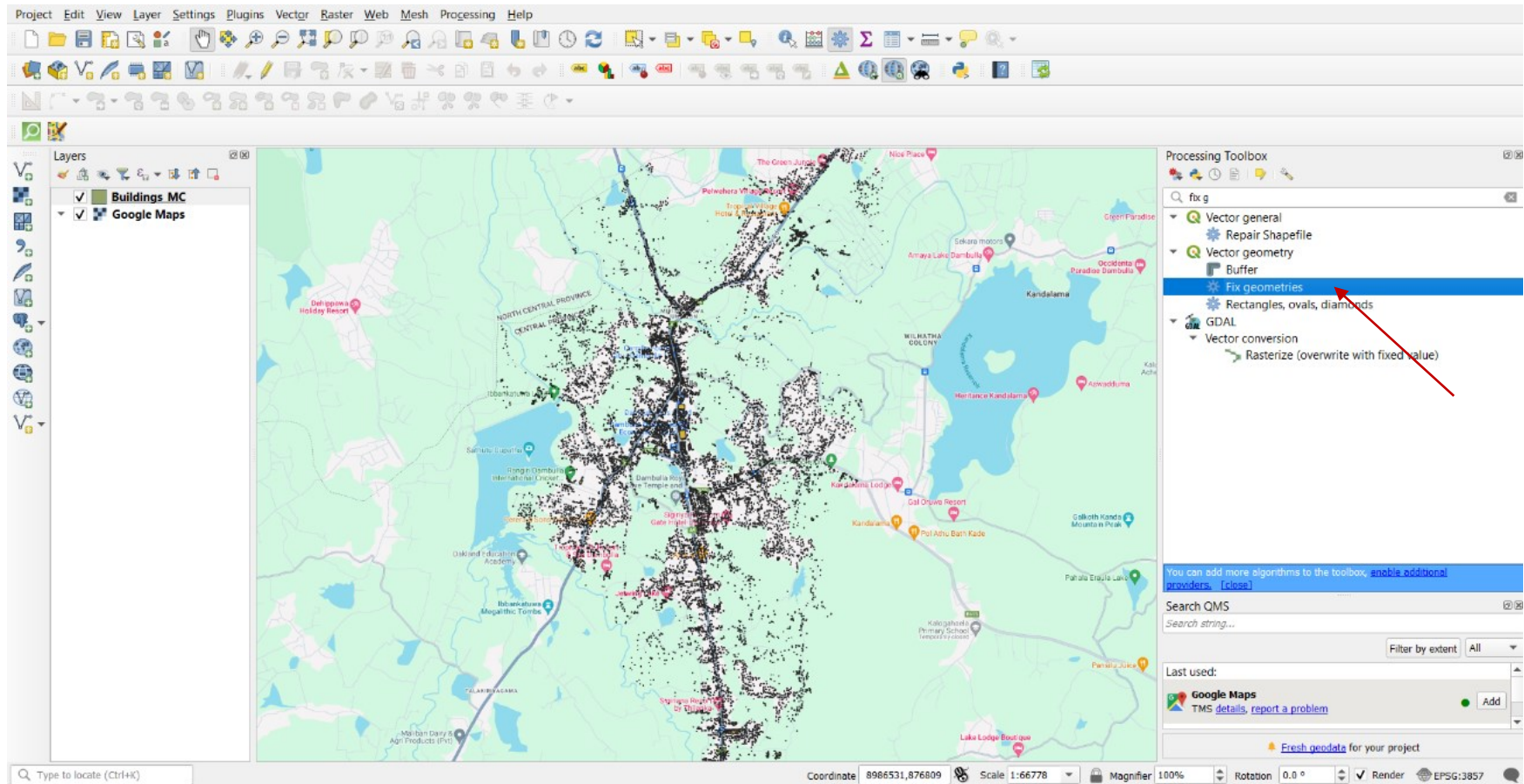


Figure 41 -Select 'Fix Geometries'

Enter the 'valid output' layer as the input layer which is generated by the check validity tool. Then give a path to the output layer and run the tool.

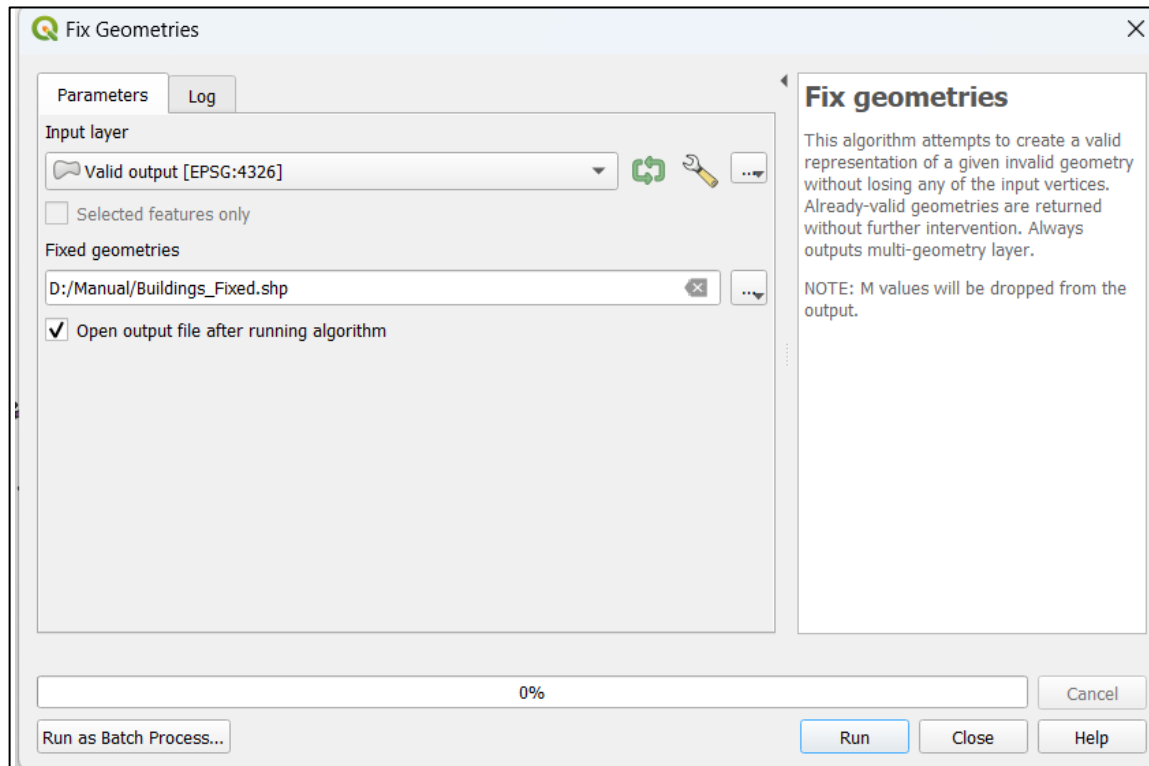


Figure 42 -Fix Geometries

- After fixing the geometry, it can be rerun the centroid tool using those steps.

Now, that error is solved. Then it can create a point layer for the Building in Dambulla MC for using the centroid tool again.

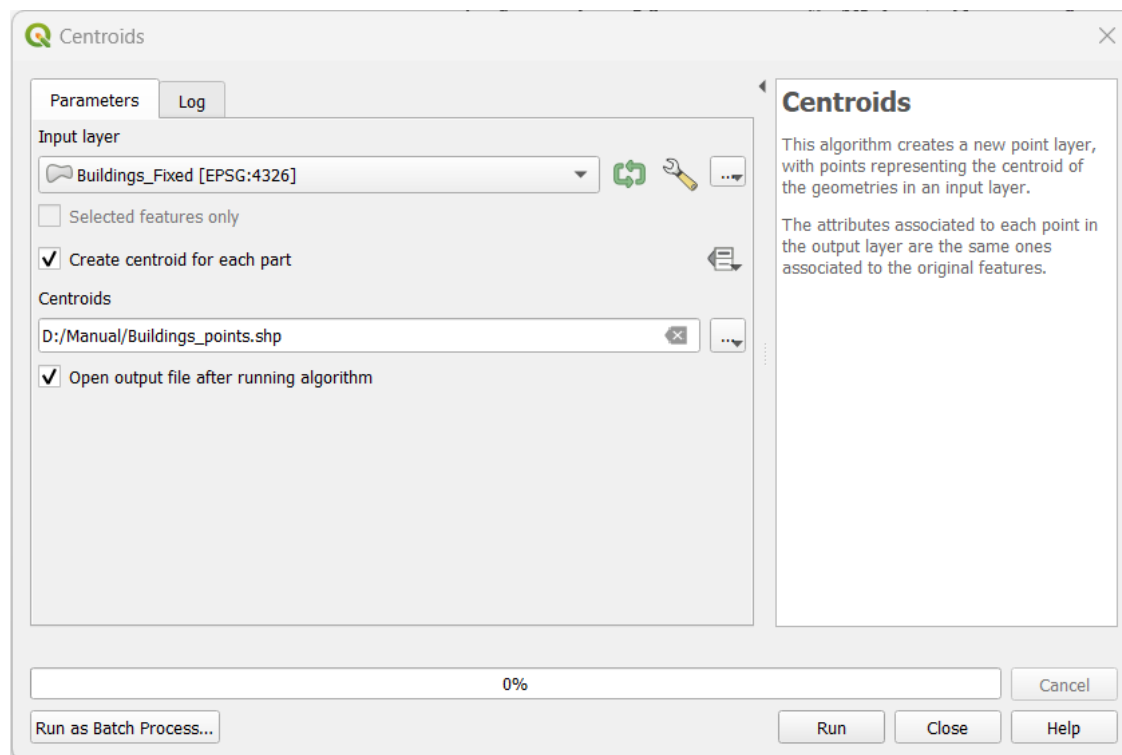


Figure 43 – Centroids

- This is the point layer of the building layer of the study area.

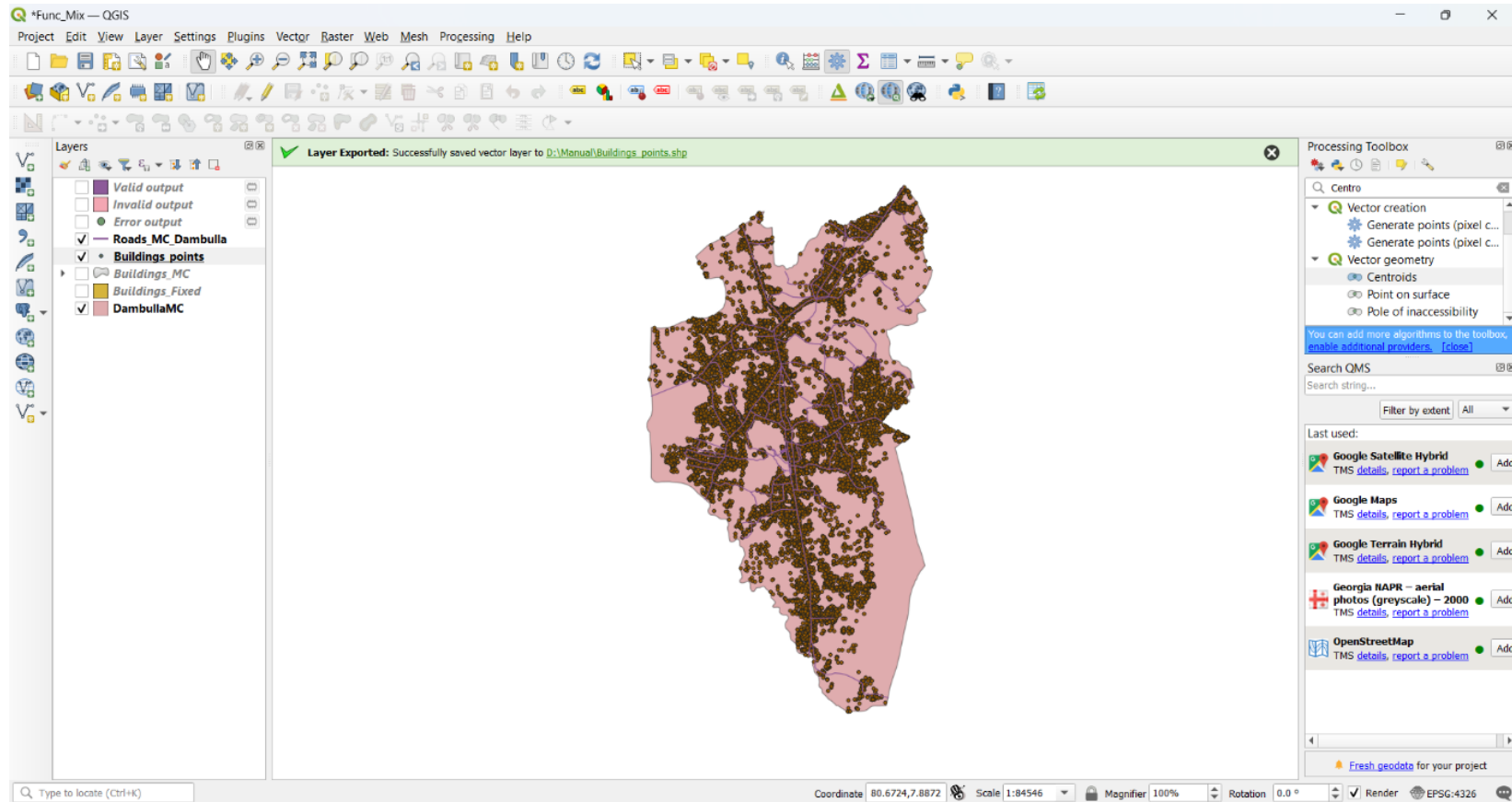


Figure 44 -Points layer of buildings

Step 05

Now before doing interpolation, we have to Code that building layer according to the above seven categories as below.

i. Open the attribute table of the point layer by right click on it.

ii. Create a new field (Step02-ii)

Name- code, Type=whole number>>OK

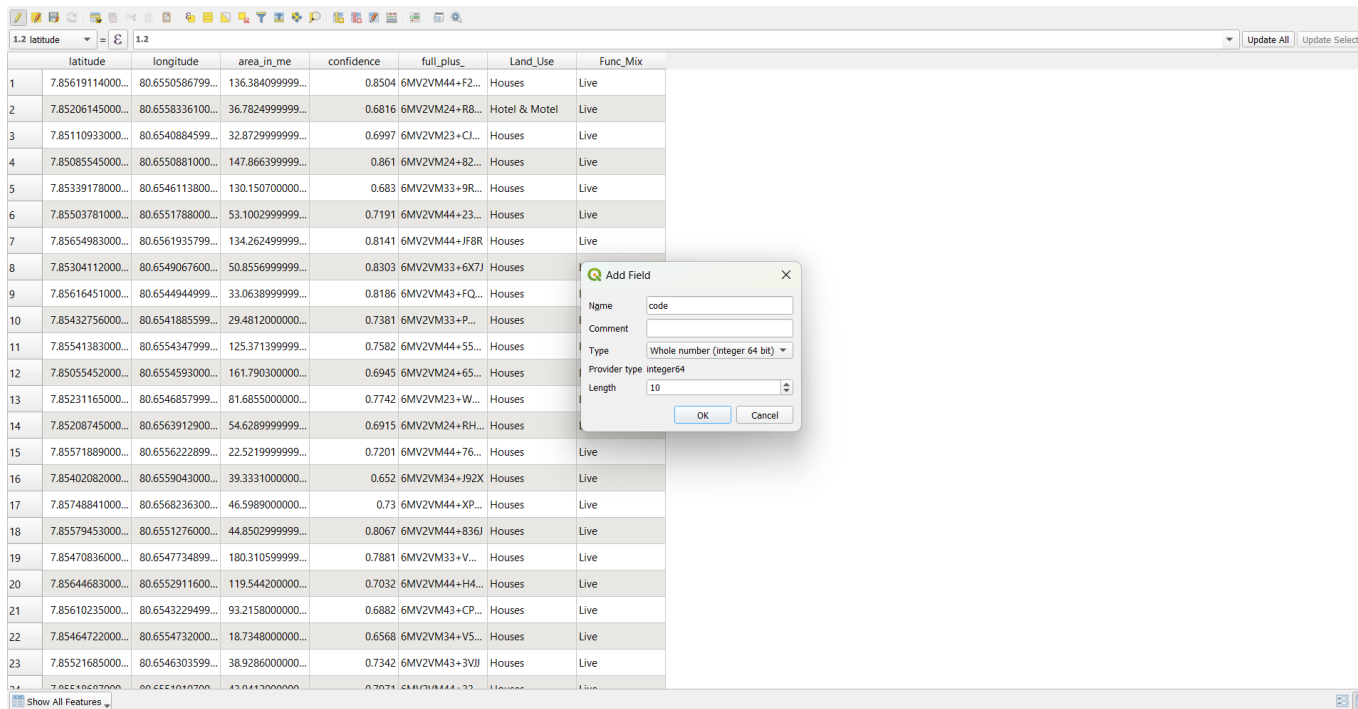
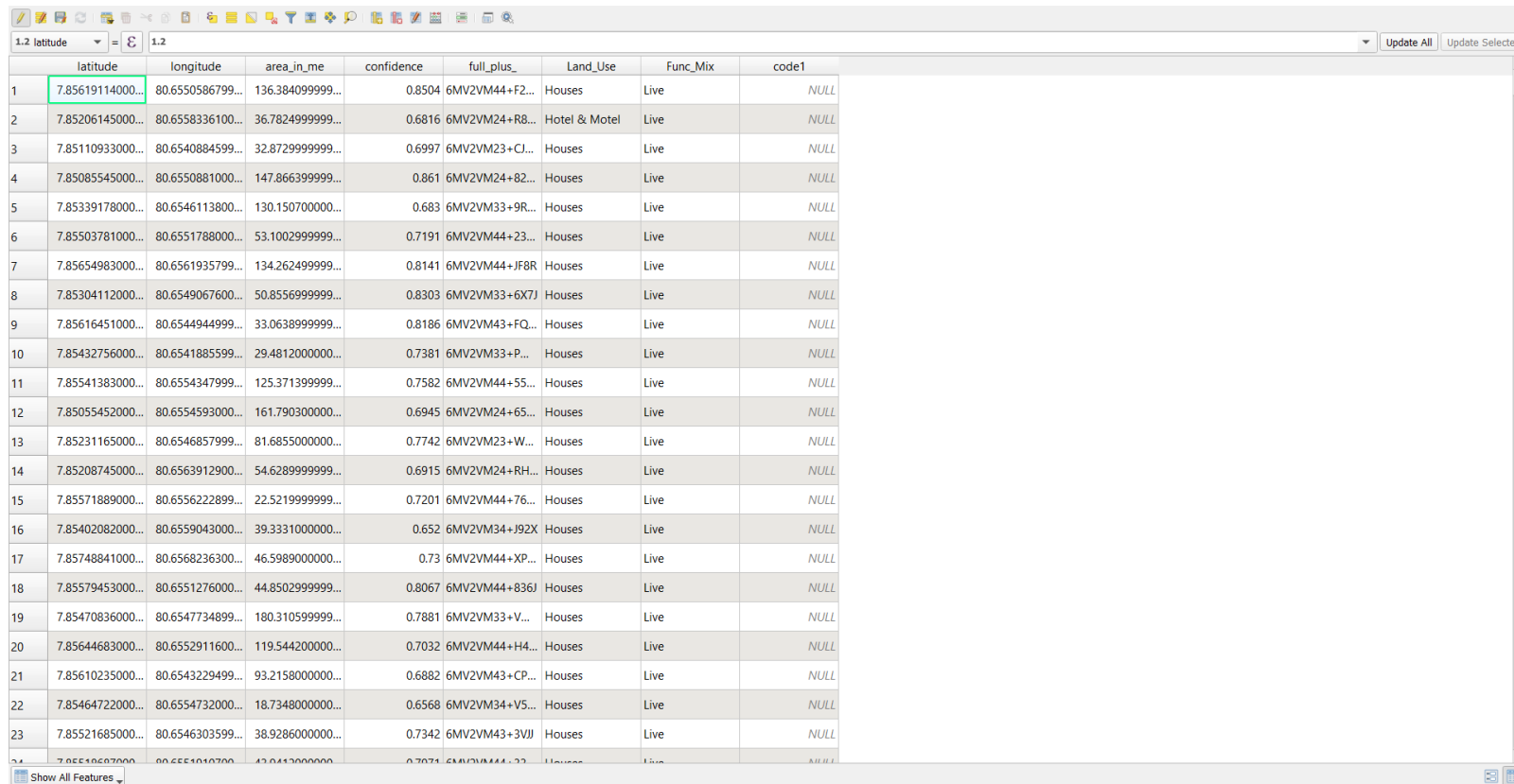


Figure 45-Add a new field for Code.

A code column is added.



	latitude	longitude	area_in_me	confidence	full_plus	Land_Use	Func_Mix	code1
1	7.85619114000...	80.6550586799...	136.384099999...	0.8504	6MV2VM44+F2...	Houses	Live	NULL
2	7.85206145000...	80.6558336100...	36.7824999999...	0.6816	6MV2VM24+R8...	Hotel & Motel	Live	NULL
3	7.85110933000...	80.6540884599...	32.8729999999...	0.6997	6MV2VM23+CJ...	Houses	Live	NULL
4	7.85085545000...	80.6550881000...	147.866399999...	0.861	6MV2VM24+82...	Houses	Live	NULL
5	7.85339178000...	80.6546113800...	130.150700000...	0.683	6MV2VM33+9R...	Houses	Live	NULL
6	7.85503781000...	80.6551788000...	53.1002999999...	0.7191	6MV2VM44+23...	Houses	Live	NULL
7	7.85654983000...	80.6561935799...	134.262499999...	0.8141	6MV2VM44+JF8R	Houses	Live	NULL
8	7.85304112000...	80.6549067600...	50.856999999...	0.8303	6MV2VM33+6X7J	Houses	Live	NULL
9	7.85616451000...	80.6544944999...	33.0638999999...	0.8186	6MV2VM43+FQ...	Houses	Live	NULL
10	7.85432756000...	80.6541885599...	29.4812000000...	0.7381	6MV2VM33+P...	Houses	Live	NULL
11	7.85541383000...	80.6554347999...	125.371399999...	0.7582	6MV2VM44+55...	Houses	Live	NULL
12	7.85055452000...	80.6554593000...	161.790300000...	0.6945	6MV2VM24+65...	Houses	Live	NULL
13	7.85231165000...	80.6546857999...	81.6855000000...	0.7742	6MV2VM23+W...	Houses	Live	NULL
14	7.85208745000...	80.6563912900...	54.6289999999...	0.6915	6MV2VM24+RH...	Houses	Live	NULL
15	7.85571889000...	80.6556222899...	22.5219999999...	0.7201	6MV2VM44+76...	Houses	Live	NULL
16	7.85402082000...	80.6559043000...	39.3331000000...	0.652	6MV2VM34+J92X	Houses	Live	NULL
17	7.85748841000...	80.6568236300...	46.5989000000...	0.73	6MV2VM44+XP...	Houses	Live	NULL
18	7.85579453000...	80.6551276000...	44.8502999999...	0.8067	6MV2VM44+836J	Houses	Live	NULL
19	7.85470836000...	80.6547734899...	180.310599999...	0.7881	6MV2VM33+V...	Houses	Live	NULL
20	7.85644683000...	80.6552911600...	119.544200000...	0.7032	6MV2VM44+H4...	Houses	Live	NULL
21	7.85610235000...	80.6543229499...	93.2158000000...	0.6882	6MV2VM43+CP...	Houses	Live	NULL
22	7.85464722000...	80.6554732000...	18.7348000000...	0.6568	6MV2VM34+VS...	Houses	Live	NULL
23	7.85521685000...	80.6546303599...	38.9286000000...	0.7342	6MV2VM43+3VJJ	Houses	Live	NULL
24	7.85510607000...	80.6551040700...	42.0413000000...	0.7071	6MV2VM44+23...	Houses	Live	NULL

Figure 46 -Attribute table of building layer

ii. Code according to the functional mix.

Live-1

Work-2

Visit-3

Live&work-4

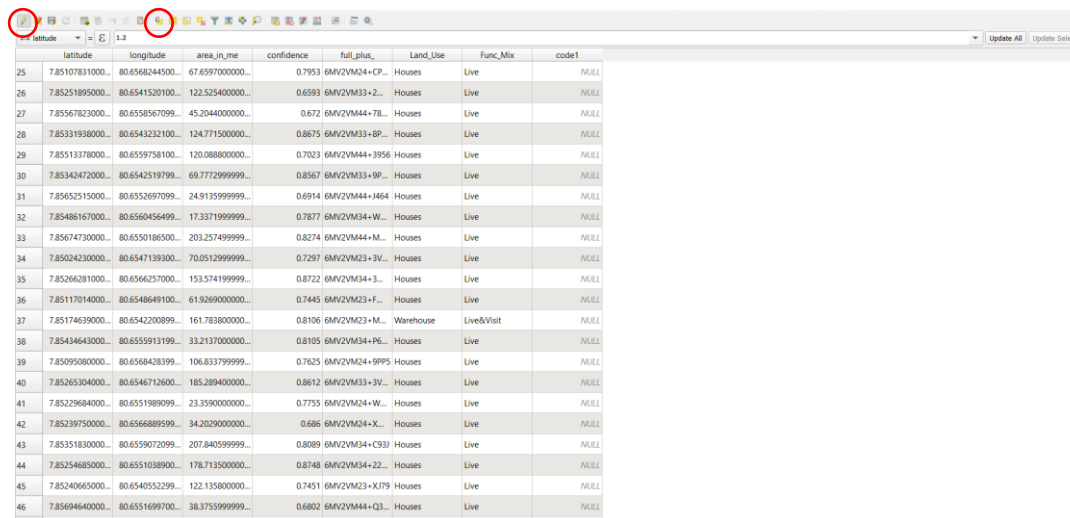
Live&Visit-5

Work&Visit-6

Live, Work&Visit-7

For that, first, select all buildings that are in the 'Live' category as below.

Open the attribute table>>click on 'Toggle editing tool'>>Click on 'select by expression tool'



	latitude	longitude	area_in_me	confidence	full_plus_	Land_Use	Func_Mix	code1
25	7.85107831000...	80.6568244500...	67.6597000000...	0.7953	6M/V2VM24+CP...	Houses	Live	NULL
26	7.85251895000...	80.6541520100...	122.525400000...	0.6593	6M/V2VM33+2...	Houses	Live	NULL
27	7.85567823000...	80.6558567099...	45.204400000...	0.672	6M/V2VM44+78...	Houses	Live	NULL
28	7.85331938000...	80.6543232100...	124.771500000...	0.8675	6M/V2VM33+8P...	Houses	Live	NULL
29	7.85113378000...	80.6559758100...	120.088800000...	0.7023	6M/V2VM44+3956	Houses	Live	NULL
30	7.85342472000...	80.6542519799...	69.7772999999...	0.8567	6M/V2VM33+9P...	Houses	Live	NULL
31	7.85652515000...	80.6552697099...	24.9135999999...	0.6914	6M/V2VM44+J464	Houses	Live	NULL
32	7.85486167000...	80.6560456499...	17.3371999999...	0.7877	6M/V2VM34+W...	Houses	Live	NULL
33	7.85674730000...	80.6550186500...	203.257499999...	0.8274	6M/V2VM44+M...	Houses	Live	NULL
34	7.85024230000...	80.6547139300...	70.0512999999...	0.7297	6M/V2VM23+3V...	Houses	Live	NULL
35	7.85266281000...	80.6566257000...	153.574199999...	0.8722	6M/V2VM34+3...	Houses	Live	NULL
36	7.85117014000...	80.6548649100...	61.926900000...	0.7445	6M/V2VM23+F...	Houses	Live	NULL
37	7.85174639000...	80.6542200899...	161.783800000...	0.8106	6M/V2VM23+M...	Warehouse	Live&Visit	NULL
38	7.85434643000...	80.6555913199...	33.213700000...	0.8105	6M/V2VM34+P6...	Houses	Live	NULL
39	7.85095080000...	80.6568428399...	106.833799999...	0.7625	6M/V2VM24+9PP5	Houses	Live	NULL
40	7.85265304000...	80.6546712600...	185.289400000...	0.8612	6M/V2VM33+3V...	Houses	Live	NULL
41	7.85229684000...	80.6551989099...	23.359000000...	0.7755	6M/V2VM24+W...	Houses	Live	NULL
42	7.85239750000...	80.6566889599...	34.202900000...	0.686	6M/V2VM24+X...	Houses	Live	NULL
43	7.85351830000...	80.6559072099...	207.840599999...	0.8089	6M/V2VM34+C931	Houses	Live	NULL
44	7.85254685000...	80.6551038900...	178.713500000...	0.8748	6M/V2VM34+22...	Houses	Live	NULL
45	7.85240665000...	80.6540552299...	122.135800000...	0.7431	6M/V2VM23+XJ79	Houses	Live	NULL
46	7.85694640000...	80.6551699700...	38.3755999999...	0.6802	6M/V2VM44+Q3...	Houses	Live	NULL

Figure 47 - Toggle editing tool

- Extract the 'Fields and Values' >> Double click on the functional mix.

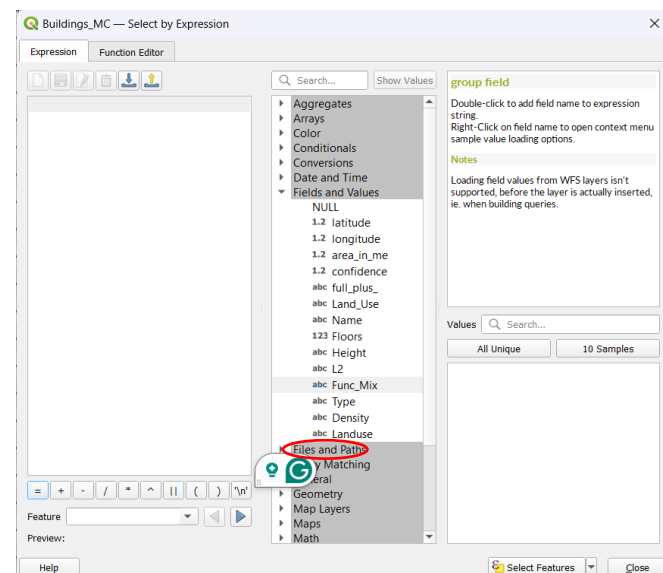
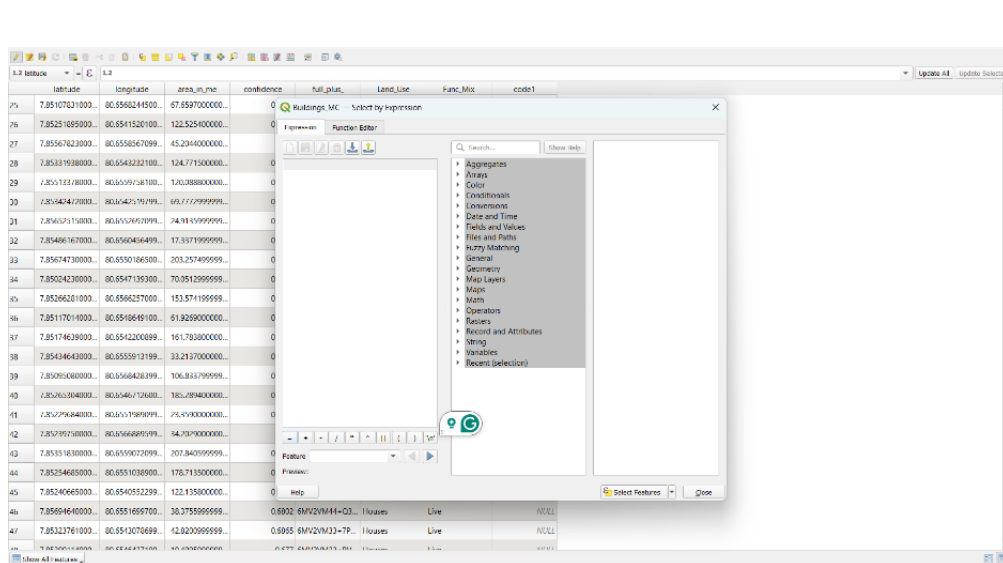


Figure 49- Select by Expression

- Now it appears on the left side vacant space.

Click '='>>click on All Unique>>Double click on 'Live'>>select features>>close

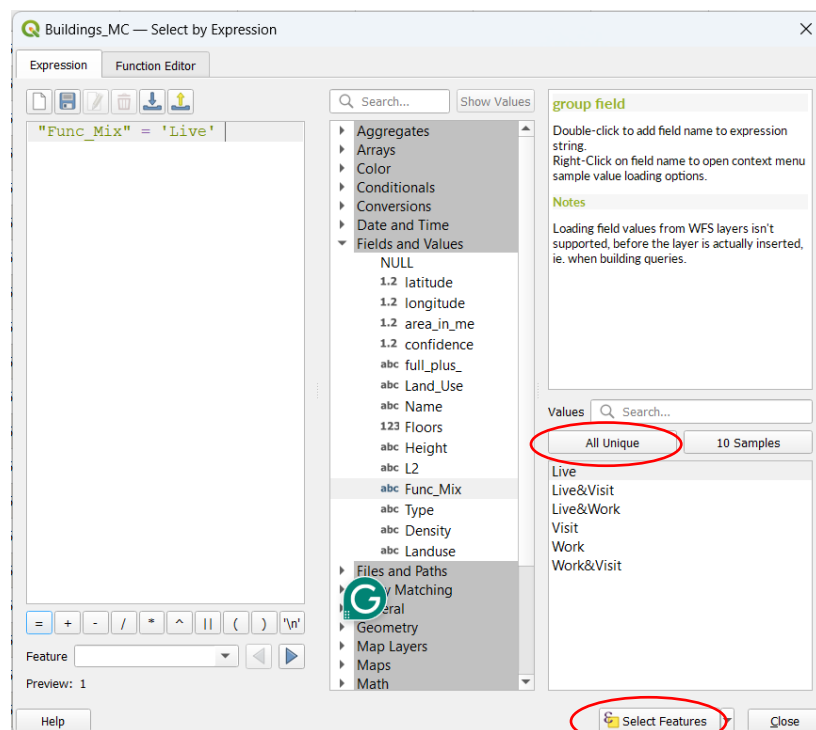
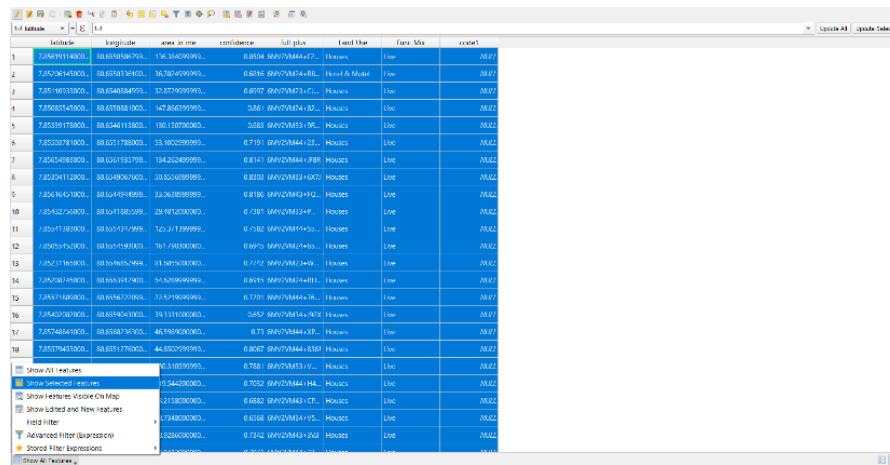


Figure 50 - Select features

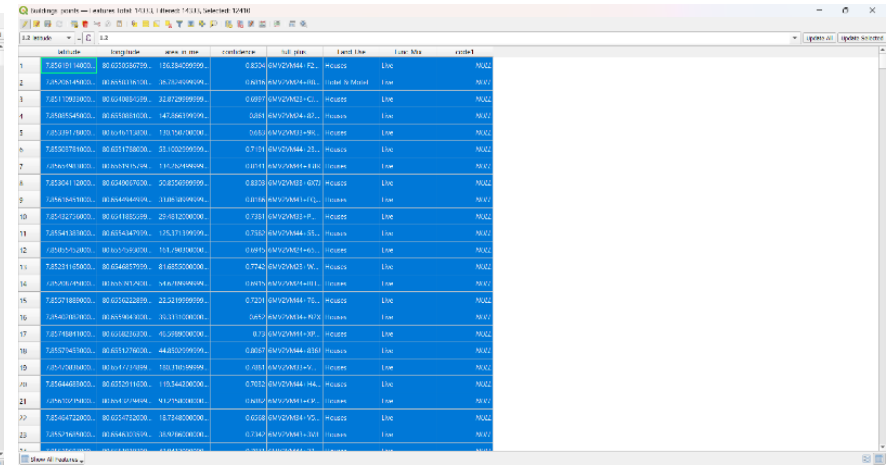
- Click on 'Show all features'>>click on Show selected features.



The screenshot shows the QGIS interface with a table of 19 features. The legend on the left has a dropdown menu open, and the 'Show all features' option is highlighted. The table columns are: latitude, longitude, area in m², confidence, full path, land use, time, and cycle1.

	latitude	longitude	area in m²	confidence	full path	land use	time	cycle1
1	7.8549114800...	80.6539382700...	136.34630990...	0.8836	RAY20844+J2...	Houses	Live	NO.02
2	7.8527064500...	80.6559132100...	36.781409990...	0.6816	RAY20844+J2...	Houses	Live	NO.02
3	7.8511603300...	80.6540344700...	32.873999990...	0.8990	RAY20844+J2...	Houses	Live	NO.02
4	7.8506574500...	80.6530881000...	147.86199999...	0.88	RAY20844+J2...	Houses	Live	NO.02
5	7.8533917500...	80.6546113300...	150.11070000...	0.883	RAY20844+J2...	Houses	Live	NO.02
6	7.8532078100...	80.6551788000...	15.180209990...	0.7191	RAY20844+J2...	Houses	Live	NO.02
7	7.8505498000...	80.6551783700...	154.23249999...	0.8141	RAY20844+J2...	Houses	Live	NO.02
8	7.8520411200...	80.6540367000...	20.852699990...	0.8338	RAY20844+J2...	Houses	Live	NO.02
9	7.8527064500...	80.6540367000...	20.852699990...	0.8186	RAY20844+J2...	Houses	Live	NO.02
10	7.8545275000...	80.6541581000...	20.48120000...	0.7387	RAY20844+J2...	Houses	Live	NO.02
11	7.8541181000...	80.6551783700...	12.31139999...	0.7382	RAY20844+J2...	Houses	Live	NO.02
12	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
13	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
14	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
15	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
16	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
17	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
18	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
19	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02

Figure 51- Show selected features



The screenshot shows the QGIS interface with a table of 24 features. The legend on the left has a dropdown menu open, and the 'Show selected features' option is highlighted. The table columns are: latitude, longitude, area in m², confidence, full path, land use, time, and cycle1.

	latitude	longitude	area in m²	confidence	full path	land use	time	cycle1
1	7.8549114800...	80.6539382700...	136.34630990...	0.8836	RAY20844+J2...	Houses	Live	NO.02
2	7.8527064500...	80.6559132100...	36.781409990...	0.6816	RAY20844+J2...	Houses	Live	NO.02
3	7.8511603300...	80.6540344700...	32.873999990...	0.8990	RAY20844+J2...	Houses	Live	NO.02
4	7.8506574500...	80.6530881000...	147.86199999...	0.88	RAY20844+J2...	Houses	Live	NO.02
5	7.8533917500...	80.6546113300...	150.11070000...	0.883	RAY20844+J2...	Houses	Live	NO.02
6	7.8532078100...	80.6551788000...	15.180209990...	0.7191	RAY20844+J2...	Houses	Live	NO.02
7	7.8505498000...	80.6551783700...	154.23249999...	0.8141	RAY20844+J2...	Houses	Live	NO.02
8	7.8520411200...	80.6540367000...	20.852699990...	0.8338	RAY20844+J2...	Houses	Live	NO.02
9	7.8527064500...	80.6540367000...	20.852699990...	0.8186	RAY20844+J2...	Houses	Live	NO.02
10	7.8545275000...	80.6541581000...	20.48120000...	0.7387	RAY20844+J2...	Houses	Live	NO.02
11	7.8541181000...	80.6551783700...	12.31139999...	0.7382	RAY20844+J2...	Houses	Live	NO.02
12	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
13	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
14	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
15	7.8527188000...	80.655222800...	22.321999990...	0.7221	RAY20844+J2...	Houses	Live	NO.02
16	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
17	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
18	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
19	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
20	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
21	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
22	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02
23	7.8541181000...	80.6551783700...	10.12810000...	0.7712	RAY20844+J2...	Houses	Live	NO.02
24	7.8545275000...	80.6551783700...	10.12810000...	0.8493	RAY20844+J2...	Houses	Live	NO.02

Figure 52 - Show selected features

- Now we have to code them as '1'. For that, we can use an open-field calculator.

Tick on the Update existing field>> select the code as the field in which we want to enter the data>>type as “1”>>OK

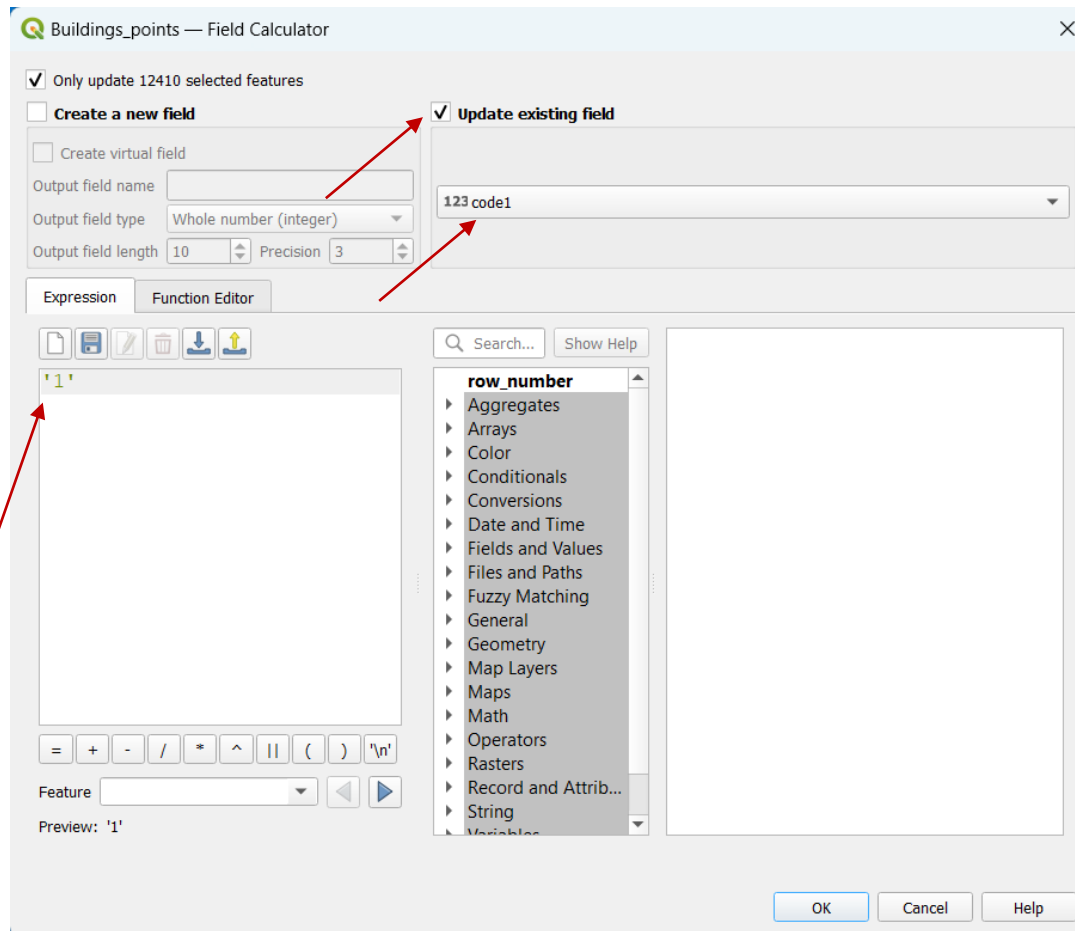


Figure 53 -Field calculator

- Now all buildings that are in the 'Live' Category are coded.

	latitude	longitude	area_in_me	confidence	full_plus	Land_Use	Func_Mix	code1
1	7.85619114000...	80.6550586799...	136.384099999...	0.8504	6MV2VM44+F2...	Houses	Live	1
2	7.85206145000...	80.6558336100...	36.782499999...	0.6816	6MV2VM24+RB...	Hotel & Motel	Live	1
3	7.85110933000...	80.6540884599...	32.872999999...	0.6997	6MV2VM23+CJ...	Houses	Live	1
4	7.85085545000...	80.6550881000...	147.866399999...	0.861	6MV2VM24+82...	Houses	Live	1
5	7.85339178000...	80.6546113800...	130.150700000...	0.683	6MV2VM33+9R...	Houses	Live	1
6	7.85503781000...	80.6551788000...	53.100299999...	0.7191	6MV2VM44+23...	Houses	Live	1
7	7.85654983000...	80.6561935799...	134.262499999...	0.8141	6MV2VM44+JRR...	Houses	Live	1
8	7.85304112000...	80.6549067600...	50.855699999...	0.8303	6MV2VM33+6X7...	Houses	Live	1
9	7.85616451000...	80.6544944999...	33.063899999...	0.8186	6MV2VM43+TQ...	Houses	Live	1
10	7.85432756000...	80.6541885599...	29.481200000...	0.7381	6MV2VM33+P...	Houses	Live	1
11	7.85541383000...	80.6554347999...	125.371399999...	0.7582	6MV2VM44+55...	Houses	Live	1
12	7.85055452000...	80.6554593000...	161.790300000...	0.6945	6MV2VM24+65...	Houses	Live	1
13	7.85231165000...	80.6546857999...	81.685500000...	0.7742	6MV2VM23+W...	Houses	Live	1
14	7.85208745000...	80.6563912900...	54.628999999...	0.6915	6MV2VM24+RH...	Houses	Live	1
15	7.85571889000...	80.6556222899...	22.521999999...	0.7201	6MV2VM44+76...	Houses	Live	1
16	7.85402082000...	80.6559043000...	39.333100000...	0.652	6MV2VM34+J92X...	Houses	Live	1
17	7.85748841000...	80.6568236300...	46.598900000...	0.73	6MV2VM44+XP...	Houses	Live	1
18	7.85579453000...	80.6551276000...	44.850299999...	0.8067	6MV2VM44+836...	Houses	Live	1
19	7.85470836000...	80.6547734899...	180.310599999...	0.7881	6MV2VM33+V...	Houses	Live	1
20	7.85644683000...	80.6552911600...	119.544200000...	0.7032	6MV2VM44+H4...	Houses	Live	1
21	7.85610235000...	80.6543229499...	93.215800000...	0.6882	6MV2VM43+CP...	Houses	Live	1
22	7.85464722000...	80.6554732000...	18.734800000...	0.6568	6MV2VM34+V5...	Houses	Live	1
23	7.85521685000...	80.6546303599...	38.928600000...	0.7342	6MV2VM43+3VB...	Houses	Live	1

Figure 54 - Live Category

Following the above steps, we can code all buildings according to the functional mix.

Live-1	Live&Visit-5
Work-2	Work&Visit-6
Visit-3	Live, Work&Visit-7
Live&work-4	

Step 06:

Using the IDW interpolation tool, we can interpolate the above point layer.

For that, we can use the IDW interpolation tool in the processing toolbox.

I. Search the IDW interpolation tool in the processing toolbox.

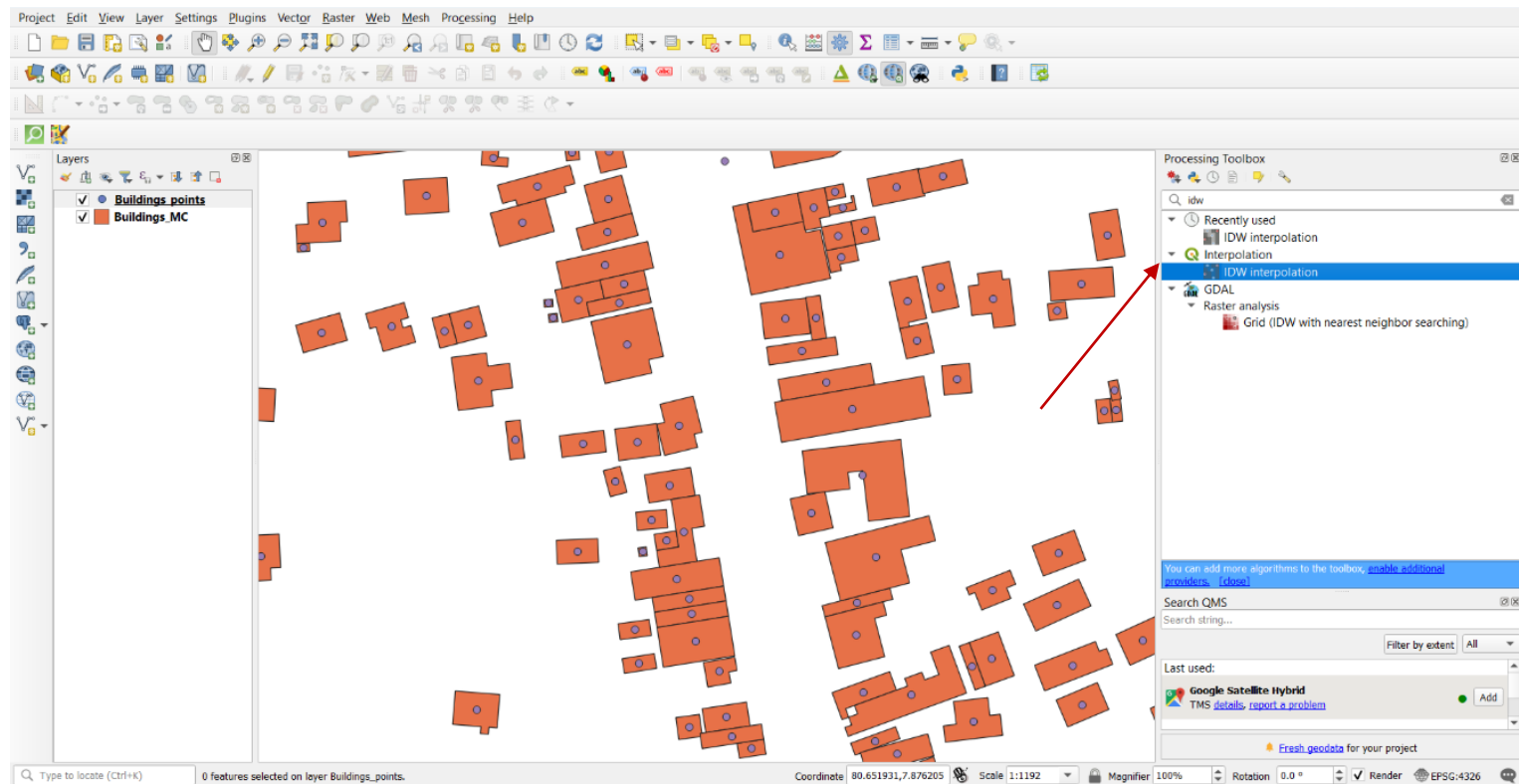


Figure 55 -Select 'IDW Interpolation' tool

In IDW Interpolation window

- i. Enter the point layer as the input layer.
- ii. The code column is the interpolated attribute.
- iii. Then press '+'
- iv. Note- if these are to analyze the urbanity level of this area, we need to make sure that the functional mix, space matrix, and space syntax layers all have the same pixel size.
- v. Give a path for the output.
- vi Run

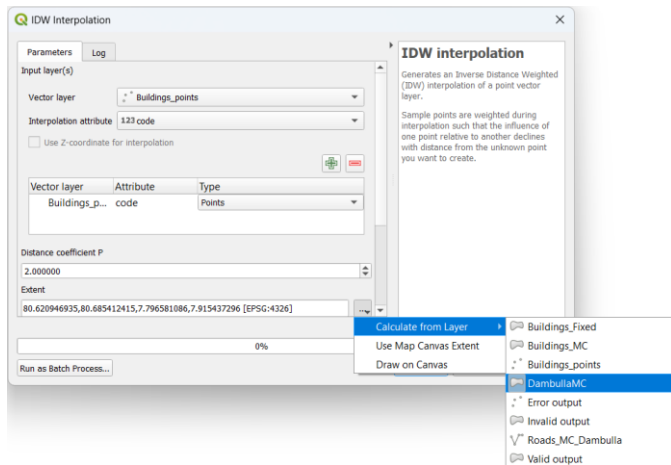


Figure 56 - IDW Interpolation

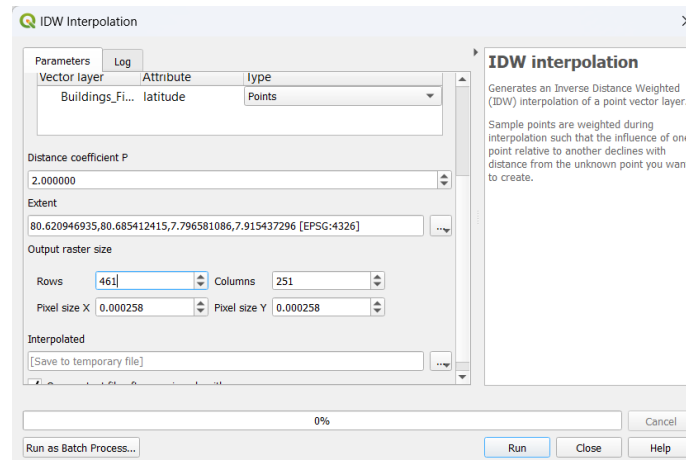


Figure 57- IDW Interpolation

This is the output.

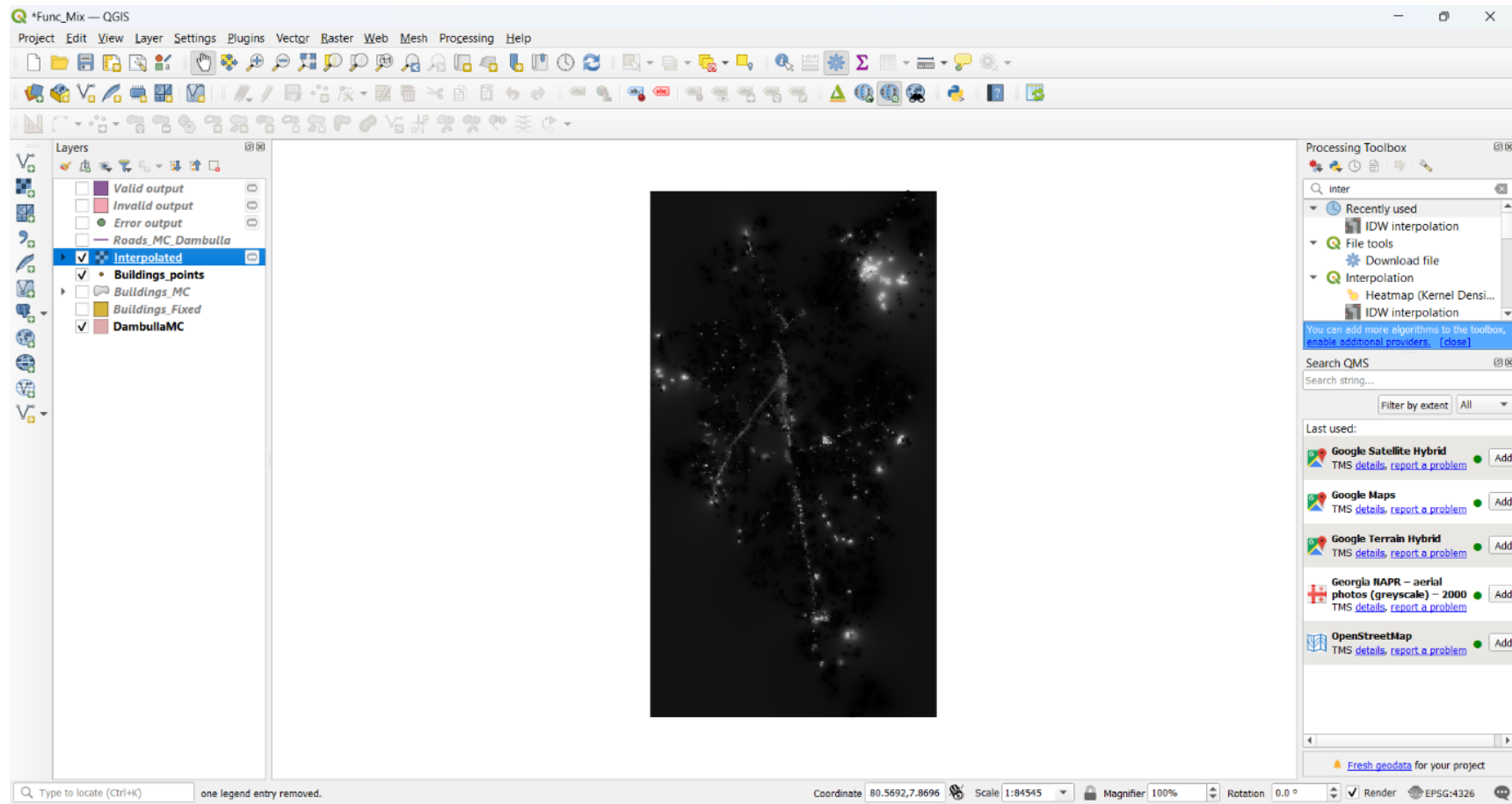


Figure 58-Interpolated Output

Step 07

- Now, we have to reclassify this raster layer. For that,

Access the Processing Toolbox >> Search for the "Reclassify by Table" Tool.>>Double click on it

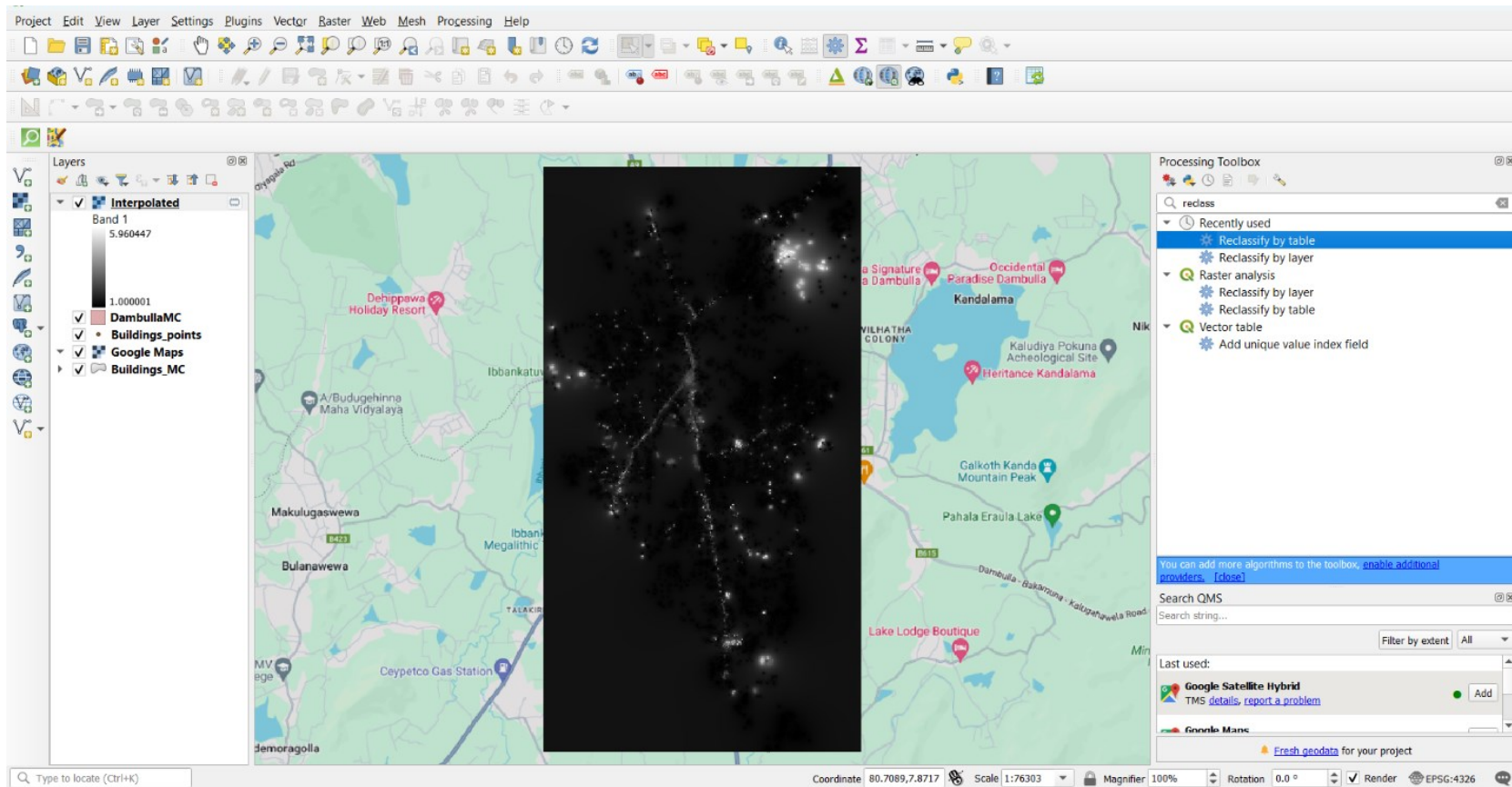


Figure 59 -Select 'Reclassify by table'

i. Enter interpolated layer as input layer>> Enter the maximum and minimum values according to the code which we created above using functional mix>> Give path for the Output.

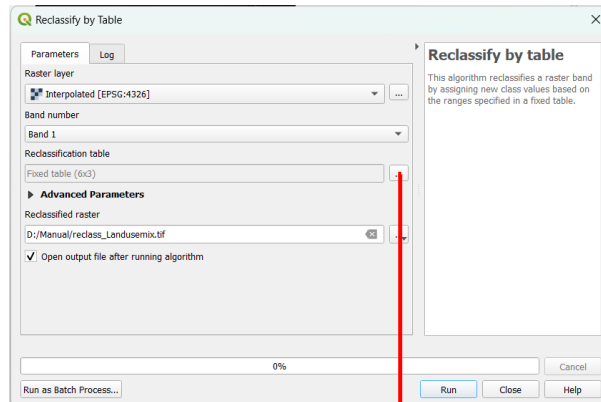


Figure 60 -Reclassify

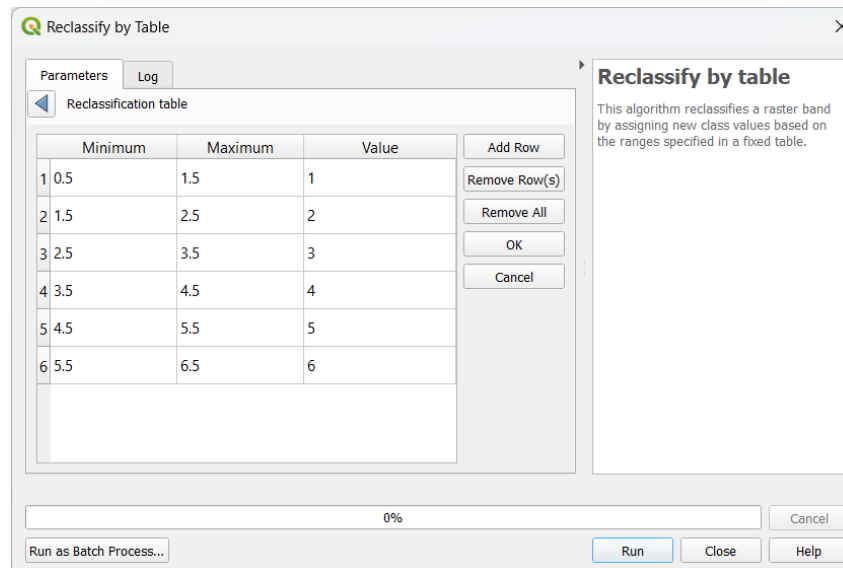


Figure 61 -Reclassify by table

This is the output.

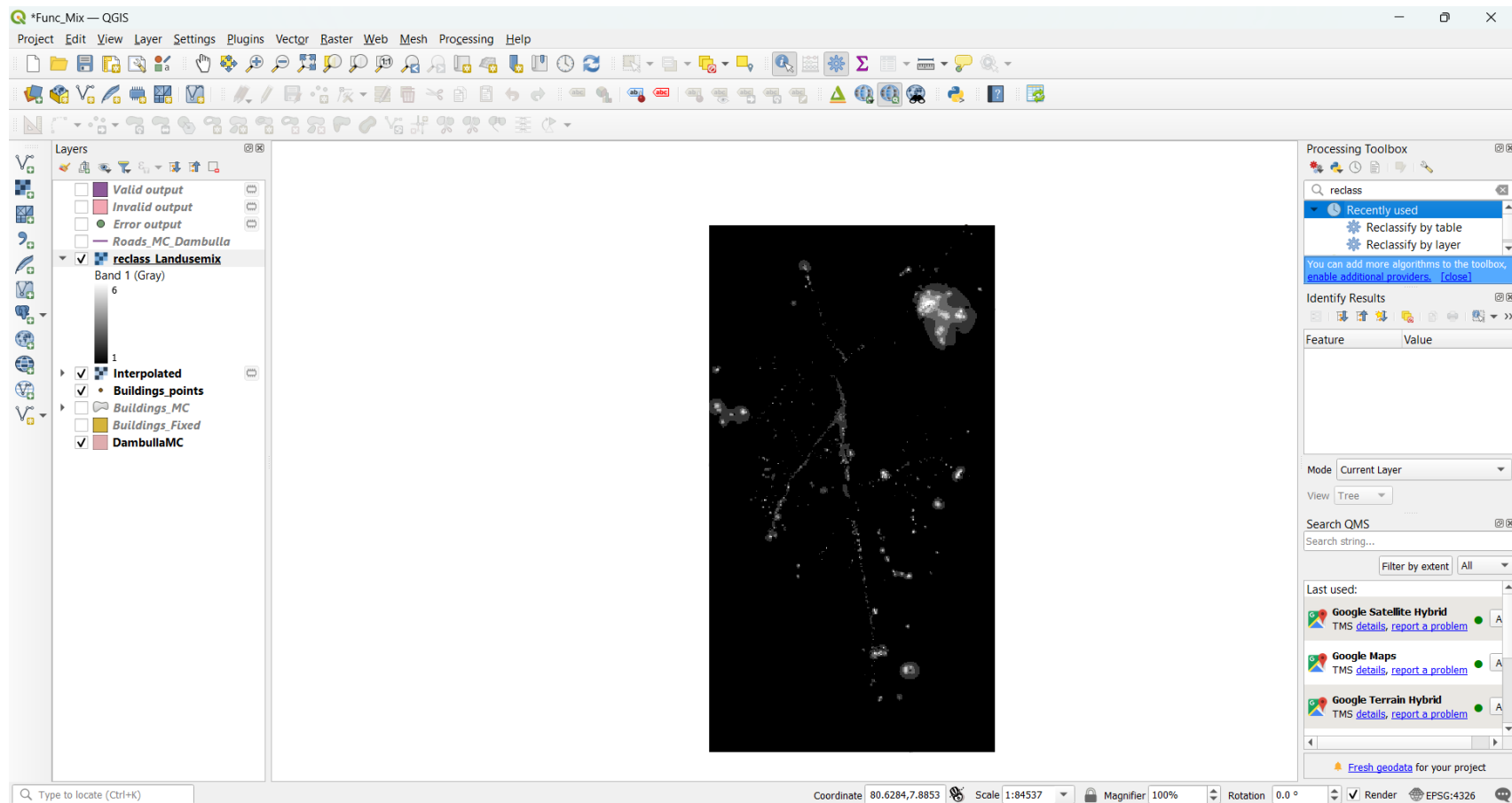


Figure 62 -Reclarified Output

Step 08

Now we have to clip this layer with the Dambulla MC layer to define the boundary. For that, it can be used 'Clip Raster by Mask Layer' In the Processing Toolbox panel.

- Go to processing toolbox>>search 'Clip raster by mask layer'

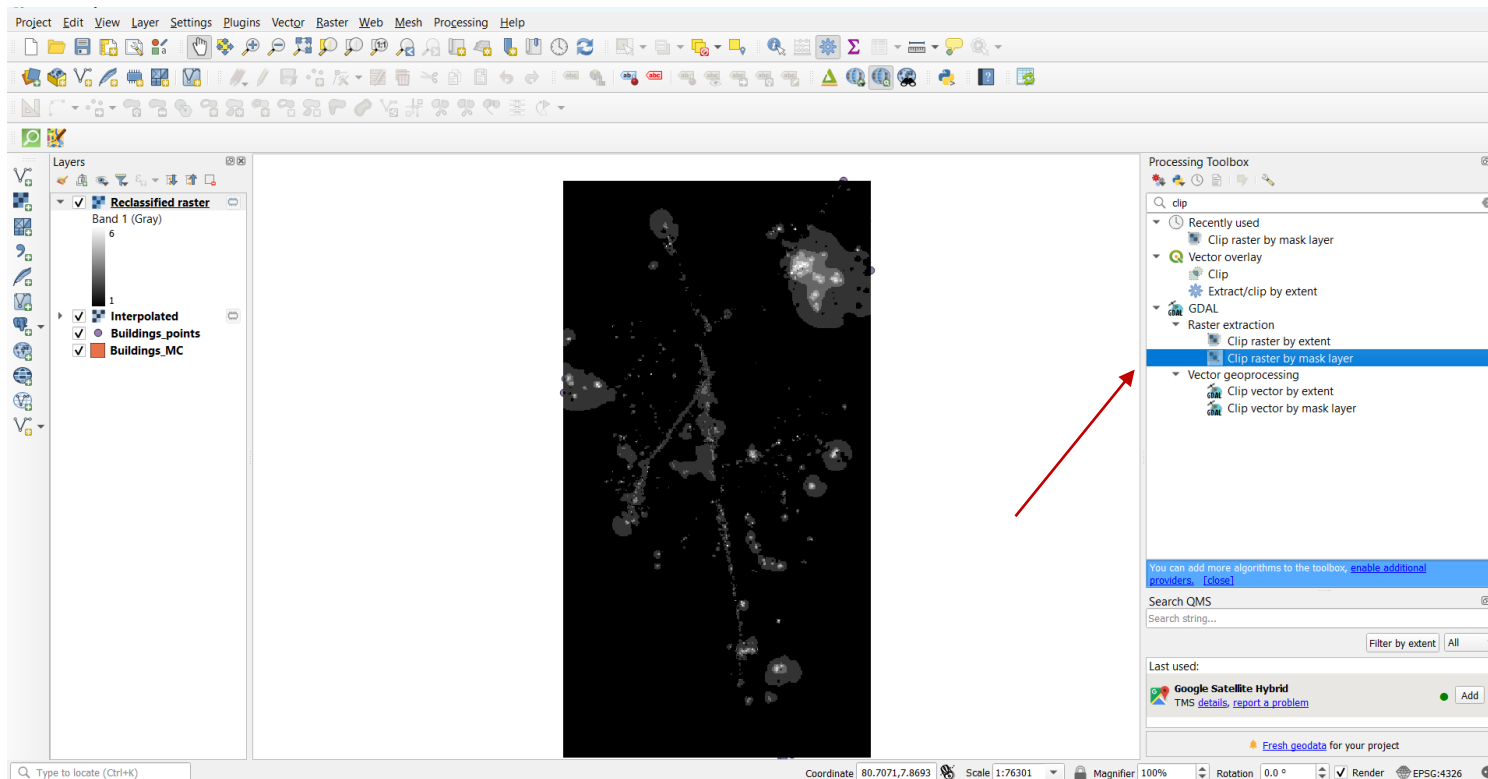


Figure 63 -Clip raster by Mask layer

- Enter Reclassed layer as input layer>>Give the Study area as Mask layer>>Run

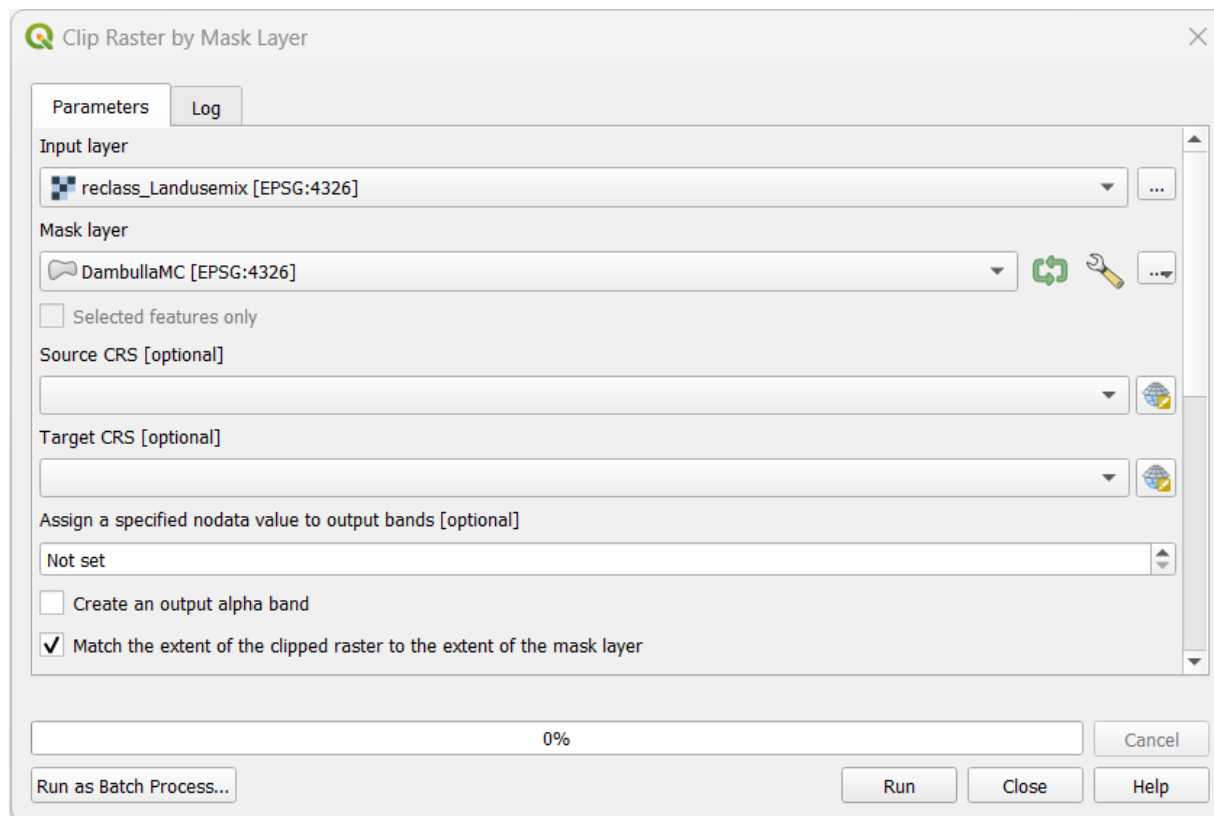


Figure 64 – Clip Raster by Mask Layer

This is the output layer.

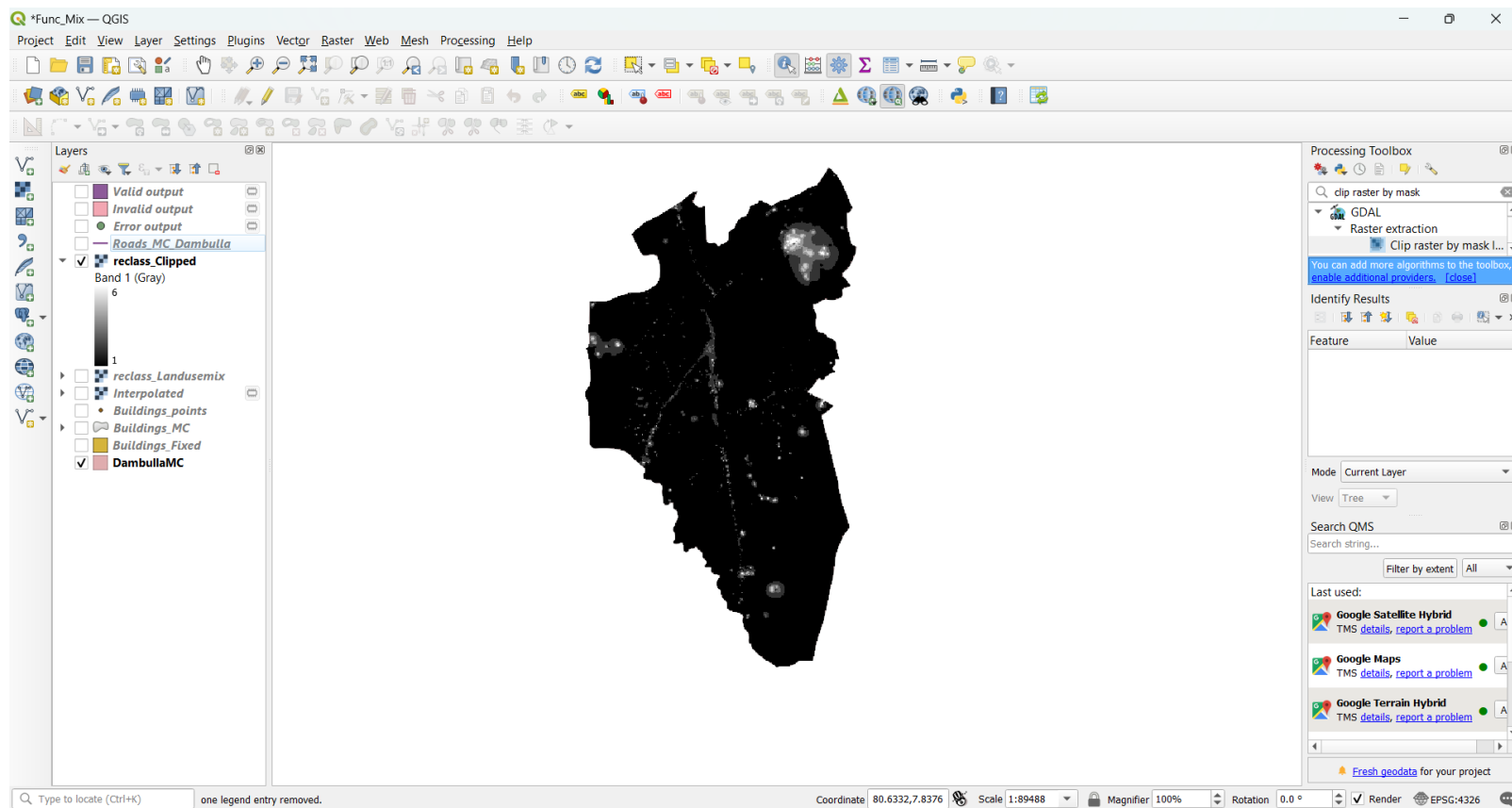


Figure 65 -Clipped Output

Step09

By right click on that clipped layer,

- i. **Go to layer properties and symbology.**

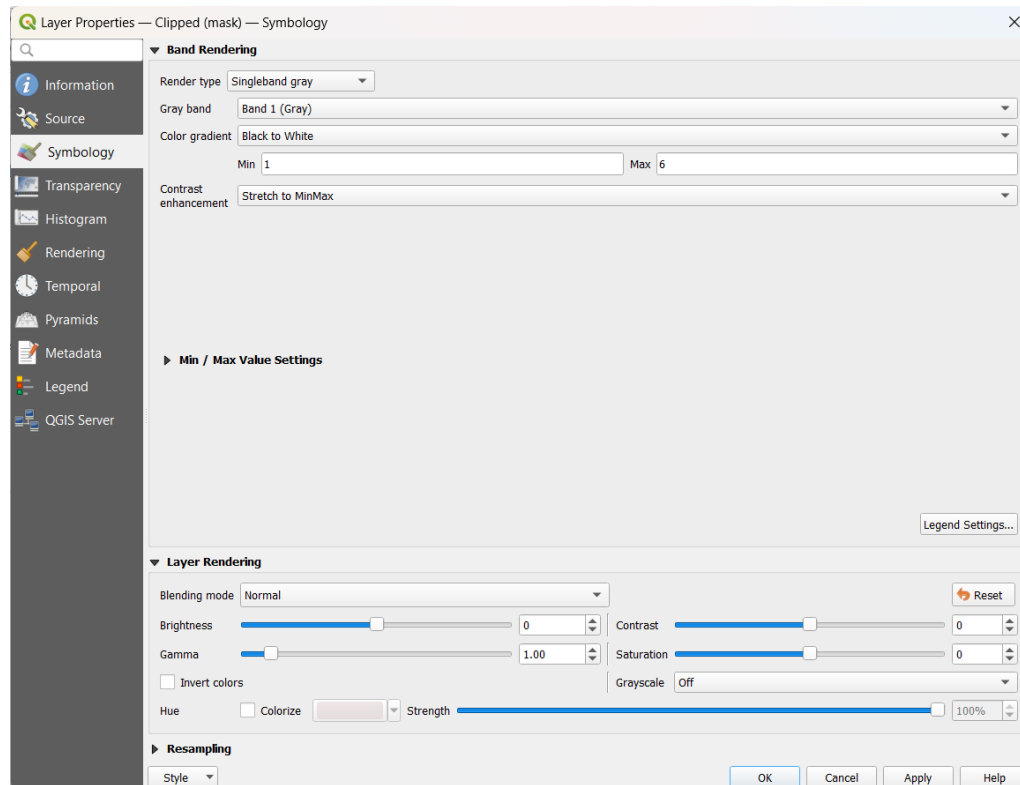


Figure 66 - layer properties

ii. Give Platted as render type.

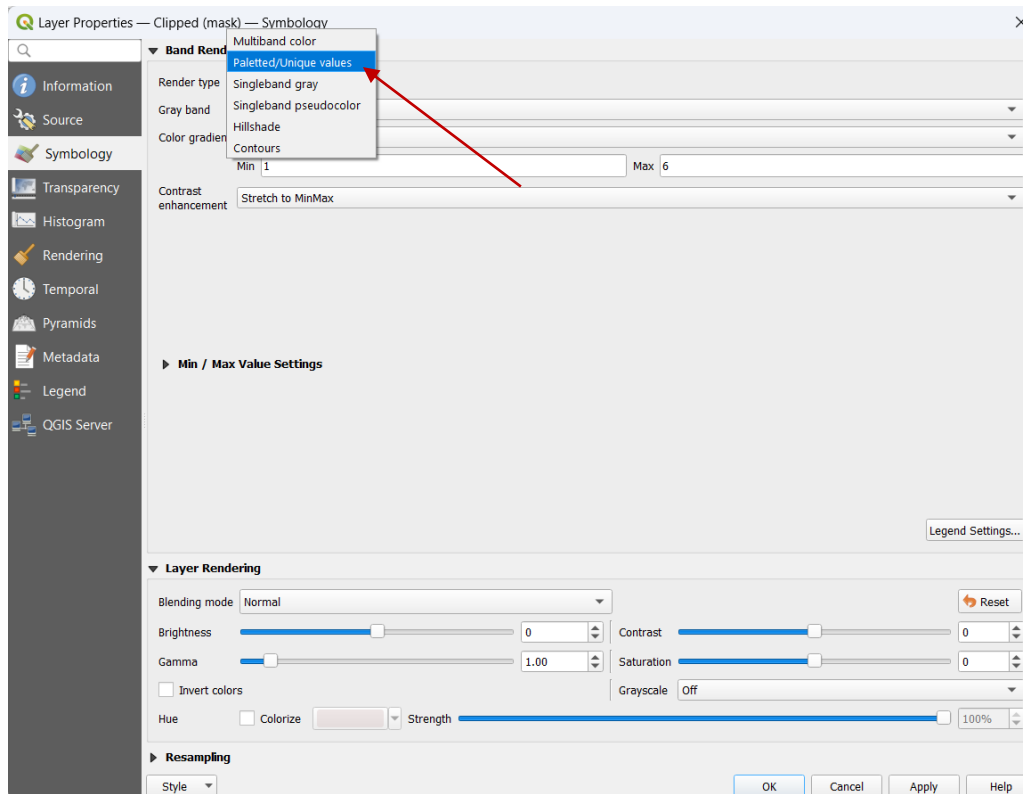


Figure 67- Render type

iii. Give an appropriate color ramp.

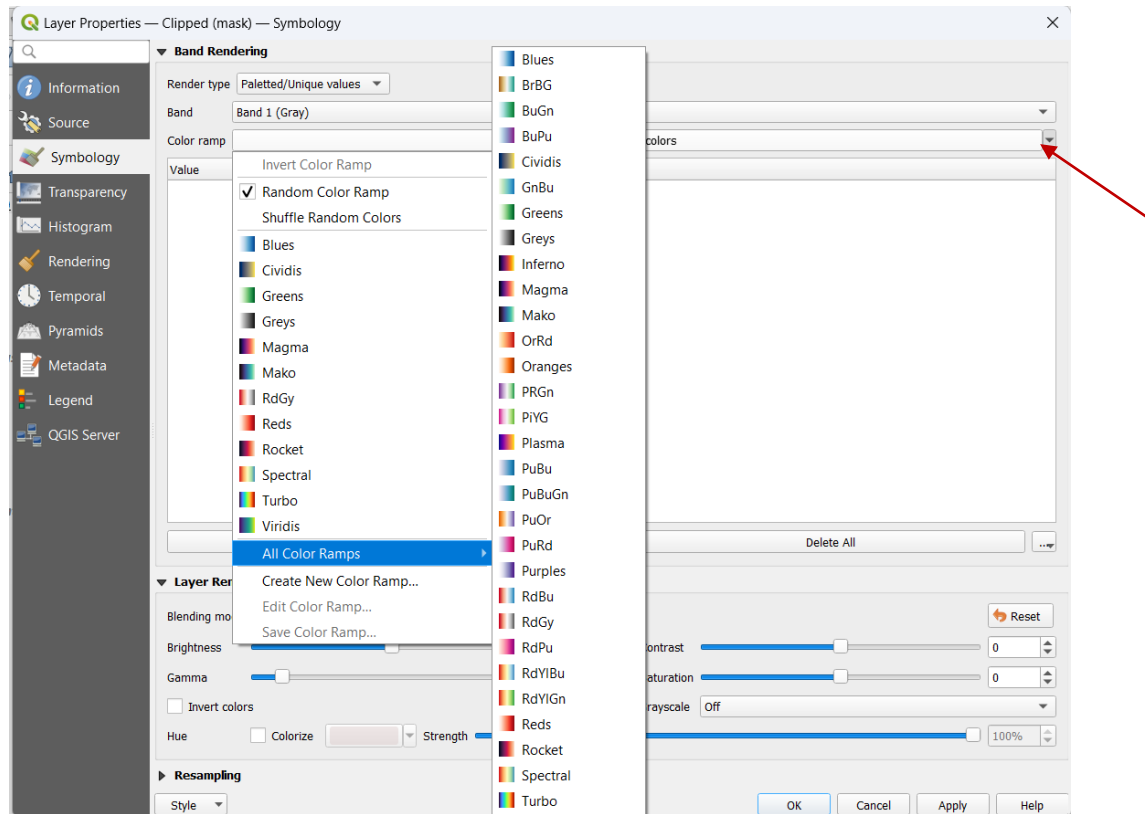


Figure 68 - Color ramp.

When it classifies,

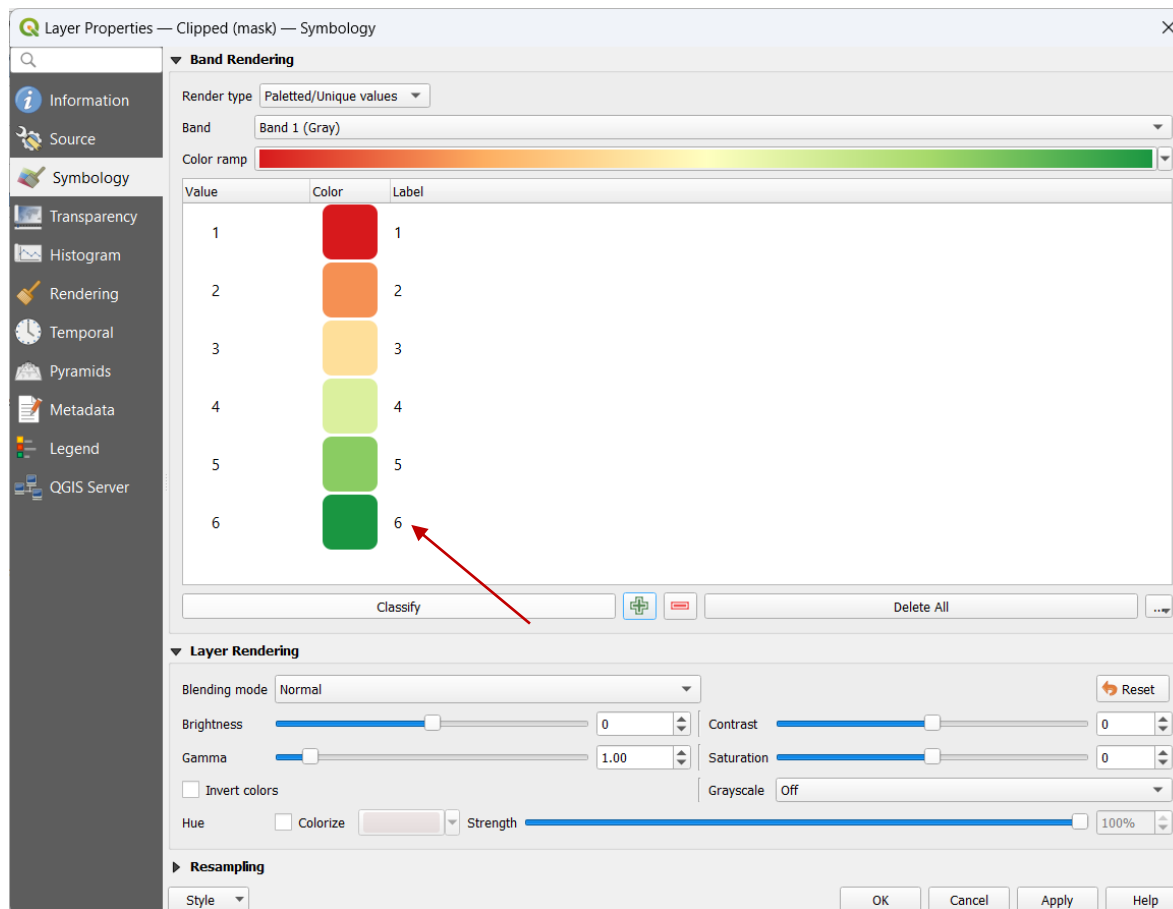


Figure 69 -Classifying

iv. Rename according to the above 7 categories.

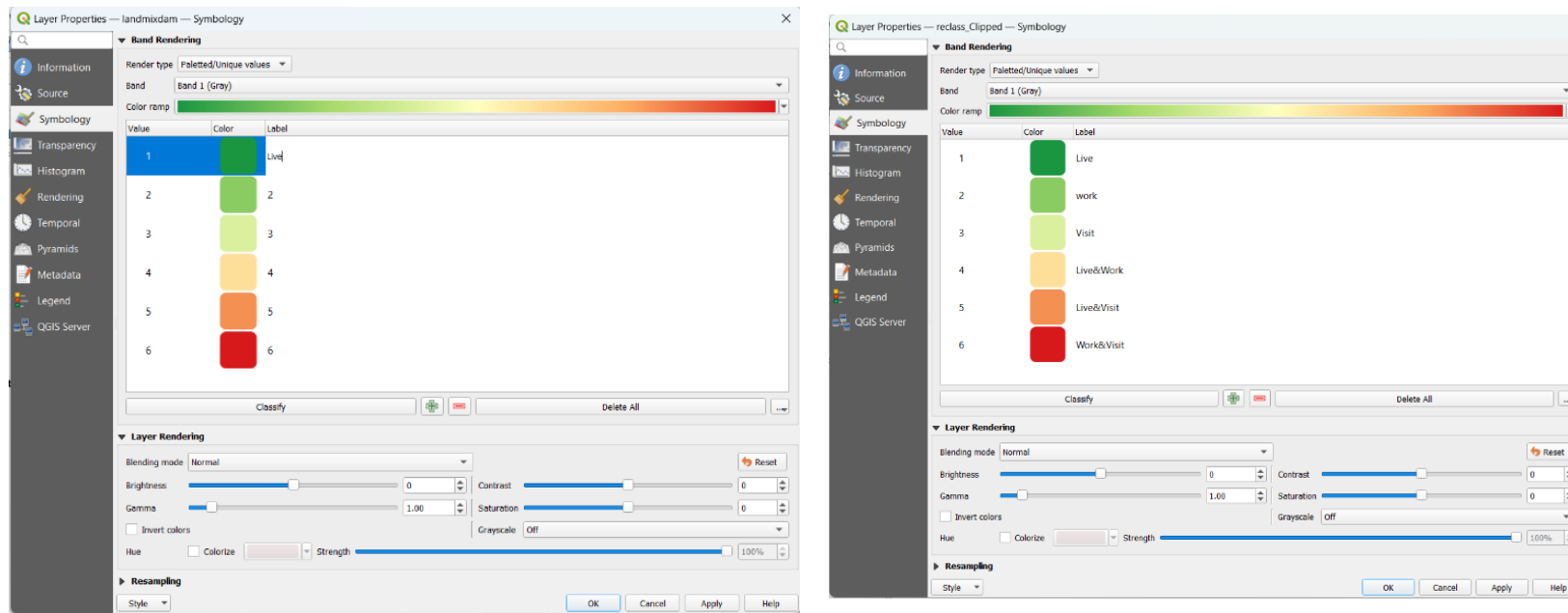


Figure 70- Rename according to the above 7 categories.

This is the LandUse Mix in Dambulla MC. (Final output)

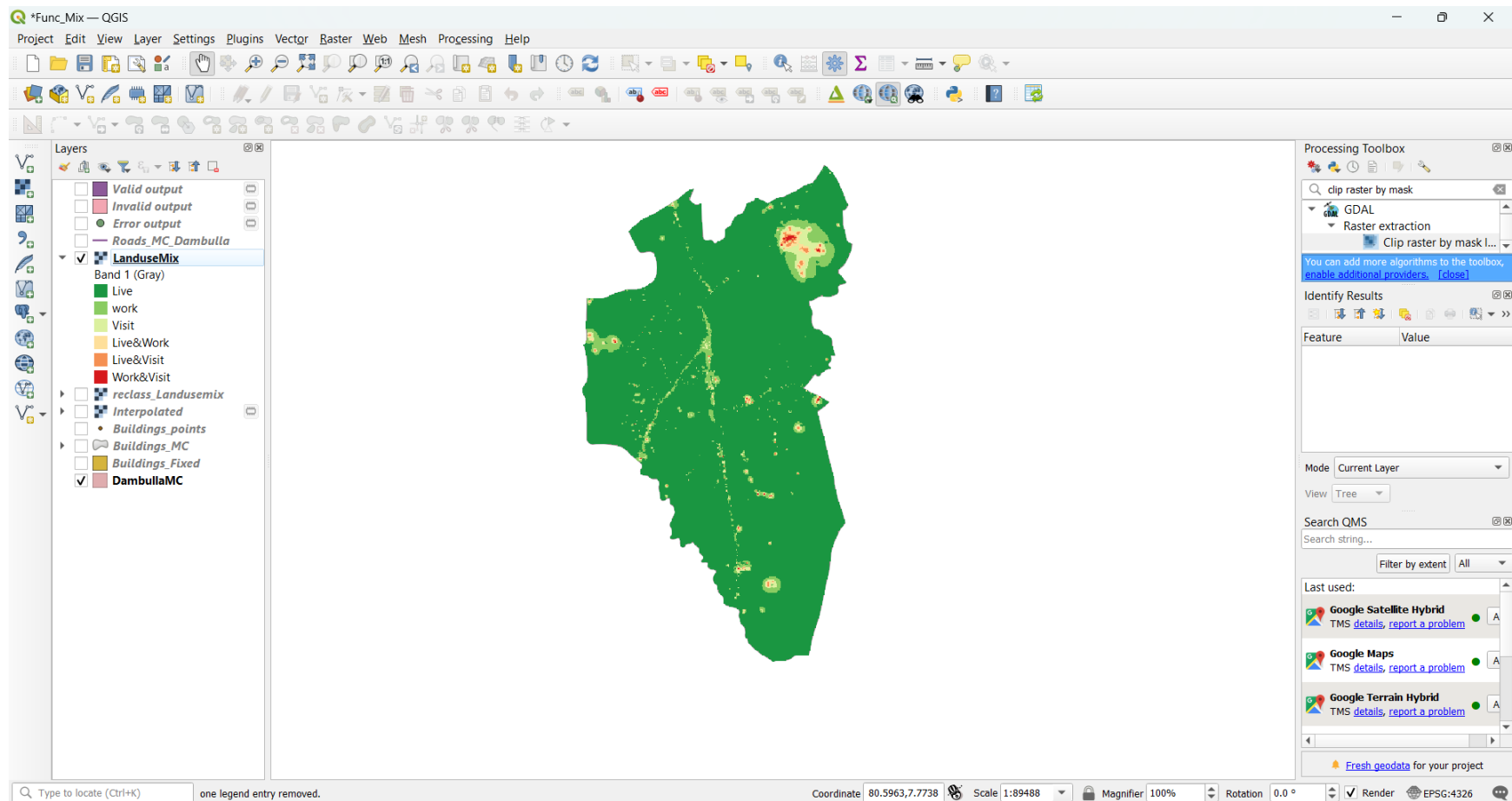


Figure 71 -Landuse mix in Dambulla MC

This is the final output in this analysis.

Functional Mix Map of Dambulla MC

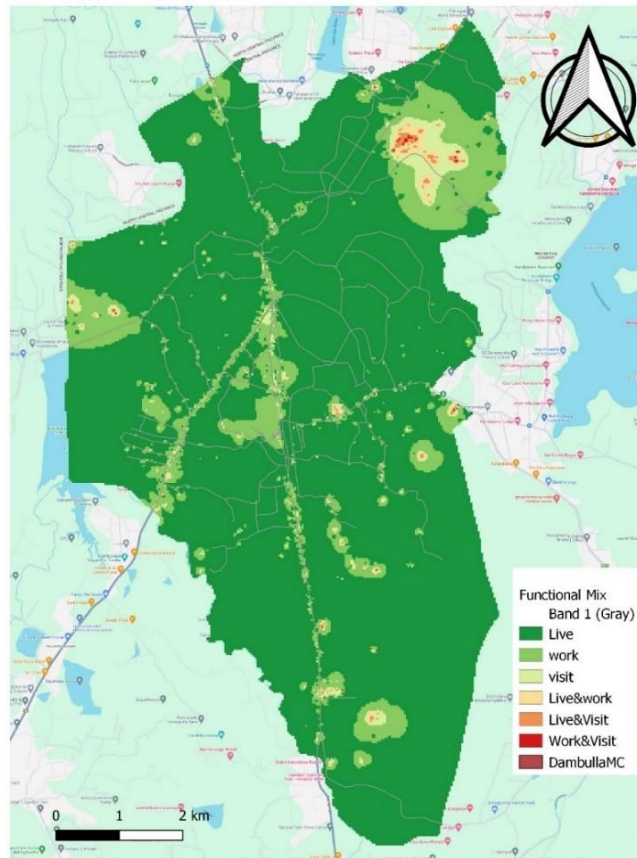


Figure 72 -Functional Mix Map of Dambulla MC

4. PREPARATION OF MAPS

Use Suitable Colors & Symbols

Show adjacent administration boundaries.

Maximum utilization of map space

Show the Graticule Network with appropriate grid size.

Show the basic elements in the map.

Transportation Networks

Water Bodies

Prepare a descriptive map.

Check the units of the scale bar.

Mention correct units at the legend.

Check the text given in the legend.

Mention the correct sources.

Examples

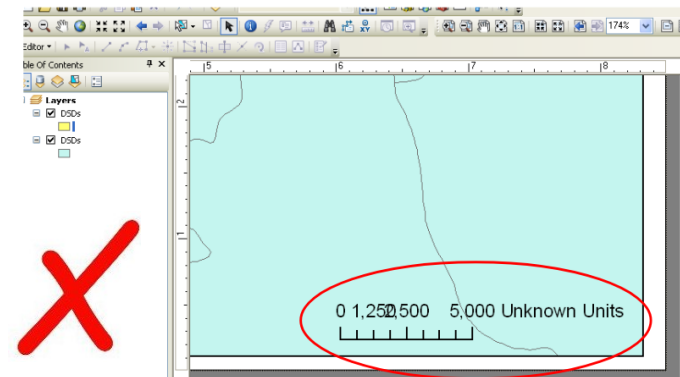
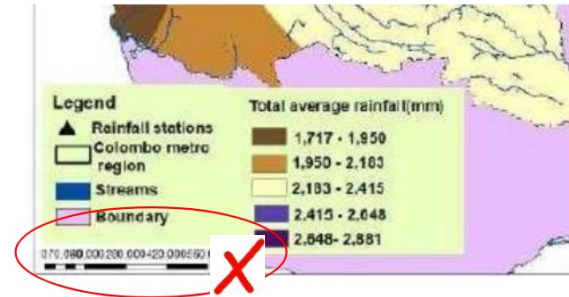
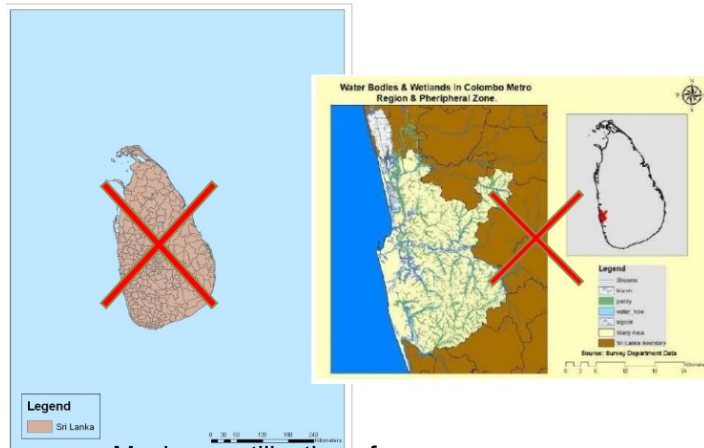


Figure 73 -Wrong formats of Maps
Mention the correct sources.

AFTERWORD

In an era where urban sustainability and livability are central to planning discourse, understanding land use mix has never been more vital. This book offers more than just technical instruction—it provides a foundation for spatial thinking that supports balanced, inclusive, and vibrant urban development.

By guiding readers through GIS-based land use mix analysis, we hope to empower future planners, educators, and practitioners to make informed, evidence-based decisions. Let this guide inspire thoughtful application, continued learning, and innovation in shaping cities that are cohesive, walkable, and resilient.



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