CE203: Geospatial Engineering

Assignment 4: Vector Selection and Proximity Analysis

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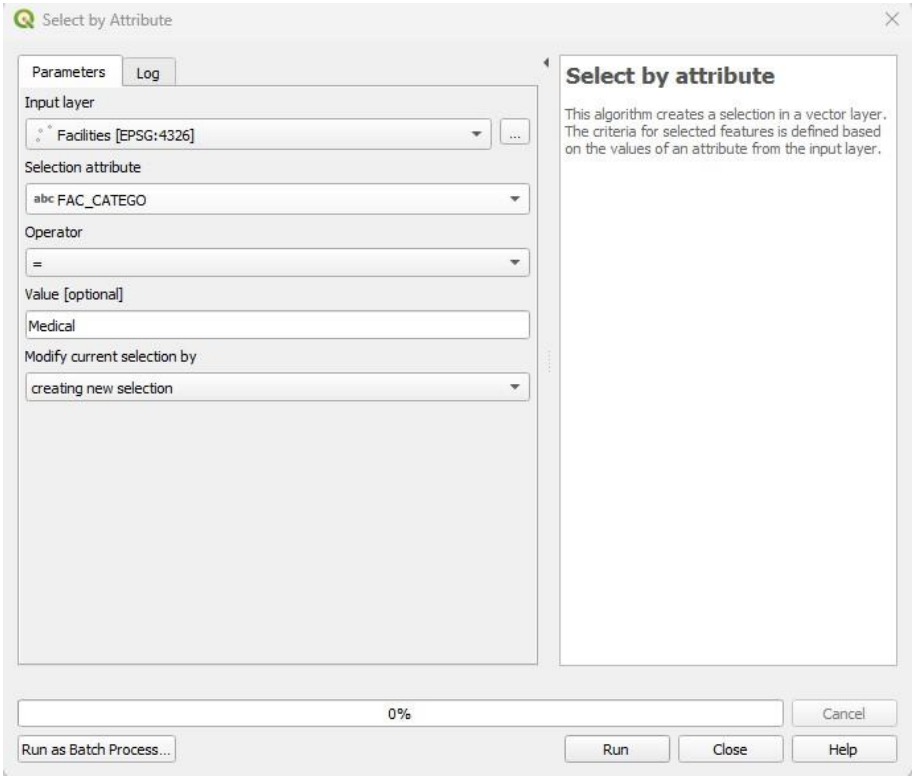
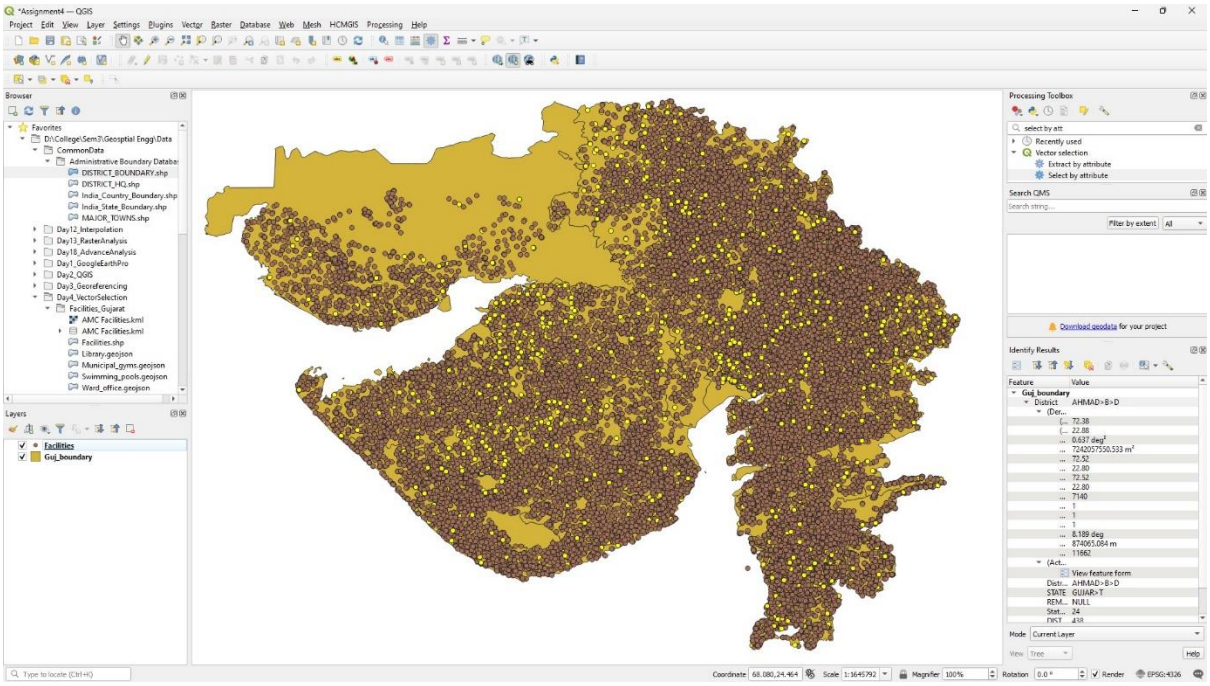
Analysis of Rural Facilities in Gujarat: The Ministry of Rural Development, under its GeoSadak initiative, provides geospatial data related to important facilities such as agro, medical, educational, and administrative services. This data aids in planning future infrastructure projects by analyzing nearby facilities. In this exercise, we will explore the data pertaining to various facilities and extract information relevant to future development. Through this analysis, we will answer the following questions:

1. **How many medical facilities are available in Gujarat?**

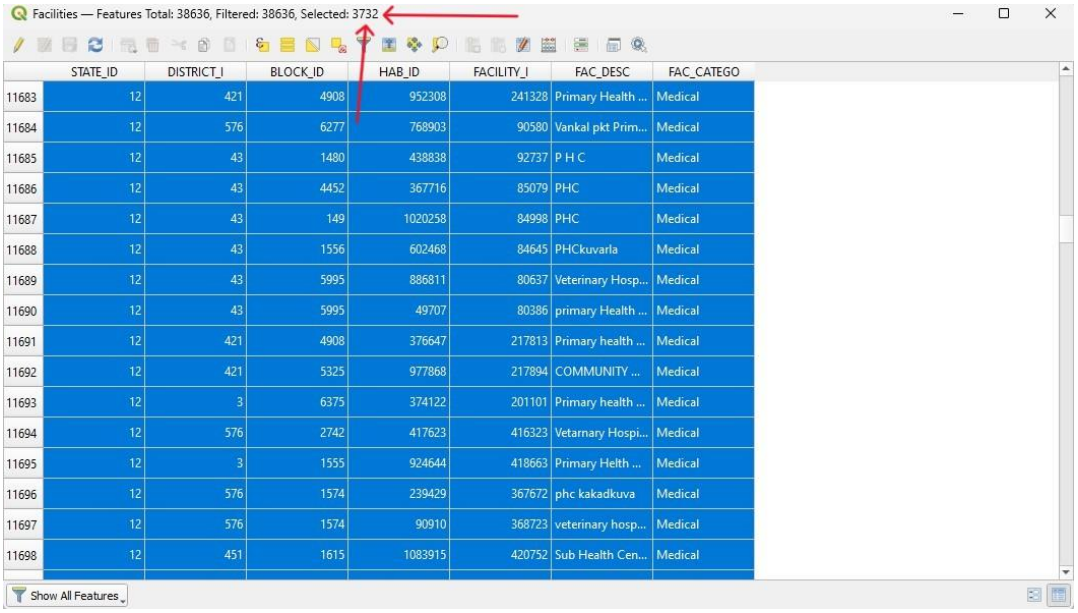
   So, to count the number of medical facilities in Gujrat, import the facilities layer into QGIS. Use Vector Selection and Select by Attribute to select the medical value in the FAC_CATEGO attribute.



   Press Run and then we can see all the medical facilities selected and represented by different colour, we can verify it by the image below,



So, the **Yellow** dots amongst the brown on the map represents the medical facilities. We can refer to the attributes table to count the number of medical facilities.

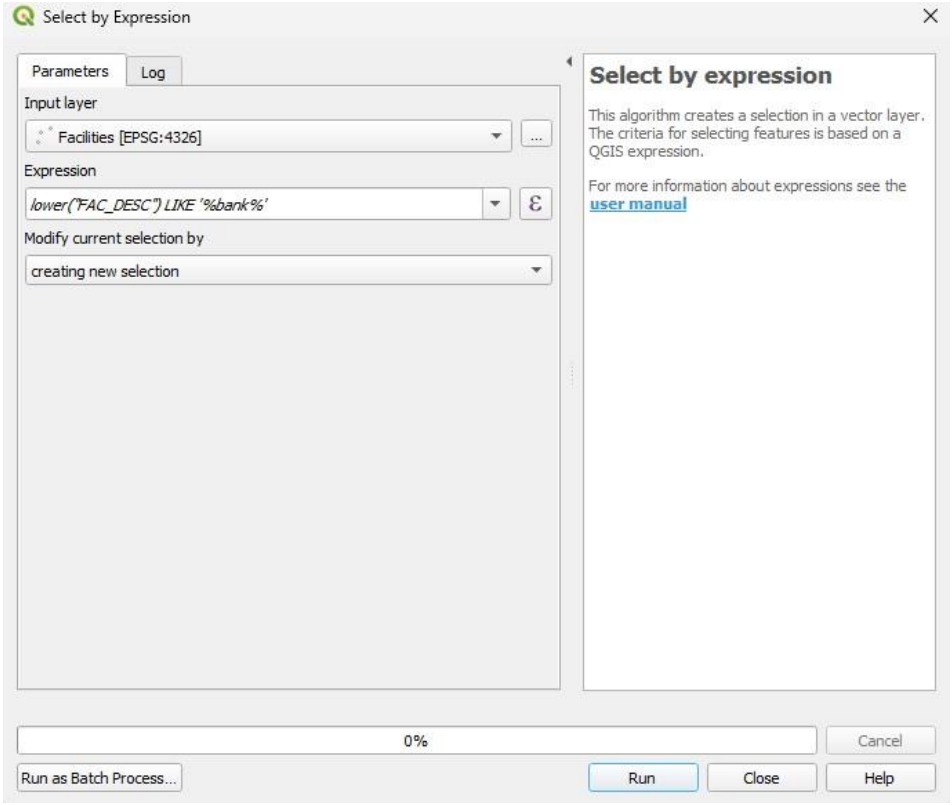


	STATE_ID	DISTRICT_I	BLOCK_ID	HAB_ID	FACILITY_I	FAC_DESC	FAC_CATEGO
11683	12	421	4908	952308	241328	Primary Health ...	Medical
11684	12	576	6277	768903	90580	Vankal pkt Prim...	Medical
11685	12	43	1480	438838	92737	P H C	Medical
11686	12	43	4452	367716	85079	PHC	Medical
11687	12	43	149	1020258	84998	PHC	Medical
11688	12	43	1556	602468	84645	PHCkuvarla	Medical
11689	12	43	5995	886811	80637	Veterinary Hosp...	Medical
11690	12	43	5995	49707	80386	primary Health ...	Medical
11691	12	421	4908	376647	217813	Primary health ...	Medical
11692	12	421	5325	977868	217894	COMMUNITY ...	Medical
11693	12	3	6375	374122	201101	Primary health ...	Medical
11694	12	576	2742	417623	416323	Vetarnary Hospi...	Medical
11695	12	3	1555	924644	418663	Primary Helth ...	Medical
11696	12	576	1574	239429	367672	phc kakadkuva	Medical
11697	12	576	1574	90910	368723	veterinary hosp...	Medical
11698	12	451	1615	1083915	420752	Sub Health Cen...	Medical

So, from attribute table we can say that there are **3732** Medical facilities in Gujarat.

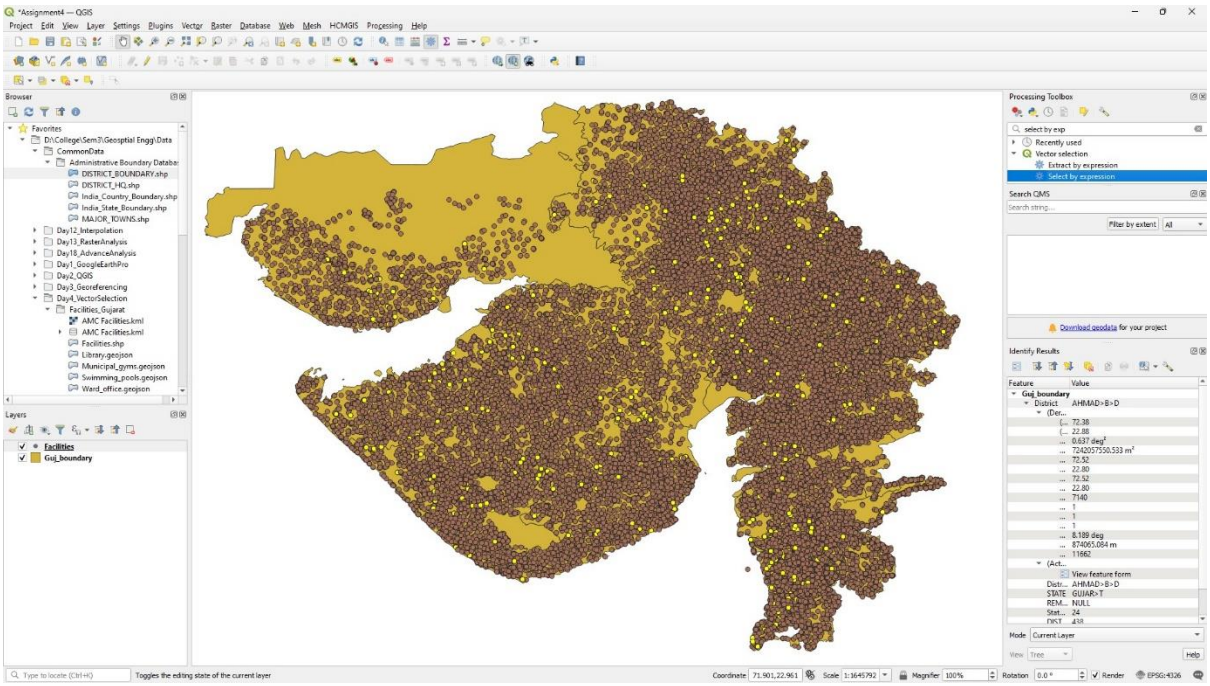
2. How many bank facilities are available in Gujarat?

For calculating the number of bank facilities we need to check under Facility Description (FAC_DESC) attribute of the attribute table. Also, we need to whether the value contains the keyword Bank in it. So, we'll proceed by choosing **Select by Expression** and enter the below values,

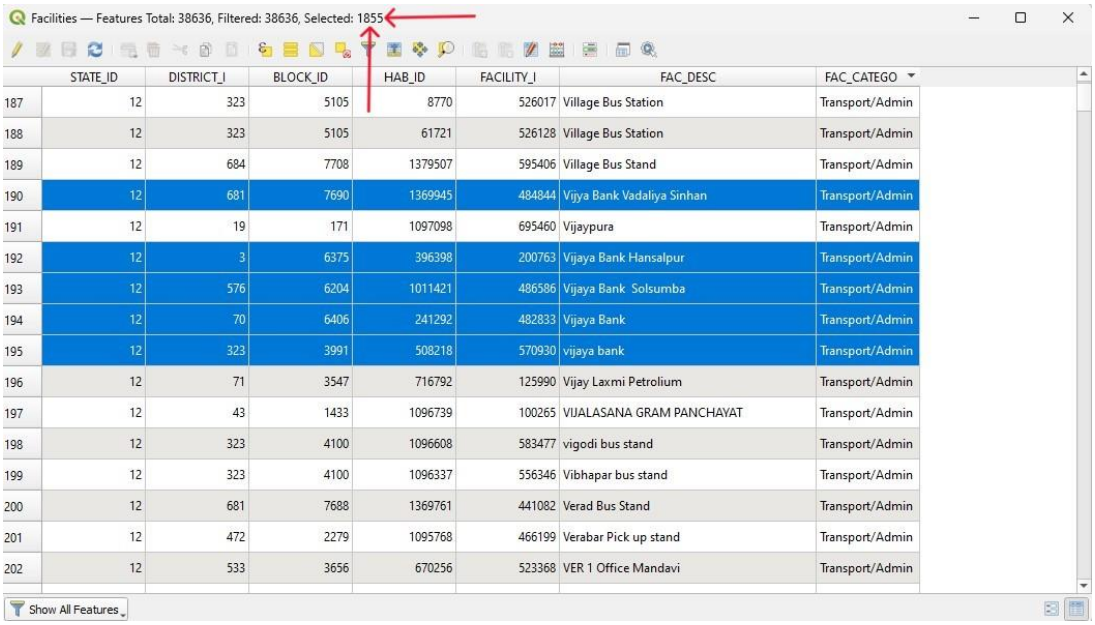


The expression $lower(\text{"FAC\_DESC"}) LIKE\ '\%bank\%'$ will firstly convert all the value to lower case (to also consider Case Sensitive elements) and then check for the keyword bank in it.

After we hit the RUN button the bank facilities will be marked on the map with different colours.



We can refer to the attributes table to count the number of bank facilities.

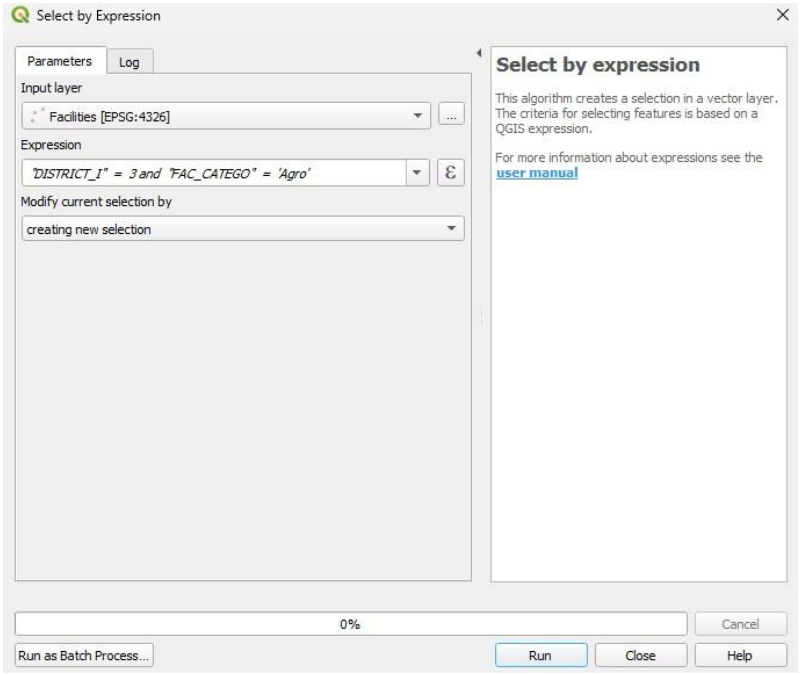


	STATE_ID	DISTRICT_I	BLOCK_ID	HAB_ID	FACILITY_I	FAC_DESC	FAC_CATEGO
187	12	323	5105	8770	526017	Village Bus Station	Transport/Admin
188	12	323	5105	61721	526128	Village Bus Station	Transport/Admin
189	12	684	7708	1379507	595406	Village Bus Stand	Transport/Admin
190	12	681	7690	1369945	484844	Vijya Bank Vadaliya Sinhan	Transport/Admin
191	12	19	171	1097098	695460	Vijaypura	Transport/Admin
192	12	3	6375	396398	200763	Vijaya Bank Hansalpur	Transport/Admin
193	12	576	6204	1011421	486586	Vijaya Bank Solsumba	Transport/Admin
194	12	70	6406	241292	482833	Vijaya Bank	Transport/Admin
195	12	323	3991	508218	570930	vijaya bank	Transport/Admin
196	12	71	3547	716792	125990	Vijay Laxmi Petrolium	Transport/Admin
197	12	43	1433	1096739	100265	VIJALASANA GRAM PANCHAYAT	Transport/Admin
198	12	323	4100	1096608	583477	vigodi bus stand	Transport/Admin
199	12	323	4100	1096337	556346	Vibhapar bus stand	Transport/Admin
200	12	681	7688	1369761	441082	Verad Bus Stand	Transport/Admin
201	12	472	2279	1095768	466199	Verabar Pick up stand	Transport/Admin
202	12	533	3656	670256	523368	VER 1 Office Mandavi	Transport/Admin

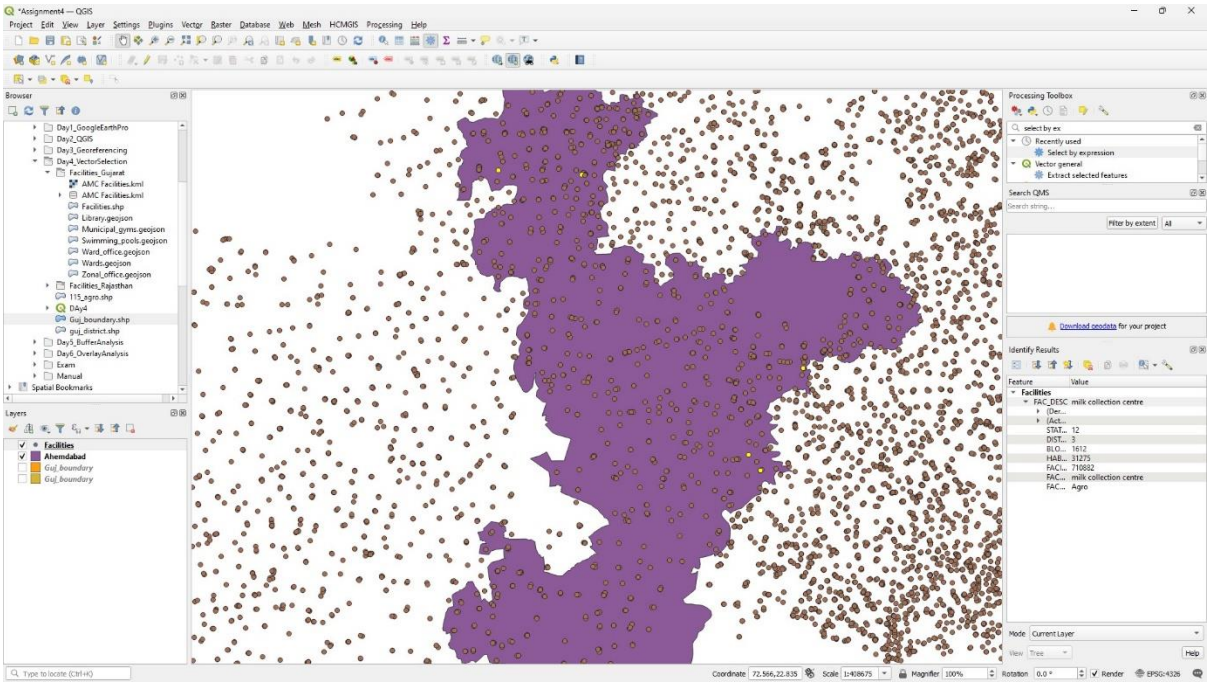
So, from attribute table we can say that there are **1855** Bank facilities in Gujarat.

3. How many agro facilities are available in the Ahmedabad district?

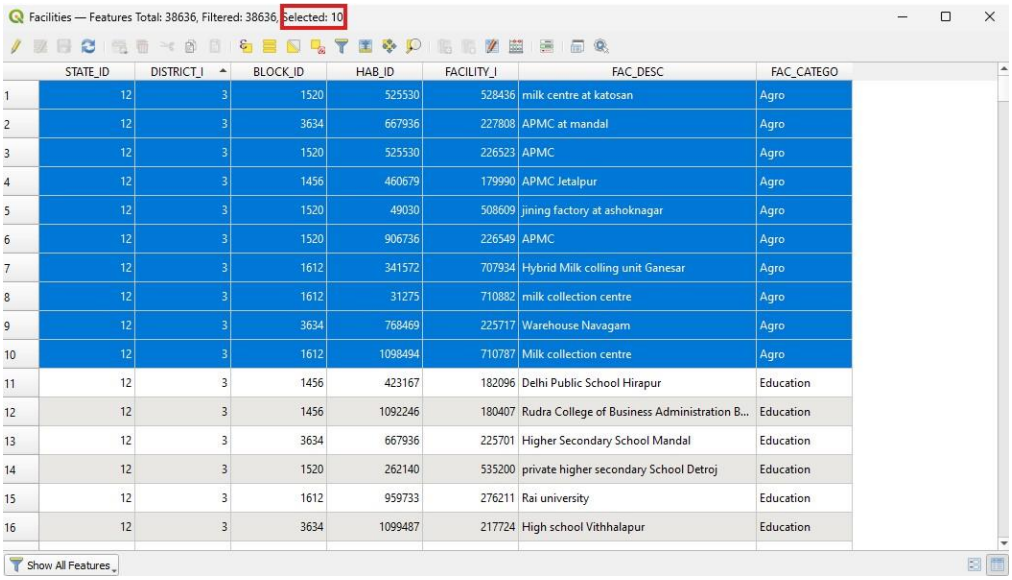
To calculate the number of agro facilities in the Ahmedabad district, we'll use the Select by Expression option and use the expression "DISTRICT" $= 3$ *and* "FAC_CATEGO" $= 'Agro'$ for selecting the data.



Then we overlay the data on Ahmedabad map. The agro facilities are shown in the map below,



To check the count of total number of agro facilities in the area we'll check the Attribute Table, here is how the Attribute table look like,



Facilities — Features Total: 38636, Filtered: 38636, Selected: 10

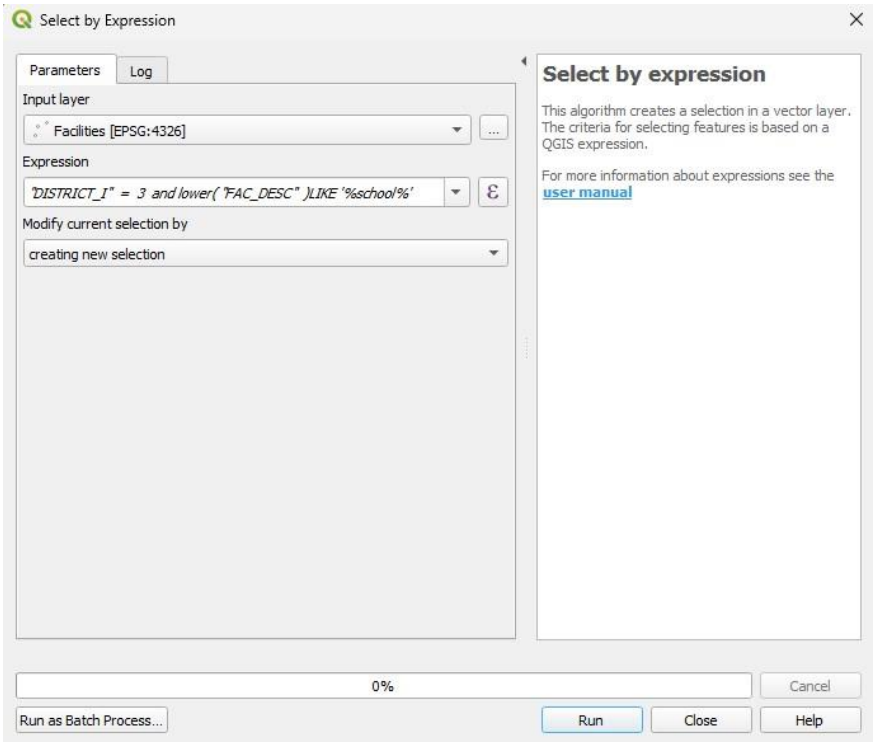
	STATE_ID	DISTRICT_I	BLOCK_ID	HAB_ID	FACILITY_I	FAC_DESC	FAC_CATEGO
1	12	3	1520	525530	528436	milk centre at katosan	Agro
2	12	3	3634	667936	227808	APMC at mandal	Agro
3	12	3	1520	525530	226523	APMC	Agro
4	12	3	1456	460679	179990	APMC Jetalpur	Agro
5	12	3	1520	49030	508609	jining factory at ashoknagar	Agro
6	12	3	1520	906736	226549	APMC	Agro
7	12	3	1612	341572	707934	Hybrid Milk colling unit Ganesar	Agro
8	12	3	1612	31275	710882	milk collection centre	Agro
9	12	3	3634	768469	225717	Warehouse Navagam	Agro
10	12	3	1612	1098494	710787	Milk collection centre	Agro
11	12	3	1456	423167	182096	Delhi Public School Hirapur	Education
12	12	3	1456	1092246	180407	Rudra College of Business Administration B...	Education
13	12	3	3634	667936	225701	Higher Secondary School Mandal	Education
14	12	3	1520	262140	535200	private higher secondary School Detroj	Education
15	12	3	1612	959733	276211	Rai university	Education
16	12	3	3634	1099487	217724	High school Vithhalapur	Education

Show All Features

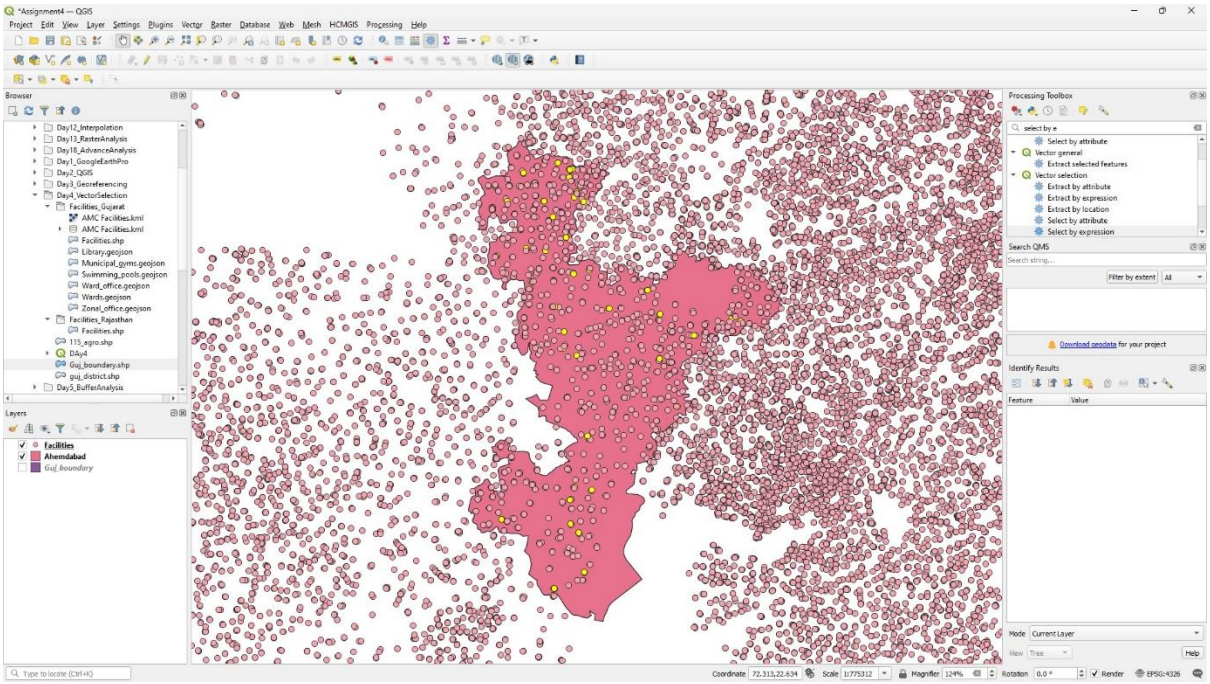
From the attribute table we know that there are **10** Agro facilities in Ahemdabad.

4. How many schools are available in the Ahmedabad district?

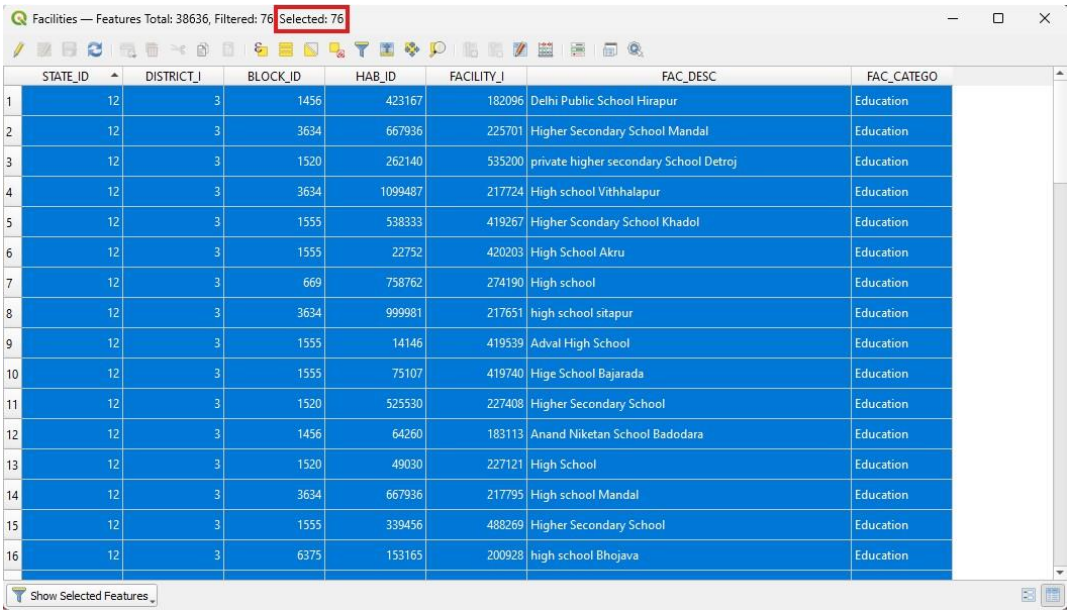
To calculate the number of School facilities in the Ahmedabad district which can be selected by Education in FAC_CATEGO. So, we'll use the Select by Expression option and use the expression "DISTRICT" = 3 *and lower*("FAC_DESC")*LIKE* '%*school*%' for selecting the data.



Here is the overlay of the data on the Ahmedabad map,



To know the count, we head towards the Attribute table,

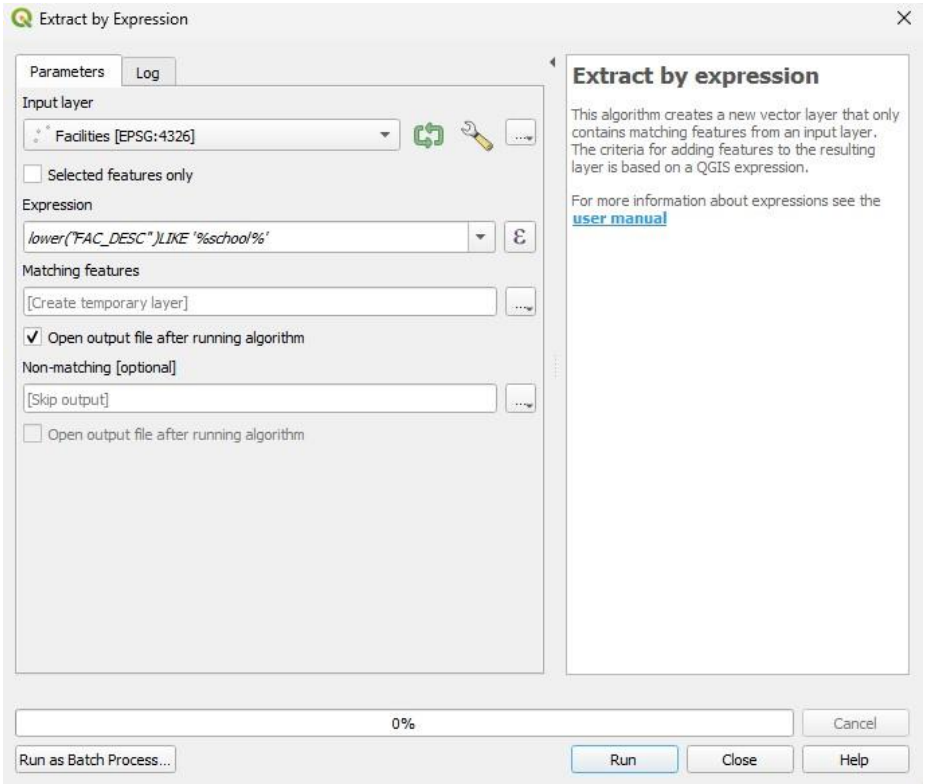


	STATE_ID	DISTRICT_I	BLOCK_ID	HAB_ID	FACILITY_I	FAC_DESC	FAC_CATEGO
1	12	3	1456	423167	182096	Delhi Public School Hirapur	Education
2	12	3	3634	667936	225701	Higher Secondary School Mandal	Education
3	12	3	1520	262140	535200	private higher secondary School Detroj	Education
4	12	3	3634	1099487	217724	High school Vithhalapur	Education
5	12	3	1555	538333	419267	Higher Scondary School Khadol	Education
6	12	3	1555	22752	420203	High School Akru	Education
7	12	3	669	758762	274190	High school	Education
8	12	3	3634	999981	217651	high school sitapur	Education
9	12	3	1555	14146	419539	Adval High School	Education
10	12	3	1555	75107	419740	Hige School Bajarada	Education
11	12	3	1520	525530	227408	Higher Secondary School	Education
12	12	3	1456	64260	183113	Anand Niketan School Badodara	Education
13	12	3	1520	49030	227121	High School	Education
14	12	3	3634	667936	217795	High school Mandal	Education
15	12	3	1555	339456	488269	Higher Secondary School	Education
16	12	3	6375	153165	200928	high school Bhojava	Education

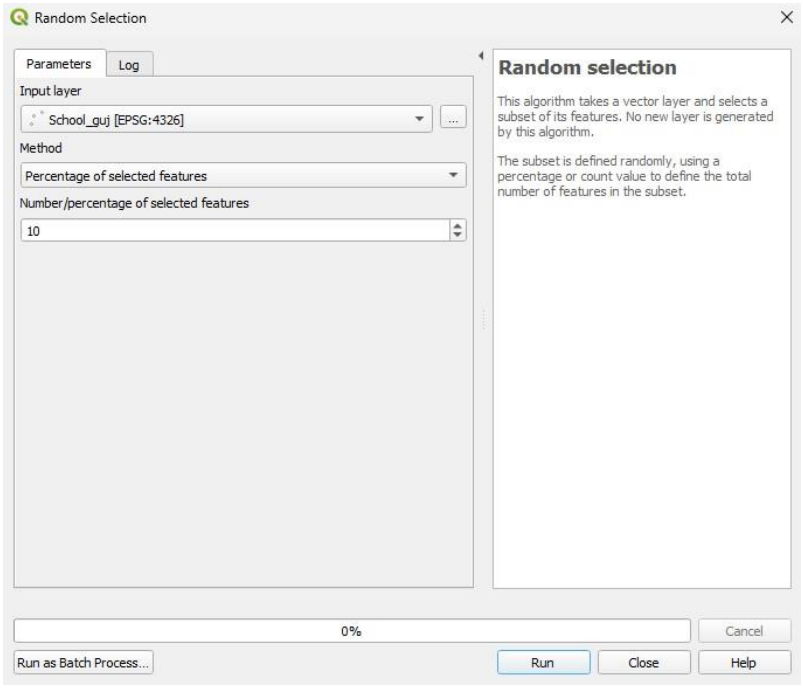
From attribute table data we know that there are **76** schools in Ahmedabad district.

5. Select 10% random schools in Gujarat for the upcoming inspection of the Swachh Bharat Mission.

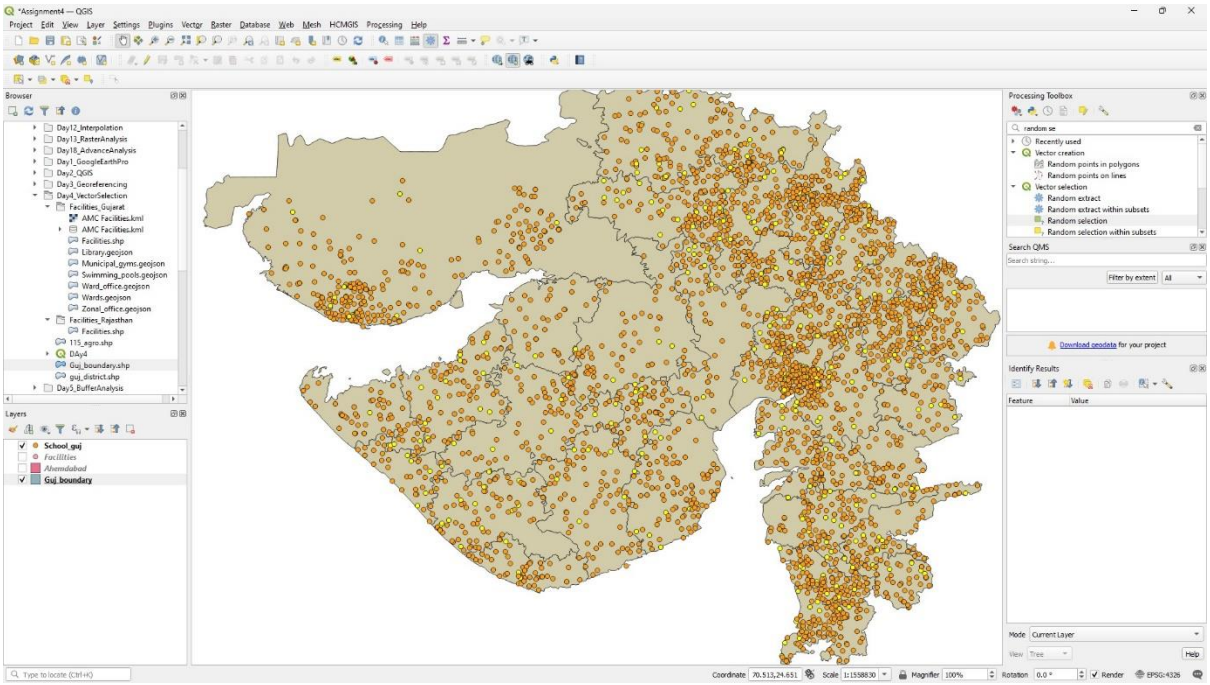
First of all, let's extract the schools data from the Facilities layer by using Extract by Expression and put the expression $lower(\text{"FAC\_DESC"}) LIKE\ '\%school\%'$ to extract all the schools.



So now we can use Random Selection option to randomly select 10 % schools for upcoming inspection of the Swachh Bharat Mission.



Also, we can visualize the randomly selected schools by overlaying them on the State Map,



Also, from Attribute Table we can see that from 3631 schools 363 schools are selected by random.

School_guj — Features Total: 3631, Filtered: 363, Selected: 363

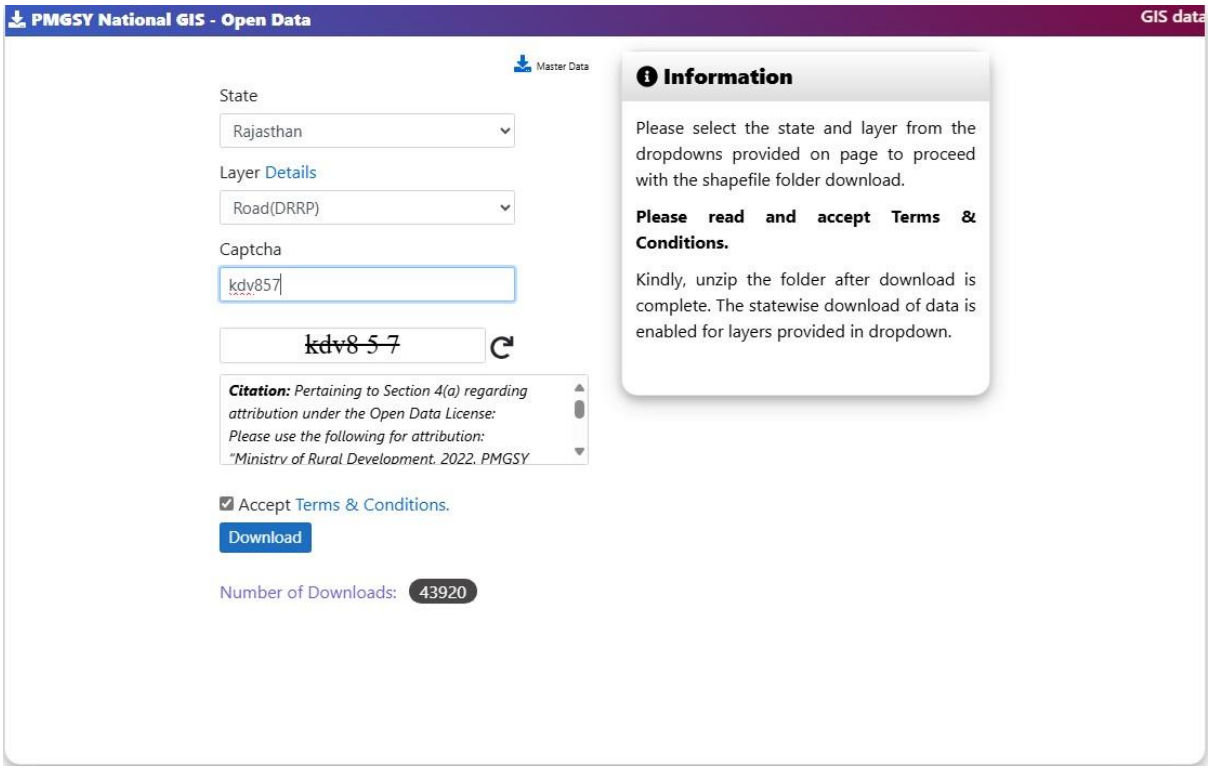
	STATE_ID	DISTRICT_I	BLOCK_ID	HAB_ID	FACILITY_I	FAC_DESC	FAC_CATEGO
1	12	3	1456	423167	182096	Delhi Public Sc...	Education
2	12	421	4593	260972	246238	DER HIGHSCH...	Education
3	12	43	4452	334291	85832	SHRIMATI VIML...	Education
4	12	43	1496	259210	82590	Model School	Education
5	12	43	2728	317233	82773	Shri Dugrasan ...	Education
6	12	43	1556	664430	84211	Adarsh Second...	Education
7	12	680	7684	1369468	431231	secondry or hig...	Education
8	12	363	2568	685875	536068	b h patel h s sc...	Education
9	12	247	1618	717028	501708	Mota Garediya ...	Education
10	12	17	372	1084418	495305	High School JU...	Education
11	12	262	3671	84733	528112	HIGHER SECON...	Education
12	12	262	3671	205039	528146	AIYUBI EDUCAT...	Education
13	12	19	1041	648336	702558	Primary School ...	Education
14	12	43	1496	259210	82679	Govt Higher Se...	Education
15	12	3	3634	1099487	217724	High school Vit...	Education
16	12	472	2213	416309	404963	Smt S R Shah H...	Education

Show Selected Features

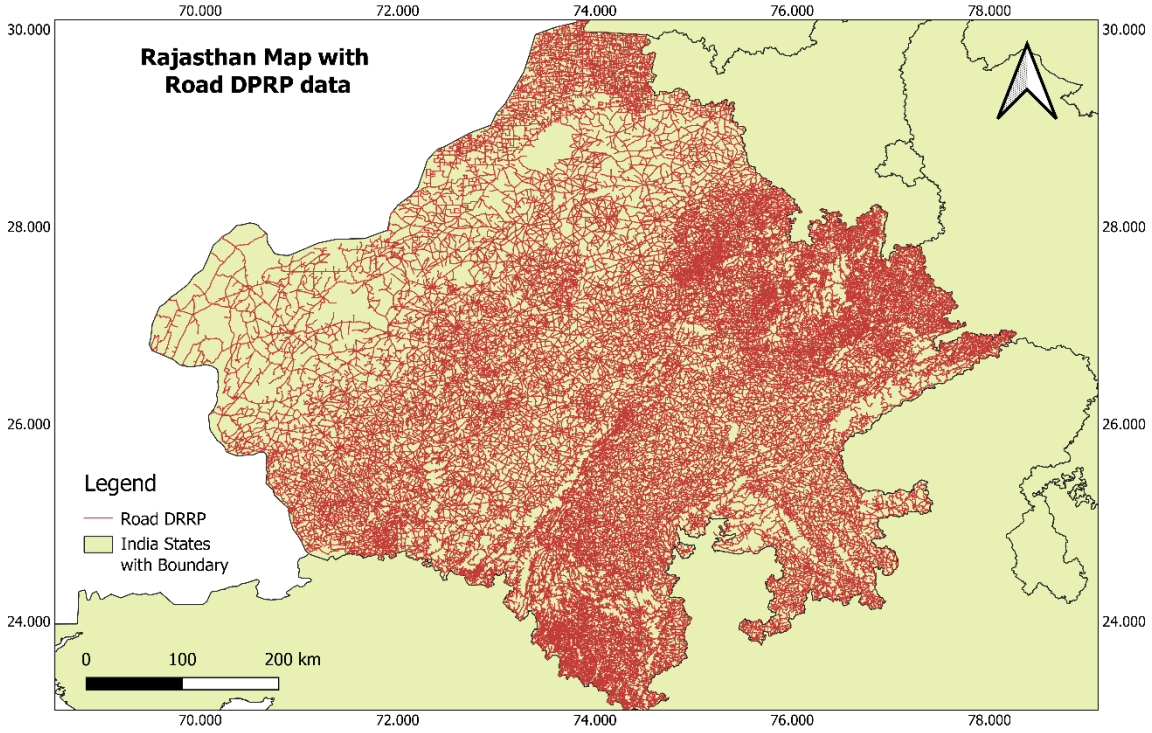
Plan your own analysis:

- **Download any line, point, or polygon data from the internet.**

For this part of the question, I have used this website [PMGSY National GIS - Open Data PMGSY GeoSadak (geosadak-pmgsy.nic.in)](geosadak-pmgsy.nic.in) to download the Road (DRRP) data of state **Rajasthan**.



Also you can directly download the data from this link.
Here is how the imported data look like,

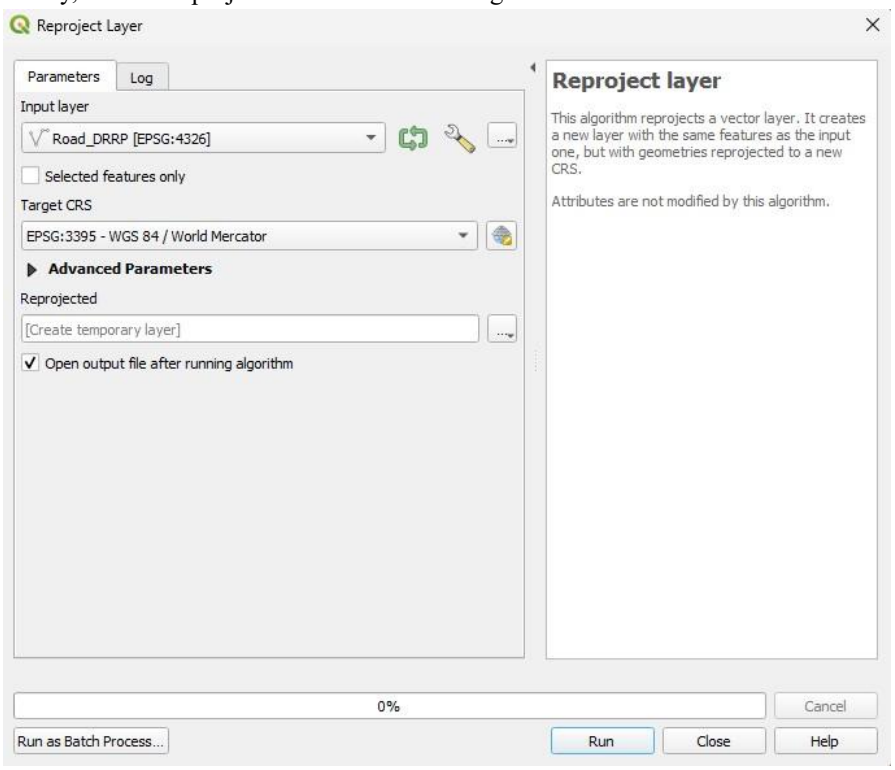


- **Frame a question that involves the use of vector selection and buffer analysis.**

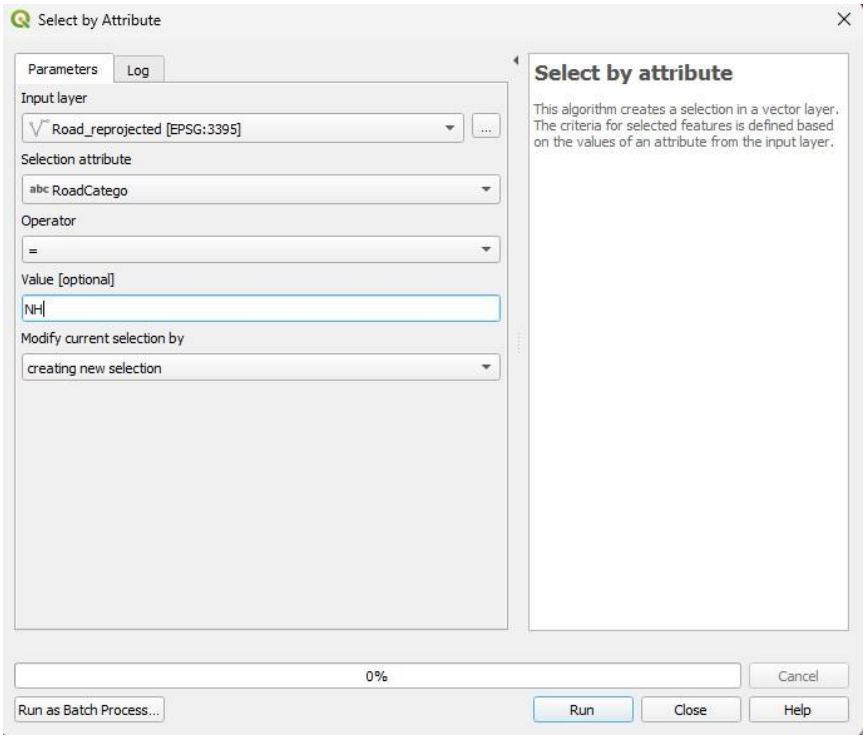
I have framed the question as,

Which major district roads (MDR) fall within a 5 km buffer of national highways (NH) in Rajasthan?

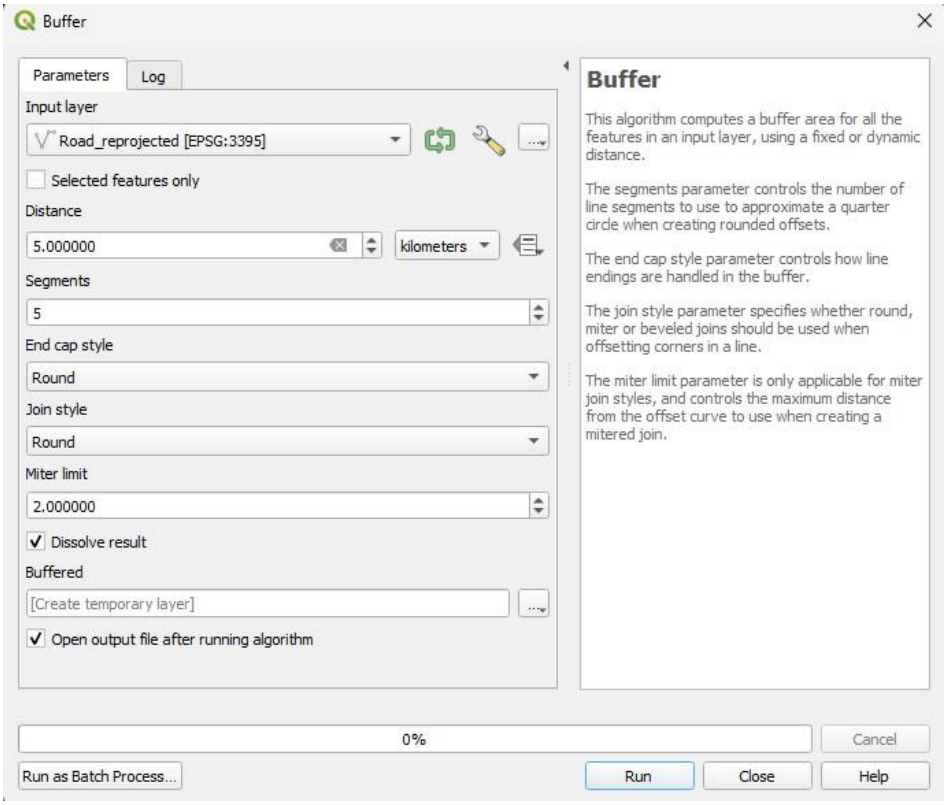
Firstly, we will reproject the data as it is in degrees as we want to create 5Km buffer.



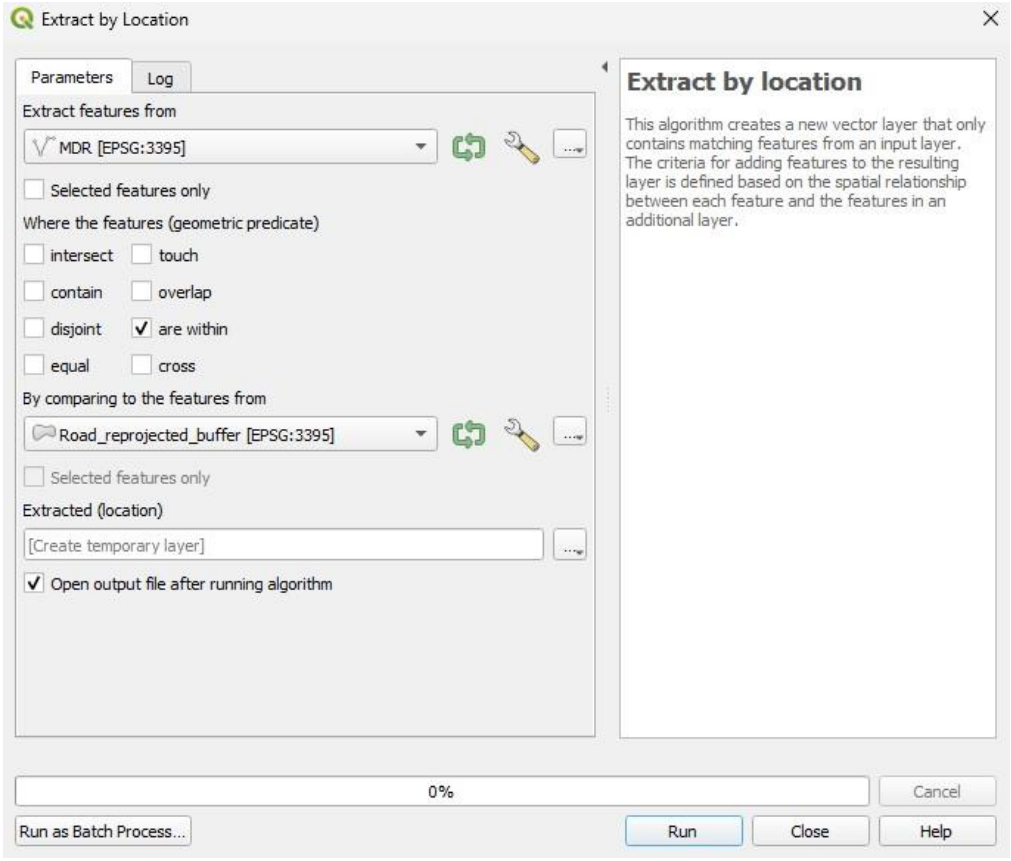
First, use Select by Attribute to filter for roads in the RoadCatego NH.



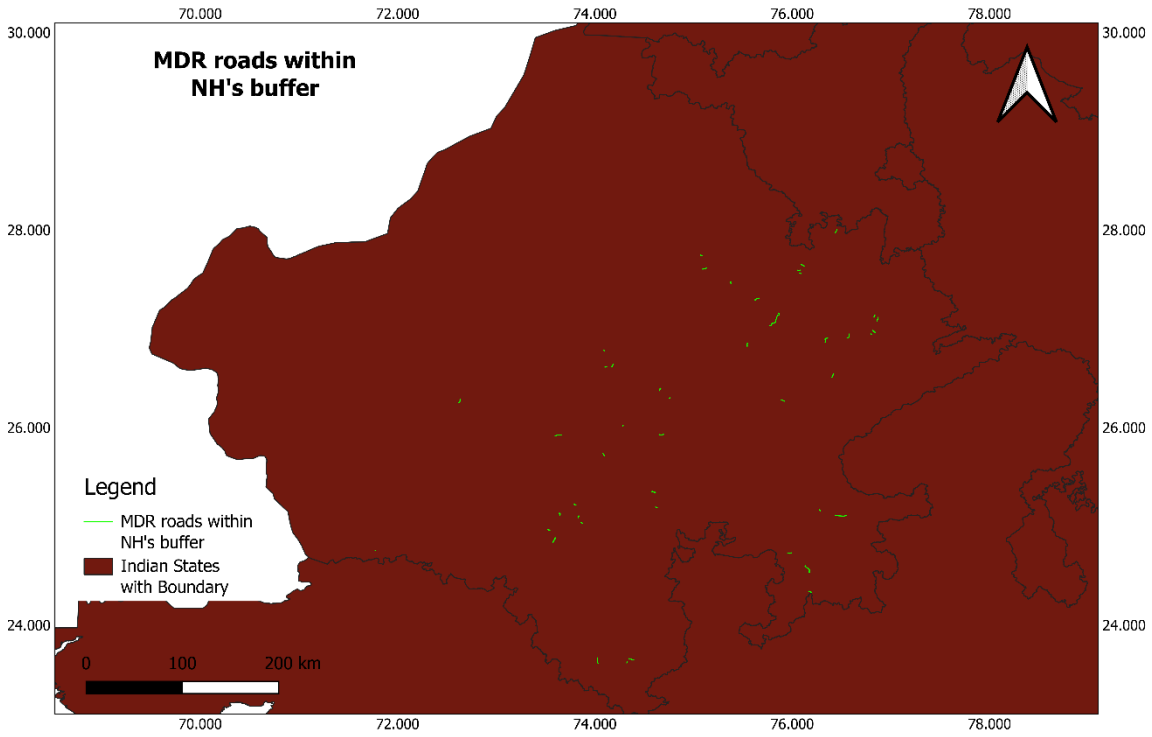
Then, we will create a buffer of 5 km,



Once the buffer is created, we will extract the MDR roads within the buffer region by using Extract by Location.



And finally we can visualize the major district roads (MDR) fall within a 5 km buffer of national highways (NH) in Rajasthan,



- **Write a 100-word note on the selected topic.**

  This analysis aims to identify which major district roads (MDR) in Rajasthan fall within a 5 km buffer of national highways (NH). By creating a buffer around NH, we can evaluate the proximity of MDR roads to larger transportation routes. This proximity is important for improving connectivity, ensuring that smaller district roads link efficiently to major highways, facilitating smoother travel across regions. The results of this analysis can aid infrastructure planning, allowing for better allocation of resources to road maintenance and development. This is essential for enhancing local mobility, supporting regional economic activities, and improving access to essential services. This also represent the overall the development of the area.