Tutorial for mapping Census 2016 data in Qgis by census tracts

Skills you will learn: How to join a Census 2016 map layer to a Census 2016 non-map layer, based on a common joining field shared by the two tables. The data behind the joined table and the location of the census tracts can be analysed for newsworthy trends.

If you are unfamiliar with the basic functionality of QGIS, such as how to add map layers and other data tables to the map document, please review the tutorial **A Quick Tour of QGIS Desktop**, which you can access by clicking here.

We will be using version 2.18.7. If you're using a different version, there may be some minor differences in the interface, but the functionality remains the same.

Getting started

Census tracts (CTs) are among the smallest of geographic areas that have populations between 2,500 and 8,000 people. The tracts allow journalists looking for Census-related stories to see patterns at the neighborhood level. Census tracts are located in cities, also known as census metropolitan areas, of more than 100,000.

Statistics Canada points out the many ways in which census tracts and the data inside can be used: municipalities evaluating and revising their officials plans; high schools and post-secondary institutions conducting research; companies evaluating areas to conduct marketing campaigns, build recreational facilities or retail outlets. Journalists can use similar research techniques to find stories.

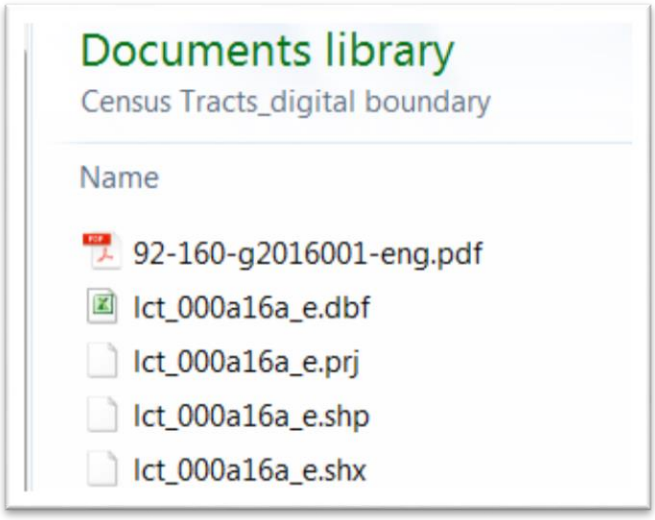
It is for these reasons that Statistics Canada's 2016 Census Program releases are extremely valuable. For instance, knowing the neighborhoods with the fastest growth rates in high- or low-income

earners, new housing or, in the case of this tutorial, visible minorities, allows newsrooms to know where to conduct interviews.

So, let's get started!

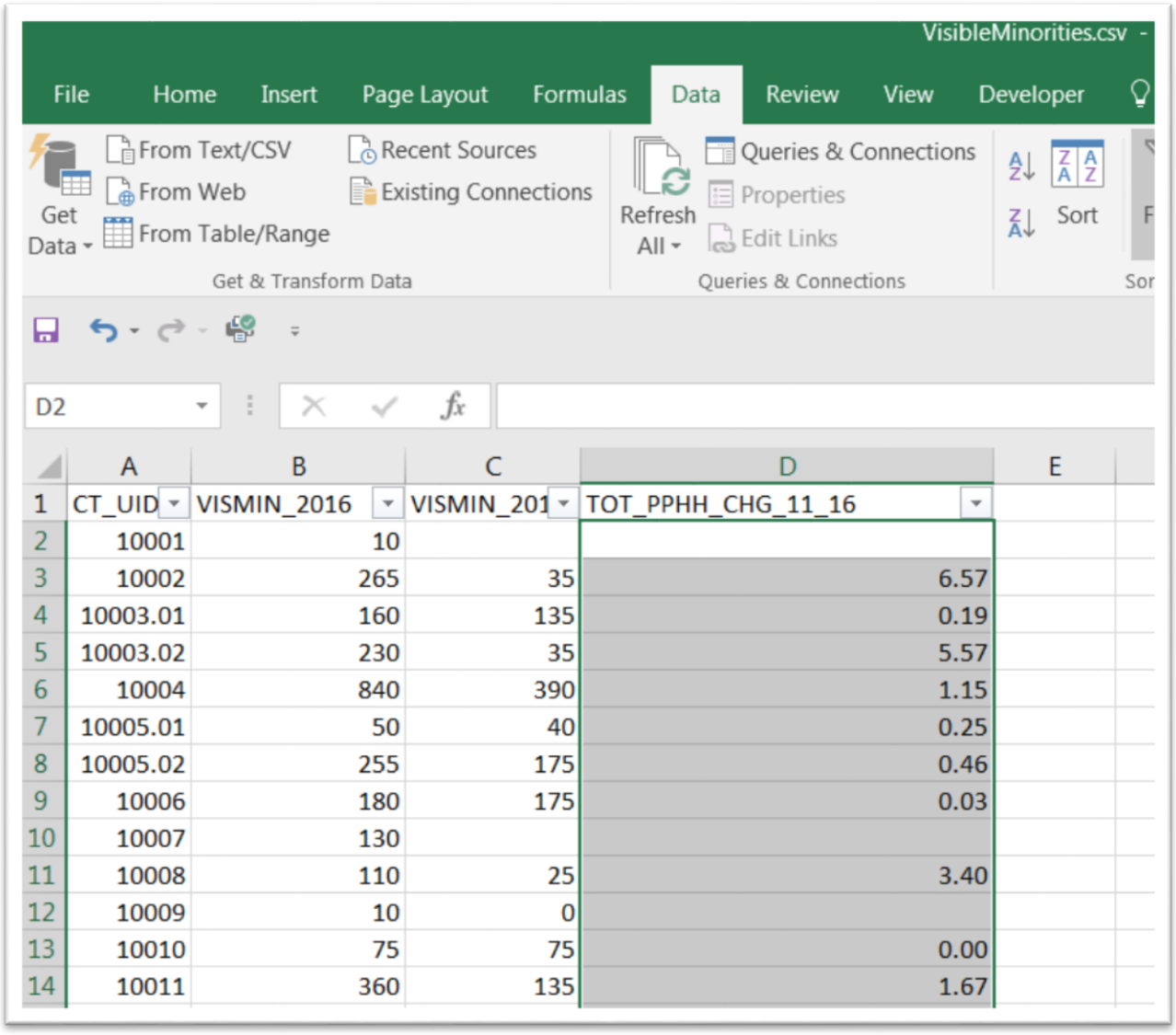
Add the map layer and the non-geographic layer to the data frame.

For the purposes of this illustration, we are using a shapefile of census tracts in Canada and a dataset of visible minorities from the 2016 census. To obtain the zip folder with these contents, please click here. Be sure to save the file in the folder for this tutorial. Once you've downloaded it into the folder, unzip the file, which will look like this:



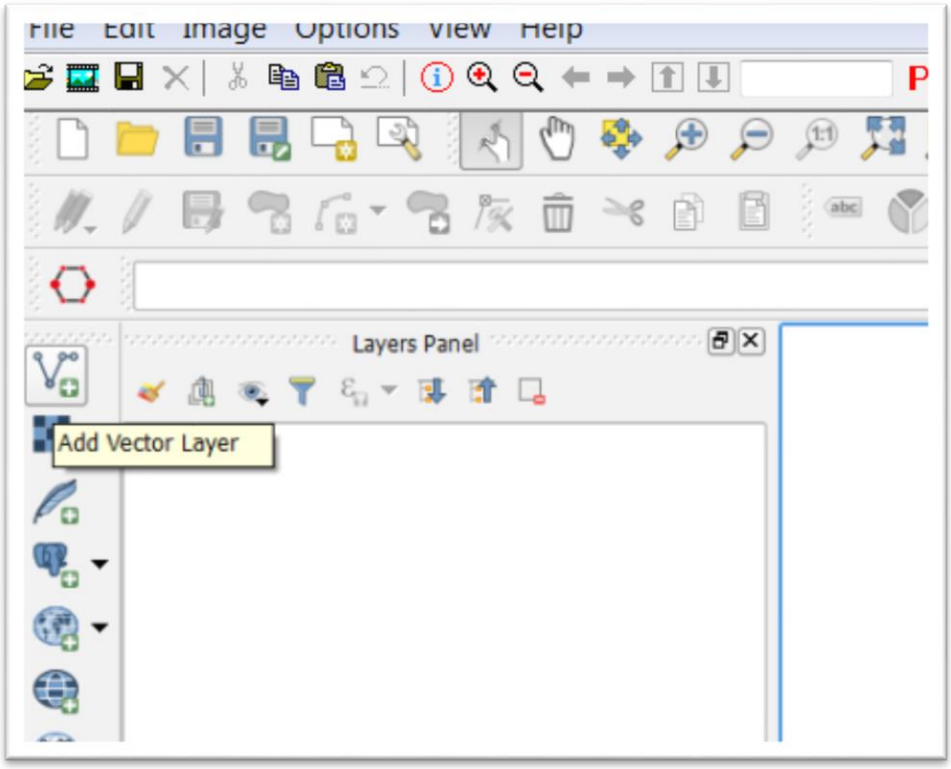
Page 121 of The Data Journalist explains the shape file and its component parts.

This is what the csv table looks like in the data table when we open it in Excel. You can download the table by clicking here. Be sure to save the file in the folder used for this tutorial.

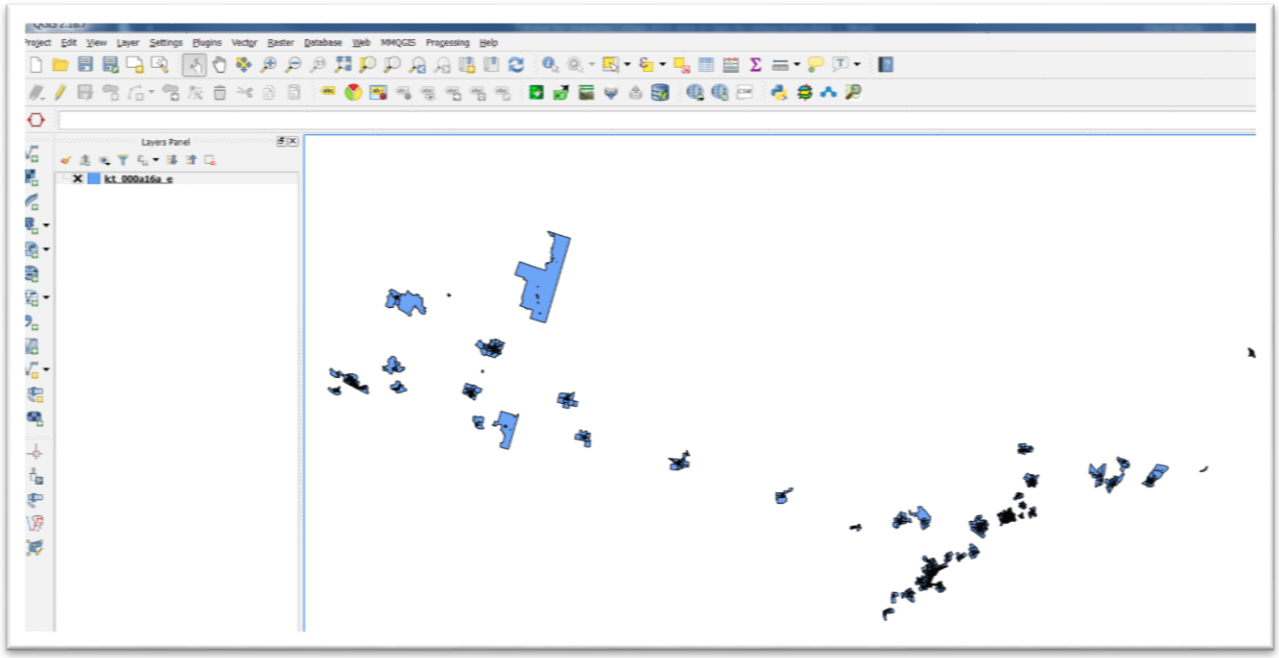


Importing files into QGIS

Open Qgis and select the “Add Vector Layer” icon.

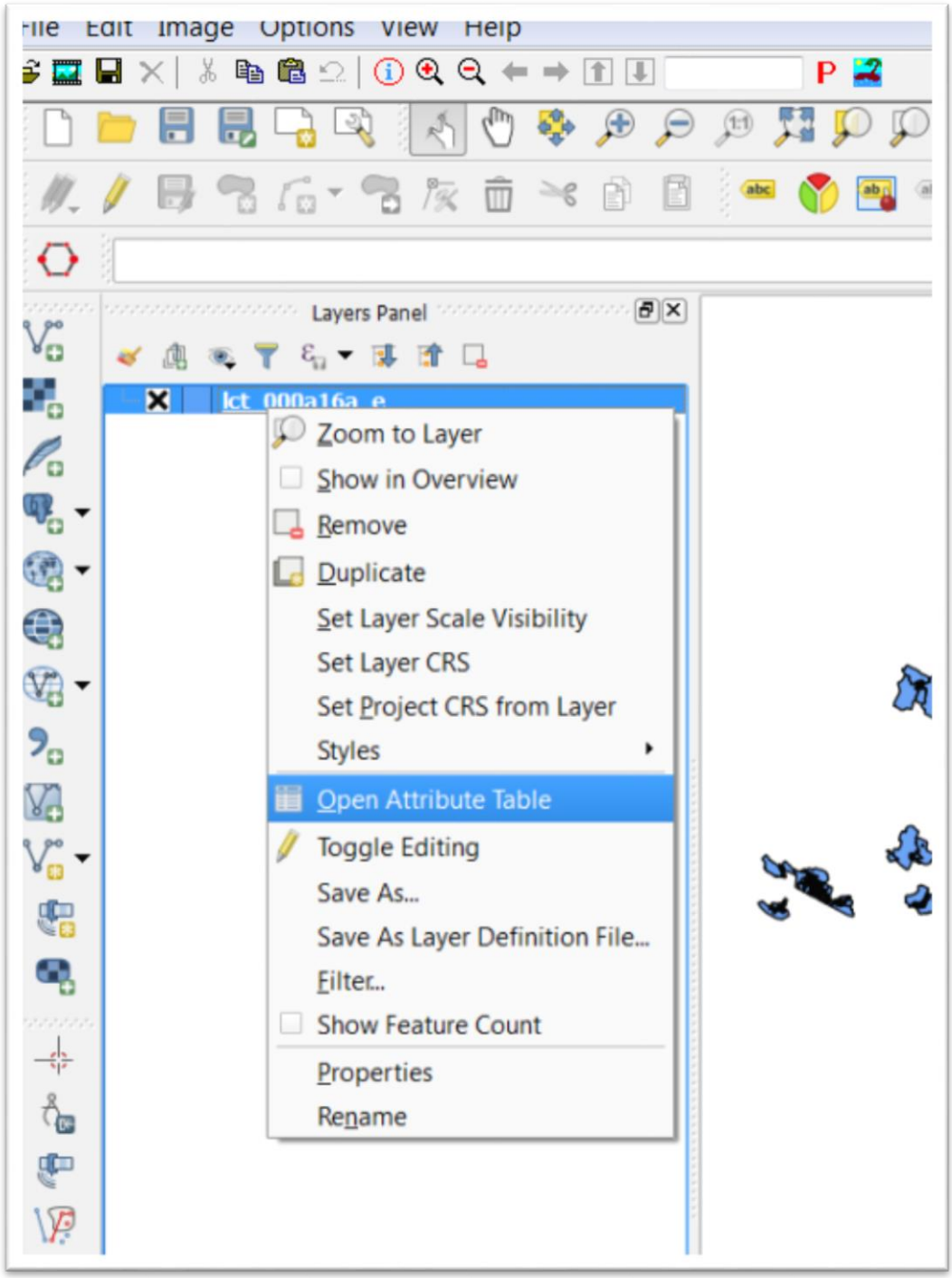


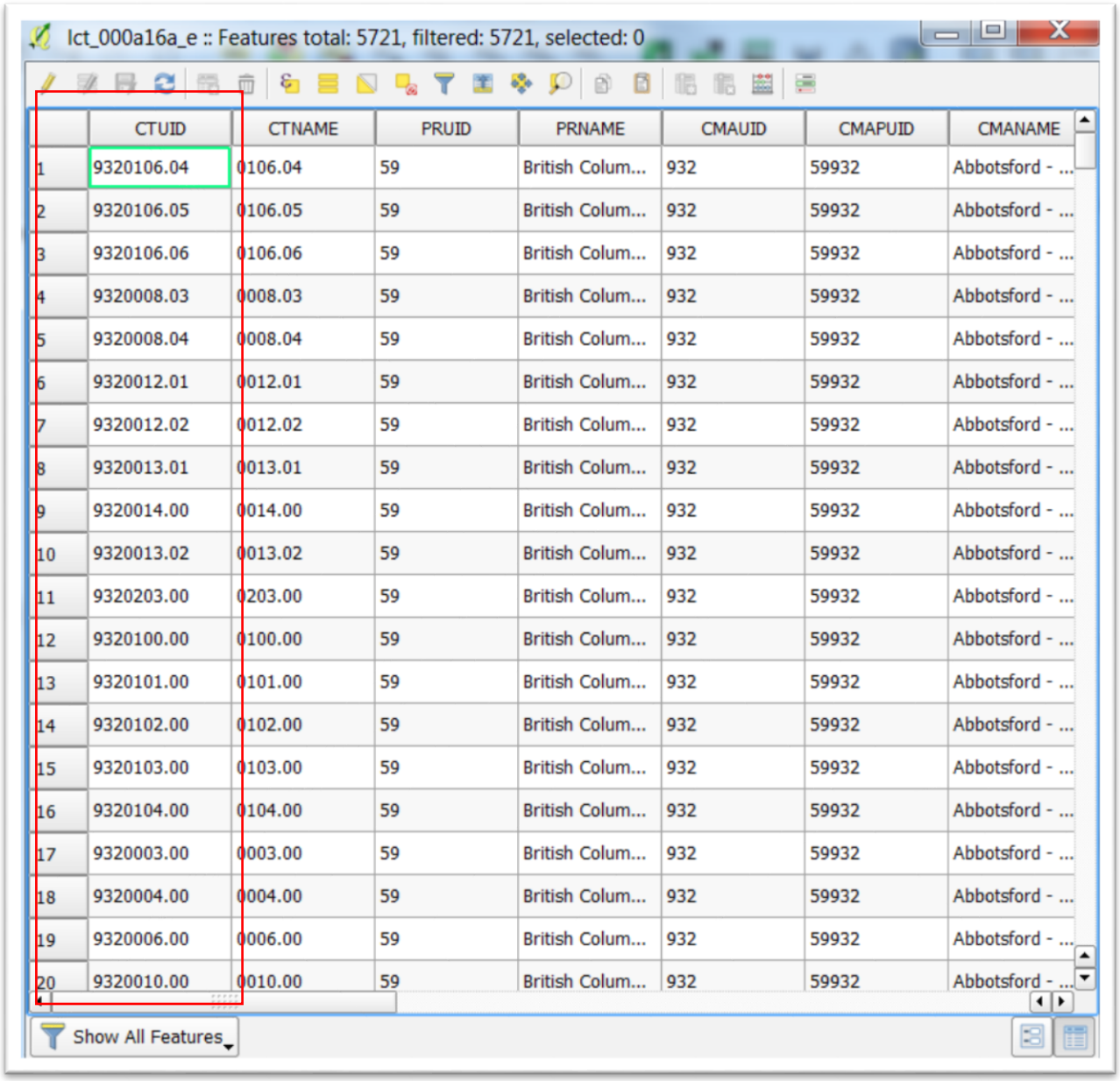
Browse to the folder that contains the shape file, and choose the layer with the ".shp" extension. Your layer will look like this:



Only parts of the country are represented. Remember, census tracts are geographic areas only located in the country's largest municipalities of more than 100,000 people.

To see the data behind the layer, right-click on its icon in the menu to the left, and select the "Open Attribute Table" from the shortcut menu.

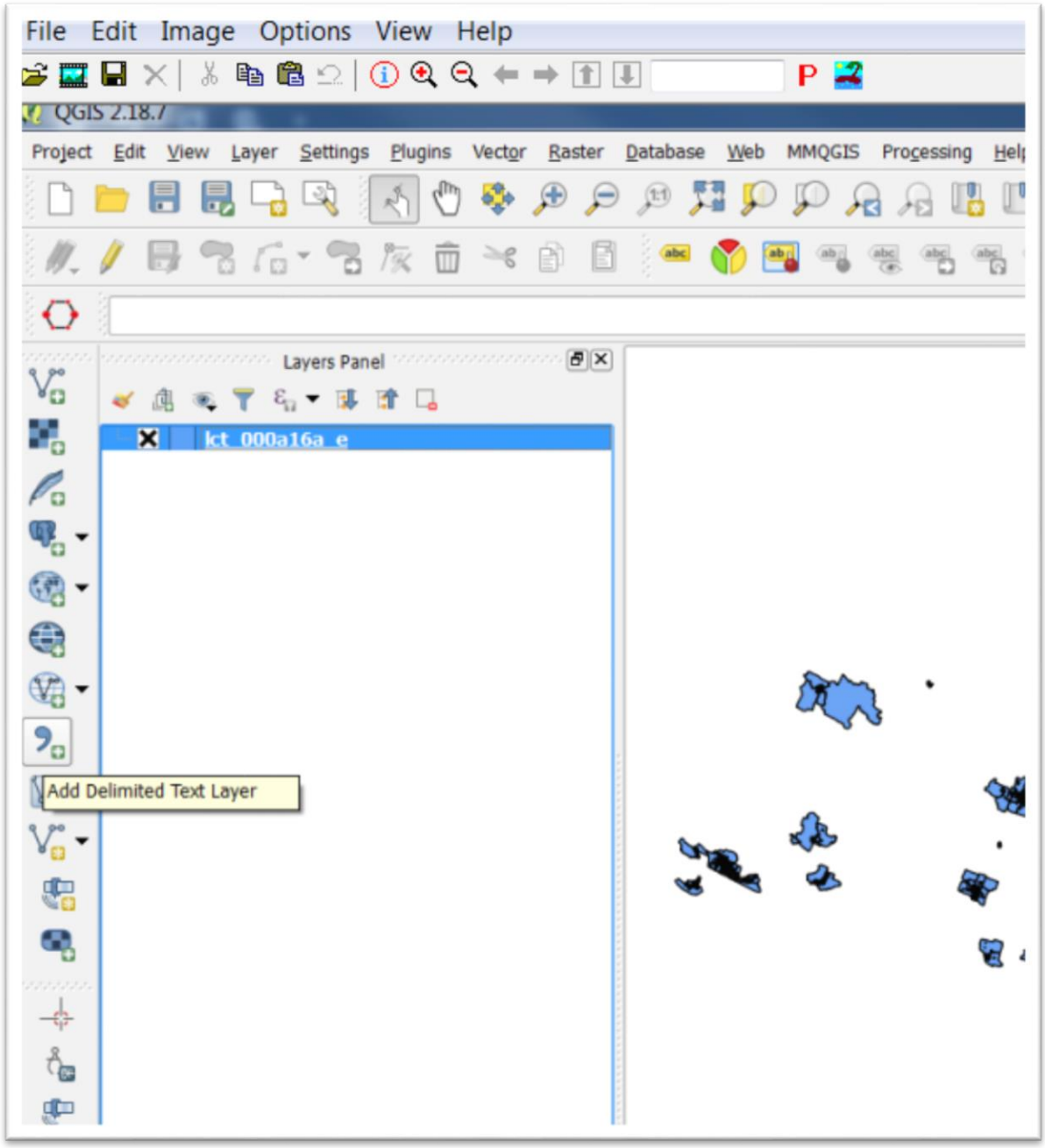

File Edit Image Options View Help
Layers Panel
Zoom to Layer
Show in Overview
Remove
Duplicate
Set Layer Scale Visibility
Set Layer CRS
Set Project CRS from Layer
Styles
Open Attribute Table
Toggle Editing
Save As...
Save As Layer Definition File...
Filter...
Show Feature Count
Properties
Rename

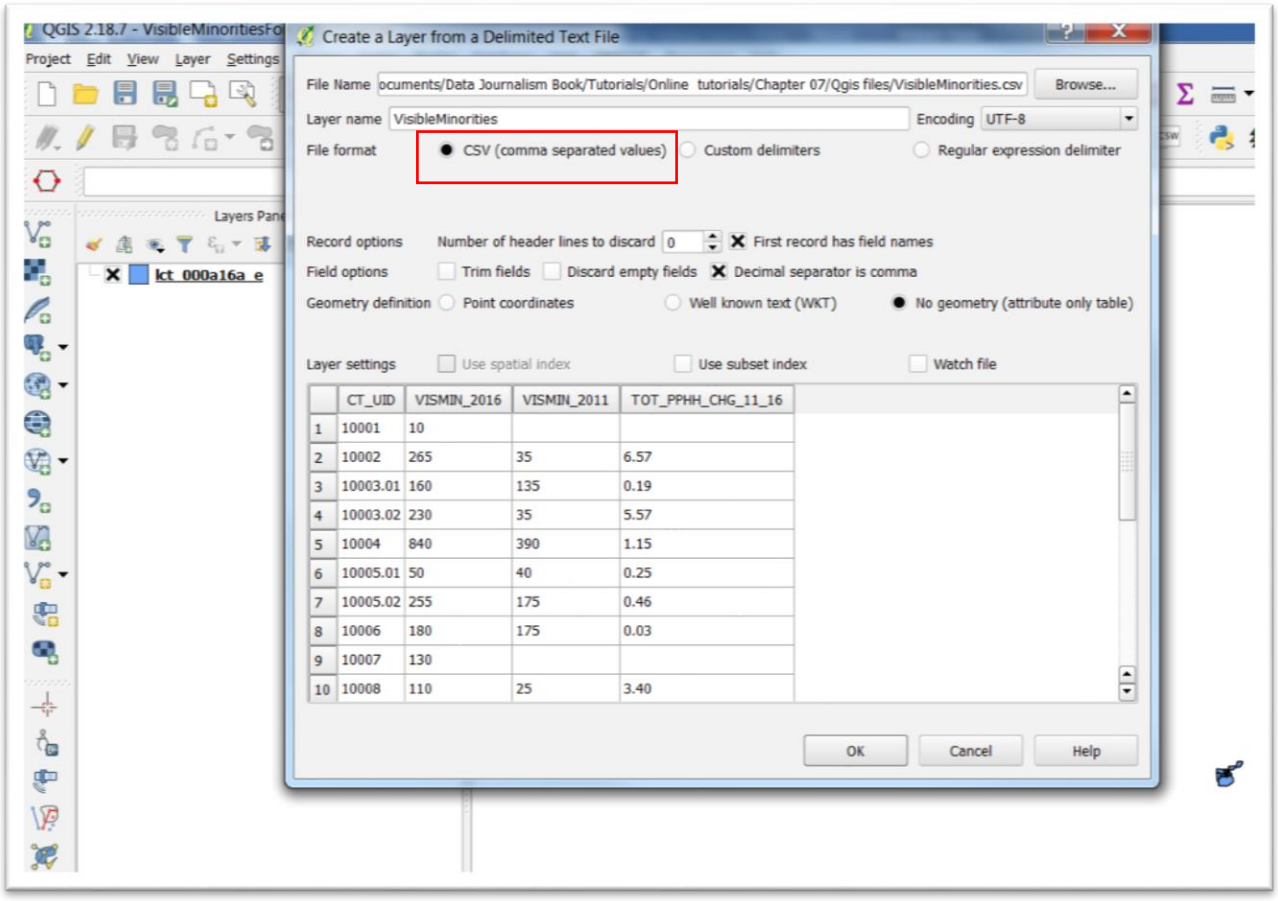


	CTUID	CTNAME	PRUID	PRNAME	CMAUID	CMAPUID	CMANAME
1	9320106.04	0106.04	59	British Colum...	932	59932	Abbotsford - ...
2	9320106.05	0106.05	59	British Colum...	932	59932	Abbotsford - ...
3	9320106.06	0106.06	59	British Colum...	932	59932	Abbotsford - ...
4	9320008.03	0008.03	59	British Colum...	932	59932	Abbotsford - ...
5	9320008.04	0008.04	59	British Colum...	932	59932	Abbotsford - ...
6	9320012.01	0012.01	59	British Colum...	932	59932	Abbotsford - ...
7	9320012.02	0012.02	59	British Colum...	932	59932	Abbotsford - ...
8	9320013.01	0013.01	59	British Colum...	932	59932	Abbotsford - ...
9	9320014.00	0014.00	59	British Colum...	932	59932	Abbotsford - ...
10	9320013.02	0013.02	59	British Colum...	932	59932	Abbotsford - ...
11	9320203.00	0203.00	59	British Colum...	932	59932	Abbotsford - ...
12	9320100.00	0100.00	59	British Colum...	932	59932	Abbotsford - ...
13	9320101.00	0101.00	59	British Colum...	932	59932	Abbotsford - ...
14	9320102.00	0102.00	59	British Colum...	932	59932	Abbotsford - ...
15	9320103.00	0103.00	59	British Colum...	932	59932	Abbotsford - ...
16	9320104.00	0104.00	59	British Colum...	932	59932	Abbotsford - ...
17	9320003.00	0003.00	59	British Colum...	932	59932	Abbotsford - ...
18	9320004.00	0004.00	59	British Colum...	932	59932	Abbotsford - ...
19	9320006.00	0006.00	59	British Colum...	932	59932	Abbotsford - ...
20	9320010.00	0010.00	59	British Colum...	932	59932	Abbotsford - ...

The first field is the one we will join to the layer that contains the data for visible minorities. Ten characters in length, a CTUID is a unique identifier for a census tract within a census metropolitan area.

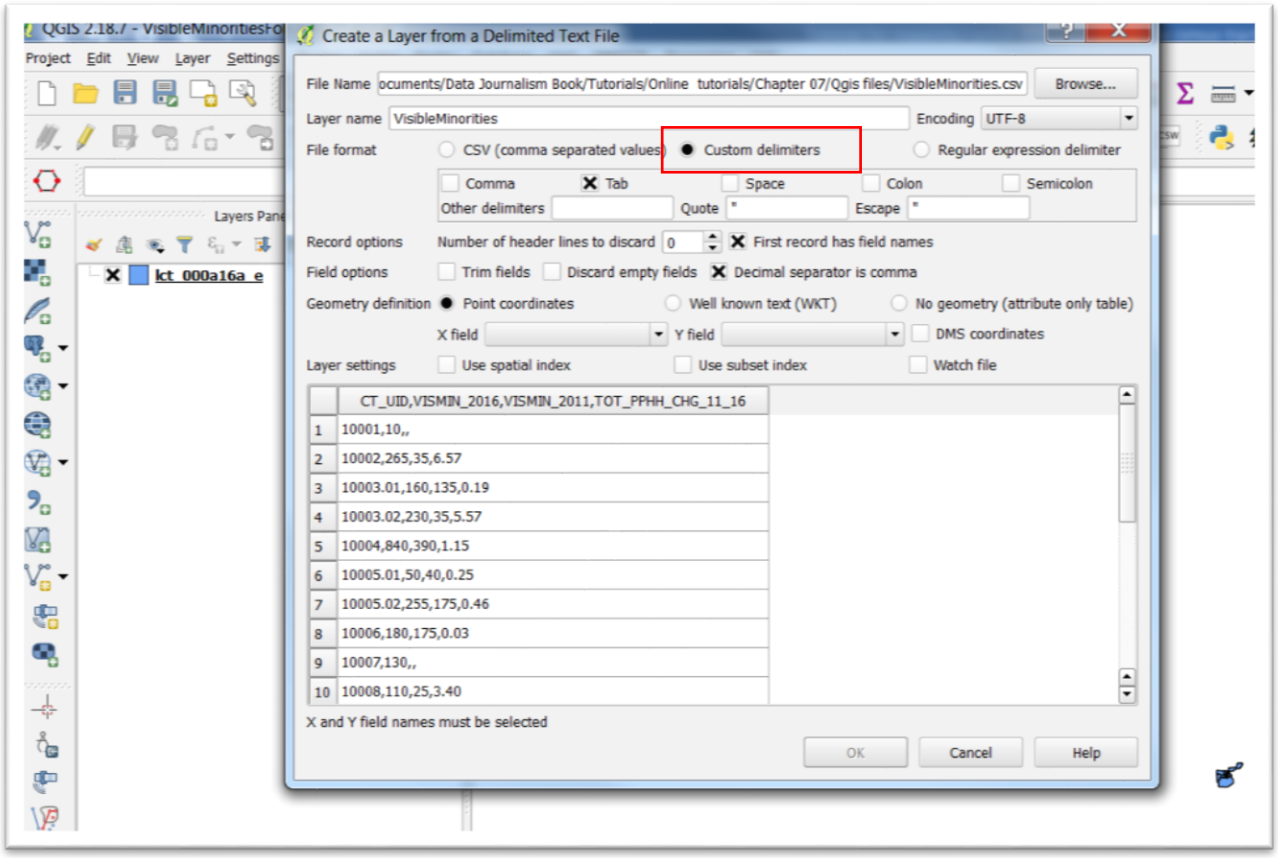
Close the attribute table. And use the “Add Delimited Text Layer” option to browse for, and then import our csv file.


File Edit Image Options View Help
QGIS 2.18.7
Project Edit View Layer Settings Plugins Vector Raster Database Web MMQGIS Processing Help
Layers Panel
lct_000a16a_e
Add Delimited Text Layer

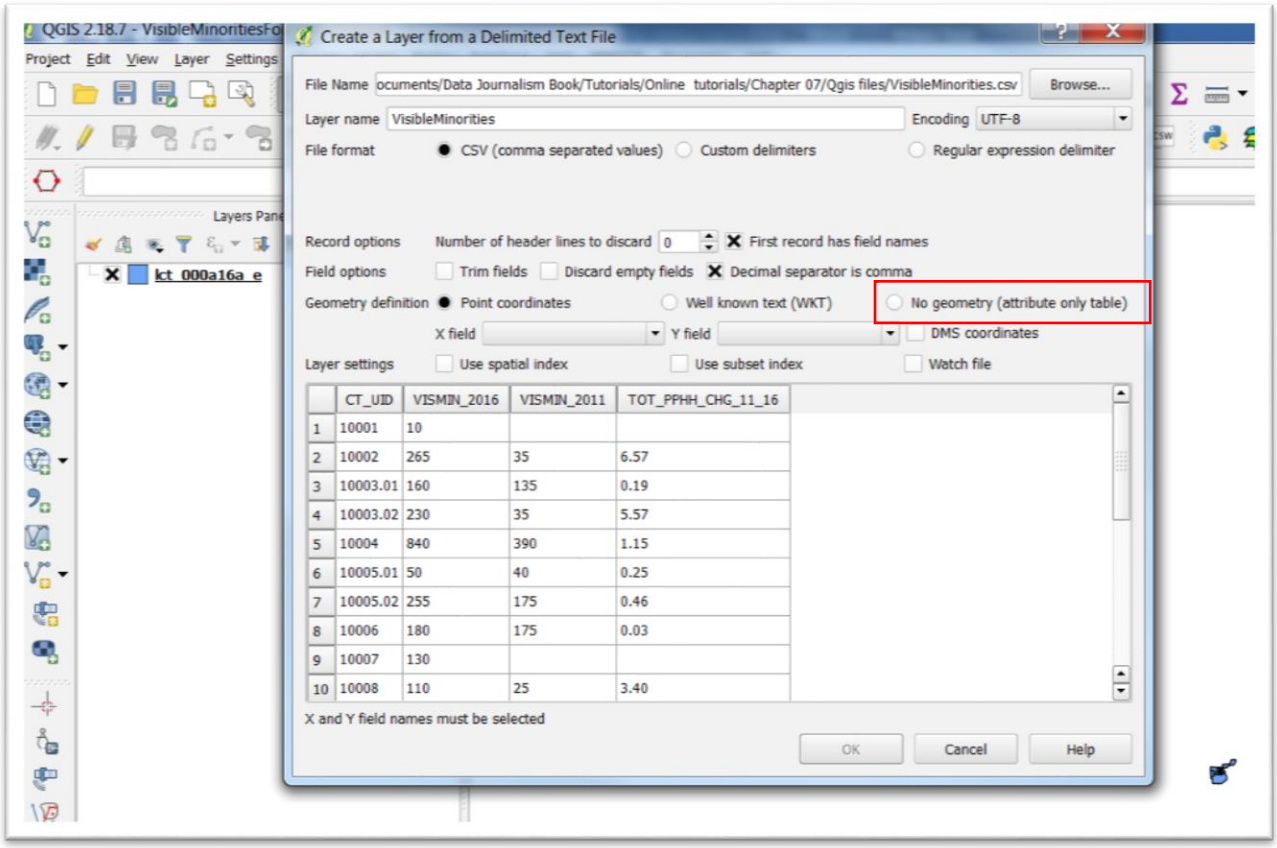


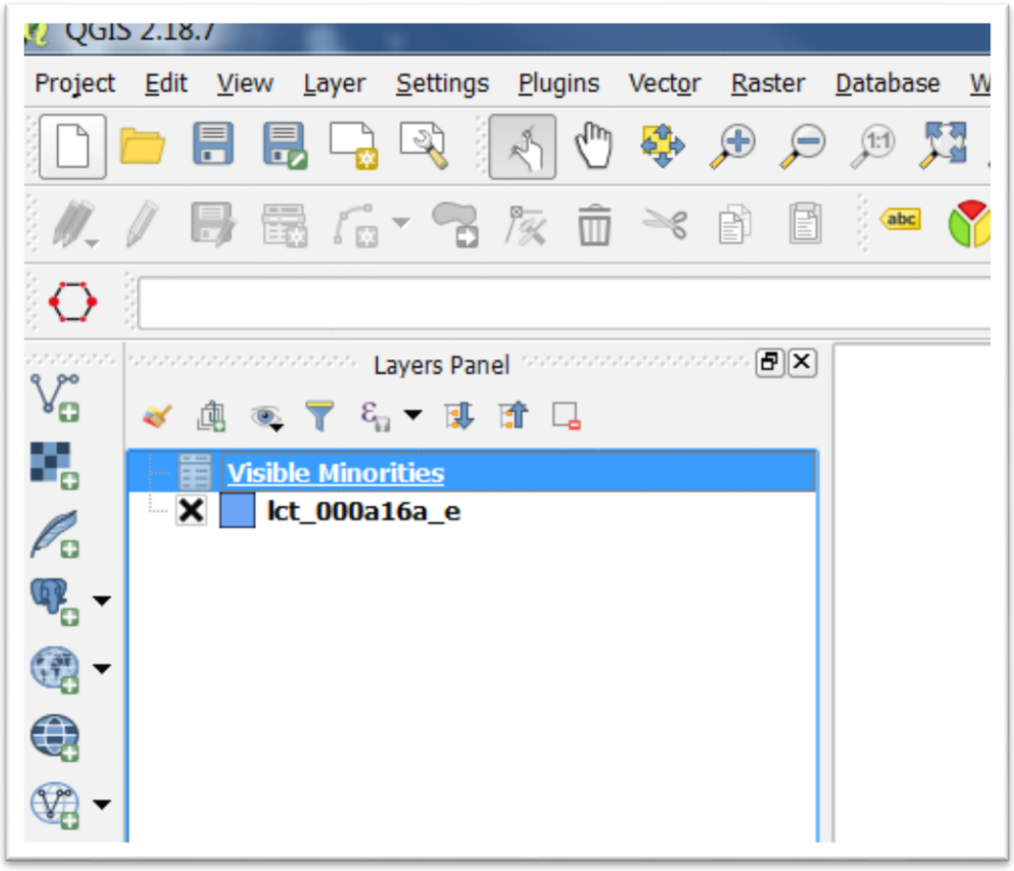
Qgis defaults to the “csv” file format. Text file can also be in other formats like tab delimited, which you can locate by clicking the radio

button to the left of “Custom delimiters”.

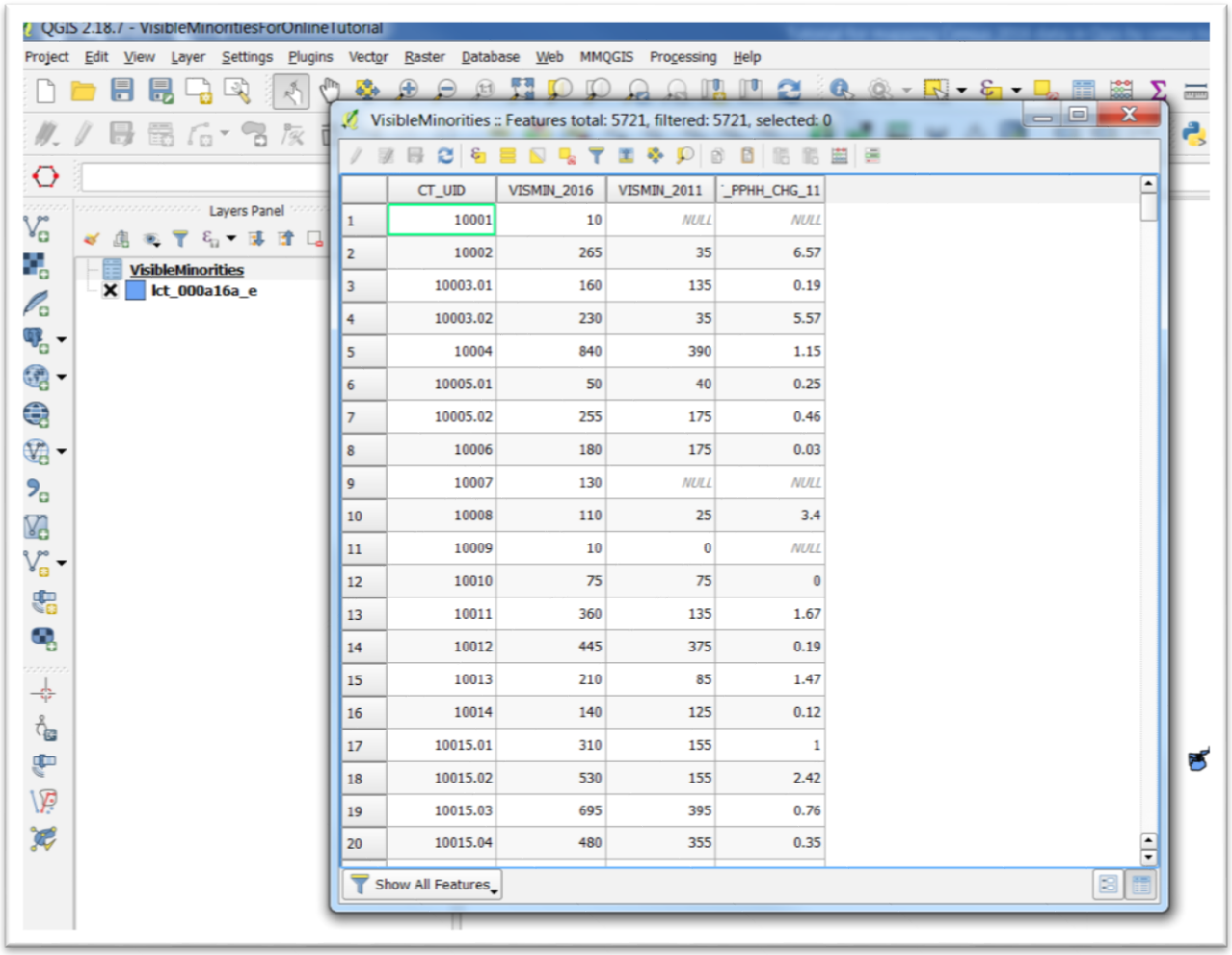


But, this is a csv file, so we’ll stick with that format, and make sure that the radio button to the left of “No geometry (attribute only table)” option is selected.


QGIS 2.18.7 - VisibleMinoritiesFo
Project Edit View Layer Settings
Layers Pane
kct_000a16a_e
Create a Layer from a Delimited Text File
File Name ocuments/Data Journalism Book/Tutorials/Online tutorials/Chapter 07/Qgis files/VisibleMinorities.csv
Browse...
Layer name VisibleMinorities
Encoding UTF-8
File format CSV (comma separated values) Custom delimiters Regular expression delimiter
Record options Number of header lines to discard 0 First record has field names
Field options Trim fields Discard empty fields Decimal separator is comma
Geometry definition Point coordinates Well known text (WKT) No geometry (attribute only table)
X field Y field DMS coordinates
Layer settings Use spatial index Use subset index Watch file
CT_UID VISMIN_2016 VISMIN_2011 TOT_PPHH_CHG_11_16
1 10001 10
2 10002 265 35 6.57
3 10003.01 160 135 0.19
4 10003.02 230 35 5.57
5 10004 840 390 1.15
6 10005.01 50 40 0.25
7 10005.02 255 175 0.46
8 10006 180 175 0.03
9 10007 130
10 10008 110 25 3.40
X and Y field names must be selected
OK
Cancel
Help


QGIS 2.18.7
Project
Edit
View
Layer
Settings
Plugins
Vector
Raster
Database
Layers Panel
Visible Minorities
lct_000a16a_e

Open the csv layer's attribute table.



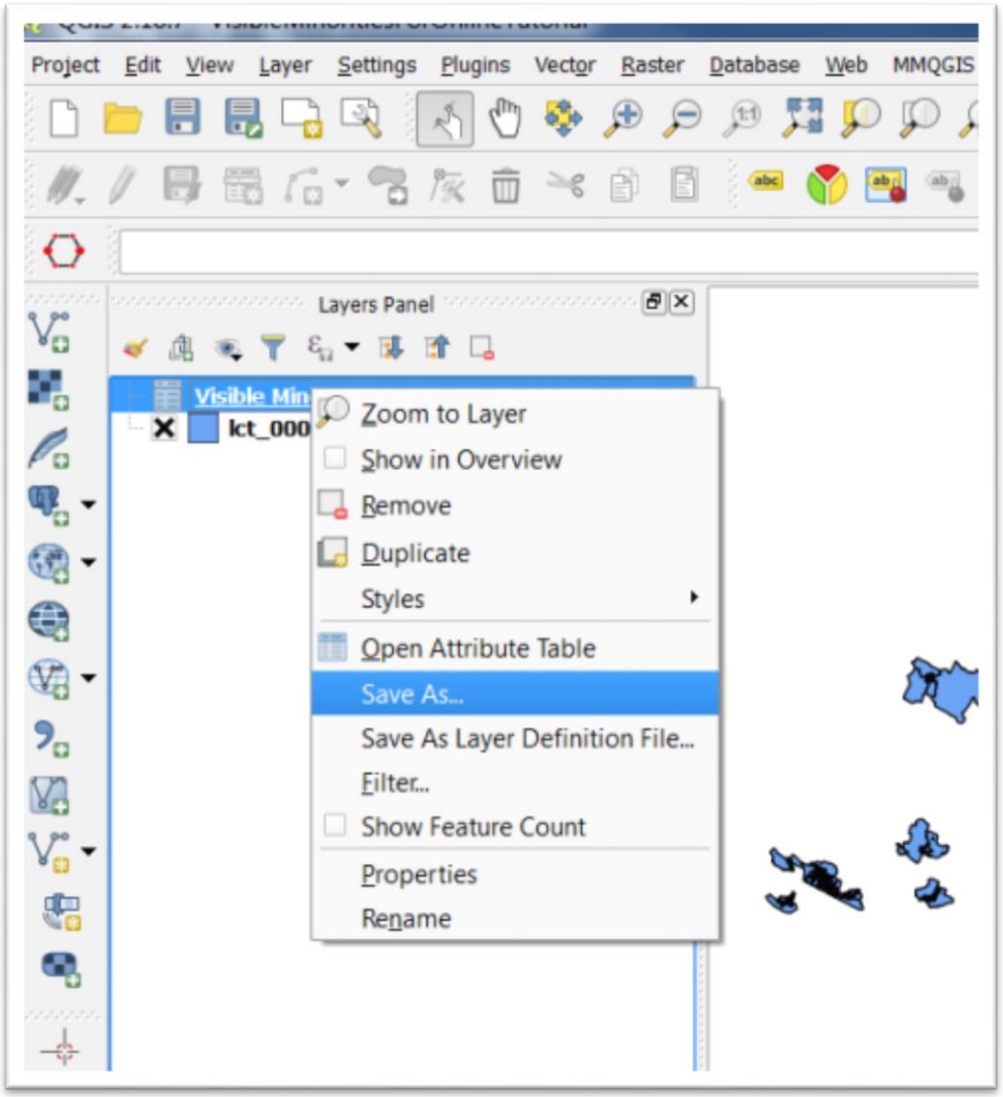
	CT_UID	VISMIN_2016	VISMIN_2011	_PPHH_CHG_11
1	10001	10	NULL	NULL
2	10002	265	35	6.57
3	10003.01	160	135	0.19
4	10003.02	230	35	5.57
5	10004	840	390	1.15
6	10005.01	50	40	0.25
7	10005.02	255	175	0.46
8	10006	180	175	0.03
9	10007	130	NULL	NULL
10	10008	110	25	3.4
11	10009	10	0	NULL
12	10010	75	75	0
13	10011	360	135	1.67
14	10012	445	375	0.19
15	10013	210	85	1.47
16	10014	140	125	0.12
17	10015.01	310	155	1
18	10015.02	530	155	2.42
19	10015.03	695	395	0.76
20	10015.04	480	355	0.35

You'll notice that it's identical to the file we opened in Excel.

We join the CT_UID field to the CTUID field in the shape file, but not before we do bit of formatting.

In order to edit the numbers in the csv layer, we have to make a copy.

Return to the menu, right-click on the "Visible Minorities" layer, and select "Save as".


Project Edit View Layer Settings Plugins Vector Raster Database Web MMQGIS
Layers Panel
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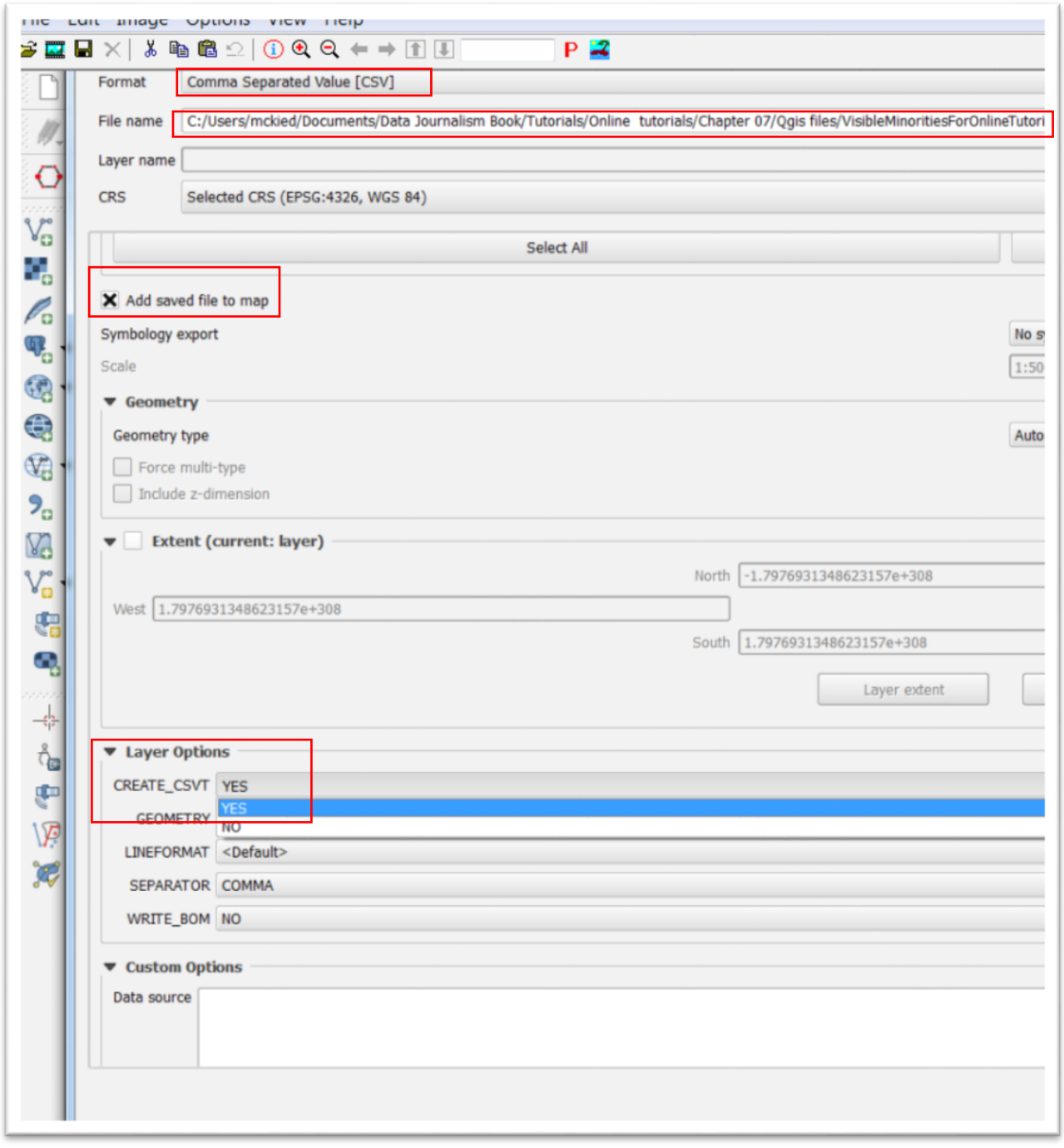
lct_000
Zoom to Layer
Show in Overview
Remove
Duplicate
Styles
Open Attribute Table
Save As...
Save As Layer Definition File...
Filter...
Show Feature Count
Properties
Rename



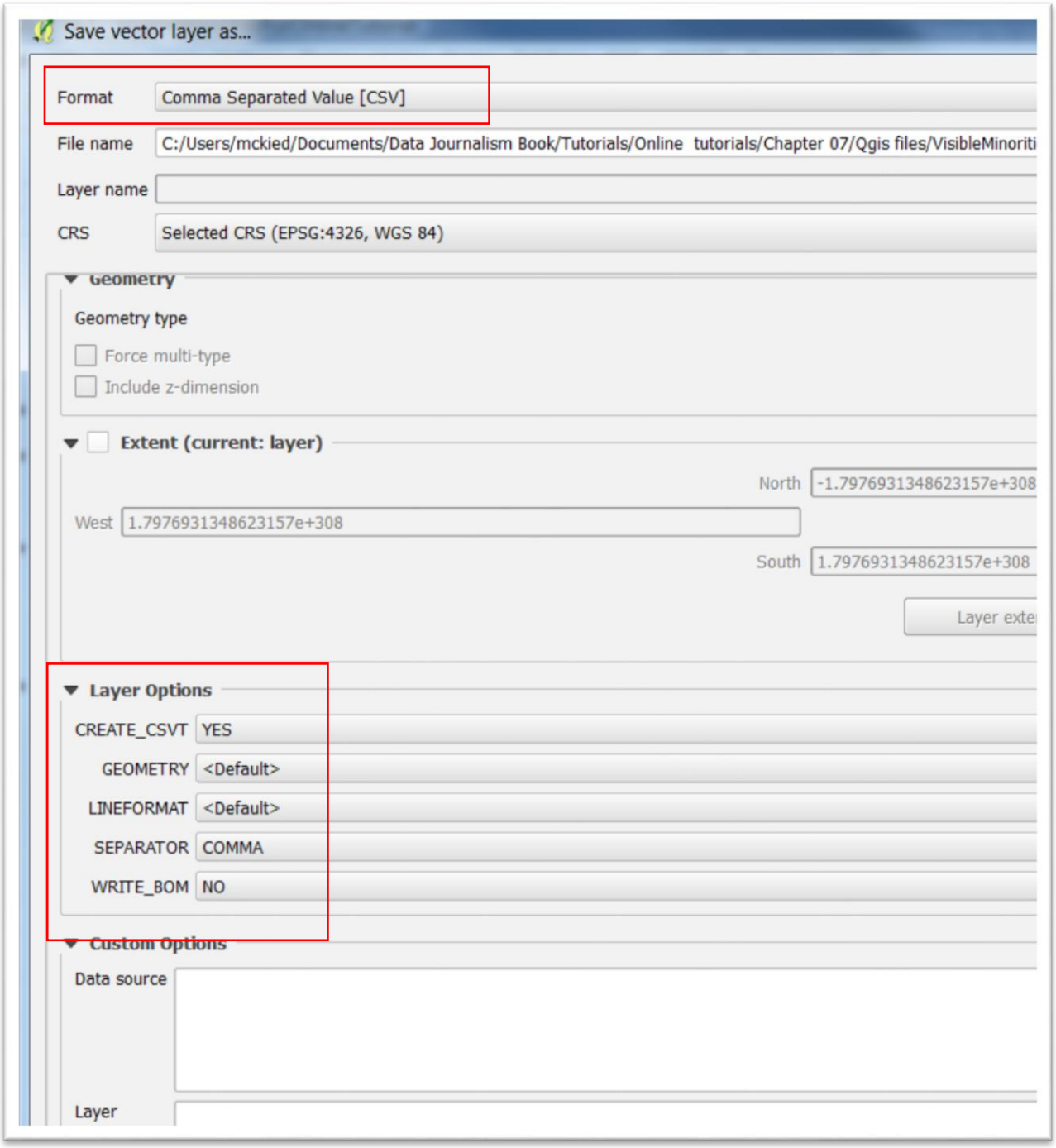
Make sure the file format is “Comma Separated Value (CSV)”. Make sure to add this saved layer to the map.

Browse to the folder for this tutorial and save the file with a name that makes sense. Scroll to the dialogue box’s “Layer Options” section, the select the “YES” option from the drop-down menu to the right of

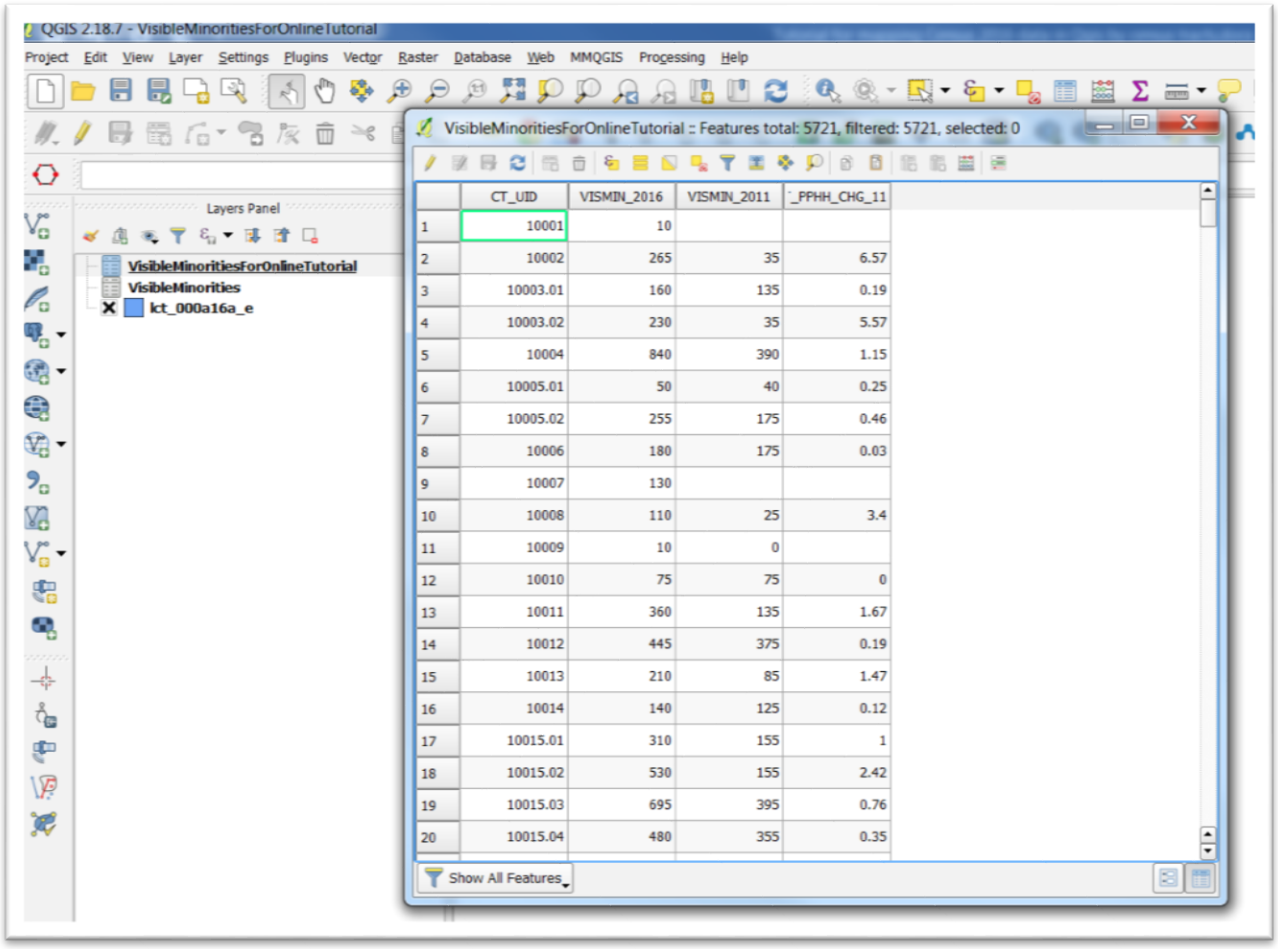
“CREATE_CSVT”. The csvt file is a helper file that Qgis creates that will make sure that the numbers are formatted as integers, which will allow us to colour the map based on numeric values later in this tutorial.

Also select the “default” from the drop-down menu to the right of “GEOMETRY”.

Make sure the selections in your “save vector layer as” dialogue box match those in the screen shot below.



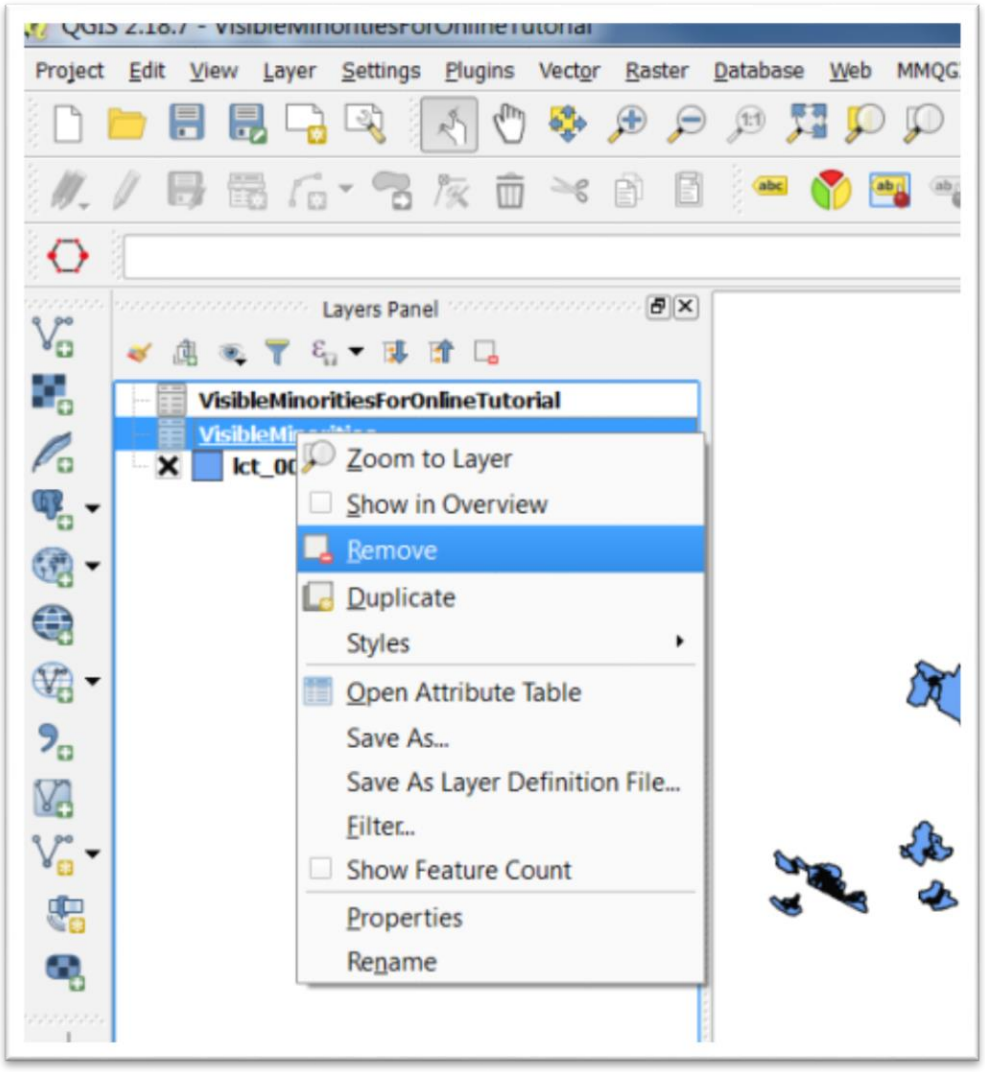
Open the attribute table for your new csv file.



	CT_UID	VISMIN_2016	VISMIN_2011	_PPHH_CHG_11
1	10001	10		
2	10002	265	35	6.57
3	10003.01	160	135	0.19
4	10003.02	230	35	5.57
5	10004	840	390	1.15
6	10005.01	50	40	0.25
7	10005.02	255	175	0.46
8	10006	180	175	0.03
9	10007	130		
10	10008	110	25	3.4
11	10009	10	0	
12	10010	75	75	0
13	10011	360	135	1.67
14	10012	445	375	0.19
15	10013	210	85	1.47
16	10014	140	125	0.12
17	10015.01	310	155	1
18	10015.02	530	155	2.42
19	10015.03	695	395	0.76
20	10015.04	480	355	0.35

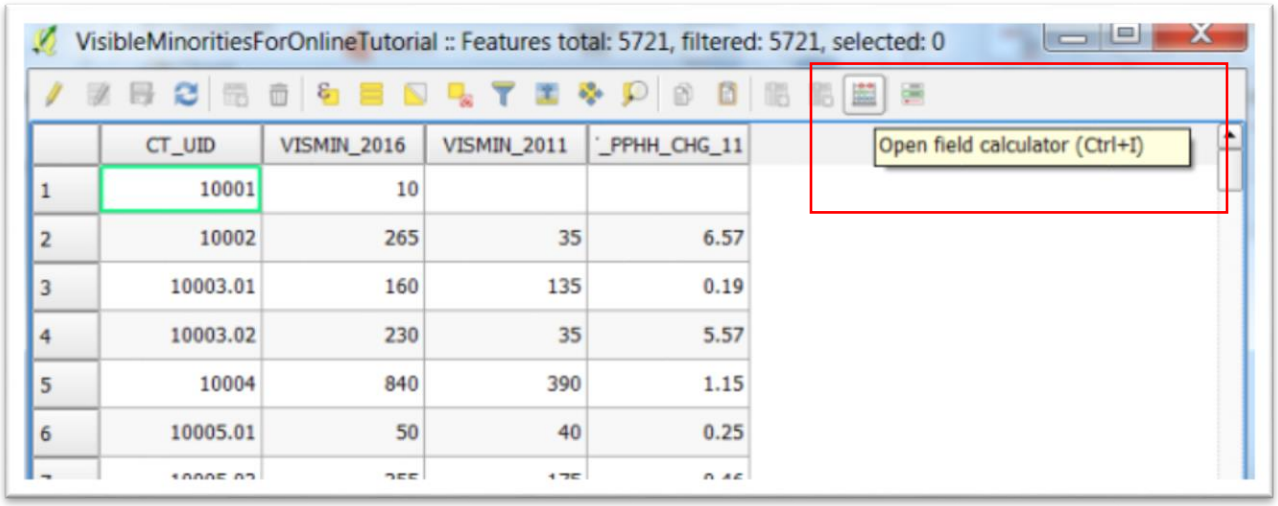
Because we don’t need the original VisibleMinorities csv layer, we can remove it from the “Layers Panel” by right-clicking and selecting the

“Remove” option, or simply leave it in place.

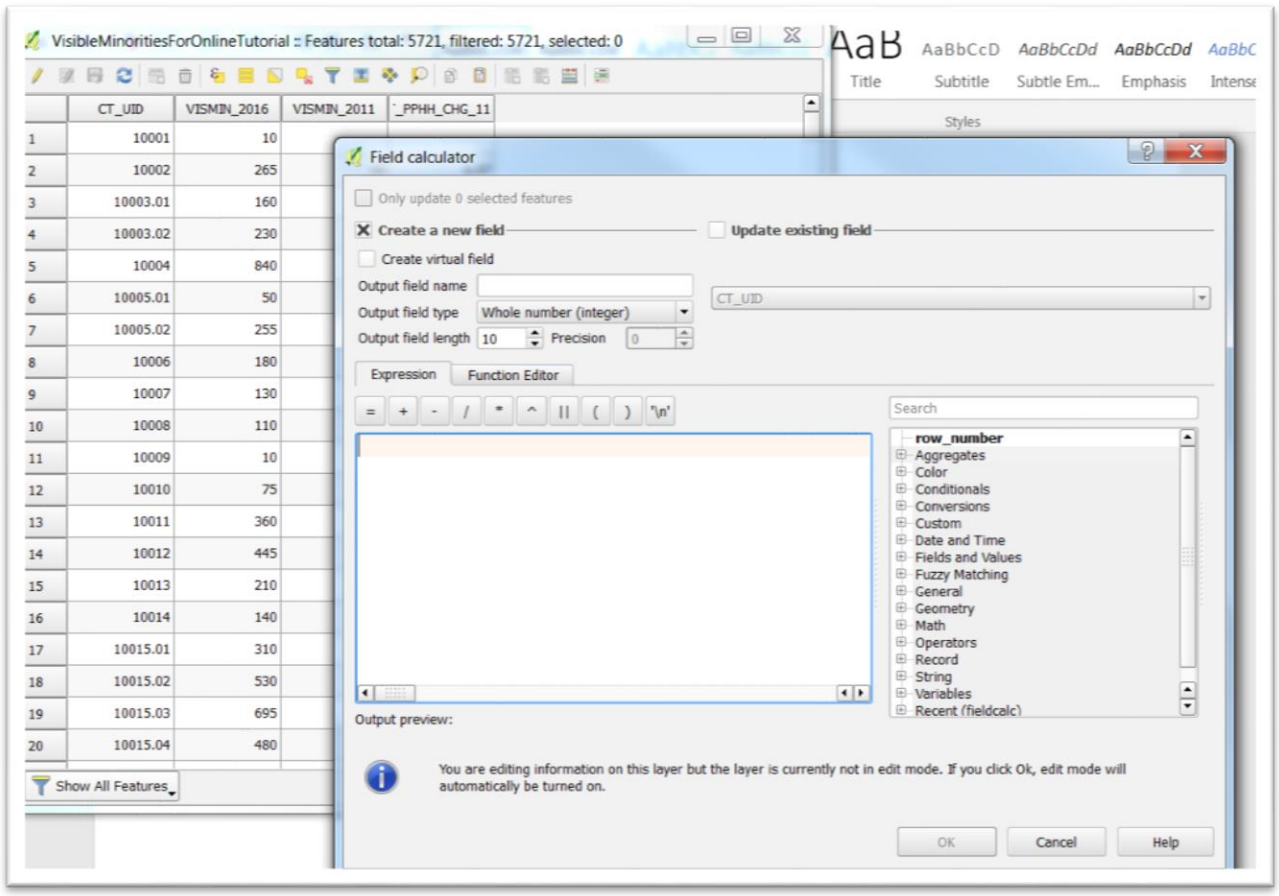


Before joining two layers, we must reformat the numbers in the census tract identification fields for both layers.

Let’s begin with the new csv layer that we created. Open the attribute table and select the “Open field calculator” icon at the top right-hand corner of the table’s menu.

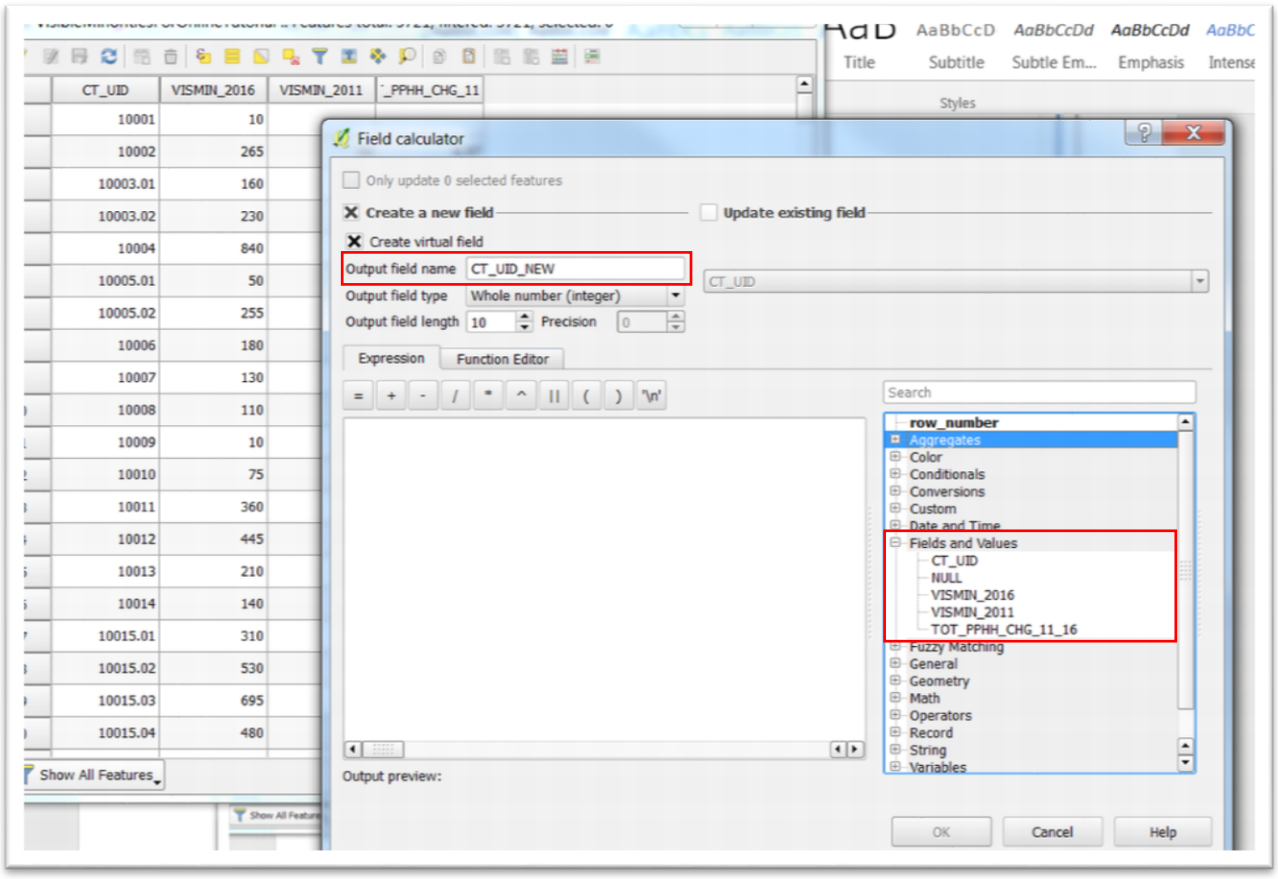


	CT_UID	VISMIN_2016	VISMIN_2011	'_PPHH_CHG_11
1	10001	10		
2	10002	265	35	6.57
3	10003.01	160	135	0.19
4	10003.02	230	35	5.57
5	10004	840	390	1.15
6	10005.01	50	40	0.25

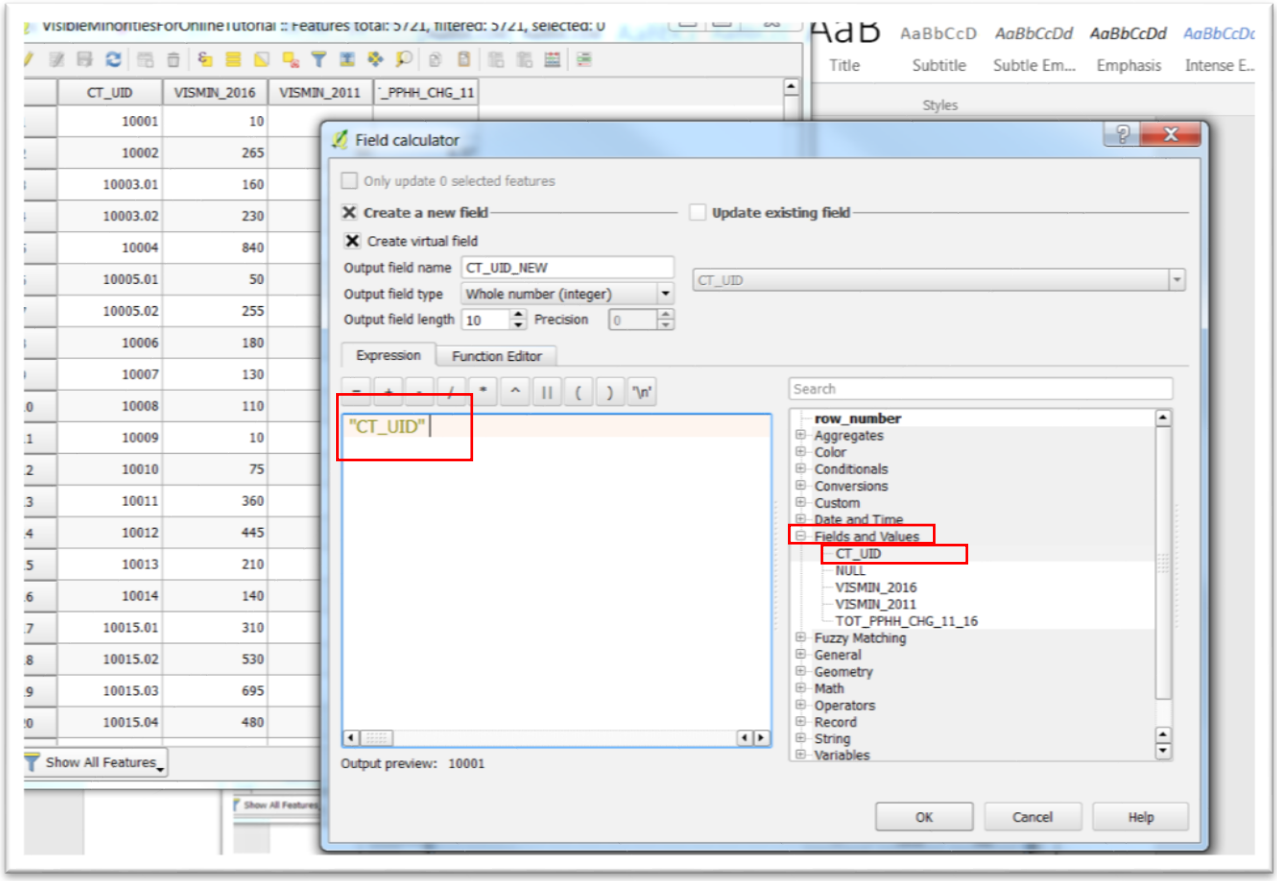


	CT_UID	VISMIN_2016	VISMIN_2011	'_PPHH_CHG_11
1	10001	10		
2	10002	265		
3	10003.01	160		
4	10003.02	230		
5	10004	840		
6	10005.01	50		
7	10005.02	255		
8	10006	180		
9	10007	130		
10	10008	110		
11	10009	10		
12	10010	75		
13	10011	360		
14	10012	445		
15	10013	210		
16	10014	140		
17	10015.01	310		
18	10015.02	530		
19	10015.03	695		
20	10015.04	480		

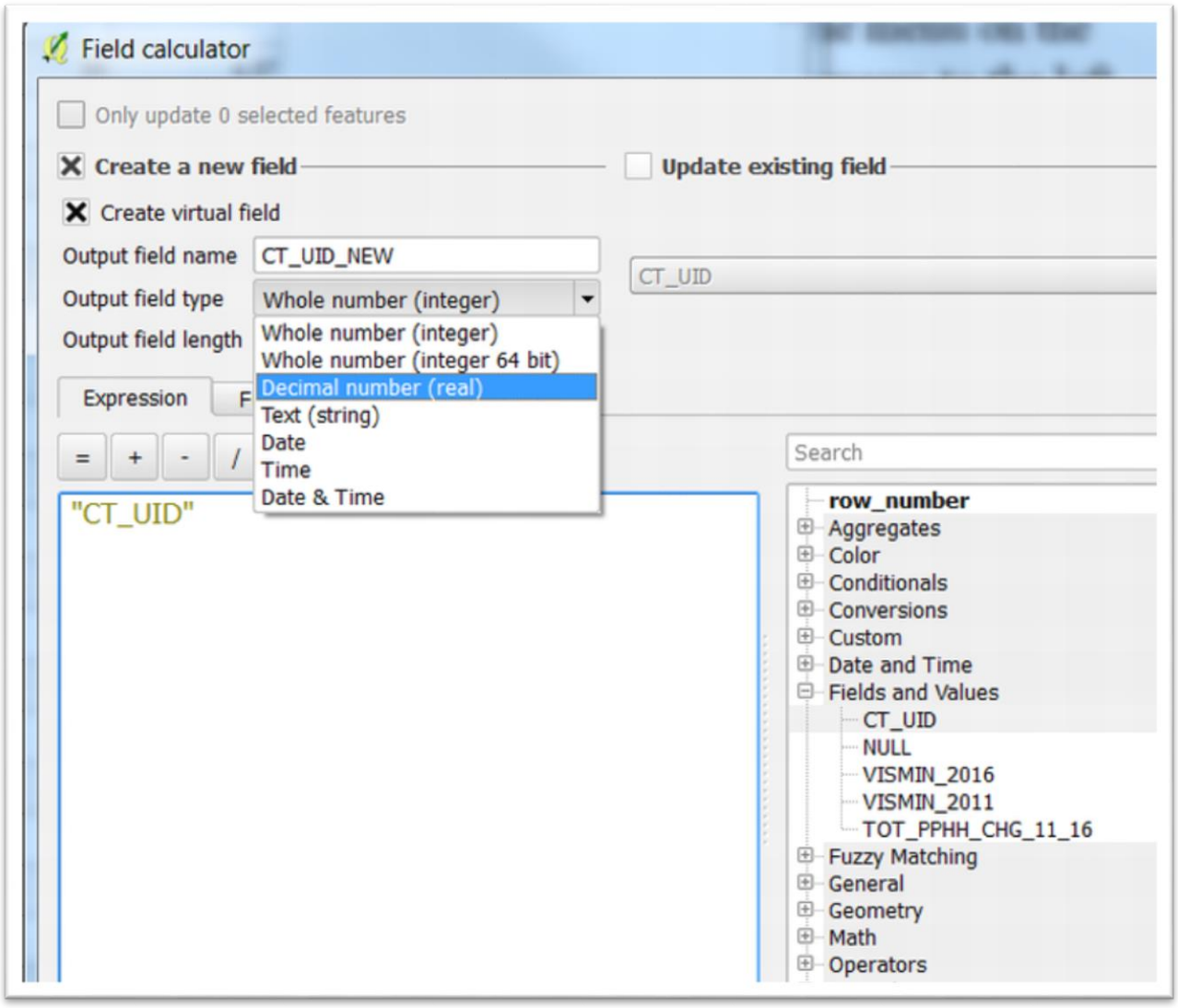
Click the box below “Create virtual field” and type “CT_UID_New” to the right of “Output field name”.



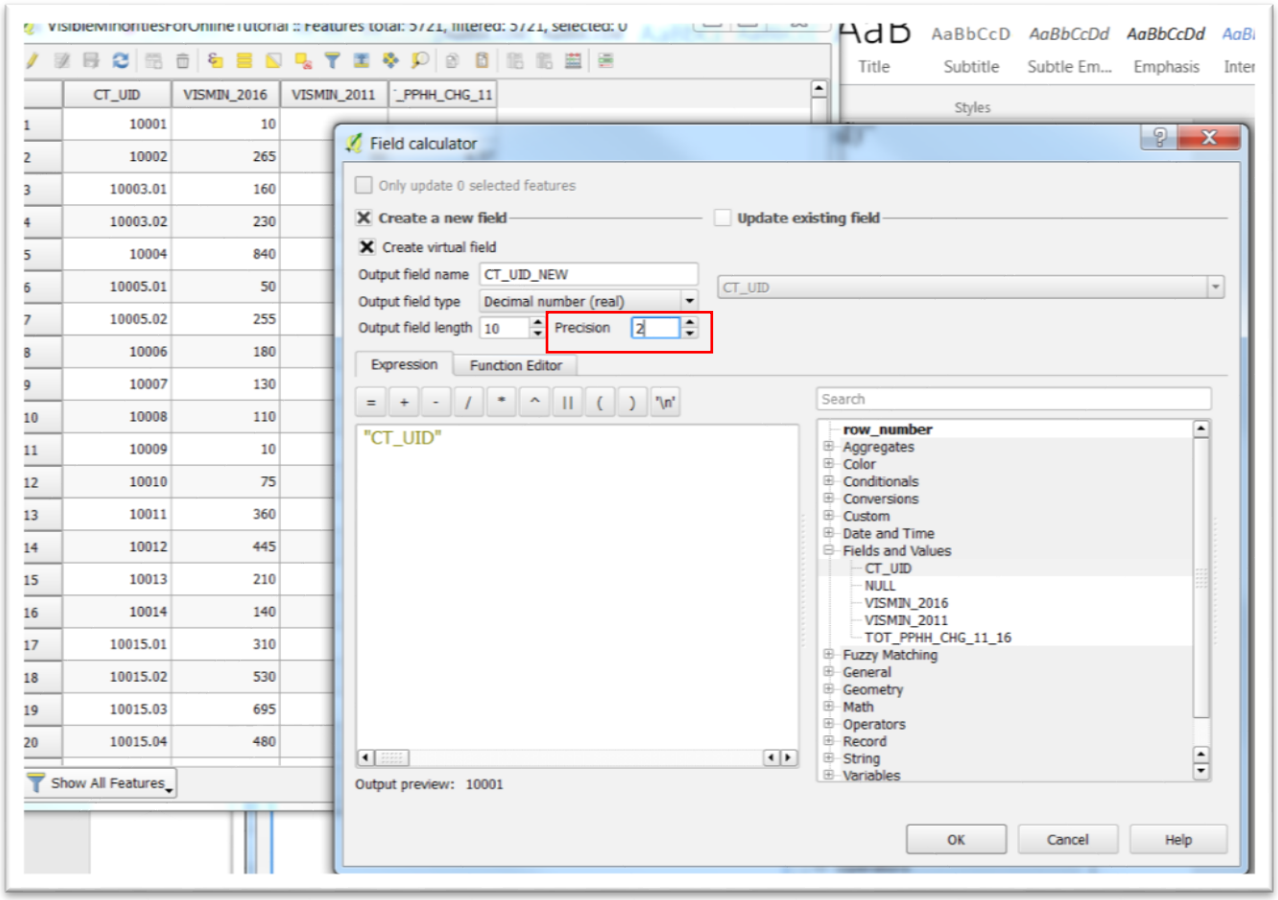
Click the “+” sign for the “Fields and Values” from the menu on the right, and double-click the “CT_UID” column so it appears to the left.



Click the downward arrow to obtain the drop-down menu to the right of “Output field name” and select “Decimal number (real)”



Leave the “Output length” as 10. Increase the precision from zero to “2”.

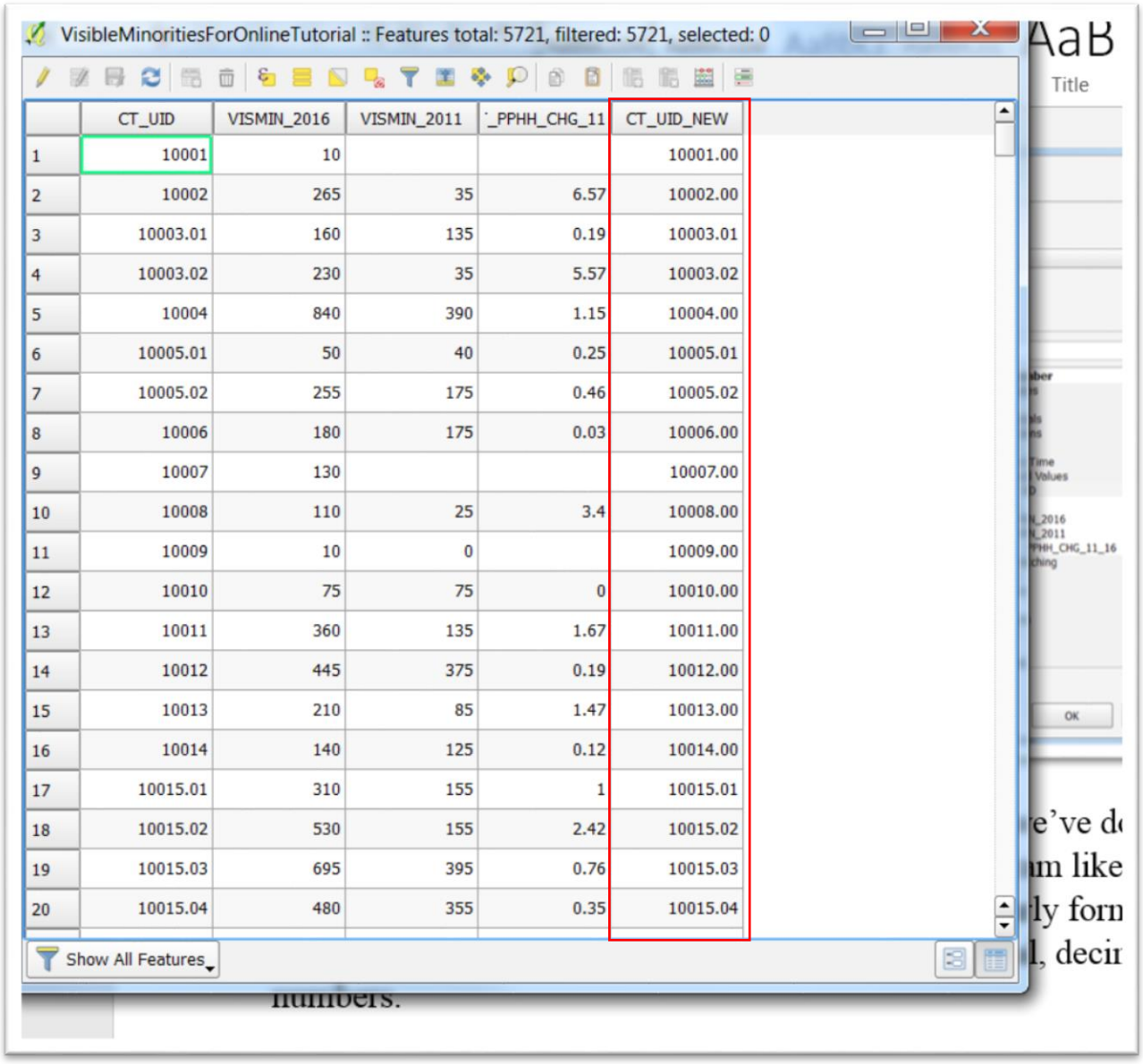


Before selecting OK, it’s important to explain what we’ve done.

In order to execute a join in Qgis, or any other database program like MySQL or Microsoft’s Access, the columns must contain similarly formatted data. For numbers, they must be integers, or for this tutorial, decimal numbers.

So, let’s continue.

Select OK to return to the attribute table.

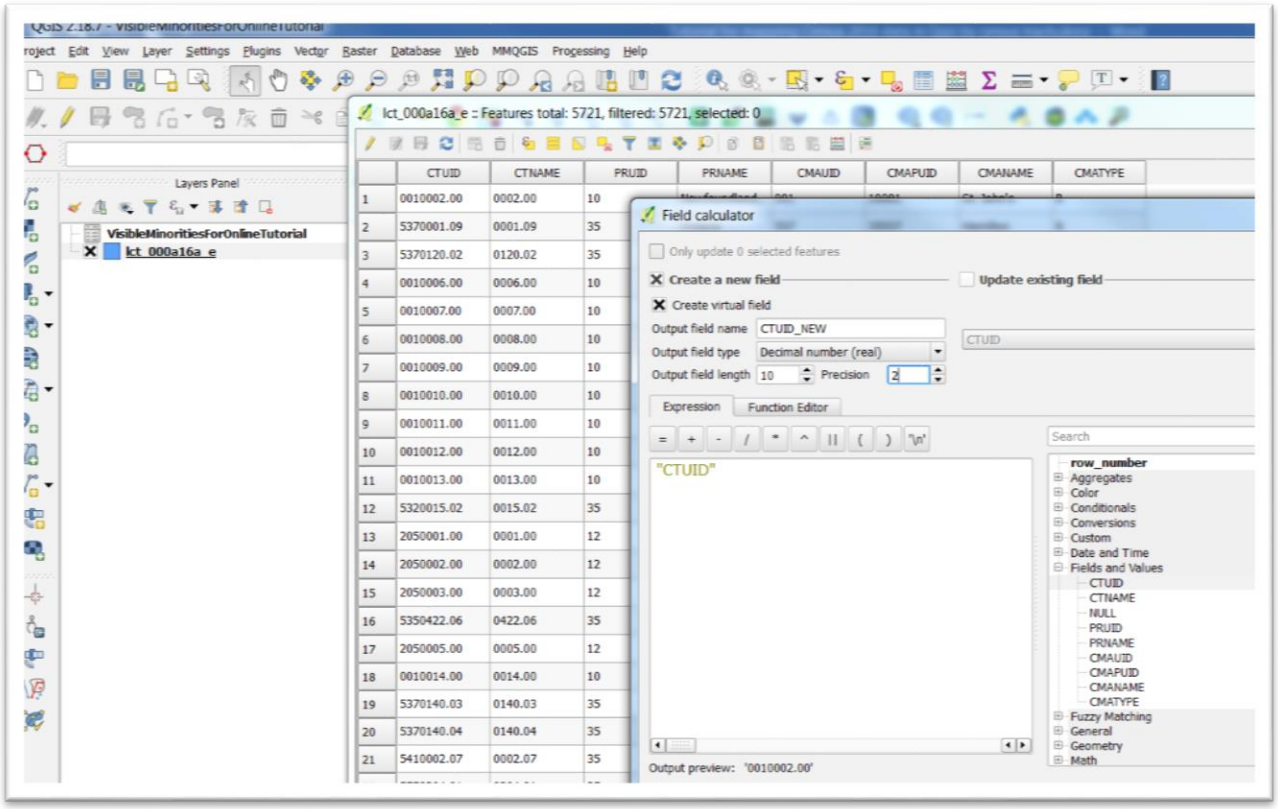


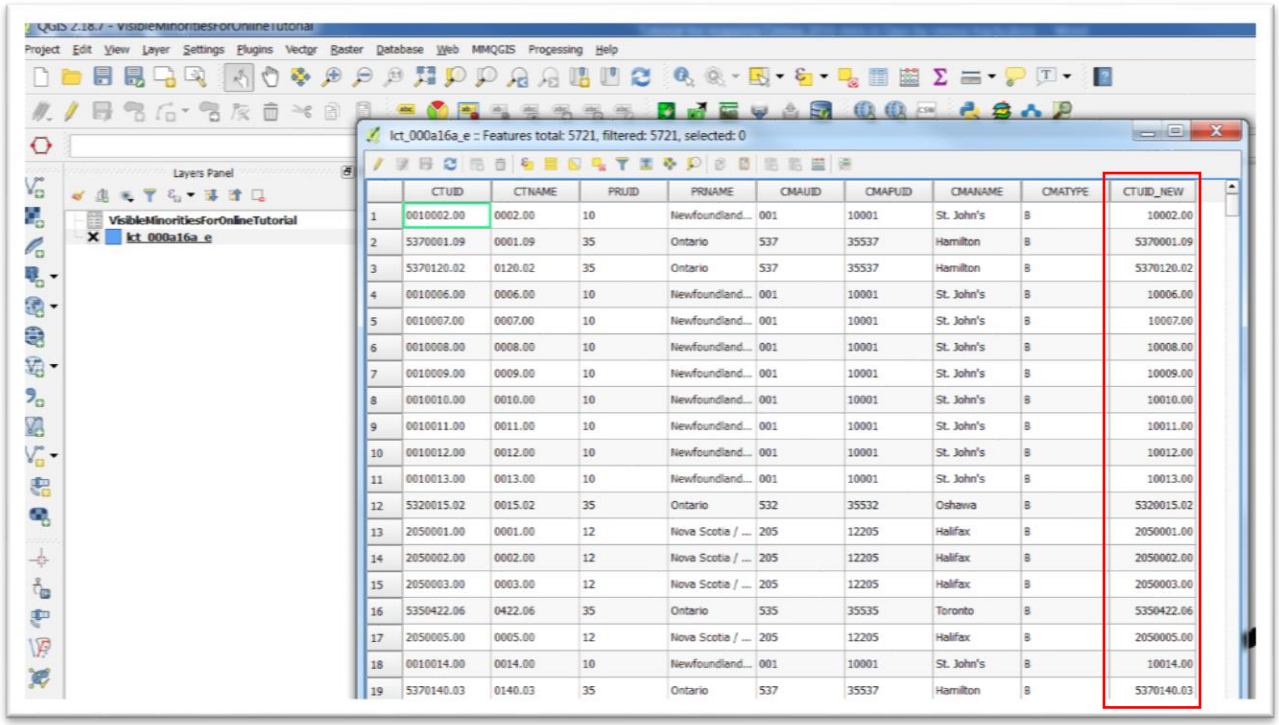
	CT_UID	VISMIN_2016	VISMIN_2011	_PPHH_CHG_11	CT_UID_NEW
1	10001	10			10001.00
2	10002	265	35	6.57	10002.00
3	10003.01	160	135	0.19	10003.01
4	10003.02	230	35	5.57	10003.02
5	10004	840	390	1.15	10004.00
6	10005.01	50	40	0.25	10005.01
7	10005.02	255	175	0.46	10005.02
8	10006	180	175	0.03	10006.00
9	10007	130			10007.00
10	10008	110	25	3.4	10008.00
11	10009	10	0		10009.00
12	10010	75	75	0	10010.00
13	10011	360	135	1.67	10011.00
14	10012	445	375	0.19	10012.00
15	10013	210	85	1.47	10013.00
16	10014	140	125	0.12	10014.00
17	10015.01	310	155	1	10015.01
18	10015.02	530	155	2.42	10015.02
19	10015.03	695	395	0.76	10015.03
20	10015.04	480	355	0.35	10015.04

Our new column is on the far right.

We must perform the same task with our csv layer.

Open the attribute table, and repeat the same steps.

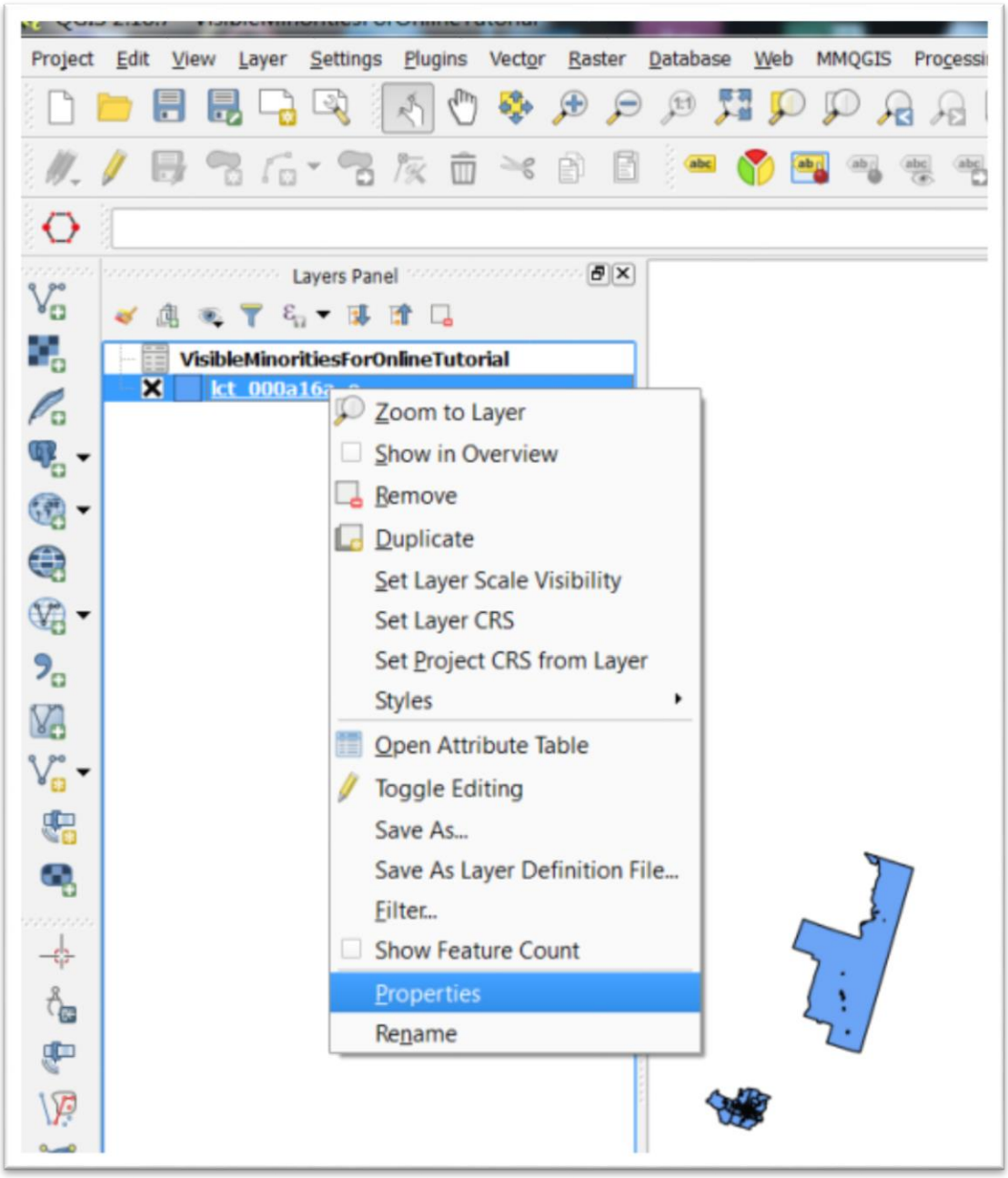




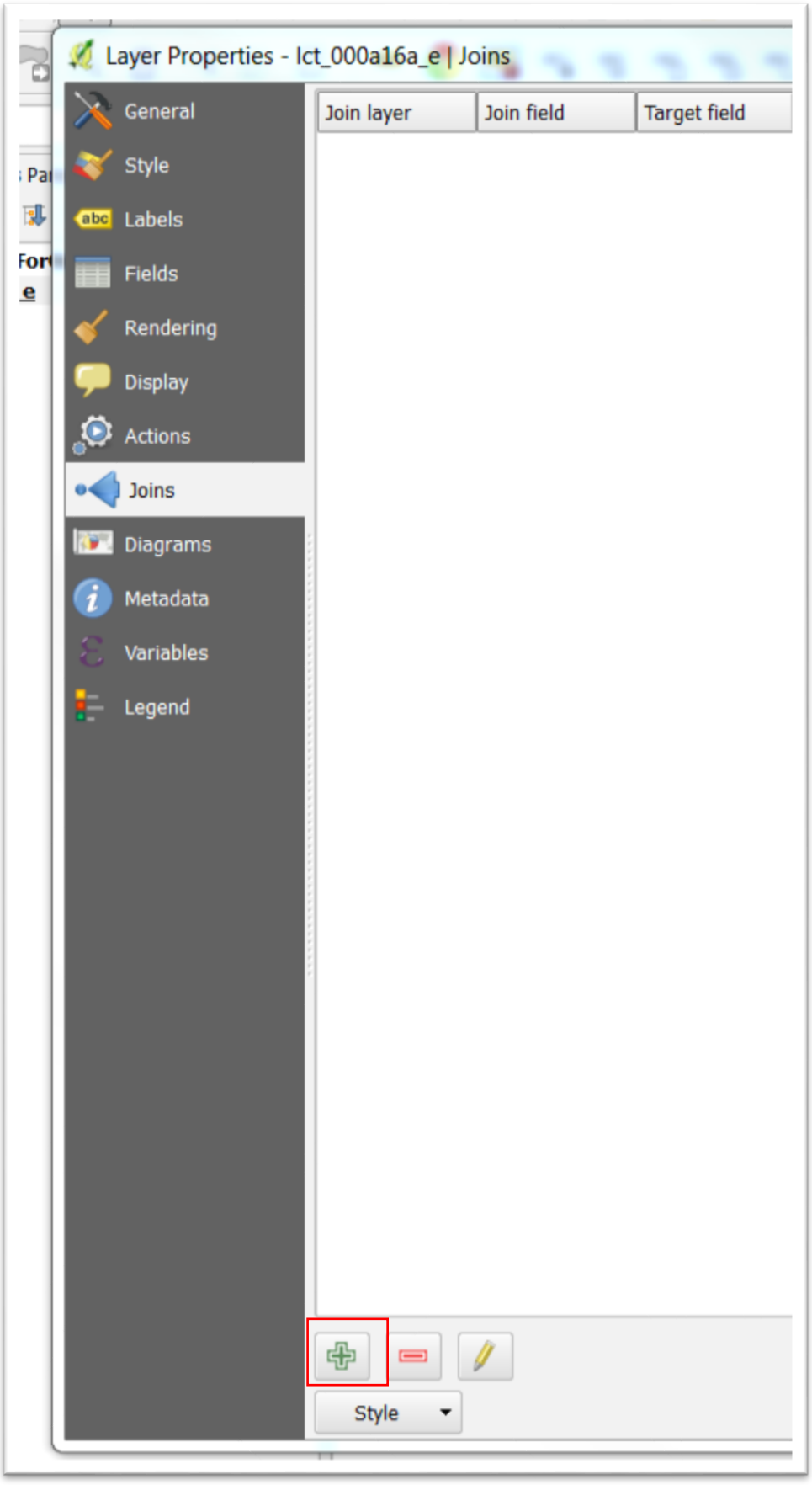
Now we have two matching census tract identifications fields.

Return to the Qgis “Layers Panel” menu, and select your shape file.

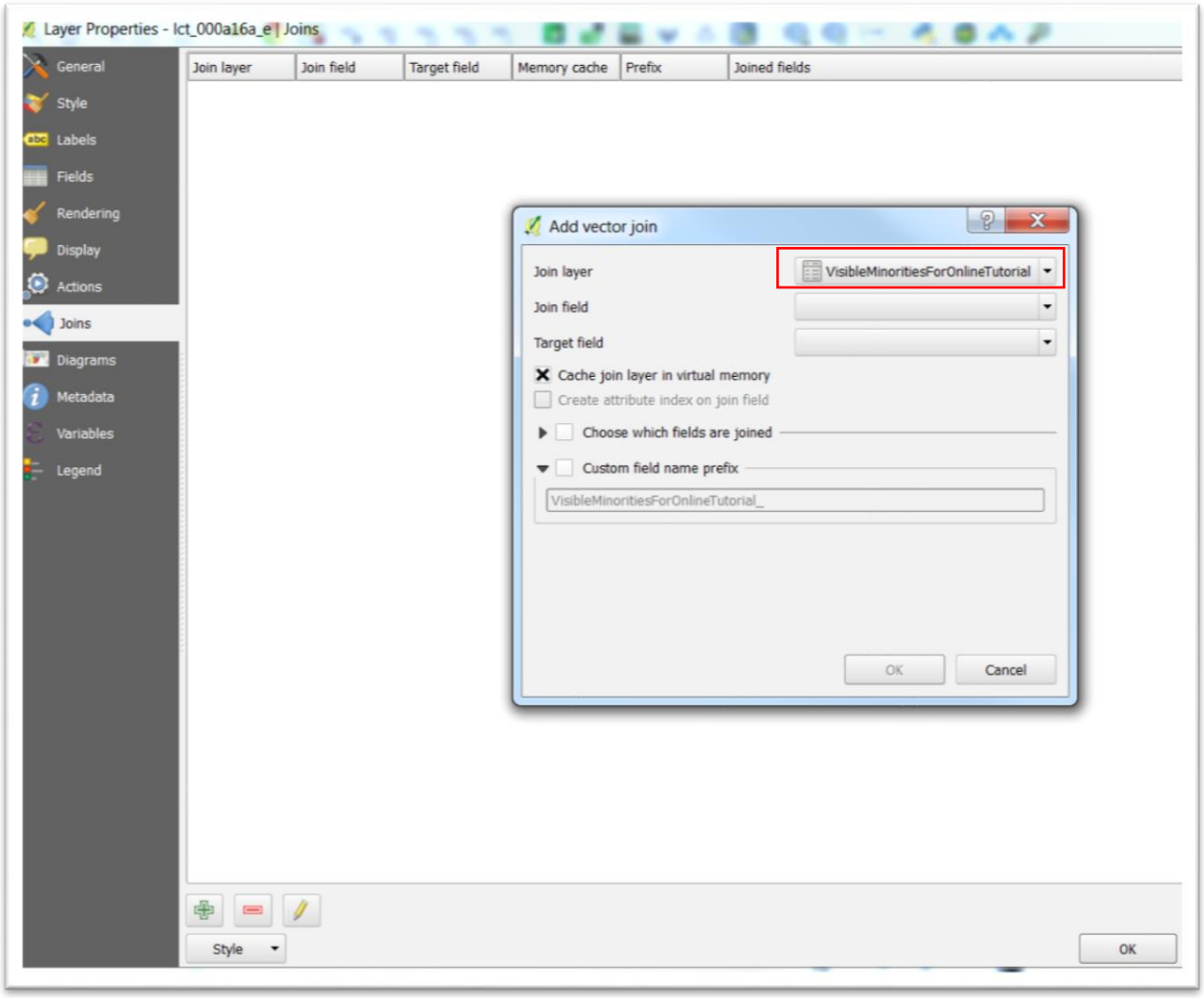
Right-click, and select “Properties” from the short-cut menu.



Select the “Joins” option.


Layer Properties - Ict_000a16a_e | Joins
General
Style
Labels
Fields
Rendering
Display
Actions
Joins
Diagrams
Metadata
Variables
Legend
Join layer
Join field
Target field
Style

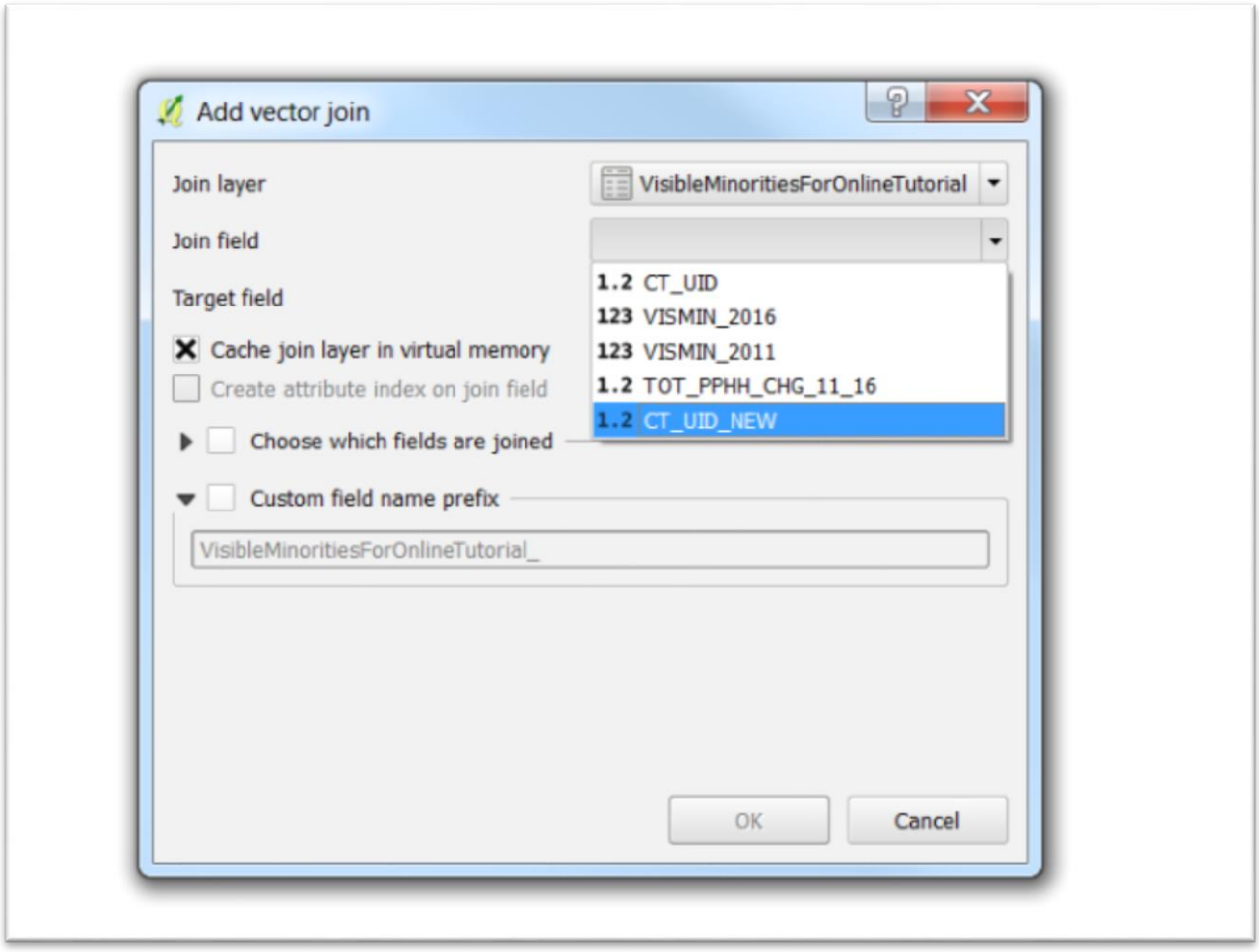
Click the green “+” sign.



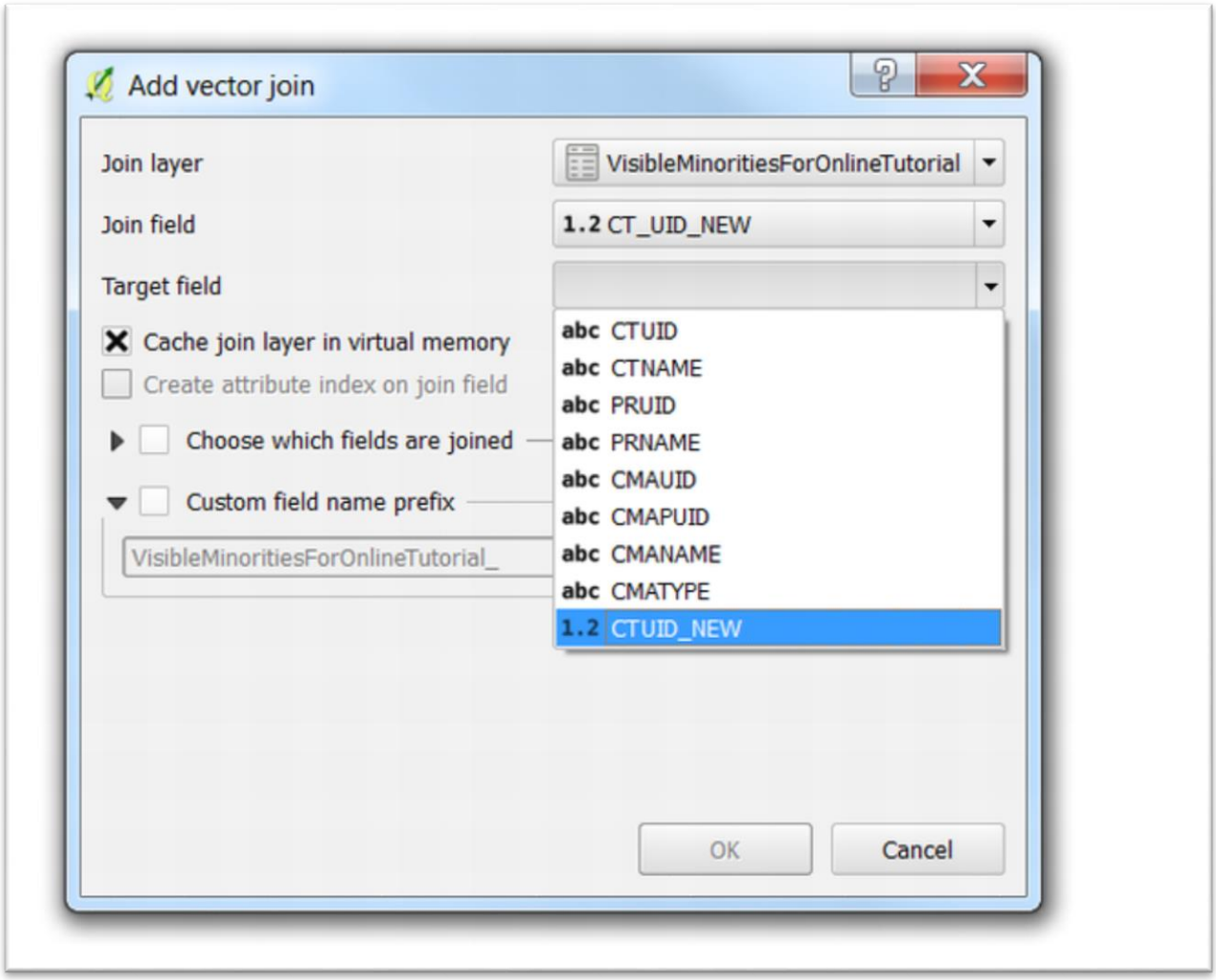
The layer identified in the “Add vector join” dialogue box is the csv file we’re about to join to the shape file.

All that’s left is to tell Qgis which fields we want to join, which will be the new ones we’ve created. Select the CT_UID_NEW field from the

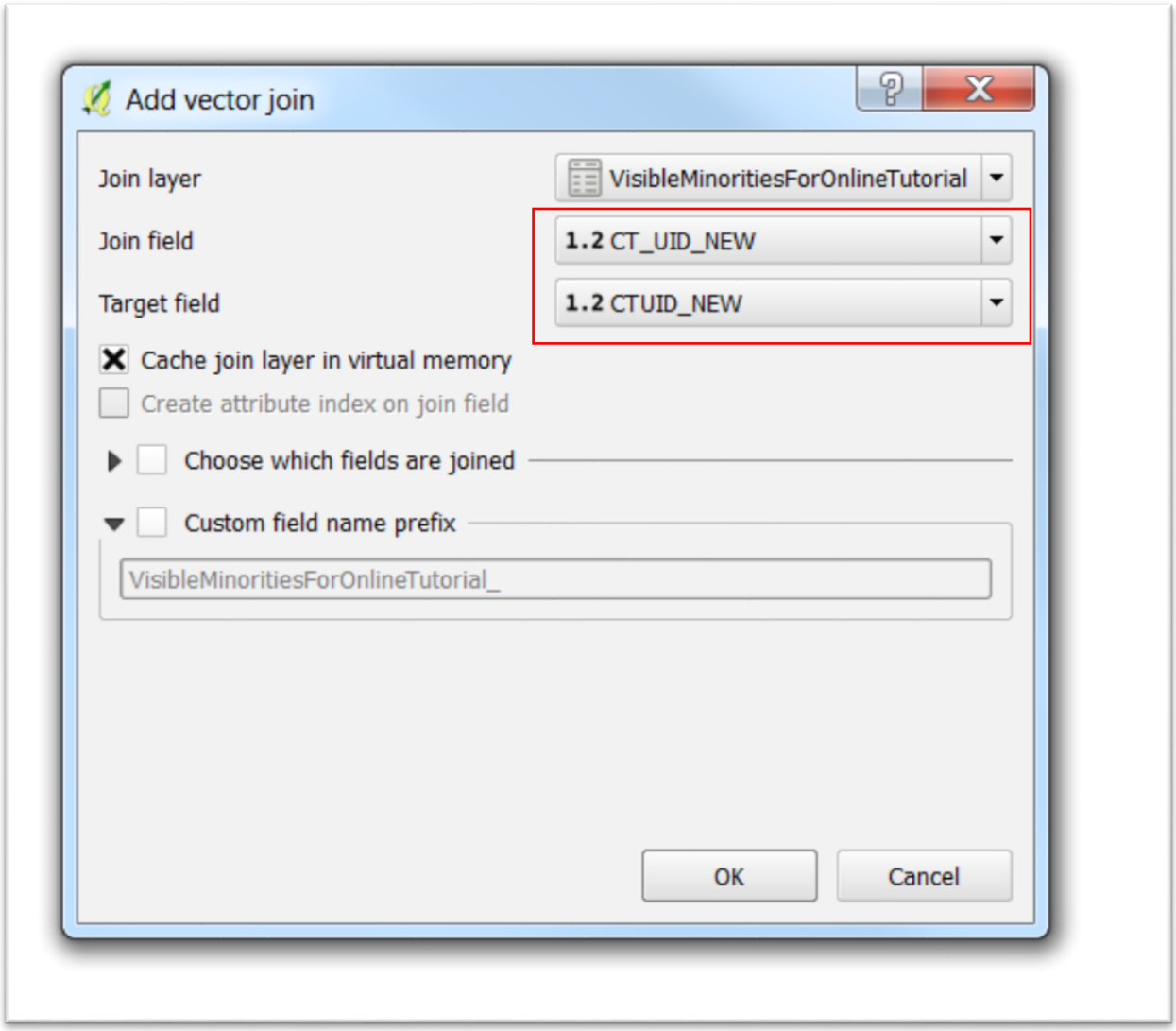
drop-down menu.



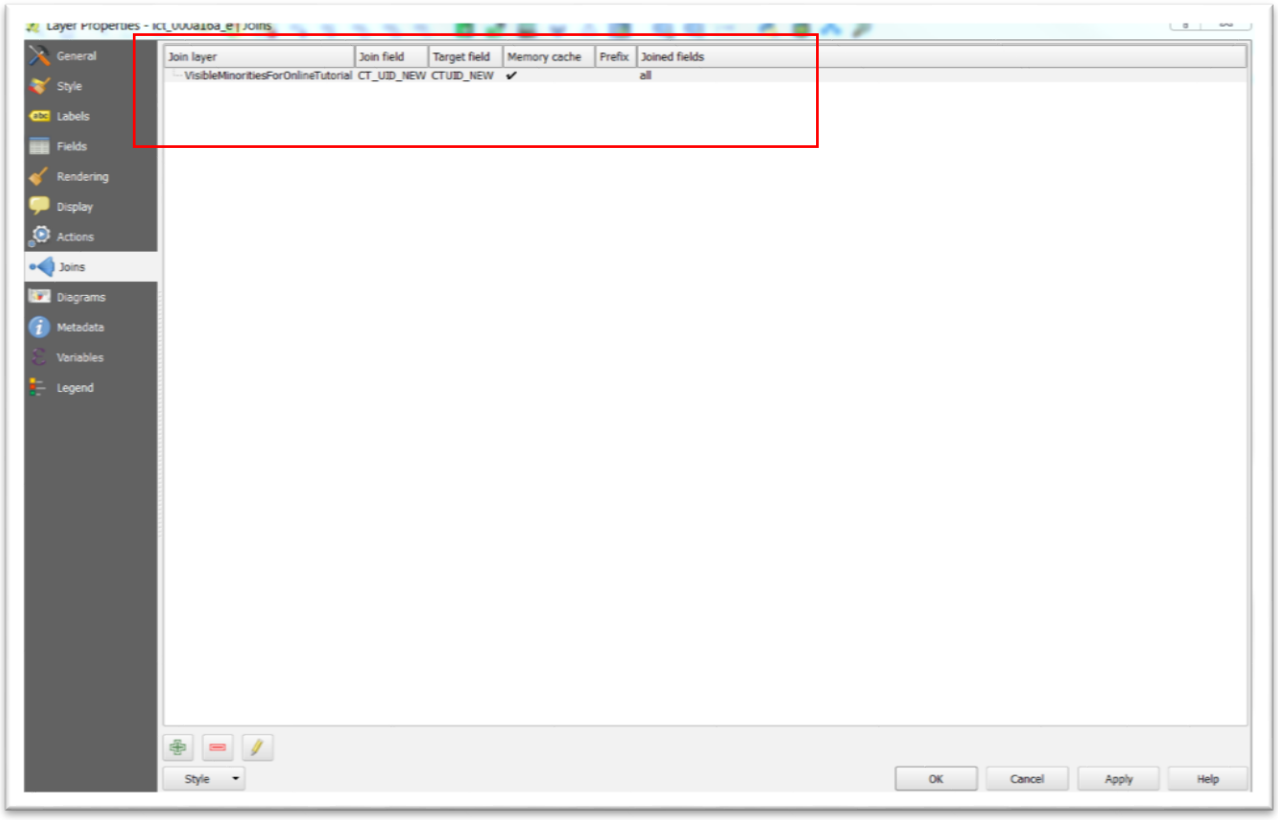
And the CTUID_NEW field from our shape file.



You should now have the two matching fields to be joined.

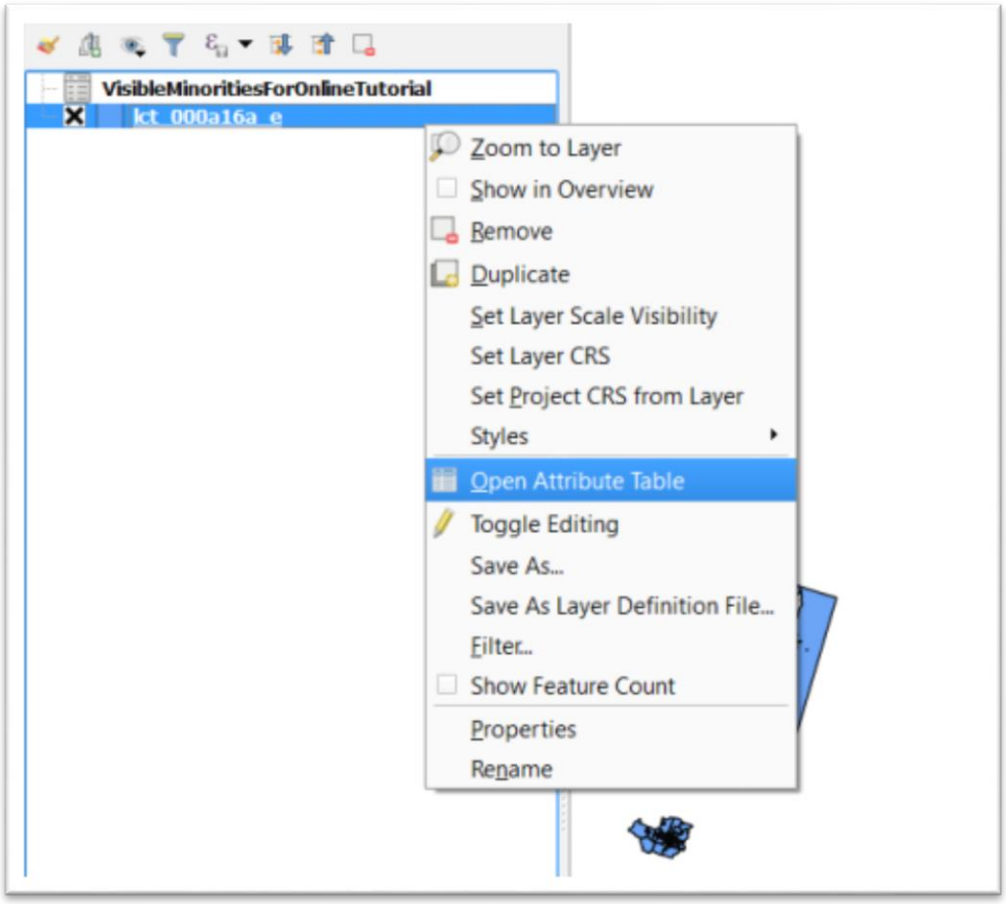


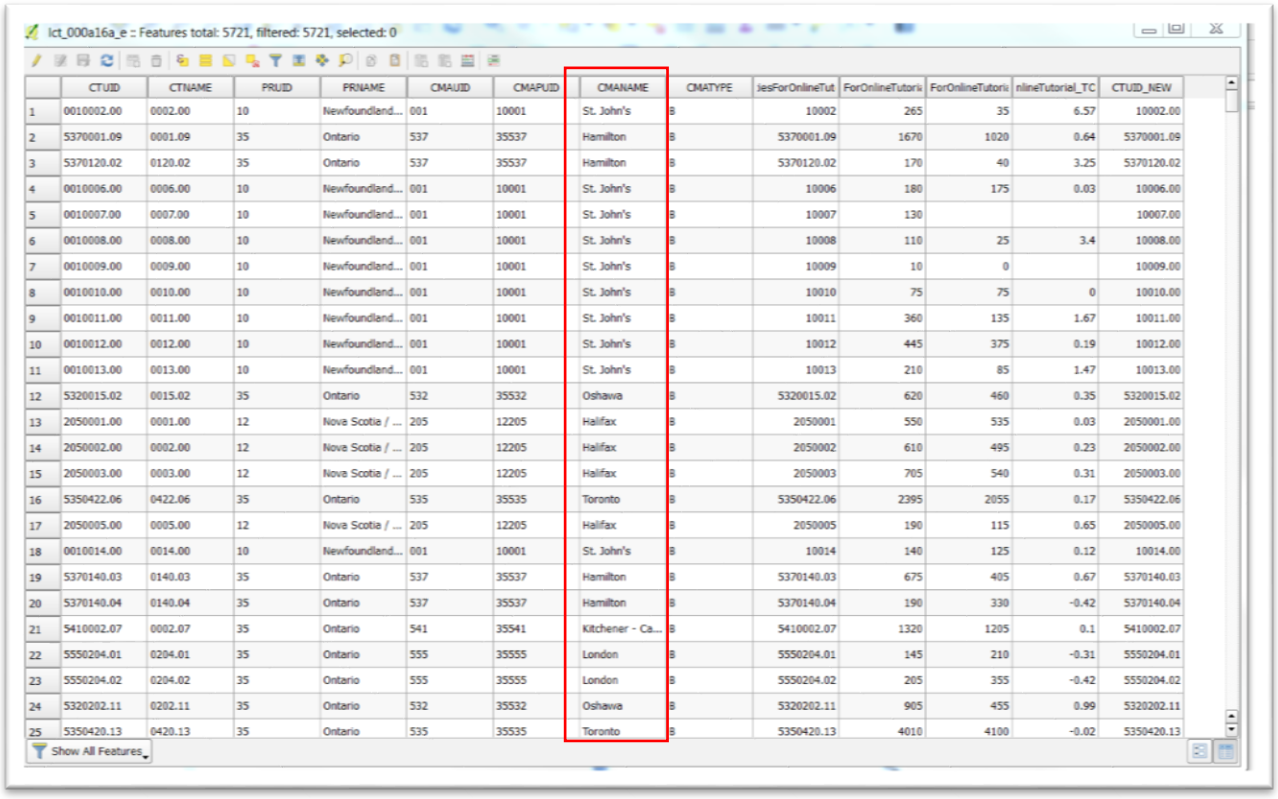
Select “OK”.



Select “Apply” and “OK”.

Open the attribute table to see the joined tables.





	CTUID	CTNAME	PRUID	PRNAME	CMAUID	CMAPUID	CMANAME	CMATYPE	esForOnlineTut	ForOnlineTutori	ForOnlineTutori	nlineTutorial_TC	CTUID_NEW
1	0010002.00	0002.00	10	Newfoundland...	001	10001	St. John's	B	10002	265	35	6.57	10002.00
2	5370001.09	0001.09	35	Ontario	537	35537	Hamilton	B	5370001.09	1670	1020	0.64	5370001.09
3	5370120.02	0120.02	35	Ontario	537	35537	Hamilton	B	5370120.02	170	40	3.25	5370120.02
4	0010006.00	0006.00	10	Newfoundland...	001	10001	St. John's	B	10006	180	175	0.03	10006.00
5	0010007.00	0007.00	10	Newfoundland...	001	10001	St. John's	B	10007	130			10007.00
6	0010008.00	0008.00	10	Newfoundland...	001	10001	St. John's	B	10008	110	25	3.4	10008.00
7	0010009.00	0009.00	10	Newfoundland...	001	10001	St. John's	B	10009	10	0		10009.00
8	0010010.00	0010.00	10	Newfoundland...	001	10001	St. John's	B	10010	75	75	0	10010.00
9	0010011.00	0011.00	10	Newfoundland...	001	10001	St. John's	B	10011	360	135	1.67	10011.00
10	0010012.00	0012.00	10	Newfoundland...	001	10001	St. John's	B	10012	445	375	0.19	10012.00
11	0010013.00	0013.00	10	Newfoundland...	001	10001	St. John's	B	10013	210	85	1.47	10013.00
12	5320015.02	0015.02	35	Ontario	532	35532	Oshawa	B	5320015.02	620	460	0.35	5320015.02
13	2050001.00	0001.00	12	Nova Scotia / ...	205	12205	Halifax	B	2050001	550	535	0.03	2050001.00
14	2050002.00	0002.00	12	Nova Scotia / ...	205	12205	Halifax	B	2050002	610	495	0.23	2050002.00
15	2050003.00	0003.00	12	Nova Scotia / ...	205	12205	Halifax	B	2050003	705	540	0.31	2050003.00
16	5350422.06	0422.06	35	Ontario	535	35535	Toronto	B	5350422.06	2395	2055	0.17	5350422.06
17	2050005.00	0005.00	12	Nova Scotia / ...	205	12205	Halifax	B	2050005	190	115	0.65	2050005.00
18	0010014.00	0014.00	10	Newfoundland...	001	10001	St. John's	B	10014	140	125	0.12	10014.00
19	5370140.03	0140.03	35	Ontario	537	35537	Hamilton	B	5370140.03	675	405	0.67	5370140.03
20	5370140.04	0140.04	35	Ontario	537	35537	Hamilton	B	5370140.04	190	330	-0.42	5370140.04
21	5410002.07	0002.07	35	Ontario	541	35541	Kitchener - Ca...	B	5410002.07	1320	1205	0.1	5410002.07
22	5550204.01	0204.01	35	Ontario	555	35555	London	B	5550204.01	145	210	-0.31	5550204.01
23	5550204.02	0204.02	35	Ontario	555	35555	London	B	5550204.02	205	355	-0.42	5550204.02
24	5320202.11	0202.11	35	Ontario	532	35532	Oshawa	B	5320202.11	905	455	0.99	5320202.11
25	5350420.13	0420.13	35	Ontario	535	35535	Toronto	B	5350420.13	4010	4100	-0.02	5350420.13

Before assigning colours to values, give some thought to the focus of your story. If you're in a particular city, you'd want to colour-code the census tracts for that area in order to spot the neighborhoods of interest – fastest growth, zero growth, declines, and so on. For instance, we may choose to do a story about an area of the city were visible minorities are leaving.

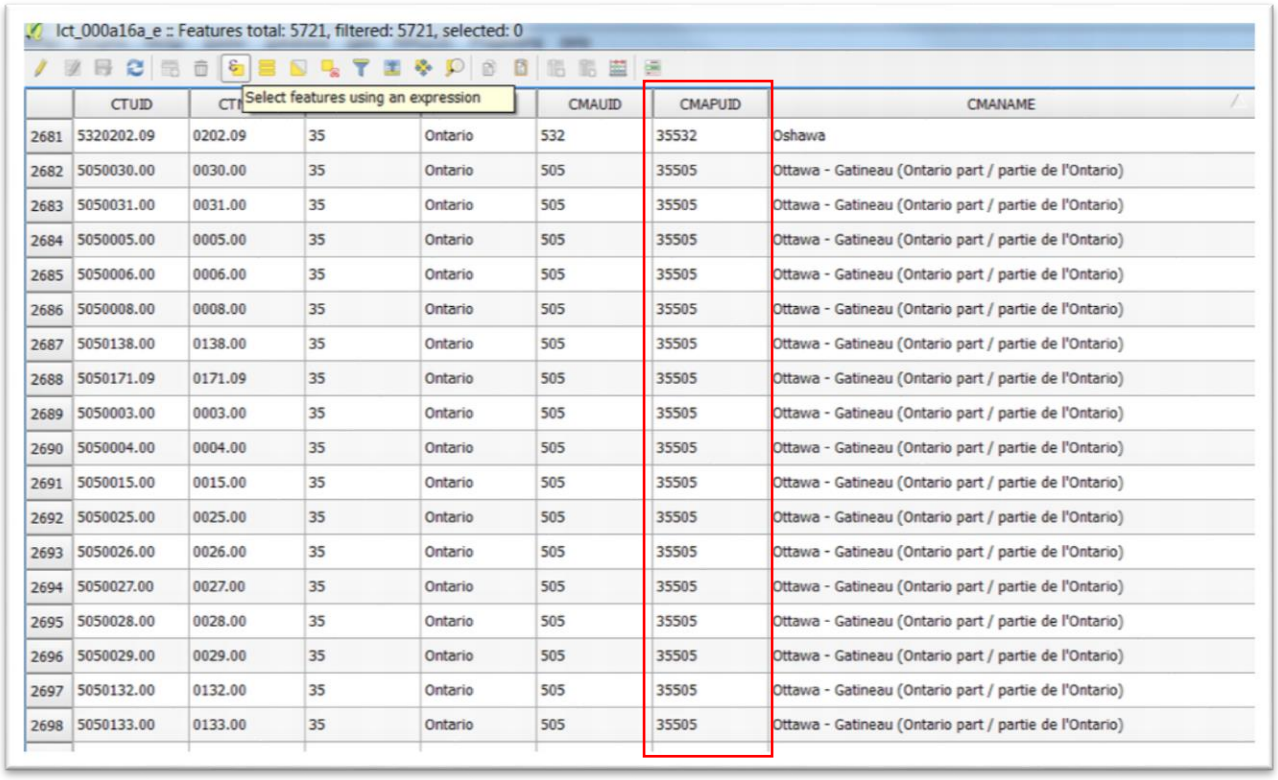
For this tutorial, we'll focus on the nation's capital, Ottawa. However, the same steps can be followed to highlight any other city such as Vancouver, Toronto, Montreal, Halifax or St. John's.

Leave the attribute table open. We'll use an SQL query to select the Ottawa census tracts, which we will save as a new layer.

Sort the CMANAME column in descending order and scroll down to Ottawa. Because the national capital region spans both sides of the Ottawa River to take in Ontario and Quebec, we only want the Ontario section. To the left of the CMANAME column is the CMAPUID for the region, which is 35505.

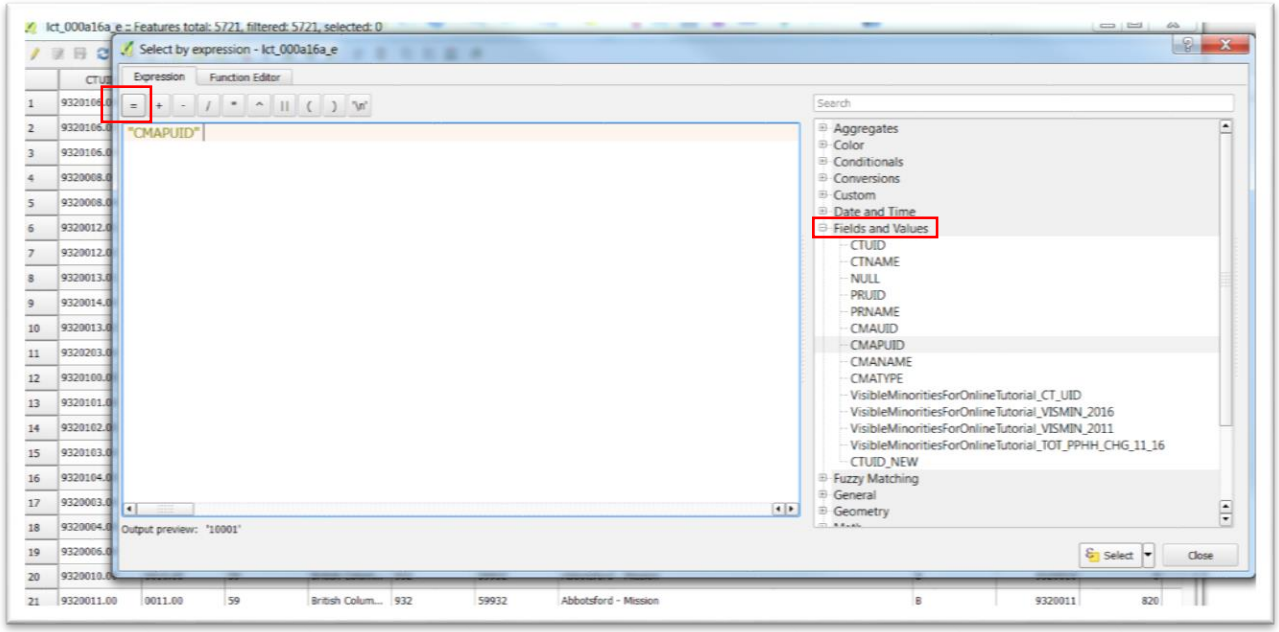
Now we can run a query that will select the CMAs, or Census Metropolitan Areas, numbered 35505. Hover your mouse over the "Select features using an expression" icon above the table towards the left-

hand side.

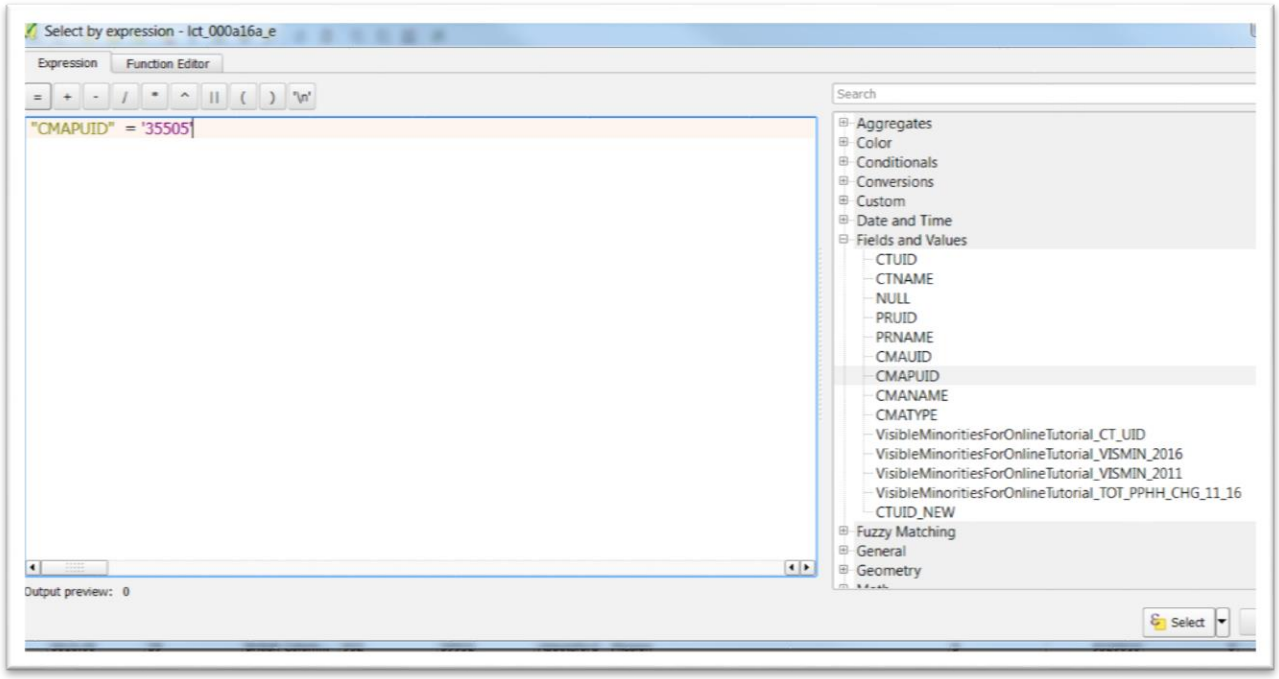


	CTUID	CT			CMAUID	CMAPUID	CMANAME
2681	5320202.09	0202.09	35	Ontario	532	35532	Oshawa
2682	5050030.00	0030.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2683	5050031.00	0031.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2684	5050005.00	0005.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2685	5050006.00	0006.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2686	5050008.00	0008.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2687	5050138.00	0138.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2688	5050171.09	0171.09	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2689	5050003.00	0003.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2690	5050004.00	0004.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2691	5050015.00	0015.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2692	5050025.00	0025.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2693	5050026.00	0026.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2694	5050027.00	0027.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2695	5050028.00	0028.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2696	5050029.00	0029.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2697	5050132.00	0132.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)
2698	5050133.00	0133.00	35	Ontario	505	35505	Ottawa - Gatineau (Ontario part / partie de l'Ontario)

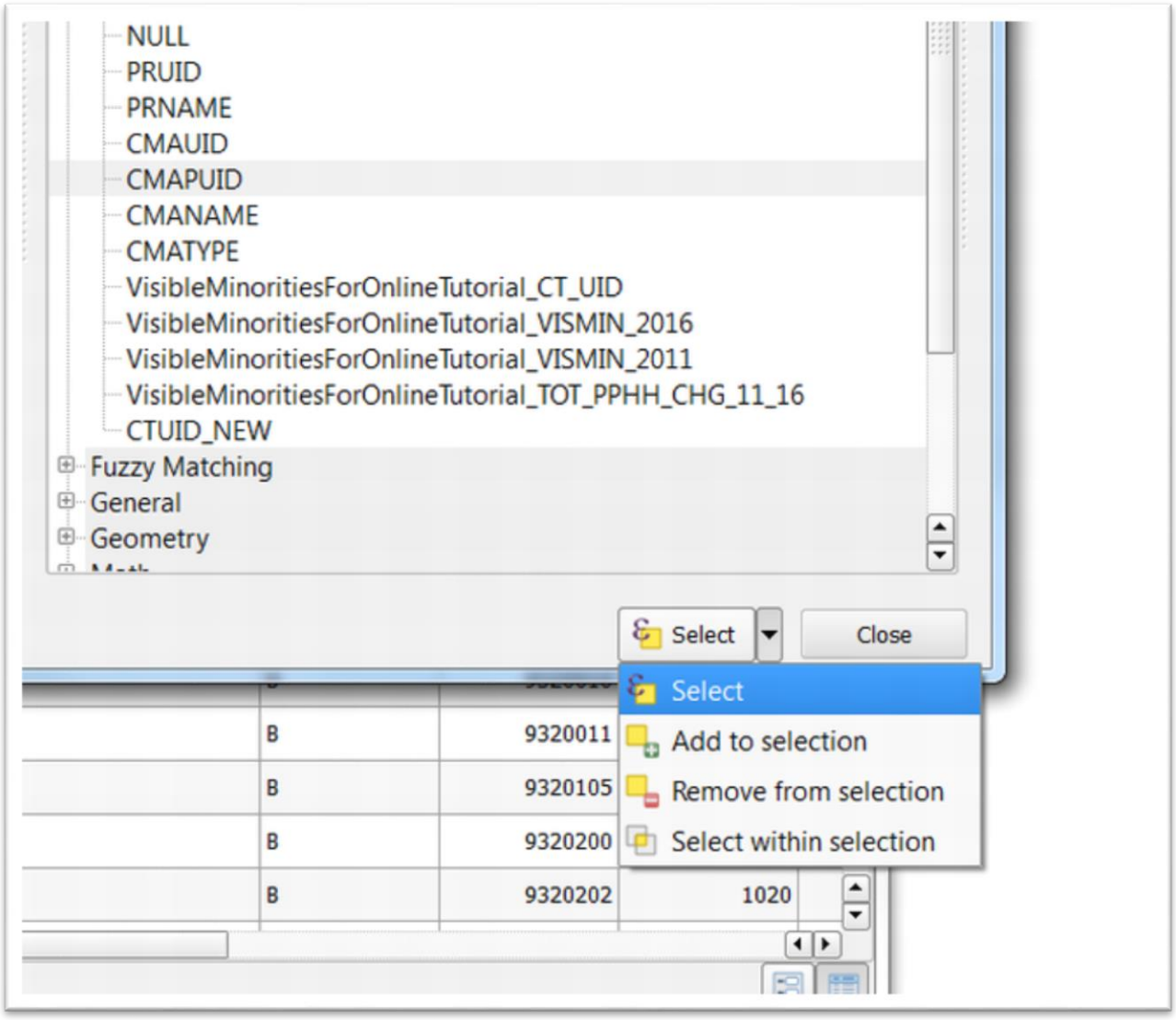
Click the “+” sign to the left of “Fields and Values” on the dialogue box’s right-hand side.



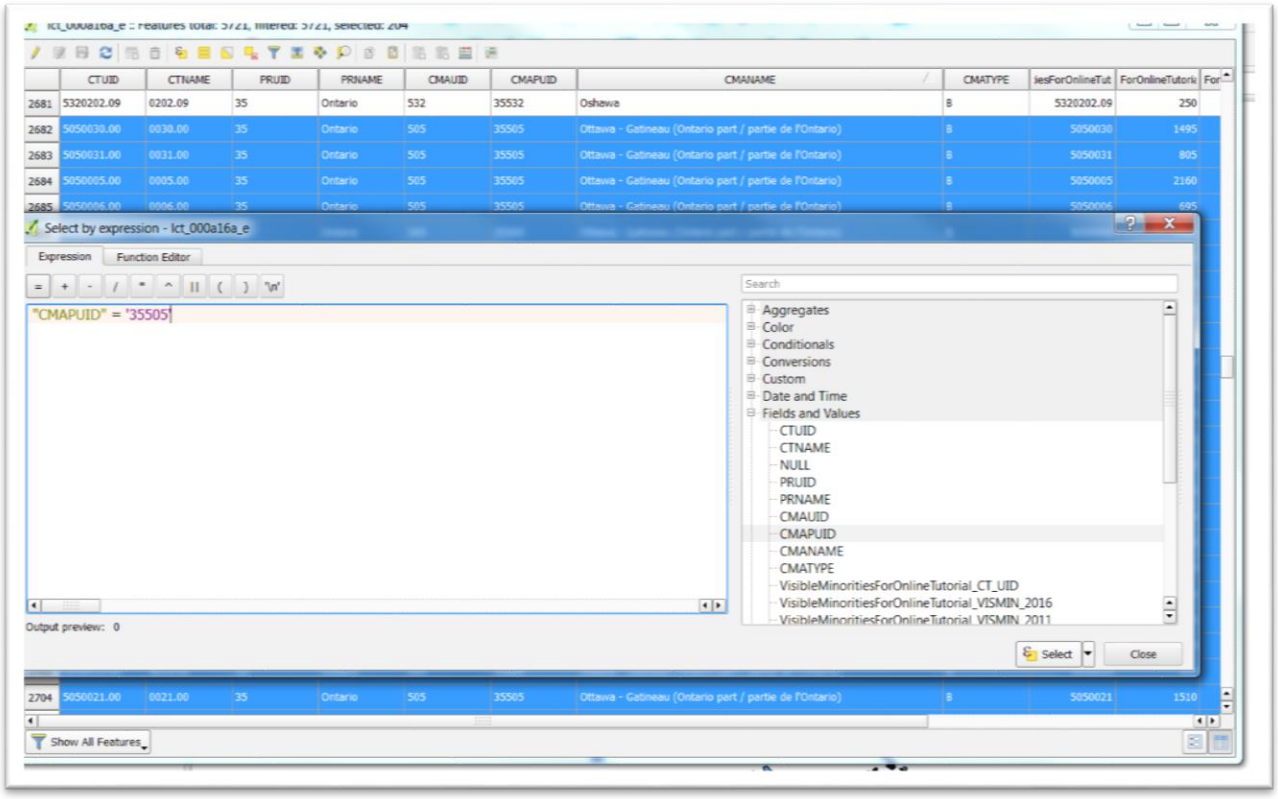
Click the “=” tab above “CMAPUID”, and then 35505, bracketed by single quotes.



Click the “Select” tab a the bottom right.



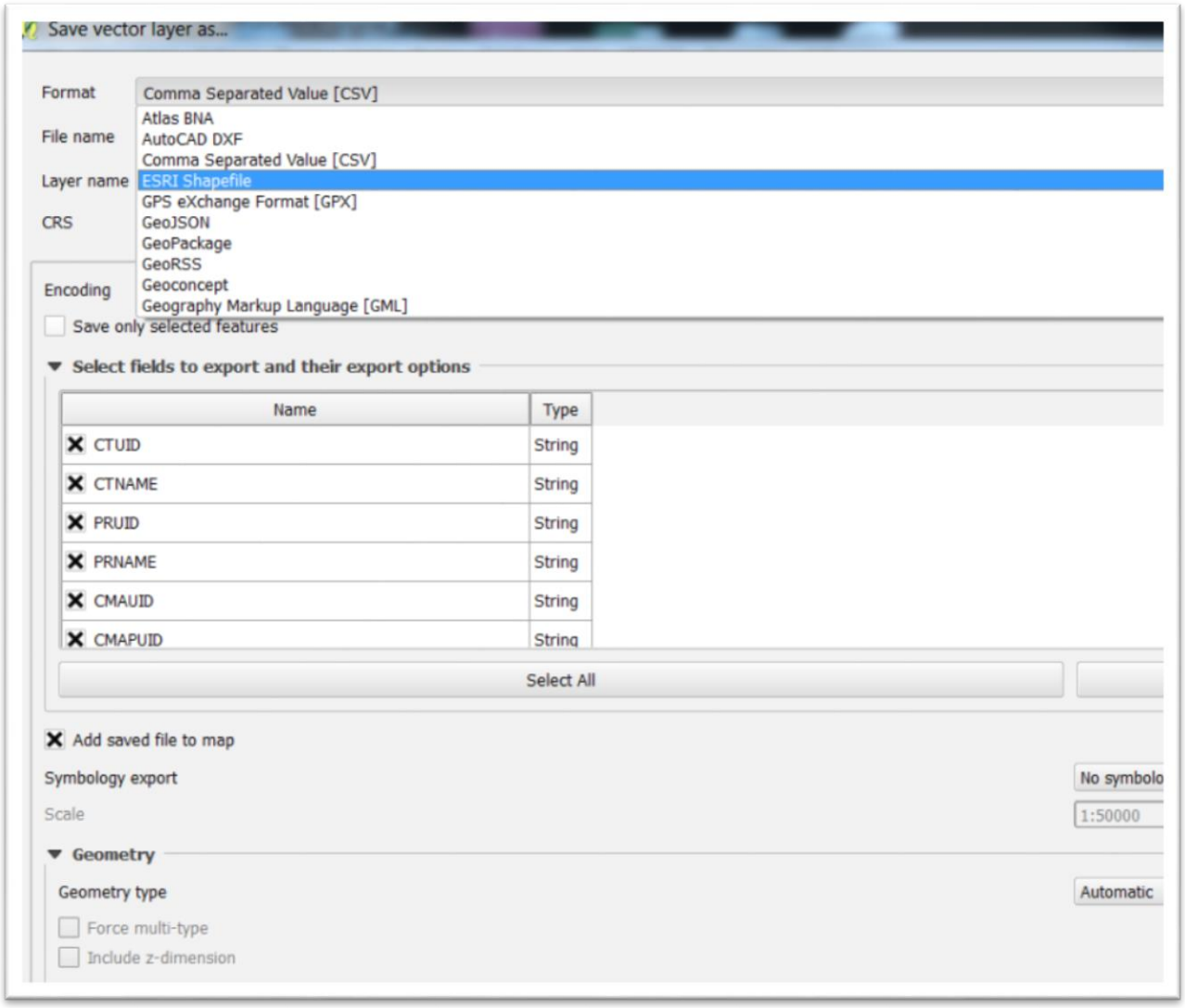
You'll notice that all the rows with the CMAPUID number 35505 have been selected.



Close the dialogue box.

Now we want to save a new layer with only those selected identification numbers.

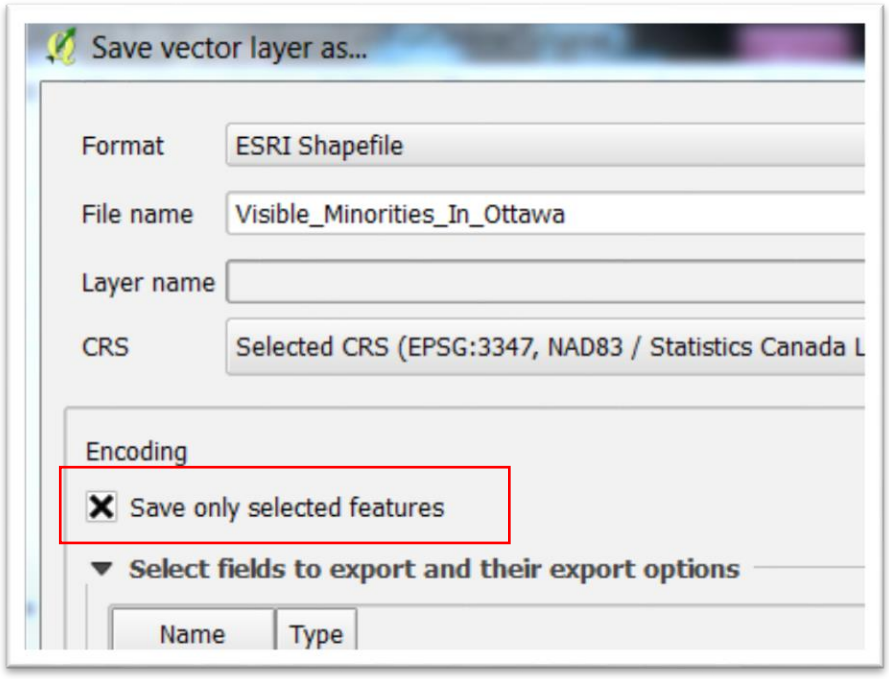
Right-click on the layer, and select “Save As” from the short-cut menu.



The new layer’s format will be a shape file, so make sure that option is selected.

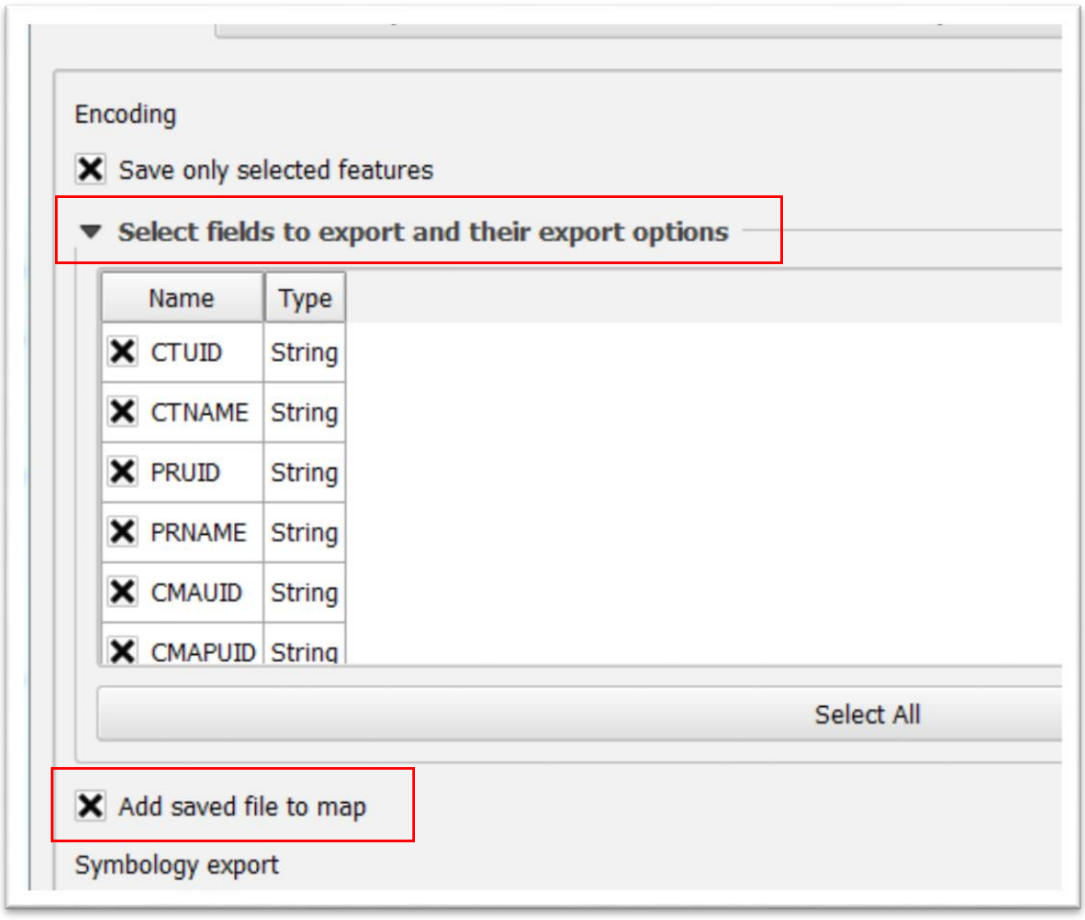
Browse to the folder for this tutorial and name the file something like “Visible_Minorities_In_Ottawa”.

Be sure to select “Save only selected features”.



Neglecting to check this box is an easy mistake to make. However, if you don’t select it, then you simply end up re-saving the entire file.

In the “Select fields to export and their export options” section, you can deselect the columns that you don’t want to appear in your new layer.

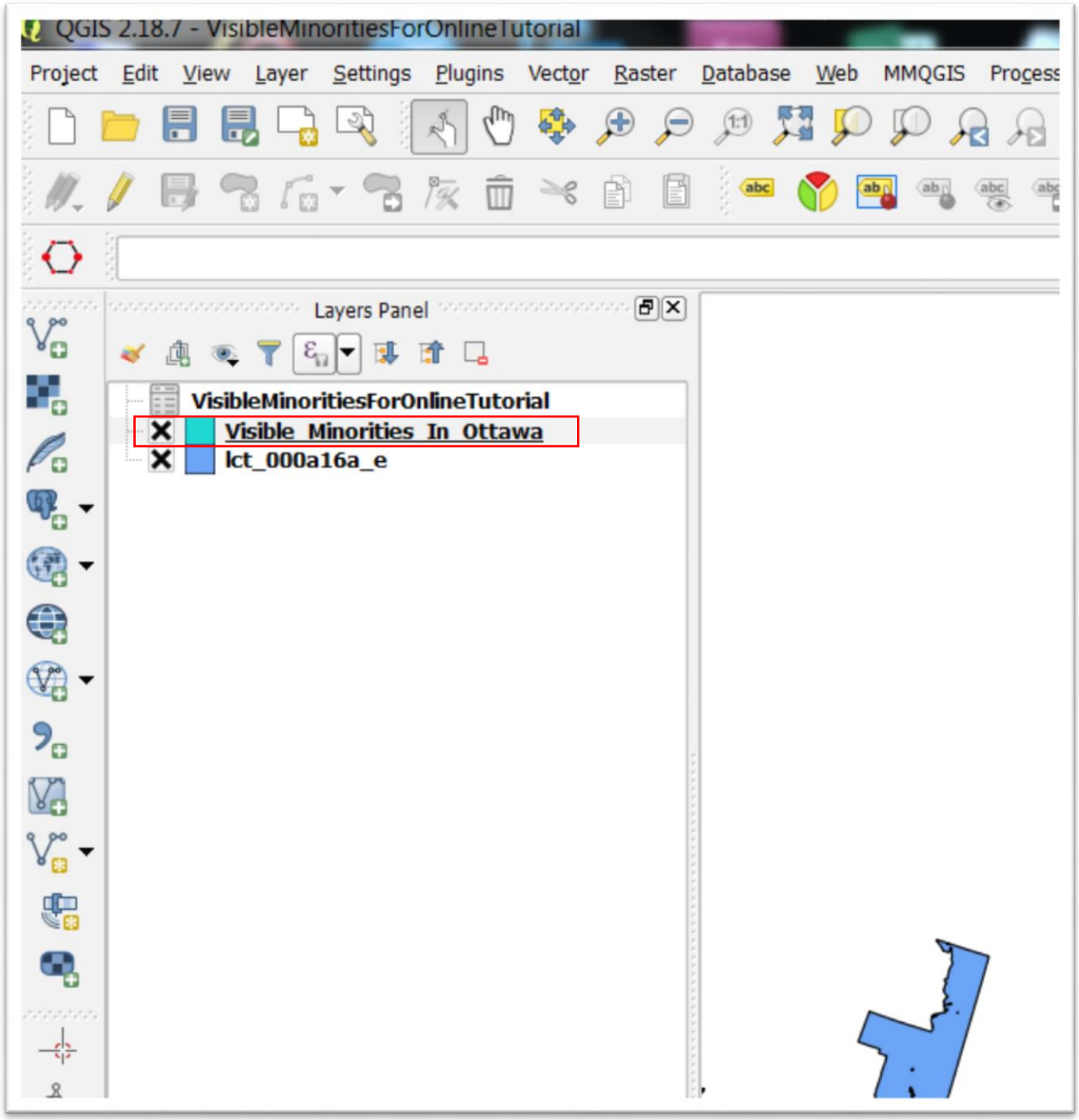


Let’s just leave all the fields selected.

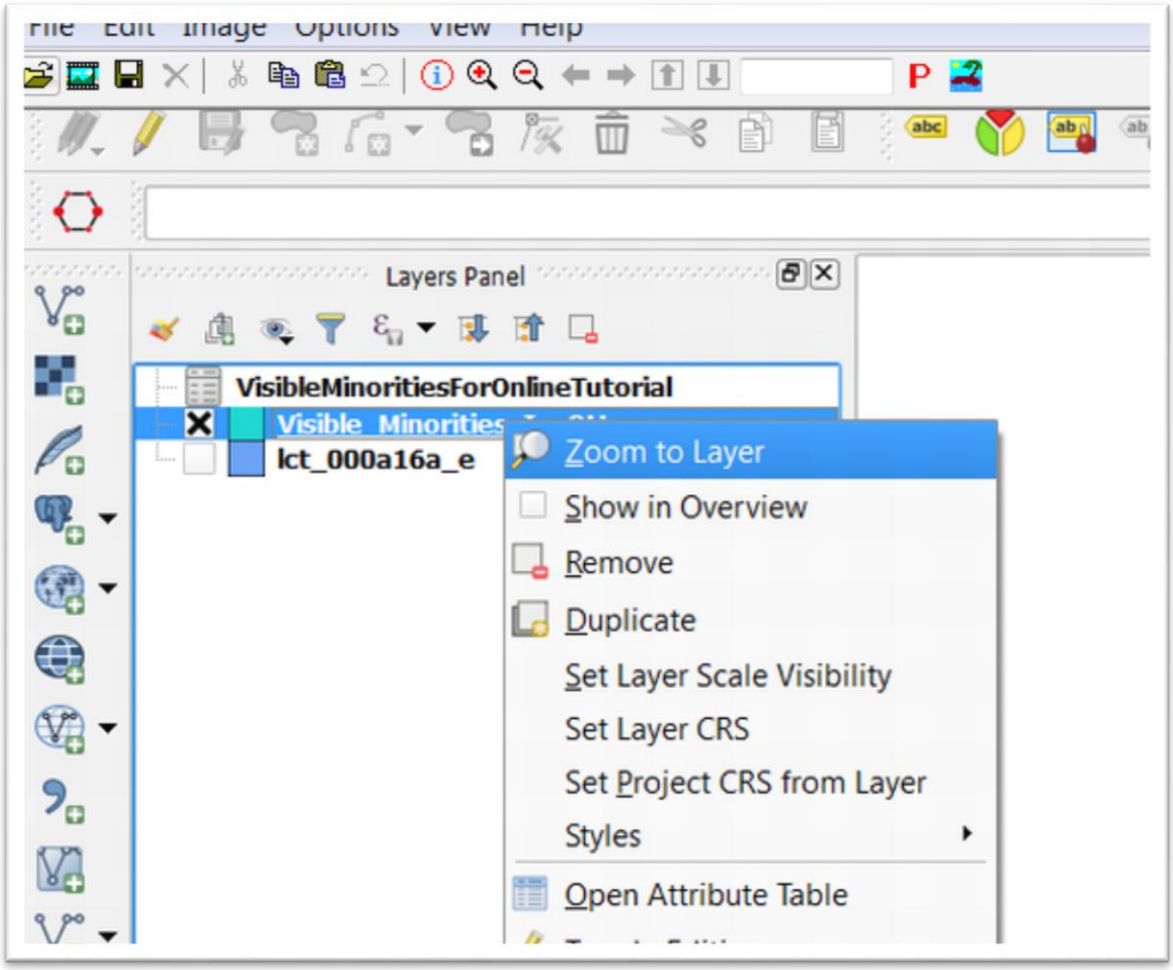
Before saving, make sure that the box to the left of “Add saved file to map” layer is checked off.

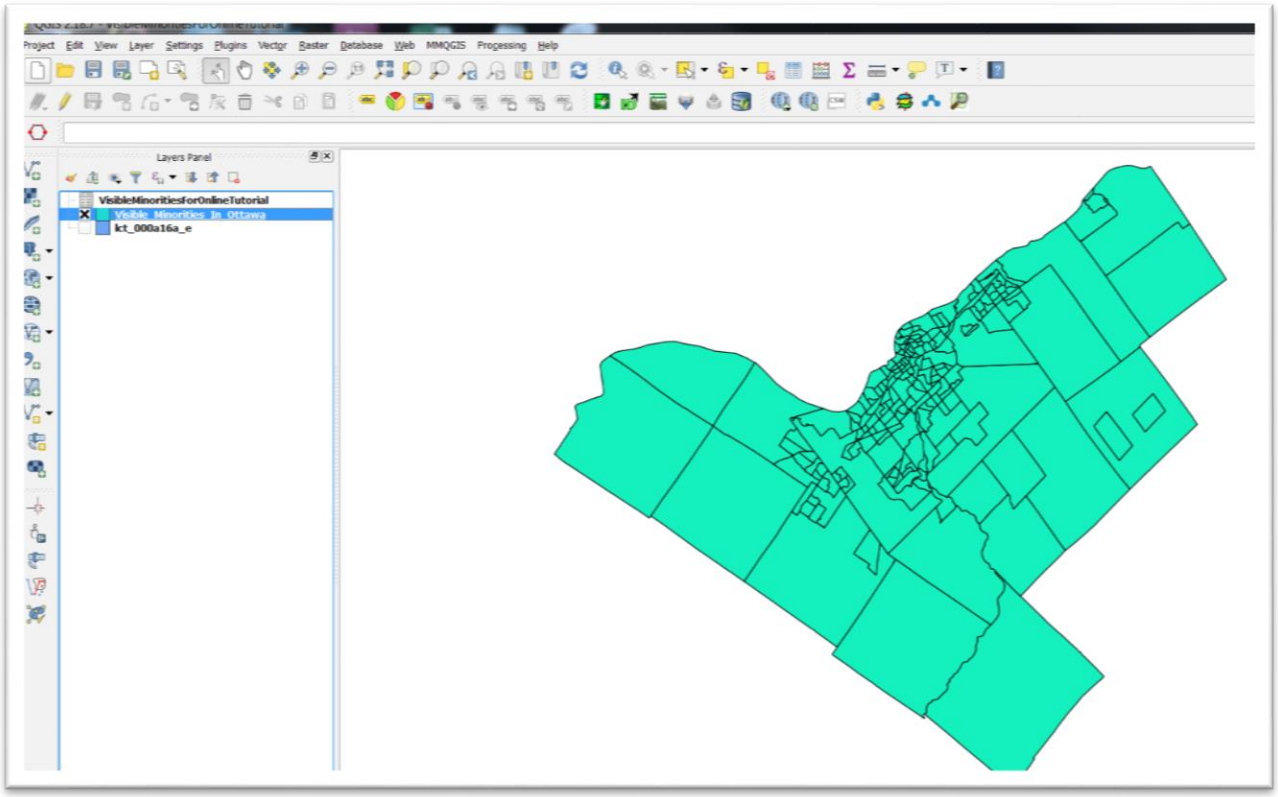
Double check all of your steps (a good habit to get into for each step in the process) before selecting the OK tab.

A message indicating success will briefly appear. To your left, you'll notice the new layer.



Deslect the first layer, right-click on your new layer, and choose the "Zoom to layer" option in order to see the Ottawa census tracts.


File Edit Image Options View Help
Layers Panel
VisibleMinoritiesForOnlineTutorial
Visible_Minorities
lct_000a16a_e
Zoom to Layer
Show in Overview
Remove
Duplicate
Set Layer Scale Visibility
Set Layer CRS
Set Project CRS from Layer
Styles
Open Attribute Table

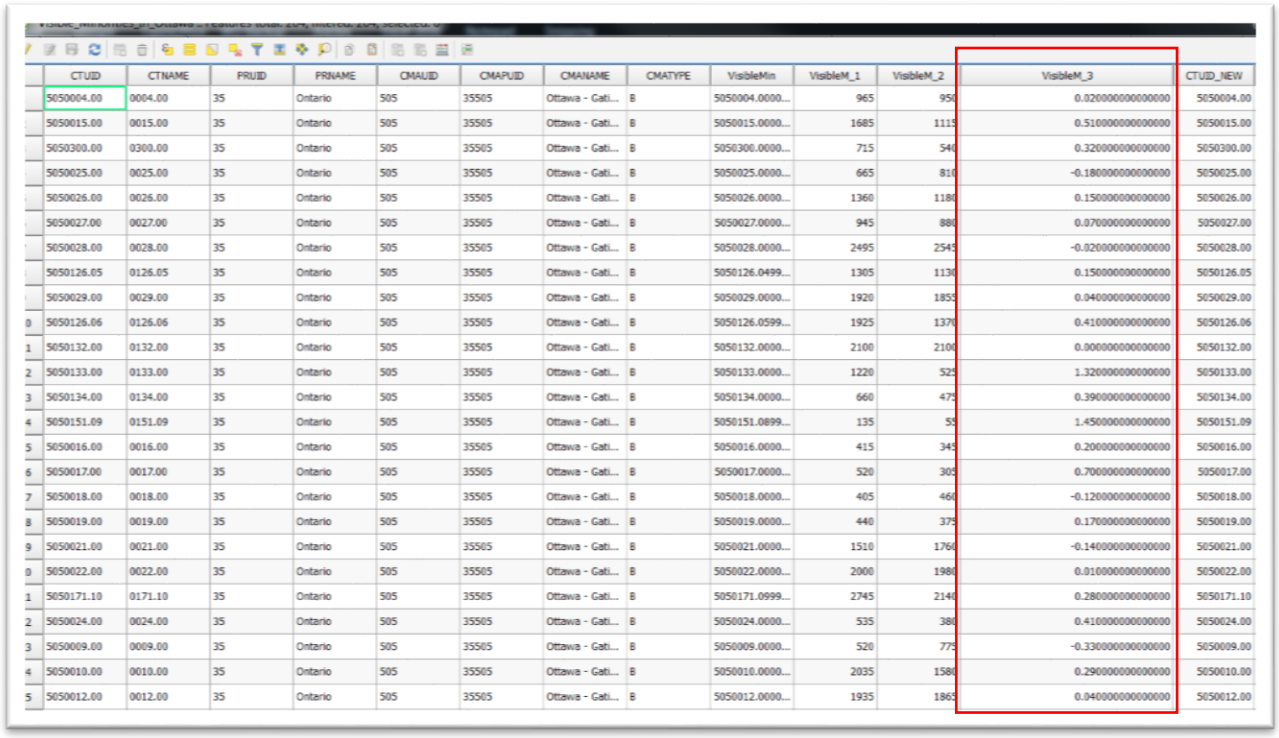


Note, your default colour will likely be different.

The uniform colour might make you think nothing has happened. However, that's because we must symbolize, or create a colour scheme that assigns colours on a grid to specific ranges of values.

Before we assign values to differentiate census tracts, we'll have to clean up the numbers in our new layer's attribute table, add a new column, and then rename some columns.

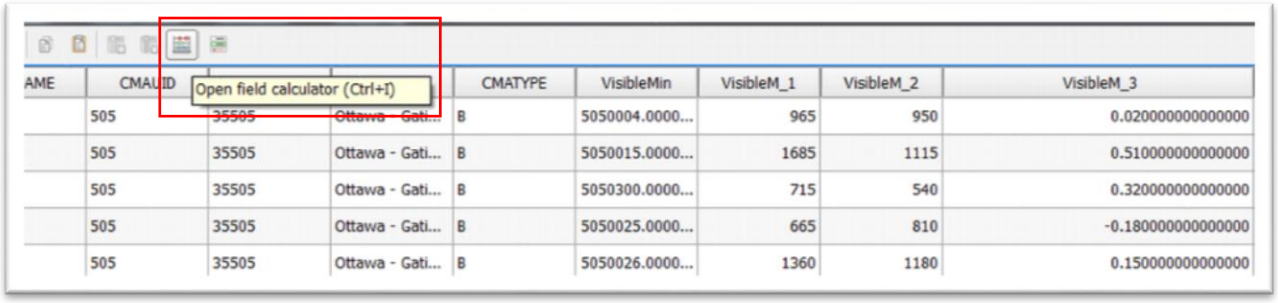
Open the attribute table.



CTUID	CTNAME	PRUID	PRNAME	CMAUID	CMAPUID	CMANAME	CMATYPE	VisibleMin	VisibleM_1	VisibleM_2	VisibleM_3	CTUID_NEW
5050004.00	0004.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050004.0000...	965	950	0.020000000000000	5050004.00
5050015.00	0015.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050015.0000...	1685	1115	0.510000000000000	5050015.00
5050300.00	0300.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050300.0000...	715	540	0.320000000000000	5050300.00
5050025.00	0025.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050025.0000...	665	810	-0.180000000000000	5050025.00
5050026.00	0026.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050026.0000...	1360	1180	0.150000000000000	5050026.00
5050027.00	0027.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050027.0000...	945	880	0.070000000000000	5050027.00
5050028.00	0028.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050028.0000...	2495	2545	-0.020000000000000	5050028.00
5050126.05	0126.05	35	Ontario	505	35505	Ottawa - Gati...	B	5050126.0499...	1305	1130	0.150000000000000	5050126.05
5050029.00	0029.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050029.0000...	1920	1855	0.040000000000000	5050029.00
5050126.06	0126.06	35	Ontario	505	35505	Ottawa - Gati...	B	5050126.0599...	1925	1370	0.410000000000000	5050126.06
5050132.00	0132.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050132.0000...	2100	2100	0.000000000000000	5050132.00
5050133.00	0133.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050133.0000...	1220	525	1.320000000000000	5050133.00
5050134.00	0134.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050134.0000...	660	475	0.390000000000000	5050134.00
5050151.09	0151.09	35	Ontario	505	35505	Ottawa - Gati...	B	5050151.0899...	135	55	1.450000000000000	5050151.09
5050016.00	0016.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050016.0000...	415	345	0.200000000000000	5050016.00
5050017.00	0017.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050017.0000...	520	305	0.700000000000000	5050017.00
5050018.00	0018.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050018.0000...	405	460	-0.120000000000000	5050018.00
5050019.00	0019.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050019.0000...	440	375	0.170000000000000	5050019.00
5050021.00	0021.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050021.0000...	1510	1760	-0.140000000000000	5050021.00
5050022.00	0022.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050022.0000...	2000	1980	0.010000000000000	5050022.00
5050171.10	0171.10	35	Ontario	505	35505	Ottawa - Gati...	B	5050171.0999...	2745	2140	0.280000000000000	5050171.10
5050024.00	0024.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050024.0000...	535	380	0.410000000000000	5050024.00
5050009.00	0009.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050009.0000...	520	775	-0.330000000000000	5050009.00
5050010.00	0010.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050010.0000...	2035	1580	0.290000000000000	5050010.00
5050012.00	0012.00	35	Ontario	505	35505	Ottawa - Gati...	B	5050012.0000...	1935	1865	0.040000000000000	5050012.00

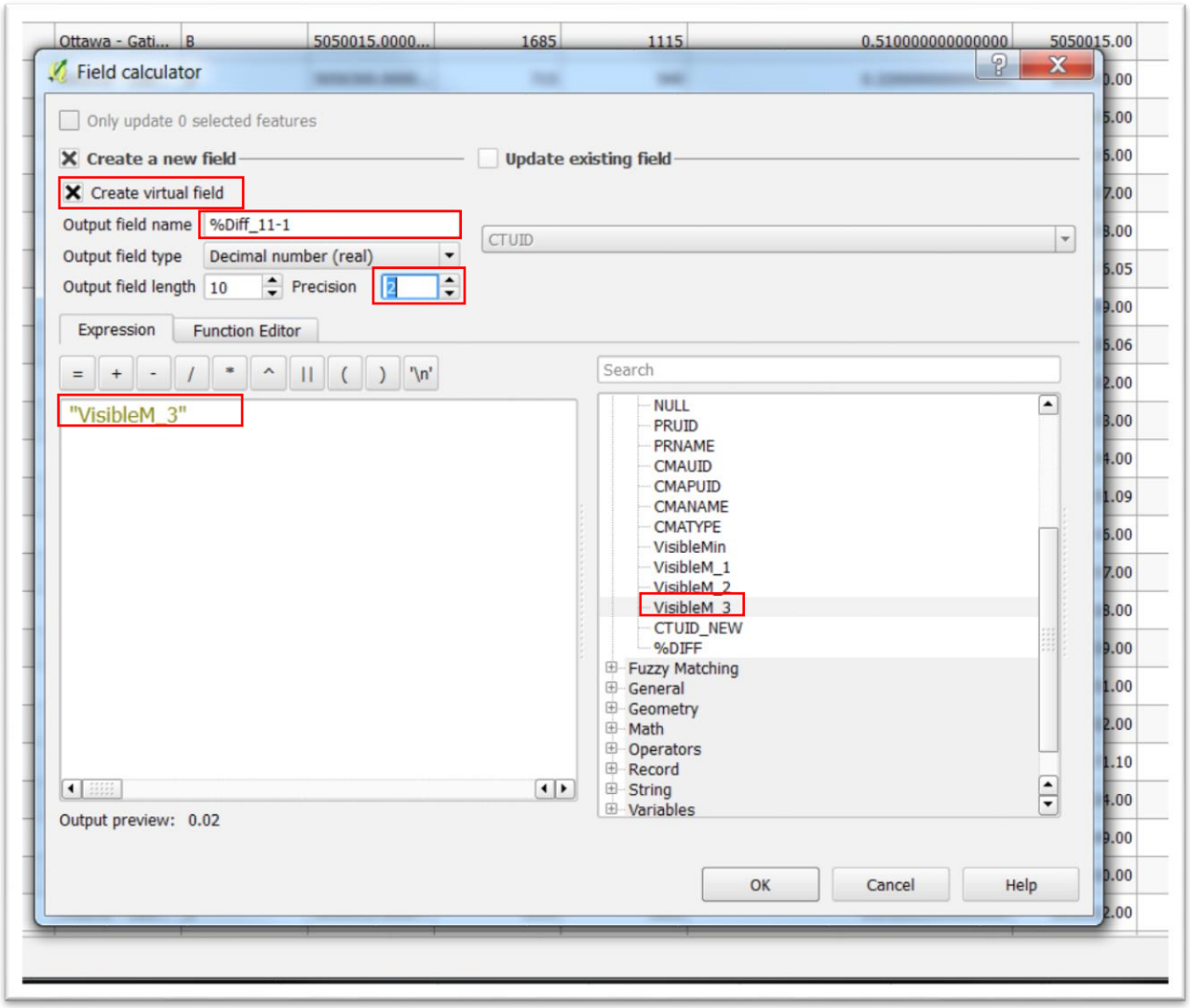
There are too many decimal points in the percent difference column, which Qgis has renamed "VisibleM_3". (more on the reason for this a bit later in this tutorial).

Select the "Open field calculator" icon.

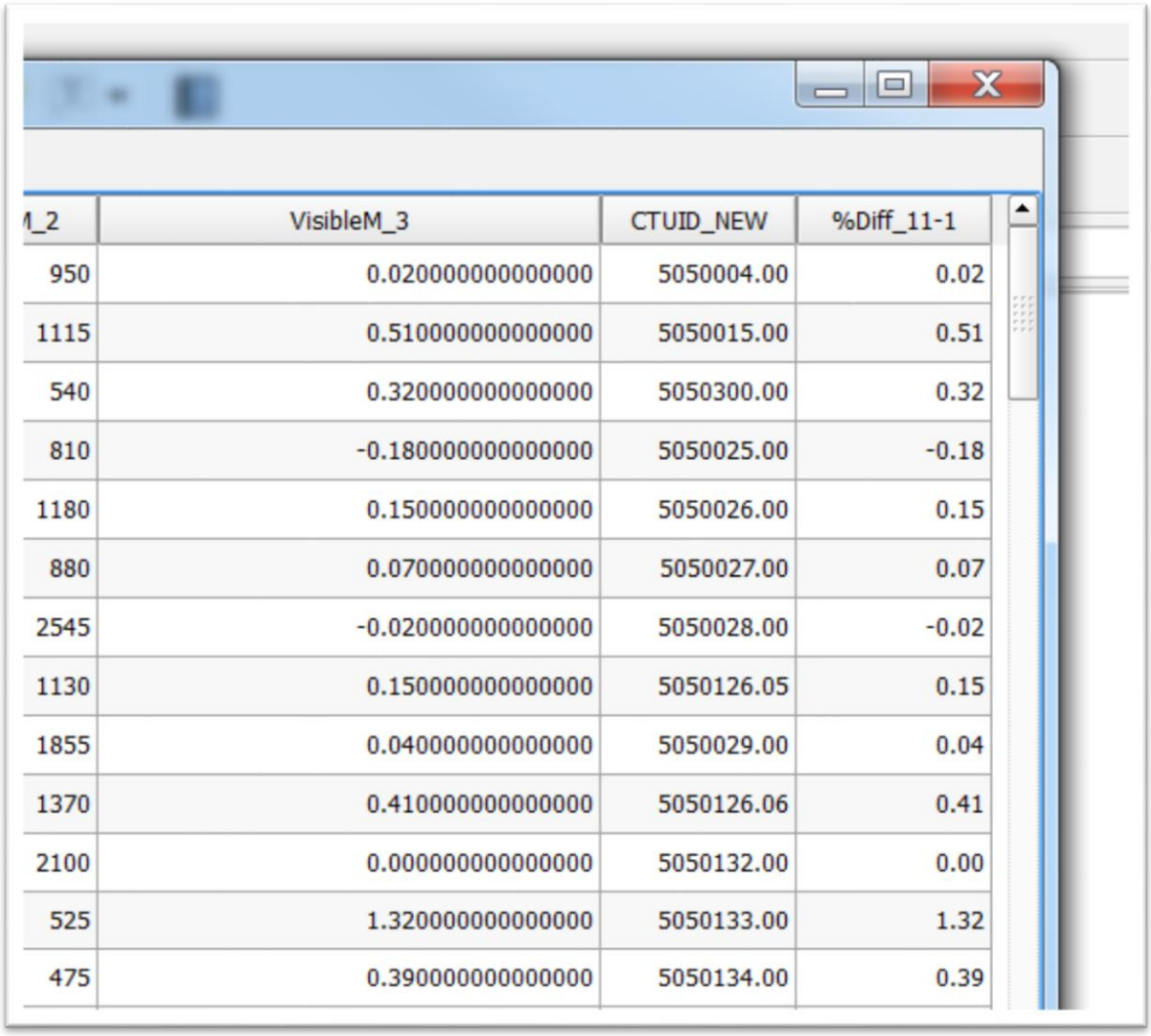


AME	CMAUID			CMATYPE	VisibleMin	VisibleM_1	VisibleM_2	VisibleM_3
	505	35505	Ottawa - Gati...	B	5050004.0000...	965	950	0.020000000000000
	505	35505	Ottawa - Gati...	B	5050015.0000...	1685	1115	0.510000000000000
	505	35505	Ottawa - Gati...	B	5050300.0000...	715	540	0.320000000000000
	505	35505	Ottawa - Gati...	B	5050025.0000...	665	810	-0.180000000000000
	505	35505	Ottawa - Gati...	B	5050026.0000...	1360	1180	0.150000000000000

Give your field a new name, make the field type a decimal number with a precision of 2, and select the “VisibleM_3” column.



If your dialogue box looks like this, select the OK tab to return to the attrbute table.



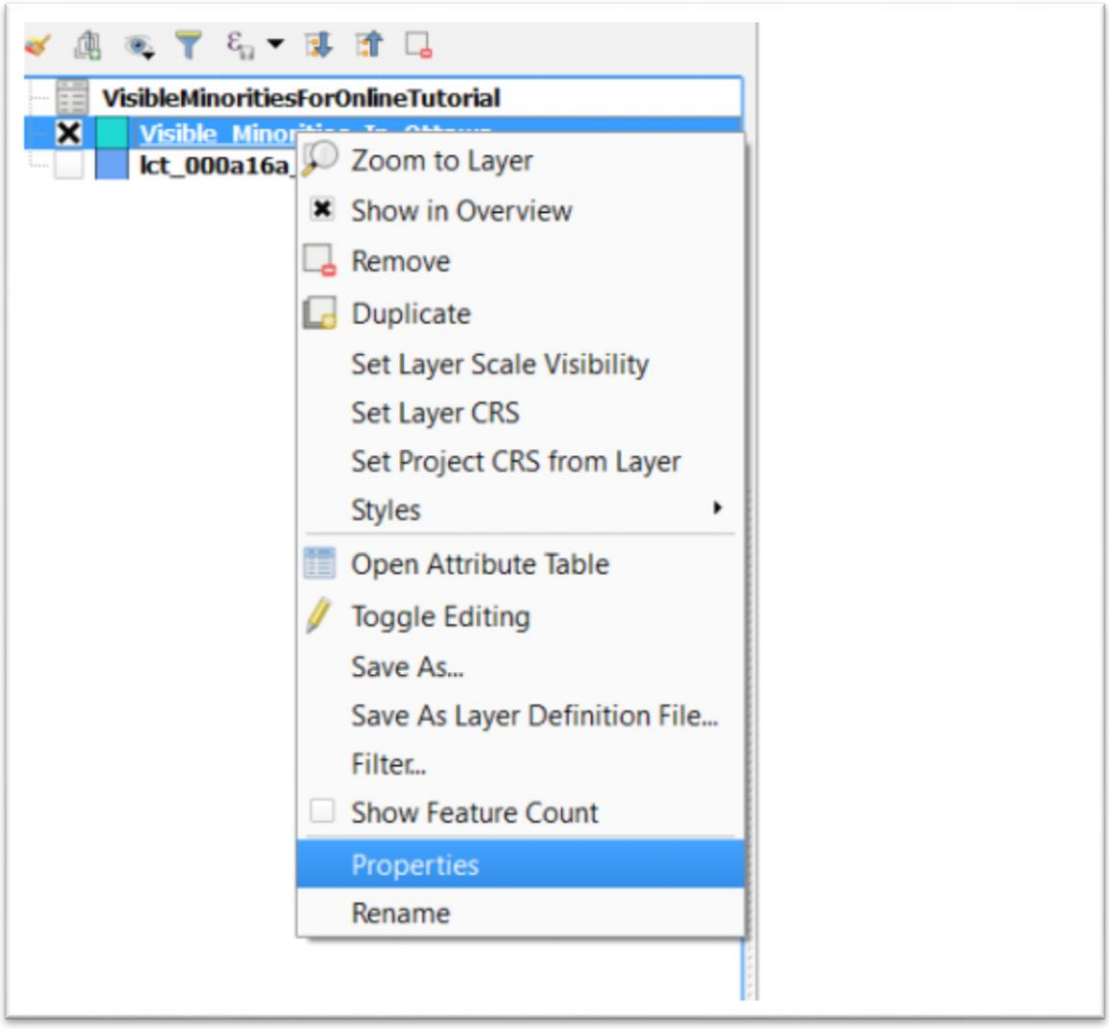
M_2	VisibleM_3	CTUID_NEW	%Diff_11-1
950	0.020000000000000	5050004.00	0.02
1115	0.510000000000000	5050015.00	0.51
540	0.320000000000000	5050300.00	0.32
810	-0.180000000000000	5050025.00	-0.18
1180	0.150000000000000	5050026.00	0.15
880	0.070000000000000	5050027.00	0.07
2545	-0.020000000000000	5050028.00	-0.02
1130	0.150000000000000	5050126.05	0.15
1855	0.040000000000000	5050029.00	0.04
1370	0.410000000000000	5050126.06	0.41
2100	0.000000000000000	5050132.00	0.00
525	1.320000000000000	5050133.00	1.32
475	0.390000000000000	5050134.00	0.39

Now we can fix the column titles for our 2011 and 2016 visible minorities' numeric values.

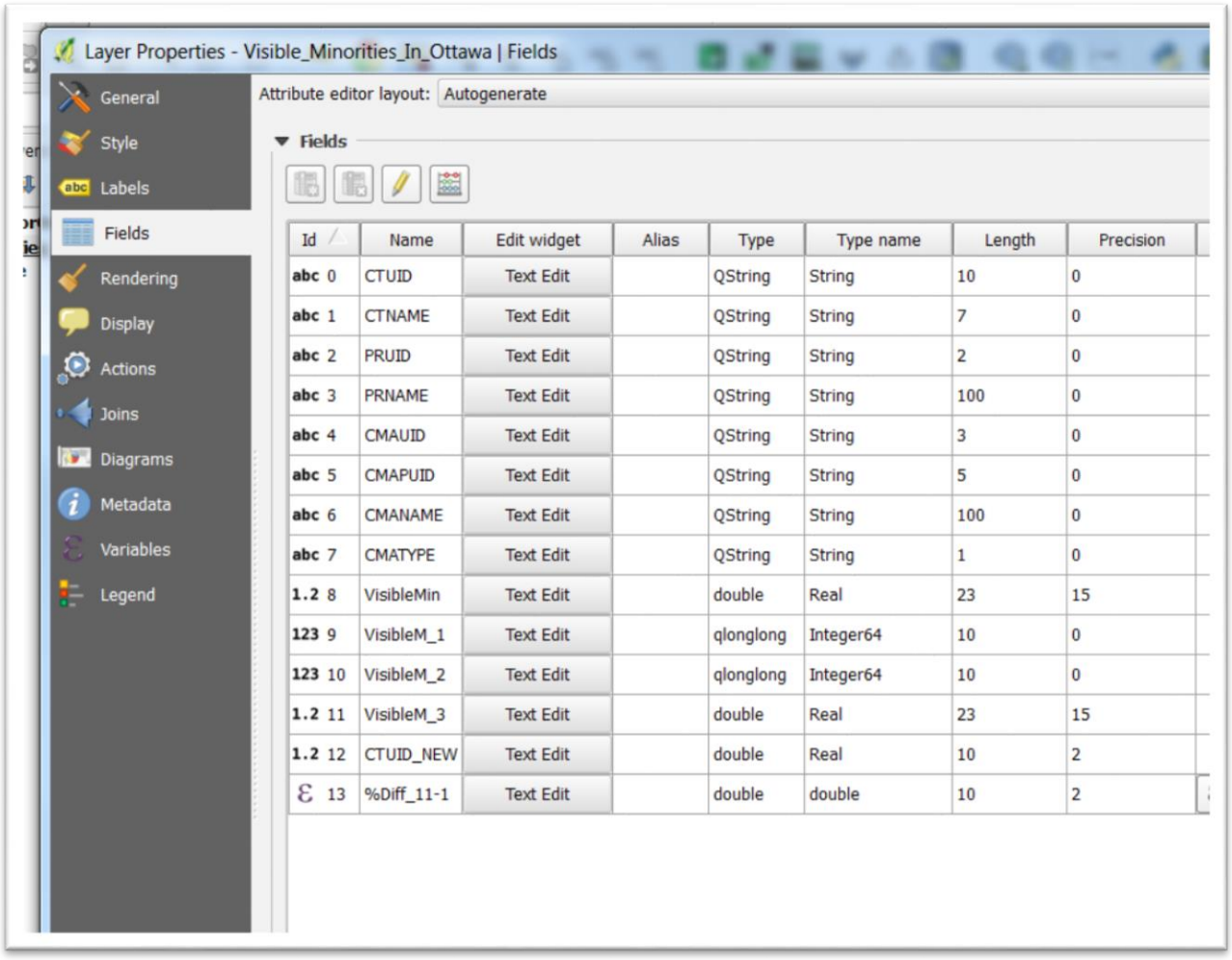
VisibleM_1	VisibleM_2	VisibleM_3
965	950	0.020000000000000
1685	1115	0.510000000000000
715	540	0.320000000000000
665	810	-0.180000000000000
1360	1180	0.150000000000000

The first column to the left represents the 2016 values. The second, 2011. The third is the field that contains the percent difference, which was refomatted with two decimal places in the previous step.

Close the attribute table, right click on the layer. Go to “Properties”.

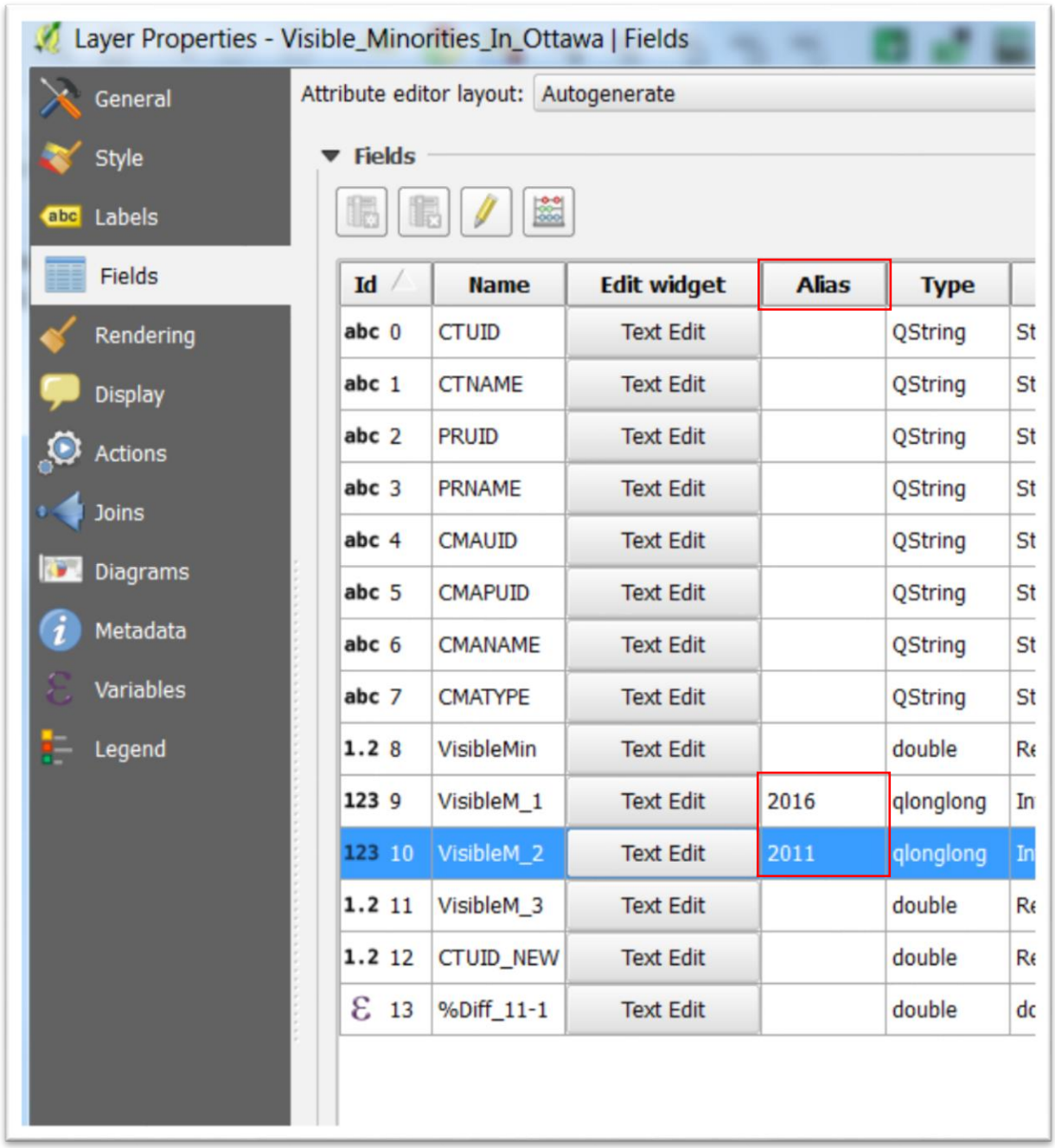


Select the “Fields” icon.

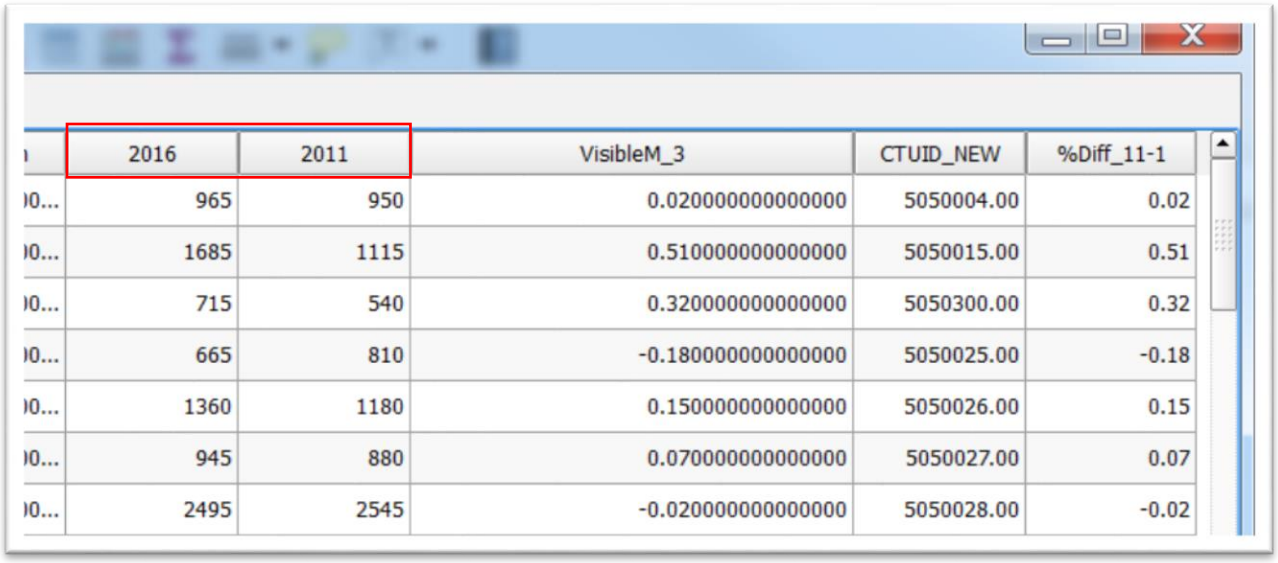


Id	Name	Edit widget	Alias	Type	Type name	Length	Precision
abc 0	CTUID	Text Edit		QString	String	10	0
abc 1	CTNAME	Text Edit		QString	String	7	0
abc 2	PRUID	Text Edit		QString	String	2	0
abc 3	PRNAME	Text Edit		QString	String	100	0
abc 4	CMAUID	Text Edit		QString	String	3	0
abc 5	CMAPUID	Text Edit		QString	String	5	0
abc 6	CMANAME	Text Edit		QString	String	100	0
abc 7	CMATYPE	Text Edit		QString	String	1	0
1.2 8	VisibleMin	Text Edit		double	Real	23	15
123 9	VisibleM_1	Text Edit		qlonglong	Integer64	10	0
123 10	VisibleM_2	Text Edit		qlonglong	Integer64	10	0
1.2 11	VisibleM_3	Text Edit		double	Real	23	15
1.2 12	CTUID_NEW	Text Edit		double	Real	10	2
ε 13	%Diff_11-1	Text Edit		double	double	10	2

We will rename VisibleM_1 and Visible_2. Double-click the cell in the Alias column and type 2016 and 2011, respectively.



Select “Apply” and “OK”. Return to the attribute table to see the renamed columns.

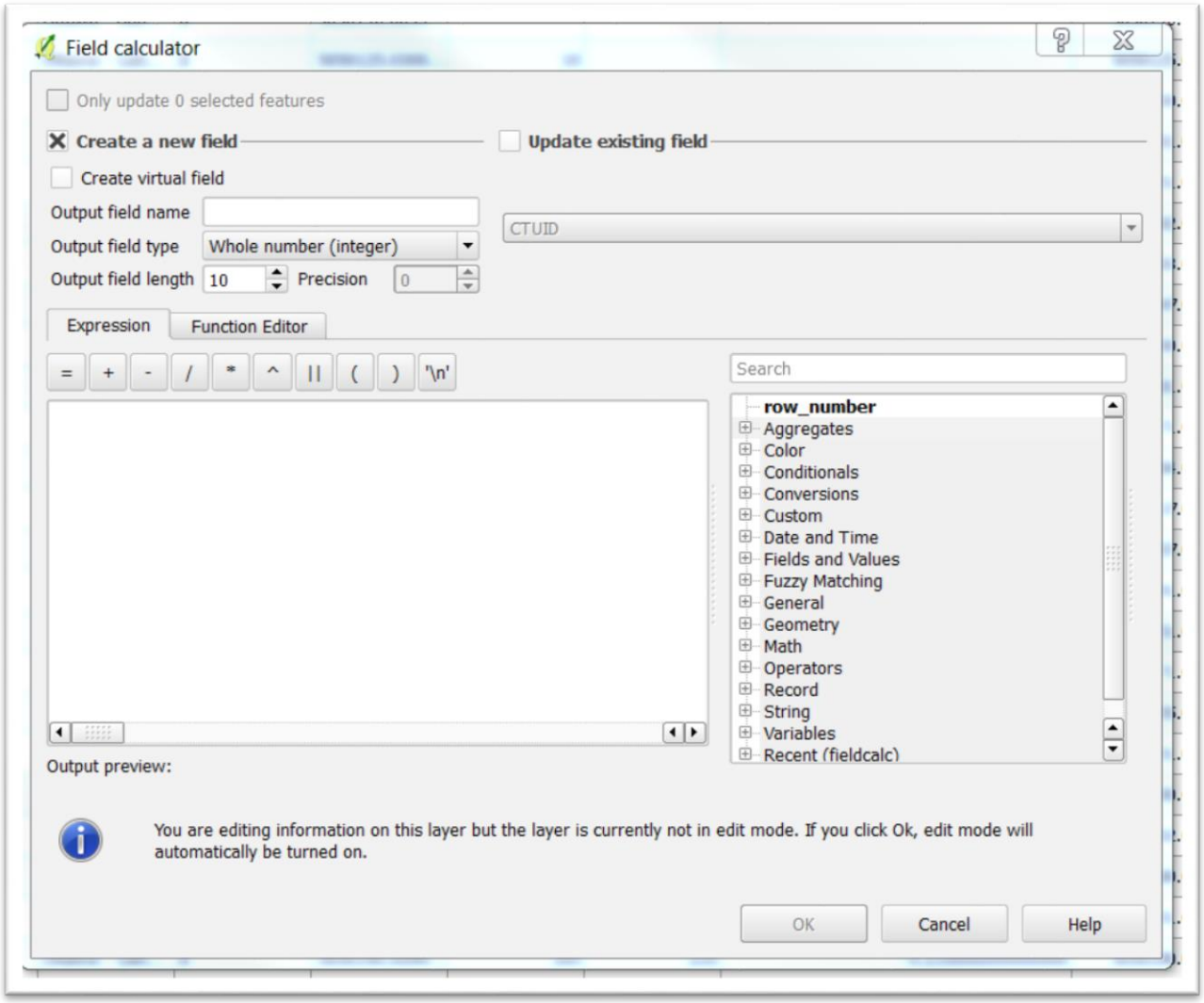


	2016	2011	VisibleM_3	CTUID_NEW	%Diff_11-1
)0...	965	950	0.020000000000000	5050004.00	0.02
)0...	1685	1115	0.510000000000000	5050015.00	0.51
)0...	715	540	0.320000000000000	5050300.00	0.32
)0...	665	810	-0.180000000000000	5050025.00	-0.18
)0...	1360	1180	0.150000000000000	5050026.00	0.15
)0...	945	880	0.070000000000000	5050027.00	0.07
)0...	2495	2545	-0.020000000000000	5050028.00	-0.02

So far, for each census tract, we have visible minority numbers for 2016, 2011 and the percent differences. This means that we can eventually assign column colours based on numeric values in each of these fields. However, before doing this, let’s create one more column -- the growth or decrease from 2011 to 2016. In a spreadsheet, we would just create a new column, and use a calculation using the “-“ operator to obtain the difference.

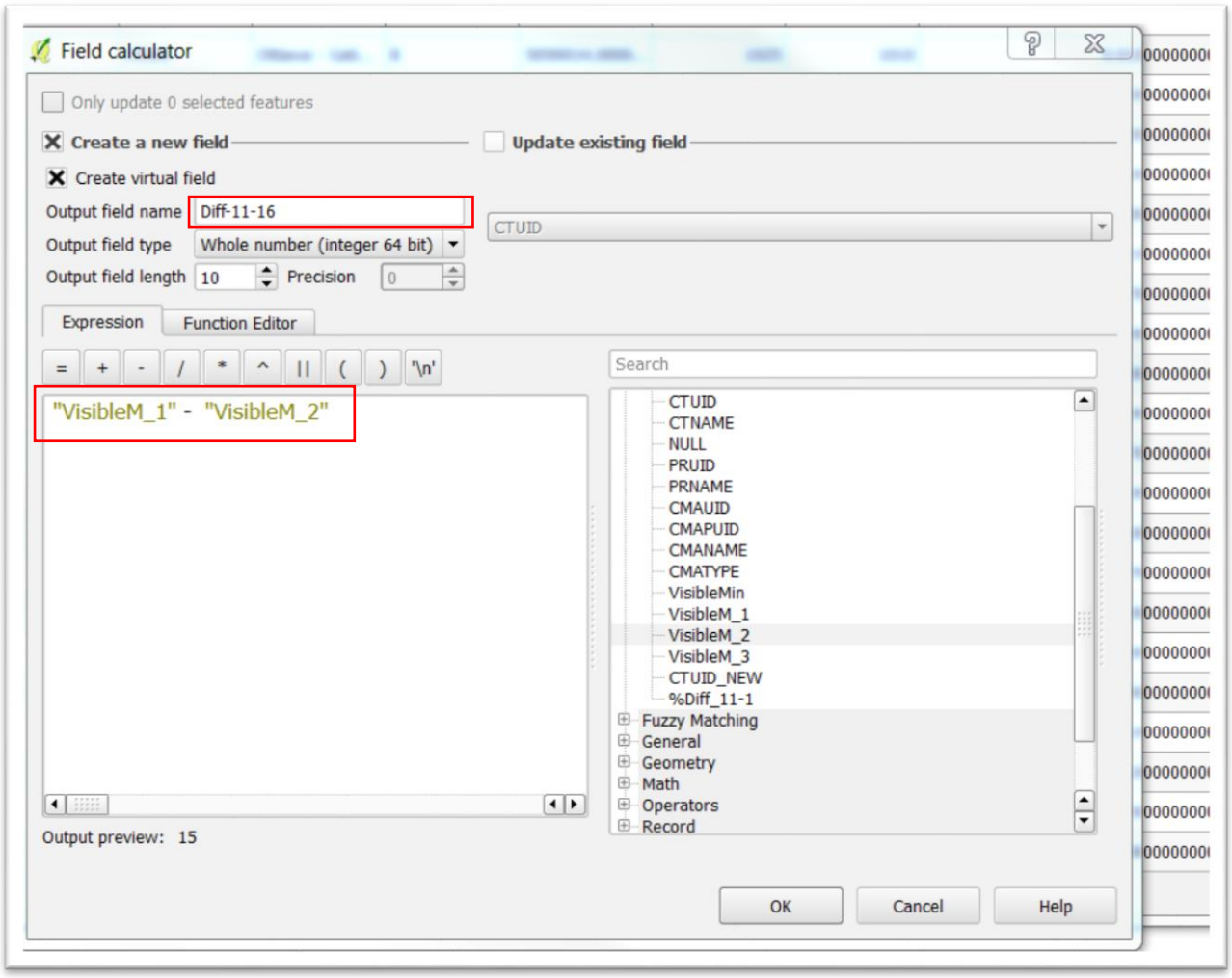
In Qgis, we can do the same thing, using an SQL expression .

Select the “Open field calculator” to obtain the dialogue box.

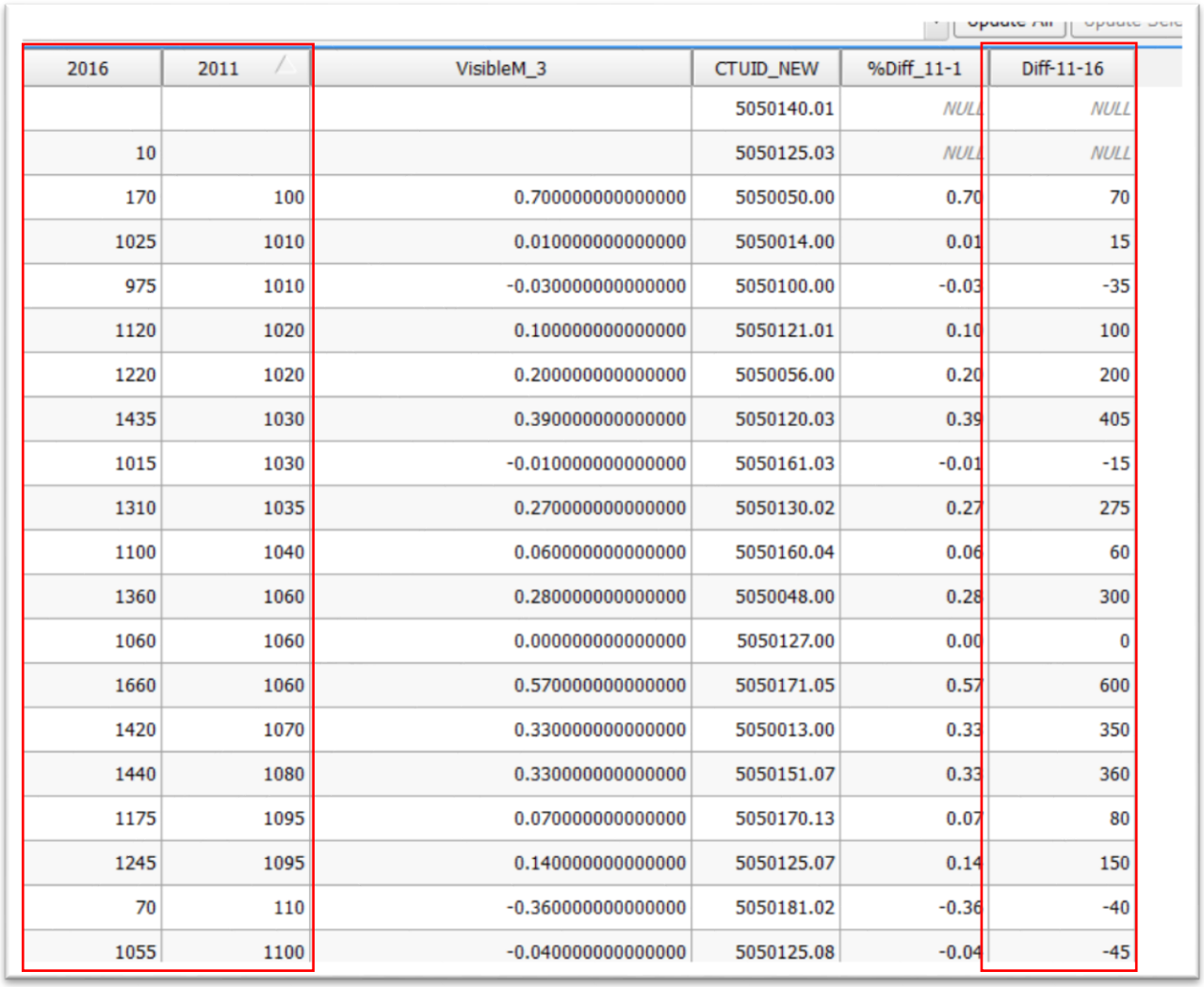


Call the new field “Diff-11-16.”

Select “VisibleM_1” the “-“ operator, and then “VisibleM_2”. (NOTE: The field calculator dialogue box does not retain the aliases we created in the previous step.)



Return to the attribute table.

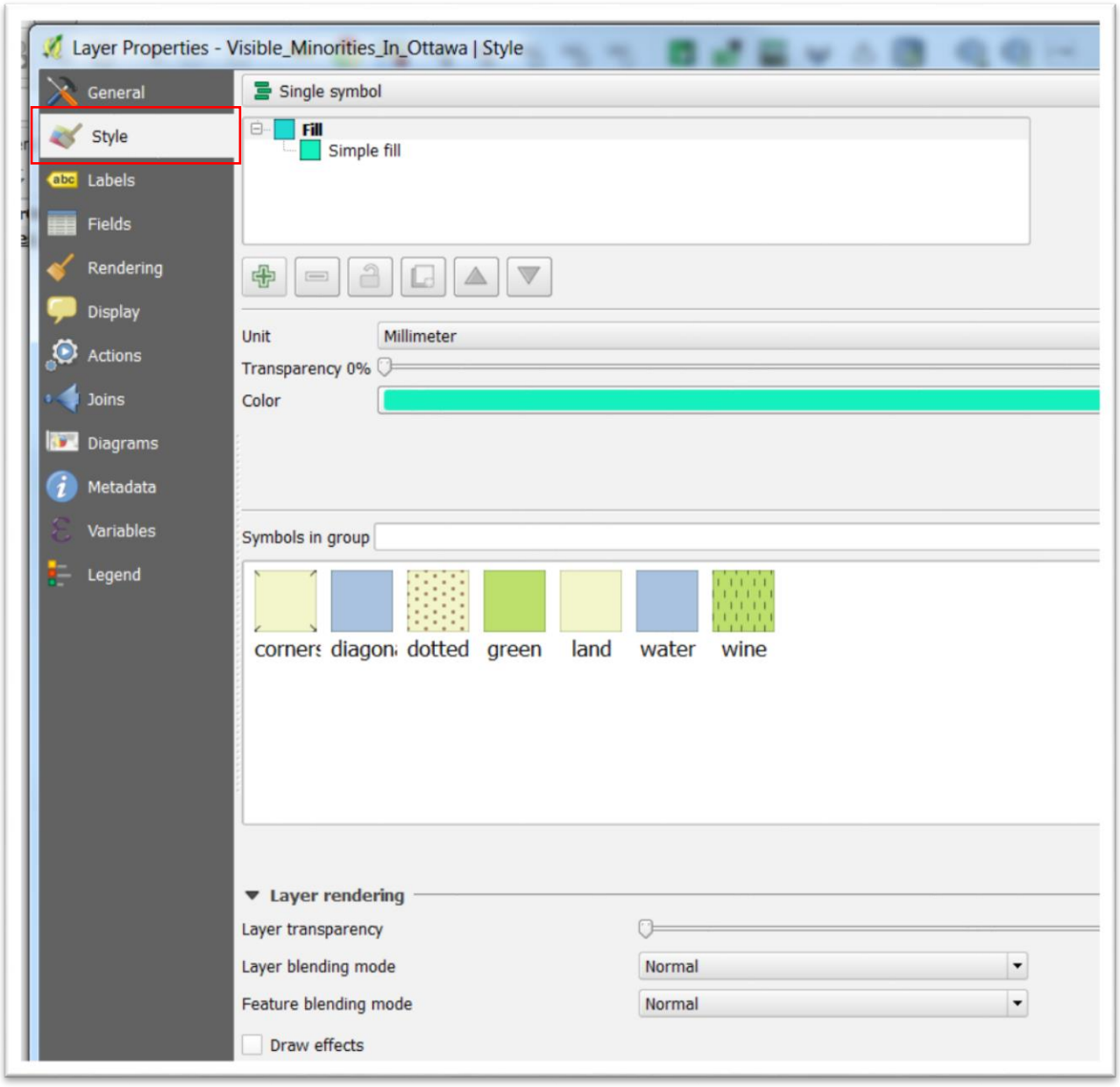


2016	2011	VisibleM_3	CTUID_NEW	%Diff_11-1	Diff-11-16
			5050140.01	NULL	NULL
10			5050125.03	NULL	NULL
170	100	0.700000000000000	5050050.00	0.70	70
1025	1010	0.010000000000000	5050014.00	0.01	15
975	1010	-0.030000000000000	5050100.00	-0.03	-35
1120	1020	0.100000000000000	5050121.01	0.10	100
1220	1020	0.200000000000000	5050056.00	0.20	200
1435	1030	0.390000000000000	5050120.03	0.39	405
1015	1030	-0.010000000000000	5050161.03	-0.01	-15
1310	1035	0.270000000000000	5050130.02	0.27	275
1100	1040	0.060000000000000	5050160.04	0.06	60
1360	1060	0.280000000000000	5050048.00	0.28	300
1060	1060	0.000000000000000	5050127.00	0.00	0
1660	1060	0.570000000000000	5050171.05	0.57	600
1420	1070	0.330000000000000	5050013.00	0.33	350
1440	1080	0.330000000000000	5050151.07	0.33	360
1175	1095	0.070000000000000	5050170.13	0.07	80
1245	1095	0.140000000000000	5050125.07	0.14	150
70	110	-0.360000000000000	5050181.02	-0.36	-40
1055	1100	-0.040000000000000	5050125.08	-0.04	-45

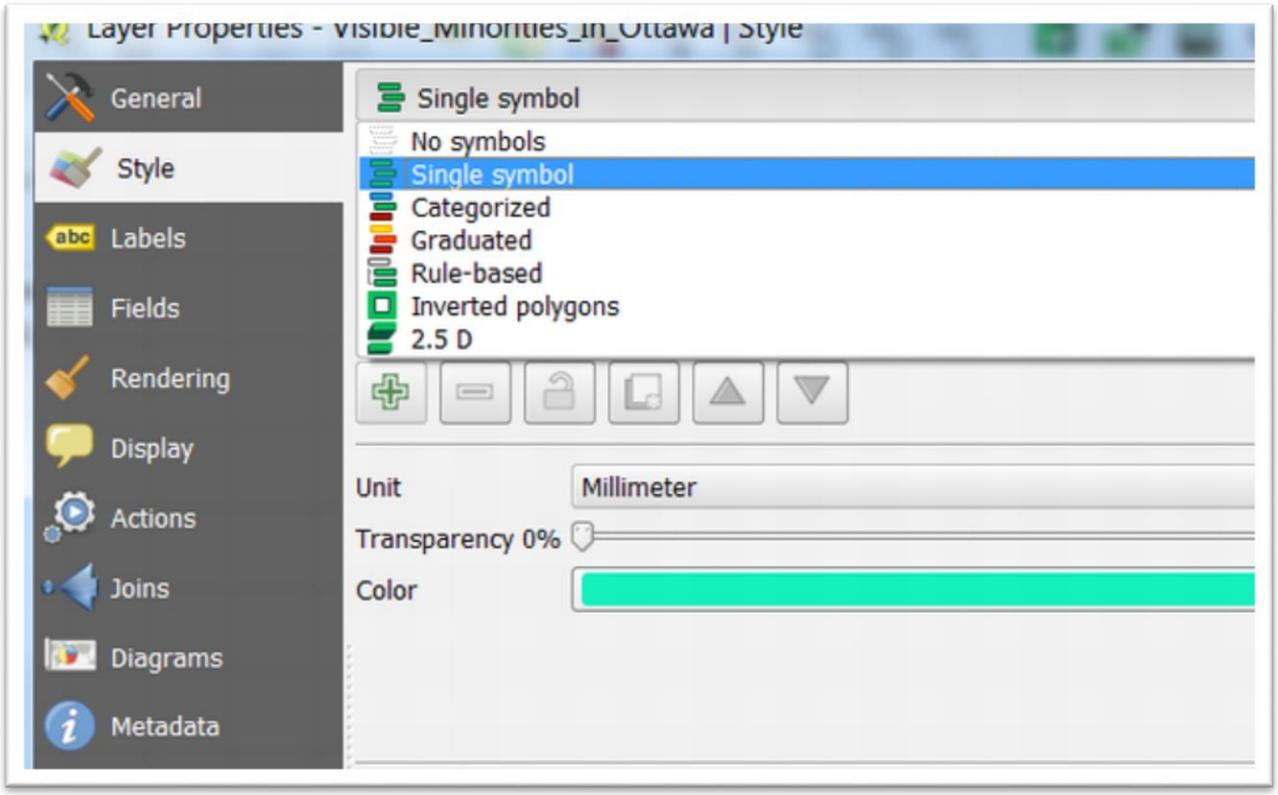
Now we have a new column with the raw differences between 2011 and 2016.

We are ready to symbolize or assign colours to our values we choose to write about.

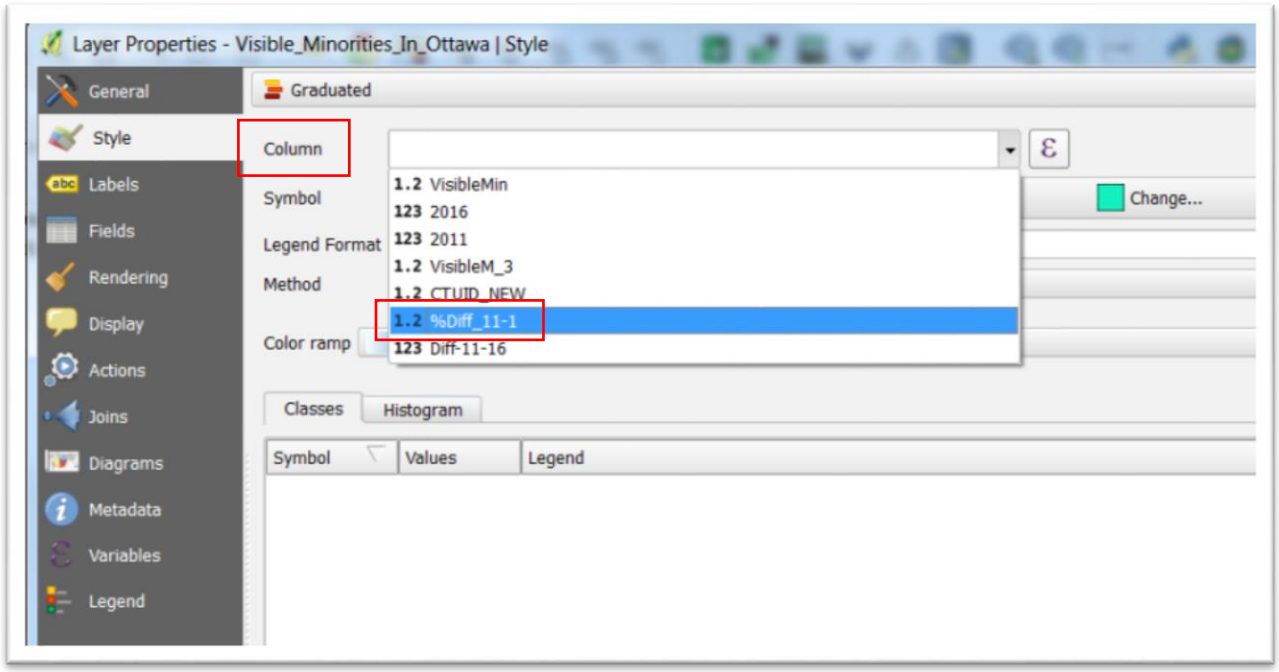
Close the attribute table, right-click on your layer, chose “Properties” from the short-cut menu to produce your “Layer Properties” dialogue box, and then the “Style” section.

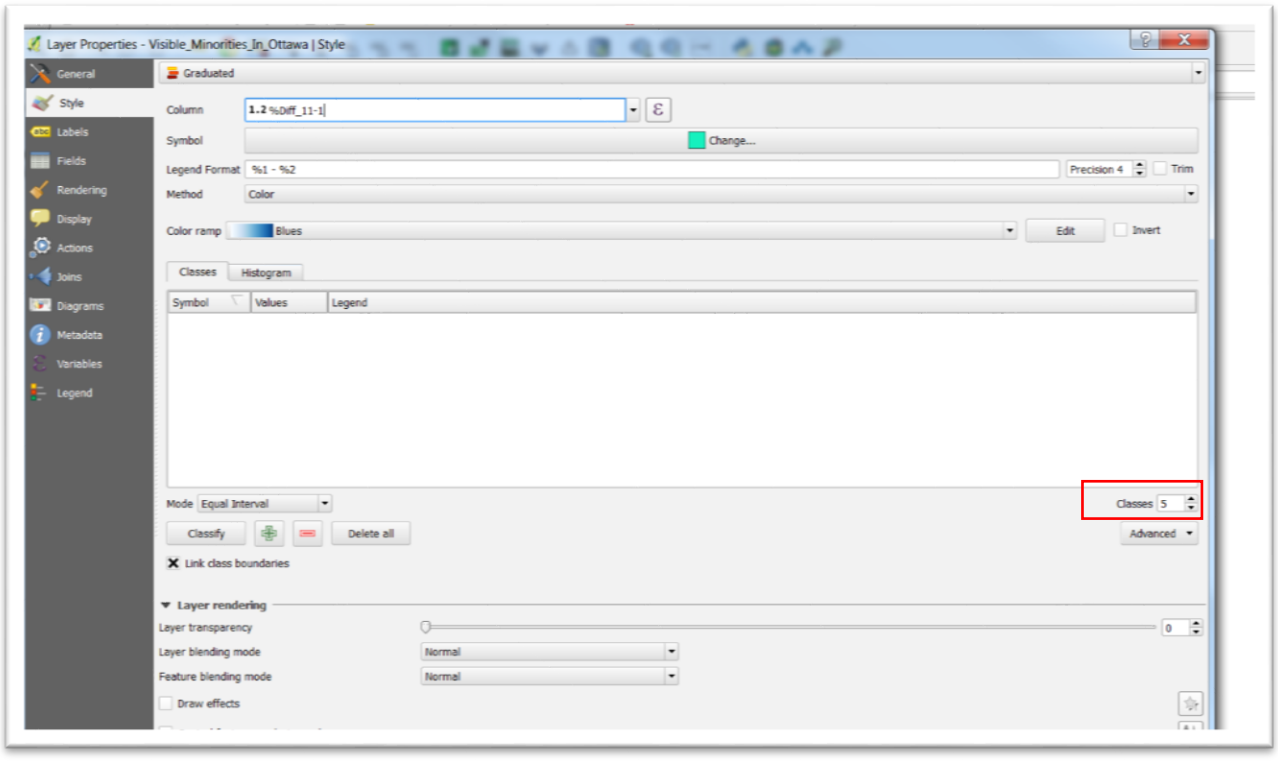


Just below the “Single symbol” option at the top, click the arrow to obtain the drop-down menu.



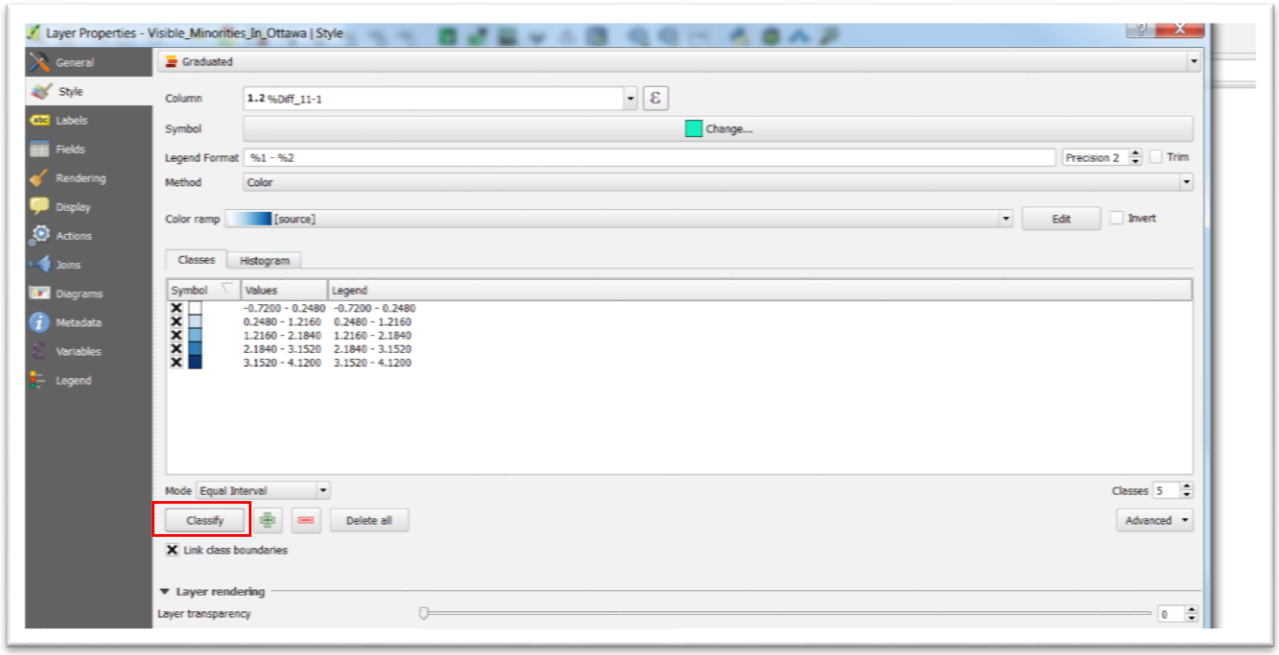
Choose “Graduated”. And click the arrow to right of the rectangular box beside “Column” to obtain a drop-down menu.





Qgis defaults to five “Classes” or categories, which we can increase or decrease.

Select the “Classify” tab.

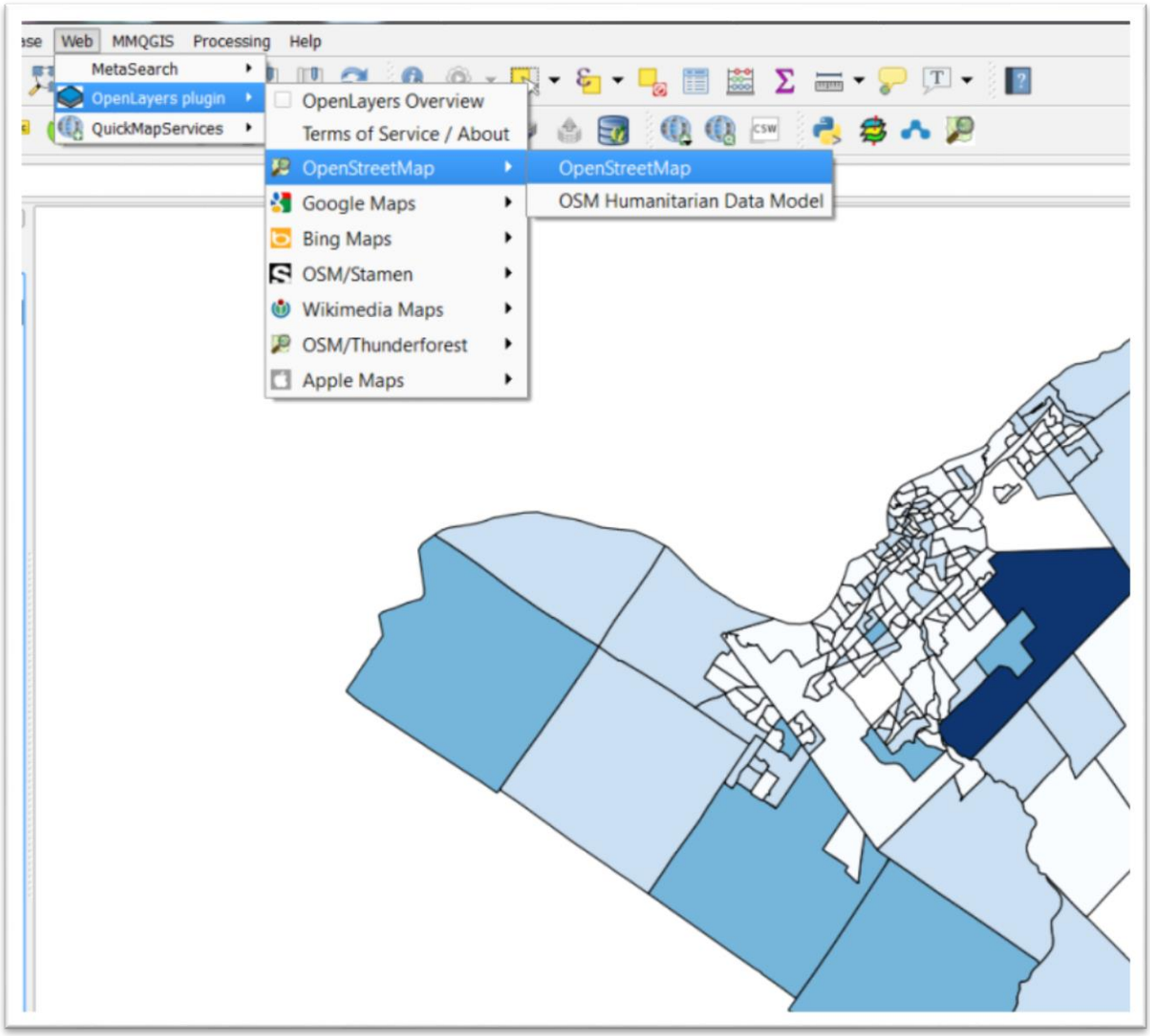


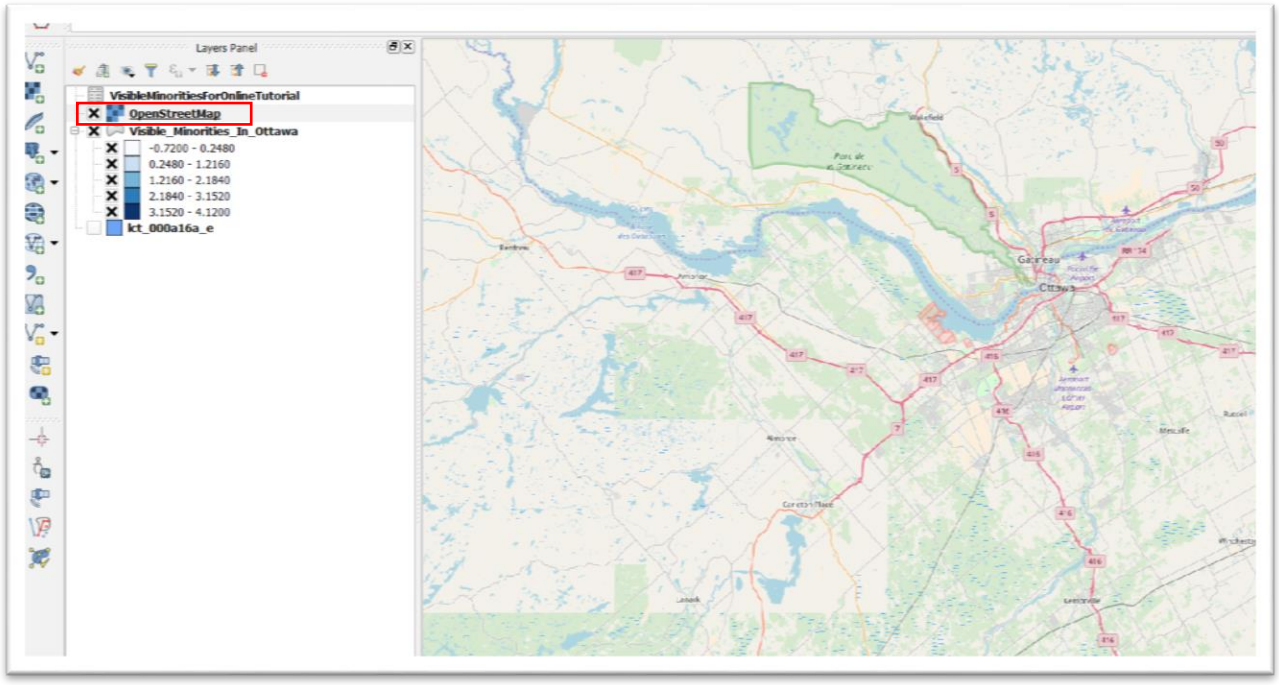
Qgis defaults to the blue colour ramp, which you can change by clicking on the colour to the right of “Colour ramp”. We can also change the intervals between the numbers so that the census tracts with the negative growth are one category.

Qgis will only display the columns with numeric values. In this step, the aliases we’ve created for the new columns have been preserved, making it easier to determine which column contains the values we want to display on our map. Let’s choose the percent differences, which will allow us to symbolize, or colour-code, the census tracts that experienced the fastest growth between 2011 and 2016.

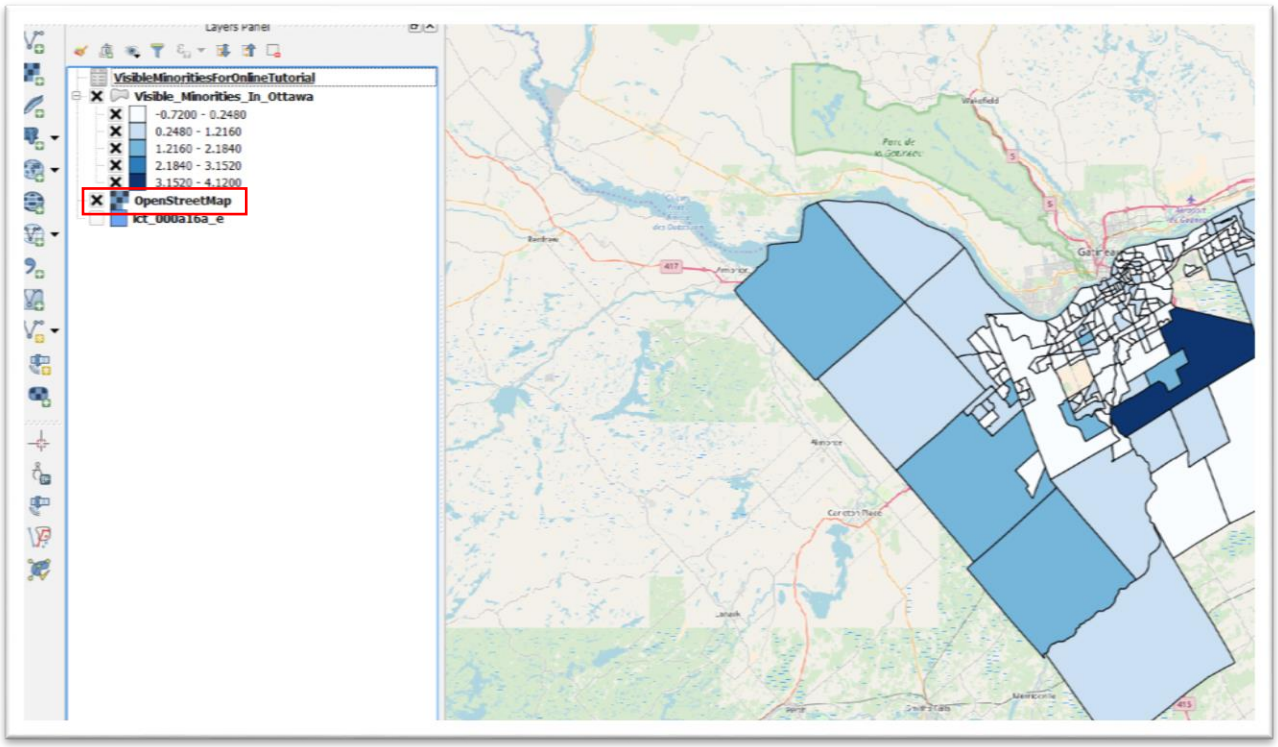
If we're happy with our choice, select "Apply", and then "OK".

Let's add an OpenStreetLayers base map. If you don't have it, go to the "Plugins" section of the menu, select "Manage and Install Plugins…", and search for "OpenLayers" and "Quick Finder." Click "Install plugin."

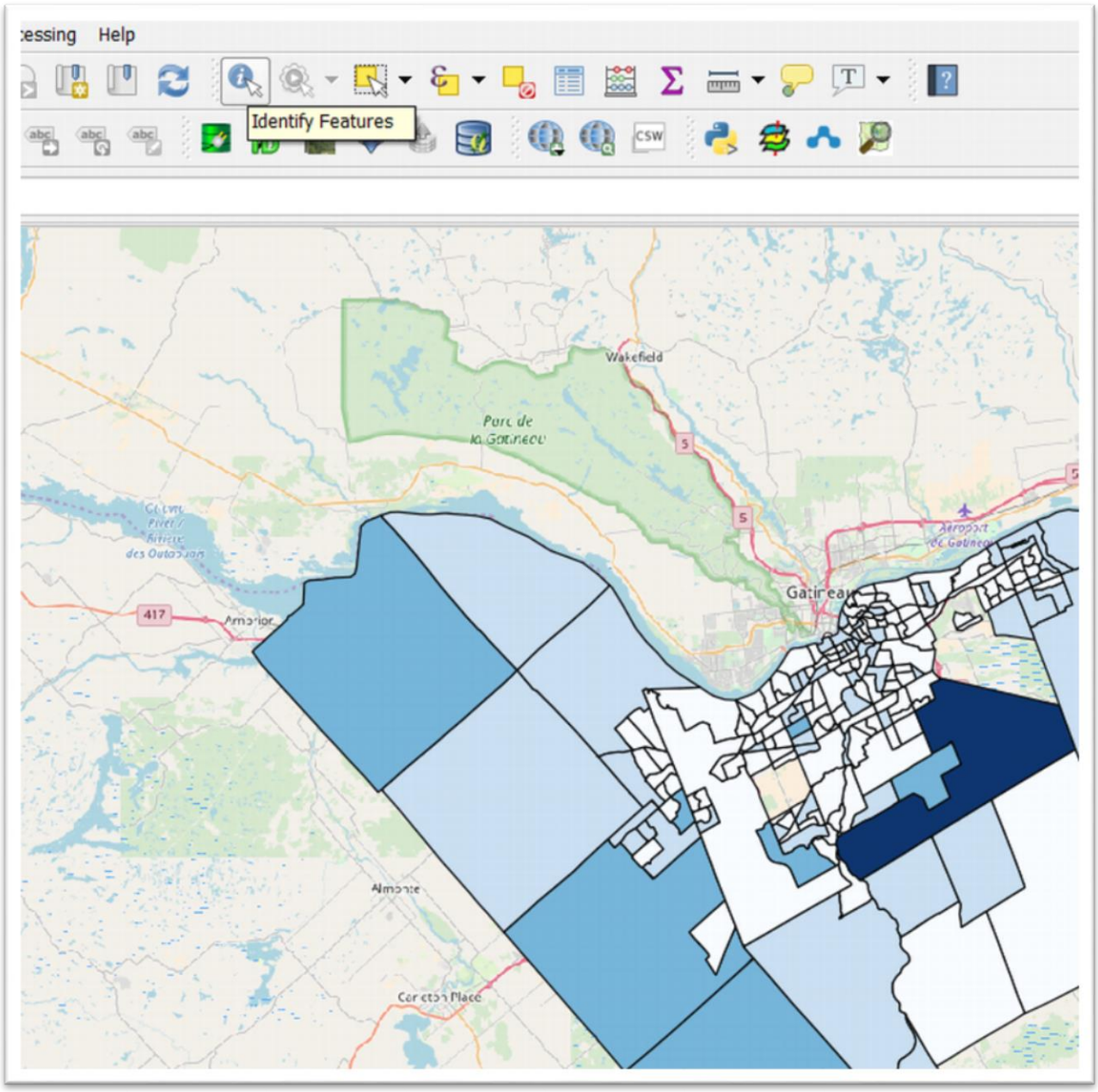

Web
MMQGIS
Processing
Help
MetaSearch
OpenLayers plugin
QuickMapServices
OpenLayers Overview
Terms of Service / About
OpenStreetMap
Google Maps
Bing Maps
OSM/Stamen
Wikimedia Maps
OSM/Thunderforest
Apple Maps
OpenStreetMap
OSM Humanitarian Data Model



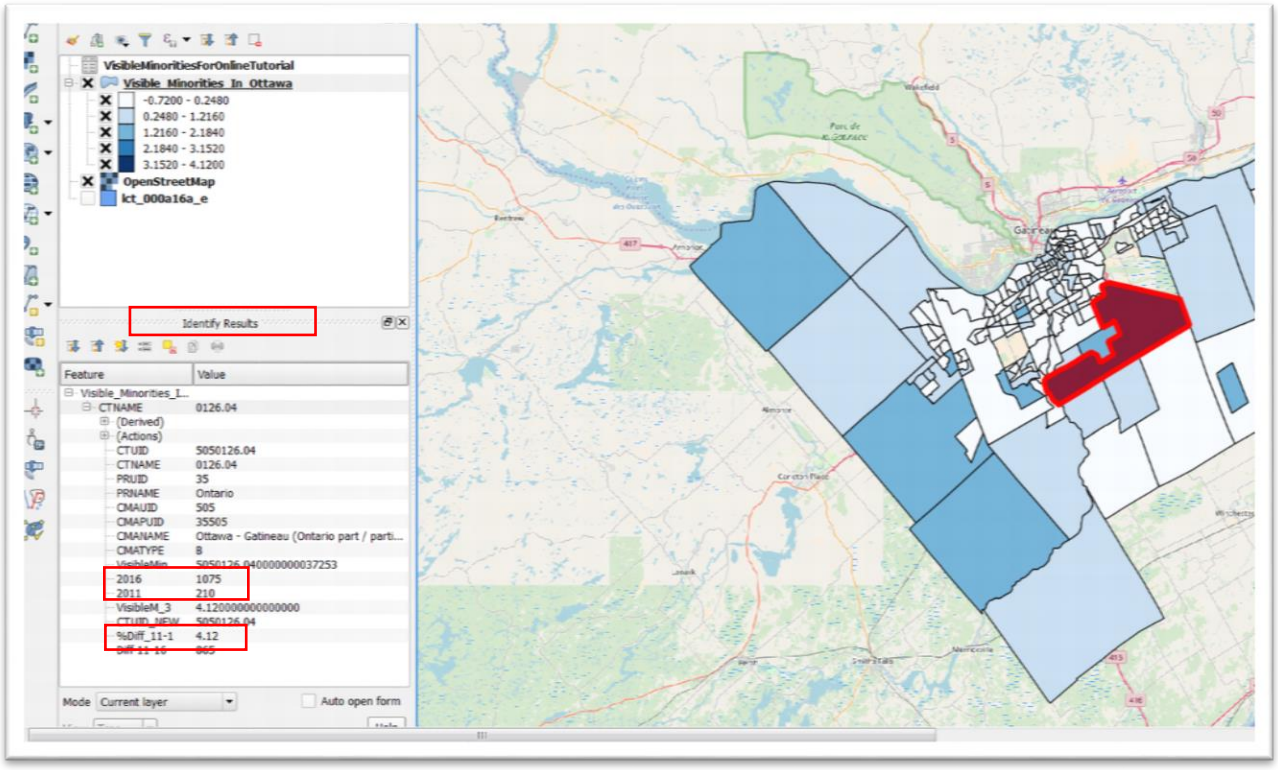
Click on the“OpenStreetMap” layer label and drag it to the bottom of the menu.



The darkest colours are the areas with the highest growth. To see the actual data, select the “Identify Features” icon above the map.



Make sure the Visible_Minorities_In_Ottawa layer is highlighted, then click the dark blue census tract.



The census tract's information is located in the "Identify Results" section to the left.

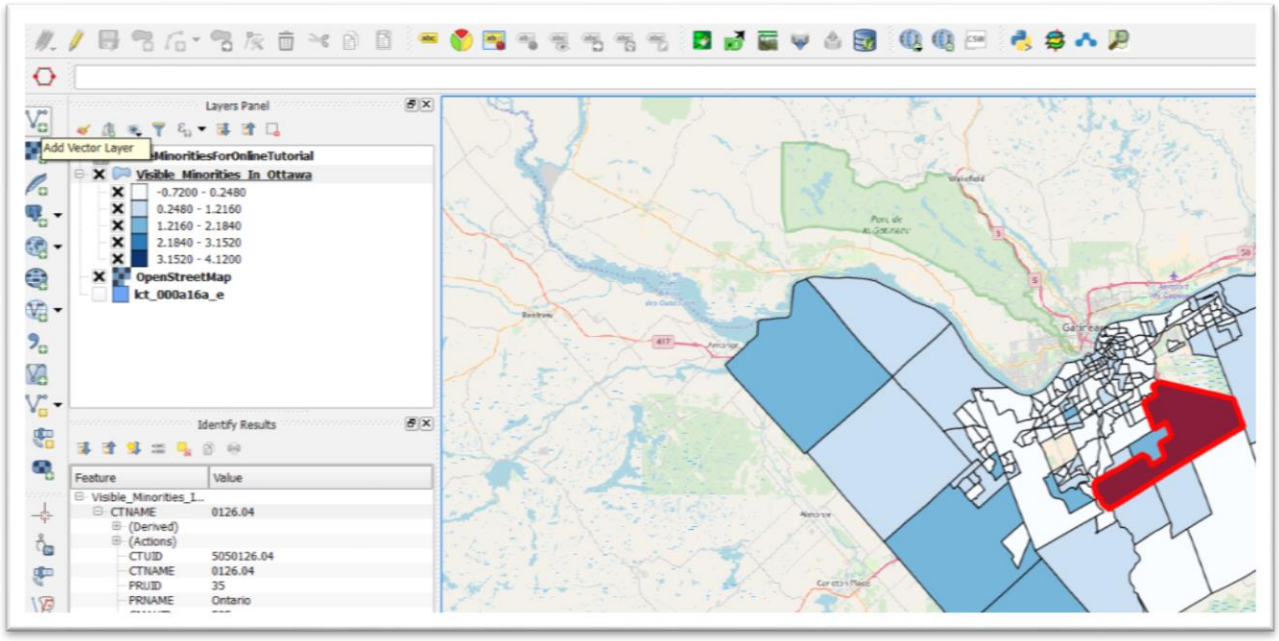
Because we have renamed the key number fields, it's easy to spot the "%Diff", which is the difference expressed as decimal number. From the "Diff_11-16", we can also see that the number of visible minorities in this census tract also increased significantly, which is also obvious by looking at the values in 2011 and 2016.

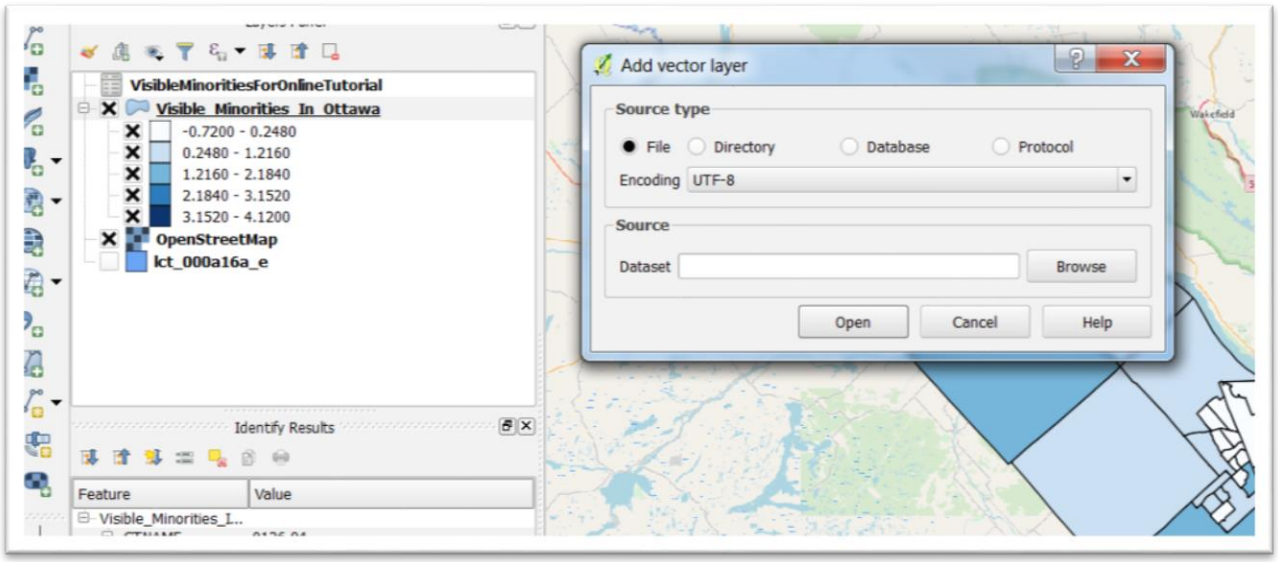
We will eventually export this layer to ArcGIS Online, which we learn in the tutorial, Building Maps with ArcGIS Online.

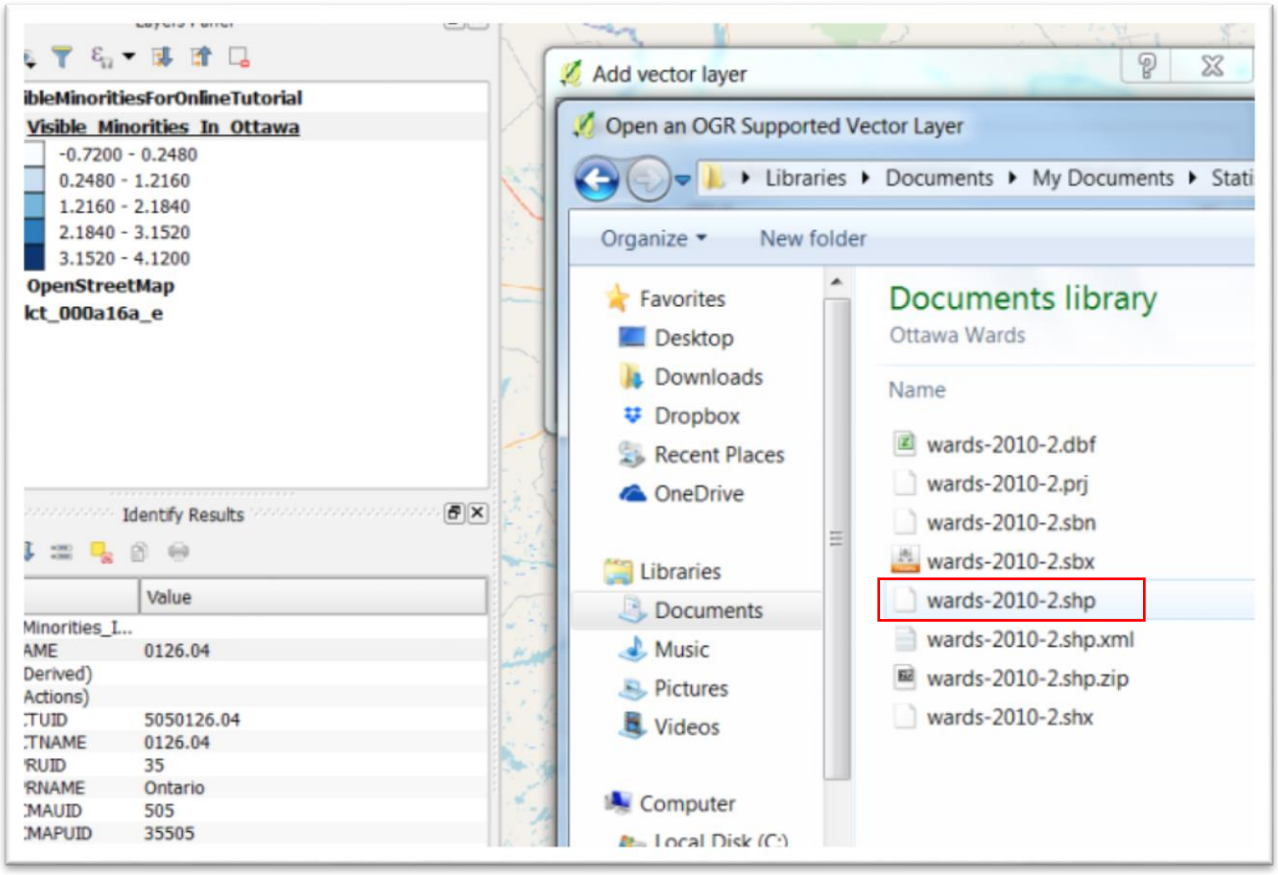
But before we're done, we have one more layer to import which will help with our analysis, Ottawa's municipal ward boundaries. They will help us identify the city politicians whose wards contain the kind of growth that we want to write about. In this case, it could be the ward with the fastest visible minority growth rate.

Click here to obtain the zipped folder that contains Ottawa's wards.

Unzip the folder and use the “Add Vector Layer” icon to import the shape file into Qgis.






ibleMinoritiesForOnlineTutorial
Visible_Minorities_In_Ottawa
-0.7200 - 0.2480
0.2480 - 1.2160
1.2160 - 2.1840
2.1840 - 3.1520
3.1520 - 4.1200
OpenStreetMap
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Identify Results
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AME 0126.04
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Actions)
TUID 5050126.04
TNAME 0126.04
RUID 35
RNAME Ontario
MAUID 505
MAPUID 35505
Add vector layer
Open an OGR Supported Vector Layer
Libraries ▸ Documents ▸ My Documents ▸ Stati
Organize
New folder
Favorites
Desktop
Downloads
Dropbox
Recent Places
OneDrive
Libraries
Documents
Music
Pictures
Videos
Computer
Local Disk (C:)
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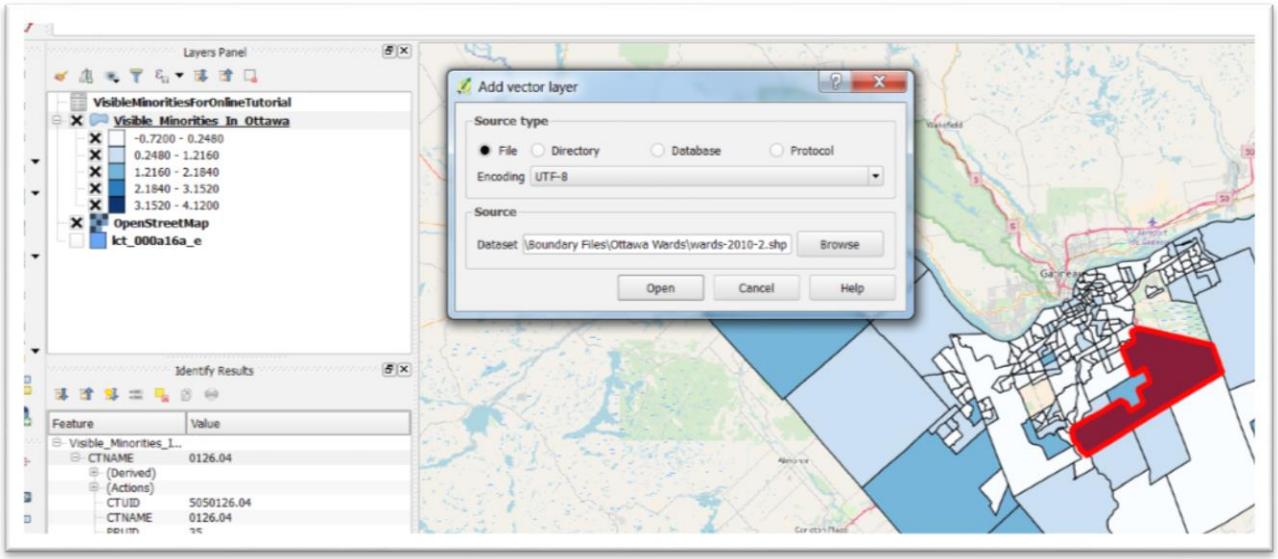
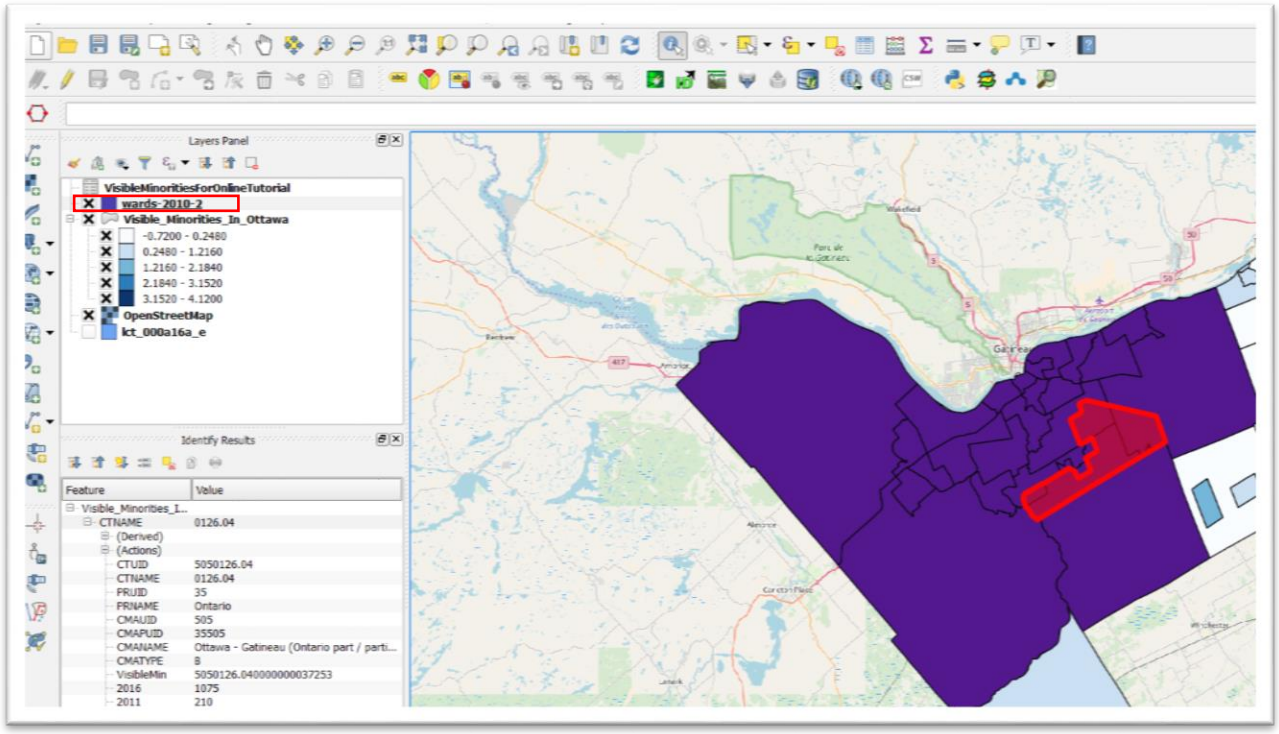
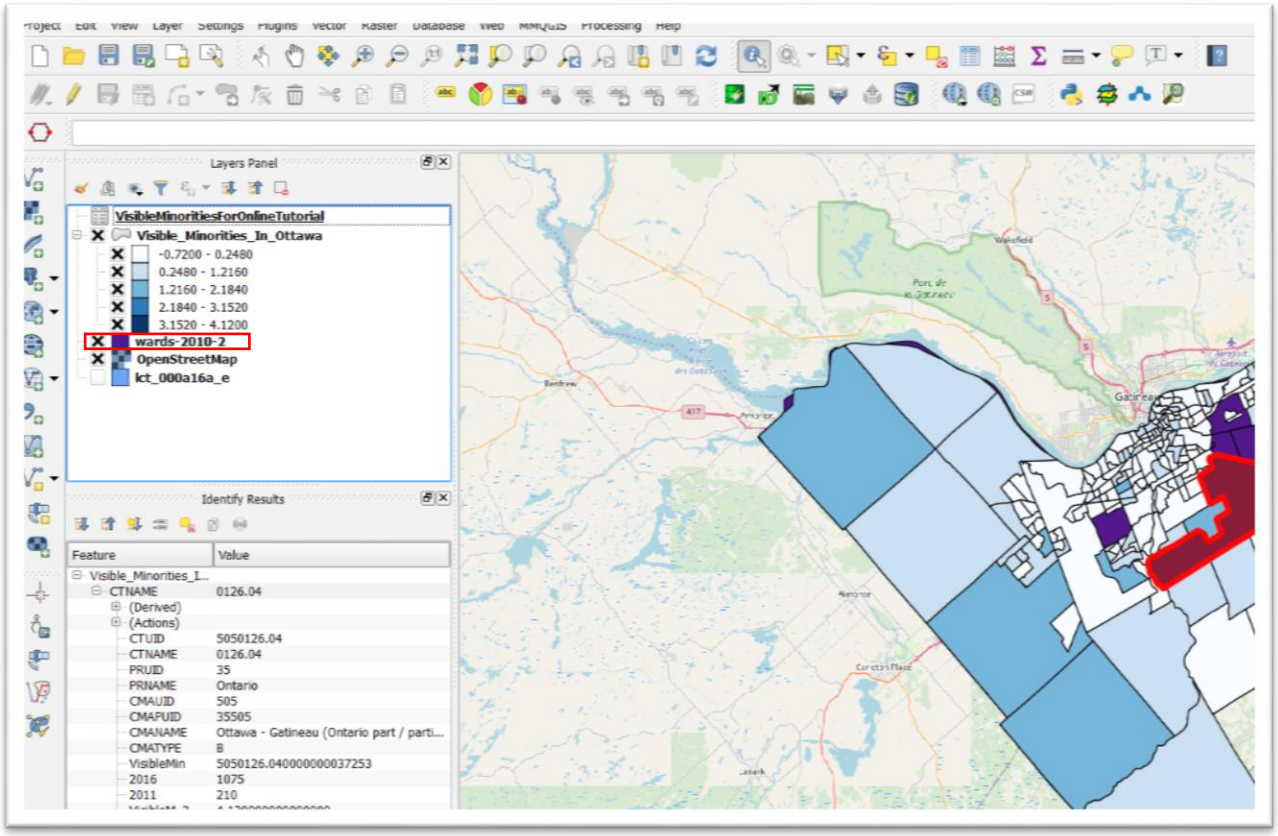
Ottawa Wards
Name
wards-2010-2.dbf
wards-2010-2.prj
wards-2010-2.sbn
wards-2010-2.sbx
wards-2010-2.shp
wards-2010-2.shp.xml
wards-2010-2.shp.zip
wards-2010-2.shx


Layers Panel
VisibleMinoritiesForOnlineTutorial
Visible_Minorities_In_Ottawa
-0.7200 - 0.2480
0.2480 - 1.2160
1.2160 - 2.1840
2.1840 - 3.1520
3.1520 - 4.1200
OpenStreetMap
lct_000a16a_e
Identify Results
Feature
Value
Visible_Minorities_I...
CTNAME 0126.04
(Derived)
(Actions)
CTUID 5050126.04
CTNAME 0126.04
Add vector layer
Source type
File
Directory
Database
Protocol
Encoding UTF-8
Source
Dataset \Boundary Files\Ottawa Wards\wards-2010-2.shp
Browse
Open
Cancel
Help

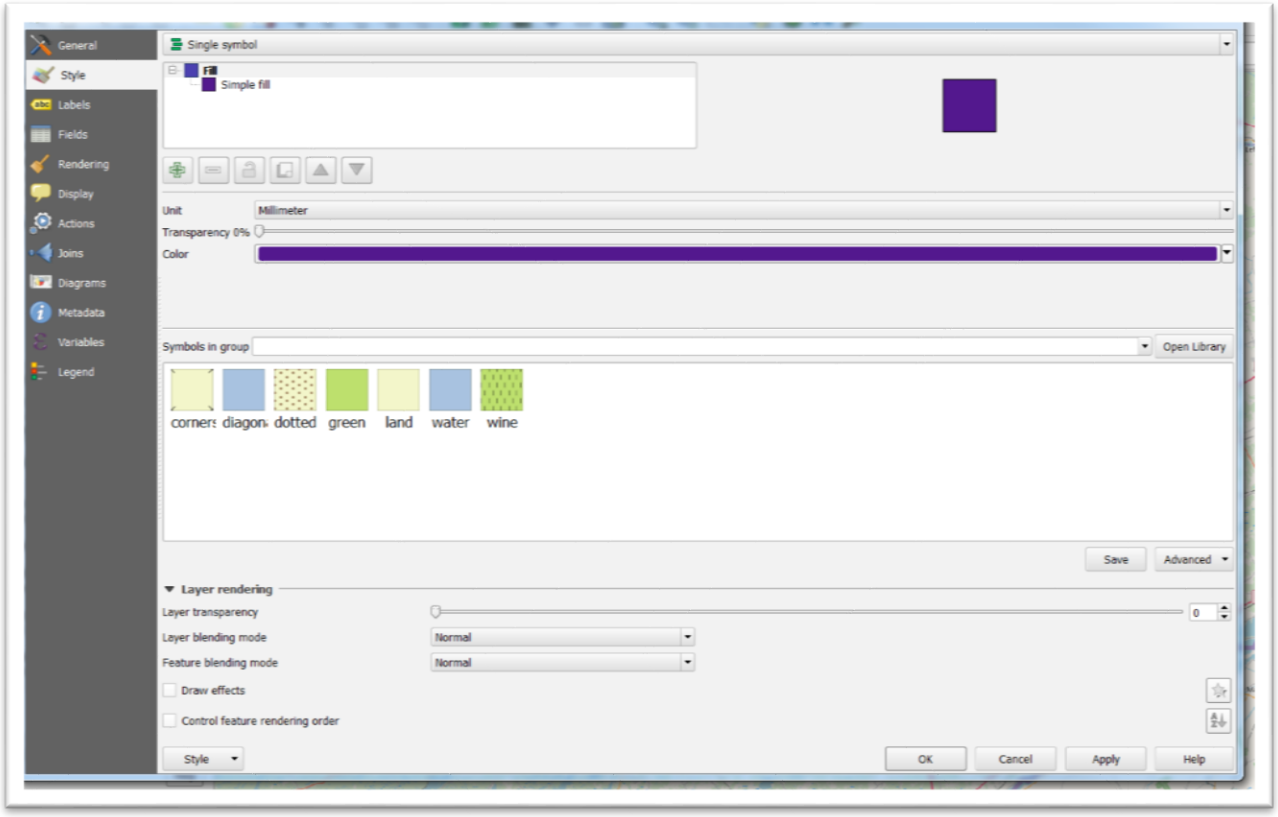


Move the wards layer to the bottom.

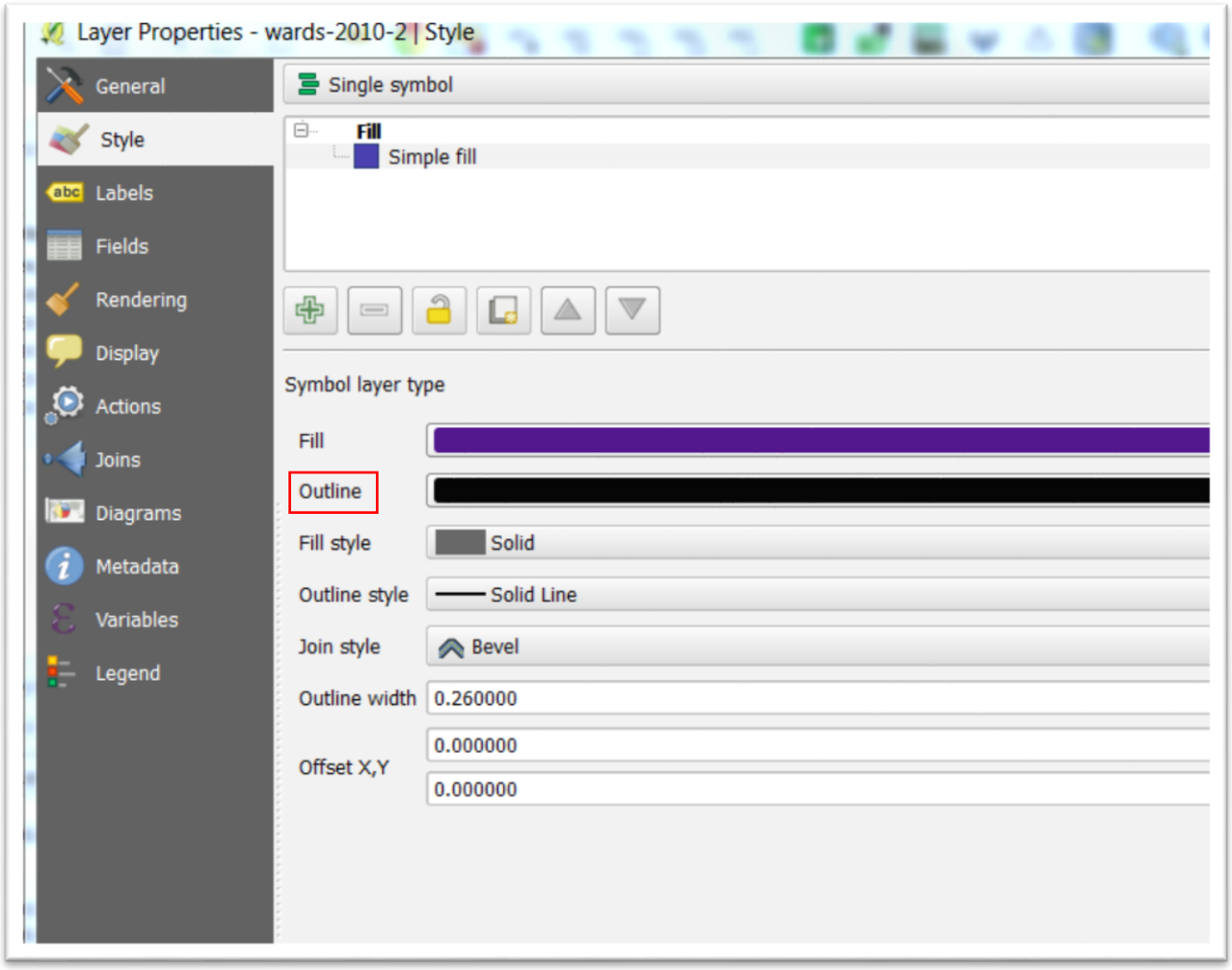


Now we want to make the ward boundaries tranparent, display the ward names, and thicken the boundaries to make them easy to see where the census tracts lay.

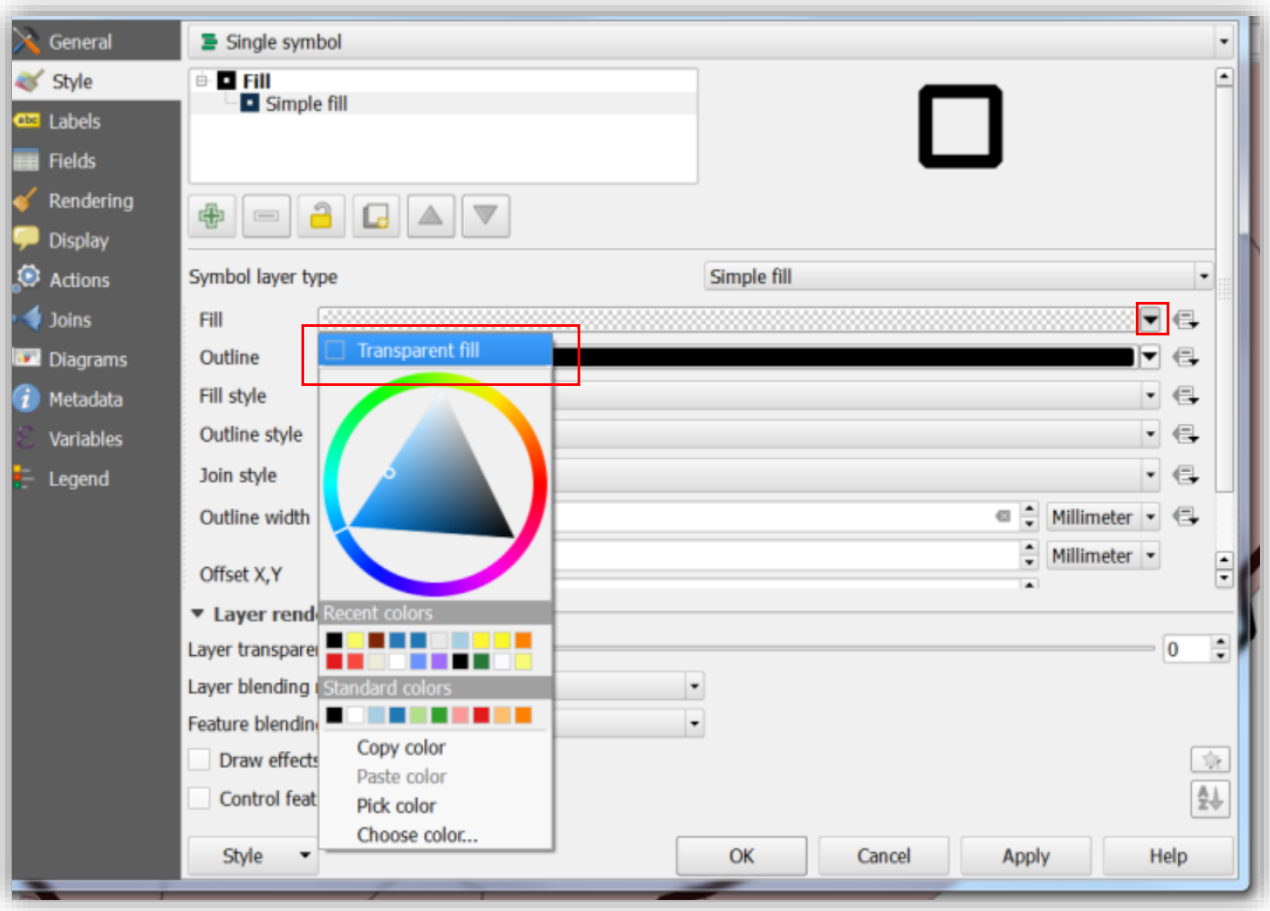
Right click on the “wards=2010-2” layer and select properties from the short-cut menu.



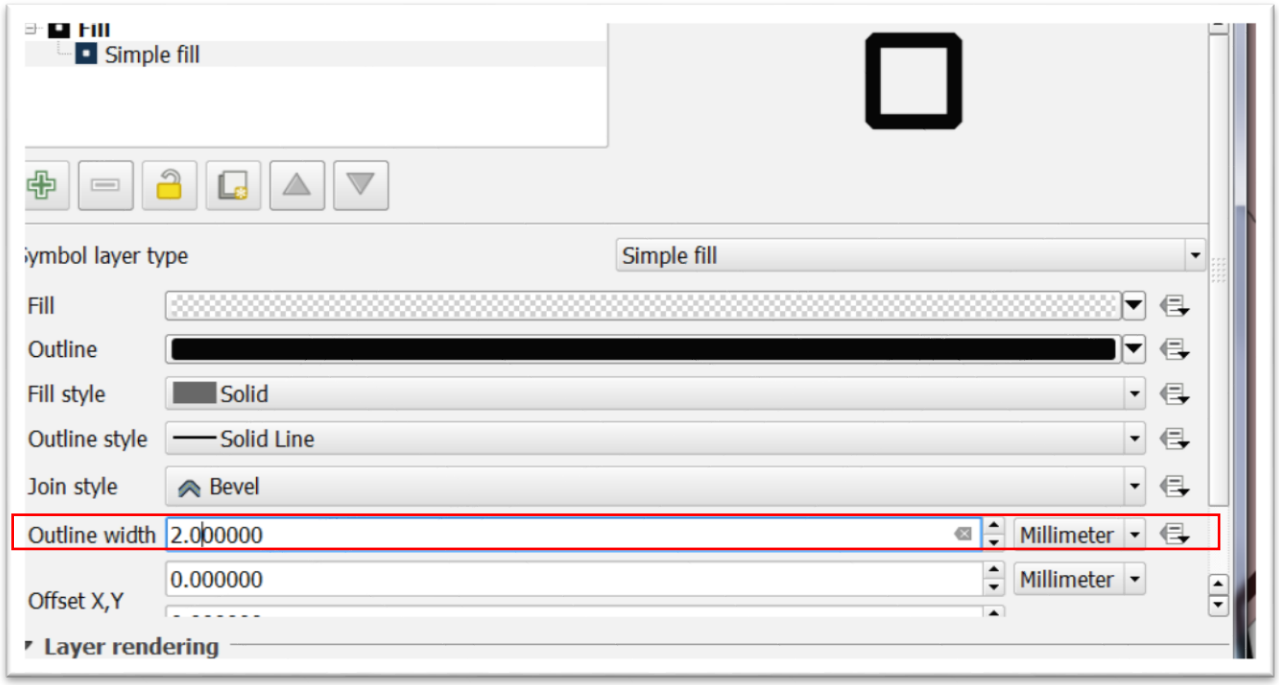
Click “Sample Fill” (your colour may be different). If it isn’t already chosen, select the colour black for your “Outline.”



Make the “Fill” colour transparent from the selection in the drop-down menu.

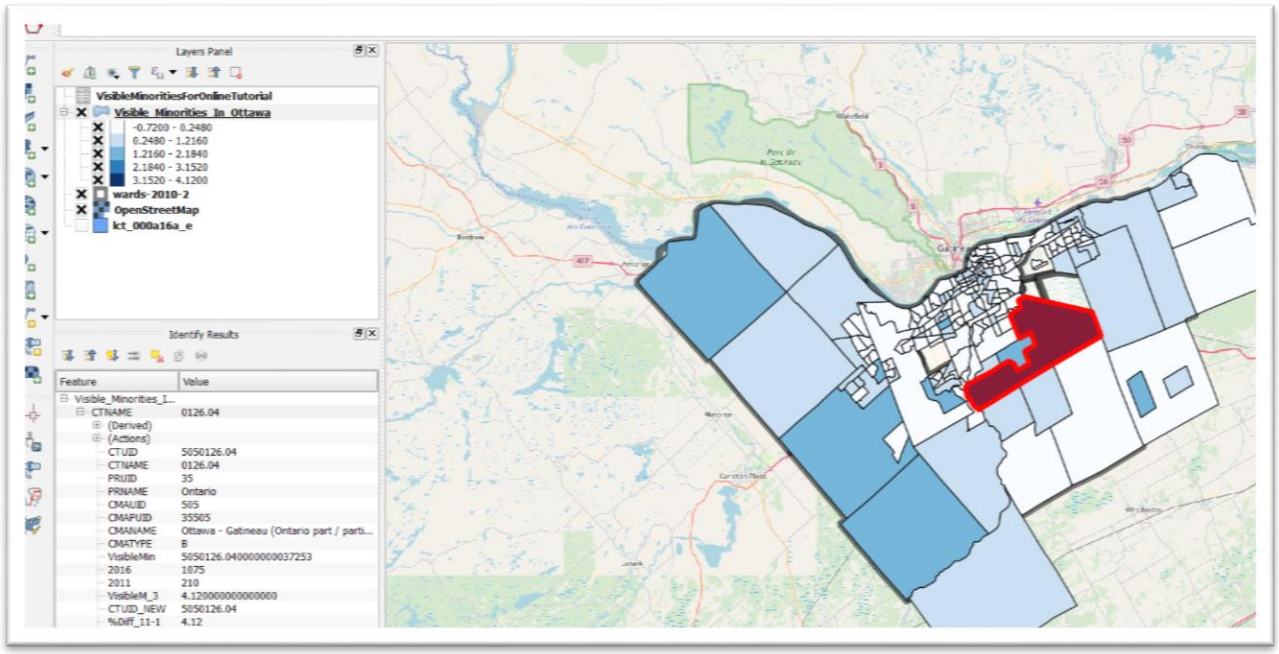

General
Style
Labels
Fields
Rendering
Display
Actions
Joins
Diagrams
Metadata
Variables
Legend
Single symbol
Fill
Simple fill
Symbol layer type
Simple fill
Fill
Outline
Fill style
Outline style
Join style
Outline width
Millimeter
Offset X,Y
Millimeter
Layer rend
Layer transpare
0
Layer blending
Feature blendin
Draw effects
Control feat
Transparent fill
Recent colors
Standard colors
Copy color
Paste color
Pick color
Choose color...
Style
OK
Cancel
Apply
Help

Increase the “Outline width” to 2 millimetres.



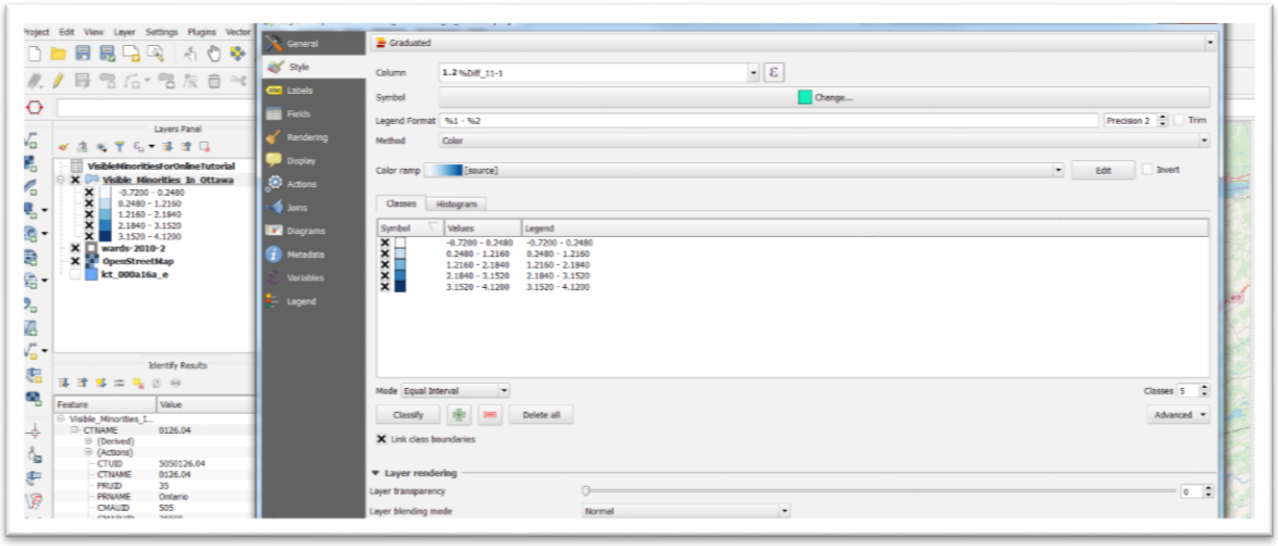
Leave the transparancy at zero, which now means that only the bondary outlines will appear

Select “Apply”, then OK.

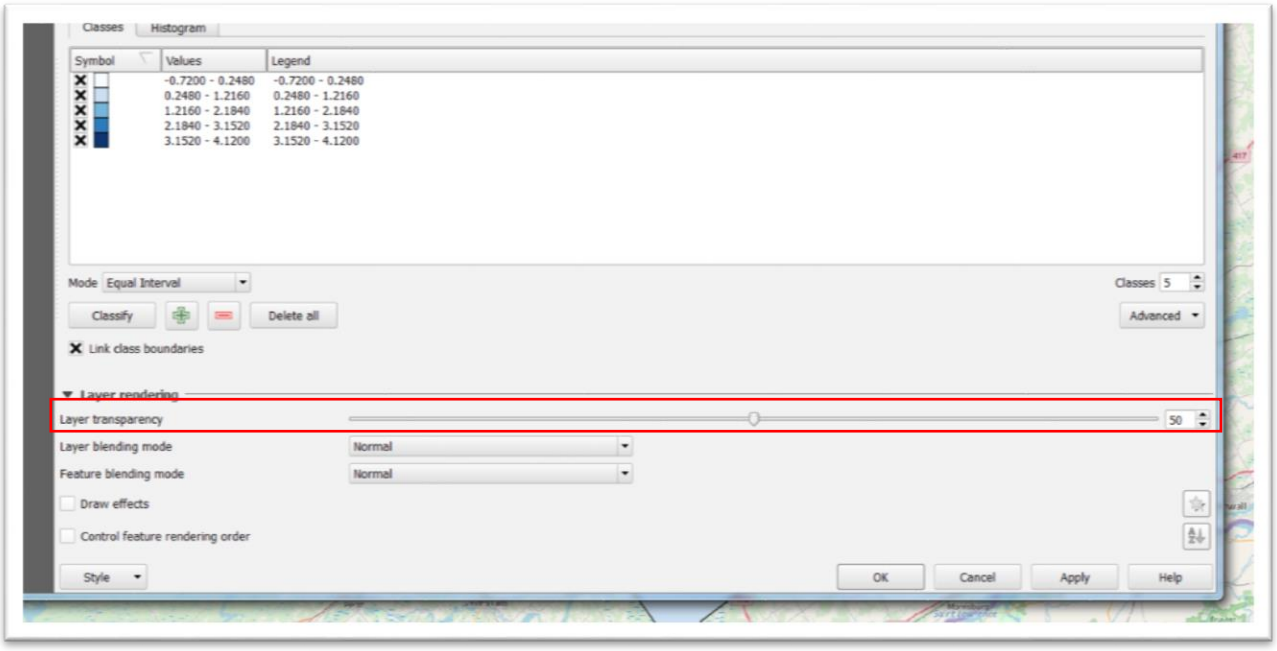


To make the ward boundaries easier to see, we’ll need to make the colours for the census tracts more transparent.

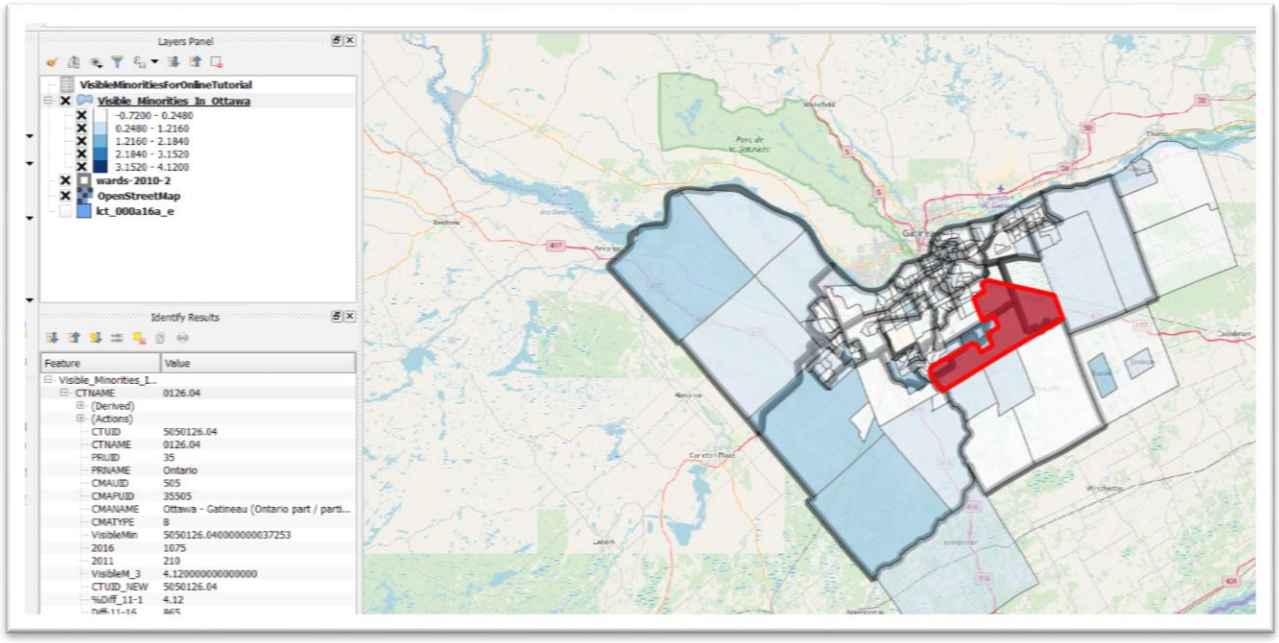
Right-click on the visible minorities layer, select properties.



To increase the transparency, use your cursor to slide the arrow on the bar to the right of the “Layer rendering” label to the 50% mark.

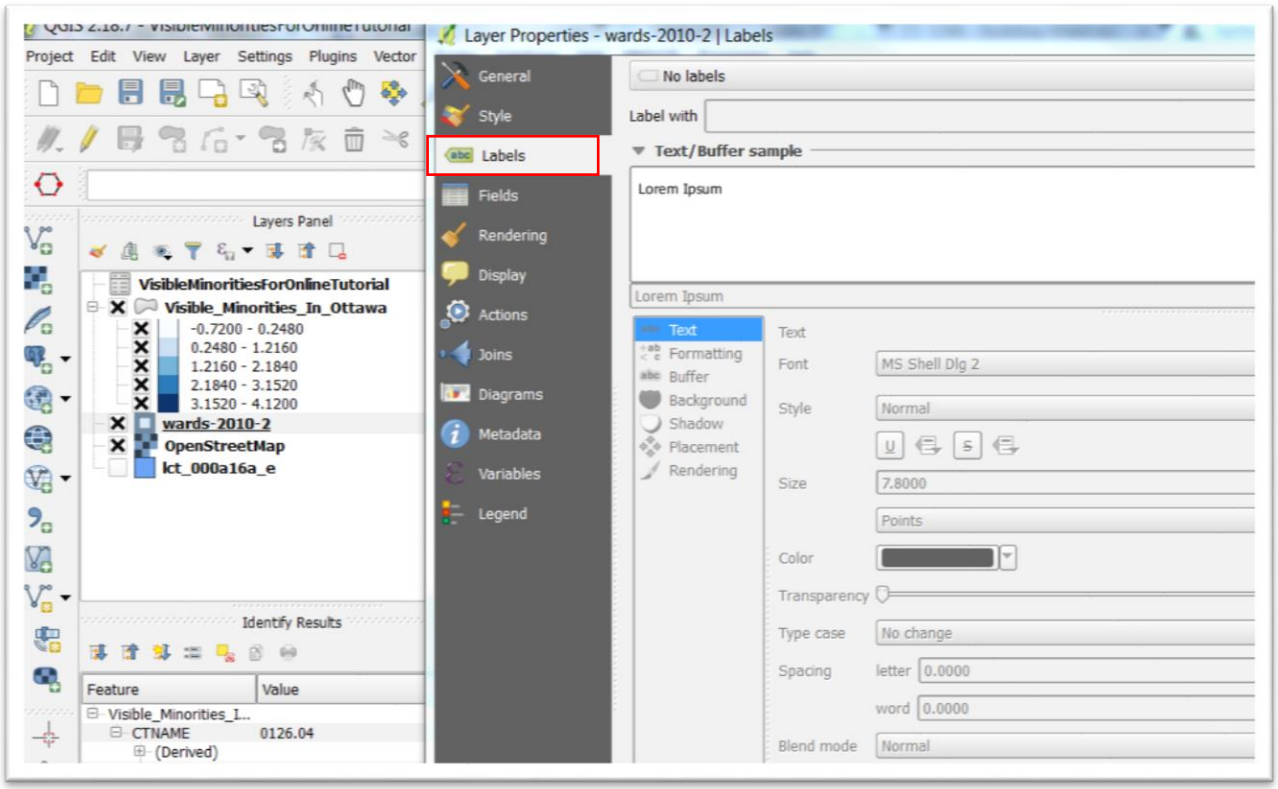


Select “Apply” and “OK”.

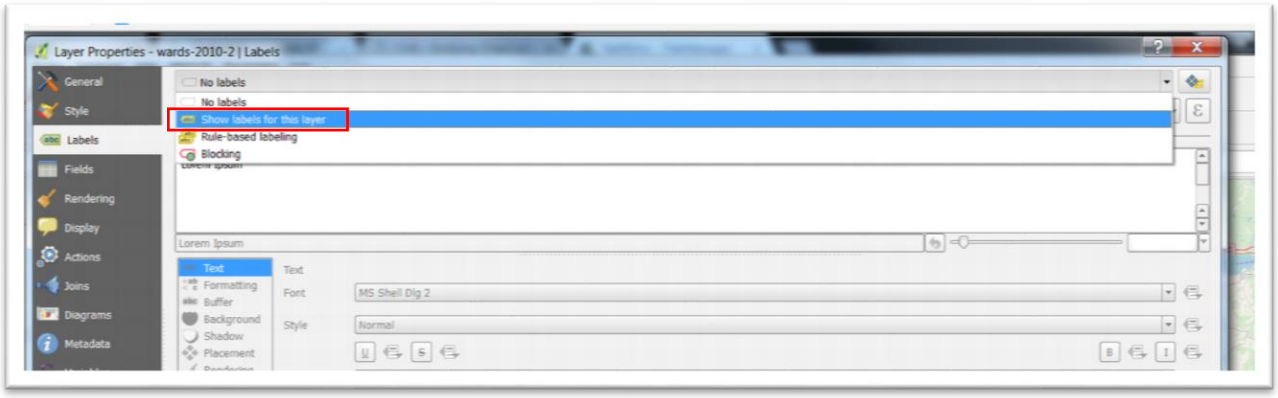


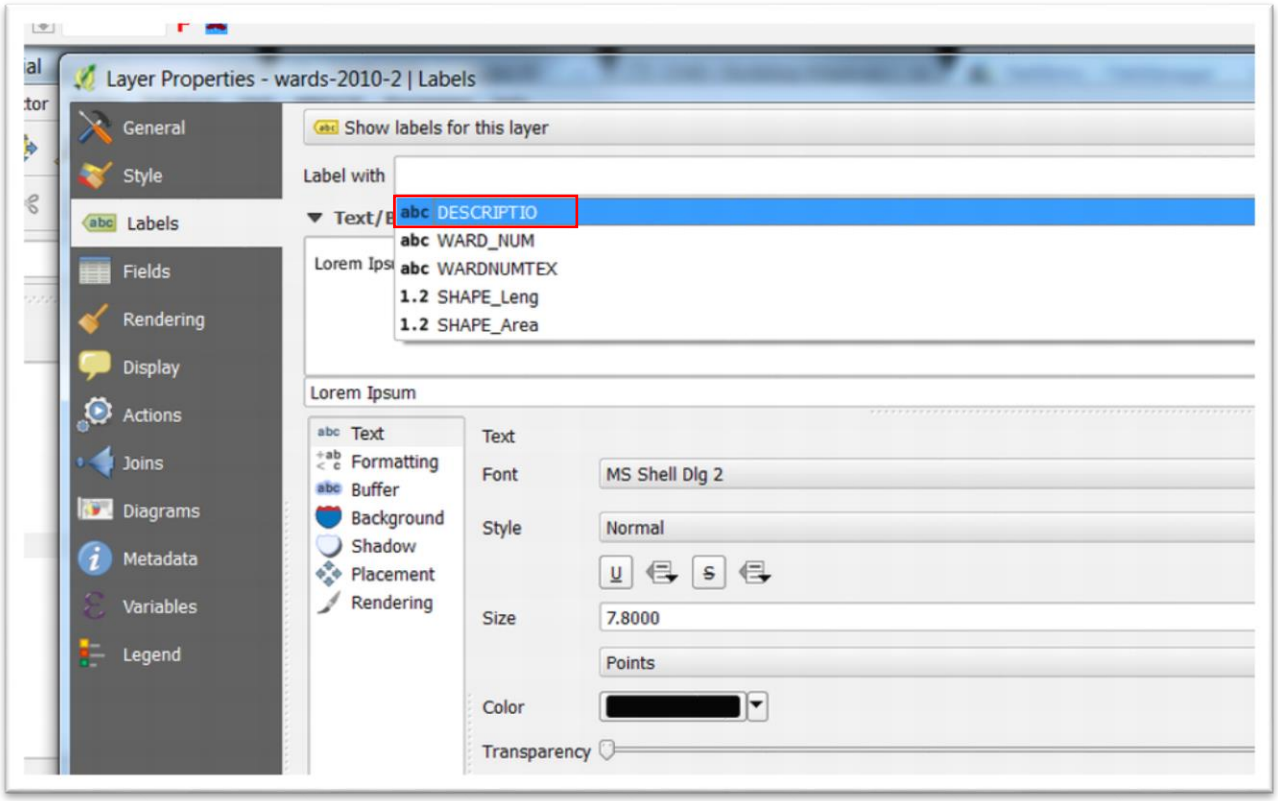
It would help to have the ward labels displayed on the map.

Right-click the wards layer, select properties and the “Labels” tab.



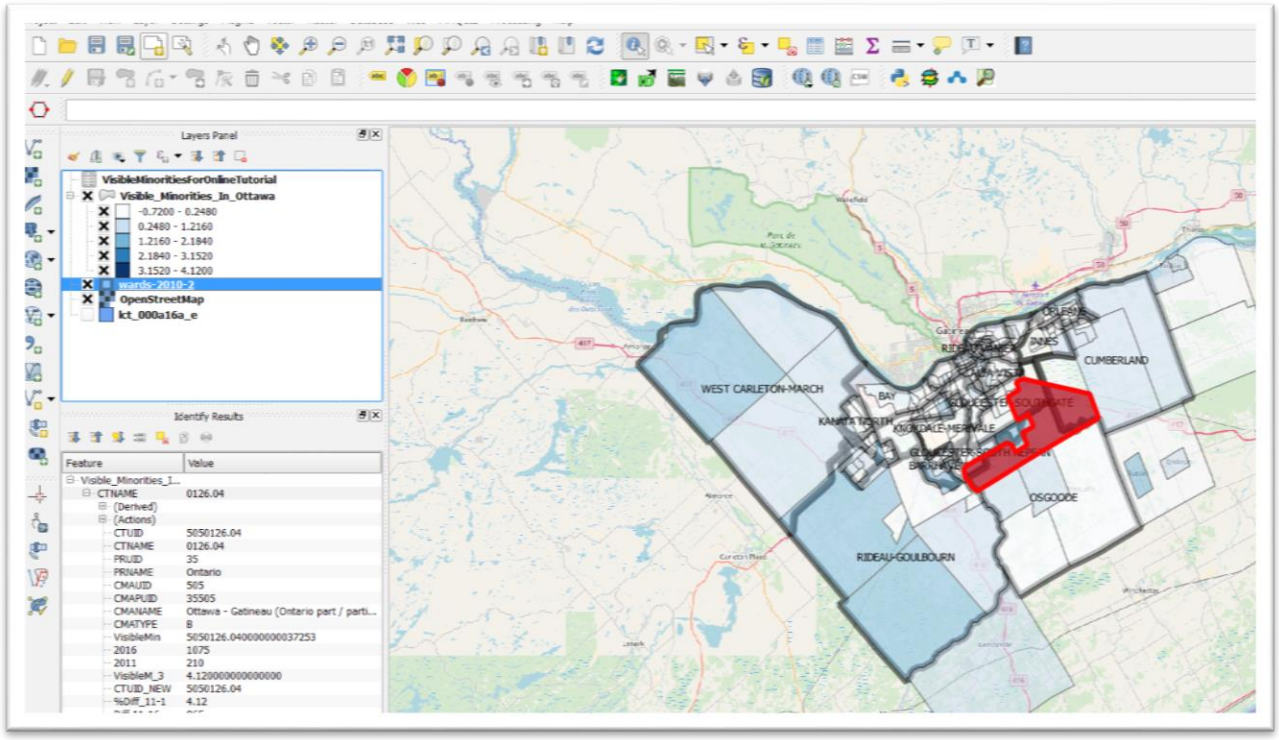
Select the “Show labels for this layer” option.





“Description” is the field that contains the ward names. You can also change the font, point size, colour and transparency.

Select “Apply” and “OK”.



If we zoom to the high-growth area still highlighted, we can see that the tracts fall within three wards, located on the outskirts of Ottawa. Now we know which councillors to interview for our story.

What we have created is a choropleth map, which as we learned on page 156 in The Data Journalist’s chapter seven, “applies a number of colours to polygons to show variations in the values of a particular numeric value.”

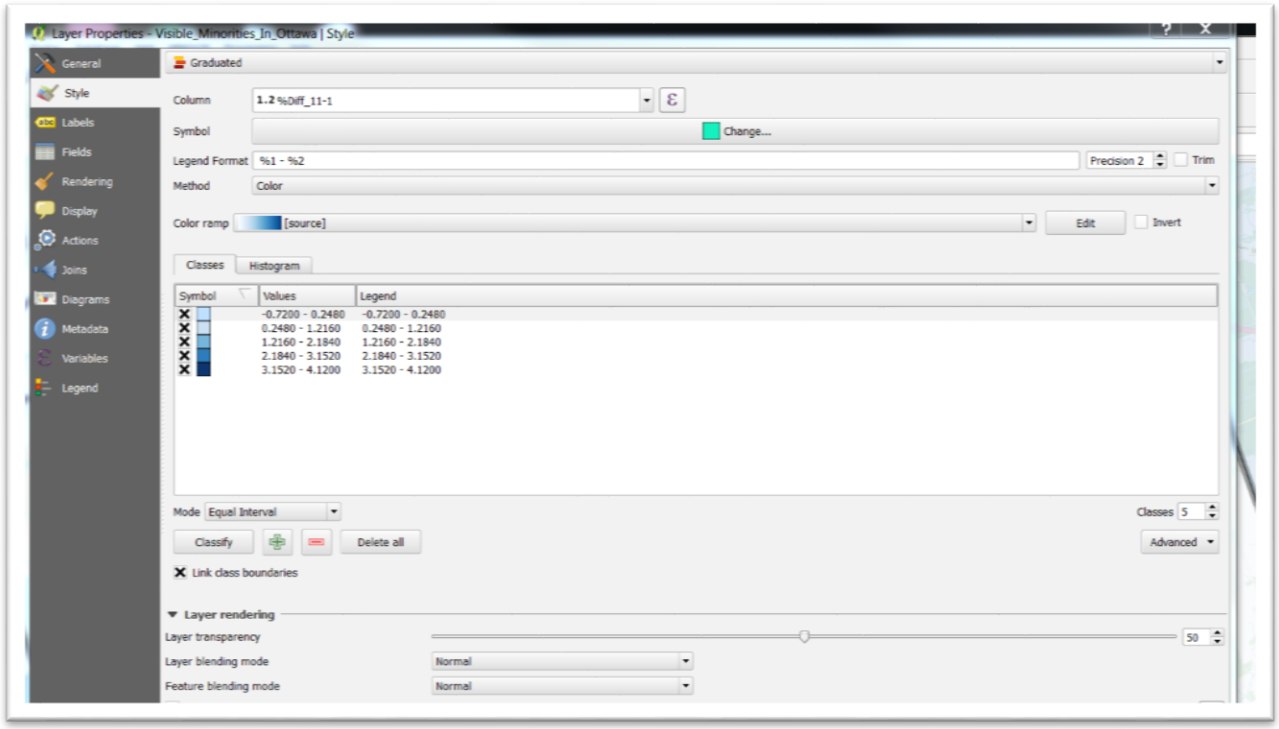
For the positive values, it’s best to use a colour grid. We can stick with blue, Qgis’ default grid.

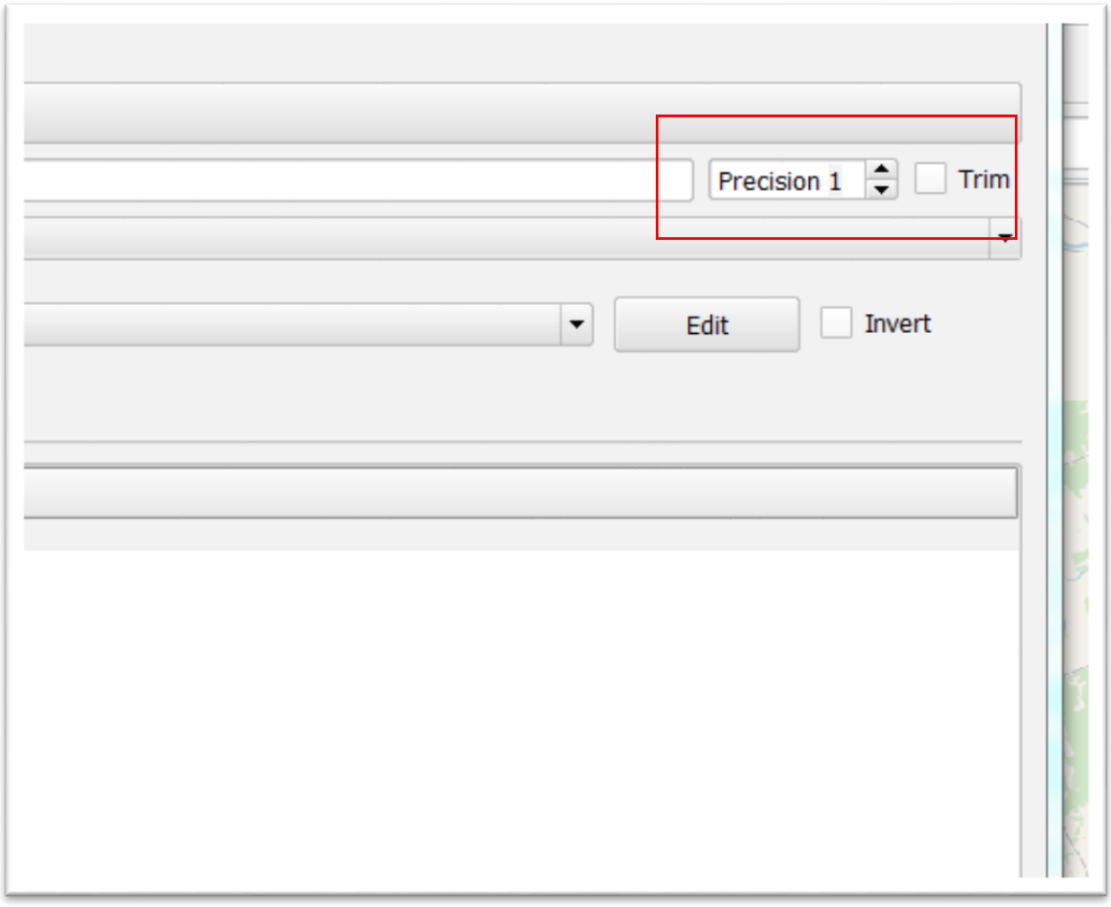
For zero values, we can use yellow.

And for negative values, we can use another contrasting colour like red.

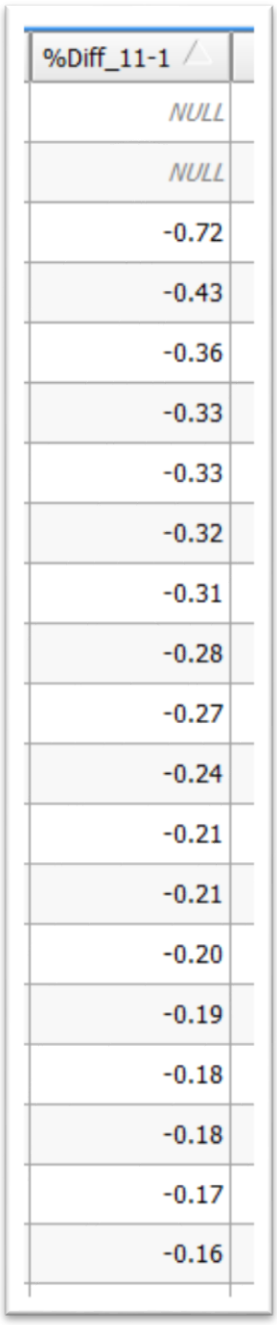
We can begin by increasing the number of classes from five to a greater number. Since our range of values is fairly limited, we can stick with five classes: one for negative; one for zero; and the remaining three colours on the blue colour ramp for positive values. This red-yellow-blue combination creates a nice contrast that helps distinguish the different ranges at first glance.

Right-click on the visible minorities layer, go to properties and select “Style”. Change the precision – number of decimal points” from 2 to one.


Layer Properties - Visible_Minorities_In_Ottawa | Style
General
Style
Labels
Fields
Rendering
Display
Actions
Joins
Diagrams
Metadata
Variables
Legend
Graduated
Column
1.2 %Diff_11-1
Symbol
Change...
Legend Format
%1 - %2
Precision 2
Trim
Method
Color
Color ramp
[source]
Edit
Invert
Classes
Histogram
Symbol
Values
Legend
-0.7200 - 0.2480
0.2480 - 1.2160
1.2160 - 2.1840
2.1840 - 3.1520
3.1520 - 4.1200
Mode
Equal Interval
Classes
5
Classify
Delete all
Advanced
Link class boundaries
Layer rendering
Layer transparency
50
Layer blending mode
Normal
Feature blending mode
Normal

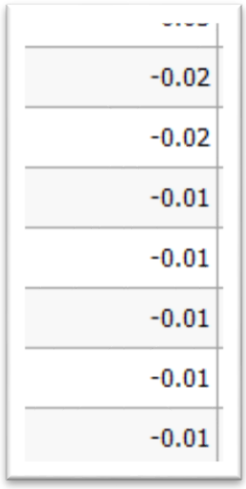

Precision 1
Trim
Edit
Invert

To get an idea of your range of values, open the attribute table, and sort the percent difference column in descending order.



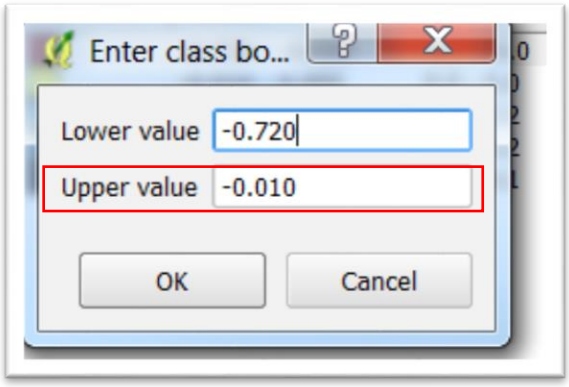
%Diff_11-1
NULL
NULL
-0.72
-0.43
-0.36
-0.33
-0.33
-0.32
-0.31
-0.28
-0.27
-0.24
-0.21
-0.21
-0.20
-0.19
-0.18
-0.18
-0.17
-0.16

The values in the negative column go from (ignore the NULL values) from -0.72 -0.01.

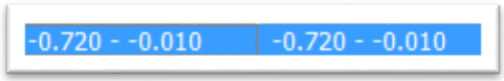


So your negative range will be -0.72 to -0.01.

Double-click on the first number range in the “Values” column to obtain a dialogue box where we will type “-0.0100” beside the “Upper value.”

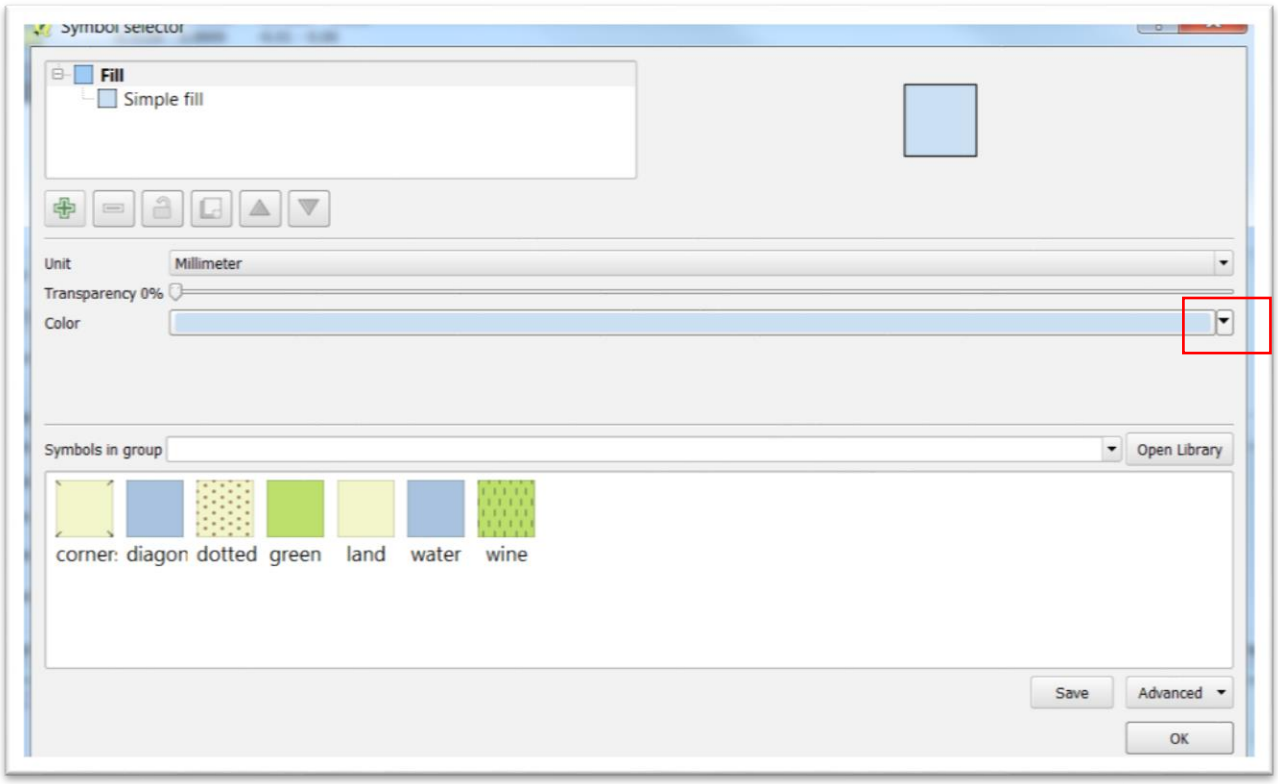


Double-click on the corresponding numbers in the “Legend” (which does not produce a dialogue box) and plug in the same number for the upper value of the range.



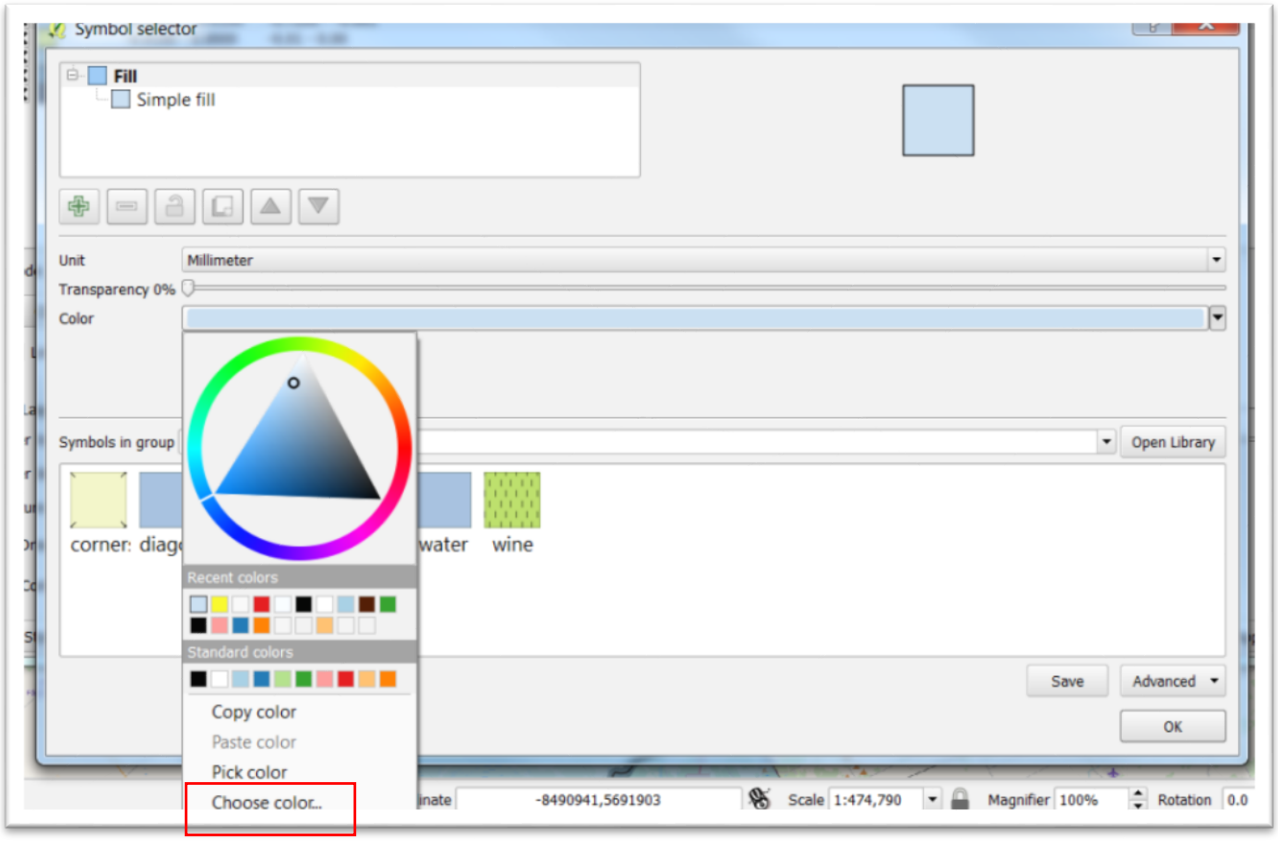
Select OK.

To change the colour, click the first coloured square under “Symbol” to obtain the “Symbol selector” dialogue box.

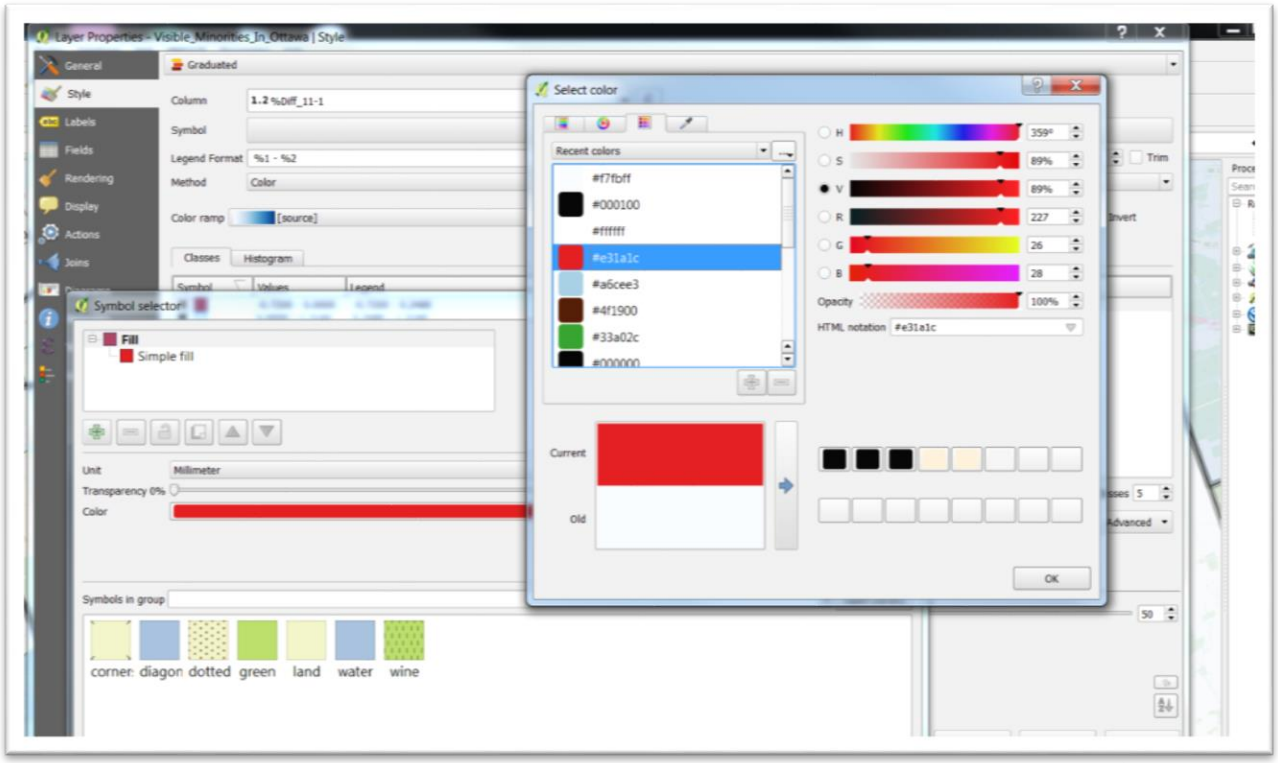


Click the arrow to the far right.

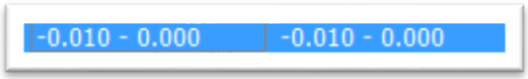
Click the “Choose color” option.



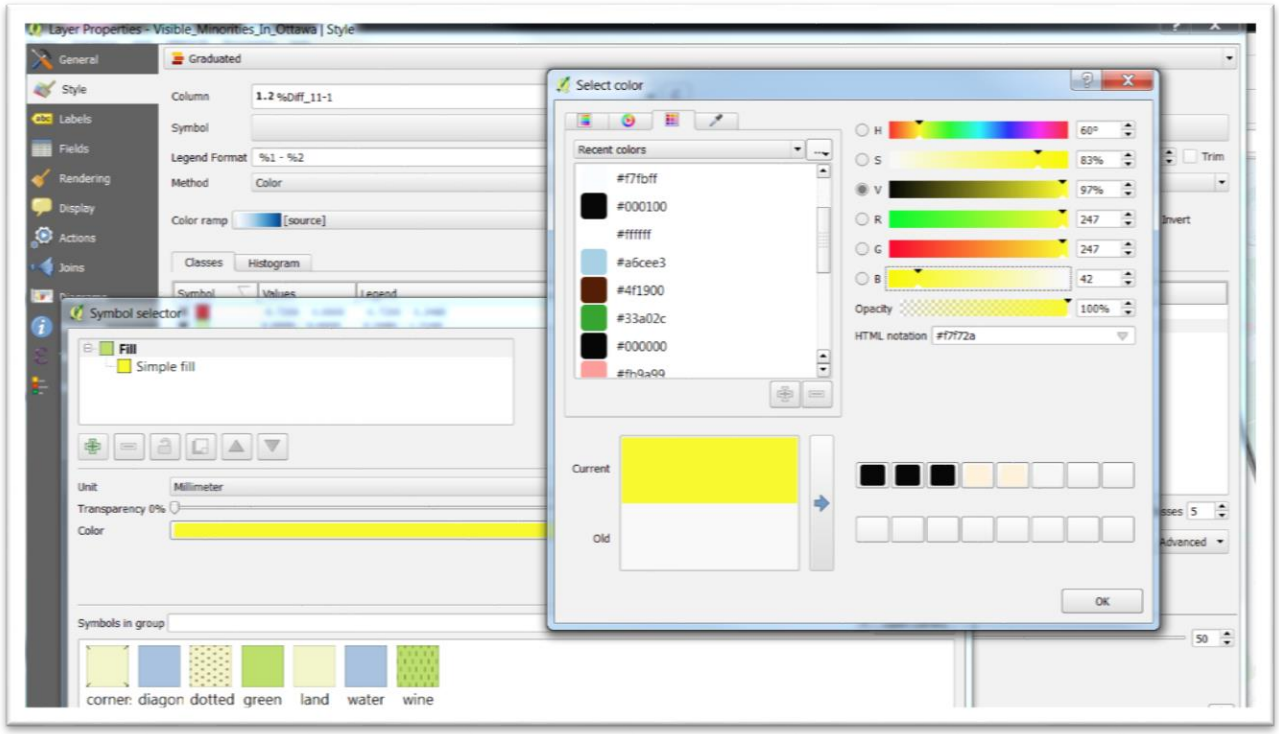
Select red.



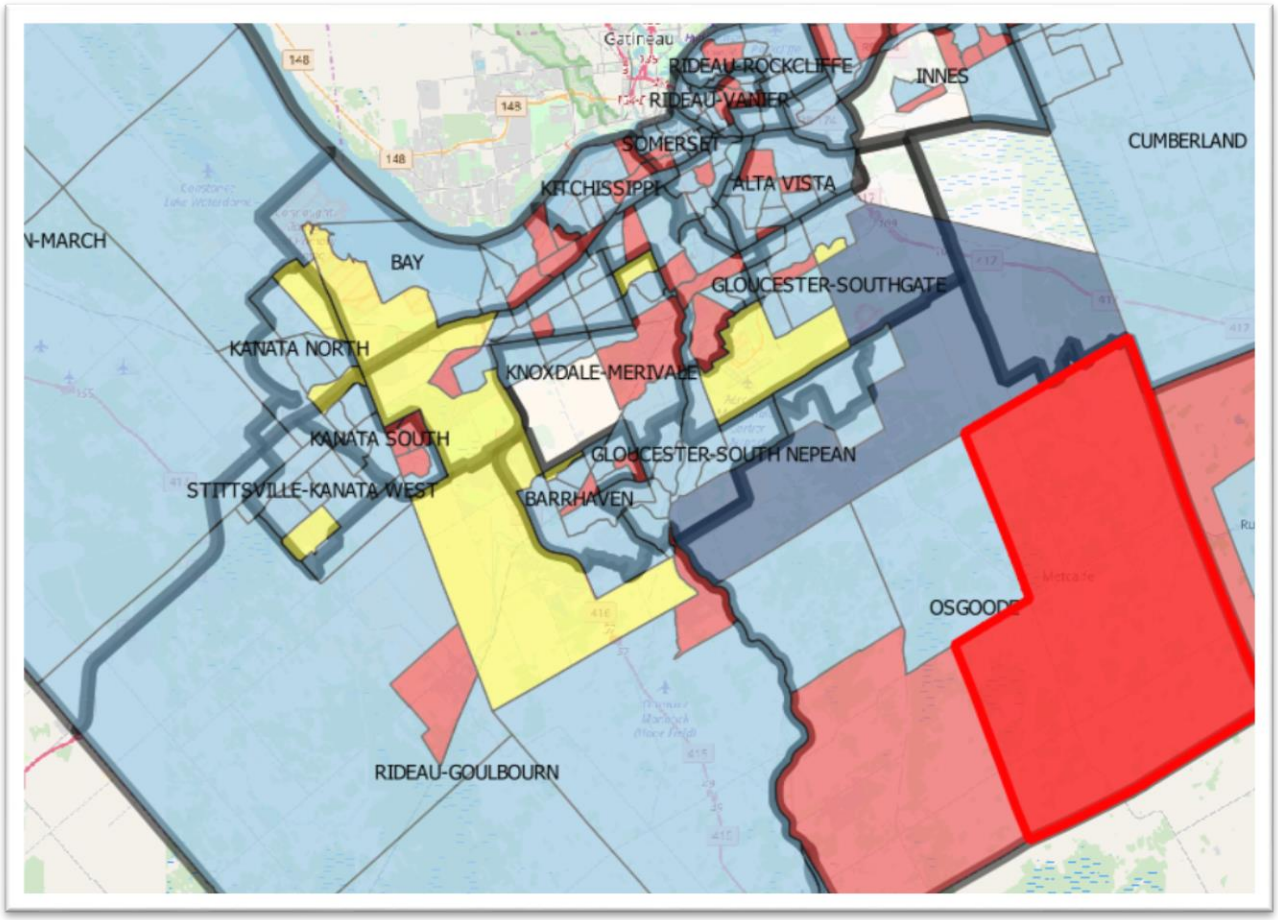
Once the red has been selected, click OK to return to the “Layer Properties” dialogue box to change the next value range for the census tracts where growth was between -0.0010 and 0.000, basically zero growth.



Using the same process used to colour code the negative-growth census tracts, make this range yellow.


Layer Properties - Visible_Minorities_In_Ottawa | Style
General
Style
Labels
Fields
Rendering
Display
Actions
Joins
Graduated
Column
1.2 %Diff_11-1
Symbol
Legend Format
%1 - %2
Method
Color
Color ramp
[source]
Classes
Histogram
Symbol selector
Fill
Simple fill
Unit
Millimeter
Transparency 0%
Color
Symbols in group
corner
diagon
dotted
green
land
water
wine
Select color
Recent colors
#f7fbff
#000100
#ffffff
#a6cee3
#4f1900
#33a02c
#000000
H
S
V
R
G
B
Opacity
HTML notation
#f7f72a
Current
Old
OK

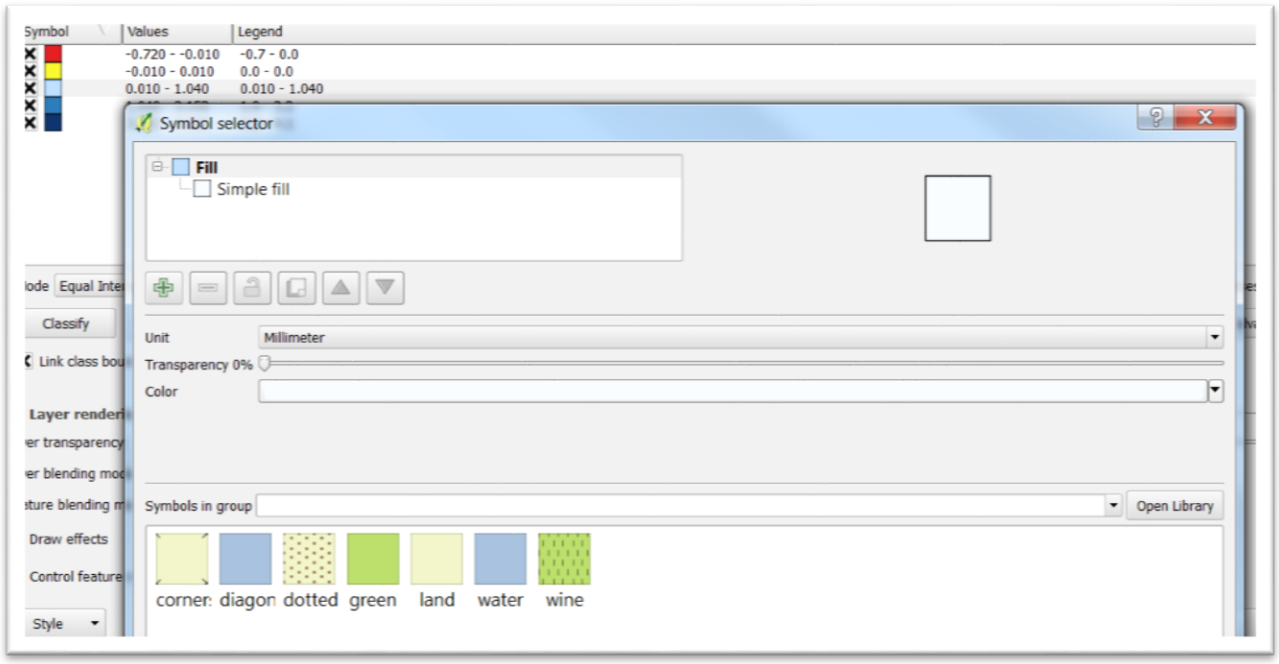
Click OK to return to the map.



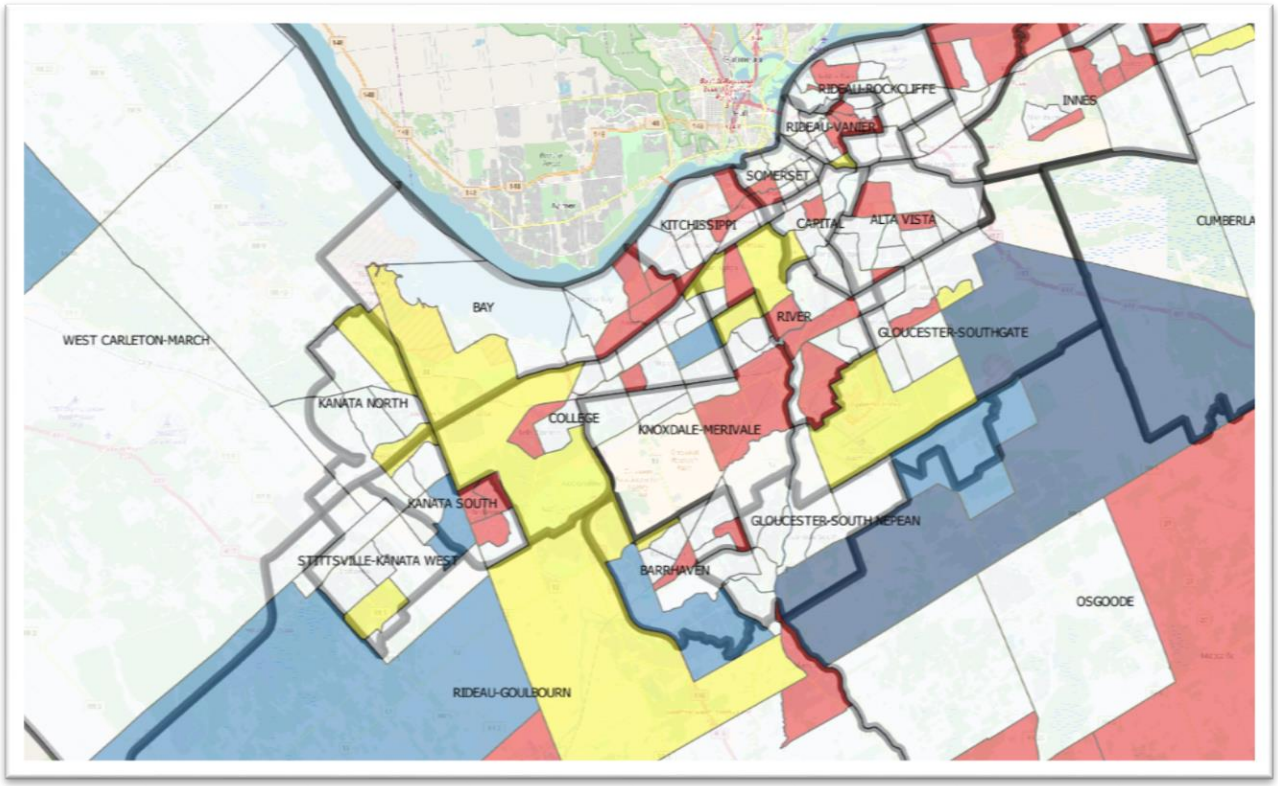
Let’s change the value range in the lowest category of the positive growth census tracts.

Return to properties. And using our attribute table as a reference, choose a range for the census tracts with the lowest growth rate, 0.010-1.040.

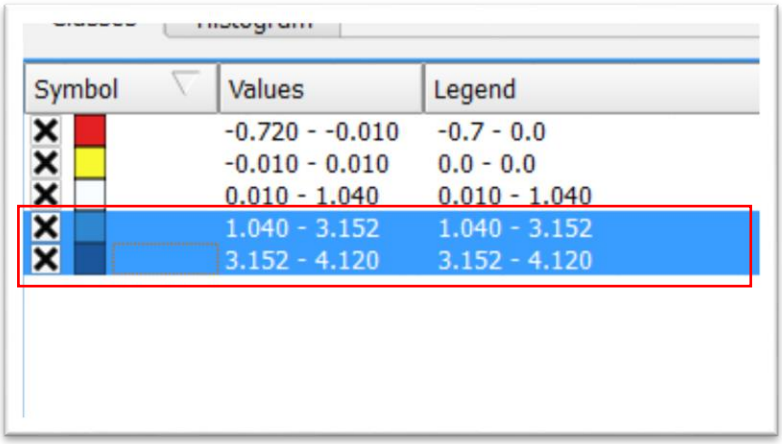
For this range, we want a blue colour, but the lightest shade possible to contrast with the remaining two colours that will symbolize more robust growth.



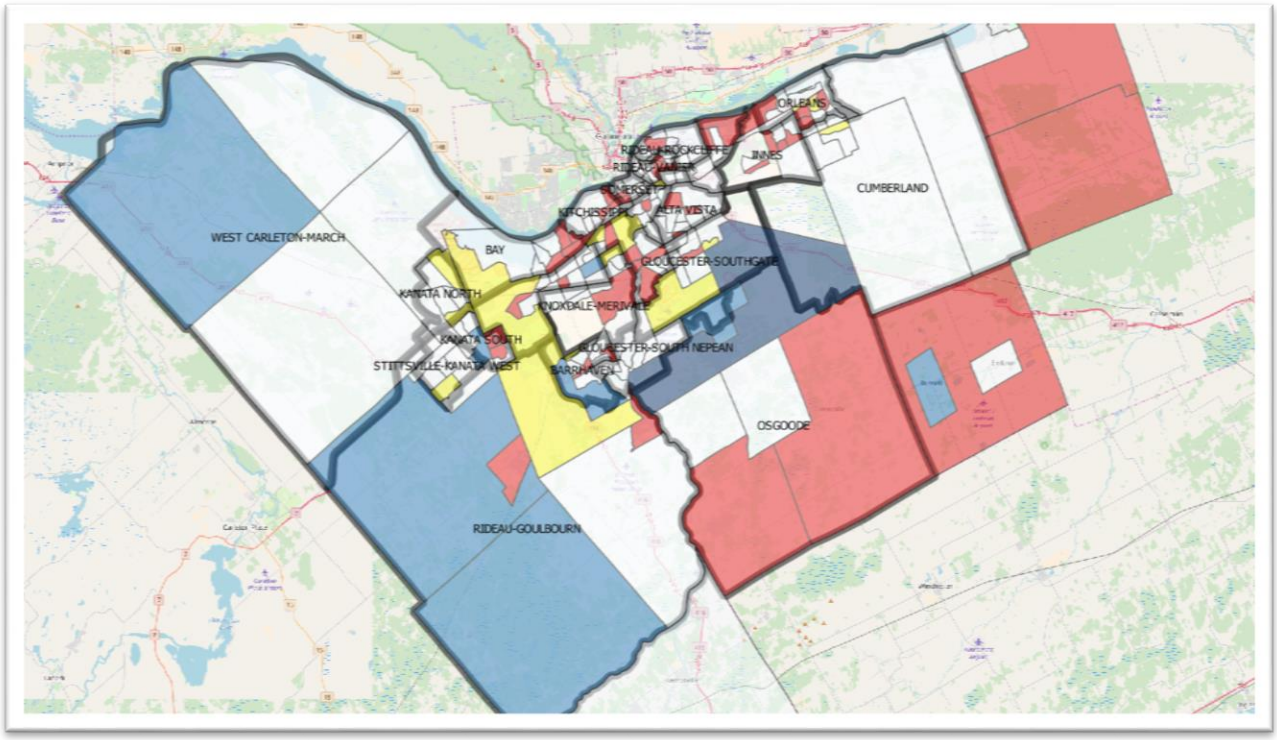
Select “Apply” and “OK” to return to your map.



For the remaining two upper ranges, leave the shades of blue as they are, and adjust the ranges.

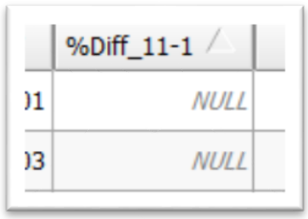


Symbol	Values	Legend
	-0.720 - -0.010	-0.7 - 0.0
	-0.010 - 0.010	0.0 - 0.0
	0.010 - 1.040	0.010 - 1.040
	1.040 - 3.152	1.040 - 3.152
	3.152 - 4.120	3.152 - 4.120



The red, yellow and blue create a nice contrast that allows the viewer to quickly distinguish between the areas of town with positive and negative growth of visible minorities.

You'll also notice the the map contains bare polygons. These represent the tracts with the NULL values for the percent change column.



	%Diff_11-1
)1	NULL
)3	NULL

If you wanted to symbolize the map using another value, numbers of 2016, or the difference in raw numbers between 2011 and 2016, you can select the appropriate columns and repeat this steps to produce your choropleth map.