

The Data Journalist

Chapter 7 tutorial

Spatial Joins in Qgis

Summary: As we learned in Chapter 7, one of the most useful kinds of analysis journalists can perform with mapping software is a spatial join, a concept we also learned in Chapter 5's discussion of database programs such as Access and MySQL. However, in a mapping software, instead of joining two tables based on a common field, as we learned in the "Joining Maps to Other Datasets" tutorial, you join them based on geographic location. The two tables will be the federal contaminated sites and the updated federal electoral boundaries.

Before we beginning the tasks of importing and adding the shape and csv files, you may wish to review the tutorial [A Quick Tour of Qgis Desktop](#).

This tutorial uses Qgis 2.18.7.

Skills you will learn:

1. How to find and download the federal electoral boundaries.
2. How to set your projection
3. How to import the shape file and csv file.
4. How to use the "save as" tool convert the csv file into a shape file with geographic coordinates similar to those of our federal contaminated shape file.
5. How to complete a spatial join in Qgis and save the new layer.

Task 1: How to find and download the federal electoral boundaries.

The updated federal ridings shape file can be found here:

<http://www12.statcan.gc.ca/census-recensement/2011/geo/bound-limit/bound->

limit-2016-eng.cfm

Boundary files options

To download this product, please select from the choices below:

Language
 English French

Format
 ArcGIS[®] (.shp)
 Geography Markup Language (.gml)
 MapInfo[®] (.tab)

Boundary files

Geographic area or water feature	Cartographic Boundary File	Digital Boundary File	Water File
Provinces/territories	<input type="radio"/>	<input type="radio"/>	...
Federal electoral districts (2013 Representation Order)	<input checked="" type="radio"/>	<input type="radio"/>	...
Economic regions	<input type="radio"/>	<input type="radio"/>	...
Census divisions	<input type="radio"/>	<input type="radio"/>	...

Select “Federal electoral districts (2013 Represents Order) and the “Cartographic Boundary File option. You can find an explanation of the cartographic and digital boundary files by clicking [here](#).

Select the “Continue” tab.

 Statistics Canada Statistique Canada

Search website

[Home](#)

Alternative format - ZIP document

The following document is available for downloading or viewing:

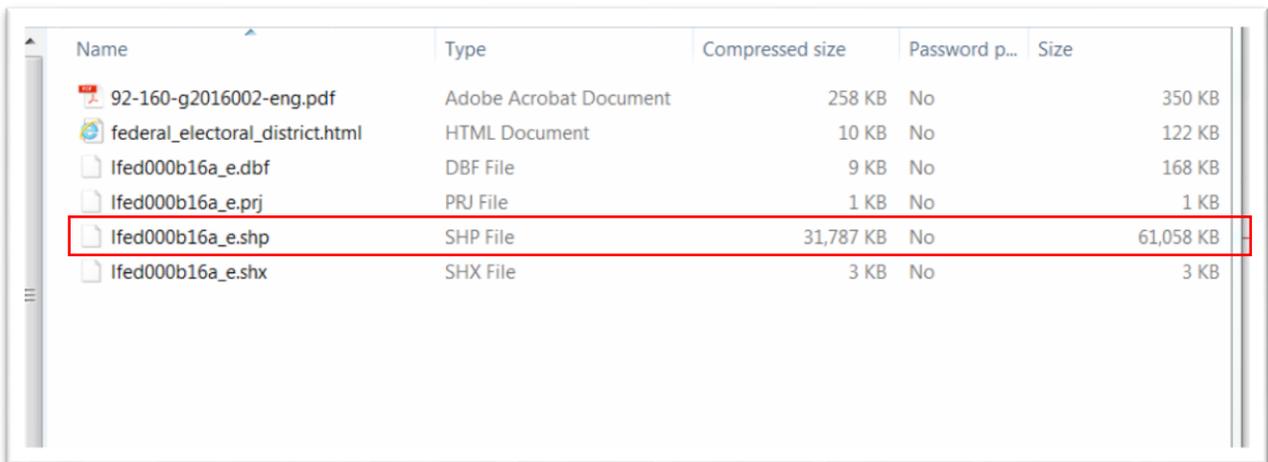
- [lfed000b16a_e.zip \(ZIP Version, 32065.0 kb\)](#)

To access the Compressed Archive (ZIP) version, you do not require special software if you are using Windows XP (just download the file and view it using Windows Explorer). There are many packages to zip/unzip files available for free or for purchase on the Internet:

- [Winzip](#)
- [7-zip](#)

Browse to a location on your hard drive you’ll be using for this exercise and save the zipped file. After extracting the files from the zipped folder this is what you

should see.



Name	Type	Compressed size	Password p...	Size
92-160-g2016002-eng.pdf	Adobe Acrobat Document	258 KB	No	350 KB
federal_electoral_district.html	HTML Document	10 KB	No	122 KB
lfed000b16a_e.dbf	DBF File	9 KB	No	168 KB
lfed000b16a_e.prj	PRJ File	1 KB	No	1 KB
lfed000b16a_e.shp	SHP File	31,787 KB	No	61,058 KB
lfed000b16a_e.shx	SHX File	3 KB	No	3 KB

As we learned in Chapter 7, shape files come with accompanying or helper files which contain information the mapping software needs in order to display the boundaries. Here, the file Qgis needs is the one with the “.shp” extension. Open a new Qgis file.

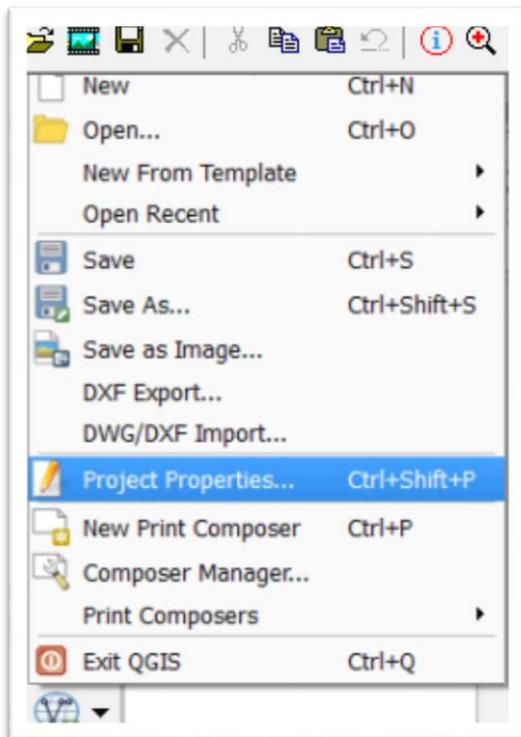
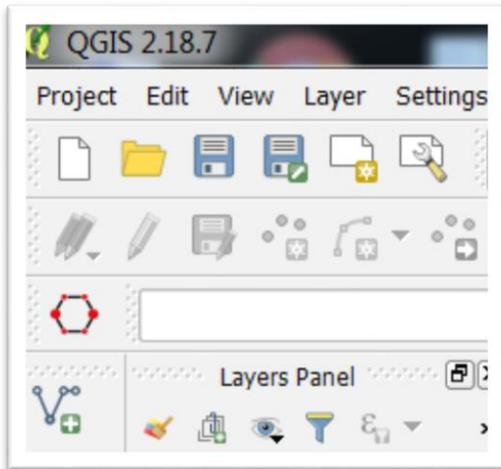
Task 2: How to set your projection

Before we go any further, it’s important to briefly discuss projected coordinate systems. As we learned in Chapter 7 it’s important for your layers to have the same projected coordinate system.

In the corresponding ArcMap tutorial, we learned about its ability to automatically line up the projection systems of the layers that it is importing. That is, when the first layer is displayed, ArcMap displays it according to the coordinate values of its features, which are either geographic or projected. ArcMap then automatically matches the coordinate systems of the first layer, using a process calleed “on-the-fly projection.”

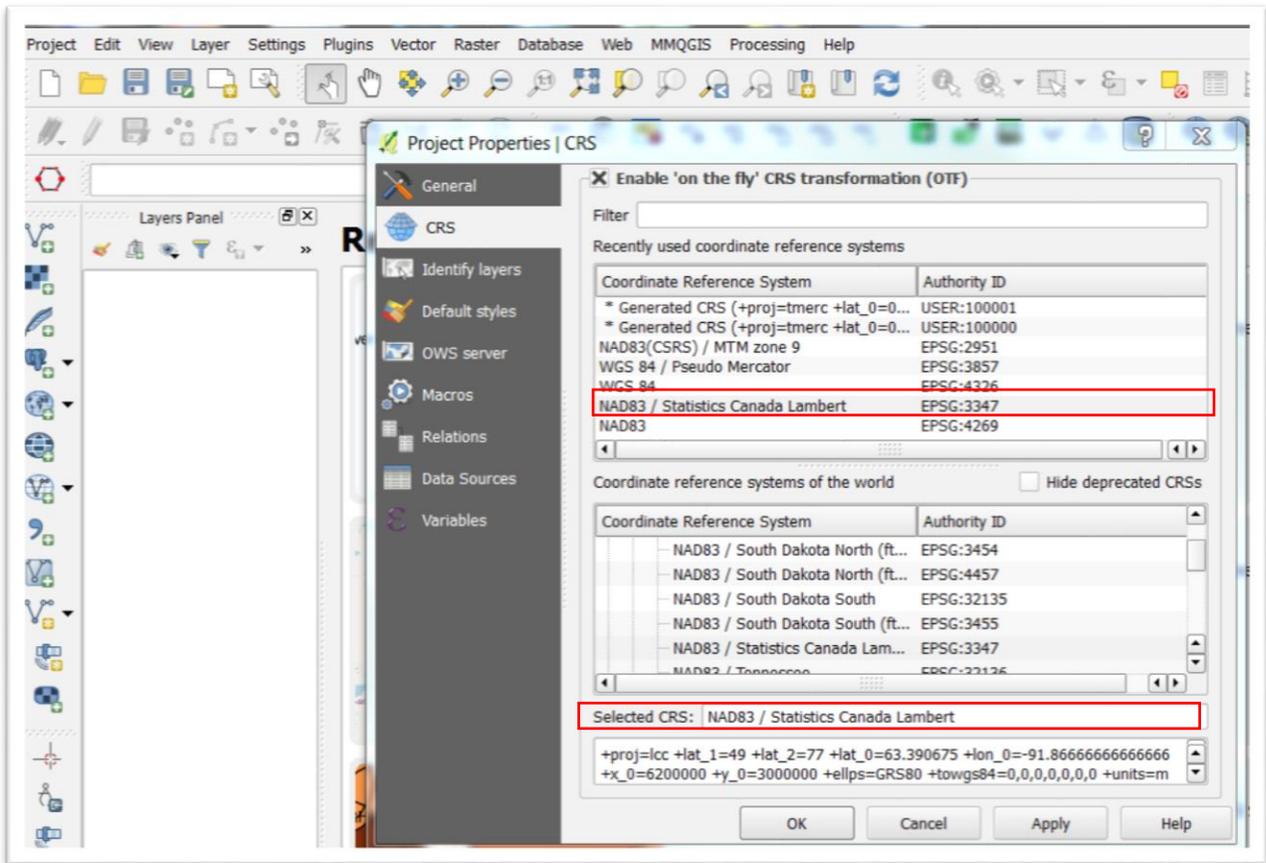
Qgis does the same thing. The difference is that you have to give it a specific prompt. It’s important to note that while the mapping software changes the data’s display position is being changed, and not the data itself.

Now that we have that out of the way, let's open Qgis, and click on "Project" in the menu.



Select "Project Properties."

Check the box to the left of "Enable 'on the fly' CRS transformation" and select the "Apply" tab.

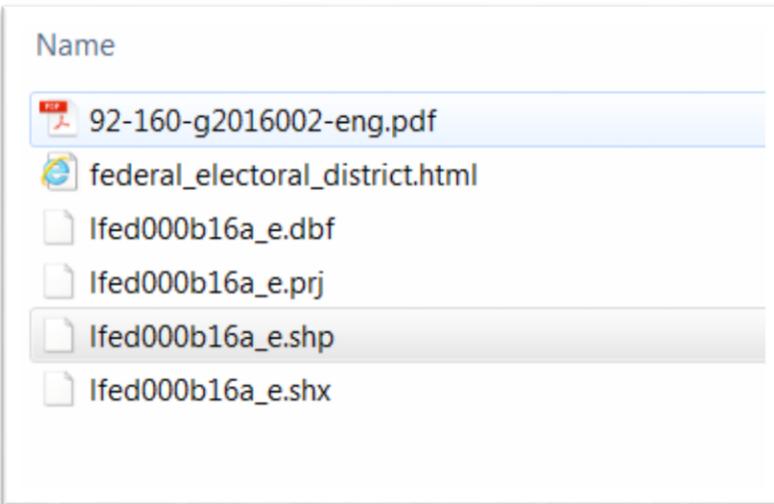
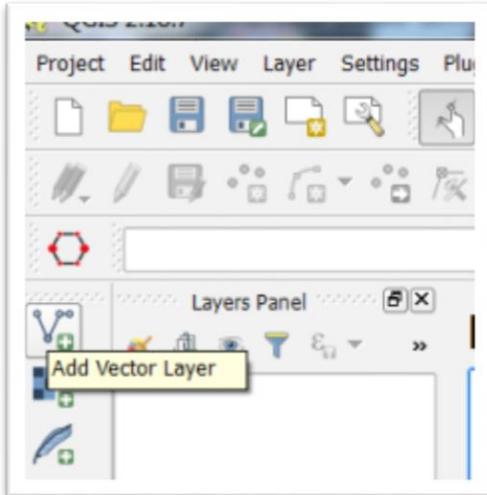


Select “NAD83/Statistics Canada Lambert” coordinate, which is the system the federal electoral boundary file uses. Hit the “Apply” tab. (NOTE: Information about the file’s coordinate system should be contained in the institution’s readme, data dictionary or meta data. If you can’t find it, then it’s worth calling or emailing the institution to find out.)

Now we’re ready to begin.

Task 3: How to import the shape file and csv file.

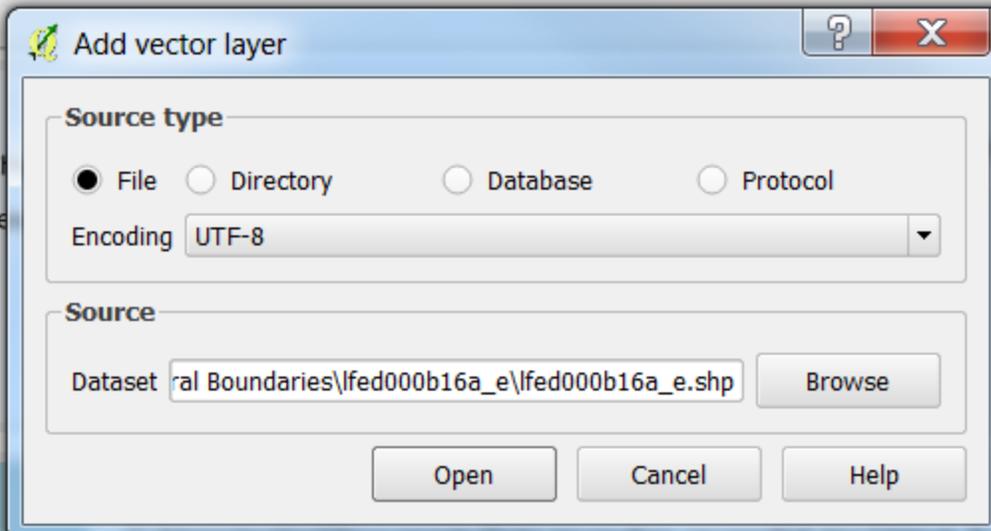
Using the “Add Vector Layer” icon.



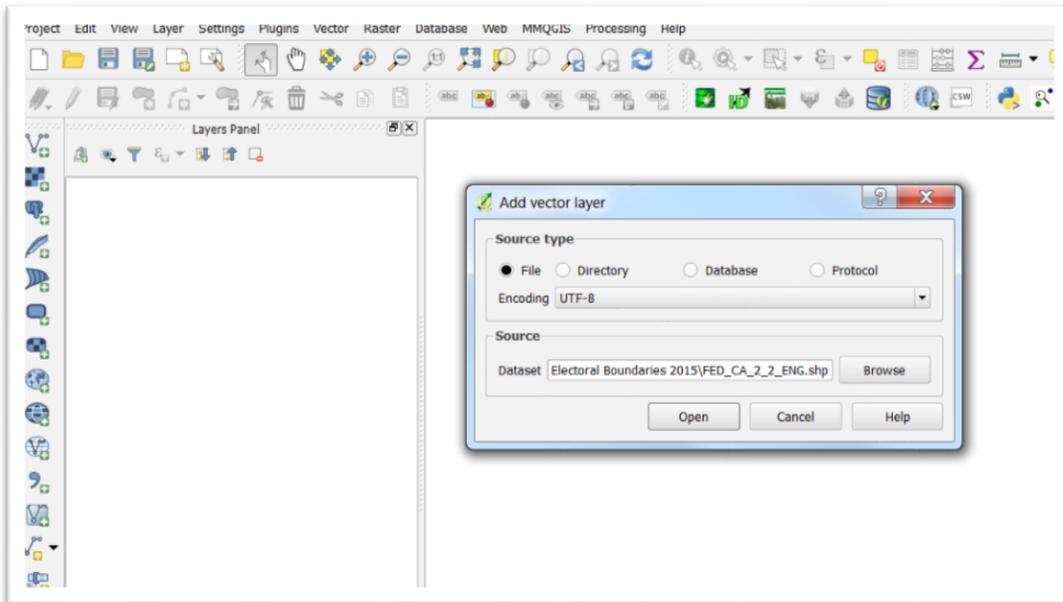
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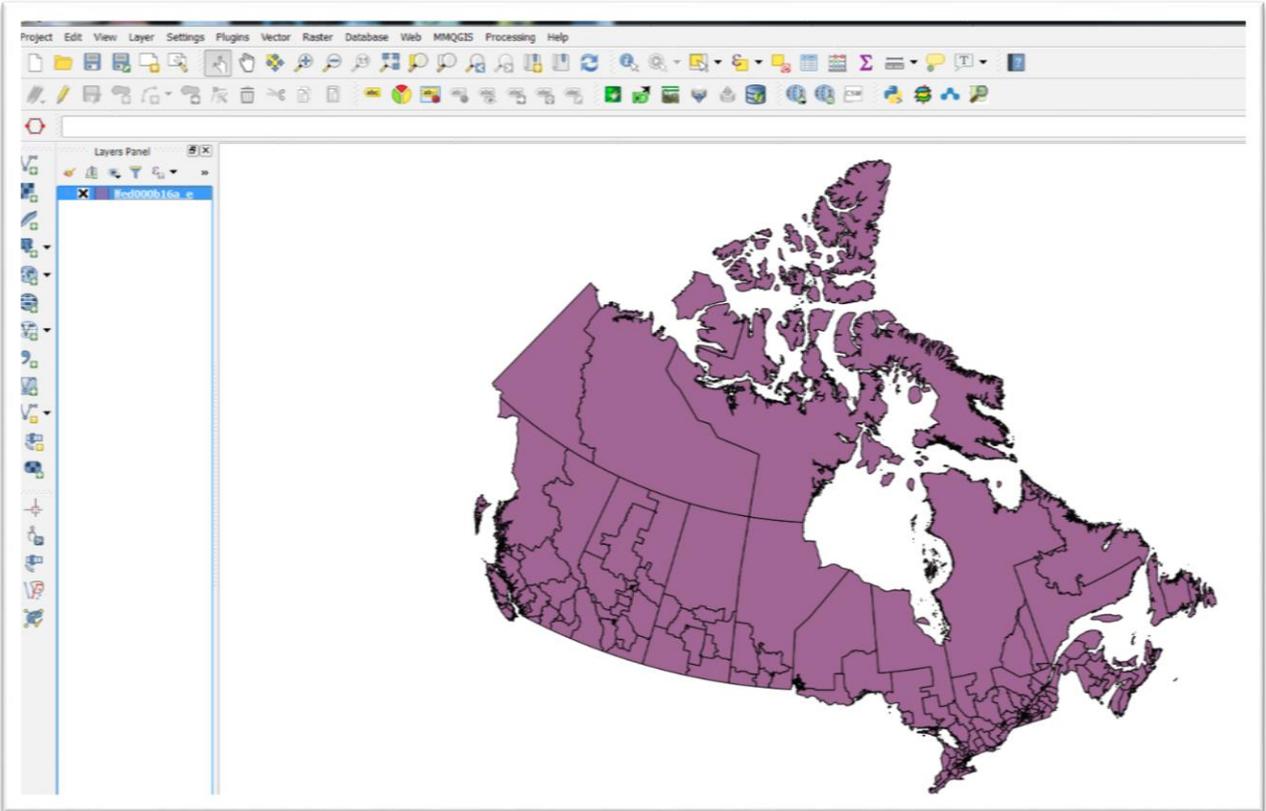
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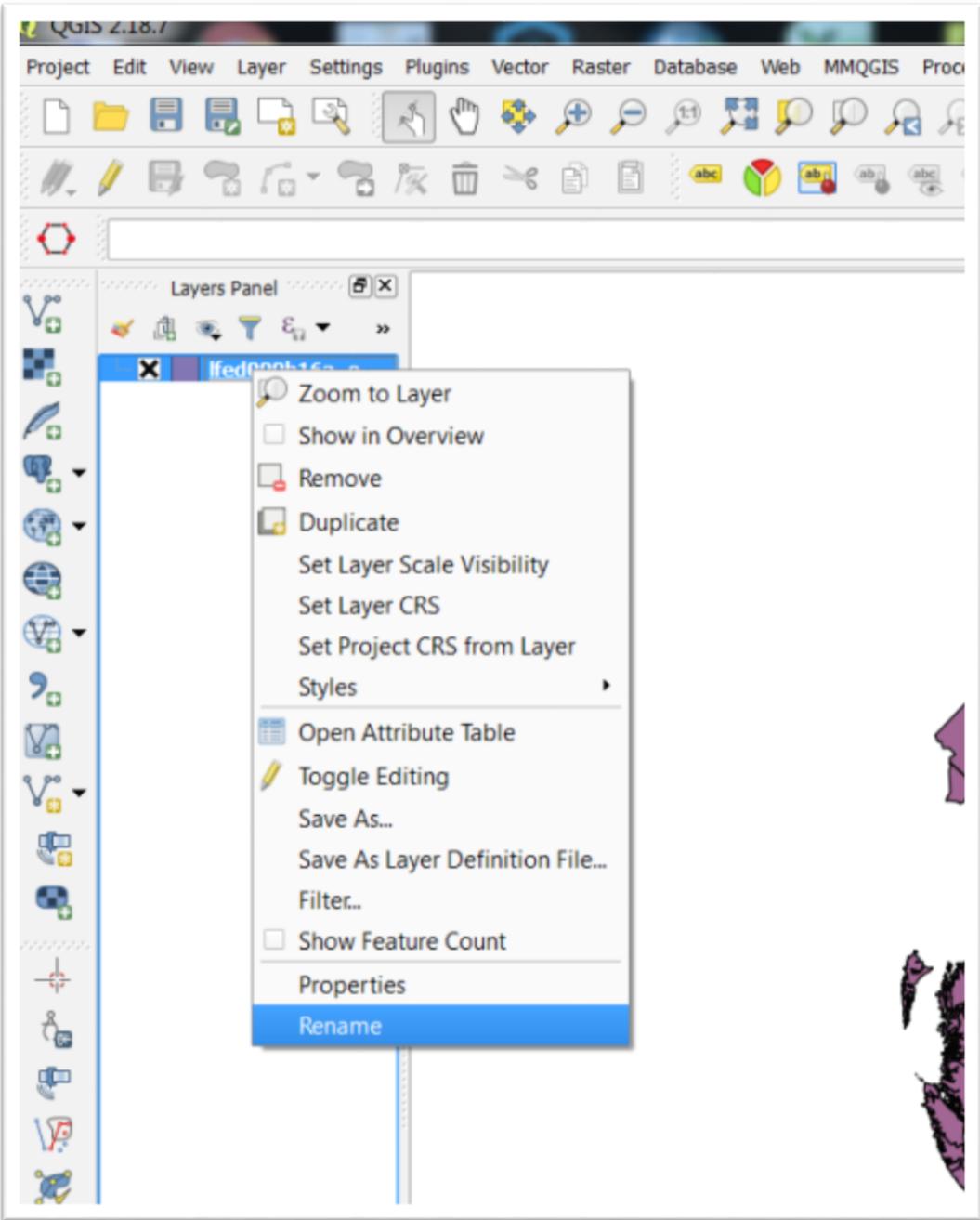


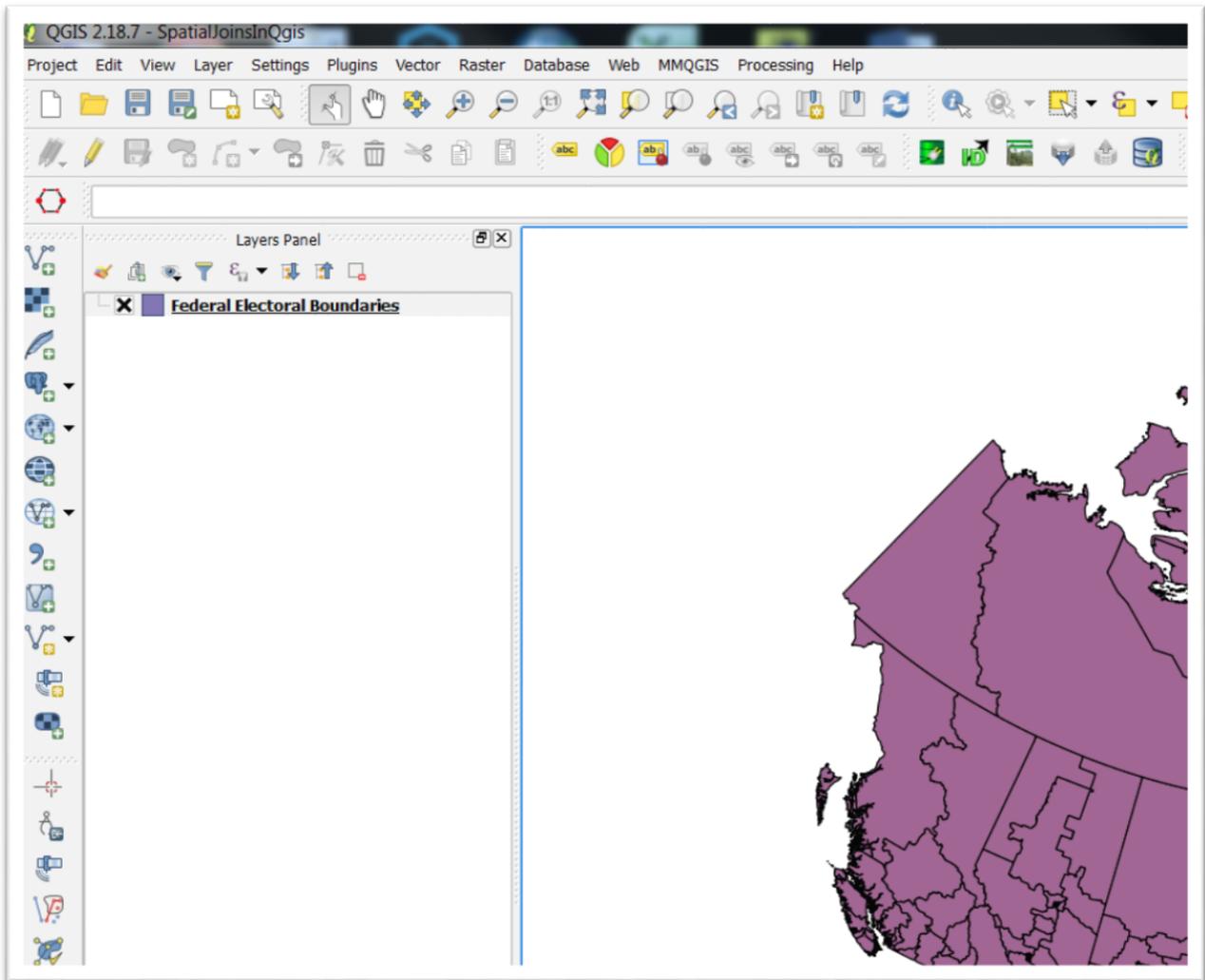
Right-click on the layer in the “Layer Panel” menu to the left and select the “Open Attribute Table” option to see some of the data Qgis is using to display the map.

	FEDUID	FEDNAME	FEDENAME	FEDFNAME	PRUID	PRNAME
1	24054	Outremont	Outremont	Outremont	24	Quebec / Qu...
2	24055	Papineau	Papineau	Papineau	24	Quebec / Qu...
3	24056	Pierrefonds--...	Pierrefonds--...	Pierrefonds--...	24	Quebec / Qu...
4	24057	Pontiac	Pontiac	Pontiac	24	Quebec / Qu...
5	24058	Portneuf-Jacq...	Portneuf-Jacq...	Portneuf-Jacq...	24	Quebec / Qu...
6	24059	Qu ◆ bec	Qu ◆ bec	Qu ◆ bec	24	Quebec / Qu...
7	24060	Repentigny	Repentigny	Repentigny	24	Quebec / Qu...
8	24061	Richmond--Ar...	Richmond--Ar...	Richmond--Ar...	24	Quebec / Qu...
9	24062	Rivi ◆ re-des-...	Rivi ◆ re-des-...	Rivi ◆ re-des-...	24	Quebec / Qu...
10	24037	LaSalle-- ◆ m...	LaSalle-- ◆ m...	LaSalle-- ◆ m...	24	Quebec / Qu...
11	24038	Laurentides--...	Laurentides--...	Laurentides--...	24	Quebec / Qu...
12	24039	Laurier--Saint...	Laurier--Saint...	Laurier--Saint...	24	Quebec / Qu...
13	24040	Laval--Les ◆ les	Laval--Les ◆ les	Laval--Les ◆ les	24	Quebec / Qu...
14	24041	Longueuil--Ch...	Longueuil--Ch...	Longueuil--Ch...	24	Quebec / Qu...
15	24042	L ◆ vis--Lotbini...	L ◆ vis--Lotbini...	L ◆ vis--Lotbini...	24	Quebec / Qu...
16	24043	Longueuil--Sa...	Longueuil--Sa...	Longueuil--Sa...	24	Quebec / Qu...
17	24044	Louis-H ◆ bert	Louis-H ◆ bert	Louis-H ◆ bert	24	Quebec / Qu...
18	24045	Louis-Saint-La...	Louis-Saint-La...	Louis-Saint-La...	24	Quebec / Qu...
19	24046	Manicouagan	Manicouagan	Manicouagan	24	Quebec / Qu...
20	24047	M ◆ gantic--L'...	M ◆ gantic--L'...	M ◆ gantic--L'...	24	Quebec / Qu...
21	24048	Mirabel	Mirabel	Mirabel	24	Quebec / Qu...

In subsequent tutorials, we’ll use the information in these attribute tables to select subsets such as ridings for a particular province, which can then be saved as new layers. But for now, it’s important to stress the good habit of opening a layer’s attribute table after importing it.

To rename the layer with a label that makes more sense, right-click on the layer and choose the “Rename” option from the short-cut menu.



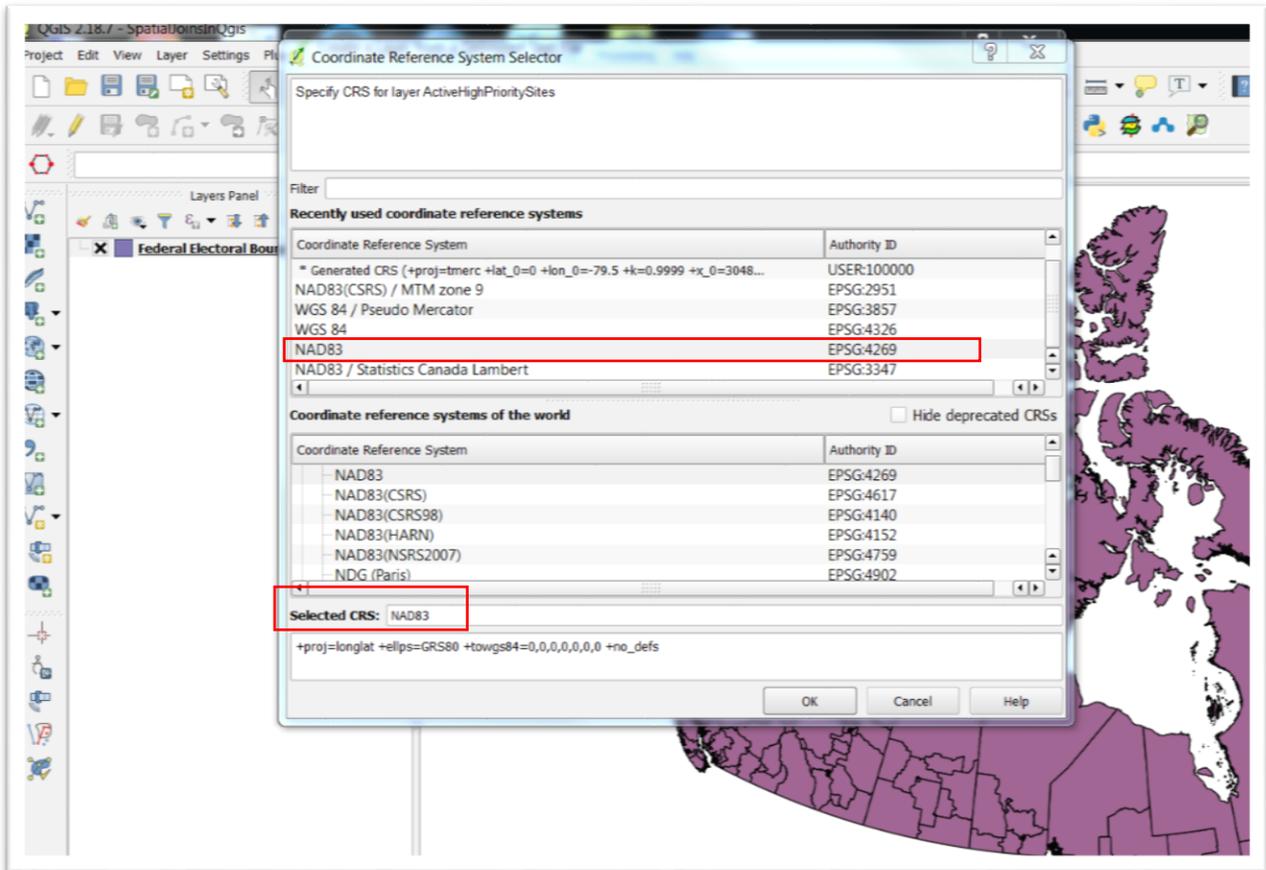


Now let`s use the “Add Delimited Text Layer” icon to add the [csv file](#) that contains the federal contaminated sites file that we used in the Fusion Table and ArcGIS Online tutorials.

Qgis has correctly determined that the table is contained in a csv file, and it has assigned map units or decimal degrees of the Longitude and Latitude coordinate value system into X and Y coordinates in meters or feet.

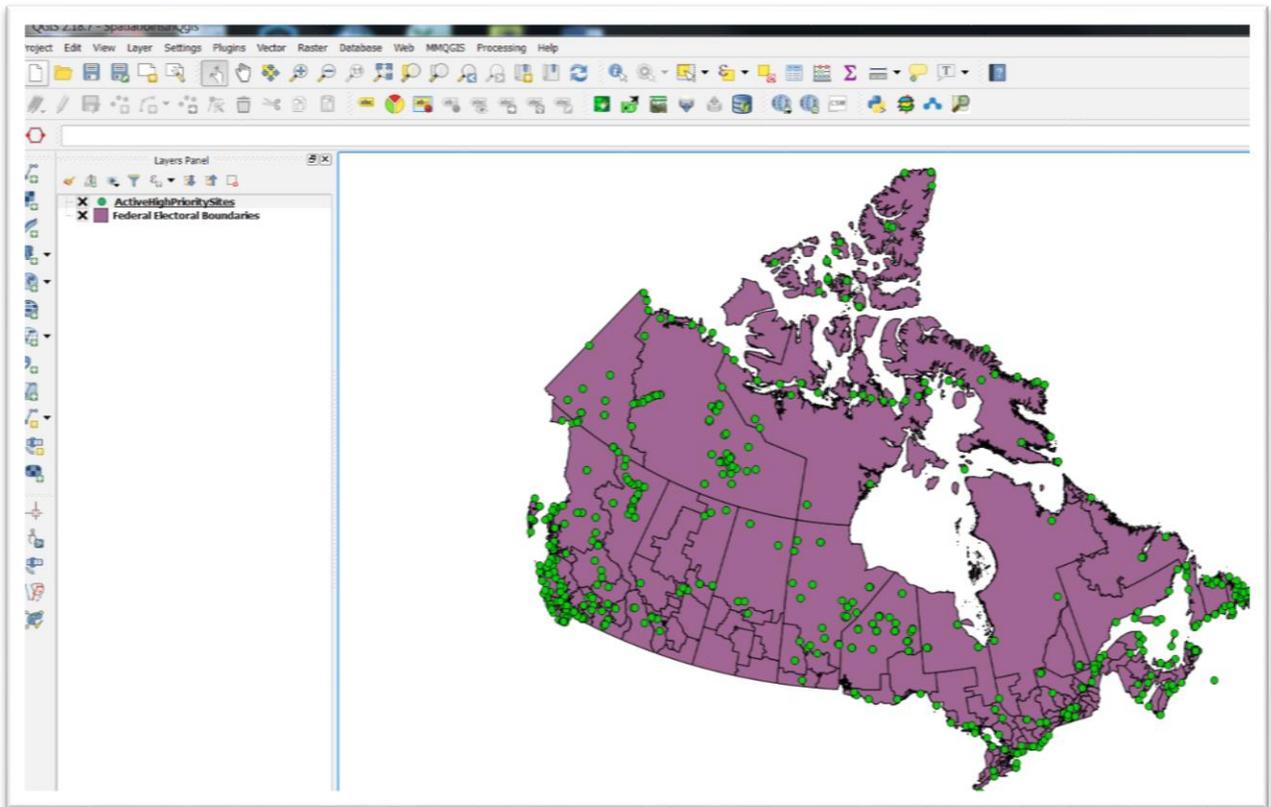
You can use the horizontal scroll bar at the bottom of the displayed table to ensure that all the information is there.

Once you're satisfied, select the "OK" tab.

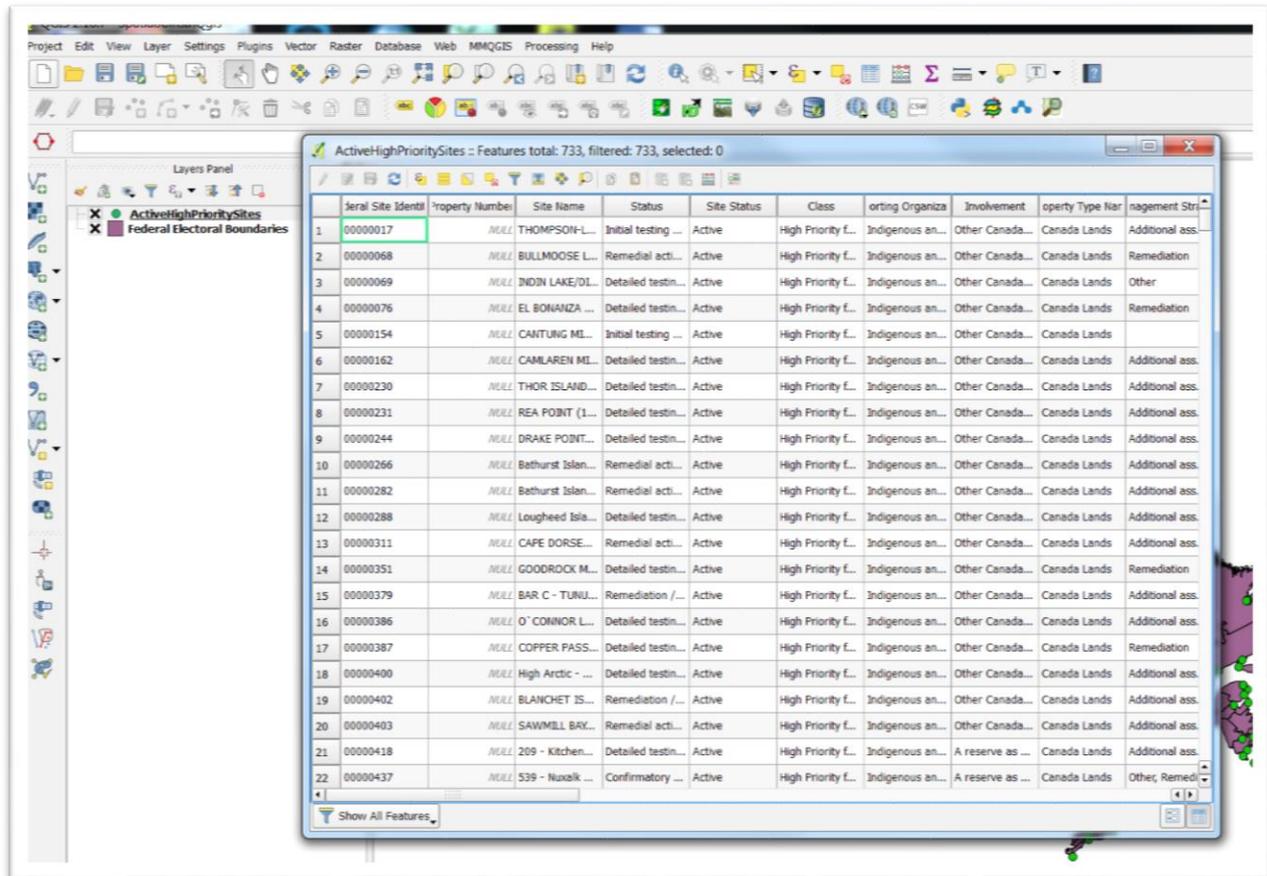


In the area to the right of the "Selected CRS" label, you can see that this file has a different Coordinate Reference System, NAD83 (EPSG4269). However, because QGIS is projecting "on-the-fly", we'll be able to see the points superimposed on the federal electoral map.

Select the OK tab.



Open this layer's attribute table.



ActiveHighPrioritySites - Features total: 733, filtered: 733, selected: 0

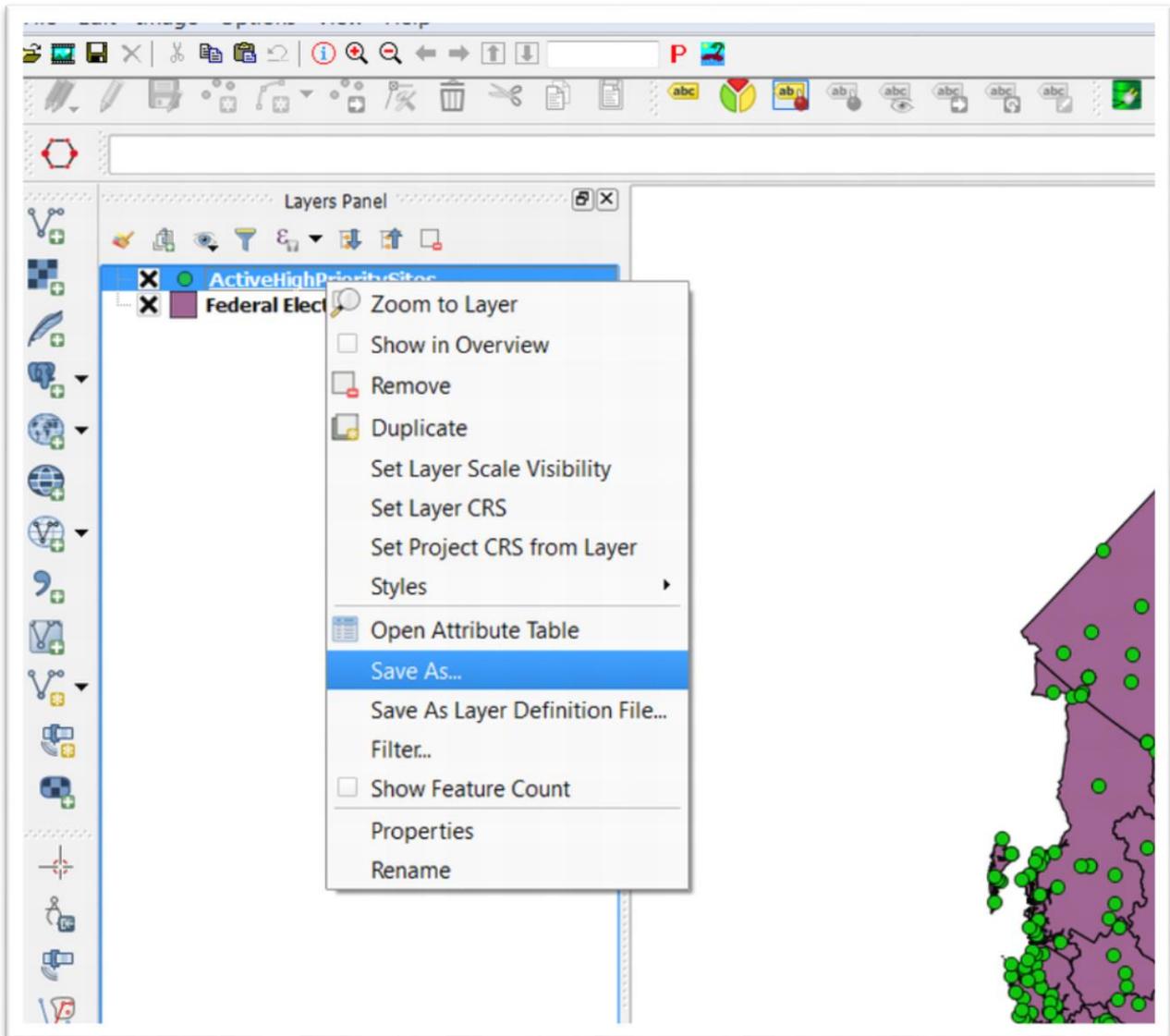
Serial Site Identif	Property Number	Site Name	Status	Site Status	Class	Reporting Organiza	Involvement	Property Type	Management Str
1	00000017	THOMPSON-L...	Initial testing ...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass...
2	00000068	BULLMOOSE L...	Remedial acti...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Remediation
3	00000069	INDIAN LAKE/DL...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Other
4	00000076	EL BONANZA ...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Remediation
5	00000154	CANTUNG ML...	Initial testing ...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	
6	00000162	CAMLAREN ML...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
7	00000230	THOR ISLAND...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
8	00000231	REA POINT (1...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
9	00000244	DRAKE POINT...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
10	00000266	Bathurst Islan...	Remedial acti...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
11	00000282	Bathurst Islan...	Remedial acti...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
12	00000288	Loughheed Isla...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
13	00000311	CAPE DORSE...	Remedial acti...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
14	00000351	GOODROCK M...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Remediation
15	00000379	BAR C - TUNJ...	Remediation /...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
16	00000386	O'CONNOR L...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
17	00000387	COPPER PASS...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Remediation
18	00000400	High Arctic - ...	Detailed testin...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
19	00000402	BLANCHET IS...	Remediation /...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
20	00000403	SAWMILL BAY...	Remedial acti...	Active	High Priority f...	Indigenous an...	Other Canada...	Canada Lands	Additional ass.
21	00000418	209 - Kitchen...	Detailed testin...	Active	High Priority f...	Indigenous an...	A reserve as ...	Canada Lands	Additional ass.
22	00000437	539 - Nuxalk ...	Confirmatory ...	Active	High Priority f...	Indigenous an...	A reserve as ...	Canada Lands	Other, Remedi...

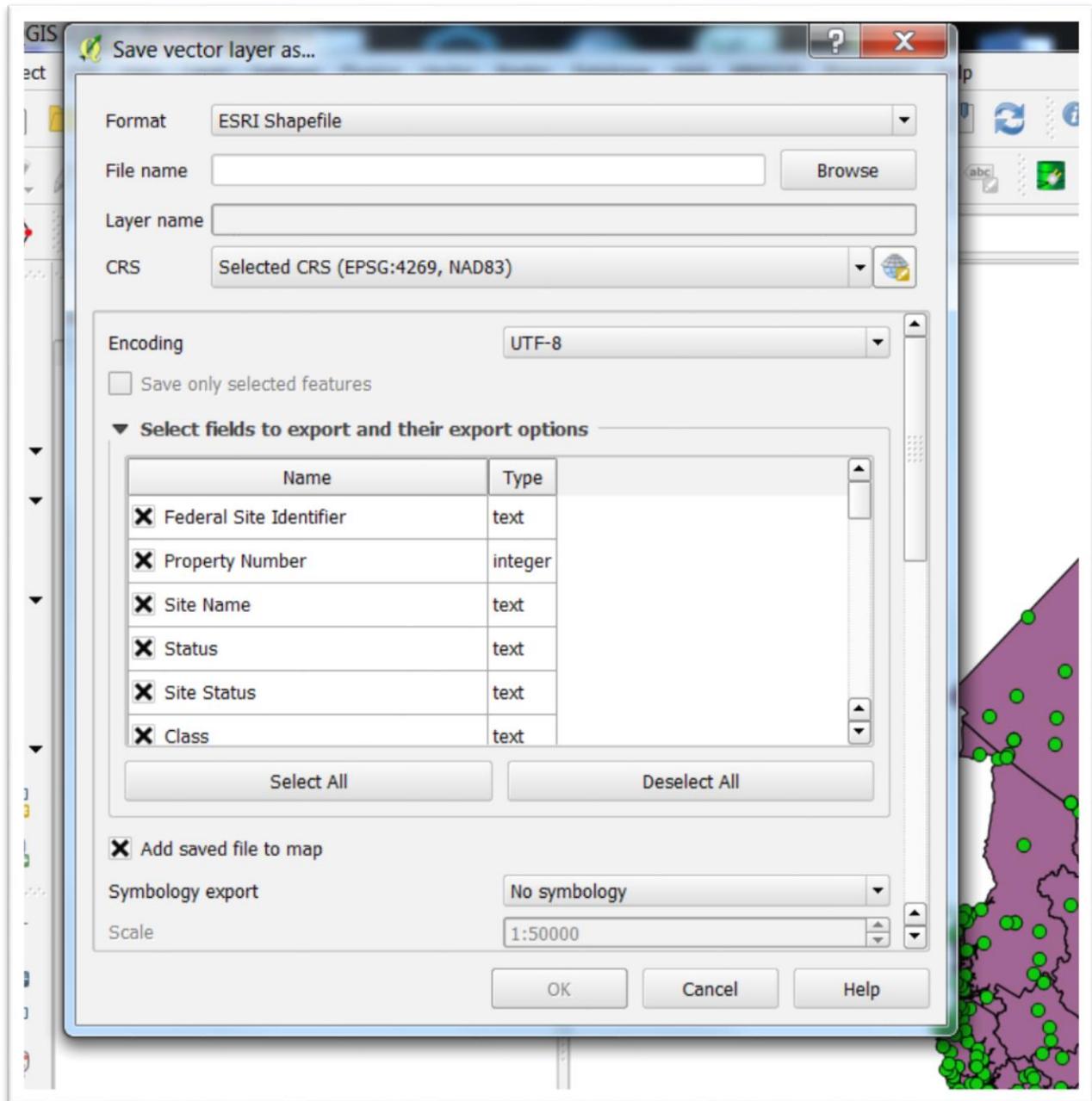
We can see the table contains the same number of records as the [csv file](#) that can also be downloaded from the federal contaminated sites [website](#).

Task 4: How to use the “save as” tool convert the csv file into a shape file with geographic coordinates similar to those of our federal contaminated shape file.

As we've learned in previous tutorials in this chapter, layers must be saved as shape files before we can perform any analysis.

So right-click on the csv layer, and select the “Save as” option.

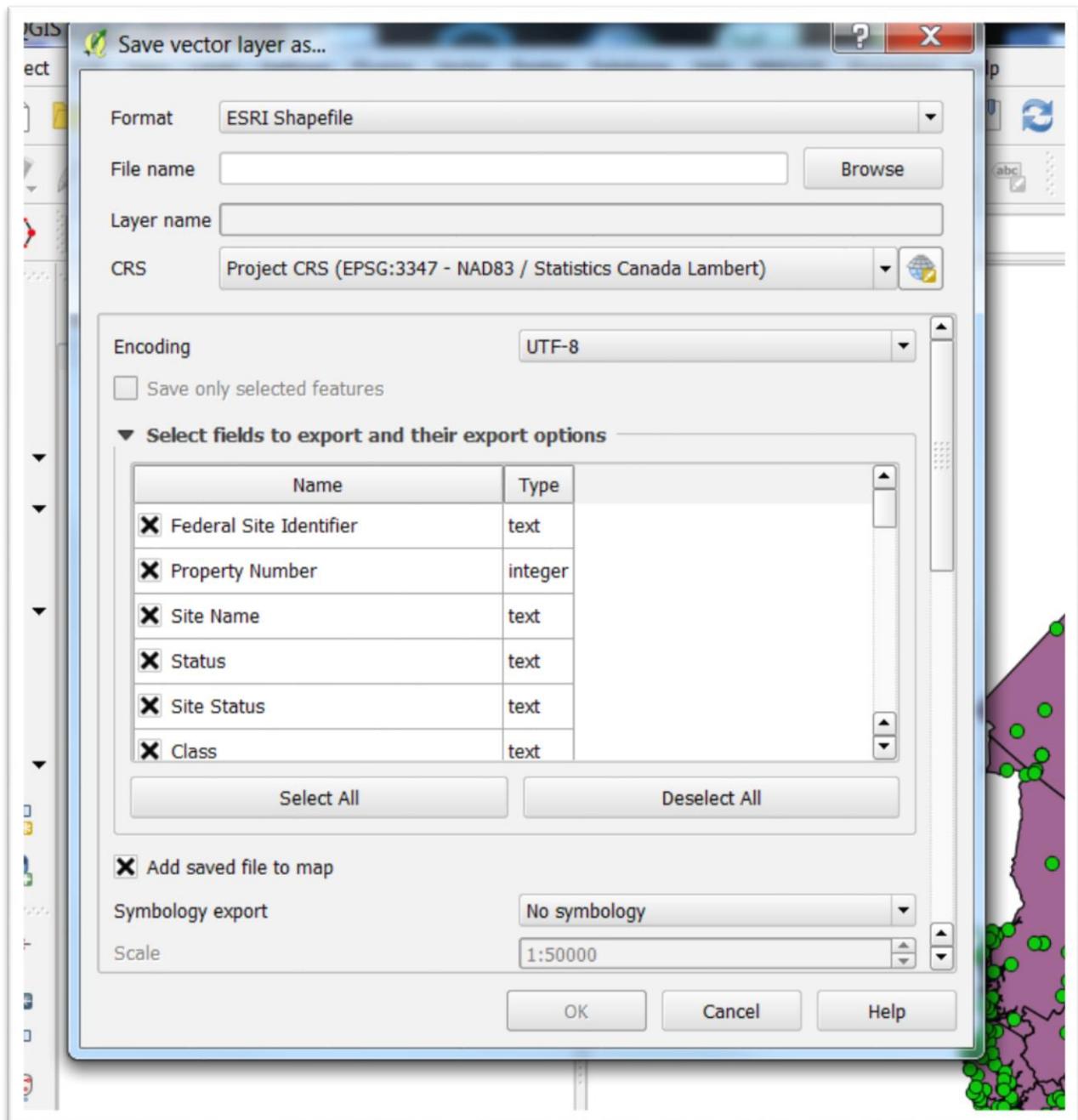




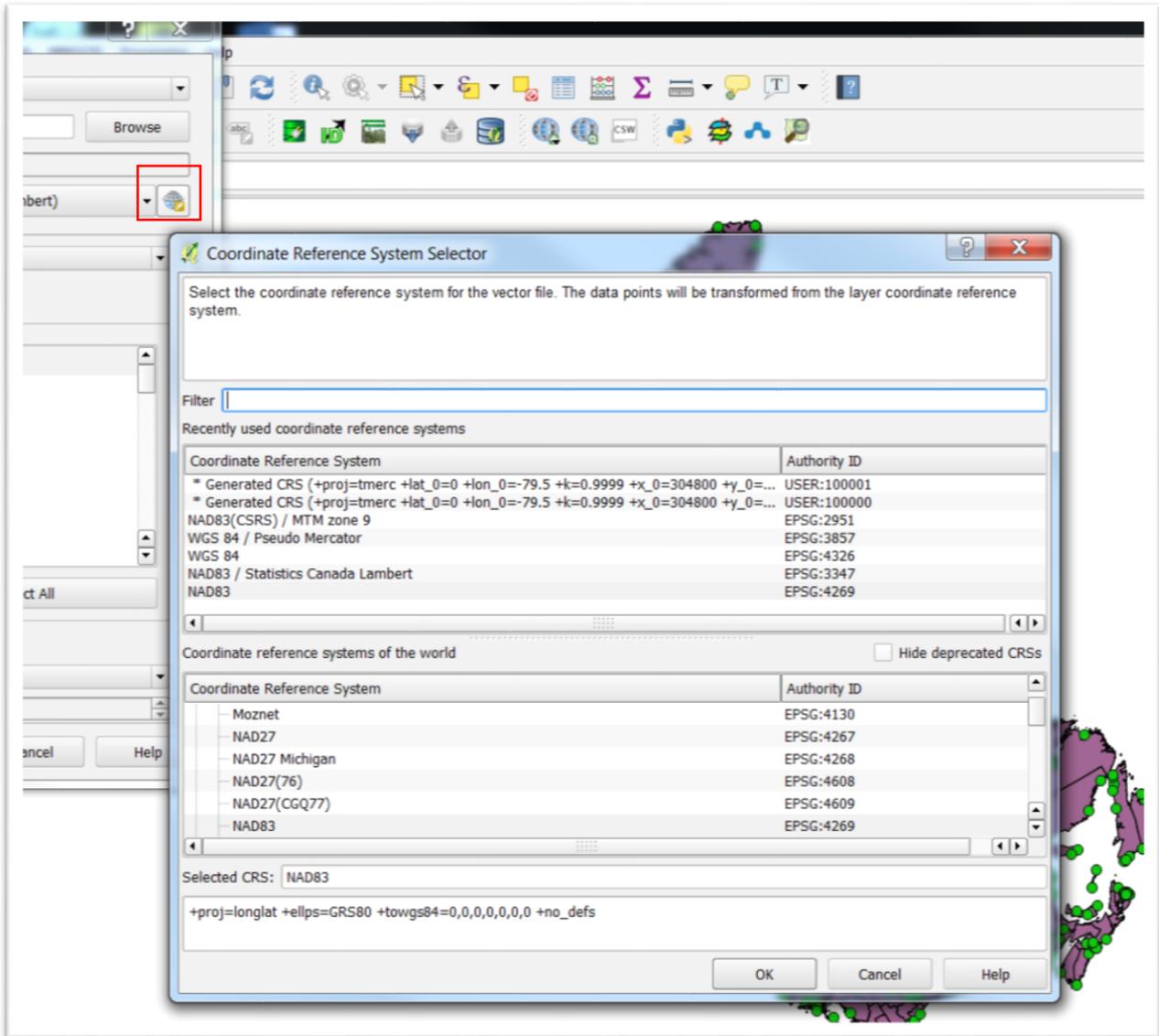
Name, and then browse to location on your hard drive where you want to store the files.

In the area to the right of the “CRS” label, select the one that corresponds to the federal electoral districts, which is “EPSG:3347 – NAD83/Statistics Canada Lambert”. Qgis has already selected the box to the left of the “Add saved file to

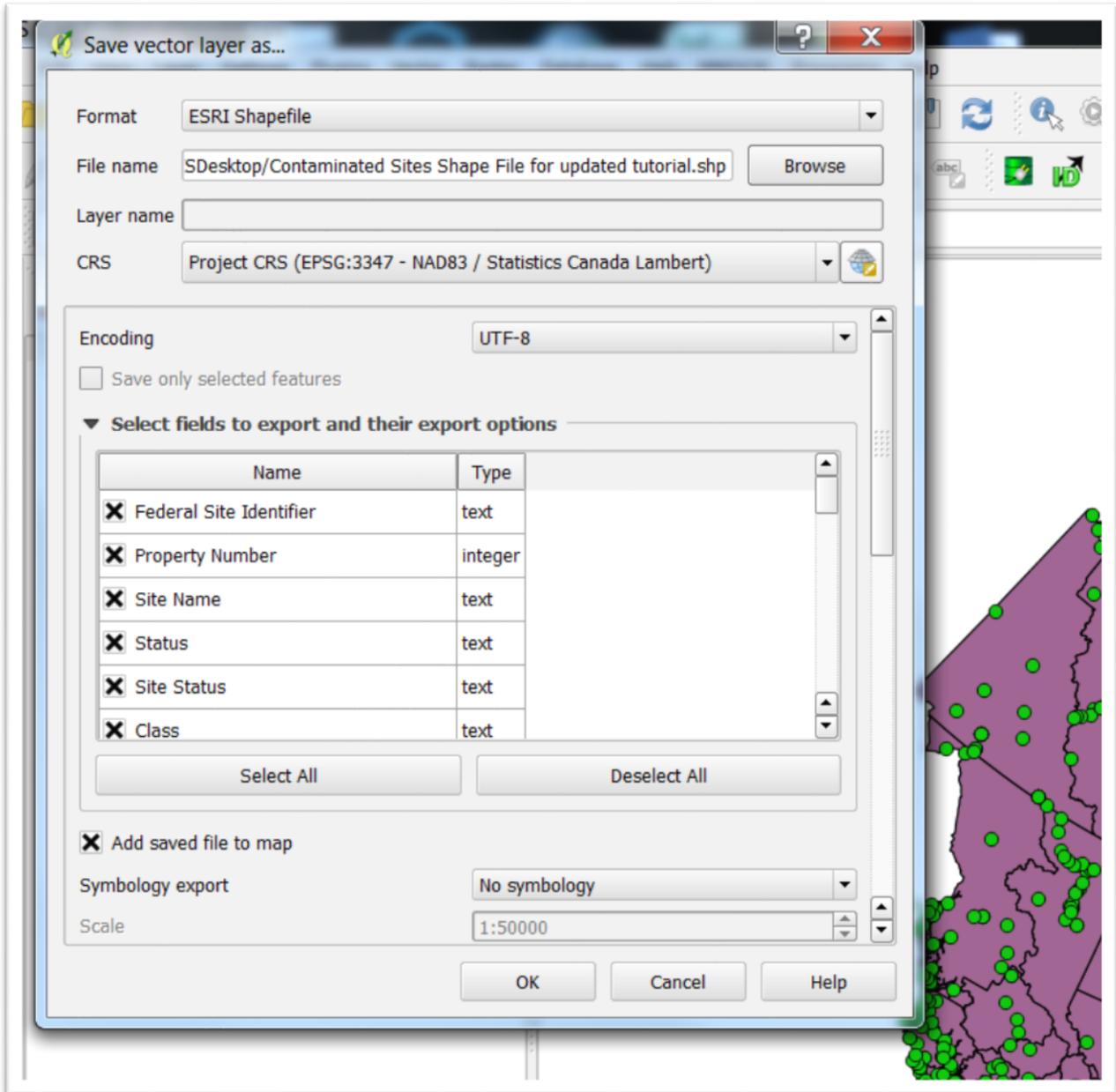
map" label.

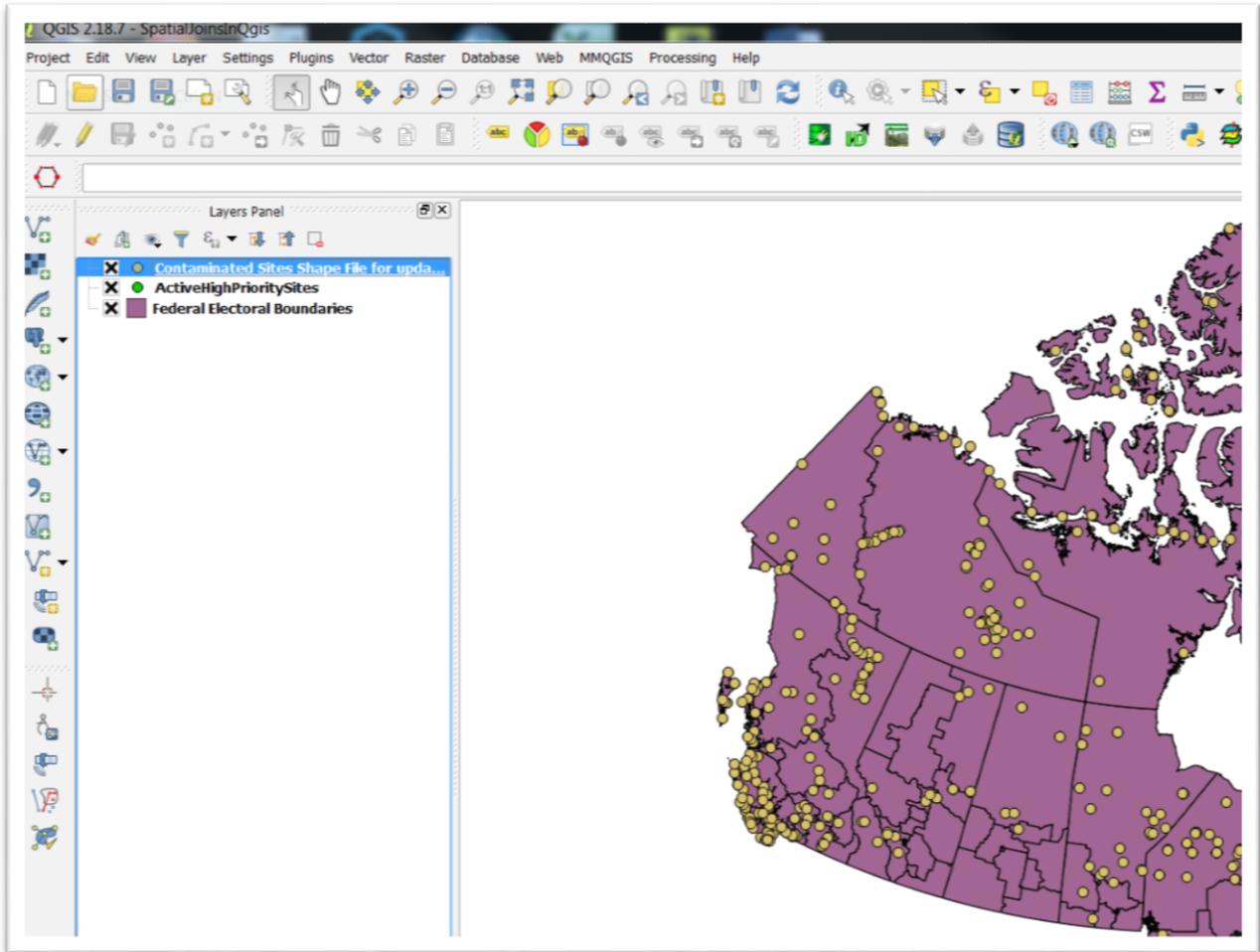


If you don't see this Project CRS in your drop-down menu, click on the globe icon to the right of the CRS box, and add the coordinate system from that inventory.

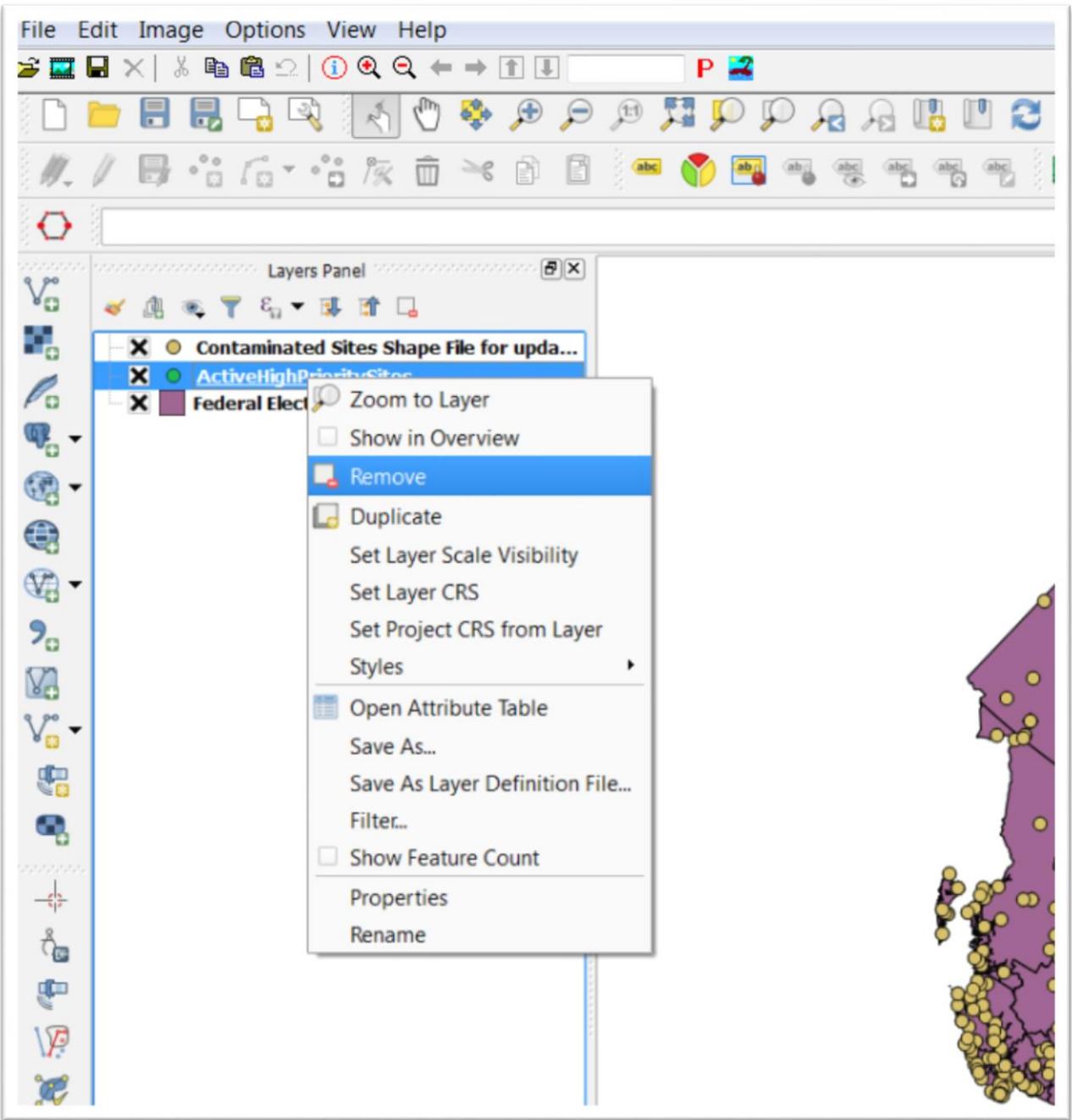


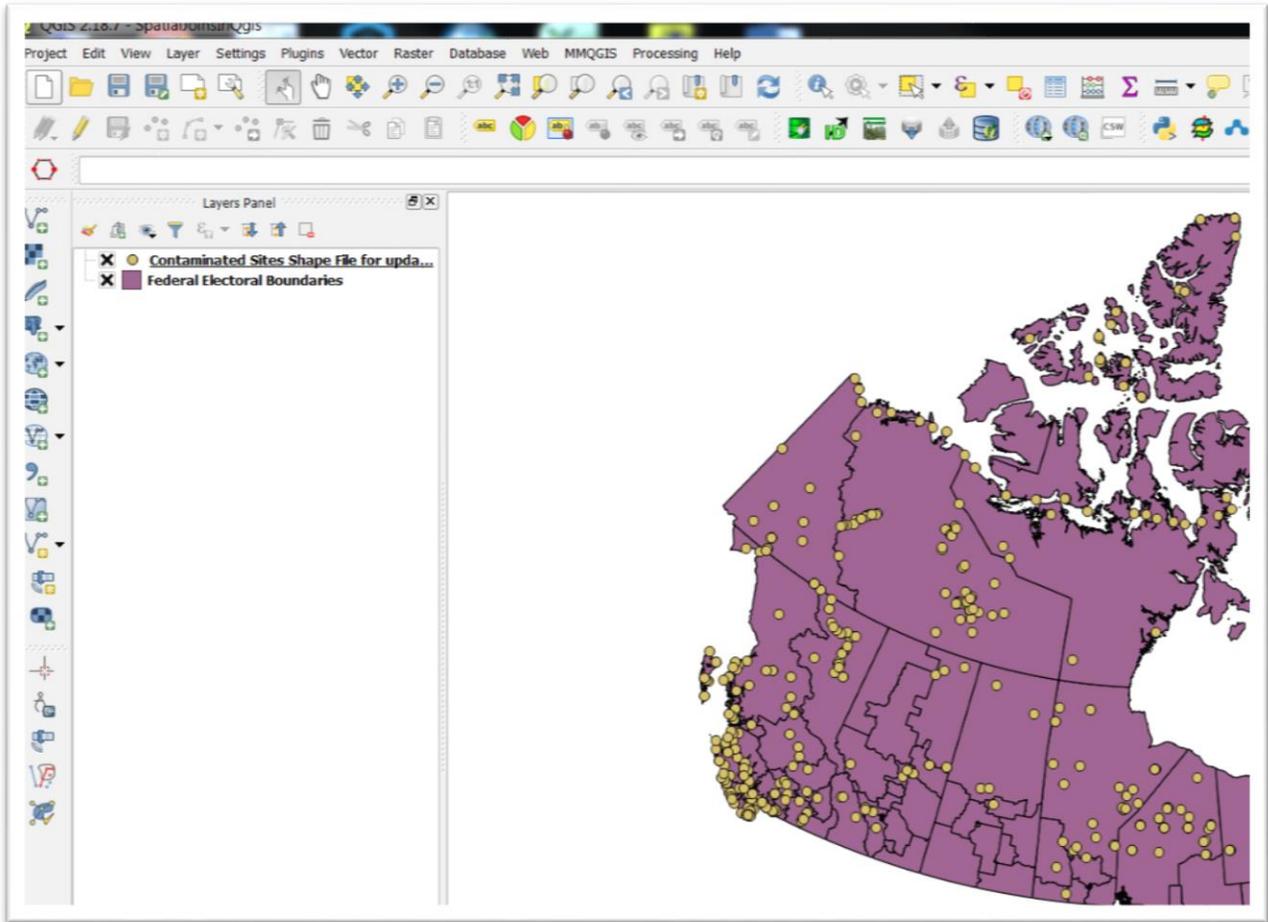
Once you've selected the CRS that corresponds to your federal ridings file, name the file, browse to the location on your hard drive and select OK.





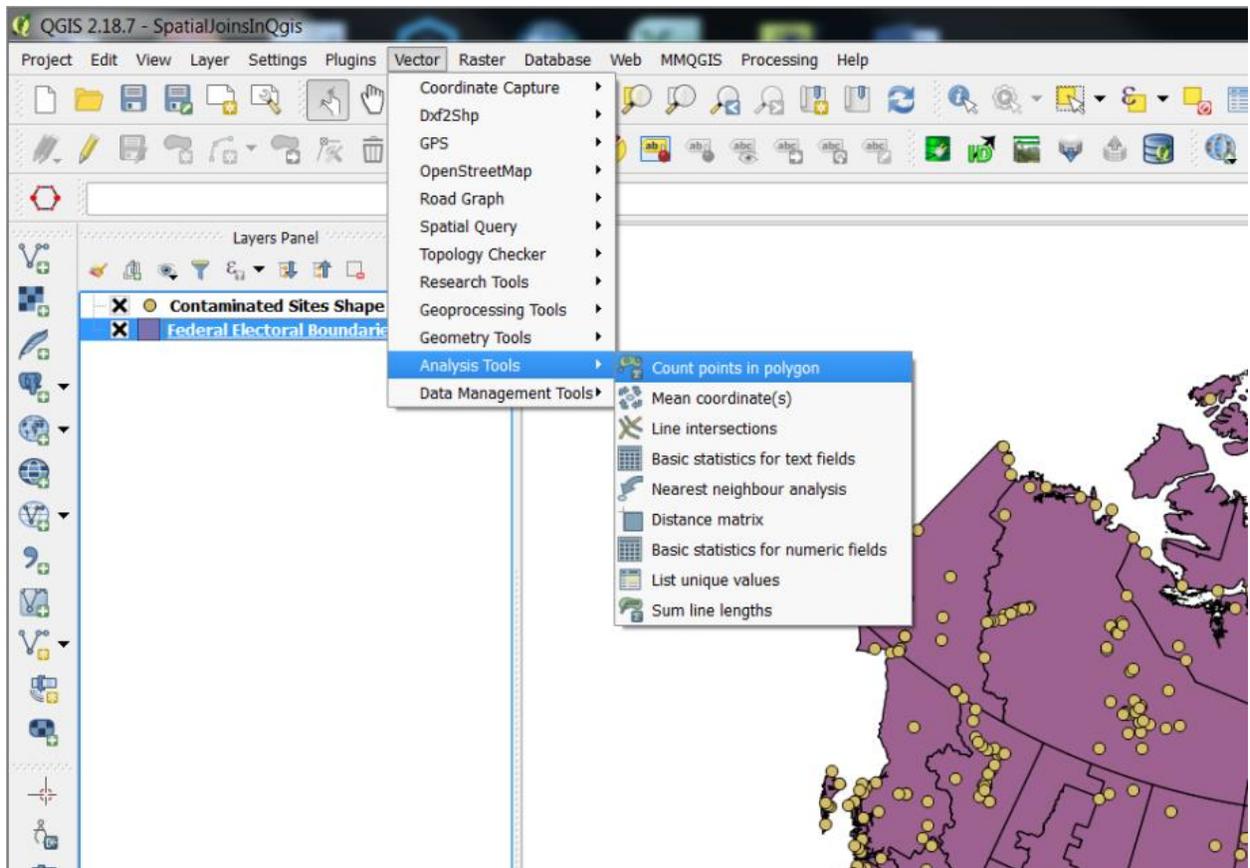
Qgis has added the new layer, which is why the locations are now a different colour. We no longer need the original csv file, and can right click to select the “Remove” option.

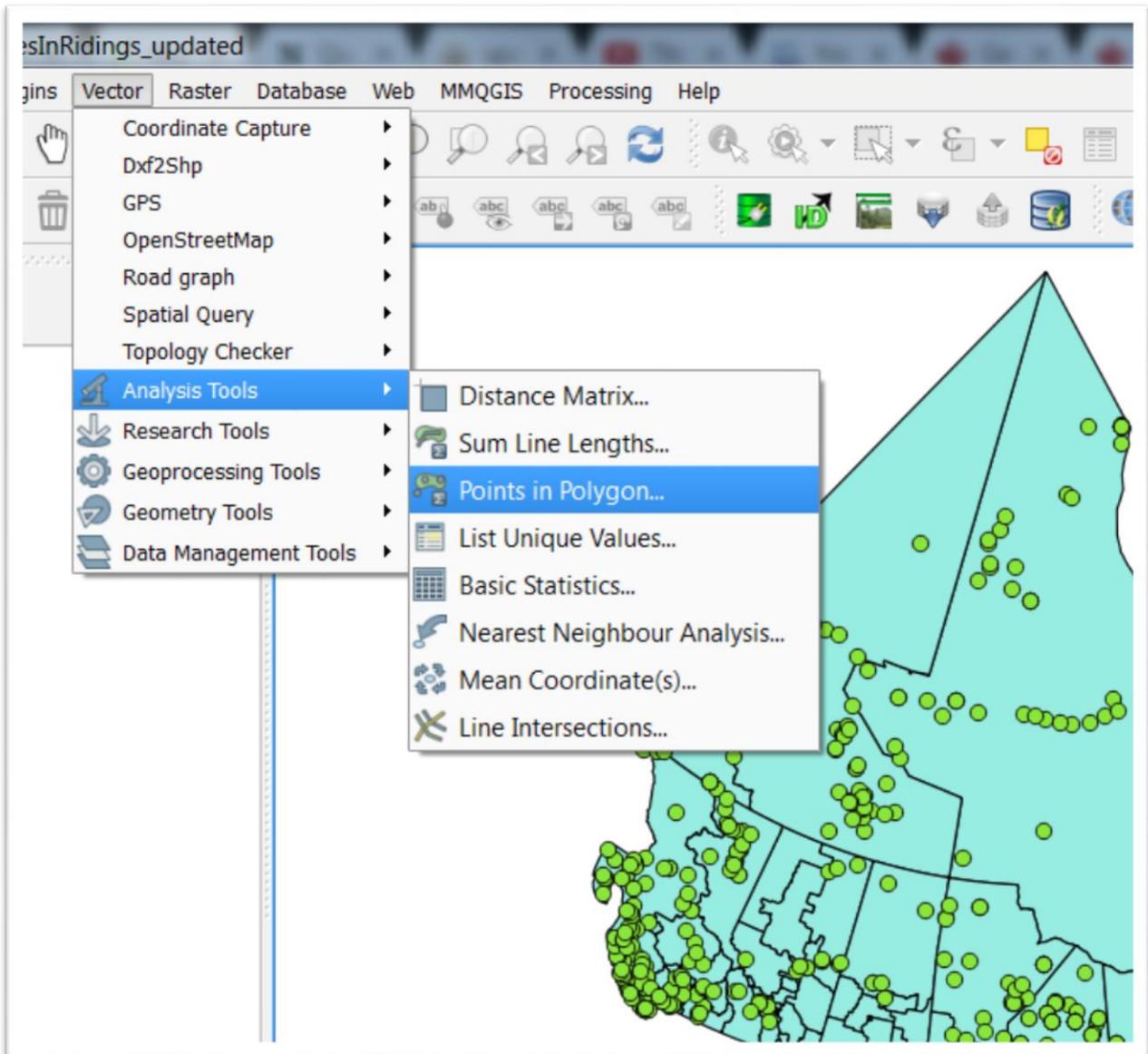




Task 5: How to complete a spatial join in Qgis and save the new layer.

Now we'd like to count the number of contaminated sites in the ridings. To perform this task, we must join the two layers, and then count the number of sites in each riding or polygons. Make sure the federal ridings layer is highlighted, and select "Vector" and "Count points in polygon."

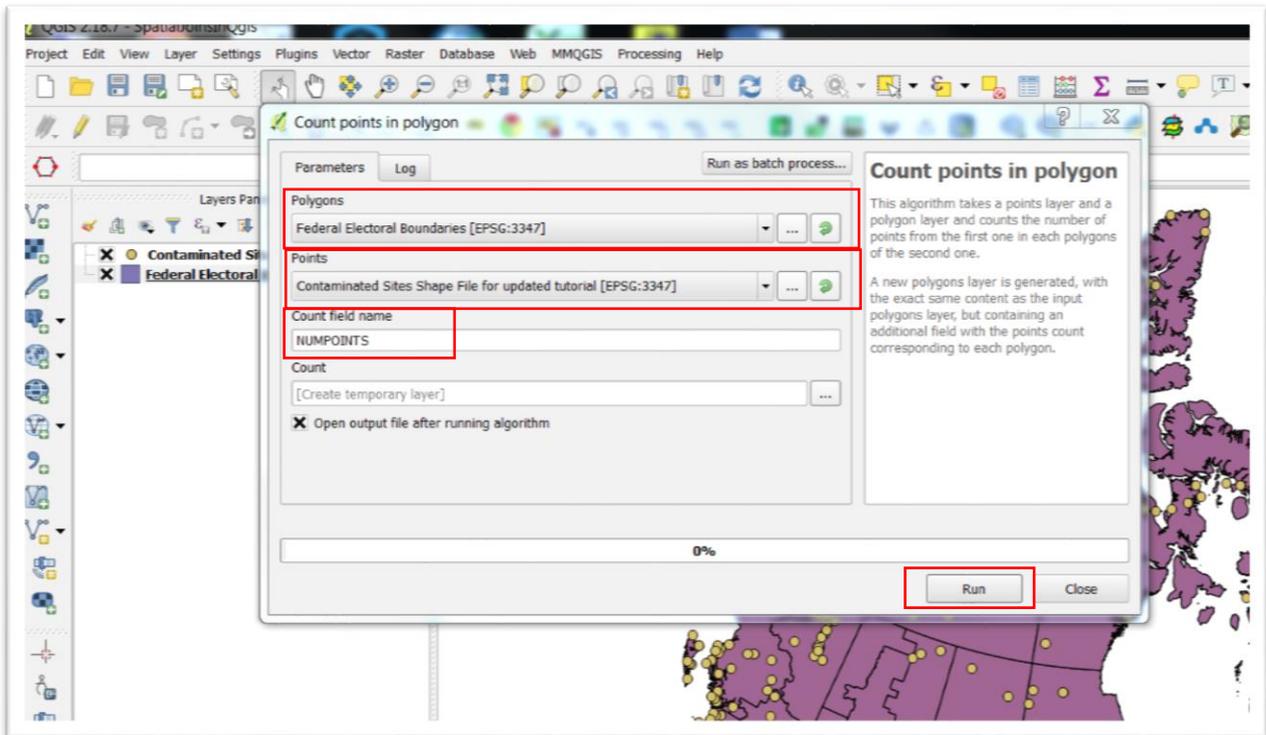




The “Input polygon vector layer” is the one we’ve selected from the menu, Electoral Boundaries. The “Input point vector layer” is “Contaminated Sites”.

Qgis uses a default “PNTCNT” (short for point count) for the name of the new field that will be created with the contaminated site counts in each riding. You can

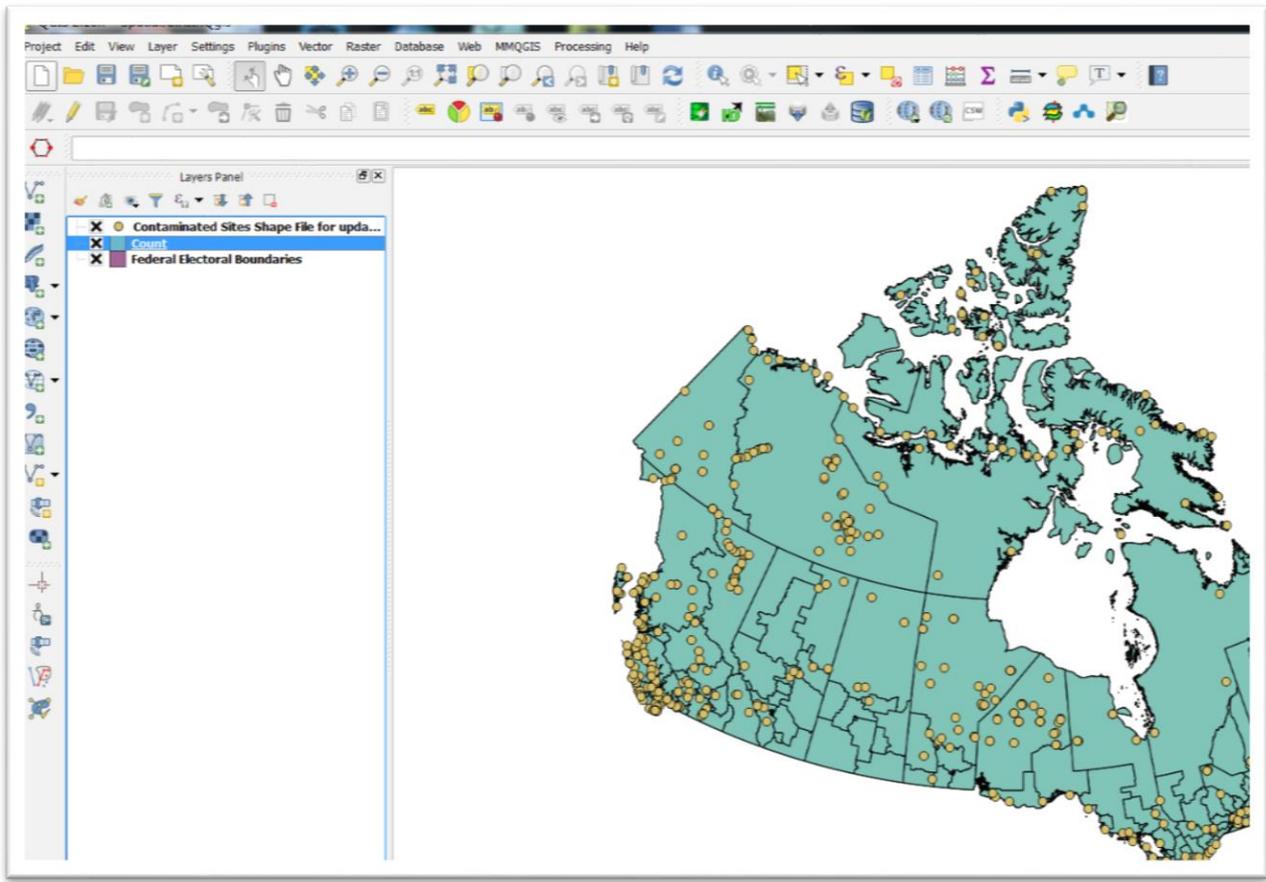
give it another name such as “Count”.



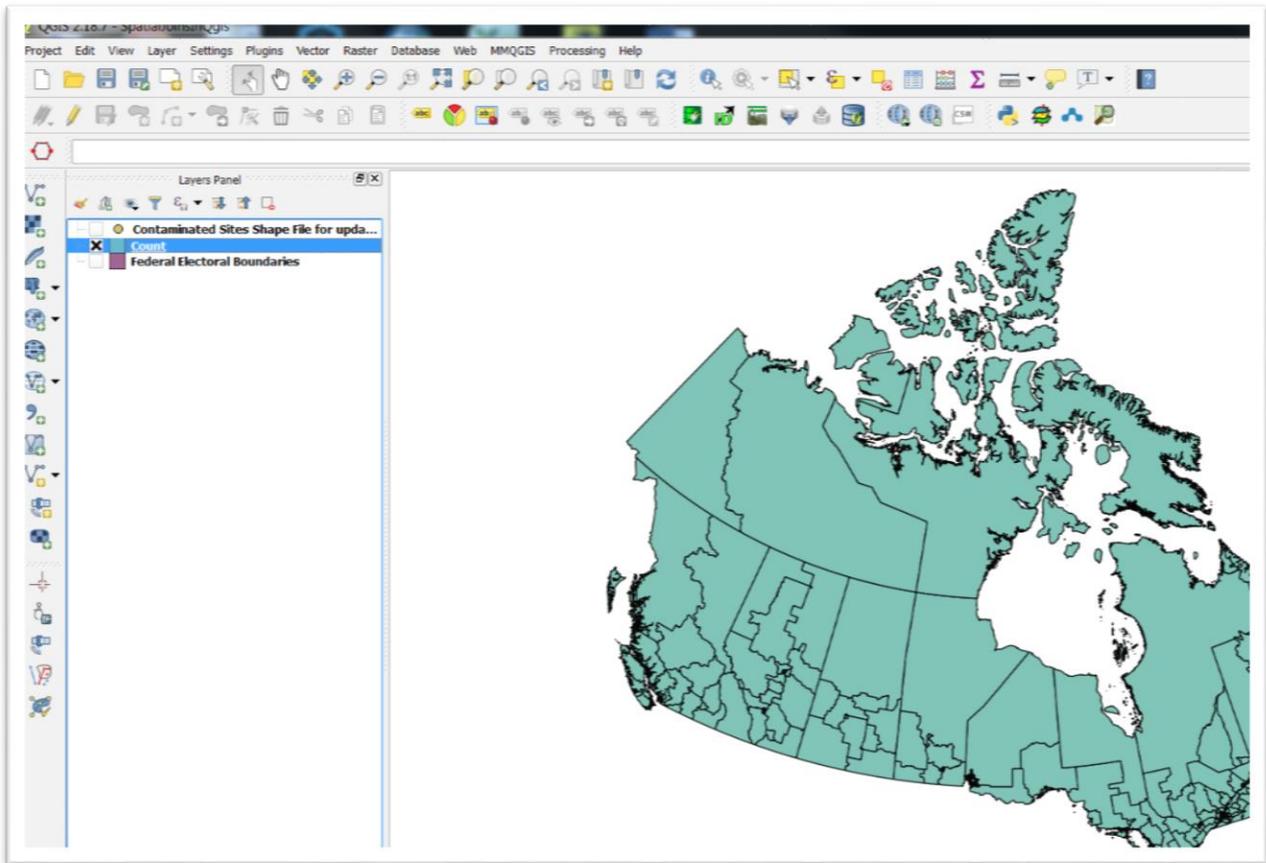
You’ll notice that the coordinate systems for the two layers are identical. If they are not, then it probably means that you neglected to select the proper CRS when creating a new layer for the contaminated sites points file.

This process counts the number of contaminated sites in each federal riding. Qgis has given the new field that will contain those values the generic name of NUMPOINTS, which you’re free to change. Qgis will also create a temporary layer that we will have to save as a new shape file.

Let’s run what we have.



Qgis has produced a temporary layer called "Count". De-select the other two.



You might be tempted to conclude that nothing has happened. Let's look at the layer's attribute table to see what's going on.

Count : Features total: 338, filtered: 338, selected: 0

	FEDUID	FEDNAME	FEDENAME	FEDNAME	PRUID	PRNAME	NUMPOINTS
1	24054	Outremont	Outremont	Outremont	24	Quebec / Qu...	0
2	24055	Papineau	Papineau	Papineau	24	Quebec / Qu...	0
3	24056	Pierrefonds--...	Pierrefonds--...	Pierrefonds--...	24	Quebec / Qu...	0
4	24057	Pontiac	Pontiac	Pontiac	24	Quebec / Qu...	0
5	24058	Portneuf-Jacq...	Portneuf-Jacq...	Portneuf-Jacq...	24	Quebec / Qu...	8
6	24059	Qu \heartsuit bec	Qu \heartsuit bec	Qu \heartsuit bec	24	Quebec / Qu...	0
7	24060	Repentigny	Repentigny	Repentigny	24	Quebec / Qu...	0
8	24061	Richmond--Ar...	Richmond--Ar...	Richmond--Ar...	24	Quebec / Qu...	0
9	24062	Rivi \heartsuit re-des-...	Rivi \heartsuit re-des-...	Rivi \heartsuit re-des-...	24	Quebec / Qu...	0
10	24037	LaSalle-- \heartsuit m...	LaSalle-- \heartsuit m...	LaSalle-- \heartsuit m...	24	Quebec / Qu...	0
11	24038	Laurentides-...	Laurentides-...	Laurentides-...	24	Quebec / Qu...	0
12	24039	Laurier--Saint...	Laurier--Saint...	Laurier--Saint...	24	Quebec / Qu...	0
13	24040	Laval--Les \heartsuit les	Laval--Les \heartsuit les	Laval--Les \heartsuit les	24	Quebec / Qu...	0
14	24041	Longueuil--Ch...	Longueuil--Ch...	Longueuil--Ch...	24	Quebec / Qu...	0
15	24042	L \heartsuit vis--Lotbini...	L \heartsuit vis--Lotbini...	L \heartsuit vis--Lotbini...	24	Quebec / Qu...	0
16	24043	Longueuil--Sa...	Longueuil--Sa...	Longueuil--Sa...	24	Quebec / Qu...	0

You can see the new field to the far right.

Sort the values in descending order by double-clicking on the title NUMPOINTS.

	FEDUID	FEDNAME	FEDENAME	FEDFNAME	PRUID	PRNAME	NUMPOINTS
1	61001	Northwest Ter...	Northwest Ter...	Territoires du ...	61	Northwest Ter...	62
2	62001	Nunavut	Nunavut	Nunavut	62	Nunavut	58
3	35042	Kenora	Kenora	Kenora	35	Ontario	42
4	59028	Skeena--Bulkl...	Skeena--Bulkl...	Skeena--Bulkl...	59	British Colum...	38
5	46003	Churchill--Kee...	Churchill--Kee...	Churchill--Kee...	46	Manitoba	32
6	59024	Prince George...	Prince George...	Prince George...	59	British Colum...	27
7	60001	Yukon	Yukon	Yukon	60	Yukon	24
8	59037	North Island--...	North Island--...	North Island--...	59	British Colum...	22
9	12010	Sydney--Victo...	Sydney--Victo...	Sydney--Victo...	12	Nova Scotia / ...	15
10	59017	Mission--Mats...	Mission--Mats...	Mission--Mats...	59	British Colum...	14
11	12004	Dartmouth--C...	Dartmouth--C...	Dartmouth--C...	12	Nova Scotia / ...	12
12	59026	Esquimalt--Sa...	Esquimalt--Sa...	Esquimalt--Sa...	59	British Colum...	12
13	10002	Bonavista--Bu...	Bonavista--Bu...	Bonavista--Bu...	10	Newfoundland...	10
14	59009	Courtenay--Al...	Courtenay--Al...	Courtenay--Al...	59	British Colum...	10
15	10004	Labrador	Labrador	Labrador	10	Newfoundland...	9
16	35107	Timmins--Jam...	Timmins--Jam...	Timmins--Ba...	35	Ontario	9
17	24058	Portneuf--Jacq...	Portneuf--Jacq...	Portneuf--Jacq...	24	Quebec / Qu...	8
18	12001	Cape Breton--...	Cape Breton--...	Cape Breton--...	12	Nova Scotia / ...	8
19	35006	Bay of Quinte ...	Bay of Quinte	Baie de Quinte	35	Ontario	8
20	10002	Coast of Bays	Coast of Bays	Coast of Bays	10	Newfoundland	7

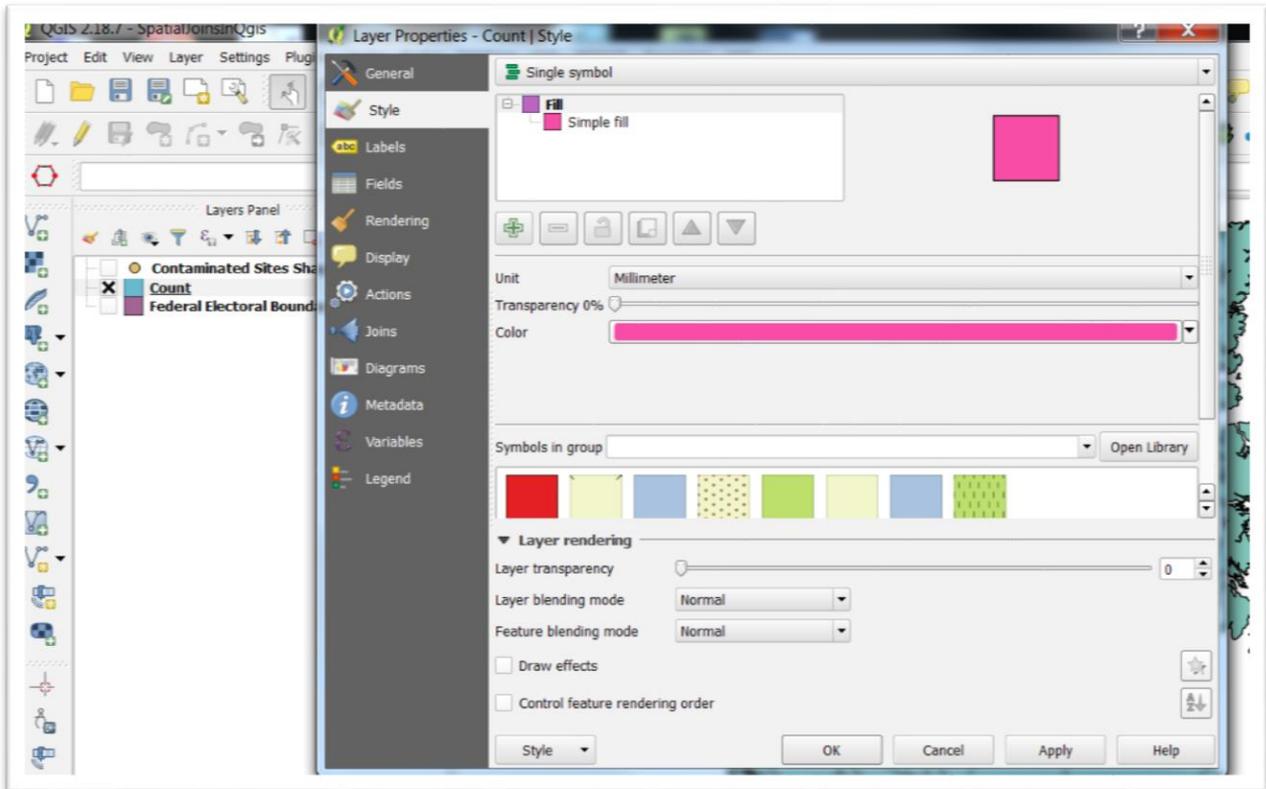
Adjust the column widths to make it easier to see when ridings have the highest number of sites.

	FEDUID	FEDNAME	FEDENAME	FEDFNAME	PRUID	PRNAME	NUMPOINTS
1	61001	Northwest Territories / Territoires du Nord-Ouest	Northwest Territories	Territoir...	61	Northwest Territories / Territoires du Nord-Ouest	62
2	62001	Nunavut	Nunavut	Nunavut	62	Nunavut	58
3	35042	Kenora	Kenora	Kenora	35	Ontario	42
4	59028	Skeena--Bulkley Valley	Skeena--Bulkley Valley	Skeena...	59	British Columbia / Colombie-Britannique	38
5	46003	Churchill--Keewatnook Aski	Churchill--Keewatnook Aski	Churchill...	46	Manitoba	32
6	59024	Prince George--Peace River--Northern Rockies	Prince George--Peace River--Northern Ro...	Prince G...	59	British Columbia / Colombie-Britannique	27
7	60001	Yukon	Yukon	Yukon	60	Yukon	24
8	59037	North Island--Powell River	North Island--Powell River	North Is...	59	British Columbia / Colombie-Britannique	22
9	12010	Sydney--Victoria	Sydney--Victoria	Sydney...	12	Nova Scotia / Nouvelle-Écosse	15
10	59017	Mission--Matsqui--Fraser Canyon	Mission--Matsqui--Fraser Canyon	Mission...	59	British Columbia / Colombie-Britannique	14
11	12004	Dartmouth--Cole Harbour	Dartmouth--Cole Harbour	Dartmo...	12	Nova Scotia / Nouvelle-Écosse	12
12	59026	Esquimalt--Saanich--Sooke	Esquimalt--Saanich--Sooke	Esquim...	59	British Columbia / Colombie-Britannique	12
13	10002	Bonavista--Burin--Trinity	Bonavista--Burin--Trinity	Bonavist...	10	Newfoundland and Labrador / Terre-Neuve-et-Labrador	10
14	59009	Courtenay--Alberni	Courtenay--Alberni	Courten...	59	British Columbia / Colombie-Britannique	10

The Northwest Territories has the highest number.

As we did during the tutorial on mapping census data, we must assign different colours to these values.

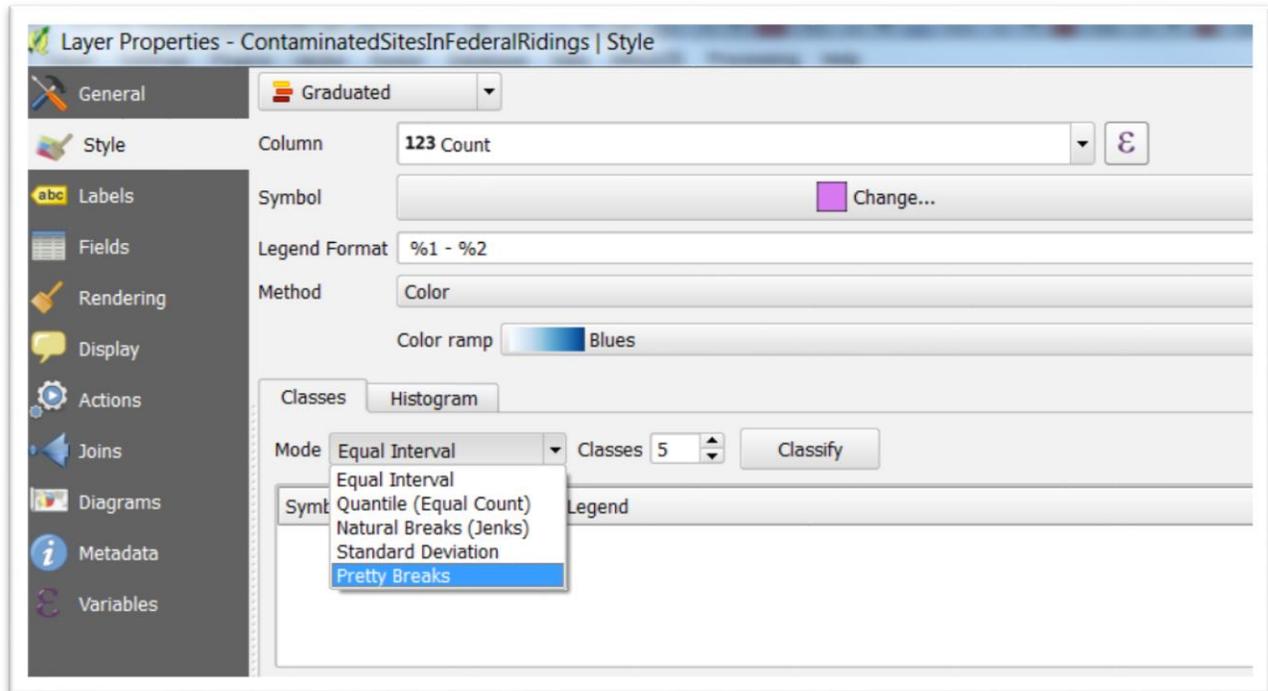
Right click on the layer to get the “Properties” option, and go to the “Style” section.



Select the arrow to the right of “Single Symbol”, and chose the “Graduated” option from the drop-down menu.

Then select the “Count” field from the drop-down menu that you can obtain by clicking on the downward arrow to the right of the space next to “Column.”

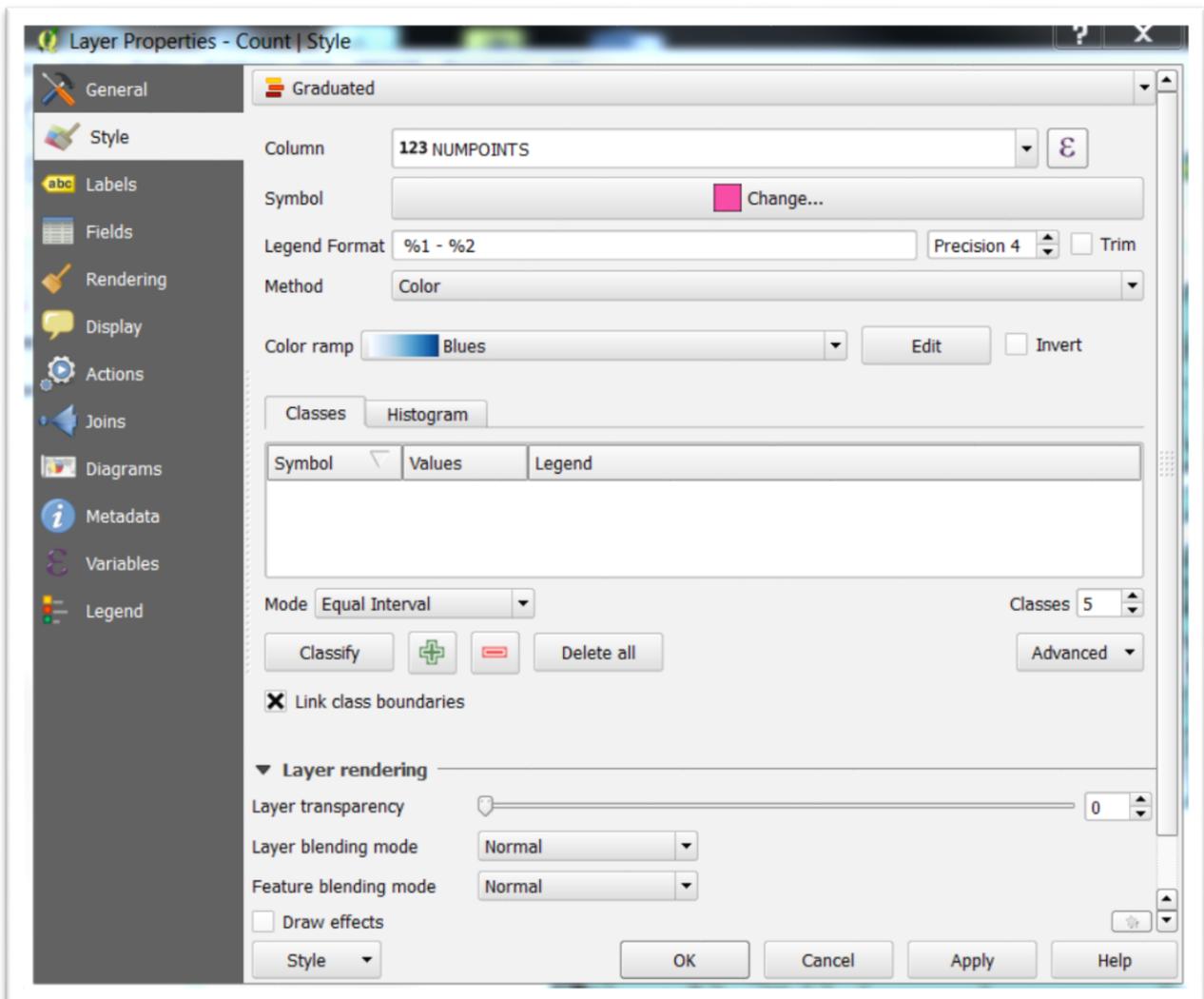
By default, Qgis divides up the class in five equal intervals. This might not make sense, depending on your dataset. You may want more or fewer categories.



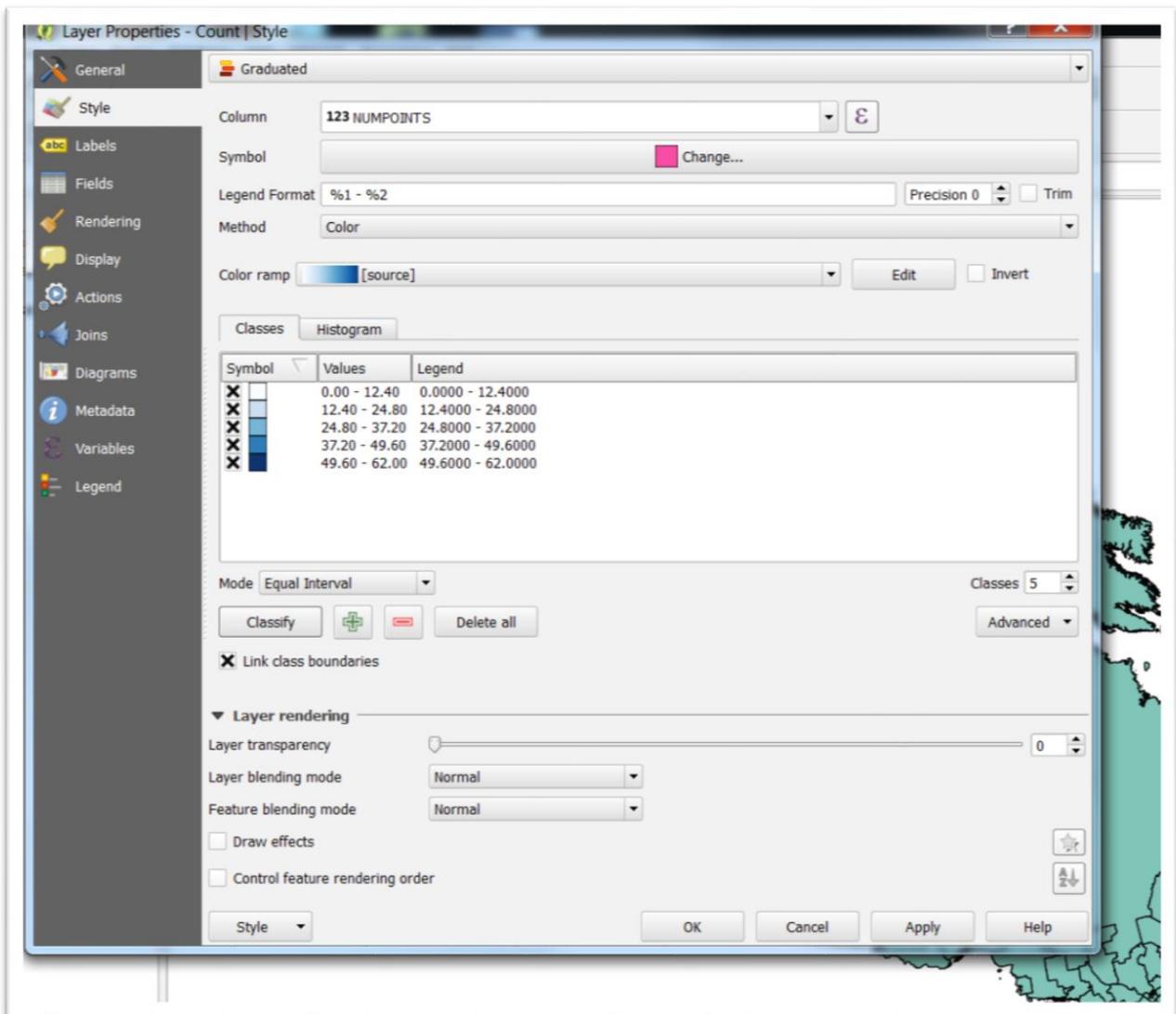
You'll find more options from the drop-down menu to the right of "Mode."

For the sake of this exercise, let's stick with the default number, as well as the default colour, blues. Different colour ramps are available on the "Color ramp"

menu that can be obtained by clicking the arrow to the right.

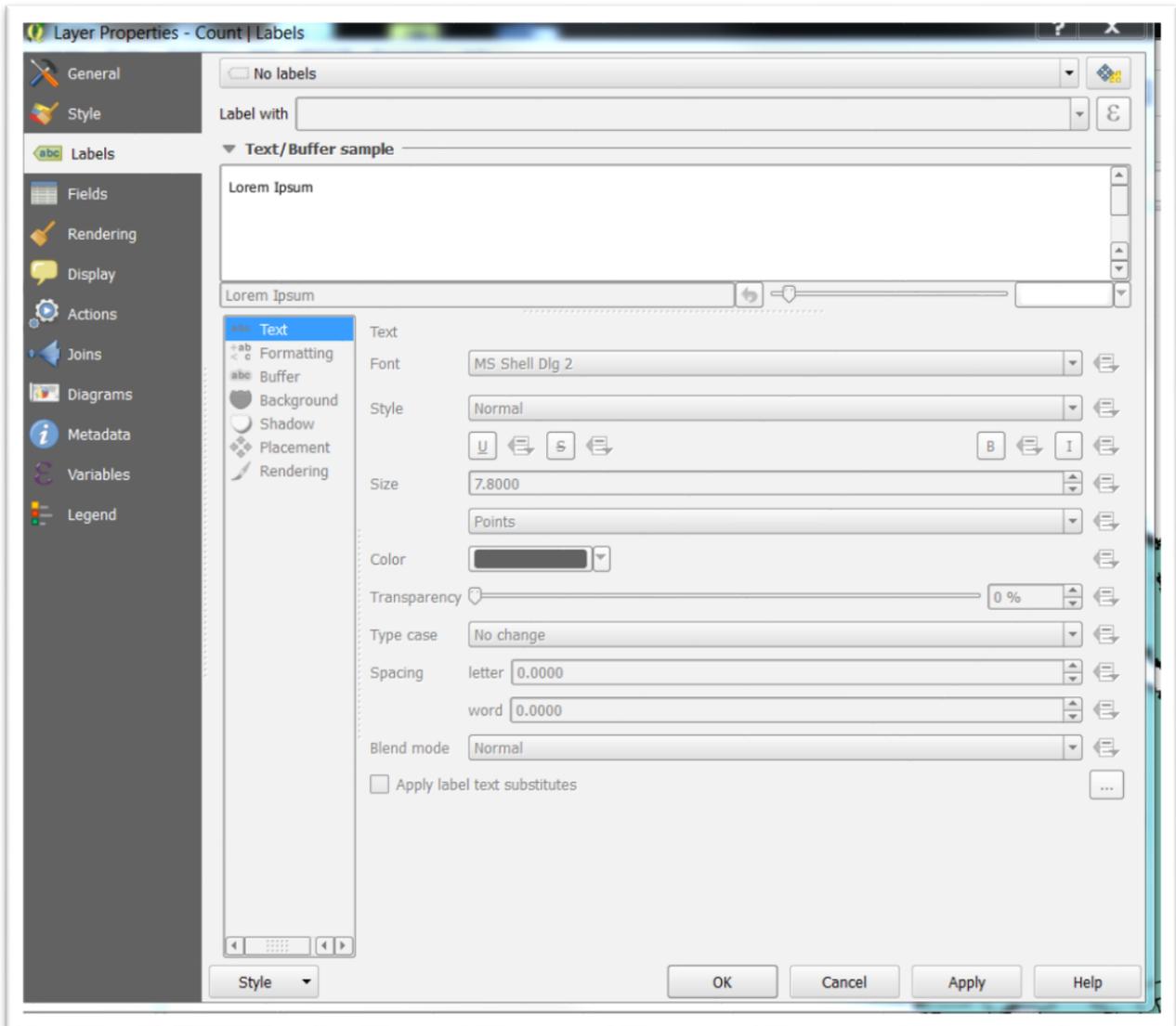


To add the “classes”, select the “Classify” tab.

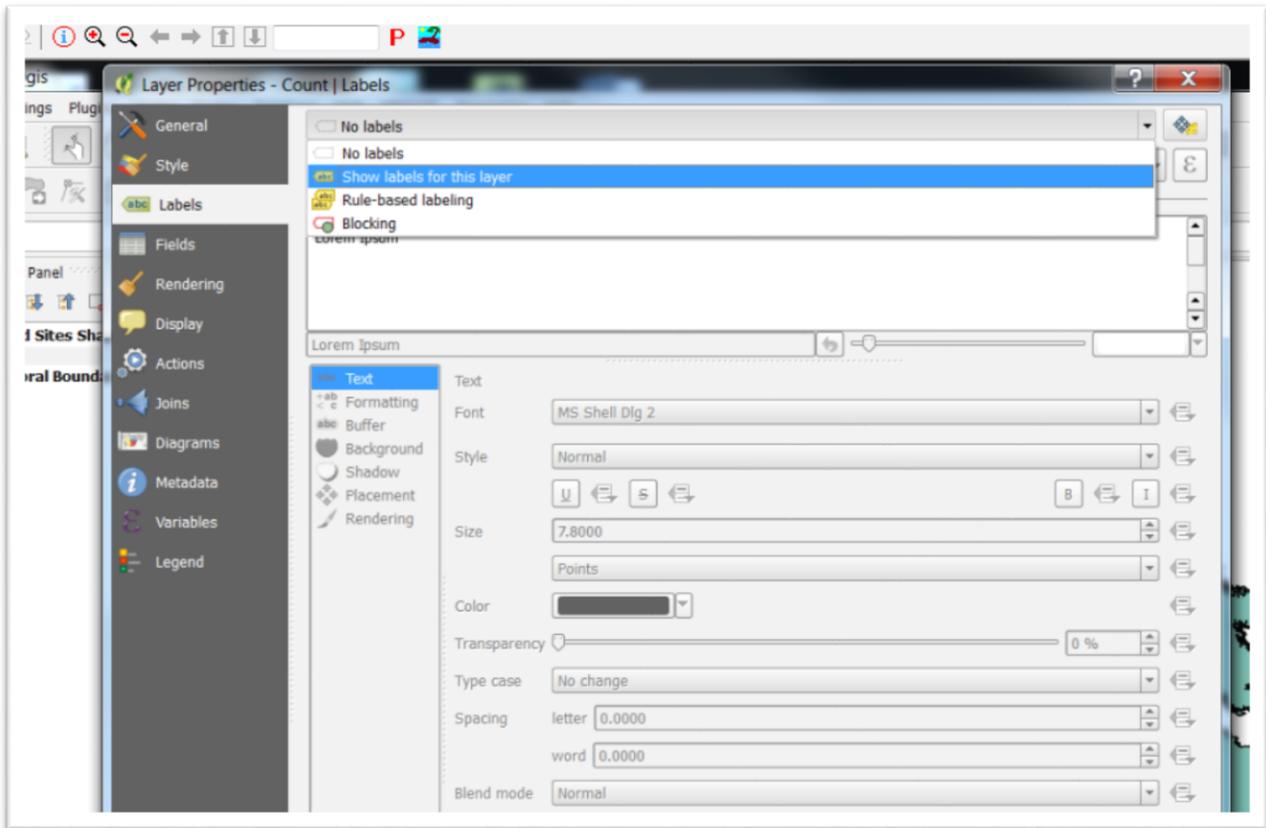


Before we apply the result, we may want to label the ridings to give folks a sense of place.

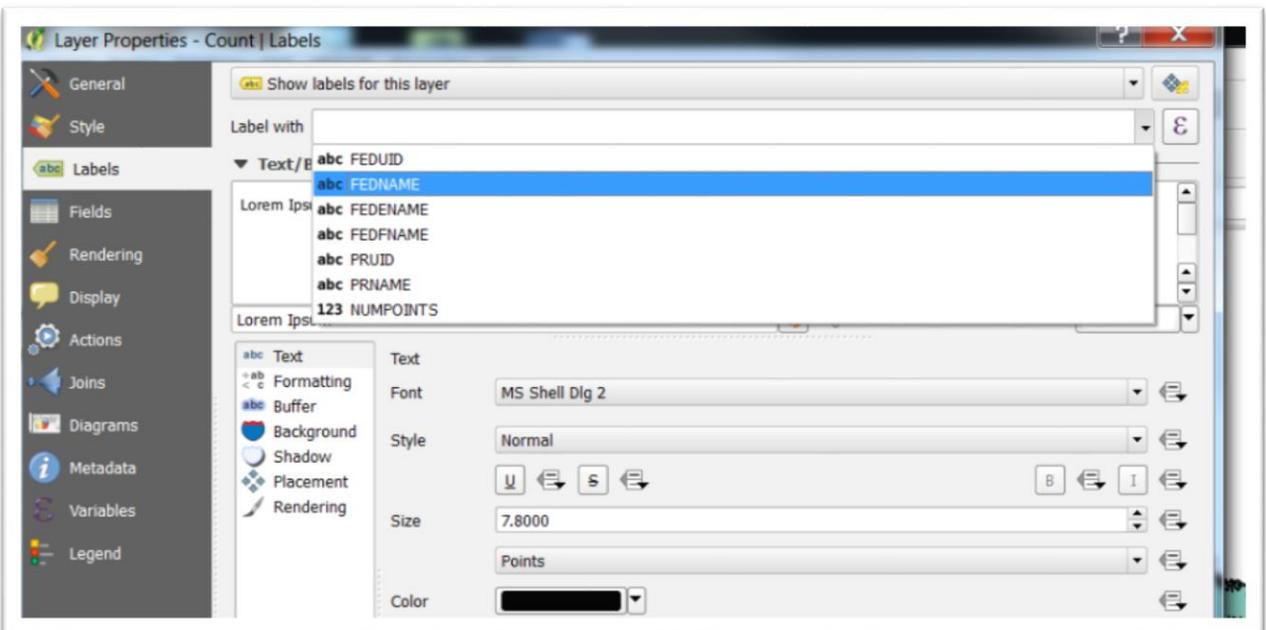
Select the “Labels” option from the menu on the left.



Select the First option from the drop-down menu.



And then the column name from the “Label with” drop-down menu.

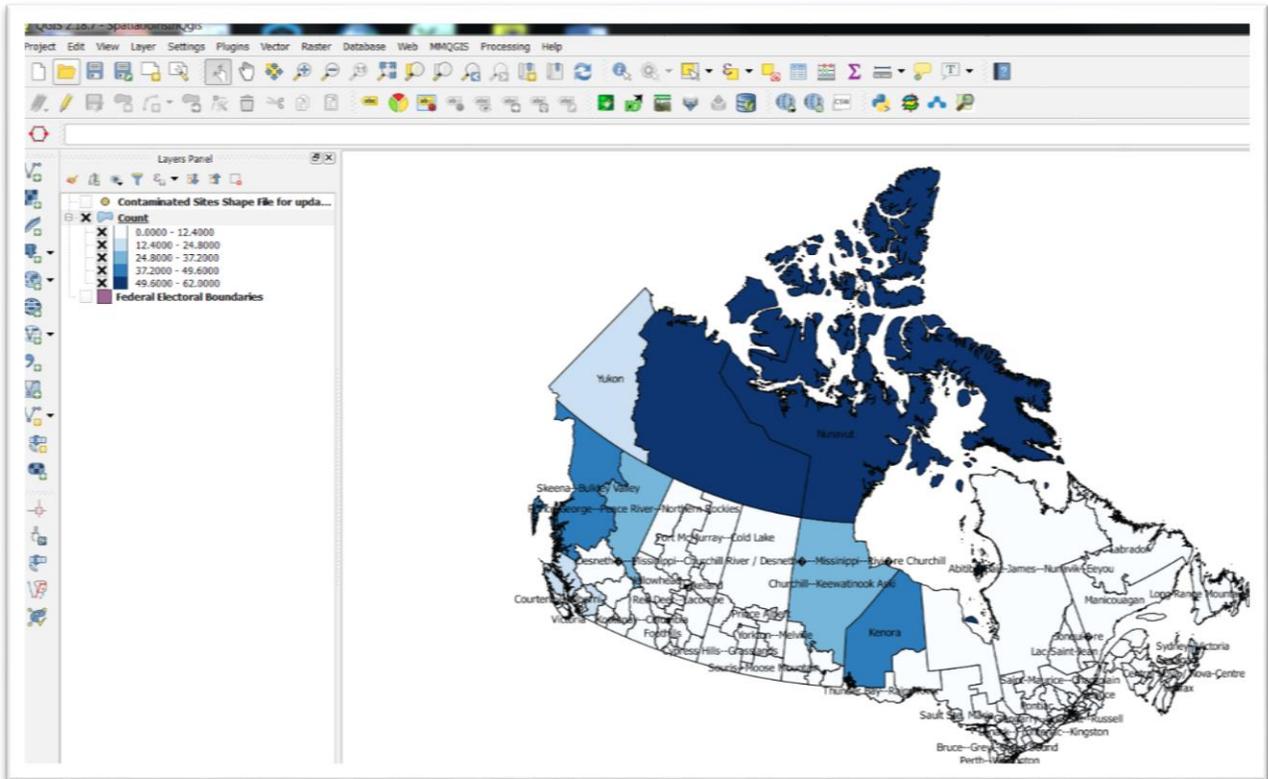


You can also select options such as different colours and point sizes.

Select “Apply” and then “OK.”

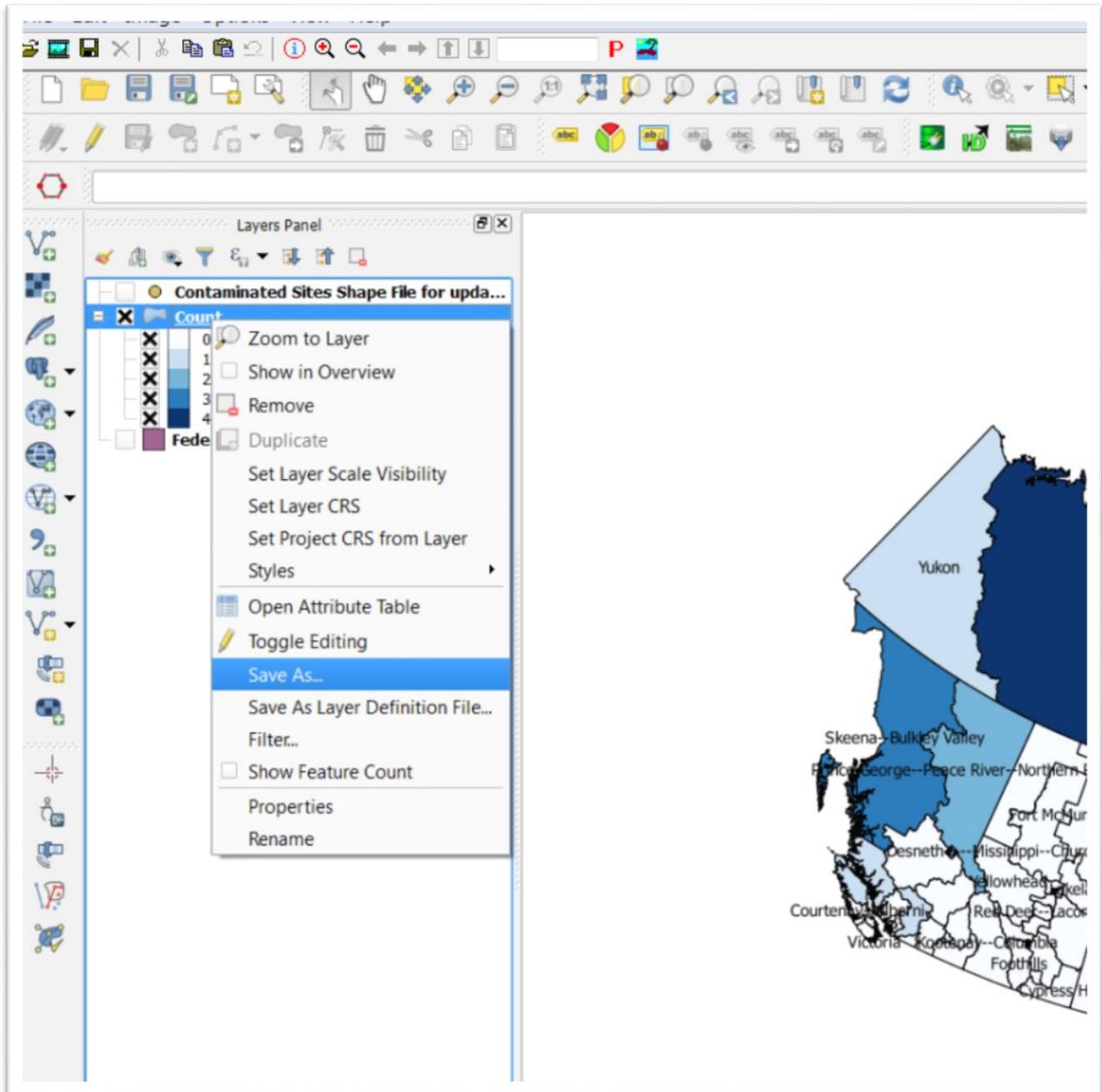
Qgis has created a legend to correspond with the colours on the map.

You can get rid of decimals by returning to style section of “Properties”, and double-clicking on each class.



As we did with the census data, we can return to properties and reassign different counts to the classes, or even add more classes.

If you're happy with what you've created for the temporary file, be sure to save it as a new file that won't disappear when you close this project.



Save vector layer as...

Format: ESRI Shapefile

File name: ISDesktop/Contaminated Sites in Ridings for updated tutorial.shp Browse

Layer name:

CRS: Selected CRS (EPSG:3347, NAD83 / Statistics Canada Lambert)

Encoding: UTF-8

Save only selected features

Select fields to export and their export options

Name	Type
<input checked="" type="checkbox"/> FEDUID	string
<input checked="" type="checkbox"/> FEDNAME	string
<input checked="" type="checkbox"/> FEDENAME	string
<input checked="" type="checkbox"/> FEDFNAME	string
<input checked="" type="checkbox"/> PRUID	string
<input checked="" type="checkbox"/> PRNAME	string

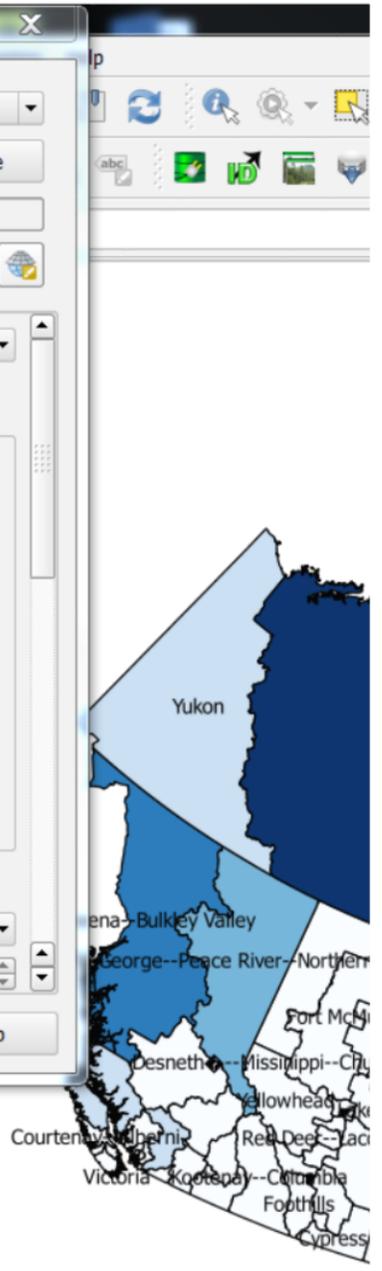
Select All Deselect All

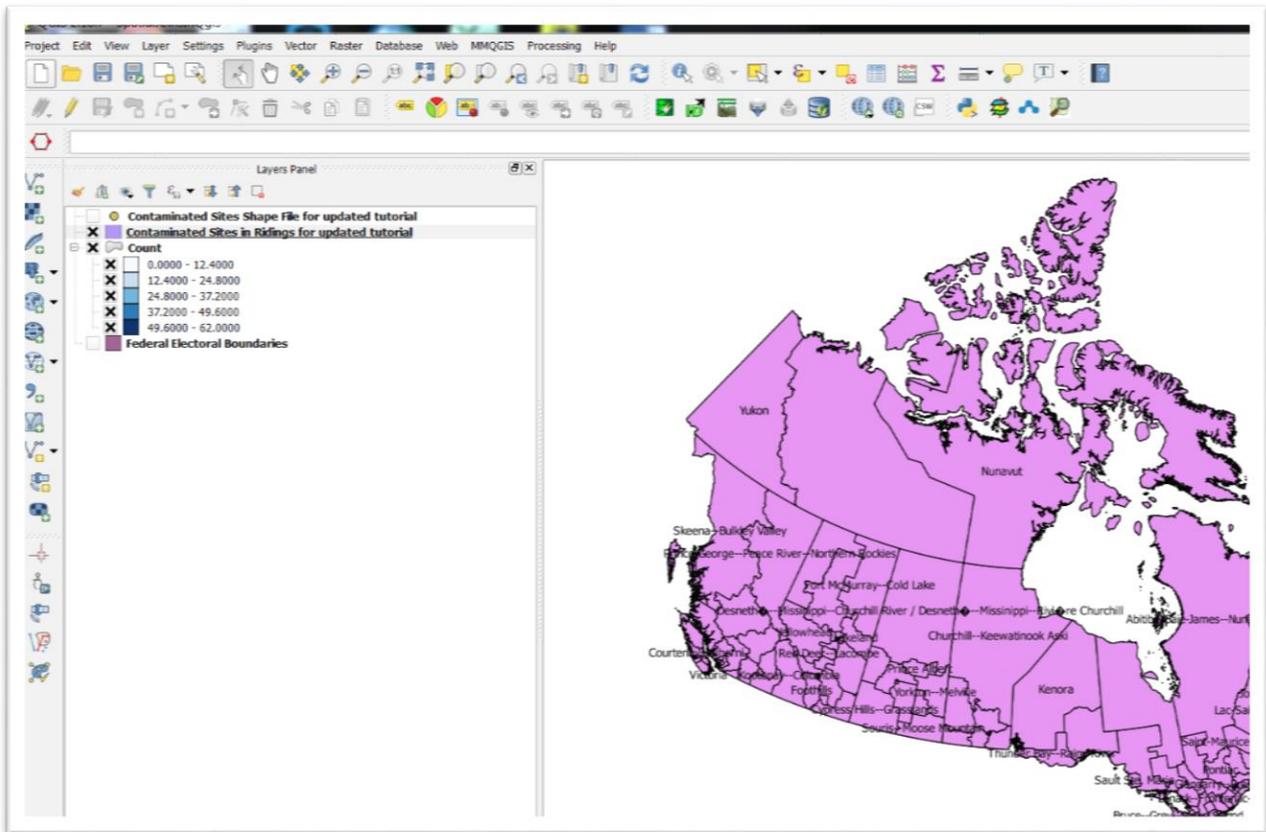
Add saved file to map

Symbology export: No symbology

Scale: 1:50000

OK Cancel Help

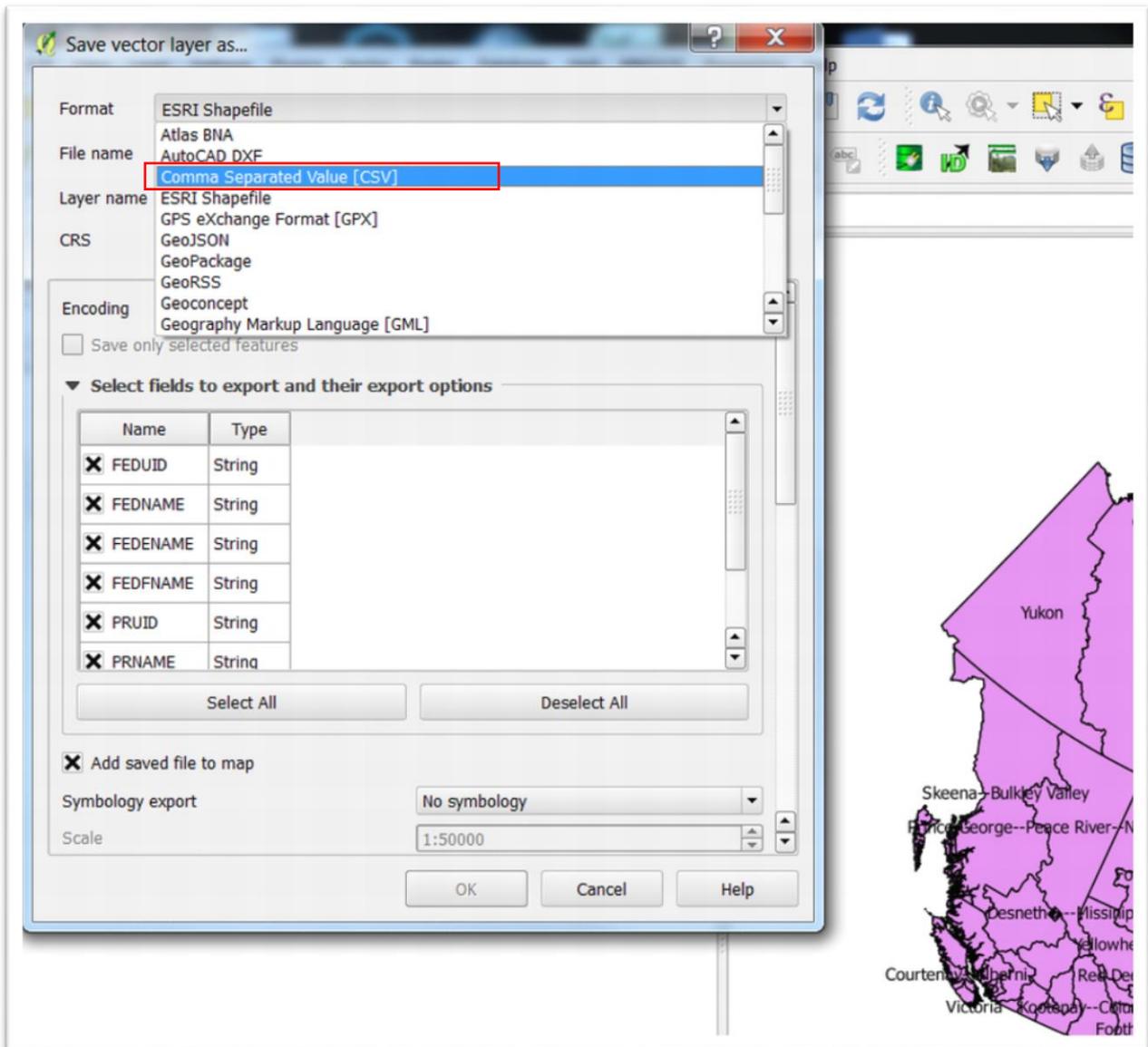




Qgis has created a brand new layer, which you will have to symbolize once more using the same classification as before.

Now we can export this layer as a shape file, which can be zipped and uploaded to ArcGIS Online, for now, a more user-friendly alternative than Qgis' cloud option. Or you can export it as a KML file and upload it to Fusion Tables, where you'll have to symbolize it again.

Or if you're only interested in the analysis, you can save the layer as a csv file by right-clicking on the layer, and saving it as a csv file.



So, Qgis has allowed us to do a sophisticated piece of analysis using a spatial join, and then permitted us to see the results. As we have pointed out many times, this just scratches the surface, but represents one of the key ways that journalists use mapping to tell stories about contaminated sites in federal ridings, the number of infrastructure projects in federal ridings, break-and-enters within certain police districts, the outbreak of a certain illness or disease in parts of the country, or the locations of some of the heaviest industrial polluters.

