Community Health Maps

Information on Low Cost Mapping Tools for Community-based Organizations

Community Health Maps Lab Series:

Lab 3—Combining Field Data With Other Organizational Data

Objective: Understand How To Incorporate Other Organizational Data Into QGIS

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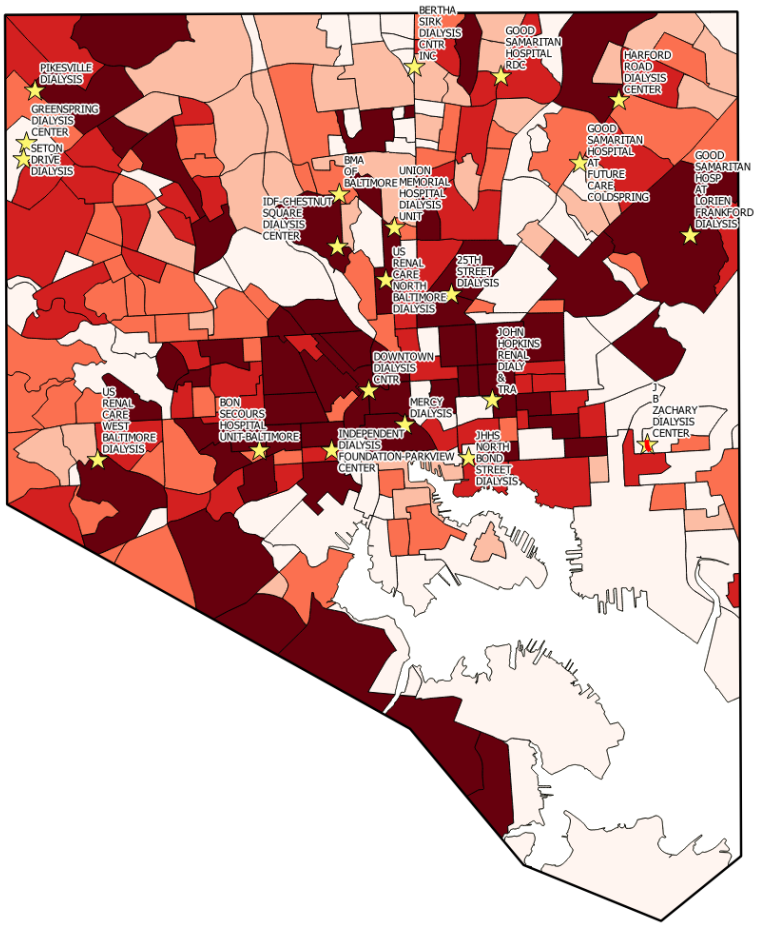

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1. Introduction

Now that you have been introduced to QGIS, you will learn some important fundamentals of working with spatial data in QGIS. First, you will work with projections and coordinate systems. You will then learn some important data management and community mapping skills.

2. Objective: Understand How To Incorporate Other Organizational Data Into QGIS

In this lab exercise, you will explore how to integrate data collected in the field with other organizational datasets. You will first learn how to work with projections and coordinate systems in QGIS Desktop. You will then learn how to conduct a join and how to geocode some address-based data. The data for this lab covers Baltimore City and focuses on diabetes.

- Task 1 – Work With Projections and Coordinate Systems
- Task 2 – Join Tabular Data to an Attribute Table
- Task 3 – Geocode Address-Based Data

3. How Best To Use Video Walkthrough With This Lab

To aid in your completion of this lab, each lab task has an associated video that demonstrates how to complete the task. The intent of these videos is to help you move forward if you become stuck on a step in a task, or if you wish to see every step required to complete the tasks.

We recommend that you do not watch the videos before you attempt the tasks. The reasoning for this is that while you are learning the software and searching for buttons, menus, and other features, you will better remember where these items are and, perhaps, discover other features along the way if you discover them on your own. With that being said, please use the videos in the way that will best facilitate your learning and successful completion of this lab.

4. Lab Tasks

Task 1. Work With Projections and Coordinate Systems

Watch a Task 1 Video Walkthrough on YouTube.

In this task, you will begin with an existing QGIS map document that contains data for Baltimore City. You will learn how to determine the coordinate reference system (CRS) for both the individual GIS layers and the overall map. The CRS has several components:

- Projection/Coordinate System
- Datum (includes ellipsoid/spheroid model)
- Coordinate units

Coordinate reference systems (CRS) provide the spatial framework for defining real-world locations. Data are represented using either a geographic coordinate system (GCS) or a projected coordinate system. GCS locations are defined in terms of the position on a globe using latitude and longitude values. GCS is an elliptical coordinate system. Latitude measures the north-south position on the earth's surface. Longitude measures the position east west. The units of GCS are degrees, minutes, and seconds.

The earth is not a perfect sphere and in fact has an irregular surface. Because of this fact, we use a number of simplified earth models (ellipsoids & spheroids) in a GIS. Each ellipsoid/spheroid model has slightly different characteristics. The most common geographic coordinate systems are:

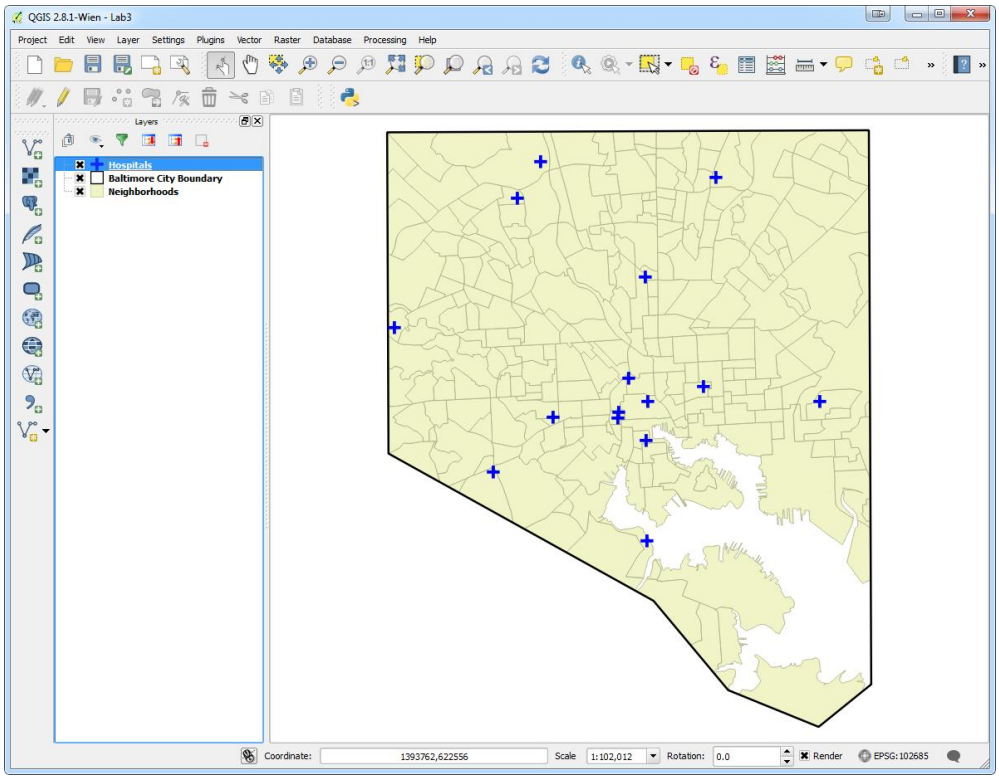
- World Geodetic System 84 (WGS84)
- North American Datum of 1983 (NAD83)
- North American Datum of 1927 (NAD27)

Projected coordinate system locations are defined using Cartesian X, Y coordinates on a flat, two-dimensional plane. These systems use feet and meters for the X and Y coordinate values, which are called eastings and northings. Projected coordinate systems employ a mathematical projection to flatten the elliptical earth onto a flat plane. The projections introduce distortion to the map. The four types of distortion are area, shape, distance, and direction. There is no map projection that will maintain all four of these characteristics. Projections are chosen based on which of the map characteristics are maintained, and the size and shape of the mapped area. Projected coordinate systems also incorporate an ellipsoid/spheroid model (for example, WGS84 or NAD83). Projected coordinate systems are often referred to as "projections." Common projected coordinate systems include:

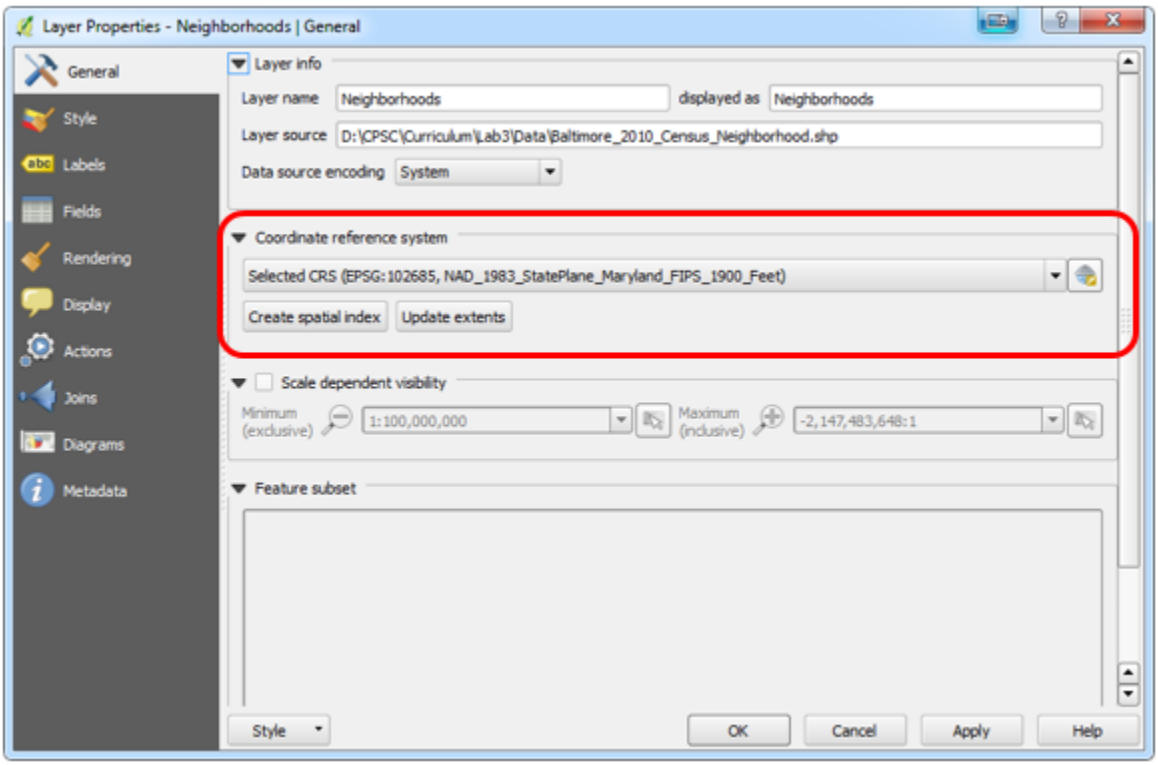
- State Plane Coordinate System
- Universal Transverse Mercator (UTM)
- Albers Equal Area

Everything in a GIS is in real-world coordinate space, either with a geographic coordinate system or a projected coordinate system. Therefore, understanding how to work with projections and coordinate systems is an important part of using a GIS.

1) Open QGIS Desktop.
2) Click on the Project menu | Open.
3) Navigate to the Lab3 folder and open the *Lab3.qgs* file.
4) A map of Baltimore City will open. It has three layers: *Hospitals*, *Baltimore City Boundary*, and *Neighborhoods*.



5) Open the **Layer Properties** for the *Neighborhoods* layer and click on the **General** tab.
6) The Coordinate Reference System section shows the selected CRS.

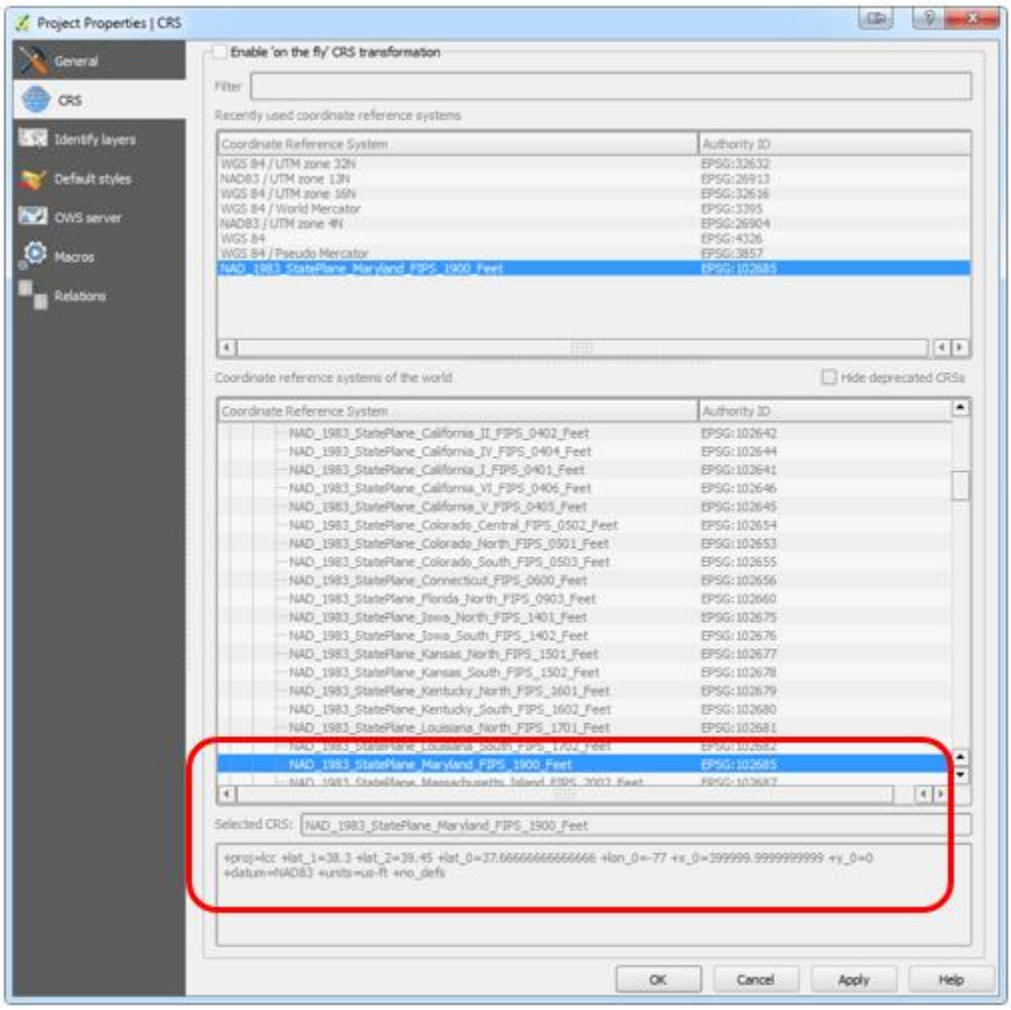


The CRS for this layer is: *EPSG: 102685, NAD_1983_StatePlane_Maryland_FIPS_1900_feet*. Going back to the components of a CRS, this can be broken down as:

- Projection/Coordinate System = State Plane Maryland Zone
- Datum (includes ellipsoid/spheroid model) = NAD83
- Coordinate units = feet

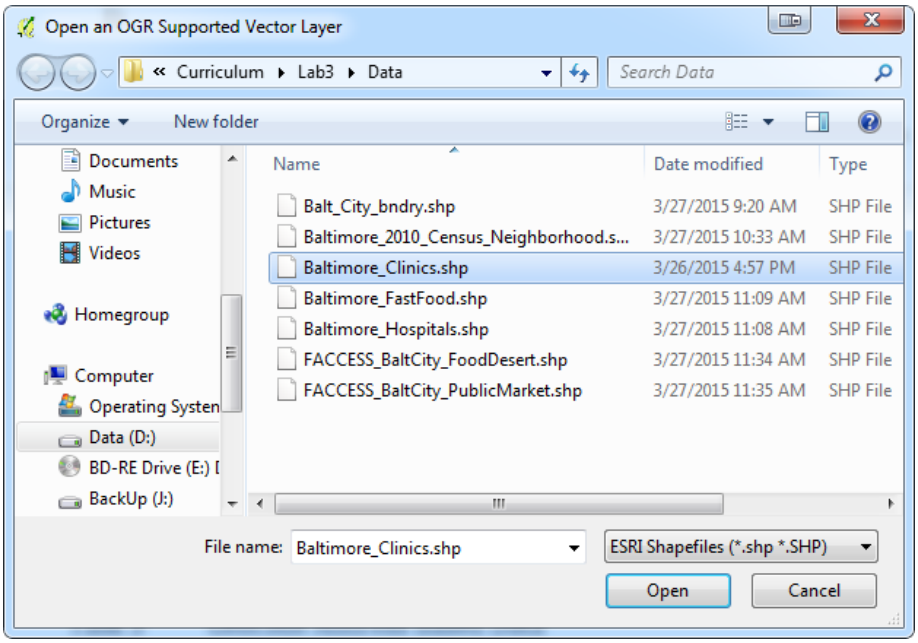
The EPSG code is a unique code for this CRS. There are EPSG codes for most CRS's. These are handy ways to search for CRS's within QGIS. Find EPSG codes in the EPSG online registry.

7) Close the **Layer Properties** window.
8) If you check the CRS of the other two layers, you will find them to be in the same CRS. So all three layers are in the same CRS.
9) Click on the **Project** menu | **Project Properties**. Open the **CRS** tab.

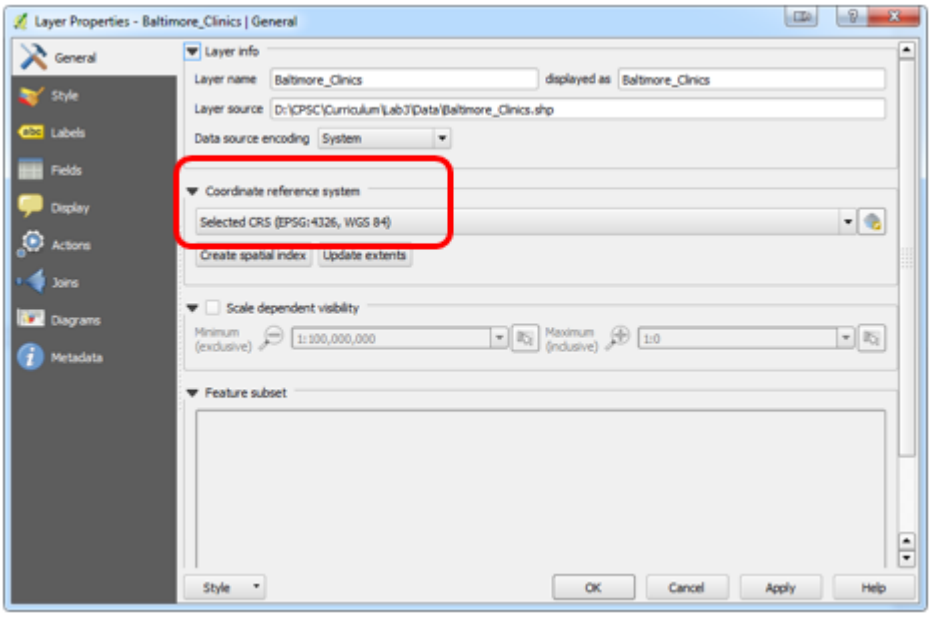


10) In QGIS, not only do the individual map layers have a CRS but the map does as well. Here you can see that the map is in the same CRS as the map layers.
11) Close the **Project Properties** window.

12) Now you will add some data mapped during a field survey. The data have already been converted to a shapefile.
13) Click the **Add Vector Layer** button and click the **Browse** button. Navigate to the Lab 3 data folder.
14) In the **Open an OGR Supported Vector Layer** window, set the file type filter to ESRI Shapefile and choose the *Baltimore_clinics.shp* file. Click **Open** to add it to QGIS Desktop.

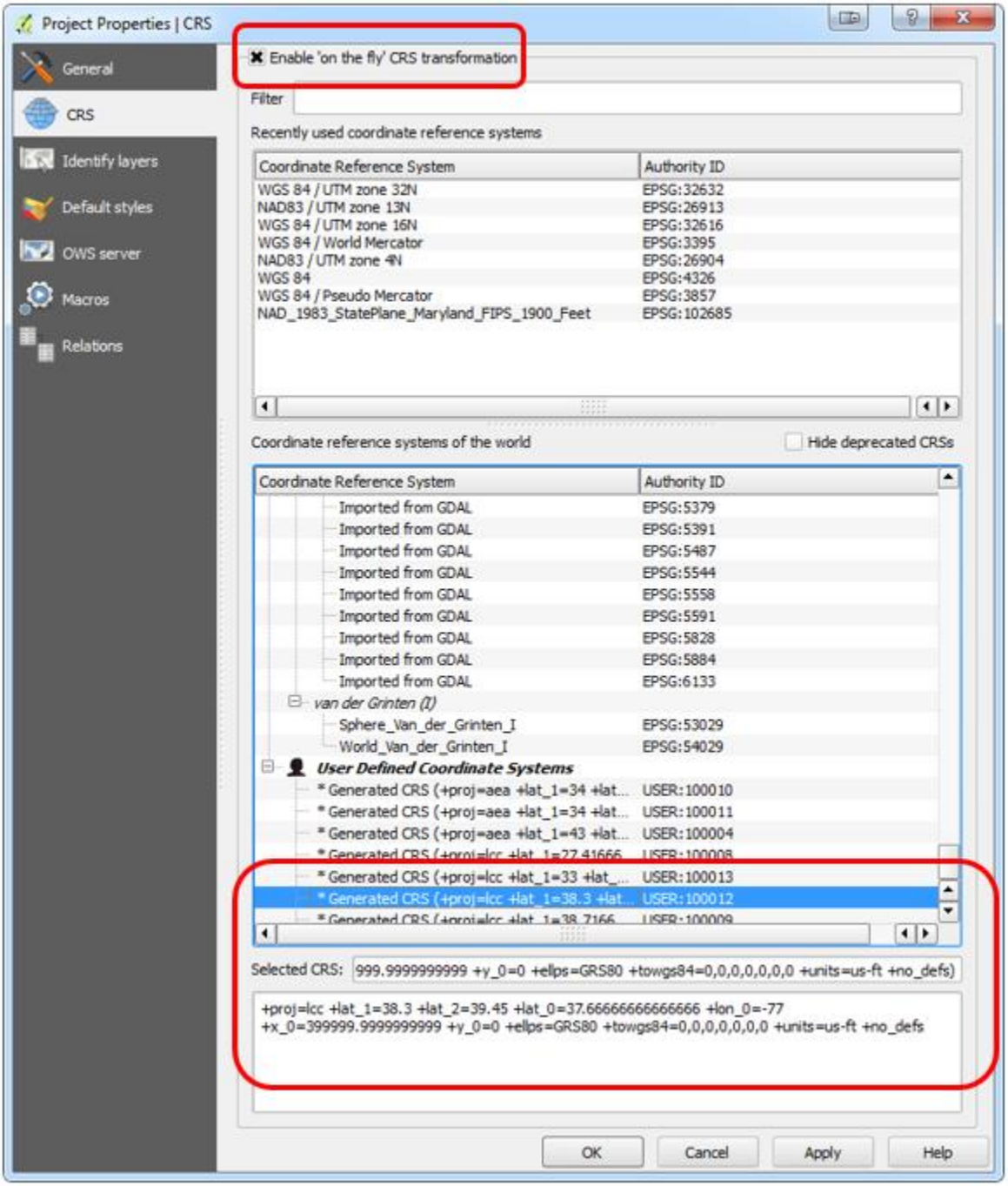


15) Open the Layer Properties | General tab for the newly added *Baltimore_clinics* layer.



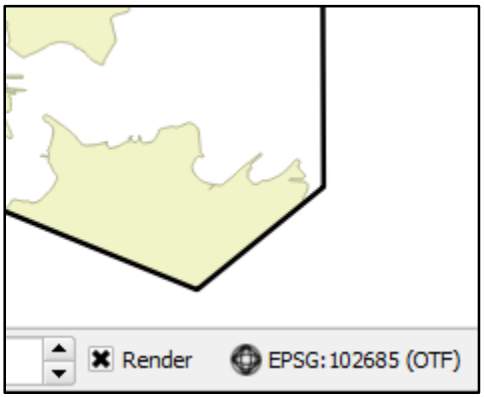
16) Here you can see that this layer is in a different CRS. It is in WGS 84, which is a geographic coordinate system (GCS). Since a QGIS map can only be in one coordinate space, why are the clinics lining up with the rest of the data in State Plane?

17) Close the Layer Properties window.
18) Once again click on the **Project** menu | **Project Properties**. Open the **CRS** tab.



19) Notice at the top of the window that **Enable 'on the fly' CRS transformation** is now checked. Initially it was not.
20) **On the fly CRS transformation** is a feature whereby QGIS projects data layers that are in a different CRS from the map into the CRS of the map. It is very convenient for cartography because you can bring together map layers from different sources and different CRS's and have them align properly.

21) You can also see that QGIS has changed the CRS of the map. It is actually the same State Plane CRS but is now being displayed as a User Defined Coordinate System.
22) Close the **Project Properties** window.
23) Right click on the *Neighborhoods* layer and choose **Set Project CRS From Layer** from the context menu. This is a convenient way to set the CRS of your map. Notice that in the lower right hand corner of QGIS Desktop, the EPSG code for the map's CRS is displayed. The (OTF) indicates that on-the-fly transformation is enabled.



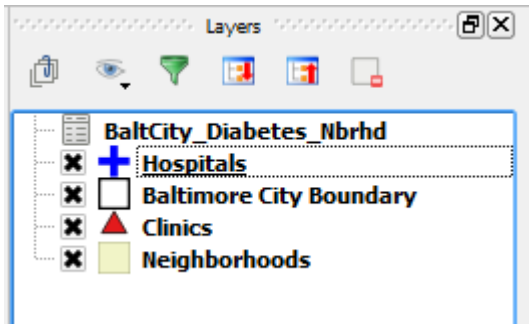
24) Using what you learned in Lab 2, style the *Baltimore clinics* layer.
25) Save your QGIS project as *Lab3.qgs*.

Task 2. Join Tabular Data to an Attribute Table

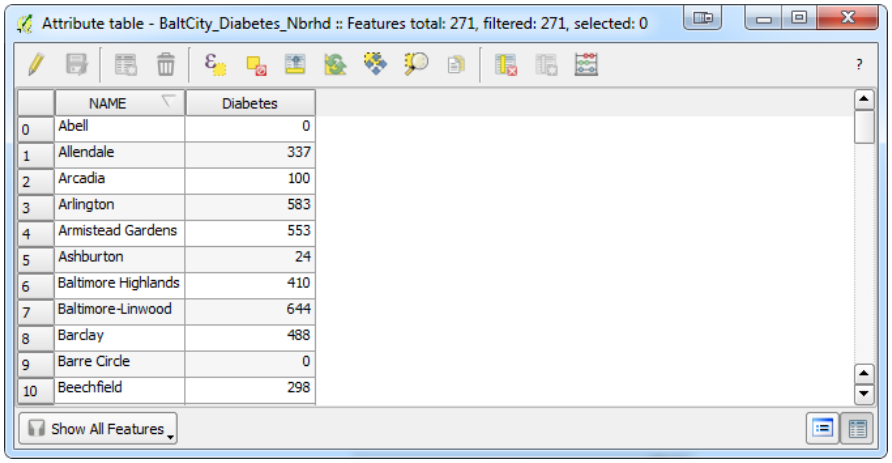
Watch a Task 2 Video Walkthrough on YouTube.

In this task, you will learn how to perform a join. Your organization has diabetes morbidity counts by neighborhood in Baltimore. They are stored in a database table and are not currently associated with a GIS layer. Therefore, in their current state you cannot display the data on a map. You will join that data to the *neighborhoods* layer so that these data can be rendered on the map.

1) Open QGIS Desktop and open the Lab3 QGIS map document you saved at the end of Task 1.
2) Click the **Add Vector Layer** button and click the **Browse** button. Navigate to the Lab 3 data folder.
3) In the **Open an OGR Supported Vector Layer** window, set the file type filter to All files and choose the *BaltCity_Diabetes_nbrhd.dbf* file. Click **Open** to add it to QGIS Desktop.
4) The table will be added to the Layers panel with a table icon.



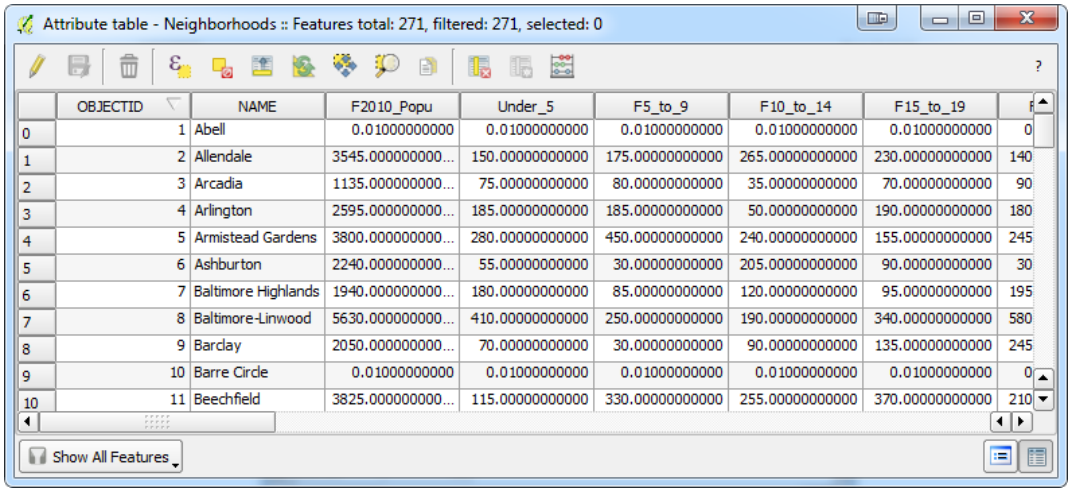
5) Right click on the table and choose **Open Attribute Table**. The table has two columns, one with the neighborhood name [NAME] and one with the population diagnosed with diabetes [Diabetes].



	NAME	Diabetes
0	Abell	0
1	Allendale	337
2	Arcadia	100
3	Arlington	583
4	Armistead Gardens	553
5	Ashburton	24
6	Baltimore Highlands	410
7	Baltimore-Linwood	644
8	Barclay	488
9	Barre Circle	0
10	Beechfield	298

NOTE: These data are fictional. They were created purely for educational purposes.

6) Close the table by clicking on the X in the upper right corner.
7) Now open the attribute table for the *Neighborhoods* layer.
8) There is a column with neighborhood name [NAME] and many columns of socio-economic data from the 2010 Census.



	OBJECTID	NAME	F2010_Popu	Under_5	F5_to_9	F10_to_14	F15_to_19	F
0	1	Abell	0.01000000000	0.01000000000	0.01000000000	0.01000000000	0.01000000000	0
1	2	Allendale	3545.000000000...	150.00000000000	175.00000000000	265.00000000000	230.00000000000	140
2	3	Arcadia	1135.000000000...	75.00000000000	80.00000000000	35.00000000000	70.00000000000	90
3	4	Arlington	2595.000000000...	185.00000000000	185.00000000000	50.00000000000	190.00000000000	180
4	5	Armistead Gardens	3800.000000000...	280.00000000000	450.00000000000	240.00000000000	155.00000000000	245
5	6	Ashburton	2240.000000000...	55.00000000000	30.00000000000	205.00000000000	90.00000000000	30
6	7	Baltimore Highlands	1940.000000000...	180.00000000000	85.00000000000	120.00000000000	95.00000000000	195
7	8	Baltimore-Linwood	5630.000000000...	410.00000000000	250.00000000000	190.00000000000	340.00000000000	580
8	9	Barclay	2050.000000000...	70.00000000000	30.00000000000	90.00000000000	135.00000000000	245
9	10	Barre Circle	0.01000000000	0.01000000000	0.01000000000	0.01000000000	0.01000000000	0
10	11	Beechfield	3825.000000000...	115.00000000000	330.00000000000	255.00000000000	370.00000000000	210

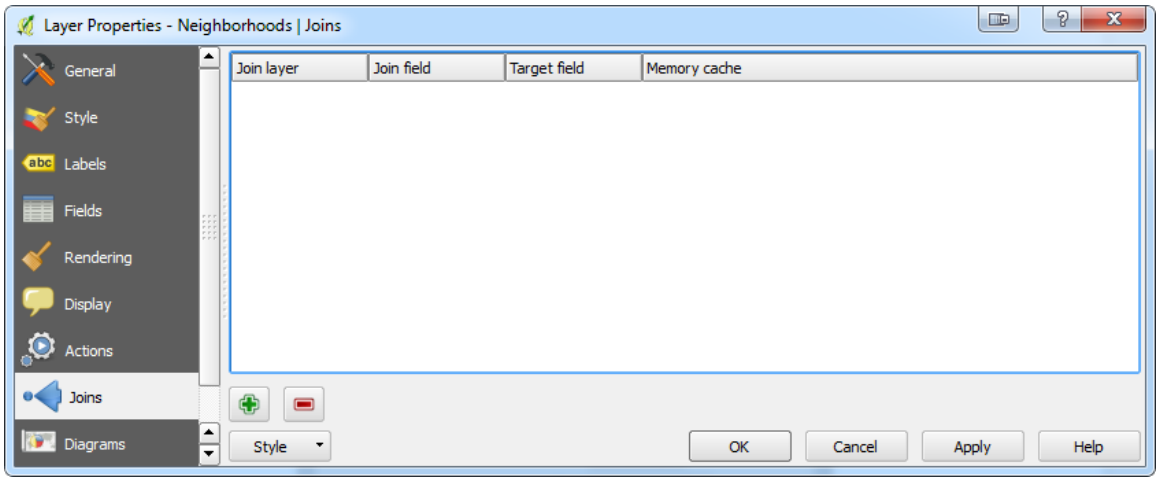
9) Once you are finished reviewing the table close it.

There are two requirements for a table join:

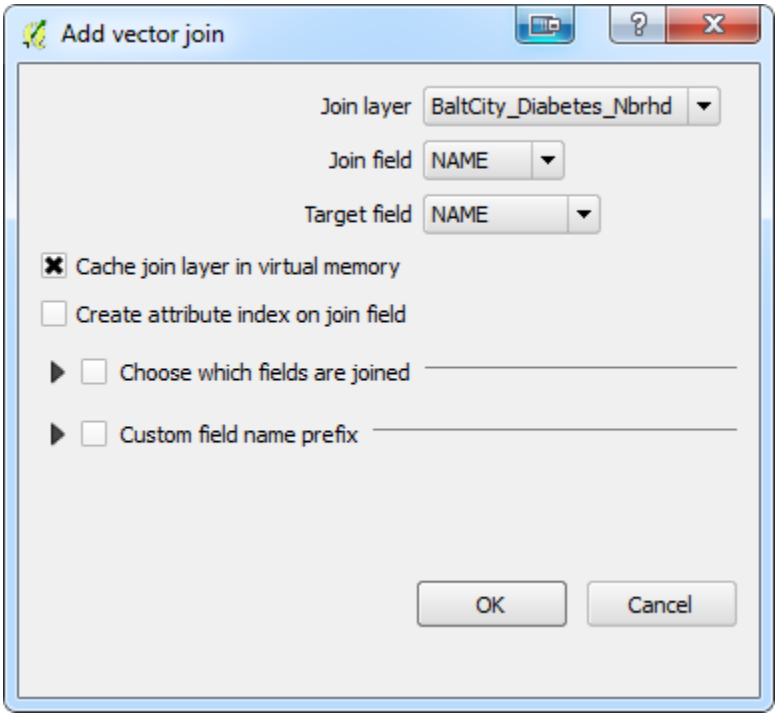
- The two tables need to have a common field upon which the join will be based.
- There needs to be a cardinality of one-to-one or many-to-one between the attribute table and the standalone table.

In this case there is a column containing the neighborhood name in both tables. There are 271 records in each table, meaning there is a cardinality of one-to-one. We have met the requirements for a join.

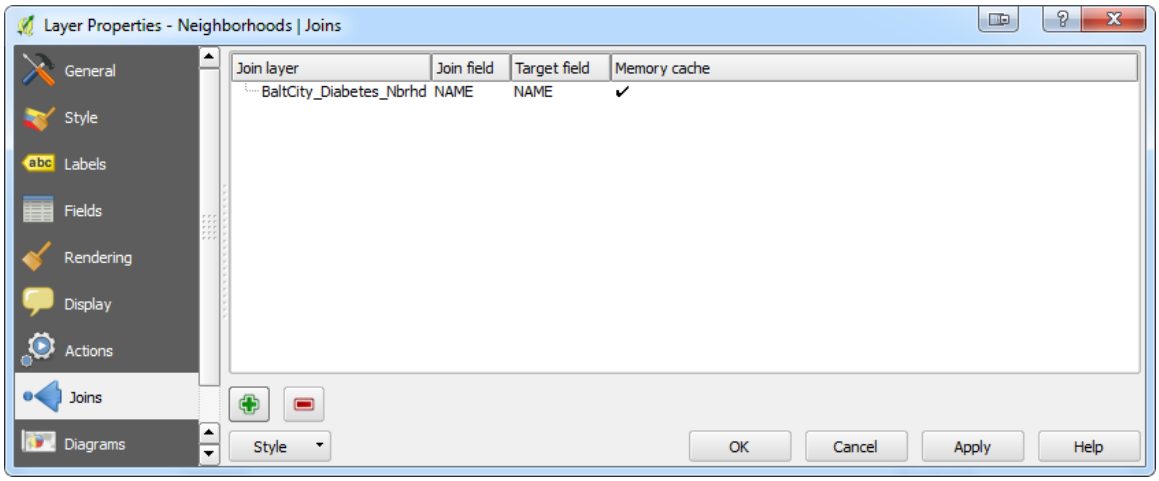
10) Open the **Layer Properties** for the *Neighborhoods* layer.
11) Select the **Joins** tab.



12) Click the green plus button to add a join.
13) The **Add vector join** window opens. The Join layer is the table you wish to join to the *Neighborhoods* layer. Click the Join Layer dropdown button and select the *BaltCity_Diabetes.Nbrhd.dbf* file.
14) In this case, the field the join will be based on is called *NAME* in each table. Select the *NAME* field for both the **Join field** and **Target field**.
15) Take the remaining defaults and click **OK** to create the join.

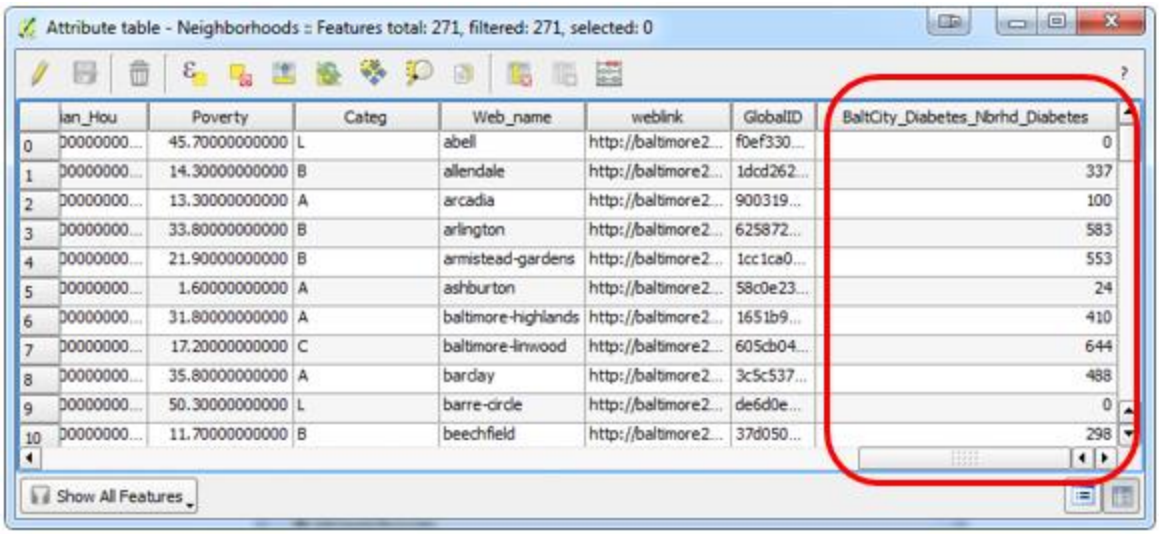


16) The join now appears on the Joins tab of the **Layers Properties** for the *Neighborhoods* layer.



17) Click **OK** to close the **Layer Properties** window.
18) Open the attribute table for the *Neighborhoods* layer.
19) Scroll to the right to see the new column appended to your attribute table. Its name is the *Join field name_column name* (*BaltCity_Diabetes_Nbrhd_Diabetes*).

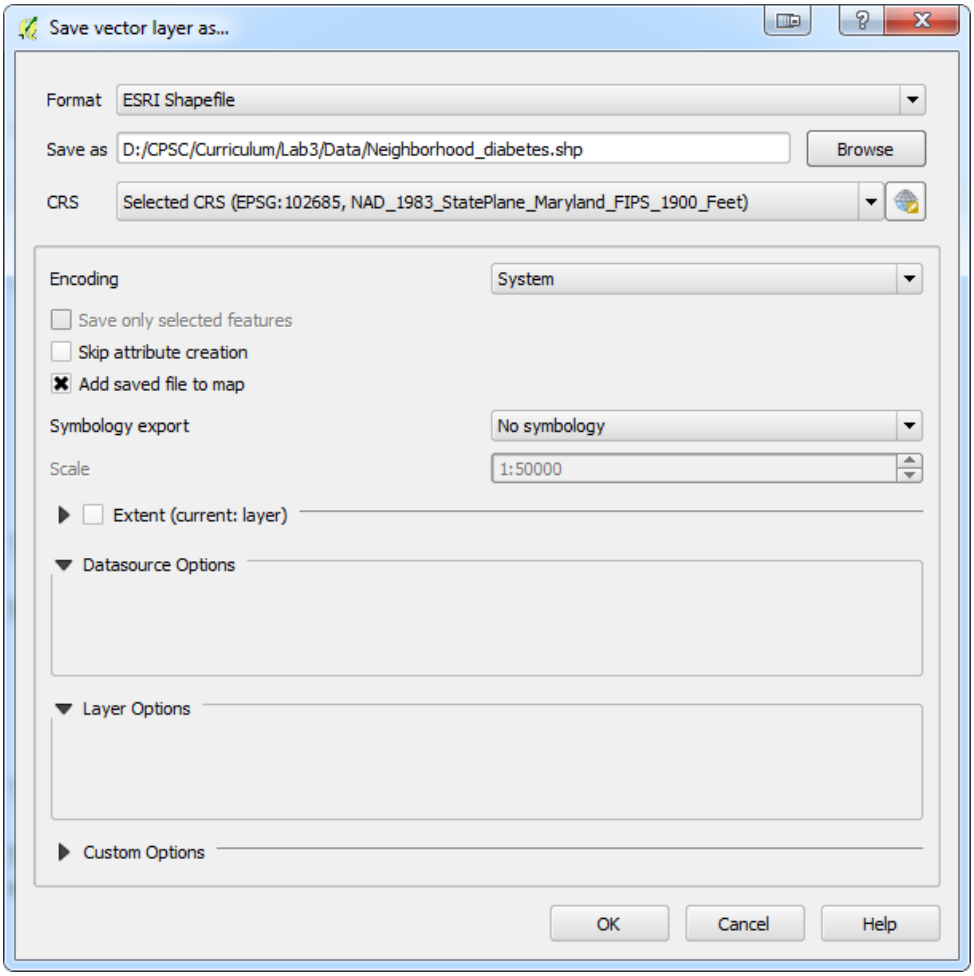
> NOTE: If you do not see the new column, re-open **Layer Properties** for the layer and check the Join properties. The join should match the figure above. If not, you can select the join and click the red minus sign (Remove join) to delete it. Then simply recreate the join.



	ian_Hou	Poverty	Categ	Web_name	weblink	GlobalID	BaltCity_Diabetes_Nbrhd_Diabetes
0	00000000...	45.70000000000	L	abell	http://baltimore2...	f0ef330...	0
1	00000000...	14.30000000000	B	allendale	http://baltimore2...	1dcd262...	337
2	00000000...	13.30000000000	A	arcadia	http://baltimore2...	900319...	100
3	00000000...	33.80000000000	B	arlington	http://baltimore2...	625872...	583
4	00000000...	21.90000000000	B	armistead-gardens	http://baltimore2...	1cc1ca0...	553
5	00000000...	1.60000000000	A	ashburton	http://baltimore2...	58c0e23...	24
6	00000000...	31.80000000000	A	baltimore-highlands	http://baltimore2...	1651b9...	410
7	00000000...	17.20000000000	C	baltimore-linwood	http://baltimore2...	605cb04...	644
8	00000000...	35.80000000000	A	barclay	http://baltimore2...	3c5c537...	488
9	00000000...	50.30000000000	L	barre-circle	http://baltimore2...	de6d0e...	0
10	00000000...	11.70000000000	B	beechfield	http://baltimore2...	37d050...	298

20) Joins only exist in virtual memory within the QGIS Desktop document. The data are not permanently attached to the *Neighborhoods* layer attribute table.
21) To preserve the join outside the map document right click on the layer and choose **Save as...**

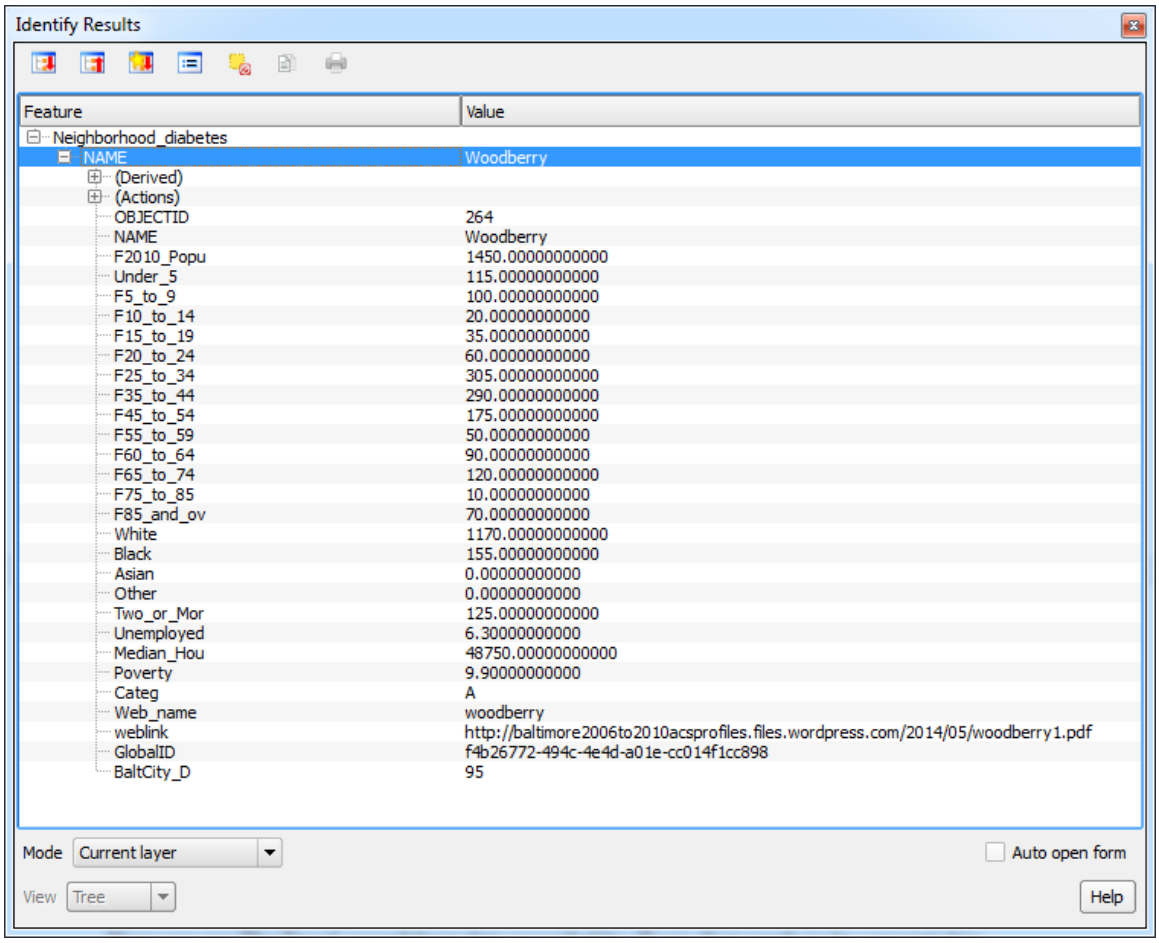
22) The **Save vector layer as…** window will open.
    a) Set the **Format** to ESRI Shapefile
    b) Click the **Browse** button and save the new layer to the Lab 3 data folder. Name the file *Neighborhood_diabetes.shp.*
    c) Click **OK**.



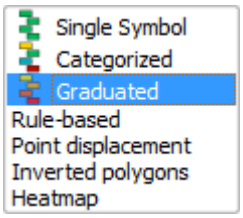
23) The new layer will include the attributes appended via the join. The new column has been truncated to the first 10 characters and is named *BaltCity_D.*
24) Select the *Neighborhood_diabetes* layer in the **Layers panel**. To explore some of these new data, click on the tool. Once you've selected this tool, click on one of the neighborhoods on the map.

NOTE: If the **Identify Results** window opens as a panel, you can undock it and reposition it by grabbing the title bar and dragging it until it is free floating.

25) Expand the window so that you can see all the fields and associated values. This tool gives you an interactive way to explore the attribute values. Click on several more neighborhoods to investigate the values.

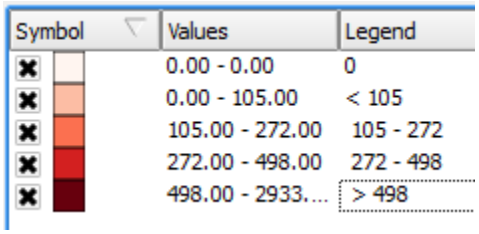


26) As handy as the Identify Features tool is it will be much more powerful to be able to see all the data on the map.
27) Open the **Layers Properties** for the *Neighborhood_diabetes* layer. Select the **Style** tab.
28) So far you have only explored the Single Symbol renderer. This time, click the dropdown button to the right of **Single Symbol** and choose **Graduated**. This allows you to classify the features on the map by a numeric attribute column.

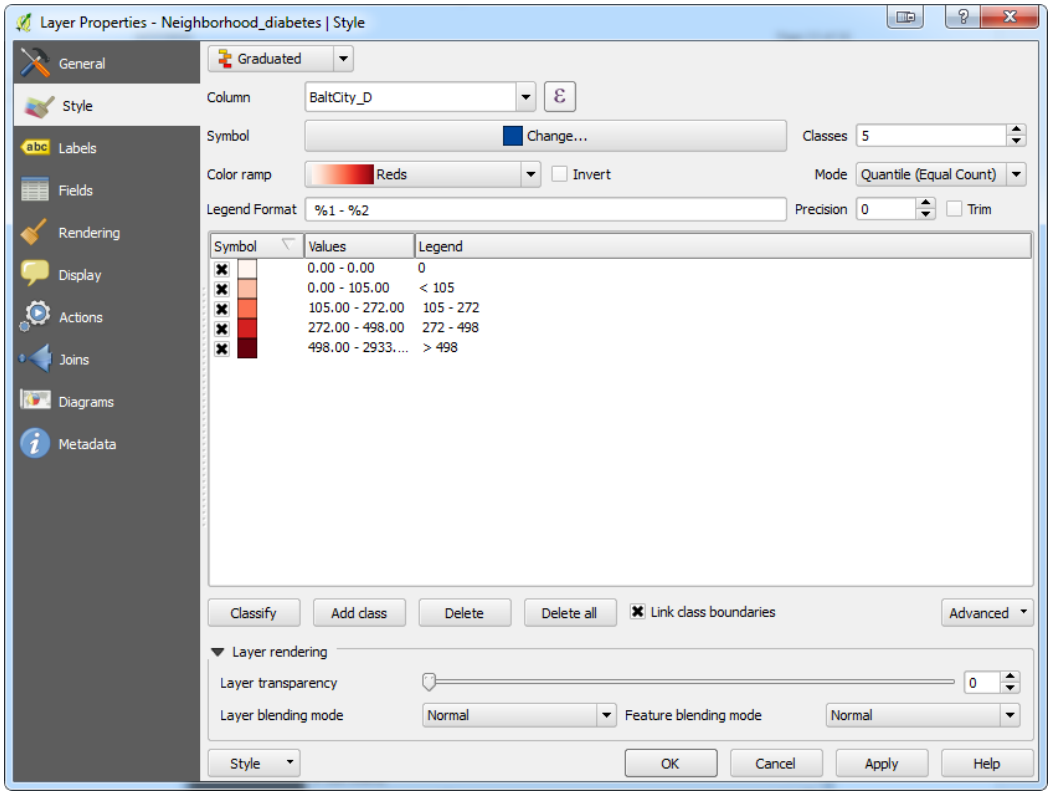


29) Choose *BaltCity_D* as the **Column**.
30) Click the dropdown next to **Color ramp** and choose **Reds**.
31) Choose a **Mode** of **Quantile (Equal count).** This method classification tries to put an equal number of features (neighborhood polygons) in each class. Leave the number of **Classes** at **5**.
32) Now you see columns for the **Symbol**, **Values**, and **Legend**. The **Legend** column contains what will be seen in the map legend. There are extraneous decimal values. Double click in each Legend value to edit it. The top class can be changed to just *0*. Then

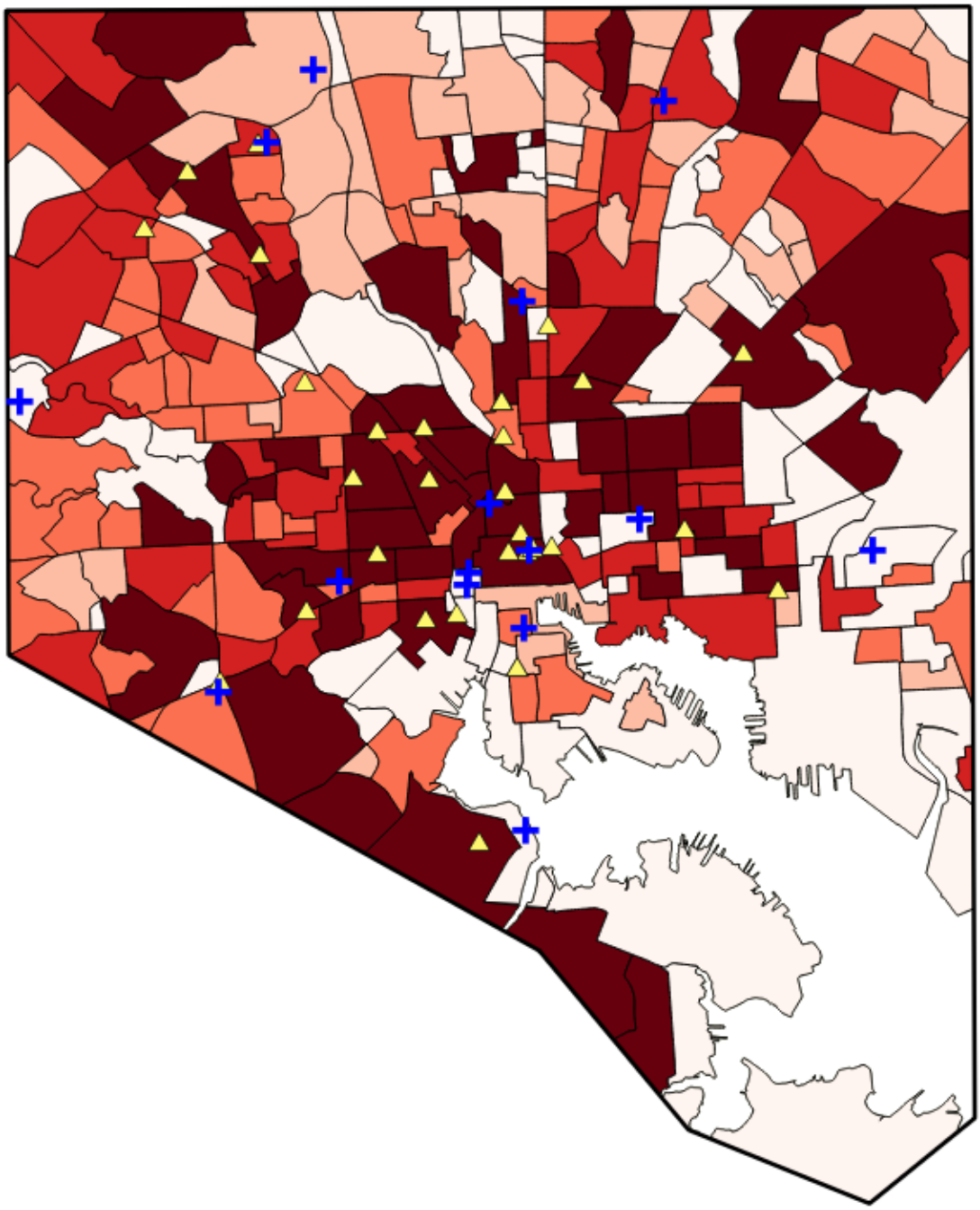
next can be edited to read < *105*. The bottom class can be edited to read > *498*. Remove the decimal places for the middle classes.



33) Click **OK**.



34) Now you are able to see the data that had been stored in a tabular file! The map should resemble the figure below.



35) Now you will do some clean up. Since the data are now attached to a new version of the neighborhoods layer you no longer need the original join. Open the **Layer Properties | Joins** tab for the *Neighborhoods* layer. Select the join and remove it by clicking on the button. The join was an intermediate step.
36) Close **Layer Properties** when done.
37) Right click on the *BaltCity_Diabetes_Nbrhd* table and **Remove** it.
38) **Save** your QGIS project.

Task 3. Geocode Address-Based Data

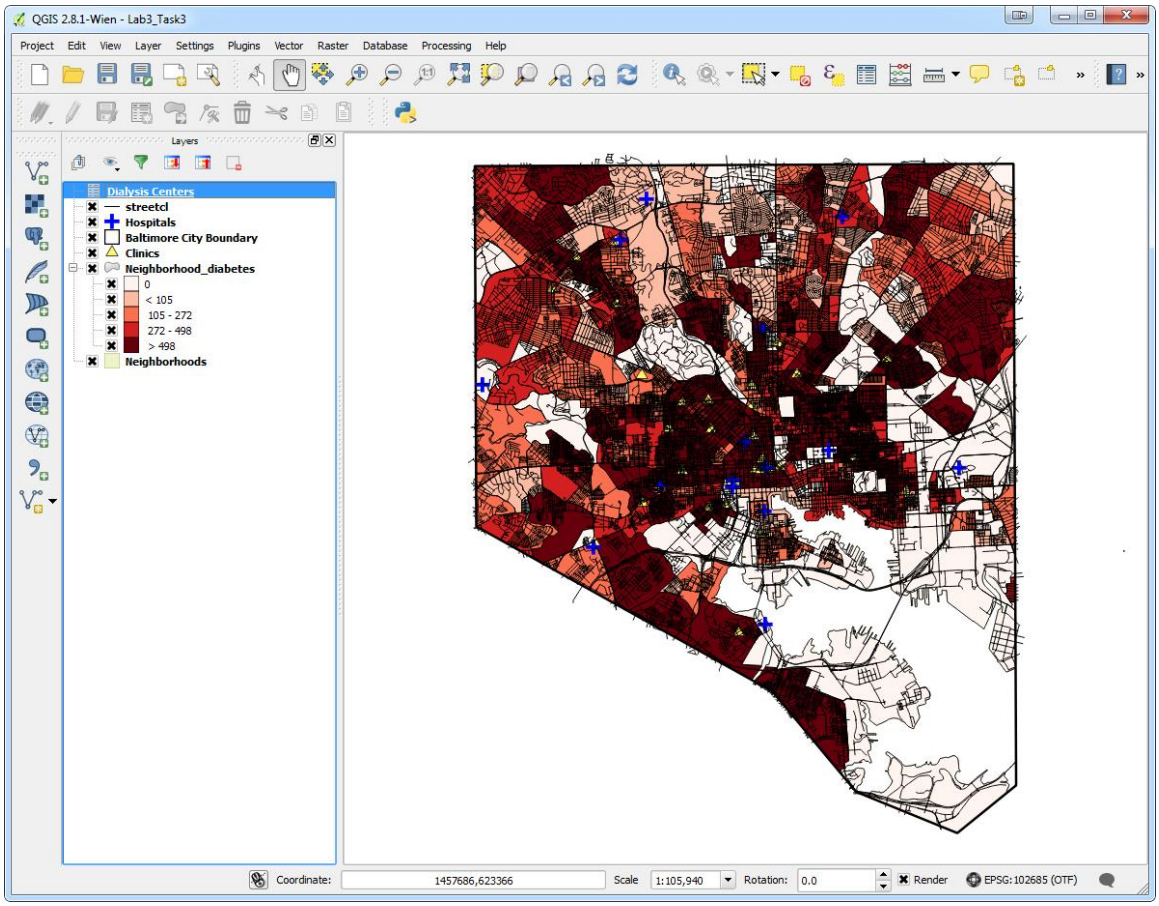
Watch a Task 3 Video Walkthrough on YouTube.

Another useful and common tabular spatial data source is street addresses. Geocoding addresses has many public health applications, such as mapping the patient addresses or facility locations. Once mapped, the points can be used in many ways to generate information. For example, they can be used as inputs to generate density surfaces, or they can be linked to parcels of land and be characterized by socio-economic data.

An address geocoding operation typically involves the tabular address data, and a street network dataset. The street network needs to have attribute fields for address ranges on the left and right side of each road segment.

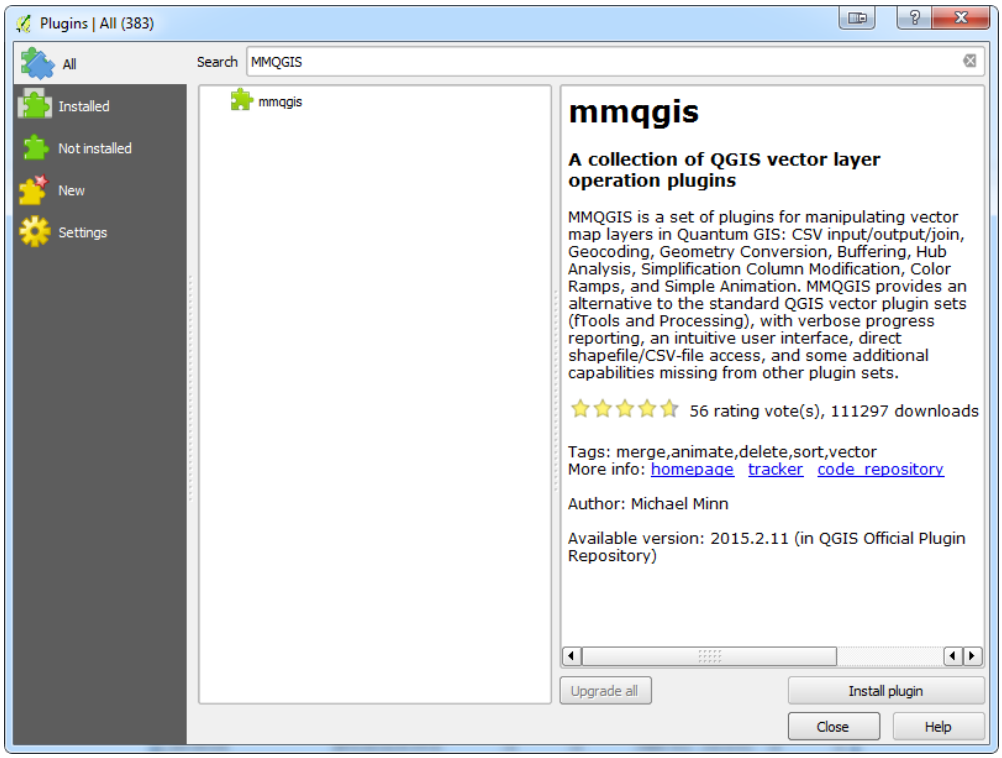
Your organization has a comma delimited text file with addresses for all of Baltimore's dialysis centers. You will geocode these so that you can put the dialysis center points on the map.

1) Open QGIS Desktop and open the Lab 3 QGIS map document you saved at the end of Task 2.
2) Using the **Add Vector Layer** button add the *streetcl.shp* shapefile to QGIS.
3) Use the **Add Vector Layer** again to add the *BaltDialysisCenters.csv* to QGIS. Remember to set the filter to all files so that you can see the file.



4) You can geocode within QGIS using a plugin named **MMQGIS**. **MMQGIS** is a collection of vector data processing tools developed by Michael Minn.

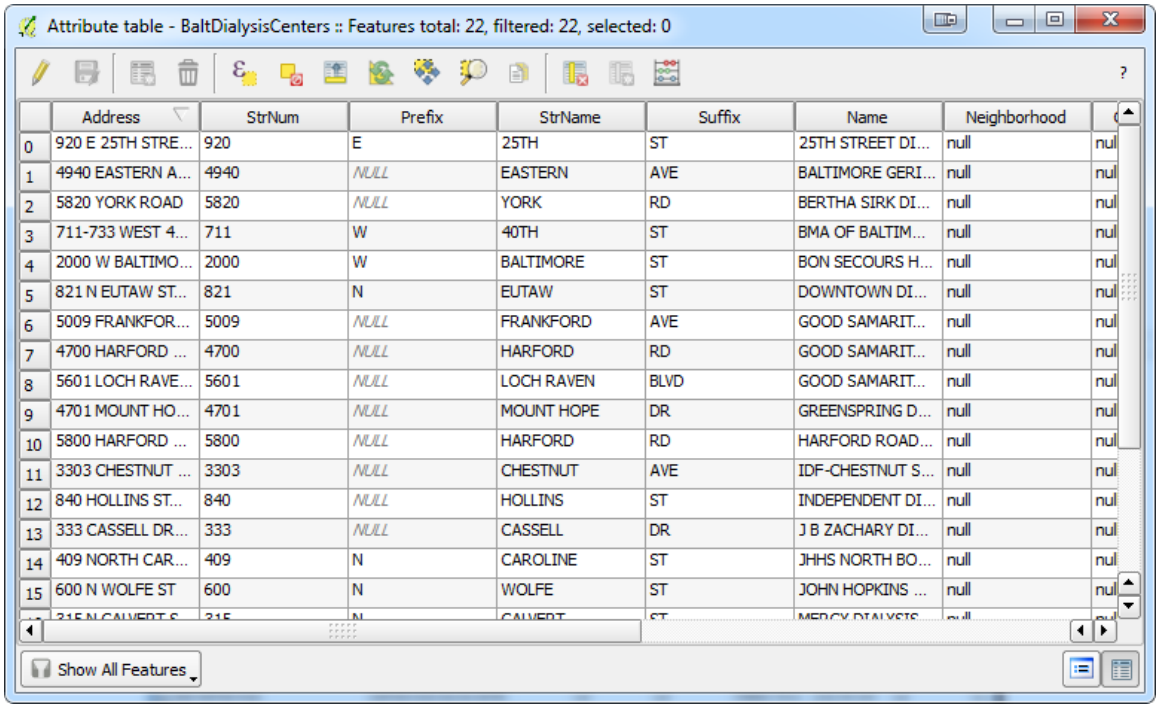
5) To install the plugin, click on **Plugins | Manage and Install Plugins**.
6) Click on the **All** tab and type MMQGIS into the Search bar.



7) Install the plugin. It will appear as MMQGIS on the menu bar.

MMQGIS has many useful tools. For geocoding, you will use the tools found in **MMQGIS | Geocode**. There are two tools there: **Geocode CSV with Google/ OpenStreetMap** and **Geocode from Street Layer**. The first allows you to geocode a table of addresses using either the Google Maps API or the OpenStreetMap Nominatim web service. This tool requires an Internet connection but no local street network data. The web services provide the street network. The second tool uses a local street network dataset with address range attributes to geocode the address data.

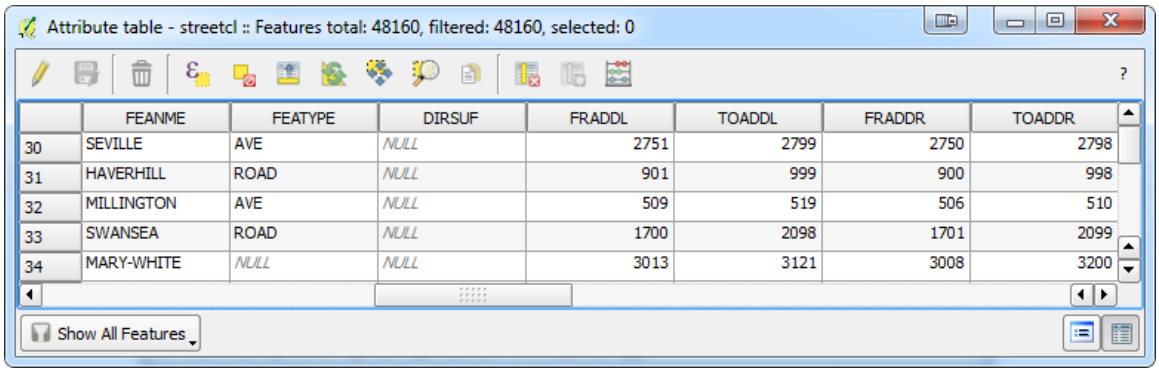
8) You will use the **Geocode from Street Layer** option.
9) First, familiarize yourself with the data. Open the *BaltDialysisCenters* table by right clicking on it and choosing **Open Attribute Table**.
10) Notice that there is an *Address* column containing the full address. Then that full address is parsed out into four columns: *StrNum*, *Prefix*, *StrName*, and *Suffix*. This is good because the MMQGIS plugin requires that the street number and street name be held in separate fields. Identify these columns and write the names down on a scratch piece of paper. Notice that suite and apartment numbers have been removed from the *StrName* column because they will hurt the geocoding success rate.


Attribute table - BaltDialysisCenters :: Features total: 22, filtered: 22, selected: 0

	Address	StrNum	Prefix	StrName	Suffix	Name	Neighborhood
0	920 E 25TH STRE...	920	E	25TH	ST	25TH STREET DI...	null
1	4940 EASTERN A...	4940	NULL	EASTERN	AVE	BALTIMORE GERI...	null
2	5820 YORK ROAD	5820	NULL	YORK	RD	BERTHA SIRK DI...	null
3	711-733 WEST 4...	711	W	40TH	ST	BMA OF BALTIM...	null
4	2000 W BALTIMO...	2000	W	BALTIMORE	ST	BON SECOURS H...	null
5	821 N EUTAW ST...	821	N	EUTAW	ST	DOWNTOWN DI...	null
6	5009 FRANKFOR...	5009	NULL	FRANKFORD	AVE	GOOD SAMARIT...	null
7	4700 HARFORD ...	4700	NULL	HARFORD	RD	GOOD SAMARIT...	null
8	5601 LOCH RAVE...	5601	NULL	LOCH RAVEN	BLVD	GOOD SAMARIT...	null
9	4701 MOUNT HO...	4701	NULL	MOUNT HOPE	DR	GREENSPRING D...	null
10	5800 HARFORD ...	5800	NULL	HARFORD	RD	HARFORD ROAD...	null
11	3303 CHESTNUT ...	3303	NULL	CHESTNUT	AVE	IDF-CHESTNUT S...	null
12	840 HOLLINS ST...	840	NULL	HOLLINS	ST	INDEPENDENT DI...	null
13	333 CASSELL DR...	333	NULL	CASSELL	DR	J B ZACHARY DI...	null
14	409 NORTH CAR...	409	N	CAROLINE	ST	JHHS NORTH BO...	null
15	600 N WOLFE ST	600	N	WOLFE	ST	JOHN HOPKINS ...	null

Show All Features

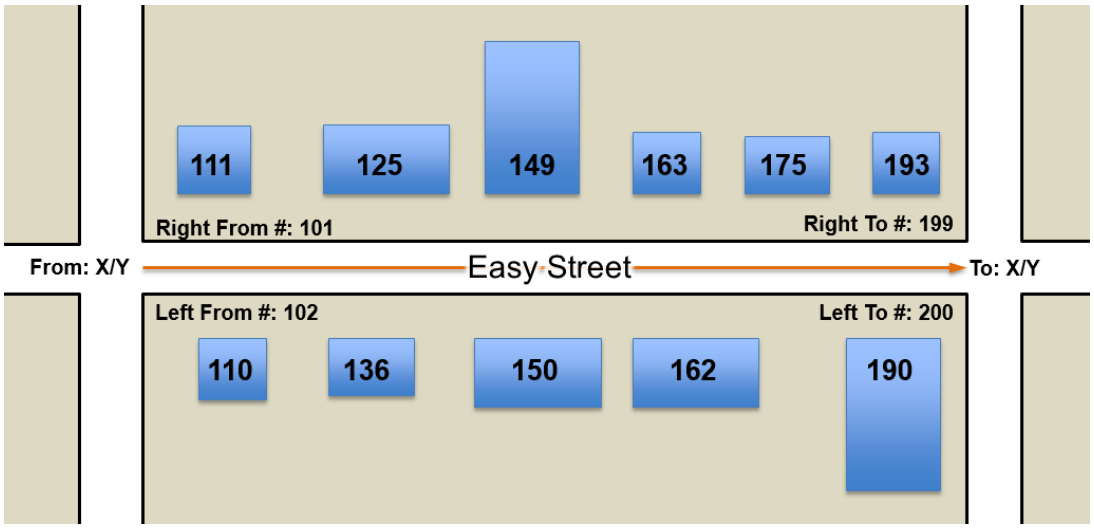
The basic mechanics of address geocoding are straightforward. The street network GIS data layer has attribute columns containing the address ranges on both the even and odd side of every street segment. In the example below, you are seeing a piece of the attribute table for the *streetcl* layer. The columns *FRADDL*, *TOADDL*, *FRADDR*, and *TOADDR* contain the address ranges for each street segment.


Attribute table - streetcl :: Features total: 48160, filtered: 48160, selected: 0

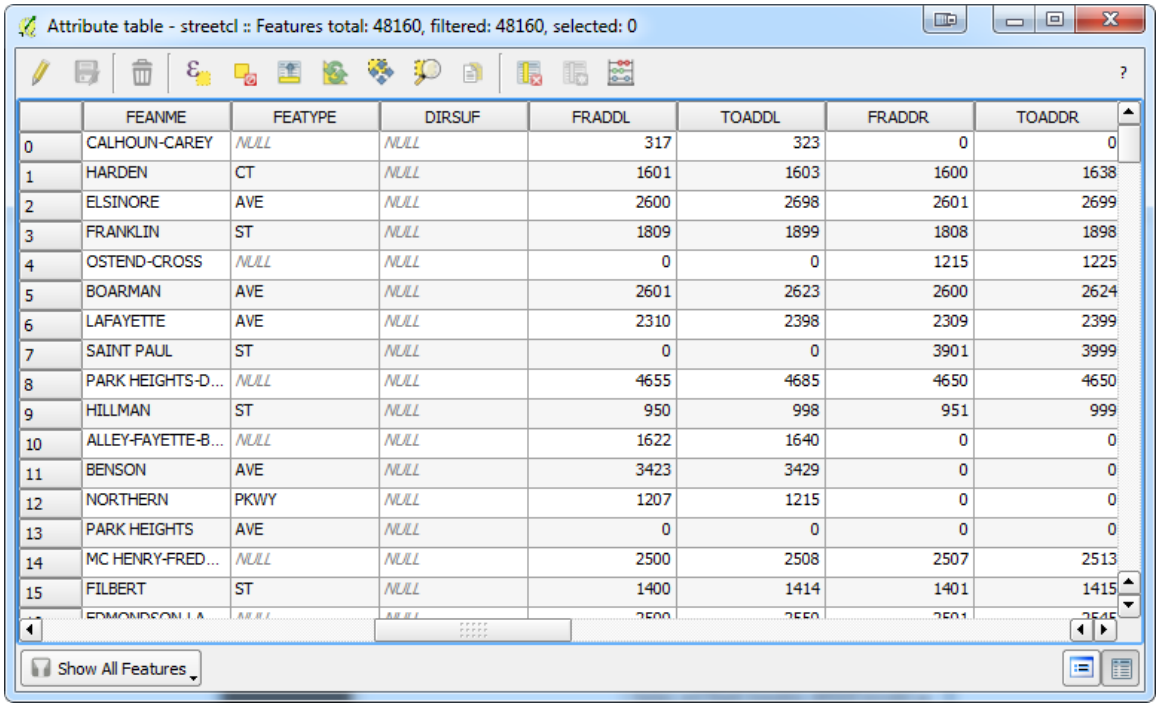
	FEANME	FEATYPE	DIRSUF	FRADDL	TOADDL	FRADDR	TOADDR
30	SEVILLE	AVE	NULL	2751	2799	2750	2798
31	HAVERHILL	ROAD	NULL	901	999	900	998
32	MILLINGTON	AVE	NULL	509	519	506	510
33	SWANSEA	ROAD	NULL	1700	2098	1701	2099
34	MARY-WHITE	NULL	NULL	3013	3121	3008	3200

Show All Features

In the example below we are looking at Easy Street. On the odd side of the street, the addresses range from 101 to 199. On the even side, they range from 102 to 200. If you wanted to map 150 Easy Street, QGIS would assume that the address is located halfway down the even side of that block. Similarly 175 Easy Street would be on the odd side of the street roughly three quarters the way down the block. Address geocoding assumes that the addresses are evenly spaced along the linear network. QGIS should place the address point very close to its actual position, but due to variability in lot sizes not every address point will be perfectly positioned.



11) Open the attribute table for the *streetcl* layer. When you run the geocoding tool you will have to identify the attribute columns containing the **Left From Number**, **Left To Number**, **Right From Number**, and **Right To Number** along with the column containing the **Street Name**. Identify these columns and write the names down on a scratch piece of paper.

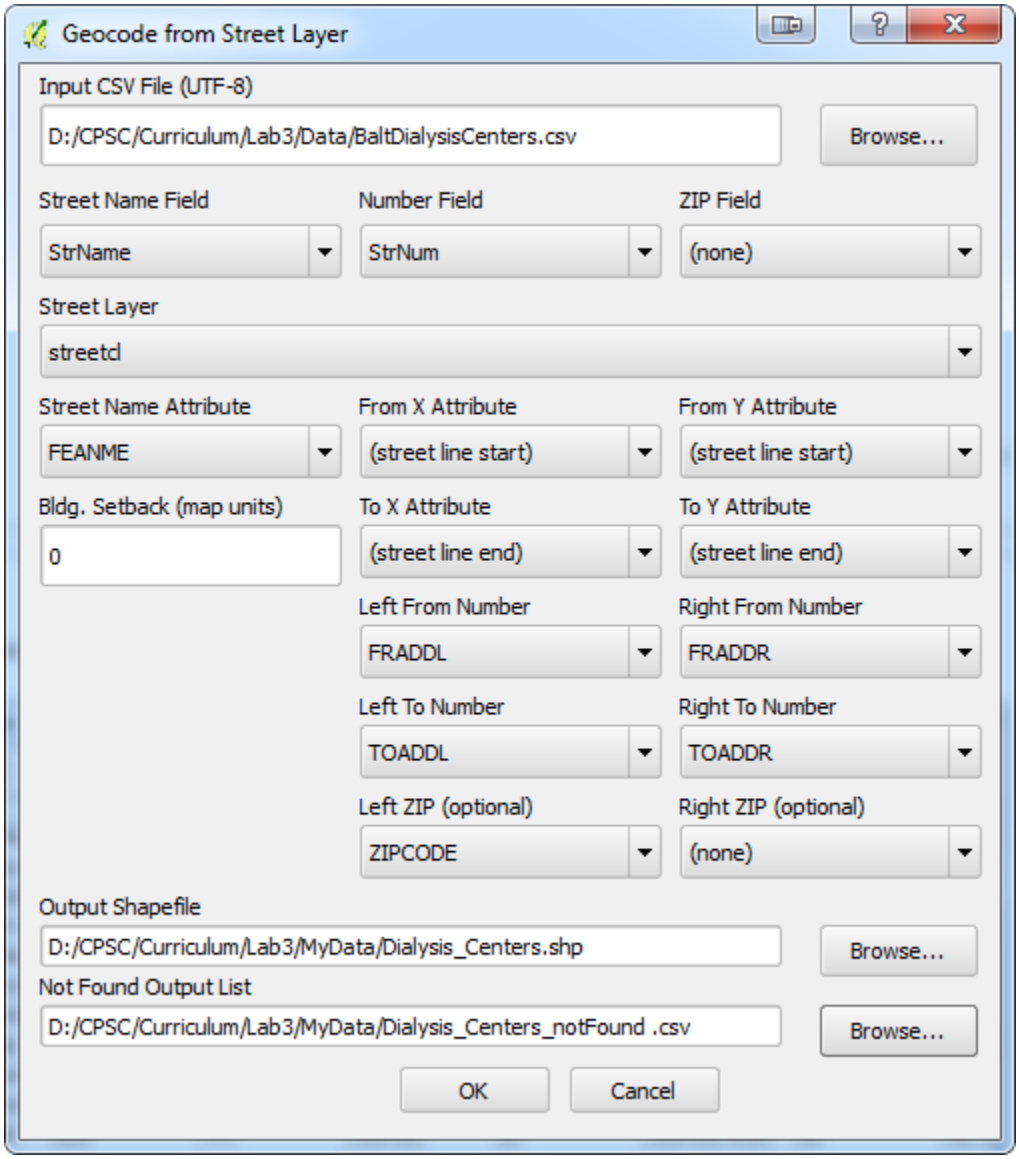


	FEANME	FEATYPE	DIRSUF	FRADDL	TOADDL	FRADDR	TOADDR
0	CALHOUN-CAREY	NULL	NULL	317	323	0	0
1	HARDEN	CT	NULL	1601	1603	1600	1638
2	ELSINORE	AVE	NULL	2600	2698	2601	2699
3	FRANKLIN	ST	NULL	1809	1899	1808	1898
4	OSTEND-CROSS	NULL	NULL	0	0	1215	1225
5	BOARMAN	AVE	NULL	2601	2623	2600	2624
6	LAFAYETTE	AVE	NULL	2310	2398	2309	2399
7	SAINT PAUL	ST	NULL	0	0	3901	3999
8	PARK HEIGHTS-D...	NULL	NULL	4655	4685	4650	4650
9	HILLMAN	ST	NULL	950	998	951	999
10	ALLEY-FAYETTE-B...	NULL	NULL	1622	1640	0	0
11	BENSON	AVE	NULL	3423	3429	0	0
12	NORTHERN	PKWY	NULL	1207	1215	0	0
13	PARK HEIGHTS	AVE	NULL	0	0	0	0
14	MC HENRY-FRED...	NULL	NULL	2500	2508	2507	2513
15	FILBERT	ST	NULL	1400	1414	1401	1415

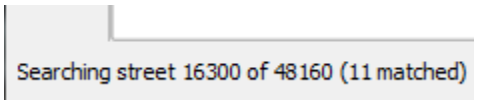
12) Click on the **MMQGIS** menu | **Geocode | Geocode from Street Layer**. Fill out the Geocode from Street Layer form as follows:

   a) **Input CSV File**: **Browse** and select the *BaltDialysisCenters.csv*.
   b) Identify the **Street Name Field** and the **Number Field** using the dropdown lists.
   c) Identify the loaded **Street Layer** *streetcl*.
   d) Identify the **Street Name Attribute** | *FEANME*.

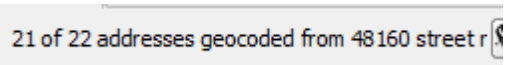
e) Identify the **Left From Number**, **Left To Number**, **Right From Number**, and **Right To Number** columns.
f) **Output Shapefile—**Click the **Browse** button and navigate to the Lab 3 MyData folder. Name the resulting shapefile *Dialysis_Centers.shp*.
g) **Not Found Output List—**This option will save a CSV file with information on any records not matched. Click the **Browse** button and navigate to the Lab 3 MyData folder. Name the resulting CSV file *Dialysis_Centers_notFound.csv*.
h) Click **OK** to run.



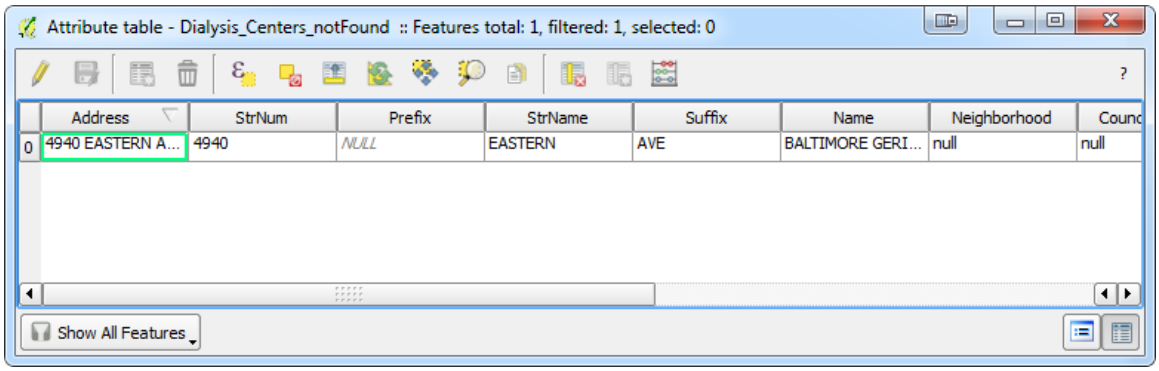
13) The operation will take a minute or two to complete. A status message in the lower left corner of QGIS Desktop will inform you of the status.



14) When done you will see the results in the lower left corner of QGIS Desktop and the shapefile will appear in the **Layers panel**.



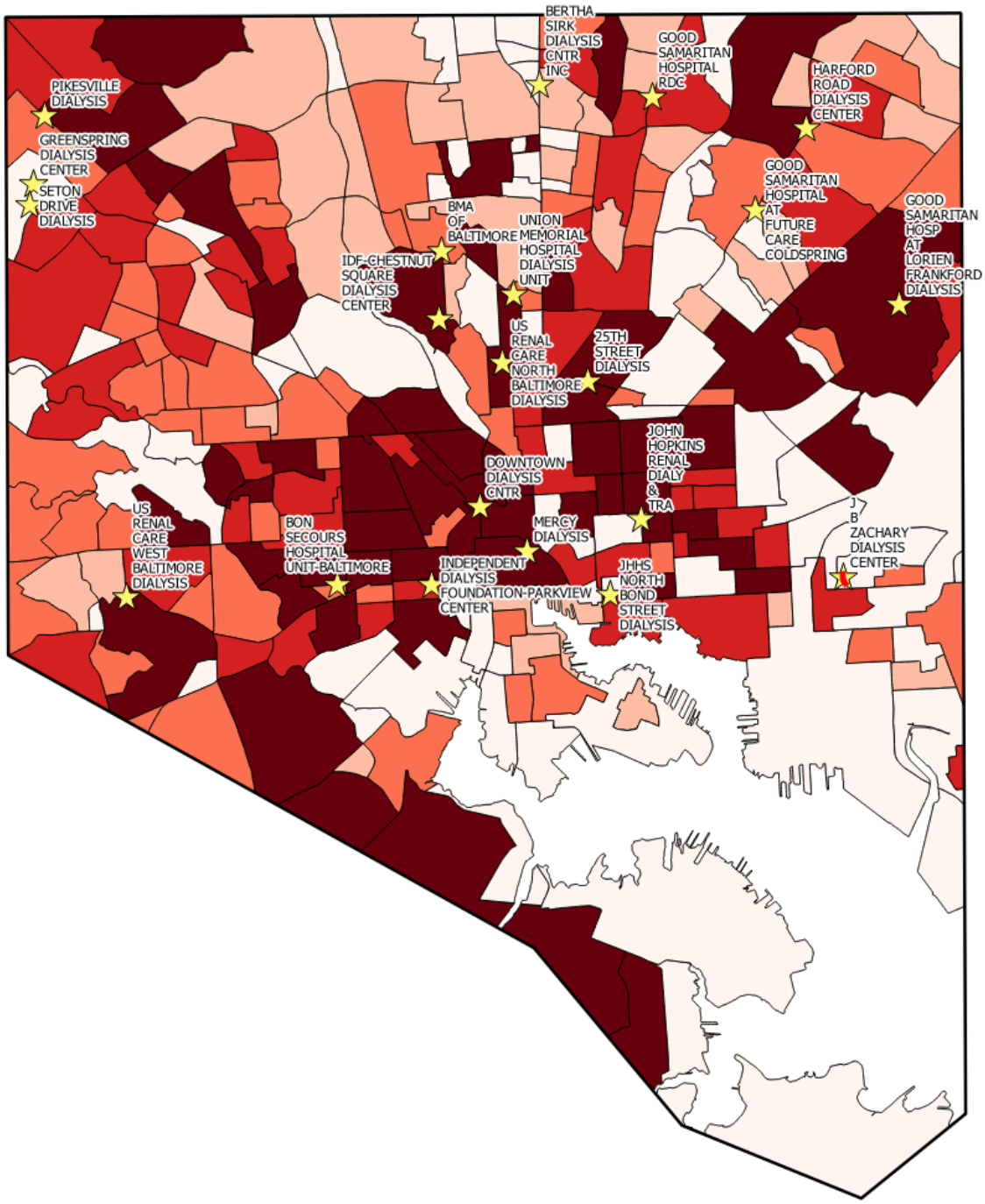
15) In this case 21 out of the 22 records match, which is a pretty good success rate.
16) Open the *Dialysis_Centers_notFound.csv*. It has the one record that didn't match. We won't deal with this one record for this lab. However, knowing which ones did not find matches will allow you to try to troubleshoot them later on. Close the table.



17) **Remove** the *BaltDialysisCenters* table from the **Layers panel**. Now that the centers have been mapped this is no longer needed.
18) **Remove** the *Dialysis_Centers_notFound* table too.
19) Style the *Dialysis Centers*. Yellow stars were chosen in the final screenshot below.
20) Label the Dialysis Centers. Open the Layer Properties for the layer and choose the Labels tab.

    a) Check "Label this layer with" checkbox
    b) **Label this layer with** *Name*
    c) **Text—**Font **Size** *6.25*
    d) **Formatting—**Enter a space as the **Wrap on character** (this will put a carriage return in after each space in the Name)
    e) **Buffer—**Check **Draw text buffer** with a **Size** of *1.0* (this produces a halo around the label)
    f) **Placement—**Enter a **Distance** of *2.0*
    g) Click **OK**

21) Turn off all layers except the *Neighborhood_diabetes* and *Dialysis_Centers*.
22) The figure below shows just the *Neighborhood_diabetes* layer and the *Dialysis_Centers*.



23) **Save** your QGIS project.
24) By bringing all of these data together, you can now begin to visually analyze the data and look for spatial trends. A picture is truly worth a thousand words!

5. Conclusion

In this lab, you've begun to explore coordinate reference systems and how to identify them in QGIS Desktop. You have also seen how to join tabular data to spatial data and how to geocode address-based data.

6. Discussion Questions

1) What is required to perform a join?
2) What two datasets are needed to geocode address-based data? Describe any required characteristics of these data.
3) After seeing the locations of the *dialysis centers* and the *diabetes morbidity* data, does it appear that the *dialysis centers* are well located? Do there appear to be any underserved or overserved areas? Describe.
4) Is there anything else that would help make the determination of overserved or underserved areas?