

Using Open Source GIS to Map Health Data

by David Crowther

This blog was inspired mainly as a result of a Cadline **Introduction to QGIS** Training course that I delivered for a UK Local Authority in December 2019. The team I trained were mainly new to GIS and wanted to be able to **Map Health** related datasets, including Locations of Care Homes and Private Care Facilities, in order to provide more timely and accurate responses to Care Needs for Vulnerable people.

With the current **COVID-19** epidemic, the ability to utilise spatial analysis tools to map Health related datasets is now more important than ever.

This blog aims to demonstrate how utilising some core geospatial tasks, such as:

- Creating Points from XLS data
- Spatial Analysis
- Buffering
- Masking Data
- Distance Analysis
- Heatmapping

.... can then enable you to better support the decisions that you make regarding Health Care and the Support of Vulnerable People in your Community.

The blog covers a suite of Open Source GIS tools including **QGIS** (desktop GIS), **PostGIS** (Spatial Database) and **GeoServer** (Web Mapping) which are fully supported by Cadlines **DynamicMaps** spatial experts.

1 – Acquiring the Data

While delivering the QGIS Training course we utilised Health related datasets that we downloaded from the **Care Quality Commission** website - <https://www.cqc.org.uk>



In particular we downloaded an XLS file of **Active Care Homes Data**.

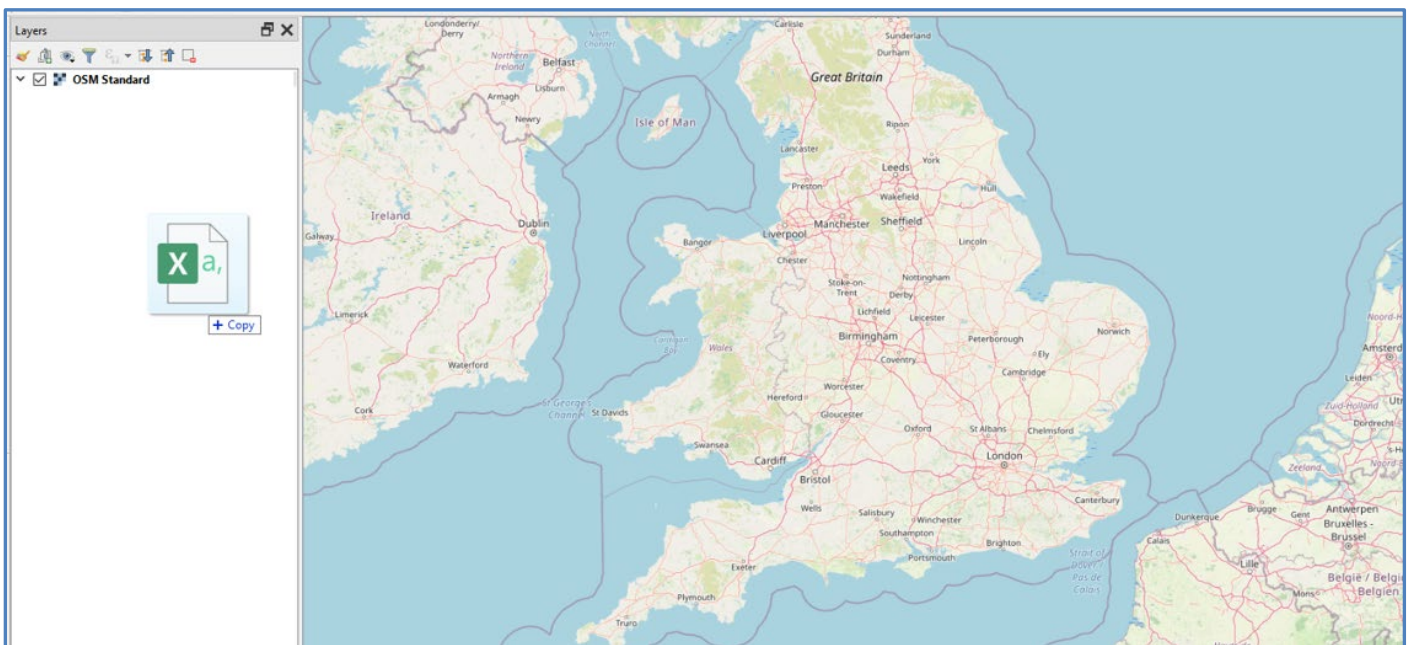
	L	S	X	Y	Z	AA	AB	AC
1	Location Primary Inspection Category	Location ONSPD CCG	Location City	County	postcode	uprn	latitude	longitude
2	Residential social care	NHS Hastings and Rother CCG	St Leonards On Sea	East Sussex	TN37 6HR	100062576733	50.857239	0.561998
3	Community based adult social care services	NHS Trafford CCG	Sale	Cheshire	M33 7HF	100012702383	53.427726	-2.323301
4	Residential social care	NHS Lewisham CCG	London		SE6 1HP	100022018752	51.441104	0.002335
5	Residential social care	NHS Devon CCG	Exeter	Devon	EX1 2QE	10013048934	50.721541	-3.508053
6	Residential social care	NHS North Durham CCG	Durham	County Durham	DH1 2QW	100110709841	54.786148	-1.528160
7	Community based adult social care services	NHS Horsham and Mid Sussex CCG	Burgess Hill		RH15 9RN	100062484614	50.956405	-0.939392
8	Community based adult social care services	NHS Blackpool CCG	Blackpool	Lancashire	FY4 3RS	10008476022	53.778139	-3.025127
9	Acute hospital - independent specialist	NHS Dartford, Gravesham and Swanley CCG	Greenhithe	Kent	DA9 9SJ	20000544414	51.438086	0.271001
10	Acute hospital - independent specialist	NHS Cambridgeshire and Peterborough CCG	Cambridge	Cambridgeshire	CB2 3NB	200004214460	52.205264	0.120300
11	Acute hospital - independent specialist	NHS Leeds CCG	Leeds	West Yorkshire	LS1 5AW	72001988	53.798435	-1.545373
12	Acute hospital - independent specialist	NHS Liverpool CCG	Liverpool	Merseyside	L1 8BU	38269202	53.403947	-2.987230
13	Acute hospital - independent specialist	NHS Central London (Westminster) CCG	London		W1G 9AP	100023617681	51.518024	-0.146214
14	Dentists	NHS Buckinghamshire CCG	Aylesbury	Buckinghamshire	HP20 2AH	766259845	51.826584	-0.804515
15	Acute hospital - independent specialist	NHS Camden CCG	London		WC2H 8EL	5083865	51.516194	-0.126701
16	Acute hospital - independent specialist	NHS Hammersmith and Fulham CCG	London		W12 7GF	54144363	51.508054	-0.223670
17	Dentists	NHS Buckinghamshire CCG	Amersham	Buckinghamshire	HP7 9NU	200003289615	51.667723	-0.566641
18	Acute hospital - independent specialist	NHS Manchester CCG	Manchester	Lancashire	M3 4DN	77100617	53.477436	-2.250814
19	Acute hospital - independent specialist	NHS Nene CCG	Northampton	Northamptonshire	NN1 5BT	5039184	52.236378	-0.877334
20	Acute hospital - independent specialist	NHS Norwich CCG	Norwich	Norfolk	NR2 1QD	200004350019	52.627360	1.293481
21	Acute hospital - independent specialist	NHS Nottingham City CCG	Nottingham	Nottinghamshire	NG1 7DD	100023095283	53.950930	-1.149030
22	Acute hospital - independent specialist	NHS Sheffield CCG	Sheffield	South Yorkshire	S9 1EP	10022927827	53.414067	-1.412799
23	Dentists	NHS Greenwich CCG	London		SE9 3UL	100023283293	51.436693	0.073450
24	Residential social care	NHS High Weald Lewes Havens CCG	Mayfield	East Sussex	TN10 6TZ	100062555534	51.019245	0.278748
25	Community based adult social care services	NHS Bristol, North Somerset and South Gloucestershire CCG	Bristol	Avon	BS16 5EL	520329	51.481001	-2.513506
26	Community based adult social care services	NHS Barking and Dagenham CCG	Barking		IG11 7BZ	1000525264	51.533744	0.074525
27	Dentists	NHS Sheffield CCG	Sheffield	South Yorkshire	S6 3BZ	100052187579	53.398699	-1.480759
28	Acute Services - Non Hospital	NHS North Norfolk CCG	Fakenham	Norfolk	NR21 8BQ	10034796177	52.830843	0.852113
29	Community based adult social care services	NHS Barnsley CCG	Barnsley		S71 1HH	100022877231	53.550012	-1.465128
30	Dentists	NHS Sandwell and West Birmingham CCG	Birmingham	West Midlands	B19 2ER	100070444993	52.497661	-1.904123
31	Residential social care	NHS Birmingham and Solihull CCG	Birmingham	West Midlands	B31 2TX	1000070537642	52.399843	-1.989241
32	Residential social care	NHS West Lancashire CCG	Skelmersdale	Lancashire	WN8 0PY	100010676589	53.548556	-2.726982
33	Community based adult social care services	NHS Surrey Downs CCG	Surbiton	Surrey	KT6 5JY	100061321441	51.387763	-0.318231
34	Acute hospital - independent specialist	NHS Bristol, North Somerset and South Gloucestershire CCG	Bristol		BS5 7PH	92115	51.460577	-2.528707
35	GP Practices	NHS Derby and Derbyshire CCG	Derby	Derbyshire	DE65 6QT	10090307359	52.850285	-1.566835
36	Residential social care	NHS Doncaster CCG	Doncaster	South Yorkshire	DN12 4AR	100050786276	53.487655	-1.250201
37	Residential social care	NHS Doncaster CCG	Doncaster	South Yorkshire	DN11 9AG	10006587480	53.456692	-1.147388

The data provided had very useful information about the **Location**, **Type of service** and **Quality of service** of each provider. Each of these attributes could be used for spatial analysis and styling.

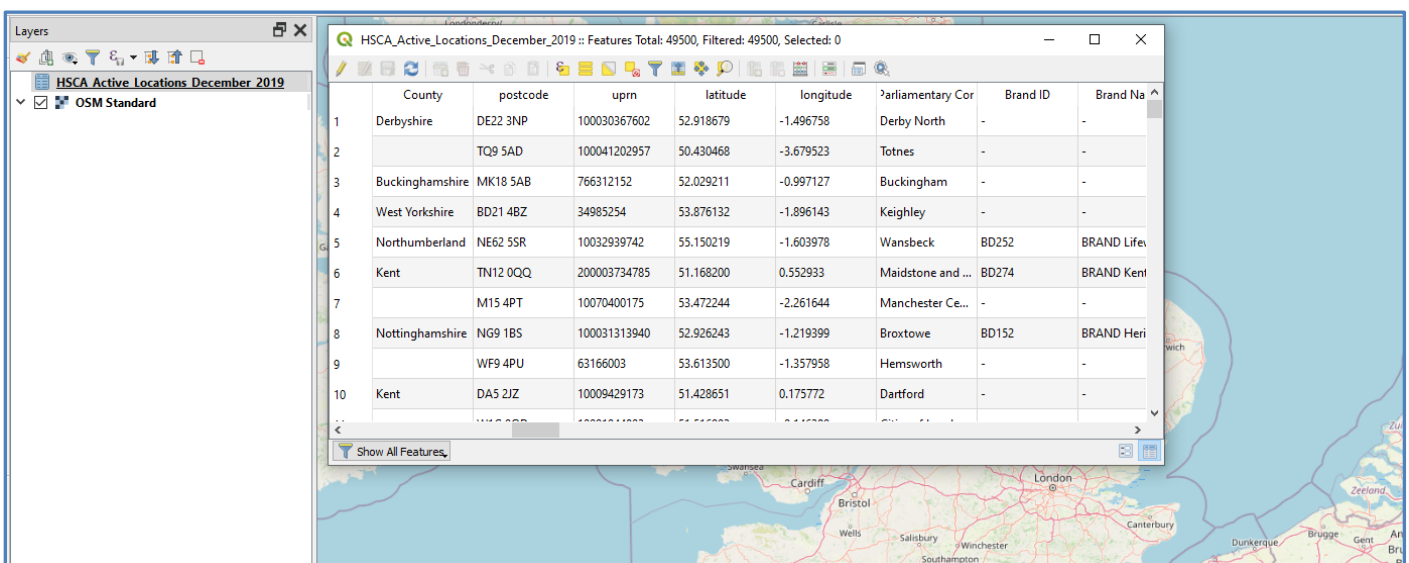
Care home?	Location Name	Care homes beds	Directorate	Location Latest Overall Rating
Y	Kingswood House Nursing Home	22	Adult social care	Good
Y	Little Haven	15	Adult social care	Good
Y	Highlands Borders Care Home	27	Adult social care	Good
Y	Belmont Grange Nursing and Residential Home	30	Adult social care	Outstanding
Y	Mayfield Adult Services	4	Adult social care	Good
Y	Meadow Rose Nursing Home	56	Adult social care	Requires improvement
Y	The Spinney Nursing Home	35	Adult social care	Requires improvement
Y	Ashdale Care Home	22	Adult social care	Good
Y	The Hall	10	Adult social care	Good
Y	Ashlea House	4	Adult social care	Good
Y	Birch House	5	Adult social care	Good
Y	Sunnyside	4	Adult social care	Inadequate
Y	Poplars Care Home	14	Adult social care	Inadequate
Y	Peace Manor Residential Care Ltd - Waverley	4	Adult social care	Good
Y	Knightsbridge Lodge	22	Adult social care	Good
Y	Cygnets House	2	Adult social care	Good
Y	Wiltshire Heights Care Home	63	Adult social care	Outstanding
Y	Ambleside	60	Adult social care	Good
Y	Clearbury	4	Adult social care	Good
Y	Ashley House	16	Adult social care	Good

2 – QGIS

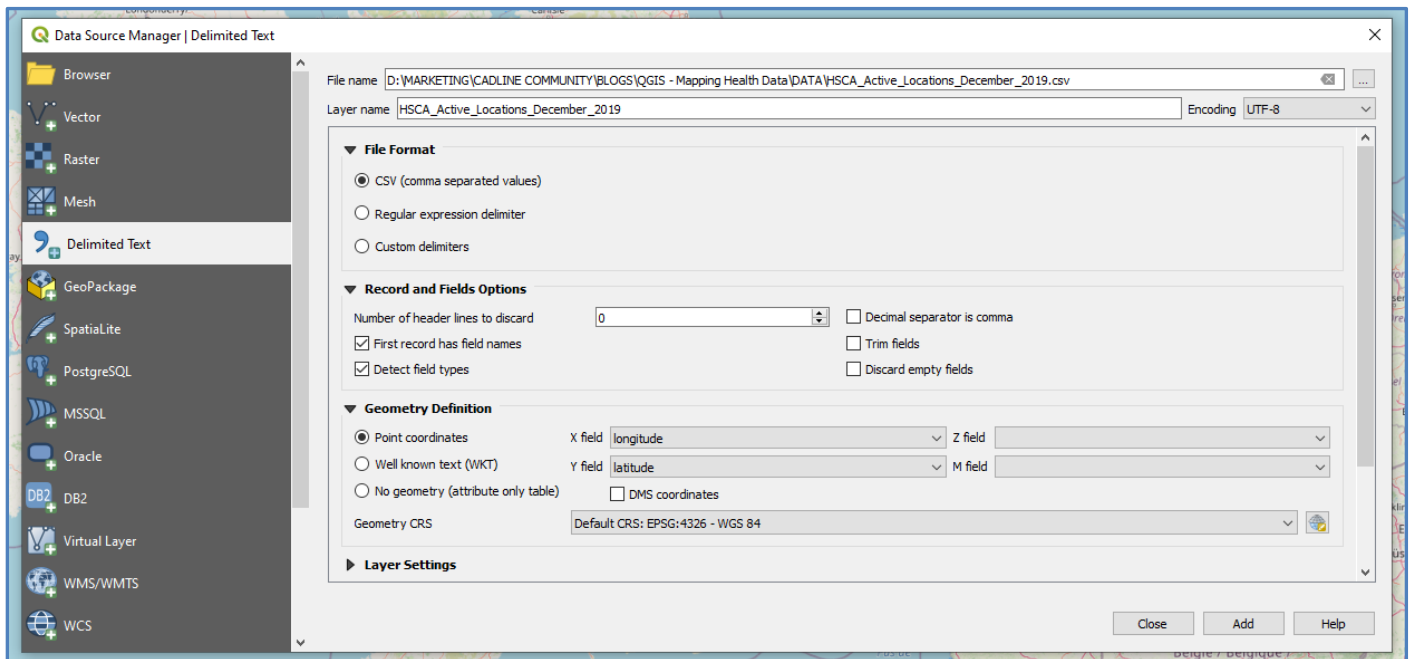
To open the data within QGIS we simply dragged and dropped the **XLS** file into the QGIS Layers Panel.



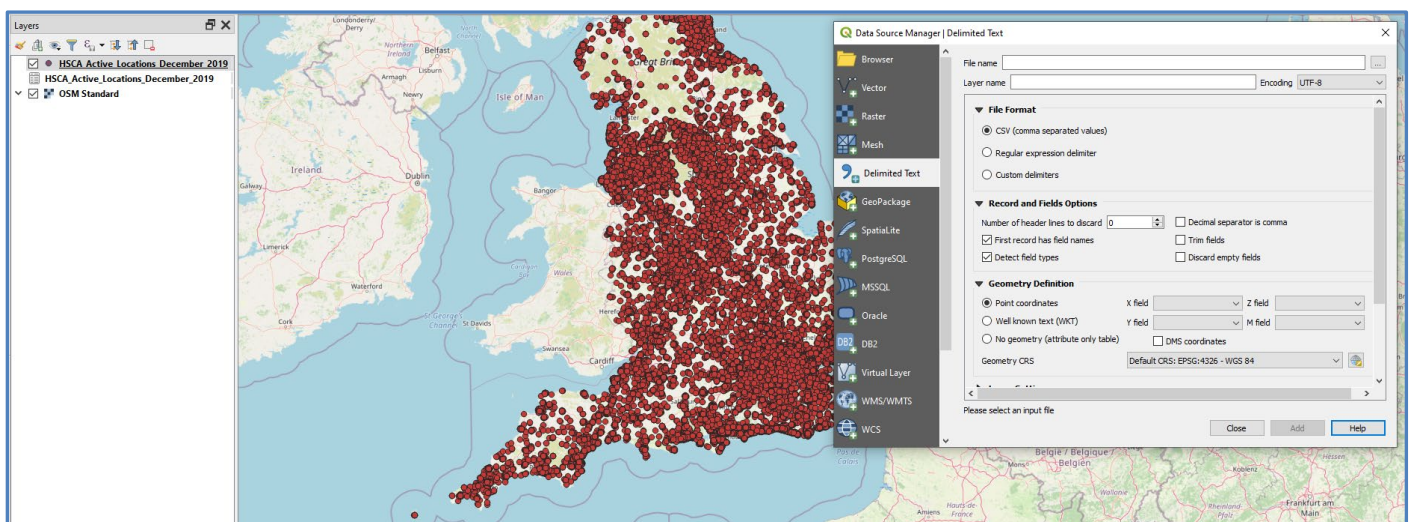
Each Care Home record had an **Address**, but more importantly they also had **coordinates** in Longitude and Latitude which will make it even easier to create them as Points within the map.



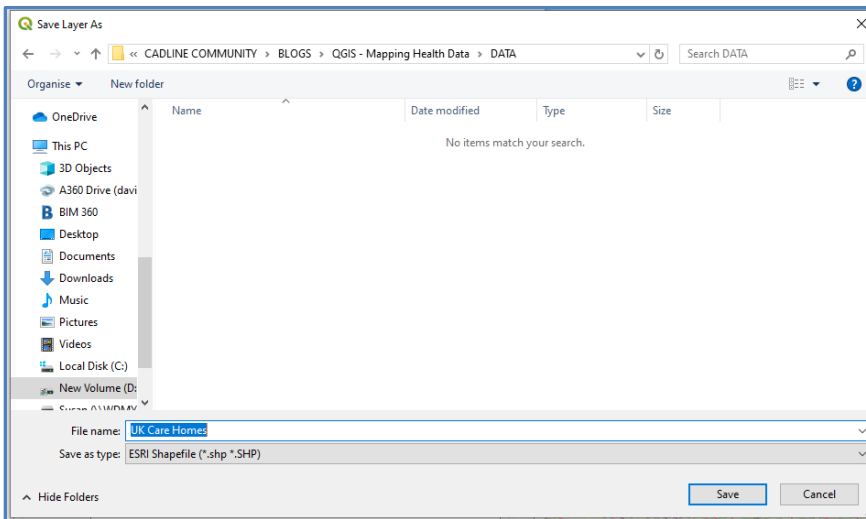
Using the **Add Delimited Text File** option, we simply pointed to our XLS file and created Points using the Longitudes and Latitude coordinates.



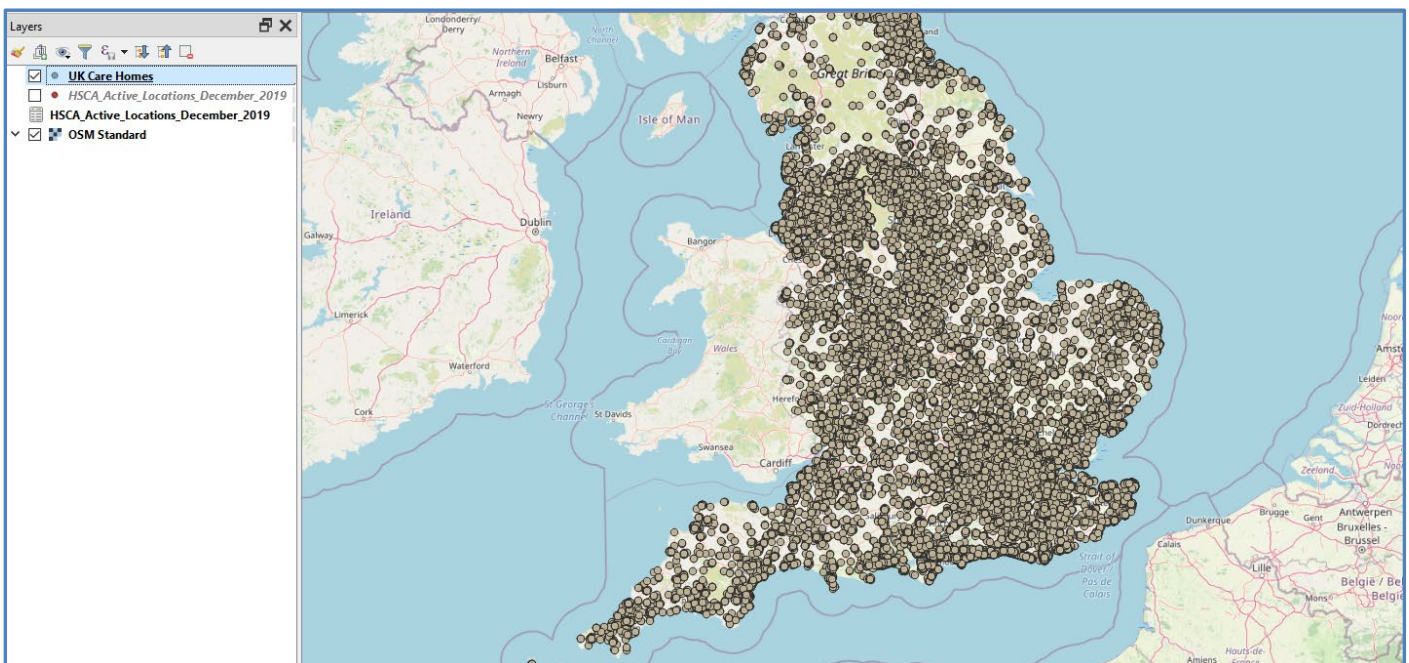
Once the routine was applied, we now had all the Care Home Points created within the Map.



In order to work with our other spatial data, we then saved the Points Layer as a new Shapefile in **British National Grid (27700)**.



And the Shapefile of UK Care Homes was then automatically added to the map for analysis.

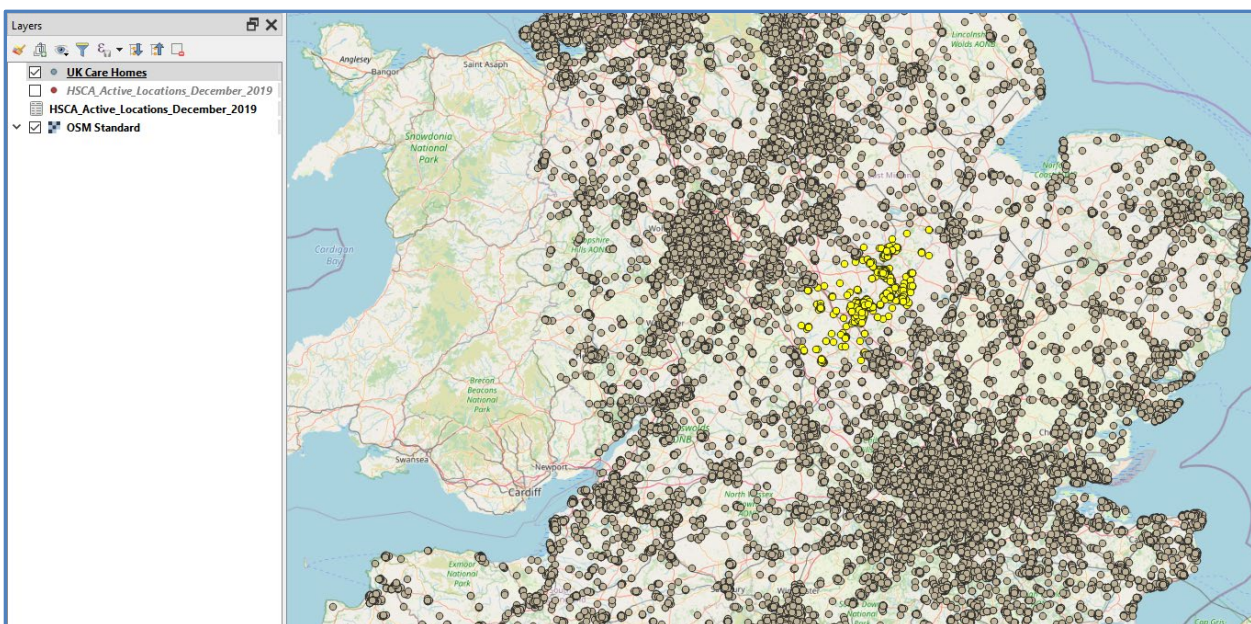
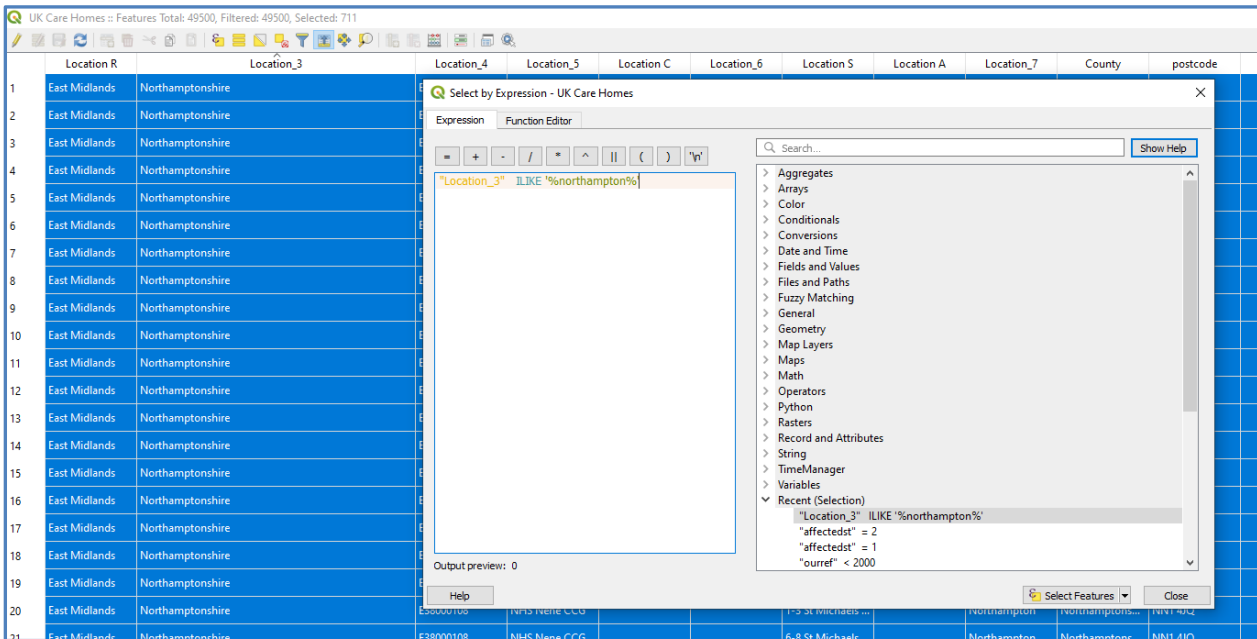


SQL Select

Our first step in analysing the data was to use **Structured Query Language (SQL)** to then filter the UK Care Homes file to show just those records in **Northampton**. This can be done using the **Expression Builder** in QGIS.

Using the **Expression Builder** we selected just those records where their **Location** value has **Northampton** within the name. As below we used the **ILike** Operator to remove any case sensitivity.

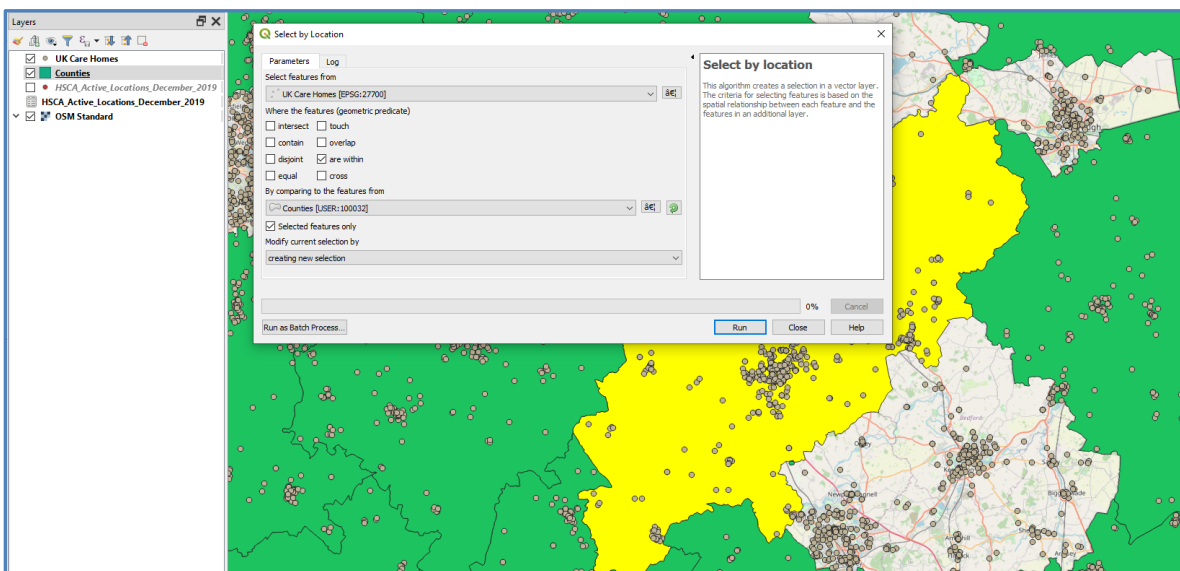
```
"Location_3" ILIKE  
"%northampton%"
```



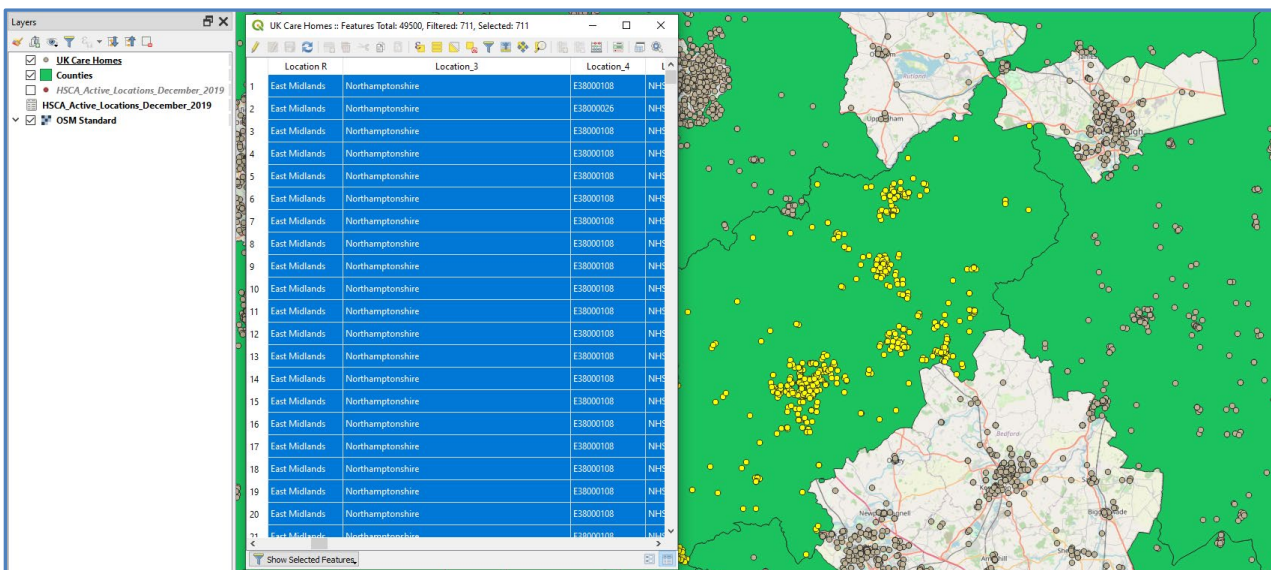
Spatial Select

Another method to select the Points within Northamptonshire would be to **spatially** identify the Points that fall in the County Boundary. This is often a more accurate technique as it will remove errors where attribute data is incorrect or missing.

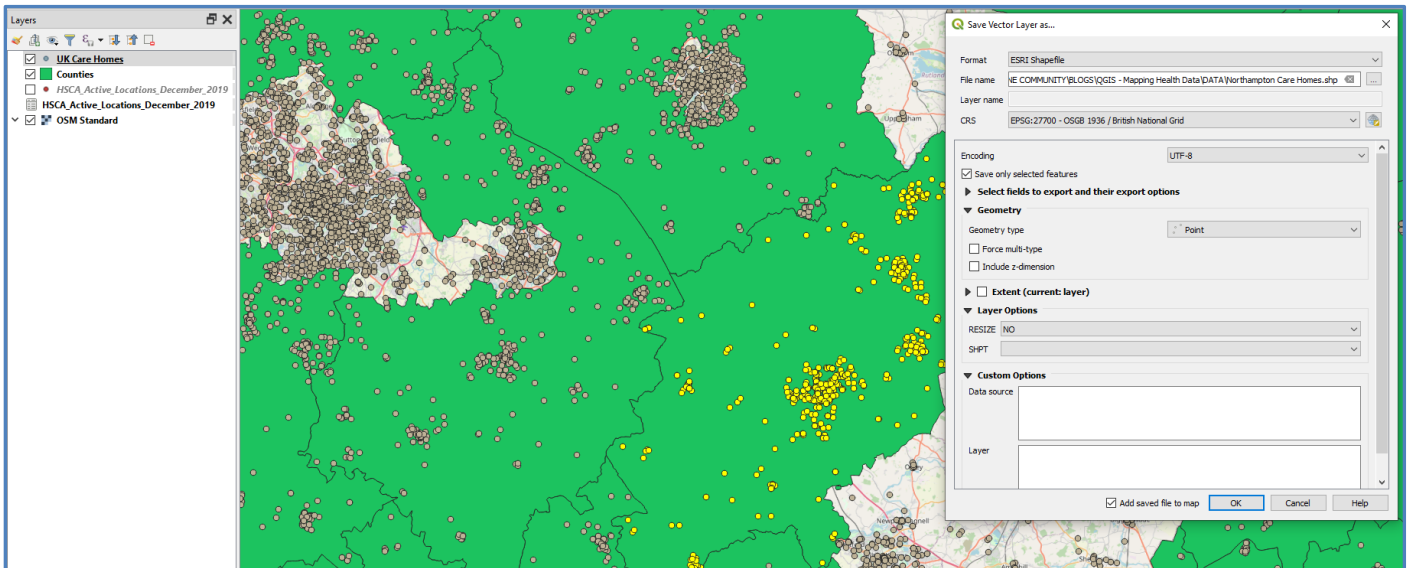
In QGIS we ran the **Select by Location** tool which is available from the **Vector > Research** menu.



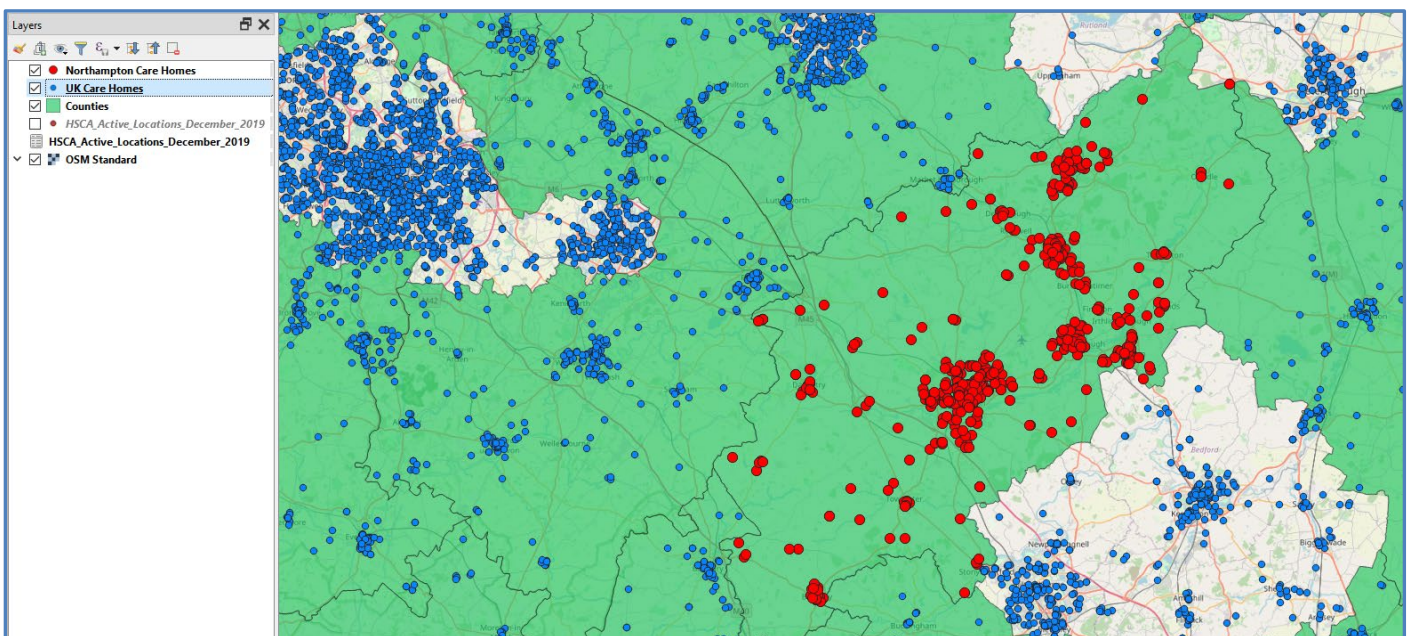
Using the County Boundary of Northamptonshire (pre-selected) we were then able to find all the Points within that area – now displayed as **yellow dots** in the map.



Again, by exporting the results – only those **currently selected** - we created a New GIS Layer to add to the Map.



Changing the colour of this new layer it's now easier to see those points within the boundary of Northamptonshire.

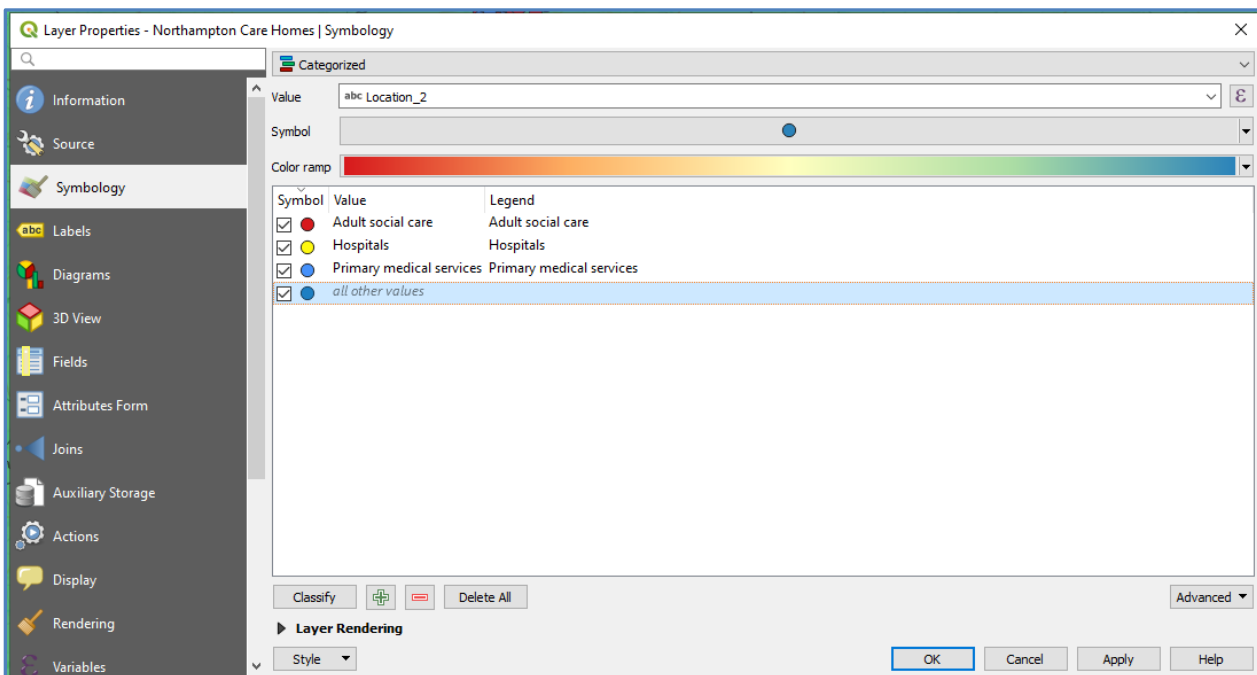


Thematic Maps – to Show Type of Service

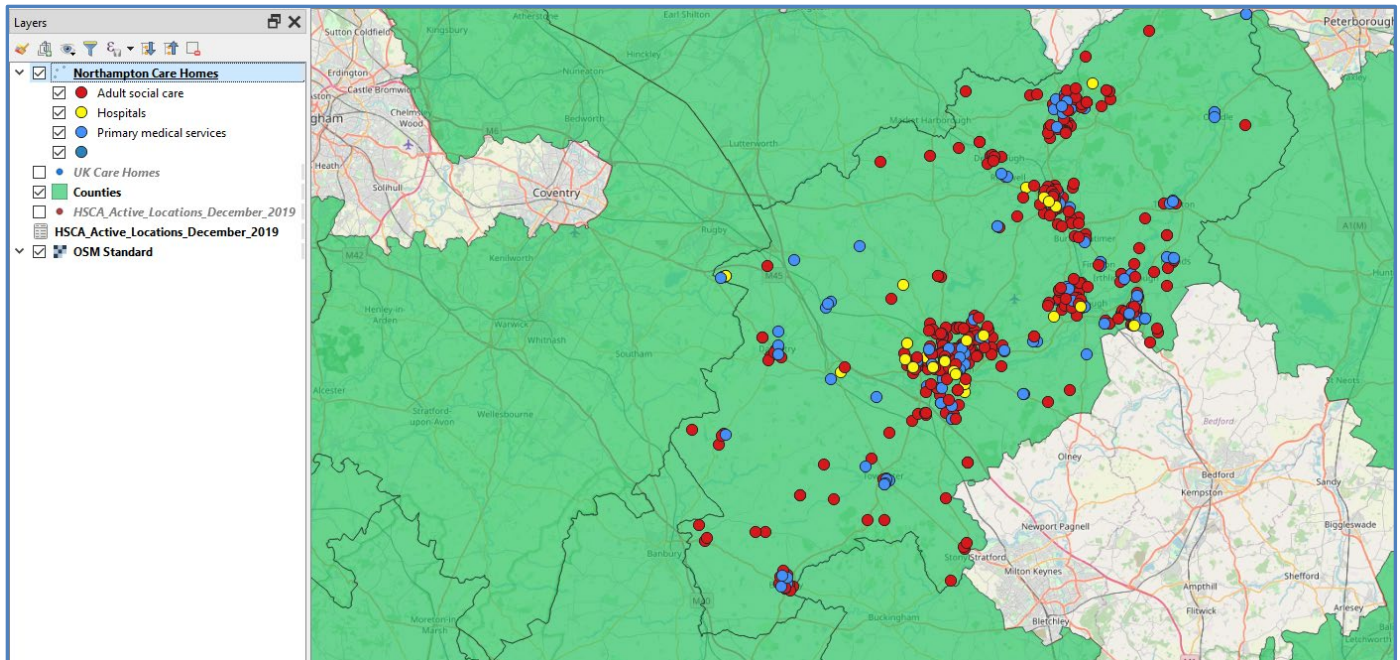
A common GIS task is to take the **Attribute** information, in this case the **Type of Care Facility** to then thematically colour the Point Objects within the map.

	Location_1	Location_2	Location P
160	Social Care Org	Adult social care	Community ba...
161	Social Care Org	Adult social care	Residential soci...
162	Social Care Org	Adult social care	Residential soci...
163	Social Care Org	Adult social care	Community ba...
164	Social Care Org	Adult social care	Community ba...
165	Social Care Org	Adult social care	Residential soci...
166	Primary Dental Care	Primary medical services	Dentists
167	Independent Healthcare Org	Hospitals	Acute hospital ...
168	Social Care Org	Adult social care	Residential soci...
169	Social Care Org	Adult social care	Community ba...
170	Social Care Org	Adult social care	Residential soci...
171	Independent Healthcare Org	Primary medical services	Prison Healthcare
172	Social Care Org	Adult social care	Residential soci...
173	Social Care Org	Adult social care	Residential soci...
174	Social Care Org	Adult social care	Community ba...
175	Social Care Org	Adult social care	Residential soci...

The Thematic is created by simply changing the **Symbology** option from **Single Symbol** to **Categorized**, choosing the field to use (**Location_2**) and applying a Style/Colour for each Unique value.



Once applied it is now more obvious to the User what **Type of Facility** each Point represents. A **Legend** is also auto generated next to the map, which can then be printed to enable a wider audience to better interpret the map.

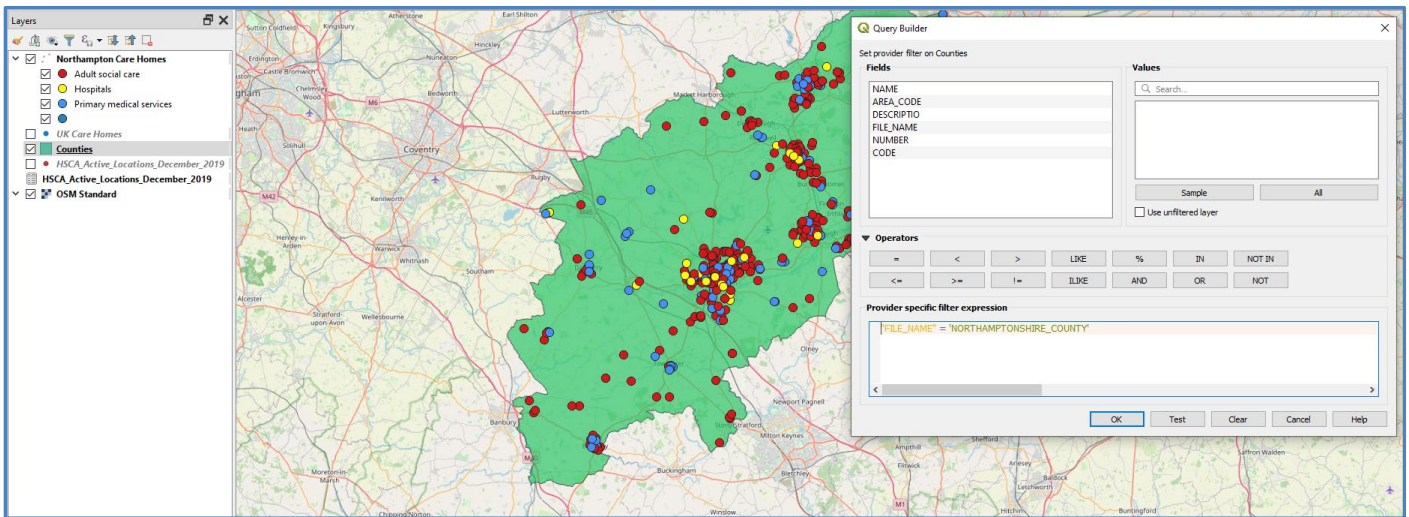


Masking Maps

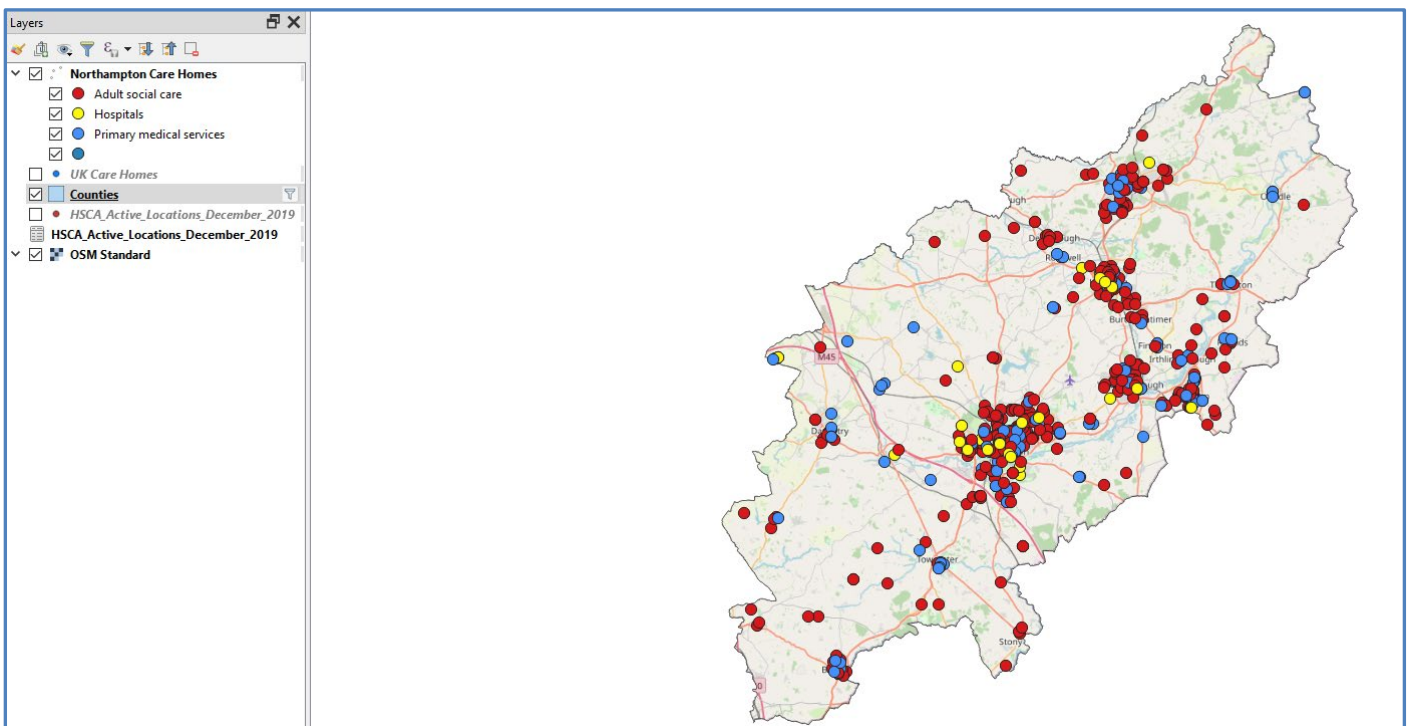
In the Cadline FAQ below, we have explored how to use a **Masking** technique to hide data that isn't important to our analysis:

<https://www.cadlinecommunity.co.uk/hc/en-us/articles/360004789857-QGIS-Creating-Masks>

The Masking option is very easily achieved by applying a **Filter** to the Counties Layer where the Name is '**Northamptonshire**'.

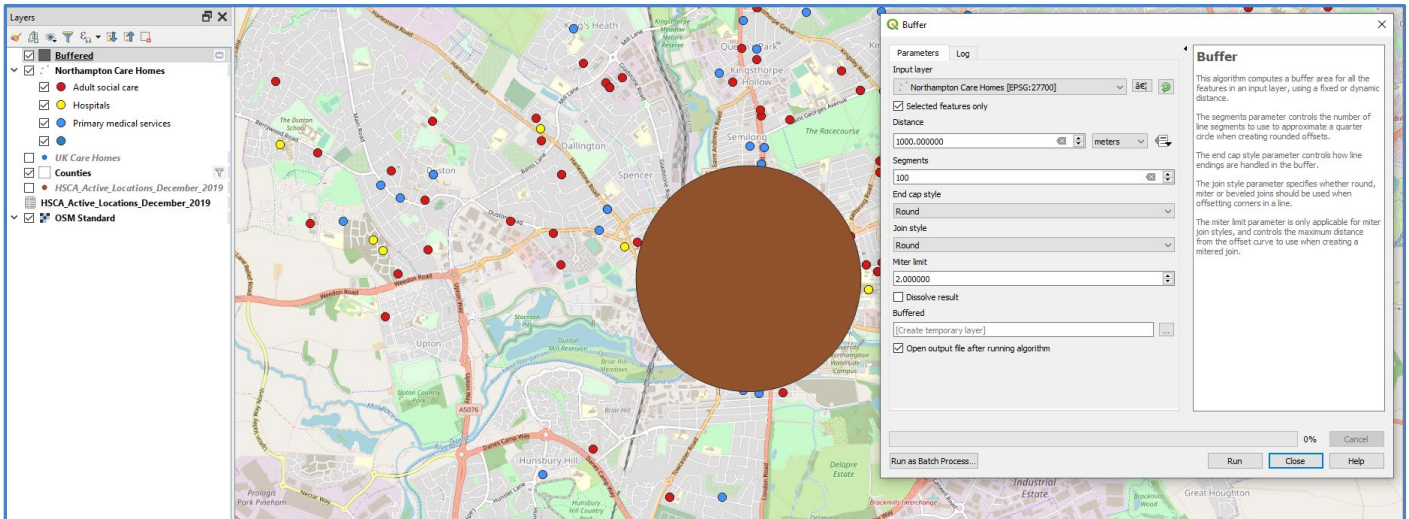


And then applying an **Inverted Polygon Style** to the Counties Layer, so that all Counties apart from Northamptonshire are coloured in **White**. By then **re-ordering** the Counties above your spatial layers all data is masked apart from those features in Northamptonshire.

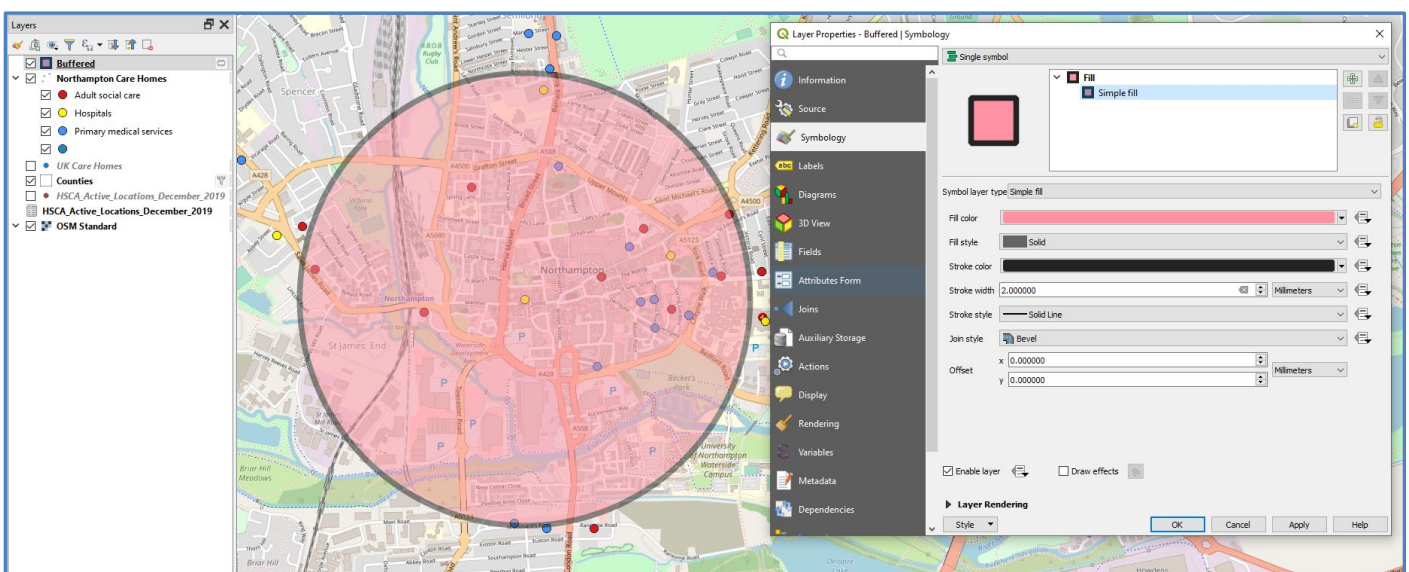


Buffering

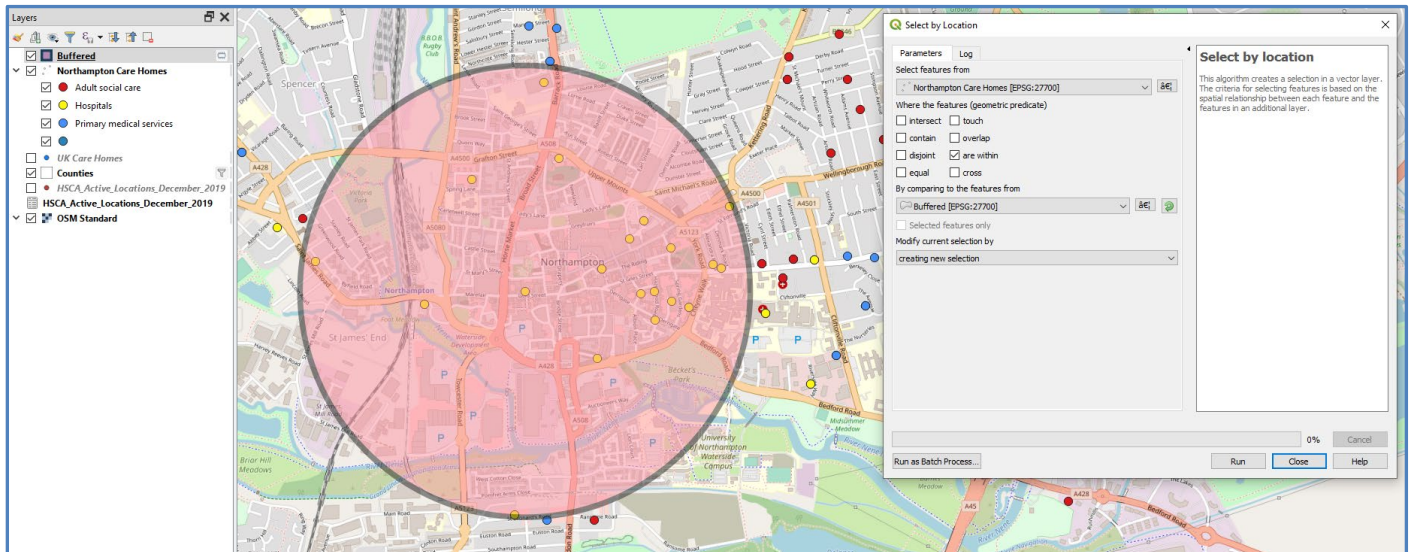
A common geospatial analysis routine is to create **spatial buffers** which can then be used to identify resources within **set distances**. In the example below we created a **1000 metre (1km)** buffer from the centre of Northampton.



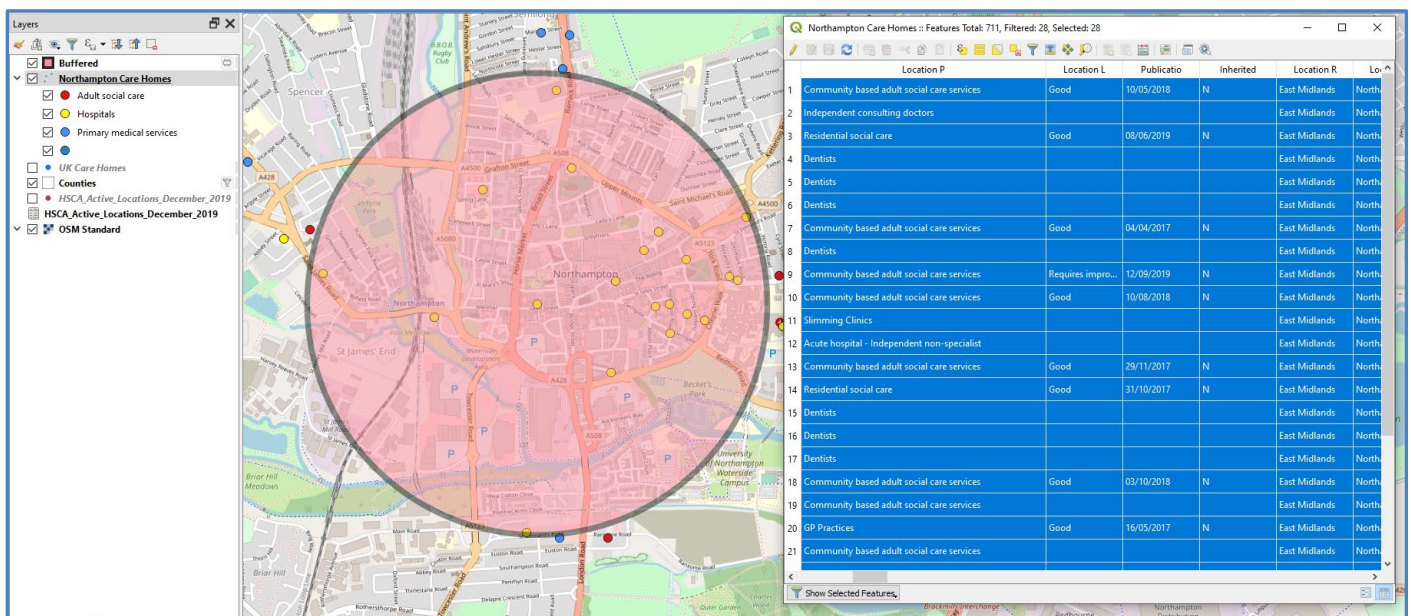
By applying some **Styling** options we were able to make the Buffer object **transparent** so the Care Homes within the 1km are more easily seen.



Again, using the **Select By Location** routine we can use the 1km Buffer object to identify only the Care Home Points within the 1km radius.



With the Points being shown as **yellow** in the map and also selected within the **Table** view, allowing us to determine a **Count** of the Points in the 1km Buffer.

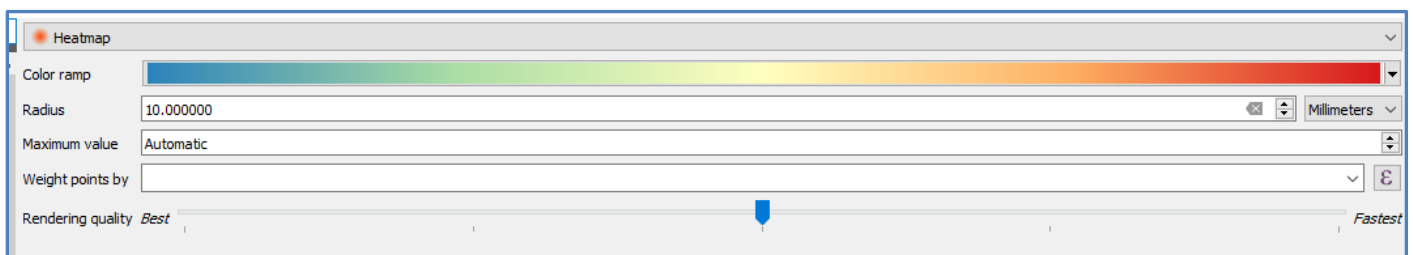


Buffering enables you to understand if your Local Community, especially Vulnerable people, can easily reach resources, or will some necessary action need to be taken to increase coverage within your Local Authority.

Heatmaps

An especially compelling Map can be generated using **heatmaps** from your underlying spatial data. Health Incidents, similar to Crime patterns can more easily be monitored when you take simple Point locations and **interpolate** that geometry to create **hotspot** heatmaps.

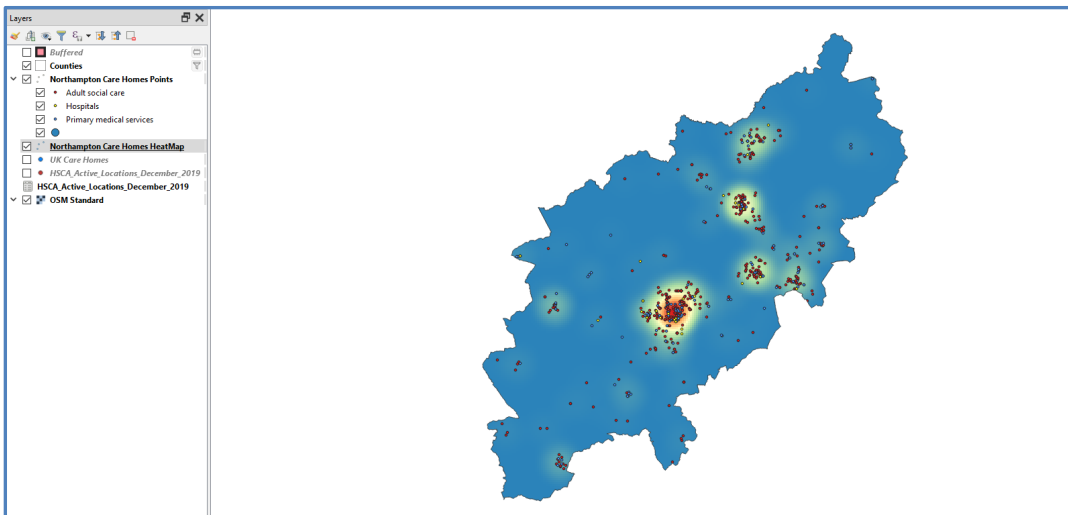
In order to do this we simply **duplicated** the original Care Homes Point Layer and changed the **Layer Properties** to apply a **Heatmap** style.



Choosing a **Colour Ramp** such as **Spectral** then allows you to apply a common styling technique where hotspots are represented as **red colours** and cooler areas shown in **blue**.



If we now move the Counties Mask layer above the Heatmaps Layer we now only show the Heatmap for our Local Authority area.



Routing and Distance Tools

QGIS provides a number of inbuilt and **Plugin** tools for performing distance analysis and many of these have been explored in my previous blog here:

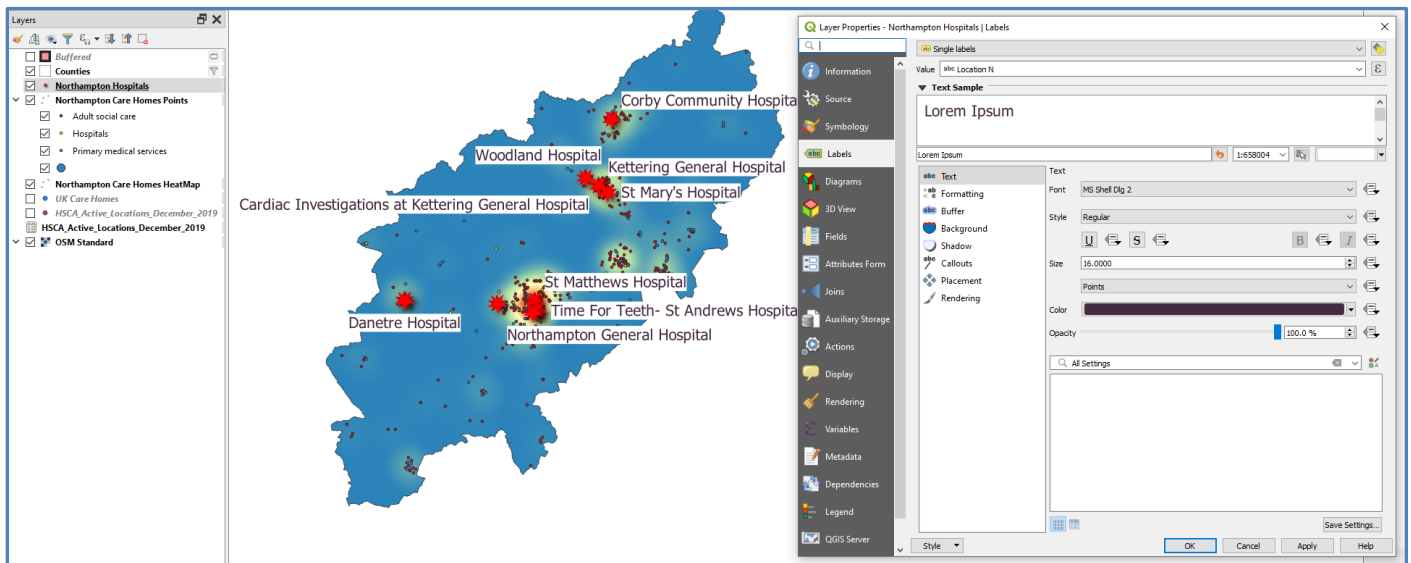
<https://www.cadlinecommunity.co.uk/hc/en-us/articles/360001338178-QGIS-Routing-and-Distance-Tools>

A perfect use for these **Distance Tools** would be to create a **Distance Matrix** from Vulnerable People to their nearest Hospitals.

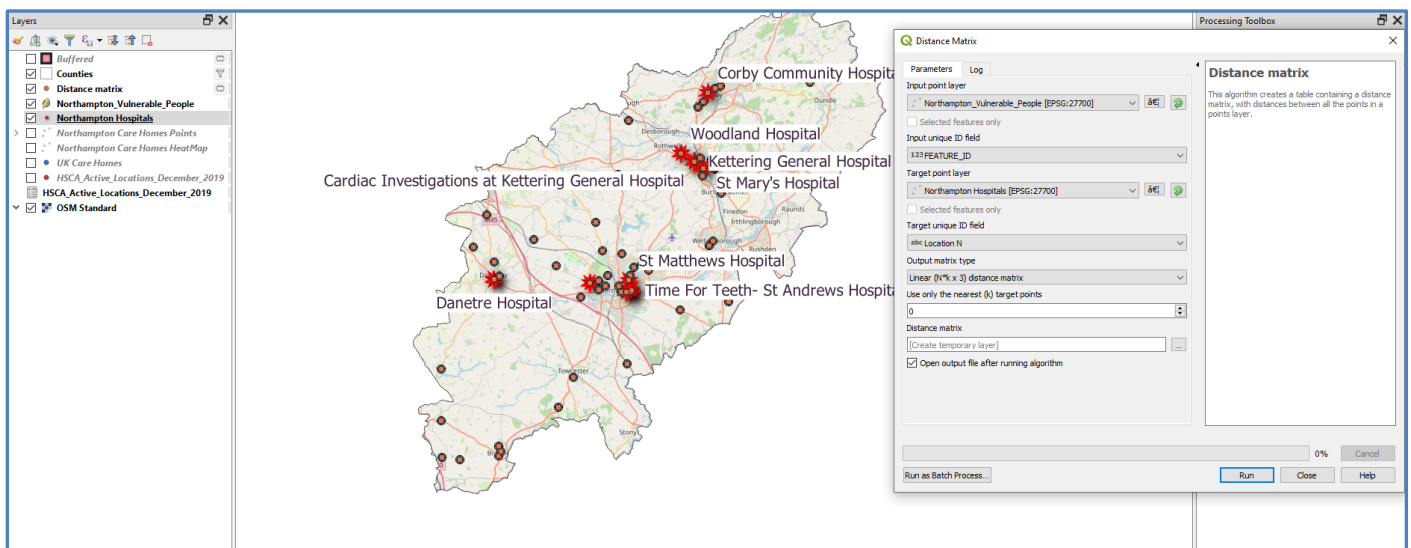
In order to do this we used an **Expression Builder (SQL)** to filter the UK Health Care Data to create a **Hospitals Layer**.

Location ID	Care home?	Location N	Location L
1	16/06/2010	N	Berrywood Hospital
2	29/05/2015	N	BMI Three Shires Hospital
3	03/11/2017	N	Cardiac Investigations at Kettering General Hospital
4	12/04/2016	N	Corby Community Hospital
5	12/04/2016	N	Danetre Hospital
6	17/10/2012	N	Danetre Hospital
7	16/06/2010	N	Kettering General Hospital
8	15/06/2010	N	Northampton General Hospital
9	16/06/2010	N	St Mary's Hospital
10	24/01/2011	N	St Matthews Hospital
11	26/07/2019	N	Time For Teeth- St Andrews Hospital Northampton
12	20/12/2010	N	Woodland Hospital
13	29/03/2016	N	10 Hedgerow Lane
14	19/05/2016	N	11b Brackley Road
15	15/07/2019	N	19 pine ridge
16	05/10/2011	Y	2 Windsor Avenue
17	01/06/2011	N	230 Limited
18	28/06/2018	N	22 Ecton Park Road

Exporting the results as a new GIS File for the **Hospitals**, then allowed us to add the layer into the map and label each hospital.



We then ran the **Distance Matrix** tool to calculate the Distance from each Vulnerable Person to each of the 7 Northamptonshire Hospital Locations.



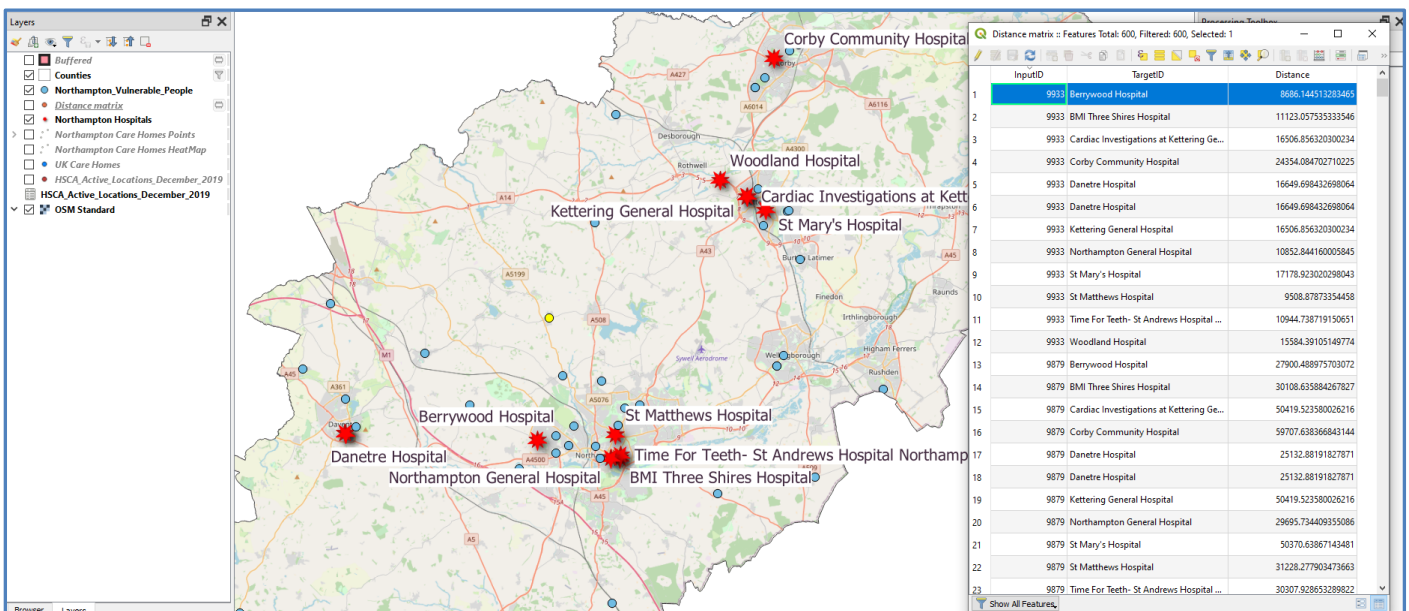
We had **50** Vulnerable Person Points and **7** Hospital Locations, which meant that the Distance Matrix calculated **600** measurements.

Distance matrix :: Features Total: 600, Filtered: 600, Selected: 12

InputID	TargetID	Distance
1	10083 Berrywood Hospital	23736.06527831523
2	10083 BMI Three Shires Hospital	21453.17368205806
3	10083 Cardiac Investigations at Kettering Ge...	943.1754101099865
4	10083 Corby Community Hospital	9309.733920070443
5	10083 Danetre Hospital	34091.71440760153
6	10083 Danetre Hospital	34091.71440760153
7	10083 Kettering General Hospital	943.1754101099865
8	10083 Northampton General Hospital	21765.85126305247
9	10083 St Mary's Hospital	1567.740829483708
10	10083 St Matthews Hospital	20143.183619886233
11	10083 Time For Teeth- St Andrews Hospital ...	21236.188772099278
12	10083 Woodland Hospital	2795.702315957525
13	10210 Berrywood Hospital	18554.8554451559
14	10210 BMI Three Shires Hospital	13757.48288820767
15	10210 Cardiac Investigations at Kettering Ge...	11580.811101876812
16	10210 Corby Community Hospital	21052.400896794334
17	10210 Danetre Hospital	31717.11107610794
18	10210 Danetre Hospital	31717.11107610794
19	10210 Kettering General Hospital	11580.811101876812
20	10210 Northampton General Hospital	14317.049682300581
21	10210 St Mary's Hospital	10400.123238478482
22	10210 St Matthews Hospital	13236.55238370644

Show All Features

Each Vulnerable Person therefore had 7 unique Distance Measurements – one to each Hospital.



QGIS is fully interoperable with **Excel**, so by exporting the Distance Matrix records into Excel we were able to create **Pivot Tables** to summarise and further analyse the results.

The **Pivot Table** view made it very easy to identify **distances** from each Vulnerable Person to each Hospital.

	A	B	C	D
1				
2				
3	Row Labels	Sum of Distance		
4	ID10083	192077.4193		
5	Berrywood Hospital	23736.06528		
6	BMI Three Shires Hospital	21453.17368		
7	Cardiac Investigations at Kettering General Hospital	943.1754101		
8	Corby Community Hospital	9309.73392		
9	Danetre Hospital	68183.42882		
10	Kettering General Hospital	943.1754101		
11	Northampton General Hospital	21765.85126		
12	St Mary's Hospital	1567.740829		
13	St Matthews Hospital	20143.18362		
14	Time For Teeth- St Andrews Hospital Northampton	21236.18877		
15	Woodland Hospital	2795.702316		
16	ID10210	204758.7079		
17	Berrywood Hospital	18554.85545		
18	BMI Three Shires Hospital	13757.48289		
19	Cardiac Investigations at Kettering General Hospital	11580.8111		
20	Corby Community Hospital	21052.40089		
21	Danetre Hospital	63434.22215		
22	Kettering General Hospital	11580.8111		
23	Northampton General Hospital	14317.04968		
24	St Mary's Hospital	10400.12324		
25	St Matthews Hospital	13236.55238		
26	Time For Teeth- St Andrews Hospital Northampton	13604.9655		
27	Woodland Hospital	13239.43348		
28	ID1087	263928.4723		
29	Berrywood Hospital	13979.0788		
30	BMI Three Shires Hospital	19997.48935		
31	Cardiac Investigations at Kettering General Hospital	31964.51727		

As well as calculate the **Average Distance** and **Minimum Distances** to Hospitals.

	A	B	C
1			
2	Row Labels	Average of Distance	Min of Distance
3	ID10083	16006.45161	943.1754101
4	ID10210	17063.22566	10400.12324
5	ID1087	21994.03936	2446.119286
6	ID1122	21913.90782	10296.15559
7	ID1833	13141.55035	2752.162805
8	ID1860	13044.86201	3909.686787
9	ID1899	21385.45902	13980.71344
10	ID1903	37261.53787	23817.80314
11	ID1911	37710.09035	24501.09159
12	ID1963	13621.14747	4922.745778
13	ID1975	24671.30661	5475.945729
14	ID1977	19469.17041	8739.4406
15	ID2038	16550.1083	5409.926258
16	ID2567	13325.76391	1341.268299
17	ID2803	34386.42015	14854.26823

3 – PostGIS and GeoServer

Having explored a number of desktop GIS techniques for viewing, modeling and analysing Health Care data, the next step is to look at other **Open Source** geospatial tools to better **store** and then **present** that data across the web.

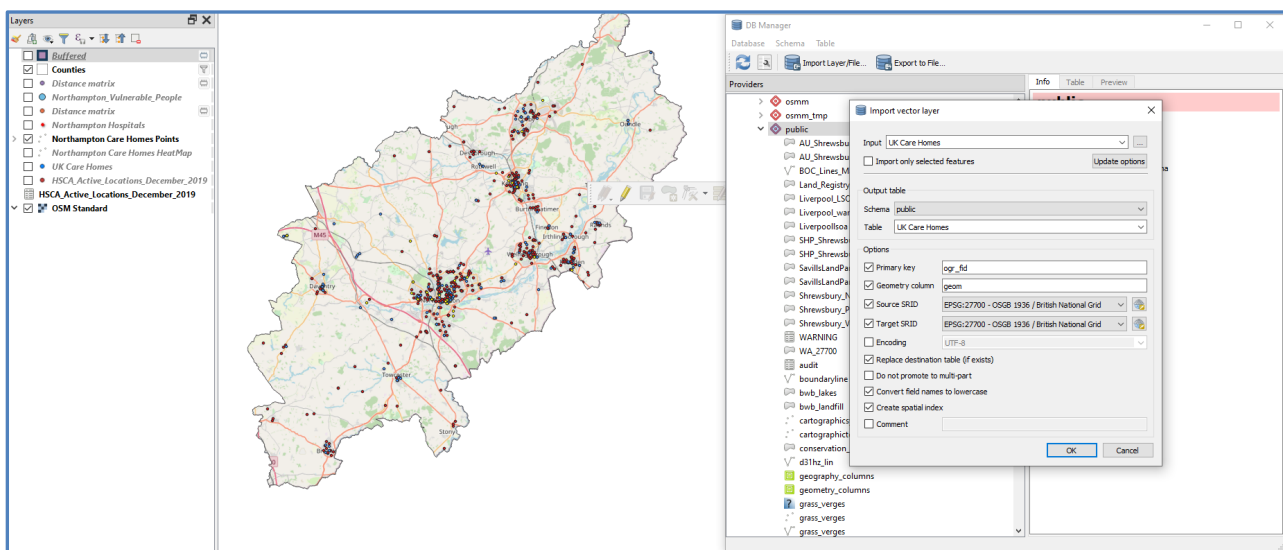
Cadline's Geospatial Team are listed as a Provider of Support for Open Source Geospatial tools for the **OSGeo Community**.



As part of that we deliver an **Introduction to GeoServer** Training course and an **Integrated Open Source GIS** Course, which includes working with PostGIS.

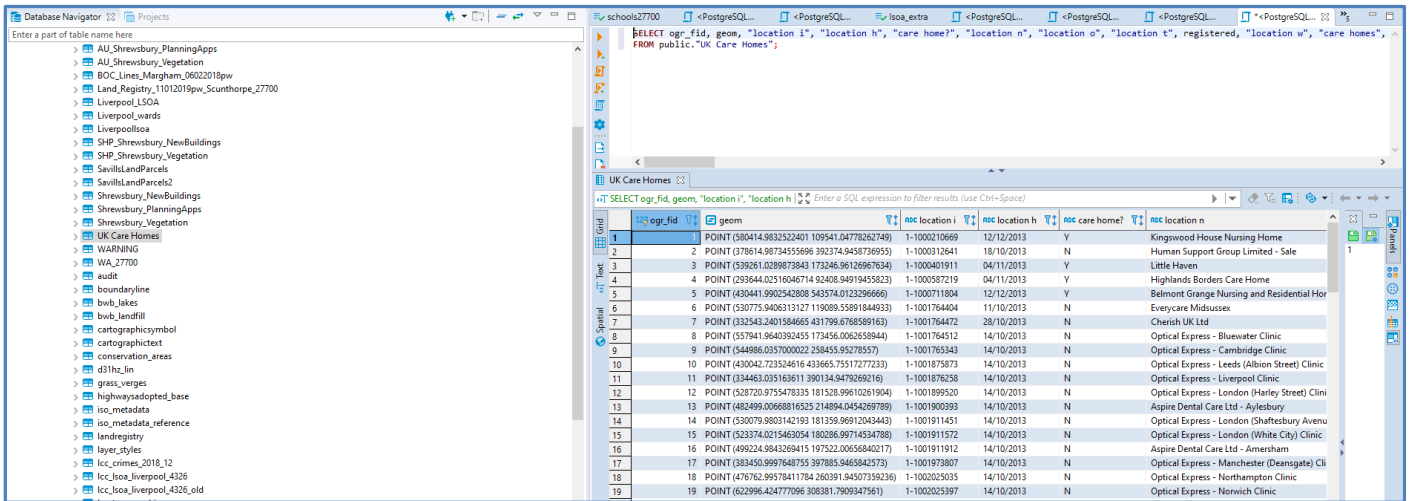
We recommend to all our GIS Clients that both GeoServer and PostGIS will provide the right tools for them to store, manage and publish their spatial datasets and this definitely makes sense for our Health Care information.

Using the integrated **Database Tool** within QGIS, we are able to very easily **upload** the Flat GIS file format into our **PostGIS** Spatial Database.



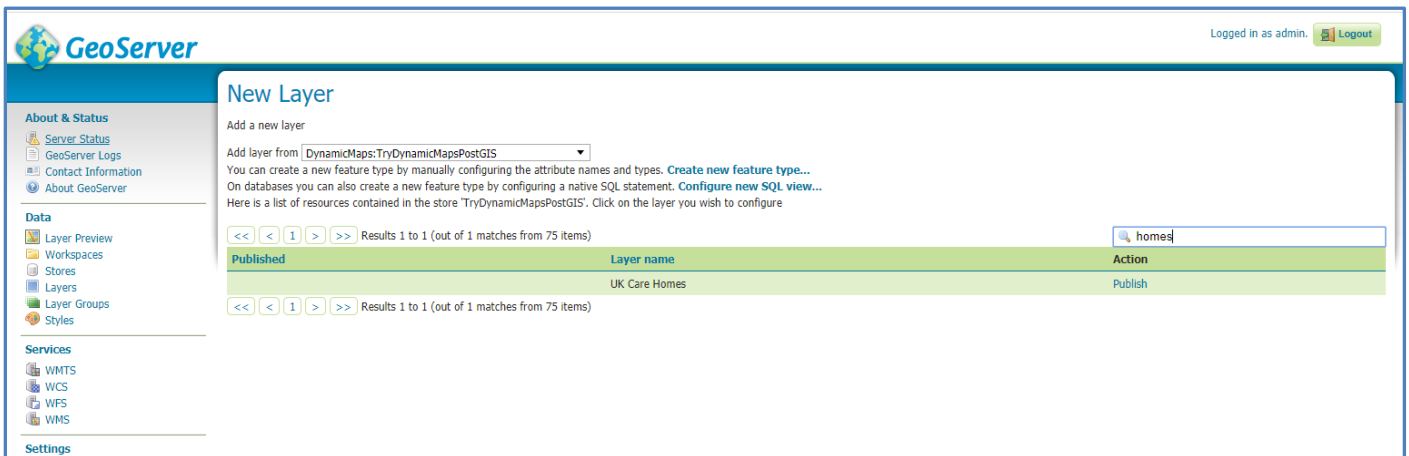
Once uploaded you can either use **PGAdmin** or another User Interface tool such as **DBeaver** to visualise and manage your Health Care Datasets:

<https://www.cadlinecommunity.co.uk/hc/en-us/articles/360003480218-PostGIS-PGAdmin-or-DBeaver->



Having uploaded the spatial data into a PostGIS Database, it's now very easy to publish that data as **Web Map Services (WMS)** via **GeoServer**.

We simply connect GeoServer to our PostGIS Database to **Publish** the UK Care Homes table.



Then create a **New Layer** called UK Care Homes.

The screenshot shows the GeoServer 'Edit Layer' interface. The main title is 'DynamicMaps:UK Care Homes'. Below the title, there are tabs for 'Data', 'Publishing', 'Dimensions', and 'Tile Caching'. The 'Basic Resource Info' section contains the following fields:

- Name: UK Care Homes
- Enabled:
- Advertised:
- Title: UK Care Homes
- Abstract: (empty text area)

By default the UK Care Homes data will be shown as **Red Squares**.....

The screenshot shows a map of the United Kingdom with numerous red squares representing care home locations. Below the map, a data table is displayed with the following columns: fid, ogr_fid, location_i, location_h, care_home?, location_n, location_o, location_t, registered, location_w, care_homes, location_1, location_2, location_p, location_l, publicatio, inherited, location_r, location_3, location_4, and loca. The table contains two rows of data:

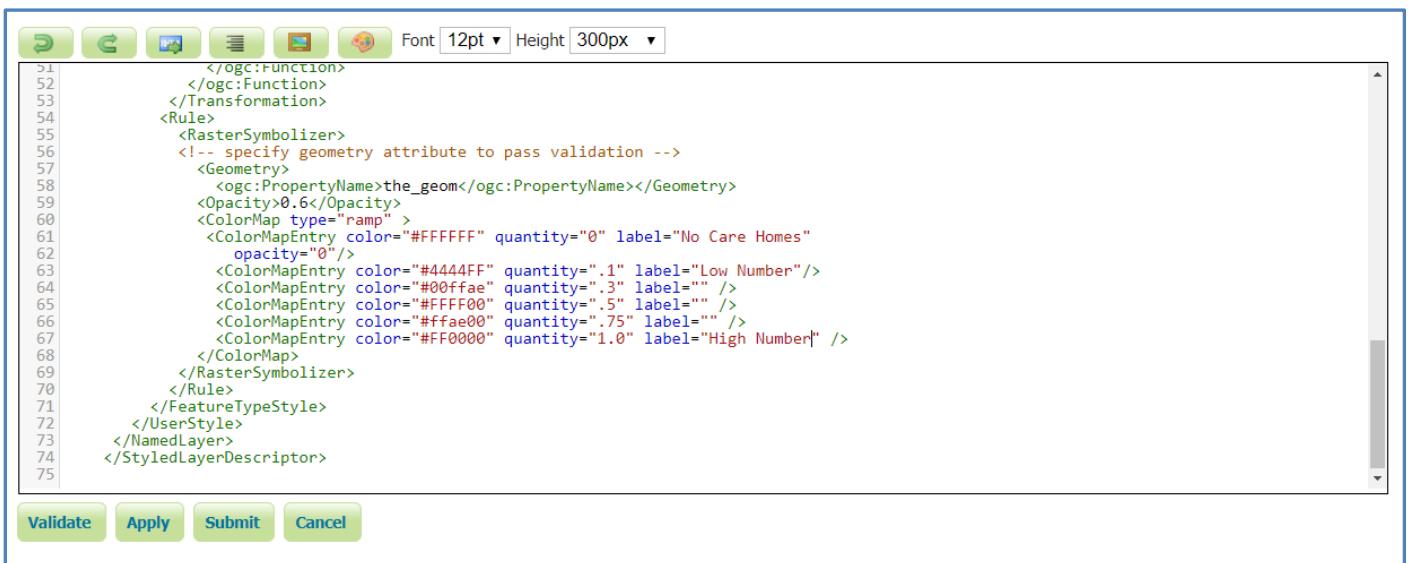
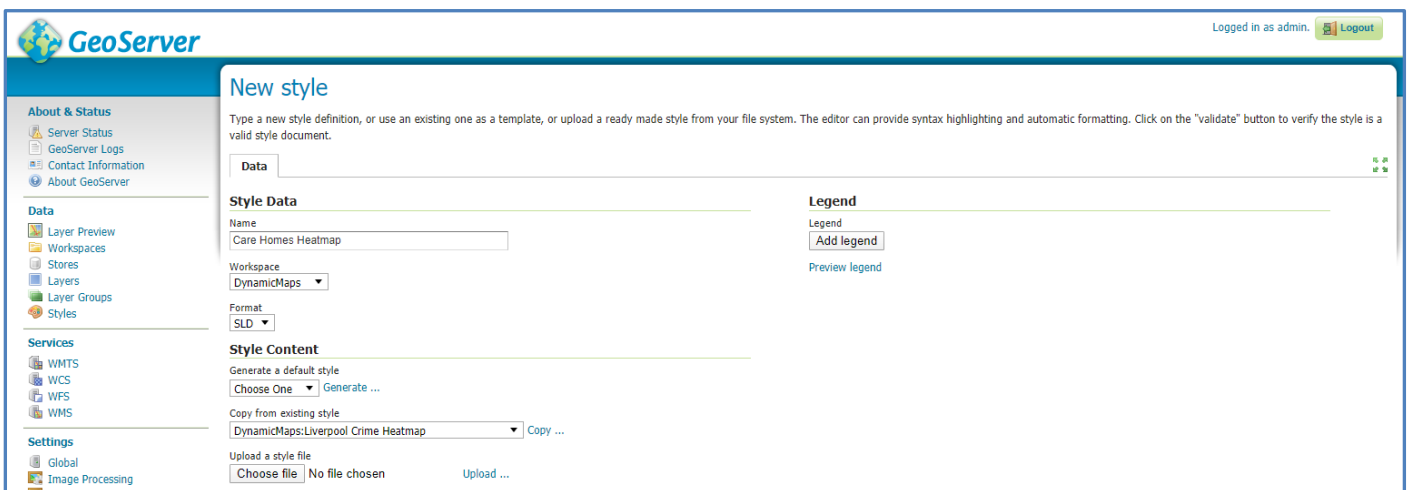
fid	ogr_fid	location_i	location_h	care_home?	location_n	location_o	location_t	registered	location_w	care_homes	location_1	location_2	location_p	location_l	publicatio	inherited	location_r	location_3	location_4	loca
UK Care Homes.199	199	1-1052529329	02/12/2013	N	Appoline Dental Care	V25154	01476563105	*		0	Primary Dental Care	Primary medical services	Dentists				East Midlands	Lincolnshire	E38000165	NHS West Linc CCG
UK Care Homes.1042	1042	1-111193652	09/12/2010	Y	Harrowby Lodge Nursing Home	VLN0E	01476568505	Salt, Julie		30	Social Care Org	Adult social care	Residential social care	Good	01/11/2019	N	East Midlands	Lincolnshire	E38000165	NHS West Linc CCG

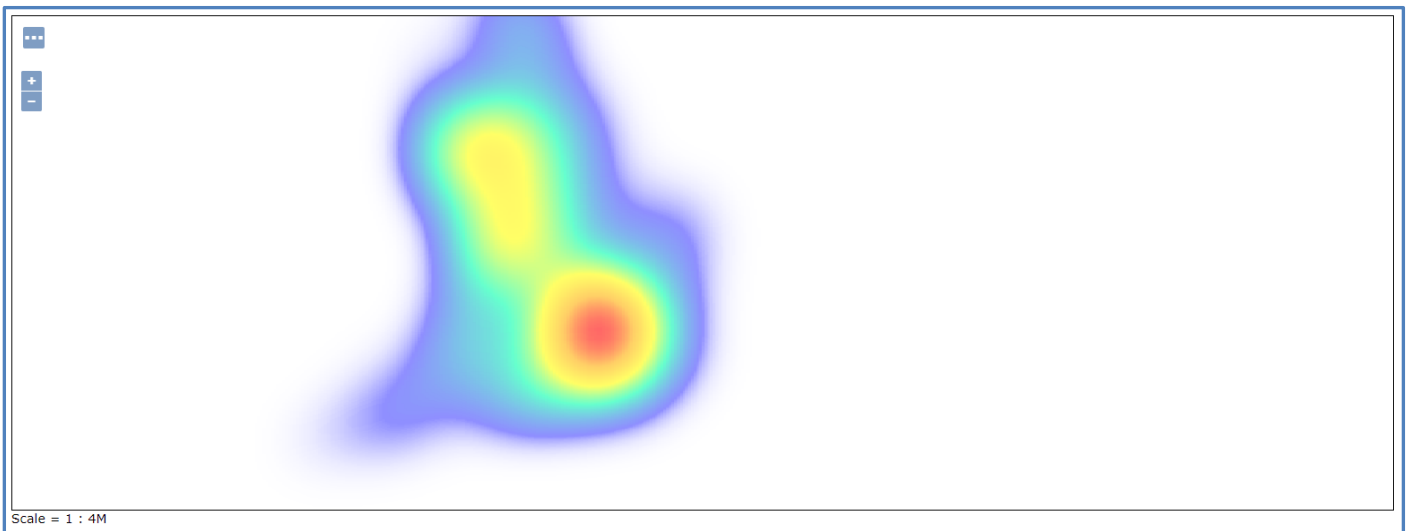
.... but using the power of **Style Layer Descriptors (SLDs)** we can style the data in GeoServer to better meet our needs.

For example, here is a Cadline FAQ on how to generate **Heatmaps** from your WMS Layers –

<https://www.cadlinecommunity.co.uk/hc/en-us/articles/360007408617-GeoServer-Creating-HeatMaps>

The SLD uses a **Vector to Raster Symboliser** and a series of Range Categories to Colour the Map to generate a Heatmap.





Adding this New WMS Layer into our Web Mapping software – **MapThat**

Edit Data Layers

Edit | Role Layers | Layer Headers | Search Parameters | Information Bubbles | Themes

Layer Id: 14856

Layer Name: UK Care Home Heatmap | Layer Type: WMS

Zoom On: 2 | Zoom Off: 22

Opacity: 75 | Opacity Slider:

Show in Tree: | On Off Box:

Display Startup: | Display Priority: 30

Layer SQL Statement: Test SQL

Database: --- | Geo Table Name: ---

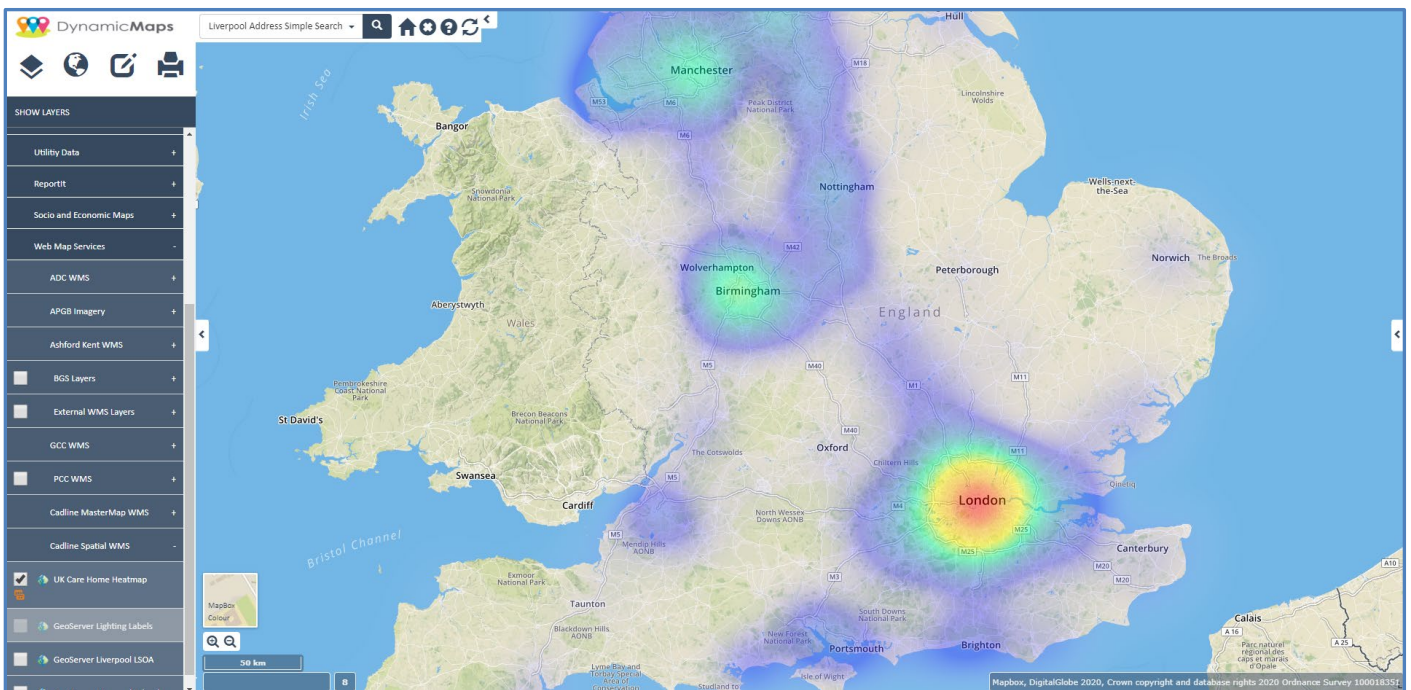
Geo Schema: --- | Geometry Column: ---

Unique Id Fields: --- | Show Record Count:

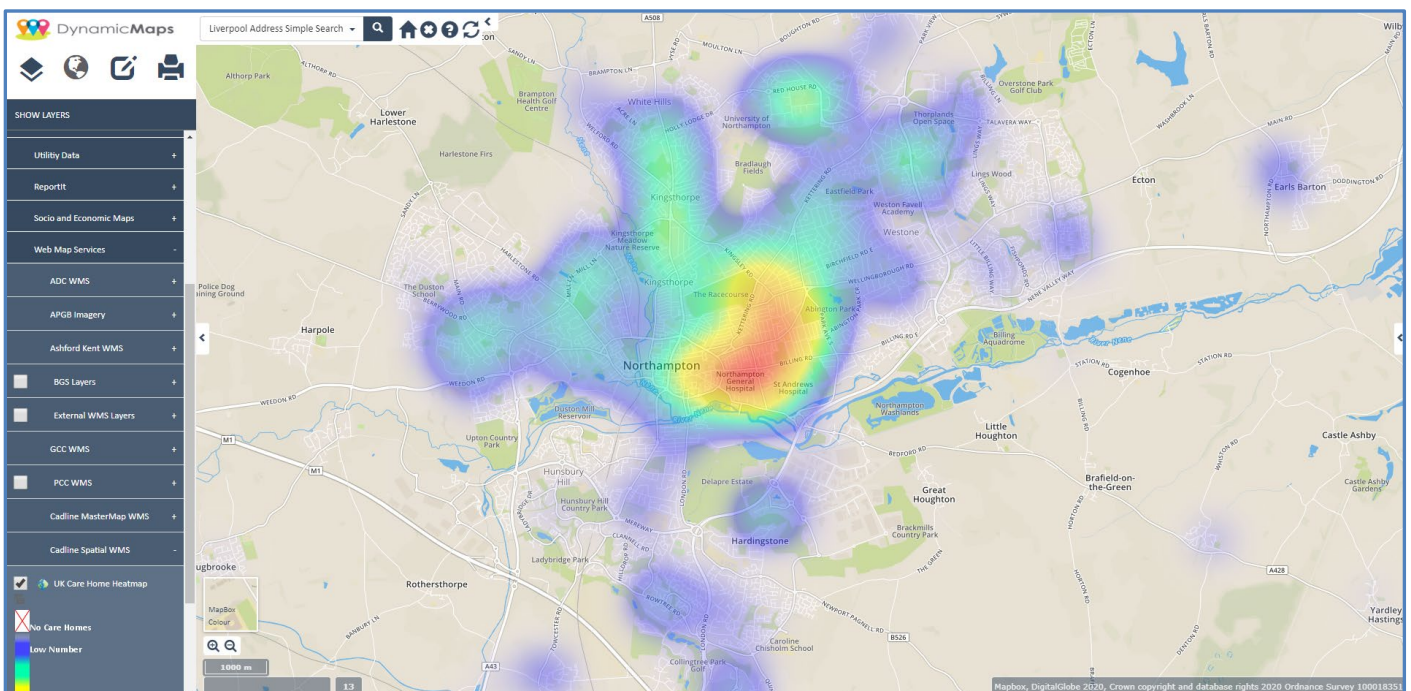
Record Count: ---

WMS/WMTS Link: http://Try.DynamicMaps.co.uk:8080/geoserver/DynamicMaps/wms?service=WMS&version=1.1.0&request=GetMap&layers=DynamicMaps:UK_Care_Homes

.... means we can visualise the UK Care Homes as a **WMS Heatmap!**



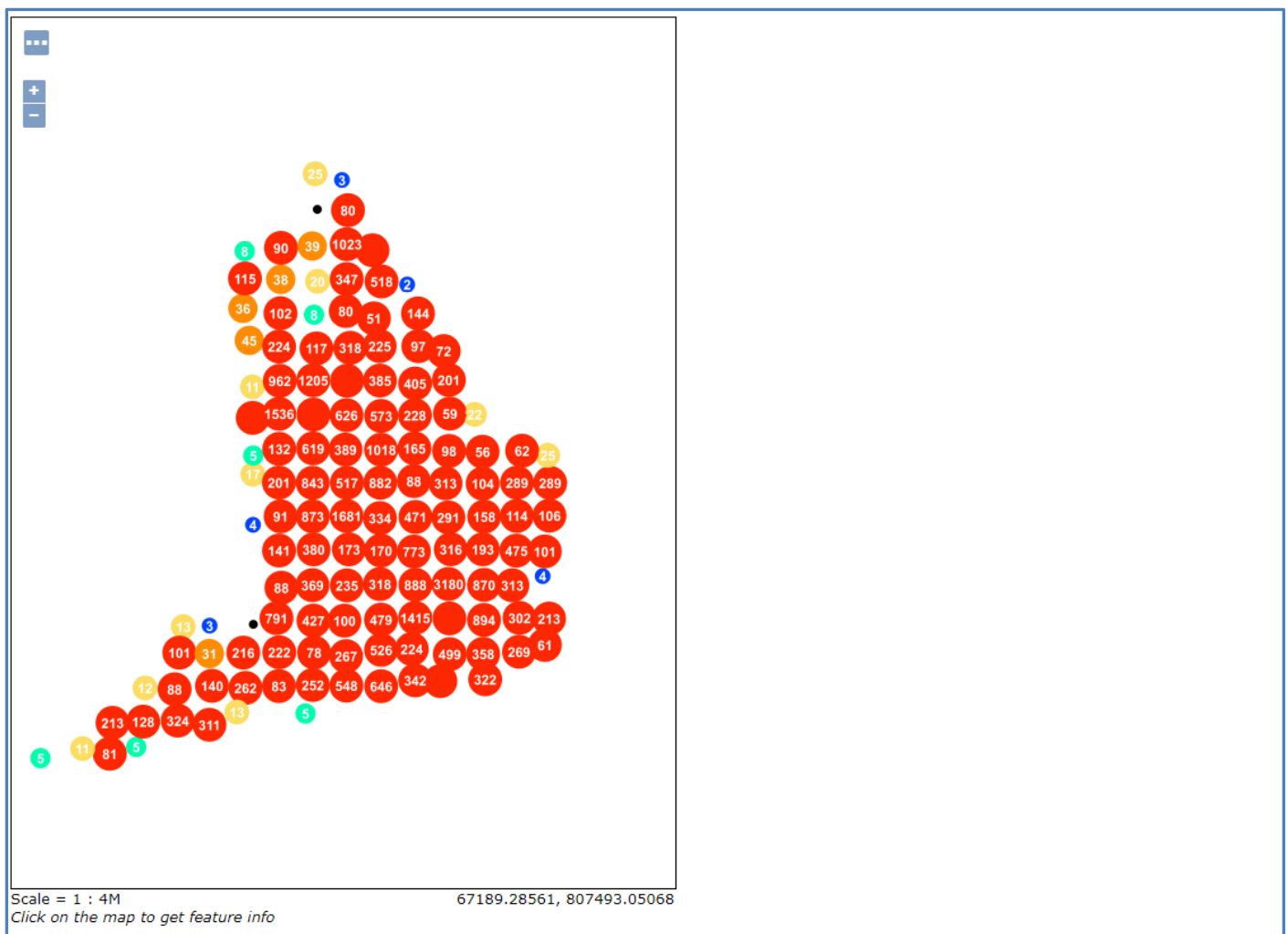
Each time we **zoom in** to a specific geographic location the **Heatmap** is re-calculated, showing the **hotspots** for the underlying point data.



Another great way to visualise Point Data is to use **Clustering**. In GeoServer this is referred to as **Stacked Points** and this FAQ outlines how to achieve this:

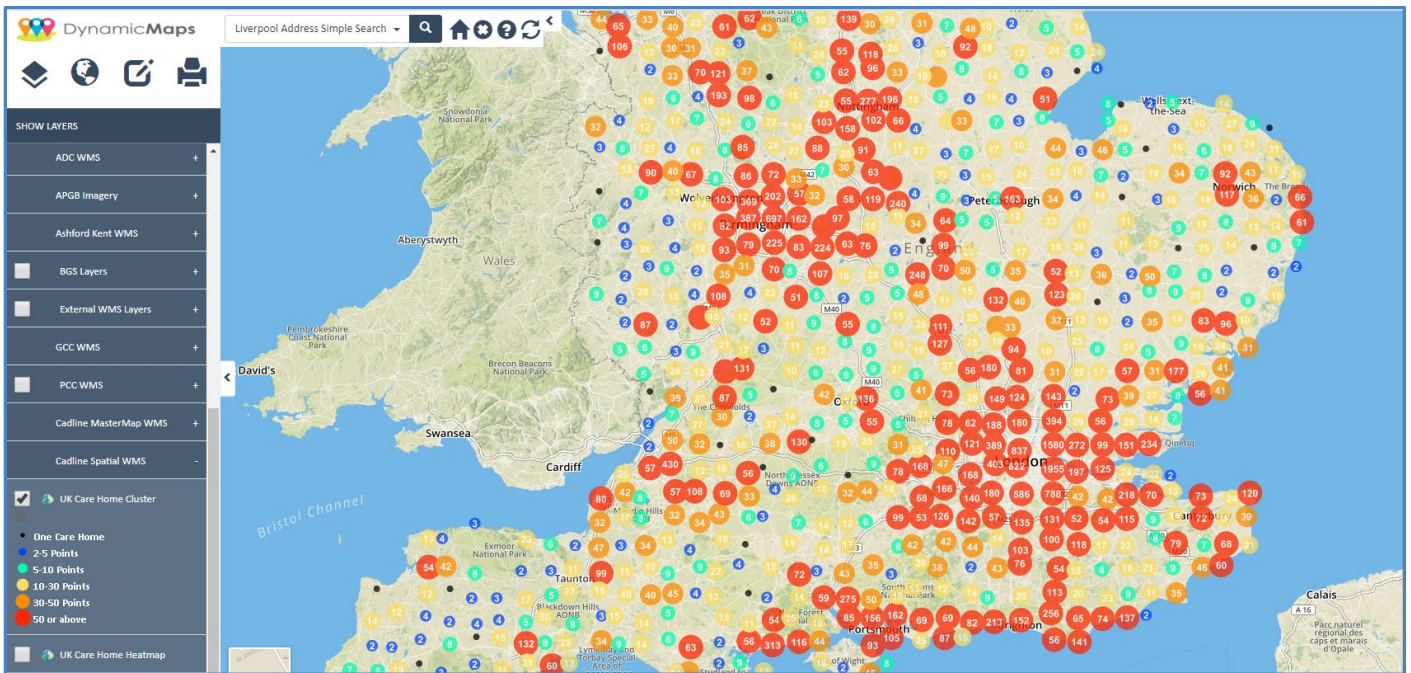
<https://www.cadlinecommunity.co.uk/hc/en-us/articles/360007541578-GeoServer-Creating-Stacked-Points>

Having created a **New WMS Layer** of the UK Health Care Locations and applying the **Stacked Points WMS**, the points now show as clustered Point objects.

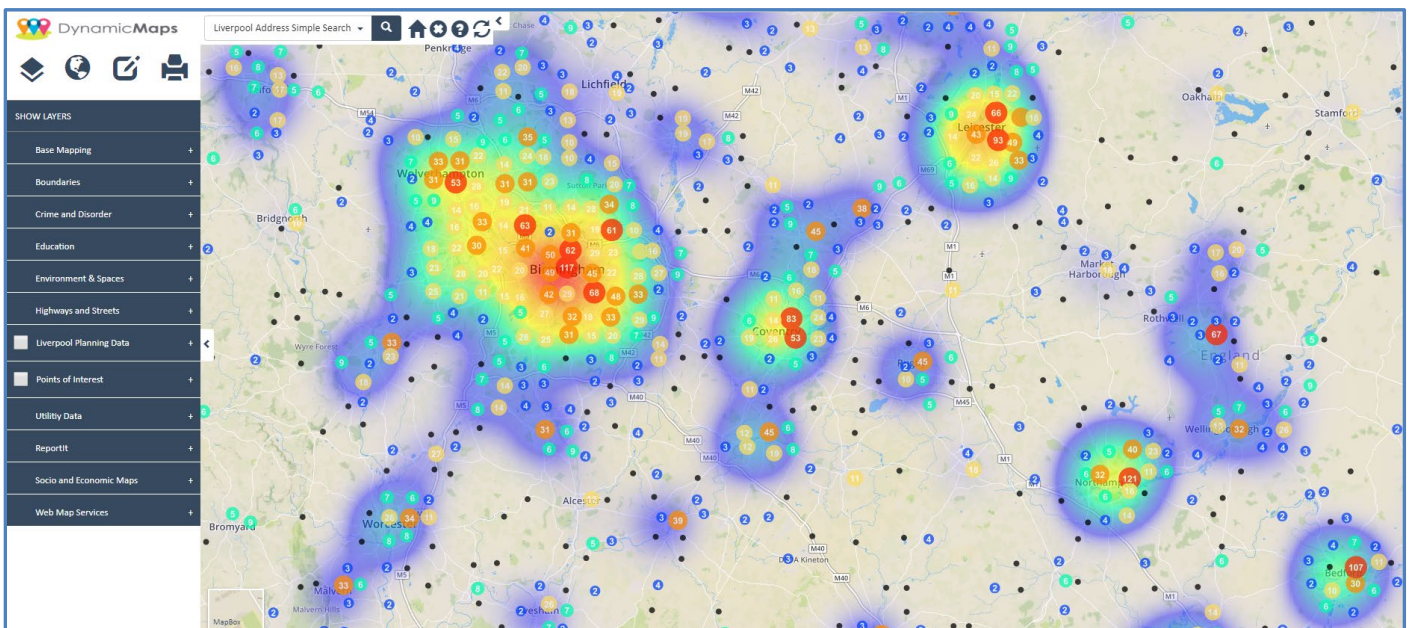


Once added as a Layer in **MapThat**, we now have a very fast rendering and high impact layer for all Users to interpret.



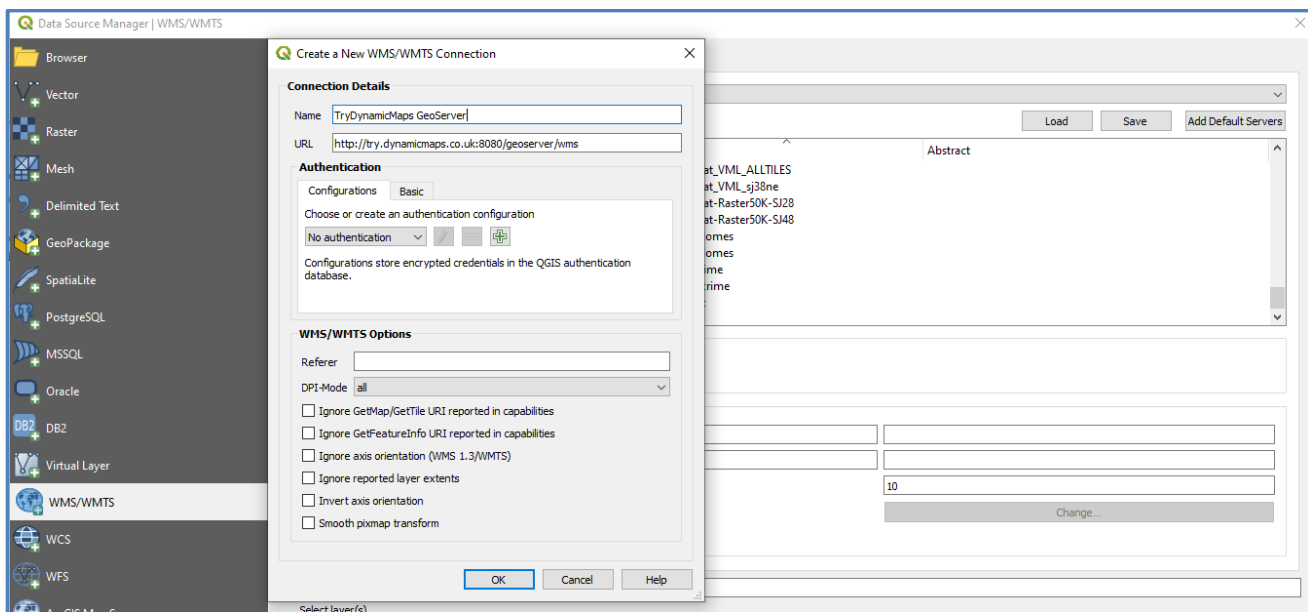


Viewing the **Stacked Points WMS** and the **Heatmap WMS** at the same time is a great way to see where we have the **highest intensity** of data.... be that **Care Home** locations or indeed **Disease Incidents**.

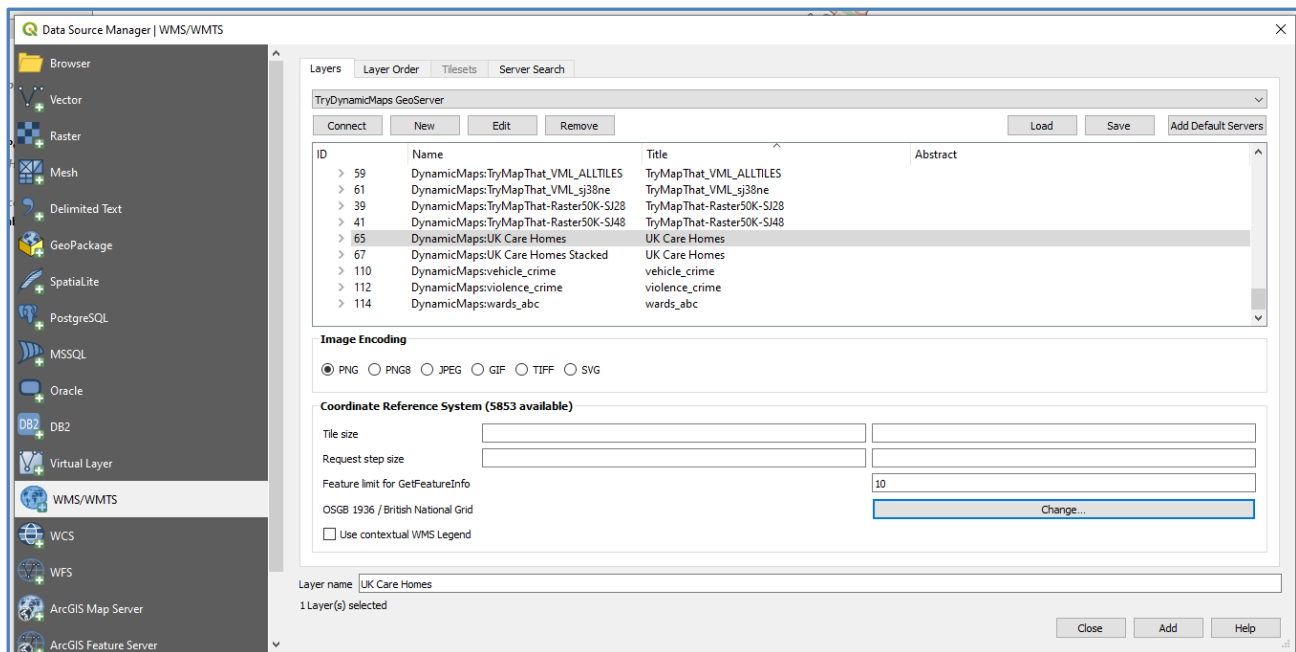


Having created Web Map Services (WMS), these can also be shared with desktop GIS Users – e.g. via **QGIS**.

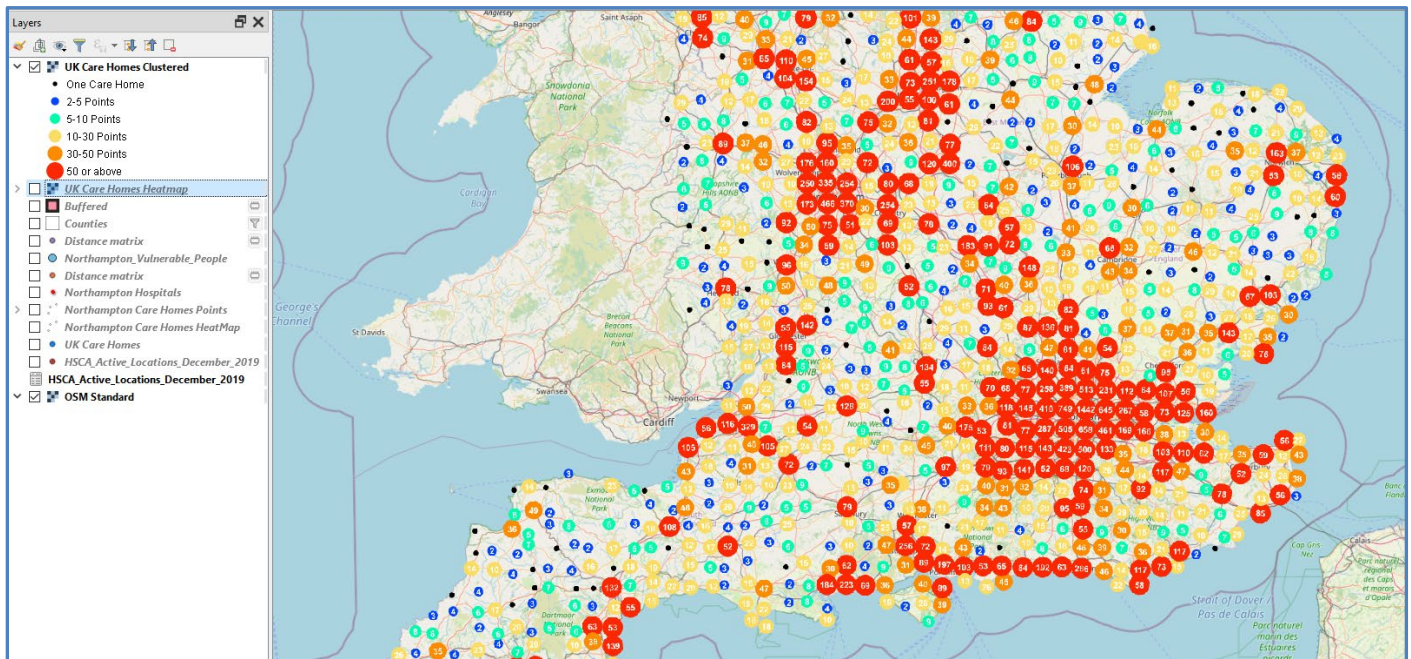
Simply create a **New Connection** to your GeoServer Instance using the **Data Source Manager**.



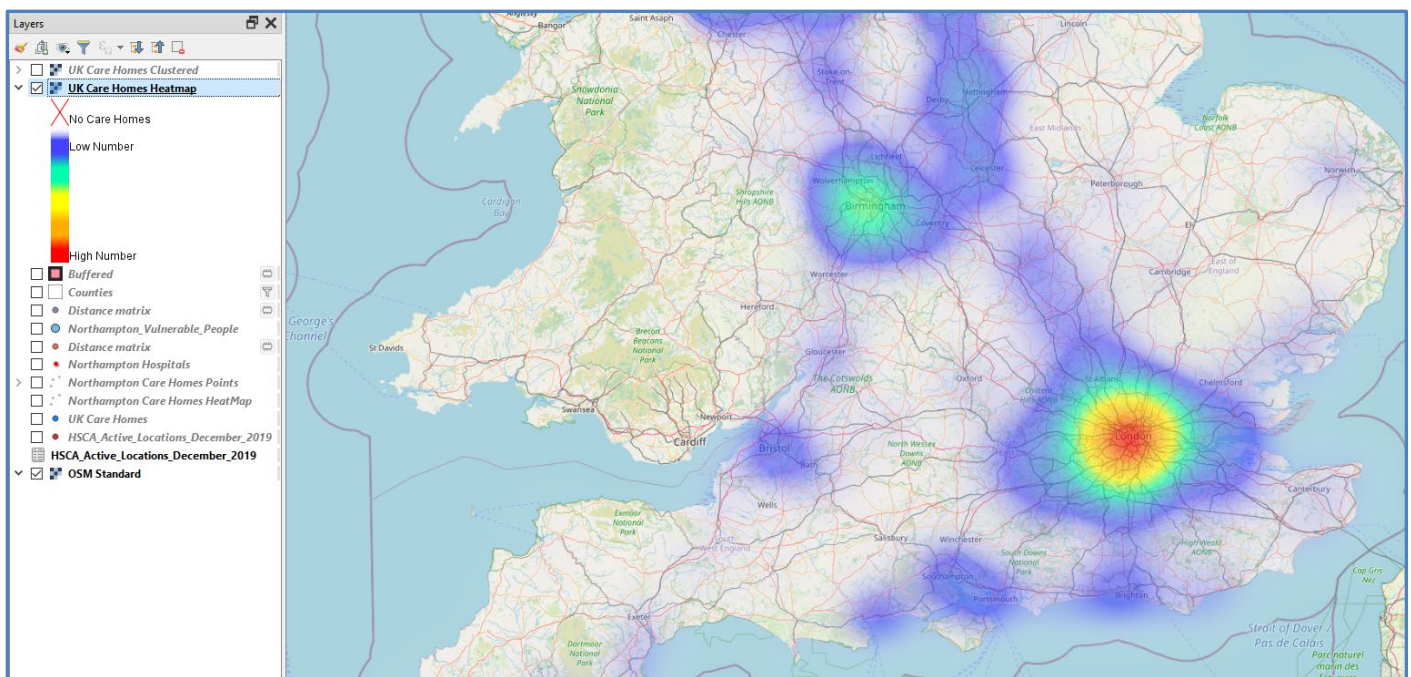
And then **Add the WMS Layers** that we created in GeoServer.



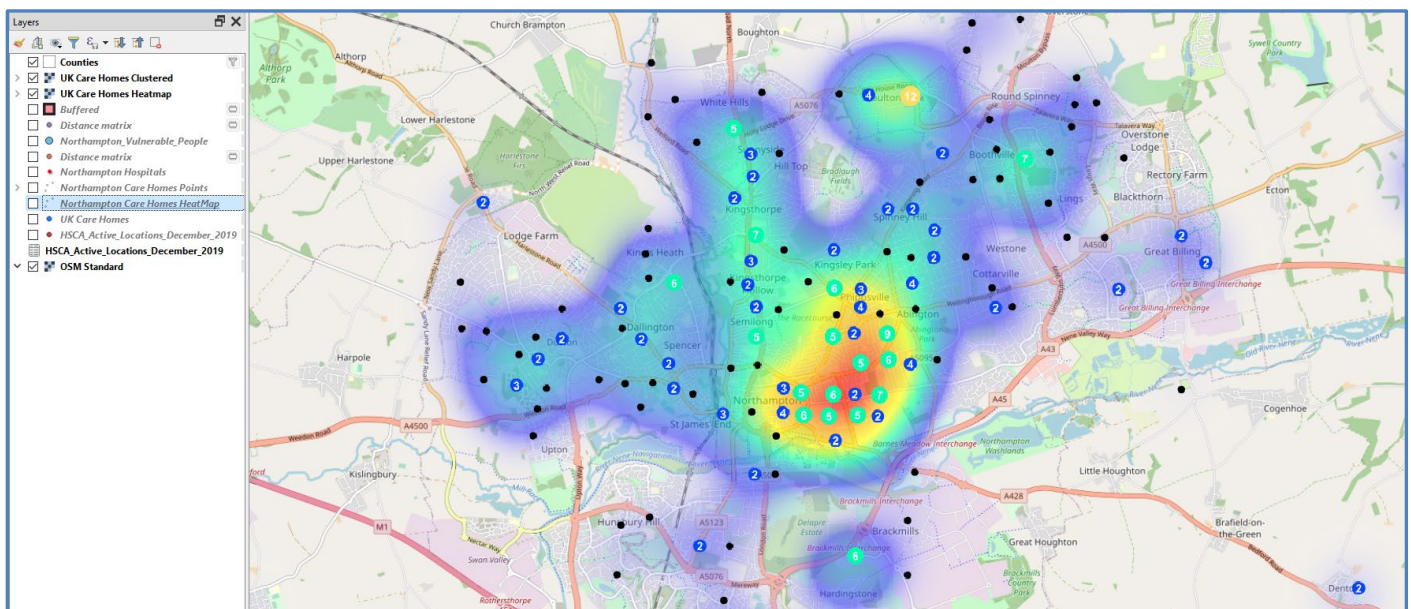
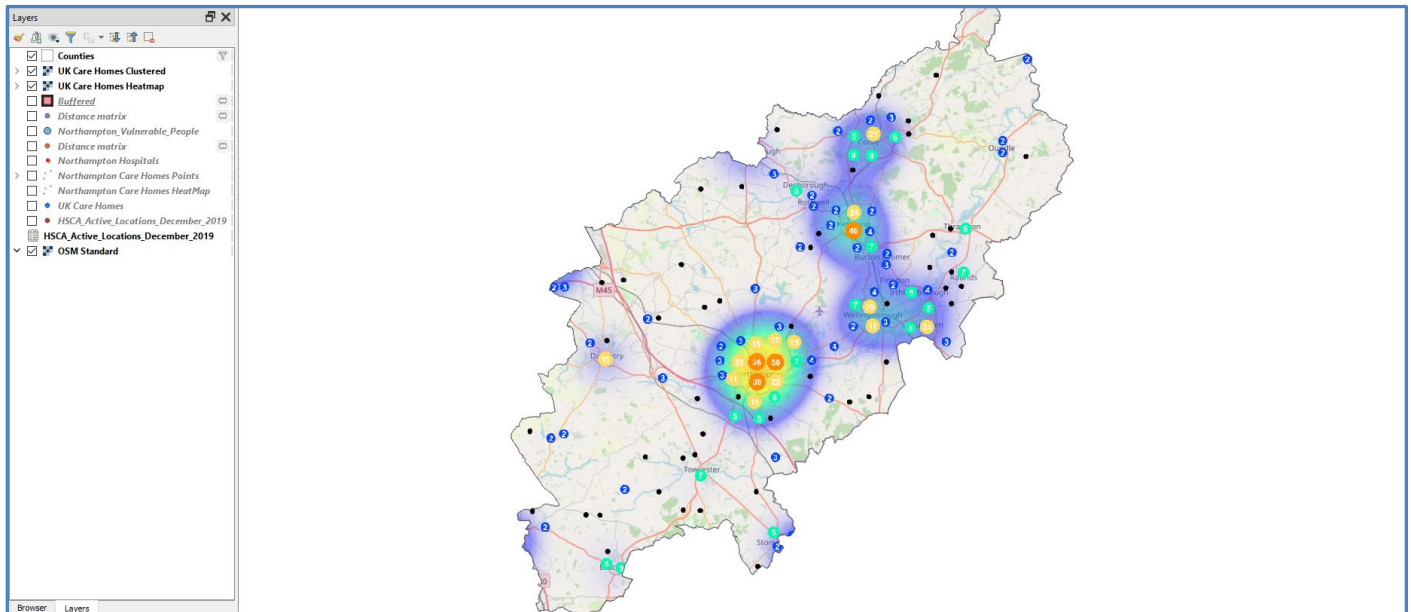
Here the **Stacked Points WMS** is shown in QGIS...



... and then the **Heatmap WMS** layered onto OpenStreetMap.



Finally, applying our **Mask Layer** we can view the Clustering of Care Homes and the Heatmap for Northamptonshire.



Geospatial Tools really are a great way to add further analytics to your data and ensure your decision making is as **accurate** and **effective** as possible! Furthermore, using QGIS, PostGIS and GeoServer, these tools won't add any further economic pressures to your business.