

# An Introduction to QGIS – Level 1

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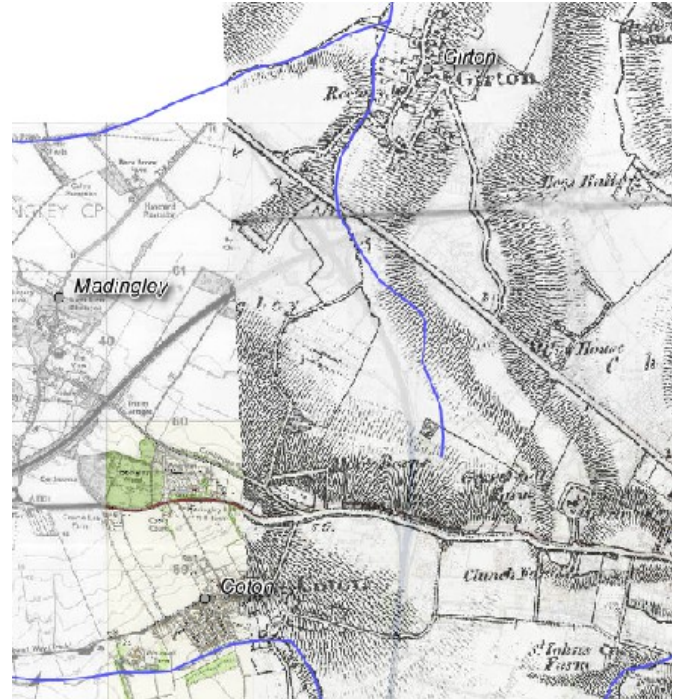
Edited by Jemima Woolverton

## About QGIS

QGIS is OpenSource software developed by an open community, by various commercial and governmental organisations around the world. New versions (with bug fixes) are released frequently. **This guide is designed for QGIS 2.6.0.**

It is available to download at <http://www.qgis.org/>

The full user guide can be found here: <http://www.qgis.org/en/site/forusers/index.html>



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## Sources of Free Map Data

Free (as in speech/beer) data sources:

**OS Open Data** but must attribute Crown Copyright if redistributing:

<https://www.ordnancesurvey.co.uk/opendatadownload/products.html>

Various raster map scales and vector data, including height, contours etc. Does not display plot boundaries.

**Shuttle data** (NASA scan of the globe, elevations): <http://www.sharegeo.ac.uk/handle/10672/5>

**OpenStreetMap:** <http://www.openstreetmap.org/export>

Vector files are free to download (check re-use permissions but I think it's free) showing roads, buildings, paths, field boundaries, woods.... but will be in lat/long coordinate system. Shouldn't be a problem to display them as background layers though.

**Paid OS data** (more detail, field boundaries etc.): <http://www.centremapslive.co.uk/page/home>  
...or other suppliers, pricing schemes vary. ~£15 for 1:10000 raster image covering 1km x 1km.

## Introduction

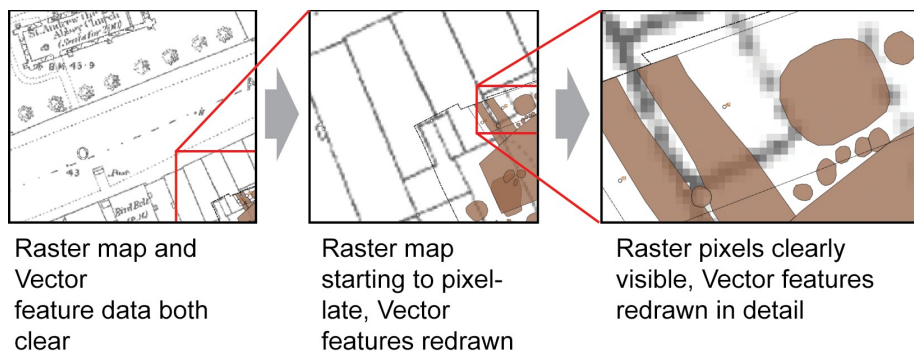
This is a brief introduction in to the way QGIS manages data. Don't worry if this is confusing at first, it's not essential yet and working through the examples should make things clearer!

## Raster vs. Vector

QGIS uses two types of graphical data. The first is called *Raster* with images represented as a

series of cells or pixels, each with a colour value. Imagine a TV screen up close, you can see each pixel individually but as a whole they make up an image. Raster images can only be 'zoomed in' to a certain point before all you can see is the individual pixels/cells. The mapped size of each pixel for a layer is called the *resolution*. So a 1:10000 OS map might have pixels that are 5m across while a 1:50 plan might have pixels that are 5mm across. QGIS can display both together but as you zoom in closer, the pixels become more apparent.

The second kind of data is called *Vector* data. This is where shapes or information are not stored in a rigid pixel arrangement but instead the values of points along a line or area are recorded precisely. If you zoom in on a *vector* line on a computer, the line is redrawn and so always appears sharp, never pixelating. This does not necessarily mean the line is *precise* but it can be displayed on screen at any scale.



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## Summary

Raster data	Vector data
<ul style="list-style-type: none"> <li>Made up of pixels</li> <li>Generally image data: maps, aerial photos</li> <li>Fixed resolution: pixelates when zoomed in too far</li> </ul>	<ul style="list-style-type: none"> <li>Made up of points and lines</li> <li>Points, lines, polygons</li> <li>Can 'zoom in' continuously</li> </ul>
<ul style="list-style-type: none"> <li>Map <i>images/scans</i></li> <li>Aerial photographs</li> <li>Scanned site drawings</li> </ul>	<ul style="list-style-type: none"> <li>Map <i>data</i></li> <li>GPS/survey data</li> <li>SatNav roads &amp; traffic</li> </ul>

## File types

Each layer in GIS is a reference to a file containing that layer's data. QGIS will usually display the following file types with little trouble. With plugins and tweaking it will open most other formats too.

Raster		Vector	
.tiff	Image (GeoTIFF), image data, usually coloured and <i>georeferenced</i> *. Can be compressed.	.shp	Shapefile, gives shapes (1 of points, lines polygons) <i>and attached table data</i>
.asc	Non-coloured pixel data – e.g. heights above OD in an area. Pixels can be colour coded later to represent heights	.gpx	Point or line data recorded by hand held GPS
		.dxf	CAD data (in Drawing eXchange Format), contains points, lines and polygons

\*more on georeferencing later – it means the pixels have a location on the map, rather than floating nowhere. Non-georeferenced images will load up at 000000 000000, somewhere off Land's End! For now all data we are using will be georeferenced.

## Shapefiles

Shapefiles are a standard format developed by ESRI (creators of ArcGIS etc.) but used by most GIS software.

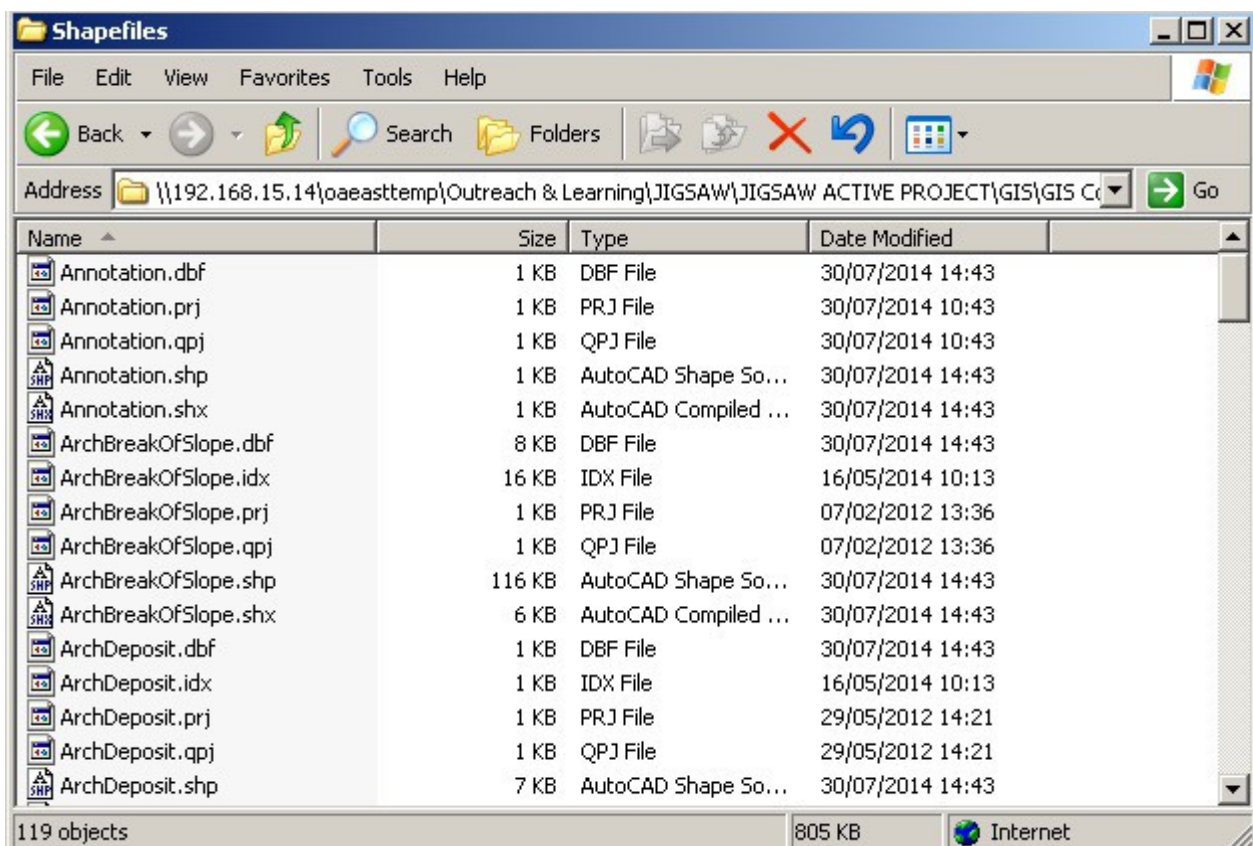
Each shapefile is made up of 3 (or more) helper files with the same name but different extensions. You only need to add the main *.shp* file to a project and the rest happens behind the scenes.

QGIS Layer name (Easterngate Example)		<i>ArchFeature</i>	<i>Excavated Slot</i>
.shp	Contains polygon data	ArchFeature.shp	ExcavatedSlot.shp
.dbf	Table of attributes for each shape	ArchFeature.dbf	ExcavatedSlot.dbf
.shx	System index of shapes (don't touch)	ArchFeature.shx	ExcavatedSlot.shx
.prj	Projection information*	ArchFeature.prj	ExcavatedSlot.prj

\* more on projections and coordinate systems to follow.

This becomes a handful, so it is important to keep your files organised! **Note** that if you want to send data files to other people you need to send **all** of these helper files, not just the *.shp* one.

Other shapefile helper file types will appear...



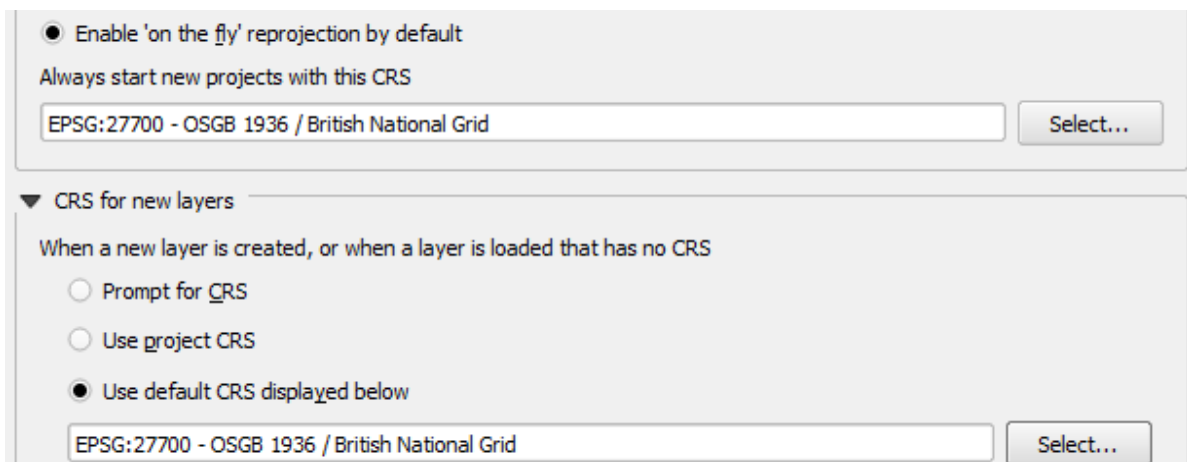
...if moving/copying/sending make sure you include them all!

## QGIS Project Files

- QGIS loads up project files (extension: .qgs).
- It's important to remember each project only stores *references to files* for each layer. Edits to layers must be saved separately.
- Project files define what you see on screen:
  - which layers, in what order
  - how layers are styled
  - what labels are displayed
  - viewing area
- Multiple projects can reference the same shapefiles – so editing layers in one project will show up in another. Hence the importance of file **housekeeping!**

## Initial (one-time) set up

1. Open QGIS. If using a laptop, you may find it useful to connect a mouse.  
The default co-ordinate reference system should be set to OSGB 1936 (EPSG: 27700) – the Ordnance Survey 6 figure grid for the UK.
2. **Settings>Options**
3. Go to the **CRS** tab on the left.
  - Select *Enable on-the-fly reprojection*.
  - Select *Use default CRS displayed below*.
  - Using the **Select** button, set both default CRS fields to *EPSG:27700 - OSGB 1936 / British National Grid*. You may need to type 'OSGB' into the 'Filter' bar to find it and select '27700'.

☒ Enable 'on the fly' reprojection by default  
 Always start new projects with this CRS  
 EPSG:27700 - OSGB 1936 / British National Grid Select...

▼ CRS for new layers  
 When a new layer is created, or when a layer is loaded that has no CRS  
☐ Prompt for CRS  
☐ Use project CRS  
☒ Use default CRS displayed below  
 EPSG:27700 - OSGB 1936 / British National Grid Select...

Alternatively you could select 'WGS84' (for world lat/long data); GPS or satellite data may come in this format but will automatically be reprojected over our OS grid system

OSGB/1936 EPSG7405 is for 3D work and can mix things up a bit – avoid these options for now!

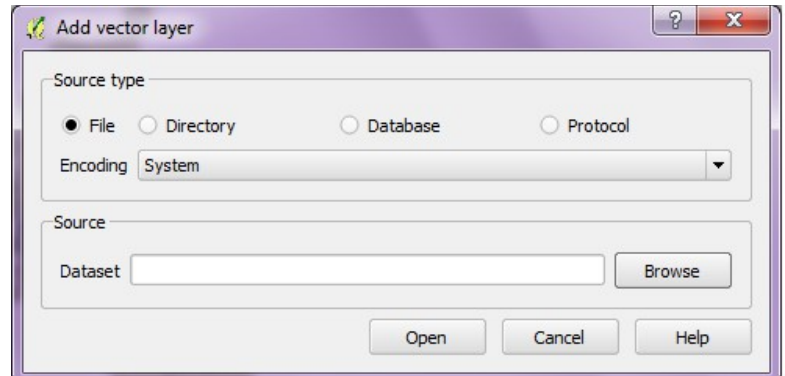


## Exercise 1 – Vector (shapefile) basics

In this exercise you will learn basic manipulation of map data imported from the Ordnance Survey.

### 1 Add some shapefiles

1. **Layer>Add Layer>Add Vector Layer**
2. Next to **Dataset**, select **Browse** and navigate to *Exercise 1 – Basics* then the *Shapefiles* folder from the files supplied.
3. Narrow the search field by selecting **ESRI Shapefiles (\*.shp \*.SHP)** as the file type, and then select all the .shp files listed (by pressing Ctrl and clicking on each one). Click **Open** twice.



4. You will see that the four shape files have appeared in the Layers panel on the left. The files may have loaded in the wrong order so that your county areas cover your settlement points – drag the layers up and down until they are in the following order:

settlement_point east anglia	points	villages/towns/cities
river_polyline east anglia	polyline (line)	rivers
woodland_region east anglia	polygon (area)	woodlands
county_region east anglia	polygon (area)	county bondaries


Data available from Ordnance Survey © Crown Copyright 2014 available here:

<https://www.ordnancesurvey.co.uk/opendatadownload/products.html>

These files are subsets of the Meridian2 shapefiles

### 2 Save Save SAVE!


There can be a tendency for QGIS to crash, so save often!

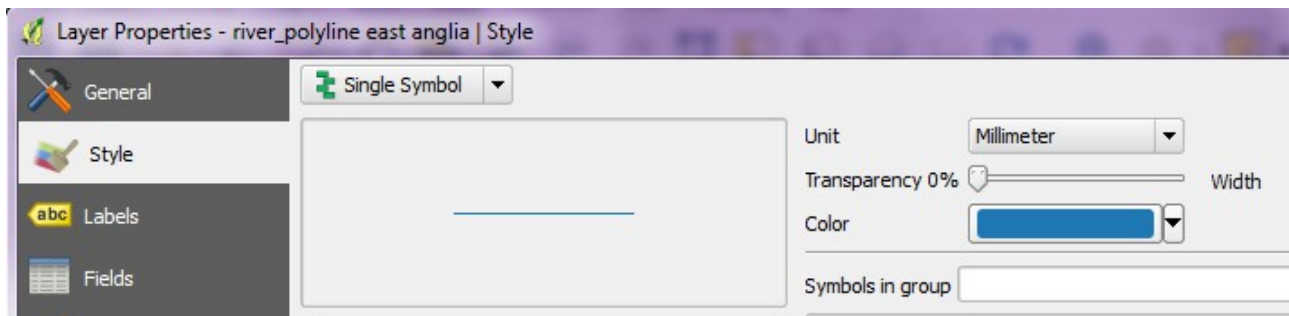
1. **Project>Save**. Alternatively, click the **Save**  icon.
2. Navigate to the *Exercise 1 – Basics* folder (above the *Shapefiles* folder)
3. Enter a file name *Exercise 1 Map*, and click **Save**.

Save repeatedly and often throughout these exercises.

### 3 Setting colours and styles

QGIS will automatically assign colours to your new layers. You most likely want to change these!

1. Right click on *river\_polyline east anglia* and then open **Properties** and go to the **Style** tab. 
2. Click the **Color** box and choose a blue (or colour of your choice) using the dropdown menu. Press **OK** twice to return to the map canvas. If you can't see the river lines, you may need to reorder the layers in the left-hand menu by clicking and dragging this point to the top of the list.



3. Choose suitable colours for your other layers. Note: polyline areas have border and fill colours. There are many other style options: Transparency, line width etc...

### 4 Viewing attribute data

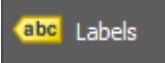
Right click on *settlement\_point east anglia* and then *Open Attribute Table*.

For each point on the map, there is a row in this table. Much of this is OS system data but the column for attribute **NAME0** contains plain text with the name of each settlement.

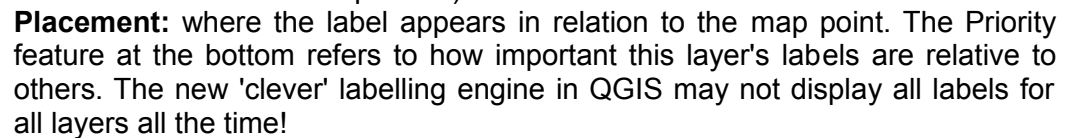
You can close this table or leave it in the background. You don't need to do anything with this for now.

### 5 Label points with an attribute

We are going to label each settlement point on the map with its name (NAME0) – this may be slow!

1. Right click on the layer and open **Properties**, then go to the **Labels** tab on the left. 
2. Tick *Label this layer with* and select **NAME0** from the dropdown list. Set the size to **10 points** (i.e. always size 10 font on screen. Setting to 10 **map units** will make the labels 10m tall on the map!).
3. Do the same for the *river\_polyline east anglia* layer to display river names in a different style (Note: you select NAME rather than NAME0 for this option).

In **Properties>Labels** there are many options in the latest version of QGIS for displaying (rendering) labels.



- Zoom extents (whole map)

This map shows the Cambridgeshire and Huntingdonshire area, with numerous villages and towns labeled. The map is color-coded with green for parks and woodlands, blue for water bodies, and yellow for urban areas. Major roads are shown in red and orange, while minor roads are in grey. The map includes a scale bar at the bottom left and a north arrow at the bottom right.

Key locations include:

- North:** HIGGAY, MARCH, Town End, Christchurch, Southery, Black Horse Down, Little Ouse.
- West:** Cliffe, pethorpe, Woodnewton, Alwalton, Farcat, Haddon, Yaxley, Norman Cross, Stilton, Lutter, Denton, Holmes, Hemington, Wigsthorpe, Pilton, Ske Doyle, CUNDE, Lutton, Sawtry, Ramsey Heights, Ramsey, Mereside, Ramsey, Upwood, Wood Walton, Wennington, Warboys, Hamerton, Upton, Broughton, Somersham, Woodhurst, Colne, Bluntham, Bythorn, Old Weston, Alconbury, Weston, Catworth, Woolley, Great Stukeley, Hartford, ST IVES, Hemingford Grey, Over, Fen Drayton, Hildon, Coughton, Easton, Brampton, Shelton, Tibbrook, Chelham, West Perry, Offord, D'Arcy, Hilton, Boxworth, Knapwell, Oakington, Madingley, Coton, CAMBRIDGE, Little Wilbraham, Stetchworth, Westley, Waterleaze, Brinkley, Weston, Colville, Balsham, Hildersham, West Wickham, Hinton, Horseheath.
- South:** Wicken, Fordham, Snailwell, Exning, Reach, Commercial End, NEWMAI, Fen Ditton, Bottisham, Fulbourn, Trumpington, Hauxton, Stapleford, Sawston, Whittham, Shepreth, Croydon, Tadiworth, Wapdy, Sutton, Potton, Sandy, Hatching, Wilton, Harrowden, Blunham, Church End, Ravensden, Napham, Salph End, nham, End.

7

"NAME0" IN ('Cambridge', 'Huntingdon', 'Ely', 'March', 'Chatteris', 'Brandon', 'Fordham', 'Soham', 'Wisbech')

**NOTE:** you need to double click on 'NAME0' to select it. You can add more place names, but make sure they have single inverted commas and a comma between each one.

3. Before closing the dialog box, Press **Test** at the bottom and it will tell you how many results match that query, or if you made a mistake! But note: it won't tell you if you spell a town name wrong. When you're happy, press **OK** twice to get back to the map.
4. Repeat for the *river\_polyline east anglia*: this time we'll exclude any rivers with no name (presumably smaller ones). This query expression is a bit different:

NOT "NAME" IS NULL



Now look at the Attribute Table again (or re-open it by Right click on *settlement\_point east anglia* and then **Open Attribute Table**). It is now much shorter, but the underlying shapefile still contains all the original data. The map is less cluttered and will load more quickly now.

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Attribute table - settlement\_point east anglia :: Features total: 11, filtered: 11, selected: 0

	CODE	OSODR	NAME	NAME0	INDICATOR	LINK_OSODR	LEVEL	TERMINAL
0	3500	O167M92B8LRAW	NULL	WISBECH	NULL	NULL	0	NULL
1	3500	O1680EBBUA5TW	NULL	HUNTINGDON	NULL	NULL	0	NULL
2	3500	O167QKVBLALTW	NULL	CHATTERIS	NULL	NULL	0	NULL
3	3500	O167MC4V1KMTW	NULL	CAMBRIDGE	NULL	NULL	0	NULL
4	3500	O167PGYUF14TW	NULL	MARCH	NULL	NULL	0	NULL
5	3500	O167HD68PDGTW	NULL	ELY	NULL	NULL	0	NULL
6	3500	O167EWWUT9M...	NULL	Soham	NULL	NULL	0	NULL
7	3500	O167D72UUQ9TW	NULL	Fordham	NULL	NULL	0	NULL
8	3500	O167DHGUDJQTW	NULL	Fordham	NULL	NULL	0	NULL
9	3500	O1675K6UL38AW	NULL	BRANDON	NULL	NULL	0	NULL
10	3500	O166XHJVGPAPW	NULL	Fordham	NULL	NULL	0	NULL

Show All Features

**NOTE:** this reduced query is only set by this project. You could have a different QGIS project using the same shapefile at the same time and show all or a different subset of place names if you wanted.



## 7 Identify Tool

This tool allows you to click anywhere in the map canvas and retrieve attribute data for selected shapes. This has changed with version 2.6. First only works on selected layer. Then have to change Mode from 'Current Layer' to 'Top Down'.

This is another one-time setup task:



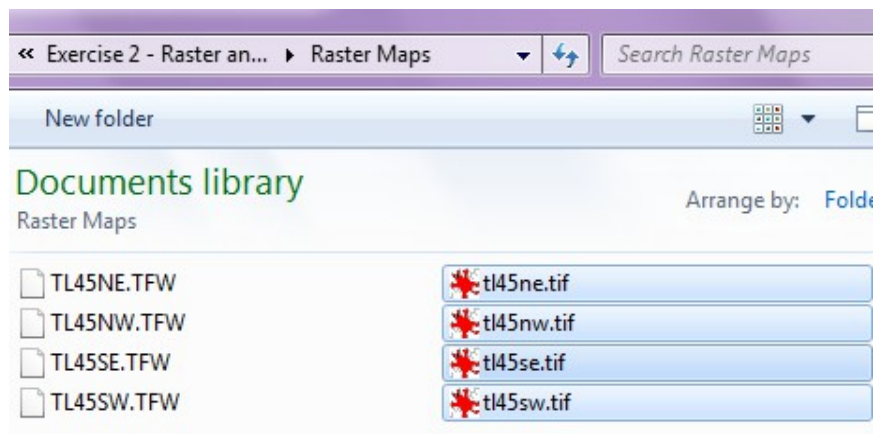
1. Select the **Identify Features** icon in the top bar.
2. Click on an area of the map you are interested in, e.g. a river or settlement point. A dialog box entitled **Identify Results** appears. Use the dropdowns to find relevant information.
3. If you wish to keep the dialog box accessible, you can drag it into the lefthand pane of the QGIS window.

## Exercise 2: Working with rasters

In this exercise we will work with some raster data (pixels, images). This includes freely available OS Maps, scanned OS and historical maps, aerial photos and other types of data. Create a new project:

### 1 Add the background maps

1. **Project>New.**
2. **Layer>Add Layer>Add Raster Layer.**
3. Navigate to *Exercise 2 – Raster and Georeferencing*, then *Raster Maps*
4. Open the four **.tif** files (not the corresponding **.tfw** files). Your computer may not list the **.tif** files as this – so just select the files which aren't **.tfw**.
5. This may generate a warning about CRS – ignore this.



### 2 Georeferencing


This is the process of taking an image with no spatial data or reference points (scanned maps or aerial photos) and locating them on our map projection. QGIS does this by taking the original image file and some reference points and producing a new georeferenced file and displaying it on our map.

### 3 Scanned OS Map

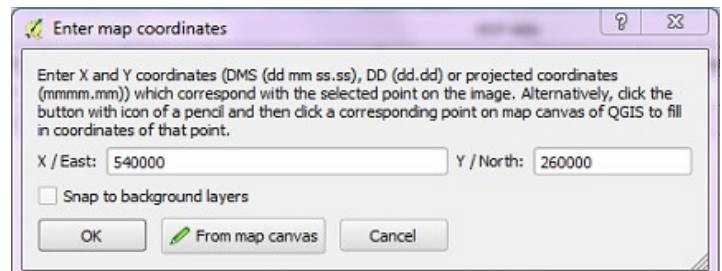
The advantage here is that the Ordnance Survey Explorer Map has a grid printed on it, so we know where each point is.

1. From the top menu, select **Raster>Georeferencer>Georeferencer**. Sometimes this feature is not installed or enabled, in which case go to **Plugins>Manage and Install Plugins...** and search for 'Georeferencer'.
2. Open the scanned Explorer Map of Cambridge: **File>Open Raster**. Navigate to *Exercise 2 – Rasters and Georeferencing*, and then select *Raster Scans*, and *209 Cambridge.jpg*. This could take a while, since the file is quite large.
3. Zoom in to Madingley, just west of Cambridge, to show several km on screen. As with the main canvas window you can pan by holding the middle mouse button down and zoom in and out by scrolling up and down, or click on the 'hand' icons and 'zoom in' and 'zoom out' buttons.

We are going to map the grid point north of Madingley wood onto our map canvas (TL4060 but we have to use the full 6 figure reference 540000 260000).

4. Select the '**Add point**'  tool, and click on the grid point where the 40 easting meets the 60 northing (TL 40 60).

Enter X = 540000 and Y = 260000 (see right). Press **OK**.



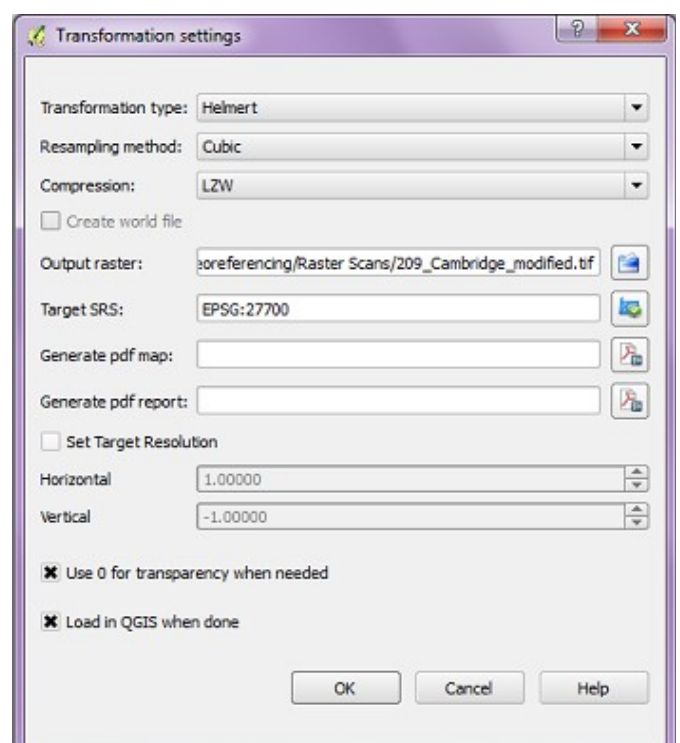
5. We need a second point. Scroll east to the other side of Cambridge, just east of Fen Ditton. Add a new point where the 50 Easting meets the 60 Northing (TL 50 60).

Enter coordinates X = 550000 and Y = 260000 and press **OK**.

6. Press the **Start Georeferencing** (play) button (if not present on the screen, it's under 'File') and it will ask you to set some transformation settings first time.



7. Set:
  - **Transformation type:** Helmert (this is 'scale and rotate' and only requires the two reference points we've given).
  - **Resampling method:** Cubic (a bit slower but better quality)
  - **Compression:** LZW (a bit slower but results in smaller files)
  - Click the file symbol next to **Output Raster** and it will automatically fill in the new file name as *209 Cambridge\_modified.tif*, then press **Save**.
  - **Target SRS** should already be set to EPSG:27700 (so the output image is in OSGB coordinates).
  - Make sure **Set Target Resolution** is **Unchecked** for now (this is a more



advance option for tweaking the output file size and quality but it can easily go wrong!).

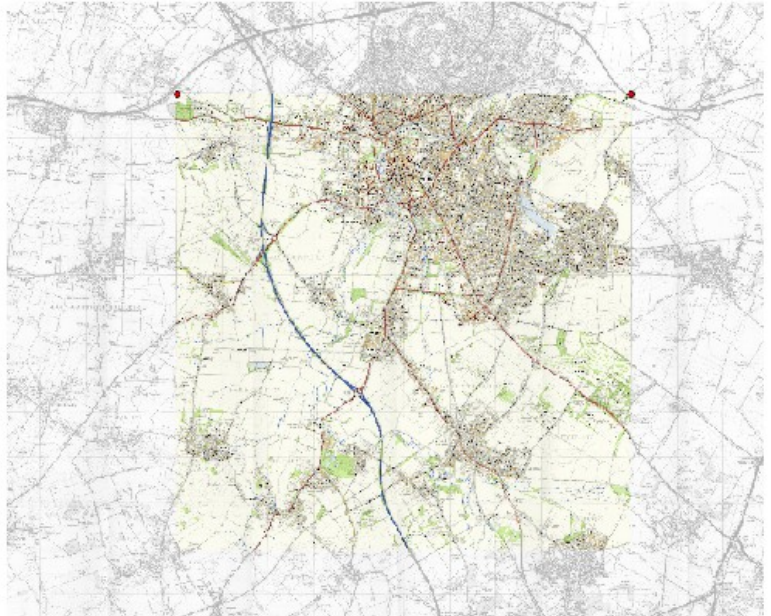
- Check **Use 0 for transparency** and **Load in QGIS when done**.
- Press **OK** (takes a little while).

10. Minimise the Georeferencer. In the Layers panel, move this new layer to the top of the stack, if not there already. You should have a picture like this (see right).

11. Right click on this layer, **Properties>Transparency**. Change its transparency to 70%. Click **OK**.

You should now be able to see the OS Open Data maps through the scanned OS Explorer map.

12. Look around the map now. You'll see near our reference points it matches well but further away it may have drifted out. This is okay for now, but we may want to repeat the process using two points further apart to tighten it up.



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13. If you look in the Raster Scans folder, you'll see there are several additional files generated. The **.tif** file is the new image and normally quite large. The original **.jpg** file is unaffected.

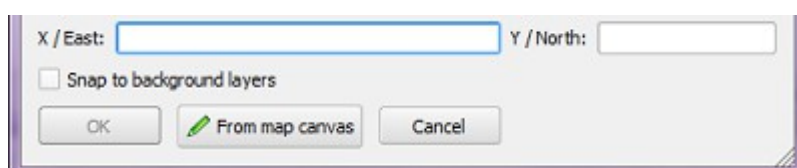
## 4 Scanned Historic Map

The first edition 1 inch Ordnance Survey Map does not have the modern metric OSGB grid printed on it, so we can directly use grid coordinates. Fortunately we can specify points where it fits on the map canvas so QGIS can position it correctly.

1. Open the georeferencer window again (**Raster>Georeferencer>Georeferencer**).
2. **File>Open Raster>45\_Cambridge 1st Ed 1inch.jpg**
3. Zoom and pan across to Fulbourn in the south-east corner.
4. Click the **Add point** tool and click on the T-junction south of the 'n' in Fulbourn (see right).
5. Now instead of entering co-ordinates, we can get them automatically from the main map canvas. Click **From Map Canvas**.



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6. Without clicking the left mouse button pan across the main map (using the middle button and scrolling to zoom) to the same point in Fulbourn and then click on it:



7. You will be returned to the georeferencer window. Click **OK**.

8. Repeat with another point near Girton at the north-western corner of the map. The road junction near the south of the village is a landmark that has not moved:



Press **Play**.

9. Close the georeferencer (agreeing to Save GCP Points) and adjust the transparency of the new layer to about 40%.

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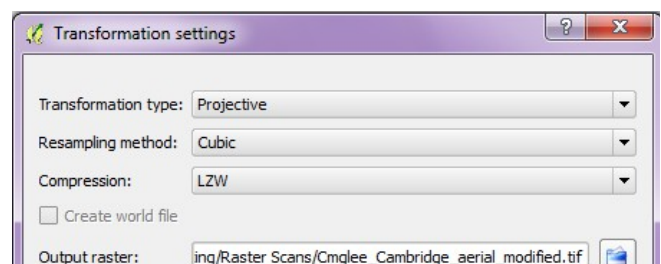
You should be able to see that the maps agree. If not, you may have to repeat the process, checking you have to right reference points. The resulting image is ugly but useful. You can turn different layers on and off at the side to help.

## 5 Georeferencing an Aerial Photograph

We use the same process for georeferencing/rectifying photographs. Ideally shots should be as close to perpendicular as possible, however it is possible to rectify oblique shots relatively accurately.

In this example, I have already created GCPs (ground control points) which will load when you open the photo.

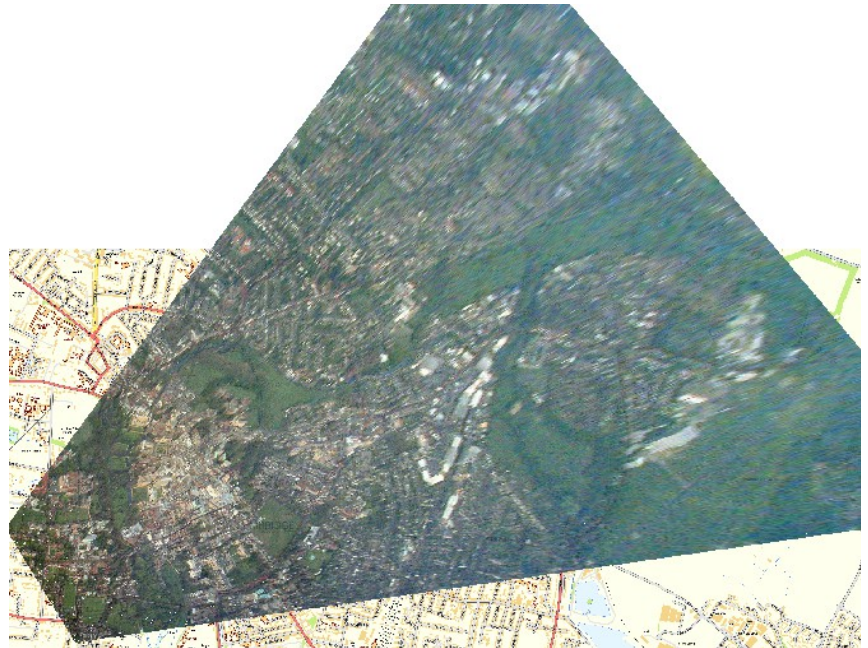
1. Open the Georeferencer.
2. **File>Open Raster...** and choose to *Cmglee\_Cambridge\_aerial.jpg* (from the Raster Scans folder).  
This file is available from wikipedia under a Creative Commons License  
[http://en.wikipedia.org/wiki/Cambridge#mediaviewer/File:Cmglee\\_Cambridge\\_aerial.jpg](http://en.wikipedia.org/wiki/Cambridge#mediaviewer/File:Cmglee_Cambridge_aerial.jpg)
3. The reference points have already been defined for you and should appear automatically.
4. Press **Play**, and it will prompt you to set up the **Transformation Settings**.
5. This time set the **Transformation Type** to **Projective**.
6. Set the **Output Raster** file name (it will fill in a name for you) then press **OK**. Leave the Georeferencer.





**Note:** whenever you are asked to save points after working with an image, just press **OK** to save as the default file name.

The resulting image is badly distorted because the original was so oblique. However, most features match up, even 4-5km away from the camera (try increasing the transparency of the layer to check against the map below).



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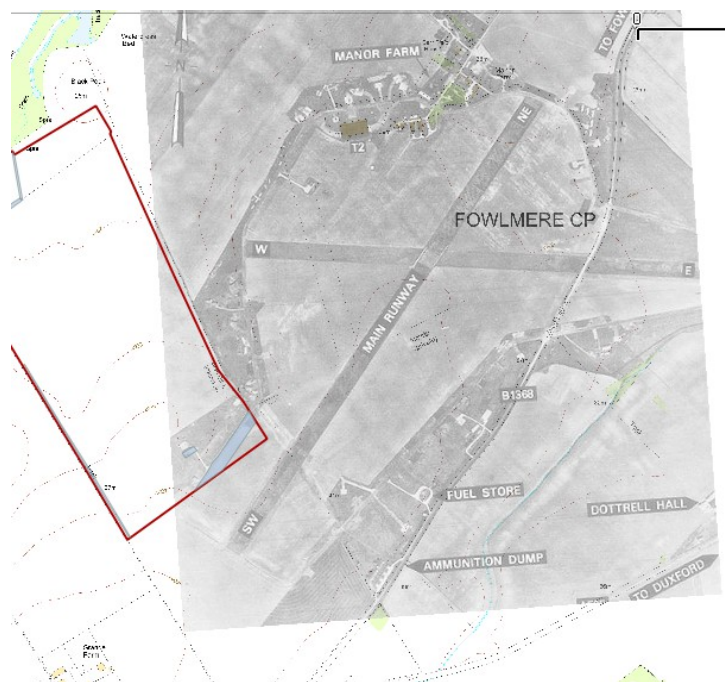
## 6 Perpendicular View

Doing this with historic (particularly RAF) aerial photographs allows you to trace features which may not appear on any of your maps.

For example, this photo of Fowlmere Airfield shows the airfield's layout between editions of the OS map before the old field boundaries were re-established.

The perimeter track (now ploughed away) had shown up in geophysics as an unknown feature, but was never shown on OS maps.

Study area: red; perimeter track: blue.



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Image downloaded from wikipedia:

[http://en.wikipedia.org/wiki/RAF\\_Fowlmere#mediaviewer/File:Fowlmere-13April1947.png](http://en.wikipedia.org/wiki/RAF_Fowlmere#mediaviewer/File:Fowlmere-13April1947.png)

Public domain

QGIS will open a lot of different spatial file types, usually the only hitch is with different coordinate systems but it will normally open them and reproject them on the fly for you.

- 
- Open an OGR Supported Vector Layer
- Look in: KML
- Recent
- Desktop
- My Documents
- My Computer
- My Network Places
- Melbourn AP.kml
- File name:
- Files of type: Keyhole Markup Language [KML] [OGR] (\*.kml)
- Atlas BNA [OGR] (\*.bna \*.BNA)  
 Comma Separated Value [OGR] (\*.csv \*.CSV)  
 Geography Markup Language [GML] [OGR] (\*.g  
 GPS eXchange Format [GPX] [OGR] (\*.gpx \*.GF  
 Keyhole Markup Language [KML] [OGR] (\*.kml  
 GeoJSON [OGR] (\*.geojson \*.GeoJSON)  
 INTERLIS 1 [OGR] (\*.itf \*.xml \*.itf \*.XML \*.I  
 INTERLIS 2 [OGR] (\*.itf \*.xml \*.itf \*.XML \*.I  
 Generic Mapping Tools [GMT] [OGR] (\*.gmt \*.G  
 SQLite [OGR] (\*.sqlite \*.db \*.SQLITE \*.DB)
- Open
- Cancel

*Exercise 3 – Importing>GPX* - for handheld GPS tracker files. Select one file (do the second after the first is loaded). GIS will ask you which sub-layers to import, just choose **track points**. Repeat for the second layer.

Usually you will want to edit this data, but currently these files aren't editable. To make changes (add attribute data, add or delete shapes) you will need to save these layers as shapefiles.

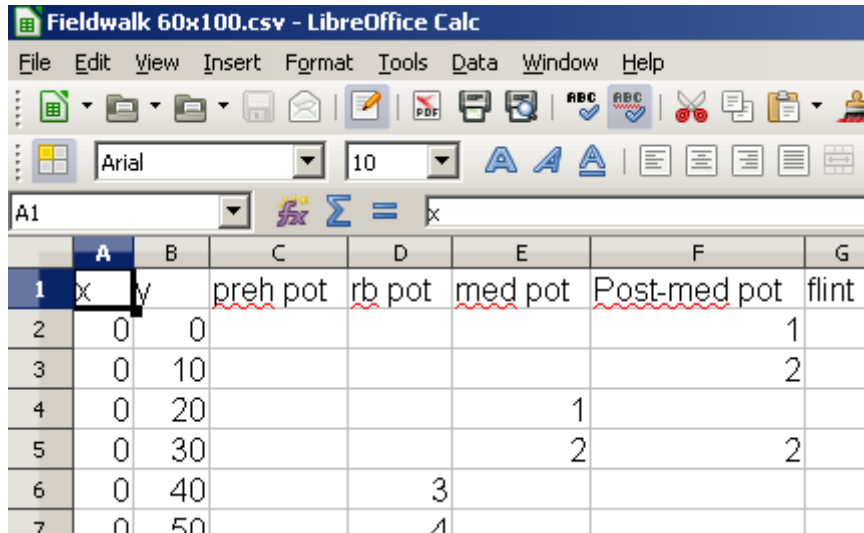
- In order to make changes to a layer and commit them to the shapefile, you first have to enable (toggle) editing for that layer. Select the new Track Points layer, right click on it, then click *Toggle Editing*.

14

## Exercise 4 – Fieldwalking Results

An imaginary field walking exercise has been undertaken, results have been recorded in a spreadsheet, and exported as a CSV file. Grid co-ordinates were known for the south-west corner of each grid square of 10m sides.

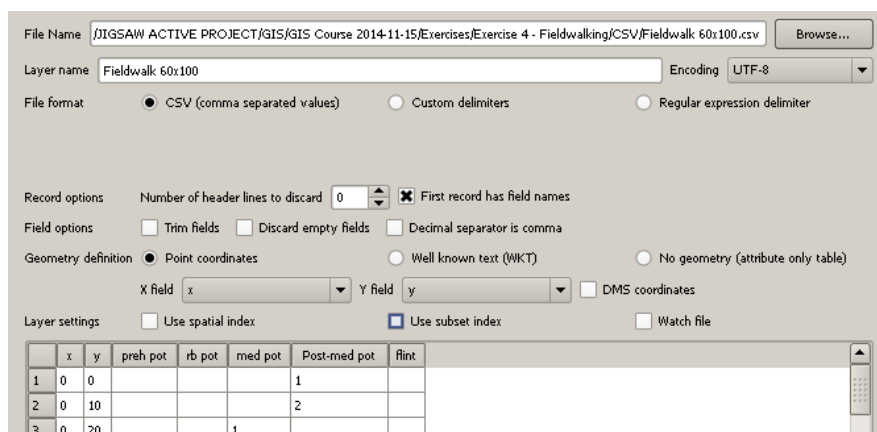
We are going to take this data and display it with symbols appearing at the x,y representing the data at that coordinate.



	A	B	C	D	E	F	G
1	x	y	preh pot	rb pot	med pot	Post-med pot	flint
2	0	0					1
3	0	10					2
4	0	20			1		
5	0	30			2		2
6	0	40		3			
7	0	50		4			

### 1 Importing CSV Data

1. Start a new project.
2. Import the CSV file by adding it as a new layer **Layer>Add Delimited Text Layer**.
3. Browse and select *Exercises 4 – Fieldwalking/CSV/Fieldwalk 60x100.csv* (or you can drag and drop it into the layers folder).
4. QGIS will need to know how to read the file, so tweak the options until the sample table looks correct by ticking **CSV (comma separated variables)** and **First record has field names**
5. Set the **X field** and the **Y field** to come from the appropriate columns (named **x** and **y** here).
6. Press **OK**.

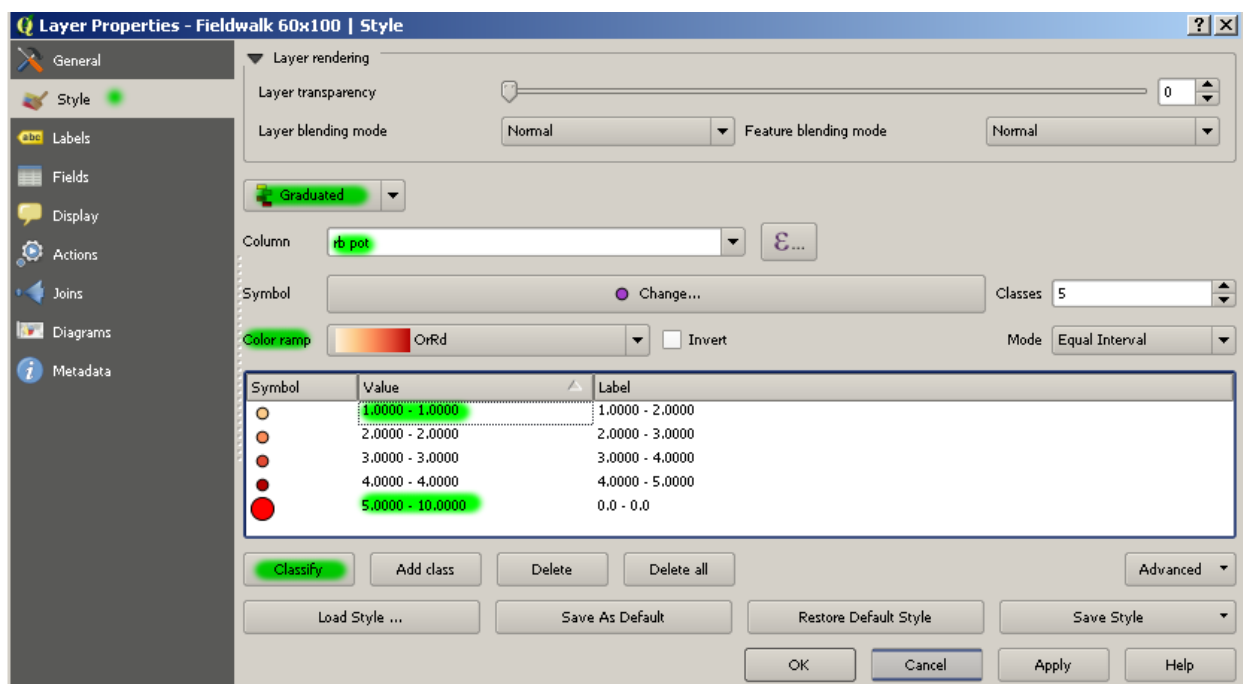
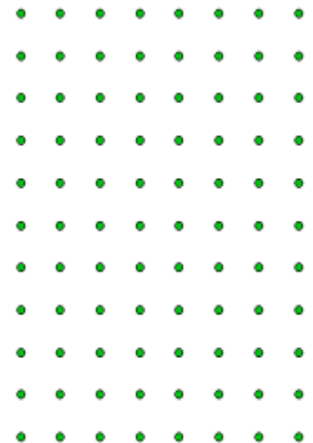


	x	y	preh pot	rb pot	med pot	Post-med pot	flint
1	0	0				1	
2	0	10				2	
3	0	20			1		

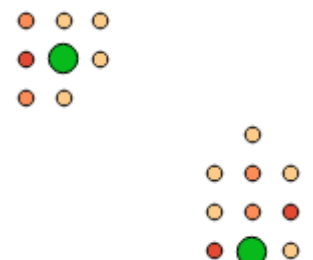
## 2 Displaying Symbols

Initially we see every point as a uniform dot, whether there were finds there or not. We need to adjust the styling of the layer's points according to the data we have, so right-click on the filename in the Layers panel, open **Properties** and go to the **Style** tab.

1. Change **Single Symbol** to **Graduated** in the dropdown menu. This allows us to specify different symbols depending on data attached to each point.
2. Select the data **Column** we want to use (e.g. 'rb pot').
3. Select a memorable **Color ramp** from the drop down, then press **Classify**. This will generate a selection of symbols for each value for **rb pot**.
4. Initially symbol values will be overlapping, so double click on the value in each case and set the ranges to 1-1, 2-2, 3-3 etc. You can also add a class for 5-10 by selecting **Add Class**.
5. You can change the style of each symbol by double clicking on it (size, colour, different symbols even – E.g. you could make 5-10 a larger circle).



6. Press **OK** to see the results. Hopefully the 0 values have disappeared from the map, leaving the hot spots highlighted (e.g. see right).
7. This only shows our **rb pot** points. We can look at others instead by changing the column used in the **Style** tab.



Try switching the data column to **flint** or **med pot**. You might want to adjust the symbol value ranges for these other data views.

If you wish to display two of these results at once, you have to add the CSV file again (**see Step 2**). Your project will then have **TWO layers** referring to the same data, but each with their own styling. You could do this for all of the data columns or just switch between them to show one at a time.



## Print Composer

GIS is a useful tool for overlaying different spatial data to enable analysis – without reaching for the photocopier, acetate and overhead projectors. However, it is likely that you will want to distribute the images you have created.

You can think of a print composer as representing a page. You can have multiple print composer for a project, so one might show a view (map) of the project at 1:100 and another at 1:500. If you make changes to the project, the results are then reflected in both composers at their scales.

The print composer system in QGIS enables you to export images in a variety of formats.

- png - a web-friendly raster image format
- svg - vector format for use in Adobe Illustrator or Inkscape
- pdf - vector (i.e. zoomable on screen) pdf useful for sharing but can sometimes be overcomplicated and load slowly.

You can also print directly from a print composer, although this can have undesired results! It is usually safest to create a PDF and print from there. For professional reports, its best to do the final polishing, styling, moving labels etc. in a graphics package to ensure report figures are all consistent.


### How Print Composers work

Each project can have a number of print composers. A print composer represents a printed page or output image area so you can specify A3, A4, A5 etc. from the start. You can manage these from the Composer Manager (**Project>Composer Manager...**)

Each print composer can have multiple 'Maps'. These are numbered Map 0, Map 1... as you add them to the page. Normally you would only want one map on a print composer sheet.

Each map on the page will display all the layers currently 'switched on' in your project. You can specify the scale and move the contents around. You can also display a grid and coordinates within or outside the map.

### For Starters...

1. **Project>New Print Composer.** Give the file a name, and click **OK**.
2. Click the **Add new map** button.  Draw a box on the Print Composer. It grabs whatever is on your screen.
3. You can add more than one map by zooming in and out of your original map and then capturing images at different scales on the same page on the Print Composer. But:

**Tip:** If you want different maps on a page to display different layers, you have to tick **Lock layers for map item** for one map, then change the displayed layers and do the same for the second map. The problem comes when you want to change this later or add a new one in since you have to repeat the process! Often it is simpler to display everything, export the image as an SVG and then use Illustrator/Inkscape to delete layers or labels you don't want.



You can add additional map decorations:

- scale bars (associated with each map) can be customised
- legends/keys for each map
- images (such as logos)
- text
- arrows and arbitrary shapes