

QGIS Practical 9: Critical Infrastructure Map

In this practical exercise, you will build a Critical Infrastructure Map.

- A Critical Infrastructure Map helps with understanding where resources of different types are located, and general access routes and avenues.
- It is also very important as it will be most likely updated with the status or damage to each facility, once the information starts to come in.

We are starting to work at a fairly large scale. We are probably at the city or town level, we will need to zoom in significantly and find data that is appropriate for the detail required.

In this exercise, we will focus on hospitals and main medical centers, fire and police stations, transport networks, and education facilities, but there are other types of critical locations you may want to keep in mind for an emergency, for example - the location and status of shelters, water, wastewater, and electricity networks, banks and ATMs, markets, communication towers.

We will select the relevant data according to our scale of work and our final desired output.

1.0 Planning your map project

As you start working on your product, it is a good idea to take a step back and reflect on what you want the final product to look like. Also remember, that map projects are often iterative in nature. You may start with a simple product, that you can then use as a base for the next versions, or other products altogether.

Here are some points to take into consideration as you start your work:

- Who is this product for?
- What data do I need?
- What is the status of those datasets? Are they fit for purpose? Is any cleaning necessary?
 - Always open the datasets and inspect them to make sure they are indeed fit for purpose. You can start by opening them to do a visual check, but it is also always a good idea to open the attribute table and have a sense of how the information they contain is organized.
- Is there anything I should warn my final user about? Anything about how to read the map, any caveats regarding the data, its use, and its shareability?

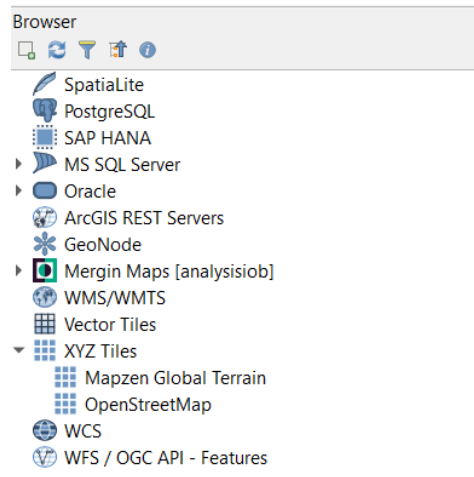
2.0 Getting Started

1. Start a new project and add the following datasets:
 - o The Admin 1 layer for the country:
dma_admn_ad1_py_s0_unocha_pp_parish in GIS\2_Active_Data\201_admn
 - o The Roads layer: dma_tran_rds_ln_s0_osm_pp_roads.shp in
GIS\2_Active_Data\214_tran
 - o The Airports layer: dma_tran_air_pt_s0_ourairports_pp in
GIS\2_Active_Data\214_tran
 - o The Points of Interest dataset: dma_pois_poi_pt_s3_osm_pp in
GIS\2_Active_Data\211_pois
 - o The Health centers layer: dma_heal_heal_pt_s3_osm_pp_healthsites in
GIS\2_Active_Data\209_heal
 - Have a look in the Original Data folder, under the GeoCris folder.
Could you add anything from there? Remember to activate any new layer!
2. Right-click on Admin 1 layer and select the first option, **Zoom to Layers**.
3. Spend some time choosing the appropriate symbology for the following datasets:
 - o Airports, Hospitals: These are point datasets, and **Single Symbol** will be great for these. If we had information about damage, we could add a field in each dataset that specifies whether that facility is damaged or not, in which case we may use a categorized symbology. But for now, we will choose a **Single Symbol** for each, and in the **Simple Marker** category “Topology,” you will find some great options for these.
 - o For the Admin 1 dataset, choose this time a transparent fill, with a black outline. Add a label that contains both the name of the parish and its PCode.
 - o You can leave the points of interest and the roads for now, we will work with them a little later.
4. Take a final moment to look at all of your symbology.
 - o Are you completely happy with how everything looks? Is the information clearly displayed? Can you differentiate between different items on the map?
 - o Make your final adjustments now. Remember to check and adjust the order of the layers. Should a layer be on top of another?
5. Before you move on to the next step, take a moment to save your project as **“Critical_Infrastructure_Map”** in GIS\3_Mapping\33_Map_Projects.

3.0 Working at a large scale: basemaps and overview maps

When working at this scale, the map product might benefit from a good amount of detail. This can be achieved by using a basemap.

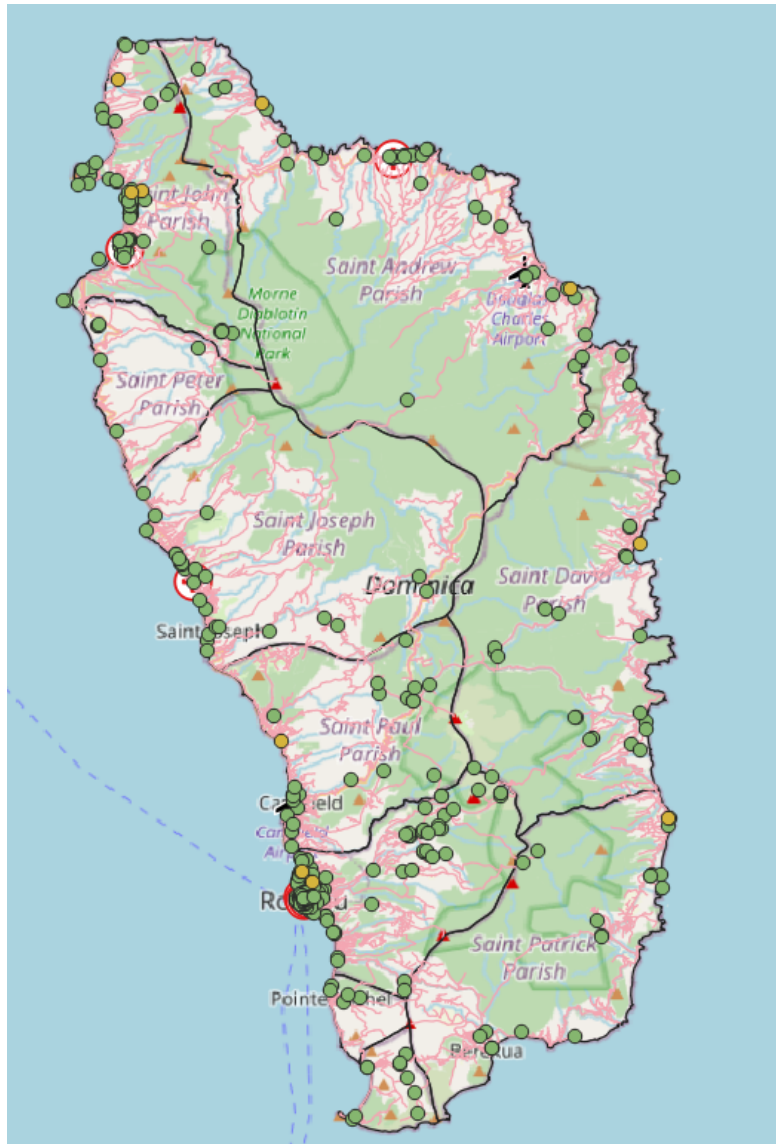
1. In the **Layer Browser**, navigate to **XYZ Tiles**, and select **OpenStreetMap** to import it. It will now show in the layers list.



As you can see, the basemap is a visual layer with a lot of detail. There are many different types of basemaps, and this one is great for orientation as it has roads and points of interest.


Though it looks similar, a basemap is different from the vector layers we have been working with. It is an image, and as such, you can't view the various elements' attribute tables, or select any particular feature. It is meant to be used as a visual aid, but cannot help in terms of analysis.

Your map workspace will now look something like this - clearly a little confused.



We will now spend some time selecting the appropriate information and working on representing everything clearly. We will also create some order in the Layers list, which is always a good idea when we start to work on products with many different datasets.

3.1 Organising the layers list

1. In the Layers list, click on **Add Group**  and call it “Transportation Network”
2. While pressing “ctrl” on your keyboard, select the Airports and the Roads datasets and drag and drop them into the new group
3. Move the Group at the top, just underneath the Admin 1 layer. You can now control these 2 datasets with a single click.
4. And another one for “Education and Health”

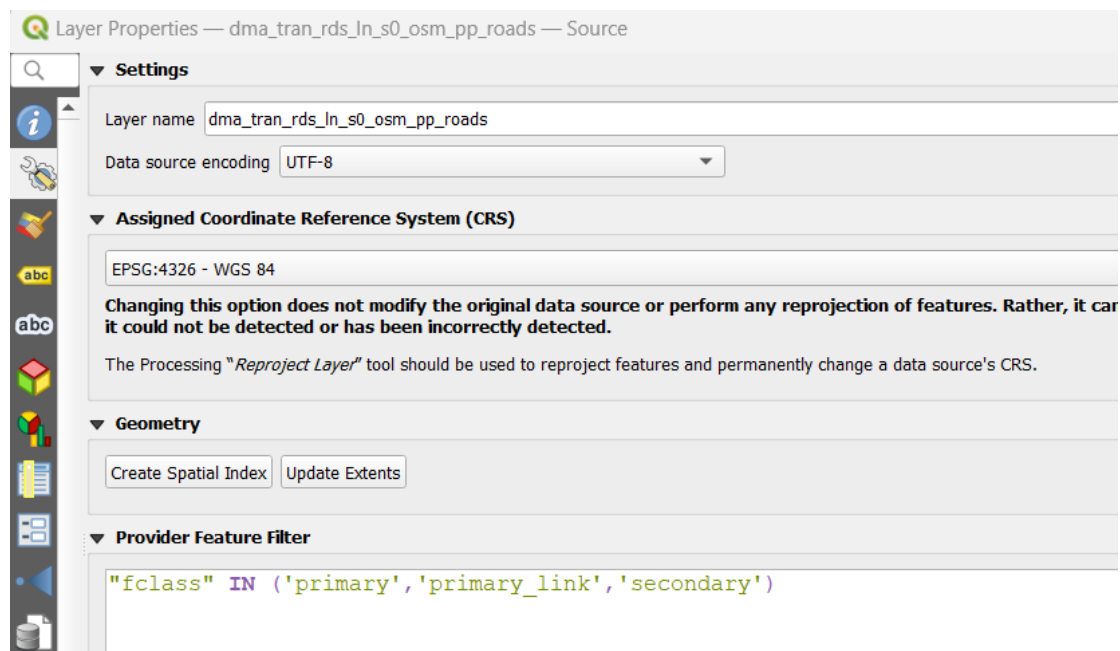
This looks a lot clearer!

- dma_pois_poi_pt_s0_osm_pp_pointsofinterest
- ▼ Transportation Network
 - dma_tran_air_pt_s0_ourairports_pp
 - dma_tran_rds ln_s0_osm_pp roads
- ▼ Education & health
 - dma.dma_hlt_health_facilities_point
 - dma_heal_heal_pt_s3_osm_pp_healthsites
- dma_admn_ad1_py_s0_unocha_pp_parish
- ▼ OpenStreetMap

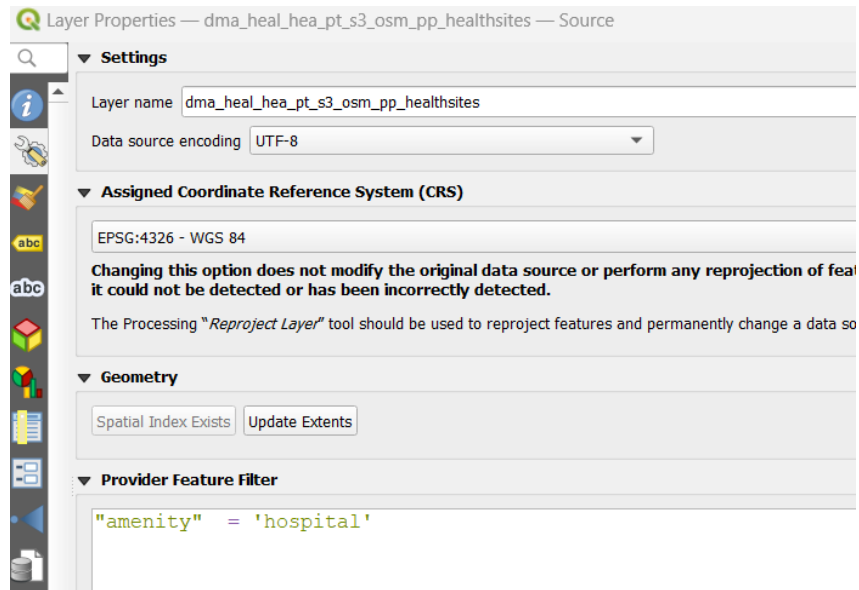
3.2 Selecting relevant data from general datasets: Filtering and Selecting by Attribute

As we have a lot of road detail from the basemap, we don't need to keep all the minor roads in our roads dataset.

1. Right-click on the roads dataset and open its **Attribute Table** to remind yourself of the categories of roads it contains. Look for major roads!
2. Right-click again to open its **Properties**, and under **Source** click on **Query Builder**.
3. Double-click on the various elements to form the following expression




4. Have a pan around and zoom in to look at the result.
5. Change the color so that all main roads are of visible, for example choosing a bright red.
6. Do the same for the Health facilities layer: if you look at the attribute table, you will notice that the layer contains pharmacies and doctors. Let's make sure only Hospitals and/or major health centers are included.

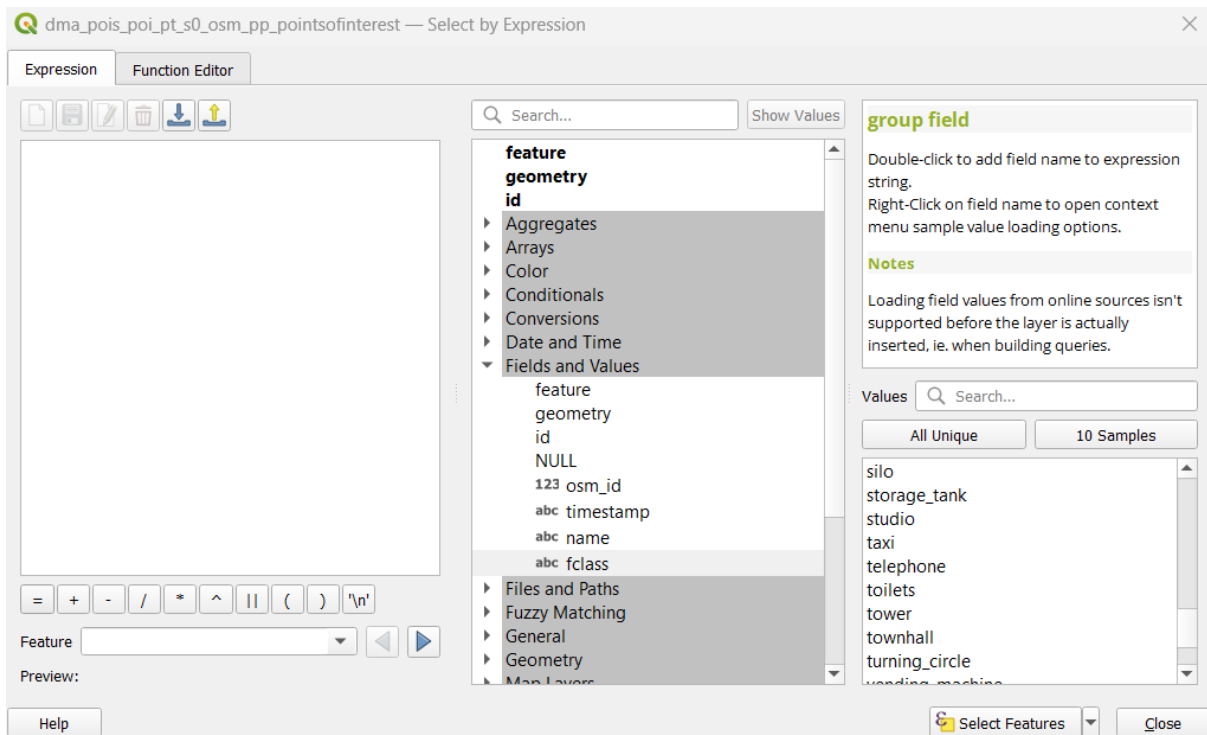


7. Finally, let's look at the points of interest dataset. Open the **Attribute Table** and familiarise yourself with its content and structure. While there are many interesting features in this dataset, we are particularly interested in:

- Ports and ferry terminals, as we are still missing that data for our Transportation Network group.
- Schools

8. On the **Attribute Table** window, click on **Select by Expression** 

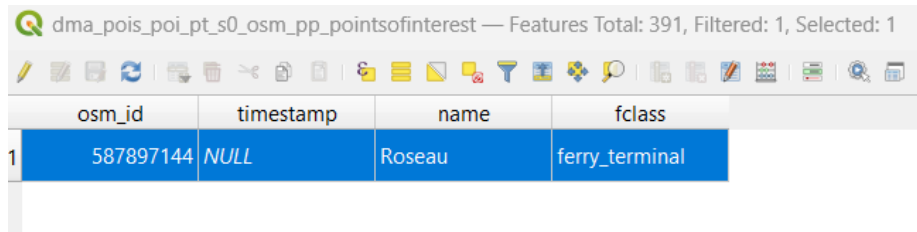
9. Open up the **Fields and Values** middle section, click on **fclass**, and on **All Unique** on the right-hand side to view all the categories in the dataset



10. Compose the Expression: **"fclass" like 'ferry_terminal'** by typing or double-clicking on the various elements

You should now see on the Attribute Table that some features are highlighted in blue, and the points are highlighted in yellow on the map.

11. At the bottom left corner of the Attribute Table, click on **Show Selected Features**



osm_id	timestamp	name	fclass
1	587897144	NULL	Roseau
			ferry_terminal

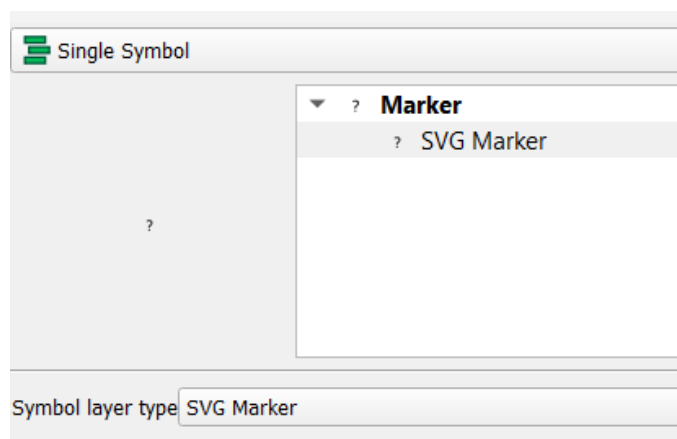
12. We are going to export this as a new dataset: you can close the attribute table (it will maintain the selection), right-click on the points of interest, select **Export**, and the second option, **Save Selected Features As**. Navigate to GIS\2_Active_Data\214_tran and call it dma_tran_por_pt_s0_osm_pp.

13. Repeat this process to obtain a schools dataset:

- From the Attribute Table, click on **Select by Expression**
- Compose the Expression: **"fclass" like 'schools'** by typing or double-clicking on the various elements
- Save as a new layer

14. You can now pick a symbol for your new datasets, and remove the points of interest from the Layers list.

1. For datasets such as education facilities and ports, you may need to be a little creative in terms of Symbology: click on **Simple Marker** and select **SVG Marker** as Symbol layer type

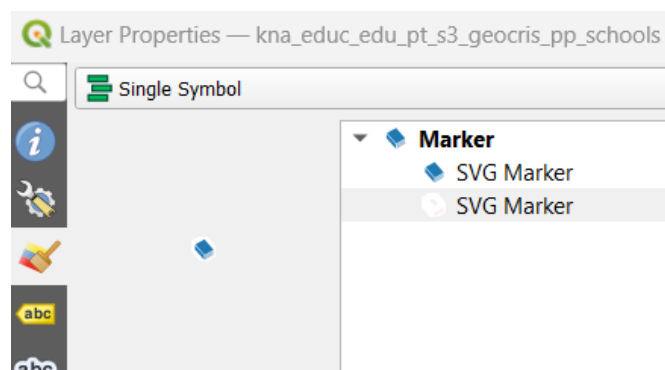


2. Browse the images that appear in the window below to find something appropriate for each of these categories. Could a book represent schools? An anchor represent the ports?

3. To make sure the symbols are clearly readable on the map, also select an appropriate size, and add a white outline. This can be achieved by doing the following:
 - Add a second symbol, the same, by clicking on the green plus icon at the upper right-hand corner of the menu, and move it below the first using the arrows next to the green plus.



- Change its size so that it is slightly bigger than your main symbol
- Change the **Fill color** to transparent
- Change the **Stroke color** to white
- Change the **Stroke width** to a value such as 1



4. Finally, move your ports and ferry terminals in the Transportation Network Group, and the schools in the Education and Health group.

4.0 Reviewing and final aesthetics

You are almost done! Have a final look, and make sure all the information is clearly visible. Move the cities above the other layers, for example. One final, aesthetic option is to add a feather of water around the islands:

1. Right-click on the dma_admn_ad1_py_s0_unocha_pp_parish dataset and choose **Duplicate**. Make sure this copy is at the very bottom of the layers list, but above the basemap.

2. Right-click on and find the **Symbology** menu for this duplicate layer in its **Properties** window.
3. At the very top, in the dropdown window, choose **Inverted Polygons**.
4. Click on **Simple Fill** under the **Fill** option, and find in the **Symbol layer type** dropdown the option **Shapeburst Fill**
5. As Gradient colors, choose transparent as the first color (as we have the sea from the basemap already!), and white as the second, and adjust the distance so that it is about 4 or 5 millimeters.
6. **Apply** and **SAVE!**




5.0 Critical Infrastructure Map Layout

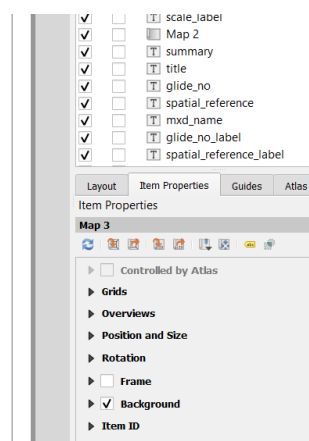
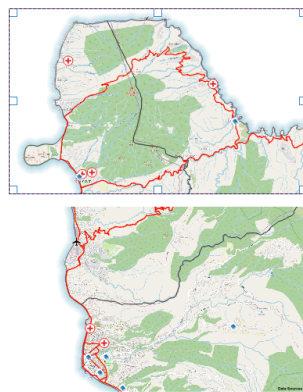
You are now ready to move onto the Map Layout workspace to create your map document.

1. If you previously saved a map document as a template - well done you! That saves a lot of time. You can find your template by clicking on **Project**, and then on **Layout Manager**. Under **New from Template**, choose one of your Landscape templates!
2. If not, from the **Project** menu select **New Print Layout**. You will be prompted to enter a title. Click **OK**.

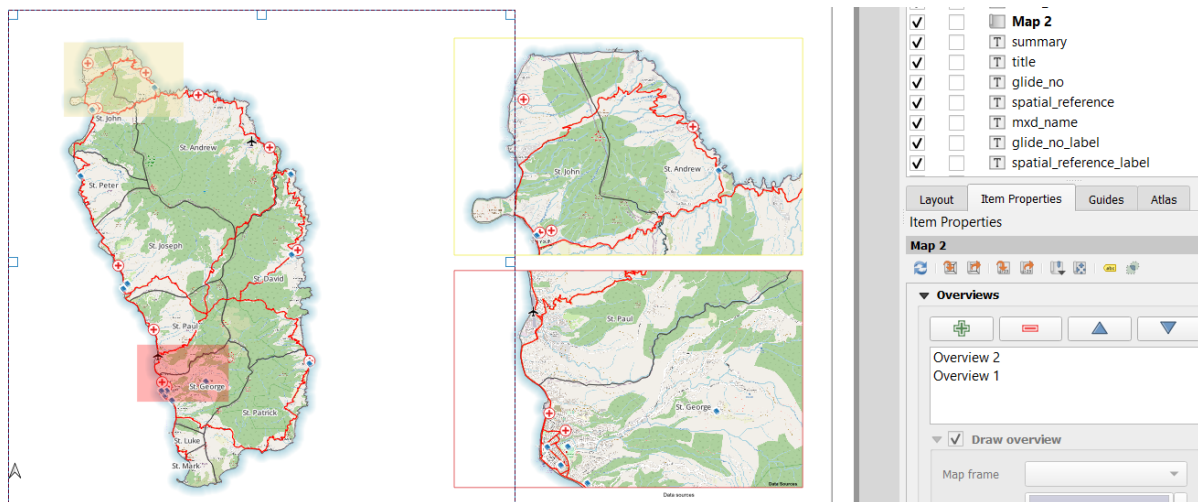
You can refer back to Practical # 4 to know how the Print Layout Workspace works and how to get to your final product.

For this map, we will add various elements.

1. Start with your landscape page, and add on the left side a main map of the country. Now, because these maps are very busy with information, we are going to zoom into some of the areas with more points
2. With the **Add Map** tool,  add a second map on the top right side of the page, and a third just underneath.
3. With the **Select Tool**,  click on the second map and adjust the zoom in the **Main Properties** menu on the right, and Pan around the map  to create a nice overview of Roseau



4. And do the same for the third map, this time focusing on the north of the island.
5. Back on the Main Map, using the **Select Tool** to open its Item Properties menu on the right, scroll down to Overviews, click on the green plus, and select the Roseau Map in the dropdown below to create a highlighted area on the main map that shows where the area in the overview is located. Repeat again for the northern area overview, perhaps choosing a different color, by clicking on the **Frame Style**. If you wish, you may go back to the two overview maps and add a frame of the color of the two highlighted areas on the main map, to make sure it is clear which represents which area.



6. Now spend some time adding all the final elements, such as a descriptive title, description, data sources, legend, and scalebar.
7. When you are happy, **Export** and **Save!**

6.0 Saving a project

Saving a project allows you to return to it later and continue working on it.

1. From the project menu select **Save**
2. If it is the first time saving the project, use the menu prompted by QGIS to save the project within the folder `..GIS\3_Mapping\33_Map_Projects` and change its name to call it "**Critical_Infrastructure_Map.**"

7.0 Summary

In this session, you produced a very important product in a response and learned how to work with basemaps at larger scales.

Well done!