Massey University

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Location Data: Mapping, Analysis and Visualisation

At-Home Activity 4: Joining Spatial Data using QGIS

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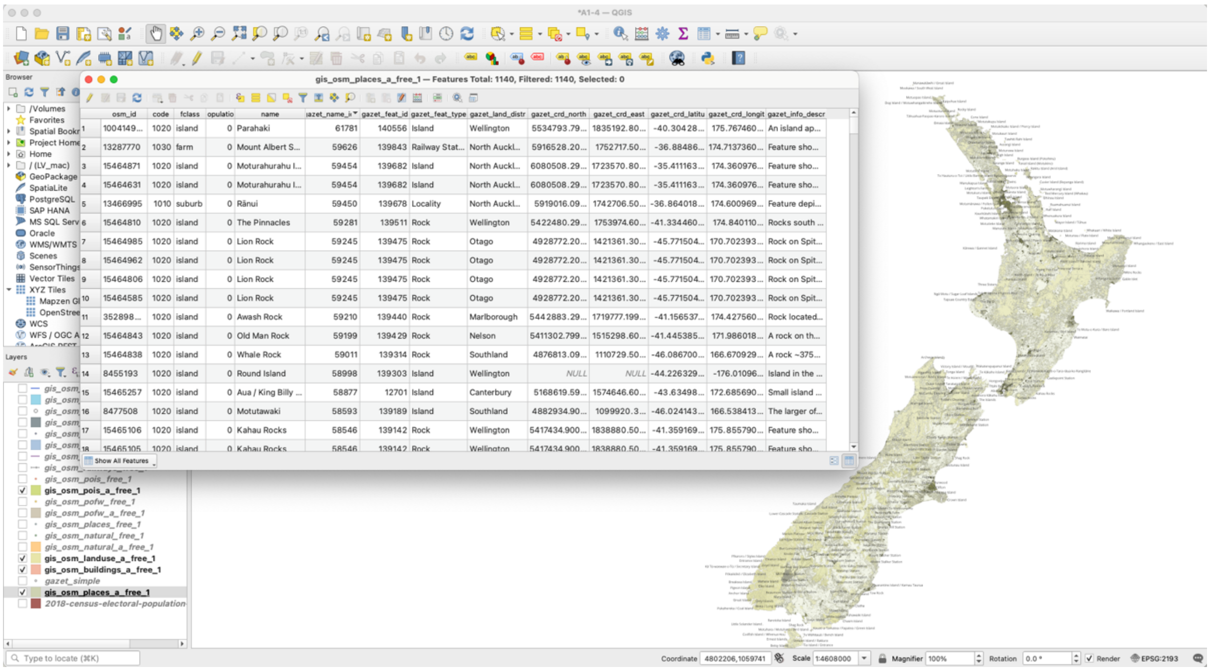
Task: Use the Join Attributes by Field Value function in QGIS to perform two different attribute joins.

1. Joining Place Names (OSM Places and Gazetteer)

Joined place names from "*gis_osm_places_a_free_1*" with Gazetteer place names. First, I exported a more basic subset of the Gazetteer, for performance reasons. Then, performed the attribute join navigating to Joins Tab in "*gis_osm_places_a_free_1*" Properties. Created a new join of simplified Gazetteer layer "*gazet_simple*" and using "name" as join and target field, whilst leaving "gazet_" prefix as shown in the final join result in Fig.1 (QGIS, 2024, Section 16.4; Longley, Goodchild, Maguire, & Rhind, 2015).

Figure 1

Gazetteer Layer Attribute Table After Common Name Field Value Join

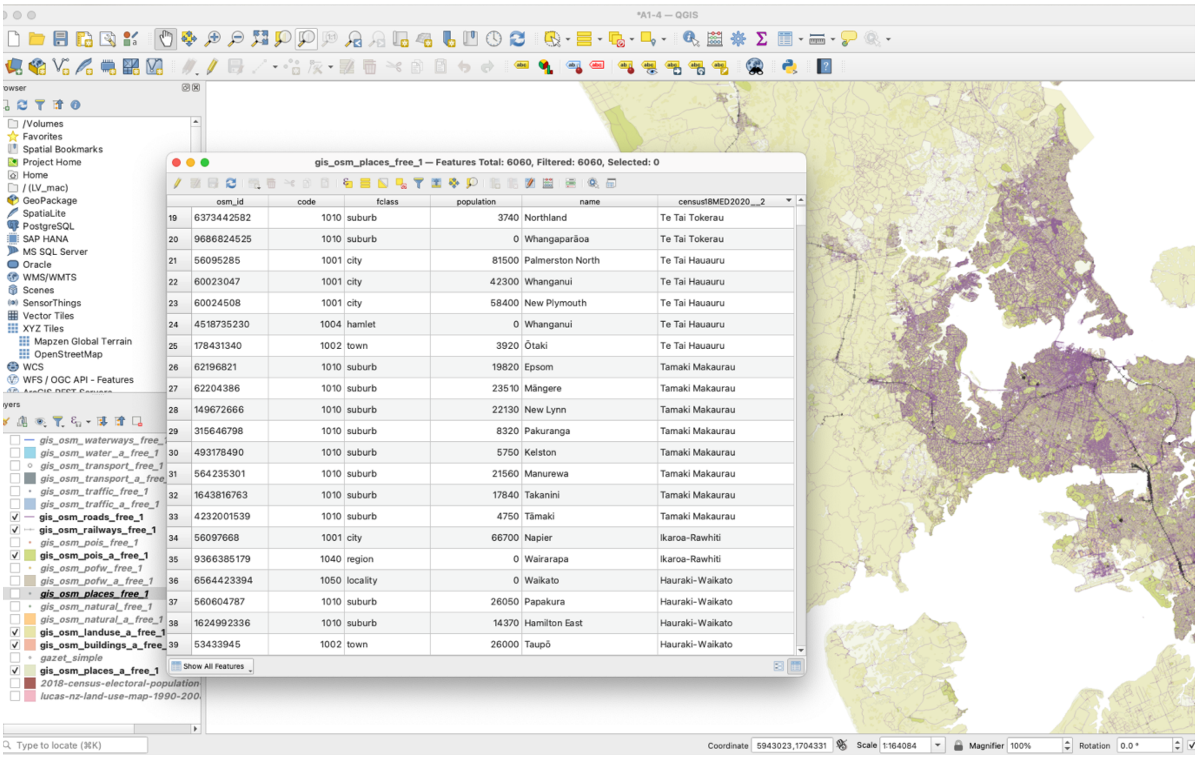


2. Joining Māori Place Names (OSM Places and 2018 Census)

For the second join, I used 2018 Census Electoral Population and the OSM Places layers. The goal was to add the Māori names to the "*gis_osm_places_free_1*" layer. Thus, opened Joins Tab (from Properties), joining 2018 Census, field "*GED2020__2*" and target field "*name*". Also included the prefix "*census18*" and joined only the field "*MED2020__2*", which together with the created spatial indices allowed to speed up the join process.

Figure 2

OSM Places Layer Attribute Table After Common Field Value Join



Task: Use Join Attributes by Location to:

a. Create a table/layer that shows the population for all meshblocks along railway lines.

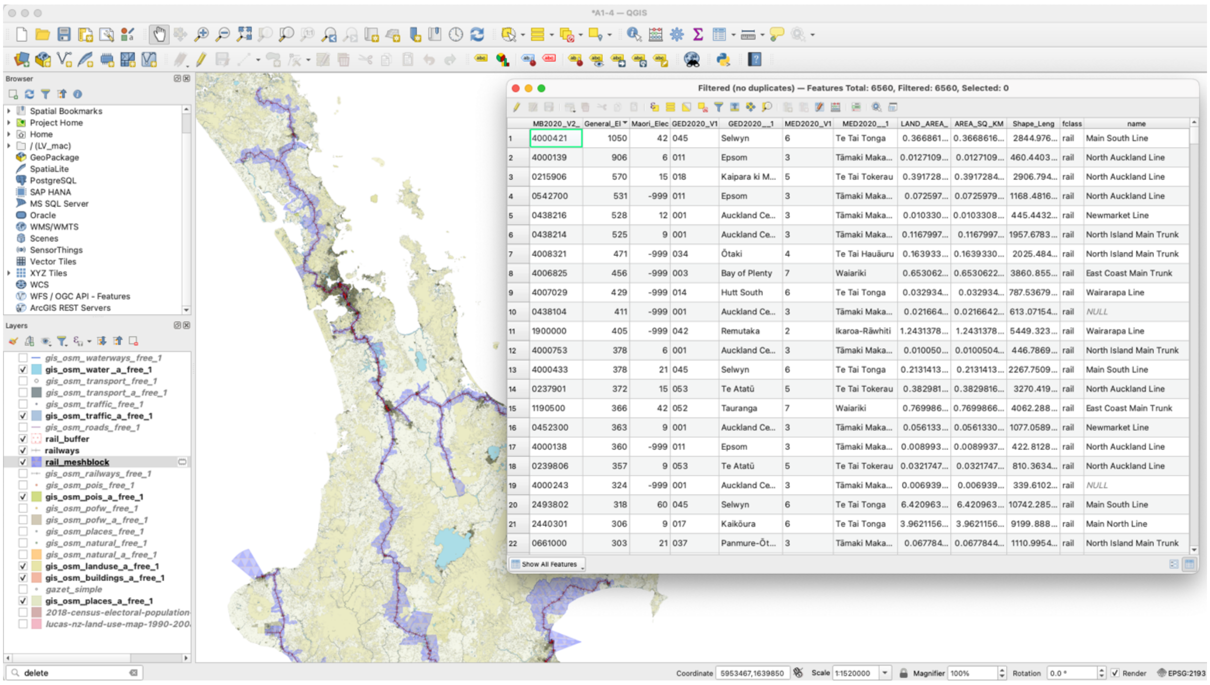
Created "*rail_buffer*" around the "*railways*", an area of 150 meters[1] "along railway lines".

Then, I *Join Attributes by Location* of 2018 Census that **intersect** with the "*rail_buffer*" layer by "*name*". Found some meshblock duplicates, due to multiple rail lines intersecting with same meshblock. Thus, used *Delete duplicates by attribute* based on meshblock "*MB2020_V2_*", as shown in Fig.3.

Using predicate **intersect** guarantees all meshblocks with partial and/or full overlap gets captured, for a complete representation of populations along the railways.

Figure 3

Meshblocks Along Railways – Partial view of North Island



Note. QGIS screenshot shows a partial projection of the meshblocks along railways (intersecting a region of 150 meters from the railways) in purple. A table of the layer's attributes, displaying the electoral population for these meshblocks along the railways.

[1] The assumption was based on two minutes walking distance. I averaged the Australian 1.2m/s (Akçelik, 2001) and Japanese 1.3m/s (Obuchi, Kawai, & Murakawa, 2020) studies, thus 150 meters.

b. Perform two other join attribute by location operations between pairs of tables.

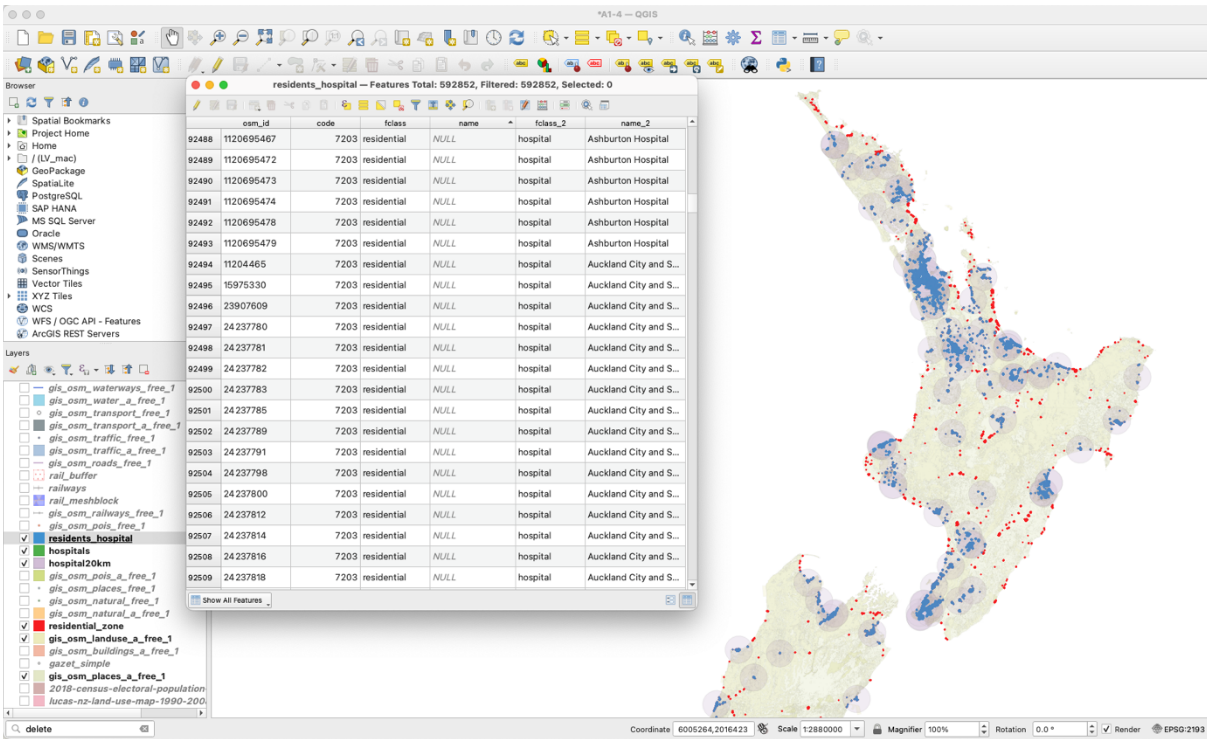
1. Residential areas covered with Hospitals within a 20km radius

First, isolated feature "*hospitals*", and repeated for "*residential_zone*" layer. Then, created a 20Km buffer around hospitals "*hospital20km*".
Finally, proceeded with "*Join Attributes by Location*" tool, joined "*residential_zone*" within the buffer "*hospital20km*", resulting layer "*residents_hospital*".

Used predicate **within** to capture only residential areas that fall inside a 20Km radius from a hospital, focusing on the residents perspective rather than the hospitals' buffers (contains predicate). This allows to visualise hospital coverage, helping planning healthcare services, and emergency response (Rahimi, Goli, & Rezaee, 2017).

Figure 3

Residential Areas Covered by Hospital within a 20 Km Radius – North Island



Note. The screenshot from QGIS illustrates in blue residential areas within a 20 Km radius from a hospital. In red, residential areas outside the 20Km radius. The attribute table after the join attribute by location is also displayed.

2. Residential Areas near Schools, Parks and Beaches

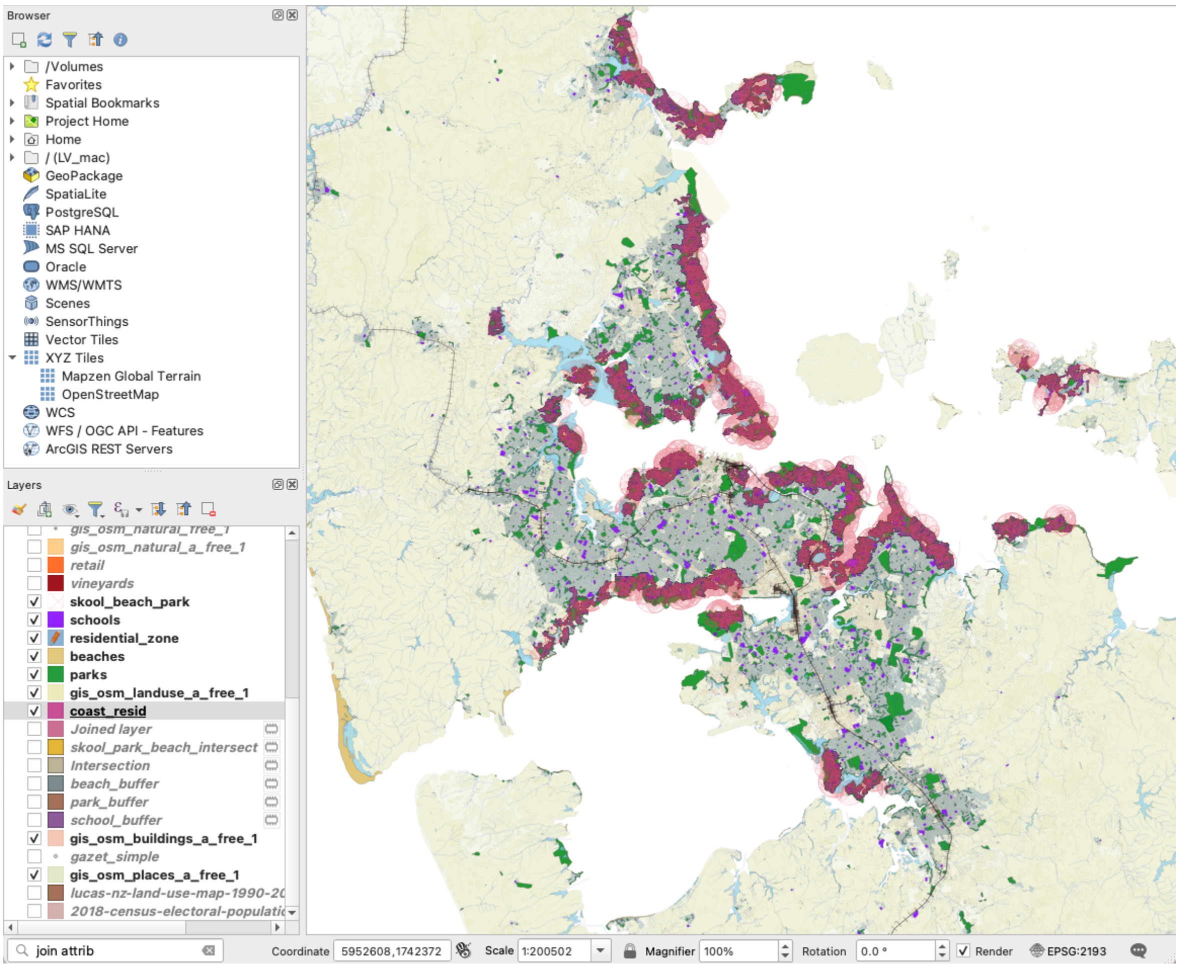
First, isolated Schools, Parks & Beaches into new layers, before creating a 1 km buffer for each. Then, used vector intersection tool to obtain only common areas where all buffers overlap.

Did a spatial join of residential homes with merged buffer, to extract the residential zones that **intersect** with schools and parks and beaches 1 Km radius (in burgundy in Fig.4).

This projection could benefit businesses such as real estate developers, retail and services location and marketing strategic assessments, as well as families looking for the perfect home location with seaside proximity, thus using **intersect** predicate to capture that proximity to the amenities.

Figure 4

Residential Areas near Schools, Parks and Beaches (in burgundy) - Auckland



Task: Use Join Attributes by Location (Summary) to answer the following questions:

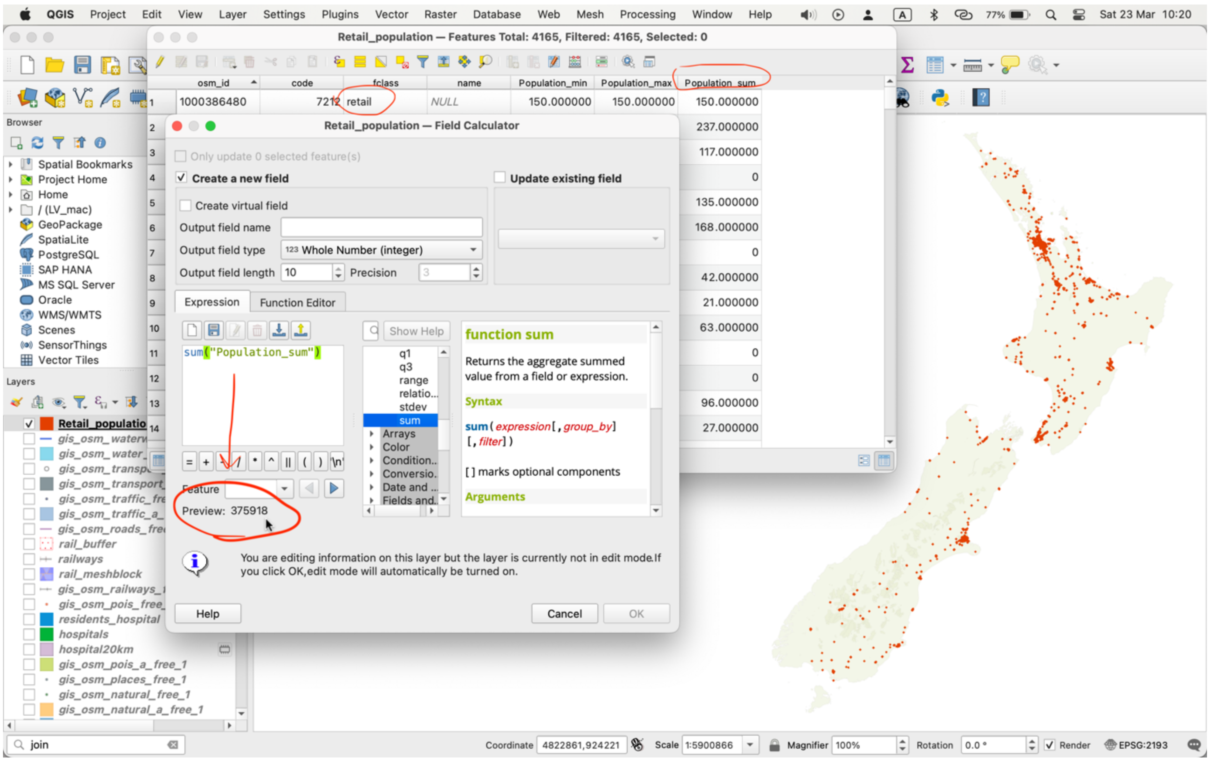
a. What is the total population of all retail areas across New Zealand?

The total population of all retail areas across New Zealand is **375,918**.

I created "Population" field considering only general electoral with a positive value, converting -999 into Null, to avoid skewing data. Then, using the join of "retail" and Census layer attributes to obtain their intersection's "Population_sum". Finally, used the Field Calculator to obtain the total sum of the population for retail areas, Fig.5. (Longley, Goodchild, Maguire, & Rhind, 2015).

Figure 5

Total Population of All Retail Areas Across New Zealand



b. Which land use has the greatest number of place names in New Zealand?

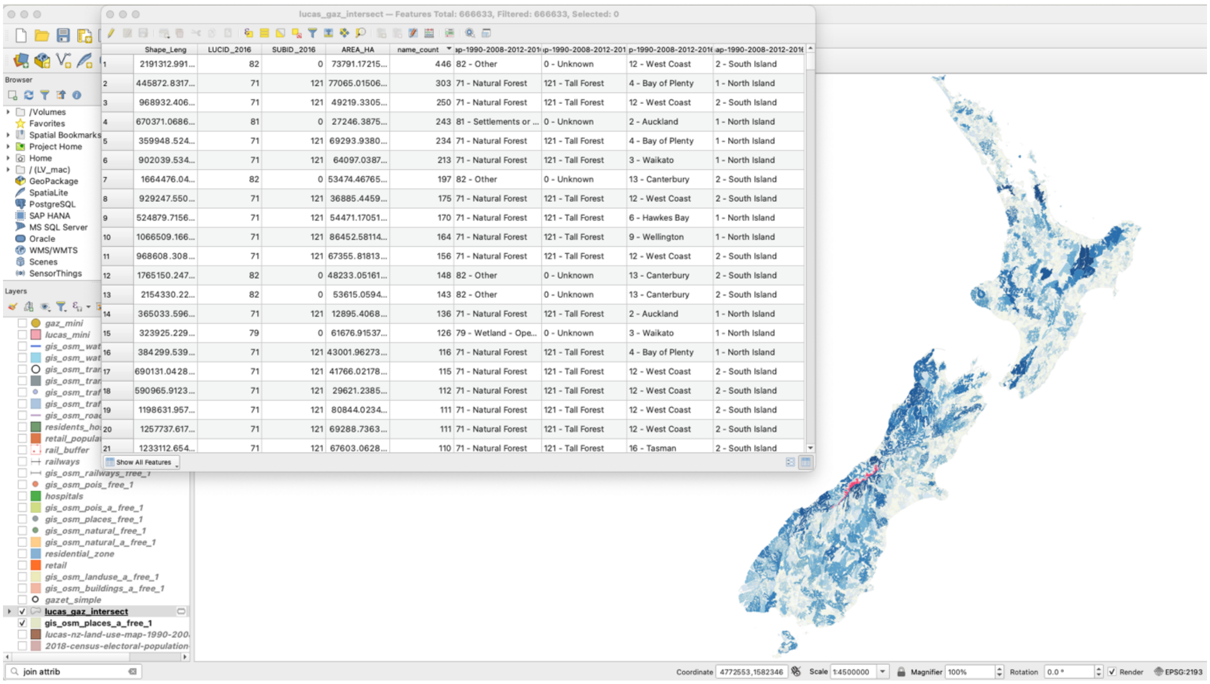
Land use 82-Other 0-Unknown in South Island West Coast with **446 place names**, shown in red in Fig.6.

Using the land use layer LUCAS NZ and the Gazetteer for places names, I use the Refactor tool to reduce columns, creating the smallest subset of both layers to minimise the computation time. Then, using joining attribute by location of "*lucas_mini*" and "*gaz_mini*", counting place names intersecting with land use areas. The new "*lucas_gaz_intersect*" layer was then joined with attributes from LUCAS NZ to retrieve the land use name and region.

This procedure allowed to reduce the initial join estimate of over 230 minutes (Fig.7) to a few minutes. I also experimented using Dissolve on the LUCAS layer but kept crashing QGIS.

Figure 6

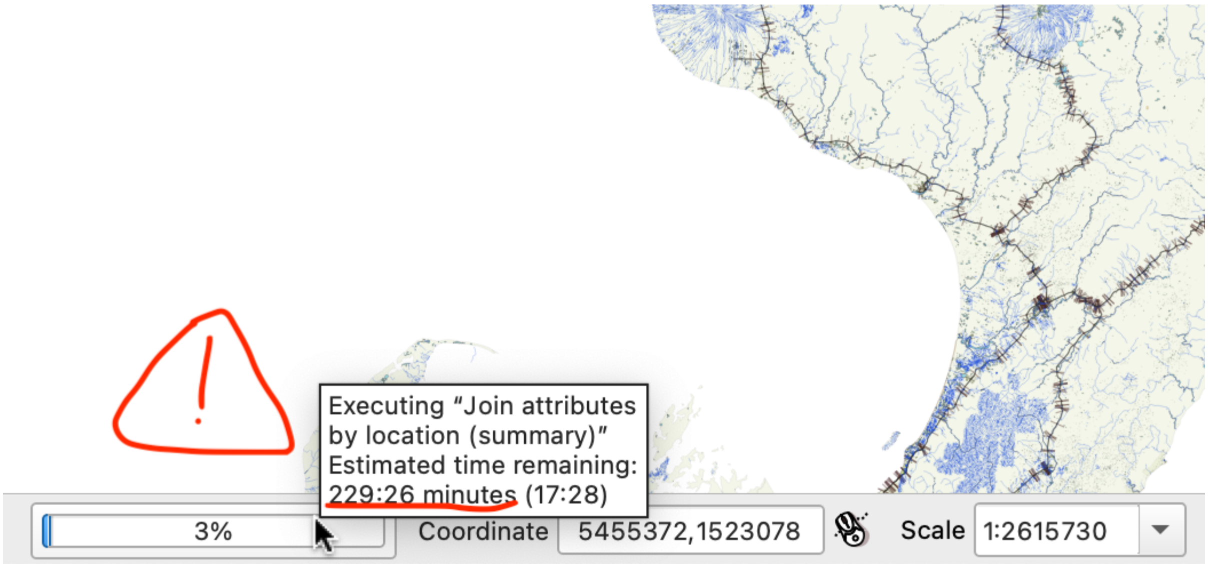
Land Use by Count of Place Names



Note. QGIS screenshot displays the table with land use areas and the count of place names in descending order. The map shows a graduated blue colour, darker for land use areas with larger number of place names. In red, the land use area with the largest number of place names.

Figure 7

Join Attribute by Location (Summary) Initial Estimate Time



c. What is the total area of buildings that are within 2km of a vineyard in New Zealand?

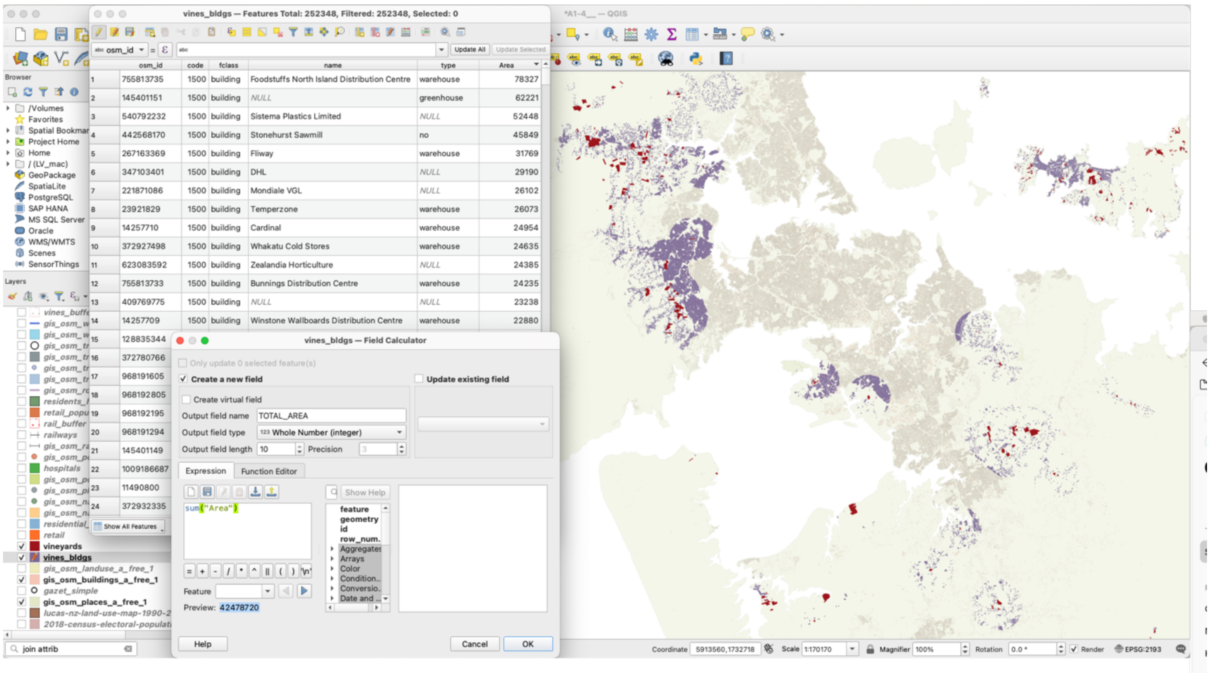
The total area of buildings within 2 Km of a vineyard is **42,478,720** m^2.

First, isolated vineyards "*gis_osm_landuse_a_free_1*" and exported as new layer. Next, create new Area field in "*gis_osm_buildings_a_free_1*" layer, and Buffer of 2 Km around the new layer "*vineyards*".

Then, using the tool Join Attribute by Location (Summary) joined buildings that are within the "*vines_buffer*" and summarising as "*sum*". Finally, using the field calculator, retrieved the total area (Fig. 8).

Figure 8

Buildings Area Within a 2km Radius of a vineyard



Note. Partial view of Auckland Region, showing in dark red the vineyards, and in purple the buildings within a 2 Km radius. Table shows the buildings area within the buffer by Area, in descending order. At the bottom left, the total area sum for all buildings within this 2 Km radius from a vineyard. The largest building area is Foodstuffs' Auckland Distribution Centre with about 78,000m² [2].

[2] https://www.stuff.co.nz/business/124857669/foodstuffs-staff-move-into-building-big-as-8-rugby-fields (Harris, 2021)

References

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