



# Creating and Editing Data in QGIS: Plotting household locations and creating survey areas

**Learning objectives:** In this course we will create and edit both **spatial** data and **attribute** data, in a Geographic Information System. By spatial data we are referring to points, lines and polygons that represent real-world features (those could be road networks, locations of schools or health facilities, or as in this course – enumeration area boundaries). By attribute data we are referring to contextual information about those spatial features (e.g. survey location ID, road type, number of accidents per month, estimated population of a built-up area, etc., etc).

**Scenario:** continuing the theme of course B002 (working with primary field data), you are again a survey planner; you are tasked with creating new and editing existing survey area boundaries as a means of improving ongoing surveys.

**By the end of this session you will be able to:**

- Navigate to an area using shared *Spatial Bookmarks*
- Create a new *GeoPackage* and point layer
- Digitise new GPS survey point locations
- Add attribute data to new location points
- Move existing location points
- Set up snapping for accurate digitising of area polygons
- Create new- and modify existing enumeration area polygons
- Locate and correct topological errors in area polygons
- Apply advanced digitising and error checking with *Geometry Checker* Plugin (optional section)
- Apply an advanced method of data attribution to reduce errors during digitisation (optional section)
- Manage attribute fields effectively
- Use *Field Calculator* to calculate enumeration area (polygon) coverage

**Required GIS software:** to complete this exercise you must have QGIS open source software installed on your computer. The exercise was written for **QGIS version 3.22** ('Long Term Release' version, at time of writing) and for the Microsoft Windows operating system. To download QGIS, go to <https://qgis.org/en/site/forusers/download.html> and follow the installation instructions.

## Part 1 – Create a GeoPackage database to store new point locations

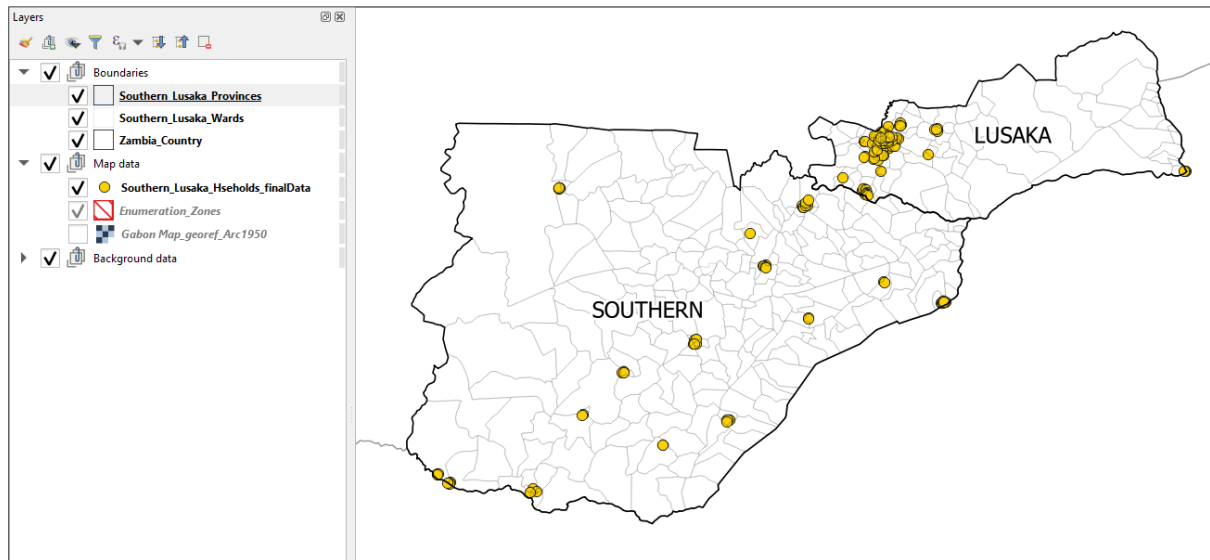
You are planning to send survey staff to some new residential locations. Enumeration areas have been defined but surveyors will need a digital GPS location for each area, and which corresponds to the paper map they will have with them. You will create some points which could then be loaded into a GPS unit.



1. Open an existing QGIS project and inspect the data

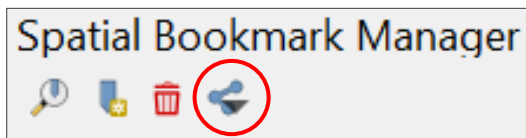
- Open the following QGIS project file:
 

*C:\G3\_GIS\_Training\Exercises\B003\_Exercise\_Creating Editing Data.qgz*
- Inspect the data layers, the attribute tables, zoom and pan around the map window to understand the data



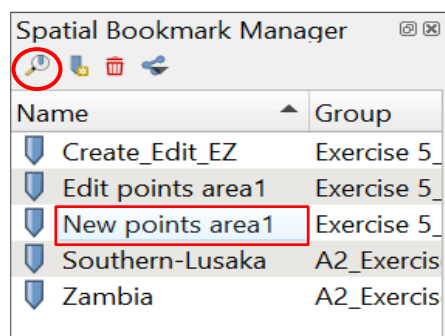
2. Import a bookmarks file and zoom to a pre-saved location

- Open the Spatial Bookmarks panel if it is not already open (go to View > Panels > Spatial Bookmark Manager)
- From the bookmark tools, click **Import/Export Bookmarks**



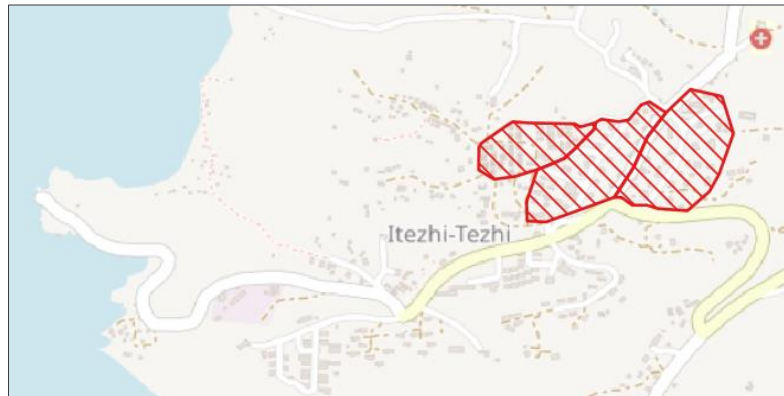
- Select **Import**
- Navigate to and select the following bookmarks file:
 

*C:\G3\_GIS\_Training\Exercises\Data\Bookmarks\B003\_Bookmarks.xml*
- Click **Open**
- You should see the following bookmarks appear:



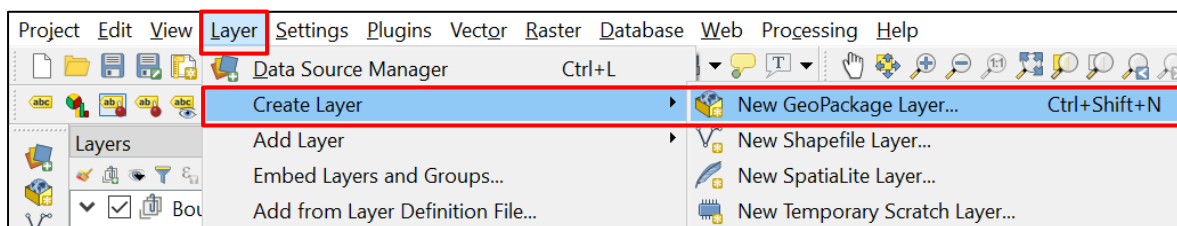


- Either double-click *New points area1* or single click then select **Zoom to bookmark** highlighted above
- The map should zoom to a new location – the settlement of *Itezhi-Tezhi*; other data layers have now appeared (their visibility is controlled by **Scale dependent visibility**)



3. Create a new point location layer inside a new GeoPackage

- Go to Layer > Create Layer > New GeoPackage Layer



- In the dialog box that appears complete the details as below:



New GeoPackage Layer

Database: Data\Output\_data\GPKG\_CreateEditData.gpkg

Table name: GPS\_point\_locations

Geometry type: Point

Include Z dimension  Include M values

EPSG:4326 - WGS 84

**New Field**

Name: GPS\_ID

Type: abc Text data

Maximum length: 5

Add to Fields List

**Fields List**

Name	Type	Length

Remove Field

► **Advanced Options**

OK Cancel Help

- We will establish the database in the following location:  
C:\G3\_GIS\_Training\Exercises\Data\Output\_data\GPKG\_CreateEditData.gpkg
- Name the new table as indicated and ensure you select **point geometry**
- Set up a **Test data** field named *GPS\_ID* with a maximum character length of 5
- Now click Add to Fields List
- Complete the **Fields List** as shown below
- Expand the Advanced Options
- Add a **Layer Description** as follows: Layer used for training to generate GPS survey locations
- Click **OK**



**Fields List**

Name	Type	Length
GPS_ID	text	5
plotted_by	text	30
comments	text	150

Remove Field

**Advanced Options**

Layer identifier: GPS\_point\_locations

Layer description: Layer used for training to generate GPS survey loc

Feature id column: fid

Geometry column: geometry

Create a spatial index

OK Cancel Help

- Your new layer *GPS\_point locations* now appears in your **Layers** list; you now have an empty dataset in which to digitise new GPS survey points

**Layers**

Boundaries
 

- Southern\_Lusaka\_Provinces
- Southern\_Lusaka\_Wards
- Zambia\_Country

  Map data
 

- GPS\_point locations**
- Southern\_Lusaka\_Hseholds\_finalData
- Enumeration\_Zones
- Gabon\_Map\_georef\_Arc1950

  Background data



## Part 2 – Digitising new point locations and editing existing locations

You can see three enumeration zones already digitised; each zone requires a point feature located within its boundary which could then be uploaded to a GPS and taken to the field for navigation. You will place the points in logical locations such as road intersections or open areas close to the centre of each zone. We will then move on to moving and deleting existing points.

### 1. Digitise new point locations on the map canvas

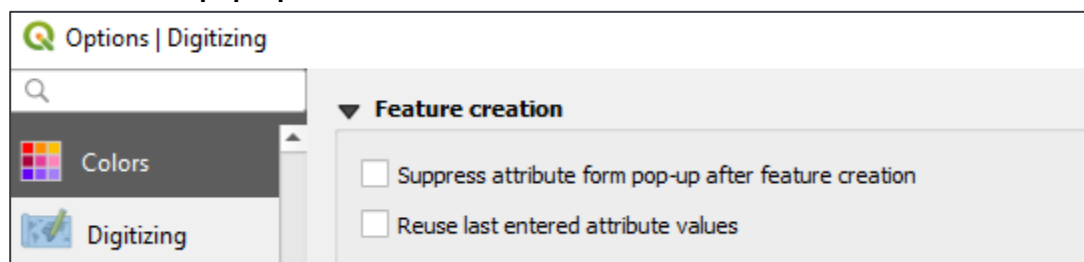
- Firstly, zoom in to the three enumeration areas
- Now we will start an editing session; first, ensure that *GPS\_point locations* is the **Active Layer** by clicking it in the **Layers** panel
- Now locate the Digitizing Toolbar (if it is hidden, go to View > Toolbars > Digitizing Toolbar)
- Click the pencil icon (**Toggle Editing**), to start editing, then click the **Add Point Feature icon**



- Now place the first point in one of the zones by left clicking at the desired location:
- A dialog box will appear – this allows you to add attribute data regarding this new point location; fill it in as follows:

- Now digitise two more points in the same way for the other zones

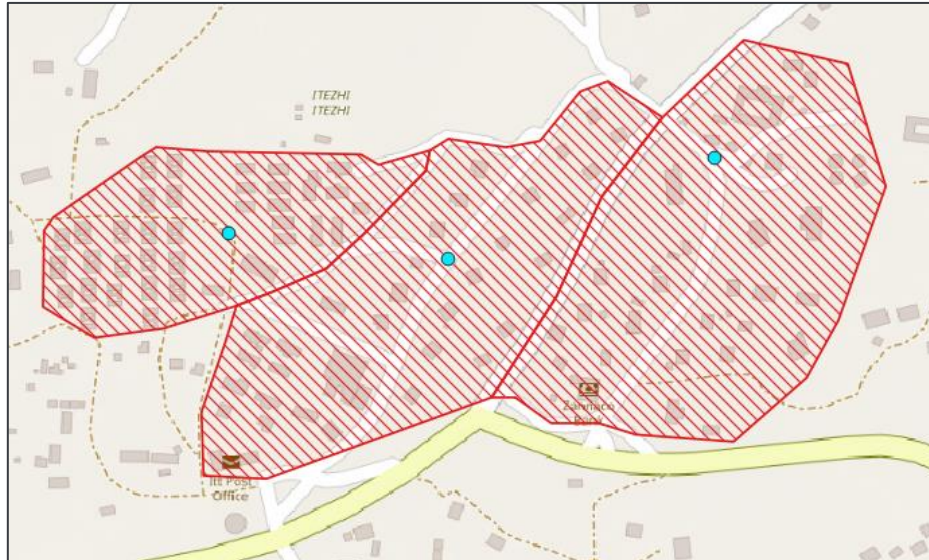
**Note!** If this **Feature Attributes** window does not pop up, it may have been disabled in your QGIS settings. Go to **Settings > Options... > Digitizing tab > then untick Suppress attribute form pop-up after feature creation:**





### Challenge:

Use the **Identify** tool to work out the enumeration zone ID for each area and use this value as the GPS\_ID for your new points



- Now open up the **Attribute Table** for *GPS\_point locations* and ensure all is correct
- When you have finished creating data locate the **Digitizing Toolbar** click **Save Layer Edits**:



- Finally click the pencil icon again to **Toggle Editing** off



**User tip:** For efficient, advanced editing look at setting up widgets for feature attribute classification (**Layer Properties > Attribute Form** tab)

### Challenge:

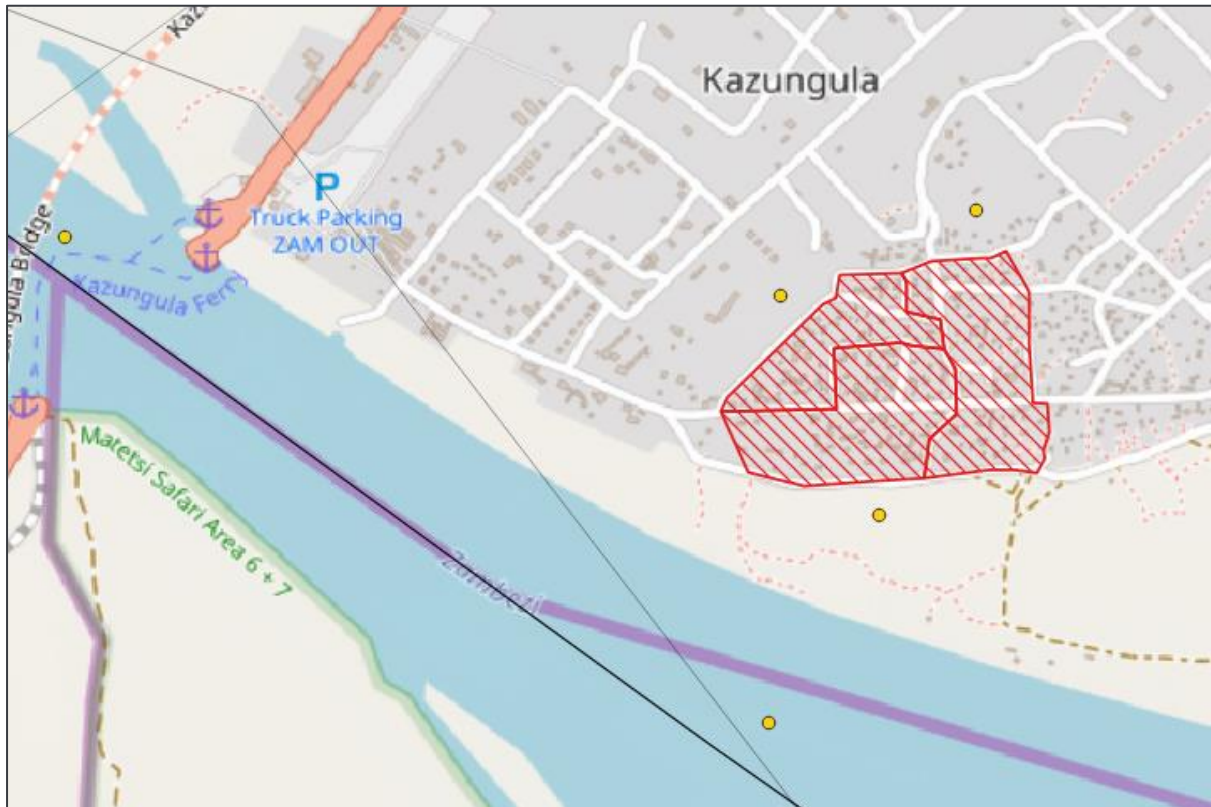
if you have a GPS device, apply the knowledge you gained in B001 to upload these new points to the device, using the **GPS** tools, in the **Processing Toolbox**

We will now return to the household survey cluster locations to clean up some data errors, i.e. editing existing data. Some of the points in the dataset need deleting, whilst others are in the wrong location.

2. Delete existing point locations on the map canvas
  - Hide the layer *GPS\_point* locations by ticking the checkbox next to it in the Layers panel



- In the **Spatial Bookmarks** panel, go to *Edit points area1*
- A new location appears, zoom out to orientate yourself to this location

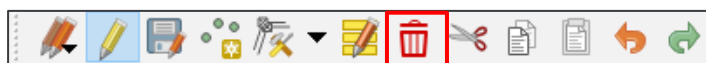


The yellow point data you can now see are part of the dataset *Southern\_Lusaka\_Hseholds\_finalData*. There are clearly two household location points incorrectly plotted. These are duplicates and should be deleted.

- Ensuring that *Southern\_Lusaka\_Hseholds\_finalData* is the **Active Layer**, start an editing session in the way previously described (*hint: pencil icon...*)
- On the Selection Toolbar, locate and click the tool: Select Features by area or single click



- Now single click one of the points; you should see a faint red cross appear in the point; it is now selected
- Click Delete Selected on the Digitizing Toolbar:



- Repeat for the second point
- Now Save Layer Edits as before

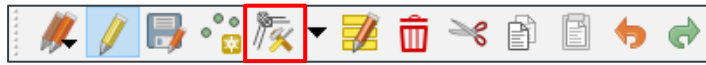
### 3. Move existing point locations on the map canvas

Remaining in the same map extent, notice three points which are not located within the enumeration zones. We will re-locate these to a sensible location.

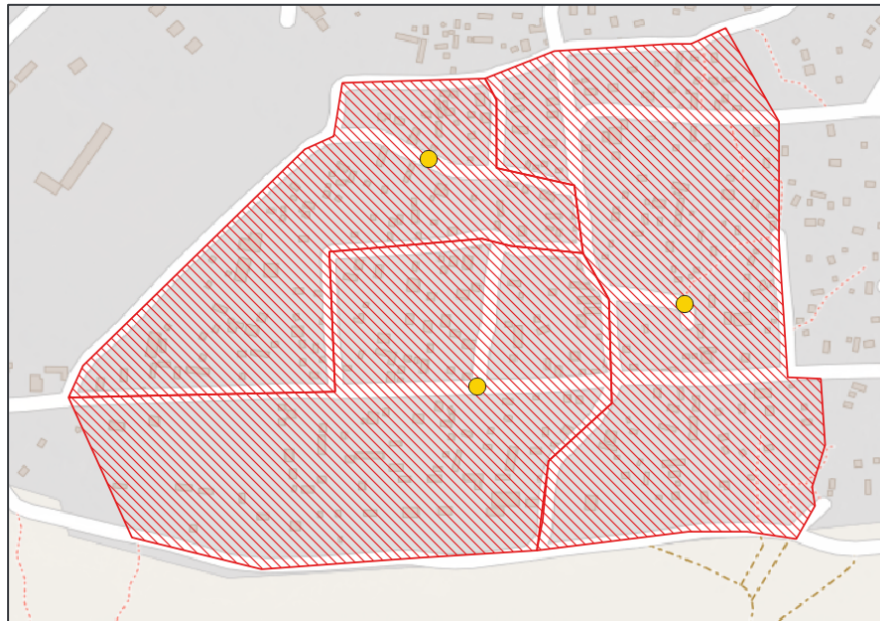




- Make sure you are still in *editing* mode
- Click the **Vertex Tool** icon:



- Take the cursor and hover over the point you intend to move, when the point clearly highlights RED, single-click the point
- Now take your cursor to a location within the closest enumeration zone, and single click to move the point:



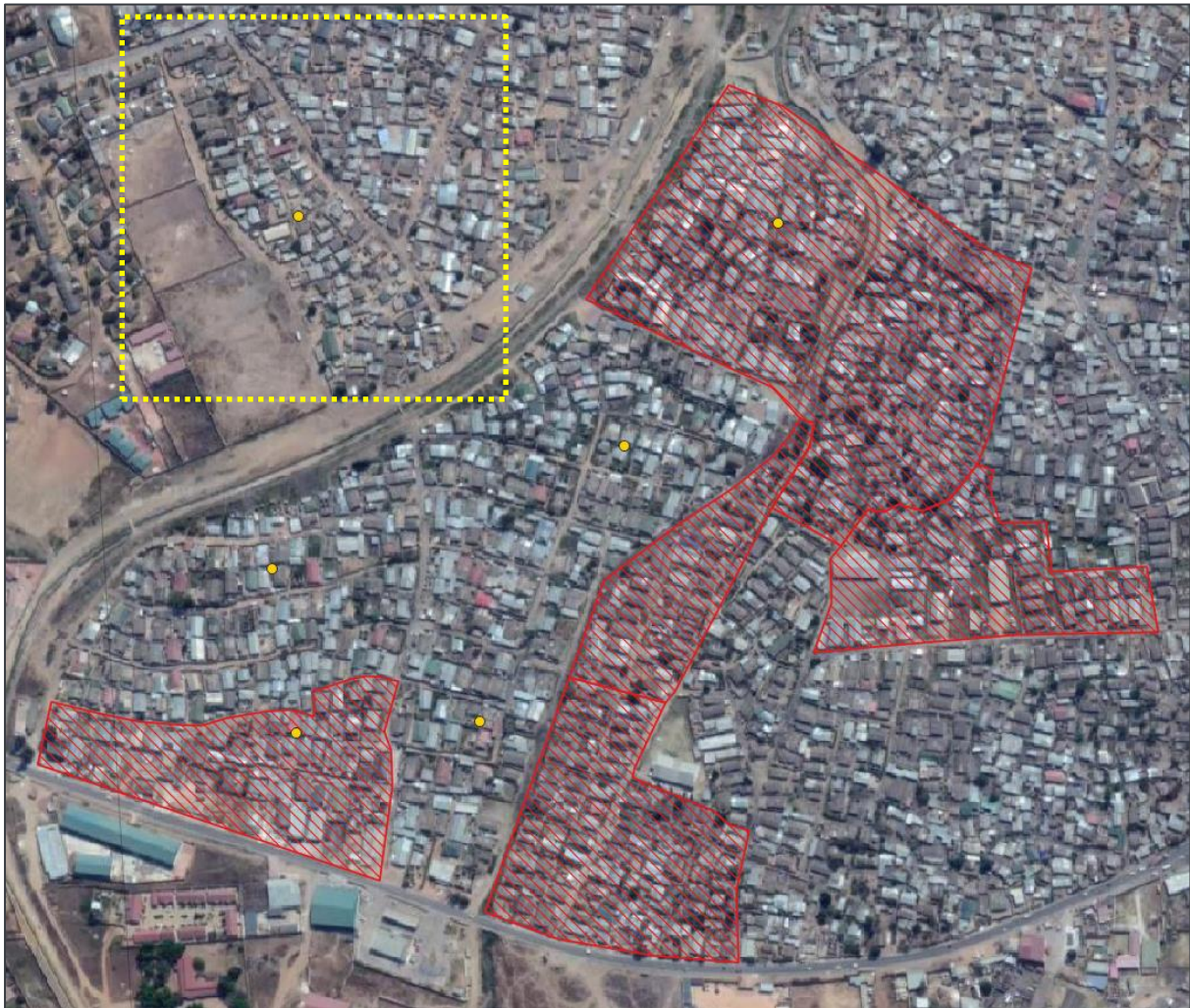
- Save your edits and stop editing



## Part 3 – Digitising new, and edit existing polygons (enumeration zones)

We will now focus on polygon data, i.e. data that could represent enumeration zones (EZ), or built-up areas, neighbourhood classification blocks etc. Initially we will be adding new EZs to a dataset before going on to edit an existing EZ; we will use a range of digitizing tools provided by QGIS.

1. Navigate to a pre-saved spatial bookmark
  - In your **Spatial Bookmarks** panel, zoom to *Create\_Edit\_EZ*



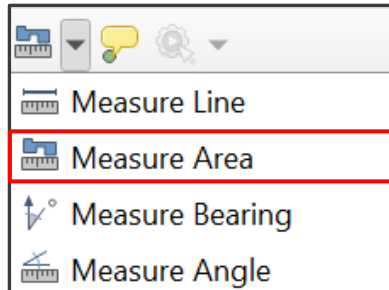
This is an area of Lusaka, north of Emmasdale, in which somebody has been digitizing EZs (red hashed regions) in preparation for upcoming household surveys. The location of an enumeration zone is initially determined by a point location – in this case the yellow points. (The points are typically created using a statistical sampling process to ensure the locations are representative of the wider region.) Enumeration zones must also adhere to a number of important criteria:

- The area must be 3 - 5 Ha (thus ensuring it is 'walkable' by a survey team)
- EZ boundaries should not cross rivers
- Roads should be used, where possible, to determine boundaries

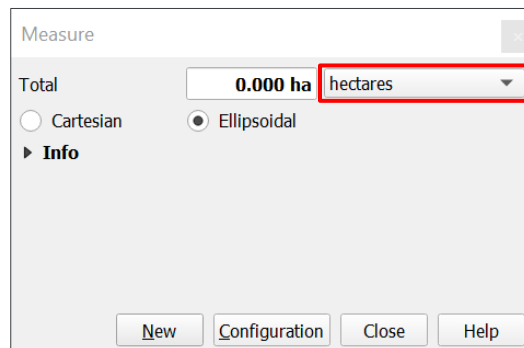
As you can see the digitising process in this area is incomplete; you will notice there are four point locations which have no corresponding EZ.



2. Plan the size and dimensions (i.e. 3-5 Ha) of your 'enumeration zone' polygon
  - First, zoom in to the area highlighted in yellow, above
  - Bring up your **Measure Area** tool from your **Attributes** Toolbar



- In the dialog box that opens change the units to **hectares**



- Whilst keeping the tool open, use the **Measure Area** tool to get a sense of the size of 3-5 Ha in this context; study the road layout and other features
- Now plan the size and dimensions of your Enumeration Zone

3. Digitize a new simple polygon.

- Ensuring that *Enumeration\_Zones* is the **Active Layer**, start an editing session as you were shown earlier in this exercise
- Next, click Add Polygon Feature from the Digitizing Toolbar



- Using single left-click create your enumeration zone; when you click the final vertex, do a right-click anywhere on the page and the polygon will auto-complete
- In the **Feature Attributes** window that pops up, complete the first two fields as shown:



Enumeration\_Zones - Feature Attributes

Actions

fid 12 ✓

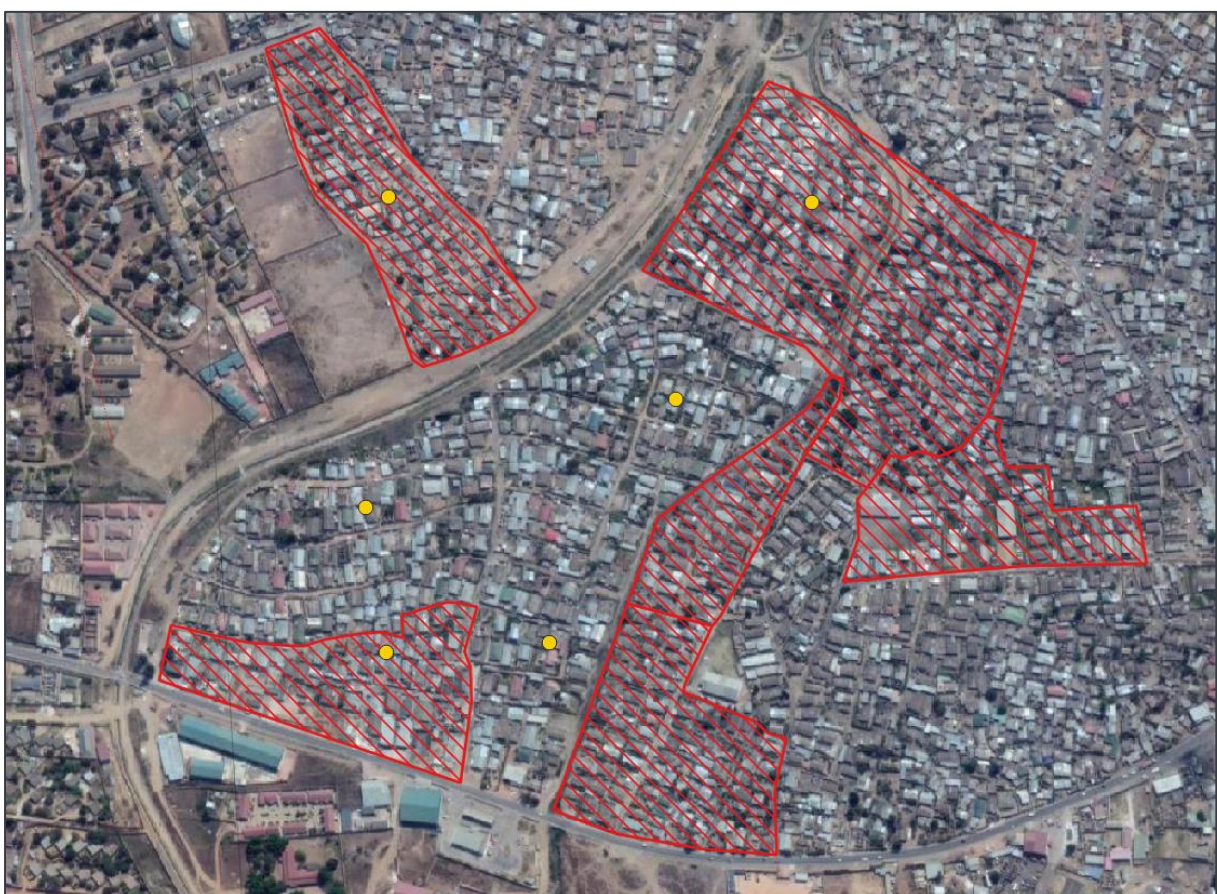
EZ\_ID EZ012

Rank\_Z NULL

m\_value NULL

OK Cancel

- Click **OK**; your new polygon should be displayed:



- Remember to **save Layer Edits** regularly, from the **Editor** toolbar



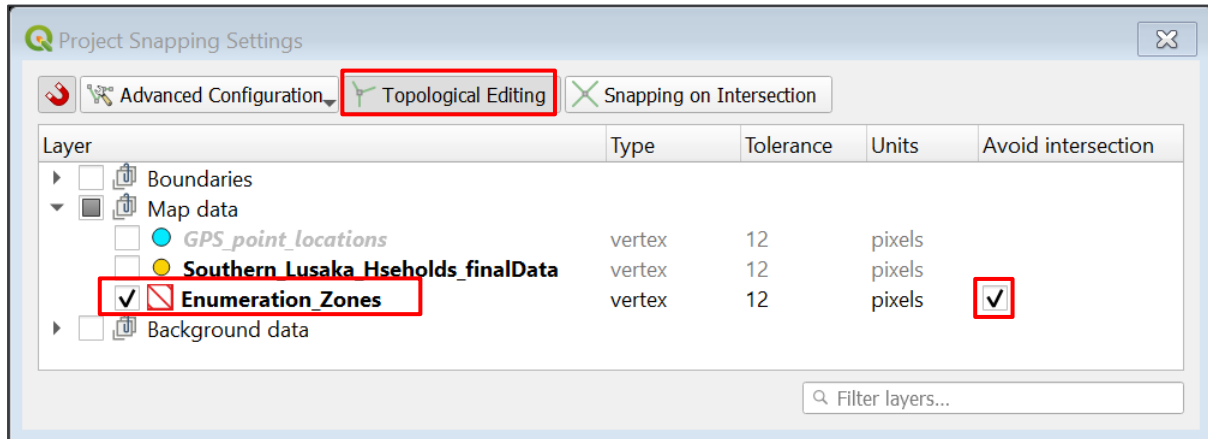
This is very simple digitizing, i.e. creating a standalone, non-adjacent polygon. We are likely at times to need to create accurate adjacent polygons. For that purpose, it is essential to set up **Snapping**.

#### 4. Set up **Snapping** to ensure accurate digitising

- Locate the following toolbar within your QGIS interface:
- If the toolbar is not visible go to **View > Toolbars > Snapping Toolbar**



- From the dropdown highlighted above Click **Advanced Configuration**, then click **Open Snapping Options**



- Expand the **Map Data** folder and tick *Enumeration\_Zones*
- Under the **Type** column, ensure you are snapping to vertex
- Ensure that **topological editing** is enabled (we will look at why this is useful later on)
- Finally, tick **Avoid Overlap** for *Enumeration\_Zones* (on older versions, you may see 'Avoid Intersections')

These settings will be explained when they are made use of, in the instructions below.

##### 5. Create a new polygon feature, adjacent to an existing feature

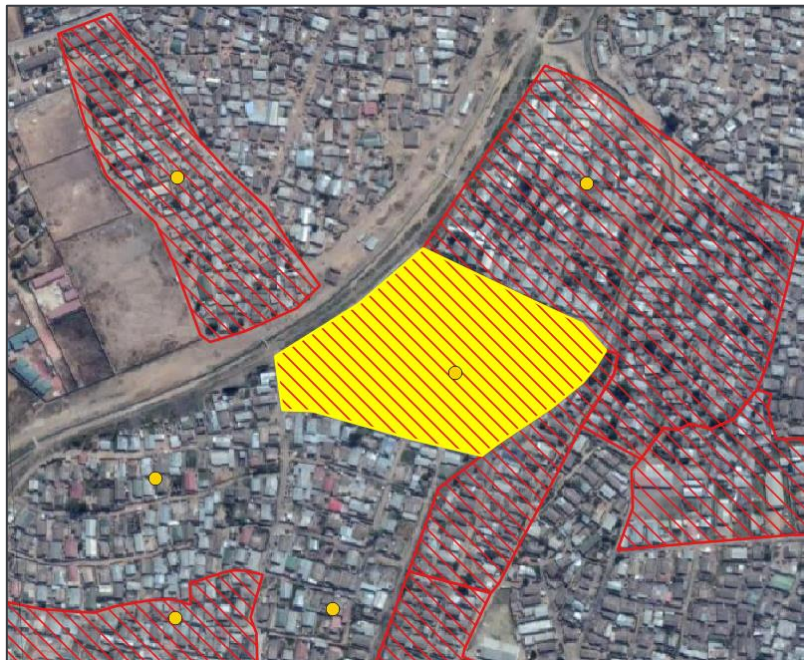
- Ensuring you are still editing, select **Add Polygon Feature**, from the **Digitizing Toolbar**
- Take your cursor close to the corner vertex of the polygon below, until you see a pink icon appear – this indicates that snapping has identified and *snapped to* a vertex from your target dataset:



- Left-click at this point to start digitizing your new feature, then follow the boundary of the polygon and left-click every pink icon (vertex snap) that you encounter along the boundary



- Digitise the rest of your new polygon as shown below, remember to right-click to finish the polygon and attributing it as follows: *fid = 13*, *EZ\_ID = EZ013*



- Now digitise a new polygon adjacent to, and to the south of this new one and attribute it as follows: *fid = 14*, *EZ\_ID = EZ014*





### Challenge:

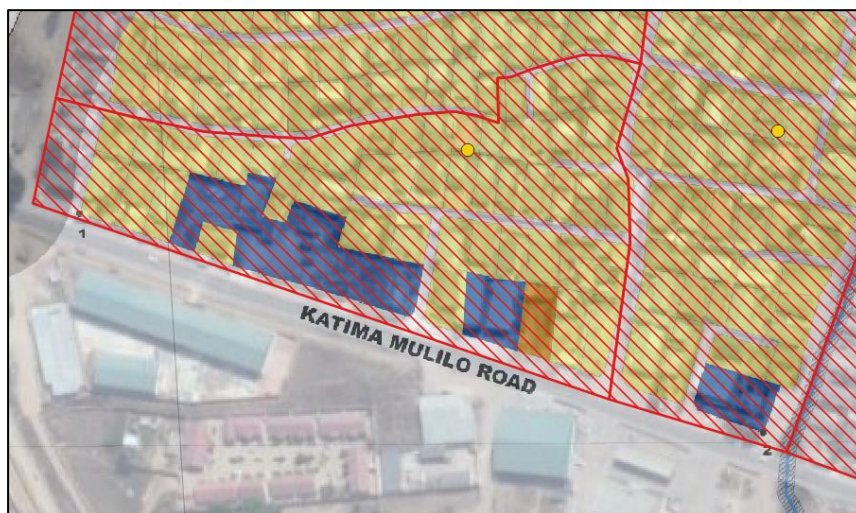
Investigate the 'Tracing' tool at the end of the **Snapping** toolbar – it enables you to trace an existing boundary without having to click each vertex. See if you can use it to digitise the new zone pictured here:




#### 6. Modify existing enumeration area polygon boundaries.

We will now turn to editing existing polygons which means manipulating the individual points (or vertices) of existing features, in our case existing enumeration areas. We will use the **vertex tool** which enables you to either move existing vertices or create new ones. In this exercise we will refer to the map you georeferenced in the previous exercise.

- In the **Map data** folder of the **Layers** panel, tick the box next to *Gabon Map\_georef\_Arc1950* and navigate to the area pictured below



Notice that the map highlights a number of buildings which are classed as *Commercial* or *Mixed Use*. We need to remove these buildings from our 'residential' household survey, which involved reshaping the polygon to exclude the buildings.

- Make sure you are still editing
- Select the Vertex Tool from the Digitizing toolbar 
- Hover your cursor over the polygon segment adjacent to *Katima Mulilo Road*; this segment will be highlighted



- Double-click on this line, as indicated by the cross, above
- You have created a new vertex, which you can place anywhere – place it in exactly the same position
- Now double-click on the line, a short distance to the left of your new vertex to create another new vertex, relocate this as indicated below



- Continue this process until you have fully excluded the non-residential buildings



- Click Save edits

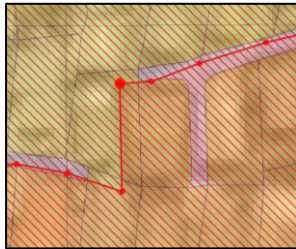




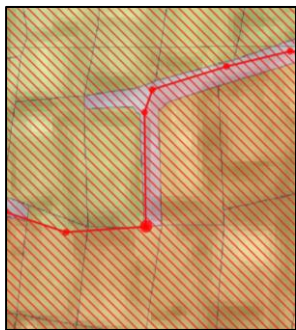
## 7. Applying **Topological Editing** to edit adjacent features

When you previously set up your **Snapping** settings, you enabled topological editing. This simply means that when you click a vertex which is on a shared boundary of two polygons, and then reposition it, it will adjust the boundary of **both** polygons, not just one. This feature means that the two features can be edited in sync.

- In the picture above notice this shared boundary of two enumeration zones, slightly to the north; we will re-orientate this boundary to take in the road



- Ensuring you are still editing, hover your cursor over the corner vertex and notice it gets bigger, as shown
- Click the vertex and now reposition as shown below (apply the same process to the vertex next to it)

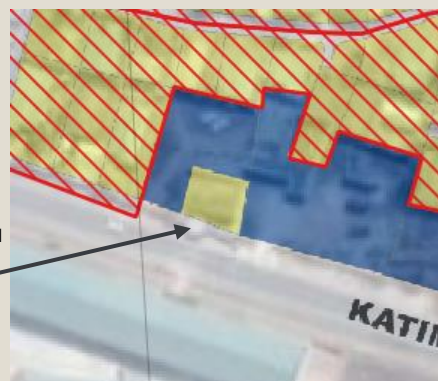


- The two polygon features have adjusted in sync with each other; this is a very useful feature to ensure you don't have overlaps or gaps in your digitizing
- Click Save edits
- Click **Toggle Editing Mode** to stop editing

### Challenge:

When you edited the non-residential blocks you may have noticed a remaining 'residential' building (highlighted). Go to the **Edit** drop-down menu > **Edit Geometry**; explore the tools that appear in the sub-menu and see if you can add a *part* to the edited Polygon...

....this creates a *multi-part polygon*.

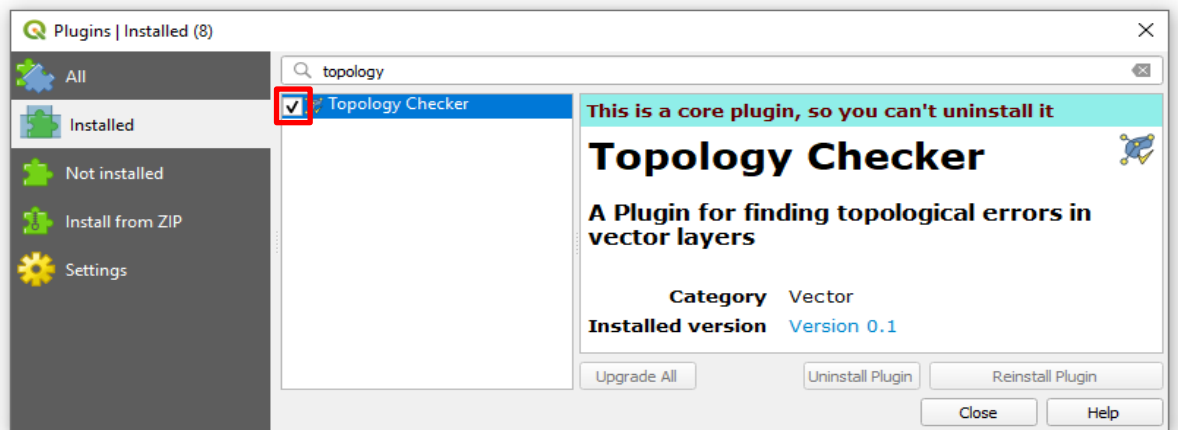





## 8. Using the **Topology Checker** plugin to locate errors.

Despite the fact that the digitization was based on well-defined **snapping** parameters and even following the modification rules previously discussed, errors can still exist on the created polygons. The most reliable way to examine the work is using the *Topology Checker* plugin.

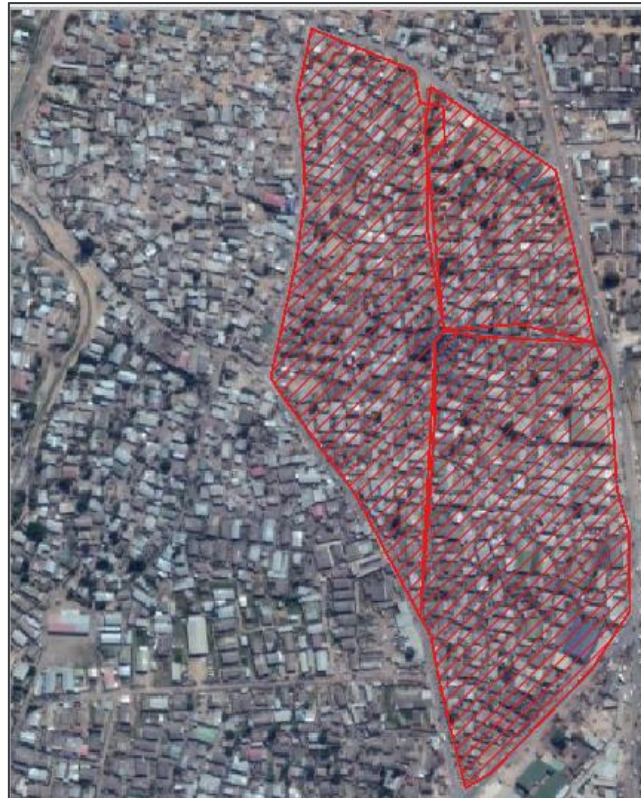
- First, make sure the plugin is activated. If it's not, do it by ticking the checkbox, as shown below; go to the drop-down menu **Plugins > Manage and Install Plugins**
- Search for *topology* in the **Installed** plugins




- Once activated, click on the plugin icon.  which will appear at the top of your screen, or go to the drop-down menu **Vector > Topology Checker**
- Now import the following shapefile into your map window:

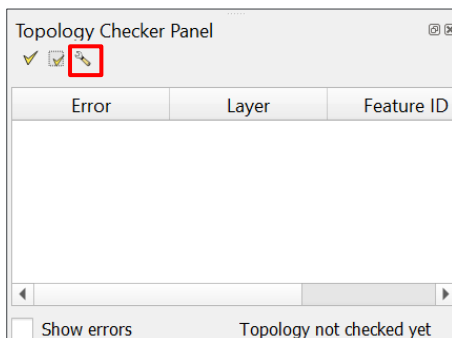
*C:\G3\_GIS\_Training\Exercises\Data\Vector\Survey\topology\_checker.shp*

- Hide the layers *GPS\_point\_locations*, *Southern\_Lusaka\_Hseholds\_finalData* and *Enumeration\_Zones* by ticking their checkbox.
- Right click on the *topology\_checker* layer and zoom to the layer; your map should look as follows:

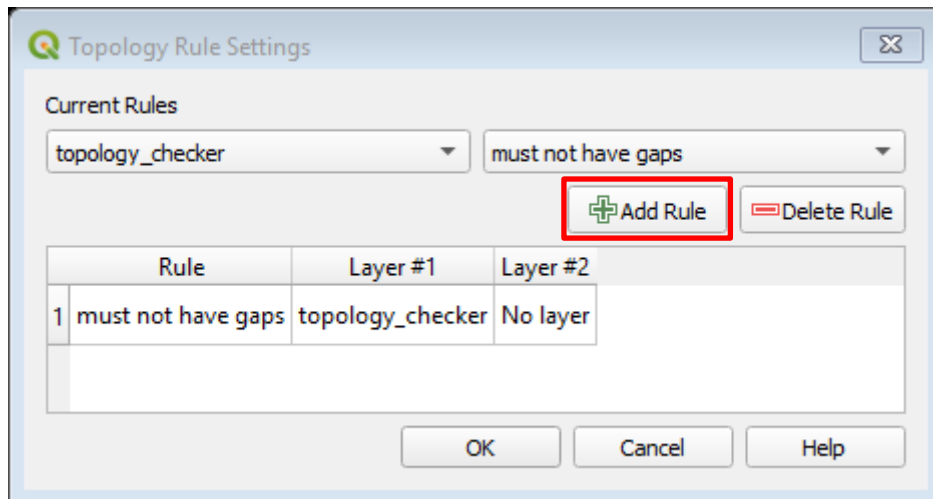


The **Topology Checker** tool has several applicable rules for examining polygons; in the following example we will study the most common two cases.

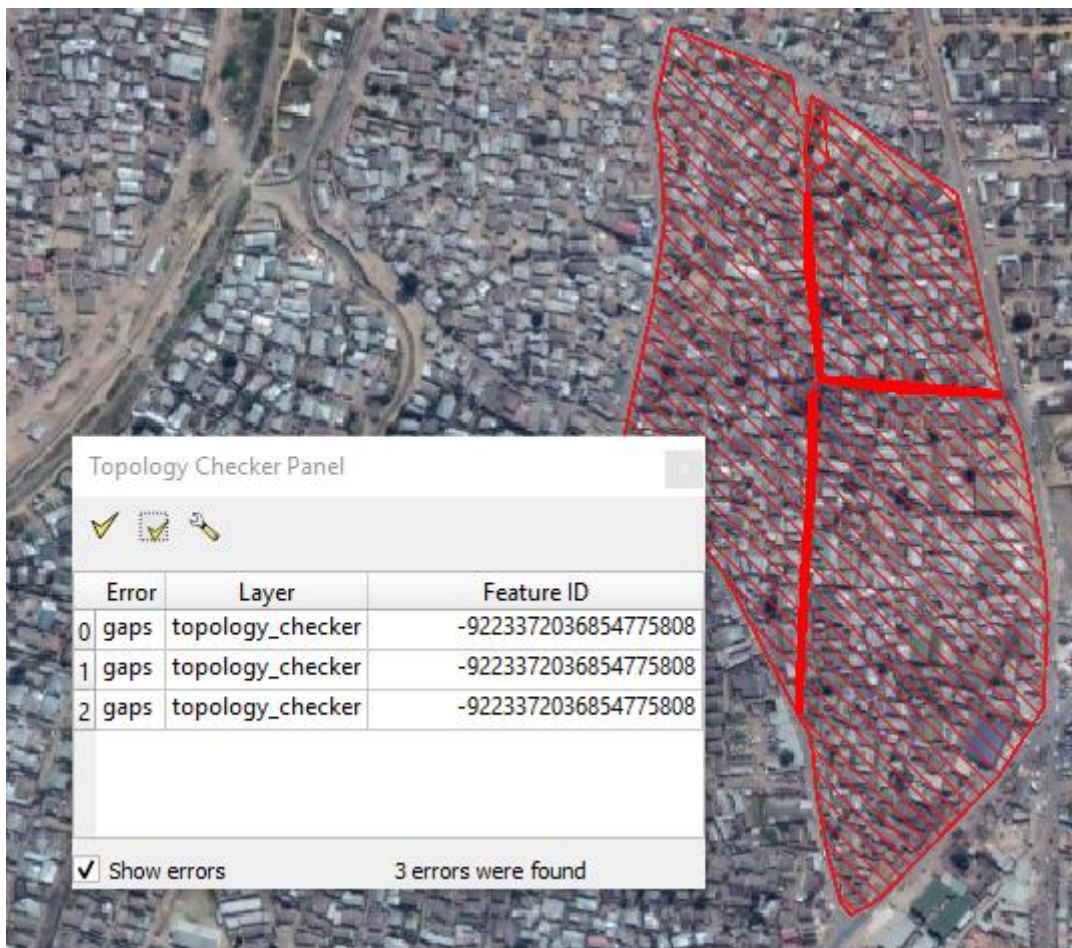
- In the **Topology Checker** panel, click the **Configure** icon 



- In the dialog box that appears, select the layer *topology\_checker* and the rule **must not have gaps**



- Then click on **Add Rule** then **OK**
- Now click on the **validate all** icon.  You will have as a result 3 identified errors:

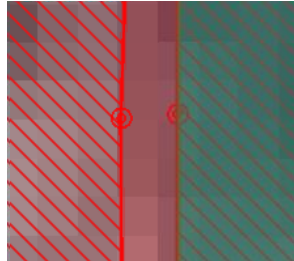


- We will then proceed to their corrections. Activate edit mode on the *topology\_checker* layer.
- Double click on the first error, you will notice that the map zoomed directly to the error.
- Untick **Show errors**  Show errors

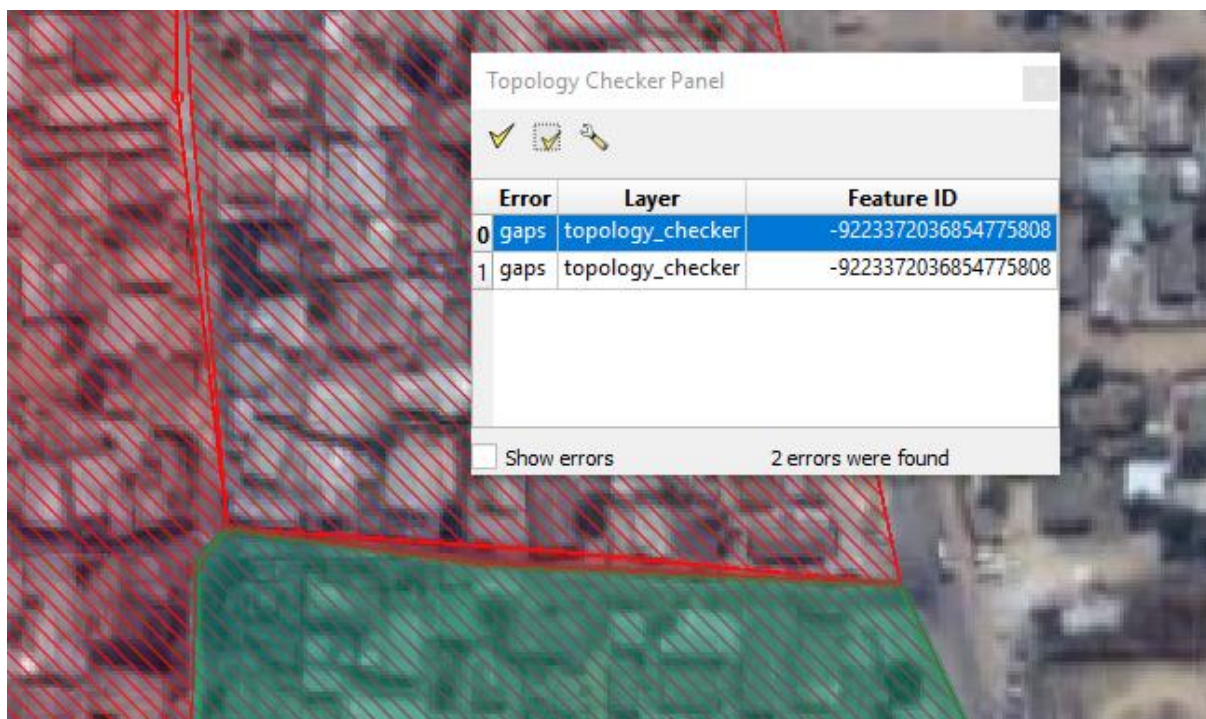


- Activate the vertex tool and try to bring the 3 vertices on the right to the feature on the left

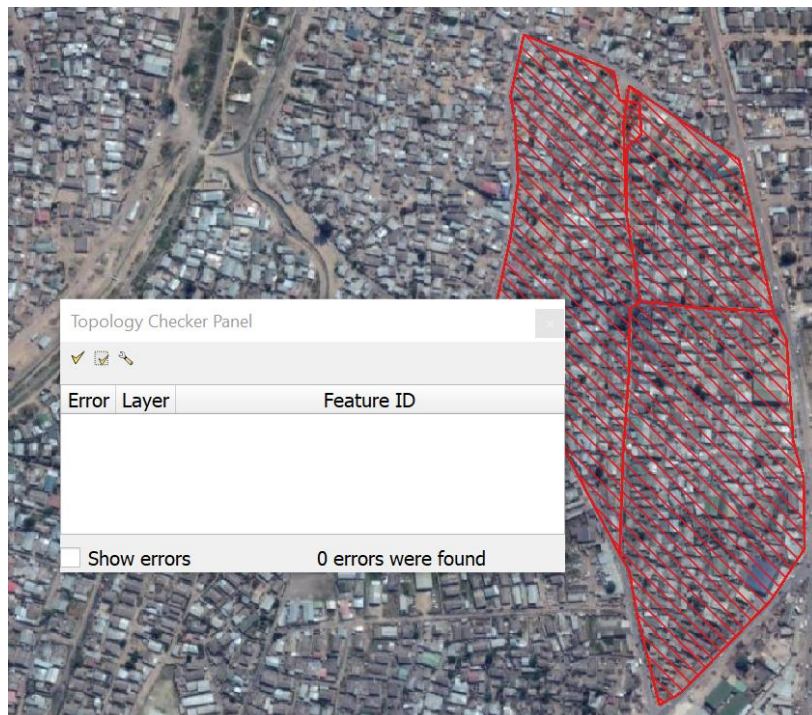
*Note: best practice in topology recommends a 'node-to-node' relationship when dealing with adjacent polygons; that means there should be an identical number of vertices, 'snapped' to each other, along a shared boundary line between two polygons – so make sure you zoom in close and that you've enabled 'snap to vertex'!*



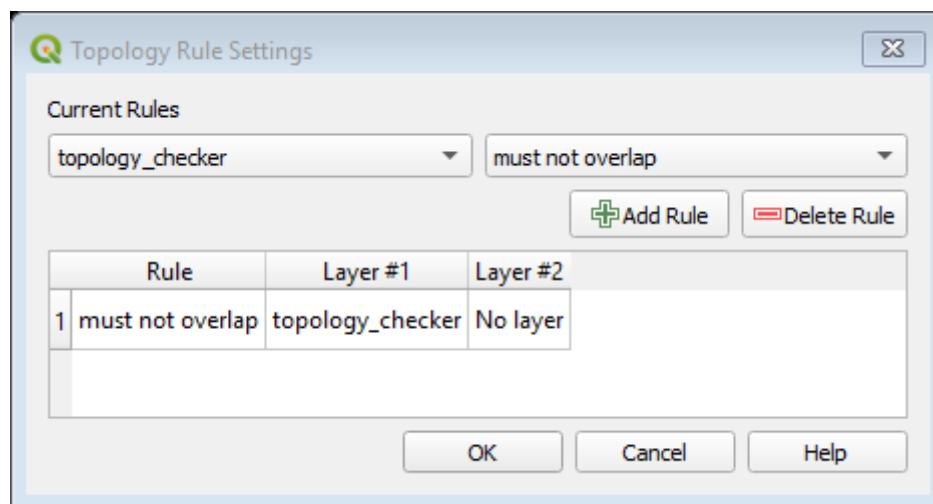
- Once done, save the changes and click **Validate All** again. You should have the following result:



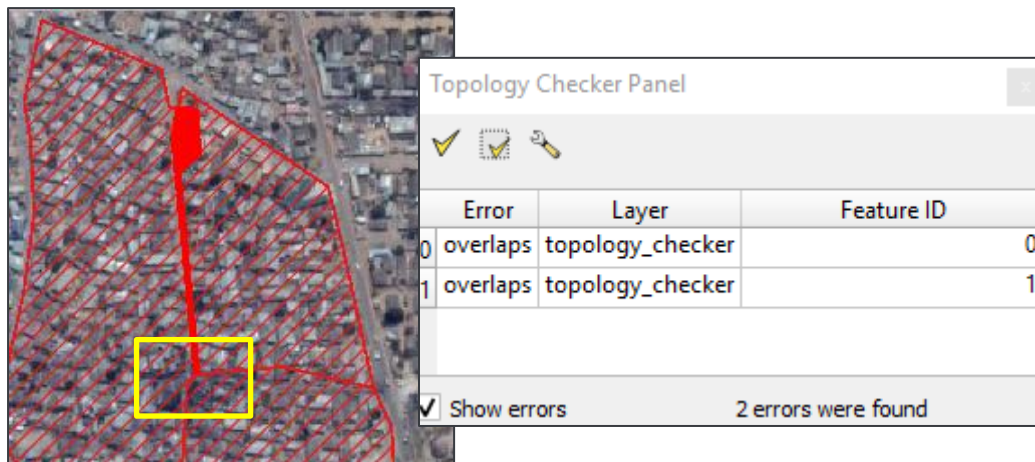
- Repeat the same for the other 2 errors
- Confirm with a final validation that there are no more errors



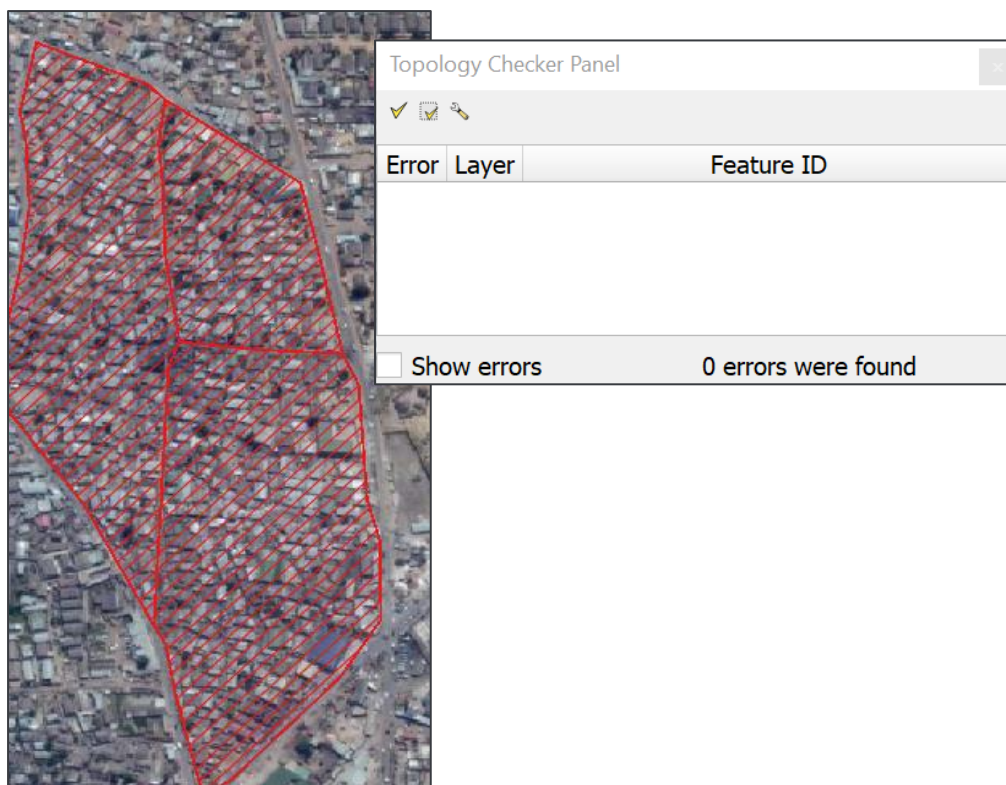
- Now in the **Topology Checker Panel** , click the **Configure** icon
- In the dialog box that appears, click on the old rule and then on **Delete Rule**
- Under **Current Rules**, again select the layer *topology\_checker* and the rule **must not overlap**
- Then click on **Add Rule** and click **OK**



- Again, click on **Validate All**.
- You will have 2 errors which indicate that there are 2 overlaps in the polygons.



- Following the same method, double click on the errors and try to correct them with the vertex tool.
  - Hint 1 - sometimes the precise vertices which have caused the error are hard to find – for ‘error 0’, zoom into the central point where the three polygons meet, indicated by the yellow box above; you will find that one vertex is overlapping
  - Hint 2 - the remaining overlap, which is very obvious (in the northern part of the same polygons) requires a different approach; rather than simply moving existing vertices you should delete some of the existing vertices so that the remaining ones establish a vertex-to-vertex (or node-to-node) relationship
- A final click on **Validate All** should display no remaining errors
- Save your edits and stop editing





9. Advanced digitization with the **Geometry Checker** plugin:

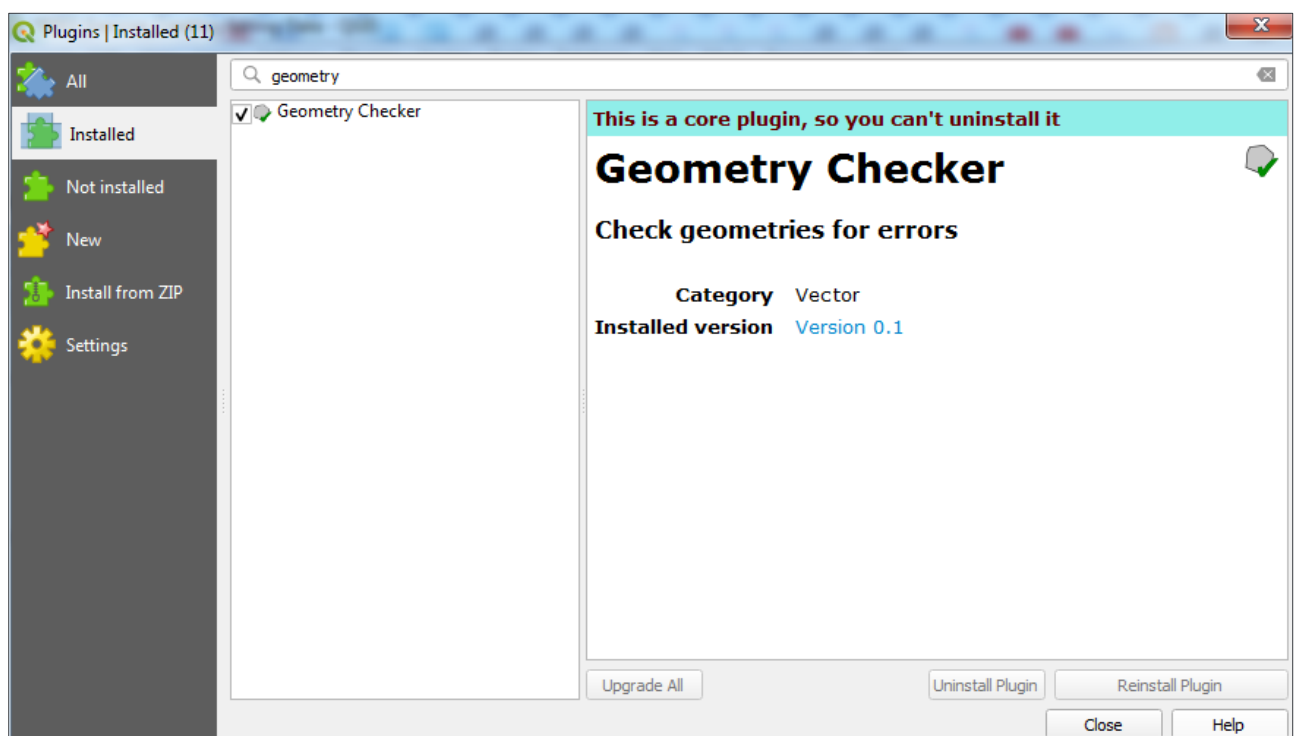
*Note: this advanced section is optional*

There exists another plugin that performs the functions provided by Topology Checker, but it is arguably *more powerful* with a wider range of functions (however it can be tricky to run, particularly for newcomers). It is called the **Geometry Checker**. It is similar in that it checks for topology errors, but also for geometry validity of features. The main difference is that Geometry Checker offers an **auto-correction function** which can be really useful when you can't see some really small errors previously highlighted by the Topology Checker such as small overlaps and gaps.

*Note: auto correction is clearly very powerful and potentially a huge time-saver; however, it should be used with caution to ensure it is not making unwanted corrections - review the automatic corrections manually for validation.*

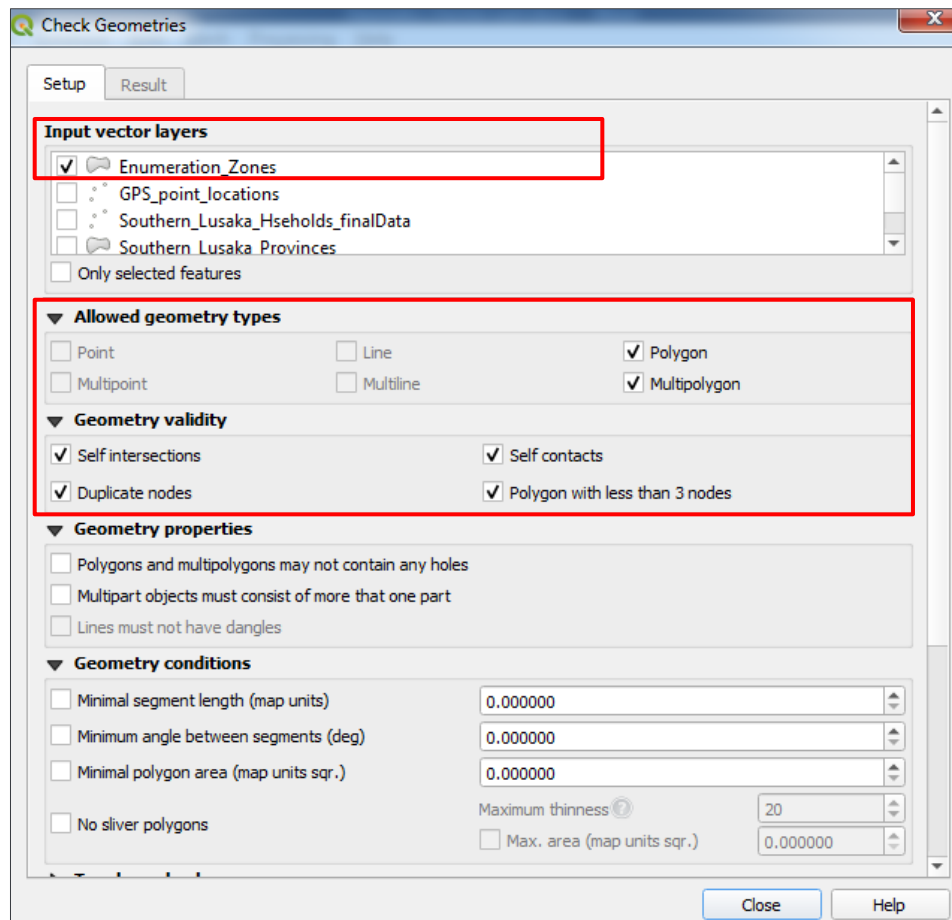
For the purpose of demonstration, we will use the tool to check for geometry and topology issues in your original *Enumeration\_Zones* layer.

- Firstly, check if the plugin is enabled by visiting **Plugins > Manage and Install Plugins**. Search for **Geometry Checker**.

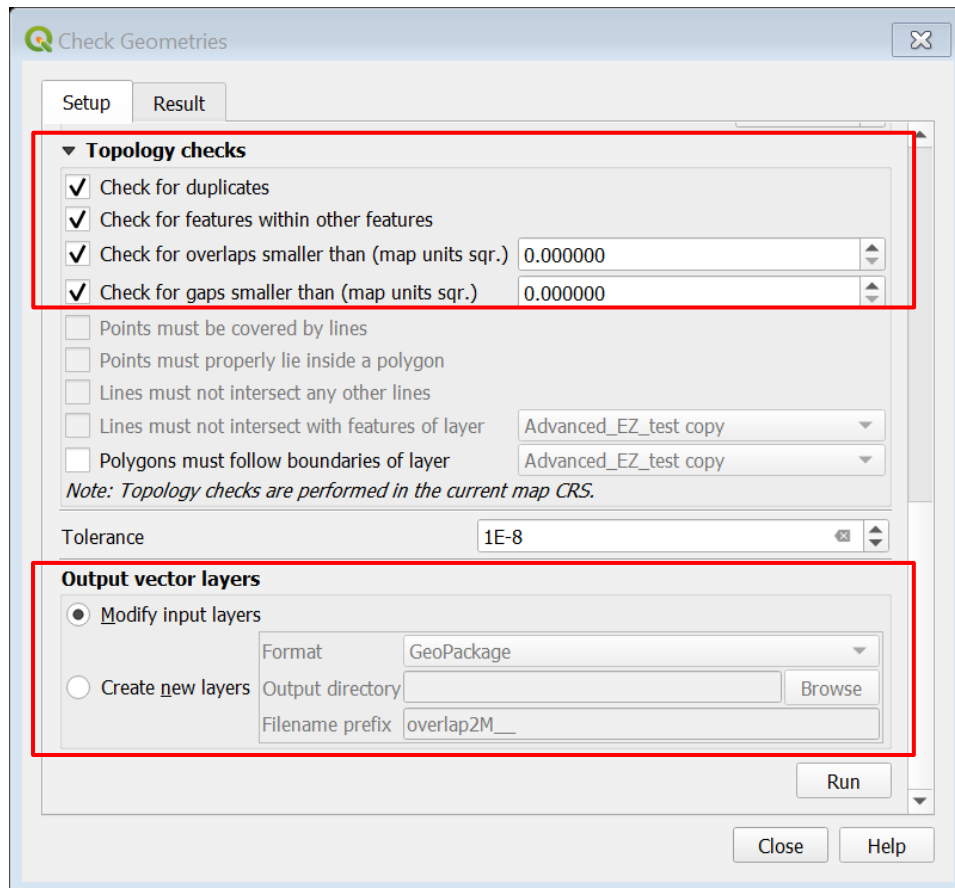



- To open its panel, go to the dropdown menu **Vector > Check Geometries**.
- In the window that appears, under **Input vector layers** ensure that *Enumeration\_zones* is ticked
- Now confirm the **Allowed geometry types** (i.e. what features you want to focus on, in this case only *polygons & multipolygons*)
- Next you can tick the type of geometry issues that you want to validate, e.g. by checking that polygons are not being *self-intersected*, not *in self-contact*, does not have *duplicate nodes &* should have *more than 3 nodes*; these settings are displayed below



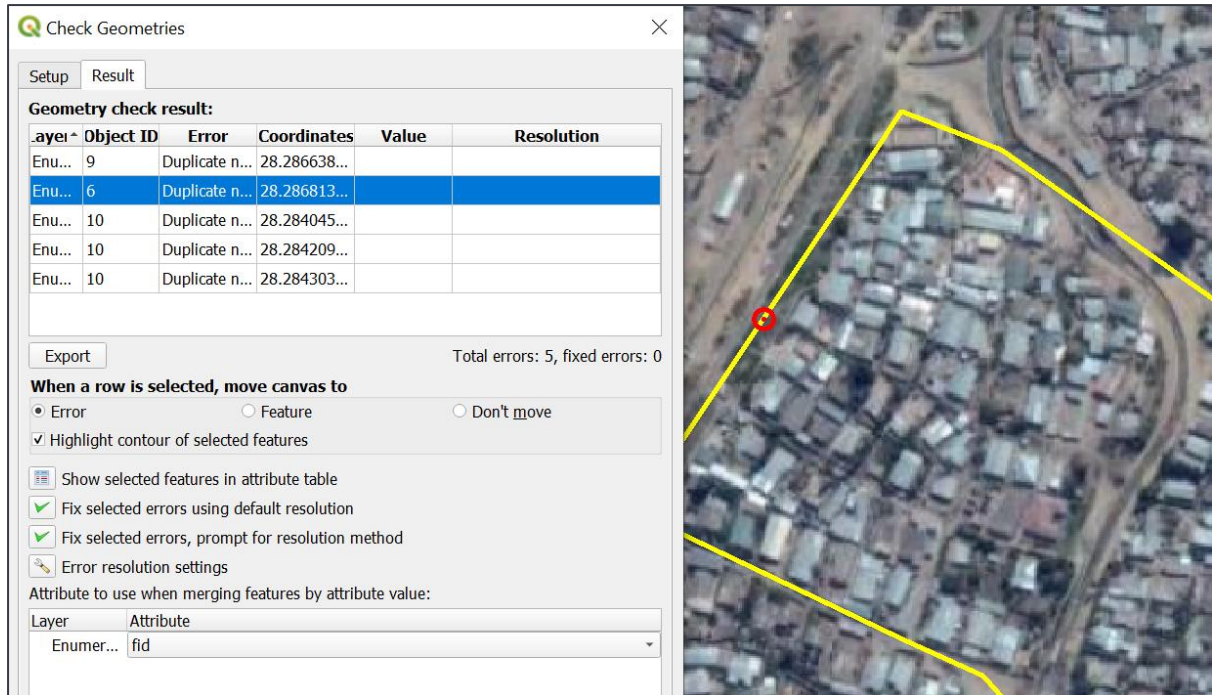


- Now scroll down within the setup tab
- You can also review the **Topology checks** by looking for *duplicates*, for *features within other features*, for *overlaps* & for *gaps* (note: for the *overlaps* & *gaps*, you can decide the tolerance you want based on the map units)



- Scroll further down in the setup tab window to **output vector layers**
- you have a choice at this stage, to either modify input layer (the current live data layer in your project) or create a separate dataset
- For now, click Modify input layers
- Click on **Run**
- You'll now gain access to the Result tab and there you'll find the errors discovered (in the **Geometry check result** table.
- You can check each error by selecting them on the table and they'll be highlighted and displayed on the map
- You could manually correct the error at this stage, or you can use the **auto-correction** function by clicking on the icon 

*here you should be extra careful and check results carefully!*



We will leave this demonstration at this point, but we encourage you to explore the plug-in further, if you plan to incorporate it in your work or studies.

In conclusion, the **Geometry Checker** is a powerful tool, but it must be used cautiously by experienced GIS users. It is often used by data managers to help with the *Quality Assurance* of the work done by their teams. We would recommend that, at least initially, its use is limited to only supervisors or a technical lead.

For more information on using the plugin, visit the link:

[https://docs.qgis.org/3.22/en/docs/user\\_manual/plugins/core\\_plugins/plugins\\_geometry\\_checker.html](https://docs.qgis.org/3.22/en/docs/user_manual/plugins/core_plugins/plugins_geometry_checker.html) (support link is correct at time of writing; check QGIS for any updates to this help page)



## Part 4 – Managing attribute tables and using field calculations

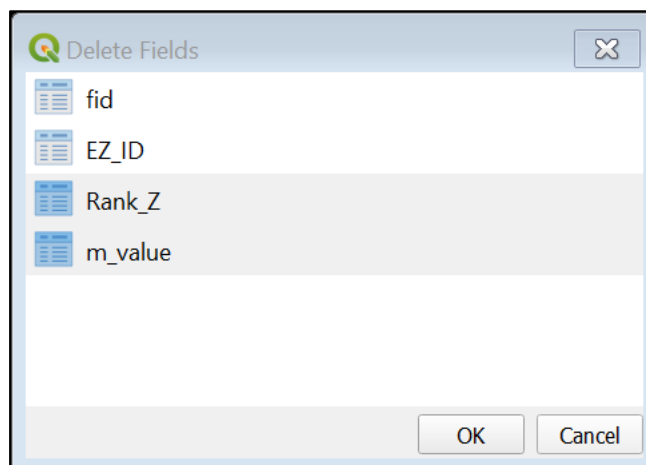
We will now focus on editing within the **Attribute Table**. Firstly, we make changes to the table structure, adding and deleting fields as we need them. Secondly, we will look at generating area calculations using the **Field Calculator** application. Specifically, we will be calculating surface area (in Km<sup>2</sup>) of the enumeration zone polygons.

### 1. Deleting fields in attribute tables

- Open the **Attribute Table** for *Enumeration Zones*
- The following fields are now surplus to requirements; locate them in your table:
  - Rank\_Z
  - M\_value
- Click **Toggle Editing** to start editing
- From the attribute table tools, click **Delete field**



- In the **Delete Fields** dialog box, select the fields for deletion:



- Click **OK**
- Click Save edits
- Click **Toggle Editing Mode** to stop editing

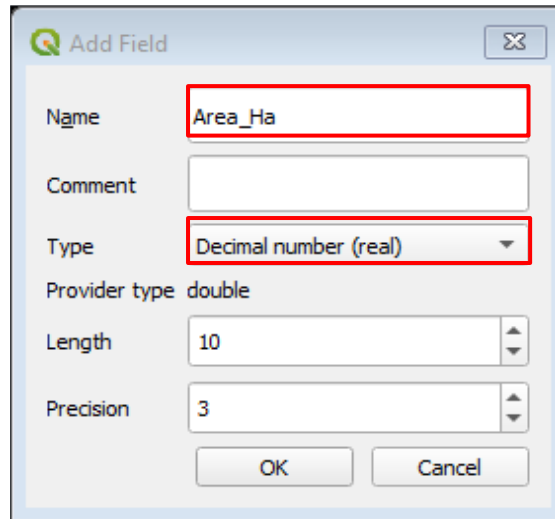
We will now calculate the surface area in km<sup>2</sup> of the enumeration zone polygons, but first we need to create a new table field to store the values

### 2. Add new fields to attribute tables


- Returning to the Attribute Table Tools, click Toggle Editing Mode then click New Field




- In the dialog box that appears, complete as below:

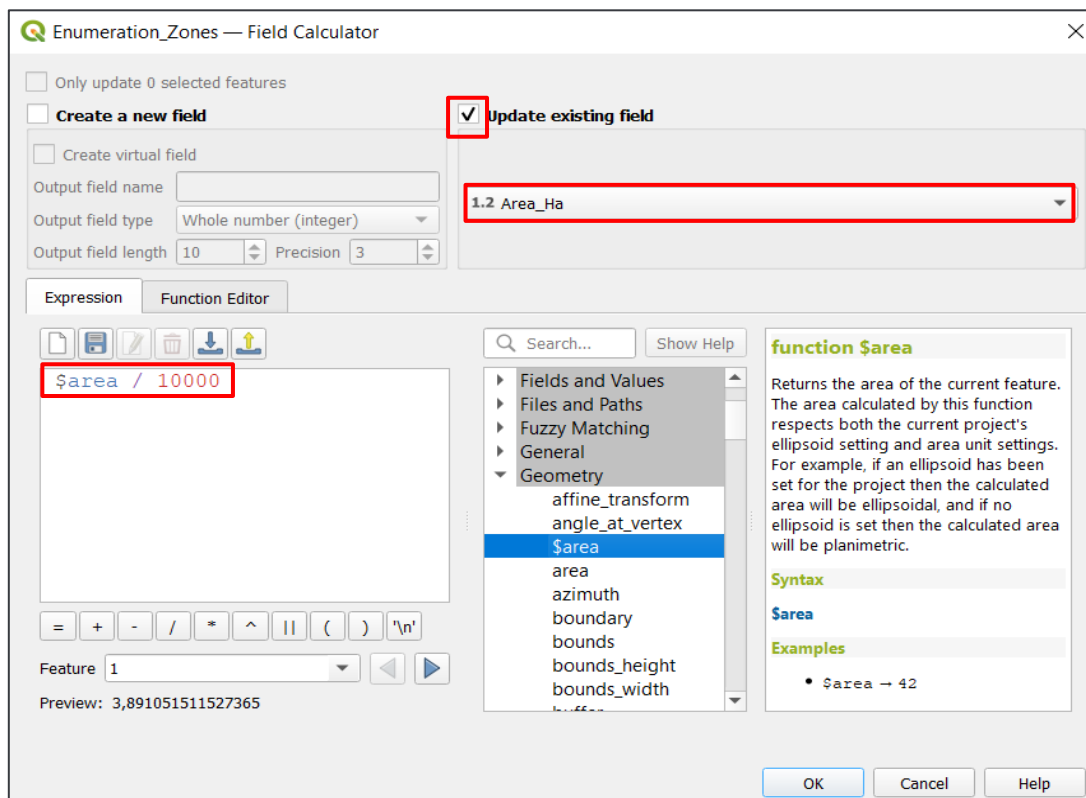


- Ensure that you select **Decimal number (real)** for the field data **Type**
3. Calculate areas of polygon features into new empty field

- From the Attribute Table Tools above, click Field Calculator 
- In the dialog box that appears choose to **Update existing field** and select *Area\_Ha*
- In the middle section of the window expand the **Geometry** group and double-click **\$area** (an in-built function which calculates surface areas of polygon features, in the current map unit of your project, typically square metre (m<sup>2</sup>))

However, we need area in hectares, and need to finish the expression to calculate this automatically.

- Click the divide button , from among the mathematical operators, and then type in 10000 to construct the following expression:  $\$area / 10000$





**User tip:** if you want to calculate areas in kilometre squared (km<sup>2</sup>) use \$area / 1,000,000

- Click **OK**. The values will now be generated in your **Attribute Table** – open it and check
- Using the **Show Statistical Summary** button on the **Attributes Toolbar**, inspect the field statistics:



- What is the smallest enumeration zone polygon? \_\_\_\_\_
- What is the largest? \_\_\_\_\_
- What is the average area value for all enumeration zones? \_\_\_\_\_

**Challenge 1: Validate Calculations**

Use your **Measure** tool to measure some of the zone polygons and ensure that the field calculator measurements are correct.

**Challenge 2: Digitise Road features and create a walking route**

- Create a new **Polyline** GeoPackage layer here:
- C:\QGIS\_Intro\Exercises\Data\Output\_data\GPKG\_CreateEditData.gpkg
- Working in the same region, pick one of the enumeration zones and digitise a walking route on the roads within the zone which would enable each settlement to be visited



- Ensure you use Snapping to Vertex
- Create a new field in the attribute table for your roads layer
- Calculate distances for every section of the walk



## Part 5 – Improving data attribution in QGIS using Attribute Forms (Advanced)

*Note: this advanced section is optional*

This is an advanced part where we will focus on how to manage digitisation using **Attribute Forms** – a feature found within the layer properties window. First of all, we will see how to customise field input values. Then, we will constrain the fields based on specific rules in order limit input errors while entering data.

1. Import the shapefile *Advanced\_EZ.shp* and review it
  - Go to **Layer > Add Layer > Add Vector Layer** and import the shapefile from: `C:\G3_GIS_Training\Exercises\Data\Vector\Survey\Advanced_EZ.shp`
  - Right click on the layer and **Open Attribute Table**

	id	EZ_ID	province	commune	locality	comments
1	18	EZ018	Lusaka	Garden	Katima	NULL
2	19	EZ019	Lusaka	Garden	Katima	NULL
3	20	EZ020	Lusaka	Garden	Katima	NULL
4	21	EZ021	Lusaka	Garden	Katima	NULL
5	22	EZ022	Lusaka	Garden	Katima	NULL
6	23	EZ023	Lusaka	Garden	Young C	NULL
7	24	EZ024	Lusaka	Garden	Zambeef	NULL
8	25	EZ025	Lusaka	Garden	Zamherit	NULL
9	26	EZ026	Lusaka	Chaisa	Chikankata	NULL
10	27	EZ027	Lusaka	Mandevu	Balaji	NULL
11	28	EZ028	Lusaka	Chaisa	Emmasdale	NULL

Notice that we have 6 fields. An *id* field that seems to be numerical, another field named *EZ\_ID* that has the name of the Enumeration zone, then location fields – *province*, *commune* and *locality* – and finally a *comments* field for useful notes, if there are any.

2. Set up the “*id*” field to automatically increment

Each individual polygon (or row in the table) must have a unique value in the *id* field. This is vital, in order that QGIS can uniquely identify each polygon.

- Right-click on the *Advanced\_EZ* layer > ...**Properties** > **Attributes Forms**
- Under the **Available Widgets**, expand the **Fields** and choose the *id* field
- Expand **General** and make sure to uncheck “*Editable*” (*Note: this is unchecked because the user should not edit this field by themselves, it’ll be updated automatically*)
- Expand **Widget Type**
- Choose **Text Edit** from the Widget Type drop-down list



Layer Properties — Advanced\_EZ — Attributes Form

Autogenerate Show Form on Add Feature (global settings)

Available Widgets

- Fields
  - 123 id
  - abc EZ\_ID
  - abc province
  - abc commune
  - abc locality
  - abc comments
- Relations
- Actions
- Other Widgets
  - QML Widget
  - HTML Widget

Style

**General**

Alias

Comment  Editable  Reuse last entered value  Label on top

**Widget Type**

Text Edit

Multiline

HTML

**Constraints**

Not null  Enforce not null constraint

Unique  Enforce unique constraint

Expression  ⌘

Expression description

Enforce expression constraint

**Defaults**

Default value  ⌘

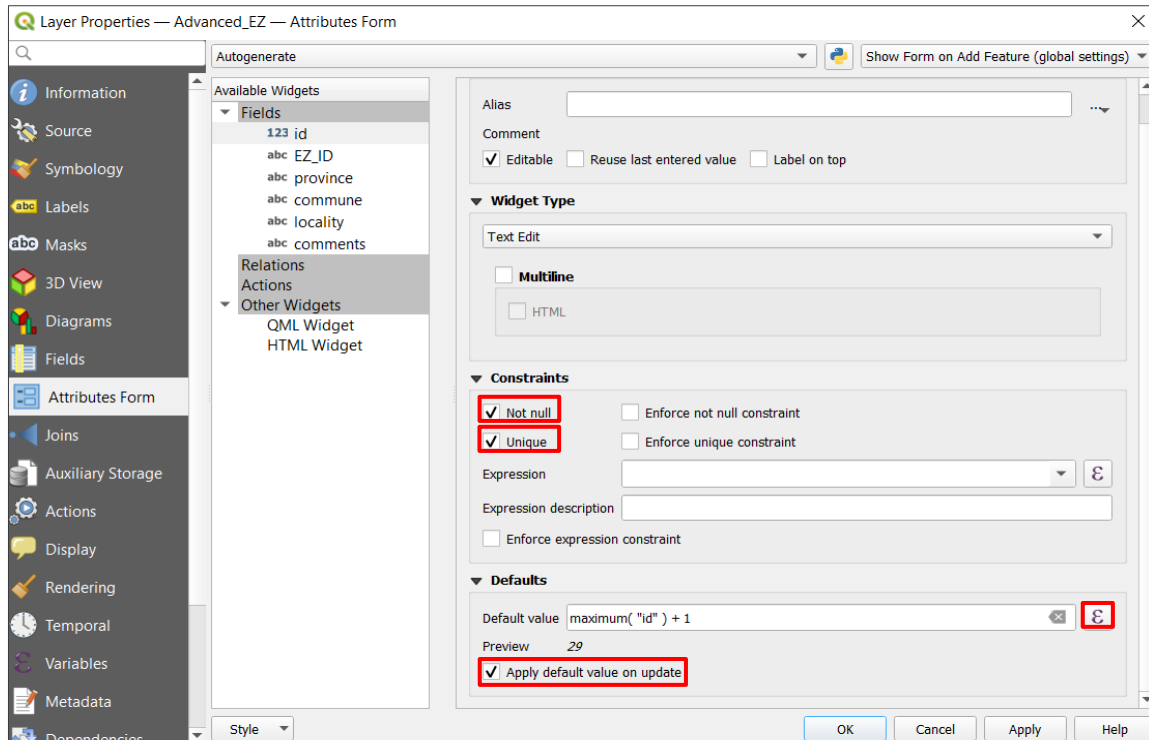
Preview

Apply default value on update

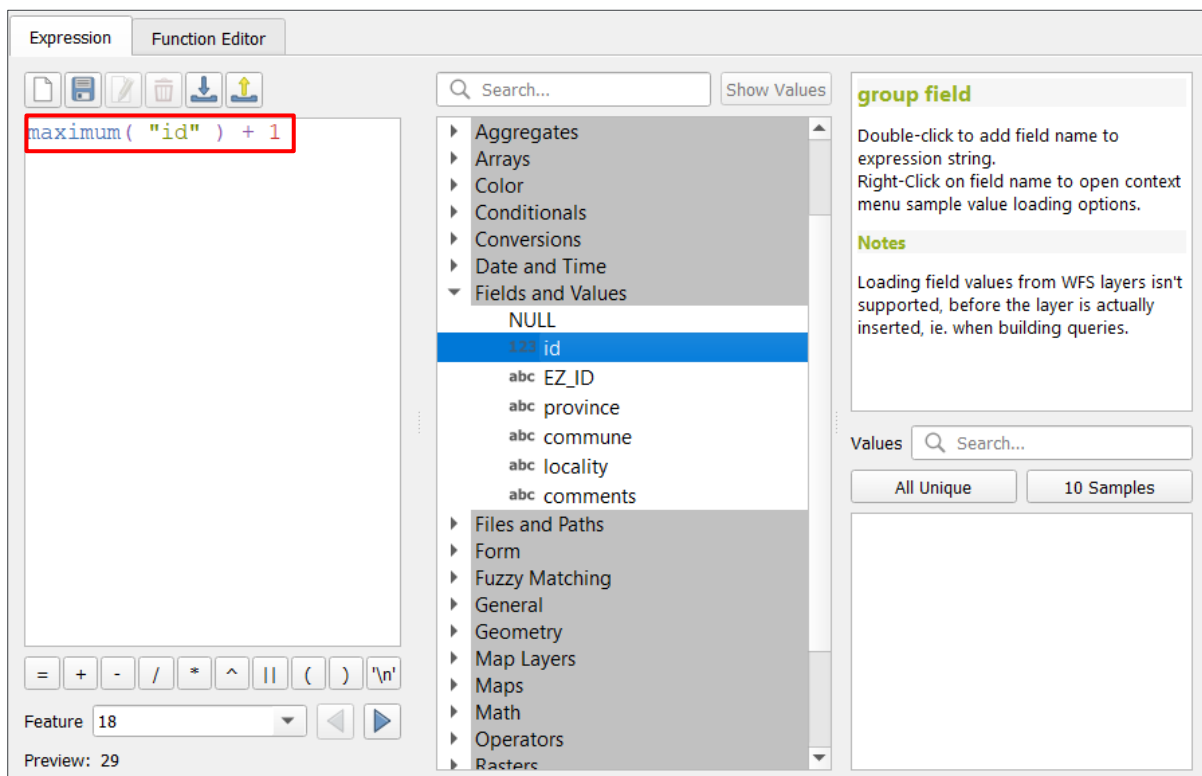
OK Cancel Apply Help

- Scroll down the list and expand **Constraints**, make sure to check both *Not null* & *Unique* to ensure that anyone who edits these data in future doesn't leave it blank, and that the value is unique
- Now expand **Defaults** and click on the icon ⌘ to open the expressions dialog (check *Apply default value on update*)





- In the **Expression Dialog** that appears, add the function `maximum( "id" ) + 1` and click **Ok** (note: you can either type the expression in directly – it must be exactly the same as shown here – or expand the categories in the middle section, to auto-generate the expression)



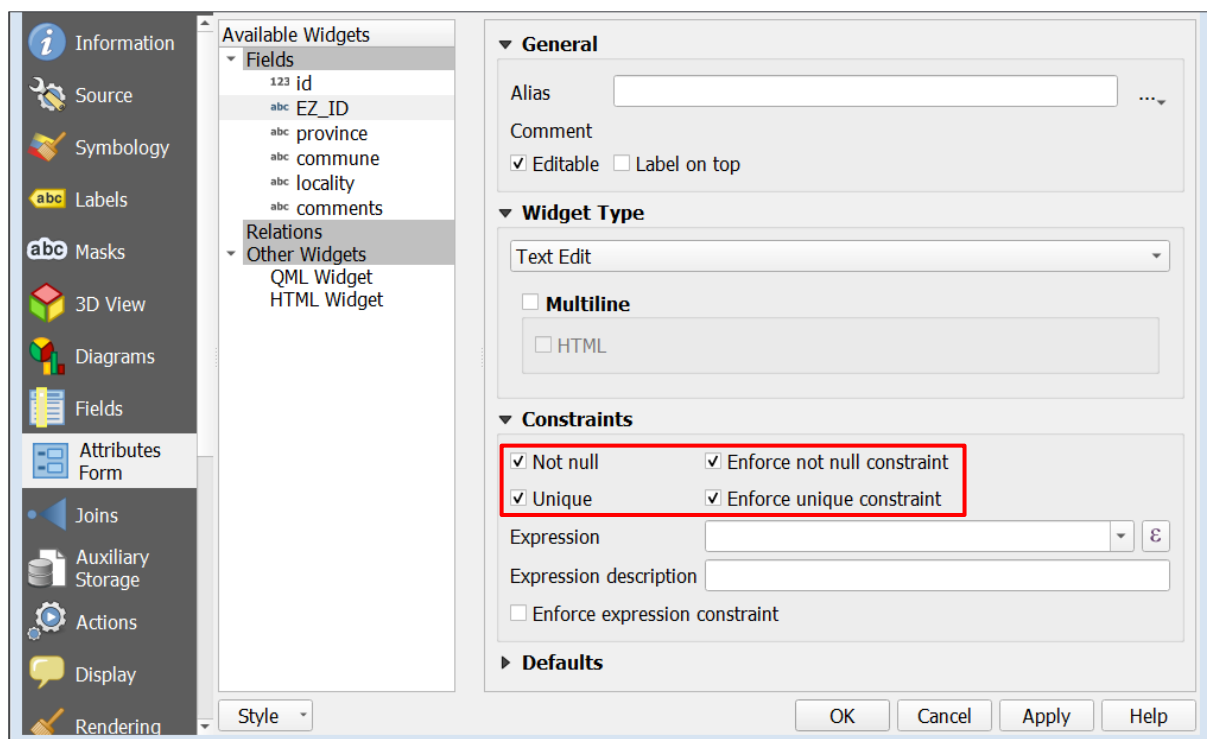


**User tip:** For this to work, there should be at least one polygon with an *ID* number already written manually. Otherwise, the function won't have anything to increment on. It can also be avoided if you change the function to: *if (maximum("id") is NULL, 1, maximum("id") + 1)*

### 3. Add rules and constraints to the *EZ\_ID* field

Like the *id* field, the *EZ\_ID* field is another way of uniquely identifying features, however in our scenario *EZ\_ID* codes relate to enumeration area specifically; they contain letters as well as numeric characters. The *EZ\_ID* field was already constrained to allow only 5 characters (this is something you can do while creating your data for the first time, refer to Part 1 for details). We will now ensure that values entered for *EZ\_ID* are unique and not left blank

- Right click on the layer *Advanced\_EZ* and go to **Properties**
- In the **Attribute Forms** panel again, go to **Available Widgets > Fields >** click on *EZ\_ID*
- Next in the constraints widget, check the rule *Not null & Unique* to ensure that the digitizer does not leave it blank and that the value generated will be unique
- Be sure to also click *Enforce not null constraint* and *Enforce unique constraint*
- Click **Ok**

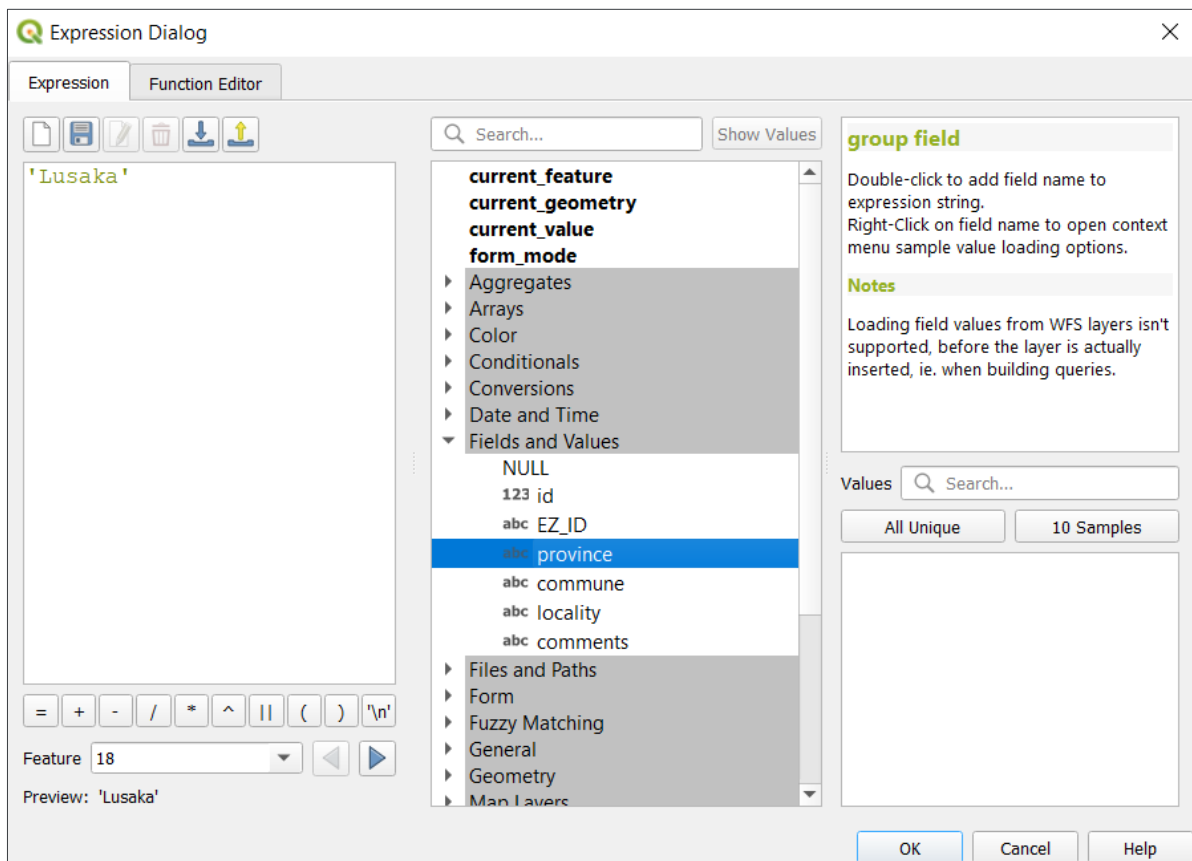


### 4. Created a fixed value for all records in a field

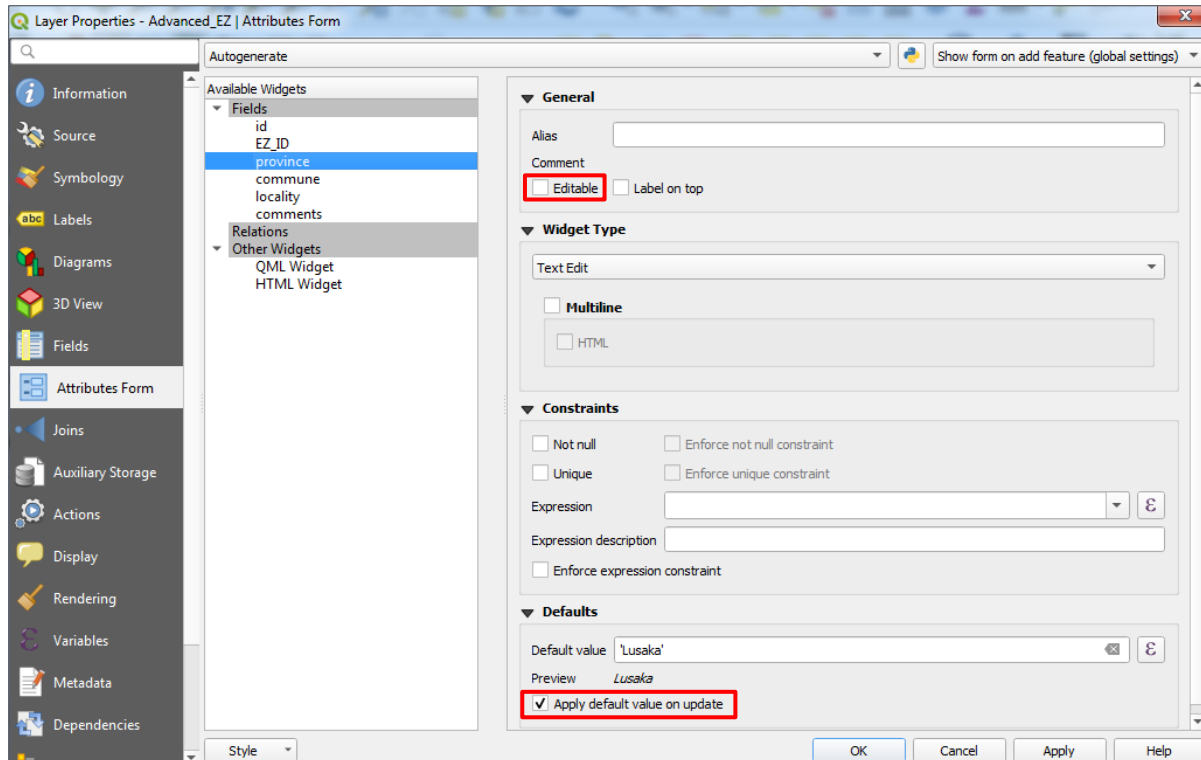


Turning to the **province** field, all enumeration areas that we are digitising are in *Lusaka* province, therefore to save time and reduce potential for data entry errors, we can ensure *Lusaka* is entered each time a new area is created.

- Again, right-click on the layer *Advanced\_EZ* and go to **Properties > Attributes Form**
- Next to, Available Widgets > Fields > click on province.
- In **Defaults**, click again on the expression icon
- In the **Expression Dialog**, go to **Fields & Values**, click on *province*, then click **All Unique**, and finally double click on “*Lusaka*” and then on **Ok**.



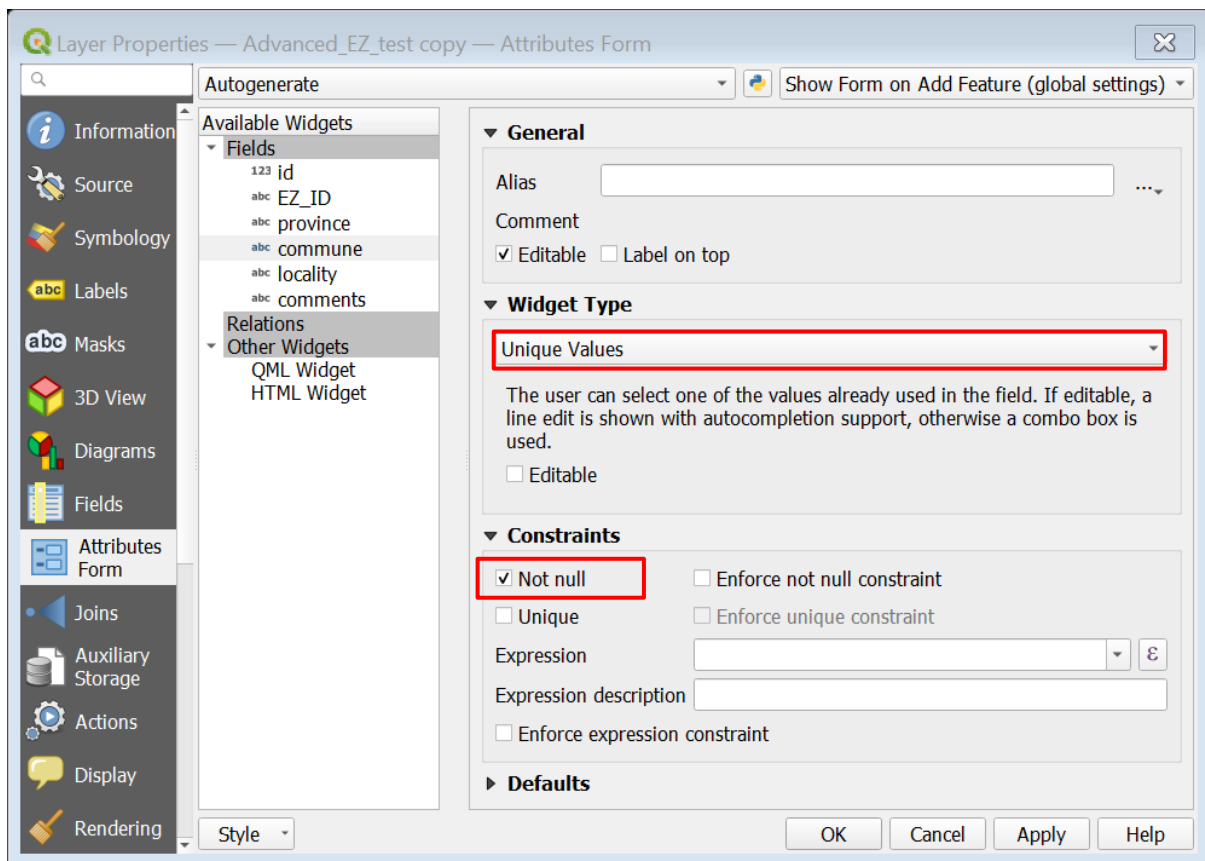
- You'll get back to the **Attributes Form** tab and here make sure to uncheck “*Editable*” since you won't need to change it anymore and you can check “*Apply default value on update*” and click on **Ok**.



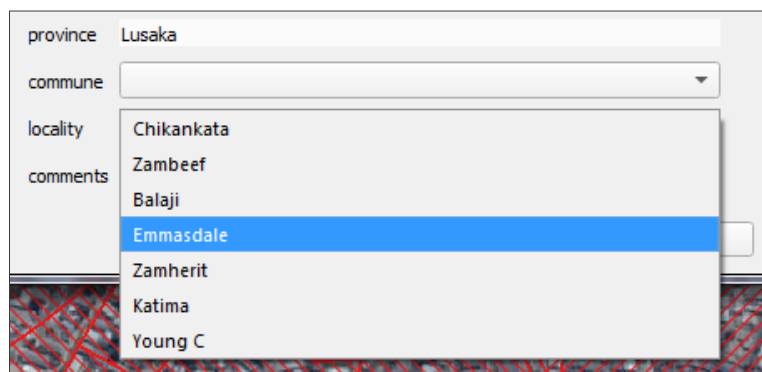
5. Finally, we will set up drop-down menu options for the fields *commune* & *locality*.

Since there is a limited number of communes and localities in Lusaka, we can force the digitiser to select one of these limited options, meaning they won't need to type it manually (and perhaps mis-spell it)! It is also much quicker to select a name from a menu rather than typing it out!

- Again, right-click on the layer *Advanced\_EZ* and go to **Properties > Attributes Form**
- Next to, **Available Widgets > Fields** > click on **commune**.
- Under **Widget Type**, choose the option **Unique Values**
- Under **Constraints** click **Not null**
- Now do the same for **locality**



- As you will soon discover, when digitising, you'll get drop-down options like this:



- Now that you have set up your rules and constraints, digitize the Enumeration area *EZ029*
  - Make sure the layer *Advanced\_EZ* is active and go to editing mode.
  - Digitize *EZ029* based on the red polygon below:



- Notice that the **id** has been added automatically, the **province** is already fixed to “Lusaka” and if you enter “EZ028” as an **EZ\_ID**, it will be refused and ask you to change it because it already exists.

id	29	✓
EZ_ID	EZ028	✗
province	Lusaka	

- You can go ahead and choose *Chaisa* as the **commune** & *Emmasdale* as the **locality**. In the **comments** field, you can write “School” since there’s a school in this area.

id	29	✓
EZ_ID	EZ029	✓
province	Lusaka	
commune	Chaisa	
locality	Emmasdale	
comments	School	

OK Cancel



In conclusion, we have outlined a method that will make digitizing much easier and quicker for an individual. More importantly however, it will ensure that they are less prone to mistakes and enforces greater data consistency, particularly when you have a large team working on the same data!



**User tip:**

If you have a CSV file containing data like the name of localities, you can upload it as a drop-down menu using the option “**Value Map**” under the **Widget Type**.