1 QGIS Processing Models and the Graphical Modeller

The objectives of this workshop are to learn about:

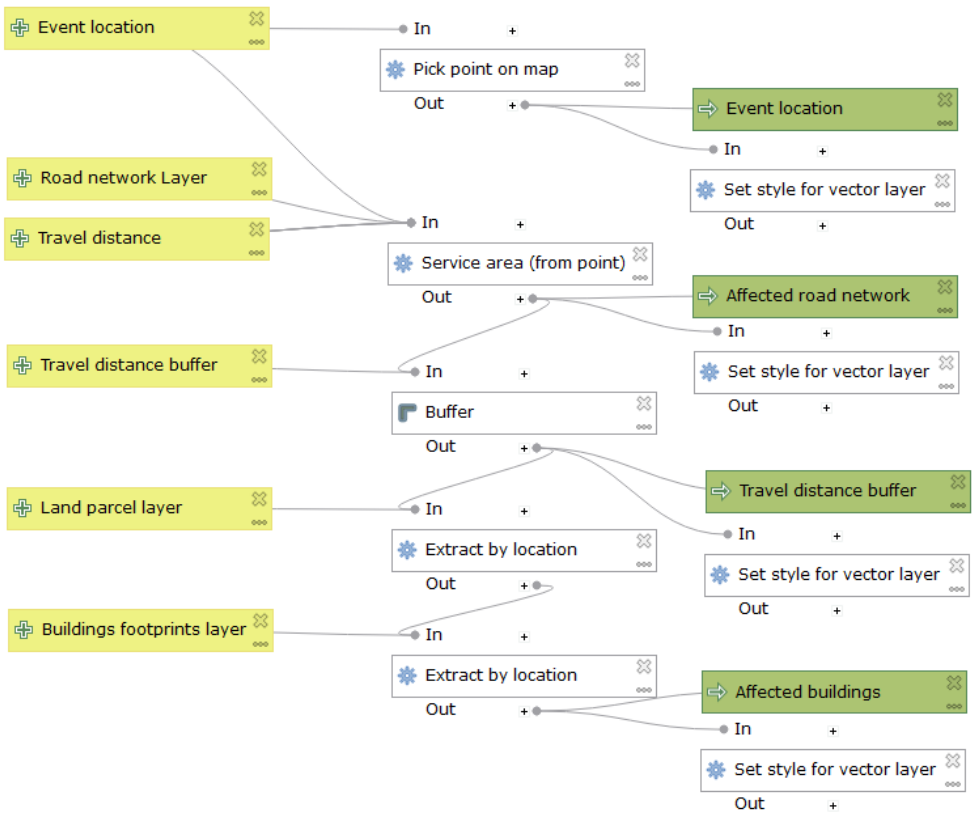
- Processing Models
- The Graphical Modeller

1.1 Processing Models and the Graphical Modeler

The graphical modeler, is a powerful component that we can use to define a workflow and run a chain of algorithms (a processing model).

A normal session with the processing framework tools includes more than running a single algorithm. Usually several of them are run to obtain a result, and the outputs of some of those algorithms are used as input for some of the other ones.

Using the graphical modeler, that workflow can be put into a processing model, which will run all the necessary algorithms in a single run, thus simplifying the whole process and automating it.



1.2 Exercise – Affected Buildings Model

In this exercise we will create a processing model in the graphical modeler that displays buildings affected by some event within a distance from the event location.

The affected buildings are determined by

- travelling a distance along the road network from the event location,
- buffering the travel distance to intersect land parcels,
- extracting building footprints that that intersect the land parcels.

The Inputs

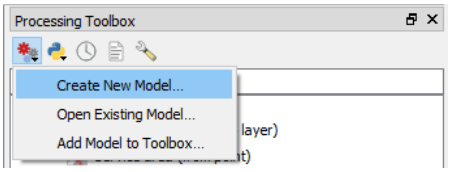
- Event location point chosen on the Map Canvas
- Road network layer
- Travel distance value
- Travel distance buffer value
- Land parcel layer
- Building footprints layer

The outputs

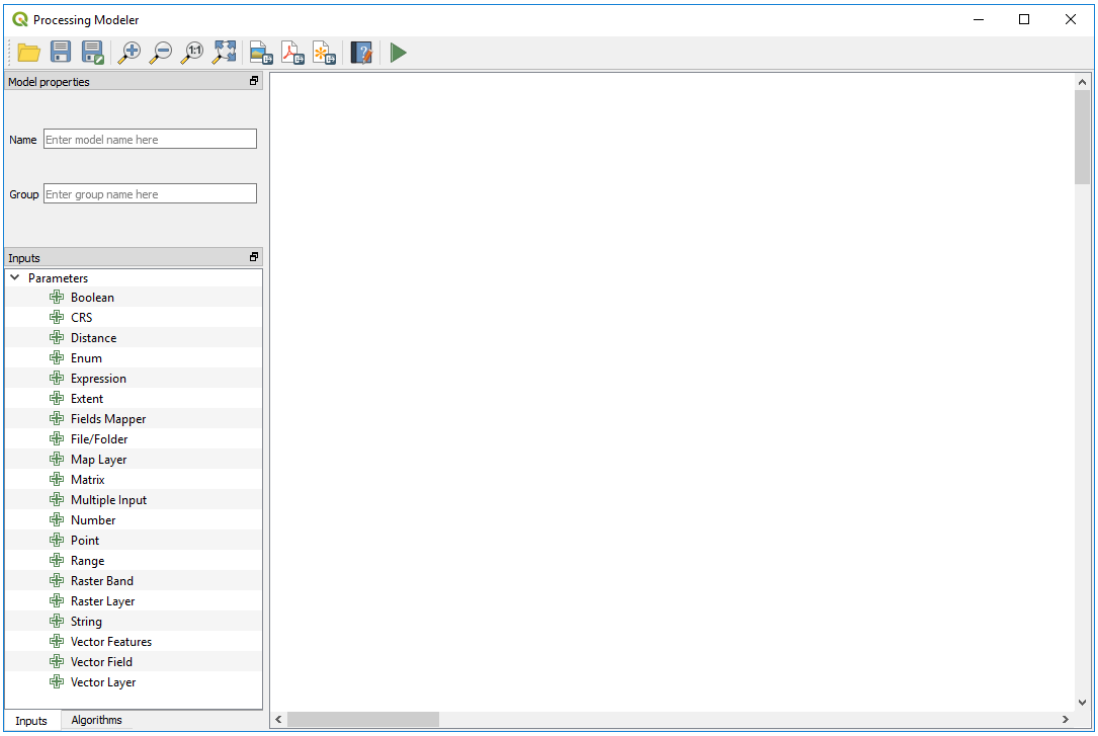
- Event location point layer
- Affected road network line layer
- Travel distance buffer polygon layer
- Affected buildings polygon layer

1.2.1 Creating the model

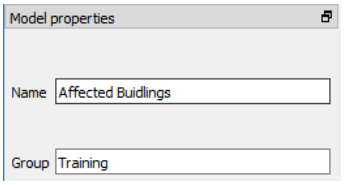
☐ In the **Processing toolbox**, click the **Models** tool, choose **Create New Model…**



Note that the graphical **Processing modeler** window opens



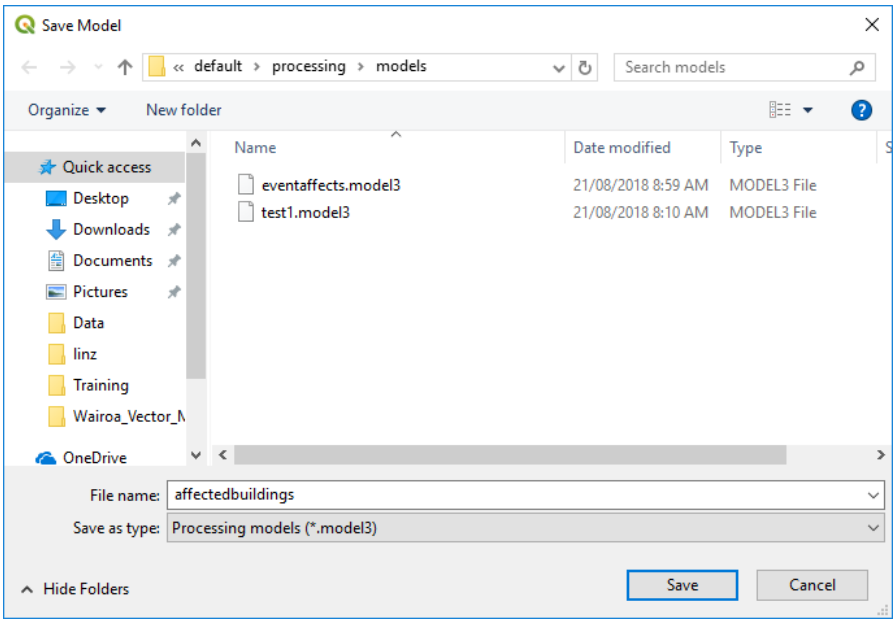
☐ In the **Model properties** panel, set the **Name** to **Affected Buildings**
☐ In the **Model properties** panel, set the **Group** to **Training**



☐ Save the model by clicking the save tool on the toolbar

The **Save Model** dialog will be displayed.

☐ Set the **File name** to **affectedbuildings**



The save path for your model will be like…

C:\Users\training\AppData\Roaming\QGIS\QGIS3\profiles\default\processing\models

☐ Click the **Save** button

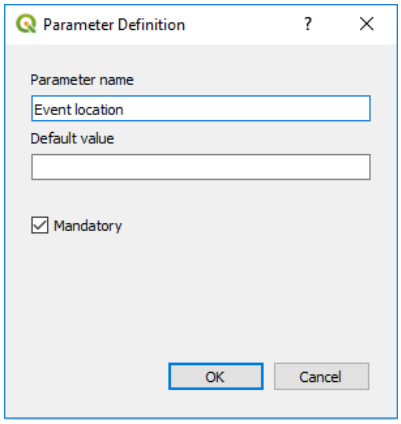
1.2.2 Adding the first input parameter

Our first input is the Event location point that will be chosen on the Map Canvas

☐ In the **Inputs** panel, double click the **Point** input

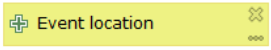
Note that a **Parameter Definition** dialog opens

☐ Set **Parameter name** to **Event Location**



☐ Click the **OK** button

Note that we now have the first input parameter in our graphical modeler…



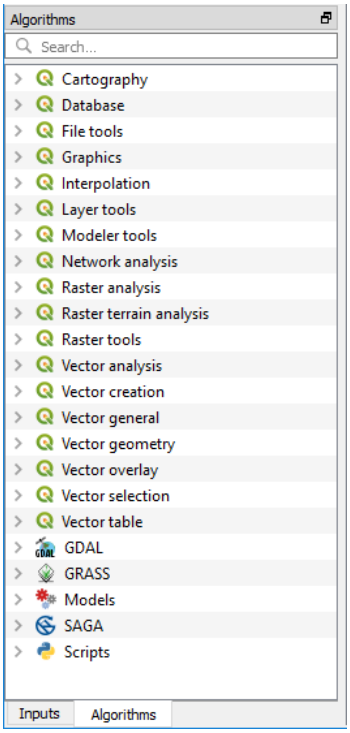
The input parameter can be dragged in the window and to edit double click.

1.2.3 Adding the first algorithm and output

Our next task is to assign this **input** parameter to an **algorithm**

☐ Switch to the **Algorithms** panel (use the tabs at the bottom of the Inputs panel)

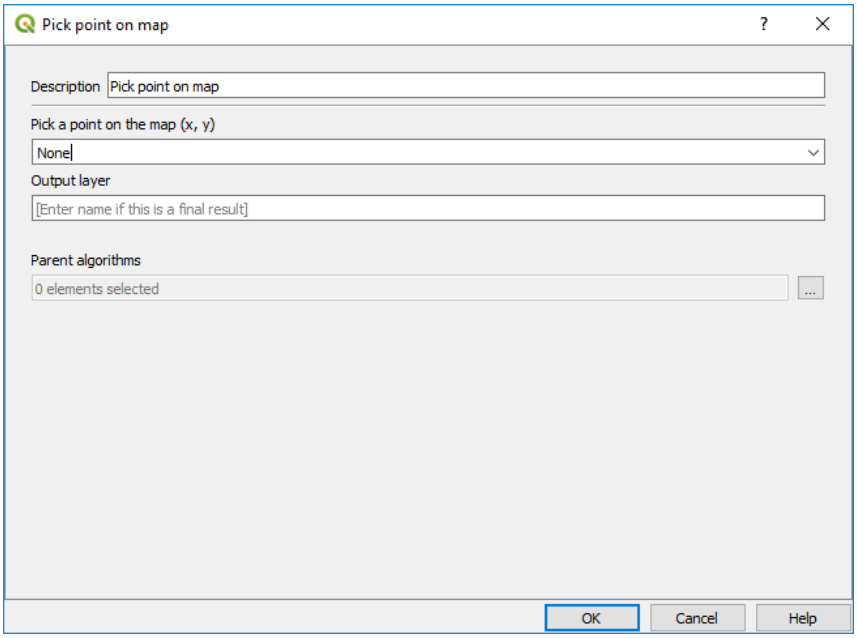
Note that the panel now displays the different categories of algorithms available to the graphical modeler…



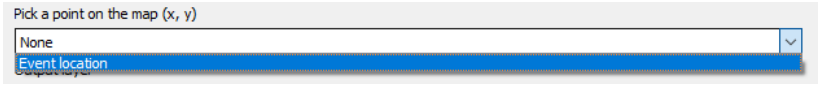
☐ **Expand** the **Scripts** category, then expand **Custom Scripts**

☐ **Double click** the **Pick point on map** script

Note that a dialog opens for the **Pick point on map** script…



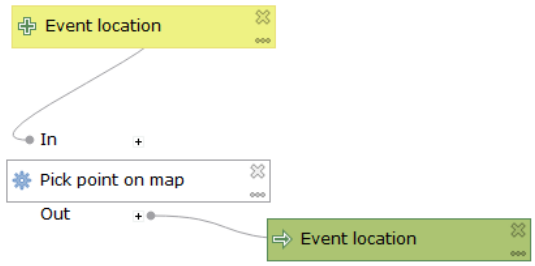
☐ Set **Pick a point on the map (x, y)** dropdown list to **Event Location** (that's the input parameter we defined previously)



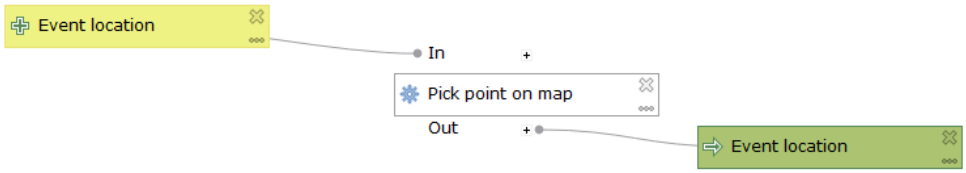
☐ Set **Output layer** to **Event location** (this will be the name of the output layer displaying the event location point in QGIS)

☐ Click the **OK** button

Note that the **Pick point on map** script has been added to the graphical modeler, along with the output layer…



☐ Re-position the items to look like below…



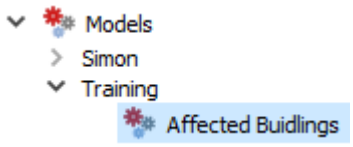
☐ Save the model by clicking the save tool on the toolbar

1.2.4 Testing the model

We now have an input parameter, an algorithm and an output – let's test the model.

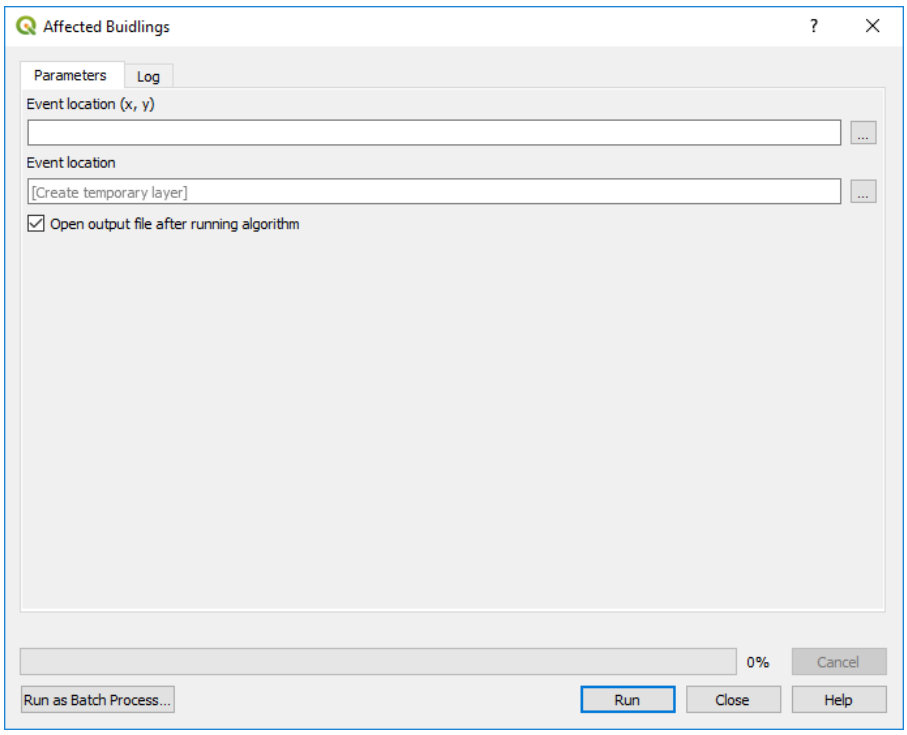
☐ Close the **Processing Modeler** window

☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group



☐ **Double click** the model named **Affected Buildings**

Note that Affected Buildings dialog is displayed…



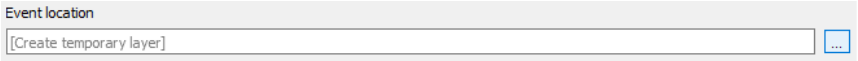
☐ Click the  option button next to the **Event location (x, y)** textbox

Note that we are switched to the **Map Canvas** and we can click a location for the event on the Map Canvas.

Click a location as indicated below on the **Map Canvas**…

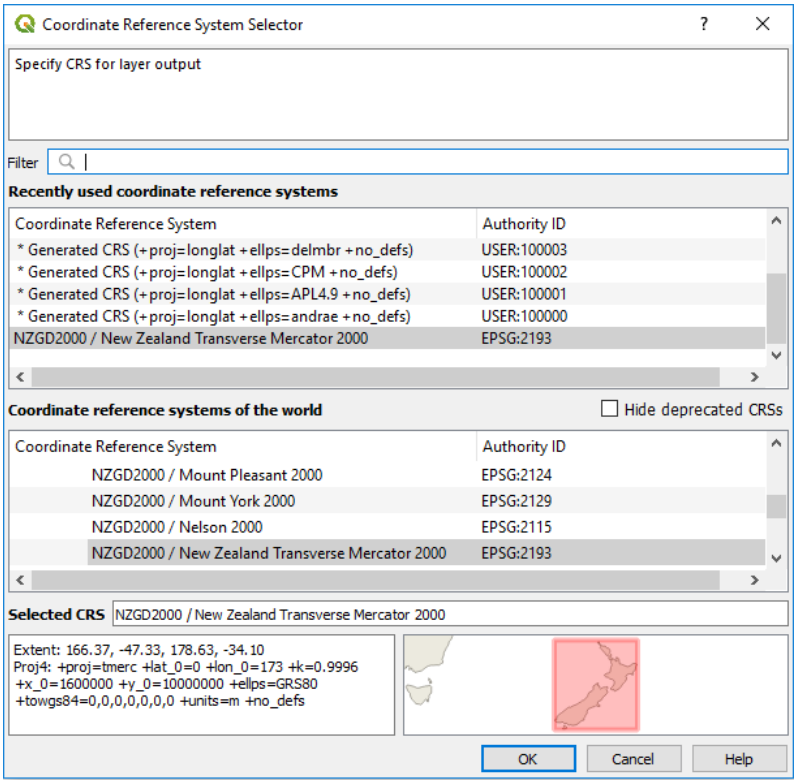
☐ The **Event location (x, y)** textbox will now be populated with the coordinates of the location we clicked on the Map Canvas

☐ Leave the **Event location** output set to **[Create temporary layer]**



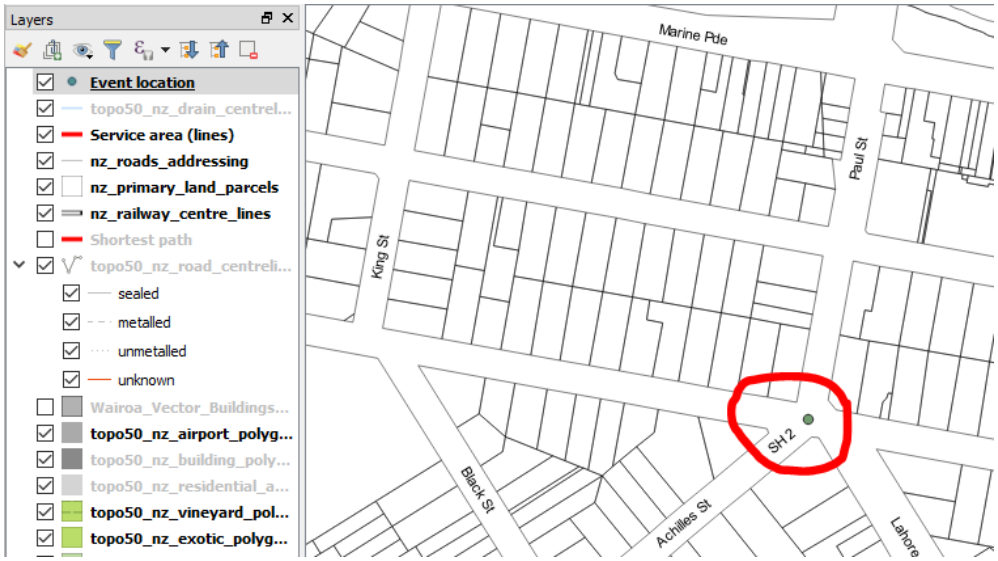
☐ Click the **Run** button

☐ When the **Coordinate Reference System Selector** dialog opens, click the **OK** button



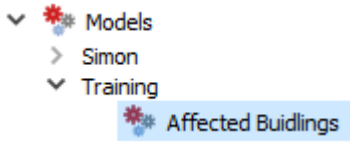
☐ In the **Affected Buildings** dialog, click the **Close** button

The **Map Canvas** should now show a point feature for the location we chose, and the **Layers Panel** will display a new temporary layer named **Event location**...

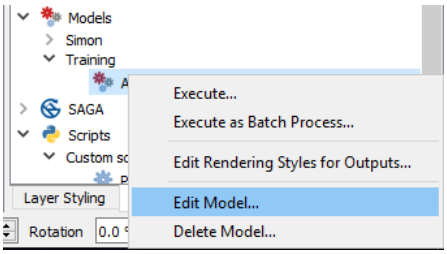


1.2.5 Edit the existing model

☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group



☐ **Right click** the model named **Affected Buildings**, choose **Edit Model…** to open the **Graphical Modeler** window



1.2.6 Add input parameter for Road network layer

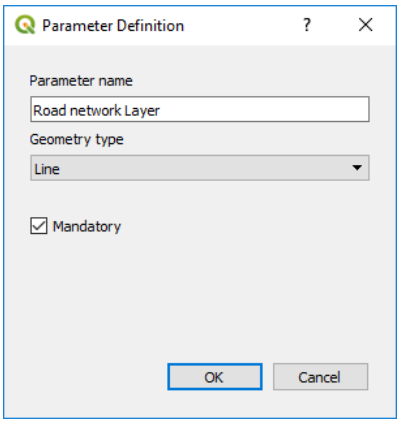
Let's add the input parameter for the road network layer

☐ Switch to the **Inputs** panel (use the tabs at the bottom of the Algorithms panel)

☐ **Double click** the **Vector Layer** input

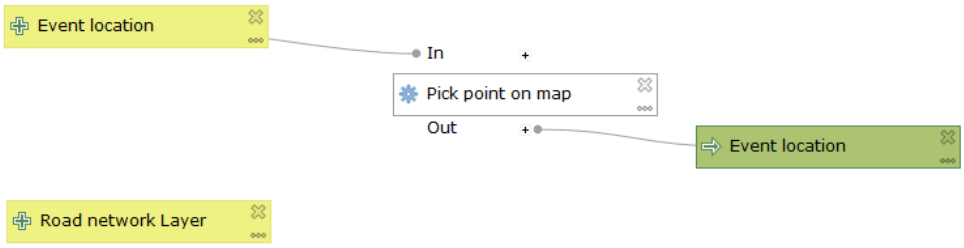
Note that a **Parameter Definition** dialog opens

☐ Set **Parameter name** to **Road network layer**
☐ Set **Geometry Type** to **Line**



- ☐ Click the **OK** button

- ☐ Re-position the items to look like below…



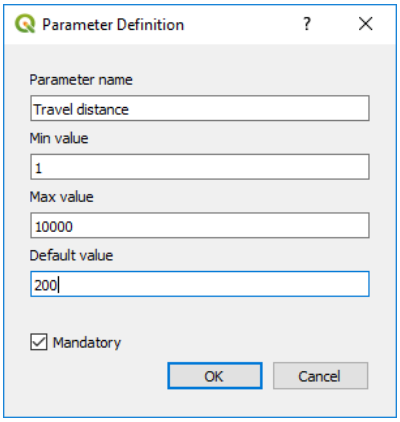
- ☐ Save the model by clicking the save tool on the toolbar

1.2.7 Add input parameter for Travel distance

Now let's add the travel distance input parameter

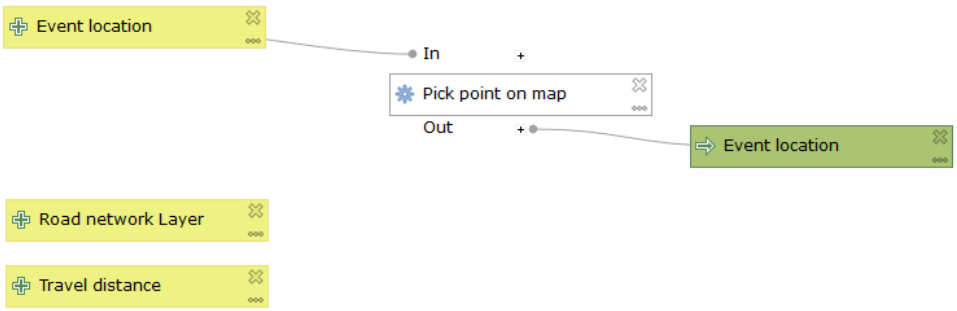
- ☐ **Double click** the **Number** input

- ☐ Set **Parameter name** to **Road network layer**
- ☐ Set **Min value** to **1**
- ☐ Set **Max value** to **10000**
- ☐ Set **Default value** to **200**



- ☐ Click the **OK** button

- ☐ Re-position the items to look like below…



☐ Save the model by clicking the save tool on the toolbar

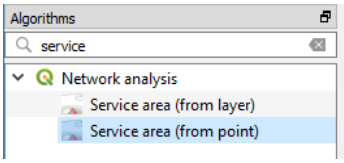
1.2.8 Add algorithm for Service area (from point)

Now well add an algorithm that calculates the service area form the event location along our road network

☐ Switch to the **Algorithms** panel (use the tabs at the bottom of the Inputs panel)

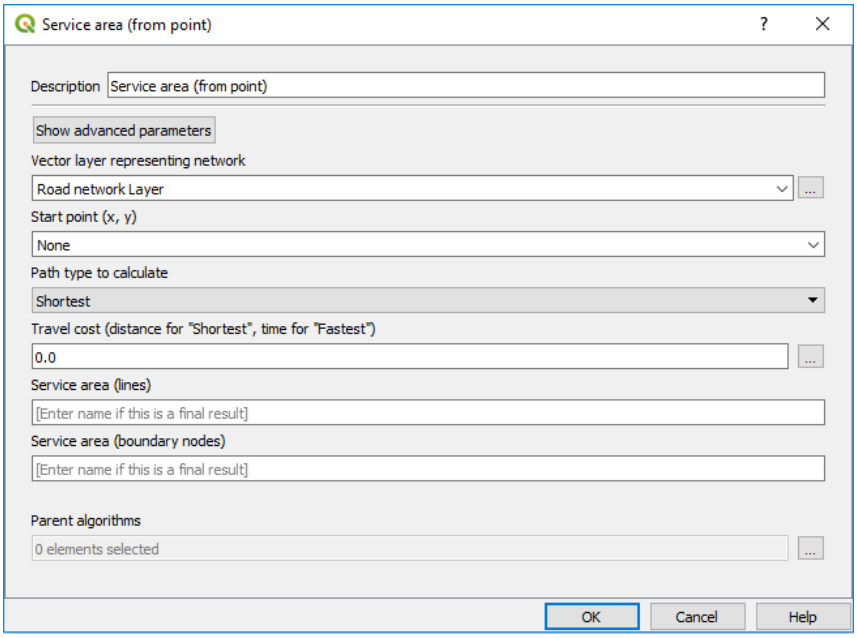
☐ In the **Algorithms** panel, type **service** in the **search** bar

Note that the list of algorithms is automatically filtered as we type in the search value…



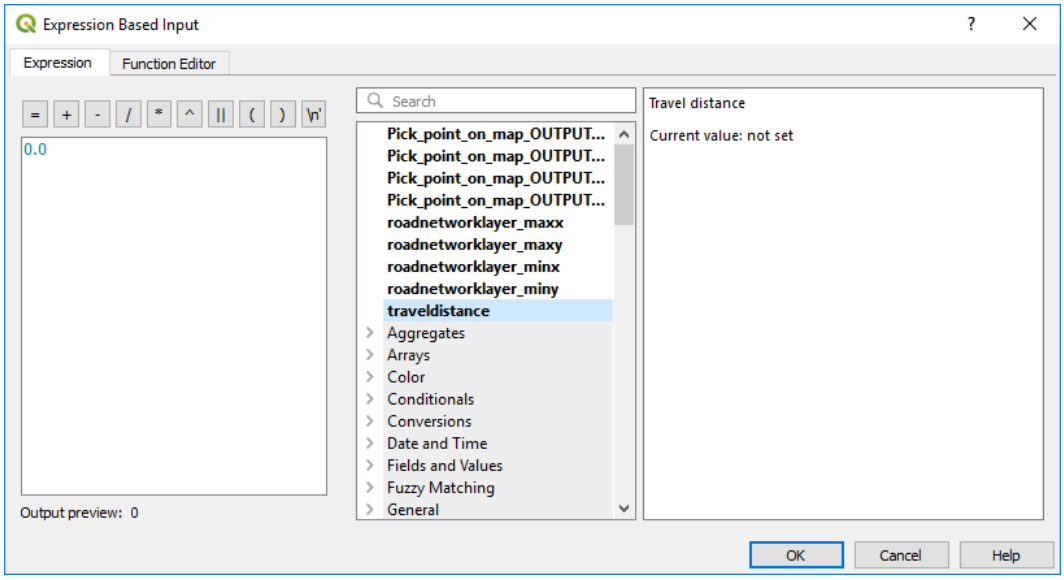
☐ **Double click** the **Service area (from point)** algorithm

Note that the **Service area (from point)** properties dialog opens…



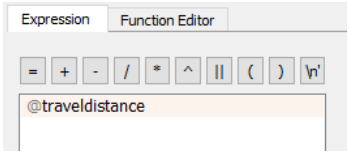
- ☐ Set **Vector layer representing network** to **Road network layer**
- ☐ Set **Start point (x, y)** to **Event location**
- ☐ Click the  option button next to the **Travel cost** textbox

Note the **Expression Based Input** dialog window opens…



- ☐ Remove the value **0.0** in the expression panel

- ☐ Double click the **traveldistance** variable in the middle panel

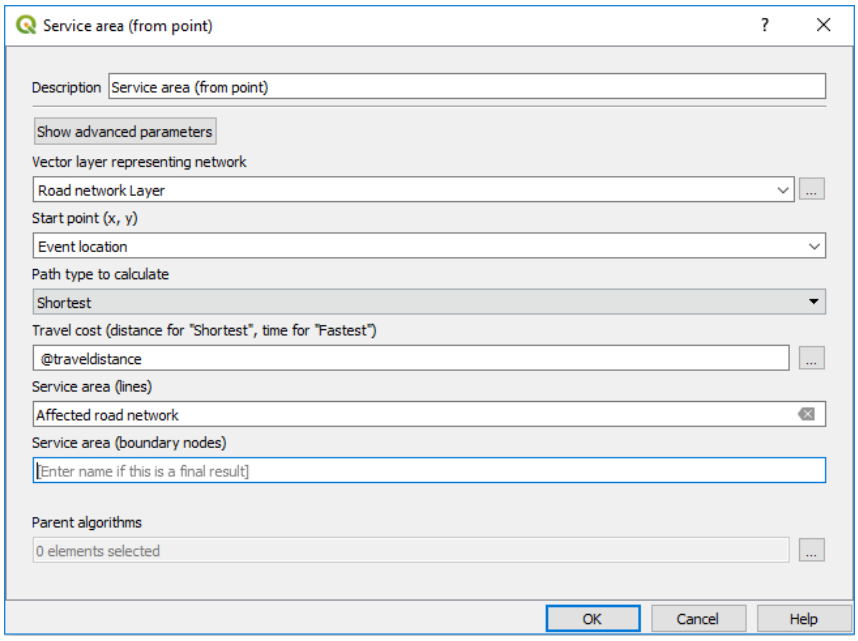


☐ Click the **OK** button

Note that the **Travel cost** is now populated with the variable **@traveldistance**

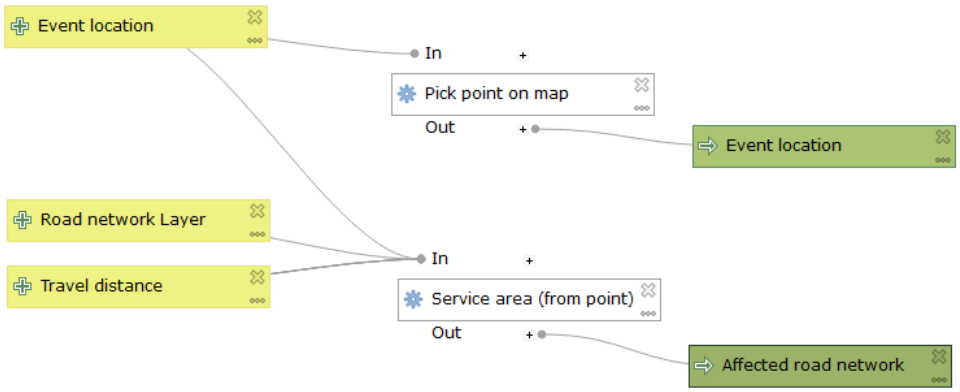
☐ Set the **Service area (lines)** to **Affected road network**

The **Service area (from point)** properties dialog should look like…



☐ Click the **OK** button

☐ Re-position the items to look like below…



☐ Save the model by clicking the save tool on the toolbar

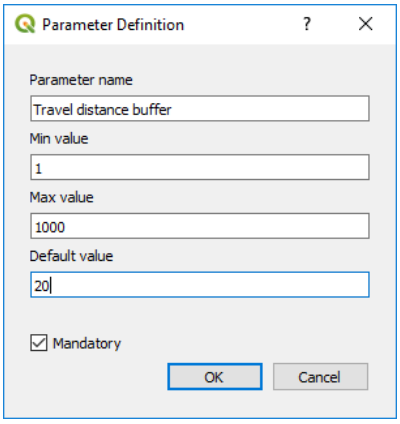
1.2.9 Add input parameter for road network buffer

Now let's add the input parameter for the road network buffer

☐ Switch to the **Inputs** panel (use the tabs at the bottom of the Algorithms panel)

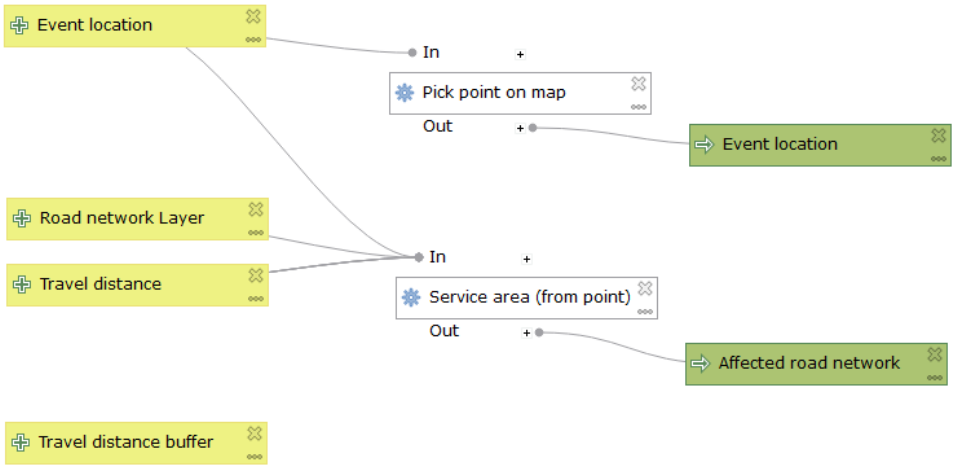
☐ **Double click** the **Number** input

☐ Set **Parameter name** to **Travel distance buffer**
☐ Set **Min value** to **1**
☐ Set **Max value** to **1000**
☐ Set **Default value** to **20**



☐ Click the **OK** button

☐ Re-position the items to look like below…



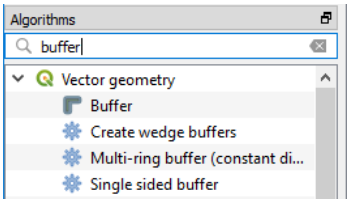
☐ Save the model by clicking the save tool on the toolbar

1.2.10 Add algorithm for buffer

Now let's add the buffer algorithm

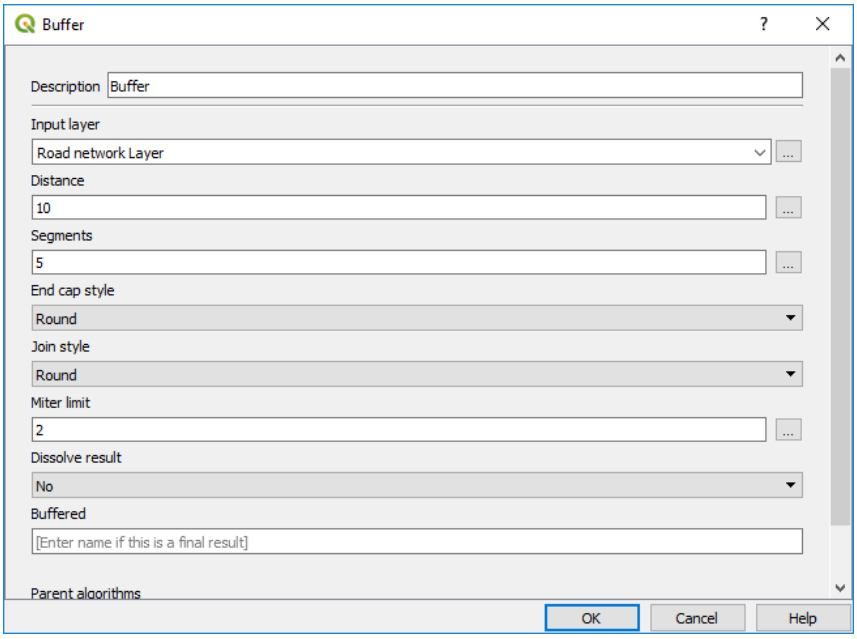
☐ Switch to the **Algorithms** panel (use the tabs at the bottom of the Inputs panel)

☐ In the **Algorithms** panel, type **buffer** in the **search** bar

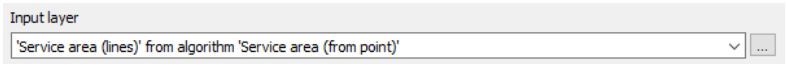


☐ **Double click** the QGIS **Buffer** algorithm

Note that the **Buffer** properties dialog opens…

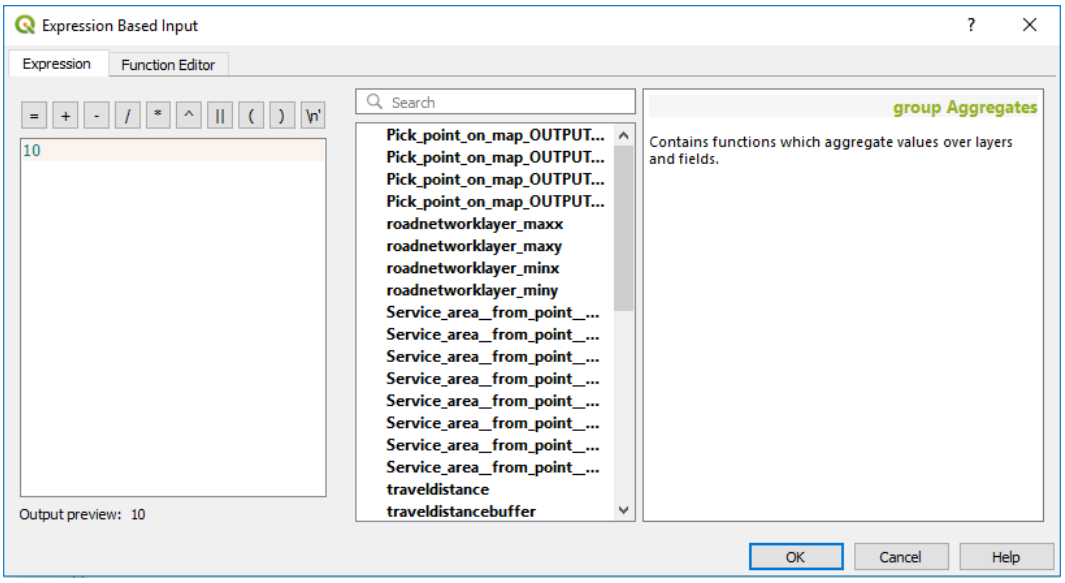


☐ Set **Input layer** to **'Service area (lines)' from algorithm 'Service area (from point)'**



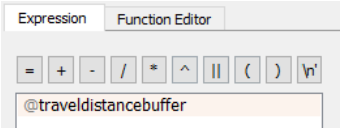
☐ Click the  option button next to the **Distance** textbox

Note the **Expression Based Input** dialog window opens…



☐ Remove the value **10** in the expression panel

- ☐ Double click the **traveldistancebuffer** variable in the middle panel

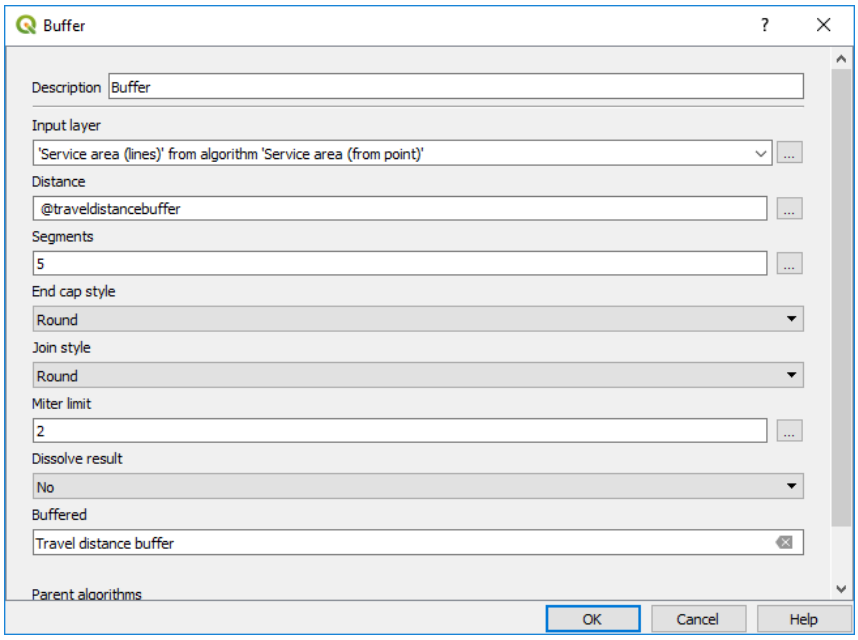


- ☐ Click the **OK** button

- ☐ Note that the **Distance** is now populated with the variable **@traveldistancebuffer**

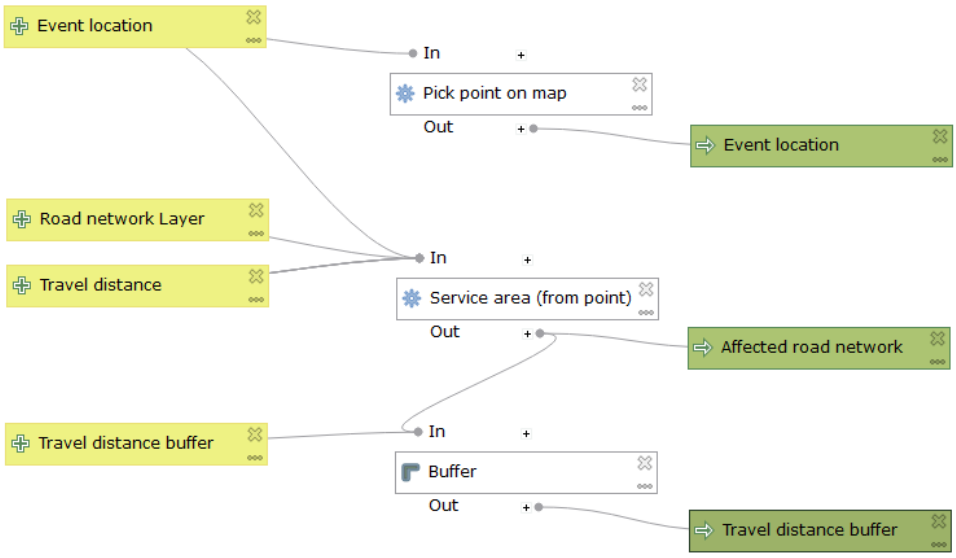
- ☐ Set **Buffered** to **Travel distance buffer**

The **Buffer** properties dialog should look like…



- ☐ Click the **OK** button

- ☐ Re-position the items to look like below…



☐ Save the model by clicking the save tool on the toolbar

1.2.11 Add input parameter for land parcel layer

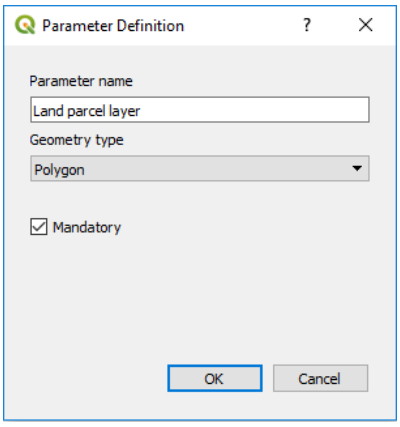
Now let's add the input parameter for the land parcel layer

☐ Switch to the **Inputs** panel (use the tabs at the bottom of the Algorithms panel)

☐ **Double click** the **Vector Layer** input

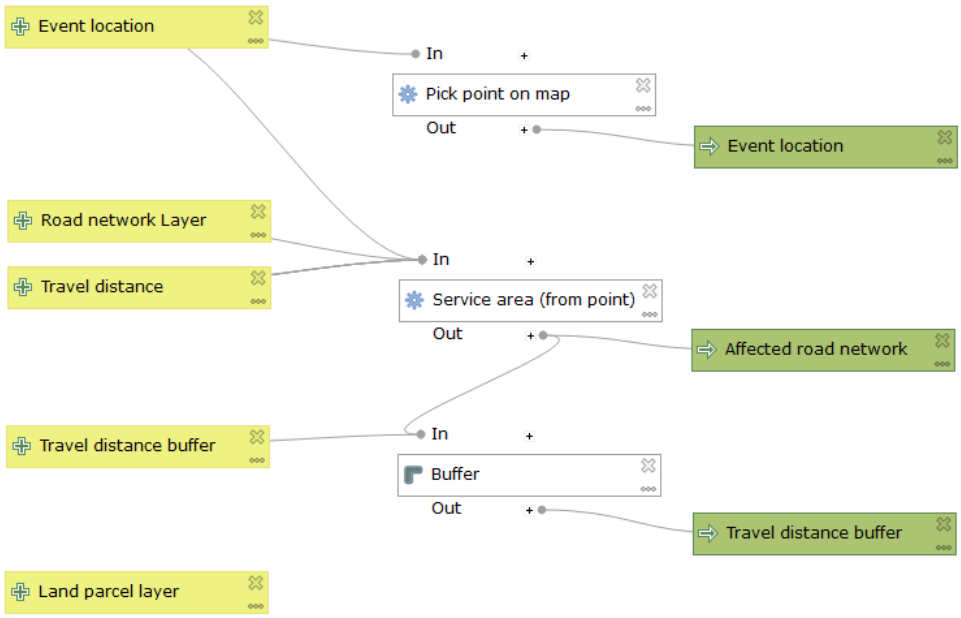
Note that a **Parameter Definition** dialog opens

☐ Set **Parameter name** to **Land parcel layer**
☐ Set **Geometry Type** to **Polygon**



☐ Click the **OK** button

☐ Re-position the items to look like below…



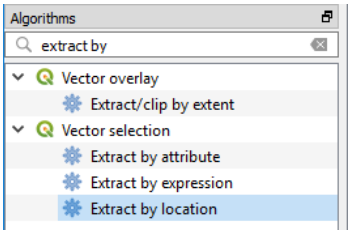
☐ Save the model by clicking the save tool on the toolbar

1.2.12 Add algorithm for extracting by location for land parcels

Now let's add the extract by location algorithm

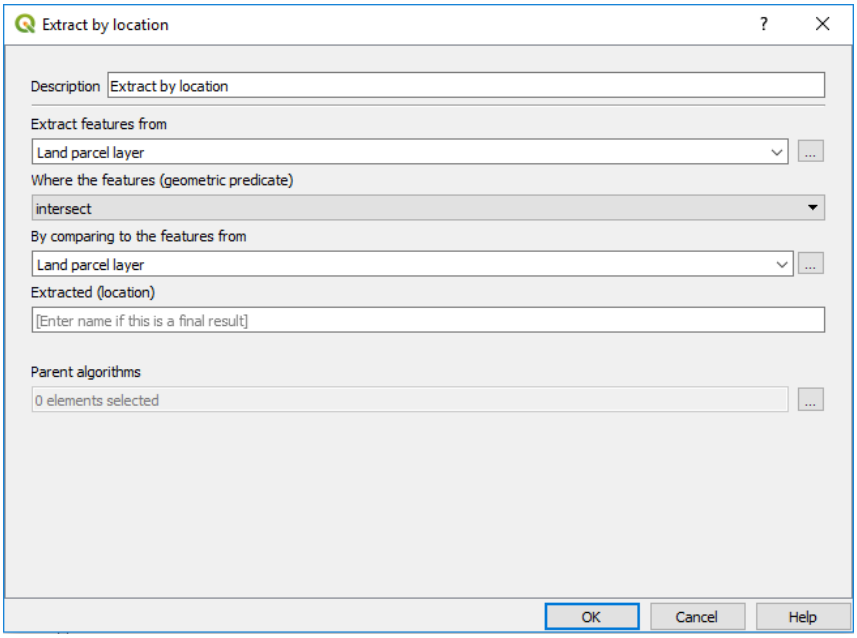
☐ Switch to the **Algorithms** panel (use the tabs at the bottom of the Inputs panel)

☐ In the **Algorithms** panel, type **extract by** in the **search** bar



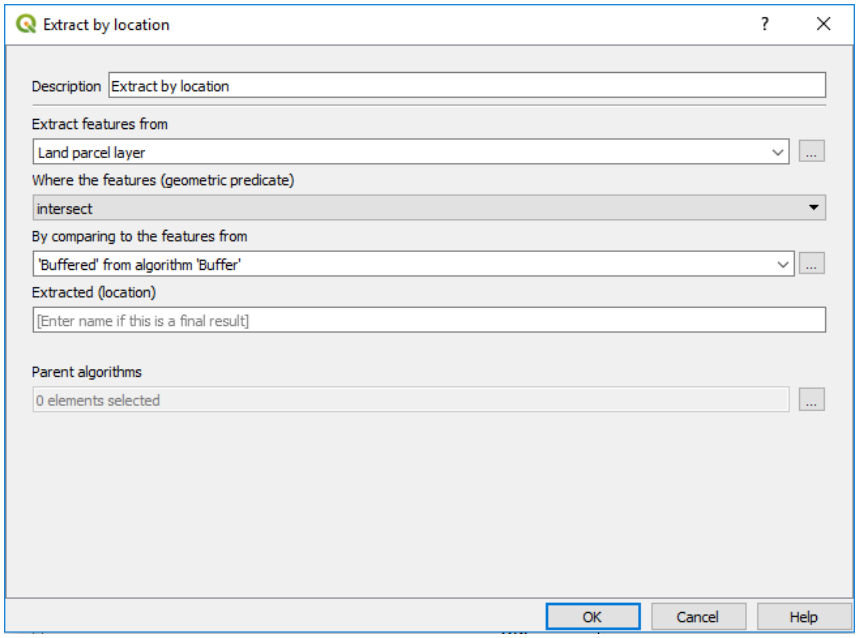
☐ **Double click** the **Extract by location** algorithm

Note that the **Extract by location** properties dialog opens…



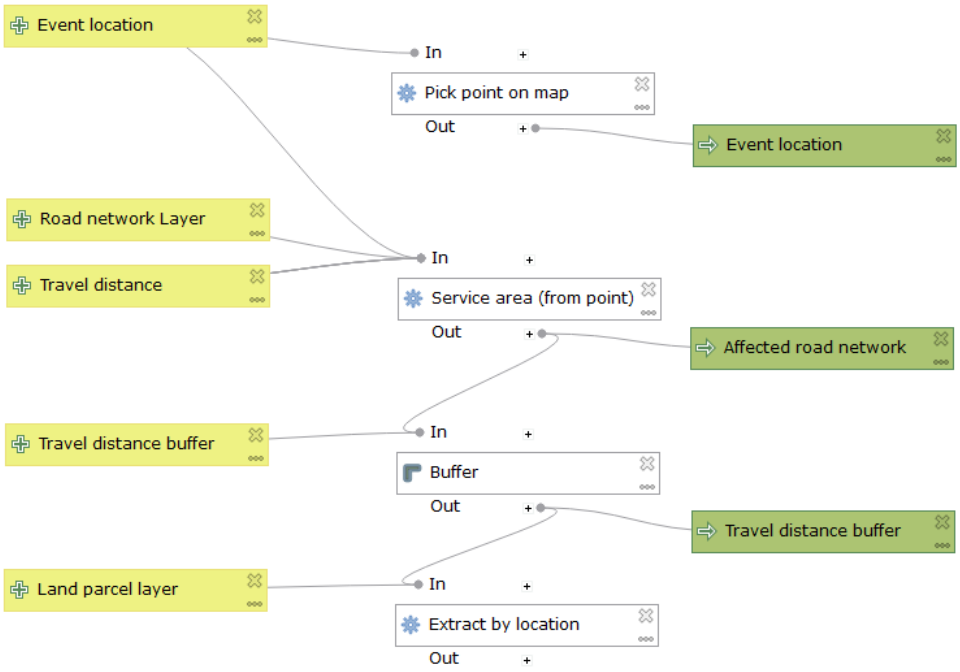
- ☐ Set **By comparing to the features from** to **'Buffered' from algorithm 'Buffer'**

The **Extract by location** properties dialog should look like…



- ☐ Click the **OK** button

- ☐ Re-position the items to look like below…



☐ Save the model by clicking the save tool on the toolbar

1.2.13 Add input parameter for building footprints layer

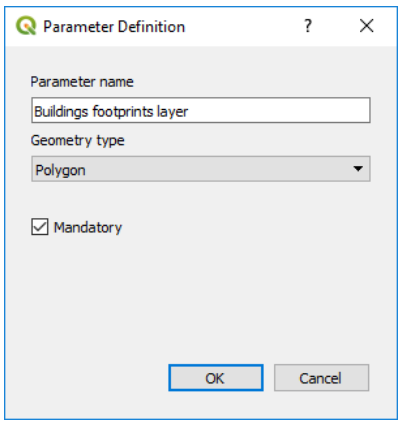
Now let's add the input parameter for the building footprints layer

☐ Switch to the **Inputs** panel (use the tabs at the bottom of the Algorithms panel)

☐ **Double click** the **Vector Layer** input

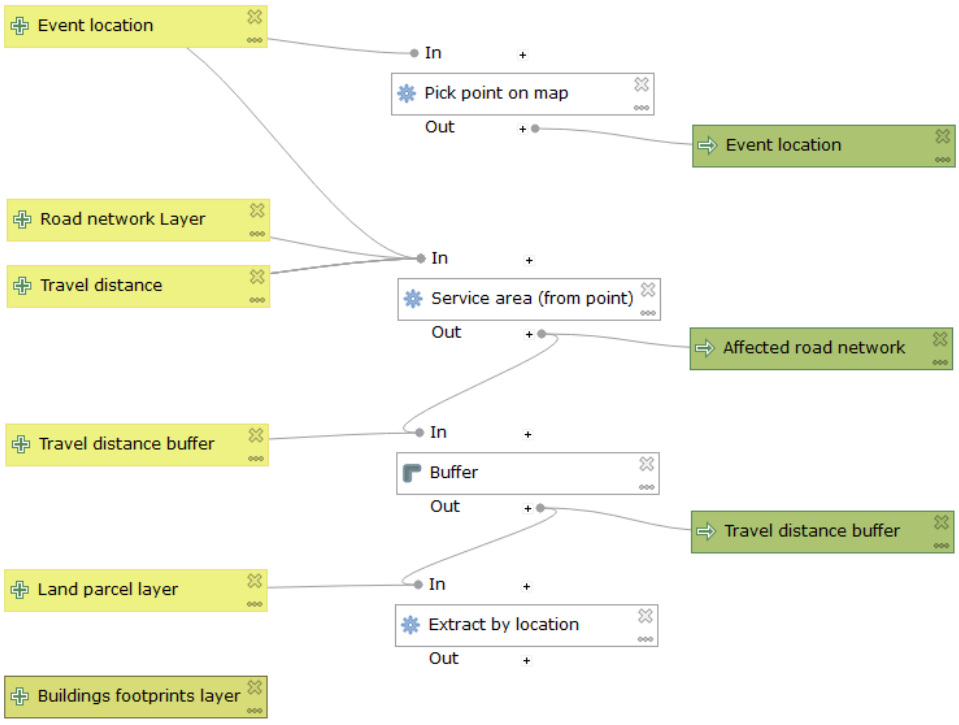
Note that a **Parameter Definition** dialog opens

☐ Set **Parameter name** to **Buildings footprints layer**
☐ Set **Geometry Type** to **Polygon**



☐ Click the **OK** button

☐ Re-position the items to look like below…



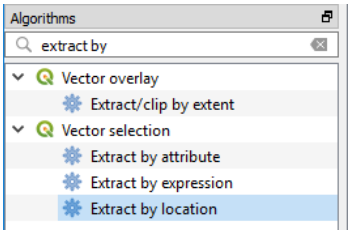
☐ Save the model by clicking the save tool on the toolbar

1.2.14 Add algorithm for extracting by location for building footprints

Now let's add the extract by location algorithm

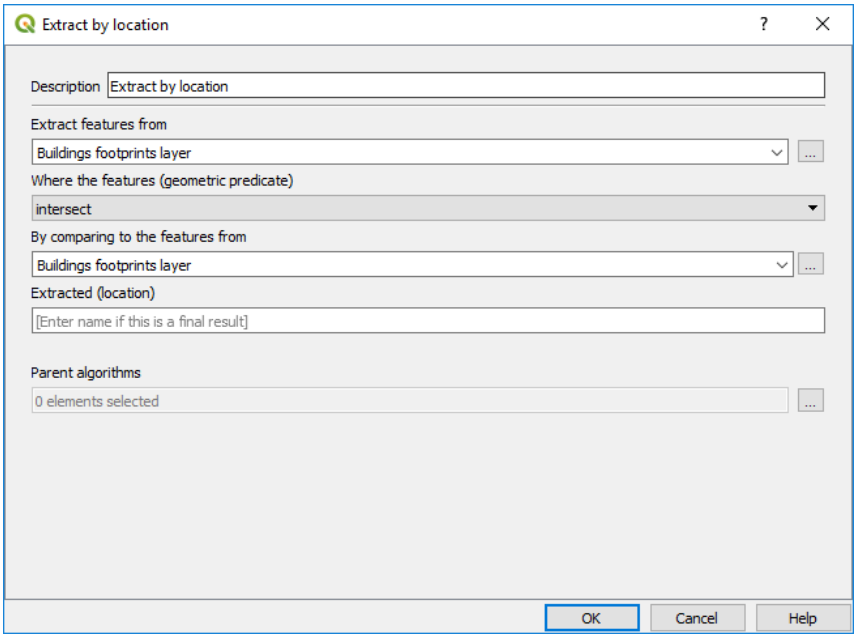
☐ Switch to the **Algorithms** panel (use the tabs at the bottom of the Inputs panel)

☐ In the **Algorithms** panel, type **extract by** in the **search** bar



☐ **Double click** the **Extract by location** algorithm

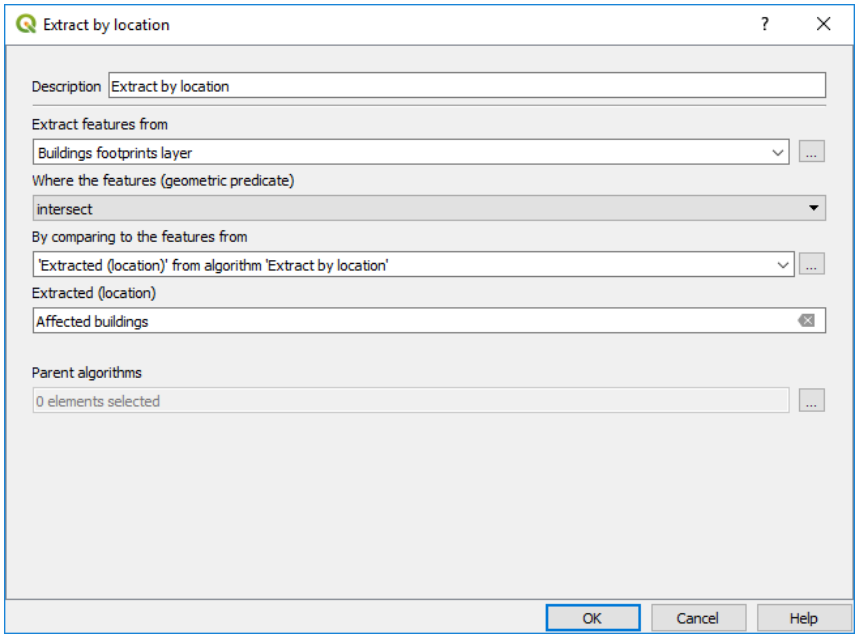
Note that the **Extract by location** properties dialog opens…



☐ Set **By comparing to the features from** to **'Extracted (location)' from algorithm 'Extract by location'**

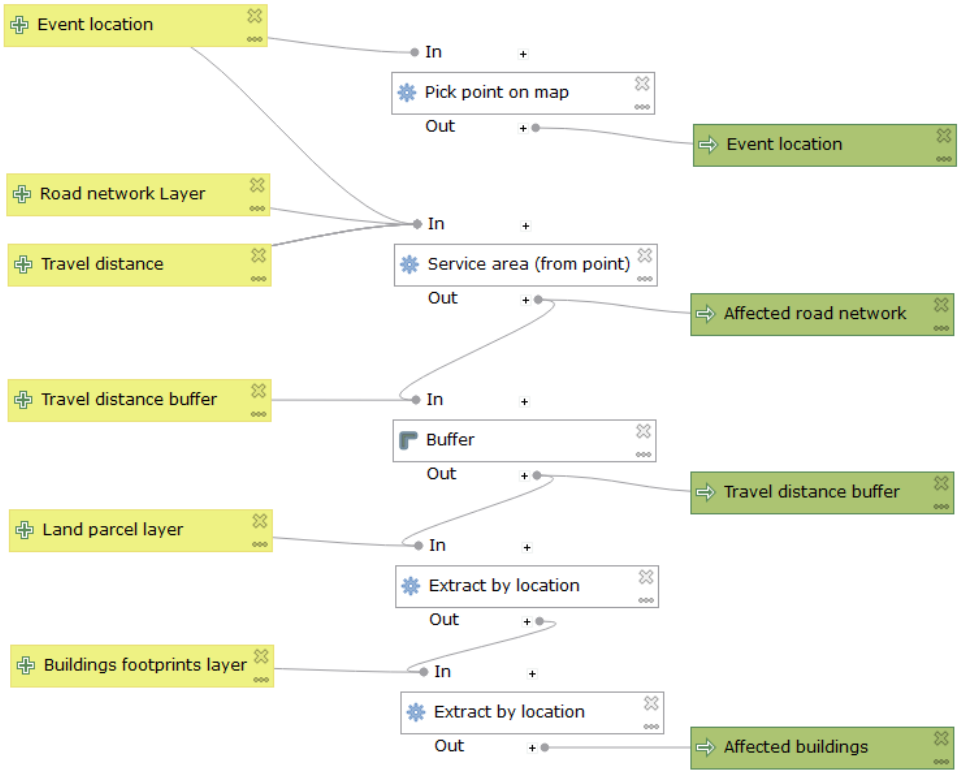
☐ Set **Extracted (location)** to **Affected buildings**

The **Extract by location** properties dialog should look like…



☐ Click the **OK** button

☐ Re-position the items to look like below…



☐ Save the model by clicking the save tool on the toolbar

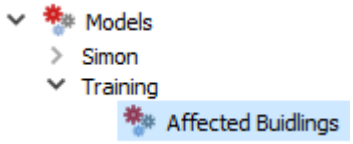
1.2.15 Running the model

We now have our processing model completed – let's run the model.

- ☐ Close the **Processing Modeler** window

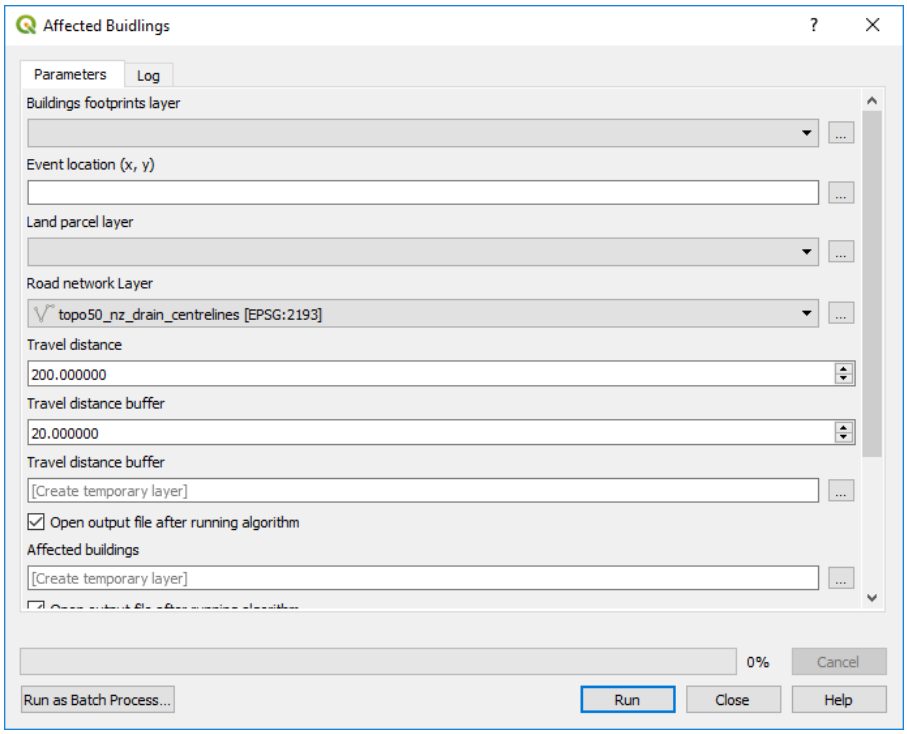
- ☐ In the **Layers panel** remove the layer named **Event Location** from our previous testing.

- ☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group



- ☐ **Double click** the model named **Affected Buildings**

  Note that Affected Buildings dialog is displayed…



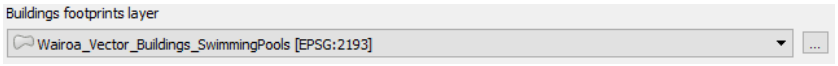
- ☐ Click the … option button next to the **Event location (x, y)** textbox

  Note that we are switched to the **Map Canvas** and we can click a location for the event on the Map Canvas.

  Click a location as indicated below on the **Map Canvas**…

The **Event location (x, y)** textbox will now be populated with the coordinates of the location we clicked on the Map Canvas

- ☐ Set **Buildings footprints layer** to **Wairoa_Vector_Buildings_SwimmingPools**

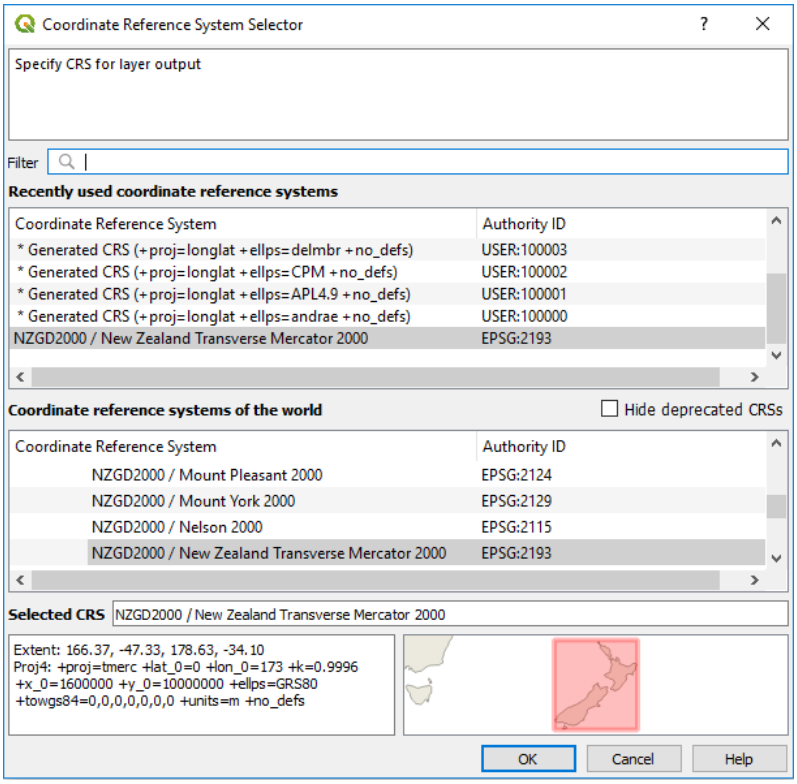


- ☐ Set **Land parcel layer** to **nz_primary_land_parcels**

- ☐ Set **Road network layer** to **nz_roads_addressing**

- ☐ Click the **Run** button

- ☐ When the **Coordinate Reference System Selector** dialog opens, click the **OK** button



☐ In the **Affected Buildings** dialog, click the **Close** button

The **Map Canvas** should now show the results of the **Affect buildings** processing model...

1.2.16 Setting styles for the output layers

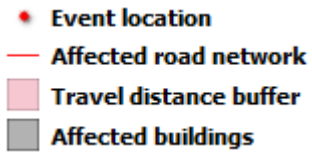
Whenever the **Affected Buildings** model is run the output layers styles are determined randomly by QGIS.

We can extend our model by applying a QGIS **.qml** style file to each layer output

We have the following pre-defined style files:

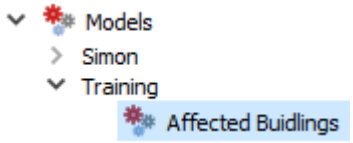
- C:\Training\AffectedBuildings_event_location.qml
- C:\Training\AffectedBuildings_travel_distance_buffer.qml
- C:\Training\AffectedBuildings_affected_road_network.qml
- C:\Training\AffectedBuildings_affected_buildings.qml

These style files define the following styles:

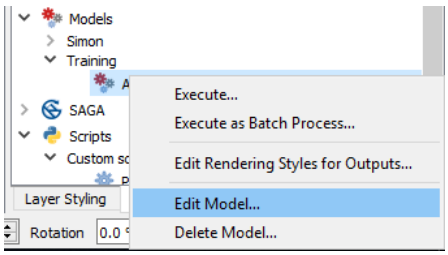


Let's start editing our model

- ☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group

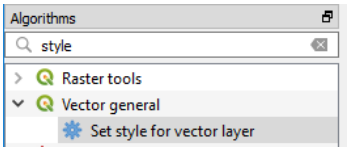


- ☐ **Right click** the model named **Affected Buildings**, choose **Edit Model…** to open the **Graphical Modeler** window



Add the Event Location style

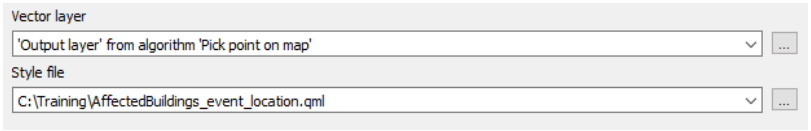
- ☐ In the **Algorithms** panel, type **style** in the **search** bar



- ☐ **Double click** the **Set style for vector layer** algorithm

  Note that the **Set style for vector layer** properties dialog opens…

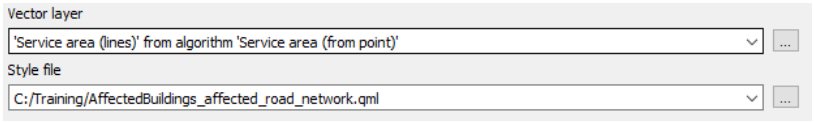
- ☐ Set **Vector layer** to **'Output layer' from algorithm 'Pick point on map'**
- ☐ Set **Style file** to **C:\Training\AffectedBuildings_event_location.qml**



- ☐ Click the **OK** button
- ☐ Re-position the items

Add the Affected road network style

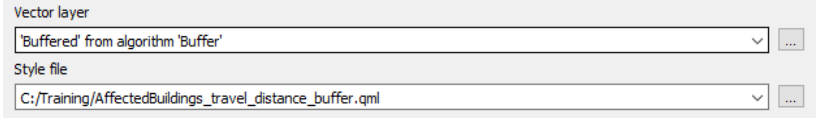
- ☐ **Double click** the **Set style for vector layer** algorithm
- ☐ Set **Vector layer** to **'Service area (lines)' from algorithm 'Service area (from point)'**
- ☐ Set **Style file** to **C:/Training/AffectedBuildings_affected_road_network.qml**



- ☐ Click the **OK** button
- ☐ Re-position the items

Add the Travel distance buffer style

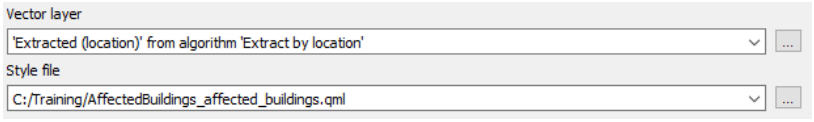
- ☐ **Double click** the **Set style for vector layer** algorithm
- ☐ Set **Vector layer** to **'Buffered' from algorithm 'Buffer'**
- ☐ Set **Style file** to **C:/Training/AffectedBuildings_travel_distance_buffer.qml**



- ☐ Click the **OK** button
- ☐ Re-position the items

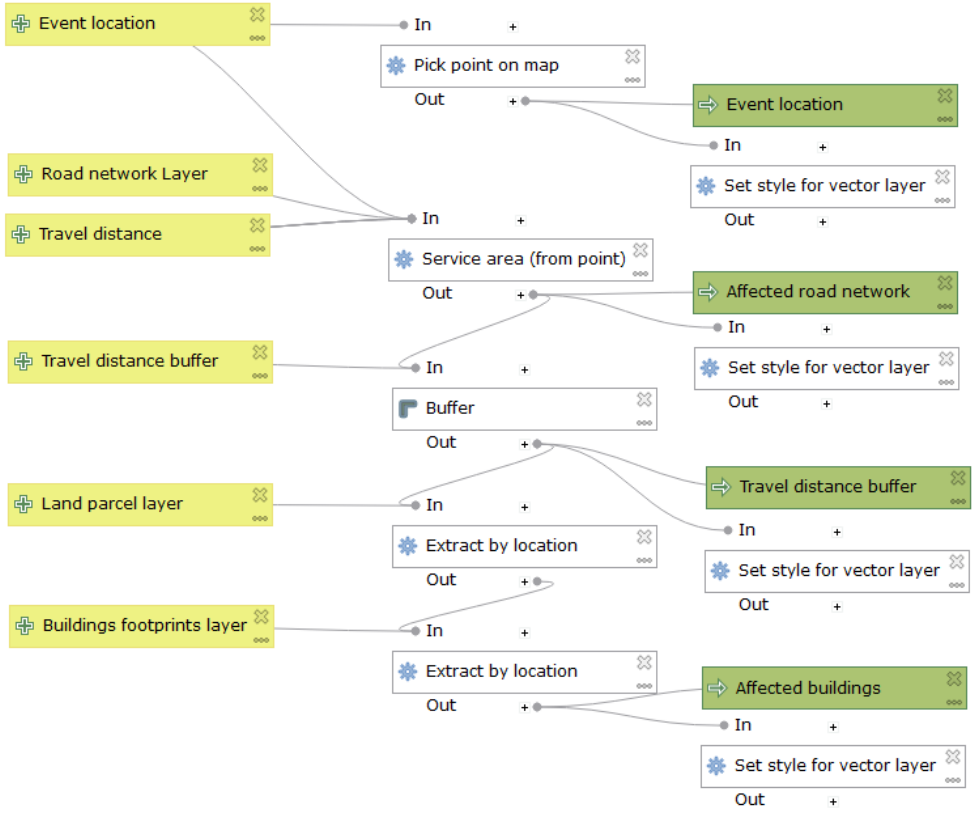
Add the Affect buildings style

- ☐ **Double click** the **Set style for vector layer** algorithm
- ☐ Set **Vector layer** to **'Extracted (location)' from algorithm 'Extract by location'**
- ☐ Set **Style file** to **C:/Training/AffectedBuildings_affected_buildings.qml**



- ☐ Click the **OK** button
- ☐ Re-position the items

Our model should look like this now…

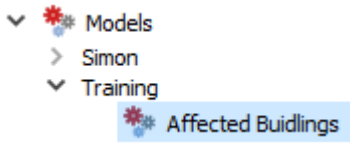


- ☐ Save the model by clicking the save tool on the toolbar

1.2.17 Running the final model with styling

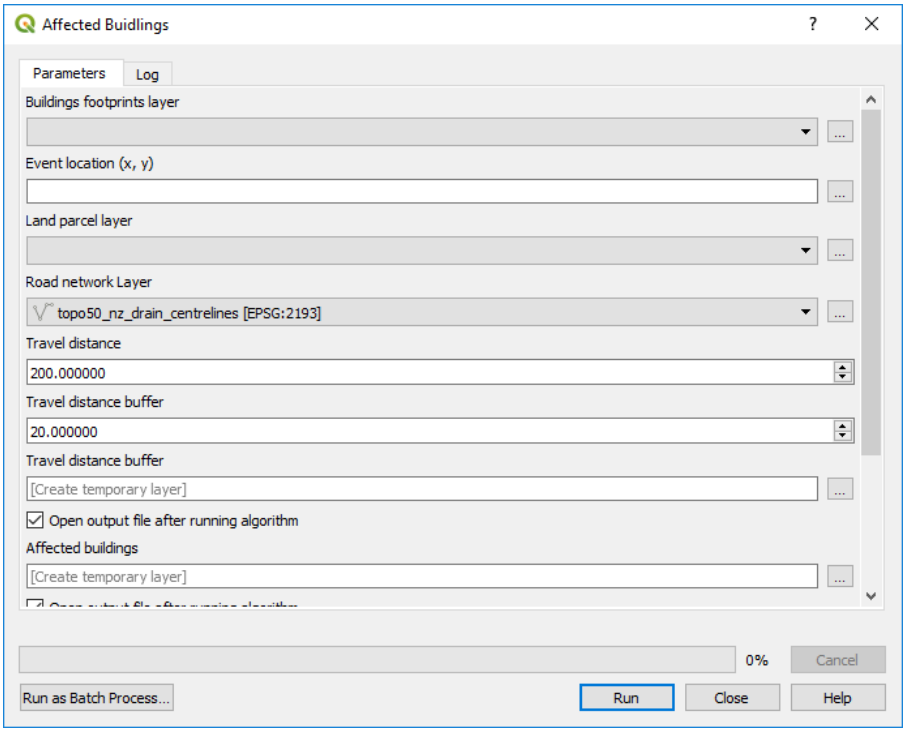
We now have our processing model completed – let's run the model.

- ☐ Close the **Processing Modeler** window
- ☐ In the **Layers panel** remove the layers from previous running of the model
    - **Event Location**
    - **Affected road network**
    - **Travel distance buffer**
    - **Affected buildings**
- ☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group



- ☐ **Double click** the model named **Affected Buildings**

  Note that Affected Buildings dialog is displayed…



☐ Click the ... option button next to the **Event location (x, y)** textbox

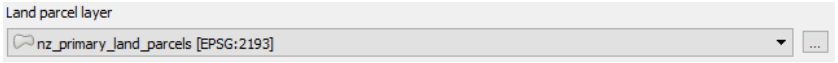
Note that we are switched to the **Map Canvas** and we can click a location for the event on the Map Canvas.

Click a location as indicated below on the **Map Canvas**...

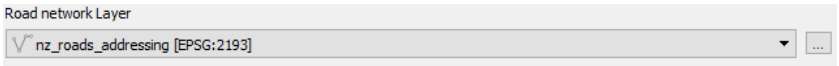
The **Event location (x, y)** textbox will now be populated with the coordinates of the location we clicked on the Map Canvas

- ☐ Set **Buildings footprints layer** to **Wairoa_Vector_Buildings_SwimmingPools**

- ☐ Set **Land parcel layer** to **nz_primary_land_parcels**

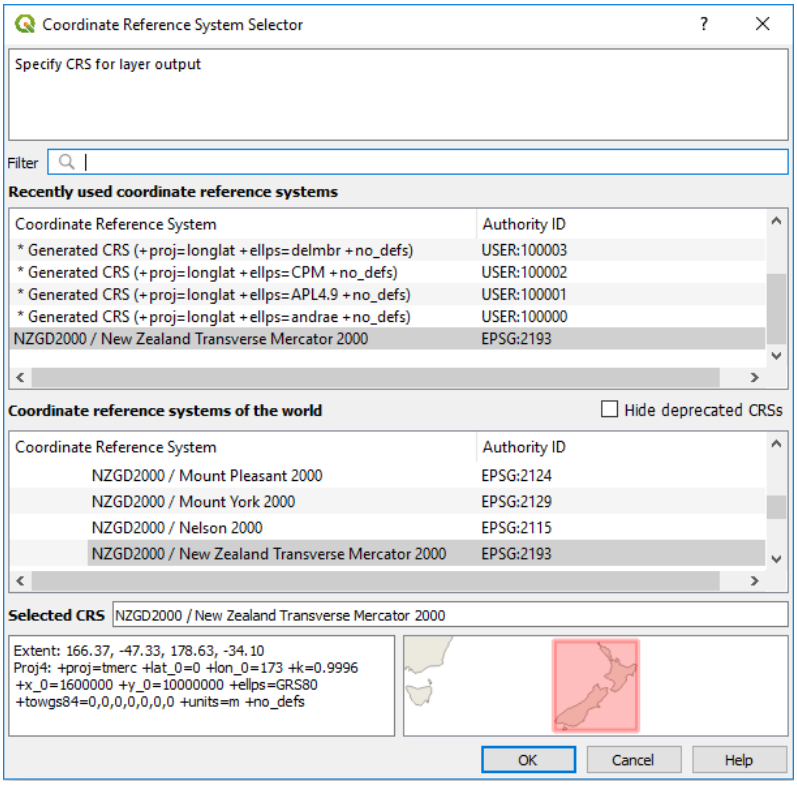


- ☐ Set **Road network layer** to **nz_roads_addressing**



- ☐ Click the **Run** button

- ☐ When the **Coordinate Reference System Selector** dialog opens, click the **OK** button



☐ In the **Affected Buildings** dialog, click the **Close** button

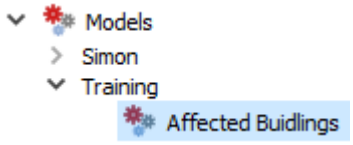
The **Map Canvas** should now show the results of the **Affect buildings** processing model with our style files applied to each output layer…

1.2.18 Editing model help

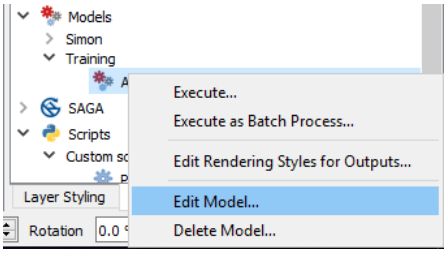
We can document our models from within the graphical modeler itself.

To document our **Affected Buildings** model, let's start by editing our model

☐ In the **Processing toolbox**, expand the **Models** category, then expand the **Training** group



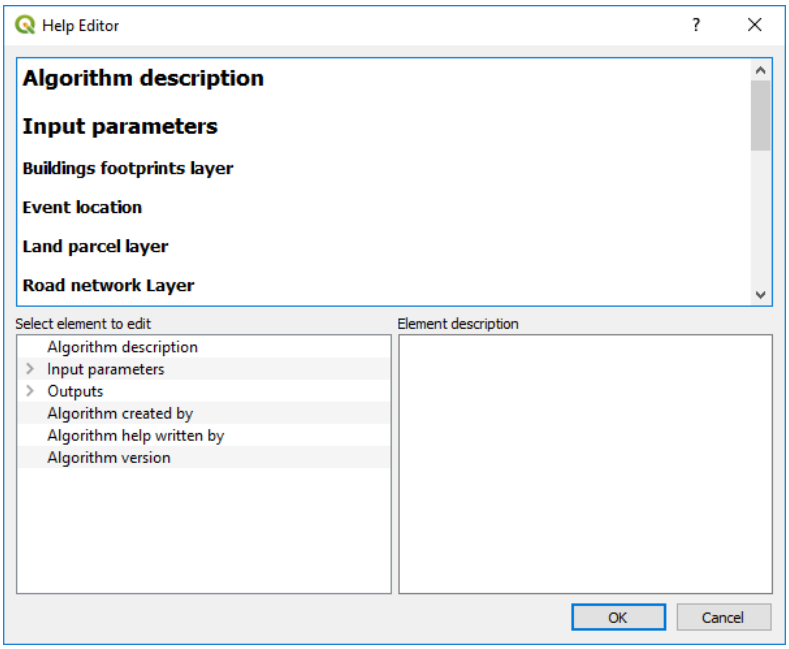
☐ **Right click** the model named **Affected Buildings**, choose **Edit Model…** to open the **Graphical Modeler** window



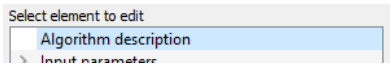
Now let's edit the model help

☐ In the **Graphical Modeler** window, click the **Edit model help** tool on the toolbar

Note that **Help Editor** dialog opens…

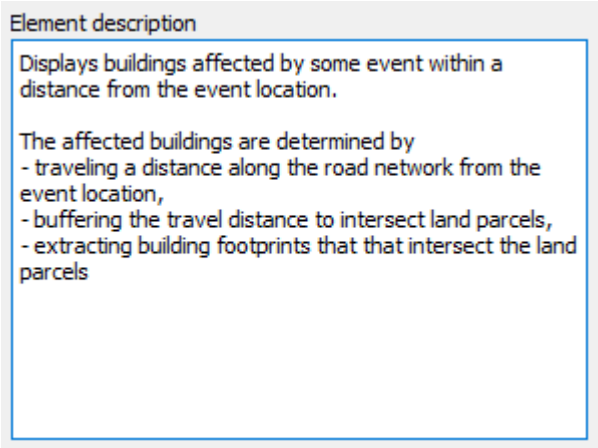


☐ Select the element named **Algorithm description** in the **Select element to edit panel**



☐ Click inside the **Element Description** panel, and **type a description** for the model

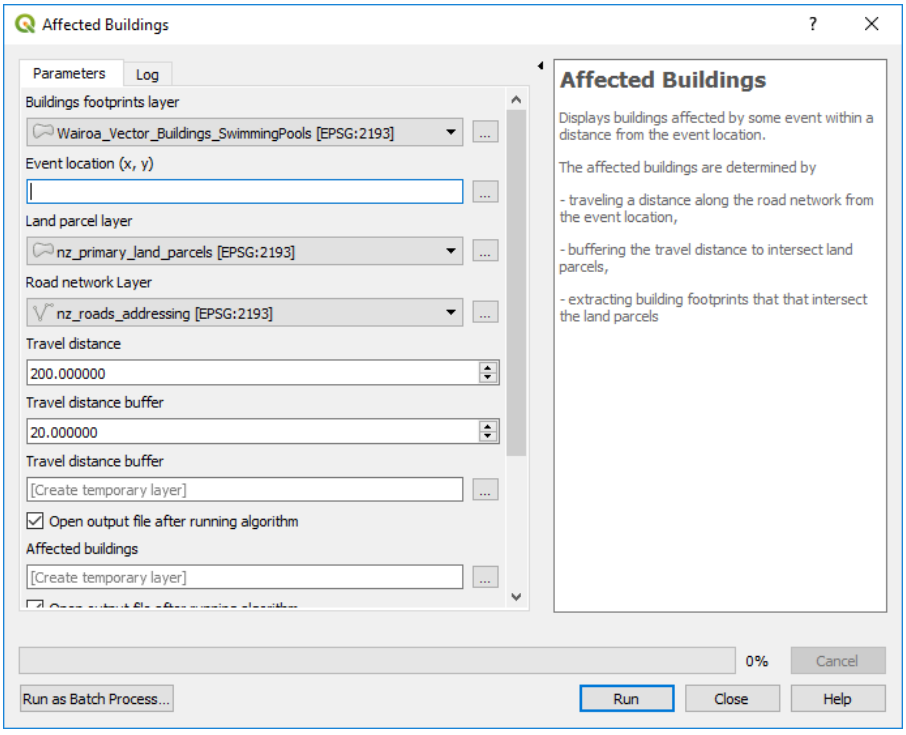
TIP – Copy and paste the text saved in the file C:\Training\AffectedBuildings_help_text.txt



☐ Click the **OK** button

☐ In the **Graphical Modeler** window, click the **Run model** tool on the toolbar

Note that the Model now displays a description panel on the right-hand side of the model dialog…



- ☐ Click the **Close** button
- ☐ Save the model by clicking the save tool on the toolbar