



International Federation  
of Red Cross and Red Crescent Societies



# PARTICIPATORY MULTI-HAZARD RISK MAPPING METHODOLOGY

FOR URBAN AND PERI-URBAN CONTEXTS

## Module 2 – Technical Instructions for Developing and Updating Multi-hazard Risk Map using Quantum Geographic Information System (QGIS)

November, 2017

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# PART 1

## INSTALLING QGIS SOFTWARE AND IDENTIFYING ADMINISTRATIVE BOUNDARIES FOR MAPPING AREA

### I. INSTALLING QGIS SOFTWARE

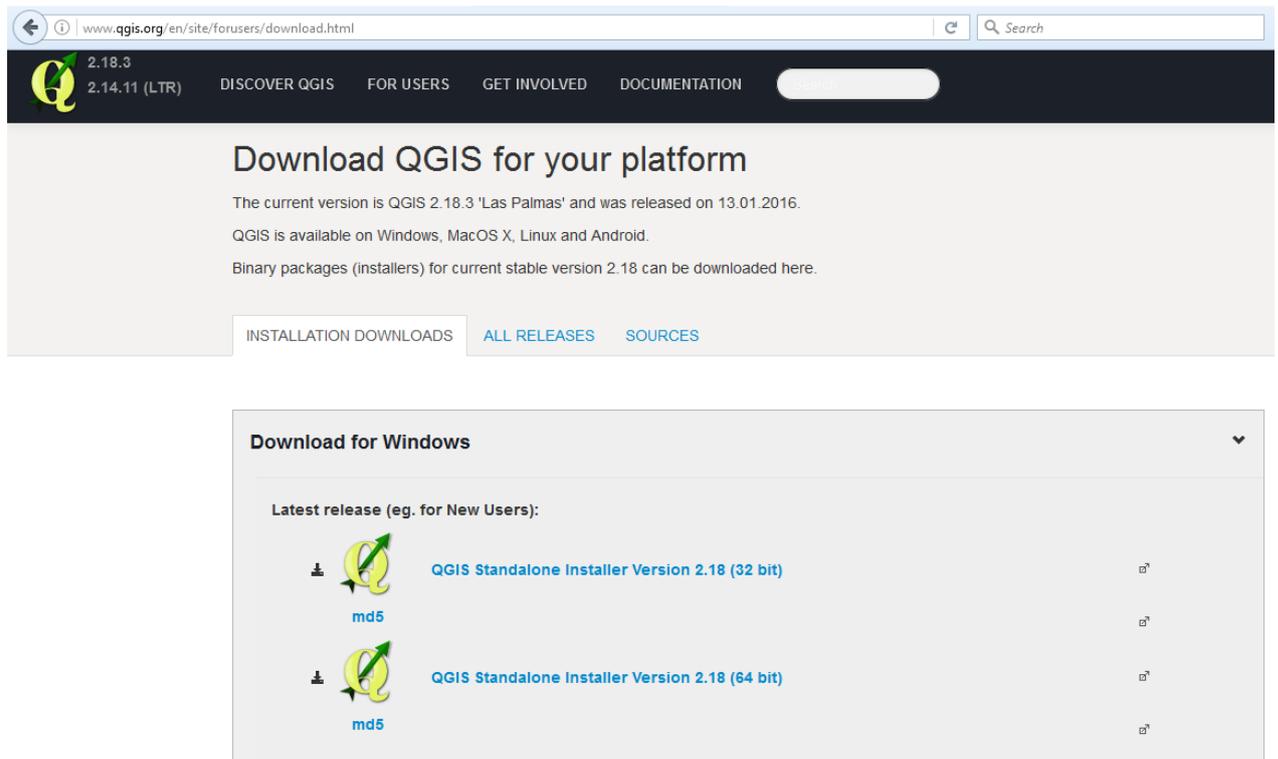
#### 1. Selecting QGIS version

GIS can be downloaded directly from the QGIS official website of QGIS software: <http://www.qgis.org>. User should use the latest version of QGIS. In this guideline, we are using QGIS version 2.18.2-1.

- If the computer is installed with WINDOWS 32BIT, please choose the link: <http://www.norbit.de/~jef/QGIS-OSGeo4W-2.18.2-1-Setup-x86.exe> to download.

- If the computer is installed with WINDOWS 64BIT, please choose the link: [http://www.norbit.de/~jef/QGIS-OSGeo4W-2.18.2-1-Setup-x86\\_64.exe](http://www.norbit.de/~jef/QGIS-OSGeo4W-2.18.2-1-Setup-x86_64.exe) to download.

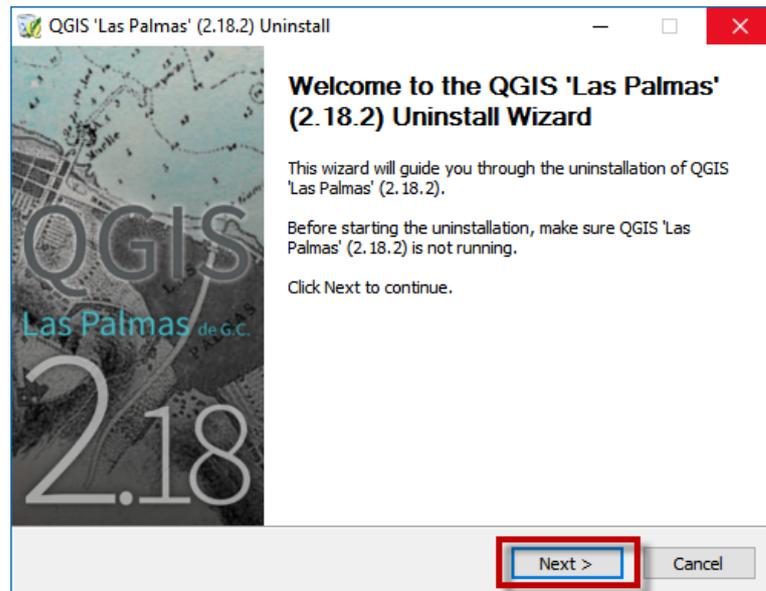
- In addition, the older version of QGIS software could be downloaded directly in the following **Download** folder: <http://www.qgis.org/en/site/forusers/download.html>



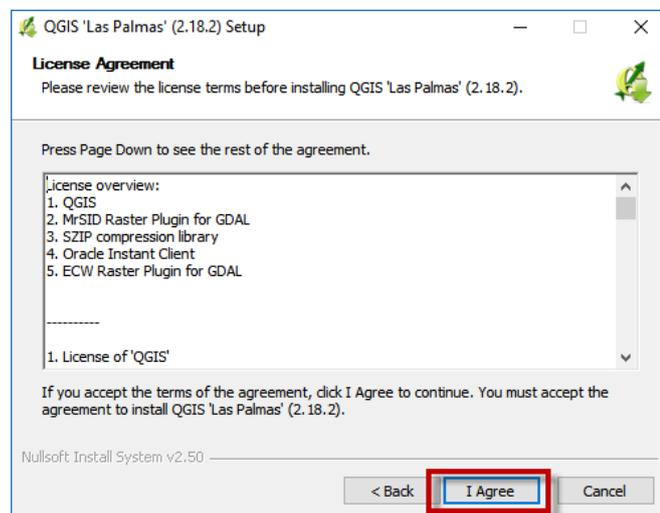
#### 2. Installing QGIS software

After being downloaded to the computer, the software will be installed as follows:

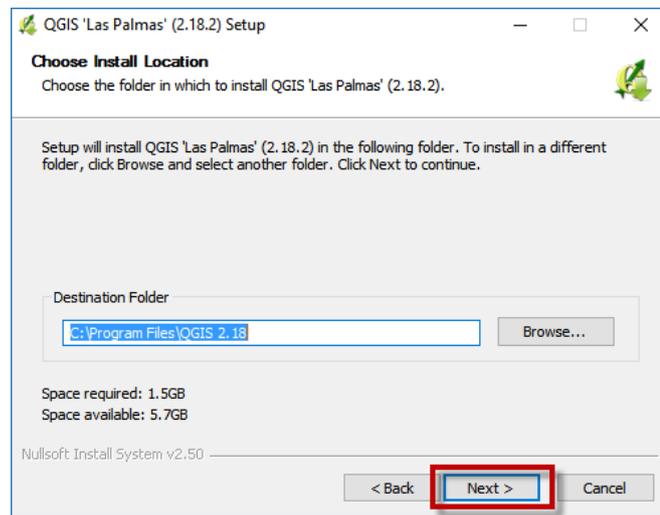
**Step 1:** Run the file **QGIS-OSGeo4W-2.18.2-1-Setup-x86\_64.exe** (if the computer is installed with windows 64 bit, or file **QGIS-OSGeo4W-2.18.2-1-Setup-x86.exe** if the computer is installed with windows 32 bit) , click **Next** to move to Step 2.



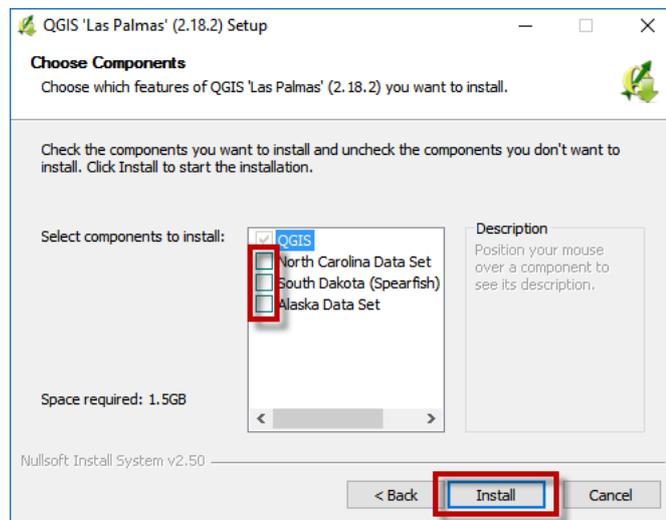
**Step 2:** Select **I Agree** to agree with the terms of the agreement.



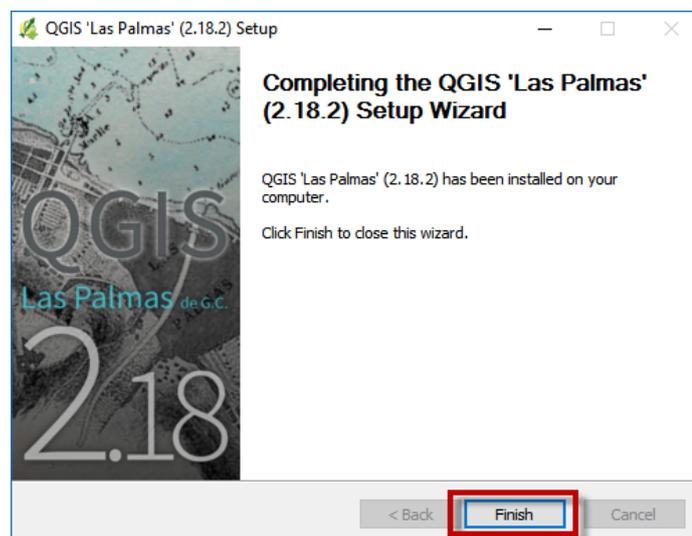
Then choose the location of installation (set default), press **Next**.



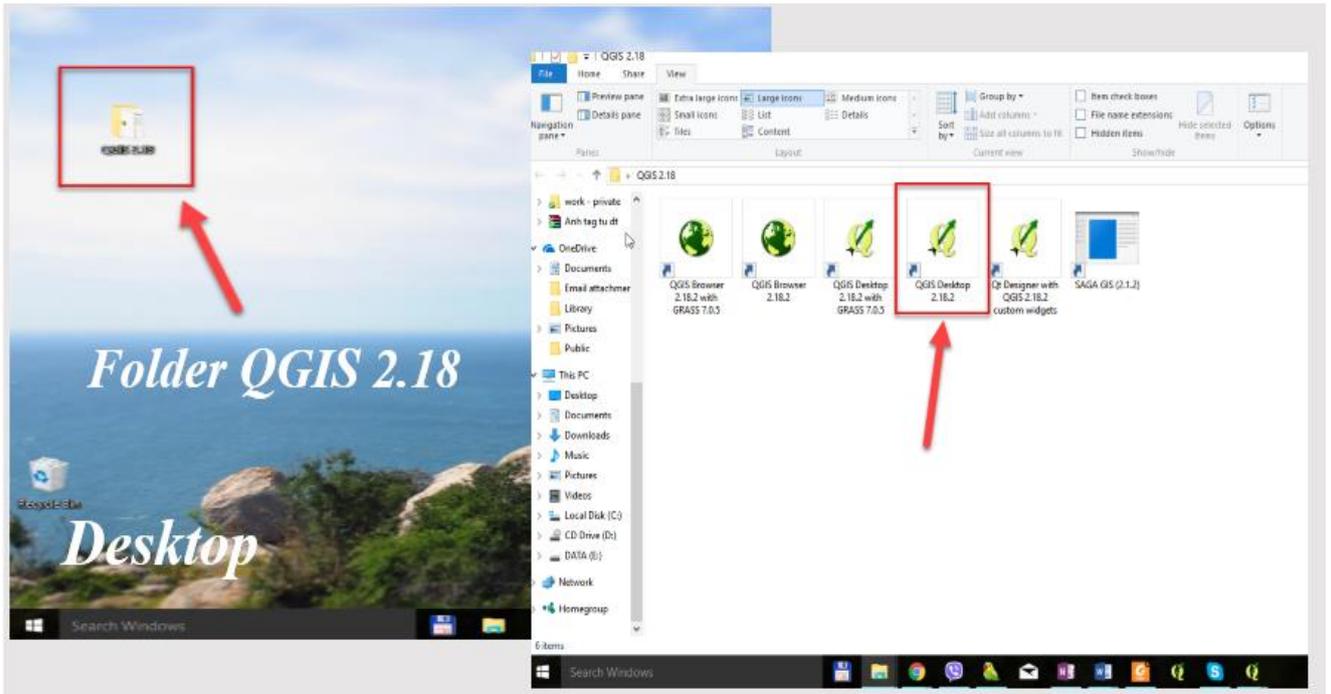
**Step 3:** Click **Install** to proceed to installation (*do not tick options from **Select components to install***)



**Step 4:** The installation process would take a few minutes. Then, click **Finish** to complete the installation.



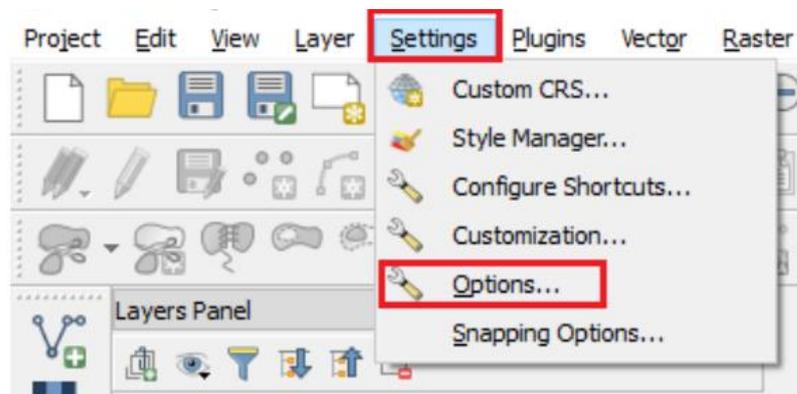
**Step 5:** To run QGIS software, open “QGIS Desktop 2.18.2” inside folder QGIS 2.18 which is on the desktop. Also, you can create an icon of QGIS Desktop 2.18.2 on the desktop for later use.



### 3. Setting your own language for QGIS software

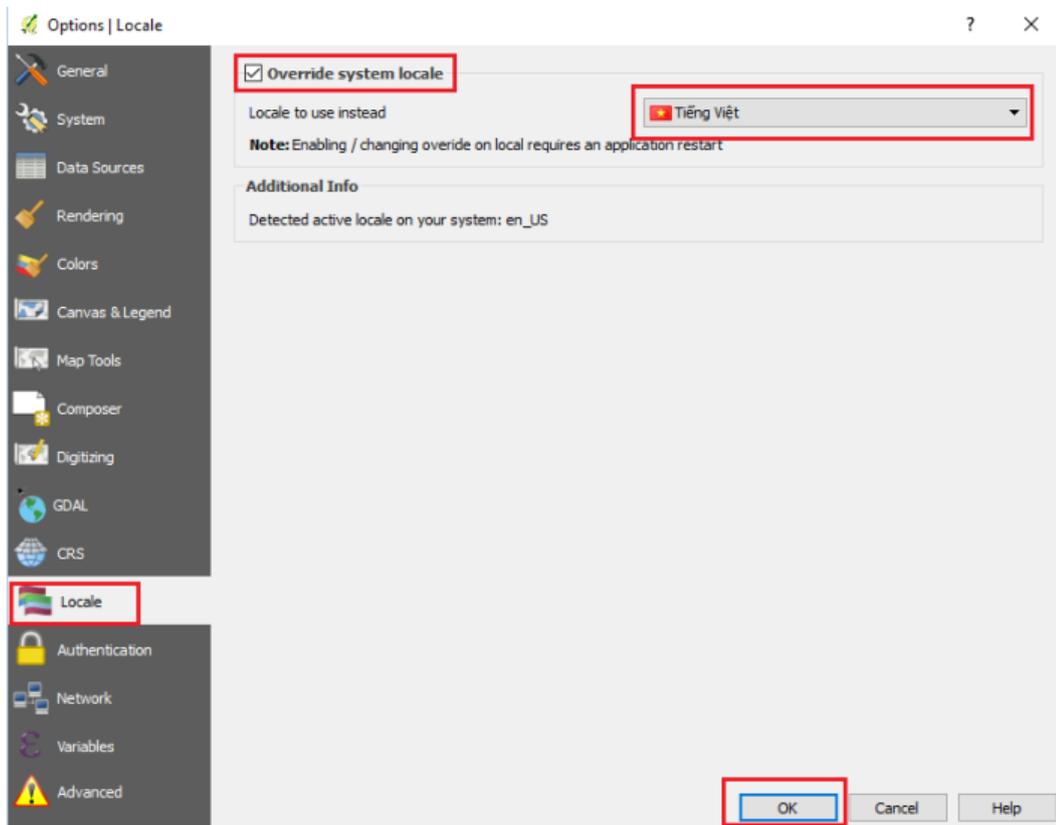
English is defaulted language in the QGIS interface. If you want to switch to your own language, open **QGIS Desktop** and perform the following steps:

**Step 1:** Go to **Settings**, select **Options**



**Step 2:** A new window opens, select **Locale**, tick **Override system locale**

At **Locale to use instead**, seek the language you desire, then **OK**

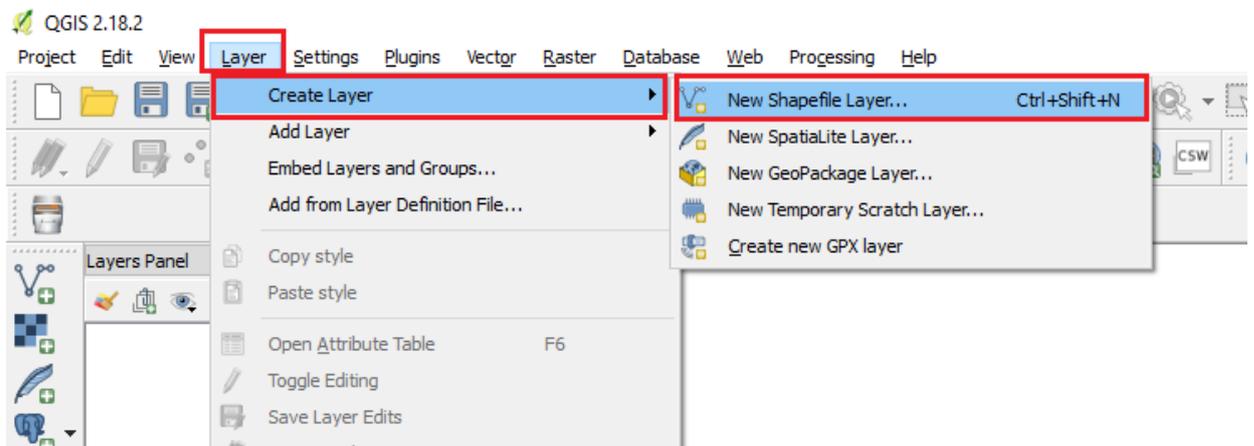


#### 4. The configuration requirements of the computer

To install and operate QGIS, the computer configuration shall be at minimum: Ram 4GB - CPU Core i3 - HDD 10Gb available.

## II. ESTABLISHING THE ADMINISTRATIVE BOUNDARIES

Step 1: Create a layer: on the toolbar, go to **Layer/Create layer/New shapefile layer**



Or you can click to icon New Shapefile Layer  on the vertical toolbar on the left of the window.

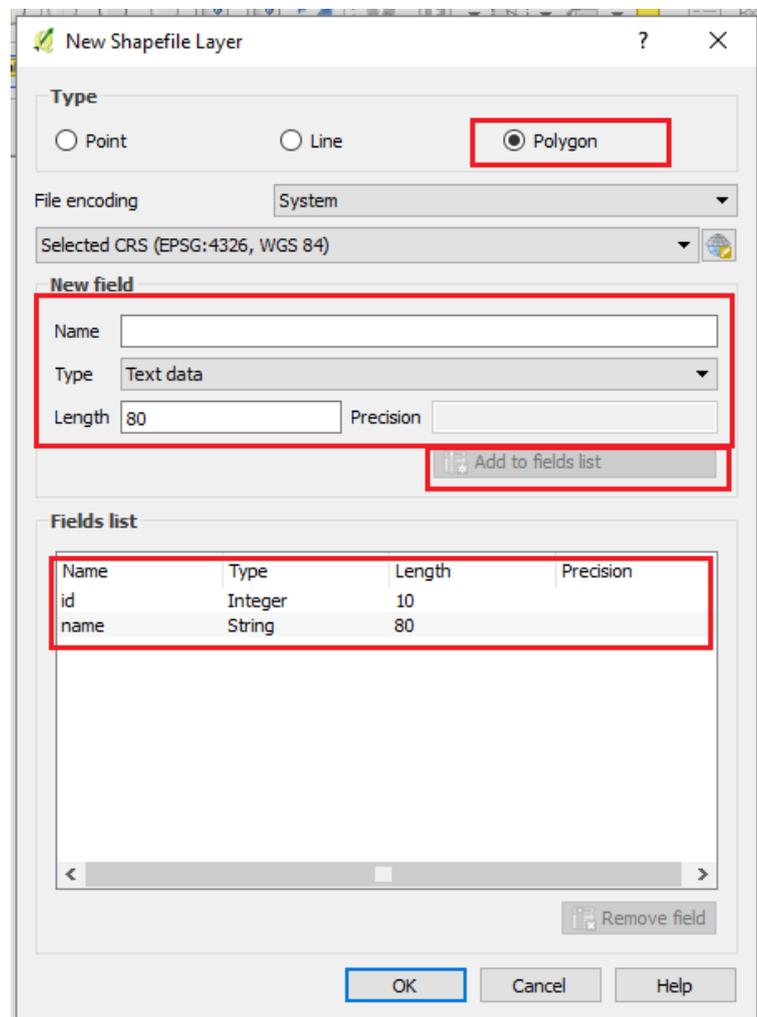
Step 2: Upon the appearance of a new window, select “**Polygon**” under “**Type**”

a) At **File Encoding**, choose a code of your language for the display on the layer

b) In “**New field**” provide the following information:

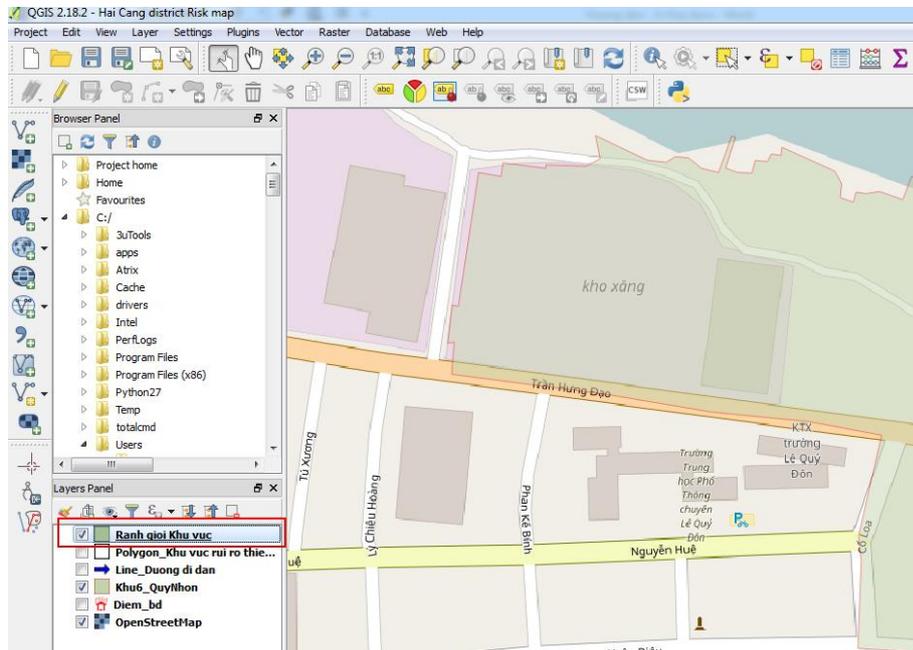
- Name: name of information field. E.g.: name, code, etc.
- Type: select “**Text data**” (for data in the form of character); select the type “**Whole number**” (for data in the form of number); select the type “**Decimal number**” (for data in the form of decimal number); select the type “**Date**” (for data in the form of date).
- Length: Maximum number of characters that can be used to update information
- Click “**Add to fields list**” to save.
- Click **OK** to end. Other parameters stay unchanged.

**Note:** A name given in the box “**Name**” should be identical and descriptive to the object in the layer.

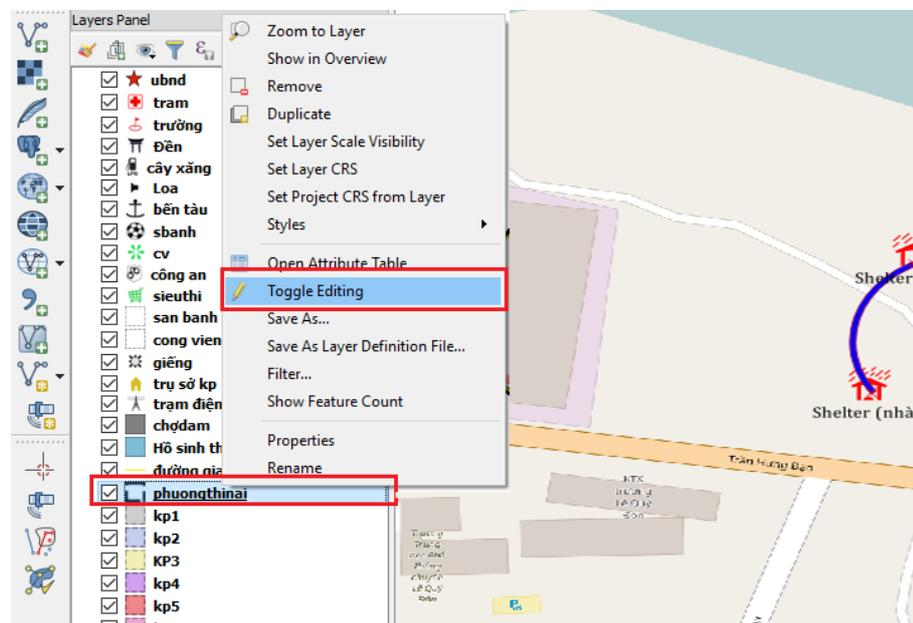


**Step 3:** Name the file and choose the folder to save (the format of the saved file is \*.shp) - click **OK**

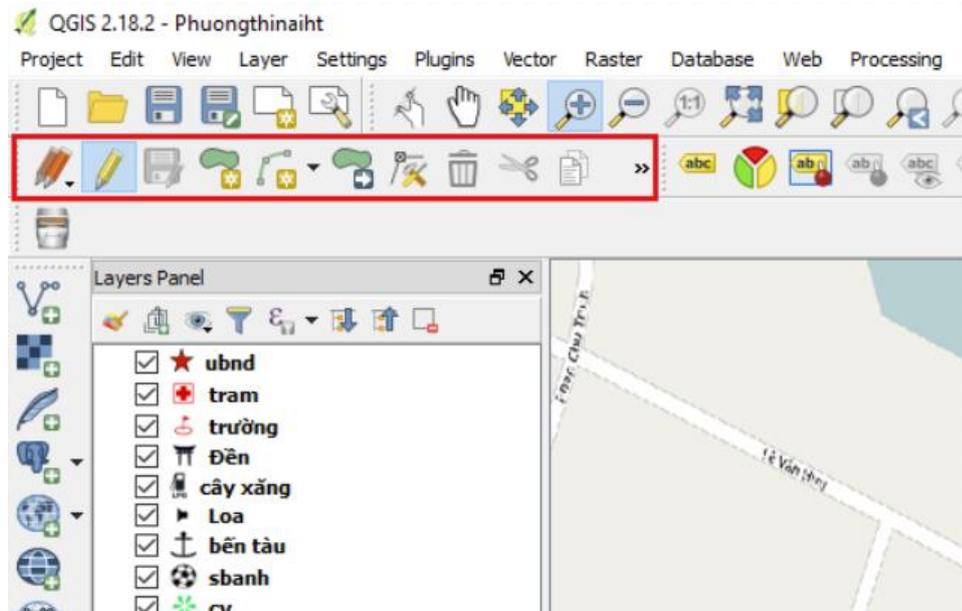
**Step 4:** To select a data layer for modification, click the left mouse button on that layer. Ensure that you have Layers Panel displayed on the left of the screen by go to **View/Panels** and tick **Layers Panel**. You will see all the layers in the panel.



**Step 5:** Right click, select **Toggle Editing** to turn on the editing toolbar and start drawing the boundary.



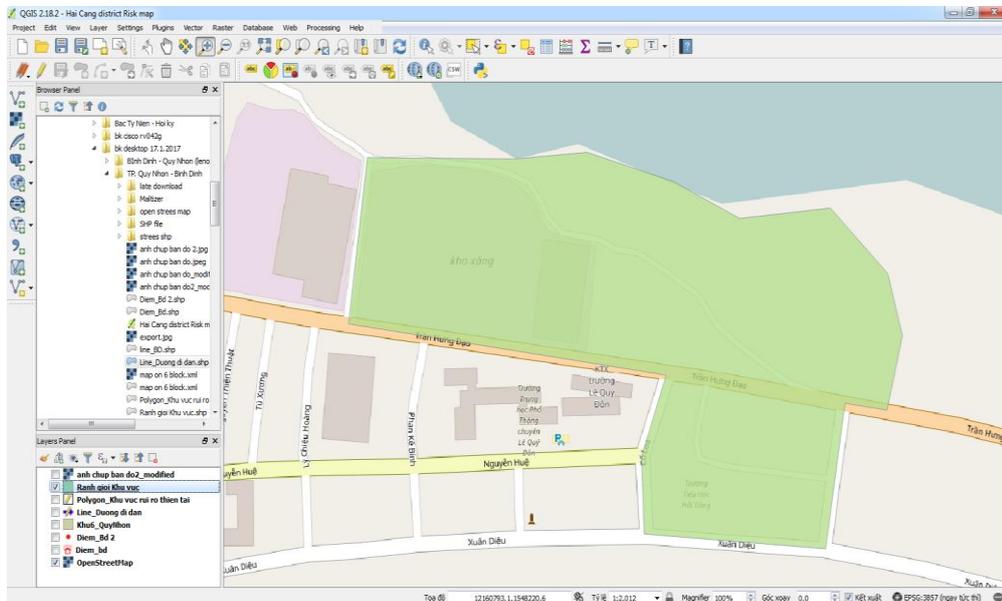
Step 6: The editing toolbar will appear in the upper left of the screen



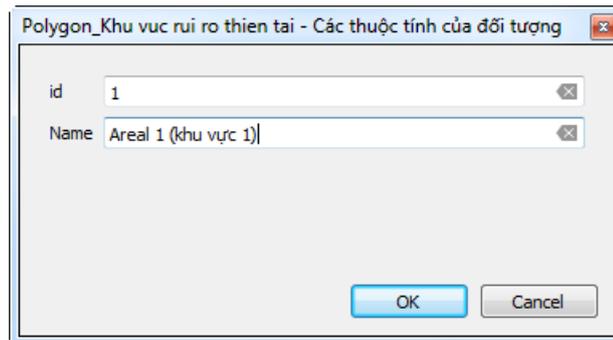
Step 7: Click the icon  to add a new polygon:



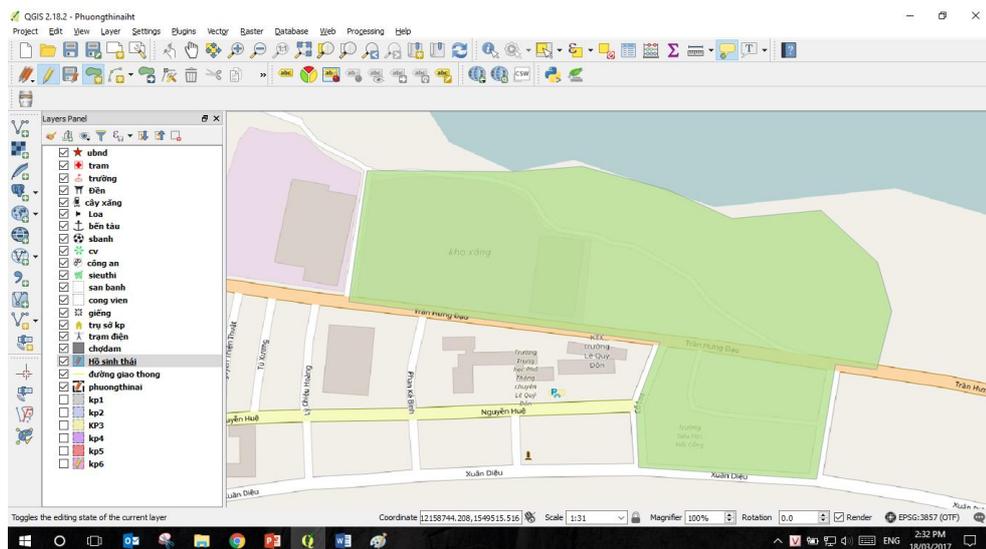
Step 8: Use the mouse to define the points on the map, left click to mark the landmarks, right click to finish.



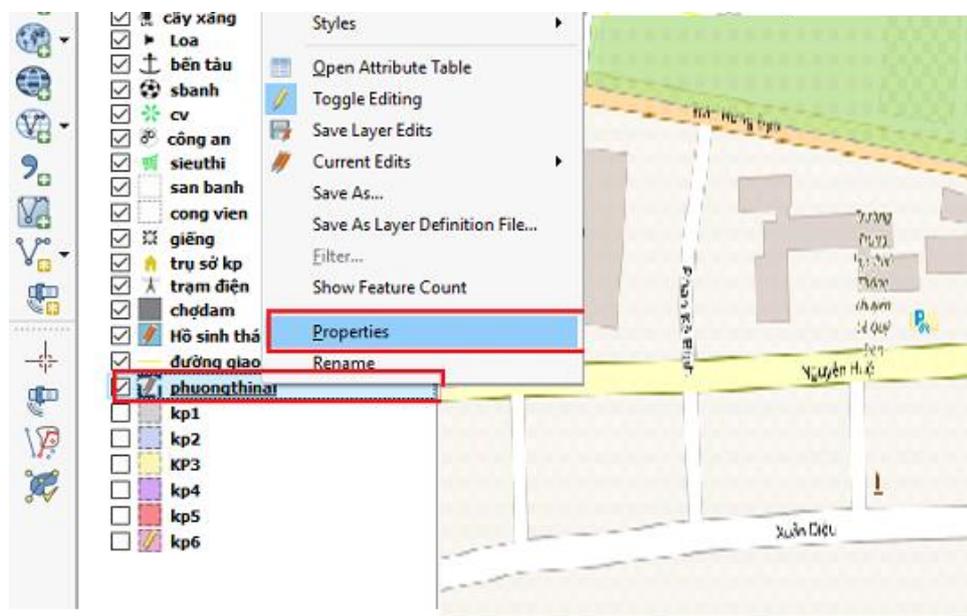
**Step 9:** Enter the order number of the point in the line "id" and the description for the object on the map.



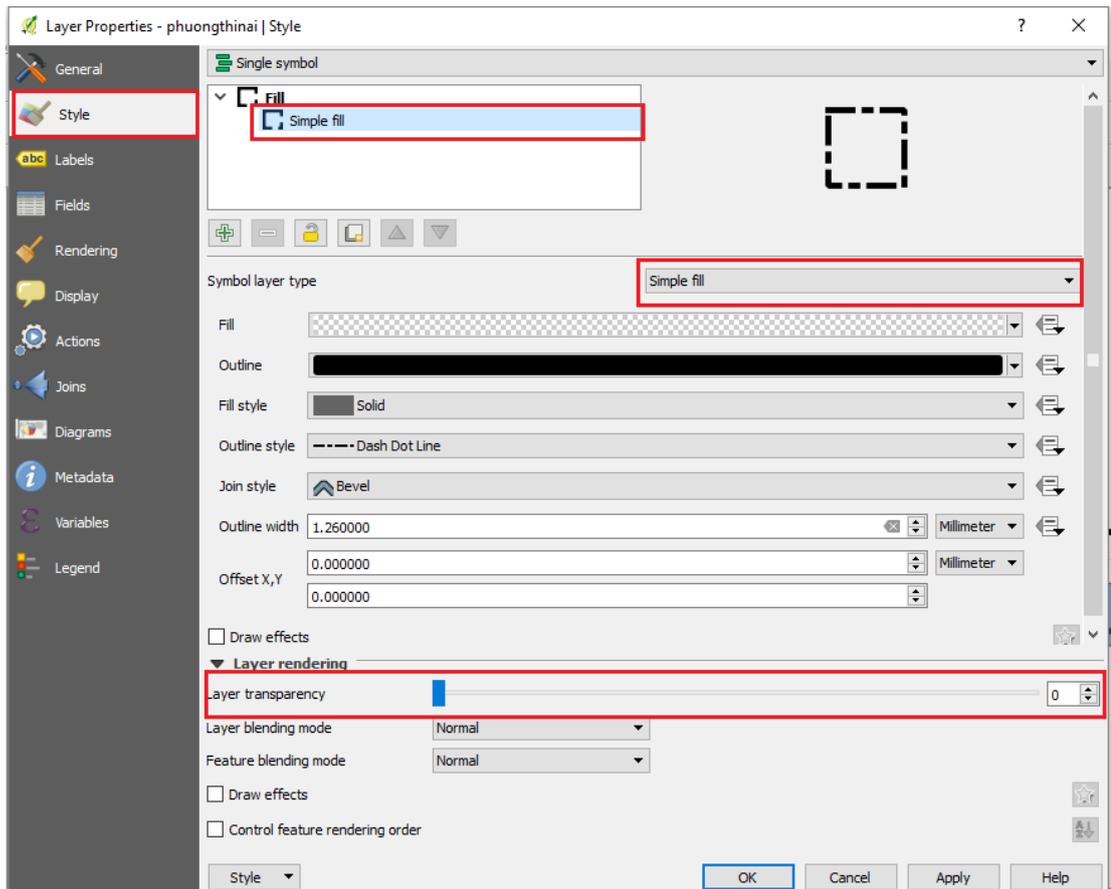
**Note:** The Id of lines on the same layer is unique.



**Step 10:** To blur the boundary layer, right click, select **Properties**

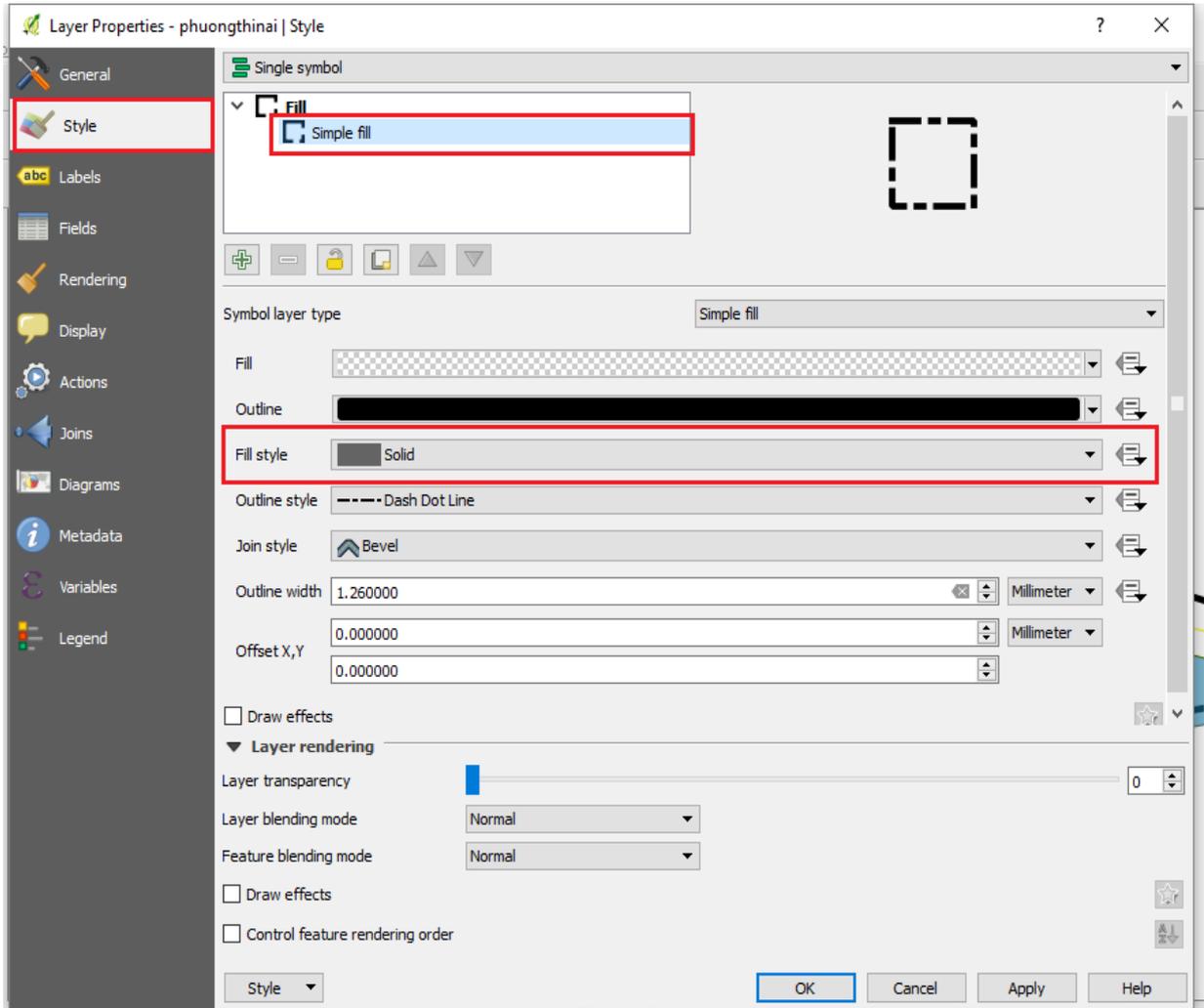


Step 11: Select **Style**, edit the option **Layer Transparency** from 30 – 60% to adjust the transparency of the polygon layer, so that we can show or hide completely other information layers underneath.

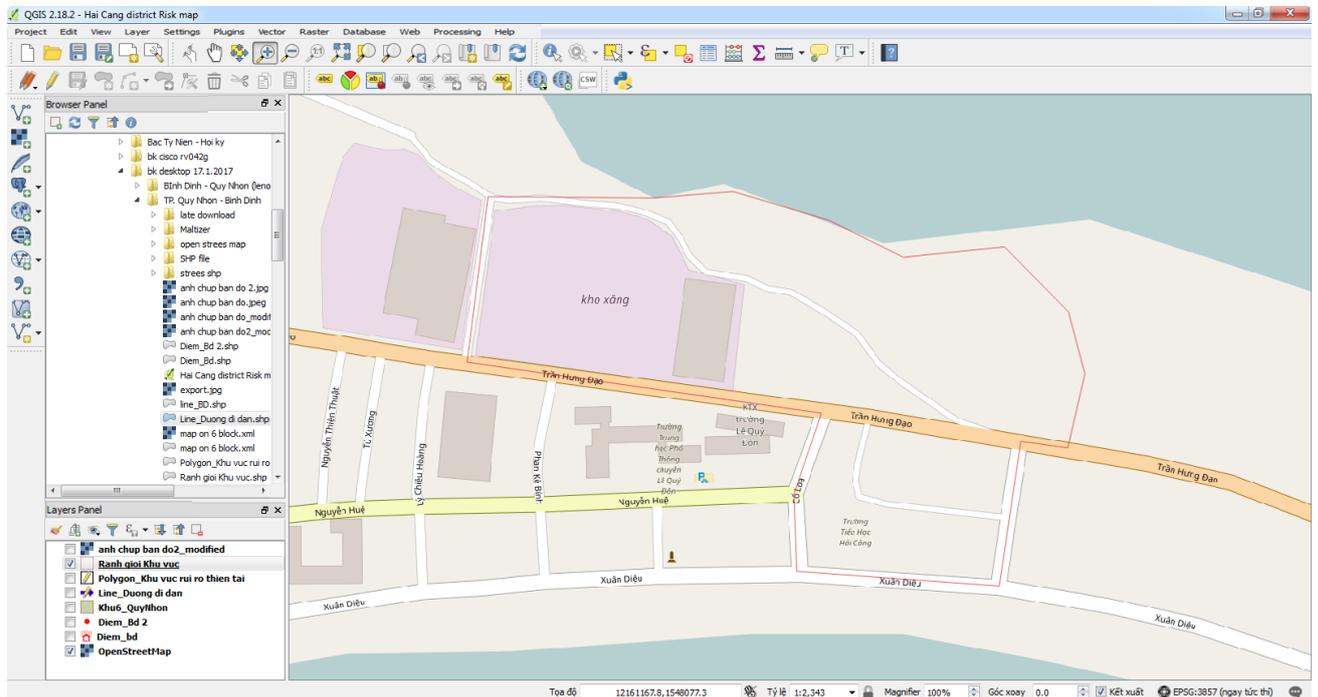


Step 12: Click **OK** to show the results out of the map.

**Step 13:** If you do not want to color the inside of the boundary, in "Fill Type" as "No brush"



The result is shown below.



## PART 2

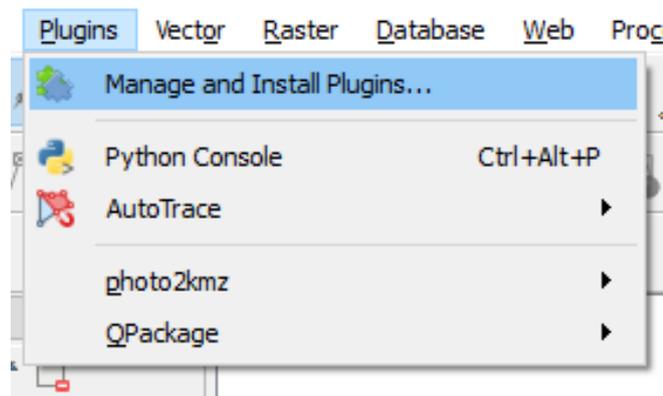
# DEVELOPING MULTI-HAZARD RISK MAP IN URBAN AND PERI-URBAN AREAS

### I. DEVELOP OF A BASE MAP

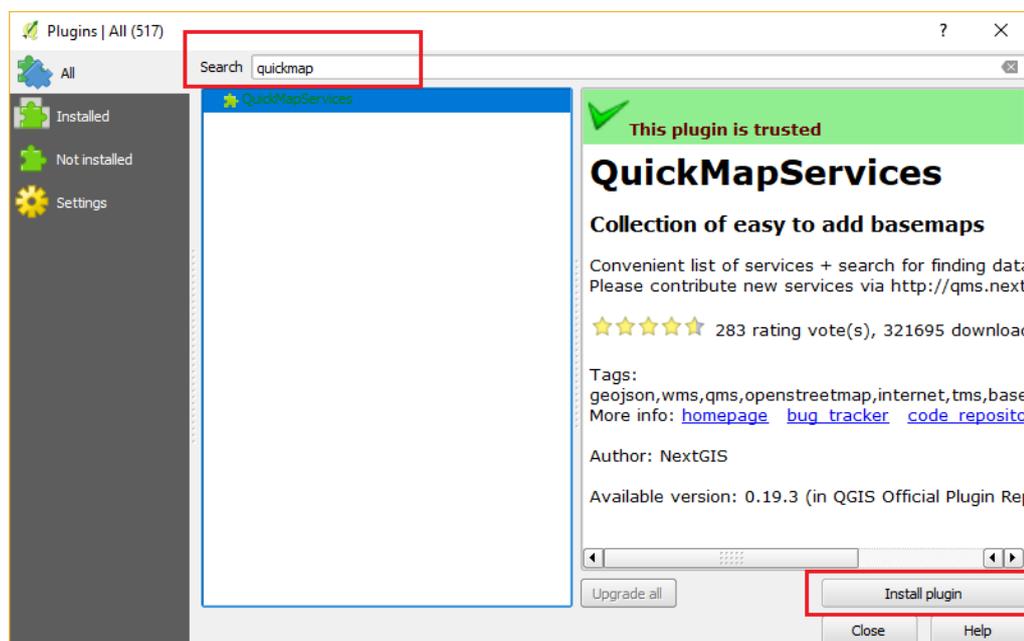
Several open maps are available on the Internet, including Google Satellite Map, Google Hybrid Map, Open Street Map, etc. It is up to user to decide which map you want to use. In this guidelines, we use Open Street Map (OSM) since it is open for community and friendly to users. However, this map is not regularly updated. You may want to use other maps that are more regularly updated such as Google Hybrid Map, Google Satellite Map or local digitalized map.

#### 1. Install Open Street Map (OSM) plugin

Step 1: Click “Plugins” on the top bar and select “**Manage and Install Plugins**”

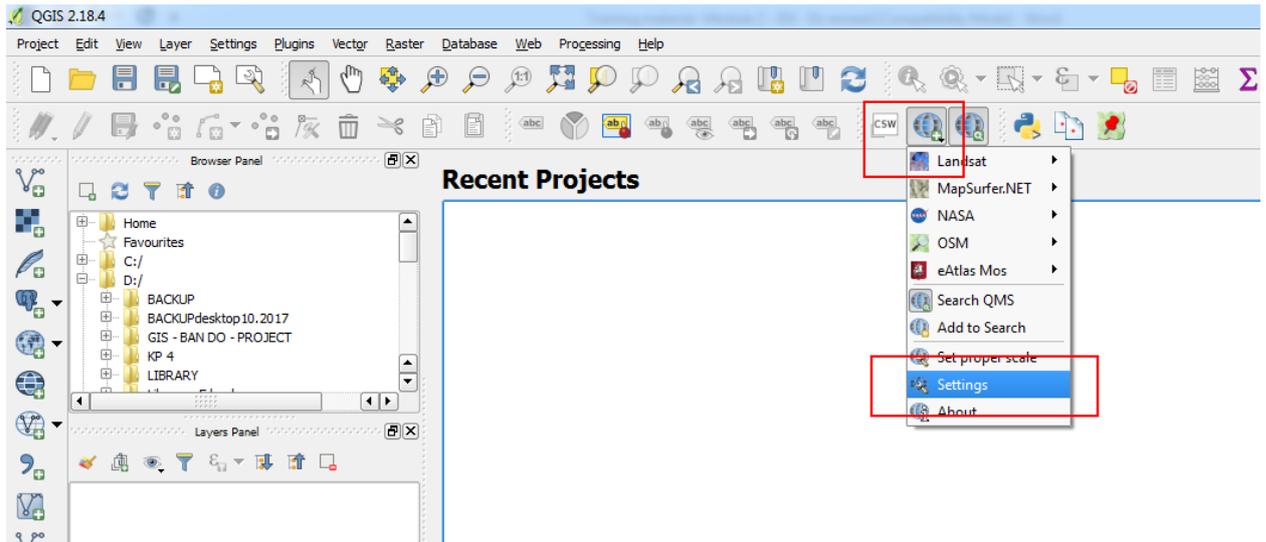


Step 2: Type “QuickMapservices” in search area to find the suitable plugin.

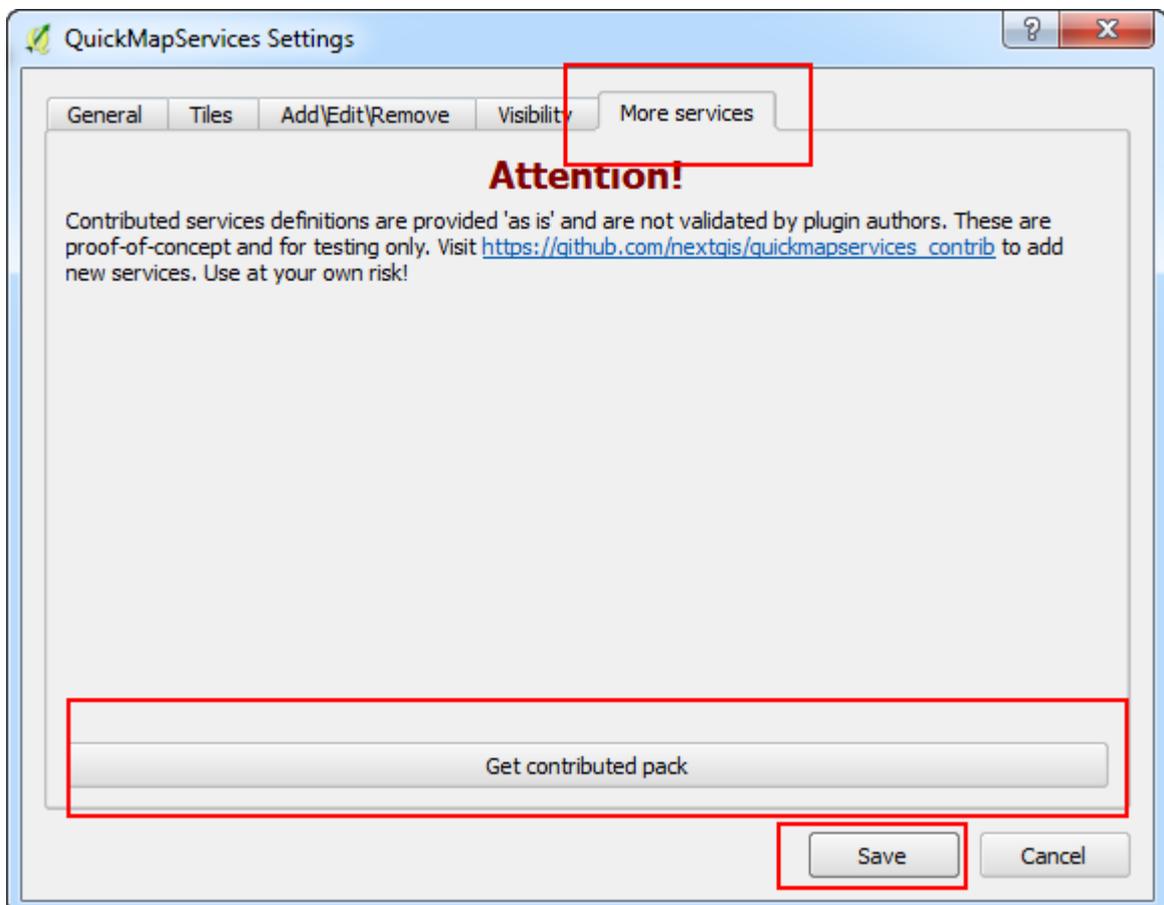


Step 3: Click “Install Plugin”. After plugin installed, click “Close” to close the plugin windows.

Step 4: Click the icon of Quick map services  , choose **Settings**



Step 5: Click **“More services”**, then click **“Get contributed pack”** and **“Save”** to have more maps installed such as Google Satellite Map, Google Hybrid Map.



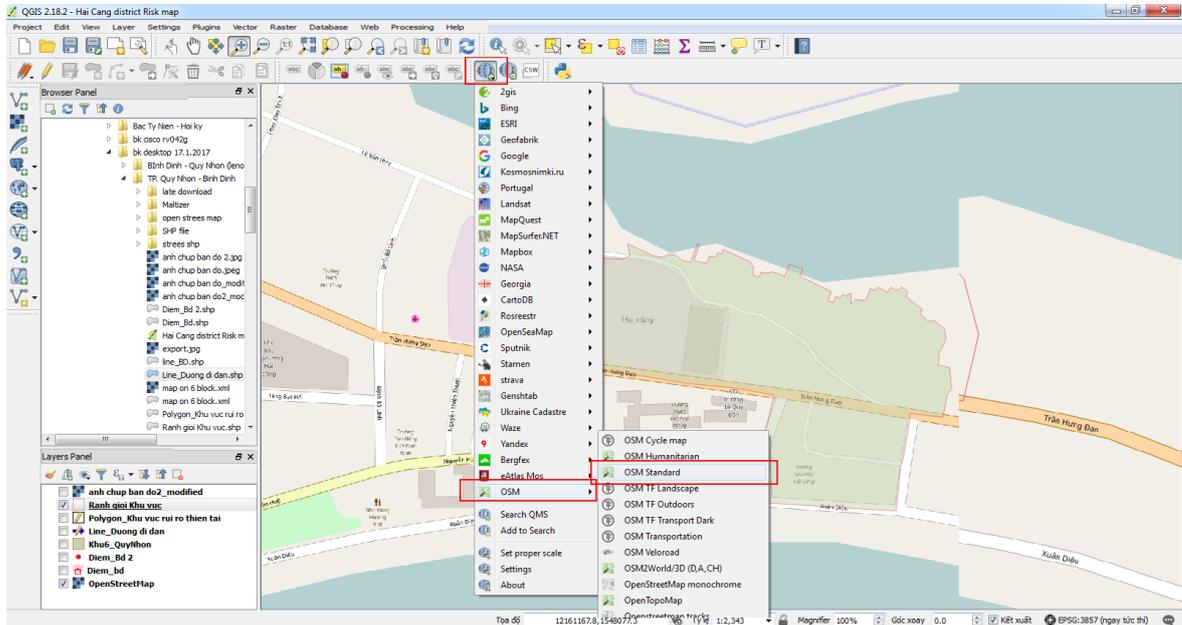
## 2. Develop a base map for a ward<sup>1</sup>

Step 1: Click the icon of **Quick map services**

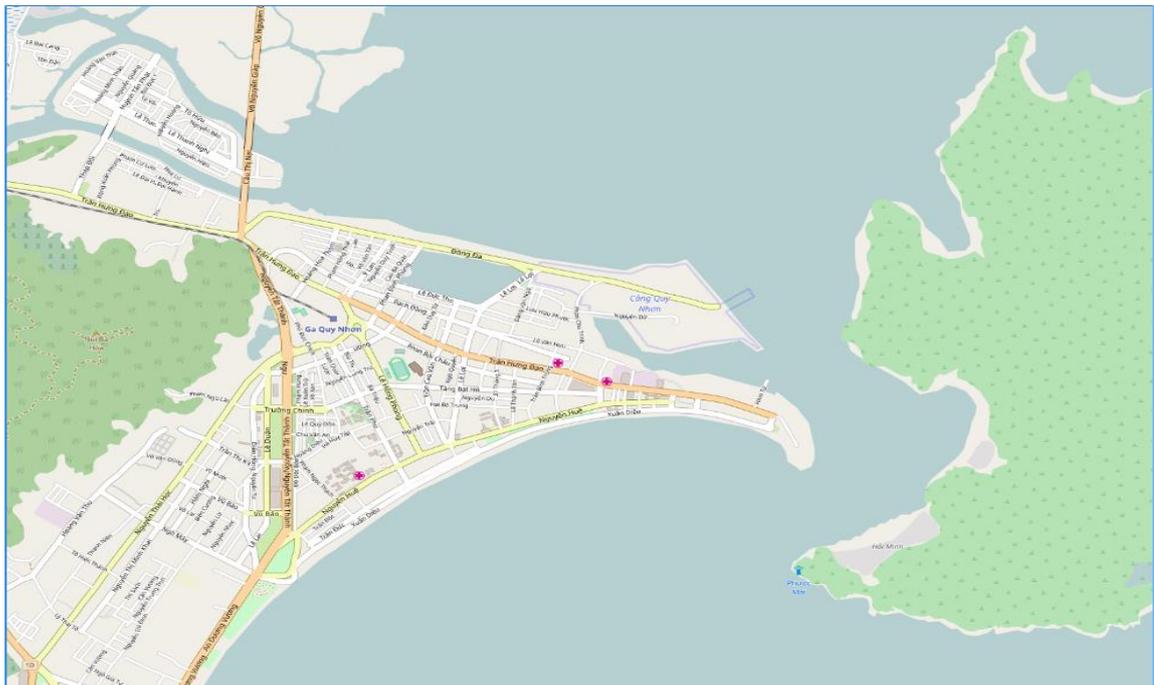


Step 2: Select **OSM** → **OSM standard**.

**Note:** If you prefer other maps (such as Google Hybrid Map, Google satellite maps,) you could select Google/ Google Hybrid or Google/ Google Satellite).



Step 3: Select an area for mapping. In this example is a coastal ward of Quy Nhon city in Vietnam.



Step 4: Edit and print the base map: See detailed guidelines in Part 2, Section II.

<sup>1</sup> In the context of Vietnam, ward is an administrative unit in urban area.

### 3. Develop a base map of a hamlet<sup>2</sup>

Step 1: Identify administrative boundary of a hamlet and zoom in the screen focusing on the hamlet that need to be shown. You can follows steps developing a base map for a ward described in Section I.2. above.

Step 2: Edit and print the base map: See detailed guidelines in Part 2, Section II.

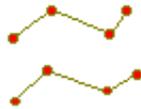
### 4. Modify and supplement information on the base map

#### Points



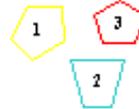
Distance  
Functions

#### Lines (Arcs)

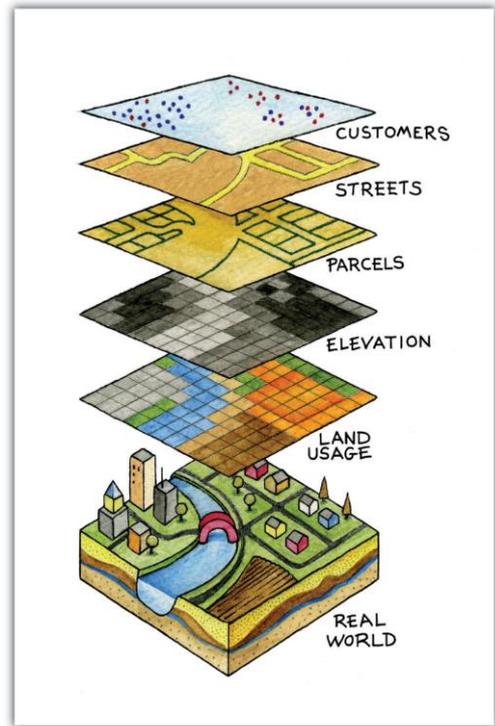


Routing

#### Polygon (Area)



Area  
Analysis



**Point:** a discrete location is represented by a pair of co-ordinates (e.g., , hospitals, government premise).

**Line (Arc):** a set of ordered co-ordinates represented by a string of co-ordinates (e.g., streams, power grid and pipelines, and transportation routes).

**Polygon (Area):** represented by a closed chain of coordinates encompassing an area (e.g. a lake, a hospital area, township boundaries, etc.).

#### 4.1. Principle of modification and supplementation

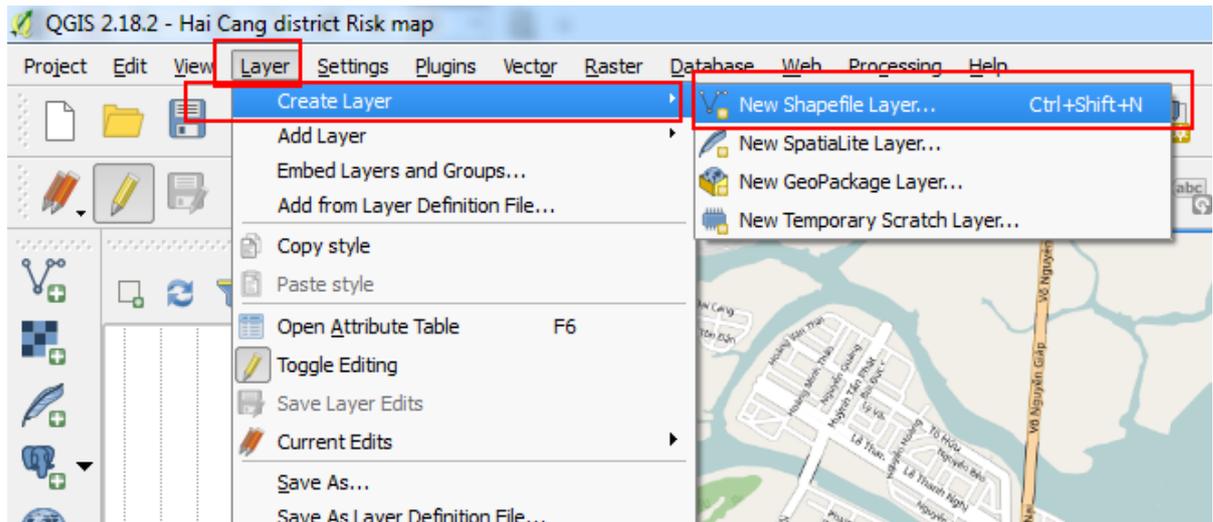
- Each type of object will be classified and developed as a layer of information(e.g. a layer of permanent houses, schools, enterprises, a layer of main streets, etc.)
- Creating a layer and adding follow the method of creating points, lines and polygons of QGIS

#### 4.2. Create a point in QGIS

##### 4.2.1. Add a point layer

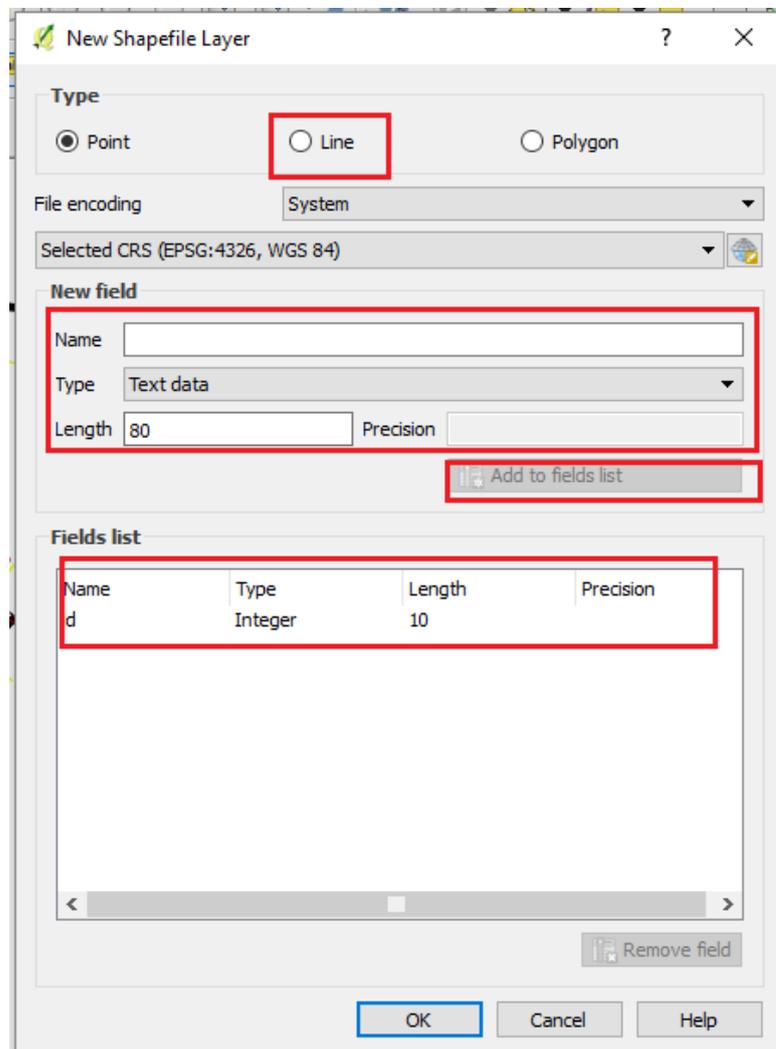
<sup>2</sup> In the context of Vietnam, a hamlet is a sub-unit of a ward (in urban area) or a commune (in peri-urban area)

**Step 1:** Creating a layer, select the icon **Layer** → **Create layer** → **New Shapefile layer**



**Step 2:** Select **Point**, by default each data layer has an **ID** field on the map. To add other descriptive information to the data layer, we create additional information fields here.

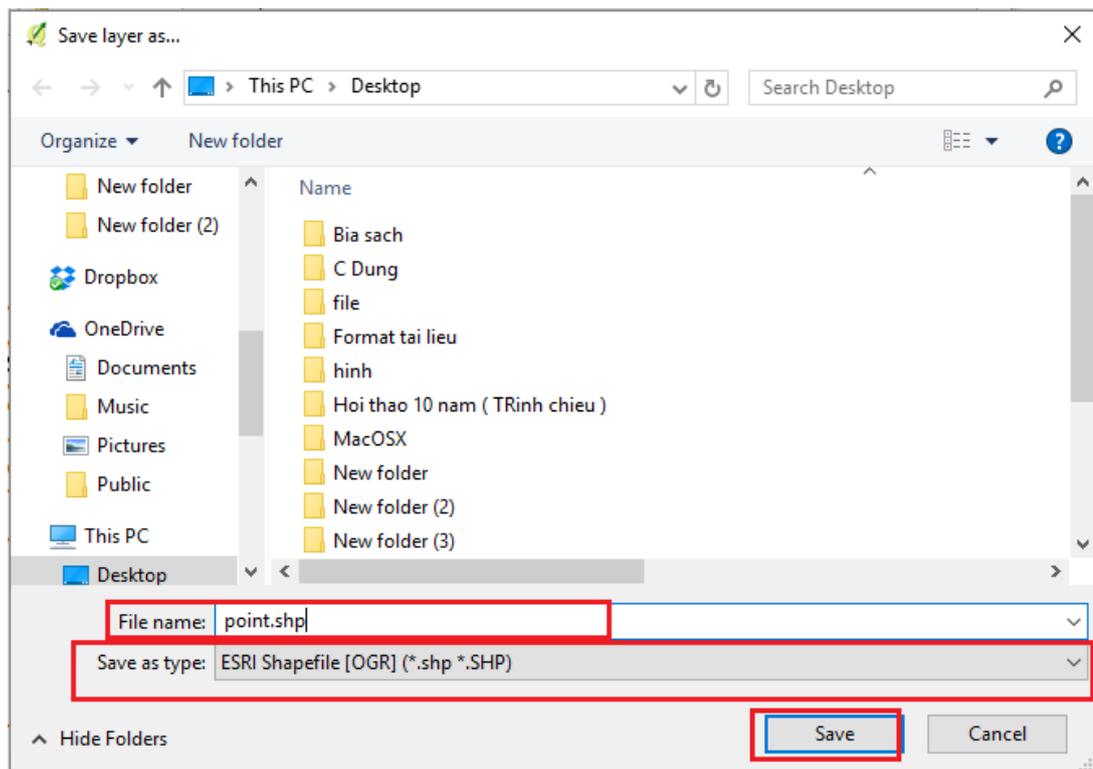
To display your own language in the information fields, select a code in File Encoding.



Name the new information field in **"New field"** with the following information:

- Name: name of the field. E.g.: name, code, etc.
- Type: Choose the type **"Text data"** (For data in the form of character); Select "Whole number" type (for data in the form of number); Select **"Decimal number"** type (for data in the form of decimal number); Choose **"Date"** type (for data in the form of date).
- Length: Maximum number of characters that can be used to update information
- Click **"Add to fields list"** to save
- Click **OK** to finish.

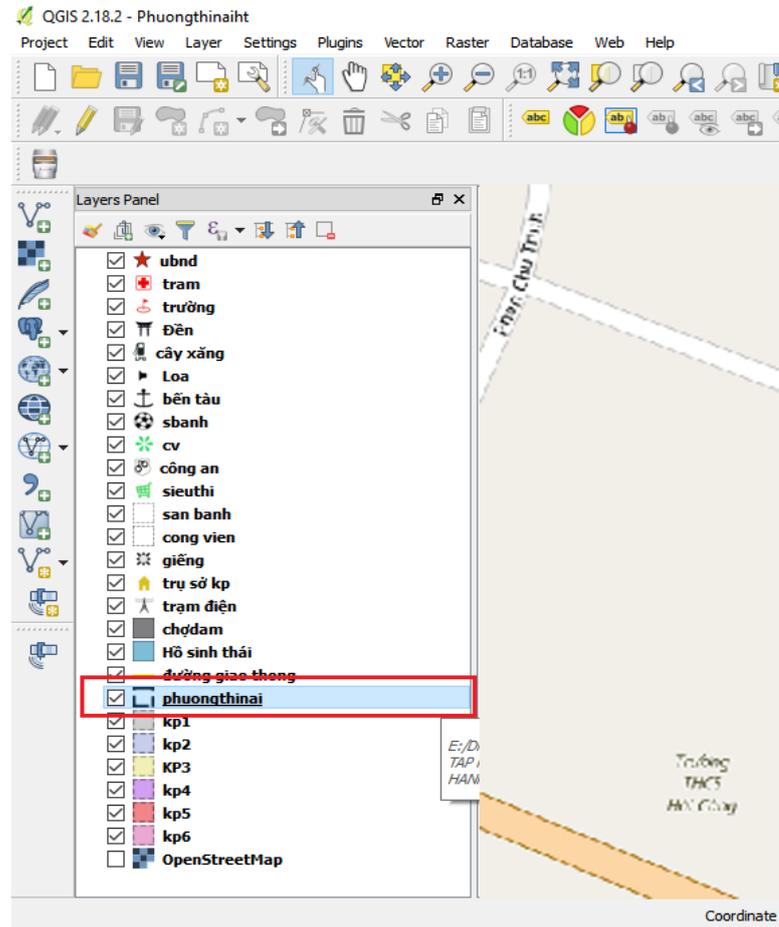
Step 3: Name the file and choose the folder you want to save (the file is saved in the format \*.shp) - click **OK**.



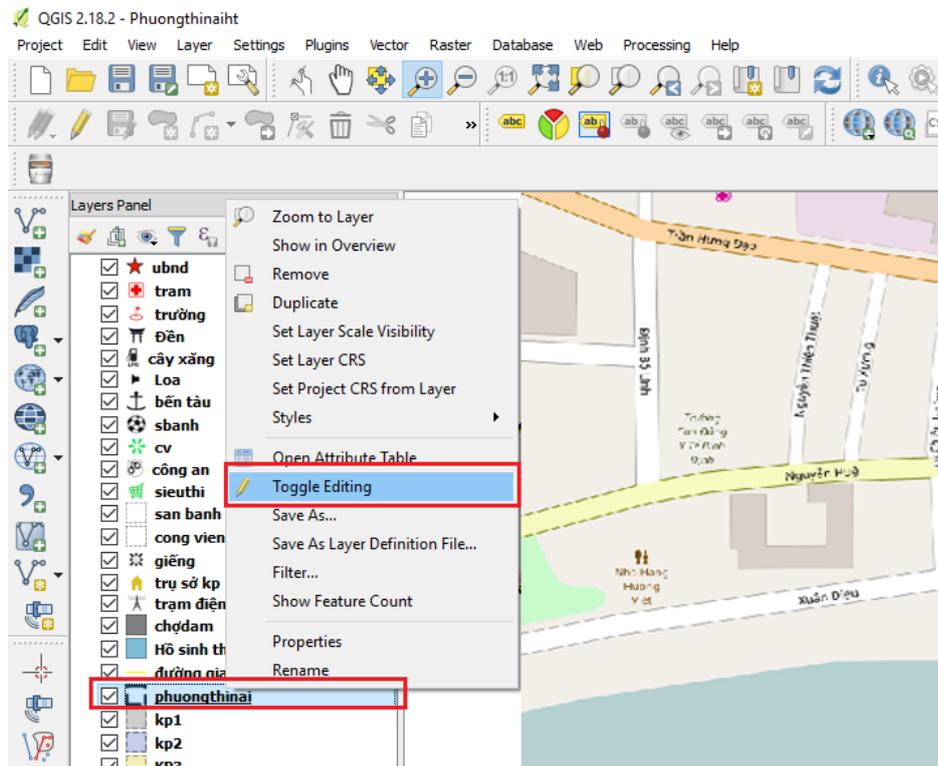
#### 4.2.2. Add a point to the base map

Ensure that you have Layers Panel displayed on the left of the screen by go to **View/Panels** and tick **Layers Panel**. You will see all the layers in the panel.

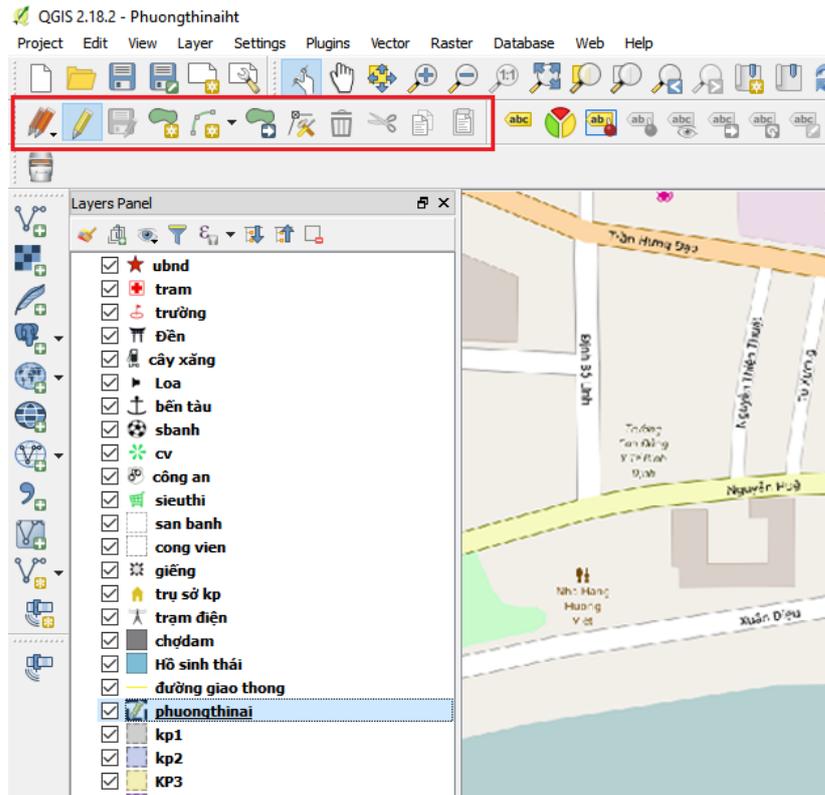
Step 1: Left click on the layer that need to revise



Step 2: Right click, select "Toggle Editing"



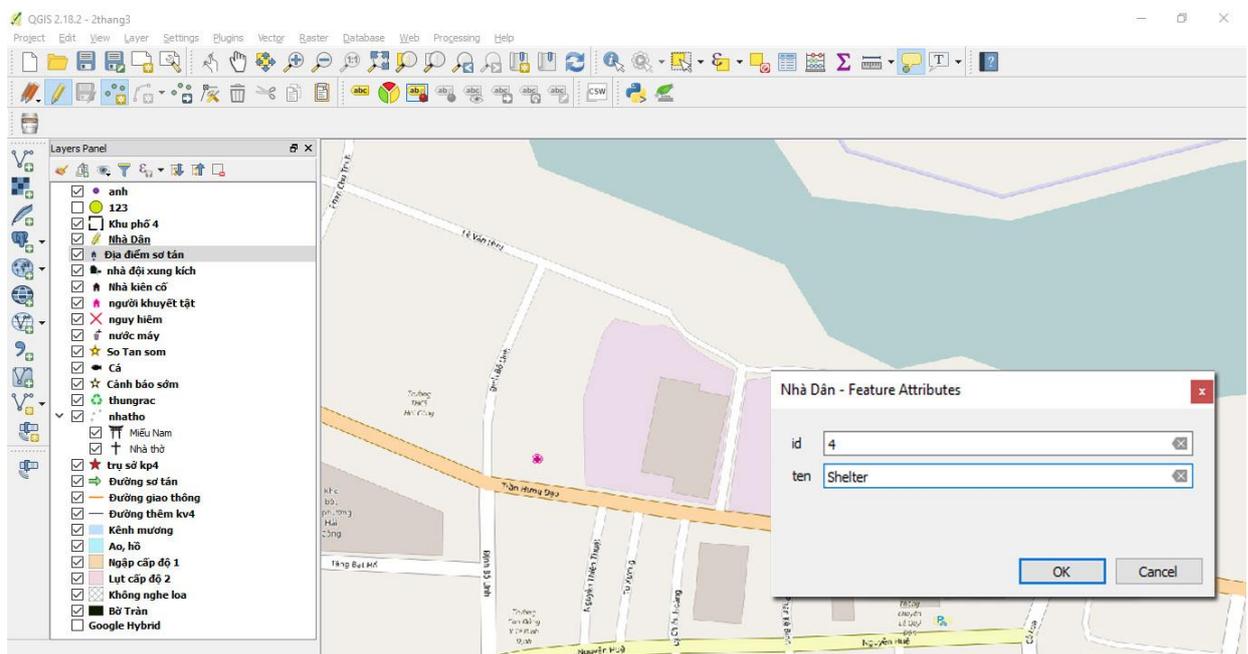
**Step 3:** The edit toolbar will appear on the upper left of the screen



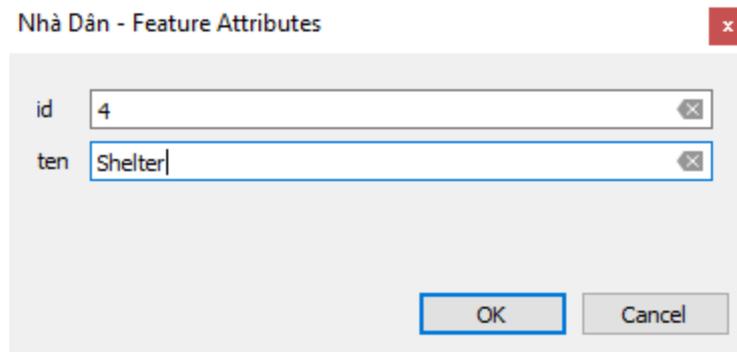
**Step 4:** Click the icon  to add 1 point:



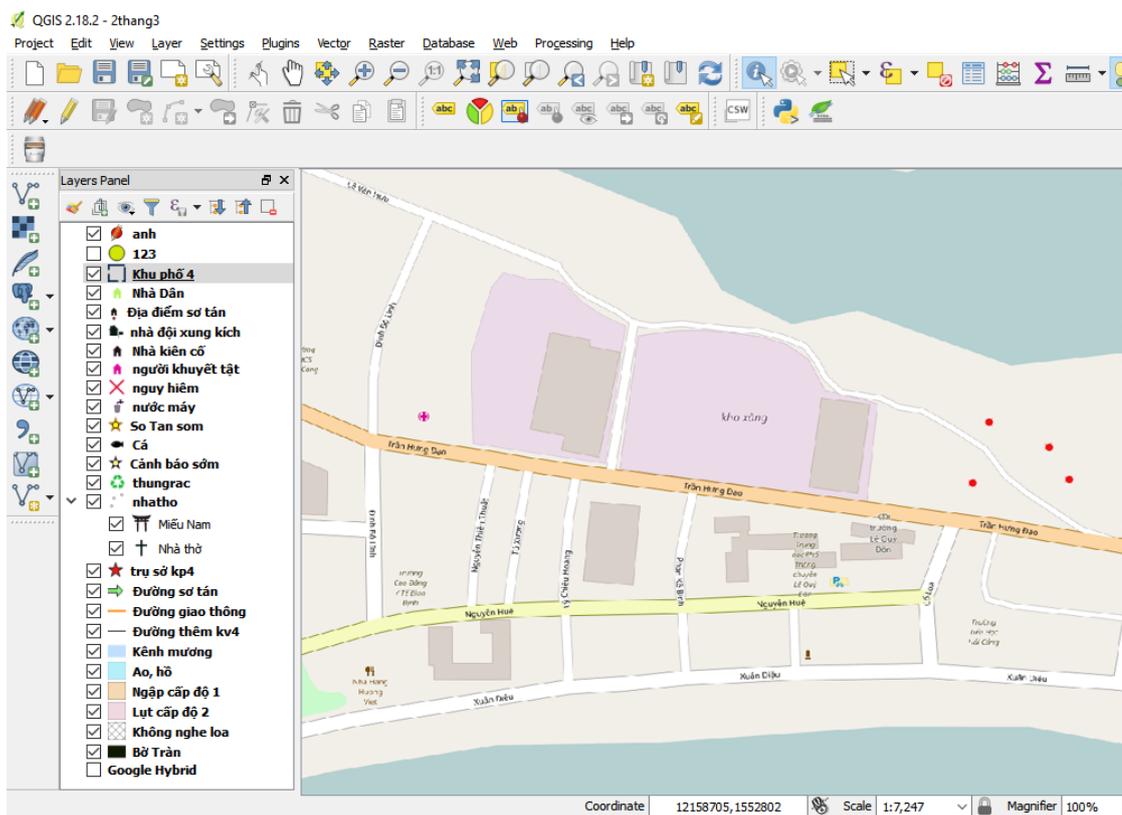
**Step 5:** Use the cursor to identify points on the map, left click once to select.



**Step 6:** Enter the order number of the point in "id" and enter a description for the object on the map.



**Note:** Id of points is unique on the same layer. For example: ID of 04 red points created in the picture are 1, 2, 3, 4.



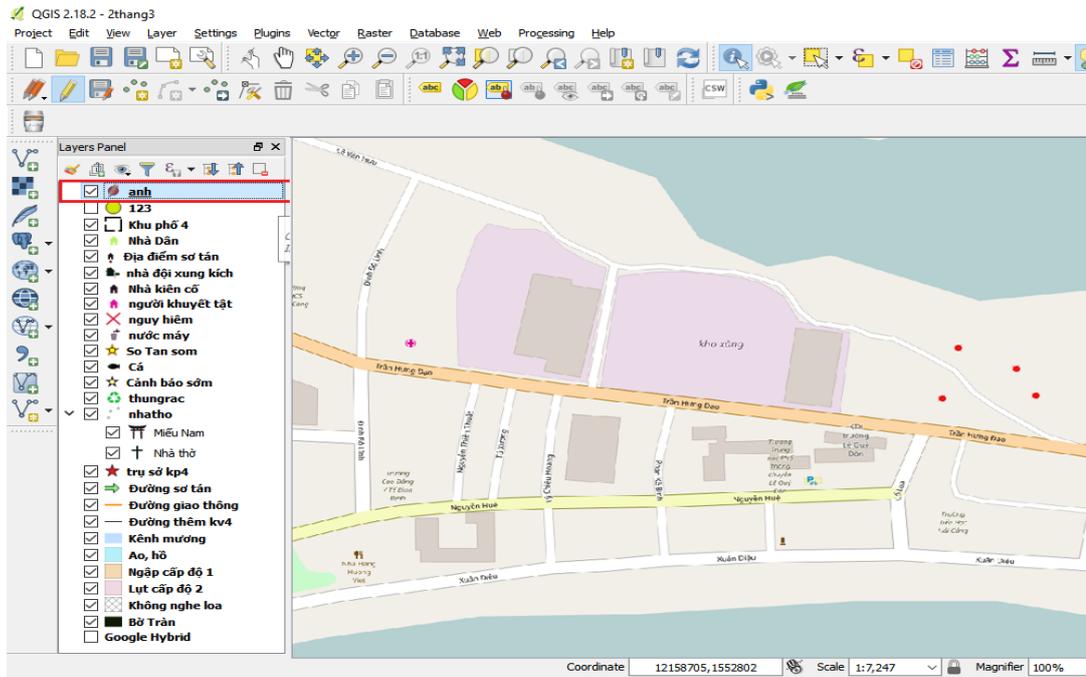
**Step 7:** In order to move the point created in the map, select the icon **"Move Feature(s)"** ; Select the point you want to move, hold left mouse button and move to the location you desire.

**Step 8:** In order to delete one point created, select the icon **"Select feature(s) by area or single click"** . Move the mouse to the point that you want to delete, left click (hold Shift

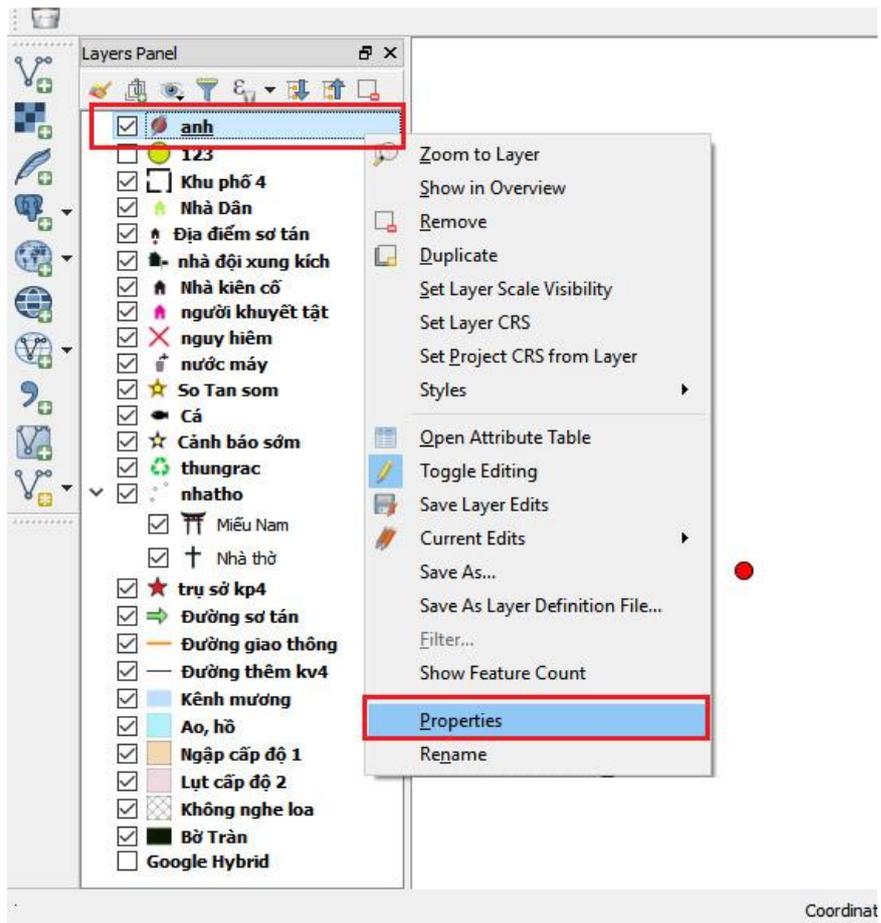
key and left click to select many points). Select icon **Delete selected(s)**  to delete points (When selecting many points, release Shift key and left mouse button before clicking the deleting icon).

### 4.2.3. Name the point

Step 1: In order to display names of these points on the map, select the point layer by left clicking.

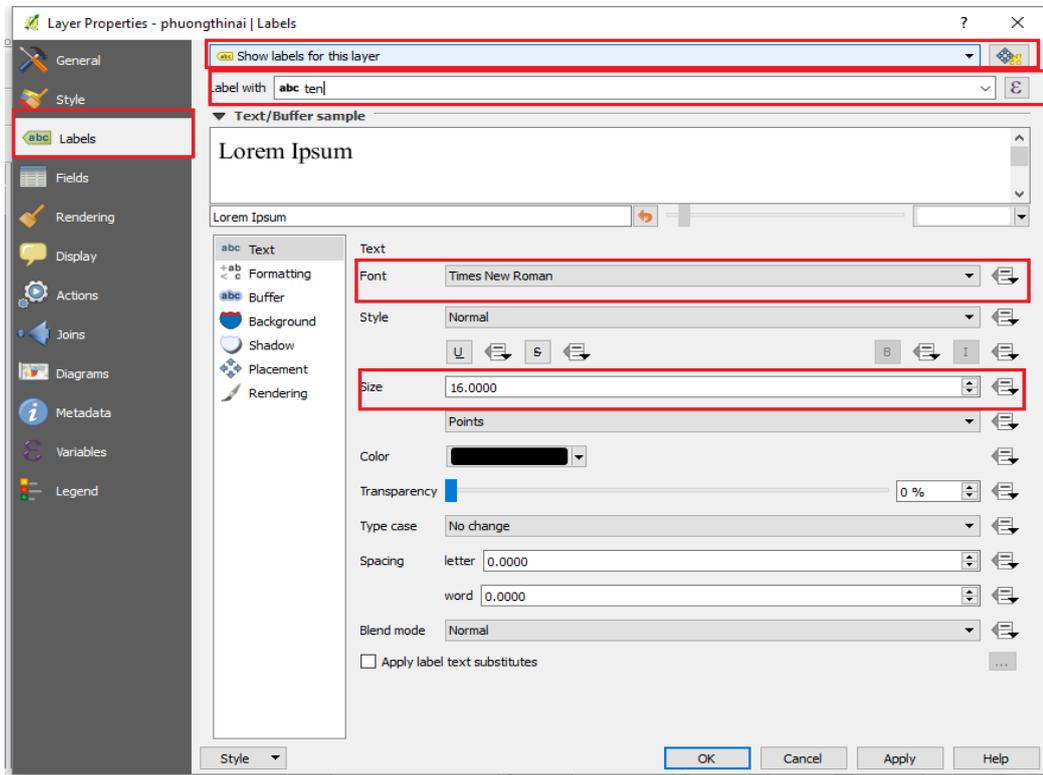


Step 2: Right click, select **Properties**.

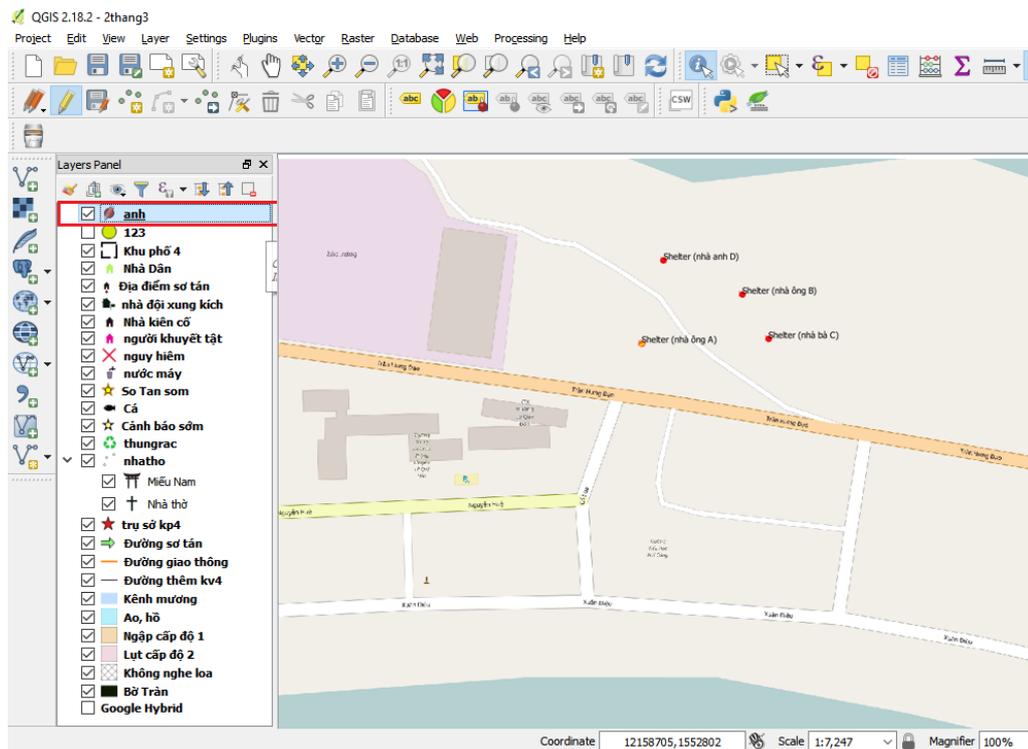


**Step 3:** Select **Labels**, modify the information:

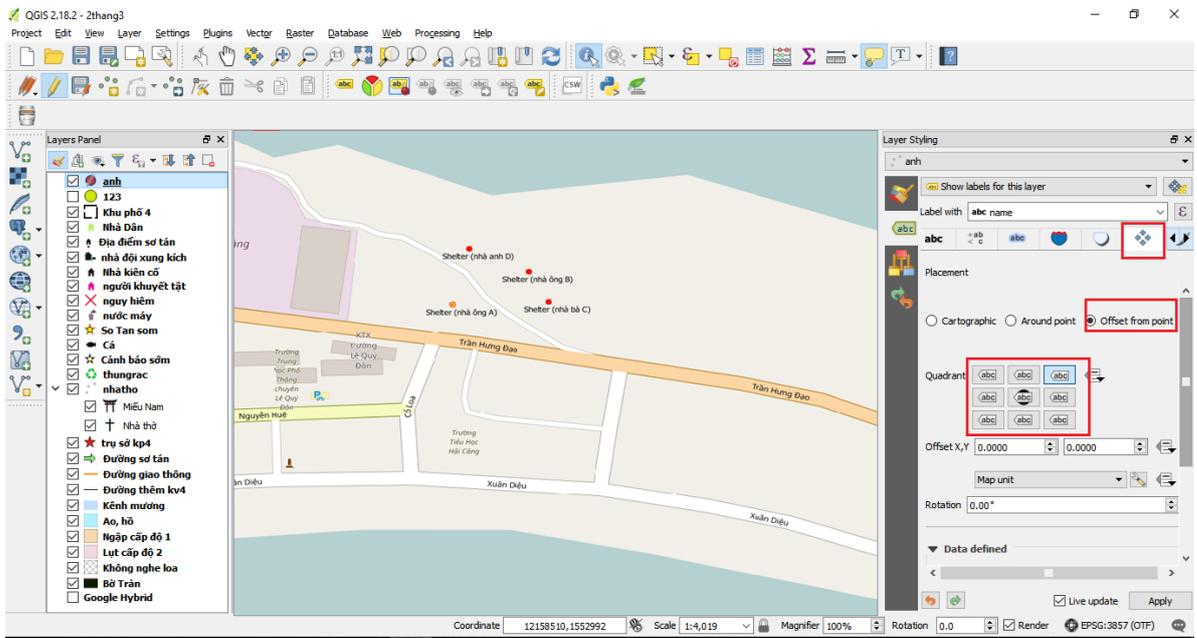
- At the top line, move from “**No label**” to “**Show labels for this layer**”
- In “**Label with**”: select information filed of “**Name**” created
- In “**Font**”: select the font that you want to show.



**Step 4:** Click **OK** to display results on the map



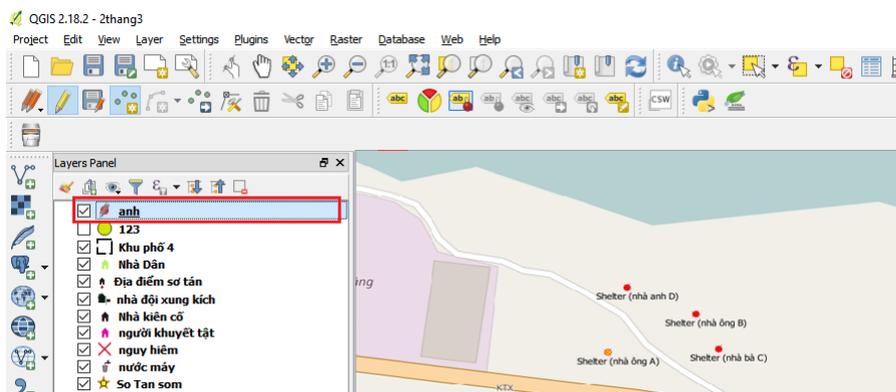
**Step 5:** To move the name position on the left/right/ top/under the location of point, select icon of **Layer labeling options** , **“Offset from point”**, **Placement**  and position you desire.



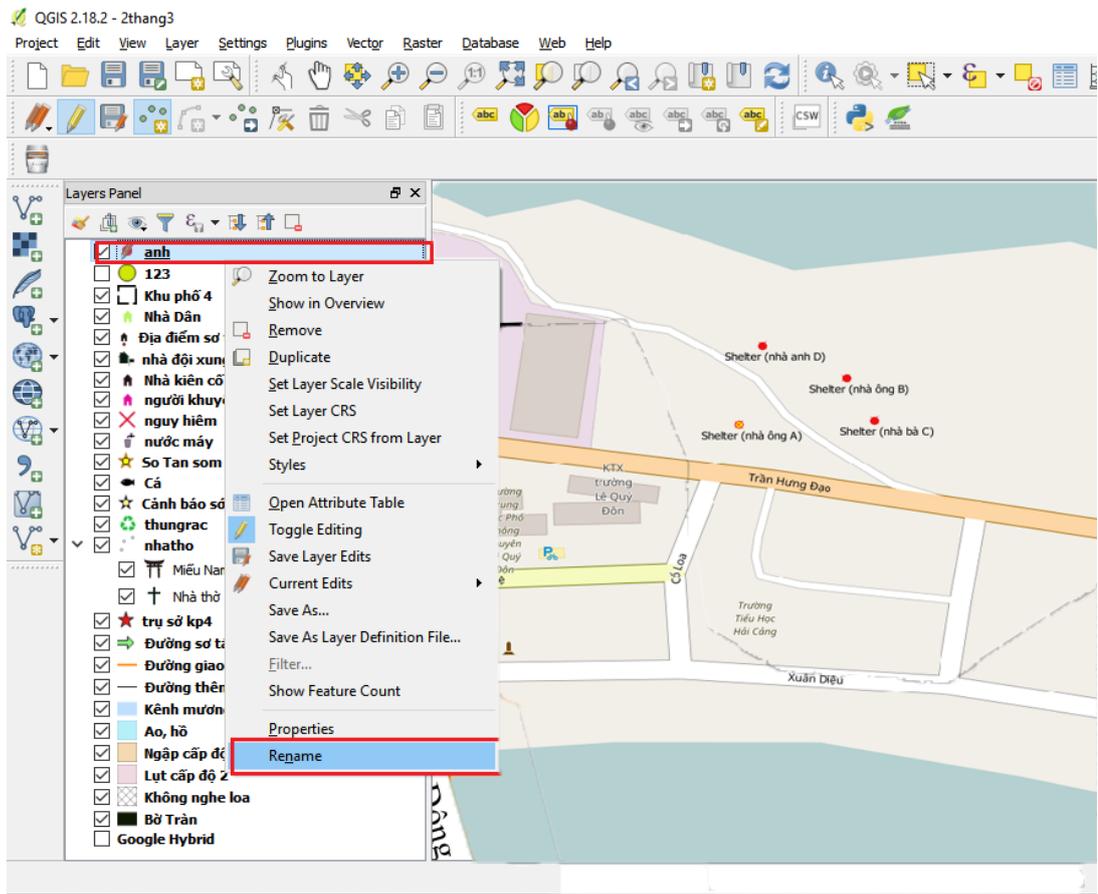
#### 4.2.4. Change icon of the point

For example, if you want to turn the created points as safe houses for evacuation in case of emergency.

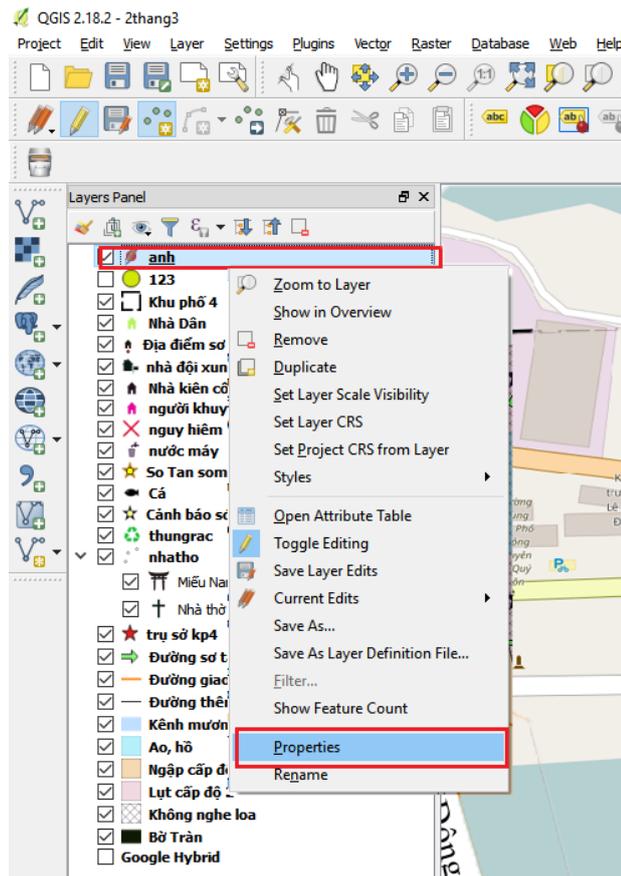
**Step 1:** Select the point layer that need to change the icon by left clicking on that layer.



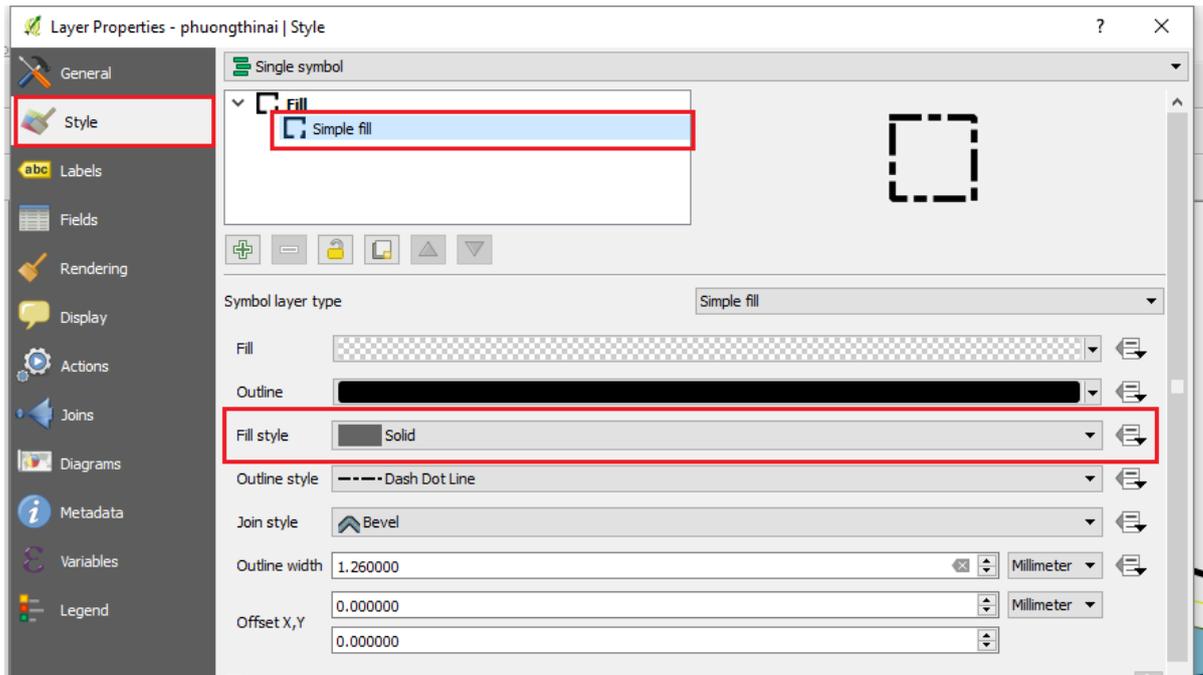
**Note:** If you want to change the name of the layer, right click, select **“Rename”** and enter new name.



**Step 2:** Right click, select **Properties**.

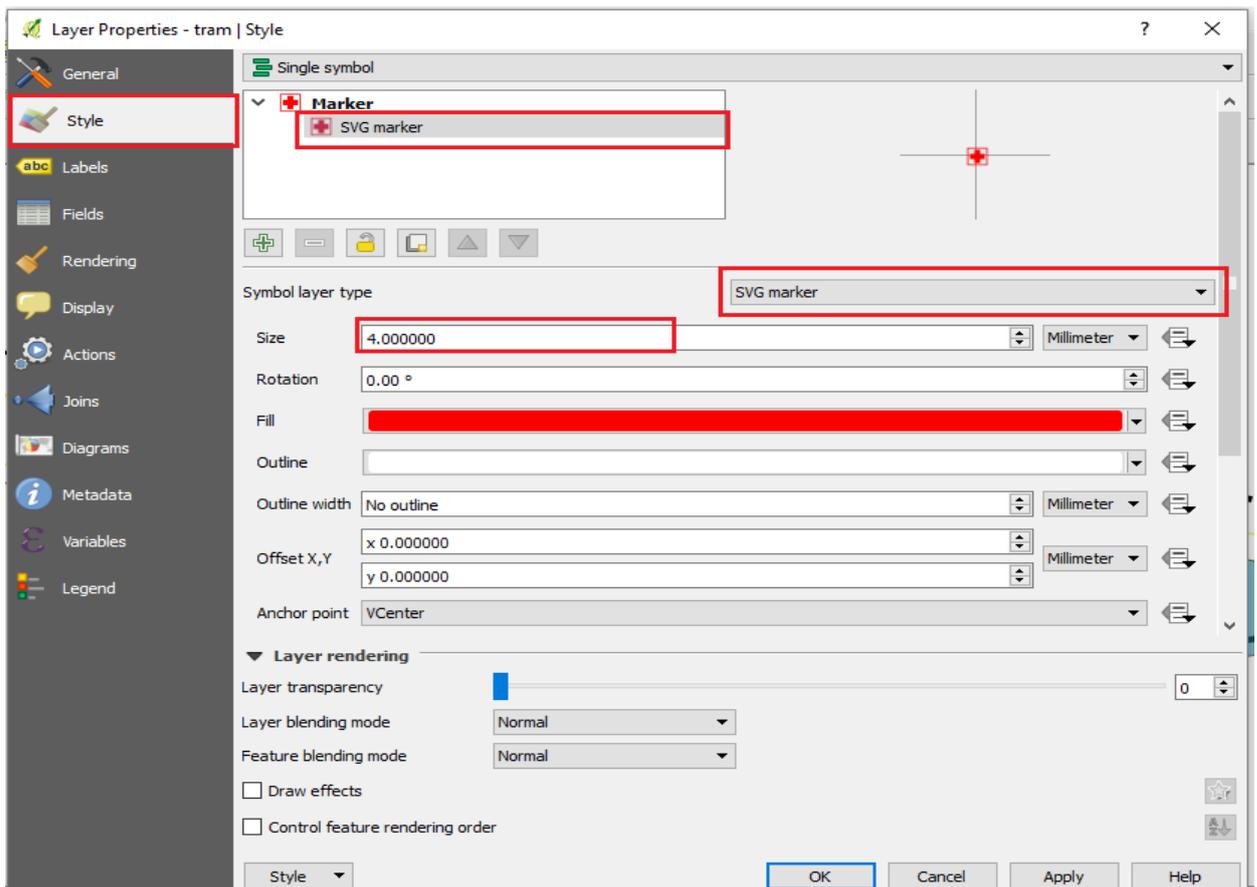


**Step 3: Select **Style** to modify character/icon of the point**



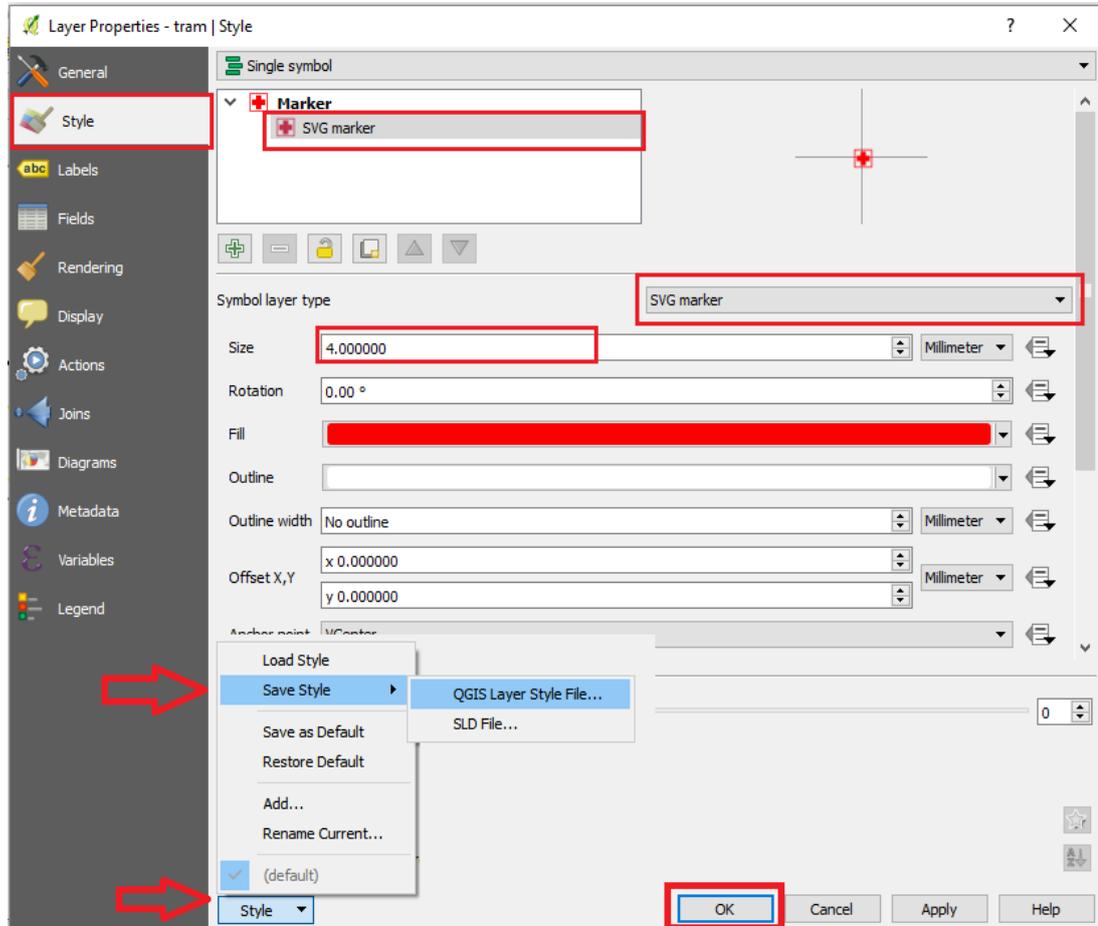
**Step 4:** To add other icons, select **SVG marker** in the “**Symbol layer type**”, then select **Size** to select suitable size of the icon.

*Note: The point icon size depends on the scale of the map. For example, an icon size of 5.00 mm would work on a map scale of 1:5000 on A0 paper size.*



**Step 5:** Select suitable **SVG image** and click **OK** to display on the map.

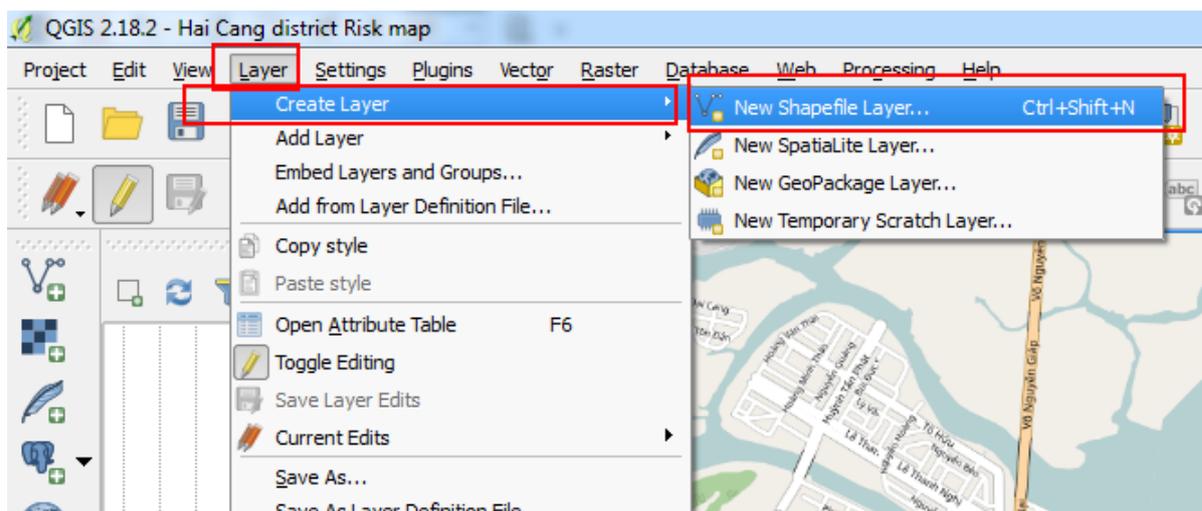
**Note:** After setting up the symbol characters (colours / appearance), you can save the settings together with the shapefile by clicking the **Save Style** button and select "**QGIS Layer Style File**", then save it with the same name with shapefile in the same folder. Then it will automatically be rendered in the same way when it is next loaded into QGIS, even on another computer.



### 4.3. Create a line (Line layer) in QGIS:

#### 4.3.1. Add a line layer

**Step 1:** In **Layer**, select **Create layer** → **New Shapefile layer**



**Step 2: Select Line.** By default, each data layer has 1 field of information of "Id". In order to add description for the data layer, we can create fields of information here.

Give the name to new field of information at the box **New field** with the following information:

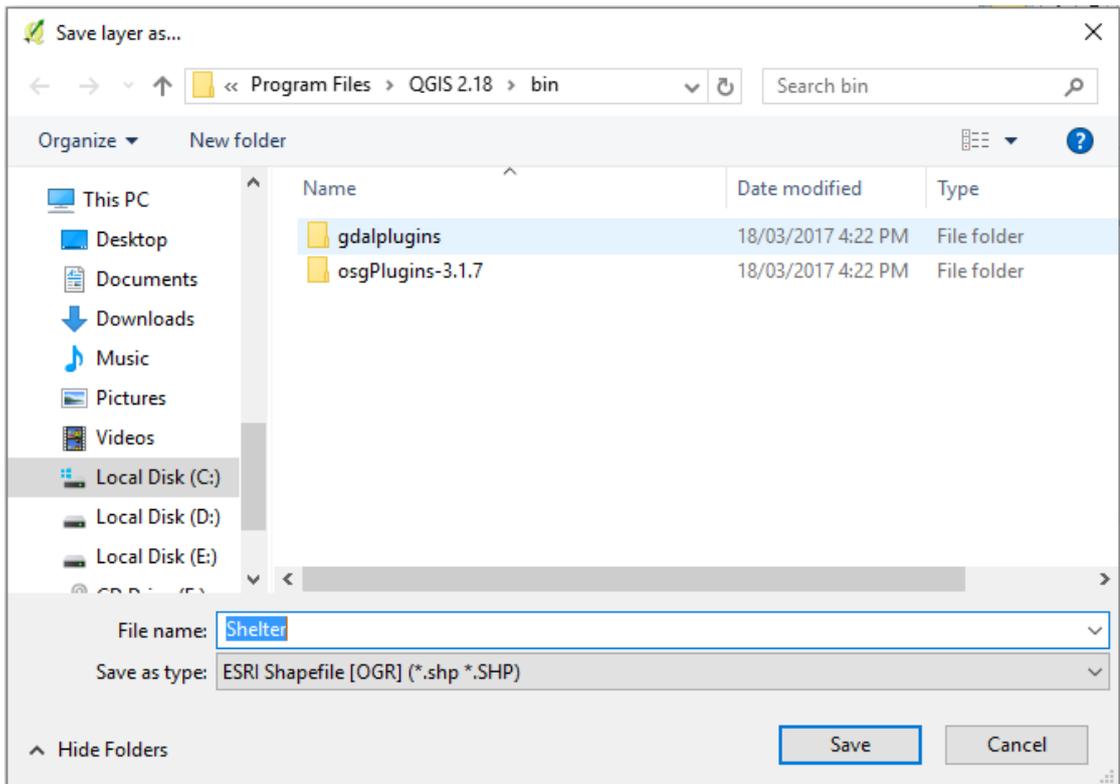
- **Name:** Name of information field (e.g. name, code, etc.)
- **Type:** Select type of **Text data** (for the data under the form of character); select type of **Whole number** (for the data under the form of number); select type of **Decimal number** (for the data under the form of decimal number); select type of **Date** (for the data under the form of date).
- **Length:** number of maximized characters that can be used to update information
- Click **Add to fields list** to save to the list
- Click **OK** to finish. Other parameters remain unchanged.

The screenshot shows the 'New Shapefile Layer' dialog box. The 'Type' section has three radio buttons: 'Point', 'Line' (selected), and 'Polygon'. The 'File encoding' dropdown is set to 'UTF-8'. The 'Selected CRS' dropdown is set to 'EPSG:4326, WGS 84'. The 'New field' section contains a 'Name' text box, a 'Type' dropdown set to 'Text data', and a 'Length' text box set to '80'. The 'Precision' text box is empty. The 'Add to fields list' button is highlighted. The 'Fields list' section contains a table with the following data:

Name	Type	Length	Precision
id	Integer	10	

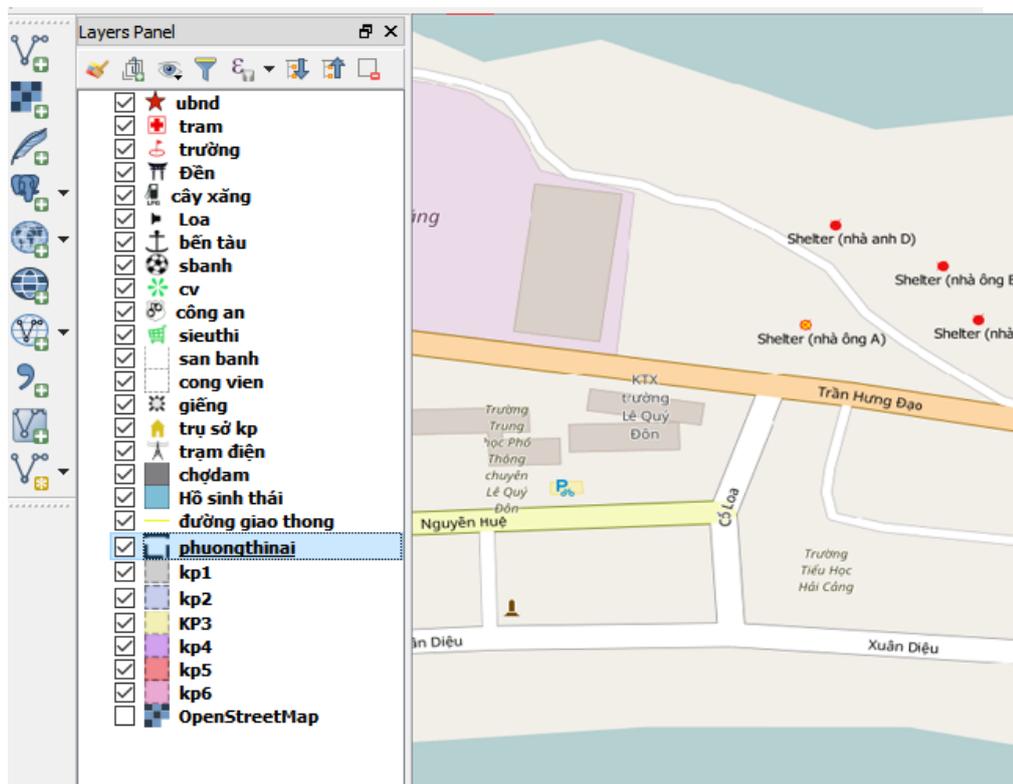
At the bottom of the dialog, there are three buttons: 'OK', 'Cancel', and 'Help'.

**Step 3:** Give the name to the file and select the folders that you want to save the file in (format of the saving file is \*.shp) – click **OK**

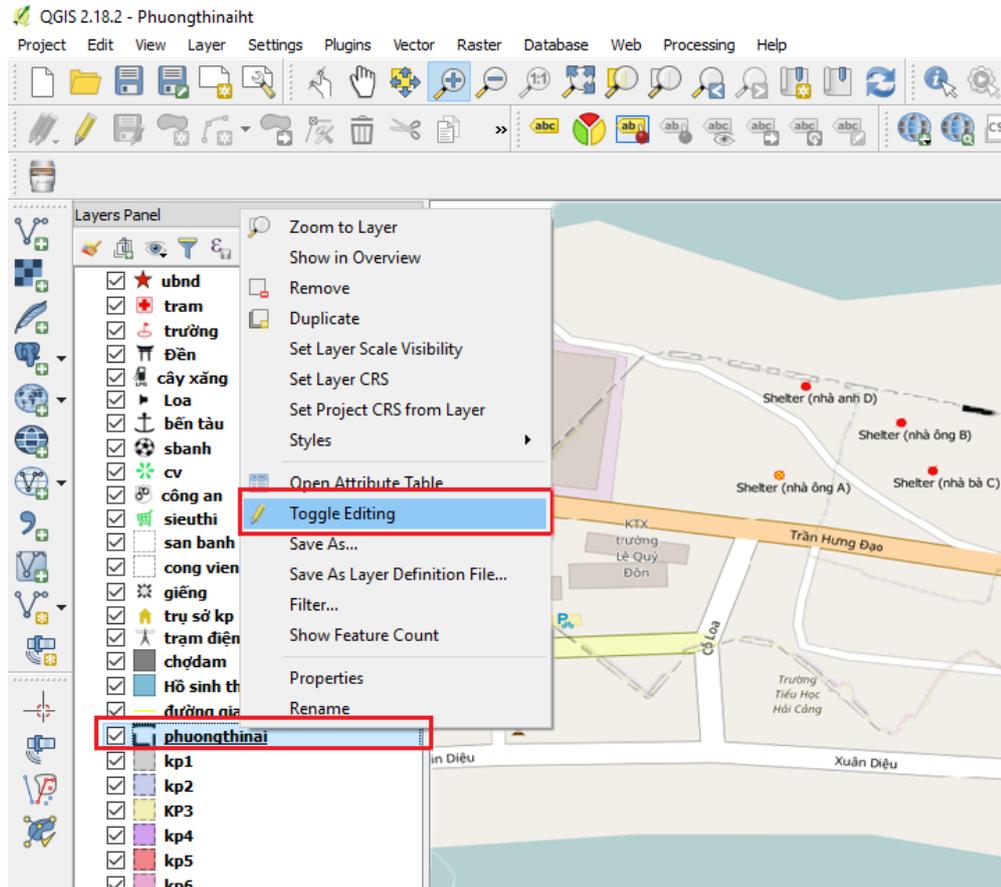


#### 4.3.2. Add a line on the base map:

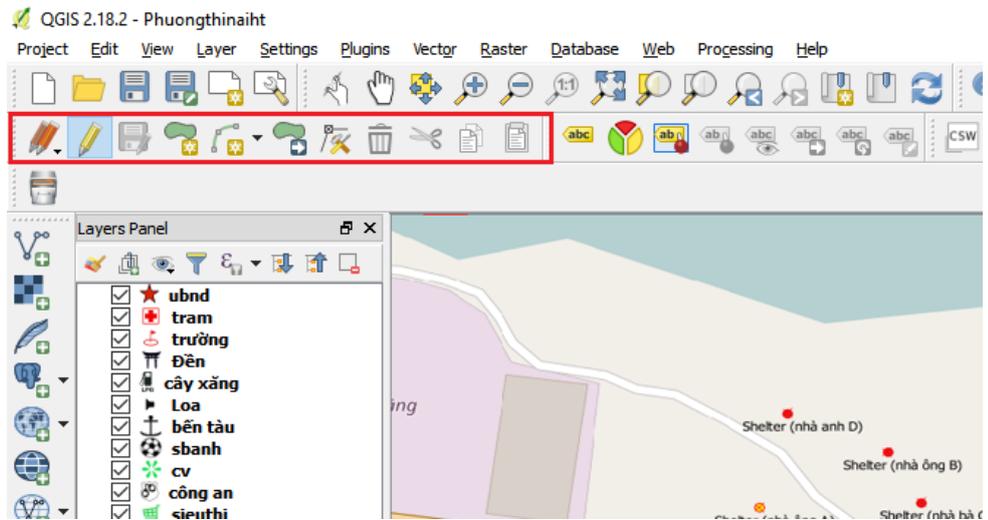
**Step 1:** Left click on the layers that need to modify



**Step 2: Right click, select **Toggle Editing****



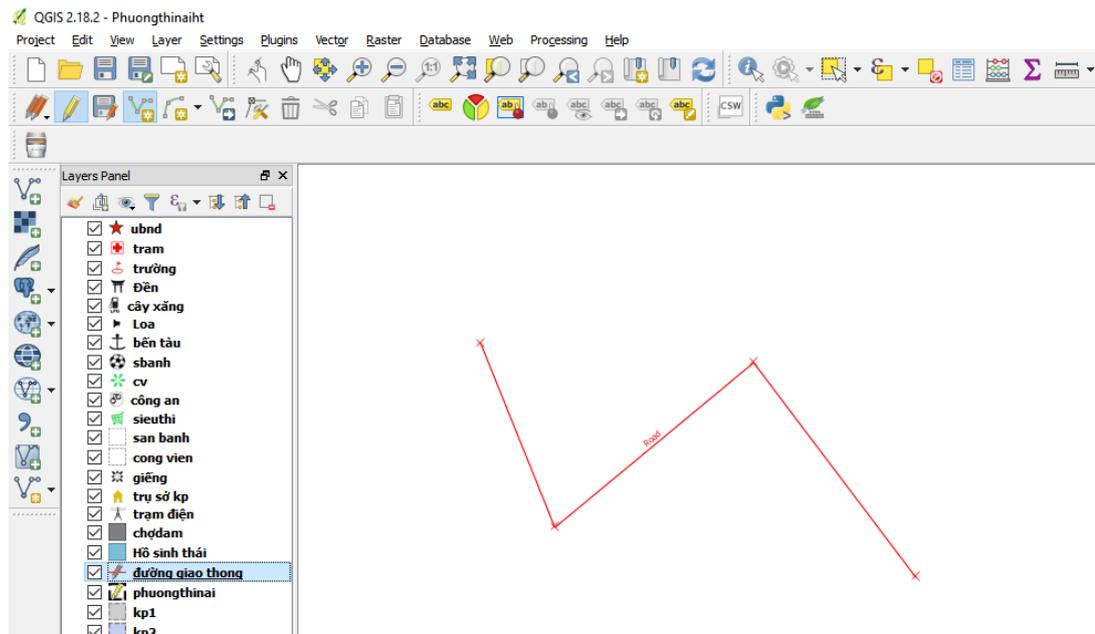
**Step 3: See the editing tool table at the upper left of the screen**



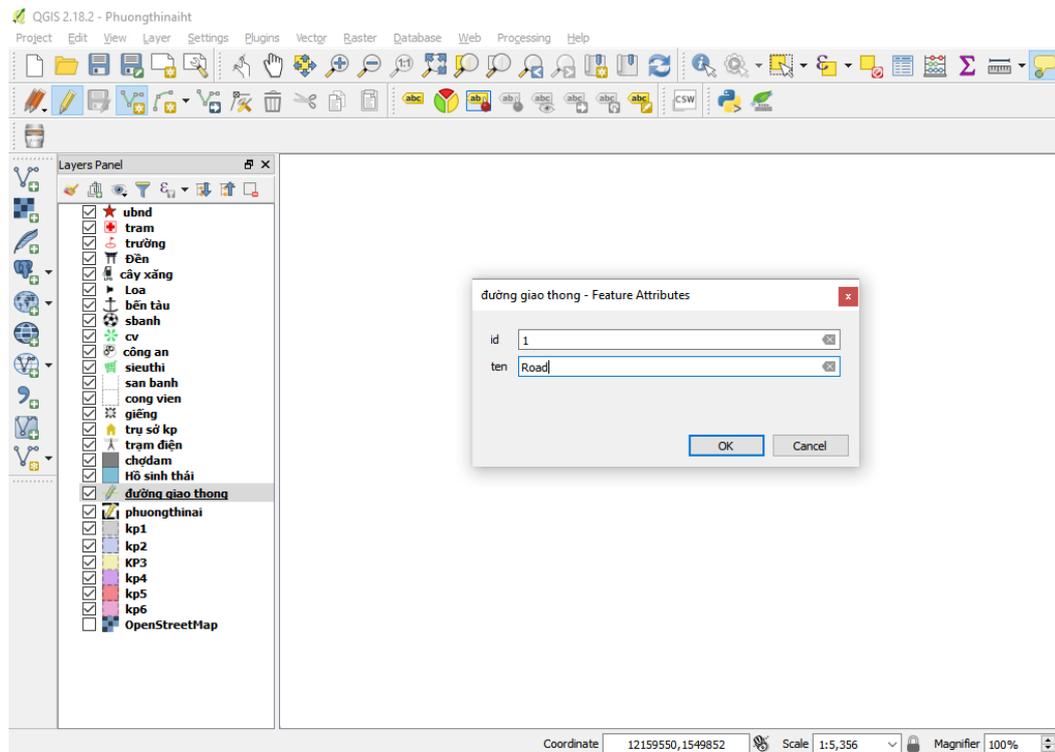
**Step 4: Click the icon  to add one new line**



**Step 5:** Use the cursor to identify points on the map, left click to mark datum- points, right click to finish.



**Step 6:** Add the order of that point in "Id" and give the name of the object on the map



**Note:** Id numbers of the fields on the same layers should not be the same.



Example: The evacuation road is from D house to A house, then to B house and to the main road.

Step 7: To move lines created in the map, select icon “**Move Feature(s)**”  , select the point that needs to relocate, keep pressing left mouse button and move it to the location you want.

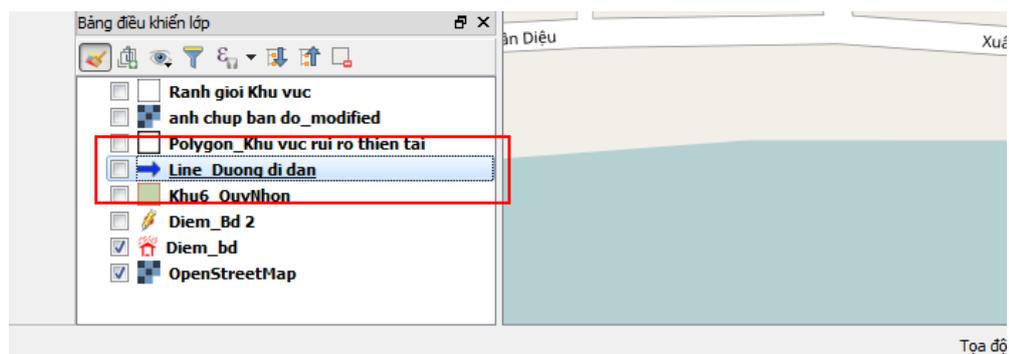
Step 8: In order to delete one line created, select icon “**Select feature(s) by area or single**

**click**”  . Move the cursor to the line that needs to delete, left click to select the line (hold

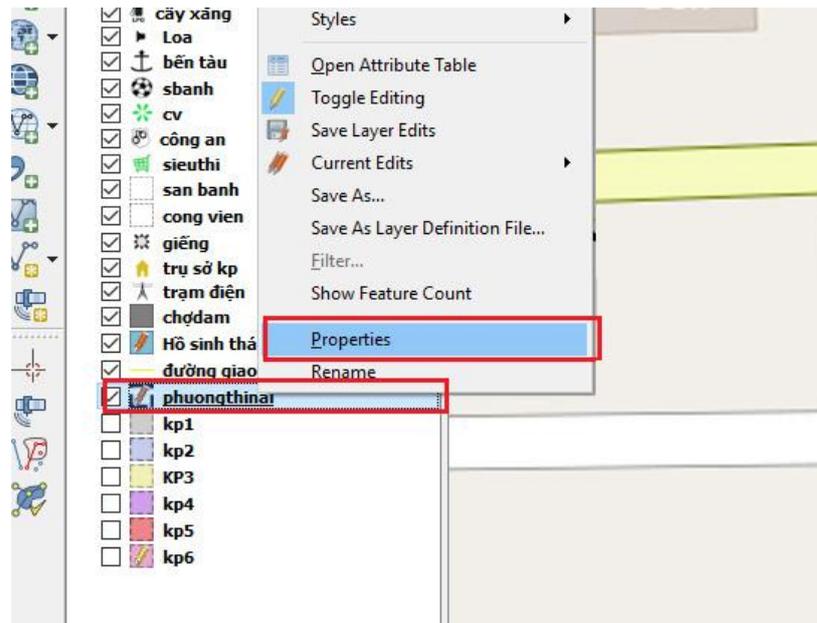
the Shift key and left click to select many lines). Select icon of **Delete selected(s)**  to delete these lines (as for selection of many lines, release **Shift** key and left mouse button before clicking the deletion icon).

### 4.3.3. Display name on the map

Step 1: In order to display points on the map, select the line layer by clicking the left mouse button

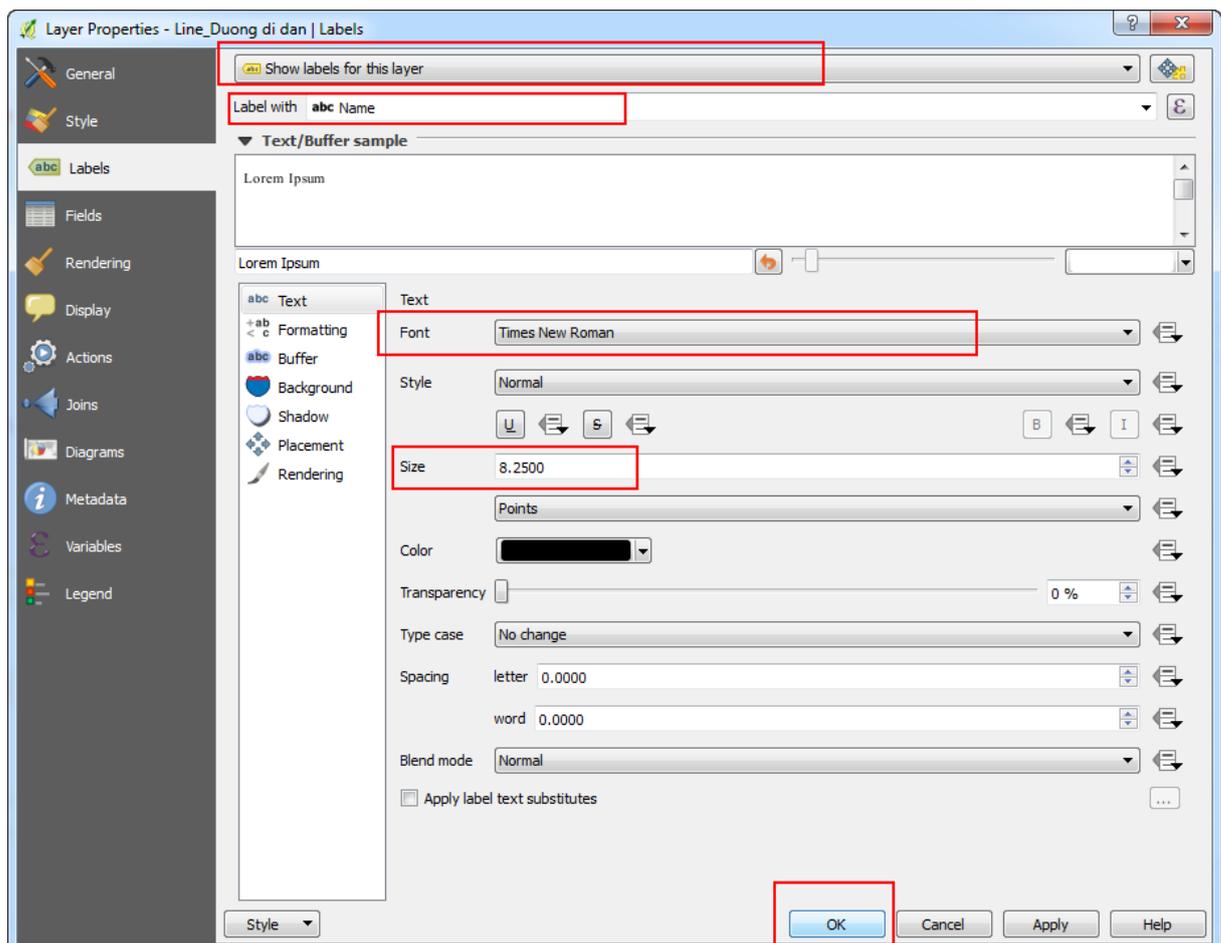


**Step 2: Right click, select Properties**

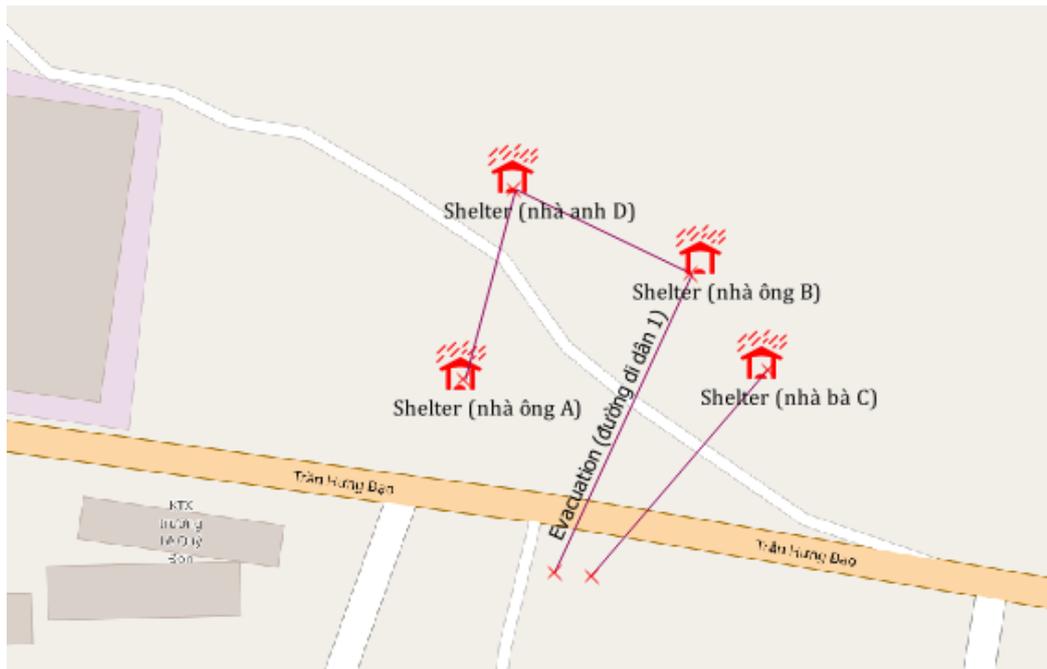


**Step 3: Select Labels, modify the information:**

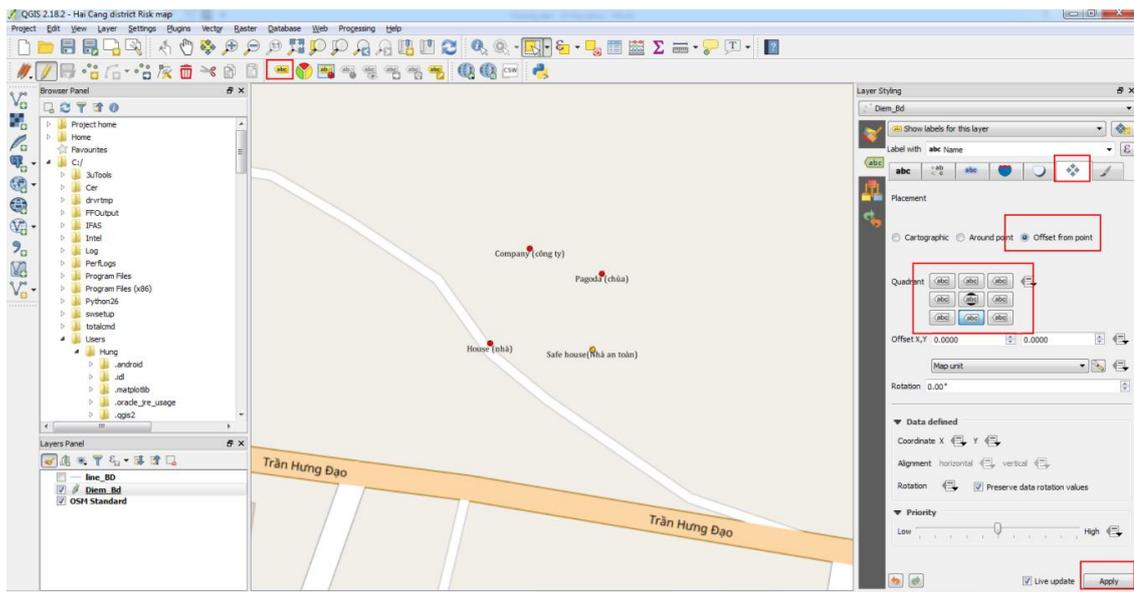
- At the top line: move from “No label” to “Show labels for this layer”
- Box of **Label with**: select field of information of “Name”
- Box of **Font**: select the font that you want to display.



**Step 4:** Click **OK** to display the results on the map



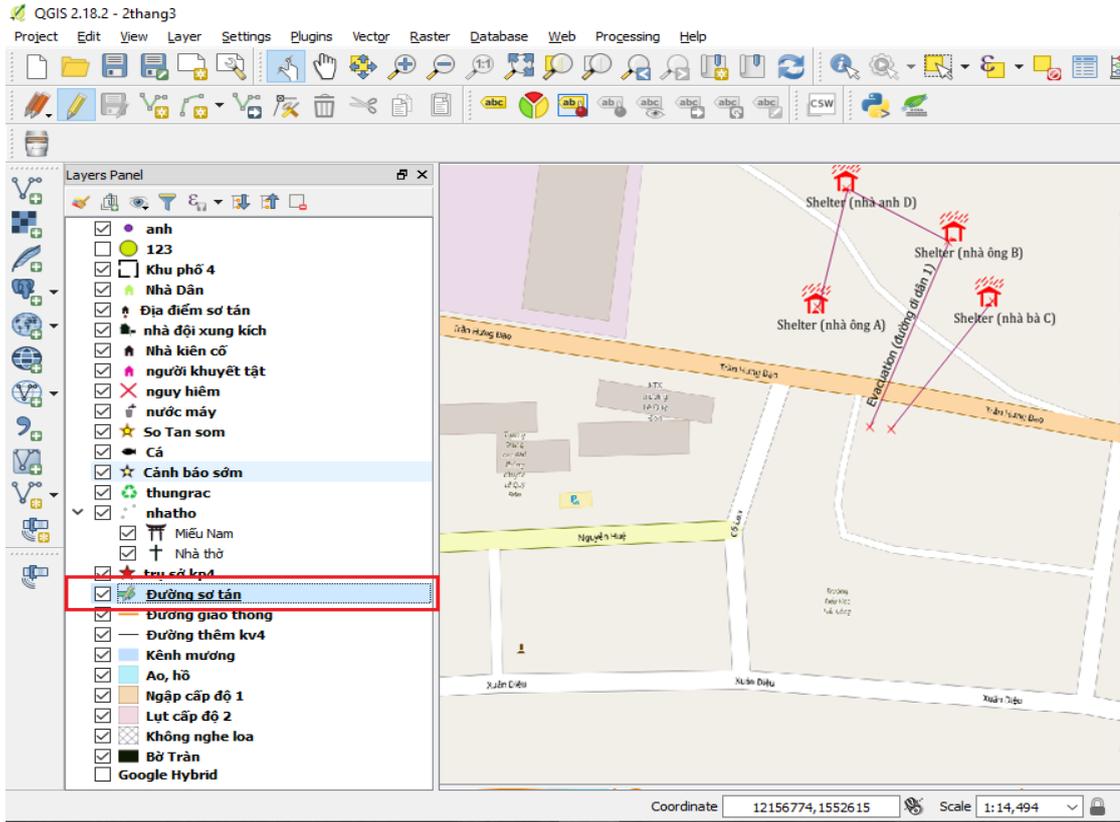
**Step 5:** To change location of the point name (on the left/right/on the top/under) to the line, select icon **Layer labeling options** , **“Offset from point”** and **Placement**  then select the location we want.



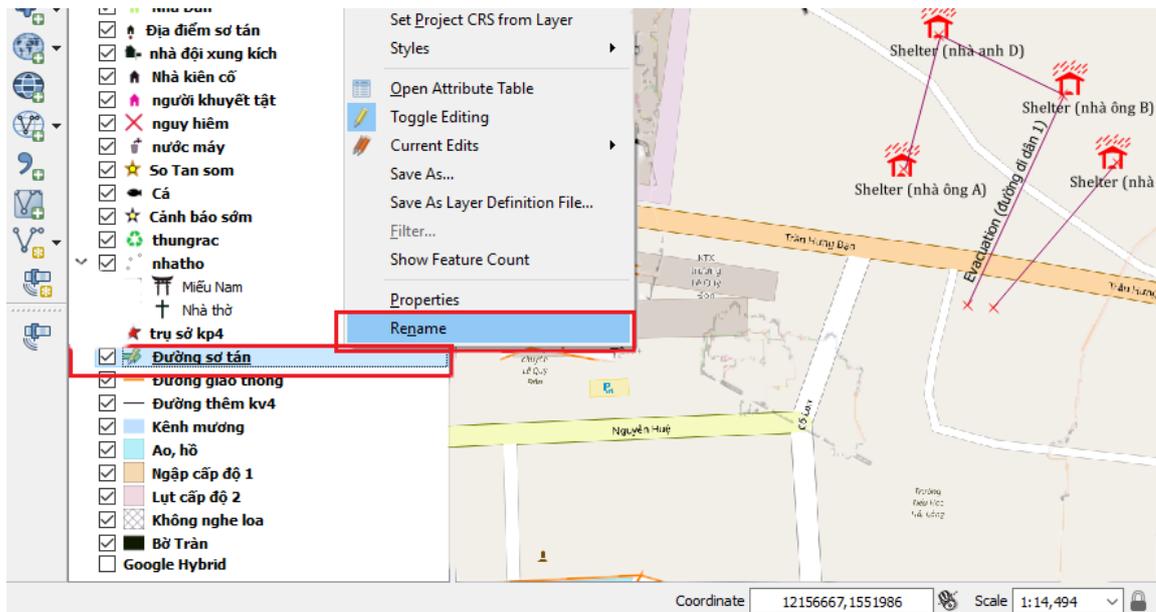
#### 4.3.4. Change icon of the line

Let's take an example of identifying evacuation road in case of emergency.

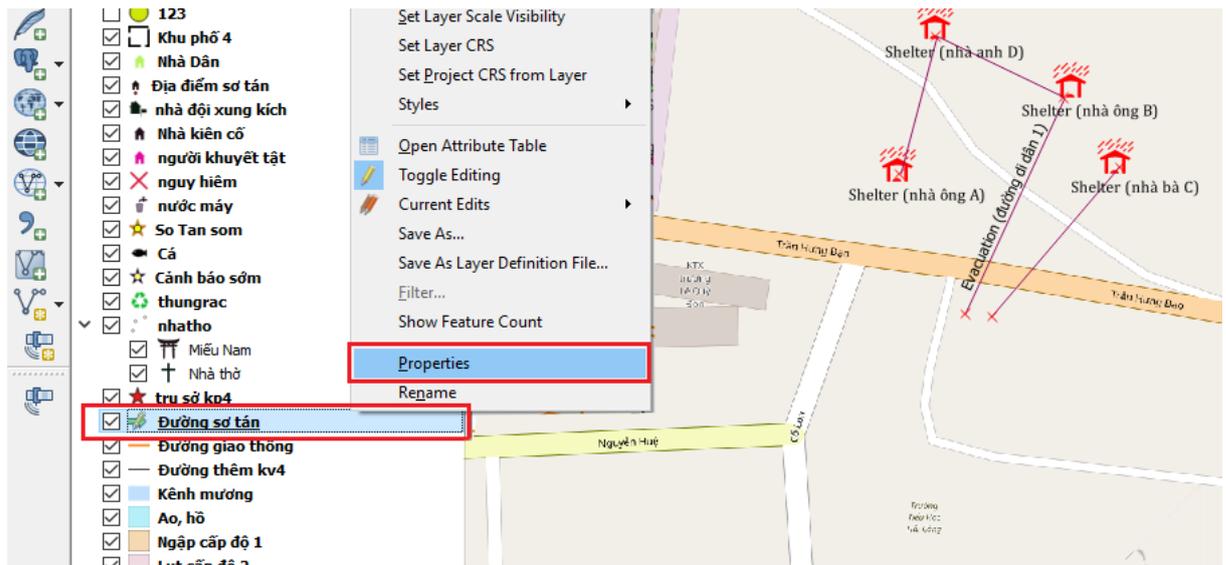
**Step 1:** Select the line data layer that needs to change the icon by clicking the left mouse button at that layer.



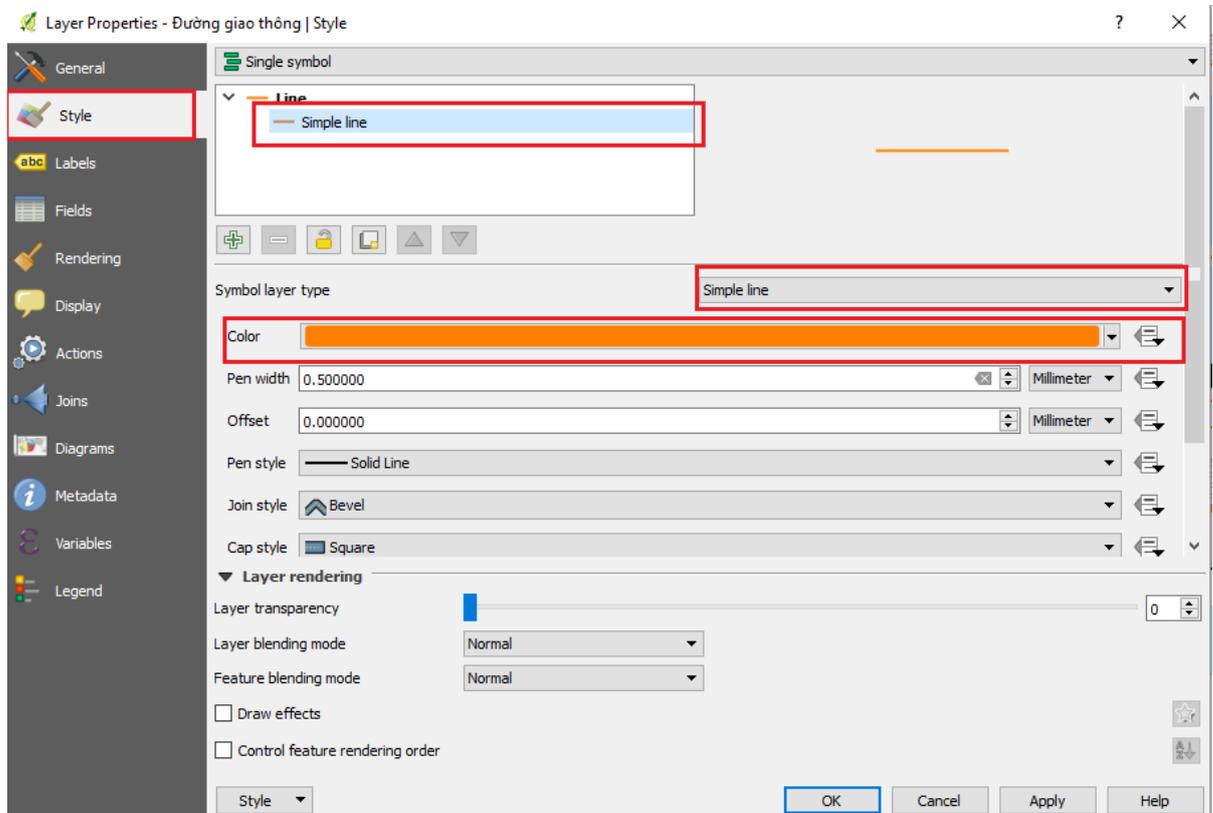
**Note:** For changing the layer name, right click , select “Rename” and enter new name.



**Step 2:** Right click, select **Properties**

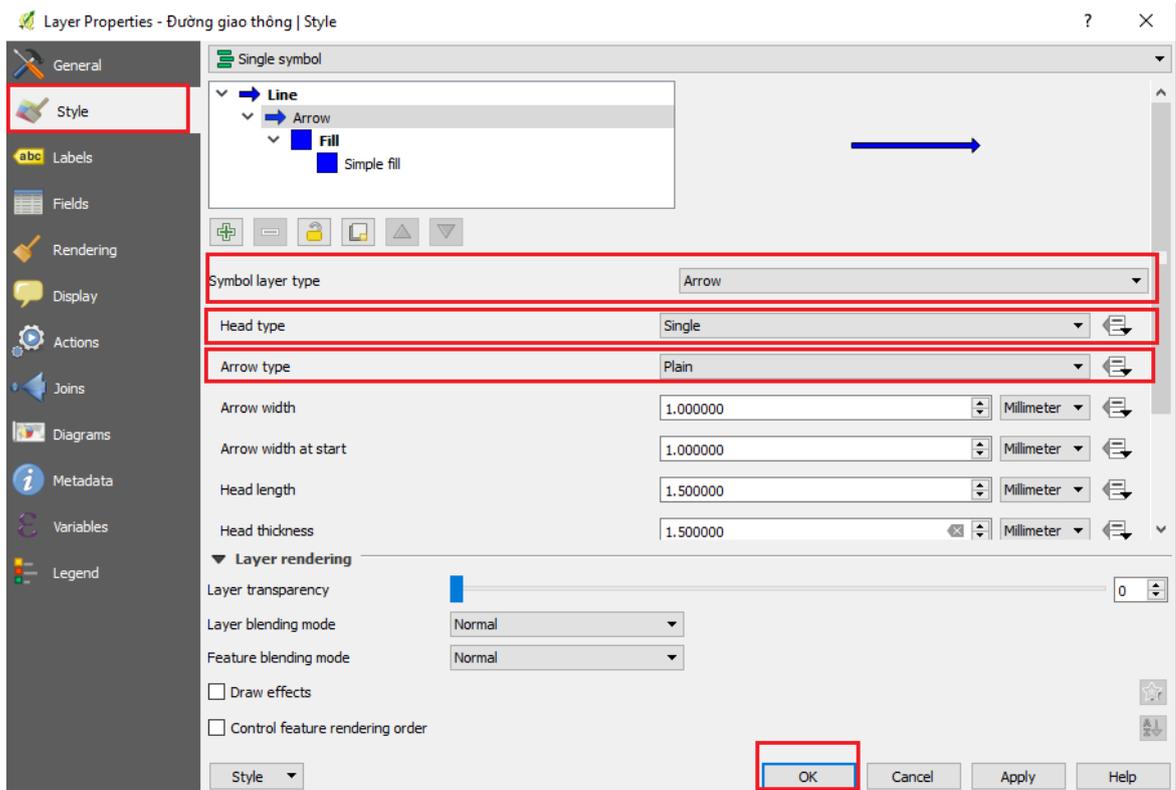


**Step 3:** Select **Style** to modify characters/icons of the line

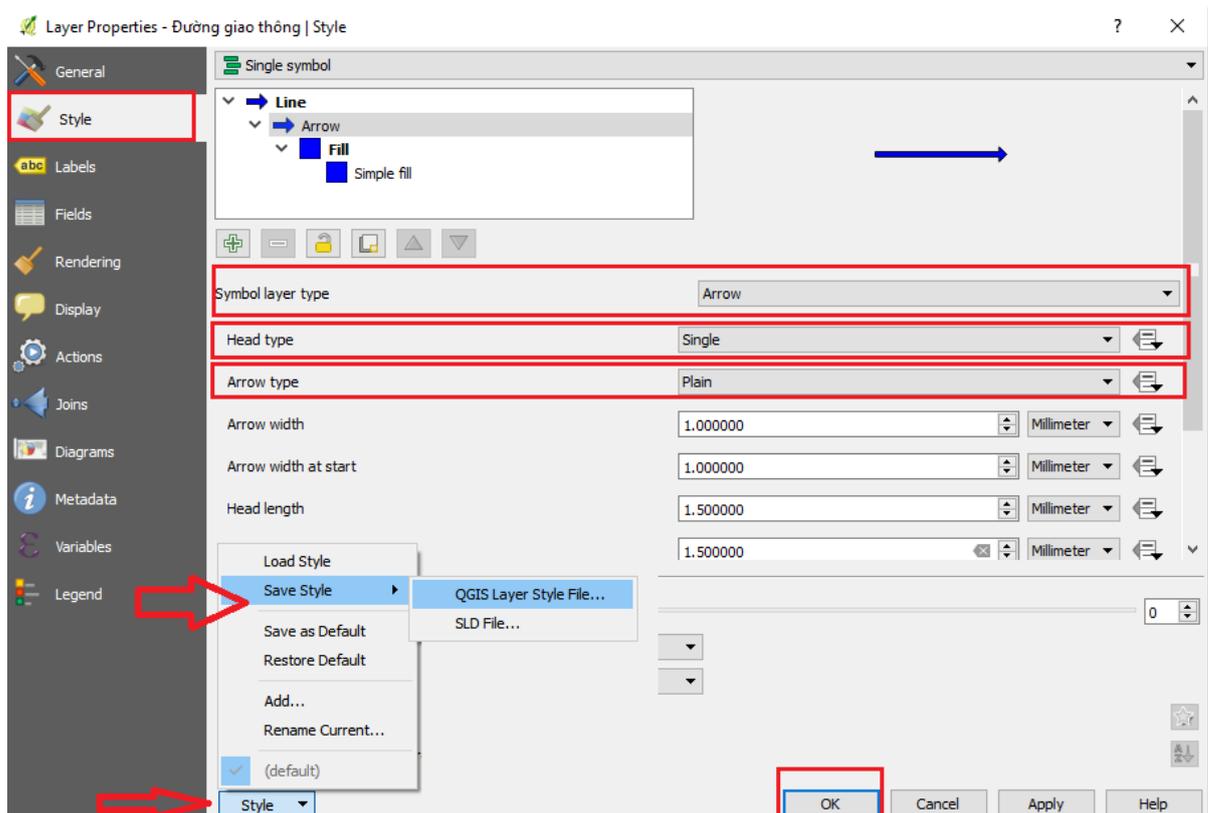


**Note:** Normally, the icon of one simple line is 1 line with the same colour

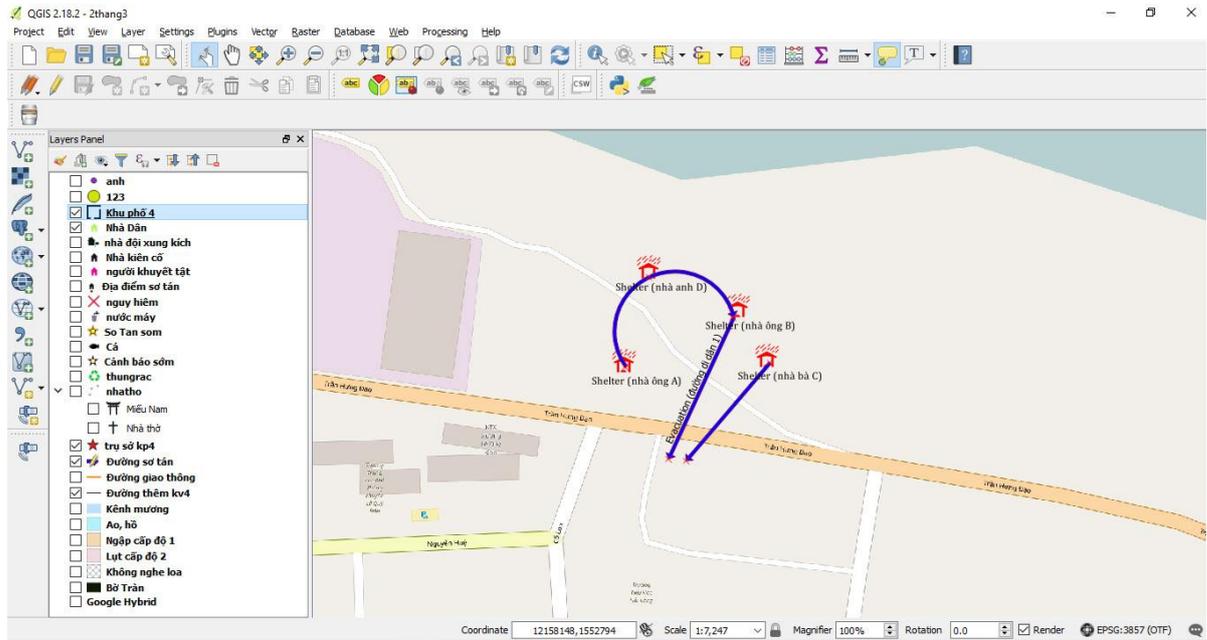
**Step 4:** To make an arrow line, select **Arrow** in “Symbol layer type”.



**Note:** After setting up the symbol characters (colours / appearance), you can save the settings together with the shapefile by clicking the **Save Style** button and select "QGIS Layer Style File", then save it with the same name with shapefile in the same folder. Then it will automatically be rendered in the same way when it is next loaded into QGIS, even on another computer.



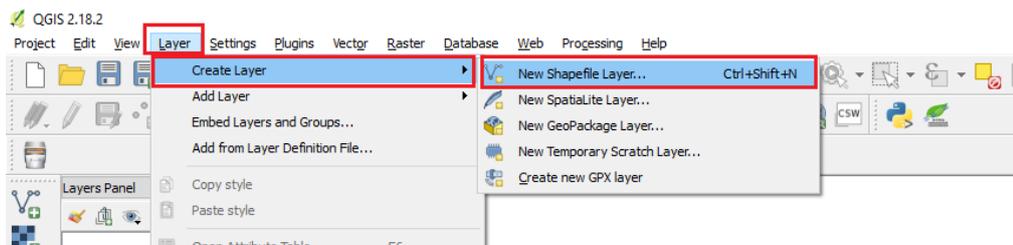
**Step 5:** Select a suitable icon and click **OK** to display on the map.



#### 4.4. Create a polygon in QGIS:

##### 4.4.1. Add a polygon layer

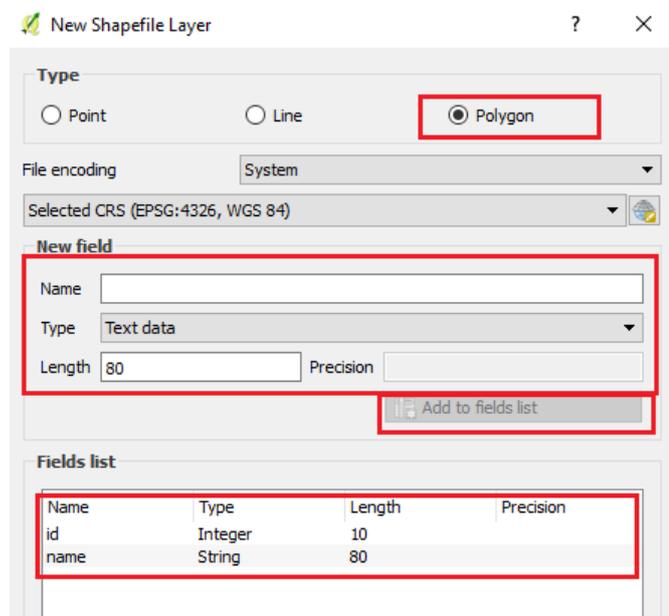
**Step 1:** In **Layer**, select **Create layer** → **New Shapefile Layer**



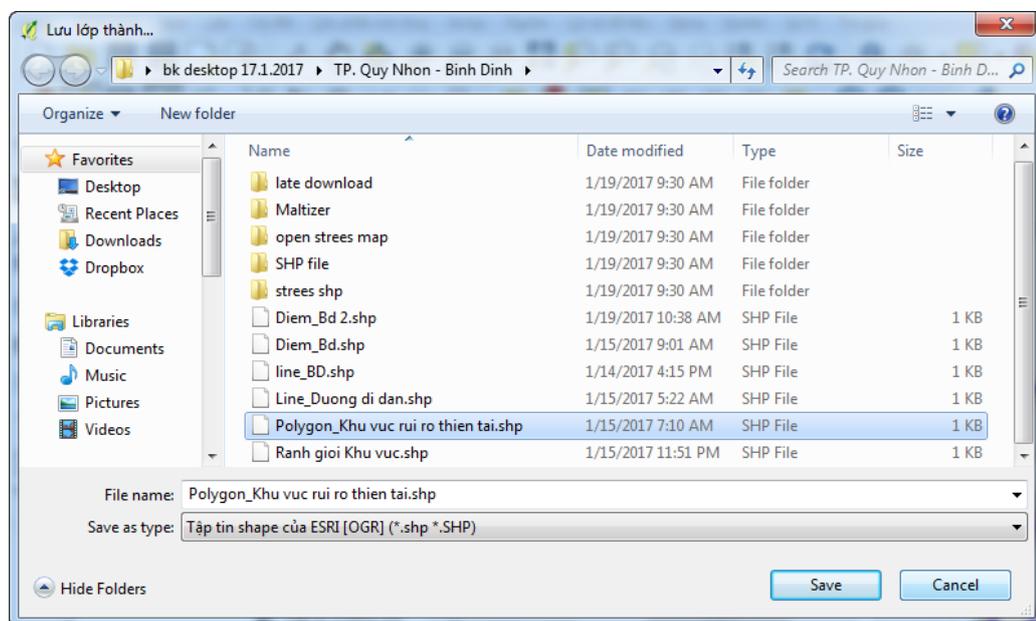
**Step 2:** Select **Polygon**, by default, each data layer has 01 field of information of "**Id**". To supplement other information for the data layer, we can create field of information here.

Give the name to new field of information at the box **New field** with the following information:

- **Name:** Name the field of information (example: name, code,...)
- **Type:** Select type of **Text data** (for the data under the form of character); select type of **Whole number** (for the data under the form of number); select type of **Decimal number** (for the data under the form of decimal number); select type of **Date** (for the data under the form of date/month).
- **Length:** number of maximized characters that can be used to update information
- Click **Add to fields list** to save to the list
- Click **OK** to finish. Other parameters remain unchanged.

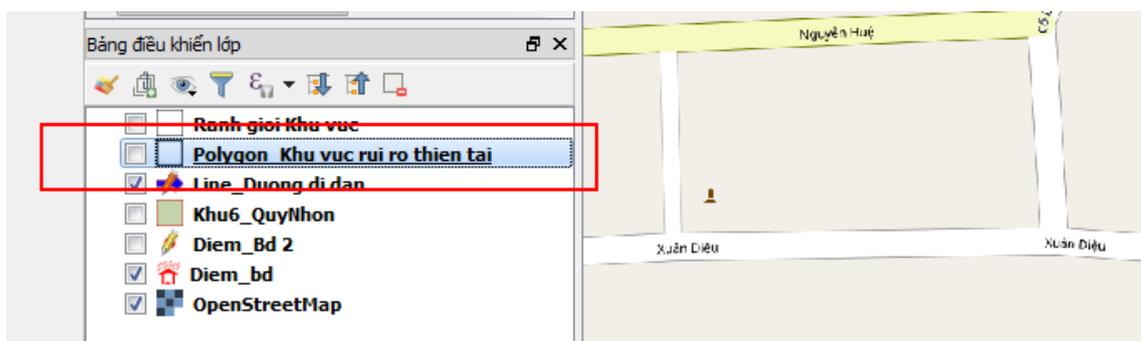


**Step 3:** Give the name to the file and select the folder you want to save the file (format of the saving file is \*.shp) – click **OK**

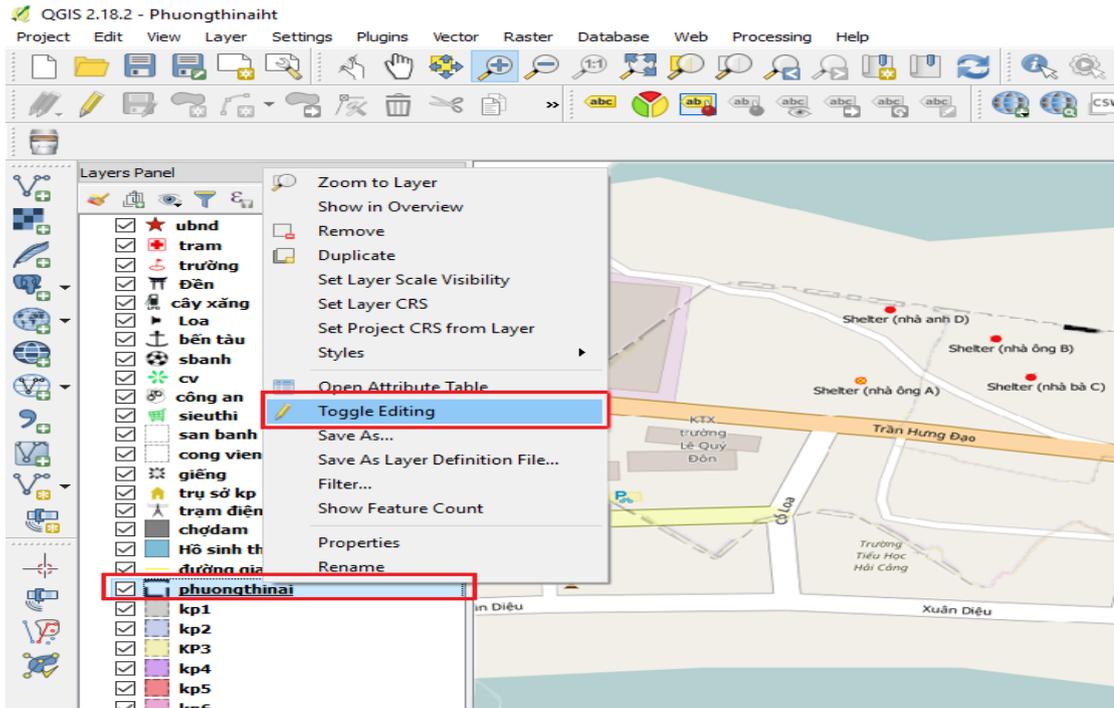


#### 4.4.2. Add a Polygon layer

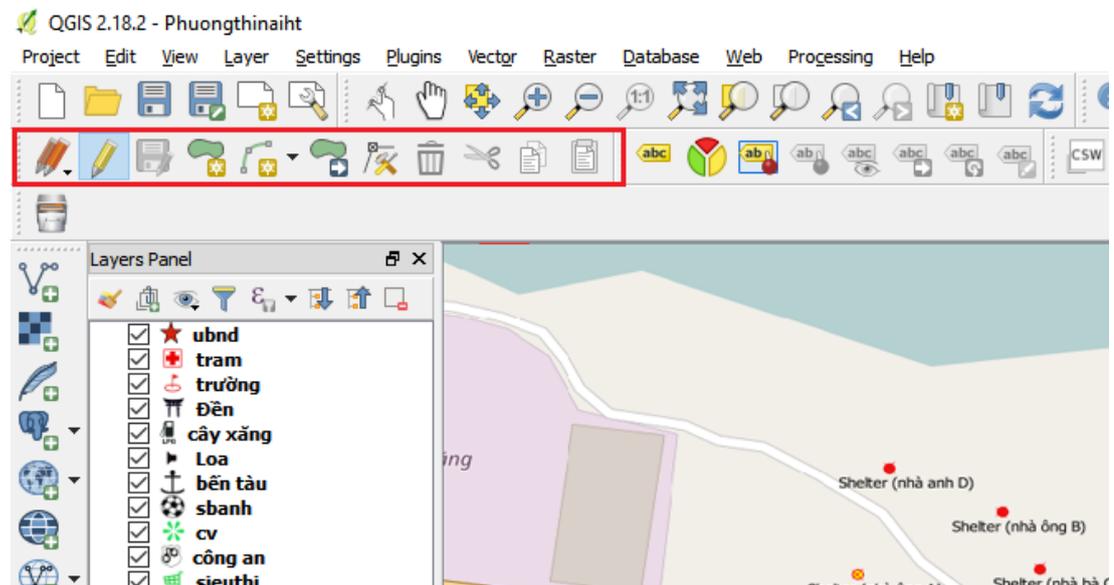
**Step 1:** Left click at the layer that needs to modify.



**Step 2:** Right click, select **Toggle editing**



**Step 3:** See the editing tool table on the upper left side of the screen



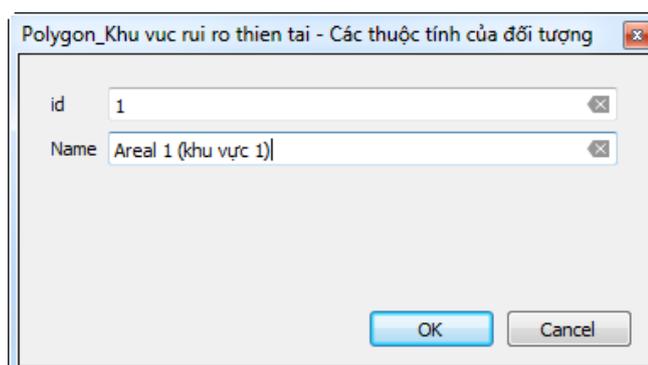
**Step 4:** Click the icon  to add 1 new *Polygon*



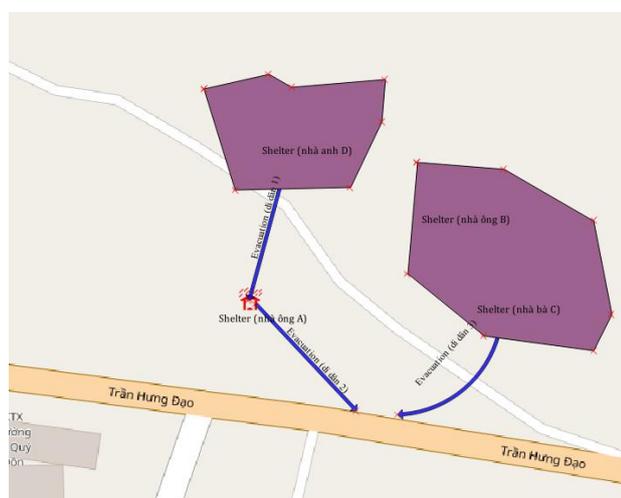
**Step 5:** Use the mouse to identify points on the map, click left mouse button to mark points for the polygon shape as you want, right click to finish.



**Step 6:** Add the order of that point in the “**Id**” line and give the description of the object in the name box.



**Note:** The **Id** numbers of the lines within one layer should not be the same.



Example: In areas affected by a disaster. Area 1 includes house B, C; area 2 includes house D

**Step 7:** To move polygons created on the map, select the icon “**Move Feature(s)**” . Select the point that needs to move, keep pressing the left mouse button and relocate the point to the desired location.

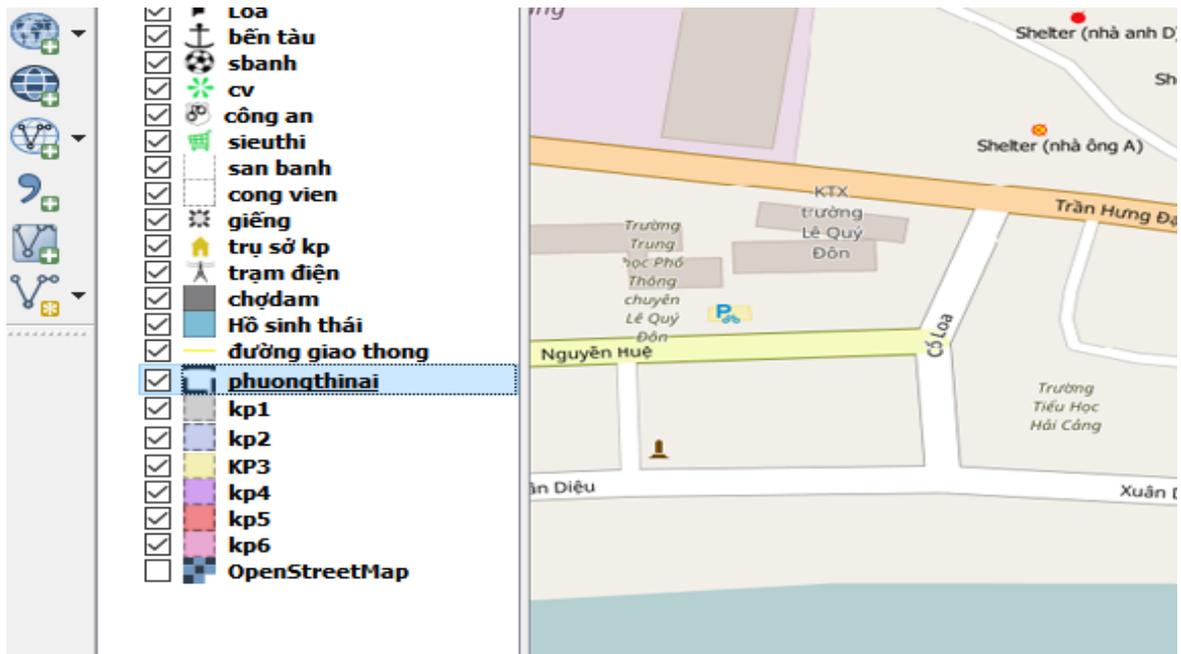
**Step 8:** To delete a polygon created, select the icon of **“Select feature(s) by areas or single**

**click”**  Move the mouse to the polygon that needs to delete, left click to select the polygon (keep pressing **Shift** key and left click to select many polygons). Select the icon **delete**

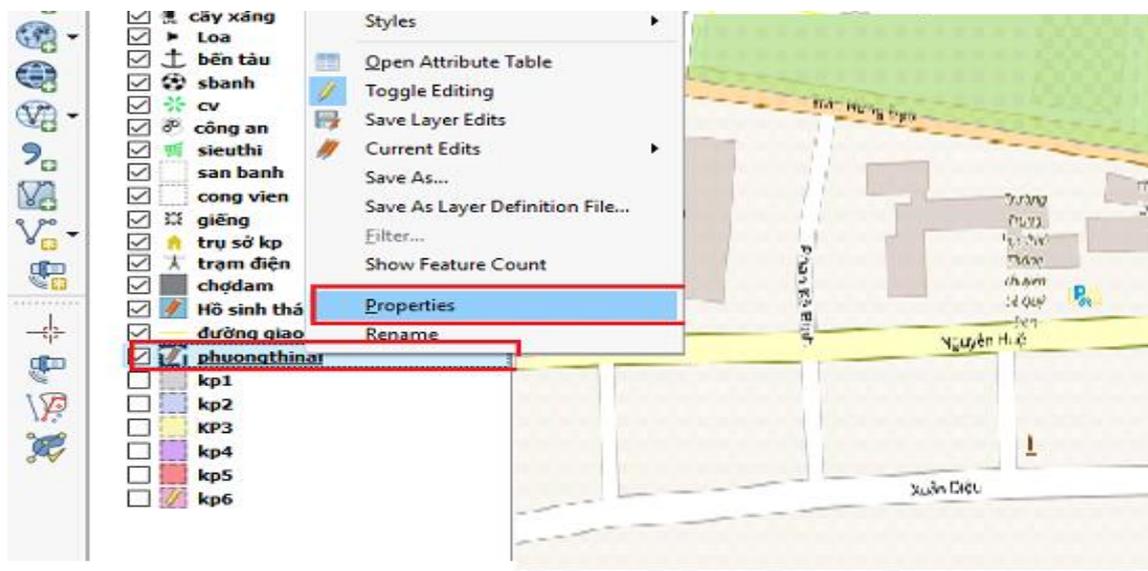
**selected(s)**  to remove the polygons (if selecting many polygons, release **Shift** key and the left mouse button mouse before clicking the deleting icon).

#### 4.4.3. Display polygon name on the map

**Step 1:** In order to display name of the polygons on the map, select polygon layer by left clicking on that polygon.

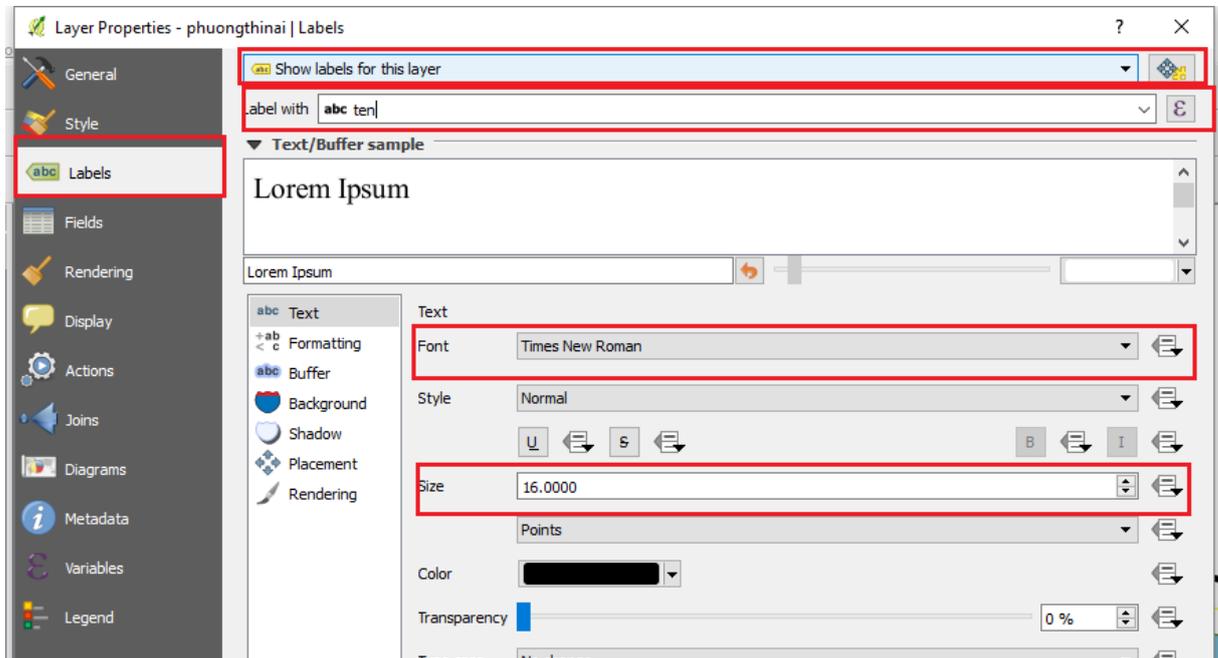


**Step 2:** Right click right, select **Properties**

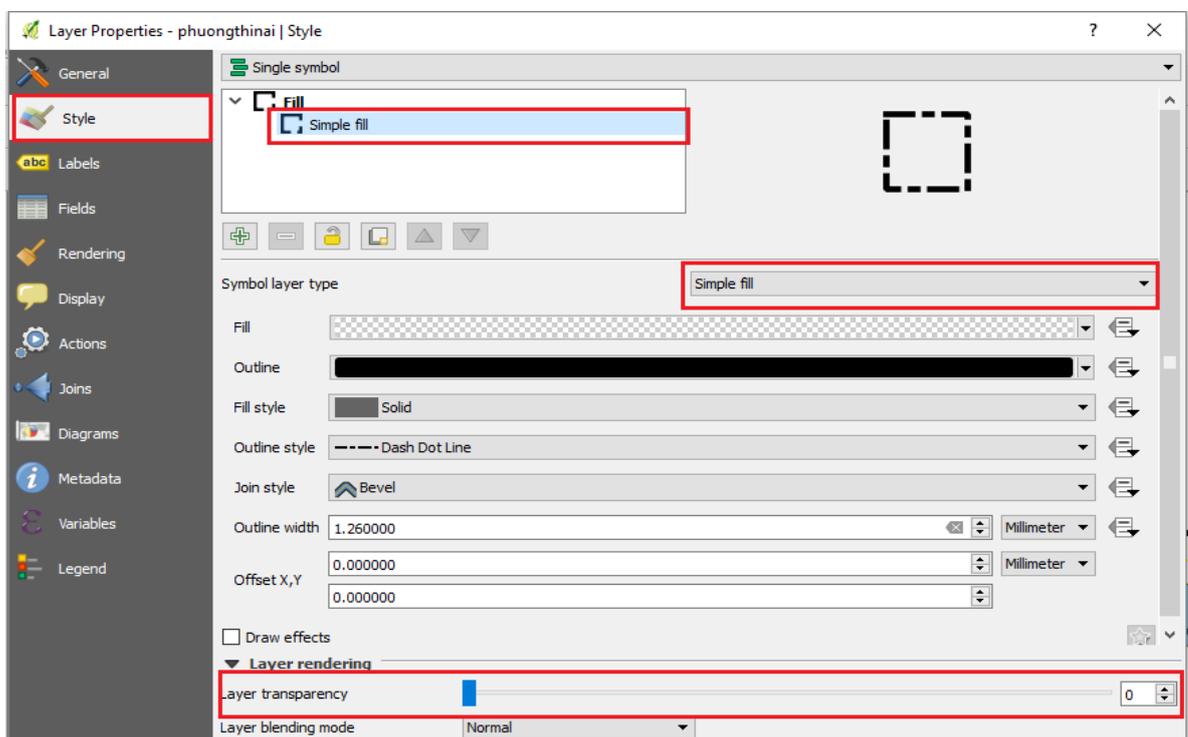


**Step 3:** Select **Labels**, modify information:

- At the top line, move from “**No label**” to “**Show labels for this layer**”
- Box of **Label with**: select field of information of “**Name**”
- Box of **Font**: select the font desired.
- Select **Transparency** to modify dull or solid level of the polygon layer to display or hide completely the underneath information layers.



**Note:** Use “Layer transparency” function to dim the underneath objects by changing level of transparency from 30% to 60%.

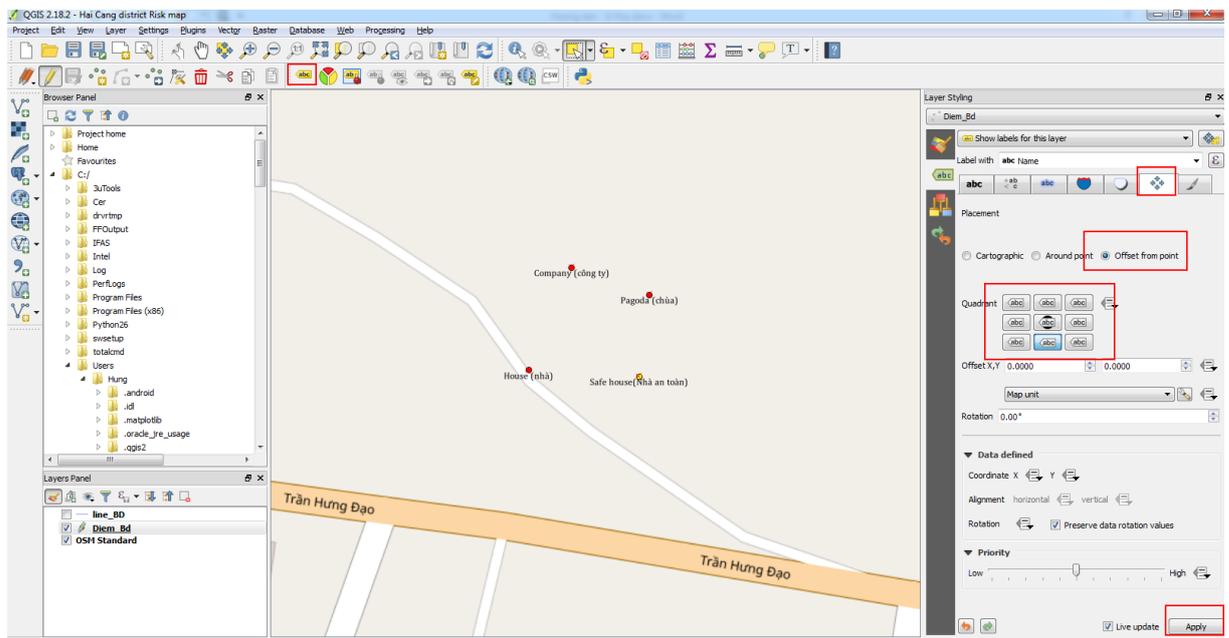


**Step 4:** Click **OK** to display results on the map



**Step 5:** When we want to change location of polygon name (on the left/right/ top/underneath, etc.) to the polygon, select icon of **Layer labeling options**  **“Offset from point”**,

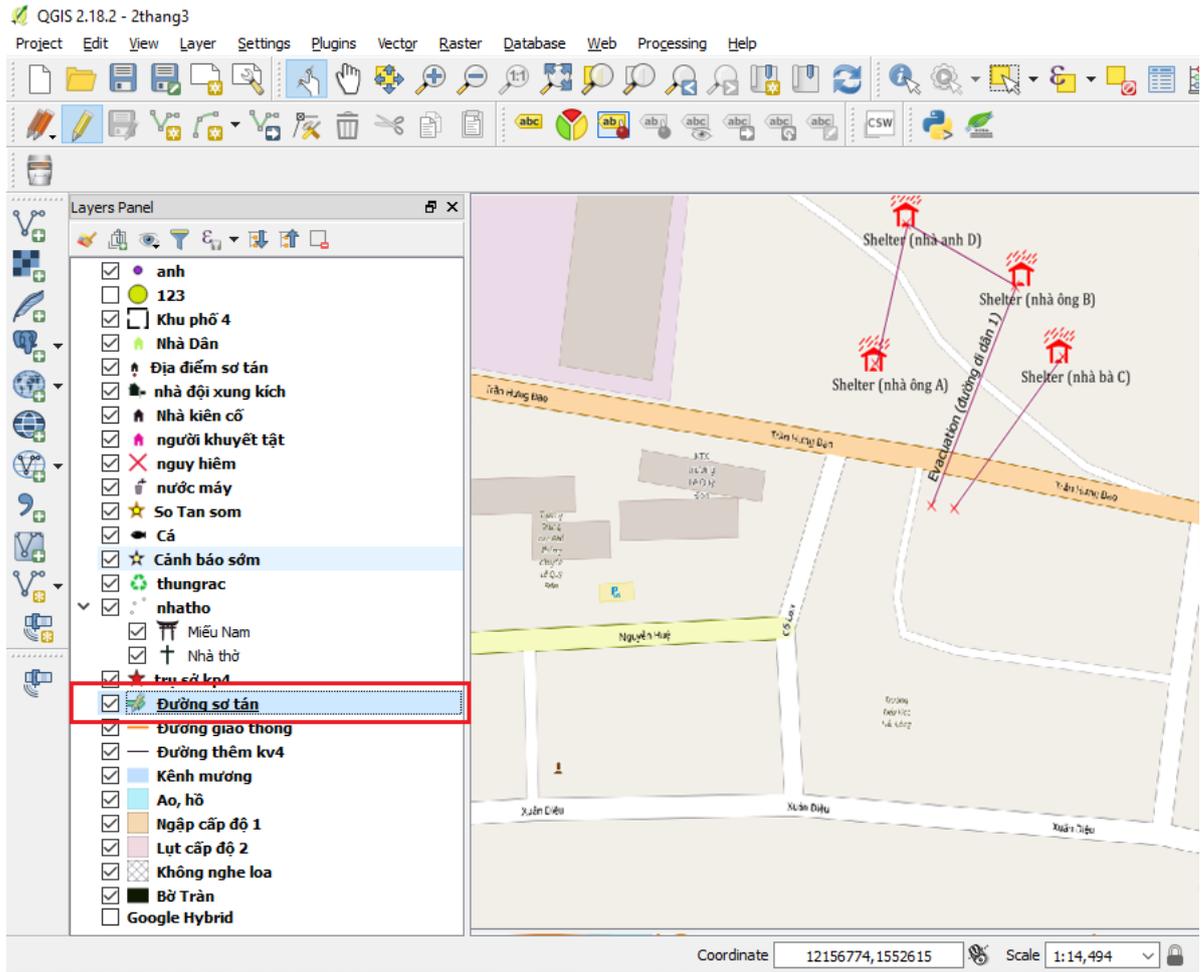
**Placement**  and the desired location.



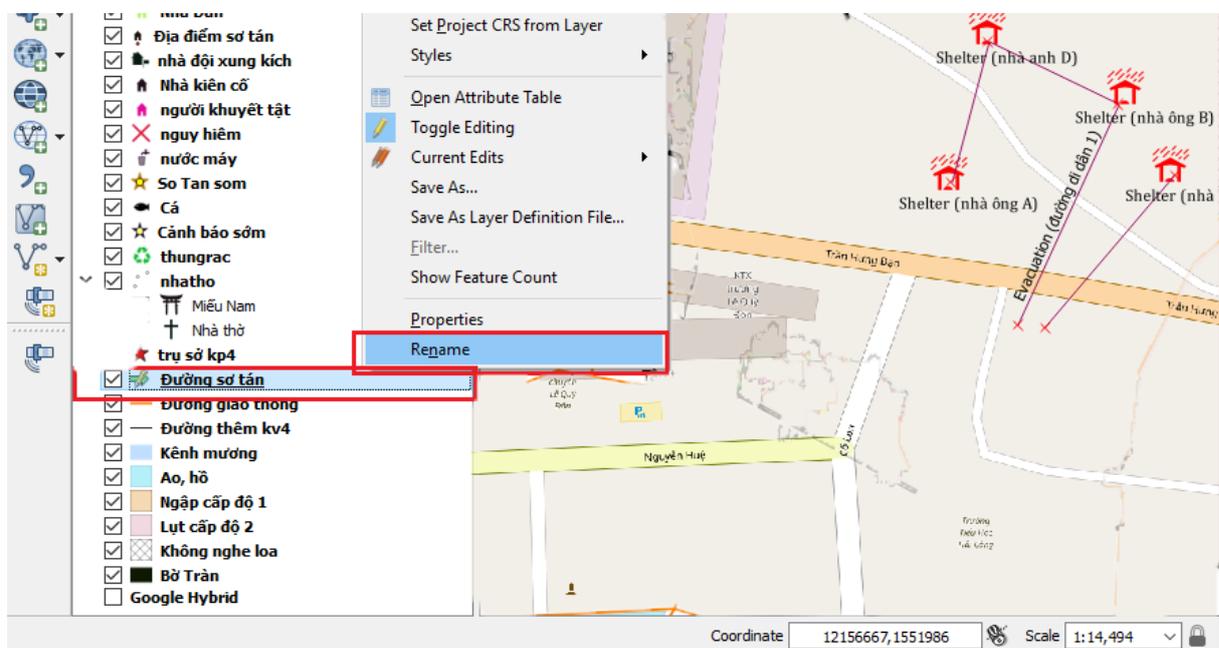
#### 4.4.4. Change icon of the polygon

To be easy for imagination, let's take example of localizing disaster risk

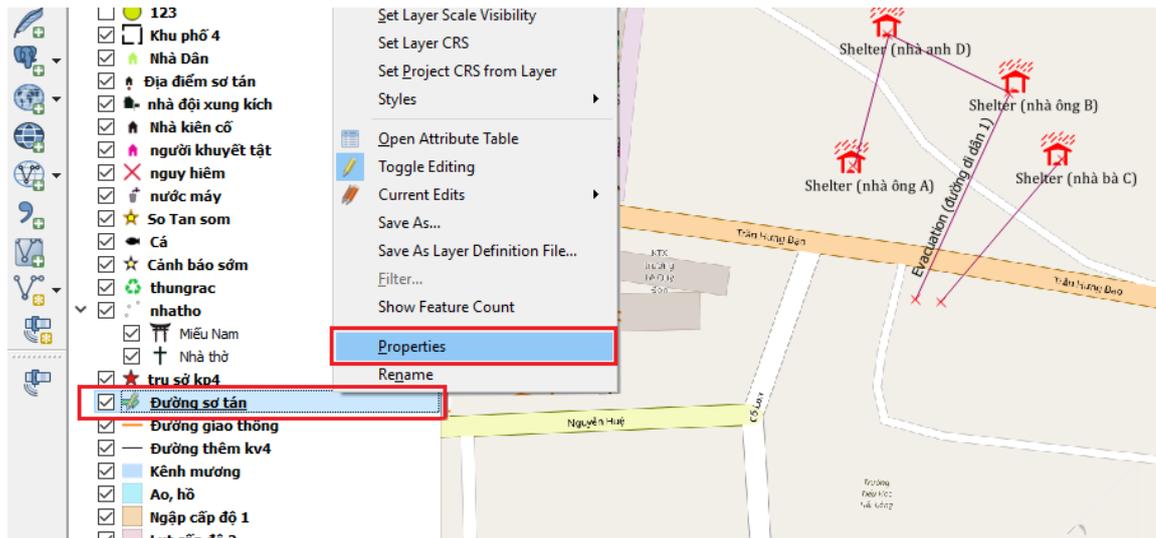
**Step 1:** Select polygon layer that needs to change icon by left clicking at that layer.



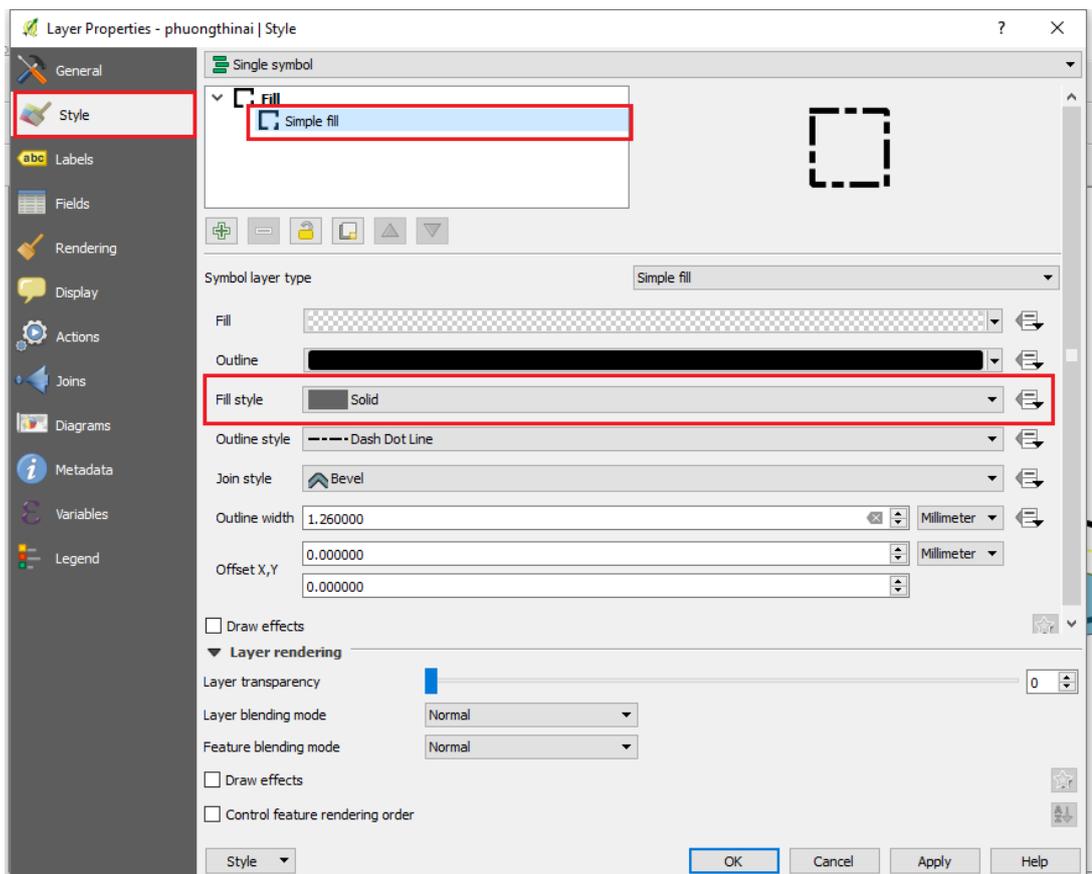
**Note:** Select “Rename” and enter new name to change the layer name.



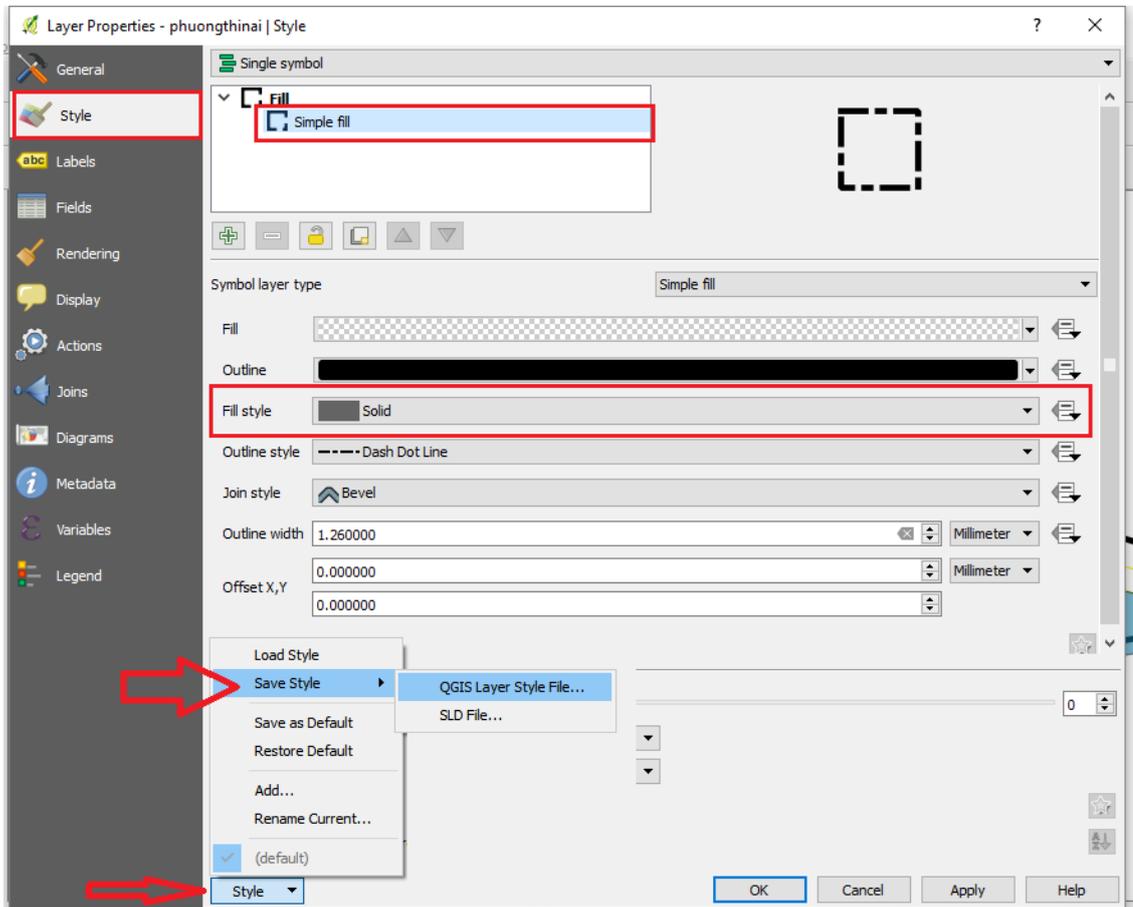
**Step 2:** Right click, select **Properties**.



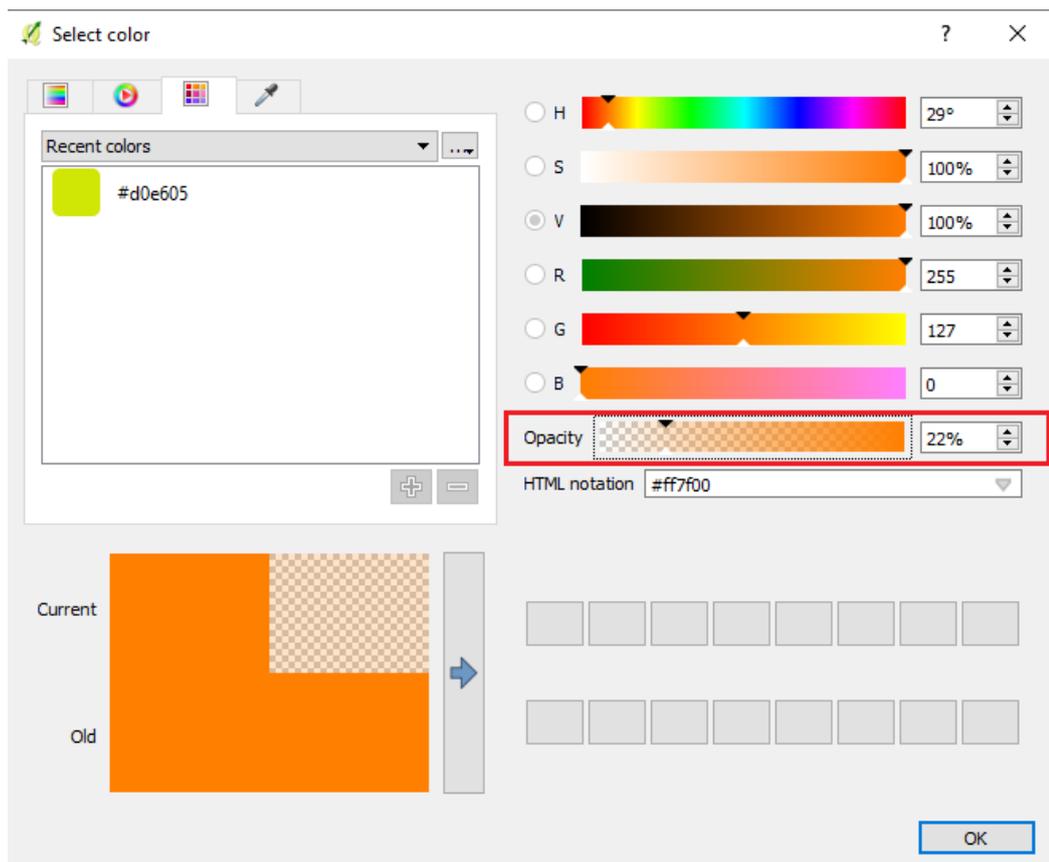
**Step 3:** Select **Style** to modify fill style of the polygon.



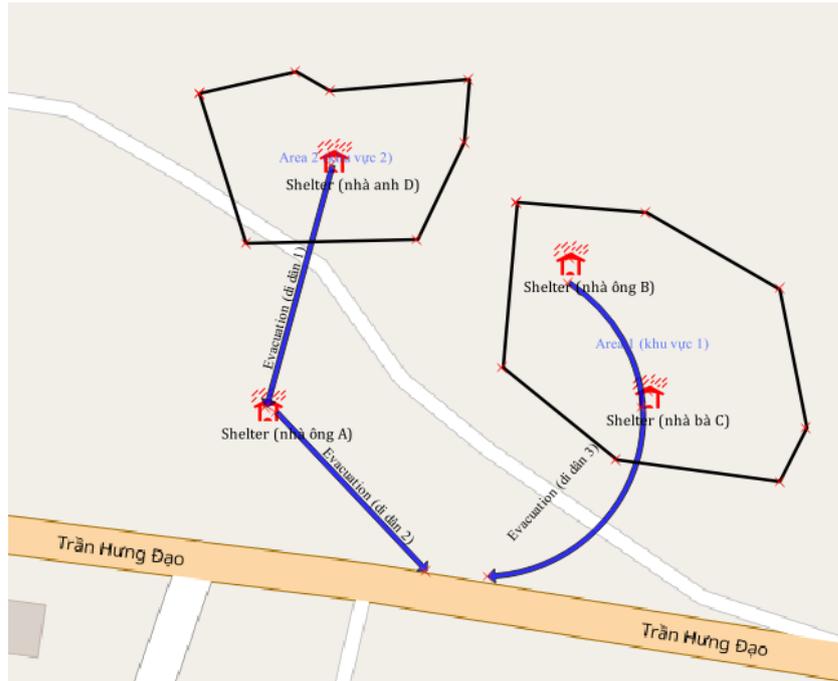
**Note:** By default, it is usually simple fill. After setting up the symbol characters (colors / appearance), you can save the settings together with the shapefile by clicking the **Save Style** button and select "**QGIS Layer Style File**", then save it with the same name with shapefile in the same folder. Then it will automatically be rendered in the same way when it is next loaded into QGIS, even on another computer



**Step 4:** For the inside of the polygon to be filled with no colour, select **Fill Style/Select color: Opacity 0%**



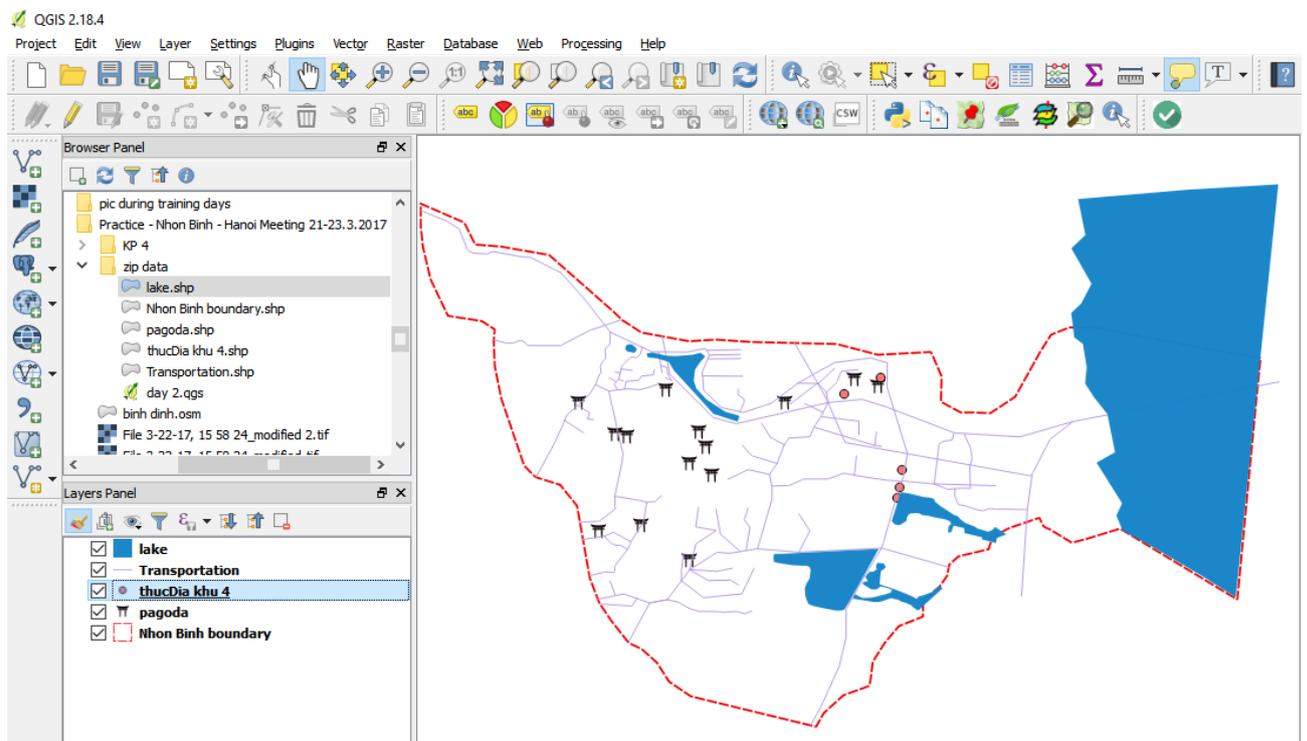
We have 01 polygon with black borderline.



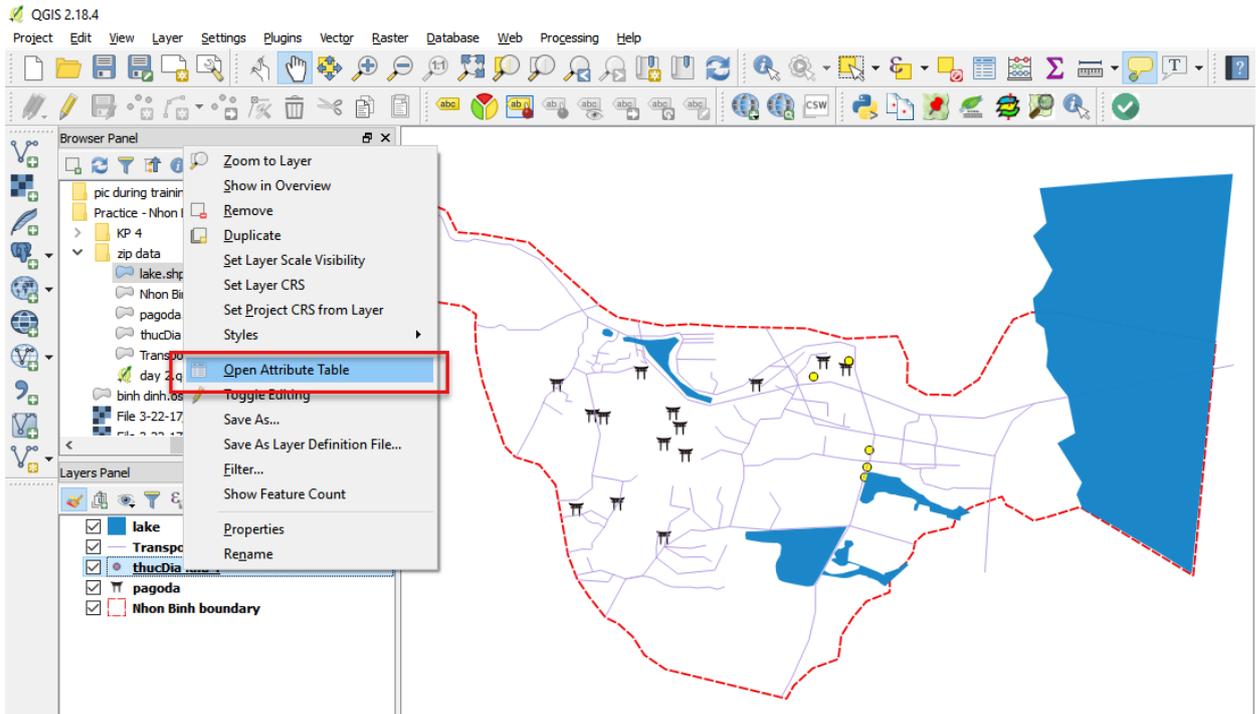
#### 4.5. Edit objective in attribute table

Each objective has its descriptive information. For example: Mr. B house is about 50 m<sup>2</sup>. Mr. A's house has 3 people, etc. All those information will be collected and showed on a table called "attribute table". If you need to change the information of objective (for example: if you want to change that Mr. A's house has 5 people instead of 3), you have to change the information on the attribute table. We can add, delete or edit information in the attribute table. Below is the guidance for point layer. You can perform similar steps for polygon or line layers.

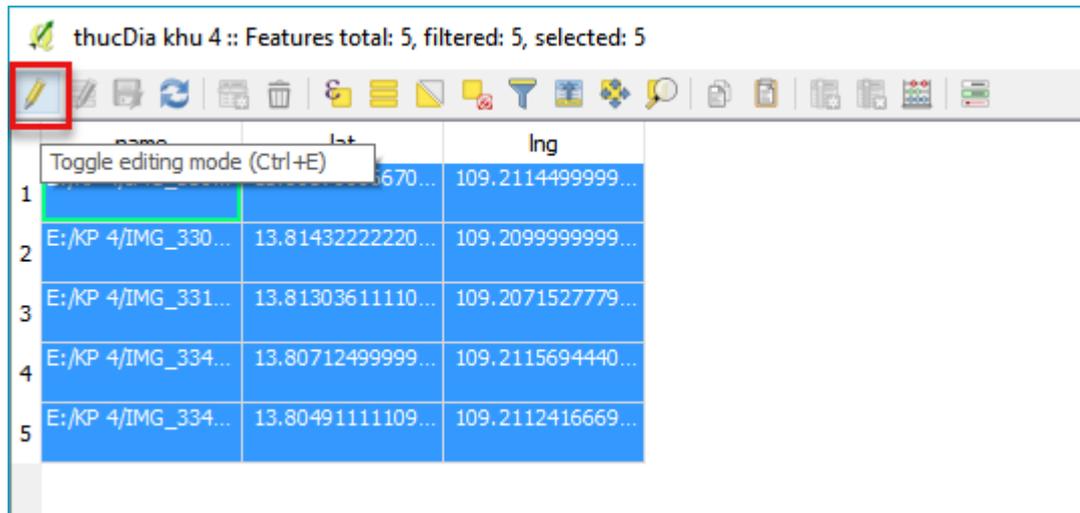
**Step 1:** Select point layer that needs to edit **attribute table** by left clicking at that layer.



**Step 2: Right click, select **Open Attribute Table****

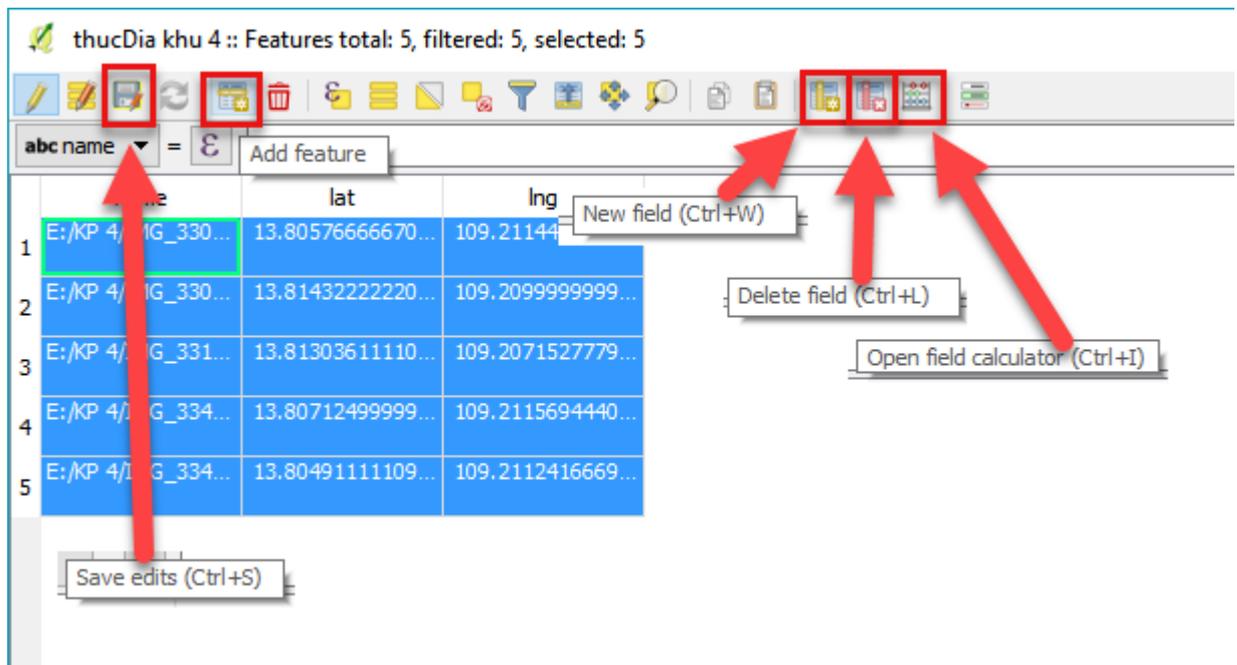


**Step 3: Click **Toggle editing mode** icon to start editing**



**Step 4: Click on icons on the tool bar for editing.**

- **Add feature:** to add new objectives on the layer
- **New field (Ctrl + W):** to add more information to the current objective
- **Delete field (Ctrl + L):** to delete one information of the current objective on the layer
- **Open field calculator (Ctrl + I):** to open the calculator function.
- Click **Save edits (Ctrl +S)** after finishing.

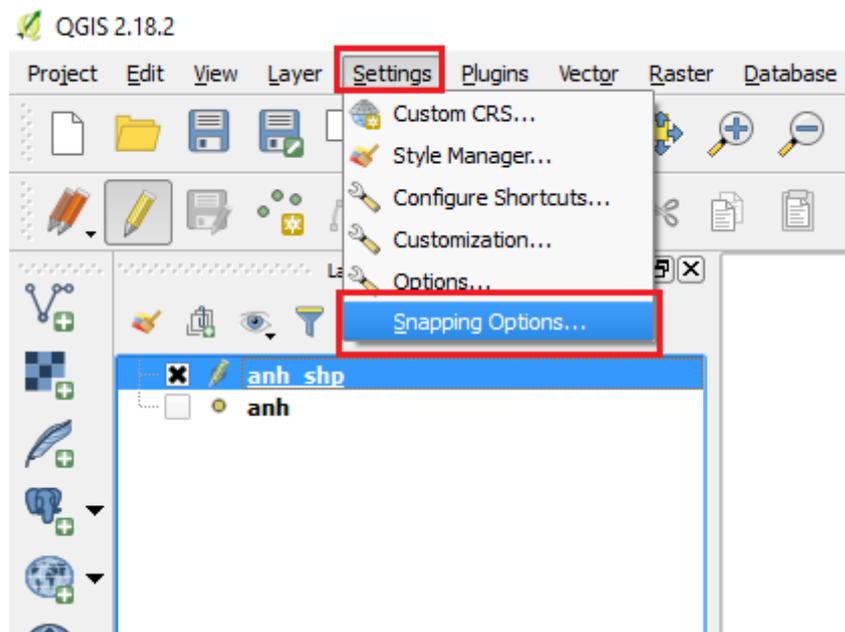


Click on **Toggle editing mode** icon again to stop editing.

#### 4.6. Snapping points in QGIS

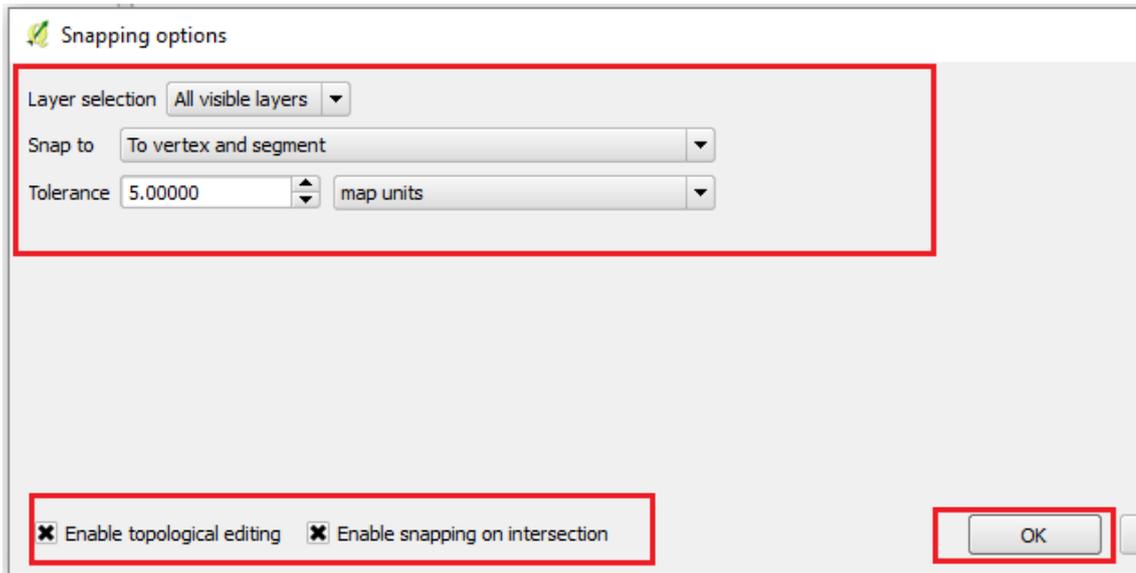
This tool automatically snaps the point of another object within the digitalized area (points, lines, and polygons).

Step 1: Go to **Settings**, click **Snapping Options**:



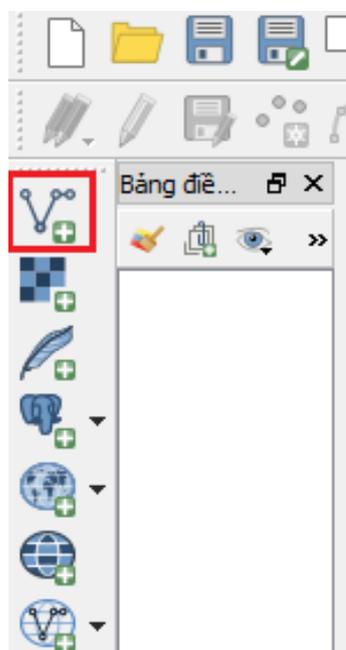
Step 2: Set the parameters for snapping points as follows:

- Layer selection: Select "**Current layer**" if snapping a point on the current working layer; or select "**All visible layers**" to snap points on visible layers; Or select "**Advanced snapping**"
- **Snap to:** select type "**To the vertex**"; type "**To the segment**" or type "**to the vertex and segment**".
- **Tolerance:** Usually choose from 2 to 5 mapping units.
- Tick the **Enable topological editing** and **Enable snapping on intersections**.



#### 4.7. Open a data layer

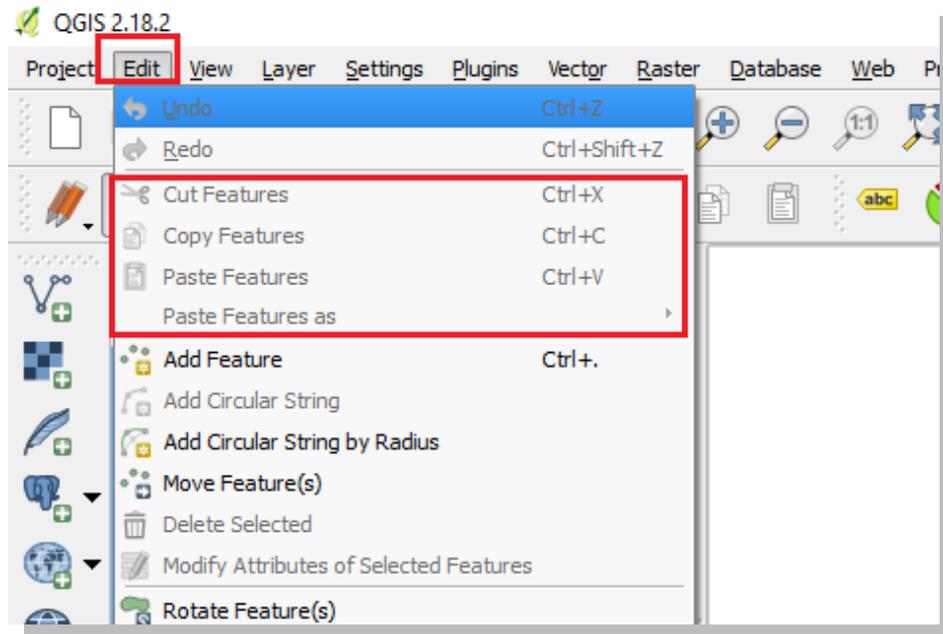
To open a data file (.shp format), click on the vector-shaped icon  to add a vector layer.



#### 4.8. Cut/ copy and paste the objects

Click "**Edit**" to cut or copy and paste objects across layers. Then click "**Cut Features**" or "**Copy Features**", then "**Paste Features**".

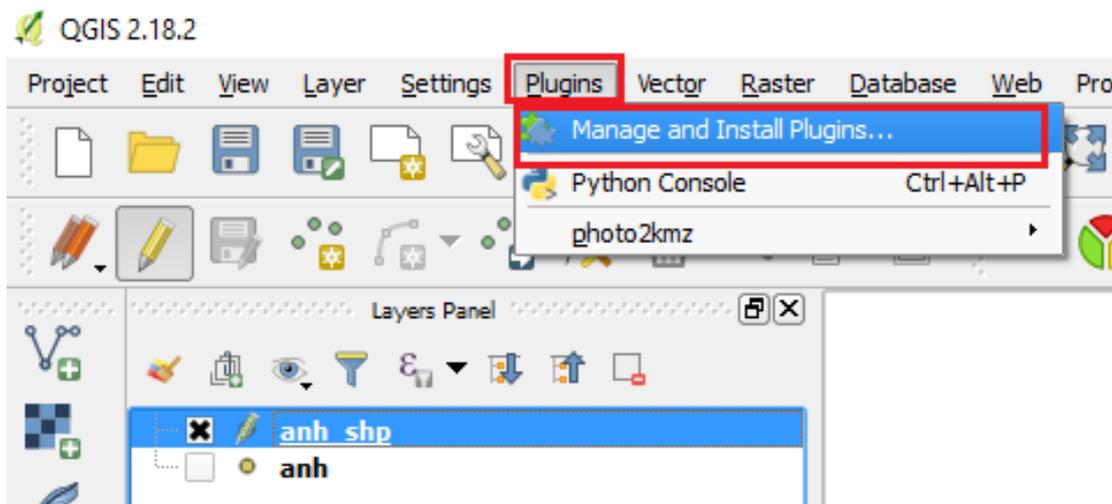
Note: the object selected for cutting / copying and then pasting should be activated on the pencil edit icon for that object.



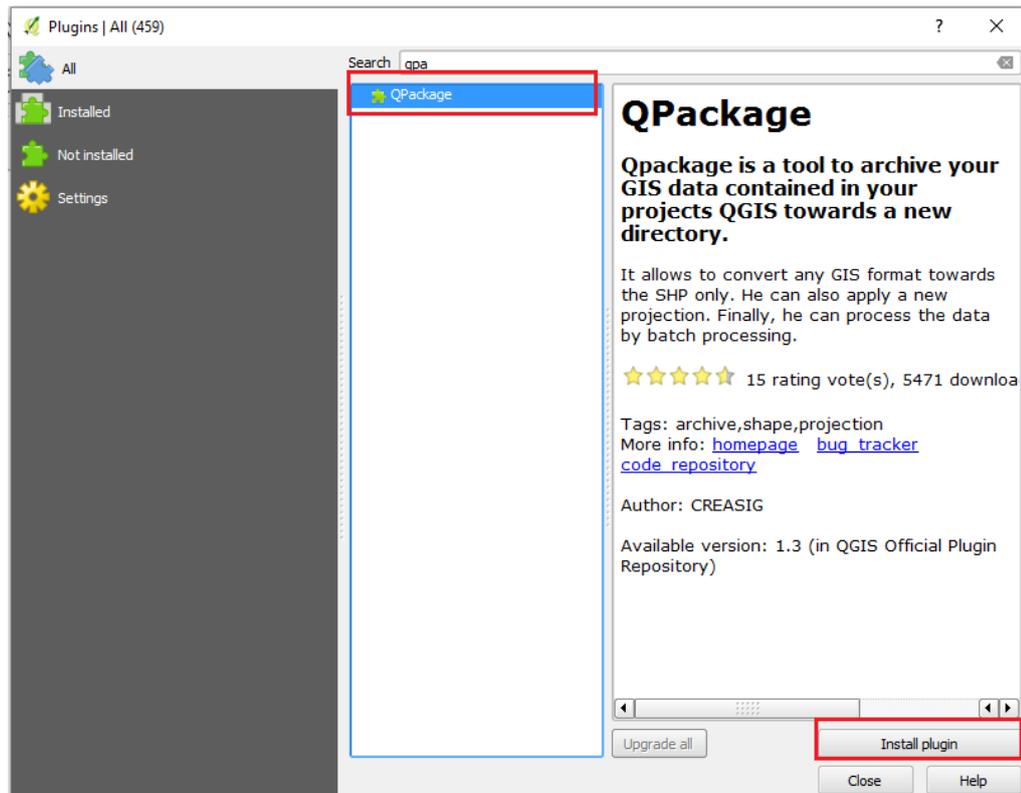
#### 4.9. Packing the data

During the process of developing a map, data layers can be saved in different folders or drives which would be hard to share to other computer with the same format or style. Data packing tool helps to pack them into the same folder. So, you could backup or copy to other computer to use with the same format.

Step 1: Go to "**Plugins**", click "**Manage and install plug-ins**"



**Step 2:** Search “QPackage”, then click “Install plugin”

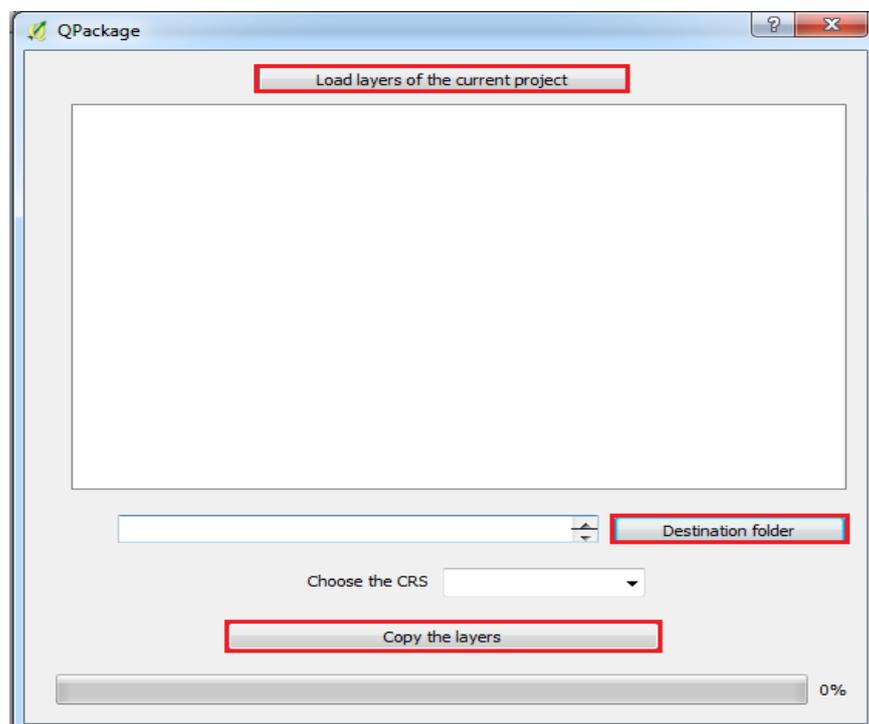


**Step 3:** After installation, select icon  and the following image will appear:

Select “**Load layers of the current project**”

Destination folder: find the path and create a new folder to save the layers created.

Click “**Copy the layers**”



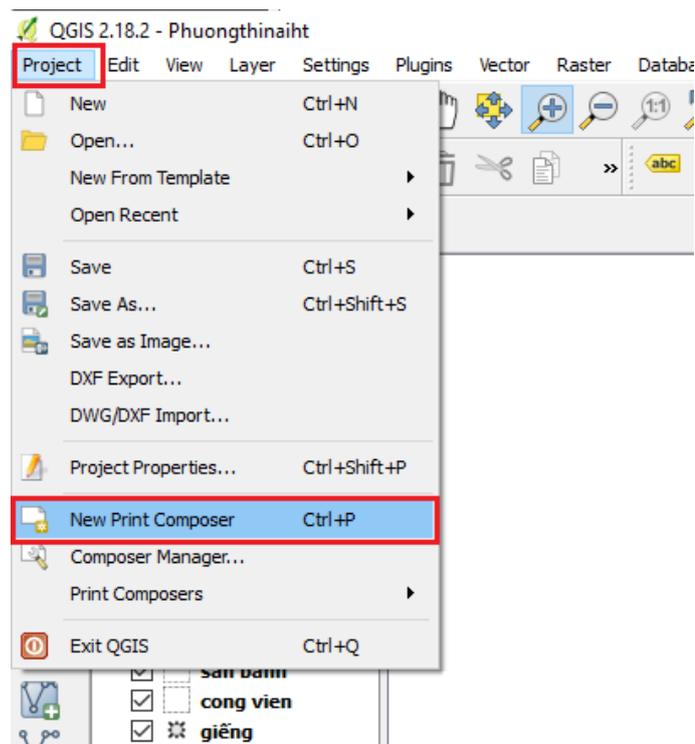
## II. EDIT AND PRINT THE BASE MAP

This ensures that information and data layers are shown on the map in a manner of consistency, understandable and friendly to users. The main contents in this step include:

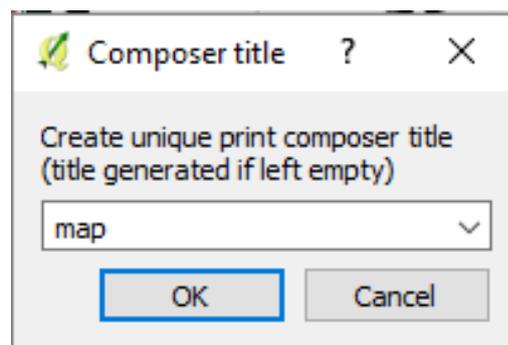
- Select paper size and orientation of the map
- Map scale
- Coordinate system, formats and icons to be displayed on the map.
- Legends: position, content, font, etc.
- Direction indicator and direction pointer in the map

### 1. Add a new print out

#### Step 1: Choose **Project/ New Print Composer**

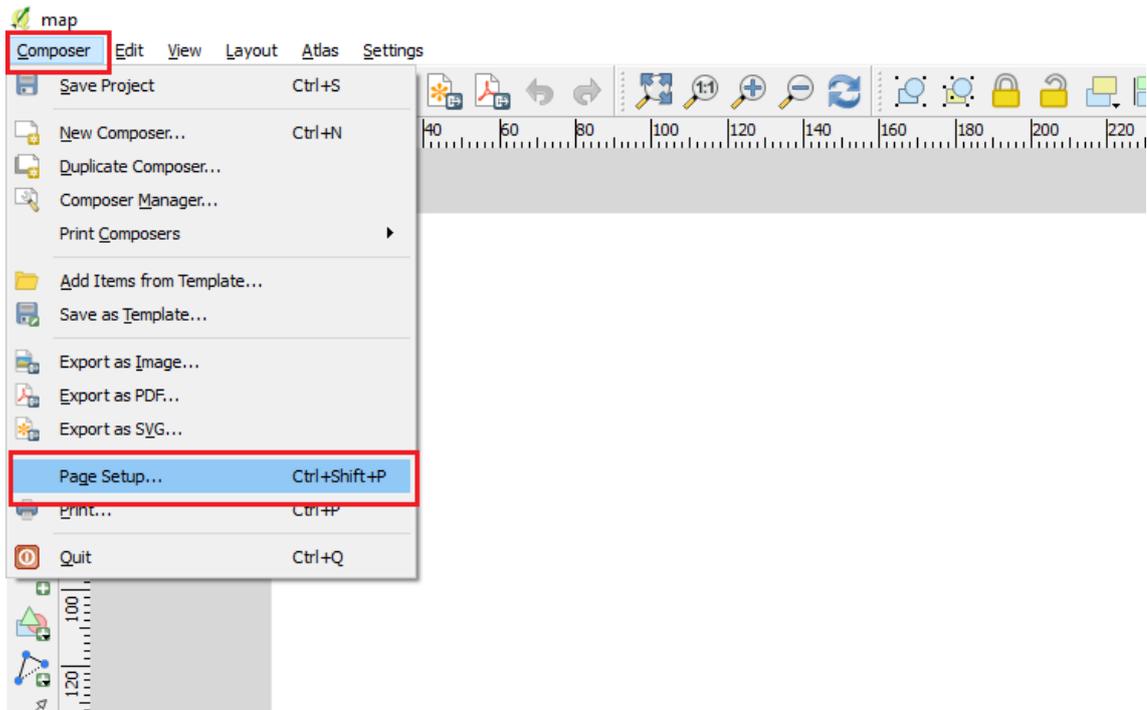


#### Step 2: Name the print-out and choose **OK**



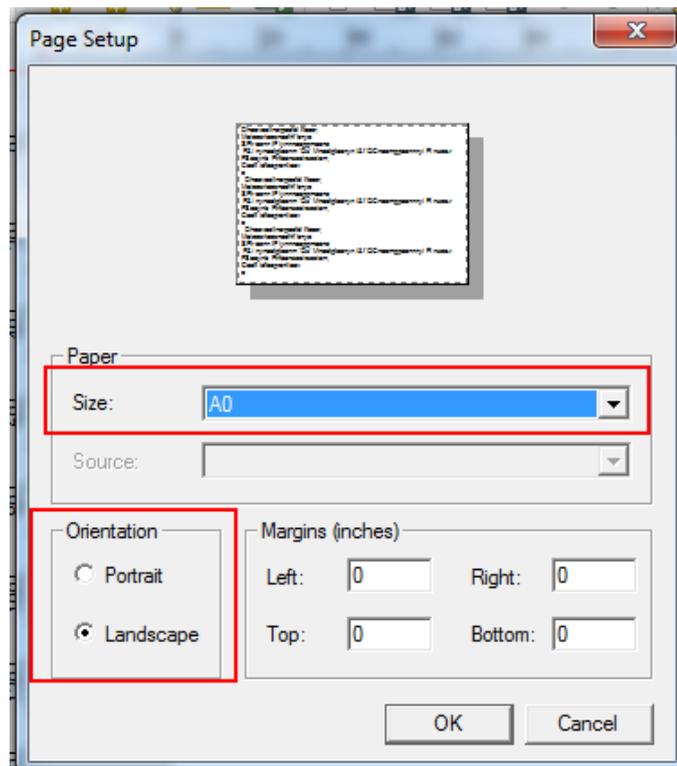
## 2. Select paper size and paper orientation

### Step 1: Choose **Composer/ Page setup**

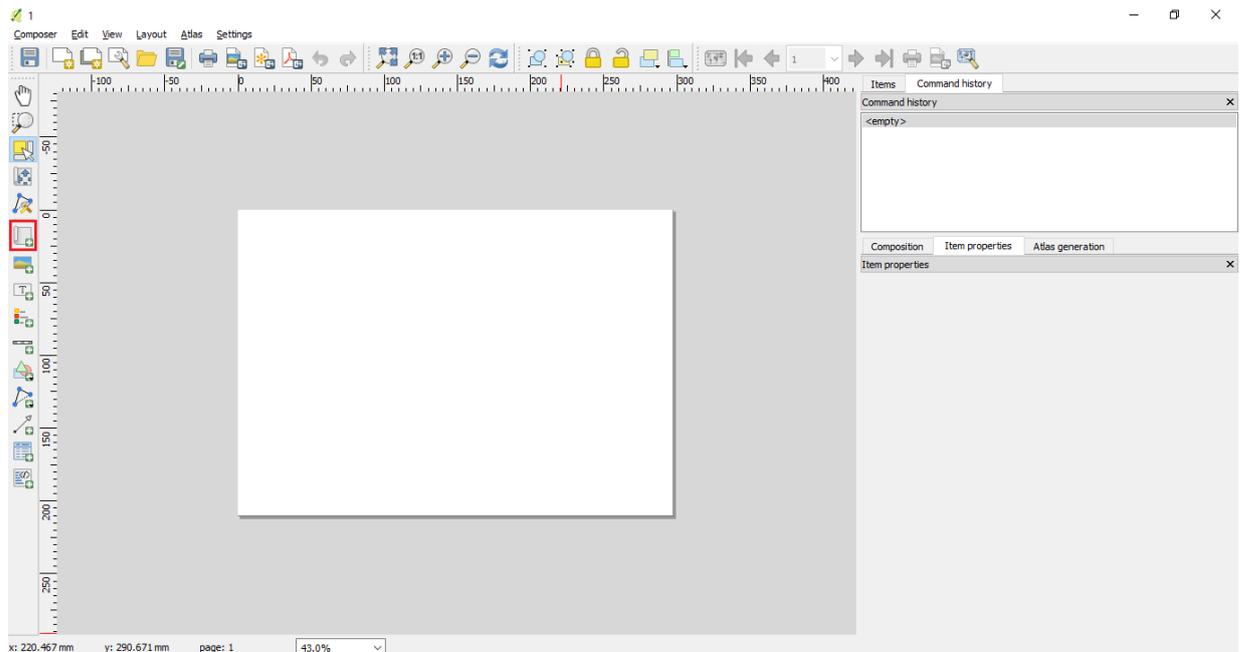


### Step 2: Customize some parameters:

- **Size:** A0 (or any paper size appropriate)
- **Orientation:** Portrait or Landscape



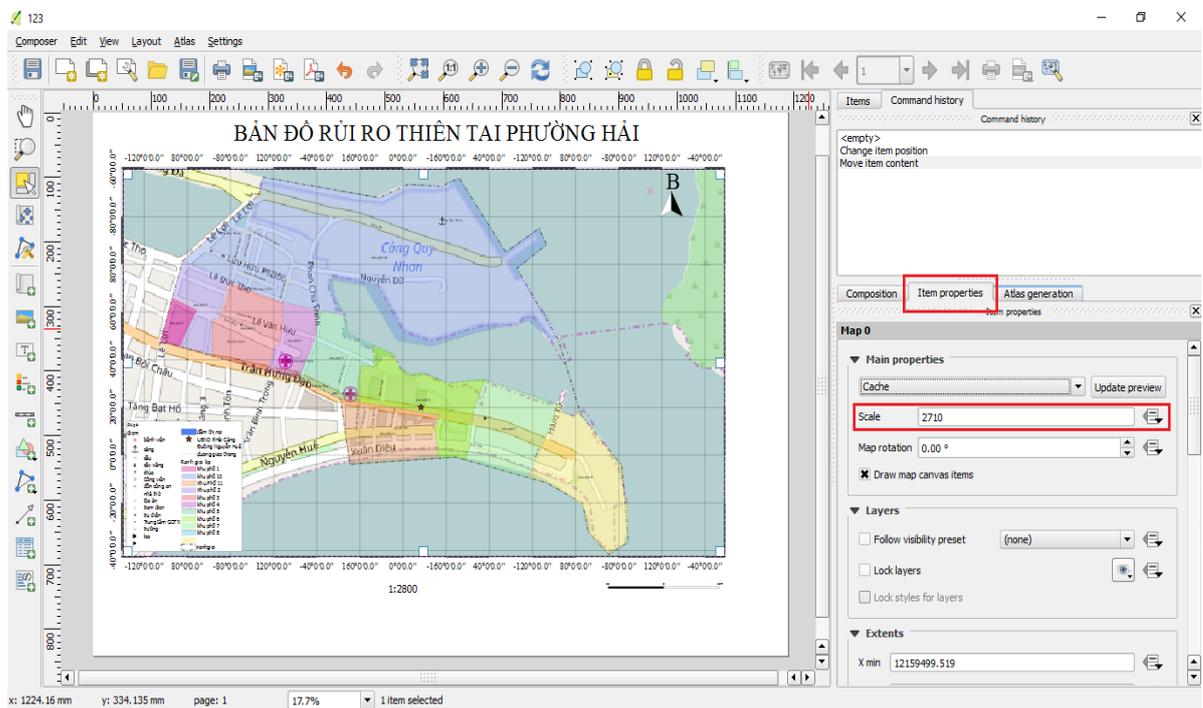
**Step 3:** Click icon  (new map) in the left of toolbar.



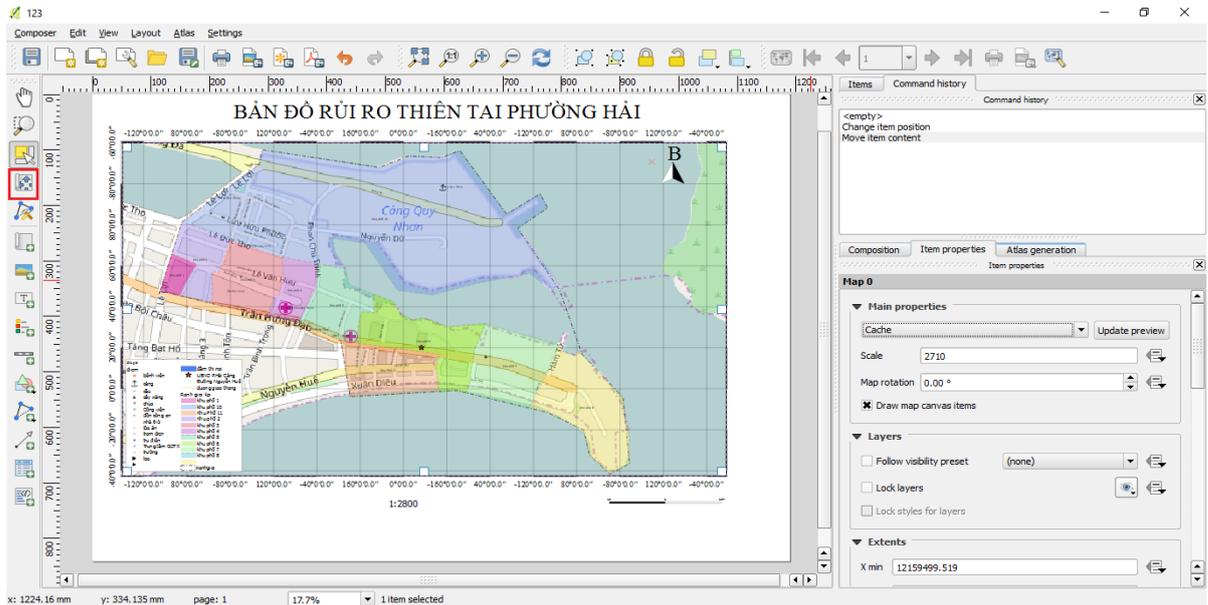
**Step 4:** Press and hold the left mouse button then drag the closed space on the screen to have a suitable map frame (the objects and layers of information on the map will be displayed in this frame).

### 3. Map scale:

**Step 1:** Choose **Item properties/ Scale** to fix *Scale* appropriate to the map.



**Step 2:** Click icon  to move the map around the frame.



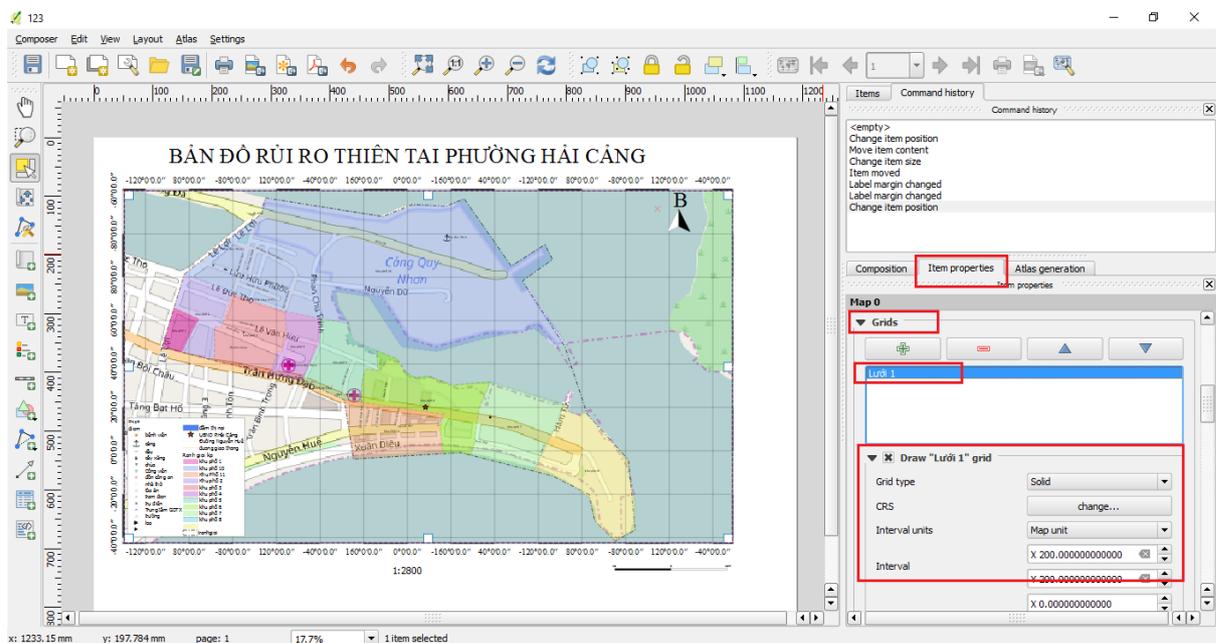
#### 4. Coordinate system, format and icons

Step 1: Click **Grids** on the tool bar on the right to create grids of map. Put parameters of coordinate grid as follows:

- **Grid type:** Solid
- **CRS:** Choose CRS (Coordinate system) coincided with the coordinate system used for the data layers.
- **Interval units:** Map interval

For CRS is UTM (unit in meter): 50 or 100 m.

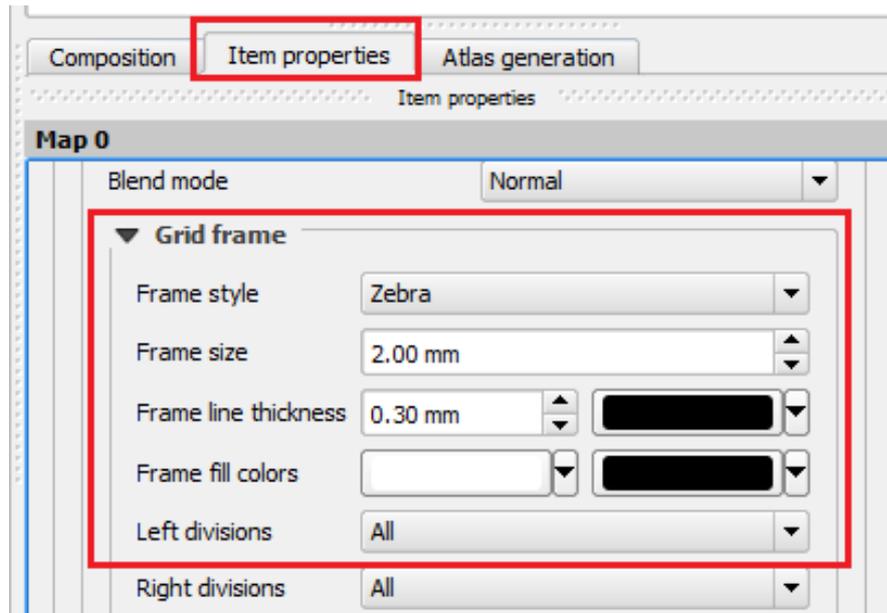
For CRS is latitude and longitude 0.05 or 0.1 degree.



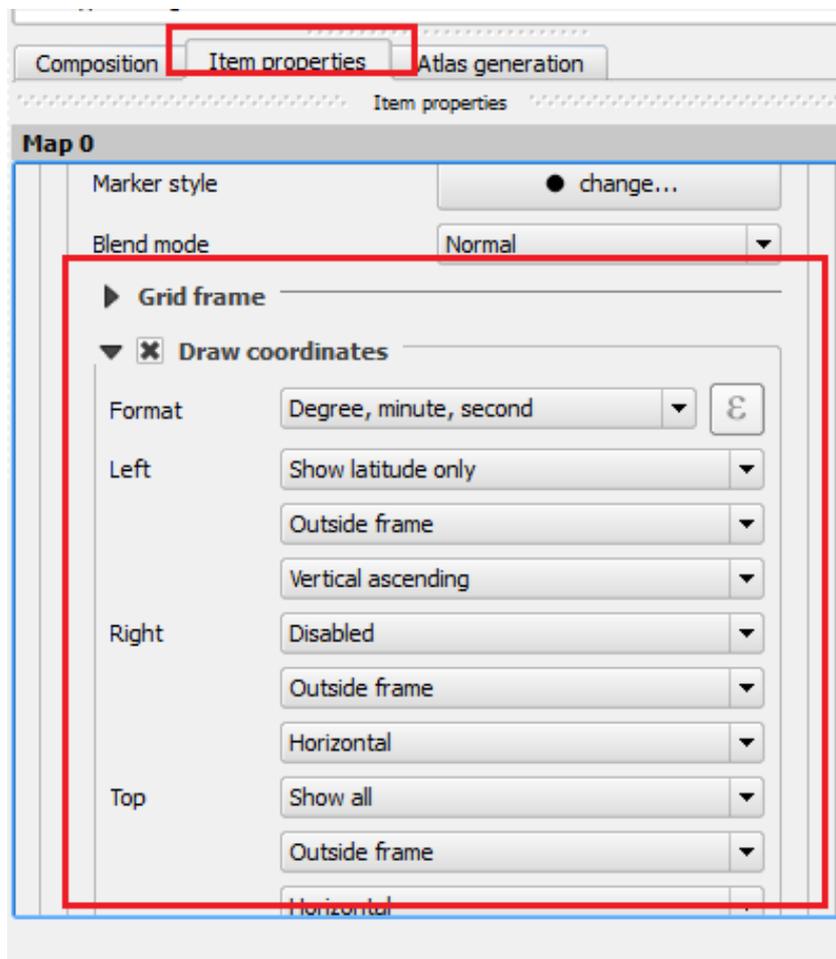
Step2: Choose **Grid frame** for frame setting, at appropriate paper size

- **Frame style:** Zebra

- **Frame size:** 1 mm
- **Frame line thickness:** 0.2 mm

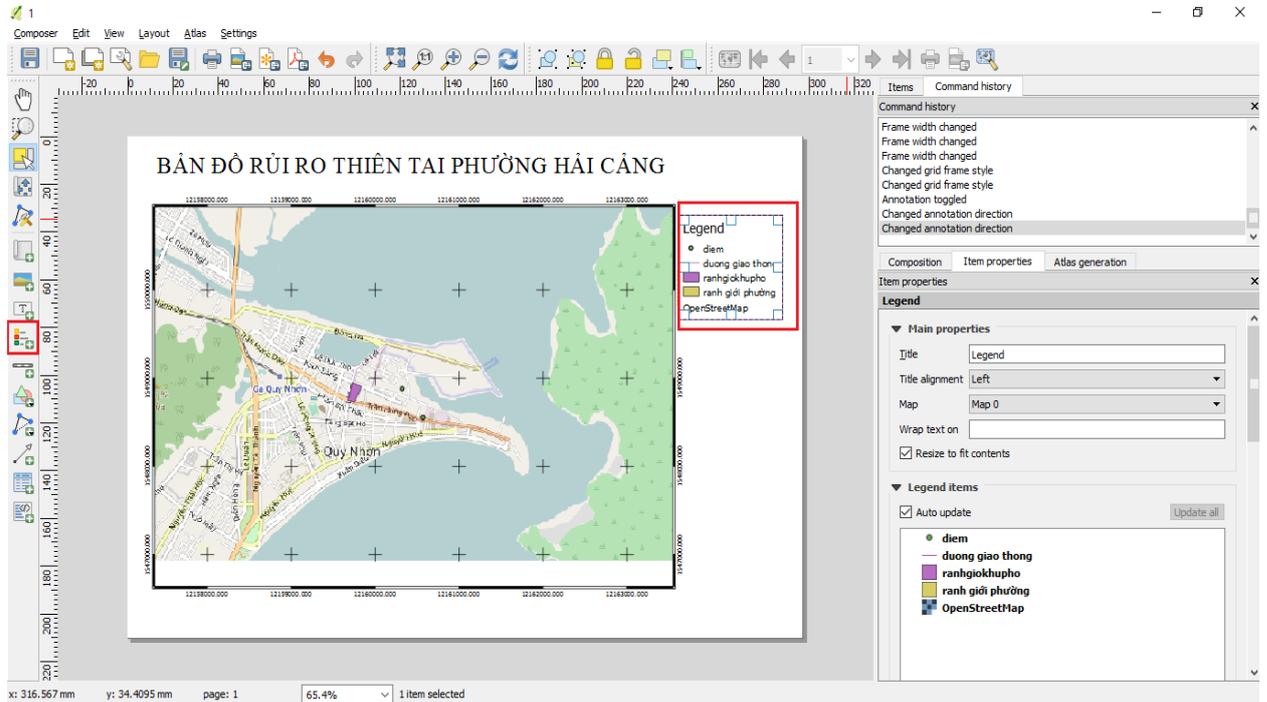


Step 3: Click **Draw coordinates**, then set parameters as below.



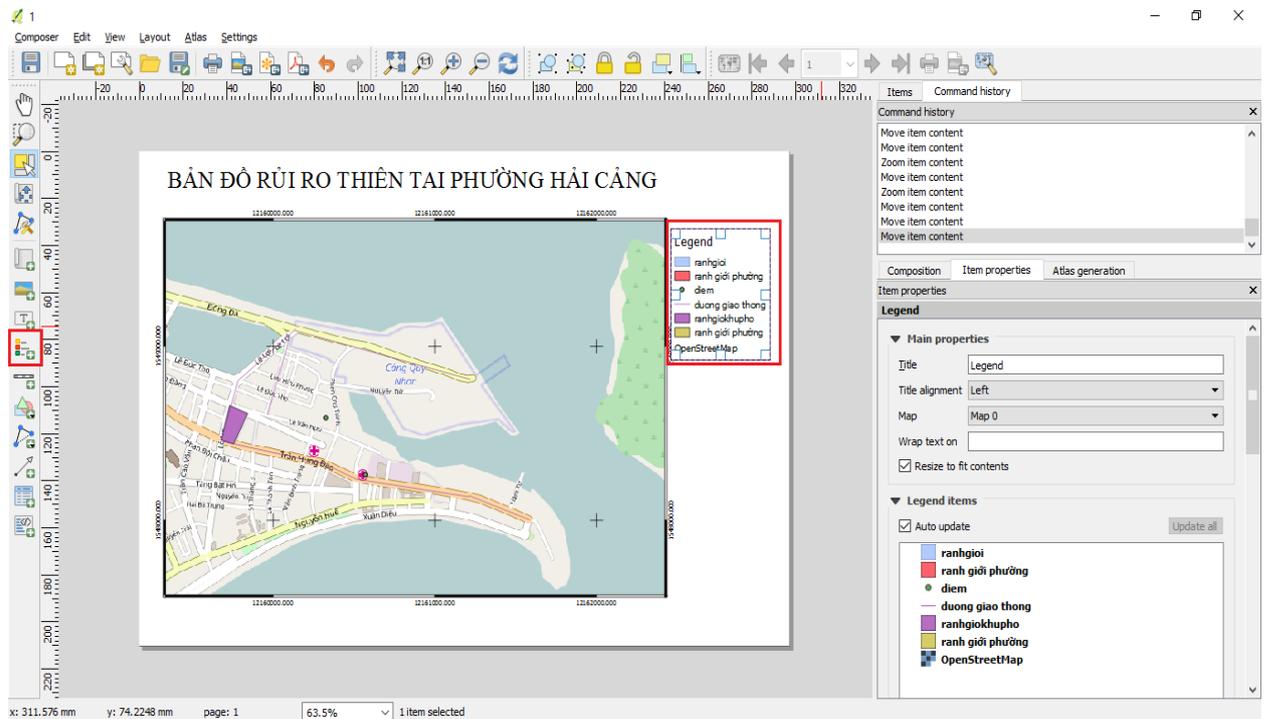
## 5. Legends: position, contents and font

**Step 1:** Create legends for map by using tool “Add new legend”  in vertical tool bar on the left.

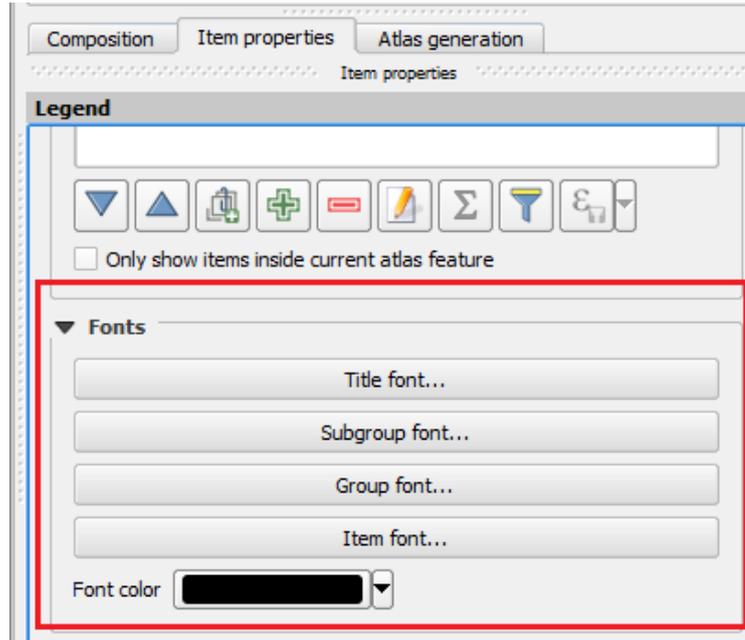


**Step 2:** Left click and drag an area of map in an appropriate position.

**Step 3:** Edit parameters under **Legend**.

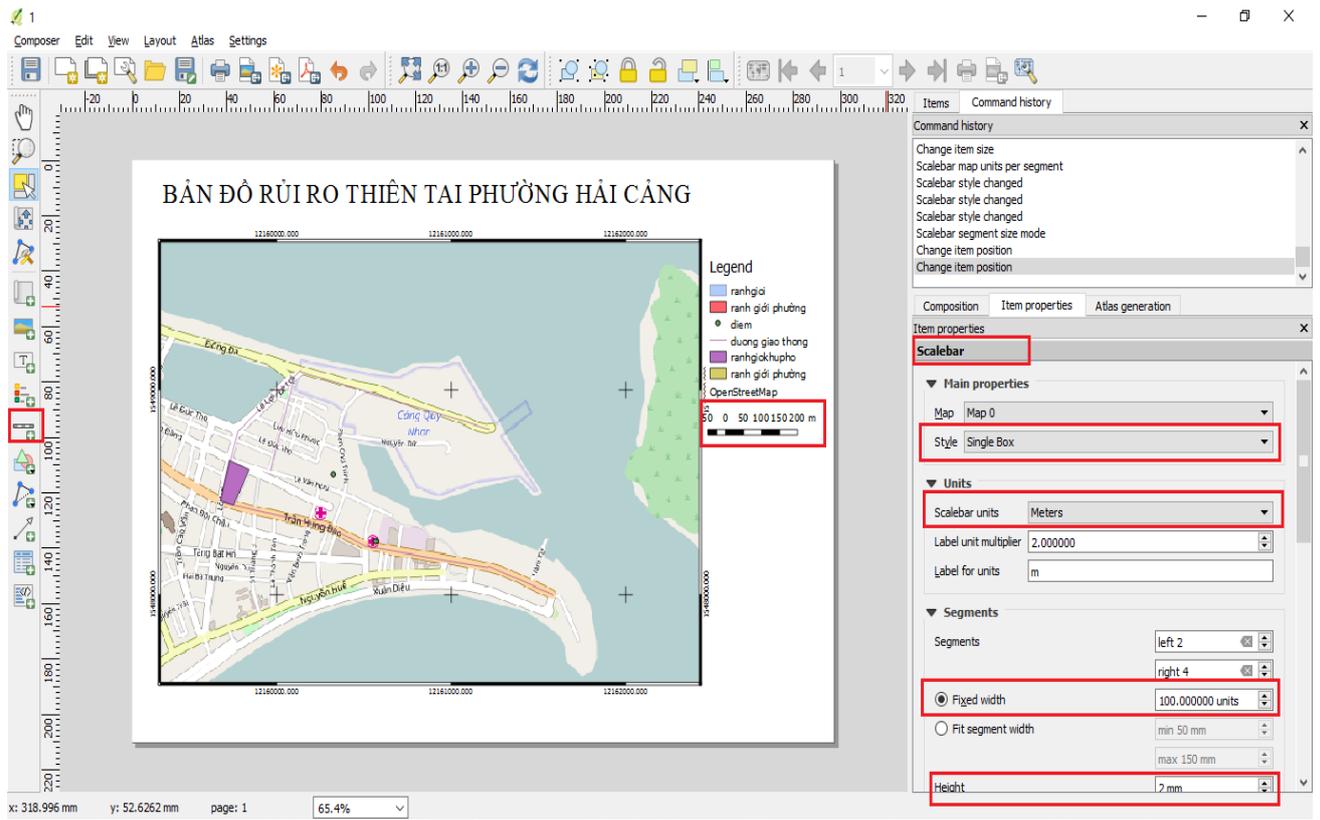


**Step 4: Edit Fonts.**



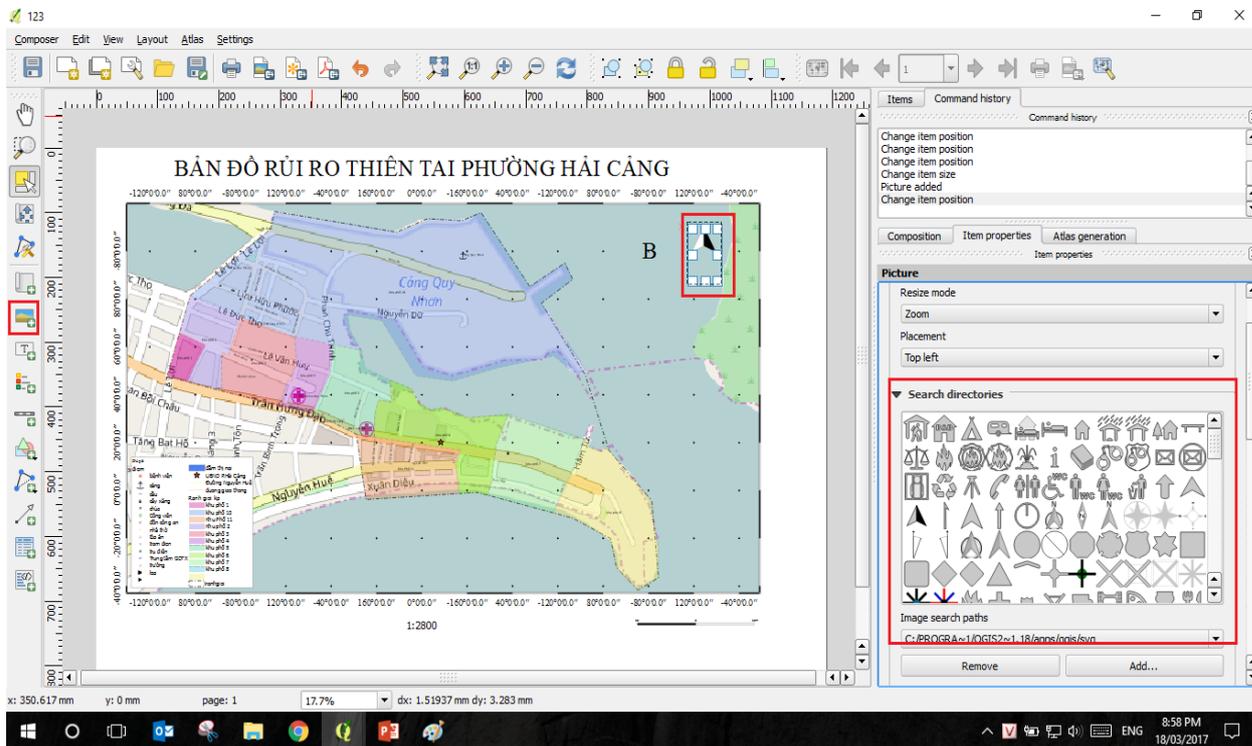
**6. Scale bar and direction indicator**

**Step 1:** Use tool “Add new scale bar” to display scale bar in map. Left click and drag an area on the map in an appropriate position.

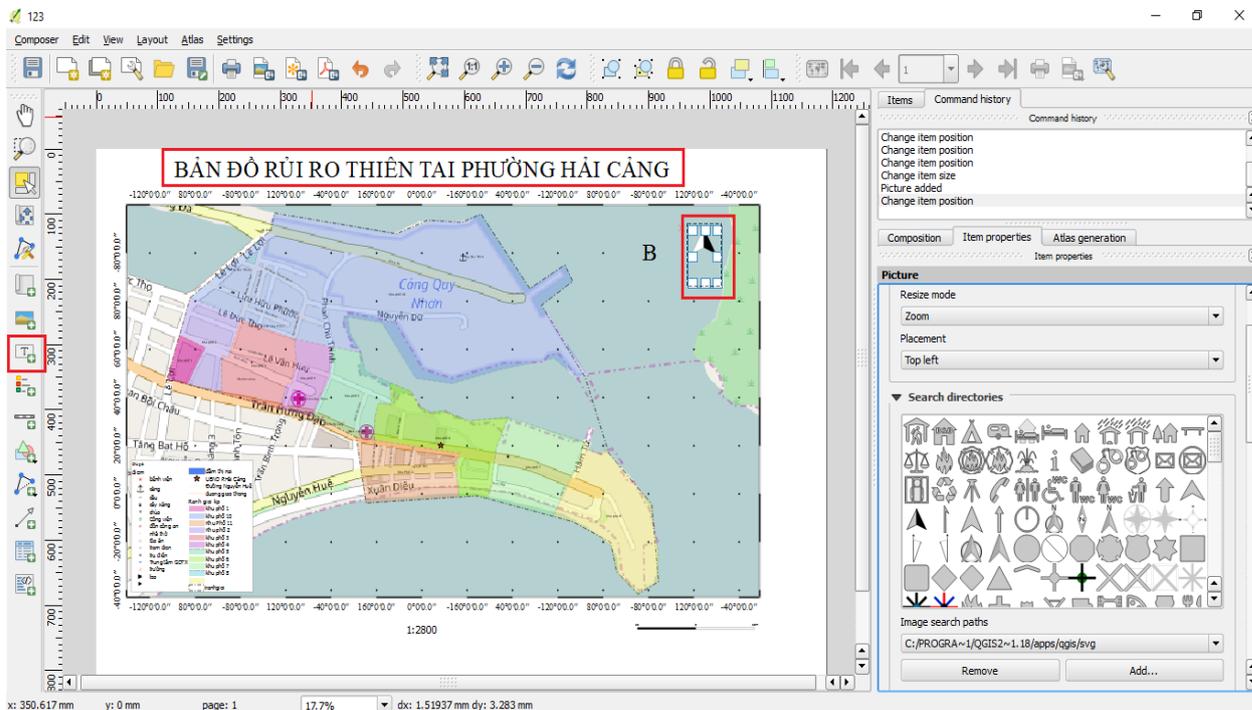


**Step 2:** Use tools “Add image”  in vertical tool bar on the left to add a direction indicator on a map. - Left click, drag an area on the map in an appropriate position.

- Choose **Search directories** on the right, and select an appropriate image

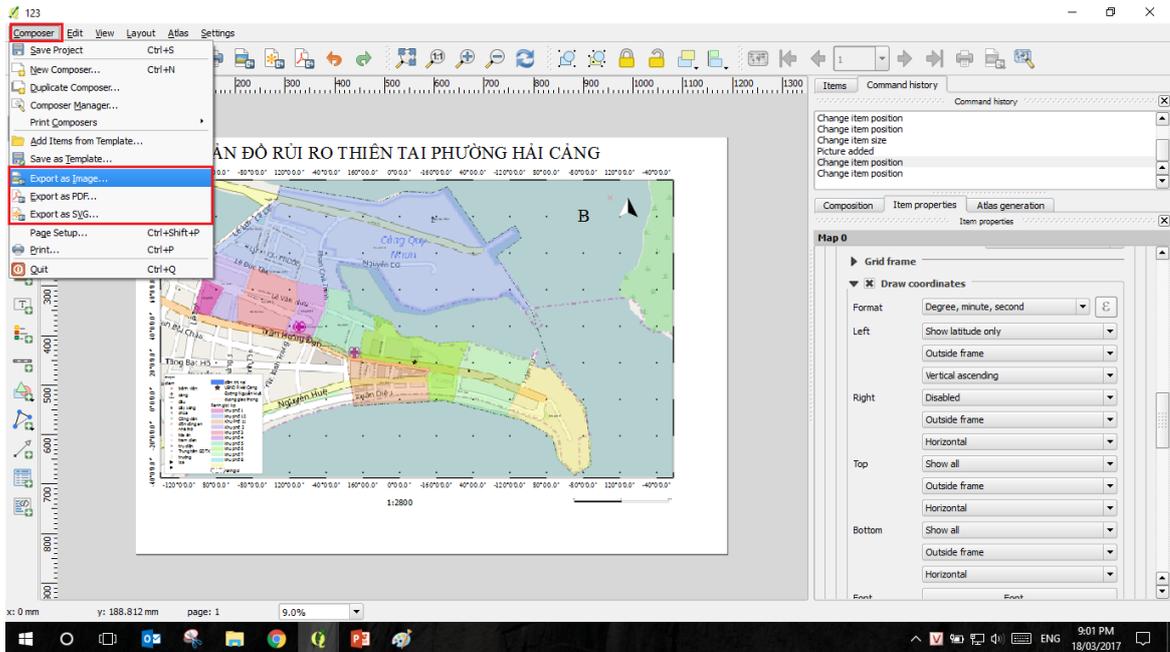


**Step 3:** Use tool “Add text”  to add name of the map and adjacent areas.

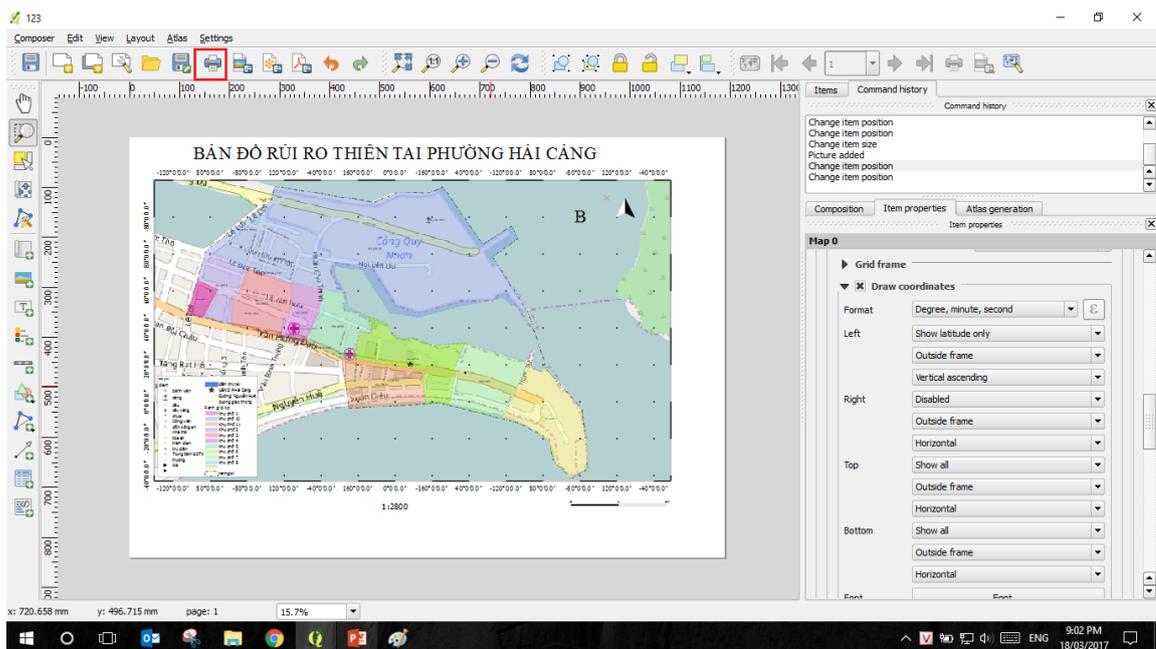


## 7. Export/print map

After completing the development of map components, we can export maps into image files for print by using the tool **Composer/ Export as Image**.



You can print map directly from the software by clicking the icon  in the toolbar.



### Note for printing

Resolution for printing images shall be suitable with the size of the map and level of detail required. If the size of the map is designed to frame of small sized paper (A4, A5) users can choose high-resolution (200 dpi – 300 dpi), for the large sized map, you can select the mode less than 200 dpi.

## PART 3

### UPDATING INFORMATION AND DATA TO THE MULTI-HAZARD RISK MAP USING QGIS SOFTWARE

There are two methods to transfer information and data from a paper map into the digital map:

- Directly (or manually) transfer the objects / information from paper- maps into the digital map;
- Transfer the information using scanned files or photos of the paper- maps and manipulation of coordinates.

#### I. TRANSFER MANUALLY INFORMATION FROM PAPER MAP INTO DIGITAL MAP

- a) *Information:* Collected from community. Information displayed in the base map is printed out
- b) *Updated by:* local practitioners
- c) *Method:* Put position of objects manually or directly into digital map by creating points/lines/polygons. (See detailed guidelines on Creating a Point / Line / Polygon and put the point/ line/ polygon on the map in Part 2).
- d) *Product:* Multi-hazard risk map of the communities (e.g. hamlet and ward).

Accuracy of update largely depends on capability of local practitioners due to the naked eyes comparison of updated positions of objects between paper map and digital map.

For example: In a paper map, local people directly position safety houses for evacuation in occurrence of flood and storm. Local practitioners shall make manual identification (by their naked eyes) of positions of safety houses in digital map and paper map; and supplement these positions in digital map by creating points.



**Notes:**

- Scanning map is subject to size of map paper; for small-sized map, scan whole in once, for large sized map, separate into pieces to scan for the whole map.
- Scanning will produce more accuracy than taking photo for the purpose of manipulating coordinates.
- Product after scanning/snapping shall be an image file in the format of JPEG (.jpg). For development of a multi-hazard risk map, resolution of images ranks 200 - 300dpi.

Object information in map is classified into 4 basic types including:

- ✓ Point objects: Shown the objects of a small area but deemed to very important information and indispensable such as: Headquarters of offices, the buildings, bridges, etc...
- ✓ Line objects: Shown unclosed objects of geometry, including straight lines, broken lines and arc such as: roads, rivers, streams, etc...
- ✓ Area (Polygonal) objects: Shown the closed objects of geometry covering an area of a certain area, including the polygons (polygon), oval, ellipse (ellipse) and rectangular, for example, boundary territory of one commune, lakes, forests, etc...
- ✓ Letter objects: Shown non-geographical objects including labels, titles, notes, etc.

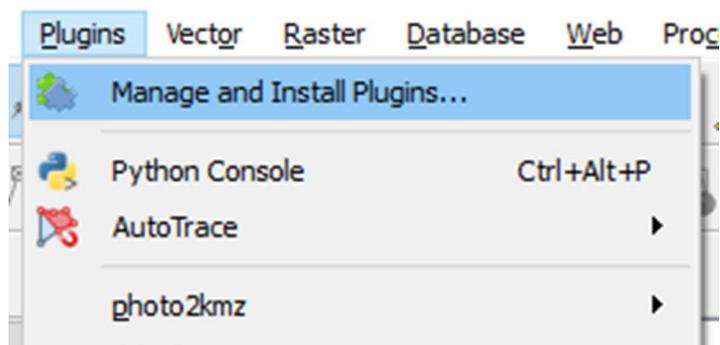
**Step 2: Manipulation of coordinates**

Manipulation of coordinates is the most important step in developing a digital map from paper map. Manipulating is the process to put location (coordinates) of points, image objects coincided with digital map.

Firstly, Open QGIS software and all layers on the base map that we had done (it may not be necessary to open the Open Street Map in this step).

For manipulation of coordinate system, it is required to use plugin in QGIS. To check the installation of plugin, perform steps as follows:

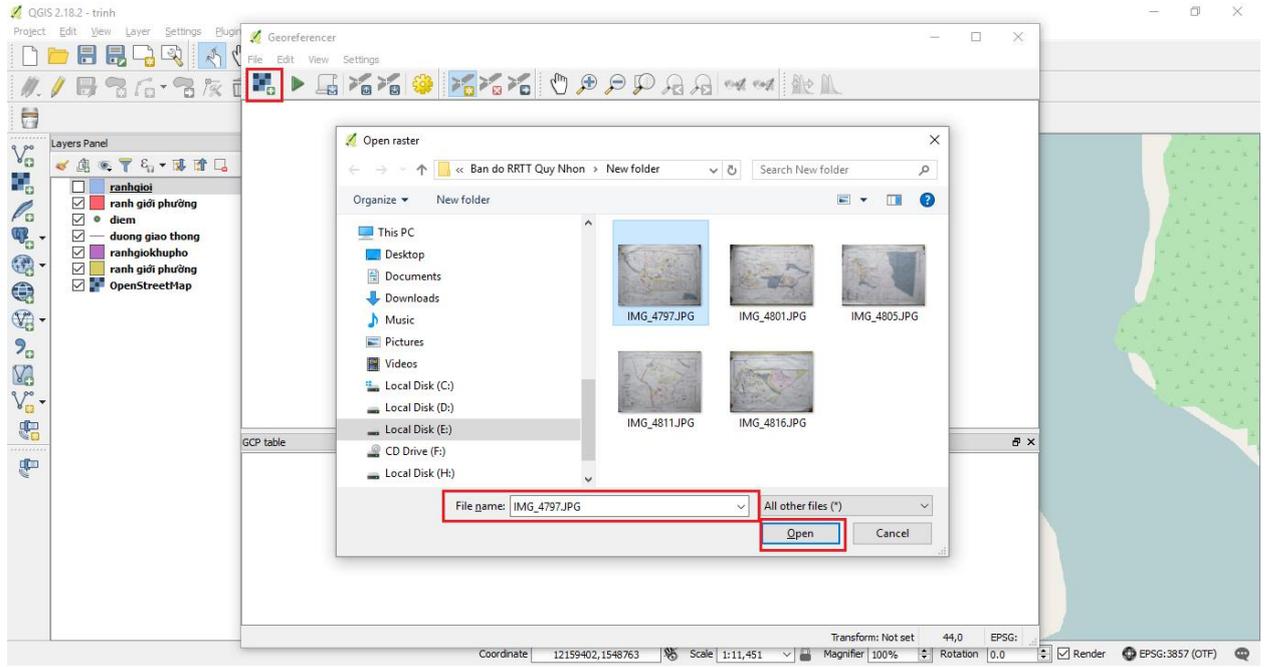
Step 2.1: Choose **Plugins** in the top toolbar, then choose **Manage and Install plugins**.





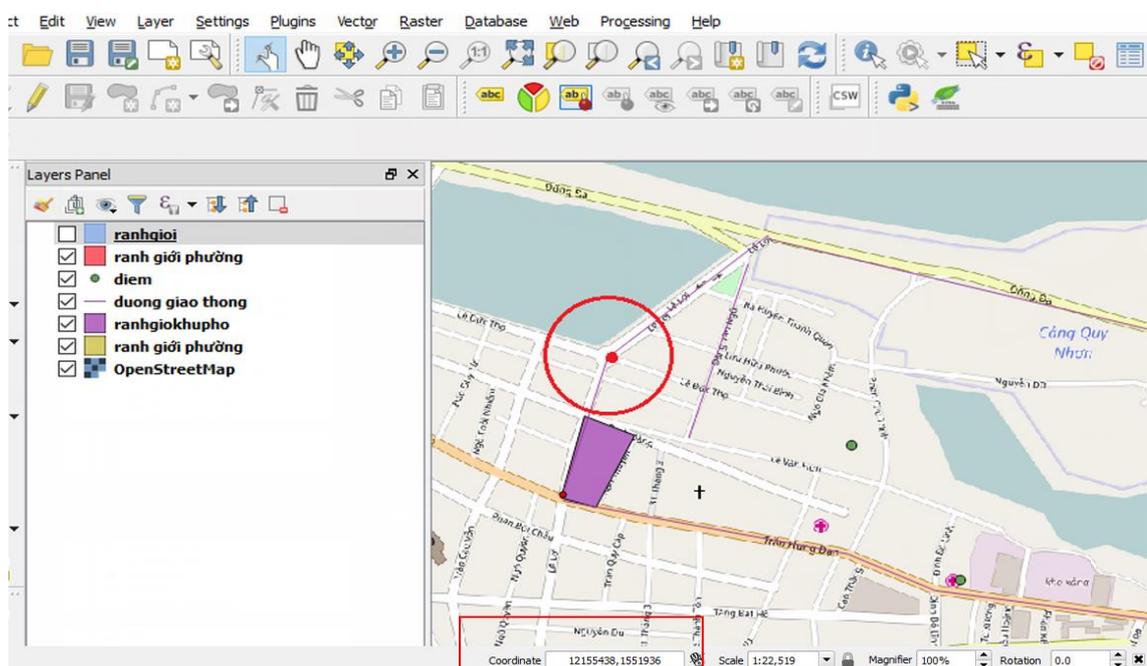
### Step 2.4: Open snapped/scanned photos in QGIS software

- Click icon  and move cursor to folder containing file of snapped/scanned photos (image file commonly ended .JPG or .PNG) and select the file.
- Choose **Open**

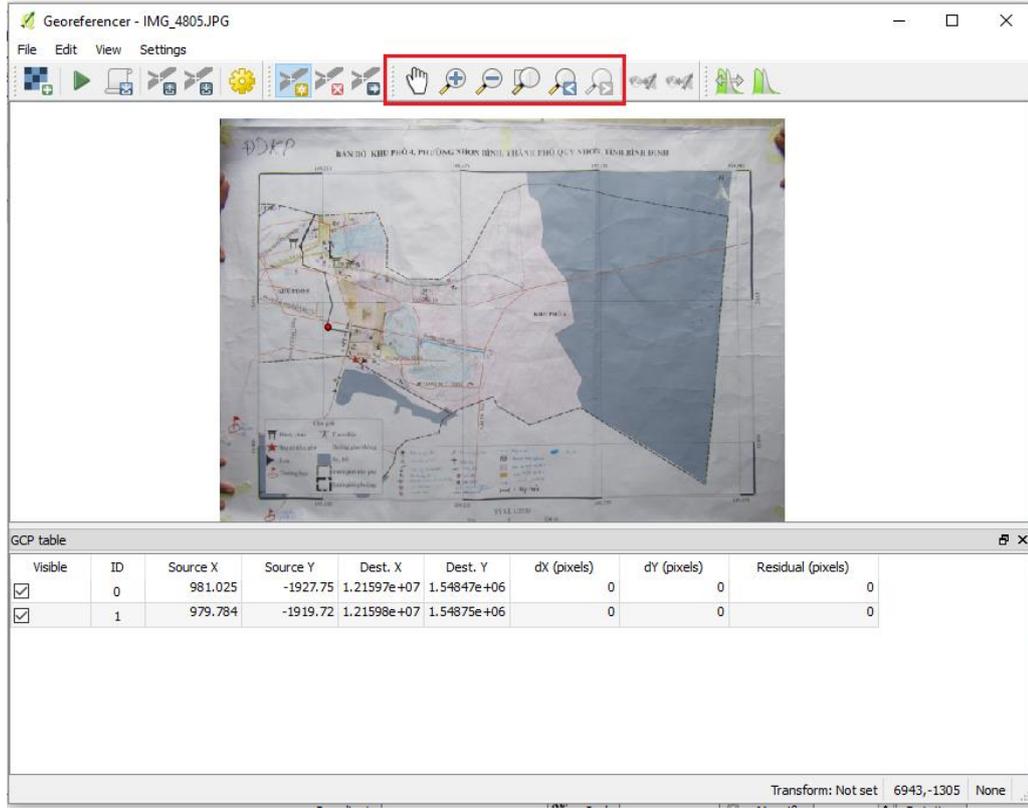


### Step 2.5: Choose points in digital map for the manipulation of coordinate system

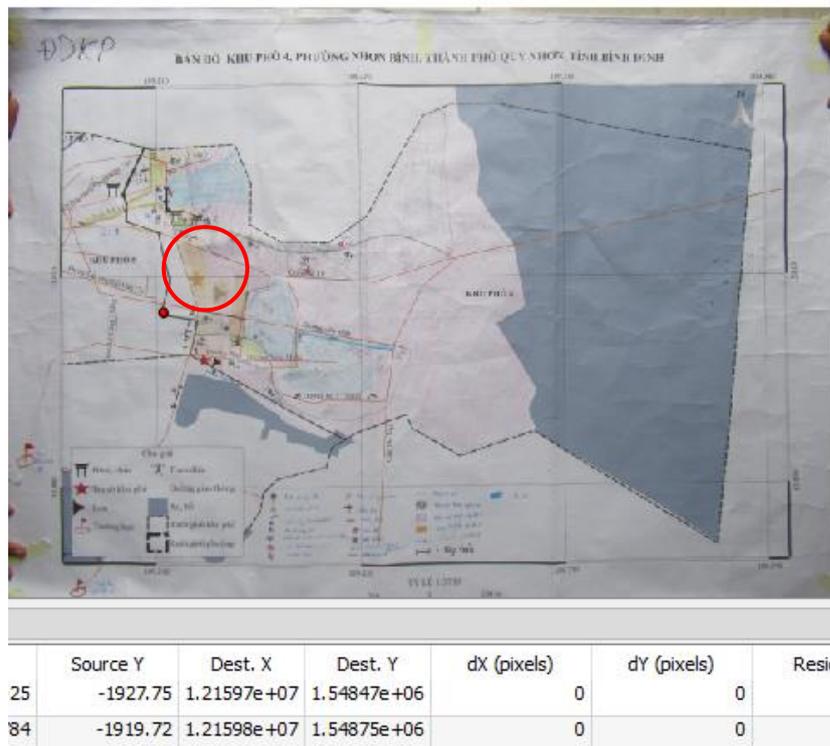
- The manipulation of coordinate system requires at least 03 points arranged in 03 corners of the map (the more points you get, the more accurate the manipulation is).
- You may choose points that are easily identified on the map by dragging cursor over the point, the coordinates will display at the bottom of the screen.



Step 2.6: Use supporting tools to select points



Step 2.7: Click the icon  on the tool bar, then move cursor to respective positions of photos (.JPG) as you want.

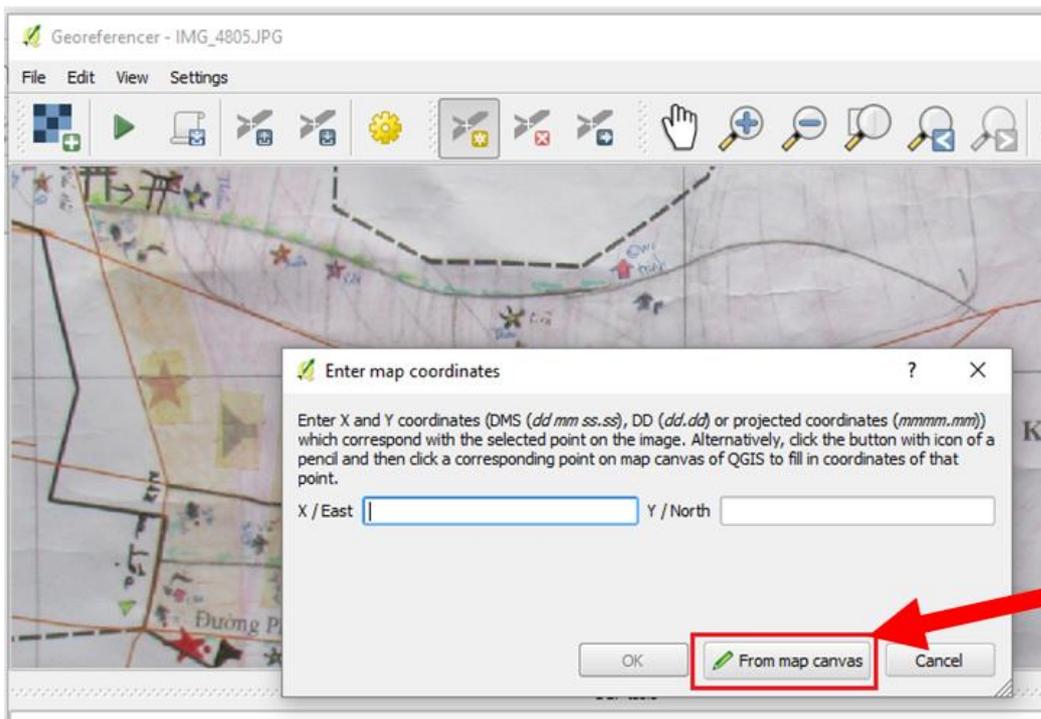


Note: Also, we can chose the point which is the cross of Latitude (X) and Longtitude (Y); coordinate of 5 points in the scan map are as the table below:

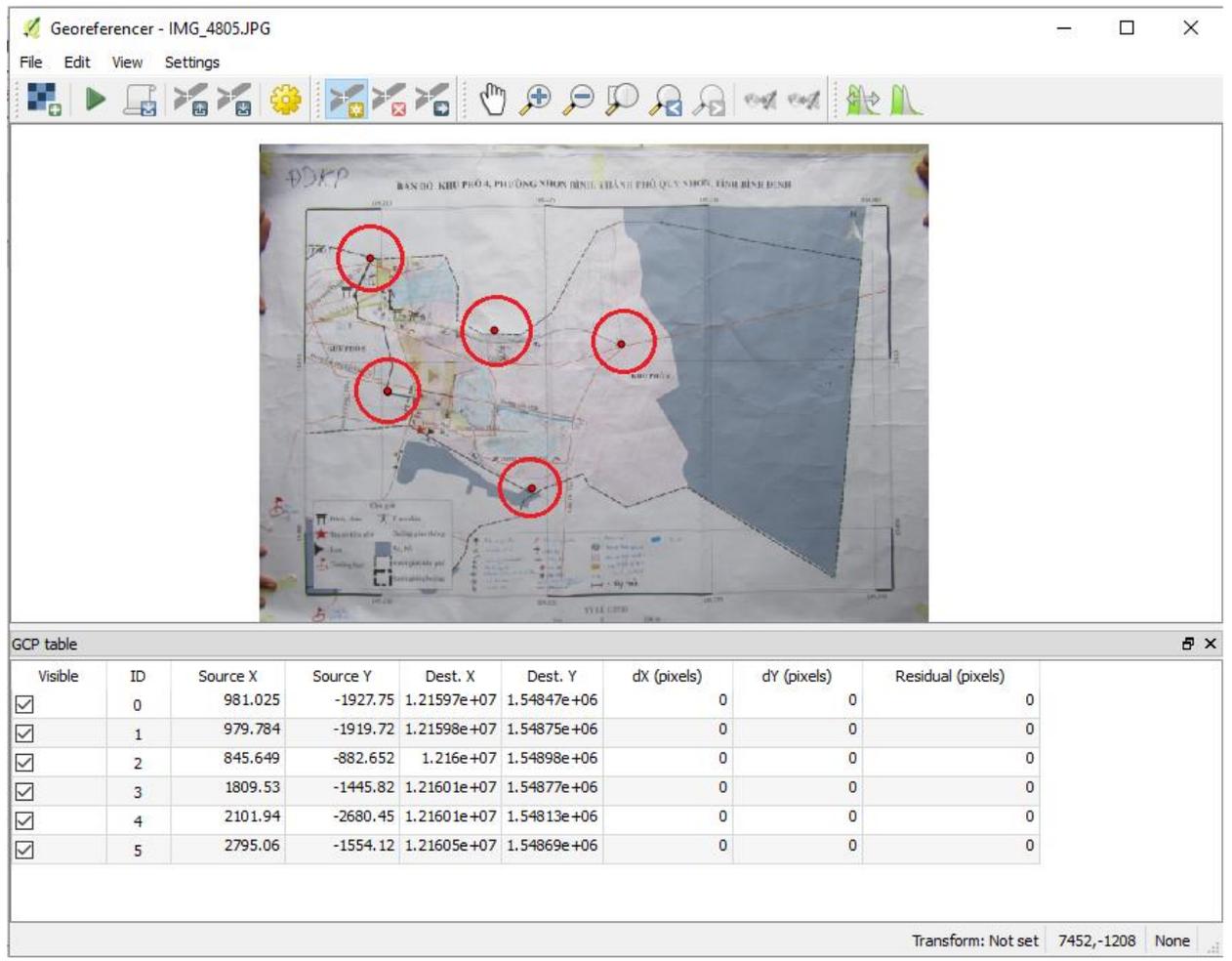
<b>Point</b>	<b>X</b>	<b>Y</b>
1	109.200	13.811
2	109.205	13.815
3	109.210	13.810
4	109.203	13.812
5	109.204	13.813



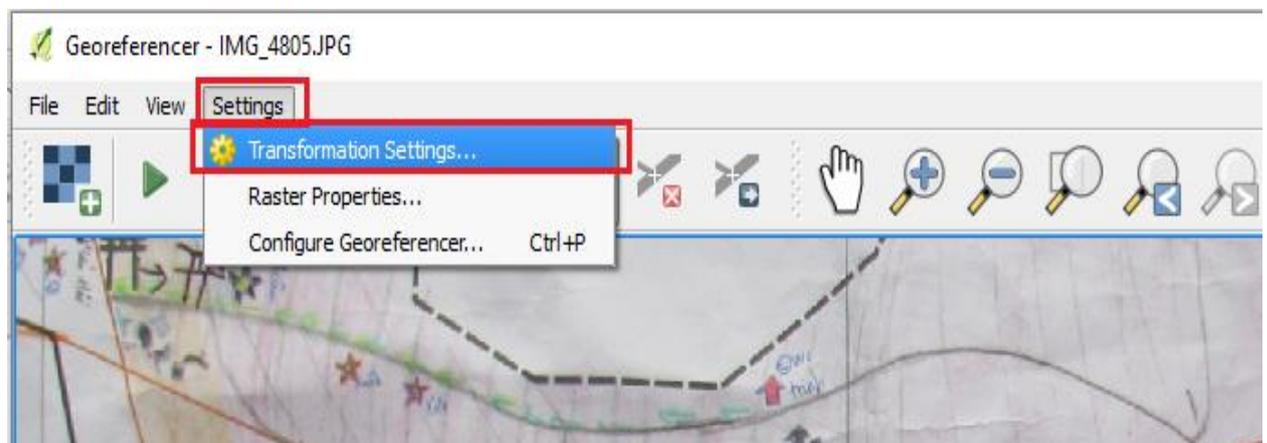
Step 2.8: Enter coordinates of that **point** or click on **“From map canvas”** to choose the same position in QGIS interface.



Step 2.9: After entering coordinates of 05 points, window is displayed as follows

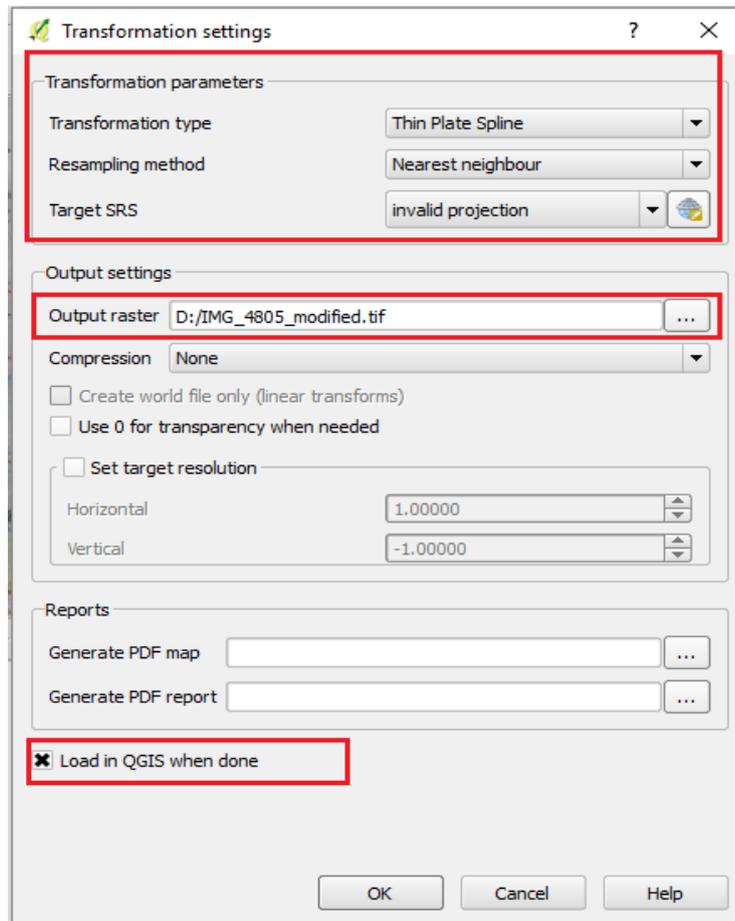


Step 2.10: Choose **Setting/ Transformation Settings...** to offset the transformation parameters.

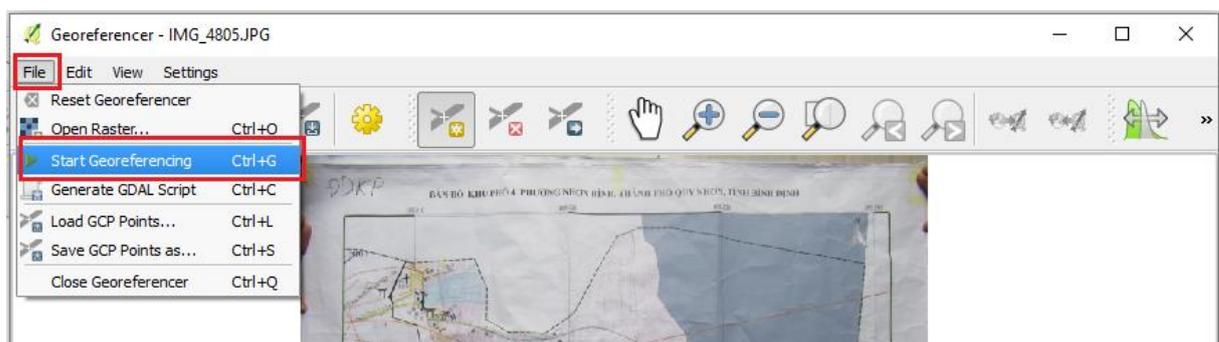


Some parameters shall be modified as follows

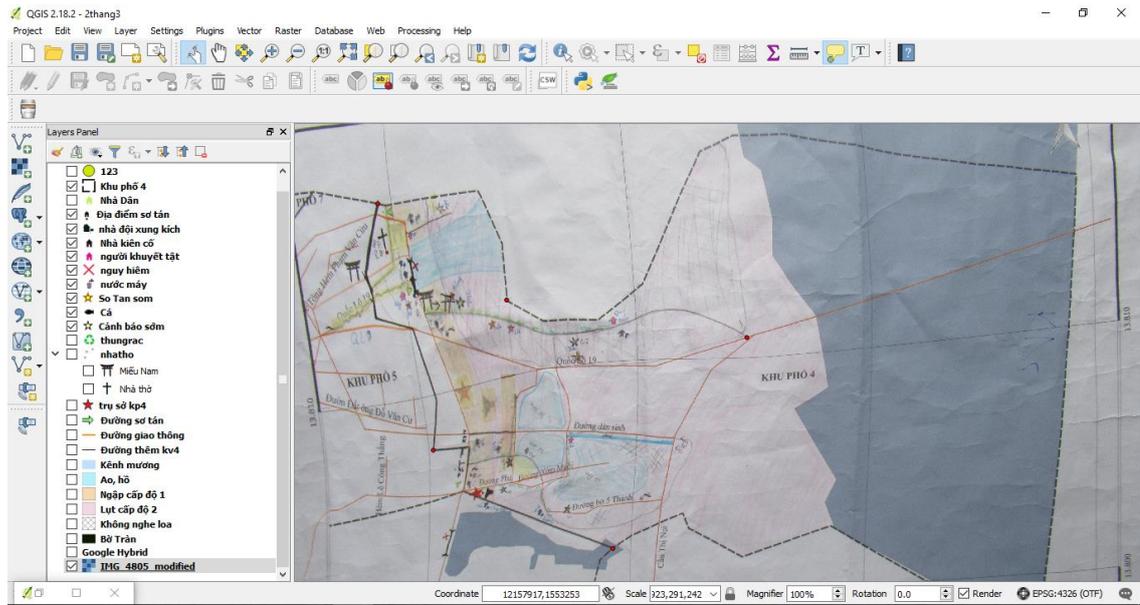
- **Transformation type:** choose “Thin Plate Spline”
- **Resampling method:** choose “Nearest neighbour”
- **Target SRS** (Spatial Reference System): choose the same types of coordinates to the first base map.
- Output raster: Choose location to save photos after manipulation
- Tick “**Load in QGIS when done**”.



**Step 2.11:** Choose **File/ Start Georeferencing** for manipulation of images



**Step 2.12:** After manipulation, we can turn off the Geographic Reference window to test the result by overlapping several pre-built vector layers on the image to verify the accuracy of the manipulation.



**Step 3: Update new objects in digital map.**

After manipulation of coordinates system, update information and objects as follows:

- a) In case layers of points/lines/polygons are in place at the base map stage.
  - Choose available layers of points/lines/polygons
  - Update point objects into layer of points/line objects into layer of lines/area objects into layer of polygons. Refer to guidelines in Part 2, Section I.4
- b) In case no layers of points/lines/polygons are made, follow guidelines in Part 2, Section I.4

## PART 4

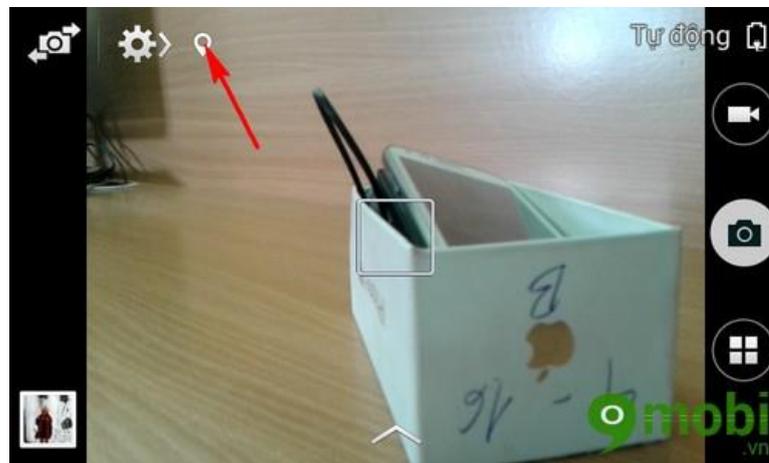
# COLLECTING INFORMATION, FIELD DATA BY GPS DEVICES, SMART PHONES AND UPDATING THE MULTI-HAZARD RISK MAP

### I. SETTING SMARTPHONE POSITIONING FEATURES

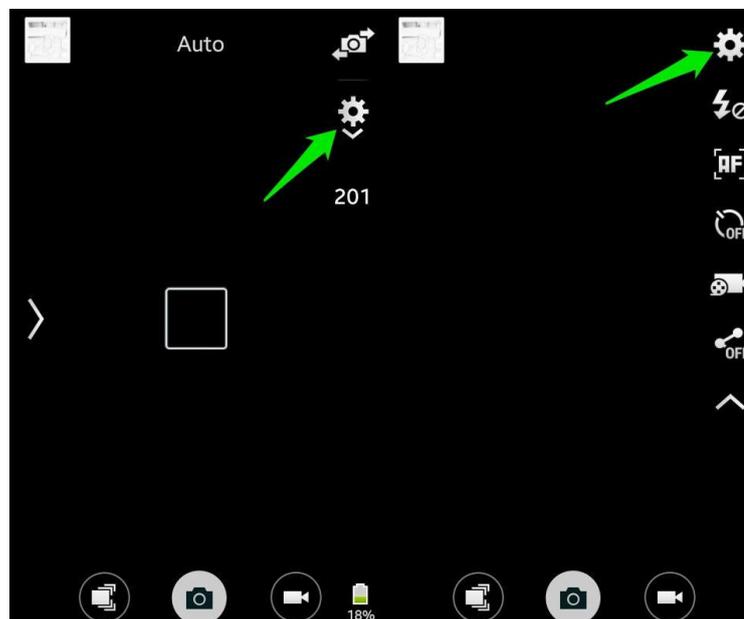
Interfaces and options are slightly different on different devices. Below are guidelines for 02 smartphones most commonly used.

#### 1. Turning on/off the positioning feature on Samsung phones

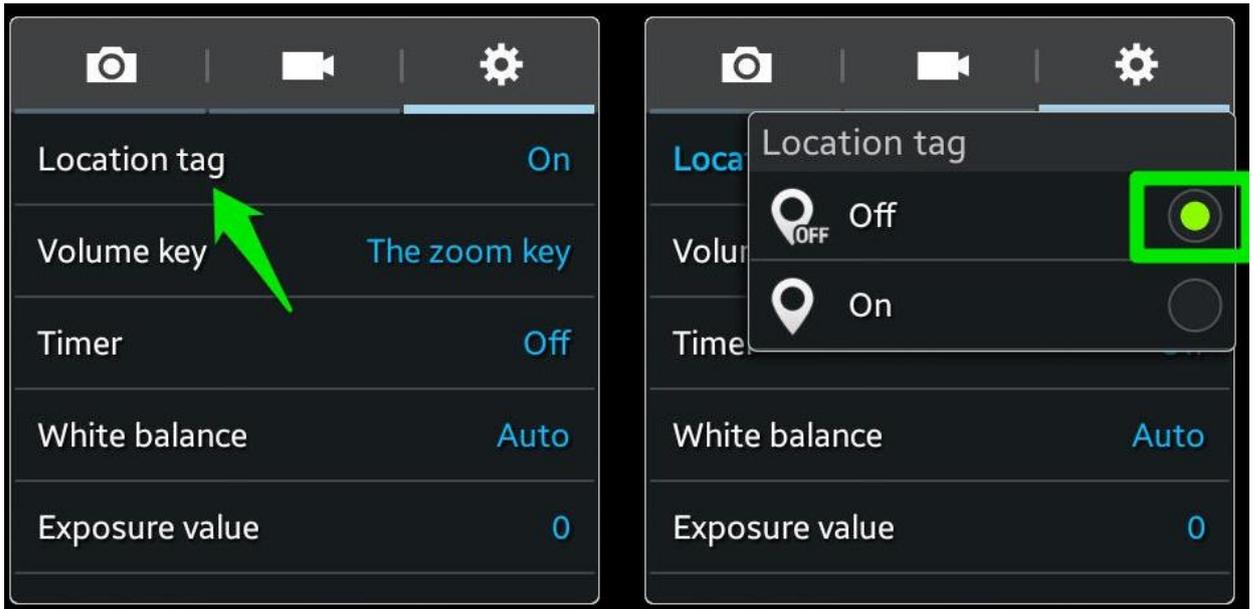
Step 1: Start your phone's default Camera app. If the icon "Pin" appears when taking photos, the positioning function is on.



Step 2: Click the icon "Settings".



Step 3: Select “**Settings**” again > Select “ **Location Tag**”. Turn it off or on as desired

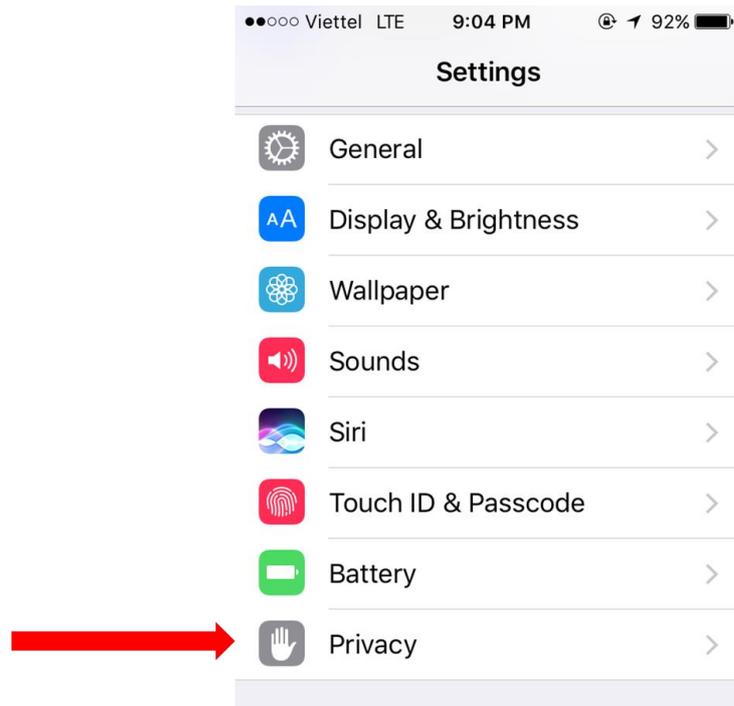


## 2. Turning on/ off the positioning feature on iPhone

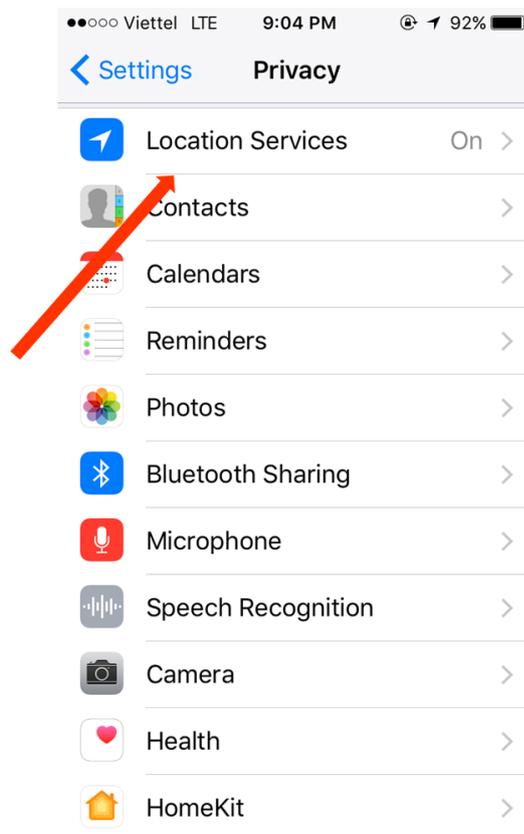
Step 1: Access to the **Settings** menu on the **iPhone Menu** screen



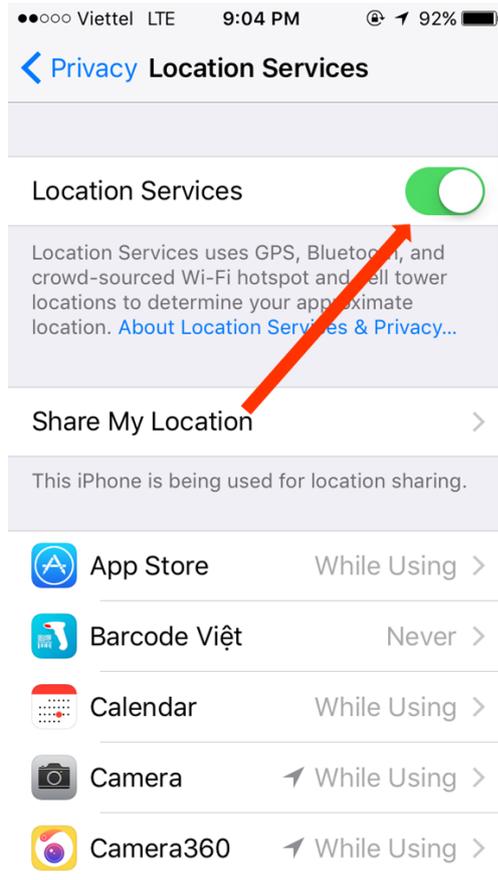
**Step 2:** Scroll down and select **Privacy** or **Security**



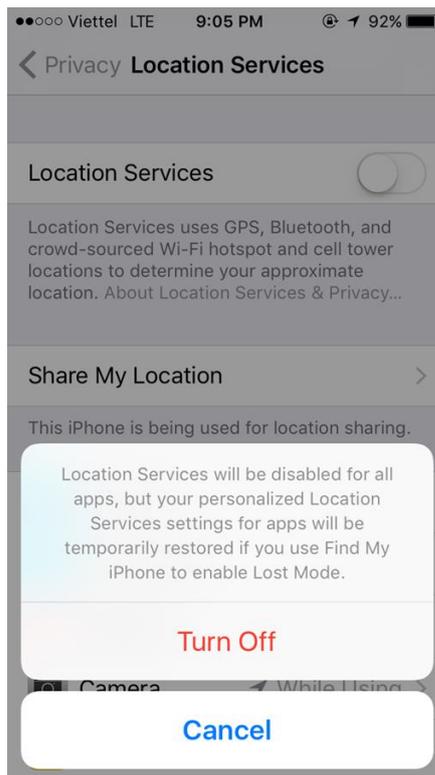
**Step 3:** Click to select **Location Services**



Step 4: Drag the lever to the left to turn off the positioning feature of iPhone



Step 5: Confirm by clicking Turn off again



Now, you can take similar steps to turn on the positioning feature and use this feature for your iPhone's default capture application.

To have more accurate coordinates, please note the following

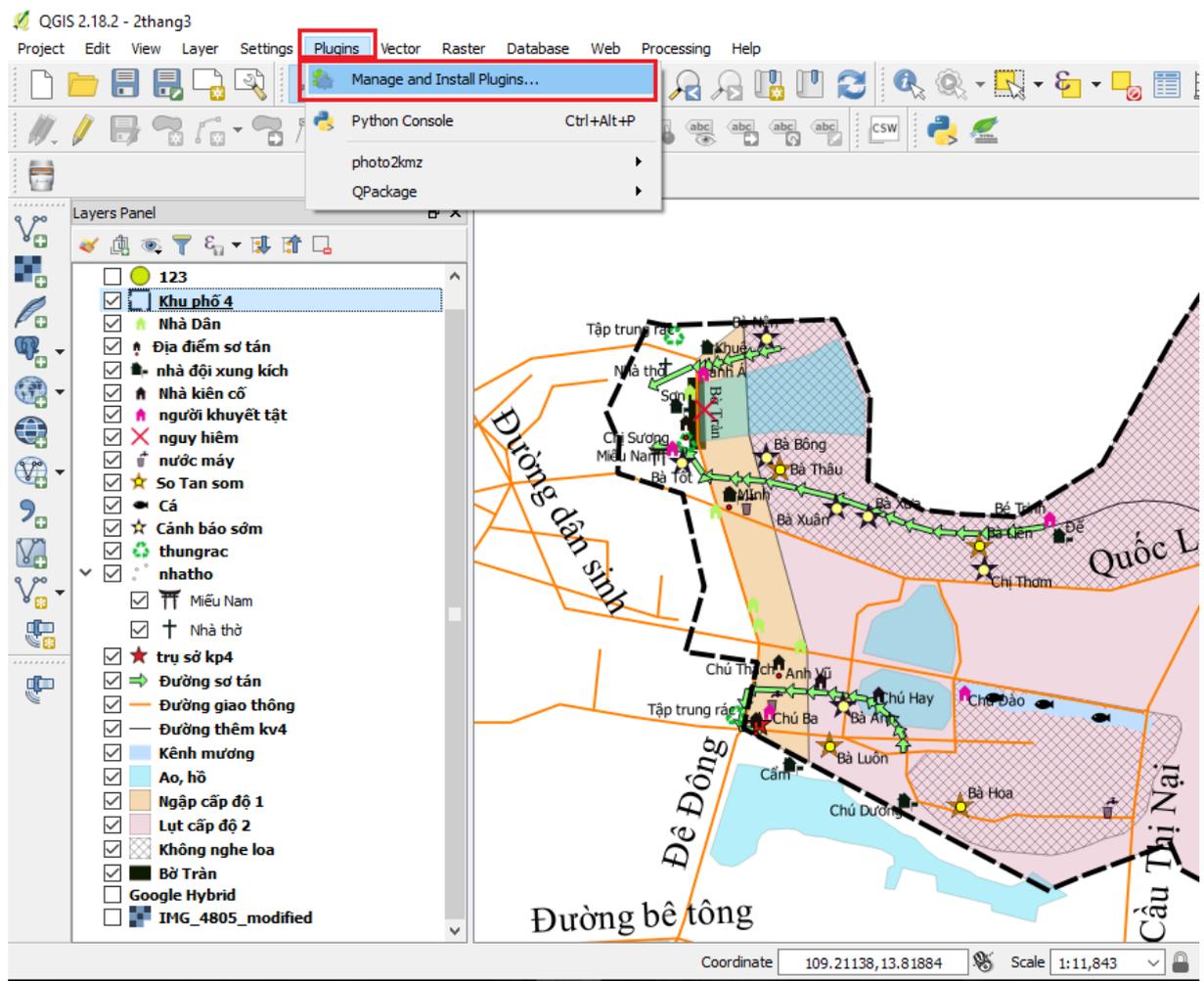
- When taking a photo, the photographer should stand as close to the object as possible and take photo outdoors.
- The GPS feature needs to be turned on before shooting for 10-15 minutes so that the phone has more time to capture signal of more satellites.
- Use the internet, telephone reception to obtain coordinates faster and more accurately.
- The photographer may use high quality phones, such as Samsung and Iphone because some low quality phones may cause difficulty in loading picture points to software, which leads to high GPS errors and takes longer time to catch satellite signals.

## II. COLLECT FIELD DATA VIA SMARTPHONES

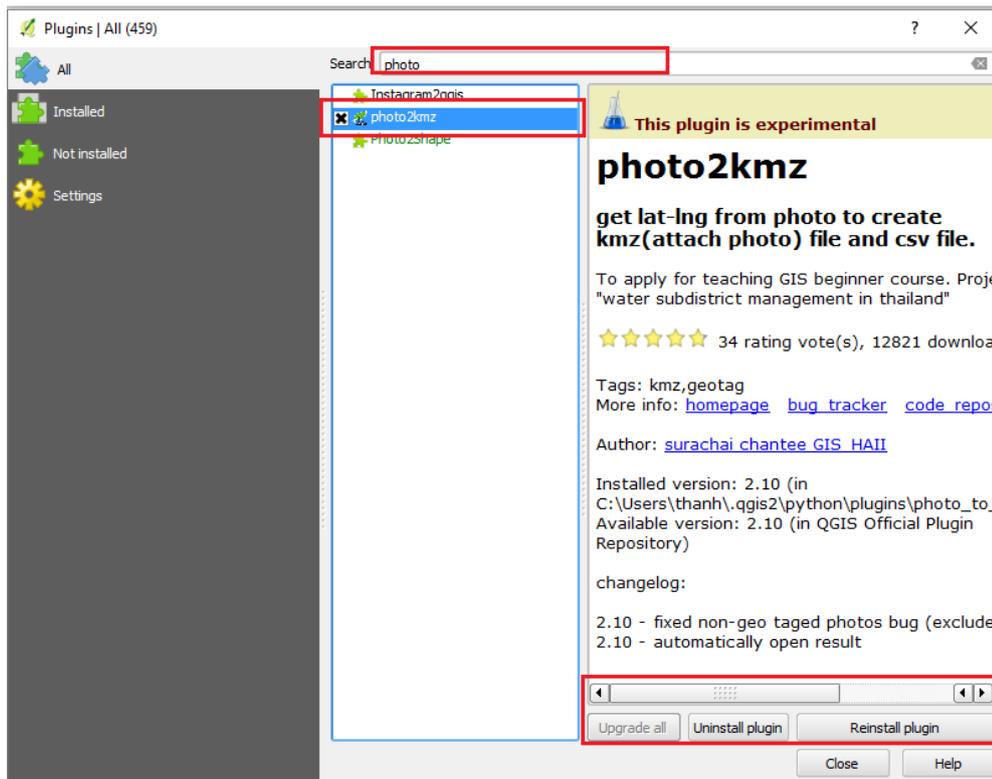
### 1. Installing plugin Photo2kmz and get the coordinates of the image

Step 1: Open QGIS

Step 2: Select "Plugins" on the taskbar, select "Manage and install the plug-ins"

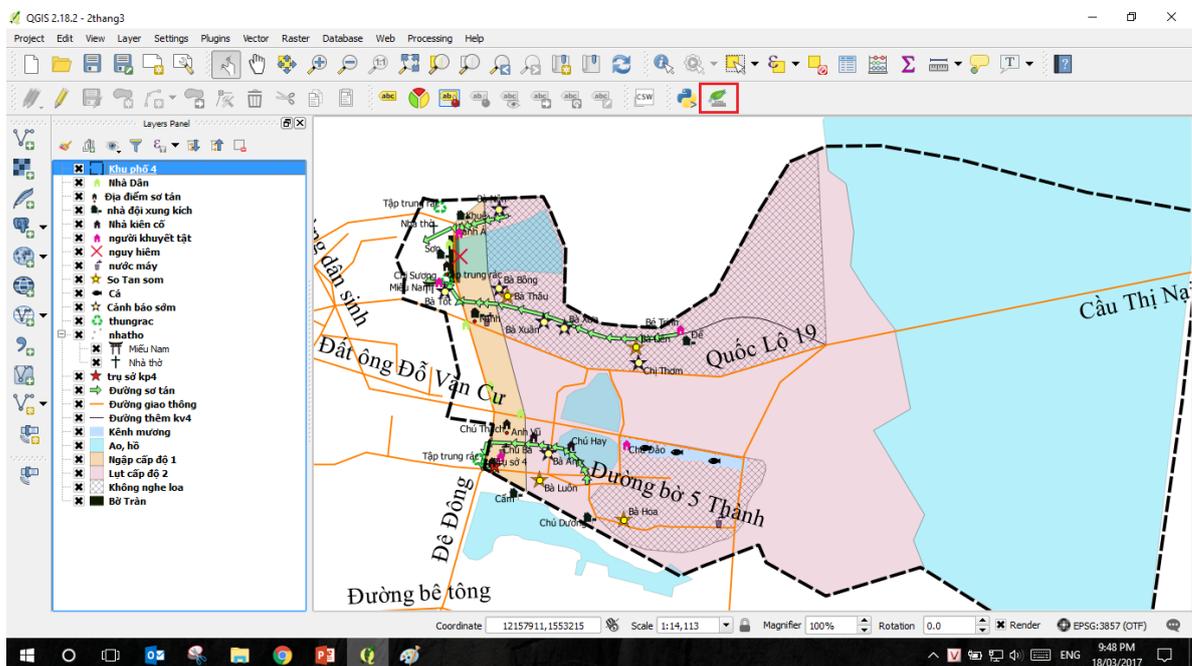


**Step 3:** Type **Photo2kmz** into the search box of the "**Search**". If it is not installed yet, click to select and then select **Install**.

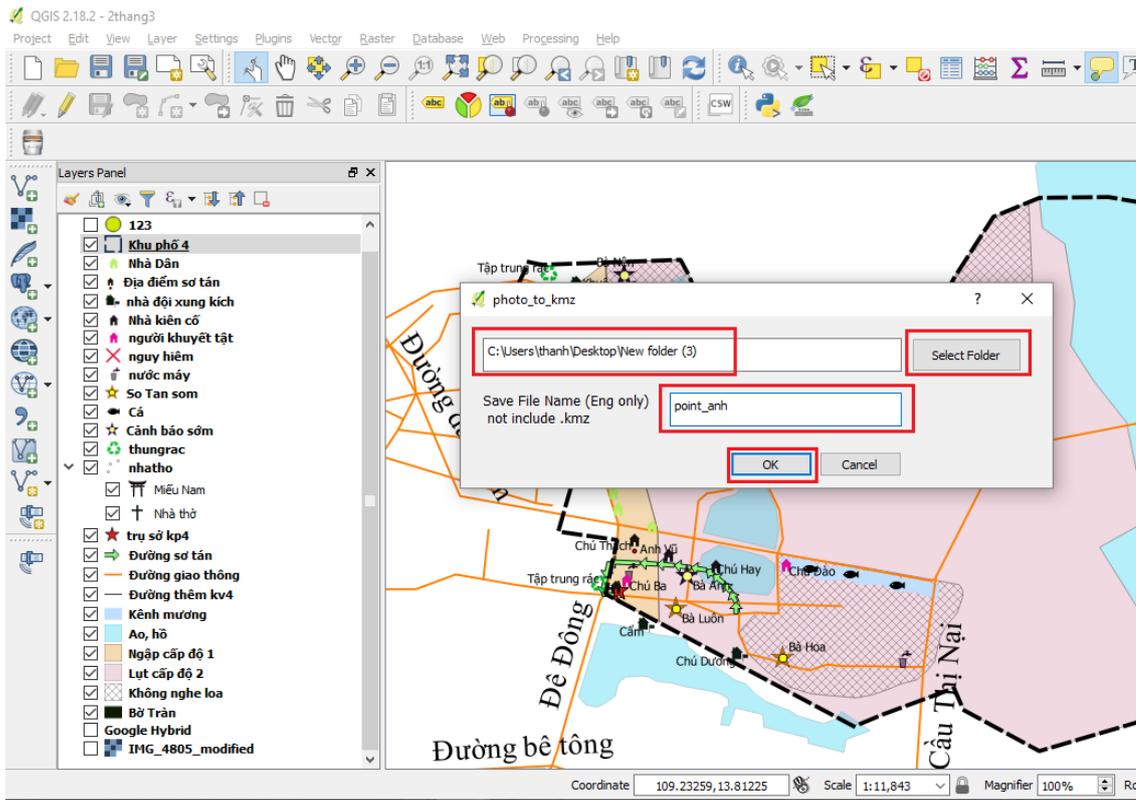


**Step 4:** After installing plugin, on the main screen, click the icon of the plugin photo2kmz on the toolbar, open the folder containing the photo (the photo automatically mounted coordinates when taking by a smartphone or a camera with GPS support).

**Note:** It is recommended not to create many layers for the folders.



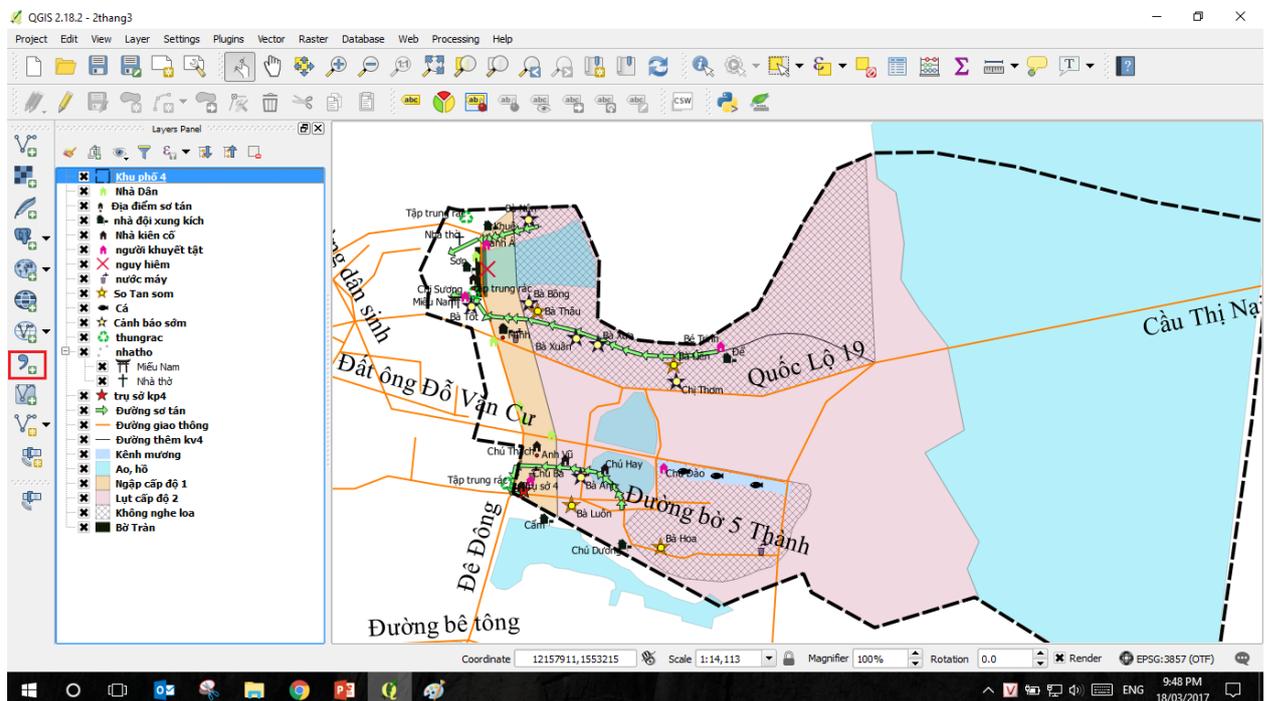
**Step 5:** Name the file. This file will list the photo's name and coordinates by latitude and longitude.



Once created, the folder containing the photo will have two files: \*.csv and point\_\*.kmz.

## 2. Creating a data layer shape file

**Step 1:** Click on the icon "Add Delimited Text Layer" on the left toolbar to import the "\*.csv" data file.



Step 2: Enter the information shown below:

- File name: Brings the cursor to the folder containing the file "\*.csv" created in the previous step.
- Layer name of layer: By default, the name is that of file \*.csv
- Geometry Definition : Select coordinate points, in which:
  - +Field X: lng
  - +Field Y: lat

The other fields remain unchanged.

File Name: C:/Users/thanh/Desktop/New folder (2)/anh.csv

Layer name: anh

Encoding: UTF-8

File format:  CSV (comma separated values)  Custom delimiters  Regular expression delimiter

Record options: Number of header lines to discard: 0  First record has field names

Field options:  Trim fields  Discard empty fields  Decimal separator is comma

Geometry definition:  Point coordinates  Well known text (WKT)  No geometry (attribute only table)

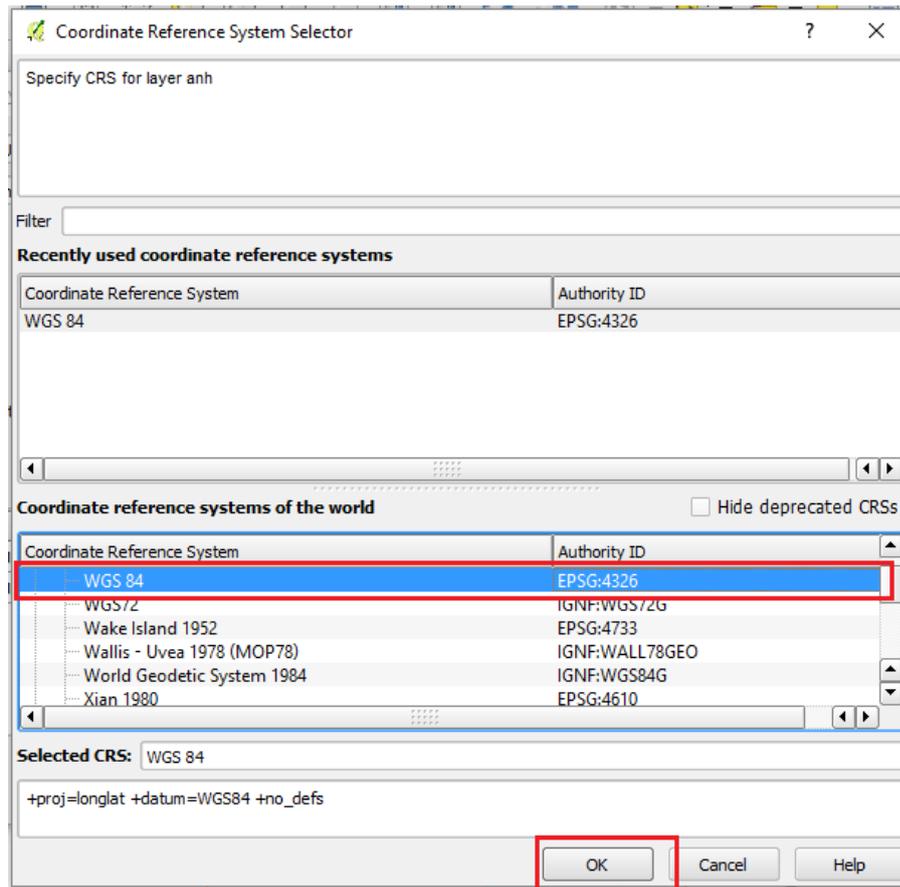
X field: lng Y field: lat  DMS coordinates

Layer settings:  Use spatial index  Use subset index  Watch file

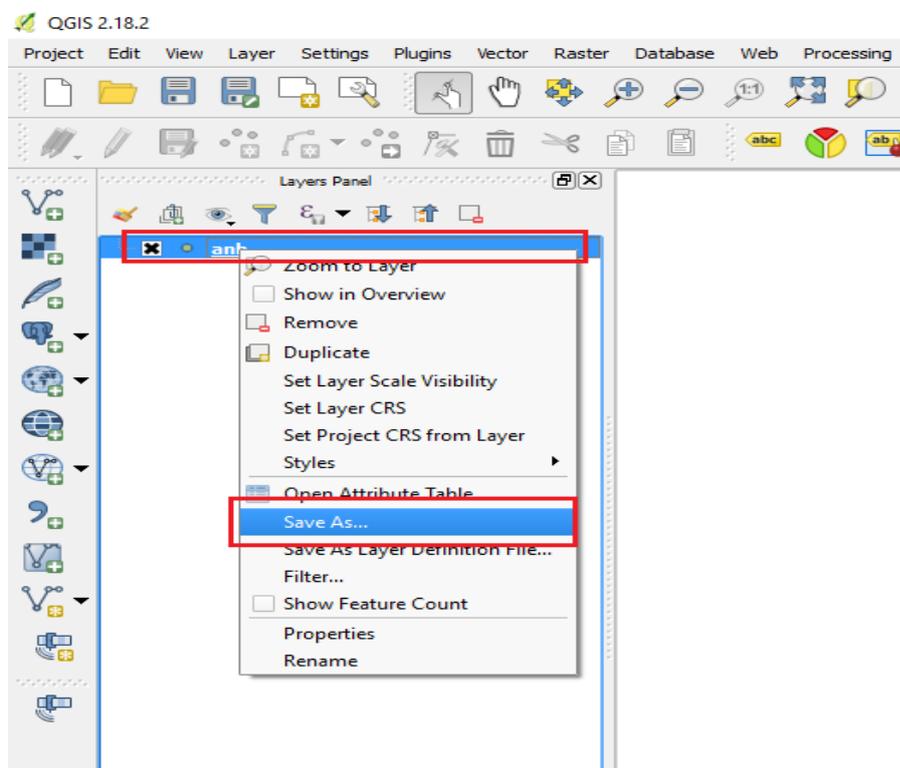
	name	lat	lng
1	IMG_3184.JPG	13.8057111111	109.211525
2	IMG_3185.JPG	13.80575	109.211533333

OK Cancel Help

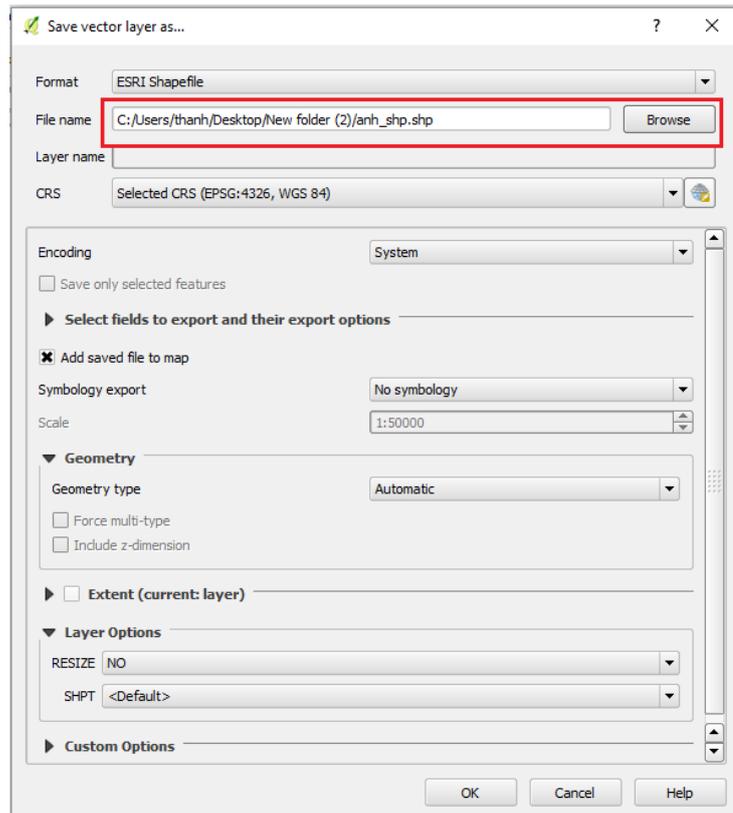
Step 3: Select "**Coordinate reference system**" (in the case of Vietnam, it is WGS 84 EPSG:4326)



Step 4: Select the data layer you have just opened, select the right-click, select "**Save As**" to save the shape file (.shp)

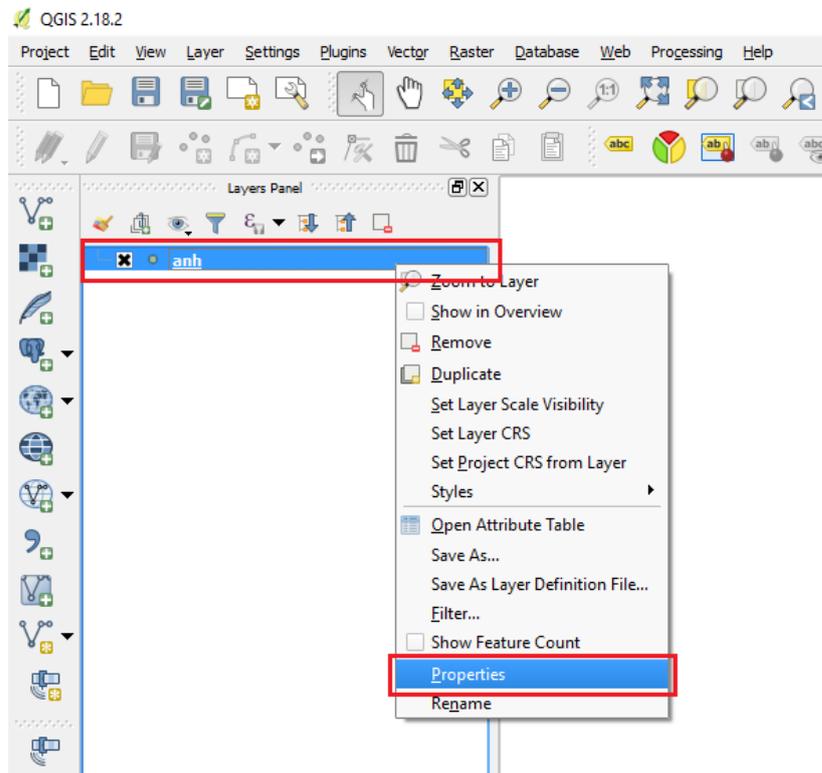


**Step 5:** Select the location to save the file and click **OK**. Other parameters remain unchanged.

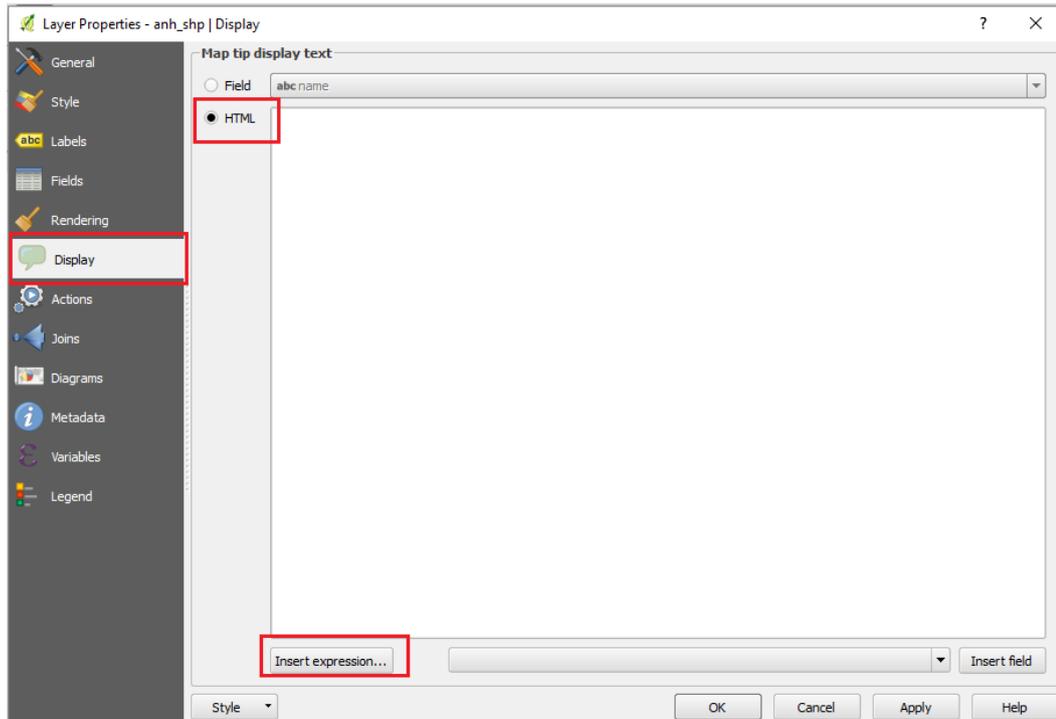


### 3. Display the photo on the shape file

**Step 1:** Put the cursor to select the point layer to display the photo, right-click, select "Properties".

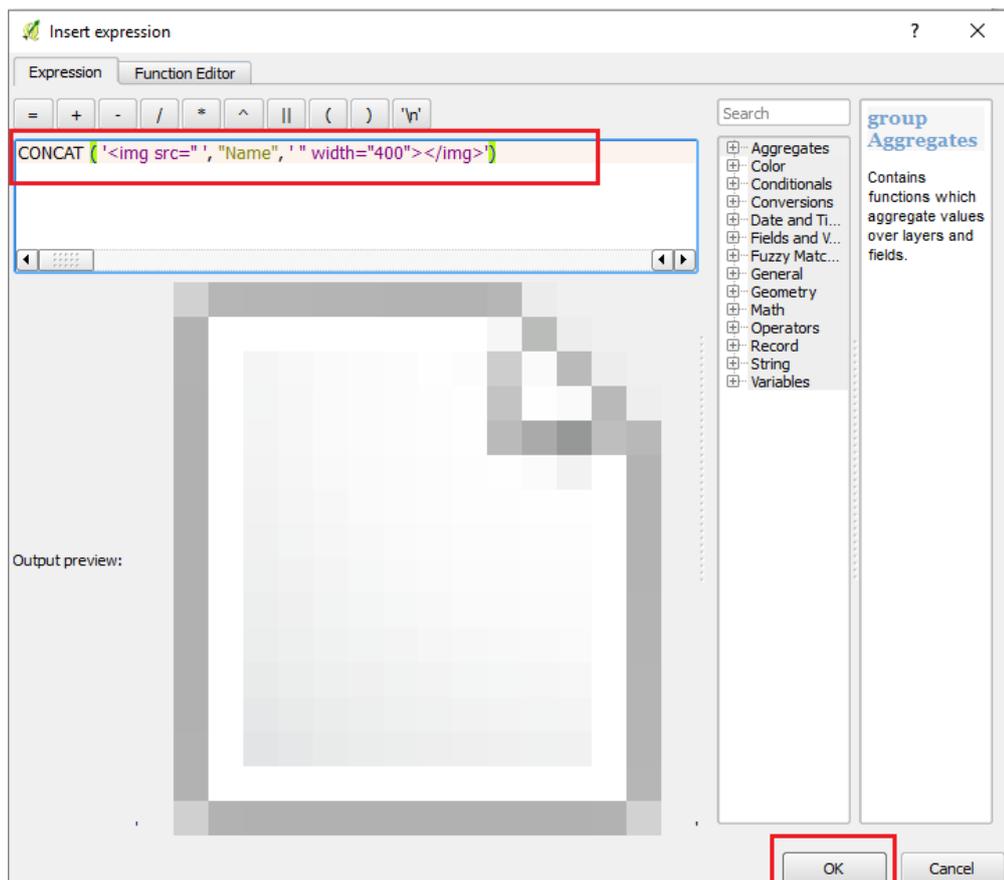


**Step 2:** Select **Display / HTML / "Insert expression"** as shown below.

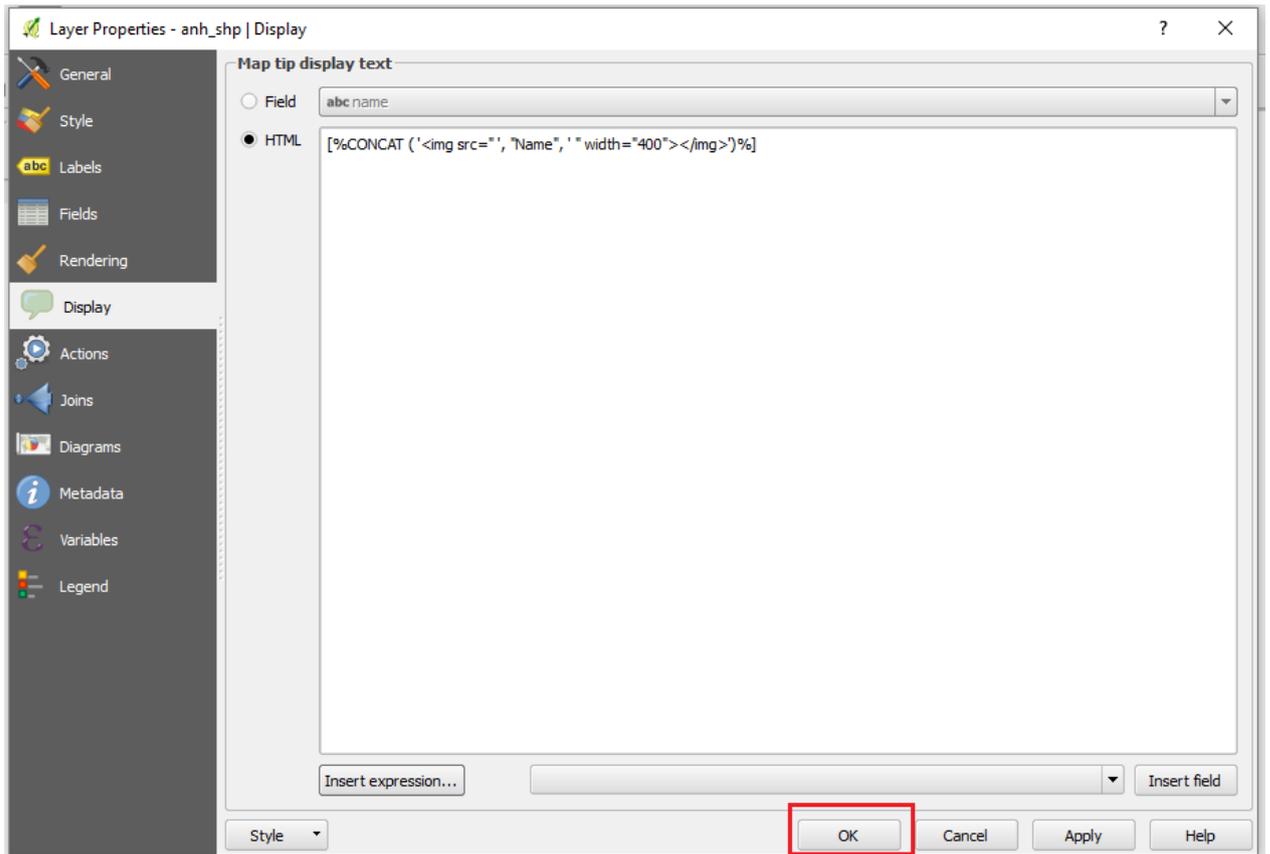


**Step 3:** Insert the following formula:

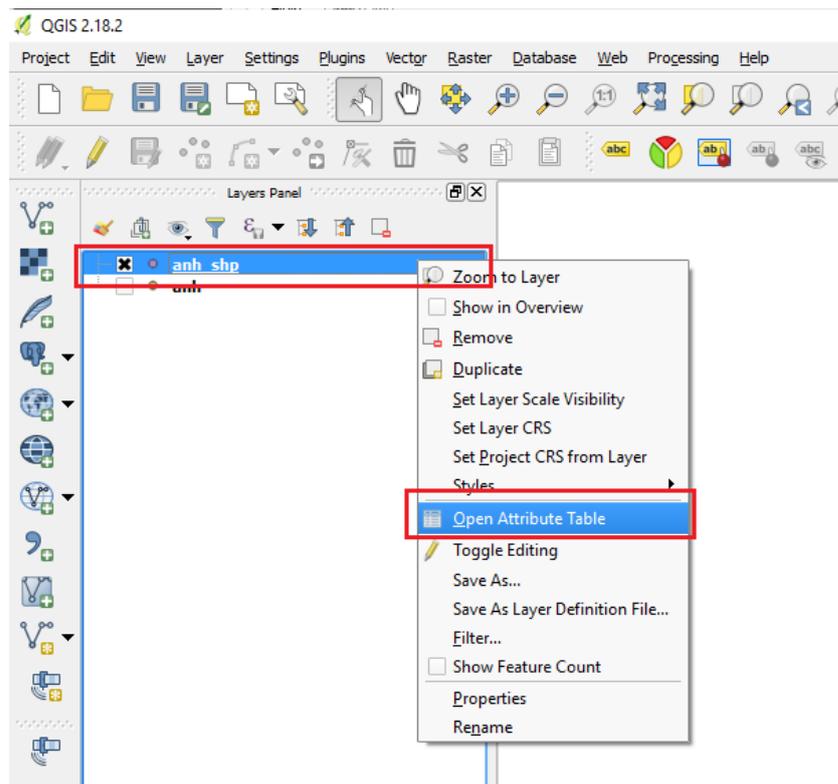
**CONCAT ( '</img>' )**



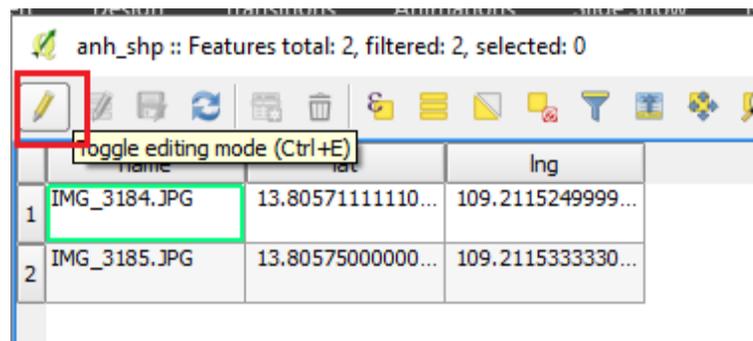
**Step 4:** Click **OK** to close the current window.



**Step 5:** Put the cursor to select the point layer to display the photo, right-click, select "Open Attribute Table".



**Step 6:** Click the yellow pencil icon “Toggle Editing mode” in the upper left corner to start editing the data.

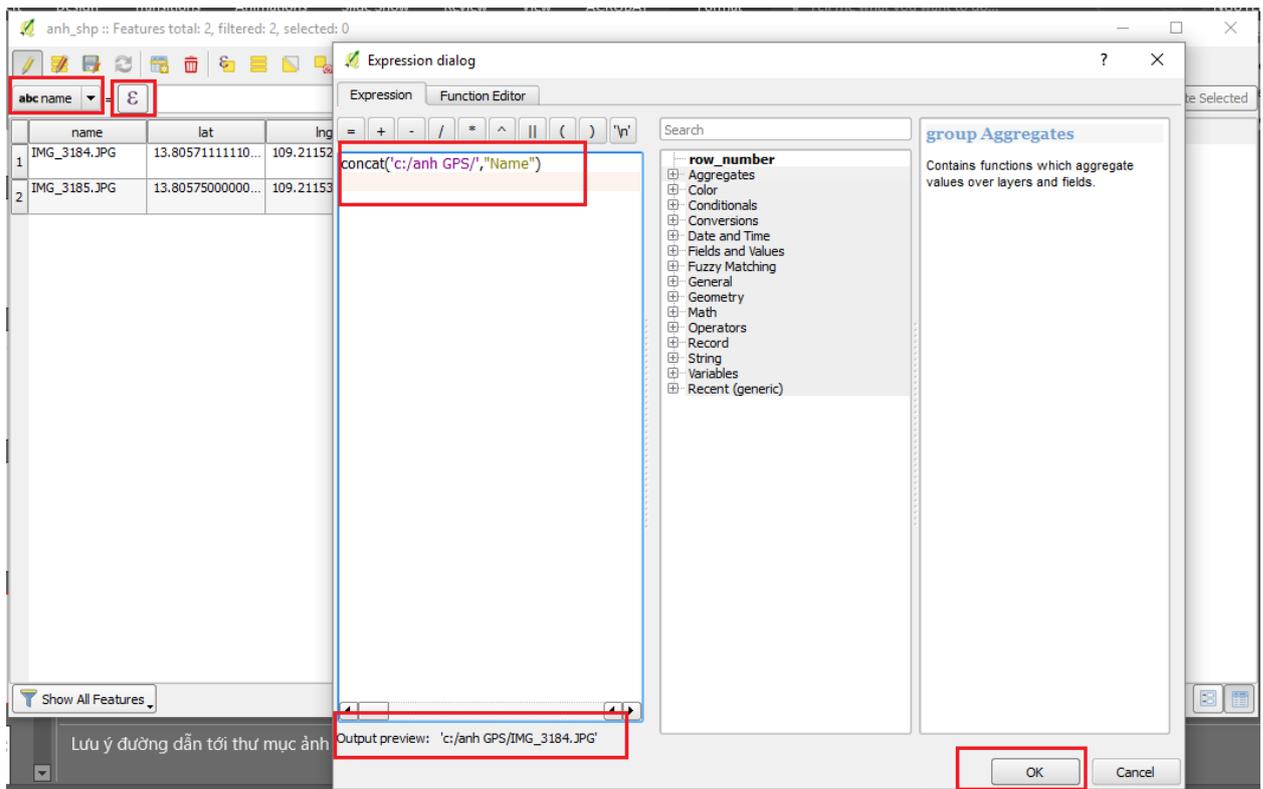


**Step 7:** Select “Name”, then select the icon “Expression” ε to insert the path to the photo name. Insert the following formula:

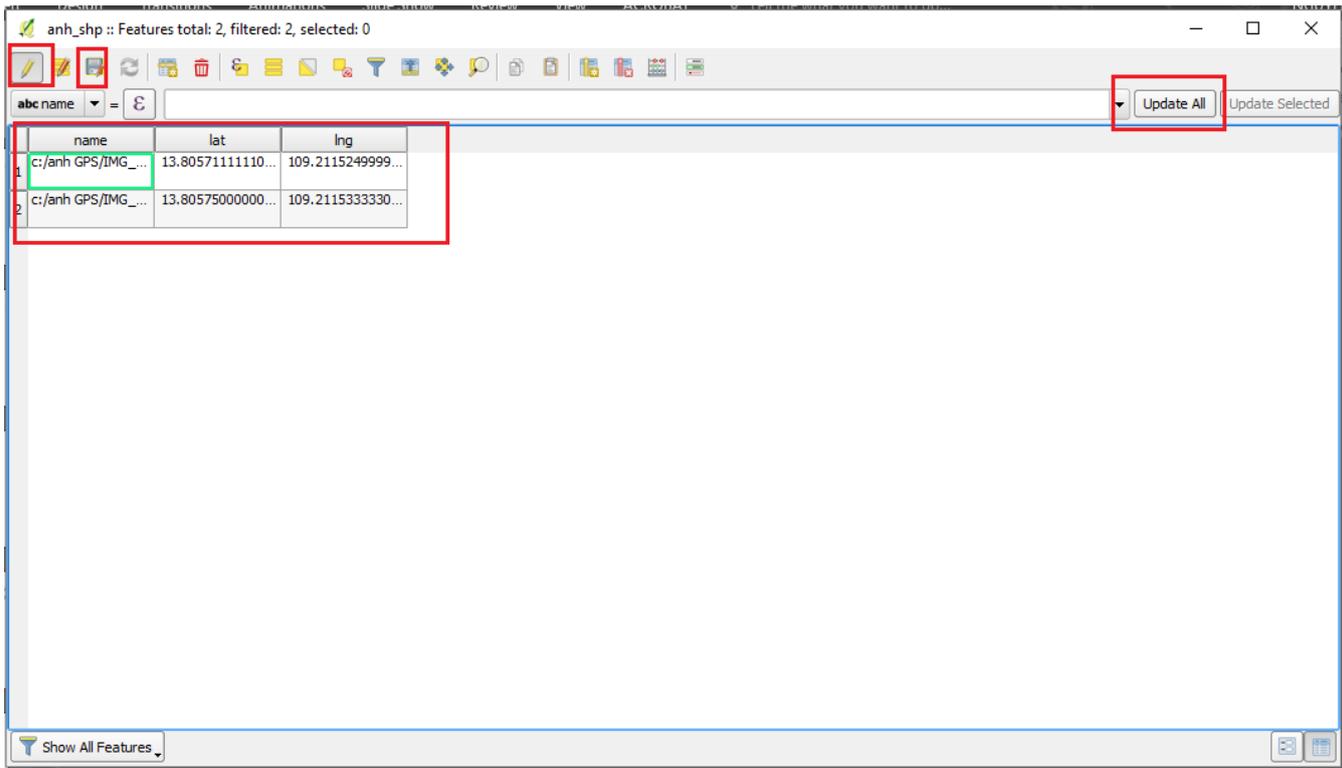
**concat('c:/anh GPS/', "Name")**

In which: “c:/anh GPS/” is the path to the folder containing the photo taken.

**Note:** Use the character “/” instead of the character “\” in the path to the folder containing the photo.

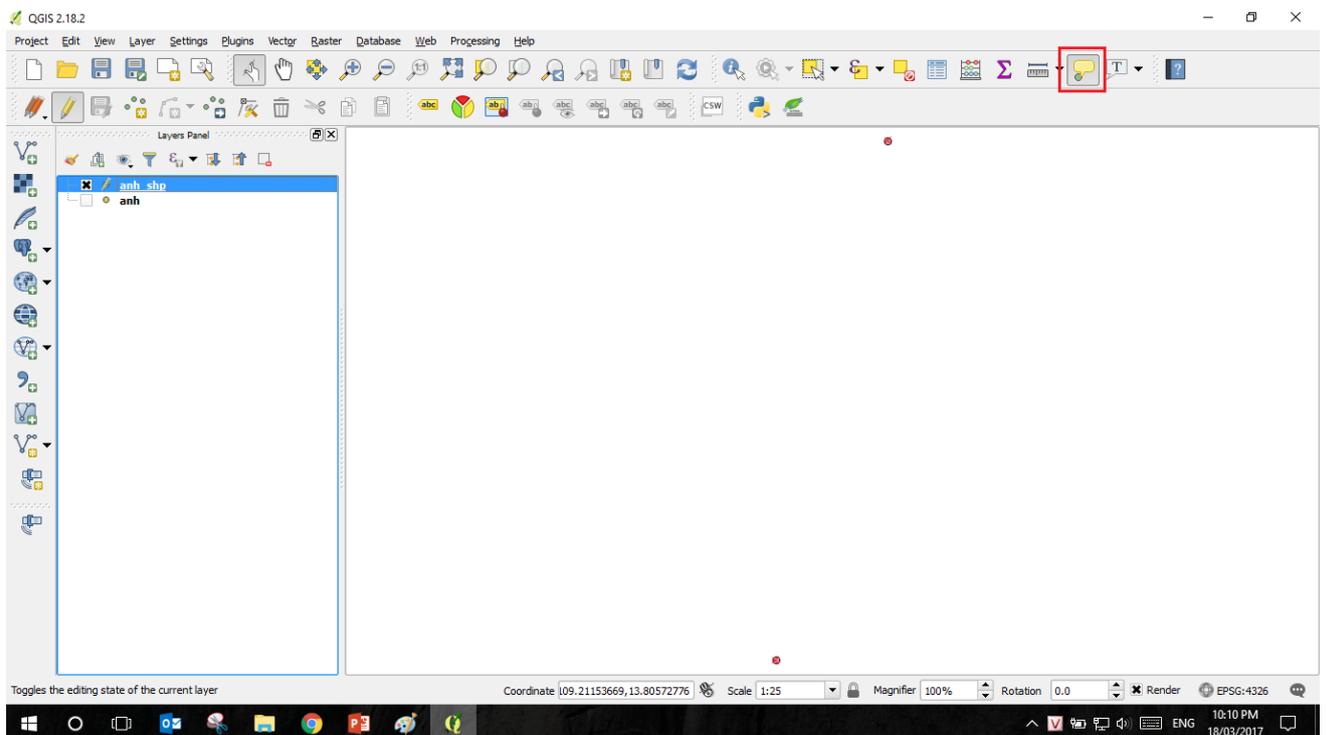


**Step 8:** Click "**Update All**" to update the path, then click the **Save** icon to save the changes. Click the pencil icon to finish editing.

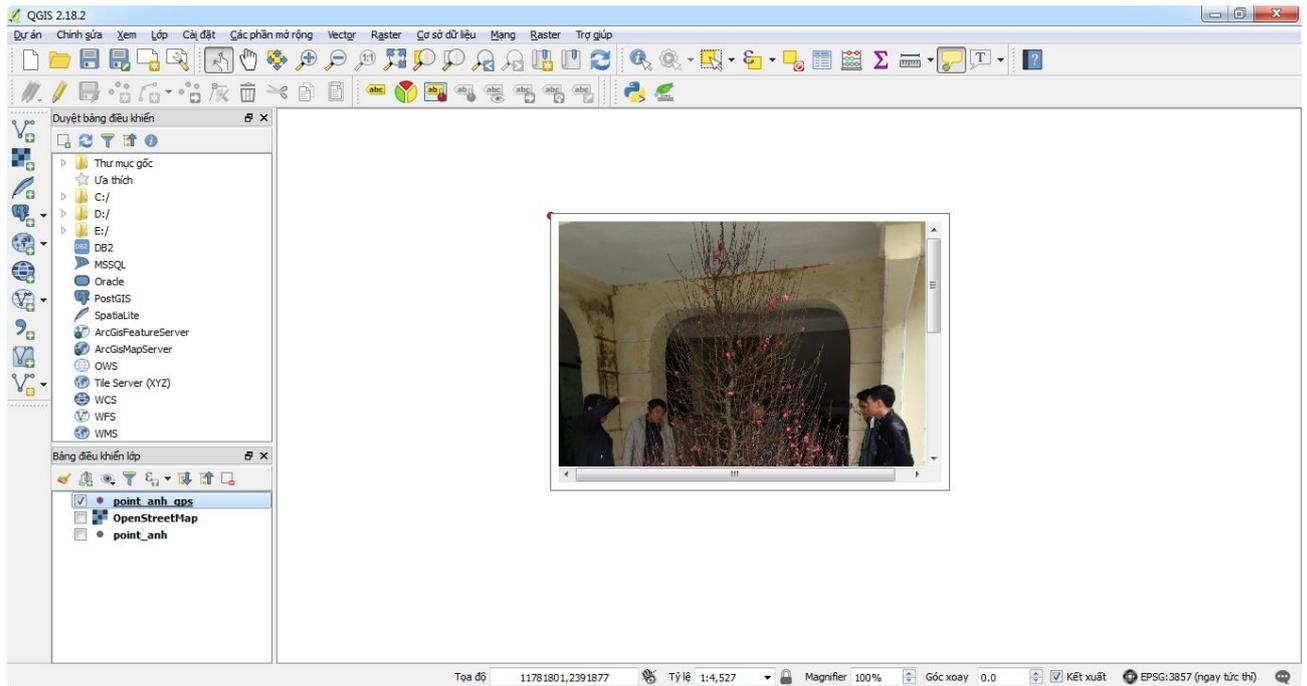


**Step 9:** Close the current window and return to the main window of the QGIS program.

**Step 10:** Click the "**Map Annotation**" icon to open the annotation feature.



**Step 11:** Bring the pointer to the location of the photo, the photo will be displayed as below.



### III. USE OF GPS DEVICES

Several GPS devices are available including Garmin Etrex 10, Etrex 20, Etrex 20x, Etrex 30x. There are few differences among these devices, users can skip instructions for features that are not relevant in the eTrex 10 / eTrex 20 series (for example: electronic compass).

#### 1. Function of the keys



#### Zoom key (1):

To zoom in or zoom out the map scale. When we click the ▲ button to decrease the map scale, we will only see a small but detailed area. Conversely, when we click ▼ we will see a larger but less detailed area.

**Back key (2):**

Click this key to return to the previous menu.

**Thumb Stick key (3):**

To move light up, down, to the right or left to select a function in the menu or to move the pointer in the map screen.

Press this key to act as the Enter key to accept a certain command.

**Menu key (4):** From any screen page:

- Click Menu twice to go back to the main menu.
- Click Menu once, we will have a list of extra functions for that screen page

**Backlight key (5):**

To turn the camera off or on, and adjust the brightness / darkness of the screen.

**2. Set parameters for the device before measuring****2.1. Set the positioning system**

From the Main Menu screen, select **Setup > System > GPS**, and you will have 3 options:

- **GPS** : The device will operate under normal mode of GPS satellite system
- **GPS + GLONASS**: You should choose this mode so that the device can have higher accuracy and get satellite reception faster.
- **Demo Mode**: already switched off the satellite reception mode, the device will run in simulation mode. Only use this mode when you want to practice with the device.
- **WASS/EGNOS**: select **ON**

**2.2. Set the screen**

From the main menu screen, select **Setup > Display**

- **Backlight Timeout**: Set the time when the screen light will automatically turn off, the default mode is 15 seconds.
- **Screen Capture**: the mode of capturing the screen.
- **Colors**: Choose color mode.

**2.3. Sound settings (Tone)**

- Select **Setup > Tones**
- Choose a tone that you like for each application.

## 2.4. Set measurement units

For example, to select meter system, from the Main Menu screen, select **Setup > Units**

- **Distance and Speed:** select **Metric**
- **Elevation (Vertical Speed):** select **Meters (m/s)**
- **Depth:** select **Meters**
- **Clickure:** select **Millibars**

## 2.5. Setting time

From the Main Menu screen, select **Setup > Time**

- **Time Format:** select the mode of 12-hours or 24-hours
- **Time Zone:** select **Automatic**, the device will automatically select the appropriate time zone for you.

## 2.6. Set coordinates and maps

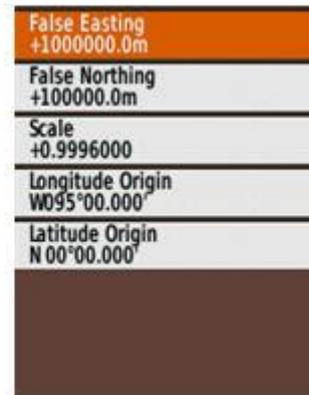
From the main Menu screen, select **Setup > Position Format**

- Select **hddd'mm.mmm'**: If you want to see coordinates in degrees, minutes, seconds.
- Select **UTM UPS** : If you want to see coordinates in meters.
- Map **Datum:** select map datum where appropriate, e.g. **Indian Thailand** or **WGS 84**  
Also, if you want to install the VN 2000 coordinate system, implement as follows:
- Select **Setup > Position Format > Map Datum > User**
- Then enter the values of DX, DY, DZ:
  - **DX= - 00000193.0m** (then select Save> Enter to produce the value of **-193.0m**)
  - **DY= - 00000039.0m** (then select Save> Enter to produce the value of **-39.0m**)
  - **DZ= - 00000111.0m** (then select Save> Enter to produce the value of **-111.0m**)

After entering the above values, click the Back key to exit. Continue to choose **Position Format > User Grid > UTM** and enter the values below:

- **False Easting:** Change the value to 500000.0m
- **False Northing:** Change the value to 0.0m
- **Scale:** Maintain the value
- **Longitude Origin:** Enter the local Greenwich meridian value (see the value of Greenwich meridian at the end of this document).

Note: Remember to convert the letter W to E before the value of the Greenwich meridian.

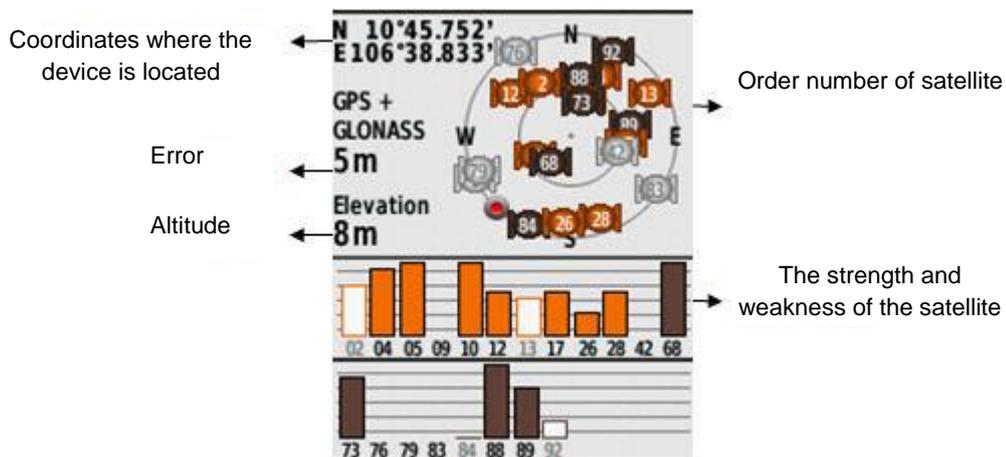


### 3. Main screens:

There are following main screens: satellite screen, map screen, compass screen, main Menu screen, Trip Computer screen.

#### 3.1. Satellite screen:

- This is the first screen you should check to see whether the device has captured satellite signals before using the device.
- From the main screen, select Satellite > Enter
- Small circles with numbers are the number of satellites that are available in the sky. Among two rings containing satellites, the satellites over your head are satellites located in or on the small ring. The satellites on the large ring are those located at an angle of 45 degrees to the horizon that are often obscured by the terrain which is difficult to capture the signal.
- The left column contains 3 rows. The top row is the coordinate of your current location, the middle row is the GPS error, the stronger the satellite signal is, the smaller the error is, and the smaller the error is the more accurate the measurement will be; the last row represents altitude to the sea level.



### 3.2. Map screen

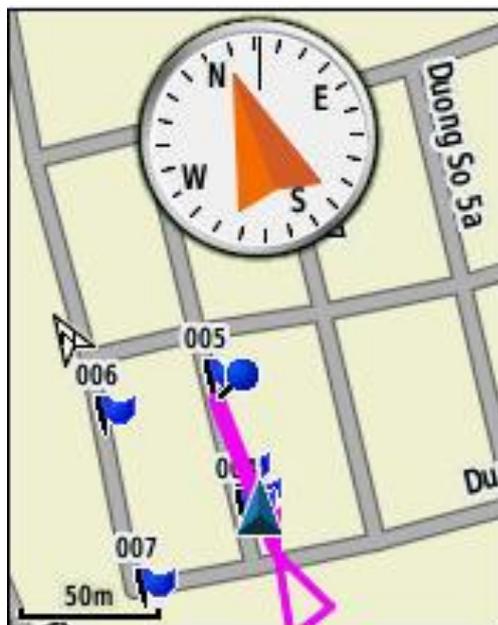
On the map screen, the symbol ▲ will represent your location on the map. As you move, the position of the icon moves along and draws a track log. The name of the point coordinates (if any) and its symbol also appear on the map.

a) *Settings the map screen:*

- From the main Menu screen, select **Map > Enter**
- Click the Menu key once, select **Setup Map > Enter**
- Select one of the followings:
  - o Select **North Up:** to display the standard north face, which is the top of the screen. As you move, the tip of ▲ will always point north.
  - o Select **Track Up:** to display the direction you are moving, at the top of the screen, the tip of ▲ will always point to the direction you are moving.
  - o Select **Automotive Mode:** to give you a panoramic view.

In addition, to be able to observe in the navigation function; we can attach the compass to the map screen as follows:

- Select **Setup > Map > Enter**
- Select **Data Fields > Dashboard > Compass > Enter**



To remove the compass out of the map screen: Select **Setup > Map > Datafields > 0 > Enter**

### 3.3. Compass screen

This screen is often used for navigation. When you need to move to a certain point, the tip of ▲ always points to the direction you need to go, regardless of the direction you are moving.



Moving to the left



Moving to the right



The current speed

The expected arrival time

The remaining distance to reach the destination

The remaining time to reach the destination is in the right direction

If we go in the right direction, we will see that the distance to the destination is smaller and smaller.

#### Installation for compass:

##### a. Display settings:

From the main Menu screen, choose **Compass** > **Enter**. Click the Menu key, then select **Setup Heading**, choose one of two ways to display:

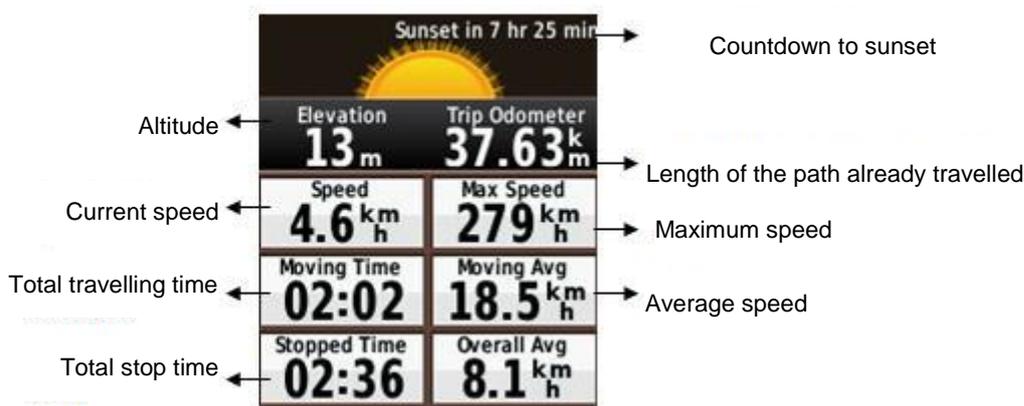
- **Directional Letters:** Read the compass in the direction of N, S, E, W: north, south, east and west.
- **Numeric Degrees:** Read compass in degrees (0 degrees - 359 degrees)

b. *Installing the north as a standard direction:*

- Select **Compass > Enter**
- Click **Menu**, select **Setup Heading > North Reference > True**

### 3.4. Trip Computer screen

This screen displays the speed you are traveling, the average speed, the maximum speed, the actual distance you traveled and other parameters.



Specific settings for the **Trip Computer** screen:

From the **Trip Computer** screen, click **Menu**:

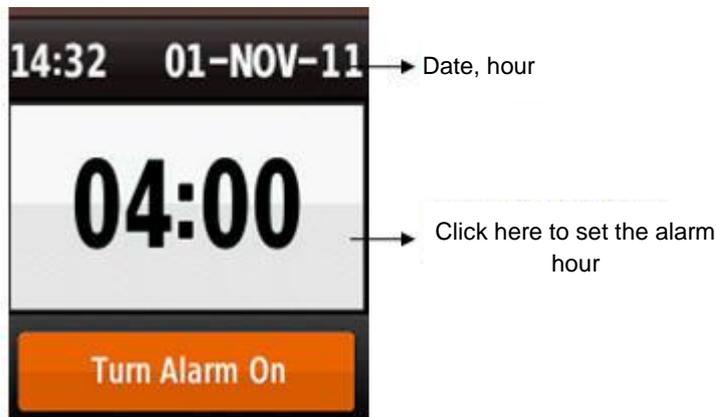
- Select **Reset > Reset Trip Data Timers, etc. > Yes**: Put all values in this screen to zero. At the start of a journey, to get accurate information, you need to do this.
- Select **Big Numbers**: Change the font size displayed on the screen.
- **Change Dashboard**: Change the wallpaper and the information displayed on the screen.

### 3.5. Main menu screen

Other tools in the main Menu screen include:

- **Calendar**: show the date and show the time creating other data such as **waypoint, track, route**.
- **Calculation**: Display a calculator.

- **Sun and Moon:** Indicates the time of sunrise/sunset and moonrise and moonset on the day at the device location.
- **Alarm Clock:** show date, time. Also, it is possible to set the autostart at a certain time and act as an alarm clock.



- **Hunt and Fish:** Show the best satellite calendar of the day at the device location. Before the measurements in the field, it is necessary to refer to this function to know the time of day generating the highest accuracy.

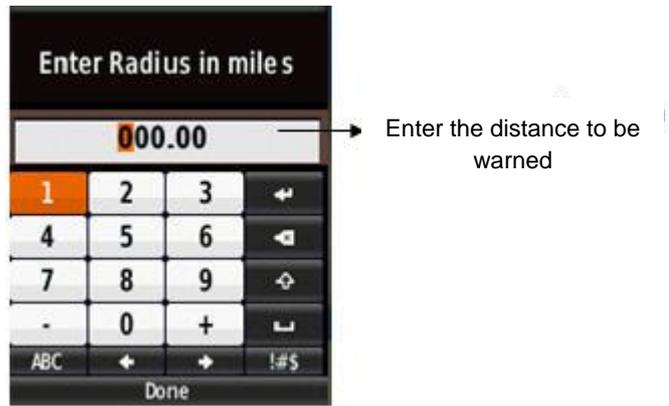


- **Proximity Alarms:** This function is mainly used for warnings. The device will alarm when we go into the area of a certain pre-set area. Examples are minefields, radioactive contamination areas, reefs, etc.

From the main menu screen, select **Proximity Alarms > Create Alarm > Enter**

The screen will appear the options to center the point to be warned. We usually use **“Use Map”** or **“Waypoints”**.

After selecting the warning points from the list of waypoints or on the map, continue to select **Use > Enter**, the screen will appear as below:



Enter the radius to be warned, then select **Done> Enter**

**Note:** The default unit here is **mile (1 mile = 1,609 meters)**.

The point you want to warn is the center of a circle, the distance you want to set is the radius of the circle. When we go into the range of that circle, the device will alert.

### **Man Overboard**

When sailing on the river or sea, if someone or something falls into the sea, use this function to bring the boat back to place of falling of the person or thing.

From the main Menu screen, select **Man Overboard> Start> Enter**.

The device automatically switches to navigational functions, helping ships return to the place of person or object falling into the water.



## **IV. COLLECTING OBJECT INFORMATION THROUGH A GPS DEVICE**

### **1. Measure and save a waypoint**

The device can measure and store 2000 waypoints with any names and symbols, there are 3 different measurements:

a. *Measure and save the waypoint:*

From the main Menu screen, use the **Thumb Stick** to move the light to **Mark Waypoint > Enter**, the device will automatically save the name of the waypoint in numerical order from 001 through 2000 and the default icon is a flag.

If you accept the default name and icon as above, select **Done > Enter** to save the information to your device.

**Note:** To name or set another symbol for the waypoint; go to the top row of the screen, the left is the icon column, the right is the column name. Click Enter in each column, we will have list of symbols, alphabets and numbers in turn. Select the letters and numbers by the names we want to place, name them and select **Done > Enter**. Then go to **Note** to write the information for the waypoint. Select **Done** in the alphabet to finish creating the information.



Finally, select **Done** to save all above information to the device.

b. *Delete a Waypoint:*

- Select **Waypoint Manager > Enter**
- From the list of waypoints, select one waypoint we need to delete, click **Enter**
- Click **MENU** once
- Select **Delete > Yes**

c. *Delete all waypoints:*

You need to be careful before using this command, once deleted, data can not be recovered.

Select **Setup > Reset > Delete All Waypoints > Yes**

2. **Measuring the distance between 2 points**

This distance is calculated in a beeline, the measurement is as follows:

a. *Measuring the distance between any two points:*

Select **Map > Enter** to return to the map screen.

Use the **Zoom** key to increase or decrease the scale of the map to have 2 positions on the screen.

Use the **Thumb Stick** key to move the pointer to the first position.

Click **Menu**, select **Measure Distance > Enter**

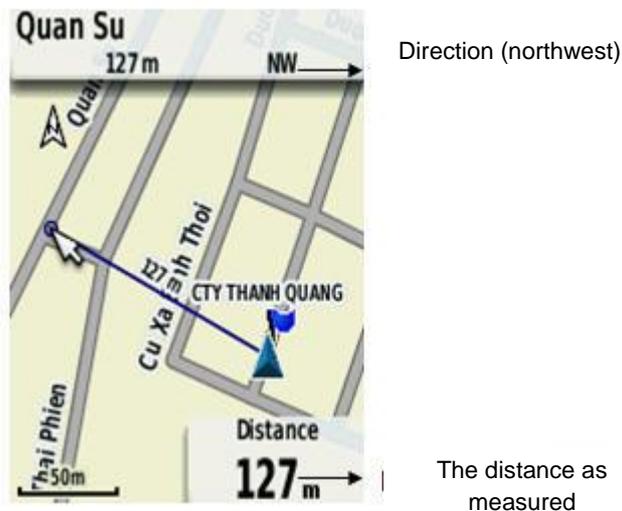
Continue to use the **Thumb Stick** key to move the pointer to the second position. You will see the distance, direction (from the first point) as well as the coordinates of the second point on the top of the screen.

*b. Measuring the distance from the device location to any point:*

It is similar to the above method of measurement, but simpler:

Select **Map > Enter**, click Menu once, select **Measure Distance > Enter**

Use the **Thumb Stick** key to move the pointer to the position you want, the results will appear on the screen.



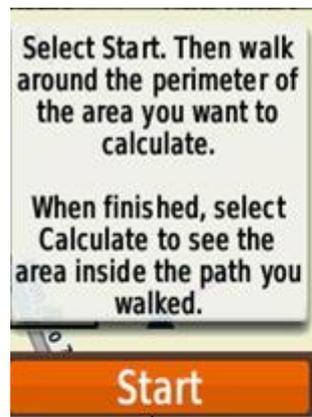
In addition, we can see the distance from the current position to all saved waypoints. Select **Waypoint Manager > Enter**: we will see below each waypoint the distance as well as direction from the position we are standing to that Waypoint.

### 3. Measuring the area of a region

From the main Menu screen, select **Area Calculation > Start**

Walk around the area you want to measure.

Select **Calculate** when you get to the last point (must be the same as the starting point). The area of the region will appear, select **Save Track** to save this track, rename if you want. Then select **Change Units** to choose the unit of measure in square meters, Hectares, or Square Kilometers,...



Click here to start moving



Click here after looping around the area to be measured



Square meter of the measured area

Click here to save

Change the unit of measurement

After measuring a certain area, turn off the device before going to another area which would enable the separation of different regions. The device will show the shape of each individual region.

If you still want to see separated shapes but do not want to turn off the device, you should use the Clear Track command before you start measuring the next area.

Select **Setup> Reset> Clear Current Track> Yes**

Deleting this track does not affect the tracks you saved earlier.

To review the perimeter and area of a previously measured plot, proceed as follows:

Click Menu twice and the main Menu will appear

Click **Track Manager**

Choose one track from the list

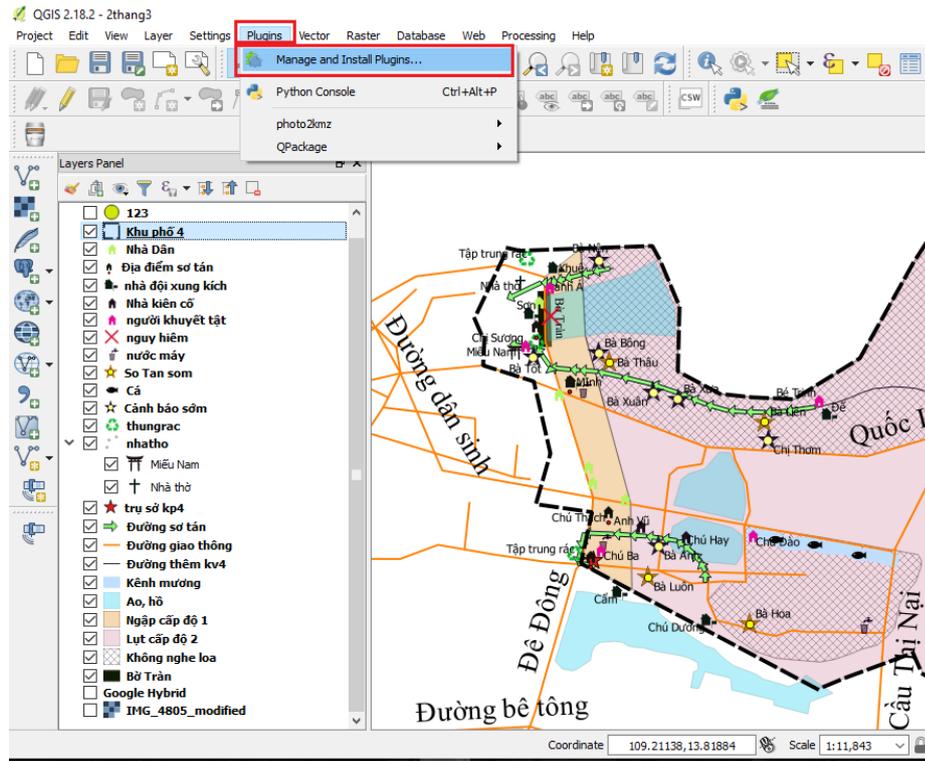
Select **View Map**

Click Menu once.

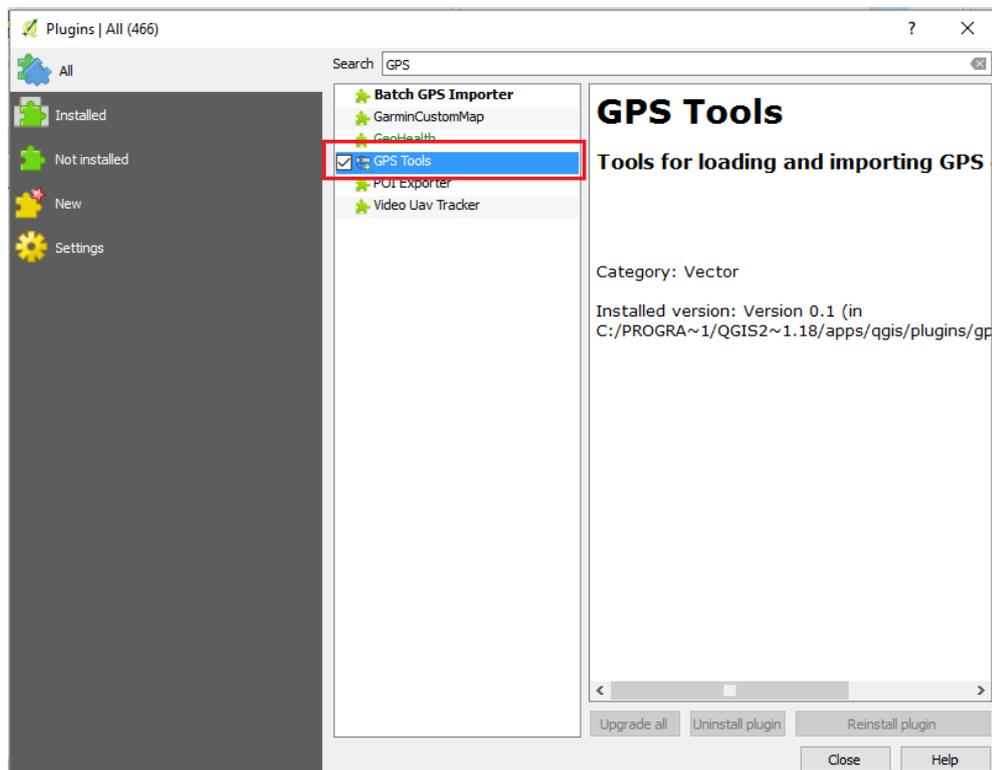
Select **Review Track**: the perimeter and area of the plot will appear.

#### 4. Transmitting the data to the computer

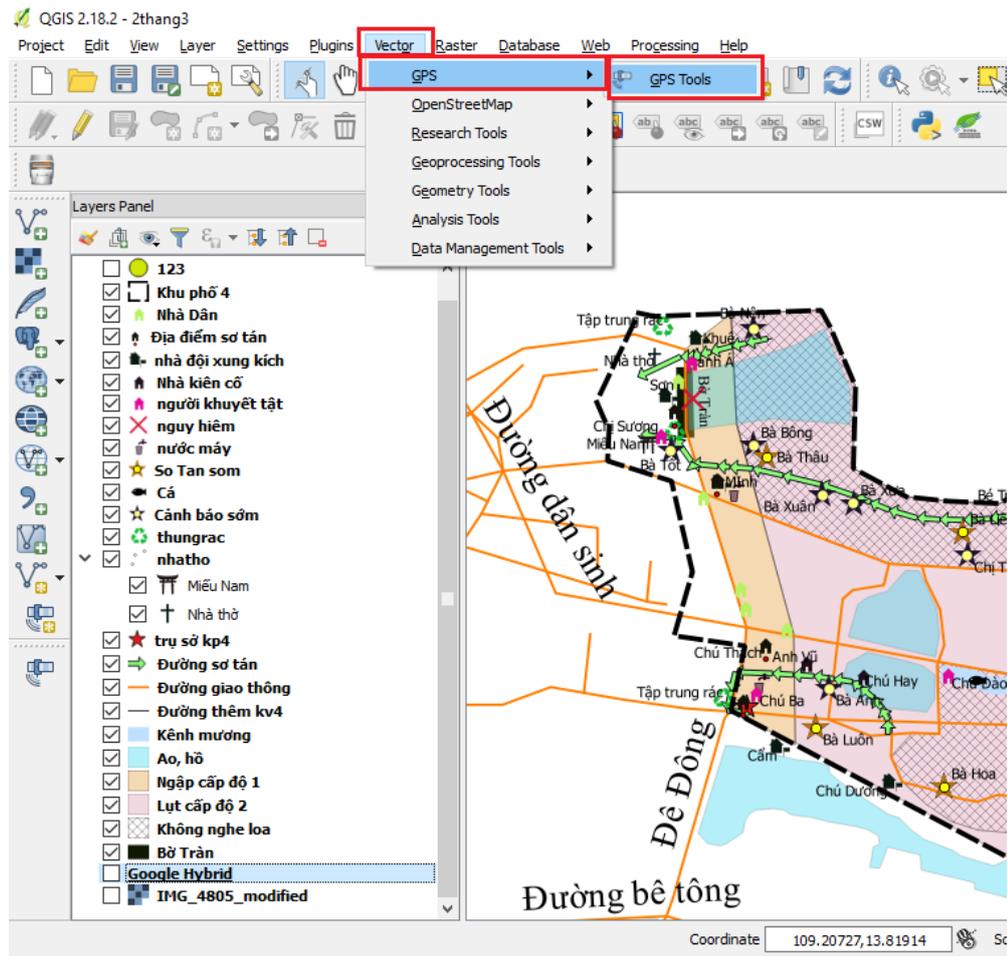
Step 1: Go to the function “**Plugins**”, select “**Manage and install plug-ins**”



Step 2: In **Search** box: type **GPS**, then choose “**GPS tools**”; click “**Settings**”



**Step 3:** Go to **“Vector”**, select **“GPS”** and click **“GPS tools”**



**Step 4:** **“GPS tools”** appears; set parameters in **“Downloaded from GPS”** as follows:

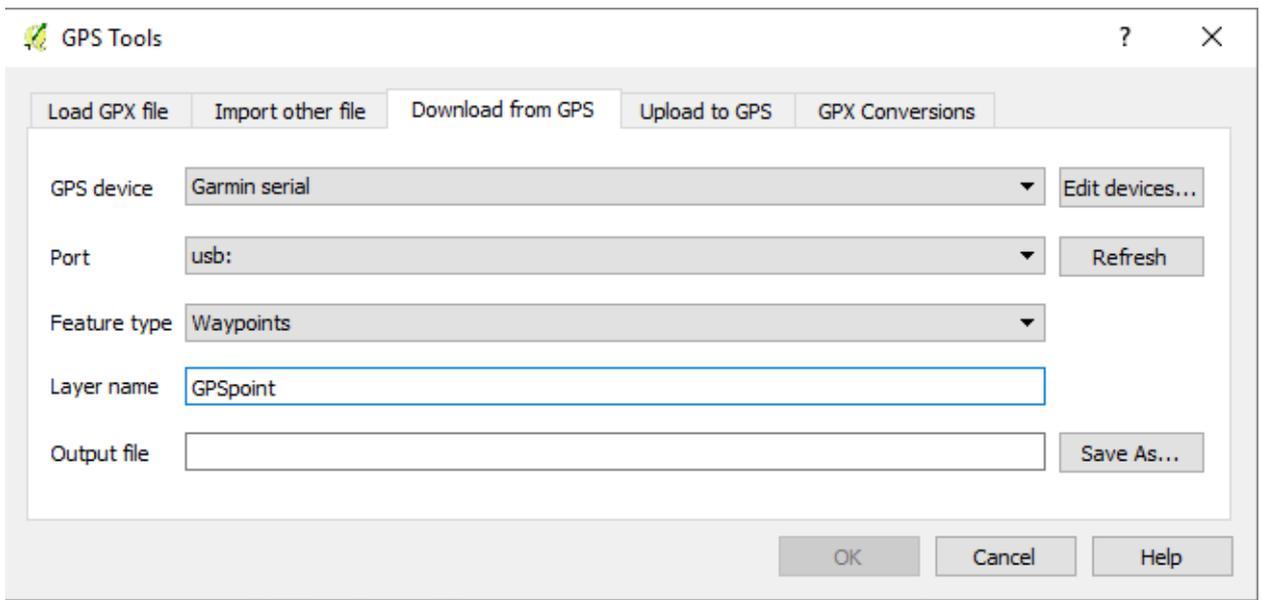
**GPS device:** choose the type of device under operation

**Port:** select **“local gpsd”** or **“usb”**

**Feature Type:** select **“Waypoint”** or **“Route”** or **“Path”**

**Layer Name:** name the layer

**Output file:** find the path to save and name the folder



**Note:** Clean the device after use and remove the battery from the device if not using for a long time. In case of damages, contact the supplier for repair - genuine warranty, do not disassemble yourself.

The device is IPX7 waterproof, water resistant to 1 meter deep within 30 minutes. However, during use, it is necessary to limit contact with water. If the device accidentally falls into the water, dry before storing it.

## APPENDICE 1 – MAP SYMBOLS

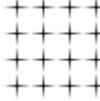
The following symbols are recommended for common icons used in developing a multi-hazard risk map.

Types	Content	Symbol
<b>Point</b>	Local government building	
	School	
	Hospital/clinic	
	Open well	
	Dangerous area	
	Tree	
	Bridge	
	Culvert/Drainage pipelines	
	Electric poles	

Types	Content	Symbol
	Loud speaker	
	Boat	
	Dustbin	
	Domestic water use (symbol for group)	
	Petrol station	
	Factory	
	Church	
	Pagoda/Temple	
	Toilet	
	No toilet	
	Football ground	

Types	Content	Symbol
	Park	
	Hill	
	Flood pole	
	Strong/permanent houses (for flood evacuation)	
	House of people with disabilities	
	House of elders living alone	
	Temporary house	
	House of the poor	
	House with children	
	House of city authority	
	House of other people	
	House of people with serious diseases	

Types	Content	Symbol
	House of rescue team member	
	Place for rescue equipment store	
	Market	
	In need of early warning	
	In need of early evacuation	
	Evacuation shelter	
	garbage collection point	
	Place for relief delivery	
	Clean water provision point	
Line	Adminsitrative border of quarter/ district  Concrete road	  

Types	Content	Symbol
	Unpaved road	
	River, stream, dyke	
	Evacuation road	
	spillway	
<b>Region</b>	Sea	
	Lake	
	Flooded area (level 1)	
	Flooded area (level 2)	
	Cyclone prone area	
	Tidal surge prone area	
	Area inaccessible to early warning	
	Landslide prone area	
	Area of salt intrusion	
	Rice paddy field	

**Note:**

1. When saving the layers, you should group the layers based on a specific purpose. For example: a layer for vulnerable group would include House of people with disabilities, house of people living alone, house of the elderly,; a layer for local capacity: Loud Speaker, drum alarm, etc.; a layer for response: Evacuation road, safe houses for evacuation, flood proof houses, etc.
2. In case an object fits more than one criterion (for example, one household has person with disability, classified as poor family and also a household of person living alone). If you need to show all 3 characteristics on the map, you need to build 3 layers for 3 characteristics and add one more layer with a new symbol to consolidate all the above features.

For example: one household has person with disability, classified poor and also a household of person living alone, you need to build the layers as below:

No	Layer	Symbols	Content
1	House having PWD		Household with person with disability
2	Poor household		Poor household
3	House of person living alone		Person living alone
4	Vulnerable House		House having PWD, classified as poor and having person living alone.