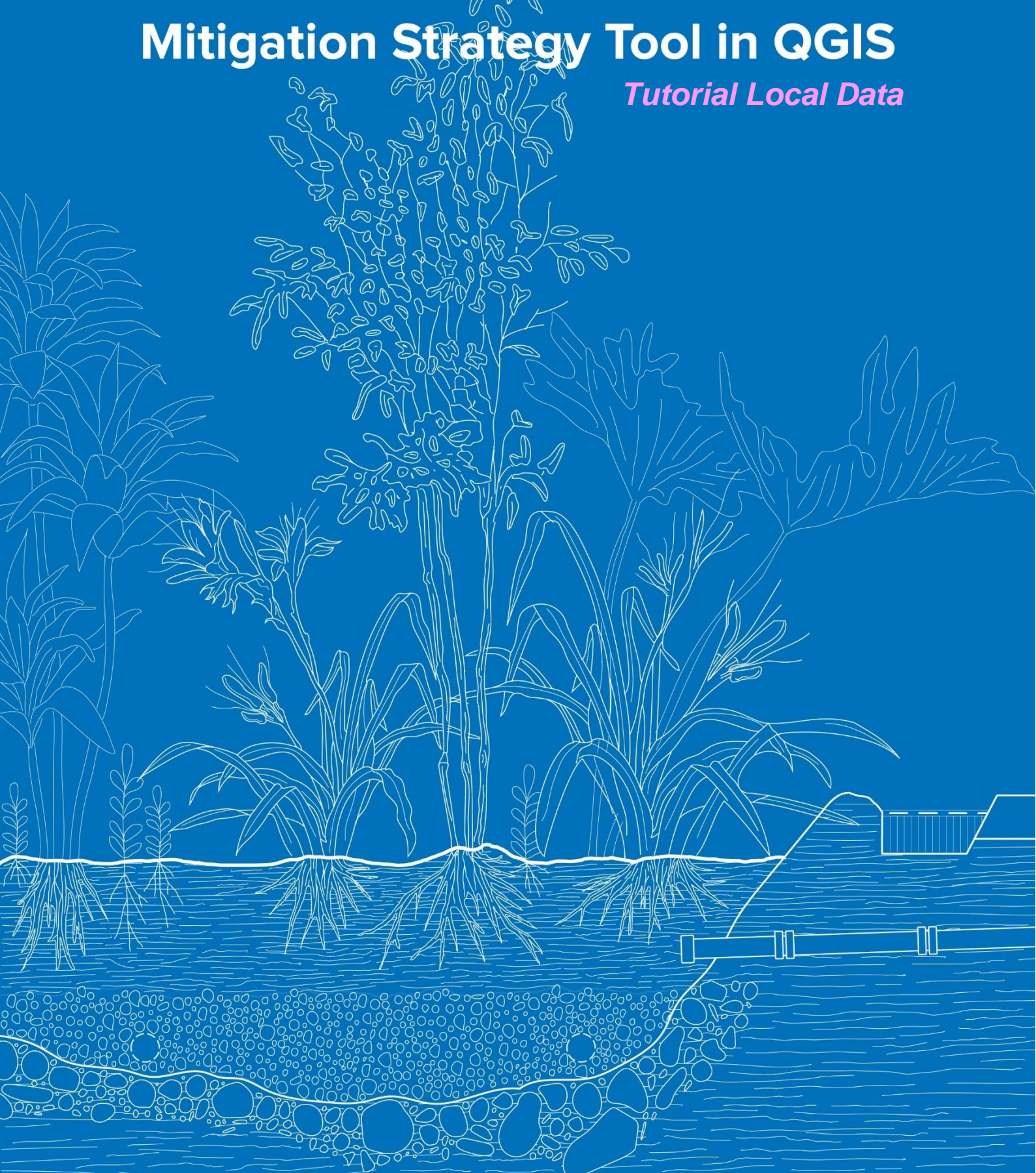# User Manual for the Risk Mitigation Strategy Tool in QGIS

Tutorial Local Data

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Project team:

ETH Zurich - Institute for Spatial and Landscape Development

Spatial Development and Urban Policy, SPUR: David Kaufmann, Bruna Rohling, David Kostenwein, Mona Gairing, Nadine Antenen

Planning of Landscape and Urban Systems, PLUS: Adrienne Grêt-Regamey, Laura Schalbetter

Geneva Technical Hub, co-convened by UNHCR and SDC: Ammar Al-Madhawi, Emilie Schmid (coordination)

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humanitarian planning hub

SPUR Spatial Development and Urban Policy

PLUS PLANNING OF LANDSCAPE AND URBAN SYSTEMS

GENEVA TECHNICAL HUB Co-convened by **UNHCR** The UN Refugee Agency

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

About this Document

The manual for the Risk Mitigation Strategy Tool consists of three documents:

- General Manual
- Tutorial Local Data
- Tutorial Global Data (this document)

The **General Manual** explores the integration of the Risk Mitigation Strategy Tool into the broader context of the project. It also covers installation instructions, QGIS project setup, and provides additional insights to enhance your understanding of the analysis.

In **this document**, you will find a detailed step-by-step analysis showing the use of the GIS plugin. The example is based on the Al-Redis settlement in Sudan, using local data sources. Even if you choose a different location, you can move seamlessly through this guide by simply selecting the appropriate data for your chosen area. The **tutorial on global data** offers the same detailed steps but with a focus on utilizing global data sources.

This tutorial begins with stating the data requirements when using local data and continuous with detailed explanations for each step. Steps marked as "optional" are not essential for the tool's functionality but are intended for adjustments on data that can enhance the accuracy of results.

Data requirements

Local data - buildings and flood areas
In this example, local building and riverine flood data are supplied in shp-file format. You can find them in the respective data folder on SharePoint Al-Redis Settlement Data. The data from Al-Redis Settlement serves as an example in this tutorial. Should you opt for a different settlement, you will need to have or provide the corresponding data yourself.

Global data - transport infrastructure
Please download the global transport infrastructure from http://download.geofabrik.de/. Choose the Sub Region Africa and download the shp-file for Sudan.

Sub Region	Quick Links		
	.osm.pbf	.shp.zip	.osm.bz2
Africa	[.osm.pbf] (5.4 GB)	✖	[.osm.bz2]
Antarctica	[.osm.pbf] (31.0 MB)	[.shp.zip]	[.osm.bz2]
Asia	[.osm.pbf] (11.1 GB)	✖	[.osm.bz2]
Sudan	[.osm.pbf] (91 MB)	[.shp.zip]	[.osm.bz2]

Open your download folder and unzip the folder you have just downloaded. Save it to a folder you will remember.

> ⓘ You can find information on data source and content in the **General Manual.**

Step-by-step Guide

Please follow all steps making use of the numbered blue buttons to finally create the risk map and the risk mitigation strategy.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

Step 1 - Definition of settlement extent

Adjust the map view so that the focus is on the settlement of Al-Redis in Sudan. The easiest way to do this is to copy the following values into the status bar located at the bottom of QGIS.

Coordinate	12.588338, 32.77774
Scale	1:4709

Coordinate 12.588338,32.77774   Scale 1:4709   Magnifier 100%   Rotation 0.0 °

Click on button **1** of the plugin to outline the extent of your settlement or the area you intend to analyze. You can now define the boundaries of the settlement by left-clicking to set edge points. Complete the drawing by right-clicking.

⚠ Make sure the *SettlementArea* Layer is selected by clicking on the layer name (not the check box) in the Layers Window.

Step 2 - Upload data

To choose the data to be used for the analysis, click the button **2** and execute all uploads one after the other. Transport Infrastructure, Buildings and Riverine Flood Data have to be uploaded; for Pluvial Floods there is no local data available for the Al-Redis settlement. The order in which you upload the data does not matter.
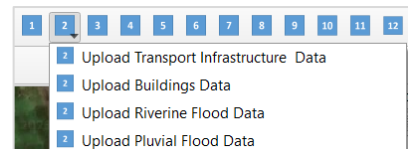
> ⓘ For the Al-Redis settlement, no local Pluvial Flood data is available, and we will skip its upload in this tutorial. However, if you have local pluvial flood data for your settlement, you can upload it here.
>
> In any case, you can also add areas prone to pluvial flood based on your local knowledge in step 4.
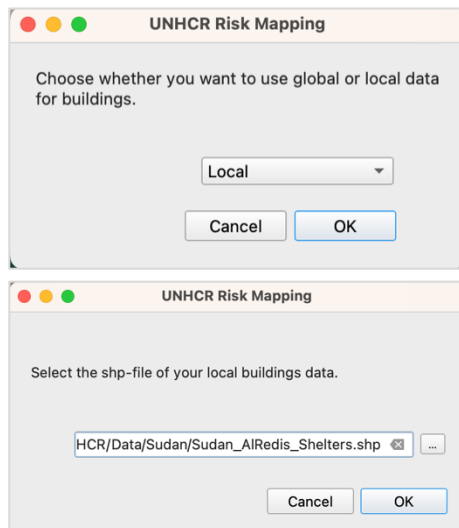
Transport infrastructure

To upload transport infrastructure data, select the shp-file you downloaded from Geofabrik and click OK.
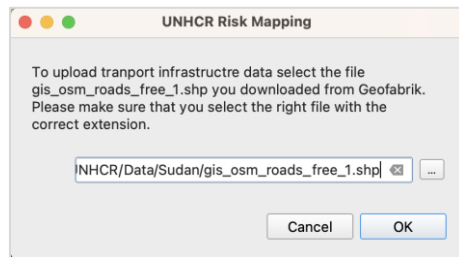
> ⓘ If you have local transport infrastructure data for your settlement, you can upload it here instead.

Buildings

To upload buildings data, opt for the local data upload option. Choose the buildings shp-file provided and click OK.

Riverine flood

To upload riverine flood data, select the global data upload option. Upload the riverine flood shp-file provided and click OK.
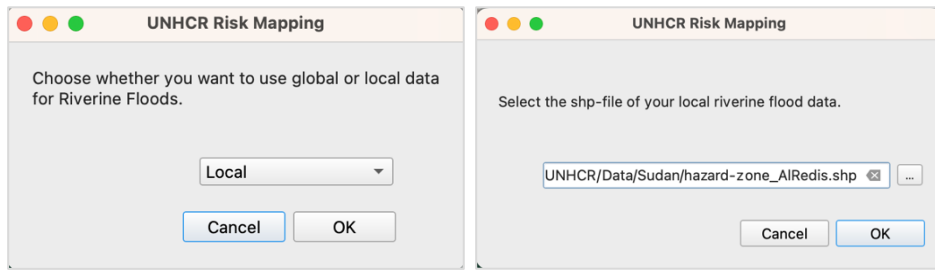
The following window will appear where you need to edit the attribute table of the local riverine flood data to make sure that all the required information is present. To start editing, click on the edit button in the upper left corner. To know where the feature is located, you can click on the feature, which will make it light up red on the map. For each feature you need to enter the gridcode and RepeatYear values based on your local knowledge. For this example, we provide you with the values you need to enter in the following table.
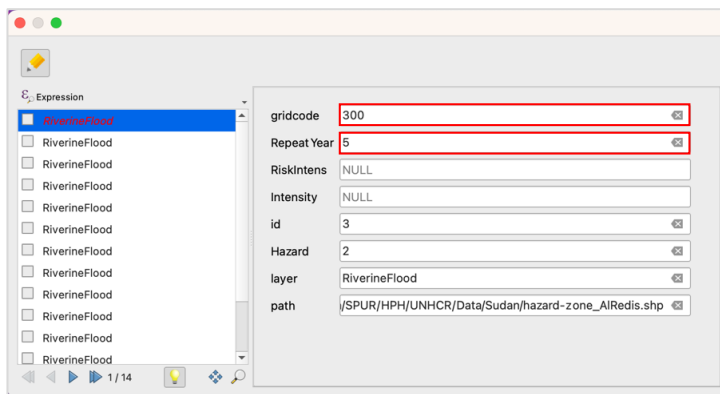
|	gridcode (water depth)	RepeatYear (return period)
1	300	5
2	300	5
3	300	5
4	300	5
5	300	5
6	100	100
7	600	1
8	100	100
9	100	100
10	100	100
11	300	5
12	300	5
13	300	5
14	100	100

> (i) The term "gridcode" refers to the water depth, while "RepeatYear" corresponds to the return period of a flood event. Find out more about water depth and return period of a flood event in the **General Manual** under "Flood attributes" to understand the appropriate values to enter.

Step 3 - Riverine flood adjustment [optional]

If you want to add more or adjust zones prone to riverine floods manually, click on button 3. Select both the return period and intensity level for the flood event within the designated area. Click OK and proceed to outline the extent of this flood event on the map using left-click for edge points and right-click to conclude the drawing.
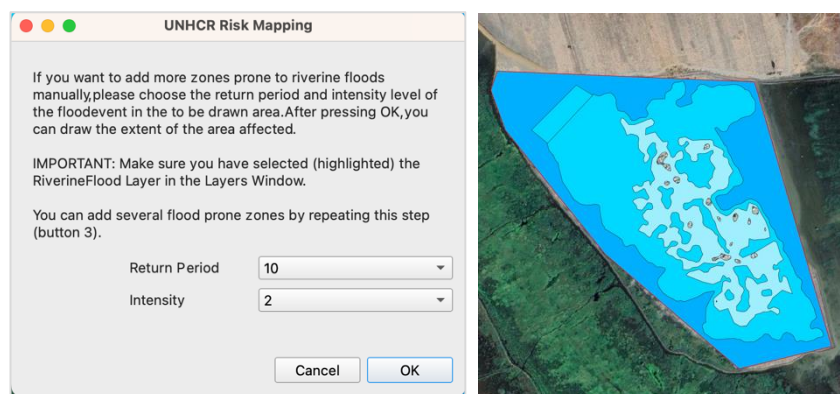
> ⚠ Make sure the *RiverineFlood* layer is selected by clicking on the layer name (not the check box) in the Layers Window.
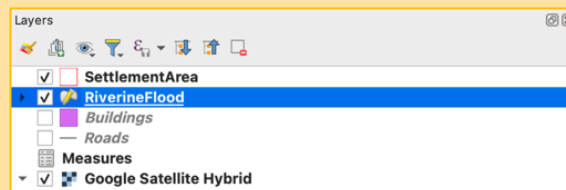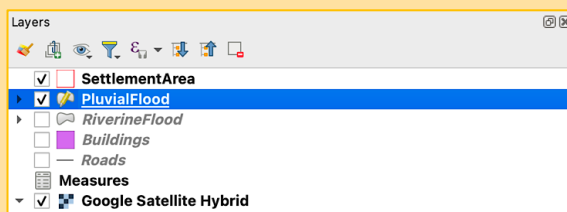

> (i) You can add or adjust several flood prone areas by repeating this step.

Step 4 - Pluvial flood adjustment [optional]

If you want to add or adjust zones prone to pluvial floods, you can do it manually by clicking on button 4. Again, choose the return period and intensity level for the flood event within the designated area. Click OK and proceed to outline the extent of this flood event on the map using left-click for edge points and right-click to conclude the drawing.
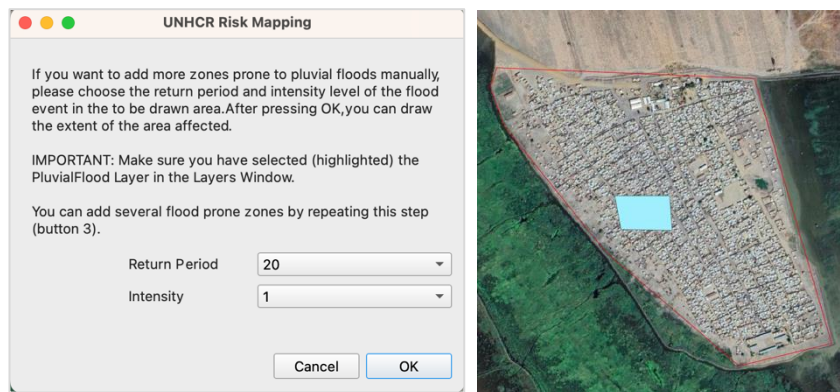
⚠ Make sure the *PluvialFlood* layer is selected by clicking on the layer name (not the check box) in the Layers Window.


ⓘ You can add or adjust several flood prone areas by repeating this step.

Step 5 - Risk area calculation

In the fifth step, the hazard areas and corresponding risk intensities are automatically calculated. You have the possibility to adjust the findings in later steps. Click on button 5 and press OK. Wait until the layers are added and the success message appears.

Step 6 - Adjust buildings [optional]

By default, all loaded buildings are categorized as "Residential Shelters" with "transitional" construction. In step 6 , you can modify the building type and type of construction of an existing building. Select the desired building type and construction type from the drop-down menus and confirm by clicking OK. Subsequently, designate the specific buildings for the updated values by drawing on the map, using left-click for edge points and right-click to conclude the process.
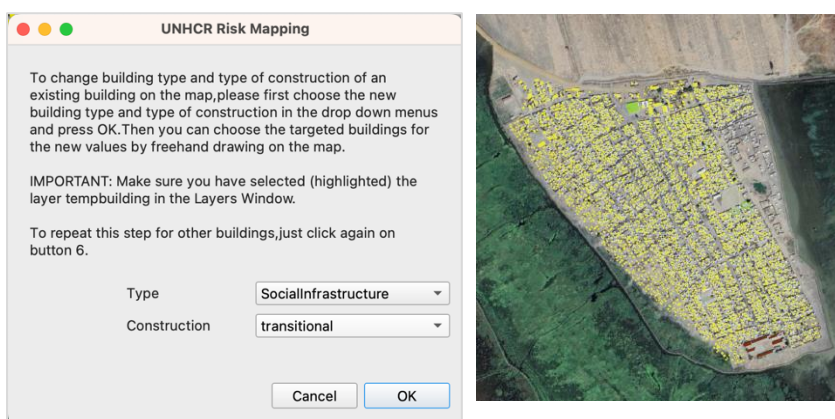
⚠ Make sure the *tempbuilding* layer is selected by clicking on the layer name (not the check box) in the Layers Window.
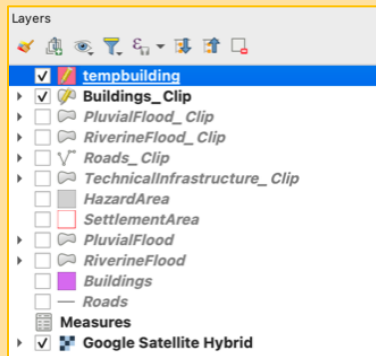

ⓘ You can adjust several buildings by repeating this step.

If you need to remove one or multiple preloaded buildings, please refer to the "QGIS Workarounds" section in the **General Manual** for detailed instructions.

ⓘ Find out more about Type and Construction of a building in the Overall Guide under "Types of vulnerable assets" and "Type of construction".

Step 7 - Add buildings [optional]

To add new buildings to the map, click button 7 . Select the building type and construction type from the dropdown menus and confirm by clicking OK. Subsequently, outline the structure by using left-click for edge points and right-click to complete the drawing.
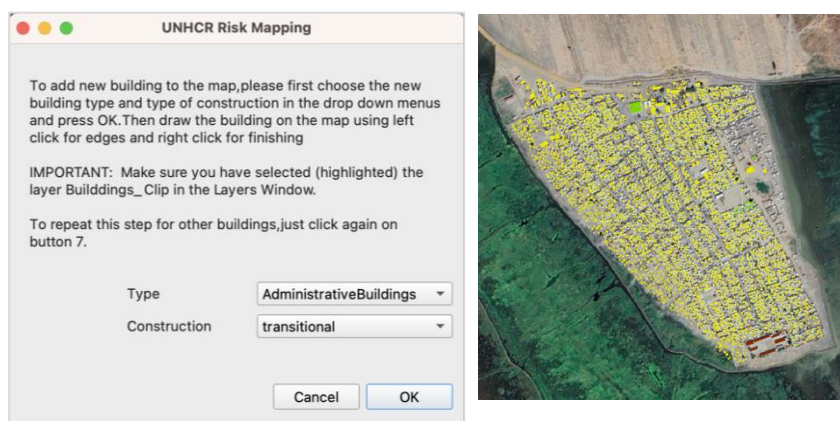
ⓘ You can repeat this step for all missing buildings.

> ⚠ Make sure the *tempbuilding* layer is selected by clicking on the layer name (not the check box) in the Layers Window.
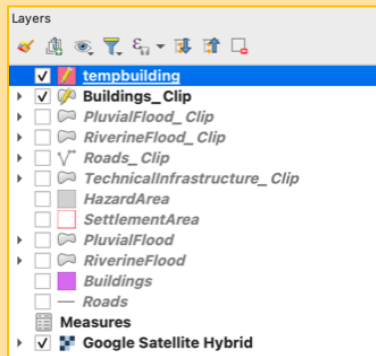
Step 8 - Add technical infrastructure [optional]

To add technical infrastructure to the map, click button 8 . Select the type from the dropdown menu and confirm by clicking OK. Subsequently, outline the structure by using left-click for edge points and right-click to complete the drawing.
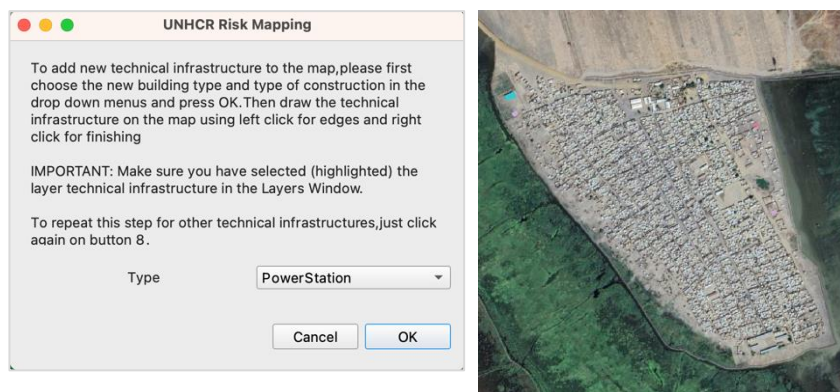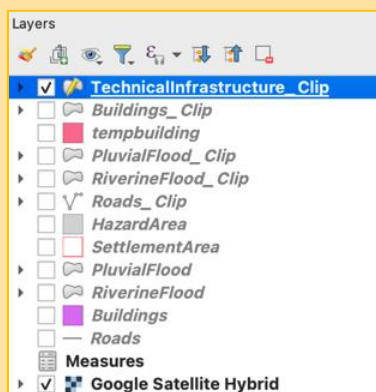

> ⚠ Make sure the *TechnicalInfrastructre* layer is selected by clicking on the layer name (not the check box) in the Layers Window.

> ⓘ You can repeat this step for all missing technical infrastructure.

Step 9 - Add transport infrastructure [optional]

To add transport infrastructure to the map, click button 9 . Select the type from the drop-down menu and confirm by clicking OK. Subsequently, outline the structure by using left-click for edge points and right-click to complete the drawing.
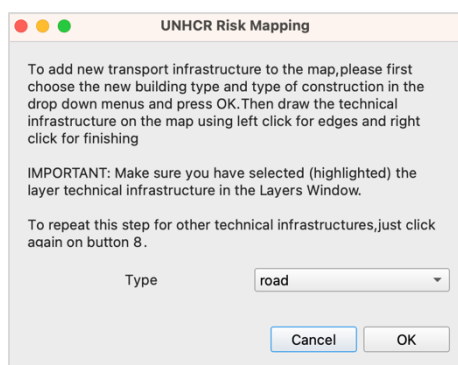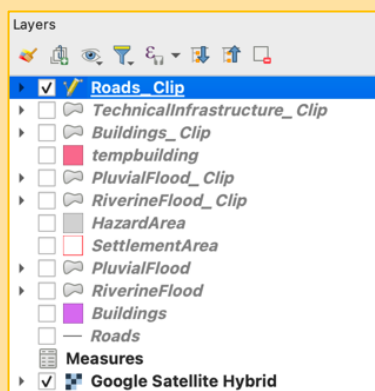

⚠ Make sure the *Roads_Clip* layer is selected (and highlighted – see image below) by clicking on the layer name (not the check box) in the Layers Window.

ⓘ You can repeat this step for all missing technical infrastructure.

If you need to remove one or multiple preloaded roads or bridges, please refer to the workaround section for detailed instructions.

Step 10 - Calculate risks

In this step, the risk of every building, transport infrastructure and technical infrastructure is automatically calculated, based on the flood hazard as well as 10 physical and socioeconomic vulnerability. Click button and start the calculation by pressing *OK*. Wait until the layers are added and the success message appears.

Step 11 - Adjust risk [optional]

To adjust the risk level manually, click on button `11`. Choose the layer (type of asset and flood) to be adjusted from the drop-down menu and select the new risk level value. Confirm by clicking OK and outline the area by using left-click for edge points and right-click to complete the drawing.
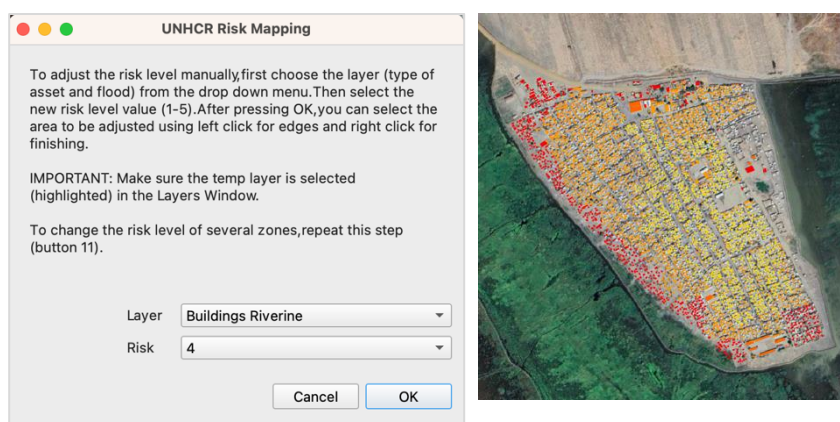
⚠ Make sure the temp layer is selected by clicking on the layer name (not the check box) in the Layers Window.
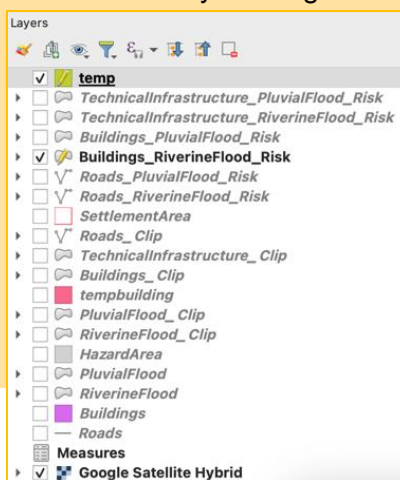
ⓘ You can repeat this step to change the risk level of several areas.

Step 12 - Export risk map

By pressing button 12 the Risk Map will be exported as a PDF to the project-folder. If no areas prone to riverine floods are registered, only the "Output_RiskMap_Riverine" will be displayed.

> ⓘ If you are modifying data, you can regenerate the risk maps by clicking button 12 once again.
> If you wish to retain the existing maps, it is necessary to either copy them to another folder or rename them, as the current maps will be overwritten.

Step 13 - Choose risk mitigation measures

You can filter the selection of potential risk mitigation measures to incorporate into the risk mitigation strategy by clicking on button 13 . Choose the preferred characteristics for the measures across various categories and then press OK.
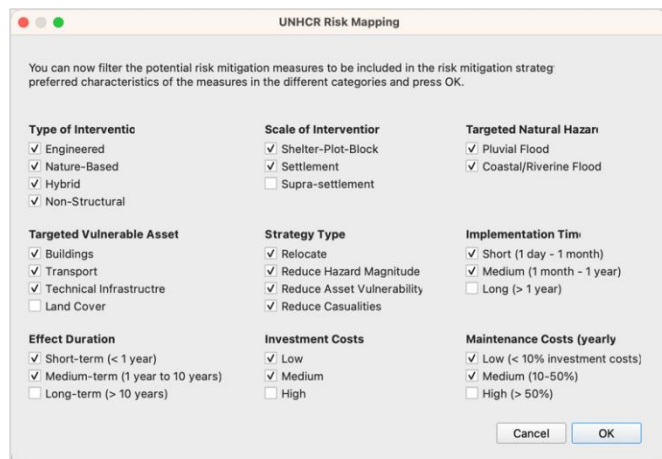
> ⓘ Find out more about the categories in the Compendium.

> ⚠ Ensure that you have selected at least one item per category. It is possible that specific combinations of chosen categories may not yield any measure output, therefore we recommend including more options rather than fewer.

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Step 14 - Export risk maps including risk mitigation measures

Press button [14] to export risk maps, including the tables constituting the Risk Mitigation Strategy.

Measurements Building - Riverine Flood
12-02-2024

Legend
Buildings_RiverineFlood_Risk
- no data
- very low
- low
- medium
- high
- very high
Google Satellite Hybrid

Scale 1:4638

Catalog_No	Name
(02)	Vernacular and Non-engineered Dams
(03)	Geotextile Tubes and Containers
(07)	Drainage Systems
(11)	Elevated Architecture
(12)	Amphibious Constructions
(13)	Consolidation of Structures
(14)	Temporary Flood Barriers

In addition, an Excel file is generated, providing details on the quantity of assets categorized by asset type and flood type for a specified risk.

	Asset_Type	Asset	Flood_Type	Risk	Count
0	Buildings	AdministrativeBuildings	Riverine	3	3
1	Buildings	AdministrativeBuildings	Riverine	4	3
2	Buildings	Logistics	Riverine	3	24
3	Buildings	Logistics	Riverine	4	24
4	Buildings	OpenSpaces	Riverine	2	3
...					

> (i) If you need to regenerate the risk mitigation strategy after adjusting the data in the preceding steps, simply click on button 14 again.
>
> To preserve the existing files, it's essential to copy them to another folder, as they will be overwritten.