MBL617 Theory and Methods in Digital Heritage

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Contents

Chapter 1

Syllabus

1.1 Content

The course is an introduction to **Digital Heritage** and has a two-fold purpose. In addition to giving an overview of theories and principles in digital heritage, both in Turkey and internationally, the course gives an introduction to research methods in three areas related to cultural heritage: **collection/management, visualization/communication,** and **analysis/ interpretation.**

1.2 Aims

To help students understand the link between cultural heritage and computing; to introduce key issues in digital heritage; to provide students with the basic theoretical and practical knowledge of digital methods such as GIS, AR/VR, AI.

1.3 Learning outcomes

Students who take this course gain will knowledge, ability and proficiency in the following subjects:

- Knowledge of historical, contemporary and specialized issues in the area of visual computation through original research,
- Understanding of the interdisciplinarity of computation in cultural heritage,
- Ability to assess methods and applications of digital heritage through systematic approaches,

- Ability to assess and apply research methodology,
- Competence in creative and critical thinking, problem-solving and decision making.

1.4 Conduct

The course will be conducted as seminars with weekly readings and assignments. During the course of the semester, students are required to submit written and practical assignments as requested by the instructors during class, and one final paper, based on either literature research or an original argument, and an in-class presentation of the final paper at the semester end. The essays submitted throughout the semester are to constitute the basis for the final paper; these should take into account class discussions, as well as students' own reflections. The final paper should be around 3000 words and structured with an introduction, development, and conclusion. The grading for the course is as follows: attendance and in-class participation in discussions and weekly response papers, 30%; hands-on practices, 30%; one end-of-semester paper, 20%; final project presentation by individual/group 20%.

1.5 Project

The collective efforts of the course participants will be part of a digital heritage project on Caravanserais of Anatolia. **All works will be uploaded to the website.**

1.6 Weekly Schedule

Chapter 2

Quick Start to QGIS

2.1 Installing QGIS

There are two options for installation:
* OSGeo4
* Standalone Installer

2.2 Familiarizing yourself with QGIS Desktop

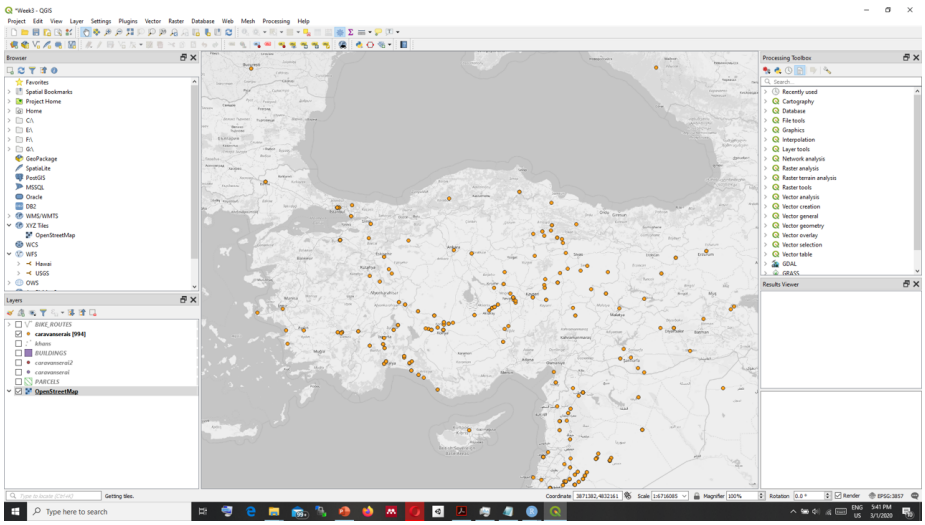

Figure 2.1: QGIS GUI

1. Menu Bar
2. Toolbars
3. Panel
4. Map Canvas
5. Status Bar

Chapter 3

Vector Data

3.1 Types of vector data in QGIS

- Points
- Lines
- Polygons

  layer > add layer > add vector layer

- File
- Folder
- Database
- Protocol

Files that can be loaded as vector files:

- Geopackage
- ESRI Shapefile
- Geography Markup Language
- CSV
- ...

WFS data example: https://mrdata.usgs.gov/services/wfs/ofr20051294?request=GetCapabilities&service=WFS&version=1.1.0

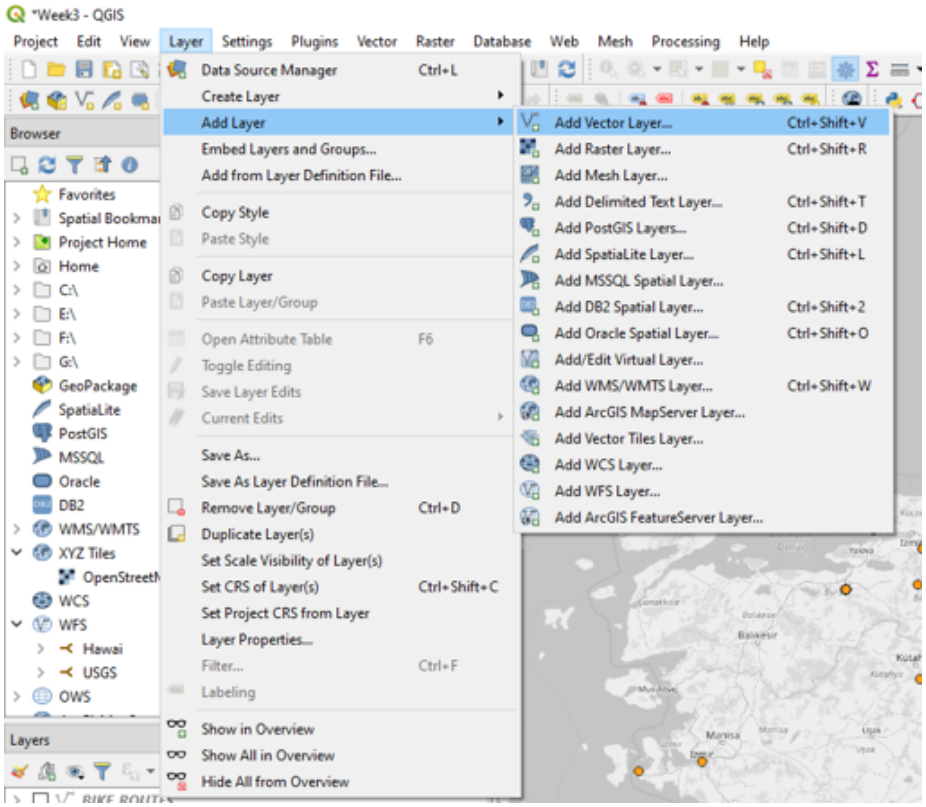

Figure 3.1: Adding Vector Layer

Chapter 4

Raster Data

- Image based
- Georeferencing
- TIFF

  layer > add layer > add Raster layer

4.1 CRS - Coordinate Reference Systems

- 4326 – Google Earth
  - Degrees – lat long
  - globe
- 3857 – Google Maps
  - Meters
  - map
- Many others

4.2 Raster File types

4.2.1 WMS

WMS - Web map services: https://mrdata.usgs.gov/services/ofr20051294?request=GetCapabilities&service=WMS&version=1.3.0

4.2.2 DEM - Digital Elevation Model

DEM is special satellite image that represents elevation of the terrain in a raster graphic. Every pixel value represents elevation on the terrain.

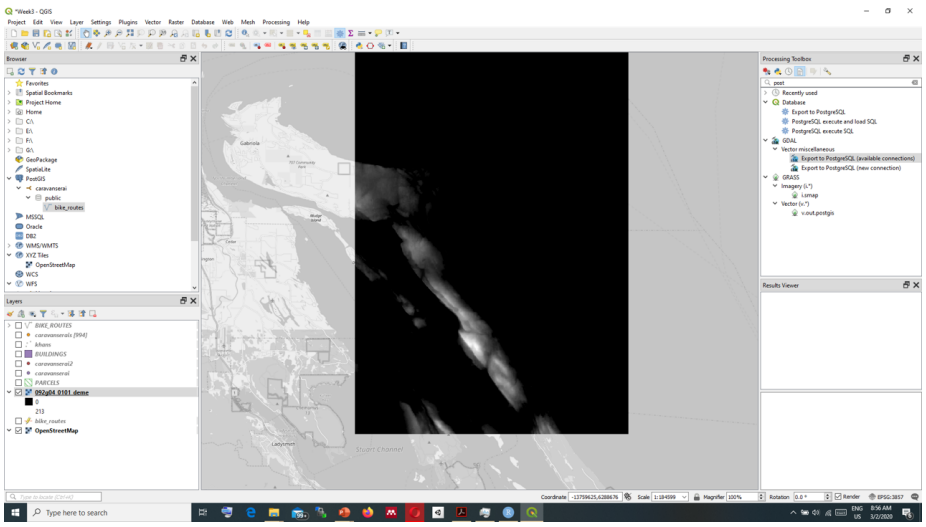

Figure 4.1: DEM

We can add DEM images similar to other raster files.

We can convert raster DEM files to vector contour lines.

GDAL>Raster extraction>Contour

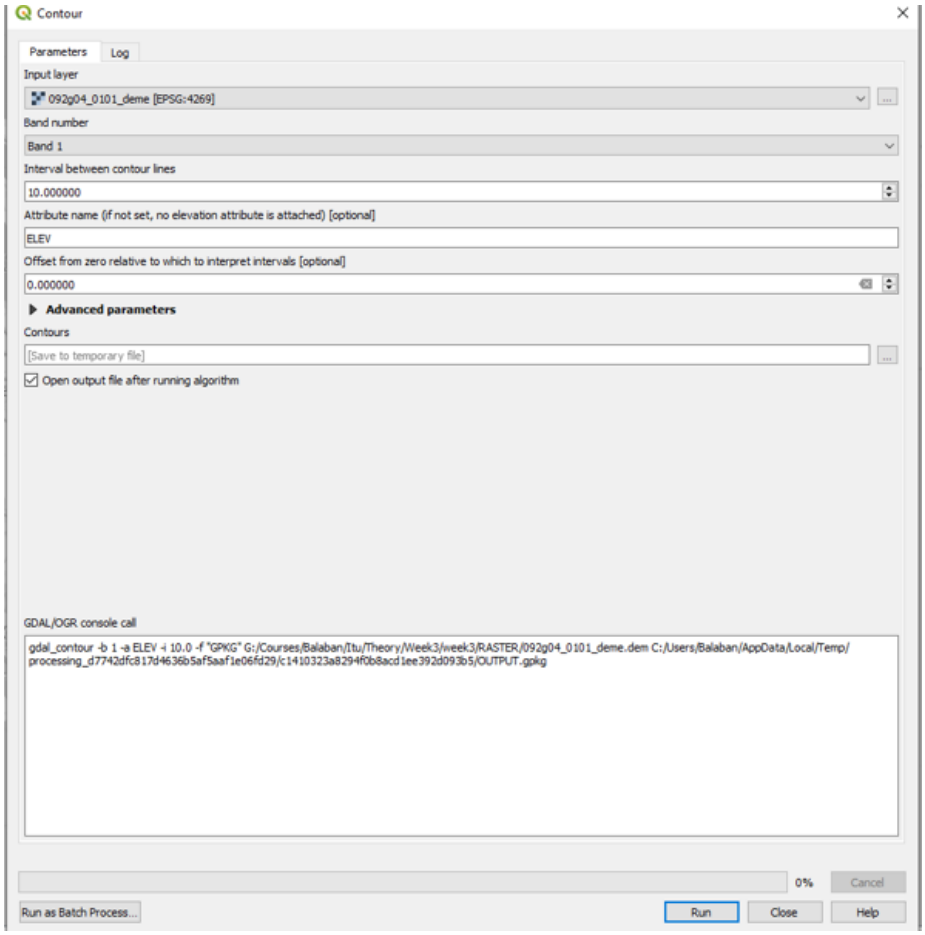

Figure 4.2: Contour

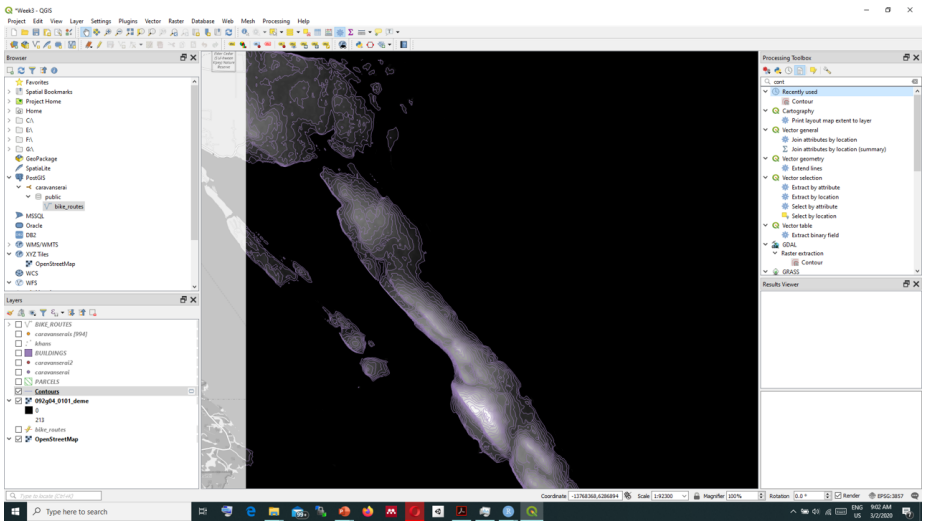

Figure 4.3: After extracting the contours

Chapter 5

3D Maps

We can create 3D maps to visualize the map in 3D. To do this

View >New 3D Map

That opens up a new window with 3D view. You can adjust, pan, zoom to the map.

We can make the vectors from the buildings into 3D objects. For this go to 3D View from layer Properties. Select extrusion and you can set one value for every polygon. Or you can assign a variable by clicking to the icon at the right and setting a variable for extrusion.

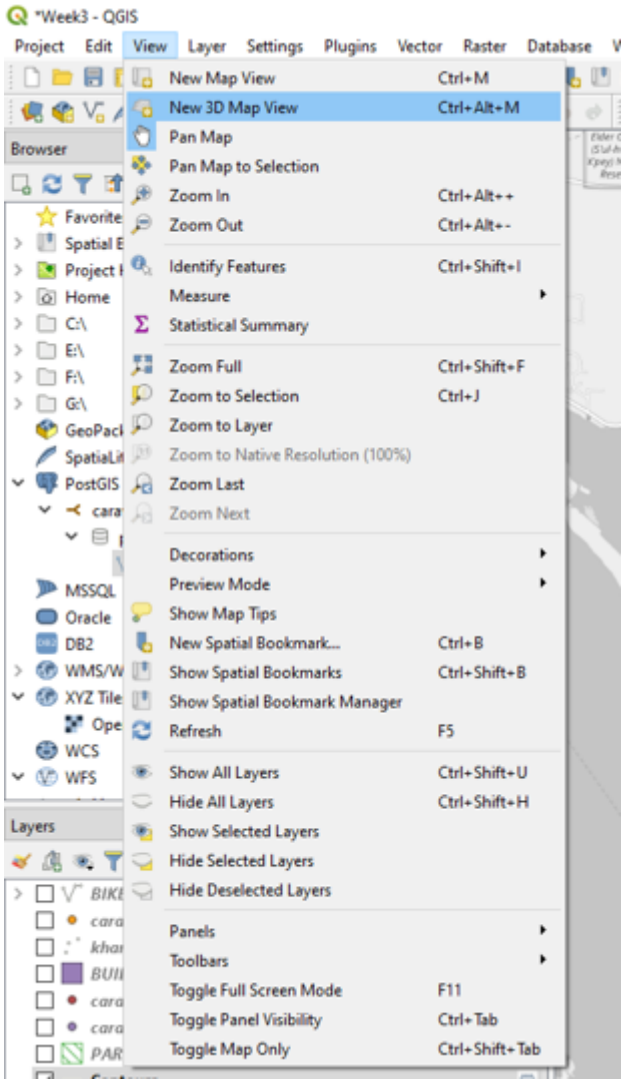

Figure 5.1: Adding 3D Map

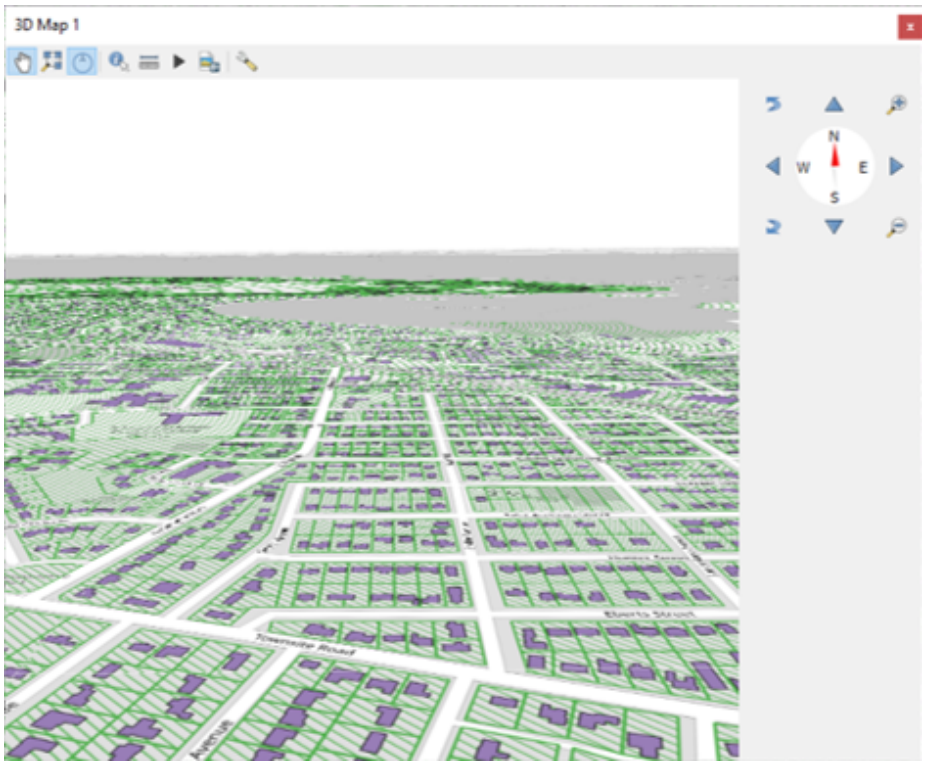

Figure 5.2: 3D Map Example

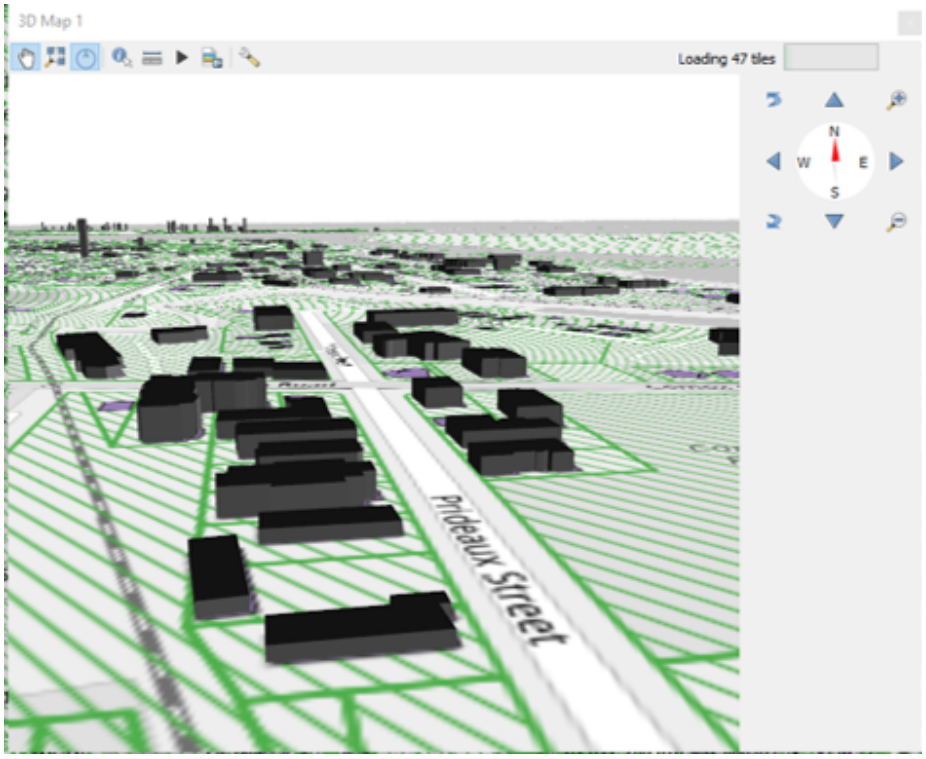

Figure 5.3: 3D Map Example with 3D polygons

Chapter 6

Styling Data

QGIS is very flexible in styling data. We can style our layers to visualize the information better.

6.1 Points

6.2 Polylines

6.3 Polygons

6.4 Raster

Chapter 7

Printing Maps

Chapter 8

Creating Data

Chapter 9

Databases

QGIS has an ability to connect to various different databases. Geopackage, Oracle Spatial, PostGIS, SpatiaLite.

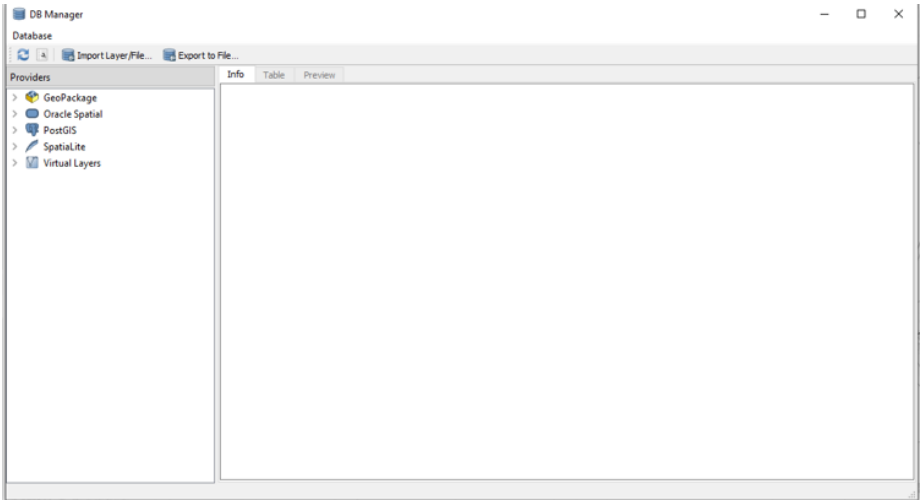

Figure 9.1: Databases that can be connected through QGIS

We are going to use PostGIS in our projects.

> PostGIS is the geographic extension of the database management system, PostgreSQL, which allows us to store geographic objects as part of our data tables. A geographic object is a special type of data that allows us to store a geographic position or a set of them as part of a line or a polygon. Essentially, PostGIS is a powerful tool that enables you to handle complex geographical data

and visually explore this data when you use it along with graphical tools, such as QGIS.

We will be hosting our PostGIS database using Google Cloud.To access it we need to connect using SSL. (However, the eduroam connection in the campus prevents us to use the port 5432 which is the usual postgreSQL port so we need to use out of the ITU network)

To connect you will need to download 3 certificate files. server-ca.pem, client-cert.pem, client-key.pem. Download these files and place them to a folder that is accesible.

From processing toolbox click the right most icon, **options**.

From the menu select **Authentication**.

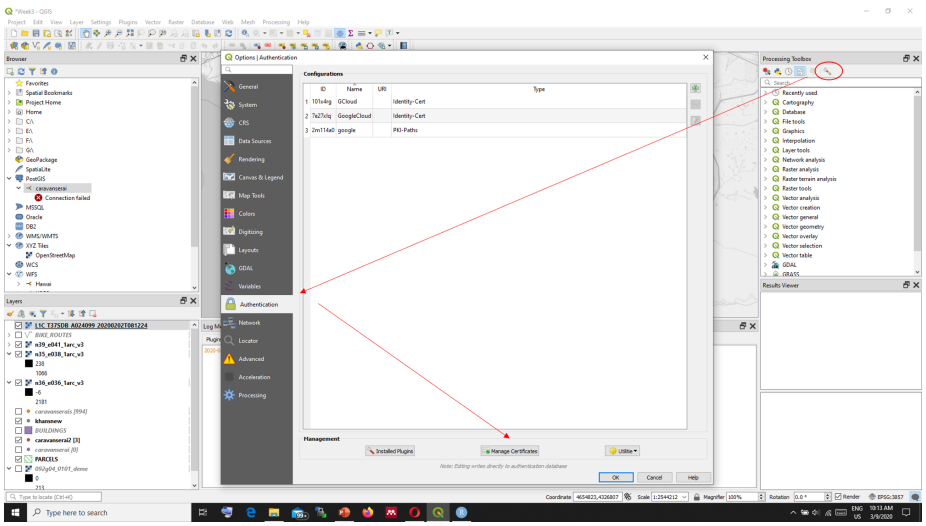

Figure 9.2: Manage Certificates

And next select **manage certificates**.

Here from the authorities tab, click + to add Google Cloud certificate.

Here from the import certificate menu, click … icon and locate your server-ca.pem file.

Back from the certificate manager screen click to the identities tab and click + icon.

From the import identity screen, select PKI PEM/DER Certificate Paths. For cert select client-cert.pem and for key select client-key.pem.

Next, close the identity screen and from the Authentication screen click + icon.

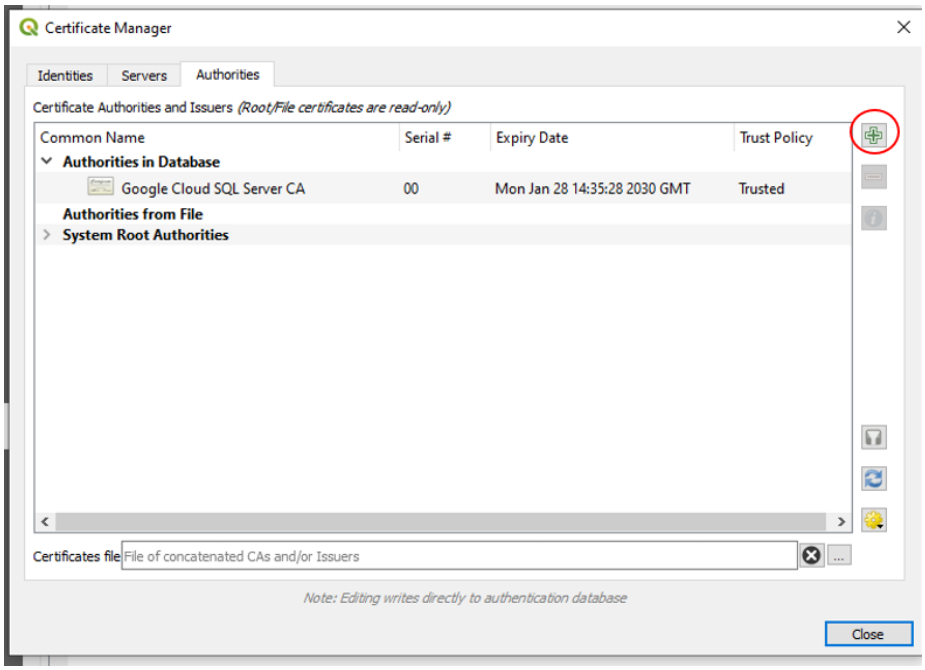

Figure 9.3: Certificate Manager

From the dialogue box, select PKI stored identity certificate, and select the certificate that you have created (postgres). write a name (eg. Google Cloud) and save.

Now close the windows and from the browser panel select PostGIS and right click and select new connection.

Here you need to enter information required to setup a connection to our server. Fill out the information as following:

The username and password for our database is **postgres** and **123post**. After this step we will be connected to the server.

Server connections work similar to the layers. If you have a geospatial data you can import or export to the database.

For this project, we need to have a database of caravanserais as point geometries and we need topography information as vector layer.

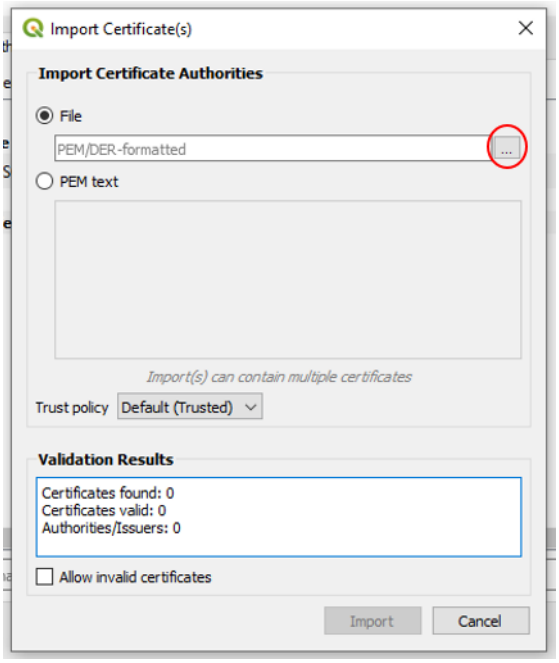

Figure 9.4: Import Certificate

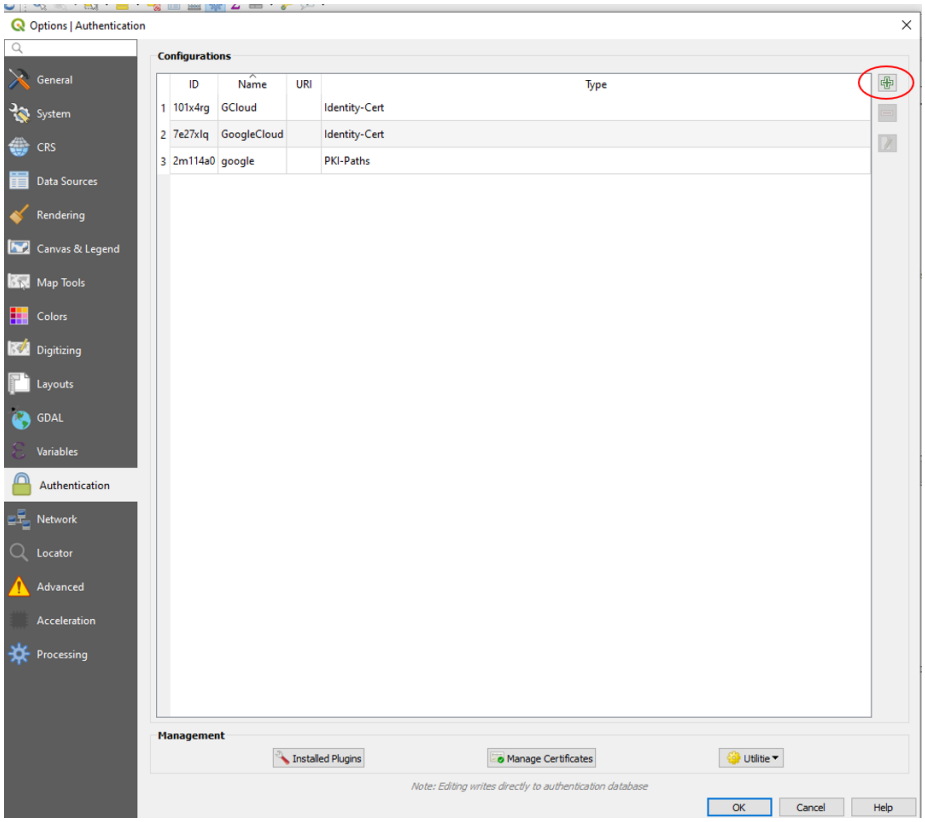

Figure 9.5: Authentication window

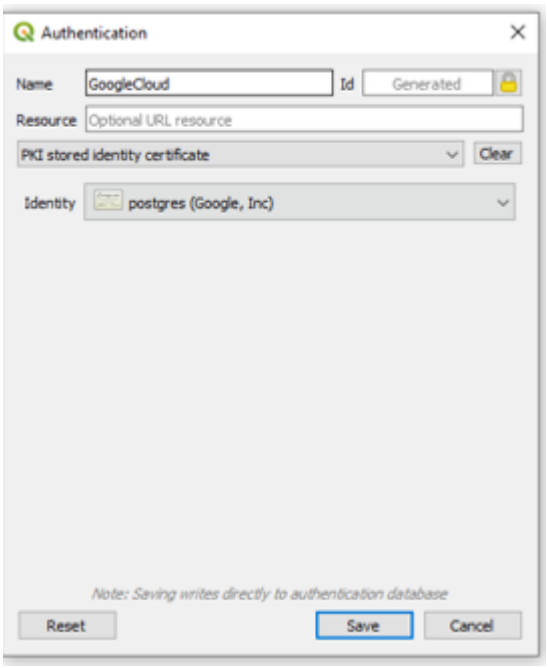

Figure 9.6: Authentication Dialogue Box

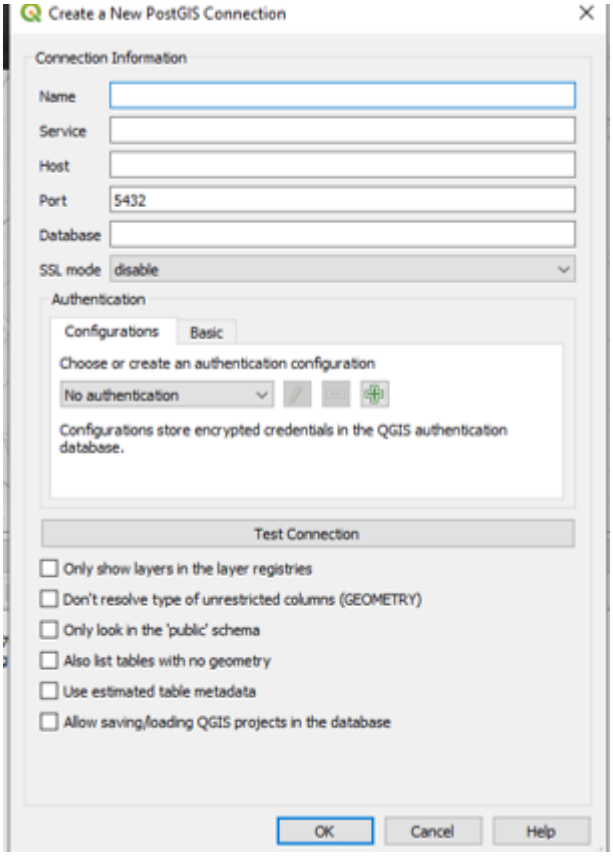

Figure 9.7: PostGIS server settings

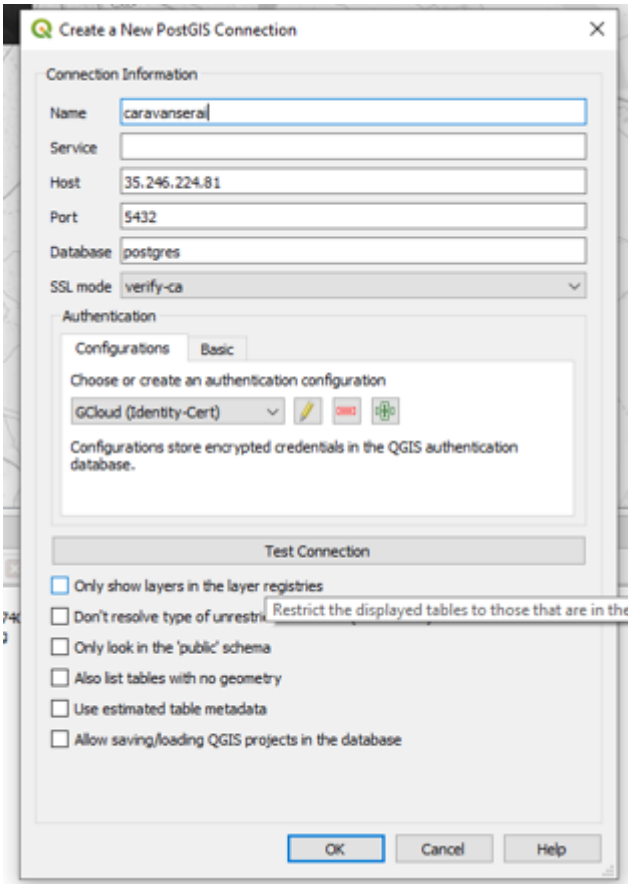

Figure 9.8: PostGIS information

Chapter 10

Assignment

You have been collecting data from the written resources.The primary resources were:

- International database on caravanserais, OWTRAD
- Academic publications, ACUN, ERDMANN, ILTER, CEKUL, etc..
- Websites by travelers, TURKISHHANS

You have been using QGIS, Google Earth, Gsheet, Gdrive to structure the data. As our approach is rather Geotemporal, for the next step, you will be using the central database of QGIS.

Next step will to explore the ACCURACY of the data:

- Level 1: REGISTERED HISTORICAL BUILDINGS (TESCILLI BINALAR) by Ministry of Culture and Tourism, State Museums/Sites (Müzeler ve Ören Yerleri), Local Authorities (Belediyeler):
- https://www.kulturportali.gov.tr/
- https://muze.gov.tr/muzeler

Level 2: Researched Historical Buildings by Local and Academic Authorities. ÇEKÜL: https://www.cekulvakfi.org.tr/ International Universities Local/National Universities Level 3: Travelers, Touristic Informations, Locals Level 4: Digital Tools and Methods

```
n = c(1, "Bursa - Konya", "AYS", "Bursa, Bilecik, Kütahya, Eskişehir, Afyon, Konya")
s = c(2, "Denizli- Alanya- Konya", "TAN", "Denizli, Uşak, Burdur, Isparta, Antalya, (Alanya, Beyş
b = c(3, "Mersin - Aksaray- Konya", FALSE, TRUE)
df = data.frame(n, s, b)
knitr::kable(df, caption = "Table with kable")
```

Table 10.1: Table with kable

n	s
1	2
Bursa - Konya	Denizli- Alanya- Konya
AYS	TAN
Bursa, Bilecik, Kütahya, Eskisehir, Afyon, Konya	Denizli, Usak, Burdur, Isparta, Antalya, (Alanya,

1 Bursa - Konya

Bursa, Bilecik, Kütahya, Eskişehir, Afyon, Konya, 2 Denizli- Alanya- Konya

Denizli, Uşak, Burdur, Isparta, Antalya, (Alanya, Beyşehir, Eğirdir) 3 Mersin - Aksaray- Konya

Mersin, Karaman, Konya, Niğde, Aksaray, Adana, Osmaniye 4 Konya - Aksaray - Konya

Konya -Aksaray- Nevşehir 5 Sakarya - Kayseri- Sivas

Sakarya, Düzce, Bolu, Ankara, Çankırı, Kırıkkale, Kırşehir, Nevşehir, Kayseri, Sivas 6 Sinop - Sivas - Malatya

Sinop, Kastamonu, Samsun, Amasya, Çorum, Yozgat, Tokat, Sivas, Malatya 7 Urfa - Kayseri

Urfa, Kilis, Antep, Adıyaman, Maraş, Kayseri, Sivas 8 Mardin - Sivas

Mardin, Şırnak, Siirt, Batman, Diyarbakır, Bingöl, Malatya, Elazığ, Tunceli, Sivas 9 Iğdır - Sivas

Iğdır, Kars, Ağrı, Bitlis, Muş, Van, Erzurum, Bayburt, Gümüşhane, Erzincan, Sivas

10.1 Collecting the data & Creating the layer

First step for this assignment is to gather the location info for the caravanserais that you are assigned.

Create a GeoPackage layer.

> Layer>Create Layer>New GeoPackage Layer…

After creating an empty geopackage layer, we are going to create our caravanserais as points.

Right click on the created layer and select **Open Attribute Table**.

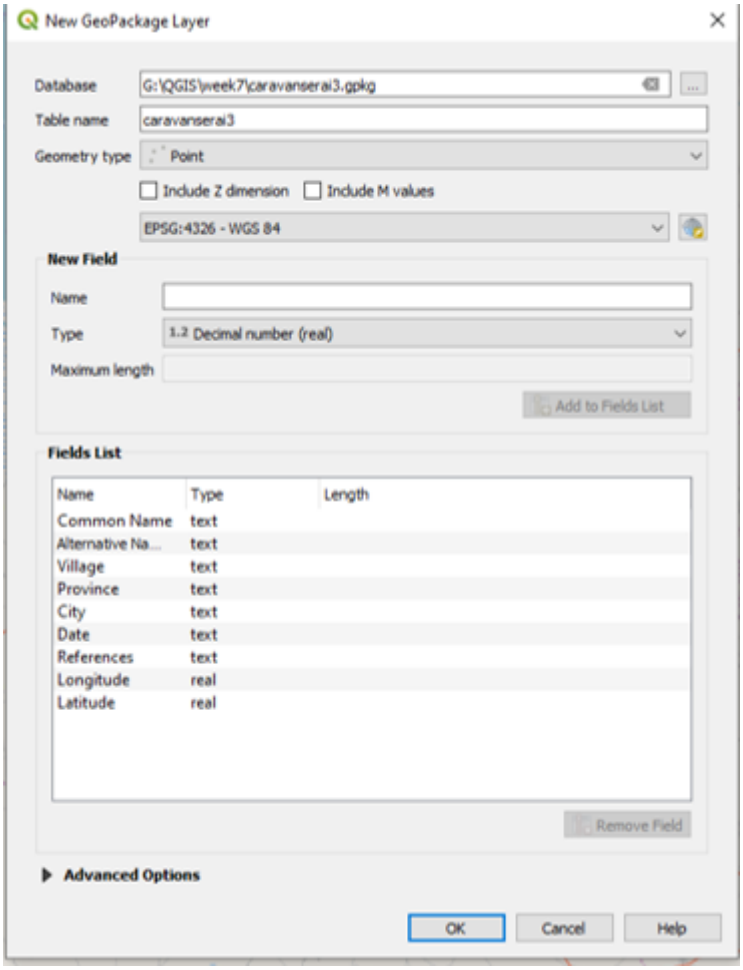

Figure 10.1: Create GeoPackage Layer

Here you can see our empty table we need to create as many fields as we require. We will at least require Name field as text and Longitude and Latitude as decimal fields. In this table to edit the layer we need to click on the **Toggle Editing mode** icon. Enter the fields with the collected data.

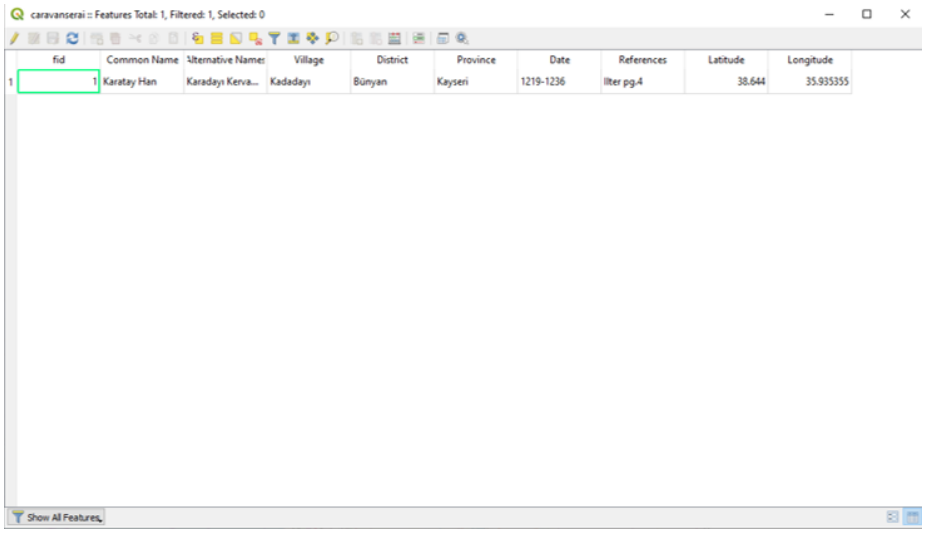

Figure 10.2: Create GeoPackage Layer

After creating all the features in our table we need to create the point geometries that is on the coordinates that we entered. For this, we are going to use **Create points layer from table** from processing toolbox.

After creating an empty geopackage layer, we are going to create our caravanserais as points.

Right click on the created layer and select **Open Attribute Table**.

Here you can see our empty table we need to create as many fields as we require. We will at least require Name field as text and Longitude and Latitude as decimal fields. In this table to edit the layer we need to click on the **Toggle Editing mode** icon. Enter the fields with the collected data.

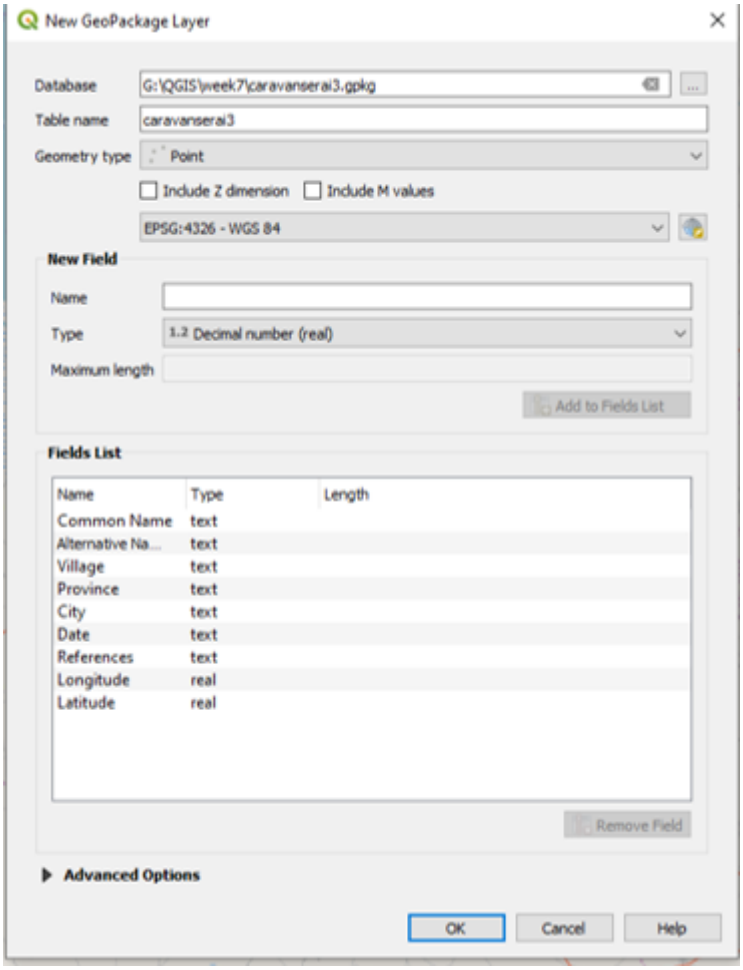

Figure 10.3: Create GeoPackage Layer

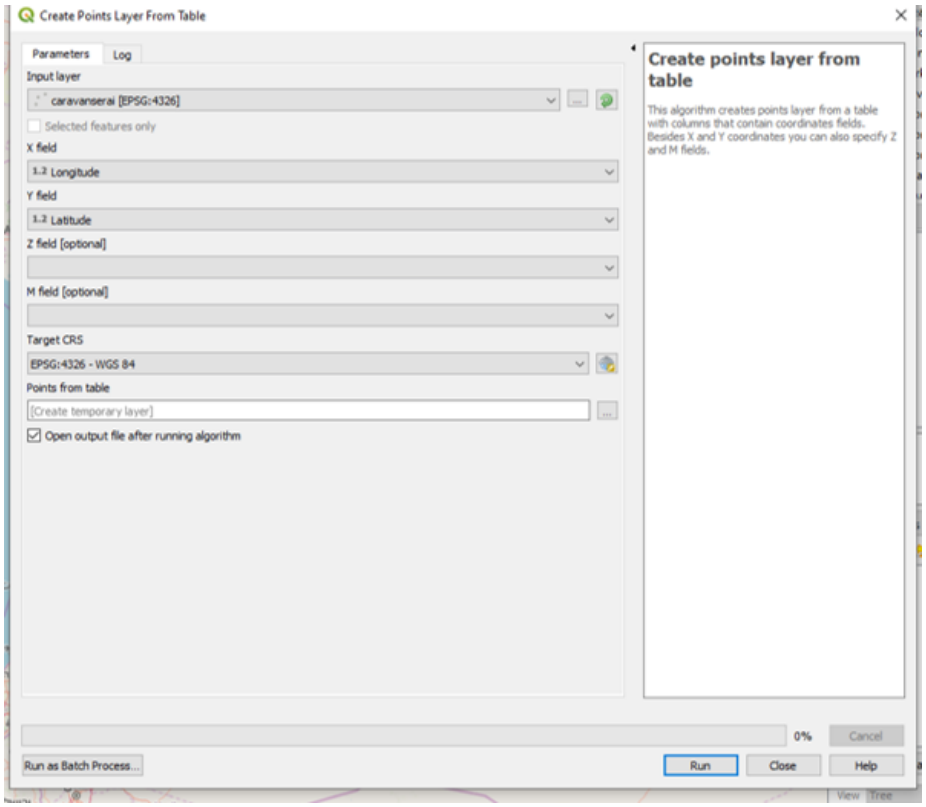

Figure 10.4: Create Points Layer from table