Assessing the trend in flow variability: the Case of Qadisha River

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People need to change their environmental behavior

Objectives

Literature review: Establishing a database for the River and flow variation based on the literature review

Field investigation: Selection and description of sampling points

Methodological approach: Development of testing methods for the analysis of flow variation in the Qadisha River.

Records and Database: Establishing a preliminary database on the flow variation and water quality along the watershed of Qadisha River.

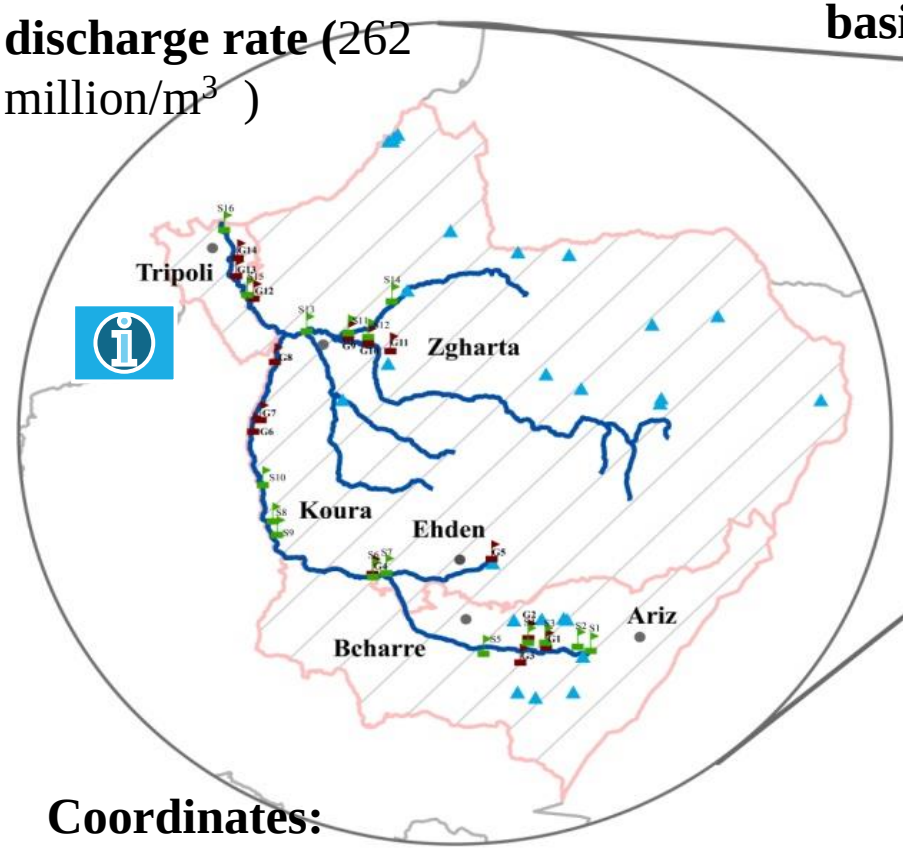
Literature review

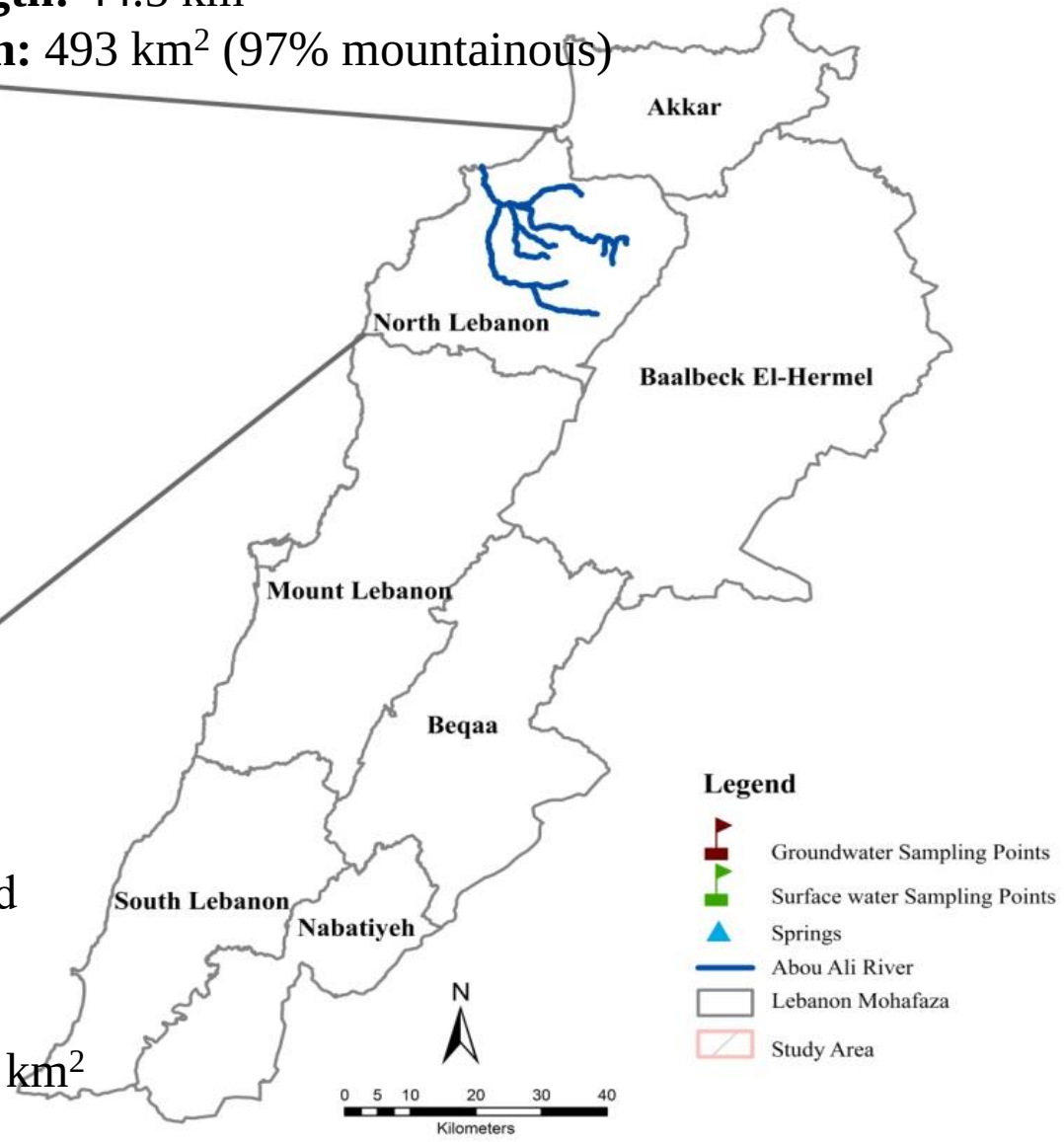
Case Study: Qadisha River (North Lebanon)

Mean water annual discharge rate (262 million/m^3)

Length: 44.5 km

basin: 493 km^2 (97% mountainous)





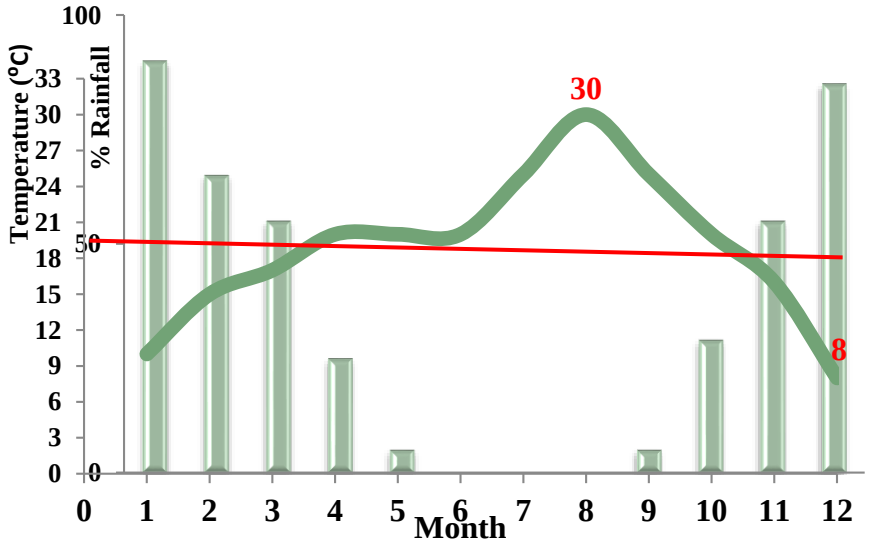
Coordinates:
34˚12’ and 34˚27’ North latitudes 35˚50’ and 36˚07’ East longitudes

Population: Exceeding 10,000 inhabitants/ km^2 (23,000 inhabitants/ km^2 in Tripoli)

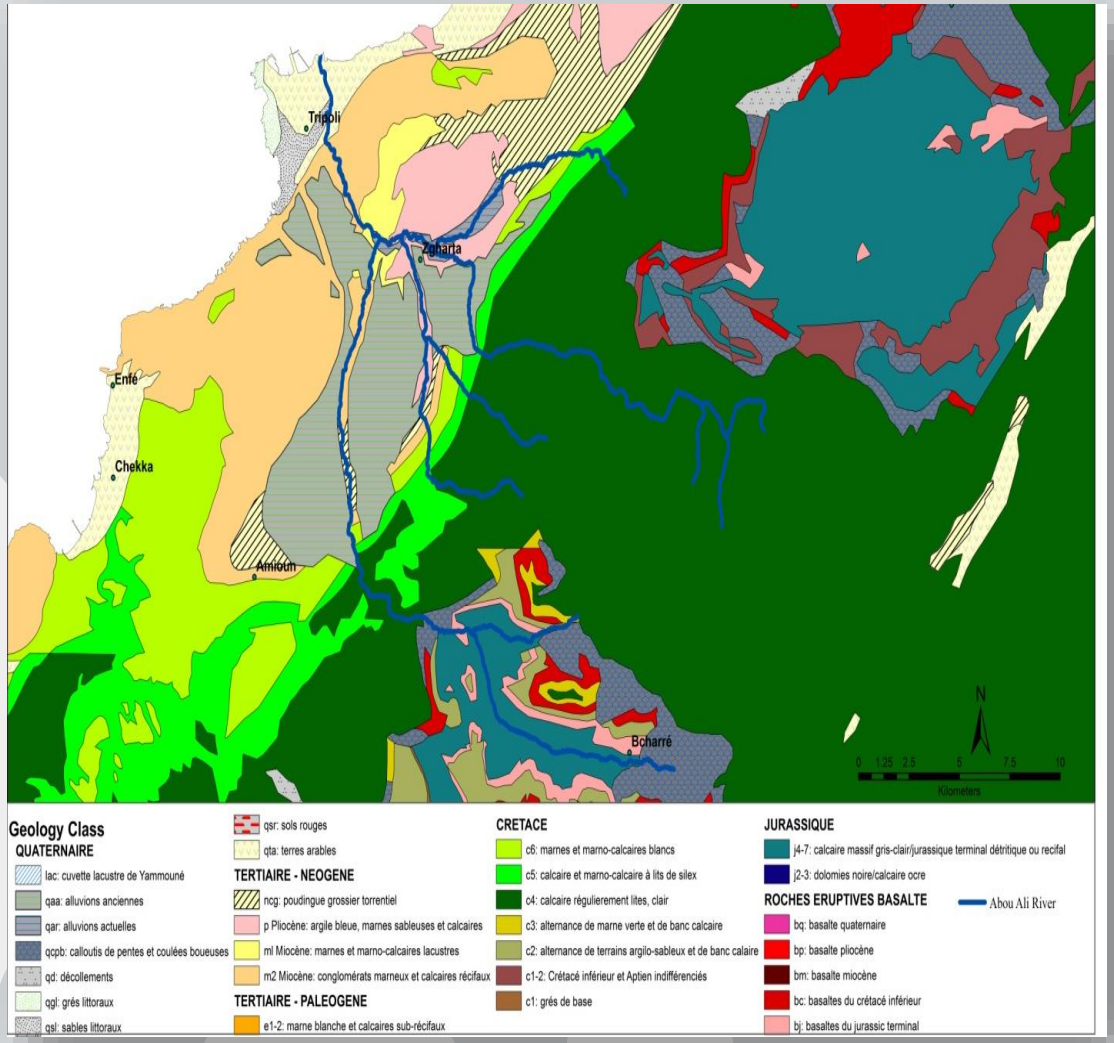
Case Study: The Abou Ali River (North Lebanon)

➢ Climate

- Mediterranean climate (mild winters and warm summers)
- Mean annual rainfall (1012 mm at Kadisha grove and 848mm at river mouth)

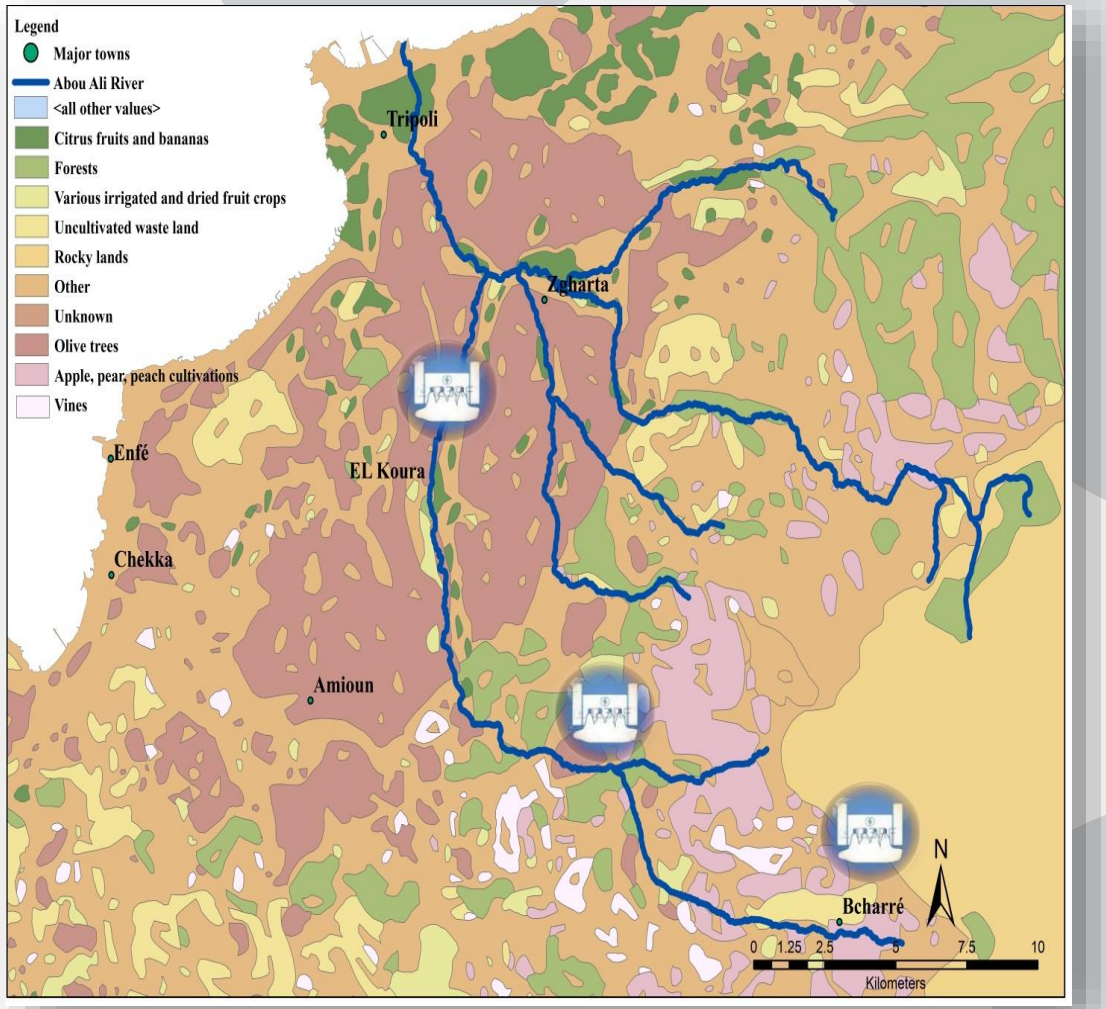


➢ Geology

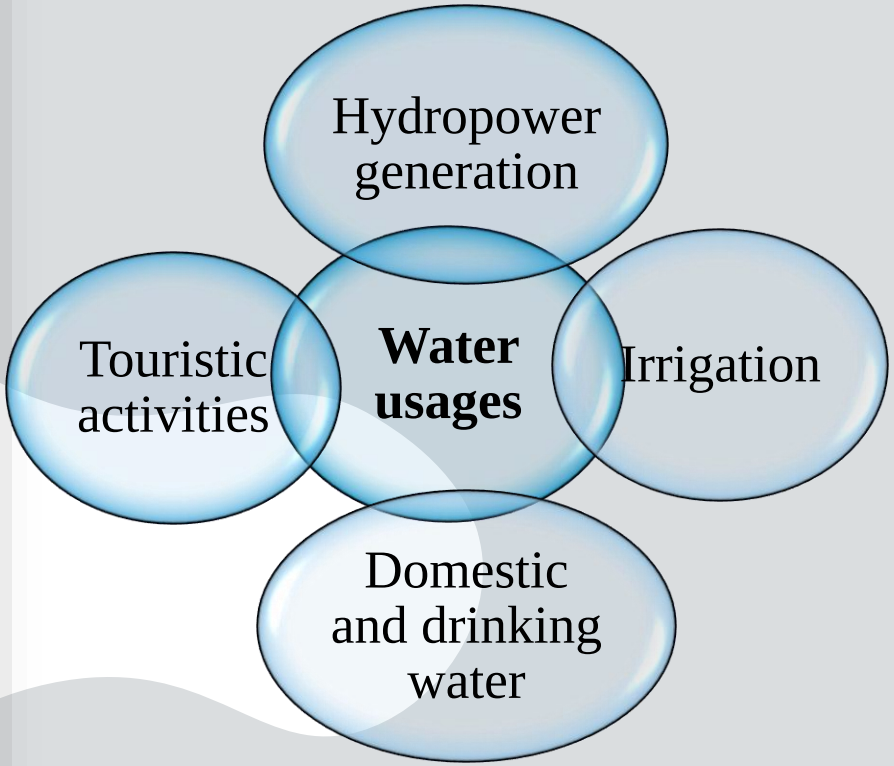


Case Study: The Abou Ali River (North Lebanon)

➢ Land use

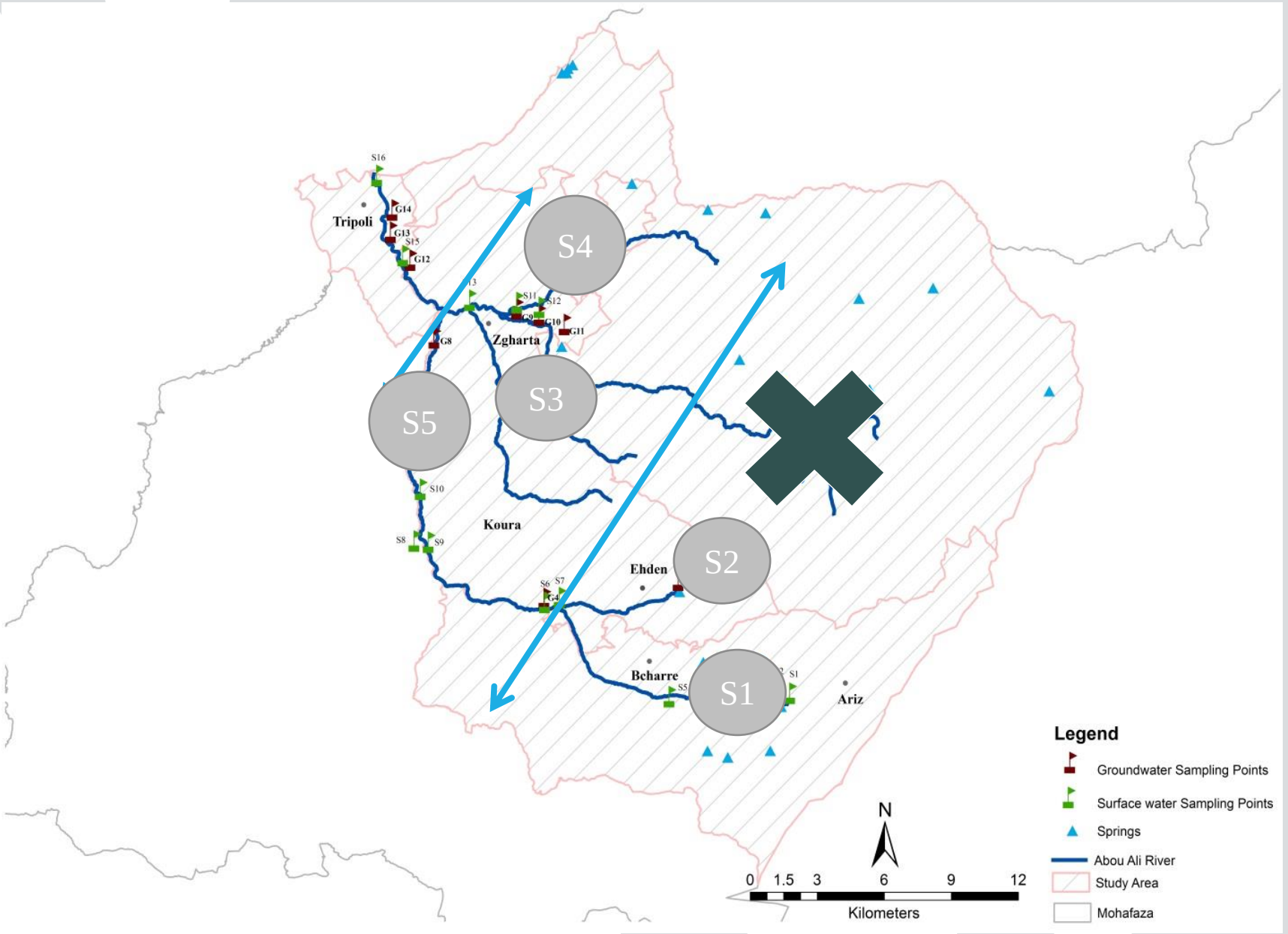


➢ Water usages



Field investigation

Sampling Locations



Sampling Locations

Sample ID	Description of sampling stations/ location	Land use	Elevation (m)	N	E
S1	Kadisha Grotto (Source) / Bcharre	Arable	1778	34.14632	36.02201
S2	Ferdos- Ehden	Agricultural and recreational	1475	34.28959	35.98400
S3	Daraya “Saydet el Najat”/ Bsarma	Residential and agricultural	196	34.32841	35.86011
S4	Rachiin- Zgharta	Recreational and Agricutural	115	34.38729	35.93076
S5	Kousba	Arable and agricultural	263	34.18438	35.51796

Methodological Approach

1. Workplan
2. Development of testing methodology for the analysis of the flow of Qadisha River
3. Materials and methods used
4. Visit to the EELN in Zgharta to conduct training on the flow measurement equipment

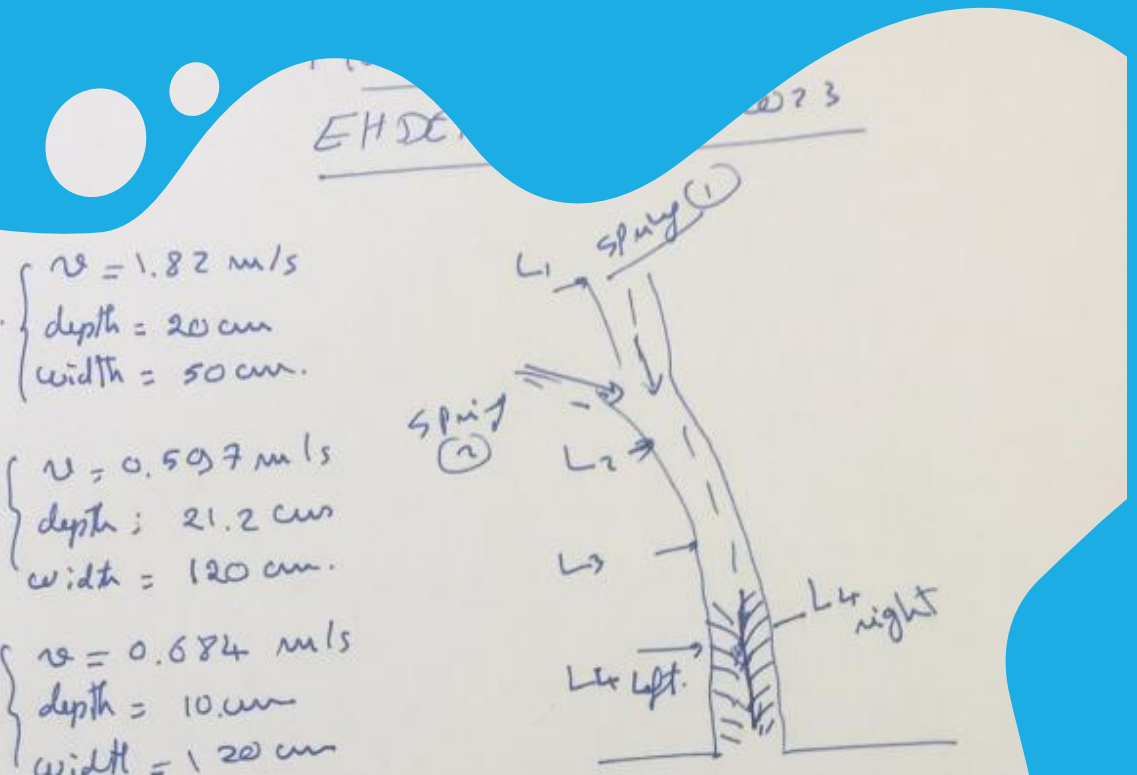
Materials and methods

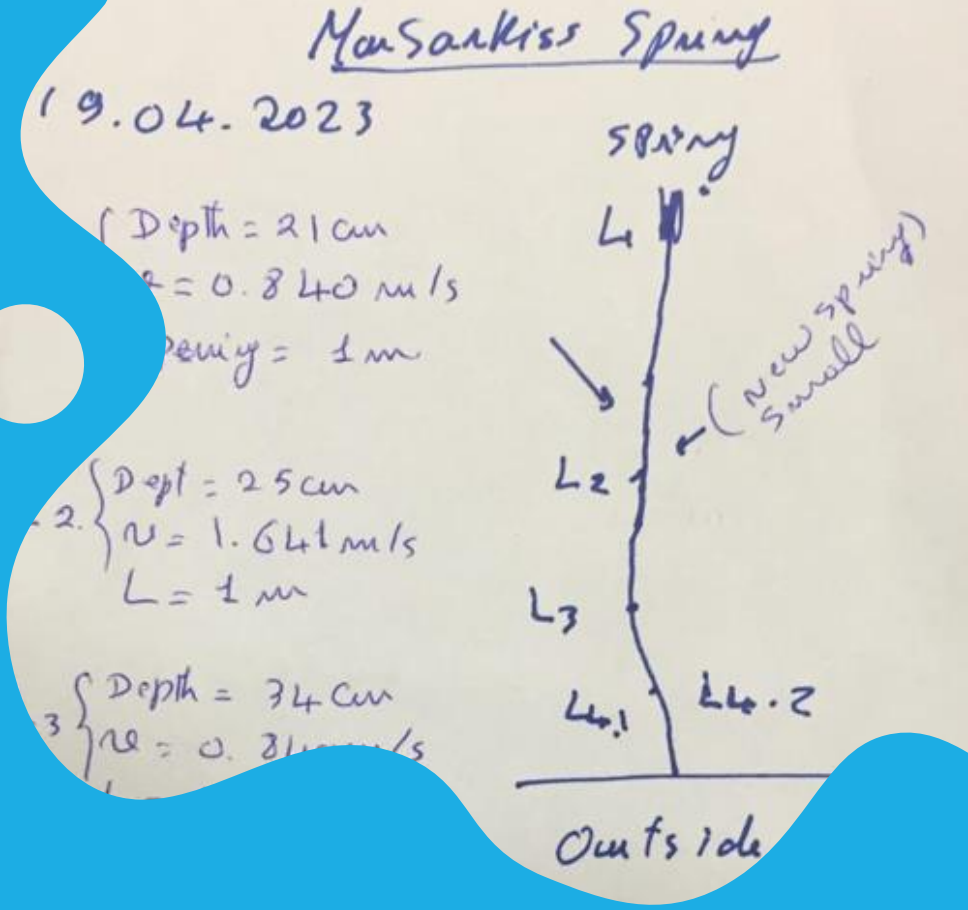
- Each sampling point was divided into sub-points and for each, the section opening, flow velocity, and depth were recorded.
- Area of each section and flow were calculated theoretically and averaged.
- Afterward the flow was recorded for each sampling point and each sampling campaign.

Equipment Used on-site:

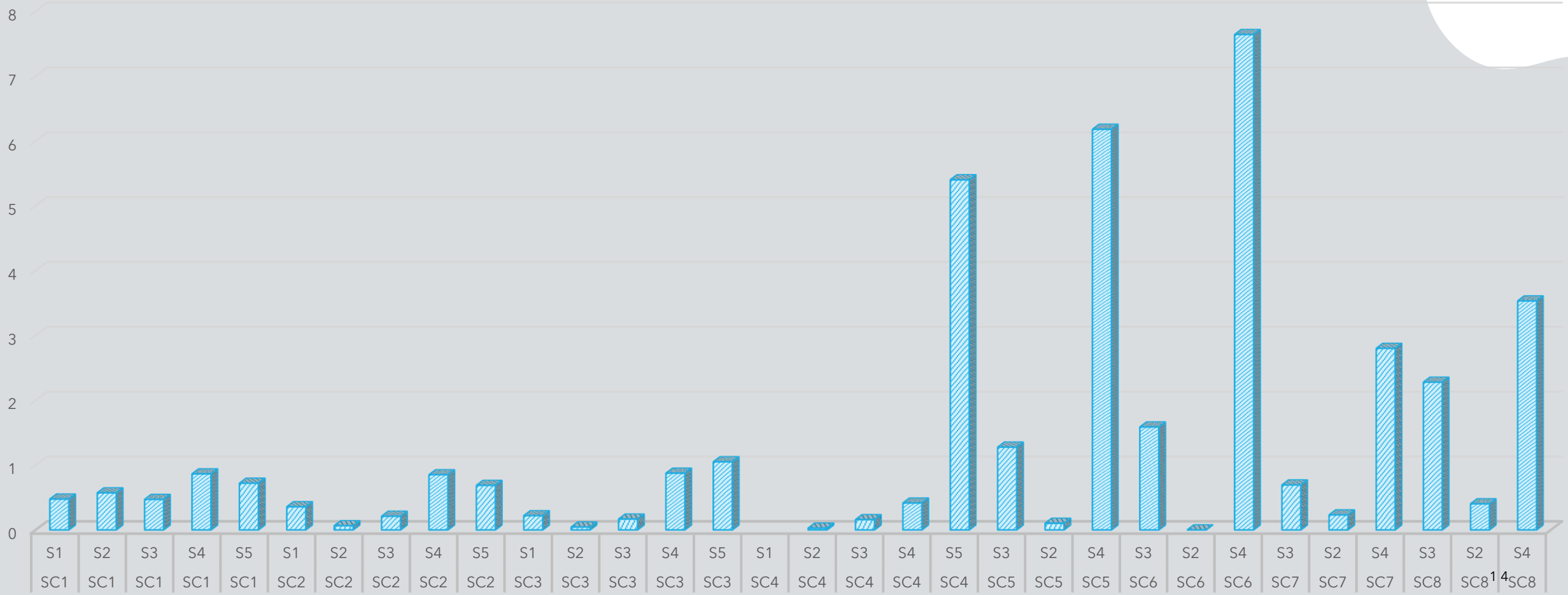
- GPS Watch

Records and database

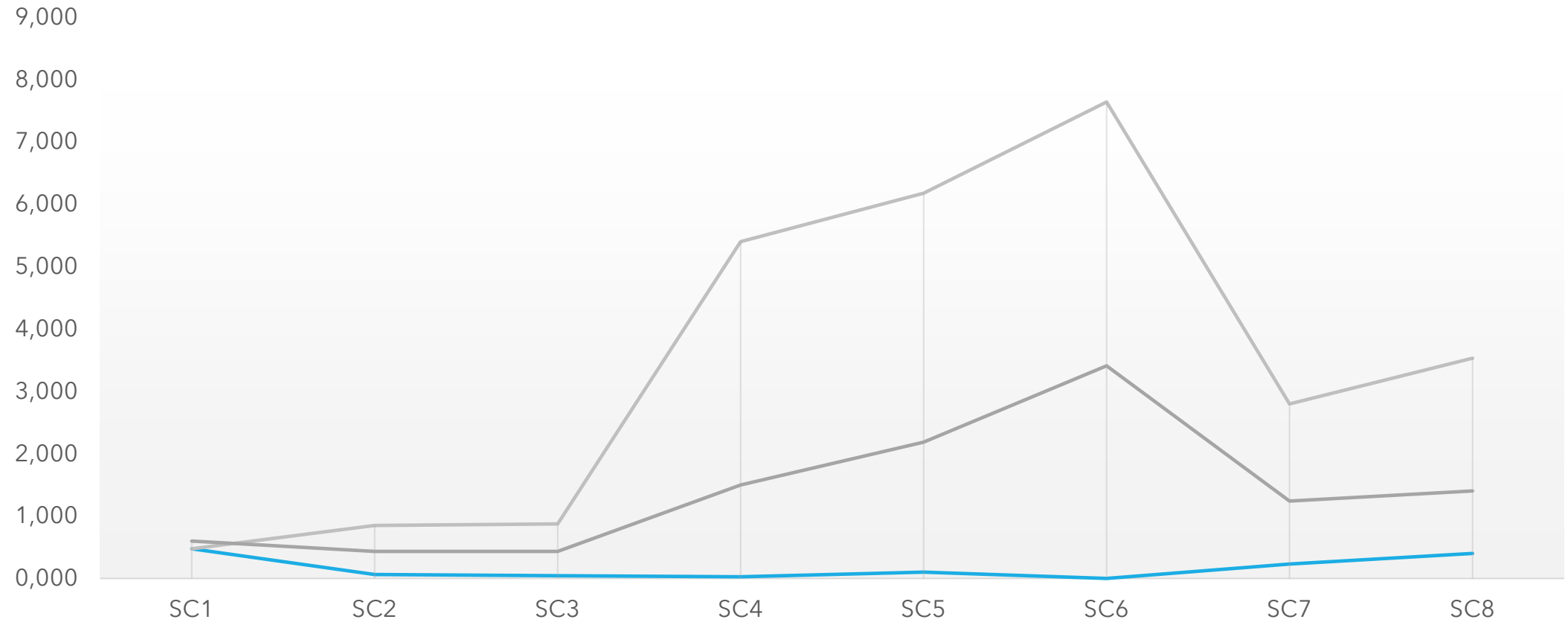




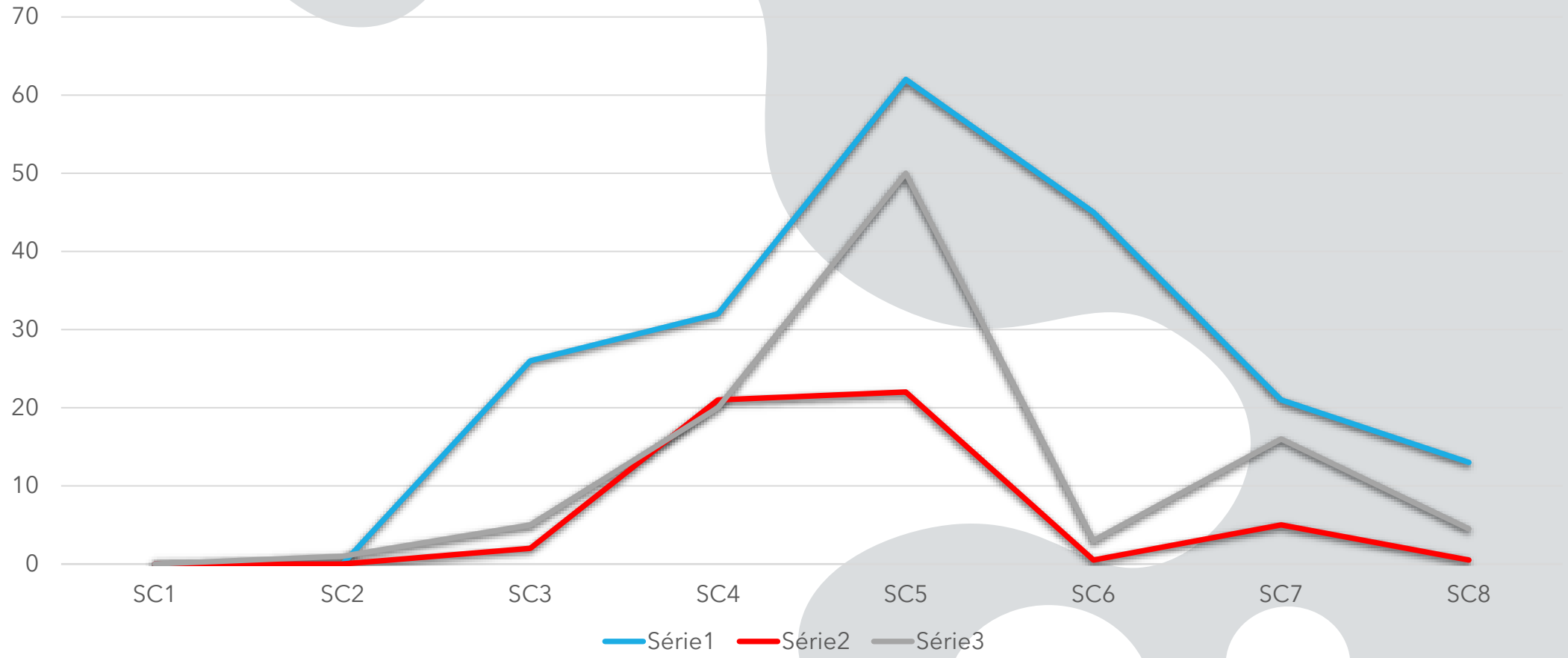
Flow data recorded



Flow fluctuation/Sampling Campaign



Precipitation fluctuation (mm)



Seasonal Variation/Clusters

Dry Season Campaigns (SC1, SC2, SC3):

During the dry season campaigns, which include SC1, SC2, and SC3, lower flow rates are expected due to limited rainfall and reduced water inputs. The absence or minimal precipitation recorded during these campaigns corresponds to the lower flow values observed. With lower rainfall amounts, there is less water available to contribute to streamflow, resulting in relatively consistent and lower flow rates during the dry season.

Wet Season Campaigns (SC4, SC5, SC6, SC7):

The wet season campaigns, including SC4, SC5, SC6, and SC7, are characterized by increased flow rates due to higher precipitation and enhanced water inputs. These campaigns coincide with periods of significant rainfall, as indicated by the recorded precipitation data. The higher flow rates observed during these campaigns can be attributed to the increased surface runoff, groundwater recharge, and higher water availability from rainfall events.

End of Wet Season Campaign (SC8):

SC8, which marks the end of the wet season, shows moderate flow variations. During this period, rainfall amounts may start to decrease as the wet season concludes. However, residual effects from previous rainfall events, such as higher groundwater levels or delayed runoff, may still contribute to the flow rates observed during SC8.

Other Interesting factors

Local hydrological conditions

Watershed Characteristics: The physical characteristics of the watershed, such as its size, shape, slope, soil type, and land cover, can affect how water is captured, stored, and released.

Precipitation Patterns: The amount, intensity, and distribution of rainfall in a region play a crucial role in determining flow rates. Factors such as seasonal variations, storm events, and long-term climate trends can influence flow. For example:

Evapotranspiration: Higher evapotranspiration rates can reduce the amount of water available for runoff and, consequently, lower flow rates.

Groundwater Interactions: Factors such as the presence of aquifers, the permeability of soils, and the water table depth can influence how groundwater contributes to streamflow.

Human Activities and Water Management: Human activities, including water abstraction, reservoir operations, irrigation, and land development, can modify natural hydrological conditions.

Perspectives

Understanding local hydrological conditions and linking them to flow patterns

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Studying Evapotranspiration

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Thank You!