

### Zone 1

Zone 1 is totally fenced-in. Access is restricted to authorized persons only. A signpost indicating the extent of Zone 1 and the landuse restrictions for the public is fixed on the fence.

### Zone 2

Zone 2 is an area where infiltrating water travels only short time until it reaches the well or spring. A signpost indicating Zone 2 and its landuse restrictions is fixed on all roads entering protection zone 2.

#### Do :

- **Connect your household to a local sewerage system.**
- If not possible, **empty existing cesspits regularly !**
- **Use only organic fertilizers** in agriculture and your garden.
- Do not use an excessive amount of fertilizers in agriculture and your garden.
- Produced wastewater must be conveyed or transported to a wastewater treatment plant.
- **New industries will not be allowed**, existing industries have to establish their own treatment plant which fully complies with Lebanese laws and regulations.

#### Do not :

- Dump chemical substances, waste or wastewater.
- Use chemical fertilizers.

### Zone 3

Zone 3 covers the entire groundwater recharge area of a well or spring.

All activities are allowed in this area if they comply with Lebanese laws and regulations and if they implement environmentally sound practices.

### What can you do?

**Groundwater is contaminated by people and it needs to be protected by people, not only in protection zones !**

- Dispose your garbage at an official dumping place
- Dispose your household chemicals (e.g. polish, insecticide) at an official dumping place
- Take used motor oil to a recycling center (or gas station)
- Use organic fertilizers
- Limit the amount of fertilizers used on plants
- Limit the use of pesticide on the amount prescribed by the producer
- Install a sealed septic system and empty it regularly
- Connect to a local sewerage system if possible
- Tell your neighbours how to protect our water

#### Contact:



Federal Institute for  
Geoscience and  
Natural Resources



Council for Development  
And Reconstruction  
Lebanon

Dr. Armin Margane  
Project Team Leader  
St. Roche St.,  
Raifoun, Keserwan  
LEBANON  
phone: +961-9-957348  
mobile: +961-70-398027  
email: armin.margane@bgr.de

Eng. Ismail Makki  
Director of Planning Department  
Council for Development and  
Reconstruction  
Tallat al Serail  
Beirut (BCD)  
LEBANON  
phone: +961-1-980096  
ext.107/569  
email: ismailm@cdr.gov.lb



**Groundwater Protection  
Zones**

**Protection of Jeita Spring**

### Where do we get our drinking water from ?

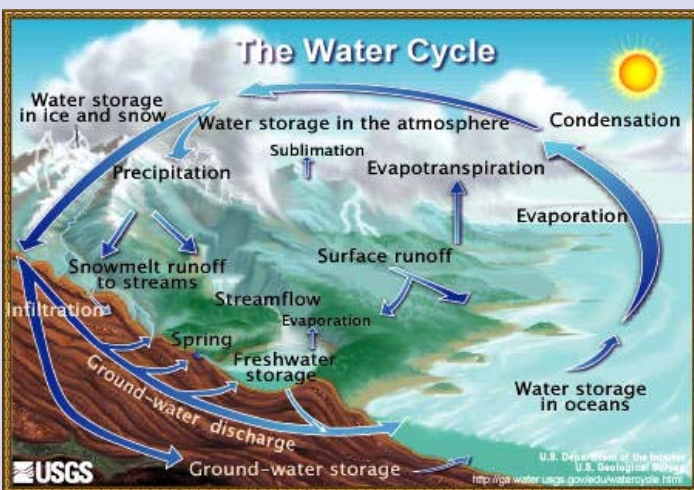
About 70% of drinking water for Beirut comes from Jeita spring. The upper Keserwan district is mainly supplied by the Assal and Labane springs and some wells. All this drinking water comes from groundwater stored in limestone aquifers. There are two main limestone aquifers recharged by infiltrating rainfall, one at elevations between 1600 and 2600 m (Cretaceous aquifer), the other below 1600 m (Jurassic aquifer).

### What is groundwater ?

Groundwater fills the cracks and pores of rocks and sediments; in limestone groundwater flows mainly along fractures and channels where limestone had been dissolved (conduits). When it infiltrates into the rock, groundwater is naturally clean and free from any pollution.

### Where does groundwater come from ?

Groundwater comes from rainfall and snow. It infiltrates through the soil until it reaches a zone, where the rock is full (saturated) with water.



### How does groundwater move ?

In the saturated zone groundwater moves following the geological structure towards a topographically lower position and discharges at springs, lakes or into rivers. In sands groundwater moves very slowly, only centimeters per day, while in limestones it often moves very fast, several hundred meters or even kilometers per day.

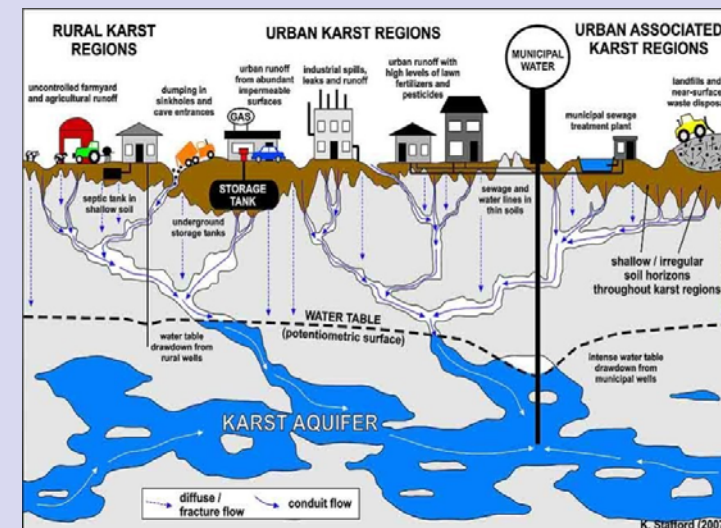
### How is groundwater extracted ?

Groundwater can be exploited by drilling **wells** in the ground or by capturing **springs**. Every well and spring has its own groundwater recharge area.



### How can groundwater be contaminated ?

Pollutants **infiltrate into the ground** from poorly constructed wastewater systems or damaged tanks e.g. for fuel. Groundwater might also become polluted by runoff from fertilized fields, livestock areas, abandoned mines and industrial areas. Humans might contribute directly to groundwater pollution by dumping on non-official dumpsites or pouring household chemical waste, or used motor-oil on the ground.



### How are people affected by contaminated groundwater ?

Groundwater contaminated with bacteria, chemicals, pesticides, gasoline or oil can result in human health problems when consumed as drinking water.

### What can we do to protect our groundwater ?

Protection zones can be established to avoid contamination risks. A zoning system is applied, where only certain landuses are allowed:

- **Zone 1 is the Immediate Protection Zone** and protects a well or spring and the water supply infrastructure
- **Zone 2 is the Inner Protection Zone** and protects the water against microbiological pollution such as bacteria, viruses, parasites and worm eggs.
- **Zone 3 is the Outer Protection Zone** and protects the water against contamination by chemicals which are non or hardly degradable. Those can travel over long distances