

# Planning of Wastewater Schemes

## I. Introduction

- There are no wastewater (WW) collection and treatment facilities yet in the Jeita catchment.
- Three major WW schemes are planned to be implemented since many years but the projects meet major obstacles from different stakeholders.
- The geological conditions in Mount Lebanon are difficult (open karst) so that planning for wastewater facilities must consider geological aspects.
- For protection of Jeita spring **geoscientific aspects** were integrated the first time in planning processes.

## II. Problem Statement

- Planning of WW facilities is done in parallel by the Council for Development and Reconstruction (CDR) and the Ministry of Energy and Water (MoEW); both have insufficient capacities and follow different concepts (CDR: decentralized approach, MoEW: centralized solution).
- The Water Establishments (WE) are not involved in the planning but by law have to operate the WW facilities.
- The municipalities can stop the planning if they don't want a WWTP on their land.

- This has caused a stalemate in many WW projects. The municipalities are responsible to operate and maintain the WW network but they don't have the expertise and often cannot afford to cover O&M costs.
- Until now water resources protection is insufficiently integrated in the planning although it is the main objective of WW projects.
  - The high degree of karstification of the limestones makes water resources protection a difficult task.

## III. Methodology

### Planning & Site Selection

- A **Wastewater Master Plan** was established for the catchment, considering not only population numbers, topographic, socio-economic and technological but also geoscientific aspects.
- A **criteria catalogue** was developed so that the optimal site locations for treatment, and effluent discharge could be selected.
- Boundaries for individual **wastewater schemes** in the catchment (WW projects) were defined.
- The **suitability of WWTP sites** was assessed based on groundwater investigations (e.g. tracer tests/colorations).

### Management, Technologies, Reuse & Capacity

- Because there is still very limited experience in planning, operation and maintenance of wastewater facilities, a **Best Management Practice Guideline (BMP)** was proposed.
- Local capacity to operate and maintain WWTPs and collector lines must be developed to ensure sustainability.
- Options for **treated wastewater and sludge reuse** were proposed and a related national standard was suggested.
- A guideline for the prepara-

- tion of **Environmental Impact Assessments (EIA)** for WW facilities was suggested and accepted by Ministry of Environment.
- The selection for the KfW/CDR WWTP site was finalized and agreed to by the municipality.
  - Because there is no national agreement on treated WW and sludge reuse a reuse concept could not be considered.
  - There is no **laboratory capacity** and **monitoring plan** ensuring that quality of treated effluents would meet the standards.

## IV. Results

- The originally proposed concept for site selection of WW collection and treatment facilities bear major risks for groundwater contamination and the planning for the KfW/CDR WW facility therefore had to be reiterated.
- Extensive groundwater investigations were necessary to find the optimal WWTP site.
- In negotiations with all involved stakeholders an agreement, benefitting all parties could be reached.
- To minimize the impact on water resources a centralized approach with treatment and effluent discharge downstream of the water source to be protected must be followed.

## V. Recommendations

- Geoscientific expertise proved to be important in the planning process for WW facilities in Lebanon. The suitability of the WWTP site from geoscientific perspective must be ensured.
- EIAs for WW facilities have to address more comprehensively the impact on water resources and the impacts of geohazards on the facilities.
- Effluent monitoring is needed.





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## Protection of Jeita Spring



Most buildings have so-called cesspits which are unsealed so that wastewater can easily infiltrate into the underground and reach groundwater. All houses in the catchment must be connected to the new wastewater schemes.



Even large residential compounds do not have wastewater collection and treatment systems, some even have wastewater injection wells.



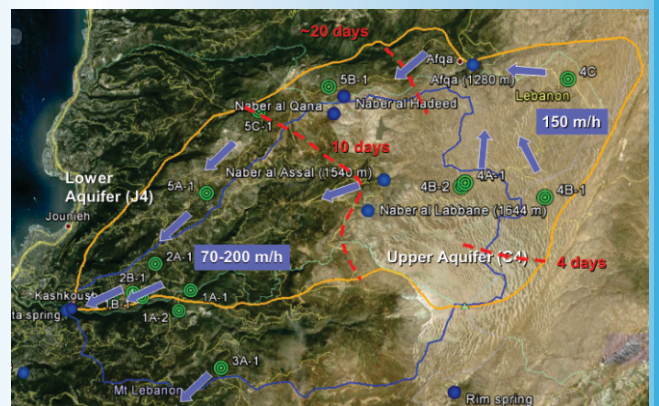
Some municipalities have begun to establish their own WW networks. However, these are mostly poorly constructed and discharge untreated WW into the rivers. They can not be used by the new WW projects.



Tracertests (colorations) were done to investigate the boundaries of the groundwater catchment and the behavior of the GW system. By injecting tracer at the proposed WWTP sites it can be determined whether the effluent would arrive at a drinking water source.

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Tracertests have shown that flow velocities in the GW catchment are very high, resulting in insufficient time for attenuation of contaminants. Because the karst is directly exposed and not covered with a sufficiently thick soil, contaminants can infiltrate unhindered. The contamination risk is therefore extremely high.

