



Council for Development and Reconstruction (CDR)
Ministry of Energy and Water (MoEW)
Water Establishment Beirut and Mount Lebanon (WEBML)

Federal Institute for Geosciences
and Natural Resources (BGR),
Hannover, Germany

German-Lebanese Technical Cooperation Project

Public Awareness Campaign for Schools Water Supply in the Jeita Catchment & for Beirut

BGR
September 2012

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Outline

- Water supply for Beirut
- Water supply within the Jeita catchment
- Constraints
- Recommendations



- Sources:
 - Antelias spring
 - Kashkoush spring / 6 wells
 - Jeita spring / 4 wells
 - Mokhada wells
 - Beirut wells
- Treatment: Dbayeh
 - Screening
 - Turbidity reduction
 - Rapid sand filtration
 - Chlorination
- Conveyance Jeita-Dbayeh:
 - single-lane canal: max. capacity 4.3 m³/s)
 - one tunnel: max. capacity 3.1 m³/s

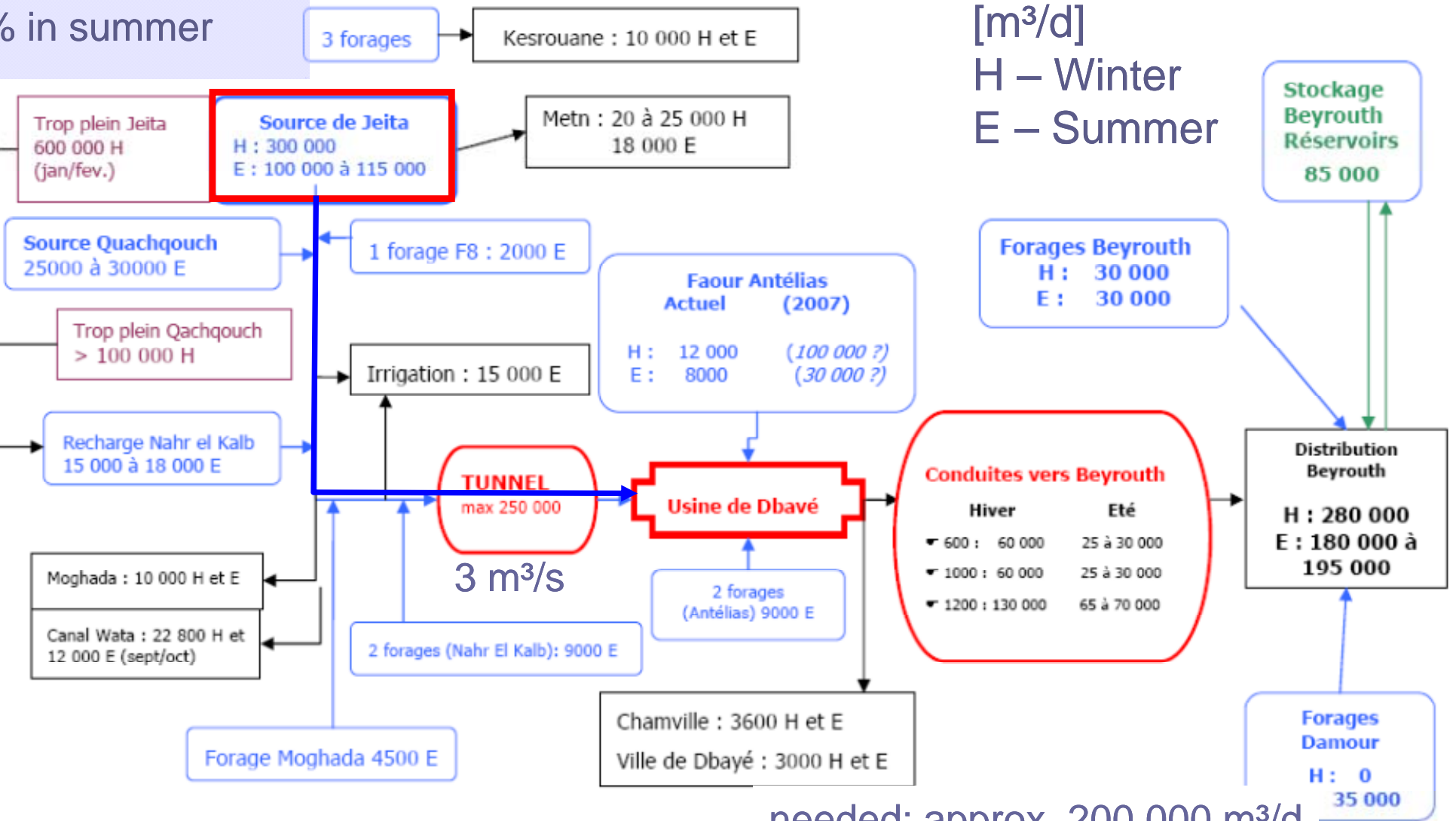
Map Jeita/Kashkoush - Dbayeh - Beirut



WEBML Water Supply System

85% in winter
45% in summer

Nahr El Kalb



[m³/d]
H – Winter
E – Summer

needed: approx. 200.000 m³/d
~ 70 MCM/a



WEBML Water Supply System

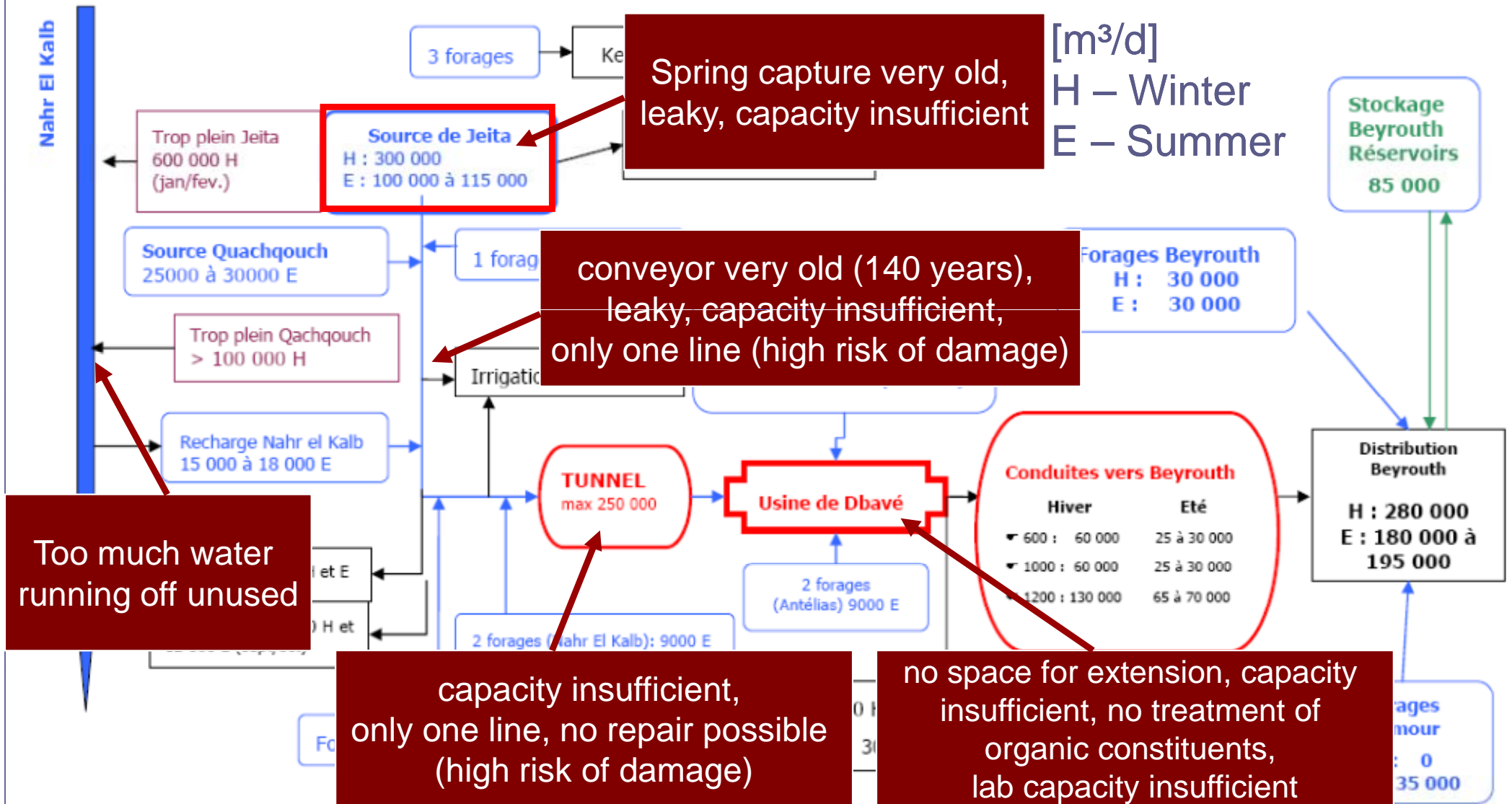


Photo Canal Jeita-Dbayeh



Photo Nahr el Kalb autumn



Water Supply within the Jeita catchment

- Supply:
 - Domestic
 - Irrigation
- Sources:
 - 13 wells
 - 6 main springs:
 - Afqa
 - Assal
 - Hadeed
 - Labbane
 - Qana
 - Rouaiss
 - Chabrouh dam



Water Supply within the Jeita catchment

- Distribution:
 - Pressurized pipe-system
 - Water trucks
 - On-site spring bottling
 - Water vendors
 - Open irrigation canals



Agricultural- & domestic water supply within the Jeita Spring Catchment

35°35'0"E

35°40'0"E

35°45'0"E

35°50'0"E

35°55'0"E

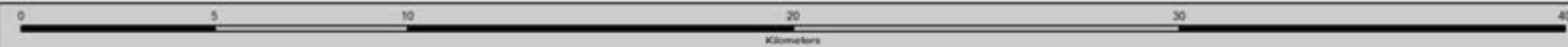
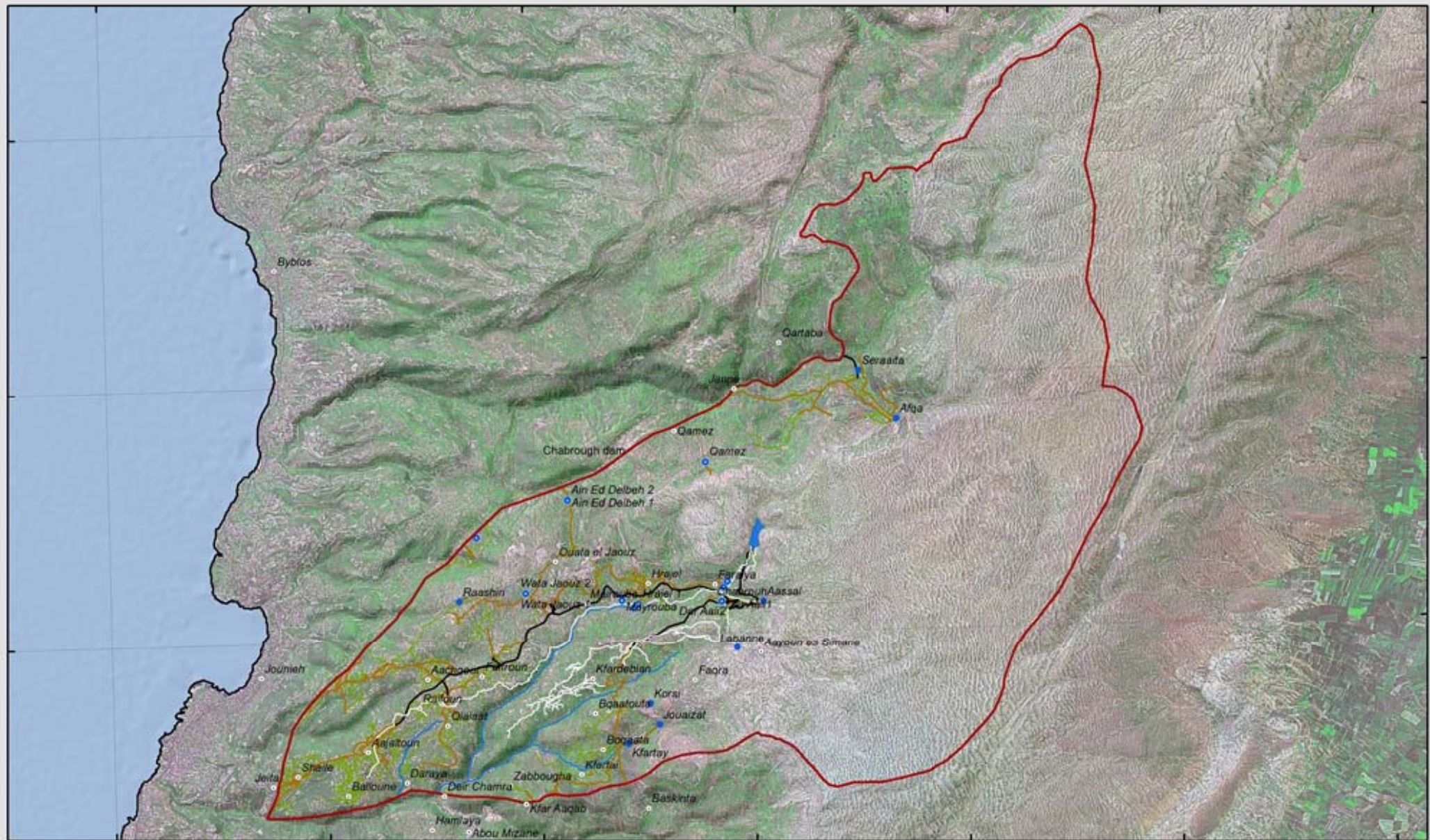
36°0'0"E

36°5'0"E

34°10'0"N

34°5'0"N

34°0'0"N



Data basis: WEBML 2011, BGR, LANDSAT 7 (2000), SRTM DEM

Water infrastructure under responsibility of WEBML

Pipes [diameter in mm]: — 13 - 90 — 100 - 350 — 400 - 800 Supply: ● Wells ● Springs

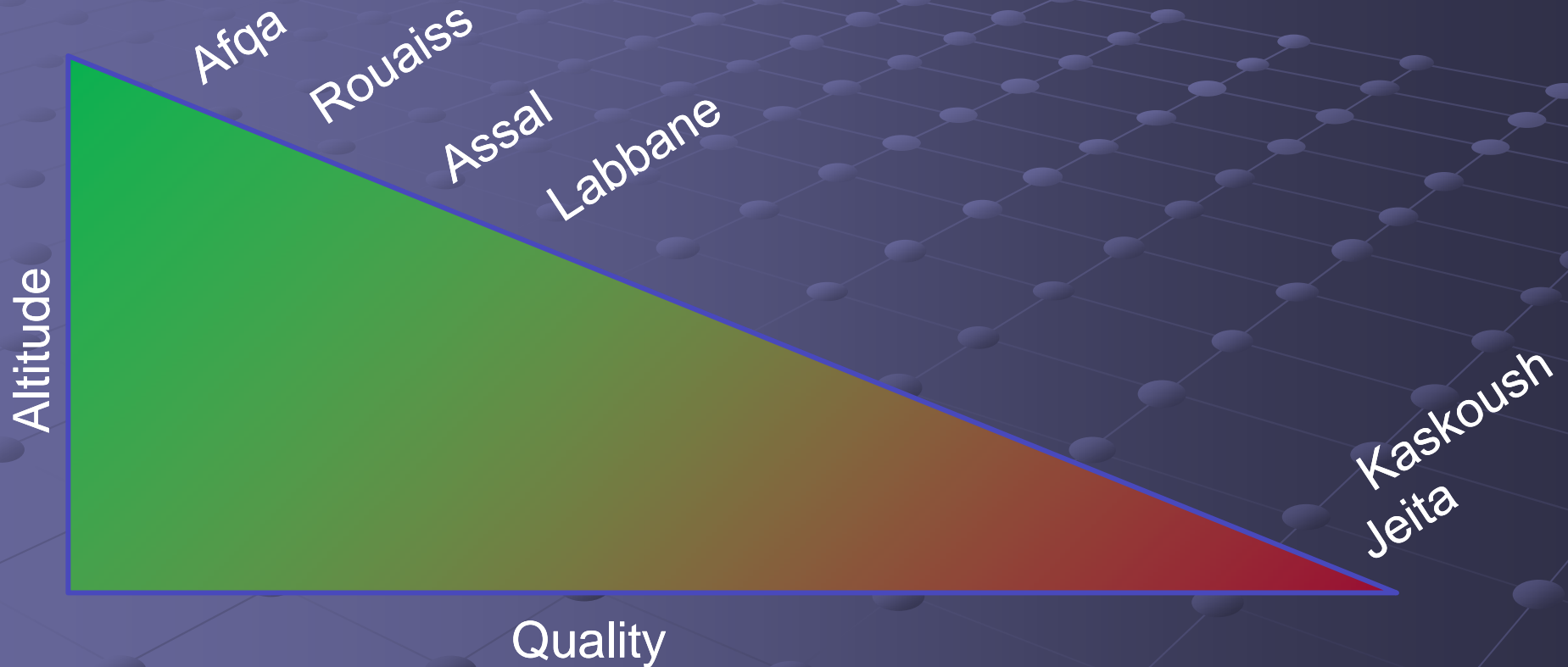
Sub-surface catchment of Jeita Spring

— Irrigation canal

● Villages & cities

Water Supply within the Jeita catchment

- Water quality:



Recommendations

- Renew conveyance Jeita/Kashkoush – Dbayeh:
 - Improved spring capture
 - Two independent water conveyors
 - Two tunnels
- Improve treatment at Dbayeh:
 - Quality: e.g. coagulation/flocculation, activated carbon
 - Quantity: increase capacity
- Artificial GW recharge in Nahr Ibrahim and Nahr es Salib valleys
- Irrigation system:
 - Demand-driven supply, replace open canals with pipelines
- Springs:
 - Prevent public access



How good is the our drinking water ? (quality)

- WEBML conducts few analyses on Dbaye raw water and even fewer on springs used for drinking purposes and Chabrough dam
- Dbaye lab has insufficient capacity
- Very few trustworthy analyses by other institutions
- Results not published > drinking water not trusted by consumers
 - ▶ Continuously high bacteriological contamination
 - ▶ probably heavy metals
 - ▶ probably MTBE (fuel additives)



Contamination Risks from Conveyance System



Collection and conveyor system is very old, leaky, unprotected and of insufficient capacity





Inside the canal @ Mokhada



Roots growing in canal
damaging side walls



Jeita-Dbaye canal inspection 2011



rock collapses in
tunnel section



Raw water partly conveyed through Nahr el Kalb during dry season due to leaky canal

Animal City

Nahr el Kalb River

raw water diverted back to canal at Mokhada station

Mokhada „dam“

Mokhada station





flooding of raw water canal
during rainy season

polluted surface water
enters canal



Workshop at canal

pollution sources along canal

pollutants enters canal

Jeita-Dbaye raw water canal



Houses along canal take water from canal – canal is open at many places



Jeita-Dbaye raw water canal



Jeita-Dbaye raw water canal

on of Jeita

Dbaye treatment plant

116 years old

cannot be expanded (no space)

only sandbed filters + chlorination

no treatment of organic constituents (pesticides, hydrocarbons) and heavy metals

possible formation of chlorinated hydrocarbons

laboratory not fully functional and too small



WEBML Water Supply System

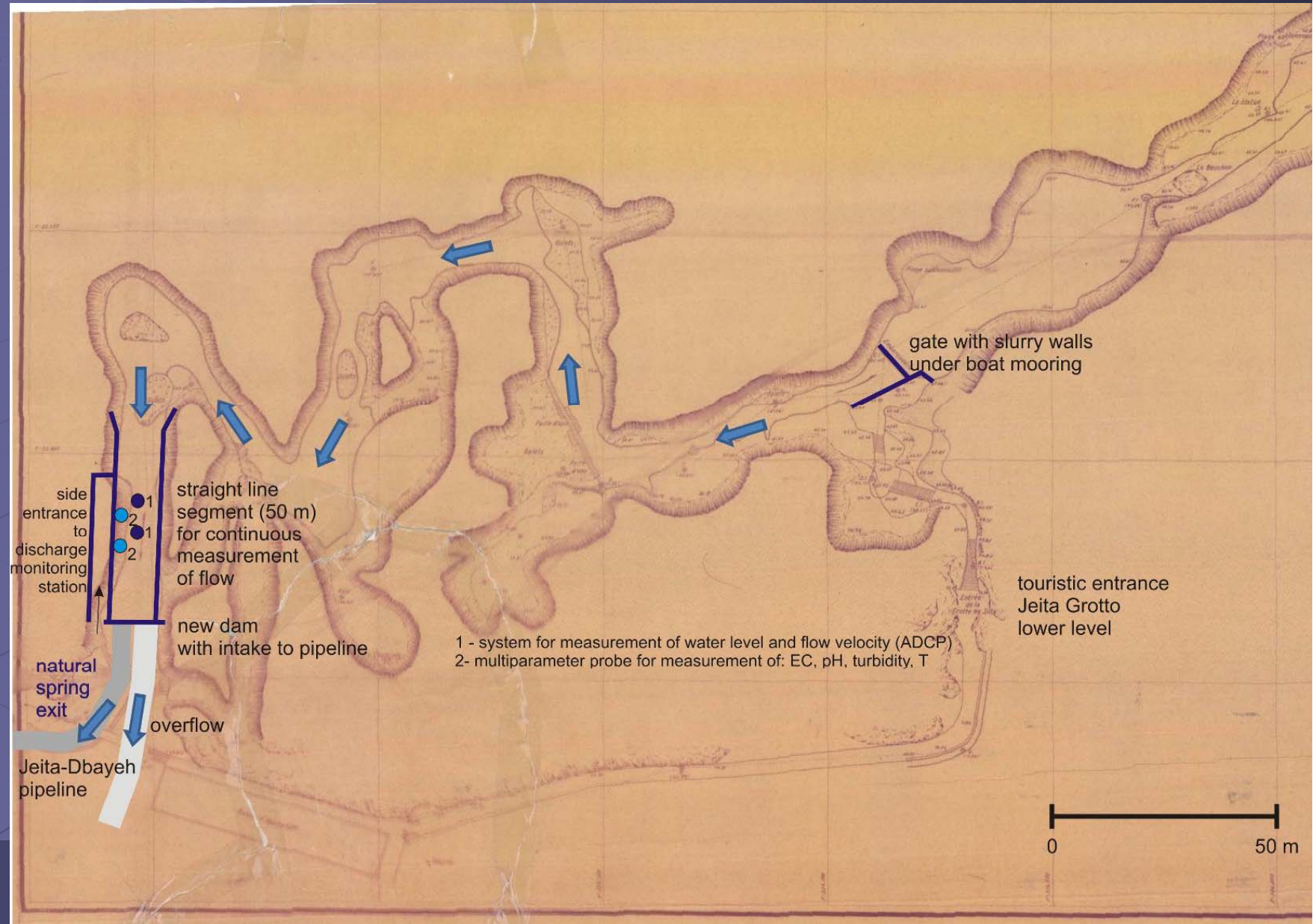
current tunnel too small
(max. capacity: 3.1 m³/s)

loss in existing canal:
30%

second tunnel needed
(redundacy)



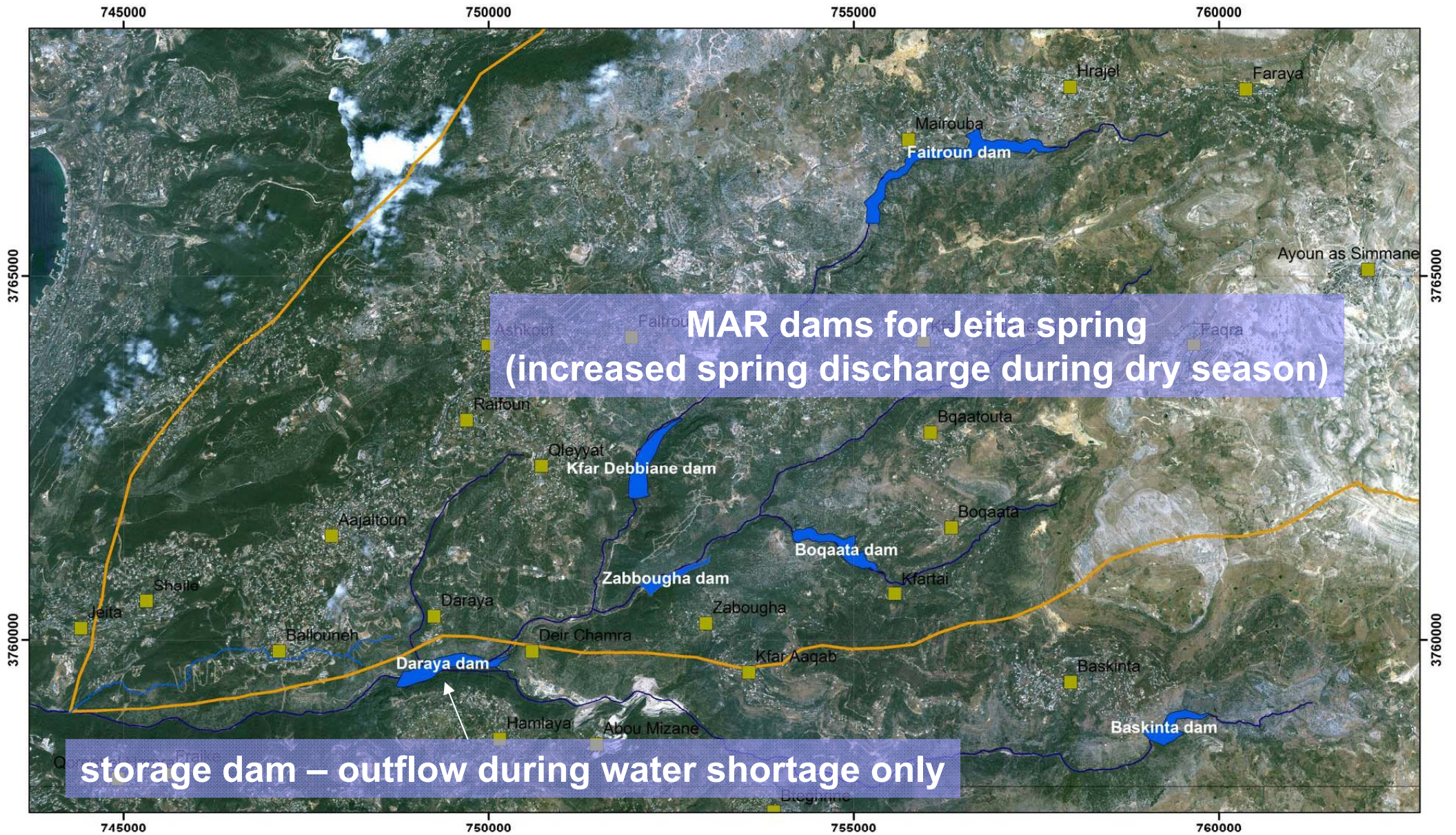
Jeita proposed new spring capture



Name	UTM_E	UTM_N	Elevation [m asl]	Dam crest [m]	Storage [MCM]	Surface area [m ²]	Catchment [km ²]	Rainfall [mm/a]	Rain volume [MCM/a]
Kfar Debbiane dam	752020	3761940	720	100	7.3	224,721	91.0	1,565	142.4
Faitroun dam	755210	3765710	1115	65	6.6	459,963	80.1	1,596	127.8
Boqaata dam	754200	3761500	900	80	4.1	198,025	16.8	1,442	24.2
Baskinta dam	759060	3758630	1035	100	6.0	157,730	28.5	1,659	47.4
Zabbougha dam	752120	3760710	635	100	3.0	104,976	46.9	1,454	68.2
Daraya dam	748720	3759500	320	100	9.0	235,215	222.0	1,494	331.7

Proposed Dam	Storage [m ³] met by runoff	Function	Infiltration capacity
Kfar Debbiane	7.3	MAR > Jeita spring	High
Faitroun	6.6	MAR > Jeita spring	Very high
Zabbougha	3.0	MAR > Jeita spring	High
Boqaata	4.1	MAR > Jeita spring	Very high
Daraya	9.0	storage	Low
Baskinta	6.0	MAR > Faouar Antelias spring	Very high

Storage & MAR Dams



WEBML Water Supply System – what must be done ?

- Improve **capture of Jeita spring**
- Establish a **new raw water conveyer** (pipelines/new tunnel) with increased capacity (7 m³/s) (2 separate lines because one line could be damaged; redundancy)
- Establish **dam with medium capacity** (Daraya dam: 9 MCM) to overcome water shortages at end of dry season
- Do not allow illegal connections and illegal uses (“irrigation”)
- **Increase capacity of treatment & improve treatment process**
- Establish **water quality monitoring & increase laboratory capacities**
- Reduce water losses in Beirut

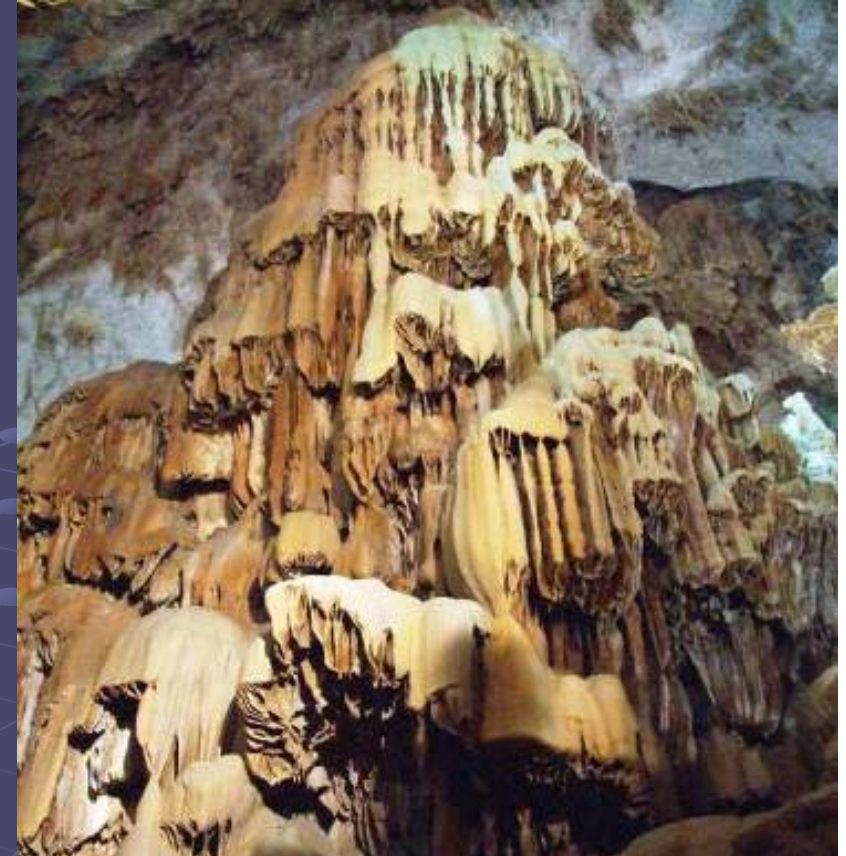
30-50 Mio USD



*Thank you for your
kind attention*

www.bgr.bund.de/jeita

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Protection of Jeita Spring

