Federal Ministry of Education and Research

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Achievements and Opportunities of Research Cooperation between Egypt and Germany

How Cloudy Nile Water Can Turn into Drinking Water

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Outline

- Drinking water supply (DWS) in Egypt
- Problems & Challenges
- RBF Technology advantages & disadvantages
- GERF-Project outcomes
- Conclusions, proposed future steps

Drinking water supply (22.1 million m^3/day)

River Nile	Artesian Plants	Desalination
18.15 million m^3/day	3.79 million m^3/d	0.17 million m^3/d

Drinking Water Supply Coverage for cities (100%) and for villages (98%)

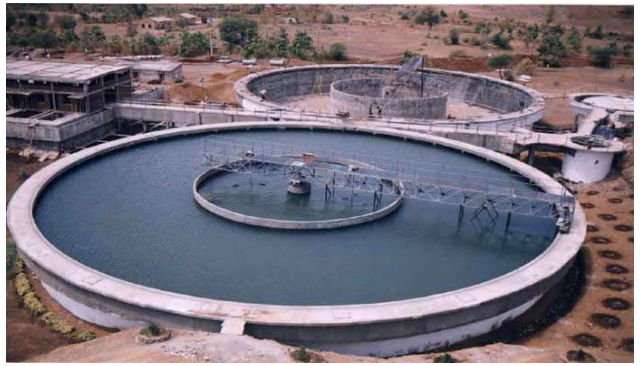
Population yearly growth rate for 2012 is 2.21%

Total population in March 2017 is 94.5 million and was 85.6 million in 2012 (Data World Bank)

Water demand exceeding available supply

Conventional techniques for DWS in Egypt

- Intake (screening)
- Pre-treatment (coagulation-flocculation)
- Sedimentation
- Sand filtration (Rapid & Slow)
- Disinfection (chlorination)
- Backwashing water and sludge



Challenges

How to keep the River Nile as the main source for DWS in Egypt ?

- Pollution & water quality deterioration
- Population growth/density → Increasing demand
- Climatic changes, potential low flow
- Economy & treatment costs

Nile Water Quality in Upper Egypt

Low turbidity Nile water

High turbidity after floods

Increasing Demand & Economic constraints

Population growth, increasing demand

Urbanization growth around DW plants

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Low flow

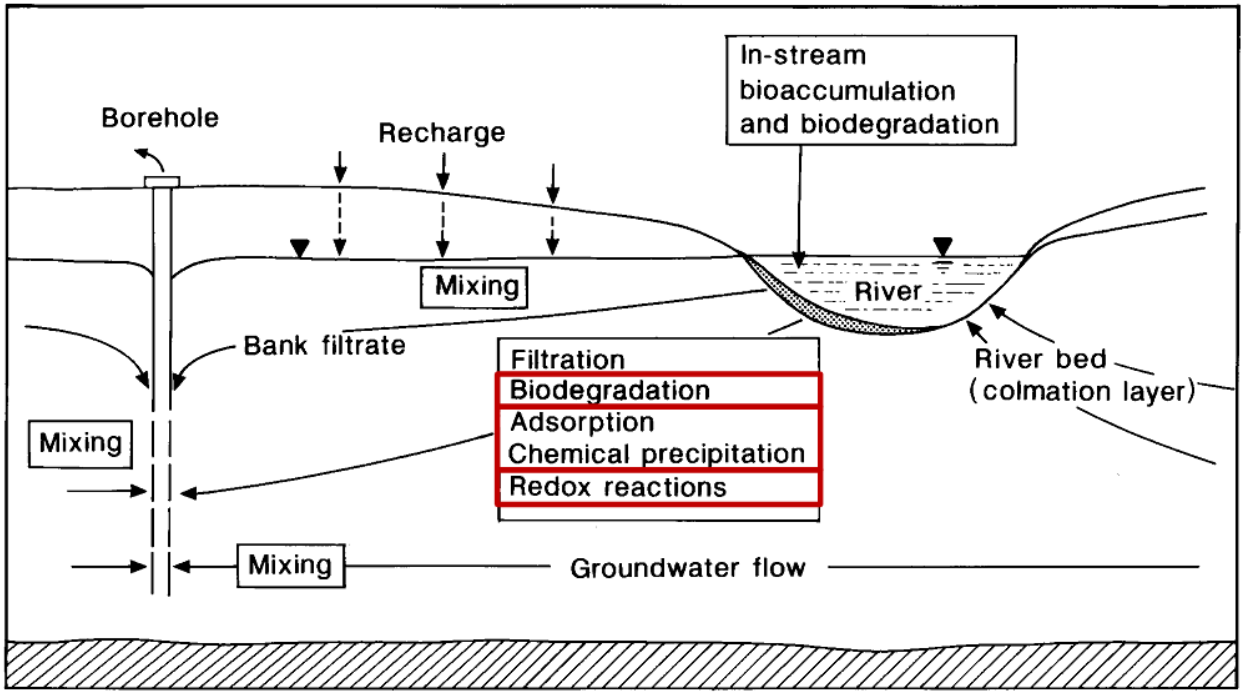
Emerging islands in the River Nile

Abandoned Surface Water Intakes

Low flow

Replacement of surface water intakes with subsurface ones

Riverbank Filtration (RBF) Technology



Hiscock & Grischek 2002

Pharaohs discovered RBF and **Arab Scientists** developed it.

Germans used it on a large scale and identified treatment processes during RBF.

Advantages of RBF

- Removal of suspended solids and particles, pathogens, biodegradable and adsorbable compounds, heavy metals
- Reduced formation of disinfection by-products
- High buffering capacity against contaminants (spills)
- Robust against predicted climate change
- Pre-treatment: Cost savings in water treatment

Disadvantages of RBF

- Dissolution of Fe, Mn, NH_4 under anoxic conditions, requiring adapted post-treatment,
- Slight increase in hardness, normally not requiring further treatment measures.

GERF-Project (2011-2014)

Bank filtration under arid conditions for drinking water supply at low cost

Project partners

University of Applied Sciences Dresden, Thomas Grischek, German PI
Suez Canal University (SCU), Kamal Ghodeif, Egyptian PI
Holding Company for Water and Wastewater (HCWW)

Acknowledgement: German-Egyptian Year of Science and Technology 2007 supported the 1st Workshop "Natural Treatment Technology for Drinking Water Supply“, 12 Dec. 2007, Suez Canal University, Ismalia

GERF-Project outcomes

Recognition of potential RBF sites & optimum design

"Cloudy" Nile water → RBF → Drinking

	Nile River	RBF well(s)
Turbidity in NTU		
Sohag (2016)	2.7	0.25 – 0.3
Embaba (2016)	16 - 20	0.2 – 2.5*
Dishna (2013)	1.2 – 3.8	0.2
Fecal coliform in MPN/100 mL		
Sohag (2016)	>1000	0
Embaba (2016)	> 1000	0
Dishna (2013)	200 - 1700	0

*due to Fe/Mn conc.

GERF-Project outcomes

- Detailed site investigation, supporting infrastructure
- Water quality monitoring, riverbed clogging study
- Capacity building via training courses, staff/student exchange
- 3 publications in refereed int. journals, poster exhibition
- Further cooperation with HCWW, GIZ, DWZ

Conclusions, proposed future steps

RBF has been proven as alternative for DWS in Egypt

→ Starting a new Egyptian-German Applied Research Project "Masterplan for RBF in Egypt" including the following tasks:

- Detailed investigation of existing and potential RBF sites in Egypt,
- Optimization of post-treatment techniques for RBF in Egypt,
- Development of a tool-box for site investigation and prediction of removal rates for contaminants,
- Scientist exchange/meetings/capacity building


Vielen Dank für Ihr Interesse
Thank you for interest