

Water reuse in hydroponic systems: results from four European feasibility studies

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M. Mohr, T. Günkel-Lange, M. Fischer, J. Germer, M. Winker, G. Bürgow

HypoWave - Reuse in hydroponic systems

- Hydroponic systems* for a resource efficient agricultural reuse of wastewater
- Objectives:
 - ▶ System with multiple barriers and protection of environment (water and soil) from contaminants
 - ▶ Multiple added-value and economic exploitation (high product quality, adaptation to different framework conditions)
- Funding period: 2016 - 2019



*Plant grows in water or on an inorganic substrate (not in soil)

Challenges

- Use of nutrients in wastewater
- No contamination of product with heavy metals, pathogenic or antibiotic-resistant microorganisms, micro-pollutants
- Discharge of effluent into environment without further treatment
- Economically feasible system solution



Source: Aquatectura

Pilot plant in Wolfsburg-Hattorf

- Operating since April 2017 at municipal WWTP Wolfsburg-Hattorf
- Different wastewater treatment processes in parallel
- Growing lettuce in hydroponic greenhouse in parallel lines
- Results presented at IWA on Tuesday by A. Bliedung



Overview: feasibility studies

- Identification of framework conditions, barriers and drivers for realization of water reuse in hydroponic systems
- Development of concepts for implementation for different regions with local stakeholders
- First step for implementation of analyzed innovation



Methodology of feasibility study

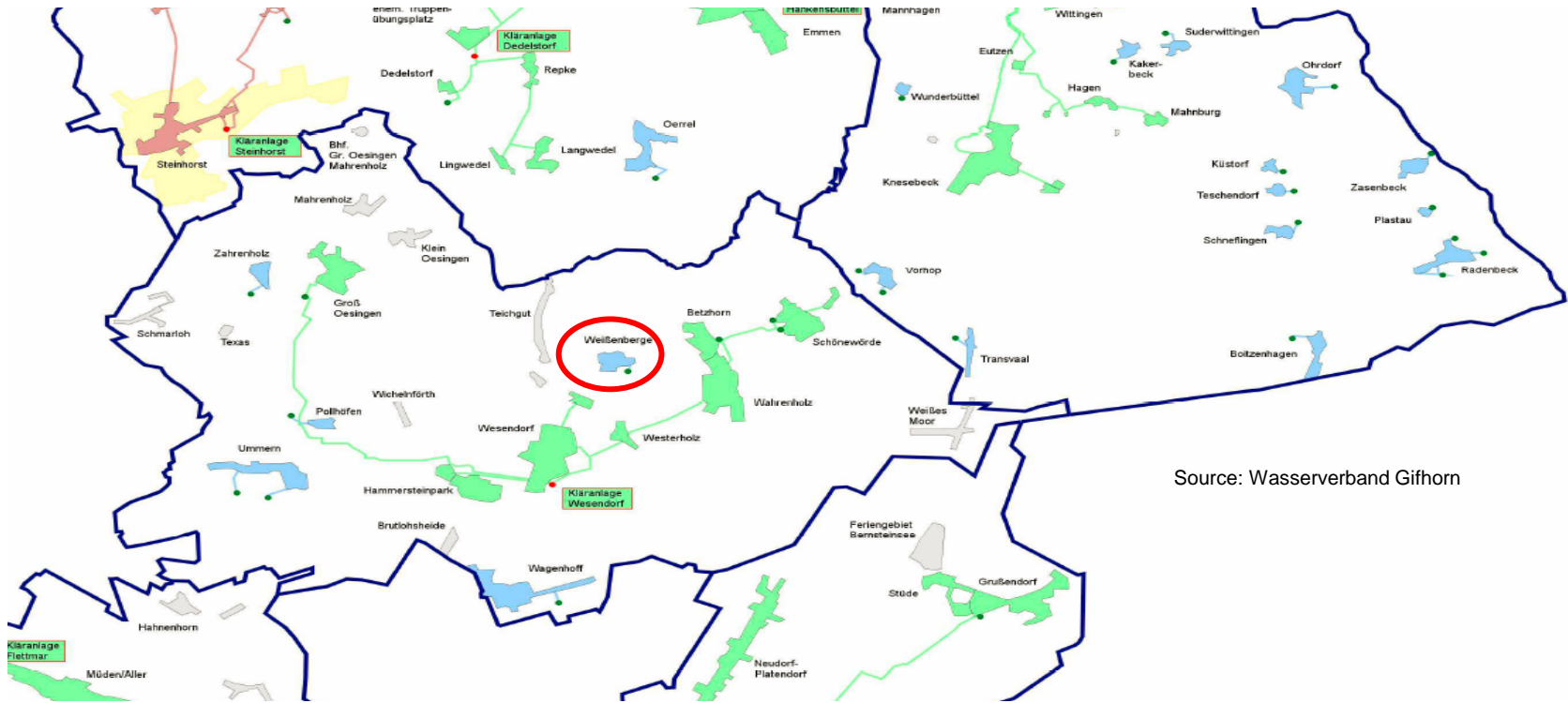
- Formation of interdisciplinary team, representing expertise in urban water management, crop production, social sciences and landscape design
- Desktop research, literature analysis and site visits: local conditions, supporting / limiting factors for water reuse in hydroponic systems
- Semi-structured interviews with relevant stakeholders
- Discussion of resulting concept with local stakeholders for validation within a workshop
- Publication of results in a brochure: www.hypowave.de (German language)

Case study 1: Gifhorn

- Seasonal water scarcity in agriculture
- Market for regional products
- Share of costs for water and nutrients relatively low: economical feasibility of water reuse challenging
- More than 30 wastewater ponds to be connected to WWTPs in coming years



Wastewater disposal in Gifhorn county

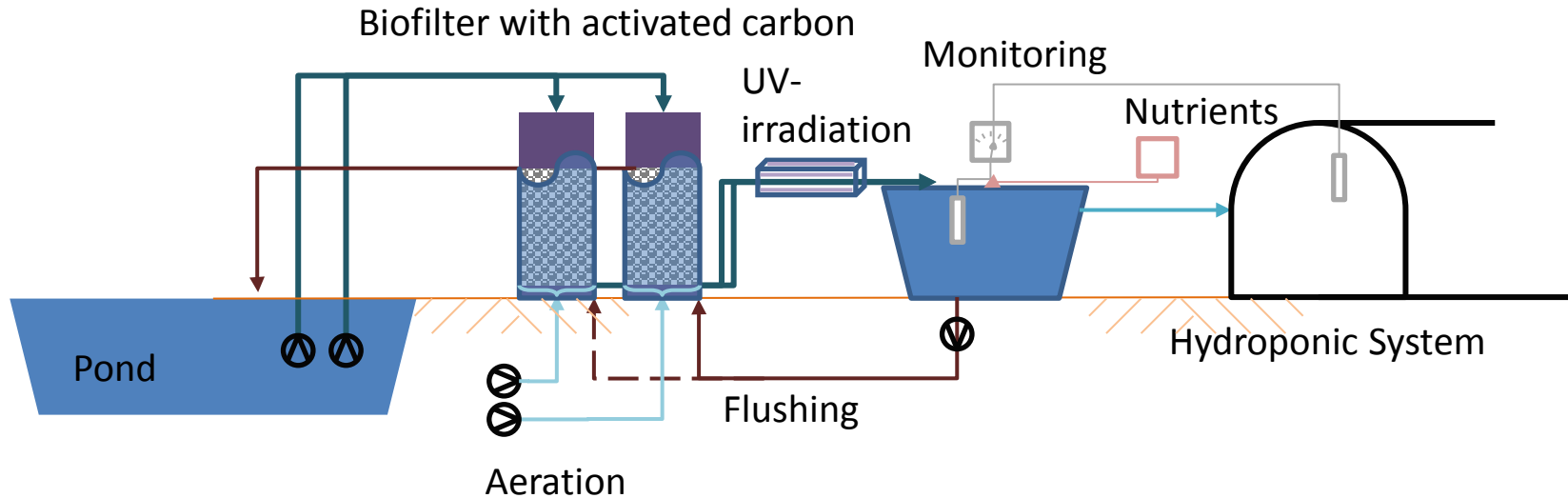


Source: Wasserverband Gifhorn

Polishing of pond effluent

- Weißenberge: 500 inh. Connected to pond system
- Economically feasible if connection to WWTP not necessary due to post-treatment in hydroponic system
- Pre-treatment of effluent of ponds necessary, as nitrogen present as ammonium
- Continuous operation necessary: heating and lighting
- Contract between operator of hydroponic system and utility needed

Proposed treatment process in Gifhorn county

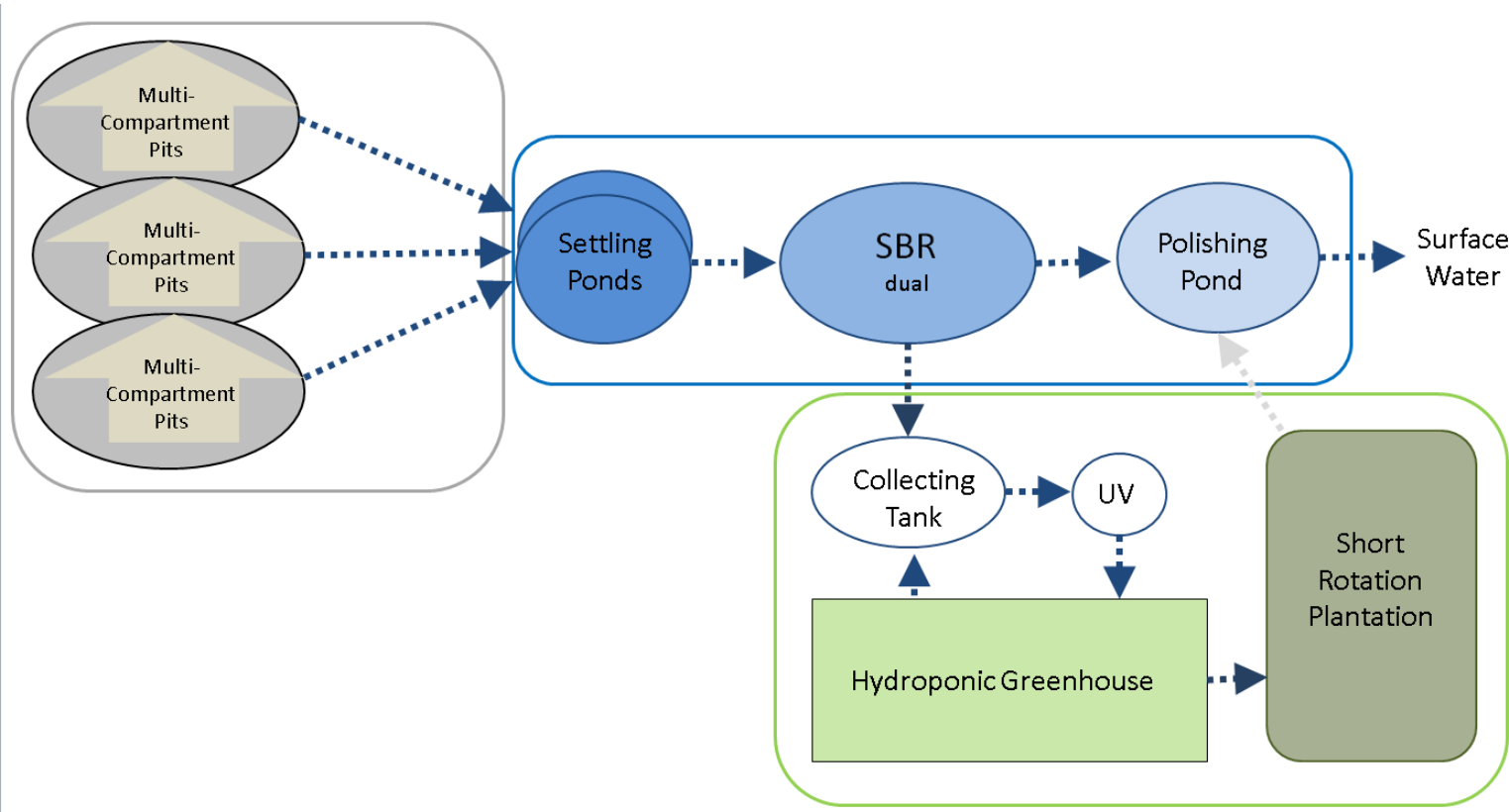


Case study 2: Raeren (Belgium)

- Sufficient water, but poorly developed wastewater infrastructure
- Wastewater of 1650 inhabitants only pre-treated in septic tanks – connection to WWTP necessary
- Proposed solution: flexible WWTP, use of nutrients of partial stream for growing flowers
- Short rotation plantation for polishing of effluent



Flow chart of proposed treatment process



Case study 3: Hessian Ried

- Area south of Frankfurt/Main, high population density, competition for water resources: drinking water, industry, irrigation, ecology
- Utilization of treated surface water (Rhine) and groundwater
- Highly developed wastewater infrastructure: removal of micropollutants under discussion
- Design of additional treatment processes adapted to requirements of agricultural reuse?

Case study 3: Hessian Ried

- Protection of soil and groundwater as potential driver for reuse in hydroponic systems
- Calculations for implementation at WWTP Griesheim (50,000 inh): utilization of water without nutrients
- Additional treatment: ozone, activated carbon, UV



Source: aquadrat ingenieure, Griesheim

Case study 4: Évora

- Arid region, high water demand for irrigation
- Smaller settlements not yet connected to WWTP's
- Design of treatment process adapted to potential reuse
- Seasonal variations in utilization of water

■ Main drivers:

- ▶ Water scarcity
- ▶ Insufficient wastewater infrastructure
- ▶ Innovative local actors (first movers)

■ Main barriers:

- ▶ Complex system, difficult to integrate into existing infrastructure
- ▶ Low prices for water and nutrients
- ▶ Perception of risks

Way ahead

- Follow-up proposals for piloting solutions identified in Gifhorn county and Raeren under preparation
- Brochures for Hessian Ried and Évora to be finalized until end of 2019
- Conceptual work regarding risk assessment and quality management in the next months



Acknowledgement



HypoWave

New Pathways Towards Wastewater Re-Use in
Agriculture

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