EUROPEAN COMMISSION
Executive Agency for Small and Medium-sized Enterprises
Director

AMENDMENT Reference No AMD-689450-16

Grant Agreement number: 689450 — Demonstrating synergies in combined natural and engineered processes for water treatment systems (AquaNES)

The parties agree to amend the Grant Agreement as follows ('**Amendment**'):

1 . Change of beneficiary due to partial takeover

As from 1 February 2017 the Grant Agreement is transferred from:

- **EOTVOS JOZSEF FOISKOLA (EJC)**, 881532001, established in SZEGEDI UT 2, BAJA 6500, Hungary, HU15308988 (the 'former beneficiary').

to

- **NEMZETI KOZSZOLGALATI EGYETEM (NUPS)** HU13, FI99859, established in LUDOVIKA TER 2, BUDAPEST 1083, Hungary, HU15795719 (the 'new beneficiary' No 31), if it acceded to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52).

This implies the **following changes** to the Grant Agreement:

- The 'transfer date' and the new beneficiary are added to the **Preamble**:

  "26. **EOTVOS JOZSEF FOISKOLA (EJC)**, 881532001, established in SZEGEDI UT 2, BAJA 6500, Hungary, HU15308988 — until 31 January 2017."

  "31. **NEMZETI KOZSZOLGALATI EGYETEM (NUPS)** HU13, FI99859, established in LUDOVIKA TER 2, BUDAPEST 1083, Hungary, HU15795719 — as from 1 February 2017."

The former beneficiary's obligations continue to apply after the transfer (in particular, Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44), although it no longer participates in the action.

The new beneficiary(ies) take over all the rights and obligations of the former beneficiary under the Grant Agreement and have full responsibility for implementing the action and complying with the Agreement. In addition, the new beneficiary is jointly and severally liable for any debts of the former beneficiary, concerning recoveries.

2. Change of Annex 1 (description of the action)

Annex 1 is changed and replaced by the Annex 1 attached to this Amendment.

3 . Changes of Annex 2 (estimated budget of the action)

As from 1 February 2017 , **Annex 2** is changed and replaced by the Annex 2 attached to this Amendment.

4. Change to the action's estimated eligible costs

The 'estimated eligible costs of the action' set out in **Article 5.2** are changed to:

> "**EUR 9,739,405.63** (nine million seven hundred and thirty nine thousand four hundred and five EURO and sixty three eurocents)".

All other provisions of the Grant Agreement and its Annexes remain unchanged.

This Amendment **enters into force** on the day of the last signature.

This Amendment **takes effect** on the date on which the amendment enters into force, except where a different date has been agreed by the parties (for one or more changes).

Please inform the other members of the consortium of the Amendment.

SIGNATURES

For the coordinator	For the Agency
Falko SCHLOTTIG with ECAS id nschlflk signed in the Participant Portal on 12/10/2017 at 13:53:27 (transaction id SigId-151425-pY3bruCzJGGGoU6EVm17dIs8eHqh8Zvv9bxILRqgeGD0FfGAzm7i1WEPxsnja1pEPD7PQOVZwGzOIaYNqDzH7O4-Jj71zxYb8yrGXJFnP0oDp0-SF5FxwYhUMpxrdC5YddeFpbv8ObIsew98KJ6YJlJsSa). Timestamp by third party at Thu Oct 12 14:54:03 CEST 2017	Signed by Patrik KOLAR with ECAS id kolarpa as an authorised representative on 03-11-2017 10:10:26 (transaction id SigId-33716-tSP2NoDC6RNrbLFmQUwrpR9nrzl0PUY8rabCfLXzTBCZLtJuLTKK1LzkrJcrDWsRkIbzzzVKw1Q0ardrZtjKtt40-Jj71zxYb8yrLVqla4bW6bC-24St8oO3lg3bJXrwNtQUMdqw3JFRtPqGR6bFnMSJSZC) Fri Nov 03 10:10:32 CET 2017

Enclosures:

Annex 2
Annex 1

EUROPEAN COMMISSION
Executive Agency for Small and Medium-sized Enterprises
H2020 Environment & Resources

ANNEX 1 (part A)

Innovation action

NUMBER — 689450 — AquaNES

Table of Contents

1.1. The project summary

Project Number [1]	689450	Project Acronym [2]	AquaNES

One form per project

General information	
Project title [3]	Demonstrating synergies in combined natural and engineered processes for water treatment systems
Starting date [4]	01/06/2016
Duration in months [5]	36
Call (part) identifier [6]	H2020-WATER-2015-two-stage
Topic	WATER-1b-2015 Demonstration/pilot activities
Fixed EC Keywords	Water technology
Free keywords	natural and engineered water treatment systems, constructed wetlands, managed aquifer recharge, bank filtration, ecosystem services, drinking water, wastewater treatment, water reuse, LCA

Abstract [7]

The AquaNES project will catalyse innovations in water and wastewater treatment processes and management through improved combinations of natural and engineered components. Among the demonstrated solutions are natural treatment processes such as bank filtration (BF), managed aquifer recharge (MAR) and constructed wetlands (CW) plus engineered pre- and post-treatment options.
The project focuses on 13 demonstration sites in Europe, India and Israel covering a repre-sentative range of regional, climatic, and hydrogeological conditions in which different combined natural-engineered treatment systems (cNES) will be demonstrated through active collaboration of knowledge and technology providers, water utilities and end-users. Our specific objectives are
• to demonstrate the benefits of post-treatment options such as membranes, activated carbon and ozonation after bank filtration for the production of safe drinking water
• to validate the treatment and storage capacity of soil-aquifer systems in combination with oxidative pre-treatments
• to demonstrate the combination of constructed wetlands with different technical post- or pre-treatment options (ozone or bioreactor systems) as a wastewater treatment option
• to evidence reductions in operating costs and energy consumption
• to test a robust risk assessment framework for cNES
• to deliver design guidance for cNES informed by industrial or near-industrial scale expe-riences
• to identify and profile new market opportunities in Europe and overseas for cNES
The AquaNES project will demonstrate combined natural-engineered treatment systems as sus-tainable adaptations to issues such as water scarcity, excess water in cities and micro-pollutants in the water cycle. It will thus have impact across the EIP Water's thematic priorities and cross-cutting issues, particularly on 'Water reuse & recycling', 'Water and wastewater treatment', 'Water-energy nexus', 'Ecosystem services', 'Water governance', and 'DSS & monitoring'.

1.2. List of Beneficiaries

Project Number [1]	689450	Project Acronym [2]	AquaNES

List of Beneficiaries

No	Name	Short name	Country	Project entry date[8]	Project exit date
1	FACHHOCHSCHULE NORDWESTSCHWEIZ	FHNW	Switzerland		
2	AKUT UMWELTSCHUTZ INGENIEURE BURKARD UND PARTNER	AKUT	Germany		
3	AUTARCON GMBH	AUT	Germany		
4	BioDetection Systems B.V.	BDS	Netherlands		
5	HYDROBUSINESS BV	HYBU	Netherlands		
6	IMAGEAU SAS	imaGeau	France		
7	GEO-HYD	GEOHYD	France		
8	MicroLAN	MicroLAN	Netherlands		
9	X-FLOW BV	XFLOW	Netherlands		
10	VERTECH GROUP	VTG	France		
11	WADIS LTD	WADIS	Israel		
12	WATSTECH LIMITED	WatStech	United Kingdom		
13	XYLEM SERVICES GMBH	XYLEM	Germany		
14	FOVAROSI VIZMUVEK ZARTKORUEN MUKODORESZVENYTARSASAG	BUWW	Hungary		
15	BERLINER WASSERBETRIEBE	BWB	Germany		
16	DIMOTIKI EPICHIRISI YDREVSIS APOCHETEFSIS DIMOY THIRAS NOMOU KYKLADON	DEYAT	Greece		
17	DIMOS ANTIPAROU	MUOA	Greece		
18	DREWAG NETZ GMBH	DREWAG	Germany		
19	ERFTVERBAND	EV	Germany		
20	IWB INDUSTRIELLE WERKE BASEL	IWB	Switzerland		
21	MEKOROT WATER COMPANY LIMITED	MEK	Israel		
22	UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU	AMU	Poland		
23	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES	BRGM	France		
24	CRANFIELD UNIVERSITY	UCRAN	United Kingdom		
25	Hochschule fuer Technik und Wirtschaft Dresden	HTWD	Germany		

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry date[8]	Project exit date
26	EOTVOS JOZSEF FOISKOLA	EJC	Hungary		31/01/2017
27	KWB KOMPENTENTZZENTRUM WASSER BERLIN GEMEINNUTZIGE GMBH	KWB	Germany		
28	KWR WATER B.V.	KWR	Netherlands		
29	NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	NTUA	Greece		
30	Uttarakhand Jal Sansthan	UJS	India		
31	NEMZETI KOZSZOLGALATI EGYETEM	NUPS	Hungary	01/02/2017	

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Potential of bank filtration and post-treatments in (drinking)water supply	25 - HTWD	254.00	1	34
WP2	Managed aquifer recharge & soil aquifer treatment for water storage and quality improvement	23 - BRGM	220.30	1	34
WP3	Constructed wetlands and other natural systems for improved wastewater treatment	27 - KWB	200.70	1	36
WP4	Risk Assessment and Water Quality Control	28 - KWR	96.00	1	33
WP5	Interfaces with the Environment & Society	24 - UCRAN	104.00	1	34
WP6	Decision Support and System Design	29 - NTUA	67.00	1	36
WP7	Exploitation and Dissemination	10 - VTG	100.00	1	36
WP8	Management	1 - FHNW	35.00	1	36
WP9	Ethics requirements	1 - FHNW	N/A	1	36
		Total	1,077.00		

1.3.2. WT2 list of deliverables

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Database on bank filtration sites	WP1	22 - AMU	Report	Public	18
D1.2	Design of bank filtration schemes and coupled engineered solutions	WP1	3 - AUT	Report	Public	24
D1.3	Demonstration of using software tools SOMA 2 for predicting the behaviour of micropollutants and SIPHON for energy efficient siphon well operation	WP1	25 - HTWD	Other	Public	30
D1.4	Tool box for risk assessment and decision support for BF design/operation in combination with engineered post-treatment	WP1	22 - AMU	Report	Public	32
D1.5	Planning of siphon well systems	WP1	25 - HTWD	Report	Public	32
D1.6	Advantages and limitations, impact of BF design, recommendations for operators	WP1	31 - NUPS	Report	Public	34
D2.1	Oxidative pre-treatment for managed aquifer recharge and soil-aquifer treatment systems	WP2	1 - FHNW	Report	Public	30
D2.2	High flow pre-treatment and infiltration system for aquifer storage and recovery with storm water runoff	WP2	28 - KWR	Report	Public	30
D2.3	Novel monitoring-modelling systems to manage qualitative and quantitative status of coastal aquifers	WP2	23 - BRGM	Report	Public	30
D2.4	SAT-MAR-specific ICT system for stakeholder use	WP2	7 - GEOHYD	Other	Public	32

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Combining constructed wetlands and engineered treatment for water reuse	WP3	27 - KWB	Report	Public	24
D3.2	Combining constructed wetlands and engineered treatment for surface water protection	WP3	24 - UCRAN	Report	Public	30
D3.3	Design recommendations for combining CW with engineered pre- or post-treatments including case studies of demonstration sites	WP3	2 - AKUT	Report	Public	34
D4.1	R packages for integrative data processing & visualisation tool	WP4	27 - KWB	Other	Public	12
D4.2	Blueprint for a water quality assessment framework for cNES	WP4	28 - KWR	Report	Public	18
D4.3	Fast monitoring systems for various contaminants in cNES	WP4	28 - KWR	Report	Public	27
D4.4	Web based interactive tools for QMRA tool and chemical water quality assessment	WP4	28 - KWR	Other	Public	30
D5.1	EU governance for cNES	WP5	24 - UCRAN	Report	Public	24
D5.2	Ecosystem services from cNES	WP5	24 - UCRAN	Report	Public	30
D5.3	LCA & LCC in combined natural and engineered treatment systems	WP5	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	33
D5.4	Guidance on citizen science approaches	WP5	24 - UCRAN	Report	Public	34
D5.5	Gaming approach for stakeholder engagement	WP5	28 - KWR	Report	Public	34
D6.1	cNES Decision Framework	WP6	29 - NTUA	Report	Confidential, only for members of the consortium	12

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
	and Knowledge Management System				(including the Commission Services)	
D6.2	Suite of cNES Decision Support Tools (1st prototype)	WP6	29 - NTUA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	22
D6.3	Decision Reasoning System for cNES (1st prototype)	WP6	29 - NTUA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	28
D6.4	AquaNES Decision Support System and relevant documentation	WP6	29 - NTUA	Demonstrator	Public	34
D7.1	Project Website	WP7	1 - FHNW	Websites, patents filling, etc.	Public	3
D7.2	Exploitation Plan	WP7	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D7.3	Dissemination Plan & Report	WP7	1 - FHNW	Report	Public	6
D7.4	Market Analysis Report	WP7	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D7.5	Dissemination Events	WP7	1 - FHNW	Other	Public	36
D7.6	Marketing Report & Brochures	WP7	1 - FHNW	Report	Public	27
D8.1	Meeting minutes	WP8	1 - FHNW	Report	Confidential, only for members of the consortium (including the Commission Services)	2
D9.1	EPQ - Requirement No. 3	WP9	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the	2

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
					Commission Services)	
D9.2	NEC - Requirement No. 4	WP9	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2
D9.3	EPQ - Requirement No. 1	WP9	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	Lead beneficiary [10]	25 - HTWD
Work package title	Potential of bank filtration and post-treatments in (drinking)water supply		
Start month	1	End month	34

Objectives

In WP1 new technology components will be integrated and monitoring and operating regimes will be adopted to further optimise water treatment in bank filtration schemes for these new requirements. Specific goals of WP1 are to:
1. improve the confidence with which water service providers are able to specify, design, and implement combined bank filtration (BF) and engineered water treatment systems,
2. evidence how full scale combined systems can achieve reductions in operating costs of 10%-30% and in energy consumption per m3 treated of up to 50% compared to current established solely engineered solutions,
3. demonstrate the benefits of post-treatment options such as nanofiltration (NF), ultrafiltration (UF), reverse osmosis (RO), granular activated carbon (GAC), ultraviolet disinfection (UV), ozonation and electrochlorination after bank filtration for the production of safe drinking water,
4. deliver design guidance for bank filtration systems combined with engineered treatment components informed by industrial or near-industrial scale experiences and to prove the transferability of tested technical approaches across contexts and water quality challenges,
5. strengthen the leading position of European researchers and water utilities in efficient use of bank filtration worldwide and achieve a new level of market penetration in Asia.

Description of work and role of partners

WP1 - Potential of bank filtration and post-treatments in (drinking)water supply [Months: 1-34]
HTWD, AUT, XFLOW, BUWW, BWB, DREWAG, AMU, EJC, KWB , UJS, NUPS
Demonstration sites: Overview (bold = innovative product/services)
Site 1: Berlin (DE). Operated by BWB. demonstrating RBF + Anoxic/ Suboxic NF (pilot)+ aeration + sand filtration
Site 2: Dresden, river Elbe (DE). Operated by DREWAG, demonstrating RBF + Aeration + UF (pilot) + Activated Carbon Filtration + Disinfection (Cl2)
Sit 3: Budapest, River Danube (HU). Operated by BUWW, demonstrating RBF + RO (pilot) + Disinfection (ClO2) + UV
Site 4: Poznan, River Warta, (PL). Investigated by AMU, demonstrating RBF + Aeration + Ozonation + GAC + Disinfection (ClO2)
Site 5: Haridwar, Ganga River (IN). Operated by AUT (SME), UJS (Utility), demonstrating RBF + Disinfection (Cl2) using in-line electro-lysis (existing and pilot)

Task 1.1 Decentralized NF for anoxic to suboxic BF, Site 1 (M1-M30)
Lead: KWB, Contributors: BWB, XFLOW
NF can remove both sulphate and EDTA in one treatment step (Van der Bruggen et al., 2004). BF in front of the NF is a reliable measure to remove biopolymers (Gruenheid et al., 2005), a primary UF foulant, and ensures a high level of membrane filtration performance. Beyer et al. (2014) demonstrated the long-term stability of spiral wound NF of strictly anoxic groundwater, a concept which will be adapted to bank filtration and suboxic conditions. Demonstrate long-term stability of anoxic capillary NF as post-treatment for BF, operated at single wells for decentralized partial removal of selected inorganic and organic compounds; extend applicability of NF for BF/groundwater treatment from strictly anoxic to suboxic conditions and highlight benefits of BF regarding biofouling prevention of the membrane in comparison to direct surface water treatment via NF (site 1).

Subtask 1.1.1 Planning of demonstration site and production of innovative NF modules
Lead: KWB, Contributors: BWB, XFLOW
• Design and first industrial size production of capillary NF modules with optimized removal of sulphate vs. reduced transmembrane pressure
• Design and installation of a decentralized NF-pilot scheme (< 5 m3/h) for targeted partial treatment for an/suboxic bank filtrate
• Survey of existing NF schemes for groundwater or BF treatment, analysis of available data on the selected sites (recovery ratio, pressure loss, fouling, energy demand, maintenance) to benchmark AquaNES improvement in energy and cost savings

Subtask 1.1.2 NF-performance analysis and integration of results
Lead: BWB, Contributors: XFLOW, KWB
• Evaluation of the operational requirements for suboxic bank filtrate treatment. Monitoring with special focus of sulfate, DOC, micropollutants (yet to be determined) and EDTA.
• Demonstration of long-term stability of operation with anoxic and suboxic BF as feed water
• Validation of removal capacity for selected inorganic and organic compounds, integration into centralized water distribution system and evaluation of cost/energy savings compared to mainstream centralized treatment.

Task 1.2 Centralized UF/RO to reduce breakthrough of pathogens and micropollutants after BF, Sites 2, 3, 5 (M1-M34)
Lead: HTWD, Contributors: DREWAG, BUWW, EJC, AUT, NUPS
UF with coagulation achieves effective removal of pathogens (ElHadidy et al., 2013; Mueller, 2005) and TOC removal of >40 % (Kabsch-Korbuowicz, 2005). However, UF, coagulation or both in combination are not effective at removing MP, except specific compounds (Wray et al., 2014). BF in front of the UF can remove degradable micropollutants (Maeng et al., 2011) and the combination of both, UF/RO and BF can be applied as a reliable multi-barrier treatment. Demonstrate advantages and limitations of centralized oxic membrane filtration (UF, RO) in combination with BF after Fe/Mn removal. Assess UF as additional barrier to the breakthrough of pathogens and organic compounds during subsequent activated carbon filtration (sites 2, 3)

Subtask 1.2.1 Running of UF-pilot scheme at site 2
Lead: DREWAG, Contributors: HTWD, AUT
Design, installation and operation of an UF-pilot scheme (0.5-2 m3/d) at site 2, long term monitoring of selected organic and biological parameters as well as membrane performance (recovery ratio, pressure loss, fouling, energy demand, maintenance) for 24 months, estimation of removal rates and comparison of life-cycle costs and advantages of additional UF-treatment against regular reactivation of GAC (higher organic load) plus additional disinfection. Survey of existing UF schemes for groundwater or BF treatment, analysis of available data on the selected sites (recovery ratio, pressure loss, fouling, energy demand, maintenance).
Inline electrolysis coupling to the ultrafiltration will be tested for the supply of residual disinfectant, and the additional removal of manganese from permeate to allow its use for UF membrane backwash.

Subtask 1.2.2 Running of RO-pilot scheme at site 3
Lead: BUWW, Contributors: EJC, NUPS
Design, installation and operation of a RO-pilot scheme (0.3 m3/d) at site 3, event based operation and monitoring of selected biological parameters and membrane performance (recovery ratio, pressure loss, fouling, energy demand, maintenance) at the RO-pilot scheme (24 months) and estimation of removal rates (BUWW, EJC,NUPS).

Task 1.3 Ensure water supply safety with BF and modern disinfection, Sites 2 - 5 (M1-M34)
Lead: AUT, Contributors: UJS, BUWW, EJC, DREWAG, HTWD, AMU, NUPS
BF is a worldwide recognized natural and low cost treatment for pathogens. But field investigations have confirmed that some wells are at risk during floods such that contamination, especially by pathogens, can occur (Sandhu et al., 2015; Saph Pani, 2013). The risks identified as a result were mostly associated with the location of the BF wells and their designs resulting in direct contamination, inadequate existing flood protection measures and insufficient contingency measures. For site 5 it was shown that monsoon floods were a major contributor to the risk for human health and disability-adjusted life years (DALY's) were strongly dependent on RBF and disinfection pathogen removal capabilities (Bartak et al., 2015). Demonstrate how to ensure water supply safety with BF and modern disinfection including UV (Site 3) and on-site electrochlorination (Site 5) during extreme weather conditions such as floods and droughts. Developing a robust operation strategy to apply in-line electrolysis modules at sites where chloride concentration is <10 mg/L as observed at site 5 and often found in regions in Asia (sites 3 & 5).

Subtask 1.3.1 BF and decentralized large scale and small scale in-line electrolysis
Lead: AUT, Contributors: UJS, HTWD
Current disinfection practice at site 5 involves questionable manual NaHOCl disinfection at the well heads, which is common in India. In order to improve water safety, an existing innovative in-line electrolysis module (40 m3/d) for production of chlorine on-site for water disinfection will be tested at site 5 at a large caisson well. Also, a new in-line electrolysis module (4 m3/d) produced by the SME AUTARCON will be coupled with a so-called Koop-well system and an advanced media filtration near site 5 to prove the potential for small scale RBF and disinfection for small communities; monitoring of residual chlorine.

Subtask 1.3.2 BF and disinfection using UV and/or ozone
Lead: BUWW, Contributors: EJC, AMU, DREWAG, HTWD, NUPS
Long term and event based monitoring of selected water quality parameter before and after UV disinfection (sites 2 & 3). Effect of ozonation on pathogen removal after BF and before GAC will be studied at site 4.

Subtask 1.3.3 Adaption strategies to improve water safety at BF-sites
Lead: HTWD, Contributors: AUT, DREWAG, BUWW, AMU
Evaluation of existing data during extreme weather conditions, demonstrate compliance and non-compliance with regular operation, develop strategies to improve water safety (well operation, well design, well head safety, etc.) at sites in Europe as well as for future sites under different climate conditions such as in Asia or Africa. Specific methods will be tested to identify leakages at well heads, protective measures will be tested and evaluated in order to maximize well head protection, reduce surface water ingress (e.g. floods) and increase water safety.

Task 1.4 Treatment efficiency of combined natural and engineered BF systems, Sites 1-4 (M6-M34)
Lead: AMU, Contributors: DREWAG, BUWW, EJC, KWB, HTWD, NUPS
Despite direct effects on source water quantity and quality, extreme weather affects BF efficacy indirectly by variations in travel time and redox conditions (Sprenger et al., 2011; Schoenheinz & Grischek, 2011; Massmann et al., 2006). Demonstrate the impact of travel time of BF and coupling with managed aquifer recharge (MAR) on the efficacy of existing BF post treatment (ozonation, activated carbon filtration, disinfection); evaluate the effectiveness of additional treatment steps (NF, UF, RO, UV, in-line disinfection) and summarize results in a software tool for prediction of the behaviour of micropollutants and other water constituents. Key performance indicators will be summarized for WP5&6.

Subtask 1.4.1 Removal of organic micropollutants with respect to travel time and redox conditions, Sites 1-5
Lead: AMU, Contributors: all others
Evaluation of removal rates for organic compounds with respect to travel time and development of well operation strategies to increase travel time. Study of existing data from the demonstration sites including travel times (1, 2, 3, 4, 5) demonstration of the current state of the art performance with respect to travel time. Create data base on BF sites and existing post-treatment in Eastern Europe. Application and adaptation of the software tool SOMA 2 based on SOMA (EU-Project TECHNEAU) to predict removal rates of micropollutants.

Subtask 1.4.2 Pilot experiments to determine BF-boundary conditions
Lead: NUPS, Contributors: BUWW
Pilot scale experiments focused on crucial processes in order to determine the boundary conditions of the BF operation, including biofilm dynamics, bacterial production, nitrification/denitrification, removal of markers trace molecules, effects of environmental stressors (heat stress, dehydration stress, toxic effects), and the 3D changes of various electron donors (NH4+, Fe etc.) within the active zone of the BF. Key performance indicators will be summarized for WP5&6.

Subtask 1.4.3 Evaluation of additional treatment for pathogen removal
Lead: HTWD, Contributors: AMU, BUWW, KWB
Evaluation and demonstration of the advantages of additional pathogen removal by membranes, UV and in-line electrolysis - disinfection using a quantitative risk assessment approach (QMRA) from WP4. Assessment of energy saving potential and ecosystem service when using BF as first barrier to remove pathogens.

Task 1.5 Long term BF abstraction rates and siphon wells for energy reduction, Sites 2-5 (M6-M24)
Lead: HTWD, Contributors: DREWAG, EJC, NUPS, AMU, KWB, BWB, BUWW, UJS
Demonstration of an evaluation tool for prediction of riverbed clogging and required long term abstraction rates. Validation of a design tool for siphon systems to achieve a “renaissance” of siphon systems in BF using modern armatures and monitoring equipment to reduce pumping energy costs by >50%.

Subtask 1.5.1 Management of riverbed clogging
Lead: BUWW, Contributors: EJC, AMU, DREWAG, HTWD, NUPS
Comparison of riverbed clogging studies from demonstration sites 2-4, maximum infiltration rates during flood and drought periods, demonstration of operational procedures to manage floods and droughts: declogging of riverbeds - dredging of the Warta River bottom, water abstraction during droughts in order to avoid unwanted water quality changes.

Subtask 1.5.2 Energy efficiency of different well types and siphon well design tool
Lead: HTWD, Contributors: DREWAG, BUWW, AMU, EJC, NUPS, UJS
Assessment of the energy efficiency and life cycle costs of different well types (single operated with pumps vs. siphon wells vs. horizontal collector wells) and develop measures for energy management (sites 2-5). Demonstration of new constructive elements for novel siphon systems (replacement and new design) including recent developments in vacuum technology, testing of commercially available technical equipment for trenchless vacuum leak survey and measures for siphon rehabilitation; Developing a planning guideline for the design of siphon wells. Key performance indicators will be summarized for WP5&6.

Task 1.6 Interfaces with WP5 and WP6, Sites 1-5 (M3-M34)
Lead: HTWD, Contributors: BWB, KWB, DREWAG, NUPS, AMU, BUWW, AUT, XFLOW, UJS

This task will ensure that data from WP2 will effectively feed into the activities of WP4 (Water quality assessment framework), WP5 (namely the LCA and ecosystem services assessments) and WP6 (namely AquaNES DSS and knowledge repository). Among the data derived from demonstration activities will be
• water quality parameters
• energy use
• chemicals use
• land use and
• flow data
This will involve liaising with partners on WP5 and WP6 in order to establish the scope of WP5 assessments and WP6 decision support, to define data needed for WP5&6 and to establish templates for data collation.

Participation per Partner

Partner number and short name	WP1 effort
3 - AUT	25.00
9 - XFLOW	18.00
14 - BUWW	38.00
15 - BWB	29.00
18 - DREWAG	14.00
22 - AMU	36.00
25 - HTWD	32.00
26 - EJC	4.00
27 - KWB	24.00
30 - UJS	9.00
31 - NUPS	25.00
Total	254.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Database on bank filtration sites	22 - AMU	Report	Public	18
D1.2	Design of bank filtration schemes and coupled engineered solutions	3 - AUT	Report	Public	24
D1.3	Demonstration of using software tools SOMA 2 for predicting the behaviour of micropollutants and SIPHON for energy efficient siphon well operation	25 - HTWD	Other	Public	30

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.4	Tool box for risk assessment and decision support for BF design/ operation in combination with engineered post-treatment	22 - AMU	Report	Public	32
D1.5	Planning of siphon well systems	25 - HTWD	Report	Public	32
D1.6	Advantages and limitations, impact of BF design, recommendations for operators	31 - NUPS	Report	Public	34

Description of deliverables

D1.1 : Database on bank filtration sites [18]

An existing, limited database on BF sites in Europe will be completed with a special focus on BF sites in south-east Europe. The database will contain mainly geohydraulic site parameters, contact addresses, references and description of existing post-treatment

D1.2 : Design of bank filtration schemes and coupled engineered solutions [24]

Marketing Report: The marketing report will focus on regional needs in Europe, Asia and Africa and market options for combined systems with special focus on cost savings. It will highlight favourite design practices and adaption strategies for the combination of BF with engineered solutions in order to secure water supply under extreme weather conditions.

D1.3 : Demonstration of using software tools SOMA 2 for predicting the behaviour of micropollutants and SIPHON for energy efficient siphon well operation [30]

Improved/adapted software tools SOMA 2 for predicting the behaviour of micropollutants and SIPHON for energy efficient siphon well operation will be validated at demo sites. Results from monitoring programs, pilot testing, pumping tests and energy consumption measurements will be combined and used to test the application limits/ advantages of the software tools

D1.4 : Tool box for risk assessment and decision support for BF design/operation in combination with engineered post-treatment [32]

Technical REport: The report will present a validation of how existing tools can be applied for risk assessment and decision support for BF design/operation in combination with engineered post-treatment (all sites). Required qualification/training for using such tools will be evaluated.

D1.5 : Planning of siphon well systems [32]

Technical Report: A guideline for planning, construction and technical equipment of siphon well systems will be prepared. Users of the guideline will be engineers, consultancies, water companies.

D1.6 : Advantages and limitations, impact of BF design, recommendations for operators [34]

Technical Report: Information from demonstration sites and literature data on advantages, limitations, design and operation of BF schemes will be analysed to draw conclusions for managers, decision makers and operators. Key outputs are transferable numbers on attenuation rates for relevant pollutants in relation to the Water Framework Directive and on technical problems related to redox conditions. The report includes BF + Membrane filtration (Task 1.1+1.2); BF + Disinfection (Task 1.3+1.4); Energy efficient operation (Task 1.5)

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Set-up for all pilot/ demonstration sites completed	1 - FHNW	9	Site description, technical specification and operational procedure documented. HTWD, BRGM and KWB are supporting the collection of info within WP1, WP2 and WP3
MS2	Qualitative and first quantitative information for WP4-6 shared	23 - BRGM	12	Data exchanged & transferred according to procedures. Concerns all partners in WP1-4, to be coordinated by HTWD for WP1, BRGM for WP2, KWB for WP3, KWR for WP4.
MS3	First integrated data sets from pilot / demonstration sites available for WP5&6	25 - HTWD	24	Comprehensive data set from demonstration sites in WP1-4 at hand and exchanged. Input per Work Package to be coordinated by relevant WP Leaders (WP1-4), i.e. shared Lead for this milestone
MS10	Monitoring parameter inventory from demonstration sites	28 - KWR	10	List available, structured data base for parameters relevant for cNES to be compiled by KWR
MS27	Project internal data exchange procedures defined	7 - GEOHYD	10	Formats defined, decision on potential system made

Work package number [9]	WP2	Lead beneficiary [10]	23 - BRGM
Work package title	Managed aquifer recharge & soil aquifer treatment for water storage and quality improvement		
Start month	1	End month	34

Objectives

Demonstrate the effectiveness and validate the long-term feasibility of combined natural and engineered (cNES) treatment technologies for Soil Aquifer Treatment (SAT) and Managed Aquifer Recharge (MAR) sites for various hydro-climatic and regional contexts and a broad range of source waters (surface water, storm water, waste water) treated for drinking water purposes or water reuse. Specific goals of WP2 are to:

• Demonstrate the impact of oxidative pre-treatment steps to SAT on bulk organics, micropollutants and microbiological quality at pilot plant scale (Lange Erlen site)

• Test the combination of alternating ozonation-biofiltration-oxidation with short SAT to improve reduction of organic matter, micropollutants and pathogens for indirect potable reuse at demonstration scale (Shafdan site)

• Test and optimise a mobile high-rate filtration system combined to MAR for temporary storage of storm water at demonstrator scale (Waddinxveen site)

• Demonstrate the efficiency of combined secondary wastewater treatment + reed bed filtration with SAT/MAR on groundwater quality and quantity at aquifer scale through novel subsurface monitoring, data management and modelling including advanced chemical and isotopic analysis (Agon Coutainville site)

• Assess the overall long-term performance of combined engineered-MAR/SAT solutions for operational implementation, assisted by advanced monitoring and modelling (ICT) for system control and optimisation

Description of work and role of partners

WP2 - Managed aquifer recharge & soil aquifer treatment for water storage and quality improvement
[Months: 1-34]
BRGM, FHNW, HYBU, imaGeau, GEOHYD, MicroLAN, WADIS, XYLEM, IWB, MEK, KWR
Four MAR-SAT sites have been selected in Switzerland, Israel, Netherlands, and France for the demonstration of cNES treatment. These long established recharge sites exhibit operational features common to many schemes so that the demonstrated synergies of high technology with MAR/SAT will be representative and widely applicable.

Task 2.1 Oxidative pre-treatment of pre-filtered surface water prior to forest soil infiltration - Lange Erlen site (M 1-30)
Lead: FHNW, contributors: IWB, XYLEM
The Lange Erlen site (Site 6) produces drinking water for the city of Basel (CH) from the river Rhine (surface water abstraction). The treatment train encompasses screening, filtration and subsequent soil infiltration. After re-abstraction the water is treated by granular activated carbon and UV-disinfection. A pilot plant (reactor and column set-ups) will be operated to demonstrate the effectiveness of UV+H2O2 pre-treatment before infiltration, especially with respect to micropollutant removal and its effects on biodegradation and sorption processes (see scheme below).

Subtask 2.1.1 Oxidation processes for pre-filtered water from river Rhine and river Wiese
Lead: XYLEM, contributors: IWB
The demonstration site consists of a pilot plant capable of operating advanced oxidation processes including H2O2 dosing and UV activation to foster radical formation by Xylem. It will be set-up and put into operation, with subsequent column passages, to treat pre-filtered surface water both from the river Rhine and the nearby river Wiese, which is an alternative source water but has a lower water quality. The setup of the pilot plant and the columns will be finalized by M5 followed by a test- and conditioning period in M5-M6.

Substask 2.1.2 Column set-ups
Lead: FHNW, contributors: IWB
To model the infiltration conditions, several columns will be set up with (1) disturbed soil samples from the infiltration area and (2) biological activated carbon with better controllable flow conditions. There will be reference columns fed with pre-treated water without oxidation and columns fed with the oxidized feed. All columns will be fed in the wet-dry cycles as encountered in the full scale system and will have several sampling ports at different points. Tracer experiments will be conducted to characterise the mass transfer in the column. The column material properties will be characterised before and after the experiment (e.g. particle size distribution, organic content, mineral composition and microbial composition). The column experiments are supposed to run in parallel for 12 months on each feed water (Rhine/Wiese).

A comprehensive characterisation of the feed and product water is foreseen, in terms of bulk organics (DOC fractionation by LC-OCD) and micropollutants (LC-MS/MS, transformation products will be measured for some target compounds) as well as microbiological parameters (indicators and flow cytometry). The treatment influence of H2O2 and UV dose will be tested in pre-experiments (M1-M5) for different feed water conditions (e.g. turbidity).

Subtask 2.1.3 Processes evaluation
Lead: FHNW, Contributors: XYLEM, IWB
The treatment performance of the demonstrated system will be compared to the existing infiltration plus adsorption system particularly with respect to organic removal. Recommendations will be derived on how the natural treatment system can be intensified by appropriate oxidative pre-treatment. Transferability to other managed aquifer recharge sites will be considered.

Task 2.2 Optimised advanced oxidation processes as pre-treatment for soil-aquifer treatment Indirect Potable Reuse (InPR) Shafdan site (M1-30)
Lead: MEK, Contributors: WADIS, XYLEM
The Shafdan demonstration site (Site 7) is located near Tel Aviv. Treated wastewater is infiltrated into an aquifer, which is re-abstracted for agricultural irrigation. Various comprehensive pre-treatment options have been tested previously to remove nutrients, micropollutants and increase the redox potential control for removal. The Shafdan pilot will demonstrate effectiveness of different combinations of ozonation-biofiltration-oxidation steps with short Soil Aquifer Treatment (sSAT) to improve the biodegradability and reduction of DOC, micropollutants and pathogens to satisfy Israeli and EU drinking water criteria for Indirect Potable Reuse (InPR). Different treatment trains (recirculated ozonation-sSAT, ozonation-BAC-UF, electric pulse (WADIS) – BAC-UF or sSAT) will be assessed. This demonstration site will validate the technical feasibility of two main innovative engineered pre-treatment processes combined with natural treatment system (sSAT) at a large scale:

• An optimization of the ozonation yield with recirculation of ozonated streams from the Xylem ozonator to biological treatment steps for organic matter, microorganisms and MPs removal
• A chemical-free treatment alternative with Wadis electropulse oxidation for organic matter, micro organisms and MPs removal.

Work is performed on an existing pilot plant which will be refurbished according to needs. The planned demonstration steps are as follows:

Subtask 2.2.1 Refurbishing and adopting existing pilot plant
Lead: MEK, Contributors: WADIS, Xylem
The existing pilot will be upgraded to accommodate the ozonated return stream. The biofilter height also will be doubled to cope with increasing ammonia concentrations in the secondary effluents. Additional monitoring equipment will be installed in the upper short SAT layer to allow for process control and evaluation, including on-line instrumentation by XYLEM (UV, DOC, DO., …). The BAC-ceramic UF (0.3-0.5 m3/hr) system will be installed. An electric pulse oxidation system (WADIS) will be installed, for high performance for organic matter, microorganisms and MPs removal based on high electric voltage discharge into pre-treated secondary effluent. An analysis and monitoring program related to WP4 will be prepared including chemical analysis (trace organics and disinfection by-products like bromate and NDMA analysis) and microbial analysis (coliform, crypto, giardia and viruses log removal criteria for drinking water).

Substask 2.2.2 Running of the pilot with sSAT
Lead: MEK, Contributors: WADIS, Xylem
This will be done in 3 steps: 1.Biofilter-ozonation (with return stream)-sSAT for 11 months (first operation year), 2.sSAT cleaning for 3 months, only combined to biofilter. 3. Biofilter- EP WADIS (with return stream) - sSAT testing for 11 months in the second year.

Subtask 2.2.3 Running of the pilot with BAC-UF
Lead: MEK, Contributors: WADIS, Xylem
For comparison with the cNES system, the first operation year 0.3-0.5 m3/hr of the biofilter-recirculated ozonation will be combined with biologically activated carbon (BAC) and ceramic UF for 11 months. The second year of operation, for half year, 0.3-0.5 m3/hr of Electropulse (EP WADIS)) treated water will be combined with BAC-UF in parallel to the EP WADIS-sSAT for comparison. Another half year secondary effluents without biofilter pretreatment will be ozonated and sent to the BAC –UF to see the effect of the biofilter to the BAC-UF process. The first half of the third year secondary effluents without any oxidative treatment will be sent to the BAC-UF for comparison to the effects of biofiltration-ozonation or biofiltration-Ep to the BAC-UF polishing process.

Subtask 2.2.4 Treatment train performances analysis
Lead: MEK

For each treatment train, chemical, microbial, MPs analyses will be conducted at numerous sampling points along the system. The results will be analysed in order to assess the quality performance and the economic feasibility for each of the trains in accordance with WP4 and WP5 with a planned collaboration with the Israeli Health Ministry

Task 2.3 High rate (in)filtration and Aquifer storage and recovery (ASR) for flood prevention and additional water supply, Waddinxveen site M1 - M30
Lead: KWR, Contributors: HYBU
The Waddinxveen site (Site 8) is a polder located app.10-15 km NE of Rotterdam. It will be used to demonstrate an innovative technology for enhanced subsurface storage of storm water for later withdrawal and use. The technology is based on high rate water treatment and subsurface infiltration.

Subtask 2.3.1 Deliver a prototype of a high flow pre-treatment and infiltration system for storm water runoff
Lead: KWR, Contributors: HYBU
The prototype of a high flow water treatment facility connected to a high flow infiltration system will feature the following unique properties: (1) can handle high rate flows and (2) is capable to handle a range of water qualities from various sources such as surface water and storm runoff from greenhouses and commercial buildings (3) is effective in removing pollutants and suspended material in order to prevent clogging of injection wells by particles and contamination of groundwater. The filter will be based on the fuzzy filter concept of compressible filter media made of fibrous spheres, enabling adaptable pore sizes and flows. The filter media can be adapted to the contaminants to be removed.

Subtask 2.3.2 Demonstrate the high flow pre-treatment and infiltration prototype
Lead: KWR, Contributors: HYBU
The prototype system will be demonstrated at Waddinxveen for various water types roofwater, surface water, treated flushwater greenhouses). A fuzzy filter will be tested as one of the pre-treatment options next to combinations of proven treatment steps. The minimal water quality standards will be established as well as maximum capacities for "ephemeral" injection wells during short periods of high rate filtration to prevent well clogging and maintaining well integrity. To assess water quality regarding the presence of bacterial contamination, the BACTcontrol, an online automated instrument for the detection of microbiological activity in water will be used.

Subtask 2.3.3 Develop and demonstrate an operational remote control system
Lead: KWR, Contributors: HYBU
Develop and demonstrate a remote control system for Monitoring and operational decision support of the high flow pre-treatment and infiltration system. The remote control system will be based on now-casts of fresh groundwater supplies, water demand and meteorological predictions. A main task is the selection of appropriate proxy parameters for well clogging including trigger values for intervention.

Task 2.4 Advanced monitoring-modeling interface for optimised MAR/SAT system design & operation, Agon-Coutainville site (M1-M32)
Lead: BRGM, contributors: IMAGEAU, GEOHYD, microLAN).
The Site 9 of Agon-Countainville uses secondary effluent after reed bed and sand dune filtration for golf course irrigation in a coastal area. The underlying aquifer is prone to salinization. This task will demonstrate how innovative water quality monitoring and modelling linked to data management and communication, facilitates an optimised management of cNES sites and their future implementation.

Subtask 2.4.1. Online monitoring to constrain saline intrusion into coastal aquifers
Lead: IMAGEAU, Contributors: BRGM
The Subsurface Monitoring Device (SMD) is an in-situ and autonomous remote-controlled downhole monitoring device designed to record and transmit calibrated and validated physical and chemical pore water data (resistivity, gamma ray, sonic, T°C, pressure…). Drilling operation will be implemented on site in order to set up vertically several sensors. Results will be used to constrain the geological structure, water flow and geochemistry of the reactive transport model. Online continuous data access will be integrated in the ICT system to provide insights to remediation of saline intrusion through SAT/MAR

Subtask 2.4.2. Validate water quality improvement at demonstrator scale (BRGM, MicroLAN)
Lead: BRGM, Contributors: microLAN
Based on non-target screening data obtained by LC-Q-TOF, a shortlist of pertinent MPs will be monitored by target analysis, together with geochemical and using the BACTcontrol (linked to WP4) microbial parameters, needed for reactive modelling (subtask 2.4.3), throughout the treatment train and in the aquifer. As a complement to the BACTcontrol system. Virus and pathogens sampling will be performed for laboratory analysis in order to ensure the required log removal. This will allow calculating elimination rates, contaminant transfer.

Results will be integrated in the reactive transport model. The monitoring methodology will also comprise innovative environmental isotope tracing providing information on progress and spatial extension of storage, and mixing processes during storage-retrieval, thus constraining boundary conditions, as control parameters for the geochemical models.
Subtask 2.4.3. Innovative reactive transport modelling products for water quality management in SAT/MAR system
Lead: BRGM, Contributors: GEOHYD
Based on a conceptual soil-unsaturated zone-aquifer model, the performance of a combined thermo-kinetic hydrodynamic reactive transport approach will be demonstrated, based on up-to date thermodynamic data. It will be shown that this model is able to predict the geochemical processes that may lead to long term decrease of system performances and test system optimisation options. It will also be used to specifically simulate elimination of pathogens and organic pollutants in the reed bed pre-treatment.

Subtask 2.4.4. SAT/MAR-specific ICT system and system performance optimisation
Lead: GEOHYD, Contributors: BRGM
The design and implementation of a SAT/MAR-specific ICT system will ensure the knowledge integration.. ICT tool will integrate the collected data from online monitoring systems (SMD task 2.4.1, BACTcontrol task 2.4.2) and laboratory analysis as well as the reactive transport model (task 2.4.3). The off-the-shelf software will be validated with data from the Agon-Coutainville site. The evaluation of system optimisation options will be simulated for scenarios of pre-treatment train modulation, SAT/MAR efficiency, inflow quality changes and constraints such as groundwater quality standards, and climatic conditions. This tool will facilitate the implementation and operation of SAT-MAR based cNES systems as an input to WP6.

Task 2.5: Interface with work packages 4, 5 & 6 (M3-M30)
Lead: BRGM, Contributors: all WP2 partners
This task will ensure that data from WP2 will effectively feed into the activities of WP4 (Water quality assessment framework), WP5 (namely the LCA and ecosystem services assessments) and WP6 (namely AquaNES DSS and knowledge repository). Among the data derived from demonstration activities will be
• water quality parameters
• energy use
• chemicals use
• land use and
• flow data
This will involve liaising with partners on WP5 and WP6 in order to establish the scope of WP5 assessments and WP6 decision support, to define data needed for WP5&6 and to establish templates for data collation.

Participation per Partner

Partner number and short name	WP2 effort
1 - FHNW	18.00
5 - HYBU	9.00
6 - imaGeau	12.50
7 - GEOHYD	30.00
8 - MicroLAN	2.00
11 - WADIS	16.00
13 - XYLEM	23.00
20 - IWB	10.00
21 - MEK	45.80
23 - BRGM	42.00
28 - KWR	12.00
Total	220.30

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.1	Oxidative pre-treatment for managed aquifer recharge and soil-aquifer treatment systems	1 - FHNW	Report	Public	30
D2.2	High flow pre-treatment and infiltration system for aquifer storage and recovery with storm water runoff	28 - KWR	Report	Public	30
D2.3	Novel monitoring-modelling systems to manage qualitative and quantitative status of coastal aquifers	23 - BRGM	Report	Public	30
D2.4	SAT-MAR-specific ICT system for stakeholder use	7 - GEOHYD	Other	Public	32

Description of deliverables

D2.1 : Oxidative pre-treatment for managed aquifer recharge and soil-aquifer treatment systems [30]

Integration, synthesis and recommendations from demonstration sites applying combinations of oxidative and biological treatments. Report covering performance and design aspects derived from Task 2.1 (Lange Erlen site) and Task 2.2 (Shafdan site). Two part report with responsibilities at FHNW and MEK alike

D2.2 : High flow pre-treatment and infiltration system for aquifer storage and recovery with storm water runoff [30]

Report on design, applicability and performance of high flow pre-treatment and infiltration system for storm water runoff including its remote control system as elaborated in Task 2.3. (Waddinxveen demonstration site)

D2.3 : Novel monitoring-modelling systems to manage qualitative and quantitative status of coastal aquifers [30]

Integration, synthesis and recommendations from demonstration site 8 applying a combination of monitoring and modelling tools for optimised SAT/MAR system. Characterisation of performance in dependence of environmental and other parameters (climatic constraints, waste water quality & flux, golf water supply,…). (Task 2.4)

D2.4 : SAT-MAR-specific ICT system for stakeholder use [32]

SICT tools as an innovative water quality monitoring and modelling linked to data management and communication, for optimised management of cNES sites and their future implementation. Stand-alone software derived from Task 2.4.4 and to handed over to AquaNES DSS.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Set-up for all pilot/ demonstration sites completed	1 - FHNW	9	Site description, technical specification and operational procedure documented. HTWD, BRGM and KWB are supporting the collection of

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				info within WP1, WP2 and WP3
MS2	Qualitative and first quantitative information for WP4-6 shared	23 - BRGM	12	Data exchanged & transferred according to procedures. Concerns all partners in WP1-4, to be coordinated by HTWD for WP1, BRGM for WP2, KWB for WP3, KWR for WP4.
MS3	First integrated data sets from pilot / demonstration sites available for WP5&6	25 - HTWD	24	Comprehensive data set from demonstration sites in WP1-4 at hand and exchanged. Input per Work Package to be coordinated by relevant WP Leaders (WP1-4), i.e. shared Lead for this milestone
MS10	Monitoring parameter inventory from demonstration sites	28 - KWR	10	List available, structured data base for parameters relevant for cNES to be compiled by KWR
MS27	Project internal data exchange procedures defined	7 - GEOHYD	10	Formats defined, decision on potential system made

Work package number [9]	WP3	Lead beneficiary [10]	27 - KWB
Work package title	Constructed wetlands and other natural systems for improved wastewater treatment		
Start month	1	End month	36

Objectives

Demonstrate the combination of constructed wetlands (CW) and other natural treatment systems with different technical post- or pre-treatment options such as ozonation, bioreactor systems or disinfection in pilot and full scale sizes in different European climates (UK, Germany, Greece) for innovative and resource-efficient treatment of wastewater and combined sewer overflows. Specific goals of WP3 are to:
• Demonstrate the impact of CW as low energy post-treatment for ozonation of WWTP effluent, especially regarding removal of micropollutants and microbiological contamination at pilot plant scale (Germany)
• Demonstrate the flexible use of CW for combined CSO treatment and WWTP polishing at full scale targeting the reduction of nutrients, heavy metals, micropollutants and pathogens (Germany)
• Demonstrate the application of CW as pre-treatment for disinfection targeting water reuse applications for treatment of primary effluent at full scale (Greece)
• Demonstrate the use of cNES for nutrient removal and surface water protection at small WWTP (UK)
Establish design and marketing recommendations for combining constructed wetlands with engineered systems

Description of work and role of partners

WP3 - Constructed wetlands and other natural systems for improved wastewater treatment [Months: 1-36]
KWB , AKUT, WatStech, XYLEM, BWB, DEYAT, MUOA, EV, UCRAN, NTUA
The operation, monitoring and data analysis of 6 different innovative system combinations at 4 demonstrations sites are the core tasks and activities in WP3.

Task 3.1 Constructed wetlands as post-treatment after ozonation (M1-M24)
Lead: KWB, Contributors: AKUT, BWB, XYLEM
The combination of an ozonation (engineered system) with two different constructed wetlands (natural treatment system) for further polishing of secondary effluent will be realized at pilot scale and operated at the WWTP Schönerlinde north of Berlin, Germany. The pilot systems will be operated for 18 months under controlled conditions making use of adapted plants transferred from a tertiary treatment wetland. This will reduce commissioning time and provide real conditions from the beginning.
The main treatment goals in this combined system are:
• the removal of micropollutants,
• the improved removal of pathogens and antibiotic resistance genes (chemical and physical barrier)
Field of application is further polishing of secondary effluent especially at WWTP below 100.000 PE (person equivalents) with downstream demands, e.g. when indirect potable reuse through bank filtration (removal of micropollutants necessary), reduction of micropollutant levels in surface water (e.g. Diclofenac) to comply with potential environmental quality standards ¬or compliance with Bathing Water Directive (removal of pathogens) is anticipated.

Subtask 3.1.1 Construction and demonstration of system performance (ozonation + CW) (M1-M24)
Lead: KWB, Contributor: AKUT, BWB, XYLEM
Construction, test and long-term operation of the combined system will be accomplished. A monitoring strategy will be developed and implemented in line with the objectives and treatment goals described above and contemplated in WP4.

Subtask 3.1.2: Comparison of CW type (M12-M24)
Lead: KWB, Contributor: AKUT
Two types of wetlands will be constructed in parallel (subsurface and surface flow wetland) to determine the best system combination. They will be evaluated with regards to treatment performance and operation robustness. The results will be compared to other post-treatment options such as dual media filtration in respect of cost and energy demand. Results will feed into design recommendations developed in task 3.5.

Subtask 3.1.3: Closed-loop control of ozonation based on online monitoring (M1-M24)
Lead: KWB, Contributor: XYLEM

Effective control of the energy-intensive ozonation unit is necessary to optimize treatment efficiency and minimize energy demand. In this subtask the operational control of the ozonation unit via online monitoring (UVA254nm) will be implemented as innovative control of the required ozone dose for efficient operation.

Task 3.2 Retention soil filters for flexible treatment of WWTP effluent and combined sewer overflows (M1-M30)
Lead: EV
The objective of this task is to demonstrate at full scale a retention soil filter (RSF+WWTP) system with an innovative flow and treatment management for the reduction of nutrients, heavy metals, micropollutants and pathogens in different conditions:
• Dry weather flow: alternative tertiary treatment step to polish WWTP effluent
• Heavy storm events: treatment of combined sewer overflows (CSO)

Subtask 3.2.1 Full scale flexible flow system for combined treatment of CSO and WWTP effluent (M1-M30)
Lead: EV
A full scale retention soil filter system (RSF+WWTP, size: 4500 m²) for flexible treatment of WWTP effluent or water from CSOs will be constructed at WWTP Rheinbach in Germany and operated under field conditions for 2 years. The key innovation is the flexible use of the constructed wetland as CW for combined sewer overflow often suffering from long periods without any water flow. The innovative combination of systems for CSO treatment with WWTP effluent polishing will reduce chemical and micro-biological contamination of the receiving river used for bank filtration (drinking water production) and recreational purposes. Removal capacities of the following parameters will be monitored: sum parameters such as biological/chemical oxygen demand, nutrients, heavy metals, pharmaceutical compounds, X-ray contrast media, biocides, pesticides, disinfection products, flame retardants, endocrine disrupting compounds and microbial indicators (intestinal enterococci, Escherichia coli).

Subtask 3.2.2 Pilot systems targeting innovative substrate additions for wetland (M1-M30)
Lead: EV
In addition to the full scale system, pilot systems for testing of innovative substrate additions (e.g. GAC, Biochar, CaCO3) will be operated in columns to improve the design of other full scale RSF for optimized removal of targeted pollutants. Results will feed into design recommendations of task 3.5.

Subtask 3.2.3 Feasibility studies
Lead: EV
The transferability of RSF +WWTP will be tested. The Erftverband is operating 28 RSF, most of them used as RSF CSO. These existing RSF CSO within the Erft river catchment (the Erftverbands area of activity) will be examined for their possible usability as RSF +WWTP. Effects on water quality through the extended treatment and costs will be estimated.

Task 3.3 Constructed wetlands as pre-treatment for disinfection targeting water reuse applications (M1-M24)
Lead: NTUA, Contributor: DEYAT, MUOA
In this task innovative pre- and post-treatment options for constructed wetland systems at full scale will be demonstrated for treatment of raw wastewater. At two sites in Greece characterized by significant seasonal variations of hydraulic and pollution loads the combination of natural and engineered treatment for water reuse will be implemented in 2015. Within this task partners will:
• demonstrate the feasibility of including CW in the treatment train to obtain water for irrigation of public spaces in small municipalities,
• demonstrate that high human health standards can be achieved even at remote WWTP by relying not only on a technical system but also on a robust natural treatment (results will especially feed into task 4.1 of WP4 regarding the Water Safety Plan approach for cNES),
• intensively assess the water quality data and operational cost of the first 2-3 years of operation to derive recommendations for the local operator and also for potential operators at other sites (together with WP4).
Field of application is wastewater treatment at smaller communities with need for subsequent use of effluent for irrigation of agriculture, public spaces (e.g. in the proximity of the WWTP) or use for industrial purposes, as the combination of constructed wetlands with disinfection improves significantly the quality of treated effluents.

Subtask 3.3.1: Full scale demonstration of disinfection performance after constructed wetlands as secondary treatment (Antiparos) (M1-M24)
Lead: NTUA, Contributor: MUOA
The application of a CW system (2-stage subsurface wetland system followed by stabilization pond) for secondary treatment with subsequent disinfection (chlorination) will be demonstrated at full scale.

Subtask 3.3.2: Full scale demonstration of solar photo-catalysis and ultrafiltration as pre- and post-treatment for CW (Thirasia) (M1-M24)
Lead: NTUA, Contributor: DEYAT

At the second Greek site (Thirasia), solar heterogeneous photo-catalysis with TiO2 as catalyst is currently (2015) implemented for the first time in full scale as innovative pre-treatment for constructed wetlands. In addition, the constructed wetland serves as pre-treatment for an ultrafiltration unit to minimize membrane fouling. Specific aims of this subtask are:
• to validate the positive impact of solar photo-catalysis as pre-treatment for CW at full scale,
• to demonstrate the operational stability of ultrafiltration after CW treatment
• to show the reliability of the overall system

Task 3.4 Natural systems for P-removal at small WWTP in rural areas (M1-M24)
Lead: UCRAN, Contributor: WatStech
The main objective of this task is to demonstrate the removal of phosphorus to low levels in the effluent of oxidation ditch based WWTP by two innovative natural post-treatment options. At the demonstration site located in Packington northeast of Birmingham (UK), an existing sewage treatment plant (32,000 p.e.) based on oxidation ditches will be combined with two separate natural treatment systems operated at demonstration scale. Both systems will receive the effluent from the oxidation ditches as inflow for further improvement of water quality, in particular for the removal of phosphorus to very low levels (< 0.3 mg/L) and hazardous chemicals (metals, micropollutants) in order to limit the discharge to the river Mease, an ecologically sensitive area.
The work will not only focus on the ability of these technologies to remove phosphorus to very low levels but also on the potential added value of the technologies such as biomass production with potential for energy generation and P recovery. The field of application for this combination is advanced wastewater treatment at small WWTP, when sensitive water bodies require low nutrient concentrations.

Subtask 3.4.1 Reactive media CW for P-removal (M1-M24)
Lead: UCRAN, Contributor: WatStech
The first natural system consists of a reactive media reed bed for advanced P removal from the WWTP effluent. The constructed wetlands (100 m2) will be operated with steel slag as reactive media. Beside demonstration of effective P-removal, the potential for phosphorus recovery from the reed bed system will also be investigated with possible precipitate collection or regeneration of the reactive media.

Subtask 3.4.2 Immobilised microalgae photo-bioreactor for P and N removal (M1-M24)
Lead: UCRAN, Contributor: WatStech
In parallel, a microalgae photobioreactor (4 m3) with immobilized algae (entrapped in alginate beads) will be demonstrated in pilot scale for advanced removal of both N and P. Additional benefits of the algae system to be investigated are methane production from anaerobic digestion of the algal biomass recovered (energy production) and potential recovery of nutrients.

Task 3.5 Establish design and marketing recommendations (M18-M36)
Lead: AKUT, Contributors: EV, KWB, UCRAN, XYLEM, NTUA
Within this task the results of task 3.1-3.4. will be combined to derive design recommendations for combining constructed wetlands with engineered systems. The different goals of the treatment (e.g. surface water protection or water reuse), size factors (urban vs. rural) and local climate (UK vs. Greece) will be included to facilitate the implementation of the combined approach by consulting and engineering companies.
A main issue will be the evaluation of results with respect to application in practice. Operators need to understand advantages as well as costs of innovative technologies. Operation and maintenance, availability of raw materials and available building technologies will influence operators' choice. All useful combinations and variations will be listed and sorted by treatment goals and range of performance for target and general treatment parameters. If applicable, restrictions by technologies or countries will be defined.
A strategy for introducing these new innovative technology combinations with respect to private and public structure within the water and wastewater sector in the participating countries will be outlined and elaborated under WP7 activities.

Task 3.6 Interface with work packages 4, 5 & 6 (M3-M30)
Lead: KWB, Contributors: all WP3 partners
This task will ensure that data from WP3 will effectively feed into the activities of WP4 (Water quality assessment framework), WP5 (namely the LCA and ecosystem services assessments) and WP6 (namely AquaNES DSS and knowledge repository). Among the data derived from demonstration activities will be
• water quality parameters
• energy use
• chemicals use
• land use and

• flow data
This will involve liaising with partners on WP5 and WP6 in order to establish the scope of WP5 assessments and WP6 decision support, to define data needed for WP5&6 and to establish templates for data collation.

Participation per Partner

Partner number and short name	WP3 effort
2 - AKUT	21.00
12 - WatStech	18.00
13 - XYLEM	6.00
15 - BWB	29.00
16 - DEYAT	9.00
17 - MUOA	17.50
19 - EV	45.20
24 - UCRAN	25.00
27 - KWB	24.00
29 - NTUA	6.00
Total	200.70

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Combining constructed wetlands and engineered treatment for water reuse	27 - KWB	Report	Public	24
D3.2	Combining constructed wetlands and engineered treatment for surface water protection	24 - UCRAN	Report	Public	30
D3.3	Design recommendations for combining CW with engineered pre- or post-treatments including case studies of demonstration sites	2 - AKUT	Report	Public	34

Description of deliverables

D3.1 : Combining constructed wetlands and engineered treatment for water reuse [24]

The demonstration activities are summarized and the benefits of the combined treatment especially in regard to the reduction of human health risks are highlighted. Key output will be a comprehensive comparison of water reuse related water quality data with national water reuse legislations (e.g. Greece, Italy, Spain) to evaluate the marketability of the approach in different EU member states.

D3.2 : Combining constructed wetlands and engineered treatment for surface water protection [30]

The demonstration activities in the field of surface water protection (Sites: Task 3.1, 3.2, 3.4) are summarized and the benefits of the combined treatment are highlighted. Key outputs are transferable numbers on e.g. load reduction of nutrients or pharmaceuticals into surface water bodies in relation to the Water Framework Directive.

D3.3 : Design recommendations for combining CW with engineered pre- or post-treatments including case studies of demonstration sites [34]

Technical report: The recommendations combine the results from AquaNES with existing guidelines for constructed wetlands and summarize also the design data of the studied sites. The aim of the report is to facilitate the market replication of the combined solutions by giving detailed information on its design and benefits.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS1	Set-up for all pilot/ demonstration sites completed	1 - FHNW	9	Site description, technical specification and operational procedure documented. HTWD, BRGM and KWB are supporting the collection of info within WP1, WP2 and WP3
MS2	Qualitative and first quantitative information for WP4-6 shared	23 - BRGM	12	Data exchanged & transferred according to procedures. Concerns all partners in WP1-4, to be coordinated by HTWD for WP1, BRGM for WP2, KWB for WP3, KWR for WP4.
MS3	First integrated data sets from pilot / demonstration sites available for WP5&6	25 - HTWD	24	Comprehensive data set from demonstration sites in WP1-4 at hand and exchanged. Input per Work Package to be coordinated by relevant WP Leaders (WP1-4), i.e. shared Lead for this milestone
MS4	Construction of wetland and installation/test of ozonation system completed	27 - KWB	4	System ready for operation
MS5	Monitoring completed at site 12	27 - KWB	20	Demo phase and monitoring program successfully completed
MS6	Evaluation of RSF+WWTP	19 - EV	12	Evaluation of operational processes of monitoring completed
MS7	Feasibility studies	19 - EV	20	Investigations on technical implementation in river basins (Erft catchment) completed
MS8	First year of operation completed in site 10 and data transfer to WP4	29 - NTUA	12	KWR received all required data from local operator

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS9	Evaluation of energy recovery from algal biomass completed	24 - UCRAN	12	Anaerobic digestion trials in relation to site 13 completed
MS10	Monitoring parameter inventory from demonstration sites	28 - KWR	10	List available, structured data base for parameters relevant for cNES to be compiled by KWR
MS26	Start-up of the test units at Site 13	24 - UCRAN	1	Systems ready for operation
MS27	Project internal data exchange procedures defined	7 - GEOHYD	10	Formats defined, decision on potential system made

Work package number [9]	WP4	Lead beneficiary [10]	28 - KWR
Work package title	Risk Assessment and Water Quality Control		
Start month	1	End month	33

Objectives

The treatment efficiency of combined natural and engineered processes (cNES) requires a tailored monitoring strategy that integrates microbial and chemical water quality parameters. Such a monitoring strategy includes a proper monitoring set-up, definition of risk based thresholds of monitored parameters, robust and sensitive monitoring systems, easy to use data processing and visualization as well as integrated (automated) data interpretation of parameters of multiple monitoring tools. WP4 will design and demonstrate an efficient quantitative water quality assessment framework for cNES that is easy to use and allows integration of innovative monitoring approaches. Modules will be designed using a set of monitoring systems for a variety of emerging water quality issues such as fecal contamination, antibiotic resistance genes and biological effects of complex mixtures of chemicals. The effectiveness of cNES to remove the monitored biological and chemical contamination will be demonstrated.

Specific goals of WP4 are to:
• Design a water quality assessment framework for cNES
• Implement innovative monitoring modules to demonstrate cNES treatment efficacy:
o An innovative sensor to monitor fecal contamination
o An innovative monitoring system to assess antibiotic resistance genes
o Quantitative CALUX bioassays to monitor endocrine disrupting/toxic compounds
• Demonstrate data-processing and -visualization techniques and integrate results of multiple monitoring tools in an open access software based water quality reporting tool
• Demonstrate its use in selected demonstration sites from WP1-3 and derive an interactive water quality assessment tool to be embedded in the decision support platform in WP6.

Description of work and role of partners

WP4 - Risk Assessment and Water Quality Control [Months: 1-33]
KWR, BDS, MicroLAN, WADIS, BWB, MEK, KWB , NTUA
The water quality assessment framework and the monitoring systems will be implemented and demonstrated at selected sites with two major functions. (1) Illustrating the added value for water quality assessment and (2) demonstrating treatment efficiency and robustness of cNES technologies for these essential water quality parameters. Thereby, the work package will both facilitate the exploitability of the tools demonstrated within the work package and that of the monitored cNES, by proving the efficacy and robustness.

The water quality assessment framework to be developed in AquaNES combines conventional and new monitoring systems and relates the outcomes to trigger values thereby using advanced data handling tools. The framework will be tailored to the type of water use and is to support operators of water reuse and production systems. Also the framework will feed improvements of existing treatment schemes.
WP4 is defined in four tasks.

Task 4.1 Design and validate a water quality assessment framework (M1-M18)
Lead: KWR, Contributor: KWB.
The aim of this task is to design, implement and validate a water quality assessment framework, thereby ensuring comparability and consistency of data produced from the different pilot sites. All water quality parameter needed for the risk assessment and overall technology assessment in WP5&6) are made available in a comparable way (water quality parameter, monitoring methods, sample type). The approach will be to
• Validate a water quality assessment framework (based on the WHO Water Safety Plan approach) for cNES.
• Coordinate the compilation of required data on water quality for risk assessment, LCA and AquaNES DSS for each site together with WP1-3 (linked to Task “Interface with WP5&6” in WP1-3)
• Validate tailored monitoring strategies by defining cNES site specific requirements for monitoring parameters, monitoring frequency, required sensitivity and risk based thresholds for water quality monitoring.
• Tailor and test it at demonstration sites

Task 4.2 Implementation of three innovative monitoring tools (M4-M24)
Lead: KWR, Contributors: microLAN, BWB, BDS.

Adding to the commonly applied monitoring systems, this task demonstrates three innovative monitoring systems for cNES relevant parameters and enabling fast interventions. They address(1) fecal (microbial) contamination, being the major human health threat, (2) antimicrobial resistance development that is considered an increasingly serious human health threat by the WHO and (3) effects of complex mixtures of micro pollutants (e.g. endocrine disruption) that affect organisms in the environment and thereby threat functionality of aqueous ecosystems. The tools enable (1) faster detection of fecal contamination by detecting E. coli and Coliform bacteria (2) quantitative detection of antibiotic resistance genes and (3) quantitative detection of biological effects induced by chemicals present in a sample. All three tools are ready to use, but need adaptation to be applied in the cNES treatment trains, e.g. the online microbial monitoring tool was not yet used to assess ozonation of WWTP effluent which may require an adapted maintenance protocol.

Proper water quality monitoring requires an array of sensitive and selective monitoring tools to cover relevant parameters. An enhancement of the monitoring response with respect to presence of fecal contamination (Ryzinska-Paier et al., 2014) and the detection of antibiotic resistance genes (Hoekstra and Hornstra, 2015) and the detection and characterization of yet (unknown) endocrine disrupting compounds (Brand et al., 2013; van Der Linden et al., 2008) is called for. Three innovative monitoring tools addressing these issues are implemented, validated and demonstrated at selected demonstration sites.

Subtask 4.2.1 Fast detection of E. coli (faecal contamination) by photometric on-line measurement
Lead: microLAN, Contributor: KWR
This subtask is to demonstrate and validate the BACTcontrol™ system, which is an automated online instrument for the detection of microbiological (enzymatic) activity in water. This system can monitor microbial activity, and notice changes (events) within a time frame of 4-6 hours. Registration of an event can initiate in depth microbiological analysis in the laboratory, which makes this sensor complementary to off-line cultivation methods. Three activities are planned:
• Demonstrate application in bank filtration (BF with WP1) combined with pre- and post-treatment techniques (membrane filtration, activated carbon filtration, ozonation) at the Elbe (Germany) and, Ganga River (India)
• Demonstrate application in MAR/SAT in the Waddinxveen demonstration site (Task 2.3)
• Demonstrate application of constructed wetlands (CW WP3) with pre- and post-treatment techniques (ozonation) and validation of the performance of the closed-loop control of ozonation. The selected demonstration site is WWTP Schonerlinde north of Berlin, Germany.
Obtained data from analyses will feed into Task 4.3.

Subtask 4.2.2 Implement DNA-based techniques for detection of antibiotic resistance genes along cNES treatment trains
Lead: KWR, Contributor: BWB
Within this task the demonstration site WWTP Schonerlinde north of Berlin (Task 3.1) are screened for DNA fragments of resistance genes. Three activities are planned:
• Develop a list of relevant antibiotic resistance genes for the demonstration sites
• Develop and apply a monitoring programme for the antibiotic resistance genes
• Assess removal performance of antibiotic resistance genes by cNES at the selected demonstration sites
• Comparison of ARG removal during CSO treatment with removal rates for WWTP effluent polishing
Obtained data from analyses will feed into Task 4.3.

Subtask 4.2.3 Implement CALUX assays to monitor a broad set of biological effects along cNES treatment
Lead: BDS, Contributor: KWR
This task validates CALUX assays at cNES sites. CALUX assays are sensitive cell based bioassays that enable the detection of mixtures of biological active compounds in environmental samples (van Der Linden et al., 2008). These whole effluent bioassays enable an effect based water quality monitoring thereby providing valuable information for both technology assessment and valorization. Furthermore, risk based thresholds enable implementation of these techniques in the WFD and other legislative frameworks.
The following activities are planned.
• Based on the initial screening a selection will be made of the most informative assays for operational analysis of cNES efficiency. A range of CALUX assays are known to be relevant for water quality monitoring (as shown in the FP7 DEMEAU project), such as for certain disinfection byproducts.
• Validate selected CALUX assays at two cNES sites in each of the demo WP's (WP1-3) including as a priority the sites with AOP
• Assess removal performance of the toxic compounds as measured by the CALUX assays at the selected demonstration sites.
Obtained data from analyses will feed into Task 4.3.

Task 4.3 Data processing and data visualization techniques and an integrative water quality reporting tool based on open access software "R" (M12-M24)

Lead: KWB, Contributors: KWR, NTUA.
The output of (on-line) monitoring technologies is often difficult to interpret and also inconvenient to handle as the output formats of different devices (in one water treatment scheme) can vary strongly. Furthermore, frequent reporting and documentation of the treatment performance via (on-line) monitoring can be time consuming for the personnel and requires advanced software solutions. An alternative to commercial (and often expensive) software solutions are tools which are based on the open software R. The free software approach allows any R programmer to produce customized tools for each individual end-user (Gibert et al., 2015; Sonnenberg et al., 2014).

Subtask 4.3.1: Adaptation of "R" software package to selected cNES sites (M1-12)
Lead: KWB, Contributors: KWR, NTUA
Software package already developed at KWB and KWR will be adapted to the needs of cNES technologies and the targeted treatment goal. Sites will be selected as part of Task 4.1. to identify sites with the highest need for integrative data reporting.

Subtask 4.3.2: Demonstration of "R" tools:(M12-18)
Lead: KWB, Contributor: KWR, NTUA
The aim is to demonstrate the benefit of 3-4 exemplary data analysis tools that ease an integrative assessment of the different monitoring devices and integration with water quality data obtained from analysis in the laboratory for a selected demo-site. The applied tools will:
• Increase the reliability and reproducibility of handling large amounts of data by reducing the likeliness in human error in complex systems and by increasing the transparency of the data processing.
• Promote the use of customized R tools for different end-user such as utilities, consultants and other research teams.

Task 4.4 Implementation and validation of an interactive water quality assessment tool (M19-M33)
Lead: KWB, Contributors: KWR, microLAN, NTUA, MEK, WADIS
Probabilistic and/or stochastic approaches become more and more frequent for the assessment of water treatment and water quality (Rieckermann et al., 2011; Smeets, 2008) which both require in depth knowledge in computation and programming. The aim of this task is to reduce the hurdle to use such state-of-the-art assessment approaches by making them available in a web-based user-friendly form.

Subtask 4.4.1 Quantitative microbial risk assessment tool
Lead: KWB, Contributor: microLAN, NTUA
Quantitative microbial risk assessment (QMRA) becomes more and more widespread in the water sector (e.g. the drinking water directive in the Netherlands), increasing the need of consultants, utilities and consumer protection association to perform or to verify risk calculations as part of the overall risk management process. The main features and activities related to this tool will be:
• a first stage risk assessment of a given treatment train
• an interactive user interface, which allows to change the QMRA settings according to the local conditions
• an automated reporting tool, which states the likeliness to fulfil or exceed the required tolerable risk level e.g. according to the WHO standards for water reuse
• the implementation and validation of the tool for 1-2 bank filtration sites (see task 1.4.4) and 1-2 MAR site (see task 2.4.4) by the local partner
• Implementation in the AquaNES DSS (WP6)

Subtask 4.4.2 Chemical water quality assessment tool
Lead: KWR, Contributor: MEK, WADIS, NTUA
•Construction of a decision tree for possibly applicable technologies based on local occurrence of chemical pollutants. This decision tree will give information on the general applicability of selected technologies
• Construction of a database on removal efficiencies of various techniques for a broad range of pollutants and an overview on current guidance values and toxicological evidence.
• Implementation of the decision tree and database in the AquaNES DSS (WP6).

Participation per Partner

Partner number and short name	WP4 effort
4 - BDS	21.00
8 - MicroLAN	14.00

Partner number and short name	WP4 effort
11 - WADIS	2.00
15 - BWB	15.00
21 - MEK	3.00
27 - KWB	13.00
28 - KWR	20.00
29 - NTUA	8.00
Total	96.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	R packages for integrative data processing & visualisation tool	27 - KWB	Other	Public	12
D4.2	Blueprint for a water quality assessment framework for cNES	28 - KWR	Report	Public	18
D4.3	Fast monitoring systems for various contaminants in cNES	28 - KWR	Report	Public	27
D4.4	Web based interactive tools for QMRA tool and chemical water quality assessment	28 - KWR	Other	Public	30

Description of deliverables

D4.1 : R packages for integrative data processing & visualisation tool [12]

The developed R packages for data processing and visualisation will be transferred to the site operator together with a short comprehensive manual to enable the use and future adaption of the tools

D4.2 : Blueprint for a water quality assessment framework for cNES [18]

Report on the design and validation of water quality assessment frameworks for demonstration sites of WP1 -3, having regard to Water Safety Plan approaches

D4.3 : Fast monitoring systems for various contaminants in cNES [27]

Report and application manual for demonstrated and validated innovative monitoring systems for E. coli, endocrine disruptors/toxic compounds and antibiotic resistance genes

D4.4 : Web based interactive tools for QMRA tool and chemical water quality assessment [30]

A web based QMRA application will be launched which allows the assessment of various treatment trains regarding the compliance with WHO health targets (subtask 4.4.1). Further this deliverable provides a decision tree to select a treatment train based on chemical water quality and application (subtask 4.4.2). Both parts ready to be integrated into the AquaNES DSS

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	Qualitative and first quantitative information for WP4-6 shared	23 - BRGM	12	Data exchanged & transferred according to procedures. Concerns all partners in WP1-4, to be coordinated by HTWD for WP1, BRGM for WP2, KWB for WP3, KWR for WP4.
MS3	First integrated data sets from pilot / demonstration sites available for WP5&6	25 - HTWD	24	Comprehensive data set from demonstration sites in WP1-4 at hand and exchanged. Input per Work Package to be coordinated by relevant WP Leaders (WP1-4), i.e. shared Lead for this milestone
MS10	Monitoring parameter inventory from demonstration sites	28 - KWR	10	List available, structured data base for parameters relevant for cNES to be compiled by KWR
MS11	Implement innovative monitoring tools at selected demonstration sites	28 - KWR	12	Systems up and running
MS12	Implementation of risk assessment tools in AquaNES DSS of WP6	27 - KWB	30	Tool online available
MS27	Project internal data exchange procedures defined	7 - GEOHYD	10	Formats defined, decision on potential system made

Work package number [9]	WP5	**Lead beneficiary** [10]	24 - UCRAN
Work package title	Interfaces with the Environment & Society		
Start month	1	**End month**	34

Objectives

Robust cases for investment in combined natural and engineered treatment systems will not only need to address treatment performance and financial criteria but also be able to demonstrate that such systems offer environmental benefits, can be appropriately and effectively regulated, and will meet with citizen approval.
The central ambition of WP5 is therefore to better understand the ways in which considerations such as environmental impacts, ecosystem service contributions, policy and governance arrangements, and socio-economic perspectives influence the desirability and feasibility of combined natural and engineered water services. Working closely with demonstration sites, WP5 will explore the dynamics between these considerations and scheme design. The goal is to develop more credible pathways to market opportunities for combined treatment systems, by helping system owners and operators to mitigate environmental impacts, assess costs, navigate regulatory compliance, and build trust and confidence in their wider communities.
The specific objectives are to:
• Characterise and evaluate the environmental impacts of combined systems throughout their life cycles, as well as the ecosystem services derived from their operation
• Identify potential gaps, barriers and leverage points in regulatory frameworks, both at national and EU level, that facilitate or hinder the advancement of combined systems
• Evaluate the social impacts of, and public receptivity towards, combined system, and identify new mechanisms to support effective citizen engagement
The outcomes from WP5 will help facilitate innovation in combined systems by providing new ways for system managers to understand and address impacts on the environment and society. Outcomes will also inform emerging regulation and policy at both national and European levels (e.g. realization of the Blueprint, maturing a European strategy on water scarcity and droughts) to make them more supportive of combined systems.

Description of work and role of partners

WP5 - Interfaces with the Environment & Society [Months: 1-34]
UCRAN, FHNW, VTG, DREWAG, MEK, BRGM, HTWD, KWR, NTUA
Task 5.1 Characterising environmental interfaces (M1-34)
Lead: UCRAN, Contributors VTG, NTUA, FHNW

Subtask 5.1.1 – Environmental Life Cycle Assessment – M1-M34
Lead: VTG, Contributors: NTUA, FHNW
Life cycle assessment (LCA) is a methodology that enables the systematic evaluation of the impacts from a product or system throughout all stages of its life cycle, from 'cradle to grave'. LCA will involve the definition of scope and goal (scope definition), the development of relevant inventory inputs and outputs of the system (inventory analysis), the assessment of their potential impacts (impact assessment) and the interpretation of the results within the context of proposed targets (interpretation). For this subtask AquaNES will focus on three demonstration sites, using LCA to comprehensively characterise their environmental impacts (E-LCA). LCA will be carried out taking into account the guidelines of ISO 14040/14044 on product life cycle assessment. The analysis will draw on existing data from the demo sites, as well as outputs from WPs 1 - 3. One demo site from each of the initial three WPs will be selected for this task, and the selection will be based on the availability and suitability of relevant data as well as their technical (or techno-economical) performance. The outcome from this task will be the development of a life cycle assessment approach that is specifically tailored for cNES, which will be applied to three demo sites. The assessment approach will be made available (as part of D5.3) as a decision support mechanism to be fed into WP 6.

Subtask 5.1.2 Ecosystem services analysis – M6-M30:
Lead: UCRAN, Contributor: KWR
This subtask will identify and characterise the ecosystem services (ES) associated with combined systems. The analyses for this subtask will focus principally on the current operation of combined systems, rather than the whole life cycle of the project (as in 5.1.1). As a starting point for the analysis, we will draw from the outputs of the DESSIN project and their ecosystem services framework and tool box. This will involve working closely with three demonstration sites.

These will be different sites to those included in 5.1.1 in order to minimise the burden on individual sites and maximise the learning opportunities for the WP as a whole. ES approaches involve characterising and valuing the flow of services from given sites, including provisioning services (e.g. supply of water and other natural resources); regulating services (e.g. hydrologic functions, climate change mitigation); supporting services (e.g. habitats, nutrient cycles) and cultural services (e.g. amenity benefits, recreational uses). Data inputs for the ES analysis will build on outputs from WPs 1 - 3, along with some additional data collection (see Task 5.4). Data sharing opportunities between 5.1.1 and 5.1.2 will be maximised, in order to optimise learning and ensure an efficient spread of resources. The outcome from this task will be the development of an ecosystem services evaluation approach that is specifically tailored for cNES, which will be applied to three demo sites. The evaluation approach will be made available (D5.2) as a decision support mechanism to be fed into WP 6.

Task 5.2 Characterising policy and governance interfaces (M6-36)
Lead: UCRAN, Contributors: BRGM, KWR, MEK

Subtask 5.2.1 – Enablers and barriers for demonstration sites – M6-M18:
Lead: UCRAN, Contributor: BRGM
This subtask will involve working with a range of existing combined systems (including but not limited to the demonstrations sites) to identify any enablers for and/or barriers to the development of combined systems in relevant policy and regulatory frameworks, with a focus on the national level. The work will cover a variety of systems exhibiting a range of combinations of 'hard' and 'soft' treatment systems. The data will be drawn from existing published sources as well as from interviews with key informants (e.g. scheme operators, regulators). The analysis will look to identify common issues between types of schemes and/or between countries, in order to synthesise a set of key regulatory considerations for combined systems. Insights will be considered when investigating the market potential in WP7 (link to PEST analysis used there).

Subtask 5.2.2 Mapping governance systems and identifying leverage points – M10-M22:
Lead: UCRAN, Contributor: BRGM
Using systems mapping and visualisation software, this subtask will map and analyse the overlapping governance domains and jurisdictions at EU level that apply to combined systems. The analysis will identify gaps, positive and negative feedback loops, and potential leverage points to create more supportive frameworks.

Subtask 5.2.3 Governance frameworks for selected cNES M18-M36:
Lead: UCRAN, Contributor:MEK
Drawing on the findings from 5.2.1 and 5.2.2, this subtask will use test cases to identify and develop governance frameworks to better support combined systems. One will be the fast infiltration and flood protection system in NL (Site 9), examined in WP 2 (Task 2.3). The fast ASR-system will be privately owned and operated but will generate private and public benefits such as prevention of flooding. The governance framework will outline responsibilities, operational schemes and financial regimes for the public-private partnership. Further the case of the Shafdan site (Site 7) aspiring for indirect potable reuse will be investigated. The site owner will work with the Israel's Health Ministry (Environmental Health Department) regarding the cNES processes deployed at the site. This work will explore options for governing indirect potable reuse and help establish appropriate and robust water quality criteria

Task 5.3 – Characterising socio-economic interfaces (M1-34)
Lead: UCRAN, Contributors: VTG, NTUA, KWR

Subtask 5.3.1 Life Cycle Cost Analysis (M1-M34)
Lead: VTG, Contributor: NTUA
Life cycle cost analysis (LCC) will be conducted in parallel to the LCA. This involves assessing the cost of the whole chain for the selected demo sites. As a result, a complete analysis of Life Cycle Costs (LCC) will also be addressed which will be intimately linked to the E-LCA (Subtask 5.1.1). LCC will be developed in two basic steps: cost identification and an economic feasibility study. LCC will present a similar structure as in parallel conducted on LCA (in terms of functional unit and approach). The results of this analysis will make it possible to compare the proposed technologies with currently used techniques, from an economical point of view, and to determine the overall reduction of investment (CAPEX) and operating costs (OPEX) that will be achieved, identifying the cost-effectiveness of the technologies. As with 5.1.1, the assessment approach will be made available (as part of D5.3) as a decision support mechanism to be fed into WP 6.

Subtask 5.3.2 Social Life Cycle Assessment (M1-M34)
Lead: VTG, Contributor: NTUA, UCRAN
In conjunction with 5.1.1 (and using the same demonstration sites) this subtask will apply LCA to the evaluation of social impacts of combined systems throughout their life cycles, and compare these to the impacts of engineered systems. This analysis will focus particularly on socio-economic impacts on the organisations (and their employees) involved

throughout the project life cycle, including within the operational supply chain. Impacts on users and/or the wider public will also be considered (in conjunction with subtask 5.3.3). The impact analysis will include an initial evaluation of social and socio-economic impacts according to different impact categories and the interpretation of the results obtained. The impact categories evaluated will include: human rights; working conditions; health and safety; cultural heritage; governance; socio-economic repercussions. As with 5.1.1, the assessment approach will be made available (as part of D5.3) as a decision support mechanism to be fed into WP 6.

Subtask 5.3.3 Public receptivity – M10-M24:
Lead: UCRAN
This subtask will involve primary data collection (through large-scale surveys) in multiple countries. Sample populations will include the sites' users / customers, as well as the wider public. The analysis will develop a detailed understanding of how citizens understand, value and trust combined systems, compared to engineered systems. We will maximise the synergies between data collection activities and data sharing between 5.3.2, 5.3.1 and 5.1.2 (for cultural ecosystem services) in order to optimise learning and ensure efficient use of resources.

Subtask 5.3.4 Citizen science – M18-M34:
Lead: KWR, Contributor: UCRAN
Based on the review of monitoring activities undertaken in WP 4, this subtask will assess whether and how a citizen science initiative might effectively support the monitoring and control activities for any of the demo sites. It will also identify what the value of such an initiative might be, both in terms of monitoring effectiveness and improved citizen engagement. A pilot CS initiative will be developed for one demonstration site as a test case.

Subtask 5.3.4 Gaming for citizen & stakeholder engagement (M18-M34)
Lead: KWR, Contributor: UCRAN
Drawing on the findings from 5.3.2, this subtask will develop a gamified modelling approach to support citizen and stakeholder engagement with combined systems. The game approach will be developed and implemented with one demo site –the Waddinxveen (Rotterdam area) site – as the test case. The game will be played with groups of stakeholders to extract their opinions on governance mechanisms, financing schemes and technical set up for combined systems. Outcomes will be fed back into decision-making processes for the owners / operators of combined systems. The subtask will also develop a skeleton framework and guidelines for gaming at other sites in AquaNES and beyond.

Task 5.4 Interfaces with other WPs (M1-36)
Lead: UCRAN, Contributors: NTUA, VTG

Subtask 5.4.1 Data interface with WPs 1, 2 and 3 (M1-M18)
Lead: UCRAN, Contributors: NTUA, VTG
This subtask will involve liaising with partners and WP leaders from WPs 1-3, in order to ensure that data from those WPs can effectively feed into the activities of WP 5 (principally the life cycle assessments and ecosystem services assessments). We will establish the scope of WP 5 assessments, select appropriate exemplar sites from WPs 1-3 (where needed), and establish templates for data collation.

Subtask 5.4.2 Interface with the DS Platform – M19-M36:
Lead: UCRAN; Contributor: NTUA
This subtask will facilitate the interface between the outputs from WP5 and the development of the decision support platform in WP6.

Participation per Partner

Partner number and short name	WP5 effort
1 - FHNW	1.00
10 - VTG	44.00
18 - DREWAG	1.00
21 - MEK	1.00
23 - BRGM	3.00
24 - UCRAN	30.00
25 - HTWD	2.00

Partner number and short name	WP5 effort
28 - KWR	8.00
29 - NTUA	14.00
Total	104.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D5.1	EU governance for cNES	24 - UCRAN	Report	Public	24
D5.2	Ecosystem services from cNES	24 - UCRAN	Report	Public	30
D5.3	LCA & LCC in combined natural and engineered treatment systems	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	33
D5.4	Guidance on citizen science approaches	24 - UCRAN	Report	Public	34
D5.5	Gaming approach for stakeholder engagement	28 - KWR	Report	Public	34

Description of deliverables

D5.1 : EU governance for cNES [24]

Map of EU governance systems and analysis of leverage points

D5.2 : Ecosystem services from cNES [30]

Full report on the ecosystem services analysis from demonstration sites

D5.3 : LCA & LCC in combined natural and engineered treatment systems [33]

Full report on the LCA and LCC analysis from the demonstration sites. Evaluation of technical achievements according to environmental and costs key performance indicators and room for optimization. Life Cycle Costing (LCC) studies will evaluate CAPEX and OPEX.

D5.4 : Guidance on citizen science approaches [34]

Guidance document on the potential value of citizen science approaches for cNES and tools / approaches for implementation

D5.5 : Gaming approach for stakeholder engagement [34]

Guidance document on the potential value of gaming approaches to promote stakeholder engagement with cNES and approach for implementation

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS13	Boundary conditions defined, and templates for data	10 - VTG	8	Development of templates for data collation from WPs

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
	collation for LCA, LCC and ES from WPs 1-3 developed			1-3. Templates agreed with partners and distributed
MS14	Framework for pilot citizen science initiative	24 - UCRAN	24	Description uploaded to project intranet
MS28	Approach / methodology for Ecosystem Services analysis	24 - UCRAN	12	Description of methodology available
MS29	Intermediate version of LCA/ LCC report to be shared with other WPs / interface with AquaNES DSS	10 - VTG	15	Report available
MS30	Second intermediate version of LCA/LCC report to be shared with other WPs, interface with AquaNES DSS	10 - VTG	24	Report available

Work package number [9]	WP6	Lead beneficiary [10]	29 - NTUA
Work package title	Decision Support and System Design		
Start month	1	End month	36

Objectives

Objectives
The goal of WP6 is to integrate existing and new methodologies, tools and knowledge into a fully-fledged and validated platform, providing a unified environment (AquaNES DSS) for supporting strategic and as operational decisions in cNES. The AquaNES DSS will target the needs of different end-users (water utilities, water and regional authorities, enterprises, technology providers, water managers, system operators, environmental agencies, academic institution and citizens) and will provide support in all decision making stages (system selection and design, system assessment, system operation and monitoring, market penetration and system replication).
The following objectives are set:
• Improve the confidence with which service providers are able to specify, design and implement cNESs.
• Facilitate market penetration of cNES solutions.
• Maximize replication potential of AquaNES innovations.
WP6 will integrate previously fragmented approaches in decision frameworks, in modelling and in decision support tools. It will create a homogeneous and consistent decision support environment following a holistic approach to water and wastewater management, covering all water cycle aspects (hydrological, economic, environmental, social and market). Communication interfaces between tools, based on open ICT standards, will be provided, and gaps in the decision making chain will be addressed through further development. Data, tools and methods will follow the EU open access policy, thus promoting their market penetration.

Description of work and role of partners

WP6 - Decision Support and System Design [Months: 1-36]
NTUA, FHNW, GEOHYD, VTG, DEYAT, MEK, AMU, HTWD, KWR
WP6 will deliver:
• A Decision Framework encompassing all levels of cNES management, from adoption/selection and design to system uptake and operation management.
• A Suite of Tools to support all the stages in the Key Performance Indicators' (KPIs) estimation.
• A Knowledge Repository (KR) for all AquaNES results and knowledge.
• An intelligent knowledge-driven Reasoning System, which will use the information stored in the KR to suggest Decision Support Roadmaps, providing information on DSS tools and procedures for meeting user questions and objectives (e.g. system design and technology to meet specific environmental standards and risk assessment).
• A Decision Support Platform (DSP) providing the foundation for integrating the suite of DSS tools as well as communication channels for interaction and information exchange among DSS tools

The approach will build on already prototyped models and methodologies, and the components will be exploited, tested and validated in AquaNES demonstration sites. Each tool will be able to function independently, providing specific decision support services, and, finally, all tools will be integrated in a platform, enabling their seamless operation through proper communication protocols and data sharing. Where required, additional minor tool development will be implemented, to tackle specific aspects not addressed within the existing tools.
The KR will integrate data and knowledge from the AquaNES demonstration sites concerning innovative technologies and their parameters, system specifications, configuration options, technical-environmental-economic and social indicators, monitoring and assessment variables and results, information on policy and regulatory frameworks, involved actors and market conditions. Knowledge integration will expand beyond the geographical focus of the project, including legislation, good design practices and success stories from other sites.
A vertical integration approach will be followed, where methodologies, tools and data will be integrated into the decision platform in different stages. Each integration stage will be marked by a relevant milestone (see list of milestones) and supported by relevant training sessions, organised in WP7.

Task 6.1: AquaNES Decision Framework and Knowledge Management System Design (M1–M10)
Lead: NTUA; Contributors: HTWD, GEOHYD, FHNW
The Task will develop the overall framework of the AquaNES DSS, including the analysis of the DSS tools as well as the design of the KR and the integration platform, releasing the first conceptual prototype of the DSS.

Subtask 6.1.1: End-Users Analysis and Tools Specifications (M1–M6)
Lead: NTUA; Contributors: HTWD, GEOHYD, FHNW
This subtask will perform an analysis of the information and decision support needs of the main end-users, for different design/operation stages, to identify critical variables/parameters, key performance/ assessment criteria and indicators and user-interface/knowledge requirements. This analysis will be primarily based on data and end-user consultation processes among consortium partners and at the AquaNES demonstration sites; the process will also be informed by one small-scale workshop and targeted semi-structured interviews with technology providers and end-users. A detailed analysis of the functionalities, data requirements and outputs of the tools will also be performed, and overlaps among the services provided by the tools and potential gaps will be identified.

Subtask 6.1.2: Outline for DSS Development (M4–M8)
Lead: NTUA; Contributors: HTWD, GEOHYD, FHNW
This subtask will elaborate an outline for the development of the AquaNES DSS, delineating the mission, goals and objectives, rules, entities, relations, available options and choices, overall model and specifications for the linking of the different tools. Based on the outcomes of the 'suppliers and users' consultation process, the outline will also describe a limited application cases of the DSS, to illustrate the decision framework and to be served as an initial database for the reasoning system (Task 6.3).

Subtask 6.1.3: Knowledge Repository Design (M6–M10)
Lead: NTUA; Contributors: HTWD, GEOHYD, FHNW
This subtask will develop a first release of the KR, aiming at providing structured information and data placeholder, which will enable the collection and retrieval of evidence, data and information from the AquaNES demonstration sites.

Task 6.2: Integration of Decision Support Tools for the Uptake, Design, Assessment and Operation of cNES (M8–M22)
Lead: NTUA; Contributors: KWR, GEOHYD, FHNW, VTG
Task 6.2 will adapt, extend and integrate into the decision support platform existing tools or tools developed in other WPs, to support the strategic and operational decisions of the framework developed in Task 6.1.

Subtask 6.2.1: Process Selection and Configuration Design (M8–M15)
Lead: NTUA; Contributors: GEOHYD, FHNW
This subtask will extend and integrate existing tools to support the selection of technically feasible alternative system configurations (treatment trains), in order to meet specific water quality standards. Design objectives that will be used for developing and selecting feasible configurations will include a list of performance targets for the effective removal of key pollutants and contaminants. Expert knowledge expressed as heuristics will be used to account for non-technical and non-quantitative factors/constraints influencing the design process (such as regulations, policies and legislation). Spatial constraints (e.g. land use restrictions) and geomorphological features (e.g. soil characteristics, topology) will be taken into account by integrating GIS features. Each component of the proposed systems will be appropriately modelled in WP1-3, and the sub-models will be linked, to be able to technically analyse the behaviour of the configuration in a systemic and holistic way.

Subtask 6.2.2: Performance and Risk Analysis (M13–M16)
Lead: NTUA; Contributors: KWR
This subtask will integrate tools developed and validated in WP4, aiming at assessing the design as well as the operational risk of cNES.

Subtask 6.2.3: Environmental and Socio-Economic Impact Assessment (M15–M19)
Lead: NTUA; Contributors: GEOHYD
This subtask will integrate tools, used and validated in WP5, aiming at assessing the environmental impacts and benefits of the proposed configurations, using life cycle analysis and ecosystem service valuation concepts and assessing wider socio-economic implications. A life-cycle approach will be used to address the environmental (e-LCA), social aspects (s-LCA) and economic (LCCA) aspects. Additionally, the subtask will adapt tools for quantifying key Ecosystem Services and the relevant KPIs.

Subtask 6.2.4: Economic Viability, Market Analysis and Technology Uptake (M17–M22)
Lead: NTUA; Contributors: VTG
This subtask will adapt and link existing tools demonstrated in WP1-5 as well as methodologies and tools applied in WP7 (involving PEST and Porter's Forces analyses), for assessing the economic viability of cNES configurations, performing a market analysis and supporting the uptake of cNES solutions.
A list of tools to be integrated into the platform is presented in the following table:
Name of the tool; WP to be used/ developed; Holder/ Partner; Description
• Micropollutant Predictor; WP1; AMU; Predicting the fate and behaviour of micropollutants and other water constituents

• Riverbed Clogging; WP1; HTWD; Predicting and evaluating riverbed clogging and required long term abstraction rates
• Siphon Systems; WP1; HTWD; Designer of siphon systems, achieving a “renaissance” of siphon systems
• Performance assessment software; WP2; GEOHYD; Assess the performance of innovative water quality monitoring and modelling technology
• QMRA; WP4; KWB; Web-based human health risk assessment tool via quantitative microbial risk assessment (QMRA)
• Data processing tool; WP4; KWB; Reporting water quality based on data processing and data visualization techniques
• Environmental Life Cycle Assessment; WP5; VTG; Assessing the environmental impacts following a life cycle approach
• Social Life Cycle Assessment; WP5; VTG; Assessing the social impacts following a lifecycle approach
• Life Cycle Cost Assessment; WP5; VTG; Assessing the life cycle cost of a cNES configuration
• Ecosystem Services; WP5; UCRAN; Quantifying key Ecosystem Services
• Market Analysis; WP7; VTG; Identify potential barriers for technology uptake and aiding water governance

Task 6.3: Knowledge Exploitation and Decision Support Reasoning System (M19–M28)
Lead: NTUA; Contributors: FHNW
This task aims at integrating existing methodologies to allow the exploitation of the knowledge stored in the KR. The objective is to combine the knowledge stored in the KR with the decision framework developed in Task 6.1 and the tools integrated in Tasks 6.2 and 6.3, to provide intelligent decision support to different end-users. Based on the analysis performed in Task 6.1 concerning the end-user decision support needs, an extensive list of queries answered by the KS will be designed and implemented.
An intelligent decision support reasoning system will also be developed, intended to guide the end-user and achieving specific goals. The system will propose decision making roadmaps, entailing DSS application pathways along the overall decision framework, and will recommends specific DSS tools in each stage, to help meet the end-users goals. The methodology will be based on a case base inference engine to generate decision/guidance roadmaps from the knowledge provided by the KR. The system will use the experience collected from the demonstration sites and other cNES applications to provide solutions to similar problems. Gathered experience will be stored in a database of Cases, where a Case will be composed by a set of features as well as the complete Roadmap to its solution. The features will establish a basis for expressing/translating end-user goals and will permit the system to identify and retrieve similar Case information/knowledge from the database. The system will be dynamic, by adapting previous solutions to the new situation, evaluating the suggested roadmaps and revising them in light of the evaluation. Revised cases will be retained in the database for future use, providing a continuous revision of the KR with problems that the system has learned to solve.

Task 6.4: Implementation, Validation and Final Integration of the AquaNES DSS (M13–M36)
Lead: NTUA; Contributors: HTWD, GEOHYD, FHNW, DEYAT, MEK, AMU
Task 6.4 will be horizontal, running from the completion of Task 6.1 and until the end of the project. It will consistently and continuously develop the infrastructure for implementing the services of the AquaNES DSS, integrating knowledge into the KR and testing/validating the AquaNES DSS, ensure that it conforms to user needs, is supportive to decision-making requirements, and is well validated against the demonstration sites of the project.
This Task will also encompass the continuous collection, and integration within the KR, of the information collected from the AquaNES demonstration sites as well as from sources outside the project. Inputs from the WP1, WP2 and WP3 will be fully integrated. Proper front-end and back-end layers to the KR will be implemented and integrated into the platform, allowing administrators to manage the information and users to exploit the knowledge stored in the KR.
The final release of the AquaNES DSS, following extensive validation at the level of demonstration sites, will integrate all application tools, permitting their operation through proper communication protocols and data sharing. It will allow the end users to search the KR, investigate the potential application of solutions and their impact in application cases in Europe and other areas, perform comparative assessments of alternative cNES applications, visualise outcomes and receiving decision making roadmaps toward their goals.
To ensure that all consortium partners and local coordinators will apply the AquaNES DSS consistently, training sessions will be organized starting from the first release of the DSS prototype and at each vertical integration step.

Participation per Partner

Partner number and short name	WP6 effort
1 - FHNW	4.00

Partner number and short name	WP6 effort
7 - GEOHYD	15.00
10 - VTG	1.00
16 - DEYAT	1.00
21 - MEK	1.00
22 - AMU	2.00
25 - HTWD	3.00
28 - KWR	1.00
29 - NTUA	39.00
Total	67.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D6.1	cNES Decision Framework and Knowledge Management System	29 - NTUA	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D6.2	Suite of cNES Decision Support Tools (1st prototype)	29 - NTUA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	22
D6.3	Decision Reasoning System for cNES (1st prototype)	29 - NTUA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	28
D6.4	AquaNES Decision Support System and relevant documentation	29 - NTUA	Demonstrator	Public	34

Description of deliverables

D6.1 : cNES Decision Framework and Knowledge Management System [12]

Results from the end-user analysis will be summarized and conclusions will be drawn towards the requirements and restrictions for cNES tools and decision support. Concise cNES tool specifications will be compiled, with emphasis to interfacing and function within an integrated decision support environment. The goals, procedures and overall design of the DSS platform will follow, complemented with representative cases of DSS use. A plan for the development of AquaNES DSS Platform will also be included. Finally, the entire cNES knowledge domain will be described and structured, on the basis of both the requirements resulting from the DSS Platform specifications and the analysis of available data and information. The design of a cNES Knowledge Management System and its underlying Database (Knowledge Repository) will be described.

D6.2 : Suite of cNES Decision Support Tools (1st prototype) [22]

All cNES Tools developed in WP1 to WP5 will be finalized, interfaced, integrated as a Suite of DSS tools and tested in a common operating environment, producing the AquaNES Decision Support Platform (DSP) for the Uptake, Design, Assessment and Operation of cNES. AquaNES Tools that have not been yet finalized by their respective tasks, will be added in preliminary versions and their final versions will be delivered in D6.4 in order to ensure the full integration of all tools in their final version into the Suite. Additional, already available tools will be adapted and added to the Platform, closing functionality and communication gaps, according to the specifications outlined in D6.1. The resulting AquaNES Decision Support Platform will be delivered in 1st prototype, together with examples of use, description of the work done in Task 6.2 and a preliminary documentation of the software.

D6.3 : Decision Reasoning System for cNES (1st prototype) [28]

A prototype version of the knowledge-driven Decision Reasoning System (DRS) will be delivered, with a linked database of cases of decision pathways. The software will provide users with complete roadmaps to solutions for their specific problems, utilising knowledge stored in the Knowledge Repository (KR). The DRS will include an extensive set of queries to the KR, covering all user/use requirements. A report of the development work, the overall methodology, description of inference engine algorithms, description of KR queries, examples of use (problems solved) and relevant documentation, will also be delivered.

D6.4 : AquaNES Decision Support System and relevant documentation [34]

The AquaNES DSS final version will be delivered, including final versions of tools developed by WP1 to WP5, the Decision Reasoning System (DRS), the Knowledge Management sub-system and any other component, as well as complete documentation on all the above. The Knowledge Repository will be fully populated with data & knowledge collected or generated by all AquaNES tasks and demonstration and it will be fully functional both as i) a component of the DRS for producing problem-solving Roadmaps to the available knowledge, as well as ii) a stand-alone DSS component to be exploited by end-users. Complementary to the DSS documentation provided, training and presentation material will also be delivered, as well as detailed recommendations for further development.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS12	Implementation of risk assessment tools in AquaNES DSS of WP6	27 - KWB	30	Tool online available
MS15	First Integration: First conceptual prototype of the AquaNES DSS	29 - NTUA	10	Detailed mapping and analysis of the system and end-user requirements, the specifications for the decision framework and the suite of tools as well as the design of the KR.
MS16	Second Integration: Adaptation and the linking of tools and population of KR with information relating to system design and risk analysis	29 - NTUA	14	Embedded tools for system design and risk analysis. Training session for demonstration site users and WP4, 5 and 7 partners.
MS17	Third integration: Adaptation and linking of tools and population of KR with information relating to system assessment and market analysis.	29 - NTUA	22	Embedded tools for environmental and socio-economic impact assessment, and market analysis. Training session.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS18	Fourth Integration: Integration of decision reasoning system.	29 - NTUA	28	Developed decision reasoning system. Training session.
MS19	Final Integration: Final release of the AquaNES DSS and its wide dissemination beyond the consortium.	29 - NTUA	34	Completely validated tools, the fully-populated KR and the front-ends to the KR and the decision support reasoning system.

Work package number [9]	WP7	Lead beneficiary [10]	10 - VTG
Work package title	Exploitation and Dissemination		
Start month	1	End month	36

Objectives

The main objective of WP7 is to carry out exploitation and dissemination activities for the AquaNES innovations, as outlined in Section 2.2, to support and accelerate their market uptake. Specific objectives are:
• To perform a comprehensive market analysis to gather data on market needs, identify the full range of potential customer segments as well as opportunities and threats for the positioning of the innovation on the market.
• To develop and adapt business models for commercial innovations to strategically manage their marketability beyond the duration of the project
• To develop a final exploitation plan for each exploitable result in order to outline the project main results, minimize exploitation risks and to determine the exploitation activities for each of the results.
• To implement a dissemination plan of the project results towards potentially interested parties across stakeholders including policy makers, industry groups, geographical markets and the academic community

Description of work and role of partners

WP7 - Exploitation and Dissemination [Months: 1-36]
VTG, FHNW, AKUT, AUT, BDS, HYBU, imaGeau, GEOHYD, MicroLAN, XFLOW, WADIS, WatStech, XYLEM, BUWW, BWB, DEYAT, DREWAG, EV, MEK, AMU, BRGM, HTWD, KWB , KWR, NTUA, UJS
Task 7.1 Exploitation Plans for AquaNES innovations (M1-M36)
Lead: VTG, Contributors: AKUT, AUT, BDS, HYBU, IMAGEAU, GEOHYD, microLAN, XFLOW, VTG, WADIS, WatStech, XYLEM, EV, MEK
Exploitation plans for AquaNES innovations will be developed during the project's lifetime. The elaboration of the exploitation plans will be an iterative and continuous process which will be handled in the 'innovation exploitation teams (IET) as outlined in Part B Section 2.2 and supervised by an Exploitation and Dissemination Committee (E&DC). The E&DC will be formed at the beginning of the project (M1) from IET members, the Dissemination Manager and the Exploitation Manager (see Part B Section 3.2 for more details)
The draft Exploitation Plans will be detailed for each innovative technology and approach during the project contemplating major parameters and routes for exploitation and market uptake. Aspect to be considered are:
• List and description of project innovative results
• Business idea and business models development
• General environment analysis: PEST analysis.
• Specific environment analysis: SWOT analysis
• Operation, Organization, Financial and Marketing plan
• Exploitation risk analysis

The long-term sustainability of the water quality assessment framework and other tools derived from AquaNES demonstration will be guaranteed and various options will be investigated, such as the incorporation of the assessment framework into the Knowledge Management Platform Watershare (www.watershare.eu) where appropriate.

Subtask 7.1.1 Market analysis (M1-M12)
Lead: VTG, Contributors: FHNW, XYLEM, XFLOW, AUT, MEK BUWW
A water market analysis (drinking water, wastewater and water reuse) will be carried out during the first year of the project. Thereby water sector needs, current practice and trends for future developments in and outside Europe (as described in Part B section 2.2) are investigated, as well as market structure, agents and world and market information. This will be performed with two approaches: a) general market and b) specific market.

The general market study will include a PEST analysis to characterise the Political, Economic, Socio-Cultural, and Technological factors and changes to better understand the overall conditions in target markets. Moreover, a market Porter's analysis will be performed for AquaNES innovative exploitable results and objective markets to determine the level of competition expected and support business model development.
To evaluate the specific market environment a SWOT analysis (strengths, weaknesses, opportunities and threats) will be performed. It will identify the internal and external factors that are favourable and unfavourable for commercial exploitation.

Markets continuous monitoring will be applied to detect new trends and possibilities, which will allow the consortium to react to the market changes and adapt the projects' outcomes accordingly to upgrade the deployment of the studied water treatment technologies and business models. Towards the end of the project (M32), the states of development achieved (proof of principle/proof of concept/prototype etc) of the studied AquaNES technology innovations will be compared to the progress of any competing technologies.

Subtask 7.1.2 Business models and financial impacts (M3-M18)
Lead: VTG, Contributors: AKUT, AUT, BDS, HYBU, IMAGEAU, GEOHYD, microLAN, XFLOW, VTG, WADIS, Watstech, XYLEM, EV, MEK
A business model of each of the commercially exploitable innovations will be elaborated using CANVAS methodology adapted to the relevant target markets as identified in task 7.1.1.
Given the importance of the financial aspects, value finance will be studied beyond the business model definition, and will be approached as follows:
• Investment Profitability Analysis: to assess the sustainability of business, profitability is calculated through a spreadsheet approach. Economic parameters will be used (Net Present Value, Internal Rate of Return).
• Sensitivity analysis: Many of the financial parameters in a business model are difficult to estimate. Consequently, this analysis will identify the future steps which may strengthen or threaten the business case. Such events may influence evaluations or even the structure of the value model itself.
• Cash flow analysis to reach first sales and break even for such results: Financial needs to reach first sales, and to reach breakeven over the life cycle of the key results will be evaluated. We will particularly elaborate the potential for return on invest and estimate the cost-effectiveness of the technologies to enable their commercialization
Boston Consulting Group (BCG) matrix will be used to assess the commercial potential of the technologies. Based on this outcome we will
• draw innovative products portfolio strategy which will help the consortium and partners commercializing several products to prioritize when allocating resources.
• shortlist technologies for the ETV Pilot programme

Subtask 7.1.3 IPR and Exploitation Risk Management (M1-M36)
Lead: VTG, Contributors: E&DC, IET
The overall IPR strategy of the project will ensure that partners are free to benefit from their complementarities and are able to fully exploit their market position. The assessment of knowledge generated in the project (Foreground IP) concerning definition of IPR, patentability and optimal IPR protection options, and commercialization potential shall all be covered here. Any disputes over IPRs shall be settled according to the rules laid out in the Consortium Agreement, which will assign this responsibility to the Steering Committee. Solutions are being prepared in mutual discussions within the E&DC Meetings.
Exploitation risk management aims at setting identifying risk management strategies taking into account the internal and external factors which may prevent the successful exploitation of the AquaNES innovations. This task follows two steps: the identification of exploitation risks and the assessment of these exploitation risks along two dimensions (probability of occurrence and potential impact). This risk mapping will be reviewed and updated at each E&DC Meeting. The risk management provisions will form a part of the Exploitation Plan.

Task 7.2 Dissemination Plan (M1-M36)
Lead: FHNW, Contributors: all partners, especially E&DC
This task will be coordinated by the Dissemination Manager. Jointly with the E&DC thy will be responsible for developing the communication strategy and for drafting and implementation of the Dissemination Plan.
Key messages of the project on a number of points (technology, efficiency, environmental and economic impact) will be defined. The main messages will be developed taking into account the different target groups identified. The messages must be suitable to promote the AquaNES project and its outcomes, making the case for European added value of R&D cooperation, understandable and relevant to the target audience.
All planned and performed dissemination activities will be compiled and described in this document. It complements the Exploitation Plan as it details (marketing) actions for specific AquaNES innovations.
• identify target groups, stakeholders for interaction and outline routes of communication / communication channels
• provide a tentative planning of dissemination event
• facilitate the organisation of dissemination actions by a calendar function.

Task 7.3. Project website, online media and print (M1-M36)
Lead: FHNW, Contributor: all WP7 partners
The visibility of the project and accessibility of its output will be promoted by various activities. Project specific dissemination material will be elaborated
• Design of project identity (logo, layouts)

• Dedicated website, including information on all aspects of the project
• Active participation in social networks communities targeting a more general public (citizens and youngsters) via Facebook, Twitter, YouTube (for VNRs).
• Project flyer and factsheets,
• Marketing and information brochures of validated AquaNES innovations for customers and policy
Material will be produced in English and in local languages where appropriate. In these cases, consortium partners will support translation and proper societal perception adaptation.

Task 7.4 Outreach to markets, industry and stakeholders (M3-M36)
Subtask 7.4.1 Events and training (M3-36)
Lead: FHNW Contributors: AUT, AKUT, VTG, BUWW, BWB, DREWAG, DEYAT, MEK, AMU, BRGM, HTWD, KWB, KWR, NTUA UJS,
This task will facilitate the timely exchange with relevant end-users and their associations, scheme planners and decision makers on public and dedicated project events (exhibitions, fairs, conferences, workshops).
AquaNES will host dedicated sessions and workshops on selected cNES innovations on the following events and occasions (non-exhaustive list):
Event; Topic, Format, target audience; Lead; Promoted innovation
• Wasser Berlin; (March 28-31, 2017); exhibition, visualization/model for cNES at trade fair; KWB / BWB; All AquaNES innovations
• International Water Week, Amsterdam (2017, 2019); Conference/fair; KWR; Monitoring devices WP4
• WATEC Israel (2017); Exhibition, Workshop with Health authorities; MEK / WADIS; AOP-MAR/SAT for indirect potable reuse
• Water Innovation Europe (Annually); Conference/fair; KWR; All AquaNES innovations
• IWA Specialist Conference on Wetland Systems for Water Pollution Control (2016, Poland or 2018, tbd); Scientific exchange; KWB and WP3 partners; Various CW based treatment trains
• AQUATECH India, Delhi (2017, 2019); Exhibition stall at trade fair and presentation; AUT, HTWD, UJS, ; WP1
• 3rd KWB Wasserwerkstatt “Next generation constructed wetlands – combining CW with engineered solutions” (ca 80-100 participants from local water sector) date tbd;
• End-user oriented workshop; KWB; O3 + CW,RSF WP3
• Masterplan “Bank filtration” in India – Activities 2016-2018; Cooperation with Indo-German Science & Technology Centre in Chennai; training courses in India to promote European monitoring equipment and disinfection modules; HTWD, AUT, UJS, other Indian institutions; WP1
• Webinar and/or presentation at exhibitions ; Designing cNES with the AquaNES DSS, training
• Water planners, engineering consultants; NTUA; WP6 AquaNES DSS
• International training and consultancy; formation of group of bank filtration experts to get Europe leading in the field of BF and subsequent water treatment, installation of a contact point via website bankfiltration.com; HTWD; WP1

Subtask 7.4.2 Link to EiP Water Action Groups, WssTP and related projects (M3-36)
Lead: KWR, Contributors: AKUT, AUT, BDS BUWW, MEK, KWB, KWR
We will ensure awareness of tested solutions through dissemination activities and interaction and collaboration with related EIP Water Action Groups and WssTP working Groups
EIP-W Action Groups include
• AG128 Managed Aquifer Recharge Strategies and Actions
• AG100 RTWQM – Real Time Water Quality Monitoring
• AG228 NatureWat - Nature-based technologies for innovation in water management
WssTP Working Groups include those of Ecosystem Services, Emerging pollutants and urban water pollution, Green infrastructure, TechWatch (promoting innovative technologies), Water & ICT and Water-Energy-Food-Biodiveristy nexus. This includes active involvement in their activities and shaping of work programmes. AquaNES partners are represented in almost all these groups which facilitates the dissemination.

Participation per Partner

Partner number and short name	WP7 effort
1 - FHNW	14.00
2 - AKUT	3.00
3 - AUT	3.00

Partner number and short name	WP7 effort
4 - BDS	2.00
5 - HYBU	2.00
6 - imaGeau	2.00
7 - GEOHYD	5.00
8 - MicroLAN	4.00
9 - XFLOW	2.00
10 - VTG	30.00
11 - WADIS	1.00
12 - WatStech	2.00
13 - XYLEM	2.50
14 - BUWW	4.00
15 - BWB	3.00
16 - DEYAT	0.50
18 - DREWAG	1.00
19 - EV	2.00
21 - MEK	2.00
22 - AMU	1.00
23 - BRGM	2.00
25 - HTWD	4.00
27 - KWB	1.00
28 - KWR	1.00
29 - NTUA	5.00
30 - UJS	1.00
Total	100.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D7.1	Project Website	1 - FHNW	Websites, patents filling, etc.	Public	3
D7.2	Exploitation Plan	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D7.3	Dissemination Plan & Report	1 - FHNW	Report	Public	6

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D7.4	Market Analysis Report	10 - VTG	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D7.5	Dissemination Events	1 - FHNW	Other	Public	36
D7.6	Marketing Report & Brochures	1 - FHNW	Report	Public	27

Description of deliverables

D7.1 : Project Website [3]

public project website

D7.2 : Exploitation Plan [6]

Exploitation Plan (including Business Models, addressing IPR & Exploitation Risk Management as well as project follow-up) to be updated periodically M 6, M 18, M 30 and M36

D7.3 : Dissemination Plan & Report [6]

Dissemination Plan & Report to be updated periodically about planned and performed dissemination activities, M6, M18, M30 and M36

D7.4 : Market Analysis Report [12]

Study of the attractiveness and the dynamics of a water market for AquaNES cNES solutions. • PESTLE analysis to characterise the Political, Economic, Socio-Cultural, and Technological factors. • Porter's 5 forces analysis to determine the level of competition expected and support business model development. and • SWOT analysis (strengths, weaknesses, opportunities and threats)

D7.5 : Dissemination Events [36]

3 dedicated dissemination events (e.g.Workshops, Training) M36 (between M24-M36)

D7.6 : Marketing Report & Brochures [27]

Marketing Report/ Brochures for selected innovations

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS20	Stakeholder database established	1 - FHNW	6	Database available
MS21	Business model canvas for of each exploitable result drafted	10 - VTG	12	Canvas created and presented to E&DC
MS22	Exploitation Plan update & Risk Management Strategy	10 - VTG	32	Exploitation Plans updated / internal workshop held
MS23	Innovations selected for ETV	10 - VTG	34	Assessment matrix for selection completed and adopted by E&DC

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS25	E&DC composed	10 - VTG	1	Kick off meeting minutes and list of members of the Exploitation and Dissemination Committee

Work package number [9]	WP8	Lead beneficiary [10]	1 - FHNW
Work package title	Management		
Start month	1	End month	36

Objectives

• manage the project implementation within contractual rules and deadlines
• assure project success by project monitoring and steering
• facilitate communication with the European Commission
• guarantee a smooth flow of information and efficient decision making processes within the consortium
• control the financial expenditures of project partners
• organize regular project meetings

Description of work and role of partners

WP8 - Management [Months: 1-36]
FHNW, VTG, BRGM, UCRAN, HTWD, KWB , KWR, NTUA
Task 8.1 Project steering and decision making (M1-M36)
Decision making competence within the consortium is assigned to different project entities. The Steering Committee (SC) will represent the highest level of decision making in the consortium. The steering Committee consists of one person per partner with the authority of making decisions on behalf of their institution. The tasks of the Steering Committee are:
• to define the overall project strategy
• to handle contractual matters (Grant Agreement amendments, extension of the consortium, termination of participants)
• to agree on the principles for resource allocation (consortium budget and payment schedules)
• to agree an intellectual property right related strategy

In order to enable decision making in such a large consortium, the SC will vote on major decisions by simple majority of the quorum. The details will be fixed in the Consortium Agreement
Decisions related to the implementation of work, and the assessment of work progress are made by the Project Management Board (see Task 8.3). It will propose adjustment and means of remediation in case of deviation from the work plan or occurrence of any of the risks and contingencies identified in WT5 (List of critical implementation risks and mitigation actions). The PMB will also discuss and prepare decisions for all issues requiring a vote of the Steering Committee. In that respect the PMB will be responsible for preparation of conflict solving interventions. It will make its decision on simple majority.

Task 8.2 Project Coordination (M1-M36)
Lead: FHNW
The project coordination and management will be accomplished by the entities described under Part B, Section 3.2. The Coordinating Team at FHNW will
• Act as link to the European Commission in all matters related to the Grant and dissemination
• Establish and maintain an effective and efficient management and coordination structure
• Keep track of administration of financial matters, i.e. manage the financial contribution from the EC and ensure a proper distribution to the partners.
• Prepare, chair and report on project meetings
• Coordinate and facilitate good collaboration among the project partners
• Timely submission of reports, deliverables, cost statements etc. to the EC
• Contribute, upon invitation by EASME, to common information and dissemination activities and attend workshops and other events, in order to facilitate the exchange of information to increase synergies between and the visibility of H2020 projects, to increase the uptake of innovations and to facilitate policy feedback and priority setting activities to maximize their impact.

Task 8.3 Implementation of Work & Progress Monitoring (M1-M36)
Lead: FHNW, Contributors: HTWD, BRGM, KWB, KWR, UCRAN, NTUA, VTG
Jointly the WP leaders constitute the Project Management Board (PMB). This project entity will meet twice a year and on bi-monthly web conferences
• to monitor work progress

• to review of timely execution of tasks, quality control and validation of the project deliverables and rescheduling of tasks when necessary
• to assess the fulfilment of tasks and deliverables;
to promote the integration of results and facilitate the interfaces between work package.
For these various tasks a responsible persons will be appointed among the members of the PMB to act as Data Quality Invigilator, Risk Reviewer, etc.
The PMB members are responsible
• to run and supervise action list of their respective work packages
• inform the Coordinator in case of delay in the performance of the work packages or in case of breach of responsibilities of any beneficiary
• analyse and document a presumed breach of responsibilities of a beneficiary and preparing a proposal of remedies to the Steering Committee

Task 8.4 Contractual Reporting (M1-M36)
Lead: FHNW, Contributors: HTWD, BRGM, KWB, KWR, UCRAN, NTUA, VTG
The task will involve the preparation and communication of reports on the project implementation and progress to the European Commission services. It includes also the reporting on the use of resources (financial reporting). In this reporting, the Project Coordinator will be supported by the Project Management Board, who will collate the relevant information from their work package partners.

Task 8.5 Risk Management
The risk of failing to achieve the project objectives and deliverables will be managed by a close monitoring of the work progress facilitated by regular reporting obligations. These extend to
- bi-monthly status reports of the WP Leader within the PMB meetings
- bi-annual risk assessment reports by the WP Leaders about the work package
- bi-annual activity reports of all partners in preparation for the project meetings
If major deviations are recognised the PMB will investigate the reasons and decide on countermeasures and request remediation within defined periods (see Task 8.2).

Participation per Partner

Partner number and short name	WP8 effort
1 - FHNW	18.00
10 - VTG	2.00
23 - BRGM	3.00
24 - UCRAN	2.00
25 - HTWD	3.00
27 - KWB	3.00
28 - KWR	2.00
29 - NTUA	2.00
Total	35.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D8.1	Meeting minutes	1 - FHNW	Report	Confidential, only for members of the consortium (including	2

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
				the Commission Services)	

Description of deliverables

D8.1 : Meeting minutes [2]
Minutes of bi-annual consortium meetings M2, M7, M13, M19, M25, M31, M36

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS24	Kick-off meeting	1 - FHNW	1	Kick-meeting being held

Work package number [9]	WP9	Lead beneficiary [10]	1 - FHNW
Work package title	Ethics requirements		
Start month	1	End month	36

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP9 - Ethics requirements [Months: 1-36]
FHNW
This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D9.1	EPQ - Requirement No. 3	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2
D9.2	NEC - Requirement No. 4	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2
D9.3	EPQ - Requirement No. 1	1 - FHNW	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D9.1 : EPQ - Requirement No. 3 [2]

The applicant must provide further information about the possible harm to the environment caused by the research and state the measures that will be taken to mitigate the risks.

D9.2 : NEC - Requirement No. 4 [2]

Detailed information must be provided to confirm that fair benefit-sharing arrangements with stakeholders from low and/or lower-middle income countries are ensured during the project.

D9.3 : EPQ - Requirement No. 1 [2]

The applicant must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

1.3.4. WT4 List of milestones

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS1	Set-up for all pilot/ demonstration sites completed	WP1, WP2, WP3	1 - FHNW	9	Site description, technical specification and operational procedure documented. HTWD, BRGM and KWB are supporting the collection of info within WP1, WP2 and WP3
MS2	Qualitative and first quantitative information for WP4-6 shared	WP1, WP2, WP3, WP4	23 - BRGM	12	Data exchanged & transferred according to procedures. Concerns all partners in WP1-4, to be coordinated by HTWD for WP1, BRGM for WP2, KWB for WP3, KWR for WP4.
MS3	First integrated data sets from pilot / demonstration sites available for WP5&6	WP1, WP2, WP3, WP4	25 - HTWD	24	Comprehensive data set from demonstration sites in WP1-4 at hand and exchanged. Input per Work Package to be coordinated by relevant WP Leaders (WP1-4), i.e. shared Lead for this milestone
MS4	Construction of wetland and installation/test of ozonation system completed	WP3	27 - KWB	4	System ready for operation
MS5	Monitoring completed at site 12	WP3	27 - KWB	20	Demo phase and monitoring program successfully completed
MS6	Evaluation of RSF +WWTP	WP3	19 - EV	12	Evaluation of operational processes of monitoring completed
MS7	Feasibility studies	WP3	19 - EV	20	Investigations on technical implementation in river basins (Erft catchment) completed
MS8	First year of operation completed in site 10 and data transfer to WP4	WP3	29 - NTUA	12	KWR received all required data from local operator
MS9	Evaluation of energy recovery from algal biomass completed	WP3	24 - UCRAN	12	Anaerobic digestion trials in relation to site 13 completed
MS10	Monitoring parameter inventory from demonstration sites	WP1, WP2, WP3, WP4	28 - KWR	10	List available, structured data base for parameters relevant for cNES to be compiled by KWR

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS11	Implement innovative monitoring tools at selected demonstration sites	WP4	28 - KWR	12	Systems up and running
MS12	Implementation of risk assessment tools in AquaNES DSS of WP6	WP4, WP6	27 - KWB	30	Tool online available
MS13	Boundary conditions defined, and templates for data collation for LCA, LCC and ES from WPs 1-3 developed	WP5	10 - VTG	8	Development of templates for data collation from WPs 1-3. Templates agreed with partners and distributed
MS14	Framework for pilot citizen science initiative	WP5	24 - UCRAN	24	Description uploaded to project intranet
MS15	First Integration: First conceptual prototype of the AquaNES DSS	WP6	29 - NTUA	10	Detailed mapping and analysis of the system and end-user requirements, the specifications for the decision framework and the suite of tools as well as the design of the KR.
MS16	Second Integration: Adaptation and the linking of tools and population of KR with information relating to system design and risk analysis	WP6	29 - NTUA	14	Embedded tools for system design and risk analysis. Training session for demonstration site users and WP4, 5 and 7 partners.
MS17	Third integration: Adaptation and linking of tools and population of KR with information relating to system assessment and market analysis.	WP6	29 - NTUA	22	Embedded tools for environmental and socio-economic impact assessment, and market analysis. Training session.
MS18	Fourth Integration: Integration of decision reasoning system.	WP6	29 - NTUA	28	Developed decision reasoning system. Training session.
MS19	Final Integration: Final release of the AquaNES DSS and its wide dissemination beyond the consortium.	WP6	29 - NTUA	34	Completely validated tools, the fully-populated KR and the front-ends to the KR and the decision support reasoning system.
MS20	Stakeholder database established	WP7	1 - FHNW	6	Database available

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS21	Business model canvas for of each exploitable result drafted	WP7	10 - VTG	12	Canvas created and presented to E&DC
MS22	Exploitation Plan update & Risk Management Strategy	WP7	10 - VTG	32	Exploitation Plans updated / internal workshop held
MS23	Innovations selected for ETV	WP7	10 - VTG	34	Assessment matrix for selection completed and adopted by E&DC
MS24	Kick-off meeting	WP8	1 - FHNW	1	Kick-meeting being held
MS25	E&DC composed	WP7	10 - VTG	1	Kick off meeting minutes and list of members of the Exploitation and Dissemination Committee
MS26	Start-up of the test units at Site 13	WP3	24 - UCRAN	1	Systems ready for operation
MS27	Project internal data exchange procedures defined	WP1, WP2, WP3, WP4	7 - GEOHYD	10	Formats defined, decision on potential system made
MS28	Approach / methodology for Ecosystem Services analysis	WP5	24 - UCRAN	12	Description of methodology available
MS29	Intermediate version of LCA/LCC report to be shared with other WPs / interface with AquaNES DSS	WP5	10 - VTG	15	Report available
MS30	Second intermediate version of LCA/LCC report to be shared with other WPs, interface with AquaNES DSS	WP5	10 - VTG	24	Report available

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	NF clogging with Fe/Mn (operational risk) D1.6 in WP1	WP1	Fe/Mn removal before NF
2	Extreme Elbe/Danube/Ganga River flow conditions with subsequent risk of flooding/ damage of pilot sites	WP1	Flood proof installation, in extreme events decommission or dismantling of pilot site
3	High oxidant dose might be required to achieve better degradability of specific pollutants in sub-surface	WP2	Ideal combination of UV and oxidant dose has to be verified, suitability for up-scaling will be assessed
4	Difficulties to be expected for pretreatment and infiltration of surface water with higher TSS,	WP2	Alternative for stormwater is the sand filtration (but is less compact, higher volumes needed). Adapt the water treatment by adding for example adsorbents to the Fuzzy filter (eg. activated coal), for the removing pollutants.
5	Online monitoring implementation delay Delay of data acquisition	WP2	Establish a stringent schedule for operation concerning monitoring tools installation and sampling campaigns in close collaboration with IMAGEAU, SAUR to prevent delays
6	Difficulties in close interactions with end-users	WP2	Anticipate the need of end-user for a user-friendly interface of the system by organizing early consultation meeting in the project
7	Ozonation imposed health and safety risk during operation also at pilot scale. Without adequate preplanning the H&S department of BWB might causing delays in the project.	WP3	Xylem, KWB and BWB need to implement a H&S management which follows the local legislation before first operation of the pilot.
8	Technical problems of engineered system parts (e.g. disinfection, membrane system) at demonstration sites in Greece not solved in time as the operator (first year only) is not an AquaNES partner WP3 D3.1: Combining constructed wetlands and engineered treatment for water reuse (M24)	WP3	Close cooperation between Greek partners (especially DEYAT and MUOA) and company that has built the whole treatment systems at both sites to quickly solve problems and to prevent delays. If delays cannot be prevented, sampling period will be shortened while increasing sampling frequency.
9	Design recommendations might be perceived as too site specific for broader market application Results of demonstration sites delayed WP3 D3.3: Technical Report - Design recommendations	WP3	Include also results from literature (other study sites with constructed wetlands) in evaluation to ensure broad applicability See risk mitigation measures for D3.1 and 3.2 (above)

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
	for combining constructed wetlands with engineered pre- or post-treatments including case studies of demonstration sites		
10	Tools do not fit with the infrastructure or operations of the selected site. Fast delivery of samples is required to achieve reliable antibiotic resistant gene analyses WP4 D4.3	WP4	Choose other (from the many) AquaNes sites for implementation Select suitable delivery service and prepare each sampling carefully. In case delivery turn out to difficult, onsite pre-treatment of samples is needed.
11	WP4 data processing: Needs and expectations of end-user does not match with the implemented solution For QMRA tool: Implemented QMRA tool might fail due to low trust of users and authorities in the approach WP4 D4.4	WP4	Discuss early in project the expectation of potential end-users and also be transparent of about the limitation of an open software a) organize review of the tool by at least two internationally known QMRA experts (Proposal: G.Medema + B. Stanford); b) ensure an transparent documentation of the assumptions made for the QMRA
12	Lack of data available from demonstration sites to sufficiently complete the required analyses WP5 D5.2 and D 5.3	WP5	We have built in a number of tasks across the work packages that are specifically dedicated to facilitating the interfaces between WPs 1-3 and WP 5. These tasks will help ensure the approach to analysis is built around the kind of data that the sites can realistically provide.
13	Communication between tools developed in AquaNES and integrated in DS platform is inconsistent or unreliable. WP6 D6.2 cNES Decision Support Tools (first prototype), D6.4 AquaNES DSS final version and documentation	WP6	Provide analytical definition of decision support framework and specifications of tools early in the project (T6.1 and D6.1) combined with workshop with tool developers. Reliable open standards will be exploited to provide a common data interchange format.
14	The validation of tools and/or and the DSS in the demonstration site fails. WP6 D6.4 AquaNES DSS final version and documentation	WP6	Risk will be minimized by complementarity of partners and scheduling tasks for updating/ calibration.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	Total Person/Months per Participant
1 - FHNW	0	18	0	0	1	4	14	18		55
2 - AKUT	0	0	21	0	0	0	3	0		24
3 - AUT	25	0	0	0	0	0	3	0		28
4 - BDS	0	0	0	21	0	0	2	0		23
5 - HYBU	0	9	0	0	0	0	2	0		11
6 - imaGeau	0	12.50	0	0	0	0	2	0		14.50
7 - GEOHYD	0	30	0	0	0	15	5	0		50
8 - MicroLAN	0	2	0	14	0	0	4	0		20
9 - XFLOW	18	0	0	0	0	0	2	0		20
10 - VTG	0	0	0	0	44	1	30	2		77
11 - WADIS	0	16	0	2	0	0	1	0		19
12 - WatStech	0	0	18	0	0	0	2	0		20
13 - XYLEM	0	23	6	0	0	0	2.50	0		31.50
14 - BUWW	38	0	0	0	0	0	4	0		42
15 - BWB	29	0	29	15	0	0	3	0		76
16 - DEYAT	0	0	9	0	0	1	0.50	0		10.50
17 - MUOA	0	0	17.50	0	0	0	0	0		17.50
18 - DREWAG	14	0	0	0	1	0	1	0		16
19 - EV	0	0	45.20	0	0	0	2	0		47.20
20 - IWB	0	10	0	0	0	0	0	0		10
21 - MEK	0	45.80	0	3	1	1	2	0		52.80
22 - AMU	36	0	0	0	0	2	1	0		39
23 - BRGM	0	42	0	0	3	0	2	3		50

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	Total Person/Months per Participant
24 - UCRAN	0	0	25	0	30	0	0	2		57
25 - HTWD	32	0	0	0	2	3	4	3		44
26 - EJC	4	0	0	0	0	0	0	0		4
27 - KWB	24	0	24	13	0	0	1	3		65
28 - KWR	0	12	0	20	8	1	1	2		44
29 - NTUA	0	0	6	8	14	39	5	2		74
30 - UJS	9	0	0	0	0	0	1	0		10
31 - NUPS	25	0	0	0	0	0	0	0		25
Total Person/Months	254	220.30	200.70	96	104	67	100	35		1077

1.3.7. WT7 Tentative schedule of project reviews

Review number [19]	**Tentative timing**	**Planned venue of review**	**Comments, if any**
RV1	21	Europe	Brussels/Demonstration site
RV2	36	Europe	Brussels/Demonstration site

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public
CO	Confidential, only for members of the consortium (including the Commission Services)
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA	if virtual access,
TA-uc	if trans-national access with access costs declared on the basis of unit cost,
TA-ac	if trans-national access with access costs declared as actual costs, and
TA-cb	if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

History of changes

Version	Changes	By	on
V1	Changes addressing the comments in the Evaluation Summary Report	RH	13.01.16
V2	Minor revision of the estimated budget for the action and clarifications on pilots' innovative aspects	RH	23.02.16
V5	Last specification on budgets • shift from subcontracting to Other Goods & Services (imageau) • changes in amount of some subcontracts (MEK), • reallocation of funds for project meetings (from BRGM, AMU, XYLEM to KWB, KWR, VTG, BUWW, NTUA) Updated GANTT chart Tentative meeting schedule added Remaining comments addressed (pilot sites, overall structure of the work plan)	RH	15.03.16 18.03.16
V6	Table 1 edits, correction of pagebreaks	RH	29.03.16
V7	Corrections required due to termination of EJC and accession of new beneficiary NUPS and other changes incorporated in course of the consortium requested amendment Section 3.4 - use of resources by NUPS, essentially taking over the former EJC budget items - changes of use of resources of the leaving party beneficiary no. 26 EJC according to declared costs - adaptation of budget use of beneficiary no. 16 DEYAT Section 4.1 - addition of partner description for NUPS Section 4.2 - increase of number of subcontracts from 2 to 3 for AMU as agreed with PO (mail of 20.12.2016)	RH	20.07.17
V8	Correction of use of resources for beneficiary no. 16 DEAYT	RH	08.08.2017

Part B

1 Excellence

1.1 Objectives

Europe's water service providers are under increasing pressure to deliver improved and affordable water services to a growing population whilst reducing the amount of energy used, lowering the environmental impact of their activities and coping with climate change (EC, 2013a, EA, 2012). These challenges have prompted water sector professionals to revisit the potential role of catchment landscape features such as river banks, aquifers and wetlands in providing treatment potential and storage capacity.

Whilst the role of ecosystems (natural water bodies) in providing water services has long been acknowledged (EC, 2013), heightened interest in integrated water resources management has provoked closer assessment of the benefits of combined natural and engineered treatment systems - cNES (GWP & INBO, 2009). There is now a pervasive recognition that 'Investing in integrated water management strategies that combine engineered solutions with '*natural infrastructure" can reduce costs, enhance services, and provide a suite of co-benefits for communities and the environment*' (WRI, 2013). These developments, combined with contemporary debates around the potential social and economic value of Green Infrastructure (The Nature Conservancy, 2013) have challenged the research community to develop more accurate understandings of how such combined natural and engineered systems can best be designed and operated so as to deliver safe, reliable water services.

Natural water bodies are already being exploited as low energy treatment options which, although often associated with longer residence times, provide welcome flexibility for water service providers aiming for more cost-effective processes with lower environmental impact (energy & chemical demand, CO_2 footprint). Research on the fundamental processes and performance of natural treatment systems has advanced rapidly in recent years (see, for example, Dillon et al., 2008, Maeng et al., 2010; García et al., 2010;). These advances provide the underpinning knowledge required to enable scale up and demonstration of suitable combinations of natural and engineered water treatment process steps in practice.

More broadly, the widespread adoption of such treatment systems by utilities and communities is still hampered by several sources of uncertainty, particularly in terms of the distribution of responsibilities, risks, and rewards amongst stakeholders. As the water passes back and forth across the interfaces between public, private, and shared environments, so the regulatory, financial and contractual arrangements which guarantee service levels become complicated and contentious. We argue that the consequential lack of robust risk management and governance arrangements (critical if investors are to be constructively engaged) is crippling both the confident design and widespread implementation of combined natural and engineered treatment systems.

The AquaNES project will have demonstrable impact across the EIP Water's thematic priorities and cross-cutting themes with particular emphasis on 'Water reuse and recycling', 'Water and wastewater treatment', 'Water-energy nexus', 'Ecosystem services', 'Water governance', and 'Decision support systems and monitoring'. It will catalyse innovation in the European water sector, accelerate the implementation of more sustainable water management systems, and improve Europe's ability to deliver sustainable water services for its communities, industry, agriculture, and the environment. In demonstrating the impacts and benefits of combined natural and engineered water treatment trains we will promote more sustainable adaptations to issues such as water scarcity, excess water in cities and micropollutants in the water cycle as well as make a number of substantive contributions to Europe's transition to a Green Economy.

The AquaNES consortium will deliver on the following **specific objectives.** We will:

- improve the confidence with which water service providers are able to **specify, design, and implement** combined natural and engineered water treatment systems (cNES),
- advance the technology readiness levels of a range of innovative cNES technologies from typically 5/6 to 7/8
- evidence how full scale combined natural and engineered treatment systems can **achieve reductions** in operating costs of 10%-30% and in energy consumption per m^3 treated of up to 50% compared to current established solely engineered solutions,
- test a robust **risk assessment framework** which is sensitive to the variety of phenomena and processes exhibited by combined natural and engineered treatment processes,
- deliver **design guidance** for combined natural and engineered treatment components and systems informed by industrial or near-industrial scale experiences,
- evidence the relative **environmental impact** of cNES compared to fully engineered conventional solutions,
- demonstrate the benefits of post-treatment options such as nanofiltration, activated carbon, ozonation and electrochlorination after **bank filtration** for the production of safe drinking water,
- validate the full exploitation of the treatment and storage capacity of **soil-aquifers systems** in combination with conventional or oxidative pre-treatments in both drinking water production and water reuse,

- demonstrate the combination of **constructed wetlands** and other natural treatment systems with different technical post- or pre-treatment options such as ozonation or bioreactor systems as a wastewater treatment option,
- replace chemically assisted **phosphorous removal** in wastewater treatment by natural treatment components with energy and nutrients recovery potential,
- aid w**ater governance** by addressing the unclear responsibilities of the various stakeholders in order to alleviate barriers for the widespread implementation of such systems throughout Europe,
- provide **decision support** by delivering a sound basis for water managers and governments for proper process assessment and selection,
- **prove the transferability** of tested technical approaches across contexts and water quality challenges,
- **deliver new market opportunities** in Europe and overseas for innovative cNES.

1.2 Relation to the work programme

The AquaNES proposal responds to the call Water1B for *Bridging the gap: from innovative water solutions to market replication* by demonstrating combined natural and engineered water treatment systems as viable concepts to address the EIP for Water priorities on water & wastewater treatment, water reuse & recycling as well as flood & drought risk management. Our creative solutions will be implemented in real environments and at industrial scale to demonstrate their long-term viability. Their globally positive environmental impact will be demonstrated by life cycle analysis. AquaNES addresses the pre-commercialisation challenges and the residual risk linked to scale-up. It tackles these challenges from both technical and non-technical perspectives, applying new concepts in water governance and providing decision support systems to facilitate consideration and uptake of these combined technologies in water management decisions.

The design and implementation of combined natural and engineered water treatment systems which make best use of the relative strengths of both environmental and engineered processes presents a multifaceted set of challenges for water service providers. Whilst the call text rightly points out that innovative solutions '*often do not reach the market due to pre-commercialisation challenges and the residual risk linked to scaling-up*.' it is important to remember that such scale-up risks do not only relate to technical and operational issues. The transition from one-off or demonstrator schemes to an established solution also presents challenges for regulation, calls for greater attention to be paid to environmental impact and ecosystem services, and demands a more nuanced understanding of how communities might respond to new solutions. A comprehensive list of our responses to the challenges set out in the work programme is compiled below.

Challenges and scope of call "H2020-WATER-1-2015"	How AquaNES will address the challenge
Lack of real scale demonstration of their long-term viability.	AquaNES is founded on 13 full- or pilot scale and demonstration sites. These demonstrations will be the first references in an operational environment of the proposed technology combinations and las around two years.
Pre-commercialisation challenges and the residual risk linked to scaling-up.	Those challenges will be answered by the full- and demonstration scale in AquaNES. They will act as "first movers" and therefore will greatly reduce the residual risk associated with implementation of innovative technologies
Accelerate the commercialisation of eco-innovative water solutions with a view to stimulating sustainable economic growth, business and job creation in the water sector.	AquaNES will accelerate the opening of a new market: the market of cost-effective solutions for treatment of (waste)water targeting the synergies of technical and natural treatment systems. This will contribute to the development of the green economy in Europe, stimulating sustainable economic growth, business and job creation in the water sector.
Focus on the cross cutting priorities identified in the EIP on water, while addressing the thematic priorities.	AquaNES has a strong focus on the EIP water cross cutting themes, in particular the set up and demonstration of governance regimes and risk management frameworks (including decision support and monitoring) for the cNES demosites as these are main barriers for the implementation of innovative cNES. In addition AquaNES fully addresses the EIP water thematic priorities "Water and wastewater treatment", "Water reuse and recycling" and "Role of ecosystem services in the provision of water related services", as well as "flood & drought risk management" with particular relevance to the following actions: "reducing energy consumption related to wastewater treatment", "*improved water quality to increase water reuse potential*" and "*innovative concepts for alternative water treatment.*" They are also suited for '*regions that currently lack of appropriate sewer systems and treatment and sanitation facilities, by applying smart technologies and decentralized systems with a focus on alternative water sources*'.

Challenges and scope of call "H2020-WATER-1-2015"	How AquaNES will address the challenge
First application and market replication of near-market water solutions.	Technologies proposed in AquaNES are mature for commercialisation and need a first full-scale application before market replication.
Aim to help process industries ensuring efficient management of resources (e.g. raw materials and energy).	AquaNES' contribution to an efficient management of resources in the water sector will primarily focus on reduced energy consumption by combining engineered solutions with low-energy natural treatment systems. In addition, the potential of energy recovery through biomass harvesting will be assessed (e.g. Microalgal photo-bioreactor in WP3) and the use of solar energy will be fostered (solar driven disinfection WP 1, photocatalysis WP3).
Exploiting untapped potential of ICT by developing and deploying advanced ICT solutions for water resources management	AquaNES will deliver a framework for water quality assessment at combined natural and engineered water production sites, with specifical emphasis on transparent and reproducible data-handling and data-analysis techniques (ICT) and user-friendly reporting tools.
Complex issues should be addressed with innovative, creative solutions with a globally positive environmental impact demonstrated by lifecycle analysis.	All technology lines in AquaNES will be assessed by methods such as environmental impact and life cycle assessment. The scope and intensity of environmental impacts resulting from the use of combined systems will be characterised and a comparative analysis related to benchmark systems such as fully engineered alternatives will be delivered. We will also describe and quantify ecosystem service benefits from of cNES utilisation.
Social, institutional, economic and governance aspects ensuring a more rapid uptake of solutions; aspects affecting market deployment and uptake, such as, standardisation and regulatory issues, market assessment and business plan.	The results of the project will be widely disseminated via scientific and end-user conferences and workshops. Key results will be used to support the business plans of the involved companies and to influence design standards and good design practice documents where appropriate, such as guidelines. On regulation we will identify areas of policy and regulation which constrain or hamper progress in the utilisation of combined systems, identify the gaps and tensions between those governance domains and jurisdictions which would have to work together to effectively regulate cNES.
Include the participation of SMEs, as far as possible.	The consortium has been built around a coalition of SMEs who all play active roles in AquaNES. **Eight SMEs will participate (> 30% of budget)**, bringing in specific competencies in a critical aspect of technical innovation. Project outputs support capacity building and business / market development.

1.3 Concept and approach

AquaNES pursues the concept of integrating nature-based elements into solutions for water management challenges. 'These solutions are inspired and supported by nature, while maintaining and enhancing natural capital. They are sustainable measures that simultaneously meet environmental and socio-economic objectives (EC, 2014). We will focus on soil aquifer treatment coupled to managed aquifer recharge (MAR/SAT), constructed wetlands (CW) and bank filtration (BF) and their combinations with engineered pre- or post-treatments as illustrated in Figure 1.

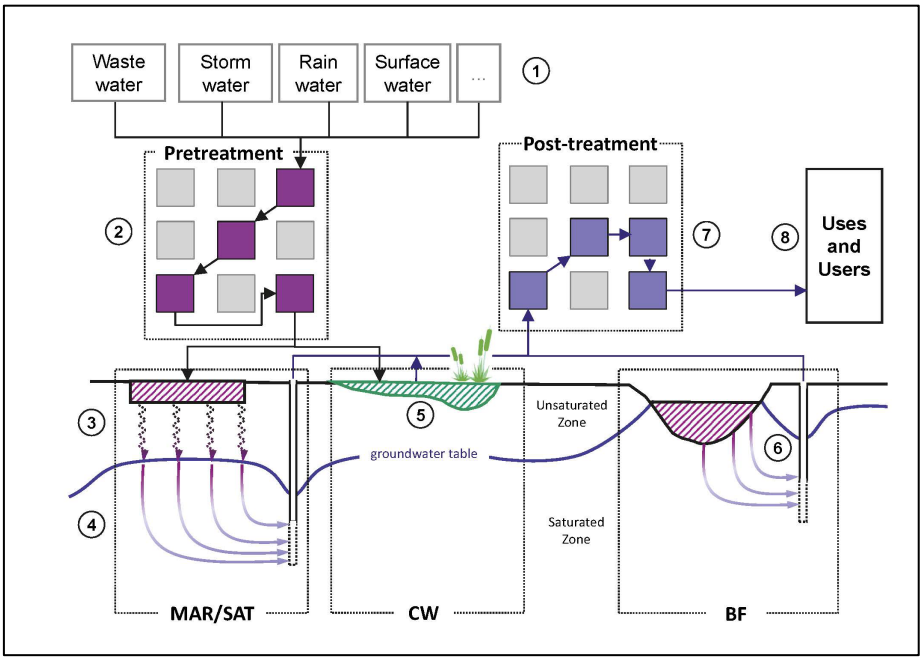


Figure 1 AquaNES project scope (MAR/SAT=managed aquifer recharge / soil aquifer treatment, CW= constructed wetland, BF=river bank filtration. (1) variety of water types to be treated, (2) matrix of pre-treatment options, (3)-(6) ecosystem services (3) of the unsaturated soil zone, (4) of the aquifer, with a combined physical, geochemical and microbiological cleaning potential, (5) of constructed wetlands, (6) of the river bank and associated alluvial aquifer, (7) matrix of post-treatment options, (8) uses and related water quality targets

Our approach is to demonstrate the synergistic benefits of combined natural and engineered components in delivering water services; benefits that go beyond the mere addition of the processes, e.g. better pollutant removal or lower energy demand. The demonstration site activities will evidence the technical and economic feasibility of the chosen treatment trains, assess their long-term performance, and specifically demonstrate how the the purification capacity of natural treatment systems can be enhanced, e.g. through pre-oxidation for better biodegradation, compound adsorption and subsequent biodegradation. AquaNES assembles a balanced consortium of leading European players with representation along the value chain: (i) scientific partners as knowledge providers for evaluation and optimization, (ii) SMEs and industries providing design, engineering and/or manufacturing of equipment, and (iii) water utilities who are responsible for scheme implementation. The consortium contains leading edge competencies across the science, engineering and humanities professions with many partners having extensive experience of European level collaboration.

AquaNES will enhance the development stage of combined natural and engineered water treatment processes from pilot / demonstration to market replication. Each demonstration treatment scheme incorporates one TRL >7 component and one TRL >5 component. The combined applications will achieve TRL7-8 with systems demonstrated in operational environments (see Table 3). AquaNES draws on a number of **past and ongoing research activities** coordinated or supported by consortium partners. Process performance and substance fate modelling approaches derived in the RECLAIM Water and TECHNEAU projects will be further refined and deployed for assessing cNES. Our work on governance and ecosystem services is guided by amongst others the MAR authorization protocol elaborated in DEMEAU and an overarching assessment framework developed in the DESSINS project and approaches from TRUST. Activities and exploitation ambitions for India are complementing work of the projects SaphPani, Water4India and SWINGS. During its lifetime AquaNES will continuously exchange with and inform the work of several EIP Water Action Groups, namely AG128: MAR Solutions, AG100: RTWQM – Real Time Water Quality Monitoring and AG228 NatureWat on Nature-based technologies for innovation in water management.

1.3.1 Overall approach and methodology

The methodological focus is on demonstrating the feasibility and value of cNES process combinations at pilot to full-scale. The sites involved cover a range of geographical, climatic, and source water availability contexts. They are located in densely populated areas with semi-closed water cycles as well as in more rural areas and regions with seasonal population variations due to tourism. Site activities will run for an extended period of one to two years and generate recommendations on best practice for water utilities and technology providers. Figure 6 in section 3.1.1 illustrates the overall structure of the project. The project is comprised of eight workpackages as follows. All sites mentioned are summarised in Table 1.

WP1. Potential of bank filtration and post-treatments in (drinking)water supply

Bank filtration (BF) schemes for the production of drinking water are increasingly challenged by new constituents of concern such as organic micropollutants (MP) and pathogens in the source water and hydrological flow variations due to weather extremes.

Objective: In WP1 new technology components will be integrated and monitoring and operating regimes will be adopted to further optimise water treatment in bank filtration schemes for these new requirements.

Approach: Demonstration actions in four sites in Europe and one in India will be carried out in cooperation between water utilities, research institutions and SME, covering a wide range of source water qualities in order:

- to demonstrate the long-term stability of **anoxic capillary nanofiltration** operated at single wells for partial removal of selected compounds, extension of applicability of nanofiltration for bank filtrate/groundwater treatment from strictly anoxic to suboxic conditions and to highlight benefit of BF regarding biofouling prevention of the membrane in comparison to direct surface water treatment via nanofiltration (Site 1),
- to demonstrate the advantages and limitations of membrane filtration (nanofiltration, ultrafiltration, reverse osmosis) in combination with BF, to assess ultrafiltration (UF) as additional barrier to the breakthrough of pathogens and organic compounds during subsequent activated carbon filtration (Sites 1, 2, 3),
- to demonstrate how to ensure water supply safety with BF and modern disinfection including UV and on-site electrochlorination during extreme weather conditions such as floods and droughts (Sites 3 and 5),
- to demonstrate the impact of travel time of bank filtrate and coupling with MAR on the efficacy of existing treatment (ozonation, activated carbon filtration, disinfection) and additional treatment steps (membranes, UV) and to summarize results in a software tool for prediction of the behaviour of micropollutants and other water constituents (Sites 2, 3 and 4),
- to prepare a design tool for siphon systems to achieve a “renaissance” of siphon systems in BF using modern armatures and monitoring equipment to reduce pumping energy costs by >50% (Sites 2 and 3).

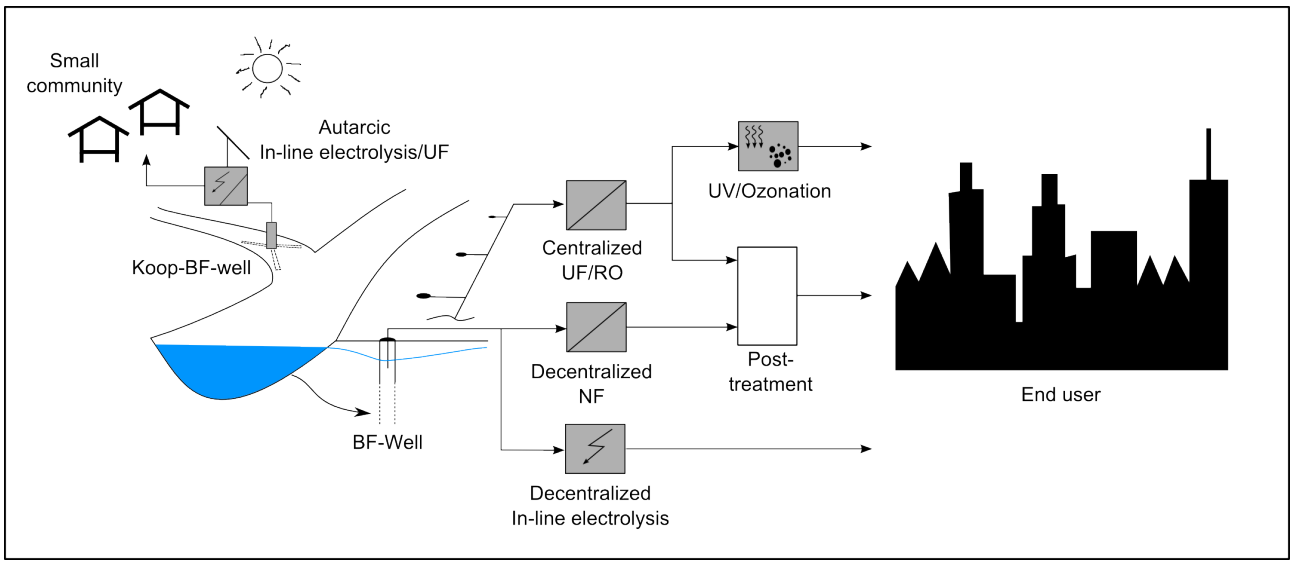


Figure 2 Overview of demonstrated combinations of BF and engineered post-treatment technologies

WP2. Managed aquifer recharge/soil aquifer treatment for storage and quality improvement

Managed groundwater recharge is an inherent component of many water supply schemes. It provides both water treatment and storage capacity.

Objectives: WP2 will assess the effectiveness and long-term feasibility of natural and engineered treatment combinations for SAT and MAR sites in various hydro-climatic and regional contexts. The activities encompass a broad range of source waters (surface water, storm water, wastewater) treated for drinking water purposes or water reuse.

Approach: progress will be brought about in four demonstration sites:

- Agon-Countainville (Site 8): effluent treatment by a reed bed followed by dune filtration for water reuse. The complexity of MAR-SAT systems needs innovative monitoring strategies and process modelling to be able to assess their efficiency under varying conditions. Special attention will be paid to the fate and transport of micropollutants in groundwater using reactive transport modelling tools, continuous and dynamic medium to long-term monitoring of the quality and quantity of water resources, and online access to groundwater data. We will develop ICT solutions as input to a decision support system (WP6).
- The Shafdan MAR/SAT system (Site 7) is a long-established scheme for the use of treated wastewater for agricultural irrigation. In previous pilot studies, the effect of an oxidation/ ozonation step prior to infiltration was investigated. Indirect Potable Reuse is now envisaged. Novel technologies will be combined with MAR/SAT including high voltage pulsed electric discharge in the liquid leading to advanced oxidation process (AOP) of organic pollutants.
- The Lange Erlen site (Site 6) produces drinking water for the city of Basel (CH) from the river Rhine (surface water abstraction). The treatment train encompasses screening, filtration and subsequent soil infiltration. After re-abstraction the water is treated by granular activated carbon and UV-disinfection. A pilot plant (reactor and soil column) will be operated to demonstrate the effectiveness of UV+H_2O_2 pre-treatment before infiltration with respect to micropollutants removal especially and how it affects the biodegradation and sorption processes in the soil.
- A pilot in Waddinxveen (NL) will be utilised to demonstrate subsurface storage of storm water for later withdrawal and use. The pilot includes innovative pretreatment (a.o. fuzzy filters) and infiltration technologies to enable high infiltration flow rates. This approach has additional value to traditional solutions to deal with flooding events leading to turbidity peaks.

WP2 will be in close interaction with WP5, 6 and 7 in order to help technology providers to implement facilities, fulfil the end-users needs and supply the planners with innovative and connected decision support tools

WP3. Constructed wetlands and other natural systems for improved wastewater treatment

Objectives: In work package 3, the combination of constructed wetlands and other natural treatment systems with different technical post- or pre-treatment options such as ozonation, bioreactor systems or disinfection will be demonstrated in pilot and full scale sizes in different European climates (UK, Germany, Greece).

Approach: Six different innovative system combinations treating wastewater as well as polishing of wastewater treatment plant effluent were chosen to demonstrate long-term viability of these eco-innovative water solutions and facilitate market uptake. In particular, demonstration sites will include:

- constructed wetlands with ozonation as pre-treatment for removal of micropollutants, pathogens and antibiotic resistance genes in WWTP effluent as well as biodegradation of transformation products generated by ozonation (Site 12),
- retention soil filters (with biochar and/or GAC layer) for combined treatment of WWTP effluent and combined sewer overflows (CSO) for nutrient, heavy metal, micropollutant & pathogen removal for surface water protection (Site 11),
- solar catalytic photo-oxidation as pre-treatment of constructed wetlands treating primary effluent followed by ultrafiltration for urban water reuse and potentially aquifer recharge (Site 10),
- disinfection as post-treatment of constructed wetlands treating primary effluent for irrigation of public spaces (Site 10)
- reactive media reed beds as post-treatment of oxidation ditches for advanced P removal in WWTP effluent to comply with strict P-consent for surface water quality (Site 13),
- microalgal photobioreactor with immobilized algae as post-treatment for advanced removal of N and P from WWTP effluent with potential for energy/nutrient recovery (Site 13).

WP4. Risk assessment and water quality control

Objectives: WP 4 will develop and test a water quality assessment framework for the cNES demonstrated in WP1-WP3. It aims at providing guidance to tailor monitoring strategies specific for such schemes.

Approach: The innovative concept of WP4 is to develop a more integrated chemical and microbiological monitoring approach for water quality making use of automated data analysis to inform risk assessment workflows. The monitoring will comprise important water quality parameters such as e.g. pathogens, antibiotic resistance genes, organic

substances or heavy metals. For ensuring maximum reproducibility the data transfer, analysis and visualisation will be automatized using the open source programming. This approach allows event (e.g. in case of outliers) or demand based reports and optimizing the monitoring strategy (e.g. measurement frequency). Risk assessment is a powerful tool to optimize water quality monitoring strategies and serves as basis for operational decision-support for the various demonstration sites.

The water quality assessment framework will be tested, implemented and demonstrated at selected demo sites. The framework will be tailored to the specific water quality risks of the sites in terms of type and frequency of critical parameters to be monitored as well as related monitoring systems and trigger values above which actions should be considered. Data processing and data visualization techniques will be developed and applied at the sites to support decision making.

The water quality assessment framework to be developed in AquaNES combines conventional and new monitoring systems and relates the outcomes to trigger values thereby using advanced data handling tools. The framework will be tailored to the type of water use and is to support operators of water reuse and production systems. The potential of the water quality assessment framework can also be exploited by improving existing treatment schemes.

In detail we will

- Assess the efficiency of the different treatment technologies (WP1-WP3) through water quality monitoring (by e.g. well established generic online sensor technology for parameters such as pH, EC, TOC, nutrients, etc.,
- Implement innovative monitoring systems for antibiotic-resistance, bioassays for toxic compounds and online detection of microbial parameters,
- Develop data-processing and -visualisation techniques such as an automated routine for water quality report generation based on data analysis,
- Develop and program an automated water quality reporting tool, critically combining the data from chemical and microbiological parameters,
- Derive an interactive quantitative risk assessment tool based on open software R.

To keep the water quality assessment framework alive after completion of the project, it will be incorporated in the recently launched Knowledge Management Platform Watershare (www.watershare.eu). This platform is to sustain outcomes of water research and to facilitate their implementation in real life.

WP5. Interfaces with the Environment & Society

Objective: The central ambition of WP5 is to better understand the ways in which considerations such as environmental impact, ecosystem services contribution, regulation, and consumer perspectives influence the desirability and feasibility of combined natural and engineered water services.

Approach: Working closely with demonstration sites (WPs 1-3), WP5 outcomes will provide input to policy (e.g. realization of the Blueprint for Water, maturing a European strategy on water scarcity and droughts) and shape practice. The following activities also help to ensure that the AquaNES consortium can extend the relevance and value of its findings beyond the demonstration sites.

The project addresses public receptivity through sub-task 5.3.3 where we seek a detailed understanding of how citizens respond to combined engineered / natural treatment systems. Large scale surveys in several member states using stratified sampling will be used to expose public understanding of the systems' function and operation as well as identifying how the public values their contribution to water services. Analysis of survey responses will enable us to both characterise significant differences between attitudes in different member states and deliver a profile of pan European receptivity. Ultimately, deliverables will characterise public trust in combined systems so as to inform communication and learning initiatives.

We also assess the potential for citizen science contributions to support the monitoring and control activities at the AquaNES demo sites through sub-task 5.3.4. This activity focuses on the practicalities and reliability of data and information collection as well as how such involvement can catalyse improved citizen engagement with the schemes. A pilot Citizen Science initiative will be developed for one demonstration site as a test case. This will involve roll out of a 'live' demonstration of volunteer citizens utilising mobile phone apps to provide scheme monitoring data. An Action Research methodology will be used to evaluate the success of this initiative leading to targeted recommendations on the design and management of citizen science operations

On environmental interfaces we will:

- characterise the scope and intensity of potential environmental impacts resulting from the use of combined systems and describe the relative environmental impact of combined systems as contrasted with fully engineered alternatives. The environmental aspects will be addressed by implementing the standard Environmental

Life Cycle Analysis (E-LCA) methodology while a Social Life Cycle Assessment (S-LCA) will be applied to address socio-economic aspects.
- describe and quantify the ecosystem service benefits of combined systems and characterise the sensitivity of these ecosystem service benefits in the face of climate change and varying hydrological flows.

On regulatory interfaces we will:

- identify areas of policy and regulation which constrain or hamper progress in the utilisation of combined systems
- identify the gaps and tensions between those governance domains and jurisdictions which would have to work together to effectively regulate combined natural and engineered systems
- develop and field test a set of regulatory principles and mechanisms for combined systems.

On consumer interfaces we will:

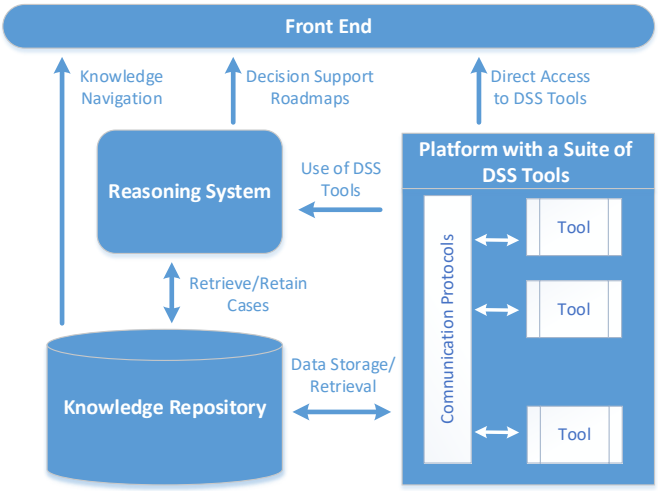
- generate a detailed understanding of how consumers and citizens understand, value, and trust engineered, natural, and combined treatment processes
- determine the extent to which Citizen Science may be used in support of the combined system monitoring and control.

WP6. Decision support and system design

Designing and operating water treatment plants involves complex decision making, due to of trade-offs between technical, economic, environmental, and social factors (Roda et al., 1999; Hamouda et al., 2009).

Objectives: WP6 will integrate existing and new modelling, monitoring data management and decision support tools and knowledge into a platform, providing a unified environment (AquaNES DSS) for supporting strategic and operational decisions in cNES.

Approach: With a view to contributing to the sustained use of the AquaNES DSS by various end-users of different levels and types of expertise, the DSS will aim at encapsulating and making all useful knowledge collected or developed by AquaNES easily available.



A. The AquaNES DSS will provide a unified environment for strategic and operational decisions by offering support in all decision making stages of cNES applications (system selection and design, system assessment, system operation and monitoring, market penetration and system replication). The AquaNES DSS will provide a platform for integrating a suite of modelling and decision support tools (DSS Tools), enabling their seamless operation through proper communication protocols (based on open ICT standards), providing smooth data sharing/exchange and a common interface. The suite of DSS Tools will bundle already prototyped models and methodologies.

B. The AquaNES DSS will be built around a Knowledge Repository (KR), incorporating data and information on successful applications, technologies, experience, and market conditions. The KR will also integrate knowledge from outside the project, including legislation, good design practices and success stories. All AquaNES data and knowledge will be integrated, categorized, indexed and inter-related in the KR, forming an extensive cNES knowledge network. Knowledge integration will expand beyond the geographical focus of the project including information and storylines from other locations. The KR will provide all data and other information necessary for making decisions at all stages. The structure of knowledge in the KR and the network of relations within it will reflect that objective. The KR knowledge and data will be organized into thematic areas and thematic clusters within these areas. In addition, a meta-knowledge area will encompass all knowledge and greatly facilitate both its retrieval and

the use of the DSS suite of tools. The KR meta-knowledge will be used to dynamically provide to end-users roadmaps to the KR information content and decision support using the tools.

C. The AquaNES DSS will allow end-users to perform complex operation sequences without special training, by providing Decision Support Roadmaps through an intelligent knowledge-driven Reasoning System (RS). This will exploit past experience gained from the demonstration sites as well as successful cNES application Cases outside the project, to address specific questions/objectives of the users. Application cases of the decision framework, using the DSS tools, will be stored in the KR to provide roadmaps for knowledge and decision support. A dynamic RS will be based on this information, guiding end-users (through the KR front-end) towards specific goals. The RS will be able to answer specific questions such as: which system design and technology can meet specific environmental standards, how to perform a market analysis, what is the risk of implementing a specific solution. The answers will have the form of a Roadmap suggesting the exact path to reaching a goal. This would include the tools/methods to be used, the procedure of use (steps/ action list, data, parameters, decisions to be taken, etc.) as well as explanations and references on these. The RS will be based on a case-based inference engine to generate decision/guidance roadmaps exploiting the knowledge provided by the KR. Case based reasoning is a well-established intelligent methodology that has been successfully applied for supporting decisions in many water management (Anzaldi et al.), engineering (Yang), medical (Pla et al.) and other fields (Amailef and Lu) of decision making. The main features will be:

- Gathered experience is stored in a database of Cases, combining case-specific patterns of attribute ranges with complete Roadmaps to their solution.
- Stored patterns establish a basis for expressing/translating end-user situations/conditions and goals.
- The system identifies and retrieve relevant knowledge and roadmaps from the KR.
- Suggested roadmaps are adapted to new situations, evaluated and revised.

Revised cases are retained for future use, enabling the continuous revision of the KR with problems that the system has learned to solve. Thus the RS, being dependent on the KR informational content and rules stored in the KR, will be fully configurable, adaptable and capable of evolution.

D. A Front-End will also be developed, allowing end-users to query/navigate the information stored in the KR, ask specific questions and receive decision roadmaps, follow complex qualitative and quantitative procedures for decision making, and obtain direct access to modelling and decision tools.

WP7. Exploitation and dissemination

Objectives: WP7 will provide the mechanisms to exploit AquaNES innovations and prepare their market uptake.

Approach: The activities will include dissemination of results and exchange with target groups as well as support in pre-commercialization and up-scaling laid down in the Exploitation Plan. Market search and analysis as well as appropriated IPR management will prepare the development of business plans for our products. In particular we will

- establish exploitation plans for all technology lines by identifying their unique selling propositions based on results from technology testing and socio-economic assessment.
- develop financing models and funding schemes having regard to the analyses of costs and investment barriers as performed in the project.

In terms of dissemination the visibility of the project and accessibility of its output will be promoted by

- a dedicated website, including information on all aspects of the project and interactive elements
- timely exchange with relevant end-users and their associations, scheme planners and decision makers on public and dedicated project events (exhibitions, fairs, conferences, workshops), e.g. formation of group of bank filtration experts to get Europe leading in the field of BF and subsequent water treatment.
- prominently placing the AquaNES DSS on selection and operation of cNES in the watershare® suite of tools

WP8. Management

The project will be implemented and coordinated by an experienced team at FHNW adhering to best management practice. Staff involved also brings in technical expertise in the project topic having coordinated previously the FP5, FP6 and FP7 projects: AQUAREC, RECLAIM WATER and SaphPani.

The **technical scope, application purposes and relation to the EIP thematic priorities** of the combined natural and engineered treatment processes at the demonstration sites are summarised in Table 1.

Table 1 **Technical scope, application purposes and relation to the EIP thematic priorities of AquaNES demonstration sites (AOP=advanced oxidation processes, CAS=conventional activated sludge process, CSO=combined sewer overflow, DW=drinking water, GAC=granular activated carbon, MP=micropollutant removal, PAT=pathogen removal, SFW=surface water, STW=stormwater, TWW=treated wastewater, WW=raw wastewater)**

No.	**Natural & engineered components,** natural components in colour, engineered ones in grey		WP	Case study site / Country		Source water	State of the existing installations		AquaNES Pilot installation: Size of demo activity / treated flow		Water reuse and recycling	Water and WW treatment incl. recovery of resources	Water and energy integration	Flood and drought risk managemen	Role of ecosystem services
							Description	Size/capacity	Description	Size/capacity					
1	Bank filtration	Nanofiltration on single well level	1	Water works Berlin	DE	SFW	Full scale bank filtration system for drinking water production	80'000 m³/d 55 wells	Single well nanofiltration demonstration	For partial flow treatment 5 m³/h (2 parallel lines to compare membrane types)		DW MP	✓		
2	Bank filtration	Ultrafiltration		Dresden	DE	SFW	Full scale bank filtration system for drinking water production	3'000 m³/d	UF pilot plant	0.5-2 m³/h		DW MP PAT	✓	✓	
3	Bank filtration	Dense membrane / UV disinfection		Budapest	HU	SFW	full scale bank filtration system for drinking water production for post-treatment (UV, O_3) + 3 BF wells for non-potable water supply at Baja on the premises of the NUPS (EJC) for post-treatment options (RO, UV, O_3)	2500 m³/h, 150 m³/h.	new RO-equipment, UV and ozonation accessory at the Baja site with partner NUPS (EJC)	0.3 m³/h		DW MP PAT		✓	✓
4	Bank filtration / MAR	Ozone / Activated Carbon		Poznan	PL	SFW	Full scale bank filtration system for drinking water production Full scale post-treatment options (AC, Ozone)	2500 m³/h	No new piloting Full-scale demonstration at existing installation	2500 m³/h		DW MP PAT		✓	✓
5	Bank filtration	On-site electrochlorination		Haridwar, Ganga River	IN	SFW	Full scale bank filtration system for drinking water production	2550 m³/h	In-line electrolysis unit	0.5-10 m³/h		DW PAT	✓		✓
6	AOP / Ozone	MAR soil infiltration	2	Basel, Lange Erlen	CH	SFW	Full scale drinking water production by soil infiltration	100'000 m³/d	AOP / H2O2 pilot plant as pretreatment before soil infiltration Soil column testing	1-3 m³/h		DW MP			✓
7	AOP	Biofilter / Short SAT		Shafdan	IL	TWW	Full-scale municipal WWTP with Infiltration basins for SAT Part of pilot plant (ozonator, mechanical pretreatment)	15'500 m³/h	Enlarged biofilter and ozonation pilot with recycled ozonated stream	10 m³/h biofilter 5 m³/h (SAT)	✓	DW MP	✓		
	AOP/ O_3	Bio GAC / Ceramic UF / sSAT							Electric pulse oxidation on pre-treatment with recirculation	1.5 m³/h	✓	DW MP	✓		
									BioGAC filter or activate clay and ceramic UF or MF	0.5- 1 m³/h	✓	DW MP	✓		

No.	**Natural & engineered components,** natural components in colour, engineered ones in grey			WP	Case study site / Country		Source water	State of the existing installations		AquaNES Pilot installation: Size of demo activity / treated flow		Water reuse and recycling	Water and WW treatment incl. recovery of resources	Water and energy integration	Flood and drought risk managemen	Role of ecosystem services
								Description	Size/capacity	Description	Size/capacity					
8	CAS	SAT dune infiltration		2	Agon-Coutainville	FR	TWW	Full-scale municipal wwtp with dune infiltration	280 m³/h	No new piloting Full-scale demonstration at existing installation	280 m³/h	✓	MP PAT			
9	High flow pretreatment and infiltration system	Aquifer storage & recovery			Wadinxveen	NL	STW	No existing installation	N/A	Prefiltration plant based on FuzzyFilter or comparable technology	35-200 m³/h	✓			✓	✓
10	Prim. treatment Photocat. oxid	CW	Ultra-filtration	3	Thirasia Island	GR	WW	Recently constructed municipal WWTP (including all listed elements)	Peak instantaneous flow: 16 m³/h	No new piloting Full-scale demonstration at existing installation	16 m³/h	✓	WW PAT	✓	✓	✓
	Prim. treatment	CW	Stabilisation ponds & Disinfection		Antiparos Island	GR	WW	Recently constructed municipal WWTP (including all listed elements)	Peak instantaneous flow: 71 m³/h	No new piloting Full-scale demonstration at existing installation	71 m³/h	✓	WW PAT		✓	✓
11	CAS	Retention Soil Filter modified with GAC			Erftverband	DE	TWW / CSO	Full-scale municipal WWTP (Rheinbach)	240 m³/h	Retention soil filter	240 m³/h		WW MP PAT			✓
12	CAS	O_3	CW		Berlin	DE	TWW	Full-scale municipal WWTP(Schönerlinde) Full scale wetland	WWTP: 4'375 m³/h Wetland: 250 m³/h	Ozonation pilot followed by Constructed wetland	Ozone: max.. 12 m³/h Constructed wetland: 1-4 m³/h		MP PAT			
13	Oxidation ditches	Algal photo-bioreactor			Packington	UK	WW	Full-scale municipal WWTP	194 m³/h	Algal photo-bioreactor	0.2-2 m³/h		WW	✓		
	Oxidation ditches	Reactive media reed beds			Packington	UK	WW	Full-scale municipal WWTP	194 m³/h	Reactive media reed bed	1-5 m³/h		WW	✓		

Out of 13 demonstration sites the installation and operation of only 3 requires additional permits (see list below). The partners are aware of the required procedure which will be started in due time. In each of the Work packages concerned a first milestone marks the achievement of an operational pilot which includes all mandatory permits.

For the other demonstration sites, some of them are either existing (full-scale) demonstrator where all authorisations are at hand (Site 4, Site 8, Site 10, Site 11, Site 13) or where due to the limited extend of piloting (capacity, spatial) no authorization is required (Site 2, Site 3, Site 5, Site 6) and where a written information of the authorities is sufficient (Site 12).

List of sites requiring new permits

Site 1:

Two options for the NF implementation are currently reviewed regarding pro/cons:

- At an existing well or the construction of a new well with is not yet feeding in the drinking water supply system to avoid safety issue with the produced drinking water
- Both options will require a temporary permit to place the NF pilot (Pentair) within a drinking water protection zone

The permission process at BWB will be started even before the project start to discuss any special needs regarding the environmental safety design with the water authority and the supplier (Pentair) directly at the start of the project. The final request for permission will be submitted to the water authority until months 3 of the project:

- If a separate well is constructed a permission for construction from the water authority is needed. This is a standard procedure often conducted by BWB.

Site 7:

- does not require additional permits by the water authorities,
- yet the installation of the containerized pilot plant, especially the preparation of the cement foundation need a construction permit from the Ministry of Interior

Site 9:

- Permit from the Dutch water Board is needed for soil infiltration of storm water. This is a standard procedure and will be requested once the GA is signed and the design of the pilot is further progressed.

1.4 Ambition

1.4.1 Advances beyond the state-of-the-art

Whilst many natural treatment components have proven their effectiveness in water treatment over recent decades (Kazner et al., 2012) their capacity may become limited due to space restrictions (e.g. size of CW and infiltration basins) or negatively impacted by flow variations during floods and droughts (bank filtration). In the AquaNES project we will demonstrate how engineered pre- and post-treatment components help to improve performance and increase resilience.

Bank filtration (BF) at lakes and rivers has been used in Europe for more than 140 years, primarily for removal of pathogens. Later, the systems have been completed by conventional aeration, filtration for Fe/Mn removal and often activated carbon to improve drinking water quality (Hiscock & Grischek, 2002). Many schemes are not any more adequate to remove pathogens (viruses, protozoa) and emerging micropollutants, especially during extreme events such as floods and droughts and need to be adapted accordingly (Maeng et al., 2010; Sandhu et al., 2015). To date, membrane technology is implemented in flow sheets for drinking water production from surface water only in specific cases in Europe (established plants include Mery sur Oise, Dinslaken, Roetgen). Its introduction as an additional barrier will result in higher safety and optimal use of other treatment steps such as activated carbon filtration and disinfection. As many water utilities are forced to improve their water safety systems, demonstration of operating new treatment combinations and tools for optimal design will offer a wide market in Europe (Beyer et al., 2014;). First time decentralized treatment at single wells will be tested using a new type of capillary membrane, produced based on a 'Layer by Layer' technique as developed in the FP7 projects Nametech and LbLBRANE and demonstrating two inline electrochlorination modules at different scale. Such systems could prevent closure of existing sites affected by specific pollutants and set new standards in chemical consumption, operational ease and maintenance cost (Schmidt, 2012; Sandhu et al., 2015).

For water safety plan development and implementation at BF schemes during floods and droughts, customised well operation procedures, innovative adaption strategies and technical measures will be applied and qualified to be market ready at the end of the project.

Siphon well systems are flood proof, independently operating and do not require permanent power supply. As compared to a series of single-operated wells with submersible pumps, which are commonly used in water supply, they reduce energy costs and CO_2-emmisions by >50 %. Their design is complex and such systems were constructed in the early 1900 mainly by experience, which has been lost to date (Ray et al., 2011). Based on still operating siphon well examples at site 2, 3 and 4, recommendations for the rehabilitation of such systems as well as a software tool for the design of new siphon wells will be validated and demonstrated.

Managed aquifer recharge schemes play a vital role in drinking water supplies (Grützmacher et al., 2013). The technology has also gained increasing attention as water reuse application (Lazarova et al., 2011, Kazner et al., 2012). In both cases appropriate pre-treatment of the infiltration water is necessary to enhance system performance and efficiency, to remove critical contaminants (pathogens, ammonia, trace metals…) from the source water, to ensure the long-term system performance and to meet regulatory demands. Methods that are commonly used for pre-treatment for MAR are sedimentation, different forms of assisted filtration and disinfection to avoid clogging of the system (Van der Hoek et al., 2000; Balke & Zhu, 2008; Dillon et al., 2009). In the view of micropollutants, pathogens and antibiotic-resistant bacteria and genes (Pal et al., 2010) new approaches are required to reduce associated risks. Specifically new target uses, as indirect potable use, will come with high regulatory standards so that optimised approaches are required to reduce associated risks and allow wider implementation for MAR systems in the EU regulatory framework. Within AquaNES we will thus better eliminate or retain these constituents with appropriate engineered pre-treatment, such as advanced oxidation Zucker *et al.*, 2015.The use of subsoil natural systems (soil and aquifer) for water treatment also requires a stringent monitoring and modelling to detect and foresee any adverse effects and risks for the concerned water bodies (e.g. contaminant flow beyond the confined injection-pumping perimeter). In AquaNes, advanced monitoring and data management techniques will assure surveillance of the water bodies used for SAT/MAR. Improved monitoring and reactive transport and fate modelling of these constituents extending previous work (Pettenati, 2012, Thiéry, 2010) will be used for improved operation and design in large-scale applications.

Constructed wetlands (CW) and other natural treatment systems can be a cost-efficient and easily operated alternative or additional to technical systems for treatment of wastewater, combined sewer overflows, surface water, or polishing of WWTP effluent (Kadlec & Wallace, 2009, Vymazal, J. 2005) with additional ecological and social benefits (e.g. treatment systems as habitats, potential recreational use), thus providing additional ecosystem services compared to pure technical systems. However, the performance of natural treatment systems is limited by several factors. As microbiological degradation processes are reduced at low temperatures, treatment performance for biodegradable compounds depends on the local climate and seasonal variations, especially low temperatures in winter (Kadlec & Reddy, 2001). In addition, not all relevant compounds can be removed in natural treatment systems, especially compounds with low biodegradability and low adsorption such as certain micropollutants (Li et al., 2014). Finally, removal requires sufficient retention times usually in the order of several days that result in large system sizes.

The combination of natural treatment systems with technical treatment systems can overcome these disadvantages and even provide additional benefits regarding the treatment efficiency by combining the removal mechanisms of both system types (Liu et al. 2015). For example, ozonation as pre-treatment for constructed wetlands is able to oxidize a number of compounds recalcitrant to removal in wetlands, e.g. carbamazepine (Hollender et al., 2009). Transformation products generated during the ozonation process are often more easily biodegradable (Hübner et al., 2015) and can then be further eliminated in subsequent natural treatment systems such as constructed wetlands. Furthermore, sizes of the wetland system could be reduced due to the treatment capabilities of the complementary technical system. An innovative example is the application of solar photocatalysis (Ibhadon & Fitzpatrick 2013, Araña et al. 2008) as pre-treatment for constructed wetlands to significantly reduce land requirements and costs of CWs (Antoniadis et al. 2010: size reduction of CW by ~50% through combination with solar photocatalytic oxidation).

Finally, pathogenic bacteria present in effluents are of increasing concern, especially in case of reuse applications. A recent study on agricultural reuse of effluents from constructed wetlands treating wastewater in South Europe concluded that constructed wetlands were found to have problems meeting required levels of microbial contamination (Stevo & Maurozio 2015). In addition, the presence of antibiotic-resistant bacteria and resistance genes after conventional wastewater treatment and associated risks came into focus in recent years. For example, it could be shown that antibiotic resistance genes are present in chlorinated effluent of a conventional wastewater treatment plant (Al-Jassim et al. 2015).

In this context the combination of constructed wetlands with disinfection technologies as well as the utilization of removal mechanisms for bacteria in constructed wetlands (Scheurer et al. 2015, Kadlec & Wallace, 2009) as post-treatment of technical systems are innovative approaches tackled within AquaNES through combination of natural and engineered systems to promote reuse of treated wastewater in arid regions.

Safety and compliance checking of drinking water supply systems is moving from substance based monitoring to **risk assessment** and risk management (RA/RM) approaches tailored to the context of the supply system (e.g. WHO Water Safety Plans, EC Stakeholder Forum on Revision Drinking Water Directive, 26 May 2015, Brussels). Nevertheless quantitative microbial risk assessment can also be a hurdle, as experts might not be available within especially smaller water utilities (WHO/UBA/IWA, 2014) and as quantitative microbial risk assessment (QMRA) is sometimes perceived as too complicated. AquaNES will develop operational RiskAssessment / Risk Mananagement protocols and monitoring tools which are beyond what is currently available and which enable to implement the RA/RM trend. One key feature shall be an easy-to-use online tool for QMRA which AquaNES will launch. The tool shall serve operators a guided instrument for QMRA without the need for own programming work.

Statistical analyses from full scale drinking water plants showed, that grab sampling of e.g. microbial parameter might not fulfil the data requirements needed e.g. to prove > 4 log removal during disinfection as the data density is too low. Increased monitoring frequency of microbial parameters using online tools thus can increase the safety of water production (Smeets, 2008). Therefore improvement of real-time monitoring based on core water quality parameters and new monitoring technologies is envisaged within AquNES in order to cost-effectively provide relevant information for the operations of cNES and to increase the data density for process performance validation. Nowadays, new monitoring technology is coming to the market that is ready for implementation, e.g. online sensors for microbial parameters, sensitive cell based bioassays for whole effluent assessment and detection of antimicrobial resistance genes.

A bottleneck for the implementation of (online) monitoring is how to deal with large amounts of data and how to extract relevant information from this data. One key approach is automated handling of data, which a) does not change the raw data and b) for which the calculation and data transformation is documented in a reproducible and transparent manner (Sonnenberg et al., 2013)(QQ). The use of the free software R for data handling and documentation data processing will be demonstrated within AquaNES.

Another bottleneck for the implementation of cNES is proper illustration of the robustness of the technique. The proposed innovative monitoring tools can show the robustness of the techniques. New methodologies for looking into data are being investigated (Che & Liu, 2014). Therefore, the project aspires to use data-aggregation and analysis techniques for the efficient unravelling of useful information from monitoring data.

[WP5] With regards to market uptake of cNES, AquaNES will expose those systems to a level of critical scrutiny and, for the first time, undertake a systematic comparative analysis of their environmental, regulatory, economic and social dimensions. WP5 will use well established methodologies (e.g. life cycle assessment, ecosystem services) and apply them in novel ways to develop a holistic understanding of the impacts from cNES and their potential pathways to market. We will also apply highly innovative mechanisms for public and stakeholder engagement through gamification and citizen science initiatives. Both are the subject of growing interest for their potential to enhance community awareness and buy-in around environmental decision making processes (e.g. Conrad & Hilchey, 2011, Tolmie et al. 2014), but both have yet to be significantly explored in the context of treatment technology. The configurational and contextual variety of combined treatment systems makes the identification of generic principles and conclusions a particular challenge. However, the work undertaken within WP5 will allow professionals working in the water sector to make decisions on combined natural and engineered treatment systems with greater confidence.

[WP6] The main challenge when designing/operating a water or wastewater treatment plant is to decide on the suitable configuration among a large number of potential unit process combinations (Patil et.al, 2014; Hamouda, 2011). Currently, most approaches focus on satisfying water quality constraints, regardless of other parameters including socio-economic and environmental sustainability (Joksimovic, 2008; Hamouda et. al., 2009). The AquaNES DSS, to be developed in the context of WP6, will allow the design and analysis of water and wastewater treatment configurations, embedding natural water treatment processes. It will widen the scope to a more holistic approach, which will cover not only the hydrological but also the ecological and socio-economic aspects. WP6 will also address the currently fragmented approach in decision making. It will provide a concrete decision framework, covering all decision making stages. The AquNES DSS will also provide a platform for integrating a suite of modelling and decision support tools (DSS Tools), enabling their seamless operation through proper communication protocols, providing smooth data sharing/exchange and a common interface. An innovative knowledge-driven Reasoning System, based on a case-based inference engine (Anzaldi et al., 2014; Yang,

2 014), will also be developed, allowing end-users to easily perform complex operation sequences with no special training. The exploitation of the information embedded in the Knowledge Repository will enable industries, SMEs, water utilities/authorities to use and knowledge on CNES technologies, enhancing networking in the market and among professionals. This will also ensure the marketability of the products beyond the duration of the project.

Table 2 Progress beyond state of previous projects (that influenced / drove AquaNES innovations)

Project Full name, acronym, GA / funding no.	Product / output / tool used in AquaNES and progress cp. to previous	WP, site where it will be applied	AquaNES partner involved
LbLBRANE	Modification of UF membranes by layer-by-layer technology Progress to be achieved in AquaNES: Demonstration in full-scale	WP1, BF, single well NF, Berlin	XFLOW
Joint German-Israeli cooperation program funded by the German BMBF and MOST	Hybrid process of biofiltration of secondary effluent followed by ozonation and short soil aquifer treatment for water reuse Progress to be achieved in AquaNES:	WP2, recirculated ozonated stream, Shafdan site	XYLEM, MEK
ASKURIS/IST4R (local funding, German BMBF and ERDF)	Comparison of different filters for post-treatment after ozonation (sand filter, biological activated carbon)	Used in WP3 as benchmark for constructed wetland	BWB, KWB, AKUT
	First short term application of closed-loop control for ozonation (target: trace organics)	WP3: improvement of reactivity + long-term validation for disinfection and trace organic removal	KWB, BWB, microLAN
Demeau	European MAR catalogue	WP7, catalogue will be used for market transfer	KWB, FHNW
Demoware (FP7 – GA No.619040)	Microbial risk assessment for water reuse	WP4, implement and demonstrate online tool for risk assessment	KWB, KWR
ELAN (German BMBF)	treatment performance of different constructed wetlands for effluent polishing (without ozonation)	Use of performance data for design of CW in AquaNES and as benchmark of cNES technologies	AKUT, BWB, KWB
Reclaim Water	Isotope tracing methods to characterise MAR	Agon-Coutainville/FR	BRGM
EcoWater FP7, GA No 282882,	EcoWater Toolbox SEAT modelling tool EVAT modelling tool EcoWater Technology Inventory	WP1, WP2, WP3	NTUA
Coroado, FP7, GA No 283025,	POSEIDON tool	WP1, WP2, WP3	FHNW
AquaStress , FP6, GA 511231-2	AquaDT tool	WP1, WP2, WP3	NTUA
GERF RBF in Arid Regions (German-Egyptian Research Fund)	Assessment strategies, indicator parameters to study the effect of extreme droughts on BF	WP1	HTWD
Saph Pani	Flood-proofing of BF sites; on-site enrichment of micropollutants in India for water analysis	WP1	HTWD, UJS
	Network for marketing	WP7	AUT

1.4.2 Innovation potential

Innovations derived in AquaNES cover new, improved technology combinations and configurations as well as predictive modelling and DSS tools. Moreover, the use of advanced monitoring tools to confirm required performance and aid operation as well as new operational set-ups and use in contexts will be demonstrated. A concise overview of the innovations and associated exploitation teams are listed in Table 3.

Table 3 Innovative products developed in AquaNES (technologies, design and operational support): * TRL of the demonstrated technology at the beginning and end of the project

Products & services already on the market / State of the Art	Innovated product / service demonstrated through AquaNES	TRL start *vs* end*	Exploitation team in AquaNES & ambition
BF in combination with aeration, sand filtration and AC filtration	BF combined with membrane technologies – ultrafiltration and dense membrane processes to remove organic micropollutants and pathogens	6 → 7	WP1: NUPS, DREWAG, HTWD, AMU; setting new standard for BF-membrane filtration in Europe
BF and conventional disinfection using Cl_2 and Cl_2O	Market ready coupling of BF with small and large scale on-site electrochlorination modules for disinfection; optimized usage of Cl_2 + UV and ozonation for disinfection	6 → 8	WP1: HTWD, AUT; BUWW, NUPS; Indian associated partners; opening significant market in Asia
Closure of BF schemes during floods or operation with higher chlorine dosage	Innovative concepts for well operation & protection during floods and droughts, DSS	5 → 7	WP1: BUWW, HTWD, new quality/scope of prediction+DSS tools
Centralized treatment of all bank filtrate in waterworks	Decentralized targeted partial treatment, new type of optimised nanofiltration membrane for an-/suboxic bank filtrate	5 →7	WP1: KWB, BWB, XFLOW - first application, new module, development of market
Novel siphon well systems	Design tool for siphon systems	6 → 8	WP1: HTWD, DREWAG
Infiltration basins with limited infiltration capacity and prone to clogging	High velocity infiltration of excess urban run-off; Innovative application of fuzzy filters enabling fast subsurface storage of storm water and reuse	6 → 8	WP2: KWR, HYBU; demonstration and worldwide roll-out
AOPs as final treatment step (e.g. Waternet in NL)	Enhanced bio-degradation of organic compounds during soil passage by pre-oxidation with AOPs addressing refractory compounds	5 → 6	WP2:FHNW, IWB, XYLEM - first application, development of market
Advanced oxidation processes based on UV/H_2O_2 or ozone	Chemical free and less energy demanding electric pulse oxidation process to decrease residual DOC and micropollutants	6→ 7	WP2: MEK, WADIS - Demonstrate effectiveness, prepare for market
Energy intensive double membrane processes for indirect potable reuse	Membrane-free, less energy demanding indirect potable reuse scheme. Recirculation of ozonated water for enhanced DOC removal	6 → 7	WP2: MEK, XYLEM - Demonstrate groundbreaking technology
CW for treatment of wastewater for small communities (Vyzmal, 2005)	Combination of CW treatment with photocatalytic oxidation and membrane filtration: solar photocatalysis as pre-treatment to significantly reduce land requirements and cost of CWs, subsurface CWs as pre-treatment for ultrafiltration (UF) to significantly reduce membrane fouling	5 → 7	WP3: NTUA, DEYAT, AUT microLAN Demonstrate novel process configuration, roll-out small communities
CW for treatment of wastewater for small communities (Vyzmal, 2005)	Validation of technical and economic viability of the treatment systems under seasonal variations of hydraulic and pollution loads.	5 → 7	WP3: NTUA, DEYAT – Knowledge base for scheme design

Products & services already on the market / State of the Art	Innovated product / service demonstrated through AquaNES	TRL start *vs* end*	Exploitation team in AquaNES & ambition
CW (retention soil filters - RSF) for single treatment of CSO (Scheurer et al., 2015)	Evolve from stand-by / occasionally used infrastructure to polishing of WWTP effluent during dry weather flow in one system focussing on additional removal of pathogens by the CW and of micropollutants through amending the system with e.g. granular activated carbon layer	6 →7	WP3: EV, AKUT, Establish worldwide 1st full-scale reference of RSF ap-plication. Demonstrate removal capacity & benefits for the receiving water
CW alone for polishing of WWTP effluent (Llorens et al, 2009)	CW with ozonation pre-treatment (with operational control of ozonation unit via online monitoring) for advanced removal of micropollutants, degradation of transformation products generated by ozonation, improved removal of antibiotic resistance genes and pathogens by combining treatment steps	5 →7	WP3: KWB, BWB, XYLEM, AKUT Demonstrate upgrade options for large number of established CW to enhance performance
Biological nutrient removal plant in combination with coagulant dosing for phosphorus (P) removal	Combination of oxidation ditch based WWTP and microalgal photo-bioreactor for nutrient removal of both P & N to very low levels (< 0.3 mg/L). Immobilisation of microalgae in alginate beads for cost-effective harvesting of the algal biomass and option for energy recovery from anaerobic digestion	5 →7	WP3: UCRAN, WatStech Provide low cost and low energy options for wastewater polishing with opportunities for nutrient recovery
Conventional biological treatment plant in com-bination with coagulant dosing for P removal	Combination of oxidation ditch based WWTP and low energy, chemical free CW with steel slag as reactive media for phosphorus removal to low levels (< 0.3 mg/L)	6 →7	WP3: UCRAN, WatStech Demonstrate value of waste material use in wastewater treatment.
Current monitoring acc. to legal requirements often lacks knowledge about specific risk determining aspects	Development of a more integrated chemical and microbiological water quality monitoring approach for cNES to inform adapted risk assessment & management.	5 →7	WP4: KWR, KWB Demonstrate methodology with end-users, roll-out in the water sector
Indicator organisms and cultivation technique based microbial monitoring	Improved on-line microbiological monitoring techniques with short analysis time; screening techniques based on (meta)genomics; microbial community fingerprinting; antibiotic resistance genes	4/5 →6	WP4: KWR, microLAN, KWB, BWB Demonstrate methodology with end-users, roll-out in the water sector
Classical, punctual monitoring procedures with no connected data analysis support system	Operate SAT and recharge scheme constraining saline intrusion with SMD (Subsurface Monitoring Device). Real time, calibrated and dynamic monitoring system to enhance groundwater quality for water reuse.	7 →8	WP2: Imageau/BRGM Demonstrate MAR/SAT performance through dynamic monitoring of water resources quality and availability
Suite of independent modelling programmes to depict processes in individual treatment train components.	ICT solutions for water managers, via a connected decision support system, for efficient monitoring and management of hybrid systems including SAT-MAR connecting surface treatment processes to groundwater quality evolution.	5 →7	WP2/6: BRGM, Geohyd, Market introduction of integrated modelling tools for end-users to manage schemes in compliance with groundwater quality targets
Individual tools to assess and depict system performance	Decision support system for cNES, improved and validated tools, based on their application in the demonstration sites and on their integration into a versatile DSS (GIS components compliant with provisions & standards of the INSPIRE directive)	5 →6	WP2/6: NTUA, Geohyd, BRGM, AMU, HTWD Demonstrating usability and benefits by end-users

Products & services already on the market / State of the Art	Innovated product / service demonstrated through AquaNES	TRL start *vs* end*	Exploitation team in AquaNES & ambition
Software solutions tending to out-date, low flexibility and higher workload for user	Automatized data analysis and risk assessment workflows based on open source software enables flexible tailor fit solutions	5 →7	WP4/6:KWB, KWR Demonstrate methodology with end-users, roll-out in the water sector

2 Impact

2.1 Expected impacts

2.1.1 Wide and fast deployment of sustainable innovative solutions in the water management sector and contribution to the implementation of the EIP 'Water'

The water sector does not readily implement innovative technologies and processes in the absence of a systematic evaluation of their industrial scale operation. To support the goals of the European Innovation Partnership on Water AquaNES will:

- deliver a series of comprehensively field-tested combined natural and engineered water treatment trains,
- demonstrate their technical and environmental performance including comparisons to benchmark technologies with respect to treatment effectiveness, energy demand and cost. In doing so it will offer water sector professionals greater confidence in making decisions on the design, implementation and management of combined treatment systems,
- increase the Technology Readiness Level of several process combinations, typically from 5/6 to 7/8 (table 3),
- provide the contextual information and tools that water managers and authorities require to preference innovative combined natural and engineered water treatment solutions.

These outputs will be shaped by the active involvement of the water sector and will form the cornerstone of further market penetration. Rapid deployment of these innovative solutions within two to three years of demonstration in the AquaNES project will be supported by market analysis and an exploitation and dissemination strategy (see Section 2.2). We will ensure awareness of tested solutions through dissemination activities and close collaboration with related EIP **Action Groups** (e.g. AG128 Managed Aquifer Recharge Strategies and Actions, AG100 RTWQM – Real Time Water Quality Monitoring and AG228 NatureWat - Nature-based technologies for innovation in water management) of which AquaNES partners are members.

We will **foster the uptake of solutions** by addressing two of the **cross-cutting priorities of the EIP 'Water** ('Water governance', and 'Decision support systems and monitoring'). Specifically, the outcomes from WP5 will allow the deployment of combined systems to be more ambitiously specified within an appropriate environmental, regulatory, and societal context. Further support is provided in WP6 by (a) supporting a holistic approach to the design, operation and assessment of natural and engineered water systems and (b) providing improved and direct access to information and resources for such systems. It is also relevant to the thematic priorities on (a) 'flood and drought risk management', through the integration of relevant risks for the development of appropriate operational strategies, and (b) 'ecosystem services' by providing tools to develop preliminary assessments of how the AquaNES systems contribute to sustaining and further enhancing ecosystem services.

These actions will **increase the full-scale implementation chances of combined systems significantly** and deliver a competitive advantage for both the solution providers and end-users in the water sector. Market chances will also be generated for the export business through demonstration outside Europe (e.g. in Israel and India).

As many of the demonstrated solutions could support a range of process industries in their efforts to cope with water challenges, market potential across these sectors will be explored. Through dissemination and exploitation activities we will illustrate how industry can increase sustainability. This will be complemented by increasing awareness on water value and social conscience on sensible use of this resource - in support of SPIRE PPP ambitions on sustainable water management and resource efficiency as described in the **SPIRE PPP roadmap** and Key Action 1.3: Optimal and integrated (re) use of water. An explicit ambition of AquaNES is to improve our understanding of how **consumers understand, value, and trust different forms of treatment processes**. In doing so, we will be informing the rich debate

around the social and economic value of water. Outputs from WP5 on these issues will play an important role in shaping future attitudes and behaviours.

2.1.2 Market penetration and demonstration, long-term application and sustained use by various end-users

The AquaNES activities are tailored to stimulate long-term application of successful and sustainable innovative solutions. We carry out extended on-site demonstration of large scale cNES with comprehensive testing and definition of operational procedures and limits, performance, environmental sustainability, etc. This will feed into water quality control and risk management frameworks to assure systems safety and regulatory requirements fulfilment based on the WHO Water Safety Plan concept.

cNES are to become **competitive with more traditional solutions**. WP5 will deliver evidence and guidance to ensure that the full value of combined treatment systems is taken into account when such assessments are being made. WP6 will provide, through the developed decision support platform, the opportunity to **maximise the replication potential** of the AquaNES innovations, and help to identify relevant economic incentives and strategies for accelerated uptake. It will also enable e.g. planners and end-users less familiar with natural treatment systems to perform an initial assessment of the feasibility and hence include those options in the further stages of planning if deemed appropriate (e.g. initial design, detailed design). To ensure effective market penetration and demonstration WP7 will develop detailed exploitation plans for each tested technology, product or service and follow bespoke dissemination strategies among which will be three specialised conferences/workshops organised at international level (e.g. during water fair WasserBerlin 2017) on BF, MAR and CW to achieve better market penetration.

2.1.3 Creation of new market opportunities both inside and outside Europe

The management of aging water and wastewater treatment assets poses additional challenges to countries in Europe or the United States (WssTP, 2010; US EPA 2014). These **challenges require innovative technologies and represent market opportunities** in a number of areas as reflected in current estimates of the growing global water market for water-related equipment and operations reaching $696 billion (CAPEX and OPEX) in 2018 (GWI, 2014). We identify clear growth potential in a number of fields and technology market segments such as NF membranes, smart water sensors or software, and advanced oxidation processes combined with natural treatment components:

Extending existing markets: Replacement and upgrading of infrastructure to comply with new requirements will be one of the major opportunities: Natural treatment technologies are already practiced **in Europe** to a great extent, i.e., around **270 MAR sites** out of which 145 (54%) are induced bank filtration (BF) facilities followed by infiltration ponds & basins (23%) and well, shaft and borehole recharge systems (16%). More than half of all these sites are located in Germany and the Netherlands. MAR systems play an important role in the European water supply and especially induced bank filtration produces large water quantity. 60% of Berlin's drinking water (120 million m^3/year) is based on MAR (Site No. 1). Similarly, 60% of Basel's drinking water (16 million m^3/year) derives from MAR through Soil infiltration (Site No. 6). Along the rivers Rhine and Danube bank filtrate serves > 20 Mio. people. In Hungary, for example, MAR sites contribute to approximately 60 % of the public water supply, in Slovakia to about 55%. In France and the Netherlands drinking water supply is fed up to 50 % by BF and 16% dune filtration respectively (Grützmacher et al., 2013; Hannappel et al., 2014). The combination of those already proven natural components with engineered options allows **addressing several key challenges** such as enhanced **removal of persistent compounds**, coping with water quality and water quantity changes as well as limited space availability. Combining strengths of both technology classes and mitigating their weaknesses through smart combination will create new market opportunities for involved solution providers. *Based on the assumption that every second water utility using BF in Europe needs to improve the treatment process within the next 10 years and an additional treatment step (e.g. membrane filtration) would cost 1 to 10 million Euro depending on the waterworks capacity, we estimate the required invest to at least >50 million Euro per year.* **Constructed wetland**s with horizontal sub-surface flow as viable alternative treatment for wastewater with small sources of pollution (organics and suspended solids) are used **throughout the world**. Over 50,000 horizontal subsurface flow constructed wetlands are in operation Germany, ca. 1,000 in Austria, ca. 800 in the UK, ca. 300 in Italy, around 160 in the Czech Republic and 120 in Poland or Portugal. In North America around 8,000 horizontal sub-surface flow constructed wetlands are estimated (Vymazal, 2005). Combinations with engineered elements to increase removal efficiencies and reduce land requirements are essential to preserve the advantages of this low-cost, low-energy and ecosystem services providing treatment solution. This understanding is reflected e.g. in Israel where 5-15 Mt/d combined sewer wetlands with integrated technical solutions for water re-use are part of actual tenders. In Greece (Site No.10) and other Mediterranean regions with remote areas such as islands with limited natural water resources and high tourist driven seasonal demand, constructed wetlands have considerable potential in terms of water reuse and recycling for various purposes.

Assuming that 25% of 100 remote sites in Greece will select constructed wetlands with integrated engineered elements for wastewater treatment (ca. 2 million Euro per system), around 50 million Euro could be generated.

Provide low-cost, low energy solutions to new markets: Through our demonstration sites in Hungary and Poland (Demonstration sites No. 3 and 4) we will directly **reach out into the eastern European water sector**, where a strong need for improvement of water treatment is recognised. Further investments are also necessary to achieve conformity with EU wastewater legislation e.g. compliance with UWWTD targets are still below 40% for Estonia, Poland, Bulgaria, Romania and Slovenia (EC, 2013c). A recent study has estimated implementation cost of 12 billion EUR for achieving this and 230 million EUR for providing wastewater services to smaller agglomerations, for Poland only (SGE, 2013).

Since, recent water reuse projects such as the IWVA scheme at Torreele/Belgium and Singapore's NEWater programme have demonstrated that the reuse of treated **wastewater for** high-value urban applications such as **indirect potable reuse** is an efficient means for the local adaptation and mitigation to climate change and the diminishing water resources (GWI, 2010; WssTP, 2010), additional market shares are expected in this sector. The 'current gold standard' for direct and indirect potable reuse uses energy intensive and costly UF & RO processes yet the combination of ozone / AOP oxidation with natural soil treatment can reduce OPEX and CAPEX by more than 50% and thus is an attractive alternative to membrane based processes for reusing water (Site No. 7). *According to GWI (2010), UF Membranes for drinking water applications have an estimated market value of 330 million USD in 2016, Xylem therefore estimates up to 30 million EUR additional turn-over within the next 6-7 years due to the introduction of an alternative indirect potable reuse scheme.*

Outside Europe the implementation of cNES poses an even greater potential, specifically in achieving the post-2015 Sustainable development Goals (i.e., 'Goal 6: Ensure availability and sustainable management of water and sanitation for all' and protection and restoration of ecosystem services of aquatic and terrestrial ecosystems as per Goals 15 and 16') in developing and emerging countries such as India where one of the demonstration sites is placed. Asia will be one focus of exploitation activities. For example, on-site production of disinfectants by electrochlorination will be studied at different scales at a site in India, where a *market of several million EUR is expected for the SME (AUT) involved* Overall the international market in Asia, America and Africa has a huge potential for low-cost and medium-cost treatment systems. Growth rates of the municipal water market in Southern Asia is larger than 5% per annum and just in China to where some of the demonstrated technologies can be exported both the municipal water and wastewater market is expected to reach 20 billion USD each in 2015 (GWI, 2014).

The development of new market opportunities will also be directly fostered through the integration of results from the innovation demonstration in the AquaNES **Decision Support System**. The **knowledge base** and the attached modules will allow users (mainly water managers, planners and authorities) to investigate the potential application of solutions and their impact in application cases in Europe and other areas.

Reach technology market segments: For the each of the innovative products and services demonstrated within AquaNES it is expected that commercialisation can be achieved soon after project completion with deployment at full scale within two to three years. The **expected number of installations** or applications will range from several initial sites for very specific technologies (e.g. electric pulse technology) with great potential for broader uptakes internationally in the medium term to rapid market uptake for other solutions (such as *for ozone pre-treatmment equipment and control is estimated at > 4 million € through 5 years).*

- *microLAN:* Expected increase in sales of BACTcontrol™ system from 800,000 € in 2015 to *2 million € in 2018.*
- *BDS:* The size of water monitoring market in 2020 is forecasted at 1.6 billion (EPEC, 2011), additional turn-overs of *2-5 million €* are expected, depending on implementation in regulatory framework and standardisation.
- *imaGEAU*: In Europe, soil and groundwater monitoring and remediation technologies are estimated to rise up to 2.7 billion € in 2020 (EPEC, 2011), imaGEAU expects sales of the Subsurface Monitoring Device (SMD) *of > 10 million EUR until 2018.*
- *EV*: Assuming that 10% of 38'000 combined sewer outflows (CSO) need to be refurnished in Germany, the size of potential market is 3'800 CSOs which could be upgraded with Retention soil filters (RSF_{WWTP+}). During AquaNES, 5 RSF_{WWTP+} installations per year are expected (costs of filter: 2 million *€)* generating an *additional turn-over of 50 million € until 2018*.

2.1.4 Increased resource efficiency and environmental performance of the water sector

The environmental assessment of technological interventions to be pursued in the demonstration sites will evidence the optimised use of resources and the reduced ecological footprint of the combined treatment technologies. Savings are

anticipated not only with respect to energy but also material intensity and chemical requirements. Water utilities will be expected to improve their **performance indicator** for "Materials, chemicals and other consumable costs". The exploitation teams at the demonstration sites are composed of water utilities (e.g. BUWW, BWB, EV, DEYAT, DREWAG, IWB), SMEs (e.g. AUT, AKUT, HYBU, WatStech, microLAN, WADIS) as well as industry (XYLEM, XFLOW) and research organisations. These intensive collaborations will facilitate early agreement and tuning of needs and expectations, thereby hastening execution of both the demonstration activities and subsequent exploitation initiatives. That way we achieve synergies between public water authorities, water utilities, various economic actors and sectors, major companies and industries, SMEs and research organisations.

2.1.5 Significant reduction in (fresh) water use

Several of the demonstrated AquaNES solutions help to better manage regional or local water cycles by efficiently and safely augmenting groundwater or incorporating water reuse into the water supply portfolio. In consequence, this will **lower the demand for freshwater abstraction from conventional sources** particularly through water solutions which can provide high quality water for various uses, e.g. irrigation but also indirect potable reuse. Examples are system combinations aiming at e.g. irrigation at the Greek and French sites (Sites no. 10, 11 & 8) and indirect potable reuse in Israel (Site no.7).

AquaNES will particularly support the ongoing policy initiative started under the Blueprint for Water to promote the development of water reuse in Europe and achieve more uniform criteria for different water reuse applications, e.g. in agriculture. Demonstration results from AquaNES will feed into the process of establishing typical performance criteria, monitoring methods and design approaches which can be beneficial for the overall water reuse development in Europe.

2.1.6 More than 50% reduction of energy demand in water supply, treatment and transportation

The European Benchmarking Co-operation (2014) published the international benchmark for water and wastewater using data of 2013 from 48 water and wastewater utilities from 17 different countries. The median electricity consumption for drinking water was 0.46 kWh/m^3 per m^3 water produced - including abstraction, pumping and treatment. The energy consumption for wastewater treatment is fairly distributed between 23 and 43 kWh/p.e., with a median score of 30 kWh/p.e. served. Another set of general estimates of energy intensity in European water supply gives a range of 0.5–4 kWh/m^3 for surface water, 1–6 kWh/ m^3 for recycled water, and 4–8 kWh/m^3 for desalination (WssTP, 2011). AquaNES aspires to identify and **demonstrate significantly less energy intensive process components and combinations** for a variety of applications. The project AquaNES will contribute to reducing the overall energy demand of water sector by

- Demonstrating natural treatment systems such as constructed wetlands or soil retention filters as low energy alternatives compared to purely technical systems. In combination, energy demand could be lowered by ca. 20-50% (WP3).
- Proposing operational schemes which allow the coupling of treated water flows to variations in delivered solar power. Ideally during day-time full supply by solar power shall be possible, resulting in >50 % reduction of primary energy demand (WP3).
- Some of the demonstration sites will validate the performance of technological options which can e.g. replace energy intensive double membrane systems for indirect potable reuse which are state of the art and consume around 1.2-1.6 kWh/m^3. With the combination of oxidation, biofiltration and soil-aquifer treatment this energy consumption can be potentially lowered to around 0.6 kW/h/m^3, even with additional safety disinfection in the reclaimed product water (WP2).
- The design support tool for siphon systems for BF schemes could prevent the currently frequent closure of such systems and catalyse a “renaissance” of siphon applications which could, in turn, be operated with sophisticated vacuum and control devices to reduce the energy consumption for water abstraction via wells by >50% (WP1).

2.1.7 Support to the implementation and evaluation of technology verification schemes, including the EU Environmental Technology Verification Pilot (ETV) programme.

AquaNES will support the EU Environmental Technology Verification Pilot programme in so far as the requirements for ETV verification will be included in the planning of the demonstration phase. As an output of our demonstration we will formulate claims on the performance and environmental benefits of the tested technologies and thereby prepare for 'independent and credible evidence of its advantages' (ETV, 2013). Application to actual verification may be considered in the exploitation plans of selected technologies. We will foresee a budget for co-fund ETV programme participation for two selected technologies from the AquaNES portfolio.

2.1.8 Other environmental and socially important impacts: Responsible innovation

Greening of water infrastructure, i.e. the integration of natural or semi-natural systems in overall water treatment and supply systems, is becoming increasingly recognized as an opportunity for addressing complex challenges of water management (UNEP, 2014) and as means to halt ecosystem degradation and biodiversity loss, i.e., Target 2 of EU Biodiversity Strategy to 2020 (2011): *'By 2020, ecosystems and their services are maintained and enhanced by establishing Green infrastructure and restoring at least 15% of degraded ecosystems'*. AquaNES will demonstrate cost-effective, long-term ecosystem-based water treatment and supply infrastructures which support ecosystems' integrity and thereby maintain the stream of valuable goods and services (e.g. water purification through soil infiltration or biodegradation of pollutants) to all members of society. This commitment to responsible innovation underpins our project's ambition and execution. **AquaNES will deliver processes, products, and services which drive both social and environmental benefit.** We believe that such a strategy anchors the innovation process in common European values (Sutcliffe, 2011) such as sustainable development, balanced economic growth, social progress, a high level of protection and improvement of the quality of the environment, and the promotion of scientific and technological advances. We will achieve these ambitions through a number of mechanisms including; (i) embedded continuing stakeholder involvement in our workplan to ensure that considerations of the public good are reflected in our actions and outputs, (ii) regular reviews of risks and opportunities allow us to prioritise formal assessment of the social, ethical and environmental impacts of the solutions being developed, (iii) robust oversight mechanisms which support us to anticipate and problems and opportunities and adapt and respond quickly to changing knowledge and circumstances, and (iv) promotion of openness and transparency along the innovation process.

2.1.9 Barriers and obstacles setting expected impacts at risk

Realising the expected impacts from the project will depend on a number of factors internal and external to the AquaNES. The successful demonstration and exploitation is essential, namely achieving the expected robust treatment performances in the full and pilot scale tests with the envisaged benefits in terms of limited energy and chemical demand as well as low maintenance requirements. Moreover, the AquaNES innovations have to go beyond the technical progress and reach out to the market through fulfilling requirements by end-users. This will challenge the AquaNES partners to interact successfully with stakeholders inside and outside the project. Market pull will depend on a number of external factors such as regulatory frameworks in Europe and beyond, e.g. the further development of a more harmonised framework for water reuse in Europe as currently envisaged by European Commission activities (DG Env and JRC) and availability of financial resources to invest in a more climate change resilient water infrastructure under the current economic constraints in most European countries. AquaNES will actively address the full range of challenges, potential barriers and obstacles to the more wide-spread implementation of cNES through integrating technical, human health and environmental aspects with socio-economic dimensions and advances of business options fitting to both market needs and profiles of the companies involved in AquaNES. In summary, AquaNES fully embodies the necessary innovation activities to address the existing uncertainties stakeholders face in fully exploiting the huge potential of combined natural and engineered water and wastewater treatment systems delivering high quality water for different purposes

2.2 Measures to maximise impacts

To achieve an improved confidence in the design and operation of combined natural and engineered systems and foster successful market-uptake of AquaNES innovative technologies, products and services, different exploitation (Section 2.2.1) and dissemination (Section 2.2.2) activities and measures will be taken during and after the project period. AquaNES innovation activities (particularly demonstration & validation in WPs 1-4 and exploitation in WP7) form essential elements in the pathway to deliver innovative products and services to market. The valuation of ecosystem services (WP5) and a suite of decision support tools (WP6) will form a solid basis to disseminate knowledge and learning on cNES more widely and promote their further implementation (WP7), strengthening and stimulating the market for the exploitable results (Figure 3). Different elements of the AquaNES innovation activities such as the exploitation and dissemination pathway are illustrated in the coming sections.

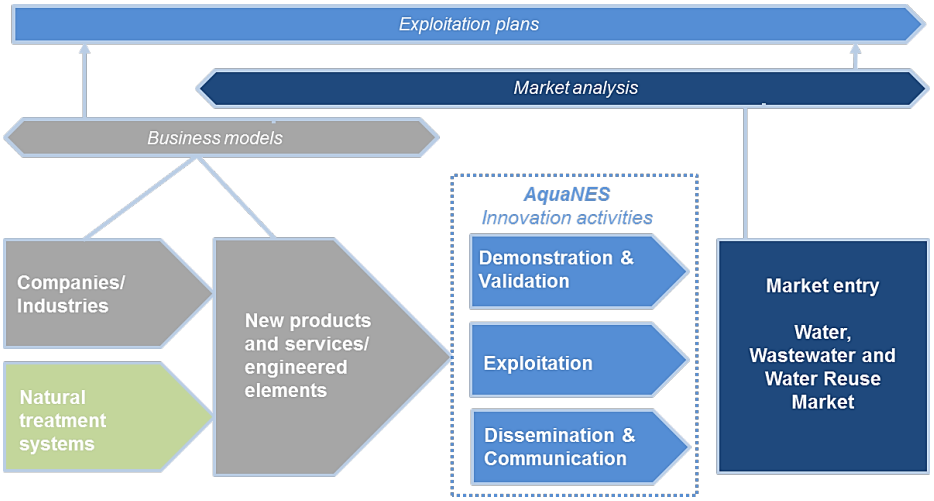


Figure 3 Innovation activities of AquaNES project

2.2.1 Exploitation

The AquaNES exploitation strategy aims to achieve **market-uptake** of promising combined natural and engineered treatment technologies, products and services **within 2 – 3 years** after the end of the project. AquaNES comprises a variety of exploitable innovations ranging from (waste)water treatment and monitoring technologies to services such as software tools for decision-support and new approaches and methodologies (Table 3) and involves commercial partners and industries who will profit from successful demonstration and validation of their products in different demonstration sites (Table 4).

Table 4 AquaNES commercial partners and products

Sector:	Commercial partner/ industry	Product	Demonstration site
pre-& post treatment technology providers	XFLOW	Capillary NF membrane (capNF)	WP1: Site No. 1
	AUT	Inline electrolysis system (SuMeWa|System)	WP1: Site No. 5
	WADIS	Electrical Pulse Oxidation Process (EPOP)	WP2: Site No. 7
	XYLEM	Diverse advanced oxidation processes (divAOP)	WP2: Site No. 6/ 7 WP3: Site No. 12
	HYBU	High velocity infiltration filter (Fuzzy Filter)	WP2: Site No. 9
	EV	Retention Soil Filter (RSF_{WWTP+})	WP3: Site No. 11
	Watstech	Microalgal bioreactor (AlgaeBead)	WP3: Site No. 13
Monitoring technology/ devices provider	microLAN	Online microbiological monitoring technique (BACTcontrol)	WP1: Site No. 2 or No. 5; WP2: Site No. 9; WP3: Site No. 12
	BDS	Bioassays for screening toxicological effects (CALUX® assays)	Two sites each in WP1, WP2 and WP3. Priority to sites with AOP (No. 4, 6, 7, 10, 12)
	imaGEAU	Subsurface Monitoring Device (SMD)	WP2: Site No. 8

Sector:	Commercial partner/ industry	Product	Demonstration site
Software service providers	Geohyd	Modelling software for management of hybrid WWTP/SAT systems (WWTP/SAT modelling)	WP2: Site No. 8
Design and consultancy service providers	AKUT	Design and engineering of (waste)water treatment solutions, Consultancy (ecological engineering)	WP3: Site No. 10

AquaNES innovations are aimed at different target markets in the water sector (drinking water, wastewater, water reuse) and diverse key areas of application. Distinct exploitation routes and commercialization roadmaps will need to be created and individual strategies (i.e., goals and measures) formulated and implemented based on consideration of companies' resources and an assessment of the internal and external environment the company or industry competes in. For each AquaNES innovation tailored exploitation plans, addressing aforementioned aspects, will be specified and deepened in WP7 by the AquaNES consortium forming Innovation Exploitation Teams. These are composed of AquaNES commercial partners supported by other project entities as outlined in section 3.2 'Management structure and procedures'. Key components of exploitation plans are market analysis and business model development forming the basis of strategy formulation and implementation.

Macro- and microenvironment analysis and assessment of the market potential for exploitable products/services

We will characterize relevant markets and market segments for different geographical regions as well as different types of application: water and wastewater sector, water reuse markets. The analyses will provide a picture of the **market size** (i.e. number of customers) and **economic opportunities** (i.e. sales revenues for existing products) and identify opportunities resulting from technology synergies and complementarities.

In WP7, we will specifically analyze the companies' macro- and microenvironment to come up with comprehensive understandings of how the company or industry can compete in existing settings. We will

- conduct country specific ***PESTLE-analyses*** (political, economic, social, technological, legal and environmental factors) to assess opportunities and threats deriving from the external macro-environment and to understand market development and opportunities (Fahey & Narayanan, 1986);
- apply the ***Porter 5 forces analysis*** to understand the level of market competitiveness which is manifested by five forces in the company's microenvironment (i.e., threat of substitute products or services, threat of established rivals, threat of new entrants, the bargaining power of suppliers and the bargaining power of customers) that determine the profitability of a business (Porter, 1980);
- and conduct ***SWOT-analyses*** to evaluate company/innovation internal strengths and weaknesses against external opportunities and threats to recognize their competitive advantages.

AquaNES exploitation teams will periodically review current and future water market trends to estimate evolving opportunities and threats for the product's positioning on the market and to ensure that exploitation strategies are well informed.

Generate business models for AquaNES innovations:

We will utilize the business model canvas approach (Osterwalder & Pigneur, 2010) to describe a set of core strategic aspects related to our companies' businesses, which derive from the understanding of companies' environmental analyses, i.e., which values (social, economic, environmental) the company creates with its product (**'value propositions'**), how they maintain their relationships with target customers (**'customer relationships'**), which **channels** they rely on to deliver 'created values' to their customer segments. Moreover, business model canvas describes **company internal structures, infrastructure and resources**. The visual representations of our partner companies, their resources and how they do business will provide a shared language and lead to candid understanding and constructive conversations within the innovation exploitation teams when creating exploitation plans and exploring possibilities for future development on the basis of analyzed market trends, threats and opportunities.

The Canvas in Figure 4 summarizes the business models of our commercial partners/industries and their products (listed in Table 4) structured into the nine Canvas Business Model categories. During the project period we will elaborate **individual Business Model Canvas for all AquaNES companies.**

Tailoring exploitation plans for each AquaNES innovation:

Drawing on both, the market analysis and business models, **a series of strategic actions for commercialization** will be formulated and implemented taking into account the companies' resources (e.g., partners, infrastructure, organizational structures) and competitive advantages. **Expected financial impacts will be quantified**. Exemplarily, Table 5 to Table 7 demonstrate 'draft exploitation plans' of AquaNES innvations for which we estimate to have considerable economic impacts. These include elements from a preliminary market analysis (e.g. trends, geographical market, size, customer segments and competitors), companies' business models (e.g. organizations key activities, value propositions/competitive advantages of innovative product), financial projections and a series of strategic actions formulated (Commercialization roadmap/Dissemination & communication actions) which will promote a successful market entry. Draft exploitation plans for all the innovations will be prepared which form the basis for further elaborating and individual tailoring.

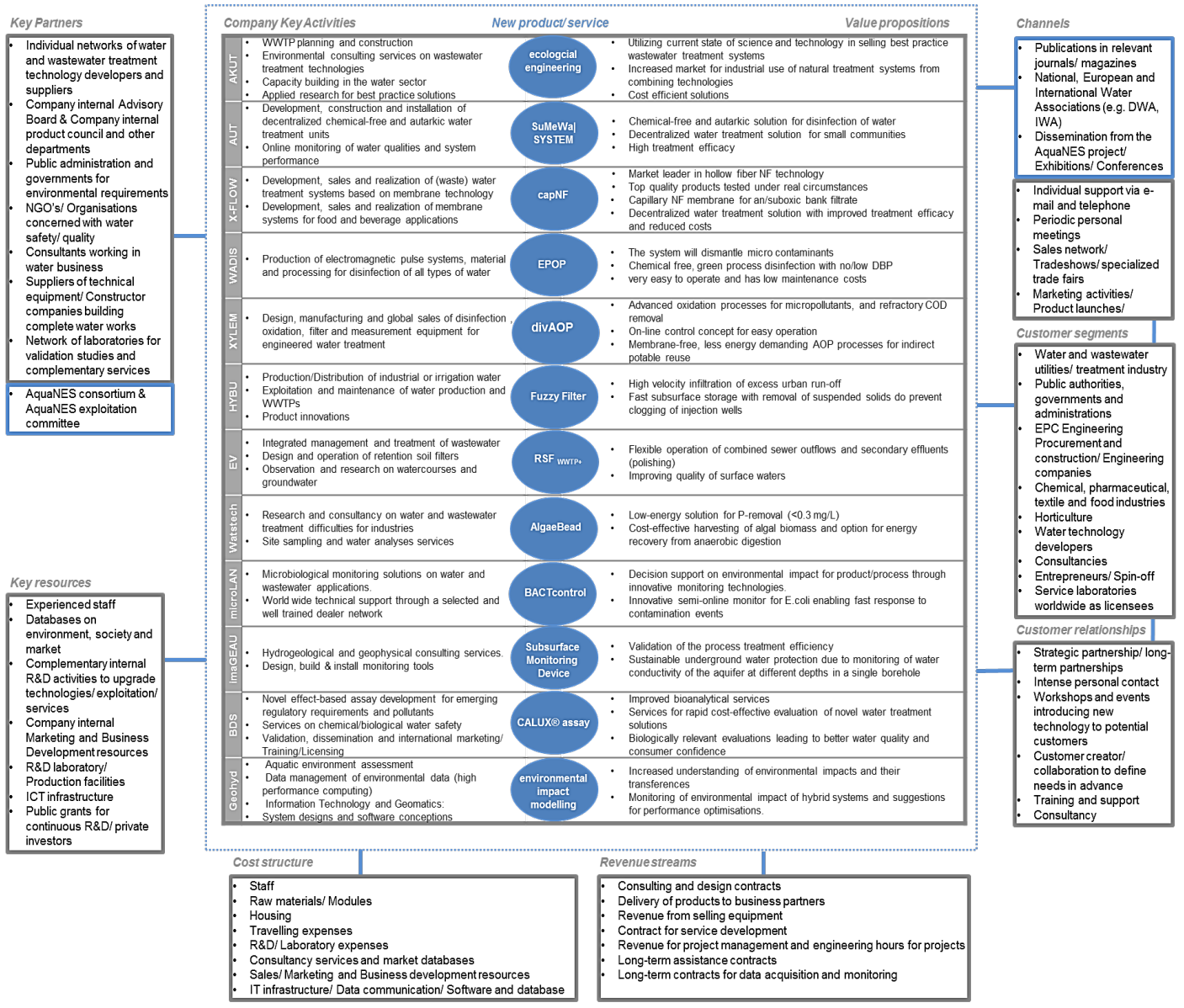


Figure 4 **Summarized business model canvas of AquaNES commercial partners. *Explanation:* A range of company internal categories (i.e. key resources, cost structure and key partners) form the basis to create and deliver value ('value propositions') to different costumer segments and thereby generate a profit (revenue stream) from a 'new product/service'.**

Table 5 Draft exploitation plans for capillary NF membrane in combination with BF (WP1)

WP/ innovation name	WP 1/ NF-WellCare
Key exploitable results	New type of optimised capillary nanofiltration (NF) membrane as pre-treatment for an-/ suboxic bank filtration Treatment targets: Biologically active bank filtration in combination with membrane filtration provide excellent product quality also with respect micropollutants and undesired inorganic constituents Development stage: The relatively open capillary hollow fibre NF (HFNF) type HFW1000 is commercially available and applied in treating surface water for drinking water production. The experiences with the development and production of the HFW1000 is the basis for a more tight and optimised HFNF for BF and applications Differences from competing product (**Value propositions**): hollow fibre NF (HFNF) has **fewer tendencies for fouling** than spiral wound NF (SWNF) and furthermore **can be cleaned using chlorine**. Applications that were not viable up till now, become economical viable.
Innovation and Exploitation Team	KWB, BWB, **Pentair.** Pentair (X-Flow) has gained exploit experiences from the FP7 LbLBRANE project to develop and produce the HFW1000 HFNF membrane on commercial scale. The HFW1000 is sold for full scale drinking water plants at the moment. It is expected that the optimised HFNF membrane in this project will be available for commercial applications before the end of the AquaNES project.
Expected key areas of application & customer segments	**Commercial application in drinking water sector as decentralized water treatment solution** with improved treatment efficiency and reduced costs. Industrial applications for optimized water reuse and further reduction of the water footprint.
Market	Trend/driver: Stricter requirements for product quality and consumer perception, emerging international markets Market: EU, US, East Asia Pacific Size: Global market of NF was 400 million $ (360 million Euro) (Frost & Sullivan, 2010). Newest figures estimate a NF market share of $445.1 million in 2019 with five-year compound growth rate of 15% (GWI, 2014). Membranes for water and wastewater treatment represent the largest share of the market ($338 million in 2019) primarily driven by sales of NF membranes for water softening, desalination, and wastewater treatment. Main competitors and **competitive advantage**: X-Flow (Netherlands), GE Water (USA), Siemens (Germany), Asahi Kasei (Japan), Hyflux (Singapore) and Kubota (Japan) are top producers of membrane filtration technologies (92% of market share in 2010). X-Flow's HFW1000 is an **innovative, chlorine-tolerant NF module** widely used in the production of process and potable water. . The tighter NF-membrane developed in this research will also be of interest for industrial applications. Its much smaller tendency for fouling in combination with its high chemical resistance opens possibilities for applications that were not economical viable up till now. HFNF is a one-step solution and therefore favourable compared to other technologies such as SWNF which requires pre-treatment including coagulant dosing and sludge processing. In remote areas and in situations where no continuous attendance of operators is available, HFNF is often the only robust option. The expected market share for the tighter NF-membrane comprises a yearly turnover of 6-7 million € within five years.
Financial projections	The project will speed up the market introduction of the existing NF membrane. Beside this 1 or 2 new membrane types shall move to the market. Expected additional turnover till 2020 will be **10 Mio €.** After 2020 a yearly turn over around 6-7 million € is expected. The payback of the tighter membrane development is expected in the second year after its introduction in the market during the project.
Dissemination and Communication actions	• Collaboration with local water supplier/works • Specialized trade fares (e.g. IFAT, Aquatech, Wasser Berlin)
Commercialisation roadmap/ exploitation routes	• Demonstrate performance and cost effectiveness in pilot trials. Use results for paper publication • Establish benchmark NF site to current practice. • Obtain the required certifications for drinking water applications. • Process optimisation for full scale applications. • Direct commercialisation and production
Risk assessment	Low risk since market ready NF membrane is used, sustainable permeat flux levels and cleaning protocols need to be confirmed ,
IPR management	NF-membrane licensed by Pentair

Table 6 Draft exploitation plan for inline electrolysis in combination with BF (WP1)

WP/ innovation name	WP 1/ SuMeWa|BF
Key exploitable results	Description: Market-ready coupling of BF with small and large scale on-site electro-chlorination (inline electrolysis) modules for disinfection Treatment targets: Oxidation and disinfection Development stage: System Adaption and demonstration Differences from competing product **(Value propositions):** Autarkic and robust system, high reliability, flexibility and monitoring options. Decentralized water treatment solution, improved treatment efficacy
Innovation and Exploitation Team	**AUT, UJS,** HTWD,: UJS is a water utility with excellent performance in India and received various awards for improving drinking water supply by innovative solutions; AUT has many international projects for groundwater disinfection and will expand to couple BF and its systems
Expected key areas of application & customer segments	**Commercial application in drinking water sector.** Thousands of **small villages in remote areas** with difficulties in ensuring storage of chemicals for disinfection, access for maintenance staff. Also application for removal of arsenic possible (on-going other project). Large scale application at wells with high production rates affected by flooding and emergency relief.
Market	Decentralized off grid drinking water supply: Trend/driver- **Legislation**: Drinking water regulations and sustainable development goals tend to more stringent guideline values for organic micro pollutants and pathogens in Europe. Given standards are not met in most developing regions. Worldwide nearly 700 million people have no access to improved water sources. 79 % of such live in rural areas (WHO, 2015). The number of people without access to water, that meets the given guidelines is expected to be by far higher. Progressive water safety improvement Most recent improvements of water supply in rural areas has been achieved by drilling new wells or the supply of water by tankers. However, no reliable decentralized technology for water treatment in these regions is available. Thus people have to drink unsafe or buy bottled water. Thus there is a stringent need and demand for decentralized, reliable, small scale and easy-to-maintain water treatment solutions that meet the drinking water regulations. BF substantially reduces treatment requirements to achieve drinking water quality and thus costs and maintenance efforts. After BF generally only residual disinfection is required as treatment step in order to achieve drinking water quality. Only in special incidents further treatment is required. The coupling of BF with on-site electro-chlorination poses an optimal treatment combination for off grid drinking water supply. Electro-chlorination is energetically highly efficient and can be run solely on solar PV basis, and thus completely independent on existing infrastructures. Market: Asia, Africa, South America The planned development of SuMeWa|BF units is expected to establish a new reliable and robust drinking water treatment alternative for remote developing regions. Size: Currently, SuMeWa units can supply up to 500 people with safe water where each person would have 20 L/d of drinking water available. In combination with BF it is expected that the capacity can be doubled without additional component costs. Assuming 500 million people, that are living in remote areas close to open water bodies and that are consuming water that does not meet the quality criteria leads to a theoretical potential market of 500.000 SuMeWa|BF units worldwide. Next to Asia AUTARCON plans to expand its sales also to Africa and South America where perennial rivers can be used. Currently, AUTARCON systems are only applied for deep wells in Africa which requires complex and costly pre-treatment. Main competitors and **competitive advantage**: Chinese companies offering low-cost water filtration units coupled with chemical disinfection. Even Reverse Osmosis Systems have become affordable. However, due to technical complexity their application in remote developing off grid regions is not possible. Advantage of SuMeWa|BF is **robustness** and **autarkic operation** using photovoltaic modules. Transport, storage and dosing of chemicals will never be required reducing sources of failure of common systems. Europe: In Europe and other developed areas the application of SuMeWa technology has the following focus: Protection from legionella in water facilities

	In Europe the market for decentralized protection from legionella in water distribution and supply facilities is increasing. Wastewater Reuse in Mediterranean region: The interest in the reuse of treated wastewater is constantly growing. Driving factors are increased demand and reduced availability of water. The SuMeWa technology has the capacity to disinfect treated grey- and wastewaters that permit their reuse in agriculture (irrigation), industrial (Cooling), and inter-urban as well domestic applications (cleaning, park irrigation and toilet flushing) and thus directly substituting fresh water resources.
Financial projections	The Asian market is especially price sensitive and generally takes more time to achieve satisfying sales. AUTARCON plans to sell 20 units in Asia by the end of 2020. Significant increase is expected after 5 years of successful technology demonstration, based on needs for improving water supply and disinfection stated by Indian government. Between 2020 and 2025 sales are expected to reach 100 units per year with an annual turnover of **one million Euro** alone in Asia. AUTARCON plans to hire new employees in the field of engineering and production. Currently, all components are manufactured in Germany and further reduction of costs is urgently necessary. With further standardization some components can be outsourced and substantial cost reductions are expected. The planned investment costs for one unit are expected to be in the range between 10.000 and 15.000 € per unit. For a brief economic evaluation, the investment, operation and maintenance cost for one unit are given in the table below.

Cost	**Euro**	**INR**
SuMeWa|BF (target costs)	12.500 €	**900.000** INR
Batteries	1.000 €	**72.000** INR
Solar Panels	1.500 €	**108.000** INR
Infrastructure/Pipes/Pump/Well etc.	2.500 €	**180.000** INR
Amount	**17.500 €**	**1.260.000** INR
Tax	**1.225 €**	**88.200** INR
Sum	**18.725 €**	**1.348.200** INR
Annual running costs		
Maintenance / Operation	100 €	**7.200** INR
Spare parts (mainly batteries)	700 €	**50.400** INR
Annual costs [€/a]	**3.225 €**	**232.198** INR
Production capacity		
Daily produced quantity of water [L/d]*	20.000 L/d	20.000 L/d
Yearly produced quantity of water [L/a]	7.300.000 L/a	7.300.000 L/a
Price per liter of water [€/L]	**0,0004** €/L	**0,032** INR/L
Price per liter of water [€cent/L]	**0,044** € cent/	**3,18** Paise
Price per 20 L jerrycan	**0,009** €	**0,64** INR
Price per m³ of water [€/m³]	**0,44** €/m³	**31,81** INR/m

Based on AUTARCON data, an intrest rate of 5 % and a amortization period 10 years

* estimated values

These numbers show that the drinking water costs per capita (20 L/day*cap) is less than on 1 Eurocent per day. If cost for water treatment is passed on to the consumers a large variety of investment mechanisms can be considered (e.g. public private partnerships) facilitating implementation and speeding up sales.

Dissemination and Communication actions	• Training courses in India to promote European monitoring equipment and dis-infection modules • Collaboration with local water supplier/works via UJS • Specialized trade fares (AQUATECH India 2017, 2019) • Workshops at IIT Roorkee and UJS office Dehradun
Commercialisation roadmap/ exploitation routes	• Demonstration of on-site chlorine production performance, pathogen removal capabilities and robust and cost effective operation with low maintenance, which is especially important for small-scale application in remote areas in Asia. • Benchmark to current practise. • Demonstrate benefits during extreme events such as floods. • Preparing maintenance and operation handbook with symbols and translation into Hindi. • Use results of demonstration actions for discussions on potential implementation of combined SuMeWa|BF into

	production • Direct commercialisation and production of SuMeWa System
Risk assessment	None, if market ready on-site electro-chlorination modules will be used for application, low demonstration risk if UF and electro-chlorination are combined into one module by AUT and power supply is not reliable at pilot site to demonstrate continuous operation performance.
IPR management	SuMeWa is licensed by AUT. IPR for combined system will be regulated in cooperation contract

Table 7 Draft exploitation plan for advanced oxidation processes in combination with MAR/SAT as an indirect potable reuse scheme (WP2)

WP/ innovation name	**WP 2/ AOP+SAT for InPR**
Key exploitable results	Description: Membrane-free, less energy demanding indirect potable reuse scheme on the basis of **advanced oxidation processes** (Ozonation/ recirculated ozonation/ UV+H_2O_2) as pre-treatment in MAR/SAT. Treatment targets: DOC, micropollutants, pathogens up to Israeli and EU drinking water standards for Indirect Potable Reuse (InPR). Development stage: Single treatment processes are well known. The development goal is to combine and integrate these in an overall process train, to understand the synergistic effects and get a more value added process. Differences from competing product **(Value propositions):** The use of the natural barrier downstream the AOP process instead of technical filter solutions (such as UF/RO) should allow for a **lower energy demand** of the full process, **higher process stability** due to better hydraulic buffering and longer retention times at even **higher elimination rates** for pollutants than achieved with technical filtration.
Innovation and Exploitation Team	**MEK** (Water utility) has a good international reputation for obtaining tenders and implements easy solutions for water production, supply and reuse; **XYLEM:** Leading manufacturer of non-chemical treatment of water, heavily engaged in the designing of AOP treatment concepts.
Expected key areas of application & customer segments	**Commercial application in water-scarce countries** with the need to further reuse the effluents of municipal wastewater plants. Customer segments: wastewater treatment facilities, water supply facilities, consultants in water business, contractors in water business, solution provider companies in targeted markets
Market	Trend/Driver: Climate change, scarcity of water resources Market: Water scarce and water stressed countries like South Europe (Portugal, Spain, South France, South Italy, Greece), Middle and Far East countries, Australia, South America, South USA, Africa Size: Global markets for **wastewater recycling and reuse** are expected to increase from **$9.5 billion in 2012 to $23.4 billion in 2017**, reflecting a five-year CAGR of 19.7% (GWI, 2014). Looking at different regions **Asia/ Australia** have the highest portion followed by **US** then **Middle East** and **Europe**. Main competitors and **competitive advantage:** The current "gold standard" for DPR and InPR uses energy intensive and costly UF & RO processes. The combination of Ozone / AOP oxidation with natural soil treatment can **reduce OPEX and CAPEX by more than 50%** and thus is an attractive alternative to membrane based processes for reusing water. Also it saves brine production, being a much "greener" process (**less CO_2 footprint and no brine**).
Financial projections	**30 Mio € through 5 years is expected minimum.** The generated revenue will increase during each year and sum up after 5 years with 30M Euro. As these are typically projects with a longer lead time (tender phase) we assume to have 0 revenue in the first year – then starting revenue in the second year – and increased revenue in years 3 – 4 - 5 . With these estimations we believe that we can get the return of our investment (money we spend in the AquaNES project) in the third year. So our estimated ROI < 3 years. The expected turn-over is a more conservative figure taking into account that we are focusing on only a part of the global wastewater reuse market and we expect a certain time delay in acceptance of new solutions and a slower start up curve for sales. The overall global market potential is bigger.
Dissemination and Communication actions	• Workshop/training and conferences: Promote scheme of InPR at WATEC Israel (2017) among health authorities; IWA Specialist Conference on Wetland Systems for Water Pollution Control (2016, Poland or 2018, tbd) • Design and marketing recommendations for combining constructed wetlands with engineered systems • Use results of demonstration activities for paper publication

Commercialisation roadmap/ exploitation routes	• **Successful demonstration** of the combined technical and natural process is a mandatory enabler to achieve acceptance of water authorities and market the solution to new drinking water treatment export markets still utilizing chlorine based oxidation. • Demonstration of treatment results and benchmarking of achieved water qualities and treatment costs to current state IPR and DPR schemes. • Proof of acceptance by end-users. • Possible implementation into production
Risk assessment	Ozonation can impose health and safety risks during operation (low-medium risks). Health and Safety management which follows local legislation has to be implemented.
IPR management	Ozone + UV units are licensed by Xylem. IPR for combined system will be regulated in cooperation contract.

2.2.2 IPR and Knowledge Management

The AquaNES Intellectual Property Right (IPR) and Knowledge Management strategy will be defined in the Consortium Agreement (CA), which will follow the DESCA Horizon2020 model and will be signed by the partners prior to signing the grant agreement. The CA will set down the basic rules covering the sharing of information and ideas, the rights of each partner for exploiting their intellectual property, the ownership of know-how and the rules for access to IPRs generated during the project. Most AquaNES innovation results involve commercially exploitable technologies, products or services suitable for direct commercialisation or potential implementation on the market (Figure 5). AquaNES CA respects the individual commercial interests of the project partners and their intellectual property rights on all pre-existing items that are used during the project period. All related matter to IPR will pass through an IPR advisor which checks patentable contents of innovations and supports partners in protecting their innovations by providing information and contacts to responsible authorities (see section 3.2 'Management structure and procedures'). Aligned with the CA is a commitment of the partners to provide open access to all peer-reviewed scientific publications of demonstration and validation results of cNES under a 'green' open access or 'gold' open access scheme. Before any dissemination activity (publication, presentation) the AquaNES Dissemination manager ensures that the intended dissemination of innovation results will not jeopardize the potential protection of generated IP (e.g., patent, product design). A detailed dissemination plan, including peer-reviewed publications, will be agreed upon during the first months and constantly updated during project execution.

WP6 will set up a knowledge depository as an AquaNES internal platform integrating several developed tools and approaches which are being tested in WP1-WP5 and test results ultimately feed-back into the Decisions Support System (DSS) for different stakeholders (i.e., engineering consultants, planning departments of water utilities). Some of the tools included in the DSS are subject to IP and not freely available (e.g., ICT modelling software of Geohyd). Efforts are undertaken to guarantee a free-of-charge access and use of the DSS by developing and implementing free-ware, light versions of the programmes and tools with restricted access.

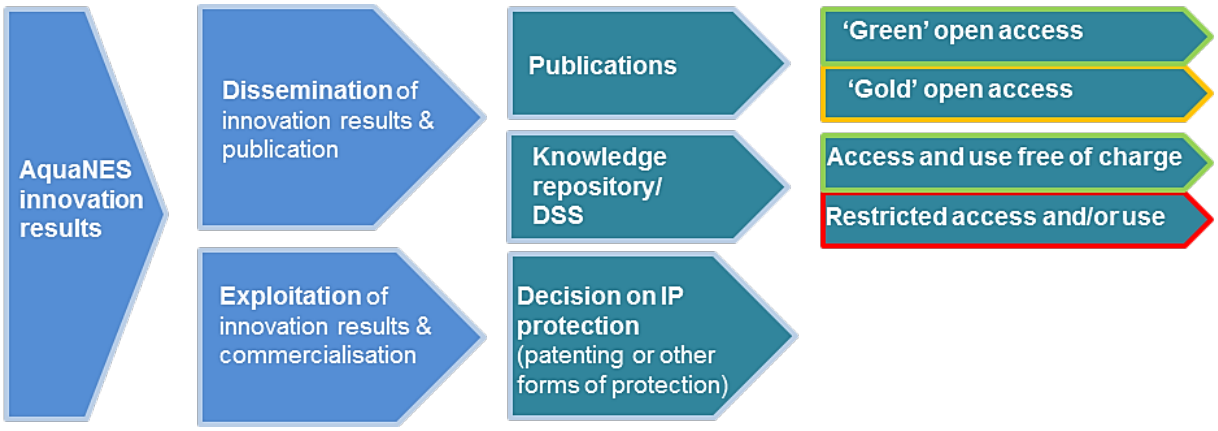


Figure 5 AquaNES IPR and Knowledge Management

Data management:

As noted above, one of our project objectives is improve the confidence with which water service providers are able to specify, design, and implement combined natural and engineered water treatment systems. The project's success is therefore contingent on the precision and accuracy of data collected through field trials etc. We will be generating new datasets and developing new insights from existing data sources. A key challenge is therefore to ensure the impartiality and accuracy of any data collected as data can become biased towards an individual or organisation's objectives and secondary data may be misinterpreted if it was collected for a different purpose. To mitigate these weaknesses we will triangulate between sources where possible, and look for result confirmation across different data / information sources. So as to hard-wire data quality management into the project's day-to-day activities we will appoint a senior member of the Project Management Board (PMB) to act as a Data Quality Invigilator with a remit to maintain a watching brief on data quality and data management issues. In addition, data quality and management will be a standing agenda item at meetings of the PMB.

The AquaNES consortium wishes to opt out of the open research data pilot. Data and information acquired during demonstration/testing will be used for dedicated exploitation of the technologies/innovations. It will key in identifying the unique advantages of our approaches and major asset in the AquaNES DSS.

2.2.3 Dissemination and communication

Whilst our technical activities will be demonstrating the benefits and feasibility of various technology lines in cNES including the tools to monitor them, our dissemination efforts will ensure that these approaches are more widely recognised, understood, and positively perceived. Our dissemination and communication activities support the exploitation ambitions of the partners and have been designed to engage, inform, and interact. Insights gained during the market analysis and business model generation will help to shape the dissemination strategy. Based on these findings we will actively address what was identified as barriers or risks to exploitation and wil

- communicate with relevant stakeholders and user groups in dedicated workshops (e.g. EiP Water events)
- enhance the credibility of demonstrated benefits by scientific publications (journal papers and conferences)
- train engineering consultants and planning departments of water utilities in the use of the DSP and other AquaNES tools
- target technology markets (fairs & exhibitions)
- address national/regional markets (fairs & exhibitions with local support of AquaNES partner WATEC Israel, WasserBerlin (KWB)
- showcase demonstration sites as good practice and successful implementation examples in regional workshops (GR, IL)
- Organize training courses in India to promote European monitoring equipment and disinfection modules

Precise activities will be described in the Plan for Dissemination and Exploitation and are exemplified in the WP7 description

It is assumed that barriers are not only or not necessarily technical. An explicit ambition of AquaNES activities is to improve our understanding of how **consumers understand, value, and trust different forms of treatment processes**. In doing so, we will be informing the rich debate around the social and economic value of water. Outputs from WP5 on these issues will be targeted at relevant scientific and practitioner communities.

Our dissemination and communication activities will be adjusted and anchored to ongoing environmental debates and related events, such as public consultations and workshops (water framework directive implementation, discussion on CSO, circular economy). C**ommunication measures** will be chosen carefully for individual target groups and defined purposes. Overall we will make use of

- classical online and social media (website, webinars)
- print (project flyer, technology/marketing brochures)
- audio (video)
- face-to-face events (training workshops, conferences, exhibitions/fairs)

An overview of major tools, their application and purpose are listed in Table 8.

Table 8 Initial list of target groups and communication purpose and measures

	Target group, audience	User needs (selection) Relevant topics	Potential dissemination event Communication tool measure
Commercial	Industrial Engineering, Procurement and Construction (EPC)	Information about achievable quality levels and related limitations of combined natural and engineered water treatment systems (cNES)	Publications at conferences and industry events
	Water treatment equipment manufacturers	Information about technology availability and quality Proven application cases of cNES	Presentation at industry events, and at WWT's (Annual Water Industry Technology Innovation Conference)
	Water utilities and municipalities	Economic, environmental and legal feasibility of the solutions, Promotion of the AquaNES DSS and individual tools	Dedicated Training Workshops
Policy making, Environment	Policy makers: European Commission; Local Authorities & National regulatory entities Regional Public Bodies (to be defined)	Guidance on effective policy options. Insights into technical feasibilities. Awareness regarding policy conflicts from a technical perspective	Policy briefs, involvement in relevant stakeholder consultations
Invest-ment	Investors: Angel Investors; Peer-To-Peer; Lending; Venture Capitalists; Banks	Profitability of the investment. Feasibility of the system: legal and economic.	Commercial brochures and specific presentations and B2B meetings
Setting stand-ards	(National) Water Associations / Technical Associations (DWA, DVGW)	Feedback on standards implementation	Exchange of specific information in events, B2B meetings
Skills & educat-ional training	End-users, engineering consultants	Familiarisation with technical performance and specifics Support placing the technology/approach in the market	Provide / develop Training modules as part of customer relation ship
Social	General Public	Concerns about general health, safety and environmental issues. Limited understanding about home water treatment systems.	Website (downloads, video) Social media Open-door days
Research	Scientific peer-group; Applied researchers; industrial R&D Dept.	Advanced beyond the state of the art and technology establishment and performance.	Scientific conferences
	Consortia from other funded projects	Create synergies and promote the impact of the project.	Joint events: conferences, seminars,

3 Implementation

3.1 Work plan- Work packages

3.1.1 Overall structure of the work plan

The project distinguishes three levels of activities to which the individual work packages are assigned (see Figure 6):

1. Demonstration of individual AquaNES innovations in the demonstration sites as shown in Table 1.
2. Innovative technology assessment considering both process performance and water quality aspects as well as interfaces with the environment and the society (e.g. ecosystem service valuation). Output from work at these levels will inform the
3. Technology exploitation: this encompasses the development of business models and plans for individual innovations but also integrates results and knowledge gained in the other work packages for decision support in scheme planning and assessment..

The technical demonstration of cNES will be addressed by three work packages, one for each type of natural treatment systems, bank filtration (WP1), MAR/SAT (WP2), constructed wetlands (WP3). cNES feasibility for full-scale implementation will be judged principally on the ability of the system to achieve throughput and quality targets. A dedicated work package (WP4) will address the framework of monitoring and modelling of water quality under varying conditions of use as well as user-friendly approaches to handle large data sets. The risks associated with failures to meet target specifications for a specific use will be evaluated as well. Furthermore, potential obstacles to market introduction situated at the interface of technology and society will be investigated in WP5, in particular regulatory constraints, economic competitiveness and consumer acceptance. Elements from WP4 and 5, and, indirectly, from WP1-3 will feed a suite of knowledge repository and decision support tools developed by WP6, allowing for the design of combined natural and engineered systems adapted to specific uses under specific local constraints. Such a tool is expected to greatly facilitate technological exploitation of combined natural and engineered systems addressed in WP7. Dissemination and communication to the broader stakeholder community will be handled by WP7. Project management including the project steering bodies will be implemented in WP8.

The work packages will produce a number of deliverables which form also the basis for exploitation and dissemination.

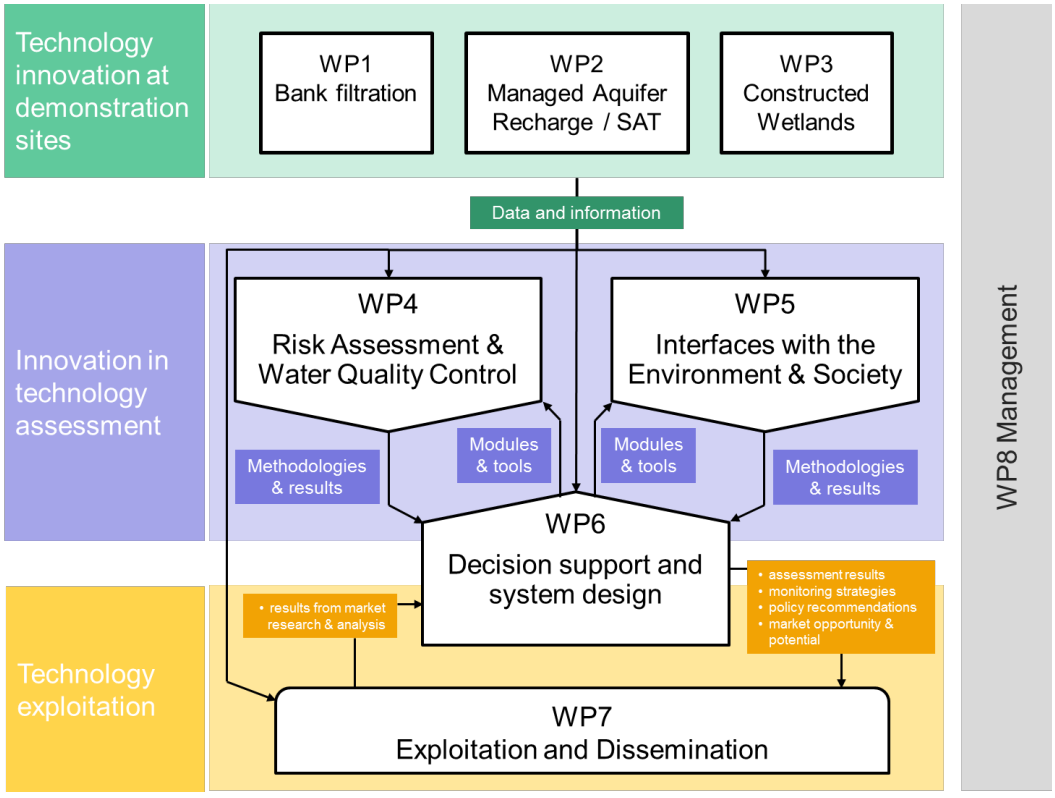
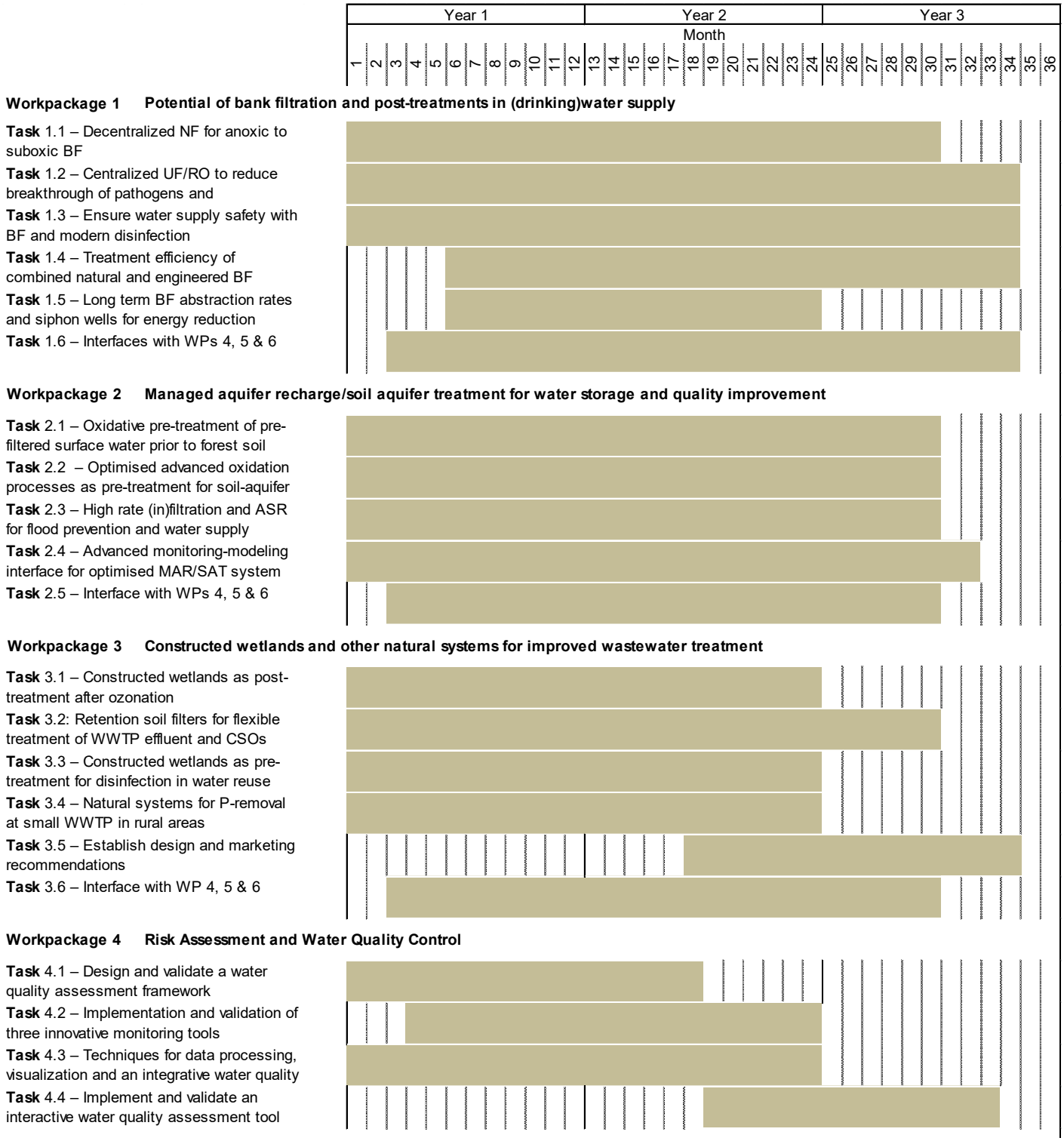
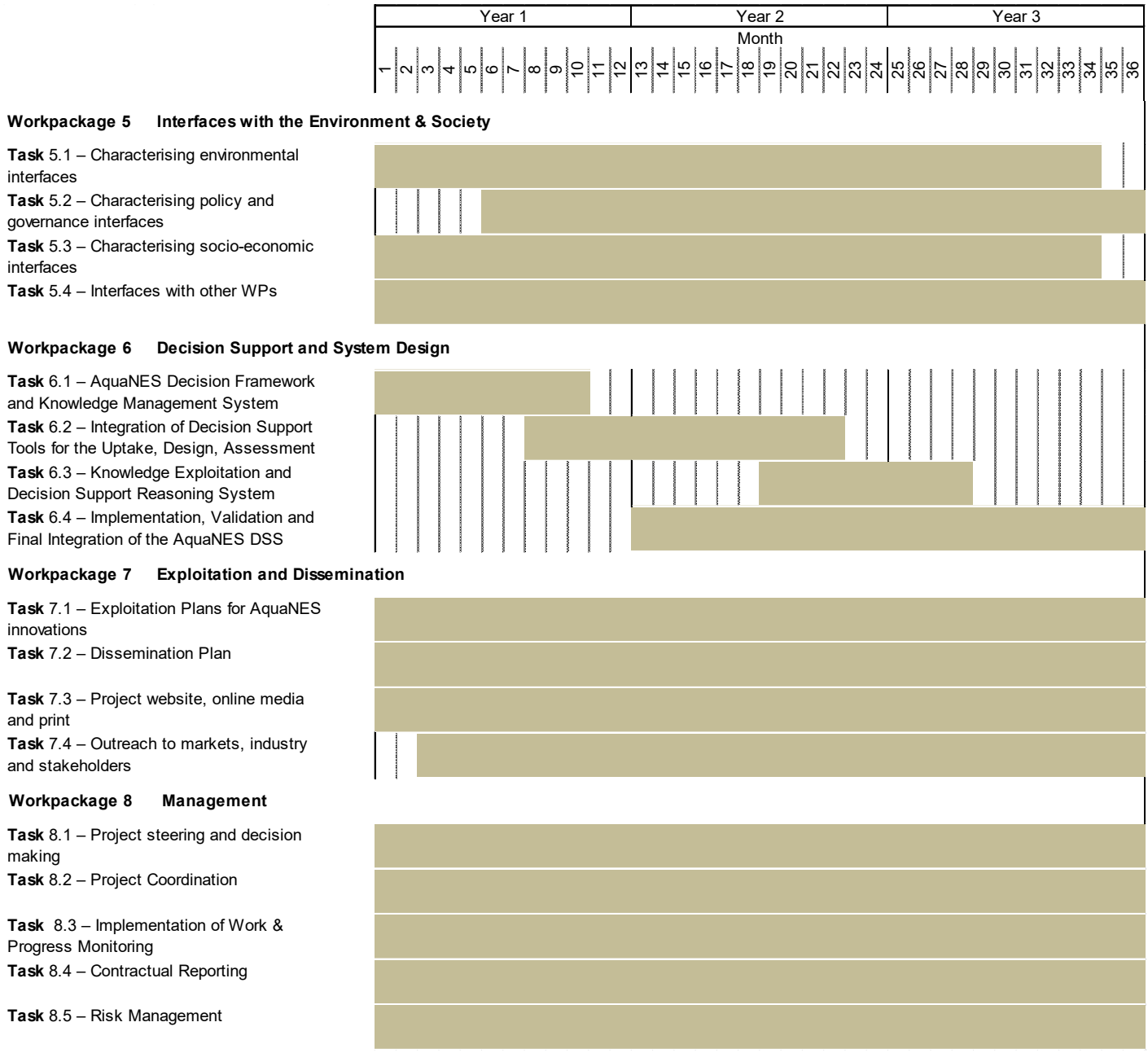


Figure 6 AquaNES project structure

3.1.2 Timing of the different work packages and their components (Gantt Chart)

Overall a three-year duration is foreseen for the project, which will allow a sufficiently long demonstration period in the demonstration sites (WP1-3) and a comprehensive assessment as well as an integration of data into a decision support structure allowing transfer of results. Exploitation and dissemination of results will be continuously supported and intensified towards the conclusion of the project. The timing of the different work packages and the included tasks in given in the GANTT chart below.




Year 1
Year 2
Year 3
Month
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Workpackage 5 Interfaces with the Environment & Society
Task 5.1 – Characterising environmental interfaces
Task 5.2 – Characterising policy and governance interfaces
Task 5.3 – Characterising socio-economic interfaces
Task 5.4 – Interfaces with other WPs
Workpackage 6 Decision Support and System Design
Task 6.1 – AquaNES Decision Framework and Knowledge Management System
Task 6.2 – Integration of Decision Support Tools for the Uptake, Design, Assessment
Task 6.3 – Knowledge Exploitation and Decision Support Reasoning System
Task 6.4 – Implementation, Validation and Final Integration of the AquaNES DSS
Workpackage 7 Exploitation and Dissemination
Task 7.1 – Exploitation Plans for AquaNES innovations
Task 7.2 – Dissemination Plan
Task 7.3 – Project website, online media and print
Task 7.4 – Outreach to markets, industry and stakeholders
Workpackage 8 Management
Task 8.1 – Project steering and decision making
Task 8.2 – Project Coordination
Task 8.3 – Implementation of Work & Progress Monitoring
Task 8.4 – Contractual Reporting
Task 8.5 – Risk Management

3.2 Management structure and procedures

The AquaNES consortium comprises 30 partners and will be implemented in 13 demonstration sites in which numerous innovative processes and tools are being demonstrated or validated. The management structure is equally addressing the challenge to implement the planned work and demonstrate the innovation, as well as to create impact from these activities. These tasks will be brought about by the Project Management Board and an **Exploitation & Dissemination Committee**.

Innovation management will be facilitated by the scope and design of the Exploitation Strategy as described in Section 2.2 and WP7. Based on our technical demonstration activities in WP1-4 we will be able to characterise the improved products and their new fields of application. We will carry out a dedicated market analysis and observation of trends in the policy area. The Exploitation Plan and Dissemination Plan will identify and perform the required actions and interventions with stakeholders and end-users of the AquaNES innovations.

The project management structure as shown in Figure 7 is derived from best practices established in the management of Framework Projects and reflects both the specific needs of an Innovation Action and the large partnership. The coordinating team at FHNW (coordinator, project manager, project assistant) has more than 12 years of experience of managing large European projects (4 in FP6, 4 in FP7) in the area of water and environmental technology with a legacy of successful implementation and delivery of sound project outputs and has developed the management concept accordingly.

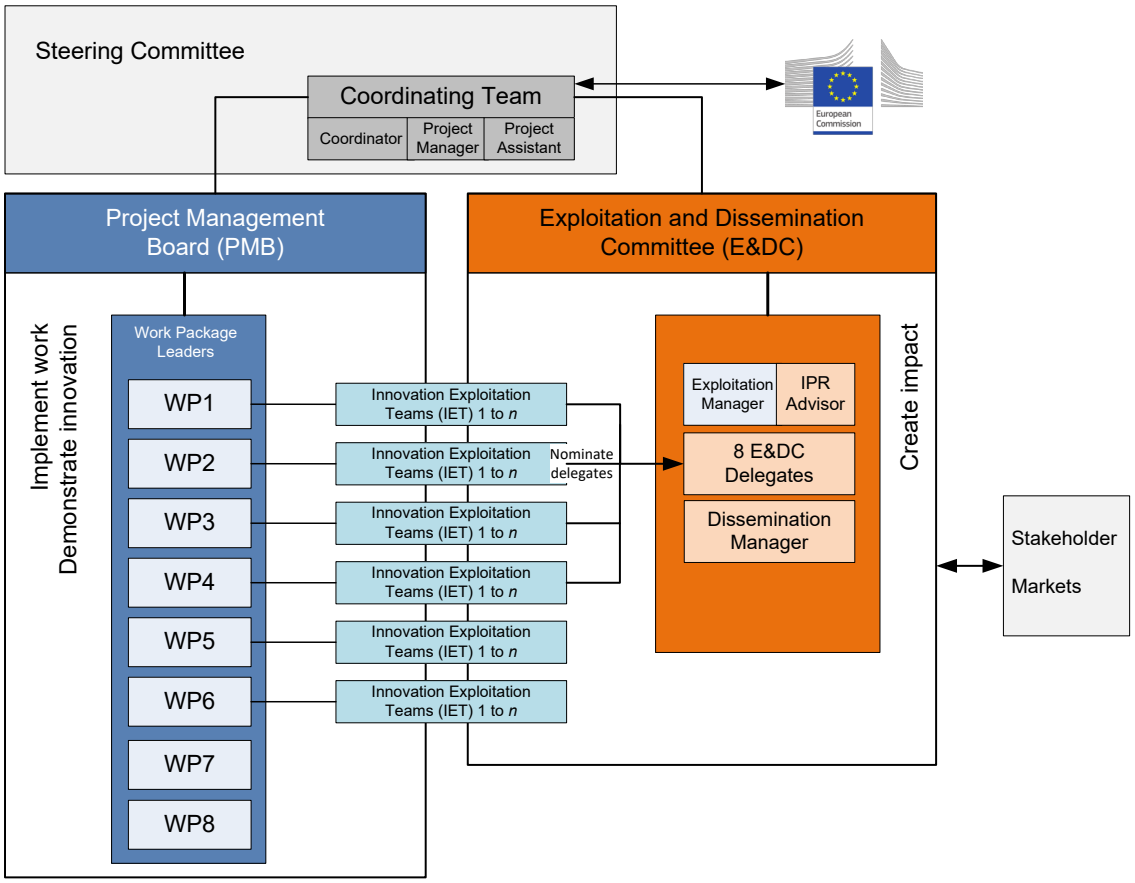


Figure 7 AquaNES project management structure

The composition and responsibilities of the different entities are explained below. Details on the rights and obligations and working procedures will be defined in the Consortium Agreement

Project Coordinating Team

The AquaNES project will be coordinated by the University of Applied Sciences and Arts Northwestern Switzerland. The project team has extensive project leading experience in FP5, FP6 and FP7. The Team will be responsible for all administrative and financial project work, communication within the consortium and towards the European Commission as also described in WP8.

Steering Committee (SC)

The steering Committee is the highest level decision taking entity in the consortium. It consists of one person per partner with the authority of making decisions on behalf of their institution. The tasks of the Steering Committee are:

- to define the overall project strategy
- to handle contractual matters (Grant Agreement amendments, extension of the consortium, termination of participants)
- to agree on the principles for resource allocation (consortium budget and payment schedules)
- to agree an intellectual property right related strategy

In order to facilitate decision making in such a large consortium, the SC will vote on major decisions by simple majority of the quorum. The details will be fixed in the Consortium Agreement

Project Management Board (PMB)

The PMB consists of the Work Package leader and is chaired by the Coordinator. It monitors the overall work progress based on milestones and deliverables, oversees the work within the work packages and facilitates relevant interfaces between the WPs. It will propose adjustment and means of remediation in case of deviation from the work plan or occurrence of any of the risks and contingencies identified in WT5 (List of critical implementation risks and mitigation actions). The PMB will also discuss and prepare decisions for all issues requiring a vote of the Steering Committee. In that respect the PMB will be responsible for preparation of conflict solving interventions. It will make decision by simple majority of the votes.

The PMB will meet regularly (bi-monthly) in web-conferences or at other project meetings to closely observe and exchange on the project implementation. Among the agenda items will be the risk register review, equality & diversity issues, appointing specific roles such as quality control (Data Quality Invigilator) or report editing and other item raised by the members.

Exploitation & Dissemination Committee (E&DC)

The Exploitation & Dissemination Committee will prepare for up-take of results and market entry of the demonstrated innovations. It will draft, develop and implement the Exploitation Plan. An IPR advisor will support partners in protecting their innovation where needed. He will inform the partners of knowledge protection issues, check patentable content of innovations and direct them to relevant national and international entities. The E&DC will consist of:

- Exploitation Manager (acting as chair of the ED&C and as IPR Advisor, staff of VTG)
- 8 ED&C delegates which are nominated by the different innovation exploitation teams of the demonstration sites. From each of the Work Packages 1 to 4, commercial partners, utilities and research partners will be delegated.
- the Dissemination Manager

For the exploitation part the E&DC will review the business plans, advice on marketing actions and shortlist technologies to be transferred to the ETV

For the dissemination part the E&DC will identify and coordinate suitable dissemination events and activities (participation in exhibitions, schedule training measures). The Dissemination Manager (Rita Hochstrat, FHNW) will be in charge of updating the Dissemination Plan.

In addition we will appoint a Gender Officer to inform about and promote gender aspects in the project and exploitation phase.

Meeting schedule

Bi-annually consortium meetings will be scheduled. In order to keep travel efforts low these events will host various side meetings allowing for

- in depth exchange of progress in the technical Work Packages (Work Package partners, 1 day)
- develop and agree on Exploitation and Dissemination issues (E&DC Meeting 0.25 day)
- share project development (Plenary Meeting, 0.5 day)
- review work progress (PMB meeting, 0.25 day)
- decide on issues requiring the vote of the Steering Committee (Steering committee, 0.1 day)

All partners have been allocated resources for participation in their respective budgets in the work packages they are mostly involved in.

The consortium will convene according to this tentative schedule:

Meeting	Frequency	Participants, type of meeting, location
Kick-off meeting	1	All partners
Full consortium meeting (incl. Steering Committee -SC meeting)	2 per year (2-3 days)	All partners Month, tentative hosting organisation and city M1- Kick-off - FHNW, Basel M6 - NTUA, Athens M12- KWR ,Nieuwegein M18 - mid-term Brussels M24 - BUWW, Budapest M30 - VTG, Nice M36 - KWB/BWB, Berlin
Exploitation & Dissemination Committee (E&DC) Meeting	2 per year	E&DC members, web conferences / during full consortium meetings
Work Package Meeting Innovation Exploitation Teams meeting	2 + 1 additional per year if need be	Work Package participants, IET (back-to-back meeting of several WPs)
PMB Meeting	6 per year	WP Leaders, web conferences and/or physical meetings during other events

3.3 Consortium as a whole

AquaNES consortium comprises high level academic partners and research institutes (9), SMEs (9) and industries (3) and (waste)water utilities (9) from eight different European countries and India, which are well balanced along a 'technology innovation' value chain (Figure 8). The roles and contributions of the different consortium entities are clearly defined and complementary: Our SME's and industries provide existing pre- or post-treatment technologies, monitoring devices or software tools (see Table 3 and Table 4) which are integrated by water utilities in existing treatment schemes to demonstrate and validate the treatment efficacy of the combined system. The close collaboration with partnering water utilities will speed-up the deployment of successfully operating combined treatment processes. The integration and combination of natural and engineered elements is supported by water treatment designers/planners and knowledge providers which share their extensive experience in natural water systems and treatment methods in Europa, Asia and Africa. Given the big number of consortium partners and innovations, the demonstrated and validated AquaNES technologies, products and services are promoted in smaller 'innovation exploitation teams' which are collective partnerships of SME's/industries reinforced by knowledge providing entities and/or water utilities. The innovation exploitation teams are further guided by a dedicated Exploitation & Dissemination Committee (E&DC) led by VTG with support of FHNW and the work package leaders. The E&DC further applies a targeted dissemination and communication strategy as outlined in Section 2.2, promoting combined natural and engineered systems in and outside Europe to achieve investments from diverse end users (e.g. water utilities, governmental water/environment authorities) and commercial success of SME's treatment technologies, monitoring devices or software tools.

No additional partners are foreseen in the project. The AquaNES consortium will closely interact and collaborate with related WssTP Working groups and relevant EIP Action Groups of which AquaNES partners are members to ensure the awareness of the tested solutions. Individual partners hold close contacts or memberships in national technical organisation which will facilitate the constructive dialogue towards wider acceptance of this type of schemes.

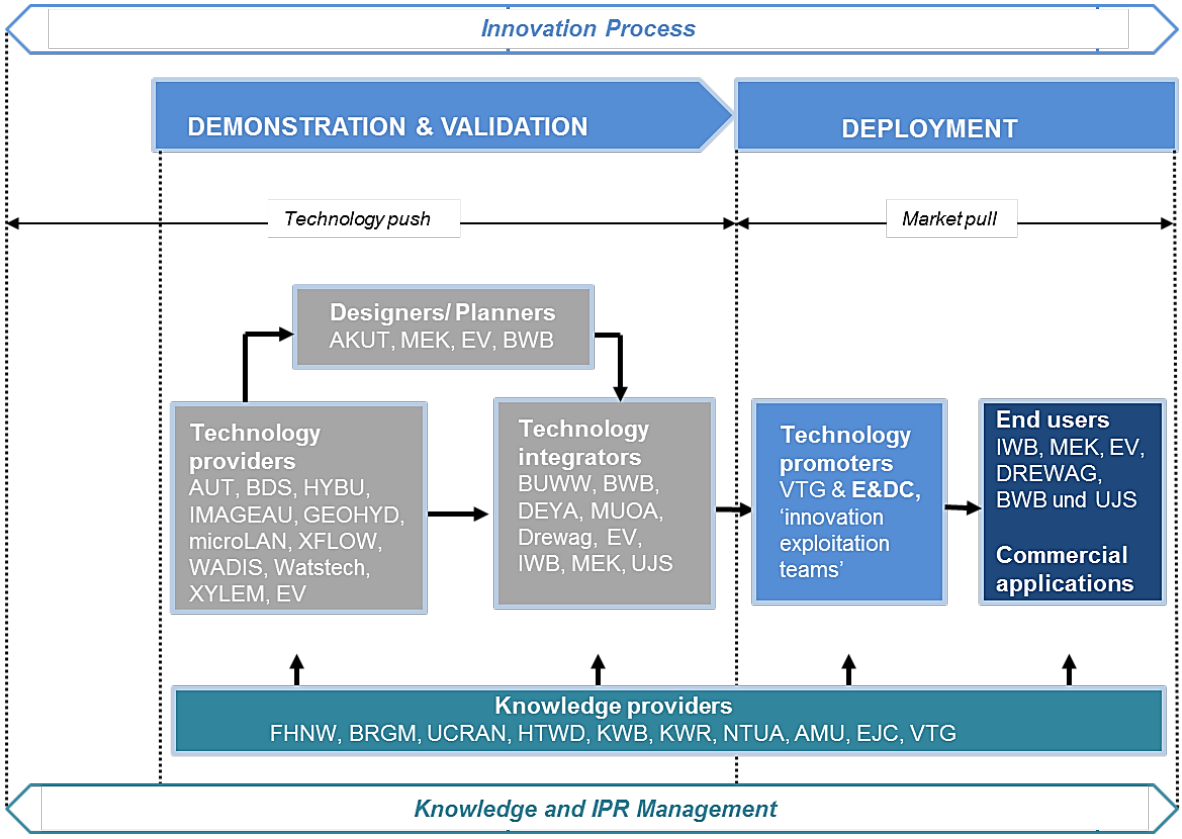


Figure 8 AquaNES consortium involved entities along technology development, demonstration and deployment value chain

There are partner from two third countries involved: Switzerland and India. The coordinating partner FHNW is from Switzerland and has both a large track record in leading European projects on natural and engineered water treatment systems (e.g. coordination of FP projects MINOTAURUS, Saph Pani and Actiwate). Switzerland has also an outstanding experience in utilising natural treatment components for water supply (e.g. the Lange Erlen scheme in Basel operated by consortium partner IWB, which is a unique scheme utilising forest soil for infiltration). The participation of an Indian partner is justified by the outstanding role of the Indian water market and builds on the close collaborations already developed during the successful Saph Pani project.

The consortium will comprise approx. 100 persons of staff of which 22% are women. Two of the work packages (WP2 & WP5) are led by female researchers. This comparatively low number is due to the fact that water and wastewater sector is a field with generally low female involvement. In order to strengthen the female participation in the project, women will be encouraged to apply for the new positions to be generated in the project.

Table 9 Role of partners (U= water utility, R=Research partner, S=SME, I=Industry, E=Engineering, T=Technology provider)

short name	Type*	Main role(s)	demonstration site
FHNW (CH)	R	Project coordinator and leader of WP8, dissemination manager (WP7) Performance assessment of pilot system in Basel CH (WP2)	WP2: Site No. 6
AKUT (DE)	S, E	Design, construction and maintenance of pilot system in Greece (WP3); Design and marketing recommendations for cNES in WP3/WP7	WP3: Site No. 10
AUT (DE)	S, T	Implementation and evaluating of solar-driven treatment unit (SuMeWa|System) for disinfection in India (WP1)	WP1: Site No. 5
BDS (NL)	S, T	Implementation of bioassays (CALUX® assays) in demonstration sites of WP1-3 (two sides per WP). Development of tailored monitoring programmes.	Sites with AOP No. 4; 6; 7; 10; 12
HYBU (NL)	S, T, E	Designing, implementing and optimizing full scale system of high velocity infiltration filter (Fuzzy Filter) in Rotterdam NL (WP1).	WP2: Site No. 9
IMAGEAU (FR)	S, T	Design, build and install three Subsurface Monitoring Devices (SMD) for electrical conductivity monitoring in France (WP2)	WP2: Site No. 8
GEOHYD	I, T	Design and implementation of an ICT System for WP2; acquisitioning of data	WP2: Site No. 8

short name	Type*	Main role(s)	demonstration site
(FR)		from SMD and integration into centralized knowledge platform(WP6)	
microLAN (NL)	S, T	Monitoring microbiological contamination with BACTcontrol device in WP1-3. Tailoring monitoring strategies for cNES.	different sites in WP1-3
XFLOW (NL)	I, T	Operation and performance evaluation of two NF-pilot plants testing capillary NF membrane after bank filtration in Berlin DE (WP1).	WP1: Site No. 1
VTG (FR)	S	WP7 leader, Exploitation Manager and IPR Advisor, Environmental assessment (E-LCA, LCC, S-LCA) of cNES	-all sites-
WADIS (IL)	S, T	Demonstration of electric pulse oxidation system in WP2	WP2: Site No. 7
Watstech (UK)	S, T	Operation of pilot plants for P-Removal in Packington UK (WP3)	WP3: Site No. 13
XYLEM (DE)	I, T	Design and implementation of AOP pilot systems in IL and CH (WP2) and evaluation of results; Operation and evaluation of ozonation unit (WP3)	WP2: Site No. 6/7 WP3: Site No. 12
BUWW (HU)	U	Design, installation and operation of a RO-pilot scheme in Budapest HU (WP1). Demonstration of BF operation in combination with usage of Cl_2	WP1: Site No. 3
BWB (DE)	U	Operation and regular monitoring of one demonstration site in WP1 and WP3 each (both in DE). Conducting of water quality analyses in WP3.	WP1: Site No. 1 WP3: Site No. 12
DEYAT & MUOA (GR)	U	Operation and maintenance of WWTP in Greece (WP3). Collection and data assessment of different demonstrated treatment technologies	WP3: Site No. 10
Drewag (DE)	U	Operation and maintenance of UF-pilot scheme in Dresden DE (WP1), coordination of testing methods, provision of performance and energy data	WP1: Site No. 2
EV (DE)	U, T	Operation, monitoring and evaluation of one demonstration site in DE (WP3). Implementation and assessment of new Retention Soil Filter (RSF_{WWTP+})	WP3: Site No. 11
IWB (CH)	U	Owner of demonstration site in Basel CH. Operation of pilot plant in WP2. Analytics of transformation products	WP2: Site No. 6
MEK (IL)	U	Operator and owner of demonstration site in Shafdan IL (WP2). Piloting and performance tests. Testing of water quality assessment framework (WP4)	WP2: Site No. 7
AMU (PL)	R	Operation and monitoring of demonstration site in Poznan PL (WP1). Assessment of travel times' impact on pollutant and pathogen removal	WP1: Site No.4
BRGM (FR)	R	Leader of WP 2. Validation of monitoring and process modelling at site in France (WP2). Characterization of policy and governance interface (WP5).	WP2: Site No. 8
UCRAN (UK)	R	Leader of WP5. Environmental, social and policy implications of cNES (will feed in WP7). Assessment of P-removal in Packington UK (WP3).	WP3: Site No. 13
HTWD (DE)	R	Leader of WP1. Site responsibility for site in Dresden DE (WP1). Contribution to assessment of site in India. Application of software tools(WP5/WP6).	WP1: Site No. 2 *(Site No. 5)*
NUPS & EJC (HU)	R	Performance assessment of site in Budapest HU and pilot in Baja (WP1)	WP1: Site No. 3
KWB (DE)	R	Leader of WP3. Data interpretation, demonstration on effluent polishing effect of CWs. Pilot operation of site in Berlin DE (WP3). Demonstration on partial treatment of bank filtration and nanofiltration in Berlin DE (WP1). Application of software tools, providing data for (WP5/WP6).	WP3: Site No. 12; WP1: Site No. 1
KWR (NL)	R	Leader of WP4. Development of monitoring and risk assessment framework, coordination of monitoring in WP1-3. Operation and results evaluation of site in Rotterdam (WP2). Gaming tool for WP5.	WP2: Site No. 9
NTUA (GR)	R	Leader of WP6. Knowledge repository, AquaNES DSS. Coordination of Greek sites (WP3), Contribution in development of data processing and water quality reporting tool (WP4), LCA, LCC and S-LCA of cNES (WP5)	WP3: Site No. 10
UJS (IN)	U	Demonstration, operation and monitoring of site in Haridwar IN (WP1)	WP1: Site No. 5

3.4 Resources to be committed

The AquaNES consortium will dedicate considerable financial and human resources to the project as summarised in the Part A of this DoA and Figure 9 below. The major staff effort is allocated to technical work in the demonstration sites (in total around 60 %) and another 25 % for assessment with respect to water quality and environment and society as well as the elaboration of the AquaNES DSS. Activities in relation to Exploitation and Dissemination are to make up 10 % of the man-months. With respect to dissemination, this comprises only the efforts for the dedicated AquaNES specific actions and events mentioned in the WP7 description.

Management accounts for only 3 % of the person-months and is limited to the coordinator and work package leaders for their project management and WP management as described in WP8. In general, all partners have been allocated resources for reporting contributions and project meeting attendance within their budgets of the work packages they are most active in.

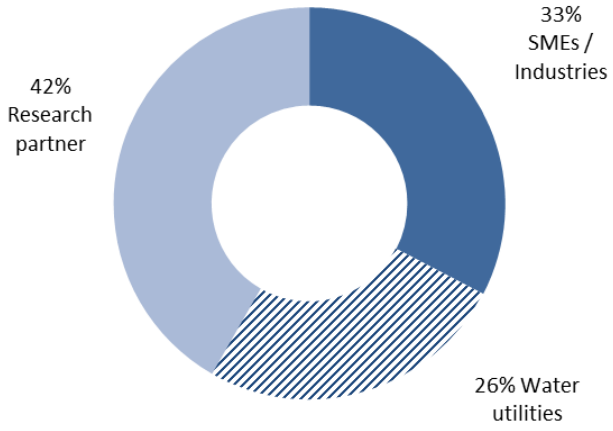


Figure 9 **Distribution of requested EU funding among types of AquaNES partners**

The activities are expected to incur about 10.7 million EUR of which 60 % is for personnel, but also expenditures for equipment and installation for our demonstration pilots and for consumables and analytical work are budgeted. Travel will be a relatively small budget.

SMEs, industry and water utilities will receive almost 60% of the requested funding. Research partners will support the innovation actions with 40 % of the total funding request (Figure 9).

Funding for participants FHNW and IWB from Switzerland, currently an Industrialized Third Country, will be provided directly by the Swiss Government through a national funding scheme specifically set up for participants in Horizon2020 projects. In H2020, 166 funding request to SERI with a total volume of 100 million CHF have been granted. The Indian partner will assure its small budget from national funding sources as well.

The allocation of resources per partner and activities in the individual work packages will be detailed during the first month of the project in order to facilitate project monitoring with respect to use of resources.

Table 10 'Other direct cost' items (travel, equipment, other goods and services Table 3.4b:)

2 AKUT	Cost(€)	Justification
Travel	7'400	Project consortium & technical meetings, dissemination events
Equipment	46'960	Assembly and delivery of containerised constructed wetland for demonstration at Berlin site no. 12 comprising: Containment, general equipment, piping , control system, machines, energy equipment
Other goods and services	4'800	Transportation of goods, safety inspections/certificates, conference fees
Total	**59'160**	

3 AUT	Cost(€)	Justification
Travel	22'600	Autarcon will be equipping and assessing the demonstration site in India for on-site electrolysis. 15'800 EUR for travel and stays in India (site selection, installation, follow-up and participation in technical fair. Site evaluation visit India (1 trip, 1 week) 1'500 EUR Installation (1 trip, 3 weeks) 3'500 EUR System checking and optimizing (3 trips ,2 weeks each: 3 x 2800 EUR = 8'400 EUR Marketing in Asia 1 trip, 2 persons 2'400 EUR, Rest for consortium and technical meetings
Equipment	3'000	Laboratory equipment for water quality monitoring in the field
Other goods and services	55'900	Technical components to be installed at site 5 in India for inline electrolysis demonstration.2 solardriven AO units (one reference unit in Kassel), Protection frame for system modularized for solar equippment and filtration, Solar energy supply (PV, Batteries, Charge controller), Pre-Filtration System (Zeolith based), UF Filtration modules for integration into system setting including control module 3 x, Data transfer unit, Substitute AO Cells 2 x, Tanks, Pipes, Fittings, Reagents for field test kits), transport of pilot plant, onsite plumber work to connect the decentral / inline electrolysis plant at household level. (53'000 EUR) Translations and publications Conference fees, fair exposition stand
Total	**81'500**	

4 BDS	Cost(€)	Justification
Travel	7'700	Project consortium and technical meetings, conferences
Equipment	-	
Other goods and services	30'000	laboratory consumables for advanced ecotoxicological test (cell culture, media, extraction) 20'000 EUR sampling material (cartridges, vials) 2'800 EUR, approx. 10 sampling campaigns at each of 6 sites, 120 EUR per shipment: 7'200 EUR
Total	**37'700**	

5 HYBU	Cost(€)	Justification
Travel	4'200	Project consortium and technical meetings, site visits
Equipment	40'000	Tailored, flexible mobile pre-treatment system for processing infiltration water (housing of the mobile infiltration, treatment and monitoring unit and its connections/piping to the local infrastructure)
Other goods and services	-	
Total	**44'200**	

Capacity	Eligible cost (EUR)	Total cost (EUR)	Depreciation period (months)	Period of use (months)	% used in the project
	40'000	40'000	24	24	100

6 IMAGEAU	Cost (€)	6
Travel	8'900	Project consortium and technical meetings, site visits
Equipment	-	
Other goods and services	31'723	Auxillary parts for measuring set-up: 3 electric arrays with remote control and high resolution monitoring (SMD), preparation of site for equipment installation (electrical works)
Total	**40'623**	

8 microLAN	Cost (€)	Justification
Travel	26'400	microLAN will install its detection systems at 3 demonstration sites incurring travel for commissioning and maintenance. Further attendance to project and technical meetings, as well as conferences and dissemination events
Equipment	21'600	Manufacturing of three BactControl systems for three demonstration sites including parts and cables, electronics, reaction chamber, pumps, valves, tubing, electrical cabinet, sampling devices.
Other goods and services	46'500	Reagents, parts and accessories needed to operate the devices: Consumables and supplies, ecoli/coliform/entero reagents, cleaning solutions (21'500 EUR), various pumps and filters for site specific water applications (17'500 EUR), Conference fees (7'500 EUR)
Total	**94'500**	

Capacity	Eligible cost (EUR)	Total cost (EUR)	Depreciation period (months)	Period of use (months)	% used in the project
NA	21'600	32'400	36	24	100

9 XFLOW	Cost (€)	Justification
Travel	14'860	travelling from Enschede to Berlin for commissioning, site support, various project (consortium) meetings
Equipment	220'000	Technical upgrading of two pilot plants for testing NF-membranes on site in Berlin (no. 1) Assembly, technical upgrading and installation of two pilot plants for testing nanofiltration (NF)-membranes on site in Berlin; modification for crossflow NF-operation: high pressure pumps, piping in general, electrical cabinet, software, monitoring equipment
Other goods and services	35'800	2 membrane modules (20'000 EUR) materials and chemicals for process optimization and membrane modification for improved operation (10'000) and sulphate removal (5'800)
Total	**270'660**	

Capacity	Eligible cost (EUR)	Total cost (EUR)	Depreciation period (months)	Period of use (months)	% used in the project
5 m^3/h	220'000	220'000	24	24	100

11 WADIS	Cost (€)	Justification
Travel	6'500	Consortium and technical meetings
Equipment	57'453	Electropulse oxidation system components High Voltage Rotating Switch, resistors, modules capacitators, control system, electro discharge chamber, electrode automatic feeding system pumps and pi-ping, body and housing
Other goods and services	13'800	consumables for all pilot period for O & M of the system for 2 years operation of the pilot in the BAC -UF and SAT mode
Total	**77'753**	

<table>
<tr><th>13 XYLEM</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>39'100</td><td>Technical meetings for pilot installation, start up and support at 3 sites (nos. 6, 7 and 12) located in Israel (5 visits,2 persons) Switzerland and Germany (ca. 6 trips), Consortium meetings</td></tr>
<tr><td>Equipment</td><td>73'667</td><td>Durable Pilot equipment for 2 sites
Israel (site no. 7): upgrade of existing ozone system (measurements, gas feedback loop, reaction system), on-line sensor equipment for ozone + biofilter system control (UV-VIS IQ Sensor Net, Ammonia, DO), on-line sensor equipment for SAT control (47'667 EUR)
Switzerland (site no. 6); complete UV-AOP pilot system (26'000 EUR)
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>5 m³/h</td><td>47'667</td><td>110'000</td><td>60</td><td>26</td><td>100</td></tr>
<tr><td>1-3 m³/h</td><td>26'000</td><td>60'000</td><td>60</td><td>26</td><td>100</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>60'000</td><td>XYLEM equips and maintains ozonation or other advanced oxidation process technologies in 3 demonstration sites (Israel, Switzerland, Germany). For those a number of project specific piping, valves, fittings, pumps, reaction system, gas preparation, safety devices are required</td></tr>
<tr><td>Total</td><td>172'767</td><td></td></tr>
<tr><th>14 BUWW</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>14'500</td><td>project consortium and technical meetings, conferences</td></tr>
<tr><td>Equipment</td><td>40'000</td><td>Dense membranes (RO) Pilot plant installation at Budapest (site no. 3),
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>0.3 m³/h</td><td>40'000</td><td>60'000</td><td>36</td><td>24</td><td>100</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>10'100</td><td>chemicals, mechanical parts, replaceable elements during operational phase, conference fees (2 x), hosting of 1 consortium meeting</td></tr>
<tr><td>Total</td><td>64'600</td><td></td></tr>
<tr><th>15 BWB</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>12'200</td><td>Besides consortium and kick-off meetings, 3 technical meetings per WP (1/3/4) are planned, 3 conferences</td></tr>
<tr><td>Equipment</td><td>-</td><td></td></tr>
<tr><td>Other goods and services</td><td>80'000</td><td>Construction material to setup demo sites and connect pilot plants of the project partners to BWB infrastructure; piping, connection to power supply and automization/ connection, smaller safety equipment parts
Laboratory consumables for chemical and microbiological analyses (solvents, HPLC equipment (columns etc.), filter cartridges, solid phase extraction cartridges, standards, sample flasks, chemicals, disposable tubes, reaction tubes, specifically designed DNA primers, pipettes etc.
conference fees (approx. 1.000 € each for IWA conferences);
open access fees 1.500 € for publication of results;
CFS is needed</td></tr>
<tr><td>Total</td><td>92'200</td><td></td></tr>
<tr><th>16 DEYAT</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>4'515</td><td>project consortium and technical meetings</td></tr>
<tr><td>Equipment</td><td>-</td><td></td></tr>
<tr><td>Other goods and services</td><td>3'000</td><td>Hosting of project meeting, consumables for analytics, minor parts for demo-site</td></tr>
<tr><td>Total</td><td>7'515</td><td></td></tr>
</table>

<table>
<tr><th>18 DREWAG</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>18'100</td><td>project consortium and technical meetings, conferences, demo site visits</td></tr>
<tr><td>Equipment</td><td>64'000</td><td>Ultrafiltration pilot plant installation at BF site 2 in Dresden (tanks. pumps, modules)
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>m³/h</td><td>64'000</td><td>96'000</td><td>36</td><td>24</td><td>100</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>9'671</td><td>chemicals, mechanical parts, replacable elements for the pilot plant in site 2; conference fees (2 x)</td></tr>
<tr><td>Total</td><td>91'771</td><td></td></tr>
<tr><th>19 EV</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>11'300</td><td>Regular project meetings are important for a successful project. Since the project consortium is international, travel costs are hence higher.</td></tr>
<tr><td>Equipment</td><td>48'000</td><td>monitoring equipment, automatic sampler and sensor for full-scale demonstration site. 11:

Sampling system and equipment
Measuring sensors
Measurement and control technique

<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>240 m³/h</td><td>33'500</td><td>67'000</td><td>60</td><td>30</td><td>100</td></tr>
<tr><td></td><td>8'500</td><td>17'000</td><td>60</td><td>30</td><td>100</td></tr>
<tr><td></td><td>6'000</td><td>12'000</td><td>60</td><td>30</td><td>100</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>47'900</td><td>Costs for analytics, Conference fees
Consumables for chemical analytics - bulk organics, heavy metals, micropollutants (sample containers, HPLC columns, GC columns, SPE cartridges, standards, helium, technical nitrogen, solvents, reagents, replacement parts GC and HPLC) 39'000 EUR, conference fees, translation, CFS</td></tr>
<tr><td>Total</td><td>107'200</td><td></td></tr>
<tr><th>20 IWB</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>8'900</td><td>Project meeting attendance,</td></tr>
<tr><td>Equipment</td><td>4'500</td><td>Pre-filtration unit</td></tr>
<tr><td>Other goods and services</td><td>60'000</td><td>Material and chemicals, labwork, analytics (micropollutants - transformation products), Columns, pre-filtration unit, piping, samplers</td></tr>
<tr><td>Total</td><td>73'400</td><td></td></tr>
</table>

<table>
<tr><th>21 MEK</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>15'800</td><td>Consortium and technical meetings</td></tr>
<tr><td>Equipment</td><td>91'932</td><td>Upgrading existing pilot installation (biofilter, ozonator, BAC), costs are composed of depreciation of existing components and that of those newly added, all components for a set-up to treat 5 m³/h
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>Existing part of the pilot plant</td><td>32'882</td><td>92'500</td><td>60-84</td><td>27</td><td>100</td></tr>
<tr><td>Ozonator (built in 2012)</td><td>10'000</td><td>35'000</td><td>84</td><td>24</td><td>100%</td></tr>
<tr><td>Dug Well and 3 observation wells connection and electrical system</td><td>7'500</td><td>50'000</td><td>180</td><td>27</td><td>100%</td></tr>
<tr><td>Expansion of Bio Filter</td><td>11'250</td><td>25'000</td><td>60</td><td>27</td><td>100%</td></tr>
<tr><td>Mixing Reservoir</td><td>4'500</td><td>10'000</td><td>60</td><td>27</td><td>100%</td></tr>
<tr><td>Ceramic UF membrane</td><td>12'000</td><td>30'000</td><td>60</td><td>24</td><td>100%</td></tr>
<tr><td>BAC Filter</td><td>13'800</td><td>34'500</td><td>60</td><td>24</td><td>100%</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>55'900</td><td>Consumables for pilot operation (flocculants, hydrogenperoxide dosing, cleaning chemicals for membrane and tanks such as NaOCl, NaOH, HCl), spare parts, piping electroinstallation and connection services and chemical and microbial analytical programme (labware, test kits, media, solvents), CFS</td></tr>
<tr><td>Total</td><td>163'632</td><td></td></tr>
<tr><th>22 AMU</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>23'900</td><td>cost of travel including consortium and technical meetings as well as frequent travel for field work in sample sites of Mosina water capture (site no. 4) and other sites in Poland to extend the database (4'500 EUR), conference attendance (5'600 EUR)</td></tr>
<tr><td>Equipment</td><td>12'438</td><td>Specialised equipment and hardware for data gathering and processing:
computer for groundwater transport modelling, field lap-top for field work at site no. 4 multifunction meter for measuring physico-chemical parameters in the field pump set for groundwater sampling from piezometers in the field (Grundfos MP1), sensors/data loggers for water level, temperature
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>computer</td><td>1'610</td><td>1'610</td><td>36</td><td>36</td><td>100</td></tr>
<tr><td>field lap-top</td><td>1'413</td><td>1'590</td><td>36</td><td>32</td><td>100</td></tr>
<tr><td>rent of multifunction meter</td><td>3'381</td><td>3'381</td><td>36</td><td>36</td><td>100</td></tr>
<tr><td>rent of pump set</td><td>1'500</td><td>1'500</td><td>36</td><td>36</td><td>100</td></tr>
<tr><td>sensors/data loggers</td><td>4'533</td><td>5'100</td><td>36</td><td>32</td><td>100</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>20'400</td><td>Reagents, certified materials for ICP-MS and HPLC-MS water analysis
Materials for field work (pH, Eh, O2 and conductivity probes, protective clothes, etc.), Computer software licences (groundwater transport, GIS), Conference fees</td></tr>
<tr><td>Total</td><td>56'738</td><td></td></tr>
</table>

<table>
<tr><th>24 UCRAN</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>30'340</td><td>cost of travel including consortium and technical meetings as well as field work in demonstration site Packington</td></tr>
<tr><td>Equipment</td><td>-</td><td></td></tr>
<tr><td>Other goods and services</td><td>27'000</td><td>Test kits, consumables and chemicals for lab work, CFS</td></tr>
<tr><td>Total</td><td>57'340</td><td></td></tr>
<tr><th>25 HTWD</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>37'640</td><td>Attendance consortium and technical meetings 18'440 EUR, field work in demonstration sites 2, 4,& 5, 9'600 EUR, trip to India for exploitation. 2'400 EUR
Conferences (IAH, IWA, DVGW, India) (excluding fees) 7'200 EUR</td></tr>
<tr><td>Equipment</td><td>28'000</td><td>monitoring equiment for pilot plant installation at BF site 2, (flowmeter, turbidity meter, pressure transducer), Bank filtrate sampling equipment, on-site parameter determination,
Data loggers for water level, temperature, conductivity, energy
<table>
<tr><th>Capacity</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>Pilot plant monitoring equipment</td><td>14'000</td><td>21'000</td><td>36</td><td>24</td><td>100%</td></tr>
<tr><td>Sampling equipment</td><td>4'667</td><td>14'000</td><td>36</td><td>24</td><td>50%</td></tr>
<tr><td>Data loggers</td><td>9'333</td><td>14'000</td><td>36</td><td>24</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Other goods and services</td><td>44'227</td><td>Consumables for water sampling (filters, bottles, preservation chemicals), pathogen filtration/enrichment in the field, chemical and microbiological analyses (columns, chemicals, IDEXX trays ..) - 22'000 EUR, Consumables for monitoring water levels, EC, temp. (accu, connectors, cable), Marketing in Asia (fair participation) - 9'000 EUR
Conference fees, open access fees, translation - 10'000 EUR, CFS</td></tr>
<tr><td>Total</td><td>109'867</td><td></td></tr>
<tr><th>26 EJC</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>1’400</td><td>Attendance consortium and technical meetings as well as field work in demonstration sites, conference</td></tr>
<tr><td>Equipment</td><td>-</td><td></td></tr>
<tr><td>Other goods and services</td><td>1’779.6</td><td>Consumables and materials for water sampling and analyses , conference fees</td></tr>
<tr><td>Total</td><td>3’179.6</td><td></td></tr>
<tr><th>27 KWB</th><th>Cost (€)</th><th>Justification</th></tr>
<tr><td>Travel</td><td>11'500</td><td>Attendance consortium and technical meetings as well as field work in demonstration sites, conference</td></tr>
<tr><td>Equipment</td><td>40'000</td><td>Online sensors, remote control, alarm system, ozone unit for sites no. 1 and no.12
<table>
<tr><th>Capacity / Equip. type</th><th>Eligible cost (EUR)</th><th>Total cost (EUR)</th><th>Depreciation period (months)</th><th>Period of use (months)</th><th>% used in the project</th></tr>
<tr><td>Remote control and safety installations</td><td>10'000</td><td>10'000</td><td>24</td><td>24</td><td>100</td></tr>
<tr><td>Online sensors (UVA)</td><td>10'000</td><td>20'000</td><td>36</td><td>18</td><td>100%</td></tr>
<tr><td>Operational sensors (flow, water level)</td><td>5'000</td><td>10'000</td><td>36</td><td>18</td><td>100%</td></tr>
<tr><td>Ozone unit</td><td>15'000</td><td>60'000</td><td>72</td><td>18</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Other goods</td><td>28'365</td><td>Chemicals for membrane cleaning - 5'065 EUR</td></tr>
</table>

and services		Lab material (bottle, filters, wipes, HSE equipment etc) - 10'000 EUR Lab material (bottle, filters) + onsite analyses - 10'000 EUR 2 conferences 500 € fee each (1'000 EUR), hosting of 1 consortium meeting (1'300 EUR) CFS (1'000 EUR)
Total	**79'865**	

28 KWR	**Cost (€)**	**Justification**
Travel	11'900	Attendance consortium and technical meetings as well as field work in demonstration sites, conference
Equipment	54'000	flexible mobile water pre-treatment facility, Analyis of resistance genes, Equipment for on-site water quality measurements and investment in mobile treatment, infiltration and monitoring equipment including high flow filtration units (fuzzy filter) at site 9. depreciation Analysis of chemicals high resolution mass spectrometry to support monitoring Q-PCR equipment for antibiotic resistance gene identification LTQ-Orbitrap machine
Other goods and services	10'800	Field and lab consumables, hosting of 1 consortium meeting CFS is required
Total	**76'700**	

Capacity / Equip. type	Eligible cost (EUR)	Total cost (EUR)	Depreciation period (months)	Period of use (months)	% used in the project
Sensor equipment	2'000	5'000	60	24	100%
Mobile pretreatment	40'000	40'000	24	24	100%
Q-PCR equipment	2'000	20'000	120	24	50%
LTQ-Orbitrap machine	10'000	500'000	120	24	10%

31 NUPS	**Cost (€)**	**Justification**
Travel	8'600	Attendance consortium and technical meetings as well as field work in demonstration sites, conference attendance
Equipment	-	
Other goods and services	16'970.4	Consumables and materials for pilot plant operation, water sampling and analyses, conference fees
Total	**25'570.4**	

4 Members of the consortium

4.1 Participants

1	**University of Applied Sciences and Arts Northwestern Switzerland (FHNW)**	n|w University of Applied Sciences and Arts Northwestern Switzerland School of Life Sciences

General description:

The School of Life Sciences (HLS) of the University of Applied Sciences and Arts Northwestern Switzerland (FHNW) is located in the centre of the tri-national Basel area (Switzerland – France – Germany). The four institutes of the HLS are Pharma Technology, Medical and Analytical Technologies, Chemistry and Bioanalytics and Ecopreneurship (IEC). Circa 200 scientists at HLS work currently on about 240 projects. The research and development activities of HLS encompasses a wide range of projects ranging from the development of new products and devices as well as the optimisation of production processes in terms of material and energy saving up to life cycle and risk assessment of some of these products.

The core activities of the Institute for Ecopreneurship (IEC) at the FHNW include Environmental Technologies, Environmental Biotechnology and Sustainable Resources Management. It possesses lab facilities such as pilot-scale lab, trace analysis lab and radioisotope lab, which are all equipped with cutting-edge devices.

IEC holds close contacts to relevant water authorities, water equipment providers, end-users in the region such as municipal water and wastewater utilities which allows for on-site pilot-testing. The institute covers the whole life cycle of technologies from proof of concept and assessment over implementation to monitoring and evaluation. Water frameworks and conclusive indicator systems play a crucial role in our daily work of assessments and evaluations in water management and technologies. The institute has extensive experience in leading and collaborating in large international research projects (e.g., AQUAREC, RECLAIM Water, Saph Pani, Water4India, COROADO) and feasibility studies in developing countries in the water sector and adopted technologies.

Main tasks in the project:

- **WP2:** Performance assessment of Lange Erlen site, AOP pilot plant and soil column experiments, chemical analysis of micropollutants based on the long-lasting collaboration with the utility IWB.
- **WP5:** selected advisor and review contributions to LCA work
- **WP6:** contribution to AquaNES DSS development
- **WP7:** Dissemination Manager
- **WP8:** Management: Project Coordinator. Project implementation by an experienced team at FHNW adhering to best management practice. Staff involved also brings in technical expertise in the project topic having coordinated the FP5, FP6 and FP7 projects: AQUAREC, RECLAIM WATER and Saph Pani.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Prof. Thomas Wintgens Chemical Engineer (PhD) and expert in water technologies. Leader of the Environmental Technology group at IEC with research focus on membrane, adsorption and advanced oxidation processes. Vast experience in EU project coordination in FP5, FP6 and FP7 programs: AQUAREC, RECLAIM WATER and Saph Pani. He is the AquaNES Project Coordinator.	**M**
Rita Hochstrat Research Associate at IEC with diploma in biology and environmental sciences background (MTechn). Acquainted with a broad spectrum of challenges in water management, specifically water reuse. Technical Secretary of Working Group Water Reuse at EurEau for the last 6 years. Profound project management experience in various EU research projects (MBR-TRAIN - FP6-MOBILITY-EST, Ref. 021050; MINOTAURUS - FP7-KBBE; GA no. 265946, Kill•Spill FP7-KBBE GA no.312139). She will be acting as AquaNES Project Manager	**F**
Julia Plattner Holds a master by research in environmental engineering and acts as research assistant at IEC. Practical experience in pilot-plant and lab-based research work related to micropollutant removal (adsorption, membrane technologies) in drinking water and wastewater. Previously she was involved in Saph Pani	**F**

where she was both carrying out field work and assisting in the administrative coordination. In AquaNES she will be carrying out the project related experiments, analytical work and oversee the pilot plant.	
Dr. Armin Zenker Armin studied biology in Salzburg (Austria) and Hohenheim (Germany) focussing on aquatic toxicology. Since 2006 he is working as post-doc at FHNW heading the environmental analysis laboratory at the IEC. He is experienced in the analysis of organic contaminants in drinking water, surface water, wastewater and sludge and will be responsible for the analysis of micropollutant in the Lange Erlen site (site 6).	**M**
Dr. Fredy Dinkel Holds a master in theoretical physics ETH Zürich and a PhD in polymer physics. About 25 years partner in environmental consultancy (Carbotech AG). Consultant in the field of environment and sustainable development, director for the department environmental consultancy: Life Cycle Assessment and mass flow analysis for cleaner production and environmental management. He is a senior expert in LCA performed more than hundreds LCA studies for industries and national and international organizations. Vast experience as lecturer (also at FHNW). Will be responsible for WP5 activities on LCA.	**M**

Relevant publications:

1. Wintgens T., Nättorp A., Elango L. and Asolekar S. R. (2015). Natural Water Treatment Systems for Safe and Sustainable Water Supply in the Indian Context: Saph Pani. IWA Publishing, London.
2. Excel-Tool for the evaluation and selection of water reuse options presented in the EU-FP7 project COROADO. Project deliverable D4.2: Development and application of a web-based geographical tool for WR&R technologies, accessible under: http://www.coroado-project.eu/?page_id=20
3. Kazner C., Wintgens T. and Dillon P. (2012) (Eds.). Water Reclamation Technologies for Safe Managed Aquifer Recharge. IWA Publishing, 460 pp.
4. Löwenberg J., A. Zenker, M. Baggenstos, G. Koch, C. Kazner, T. Wintgens (2014). Comparison of two PAC/UF processes for the removal of micropollutants from wastewater treatment plant effluent: process performance and removal efficiency. Water research 56: 26-36.
5. Dinkel F, Kägi T, Hochstrat R, Wintgens T (2015) LCA of advanced wastewater treatment to remove micro pollutants. Life Cycle Management Conference 2015, 30 August - 2 September 2015, Bordeaux, France

Relevant previous projects or activities:

1. **Saph Pani** (EU project, FP7 GA no. 282911): Saph Pani addressed the improvement of natural water treatment systems such as river bank filtration (RBF), managed aquifer recharge (MAR) and wetlands in India. The project aimed at enhancing water resources and water supply particularly in water stressed urban and peri-urban areas in different part of the sub-continent.
2. **COROADO** (EU project, FP7 GA no. 283025)**:** In order to be able to maximize the benefits from reuse and recycling technologies projects, COROADO both developed new and adapted existing concepts and operational frameworks. A web-based toolbox for reuse and recycling technologies and integrated water resources management was created in for the Latin American context, taking into account long-lasting changes, and at the same time addressing environmental and ecosystem integrity.
3. **DEMOWARE** (EU project, FP7 GA no. 619040) aims at increasing Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity. The programme aims to enhance the availability and reliability of innovative water reuse solutions, and to create a unified professional identity for the European Water Reuse sector.
4. **RECLAIM WATER** (EU project, FP6 contract no. 018309): developed hazard mitigation technologies for water reclamation providing safe and cost effective routes for managed aquifer recharge. The work assessed different treatment applications in terms of behaviour of key microbial and chemical contaminants. The project integrated technological water reclamation solutions with natural attenuation processes occurring in the subsurface to achieve upgraded water quality assessed on the basis of key contaminants.
5. **TAPES** (Transnational Action Program on Emerging Substances; INTERREG IVB 2012 – 2015. Project on technologies for the removal of micro-pollutants in water production and wastewater treatment, aiming at

knowledge development and transfer in and between water companies, managers of wastewater treatment plants, national and local government, and interested public.

Infrastructure/ technical equipment:

- LC QqQ MS, LC ESI-Ion trap and GC-(EI)-MS for analysis of micropollutants
- LC-OCD equipment for analysis of organic carbon fractions

2	**Akut Umweltschutz Ingenieure Burkard und Partner (AKUT)**	

General description:

AKUT is a small independent German SME working in all fields of ecological engineering, consulting, applied research and capacity building. It has special expertise in wastewater treatment with constructed wetlands, low energy consuming aerobe and anaerobe water treatment, renewable energy systems, ecological river engineering and water management. AKUT has more than 20 years of experience in planning and development of constructed wetlands for many applications. AKUT is founding member of the Global Wetland Technology Association (*www.global-wettech.com*), a worldwide acting group for establishing high quality wetlands all over the world. AKUT has participated in numerous national and international research and developing projects. The last EU research project (SLASORB, grant agreement RFSP-CT-2009-00028) was dealing with the use of industrial by-products such as steel slags in combination with natural and engineered wastewater treatment systems. AKUT is working in national and international specialist groups on constructed wetlands including the German DWA (German Association for Water, Wastewater and Waste) standards task group.

Main tasks in the project:

- **WP 3:** Design, construction and maintenance of the pilot system for natural wastewater treatment in combination with ozone treatment during the time of demonstration and experiments, final removal of the container system. This task has been executed in many R+D projects by AKUT.
- **WP 3:** Establishing design and marketing recommendations for combined systems. The scientific data from experiments and demonstration sites will be evaluated with the background of practical engineering. Several guidelines in Germany (DWA, DIN) and abroad have been written with substantial contributions from AKUT.
- **WP 7:** Developing a marketing strategy for innovative products such as combined NES in participating countries. AKUT has special experience in international cooperation for capacity building in the public and private water sector.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Prof. Jens Nowak Water Engineering and Management (PhD). Chair for Water Management at the University of Applied Sciences Potsdam, Department of Civil Engineering. Since 2011 consultant and managing partner of AKUT in the field of wastewater treatment and energy efficiency; 2007-2011 technical and financial manager of wastewater utilities AZV Reichenbacher Land; 1995-2007 expert on wastewater disposal concepts, combined water treatment concepts, management of WWTP monitoring as state officer at EPA Plauen /State Council Chemnitz, Saxony. His expertise includes consultancies for wastewater associations, municipalities and public authorities in Germany, Czech Republic, Romania, Albania and Russia. Nowak is chairman of German Water Association (DWA) specialist group on wastewater treatment in rural areas (FA-KA 10) and leading the German task group for new standards in wastewater treatment with constructed wetlands (A-262). Nowak will be responsible for NES design recommendations and marketing strategies derived from demonstration sites (WP 3/7).	**M**
Heribert Rustige Environmental Engineer (Dipl.-Ing., TU Berlin) founder and managing partner of AKUT. Responsible for R+D projects. Specialist in natural wastewater treatment and water engineering. German coordinator of IWA specialist group on constructed wetlands and member of IÖV and DWA task groups. Rustige has expertise as project manager for design, construction and optimization of numerous treatment wetlands in Germany, France, Spain, Portugal and China for more than 25 years. Rustige will manage design, construction and maintenance of the Berlin demonstration site (WP 3).	**M**

Relevant publications:

1. Rühmland S., Barjenbruch M., Rustige H., Heinzmann B. and Dünnbier U. (2008). Comparison of Seven Constructed Wetlands and Ponds for Advanced Wastewater Treatment, 11th International Conference on Wetland Systems for Water Pollution Control, Institute of Environment Management and Plant Sciences, Vikram University, Ujjain, India.
2. Rustige H. and Platzer C. (2001). Nutrient removal in subsurface flow constructed wetlands for application in sensitive regions, Wat. Sci. Tech., 44(11-12), 149-155.
3. Rustige H. and Nolde, E. (2007). Nitrogen elimination from landfill leachates using an extra carbon source in subsurface flow constructed wetlands, Wat. Sci. Tech., 56(3), 125–133.
4. Rustige H. (2012). Dephosphorisation of wastewater by fixed bed reactors using steel slags (in German language). Entphosphorung von Abwässern im Festbett auf Basis von Elektroofen- und Konverterschlacke, Schlacken aus der Metallurgie, Band 2, TK Verlag, ISBN 978-3-935317-86-6
5. Nowak J. and Rustige H. (2012). Combined sewage treatment with constructed wetlands, DWA Rege*n-wassertage 1.-13. Juni 2012*, Schönefeld, Berlin, Germany.

Relevant previous projects or activities

1. **Changshu:** A 5 ha system as **combined tertiary treatment wetland** for industrial water re-use (4.000 t/d) including subsurface and surface flow wetlands combined with technical units for precipitation of phosphorus and for external carbon dosing. Design and supervision of construction and operation. Jiangsu, China (2009-2017). AKUT in cooperation with German Ecological Engineering Society.
2. **SLASORB** (EU grant agreement RFSP-CT-2009-00028): AKUT designed, installed and operated a container system as fixed bed reactors for utilizing steel slags at the demonstration site in Kappe, Brandenburg, Germany. The leading university was École des Mines de Nantes. Industrial partners were Arcelor Mittal and Epur Nature.
3. **Design recommendations** on constructed wetlands for the rural areas of **Kaliningrad**, adapting German DWA standards, Russia, Nowak J. (Umweltbundesamt, 2015)
4. **Catalogue of Berlin water sector:** References, products and needs of Berlin water sector comprising more than 100 institutions from Berlin (SenWirt Berlin, 2014).
5. Proyecto de agua, saneamiento y manejo del recurso hídrico para **Piura.** Componente **fortalecimiento institucional**, comunicación y sensibilización pública (Peru, GIZ 2015-2017) Institutional strengthening of water utilities with respect to technology, economy, organization and public awareness. AKUT is supporting the building of capacities within *EPS Grau*, a large water and wastewater service provider for 750,000 inhabitants, in cooperation with SEECON GmbH, Basel.

Infrastructure/ technical equipment

Office in Berlin with all necessary hard- and software as well as a technical laboratory for common water, sludge and soil analyses for WWTP operation. A team of several engineers and technical assistants is available for construction and supervision of the demonstration site.

3	AUTARCON GmbH (AUT)	AUTARCON

General description:

AUTARCON is specialized in the development, construction and installation of decentralized water treatment units that can be run without the external supply of energy and chemicals as well as on online monitoring of water qualities and system treatment performance. The company was founded in 2010 as Spin-off from Kassel University and has implemented its technology in 10 countries since then.

The core component of the SuMeWa|SYSTEM called technology is an inline electrolytic (AO) unit to disinfect drinking or treated wastewater for a pathogen free and safe water supply. Drinking water disinfection units are installed worldwide with a current focus on Africa (Egypt and Tanzania). Units for the disinfection of treated wastewater are currently being implemented in India.

AUTARCON is conducting on-going research to develop water treatment products, which allow a stronger market penetration by offering adapted modularized treatment solutions. That way AUTARCON is able to react to locally existing water quality challenges and can offer unique cost and energetically efficient systems for e.g., the removal of turbidity, pathogens, hardness, arsenic, iron and manganese from source water.

The SME has extensive experience in collaborating in international research projects (e.g., SWINGS, UFCl2, SolArEx) and has proven to be a reliable partner especially when it comes to in-field experience. AUTARCON currently employs six people, mostly engineers.

Main tasks in the project:

- **WP 1:** AUTARCON will implement test and evaluate a solar driven treatment unit that is especially developed for pumping and disinfecting bank filtrate. Before its safe disinfection by inline electrolytic chlorine production from natural salt content of the water it can also be pre-filtered. Water quality and system performance will be online monitored and made available through a SCADA System. Integration of UF membranes into treatment setting with automated backwash and system cleaning.
- **WP 7** Market studies, exploitation & dissemination: development of an adapted water treatment product for operation in developing regions, focus on on-site disinfection using electrolysis exhibition in India

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Philipp Otter M.Sc. in Environmental Engineering and M.Sc. in Renewable Energies and Energy Efficiencies. He has conducted pilot plant research for adapted drinking water and wastewater treatment technologies in India, Tanzania, Cameroon, Egypt, Costa Rica and Brazil. Since 2010, Philipp Otter coordinates national and international water research projects for AUTARCON, such as SWINGS, $UFCl_2$ and SolArEx and has acquired in depth experience in accomplishing research projects under different challenging environments. Philipp will be coordinating the AUT activities in India (piloting and dissemination)	**M**
Alexander Goldmaier Dipl.-Ing. in electrical engineering. He developed the concept and the control unit for water disinfection based on anodic oxidation including solar-pv, pump, and water quality sensors during a research cooperation with Federal University of Ceará, Brazil. He conducted several field-tests in North-East Brazil between 2004 and 2007 and implemented a solar driven treatment system to supply drinking water in Gambia, Egypt, and Ghana. He is Co-founder and CEO of AUTARCON GmbH. Technical support and data assessment of piloting	**M**
Florian Benz	**M**

Dipl.-Ing. in electrical engineering. He developed and implemented the online monitoring unit for the remote control of SuMeWa|SYSTEM simplifying maintenance and monitoring of water quality parameters. He is Co-founder and CEO of AUTARCON GmbH and focuses on renewable off grid energy supply. Responsible for pilot assemblage and field work.	

Relevant publications:

1. Otter P., and Goldmaier A. (2014). Solar- und Wassertechnik ermöglichen neue Lösungsansätze für die Trinkwasserproblematik in Entwicklungsländern,'Solar and water technology enabling solutions to drinking water challenges in developing countries'. *Deutsche Lebensmittel Rundschau*, **110**(2), 54-59, ISSN 0012-0413.
2. Otter P. and Mishra V. (2013). Water Disinfection for Remote Areas of Developing Regions – An Innovative and Sustainable Approach using Solar Technology and Anodic Oxidation, Presentation at *1st IFAWET*, December 2013, New Delhi, India.
3. SuMeWa|SYSTEM online monitoring tool for mobile phones and computer used for water quality and system performance monitoring

Relevant previous projects or activities:

Autarcon features extensive experience in piloting their technologies in developing countries in collaboration with governmental institutions and local organisations

1. **SWINGS**, "Safeguarding Water Resources in India with Green and Sustainable Technologies" (FP7 GA no. 308502) seeks to integrated and optimized solutions for wastewater reuse in different areas of India.
2. **UFCl2**, Pure Water for Challenging Conditions. The project is developing an innovative and integrated solution for drinking water purification in off grid regions with poor source water qualities. The overall objective is to provide a system of low maintenance need and extremely low operational cost. The fully solar driven and containerized solution will join the strengths of ultrafiltration and anodic oxidation technology to supply reliably safe water (funded by German Federal Ministry of Education and Research (BMBF)
3. **SolArEx:** Solar Driven Arsenic Removal. The aim of this project is to develop an innovative technology in order to secure the drinking water supply in arsenic contaminated rural developing regions. In this project an innovative solar driven treatment system shall be developed being capable in quickly oxidizing arsenic species by means of anodic oxidation and removing them via adsorption and physical filtration. The focus will be set on the operability of such a technical solution in challenging of grid developing regions (funded by German Federal Ministry of Education and Research (BMBF)

Infrastructure/ technical equipment:

- Laboratory and workshops for prototype testing, pilot unit development and commissioning
- Basic water quality analysis equipment

4	**BioDetection Systems B.V. (BDS)**	

General description:

BioDetection Systems (BDS) (30 staff, based in the Netherlands) is an SME established in 2001 that develops, markets and applies bio-based detection methods for a wide range of applications. A main focus is on safety assessment and quality control of food, water and the environment. BDS' methods, like the CALUX® methods, are used as alternatives to chemical analytical methods and as animal alternatives. They are successfully applied in more cost effective, sustainable and ethically less controversial screening programs either as stand-alone, in a high throughput mode, or in smart combinations with more conventional technologies. Analyses carried out in its service department are strictly confidential and performed under ISO17025 and GMP+ certified conditions. BDS offers its technologies and services world-wide through a network of laboratories and agents.

BDS is a frequent partner/coordinator of national-, and EU funded projects on water safety (e.g. TECHNEAU, DEMEAU), and various projects that have contributed to the development and validation of its platform technology for various applications (e.g., ReProTect, ChemScreen, NewGeneris). National projects like Genes4water and BE-Basic contributed to the further development of comprehensive screening platforms for water quality monitoring. BDS actively participates in validation and international ring study exercises for its technologies via (inter)national organisations, including ECVAM, OECD, DIN committees, etc.

Main tasks in the project:

- **WP4:** Implementation of a range of bioassays in demonstration sites. Adaptation of monitoring technologies to needs of combined natural engineered treatment systems. Development of tailored monitoring programmes. In that frame BDS interact with other WPs (particularly WP6) for data exchange and –interpretation,
- **WP7:** BDS will participate in the exploitation plan development for its bioassays and dissemination activities (exhibit at fairs, contribute on conferences)

Principal research personnel to be involved:

Name/ Profile / Project responsibility	Gender
Dr Bart van der Burg Dr Bart van der Burg is the Director of Innovation of BDS and has ample experience in developing rapid and quantitative bioassays for various applications, including water quality monitoring as a main one. He has been coordinator and section leader of various EU- and other large scale collaborative research projects and has ample experience in valorization and open innovation. He will coordinate BDS contributions in AquaNES and actively drive the product development.	**M**
Dr Barbara van Vugt-Lussenburg Dr Barbara van Vugt-Lussenburg has a background in chemistry and biology, expert in automated cell-based screening, and risk analysis taking pharmacokinetics into account. Responsible for sample preparation and toxicity assessment	**F**
Dr Bart Pieterse Dr Bart Pieterse has a background in genomics, bioinformatics and data integration. He will be responsible for data management and their integration into the KR of AquaNES DSS (WP6)	**M**
Dr Harrie Besselink Dr Harrie Besselink is a toxicologist, with expertise in water quality monitoring and validation. Responsible for sample preparation and toxicity assessment	**M**

Relevant publications:

1. Van der Linden S., Heringa M. B., Man H. Y., Sonneveld E., Puijker L., Brouwer A. and Van der Burg, B. (2008). Detection of multiple hormonal activities in waste water effluents and surface water, using a panel of steroid receptor CALUX bioassays, *Environmental Science and Technology*, **42**, 5814-5820.
2. Schriks M., van der Linden S. C., Stoks P. G. M., van der Burg B., Puijker L., de Voogt P. and Heringa M. B. (2013). Occurrence of glucocorticogenic activity in various surface waters in The Netherlands. Chemosphere, 93(2), 450-454.
3. Van der Burg B., Van der Linden S. C., Man H. Y., Winter R., Jonker L., Van Vugt-Lussenburg B. and Brouwer A. (2013). A panel of quantitative CALUX® reporter gene assays for reliable high throughput toxicity screening of chemicals and complex mixtures. In: High throughput screening methods in toxicity testing, Steinberg P. (ed.), John Wiley and Sons, Inc. New York. ISBN 9781118065631, pp. 519-532.
4. Van der Linden S. C., von Bergh A., Van Vugt-Lussenburg B., Jonker L., Brouwer A., Teunis M., Krul C. and Van der Burg B. (2014). Development of a panel of high throughput reporter gene assays to detect genotoxicity and oxidative stress, Mutation Res., 760, 23-32.
5. Escher B. I., Allinson M., Altenburger R., Bain P., Balaguer P., Busch W., Crago J., Humpage A., Denslow N. D., Dopp E., Hilscherova K., Kumar A., Grimaldi M., Jayasinghe B. S., Jarosova B., Jia A., Makarov S., Maruya K. A., Medvedev A., Mehinto A. C., Mendez J. E., Poulsen A., Prochazka E., Richard J., Schifferli A., Schlenk D., Scholz S., Shiraishi F., Snyder S., Su G.,. Tang Y., Van der Burg B., Van der Linden S., Werner I., Westerheide S. D., Wong C. K., Yang M., Yeung B. H. Y., Zhang X. and Leusch F. (2014). Benchmarking organic micropollutants in wastewater, recycled water and drinking water with in vitro bioassays. *Environ Sci Technol*, **48**, 1940−1956.

Relevant previous projects or activities:

1. **TECHNEAU** (EU project, FP6) Integrated project to develop technologies for universal access to safe water.
2. **DEMEAU** (EU project, FP7, GA no. 308339) promotes the uptake of knowledge, prototypes and practices from previous EU research enabling the water cycle sector to face emerging pollutants and thus securing water and waste water services and public health. The project exploits four groups of promising technologies from previous EU research: Managed Aquifer Recharge (MAR), hybrid ceramic membrane filtration, hybrid advanced oxidation processes, bioassays. BDS coordinates the work on selection and validation of bioassays for water quality assessment.
3. **BE-Basic** (National project: www.be-basic.org) develops high throughput genomics-based monitoring tools for waste- surface- and drinking water

Infrastructure/ technical equipment:

BDS is able to routinely process samples for toxic/ecotoxicological effects in its facilities:

- Modern facilities specialized in qualitative effect-based bioassay measurements
- Fully equipped R&D and Service facilities with GMP+ and ISO17025 accreditation
- High throughput automated cell-based screening facility
- qPCR, next generation sequencing, and basic chemical analytics

5	**HydroBusiness (HYBU)**	HydroBusiness industriewater & afvalwater

General description:

HydroBusiness is a company in the Dutch water sector and a part of the water company Brabant Water. HydroBusiness designs, builds, finances and operates plants for the production of industrial water or wastewater treatment. At the moment HydroBusiness is a national player with the ambition to start with international projects in 2 years. To date, HydroBusiness has participated in several pilot studies and the implementation of full scale plants.

Main tasks in the project:

- **WP 2:** technology provider to Waddinxveen demonstration site, i.e. Fuzzy Filter use for on the treatment and underground storage of storm water. Designing, implementing and optimizing a full-scale system
- **WP7**: exploitation of the high velocity infiltration innovation (fairs, exhibitions; tentative training)

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Dipl. Ing. Joost Smetsers	**M**
Joost is working for HYBU since 2009 as account manager and project engineer. He completed Food and Environment studies at the HAS University of Applied Sciences (Germany). In previous positions he worked as wastewater engineer for the Dutch government. He will be supervising the technical activities in the Waddinxveen site.	
Mr. Toine Van Aard. Toine is working for HYBU since 2012 as manager exploitation. He is responsible for the exploitation of all the HYBU-plants. He will be supervising all the operational activities in the Waddinxveen site and exploit the technology in WP7	**M**

Relevant publications:

- No publications available

Relevant previous projects or activities

Various national projects on water treatment and distribution in the Netherlands, primarily for the food industry:

1. Designing irrigation water project Glasparel (ongoing)
2. Operating irrigation water project Kievitsakkers (ongoing)
3. Design, finance and operate waste water treatment plant for the food company Vion (ongoing)
4. Design, finance and operate ground water treatment plant for the food company Sensus (ongoing)
5. Operating a storm water collection system (ongoing)

Infrastructure/ technical equipment:

- Fast filtration
- Redundancy
- Remote control

6	**imaGeau (IMAGEAU)**	

General description:

imaGeau was founded in 2008 as a spin-off from the national research laboratory in Geophysics (CNRS Montpellier Geophysic laboratory part of Montpellier University). It has strong expertise in both Geophysics and Hydrogeology.

imaGeau provides a unique tool to understand/monitor groundwater resources. imaGeau's patented Subsurface Monitoring Device (SMD) is autonomous in energy and is installed in a 2" borehole where it automatically and continuously monitors the fluid conductivity in the soil pores up to an aquifer depth of 300m.

The SMD delivers online graphic representations with a high spatial and time resolution of the stratification and dynamic of the aquifer and indicates the evolution of potential pollution (e.g., by seawater, leakage, etc.). SMD provides relevant information about the water quality in aquifers and can be applied for quality monitoring in Managed Aquifer Recharge.

imaGeau has installed SMD networks in France, Spain, the Netherlands, Israel and Jordan and works with local governments and water agencies, research institutes (e.g., Deltares, BRGM, CNRS) and industries (e.g. SAUR, VEOLIA, SOLVAY). imaGeau puts a strong emphasis on R&D and has been participating in a number of EU funded collaborative research programmes such as MUSTANG, PANACEA or TRUST.

Main tasks in the project:

- **WP 2:** monitoring and visualisation of effects of aquifer recharge with reclaimed water in the Agon-Coutainville demonstration site. Validation of the tool for saline intrusion management in artificial groundwater replenishment scheme. imaGeau will design, build and install three SMDs to monitor the electrical conductivity of poral fluid in the aquifers.
- **WP 7:** develop business model for the SMD application in water reuse contexts

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Matthieu Baïsset Hydrogeologist engineer graduated from ENSG (French National Geological Engineering School). He started his career in French Guyana at the BRGM where he was scientific manager of groundwater management projects. He has now joined imaGeau in charge of data interpretation. He will be coordinating the technical-scientific contributions of imaGeau to the AquaNES project.	**M**
Dr Jean-Philippe Bellot PhD in Environmental Hydrogeology from Montpellier University (2001). He started his career at BRGM then continued in academic research for his PhD and lately managed the hydrogeological department of HGM (an environmental consulting company). He will be the AquaNES project manager Back-up at imaGeau.	**M**
Olivier Depraz Graduated from the Bordeaux Business School in 1988 and holder of an MBA from the London Business School (1995). Twenty years' experience as sales adviser then marketing manager of multinational IT companies. He is a founding partner of imaGeau and heads the Sales and Marketing department. He will be managing the imaGeau contributions to the AquaNES project. He will be looking after the commercialisation of the application.	**M**

Relevant publications:

1. Bellot J-P. and Neyens D. (2014). Continuous monitoring of in-situ electrical resistivity : imaGeau case studies and potential applications. *Réunion Sciences de la Terre – RST2014* (24th Earth science meeting), October 27-31, University of Pau, Pau, France.
2. Bellot J-P., Neyens D., Jauzein V. and Nauleau F. (2014). New downhole real time and near field hydrogeophysical observatory of groundwater quality: salt water intrusion and wastewater infiltration. *Colloque GEOFCAN*, November 13-14, Faculté des Sciences d'Orsay, Paris, France.
3. Bellot J-P., Lemaire B. and Alouran S. (2015). Real time and in-situ monitoring of groundwater conductivity for long-time management : the Azraq wellfield, Jordan. 42nd IAH Congress AQUA2015- Hydrogeology: back to the future!, September 13-18, Rome, Italy.

Relevant previous projects or activities

IMAGEAU has tested subsurface monitoring devices in various subsoil storage contexts

1. **Mustang** (EU FP7-ENERGY-2008-1): High resolution **monitoring** with Subsurface Monitoring Device - A multiple space and time scale approach for the quantification of deep saline formations for CO_2 storage.
2. **Panacea** (EU FP7-ENERGY-2011-1 GA No. 282900): **Monitoring** (With SMD) and predicting the long-term behaviour of CO_2 injected in deep geological formations
3. **Trust** (EU FP7-ENERGY-2012-1 GA no. 309067) : High resolution **monitoring**, real time visualization and reliable modelling of highly controlled, intermediate and up-scalable size pilot injection tests of underground storage of CO_2.
4. **Grain d'sel** (French Project ANR): New approaches and innovative sensors for knowledge and monitoring of coastal aquifers. Application to saltwater intrusion **monitoring** in the sedimentary basin of Roussillon (France).

Infrastructure/ technical equipment:

All necessary devices for equipping demonstration sites with the relevant monitoring system are at hand

- Subsurface Monitoring Device (design and build)
- Data acquisition box
- Wireless Communication
- Data processing infrastructure (Webserver and Database)

7	**Geo-Hyd (GEOHYD)**	

General description:

Geo-Hyd is a consultancy firm providing services in computing & Information System applied to Integrated Water Resource Management. It has about thirty collaborators, including scientists in agronomy, geology, computer science and GIS. In January 2013, Geo-Hyd became a full subsidiary of Antea Group. Currently Geo-Hyd is part of Innovation and Development Division of Antea Group (DID).

Geo-Hyd provides services and expertise in 4 domains:

- Aquatic environments expertise: water body quality assessment (physical and chemical quality of water, physical condition of the watercourse, status of biological communities);
- Data management: Data integration management, analysis and valorization of environmental data (special skill in High Performance Computing - HPC);
- Information Technology and Geomatics: needs analysis, Information System design and software conception, GIS & Relational Database Management System (RDBMS), remote sensing;
- Integrated water resources management (IWRM): public policy, master plan, river, basin and hydrological modeling.

Geo-Hyd invests significant R & D efforts on developing GIS systems and operational monitored tools for assessing fate of pollution in soil and water bodies. It has a strong R&D strategy based on several collaborations with academic partners (Agence National de la Recherche, French Ministry of Industry, European Union) such as the COQUEIRAL, SAMCO, FlocOn Bio and FRAME projects.

Main tasks in the project:

- **WP 2:** Implement a Centralized Knowledge Platform (CKP) in order to ensure the interoperability and the knowledge capitalization of WP2, design and implementation of an ICT System for WP2, data management and dissemination strategy via WP6 and WP7.
- **WP2:** Interface site data acquisition (imaGeau) and modelling/processing techniques (BRGM) into an off-the-shelf software dedicated to Agon-Coutainville demonstration site.
- **WP 2/6:** Develop SAT/MAR-specific system performance optimisation tool based on real-scale demonstration results.
- **WP 6:** Integrate WP2 ICT system and SAT/MAR efficiency assessment tool output into general Decision Support Platform of AquaNES (WP6).
- **WP 7:** Stakeholder/training workshop on 'Surface treatment-SAT/MAR' system efficiency assessment tool for different end-uses (irrigation, indirect potable reuse)

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dominique TAFANI: In the company since 2010 as project manager in water, energy and waste activities. Engineer of French "Grandes Ecoles" in water, forest and rural engineering, Dominique has a good experience in groundwater management from modelling of groundwater flows and pollutants fate to resource exploitation and protection. He has besides skills in program development, data management and analysis (statistics and geostatistics, etc.). *He will be acting as Geo-Hyd manager in AquaNES Project.*	**M**
Loïc THOMAS: In the company since 2001 as data IT and engineering information systems unit manager. Programmer analyst by training, Loïc Thomas is led to design and implement specialized computer tools in management, processing and analysis of environmental data. *In AquaNES project, he will work on implementation of the Centralized Knowledge Platform for WP2 and on IT development of the SAT/MAR ICT system.*	**M**

Axel AUROUET : In the company since 2004 with initial training in water resources management, Axel Aurouet also developed a dual expertise in the field of information systems, GIS, hydrological and hydrochemical modeling. He speaks regularly with water agencies on valuation issues, pressures-impacts assessment and regarding integrated water resource management planning issues *In AquaNES project, he will work particularly on SAT/MAR efficiency assessment tool and its integration into AquaNES Decision Support Platform.*	**M**
Dr. Hervé NOEL: In the company since 2004 as Research and Development project manager, Hervé Noël is. Doctor of Sedimentary Geology. He has a good experience in multi-scale diagnostics on transfer of dissolved and particle elements from urban and rural catchment areas to ground and surface waters. *In AquaNES Project, He will be coordinating the scientific contributions of Geo-Hyd.*	**M**

Relevant publications:

1. Dedewanou M., S. Binet, Jl. Rouet, Y. Coquet, A. Bruand and H. Noel (2015). Groundwater vulnerability and risk 1 mapping based on Residence Time Distributions: Spatial analysis for the estimation of lumped parameters. *Water Resources Management* (in press).
2. Pierre D., Aurouet A., Essayan V., Eberscheweiller Ch., Vuathier J.R., Armand C., Barrat J.M., Dodo A. and Baba Sy L. (2015). Integrated Water Resources Management of the Iullemeden-Taoudeni/Tanezrouft Aquifer Systems along with the Niger River. *25th Annual International Conference on Soil, Water, Energy and Air,* March 23 -26, 2015, San Diego, California.
3. Chasles A., Dedewanou M., Minc D., Noel H., Oppeneau E. and Talva R. (2015). Evaluer le transfert des produits phytosanitaires entre zones d'application et eaux souterraines. Application "Phyto'Scope" au Val d'Orléans, *Techniques Sciences & Méthodes,* **110**(1/2), 39-52.
4. Tafani D., Noel H., Suire P., Dedewanou M. and Thierion Ch. (2014). Prise en compte de la Zone Non Saturée (ZNS) dans l'évaluation des transferts de polluants de surface dans les eaux souterraines pour l'aide à la décision - "Innover dans les services publics locaux de l'environnement". *93ème Congrès de l'ASTEE* , June 3 -6, Orléans, France.
5. Bordeau F., Binet S., Peyraube N., Noel H., Dedewanou M., Hertout A., Thauvin M., Coquet Y., Pierre D. and Tafani D. (2014). Dynamique des transferts d'eau et de nitrate d'origine agricole, des sols vers le capatage S1 de la Saussaye (Chartes Métropole). Développement et application de l'outil DARCI: Distribution Analysis of ResidenCe tImes - "Innover dans les services publics locaux de l'environnement". *93ème Congrès de l'ASTEE* , June 3 -6, Orléans, France.

Relevant previous projects or activities:

Geo-Hyd has already developed operational tools for subsoil pollution assessment that will be used for SAT/MAR ICT system implementation in AquaNES Project

1. Integrated Water Resource management for Iuellemeden and Taoudeni / Tanezrouft aquifer – Observatoire du Sahara et du sahel – Remote sensing, Spatial recharge modeling and IWRM Strategy definition.
2. Urban community of Orléans and Chartres (French community) - DARCI Tools (Distribution Analysis of ResidenCe tImes). Simplified GIS model of agricultural contaminants transfers from soil to drinking water catchment area.
3. Many french territorial collectivity and French Water Agency - Axionne solution - Water bodies ecological status assessment with Axionne solution.
4. Nuclear facility - S-Eau-S is a friendly user interface to manipulate numerical groundwater models. The user can describe geolocalized pollution sources and pumping stations through a map interface, launch the model computation, and display the time-animated evolution of the pollution plume.

Infrastructure/ technical equipment:

For the processing of large data sets and modeling trains, Geo-Hyd may use its HPC cluster consisting of 80 processing cores and 512 graphics compute cores.

8	**microLAN BV (microLAN)**	

General description:

microLAN, based in Waalwijk, the Netherlands, is a company specialized in early warning systems for water quality monitoring based on light measurements. microLAN has developed a range of fully automated online monitoring devices for guarding the quality of drinking, surface and process waters. microLAN supplies three complementary systems that detect algae, bacteria and chemical pollutions. microLAN's online monitors instantly response to a change in water quality, giving an alarm signal to indicate a possible water pollution. The advantage of microLAN's monitoring is that the water intake is guarded permanently, avoiding the need for a high frequent collection of water samples and lab analyses. A possible pollution is detected within minutes, allowing the operator to take appropriate actions immediately.

The newly developed BACTcontrol detects the presence of bacteria - including *E.coli* and coliforms – in the water. The online monitoring is based on an enzymatic reaction performed by the bacteria that makes the degradation product visible for fluorescence detection. References of BACTcontrol users include water supply companies, environmental laboratories and operators of bathing facilities in Austria, Germany, Switzerland, the Netherlands, Denmark, Finland and Spain.

The company conducts research and development through collaborations with customers and specialized research organizations focusing on new technologies and oriented to market demand. Its current products, which include the iTOXcontrol monitor and the ALGcontrol for monitoring algae species and bio-toxins, enable microLAN to provide quick, sensitive, environmentally-friendly and cost effective monitoring solutions.

Main tasks in the project:

- **WP4:** tailor monitoring strategies for cNES based on data from site monitoring in WP1, 2 and 3. Support to QMRA task.
- **WP7**: develop exploitation strategy for the BACTcontrol. Inform the dialogue with authorities with respect to standardisation and certification of the device. Contribution to dissemination in Workshops

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Joep Appels: has a degree in analytical chemistry (HBO-A) and a degree in marketing (NIMA-B). He has 30+ years of experience in the field of (on-line) water and environmental analysis and worked for several major US instrument companies including Thermo Instruments and New Brunswick Scientific. He will co-ordinate the work within this project for microLAN and attend meetings	**M**
Jaap van den Dries: Has a bachelor degree (Avans University) and works with the company since 2009. He will be responsible for all technical developments and supports the installations, trainings and testing at local facilities.	**M**

Relevant publications:

1. Appels J., Kuster E. and van den Broeke J. (2007). Combination of an on-line biomonitor using light emitting bacteria and a UV spectrophotometer probe for homeland security and drinking water safety. In: Kamerman G. W., Steinvall O. K., Keith L. Lewis, Krapels K. A., Carrano J. C. and Zukauskas A. (eds.), *Proceedings of the SPIE 6739*, *Electro-Optical Remote Sensing, Detection, and Photonic Technologies and Their Applications*, 6739E, Florence, Italy. doi:10.1117/12.748031
2. Appels J. and van Tuijn J. (2012). iTOXcontrol Safeguards Intake Romanian Drinking Water, *Everything About Water magazine,* 31-32.
3. Appels J. and Kokkali V. (2013). On-line SPE-TOX monitoring: the end of lab toxicity testing, *Rapid Methods Europe (RME) Conference*, January 21, Noordwijkerhout, The Netherlands.

Further, microLAN contributed with instrumentation to the research described in:

4. Ryzinska-Paier G., Lendenfeld T., Correa K., Stadler P., Blaschke A.P., Mach R.L., Stadler H., Kirschner A.K. and Farnleitner A.H (2014). A sensitive and robust method for automated on-line monitoring of enzymatic activities in water and water resources, *Water Science and Technology*, **69**(6),1349-1358.

Relevant previous projects or activities:

1. **AQUAVALENS** (EU FP7, 2014 – 2018 GA no. 311846): AQUAVALENS will be developing technologies to better control water supplies with respect to health safety. The microLAN device is being tested for suitable application in drinking water production and water for the food processing industry.

Infrastructure/ technical equipment:

- BACTcontrol device: an online automated instrument for the detection of microbiological activity in water.
- workshop facilities for maintenance of systems

9	X-Flow B.V. (XFLOW)	X-FLOW

General description:

X-Flow is part of Pentair's Flow and Filtration Solutions business and produces and supplies a wide range of standard membranes and modules for filtration and purification processes in different industries, like water, waste water and beverage.

Therefore, advanced membranes are our business. We help equipment manufacturers, engineering and construction contractors to exceed expectations with membranes that make the difference, even in the most challenging tasks and conditions. Focused on practical and economic progress, we develop filtration technology with the lowest total cost of ownership and the highest efficiency.

One of the newest developments is a capillary nanofiltration membrane. X-Flow nanofiltration membranes are characterized by a low operating pressure and chlorine resistant PES membrane material. The membranes find their main applications in the removal of humic substances and other dissolved organic matter. And it also removes synthetic chemical compounds such as dyes.

Main tasks in the project:

- **WP 1**: Preparation and operation of two NF-pilot plants for testing NF-membranes after bank filtration (BF) on Berlin demonstration site (no. 1) to demonstrate long-term stability of capillary nanofiltration. Evaluation of the results and tuning/developing NF-membranes for partial removal of selected compounds and the extension of applicability of nanofiltration for bank filtrate/groundwater treatment from strictly anoxic to suboxic conditions.
- **WP7:** scientific and commercial exploitation of demonstration results (exhibitions, workshops)

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Leo Vredenbregt Leo Vredenbregt is researcher in the Advanced Filtration (AF) R&D group of Pentair X-Flow. He is specialized in the process development of especially capillary nanofiltration membranes. He coordinates the AquaNES project inside the organization of X-Flow B.V and attends the project meetings and different bilateral meetings to fulfil the expectations of the project including dissemination of results and exchange with target groups as well as support in pre-commercialization and up-scaling.	**M**
Jens Potreck Jens Potreck is R&D Manager X-Flow and is head of the AF R&D group. He supports Leo Vredenbregt in the project lead due to his experience in EU funded projects.	**M**
Radek Oborny Radek Oborny is an R&D technologist in the AF R&D group inside X-Flow. He is a specialist in the layer by layer (LbL) technology and he will transfer the generated knowledge inside the consortium into the production steps of our company.	**M**
Wika Wiratha W. Wiratha is an R&D technologist in the AF R&D group inside X-Flow. She will transfer the generated knowledge inside the consortium into the production steps of our company.	**F**
Michael Rojas Michael Rojas is project manager in the AF R&D group inside X-Flow and supports Leo Vredenbregt in all project management and commercialization related subjects.	**M**
Tom Spanjer	**M**

Tom Spanjer is senior technologist in the AF R&D group inside X-Flow. He is specialized in the process development of capillary ultra- and nanofiltration membranes. He supports the pilot research with data processing and interpretation, troubleshooting and process optimization. Furthermore he will support Henry Hamberg with the upgrading of the pilots.	
Henry Hamberg Henry Hamberg is a technician in the AF R&D group inside X-Flow and well experienced in the construction, modification and operation of pilot plants. He will have the practical lead during the upgrading and commissioning of the pilots.	**M**

Relevant publications:

1. Keucken, A., Spanjer, T., Ericsson, P., Persson, K.M., Köhler, S. (2014). Evaluation of Color Removal Package (CRP) for drinking water based on novel hollow fiber nanofiltration, The 9th Nordic Drinking water Conference, 2014.
2. De Grooth J., Oborny R., Potreck J., Nijmeier K. and De Vos W. M. (2015). The Role of Ionic Strength and Odd-Even Effects on the Properties of Polyelectrolyte Multilayer Nanofiltration Membranes. *Journal of Membrane Science*, **475**, 311-319.
3. Heidfors, I., Vredenbregt, L.,H.J., Homes, A., Van Es, B. (2015). Pilot testing with hollow fiber nano filtration membranes for removal of NOM from surface water in Sweden. NOM 6, IWA Specialist Conference on Natural Organic Matter in Water, Malmö, Sweden 7–10 September 2015

Relevant previous projects or activities:

1. **LbLBRANE (FP7 GA no. 281047):** Regenerable active polyelectrolyte nanofiltration membranes for water re-use and metal-acid recovery. XFLOW developed a modified membrane module with specific retention and filtration behaviour which will be demonstrated in full-scale application in AquaNES.
2. **SurFunCell (FP7 GA no. 214653):** Surface functionalization of cellulose matrices using cellulose embedded nano-particles.

Infrastructure/ technical equipment:

XFLOW possesses facilities to test, characterise and modify its membrane products

- Well-equipped laboratory with all relevant membrane analysis methods as: SEM/EDX, ICPE, DSC, GPC, TOC, UV-Vis, Rheometer, several retention and permeability measurement units.
- Small scale up to pilot scale process testing on real and synthetic waters.
- Pilot and laboratory membrane spinning lines.
- Module production and development equipment.
- Coating equipment from laboratory to large production module size.

10	Vertech Group (VTG)	

General description:

VERTECH GROUP (VTG) is a French research intensive SME with business focus on High-Tech Environmental Consultancy, International R&D Consultancy and Market Research and business development. VTG aims to create value by supporting and advising private and public organizations in various sectors (e.g. recycling, energy and waste treatment), and regions (e.g. Europe, Latin America) to get from research to market. VTG is member of the French Life Cycle Assessment Platform (Avnir)

VTG capabilities include:

- Sustainability Assessments of processes and strategies
- Analysis of ecological footprint
- Life Cycle Assessment and Life Cost Cycling of innovative processes and products Environmental Technology Verification
- Socio-economic impacts of innovative products by Social Life Cycle Assessment
- Techno-economic, environmental, social and legal analysis and risk assessment
- Business models and business plans definitions
- Exploitation of R&D results and exploitation plans
- Dissemination activities

The staff of Vertech Group has over 10 years of experience on international cooperation, coordinating projects and WPs. Vertech Group is member of the French Life Cycle Assessment Platform (Avnir). The company is based in Nice, in the French EcoValley, that is the first example of a real sustainable urban environment. VTG is also present in Spain and has expansion plans to other markets besides Europe (e.g South America).

Main tasks in the project:

- **WP 7**: Leader of WP7 - Exploitation and dissemination'. Responsible for exploitation strategy including market studies and business models generation, and support of dissemination of results. Designated Exploitation Manager and IPR Advisor
- **WP 5**: Environmental assessment of cNES technologies by Environmental Life Cycle Assessment (E-LCA); study of the cost of the system by performing a lifecycle costing (LCC); evaluate socio-economic impacts with Social Life Cycle Assessment S-LCA

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr Paola Castrillo Paola Castrillo has a Science and Materials Engineering PhD from Carlos III he University of Madrid. From 2004 to the present she has been active in the preparation, management, coordination and / or development of several European R & D projects in the areas of sustainability and revalorization of urban and agricultural wastes/residues (i.e. FFW-FP7, NOSHAN-FP7, GRAIL-FP7, CLOSEWEEE-H2020, INNOBITE-FP7, TECNOCAI- CENIT, etc.). Her research interests include sustainable revalorization of urban wastes, energy and resources efficiency, sustainability and manufacturing processes efficiency assessments. She is the Technical Coordinator of the FFW (FP7) and CLOSEWEEE (H2020) projects. Currently working as Commercial Manager for Vertech Group. Support on LCA, LCC and social LCA development.	**F**
Dr Erasmo Cadena Erasmo Cadena has a PhD in Environmental Science from Universitat Autónoma de Barcelona (UAB). He holds a Msc in Enviromental Engineering. Postdoctoral Researcher at University of Cambridge-UK	**M**

and Universitat Politècnica de Catalunya (UPC), BarcelonaTech. He has experience in international research initiatives and his research interests include technical, environmental and economic analysis of new processes and high-performance. products, life cycle assessment, life cycle costs analysis. Erasmo will be performing the various LCA, LCC tasks in WP5.	
Eléonore Chabbey Eléonore Chabbey is BSc in Business & Management from the University of Nice Sophia Antipolis, Msc1 and Msc2 in Economy Management of Small-Medium-Enterprises. Currently Mrs. Chabbey is in charge of business development within the company, her activities include market research and analysis, business modelling and market uptake strategies. She will be working on the market analysis and Business Model CANVAS tasks.	**F**
Antonio Barona Antonio Barona is the responsible of the overall R&D, Innovation & Business strategy of the company. He holds a Bs in Civil Engineering, M.Sc. on Materials and Innovation, M.Sc. in Project Management. Mr. Barona has more than 10 years of experience in the coordination of international research. He is member of several international academic, business and research platforms dealing with Environmental and Energy Technologies for a Sustainable Future. In terms of international research cooperation, he has not only actively participated in several project proposals but has led the project Coordination of the FP7 projects: EE-QUARRY & S4EeB. He will be performing the management of the project and WP7, assessing on strategic planning and support on LCA and LCC.	**M**

Relevant publications:

1. Garfí M., Cadena E., Pérez I. and Ferrer I. (2014). Technical, economic and environmental assessment household biogas digesters for rural communities. *Renewable Energy*, **62**, 313–318.
2. Adesanya V., Cadena E., Scott S. and Smith, A. (2014). Life cycle assessment on algae biodiesel production using a hybrid cultivation system. *Bioresource Technology,* **163,** 343-355.
3. Colón J., Cadena E., Sánchez A., Artola A. and Font X. (2012). Environmental impacts of installations of biological treatment of municipal organic wastes. *Ingeniería Química*, **44**, 62–67.
4. Colón J., Cadena E., Pognani M., Maulini C., Barrena R., Sánchez A., Font X. And Artola A. (2013). Toward the implementation of new regional biowaste management plans: Environmental assessment of different waste management scenarios in Catalonia. *Resources, Conservation and Recycling*. Volume 95, February 2015, Pages 143–155

Relevant previous projects or activities:

1. **EU FP7 WATER4INDIA** - Smart, cost-effective solutions for water treatment and monitoring in small communities in India. A Decision support system integration tool. 11 partners. www.water4india.eu/. The project develops solutions for producing drinking water, technologies for treatment of wastewater, monitoring technologies of treated waste water and a Decision Support System (DSS) integration tool aiming to large scale deployment of technologies in cost effective manner.
2. **EU FP7 INNOBITE** - Transforming urban and agricultural residues into high performance biomaterials for green construction. 9 partners. www.innobite.eu/. The project analysis of the cost effectiveness and environmental credentials of the products/processes developed and of new possible business lines and new business models.
3. **H2020 CloseWEEE** - Integrated solutions for pre-processing electronic equipment, closing the loop of post-consumer high-grade plastics, and advanced recovery of critical raw materials including antimony and graphite. 12 partners. www.closeweee.eu.

Infrastructure/ technical equipment:

- software SimaPro® 8 (PRé Consultants) and Ecoinvent v.3 databases (Swiss Center for Life-Cycle Inventories, 2010). Analytical tools in accordance with ISO 14040 & 14044 standards (ISO 14042, 2000).

11	**Wadis Ltd.**	

General description:

Wadis Ltd. is a private start-up company, located in Ness Ziona, Science Park, Israel. Founded in 2010, by Oren Gafri, a leading expert in electromagnetic pulse systems and material and processing and Riki Gafri, who has 25 years of management experience in the high-tech and clean-tech industry. The company has 7 employees, comprised of scientists, mechanical, electrical and environmental engineers.

Wadis is the first company to have developed and patented a commercially viable, industrial-scale process that applies an electrical pulse discharge technology ("EPDT") for the disinfection of all types of water. This technology has many advantages over the conventional existing disinfection technologies as being more environmental friendly process (no /low disinfection byproducts formation) while effectively disinfecting

Main tasks in the project:

- **WP 2:** WADIS will demonstrate the electric pulse oxidation system as an alternative to ozonation at the Shafdan study site (IL). The process will be tested as a pre-oxidation system for bioactive carbon filter and UF ceramic filter and also in combination with short soil aquifer treatment.
- **WP4:** test case support to Risk Assessment tool
- **WP7:** participation in the exploitation plan development for its EPDT**.**

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Riki Gafri, CEO Riki Gafri is a software engineer and a business manager (MBA), She has 25 years of management experience in the high-tech and clean-tech industries, having served as CFO, CHR as well as a director in several companies. Riki will manage the project,: coordinate between Wadis team, Mekorot and Shafdan people, take care of the project budget, be responsible for the purchase orders, see that work meets the predefined time table	**F**
Amit Izhar, R&D manager Amit serves as Wadis R&D manager since 2010. Before that he served as freelance advisor to Avkad in the fields of automated stock and commodity trading "robots" and design of noise emission metering. Prior to that, and for 10 years, he served as application engineer in Pulsar Welding, where he was involved in developing magnetic burst-energy systems (replacing explosives in welding, forming, excavation, etc.) Amit is the senior engineer of the project, he will be responsible of the design, build and run of the system. He will also be responsible for the system maintenance and he will supervise the work in the field.	**M**
Dr. Haim Cikurel In-house consultant and coordinator of the Shafdan demonstration site. He has 43 years of experience in different fields of research, operation and engineering in the Chemical Process Industries and in Environmental Engineering. He has been involved with Mekorot and other Israeli companies in all EU – Framework programmes (4th, 5th, 6th and 7th) since 1998 with different projects in effluent reuse, water and wastewater treatment (e.g., Catchwater, Aquarec, Techneau, Reclaim, Switch, MINOTAURUS, Water4India, Demoware). Supervising on-site activities in Shafdan. Contribution to technology performance validation.	**M**

Relevant patents: System and method for treatment of liquid – the Wadis system

Country	App. No.	Our Ref.	Filed	Patent No./	Grant Date/	Status/Next action
Israel	210808	2059034	23/01/2011			Examination in progress; Acceptance/Next office action received: Jul 29, 2015
Patent Cooperation Treaty	PCT/IL2012/050013	2137727	19/01/2012			National Phase entered & case finished
China	201280006215.3	2234932	19/01/2012	CN 103328390A	25/09/2013	Examination in progress; Office Action due: Jul 19, 2015
European Patent Office	12707387.2	2234942	19/01/2012	2665684	27/11/2013	Examination in progress; Acceptance/Next office action received: Jan 13, 2016
India	1382/MUMNP/2013	2234959	19/01/2012			Examination requested; Expected date for 1st Official Action: Dec 11, 2015
United States of America	13/980,734	2234970	19/01/2012	US-2013-0299351	14/11/2013	Examination in progress; Office Action due: Jul 17, 2015

Relevant previous projects or activities:

1. Running system in Kfar Sabba WWTP (waste water treatment plant), treating tertiary water (instead of UV). Disinfection results achieved were very good : a 4-5 log reduction.

Infrastructure/ technical equipment:

The Wadis System consists of three main parts:

- **Power Generator -** contains solid-state capacitors for accumulating and condensing electrical energy, and multi-vacuum switches that discharge this energy to the coil in a few microseconds. It produces electrical pulses according to predefined amount and power. The pulses move through sophisticated high voltage cables to the EDC. The generator provides high energy efficiency in switching; due to an innovative use of switches and cables the switches are durable to the recurrent discharges. **2)**
- **Electrode Discharge Chamber (EDC Reactor)** - The reactor is where the liquids flow through and undergo the electro-discharge disinfection process. It is connected by flanges to the liquid flow tubular system. Here, the pulses move to unique electrodes that are dumped in the waste water. It is a tube which includes new, innovative electrodes. The unique characteristics of electrode cells - their structure, their number and their arrangement in the tube enable high voltage pulses coming from the Pulse Current Generator (PCG) to be discharged. They enable high performance while using a low consumption of energy.
- **Control unit –** this unit incorporates an operator console and contains the operating system software to control the energy input and output (intensity and time). The software also gives a complete real time diagnostics of the system functioning.

12	**WatStech Ltd.**	

General description:

WatStech was originally a spin-off company from the University of Wolverhampton and was first formed as a research group in 2000. In 2005, WatStech Ltd. was created which in 2008 became an independent company. WatStech Ltd. is a research and consultancy company providing technical support to the Water Industry for over 10 years, with a focus on applied research and problem solving for treatment difficulties faced by the water industry. WatStech Ltd. has expertise in water and wastewater treatment with practical experience in full-scale, pilot-scale and lab-scale treatment processes. WatStech Ltd. has fully equipped laboratories for process testing and development of specialist analytical techniques. The trademarked analysis service called RapStech® was developed specifically for the water industry, to determine granular activated carbon (GAC) regeneration time scales to meet drinking water standards.

WatStech Ltd. is a framework supplier for "Wastewater Sampling & Specialist Analysis" to Severn Trent Water Ltd. from 2010-15. It provides regular site sampling and analysis services for many wastewater sites throughout the Severn Trent region and assists in the feasibility studies for full-scale plant design for the Asset Management Programme 5 (AMP5) and beyond. WatStech is a key member of the team for operating & monitoring pilot plants that are using novel technologies for the treatment of wastewaters within the West Midlands. WatStech Ltd. also works with other industry sectors; including food & drinks manufacturing, pharmaceutical products and metal processing such as the Galvanising industry.

WatStech has a team of qualified and technical experts with over 30 years of experience in water and wastewater including feasibility and project scoping studies, pilot-scale and full-scale evaluations, project management as well as research & development activities.

Main tasks in the project:

- **WP3**: operation of pilot plants for phosphorous removal at demonstration site (No. 13) Packington
- **WP7** exploitation plan development for innovative, low energy enhanced P-removal technologies

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. Kalminder "Kally" Kaur Qualifications: BSc in Biological Sciences, PhD in Chemical Engineering & Biology using Ozone as a Biocide, at the University of Birmingham, UK. Kally Kaur is an expert in the fields of operational science and engineering of water treatment technologies with 25 years of experience. She is the managing Director of WatStech Ltd., employing up to 5 staff members and with a total turnover in the last 8 years of approx. £1.7 million. Previously, Kally was the Founder and Leader of the Research Group 'WatStech' within the School of Applied Sciences at the University of Wolverhampton for 5 years. Prior to academia, Kally Kaur was an employee of Severn Trent Water for 11 years, directly involved in the research of new processes, commissioning major treatment plants including ozone and GAC plants, assessing design and operation of a wide range of water treatment assets. She will be supervising the AquaNES activities at the demonstration site and coordinating WatStech contribution within WP7.	**F**
John Churchley Qualifications: BSc. Chemistry (Leeds University, UK) and member of CIWEM (Chartered Institution of Water & Environmental Management), as well as past-Chairman of East Midlands Branch of CIWEM. John Churchley, recently retired from Severn Trent Water (2010) with over 34 years of experience working within the water industry, specifically at Severn Trent Water utility in wastewater treatment. Since, joining WatStech Ltd. in 2010, he has continued to provide expert advice to Severn Trent Water and was directly involved in two UKWIR projects WW17 "Dangerous Substances and Priority Hazardous/Priority Substances" and "Catalytic Oxidation of Pharmaceutical Compounds in Wastewater Effluents". He is principal author or co-author on a number of published papers amounting to over 25 in total. Topics have included chemical dosing, dyewaste colour removal, tip leachate treatment, phosphorus removal, ASP optimisation, heavy metal removal, struvite formation and occurrence and removal of endocrine	**M**

disrupting chemicals. He will be involved in dissemination and exploitation tasks, networking and marketing activities.	
Lovina Kulkarni Qualifications: BSc. Eng. Chemical & Environmental Engineering, University of Mauritius. MSc Environmental Technology, University of Wolverhampton UK. Lovina Kulkarni has worked at WatStech Ltd. for 9 years, since completing her MSc at the University of Wolverhampton. She has provided technical expertise and research development skills in her role as Process Technologist, with excellent interpersonal skills and ability to work under pressure to meet deadlines while maintaining the quality of work. Lovina Kulkarni has acquired 9 years of experience of operating pilot scale and full-scale plants for water/wastewater treatment on client's premises, as well as analysis in the laboratory environment. Lovina Kulkarni has developed skills for environmental problem solving, as well as managing projects with responsibilities for completion of technical reports, managing budgets for laboratory consumables and equipment. Responsible for pilot plant operation and technology assessment within WP3.	**F**

Relevant publications:

1. Baynes, A., Green, C., Nicol, E., Beresford, N., Kanda, R., Henshaw, A., **Churchley, J**., Jobling, S. (2012). Additional Treatment of Wastewater Reduces Endocrine Disruption in Wild Fish-A Comparative Study of Tertiary and Advanced Treatments. Environmental Science & Technology. 46. 10: 5565-5573
2. Pitt S., Hale, C., **Kaur, K**., Vale, P., & Wilson, R., (2008). Evaluation of suitable design configurations for Enhanced Biological Phosphorus Removal (EBPR) at Minworth WwTW. Second European Water & Wastewater Management Conference, 29-30th Sept. 2008 at Millennium Point, Birmingham, UK.
3. **Kaur K**., Pitt, S., Porter, M., & Wetherill, A., (2008). Assessing the Service Life of Field-Spent GAC using Rapid Small Scale Column Tests (RSSCTs - RapStech® service). Second European Water & Wastewater Management Conference, 29-30th Sept. 2008 at Millennium Point, Birmingham, UK.
4. Ifelebuegu, AO., Lester, JN., **Churchley, J.**, Cartmell, E (2006). Removal of an endocrine disrupting chemical (17 alpha-ethinyloestradiol) from wastewater effluent by activated carbon adsorption: Effects of activated carbon type and competitive adsorption. Environmental Technology. 27. 12: 1343-1349.
5. **Kaur, K**., **Churchley, J**., Kandhola, N (2005). Development of an electrochemical oxidation process for the treatment of landfill leachates. Water and Environment Journal. 19. 4: 384-393.

Relevant previous projects or activities:

WatStech brings in experience in technology piloting and collaboration with water utilities;

1. WatStech have operated, maintained and sampled pilot Enhanced Biological Phosphate Removal (EBPR) wastewater plants based at 4 wastewater sites within Severn Trent Water region, for durations of between 3 to 18 months. Compilation of results, production of detailed reports and regular client liaison has formed the basis of the work completed.

WatStech has also been involved with specific Chemical Investigations Programme (CIP) as follows;

2. **UKWIR project WW17 Dangerous Substances and Priority Hazardous/Priority Substances:** WatStech's remit was to provide the technical, process expertise for the consortium for C2 Investigations to Assess Treatment Options for Chemicals and specifically for C3 Investigations to Assess Advanced Treatment Options. WatStech has worked for Severn Trent Water Ltd. as part of this consortium and was operating 3 pilot plants at Hallam Fields, with associated project management, design of experiments, data analysis and provision of technical reports.
3. UKWIR project WW17: Catalytic Oxidation of Pharmaceutical Compounds in Wastewater Effluents 2012: WatStech provided technical expertise, staff and laboratory facilities to the project

Infrastructure/ technical equipment:

WatStech Ltd. has two fully equipped laboratories to provide analytical services with practical applied research facilities for laboratory scale testing of wastewaters and can be utilised as part of this project.

13	Xylem Services GmbH (XYLEM)	WEDECO a xylem brand

General description:
Xylem Services GmbH with its ozone oxidation and UV disinfection brand Wedeco is a leading manufacturer of non-chemical treatment of water with more than 250,000 installations worldwide. Xylem offers environmentally friendly, healthy and residue-free forward-looking technologies such as ultraviolet systems and ozone systems. Maximum customer benefit is provided by a comprehensive combination of standardized systems and engineered solutions for treatment of potable water, process water, municipal and industrial wastewater. Xylem is also heavily engaged in the field of Advanced Oxidation Processes (AOP) by designing improved AOP concepts.

In Xylems R&D department lab-, bench scale and technical scale pilot tests and modelling of ozone and UV systems are conducted to develop market-ready products and applications together with the product management department which focuses on cost calculations and Life-Cycle Assessments. Xylem also has an engineering department where ozone, UV and AOP systems are designed, customized and engineered as well as a manufacturing department which retro-fits and builds new equipment and is responsible for the installation and start-up of AOP systems.

Xylem Services GmbH participated in several pilot studies and the implementation of full scale plants around the globe for the treatment of drinking water sources and wastewater reuse research and full-scale projects with ozone or UV based advanced oxidation processes.

Main tasks in the project:

- **WP 2:** Xylem will design and establish AOP pilot systems at the Shafdan demonstration site (water reuse) and the Lange Erlen demonstration site (drinking water production). Xylem will further evaluate the results and assess the suitability of AOP processes in combination with MAR/SAT for indirect potable reuse of treated wastewater; feed expertise into AquaNES DSS
- **WP3:** Xylem will provide, assess and exploit the ozonation + control unit in combination with CW as post-treatment at WWTP Schönerlinde, Berlin, Germany (demonstration site No. 12)
- **WP7**: contribution to exploitation and dissemination (exhibition, fairs, workshops).

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. Achim Ried Dr. Achim Ried is in the company since 1993 as Chief Engineer of the Research and Development Department. He has a PhD in Chemistry from the Universities of Göttingen and Marburg, Germany. Dr. Achim Ried is member of the International Board of Ozone Association, secretary of IWA Specialized Group AOP, chairman of ozone working group within FIGAWA ("Firmen im Gas- und Wasserfach") as well as member of the AOP working group DWA. He has participated in EU FP5 Poseidon, EU FP7 Innovatec, EU FP7 Aquafit4use and EU FP7 Limpid. He will be supervising the XYLEM activities in AquaNES Project and	**M**
Harald Stapel Harald Stapel is in the company since 1998. He is the Manager of Industrial & Process Sales. He has a degree in environmental engineering at the Universities of Applied Sciences Höxter, Germany. Harald Stapel has been involved in the EU FP7 Aquafit4use project. He will be the Coordinator of XYLEM tasks in the AquaNES Project, overseeing pilot installation and commissioning and optimization.	**M**
Arne Wieland Arne Wieland joined Xylem in 2004 as Application and Process Engineer in the Research and Development Department. He has a degree in environmental and process engineering at University of Applied Sciences Osnabrueck, Germany. He participated in EU FP7 Innovatech and the EU FP6 Neptun projects. Arne Wieland will be Project Manager for the XYLEM activities in the AquaNES Project, responsible for pilot installation and performance assessment.	**M**

Relevant publications:

1. Scheideler J., Lekkerkerker-Teunissen K., Knol T., Ried A., Verberk J. and van Dijk H. (2011). Combination of O_3 / H_2O_2 and UV for multiple barrier micropollutant treatment and bromate formation control – an economic attractive option. *Water Practice and Technology*, 6(4), doi:10.2166/wpt.2011.0063
2. Lekkerkerker-Teunissen, J. Scheideler, A.H. Knol, A. Ried, J.Q.J.C. Verberk, J.C. van Dijk (2011). Combined O3/H2O2 and UV for multiple barrier OMP treatment and bromate formation control – One year pilot plant research. IOA World Conference, Paris, 23-27 May 2011
3. Krüger J., A. Ried, K. Teunissen, A.H. Knol,and D. Csalovszki (2009). Advanced Oxidation Process – Effective and Technical Suitable for Micropollutant Removal in Contaminated Water Sources. IOA Conference Boston, 3-6 May 2009

Relevant previous projects or activities:

Xylem has provided oxidative treatment processes for testing in various RTD projects.

1. **POSEIDON** (EU project, FP5 project reference. EVK1-CT-2000-00047): POSEIDON focused on the assessment and improvement of technologies for the removal of pharmaceuticals and ingredients of personal care products (PPCPs) in wastewater and drinking water facilities to prevent the contamination of receiving waters, groundwater and drinking water by planned and unplanned indirect potable water reuse of treated urban wastewater.
2. **INNOWATECH** (EU project, FP6 GA no. 36882): The main objective of the project was to investigate, assess and enhance the potentiality of promising technological options for the treatment of industrial wastewater with the specific aim to provide tailor-mad e solutions to end-users for a wide range of wastewaters. Such solutions are essentially based on the optimised integration of the investigated options and on technological improvements with respect to treatment system components, operation and control.
3. **AquaFit4Use** (EU project, FP7 GA no. 211534): AquaFit4Use aimed at making industries more independent of the supply of fresh drinking water for their production processes. Secondly, an important step forward was being taken within the project in obtaining water qualities that are tailored to suit product and process demands and quality standards, in other words "water fit-for-use".
4. **LIMPID** (EU project, FP7 GA no. 310177): LIMPID aims at generating new knowledge on photocatalytic materials and processes in order to develop novel depollution treatments with enhanced efficiency and applicability. The main goal of LIMPID is to develop materials and technologies based on the synergic combination of different types of nanoparticles into a polymer host to generate innovative nanocomposites which can be actively applied to the catalytic degradation of pollutants and bacteria, both in air or in aqueous solution.
5. **TransRisk** (Federal Institute for Hydrology, funding code 02WRS1275A): The project focused on transformation products that are generated through the oxidative treatment of water containing micropollutants. The resulting risk was assessed and different technologies were tested to minimize the formation of transformation products and to enhance the degradation of micropollutants.

Infrastructure/ technical equipment:

- Xylems R&D and manufacturing site for Ozone, UV and AOP products in Herford, Germany produces with 260 employees all equipment and auxiliaries for the global ozone, UV and AOP market.
- Xylems application R&D lab provides Ozone, UV and AOP feasibility testing capabilities.
- The Xylem pilot engineering team designs, builds and trains operators or operates pilot system all over the world to investigate new processes and client specific tasks.

14	**Budapest Waterworks plc., Hungary (BUWW)**	BUDAPEST WATERWORKS

General description:

The 147-year-old company provides water to the population of Budapest and the surrounding settlements. Budapest Waterworks is in charge of water production from 740 wells with bank filtration along the Danube River, the maintenance and repairing of their 5,200 km long distribution network, and serves 2 million clients at the end of the 250,000 service connections whose aggregated maximum daily demand is 581,000 m^3. The number of employees is 1,750. Through the implementation of active leakage control activity, district-metered areas and other measurements and processes during the last years, the company managed to decrease the Non-Revenue Water (NRW) rate below 16%.

Through a wide network of partner universities, industrial partners and SMEs a continuous participation in R+D+I projects is ensured. The water supply network, the laboratories and other premises of the company serve mainly as test and pilot fields for these activities.

Budapest Waterworks research and development activities focus on supply network management, pressure management, loss management / NRW-reduction and mobile water treatment. Relevant employees are regularly taking part in conferences, seminars and trainings.

Main tasks in the project:

- **WP1.** Demonstration of bank filtration operation, optimized usage of Cl_2 and other technologies. Coupling of bank filtration and UV and RO in cooperation with EJC. Innovative concepts for well operation & protection during floods and droughts.
- **WP7**. Dissemination and exploitation

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Ing. László Debreczeny, head of water production department Educated water supply and electrical engineer, professional in water and sewage treatment, with experience in water extraction, water treatment and network operation. Participated in several R&D projects in water loss management, pump analytics, life cycle analysis of water production equipment. Participates in trainee programmes and is active in professional association. Responsible in AquaNES for dissemination and exploitation of site results into the Hungarian Water Utility Association and Danube River Basin water sector.	**M**
Ing. Balázs László, water technology engineer Experienced environmental and IT engineer, chemist, with experience in water base management, surface water quality, water treatment and water quality assurance. Worked in the field of R&D at the Budapest Technical University and the research department of the Hungarian Academy of Sciences. Responsible for running of RO-pilot scheme at site 3	**M**
Ing. Till Gábor, senior consultant Engineer with strong managerial knowledge, experienced in the field of water supply, building services and energetics. Special technical fields in pumping, renewable energy, industrial processes and managing projects, multinational teams. Technical advice and support in knowledge dissemination.	

Relevant publications:

1. Davidesz J. and Debreczeny L. (2009). Long term sustainability of river bank filtration aquifers regarding availability and capacities, Hungarian Water Utility Conference
2. Davidesz J., Dorko J., Molnár Z. and Szolgay Zs. (2008). Water Production By Bank-filtration With Mini Ranney Wells, IWA World Water Congress and Exhibition in Vienna

3. Grandguillaume J.J., Pusztai A., Paillé J. S., Jano T., Molnar Z. and Davidesz J. (2008). Microbiological Water Quality of a Massive Riverbank Filtration System on the Danube River, IWA World Water Congress and Exhibition in Vienna, 7-12 September 2008
4. Dorkó J., Davidesz J., Molnár Z. and Debreczeny L. (2007). Investigations at the Northern water base of Budapest Waterworks, Hungarian Water Utility Conference
5. Fenyvesi N., László I., Davidesz J. and Molnár Z. (2009). Preparing for shallow water periods, Operation management at the Southern water base of Budapest Waterworks, Hungarian Water Utility Conference

Relevant previous projects or activities

Budapest Waterworks actively initiates and takes part in internal and external research and development projects with

1. operation of riverbank filtration among extreme weather conditions (flood and drought operation),
2. modelling and investigation of the sustainability and efficiency of the natural riverbank filtration,
3. research and development of renovation at mini Ranney wells (in co-operation with Duna-Kút ltd.)

Infrastructure/ technical equipment

Budapest Waterworks operates a

- large and complex water extraction, treatment and distribution network: 740 wells, 5,200 km distribution pipework, 67 reservoirs and serves 2 million inhabitants.
- activities certified according to ISO9001, ISO14001 and ISO22000 standards. Operations are monitored and controlled by a widespread IT infrastructure.
- accredited and certified laboratory.

15	**Berliner Wasserbetriebe (BWB)**	Berliner Wasserbetriebe

General description:

Berliner Wasserbetriebe (BWB), as a public utility is responsible for drinking water supply and wastewater disposal for the 3.5 million inhabitants of Berlin and id therefore Europe's largest integrated water utility. BWB and its predecessor organisations have been responsible for urban water supply and sanitation in Berlin for 150 years. The turn over per year is about 250 million € in infrastructure and new technologies.

BWB has a department of R&D with an annual budget of 2.5 Mio € on research. BWB is currently involved as partner or coordinator in 35 projects funded by national and international programmes.

Research activity is structured along the water cycle; including water and wastewater treatment, network modelling, hydraulic engineering and new technologies. Results from R&D are presented in the national Committee for Certification and on international conferences.

Main tasks in the project:

- **WP 1:** One of the demonstration sites (No. 1) will be operated at BWB wells (water protection area) where bankfiltration in combination with anoxic capillary nanofiltration at single wells will be assessed for their advantages and limitations. BWB will operate and regularly monitor the demonstration site, coordinates and communicates with authorities and end users.
- **WP 3:** Demonstration site No. 12 will be constructed and operated at BWB WWTP Schonerlinde to demonstrate long-term viability of constructed wetlands with ozonation as pre-treatment. BWB will operate the demonstration scheme and coordinates with regular treatment scheme at the WWTP and communicates with authorities (e.g. regarding discharge permits) and end-users.
- **WP 4**: BWB will conduct chemical and microbiological analyses of trace organic chemicals, pathogens as well as antibiotic resistance genes at WWTP Schonerlinde.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Dipl.-Ing. Regina Gnirss Regina Gnirss graduated in 1991 from TU Berlin as a civil engineer specialising in water and wastewater technologies. She has been working for the Berliner Wasserbetriebe since 1991 in the department "Laboratory" and since 1994 in the department "Wastewater operation". She was project manager since 1995 for various projects such as wastewater treatment with carbon dosing, optimisation of aeration systems, membrane-filtration and membrane bioreactors. Since 2007 she is director of the R&D department within the Berliner Wasserbetriebe with a specialised project management certificate. She is a member of the management board of specialised DWA-working groups, e.g. advanced wastewater treatment and Modelling. She is the author and co-author of over 60 journal and conference publications and one patent. Supervisor and coordinator of BWB activities in AquaNES	**F**
Dr.-Ing. Alexander Sperlich Alexander Sperlich is environmental engineer (PhD), specializing in water and wastewater technologies. After joining Berliner Wasserbetriebe in 2010, he has been responsible for a number of research projects on removal of organic micropollutants during advanced wastewater treatment as well as drinking water treatment, tertiary filtration as advanced wastewater treatment, bank filtration, etc. Responsible for pilot operation and coordination of analytical work on the demonstration sites.	**M**

Relevant publications:

1. Jekel M., Dott W., Bergmann A., Dünnbier U., Gnirss R., Haist-Gulde B., Hamscher G., Letzel M., Licha T., Lyko S., Miehe U., Sacher F., Scheurer M., Schmidt C. K., Reemtsma T. and Ruhl A. S. (2015). Selection of

organic process and source indicator substances for the anthropogenically influenced water cycle. *Chemosphere*, **125**, 155-167.
2. Altmann J., Sperlich A. and Jekel M. (2015). Integrating organic micropollutant removal into tertiary filtration: Combining PAC adsorption with advanced phosphorus removal. *Water Research*, **84**, 58-65.
3. Jekel M., Ruhl A. S., Meinel F., Zietzschmann F., Lima S. P., Baur, N., Wenzel M., Gnirss R., Sperlich A., Dünnbier U., Böckelmann U., Hummelt D., Van Baar P., Wode F., Petersohn D., Grummt T., Eckhardt A., Schulz W., Heermann A., Reemtsma T., Seiwert B., Schlittenbauer L., Lesjean B., Miehe U., Remy C., Stapf M. and Mutz D. (2013). Anthropogenic organic micro-pollutants and pathogens in the urban water cycle: Assessment, barriers and risk communication (ASKURIS). *Environmental Sciences Europe*, **25**(20), doi:10.1186/2190-4715-25-20
4. Sperlich A., Warschke D., Wegmann C., Ernst M. and Jekel M. (2010). Treatment of membrane concentrates: Phosphate removal and reduction of scaling potential. *Water Science and Technology,* **61**(2), 301-306.
5. Sperlich A., Zheng X., Ernst M. and Jekel M. (2008). An integrated wastewater reuse concept combining natural reclamation techniques, membrane filtration and metal oxide adsorption. *Water Science and Technology*, **57**(6), 909-914.

Relevant previous projects or activities

BWB participated in a number of including pilot facilities at their wastewater treatment and water production sites

1. **ASKURIS** (2011-2015, national funding BMBF): A project about the risk posed by anthropogenic micropollutants and mulitresistant bacteria in the urban water cycle. BWB developed and validated innovative analytical methods and effect-based assessment approaches.
2. EU FP 7 PREPARED: Preparing water utilities for the effects of climate change (2010-2014). Berlin was pilot city in the project
3. **NASRI** (2002-2006, BWB): Natural and artificial systems for recharge and infiltration. Inhouse project in cooperation with KWB. The interdisciplinary project focused on microorganisms and trace organic substances present in surface waters. It looked into the behaviour and removal of pharmaceutical residues during bank filtration (BWB water capture sites in Berlin).

Infrastructure/ technical equipment

- WWTP
- Drinking water wells
- fully equipped, accredited water laboratory (microbiological and chemical parameter, including micropollutants - HPLC MS/MS)

16	**Municipal Authority for Water Supply and Sanitation Thiras (DEYAT)**	

General description:

DEYA Thiras is the Municipal Company for the provision of water supply and sewage treatment and disposal of Thira (Santorini and Thirasia Islands, Greece) and was founded in May 2011, after the merging of two local water companies. It is responsible for the planning, construction, management, operation and maintenance of the water supply system (desalination plants and pumping wells), irrigation, drainage, and the wastewater collection networks and treatment plants for the islands of Thira (Santorini) and Thirasia.

DEYA Thiras is a local authority with great impact on the island population's quality of life. Since its foundation, it has undertaken and implemented numerous national and EU-funded infrastructure projects, including expansion of the water supply (network length of more than 6,500 meters) and sewerage networks, six desalination units of 4,000 m^3/d, and one wastewater treatment plant (WWTP) in Thirasia island. These projects boosted the tourism sector and enhanced the local economy, while at the same time improving the standards of living in the island by protecting public health and ensuring environmental protection.

DEYA Thiras employs 60 personnel of different affiliations and is managed by an 11 member Board of Directors, which sets the goals for the development policy of the company.

Main tasks in the project:

- **WP 3:** DEYA Thiras is in charge of the operation and maintenance of the WWTP of Thirasia island (demonstration site no. 10) which is under construction and to be completed in December 2015.
  They will collect and assess data of the demonstrated treatment technologies: solar heterogeneous photocatalysis, constructed wetlands, ultrafiltration membranes, and disinfection. Performance monitoring throughout the duration of the project under different seasonal and hydraulic conditions.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Nikolaos Mainas Nikolaos Mainas is the General Director of DEYA Thiras. He is a mechanical engineer and has more than 10 years of experience in coordinating and delivering water supply and sewerage infrastructure projects.	**M**
Stamatis Avlonitis Stamatis Avlonitis is the Head of DEYA's department in the area of Oia and Thiarasia. He holds an MSc. in Chemical Engineering and a PhD in Mechanical Engineering with more than 20 years of experience and participation in water supply and sanitation utilities and relevant projects.	**M**

Relevant publications:

Not applicable

Relevant previous projects or activities:

Vast experience in construction, operation and maintenance projects in the Greek water and wastewater sector will facilitate smooth operation and assessment of the AquaNES cNES sites in the Greek islands:

1. Previous construction, operation and maintenance projects in the water and wastewater sector
2. sewerage network in the villages of Imerovigli, Perissa, Emporio, Oia of Santorini Island and in Thirasia island.
3. Construction, operation and maintenance of the water supply network in the villages of Fira, Imerovigli, Pyrgos, Oia.
4. Studies, installation and operation of six desalination units:
5. One unit in Akrotiri village of Santorini island (capacity: 2,000 m^3/day);

6. Two units in Fira village of Santorini island (capacity: 2,000 m^3/day);
7. One unit in Thirasia island (capacity: 140 m^3/day; in operation since 2012);
8. One unit in Oia village of Santorini island (capacity: 500 m^3/day; in operation since 2012);
9. One unit for serving the settlements of Mesa Gonia and Ag. Paraskeui in Thira (capacity: 5,000 m^3/day, to be constructed).

Infrastructure/ technical equipment:

- The DEYA owns the facilities of the WWTP in Thirasia and the technical equipment related to the collection, treatment, disposal and use of wastewater and sludge. It also owns a chemical laboratory, located inside the WWTP, for quality monitoring of the treated effluent.
- Use of telemetry systems for the remote monitoring and handling of sewage pumping stations, water pumping stations, and reservoirs.

17	**Municipality of Antiparos (MUOA)**	

General description:

The Municipality of Antiparos was founded in 2010 (under the Greek administrative reform "Kallikratis"), and is a public entity responsible for the administration of the island of Antiparos (1,196 permanent inhabitants; census 2011). Among other things, it is in charge of the provision of water supply and sewerage services on the island, and is also responsible for the planning, construction, management, operation and maintenance of the main infrastructure projects that take place in Antiparos (e.g. water supply and sewerage networks, desalination unit).

The Municipality of Antiparos is a local authority with great impact on the island population's quality of life, as it has undertaken projects which boosted the tourism sector and enhanced the local economy, while at the same time improving the standards of living in the island by safeguarding public health and environmental protection. One of the most valuable infrastructure projects, recently completed, is the wastewater treatment plant (WWTP). Before the construction of the plant, the domestic wastewater of the island was disposed into septic tanks, causing contamination of groundwater and the marine environment, and generation of unpleasant odors. Municipality of Antiparos is managed by a 13 member Board of Directors, which sets goals and shapes the development policy of the island.

Main tasks in the project:

- **WP 3:** in charge of the operation and maintenance of the WWTP of the island (treatment technologies: constructed wetlands and disinfection), **provision of** data and measurements related to the operation of the plant (site 10)

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. Sotiris Skourtis Dr. Sotiris Skourtis is president of the Municipal Council. He is a General Practitioner of medicine and has worked as a doctor in Antiparos island for more than nine years. He is the president of the local committee of the Hellenic Society for the Protection of the Environment and Cultural Heritage (2006-present), a founding member of the cultural association "Antiparos En Plo", and has participated in a variety of cultural and environmental actions and projects.	**M**
Artemios Triantafillos Artemios Triantafillos is the Municipal Councillor. He is currently the president of the Municipal Committee of tourism development and promotion and has more than 10 years of experience in administrative bodies, organizations and projects concerning the development of the local community and economy.	**M**

Relevant publications:

- not applicable

Relevant previous projects or activities:

1. Construction, operation and maintenance of the 5 pumping stations which supply the island, and the two storage tanks with capacity of 1,300 m^3
2. Installation, operation and maintenance of the desalination unit which is expected to serve the potable needs of the island (capacity: 400 m^3/day)
3. Restoration of the old area of uncontrolled waste disposal located in Profitis Ilias area (total waste volume: 13,000 m^3).

Infrastructure/ technical equipment:

The Municipality of Antiparos owns the facilities of the WWTP, and the technical equipment related to the collection, treatment, disposal and use of wastewater and sludge.

18	DREWAG Netz GmbH (DREWAG)	DREWAG NETZ

General description:

The enterprise was founded in 2007 as network company by the DREWAG Stadtwerke GmbH, which is a community owned enterprise that holds 100 % of the shares. DREWAG NETZ serves more than 300.000 customers with drinking water, electricity, natural gas and district heating. It is responsible for operation, maintenance, monitoring, design, network construction and acquisition of facilities for the network.

The water supply sector consists of four water works (including demonstration site 2) and a 2.500 km long drinking water distribution network including 28 water storage reservoirs and 25 pumping stations for pressure control. A total average of 140.000 m^3 is sourced daily from both the Elbe River as riverbank filtrate and from nearby surface water reservoirs via direct abstraction.

One of the main corporate objectives is reliable, efficient and environmentally friendly water and energy supply. In order to ensure and improve its objectives, the DREWAG NETZ supports and integrates innovative energy concepts and strategies to increase customer satisfaction and the sustainable increase of its overall energy efficiency.

Main tasks in the project:

- **WP1:** Facilitation and operation of an UF-pilot scheme at demonstration site 2. Coordination of testing methods and concepts to maximize well head protection. Provision of data to evaluate removal of organic compounds.. Facilitation of energy measurements at different vertical well types. Demonstrate rehabilitation strategies and novel constructive elements for siphon well systems in collaboration with HTWD.
- **WP5:** Integrating data for life cycle assessments and ecosystem services assessments

Principal research personal to be involved:

Name	Profile/ Project responsibility	Gender
Dipl.-Ing. Rüdiger Opitz	Head of the department "distribution network" and responsible for the strategic planning and management of water supply, quality and treatment facilities. His is the coordinator for the activities undertaken at demonstration site 2.	**M**
Dipl.-Ing. Alexander Auer	Water technology engineer of the department for innovation and development strategies. His role is the assessment and evaluation of existing and alternative treatment technologies for process optimization, risk management, implementation of new technologies and life cycle assessment.	**M**

Relevant publications:

Several internal reports and contributions to DVGW and water companies newsletters (in German)

Relevant previous projects or activities

1. **Risk assessment of the infiltration of untreated river water (2011-12)** Assessment and evaluation of infiltration basin clogging and water quality changes during flooding and infiltration of untreated river water in collaboration with HWTD
2. Riverbed clogging (2013-2015) Industry research project in collaboration with HWTD to re-investigate riverbed clogging and re-estimate sustainable abstraction rates after the Elbe River water quality has improved significantly over the last 20 years.
3. Infiltration basin clogging (2014**)** Industry research project in collaboration with HWTD to investigate long term MAR infiltration rates and effect of pre-treatment options on clogging rates.

Infrastructure/ technical equipment

DREWAG NETZ operates, among others, two over 100-year-old RBF-waterworks facilities with a total capacity of 100,000 m^3/d. One of them is site 2, which has a capacity of 72.000 m^3/d and abstracts riverbank filtrate and artificially

augmented groundwater along the Elbe River from a total number of 136 wells, of which 108 wells are connected to a siphon pipe. The remainder are single-operated wells equipped with submersible pumps. Well drawdown, energy consumption and abstraction rates can be measured at various locations at different groundwater levels and operation regimes.

Electricity, space and different source water qualities along the water treatment train are available to facilitate the UF-pilot scheme. The pilot site is equipped with a large existing network of groundwater level and quality observation wells that can be used for additional monitoring purposes.

There is also a large existing database containing water quantity and quality (organic, trace and inorganic substances) information for both water works. The quality of water is continuously monitored by the own accredited and certified laboratory.

19	Erftverband (EV)	Erft Verband

General description:

The Erftverband was established as a water management association for the Erft River region in North Rhine-Westphalia (NRW) in 1958. The association is currently composed of 264 members in the region, including cities, municipalities, regional districts and commercial enterprises. As one of eleven water management associations in NRW, the Erftverband performs integrated water management services. The association's activity area comprises 4,216 km^2 with approximately 2,600,000 inhabitants. Erftverband provides wastewater treatment for around 0.7 million inhabitants and about 0.2 industrial inhabitant equivalents of the operational region and has an installed treatment capacity of 1.1 million inhabitant equivalents.

The Erftverband plans, builds and operates groundwater measurement facilities, sewage treatment plants, storm water and flood water overflow tanks and is responsible for rivers in the Erft area. The Erftverband conducts business in the following fields:

- Wastewater treatment including residual management
- Observation and research on watercourses and groundwater
- Regulation and maintenance flowing watercourses

The Erftverband has extensive expertise in the operation of retention soil filters (RSF) for combined sewer overflow and separate sewer outlets. Starting in 1998 with the implementation of the first RSF, the Erftverband is currently operating 28 conventional RSF.

Besides water management activities, the Erftverband is also involved in research projects. Since 1991 the working group water quality management has been involved in 12 national and international projects either as project leader or project partner. Through these research activities profound knowledge on water quality, emission sources and measures to reduce pollution loads has been gained.

Main tasks in the project:

- **WP 3**: The Erftverband is operating, monitoring and evaluating one of the demonstration sites in WP3 (demonstration site no. 11). Based upon the broad knowledge and experience in operating RSF, the Erftverband is going to implement a new, innovative RSF_{WWTP+}. The efficiency of this RSF_{WWTP+} and the effects on water quality will be observed. The transferability to general application cases will be shown. Extensive cooperation, knowledge and data exchange with **WP4, WP5**
- **WP7** exploitation of RSTFlex technology and dissemination within at workshops and conferences.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. rer nat. Ekkehard Christoffels Ekkehard Christoffels is environmental researcher (PhD) and head of the water quality working group within the river basin management department. He is expert in river basin management, emission balancing, water quality modelling and retention soil filters. He works at the Erftverband since 1982. Ekkehard Christoffels is project leader of several national research projects and involved in international research projects. He is member of several DWA (German Association for Water Economy, Waste Water and Waste) working groups: Central committee "Water Bodies and Soil"; Expert committee "Ecology and Management of River Basins"; Chairman of expert committee "Emissions and Impacts in Rivers"; Spokesman of working group "Numerical Simulation in Water Quality Management"; Central committee "Hydrology and Water Management"; Chairman of expert committee "Qualitative Hydrology"; Spokesman of working group "Monitoring of Water Quality"; Coordination group "Emerging substances in the hydrological cycle". Supervisor and coordinator of EV activities. Responsible for dissemination activities and technology exploitation.	**M**

Dipl. Geoecol. Andrea F. Brunsch Andrea F. Brunsch is research assistant at the river basin management department since 2011. She is involved in two international and one national research projects. She is an external PhD candidate at Wageningen University, NL. Her field of research is "Emission balancing of anthropogenic micropollutants, removal of micropollutants through retention soil filters". She will in charge of the operation and performance assessment of demonstration site.	**F**
Dipl. Ing. Jens Wunderlich-Pfeiffer Jens Wunderlich-Pfeiffer is research assistant at the river basin management department since 2010. He is involved in two international and one national research projects. His field of expertise is emission modelling. In AquaNES he will provide the interface to WP5 for environmental assessment of the combined system.	**M**

Relevant publications:

1. Christoffels E., Mertens F. M., Kistemann T. and Schreiber C. (2014). Retention of pharmaceutical residues and microorganisms at the Altendorf retention soil filter. *Water Science & Technology*, **70**(9), 1503–1509.
2. Christoffels, E. (2008): Monitoring und Modellanwendung – Entwicklung eines Immissionsinventars am Beispiel der Erft (Monitoring and Modelling – Development of an Immission Inventory with the Example of the Erft River). Erftverband, Bergheim, Germany.
3. Poster: Brunsch A. F., Christoffels E., Beyerle L., Krump R., Ter Laak T., 3, Rijnaarts H. (2015): Retention soil filter (RSF) for reducing micropollutants at wastewater treatment plant outlets. Environmental Technology for Impact Conference, 29.-30.04.2015, Wageningen, NL.

Relevant previous projects or activities:

1. **TAPES** - Transnational Action Program on Emerging Substances (Interreg IVb 2012 – 2015). Project on technologies for the removal of micro-pollutants in water production and wastewater treatment, aiming at knowledge development and transfer in and between water companies, managers of wastewater treatment plants, national and local government, and interested public. Erftverband successfully tested the RSF_{WWTP} approach in small pilot scale.
2. **RESMO** – Reduction of anthropogenic micropollutants and hygienically relevant microorganisms in watercourses with the example of the Erft river. (funded by the Ministry for Climate Protection, Environment, Agriculture, Conservation and Consumer Protection of North Rhine-Westphalia. 2013 – 2015). Project in cooperation with Bonn University, Institute for Hygiene and Public Health with Erftverband as project leader. Investigations on micropollutant and pathogen emissions from different pathways; develop methods to reduce emissions. Time integrated monitoring of Kaster RSF_{CSO}.
3. **M³** - Application of integrative Modelling and Monitoring approaches for river basin Management evaluation (funded by the European Commission – Life +). 2009 – 2012. Project on monitoring techniques, water quality and emission modelling and water management at three river catchments. Erftverband implemented micropollutant monitoring at wastewater treatment plants and water courses and developed an emission model for emission balancing.
4. **SWIST IV** – Evaluation of measures to reduce physical, chemical and microbiological loads in rivers with the Example of the Swist River (funded by the Ministry for Climate Protection, Environment, Agriculture, Conservation and Consumer Protection of North Rhine-Westphalia. 2008 – 2012). Project in cooperation with Bonn University, Institute for Hygiene and Public Health with Erftverband as project leader. Amongst other findings, Altendorf RSF_{CSO} was monitored for pathogen, nutrient, heavy metal and micropollutant removal.

Infrastructure/ technical equipment:

Operation of demonstration site and analytical work can be carried out independently

- small pilot set-up of RSF
- Automatic sampling systems for event specific time proportional sampling
- HPLC MS/MS for micropollutant analytics
- GC MS/MS for micropollutant analytics
- A-YES Test for determination of 17-β Ethinylestradiol equivalents

20	Industrielle Werke Basel (IWB)	

General description:

IWB is the company for energy, water and telecommunication services in Basel (Switzerland) and the surrounding region; it demonstrates commitment, expertise and reliability. IWB is a leading provider of renewable energy and energy efficiency. The company is heading for a fully renewable supply that allows an efficient, environmentally friendly and economic use of energy. The company supplies its customers with 100% renewable electricity, renewable district heating, drinking water and biogas natural gas. Its customer base includes more than 250,000 customers, small and medium-sized enterprises and industry and administration. It owns and manages all the necessary facilities for the distribution, storage and quality control of its services.

IWB produces drinking water for 210'000 inhabitants in two water works, supplying around 26 million m^3 per year. A great share is produced in the Lange Erlen site (Site 6) from surface water of the river Rhine. The treatment train encompasses screening, filtration and subsequent soil infiltration. After reabstraction the water is treated by granular activated carbon and UV-disinfection.

IWB controls the water quality in its own accredited water quality lab, with 15 person staff (chemists and lab assistants). IWB features long-year experiences in various pilot plant operations at their full-scale facilities

Main tasks in the project:

- **WP2.** Owner of the Lange Erlen site. Demonstration of oxidative pre-treatment of pre-filtered surface water prior to forest soil infiltration. Operation of pilot plant and analytics of transformation products

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Pascal Temmler, Dipl.-Ing.(FH) In the company since 2011 as Head of Operation Drinking Water Plant. Degree in Environmental Technology at the University of Applied Sciences Jena (Germany). Responsible, coordination and contact person of the project. Responsible for pilot plant operation.	**M**
Richard Wülser, Dipl. Chem. (FH) In the company for 28 years as Head of Water Laboratory and Head of Quality Assurance in the department of drinking water production. Leads the analytical laboratory and surveillance of production and supplying processes. Member of the professional bodies "Quality and Treatment" (Swiss Gas and Water Association, SVGW) and different scientific committees (International Association of Water Works in the Rhine Basin, IAWR and AWBR). In the project responsible for analytical work on water and quality assessments.	**M**
Fabienne Eugster, Master of Science (University) Sientific Employee of IWB Water Laboratory (analysis of organic micropollutants). Master of Science (MSc) in Environmental Geoscience, Subject area Physical and Chemical Processes of the Environment (University of Lausanne). Master Thesis (2013): „Water and mine waste of former mining sites on eastern Elba (Italy): characterisation and assessment evaluation". Responsible for sample preparation and analytical works like validation processes.	**F**
Thomas Meier, Dipl. Ing. (FH) 25 years in water treatment companies. Since 2010 head of Drinking Water Production IWB and since 2011 CEO of Hardwasser AG, drinking water supplier for IWB and communities in the state of Basel-Landschaft. Member of the "head commission water" at the SVGW (Swiss Gas and Water Association). Member of the board at the Association of Water Works in the Rhine Basin, IAWR and AWBR). Supervision of and advice to project activities. Dissemination of result in the Swiss water sector.	**M**

Relevant publications:

1. Meier T, (2014): Herausforderung der Trinkwassergewinnung aus Flussfiltraten. (*Challenges for drinking water production from bank filtrates*) In: Wasserversorgung und Uferfiltration - ein System unter Druck? Tagungsband Eawag - das Wasserforschungsinstitut des ETH-Bereichs vom 09.09.2014: 26-29.
2. Temmler P, Haist-Gulde B (2014): Aktivkohle für das Wasserwerk. (Activated Carbon for Water Works): Aqua & Gas, Nr. 9: 17-22.
3. Wülser R, Eggers J, Hambsch B, (2012): Desinfektion mit UV statt mit Chlordioxid, Aqua & Gas 3/2012: 46-53
4. Storck FR, Schmidt CK, Wülser R, & Brauch H-J, (2012): Effects of boundary conditions on the cleaning efficiency of riverbank filtration and artificial groundwater recharge systems regarding bulk parameters and trace pollutants. Water Science & Technology 66(1): 138–144.
5. Helbing J, Kaiser H-P, Wülser R, (2015): Mikroverunreinigungen in Rheinwasser, FOWA-Projekt: Abbau mit Ozon und Ozon/Wasserperoxid. Aqua & Gas 4/2015:
6. Storck F, Schütz K, Wülser R, Nagel P, Alewell Ch, (2014): Künstliche Grundwasseranreicherung für die Trinkwassergewinnung, Untersuchungen zur Nachhaltigkeit der Reinigungsleistung bei der Bodenpassage am Standort "Lange Erlen" (Basel). Regio Basiliensis Nr. 55/3: 115-125

Relevant previous projects or activities:

1. **TAPES** (Transnational Action Program on Emerging Substances; INTERREG IVB 2012 – 2015. Project on technologies for the removal of micro-pollutants in water production and wastewater treatment. IWB operated a pilot plant to compare different granular activated carbon with respect to micro-pollutant elimination
2. WV BL 21 (Water production and supply in the state of Basel-Landschaft in the 21 century). The pro-ject includes 5 different parts. Part1; Quality of spring water in the upper part of the state. Part 2; drinkingwater production near rivers (riverbank filtration) and the problem of revitalisation. Part 3; groundwater situation in the Hardwald (the location where Hardwasser AG use the groundwater). Part 4; possibilities of different processes in water treatment by using the groundwater in the Hardwald. Part 5; Discussion of different structures of waterproductions and suppliers in the state

Infrastructure/ technical equipment:

- Testing laboratory for analyses of ground water, spring water, surface water and treated drinking water in accordance with the Standard ISO/IEC 17025. The scope of accreditation is defined in the Official Directory of the Accredited Testing Laboratories.
- Analytical equipment and techniques:
  - Gaschromatography (GC) with mass selective detector (MS)
  - SPE and SPME automatic systems
  - High resolution MS-Spectrometry (Orbitrap technique)
  - High performance liquid chromatography (HPLC) with photodiode array dedector,
  - fluorescence dedector
  - Ion chromatography (IC) with conductivity detector
  - Spectroscopic techniques: Ultra-violet spectroscopy, Visible spectroscopy, Infrared spectroscopy
  - Electrochemical analysis: Potentiometry, Conductometry, Amperometry, Voltametry, Physical analysis, Thermometry, Nephelometry
- Microbiological analysis
  - Quantitative determination of hygiene relevant germs by plate count or membran filtration method
  - Quantitative determination of hygiene relevant germs by enzymatic methods
  - Quantitative determination of chemical and microbiological parameters with luminescence measurement
  - Quantitative determination and characterisation of cells with flow cytometry

21	**Mekorot (MEK)**	

General description:

Mekorot, Israel's National Water Company is a public utility founded in 1937. Mekorot is one of the world's most advanced water companies, a leader in water resources management, desalination, wastewater treatment and effluent reuse, rain enhancement, water quality, water security and water project engineering. Mekorot's uniqueness as a water utility lies in its unparalleled experience, know-how, technologies and innovative processes for the management, operation and treatment of all types of water resources, whether surface water, underground water, brackish water, seawater or effluents. Mekorot is active in the global market through its subsidiary company - Mekorot Development and Enterprise. Mekorot's revenue is about 1 billion USD in a year with 250 million USD invested in development of water infrastructure. The company is rated AAA with 2,200 employees.

In Europe and the Middle East, Mekorot was among the first to investigate and implement large-scale wastewater reuse systems like Soil Aquifer Treatment after conventional secondary treatment in Israel which has the world's highest water reclamation rate to date. Mekorot supplies 80% of the water in Israel (about 1.5 billion m^3/year) to approximately 5,000 intermediary water providers including municipalities, regional associations, agricultural settlements and industrial consumers. In addition, the company treats 40% of Israel's wastewater in eight water purification plants and with its nine wastewater reclamation plants it enables a 70% reuse of treated effluents for agriculture purposes.

Main tasks in the project:

- **WP2**: owner and operator of the Shafdan demonstration site (Site 7) . Responsible for piloting and performance assessment
- **WP 4** – Contribution to the development and testing of the water quality assessment framework for the demonstrated processes (especially for the AOP-SAT processes) and also for the derivation of an interactive quantitative risk assessment tool.
- **WP 5/6** – Contribution to understanding how the different stake holders will accept the InPR concept in Israel after proof of process in the pilot (WP5) and contribution in validation and final integration activities of AquaNES DSS (WP6)
- **WP7:** contribution to exploitation of AOP-SAT combination as treatment option for indirect potable reuse. MEK will organise a relevant workshop at the fair WATEC in Israel and establish interfaces with the Health Ministry.

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Avi Aharoni (M.Sc) is director of wastewater treatment and effluent reuse department, in water quality division in Mekorot since 2012. During the last decade the department participated in a long list of EU research projects (see below), bilateral German researches (BMBF - MOST) and national research projects. Supervisor of MEK AquaNES technical activities, main contact with authorities, in charge of conference preparation, commercialization.	M
Lilah Strasler (M.Sc) In Mekorot company since 2010 as water quality engineer in the Water Quality Department. Degree in Biology and Environmental studies at the Tel Aviv University. Works in the field of treated wastewater quality and reuse. Investigated "The effect of treated wastewater quality on UV disinfection at the Shafdan WWTP". Pilot responsible and report preparation	F
Dr. Anat Lakretz-Mashiah	F

Process Engineer at Mekorot's Desalination and Special Projects Division. Lakretz-Mashiah holds a B.Sc. (Biotechnology Engineering) degree from the Ben-Gurion University, an M.Sc. and a Ph.D. (Environmental Engineering, Biofouling control in water by UV and AOP processes) degree from the Tel-Aviv University. Researcher for the pilot and report preparation	
Dr. Shai Era Head of the Water Quality Division, Mekorot. The Division is responsible for all aspects of drinking water and wastewater and effluent reuse for quality, treatment standards. Dr. Ezra has a Ph.D (Summa Cum Laude) from the department of Geological and Environmental Sciences at Ben Gurion University. Risk assessment and decision making for pilot results	M
Dr. Haim Cikurel In-house consultant and coordinator of the project has 43 years of experience in different fields of research, operation and engineering in the Chemical Process Industries and in Environmental Engineering. He has been involved with Mekorot and other Israeli companies in EU projects since 1998 with different projects in effluent reuse, water and wastewater treatment (Catchwater, Aquarec, Techneau, Reclaim, Switch, Minotaurus, Water4India, Demoware). Adviser, pilot design, help for contact with authorities, conference preparation, commercialization	M

Relevant publications:

1. Zucker I., Mamane H., Cikurel H., Jekel M., Hübner U., Avisar D., (2015) "A Hybrid Process of Biofiltration of Secondary Effluent followed by Ozonation and Short Soil Aquifer Treatment for Water Reuse"; Water Research .http://dx.doi.org/10.1016/j.watres.2015.07.034
2. Cikurel H., Guttman J., Aharoni A., (2012), "Managed aquifer recharge for agricultural reusein Shafdan, Israel" Chapter 6 In: Water Reclamation Technologies for Safe Managed Aquifer Recharge, Kazner C., Wintgens T. and Dillon P. (eds.), pp. 460. ISBN: 9781843393443.
3. Kloppmann W., Aharoni A., Cikurel H., Dillon P., Gaus I., Guttman J., Kraitzer T., Kremer S., Masciopinto C., Miotlinski K., Pavelic P., Pettenati M. and Picot-Colbeaux G. (2012). "Use of groundwater models for prediction and optimisation of the behaviour of MAR sites". Chapter 18 In: Water Reclamation Technologies for Safe Managed Aquifer Recharge, Kazner C., Wintgens T. and Dillon P. (eds.), pp. 460. ISBN: 9781843393443.
4. Aharoni A.,Guttman J., Sharma S., Cikurel H., (2011), "Guidelines for design operation and maintenance of SAT (and hybrid SAT) systems". EU SWITCH D 3.2 Safe water reuse report.
5. Gaus I, Cikurel,H.,. Picot G., Aharoni A., Guttman Y., Azaroual M., Kloppmann W.(2007), "Alternative SAT treatment of secondary effluents using a combination of UF and short term SAT for increasing infiltration rates at the Shafdan site (Israel)" International Groundwater Recharge Conference ISMAR 6, Phoenix, Arizona, Oct. 28-Nov. 2

Relevant previous projects or activities

Mekorot has been involved in a number of research focused on the Shafdan MAR site

1. **RECLAIM WATER** (EU project, FP6 contract no. 018309): At the Shafdan site , the project assessed different treatment applications in terms of behaviour of key microbial and chemical contaminants and fate during soil passage.
2. **DEMOWARE** (EU project, FP7 GA no. 619040) aims at increasing Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity. The programme has two central ambitions (i) to enhance the availability and reliability of innovative water reuse solutions, and (ii) to create a unified professional identity for the European Water Reuse sector.
3. **SWITCH** (EU project, FP 6 contract no.018530. (2006-2011). "Sustainable Water Management Improves Tomorrow's Cities Health" Mekorot was involved in the "Natural Treatment Systems Research Theme" and Safe Water Reuse.
4. Evaluation and Enhancing Ground Water Effluent Recharge Technology, (2010-2013). A **BMBF-MOST** (German-Israeli research fund) project. The purpose of the common project with TU Berlin, Tel-Aviv Univ, and Mekorot was to use at a pilot scale level ozonation and ozone based advanced oxidation technology (AOP), H2O2/O3 as a complementary (to short SAT) source-treatment solution for: Degradation and removal of micropollutants. Prevention of manganese solubilization in the SAT system. Improvement of the infiltration rates for the SAT.

Infrastructure/ technical equipment

- existing pilot facility for oxidative pre-treatment before soil-aquifer treatment to be refurbished and reconfigurated in AquaNES.
- analytical lab for standard parameters / currently establishing capacity for micro-pollutants analytics

22	**Adam Mickiewicz University in Poznań**	

General description:

Adam Mickiewicz University in Poznan (AMU) in one of the best and most prestigious Universities in Poland. The Department of Hydrogeology and Water Protection (Institute of Geology, Faculty of Geographical and Geological Sciences, AMU) works on applied hydrogeology. Studies focus on water management and protection of groundwater resources, bank filtration and artificial recharge projects in western Poland and Poznań agglomeration area. The Department participates in EU and international research projects depending groundwater management of the rural landscape and metals in drinking water.

Main tasks in the project:

- **WP 1:** Responsibility for the site demonstration in Poland (Mosina Water Capture) and assessment of impact of travel times on removal of pollutants and pathogens

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Prof. Dr hab. Józef Górski Prof. Dr hab. Józef Górski is a hydrogeologist and director of the Institute of Geology at AMU. He is Head of the Department of Hydrogeology and Water Protection and leader of many national projects focusing on groundwater management and protection, bank filtration and artificial recharge of groundwater. He is involved in the European Project ESSEM COST Action 637. In charge of Task 1.4 Treatment efficiency of combined natural and engineered BF systems.	**M**
Prof. Dr hab. Krzysztof Dragon Prof. Dr hab. Krzysztof Dragon is expert in hydrogeology, especially in hydrogeochemistry with a focus on groundwater chemistry changes due to human activity. He is project manager of several grants funded by Ministry of Science and Higher Education and National Science Centre Poland. He is author of several publications in the field of hydrogeology and environmental protection. Responsible for data acquisition and assessment, support in Task 1.4 Treatment efficiency of combined natural and engineered BF systems	**M**

Relevant publications:

1. Górski J. (2011). Quality of Riverbank Filtrated Water on the Base of Poznan City (Poland) Waterworks Experiences. Chapter 16 in: *Riverbank Filtration for Water Security in Desert Countries*. Ray C. and Shamrukh M. (eds.), Springer Netherlands, pp 269-279. doi:10.1007/978-94-007-0026-0_16
2. Górski J., and Siepak M. (2014). Assessment of metal concentrations in tap-water – from source to the tap: a case study from Szczecin, Poland. *Geologos* **20**(1), 25-33.
3. Górski et al. (2013) Best Practice Guide on the Control of Iron and Manganese in Water Supply. Postawa, A., Hayes, C. (eds.) IWA Publishing.
4. Górski J. and Przybyłek J. (2005). Quality of bank filtrated water in different wells locations. In: IAH-BGR-2006-"Interaction between groundwater and surface water", Int. Association of Hydrogeologists, German and Polish National Chapter, Berlin – Spandau, Germany.
5. Dragon K. and Górski J. (2009). Identification of hydrogeochemical zones in postglacial buried valley aquifer (Wielkopolska Buried Valley aquifer, Poland). *Environmental Geology*, **58**(4), 859-866.

Relevant previous projects or activities:

1. **COST ACTION 637** Metals and related substances in drinking water (European Cooperation in the Field of Scientific and Technical research): Collaboration in the field of metals (especially lead) in drinking water at consumers in Poland. 2006-2010.
2. **Environmental Management of the Rural Landscape in Central and Eastern Europe**. Project coordinated by CORNEL University, USA. Collaboration in the field of "Evaluation of groundwater resources for the use in water supplies in Wyskoc River Watershead (Poland). 2000-2002
3. Migration of micropollutants in water flowing from Warta River to the Mosina bank filtration water capture (BF). Detailed two years research in the field of water quality including macro and micro chemical components, bacteria and plankton organisms. 1996-1998.
4. Groundwater treatment in the aquifer-iron and manganese removal. Project applied on Wroniawy groundwater capture (capacity of 300 m^3/hour) in Poland. Method implemented in 1989. Successful exploitation till today under supervision of Institute of Geology (AMU).
5. Project of new artificial recharge water capture (**MAR) for the Bydgoszcz City (Poland**). Capacity of 3,125 m^3/h. 2008-2011.

Infrastructure/ technical equipment:

- Analytical instruments for organic micropollutant detection: High performance liquid chromatography with inductively coupled plasma mass spectrometry (HPLC-ICP-MS)
- Metal and major anion/cation analysis: Ion chromatography (IC), Inductively coupled plasma mass spectrometry (ICP-MS), Atomic absorption spectrometry with flame atomisation (F-AAS), Graphite furnace atomic absorption spektrometry (GF-AAS)
- Sediment analysis: MARSXpress - Microwave Reaction System

23	French Geological Survey (BRGM)	

General description:

Bureau de Recherches Géologiques et Minières (BRGM) is a public institute acting as the French Geological Survey. BRGM's research activities gather a large variety of competences in geosciences, environmental monitoring, resources (water, mineral resources), material sciences, microbiology, experimental approaches and modelling. BRGM is acknowledged within France as a leading authority on Water Management and Survey, Soil Protection, Local Point Pollution and Environmental Monitoring (on groundwater resources, soil, industrial sites).

BRGM develops advanced modelling tools addressing reactive transport of organic and inorganic pollutants including microbial processes. BRGM is member of the French Committee of Experts of Prioritization and part of AQUAREF reference laboratory. It has a broad range of analytical facilities for organic and inorganic micropollutants, passive sampling, isotope fingerprinting, microbiology and molecular biology. BRGM is involved in several large-scale monitoring programs on emerging pollutants. BRGM coordinates several European Research Projects on groundwater pollution (Footprint, Pegase, Bridge, Boromed) and is/was partner of other projects such as Water JPI FRAME, Saph Pani, Reclaimwater, Safir, Norman and Aquaterra.

Main tasks in the project:

- **WP 2:** Leader of WP2. Validation of innovative monitoring strategies and process modelling for assessing efficient effluent treatment by a reed bed followed by dune filtration at Agon-Coutainville in collaboration with IMAGEAU and GEOHYD.
- **WP 5**: BRGM will be involved with UCRAN in the characterization of policy and governance interfaces.
- **WP 6**: BRGM will provide process specifications for the development of ICT solutions via a connected decision support system.
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. Marie Pettenati Marie Pettenati is a hydrogeologist and geochemist. She is a specialist for conceptualizing reactive transport models of organic and inorganic pollutants in the vadose zone-aquifer continuum, with a particular focus on active management of water resources. She has expertise on equilibrium studies of natural aquifers, transfer studies of inorganic pollutants in soils, hydro-geochemical and thermo-kinetic modelling of water-rock interactions under consideration of biogeochemical processes. Marie Pettenati is WP2 leader.	**F**
Dr. Géraldine Picot-Colbeaux Geraldine Picot-Colbeaux holds a PhD in unsaturated/saturated environments hydrogeology. She is a specialist for conceptualizing flow and reactive transport models of inorganic pollutants and emergents in the aquifer, focusing particularly on active management of water resources, polluted soils and geological storage of CO_2.	**F**
Dr. Wolfram Kloppmann Dr. W. Kloppmann hydrogeologist and isotopes geochemist. He has coordinated and participated in several EU projects (FP5, FP6) on geogenic contaminants (BOREMED), Managed Aquifer Recharge (RECLAIMWATER) and reuse of wastewater (SAFIR). Leading work on isotope analysis in WP2.	**M**

Relevant publications:

1. Pettenati M., Picot-Colbeaux G., Thiéry D., Boisson A., Alazard M., Perrin J., Dewandel B., Maréchal J. C., Ahmed S. and Kloppmann W. (2014). Water quality evolution during managed aquifer recharge (MAR) in Indian

crystalline basement aquifers: reactive transport modeling in the critical zone. *Procedia Earth and Planetary Science*, **10,** 82 – 87. doi:10.1016/j.proeps.2014.08.016
2. Pettenati M., Croiset N., Casanova J., Azaroual M., Besnard K. and Rampnoux N. (2012). Optimisation of waste water treatments through combined geomaterials and natural soil filter: modelling tools. *Journal of Water Reuse and Desalination*, **2**(4), 185–193.
3. Kloppmann W., Aharoni A., Chikurel H., Dillon P., Gaus I., Guttman J., Kraitzer T., Kremer S., Masciopinto C., Miotlinski K., Pavelic P., Pettenati M. and Picot-Colbeaux G. (2012). Use of groundwater models for prediction and optimisation of the behaviour of MAR sites. Chapter 18 In: *Water Reclamation Technologies for Safe Managed Aquifer Recharge*, Kazner C., Wintgens T. and Dillon P. (eds.), pp. 460. ISBN: 9781843393443.
4. Kloppmann W., Chikurel H., Picot-Colbeaux G., Pettenati M., Guttman.Y., Aharoni.A., Guerrot C., Millot R., Gaus.I. and Wintgens.T. (2009). B and Li isotopes as intrinsic tracers for injection tests in aquifer storage and recovery systems. *Applied Geochemistry*, **24**(7), 1214-1223.
5. Kloppmann W., Van Houtte E., Gaus I., Picot-Colbeaux G., Vandenbohede A., Lebbe L., Guerrot C., Millot R. and Wintgens T. (2008). Monitoring reverse osmosis treated wastewater recharge into a coastal aquifer by environmental isotopes (B, Li, O, H), *Environmental Science and Technology*, **42**(23), 8759-8765.

Relevant previous projects or activities:

1. **FRAME** (EU Water JPI project): The aim of FRAME is to develop an overall evaluation procedure enabling a comprehensive assessment of efficient and cost-effective indirect potable reuse measures to minimize the risks associated with emerging chemicals and microbial contaminants, while closing local and regional water cycles.
2. **Saph Pani** (EU project, FP7 GA no. 282911): Saph Pani addressed the improvement of natural water treatment systems such as river bank filtration, managed aquifer recharge and wetlands in India building on a combination of local and international expertise. The project aimed at enhancing water resources and water supply particularly in water stressed urban and peri-urban areas in different parts of the sub-continent.
3. **SAFIR** (EU project FP6, FOOD-CT-2005-023168): In order to ensure a sustainable use of our water resources and at the same time the production of high quality and safe vegetable crops the strategic objective of SAFIR was to develop irrigation management and water saving technologies for the production of high quality and safe vegetable crops using low quality water resources.
4. **RECLAIM WATER** (EU project FP6, no.018309): The strategic objective of the project was to develop hazard mitigation technologies for water reclamation providing safe and cost effective routes for managed aquifer recharge. The work assessed different treatment applications in terms of behaviour of key microbial and chemical contaminants.

Infrastructure/ technical equipment:

Data acquisition for transport modelling work will be facilitate by appropriate analytical equipment

- ICP/MS, for analytics
- Non-target screening for micropollutants data using LC-Q-TOF
- Neptune MC-ICP-MS for isotopes analysis

24	**Cranfield University (UCRAN)**	Cranfield UNIVERSITY

General description:

Cranfield University is an exclusively post-graduate, international centre of excellence in research and teaching in strategic areas of science, technology and management. The university is distinctive in undertaking near or full industrial scale evaluations of new science and technology. Cranfield combines the academic rigour and long term perspective of a university with the commercial and business focus of industry. It is a world leader in defence and natural resource management, including the management of water quality. Our research income, measured as a percentage of our turnover, puts us as one of the top five research intensive universities in the UK alongside Oxford, Cambridge, and London's Imperial College. The Cranfield Water Science Institute (CWSI) is both nationally and internationally recognised for its work on water and wastewater treatment, the human dimensions of water management, process science, technology development, water policy analysis, decision support, infrastructure management, governance and policy. CWSI also coordinates the STREAM Engineering Doctorate Centre (www.stream-idc.net) which currently includes several projects on combined natural and engineered treatment systems. Our research draws on a range of specialized laboratories as well as near-industrial scale pilot testing facilities. CWSI maintains close working relationships with the UK's water and wastewater service providers, including strategic research partnership agreements with Yorkshire Water and Severn Trent Water. The institute also has extensive experience on large international research projects (e.g., AQUAREC, RECLAIM Water, TRUST, Water4India, DEMOWARE)

Main tasks in the project:

- **WP3** – Constructed wetlands and other natural systems for improved wastewater treatment: Cranfield staff will work closely with WatsTech, with additional support from Severn Trent Water, to assess P removal through natural treatment systems, a reactive media reed bed and an immobilised algae photo-bioreactor, using the Packington test site near Birmingham, UK.
- **WP5:** Interfaces with environment and society: Cranfield will lead this work package, which examines the environmental, social and policy implications of combined natural and engineered treatment systems, in order to better understand their pathways to commercialisation. Staff on this task has expertise in the regulation and governance of water and wastewater services, public perceptions, and ecosystem services assessments.
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Cranfield's contribution to the AquaNES project will be led by **Dr Heather Smith,** who is an Academic Fellow in Water Governance. Her expertise covers policy and regulation for water and wastewater services across Europe, and how they enable and/or constrain the development and application of innovative technologies. It also covers public perceptions of water and wastewater services, and the relationship between those services and customer behaviour. Recent relevant activities have included important work on governance and public perceptions of water reuse schemes across Europe, including the development of advice for public outreach and engagement around such schemes. She will lead WP 5.	F
Dr Ronald Corstanje is a Senior Lecturer in Environmental Informatics. He works in the realm of Environmental Informatics (EI), in which he focuses on developing the modelling tools (statistical or quasi-mechanistic) which can assemble, manipulate and communicate meaningful outcomes from large environmental datasets, particularly the understanding and evaluation of ecosystem services (ESS). He will lead the ESS assessment work in WP 5.	M
Miss Joanna Zawadzka is a Research Assistant in Pedometrics. She has a strong interest in spatial data analysis in the context of the environmental mapping and modelling. She uses various GIS, remote sensing, and statistical methods to extract, analyse, and interpret data on natural environment, including for ecosystem goods and services assessments. She will support the ESS assessment work in WP 5.	F

Dr Marc Pidou is a Lecturer in Resource Recovery. His current research activities are focused on the development and optimisation of technologies (chemical, physical and biological) for phosphorus removal and recovery from wastewater effluents and for the treatment of trade wastes. He will lead Cranfield's contribution to WP 3. Dr Pidou has extensive experience on EC funded projects with contributions in the EUROMBRA, MBR-TRAIN and INNOWATECH projects.	M
Post-doctoral research associate – A PDRA with relevant skills in wastewater treatment and nutrient recovery will be hired to support Cranfield's contribution to WP 3..	

Relevant publications:

1. Smith, H.M., Rutter, P and Jeffrey, P. (2015) Public perceptions of recycled water: a survey of visitors to the London 2012 Olympic Park. Journal of Water Reuse and Desalination 5(2) 189-195.
2. Goodwin, D., Raffin, M., Jeffrey, P. & Smith H.M. (2015, in press) Applying the water safety plan to water reuse: towards a conceptual risk management framework. Environmental Science: Water Research and Technology.
3. Whitton, R., Santinelli, M., Pidou, M., Ometto, F., Henderson, R., Roddick, R., Villa, R. and Jefferson, B. (2015) Tertiary nutrient removal from wastewater by immobilised microalgae: Impact of N:P ratio and hydraulic retention time (HRT). Water Research, Submitted.
4. Pidou, M., Whitton, R., Santinelli, M., Muhammad, A., Soares, A., Villa, R. and Jefferson, B (2015) Novel technologies for low phosphorus discharge consents and resource recovery. 3rd Water Research Conference, 11-14th January, Shenzhen, China.
5. Chiverton A, Hannaford J, Holman I, Corstanje R, Prudhomme C, Bloomfield J & Hess TM (2015) Which catchment characteristics control the temporal dependence structure of daily river flows?, Hydrological Processes, 29(6) 1353-1369.

Relevant previous projects or activities:

1. **DEMOWARE** (EU project, FP7 GA no. 619040) aims at increasing Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity. The programme has two central ambitions (i) to enhance the availability and reliability of innovative water reuse solutions, and (ii) to create a unified professional identity for the European Water Reuse sector.
2. **TRUST** (EU project, FP7 no. 265122) provided research-driven innovations in governance, modelling concepts, technologies and novel approaches to integrated water, energy, and infrastructure asset management. TRUST outcomes will be incorporated into planning guidelines and decision support tools for urban water services, will be subject to life-cycle assessment and be shaped by regulatory considerations as well as potential environmental, economic and social impacts.
3. **INNOWATECH** (EU project, FP6 no. 036882) provided tailor-made solutions to end-users for the treatment of industrial wastewaters through the development and demonstration of promising novel technological options applicable to a wide range of wastewaters.
4. **Fragments, Functions, Flows & Urban Ecosystem Services** (NERC) is part of the wider Biodiversity and Ecosystem Services project (BESS) and examines the scaling of biodiversity and ecosystem services in urban ecosystems. The project is premised on the view that, in order to understand how ecosystem services are provided, we need to understand what determines the *functions* of individual *fragments* of green space, and how these are linked together by *flows* of materials, organisms, and people

Infrastructure/ technical equipment:

- The demonstration units to be tested as part of the contribution to WP 3 are installed on the Severn Trent Water owned Packington sewage works. The systems studied include a 100 m^2 reactive media reed bed (1-5 m^3/h) and a unique immobilised algae photo-bioreactor (4 m^3; 0.2-2 m^3/h). The test site is fitted with dosing units to control nutrients levels in the feed water to be treated and online monitoring on the effluents.
- Cranfield University owns state-of-the-art laboratories that have extensive analytical services. Specifically, analytical equipment such as ICP-MS and LC-MS will be used for the metals and hazardous chemicals analyses. Also a dedicated fermentation laboratory will be used for the algal biomass anaerobic digestion trials

25	Dresden University of Applied Sciences (HTWD)	Hochschule für Technik und Wirtschaft Dresden University of Applied Sciences

General description:

The HTWD was founded in 1992 and is the successor of the former University for Transport and Communications "Friedrich List" which was founded in 1966. Today it is with 180 professors and over 5,000 students the second largest university of the regional capital of Saxony. It has 8 faculties covering fields in science, engineering and economics. The HTWD has partnerships with more than 100 universities worldwide.

The Division of Water Sciences belongs to the Faculty of Civil Engineering & Architecture and has a long history in applied research and strong collaboration links to regional water utilities and water engineering consultancies. Dresden is a historic and scientific centre for riverbank filtration, having 3 waterworks along the River Elbe. Research has been focused on bank filtration for >20 years, resulting in many regional and international activities, networks, site-dependent projects, workshops, education and promotion. In 2010, HTWD founded a "Cooperation Centre for Riverbank Filtration" in Haridwar, India. Marketing activities in cooperation with SME and large companies resulted in the involvement of European companies in India, Russia and Egypt. New research foci are energy efficiency in water supply and coupling advanced water treatment technologies with bankfiltration to meet future demands for save drinking water.

Main tasks in the project:

- WP1. Work package coordinator; Responsible for site 2, focus on energy efficiency and ecosystem service of BF and especially siphon systems; contribution to assessment of site 5 in India based on long-term collaboration with UJS and AUT; application of software tools (SOMA 2, QMRA) for site assessment and providing data for WP 5 & 6.
- WP5: Life-cycle assessment of BF system, focus on site 2
- WP6: Decision support system for BF scheme design
- WP7. Dissemination, supporting AUT on Asian market for BF coupled with on-site disinfection using electrolysis
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name	Profile/ Project responsibility	Gender
Prof. Dr.-Ing. Thomas Grischek	Groundwater Engineer (PhD) and expert in water abstraction and supply. Head of the Division of Water Sciences at HTWD with research focus on bankfiltration, subsurface groundwater treatment and energy efficiency in water supply. Experience in EU project coordination and participation: AQUAREC, RECLAIM WATER and Saph Pani. He is the coordinator of WP 1 Bankfiltration.	**M**
Dipl.-Ing. Rico Bartak	Young Research Associate at HTWD with water engineering and groundwater flow modeling background. He has been a key worker in bankfiltration projects in Germany, Egypt, Thailand and India. Experience in EU research projects (Saph Pani, BF in Egypt). He will be responsible for work at the BF pilot site in Dresden, for developing energy efficiency assessment and optimization tools and integrating results from other BF pilot sites.	**M**
Dr. Ulrike Feistel	Hydrologist and surface flow modelling expert, experienced researcher and project manager. She managed the WP "Innovation in education and research" in the EDUWAT project with Syria, organised workshops and marketing activities with SMEs in Germany, Vietnam and Costa Rica. She will be involved in marketing and dissemination activities.	**F**

Relevant publications:

1. Bartak, R., Page, D., Sandhu, C., Grischek, T., Saini, B., Mehrotra, I., Jain, C.K., Ghosh, N.C. (2015) Application of risk-based assessment and management to riverbank filtration sites in India. J. Water and Health 13(1), 174-189.
2. Bartak, R., Grischek, T., Ghodeif, K.O., Wahaab, R.A. (2015) Shortcomings of the RBF pilot site in Dishna, Egypt. J. Hydrol. Eng. 20(9), 05014033.
3. Grischek, T., Schoenheinz, D., Eckert, P., Ray, C. (2012) Sustainability of river bank filtration – examples from Germany. In: Maloszewski, P., Witczak, S., Malina, G. (eds.) Groundwater quality sustainability. Selected papers on hydrogeology 17, Taylor & Francis, London, UK, 213-227.
4. Ray, C., Jaspers, J., Grischek, T. (2011) Bank filtration as natural filtration. In: Ray, C., Jain, R. (eds.) Drinking water treatment. Springer, Dordrecht, 93-158.
5. Schoenheinz, D., Grischek, T. (2011) Behavior of dissolved organic carbon during bank filtration under extreme climate conditions. In: Ray, C., Shamrukh, M. (eds.) Riverbank filtration for water security in desert countries. Springer Science+Business Media B.V., 51-67.

Relevant previous projects or activities

1. **Saph Pani** (EU project, FP7 GA no. 282911): Saph Pani addressed the improvement of natural water treatment systems such as river bank filtration (RBF), managed aquifer recharge (MAR) and wetlands in India building on a combination of local and international expertise. The project aimed at enhancing water resources and water supply particularly in water stressed urban and peri-urban areas in different part of the sub-continent.
2. **SOLAREX** (BMBF, no. 02WQ1333B, 2014-2016): Combining inline-electrolysis for drinking water disinfection and removal of arsenic with a filter unit regenerated by produced chlorine. Market studies in India and Costa Rica to sell treatment units using solar energy for small communities.
3. **EDUWAT** (EU TEMPUS SMHES project, no. 511251) aimed at developing curricula in water science education in Syria, project was kept alive despite war in Syria, final report submitted in summer 2015 will form a basis for adaptation of water engineering education in Syria to European system and for reconstruction of education system and infrastructure in Syria.
4. **GEF** (BMBF, GERF, no. EGY 10/052): Bank filtration for water supply in an arid climate; workshops & site assessments in Egypt, a feasibility study on bank filtration along the River Nile and canals; assessment of water quality (trace organics, metals) and further treatment requirements.
5. **SDWSU** (DAAD "A new passage to India", no. 57125632): Exchange program 2010-2015 for PhD and undergraduate students to work on "Sustainable Drinking Water Supply in Uttarakhand, India", including collaboration with industry, water companies and projects on bank filtration.

Infrastructure/ technical equipment

- Fieldwork equipment (various water level and discharge meters, data loggers, groundwater sampling equipment, well inspection cameras, on-site water quality parameter measurement devices, electrical current meters)
- Water quality analysis (IC, ICP, UV, IDEXX)

26	**Eötvös József College (EJC) - terminated**	

General description:

The Eötvös József College at Baja, Hungary (EJC) is located in the southern region of the country near to the Serbian and Croatian borders. Currently, about 20 scientists work at EJC. The research and development activities of EJC include a spectrum of drinking water treatment and wastewater treatment technologies. The priority activities in the field of R+D include the development of innovative technologies for arsenic removal and in addition to this iron, manganese and ammonium reduction in drinking water. Cooperation with international partners, particularly in the South-eastern European countries has long-ranging tradition, including cross-boundary projects such as the AR-SENICPLATFORM with the University of Novi Sad (HUSRB/1002/121/075).

The EJC has laboratory facilities of >1,000 m^2 containing a wide range of pilot-scale treatment units, such as UV disinfection, chlorination, various adsorbers, RO, NF, MF, FO and anaerobic membrane equipment, sand filters and flocculators, etc. The Water Technology Basis has its own bank filtered drinking water wells that can be connected to any of the additional treatment facilities.

Main tasks in the project:

- **WP 1:** Piloting: Assessment the performance of bank filtration systems under various critical hydrological scenarios (i.e., floods, droughts, redox), performance assessment of Budapest site, water chemistry analysis and collaboration with BUWW

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Dr. Erno Fleit, PhD. Biologist (PhD) and expert in water and wastewater treatment technologies. Professor of the Institute of Water Supply and Environmental Engineering at EJC. Research focus on environmental monitoring, risk assessment, biological hazards and membrane processes.	**M**
Zoltan Melicz, PhD. Professor of the Institute of Water Supply and Environmental Engineering at EJC. Civil engineer, focussing on water treatment technologies, particularly on membrane processes.	**M**

Relevant publications:

1. Gulyás P., Fleit E., Melicz Z. and Bognár F. (2015): Biológai szennyvíztisztító berendezések mikroszkópos vizsgálati módszertana. Főiskolai jegyzet. Eötvös József Főiskolai Kiadó. Budapest-Baja. ISBN 978 615 5429 16 3. pp. 303. (Microscopic diagnostic system for activated sludge – in Hungarian)
2. Fetter É., Sándor D. and Fleit E. (2010). Implementation of a monitoring system on the ecological effects of anthropogenic interventions on the Danube morphology for the Gemenc-Béda-Karapancsa floodplain. *Pollack Periodica: An International Journal for Engineering and Information Sciences*, **5**(1), 151-162.
3. Sándor D. B., Zajzon G. and Fleit E. (2012). Investigation of simultaneous nitrification and denitrification process using biofilm formed on intelligent hydrogel microcarriers. *6th IWA International Conference for Young Water Professionals*, 1-10. ISBN:978-963-87507-8-5
4. Fleit E., Melicz Z., Sándor D., Zrínyi M., Filipcsei G., László K., Dékány I.and Király Z. (2008). IASON – Intelligent Activated Sludge Operated by Nanotechnology – Hydrogel Microcarriers in Wastewater Treatment. *Progress in Colloid and Polymer Science*, **135**. 209-217.

Relevant previous projects or activities:

1. **ARSENICPLATFORM** (EU IPA project): The EJC and the University of Novi Sad conducted research and dissemination activities on removal of arsenic and ammonium from drinking water to meet EU standards in the region.

Infrastructure/ technical equipment:

- over 1,000 m^2 water technology centre. Pilot scale and laboratory scale equipment including reverse osmosis, microfiltration, ultra- and nanofiltration units, forward osmosis and anaerobic membrane facilities. Available disinfection methods advanced UV, chlorination units, sand filters, etc.
- EJC owned and operated bank filtered drinking water bases on the bank of the Danube
- Fully capable water chemistry laboratory for traditional water pollutants and heavy metals, complemented with microscopic facilities. GPS linked field equipment for on-site analyses (Eh, pH, DO, etc.).

27	**Kompetenzzentrum Wasser Berlin gGmbH (KWB)**	KOMPETENZZENTRUM WasserBerlin

General description:

The Berlin Centre of Competence for Water (Kompetenzzentrum Wasser Berlin gGmbH, KWB), is an international non-profit research center on urban water systems. The main mission consists of the planning and the execution of R&D projects, and the dissemination of project results together with the organization of conventions and symposia. The KWB has a staff of 30 full-time persons, who are active in projects mainly related to water resource management and innovative water and wastewater treatment technologies. Since its creation in 2001, KWB initiated and conducted several studies related to leading edge technologies for wastewater treatment resulting in more than 200 publications (journals and conferences). During this time, KWB gained extensive experiences in management and realization of pilot scale studies and monitoring programmes.

KWB is specialized in the management of research projects and is certified since 2010 under Quality Management System according to DIN EN ISO 9001:2008 that guarantees professional project management procedures and the maximum quality level of all our activities. KWB has also extensive experience with European projects: in the past years. KWB participated in the FP6 and FP7 projects MBR-TRAIN (#MEST-CT-2005-021050), TECHNEAU (#018320), PREPARED (#244232), and SAPH-PANI (#282911). KWB currently coordinates the H2020-project POWERSTEP (#641661), and in the past coordinated the EU-LIFE project ENREM (LIFE04 ENV/DE/000058) and the FP6 project AMEDEUS (#018328). KWB is corporate member of the International Water Association (IWA), and the Water Supply and Sanitation Technology Platform (WssTP).

Main tasks in the project:

- **WP 3:** Lead of WP3 activities, demonstration activity on effluent polishing with ozonation + constructed wetland treatment, pilot operation, sampling, data interpretation
- **WP 1:** Demonstration activity on partial treatment (bank filtration + nanofiltration), pilot operation, sampling, data interpretation
- **WP 4:** Demonstration of feasibility of open software solution for the water sector, implementation of risk management tool
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	**Gender**
Dr Ulf Miehe Dr Ulf Miehe is Head of the department on advanced wastewater engineering. He was/is the KWB internal coordinator of several projects focussing on tertiary treatment and water reuse: Demoware, ASKURIS, IST4R (see below). He is member of the working group on oxidation in the German Society for Water Chemistry. He will manage the overall activities of KWB within AquaNES.	**M**
Dr Daniel Wicke Dr Daniel Wicke is Environmental Engineer (PhD) and project manager at KWB with background in urban waters, micropollutants and eco-engineered systems. Currently he coordinates the project OGRE (EFRE co-funding) on micropollutants in urban stormwater. Daniel Wicke is (Co)-Author of > 25 papers and conference manuscripts. He is member of the working groups on ecosystem services, green infrastructure and emerging compounds in the Water Supply and Sanitation Technology Platform (WssTP). He will be leader of WP3 and coordinate the site activities of KWB.	**M**
NN (M/W): project engineer for pilot operation	**M/F**
Wolfgang Seis Wolfgang Seis brings in specialisation on environmental biotechnology, water and environmental chemistry and analytics and water supply systems. He is expert in risk assessment and in programming in open software R. He will be responsible for the utilisation and adaptation of these approaches in WP4. He is currently working especially in DEMOWARE on QMRA for water reuse.	**M**

Kristine Oppermann Kristine Oppermann is professional book-keeper. She performed book-keeping and supervised financing reporting and audits of FP6 project AMEDEUS, FP7 project P-REX and LIFE Projects ENREM and SCST. She will be the project financial officer at KWB.	**F**

Relevant publications:

1. Stapf M., Miehe U., Wiedemann B. and Jekel M. (2014). Comparison between different filter systems as a post treatment after tertiary ozonation. The 5th International Slow Sand and Alternative Biological Filtration Conference, June 19-21, Nagoya, Japan.
5. Seis W., Remy C. and Ackermann R. (2013). Microbial Risk Assessment of the Water Reuse Scheme in Braunschweig based on WHO guidelines. International conference ReWater Braunschweig, November 2- 3, Braunschweig, Germany.
6. Wicke D. (2013). Eco-engineered systems for removal of micropollutants from WWTP effluents – existing knowledge. Report, project deliverable of KWB project EcoTreat, accessible under http://www.kompetenzwasser.de/ECOTREAT.559.0.html

Relevant previous projects or activities:

1. **Saph Pani** (EU project, FP7 GA no. 282911): Saph Pani addressed the improvement of natural water treatment systems such as river bank filtration (RBF), managed aquifer recharge (MAR) and wetlands in India building on a combination of local and international expertise. The project aimed at enhancing water resources and water supply particularly in water stressed urban and peri-urban areas in different parts of the sub-continent.
7. **DEMOWARE** (EU project, FP7 GA no. 619040) aims at increasing Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity. The programme has two central ambitions (i) to enhance the availability and reliability of innovative water reuse solutions, and (ii) to create a unified professional identity for the European Water Reuse sector.
8. **ASKURIS** – (German Federal Ministry of Education and Research (BMBF)), within the project KWB assessed the efficiency of oxidation processes for the removal of trace organic compounds and performed comparative LCA studies to evaluate the tested technologies.
9. **IST4R** – (local funding + EFRE co-funding), the integration of ozonation or powdered activated carbon in tertiary treatment for phosphorus removal is assessed in pilot studies and as well via LCA. KWB successfully developed the first running closed-loop control for ozonation targeting trace organic removal.

Infrastructure/ technical equipment:

- Ozonation pilot unit acquired after former project IST4R (original prize for pilot ~300.000 €) for use in site Schönerlinde (no. 12)

28	KWR Water B.V. (KWR)	KWR Watercycle Research Institute

General description:

KWR (170 staff, based in the Netherlands) is a publicly owned research institute for the (urban) water cycle (www.kwrwater.nl). Building on 40 years of experience in the Dutch water sector, KWR has evolved into a prominent player in the European water research and innovation arena. We develop and unlock knowledge about the water cycle from water systems, technologies and water quality to governance. Our objective is to provide the water sector with the means to identify and effectively meet the challenges of our time: from climate change to the increasing amount of contaminants, and the growing pressure to use space intensively and for multiple purposes.

KWR has ample experience in European research and innovation projects, many of them as coordinator such as WE-KNOW, MICRORISK, TECHNEAU, PREPARED, DEMEAU and SUBSOL. KWR is founding member of the European Water Platform WssTP (www.wsstp.eu), member of both the High Level Steering Group and Task Force of the EIP-Water and chair of ARC (a collaborative platform of leading applied water research institutes). Other EU-funded research projects that KWR is or has been involved in, are SCENES, MICRORISK, LEGIONELLOSIS, CPDW, TOXIC. SOCOPSE, TESTNET, ARTDEMO, TRUST, TAPES, Water4India, SmartWater4Europe, DEMOWARE, SOLUTIONS and DESSIN.

Main tasks in the project:

- **WP 4** WP lead, development of innovative tools, monitoring framework and risk assessment
- **WP 2** responsible for Waddinxveen demonstration site (no.9) Guidance and interpretation of results, Validate a Monitoring and Decision Support System to optimize water supply for greenhouses
- **WP 5** Gaming tool for engaging the general public, Governance framework recommendation for the Waddinxveen site
- **WP 7** Dissemination & communication, link to WssTP and EIP Action Groups
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name/ Profile / Project responsibility	Gender
Dr Thomas ter Laak Dr Thomas ter Laak is an experienced researcher in environmental chemistry. His research focus is on occurrence of emerging substances in the urban water cycle, specifically, in drinking water sources and drinking water. He will be leading WP4	**M**
Dr Kirsten Baken Dr Kirsten Baken is an experienced researcher in toxicology and an expert in human health effects of environmental contaminants. She has experience in the field of human health risk assessment, innovative testing strategies and refinement of risk assessment tools. She will contribute to the water quality assessment framework in WP4	**F**
Dr Luc Hornstra Dr Luc Hornstra is an experienced microbiologist. His research aims at the fate and behaviour of micro-organisms in natural and engineered environmental systems. Additionally, he has experience in monitoring antibiotic resistance genes in environmental samples. He will contribute to the innovative monitoring systems in WP4	**M**
Dr Marcel Paalman Dr Marcel Paalman is a geochemist, as a senior advisor and scientist he connects policy and research issues and develops water management strategies with a scientifically sound basis and societal benefits. He will be responsible for activities at the Waddinxveen site.	**M**

Dr Theo van den Hoven Dr Theo van den Hoven is manager international research and has >30 years of experience with research, valorisation and governance issues in water and waste water services. Theo is Vice-President of WssTP and member of the EIP-W Task Force. His role is to contribute to the governance framework of the Waddinxveen site in WP5 (task 5.2.3) and the dissemination actions in WP 7 (task 7.3)	**M**
Dr Christos Makropoulos Dr Christos Makropoulos is the Chief Information Officer of KWR an Assistant Professor at the School of Civil Engineering of the National Technical University of Athens. Dr Makropoulos is an expert in hydroinformatic tools and methods for water management with an emphasis on water systems optimisation. His work focuses on risk analysis, uncertainty quantification, multi-objective evolutionary optimization, decision support and long-term policy scenario development. He will contribute to the interactive quantitative risk assessment tool in WP3 (task 4.4) and the gaming tool in WP 5 (task 5.3.4)	**M**

Relevant publications:

1. Baken K. and Kools S. (2014). Innovative testing strategies and their relevance for evaluating chemical drinking water quality. Nieuwegein: KWR. No. BTO 2014.009.
10. Van Loon A., Jalink M. and Paalman M. (2013). Potentials of groundwater storage management in the dry Stippelberg forests. Landschap, 30(4), 181-189.
11. Hoekstra J. and Hornstra L. (2015). The presence of antibiotic resistance genes in Dutch surface water and drinking water treatment plants (Confidential report, available upon request)
12. Kossieris, P., A. Panayiotakis, K. Tzouka, P. Gerakopoulou, E. Rozos, C. Makropoulos (2014). An eLearning Approach for Improving Household Water Efficiency, Procedia Engineering, Volume 89, Pages 1113-1119, ISSN 1877-7058, http://dx.doi.org/10.1016/j.proeng.2014.11.232
13. Koutiva I. and C. Makropoulos (2012) Linking tools for social simulation and urban water network modelling for supporting an adaptive approach of urban water resources management, 6th International Congress on Environmental Modelling and Software - iEMSs 2012, 1-5 July 2012, Leipzig Germany

Relevant previous projects or activities:

1. **DEMEAU** (EU project, FP7 GA no. 308339) develops and implements knowledge, prototypes and practices enabling the water cycle sector to face emerging pollutants. Feeds into water quality assessment framework and systems in WP4
14. **DEMOWARE** (EU project, FP7 GA no. 619040) aims at increasing Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity. The programme has two central ambitions (i) to enhance the availability and reliability of innovative water reuse solutions, and (ii) to create a unified professional identity for the European Water Reuse sector. pollutants. Feeds into water quality assessment framework and systems in WP4
15. **SOLUTIONS** (EU project, FP7 GA no. 603437) aims to link occurrence of chemicals with the ecological status of waters, to identify major chemical stressors, and to produce consistent solutions for the large number of legacy, present and future chemicals posing a risk to European water resources with respect to ecosystems and human health. pollutants. Feeds into water quality assessment framework and systems in WP4
16. **DESSIN** (EU project, H2020 GA no 619039) addresses the Ecosystems Services concept to boost innovative solutions in the water sector. This novel approach adds socio-economic and environmental aspects to the traditional technological assessment of innovations. This project feeds into WP5 (task 5.1.2)

Infrastructure/ technical equipment:

- Not relevant

29	**National Technical University of Athens**	National Technical University of Athens

General description:

The National Technical University of Athens (NTUA) is one of the oldest and most prestigious Academic Institutes in Greece, with a long experience in education, training and technological research and development. The Environmental and Energy Management Research Unit (EEMRU, http://environ.chemeng.ntua.gr) is an educational and research unit of the School of Chemical Engineering, with extensive research experience, particularly in regions of the Mediterranean. The EEMRU has coordinated or participated in several EU international research projects (including FP7 WatERP, EcoWater, DROUGHT-R&SPI, COROADO, SWITCH, WASSERMed, XEROCHORE, FP6 AquaStress, INECO, OPEN-GAIN, Nostrum-DSS, FP5 WaterStrategyMan, ARID Cluster etc.), and has produced numerous publications in scientific journals and conferences.

Within the framework of past and on-going research projects, the EEMRU has developed models and tools to support decision making in water management:

- The EcoWater web toolbox, which can be used to perform life-cycle and value chain analysis for water systems (developed within the framework of the FP7 ECOWATER project).
- The WSM DSS, a water demand modeling tool that provides the framework for examining the applicability of dominant and shifting paradigm options in terms of effectiveness, environmental and economic impacts under different scenarios of water availability and demand (developed within the framework of the FP5 WaterStrategyMan project).
- The OPEN-GAIN DSS, a tool that supports the design and implementation of a hybrid power system (co-generation of electrical power from renewable energy sources and water from desalination) and enables the assessment of economic, environmental and social performance for alternative configurations (developed within the framework of the FP6 OPEN-GAIN project).
- A GIS-Based tool for assessing climate change impacts on the tourism sector. The tool enables the analysis of the anticipated changes in tourism fluxes, water demand from the tourism sector and income generation. Also, the losses of coastal areas due to sea lever rise are examined (developed within the framework of the FP7 WASSERMed project).
- The AquaDT tool, a web-based Multi-Criteria Decision Analysis (MCDA) application, which supports stakeholders in participatory complex decision making processes (developed within the FP6 AquaStress Integrated Project).

The EEMRU is also responsible for courses covering a wide spectrum of subjects at both the undergraduate and post-*graduate level, which are supported through specifically tailor-made web material.*

Main tasks in the project:

- **WP 6**: work package lead, development of decision support platform
- **WP 3**: coordination of Greek demonstration sites
- **WP4**: Contribution on development of data processing and integrative water quality reporting tool based on open access software “R”.
- **WP5**: Contribution in the development of an LCA approach tailored for cNES, application of LCC analysis determine cost-effectiveness of cNES and S-LCA evaluating social and socio-economic impacts of cNES. Outputs from WP5 will support the development of AquaNEs DSS interface and platform in WP6.
- **WP 7**: (regional) stakeholder workshop on cNES/CW based solutions in remote / rural areas
- NTUA will in addition contribute to all other WPs, in an effort to receive and provide input regarding WP6 (DSS) implementation.
- **WP8**: member of the Project Management Team

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Prof. Dionysis Assimacopoulos	**M**

He is the EEMRU Coordinator, and a full Professor at the School of Chemical Engineering of NTUA. He has participated in more than 20 research projects at the national and European/International level as coordinator or partner. He will lead WP6 and coordinate the participation of the NTUA in AquaNES.

Dr. George Arampatzis **M**

He is a senior researcher in the EEMRU, and a member of the teaching staff of the School of Chemical Engineering. His expertise is on modelling and optimization of systems and processes, on the development and implementation of computational techniques and on the design and development of decision support systems. He will be in charge of the AquaNES DSS development, testing and validation in WP6.

Dr. Eleni Kampragou **F**

She holds a degree in Environmental Engineering and a Ph.D. in Water Resources Management, and has participated in 10 EU-funded projects undertaken by the EEMRU over the past 10 years. She will be in charge of the coordination of the Greek demonstration sites in WP3.

Relevant publications:

1. Assimacopoulos D., Dimova G., Ribarova I. and Stanchev P. (2014). A first iteration of an Eco-efficiency Assessment of Sofia's Urban Water System. *Procedia Engineering*, **70**, 1411-1420.
17. Levidow L., Lindgaard-Jorgensen P, Nilsson A, Skenhall S. A. and Assimacopoulos D. (2014). Eco-efficiency improvements in industrial water-service systems: Assessing options with stakeholders. *Water Science and Technology*, **69**(10), 2113-2121.
18. Ribarova I., Assimacopoulos D., Jeffrey P., Daniell K., Inman D., Vamvakeridou-Lyroudia L., Melin T., Kalinkov P., Ferrand N. and Tarnaki K. (2011). Research-supported participatory planning for water stress mitigation. *Journal of Environmental Planning and Management,* **54**, 1-18.
19. Arampatzis G., Angelis-Dimakis A., Blind M. and Assimacopoulos D.(2014). An online suite of tools to support the systemic eco-efficiency assessment in water use systems. *17th European Roundtable on Sustainable Consumption and Protection, Research – Experience – Development*, October 10, Portoroz, Slovenia.
20. Karka P., Lekkas D.F., Grigoropoulou H. and Assimacopoulos D. (2010). Conceptual modelling and data based techniques to understand urban water use and wastewater production. *Journal of Environmental Science and Engineering (USA),* **9**(4), 573-587.

Relevant previous projects or activities:

NTUA has gained experience and proven expertise in modelling tools through various projects

1. "**Ecowater:** Development of eco-efficiency meso-level indicators for technology assessment (Ecowater)", financed by the European Commission, DG Research, 7th Framework Programme, Theme: ENV.2011.3.1.9-2, Collaborative Project, 282882, 2011-2014.
21. "Water availability and Security in Southern Europe and the Mediterranean (**WASSERMed**)", financed by the European Commission, DG Research, 7th Framework Programme, Theme 6: Environment (including Climate Change), Collaborative Project, 244255, 2010-2012.
22. "Institutional and Economic Instruments for Sustainable Water Management in the Mediterranean Region (**INECO**), financed by the European Commission. DG Research, 6th Framework Programme, INCO-CT-2006-517673, 2006-09.
23. "Mitigation of Water Stress through new approaches to Integrating Management, Technical Economic and Institutional Instruments (**AquaStress Integrated Project**)", financed by the European Commission. DG Research, 6th Framework Programme, Priority 1.1.6.3 "Global Change and Ecosystems", 511231, 2005-08.
24. "Improving Competitiveness of SMEs through IT-based Environmental Business Planning (**SMITE**)" financed by the European Commission, DG AIDCO, MEDA Programme, B7–4100/2000/2165–072P421. 2002 – 2005.

30	**Uttarakhand Jal Sansthan (UJS) – Uttarakhand State Water Supply & Sewerage Organisation, India**	

General description:

The Uttarakhand State Water Supply & Sewerage Organisation – Uttarakhand Jal Sansthan (UJS) is an autonomous body of the Uttarakhand state government (> 4,250 employees). It currently operates and maintains 63 urban and 5,355 rural water supply schemes to provide wholesome water for approximately its 9 million population. Its main functions are: (1) to plan, promote, execute & operate efficient water supply schemes, (2) where feasible, to plan, promote, execute & operate sewage treatment and disposal schemes, treatment of industrial effluents, (3) to manage all of UJS's affairs so as to provide the people of the area within its jurisdiction with wholesome water and where feasible, with efficient sewerage service, (4) to take such measures, as may be necessary, to ensure water supply in times of any emergency.

UJS operates and maintains bank filtration (BF/RBF) schemes for the provision of drinking water to urban and rural areas at presently more than 7 locations in the state, notable amongst them is the AquaNES site in Haridwar. UJS is experienced in research cooperation with AQUANES partners (HTWD) with whom they have been assessing existing BF schemes and constructed 5 new BF schemes. They recently participated in the EU Saph Pani project. In recent years they have been involved in a number of network and research projects on RBF. Consequently, UJS created the dedicated Riverbank Filtration Cell and its employees are regularly taking part in conferences, seminars and trainings on BF and post-treatment.

Main tasks in the project:

- **WP1**: Demonstration of bank filtration operation in Haridwar, coupling of bank filtration and inline-electrolysis in cooperation with AUTARCON. Innovative concepts for well operation & protection during floods and droughts. Assessment of advantages of siphon systems.
- **WP7:** Dissemination and exploitation of small systems combining BF and inline-electrolysis.

Principal research personal to be involved:

Name	Profile/ Project responsibility	Gender
Ing. P. C. Kimothi, General Manager – Technical, Research and Materials	Educated civil engineer with >35 years professional experience in planning, execution, operation and monitoring of water extraction, treatment, distribution and network operation projects in Uttarakhand. >10 years experience in research and construction of BF systems in hill regions. Participated in several Indo-German and Indo-EU R&D projects on BF since 2005, water loss management, energy efficiency of pumps. Member of the Indian Water Works Association (IWWA).	M
Ing. S. K. Sharma, Superintending Engineer, Dehradun	Educated civil engineer with >38 years professional experience in planning, maintenance & operation of water extraction, treatment, distribution and network operation projects in Uttarakhand. >8 years experience in research and construction of BF systems in hill regions. Participated in several Indo-German and Indo-EU R&D projects on BF since 2007, water loss management, energy efficiency of pumps. Member of the Indian Water Works Association.	M
Ing. D. K. Singh, Superintending Engineer, Haridwar	Educated civil engineer with >30 years professional experience in planning, maintenance & operation of water extraction, treatment, distribution and network operation projects in Uttarakhand. >4 years experience as engineer-in-charge for RBF scheme in Haridwar.	M

Relevant publications:

1. Sandhu, C., Grischek, T., Ronghang, M., Mehrotra, I., Kumar, P., Ghosh, N.C., Rao, Y.R.S., Chakraborty, B., Patwal, P.S., **Kimothi, P.C.** (2015) Overview of bank filtration in India and the need for flood-proof RBF systems. In: Wintgens, T., Nättorp, A., Lakshmanan, E., Asolekar, S.R. (eds.) Saph Pani – Enhancement of natural water systems and treatment methods for safe and sustainable water supply in India. IWA Publishing, London, UK (*in press*).

25. Essl, L., Starkl, M., **Kimothi, P.C**., Sandhu, C., Grischek, T. (2014) Riverbank filtration and managed aquifer recharge as alternative water supply technologies for India: strengths – weaknesses – opportunities – threats analysis. Wat. Sci. Technol.: Water Supply 14(4), 690-697.
26. **Kimothi, P.C.**, Dimri, D.D., Adlakha, L.K., Kumar, S., Rawat, O.P., Patwal, P.S., Grischek, T., Sandhu, C., Ebermann, J., Ruppert, M., Dobhal, R., Ronghang, M., Kumar, P., Mehrotra, I., Uniyal, H.P. (2012) Development of Riverbank Filtration in Uttarakhand. J. Indian Water Works Association, Special issue on RBF, 13-18.
27. Ronghang, M., Kumar, P., Mehrotra, I., **Kimothi, P.C.**, Adlakha, L.K., Sandhu, C., Grischek, T., Voltz, T.J. (2012) Application of Riverbank Filtration for year-round Drinking Water Production in a small town in the hills of Uttarakhand. J. IWWA, Special Issue on RBF, 19-24.
28. Key members of UJS team for achieving National Urban Water Awards in India for UJS in 2008 for Uttaranchal Koop-well for small-scale decentralised RBF water supply and in 2009 for development of RBF in Uttarakhand and in 2010 for attaining demonstration-site status for RBF in Haridwar from Managed Aquifer Recharge Commission of the International Assoc. of Hydrogeologists.

Relevant previous projects or activities

1. **ADB Project (2014-2018)** Flood-protection, capacity enhancement and redevelopment of drinking water supply infrastructure including RBF systems for 9 towns affected by June 2013 flood in Uttarakhand
29. **Saph Pani** (EU project, FP7 GA no. 282911, 2011-2014): Responsible for data collection, management and operation of 3 out of 4 BF case study sites in project.
30. **Development of RBF in Hill-Regions for Sustainable Water Supply in Uttarakhand** (DST/WTI/2k9/149, 2010-2013): Site-selection, construction and monitoring of 5 new RBF schemes in Uttarakhand. Project funded by Water Technology Initiative of Department of Science & Technology, Government of India.
31. **RBFN** (BMBF project, no. IND 08/156, 2008-2011) main Indian industry member of Indo-German Riverbank Filtration Network (RBFN) project. Together with HTWD, responsible for achieving demonstration-site status for RBF site in Haridwar.
32. **CCRBF** (since 2008): UJS is founding and principal industry-member of the Cooperation Centre for Riverbank Filtration (CCRBF), Dehradun (registered under Societies Registration Act of India). The CCRBF is a resource centre on RBF in general and specifically for India. It provides technical support to national projects related to RBF systems, establishes international linkages for collaborative research, develops human resources in the field of RBF & strengthens the cooperation between water supply companies and universities.

Infrastructure/ technical equipment

UJS operates a large RBF water abstraction system in Haridwar along the Ganga River and Upper Ganga Canal comprising 22 RBF wells having a mean daily total abstraction of ~61,400 m³. The system is recognised as a demonstration site by IAH's MAR-NET. There is a large database of water quality data. Different operation schemes and water qualities are available for pilot facilities.

31	**National University of Public Service (NUPS)** **Faculty of Water Sciences,**	

General description:

The Faculty of Water Sciences of the National University of Public Service at Baja, Hungary (formerly known as Eötvös József College, EJC) is located in the southern region of the country near to the Serbian and Croatian borders. Currently, about 20 scientists work at the faculty. The research and development activities include a spectrum of drinking water treatment and wastewater treatment technologies. The priority activities in the field of R+D include the development of innovative technologies for arsenic removal and in addition to this iron, manganese and ammonium reduction in drinking water. Cooperation with international partners, particularly in the South-eastern European countries has long-ranging tradition, including cross-boundary projects such as the ARSENICPLATFORM with the University of Novi Sad (HUSRB/1002/121/075).

The faculty has laboratory facilities of >1,000 m^2 containing a wide range of pilot-scale treatment units, such as UV disinfection, chlorination, various adsorbers, RO, NF, MF, FO and anaerobic membrane equipment, sand filters and flocculators, etc. The Pilot Water Treatment Plant has its own wells and surface water intake which can be connected to any of the additional treatment facilities.

Main tasks in the project:

- **WP 1:** Piloting: Assessment the performance of bank filtration systems under various critical hydrological scenarios (i.e., floods, droughts, redox), performance assessment of Budapest site, water chemistry analysis and collaboration with BUWW

Principal research personnel to be involved:

Name/ Profile/ Project responsibility	Gender
Zoltan Goda Environmental engineer (MSc) and expert in water and wastewater treatment technologies. Leader of the Pilot Water Treatment Plant and the laboratory of the Faculty of Water Sciences of the National University of Public Service at Baja. Research focus on environmental monitoring and bank filtration processes.	**M**
Endre Salamon Civil engineer (MSc) and environmental engineer (BSc) in water and wastewater treatment specialization. Teacher of engineering at the Faculty of Water Sciences of the National University of Public Service at Baja. Main research topic: water quality modelling, water chemistry, drinking water treatment.	**M**

Relevant publications:

1. Ábrahám Ferenc, Kökény István, Salamon Endre, Mátrai Ildikó: Az arzéneltávolítás laboratóriumi és félüzemi kísérleteinek eredményei In: Melicz Zoltán, Tóth Sándor Attila (szerk.): Arzén és ammónium eltávolítás az ivóvízellátásban. 239 p. Baja: Eötvös József Főiskolai Kiadó, 2015. pp. 159-186. (ISBN:978-963-7290-99-2)
2. Fleit Ernő, Melicz Zoltán, Kökény István, Salamon Endre: Hormonrendszert megzavaró anyagok a felszíni vizekben - új kihívások a települési vízgazdálkodásban In: Szlávik Lajos, Kling Zoltán, Szigeti Edit (szerk.) Magyar Hidrológiai Társaság XXXII. ORSZÁGOS VÁNDORGYŰLÉS. Konferencia helye, ideje: Szeged, Magyarország, 2014.07.02-2014.07.04. Budapest: Magyar Hidrológiai Társaság (MHT), 2014. Paper 5. szekció 3.. 18 p. (ISBN:978-963-8172-32-7)
3. Kökény István, Salamon Endre: Lab-scale experiments in exhausted zeolite filter for Biological ammonium removal. In: Miroslav T Bešević, Ilija M Miličić, Aleksandar Landović, Ognjen Gabrić (szerk.) CONTEMPORARY ACHIEVEMENTS IN CIVILENGINEERING. 300 p. Konferencia helye, ideje: Subotica, Szerbia, 2014.04.24-2014.04.25. Beograd: Pressia, 2014. pp. 697-702. (JOURNAL OF FACULTY OF CIVIL ENGINEERING; 25.) http://www.gf.uns.ac.rs/~zbornik/index.php?lang=ENG&zbornik_id=18&menu=5

Relevant previous projects or activities:

2. **ARSENICPLATFORM** (EU IPA project): The EJC and the University of Novi Sad conducted research and dissemination activities on removal of arsenic and ammonium from drinking water to meet EU standards in the region.

Infrastructure/ technical equipment:

- over 1,000 m^2 water technology centre. Pilot scale and laboratory scale equipment including reverse osmosis, microfiltration, ultra- and nanofiltration units, and anaerobic membrane facilities. Available disinfection methods advanced UV, chlorination units, sand filters, etc.
- The Faculty and its predecessor owned and operated surface and subsurface water intake and treatment facilities on the bank of the Danube
- Fully capable water chemistry laboratory for traditional water pollutants and heavy metals, complemented with microscopic facilities. GPS linked field equipment for on-site analyses (Eh, pH, DO, etc.).

4.2 Third parties involved in the project

The project will only make use of the third parties as detailed in Table 11. Beneficiaries will not work with Linked Third Parties.

Table 11 Subcontracts to be awarded within the project

			Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)
2	AKUT	15'000	Site construction work to prepare for installation of constructed wetland, Site 12 Schönerlinde
10	VTG	60'000	1-2 subcontracts (30'000 EUR each). This amount is reserved for any potential Environmental Technology Verification procedure of up to 2 AquaNES technologies. Whether and for which technologies exactly this amount will be used will be decided based on the project activities outcome (as foreseen in Task 7.1.2). Once decided which technologies, the amount will be reallocated to the relevant participant's budget. This activity can only be carried out by qualified third parties called "Verification Bodies" which are not represented in the consortium.
11	WADIS	19'200	1 subcontract on chemical and microbiological analysis during optimization period of pilot on electropulse oxidation a Site 7 (WP2, Task 2.2.2-2.2.4) for the assessment of the effect of this oxidative treatment on organic micropollutant removal Specialised analytical expertise not available in the consortium at more competitive conditions
15	BWB	135'500	setup pilot, connect to infrastructure (WP1, WP3) external laboratory analytics (trace organics, AR gene sequencing, AR gene detection) (WP4) Dissemination material (model or video) (WP7)
18	Drewag	50'000	1 subcontract on planning, design, operation and maintenance of the ultrafiltration pilot plant in Site 2 in relation to Task 1.2.1) Neither DREWAG nor HTWD do have the technical expertise to run this pilot. All other potentially capable partners are located too far away and it would be more costly to involve them
21	MEK	62'024	2 subcontracts for – microbiological analysis and spiking (viruses, coliphages, giardia) 15'524 EUR and – organic micropollutant analysis (46'500 EUR) during operation of Site 7 (WP2 Task 2.2, WP4) which aims at indirect potable reuse. The fate of pathogens is thus to be monitored. Specialised analytical expertise not available in the consortium
22	AMU	40'500	3 subcontracts Performing chemical and microbiological analyses (including micropollutants) of – groundwater from wells and piezometers; – water samples taken after ozonation and before activated carbon filters (13 000 EUR) Adaptation of groundwater exploitation system specially for AquaNES purposes (capture, operation); – Modification of the operational monitoring system (including construction of new monitoring points and increase of the frequency of water sampling).12 500 Collection of archival data and results and their compilation in a database including – all hydrogeological drilling on the well field area; – hydrochemical analyses; – temperature and groundwater level measurements on the well field area; – the data for evaluation of the water treatment and disinfection efficiency at different steps of the water treatment.

			Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)
			(15 000) at Site 4, Poznan (WP1)
23	BRGM	8'000	1 subcontract for virus and pathogens analysis in reclaimed water for golfcourse irrigation Site 8, (WP2, Task 2.4.2 & 2.5). French legislation on water reuse requires a minimum removal effectiveness for coliphages which has to be proven in the demonstration site. Specialised analytical expertise not available in the consortium
25	HTWD	17'000	1 subcontract for pathogen analysis in Site 2 (viruses and viral indicators) in relation to Tasks 1.2.1 and 1.4.3 to assess ultrafiltration effectiveness and to contribute to WP4 QMRA tool Specialised analytical expertise not available in the consortium

5 ETHICS AND SECURITY

5.1 Ethics

The Ethics Summary Report identified Environmental issues and third countries involvement as aspects to be addressed. :

Ethics Requirements:

pre-grant – Ethics Requirement 2:

> The applicant must confirm that the ethical standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research is carried out.

The applicant confirms that the ethical standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research is carried out

Ethics Requirement 4

> Detailed information must be provided to confirm that fair benefit-sharing arrangements with stakeholders from low and/or lower-middle income countries are ensured during the project.

The activities in India are performed in close collaboration with the local utility and under support of a research institute in the area. Knowledge gained will be scientifically exploited in joint publications. Further the utility will acquaint the operational know-how which makes them potentially independent from external support in running such systems. The Indian partner will be partner in the exploitation team of the technology. More detailed information on the benefit-sharing arrangements with this partner will be submitted in Month 2 of the project.

Ethics Requirement 3

> The applicant must provide further information about the possible harm to the environment caused by the research and state the measures that will be taken to mitigate the risks.

All our demonstration facilities have permission of competent authorities as far as required. The interventions in most sites are comparably minor in terms of flow and thus of expectedly limited impact on the water environment. More detailed information related to this Ethics Requirement will be submitted in Month 2 of the project.

Ethics Requirement 1

> The applicant must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project.

All demonstration plant set-up are equipped with the legally mandatory protection devices as for (where applicable) electrical installation, EX-protection, ozone destruction etc.. More detailed information related to this Ethics Requirement will be submitted in Month 2 of the project.

5.2 Security

not applicable

The project will not involve:

- Activities or results raising security issues:
- EU classified information as background or results:

ESTIMATED BUDGET FOR THE ACTION (page 1 of 3)

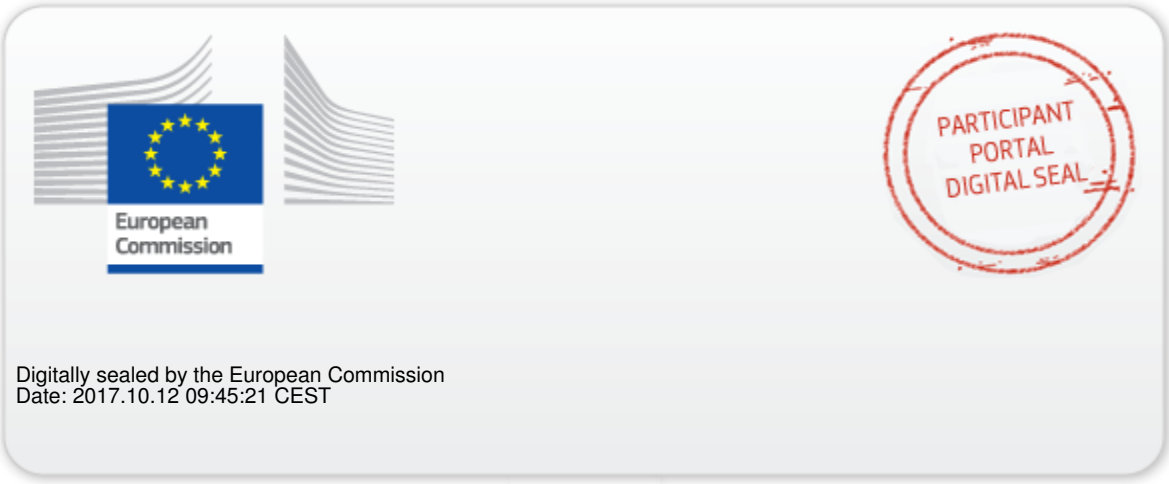
	Estimated eligible[1] costs (per budget category)									EU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	C. Direct costs of fin. support	D. Other direct costs	E. Indirect costs[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
1. FHNW[13]															726437.50
2. AKUT	38336.30	0.00	1720	55263.60	15000.00	0.00	59160.00	38189.98	205949.88	70.00	144164.92	144164.92	0.00	No	
3. AUT	138600.00	0.00	0	0.00	0.00	0.00	81500.00	55025.00	275125.00	70.00	192587.50	192587.50	0.00	No	
4. BDS	147200.00	0.00	0	0.00	0.00	0.00	37700.00	46225.00	231125.00	70.00	161787.50	161787.50	0.00	No	
5. HYBU	77000.00	0.00	0	0.00	0.00	0.00	44200.00	30300.00	151500.00	70.00	106050.00	106050.00	0.00	No	
6. imaGeau	76125.00	0.00	0	0.00	0.00	0.00	40623.00	29187.00	145935.00	70.00	102154.50	102154.50	0.00	No	
7. GEOHYD	255955.00	0.00	0	0.00	0.00	0.00	16800.00	68188.75	340943.75	70.00	238660.63	238660.63	0.00	No	
8. MicroLAN	78000.00	0.00	0	0.00	0.00	0.00	94500.00	43125.00	215625.00	70.00	150937.50	150937.50	0.00	No	
9. XFLOW	150378.00	0.00	0	0.00	0.00	0.00	270660.00	105259.50	526297.50	70.00	368408.25	368408.25	0.00	No	
10. VTG	443805.00	0.00	504	18194.40	60000.00	0.00	18800.00	120199.85	660999.25	70.00	462699.48	462699.48	0.00	No	
11. WADIS	95000.00	0.00	0	0.00	19200.00	0.00	77753.00	43188.25	235141.25	70.00	164598.88	164598.88	0.00	No	
12. WatStech	160000.00	0.00	0	0.00	0.00	0.00	22700.00	45675.00	228375.00	70.00	159862.50	159862.50	0.00	No	
13. XYLEM	176400.00	0.00	0	0.00	0.00	0.00	172767.00	87291.75	436458.75	70.00	305521.13	305521.13	0.00	No	
14. BUWW	172200.00	0.00	0	0.00	0.00	0.00	64600.00	59200.00	296000.00	70.00	207200.00	207200.00	0.00	No	
15. BWB	410400.00	0.00	0	0.00	135500.00	0.00	92200.00	125650.00	763750.00	70.00	534625.00	534625.00	0.00	No	
16. DEYAT	28500.00	0.00	0	0.00	0.00	0.00	7515.00	9003.75	45018.75	100.00	45018.75	45018.75	0.00	No	
17. MUOA	33250.00	0.00	0	0.00	0.00	0.00	2765.00	9003.75	45018.75	100.00	45018.75	45018.75	0.00	No	
18. DREWAG	96800.00	0.00	0	0.00	50000.00	0.00	91771.00	47142.75	285713.75	70.00	199999.63	199999.63	0.00	No	
19. EV	287920.00	0.00	0	0.00	0.00	0.00	107200.00	98780.00	493900.00	100.00	493900.00	493900.00	0.00	No	
20. IWB[13]															209875.00
21. MEK	343200.00	0.00	0	0.00	62024.00	0.00	163632.00	126708.00	695564.00	70.00	486894.80	486894.80	0.00	No	
22. AMU	76662.00	0.00	0	0.00	40500.00	0.00	56738.00	33350.00	207250.00	100.00	207250.00	207250.00	0.00	No	
23. BRGM	0.00	355000.00	0	0.00	8000.00	0.00	52950.00	101987.50	517937.50	100.00	517937.50	517937.50	0.00	No	
24. UCRAN	307800.00	0.00	0	0.00	0.00	0.00	57340.00	91285.00	456425.00	100.00	456425.00	456425.00	0.00	No	
25. HTWD	259600.00	0.00	0	0.00	17000.00	0.00	109867.00	92366.75	478833.75	100.00	478833.75	478833.75	0.00	No	
26. EJC	7950.00	0.00	0	0.00	0.00	0.00	3179.60	2782.40	13912.00	100.00	13912.00	13912.00	0.00	No	
27. KWB	360750.00	0.00	0	0.00	0.00	0.00	79865.00	110153.75	550768.75	100.00	550768.75	550768.75	0.00	No	
28. KWR	440000.00	0.00	0	0.00	0.00	0.00	76700.00	129175.00	645875.00	70.00	452112.50	452112.50	0.00	No	
29. NTUA	351500.00	0.00	0	0.00	0.00	0.00	29900.00	95350.00	476750.00	100.00	476750.00	476750.00	0.00	No	

ESTIMATED BUDGET FOR THE ACTION (page 2 of 3)

	Estimated eligible[1] costs (per budget category)									EU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	C. Direct costs of fin. support	D. Other direct costs	E. Indirect costs[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9]							
								25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
30. UJS[13]															45000.00
31. NUPS	65000.00	0.00	0	0.00	0.00	0.00	25570.40	22642.60	113213.00	100.00	113213.00	113213.00	0.00	No	
Total consortium	5078331.30	355000.00		73458.00	407224.00	0.00	1958956.00	1866436.33	9739405.63		7837292.22	7837292.22	0.00		981312.50

ESTIMATED BUDGET FOR THE ACTION (page 3 of 3)

(1) See Article 6 for the eligibility conditions
(2) The indirect costs covered by the operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant (see Article 6.2.E).
(3) This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Commission/Agency decided to grant for the action) (see Article 5.1).
(4) The 'maximum grant amount' is the maximum grant amount decided by the Commission/Agency. It normally corresponds to the requested grant, but may be lower.
(5) Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.
(6) See Article 5 for the forms of costs
(7) Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to beneficiary's usual accounting practice
(8) See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).
(9) Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs
(10) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).
(11) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc)
(12) Only specific unit costs that do not include indirect costs
(13) See Article 9 for beneficiaries not receiving EU funding
(14) Only for linked third parties that receive EU funding



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