SUBsurface Water SOLutions

Report

Mission Series IV in

Recife, Brasil, 29.01.2018

Solution Promotion and Capacity Development in Brasil, Mission Series IV

This report aims to inform the reader about the agenda, the content of the different presentations with ideas presented by the site partners and results of subsequent discussions as part of the public promotion event. The report concludes with an overview of refined concepts during subsequent project development workshops. These activities where part of the scope of the Mission IV Series in Recife, Brazil in the SubSol project.

This report is shared with the participatns of the event, the SUBSOL consortium members, associated partners as well as prospective partners in SUBSOL's designated target regions.

This report was written by Anika Conrad
adephi research
Contact: conrad@adelphi.de

SUBSOL has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 642228

Executive Summary of the outcomes of the Public Promotion Event

As part of the SubSol project, the adelphi water team organized a Public Promotion Event together with Brazilian site partners to discuss the possibilities of implementing subsurface water solutions (SWS) with a wide range of interested parties (engineers, researchers, government authorities, beneficiaries, etc.) and to develop in further steps new project concepts. The Event took place on January 29, 2018, in the premises of the Federal University of Pernambuco (UFPE), one of the key stakeholders in the Recife case, who maintains good relationships with a wide range of stakeholder and brings together knowledge from multiple hydrogeology and recharging research projects. Professor Suzana Montenegro, also president of FADE-UFPE, which is the Foundation of the UFPE, was so kind to take over the moderation of the event.

The event provided an overview of the SubSol technologies, their best practice examples, and the application of different tools in an accessible and inclusive manner and allowed participation of all interested stakeholders from all sectors. Furthermore, local stakeholders informed about the current situation of the water supply of the Metropolitan Region of Recife (RMR) and its regulations and problems and gave a deeper insight into existing projects and implementation opportunities for SWS. These opportunities were identified and substantiated together with the stakeholders in the previous bilateral meetings. The event lasted about three hours and concluded with a small round of discussion, which was continued during a joint lunch and will be intensified in the following days in the "SWS Project Development Workshops" in form of finished Concepts and Project Proposals.

All in all, technical as well as nontechnical stakeholder have been involved and are keen to participate in the development of local SWSs. Public authorities and decision makers are in favour of enabling regulations for the implementation of SWS. Promising locations have been determined and will be discussed in the following SWS Project Development Workshops.

Event Content

Suzana Montenegro introduced to the workshop by presenting the experience Federal University of Pernambuco (UFPE) has in international research cooperation. She mentioned ongoing research activities especially for SWS, Managed Aquifer Recharge (MAR) and Aquifer Storage and Recharge (ASR) projects and the scope for future interdisciplinary research. The RMR is a hotspot regarding finding solutions for sustainable groundwater management addressing overexploitation and saline water intrusion.

Robson Xavier (COMPESA) presented on the groundwater extraction by COMPESA and geological context of RMR in general. In 2005, COMPESA set up a project plan to artificial recharge the Beberibe aquifer, which has never been realized until today. On the contrary, the extraction of groundwater resources by COMPESA has been progressively reduced since 2000. However, the use of the Botafogo dam does not meet its expectations, which leads to the conclusion that groundwater is still a required source to north of RMR.

Waldir Duarte Costa (Consultoria e Serviços Técnicos e Ambientes Ltda) spoke about the Evolution of the RMR hydrological knowledge and its current situation. Since the 80s, studies have been carried out on the condition of the aquifers, for example in the Hydrorec project, whose results revealed that the aquifers suffer from an overexploitation, especially in Boa Viagem and Pina neighbourhoods, but also in Olinda and Jaboatão dos Guararapes. After an introduction on the various MAR techniques, Waldir Duarte Costa concluded a large potential of recharge precipitation collected by roofs of large residential buildings and a high importance of promoting recharge possibilities on a regional scale through the government for a successful implementation.

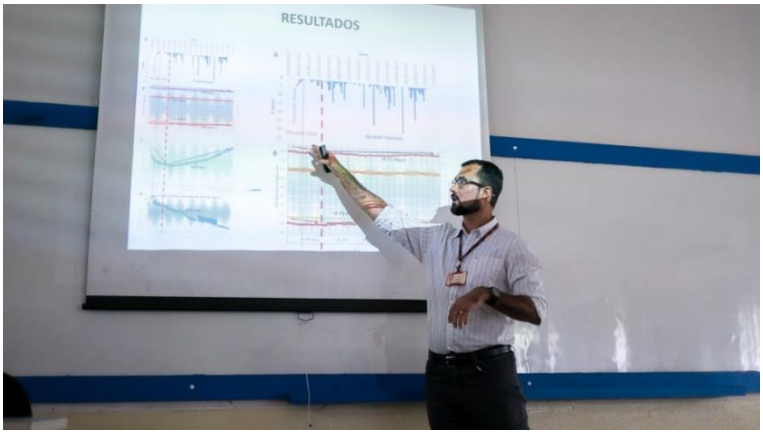
Ronjon Chakrabarti (adelphi) led the topic of the event from a general view on MAR and the situation of groundwater extraction in RMR to the solution concepts promoted by the SubSol project. After a short introduction on the three different main technologies which can be adjusted and combined regarding various characteristics of a project site, Ronjon presented best practise examples in Europe and gave an overview of the next steps for developing a new project with the site partners: Project development workshops on the 31th January and

1st February where proposals will be elaborated and invitations of the site partners to European replication sites.

Crystianne Rosal (APAC - Pernambuco State Agency for Water and Climate) presented on a study of the Availability and Vulnerability of Groundwater in the Metropolitan Region of Recife conducted by APAC. Based on this study, areas with the highest drawdown and the greatest risk of contamination were identified. Different zones have been defined for Recife where different conditions apply to groundwater abstraction. In order to improve the compliance with the formalities of the new zone system, 100 wells are being equipped with sensors for a new monitoring program capable to measure water level and electrical conductivity. The data will be accessible on the website of APAC via a password.

Recife Urban Services Company (CSURB) developed a feasibility study for a rainwater harvesting system and the potential of Subsol technologies implemented on public markets in Recife. One of these markets in the Afogados neighbourhood could harvest 7000 m³ water each year. With a consumption of 2900 m³ approximately 4000 m³ of rainwater are available

for injection into the aquifer in an area were the situation of the groundwater level of the Beberibe aquifer is particular critical.



Anderson Paiva (UFPE) gave an overview of the recent results of the UFPE's research programs and potential locations for ASR implementation. He pointed out that RMR suffers from overexploitation of the aquifers with a resulted drawdown in some areas of up to 70 m and indirect salinization from the sea over rivers and the mangroves. An increase in sea level of 55 cm is expected by 2033, which will intensify the indirect salinization of the groundwater. Within the BRAMAR project, two sites were selected for further observations: Yacht Club and a public school both located in the Pina neighbourhood. At both sites observation wells are measuring water level and electrical conductivity (multi piezometers) since one year and the installation of a rainwater harvesting system and a new well in order to inject rainwater are planned.

Another professor from UFPE, Jaime Cabral introduced us to a bank filtration pilot project at the Beberibe river. The investigations focused on benthos communities. The study

achieved very good results regarding the attenuation of pollutants and pathogenic microorganisms and reduction of turbidity levels and apparent colour.

A representor of the Institute of Agronomic Research (IPA), Josimar Gurgel presented the ideas and ongoing research activities regarding infiltration/injection opportunities in Itapirema in RMR.

Following the presentations on the various implementation options, Anika Conrad (adelphi) concluded the presentation series with an overview of the tools and services of the SubSol project. The application of the following tools was explained in detail: SubSol Knowledge Environment (KE), SWS Decision Tree, Technical and Economical Guide, Location Identification Tool, Participatory Technology Assessment and Policy Brief.

Discussion and Conclusions

The discussion focussed on the next steps regarding the solution development. It was agreed that at first a research pilot project is needed which should demonstrate and proof the technology concept in Recife. From the available options, three options were preferred: 1. Installation at the public school where an observation well is already monitoring data since one year. 2. Feasibility study for a public market for which currently rainwater harvesting structures are being implemented. 3. Potential pilot site at the holiday resort Nannai, which mentioned to have interest in installing a Freshkeeper system.

Outcomes of the Project Development Workshops

During two Project Development Workshops the first two above mentioned SWS implementation options were specified together with the stakeholder in form of new project concepts.

The public school at the first project site is located in a heavily populated residential district of Recife, which is about 200 m near the sea. Especially in this area, the aquifer is affected by heavy over-exploitation and is difficult to regulate due to a high number of illegal wells. The school already owns a well which, due to groundwater contamination (primarily caused by saltwater intrusion), had to be left unused. Together with UFPE researchers, the adelphi team evaluated the water balance and hydrolgeological feasibility of the site with the help of the technical guides for SWS technologie and part of the SubSol project outcomes. In addition a rainwater harvesting system and an injection well were designed and will be implemented with other necessary components this year. The on-site care of the SWS-pilot will be provided by UFPE researchers with the support of adelphi. In the case of a successful

pilot the system will enable the school to extract the infiltrated freshwater and stored underground for its own requirements. Furthermore the aim of this pilot is increase the public's acceptance of SWS technologies and facilitate next project executions. A hydrogeological model will reproduce underground processes to identify further potential sites for the implementation of Subsurface Water Solutions.

The second promising case site for SWS implementation is the injection of rainwater into the aquifer below two public markets in Afogados neighbourhood of Recife. With a roof area of more than 3150 m^2 and 7000 m^2 it is possible to cover the consumption of the markets by using captured rainwater. Until now, one of the markets already collects its rainwater, which CSURB plans to store in a soon to be constructed cistern with a capacity of 50 m^3. In a new project this captured rainwater with a potential volume of 7200 m^3 per year could be injected into one of the existing wells of the second market. As a next step, the roof of the second market could also be provided with a rainwater harvesting system. To conclude, Recife's public markets show a great potential for the application of SWS technologies and the responsable site partner CSURB is commited to follow up on these ideas and to work together with the SubSol team.

Schedule of the Mission IV Activities in Recife, Brazil

Date	Day	Time	Event	Attendees	Content	Method	Desired outcome
20.01.2017	*Saturday*						
21.01.2017	*Sunday*						
22.01.2017	*Monday*		Arrival				
23.01.2017	*Tuesday*	10:00 AM	Bilateral knowledge exchange and capacity building	UFPE (Anderson Paiva, Jaime Cabral, Ana Beatrize)	Joint elaboration of SWS opportunities; SUBSOL Tool; Promotion event; Project Development Workshop	Brief introductory meetings with management followed by extended meetings with technical personnel; (if possible) followed by site visits; SUBSOL replication tools and project outcomes (e.g. the SWS toolkit and technical guidelines) are used to elaborate provisional written concepts for the implementation of SWSs	SWS opportunities are fine-tuned; Local stakeholders are familiar with SUBSOL replication tools; written provisional fact sheet (e.g. type of technology, location, consortium partner, funding opportunities, etc.) for SWS implementationhas been elaborated in preparation for an open discussion during the following multi-stakeholder workshops
		3:00 PM		PCR-SDSMA (secretario ejecutivo Mauricio Guerra)			
24.01.2017	*Wednesday*	10:00 AM		TPFE (Thiago Almeida, +558133160700)			
		3:00 PM		Prefeitura Recife/CSURB (Bruno Teixeira, Berenice Vilanova de Andrade Lima; Tele: +5581 3355.2441)			
25.01.2017	*Thursday*	10:30 AM		APAC, Presidente, Macelo C Asfora, +558131831008			
		2:00 PM		COMPESA (Robson Xavier)			
		4:00 PM		Sr. Waldir Costa			
26.01.2017	*Friday*	10:00 AM		Nannai			
		3:00 PM					
27.01.2017	*Saturday*		Internal review				
28.01.2017	*Sunday*		Internal review				
29.01.2017	*Monday*	10:00 AM	Public Promotion Event	Open to the public; participation by all stakeholders is desired (particularly representatives from public authorities and regulatory bodies)	Basic introduction to SWSs; best-practice examples; Feasibility of SWSs at specific locations;	Presentations and panel (scientists/technical expert, public authorities, regulatory body, beneficiary, SubSol representative) discussions with a diverse set of stakeholders	Non-technical stakeholders (e.g. communal decision-makers) have been involved and are keen to participate in the development of local SWSs; The most promising location has been determined; Local stakeholders are interesed to participate in SWS development
30.01.2017	*Tuesday*		Internal Review	adelphi	Review of the public promotion event	Internal work	Preparatory work for the following solution workshop (revised fact sheet, draft roadmap)
31.01.2017	*Wednesday*	9:00 AM	SWS Project Development Workshop: Site Case Boa Viagem	Site Case: Public School in Pina neighbourhood (Landelino Rocha)	Joint elaboration of specific SWS project concept	Discussion in thematic groups; integration of outcomes;	Participatory elaboration of a specific SWS project; Development of a substantiated roadmap (step-by-step approach) for submission of new SWS projects in the specific target region
01.02.2017	*Thursday*	10:00 AM	SWS Project Development Workshop	CSURB Site Case: Public Markets			
02.02.2017	*Friday*		Departure				
03.02.2017	*Saturday*						
04.02.2017	*Sunday*						

Agenda Public Promotion Event

Tempo	Duração [min]	Conteúdo	Método	Facilitador	Resultados
10:00	15	Chegada	Bem-vindo Café / Chá	(UFPE) / adelphi	
	#1 Bem-vindo e abertura do evento				
10:15	10	Bem-vindo e objetivos do evento	Discussão interativa	Suzanna Montenegro (UFPE) / adelphi	warm-up, agenda e objetivos conjunto
	#2 Gerenciamento de água na Região Metropolitana de Recife (RMR)				
10:25	10	Introdução ao abastecimento de água do RMR - Situação geral e desafios do uso das águas subterrâneas	Apresentação em powerpoint	Robson Xavier (COMPESA)	Todos estão atualizados sobre o status atual
10:35	10	Aplicação geral de sistemas gerenciados de recarga de aquíferos na RMR	Apresentação em powerpoint	Waldir Duarte Costa (Consultoria e Serviços Técnicos e Ambientes Ltda)	Compreender as diferentes possibilidades das tecnologias MAR e sua aplicação anterior na RMR
	#3 Soluções de água subterrânea (SWS) no projeto SubSol				
10:45	10	Introdução ao SWS - Exemplos de funcionamento e melhores práticas	Apresentação em powerpoint	Ronjon Chakrabarti (adelphi)	Compreensão das SWS no projeto SubSol
	#4 Avista de pública				
10:55	10	Estudos e monitoramento dos poços na RMR e oportunidades de aplicação das tecnologias de recargar os aquíferos	Apresentação em powerpoint	Crystianne Rosal (APAC)	Compreender o problema atual da captação de águas subterrâneas no Recife e a necessidade de um programa de monitoramento
11:05	10	Sistema de captação de chuva e potencial das tecnologias Subsol para os mercados públicos de Recife	Apresentação em powerpoint	Berenice Lima (CSURB)	Possível implementação do SWS em domínio público
11:15	15	Coffee break			
	#5 Oportunidades para aplicação SWS na RMR				
11:30	10	Boa Viagem e Pina (BRAMAR projeto)	Apresentação em powerpoint	Anderson Paiva (UFPE)	Desenvolvimento conjunto da implementação do SWS para melhorar o abastecimento de água no RMR
11:40	10	Filtracao em margem em Recife e Olinda		Jaime Cabral (UFPE)	
11:50	10	Oportunidades de infiltração / injeção em Itapirema		Josimar Gurgel (IPA)	
12:00	20	Aplicação das ferramentas da SubSol às diferentes possibilidades de aplicação - apresentação e desenvolvimento conjunto de possíveis soluções	Ferramenta de seleção para identificação de localização para SWS, Guias técnicos e Fichas de informações	Anika Conrad (adelphi)	
12:20	15	Discussão	Discussão interativa	Todos presentes/moderadora: Suzana Montenegro (UFPE)	
12:35		Fim do evento e almoço no restaurante nas proximidades			