PROJECT PERIODIC REPORT

Grant Agreement number: 308336

Project acronym: NAWATECH

Project title: Natural Water Systems and treatment technologies to cope with water shortages in urbanised areas in India

Funding Scheme: Collaborative project

Date of latest version of Annex I against which the assessment will be made: 15.02.2012

Periodic report: **1st** ☐ **2nd** ■ **3rd** ☐ **4th** ☐

Period covered: **from** 01.01.2014 **to** 31.12.2015

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ANNEX TO THE FINAL REPORT – FIGURES AND TABLES

Table 1: *NaWaTech work plan for WP3 (part 1, until implementation of the systems) [updated after Pune-Nagpur Meeting in November, 2015]*

Step	Nagpur			Pune		
	Dayanand Park	**Ordnance Factory**	**Amanora Park Town**	**College of Engineering Pune (COEP)**	**MJP office (vertical garden)**	**Rainbow museum**
Obtaining consent			✓	✓		✓
Signing MoU	✓	✓	30/04/2013	✓	✓	-
Data collection finalised	✓	✓	✓ 30/04/2013	✓		✓
Design (Task 3.1)						
Design of treatment plant						
- Preliminary design			✓ 31/05/2013	✓ 30/09/2013		✓ 31/05/2014
- Detailed design	✓		✓ 31/07/2013	✓ 31/10/2013		✓ 18/04/2015
- Short Crop Rotation Plantation design	n/a	✓	n/a	n/a	n/a	n/a
- Landscape design			n/a	✓ 31/10/2013		
Cost Assessments	✓ 31/10/2014	✓	✓ 31/07/2013	✓ 31/10/2013		✓ 20/04/2015
Implementation and start-up (Task 3.3)						
Tender document preparation finalised	15/11/2015	✓ 31/05/2014	-	✓ 30/11/2013		✓ 20/04/2015
Procurements			✓	✓		
Transport to India (technical treatment system)	n/a	n/a	✓	n/a	n/a	n/a
Implementation of treatment system finalised	**should starting January 2016**	**30/11/2015**	✓ **31/05/2014**	✓ **31/08/2015 (excl. pumps)**	✓ **01/02/2014**	**30/11/2015**
Commissioning of treatment plant	-	31/01/2016	✓ 05/06/2014	31/12/2015	n/a	31/12/2015

Table 2: *NaWaTech work plan for WP3 (part 2, until implementation of the systems) [updated after Pune-Nagpur Meeting in November, 2015]*

Step	Nagpur		Pune			
	Dayanand Park	**Ordnance Factory**	**Amanora Park Town**	**College of Engineering Pune (COEP)**	**MJP office (vertical garden)**	**Rainbow museum**
Development of O&M scheme (Task 3.3) (as discussed at meeting in Vienna 11/2014)						
Responsible person in Indian team	Achal	Neelesh	Ajith	Sagar	Sagar	Pallavi
Development of monitoring / research programme (frequency of sampling, parameters to be analysed, etc.)*	31/10/2015	30/06/2015	✓ 31/12/2014	31/05/2015	✓ 31/05/2015	31/05/2015
Development of O&M scheme (to be ready before start-up of systems)*	??	??	✓ 31/08/2014	partly available	available	??
Development of NaWaTech Safety and O&M Plan (version 1, incl. O&M materials for operators)*	Not available yet	Not available yet	Not available yet	Not available yet	Not available yet	Not available yet
Operation	not before 04/2016	from 01/02/2016	from 01/07/2014	from 01/01/2016	from 01/02/2015	from 01/01/2016
Monitoring, sampling and analysing	not before 04/2016	from 01/02/2016	from 01/07/2014	from 01/01/2016	from 01/02/2015	from 01/01/2016
Implementation of 1st components of NaWaTech Safety Plan		01/02/2016				
Evaluation (Task 3.4)						
Evaluation of system performance						
Evaluation of NaWaTech Safety Plan						
Adaptation (Task 3.5)						
Adaptation of treatment system						
Adaptation of NaWaTech Safety Plan						
Ensuring sustainability of the implementation sites (Task 3.6)						
Finalisation of NaWaTech Safety Plan						
Hand-over to end user	30/06/2016	30/06/2016	30/06/2016	30/06/2016	30/06/2016	30/06/2016

Table 3: *Overview of European and Indian deliverables in WP2 and WP3 and their content*

Del.#	Date	Title	Content
✓ **EU-D3.1**	M31 (Jan 2015)	Design and drawings for 2 NaWaTech implementation sites	Detailed design for all field sites - Calculations for sizing the plants - Cost calculations - Design drawings
IN-D3.1	Dec 2015	Pune sites (COEP Site)	Completion of Pune sites
IN-D2.3	Dec 2015	Nullah treatment	Completion of Nullah treatment site
IN-D3.2	Jun 2016	Nagpur sites (OFAJ & NIT Park Sites)	Completion of Nagpur sites
EU-D2.5	Nov 2015	Enhancement of the potential of natural water treatment systems to cope with water shortage in urban strategy for NaWaTech systems in urbanised areas in Maharashtra	Final results and conclusions from all field sites - (Operational) experiences from all sites (from Technical Notes and Case studies) - NaWaTech Safety and O&M Plans implementation and lessons learnt from all sites - Planned handling over to stakeholders - Etc. Research results from MSc and PhD theses = basis for NaWaTech Publications I+II
IN-D2.5 **+** **EU-D5.11**	Dec 2015 (Jun 2016 for IN-D2.5)	Recommendations Paper: Implementation of NaWaTech approaches in India considering the financial, environmental, social, institutional and technical aspects (Publication 1) EU: NaWaTech Publication I	Recommendations Paper: Implementation of NaWaTech approaches in India considering the financial, environmental, social, institutional and technical aspects (Publication 1) combined with EU D5.11 "NaWaTech Publication I" EU prepares draft, Indian partners prepare final version for their deliverable later • Target audience: practitioners, authorities, municipalities • Should be a publication that is referred to when making new standards • NEERI publication with ISBN number
IN-D3.3	Jun 2016	Technically viable and cost-effective Operation and Monitoring scheme for the application in urbanised areas of India	Technically viable and cost-effective Operation and Monitoring scheme for the application in urbanised areas of India
IN-D3.4 **+**	Dec 2015 (Jun 2016 for IN-	Recommendation Paper: Ensuring Sustainability of NaWaTech systems in India (Publication 2)	Recommendation Paper: Ensuring Sustainability of NaWaTech systems in India (Publication 2)

EU-D5.12	D3.4)	EU: NaWaTech Publication II	combined with EU D5.12 "NaWaTech Publication II" EU prepares draft, Indian partners prepare final version for their deliverable later • To be merged with "NaWaTech Publication I", i.e. one publication with 2 main parts
EU-D5.13	→ Dec 2015	NaWaTech Publication III	EU D5.13 "NaWaTech Publication III" = Special issue of SSP journal Draft ToC 1. Introduction and general approach [NEERI + **TTZ**] 2. *OF site (main+ FRB + SRP) [**NEERI** + IRIDRA + TTZ] 3. *Dayanand Park [**IRIDRA** + NEERI + KRE_TA] 4. *COEP [**ESF** + IRIDRA] 5. *Vertical garden [**IRIDRA** + ESF] 6. *Amanora [ESF + **BIOAZUL**] 7. *Rainbow museum [**SEERI** + KRE_TA] 8. *Landscaping aspects [**KRE_TA**] 9. Safety and O&M planning [BOKU] 10. *Pilot-scale experiments [UPC] 11. *LCA [UPC] 12. NaWaKit [**SEECON**] 13. Business development trainings [**SEECON**] 14. COP [ESF + NEERI] 15. Summary and Outlook [NEERI + TTZ] * also for conference

Fig. 1: *Construction works of the wastewater treatment system at Amanora Park Town in Pune*

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Fig. 6: *Construction works for VF constructed wetland and anaerobic treatment at COEP in Pune*

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anaerobic treatment at COEP in Pune

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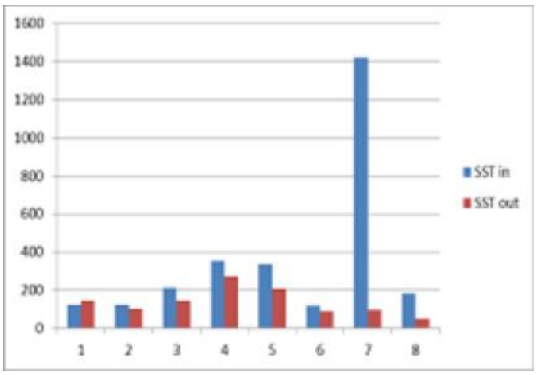
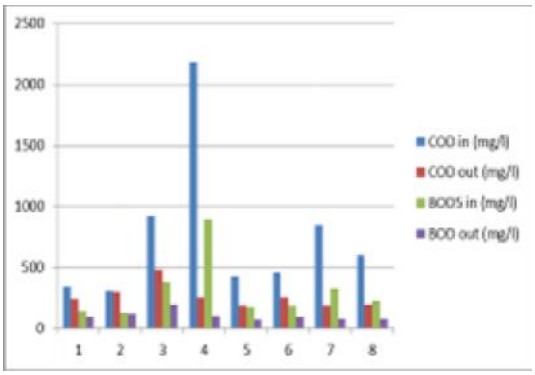


Fig. 27: *Monitoring results*



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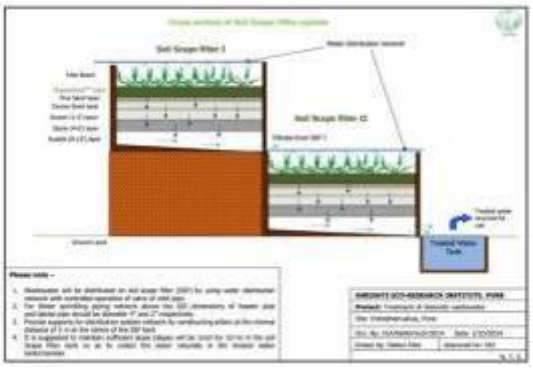

Fig. 41: *Cross section of Soil Scape Filter system*

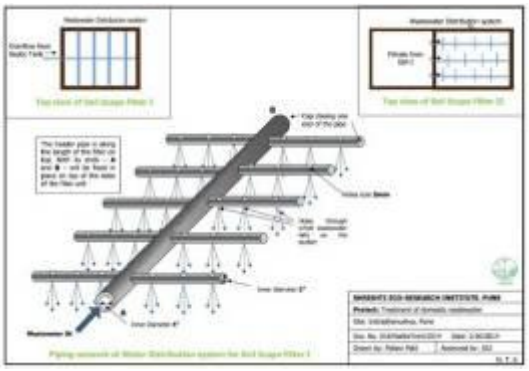

Fig. 42: *Schematic views of Soil Scape Filter system*

Fig. 43: *Pictures of the garden and implementation at the Indradhanushya Museum site*

Fig. 44: *Pictures of the garden and implementation at the Indradhanushya Museum site*

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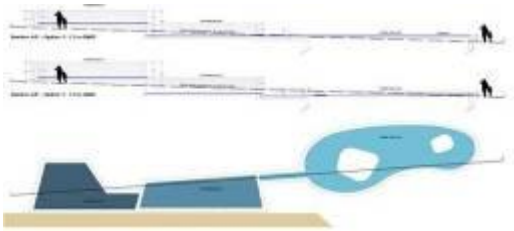

Fig. 51: *Section of the chosen scenario for the Indradhanushya Museum site, October 20th 2014*

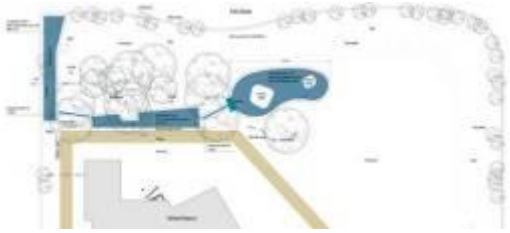

Fig. 52: *Final proposition for the Indradhanushya Museum site, December 12th 2014*

Fig. 53: *Plan of the new location at the Indradhanushya Museum site*

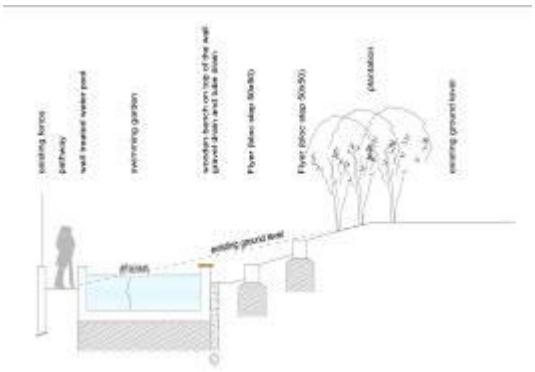

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Fig. 56: *The intake well under construction at the Indradhanushya Museum site*

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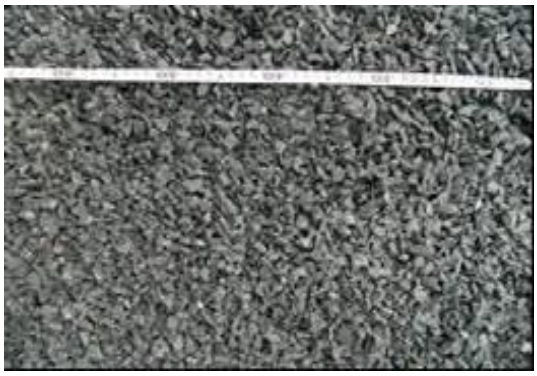

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Fig. 67: *Pictures of the almost finalized treatment at the OFAJ site in December 2015*

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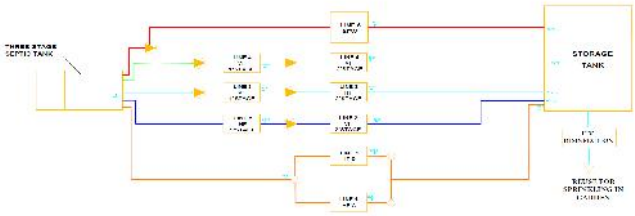

Fig. 69: *Schematics diagram of the 5 treatment lines at Dayanand Park site*

Fig. 70: *Landscaping at Dayanand Park site*

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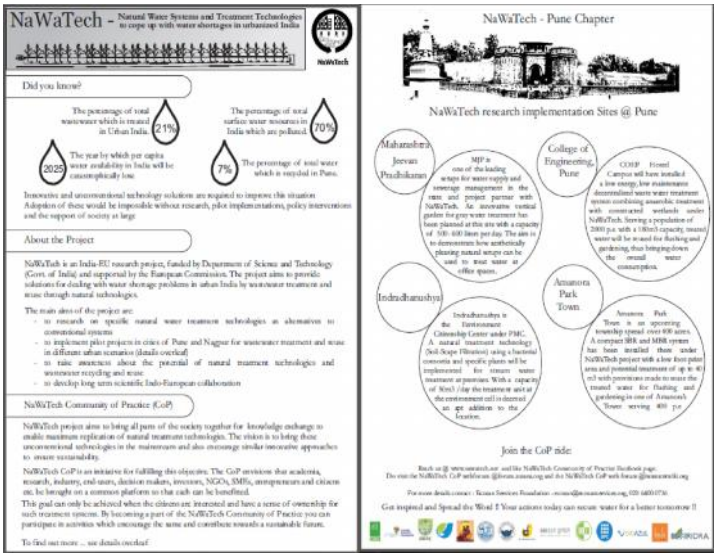

Fig. 72: *NaWaTech CoP dissemination material*


COLLABORATION MOU for NaWaTech:

ESF - MIT COE

Fig. 73: *Novel MoUs with the Engineering College Vishwakarma Institute of Technology*


COLLABORATION MOU for NaWaTech:

ESF -VIT

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Fig. 76: *Impressions of Pune CoP activities*

Fig. 77: *Impressions of Pune CoP activities*

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Fig. 79: *CoP meeting with Stakeholders at Dayanand Park*

Fig. 80: *CoP meeting with Stakeholders at MPCB Regional Office*

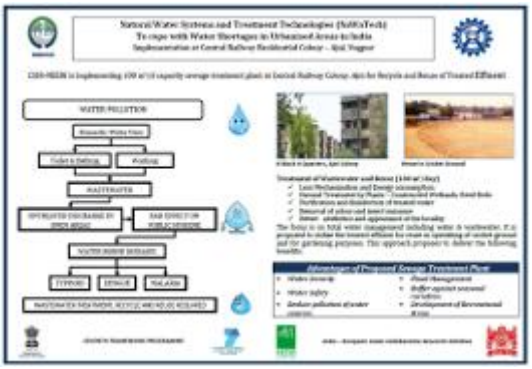


Fig. 81: *CoP meeting with Stakeholders at MPCB Regional Office*

Fig. 82: *NaWaTech CoP dissemination material, bilingual leaflet*

Fig. 83: *NaWaTech CoP dissemination material, bilingual leaflet*

Table 4: *Twinning calendar of UPC in 2014 and 2015*

<table>
<tr><th colspan="11">2014</th></tr>
<tr><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td colspan="3">Two MSc students from UPC to NEERI (Ms. Anna Cullell and Mr. Steven Haba, characterisation of new sites and social aspects)</td><td></td><td colspan="4">One MSc student from UPC to NEERI (Ms. Laura Flores, design and implementation)</td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="3">Two MSc students + one PhD student from BOKU to NEERI and ESF (Ms. Eva Staribacher, Ms. Diana Hewitt and Ms. Sandra Nicolics, safety planning)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>Project Meeting in India
Participation of students</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Project meeting in Vienna
Planning of next activities</td><td></td></tr>
<tr><td colspan="3">One MSc student from ESF to UPC (Mr. Vinay Kulkarni, modelling VF CW)</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">One PhD student from ESF to BOKU (Mr. Ajith Edathoot, safety planning)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">One PhD student from NEERI to UPC (Ms. Harkirat Kaur, emerging contaminants and CWs)</td></tr>
<tr><th colspan="11">2015</th></tr>
<tr><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td colspan="4">Two MSc students from UPC to NEERI (Ms. Maria Vidiella and Ms. Olivia Cantons, economic viability of SRP)</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Project Meeting in India
Planning of final activities</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Project Final meeting in India</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="4">One PhD student from NEERI to BOKU (Mr. Achal Khilnani, modelling CWs)</td><td></td><td></td><td></td><td></td></tr>
</table>

								One MSc student from NEERI to UPC (Mr. Neelesh Sahu, CWs)		

Table 5: *Planned MSc and PhD theses*

		MSc Theses	
Host	#	**Topic (name of student)**	**Timing**
UPC	1	Influence of hydraulic loading on treatment efficiency and water quality for reuse in a three stage hybrid constructed wetland system (Natalia Amigó Chaparro)	Finalised September 2013
	2	Effect of climatic conditions and primary treatment on the performance of a three-stage hybrid constructed wetland system (Blanca Marin Esteve)	Finalised July 2014
	3	Natural systems for wastewater treatment in warm climate regions. Influence of heavy rain episodes on removal efficiency in three stage hybrid treatment wetlands (Livia García Gil)	Finalised July 2014
	4	Comparing conventional and natural wastewater treatment with Life Cycle Assessment methodology. A case study in Nagpur, India (Anna Maria Cullell Oriols)	Finalised July 2015
	5	Life cycle assessment of a constructed wetland system for wastewater treatment and reuse in Nagpur, India (Laura Flores Rosell)	Finalised July 2015
BOKU	1	Adaptation of the approach to Sanitation Safety Planning to optimise operation and maintenance of sanitation systems in Pune, India (Eva Staribacher)	Finalised October 2015
	2	Adaptation of the approach to Sanitation Safety Planning to optimise operation and maintenance of sanitation systems in Nagpur, India (Diana Hewitt)	Finalised November 2015
TTZ	1	Concept for a short rotation plantation as a wastewater treatment system in a residential area in Nagpur, India (Christoph Knauer)	Finalised January 2014
NEERI	1	Development of techno-economical sewage treatment system for small communities in urban setups (Ordnance Factory Ambajhari) (Neelesh Sahu)	On-going (planned to finalised by June 2016)
	2	Domestic wastewater treatment using combinations of full scale horizontal and vertical flow engineered wetlands (Achal Khilnani)	On-going (planned to finalised by June 2016)
	3	Development of operation, maintenance and safety guidelines for decentralised wastewater treatment plants (Shubhankar Khare)	Finalised June 2015
	4	Development of greywater treatment & rain water harvesting system for a swimming pool in Nagpur, India (Minakshi Bagde)	On-going (planned to finalise bdy June 2016)
ESF	1	Comparative assessment of domestic wastewater treatment systems and design of the appropriate system for urban India (Vinay Kulkarni)	Finalised June 2014
	2	Treatment performance of SBR & MBR system at Amanora Park Town and vertical gardens at MJP, Pune (Sharvari Oak)	Finalised June 2015
		PhD Theses	
Host	#	**Topic (name of student)**	
UPC	1	Effect of design and operational factors on the removal efficiency of emerging organic contaminants in constructed wetlands for wastewater treatment (Chapter related to NaWaTech: "Three stage hybrid constructed wetland system for wastewater treatment and reuse in warm climate regions") (Cristina Avila Martín) – thesis defence on 9 December 2013	
BOKU	1	NaWaTech Safety and O&M Plans (Sandra Nicolics)	
NEERI	1	Identification and removal of Pharmaceutical and Personal Care Products (PPCPs) based priority pollutants from domestic wastewater (Harkirat Kaur)	
ESF	1	Appropriate decentralisation in wastewater treatment for urban growth trends in India (Ajith Edathoot)	

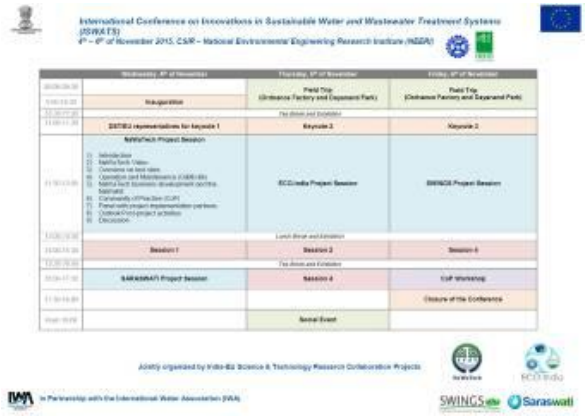


Fig. 84: *Draft ISWATS Conference programme*

Fig. 85: *Updated ISWATS Conference Leaflet*

Fig. 86: *Updated ISWATS Conference Leaflet*

Fig. 87: *Impressions of the alternative event (November 4th, Nagpur)*

Fig. 88: *Impressions of the alternative event (November 4th, Nagpur)*

Fig. 89: *Impressions of the alternative event (November 4th, Nagpur)*

Fig. 90: *Impressions of the alternative event (November 4th, Nagpur)*

Figs. 91 – 93: *NaWaTech website*

Fig. 94: *NaWaTech leaflet #1*

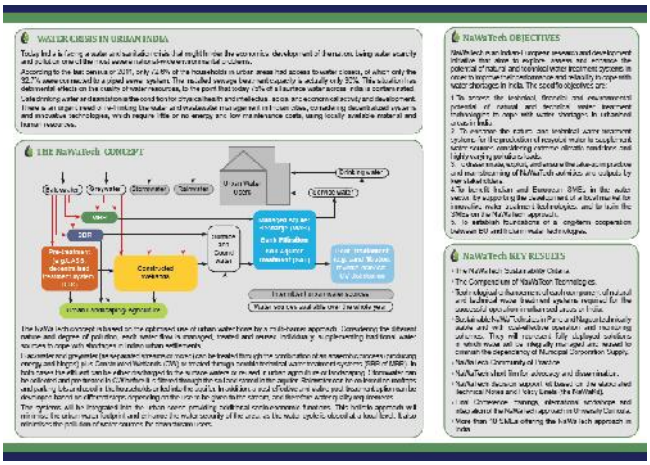


Fig. 95: *NaWaTech leaflet #1*

Fig. 96: *NaWaTech leaflet # 2*

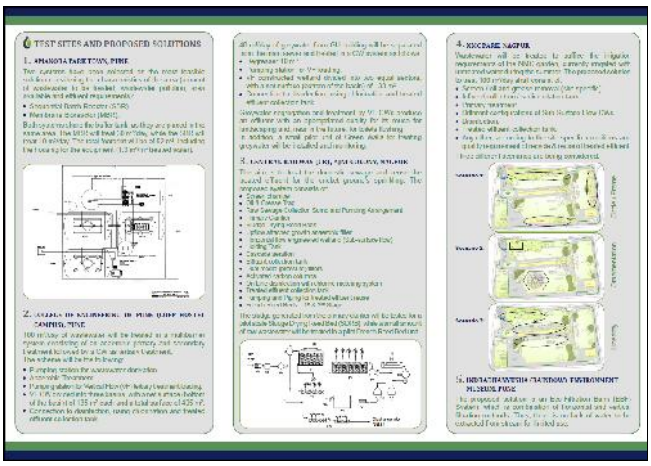


Fig. 97: *NaWaTech leaflet # 2*

Fig. 98: *NaWaTech leaflet #3*

Fig. 99: *NaWaTech leaflet #3*

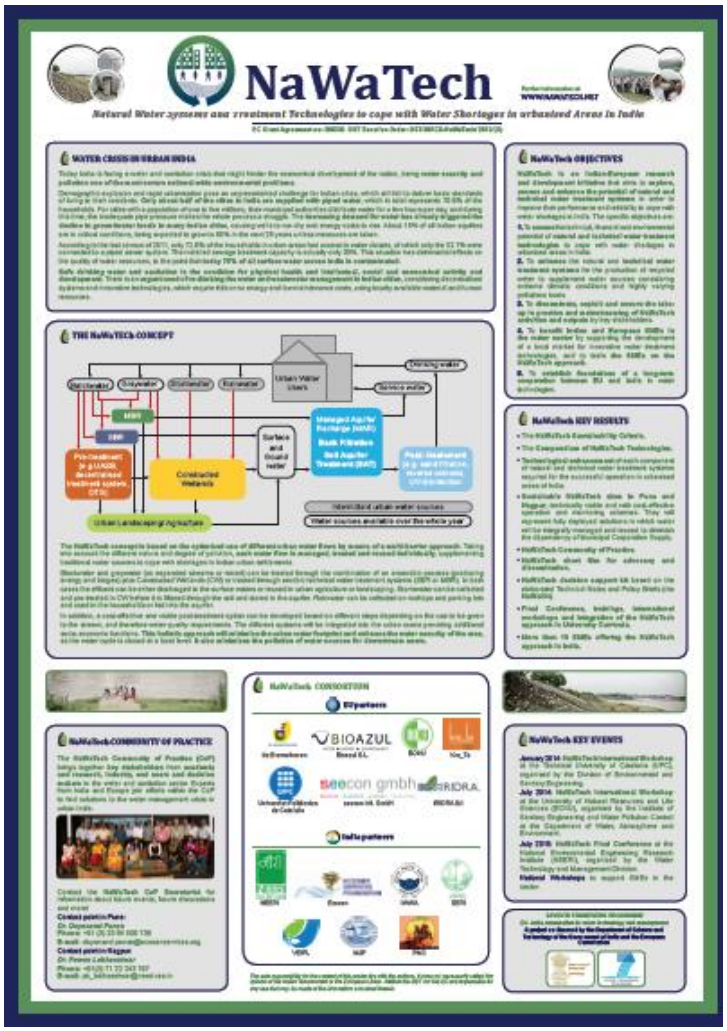


Fig. 100: *NaWaTech poster*

Fig. 101: *NaWaTech presentation*

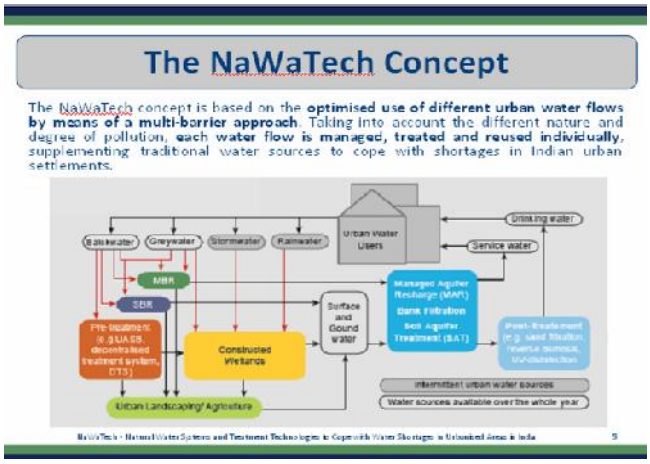
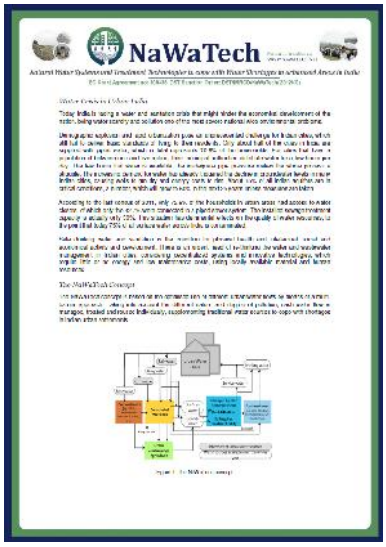


Fig. 102: *NaWaTech presentation*



Figs. 103 – 106: *NaWaTech newsletter #1*

Figs. 107 – 112: *NaWaTech newsletter #2*

Figs. 113 – 123: *NaWaTech newsletter #3*







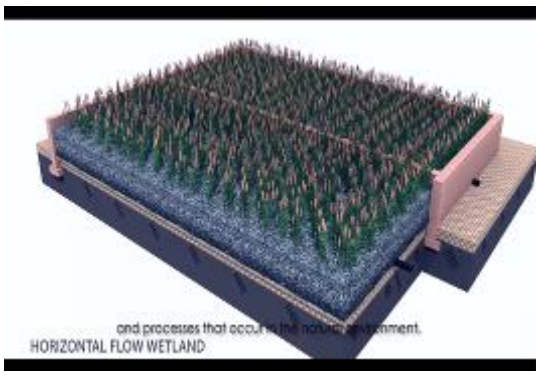


Figs. 124 – 133: *NaWaTech newsletter #4*

Figs. 134 and 135: *NaWaTech leaflet for Training Programme*

Table 6: *Papers of the SSP Journal*

	Title / *Author(s)*	**Pages**
1	Introduction to the NaWaTech Project *Katie Meinhold, Pawan K. Labhasetwar*	5-11
2	Domestic Wastewater Treatment and Reuse in Ordnance Factory Ambajhari, Nagpur *Girish R. Pophali, Neelesh Sahu, Achal Khilnani, Harkirat Kaur, Sandeep Yadav, Pawan K. Labhasetwar, Riccardo Bresciani, Fabio Masi, Katie Meinhold*	12-16
3	Wastewater Treatment and Reuse for Irrigation in an Urban Park: the Dayanand Park Treatment Wetland System in Nagpur *Fabio Masi, Riccardo Bresciani, Philip Winkelmeier, Girish R. Pophali, Achal Khilnani, Neelesh Sahu, Harkirat Kaur, Pawan K. Labhasetwar, Sandeep Yadav, Pranav Nagarnaik*	17-20
4	Natural and Cost Effective Way of Treating Domestic Wastewater with Reuse in Non-Potable Purposes: The College of Engineering Pune (COEP) Hostel Campus Case Study *Sagar Patil, Ajith Edathoot, Neha Patwardhan, Riccardo Bresciani, Dayanand Panse, Fabio Masi*	21-27
5	Greywater Treatment and Reuse in a Municipal Office in Pune by Vertical Gardens *Fabio Masi, Anacleto Rizzo, Riccardo Bresciani, Ajith Edathoot, Neha Patwardhan, Dayanand Panse*	28-33
6	Wastewater Treatment and Reuse in Amanora Park Town, Pune *Pilar Zapata, José Luis Bribián, Alejandro Caballero, Antonia Lorenzo*	34-41
7	Treatment of Contaminated Ambil Stream Water and Reuse in Indradhanushya Environment Education and Citizenship Centre, Pune *Sayali Joshi, Pallavi Patil*	42-47



Figs. 136 – 143: *Selected snapshots of the NaWaTech Video*

Fig. 144: *Entry page to the NaWaKit*

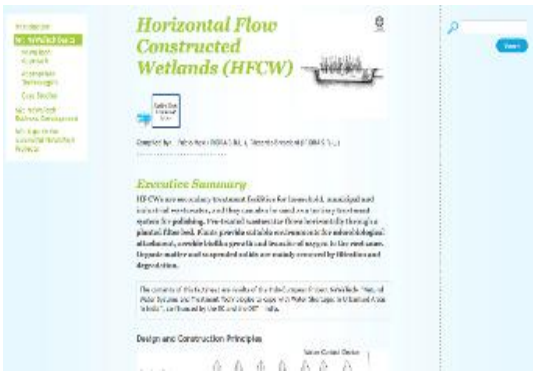


Fig. 145: *Entry page to the NaWaKit*

Fig. 146: *NaWaTech 1st International Workshop at UPC, Barcelona, Spain*

Fig. 147: *NaWaTech 1st International Workshop at UPC, Barcelona, Spain*

Fig. 148: *Group Picture of the 2nd NaWaTech International Workshop (Pune)*

Fig. 149: *Presentations at the 3rd International Workshop in Vienna*

Fig. 150: *Presentations at the 3rd International Workshop in Vienna*

Fig. 151: *Impressions from the field visit of the 3rd International Workshop: Vienna main WWTP*

Fig. 152: *Impressions from the field visit of the 3rd International Workshop: Kaiserbrunn spring, Vienna*

Fig. 153: *Impressions from the field visit of the 3rd International Workshop: Multistage constructed wetland for winery in Chianti, Italy*

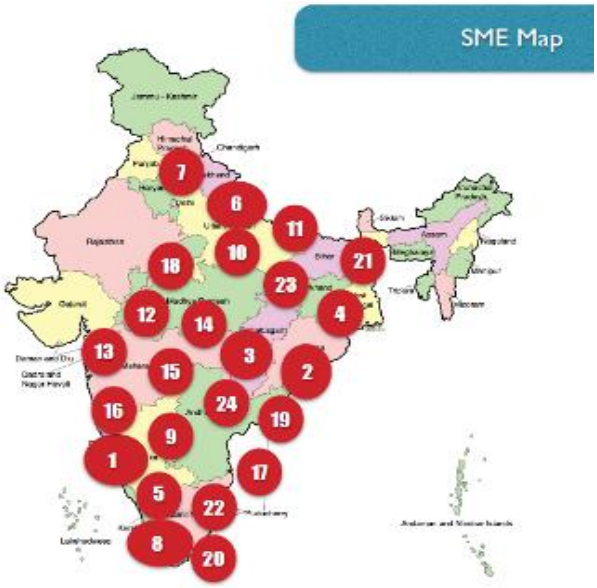


Figure 154: *Map of SMEs in the water and sanitation sector in India*

Fig. 155: *NaWaTech consortium and the training programme participants in Pune*

Fig. 156: *Field visit during the training programme to the EFB site in Pune*

Fig. 157: *SBR and MBR systems session during the training programme in Pune*

Fig. 158: *Business model development session during the training programme in Pune*

Fig. 159: *NaWaTech consortium and the training programme participants in Nagpur*

Fig. 160: *Field visit during the training programme to the OF site in Nagpur*

Fig. 161: *Anaerobic treatment technologies (ABR and AF) session during the training programme in Nagpur*

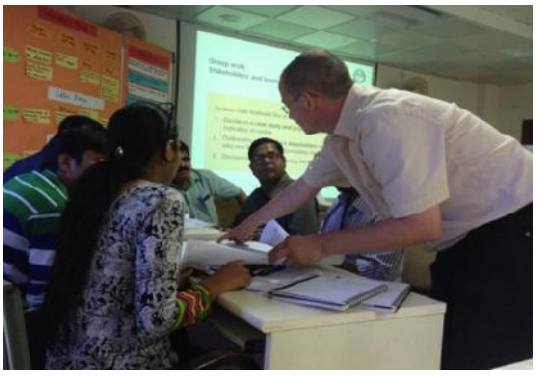


Fig. 162: *NaWaTech O&M and Safety Plans session during the training programme in Nagpur*