# Potential and Validation of Sustainable Natural & Advance Technologies for Water &Wastewater Treatment, Monitoring and Safe Water Reuse in India

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## Deliverable D7.13

## Report of 1st International Workshop

Version: 01

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| PU | Public | X |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |
| CI | Classified, information as referred to in Commission Decision 2001/844/EC | |

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## Document change history

| Version | Date | Author | Description |
|---|---|---|---|
| 1 | 19.01.2020 | Antonia Lorenzo (BIOAZUL)<br>Pilar Zapata (BIOAZUL)<br>Günter (BOKU)<br>Andrés Acosta (TTZ) | Collection of notes for minutes and definition of tasks. |
| 2 | 19.02.2020 | Antonia Lorenzo (BIOAZUL) | 1st Preliminary version |
| 3 | 25.02.2020 | Andrés Acosta (TTZ) | 2nd Version with adjustments |
| 4 | 26.02.2020 | Antonia Lorenzo (BIOAZUL) | Version for submission |

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# 1. Executive Summary

This deliverable is devoted to the 1st International workshop that took place the 28th of November 2019, at AMU facilities in Aligarh along with the project technical meeting.

International workshops foreseen with the PAVITR project are a very good and enriching tool to strength the EU-India cooperation. The workshops are designed to be the needed platform to bring together relevant stakeholders, including industry partners, local authorities, water users, research centres and communities, and enhance the project results uptake.

Indian and European representatives of PAVITR partners participate in this workshop along with nine external experts.

During the workshop, all pilots foreseen within PAVITR project were presented by PAVITR members and a visit to the site in which some of them will be installed was also organised.

During the workshop, very enriching discussions took place about the project activities in order to increase as much as possible the impact of PAVITR, especially at Indian level, and to optimise the project resources as much as possible.

## 2. Introduction and objectives

The objective of deliverable D7.13 is to report on the 1st International workshop that has taken place the 28th and 29th of November 2019 in Aligarh along with the project technical meeting. The workshop was hosted by the Aligarh Muslim University (AMU).

The workshop counted with the presence of PAVITR European and Indian partners as the core participant of the workshop and external invited experts. This workshop, organised by AMU, is the first of the two foreseen to take place in India in the frame of the project.

International workshops foreseen with the PAVITR project are a very good and enriching tool to strength the EU-India cooperation. The workshops are designed to become the needed platform to bring together relevant stakeholders, including industry partners, local authorities, water users, research centres and communities. Share the project information is very relevant to create the enabling institutional environment for the uptake of the projects results.

## 3. 1st International workshop

### 3.1. Workshop Attendees

The following Indian and European representatives of PAVITR partners participate in this workshop:

- Mirko Hänel and Andrés Acosta, ttz, Germany
- Carlos A. Arias and Dennis Konnerup, AU, Denmark
- Khaja Zillur Rahman, UFZ, Germany
- María Jesús García Galán and Antonio Ortiz Ruiz, UPC, Spain
- Günter Langergraber and Sandra Nicolics, BOKU, Austria
- Antonia M. Lorenzo López and Pilar Zapata Aranda, BIOAZUL, Spain
- Fabio Masi and Riccardo Bresciani, IRIDRA, Italy
- Philipp Otter, AUTARCON, Germany
- Max Odenthal, KRETA, Germany
- Simon Joncourt, SEECON, Switzerland
- Michael Parth, PESSL, Austria
- Nadeem Khalil, AMU, India
- Girish R. Pophali, Elsa Sony and Divya Dixit, CSIR-NEERI, India

- Sunil K. Gupta and Alok Sinha, IIT(ISM)Dhanbad, india
- Faizullah Khan and D. P. Mathuria, NMCG, India
- Dr. Sayali Apte and Kanchan Khare, SIU, India
- Prashant M. Mahagaokar and Radhika Boargaonkar, ESF, india
- Rahul P. Raut, LEPL, India

The external members invited to attend the workshop represent several faculties and departments of AMU to have the needed holistic approach of the systems and solutions proposed by PAVITR, especially taking into account the Indian context. In addition, a delegate of the Intl Multilateral & Regional Cooperation Division, DST, participated to better discuss and assess the pilots proposed with the project partners.

The list of external attendees is provided below:

1. Prof. Akhtar Haseeb - PRO VICE-CHANCELLOR, AMU Aligarh
2. Prof. Badrul Hasan Khan - Dean, Faculty of Engg. & Technology, AMU Aligarh
3. Prof. M.M. Sufyan Beg - Principal, Z H College of Engg. & Technology, AMU Aligarh
4. Prof. Mohd. Muzzammil - Chairman, Department of Civil Engineering, AMU Aligarh
5. Prof. Abdul Baqi (Structural Engineering) - Department of Civil Engineering, AMU Aligarh
6. Prof. Sarfaraz Ali Ansari (Hydraulics Engineering) - Department of Civil Engineering, AMU Aligarh
7. Prof. Rehan Ahmad Khan (Structural Engineering) - Department of Civil Engineering, AMU Aligarh
8. Dr. Mohd Shamsuddin Jafri (Composites & Earthquake Engineering) - Associate Professor, Dept of Civil Engg., AMU Aligarh
9. Dr. Arvind Kumar - Scientist F, Scientist 'F', Intl Multilateral & Regional Cooperation Division, DST, New Delhi
10. Sudhindrda Sharma, General Manager IAL Nagar Nigam


Picture 1: EU-India PAVITR Consortium – Workshop Attendants.


Picture 2: DST representative and PAVITR Coordinators & WP leaders.

### 3.2. Workshop Programme

The workshop included presentations and visits to the site in which several pilots will be installed.

Presentations of PAVITR partners were focused on the status of the work within the project work packages and also about the proposed prototypes to be built at different locations in India.

| Presentations | Responsible partner(s) |
|---|---|
| **WP1 (Base Line: Framework for PAVITR Concept Implementation) & WP 2 (Interdisciplinary Approach: Strategic Research and Innovation): Update and foreseen Tasks – Deliverables.** | **BOKU** |
| **WP3: Design, Adaptation and Development of PAVITR Technologies. Update and foreseen Tasks – Deliverables** | **TTZ** |
| **SAFF, MBBR and FSSM** | **NEERI / IRIDRA** |
| **RWH** | **KRETA** |
| **Rich Water - SBR** | **BIOZUL / AMU** |
| **SBR Upgrade** | **IIT-ISM** |
| **An Sys +CW** | **IRIDRA / SIU/ NEERI** |
| **HRAP** | **UPC / AMU** |
| **UASB+CW** | **AMU** |
| **FRB** | **IRIDRA/AMU** |
| **SRP – WS + Bamboo** | **AU/TTZ/AMU** |
| **Toxidation ($ECl_2$) and AO** | **AUTARCON / IIT-Kp / SIU** |
| **WP4: Deployment and Development of Schemes for Resource Recovery, Reuse and Recycle Update and foreseen Tasks – Deliverables.** | **AU** |

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| **WP 5: Short Term Prediction and Control: Environmental, Economic, Social and Risk assessments** | **TTZ** |
| **WP6: Planning Regional Water/wastewater Management** | **UFZ** |
| **WP7: Capacity Building and organizational Development EU-India Cooperation** | **AIMEN** |
| **WP 8: Exploitation and Dissemination of results** | **UPC** |
| **WP9: Road to Market** | **SEECON** |
| **WP10: Management tasks** | **TTZ** |

### 3.2.1 Thursday, November 28th, 2019

## Welcome and introduction (AMU)

High level-authorities from Aligarh Muslim University (AMU) welcomed the partners and introduced both the university and the project to the audience.

In this sense, welcome address was given by Prof. Mohd. Muzzammil (Chairman, Department of Civil Engineering), while the College was introduced by Prof. M.M. Sufyan Beg (Principal, Z H College of Engineering and Technology), and the Faculty profile and R&D Projects by Prof. Badrul Hasan Khan (Dean, Faculty of Engineering and Technology). PAVITR project was introduced by the Lead Indian Coordinator, Prof. Nadeem Khalil (Environmental Engineering Section, Department of Civil Engineering). Last, but not least, presidential address was given by Prof. Akhtar Haseeb (Pro-Vice Chancellor).

Picture 3: Welcome session by AMU Authorities/Directors

## Baseline: framework for PAVITR concept implementation (BOKU)

Dr. Günter Langergraber explained the main goal of WP1 is to identify and promote technical and financial sustainability of PAVITR systems. In order to achieve this, several tasks are proposed:

1. Evaluation of the state of the art, what entails the collection and evaluation of existing data and experiences (especially regarding SWINGS and NaWaTech) to promote synergies, making use of this knowledge and sharing it this way.
2. Development of an O&M management model to promote long-term technical and financial feasibility of the systems after the project closure.
3. Definition of a framework of planning tools, i.e., a decision-making support tool.
4. Successful installation program to establish logistic and supply chain management and build on previous projects.

Deliverable 1.1 has been submitted by September 1st, 2019. The information collected dealt with the main challenges and solutions faced throughout SWINGS and NaWaTech pilots implementation, the basic profiles and status of each pilot (i.e., system overview input, treatment components, outputs,

inauguration dates, status at last visit, involved partners, system owners, etc.), pictures and performance and operational data.

In addition, literature focused on sustainability factors in an Indian context was also reviewed. The next step will be therefore transferring all these lessons to WPs 2 (research clusters) and 3.

With regards to upcoming deliverables and next deadlines, contributions are needed until December 15th, 2019:

- From technologies' designers in agreement with implementing partners: implementation milestones with dates, information needed for deliverable 1.4 (TTZ's responsibility). In addition, a regular update of the implementation plan is required.
- From technologies' designers: requirements (material, staff, analysis) for operational and performance monitoring, information needed for deliverable 1.2 (BOKU's responsibility).

## Interdisciplinary approach: strategic research and innovation (BOKU)

With regards to WP2, Dr. Langergraber indicated its main goal is to upgrade and enhance the different units of the overall system for their applicability in the given context, to learn lessons as an international consortium and emphasize on and to facilitate exchange. In this sense, 6 research clusters have been configured within the consortium:

1. Up-grade Lab QM System (leader: AMU).
    - 3 sub-tasks on ECL2 system (leader: AUTARCON).
    - Rainwater system (leader: KRETA).
2. Water & Rainwater Research Cluster (leader: NEERI & AUTARCON).
3. Wastewater Treatment Cluster (leader: BOKU & AMU).
    - Aerobic PAVITR systems (leader: BOKU).
    - Anaerobic PAVITR systems (leader: AIMEN).
    - Nature-based treatment systems (leader: IRIDRA).
    - Resource recovery (leader: AU).
    - Sludge management systems (leader: IRIDRA).
    - Emerging pollutant removal (leader: AUTARCON).
4. Strategy & Decision-Making Research Cluster (leader: UFZ & AMU).
5. High-resolution Management Research Cluster (leader: UFZ & AMU).

6. Business Study Research Cluster (leader: UFZ & AMU).

With regards to upcoming deliverables and next deadlines, contributions are needed until December 15th, 2019:

- From all partners: double-check to which research cluster each one will contribute and update research questions consequently.
- From technologies' designers in agreement with implementing partners: start-up the research clusters by deciding which sites will be the focus of which research and define the research monitoring by deciding which parameters / monitoring / experiments will be required.

All this information is needed for deliverable 2.1 (BOKU's responsibility).

As an example, BOKU developed some research questions for the aerobic PAVITR systems, framed within the wastewater treatment cluster:

- Research on influence of lower Dissolved Oxygen (DO) concentration for SBR, MBBR and SAFF systems.
    - Sites: SBR upgrade (Dhanbad), MBBR (Nagpur), MBBR (Kharagpur), SAFF (Nagpur).
    - Partners involved: NEERI, AMU, BIOAZUL, IITKGP, IIT(ISM)Dhanbad.
- Enhancing the energy efficiency of an SBR thanks to monitoring and control.
    - Sites: SBR upgrade (Dhanbad).
    - Partners involved: BIOAZUL, IIT(ISM)Dhanbad.
- Technical comparison of RichWater-SBR module vs ABR+CW for irrigating valuable crops.
    - Sites: RichWater SBR (Aligarh), ABR+CW (Pune).
    - Partners involved: AMU, BIOAZUL & NEERI, SIU.
- Fertilisers' production from microalgae & agronomic evaluation with produced biomass of HRAP technology.
    - Sites: HRAP (Aligarh).
    - Partners involved: AMU, UPC.
- Enhancing emerging contaminant reduction of VFCW through a combination with toxidation module, for e.g. for hospital STP effluents.
    - Sites: MBBR-VFCW-TOX (Kharagpur).

- Partners involved: IITKGP, AUTARCON.

It is very relevant to clarify during the upcoming weeks several issues, such as how to overcome data sharing limitations between EU and Indian partners and which legal and/or formal restrictions may exist, and how the implementation process will be documented. In addition, it is important to find out if there will be budget from the Indian side for baseline data collection and for research activities line MSc students' exchange.

Dr. Arvind Kumar from the DST clarified they need a detailed planning of what is required for the systems to work until the end of the project duration, as well as some information on other activities (like MSc students' exchange, for what provisions have been made already by the Indian consortium) to decide how to restructure the budget and even enlarge it if needed. They need a detailed planning and, in case more resources are needed and the justification provided is reasonable, then it will be possible to enlarge the budget.

## Design, adaptation and development of PAVITR technologies (TTZ)

Mr. Andrés Acosta introduced the session by presenting the list of technologies to be implemented, and afterwards each responsible partner described the current state of design. In all cases, the partners described the initial technology approach, providing a general description of the prototype (including the kind of treatment, the treatment capacity, the input(s) / output(s) / product(s) and the type of sensors needed – if any), as well as the foreseen timeline showing the work development from the design of the technology to the installation phase. In addition, responsibilities distribution had to be outlined, as well as the functional requirements of the technology and the estimated costs for construction, installation and O&M.

The technologies are listed below:

| No. | Technology | Location | Designer | Implementation partner |
|---|---|---|---|---|
| 1 | Electro-chlorination System for Decentralised Water Disinfection (ECl2) | Pune | AUTARCON | SIU |
| 2 | Anaerobic system followed by constructed wetland (ABR + CW) | Pune | NEERI + IRIDRA | SIU |
| 3 | Rainwater Management System – Rainwater Harvesting | Dhanbad | KRETA | IIT – ISM |

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|---|---|---|---|---|
| 4 | Sequencing Batch Reactor (SBR) optimisation | Dhanbad | BIOAZUL | IIT – ISM |
| 5 | RichWater Sequencing Batch Reactor (SBR) | Aligarh | BIOAZUL | AMU |
| 6 | High Rate Algal Pond (HRAP) | Aligarh | UPC | AMU |
| 7 | Short-Rotation Plantation (Willow, Bamboo &Eucalyptus) | Aligarh | TTZ / AU | AMU |
| 8 | French Reed Bed (FRB) | Aligarh | IRIDRA | AMU |
| 9 | Sensors for Upflow Anaerobic Sludge Blanket (UASB) Process | Aligarh | AIMEN | AMU |
| 10 | Faecal Sludge Septage Management | Aligarh | IRIDRA | AMU |
| 11 | Improved Moving Bed Biofilm Reactor (MBBR) | Nagpur | NEERI | NEERI |
| 12 | Submerged Aerobic Fixed Film Reactor (SAAF) | Nagpur | NEERI | NEERI |
| 13 | Faecal Sludge and Septage Management (FSSM) – Mechanical Dewatering and Drying System (MDDS) | Visakhapatnam | NEERI | NEERI |
| 14 | Integrated MBBR- VFCW – toxidation unit | Kharagpur | AUTARCON / AU / IRIDRA | IIT-KGP |

1. **Electro-chlorination System for Decentralised Water Disinfection (ECl2)** – Prof. Kanchan Khare, SIU and Mr. Phillip Otter, AUTARCON.

Prof. Khare and Mr. Otter explained a reconnaissance survey was conducted in the villages under the purview of Symbiosis Centre for Outreach Program Execution (SCOPE) to choose the location for installing the ECl2 system. Taking into account the results of the survey, Lavale village was selected, being the proposed site owned by Lavale Grampanchayat. Its population rounds 7,000 people, with gram-panchayat supplying untreated water to a population of around 5,000 people. The proposed area for installing the system has 5445.44 square feet.

The village does not have any water treatment facility, and the intake well near Mula River with raw water supply reaches more than $30m^3$/day. There is sufficient land available around the water tank for installing the pilot, and the area receives sufficient sunlight throughout the year for efficient working

of solar panels. Moreover, the villagers are cooperating for the said pilot. In this sense, SIU and ESF educated the villagers about the need of using the treated drinking water and the necessity of water disinfection during various meetings.

The main target is to optimise the chloride conversion efficiency, the current efficiency, the chlorine production rate and the (per-)chlorate production.

Regarding the timeline, Mr. Otter plans to visit the site during November 2019. The detailed planning for given conditions (solar energy supply, $ECl_2$ unit, sensor setting) is expected to be finished by January 2020.

2. **Anaerobic system followed by constructed wetland (ABR + CW)** – Prof. Girish R. Pophali, NEERI and Prof. Kanchan Khare, SIU.

Prof. Pophali explained it is aimed to research on the potential and limitations of new generation anaerobic systems like the Anaerobic Baffle Reactor (ABR) in combination with constructed wetlands to produce treated water suitable for reuse in valuable crops irrigation. In this case, the advanced anaerobic system will consist in a combination of anaerobic primary settler, anaerobic baffled reactor and anaerobic filter. The liquid effluent of the AS will be polished in a tertiary treatment constructed wetland designed with a low HRT to leave nutrients available for crop irrigation and in a final UV treatment for pathogen removal; finally the water will be reused for mangos, guavas and bananas irrigation. The sludge produced in AS will be instead dried and composted in a Sludge Drying Reed Bed; the extraction of sludge can be programmed at intervals of approximately 5-6 years. The sludge looks like compost with no odour, and suitable as soil conditioner on agricultural land without further treatments.

The location of this site is not clear yet. There are three potential sites:

1. *Nala* in Pratapnagar, Lavale village.

- Social and administrative challenges; unrealistic expectations of the beneficiaries.
- Insufficient team skills and lack of sufficient funds for O&M.

2. Symbiosis InfoTech Hostel D block, Hinjawadi site.
3. Land near SIU Hospital site, Lavale.

- Available area ~ 1700 $m^2$, wastewater generation 200 $m^3$/day, 1,600 p.e.
- Potential for reuse of treated effluent for crop Irrigation near the site.

3. **Rainwater Management System – Rainwater Harvesting** – Mr. Max Odenthal, KRETA and Prof. Sunil K. Gupta, IIT(ISM)Dhanbad.

Mr. Odenthal explained a smart water management system for a building makes that stormwater falls on roofs, and rainwater gets filtered, collected and in the end will feed the groundwater. Stormwater is thus returned to the natural water cycle and can contribute to producing new groundwater.

This system will be located in a 2,000 boys' hostel in Dhanbad, with ca. 4,600 $m^2$ of roofage. It will be integrated by a succession of 240 infiltration modules of 800 x 800 x 660 mm able to store 406 water litres each (gross: 101.38 $m^3$, net: 97.32 $m^2$). In addition to the infiltration modules, the system will be completed with a control shaft and a geotextile. This system will be able to accept 100 $m^3$ of rainwater / day in the monsoon season.

Regarding the timeline, it is expected to start with the planning, design and beginning of the testing phase during December 2019. Transport and preparation works should be during January – February 2020, while construction management should take place during March 2020.

Prof. Gupta also described the system to be implemented in Dhanbad. He explained the objective is to harvest rainwater for water reuse and GW recharge for 2,000 p.e. He showed several pictures on the infiltration tests conducted at the proposed site, the scheme of the system proposed and the PID diagram.

4. **Sequencing Batch Reactor (SBR) optimisation** – Ms. Antonia Lorenzo, BIOAZUL and Prof. Sunil K. Gupta, IIT(ISM)Dhanbad.

Ms. Lorenzo explained an SBR of 150 $m^3$/day (3,000 p.e.) will be refurbished at IIT(ISM), near the Seismological Observatory, in Dhanbad. A complete SBR treatment system is already installed and in operation, but an upgrading in terms of automatisation and completion of the tertiary treatment system with new disinfection steps has been requested. The system will consist in an SBR followed by a regeneration plant (tertiary treatment system consisting of a microfiltration system + disinfection by UV and chlorination).

Regarding the timeline, concerning BIOAZUL duties, 4 weeks will be needed for the design. From the $5^{th}$ to the $12^{th}$ week, procurement will take place, followed by the shipping phase from the $13^{th}$ to the $16^{th}$ week. Confirmation of reception will take place during the $17^{th}$ and $18^{th}$ weeks, the travel to India for installation and supervision will be made on the $19^{th}$ and $20^{th}$ weeks and supervision of installation and commissioning will be done rom the $21^{st}$ to the $24^{th}$ weeks. Furthermore, regarding IIT(ISM)Dhanbad duties, the implementation of improvements on electrical and control cabinet will take place from the $5^{th}$ to the $16^{th}$ weeks, the procurement of installation materials (piping and cabling) during the $17^{th}$ and the $18^{th}$ weeks, and the installation from the $19^{th}$ to the $24^{th}$ weeks. It is important to mention the schedule has been done in number of needed weeks for each task in order to fix the right timing once all previous needed details are agreed to start the process.

Prof. Gupta also described the system to be implemented in Dhanbad. He explained the objective is to use the treated water to irrigate and commercialise crops like mango, leechi, guava and banana. The prime focus on the upgrading should be on cycle time optimisation control for enhanced efficiency using software, sensor automation (upgradation cost), Variable Frequency Drive (VFD) and PLC based automatic operation. He showed several pictures on the proposed site, the existing wastewater treatment plant, the PID diagram and the access road.

5. **RichWater Sequencing Batch Reactor (SBR)** – Ms. Antonia Lorenzo, BIOAZUL.

Ms. Lorenzo explained a brand new SBR of 25-75 $m^3$/day (final capacity to be agreed, but within the mentioned range) will be constructed and installed at the SWINGS water treatment plant in Village Qila Nagla, Aligarh. It will treat wastewater from Aligarh Muslim University, and the reclaimed water obtained will be further reused for trees (especially mango trees) irrigation. The system will consist in an SBR followed by a regeneration plant (tertiary treatment system consisting of a microfiltration system + disinfection by UV and chlorination).

Regarding the timeline, concerning BIOAZUL duties, 4 weeks will be needed for the design. From the 5th to the 8th week, procurement will take place, followed by the shipping phase from the 9h to the 12th week. Confirmation of reception and status of foundation will take place from the 13th to the 16th weeks, the travel to India for installation and supervision will be made from the 17th to the 20th weeks and supervision of installation and commissioning will be done rom the 21st to the 24th weeks. Furthermore, regarding AMU duties, the construction of tanks and / or foundations will take place from the 5th to the 16th weeks, the procurement of installation materials (piping and cabling) during the 17th and the 18th weeks, and the installation from the 19th to the 24th weeks. It is important to mention the schedule has been done in number of needed weeks for each task in order to fix the right timing once all previous needed details are agreed to start the process.

6. **High Rate Algal Pond (HRAP)** – Mr. Antonio Ortiz, UPC.

Mr. Ortiz introduced the High Rate Algal Pond (HRAP) technology, explaining it is a versatile, easy-operation technology with low maintenance costs. HRAPs are reactors in which microalgae and bacteria consortia develop. Microalgae can grow in low quality water such as wastewater effluents, using up the nutrients they still contain, and releasing oxygen during photosynthesis. Alongside, the oxygen produced supports the respiration of heterotrophic bacteria, which are able to degrade organic matter. This cooperation leads to the production of clean, high-quality water as a by-product, and, at the same time, to the growth and production of algal biomass that can be further stabilised, processed and converted to biofertilizer.

This technology will be installed next to the SWINGS water treatment plant in Village Qila Nagla, Aligarh, where approximately 1,000-1,200 $m^2$ of land will be available for the construction and implementation of the HRAP. Raw sewage will be derived from SWINGS wastewater treatment plant. This sewage is pre-treated by a coarse screen and a grit removal already installed and functioning in the site, and then it is collected in a equalisation tank from where the wastewater is already directed to different treatment units. Raw sewage is already pre-treated and therefore can directly enter the HRAP system.

Dimensioning and sizing of the prototype has been done using inlet data monitored during SWINGS. The HRAP will be divided in two independent ponds of 335 $m^2$ each, working in parallel, HRAP-1 and HRAP-2. Water depth will be set to 30 cm, so the total volume will be 200 $m^3$. The system will operate under a hydraulic retention time of 4 days, which could be optimised and modified depending on the results obtained. Following this HRAP, each pond will be fed with 25 $m^3$/day by means of two centrifugal pumps. The total outflow will be 50 $m^3$ per day, depending on the daily evaporation rate, and it will be pumped out by means of submersible pumps to the outlet storage tank.

7. **Short-Rotation Plantation (willow, bamboo and eucalyptus)** – Mr. Mirko Hänel, TTZ.

Mr. Hänel explained SRPs are fast-growing plantations of wooden species regularly harvested with no need for replanting. Fast growth implies a high uptake of nutrients from wastewater, and therefore a high treatment efficiency. It is expected these plantations are fertigated, what means fertilised + irrigated at once. This system could contribute to solve 3 important problems in India: lack of wastewater treatment, water scarcity and usable biomass scarcity.

It is planned to have a SRP of 1 hectare (100x100 $m^2$) next to the SWINGS water treatment plant in Village Qila Nagla, Aligarh, what means a treatment capacity of 25-50 $m^3$/day. Three equal section are planed (willows, bamboo and eucalyptus), and it would be desirable to run the planting phase before the beginning of monsoon (March 2020). In order to do this, existing vegetation in the selected site has to be removed first. The trees will be planted as saplings or cuttings, while Bamboo will be planted as rhizome cuttings. Regarding the irrigation needs, high water input will be needed, but no pipe network will be necessary. The water for irrigation during the first six months will be taken from the SWINGS outlet constructed wetland. Online moisture sensors 20-120 cm and weather stations will be needed.

Regarding the timeline, the initial plan is to take and analyse soil samples to check the suitability of the existing soil (AMU, TTZ & AU), dig a soil profile and percolation test (AMU), design the treatment area (size and form of treatment area, number of plants and positioning (TTZ & AU) and select the Indian plants' species (AMU, TTZ, AU) during November 2019. Afterwards, the plan is to order the plants (AMU) during February 2020 and to make the plantations of willows, bamboo, eucalyptus and implement the water distribution system (AMU) during March 2020 before the monsoon starts. Finally,

it is planned to irrigate with SWINGS water treatment plant outlet water for 6 months and to start irrigation with wastewater during September 2020.

8. **French Reed Bed (FRB)** – Mr. Riccardo Bresciani, IRIDRA.

Mr. Bresciani explained the French Reed Bed Constructed Wetland (FRB) was conceived to treat 50$m^3$/day of wastewater, being the resulting treated water used afterwards to irrigate the SRP system to be designed and installed by AMU and TTZ in the AMU site already next to the SWINGS water treatment plant in Village Qila Nagla, Aligarh. Therefore, FRB installation was expected in the same site using the raw wastewater collected upstream of the municipal wastewater treatment plant.

The aim of the CW treatment is to reduce organic load and solids load, leaving an adequate level of nutrients in the effluent for the growth of the trees; additionally, SRP will be fed in parallel with raw wastewater to compare results and environmental impacts. The proposed treatment wetland follows a very affordable and tested scheme, but totally new in India, considering that the only installation is the small pilot at SWINGS site in Aligarh, implemented for 5 $m^3$/day and combined with a horizontal flow wetland to test the treated water reuse for aquaculture. The innovation proposed in PAVITR is focused on the combination of a FRB with the SRP that needs at least 25 $m^3$/day for its regular operation and some variations in the design to achieve the expected water quality; therefore, the implementation and monitoring of a new system is necessary for the elaboration of local guidelines.

In parallel, the evaluation of alternative sites where there are the proper conditions for FBR installation is on-going by AMU and, in case a different site will be selected, the effluent should be used for another type of farm irrigation.

An alternative location for FRB was proposed by AMU at Ramghat, a small rural village of about 3,000 people located along Ganga river, about 45 Km from Aligarh. The village is not equipped with a sewer and all wastewater is collected by small open drains along the unpaved roads; 90% of the collected sewage runs down along Ramghat road towards a main drain located parallel to Ganga river and finally infiltrated in an extended wet area or discharged in the river. The area selected for the implementation corresponds to the end of the open stream, along the Ganga banks; the area is plain and its extension is about 5,000 $m^2$.The area could most likely be flooded by Ganga, therefore a flooding risk study for different return periods is necessary to assess the feasibility of the intervention and the mitigation measures.

The evaluation of other locations is also on going by AMU, including other similar rural villages along Ganga and the village of Atrauli (25 Km North-East from Aligarh).The location will be chosen once sufficient data will be available on the alternative locations.

9. **Sensors for Upflow Anaerobic Sludge Blanket (UASB) Process** – Mr. Andrés Acosta, TTZ.

In absence of any representative from AIMEN, Mr. Acosta from TTZ presented this technology. UASB reactor is a form of anaerobic digester that is used for wastewater treatment. One of the main advantages of UASB is the potential energy production by biogas generation. The necessity of control of the biological process is crucial for the technology, since the energy production depends directly on it. In this sense, sensors development, which will inform about an intermediate product concentration as Volatile Fatty Acids (VFA), will offer the possibility of intervening on the performance process before instability problems could appear.

Therefore, the idea is to develop a sensor for measuring VFAs from the UASB process control. Anaerobic PAVITR systems will be improved by working with the VFA sensor, that will measure the in-situ of total VFA concentration in the bioreactor.

Additionally, AIMEN is working on a sensor to control the presence of pathogens. The pathogen's sensor will not imply a control over the process since this sensor is used to guarantee safe wastewater treatment by controlling the quality of the final effluent in terms of pathogens presence.

Both sensors will be integrated inside a rough suitcase to be used for in situ measurements in Aligarh pilots. They will include:

- Optomechanical components, light sources and optical sensors (spectrometer, PMT sensor, camera, etc.) for measuring.
- Power plug for charging, battery and power supply for the system.
- Control electronics for measurement sequence and data gathering.
- Communication electronics for data sending through PESSL LoRa system.

These sensors will be implemented next to the SWINGS water treatment plant in Village Qila Nagla, Aligarh. A one-stage UASB reactor is proposed, which is considered appropriate taking into account the low concentration of organic matter and suspended solids in AMU's raw sewage and the high temperatures, above 20ºC. The total volume of the UASB reactor is 51 $m^3$, designed for approximately 1,000 p.e. The Anaerobic reactor in which the sensors will be implemented was constructed for SWINGS project, therefore it is no necessary to construct any unit.

10. **Faecal Sludge Septage Management** – Mr. Riccardo Bresciani, IRIDRA.

Mr. Bresciani explained the technology proposed is a bio-sludge treatment demonstrative application for SWW treatment and large-scale nutrient recovery in order to produce organic-source fertilisers and foster synergies between wastewater providers and sustainable agriculture by using a Faecal Sludge Treatment Plant (FSTP) and Sludge Drying Reed Beds (SDRB). It will treat 5$m^3$/day of faecal sludge

and it will provide composted sludge. Processes are essentially dewatering, driven by evapotranspiration, and mineralisation of organic matter due to complex interactions between oxygen, bacteria and plant roots. SDRBs are generally loaded with a Sludge Loading Rate (SLR) of 50-80 kg/m$^2$ of dry matter per year, depending on the type and characteristics of sludge and climatic conditions; SLR until 200 kg/m$^2$ has been tested in hot climate, even if SLR of 80-120 are likely more prudential and effective.

The characteristics of the sludge at the end of one complete cycle (6-12 years) depends on SLR, climate conditions and operational strategies (loading and resting periods). Following the standards, a water content of 40-50% and a volume reduction of 80-90% is generally achievable. Final sludge from urban sewage is well stabilised and a safe reuse in agriculture is possible, being also possible further composting, recultivation, gardening, landscaping or temporarily covering of landfill.

The site location is in the North-East portion of Aligarh, just outside the high density population settlement in a peri-urban area. The area is suffering from waste and wastewater irregular dumping; during monsoon period, the area is occasionally flooded due to insufficient drainage capacity. The main road is located about 2 m higher, and it can be assumed as the safety level during heavy rains. Key points here will be therefore the flooding risk, the proximity of households and the absence of streams for discharge.

The minimum capacity expected in PAVITR is 5 m$^3$/day; considering the needs of the municipality to construct several Faecal Sludge Treatment Plants for the sludge management in the neighbourhoods where the public sewer has not been provided, a site of about 2,700 m$^2$, property of the municipality, has been individuated in a peri-urban zone of the city, where to place a treatment system with SDRB sized for the maximum capacity allowed by the extension of the area. The additional funding for the increased capacity could be covered by the municipality of Aligarh. The area is far from the public sewer or any STP, therefore also the filtrate of the SDRBs need to be treated with the aim to fulfil the limits for environmental discharge.

11. **Improved Moving Bed Biofilm Reactor (MBBR)** – Prof. Girish R. Pophali, NEERI.

Prof. Pophali explained a Moving Bed Biofilm Reactor (MBBR) will be implemented. The process consists in adding small cylindrical shaped polyethylene carrier media in aerated basin to support biofilm growth. The idea is to adopt the best from both the activated sludge process and the biofilter process without including the cons. Contrary to most biofilm reactors, the MBBR uses the whole tank volume for biomass growth as also does the activated sludge reactor. The important factor in MBBR process is the sufficient and frequent contact between the wastewater components and the microorganisms attached to the carrier (biofilm). The necessary mixing of the carrier elements in the

reactor (reaction tank) can be achieved using the process air supply required in aerobic treatment processes.

Thus, an MBBR of 50 $m^3$/day will be installed in the Maharashtra Industrial Development Corporation (MIDC), in Butibori, Nagpur for 500 p.e. The site is finalised in consultation with MIDC officials, and the area required for the implementation is 50 – 70 $m^2$. The garden is owned by MIDC for its residential area and at present it is not in use. MIDC wishes to revive the garden and wants to use treated sewage for maintaining lawn and green belt development in adjoining areas of garden. MIDC will also make arrangements for gardener, STP operators and security. The condition of the access road is good.

12. **Submerged Aerobic Fixed Film Reactor (SAAF)** – Prof. Girish R. Pophali, NEERI.

Prof. Pophali explained a Submerged Aerobic Fixed Film (SAFF) is a hybrid technology with a high degree of treatment while low footprint and less operation and maintenance costs. SAFF reactor comprises a column or tower packed with support media for biofilm growth and diffused aerator to supply oxygen. It can be operated in both up-flow and down-flow.

In this sense, a SAAF of 50 $m^3$/day will be installed in the Nagpur Municipal Corporation (NMC) Garden, in Deshpande Layout, Nagpur for 500 p.e. The site is finalised in consultation with NMC officials, and the area required for the implementation is 50 – 70 $m^2$. At present, the garden is maintained by NMC, and fresh water is used for gardening. The garden has water and electricity connections, full time gardener and security guards in place. Sewage manhole is also present at a distance of nearly 30 m from the garden. The condition of the access road is good.

13. **Faecal Sludge and Septage Management (FSSM) – Mechanical Dewatering and Drying System (MDDS)** – Prof. Girish R. Pophali, NEERI.

Prof. Pophali explained the aim of working on Faecal Sludge and Septage Management (FSSM) is to provide a healthier and safe environment through appropriate treatment of FS/septage. The four main functions of FS/septage treatment are: the solid-liquid separation, dewatering and drying and pathogen reduction. The collected FS is fed into Rotary Drum Filter to separate solid-liquid and then the sludge is fed into a Rotary sludge Dryer for drying and pathogen removal. End-use through nutrient recovery will be producing high quality compost as a soil conditioner.

Thus, a MDDS of 25 $m^3$/day will be installed in the Greater Visakhapatnam Municipal Corporation (GVMC), Visakhapatnam for 7,300 p.e. The site is finalised in consultation with GVMC officials, and the area required for the implementation is 30 $m^2$. At present, faecal sludge and septage is disposed at the inlet of sewage treatment plant operated by GVMC. The condition of the access road is good.

There was a general concern on updated Indian legislation on wastewater treatment, and Prof. Pophali committed to provide it to the consortium.

14. **Integrated MBBR- VFCW – toxidation unit** – Prof. A. K. Gupta, IIT-KGP, and Mr. Phillip Otter, AUTARCON.

Prof. Gupta explained the aim of this site is to characterise the hospital effluent along with detection and quantification of micro-pollutants in it, setting-up a pilot plant for hospital effluent treatment, characterise the treated effluent after each stage and evaluate the treatment efficiency at each level of the process and assess the performance and applicability of pilot plant unit targeting the removal of micro-pollutant.

The treatment unit will consist in two MBBR chambers (1 oxic and 1 anoxic). These two units will act as the secondary treatment units to treat both carbonaceous and nitrogenous organic matter. The oxic stage will reduce the BOD and COD, while the anoxic chamber will ensure nitrogen removal by nitrification/denitrification. A combination between toxidation AOP process and constructed wetland is planned to reduce the concentrations of micropollutants, mainly PhACs. The CW can serve two purposes: polishing the effluent from the MBBR prior to toxidation unit and reducing transformation products and DBPs concentrations after toxidation process. The toxidation module will produce chlorine through onsite chlorine generation (OCG) using NaCl stock solution. The chlorine will serve two purposes: disinfection of the effluent and being precoursor for radical formation in toxidation process. After dosing chlorine the treated water will pass an UVlamp, where ·OH radicals will be formed. Those are able to degrade PhACs, which are otherwise persistent to biological degradation. The DBPs and transformation product need to be reduced after toxidation. The trial should show to which extend a wetland will be capable in doing so. The treatment capacity of the system will be 3m³/day.

The treatment system will be installed on the premises of Kharagpur Sub Divisional Hospital near IIT Institute, in Chota Tengra, Kharagpur. The final location has not yet been decided, but all options on the hospital campus are evaluated and considered.

**Picture 3**: Workshop at Aligarh 28th November 2019

The external members had the opportunity to have a detailed description of the pilots, including:

- Initial Technology Approach:
- Prototype location
- Timing for the design, installation and start up for all partners involved
- Workflow, responsibilities of all partners involved
- Functional requirements of the pilots
- Budget foreseen

During the presentations, the attendees had the opportunity to ask questions and make suggestions related to the PAVITR pilots and work packages in order to increase the expected impact, specially at Indian level with regards to proper wastewater treatment and management.

### 3.2.2 Friday, November 29th, 2019

## Visit to SWINGS project AMU site (AMU)

The consortium visited the SWINGS project demo site, where several PAVITR technologies will be installed. The aim of the visit was presenting SWINGS project outcomes, as well as to show the partners the future location for some of the technologies and discuss about their concrete distribution.

Picture 4: Visit to the AMU test site the 29th November 2019

**Picture 5**: Visit to the AMU test site the 29th November 2019

## Deployment and Development of Schemes for Resource Recovery, Reuse and Recycle and Road To Market (AU + SEECON)

Prof. Carlos Arias and Mr. Simon Joncourt explained the objectives set and the activities foreseen for WP4 and WP9, which are closely related.

WP4:

- Identification of market opportunities from the products generated from PAVITR systems.
- Tackling end-users needs potential of PAVITR products.
- Preparation of effective information channels to promote the products and technology in the local market.
- Design production, distribution and commercialisation chain to reach end users.
- Promotion of energy crops' use.
- Identification of potential limitations of the technologies implemented by PAVITR.
- Establishment and ensuring of quality control for the products resulting from PAVITR.

In this sense, several activities have been defined: identification and quantification of market opportunities and key stakeholders, involvement of stakeholders and end-users with the technology and the project, development of business models to improve the market potential of the products, promotion the awareness and acceptance for reuse of PAVITR products and establishment of quality control guidelines for the PAVITR products.

Up to now, some preliminary work has been conducted, being focused on gathering information form the goods to produce a "catalogue" of products. The catalogue comprises the description of the technologies to be established and the products produced by the different technologies once they start to run. Additionally, outreaching stakeholders, authorities, decision makers and universities tasks have been started.

WP9:

- Development of adapted and didactic training material for implementing the training modules about business development in the water sector.
- Empowering and supporting to 30 industries and SMEs in India, so they can successfully manufacture, offer and commercialise sustainable water products and services.
- Promotion of joint ventures between EU and Indian industries and SMEs, so they can successfully offer sustainable water products and services.

In this sense, several activities have been defined: development of workshop modules, development of an EU-India workshop and matchmaking tour and matchmaking and coaching for joint ventures.

The interaction of these WPs has been conceived to achieve the general objective of creating a level playing field for European and Indian industries and SMEs working in the water sector, paving the way for a potential joint venture for manufacturing of water treatment technologies and systems. Furthermore, the aim is to support and empower Indian entrepreneurs in their endeavour to establish and successfully run their own business in sustainable sanitation and/or water and resource management, as well as to support existing SMEs in the water and sanitation sector to expand their portfolio including sustainable and adapted products and services.

Nevertheless, there is a very relevant concern regarding these WPs: the budget constraint sin the Indian side. Prof. Khalil, the Indian coordinator, explained no commitment can be done from the Indian consortium regarding responsibilities in WPs 4 and 9 due to the budget cut they have suffered.

This is a very serious problem, as the EU consortium cannot work on its own on this. Basic data will be needed from Indian partners, and they will have to be checked demo site by demo site. It is therefore needed to prepare a list on what is needed from each pilot, and then Indians will able to start looking for information.

There is another relevant open question: how many workshops can the Indians do with the budget they have, taking into account there is no budget for this for any Indian partner except from AMU?

The DST prefers to invest in the demo sites; once this is solved, it will be necessary to have a clearly defined list on what is needed for which activities, and then they will be able to ask the DST for additional funds.

## Short-term Prediction and Control: Environmental, Economic, Social and Risk Assessments (TTZ)

Mr. Andrés Acosta explained the objectives of WP5, which are:

- Eco-efficiency assessment by means of Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) of PAVITR project.
- Sustainability assessment of the PAVITR system, investigating its social footprint.
- LCA of the investigated processes and products of the PAVITR project.
- Comparative LCA in order to illustrate the specific advantages of the new technology compared with the traditional technology.

- Safety, Health and Environment (SHE) evaluation of the PAVITR technologies and if needed establishment of prevention or minimisation measures for possible SHE risks.
- Techno-economic assessment and verification by an external entity of the PAVITR technologies.

This WP will start by month 20 and it will last until month 48, but the first inputs requested to the partners are the design data and costs estimation, which should be available by December 2019. TTZ will prepare also a template to star working on these tasks, which will be distributed by 2020.

## Planning regional water/wastewater Management – GIS Mapping for Cluster Sewerage Planning (UFZ)

Dr. Khaja Rahman explained the objectives of WP6, which are:

- Testing the use of a GIS-based water/wastewater infrastructure planning tool (ALLOWS) in one region/area in the vicinity of Aligarh.
- Production of realistic water and sanitation management scenarios.
- Evaluation and comparison of the scenarios on the technical and economic levels.
- Provision of recommendations to the local stakeholders for planning at regional scale.

Thus, it is aimed to create a planning tool to compare wastewater management scenarios (centralised /semi-centralised, clustered, on-site treatment). It will be needed to understand the local conditions, be specific according to the technical solutions (transport, treatment and reuse), run a cost assessment of the scenarios and prioritise the investment. In this sense, Dr. Rahman explained several sources will be used, such as ALLOWS (Assessment of Local Lowest-Cost Wastewater Solutions, van Afferden et al, 2015), which is a GIS-planning tool to manage management scenarios including degree of decentralisation and technology selection and prioritisation. CLARA also offers cost assessment of management solutions (technologies). O&M planning (WP1) should be also integrated.

Regarding the study area, several options are being evaluated. Only one test region will be used, instead of two (according to the new amendment). Pune region is cancelled due to budget constraints. Thus, the test region will be located in the vicinity of Aligarh. Several potential regions around Aligarh, located in the wider catchment of the Ganga River, are being considered. The area near Aligarh is likely to be in a lower state of development.

Different types of data will be needed, such as:

- Open access data:

- Data from local municipalities, partners, stakeholders (population, connection degree, hydrology, groundwater, etc.).

- Satellite data:
  - Built area, Street network, Digital Elevation Model (DEM), etc.
  - Provider: Airbus Defense and Space.
  - The final size (area) of the images depend on budget and accuracy of data.
  - UFZ will initiate the purchase of satellite images.
  - Data will be processed in a Geographical Information System (GIS).

Then, UFC will define technical requirements for each scenarios (no. of WWTP, km of sewer, etc.), support the EU partners with their business models, connect BOQ to cost data base, prepare cost-curves for each technology/treatment chain (cost vs. PE), define the cost(s) of wastewater management for the test region (World Bank, linked to WP8) and prioritise investments. Technologies to be assessed will be limited to PAVITR technologies.

The work with EU partners will be devoted to determine the application range of each technology (using performance data), prepare 3 "standard" design options for each technology (50PE, 500PE & 5000PE), prepare BOQ for each design, define construction requirements (labour, plumber, etc.) for each design and define O&M requirements of each technology, while the work with Indian partners will consist in identifying additional technology (sewer, reuse, etc.) and preparing and filling-in the cost database.

## Dissemination and Exploitation of Results (UPC)

Dr. María Jesús García explained the objective of WP8 is to disseminate, exploit and ensure the uptake in practice and mainstream of the outputs of PAVITR, having as specific objectives:

- Reaching water practitioners in India, EU and world-wide, so the improved and efficient systems for wastewater treatment, water purification, quality monitoring and management are uptaken.
- Ensuring the outcomes and results of PAVITR are known by the local and national authorities.
- Offering an information toolkit for water practitioners about the improved, tested and validated technologies and systems.
- Disseminating within the main actors in the Indian water sector and world-wide.

In this sense, there are several tasks planned, such as:

- Electronic dissemination and communication, what includes the setting-up of a project website (online already, www.pavitr.net), the use of social networks, the production of publications and the dissemination within relevant professional networks.
- Elaboration of policy briefs – PAVITR policy advocacy. The documents will outline the rationale for choosing a particular policy alternative or course of action in the current policy debate and serve as a working base for the advocacy group in order to convince the target audience of the urgency of the current problem and the need to consider and, in the best case scenario, adopt the different systems and methodologies produced by the project.
- Development of the PAVITR toolkit, which will support practitionres, SMEs and local authorities to facilitate the implementation of PAVITR approach and results. This will be based on the NaWaKit, a toolkit created within one of PAVITR's former projects: NaWaTech, and contains all its key results that aimed at maximizing the exploitation on natural and compact technical systems and processes for the effective management of municipal water resources in urbanised areas on India. PAVITR toolkit will be hosted at the Sustainable Sanitation and Water Management (SSWM) toolbox. It is estimated PAVITR toolkit will contain:
    - Technical information, guidelines and manuals of the design and implementation of different improved systems of PAVITR.
    - Information on management and operation and maintenance options (including monitoring).
    - Information on policies and guidelines that need to be respected when considering the PAVITR approach.
    - An overview of the technical, financial and environmental advantages of the PAVITR approach compared to conventional solutions.
- Organisation of PAVITR side events in key conferences.
- Organisation of PAVITR final conference.

## Management. Inclusive Definition of Responsibilities for Prototypes implementation (TTZ)

Mr. Andrés Acosta summarised the work performed within WP11. He listed the deliverables already submitted and schematised the work methodology:

- Official communication from TTZ at the end of each month.
- Official PAVITR work portal → BOKU Drive.

- Guidelines for task leaders. → Template uploaded to PAVITR Portal.
- Template for deliverables → Uploaded to PAVITR Portal.
- Web page for Uploaded Deliverables → An ID and password section will be open for EC and DST in addition to the public section.
- Skype regularly → once each two months?

Then, he summarised the foreseen tasks for the upcoming weeks, their responsible and their corresponding deadlines:

| **Task** | **WP** | **Description** | **Responsible** | **Date** |
|---|---|---|---|---|
| Information D1.4 and & D1.2 | WP 1 | Guideline Information | Prototype Responsible | *15.12.2019* |
| Information for D2.1 and D2.2 | WP 2 | PAVITR Research and Enhancement Strategy & Laboratory Quality Management Plan | UPC | *End December* |
| Guidelines for D3.1 | WP 3 | To collect Data | AUTARCON KRETA | *5.12.2019* |
| Information for D3.1 | WP 3 | To feed Deliverable | Prototype Responsible | *End December* |
| Meeting AMU and AU | WP 4 | Strategy development | AU | *End December* |
| 1st Deliverable 10.1 | WP 10 | Report of activities | All partners | *asap* |
| Meeting DST and India Coordination | WP 10 | FRB location | AMU | *End December meeting and January result of meeting* |

| | | | | |
|---|---|---|---|---|
| Sharing documents | WP 1 | To share new regulation with Partners | IRIDRA | *In Bokus Portal folder „Legislation“* |
| CAD Test Site | WP3 | | AMU | *First week december* |
| Complete analys of SWINGS pilots. | WP1 | Updated data ! Please | AMU | *First week december* |
| Table with costs and responsabilities EU and India | WP3 | Description of the system, with clear | All partners | *Middle of december* |

Regarding next meetings, Indian partners will meet some of the EU partners in March 2020 during their visit to India, while the whole consortium will meet next year; date proposed: November, 23rd – 25th. By 2021, there would be a possibility of organising another joint meeting during BOKU Conference, WETPOL, in Vienna, Austria during mid-September 2021. BOKU offers the space to organise a consortium meeting then.

Regarding the location and responsibility of organisation of the meetings in India, responsibility will rotate among Indian partners; they, as hosts, will decide where to organise the meeting. The next one should take place in Dhanbad. It is important to take into account Diwali will take place on November, 14th, so this date is not available. An appropriated date would be after a conference in Bangkok that will be attended by many EU partners, i.e., November 23rd – 25th.

Last, but not least, the location of the technologies within SWINGS site was discussed, and several configurations were explored. Finally, 3 systems will be implemented there: SBR, SRP and HRAP, and FRB if it is finally possible to install the system there.

With regards to the SBR, it will be needed to plant new mango trees to be irrigated by the SBR effluent, and it will be also needed to devote a piece of land for that.

Regarding the SRP (1 hectare), it will not be possible to irrigate with wastewater during the first 6-7 months to allow the trees' roots to properly develop. In addition, an access road will be needed.

Thus, after discussing about many different possibilities, the consortium decided the two more reasonable configurations for the technologies' location within SWINGS site are the following:


In addition, a visit to the SWINGS project demo site was organised as several PAVITR technologies will be installed there. The aim of the visit was presenting SWINGS project outcomes, as well as to show the future location for some of the technologies and discuss about their concrete distribution.

## 4. Conclusion

As foreseen, this 1st international workshop was a valuable tool to gather inputs from external relevant stakeholders and strength the EU-India cooperation. Comments, suggestions made by the external stakeholders invited will be taken into account during the project implementation.

To this 1st workshop, mainly academic experts and public authorities were invited as that was found much relevant at this project stage. In the coming workshops, other stakeholders will be invited including industry partners, water users and communities.