India's Water Magazine

# WaterAge

September 2023 ₹ 300 | US $ 15

*Your knowledge and information partner*

Initiative of SHUDH JAL FOUNDATION JAL AAJ AUR KAL

## STORM WATER TREATMENT OR SEWAGE WATER TREATMENT

Find us on:

www.waterage.in

# OPTIMUS ENVIROPRO

*Nurturing The Mother Nature*

Optimizing the use of
Earth's Precious Resource i.e. Water

## RAW WATER TREATMENT

- Dual Media Filters
- Multi Grade Filters
- Activated Carbon Filters
- Iron Removal Filter
- Water Softeners
- Demineralisation Plants
- Ultra-Filtration Plants
- Nano-Filtration Plants
- Reverse Osmosis Plants

## WASTEWATER TREATMENT

**Water Reuse & Regulatory Compliances**

- Sewage Treatment Plants (SBR, MBR, MBBR)
- Effluent Treatment Plants
- Zero-liquid Discharge Systems (ZLD)
- Automation and Process Control
- Online Monitoring System

# Water & Wastewater Treatment Solutions

### WATER TREATMENT

**Removal of Surface & Ground Water Pollutants**

### WASTEWATER TREATMENT

**Sewage, Effluent, Sullage Treatment and Recycling**


## Optimus Enviropro Pvt. Ltd. (Approved OEM of Military Engineer Services)

**CORPORATE OFFICE:**
805, Bhikaji Cama Bhawan,
New Delhi-110066.
Ph: +91 11 41551444

**HEAD OFFICE:**
SCO 146-147, IIIrd Floor,
Sector-34A, Chandigarh-160022.
Ph: +91 172-5275055, 4012755

**WORKS:**
Plot No.286, HSIIDC Industrial Estate -I,
Barwala, Panchkula, Haryana- 134 118.
Ph: +91 1733 258455

**Email: sales@optimusenviro.pro | Website: www.optimusenviro.pro**

AADYS
COMPONENTS PVT. LTD.

# One-stop-shop for Components

## Ensuring smooth running for your Water & Wastewater Plants

The components from Aadys Components are rapidly getting approvals in municipal water and wastewater treatment as well as in industrial process applications across all industries and strongly recommended by water treatment specialists. Aadys Components provides a wide of range of components for water & wastewater treatment plants which are offered either as individual item, equipment, skid mounted packages or fully integrated systems. All components are sourced from world class manufacturers and industry leaders in their respective fields. The company continually strives to improve its capabilities and performance in order to provide the highest quality and technologically advanced products available in the industry.

### COMPONENTS

- FRP Vessels
- RO Membranes
- RO Membrane Housings
- Dosing Pumps
- Sludge Dewatering Screw Press
- Filter Media
- Resins
- On-line Monitoring System
- Instruments
- RO Anti0scalants
- Iron Removal Media
- Valves etc.

### SEGMENTS SERVED

- OEMs
- Industries
- Hospitals/Hotels/Malls
- SEZs
- Defence
- Institutions
- Public Health Departments
- Public Sector Undertakings (PSUs) etc.

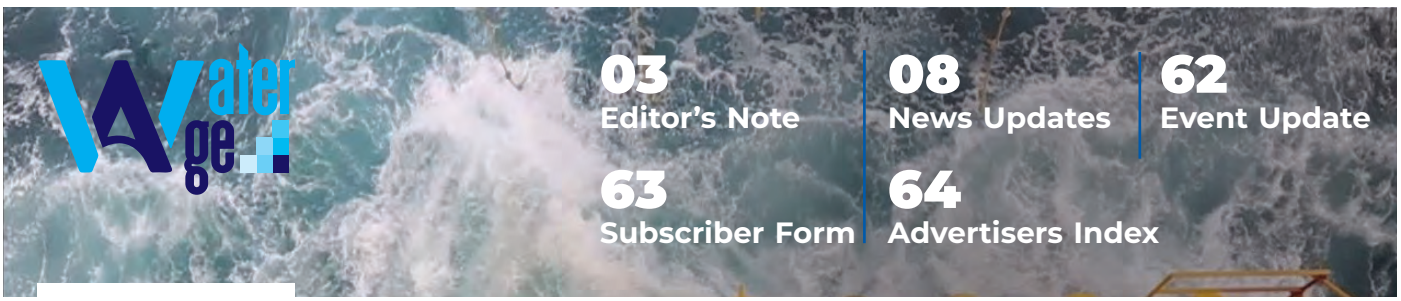
## AADYS COMPONENTS PVT. LTD.


**CORPORATE OFFICE:**
805, Bhikaji Cama Bhawan,
New Delhi-110066.
Ph: +91 11 41551444

**HEAD OFFICE:**
SCO 146-147, IIIrd Floor, Sector-34A,
Chandigarh-160022.
Ph: +91 172-5275055, 4012755

**E-mail: sales@aadys.co.in**

**www.aadys.co.in**





**MANAGEMENT**

| | | |
|---|---|---|
| FOUNDER | : | Sanjiv Chaudhary |
| GROUP EDITOR | : | Yogesh Tomar |
| EDITOR–IN–CHIEF | : | Renu Tomar |
| ASSISTANT EDITOR | : | Ria Mukherjee |
| DESIGN & GRAPHICS | : | Virender Kumar |
| MARKETING & OPERATION | : | Poonam Singh |

**PRINTER**
**Fine Art:** D–7 /3, Okhla Industrial Area, Phase 2, New Delhi 110 020

**PRINTED AT**
**Fine Art:**
D–7 /3, Okhla Industrial Area, Phase 2, New Delhi 110 020

**PUBLISHER**
**WaterAge**
**Initiative of SHUDH JAL FOUNDATION**
805, Bhikaji Cama Bhawan, Bhikaji Cama Place, New Delhi – 110 066

**EDITOR**
**Renu Tomar**
#4048, B 5 & 6, Vasant Kunj, New Delhi – 110 070

For editorial contributions / press releases, write to: **editor@waterage.in**
For advertising enquiries, write to: **info@waterage.in**
For magazine & e–newsletter subscription, write to: **enquiry@waterage.in**
For support and feedback, write to: **enquiry@waterage.in**



Published by **WaterAge** (Initiative of SHUDH JAL FOUNDATION) :
605, Bhikaji Cama Bhawan, Bhikaji Cama Place, New Delhi – 110 066, **E–mail: enquiry@waterage.in**

**RENU TOMAR**
*(Editor-in-Chief)*

**DEAR READERS,**

As the urban cities of India and many other nations continue to struggle with harsh impacts of climate change, its effects on storm water can't be overstated. With proliferation of technologies like sustainable rainwater harvesting and their implementation at industrial, commercial and residential levels, it becomes a matter importance to understand storm water management system and techniques that can be implemented for reducing and reusing runoff.

Storm Water management is about the runoff of the rainwater, storm water and melted snow, which is also been considered same as watershed management. It basically aims to reduce and control the amount of runoff which eventually makes its way into the streams, rivers, and the ocean. The urban cities of these days with its impervious surfaces due to increase in new construction of buildings, roads, parking lots, etc., has been increasing the amount of runoff that previously infiltrated the ground and can further cause flooding. Thus, it is essential to mitigate such impacts to the extent possible.

**The Vitality of Storm Water Management-**
Undeniably, there are ample environmental concerns related to storm water runoff as it can carry chemicals, bacteria and a lot of pollutants into the local aquifers and rivers that can harm the waterway ecosystems. Storm water management helps in diverting this runoff into channels for detention or collection and filtration, thus making it immensely useful for cities later during the potable and non-potable applications.
However, being one of the most crucial process in maintaining water quality and preventing flooding in the urban parts of the nation, storm water management has been largely unseen and unappreciated by the general public.

This edition of 'WaterAge' will be educating people about various aspects of Storm Water Management, its treatment, Sewage Water Treatment and other such vital aspects through informative articles, new pieces, case studies and more. Hope you like reading it.

WaterAge

# E-MAGAZINE BENEFITS

- Easy Access to Content
- Instantaneous Access
- Portable and Convenient
- Global Presence
- Interactivity
- Cost-Efficient
- Analytics
- Sustainability
- Monetization
- Easy to Update


## NO MORE WAITING

for the print copy to arrive

WaterAge E-magazine

is now LIVE!

SHUDH JAL FOUNDATION

JAL AAJ AUR KAL

To Read & Subscribe for FREE visit

www.waterage.in/e-magazine

amikon™
BLOWERS & SYSTEMS PVT. LTD.
*We Understand Your Needs*

Right Blowers for Right Projects

# Rotary Positive Displacement Twin Lobe & Tri Lobe Compressors (ROOTS Blowers)






- Twin Lobe Roots Blowers
- Water Cooled Blower
- Filter Press
- Tri Lobe Roots Blowers
- Acoustic Enclosures / Hood
- Sludge De-watering Machine
- Gas Blower
- Ring Blowers/Side Channel Blower
- Waste Water Equipment

- **BLOWERS**
- **PUMPS**
- **WASTE WATER EQUIPMENTS**


**CALL SUPPORT:**

**+91 11 41516313,**
**+91 9311108295, +91 9311108296**

## AMIKON BLOWERS & SYSTEMS PVT. LTD.

**REGISTERED OFFICE:** Plot No - 194, Block-k, Vijay Vihar, Phase-2, Sector-4, Rohini, Delhi -110085, India
**CORPORATE OFFICE:** Office No.G-92,Ground Floor, Vardhmaan Grand Plaza, Sector-3, Rohini, New Delhi - 110085 (INDIA)
**MANUFACTURING UNIT:** Plot No. 33/25 M.I.E. Part - B, Bahadurgarh - 124507 Haryana (India)
**E-MAIL:** amikonblowers@gmail.com, info@amikonblowers.com, sales@amikonblowers.com

**www.amikonblowers.com**

Constructions

Building Confidence

# Triveni Constructions

Engineers • Planers • Contractors

**Established in 1999**

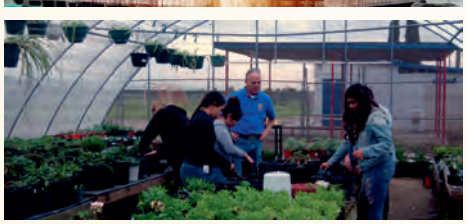
## MES Enlisted 'S' Class EPC

### Civil Engineering Works
- Building and Roads
- Water Supply and Sewage Disposal
- Pre Engineered Buildings

### Electrical Engineering works
- Low Tensin Electric Works (upto 1100 Volts)
- High Tension Electric Works (excluding 33 kV)
- Solar Panel

### Electrical/Mechanical Engineering Services
- Water and Sewage Treatment



Constructions

# Triveni Constructions

Engineers • Planers • Contractors

**Established in 1999**

**Head Office:** College Road, Pathankot-145 001 (Punjab)
**E-mail:** standard.bedi@gmail.com
**Branch Office:** E-08 Wave Estate, Sector-85, Mohali S.A.S Nagar-140 308 (Punjab)
**M.:** +91 98143 21749, +91 98141 32026, **T.:** +91 172 4039 981
**E-mail:** triveni_anand@yahoo.com, triveniconstructions.mohali@gmail.com,

Liquiclear®
NATURALLY PURE

## Unlock 80% Greater Water Savings with

## LDI Technology Compared to Traditional RO Systems

# Revolutionizing Water Filtration

### Explore the Versatile Uses of LDI Electronic Water Purifiers:

**Pure Water for Your Home**
LDI Electronic Purifiers: Compact & Convenient.
Enjoy clean drinking water daily!

**Efficiency Meets Cost-Effectiveness**
LDI Technology: Ideal for Industry & Business.
Boost your efficiency with LDI.

**Clean Water, Anywhere, Anytime**
LDI Purifiers: Perfect for Emergencies. Reliable, energy-efficient, and low maintenance.


Cleaner water shouldn't mean depleted planet.
CHOOSE WISELY,
CHOOSE LIQUICLEAR.

- Retain Essential Minerals
- Energy Efficient
- Fully Automatic
- TDS Tunable
- Low Maintenance
- 2-year Warranty

+91-8800942942 info@liquiclear.in www.liquiclear.in

## EXPLAINER: DEADLY HIMALAYAN LAKE FLOODING IN INDIA LIKELY CAUSED BY AVALANCHE

By Shivam Patel, October 5, 20237:41 PM GMT+5:30 Updated a day ago

Trucks buried in mud are seen in an area affected by flood in Sikkim in this undated handout image released by the Indian Army on October 5, 2023. India Army/Handout via REUTERS Acquire Licensing Rights

**NEW DELHI, Oct 5 (Reuters):** A Himalayan glacial lake in India probably burst its banks this week after chunks of ice fell into it in an apparent avalanche following heavy rains, triggering deadly flash floods in a small mountain state, experts told Reuters.

At least 18 people have died and nearly 100 remain missing as heavy rains and water gushing out of Lhonak Lake unleashed flash floods on Wednesday in the Teesta river in Sikkim state, which borders Nepal, Bhutan and China.

It is the latest in a series of extreme weather events that have caused widespread damage in the Himalayas of South Asia in recent years and have been blamed by scientists and officials on climate change.

**WHAT CAUSED THE FLOODING?**

The primary reason for the destruction in Sikkim was excess rainfall and a glacial lake outburst flood (GLOF) in Lhonak Lake at an altitude of 5,200 metres (17,060 ft), India's National Disaster Management Authority said.

Glacial lakes are formed when a glacier melts and fills the depression left behind. There are 503 glacial lakes in the Indian Himalayas that are larger than 10 hectares – close to the size of 10 rugby fields put together, according to a 2011 assessment by India's Central Water Commission.

Satellite images released by India's space agency on Thursday showed that Lhonak Lake more than halved in size after it flooded.

The images also show a lot of ice floating on the lake surface, said Jakob F. Steiner, a fellow at the Kathmandu–based International Centre for Integrated Mountain Development (ICIMOD), part of the Himalayan University Consortium.

"On the south of the Lhonak Lake there are steep slopes, glaciers as well, there is still snow. It could be that a chunk of either ice or unstable slopes has detached and dropped into the lake water," Steiner said, adding that the images indicate something like this happened.

This can create shockwaves across the water surface that would be enough to topple the lake's dam, Steiner added, since the lake is up to 120 metres (395 ft) deep.

Finu Shrestha, a remote sensing and geo–information analyst at ICIMOD, said a combination of factors including rainfall, a snow avalanche and increasing pressure on the lake due to its growing size could have caused it to flood.

Sharad Chandra, director of the flood forecasting division at India's Central Water Commission, said two earthquakes that struck Nepal on Tuesday, of magnitudes 6.3 and 5.3, could also be one of the probable reasons behind the GLOF event.

**WERE THERE WARNINGS AND SIMILAR EVENTS IN THE PAST?**

Indian scientists at the National Remote Sensing Centre had said in a 2013 report that there was a 42% chance of Lhonak Lake bursting its banks.

It said the lake had grown in size, from 17.54 hectares (43.34 acres) in 1977 to 98.73 hectares (243.97 acres) in 2008. Latest satellite imagery showed the lake area as approximately 162.7 hectares before it burst and shrank to 60.30 hectares.

Deadly flash floods have previously been triggered multiple times due to GLOF events in the Himalayas, including a 2013 disaster in Kedarnath in Uttarakhand state that killed about 5,000 people.

Floods caused by days of heavy rains in Sikkim in 1968 killed an estimated 1,000 people.

Editing by YP Rajesh; editing by Mark Heinrich

## FLASH FLOODS IN SIKKIM AFTER CLOUDBURST, PARTS OF NATIONAL HIGHWAY WASHED AWAY

Flash Floods in Sikkim: As per the Central Water Commission, Teesta was flowing below warning level at 6am on Wednesday and expected to cross its warning level within six hours.

India NewsReported by Saurabh Gupta, Edited by Muskaan SharmaUpdated: October 04, 2023 12:25 pm IST

Kolkata: Connectivity to Sikkim, including capital Gangtok, has been affected on Wednesday after an overflowing Teesta river washed away parts of NH–10 that connects the state to the rest of the country. The river water rose to an alarming level after a cloudburst triggered a flash flood in the northeastern state.

The cloudburst occurred over Lhonak Lake in North Sikkim leading to the flooding of the river which flows through Sikkim and West Bengal.

A massive search is on to locate 23 Army personnel, reported missing after the flash floods.

Videos recorded by locals showed a large section of a road washed away by the raging river waters. As per the Central Water Commission, Teesta was flowing below warning level at 6am on Wednesday and expected to cross its warning level within six hours.

"The flash flood made its way through River Teesta sweeping Indreni Bridge in Singtam town, some 30 kilometres from Gangtok. A connecting bridge of the Balutar hamlet was also swept away around 4 am," the Gangtok District Administration told news agency ANI. Many homes near the river basin in Singtam have been evacuated to temporary relief camps in the town.

Residents from the Chungthang town, some 90 kilometres north of Gangtok, near the Teesta Dam have also been rescued. As per the defence ministry, two bridges were also damaged in Dikchu and Toong towns connecting Singtam to Chungthang in North Sikkim. The Border Road Organisation (BRO) is rescuing locals in the areas.

Earlier, a flash flood alert was issued in the north and east districts of Sikkim. Parts of Sikkim have witnessed heavy rain since last night. "Low lying areas such as Gazoldoba, Domohani, Mekhaliganj and Ghish may be affected. Please be alert," it said.

"Nobody has been injured but there has been significant damage to public property. Some people have also been reported missing. Relief operations are going on," said Chief Minister Prem Singh Tamang said while on a visit to Singtam.

Those living on the banks of the Teesta river have also been advised to evacuate their homes to ensure their safety. All are advised to stay alert and avoid travel along the Teesta river basin, an alert message by Sikkim State Disaster Management Authority read.

## FOUNDATION OF ANTI–FREEZING WATER SCHEME LAID AT KEYLONG

Will ensure water supply in Lahaul–Spiti during winter

Updated At: Oct 07, 2023

Deputy Chief Minister Mukesh Agnihotri lays the foundation stone of the drinking water supply scheme on Friday.


**Tribune News Service, Mandi, October 6**

To ensure regular water supply in Lahaul and Spiti during the winter, the Jal Shakti Department is going to set up an anti–freezing system in the district at a cost of Rs 22.80 crore. Deputy Chief Minister Mukesh Agnihotri today laid the foundation stone of this ambitious project at Keylong. Agnihotri also laid the foundation stone of lift irrigation scheme at Manchhu to be constructed at a cost of Rs 2.26 crore.

After laying the foundation stone, Deputy CM said, "The residents of Lahaul and Spiti have been facing a shortage of water during winter every year. As temperatures plummet below zero degree, water supply lines freeze. To resolve the issue, the state government has decided to find a solution to the problem. The government had sent Jal Shakti Department officials to Leh–Ladakh, Sikkim and a few other northeast places, where temperatures fall below zero degree during the winter to study the water supply systems there."

**Pipe network 4 feet below ground**

In this technique, the pipe network of drinking water supply is laid about four feet below the ground. Other aspects of anti– freeze technology are also included in this scheme. As a result, water will not freeze inside the pipes and consumers will avail the water facility even in minus temperature. —Mukesh Agnihotri, Dy Chief Minister

"After visiting these places, the officials advised the government that setting up an anti–freezing system in Lahaul and Spiti can ensure regular water supply to local residents during the winter," he added.

He directed the officials of Jal Shakti Department to complete this project within the stipulated time to benefit the residents of Lahaul valley.

Lahaul and Spiti MLA Ravi Thakur said on the lines of America and European countries, residents of Lahaul will get water supply in Keylong using anti–freeze technology.

## WATER 'BEING TAKEN FOR GRANTED', GLOBAL TEACHER CRISIS, NIPAH IN INDIA UPDATE

Noria Kanyama, a primary school student in Chikwawa district, Southern region of Malawi, fetching water from a nearby river.

**4 October 2023, Climate and Environment**

While some 2.4 billion people live in countries where the supply of water is limited, global water demand for agriculture is expected to increase by 35 per cent up to 2050, the UN Food and Agriculture Organization (FAO) said on Wednesday.

"We must stop taking water for granted," FAO Director–General Qu Dongyu said at the opening of the Rome Water Dialogue, focused on its critical role relating to soils, land, climate change, biodiversity and agriculture.

With agriculture accounting for more than 70 per cent of the planet's freshwater withdrawals, "by increasing efficiency, reducing negative impacts and reusing wastewater, agriculture holds the solutions to the global water crisis", he said.

FAO supports countries to develop technical solutions for rainwater harvesting and storage, map out irrigation needs, provide data on water scarcity and assess the impact of floods on rural areas.

The UN agency has indicated that this year's World Food Day on 16 October will focus on the direct link between water and food security, highlighting ways to "produce more food and other essential agricultural commodities with less water, while ensuring water is distributed equally, our aquatic food systems are preserved, and nobody is left behind".

World needs millions more teachers but profession deemed too 'unattractive'

New data from the UN educational, social and cultural organisation (UNESCO) has revealed a global shortage of teachers as the profession faces a "major vocations crisis".

Ahead of Thursday's World Teachers' Day, UNESCO pointed to a gap of 44 million teachers without whom the world will not be able to provide primary and secondary education for all by 2030. The agency said that the problem lies not only in a lack of funding, but also in the "unattractiveness" of the profession.

UNESCO Director–General Audrey Azoulay underscored that that while some regions of the world lack candidates for the job, other regions face a very high dropout rate during the first few years of work.

"In both cases, the answer is the same: we must better value, better train and better support teachers," she said.

**Regional shortages**

Southern Asia is experiencing the largest lack of teachers worldwide – 7.8 million – while sub–Saharan Africa alone accounts for one in three of the current global shortfall.

In the 79 countries studied by UNESCO to better understand the reasons for the shortage, the attrition rate among primary school teachers almost doubled from 4.6 per cent in 2015 to 9 per cent in 2022.

The UN agency said that three main factors stand out: poor working conditions, high levels of stress and low pay.

UNESCO made a number of recommendations to countries to improve the status of teachers, including investment in competitive salaries and benefits, improved teacher education and mentorship programmes and access to mental health counselling.

**India: Nipah virus outbreak update**

In India, six laboratory–confirmed cases of Nipah virus, including two deaths, were reported over the course of three days in September, the UN World Health Organization (WHO) has said.

Nipah virus infection is spread to humans through contact with infected animals such as bats and pigs, and less frequently, through direct contact with an infected individual.

WHO warned that symptoms are "severe" and may include acute respiratory infection and fatal encephalitis. Case fatality rates in past outbreaks across southern Asia have ranged from 40 to 100 per cent and there are no available therapies or vaccines.

"The only way to reduce or prevent infection in people is by raising awareness about the risk factors and preventive measures," WHO said.

The cases, all in one district of Kerala, were reported between 12 and 15 September. Large–scale contact tracing was put in place by the health authorities and since 15 September, no new cases have been detected.

According to WHO, this is the sixth outbreak of Nipah virus in India since 2001.

## REBUILDING WATER SECTOR TRUST THROUGH RESEARCH AND INNOVATION

**September 20, 2023:** Registrations are now open for UKWIR's fourth annual conference, which will be held in London on 30 November 2023. The event will explore the importance of research, innovation and communication in addressing the water challenges of the 21st century, with perspectives from a range of high–profile speakers from across water companies, regulators, the water media and supply chain.

Keynote speakers are Helen Wakeham, deputy director of water quality, groundwater and contaminated land at the Environment Agency; Colin Skellett, chief executive of Wessex Water, and Ian Cameron, head of innovation at UK Power Networks, who brings experiences from outside the water sector. Niki Roach, honorary vice president of CIWEM, is returning as conference chair.

Speaking ahead of the event, she said, "Everything that we achieve – or don't achieve – is because people make choices. People underpin every organisation, every system, process, policy and regulation."

"The power of the UKWIR conference is connecting people from academia, the supply chain, water companies, regulators and environmental NGOs, to listen to experiences, challenge thinking and build understanding on the big questions the water sector is facing. Ultimately, its experiences like these that will go on to inform the choices we then make in our roles."

Confirmed speakers and panellists include Thomas Bridgewater, head of strategic asset management & innovation, Affinity Water; Jon Rathjen, deputy director, water policy & climate change and energy directorate operation, Scottish Government and Mariëlle van der Zouwen, deputy director and management team, KWR Water Research Institute.

This year's session themes will be explored through a combination of presentations and panel discussions:

- Creating a better world for customers
- Opportunities for strategic partnerships
- Tackling our big challenges
- Digital transformation

A recent Ofwat survey about how people view their water company and their perceptions of the water sector showed that trust in the water sector in England and Wales has declined, with customers expressing concerns about untreated sewage, drought warnings, and leakage.

According to the survey, people's trust in them to take away wastewater and sewage and deal with it responsibly has fallen. Trust to act in the interests of the environment has fallen. Trust to provide a reliable service has fallen.

Ofwat stressed that effective communication and transparency from water companies about their actions and plans are crucial in rebuilding trust and improving outcomes for customers and the environment.

The conference will address these issues by bringing together leading water journalists, research institutions, innovators from across the supply chain, and water companies to help the sector better communicate with customers and regulators and change the narrative about the water and wastewater sector.

"Conferences like this provide excellent opportunities for networking and collaboration and allow the sector to enhance innovation through sharing stories, knowledge and resources," said Steve Kaye, chief executive of UKWIR. "A limited number of tickets are available, so people are advised to book as soon as possible."

# Veolia Water Technologies & Solutions Implements zeeDENSE* to Achieve Super–Intensification of Wastewater Treatment at Facility in Illinois

**Advance Summary:**
The Yorkville–Bristol Sanitary District (YBSD) in Illinois was the first utility in North America to implement ZeeLung* Membrane Aerated Biofilm Reactor (MABR) technology at full–scale in 2017. The ZeeLung upgrade enabled the facility to increase biological treatment capacity and avoid the construction of new bioreactor tanks. It is now the first to adopt zeeDENSE*, which enables the plant to increase hydraulic capacity and avoid the construction of new secondary clarifiers while also improving nutrient removal in its existing infrastructure.

Veolia Water Technologies & Solutions unveiled zeeDENSE in 2022, coupling ZeeLung MABR with continuous flow densification technology to upgrade and super–intensify activated sludge plants. ZeeLung MABR intensifies biological treatment by up to 50% by supporting the growth of a nitrifying biofilm on a gas–permeable media that also reduces energy consumption by transferring oxygen without the use of bubbles. zeeDENSE is an application of ZeeLung where continuous flow densification is added to the process to improve mixed liquor settling characteristics and increase secondary clarifier capacity by up to 50%.

Prior to 2017, the YBSD facility faced two challenges – increased organic load from population growth and industrial contribution, and a new regulatory target for phosphorous removal. Rather than adopting the conventional solution of building new bioreactor tanks, YBSD partnered with Veolia to implement a ZeeLung MABR upgrade to increase treatment capacity and implement biological phosphorous removal in the existing infrastructure. This allowed the utility to reduce capital expenditure by 75% and implement the solution in less than 18 months – much faster than a conventional upgrade. The ZeeLung MABR solution has been delivering efficient, high–quality effluent for more than five years. According to the YBSD master plan, the next bottleneck in the secondary treatment process is clarification, and YBSD anticipates the need to build new secondary clarifier capacity in the coming years. zeeDENSE offers an ecological transformation with the potential to intensify the capacity of the existing secondary clarifiers and eliminate or postpone the construction of new infrastructure. zeeDENSE was implemented at the YBSD plant in November 2022 to demonstrate this value and benefits for improving nutrient removal and reducing operating costs.

"This first implementation of zeeDENSE shows the power of ZeeLung as an enabling technology and how coupling it with other intensification solutions can deliver even more value for utilities," said Thomas Buer, Senior Vice President, ES Technologies & Systems at Veolia Water Technologies & Solutions. "When we first partnered with YBSD in 2017, our ZeeLung solution de–bottlenecked the biological system and allowed the facility to avoid having to build new bioreactor tanks. Adding zeeDENSE can deliver more intensification by de–bottlenecking the secondary clarifiers and processing more flow in the existing infrastructure. The zeeDENSE solution allows YBSD to maximize value from their existing assets."

zeeDENSE was bolted onto the existing ZeeLung MABR system to increase secondary clarifier capacity, optimize biological phosphorous removal, and create operating cost savings from energy reduction and chemical savings.

"The ZeeLung MABR upgrade that we implemented six years ago allowed us to reduce costs for our ratepayers and it continues to deliver excellent effluent quality today. It was a no–brainer to work with Veolia again to solve our issues," said Cyrus McMains, Executive Director of YBSD. "The success that we've seen to date reinforced that ZeeLung is a transformative technology that can save capital and operating costs while also preserving plant footprint."

Learn more about Veolia's industry–leading water technology and process expertise that has solved the toughest water, wastewater, and process challenges for industrial clients.

## About Veolia Water Technologies & Solutions

With operations in 130 countries and over 10,000 employees worldwide,

Veolia Water Technologies & Solutions (formerly SUEZ – Water Technologies & Solutions) solves the toughest water, wastewater and process challenges around the globe. Leveraging a comprehensive set of chemical, equipment and digital enabled services and products, the company helps customers optimize water resources and overcome process challenges. Veolia Water Technologies & Solutions serves customers across all industries, including food and beverage, metals and mining, power, pharmaceutical, oil and gas, chemicals, petrochemicals, pulp and paper, and utilities. Learn more at watertechnologies.com and connect with us on LinkedIn and Twitter.

## About Veolia

Veolia Group aims to become the benchmark company for ecological transformation. Present on five continents with nearly 213,000 employees, the Group designs and deploys useful, practical solutions for the management of water, waste and energy that are contributing to a radical turnaround of the current situation. Through its three complementary activities, Veolia helps to develop access to resources, to preserve available resources and to renew them. In 2022, the Veolia group provided 111 million inhabitants with drinking water and 97 million with sanitation, produced nearly 44 million megawatt hours and recovered 61 million tonnes of waste. Veolia Environnement (Paris Euronext: VIE) achieved consolidated revenue of 42.885 billion euros in 2022. www.veolia.com

## About Yorkville–Bristol Sanitary District

The Yorkville–Bristol Sanitary District (YBSD) is an independent municipal corporation under the provisions of the Illinois Sanitary District Act of 1917. The formation of the District was authorized by referendum at the elections of December 27, 1954, and confirmed by order of the County Court of Kendall, January 5, 1955. The YBSD provides wastewater transportation and treatment services for the City of Yorkville, Illinois the county seat of Kendall County. The District Trustees, R. Brent Ekwinski, Kurt Muth, and Mark A. Luettich, are stewards of the YBSD, and are very aware of the needs of the community.

The Boundaries of the Sanitary District encompass an area greater than 10 square miles. The facility planning area of the District is 33.8 square miles, and the estimated planned ultimate area to be served is approximately 50 square miles. YBSD has one wastewater treatment facility that is designed to treat three million, six hundred twenty thousand (3,620,000) gallons of wastewater per day, or serve a population of thirty six thousand, two hundred (36,200) people. The present population equivalent (PE) is about 20,925.

**Interview with**
**MR. ANIL SETHI**
**Chairman,**
**Pump Academy Pvt. Ltd.**

Interview by
**Virender Kumar**

# iPUMPNET:

## SUSTAINABLE SOLUTION FOR OPTIMIZING PUMPING STATION

*India has planned a substantial investment over Rs. 10 trillion for the development of water infrastructure.*

**Anil Sethi** is the Chairman of Pump Academy Private Limited, a company he established to provide innovative solutions to water utilities through technologically advanced pump optimization system. His incredible contributions to water infrastructure development and management have widely been recognized with prestigious awards and honours.

☞ **www.pumpacademy.in**
**Linkedin: https://www.linkedin.com/in/anil–sethi–118530112/**

**Q. What is your view on water infrastructure development in India which has been a key focus area in recent years?**

**A.** Past few years have witnessed significant activity, both in terms of infrastructure development and investment in Indian water sector. The government has prioritized capacity building and infrastructure creation through initiatives like Jal Jeevan Mission, AMRUT, Smart Cities, Namami Gange, and Atal Bhujal Yojana etc. As part of the National Infrastructure Pipeline, a substantial capital investment of Rs. 4 trillion has been allocated for the water sector from 2019–20 to 2024–25.

Prominent water sector programs, such as the Jal Jeevan Mission (Rural) with a budget of Rs. 3.6 trillion until 2024, Jal Jeevan Mission (Urban) with an allocation of Rs. 2.87 trillion spanning from 2021 to 2026, and the Namami Gange initiative with Rs. 200 billion are flagship endeavors set to extend over next few years. Other schemes like the Pradhan Mantri Krishi Sinchayee Yojana with Rs. 90.5 billion, Dam Rehabilitation and Improvement Project (DRIP) Phase 2 & 3 having allocation of Rs. 102 billion for 10 years upto 2031, National River Linking Project with Rs. 225 billion, Atal Mission for Rejuvenation and Urban Transformation (AMRUT 2.0) with a substantial allocation of Rs. 2.99 trillion for five years until 2026, the National Hydrology Programme with Rs. 36.8 billion until 2024, and the Atal Bhujal Yojana with Rs. 60 billion until 2025, represents significant initiatives that hold the promise of a brighter future for water infrastructure development in India.

The progress of Jal Jeevan Mission has been phenomenal. It has connected an additional 99 million rural households with functional tap water connections since its launch in 2019. The JJM progress suggest that the scheme is being implemented on a mission mode and as on September 20, 2023, it has covered all households in 90,380 panchayats spread across 1,88,305 villages of 150 districts in the country with assured tap water supply.

Under the Namami Gange programme, 48 sewage management projects are under implementation whereas 99 sewage treatment projects have been completed. The work is under progress for creating sewage treatment plants of 5658.37 MLD capacities in different states. The AMRUT scheme has provided 13.7 million water tap connections and 10.5 million sewer connections across different states,

## Water Professional

*Over the past few years, India has made significant strides in the development of water infrastructure to address rural water supply issues.*

*I am fortunate that I started my career in water sector five decades ago and I am still contributing.*

apart from 6347 MLD of sewage treatment capacity is being developed including 1437 MLD being developed for reuse purposes.

### Q. What opportunities are available to EPC firms, product manufacturers, and service providers in the Indian water sector?

**A.** Water sector in India holds a promising future and presents significant prospect for a range of stakeholders, including EPC (Engineering, Procurement, and Construction) firms, private developers, consultants, as well as equipment suppliers and technology providers. Looking ahead, investments will be focused on achieving 24x7 water supply, enhancing industrial water use efficiency, implementing economical seawater desalination methods, and promoting the recycling and reuse of wastewater.

The government has initiated several ambitious programs that aimed at providing clean drinking water to every households and rejuvenating water sources through various schemes with significant fund allocation. These programs entail substantial infrastructure development, offering numerous EPC projects and manufacturing opportunities. As the country strives to address its water–related challenges, companies engaged in this sector have a good chance of benefiting from a growing market.

### Q. India water market is growing at a healthy pace. How do you see this growth pattern?

**A.** The growth pattern of the water market in India is indeed promising and reflects a positive trajectory. As per a research report, the water and wastewater management market size in India stood at Rs. 216.03 billion in 2022, expected to reach Rs. 518.15 billion in 2027, expanding at a compound annual growth rate (CAGR) of 15.95% during 2023–2027 period.

Several factors contribute to this healthy pace of growth. The growing population combined with faster urbanization and enhanced economic activities continue to escalate demand for clean water for domestic, industrial, and agricultural purposes. This is further supported by the focussed initiatives that the Indian government has launched, such as the Jal Jeevan Mission, AMRUT and Namami Gange, which are heavily investing in water and wastewater infrastructure development and management. These initiatives are driving substantial growth by expanding water supply infrastructure and addressing water quality issues.

### Q. What does pumping station optimization involve, and what drives the necessity for it?

**A.** Pumping stations are critical infrastructure that helps in the transportation of water, wastewater and other liquids. Pumping station optimization refers to the process of enhancing the efficiency and effectiveness of pumping station's operation. It is essential because it leads to improved energy efficiency, cost savings, equipment lifespan, and overall reliability.

It addresses concerns related to high energy consumption, cost–effectiveness, equipment longevity, environmental impact, and

compliance with regulations. It is absolutely worthwhile to invest in pump optimization measures that will help water utilities and companies to deliver a higher standard of service to their consumers while minimizing negative environmental effects.

### Q. How iPUMPNET is helping water utilities in their operations?

**A.** The reliability of pumping stations is critical to maintaining the water and wastewater systems. A single system failure can result in significant disruptions to services, leading to public health concerns, property damage, and lost revenue.

iPUMPNET is a cutting–edge platform designed to streamline and enhance operations of pumping stations. This innovative system, introduced by Pump Academy Private Limited, employs advanced technology of Artificial Intelligence (AI) and Industrial Internet of Things (IIoT) to facilitate various aspects of pumping system management. It offers the following benefits to water utilities in their day–to–day operations:

- It can improve operational efficiency of pumping station upto 35%, reduce energy consumption upto 25%, reduce the life cycle cost (LCC) of upto 45%, and extend the lifespan of pumping systems upto 50%
- It is equipped with features that swiftly detect faults or anomalies, allowing for prompt troubleshooting and resolution, thus practically eliminating unscheduled breakdowns and maintenance
- It allows for remote control and automation of pumping station operations, reducing the need for physical intervention and enhancing operational efficiency
- The robust platform of iPUMPNET gathers and analyzes data, providing valuable insights that can support informed decision–making and drive operational improvements
- It helps water utilities optimize energy usage in pumping operations, estimated that almost 5 GW of energy could be saved per annum if iPUMPNET is implemented across all water pumping stations in India
- Through improved operational efficiency and energy optimization, iPUMPNET contributes to reduced environmental impact, significantly reducing the carbon footprints of pumping stations, estimated to save almost 3.06 million tonnes of carbon emission annually, if implemented across all water pumping stations in India
- The return on investment for optimization will happen normally within a year.

In essence, iPUMPNET is a powerful tool that empowers water utilities with advanced technology–driven solutions, enabling them to operate more efficiently, cost–effectively, and sustainably. Its features encompass real–time monitoring, predictive analytics, remote control, compliance management, and more, all aimed at enhancing the overall performance of water management systems.

### Q. What does working in the water sector means to you?

**A.** Water is a precious and essential resource for life, agriculture, industry, and the environment. The human and economic development of a nation solely depends on adequate supply of clean water. I am fortunate that I started my career almost five decades ago with water management and I am still contributing in this sector. Providing safe and clean drinking water to people is a primary responsibility. Ensuring that water treatment and distribution systems meet strict quality and safety standards is crucial for protecting public health and industrial production. I have been directly involved in developing at least 500 medium and large water infrastructure projects for making provision of drinking water supply, agriculture as well as treating used water from both domestic and industrial discharge.

Investing, maintaining, and upgrading water infrastructure is very significant. This includes pipelines, treatment plants, pumping stations, reservoirs, and distribution networks. It is essential to keep these systems efficient and resilient to meet growing demands and adapt to changing conditions. For the past three years, I am responsible for ensuring the sustainable management of this resource by implementing technological intervention in asset management with specific focus on pumping stations.

For me, it is my deep commitment to the water sector that has helped in creating robust infrastructure for making provisions of safe and clean water to millions of people in India while managing the challenges associated with water resources, infrastructure development, and environmental stewardship.

**Neha Lakhwan**

Neha specialises in the field of Hydraulics and Hydrology with a background in hazard–related projects. She works on translating complex climate change data into accessible insights using critical analysis and data visualization. Proficient in evaluating landslide susceptibility and urban flooding causes, she is a problem–solving enthusiast. Her previous experience is in the domain of water resources analysing floods, landslides and food security using modelling techniques.

# "REVITALISING INDIAN CITIES: INTEGRATING INNOVATIVE STORMWATER MANAGEMENT SOLUTIONS"

## Introduction:

The National capital of India, New Delhi received the highest monsoon rainfall in 40 years, resulting in massive floods recently in July 2023. The unprecedented rainfall caused the river Yamuna to overflow, submerging many areas of the city. It is a dual paradox where we face challenges like Urban floods and water stress on the other. Climate change in turn is paving the path for extreme weather events such as flash floods, droughts, and heatwaves, altering the natural ecosystems and bringing in numerous challenges. It is important for cities to realise the present challenges and convert them into opportunities. To ensure that stormwater becomes an asset rather than a liability, cities must have efficient and effective stormwater management systems. In order to improve the quality of stormwater and thereby facilitate its use, natural stormwater drains which have turned into nullahs should be revitalised. The current stormwater drainage system must also be evaluated to determine if it is adequate and designed efficiently to capture rainwater.

The recent report of the Intergovernmental Panel on Climate Change (IPCC) (Assessment Report 6, AR6), states that the climate change is "widespread, rapid, intensifying and unprecedented in thousands of years." Climate change tends to make the monsoons in India more unpredictable and erratic, increasing the frequency and severity of floods. India, being the world's most populous nation, holding 18% of the world's population, has only enough water resources for just 4 % of its people, making it the world's most water–stressed country (World Bank). The impacts of extreme weather events that are mainly driven by climate change are escalating and affecting

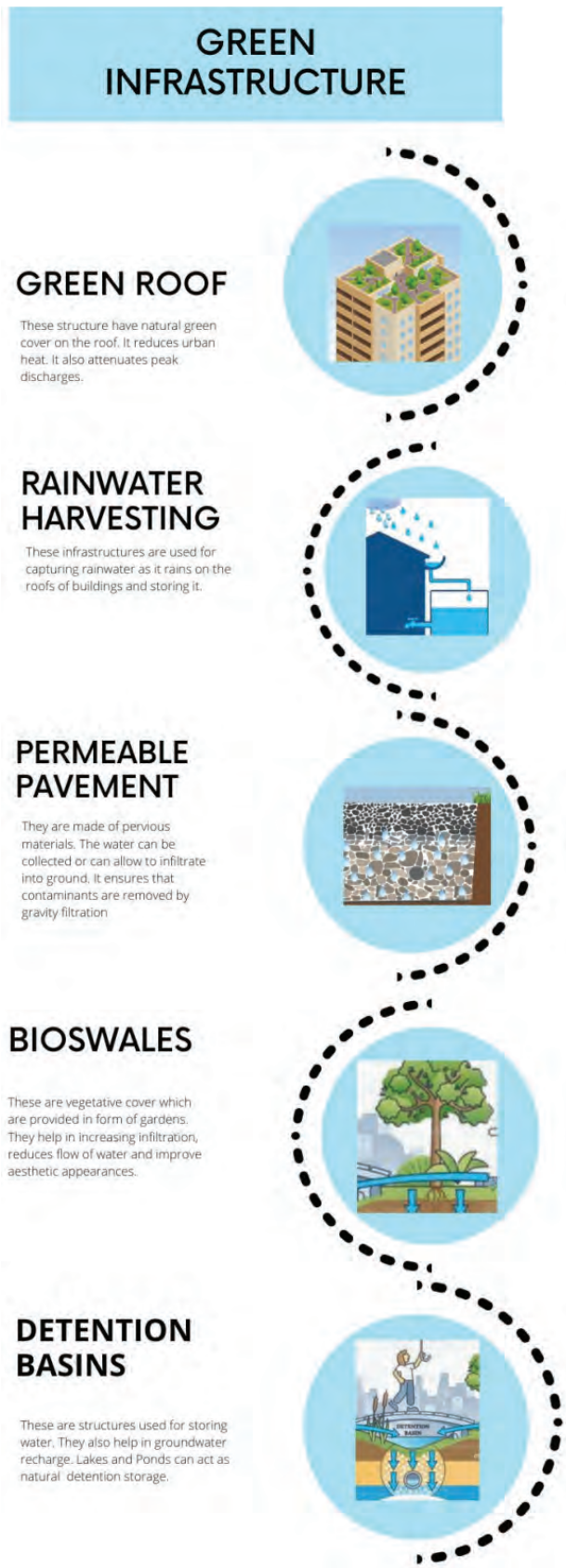
Sustainable urban storm water management incorporating technical, economic, structural, non–structural, and social dimensions is vital for maintaining better urban dwellings, lifestyle, and stress–free ecosystems.

our economy, agriculture, infrastructure, and human health like never before. In 2018 alone India experienced an economic loss of over INR 95,736 crore due to floods( PwC &ORF, 2023). The unplanned and improper urban drainage systems in Indian cities are making them more prone to urban floods during unprecedented and highly intense spells of rainfall. Stormwater is a resource that can be conserved and used, but the poor stormwater management in the cities forces the stormwater to just gush into sewer systems and drainage ditches, thus making it unutilised. This in turn aggravates the challenges in their treatment and management. A comprehensive and sustainable stormwater management plan and system in place across developed or developing cities can help in the collection, storage, and use of stormwater.

## State of Urban Drainage System in Indian cities

The urban drainage system design in India lacks proper planning and infrastructural provisions, posing a threat to stormwater management systems. Urban flooding in most of the cities is caused by a lack of proper drainage infrastructure, illegal land acquisition, and choking of drainage systems. In India, a separate sewage system is adopted where stormwater drains and sewage water drains are different. Due to inadequate drainage infrastructure, the stormwater drains in most of the Indian cities carry sewage coming from domestic, commercial, and industrial dwellings and solid waste that is dumped, apart from carrying storm water alone. Extreme rainfall events further overwhelm the existing

This allows for proactive preparation and more effective response strategies.




infrastructure leading to submergence. Stormwater management in Indian cities should be viewed through the lens of structural as well as non–structural dimensions. When we see the structural aspects of storm water drainage systems, most Indian cities lack a proper drainage infrastructure as well as the operation and management of the existing drainage channels. When it comes to non–structural aspects, it lacks a proper institutional set–up and policy framework as well as the engagement of stakeholders for bringing in proper urban drainage infrastructure. Additionally, the encroachment of wetlands for construction, lower rate of infiltration of runoff water due to the increased imperviousness of surfaces, and higher intensity rainfall events and peak runoff rates create a completely haphazard drainage system leading to contamination of stormwater.

Subsequently, comes the pollution of the stormwater that is flowing through the drains. The stormwater while making its way to drains captures most of the impurities. Unlike sewage, stormwater flows untreated and gets channelised directly into the nearby waterways. In urban areas, it is usually loaded with chemical, organic, and microbial pollutants and litter. These pollutants emerge from various sources such as organic debris, atmospheric deposition, runoff containing fertilisers and pesticides, microplastics washed out from leachate, construction debris, vehicle exhaust, animal faeces, sewage overflows, paved surfaces, from areas of poor vegetative cover. The major pollutants contaminating the storm water are mainly nutrients such as nitrogen and phosphorus, organic matter, suspended sediments, microplastics, industrial chemicals and solvents, petroleum–derived chemicals, and various heavy metals. An amalgamation of storm water with such pollutants from external sources brings in the challenge of storm water treatment.

## Stormwater Management: Challenges, Strategies and Innovations

In order to prohibit stormwater contamination, it is imperative to determine the extent, type, and sources of contamination and to control their entry into stormwater. Some of the best management practices that can be incorporated to improve stormwater quality are:

- Increased frequency of street sweeping and cleaning of catchment basins
- Pollution prevention practices for residential, business, and municipal establishments, education, and awareness for the general public.
- Rehabilitation of deteriorated drainage structures
- Retrofitting of existing drainage systems to improve water quality.
- Enforcement of norms and stormwater design standards.
- Better engineering designs for stormwater treatment structures.

Effective stormwater management planning offers a solution that encompasses both water conservation and water quality management. However, urban areas often struggle with inadequate stormwater management due to its integration with urban planning—a state–level responsibility. Niti Aayog's 2021 report, 'Reforms in Urban Planning Capacity in India,' emphasises the need for local governments to play

a more active role in urban planning. This approach extends to local infrastructure issues, which can be effectively addressed through grassroots strategies.

## Challenges pertaining to stormwater Infrastructure in India

Effective stormwater management hinges on capturing stormwater before it mixes with sewage and results in overland flow. Unlike the comprehensive manuals available for water supply and treatment (1999), sewage treatment (2013), and municipal solid waste management (2016), stormwater drainage design guidelines are relatively recent, dating back to 2019. As of the 2011 census, stormwater drainage (SWD) networks covered only about 20% of the road network in India. Of the 104 major cities assessed, 56 had coverage below 50%, categorised as needing "immediate action for improvement" by the Ministry of Urban Development. Furthermore, 93 cities had coverage below 75%, signifying a "caution for improvement." For instance, Bengaluru alone requires 658 km of SWD to avert floods. This presents an opportunity for town planners to incorporate these guidelines when expanding the existing stormwater drainage system, including the construction of new drains and interconnecting existing ones.

The additional hurdles are in the implementation of the existing guidelines. A 2021 Comptroller and Auditor General (CAG) report titled "Performance Audit of Management of Stormwater in Bengaluru Urban Area" observed that despite regulations prohibiting the installation of sewage lines in SWDs in Karnataka, non–compliance was observed. During the construction of new drains, various instances were identified where sanitary and utility lines were not relocated as required.

The guidelines for stormwater drain design were intertwined within the Indian Roads Congress (IRC) and National Disaster Management (NDM) guidelines. However, the CAG report highlighted inconsistencies in the adoption of these guidelines and the absence of detailed design calculations. The IRC guidelines recommend various infiltration methods, such as retrofitting surface roads, bore well installations, porous layers, detention ponds, and rainwater harvesting. Unfortunately, the CAG audit exposed the complete concretization of SWDs, negating the potential for infiltration. Recent design guidelines emphasise the importance of data collection, including identifying waste entry points, vulnerable silting/landslide areas, low–lying regions, coastal challenges, hilly area features / vulnerable stretches, and groundwater recharge structures. Such data collection serves as a vital tool for effective pollutant control and management.

Stormwater management can also take into consideration a number of other factors, such as:

- Urban planning must incorporate the topography of the catchment area since water naturally follows predetermined pathways. Therefore, it is crucial to avoid construction activities along these routes and floodplain areas.
- In terms of rainfall data for design discharge, it's essential to acknowledge that minor drains cannot be economically designed for extremely rare events. During flood events, rainfall patterns within a city can exhibit significant variations. For example, North Bengaluru typically experiences lesser rainfall compared to South Bengaluru. To account for these nuances, it's imperative to comprehend the long–term rainfall patterns both at macro and micro–level planning. A one–size–fits–all approach is impractical since the design discharges for different drainage systems depend on return periods calculated from Intensity–Duration–Frequency (IDF) curves, which should be periodically updated to consider the effects of climate change.
- Additionally, a comprehensive understanding of catchment hydrology is crucial. Consider Bengaluru, which is geographically divided by a ridge running from north to south, resulting in central Bengaluru being at a higher altitude than its eastern and western counterparts. In areas upstream with a higher concentration of lakes, connecting channels to these natural water bodies is advantageous. Conversely, downstream regions should prioritise the construction of wider channels based on the discharge received from the catchment.
- Incorporation of stormwater inlets from paved surfaces and catch pits reduces siltation and the presence of macroplastics in stormwater. It can also help in enhancing infiltration and mitigating peak discharge.
- Hydrological modelling can help understand the rainfall–runoff relationships within the catchment in a better way. This type of modelling takes into account the recent land use changes and forecasted rainfall. The advantage of utilising hydrological modelling is in its ability to simulate changes giving realistic assessment.
- In addition to these considerations, recently cities like Kochi and Chennai have adopted Green Infrastructure to prepare for climate change. In Kochi, Urban planners through 'EnteKochi' are planning for an ecology–based sponge city. Chennai after 2015 floods, realised the significance of wetlands like Pallikaranai and natural drains like Okayai Maduvu in flood control. Thus, urban planners in both cities are utilising technology, community support, foreign sponsorships and scientific inputs to include and restore existing green infrastructure in planning.

## Innovative approaches: Green Infrastructure

Green Infrastructure (GI), alternatively known as Sustainable Urban Drainage Systems (SUDs), Low–Impact Development Techniques (LIDs), Water–Sensitive Urban Design (WSUD), Best Management Practices (BMPs), and more, centres on the development of sustainable drainage systems. It includes best management practices, rain gardens and bioswales, detention ponds, filter strips, infiltration trenches, low–impact development techniques, green roofs, retention ponds, stormwater harvesting, permeable pavements, Wetlands, etc.

The fundamental idea is to incorporate the natural environment into stormwater management practices. Unlike traditional grey infrastructure, which primarily relies on construction methods to channel stormwater, GI offers a multitude of advantages. These include water treatment, ecological enhancement, aesthetic improvement, reduction of urban

heat effects, decreased energy requirements, and enhanced water availability. Prior to implementing any GI method, conducting a modelling analysis to assess its effectiveness can significantly enhance decision–making processes. While the conventional approach to stormwater management focused on draining runoff, there is a growing recognition of the need to shift towards a storage–oriented approach to capture and utilise runoff more effectively.

Determining the most suitable method requires a comprehensive assessment of the project's environmental, economic, social, and technical conditions. To achieve this, conducting a thorough cost–benefit analysis is essential, utilising mathematical modelling approaches. For instance, Green Bay, Wisconsin identified potential parcels of land which are available at cheaper rates for acquisition to reduce project cost for Green Infrastructure development. In this context, both hydrologic and hydraulic modelling play pivotal roles, and there is a range of available models tailored to the project's objectives and the characteristics of the watershed. These models can be broadly categorised into stochastic and deterministic models, each offering unique insights into the system's behaviour. With access to high–resolution remote–sensing data encompassing rainfall patterns, land use, soil types, and terrain characteristics, it becomes relatively straightforward to assess the combined impact of these factors on the drainage system. This information can be invaluable in determining where and which Green Infrastructure (GI) practices should be implemented. Furthermore, the integration of Artificial Intelligence and Machine Learning (AI–ML) into the analysis can provide valuable insights into the deficiencies of existing infrastructure, particularly in the face of extreme rainfall events. This allows for proactive preparation and more effective response strategies.

The table below enlists some of the important models for Stormwater infrastructure planning modelling.

| Model Name | Organisation | Public Domain | Supported GI |
|---|---|---|---|
| HEC–HMS | US Army Corps of Engineers | Yes | None. Used as an input for HEC–RAS |
| HEC–RAS | US Army Corps of Engineers | yes | Bio retention structures |
| EPA– Stormwater Management Model SWMM | Environmental protection agency | yes | Bio Retention, Infiltration Trenches, Porous Pavement, Rain Barrels, Vegetative Swales, Green Roofs, Street Planters, Amended Soil |
| Low Impact Development Rapid Assessment (LIDRA) | eDesign Dynamics, New York | yes | Determination of cost–effectiveness of GI |
| Mike Urban | DHI | No | all Green Infrastructure application |
| Model for Urban Stormwater Improvement Conceptualization (MUSIC) | eWater, Australia | No | Bio Retention Systems Infiltration Systems, Media Filtration Systems, Gross Pollutant Traps, Buffer Strips, Vegetated Swales, Ponds, Sedimentation Basins, Rainwater Tanks, Wetlands, Detention Basins. |
| System for Urban Stormwater Treatment Analysis and Integration (SUSTAIN) (2003) | US Environmental Protection Agency | Yes | Evaluates and suggests the placing of GI in an urban watershed based on user–defined criteria |
| GI Valuation Tool Kit | Mersey Forest tool kit | yes | Evaluate the economic value of environmental and social benefit of GI |
| Long–Term Hydrologic Impact Assessment (L–THIA) | Purdue University | yes | Bio Retention/Rain Gardens, Grass Swale, Open Wooded Space, Permeable Pavement, Rain Barrel/Cisterns, Green Roof. |
| RECARGA | University of Wisconsin – Madison, water resources group | yes | To design and understand performances of bio retention, infiltration basins and rain gardens |

Another aspect of the framework involves non–structural approaches, such as guidelines, laws, policies, and schemes. Under the AMRUT 2.0 initiative, the emphasis is on ensuring cities become 'water secure.' To achieve this goal, Urban Local Bodies (ULBs) are required to submit City Water Balance Plans (CWBPs) and City Water Action Plans (CWAPs). These plans are designed to revitalise existing water bodies by establishing or enhancing stormwater drains. While the grey infrastructures cost depends on the capital investment and the benefits is focussed on stormwater management. The Green Infrastructure offers benefits like ecosystem services, health and well–being, pollution control, reduced energy bills, raised water table etc. The report titled "Accounting of Ecosystem Services of Wetlands in Karnataka state, India" estimates the economic value of the Wetlands for Bengaluru ranges from Rs 10,000 to Rs 55 lakh per hectare per day. Green Infrastructures thus offers sustained economic and ecological benefits by including them in proposed plans. Therefore, ULB must possess the necessary funding, expertise, and a well–defined roadmap to anticipate and address upcoming challenges, utilising cutting–edge technologies where applicable.

## Case Study: An Effective Stormwater Management Strategy, Davangere

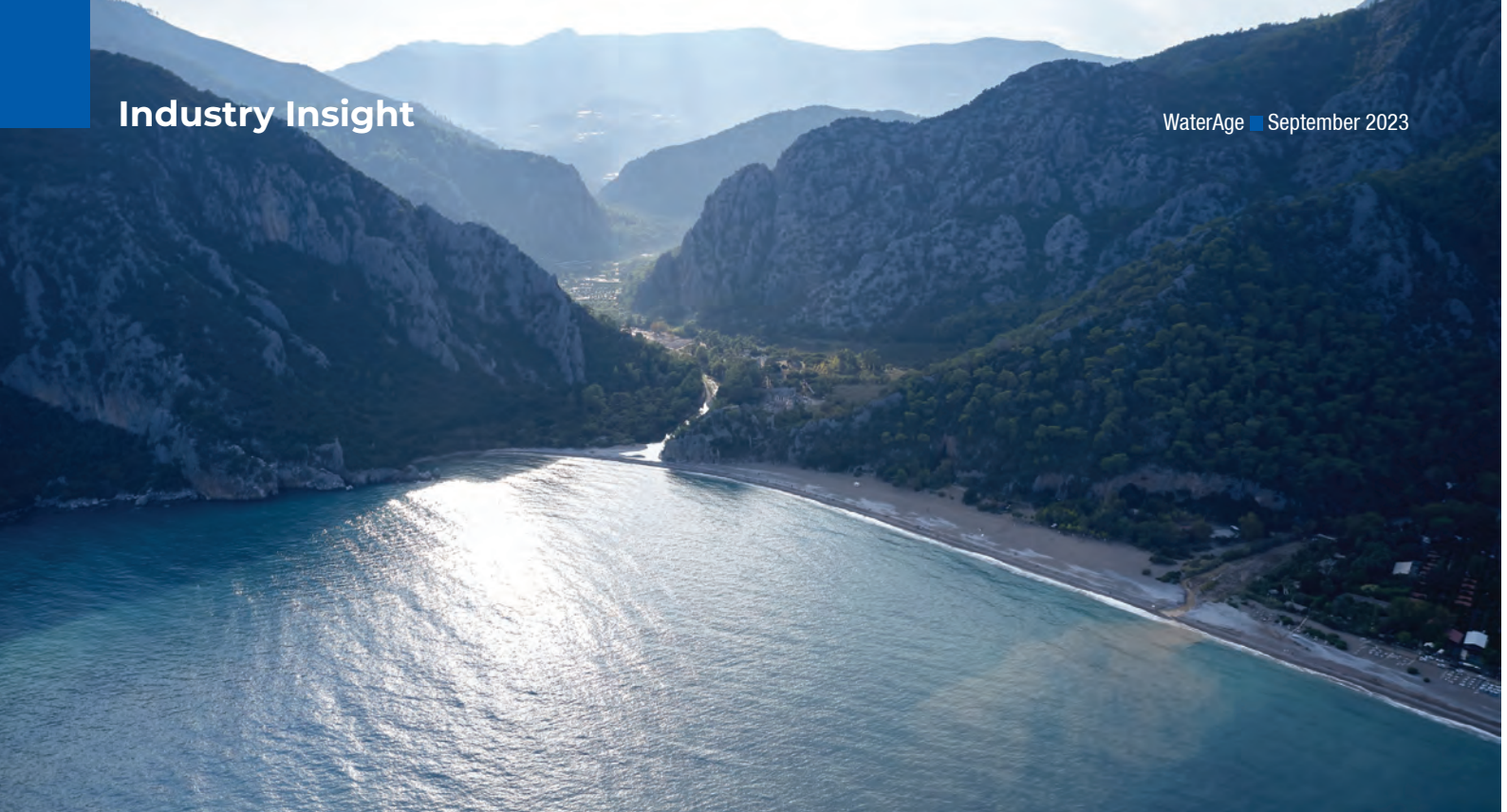
Davangere in Karnataka is lauded for its bottom–up approach to addressing deficiencies in stormwater infrastructure. The discontinuity in the stormwater drain network led to continuous contamination of rainwater after mixing with sewage. The city faced several issues, including irregular drain sections, silt deposits along drain tributaries, poorly maintained utility pipes across drains, improper drainage line disposal, and a reduction in urban water bodies due to development. In case of an inadequate drainage network, desilting alone proved insufficient. Davangere adopted innovative approaches, incorporating on–site detention storage tanks in multi–unit/building development and pervious pavements on footpaths as part of Green Infrastructure. An extensive topographical survey identified physical condition and blockages in primary drainage systems. Media reports helped in identifying flood prone areas. The process included comparative assessment of peak runoff discharge and the current drainage system's capacity, enabling targeted action and efficient resource utilisation. Under the Mandipet economic rejuvenation program's smart road project, a stormwater pipe network with recharge arrangements in each collection chamber at frequent intervals was implemented to prevent sewage from mixing with stormwater.

## Way Forward

When it rains, it drains and finds its own way into rivers, streams, or other waterways. Ideally, city planning should integrate urbanisation and industrialization to not impede natural drainage pathways. An integral part of city planning in urban environments is the appropriate design and planning of stormwater drainage infrastructure. Urban planners should also consider nature's endowments. Lakes and ponds serve as natural detention and retention ponds, while parks act as natural Bioswales. The grey infrastructure should be in a symbiotic relationship with the green infrastructure. Proper stormwater design coupled with expertise from a team of hydrologists, engineers, and environmentalists facilitates more efficient functioning of stormwater infrastructure which should be available with municipal corporations. It is necessary to capture stormwater to further treat it. For this sufficient stormwater drainage system should be available incorporating recent stormwater drainage design guidelines by MOHUA. For funds schemes like AMRUT 2.0, smart cities can be tapped for empowering the Urban local bodies. Also, management should begin from the watershed level rather than at its geopolitical boundaries, as this can easily help in tackling and mitigating risks from floods that occur during high intensity rainfall more proactively. Thus, it is important that ULBs are empowered with the latest research, knowledge, technology and training. More effective communication and collaboration amongst the stakeholders, regulators and stormwater managers and also increased public outreach and education can help tackle the challenges of stormwater management to a great extent. Reducing pollution at the source, and improving regulations at the state and local level brings in a more realistic approach to stormwater management. Stormwater should be viewed as a resource. This mandates the protection of its quality and also has the potential to be used as another source of water through its proper treatment and reuse. Sustainable urban storm water management incorporating technical, economic, structural, non–structural, and social dimensions is vital for maintaining better urban dwellings, lifestyle, and stress–free ecosystems.

**Anagha Krishnan**

Anagha specializes in the field of urban water supply, water reuse, climate change and sustainable development. She was engaged with the EU–India project unlocking wastewater treatment, water reuse and recovery opportunities for urban and peri–urban areas in India. In addition to her work on projects related to river pollution management and water conservation, Anagha also supports the development of a knowledge database for the management of plastic pollution. As a content writer, she has produced articles and reports that demonstrate her expertise.



**Mr. A. Mohan**
Co–Founder,
WSAFE (WaterSpaceAirFireEarth)
Sustainability Services Pvt Ltd.

**A. Mohan** is a seasoned IT professional who has developed a strong interest in water conservation and revitalizing water ecosystems. He firmly believes in the restorative abilities of natural waterbodies, provided that their native aquatic ecology is revitalized. A. Mohan is dedicated to advancing year round water conservation efforts through his initiative "Catch The WasteWater," which aims to promote the significance of water conservation beyond just seasonal "Catch the Rain" campaigns".

# "WATERBODY AND WASTEWATER – A CALL FOR HEALING, NOT JUST CLEANSING!"

## Introduction:

Waterbodies across the globe are vibrant ecosystems each one unique in its composition, whether they are stagnant waterbodies like ponds and lakes or flowing ones like rivers, drains, and rivulets. These waterbodies team with trillions and billions of life forms, their diversity influenced by the agro–climatic zones they inhabit. Much like the human body, which copes with various types of waste, waterbodies must also manage physical, biological, and chemical waste. Just as we seek to cure our bodies when they fall ill, it's essential to recognize that when water becomes polluted, it requires a cure, not just a cleaning. The process is cyclical, with the waste generated becoming nourishment for other organisms.

## The Problem:

Unfortunately, the balance of this natural process is deteriorating due to human activities that surpass the earth's sustainable limits. Consequently, many waterbodies are no longer capable of self–healing.

☞ **Want to know more, write at – contact@wsafess.com**

## The Flaw in Current Approaches:

Modern technologies predominantly focus on cleaning waterbodies, which, we argue, is an inadequate approach for several reasons:

## Physical Cleaning:

Efforts such as dredging disrupt wetland biodiversity, and managing the resulting sludge presents a significant challenge. The sludge often contains toxic elements, exacerbating environmental issues wherever it is disposed of.

## Chemical–Based Cleaning:

The use of chemicals in cleaning processes leaves behind residues in the water. Additionally, sludge generated from chemical–treated wastewater can be highly toxic to the environment and ecosystems where it's transported.

Despite substantial investments in time, energy, and money, the water quality achieved through chemical cleaning is often unsuitable for sustaining life.

## Biological Cleaning:

Attempts to use floating weeds or cultured algae/cyanobacteria can yield short–term improvements. However, these non–native species can harm native ecologies in the long run, earning them the label of invasive species.

## The Solution:

The sustainable solution to this pressing issue lies in the ecological restoration of native biodiversity and aqua–ecology within our waterbodies. Any method that leaves behind residues or fails to align with the natural order cannot be considered a genuine solution. The three approaches discussed earlier—physical, chemical, and biological—are merely delaying tactics and fall short of being sustainable.

## Conclusion:

In the quest to restore our ailing waterbodies, we must shift our focus from mere cleaning to holistic healing. Embracing ecological restoration and nurturing native biodiversity are the cornerstones of a sustainable approach. By doing so, we can foster the recovery and rejuvenation of our precious water ecosystems, ensuring their vitality for generations to come.

Other ecosystem services provided by Healthy Waterbodies are: Air Pollution Mitigation, Groundwater recharge and Correction, True Rain Water Harvesting, Carbon sequestration, GHG Emissions Mitigation, Biodiversity conservation, maintaining Ambient Temperature etc.

**Suhas P. Wani**
Former Director – Asia and Founding Director, IDC at ICRISAT, India.

Also served as Visiting Professor at UoA, Edmonton, and a Member of the Sustainable Agriculture Advisory Board (SAAB), Unilever, U.K. Currently, he serves as intl. Consultant, ADB Manila, FAO, IFAD, Advisory Board member for the JSW Foundation, and S.M. Sehgal Foundation. Has contributed six Strategy papers for the PMO including for DFI, Soil Health Mapping, and published 600+ research papers. He is awarded several awards by GoI, China, and Vietnam as well as recognised as the 50 Most Impactful Leaders in Water & Water Management

# RURAL WASTEWATER A WASTED VALUABLE AND SCARCE WATER RESOURCE IN SEMI–ARID TROPIC (SAT) VILLAGES: A HUGE UNTAPPED POTENTIAL

## Introduction

Wastewater management receives little social and political attention after water has been used and is an overlooked component of the water management cycle, especially in the context of water scarcity. Wastewater remains an undervalued resource, all too often seen as a burden to be disposed of or a nuisance to be ignored. This perception needs to be changed. Wastewater is not only a solution to address water scarcity but also a rich source of nutrients, minerals, and energy, all of which can be cost–efficiently extracted as per the 2017 edition of the WWDR 2017. Although data on wastewater generation, collection, and treatment is grossly lacking, it is clear that, worldwide, the vast majority of wastewater is neither collected nor treated. In many cases, collected wastewater is merely discharged directly into the environment without any treatment. Wastewater affects the environment and all living beings and can have direct impacts on mature and emerging economies. Sustainably managed wastewater can become a central pillar of the circular economy and is critical for green growth, especially for Sustainable Development SDG target 6.3). However, sustainable use of wastewater needs an enabling environment for change, including suitable legal and regulatory frameworks, appropriate financing mechanisms, and social acceptance. As the overall demand for water grows, the quantity of wastewater produced

Sustainable urban storm water management incorporating technical, economic, structural, non–structural, and social dimensions is vital for maintaining better urban dwellings, lifestyle, and stress–free ecosystems.

and its overall pollution load are continuously increasing worldwide. On average, high–income countries treat about 70% of the municipal and industrial wastewater they generate. That ratio drops to 38% in upper–middle–income countries, to 28% in lower–middle–income countries, and to 8% in low–income countries . This exasperates the situation for the poor, particularly in slums, who are often directly exposed to wastewater due to a lack of water and sanitation services.

In the face of ever–growing water demand, wastewater is gaining momentum as a reliable alternative source of water, shifting the paradigm of wastewater management from 'treatment and disposal' to 'reuse, recycle and resource recovery'. Wastewater management can be a cost–efficient and sustainable source of energy, nutrients, organic matter, and other useful by–products. The potential benefits of extracting such resources from wastewater go well beyond human and environmental health, with implications on food and energy security as well as climate change mitigation. In the context of a circular economy, wastewater represents a widely available and valuable resource. For every US$ spent on sanitation, the estimated return to society is US$ 5.5. Large–scale centralized wastewater treatment systems may no longer be the most viable option for urban water management in many countries. Decentralized wastewater treatment systems, serving individual or small groups of properties, have shown an increasing trend worldwide. They allow the recovery of nutrients and energy, save freshwater, and help secure access to water in times of scarcity. It has been estimated that the investment costs for these treatment facilities represent only 20–50% of conventional treatment plants, with even lower operation and maintenance costs (in the range of 5–25% of conventional activated sludge treatment plants).

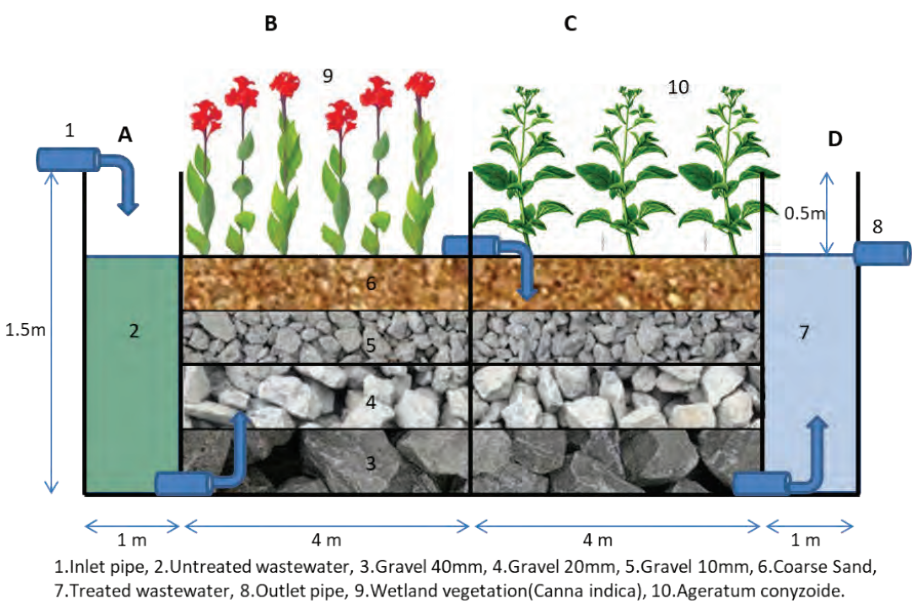
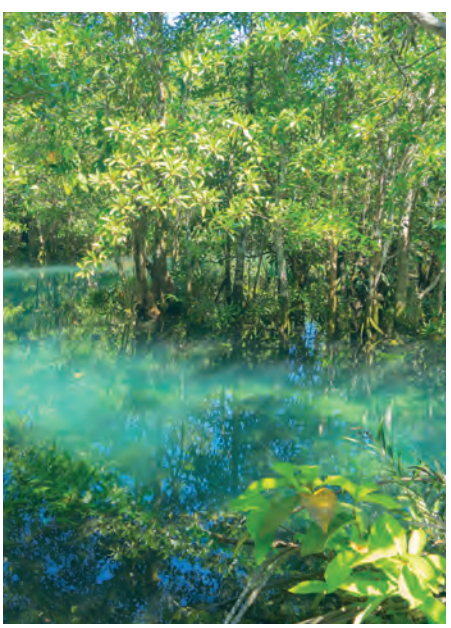



**Figure 1: Cross–section of the field scale CWs used in the study depicting media constituents along with flow regimen**



This allows for proactive preparation and more effective response strategies.

## Growing Water Scarcity.

Two–thirds of the world's population lives


**Figure 2: Constructed wetland implemented in Dhikoli (A) and Kothapally (B) (Source:15)**

in water scarcity areas . About 50% of the people facing this level of water scarcity live in China and India. About 500 million people live in areas where water consumption exceeds the locally renewable water resources by a factor of two 4. This includes parts of India, China, the Mediterranean region and the Middle East, Central Asia, arid parts of Sub–Saharan Africa, Australia, Central, and Western South America, and Central and Western North America which are dependent on water transfers from surplus water areas. Even though floods and droughts are natural phenomena and part of the spatiotemporal variable water cycle dynamics, their frequency and severity of floods and droughts have changed due to a combination of climate change and human activities. Changed storage capacity and runoff generation processes due to land use changes, including urbanization and other human activities, increase the occurrence of water–related disasters. The frequencies of floods and droughts are likely to change with increasing temperatures.

## Using wastewater as an alternative source of water

Water, food, nutrition, and energy security are important and vital issues for India and the world. The use of untreated or diluted wastewater for irrigation is since centuries. Reclaimed water offers opportunities for a sustainable and reliable water supply for agriculture in the SAT and water reuse becomes more economically feasible if the point of reuse is close to the point of production and to a water quality standard acceptable by a user that increases the potential for cost recovery. Treated and partially treated wastewater for ecosystem services can increase resource efficiency and provide benefits to ecosystems through reducing freshwater abstractions, recycling and reusing nutrients, allowing fisheries and other aquatic ecosystems to thrive by minimizing water pollution, and recharging depleted aquifers. Negative impacts of untreated wastewater on human health (increased diseases due to poor drinking and bathing water quality, unsafe food), the environment (decreased biodiversity, eutrophication, foul odors, increased greenhouse gas emissions, bioaccumulation of toxins), and the economy ( reduced agricultural, industrial productivity and market value, increased burden on healthcare, barriers to export, and water treatment).

Using appropriately treated water for agriculture and power generation enhances opportunities for water, food, energy, and nutrition security, and can help alleviate stresses. This will have positive repercussions on freshwater supplies, human and environmental health, income generation, and poverty alleviation. Water reuse can generate new business opportunities and support the green economy. There are vast opportunities for wastewater reuse and for the recovery of useful by–products, provided the appropriate incentives and business models are in place to help cover the costs as water scarcity is growing. Sustainable wastewater management requires suitable legal and regulatory frameworks that reduce the pollution load upfront, creating an enabling environment for change, cost recovery, and appropriate financing mechanisms, minimizing risks to people and the environment, building knowledge and capacity, and public awareness and social acceptance.

## Indian Scenario

In India, wastewater treatment is largely confined to municipal corporations, and that too with a record of non–functional treatment plants. Post–independence rural development mainly focused on livelihood improvement, housing, development of road infrastructure, and access to primary healthcare and education. Since the start of the millennium, drainage infrastructure across rural India has steadily improved. During the last decade, rural sanitation has received increased attention with government schemes such as the Swatch Bharat Mission and MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act). Today, wastewater sumps at the tail end of village drains invariably foster mosquito breeding which results in increased occurrence of diseases. The typical characteristics of grey water resembles that of dilute wastewater with chemical oxygen demand of 120–150 mg/L and inorganic nitrogen concentration of 30–45 mg/L and is devoid of heavy metal which can be reused for agriculture after adequate treatment. India has already joined the league of water–scarce countries (below 1700 $m^3$ per capita year–1) in 2011 . India shares 17% of the global population but only 4% of global water resources. Indian economy is agrarian as 70% of the total rural population drives the economy, however, the rural–urban divide is prominent with the average rural income per capita year–1 being less than half of the urban counterpart,. Farmers in India are in distress as farming is not profitable and 55% of agriculture is rain–fed depending on the vagaries of the monsoon and the uncertainties are further increased with climate variability and

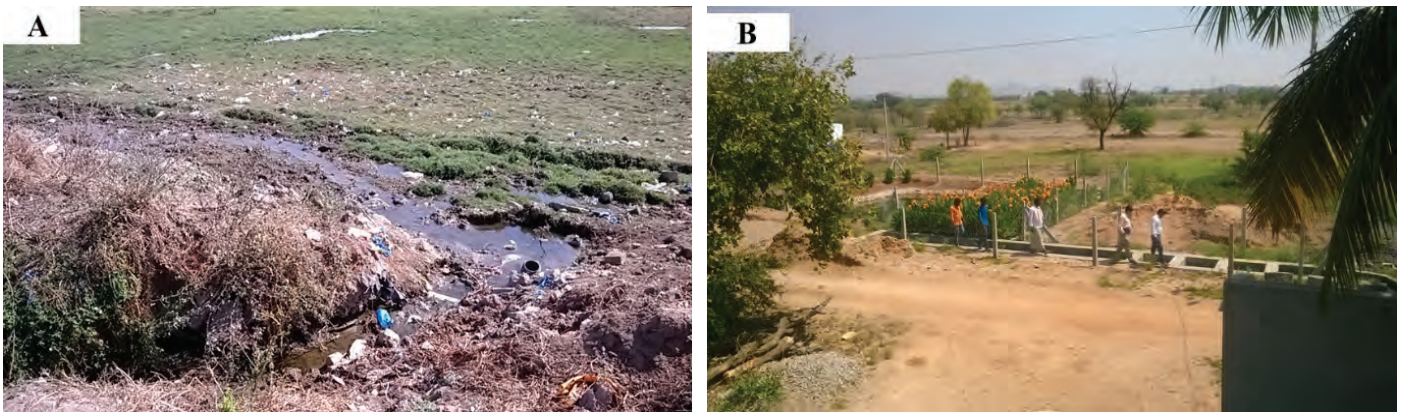



**Figure 3: Wastewater sump (A) in Mentapally was converted to a beautifully constructed wetland (B) (Source:16)**

climate change impacts. With the stagnant growth rate of 3.1 percent, achieving food, nutrition, and income security for the ever–growing population remains a challenge, and sustainable development and food security in the 21st century are challenged by growing water scarcity, climate variability, and climate change, growing population, urbanization, and increasing incomes.

## Availability of wastewater

Considering the number of villages in India as per the Integrated Information to be 608,662 with average household members 6 and 100 l freshwater availability per capita, wastewater generated per day in India works out to be 292 million liters day–1. Major cities of India produce about 38,354 million liters day–1 of sewage however, the total sewage treatment capacity in these cities is only 11,786 MLD . Often farmers use this water for cultivating vegetable crops near the wastewater drains however, reliable estimates of projected wastewater use in agriculture are scarce. Raw sewage being a perennial source of water often gets utilized for periurban agriculture. Transfer of metal ions from wastewater to cow's milk ranging from 12 to 40 times the permissible levels through para grass fodder irrigated with wastewater along the Musi river, Hyderabad was recorded. Raw wastewater irrigation poses health risks to farmers as well as consumers particularly salad crops such as onion, tomato, and leafy vegetables often consumed with minimal or no cooking. Moreover, grey water contains a high concentration of suspended particles reducing soil porosity that results in reduced infiltration rate and increased run–off. In the Indian context, the use of untreated or partially treated water in agriculture remains common.

## Harnessing the Potential of Low–cost Decentralized Constructed Wetlands

An environmentally sustainable and cost–effective treatment system for the treatment of wastewater (industrial/ domestic) by biological means (plants and microorganisms) is through the use of constructed wetlands (CWs). Often the wastewater generated from resource–poor rural households is easily biodegradable and simple low–cost technology like CW can abate the environmental degradation and cumulatively on a macroscale has the potential to influence major environmental degradation. The ICRISAT–led project Water4Crops (funded by Govt. of India and the EU), in which 22 European and 12 Indian institutes demonstrated the potential of decentralized wastewater treatment technology. Studies with sub–surface as well as free–water surface–constructed wetlands have clearly highlighted their potential. Several constructed wetland–based decentralized wastewater treatment units (DWATs) were constructed subsequently as part of the watershed development program as well as through CSR projects Table 1. In rural areas, wastewater management remains a new concept and the known potential of low–cost eco–friendly wastewater treatment technologies such as CWs for safe reuse can be achieved in water–scarce SAT villages. Such units increased water use efficiency and built climate resilience among the resource–poor rural communities. The adoption of a business model involving local SHGs (Self–help groups) ensured the long–term sustainability of decentralized wastewater treatment technologies in resource–poor villages (Fig 1).

The CWs mimic the physicochemical and biological processes commonly seen in natural wetlands such as filtration, sedimentation, adsorption, absorption, biodegradation as well as phytoremediation (Fig 1). In CWs however, the flow is engineered to achieve more precise control, to achieve desired effluent water quality13. The flow of the wastewater is engineered through a sand–gravel bed, vegetated with specific macrophytes known for their phytoremediation capacities (Fig 1). The combined effect of plant nutrient uptake and microbial biodegradation of organics present in the wastewater by the root–zone micro–organisms facilitate wastewater treatment in constructed wetlands. This type of wastewater treatment unit does not require chemicals or electricity and hence periodic harvesting of the wetland biomass is generally the only operational cost associated with such units. Typical removal efficiency observed in constructed wetlands is given in Table 2. The harvested nutrient–rich biomass can be easily converted into good–quality compost. In water–scarce semi–arid tropic villages water is precious and hence increasing water use efficiency through low–cost scientific intervention has gained traction over the last few decades. As agriculture accounts for more than 70% of the total anthropogenic withdrawal of natural water, such endeavors are very much the need of the hour to achieve 'more crop per drop'. Based on the results from the W4C (India–EU project) Government of India (GoI) has already put in place the policy

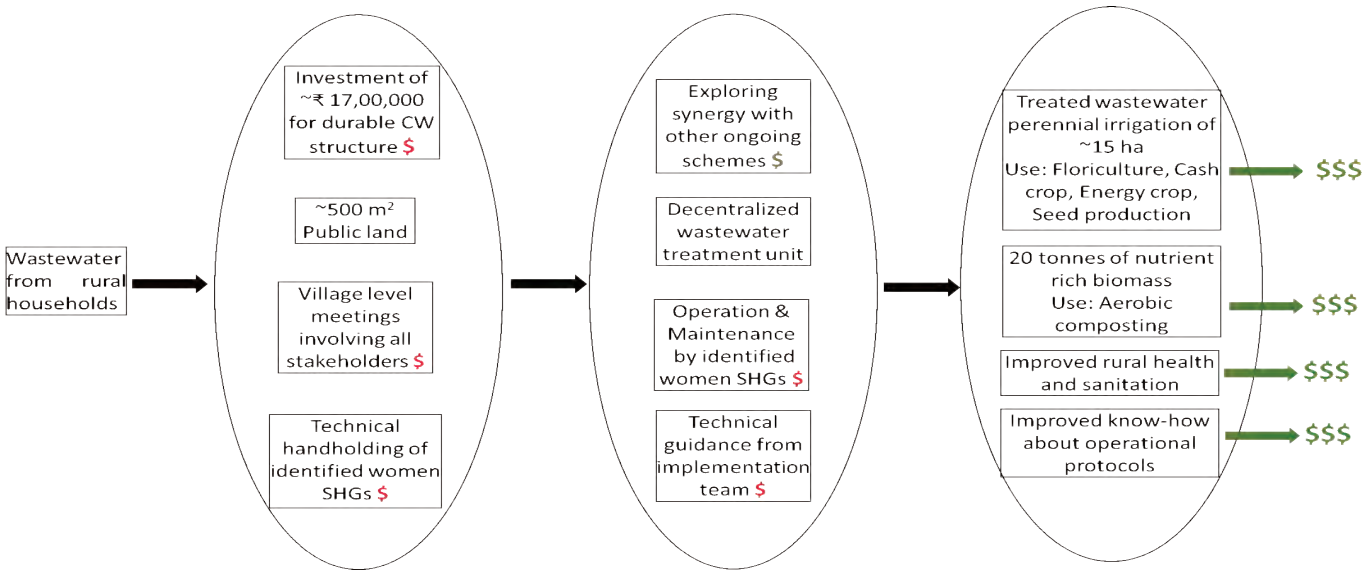



**Figure 4: Components relevant for implementation of a constructed wetland as a business model for a village of 1000 households.**

for Gram Panchayats where the GoI provides financial assistance for the construction of the wetland in the village provided the GPs provide the needed land for construction.

Table 1. Location of field–scale DWAT systems in India implemented through CSR fund.

| Village | District | | Capacity ($m^3$/day) | Collaboration work |
|---|---|---|---|---|
| Pendakal | Kurnool | Andhra Pradesh | 51 | ICRISAT, NGO, Power Grid corp |
| Mentapalle | Wanaparthy | Telangana | 20 | ICRISAT, RECL, NGO |
| Rajapeta | Wanaparthy | Telangana | 25 | ICRISAT, RECL, NGO |
| Dhikoli | Jhansi | Uttar Pradesh | 10 | ICRISAT, CAFRI, NGO |
| Dandiganahalli | Kolar | Karnataka | 10 | ICRISAT, NGO, coca cola |
| Doddanthapur | Bellary | Karnataka | 12 | ICRISAT, NGO, JSW Foundation ICRISAT, NGO, Power Grid corp |
| Ukkali | Bijapur Medak | Karnataka Telangana | 90 | ICRISAT, NGO, Asian |
| Bhanoor | | | 56 | |

• RECL = Rural Electrification Corporation Limited; CAFRI = Central Agroforestry Research Institute. Source:16.

## Constructed wetland operation and maintenance

As we get the volume of CW from the inner dimensions (Figure 1 a) as 30 $m^3$, considering the estimated porosity of 0.55, the overall wastewater retention capacity was computed as 16.2 $m^3$. This implies a 3.3 $m^3$/day or 2.29 l/min of flow rate considering a designed HRT of 5 days. The HRT here represents the time a water drop takes to travel from the inlet to the outlet of a CW. The optimum HRT for CWs reported in the literature is 3–5 days, however, as we expect the bed porosity to decrease over time due to clogging of the filter bed reducing HRT gradually a designed HRT of 5 was opted. For simplicity of operation and to avoid cost escalation, a flow rate of 2 l/min was set as the designed flow.

Table 2: Average removal efficiencies of constructed wetlands treating rural grey water

| Parameters | Removal Efficiency |
|---|---|
| Chemical Oxygen Demand | 72% |
| Sulphate | 53% |
| Total Suspended Solids | 91% |
| Inorganic Nitrogen | 64% |
| Total coliform | 88% |

**Source: 16**

Despite the known potential of low–cost wastewater treatment technology of CWs, its wide–scale adoption is limited. ICRISAT scientists have carried out in–house as well as field–scale research on constructed wetlands in collaboration with other national and international research organizations over the last decade to enhance awareness amongst the villagers as well as policymakers. A small constructed wetland was implemented in the Dhikoli village (Jhansi tehsil) of water–scarce Bundelkhand in Uttar Pradesh (Fig 2) where farmers used the treated wastewater for fodder production. Using the prowess of local masons and adhering to good quality construction practices the CW was

established with Rs.1,72,000 only. The expected minimum life of the unit is 7 years. Replacement of the filter media (gravel and sand) should rejuvenate the unit post this period. During the water–scarce summer months, local farmers grew fodder over a 1.15–acre adjacent to the CW with the availability of a perennial source of treated wastewater. Fodder cultivation supplemented farmer's income of Rs. 8000 annually. The availability of water for irrigation and income during the dry summer months curbed outward migration from the villages in search of livelihood. The Cana indica plants harvested every 45 days from the CW provided 230–260 kg (fresh weight) of nutrient–rich biomass throughout the year for soil amendments and composting. As part of the India–EU project Water4Crops ICRISAT scientists implemented one larger constructed wetland treating 20$m^3$/day of wastewater in the Kothapally village of the Ranga Reddy district of Telangana (Fig 2) in partnership with local farmers. The CW demonstrated consistently high removal efficiency of more than 90% for total coliform and total suspended solids. With the investment of Rs. 700,000, the only maintenance required was the periodic harvesting of Canna indica and Typha latifolia plants grown in the CW at Kothapally. Availability of this perennial source of irrigation water helped farmers to ensure crop survival during the unpredictable kharif 'dry spells' in addition, during the first year farmers grew sweet corn in summer using treated wastewater benefitting them with the revenue of Rs 70,000.

Successful implementation of constructed wetland at Mentapally village of the Wanaparthy district of Telangana where the wastewater sump near the tail end of the village drains was converted into a CW–based wastewater treatment facility (Fig 3). The potential of the unit was recognized by the Swatch Bharat Mission team of Telangana and further details of the unit can be found in the government portal (https://sbmgramin.wordpress.com/2019/12/03/recl–sets–up–wastewater–treatment–plant–in–wanaparthy/).

Often social and financial aspects get ignored as focus is given to the design and technical aspects of the CWs. Active participation and involvement of villagers in decision–making during the implementation and post–implementation operation phase ensures villagers' choices. Two–way communication helps to set realistic expectations and delineation of the roles and responsibilities of local user groups or gram panchayats towards the maintenance of CWs. This will help to resolve conflicts that sometimes may arise if beneficiaries refuse to pay for the maintenance of the unit. Overall, CWs together with other interventions such as aerobic compost unit, biogas unit, cash crop (e.g. flower or lemon grass) production using the treated wastewater and localized value addition of such produce together as a business model provides the best implementation strategy. Thus revenue generation and not mere wastewater treatment should always be the quest of such 'waste to wealth' initiatives (Figure 4).

## Advantages of the DWAT system16

- Devoid of chemicals or electricity; maintenance can be done by rural communities.
- Facilitates increased water–use efficiency of resource–poor rural communities.
- Income source during the construction, operation, and maintenance activities.
- Enables recycling of nitrogen, phosphates, and other nutrients.
- Biomass generated in CW can be used for composting, biogas, or ethanol production.

## Limitations of constructed wetlands

- Requires lined drainage network.
- Incomplete removal of nutrients or coliforms.

## Learnings from DWAT scaling–up

- The SSF CW is preferred over FWS CW despite the additional cost of media for the former as it avoids mosquitoes, pests, and foul odor nuisance.
- Both Canna indica and Typha latifolia are suitable for field–scale units because of their short stabilization phase post–transplantation, tolerance to both water stress and abundance conditions, as well as high phytoremediation potential.
- A better approach is to estimate the flow based on the household number or total supplied water.
- Updating and utilizing data on household numbers, volume and frequency of water supply, and length of cemented drainage network from the GP can help to approximate the wastewater flow.
- Rainwater data. terrain topography and land registration data can help not only to estimate stormwater volume but also to check the availability of public land and its suitability for this activity.
- The number of households in the village may not be useful for deciding the design treatment capacity of CW as the village wastewater often flows in different directions through multiple drains, as per the terrain. A better approach would be to identify village drains that receive wastewater from at least 100 households for this activity.

**Dr. Aviraj Datta**

Dr. Aviraj, serving as a Scientist Wastewater management at ICRISAT, and done his PhD in from IIT Madras and worked in W4C (India–EU Project). He has been associated and implemented several constructed wetland–based decentralized wastewater treatment units as part of various watershed development projects across Karnataka, Telangana, Andhra Pradesh, and Uttar Pradesh over the last 9 years. He has been working with rural communities in tribal villages across India for last several years to improve their livelihood through scientific intervention. Dr. Aviraj is GATE scholar and a recipient of DAAD fellowship. For his PhD thesis he received the GE–Eco–magination award at the 51st convocation of IIT Madras.

# BECOMING WATER POSITIVE:
# How FluxGen Revolutionizes Industrial Water Management

Water, a resource so deeply entwined with our daily existence, often slips through the cracks of our consciousness– taken for granted like the air we breathe. Yet, beneath the surface of this complacency lies a stark reality: approximately 2 billion people worldwide reside in countries grappling with inadequate water supply. Freshwater, the sole variety deemed suitable for human consumption and utility, carries a daunting price tag when we delve into desalination– about 20 times the cost of procuring the same volume of freshwater. This revelation casts a shadow on our perception of abundance, for freshwater comprises a mere 2% of the world's total water supply, a fraction that leaves us with substantially less than we might assume for our consumption needs.

Groundwater, a pivotal source of freshwater in India, shoulders a significant burden in sustaining the country's burgeoning population. India, housing a fifth of the world's inhabitants, possesses access to a mere twentieth of the world's renewable water resources. In light of this imbalance, India's quest for sustenance has spurred excessive extraction of groundwater, now eclipsing 25% of the global total and surpassing the combined withdrawals of both the United States and China. The consequences of this monumental extraction are dire, with 21 major Indian cities teetering on the brink of a perilous water crisis, their groundwater reserves exhausted to a critical extent.

Our relationship with water takes on a complex dimension when we consider that roughly 78% of our aquatic reservoirs are artificial constructs, bearing testimony to our seasonal rainfall patterns and the urgent need for water conservation. It's important to note that a substantial portion of this water,

**Manasa S. Shastri**
Marketing Lead at FluxGen

holds a Master's degree in Journalism and Communication from the University of Mumbai. Currently based in Bangalore, she is deeply committed to collaborating with organizations dedicated to creating a sustainable and regenerative future. Her focus is on raising awareness about FluxGen's role in mitigating climate change impact for industries, for she believes greater sustainability objectives can only be met through collaboration instead of competition.

**Water fuels industries for production and processes.**

> FluxGen's impact extends beyond the realms of steel and mining industries.

**Leakages and pipe breakages substantially increase the cost of water to industries.**

primarily utilized for agriculture and irrigation, remains largely in its raw form. In contrast, water earmarked for industrial and human consumption undergoes rigorous processes such as filtration, disinfection, sedimentation, and other treatments to render it usable. This transformation incurs a considerably higher cost, primarily due to the energy–intensive nature of the industrial water treatment process, which not only elevates expenses but also underscores the environmental toll. Furthermore, the capacity for water storage plays a pivotal role in dictating the extent to which an industrial facility can effectively harness and manage this precious resource.

Industries stand as formidable contenders for the title of the most voracious consumers of water, contributing a substantial 8% to India's overall water footprint. This translates to an astounding volume of billions of kiloliters of water being harnessed and utilized by various industrial sectors. However, beneath this colossal demand lies a complex interplay of factors that not only drive up water consumption but also inflate the associated costs, casting a shadow over the sustainability of these operations.

The current landscape for water management within companies is characterized by labor–intensive and often inefficient processes. These methods not only consume a significant amount of human resources but also prove extremely time–consuming. One of the major drawbacks of these manual systems is the delayed detection of leaks within the infrastructure. Often, companies remain unaware of such issues until a later stage, resulting in an abnormal surge in water consumption. This not only adds substantial extra costs but also leads to a regrettable waste of a precious resource. By the time the issue is identified, a considerable amount of water has already gone down the drain. This inefficiency not only impacts the financial bottom line but also exacerbates environmental concerns, as the mismanaged water could have been directed to those who are in dire need.

The repercussions of inadequate water management reverberate beyond just operational inefficiencies. They extend to the realm of regulatory compliance, where a tangled web of organizations monitors various aspects of water consumption and treatment. The Central Pollution Control Board (CPCB) vigilantly oversees water consumption and treatment across businesses, ensuring adherence to environmental standards. The Central Ground Water Authority (CGWA) keeps a watchful eye on groundwater extraction and enforces stringent consumption reduction measures, with penalties looming over those who fail to comply. The Food Safety and Standards Authority of India (FSSAI) diligently supervises water quality and usage within the Food and Beverage (F&B) sector. Additionally, the Business Responsibility and Sustainability Reporting (BRSR) guidelines mandate that the top 1,000 SEBI–listed companies disclose

**Installations of water meters and other equipment in the facility.**

water footprint data for every product, adding another layer of transparency and accountability.

Furthermore, the specter of water scarcity and the escalating cost of this precious resource loom ominously on the horizon, exacerbated by the effects of climate change. As climate shifts intensify, the water landscape becomes increasingly unpredictable and precarious, posing formidable challenges to businesses and communities alike. In such a context, efficient and sustainable water management emerges not only as a strategic imperative but also as a moral obligation to safeguard our environment and ensure equitable access to this life–sustaining resource for generations to come.

Now, here's the beacon of hope amid the water management challenges: Industrial plants have the potential to curtail water consumption by a substantial margin, up to a remarkable 30%, by vigilantly monitoring leaks, identifying excessive usage, and taking prompt corrective measures. This is precisely where FluxGen steps in to offer its invaluable assistance. Our cutting–edge smart digital water management system serves as the guardian of your water infrastructure, centralizing crucial data and presenting it all in a user–friendly, unified dashboard. This unified view brings transparency to your water management practices.

What truly sets FluxGen apart are the real–time prescriptive alerts that act as vigilant sentinels, promptly flagging any anomalies, leaks, or excessive water consumption occurring anywhere within your water system. We firmly believe that what can be measured can be managed effectively. Our commitment to achieving water balance is reflected in our regular, timely, and detailed analytics, along with monthly reports that empower you with the insights needed to optimize your water usage and reduce costs.


**Smart water meters connected to pipelines.**

## Case Study: Our work with one of the key players in the Steel and Mining industry

Let's delve into a real–world illustration of our impact, showcased by our collaboration with the robust steel industry. The Indian steel sector, a formidable player in the nation's economic landscape, boasts a substantial GDP contribution, accounting for over 2%. This industry wields an impressive total steel–making capacity, standing at a staggering 154 million metric tons (MT).

The Ministry of Steel reports an upward trajectory in crude steel production, surging from 75.28 million MT in the fiscal year 2010–11 to an impressive 111.24 million MT in 2020–21. This substantial increase underscores a growth rate of 47.76% over the course of a decade. FluxGen's engagement in this dynamic industry offers a compelling case study of our transformative impact, as we strive to enhance efficiency, reduce costs, and promote sustainable water management practices, all contributing to the continued success and growth of this critical sector.

In the intricate world of steel production, water plays a pivotal role, finding its place in an array of essential processes such as cooling, quenching, water treatment, cooling towers, dust cleaning, fire control, and cutting. The quantum of water required, on average, for the production of each ton of steel hovers between 2 to 20 cubic meters, contingent on the specific company and the processes they employ. Crucially, water finds its stronghold in key plants like the sinter plant, coke plant, blast furnace, basic oxygen furnace, and is equally instrumental in continuous casting and hot rolling operations.

Here at FluxGen, we harness the power of cutting–edge AI and IoT technologies to decipher intricate water consumption patterns and craft innovative solutions that champion efficiency and sustainability in water usage. Our recent collaboration with a prominent steel company serves as a testament to our commitment. In this partnership, we extended our expertise to two integral plants– the mining and ferrochromite plants.

For our client, 3 cubic meters of freshwater is typically required for the production of each ton of crude steel. The scale of the company's steel production facility posed a significant challenge in terms of effectively monitoring and addressing abnormal water usage points within their expansive system. The issue of excessive water consumption, especially in water–intensive processes like slag cooling, loomed large. Manual inspections and water consumption tracking were not only time–consuming but also inefficient, mainly due to the absence of a comprehensive water management system. This shortfall compounded the problem of achieving water balance and subsequently led to compliance issues.

In response to this pressing challenge, FluxGen embarked on a strategic intervention comprising a series of meticulously planned steps. Our journey began with a comprehensive survey of their sprawling facilities, allowing us to gain deep insights into their infrastructure and processes. This, in turn, facilitated the identification of all potential points that warranted metering for precise water monitoring.

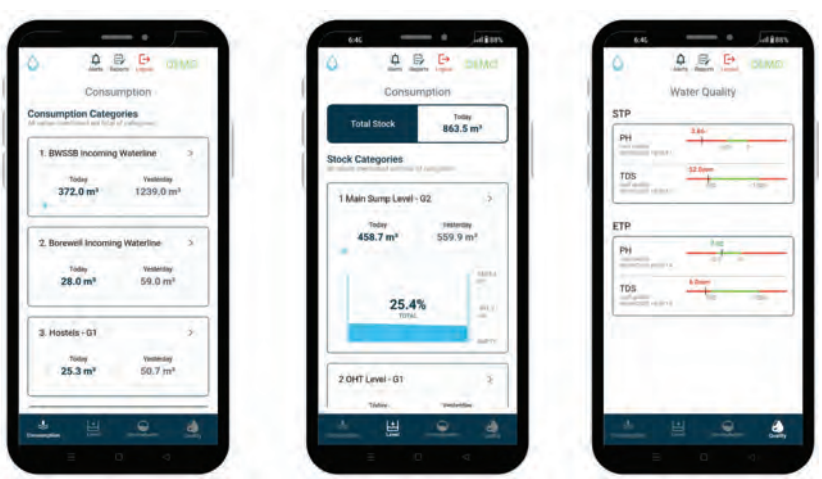
Once the meters and water level sensors were strategically installed and thresholds were set, we seamlessly transitioned to the next phase of our solution. A unified dashboard, purpose–built for real–time water monitoring needs, was crafted to centralize and present critical data. This data, collected wirelessly from the installed meters, found a secure home in a cloud–based system, ensuring accessibility and data integrity at all times. FluxGen's systematic approach not only rectified the existing issues but also laid the foundation for proactive water management and regulatory compliance.

**An example of the desktop interface of AquaGen software.**

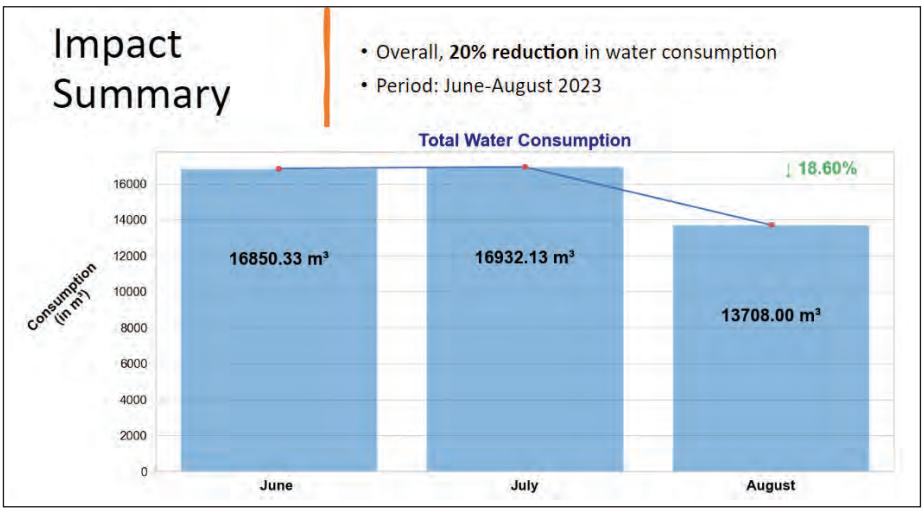
Our user–friendly AquaGen mobile and web application serve as the cornerstone of our solution, offering continuous, real–time data accessibility for water flow and level monitoring, 24 hours a day, 7 days a week. The application features a built–in alert system that springs into action, promptly notifying stakeholders whenever daily threshold levels are breached or if there's any unusual surge in water usage or detection of a leakage within the system. This feature proves to be a game–changer, particularly for industries operating on a massive scale, where manual inspection of sprawling facilities is an arduous task.

To further enrich the user experience and facilitate informed decision–making, we organize monthly review meetings to delve into the performance metrics and insights gleaned from our data analytics. Our dedicated customer care team stands ready to provide assistance whenever it's needed, ensuring a seamless and effective experience.

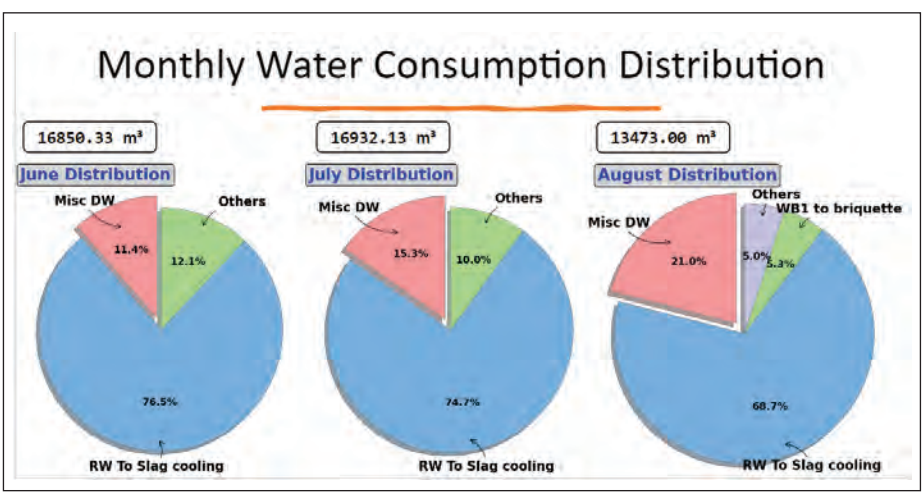
Our collaboration led to an impressive 20% reduction in water consumption, observed between the months of June and August. The most significant reduction– 3400 cubic meters– occurred in the Slag Cooling water line, owing to our real–time alerts and anomaly detection capabilities. These achievements were underpinned by the comprehensive water consumption patterns unearthed through our solution, offering a more profound understanding of how and where water was being utilized. This, in turn, laid the foundation for the creation of a water balancing report, charting a course towards more efficient and



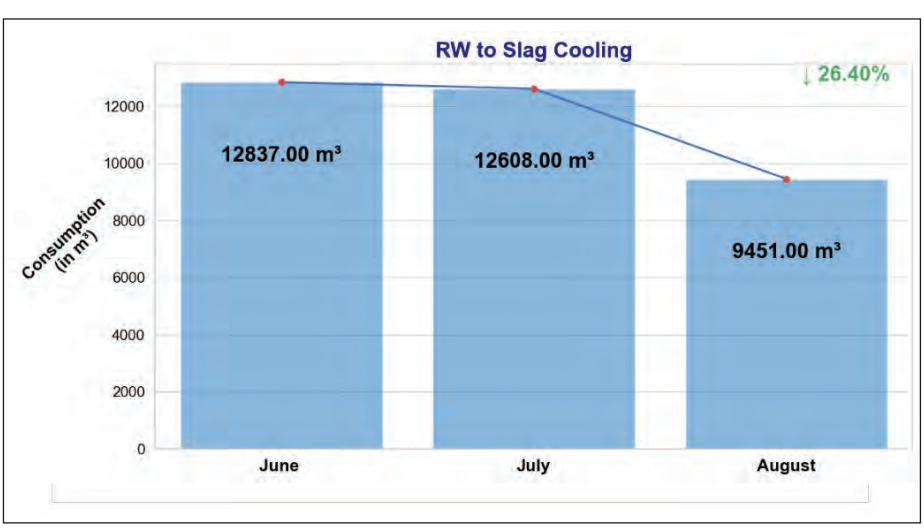

**An example of the mobile interface of AquaGen app.**




**A graph tracking the total water consumption at the facility from June to August.**




**Pie graphs showing the distribution of the water used for three different categories (Slag cooling, Miscellaneous drinking water and water used for other processes) at the facility from June to August.**




**A graph tracking the water consumption in the Slag Cooling line at the facility from June to August.**

sustainable water management practices.

Caption: Pie graphs showing the distribution of the water used for three different categories (Slag cooling, Miscellaneous drinking water and water used for other processes) at the facility from June to August.

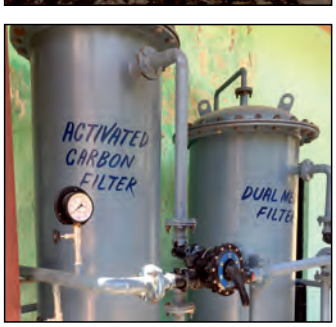
FluxGen's impact extends beyond the realms of steel and mining industries. We take immense pride in our accomplishments, notably helping a hospital conserve a substantial 28,470 kiloliters of water, equivalent to 10% of their regular water consumption. This achievement translated into an annual cost savings of Rs. 17.5 lakhs for the hospital, made possible through the implementation of the AquaGen software.

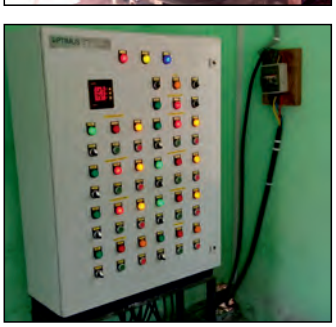
In our partnership with a dairy plant, we orchestrated a 19% reduction in water consumption, a feat that resulted in water savings equivalent to filling 180 Olympic–size swimming pools. This endeavor underscores our commitment to promoting sustainability across diverse sectors, transcending industry boundaries.Our journey has been greatly enriched by the trust and collaboration of more than 100 clients hailing from various industries. Each drop of water saved represents a tangible contribution to sustainability objectives, and we are deeply grateful for the opportunity to play a pivotal role in their journey towards water conservation.

We are also honored to have our work recognized and acknowledged by the esteemed Prime Minister, Shri Narendra Modi, in his Mann ki Baat series. This recognition reflects our unwavering commitment to derisking industries from the impacts of climate change and steering them toward becoming water–positive entities in the foreseeable future.

Our aspiration is rooted in creating a sustainable future where the precious resource of water is accessible to all who need it, enabling not just survival but thriving for communities and industries alike. FluxGen remains resolute in taking bold strides toward this vision, embodying our commitment to a world where water is not just a commodity, but a lifeline for all.

JAI MAA ASSOCIATES
ENGINEERS & CONTRACTORS



**JAI MAA ASSOCIATES** Engineers & Contractors providing services to Military Engineering Services for last two decades

| | |
|---|---|
| Pre-Engineered Building & Infrastructure | Electro-mechanical utility services |
| Water & Wastewater Treatment Projects | Low Tension Electric Works |
| Sewage Disposal and Water Distribution Network | Incinerators |

JAI MAA ASSOCIATES
ENGINEERS & CONTRACTORS

## JAI MAA ASSOCIATES

Shop No. 33 Gopinath Bazar, Delhi Cantt - 110 010
M.: +91 98111 88819, Fax: +91 11 2568 2346, E.: jaimaaassociatesdelhi@gmail.com, jaimaa98@gmail.com, info@jaimaaassociates.in

# REDUCTION IN WATER CONSUMPTION OF A PATHOLOGY LABORATORY

**Dr Mayur J. Kapadia**
*Trainer, Writer, Editor & Former AGM, Quality Control Dept, GNFC Ltd, Bharuch, Gujarat.*
*Email: mjkapadia61@gmail.com*

He is a Trainer, Writer, Editor, former AGM & Laboratory Head of GNFC Ltd, Bharuch, Gujarat, India. He possesses industrial experience of 40 years in the fields of Quality Control, Lab Set up, Cooling Water Management, ISI certification, and many other areas. He has to his credit technical suggestion awards, >25 publications and >20 presentations. He has been conducting training programs on Quality Control, NABL, ISI certification, Cooling Water Management, etc. He is an active member in committee of Bureau of Indian Standards, which has also conferred upon him an Appreciation award for his immense contributions.

Pathology Laboratory – a place where medical knowledge and scientific practices are connected together for medical diagnosis through laboratory examination and analysis of blood, tissue, body fluids, and other samples – aids doctors' roles in effectively diagnosing the diseases. Pathology laboratories operate either as standalone facilities or as a part of hospitals to help the medical team better understand the causes of various diseases. Different branches of pathology laboratory like Haematology, Flow Cytometry, Molecular Pathology, Microbiology, Virology, Bacteriology, Clinical Chemistry, Immunology, Serology, Drug Testing etc need to use water for various purposes.

With water becoming increasingly scarce, its supply is curtailed and cost hiked for non–domestic users like Pathology Laboratories. Such water cuts and higher charges do impact the revenues of pathology laboratories. In India, the state governments regulate all provisions regarding water supply. The cost per M3 of raw water by different states range from Rs 15 to 75. This cost is enhanced by the municipalities towards the charges applied for treating and piping clean water to users. Particularly in summers, water becomes a commodity as precious as gold ! Therefore, it should be an endeavour of every citizen and business units of India to conserve water for environmental preservation and increase their revenue.

Water is an overlooked part of laboratory sustainability. Water has been pouring from the taps


Pathology lab

and then disappears down in the drains. It is nearly invisible! But, it is not free – it comes from somewhere and it has to be cleaned, transported, stored, and cleaned again before being returned to the environment. All of that has an enormous energy and carbon footprint. Therefore, water needs to be given due weightage in laboratories because they consume much more water than people expect, in the wake of the fact that they need to operate instruments and equipments like Ice machines, Autoclaves, Glass washers, Water baths, Aspirator pumps, Evaporators and Condensers for carrying out various pathological tests. This paper highlights some of the practical ways which could be adopted and ensured by Pathology Laboratories for conserving the precious water.

Witer Mizer

## Autoclave:

Autoclaves used extensively to sterilize equipment, reagents, and hazardous wastes in pathology labs consume a lot of water. Small benchtop autoclaves, don't use a great deal of water, but steam jacketed autoclaves are often the biggest water consumers.

The use of water in a steam jacketed autoclaves is 2–fold – (i) to generate steam to heat the unit in order to sterilize equipment, and (ii) to cool the steam before discharge. For cooling the hot steam before discharge, cold water is continuously added so that melting of the drain pipes is not caused when steam is drained. This process can use as much as 250 – 300 litres of water per cycle. Retrofitting of this type of steam jacketed autoclaves should be considered, wherein the cooling water is stored in a reservoir and supplied again to autoclave after attaining sufficient temperature.

For restricting temperature of steam being drained, equipment called WATER MIZER should be installed, which is a water saving and tempering device that efficiently mixes cold water with steam condensate discharged from autoclave to reduce the discharged water temperature before it enters the pipe network. The water miser monitors the drain temperature and applies cold water only when needed. The temperature–actuated valve and built in thermometer of water miser ensures reliable and continuous monitoring of effluent temperature and mixing rate of cold water.

The best idea to reduce continual stream of water being drained is that water–saving autoclaves should be deployed in place of steam jacketed autoclaves. The water saving autoclaves capture steam in a closed container and use temperature sensors to know exactly how much water is needed to cool down the steam. Once appropriately cooled, it can be flushed down to the drain. New laboratories must go for this type of water–saving autoclaves, even at a higher capital cost. Replacement of steam jacket autoclaves by water–saving devices can cut back water usage by a huge margin of >75 %.

## Single–pass cooling

There are many processes, chemical reactions, equipments and instruments that require water for cooling. Apparatus of Kjeldahl Nitrogen distillation & Soxhlet distillation deploy glass condensers with continuous flow of tap water. Cooling in equipments like Rotary evaporators, Measuring cells, CCD cameras, Calorimeters, Polarimeters, etc is achieved by running tap water continuously and draining the hot water into sink. Not only does this use a lot of tap water, it can also leave laboratories vulnerable to flooding, when unattended.

For conserving precious water, investment in closed–loop water re–circulation equipments should be considered. Recirculating coolers and chillers provide an environmentally–friendly alternative to cooling with tap water. Water is recirculated around a closed system rather than flowing down the drain. Additionally, they provide constant and repeatable parameters such as flow rate, pressure and temperature.

If such replacement is not affordable for a lab, a simple but cost–effective way is to use an ice bucket alongwith an aquarium pump to create own system for cooling of the hot water coming out of the condensers / equipments.

## Vacuum aspirator

Water vacuum aspirators need about 8–10 litres of water per minute to work properly. This water is generally disposed off as a waste. Such aspirators should be replaced by vacuum pumps because they do not require water. Vacuum pumps also offer a greater control and better performance for generating enough vacuum.

## Glassware cleaning

Cleaning of glasswares and other labwares need lot of tap water, in addition to rinse water such as Distilled or Deionised Water. A Pathology Lab should take utmost care while consuming water for cleaning purposes:

- If an automatic washer is used, it should be ensured that it is fully loaded. Partial loads should not be allowed. If a new washer is to be purchased, it is good to

**Glassware cleaner**

do some homework as some manufacturers offer more energy–efficient models that require less water during their rinse cycles.

- One might think that not using an automatic washer is a good idea when it comes to water saving. However, the fact is that use of washer at full load will always use relatively less water than hand–washing the glasswares.
- When glasswares are not much spoiled, pre–washing step should be skipped.
- Whenever manual cleaning is carried out, instead of using running tap water, the sink should be filled to soak glassware.
- Many processes involved in lab need rinsing of glasswares with Deionised or Distilled or RO water. Users must use the correct water purity (grade / type) that is necessary for the application, rather than taking casual and lenient approach because it is convenient.
- For cleaning glass items used for staining preparations and colourimetric estimations, the technicians would prefer to rinse them prior to washing to make the stains faint. As a matter of fact, rinsing such glasswares with running tap water consumes good amount of water. Under such circumstances, one should prefer to soak dirty items in large bowl or sink prior to washing.

## Purified water:

For specific use in instrumental analysis like HPLC, GC, Polarimeter, Spectrophotometer and many more, Pathology Labs need high purity water generated through processes of Distillation, Deionisation or Reverse Osmosis. Since raw water consumption is almost 3 times of purified water produced, the laboratory personnel should be careful enough to operate high purity water generating apparatuses / equipments.

- The amount of water that gets wasted through purified water generators depends on the age and condition of the membrane filters in the RO unit. So, it is really important that labs upkeep and maintain their RO equipment.
- Cleaning of RO membranes correctly is very important. People generally use high and low–pH chemicals. However, the use of cleaning chemicals must commensurate with the type of foulants.
- It is not always appropriate to use low pH chemicals first, because it can cause organic foulants to lose their anionic charges and get ground into the membrane.
- If requirement of purified water is small, it is better to purchase it ready–made, rather than producing it within lab.
- The Reject Water of the RO unit is generally drained off. However, it should be collected and used for glassware cleaning, mopping, washing of parking area etc.

## Laundry:

A pathology lab needs to wash clothes like Lab coats, Caps, Napkins, Drying cloths, Dusters etc. A big laboratory has to wash a huge load of clothes.

It is best idea to run the washing machine when it has full load of dirty clothes. Apart from saving water, the user gets more clean clothes at full load because too much of water dilutes the detergent action and leaves clothes less clean. However, while washing a smaller load of laundry, one must make sure that the machine controls are adjusted to compensate water level with smaller load. Cold water wash cycle of machine consumes less water and energy. So hot cycle should be avoided.

Waste water from laundry cleaning should be directed for outdoor use. To augment this, the discharge hose of machine should be connected to a longer run off hose that can enable the collection and use of wastewater every time laundry is done.

## Leaky pipes and taps:

A single leaky tap and pipe can cause a significant setback in water–conservation efforts. It is important to realize that every drop of lost water is approximately 0.25 ml water. If water drop comes out every second, 21.6 litre water is lost each day per each leaky point. One can imagine the gravity of problem when there are various laboratories in a building with several leaky taps.

- It is a best practice to check the leakages periodically following at least a weekly schedule. Leakages could occur anywhere in the line that constantly maintains water. Such pipes and taps should be immediately identified and replaced.
- Poorly sealed toilets waste a lot of water. Many a times, it is difficult to make out whether there is a leak in the toilet or not. The internal leaks of flushing line can be checked by pouring a drop of colour pigment in toilet's tank and waiting for 10 – 15 minutes to see the passing of colour in the toilet commode. If the colour shows up in the commode, there is a leakage which needs to be arrested.
- Alongwith taps and pipes, the lab equipments like autoclaves, ice machines, and water cooled equipments should also be assessed

Low flow aerator

periodically for leakage. If found, they have to be promptly reported to maintenance agency of such equipments and early repair should be ensured.

## Efficient use of water:

It is need of the hour to use the water judiciously and efficiently through change in habits, use of gadgets / AI etc.

- **Use of timers:** Timers should be installed or used on critical or continuous water use applications. By using timers, equipment can be turned off during evenings and weekends, but ready for use when people arrive in the lab on next morning or Mondays.
- **Water flow check:** If equipment must have mains–to–drain cooling, it should be checked whether the water flow is greater than required. If so, it may be possible to fit a flow restrictor to save water usage.
- **Low–flow aerators:** Low–flow aerators can help reduce faucet flow from approx. 15–20 litres/ minute to < 5–6 litres/minute. These aerators simply screw onto the end of faucets and reduce flow without changing water pressure. It is an easy and cheap option that will significantly reduce water usage.
- **Open taps:** Habits should be changed to not let the water run through taps when there is no need to be running. While filling up containers with water, it is a common practice to walk away while the faucet is running. This can lead to unnecessary overflow. Alternatively, timed water valves should be installed for installation, which run for a certain amount of time or discharge a fixed amount of water. Use of foot pedals can also curtail water consumption because water will flow only when user presses the pedal.
- **Sink–to–toilet system:** A modern and technologically advanced option is to install a sink–to–toilet system in the lab. This system has an adjustable sink top attached to the toilet's refill cycle. The system stores the water in a reservoir, which is used to flush the toilet.
- **Hot water:** Generally, the kettles are filled upto the rim while warming water for certain estimations. Rather than filling the kettle fully with each use, one should measure the amount of water needed before filling the kettle. This way, the wastage of water can be avoided. Moreover, it also saves time and energy / gas.
- **Toilet flush:** Toilets of a pathology lab are used not only by staff but also by patients who visit lab to offer their urine and stool samples for testing. Sign boards should be placed instructing no disposal of tissue papers, cigarette butts and other stuff in toilet. If toilet is used conveniently like a waste basket, it needs unnecessary flushing. The flush tanks generally have capacity of storing 7.5 to 15 litres of water. Its button, once pressed, will pour entire quantity of water stored. Use of smaller button with a dual–flush toilet tanks saves 50% water. It is also worthwhile to displace part of water quantity of flush tank by dropping a bottle or bag filled with pebbles into the flush tank. This will displace some water and minimize the amount of water needed to fill the tank. High–efficiency toilets have improved flushing system that deploy water and vacuum for flushing, which dramatically reduce water consumption to almost one third of the common design. When going for toilet renovation, installation of high efficiency commode and flush tank must be considered.
- **Sensor taps:** These are automatic taps that are motion–sensory and include an aerator in the spout enabling dispersion of the water. They should be fixed on washbasins to reduce water consumption by upto 70%. These taps detect the movement and allows the flow

of water only when hands are moving beneath tap. As a result, user cannot keep the tap running, thereby avoiding wastage.

### Disciplined use of equipments:

Autoclaves and glass washers are two of the biggest water consumers in the laboratory. Whenever possible, a cycle should be run when they are fully and efficiently loaded. This type of action needs coordination among other departments of laboratory. To follow a schedule, say twice in a week on every Monday & Thursday, for operation of such equipments can bring harmony among various departments, since all are aware about the schedule.

Instruments which are operating on 24 hourly bases should be switched off at night and on weekends. Further, ice machines should be switched off when not in use. These actions not only save water, but also energy.

### People Involvement:

Saving water in the lab is everyone's responsibility, whether the person works only once a month or for many hours every day. Therefore, involvement of people in the endeavour has a big ground to play. It is often easier to get everyone motivated for water conservation if their suggestions are accepted, updates are provided on regular basis and inspiration is provided to achieve newer goals / heights.

The readings of water meter should be recorded and monthly consumption of water should be worked out. Such consumption figures should be displayed on notice boards / computer screens with immediate next target, which is lower but achievable. Constant follow up and genuine efforts could bring about gradual reduction in water consumption.

Another way of involving staff and getting their commitment towards water conservation is to get ISO certification like 9001 (QMS) or 14001 (EMS). As a part of such certifications, the laboratory needs to set and achieve various goals. Goal of water conservation could be achieved gradually in small steps, say 5% reduction on annual basis year on year. Working toward a certification can help people become more aware of the part they play in saving water. From there, they can examine practical ways to cut down the water usage.

### Conclusion

The reduction in fresh water consumption has clear financial and environmental benefits for a Pathology Laboratory. Water conservation is a sustainable practice that can fundamentally change laboratories to become more environmentally friendly. The world is in the midst of a climate emergency and therefore sustainability is more important, pertinent and prominent now than ever before.

Saving water does not require any major efforts. By changing a few small habits and work practices, we can go a long way towards making the world a better place! It can happen through a practical, progressive plan that requires everyone's participation. The small ideas and steps presented in this article would not save a lot of water on their own, but they will definitely add up to substantial figure over time! Using water efficiently helps to preserve the environment and take some pressure off of the public water supply. At the same time, it cuts down the utility cost of a laboratory to improve bottom line of balance sheet of the laboratory.

# BAD ODOUR REMOVAL FROM HAZARDOUS WASTE MANAGEMENT SITE

**By Mr. Ashutosh Vadanagekar & Mr. Rajesh Narayan**

## Background

Amalgam Biotech is manufacturer and supplier of Bio cultures, Odour Control enzymatic Biotechnology products for environment pollution control. Odoserve is a plant chemistry based organoleptic compounds and used by misting to remove smell of mercaptan, ammonical, faecal, putrefying, garbage, fishy etc. Amalgam Biotech took an initiative of testing gases emitted at Hazardous waste management sites.

This 50 meters * 20 meters campus provides facility for hazardous waste collection, segregation from nearby areas of Ahmedabad, Gujarat, India

## Challenge

This Hazardous waste management facility are sources of emission of toxic gases, strong fumes, stringent chemicals and mixed Odor. Approximately known measurable 24 gases are released from this hazardous waste management facility. These gases caused adverse impact on the environment and occupational health of the workers.

Ammonia detection found to be 234 ppm. Acetaldehyde was 1655 ppm, however permissible limits of 8 hours exposure, as per factories Act 1948 is 100 ppm. Also, Ethyl acetate was 345 ppm, Methyl mercaptan was 143 ppm. Methyl Sulfide was 254 ppm which is in higher concentration and caused nuisance to the society and industrial area.

| No | Emissions | No | Emissions |
|---|---|---|---|
| 1. | Ammonia | 13. | Methyl sulde |
| 2. | Acetaldehyde | 14. | N – butyraldehyde |
| 3. | I – valerate / Butyl Butarate | 15. | Propionaldehyde |
| 4. | I – butanol/ Butanol –1 | 16. | N – valeraldehyde |
| 5. | Methyl disulde/ Di Methyl disulde | 17. | Propionic acid |
| 6. | Ethyl acetate | 18. | N – valerate |
| 7. | Hydrogen sulphide | 19. | Styrene |
| 8. | N – butyric acid / iso butanol | 20. | Tri methylamine |
| 9. | I – butyl aldehyde | 21. | Toluene |
| 10. | I – valeraldehyde / iso valeraldehyde | 22. | VOC |
| 11. | Methyl isobutyl ketone | 23. | Xylene |
| 12. | Methyl mercaptan | 24. | SO2 |

**Table 1: Emissions at hazardous waste management facility**

## About OdoServe

OdoServe is a plant chemistry based organoleptic compounds. OdoServe misting can be done by cold fogging machine which deliver 25 micron or lower mist particles. Also, this liquid can be added in Process water/ Treated water/ Condensate water/ ETP Wastewater to remove bad odour.

## Observation

Very stringent, strong Odour found during 1st monitoring for all 24 gases. Propionic acid fumes concentration was 950 ppm, Hydrogen sulphide concentration was 504 ppm. Monitoring team was equipped with protective covering for safety & health aspects, as initial Odour concentration was high and unacceptable.

## Solutions to the problem:

The bad Odour molecules were engulfed by our Odour control product 'OdoServe'. OdoServe was misted in the hazardous waste facility for 3 hours intermittently which proved effective. After use of OdoServe, for the 1st time and 2nd time, percentage reduction (%) achieved was huge as observed in the table below:

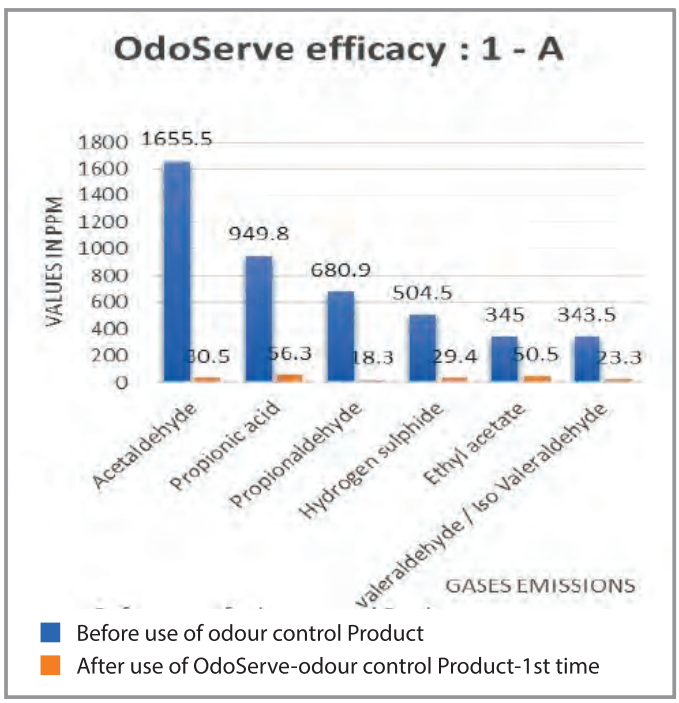
| Sr. No | Name | Unit | Before use of Odour control Product | After use of OdoServe – Odour control Product 1st time | % Reduction –1st | After use of OdoServe– Odour control Product – 2nd time | % Reduction – 2nd |
|---|---|---|---|---|---|---|---|
| 1. | Ammonia | ppm | 234.0 | 36.2 | 84.5 | 34.5 | 85.3 |
| 2. | Acetaldehyde | ppm | 1655.5 | 30.5 | 98.2 | 38.2 | 97.7 |
| 3. | I – valerate / Butyl Butarate | ppm | 15.4 | 12.1 | 21.4 | 8.2 | 46.8 |
| 4. | I – butanol / Butanol –1 | ppm | 178.7 | 36.6 | 79.5 | 31.0 | 82.7 |
| 5. | Methyl disulfide / Di Methyl Disulfide | ppm | 0.9 | 1.2 | –33.3 | 1.2 | –33.3 |
| 6. | Ethyl acetate | ppm | 345.0 | 50.5 | 85.4 | 19.8 | 94.3 |
| 7. | Hydrogen sulphide | ppm | 504.5 | 29.4 | 94.2 | 36.1 | 92.8 |
| 8. | N – butyric acid / Iso Butanol | ppm | 334.0 | 28.1 | 91.6 | 15.9 | 95.2 |
| 9. | I – butyl aldehyde | ppm | 221.3 | 9.1 | 95.9 | 4.0 | 98.2 |
| 10. | I – valeraldehyde / Iso Valeraldehyde | ppm | 343.5 | 23.3 | 93.2 | 3.9 | 98.9 |
| 11. | Methyl isobutyl ketone | ppm | 231.5 | 7.1 | 96.9 | 14.6 | 93.7 |
| 12. | Methyl mercaptan | ppm | 143.6 | 6.0 | 95.8 | 10.8 | 92.5 |
| 13. | Methyl Sulde | ppm | 254.9 | 4.9 | 98.1 | 10.7 | 95.8 |
| 14. | N – butyraldehyde | ppm | 122.0 | 6.6 | 94.6 | 9.3 | 92.4 |
| 15. | Propionaldehyde | ppm | 680.9 | 18.3 | 97.3 | 17.9 | 97.4 |
| 16. | N – valeraldehyde / Pentanal | ppm | 283.9 | 12.0 | 95.8 | 4.5 | 98.4 |
| 17. | Propionic acid | ppm | 949.8 | 56.3 | 94.1 | 50.3 | 94.7 |
| 18. | N – valerate / Pentonic Acid | ppm | 294.0 | 29.1 | 90.1 | 34.0 | 88.4 |
| 19. | Styrene | ppm | 111.9 | 1.9 | 98.3 | 2.4 | 97.9 |
| 20. | Tri methylamine | ppm | 31.1 | 2.0 | 93.6 | 2.9 | 90.7 |
| 21. | Toluene | ppm | 53.7 | 3.4 | 93.7 | 2.1 | 96.1 |
| 22. | VOC | ppm | 161.1 | 3.6 | 97.8 | 118.5 | 26.4 |
| 23. | Xylene / Xylene–m | ppm | 161.1 | 4.5 | 97.2 | 1.1 | 99.3 |
| 24. | Sulphur Dioxide SO2 | ppm | 114.1 | 11.9 | 89.6 | 4.6 | 96.0 |

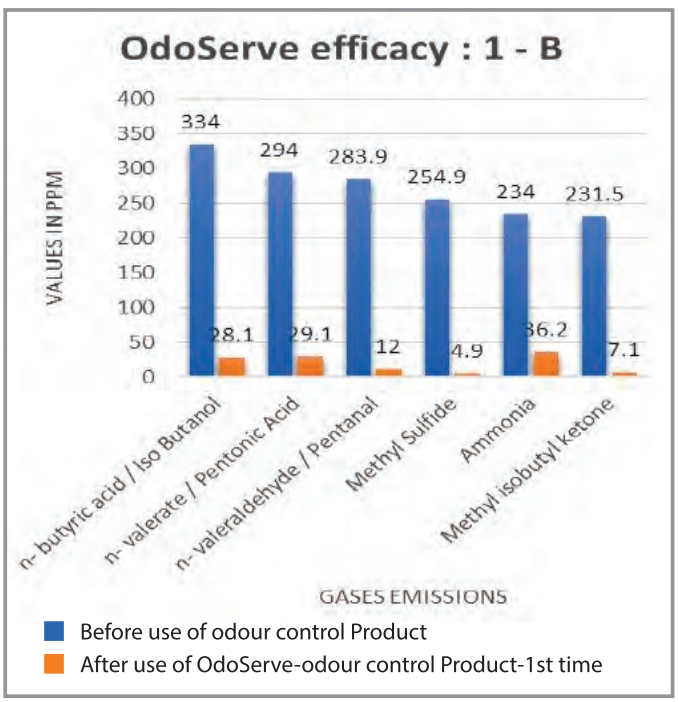
**Table 2 : Results of before and after OdoServe – Odour control product**

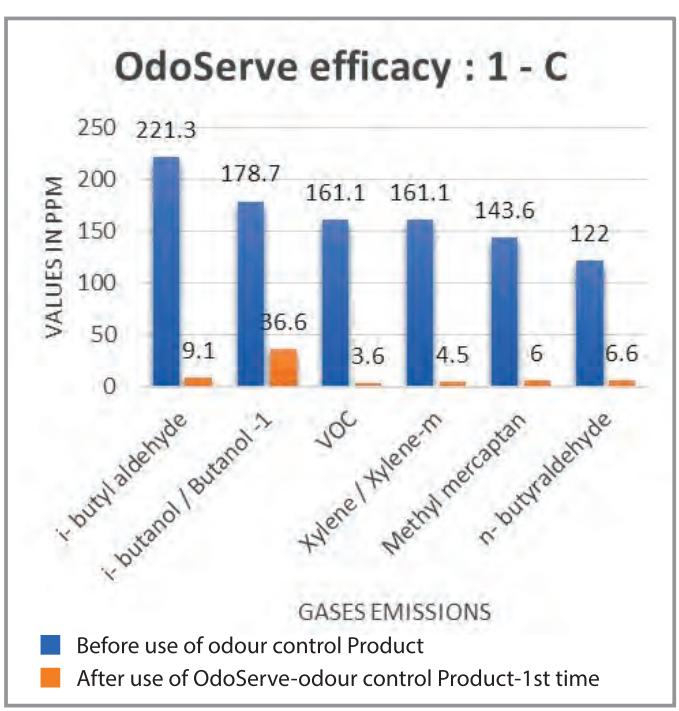
## Highlight .... We have achieved ....

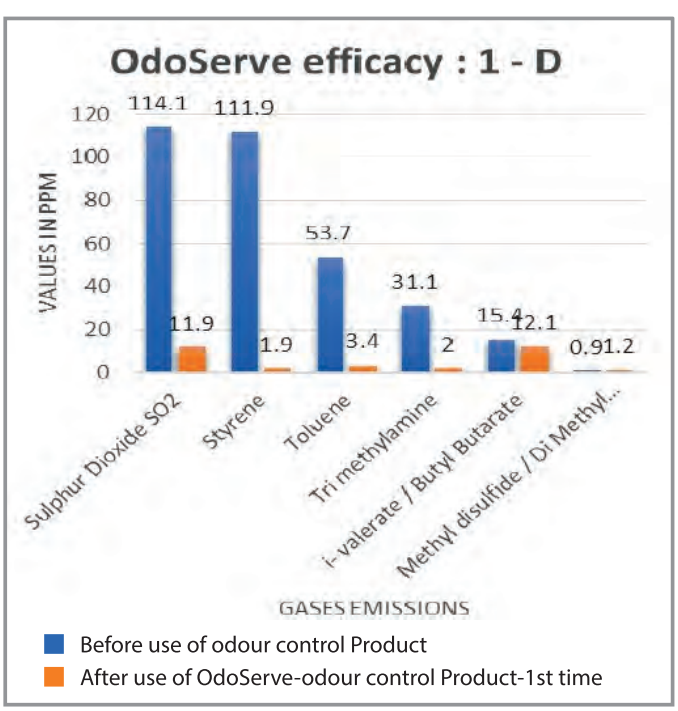
- 95% reduction in Acetaldehyde, Iso Butanol, Methyl Sulfide, Sulphur Dioxide SO2, Xylene were observed.
- Also, reduction in concentration value is below permissible limits for Ethyl acetate, Methyl isobutyl ketone, Toluene and ammonia.
- Considerable reduction in concentration of Methyl Sulfide that is 98%,
- Styrene also 98%, VOC 97% were achieved, which is favorable for toxicological, ecological & occupational health aspects.
- Methyl mercaptan has OSHA limit of 10 ppm & after OdoServe misting it was detected to 6 ppm from 143 ppm on site!!
- Quantity of OdoServe dosed was 4 lit/day and 90% of all bad Odour was gone!

## Graphical presentation of OdoServe misting efficacy – before & after:

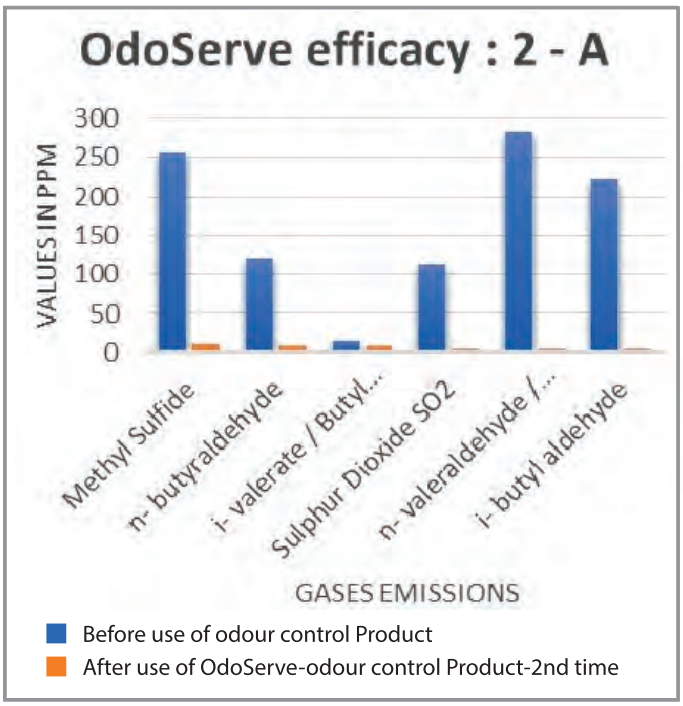


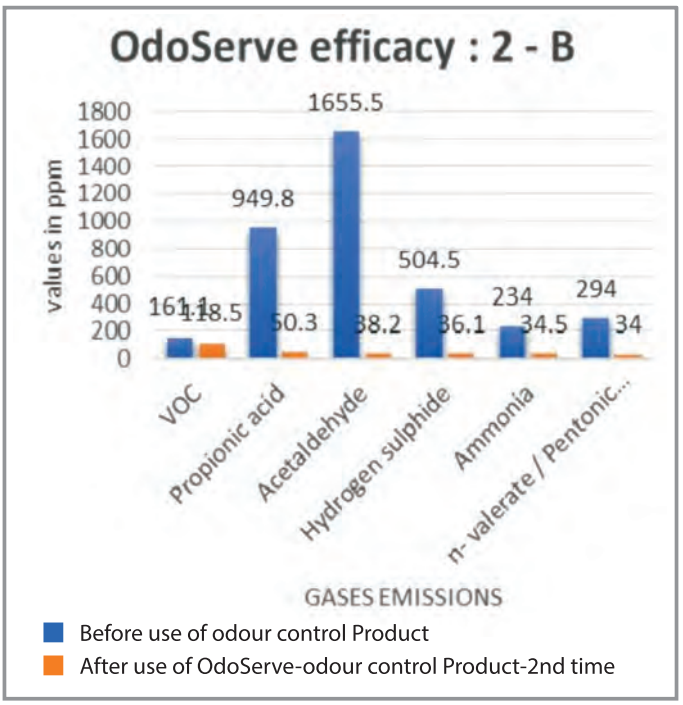



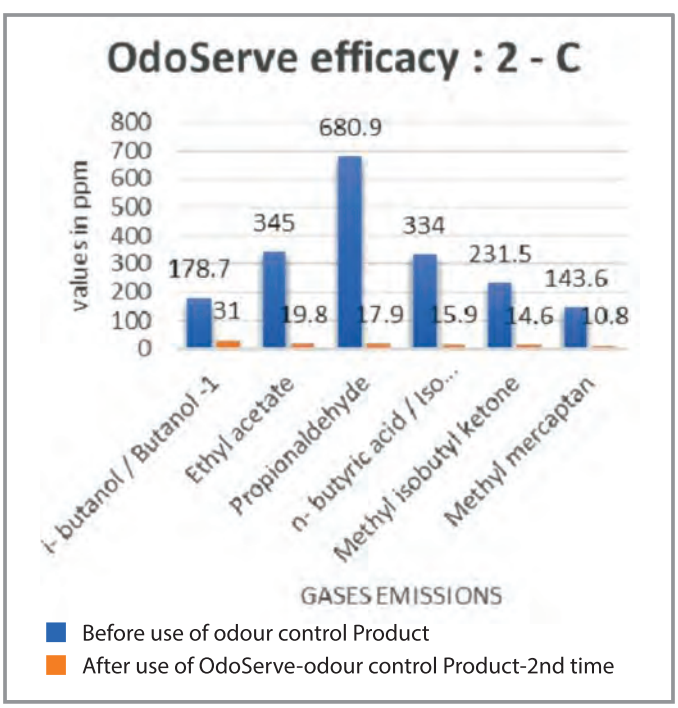



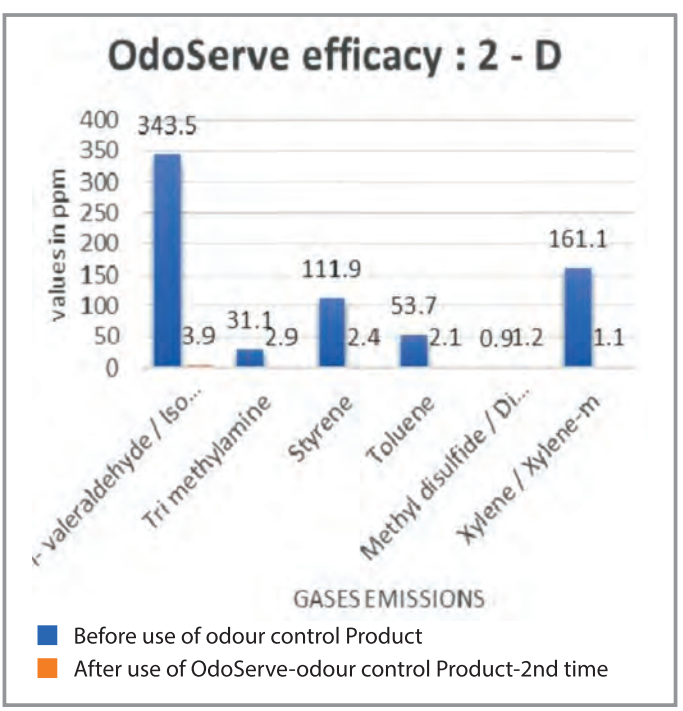



## Graphical presentation of OdoServe misting Ecacy–Before & After:




## Executive summary

Wherever there are pharmaceutical, chemical, fertilizer, textile industries, hazardous waste is generated & different types of gaseous emissions are experienced at such sites. By using our product 'OdoServe', for such a short duration, we could achieve desirable results– like 90% reduction in emissions at this site.

**OdoServe is an excellent Odour removing solution!!**

Photographic Presentation of Site

## Amalgam Biotech

- Helps in Providing optimized and sustainable solutions for different category waste
- A Biotechnology company is one–stop solution for your generated waste type.
- Has expertise in ETP–CETP–WWIP–STP process.
- Hands–on experience in Primary, Secondary and Tertiary treatment processes.
- Has Engineering solutions for Odour Control Systems.

**For Wastewater Treatment (BactaServe):** We provide customized sustainable solutions for different categories of wastewater treatment and solid wastes; in the form of Specialized Bacterial cultures for Industries like Pharma, Textile, Chemical, Dairy, Tannery, Slaughterhouses, Food Processing, Oil Refineries and others. We are also associated with the Government of India Research Institutes for Specialized technologies for treating specific wastes.

**For Process Additives (NutriServe):** We are providing the products mainly essential micronutrients that nourishes the essential bacteria for aerobic and anaerobic process associated with WWTP. The other products mainly required in enhancing the conditions of Aerobic and Anaerobic Process is also being manufactured and supplied like BOD enhancer, Supply of Nitrogen–Phosphate from Organic sources, others.

**Mr. Ashutosh Vadanagekar**

is the Managing Director of Amalgam Biotech. Ashutosh's expertise is his knowledge of Production process industries because of his past experience of commissioning close to 55 different ETPs & ZLD plants in India & overseas. He has an overall experience of 24 years, of which 12 years have been spent at Wastewater sites in commissioning & troubleshooting the plants. Ashutosh undertakes wastewater training & consulting assignments at an individual level. His work profile in Amalgam Biotech is focused on New product development & site troubleshooting. Ashutosh can be reached at **ashutosh@amalgambiotech.com**


**Mr. Rajesh Narayan**

(Business Development Manager, at Amalgam Biotech)

**Mr. Rajesh Narayan** has experience of 25+ years in the field of Sales and Marketing including Channel Sales Management and Direct Marketing. Since last 6 years he is working as Business Development Manager with Amalgam Engineering, Pune which is mainly into Waste Management – Wastewater and Solid which includes Hazardous waste site and Wet Waste Management sites. You can reach

**By – Call: +917447711668,**
**Mail: rajesh@amalgambiotech.com**

# Water & CleanTech India Expo

**17-19 JAN 2024**

PRAGATI MAIDAN
NEW DELHI

Co-located Expos

9th Smart Cities INDIA EXPO | FUTURE CITIES INDIA EXPO | BUILDING & INFRATECH INDIA EXPO | SMART ENERGY INDIA EXPO | Smart Mobility India Expo | SMART TECH India Expo

# SHOWCASING FUTURE OF WATER & CLEAN TECHNOLOGIES


## 2024 EXPO OPPORTUNITY

| 55,000 | 1,200 | 40 | 350 | 50 |
|---|---|---|---|---|
| ATTENDEES | PARTICIPATING BRANDS | COUNTRIES | STARTUPS & PITCHING COMPETITIONS | CONFERENCE SESSIONS |

Experiential Zone | Country Pavilions | Global Product Launches | Networking Opportunity | Curated Marketing Support
Business Matchmaking | City Leaders Conclave | Industry Awards

Media Partner

Organisers

India Trade Promotion Organisation (ITPO)
(A Government of India Enterprise)
Department of Commerce

Exhibitions India Group
ISO 9001:2015 - ISO 14001:2015 - ISO 45001:2018
Committed to Excellence

**Contact for more information:**
Prateek Kaushik | prateekk@eigroup.in
+91 98999 81610 | +91 11 4279 5123
www.WaterandCleanTechExpo.com

# ETP FEEDS WITH BACTASERVE FOR COD/ BOD REMOVAL FROM PHARMA INDUSTRY'S WASTEWATER

**By Mr. Ashutosh Vadanagekar (Managing Director, at Amalgam Biotech)**
**By Mr. Sanket Chawke, (Application Specialist, Amalgam Biotech)**

## Background

With a presence in 138 countries on six continents, pharma company is now the world's largest integrated supplier of solid dosage products and services – providing hard–shell capsules, lm and foil barrier solutions. Founded in Mumbai in 1961, now serves pharmaceutical companies all over the world, touching almost every aspect of solid dosage manufacturing. Company has built over 60 years long term relationships with renowned customers.

## Table of Inlet Parameters:

| Parameters | Days | INLET FEED ppm |
|---|---|---|
| COD ppm | Day 1 | 7120 |
| | Day 5 | 7150 |
| | Day 10 | 7009 |
| | Day15 | 6955 |
| | Day 20 | 6991 |
| | Day 25 | 6989 |
| | Day 30 | 6800 |
| | Day 35 | 7005 |
| **Avg** | | **7002** |
| BOD ppm | Day 1 | 2373 |
| | Day 5 | 2383 |
| | Day 10 | 1752 |
| | Day15 | 1739 |
| | Day 20 | 2330 |
| | Day 25 | 2330 |
| | Day 30 | 2267 |
| | Day 35 | 1751 |
| **Avg** | | **2116** |

**Photographic view of site:**

## Challenges

**Challenges in ETP operation & the problem:**

- COD and BOD were very high in the euent. COD 7000 ppm, BOD is 2000 ppm and it was in the same higher range through out.
- A high level of BOD can reduce dissolved oxygen (DO), thereby harming the local environment if the euent is discharged Excess COD/BOD content contributes to environmental pollution.
- Water with high COD/BOD often has poor aesthetic qualities, such as bad odour, murky appearance, and an unpleasant taste Which can impact its usability for drinking, recreational activities, and industrial processes.

## ETP Flow Diagram:

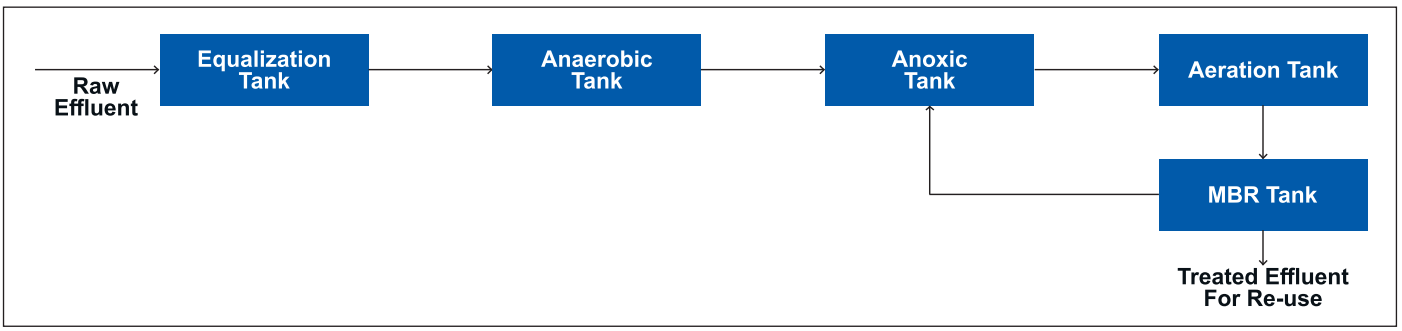
- ETP Initial ow rate of the euent was 265$m^3$/day, aeration tank 110 $m^3$, MBR tank 80 $m^3$

## Amalgam Biotech

- Helps in Providing optimized and sustainable solutions for different category waste
- A Biotechnology company is one–stop solution for your generated waste type.
- Has expertise in ETP–CETP–WWIP–STP process.
- Hands–on experience in Primary, Secondary and Tertiary treatment processes.
- Has Engineering solutions for Odour Control Systems.

**For Wastewater Treatment (BactaServe):** We provide customized sustainable solutions for different categories of wastewater treatment and solid wastes; in the form of Specialized Bacterial cultures for Industries like Pharma, Textile, Chemical, Dairy, Tannery, Slaughterhouses, Food Processing, Oil Refineries and others. We are also associated with the Government of India Research Institutes for Specialized technologies for treating specific wastes.

**For Process Additives (NutriServe):** We are providing the products mainly essential micronutrients that nourishes the essential bacteria for aerobic and anaerobic process associated with WWTP. The other products mainly required in enhancing the conditions of Aerobic and Anaerobic Process is also being manufactured and supplied like BOD enhancer, Supply of Nitrogen–Phosphate from Organic sources, others.




## Special Technical Solution:

Initial feed of BOD/COD was extremely high. We have suggested a solution – BactaServe Anaerobic and Pharma bioculture.

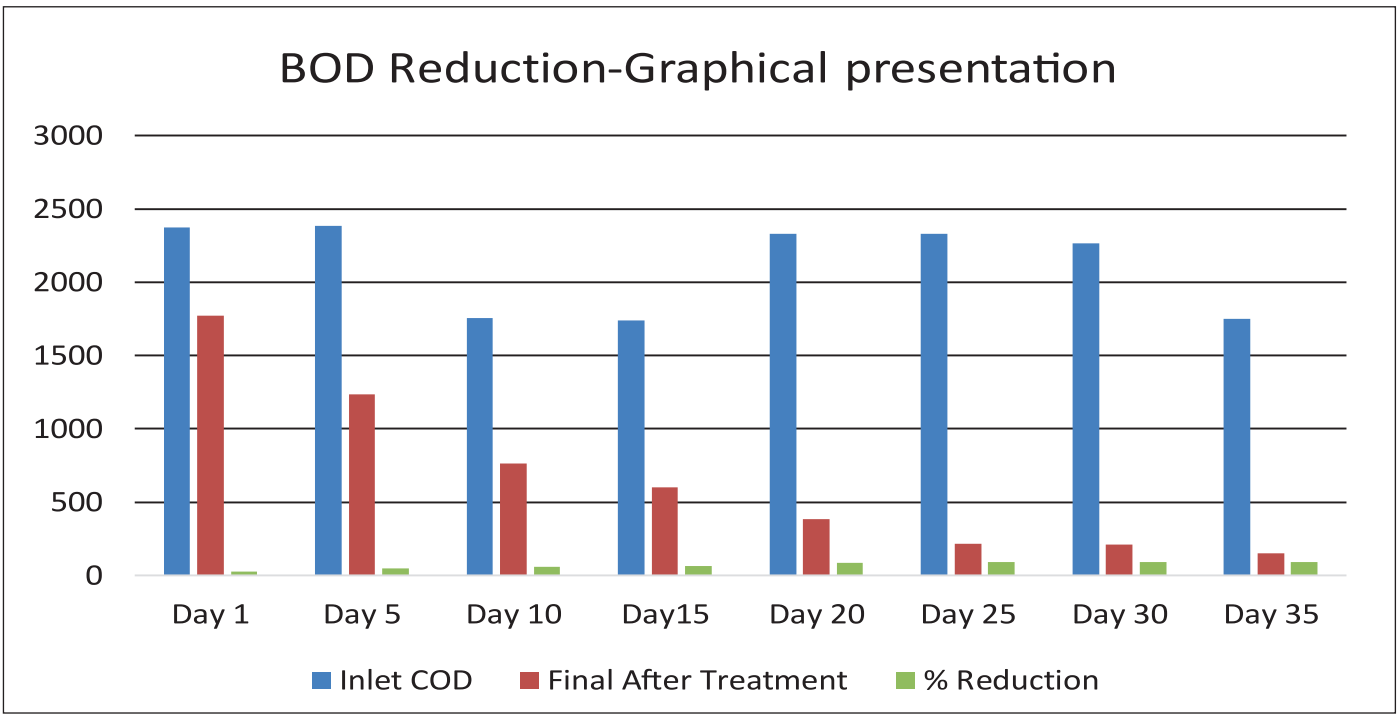
BactaServe is specially formulated naturally occurring, nonpathogenic, Non genetically altered blend of bacteria which can grow over wide temperature range 5–45°C. BactaServe when added in waste water treatment systems, bacteria starts multiplying immediately to create higher Biomass content. This helps in bio–degradation of BOD content of the waste water.

These microorganisms are not harmful and completely environmentally safe.

## Special features to highlight:

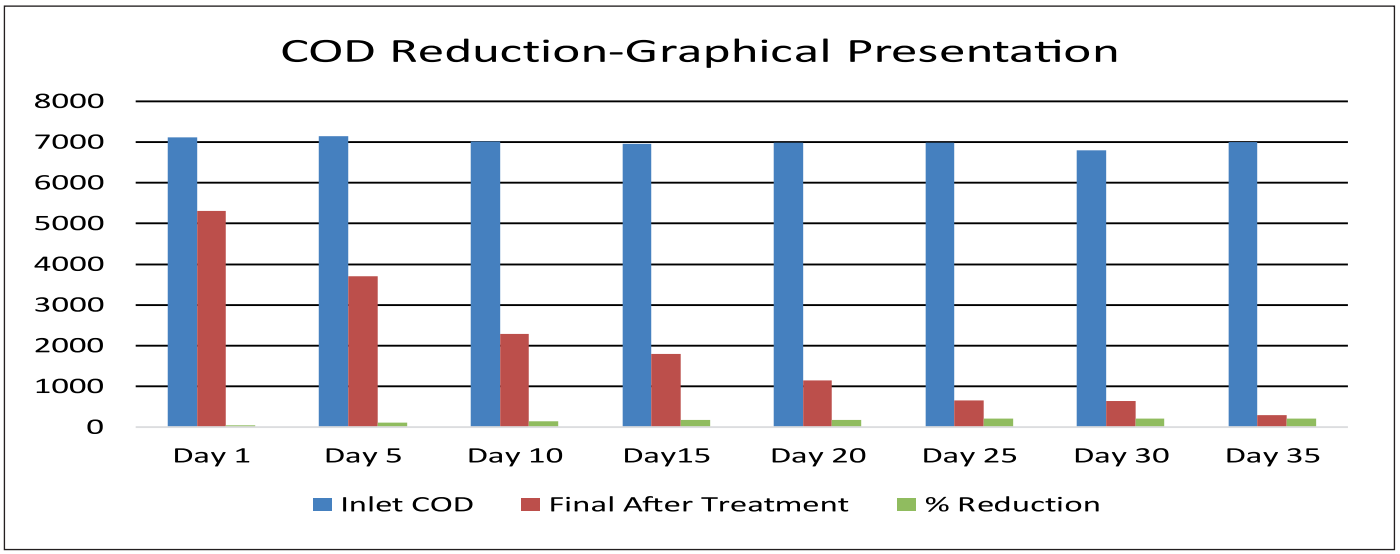
- COD of day 1 at Anaerobic tank outlet was 6408 ppm, at Aeration tank outlet 5895, in MBR tank outlet 5306 ppm
- Day 10, Anaerobic tank outlet COD was 4556 ppm, Aeration tank outlet 3326, MBR tank outlet 2295 ppm
- After 15th days BactaServe dosage 48% reduction achieved in Anaerobic tank for COD
- After a month, 82% reduction found in MBR tank outlet COD
- Total 96% COD reduction achieved Sucient growth of MLSS found in 20 days
- Maintaining ow 2 $m^3$/hr, after 10 days of MLSS development
- Increased ow from 3.5 $m^3$/day to 4.5 $m^3$/day, during this DO – 4 ppm, pH – 6.5 to 7.5
- BOD of inlet Day 1 was 2373 ppm, Anaerobic tank outlet 2136, MBR tank outlet was 1769 ppm
- BOD of Day 15 – MBR Tank outlet was 598 ppm 91% reduction in BOD value achieved

| Dosage of BactaServe | | |
|---|---|---|
| **Days** | **Estimated Kg** | **Actual Kg** |
| Day 1 – Day 15 | 85 | 80 |
| Day 16 – Day 35 | 70 | 60 |
| **Total** | **155** | **140** |






| Parameters ppm | Days | Inlet Feed ppm | Anaerobic Tank Outlet | Aeration Tank Outlet | MBR Tank Outlet | % Reduction |
|---|---|---|---|---|---|---|
| COD ppm | Day 1 | 7120 | 6408 | 5895 | 5306 | 25 |
| | Day 5 | 7150 | 5649 | 4632 | 3705 | 48 |
| | Day 10 | 7009 | 4556 | 3326 | 2295 | 67 |
| | Day 15 | 6955 | 4521 | 2848 | 1794 | 74 |
| | Day 20 | 6991 | 3635 | 1890 | 1153 | 84 |
| | Day 25 | 6989 | 2865 | 1089 | 653 | 91 |
| | Day 30 | 6800 | 2788 | 1059 | 636 | 91 |
| | Day 35 | 7005 | 2102 | 546 | 301 | **96** |
| BOD ppm | Day 1 | 2373 | 2136 | 1965 | 1769 | 25 |
| | Day 5 | 2383 | 1883 | 1544 | 1235 | 48 |
| | Day 10 | 1752 | 1519 | 1109 | 765 | 56 |
| | Day 15 | 1739 | 1507 | 949 | 598 | 66 |
| | Day 20 | 2330 | 1212 | 630 | 384 | 84 |
| | Day 25 | 2330 | 955 | 363 | 218 | 91 |
| | Day 30 | 2267 | 929 | 353 | 212 | 91 |
| | Day 35 | 1751 | 1051 | 182 | 150 | **91** |




## Executive Summary

- This project of pharma ETP was challenging due to high COD/BOD. Average MLSS earlier was 2000 ppm and after Bactaserve 4000 ppm
- Earlier average MLVSS– 1400 ppm and after Bactaserve bioculture dosing its 2800 ppm.
- This time increased ow by 20% of 170 $m^3$/day.
- Bactaserve slurry preparation and dosing has clearly shown, a spike in MLSS
- COD of Anaerobic tank has achieved 70% reduction

## Achievements

- Bactaserve bioculture solved this issue with bacterial strains
- COD day 1 inlet was 7120 ppm and after Bactaserve pharma dosing, at day 35 outlet was 301 ppm
- BOD at day 1 inlet was 2373 ppm & at day 35, outlet was 150 ppm
- We are happy to highlight 91% reduction in BOD and 96% reduction in COD – We have successfully solved the problem of ETP

'BactaServe found an excellent product for COD – BOD removal'!!

**Mr. Ashutosh Vadanagekar is the Managing Director of Amalgam Biotech.**

Mr. Ashutosh's expertise is his knowledge of Production process industries because of his past experience of commissioning close to 55 different ETPs & ZLD plants in India & overseas. He has an overall experience of 24 years, of which 12 years have been spent at Wastewater sites in commissioning & troubleshooting the plants. Ashutosh undertakes wastewater training & consulting assignments at an individual level. His work profile in Amalgam Biotech is focused on New product development & site troubleshooting. Ashutosh can be reached at

**M.: +91–9657711558**
**E–mail: ashutosh@amalgambiotech.com**

**Mr. Sanket Chawke** is an assistant manager and application specialist at Amalgam Biotech. He manages challenging technical environments in the field of wastewater and bioremediation. Sanket provides flawless operational continuity and consistent technological growth through exceptional engineering. He has completed B Tech in Chemical Engineering from MITAOE, Pune. You can reach by
**M.: +91 7447753381, E–mail: sanket@amalgambiotech.com.**

# QUATTRONE DEVELOPS COST–EFFICIENT STORMWATER NETWORK SOLUTION FOR NEW HOUSING COMPLEX IN FLORIDA

**By Sandra DiMatteo, Marketing Director, Bentley Systems**

## Developing a Superior Rental Complex

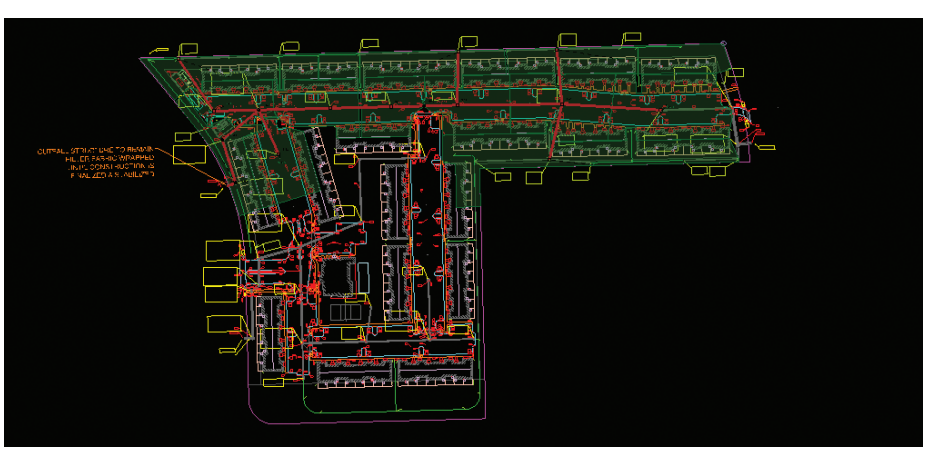
Coastland Residential is developing Mallory Townhomes as an affordable rental housing complex in the city of Fort Myers. These homes are designed to provide modern, superior communal living for local families. Offering a Key West coastal vibe, the development is a gated, villa–style community with 21 two–story buildings, featuring 126 two–bedroom and 38 three–bedroom units, as well as amenities, including gym facilities, a pool, children's play area, and a dog park. "Mallory Townhomes will provide local residents [with] a superior rental product to the typical garden–style apartments in the area," said Anthony Seijas, founder and principal of Coastland Residential.

About a year into construction, the underground contractor identified a conflict with the final stormwater outfall structure while connecting a reinforced concrete pipe (RCP) from one of the originally designed stormwater structures with the existing master stormwater network. Providing civil engineering, water management, and site planning services, Quattrone & Associates were brought on site to evaluate and discuss potential remedies to keep construction on schedule.

## Addressing Network Issues Mid–construction

The original design plan called for connecting a 42–inch stormwater RCP into one of the existing stormwater structures. However, the riser was not wide enough to connect with the RCP. The existing structure was also much lower than anticipated—located approximately 10 feet below the water table. The city of Fort Myers requested that the proposed RCP be lowered to connect to the base of the existing structure instead, where it was wide enough to make the connection. This proposal required a scuba team and would have been cost prohibitive, as well as would have delayed construction.

However, Joshua Eisenoff, the project's new civil engineer at Quattrone, was not advised



**Midway through construction of Mallory Apartments, developers identified a conflict with the originally designed stormwater structure. Image courtesy of Quattrone & Associates, Inc.**

> Using OpenFlows StormCAD Saves USD 10,000 and Avoids a Potential Six–month Construction Delay

**Sandra DiMatteo**
is the industry marketing director for water at Bentley Systems. She can be reached at **sandra.dimatteo@bentley.com.**
**(Headshot/bio)**

of these issues and the city's proposed solution until midway through construction when he was brought on site to meet with the construction team. "After initial conversations, [we discussed] the option of rerouting the entire stormwater system to have two, instead of three, outfall locations," said Eisenoff. Yet the contractor had already purchased all the RCP for the original design. Therefore, Quattrone wanted to reuse all the RCP that the contractor originally purchased so they did not have to purchase an entire new supply.

Eisenoff sought to re–network the entire system with the same size and length of the already–purchased pipe to avoid modifying the existing master stormwater system, which would take months to verify using a scuba team. "I believe the constraints of wanting to use the same RCP pipe as originally designed with a new layout was a unique challenge. When starting a project from scratch, you have less constraints than modifying a project that is halfway through construction," said Eisenoff.

## OpenFlows StormCAD Facilitates Optimal Design Solution

Upon learning about OpenFlows StormCAD from a co–worker, Eisenoff thought that it might be a useful application to quickly input the current stormwater scenario and modify the design to reroute the network. "After hearing about the OpenFlows StormCAD software, I thought I would give it a try and model the site's stormwater layout," said Eisenoff.

A first–time user, Eisenoff found Bentley's hydraulic modeling and analysis application easy to use. The ease of dropping catch basins, maintenance holes, and outflow structures proved quick and accurate. The software's flexibility allowed the team to consider and incorporate local storm events to run the model specifically for this project site while generating detailed reports. "The software let me choose and identify the size and lengths of RCP to match the size and length of material that was already purchased on site," said Eisenoff. Working in Bentley's digital environment provided a visual and analytical model to help redesign the stormwater layout, determining an optimal design solution to reroute all the existing piping while also re–networking the entire system amid construction.

## Advanced Hydraulic Modeling Drives Savings

By performing advanced hydraulic modeling and analysis with OpenFlows StormCAD, Quattrone could evaluate and visualize their design solution, reusing all the existing RCP materials to keep construction moving forward. "The design incorporated reusing RCP so it would not go to waste. This process lowered lead times of new construction material and costs greatly," said Eisenoff.

The original proposed remedy of modifying the existing master stormwater structure would have cost tens of thousands of dollars and resulted in a six–month or more construction postponement. Using OpenFlows StormCAD, Quattrone could cost effectively redesign the stormwater network within one day to keep the project on schedule. "Thankfully, Bentley's OpenFlows StormCAD software allowed us to redesign the stormwater network efficiently to save time and over USD 10,000 for the contractor and owner," said Eisenoff.

## Project Summary

- **Organization:** Quattrone & Associates, Inc.
- **Solution:** Water and Wastewater
- **Location:** Fort Myers, Florida, United States

## Project Objectives:

- To determine a cost–efficient design solution for stormwater network issues identified midway through construction.
- To reuse all existing pipe materials and avoid construction delays.

## Project Playbook: OpenFlows StormCAD

## Fast Facts

- Midway through construction of Mallory Apartments, developers identified a conflict with the originally designed stormwater structure.
- The initial proposed remedy would have delayed construction and cost tens of thousands of dollars.

> "Bentley's OpenFlows StormCAD allowed me to quickly and efficiently design a new stormwater network for a project with multiple unique challenges in a timely manner, while accommodating difficult project constraints."
>
> **Joshua Eisenoff,** Civil Engineer, Quattrone & Associates, Inc.

- Quattrone proposed using OpenFlows StormCAD to model and analyze the site's stormwater layout to resolve the issue more efficiently.

## ROI

- Bentley's application saved the owner and contractor USD 10,000 and avoided a six–month potential construction delay.


**courtesy 2: Bentley's application saved the owner and contractor USD 10,000 and avoided a six–month potential construction delay. Image courtesy of Quattrone & Associates, Inc.**

# NAVIGATING THE STORM:

## Liquiclear's Commitment to Sustainable Stormwater Treatment

Stormwater, once seen as a mere byproduct of urbanization, has now taken center stage in the realm of sustainable city planning. As the urban fabric grows, so does the importance of managing and making the most of this water resource. With Liquiclear's innovative approach, stormwater treatment is being reimagined, not just as a necessity, but as an opportunity to usher in a new era of urban sustainability.


### A Deluge of Possibilities

Urban expanses, with their dense infrastructure, naturally lead to increased surface runoff. This runoff, while often seen as a challenge, holds untapped potential. Instead of merely channeling it away, what if we could treat and repurpose it? This is where Liquiclear steps in, transforming the way we perceive and handle stormwater.

Utilizing Liquiclear's advanced Liqui-Deionization (LDI) technology, stormwater can be addressed at its very source. The renowned efficiency of LDI ensures that vast volumes of water can be processed in real-time, ensuring no drop goes wasted. Additionally, the adaptability of the Tunable Total Dissolved Solids (TDS) feature guarantees that the treated stormwater meets its intended purpose, be it for landscaping, industrial applications, or other uses.

### A Blueprint for Tomorrow

For architects and urban planners, Liquiclear's innovations offer a transformative perspective. Envision urban havens where every raindrop is captured, treated, and reused, augmenting the city's water resources. Think of green belts nourished by treated stormwater, or urban plazas employing this resource for aesthetic water features. It's an opportunity to redefine urban spaces, making them more self-reliant and sustainable.

### Navigating the Future

In the evolving landscape of urban planning, stormwater management emerges as a key pillar. Companies like Liquiclear are not just addressing the challenge but are also crafting solutions that echo with the ethos of sustainable living.

Liquiclear's commitment to stormwater treatment signifies more than just technological prowess; it represents a vision for cities where every drop counts. By harmonizing technology with sustainability, we are not merely addressing a challenge but are paving the way for urban environments that thrive, evolve, and inspire.

MESSE MÜNCHEN

# Innovative. Impactive. Informative. Your solutions at IFAT India

## October 17-19, 2023

Bombay Exhibition Centre, Mumbai, India

**Unveiling a Sustainable Future: Introducing the New Hall on Solid Waste Management at IFAT India**

### Why attend IFAT India 2023

- 3 Days of networking and engagement
- Get access to the latest environmental technologies, innovations, and trends
- Providing career development, networking and knowledge exchange opportunities
- Connect with government officials and policy Makers
- Bringing together leading industry experts from across Africa and around the world
- Unlock new possibilities for your business with innovative products and services

Scan to Exhibit

**For queries, please contact**

Bhola Mandal,
Tel: +91 99307 00292
Email: bhola@ifat-india.com

10 Years | IFAT India

www.ifat-india.com

**Interview with**
**ABDUL RAHMAN MOHAMMED**
**CEO, Sahara Industry**

Interview by
**Virender Kumar**

# WATER TREATMENT INDUSTRY: INNOVATIONS AND SUSTAINABILITY

*Indian water treatment market would reach to USD 5.59 billion (INR 46,486 Crore) by 2030, at a CAGR of 9.10% during the forecast period of 2023 to 2030.*

**Abdul Rahman Mohammed** is the CEO of acclaimed Sahara Industry. With a degree in marketing and finance, this young entrepreneur has skillfully guided the company to become a prominent manufacturer of high–quality water and wastewater treatment solutions in India. His contemporary business strategies, complemented by technological innovations and dynamic leadership, have facilitated the efficient growth of his group of companies, resulting in a turnover exceeding INR 1200 million.

**Website: www.saharaindustry.com**
**LinkedIn: www.linkedin.com/in/abdul–rahman–mohammed–0420bb56/**

**Q. How technology is transforming water treatment industry?**

**A.** Technology is creating better outcomes for people, businesses, and the environment, and it has to become a vital part of the water industry and its advancements. With current and emerging challenges in water management and quality concern, it is important that we select the right technological intervention for reaping benefits.

Technology is transforming the water industry, driving significant advancements in water treatment, leading to more efficient, sustainable and reliable treatment processes. These innovations are revolutionizing the way water is sourced, treated, distributed, and managed, crucial for addressing water scarcity, improving quality, and ensuring access to clean water to people and industries.

Technology has supported to bring more efficient treatment methods including advanced oxidation processes, electrochemical treatment, and innovative chemical treatments. Membrane technologies, such as reverse osmosis and nanofiltration, have become increasingly important. Advances in membrane materials and design have improved the efficiency and longevity as well as making the desalination process more energy–efficient and cost–effective.

The integration of sensors, IoT (Internet of Things) devices, and data analytics is enabling real–time monitoring and control of water treatment processes. Artificial intelligence and machine learning algorithms are being applied to water treatment processes to predict equipment failures, optimize chemical dosing, and improve the efficiency of treatment processes. Water treatment plants are adopting energy–efficient technologies to reduce operational costs and environmental impact.

**Q. With mounting global pressure to reduce carbon emissions, the progress and adoption of greener sources for water treatment are gaining momentum. How do you see this trend?**

**A.** In many developing countries, the problem of water pollution is worsening due to the impacts of population and industrial growth and urbanization. Simultaneously, sanitation issues are also on the rise particularly in the manufacturing sector, where water usage has expanded with corresponding increase in wastewater production. This wastewater often contains hazardous chemicals and sludge, which are separated through water treatment processes. Unfortunately, many industries discharge this wastewater into natural water bodies without adequate treatment, posing significant environmental and public health risks.

The greener approaches not only help address water pollution but also contribute to overall environmental conservation and the reduction of greenhouse gas emissions, aligning with global efforts to combat climate change.

The most common greener sources for water treatment include:

- **Natural Filtration:** Using natural processes like soil and plants to filter and purify water, such as constructed wetlands.
- **Solar Water Disinfection:** Harnessing solar energy is a simple and cost–effective method to disinfect water by placing it in clear plastic bottles exposed to the sun's UV rays. It's particularly useful in areas with limited access to clean drinking water and where other water treatment methods may be unavailable or impractical.
- **Green Chemicals:** Developing and using less harmful chemicals in water treatment processes, reducing the use of chlorine and other harsh disinfectants.
- **Membrane Filtration:** Employing advanced membrane technologies that require less energy and produce less waste compared to traditional filtration methods.
- **Energy–Efficient Technologies:** Implementing energy–efficient equipment and processes in water treatment plants to reduce carbon footprint.
- **Decentralized System:** Adopting small scale water treatment system that serve localized areas, reducing the need for extensive infrastructure, thus reducing transportation efforts of used water for treatment.
- **Sustainable Materials:** Using sustainable and biodegradable materials in water treatment equipment and processes.
- **Smart Water Management:** Employing data and technology for efficient water treatment and distribution, reducing waste.

These greener sources for water treatment

## Water Professional

*■ The technical expertise and in–depth knowledge of the water sector has enabled Sahara Industry to offer the best integrated and strategic approach to industrial and municipal water and wastewater treatment systems.*

*■ India is confronted with complex and interconnected water challenges that necessitate a comprehensive and multifaceted strategy. It will require a combination of technology, policy, and people's involvement to ensure equitable access to clean water.*

**50 M3 hr Reverse Osmosis Plant Installed in Logistic Park, Hyderabad**

offer a holistic approach that considers environmental, economic, and social aspects, making them a compelling choice for addressing treatment needs in a sustainable and responsible manner.

### Q. In recent years, the concept of "Smart Water" is gaining momentum. How do you view the utility of smart water management?

**A.** The concept of "Smart Water" has gained significant prominence and attention due to various factors including the digital revolution and our thirst for information on real time basis. Smart Water refers to the application of advanced technologies and data–driven solutions to enhance the management, distribution, and conservation of water resources. It involves the integration of various sensors, data analytics, and communication systems to create more efficient, responsive and sustainable water infrastructure.

The deployment of sensors and monitoring and IoT devices at various points in the water supply chain, such as in reservoirs, pipelines, treatment facilities, and pumping stations to collect real–time data on water quality, quantity, and infrastructure condition is on the rise.

**Industrial Water Treatment Plant**

The sophisticated data analytics and machine learning algorithms are processing the huge amount of collected data in no time helping identify trends, detect anomalies, and make informed decisions for optimizing water systems.

Smart water also facilitating remote control to manage water distribution systems, valves, pumps, and treatment processes to respond quickly to changing conditions and demands while enabling leak detection to reduce water loss and prevent infrastructure damage. It is helpful in predictive analytics to schedule maintenance and repairs, reducing downtime and extending the lifespan of water infrastructure, an important aspect in current times when water loss and aging infrastructure have become big challenge. It is also enhancing the resilience of water systems to respond to natural disasters, emergencies, and climate–related challenges effectively.

The idea of Smart Water is driven by the need to address water scarcity, aging infrastructure, controlling pollution, and increasing water demand in a more efficient and sustainable manner. It has the potential to revolutionize how water resources are managed and used, improving water quality, reducing waste, and ensuring the availability of clean water for our future.

### Q. How do you imagine the management of water in India in next 20 years?

**A.** The management of water resources in India over the next 20 years is likely to face several significant challenges and require innovative solutions to ensure sustainable access to clean water for its growing population. I can imagine the water management system becoming more digitized, with advance tools to aid decision making and predictive analysis in all areas of operations.

India, with its growing population and economic progress, faces complex and interconnected water challenges that demand a multi–faceted and holistic approach. It will require a combination of technology, policy, and people's involvement to ensure equitable access to clean water while safeguarding the environment and addressing the impacts of climate change.

I can foresee the improvements of the services by water utilities, where we are informed on the events before they occur, where we have the exhaustive information on a portal that we can access with our mobile and where we can interact with the service provider so all of us are able to preserve this valuable element, essential for the human survival. Collaborative efforts at all levels of government and society will be crucial to achieving sustainable water management in India over the next two decades.

### Q. What kind of opportunity do you see for your company in growing water market in India?

**A.** Water has been an integral part of our business for more than two decades, long before the water crisis and pollution issues became the biggest risk. India is facing significant challenges related to water quality


**Swimming Pool Filtration Tanks**

and scarcity and it keeps on growing, more than 600 million people currently facing severe water stress. Sahara Industry being a leading solution provider specializing in advanced water treatment technologies, including membrane filtration, UV disinfection, water quality monitoring, and industrial pure water have trusted customers for municipal and industrial water treatment.

A market research organization recently published their analysis that mentioned the size of Indian water treatment market, which was USD 2.78 billion (INR 23,115 Crore) in 2022, would rocket up to USD 5.59 billion (INR 46,486 Crore) by 2030, at a CAGR of 9.10% during the forecast period of 2023 to 2030. This predicted increase is mainly due to increasing population and demand for the finished goods in the country which raises the consumption of water by several industrial segments for the manufacturing of goods. With modern and advance manufacturing facilities and pursuit of constant innovation, Sahara Industry is well–placed to serve the growing demand of quality water treatment equipment and processes for both drinking water and industrial use purposes. We are wholeheartedly dedicated to the cause of water and preservation and will continue to invest in cutting–edge technology and innovative solutions to remain at the forefront of our mission, always striving to stay ahead of the curve.

### Q. How Sahara Industry is evolving with technology and what are your future plans?

**A.** Being market oriented and having modern system and processes, Sahara Industry has a technology driven approach to provide high quality water treatment products and services with excellent global standards. The technical expertise and in–depth knowledge of the water sector has enabled it to offer the best integrated and strategic approach to industrial and municipal water and wastewater treatment systems. The Company provides multi–disciplinary water and wastewater treatment and engineering services and delivering ideal solutions based on the experience of implementing hundreds of plants and projects with integrated project management approach.

In a legacy of about two decades, it has contributed immensely by making water safe for drinking, industrial and institutional purposes. The ISO 9001:2015 certified company; it has executed water and wastewater projects in the length and breadth of India as well as in several other countries.

Our future plans consist of expanding the scope and offerings of our services in water and wastewater treatment solutions. Sahara Industry is becoming future ready by embracing novel treatment technology with sustainable practices to solve the difficulties of increasing pollution while maintaining natural resources. The digital revolution will help us operate efficiently with information systems completely integrated, transversal and available to the user in any type of device, with predictive capabilities. That day is still far away, but we will gradually go that way and hopefully we can see water is managed more professionally and compassionately.

**Ultrapure Water Treatment Plant**

### IPA NEERATHON 2023 – CHENNAI
3rd September 2023, Sun, 12–10 am
Venue: Olcott Memorial Higher Secondary School, New No.2, (Old, 28, Besant Ave Rd, Besant Nagar
Chennai, Tamil Nadu.
**https://ipaneerathon.com/**

### Desalination & Industrial Water Management
12th – 13th September 2023
Venue: Le Meridien New Delhi, Le Meridien, Windsor Pl, Connaught Place
New Delhi, Delhi

### WATER EXPO – HYDERABAD 2023
21st – 23rd September 2023
Venue: HITEX Exhibition Center, at Khanammet,
Hyderabad, Telangana

### IPA NEERATHON 2023 – AHMEDABAD
5th October 2023, Sun, 5 am
Venue: Sabarmati River Front, Event Centre Block A, Ahmedabad
**https://www.townscript.com/e/ipaneerathonahmedabad**

### Renewable Energy India Expo
4th – 6th October, 2023
Venue: Greater Noida, India
**https://renewableenergyindiaexpo.com/**

### IFAT India
17th – 19th October 2023
Venue: BEC Mumbai, Bombay Exhibition Centre, NESCO, Goregaon
Mumbai, Maharashtra
**https://www.ifat-india.com/**

### India Water Week
10th – 14th October 2023
Venue: Vigyan Bhavan, Maulana Azad Rd, Rajpath Area, Central Secretariat
New Delhi, Delhi

### Waptema Water Expo Lucknow
7th – 8th November 2023
Venue: Indira Gandhi Pratishthan, Kathauta Chauraha Rd, Vibhuti Khand, Gomti Nagar
Lucknow, Uttar Pradesh
**https://waptema.in/**

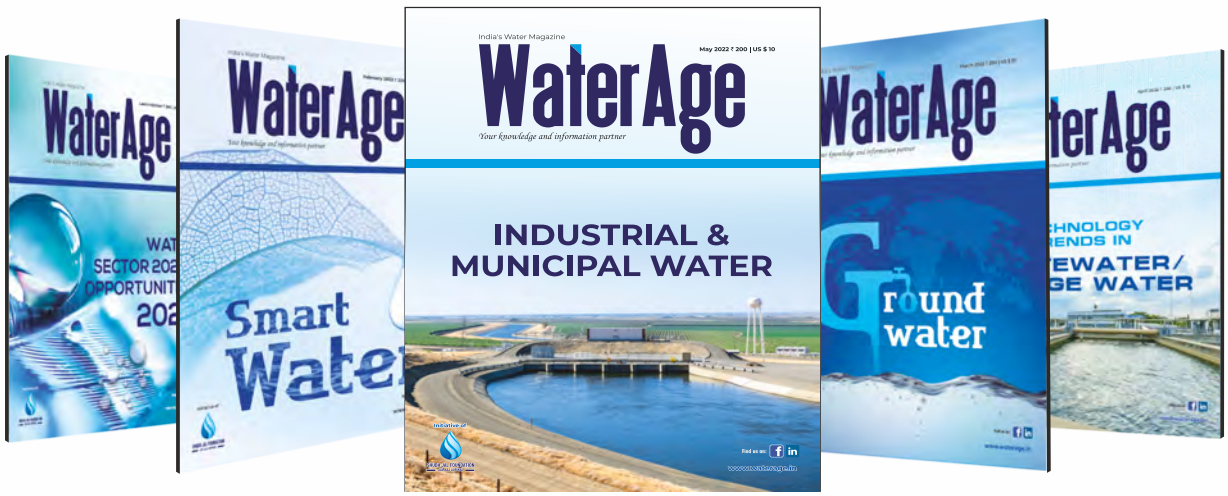
### Water Expo – Bengaluru
22nd – 24th November 2023
Venue: BIEC Bengaluru International Exhibition Centre, Bengaluru, India
**https://10times.com/water-today-s-water-expo-bengaluru**

### INDIA WATER EXPO 2023
Wed 20th – 22nd December 2023
Venue: Chennai Trade Centre, Ramapuram, Nandambakkam, Tamil Nadu

### International Conference on Water: From Pollution to Purification
7th – 10th December 2023
School of Environmental Sciences, MG University, Athirampuzha, Kerala

### Call for Proposals: Water Matters Open Electives 2023
11th – 22nd December 2023
National Institute of Design (NID), Ahmedabad, Gujarat
**http://openelective.nid.edu/**

# BOOK YOUR COPY NOW!




## MAGAZINE SUBSCRIPTION FORM

Fill out the form below and subscribe to our magazine!

Name & Designation:

Company Name:

Address: _____

_____ Pincode: _____

Mobile: | Email : | Website:

### Magazine Subscriptions

| | Subscribers | Term | Issues | Price | % Savings | PAY |
|---|---|---|---|---|---|---|
| ☐ | Domestic | 5 Years | 60 | Rs. 24000 | 40% | Rs. 14400 |
| ☐ | International | 5 Years | 60 | USD 3000 | 40% | USD 1800 |
| ☐ | Domestic | 3 Years | 36 | Rs. 14400 | 25% | Rs. 10800 |
| ☐ | International | 3 Years | 36 | USD 1800 | 30% | USD 1260 |
| ☐ | Domestic | 2 Years | 24 | Rs. 9600 | 15% | Rs. 8160 |
| ☐ | International | 2 Years | 24 | USD 1200 | 20% | USD 960 |
| ☐ | Domestic | 1 Years | 12 | Rs. 4800 | 10% | Rs. 4320 |
| ☐ | International | 1 Years | 12 | USD 600 | Nil | USD 600 |

BHIM
BHARAT INTERFACE FOR MONEY

**Scan for Pay UPI QR Code**

Merchant Name:
Shudhjal Foundation
Mobile: 70871 15455

| Company | Page No. | Telephone | E–mail | Website |
|---|---|---|---|---|
| **Aadys Components Pvt. Ltd.** | 1 | +91 11 4155 1444 | sales@aadys.co.in | www.aadys.co.in |
| **Amikon Blowers & Systems Pvt. Ltd.** | Front Cover, 5 | +91 11 41516313, +91 9311108295, +91 9311108296 | amikonblowers@gmail.com, info@amikonblowers.com, sales@amikonblowers.com | |
| **IFAT** | 57 | +91 99307 00292 | bhola@ifat–india.com | www.ifat–india.com |
| **Indus Waterways** | Back Cover Inside | +91 172 5275055, +91 11 4552 4715 | induswaterways@gmail.com | – |
| **Jai Maa Associates** | 37 | +91 98111 88819, +91 11 2568 2346 | jaimaaassociatesdelhi@gmail.com, jaimaa98gmail.com, info@jaimaaassociates.in | – |
| **Liquiclear** | 7 | +91 88009 42942 | info@liquiclear.in | www.liquiclear.in |
| **Optimus Enviropro Pvt. Ltd.** | Front Cover Inside | +91 11 4155 1444 | sales@optimusenviro.pro | www.optimusenviro.pro |
| **Rysa Infratech Pvt. Ltd.** | Back Cover | +91 11 4552 4715 | info@rysainfratech.com | www.rysainfratech.com |
| **Triveni Constructions** | 6 | +91 98143 21749, +91 98141 32026, +91 172 4039 981 | trivani_anand@yahoo.com, triveniconstructions.mohali@gmail.com | – |
| **Vrise** | 43 | +91 8826527527, +91 9871195751 | vriseengineers@gmail.com | |
| **WaterAge Banner** | 11 | +91 99589 60470 | enquiry@waterage.in | www.waterage.in |
| **WaterAge E–magazine** | 4 | +91 99589 60470 | enquiry@waterage.in | www.waterage.in |
| **WaterAge Subscription** | 43 | +91 99589 60470 | enquiry@waterage.in | www.waterage.in |
| **Water & Clean Tech India Expo (9th Smart CIties India Expo)** | 49 | +91 98999 81610, +91 11 4279 5123 | | www.smartCitiesIndia.com |

**Thank You for Advertising with Us!**

This Index is published as a service. Although every effort is taken to make it accurate, **WaterAge** assumes no responsibility for errors or ommissions.

# Indus Waterways

Water & Wastewater Solutions

**Indus Waterways providing consultancy for total water management and treatment solutions for Water and Wastewater Treatment, started business in 2009 and since then provided services to hundred of clients in Industries, Municipal and Hospitality sector**

## SERVICES TO PROVIDED BY CONSULTANT

- Detailed survey of proposed network of sewar line.
- Preparation of sewer network showing GL/IL.
- Location type design of manholes, intermediate sump well/lift well.
- Calculation of sewage generation.
- Type of treatment of sewage.
- Specification of mechanical and electrical equipment of sewage network STP & ETP.
- Preparation of drawing.
- Preparation of bill of quantities, detailed estimates BOQ and estimate based on MES SSR – 2020 and market analysis for Non-SSR items for sewage network STP & ETP.

## FIELD OF EXPERTISE


**H.O.: SCO 146-147, Sector-34A, Chandigarh-160022, T.: +91 172 5275055, 4012755**
**Corp. Office: 805, Bhikaji Cama Bhawan, Bhikaji Cama Place, New Delhi-110 066**
**Tel.: +91 11 41551444, 45524715, E-mail: induswaterways@gmail.com**

# ENGINEERING EXCELLENCE

**RYSA INFRATECH PVT. LTD. (RIPL)** is a fast-growing EPC company established in the year 2015. RIPL is an enlisted contractor with Military Engineer Services (MES) for:

- Pre-Engineered Building & Infrastructure
- Water & Wastewater Treatment Projects
- Sewage Disposal and Water Distribution Network
- Electro-mechanical utility services
- Low Tension Electric Works
- Incinerators


SEWAGE TREATMENT PLANTS


LOW TENSION ELECTRIC WORK


WATER TREATMENT PLANTS


WATER DISTRIBUTION

## COMPLETED PROJECTS


**RYSA Infratech Pvt. Ltd.**

**Delhi Office:** 805, 8th Floor, Bhikaji Cama Bhawan, Bhikaji Cama Place, New Delhi-110066,

**Chandigarh Office:**
SCO: 146-147, IIIrd Floor,
Sector-34A, Chandigarh-160022
**E-mail: info@rysainfratech.com**

**Tel.: +91-11-4552 4715**

**www.rysainfratech.com**