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RENU TOMAR
(Editor-in-Chief)

REJUVENATING RIVERS IN INDIA

India now is in serious need of solutions to its water issue. Improving the efficiency of drinking fresh water is a major problem the nation faces. Without guaranteeing a constant supply of high-quality drinking water, neither socioeconomic progress nor even political stability can ever be feasible. Therefore, it is obvious that river rejuvenation efforts must be spread out across the nation. In other words, in order to secure local water supplies and replenish every well, we will need to collect rainwater where it falls throughout a sizable portion of the nation.

As part of its development strategy, the Indian government has been prioritizing water governance more and more. To achieve this, it has adopted an integrated approach to managing water resources that addresses problems that affect many different sectors and authorities. As a direct result of these efforts, the consequences of climate catastrophe are being lessened. Initiatives are being done in the areas of cleanliness, pollution reduction, river rejuvenation, water usage efficiency, and, most critically, source sustainability.

The reuse of this purified water for non-potable uses, such as agriculture, which uses more than 80% of India's freshwater resources, surely be advantageous for the efficient and long-term management of freshwater resources.

The actions made in the water sector over the past several years are a reflection of the growing awareness of the role that water management plays in decreasing vulnerability and increasing climate resilience.

The government is dedicated to bringing about radical changes in the water sector by protecting, maintaining, and caring for this priceless natural resource that directly impacts each and every one of our lives.

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Assam's Chief Minister inaugurates The Guwahati Water Supply project, Assisted by JICA

At an event conducted on the grounds of its water treatment facility at Kharghuli, Assam Chief Minister Himanta Biswa Sarma officially inaugurated the partial commissioning of JICA–Assisted Guwahati Water Supply Water Project, which was started in 2009 with the goal of giving Guwahati people access to clean, drinkable water, is expected to be completed and fully operational by March 2024. It has the capacity to supply 1.25 lakh families in some areas of the city with water around–the–clock.

The Guwahati Jal Board will be able to supply water to roughly 13,000 homes in the various localities of the city thanks to the partial commissioning on Wednesday.

Addressing a public meeting correlating with the event, Sarma termed the partial inauguration a milestone in fulfilling the hopes and aspirations of the residents of Guwahati.

The chief minister exuded confidence that the project's partial commissioning would mitigate the water scarcity woes of many of the city's households.

He further stated that the aim was to provide water supply to more than a lakh households, adding all necessary steps are being taken to ensure the completion of the entire project by March 2024.

He added the partial commissioning would provide the residents of East Guwahati with a well–maintained water supply system, which was one of their long–standing demands.

Referring to the delay of 13 years between the project's launch in 2009 to its partial commissioning, Sarma expressed his gratitude towards Japan International Cooperation Agency (JICA) for its flexibility and patience for over a decade.

Sarma further expressed his regret at the slow pace of the project in the initial years after its launch, while assuring all JICA–assisted projects currently under various stages of implementation in the state, would be accorded top–most priority by his government.

Sarma remarked that projects such as the one partially commissioned on Wednesday would act as catalysts in realizing Prime Minister Narendra Modi's aim of sustainable growth and development of Assam and the rest of the Northeast.

The CM said the water supply project is not a project alone but symbolizes the relationship of deep trust and mutual respect between India and Japan.

All rural households in Punjab to have access to potable water by December 31

All rural homes in Punjab will have access to safe piped drinking water by the end of this year, according to officials with the Water Supply and Sanitation Department. As of now, 34.24 lakh homes (99.93% of the state's 34.26 lakh rural households) have access to piped drinking water.

Officials stated that there were only 125 remaining habitations and that effort was underway to quickly cover them.

Bram Shanker Jimpa, minister of water supply and sanitation, stated that the Bhagwant Mann–led administration had been working since day one

to give the people of Punjab the most basic amenities. It was also the aim of the government that the people should not face any kind of hardship and get all facilities on their doorstep without any hassle, he said.
He further said in many areas of Punjab, people were facing shortage of clean drinking water, but the state government had now delivered clean water through pipes to almost all rural houses. He also appreciated the commitment of officials and employees of the Water Supply and Sanitation Department for performing their duty.

The Delhi government will build a water recycling plant in Bawana for Rs. 10.3 billion

According to a formal announcement made earlier this week, the Delhi government has plans to build a water recycling unit at Bawana, a census town in northwest Delhi, with a capacity of two million gallons per day (MGD). The city's people will benefit from having access to water constantly, it was added.

According to Press Trust of India, the Delhi Jal Board (DJB) project will be developed at the 20 MGD Bawana Water Treatment Plant at a price of Rs 10.3 crore. Manish Sisodia, the deputy chief minister, gave the project his approval.

In February 2015, the Bawana Water Treatment Plant began operating. Water from this plant is distributed to households in Narela and Sultanpur, among other areas.

There is now a severe water wastage problem because the water treatment facility lacks a recycling facility. Sisodia declared, "To reduce waste, the Arvind Kejriwal administration would build a two–MGD recycling plant. He also gave the officials instructions to finish the construction within the allotted period in the official announcement.

In spite of failing to keep up with the city's expanding population, the national capital's water allocation is still carried out according to outdated regulations.

Sisoda, who is also the chairman of the DJB, stated, "In such a case, the Delhi government is working with a plan of action and a mechanism to ensure that every resident may be provided drinking water 24 hours a day in their houses." "Owing to the rising population, arrangements for future requirements are being made as well."

Along with this, the Delhi government is also working in a phased manner to upgrade the sewerage system in the capital, lay sewer lines in different areas and provide door–to–door sewer connections, he added.

Decentralized sewage treatment plants are being built by the government in various unauthorized colonies and rural areas to ensure that contaminated water does not flow into Yamuna, the minister shared.

During the FIH Odisha Hockey World Cup, more than 2L liters of fresh drinking water to be produced from air

In order to provide "drinking water from air" for the FIH Odisha Hockey Men's World Cup 2023 Bhubaneswar – Rourkela from January 13–29, 2023, Watergen, the atmospheric drinking water devices (AWG), announced its partnership with Hockey India on Tuesday.

Watergen will provide everyone gathered on the grounds of the Kalinga Stadium in Bhubaneswar and the Birsa Munda International Hockey Stadium in Rourkela with clean, mineralized, fresh drinking water that is manufactured from ambient air.

The business will instal its various products, such as GEN–L, which can produce up to 6000 litres of water, GEN–M Pro, which can produce up to 900 litres of water, and GENNY, which can produce up to 30 litres of water, in both stadiums for use by the general public as well as in the VIP lounge and office areas. The combined output of these machines is expected to produce approximately 2 lakh gallons of free water that is fresh, clean, and hygienic. The technical team and trained personnel from Watergen will also be on location to address any issues that may arise during the use of these devices.

Hockey India President Padma Shri Dilip Tirkey offered his thoughts on the group "Given that so many people enjoy sports, we at Hockey India have the chance to encourage the world to embrace sustainable methods. Water is an essential component of all sports. The FIH Odisha Hockey Men's World Cup 2023 will be held in Bhubaneswar and Rourkela, and Hockey India is happy to name Watergen as its official supplier of "Water from Air" to everyone in attendance at the stadiums."

Commenting on the partnership, Maayan Mulla, CEO, Watergen India, said, "We would like to extend our gratitude to Hockey India for taking this visionary step with us to make an event of such capacity truly sustainable. This Hockey World Cup will be the world's 1st water sustainable World Cup across sports. As we all know– water is a precious resource, but it is getting scarcer day by day– Watergen provides a new source of an unlimited produce of fresh and safe drinking water. As the sustainability partner of FIH Odisha Hockey Men's World Cup 2023, we are confident that awareness about our technology will result in an increase in corporates and other bodies to adopt our 'Water from Air' technology."

In 19 cities in Odisha, CM Naveen Patnaik launches the "Drink from Tap" project

Odisha On Wednesday, Chief Minister Naveen Patnaik introduced the "Drink from Tap" 24–hour piped drinking water project in 19 cities.
In these cities, the initiative will help almost 5.5 lakh people.

Speaking at the occasion, the chief minister declared that giving every family access to clean water has long been a goal of his and a top priority for his administration.

"Water is essential to life, making access to clean water for drinking a crucial component of public health. To build a new Odisha, set an example for others to follow, and lead the way in providing services that are centred on the needs of the citizenry, my government is dedicated to investing in the people. It is a matter of great pride that as many as 19 cities of our state are joining the prestigious league of international cities in providing directly drinking water from tap adhering to the quality parameters of the Bureau of Indian Standards," he said.

Urging the public not to waste water, Patnaik said water is a precious and important natural resource and, hence, one should use it prudently and not waste even a single drop.

Nitish inaugurates a project to give southerners with water from the Ganga Bihar

Nitish Kumar, the chief minister of Bihar, on Sunday officially launched a programme in the Nalanda district that will treat floodwaters and distribute them to homes in the state's southern region.
He stated that the project was created with the needs of the four towns in southern Bihar for the ensuing 50 years in mind after the Ganga Water Supply Scheme (GWSS) was officially inaugurated in Rajgir.

He continued, "Through the project, a total of 135 litres per person would be delivered."

It must be sufficient. Since Patna is located along the banks of the Ganga, I will also design something along these lines after seeing the effects of this initiative.

"It should be enough. Seeing the impact of this project, I will also plan something on similar lines for Patna also, which is situated on the banks of the Ganga. In a few months, Ganga water will also reach Nawada. All the four South Bihar towns will use Ganga water during the flood season and store it to tackle drinking water woes in the region," he added.

He said that the project had been envisaged as part of the "Jal–Jeevan–Hariyali" project in 2020 in view of the water woes in the region.

"Now, avoid using borewells for drinking water as you will get Gangaajal through your taps. You can drink and also take bath in Gangajal daily. It will also reach all the temples and Nalanda University. This project will also help in ground water recharge for agriculture. I have done a lot for Rajgir, which is a confluence of several religions. Its springs will also come alive," he added.

He, however, lamented that the Centre had not accepted a proposal for an airport in Rajgir.

The state's water resources minister, Sanjay Kumar Jha, said that floodwaters will be lifted through pumps at Hathidah and transported through a 151–kilometre pipeline to three enormous reservoirs in Rajgir, Tetar, and Gaya. From there the water will travel to two Water Treatment Plants (WTP), where it is treated and transported to the cities.

"These three South Bihar cities of Rajgir, Gaya, and Bodh Gaya have been experiencing water shortage due to excessive groundwater extraction via borewells. It is a historic day for Bihar and the Nitish Kumar has been involved with it right from conceptualisation to implantation stage. He thinks ahead of time and the project is a testimony to his foresight and commitment to make people's life better," he added.

Deputy CM Tejaswhi Prasad Yadav said that the GWSS was a testimony to the vision of Nitish Kumar, whose actions speak louder than words and achieve the improbable". Finance minister Vijay Kunar Choudhary said that by bringing Ganga water to the people, Nitish Kumar had done what people could not even imagine.

WABAG AND ADB ENTER INTO A STRATEGIC FUNDING TIE UP; ADB TO INVEST RS. 200 CRORES IN NON–CONVERTIBLE DEBENTURES

VA TECH WABAG LIMITED ('WABAG', 'Company'), a leading Pure Play Water Technology Indian Multinational Company has signed an agreement with Asian Development Bank ('ADB') towards raising Rs. 200 crores through unlisted Non–Convertible Debentures ('NCD') carrying a 5 years and 3 months tenor which will be subscribed by ADB over a 12 month period. This will be ADB's first investment in a Water sector company in India.

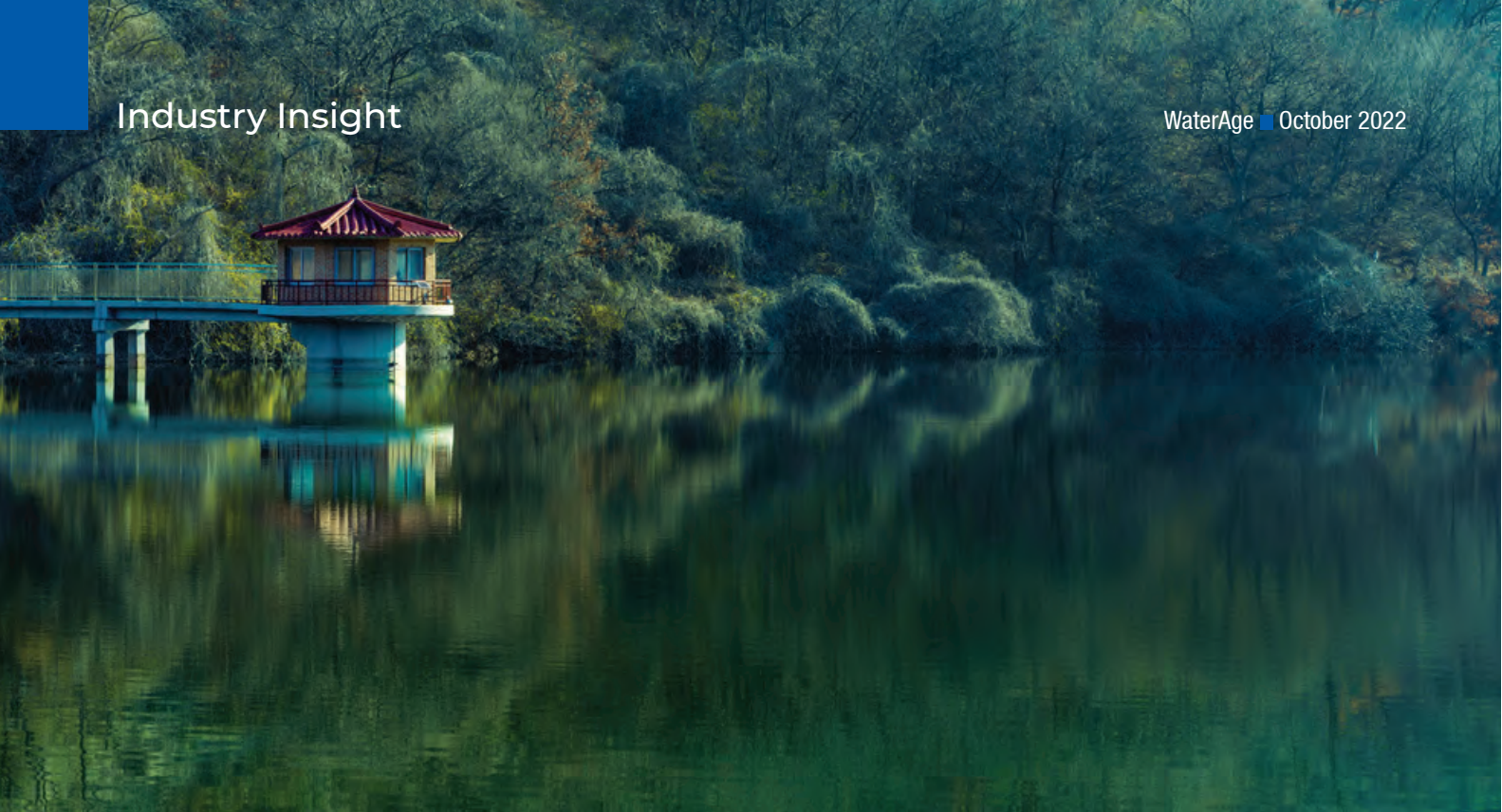
This is in continuation to the ongoing debt optimization efforts of the Company through long term and low cost funding sources. The capital raised through this NCD issuance will be used towards working capital requirements of the Company and this will be within the current borrowing limits, thereby not increasing the debt levels of the Company.

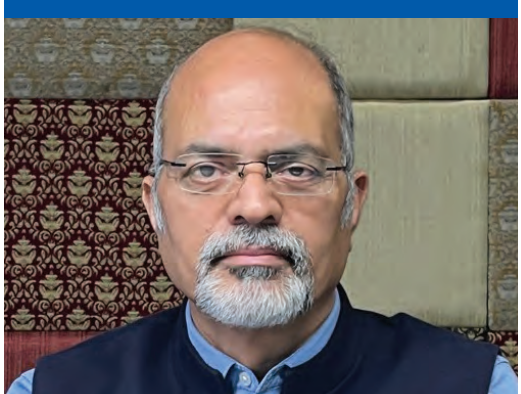
Commenting on this key milestone, Mr. Skandaprasad Seetharaman, Chief Financial Officer of WABAG said, "This is an important milestone for WABAG, as we add another feather to our cap with this strategic funding tie up with ADB. ADB's decision to collaborate with WABAG, in their first private sector water investment in India is a key validation of WABAG's leadership in the water sector and its focus on clean, green, and sustainable technologies. We have been working for many years on projects funded by multilateral agencies including ADB. This is indeed now a great moment for us to be directly associated with ADB, showing ADB's confidence in WABAG's credibility and credentials in the water sector."

Ms. Suzanne Gaboury, ADB Private Sector Operations Department Director General, said, "The disposal of wastewater without proper treatment has put significant pressure on India's already scarce water resources and the quality of those resources. This project is ADB's first private sector financing in India's water sector and will help to crowd in urgently needed international and domestic financing for the sector to ease water stress as demand increases."

WABAG is a global leader in the water industry backed by rich experience spanning over 98 years globally and over 25 years in India. Being a pure–play water technology multinational, WABAG offers a complete range of technologies and services for Total Water Solutions in both Municipal and Industrial sectors. With over 1,600 water professionals, spread over 25 countries in 4 continents, WABAG is touching millions of lives every day. With passion for innovation, WABAG has developed 3 dedicated R&D centers located in Austria, India, and Switzerland.

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members – 49 from the region.





Devendra Singh Dhapola
Consultant, WASH

Devendra Singh Dhapola has 31+ years' experience in water resource program management of large investments in project formulation & designing, bilateral loan negotiations, DPR appraisals, design reviews, budget management & disbursements, procurement process, contract management, networking in integrated water resource management (IWRM) sector, stakeholder consultation & coordination, client management, public administration, monitoring & evaluation, midterm program review, program re–engineering, sustainability risk assessment, water sector policy re–engineering process, IWRM sector institutional capacity building, and institutional framework re–engineering.

REJUVENATION OF WATER TOWERS OF INDIAN HIMALAYAS

A SCIENTIFIC PROCESS OF WATER SPRING RECHARGE

Background:

NITI Aayog report says, out of 688 villages, 221 numbers of villages are having springs in the Darjeeling district, i.e., 32.1 % of village reports have springs (Source NITI Aayog). To conserve and rejuvenate the spring sources through the springe shade area, a healthy catchment should be able to filter and clean water as it flows overland and seeps through the ground, and there should be lots of opportunities for water to seep into the ground so that it can be used by plants.

Through Catchment Area Protection, some structures (i.e., Pits, Ponds, Contour bounding & Check dam) are important to conserve rainfall, reducing soil erosion and impounding of water. While permitting more water to get recharged into the soils that can be utilized for crop cultivation. Under Catchment Area protection, springs are not only a water source but also an integral part of the hydrologic cycle with unimpaired surface water resource that needs to be managed collectively under a sustainable water resource management program. Springs are the primary source of water for rural households in the hilly region. Despite the key role that they play, springs have not received their due attention and

are today facing the threat of drying up. Spring discharge is reported to be declining due to increased water demand, changing land use patterns, ecological degradation and erratic trends in precipitation. These springs are known as Dhara, Mool, and Kuan in the central and eastern Himalayas and Chashma and naula in the western Himalayas.

There is, hence, an urgent need to restore, revive and sustain springs. Lack of knowledge, understanding and awareness of springs has further compounded the problem while also inducing elements of conflicts and haphazard development. Land–use changes, rapid urban expansion and growing commercial consumption are affecting forests and impacting spring water availability.

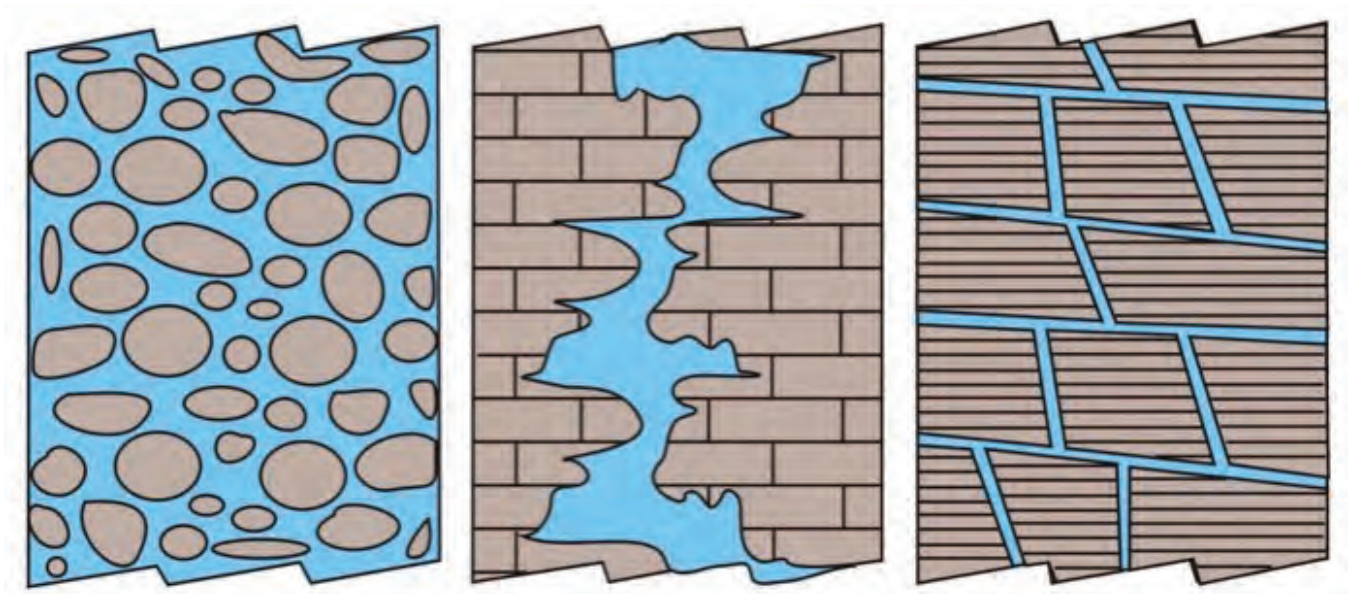
The water from the Himalayan rivers is not readily accessible to the densely populated villages and towns in the mid–hills (900–2000m). These fast–flowing rivers cut deep gorges and flow several hundred meters below, while the glaciers are far above this critical eco–zone of the mid–hills. In the mid–hills of the Himalayas, communities depend on rain–fed springs and streams for meeting their water requirements.

The method is to reduce runoff through construct recharge pits, contour bounding and checking the dam structure within the Catchment area. Spring–shed development program focuses on reviving small streams, water bodies, and innovative practices of groundwater augmentation. The idea is to

The Governments are aware & very serious about the issue but due to a reluctant attitude, lack of knowledge, funding issues, inter–departmental coordination, defragmented policies and very importantly it's not in top priority because any way community getting water.

What is Ground Water

Ground water is subsurface water that fills voids in soils and permeable geological formations.
There are three primary groups of water bearing formations, called aquifers



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reduce the surface runoff of rainwater and allow more water percolates down to recharge the underground water.

In the mountain regions, it is a climate adaptation strategy for the villagers dependent on springs for their water needs. Himalayan biodiversity health is not just fragile today, it is in ICU. Water problems in the hills are now becoming serious day by day. The glaciers are drying, and the underground water level has gone down. Extensive tourism development in the area continues to cut down trees and does not realize the impact of unplanned construction on the environment. (Source BDA).

The central government along with the state government implementing various schemes such as Jal Jeevan Mission, Amrut 0.2, Atal Bhujal yojna etc. and groundwater recharge is part of it, but funding arrangements indicated from convergence with other programs, so no one takes it on priority because of urgency for their project progress.

The good thing is that a lot of agencies and department has mandated in their policy to study, research, and pilot demonstration, but now it's time to come out of this and implement the programs for the rejuvenation of Himalayan springs. In India, 22 states have springs and communities use them for drinking as well as irrigation purposes, and they are aware of the importance of the springs. Departments also started training but in–field funding under convergence is the big obstacle in the implementation.

Springs are the main source of feeding water into the rivers and having a very crucial role in ensuring the environmental flow of the rivers maintaining the diversity of flora & fauna, and aquatic life, and improving the river health by releasing important minerals in the rivers, presence of bacteriophages in national river Ganga and its self–cleaning properties is the well–known fact.

The Governments are aware & very serious about the issue but due to a reluctant attitude, lack of knowledge, funding issues, inter–departmental coordination, defragmented policies and very importantly it's not in top priority because any way community getting water. It needs serious

intervention and is included as a part of detailed project reports (DPRs) of the water supply and irrigation projects.

Matrix for Planning & implementation of Spring Rejuvenation Projects:

2.1. Step 1–Preparatory Phase:

- Selection of study area
- Identifying implementation agency/department/partner
- Identifying funding agency/source
- Identifying technical supporting agency
- Identifying the stakeholders/community

2.2. Step 2–Project management Phase:

- Preparation of Spring shed Management Committee including VWSC
- Fixing roles and responsibilities of committee members
- Establishing communication channels for project–related activities
- Capacity building – Training of personnel for the study of Springs and developing toolkits

2.3. Step 3–Implementation Phase:

- Selection of springs sources for extensive and intensive studies
- Monitoring of spring discharge and hydro–meteorological parameters
- Selection and construction of interventions structures and other options
- Pre and post interventions impact assessment on spring discharge
- Continuous monitoring

2.4. Step 4–Project Reporting Phase:

- Documentation of results, lessons learned, recommendation
- Preparation of operational maintenance & sustainability guidelines for climate change adaptation
- Database Management System: Spring Registry & Spring Health Card

Spring Rejuvenation Concept:

3.1. Identification Area:

The artificial recharge projects are site–specific and even the replication of the techniques from similar areas is to be based on the local hydrogeological and hydrological environments. The first step in planning the project is to demarcate the area of recharge. The Project can be implemented systematically in case a hydrologic unit like watershed is taken for implementation. However, localised schemes are also taken to augment groundwater reservoirs. The artificial recharge of groundwater is normally taken in the following areas:

- Areas where groundwater levels are declining on regular basis;
- Areas where a substantial amount of aquifer has already been desaturated;
- Areas where the availability of groundwater is inadequate in lean months; and
- Areas where salinity ingress is taking place.

Community Participation(most important):

The success of the spring rejuvenation plan depends upon the involvement of the local community/GP/VWSC. Higher community participation– higher the long–term sustainability of the springs.
Scientific Inputs To plan the artificial recharge schemes following studies are needed:

Hydrometeorological Studies:

These are undertaken to decipher the rainfall pattern, evaporation losses and climatological features. These can bring out the extent of evaporation losses in post monsoon period which would help design the storages of particular capacity to have minimum losses of available water and help in deciding the capacity and design of the spring recharge structures.

Hydrological Studies:

Before undertaking any artificial recharge project, it is a basic prerequisite to ascertain the availability of source water to recharge the groundwater aquifer. For determining the source water availability for artificial recharge, hydrological investigations are required to be carried out in the Watershed/Sub–basin/basin where the artificial recharge schemes are envisaged.

Mostly surface runoff types of water source water may be available for spring recharge in hill areas. In situ precipitation will be available almost at every location but may or may not be adequate to cause artificial recharge but the runoff going unutilised outside the watershed/ basin can be stored/ transmitted through simple recharge structures at appropriate locations. the following information will be required:

- The quantity that may be diverted for artificial recharge;
-
- The time for which the source water will be available;
- The quality of source water and the pre–treatment required; and
- A conveyance system is required to bring the water to the recharge site.

Hydrological studies are undertaken to work out surplus monsoon runoff, which can be harnessed as source water for artificial recharge.

3.5.Soil Infiltration Studies:

Infiltration in its most narrow and precise sense can be defined as "The process of water entering into a soil through the soil surface". The infiltration and percolation two phenomena are closely related since infiltration cannot continue unimpeded unless percolation removes infiltrated water from the surface soil.

The actual infiltration rate equals the infiltration capacity only when the supply rate rainfall intensity less rate of retention) equals or exceeds. Infiltration capacity depends on many factors such as:

- Soil type;
- Moisture content;
- Organic matter;
- Vegetative cover;
- Season; and
- Formation of surface seals or crusts etc.

Porosity determines storage capacity and also affects resistance to flow. Thus infiltration tends to increase with porosity. Vegetal cover increases infiltration as compared with barren soil because

- it retards surface flow giving the water additional time to enter the soil
- the root system makes the soil more previous and
- the foliage shields the soil from raindrop impact and reduces rain packing of surface soil.

As water infiltrates soil under natural conditions the displacement of air is not complete even after many hours. Air spaces in the soil and intermediate zones interfere with infiltration as air is not pushed out by the infiltrating water but is gradually absorbed by water. Due to this phenomenon infiltration rate may start rising towards a new high after a few days of continuous application of water. Map showing infiltration rates of soils are prepared. This help to design suitable artificial recharge structures and to assess the extent of recharge from these structures.

3.6. Hydrogeological Studies:

A correct understanding of the hydrogeology of an area is of prime importance in the successful implementation of any Artificial Recharge scheme. A desirable first step is to synthesize all the available data on hydrogeology from different agencies. The regional geological maps indicate–

- the location of different geological strata;
- their geological age sequence;
- boundaries/contacts of individual formations and
- the structural expressions like–Strike, Dip, Faults, Folds, Flexures, Intrusive bodies etc.

The hydrogeological investigations required before the implementation of an artificial recharge scheme are given below.

3.7. Detailed Hydrogeological Mapping:

Hydrogeological mapping aims to present the following maps which facilitate the analysis of the groundwater regime and its suitability for artificial recharge schemes.

- Map showing hydrogeological units demarcated based on their water–bearing capabilities, both at shallow and deeper levels;
- Map showing groundwater contours to determine the form of the water table and the hydraulic connection of groundwater with rivers, canals etc.;
- Map showing the depths of the water table is usually compiled for the periods of the maximum, minimum and mean annual position of the water table;
- Maps that show amplitudes of groundwater level fluctuations and the maximum position of the water table of considerable importance for artificial recharge studies;
- Maps showing the piezometric head in deeper aquifers and their variations with time;
- Maps showing groundwater potential of different hydrogeological units and the level of groundwater development; and
- Maps showing the chemical quality of groundwater in different aquifers.

3.8. Aquifer Geometry:

The data on the sub–surface hydrogeological units, their thickness and depth of occurrence, and to bring out the disposition and hydraulic properties of unconfined, semi–confined and confined aquifers in the area. For surface water spreading techniques, the area of interest is generally restricted to shallow depths.

3.9. Geophysical Studies:

- Generally, the prime task is to complement the exploratory programme. Mostly it is employed to narrow down the target zone, pinpoint the probable site for artificial recharge structure and its proper design;
- The application of geophysical methods is to bring out a comparative picture of the sub–surface litho environment, and the surface manifestation of such structures, and correlate them with the hydrogeological setting;
- Stratification of the aquifer system and spatial variability of hydraulic conductivity of the characteristic zone, suitable for artificial recharge;
- Negative or non–productive zones of low hydraulic conductivity in unsaturated and saturated zones;
- Vertical hydraulic conductivity discontinuities, such as dyke and fault zone;
- Moisture movement and infiltration capacity of the unsaturated zone;
- The direction of groundwater flow under natural/artificial recharge processes; and
- Due to varied abstraction or recharge, salinity ingress, trend and short duration depth salinity changes in the aquifers.

3.10. Chemical Quality of Source Water:
The chemical and bacteriological analysis of source water besides that of groundwater is therefore essential.

3.11. Suspended Solids and Clogging Problem:
A major requirement for waters that are to be used in recharge projects is that they be silt–free. Silt may be defined as the content of undissolved solid matter, usually water with velocities not exceeding 0.1 m/hr. Methods to minimize the clogging effect of suspended matter can be

- Periodical removal of the mud cake and dicing or scraping of the surface layer.
- Installation of a filter on the surface, the permeability of which is lower than that of the natural strata (the filter must, of course, be removed and renewed periodically)
- Addition of organic matter or chemicals to the uppermost layer.
- Cultivation of certain plant covers, notably certain kinds of grass.
- Providing an inverted filter consisting of fine sand coarse sand and gravel at the bottom of infiltration pits/trenches are very effective.
- Clogging by biological activity depends upon the mineralogical and organic composition of the water and basin floor and the grain size and permeability of the floor.
- The only feasible method of treatment developed so far consists in thoroughly drying the ground under the basin.

3.12. Assessment of Sub–Surface Potential for Spring Water Recharge:
Based on the hydrogeological and geophysical surveys above, the zone for recharge should be worked out to assess the potential for artificial recharge in terms of water availability.

4. Adoptable Recharge Techniques for Springs in Hills:
The following methods may be adopted depends up of the situation analysis–

- Nala bunding;
- Contour bunding;
- Contour trenching;
- Check dams;
- Pits and Shafts;
- Gabion Structure;
- Infiltration Holes;
- Plantation of Grasses (Napier);
- Bio–Percolation Check Dams;
- Check Dams Cement Plug nala bunds;
- Fencing of Plants/Grasse; and
- Percolation tanks, etc.

5. Rainwater Harvesting (important water source):
Rainwater Harvesting is a very important water source for the spring rejuvenation technique of collection and storage of rainwater at the surface or in sub–surface water–bearing zones before it is lost as runoff. Rainwater harvesting in India and elsewhere in the world is as old as civilization however it is regaining importance in the present time. The majority of domestic and drinking water supply in Mizoram is met through harvested rainwater. However, the use of harvested rainwater for Springwater recharge is very important in hills. The following are the advantages of rainwater harvesting:

- Rainwater harvesting is an ideal solution to arrest the declining trend of water levels;
- The surface runoff, which goes waste to storm drains is utilised;
- Rainwater is bacteriologically free, the purest form of water, free from organic matter and soft in nature.
- It helps in reducing the flooding of roads and roundabouts;
- The structures required for harvesting the rainwater are simple, economical and eco–friendly;
- Rainwater can be harnessed at a time when it is surplus and utilized at the time of need; and
- Energy can be saved on account of the rise in water level.

6. Monitoring Mechanism:
The robust monitoring data speak for the efficacy of structures constructed for the recharge and greatly help in taking effective measures for spring water recharge. A comparative analysis of the discharge before & after is to be managed by collecting the discharge as well as quality data.

7. Some Examples of Structures used for Spring Rejuvenation

Counter Bunding:

Contour Trenches

Gully Plugs, Nala Bunds and

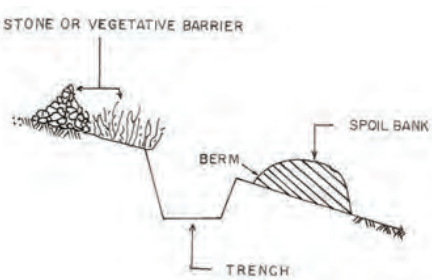
Infiltration Holes

Plantation of Grasses (Napier)

Percolation Tanks

Bench Terracing

Contour Trenches



Schematics of a Contour Trench

Gabion structure

Bio–Percolation Check Dams

Fencing of Plants/Grasse

Check Dams

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M Tech in Environmental engineering

CONCEPT PAPER: REPLACEMENT OF PRIMARY TREATMENT UNIT WITH CENTRIFUGE OR MODIFIED MECHANICAL PRESSURE FILTRES FOR SEWAGE TREATMENT

Introduction

- India is developing at a rapid pace and the development is leading to the faster urbanization of cities, towns and villages. The urban population in the country is overtaking the rural population or in a verge of overtaking. The urbanization has led to the economic growth, offering vast opportunity to the people in terms of jobs, better salary and better lifestyle.
- The fast paced urbanization is leading to several problems in terms of provision of better infrastructure, better public services and providing clean and hygienic environment to the central, state or local administration. One of the major challenge in environmental engineering field is the management of wastes namely solid waste and waste water.
- In comparison to the solid waste, waste water in terms of sewage is easier to recycle and reuse. The recycling of solid waste is a long drawn process and recycling cannot be carried out locally. However, sewage treatment and reuse also can be carried out locally.
- In this paper, the treatment methodology for sewage will be discussed and

Typically pure domestic sewage consists of organics matter, inorganic material like sand, clay and silt, Nitrates, Nitrites, grit, oil and grease.

modification in the existing method which can make the treatment process simpler, efficient and quicker with lesser land area footprint.

Background

- Water is a precious resource which needs to be preserved for future generations. Already India is a water scarce country and by the rate at which water consumption is increasing, the time is not far off wherein water will become rare commodity and will be sold like fossil fuels.
- With increase in the global warming the rainfall pattern across India is varying which is resulting to severe water shortfall during summer months at most of the cities. Even rural areas is not getting enough water to irrigate their lands which has resulted in loss of crop production.
- Sewage especially domestic sewage which is generated in large quantity discharged into the environment untreated will causes surface water pollution and even ground water pollution. This sewage water if treated efficiently, then it will become a resource and can be reused which will reduce burden on the fresh water available.
- Decadal assessment of the sewage generation and treatment capacity shows that there is an increase in sewage generation from 7067 MLD in 1978–79 to 62000 MLD in 2014–15 in comparison to increase in treatment capacity from 2758 MLD to 23277 MLD only. Also the

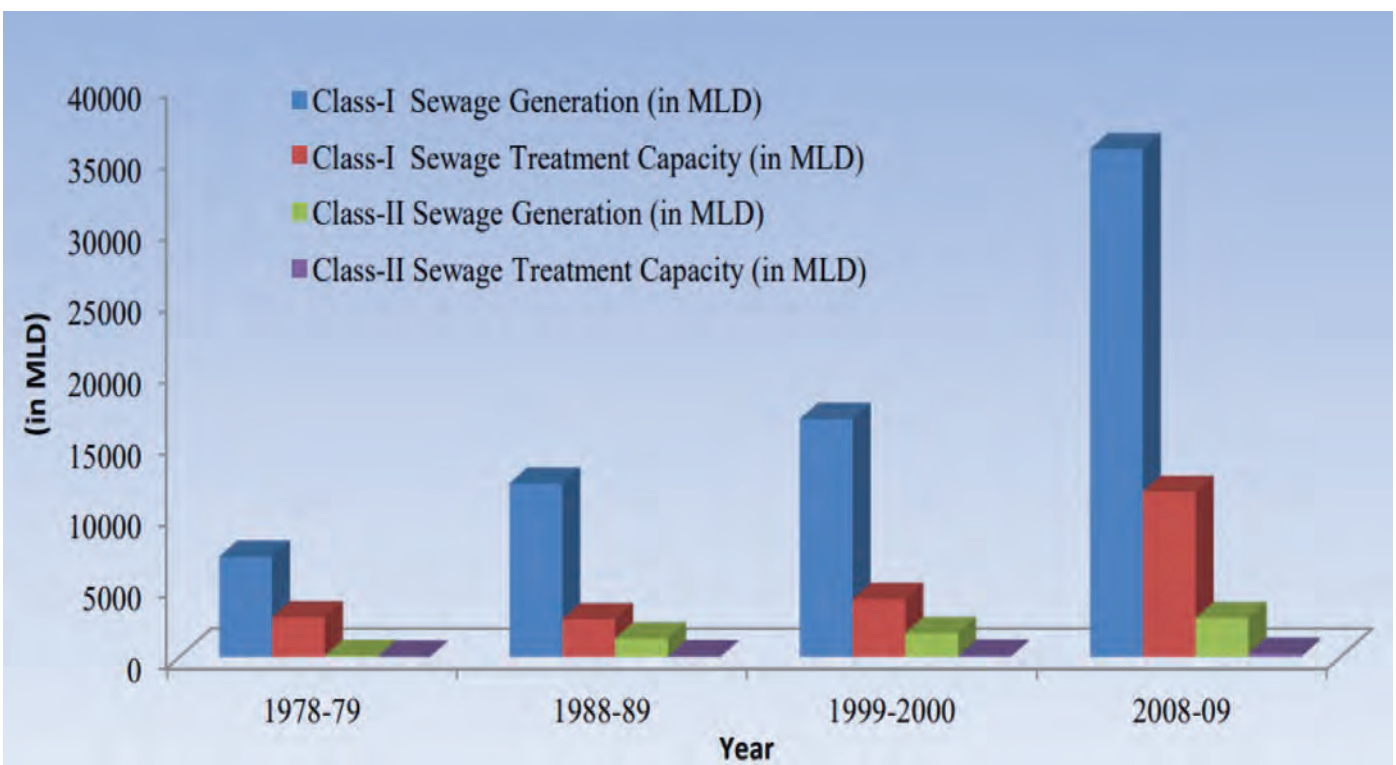


Figure 1: Sewage Geneartion Vs Sewage Treatment

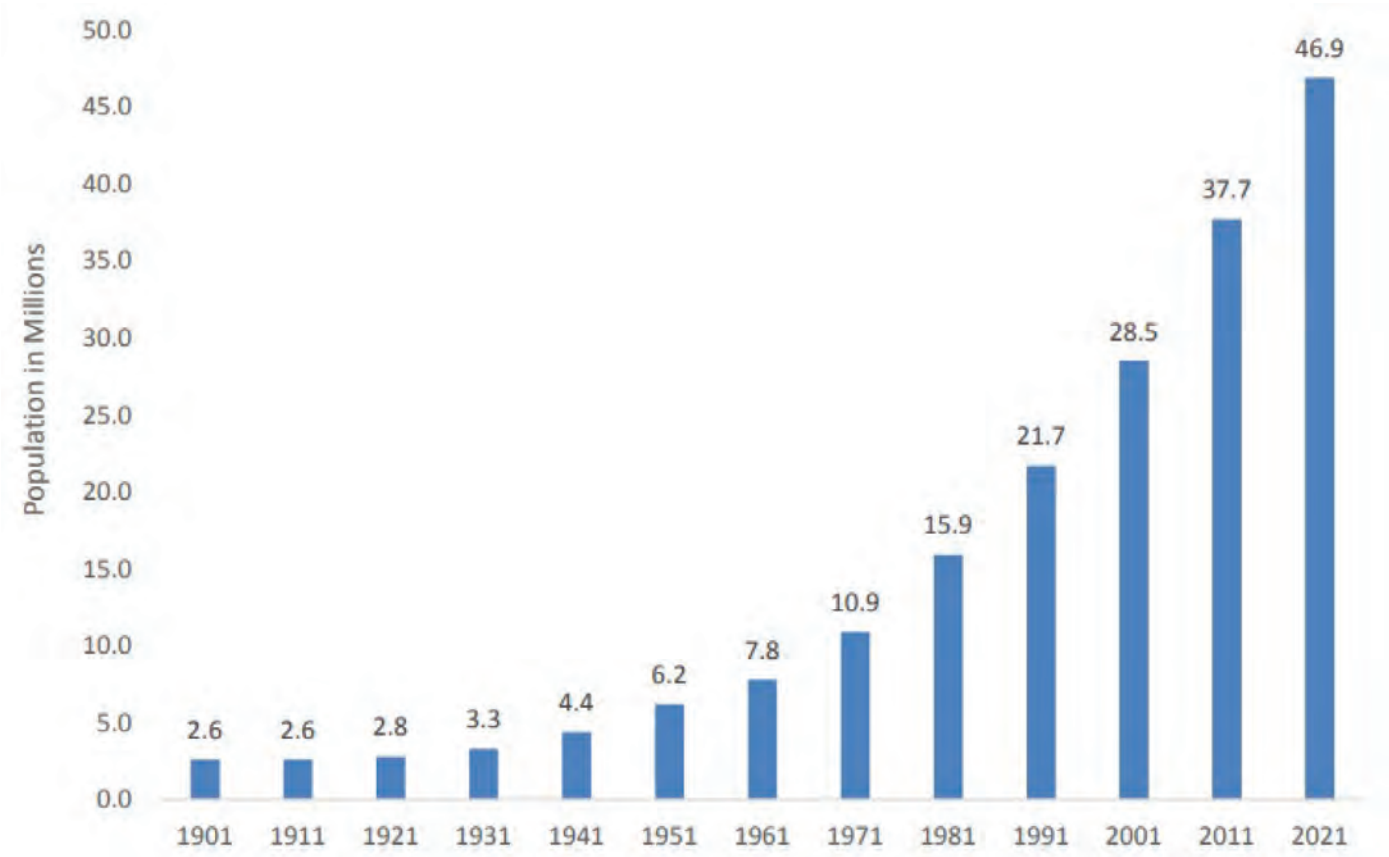


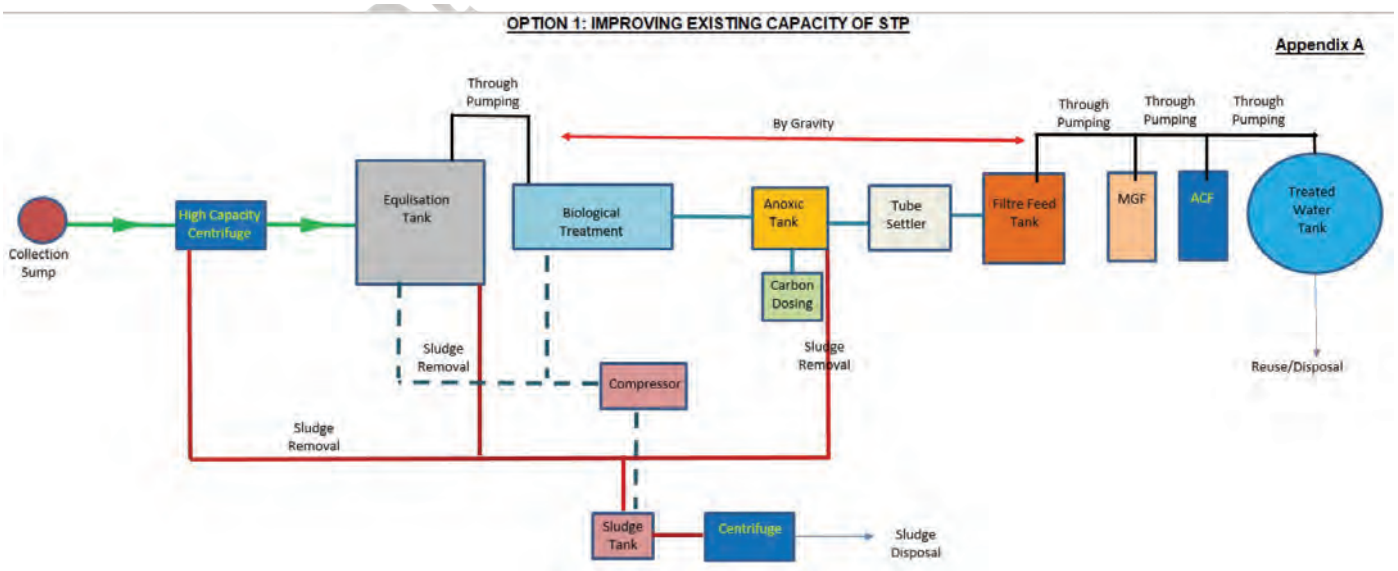
Figure 2: Decadal Urban Population Growth in Indian Cities

population growth in cities from 2.6 Million in 1901 which was 10.84 % of total population and to 46.9 Million in 2021 which is 35.69% of total population are exerting pressure on the water resource.

Present system of sewage treatment

- The Govt of India has mandated the sewage treatment in all cities and towns before discharging sewage water into drains, nallahs and rivers to reduce the pollution of surface, sub surface and ground water. Also, stringent norms are being followed by the pollution control bodies like SPCB (State Pollution Control Board), CPCB (Central Pollution Control Board) and local bodies. NGT also in one of the judgment dated 30 April 2019 had given discharge standards of treated waste water across India irrespective of city, town or village which has to be met.
- 10. Mostly in India biological treatment is a preferred option for sewage treatment. The biological treatment is dependent on the temperature, Food to Microorganism ratio and requires large areas. Also, it is difficult to handle unexpected increase in volume of sewage for these treatment plants. The table below shows the technological distribution with respect to number and capacity of STPs operating in India. Other technology includes trickling filters, Aerated lagoon, Bio towers, Electro Coagulation, MBR and root Zone treatment.

S No	Technology	Capacity in MLD	No of STPs	% of Total
1	Activated Sludge Process(ASP)	9486	321	26%
2	Extended Aeration (EA)	474	30	1.5%
3	Sequential Batch Reactor (SBR)	10638	490	30%
4	Moving Bed Biological Reactor (MBBR)	2032	201	5.5%
5	Fluidized Aerobic Bio–Reactor (FAB)	242	21	0.01%
6	Up flow anaerobic sludge blanket (UASB)	3562	76	10%
7	Waste Stabilization Pond (WSP)	789	67	5
8	Oxidation Pond (OP)	460	61	1.5%
9	Any other	8497	364	23%



- As per CPCB report of 2021, the present sewage generation in India is estimated to be 72,368 MLD whereas installed treatment capacity is only 31,841 MLD which is approximately 44 %. Out of 31,841 MLD installed capacity developed, operationalized capacity is only 26,869 MLD which is around 84%.
- The Sequential batch reactor technology is the most predominant in India followed by Activated sludge process technology. Apart from the conventional technologies, 128 STPs based on natural treatment technology like waste stabilization ponds and oxidation ponds are also operational.
- Five states namely Maharashtra, Gujrat, Uttar Pradesh, NCT of Delhi and Karnataka are contributing to treatment of 19,250 MLD of sewage which is approximately 61 % of the total treatment capacity.

Problem statement

- By the above facts presented above it is very clearly evident that a large quantity of sewage is still left untreated and needs to be addressed on priority. There is a need to shift towards the goal of achieving 100 % treatment and maximum reuse of waste water to reduce load on the limited fresh water available.
- There is a need to shift the process by which treatment are being carried out to achieve faster, better and high capacity to treat the waste water so that the existing infrastructure capability can be improved and the newer ones can be installed with lesser land footprint and provide good quality of treated water.

Constituents of sewage

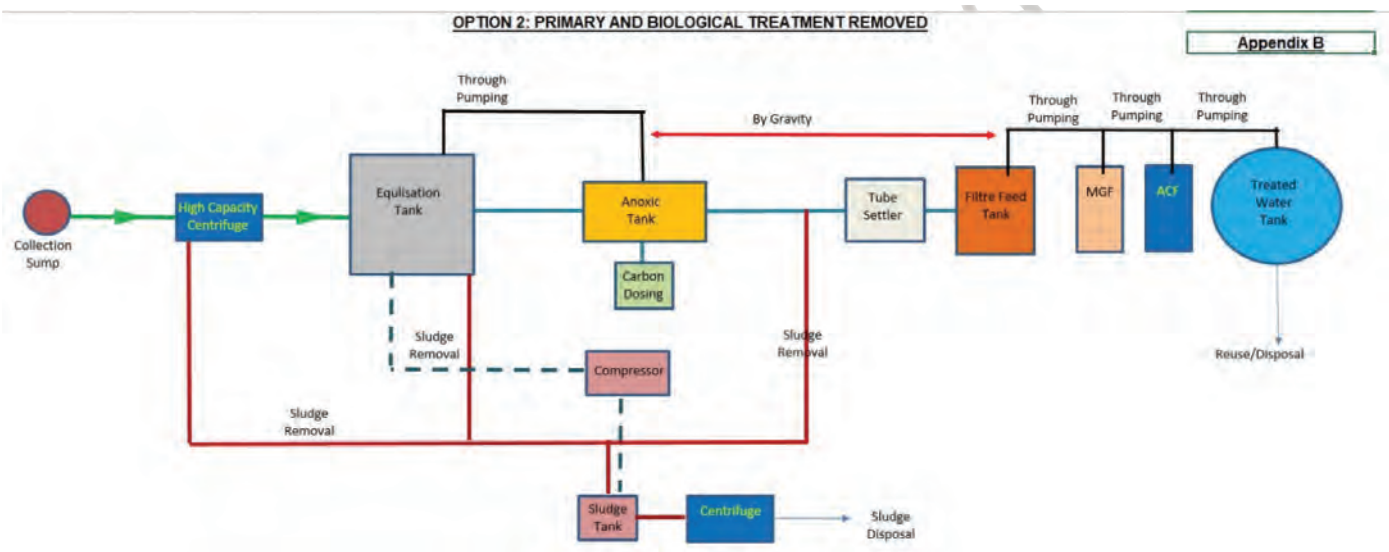
- Typically pure domestic sewage consists of organics matter, inorganic material like sand, clay and silt, Nitrates, Nitrites, grit, oil and grease. The treatment is carried out to remove/ reduce these constituents to the desired levels prescribed by the Govt of India by various Gazette notifications.
- The BOD is the main organic constituents which is in the form of solids which needs bacteria to eat the organics and to reduce the BOD level in the waste water. This solid, if can be removed from the waste water and treated separately, the process becomes easier and faster.
- The sewage water will still needs to be treated for reduction of nitrogen, phosphorus and any other constituents for which the treatment can be carried in similar way as water treatment process. The solids separated from the centrifuge/ modified mechanical pressure filter may again passed through a smaller capacity centrifuge to further thicken the sludge and the sludge can be decomposed in sludge digesters.

Typical layout of STP

- A STP consists of four process namely pretreatment, primary treatment, secondary treatment and tertiary treatment. The pretreatment consists of screen at the last manhole to remove the floating wastes to entering the sump well. The primary treatment consists of stilling chamber, screens, grit chamber, oil and grease trap wherein bigger and heavier particles are made to settle and separate from the sewage water.
- The secondary treatment consists of equalization tank, BOD reduction, Nitrogen reduction and disinfection of treated water. The technology used for BOD reduction can be of any type depending on the weather, temperature and location of STP.
- To further improve the quality of treated water, tertiary treatment using Multi Grade Filters, Activated Carbon filters, ultra filtration, Nano filtration, Reverse osmosis is used based on requirement in combination. Typically, multi grade filter and activated carbon filters are used for the purpose of tertiary filtration in majority of STPs.

Suggested Methodology for Sewage Treatment

- To reduce the land area of an STP and to get better quality treated water in shorter time span so that the capacity of treatment plant



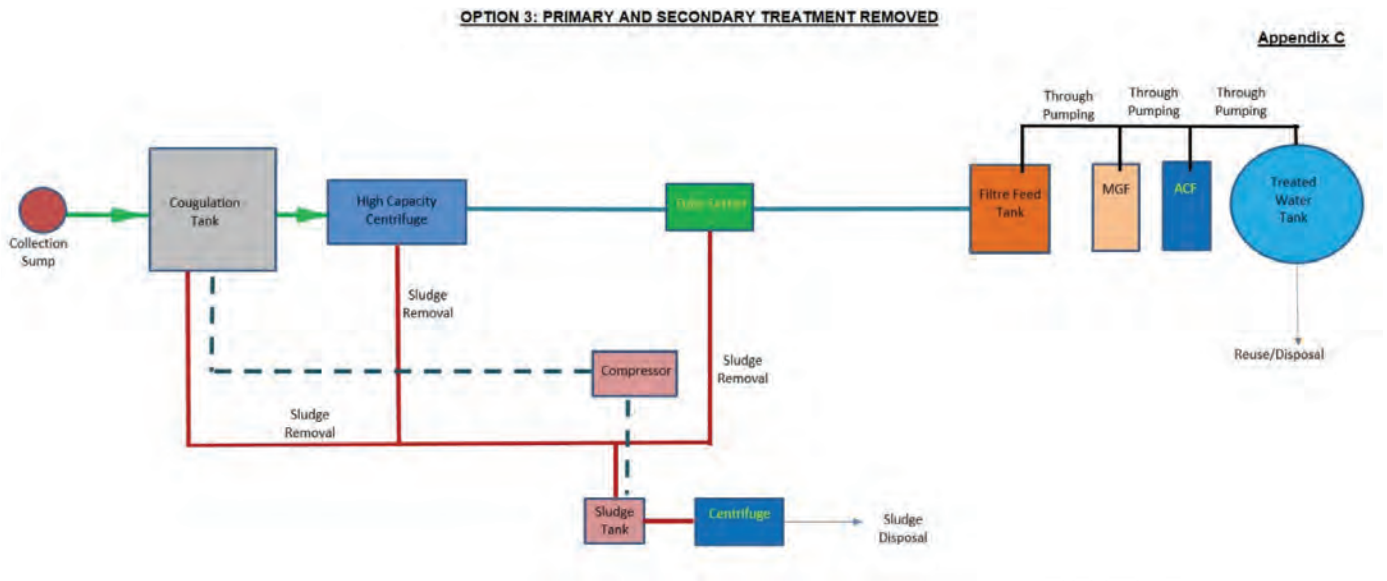
may be increased manifolds, separation of solids as the primary treatment of the incoming sewage is recommended. Mainly three different options are being recommended to achieve the desired results in treated waste water. Tertiary treatment as per the final desired quality of water will remain the same as typical STPs. The practice of provision of screens at the last manhole at the STP to remove plastics and bigger particles from the incoming sewage will continue hither– to–fore.

- **Option 1:** Improving the existing capacity of STP. The existing STPs primary treatment unit will be replaced with centrifuge/ modified mechanical pressure filter of desired capacity and the effluent out centrifuge/ modified mechanical pressure filter will be taken to the equalization tank for further treatment. All secondary units and tertiary units will remain same with some addition as per increased capacity which will be less than one third of required addition in case no centrifuge/ modified mechanical pressure filter was used.
- **Option 2:** Primary and biological treatment removed. The use of centrifuge/ modified mechanical pressure filter for separation of solids after pretreatment followed by Anoxic treatment. This is ideal for all domestic sewage with high TKN values. The tertiary treatment will remain the same.
- **Option 3:** Primary and secondary treatment removed. If the sewage water does not contain high amount of nitrogen content, the combination of centrifuge/ modified mechanical pressure filter with only tertiary treatment can be carried out. The thickening of the sludge to be carried out using chemicals to achieve efficient removal of solids. The effluent can be passed further through ultra/ nano filtration point to achieve the desired standards of treated water for specific purpose if required.

- The sludge generated from the centrifuge/ modified mechanical pressure filter needs to be passed through a smaller centrifuge to further thicken the sludge. The final sludge obtained needs to be decomposed in the composter. The composted sludge contains very high nutrient value and can be used as manure. In case wherein several STPs are located in nearby vicinity the sludge produced may be transported to a central composting facility which can be developed as a commercial venture to produce gas and manure.
- The detail of the options for modified STPs and sludge management will be dealt in the subsequent paras. This will include the tentative layout of STP, advantages & disadvantages of the option worked out over present system and tentative costs for the desired options.

Option 1: Improving the existing capacity of STP.

- The population forecasting is a very complex method for a place and the forecasted population may turn out to be wrong due to various reasons like specific government policies, socio economic condition, setting up of industrial/ corporate belts etc. The planning of the sewer networks and STPs are done keeping in view of the forecasted population. The sewer network generally have capability to take on extra load due to design of sewer network as partial flow sections and scope of extra carriage of sewage is always there. However, STPs are preciously constructed as per design population and scope of increasing the existing STP is very limited. Any increase in capacity results in construction of new STP which is cost consuming and also operation and maintenance cost increases.
- To overcome this problem, there has to be a solution to increase the capacity of the existing STP without much addition in the existing infrastructure. The solution lies in reducing the retention time of the treatment tanks so that higher volume of sewage may be treated at a given time frame. The reduction in the hydraulic retention time can be only possible if the BOD of the sewage water is reduced to certain extent before it reaches the biological process in secondary treatment.



- The reduction in the BOD to be carried out either by sedimentation or by centrifuge/ modified mechanical pressure filter. The sedimentation process requires chemicals and needs settling tanks of designate capacity which requires large space. In comparison, the centrifuge/ modified mechanical pressure filter can be installed at a small place and faster separation of solids may be done.
- The typical layout of the STP with all treatment units duly annotated and the modified STP is shown.

Advantages of Option 1.

The advantages envisaged of Option 1 over a standard STP is as follows:–

- The separation of solids takes place initially which will reduce the BOD load on the secondary treatment units and hence will entail reduced hydraulic retention time which results in higher amount of sewage treatment with same set up.
- The centrifuge/ modified mechanical pressure filter does not require large space for installation and working.
- No chemicals are used in primary treatment.
- The cost of additional construction will be much lesser to the tune of one third of the total cost as compared to conventional STPs for increasing the capacity of STP to more than double. Also, operation and maintenance of the STP can be done without incurring additional cost.
- Suitable for all kind of domestic sewage.

Disadvantages of Option 1.

- Any improvement, addition or improvisation in any existing system will come with inherent advantages and disadvantages. As the advantages are already listed above, the disadvantages envisaged for the Option 1 is as follows:–
  - The separated solid are not digested and it needs sludge digestion before disposal as manure.
  - The centrifuge/ modified mechanical pressure filter is a power consuming device and requires maintenance to keep it in serviceable condition.
  - Skilled manpower is required.

Option 2: Primary and biological treatment removed.

- Land availability in the country is becoming scarce in India. Usage of large land areas for construction of STPs is waste of available resource. To reduce the land area requirement there is a need to shift from the traditional technology of treatment of waste water to new mechanical and faster treatment technology.
- To achieve this we need to separate out the solids and liquids in the sewage water and treat both separately. However, waste water contains both dissolved and suspended matter out of which we will be able to separate suspended particles which actually requires biological treatment. The dissolved components of the sewage water has to be treated separately as per the constituents.
- Generally in domestic sewage the level of Total Nitrogen has to be addressed and brought down to the permissible level of 10 mg/ liter. This process requires two tanks, one for nitrification process in presence of oxygen and one for de nitrification in the absence of oxygen. The anoxic tank is an integral part of STP and it reduces the nitrogen level to the desired standards. Any other constituents if found in the sewage water may be treated accordingly before or after nitrogen treatment.
- The reduction in the BOD to be carried out either by sedimentation or by centrifuge/ modified mechanical pressure filter. The sedimentation process requires chemicals and needs settling tanks of adequate capacity which requires large space. In comparison, the centrifuge can be installed at a small place and faster separation of solids may be done. The process time will also reduce as there is no hydraulic retention of the sewage is done for biological treatment.

- The typical layout of the STP with all treatment units duly annotated and the modified STP is shown.

Advantages of Option 2.

The advantages envisaged of Option 2 over a standard STP is as follows:–

- The separation of solids takes place initially which will reduce the BOD load on the secondary treatment units and hence higher amount of sewage can be treated per hour.
- The centrifuge/ modified mechanical pressure filter does not require large space for installation and working.
- No chemicals are used in primary treatment.
- The cost of STP gets reduced as the biological process are removed. Nitrogen removal is also done in the process to achieve the laid down standards.
- Suitable for all kind of domestic sewage.

Disadvantages of Option 2.

Any improvement, addition or improvisation in any existing system will come with inherent advantages and disadvantages. As the advantages are already listed above, the disadvantages envisaged for the Option 2 is as follows:–

- The separated solid are not digested and it needs sludge digestion before disposal as manure.
- The centrifuge/ modified mechanical pressure filter is a power consuming device and requires maintenance to keep it in serviceable condition. Centrifuge to be maintained always in serviceable condition since it is an integral part of the treatment.
- Skilled manpower is required.
- Higher operation and maintenance cost due to more number of electrical and mechanical equipment's.

Option 3: Primary and secondary treatment removed.

- This option gives benefit of both Option 1 and Option 2 and will provide treatment of sewage water in faster time frame. The Option involves the separation of solids from the sewage water with chemical precipitation and removing the time consuming secondary treatment process completely.
- This process is essentially useful for pure domestic sewage with low total nitrogen content.
- The typical layout of the STP with all treatment units duly annotated and the modified STP is shown.

Advantages of Option 3.

- The advantages envisaged of Option 3 over a standard STP is as follows:–
  - A large quantity of sewage can be treated in a small place.
  - The separation of solids takes place initially which will reduce the BOD load on the secondary treatment units and hence higher amount of sewage can be treated per hour.
  - The centrifuge/ modified mechanical pressure filter does not require large space for installation and working.
  - The cost of STP gets reduced as the biological process are removed.
  - The system can work at any temperature.
  - The food to microorganism ration will not have any implication on the process.

Disadvantages of Option 3.

- Any improvement, addition or improvisation in any existing system will come with inherent advantages and disadvantages. As the advantages are already listed above, the disadvantages envisaged for the Option 3 is as follows:–
  - The separated solid are not digested and it needs sludge digestion before disposal as manure.
  - The centrifuge/ modified mechanical pressure filter is a power consuming device and requires maintenance to keep it in serviceable condition. Centrifuge/ modified mechanical pressure filter to be maintained always in serviceable condition since it is an integral part of the treatment.
  - Skilled manpower is required.
  - Higher operation and maintenance cost due to more number of electrical and mechanical equipment's.
  - Specific type of chemicals to be used for coagulation of solids since generated sludge needs to be treated before disposal and the chemical must not interfere with the digestion process.

Sludge Disposal

- A high amount of sludge will be generated in the process of sewage treatment. This sludge is a mixture of organic and inorganic components which needs to be further decomposed. The decomposition of the sludge is an important part of the process and disposal of this sludge cannot be carried out directly into the environment. The decomposition of the sludge can be carried out locally in the decomposer and the digested sludge can be used as manure. In case wherein a large number of STPs are located in an area, a centralized decomposition can be carried out which can generate commercial value from the sludge and management of the plant will also be easy. This decomposing plant can also include household solid waste which can be utilized along with treatment plant sludge to recover energy in terms of gas and manure.

Conclusion

- The method suggested for separation of the solids from the sewage if can be accomplished successfully, the major problem of sewage treatment will be addressed and the efficiency of all treatment plants will improve. The methods needs to be field tested and deficiencies needs to be worked out to achieve the best possible combination. Any suggestion to improve the method and interested implementation of idea, so that biological treatment can be replaced by mechanical/ chemical treatment without environmental effects are welcome.

Source: CPHEEO Report March 2021

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DOMESTIC WATER SCENARIO IN INDIA

Despite being the foundation of a strong economy, access to clean water is chronically underprioritized worldwide.

In India, less than 50% of the population has access to safe drinking water. 1.96 million homes have water that has been contaminated chemically, primarily by fluoride and arsenic. Surface water sources such as rivers, streams, ponds, and lakes, as well as groundwater that is pumped using handpumps from borewells, tubewells, and dugwells, provide the majority of the country's drinking water.

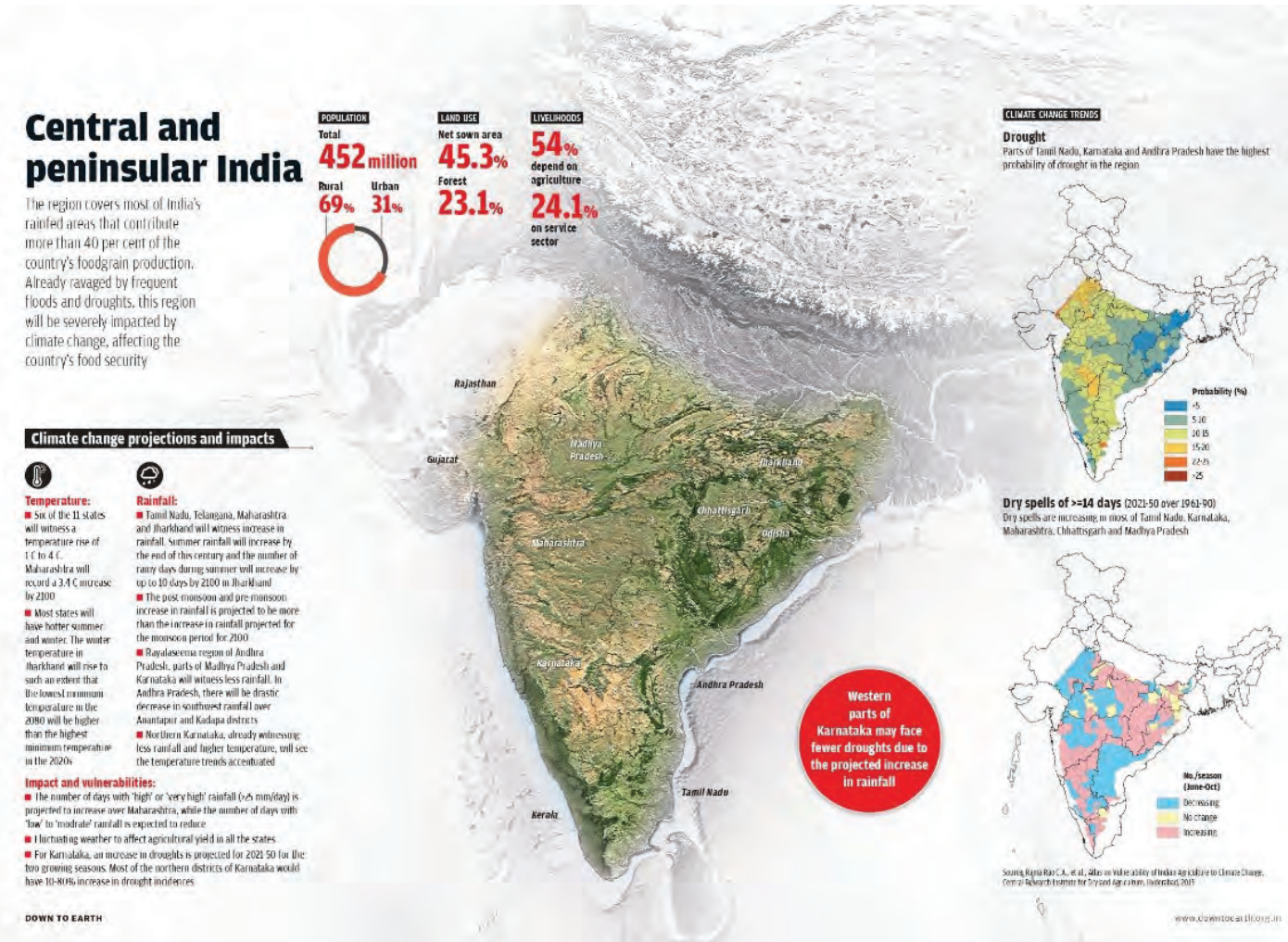
As India has varying geographical and geological conditions across the country, the current water supply scenario varies and has several layers of challenges. For instance, the eastern belt where there is abundant rainfall and sufficient catchment doesn't suffer from the availability of water, but the world's main areas of arsenic contamination are the Ganga–Brahmaputra regions. In the Ganges Delta, significant arsenic poisoning is a concern caused by the usage of tube wells for water supply. This makes accessibility to safe drinking water a challenge as the quality suffers.

Similarly in the north and some parts of the western region; the drier pockets of India; while there is less availability of water; due to lesser rainfall, people mostly depend on

groundwater leading to its severe depletion. This difficulty is exacerbated by India's reliance on a monsoon that is becoming more unpredictable for its water needs. While the accessibility of water is poor in most places of these areas due to the absence of piped water supply and other infrastructural challenges, the easiest avenue for accessing water becomes the unregulated extraction of groundwater. Lack of monitoring and irregular supply especially in the peri–urban areas has made the affordability of water an emerging challenge as well. This is not meant to minimise the fact that every community has a small number of disadvantaged individuals who are severely poor and lack access to basic essentials like food and water. But compared to any government subsidy programme, such groups of people are considerably more likely to be acknowledged and supported by their local community.

The most fundamental human need for health and well–being is access to safe water, sanitation, and hygiene, corresponding to the three interrelated, but coherent management

The drinking water technologies vary from place to place depending on the availability and the condition of water resources, land use, and topology of the area.



systems respectively, Supply Water, Wastewater and Solid Waste Management. These three pillars are managed by the Urban Local Bodies in India. The two main policies: Jal Jeevan Mission: Rural as well as Urban; and the National Water Policy (2012), aimed to enhance SDG 6's objective of Ensuring access to Water and Sanitation for all.

By 2024, it is the goal of the Jal Jeevan Mission to have connected every home in rural India to a reliable source of safe and sufficient drinking water. The mission also aims to incorporate source sustainability measures, such as water conservation, rainwater harvesting, and recharge and reuse through greywater management. The National Water Policy aims to incorporate water sensitive approach and a holistic management of water as a resource and defines the overall policy framework of the water sector from centre to states to cities and towns.

While the ULBs are mostly responsible for the water supply in households in most cities, the Public Health Engineering Department (PHED) also looks after the water supply at a district level and in smaller towns. The Service Level Benchmark for the continuity of water supply in cities is 24 hours. The benchmark is barely covered, as the average everyday supply is four hours, with many places alternating it up every other day. These issues arise in an environment with inadequate management systems and little data available on current assets, making it difficult to determine the amount and timing of necessary investments to raise service levels and increase operational effectiveness.

The drinking water technologies vary from place to place depending on the availability and the condition of water resources, land use, and topology of the area.

Due to such operational challenges, most households use have Reverse Osmosis (RO) systems connected to the main supply system as an alternative source of water. In many cases where cities disinfect supply water using chlorine, the presence of residual chlorine above permissible limits also causes the citizens to have their own purification systems at home.

In marginalised communities where piped water supply is not feasible due to infrastructural challenges, Govt. provides tankers to that location at regular intervals to provide water. Such tanker systems mostly do not

operate in an efficient manner and to meet the necessities, this is often taken up by private organisations which makes the system vulnerable to non–revenue water creating a disbalance in the city's hydrological cycle.

Villages either have community water taps which provide water on a daily basis or tube wells that are dependent on aquifers. This often leads to a threat to the quality of the groundwater is contaminated. Most rural communities perform sedimentation or coagulation using alum or simply boil the water before consumption for drinking.

India, having 18% of the world's population, only possesses 4% of the world's water resources. Around 1,100 cubic metres (m3) of water are available per person, which is much less than the 1,700 m3 per pe rson level for water stress and perilously near to the 1,000 m3 per person threshold for water shortage.

Urban areas already have a dire situation with regard to water availability and supply, and there is a significant gap across neighbourhoods and socioeconomic groups. Water availability in India's urban centres is seriously affected by climate change. Gradual alteration in the monsoon system seriously affects the urban areas of peninsular India. Due to the depletion of the glaciers and the transformation of perennial rivers into seasonal streams, the metropolitan areas in northern India that depend on rivers supplied by the Himalayan glaciers face significant challenges. Himachal Pradesh's area covered in snow decreased from 23,542 sq km in 2019–20 to 19,183 sq km in 2020–21. The majority of the main rivers, including the Chenab, Beas, Parvati, Baspa, Spiti, Ravi, and Sutlej, as well as their enduring tributaries that originate in the Himalayas, rely on the seasonal snow cover for the consistency of their discharge.

Given the current situation, it is necessary to manage water issues comprehensively and sustainably in addition to balancing environmental concerns with development objectives. The foundation of protecting and managing water as a resource is the involvement of non–government stakeholders and community participation in demand management of water for integrating water back into the natural landscape.

1. https://www.unicef.org/india/what–we–do/clean–drinking–water
2. https://openknowledge.worldbank.org/
3. https://www.worldbank.org/en/news/feature/2019/12/09/solving–water–management–crisis–india
4. https://www.downtoearth.org.in/news/climate–change

Tariq Siddiqui
Chief Strategist, TS Advisory Services

With a doctorate in media and more than 26–years of professional experience, Tariq Siddiqui has been working in water sector for long and advising several leading water companies in India. As Chief Strategist at TS Advisory Services, he has been developing, evaluating, and defining marketing and communication strategies for different industries.

SOLAR POWERED WATER TREATMENT:

ENSURING SAFE WATER

Across the world, 2.0 billion people are suffering due to not having access to safe drinking water and 3.6 billion people, nearly half the world's population do not have access to safely managed sanitation. World Bank has reported that African Nations the least access of clean water to their population which has also declined substantially the last two decades.

The share of rural population in having access to safe and adequate drinking water within premises in India has increased to 61.52% in 2022 from merely 35.76% in 2016, especially owning to the successful implementation of Jal Jeevan Mission scheme.

With the climate change and energy volatility surging, the only way of providing clean drinking water is by operating the filtration system by adopting sustainable energy management like solar power. In African and large parts of middle eastern countries, the electricity is not accessible to large populace and is becoming the main reason for people forced to drink unclean and contaminated water leading to health issues and premature deaths. Globally, 3.4 million people die from waterborne diseases every year. Water–related illnesses include waterborne diseases that are caused by pathogens such

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Solar powered water purification system is indigenously developed by Aquality Water Solutions Pvt. Ltd. with an aim to provide safe drinking water to security forces deployed in remote areas.

as viruses, bacteria, and protozoa and in India one person every four hours on average have died of these diseases.

Disease from Drinking Contaminated Water

The research studies reveal that every year:

- There are 1.7 billion cases of diarrhoea among children younger than 5 years.
- An estimated 446,000 children younger than 5 years die from diarrhoea, mostly in low and middle income countries. This amounts to 9% of the 5.8 million deaths of children younger than 5.
- There are 3 million cases of cholera and an estimated 95,000 cholera deaths.
- There are 11 million cases of typhoid fever and an estimated 129,000 typhoid fever deaths.
- Worldwide, hundreds of millions of people are infected by parasitic worms found in contaminated soil due to dirty water being disposed of without concern. These diseases are most often found in places with unsafe drinking water, poor sanitation, and insufficient hygiene practices.
- Worldwide, millions of people suffer from neglected tropical diseases (NTDs), many of which are water or hygiene related, such as Guinea worm disease, Buruli ulcer, trachoma, and schistosomiasis. An estimated 41 million people suffer from active trachoma and nearly 10

million people are visually impaired or irreversibly blind as a result of trachoma.

Access to Clean Water

The percentage of people using drinking water from an improved source that is accessible and free from contamination varies from country to country. Nearly 2.6 billion people globally have gained access to clean drinking water in the last 25 years. It is estimated that only 71% of the world population has access to safe drinking water. This means 29% of the world does not have clean water access. A look at the following table will provide the grim situation especially in African countries as they have least percentage of their population having access to safe water.

Country Name	%Population having access to safe water
China	76.0%
India	61.52%
Gambia	44.72%
Pakistan	35.84%
Zimbabwe	29.54%
Afghanistan	27.59%
Togo	19.56%
Democratic Republic of Congo	18.99%
Nepal	17.58%
Uganda	16.65%
Ethiopia	12.58%
Rwanda	12.10%
Central African Republic	6.18%
Chad	5.59%

Almost all these countries discharge billions of litres of untreated sewage every day to the their water bodies making the remaining surface water and even ground water sources further polluted. Rapid increase in economic activities, inadequate infrastructure for wastewater treatment and pollution abatement and weak environmental governance has resulted in rapid deterioration of the quality of the water.

Solar Powered Water Treatment System

Clean drinking water is essential for large rural and tribal population as well as armed forces out in the field and posted in wilderness. However, the transportation, delivery and sourcing of water is a huge challenge in such a condition with great logistical burden. Even the natural sources of clean water are difficult to find, especially in austere environments, where rivers, wells and lakes often contain harmful contaminants that are difficult to remove without proper water purification. In India, our security forces are positioned in remote locations, deep forests and completely inhabitable territories making the provision of safe drinking water more challenging.

Aquality Water Solutions Pvt. Ltd. has been leading the initiative to make clean drinking water available to our security forces and other establishments globally including human habitats in India, and African and Middle Eastern Countries. The pioneering solution of Solar Powered Water Filtration System was conceived by Mr. Naser Azeez along with Mr. B. M. Balakrishna way back in 2015 when they demonstrated the prototype system to Ministry of Water & Sanitation.

The new development of solar powered water filter has high speed water filtration unit that can purify water from practically any source, such as hand pumps, swamps, wells, floods, rivers, and even waste water. The technology being used applies innovative high purification techniques to make water absolutely clean leaving containments behind, resulting in producing high grade water suitable for drinking at any place without the requirements of conventional electric supply. These water treatment unit needs electricity as conventional units but the best part is that it generates its own electricity for the purpose and is ideally suited for areas with non–existent or erratic and unreliable power supply.

The purification device is also compact, at around the size of a big box, has low power requirements and has no removable parts that need to be maintained or replaced, such as carbon filters or reverse osmosis membranes. The best part of the system is it can recycle the used water as well for using it in toilet flush in all Swacch Bharat Mission toilets that has been constructed but not being used properly due to lack of water. Each unit has been designed as plug and function units for easy deployment at any remote site with minimal time for making it functional. The system can easily be transported to long distances by all transportation modes making it the best possible water purification system to be installed at any place in India and globally.

These systems can be used as a source of power generation as well when the water filtration is not in use and surplus electricity can be utilise for other purposes including lighting of establishments where it is being installed. During rainy or no sunny days, the system can be connected with grid electricity to function.

The technology will not only reduce the logistical challenges of

transporting bottled water, it will also reduce the risk of waterborne disease affecting mission success and ensure constant clean water supply to all far flung places wherever our security forces are deployed or even at villages where availability of clean water is a challenge due to electricity.

The solar–powered water treatment technology will help our defense services including Military, Navy, Air Force and paramilitary forces like Border Security Force (BSF), Central Reserve Police Force (CRPF), Central Industrial Security Force (CISF), Indo–Tibetan Border Police (ITBP) and even State Police Forces posted in forest and hilly areas. The portability of the system helps it in easy to install and easy to operate and maintain which will be a great advantage to the forces, by:

- enabling personnel to access clean, safe water out in the field, regardless of water source quality
- improving force resilience by reducing the logistical burden of transporting and relying on water tankers or bottled water convoys
- enabling scalable water production, with one water purification unit able to create between 500 to 20,000 liters of clean water per day as per the requirement
- promoting sustainability, by reducing the demand for electricity and bottled water
- reducing the carbon footprint associated with electricity use, and sourcing, transporting, and disposing of bottled water and traditional water purification filters
- a portable, modular and scalable water purification unit for safe drinking water at the point of use for humanitarian missions
- it can be mounted on a vehicle to provide clean drinking water to different locations everyday basis without any difficulty

Aquality Water Solutions have a team of passionate professionals to serve the customers beyond their expectation to provide the best possible water quality from the source of raw water and wastewater treatment solutions. The leadership team and field engineers have exceptional skills in project management after delivering multiple key projects of water treatment in addition to having deep technical skills to execute and deliver any project on time meeting its objectives.

Aquality Water Solutions work with their client as a trusted partner to add value to their business by reducing operational costs and improving efficiency by meeting their clean water demands. It has worked with clients in multiple industries and municipalities across the country.

Anisha Dey
SLWM Specialist, Water Sanitation & Hygiene Institute (WASH Institute)

Anisha Dey is an Architect–Planner having a specialization in Environmental Planning from the School of Planning and Architecture, New Delhi. She has an on–field and research experience of around 7 years covering WASH, settlement planning, and construction. She is currently working as SLWM Specialist in the Department of Drinking Water and Sanitation, Ministry of Jal Shakti for the implementation of Swachh Bharat Mission Grameen Phase–II. In her current position as an SLWM expert in the Technical Assistance programme she has also been involved in Liquid Waste Management. As part of the Technical Assistance team she has prepared a manual, toolkit, and action plans for greywater management, water resource conservation, FSSM and others. She has been an integral part of various capacity–building and handholding initiatives on water, sanitation and hygiene within and beyond the Ministry.

LIQUID WASTE MANAGEMENT IN RURAL INDIA – A NECESSITY FOR ATTAINING IMPROVED SANITATION AND A PATHWAY TO ENSURE THE SUSTAINABILITY OF WATER SOURCE

Water has always played an important role in our life and culture. The human civilization across the world have been evolving near the water source. Be it Mesopotamia or Indus Valley Civilization all these earliest and ancient civilizations evolved near the rivers and other water bodies. These were venerated since ancient times and even today by the locals. In the history of our civilization we all have read about how the old historic settlements have taken birth near a source of water; be it settling near water source for agriculture/cultivation or for setting up a new capital for expansion of kingdom and trade. And, India also has a few examples in case of Shahjanabad or Delhi, Agra fort was built near Yamuna, Guwahati was built near Brahmaputra, and Kolkata next to Hooghly, and so are many other settlements, be it rural or urban. However, this is only one side of the story and this is where this beautiful dependence ends. Each river holds a spiritual significance, which nurtures, cradles, sustains life, and provides the bountiful of resources not only for survival but also for earning the livelihood. While rivers continues to be the heart, soul and pride of many settlements around the world, Yamuna has been choked to death; Ganga is struggling to stay clean, while Hooghly lies abused and neglected. The lack of availability of water have had led to shifting of entire settlement or have resulted in building of infrastructure to fetch fresh water from a thousand of kilometres.

Around 71% of Earth's surface is covered with water, of which only 3% consists of fresh water and India has around 4% of these fresh water resources. These water bodies not

Moreover, to date around 1 lakh villages have reported having LWM infrastructure under SBM (G) Phase–II.

only provide us with water but play a vital role in giving us economic and social stability. They also provide with various ecosystem services falling under provisional, supporting, regulating and cultural services; which are generally not accounted for. With the increase in population growth and development, we have managed to destroy exploit this very origin of settlements/ civilization; either by dumping of solid and liquid waste, or leaving a never ending trail of pollution, or by exploiting the ecology of these water bodies. This along with climate change has resulted in decrease in fresh water sources as well as depletion in ground water level. It has put an emphasis on increasing the usability of water by treatment of wastewater, followed by reuse or recharge. There is a need to critically review the alternative approaches to ensure water availability. And, liquid waste management is one such way to reduce the demand of fresh water through treatment and reuse. It would also help in improving water management practices.

The rural India traditionally had a sustainable mechanism of managing liquid waste through kitchen garden or forestland among others. Due to none availability of household water supply system citizens are mostly dependent on water points, wells or village ponds for fresh water, thus limiting the water usage and liquid waste generation at household level. However, the pressure of land availability and increase in wastewater generation now disrupts the same practices.

Management of Liquid waste is vital for ensuring improved sanitation in the community and essential for ensuring source sustainability of fresh water. Population growth and development has not only reduced the per capita availability of fresh water but also polluted existing water bodies by unmanaged disposal of wastewater in both urban and rural areas. The National Annual Rural Sanitation Survey (NARSS) 2019–20 data shows that a high number of households are disposing off their greywater through a common system that are in general leading to water bodies.

This issue is widely recognized and the Open

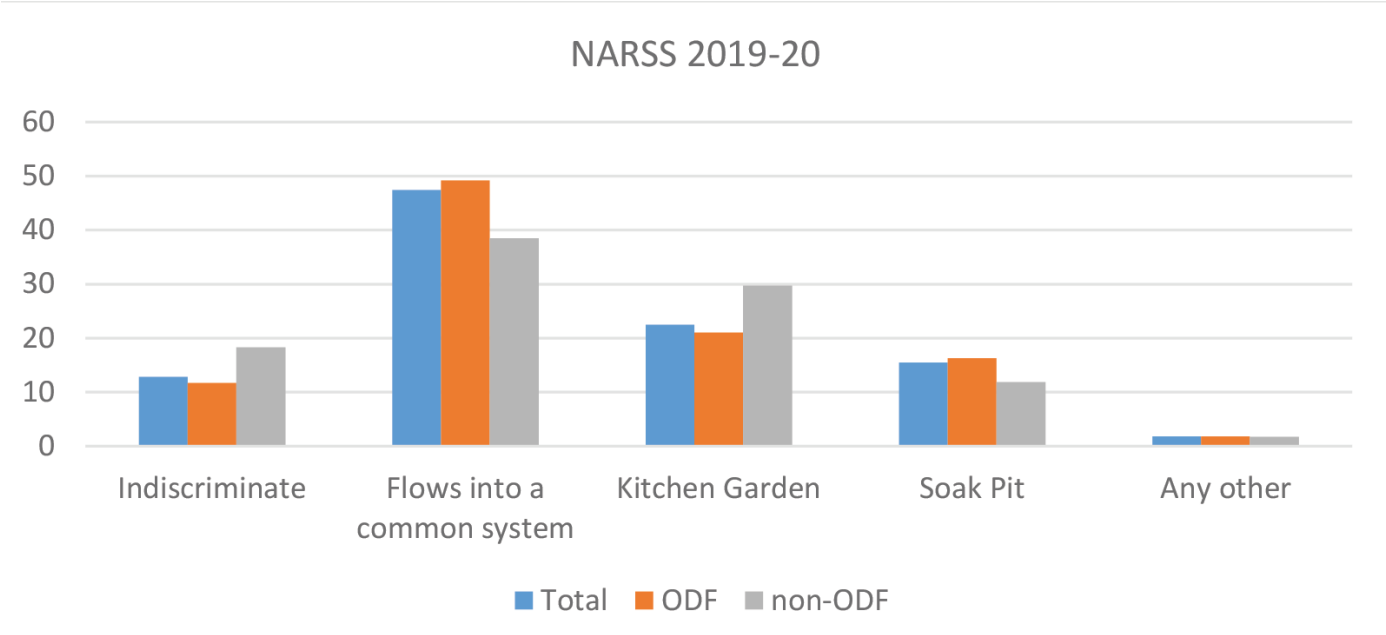

Figure 1 NARSS 2019–20 Report on Dispasal of Greywater in Rural India

Defecation Free (ODF) status was first milestone whereas the Sanitation Journey from perspective of public health and environment has just begin. The Goal 6 of UN Sustainable Development Goals of Agenda 2030 aims to provide access to clean drinking water and sanitation. The target 6.1 of the goal aims for everyone to have access to safely managed drinking water and the target–6.2 aims to provide people assess sanitation in diverse ways and these are categorized into tiers that is parallel to the categories of assess to water. India being a signatory to Agenda 2030, is aiming to achieve sustainable development by completing Goal 6, with the help of Jal Jeevan Mission (JJM) and Swachh Bharat Mission–Grameen (Phase–I & II). While JJM focuses on providing FHTC, SBM(G)–II focuses on providing sanitation services at the grass root level by managing the waste at the source or community level.

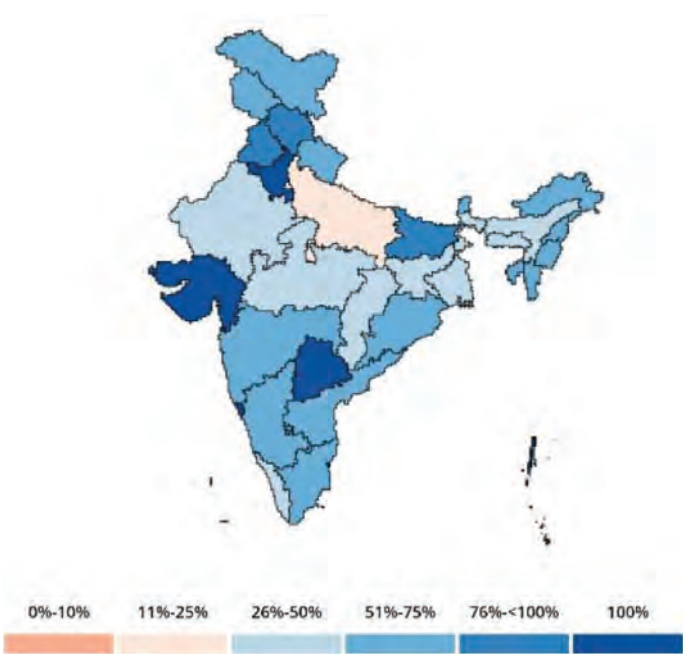

Figure 2 Status of Tap Water Connection in rural Households (HHs) under JJM

Out of SLWM, greywater is being directly impacted by the household level tap connection with a mandate to provide at least 55 lpcd potable water to all, which if not managed with caution could contamination of surface and ground water sources, and might lead to health hazards. Till date more than 10 crore households have been provided with Tap Water Connections. Thus, adding on to the responsibility of managing wastewater generated thereof. It has become crucial to manage the wastewater coming out from households especially greywater, which is flowing into open drains or resulting in waterlogged areas and degradation of fresh water ponds. The stagnated ponds of the greywater in villages, improper drains, etc. can lead to increased risks of exposure to diseases such as malaria, dengue, filariasis, and so on. The increasing amount of wastewater generated can also lead to contamination of groundwater through natural percolation, if not treated properly. While black water or faecal sludge is being managed through on–site sanitation system like twin–pit or septic tank among others. And, the same has been achieved through world's largest behavioral change campaign under Swachh Bharat Mission Grameen (2014–2019). Henceforth, the Department of Drinking Water and Sanitation, Ministry of Jal Shakti, GoI launched Swachh Bharat Mission Grameen (SBM (G)) Phase II on February 2020. The intent of the mission is to ensure sustainability of open defecation free (ODF) status and continued practice of safe sanitation, including personal and community hygiene behaviour along with creation of solid and liquid waste management (SLWM) services in rural India. The guidelines focuses on the importance of Liquid waste management (LWM) and greywater management is one

of the key components of SBM (G) Phase II for making villages ODF Plus.

A holistic approach for managing greywater is imperative to reduce the pressure on fresh water sources by using treated greywater as one of the source of water in rural areas and prevent degradation of the same because of improper disposal of liquid waste. The SBM (G) Phase II operational guidelines promotes 3R principle of– Reduce, Reuse and Recharge. It recommends treating of greywater at a place nearest to the point of generation and prescribes easy–to–use technology interventions with low operation and maintenance costs. Moreover, to date around 1 lakh villages have reported having LWM infrastructure under SBM (G) Phase–II.

There is a wide range of household and community–level technologies recommended for greywater management, such as the soak pit, Leach pit, and Magic pits, Waste Stabilization Pond, Constructed Wetland, and Phytorid, among others. It is advised to opt for sustainable technologies and solutions as per geographical conditions, availability of land, and quantity of greywater to be treated. Demography and reuse potential also plays a crucial part in the selection of these technologies. Furthermore, this treated greywater could be reused for irrigation, non–potable domestic use (such as toilet flushing, vehicle washing, gardening, etc.), cleaning of community spaces, pisciculture, groundwater recharge, and many more. This practice would not only help in keeping the surface water bodies clean but would also aid in decreasing the demand for freshwater for non–potable use. It would also aid in recharging the already constrained natural water resources and save them from liquid waste pollution through unmonitored disposal and leaching. Hence, aiding in making rural India clean and water sufficient. Although it is just the beginning, the importance of liquid waste management and treatment cannot be neglected and both the missions JJM and SBM(G) Ph–II is working hand in hand in making rural India 'Swachh and Sujal'. And these missions are going to aid the nation in making itself resilient to the effects of climate change while ensuring the sustainability of our water sources.

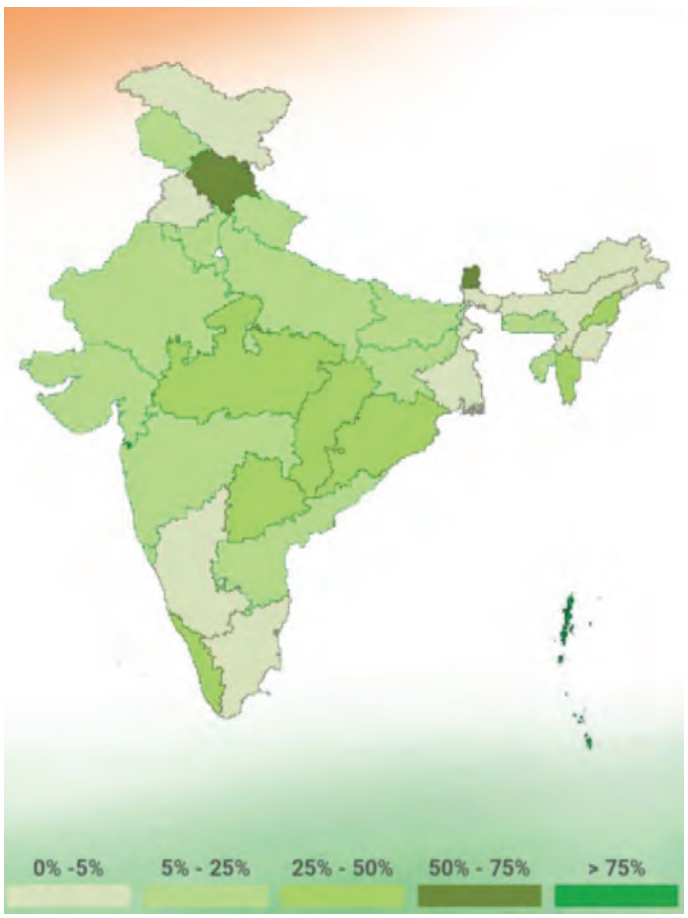

Figure 3 Percentage of villages having LWM as per SBM (G) Ph–II Dashboard

BUILDING WATER AND WASTEWATER INFRASTRUCTURE FOR A SUSTAINABLE FUTURE

Hiroaki Kobayashi
Chairperson & Managing Director,
Toshiba Water Solutions Private Limited

Hiroaki Kobayashi has held various leadership roles in international operations, business development, sales, and other commercial functions in the water & wastewater management business across Asia. His first association with India's wastewater industry dates back to 2010, where he was overseeing business development for Toshiba's wastewater management business in India. In addition to developing Toshiba Water's international business strategy, He was instrumental in securing the JICA2 funded projects like the Chandrawal Waste Treatment Plant (WTP) in Delhi, and the TK Hali WTP in Karnataka.

By bringing water to millions of people who rely on them for drinking water, household chores, and irrigating the land, rivers have always been the source of civilizations. In India, rivers also have a cultural, and spiritual significance that transcends socio–economic boundaries. However, an ever–growing population, inadequately planned urbanization, and industrialization, together with the lack of a robust municipal and industrial wastewater treatment network, have left many Indian rivers choked with effluents and toxic wastewater. Water availability is already falling rapidly, and it is estimated that by 2050, the average annual water availability per capita may decline to 1140 cubic meters from 1545 cubic meters in 2011.

The Government of India is promoting several initiatives for river development and rejuvenation. Under the aegis of the National Mission for Clean Ganga, the Ministry of Jal Shakti has

established sewage treatment infrastructure as one of the most important pillars for cleaning up the river Ganges. Toward building robust and future–ready wastewater treatment infrastructure, the government has sanctioned 402 projects so far, of which 224 are already completed and the rest are in various stages of progress.

Toshiba Water Solutions Private Limited (Toshiba Water) is an active partner in India's quest to build sustainable water and wastewater infrastructure. Headquartered in Gurugram, India, Toshiba Water has executed over 450 engineering, procurement & construction (EPC), and operation & maintenance (O&M) projects in 35 countries, and is now contributing to the government's "Make–in–India" and "Export from India" flagship programs.

Toshiba Water is a one–stop provider of comprehensive services ranging from system engineering and design to the construction, installation, and O&M of water, wastewater, and domestic waste treatment facilities. Toshiba Water also offers a IoT system as a service for both new and operating plants, to support remote monitoring and management.

Toshiba Water has a robust technology bank comprising of various owned and licensed technologies, including the ozone generator; zero liquid discharge (ZLD) using high–efficiency reverse osmosis; anaerobic biological treatment; activated sludge processing; and sequential batch reactors, etc. Its global design center and in–house engineering capabilities allow the company to offer optimum institutional knowledge, along with the best capital expenses and operating cost ratio solutions to achieve low cycle costs.

In April this year, Bihar Urban Infrastructure Development Corporation Limited (BUIDCO) awarded Toshiba Water two independent contracts for stormwater drainage pumping stations in Patna, Bihar, one with six pumping stations and another with eight pumping stations. The projects entail the construction, erection, supply, installation, testing, and commissioning of the 14 pumping stations with an outfall pipeline to the designated disposal points. All 14 will be constructed within a twelve–month period.

Toshiba Water is developing water and wastewater infrastructure in the state to rid the city and the neighboring towns of flooding and backflow during the heavy monsoon season. It will deploy specialized single–stage high–discharge stormwater pumps with vertical shafts. With these pumps, the stations can pump 2870 Lakhs liters of water per hour.

This is the first major contract awarded to Toshiba Water since Kobayashi was appointed as the Chairperson and Managing Director. Under his leadership, the company will continue to provide highly reliable water and wastewater treatment systems and operational know–how to support the Government of India, as it carries out its mission to provide water access to all.

Toshiba Water is determined to live up to Toshiba Group's basic commitment, 'Committed to People, Committed to the Future.', and has an unwavering drive to make and do things that lead to a better world. Through its knowledge and experience in constructing and operating water and wastewater treatment solutions, Toshiba Water remains steadfast in developing sustainable water infrastructure in India.

CASE STUDY:

ADVANCE TECHNOLOGY REPLACE CONVENTIONAL TECHNIQUES AND REDUCE RUNNING COST OF ULTRA FILTRATION PLANT…

By Sachin Maurya (Business Head), Neerway projects private limited

About the Author

Sachin Maurya is business head of Neerway Projects Private Limited. He is a master's in business administration from Dr. A.P.J. Abdul Kalam Technical University with entrepreneurial skills and 14 years of field experience. He has good industrial and institutional network for business implementation all over India.

Neerway Projects Private Limited (NPPL) are an ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 certified leading EPC company and Importer & Exporter of state–of–art technological water products from overseas market for advancement in water infra management. NEERWAY has produced and offered broadest range of innovative Water & irrigation products to industries, municipal water, farms, golf Courses, commercial developments.

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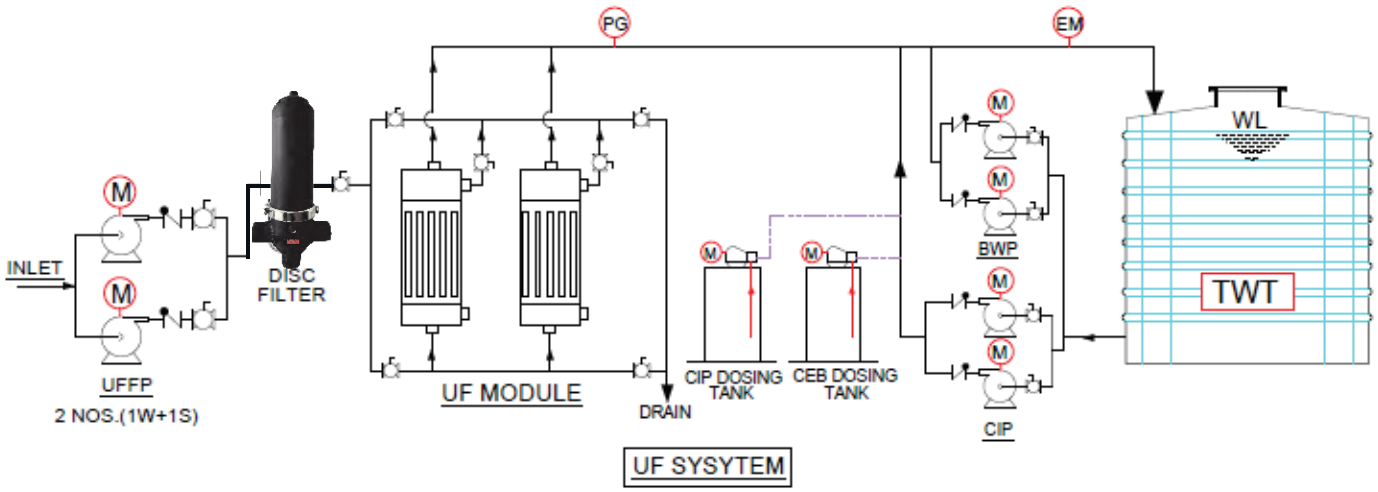

In General, UF plant is most popular concept in water industries to reduce TSS/turbidity load from water, hence many water and waste water treatment industries/organization are using UF plant from decades. Each Ultra filtration plant required pre–filtration system to avoid frequent clogging of UF membrane to provide solutions for this limitation each Water OEM's have different concept of pre–filtration.

Disc filtration technology are more appropriate concept to reduce space, running cost and improve better and absolute water quality to UF plant for better durability.

NEERWAY have installed into many industries (paper, Pharma, bottling plant, sugar, textile, building, etc. for water filtration & UF membrane protection via many water OEMs. It is going on regular basis where user/clients also are preferring such state–of art technology in to water industries to save running cost.

Disc filter are more effective/economical into small capacity of plant also, because it is available in small size also. Some unreserved differences into methodology.

Feature	Conventional Techniques	Disc filtration Technology
Price	Economical	Moderate
Footprint	Moderate	Space saving
Opex	Running Cost on regular basis	Zero running cost
Disposal	No use friendly	No replacement
accuracy	No accuracy of filtration degree	Absolute filtration degree–100/50/20/10/5 micron
Durability	Need replacement	long life
Operation	Need tools	No Tools required
Mode of operation	Manual only	Manual/Semi–automatic/ Automatic
Limitation	Not appropriate for large capacity	Best & economical for high flow/capacity of plant

UF membrane demand are emerging and to reduce the capital costing and operational costing is big opportunity or scope for new concept technology. Disc technology are better option in place of pre–filtration system to cut–down running cost of it. Numerous large capacity of plant are based on Disc filtration methods from long time.

Disc filter are available with Self–cleaning Automatic flushing design it start from 1 filter unit to 12 filters from Ø2 to 12'' connection size from 200 micron–5 micron which perform an in–depth 3D filtration, back wash valves (Ø2–4) with each filter module, it work on low–pressure backwashing. Each filter using filtered water from the rest of the filter equipment, while continues the filtered water supply downstream It is most reliable filtration system because of less backwash frequency and less water and energy consumption. It is smart, compact and modular Plug & Play technology for TSS removal, many STP/ETP/WTP/landscape irrigation/ Swimming pool/ pond filtration projects running successfully

Automatic disc filtration system are unique and compact engineered design for industrial water applications. The filters are based on innovative disc technology that arrests and retains a large amount of suspended solids particles. Its unique and efficient hydraulic self–cleaning backwash mechanism requires low water consumption and saves energy. It is simple to operate, delivers micron surface and depth operation with minimal maintenance and a short automatic backwash replace conventional filter media.

WABAG secures

Industrial Waste Water Treatment order in Romania worth about INR 260 Crores (EUR 30 Million)

VA TECH WABAG ('WABAG'), a leading pure–play water technology Indian Multinational Group, further enhances its leadership in the Industrial water treatment market in Romania with WABAG Water Services S.R.L., Romania ('WABAG Romania'), its European subsidiary, securing a repeat order from Purolite S.R.L, Romania ('Purolite') worth about INR 260 Crores (EUR 30 Million) towards upgrading the Industrial Wastewater Treatment Plant ('WWTP') in Romania.

The contract will be an Engineering & Procurement ('EP') scope contract which includes design & engineering, equipment supply, installation, commissioning and start–up of the Purolite Victoria WWTP. The project is scheduled to be executed over a 24–month period.

The existing plant, located in Victoria, Brasov County, was designed to treat 5,820 m3/day of wastewater generated from resin production. Purolite has planned to increase the production and an increased wastewater flow will result from production. Thus, an upgrade of the existing WWTP has become necessary. The upgrade will include additional pre–treatment, extension of existing lamella clarifiers and new Reverse Osmosis stage, in order to treat the effluent up to national NTPA001 discharge criteria.

The key features of the WWTP upgrade includes:

- Influent pretreatment, Cooling, neutralization
- SO4 and calcium precipitation and solids separation
- Reverse osmosis treatment stage
- Brine Evaporation Crystallizations

Commenting on this order win, Mr. Erwin Moetz, CEO – Wabag Romania said, "It is a matter of extreme pride for us to have bagged this key industrial order and we thank Purolite for the confidence they have reposed in us. We have already built a waste water treatment plant for Purolite and this repeat order is indeed a great testament of the trust that the customer has, regarding our capability and competencies. Wabag Romania specializes in design and construction of industrial water plants and this project will be another marquee reference for us."

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TENDER OF WATER WASTE

Buyer/Seller: Nagar Palika Nigam

Ref. Number: 55876686
Tender Number: 4551/2022–23

Requirement: Interception And Diverson Work Of Waste Water & Proposed Treatment Unit Sewage & Recycle Arrangement Of The Treated Sewage From Gatar Ghat, Mohan Ghat And Masura Ghat Nalla Nearby Katni River.

Document Fees: INR 20,000
EMD: INR 250,000
Tender Estimated Cost: INR 50,000,000
Closing Date: 03/01/2023
Location: Katni – Madhya Pradesh – India

Buyer/Seller: Public Works Department

Ref. Number: 55334357
Tender Number: 2022_WBPWD_429399_1

Requirement: Proposed underground drainage system for waste water and storm run off at KAKDWIP SDH DHHD RN_17000972 PH II. 2ND CALL.

Tender Detail: Wbpwd / se / sc_ss / nit08 / 2022–2023#*. proposed underground drainage system for waste water and Storm run off at kakdwip sdh dhhd rn_17000972 ph ii. 2nd call.

EMD: INR 377,399
Tender Estimated Cost: INR 18,869,944
Closing Date: 28/12/2022
Location: South 24 Parganas, West Bengal

Contact Details: Public Works Department||p.W. Directorate||pwd (South Zone) –II Southern Circle Social Sector kakdwip, South 24 Parganas.

Buyer/Seller: Public Works Department

Ref. Number: 55908578
Tender Number: CE/287/2022/21

Requirement: Construction of New Medical College and Hospital at Tinsukia. (Construction of external drainage for discharging waste water and rain water of Medical College Campus.

Special Note: Tender Submission & Opening Dates are undefined in the tender. For further details, you have to contact the Government Department or check Tender Document and Image File.

Document Fees: INR 17,600
Tender Estimated Cost: INR 87,895,317
Closing Date: 15/01/2023
Location: Tinsukia – Assam – India

Buyer/Seller: Nagar Palika Nigam

Ref. Number: 55876686
Tender Number: 4551/2022–23

Requirement: Interception And Diverson Work Of Waste Water & Proposed Treatment Unit Sewage & Recycle Arrangement Of The Treated Sewage From Gatar Ghat, Mohan Ghat And Masura Ghat Nalla Nearby Katni River.

Document Fees: INR 20,000
EMD: INR 250,000
Tender Estimated Cost: INR 50,000,000
Closing Date: 03/01/2023
Location: Katni – Madhya Pradesh – India

Buyer/Seller: Rural Development Department

Ref. Number: 55199623
Tender Number: 2022_AHMED_854970_1

Requirement: Constructing solid waste and waste water management at deothan,tal–akole ,dist–ednagar

Tender Detail: Constructing solid waste and waste water management at deothan,tal–akole ,dist–ahmednagar #*. constructing solid waste and waste water management at deothan, tal–akole, dist–ahmednagar

Document Fees: INR 5,600
EMD: INR 60,792
Tender Estimated Cost: INR 6,079,208
Closing Date: 23/12/2022
Location: Ahmednagar, Maharashtra, India
Contact Details: RDD, CEO, Ahmednagar

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- 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

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