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MY PAGE

In the month of March, as spring begins to unfold, the scenery transforms with vibrant festivals, blossoming flowers, and delightful weather. This time also marks the season of numerous events on the IPA calendar. Kicking off the year was the IPA NEERATHON- Run for Water, a resounding success despite the unseasonal rains in Delhi, where the locals displayed remarkable resilience for a noble cause.

March is also significant for World Plumbing Day (WPD), celebrated globally. All 27 Chapters of the Association are eagerly preparing to commemorate this day, and I encourage every member to participate in the festivities.

India's premier exhibition of Water, Sanitation, and Plumbing Products and services, PLUMBEX INDIA 2024, is slated to take place at the JIO International Convention Centre in Mumbai from April 25th to 27th. This event, the third in its series since its relaunch in Delhi in 2022, serves as a pivotal platform for professionals in the plumbing and water industry to connect and explore business opportunities under one roof. With features like Product Demonstrations, Success Stories, B2B meetings, and a Reverse Buyer Seller Meet, including delegates from African countries like Kenya, Tanzania, and Ghana, this mega show is indispensable for the entire plumbing fraternity.

Highlighting recent endeavors, the IPA Summit 2024, themed 'Sustainable Architecture to build a resilient Bharat,' was successfully organized by the Indian Plumbing Association (IPA) in collaboration with the Council of Architecture (CoA) and The Indian Institute of Architects (IIA) on February 24th, 2024, in Mumbai. The event provided a unique platform for leading professionals from the architectural community to converge and address the crucial goal of building a Sustainable Bharat.

IPA proudly launched 2 new Chapters in Lucknow and Sambhaji Nagar (formerly Aurangabad), with plans to add a couple more by year's end. These new chapters are expected to significantly contribute to IPA's mission of Redefining Plumbing Standards by disseminating knowledge on this essential building service.

In this issue of IPT, we have curated technical articles on the crucial subject of water audit and mitigating water crisis. Effective water infrastructure systems play a pivotal role in safeguarding public health from waterborne and sewage-related infections, thus leaving a lasting legacy of community well-being for future generations. We hope you find this issue intriguing and eagerly await your feedback as we strive towards continuous improvement.

Happy Reading!

Sharat V Rao
Managing Editor, Indian Plumbing Today
IPA National Joint Secretary

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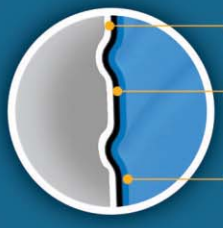

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Water Audit: Integration of Supply side and Demand side

Part 2

- Dr. Snigdha Goel

Note: The 1st Article in this series on "A Powerful Tool in Sustainable Water Management" was published in February issue of Indian Plumbing Today. This is 2nd article in the Series.

> You cannot manage what you do not measure
>
> - Peter Drucker

Introduction

Water management is a critical aspect of sustainable resource utilization, involving the careful balance of supply and demand. Within the realm of policy analysis, the water sector is typically divided into supply-side and demand-side components. The supply side primarily focuses on providing water and related services, often involving infrastructure projects aimed at capturing, storing, and delivering water. Historically, policymakers have predominantly emphasized supply-side solutions. However, with new water-related problems arising globally, policy-makers are increasingly emphasizing on demand side management of water. These demand-side management interventions attempt to address the problem of water consumption imbalance at the consumer end.[1]

Inefficient water supply or distribution affects the overall water availability at the consumer end. Effective water management in developing nations should prioritize measures such as regulating piped water usage, expanding storage capacities, minimizing distribution losses, and safeguarding supplementary water sources to promote sustainability. To investigate the feasibility of incorporating these factors, water audit has become necessary. Further, to manage water, it must be first measured both at supply end and demand end.

Energy audits have been conducted for many years, and there is a well-established cohort of service providers trained to perform them in accordance with standards developed by Bureau of Energy Efficiency in India. This is largely due to the fact that energy, or power, is a billable resource, unlike water which has traditionally been considered freely available. Thus, a corresponding level of industry maturity, and awareness of auditing water does not yet exist for auditing water performance.

The previous article in this series published in February issue of IPT, discussed what is water audit, its types and methodology and typical case studies demonstrating successful water audit operations. In this issue, we will delve deep into the types of water audit. Broadly, there are two types of water audit viz. Demand-side and Supply-side water audits. Both play pivotal roles in ensuring efficient water management practices. Let's delve into the key concepts and strategies associated with these audits.

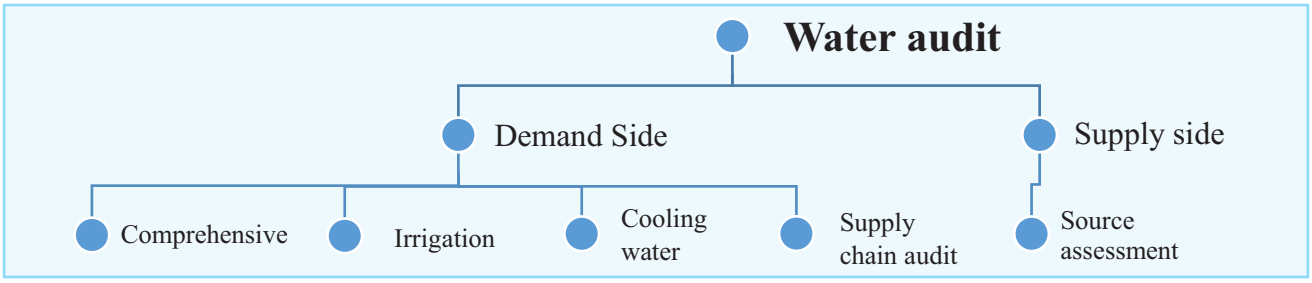


Fig 1: Different kinds of water audit

1. https://www.fao.org/3/t0800e/t0800e0c.htm

1) Supply side Water Audit

A key function of a water utility is to ensure that it has adequate supply to provide water services to its domestic, commercial, and industrial customers. Because population continues to grow nationally, utilities often need to consider whether it is appropriate to develop additional supplies. Such supplies may be provided by greater withdrawals from surface water or groundwater, construction of reservoirs, or construction of desalination or water reclamation facilities. Any of these types of projects carries a cost. As water utilities consider options, it makes sense to ensure that they are effectively managing the water resources already under their control (EPA)[2]

Supply side water audit refers to conducting of periodic exercises to determine water supplied into the distribution system as well as water lost and/or used within the distribution system. It is also an effective tool for realistic understanding and assessment of the present performance level and efficiency of the service and the adaptability of the system for future expansion & rectification of faults during modernization. Interventions at this stage through supply side management of water resources tends to increase the amount of water available.

a) Features of supply side water audits

- Supply-side water audits focus on increasing the availability of water resources through strategies like finding new sources, increasing storage capacities, or utilizing technology for water treatment
- These audits typically involve government-led initiatives to augment water supply without initially burdening end-users. However, the costs associated with supply-side management can be significant, posing challenges for regions with limited financial resources

Supply side audits were the first one to be considered by supply utilities and policy makers because it gives an estimate of non-revenue water and the losses incurred by the supplier. Two main aspects of supply side water audits are: Revenue water and non-revenue water. Let us understand the meaning of these two terminologies.

b) What is Revenue water and non-Revenue water?

i) Revenue water means the volume of water entering the distribution system that is billed and for which the utility receives revenue portion of authorized consumption that is billed and produces revenue. This revenue comes from tariffs, subsidies, and grants.

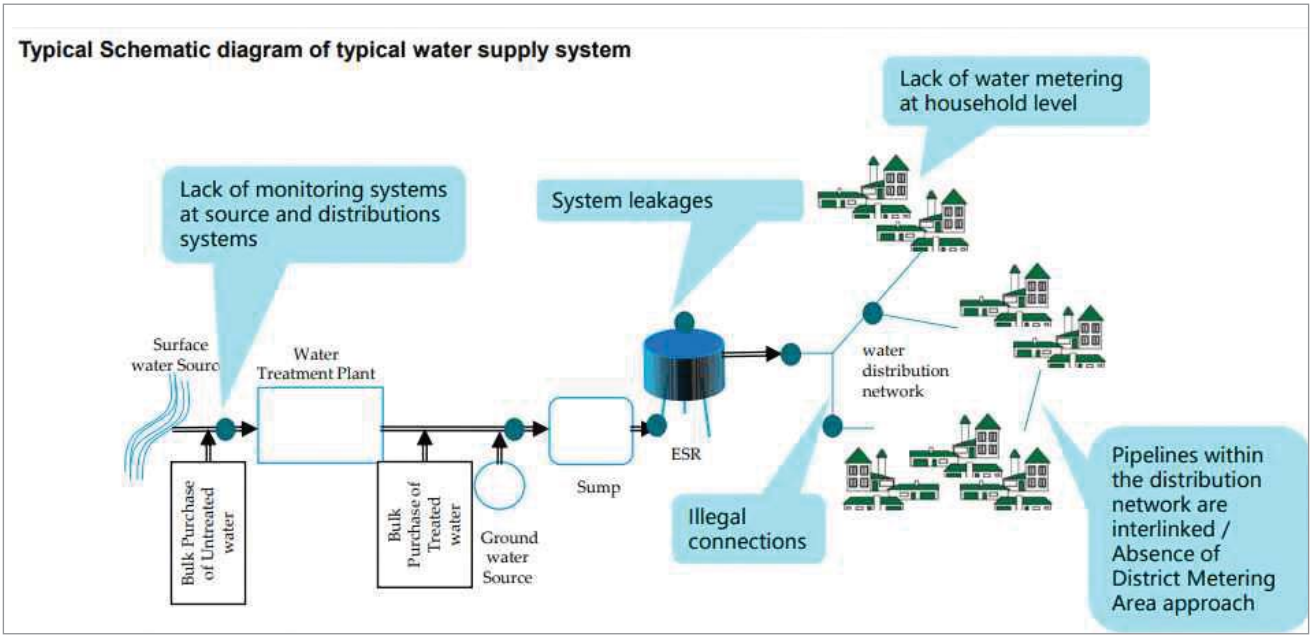


Fig.2 : Typical schematic diagram of a water supply system in a city

Source: Center for Water and Sanitation[3]

2. https://www.epa.gov/sites/default/files/2016-12/documents/wc_best_practices_to_avoid_supply_expansion_2016_508.pdf
3. Center for Water and Sanitation. 2022.

Water supply utilities aim at increasing their revenue water so as to make the supply profitable as well as maintain the sustainability of their water source.[4]

Revenue Water = Billed Metered Consumption

ii) Non-revenue water (NRW) is defined as the difference between the volume of water introduced into the Water Distribution System and the volume of water billed to end-users[5]. It is water that is produced and introduced into the water distribution system but is "lost" before reaching the end-users due to leaks, theft or wastage[6].

Global statistics of non-revenue water is almost 30% of water system input volume with the cost value of the water lost amounting to USD 39 billion per year. If the global volume of NRW is reduced by one-third, the saved water would be sufficient for approximately 800 million people assuming 150 litres per capita[7] in India, the average NRW is around 38% and is above the global average (Varatharajan, 2020). Add figures on global average Given the alarming situation of water crisis in India (around 600 million people face extreme to high water stress) (NITI Aayog, GoI, 2018), water audit of the supply facilities must be conducted regularly[8].

Non-Revenue Water = Unbilled Authorized Consumption + Physical Losses + Commercial Losses

What happens if non-revenue water is high?

Most water utilities with high NRW function at low levels of efficiency. In essence, the primary product of a water utility is treated water, but when a significant portion of this treated water is lost during distribution, the costs associated with water collection, treatment, and distribution rise, while revenue from water sales diminishes. Consequently, this situation necessitates substantial capital expenditures to meet growing demand, failing to address the root issue.[9]

To transition from this detrimental cycle to a beneficial one, water utilities should prioritize water conservation strategies identified through water audits. For instance, consider a specific city where the total water produced is 320 MLD (Million Liters per Day), yet only 240 MLD is billed to end-users. With an NRW of 25%, amounting to 80 MLD, the annual cost incurred by the water utility totals Rs. 94 crores. This cost includes Rs. 45 crores for water, Rs. 30 crores for electricity charges for water pumping, and Rs. 16 crores for staff salaries, along with Rs. 3 crores for valve operators.

Currently, only Rs. 22 crores are recovered through water charges, accounting for a mere 23% of the total cost. By not purchasing NRW from external sources, which costs approximately Rs. 6000 per MLD, the city could save Rs. 17.5 crores. Additionally, there would be a cost benefit of Rs. 14 crores from savings and redistribution of electricity, resulting in a 33% reduction in the total cost of supplying water to the city. This translates to an annual cost saving of Rs. 9.84 lakhs per MLD.

By conducting water audits and implementing strategies to reduce NRW, cities could significantly enhance their cost recovery mechanisms and overall efficiency in water supply systems.[10]

c) Objectives of supply side water audit

- Assessment of the utility's water loss situation
- Improvement in understanding and identification of problems/issues pertaining to reduction of unaccounted for water and enhance effectiveness of its improvements through more reliable data

Fig. 3: Understanding losses and consumption

4. UN-Habitat, 2012. Water Audit Manual
5. (Frauendorfer & Liemberger, 2010).
6. (Duffy, 2016).
7. (Liemberger & Wyatt, 2019).
8. PIB, 2019
9. Climate Centre for Cities, NIUA. 2021
10. Climate Centre for Cities, NIUA. 2021

- Enhance meaningful benchmarking with other service providers deepen understanding of the water balance for purposes of prioritising attention and investments
- Significant cost cutting in water bills leading to cost recovery

d) Elements of supply water audit

It includes a record of the amount of water produced (total water supply), water delivered to metered users, water delivered to unmetered users, water loss and suggested measures to address water loss (through leakages and other unaccounted for water losses). Audit is conducted by establishing a Water balance of the total volume of water added or subtracted from a water distribution system. Water balance was defined by Lambert and Hirner as part of the International Water Association's (IWA) Water Loss Task Force. This IWA water balance covers the entire water supply service chain of the water utility from the production of water to its treatment and distribution till the end-user. Fig 4 describes the process of water audit of a supply facility.

Benefits of supply side water audit:

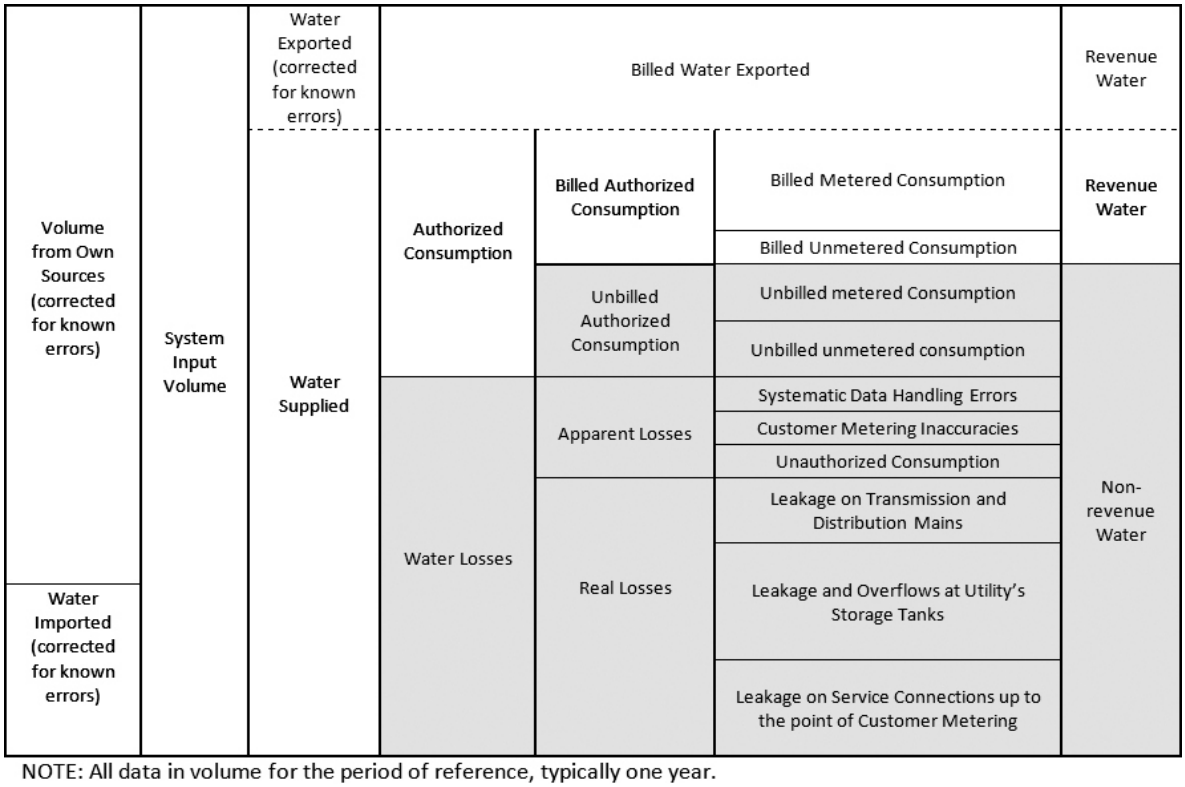
- Spatial assessment of water supply distribution
- Identification of problem areas in the water supply system for targeted remedial measures
- Accurate determination of Non-Revenue Water (NRW)
- Reduction of Operations and Maintenance costs
- More efficient use of water results in providing greater ecosystem protection, and/or free up the water saved to serve additional needs.

2) Demand-Side Water Audits

This kind of audit establishes the quantity/volume of water being used, wastage if any, leakages existing, excess use etc., and identifies areas where consumption can be reduced. It critically examines existing treatment systems and practices and recommends changes to improve efficiency and reduce usage.

Demand-side water audits focus on reducing water consumption by end-users through various measures such as conservation, efficiency improvements, and behavioural changes. These audits aim to understand how water is used by consumers and implement strategies to reduce demand effectively. Without conducting a thorough audit, the facility may:

- Invest money towards areas with slow or low returns



NOTE: All data in volume for the period of reference, typically one year.

Fig. 4: Water Balance methodology to audit water supply facilities Source: IWA [11]

11. IWA Water Losses Task Force. 2000

- Inadvertently replace fixtures or appliances that are already operating efficiently
- Not identify high efficiency items that have become less efficient over time or those that have had older replacement parts added during routine maintenance

Key components of demand-side management include:

Financial Incentives: Offering financial incentives for reducing water use or disincentives for overuse.

Public Education: Educating users on the importance of reducing demand and changing behaviour towards water consumption.

Efficiency Measures: Implementing structural changes like fixing leaks, upgrading infrastructure, or using efficient technologies to reduce waste.

To reduce demand, stakeholders can implement various measures. A structural or operational change, such as fixing leaky systems or upgrading existing infrastructure to reduce waste is one technique. Economic approaches focus on financial incentives for use reduction, or disincentives for overuse. Public education works to change user behaviour based on sharing knowledge about why reducing demand is important. Water audit professionals may suggest any one of these techniques.

Types of Demand side Water Audit

Type of Audit	Features	Facility audited	Area of water consumption audited
Comprehensive	Provides an extensive view of water usage, any risks, and opportunities for improvement within the organization. Helpful for companies seeking high-level green business certifications or serious about their sustainable business practices and achieving their sustainability goals.	Educational, - Hospitality, commercial and institutional	• Swimming Pools • Laundry • Plumbing Fixtures (kitchen, washrooms, toilets) • Landscape • Food Service • Cooling Towers • water purifiers /water treatment plant Steaming Frying /Grilling / Baking • General Cleaning • Ice Making Water quality
Irrigation	Focused specifically on outdoor water consumption, including irrigation and landscaping activities, this audit type targets businesses with significant outdoor water usage. Companies can optimize water usage in landscaping while minimizing waste, thereby promoting environmental sustainability and cost savings.	Agricultural farms Sports field and golf course fields Agricultural Universities and Research Institutions Facilities with a large landscape	Water source Water supply infrastructure (pumps, pipelines, valves, and filtration systems) Water quality
Cooling water audit	Essential for businesses relying on cooling systems, such as data centers or HVAC units, cooling water audits assess water usage associated with cooling processes. This audit type helps businesses identify opportunities for reducing water consumption, improving cooling system efficiency, and mitigating environmental impact.	Manufacturing plants, power plants, refineries & petrochemical plants Commercial buildings Data centers Food processing centers	Cooling tower, flow meters, cycles of concentration, leaks and corrosion in tower Makeup meters Blowdown meters Conductivity controllers High-efficiency drift eliminators Water quality

Process of demand side water audit

The overall procedure for a demand side water audit is largely the same for all kinds of water. Only the areas monitored during the audit change with the type of facility. The process is depicted in Fig.4. The audit must follow ISO 46001:2019 methodology and adhere to IS standards IS 17650 (Part 1 and Part 2):2021 while assessing water efficiency of sanitary wares and sanitary fittings. The main steps include collection of water consumption data followed by its processing and analysis. Based on the audit results and observations and their discussion with stakeholders, potential water saving measures are suggested in the form of an implementation plan. The facility is free to either adopt the implementation plan and take the suggestive measures or maintain status quo. If the measures are taken, a post audit assessment can help evaluate the cost-benefit analysis.

Measurement includes:

- Identify water sources and influencing environmental factors
- Past and present water use and water use activities
- Variables affecting significant water use

Audit observations and calculations include:

- Quantification of inefficiencies and leaks
- Quantification of water quality loads and discharges
- Quantification of variability in flows and quality

Benefits of Demand Side water Audit

Increasing water use efficiency at a facility makes good business sense. It can result in following benefits:

1) Reduce operating costs, secure future water supplies, and enhance public image. In many areas, water and sewer rates are increasing faster than those for energy, making investment in water efficiency a smart decision.
2) Increase water efficiency can reduce the facility's operating costs beyond the costs for potable water and wastewater.
3) Earn green credit and complete ESG compliance
4) Benchmarking by comparison of water consumption with similar other institutions

Fig. 5: Demand side Water audit methodology

Conclusion

Working in silos has seldom produced impressive results. Indeed, breaking down silos and integrating supply-side and demand-side audits creates a seamless flow towards holistic water resource management. This collaborative approach ensures that water supply aligns with actual demand while optimizing usage efficiency, thereby fostering sustainability in water management practices. By promoting equitable distribution, reducing wastage, and mitigating the risk of shortages, these audits address critical challenges while minimizing environmental impact. Education emerges as a vital catalyst in this journey, nurturing understanding and commitment to sustainable water resource management. In essence, by fostering collaboration, integration, and education, these strategies form the cornerstone of a more secure and sustainable water future.

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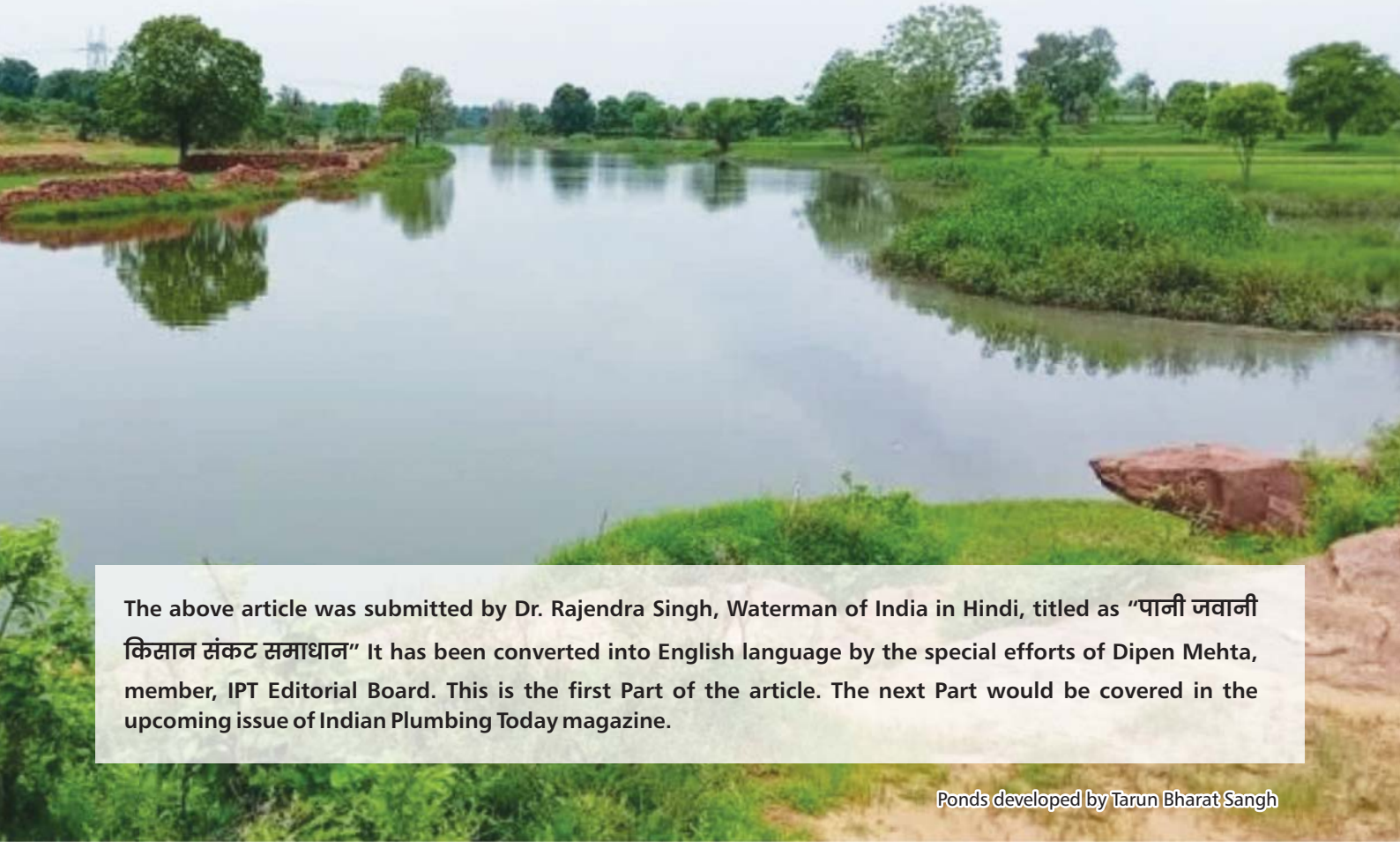

The above article was submitted by Dr. Rajendra Singh, Waterman of India in Hindi, titled as "पानी जवानी किसान संकट समाधान" It has been converted into English language by the special efforts of Dipen Mehta, member, IPT Editorial Board. This is the first Part of the article. The next Part would be covered in the upcoming issue of Indian Plumbing Today magazine.

Ponds developed by Tarun Bharat Sangh

Droughts and floods have started occurring in the world due to soil erosion, water flow and soil accumulation. This crisis is especially prevalent in Central Asia and Africa, but their desolation has increased the population of America and Europe and accelerated urbanization. Urbanization has transformed the earth from a bare, cement-concrete jungle to an ugly one. He has started getting fever. The mood of the weather has deteriorated. This water crisis is worldwide. This has forced people to migrate. Due to this, the density of population of the areas and nations called developed has increased.

Population increase has increased tension. This is creating possibilities of world war. Its root cause is flood-drought water crisis. This crisis is today's biggest challenge. The solution to this is the experience of Rajasthan and Maharashtra.

There are now dozens of new villages along the Mahakali river, the flagship of Maharashtra. Similarly, there are thousands of villages of Arwari, Sarsa, Ruparail, Sabi, Bhagani, Jahazwali, Sharni and Maheshwara in Rajasthan. Through these experiences we can avoid world war.

Avoiding the plunder of big dams farmers prospering by adapting to climate change through crop rotation.

water literacy is to be increased. This article is for those across the country who believe in the ideology of Mahatma Gandhi, for the water-heroes, water-warriors, water-lovers, water-workers, water-messengers and water-sevaks engaged in water conservation. It is going to provide water to the farmers and youth. It is an attempt to show the way to cure earth's fever and improve its mood by increasing water literacy.

River rejuvenation and climate change adaptation through community decentralized water and soil management provide sustainable prosperity to farmers.

Today's famine is a natural anger, but how did it become a natural anger? What creates anger in nature? The answer is the increasing red heat on earth. Red heat is dry heat filled with poisonous gases. Dry heat is called red heat. When moisture and vital air increase in the climate then it is called green summer. And when the effect of green heat gives blue heat. It rains. When this water suppresses the soil, yellow heat is born. Sometimes, red heat is suppressed by green heat, which makes the place suitable for farming and bio-production, which is called yellow heat. This mostly happens in mixed areas of farming and industries. Whenever the effect of red heat increases on the earth.

If so, nature's anger appears in the form of floods and droughts. Due to this heat the clouds move away from the earth. Due to the speed of air pressure, clouds flow and collide with each other, causing floods in the mountains, and if they move without rain, they cause drought. By the way, clouds which normally do not come down as rain, get attracted towards the mountains by greenery or moisture and burst and cause heavy rains there. This can also be considered as nature's anger. In olden times it was called cataclysm.

Floods and droughts were earlier called cataclysms born out of natural anger. Nowadays they are known by new names like cloud burst, cloud break, El Nino and tsunami. But all this has happened due to decrease in respect for nature and increase in human pressure and interference. As long as this pressure increases, such natural anger will only increase. There is still a great need to stop this. Many such efforts have been made across the country but these areas were few and small. Therefore, their good effect is visible only in few places.

In Rajasthan, this good effect is seen in the greenery and farming of Indira Gandhi Canal in the desert. In the sub-desert area (Aravalli), 10853 square km has been covered in the last 40 years. More than 12,000 water structures have been constructed in more than 100,000 areas and have increased the greenery in the soil by preventing soil erosion. Due to this the effect of yellow heat and green heat increased and the mood of the weather improved. The earth's fever subsided. This is the climate change adaptation process.

Due to this the natural anger has reduced. Now the impact of flood and drought is not the same in this area. The rainy season has protected the same area and recharged the wells there. This has increased farming and greenery in this area. In the last 40 years, increasing soil moisture and greenery have changed the face of the earth here. Due to increase in green heat in the season, the temperature here does not go as high as before. It started remaining 3 degrees less than that. But has increased in urban and industrial areas.

In areas where moisture and greenery have increased, it is a normal phenomenon for the temperature to be lower than normal. This general process is called climate change adaptation. This adaptation is now changing the rainfall cycle of Rajasthan. Due to this the crop cycle here has changed. The crop cycle of Thanagaji area is currently becoming a source of happiness and prosperity.

Construction of a new vegetable market is a new phenomenon in this area. This has given the youth a sense of purpose. Lust increases greed. But respect for nature has also increased in the minds of people in this area, only then adaptation to climate change has become possible. This is the way to end drought and flood. This will calm nature's anger. There will be prosperity and peace in the world. Human brain famine will also end in this way.

The path of greedy development will increase human indulgence and natural anger. This will cause floods and droughts. Preparing for famine relief, water literacy is the dialogue of water conservation. save every drop of rain.

Keep it in the belly of the earth. First collect it on the ground and then fill it in ground water reservoirs to protect it from evaporation. Engineers do not know the work of filling ground water reserves, geologists do.

These two do not work together, hence only the work of emptying the ground water reserves is being done, not the work of filling it.

India has the highest level of groundwater exploitation in the world. For this reason, despite receiving more than half the rainfall, the year 2017-18 is facing the brunt of a severe famine. For the first time in history, more than half of India's land has been hit by famine. 13 states and 327 districts were affected by famine, but as soon as July 1, 2017 came, famine was forgotten. Like before, the rain water of Mumbai has flowed into the sea today. Mumbai gets water from forests and villages.

Villages, forests and wild animals keep longing for their water. Mumbai keeps draining its water into the sea. The July rains could provide water to Mumbai for four months, even more. But in this matter our intellect is at a loss. To eradicate this famine, we will have to change the central water management done through contracts into decentralized water management. This decentralized water management provides equality to both nature and humanity.

Central water management: Big dams focus only on meeting human needs and become a burden on nature, causing floods and droughts. This type of water management leads to a lot of displacement and distortion whereas community water management is free from such defects. There is no displacement of greenery and humanity in this. It is equally auspicious and beneficial for everyone. This type of management can be done by a small group itself and a sense of ownership gets awakened along with the work. In that, the work of improving the shared future and the disciplined spirit is born. This leads us to climate change adaptation by preventing the adverse effects of global climate change. This experience, the result and experience of Tarun Bharat Sangh's work done in Rajasthan for the last 33 years, encourages all of us. This kind of work needs to be done all over the world in this 21st century.

The water resources of any country play a vital role in its progress or decline. Many civilizations and cultures are formed and destroyed due to the availability or influence of water. Therefore, water has a very high place in the cultural consciousness of our country. Used to stop the rain water at that place. Our ancestors knew that ponds nourish forests and land. Ponds are also helpful in preventing soil erosion and accumulation of soil in river beds. He had a special kind of consciousness towards water and understanding of its use. Due to this consciousness, with the wisdom of the village organization, ponds were built to properly utilize all the water in the village. Water was available from these ponds even during famine. The work of their care, maintenance, repair etc. helped in strengthening the organization of the village.

Rural Customs

As was the case with other matters related to the village system, similarly the villagers used to make some laws unanimously in their Gram Sabha for the decision and maintenance of the pond. These laws were called 'Ganwai Dastur'. These customs were written down in 'Ganwai Bahi', or were passed down from generation to generation through oral tradition. Even an outsider coming to the village had to follow these lost customs. Since these wasteful customs were followed according to common sense. That's why there was only one in almost every village. Therefore, generally people were familiar with them, even if not, a person coming from outside could easily understand them.

In this area of Alwar district, we have learned from some old village customs related to the pond that no one used to enter the 'Agor' of the pond with shoes. The toilet bowler's hands were washed outside the agar with separate water. It was forbidden to dig soil in Aagar without the permission of a village council. It was forbidden to go to the toilet for defecation not only in the reservoir but even in the catchmeant area of the pond. In some way, the person who spread filth was suggested to atone by cleaning the pond. For atonement, there was a tradition of planting a tree on the banks of the pond and taking care of it until it grows.

Arrangements were made at the time of making the pond itself to ensure that the land does not get eroded from the water catchment area of the pond and gets deposited in the pond, due to which the pond could not remain shallow for a long time. When there was a need to repair the pond, the entire village would sit together and decide to do the work. The soil coming out of the pond was used for sowing in the fields or for potters.

The pond was considered public property of the village. When the people of the village used to go to another village, the pond was first counted among the property of their village. The village was considered to be the same as the pond it had. If a village pond is good, then that village was considered prosperous, organized and powerful. Important decisions of the village were taken.

And- the understanding of the so-called educated people

This tradition continued till 1890. After this, the attention of the British turned towards destroying our

village organizations, voluntary organizations and people's initiative. They actively planned to end all these simple rural systems in various ways - somewhere by showing canal irrigation schemes, somewhere by showing dreams of big dams etc., somewhere by criticizing our high cultural heritage, pond water and somewhere by criticizing our despite attempts by our own countrymen and so-called educated people to pollute the country's education system and destroy our culture, the rich tradition of prosperous ponds continued. Irrigation was also done from these ponds. In this way, these ponds of ours were living examples of the decentralized economy of the village. Even in the areas of Rajasthan where there was only two-four centimetres rainfall, people and animals survived with the help of these ponds. The great desert areas of Jodhpur, Barmer and Jaisalmer are less.

Despite the rain, they were more developed than today. Despite less water, the old mansions, palaces, big markets and international trade centers of this area were built due to the pond system here and this was proof of its usefulness.

By 1890, the influence of English education had increased in the country and the British conspiracy started becoming successful. First of all, the impact of English education fell on our kings, feudal lords etc. Those who earlier used to pay more attention to the construction of ponds during the famine, now started giving importance to works like building the boundary walls of their capital cities etc. The ponds built by their ancestors started breaking without any care, and what once broke could not be rebuilt. Time and mud silt buried them. In this way the old ponds started disappearing.

There is a popular saying in our country that "like the king, like the people". This saying came true and the indifference towards ponds among the villagers also increased. Similarly, the village ponds were destroyed and the British policy started showing its true colors in the villages also. Due to the breakdown of village society, construction, maintenance and repair of ponds stopped. Along with the village ponds, the village organizations also started disintegrating.

Place of water and soil in western civilization

During the freedom struggle, only Bapu had glorified the village pond in his talks and speeches, but others did not pay much attention to it. Our other leaders, brought up in English education and Britishness, could not understand the merits of our social system, rather they kept criticizing it considering it inferior. At that time, it would have been better if Bapu had linked the maintenance of the village pond and pastureland with constructive programs along with the spinning wheel, although he himself was concerned about all these things. At the time of independence, Bapu had drawn the attention of the then Prime Minister Jawaharlal Nehru to revive the village system, but Nehru was influenced by western civilization. His priority was to build a dam like Bhakra. Indian and foreign vested interests took full advantage of this. Ponds were hit the most by these big irrigation schemes.

The Indian government has spent billions of rupees till 2018 on building big dams. The government claimed that two crore hectares of land would be irrigated through these schemes. How much land is actually being irrigated by these schemes? This cannot be said, because the whole thing is doubtful due to the way their data is collected. During this period, 246 big schemes were started, out of which only 65 schemes have been completed so far. The stream of losses now flowing in these big schemes is shocking. How and from where will the loss of thousands of crores in a year be covered? This thing definitely worries the conscious person. But through these schemes, big contractors get profits, engineers get bribes and jobs, politicians get a share in the loot, and big industrialists get cheap electricity from village water.

Selling big machines from big countries and big factories, cement etc., building canals, in which even village roads started being made with cement. Ministers use the material from their industries for the work of their ministries. The land of the poor goes to the poor, thus a few big families get all the benefits. This is our policy makers' definition of "development". Today we are just being told the greedy slogan of development. We are stuck in development. This development only leads to displacement, distortion and destruction, all this does not happen through ponds. This leads to peace, goodwill and lasting prosperity.

The real purpose of building big dams was just to throw dust in the eyes of the people under the pretext of "irrigation" through big dams. If the true facts come to light, then in reality due to big dams, overall irrigation has been less than before because due to the stopping of the flow of rivers by these dams, lakhs of acres of land on both sides of these flows and the wells located in them dried up. And the groundwater level has gone down by fifty to seven hundred feet in the last ten-twenty years. The real purpose of these big dams was to break the self-reliant system of the farmers and concentrate them and to benefit the big houses or

multinational companies. The traditional self-reliant system of irrigation in every village was ended and the fate of the farmers was handed over to these people.

The mistake of ignoring these simple but effective ponds is still being made. In 1950, 17 percent of the total irrigated area of India was irrigated from ponds. Along with irrigation, these ponds also maintained the underground water level, there is solid evidence available for this. Before 1950, our ponds were the only effective means of irrigation. In the distant past, more than 8 percent of irrigation was done through ponds. The stone inscriptions found in the ponds are living proof of this. These ponds are found in every corner of India. The area under irrigation from ponds continued to increase till 1890, mostly in the coastal districts and in eastern Uttar Pradesh, Bihar and Rajasthan. The planners of independent India have maintained the conspiracy that the British had deliberately hatched to end this self-reliant irrigation scheme and have rapidly implemented the present, anti-people, village-slavery irrigation scheme.

The terrible famine of recent years has once again reminded us of the ponds. Some people have done studies on this at various places. Among these researchers, Mr. Van Oppen and Subbarao believe that land irrigated by ponds gives three times more yield than non-irrigated land. Pond irrigation has proven to be very beneficial especially in dry areas. Similarly, now many voluntary groups have come to light in every corner of the country, understanding the importance of ponds, who are very concerned about this and are doing something or the other. Now it is again doing the work of pond construction in Rajasthan, Maharashtra and Karnataka.

First hand experience of small ponds

Overall, in the last years we have built or repaired more than eleven thousand small and big ponds and small dams in Rajasthan. A total of ten crore rupees have been invested in these, but their benefits.

If we look closely, we are surprised. For example, in the year 1986, the irrigation and drinking water wells of Gopalpura village had dried up. The young people of the village had gone to Delhi and Ahmedabad for labour. Nothing was being produced in the land, then the work of construction of pond was started in this village and by June 1987, three big ponds were built in Gopalpura village. The villagers call them dams and a small pond was already ready. Wheat worth ten thousand rupees was given for their construction work. In July 1987, the region received a total rainfall of 13 cm. All this rain had happened simultaneously within 48 hours. Their water

Ponds and check dams

"recharged" the land, and the water level in 20 wells around the village rose. 100 acres of barren land came under cultivation.

The rain water that had collected in the ponds had also carried away leaves, cow dung etc. from the forests and hills, which settled at the bottom of the ponds. Big ponds were built on farm lands. Therefore, by the time November reached, the water of the ponds was used to irrigate the land below and wheat crop was sown in the land below the pond. In one crop, only 300 (three hundred quintals) of grain was produced from the land of these ponds, which is worth about Rs. 5 lakh at the market price. Apart from this, the pond remained filled with water throughout the year. It was made for drinking water for animals. In this way, drinking water remained easily available to the animals of the village throughout the year. The drinking water well of the village which had dried up now remains full of water. The water level of the well has now increased from 90 feet below to 20 feet.

Green grass has started growing around the ponds. The trees have become green and started growing rapidly. The water of the ponds attracts wild animals and birds, making the atmosphere of a ruined village pleasant. The arrangement of birds eating insects that damage crops and using ground water from bird droppings is once again creating an atmosphere of community spirit and mutual cooperation. To get drinking water one had to go far, which wasted a lot of time and energy of the village women. This problem is over now. Similarly, every year people had to go out of the village to work, but now they are getting a lot of work in the village itself. There are many villages like Nimi in which earlier laborers used to go to Jaipur. Now they have become employment providers to the Sheths of Jaipur. Trucks owned by Sheths are used to transport vegetables from these villages to the cities. Thus, these ponds have brought many benefits.

Due to this area being at the foot of the mountain and being sloping, the heavy rain water used to erode the land and carry it away. The fertility of the land was lost along with the rain water, hence there was a lack of moisture in the land, and not only the seeds of the crops but even the grass did not grow. There is less rainfall there, and whatever happens, it happens simultaneously and at a higher intensity, and then there is drought throughout the year. Therefore, pond is very necessary and especially useful in this area. Land erosion has also stopped due to the ponds.

Similarly, a "check dam" has been built in Kishori village, which can be called a big pond. This too was completely ready in July 1987. The total cost of its construction was fifty thousand rupees, of which half the cost was raised from the labor donations of the village. 250 quintals of food grains were produced in the filling area of this pond alone. This pond stops a strong stream, which in the past years had made more than a hundred acres of land barren (unfit for cultivation). There were big drains and pits in the ground. That land has started levelling automatically. Now it has become cultivable. It can be said that this pond has made the entire 100 bigha land suitable for farming. The water level in the wells has come up. The water stagnating in this pond, which earlier used to spoil hundreds of bighas of land as it went down, has now stopped. With ponds, one hectare of land can be successfully cultivated at a cost of Rs 1 lakh. Not possible with a big dam. The poor do not even get this expense. Only big companies belch this money. Big companies eat all the money for farming and irrigation from the farmers' budget.

Chambal firsthand experience

The companions who used to roam around with guns in the villages of Chambal. Now he left the gun and started building ponds with a shovel, his work brought happiness, prosperity and peace in the lives of the villages of Sapotra tehsil of Karauli district. The brothers who were called dacoits became gentlemen-farmers and gods. Now their Maheshwara river started flowing like pure Sadanira. Khijura village has become a provider of milk and grains to many. He organized Kumbh by inviting thousands of people to his village. Became water positive from waterless. Till now, twelve hundred villages in an area of 10853 square kilometers have created more than eleven thousand ponds with their own hands and small rivers like Arvari, Sarsa, Ruparel, Bhagani, Jahazwali, Sabi, Sairni, Maheshwara in Rajasthan and Mahakali and leading rivers in Maharashtra have been revived. Now the groundwater level is rising and making the rivers permanent. The moisture in the ponds also corrects the increasing temperature and worsening weather by creating greenery. Trees absorb carbon from the atmosphere by storing it in their leaves, stems and roots. Therefore, a small local work like a pond is the solution to the global problem of worsening weather patterns and balancing the blazing universe.

Happiness along with financial benefits

Based on the experience of the eleven thousand ponds that we have built so far, we can say with full authority that the amount spent in the construction of any pond can be recouped in one year if there is normal rainfall.

We do not know the language of figures, but seeing the huge economic benefits from the labor involved in this work as well as the happy, joyful atmosphere of village unity and helpless animals and birds frolicking on the pond, the mind becomes happy. Due to this feeling of joy, we have got the power to build thousands to lakhs of ponds in future. American fellow Patrick McCauley has written after studying our ponds. Three rupees have been spent in holding thousand liters of water in the pond. In big dams, it costs more than three hundred rupees to capture this water and deliver it to the user. Therefore, capturing water in ponds and using it is the cheapest and permanent solution.

Pond system is a thorn in the eye of today's elite class!

Along with the material and emotional benefits, this work has also exposed the naked picture of today's exploitative and distorted system. In fact, the politicians don't know why the power being built by the villagers doesn't suit them? Administrative officers and technical people have remained unaware of the power of the villagers and the traditional method of self-reliance. When these ponds started being built, the Superintendent Engineer of the Irrigation Department of Rajasthan Government once gave a notice to demolish them, saying that they were illegal. The District Magistrate had also advocated this matter. There was a lot of effort in the State Secretariat to break them, but due to the persistence of the villagers, the investigation was done again and after six months a letter came from the Development Commissioner saying that this is a good work, the government should cooperate in it. Deputy Chief Minister, Irrigation Rajendra Singh said that Rajasthan government's water has stopped. This will remain in our judgment. Couldn't send me to jail.

It has been seen and understood that when the government is forced to do so, then the work which was earlier considered bad, harmful and sometimes even 'seditious' also becomes useful. This is exactly what happened in this pond incident. When the Chief Minister came to know that the ponds were built by the people together and if the ponds were broken, the people there were ready to die before the ponds were broken, then these 'illegal' ponds became legal as well as very good. We also got advice to get support from the government in this good work. The United Nations had considered the people who are the cause of Naru disease and had advised to eliminate them. They have started calling him 'Best Revelation' by the name Johad. The question arises, why today every good creative work has to be fought first. To do good one always has to do teaching, creation, organization and Satyagraha.

Should we hope?

The cost of irrigation through big dams and canals has reached forty thousand rupees per hectare. Apart from this, people have also seen the ill effects of the canals coming out of Tawa, Narmada, Bhankhada etc. Understanding this, there is opposition to these dams at many places. Opponents are also suggesting small dams or irrigation ponds. Hopefully, our planners will accept this and call building ponds a good work, and will recommend doing the same work through ponds at a much lesser cost than what is currently being spent on big dams. But that day will come only when we become a compulsion of the government. Now we will have to find compulsion on the part of the government to ban big dams. Only then will the ponds also get protection. The Chief Minister of Maharashtra has started Jalyukt Shivar by stopping the work of big dams. But even in this the contractors are coming and spoiling it. Otherwise this was the best plan. Now the government is making good efforts again. The government here is trying to convert water war into peace by introducing water literacy.

तेन व्यक्तेन भुन्जीठाह

'This whole creation was made for me, I have the right to use it as much and as I want - this misconception is at the root of many of today's economic problems. In reality creation is not for man, creation has its own independent purpose. Man is a part of it, hence one has to live with respect for the creation.

Overall, the entire creation is one, its various parts are not only interrelated but also mutually dependent. Creation is not 'for me'. In fact he is not 'for anyone'. Together it is for everyone. Therefore, man should take from nature only as much as is necessary for his survival. And 'Whatever is taken should also be taken by serving, by sacrificing, by doing something or the other in return i.e. by performing Yagya. In India, there was a tradition of taking it by giving it to nature through Yagya. This is stated as follows in the Upanishad.

Ishavasyamiddam sarvabh yatkich jagatyam jagat. Ten vyakten bhunjithaah magudh kasyasviddhanam.

The more we use water in our lives, the more we should contribute to the work of nature by shedding our sweat and building ponds. Whatever we take, we return the same to nature by making it a pond. That's why the tradition of ponds is time-tested and still holds true.

Where society exists. By making a pond it makes itself full of water. He saves his pond even after facing those who break the pond.

Our ponds are the largest dams in the world. Thousands and lakhs of people become homeless due to the big dams built today. Thousands of ponds make the homeless people settled by providing them houses, trees, plants, food and water. Floods prevent drought. Improves the mood of the weather. Makes the temperature of the universe balanced.

As long as the Indian farmer considered farming as a culture and conserved water and soil, he continued to move forward on the path of permanent prosperity without spoiling the earth. Till then the Indian farmer was a natural producer who taught the world. Today the farmer needs to look again towards his basic knowledge and work in that direction.

There is no respect for farmers. That's why farmers, water youth, everyone is leaving their place and migrating. There is a need for water literacy that stops the migration of helplessness, unemployment and disease and a vision and philosophy that promotes love and respect for nature. We have to do this for world peace. This path is called climate change adaptation.

Rajasthan's water conservation and rainfall cycle was linked with the crop cycle. The people who were uprooted from their villages came back and started farming. Greenery increased, rainfall cycle changed, agriculture with less water consumption increased. The trend of producing more with less water increased. Income increased. Understanding also increased. Peace was established as love and trust in nature increased. This is Indianness. This is eternal and permanent prosperity. Now we have to walk on this path.

Dr. Rajendra Singh
Waterman of India

Popularly known as 'Jal Purush, Waterman of India', Dr. Rajendra Singh is a renowned river rejuvenator and environmentalist. Born on August 6, 1959 in Dola village, Baghpat, Uttar Pradesh, he is an Ayurveda graduate and a post graduate of Hindi literature. For his work, he has been awarded honorary doctorate degrees by the University of Agricultural Sciences in Dharwad Karnataka 2014, Purnima University Jaipur in 2016, and from APJ Abdul Kalam Technical University Lucknow in 2019. Dr. Singh has been awarded several international and national awards and recognitions. He is the main incumbent Chairman of Tarun Bharat Sangh.

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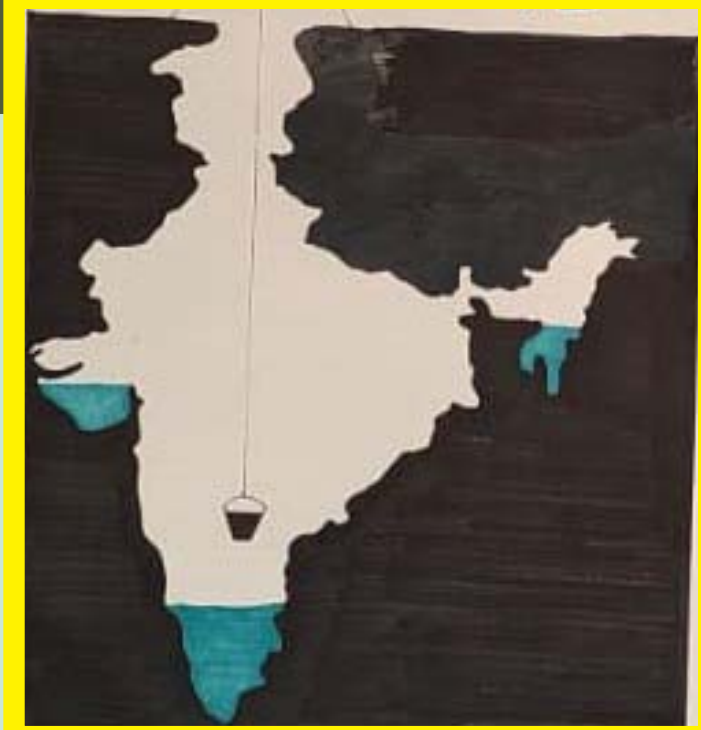
Water Crisis - Causes, Effects and Solutions

- Sharat V. Rao



It is not only in India but countries across the world are facing the problem of water scarcity. The issue in India is rendered more complex due to the ever-increasing population and dense urbanisation. Construction of roads, highways, tall structures and rapid deforestation have led to decline in the annual rainfall. Climate change and global warming has amplified the issue further. Bengaluru is already making headlines as the most water stressed urban city in India. Marathwada in Maharashtra as usual is the region which is worst hit by the drought and has only about 3% of the water left in its reservoirs as against almost 23% at the same time last year. There is a very heavy dependency on the monsoon rains which has always been on the deficit side irrespective of the forecasts.

STRATEGY TO BE ADOPTED

1) Educate the masses to change consumption and lifestyle

Low Flow Nozzles/Aerators

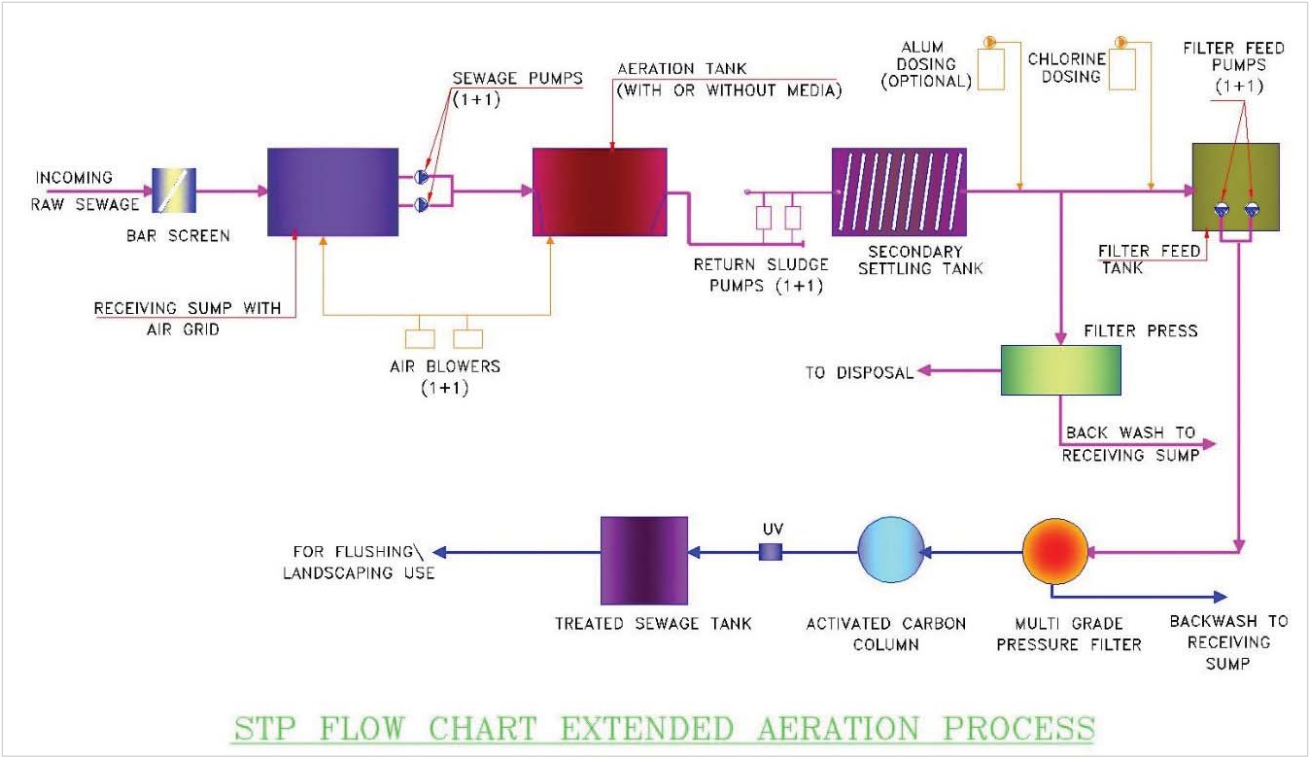
Reduce consumption at source by adopting water saving devices within households, public buildings, commercial spaces, malls and Airports. Educating the masses should be made a part of the teaching curriculum in all institutions. Multinational companies should take up this initiative in full earnest as part of their CSR activity and should spend money gainfully in rejuvenating the polluted lakes and water bodies.

2) Adopt innovative water conservation techniques

Aquifers all over the country are drying up and so are the

wells. Desilting the canals and building small bunds to retain water will go a long way in replenishing the aquifers and charging the wells. This has been adopted in several places in Maharashtra with immense beneficial effect.

Providing piped water supply in every village and small towns will reduce contamination of the water and safeguard the health of the citizens. Delivering safe drinkable water is also an important exercise in water conservation. The Jal Shakti Ministry is doing great work on this front. Measuring and monitoring water quality is essential for human health and Biodiversity. Indiscriminate use of ground water even beyond its yield potential to be disallowed. Due to this indiscriminate use the depth to which bore wells have to be dug is beyond 400 metres in many places.



STP FLOW CHART EXTENDED AERATION PROCESS

Use of Low flow fixtures and Rainwater harvesting to be made mandatory irrespective of the plot area of construction, unless it is technically unviable. This should be viewed as a major social cause issue rather than individual gains and profitability.

3) Recycling and Re-use

Sewage treatment plants with recycling to be made mandatory for all developments. The emphasis should be on reusing this recycled water for beneficial use such as flushing, make-up water for Air-conditioning, gardening and any other non- drinking use. A country like Singapore has shown the way ahead by treating the recycled water to such extent that it can be used for drinking. Greywater treatment to be encouraged.

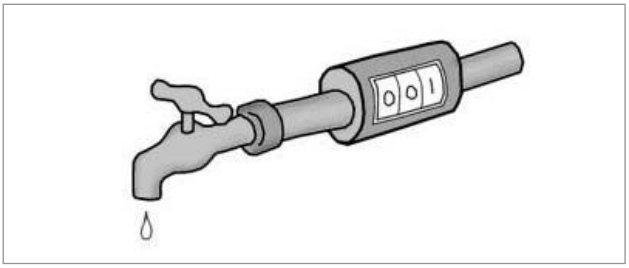
Industry exerts a huge water demand. It is common knowledge that in domestic sewage treatment plants almost 70% of the water after treatment is let into the drains. This water could be harnessed to supply to the industrial sector which are generally located near the periphery of the town. This will involve heavy capex expenditure but the return on investment will yield richer dividends.

4) Improving Irrigation and Agricultural practices.

More than 70% water is used for irrigation and agricultural purposes. Adopting water efficient technique like drip irrigation is the key. Israel has done this very effectively. Even the sowing and the crop pattern needs a complete re-look and has to be modified to suit the rapidly changing climate conditions due to global warming.

5) Pricing and incentives

It is a fact that water is fast depleting source and very essential for existence of mankind. Though it is such a precious commodity the supply price to the end user be it a resident, commercial or industry is so ridiculously low that it encourages wastage and abuse. An opinion that is fast gaining credence is that raising price will prevent pollution and misuse.



Fiscal incentives are another tangible way to encourage sustainable development and it applies to water too. Applying a Tiered water pricing will prove to be beneficial. This type of pricing is prevalent in the power sector depending on the units consumed by the user. Developments using less water than a predetermined base level should be charged a lower tariff and those exceeding the base levels should be penalised with higher water tariffs.

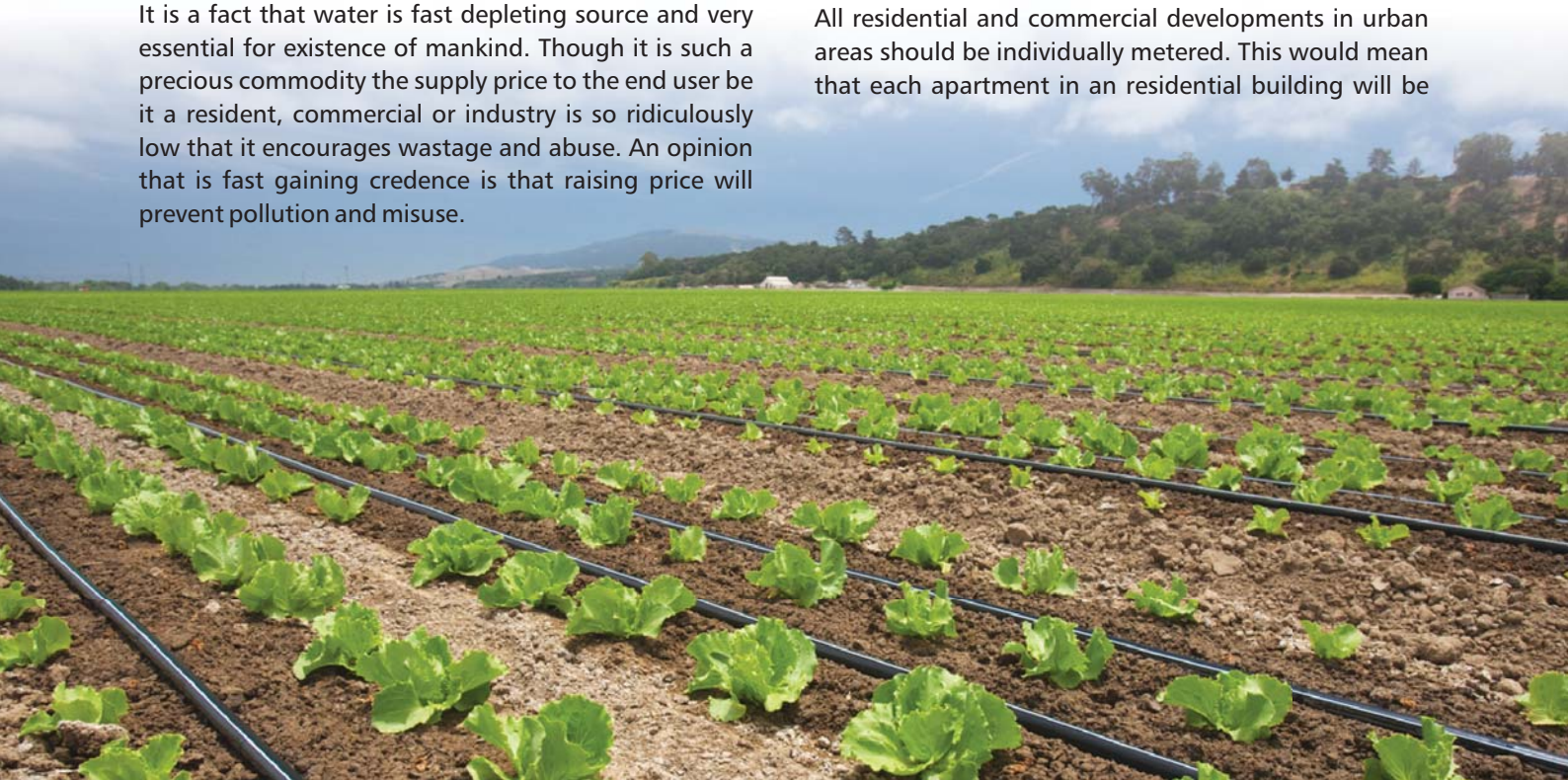
6) Desalination Plants

Desalination plants have been extensively used in Middle East and to some extent in Chennai. These are very expensive, energy intensive plants. However technological advances in solar and renewable energy may make this technology commercially viable. Continuous research to achieve break through will have to be the way forward.

7) Measurement

"Whatever can be measured can only be saved. It is of prime importance to ensure that connections to every single consumer from all sectors using water to be metred. This shall also include water for agricultural and industrial users.

All residential and commercial developments in urban areas should be individually metered. This would mean that each apartment in an residential building will be



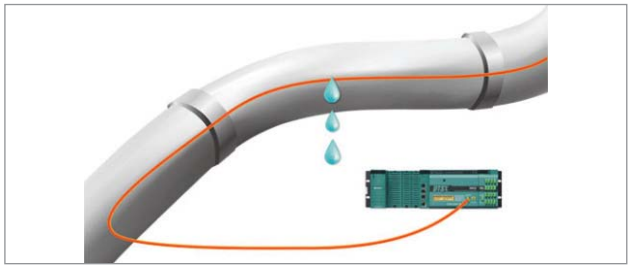
individually metred. These days cloud based digital smart meters are available which will eliminate human intervention.

Water Audit should be made mandatory and all developments will have to declare its water footprint which again should be graded for evaluation.

Tangible fiscal benefits to be made available for projects aiming towards water positivity.

SMART WATER METER

8) Leak Detection and Elimination.



It is a grim fact that almost 40-50% of water is lost in the form of leakages and pilferages in the public distribution. This is termed as non-revenue water. This is a huge drain on the country's resources. This loss has to be reduced through improvement in the distribution and storage systems. It is widely recognised that leakages depend on and are directly proportional to the pressure. Thus higher the pressure, higher will be the leakages. This calls for smart pressure management while designing the water network. Continuous 24 x 7 water supply will go a long way to mitigate this menace. Installing Pressure Reducing valves, determining number of valve stations and their ideal location and optimal control setting will help in balancing pressures in the system. Bulk water metering at appropriate locations will aid in reducing non-revenue water.

9) Public Private Partnership

Making water and sanitation services accessible for everyone is one of the major goals of good governance and development. A great amount of professional expertise and resources is available in the private sector domain.

Synergy between national and local governments with private entities will help in faster realisation of projects within the targeted period. This will allow for allocating responsibility to the person best placed to manage and deal with the

task. Good water management will require participation of all stakeholders such as, Government National and Local, Academicians, Developers, Contractors, Consultants and above all the end user himself.

CONCLUSION

It can be concluded that community participation is the essence to tackle water crisis. All stakeholders have to work in unison to make the initiative a success. Governmental regulations, legislations restricting water only for beneficial use will help in mitigating the problem.

Sharat V. Rao
National Joint Secretary, Indian Plumbing Association
Convener, IPA Technical Committee and Managing Editor, Indian Plumbing Today Magazine

He is IPA National Joint Secretary and Convener, IPA Technical Committee. Prior to becoming the National Joint Secretary, he has been the Chapter Chair for IPA Mumbai Chapter for two terms. He is also fellow of the Institute of Engineers, Member of Indian Water Works Association (IWWA). He is Managing Editor, Indian Plumbing Today, the official journal of Indian Plumbing Association.

Sharat V. Rao is the Managing Director, Engineering Creations Public Health Consultancy Pvt. Ltd. Sharat V. Rao graduated from V.J.T.I, Mumbai, in 1977 and obtained his Master's Degree in Civil Engineering with Environmental Engineering subjects in 1979 from the same institute. He can be reached on jt.secretary@indianplumbing.org .

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COLUMN 6

INCREMENTAL AND TRANSFORMATIONAL GREEN

- Hariharan Chandra

It may be useful for us to remind ourselves that urban water demand from all our 7000 towns/cities / agglomerations is no more than about 8%. Industrial wastewater is about 12%. The rest of 80% is cultivation water our farmers use across our districts for the 300+ million tonnes of foodgrains and the various commercial / cash crops as well as of course vegetables that feed our population.

In a discussion recently that I was part, a distinguished panel discussed the theme of **Planning for the Future: Rebuilding Relationship with Nature.**

Beyond the analytics, the solutions, the discussions and the policy frameworks we all are part of it, what should we do to bring such transformational solutions, instead of tinkering with the smaller challenges that a company or a city offers, with incremental solutions that we implement – from energy and water audits, to various other compliance measures under a slew of legislations [all of which largely confine to the 20% of water used across India].

Why are people like you motivated to devote your work towards improving the world around you? How do you learn to create the organizational conditions that will foster the kind of activity you aspire to create within the work ecosystem you work in? How do you create a more committed and effective organization that looks beyond the incremental to the transformational set of solutions that can inspire emulation on a national scale?

The next phase of business sustainability calls for a transformation of the market, discarding such outdated notions as treating the environment as a limitless source of materials and sink for waste, seeing economic value as the only measure of nature's worth, or encouraging unbridled consumption and considering perpetual economic growth as even possible.

As a corporate decision-maker you have a key role to play in facilitating this transition. Instead of accepting the rules of the market as given, we must change them to incorporate the planet's KPIs. For example, to turn around the KPI of climate change, the market must go carbon-neutral and eventually go carbon-negative. We know it can't be done by one company or one product. It requires a change in the overall market. I look forward as much as you to a vibrant shift from some of the top leaders of business in India.

Part of market transformation that we will see into the future is about "Shared Value" which aims at redefining business with the competitiveness of a product you offer or a service that is closely tied to the health of the communities in which it is embedded. For eg., water treatment, or local generation of power, or generation of new opportunity in the hinterland for our villages. We have 6 lac villages in India while we have only 7000 towns and cities which occupy 3 per cent of the entire land mass of India.

People are becoming much more concerned with (and vocal about) sustainable business practices. Millennials and GenZ, in particular, are known for being extremely invested in social good. You will pay **10-25% more for a sustainable product than your parents will. Generation Z also follows this trend towards more sustainable living. Their top priority is to tackle climate change and 81% of them believe that businesses need to contribute towards this. I hear this from many kids I meet.**

A Movement Away from Current

With both these generations set to become the majority workers and consumers in the future, businesses must quickly understand their attitudes towards sustainability.

The young should join forces to create sustainable economies with new models of interaction and collaboration. Among key features of these are likely to be a movement away from new to refurbished, from products to services, and from ownership to temporary use.

Citizens and consumers are making the shift. You do not simply demand safer and healthier products. More of you are now making choices based on product origin, the responsibility of supply chains, employee well-being and the overall coherence of a brand's sustainability efforts. For eg. I know many youngsters who won't buy

> ***I know many youngsters who won't buy pickles which are made of cottonseed oil thanks to the high toxicity levels in seeds in the cotton growing belts of India. Young girls I know have stopped using lipstick for they realise that nearly 400 mg of lead is ingested by you every year with the use of lipstick.***

pickles which are made of cottonseed oil thanks to the high toxicity levels in seeds in the cotton growing belts of India. Young girls I know have stopped using lipstick for they realise that nearly 400 mg of lead is ingested by you every year with the use of lipstick.

Becoming more sustainable, therefore, satisfies today's and tomorrow's shoppers.

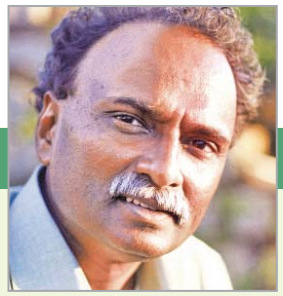
The need for sustainability is also felt in the workplace. **80% of Millennials and Gen Z prefer to work for organisations that have proactive sustainability practices in place. Businesses that are perceived as unsustainable, therefore, might find themselves struggling to recruit the right talent in the future.**

There's so much. Changes to equipment or other aspects of daily operations can help make a difference too. Every 100,000 litres of reuse is 600 CT-e of GHG emission reduction. Upgrading old servers to modern ones that use less energy and produce fewer greenhouse gases, replacing old pumps and motors with energy efficient ones that save money and justify the new cost with payback in less than one or two years has been incentive for consumers. This writer's own experience has been that an investment in a good water saving plan can save a company buying, say, 100,000 litres of water, upward of 40-45 lac a year, and every year after the assets are created. A company with a Rs 50 lac / month as electricity bill can save up to Rs 1 crore every year, with new energy assets that will ensure the saving accrues year after year. These are big savings – in money, water, energy and in GHG emission. And these are not incremental solutions, but are transformative.

The measure of a successful business is no longer solely tied to its financial performance. Public expectations of a company have never been greater. Society is demanding that companies, both public and private, serve a social purpose. To prosper over time, every company must not only deliver financial performance, but also show how it makes a positive contribution to society.

Businesses are starting to look at sustainability as something that should be **at the very core of their operations and not just a nice-to-have add-on for improving their image. Companies want to show their customers that they care about the environment.**

More and more businesses are showing increasing concern over issues like biodiversity loss, deforestation and other global threats. This comes as no surprise, considering that more and more customers and employees want companies to take action on sustainability, transparency and on fair employment.



Hariharan Chandra

The columnist is Trustee, AltTech Foundation and Prem Jain Memorial Trust, and Senior Fellow, CII IGBC. He is a green building pioneer and a Net Zero Water exponent guiding currently over a billion litres of low-carbon water for a variety of projects today. Reach him at hariharan@alttech.foundation

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Ancient Water Management System in Lothal

Shaivi Padsala
Prof. Dipsha Shah and Prof. Dipen Mehta

Introduction

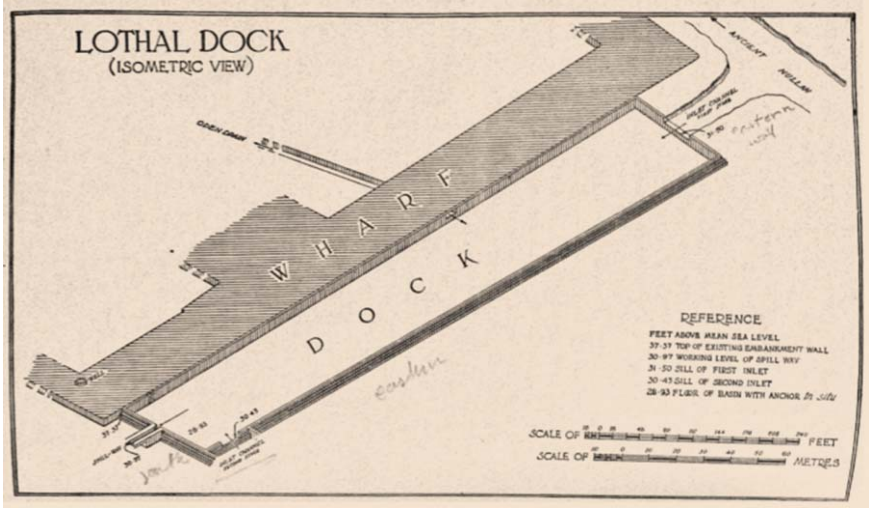
- Lothal city is called mini - Harappa. Lothal was one of the southernmost cities of the ancient Indus Valley Civilization, located in the Bhal region of the modern state of Gujarat
- The entire site of Lothal is separated into a citadel and a lower town, all of which is protected from water by a 13m thick wall on the western side. The vast rectangular sunken tank known as the dockyard is the most prominent feature of Lothal.
- Masons have shown their maximum skill in building drains, sumps, inspection chambers, water-chutes and cess-pools.
- The most unique aspect of planning during the Indus Valley civilization was the system of underground drainage. The main sewer, 1.5 meters deep and 91 cm across, connected to many north-south and east-west sewers. It was made from bricks smoothened and joined together seamlessly. The expert masonry kept the sewer watertight

Dockyard

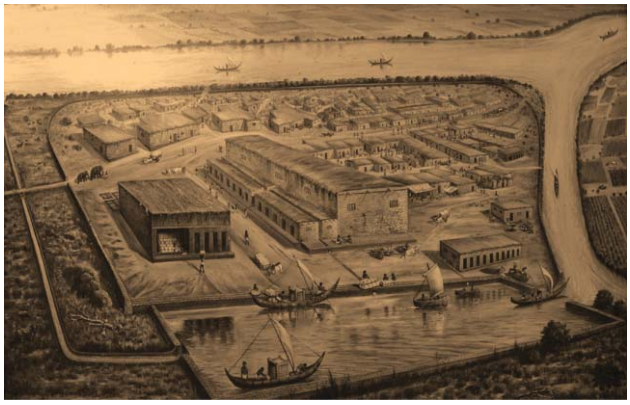
- The town planners here, according to most historians, had analysed tides in depth in order to be able to utilize the connecting river at high tide for ships to arrive into Lothal. The tank has been carefully built to withstand the current and flow of water. It also includes a water locking device to keep the water inside.
- The largest burnt-brick structure ever built by the Harappans is a brick-walled structure enclosing a trapezoid basin laid bare on the town's eastern outskirts.
- The embankment's inner wall is completely vertical on all sides, with no stairs or ramps to access the changing water level. The outer surface, on the other hand, has three offsets in the case of the western wall and two in the case of the other walls to resist the water's thrust in such a large basin.

Use:

- The objective of excavating such a large basin, measuring 711 feet by 121 feet on average, and encircling it with 14 feet high burnt brick walls could only be to provide berthing facilities for boats. It has been designed to satisfy the dock's requirements. A 41-foot-wide inlet gap in the northern wall was designed to convey ships into the basin at high tide through a nullah that ran along the town's northern edge.
- The construction of a spillway in the southern embankment ensured automatic desilting and the escape of excess water at high tide.
- There were also plans in place to slide a wooden door into the recesses of the spillway, which could be closed and the required water level kept at a low level to enable boat floatation.



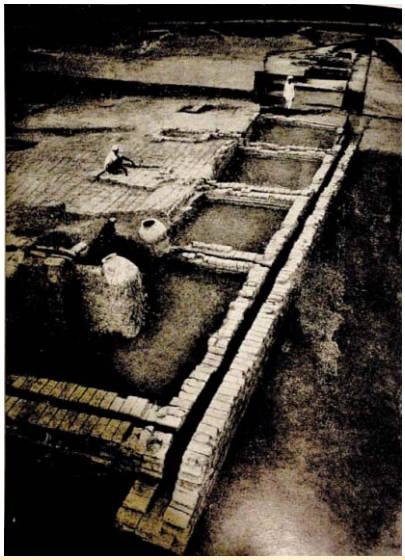
- A great flood in 2000 B.C. caused heavy breaches in the walls of the dock but they were soon mended. Thus came into existence in phase 4 an eastern embankment as the original inlet in the northern wall had ceased to function.



- Finally, the flood at the end of phase 4b in 1900B.C. was of such long duration and great intensity that the entire dock was destroyed.

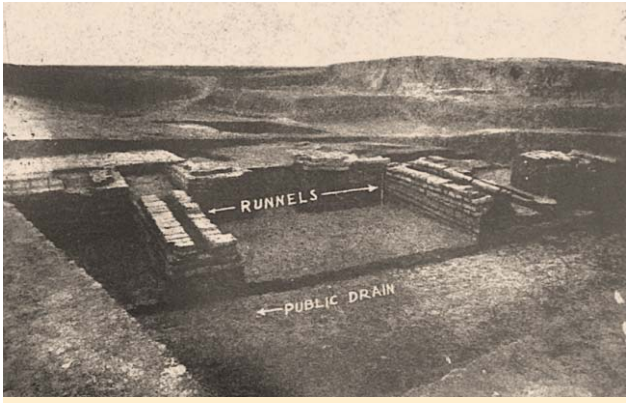
Baths and Drains

- The Harappans acquired a high sense of sanitation, as evidenced by the provision of a bath in every Lothal dwelling house.
- Some residences appear to have more than one bath or wash facility. There was a row of 12 baths, each connected to the public drain via a runnel. Originally, all of the baths were paved with polished bricks and plastered with lime. The bricks were polished down to create fine joints, making the brickwork waterproof. The floor was invariably 'wainscotted' bricks whenever or skirted with bricks laid-on-edge or flat and the height of the skirting wall was not more than 9 inches.



A row of 12 baths and drains of houses

- The waste water from the private baths of the Lower Town flowed into small brick- lined sumps or soakage jars through -runnels. These jars had a hole in the base to allow liquid waste to soak into the ground while the solid matter was regularly cleared to prevent overflowing of waste water into the streets.
- The internal width of the major sewers ranges from 4 feet to 2 feet and 1.5 inches, while house drains are 9 inches to 3.5 inches wide. Over a length of 115 feet, the drop is found to be 1ft. 2in. The public drain, has a drop of 3 feet and 2 inches over a length of 106 feet, clearly offering a greater gradient at the conclusion to assure self-clearance.



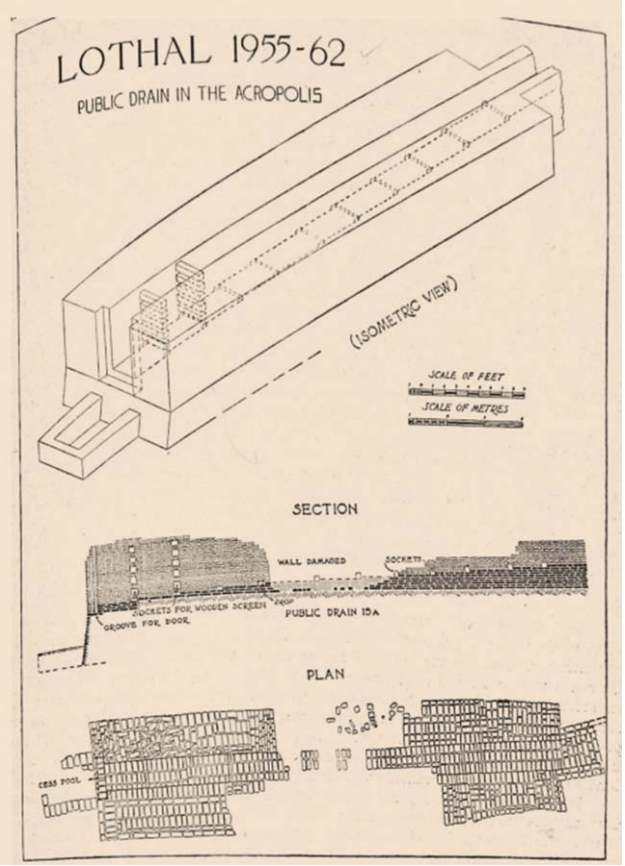
Runnels joining public drain

- The runnels' terminals were kept high enough above the public drain's level to prevent water from backflowing. The lowest part of the main drain heading northwards in the acropolis includes nine drops within a distance of 42 feet, accounting for a fall of 2.1 feet out of a total of 3.15 feet.

Acropolis Drains

- The floor is made of polished bricks with joints that are almost invisible. Another distinguishing aspect of this drain is that it slopes towards both floor margins, with the central part remaining flat, allowing for two smaller marginal channels for easy flow.

- Drops at regular intervals acted like an automatic cleaning device.
- A wooden screen at the end of the drains held back solid wastes. Liquids entered a cesspool made of radial bricks. Tunnels carried the waste liquids to the main channel connecting the dockyard with the river estuary.
- The tiny rectangular holes observed in the walls on either side of the drops indicate that wooden battens were employed to level the bricks. There is a smaller drain in the floor of the sewer constructed in the southern section of the acropolis to carry the waste.
- The depth of the northern drain rises from 2 to 5 feet. As a result, it's clear that the drains were built to convey both sewage and storm water. Smaller drains, were covered with loose bricks about 6 inches below ground level so that they could be easily lifted for inspection and cleaning of the channel below.



Cess-pools

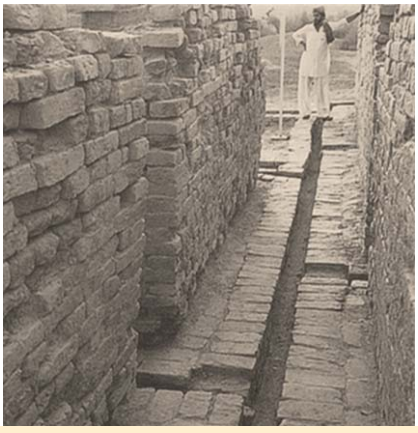
- Both of the acropolis' main drains discharged into the cess pools erected at the foot of the mud-brick

This large corbelled drain was built in the middle of an abandoned gateway at Harappa to dispose of rainwater and sewage.

platforms. The cess pool that receives sludge water from the northerly drain measures 4/1.4th × 4/1.4thft. and is approximately 5ft. deep. The vertical grooves at the drain's mouth were intended to be used to insert a screen or door to restrict solid waste from flowing into the cess pool. This structure also made it easier to clean the cesspool.

Water Chutes

- A water chute 6x4inch in section was built into a 2ft. thick wall of a house when the floor was raised to a height of 3 ft 6 inch above the level of the drain.



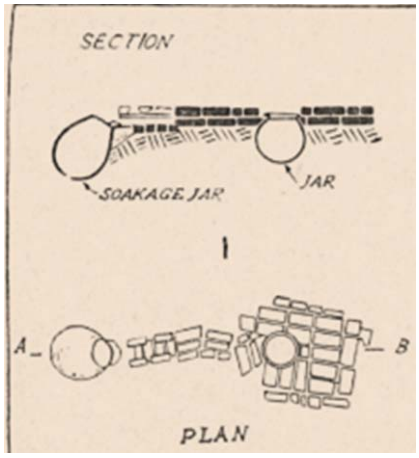
Water Chute

Inspection Chambers

- The resident of the Acropolis built one or more inspection chambers out of baked bricks, linking the runnels to the private bath on the one hand and the public drain on the other.
- Solid trash that had been deposited in the sumps was removed on a regular basis, leaving only sullage water in the drains. This gadget kept drains from clogging.

Soakage Jars

- They were buried near the mouths of the runnels that connected a house's bath or kitchen in the lower town to the streets. Some of the jars are quite enormous, with a diameter of up to 2ft 3inch.
- When a jar sank due to erosion, another jar was placed on top of it. A hole in the bottom of the soakage jars allowed liquid waste to soak into the ground. To minimise splashing, they were frequently bordered with bricks.
- Mostly each and every house had a soakage jar



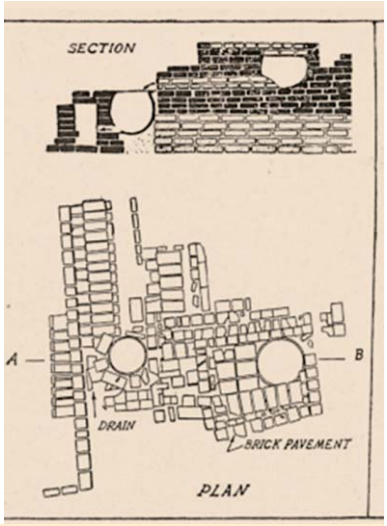
Soakage jar skirted by bricks near a home

Dye-vats

- Two jars interconnected with a small drain are found embedded at two different levels at the eastern end of the drain. The upper one is embedded in a rectangular brick pavement skirted by bricks that are laid flat. The lower jar, also skirted by bricks along the rim, received water overflowing from the upper jar through a covered drain.
- Neither of the two could have served as a soakage jar as there is no hole in the bottom of either. On the other hand, the water overflowing the lower one entered the public drain.

Conclusion

- From this study of the construction of baths, drains, manholes, soakage jars, sumps, water chutes, cess-pools and main sewers it becomes clear that Lothal had a well planned underground drainage system which could effectively carry the monsoon water beside the domestic sewage.
- The entire waste water was left into the dock on the east, the river on the southeast and the nullah on the north .
- The solid matter was screened of in the brick-built sewers before entering the cess-pools



A Dye-vat embedded in lime plastered brick pavement.

Shaivi Padsala
Student, CEPT University

Shaivi is currently in her fifth year pursuing a Bachelor's degree in Construction Technology. As part of her studies, she delved into the mysteries of ancient urban planning with her topic on ancient water management system of Lothal. Through research, she uncovered ingenious techniques employed by ancient civilizations, shedding light on their remarkable efficiency in managing water resources thousands of years ago.

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Plumbing (Water and Sanitation) elective is not only confined to Civil Engineering alone. It has been designated as an open elective, thus offering flexibility for adoption by various other disciplines such as Mechanical Engineering, Interior Design, and beyond. This inclusivity ensures a broader scope for students across diverse fields to benefit from this critical area of study.

This historic step will lead to a new era for the plumbing science, marking its formal recognition as an academic discipline within the Civil Engineering degree program. Plumbing is a very important service in the building & infrastructure as it directly deals with human health hygiene & environment. Such recognition is pivotal in equipping future professionals in the building industry with the requisite skills and expertise necessary to meet the evolving demands and challenges of our time.

There is a huge demand in the building industry for professionals with such education and knowledge. IPA anticipates that the integration of the Plumbing (Water and Sanitation) course into the engineering curriculum will greatly enrich the educational experience of your students and prepare them for fulfilling careers in their respective fields.

With this, IPA makes an appeal to all its student Chapters to go through this uploaded Civil Curriculum.

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SUMMIT 2024

"Sustainable Architecture to build a Sustainable Bharat"

Architects at the Summit 2024

IPA SUMMIT 2024 themed on '**Sustainable Architecture to build a Resilient Bharat'** was organized by the Indian Plumbing Association (IPA) in collaboration with the Council of Architecture (CoA) and The Indian Institute of Architects (IIA) on 24th February 2024 at Hotel Sahara Star in Mumbai. The event served as a unique platform where leading professionals from the Architectural community and Plumbing fraternity interacted to address the crucial topic of bringing sustainability in all our building projects to lead to a Resilient Bharat.

Prof. (Ar.) Abhay Vinayak Purohit, President of the Council of Architecture, was the Chief Guest, and Ar. Vilas Vasant Avachat, President of The Indian Institute of Architects, presided as the Guest of Honour. There was good presence of architects from the Mumbai area in the event.

Plumbing is a science and Plumbing not only constitutes 13%- 15% of a building's structure cost, but is also a very crucial service as there are only two live lines in a building: Plumbing and Electrical. Plumbing not only is responsible for supplying you water but it also takes away your waste in a hygienic manner. On the contrary, there is a disconnect between the architect and the plumbing installation because by the time the plumbing consultant comes on board, the Civil structure is already ready. We have found lot of problems in installing Correct Plumbing systems in many building sites. It is therefore important to have correct coordination between plumbing services, firefighting and the architect. This IPA Summit aimed to address this pain area by building a bridge between both these building industry stakeholders through this interaction. 2 Panel discussions were conducted on the following topics:

a) Sustainable Architecture to build a Sustainable Bharat

b) Humanizing High Density: Nature and Urban Spaces

Sustainable Architecture to build a resilient Bharat

Ar. Vilas Vasant Avachat (President, IIA), Ar. Atul Shah (Founder, Access Architects), Ar. Dr. Roshni Udyavar Yehuda (CEO, RUA Ecospaces LLP), Ar. Rahul Mehta (Founder & Principal, Rahul Mehta Architects), and Prof. (Ar.) Vinit Mirkar (Principal-IES College of Architecture) were the panelists in this discussion. The panelists engaged in a thoughtful exchange of ideas. Discussions ranged from innovative architectural practices to the integration of sustainability in designs.

From left to right: Ar. Atul Shah, Prof. Ar. Vinit Mirkar, Mr. Gurmit Singh Arora, Ar. Vilas Vasant Avachat, Ar. Dr. Roshni Udyavar Yehuda, Ar. Rahul Mehta

'Humanising High Density - People, Nature & Urban Spaces" Panel Discussion

Prof. (Ar.) Abhay Vinayak Purohit (President- CoA), Ar. Saurabh Chatterjee (CEO Founder-Skyline Architects), Ar. Milind Sambhare (Principal Architect - G. D. Sambhare & Co.), Ar. Abhay Bhonsale (Partner -Ingrain Architects), Mr. Dilip Sonwane (Water, Urban Infra Advisor), and Mr. Minesh Shah (Chairman - IPA Ahmedabad Chapter), explored the intricate relationship between human experiences, nature, and urban spaces in high-density environments.

From left to right: Dilip Sonawane, Ar. Milind Sambhare, Sharat V Rao, Prof. Ar. Abhay Vinayak Purohit, Ar. Saurabh Chatterjee, Minesh Shah, Ar. Abhay Bhonsale

This edition of IPA SUMMIT, with its engaging panel discussions and esteemed speakers, successfully fostered a collaborative spirit between the plumbing and architectural community. The event not only showcased the collective commitment to building a Sustainable Bharat but also highlighted the indispensable role of innovative designs and practices in achieving this vision.

IPA office bearers and Plumbing industry leaders

HEAR FROM SPEAKERS AND PANELLISTS at IPA SUMMIT 2024

"It was a privilege to be Chief Guest and Panellist at IPA Summit 2024, where architects and plumbing professionals converged. The event, organized by the Indian Plumbing Association, is a pivotal bridge for sustainable collaboration. Congratulations to IPA for fostering a dialogue that will shape a resilient future for our built environment. The IPA Summit has undoubtedly set a benchmark for future industry gatherings, and I am confident that its impact will resonate across our professional communities for years to come."

Prof. Ar. Abhay Vinayak Purohit
President, Council of Architecture

"IPA Summit 2024 was impeccably organized, with a diverse range of speakers who shared their insights, experiences, and innovative ideas that are shaping the future of the plumbing and architectural industries.

Ar. Vilas Vasant Avachat
President, The Indian Institute of Architects

"Thank you ipa for inviting me. Great effort and endeavour

Rahul Mehta
Founder and Principal, Rahul Mehta Architects

"The IPA summit with its focus on 'Sustainable Architecture for a resilient Bharat' highlighted significant issues and positive recommendations. The cross disciplinary initiative brought together the plumbing and architecture fraternity that is much-needed for achieving sustainability".

Ar. Dr. Roshni Udyavar Yehuda
CEO, RUA Ecospaces LLP

"Insightful Panel Discussions and excellent program

Ar. Jayashree Deshpande
Director, National Institute of Advanced Studies in Architecture

"Indian Plumbing Association (IPA) is an excellent platform for professionals---architects, engineers, manufacturers and government authorities to come together and discuss various issues. IPA's focus on people, resource management and product efficiency is an action to make human life better & sustainable on this planet Earth.

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CHAPTER EVENTS

Chhatrapati Sambhaji Nagar Chapter Launch: 26th IPA Chapter

Indian Plumbing Association Chhatrapati **Sambhaji Nagar** (formerly known as **Aurangabad**) Chapter was formed on Saturday, 10 February 2024. This Chapter Installation ceremony organized at the city's Hotel Aures, in the presence of the chief guest, Dr Uttam Kalwane (Chairman, IEI-Institution of Engineers - Chhatrapati Sambhaji Nagar) & Guest of Honour was Arc. Shyam Shelar (President IIA- Indian institute of Architects-Chhatrapati Sambhaji Nagar)

On this occasion, many eminent architects of the city such Arc. Vikas Choudhari, CREDAI President, Mr. Ajay Shah, CAIT VP, Ar. Nadkarni, Mr. Sanjay Kankriya, AJVM President, Mr. Shiv Swami, Secretery, Mr. Pravin Pande Income, Tax Asst. Commissioner and many people from other prominent building organizations were present. They congratulated the newly appointed executive committee.

Prabhanjan Mahatole, newly elected Chairman of Chhatrapati Sambhaji Nagar Chapter, addressed the audience and said, "As we embark on this journey, let us keep in mind our noble aim: "Better plumbing for better living" for the citizens of our city. Human health and hygiene stand at the forefront of our mission, and it is with this motto that we strive to make a difference in our community.

Reflecting on the Chapter Vision for 2024, he said, we have set forth some ambitious goals to start with:

1. To enhance good plumbing practices that ensure the safety and well-being of our residents.
2. To create awareness about the importance of saving water, a resource for our planet's sustainability.
3. To organize six workshops throughout the year, aimed at empowering plumbers with knowledge and skills to excel in their profession.
4. To promote the recycling of water, recognizing its significance in addressing our water challenges and conserving our environment.
5. To increase IPA membership, with a target of 50 new members in 2024, fostering a stronger community of plumbing professionals dedicated to IPA vision.

This program was sponsored by Kitec, Maxflow, Wilo, SDES, Eltech, Ozone, Future creed Engineers, Kanayalal Brothers, Samruddhi House & Technoply.

K Bhaskar, Convener, IPA Membership Growth Committee detailed the IPA Vision & conducted the election and oath ceremony to all elected members. Rahul Dadhphale, IPA National Secretary acquainted the audience on the IPA vision, mission and activities through an engaging presentation.

Rajesh Dabhuwala, Chairman, IPA Surat chapter gave a Technical Presentation on "Before Draining Water, SAVE WATER".

Election was unopposed and the following members were elected.

S. No	Name	Designation
1	Prabhanjan Mahatole	Chairman
2	M.A. Azmi	Vice Chairman
3	Shaikh Shoebuddin	Secretary
4	Ramesh Agrawal	Jt. Secretary
5	Anand Gangapurwala	Treasurer
6	Deepak Sanghai	Executive Member
7	Shrirang Farkade	Executive Member

From Left to right K. Bhakskar, Prabhanjan Mahatole , Dr. Uttam Kalwane , Arc Shyam Shelar, Rajesh Dabhuwala, Shaikh Shoeb & Rahul Dahiphale

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Elections Update

IPA Chennai Chapter

Elections were held in IPA Chennai Chapter for the 3 years term 2024 – 27 on Wednesday, 05th March 2024 with the General Body Meeting, virtually. Elections were held for 7 posts and the followed office bearers were elected. For 5 positions, office bearers were elected unopposed.

The oath was administered by the Returning Officer.

IPA congratulates the newly elected team and wishes them good luck in all their future endeavors to move towards IPA's objective of Redefining Plumbing Standards.

S. No.	Name of Member	Contested for the post	Nature of Election
1	Dr. S Virapan	Chairman	Elected Unopposed
2	V Balasubramani	Vice Chairman	Elected Unopposed
3	J Sankar	Hon. Secretary	Elected Unopposed
4	P Manohar	Hon. Jt Secretary	Elected
5	G Jayaprakash Narayanan	Hon. Treasurer	Elected
6	A Joseph Mathew	NEC Member	Elected Unopposed
7	K Sivapraksh	NEC Member	Elected Unopposed
8	R Balaji	Chapter Executive Committee Member	Elected
9	M Duraisingam	Chapter Executive Committee Member	Elected
10	S Sathiyaseelan	Chapter Executive Committee Member	Elected
11	Shanmugam Thirunavukkarasu	Chapter Executive Committee Member	Elected
12	S Thiyagarajan	Chapter Executive Committee Member	Elected

Returning Officer:
Dr K. Nagakarthigan, Chairman, IPA Puducherry Chapter

Election Date:
05th March 2024

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WINNERS SPEAK

Winners of IPPL 2023

S. Viswanathan and
K. S. Thayumanavan

Chennai Team

"Being a part of the IPPL was an enlightening journey that immersed me in the world of plumbing excellence by means of knowledge sharing of Codes and standards & emphasizing better plumbing practices.

IPPL has provided a significant perspective on various standards within the plumbing industry & emphasizing the importance of adhering to these standards right from the design phase."

S. Viswanathan
Asst Engg. Manager, L& T Construction

and

KS Thayumanavan, Asstt.
Engineering Manager, L&T Construction

1st Runner Up:

Denish Prakash Koli and
Durga Satapathy

Mumbai Team

"IPPL 2023 was an amazing experience, where we learnt a lot about correct plumbing practices. IPPL also made us aware of latest technologies available with an exposure to the industry leaders.

I have gained confidence as plumbing professional to suggest and implement the latest technical solutions in my projects."

Denish Prakash Koli
Assistant Manager – Services, Kalpataru Limited

"The experience was great, skilful, knowledgeable. Each and every session, brand presentations are informative which help us a lot in our professional career.

After winning the 1st runner up in IPPL, I got a huge recognition in my organisation. I have been assigned with some new responsibilities and assignments. I feel IPPL makes a huge impact on my career in a positive direction."

Durga Satapathy
Manager – Services, Kalpataru Limited

2nd Runner Up:

S Jayanthi and
B Pratabh

Puducherry Team

"The networking opportunities provided by IPPL have opened doors to new possibilities and connections in my field, contributing positively to my career growth.

The opportunity to collaborative with skilled professionals made it a memorable journey. I gained valuable insights into my performance and honed my skills, through this experience."

S Jayanthi
Design Engineer, Design Collaborative Services, Puducherry

"I am thrilled to have participated in this event because it was an incredibly amazing experience. The competition was intense due to the abundance of talented people, but we remained confident in our abilities. This opportunity served as a platform for youth, and we are proud to have been a part of it. We extend our gratitude to our state chairman for providing us with this opportunity.

It really helped me express my individuality, liaison with multi-multi-national companies which in turn led to a transformative positive change in my personality.

B Prathab
Design Engineer, Design Collaborative Services, Puducherry

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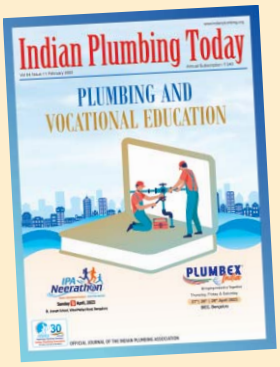

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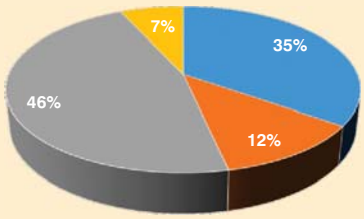

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- Others

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>
> **Hiren Shah**
> Sr. Project Coordinator
> Aqua Utility Designs
> Ahmedabad

> We strengthen our skills and knowledge in plumbing field through IPT.
>
> **Sanjay Bhaskar Kajwe**
> Proprietor
> Hydrotech Systems
> Mumbai

> IPA is a good platform for awareness of advances in the field of Plumbing Technology.
>
> **Dr. Kailas Arjun Patil**
> Professor, Civil Engineering
> College of Engineering, Pune
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