August 2018

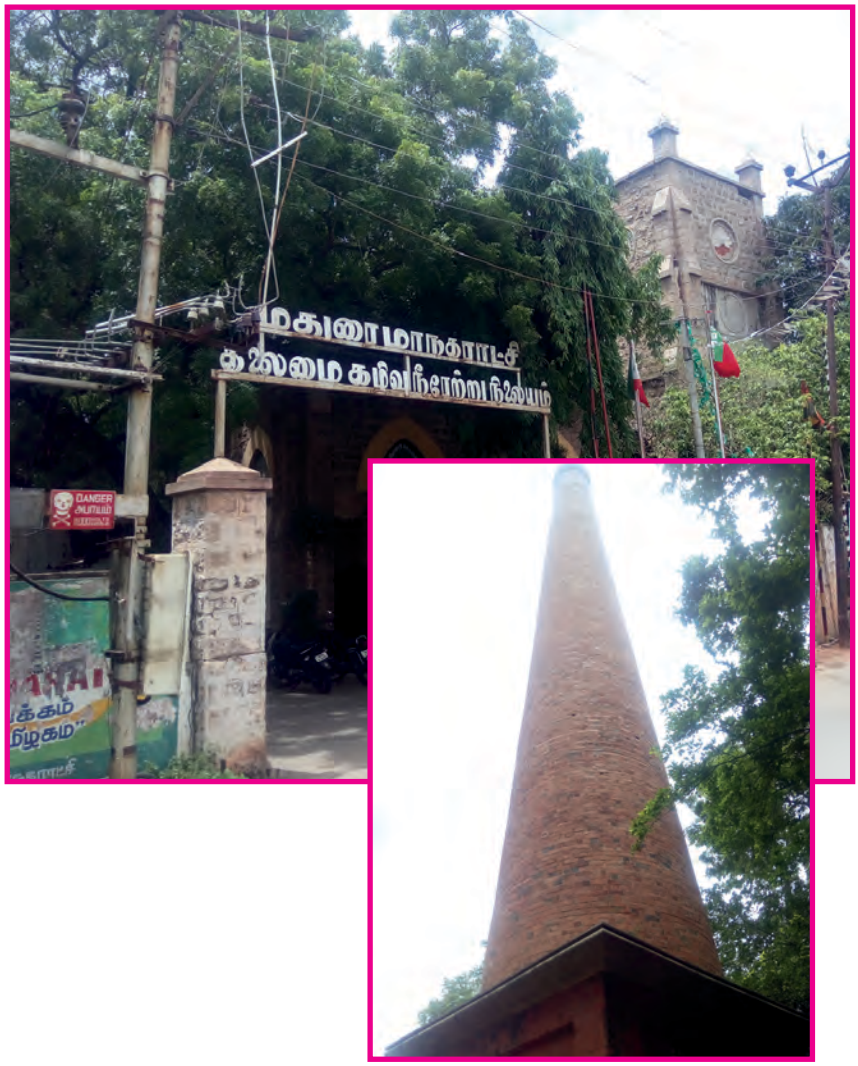
Water Watch

Quality Matters

Used Wastewater

The Missed Agenda

Water Watch
Monthly Water update from CURE
Vol. I Issue 3 August 2018



Santhaipettai pumping station which is established on 1924. It is located in the bank of river Vaigai. Which was named after the butler of a British officer who lived beyond Santhaipettai, which was perhaps the past boundary of Madurai. Even now, Footprints of the old sewage system can be seen on this street. To ensure the sustainability, this first sewage treatment system was to collect waste water from seven sub-stations to the Santhaipettai pumping station through gravity and by using the steam furnace energy sewage is pumped to Avaniapuram, 7 km away, for treatment. This ensured that sewage generated by a population of 1.52 lakh was pumped away from the city daily, thus protecting the Vaigai from pollution.

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Wastewater - The Missed Agenda !

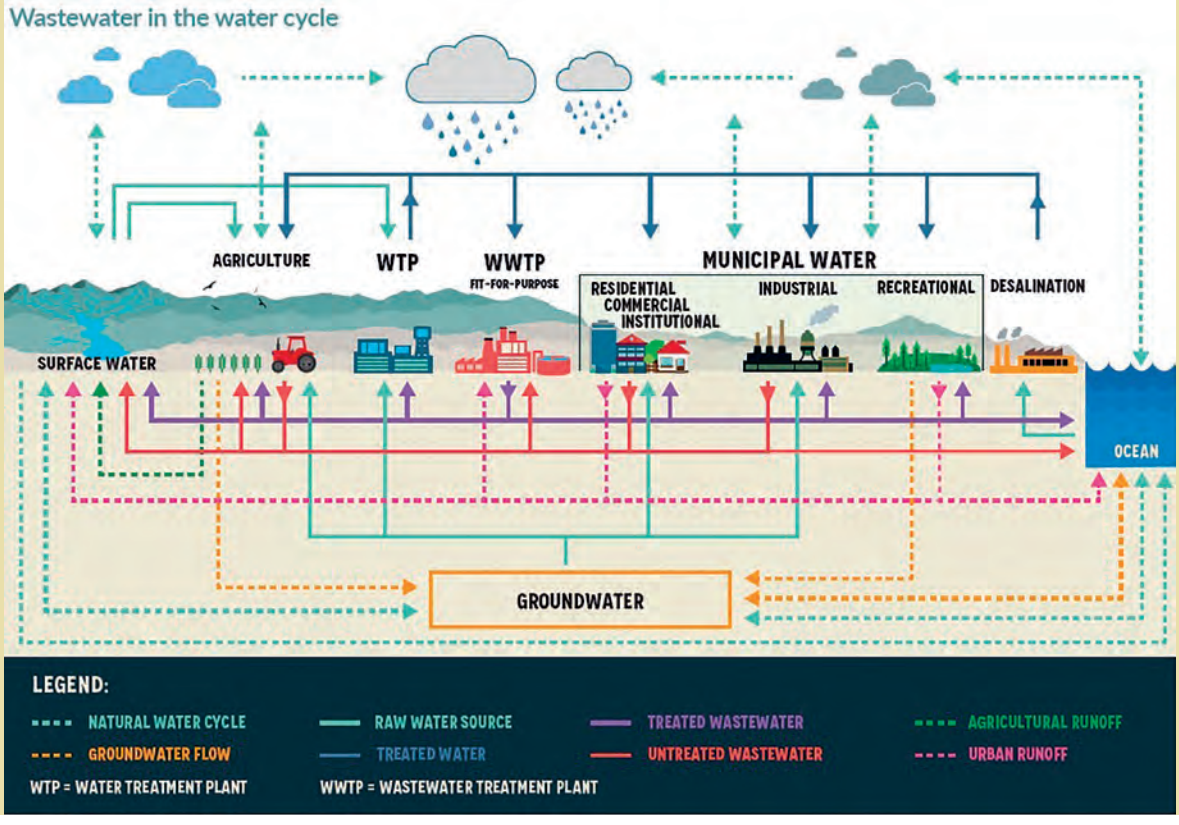
Wastewater, which is directly referred as 'used water' or 'effluent' or 'Sick water' can and has been defined in several different ways. As such, there is no single universally accepted definition for the term. For example, wastewater has been defined as "water that has been used and contains dissolved or suspended waste materials" (As per USEPA), or "water that has been adversely affected in quality by anthropogenic activity" (As per Culp et_al).

As per United Nations Environment Programme (UNEP), the United Nations Human Settlement Programme (UN-Habitat) and the UN-Water Analytical Brief on Wastewater Management.

Wastewater is regarded as a combination of one or more of: domestic effluent consisting of blackwater (excreta, urine and fecal sludge) and grey water (used water from washing and bathing); water from commercial establishments and institutions, including hospitals; industrial effluent, storm water and other urban runoff; and agricultural, horticultural and aquaculture runoff. Wastewater remains an undervalued resource, all too often seen as a burden to be disposed of or a nuisance to be ignored. This perception needs to change to correctly reflect its value – wastewater is a potentially affordable and sustainable source of water, energy, nutrients, organic matter and other useful by-products. So this particular 'WaterWatch' issue are in search of sustainability in the wastewater.

Madurai's Fact

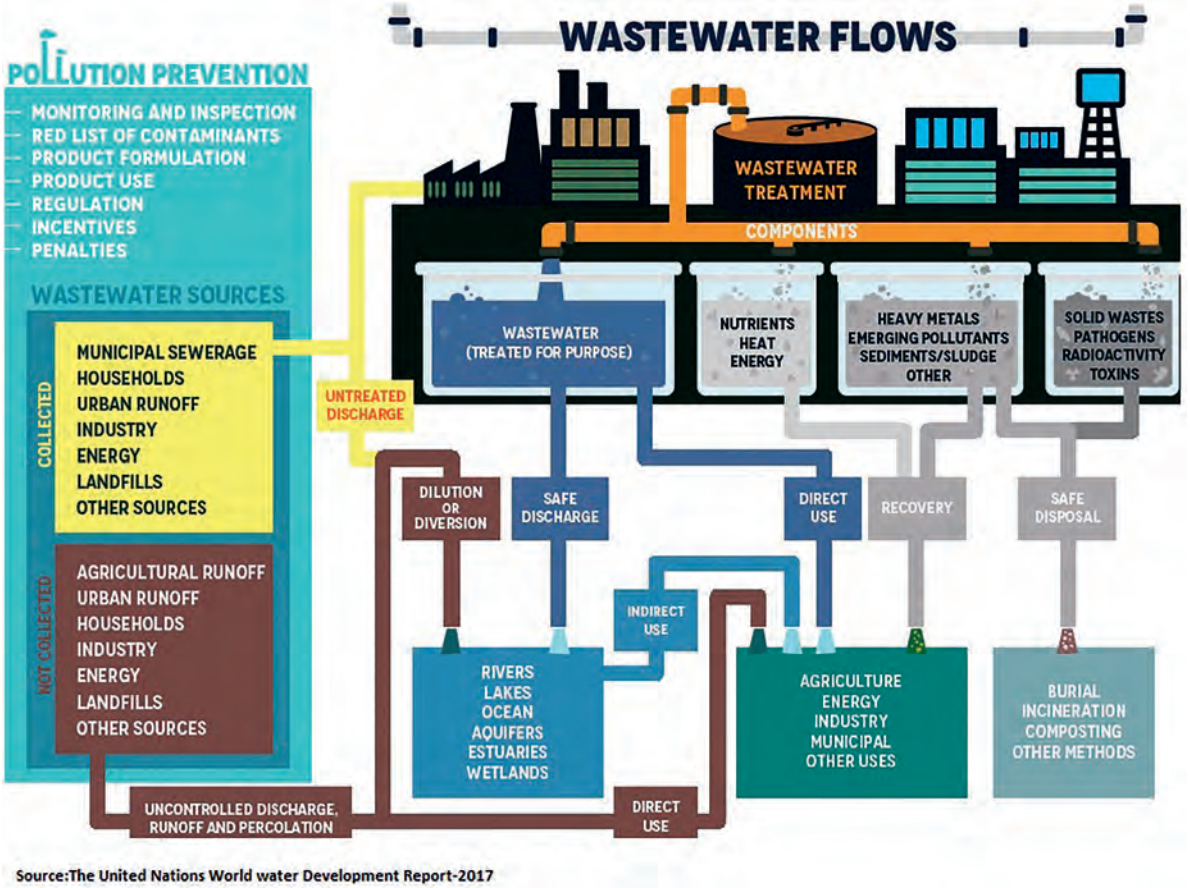
170.70 Million Litres per Day (MLD) **Wastewater Treatment capacity for Madurai City**	
14.53% Overall efficiency of Madurai's sewage Treatment Plant.	**48%** Coverage of Drainage length compared to the total street length of Madurai
Source: Smart city proposal by Madurai Corporation Operative Guidelines for Septage Management (TN)	



Source: The United Nations World Water Development Report 2017

Wastewater Pollutants - Source & Effects

Pollutant	Main representative parameters	Effects from the Source		Possible effects of the pollutant
		Urban Wastewater	Urban Runoff	
Suspended solids	Total suspended solids	High	Medium	• Aesthetic problems • Sludge deposits • Pollutant adsorption
Biodegradable organic matter	Biochemical oxygen demand	High	Medium	• Death of fish • Oxygen consumption & Septic conditions
Nutrients	Nitrogen, Phosphorus	High	Medium	• Excessive algae growth • Toxicity to fish (ammonia) • Illness in new-born infants (nitrate)
Pathogens	Coliforms	High	Medium	• Water-borne diseases
Non biodegradable organic matter	Pesticides, some detergents, others	Small	Small	• Toxicity • Foam (detergents) • Reduction of oxygen transfer (detergents)
Metals	Specific elements (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn, etc.)	Small	Small	• Toxicity • Inhibition of biological sewage treatment • Problems in agriculture use of sludge • Contamination of groundwater
Inorganic dissolved solids	Total dissolved solids, conductivity	Medium	Small	• Excessive salinity • Toxicity to plants (some ions) • Problems with soil permeability (sodium)



Source:The United Nations World water Development Report-2017

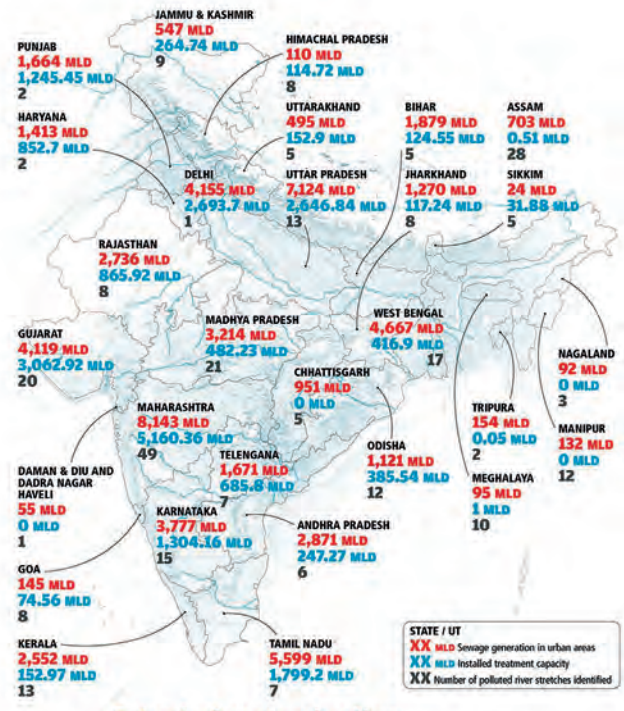
India's Agenda - Wastewater !

A report, 'Intervention of Sewage Treatment Plants' from Central Pollution Control Board (CPCB) brought out the fact that India generates 62,000 Million Litres per day (MLD) of sewage. There are 816 sewage treatment plants in the country (of which 522 were operational), with a treatment capacity of about only 38% (23,277 MLD). However, only about 30% (18,883 MLD) of sewage is actually treated. This means there is a huge demand-supply gap in wastewater generation and treatment. This report clearly says that there has been a 30 per cent increase in wastewater generation over the last seven to eight years. As a result, more than 38,000 million litres of wastewater goes into the major rivers, water bodies and even percolates into the ground every day. This over statics excludes the Industrial effluent and the rural sewage.

Treatment of sewage is a significant challenge . In concern to the Urban sewage and to clean the river government have been spending lot of money for cleaning rivers under the Centre's National River Conservation Plan (NRCP), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission programmes of the Ministry of Urban Development.

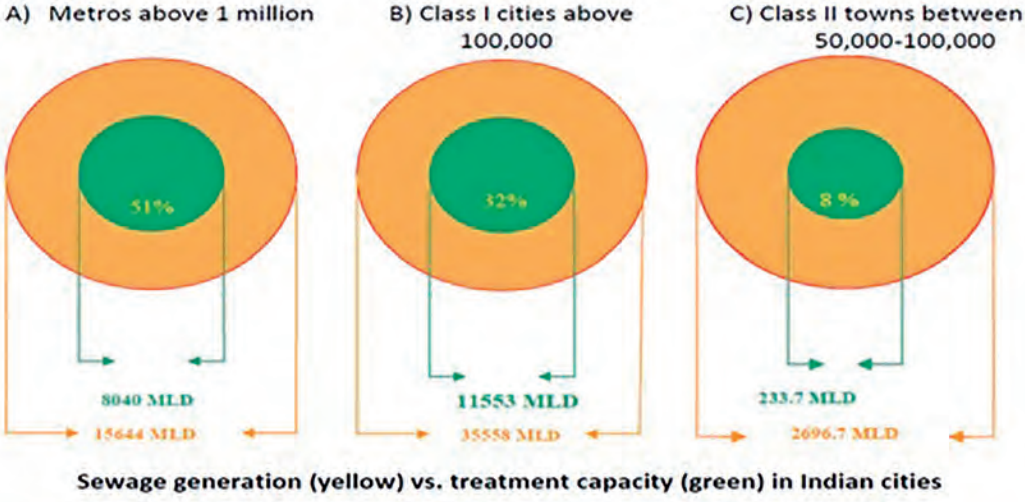
Under NRCP, The Ministry of Environment, Forest and Climate Change has so far released Rs 2,066.98 crores for implementation of various pollution abatement projects and STPs of capacity 2,446.24 million litres per day (MLD). Till March 2017, around Rs 7,000 crores was spent only for cleaning the Ganga, as noted in an order of the National Green Tribunal (NGT).

Citizens and officials need to understand that the centralised system is not the only solution and it can be supplemented by decentralised techniques which creates sustainability through the community participation



Extent of contamination

Source: State of India's Environment-2018,P54

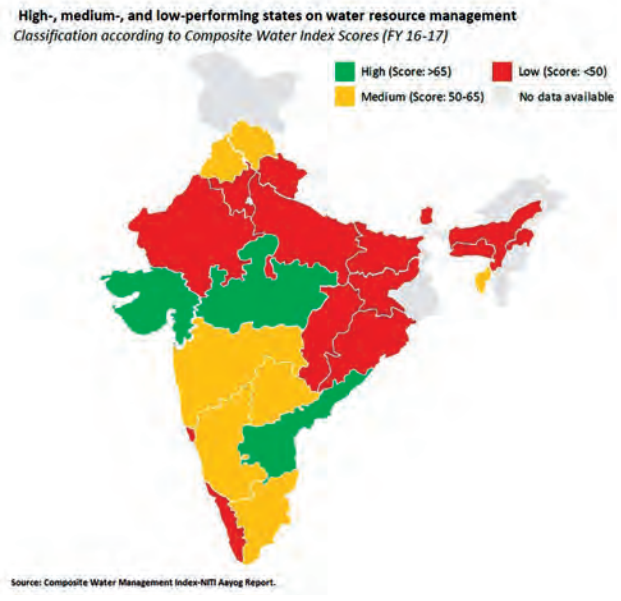


Sewage generation (yellow) vs. treatment capacity (green) in Indian cities

A Transforming Water Data - NITI Aayog

India is suffering from the worst water crisis in its history and millions of lives and livelihoods are under threat. Currently, 600 million Indians face high to extreme water stress and about two lakh people die every year due to inadequate access to safe water. Thus, there is an imminent need to deepen our understanding of our water resources and usage and put in place interventions that make our water use efficient and sustainable.

Recently, National Institute for Transforming India (NITI) Aayog has developed the Composite Water Management Index (CWMI) to enable effective water management in Indian states. This CWMI is a major step towards creating a culture of data-based decision-making for water in India, which can encourage 'competitive and cooperative federalism' in the country's water governance and management.



Same as 'Water Watch', CWMI also provide policymakers and other stakeholders with the information they need in order to make informed decisions to address this quality issue.

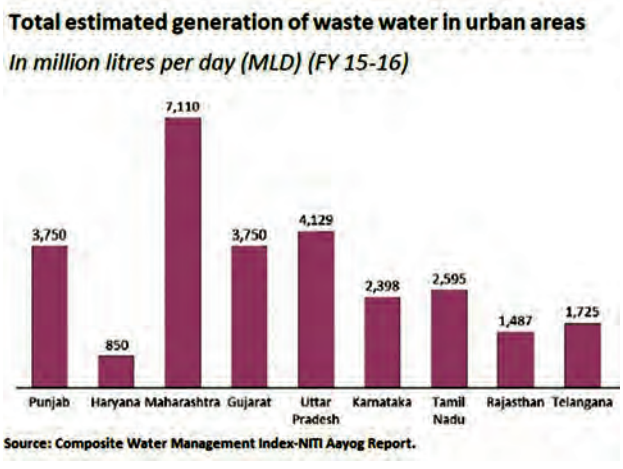
The indicators in the Water Index have been grouped into nine broad themes, which are:

1. Source augmentation and restoration of water bodies
2. Source augmentation (Groundwater)
3. Major and medium irrigation—Supply side management
4. Watershed development—Supply side management,
5. Participatory irrigation practices—Demand side management
6. Sustainable on-farm water use practices—Demand side management
7. Rural drinking water
8. Urban water supply and sanitation, and
9. Policy and governance.

Centre for Urban Water Resources (CURE) reviewed the theme 8: Urban water supply and sanitation focuses on the supply and treatment of urban water. The indicators for the theme includes

1. Access to drinking water in urban areas

2. The capacity for and actual treatment of urban wastewater.



While urban water access is high on average, significant gaps remain across the country, and wastewater treatment remains stuck at the national average of ~33%. It is imperative for the country to boost treatment of urban wastewater, both to ensure that downstream areas are not contaminated, and to enable the reuse of water. By reusing water, the country can significantly increase the utility gained out of all available water. The reused water can also be used towards meeting the country's vast

agricultural demand. Israel offers the perfect example as the global leader in reusing water—it reuses 94% of all water, with the majority being used to meet 50% of the country's agricultural water demands.

Indicator 1: Percentage of urban population being provided drinking water supply

It measures urban drinking water access as the percentage of urban population being supplied with drinking water. Although 93% of India's urban population has access to 'basic water', there are still sharp inter-city and intra-city inequities. Further, supply gaps are causing city dwellers to depend on privately extracted ground water, bringing down local water tables. In fact, by 2020, 21 major cities, including Delhi, Bangalore, and Hyderabad, are expected to reach zero groundwater levels, affecting access for 100 million people. It is critical for state governments to work on the dual policy prongs of building out supply networks and limiting private groundwater access to ensure sustainable water use in cities, and prevent the rationing and strife witnessed in the recent water crisis of Cape Town.

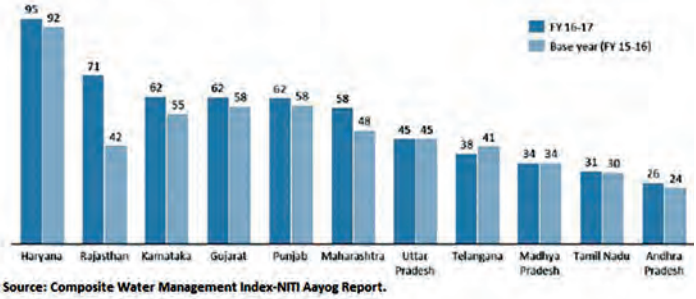
Indicator 2: Capacity installed in the state to treat the urban wastewater as a proportion of the total estimated wastewater generated in the urban areas of the state

It measures the ability of states to treat urban wastewater by examining the percentage of total urban wastewater that can be treated with the currently installed capacity. Treating wastewater is important as water contamination is a significant challenge for India, and is estimated to affect three-fourth of the Indian population, contributing 20% of the country's disease burden.

Indicator 3: Percentage of wastewater treated.

It narrows down on the actual proportion of urban wastewater treated. Large urban states need to invest significantly in treatment systems now to meet the projected 65% increase in urban populations by 2050. Further, treatment can enable reuse of water, helping to significantly bridge the supply-demand gap.

Percentage of waste-water treated
In % (Base year (FY 15-16), FY 16-17)



Source: Composite Water Management Index-NITI Aayog Report.

Going forward, states need to increase investments in wastewater treatment to both meet the growing demand due to rapid urbanization and enable reuse of water.

Centre for Urban water resources (CURE) welcomes the effort of NITI Aayaog, Now the government can amplify the impact of the Index by developing a platform that can be accessed by researchers, NGOs, entrepreneurs and policymakers to enable innovation in the broader water ecosystem.

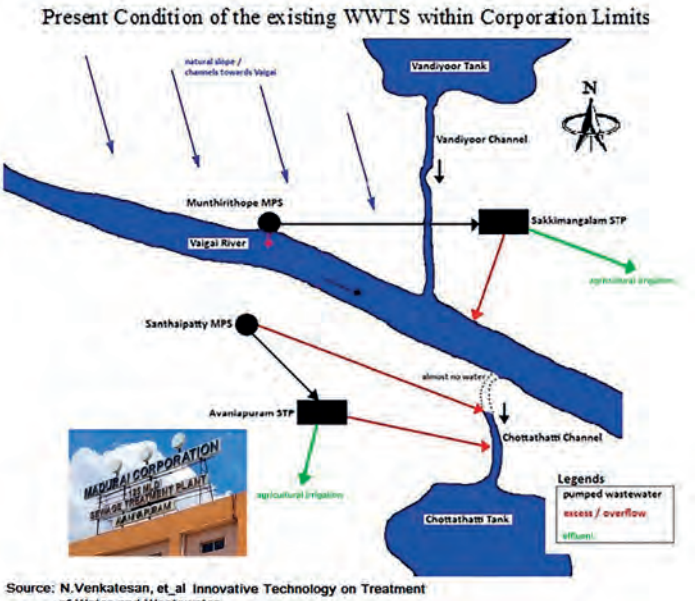
The Detailed report is available at http://niti.gov.in/content/composite-water-management-index-june-2018-0

Madurai's Agenda - Wastewater

Variables	Amount	Remarks
Current population	1.5 Million	As per the population trend
Total water need of the city	200 MLD	(1.5Million*135 lpcd) But available water source for Corporation is 160 MLD
Estimated Sewage generation	160MLD	80% of the total supply
Existing Treatment Capacity	170.7 MLD	Avaniapuram - 125MLD; Sakkimangalam - 45.7MLD
Efficiency of the treatment	24 MLD	Treatment efficiency: 14.53%
136 MLD of Wastewater are discharged to Water bodies or river Vaigai.		

In several Ancient literatures, Madurai is one among the well planned city in the world. This Cultural capital has one of the oldest, systematic wastewater collection and disposal systems in the world. The origin of Madurai's wastewater disposal system goes back to 1865 when the First Royal Commission on Sewage Disposal in England gave its approval to the practice of wastewater irrigation. In its report, it said, "The right way to dispose of town sewage is to apply it continuously to the land and it is by such application that the pollution of rivers can be avoided." Madurai, which became a municipality in 1867, adopted this principle and put in place a sewage treatment system that did not allow wastewater to pollute the river Vaigai.

The first sewage treatment system was established to collect wastewater from seven sub-stations to the Santhaipettai pumping station through gravity and pumped to Avaniapuram, 7 km away, for treatment. This ensured that sewage generated by a population of 1.52 lakh was pumped away from the city daily, thus protecting the Vaigai from pollution.



Source: N.Venkatesan, et_al Innovative Technology on Treatment of Water and Wastewater

The Santhaipettai pumping station is located on Kadar Khan Butler Street, which has an interesting, unverified anecdote associated with it. It was named after the butler of a British officer who lived beyond Santhaipettai, which was perhaps the boundary of Madurai. Footprints of the old sewage system can be seen on this street.

Description	Present Status	
WWTS	Avaniapuram	Sakkimangalam
Drainage zone	South	North
Year of commissioning	1924	1990
Design Capacity of STP	125 MLD	45.7 MLD
Effluent disposal	discharged into agricultural fields or water channels for irrigation .	

In early 19th Century, The two exiting WWTS in Avaniapuram and Sakkimangalam are operated in the technology of wastewater stabilization lagoons. Now both stabilizing lagoons are changed as an typical Sewage Treatment Plant with the technology of Cyclic Activated Sludge Process.

Vaigai Vs Wastewater

In the management of wastewater, River Vaigai has played a major role. The underground drainage was developed for the ultimate population of 2.4 lakhs in the year 1952. Due to the rapid increase in population coupled with limitations in amenities, the city faced a great deal of suffering in all basic facilities especially wastewater disposal without polluting Vaigai river. The sewage from the fully and partially sewered wards in North Zone are collected at the pumping stations at various locations and pumped to the main pumping station for further reuse. But due to the inefficiency of the system, the wastewater is simply allowed to flow in to the River Vaigai either from the pumping station or through the following channels. There are 6 sewage carrying channels in the North Bank, which are (i) Vilangudi; (ii) Thathaneri; (iii) Sellur tank surplus; (iv) Pandalgudi; (v) Sikkandar Puram and (vi) Vandiyur. The sewage from unsewered areas are flowing into the channels running through these areas and finally discharged into the River Vaigai. The South Bank consists of 7 sub pumping stations and a mainpumping station at Santhaipettai. The following are the sewage carrying channels in the South Zone: (i) Chottathatti channel; (ii) Panaiyur channel; (iii) Anuppanadi channel; (iv) Chinthamani channel at Arapalayam; (v) Bethaniapuram channel; and (vi) Girudhumal river.

The overall Madurai's Wastewater agenda shows we are already started to lose the indigenous water bodies of Madurai City.

French Drain System

CURE likes to focus on the situation of people suffering from bad or inadequate sanitation, by showing and discussing alternative and additional wastewater and sanitation management strategies for Madurai and comparable cities: decentralized wastewater treatment.

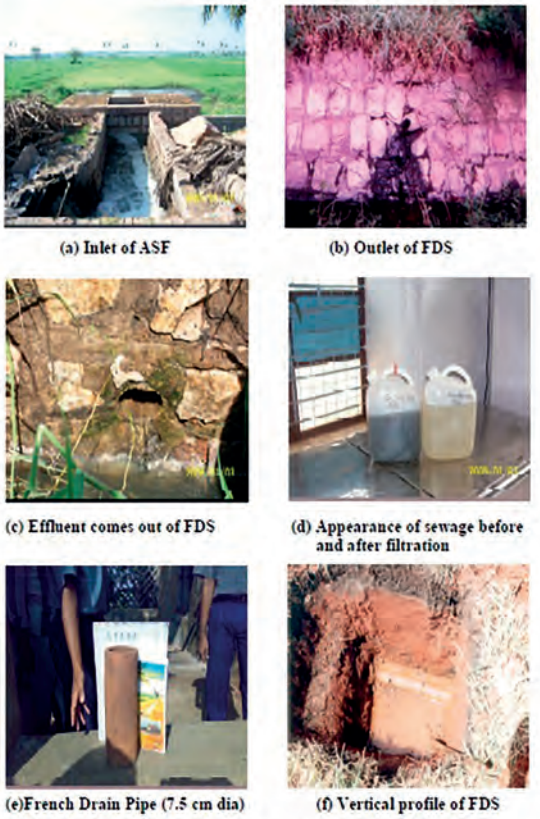
In this scenario British's created a sustainable model to manage the Urban wastewater of Madurai City. In deepen to the Doctorate thesis of Dr.Chandran reveals lot of scientific information about the French drain system. In past Avainapuram Area, Out of 155.87 ha of land, around 87.80 ha is being irrigated with wastewater. Remaining land is utilised as lagoons, roads and garbage dumping sites. This cultivated area of 87.80 ha was divided in to 64 plots each measuring 20.11 m in width, 500 m to 600 m length measuring nearly 1.012 to 1.21 ha per plot. This area was built up with a French Drain System (FDS), where each plot was divided longitudinally at its centre and the land was excavated for a depth of 90 cm and a width of 60 cm. The entire area was filled up with Laterite soil for depth of 100 cm and divided in to 64 plots. Earthern pipes of 7.5 cm diameter and 32 cm length were laid with loose joints for easy penetration of wastewater. Pebbles were filled up for a depth of 18 cm above the pipe, continued by gravels and sand stone for 12 cm depth in each layer. The above three layers were filled for a depth of 18 cm. The top most layer is filled with sand for a depth of 48 cm and width of 60 cm. This arrangements act as a filter media.

When the sewage water flows on to this bed, the waste particles were filtered and the clear wastewater gets collected through the longitudinal pipes and finally reaches the effluent channel. This filtered crystal clear effluent is reused for aquaculture. The silt settled on the top layer of the land due to sewage filtration is removed and auctioned to the private parties once in a year, which is used as organic manure. Guinea grass was planted in the sewage farm in the year 1927, later vegetables like brinjal, greens, ladies finger and coconut were also cultivated. The details of the Avaniapuram Sewage Farm are given below:

(i) Year of Commissioning – 1924
(ii) Area of the farm - 155.87 ha
(iii) Total cultivated land - 87.80 ha
(iv) Area of Guinea grass cultivation - 74.85 ha
(v) Capacity of Lagoons - 13.62 Mld
(vi) No. of Lagoons - 2; (Size - 95m x 95m x 2.5m)

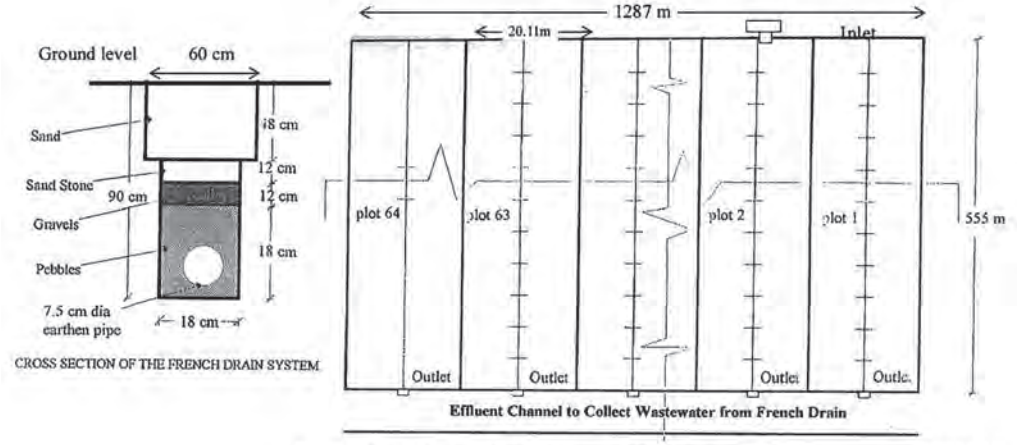
This overall system reveals a single fact as to protect Vaigai they found the sustainable wastewatersystem as French drain

Details of French Drain System (FDS)



(a) Inlet of ASF
(b) Outlet of FDS
(c) Effluent comes out of FDS
(d) Appearance of sewage before and after filtration
(e)French Drain Pipe (7.5 cm dia)
(f) Vertical profile of FDS

Source: Chandran S, Environmental Impact s of Urban Sewage Irrigation
Site: http://hdl.handle.net/10603/27386



French Drain System at Avaniapuram Sewage Farm

NOT TO SCALE

DEWATS- A Hope on Wastewater

The campus of 'THE DHAN Academy' in Melakkal at Madurai ensuring the sustainability in the wastewater cycle . In search of several technologies for treatment, Nature shows the suitable wastewater treatment system which works biologically without electricity and chemicals. This nature based system is called as Decentralised Wastewater Treatment System.(DEWATS)

DEWATS is a socio-technical sanitation approach developed by the Bremen Overseas Research and Development Association (BORDA), an international development organization headquartered in Germany. The Consortium for DEWATS Dissemination (CDD) Society and DHAN Foundation are transforming the myth of wastewater by the tool of DEWATS.

DEWATS systems are effective, reliable, cost efficient and custom-made wastewater treatment systems, which are perfectly suited for small to medium-size systems (5-1000m3/d) on community level and for individual users like e.g. schools, hospitals, or enterprises (SME). DEWATS solutions are not intended to replace but rather to complement centralised systems in applicable areas.

The basic technical treatment processes are

- Mechanical treatment (sedimentation and flotation)
- Biological (anaerobic and aerobic) treatment.

The academy consists of an administrative block (including classrooms and offices), a library block, and a hostel complex (including kitchen and canteen) for students and permanent staff. The complete campus is covered by two DEWATS units. One DEWATS is constructed at the admin cluster to treat the wastewater generated at the school and the library. Another DEWATS serves the hostel block

Treatment Unit	No of users	Design quantity (m3/day)	Buildup Area in Sq,m	Total project cost in Lakh INR
Admin Block	200	8	150	9.00
Hostel Block	100	15	210	

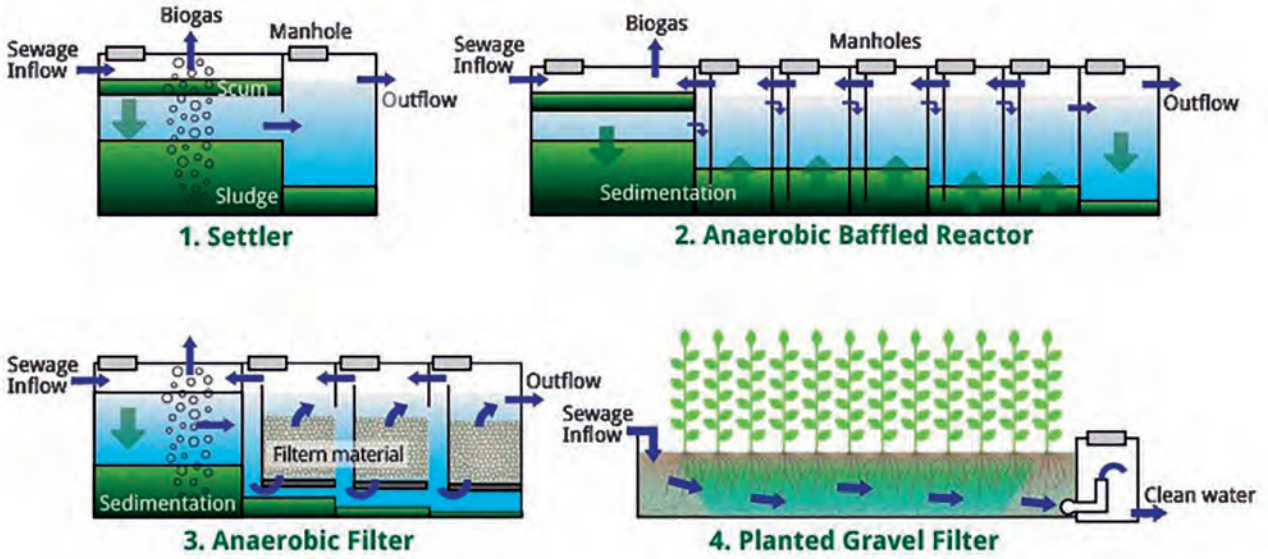
Concept of technology

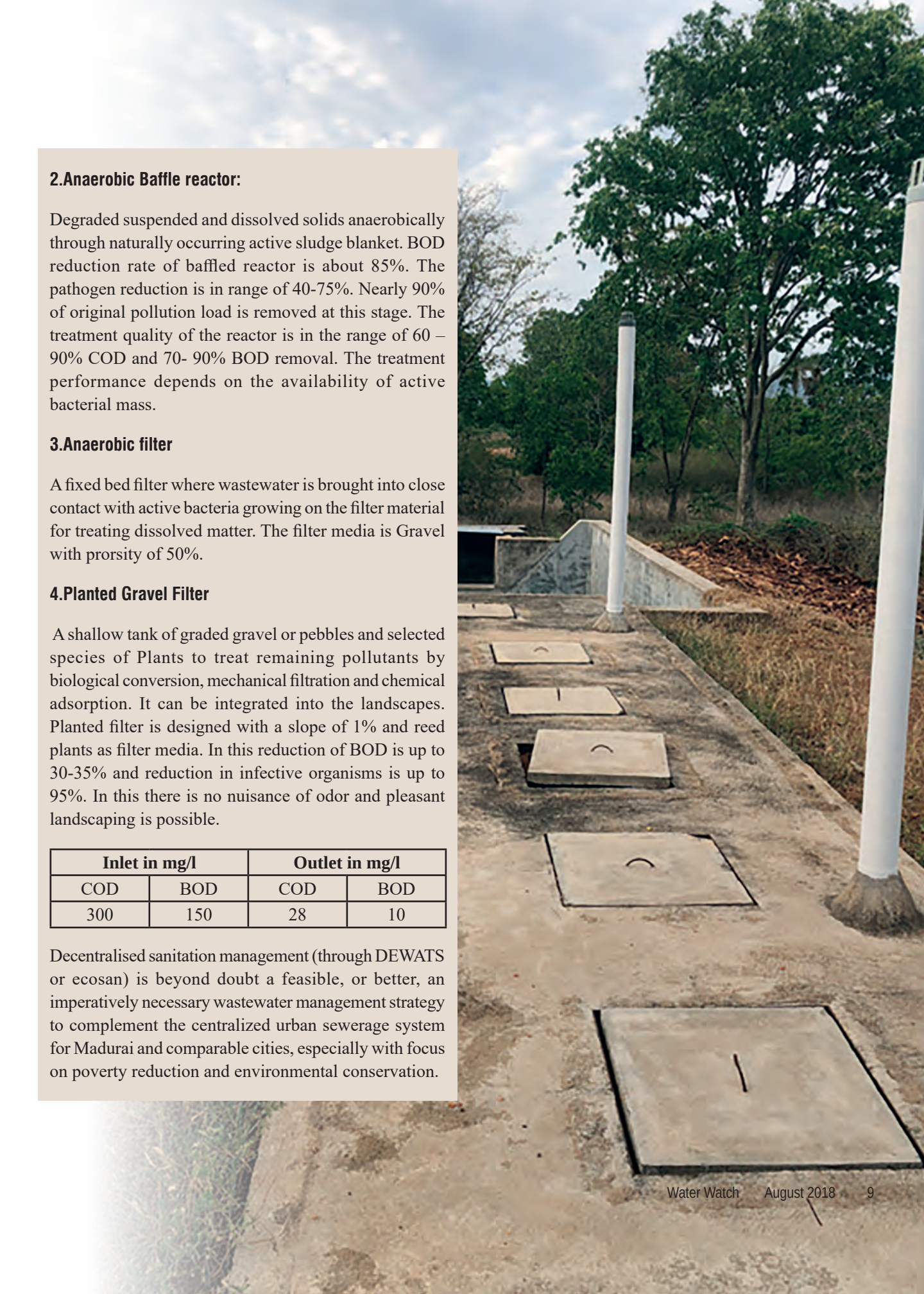
Wastewater treatment is a matter of degradation of organic compounds and finally a matter of oxidizing carbon to carbon dioxide, nitrogen to nitrate, phosphorous to phosphate and sulphur to sulphate. Hydrogen is oxidized to water. The process of oxidation happens aerobically with free dissolved oxygen present in water or anaerobically without oxygen from outside the degrading molecules.

The most common DEWATS modules are 1. Settlers, 2. Anaerobic baffled reactors (ABR), 3. Anaerobic filters (AF), 4. Planted gravel filters (PGF), and (if needed) polishing ponds. The systems can be designed for individual needs.

1.Settler

A sedimentation tank that retains most of the settable organic matter and decomposes some of it through anaerobic digestion. The HRT: 20- 22 hrs (decrease continuously as sludge is settling down)





2.Anaerobic Baffle reactor:

Degraded suspended and dissolved solids anaerobically through naturally occurring active sludge blanket. BOD reduction rate of baffled reactor is about 85%. The pathogen reduction is in range of 40-75%. Nearly 90% of original pollution load is removed at this stage. The treatment quality of the reactor is in the range of 60 – 90% COD and 70- 90% BOD removal. The treatment performance depends on the availability of active bacterial mass.

3.Anaerobic filter

A fixed bed filter where wastewater is brought into close contact with active bacteria growing on the filter material for treating dissolved matter. The filter media is Gravel with prorsity of 50%.

4.Planted Gravel Filter

A shallow tank of graded gravel or pebbles and selected species of Plants to treat remaining pollutants by biological conversion, mechanical filtration and chemical adsorption. It can be integrated into the landscapes. Planted filter is designed with a slope of 1% and reed plants as filter media. In this reduction of BOD is up to 30-35% and reduction in infective organisms is up to 95%. In this there is no nuisance of odor and pleasant landscaping is possible.

Inlet in mg/l		Outlet in mg/l	
COD	BOD	COD	BOD
300	150	28	10

Decentralised sanitation management (through DEWATS or ecosan) is beyond doubt a feasible, or better, an imperatively necessary wastewater management strategy to complement the centralized urban sewerage system for Madurai and comparable cities, especially with focus on poverty reduction and environmental conservation.

BLACK to GREEN- A real story of Urban Irrigation Tank nourish with wastewater

Tamil history evidently shows that there was strong relationship among Temple, Land and Caste. Kings of different dynasties donated acres of agricultural land to temple/God they worship. It's not only for the maintenance of temples but also to establish the authority of communities associated with those temples over deprived one. This system doesn't stop with Shaivam and Vaishnavam temple, it was extended to other religions like Islam and Christianity. Command Area of Kaathiyanoor tank is one of such agricultural lands which was donated to 'Kazimar Periya Pallivasal' of Madurai.

The 42 acres of command area was leased to families of different communities. The farmers spare a particular share of their yield to the 'Kazimar Periya Pallivasal' for its maintenance. The lease contract of farmers who refuse to pay the deposits or leaving the land fallow for an extended period will be cancelled. Currently, only 38 acres are under the 'Kazimar Periya Pallivasal trust'. Board of trustees govern these trust. A standard share of 6 sacks of paddy per acre yield and Rs. 72 per acre of Raggi yield has been followed for past 3 decades. Currently 25 families of different communities are carrying out agriculture in this land. Newly formed board is planning to revise these deposits against the restrains of farmers as the expenses of Pallivasal is increasing day by day.

Centralization pulled rural communities with wide scope for employment. Better employment opportunities with improved standard of living which further pulled the rural communities towards Madurai. Fabrics of Madurai demanded for urbanisation in a rapid phase, leading to the poorly planned land use land cover conversion. Agricultural lands, irrigation tanks and channels were converted into concrete masses. This affected flow of water through the chain of tanks in the downstream resulting in collapse of agricultural livelihood in rural fabrics. The villages in downstream pushed into the agrarian communities urban further complicated the system.

Most of the irrigation tanks in Madurai urban have lost their command area and the tanks have lost their importance. But not the Kaathiyanoor tank. The tank is located in Airavathanalloor, a rapidly urbanizing area still serving its purpose. It is live example of 'Economy of Enterprise' versus 'Economy of Gregation'J.C.Kumarappa, a Gandhian Economist explains that 'Economy of Enterprise' is driven by self-interest and ambition but 'Economy of Gregation' is driven by common-interest and common good.

The command area of Kaathiyanoor tank is an example of 'Economy of Gregation', protected itself from urbanization because 'It is not an individual property' and 'it falls under Wakfu norms'. The Wakfu norms do not permit the Pallivasal trust to convert agricultural land into infrastructure.

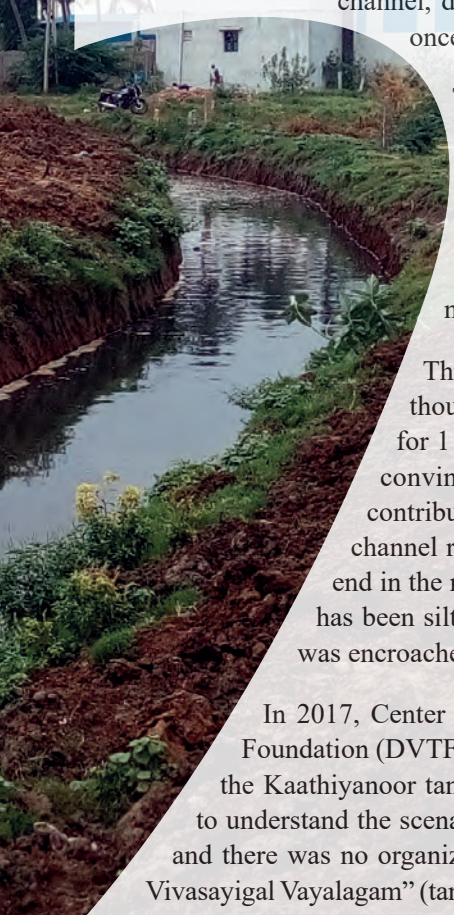
Kaathiyanoor tank which received storm water and Vaigai river water in the monsoon season through Sottathatti channel became perennial due to untreated urban sewage discharge. The farmers who had ensured income through sewage irrigated paddy farming for past 6 decades, left

their fields fallow after 2012. This was an impact of JnURM (Jawaharlal Nehru Urban Renewal Mission) project implementation.

JnURM Project had a component of RCC (Reinforced Cement Concrete) lining of Irrigation channels. As the urban fabrics expanded unlined irrigation channels were subjected to encroachment. This reduced the flow of water in channel. It aggravated the risk of flood prone zone both in terms of spatial extent and intensity of disaster. The lining has not only reduced recharge to shallow aquifers but also has cut off the water supply to some of the irrigation tanks. During the process of lining, channels were deepened to a meter depth than their existing bed levels. Kaathiyanoor tank is one such tank which lost its supply from the Sottathatti channel. The elevation difference between bed level sottathatti channel and Kaathiyanoor channel was more than 2 meters so that the Kaathiyanoor channel could not receive any water from Sottathatti channel. Since the Kaathiyanoor channel could not feed the tank, the command area was left fallow. This shows how absence of people participation could misshape the purpose of scheme.

It is obvious that small farmers of Kaathiyanoor who lease not more than 2 acres could never lead their life with just farming in these urban fabrics. As the primary livelihood of the farmers was affected by RCC lining, their survival was under threat. Farmers gave repeted petitions to the district administration to address the issue but did not turn on. Therefore, the farmers left the land fallow and focused on other livelihoods which was their secondary one earlier.

As the Kaathiyanoor channel lost its purpose, urban residents along the channel started encroaching the feeder channel, dumping their solid waste and disposing sewage in it. The channel which was once 15 feet wide had shrunk to 6 feet on an average and to 3 feet at few stretches.



Though most of the farmers lost their hope on reviving the feeder channel few didn't relent. Mr.Sethuraman, a communist activist, Mr.Kumaresan, retired post master and Mr.Alagusundaram, manager of Pallivasal trust thought of renovating the channel at any cost. They approached Tasildhar, District magistrate and PWD executives. They put forward the application to construct a weir across Sottathatti channel to rise water level. They accepted petitions, reacted to it but nothing turned into action.

Three years of repeated request and no action created fatigue among them. They thought of an alternative plan. The plan of deepening the Kaathiyanoor channel for 1 meter so that the water in Sottathatti channel could feed it. Mr.Alagusundaram convinced the trustees to sanction 1 lakh rupees for this intervention and farmers contributed Rs.25,000. The work was initiated but poor understanding on levels of the channel resulted in failure of the deepening process. The channel deepening came to an end in the mid-way as the funds got exhausted. Farmers lost their hope. Deepened channel has been silted again. Prosopis invaded the fallow command area. Tank water spread area was encroached by green leaf cultivators.

In 2017, Center for Urban water Resources (CURE), a component of Dhan Vayalagam Tank Foundation (DVTF) carried out an assessment of tanks in Madurai urban. This assessment brought the Kaathiyanoor tank to its view. Multiple focus group discussions were carried out with farmers to understand the scenario. It was understood that the petitioning and follow up process was irregular and there was no organization to represent them. This resulted in formation of "Kaathiyanoor Kanmai Vivasayigal Vayalagam" (tank farmers' association). The association planned to re-deepen the channel, remove

the agricultural encroachment in the water spread area and desilt the tank. With technical support of CURE, the association estimated a budget for 2 lakhs. Farmers of the association contributed fifty thousand and DVTF contributed one lakh fifty thousand for the renovation activity. The issue was in getting 'No Objection Certificate' for the renovation activities from authorities. The farmers collectively started to petition through their association. The follow up was regular.

After frequent visits to the Tasildhar office, the association got an unofficial communication that it will not be permitted to desilt the tank for silt application in their field for two reasons. One, the command area is registered under single Patta. Two, the land belongs to a trust not farmers. 'Kudimaramathu' does not permit desilting in both cases.

The association applied to Department of mines for deepening channel with sewage and silt and file was forwarded to public works department and the PWD informed that the Kaathiyanoor channel does not fall under their list. But the association submitted a copy of letter approved by PWD to construct culvert across the same channel for some private resident. Then the PWD gave an oral permission to deepen the channel but not an official one. Understanding the situation of farmers, VAO (Village Administrative Officer) of Airavathanalloor gave the 'No objection Certificate' noting that the activity should not affect anyone.

As the encroachers of the residents may stop the channel deepening process, the farmers' association informed the local police station in prior. Channel deepening process was initiated with techno- managerial support of CURE. As expected the residents who encroached the channel started petitioning against the association.

Deepening channel was not as simple as in rural context. The channels were narrow at few portions, there was very few space to dump the excavated silt and the houses were disposing sewage into the channel continuously. The silt was slurry and the excavation duration increased than the estimate. The excavation was not continuous as the spaces for dumping was less sufficient. Then the sewage silt slurry was transferred to the nearby farm with dippers. As, the culverts were disrupting the flow of water, they were dismantled overnight. The culverts were reconstructed by one of the farmers who is also a mason. The channel deepening, agricultural encroachment removal and tank desilting were successfully completed after 10 days of struggle. Farmers spent day and night to monitor the process and there was smile on their faces when the sewage water reached the tank.

Farmers association was thankful to the excavator operators Mr.Sebastine and Mr.Raja for being patient with the excavation process and bearing with the foul odour. There was shower for next two days after completion of the tank work. This was seen as sign of nature. Immediate post intervention, farmers went for paddy cultivation. There was harvest after 5 years of fallow. Restoration of tank brought back flock of Sparrows, swamp hens, cranes, ducks and kingfishers to its ecosystem.

As a token of thanksgiving, the farmers offered Pongal from their first harvest to the Ayyanar temple in the bund of the tank. Farmers sat and recollected all the odds they overcome. Mr. Sethuraman said, "Though the yield was not as expected, it's not about yield this year. It is about the learnings. How administration deals with farmers? How common man treats farmers? All are pro farmers. They pity. They support until we were out of their court."

There was complete silence.

Baya weaver birds were chirping and weaving their nests on fronds of date palm trees in the bund.

Analysis of Wastewater at the Laboratory

This issue of Waterwatch having a theme of Wastewater. Based on the expert guidance we sampled the wastewater at the urban irrigation tank fed by Wastewater. For this purpose Kathiyanoor tank in Madurai city is taken which comes under Viraganur post. The tank is located at 9º54´2.66´´ N, 78º9´23.96´´E and 145m above Mean Sea Level. The tank comes under Kondhagai cascade of Gridhumal subbasin. The tank has a capacity of 0.0680MCM and spreads over an area of 25 acres. The tank is fed by Sottathatti channel and kathiyanoor channel. This tank has four sluices and has a command area of 42 acres on to its downstream. The cultivational crops that are sown include paddy, spinach, cucumber, coconut, ragi, foxtail millet.

In Madurai urban most of the channels are fed by the wastewater which leads urban farmers to irrigate their farm with sewage. The wastewater are sampled from

Sample 1.Sotathatti channel (Main channel)

Sample 2.Kathiyanoor Channel (Sub Channel)

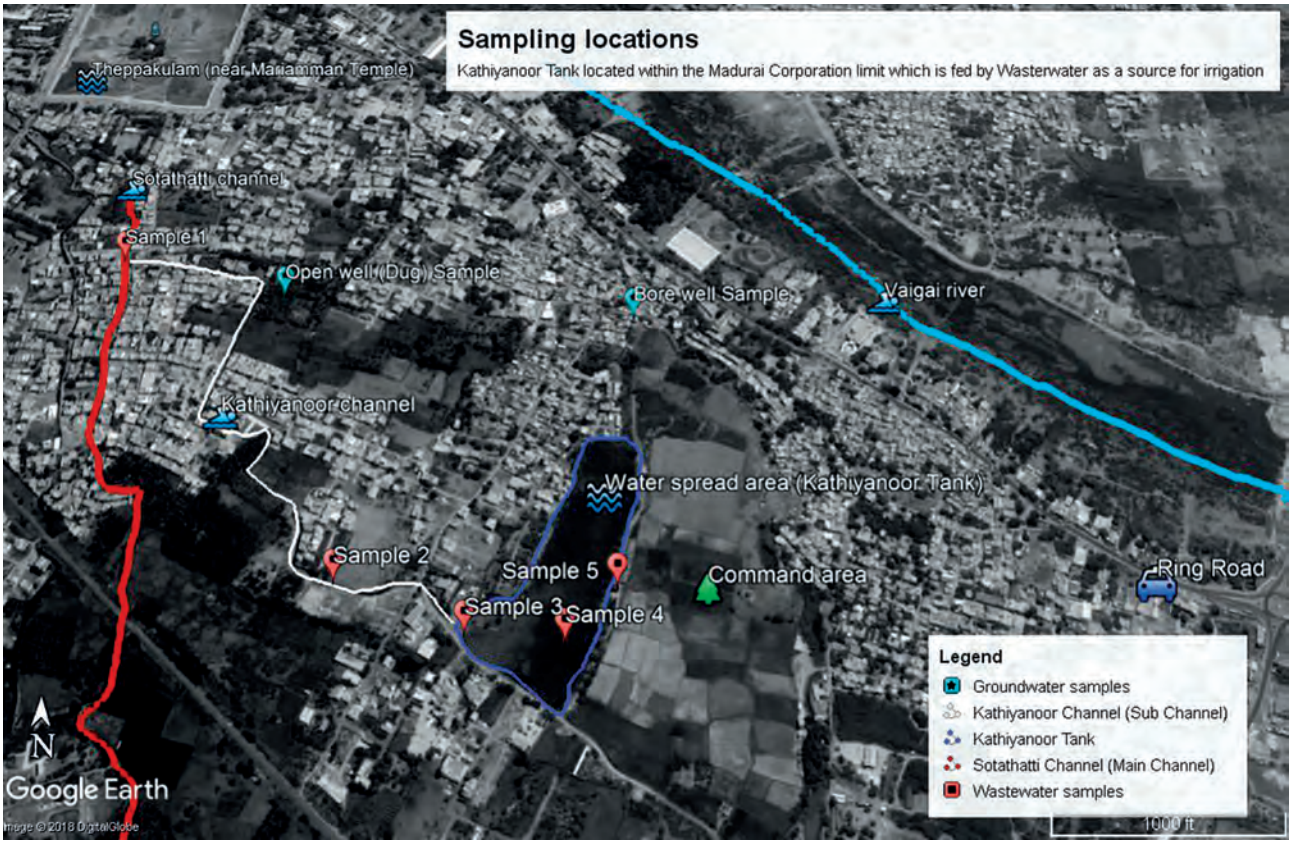
Sample 3.At inlet of Kathiyanoor Tank

Sample 4.At the Kathiyanoor Tank

Sample 5.At the outlet of Kathiyanoor Tank.

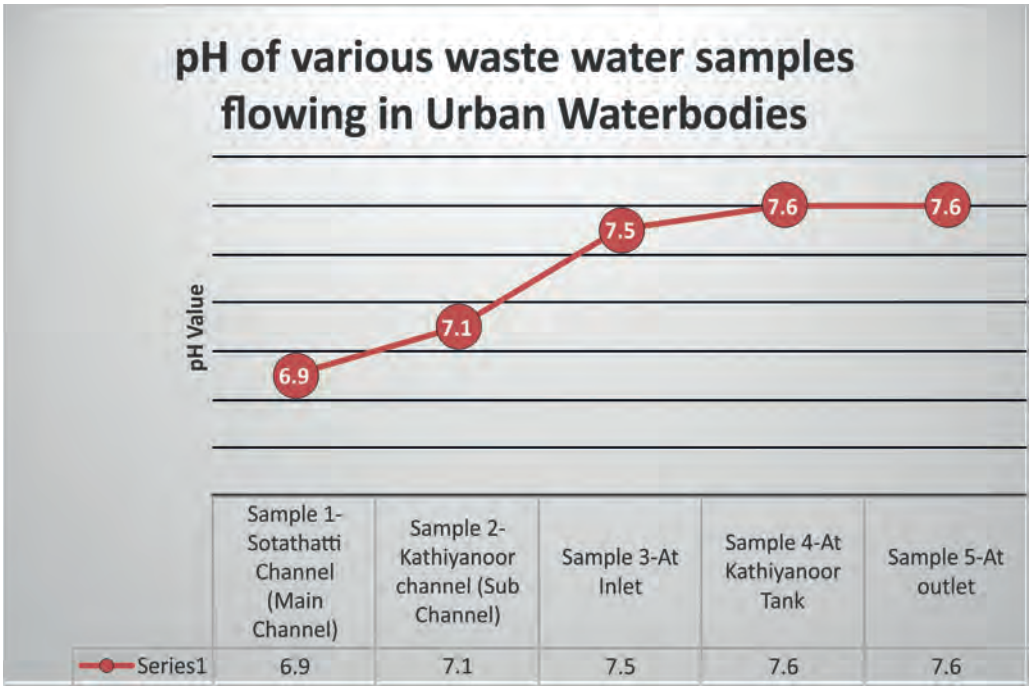
Sample 6.Open well(Dug) sample

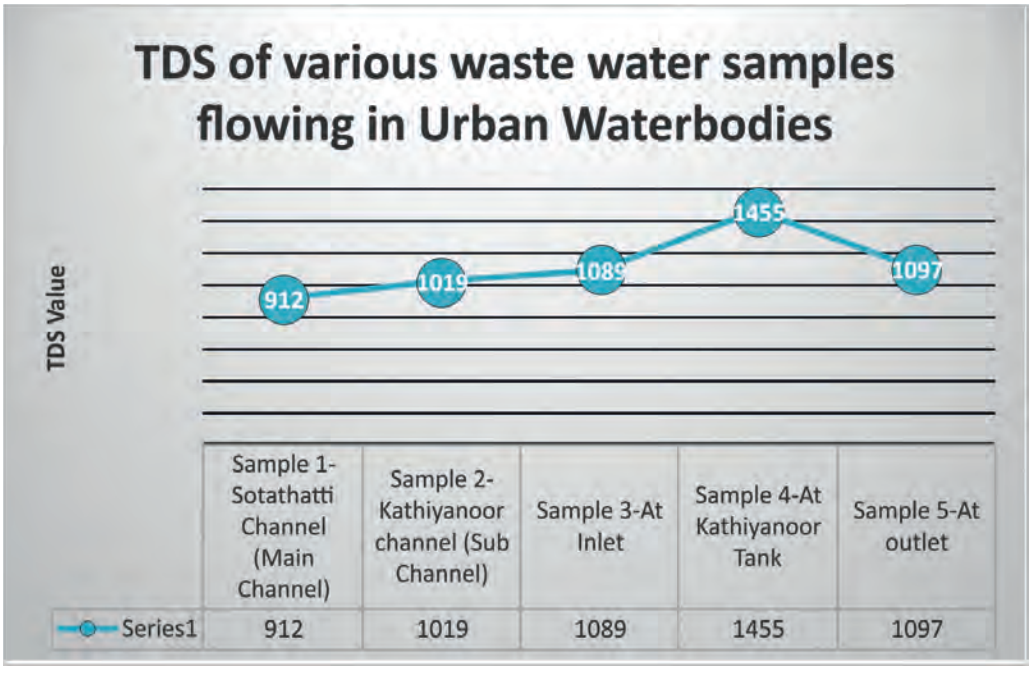
Sample 7.Bore well sample

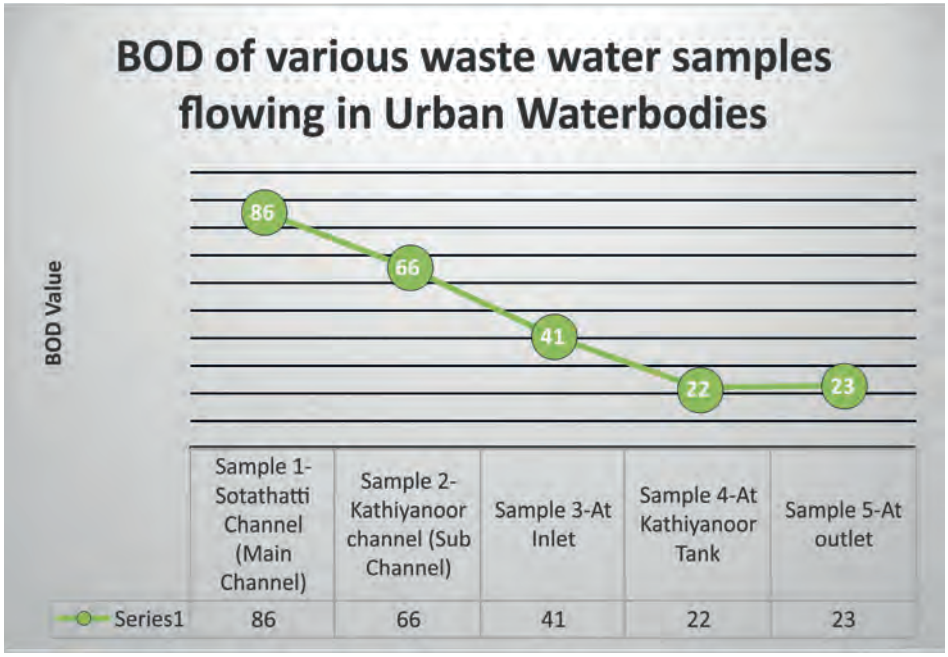


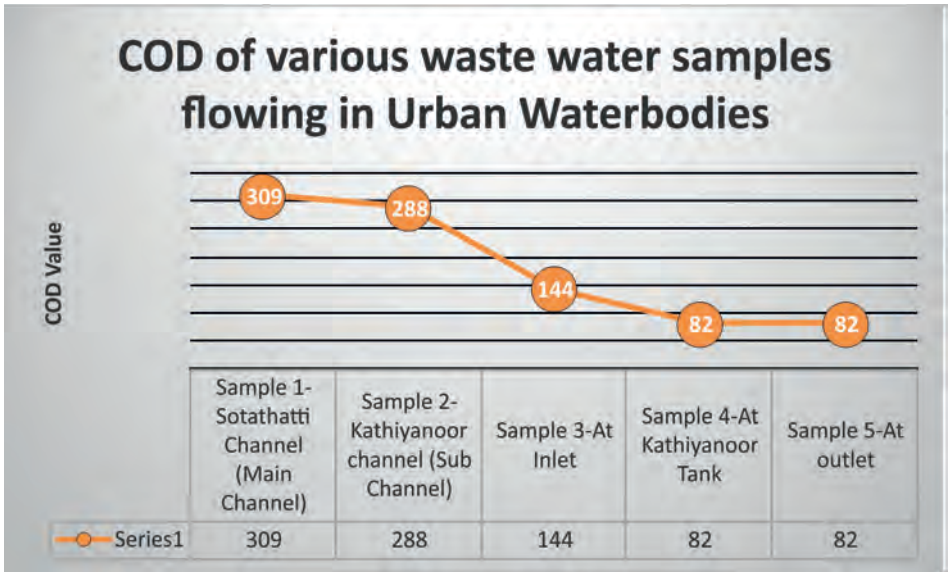
Comparison of Various Parameters

From the test results obtained, few parameters which are much deviating from that of the maximum permissible limits as prescribed by TNPCB standards are chosen and are plotted in the graph to show the variations of it along the different sewage environments.





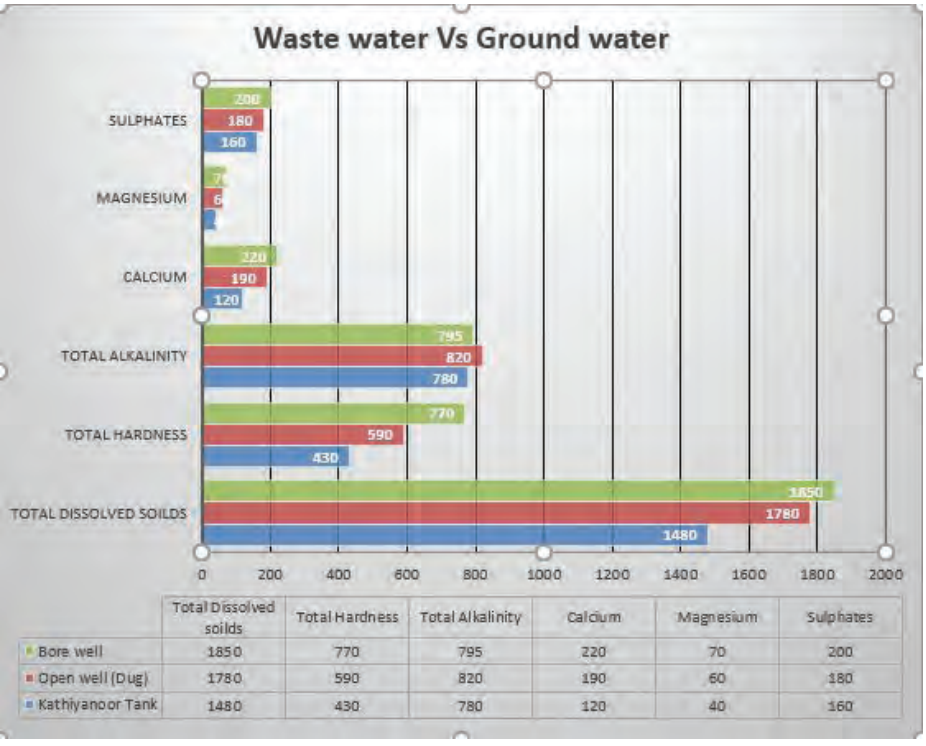




Inference

- Almost 80% of Madurai sewage is entering to the water bodies. This continuous inflow of sewage leads to the server contamination of water, soil and crop.
- Most of the Spinach (Green's) which is available in the Madurai are cultivated through the sewage generated by the Madurai Urban.
- Throughout the path of flowing wastewater, nowhere the waste achieved the discharge standard. These sewages are directly utilized for irrigation purpose.
- The flow of wastewater leads to reduction of concentration in the wastewater. But nowhere it achieve the standard prescribed by FAO for irrigation.
- Since farmers do not receive any support from agricultural experts, they approach shopkeepers for purchase of seeds, fertilizers and pesticides. Which again leads to maximum usage of fertilizers.

Comparison between Wastewater and Groundwater at Kathiyanoor



Inference

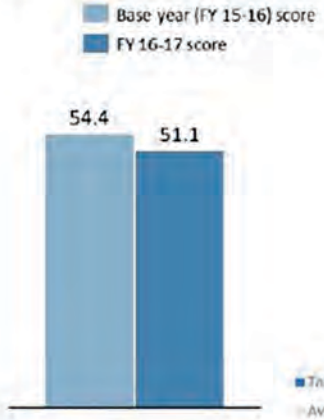
- The Bore well water crossed the maximum permissible limit. This might be due to over abstraction of ground water.
- As equal to the bore water, Open well water also crossed the acceptable limit of the water.
- Apart from biological contamination, all three samples are chemically contaminated due to soilds.

Wastewater quality at Avaniyapuram Sewage Treatment Plant (125 MLD), Madurai Corporation

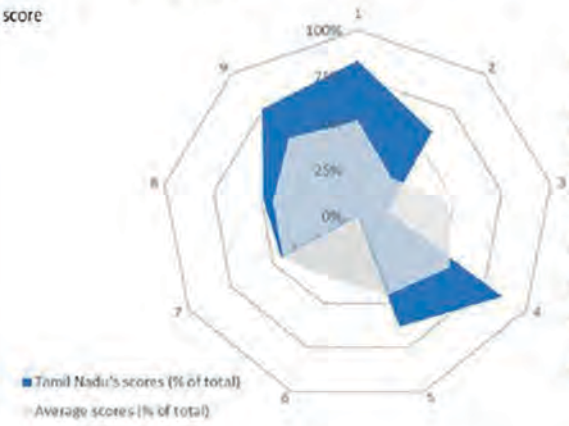
S.No	Parameter	Unit	Raw Sewage		Treated Sewage	
			Standard Inflow	Tested value on March, 2018	Standard Outflow	Tested value on March, 2018
1	BOD(3days)	mg/L	200-300	220	≤10	16
2	COD	mg/L	400-500	448	≤100	80
3	TSS	mg/L	200-400	378	≤10	12
4	pH	-	7.0-9.0	8.06	7.0-9.0	7.45
5	Oil & Grease	mg/L	15	11.2	≤5	4.0

Overview of Tamil Nadu's CWMI performance STATE: TAMIL NADU

State index scores
(FY 15-16, FY 16-17)



Performance on indicator themes
(FY 16-17)



1. Source augmentation and restoration of water bodies
2. Groundwater augmentation
3. Major and medium irrigation
4. Watershed development
5. Participatory irrigation practices
6. Sustainable on-farm water use practices
7. Rural drinking water
8. Urban water supply and sanitation,
9. Policy and governance.

Things going well

- *Surface water restoration:* The state has restored ~80% of the irrigation potential of identified bodies
- *Watershed development:* The state has constructed 100% of its targeted water harvesting structures, all of which have been geo-tagged
- *Policy & data:* The state has enacted conservation legislation, charges ~50% of urban households for water, and has set up an integrated data centre

Things to improve

- *Irrigation utilization and O&M:* Tamil Nadu utilizes only ~36% of its irrigation potential and has lined <10% of identified canals
- *On-farm use:* The state has not begun the process of power feeder segregation, is one of the few states to not charge for borewell electricity, and has negligible micro-irrigation coverage

Source: Composite Water Management Index-NITI Aayog Report.

Innovation Matters

The straw-style filter- 'LifeStraw' which turn up to 4,000 liters of contaminated water into safe drinking water. LifeStraw's parent company, Vestergaard designed a cloth filter with hollow fiber membrane technology allows 0.2 Microns to drink directly from streams and meets USEPA drinking water standards. It removes waterborne bacteria, including E. coli and salmonella and waterborne protozoa, including Giardia and Cryptosporidium but not chemicals. It costs INR 1099 which requires no electrical power, batteries or replacement parts. LifeStraw is ideal for emergency preparedness and for travel.

Meteorological Updates

SW-Monsoon Rainfall 2018 Updates (From 01.06.2018 to 01.08.2018)			
Code	Name	Actual in mm	Normal in mm
31	Tamil Nadu - State	117.2	133.8
471	Madurai District	79.6	132.2

Source: Regional Meteorological Centre, Chennai
Ministry of Earth Sciences India Meteorological Department

Rainfall Data

Station Name: DHAN Central Office, Madurai
Device: Automated rain gauge.
Average Annual rainfall for Madurai: 840mm

Temperature Data

July 2018 - Rainy days	
Date	Intensity (mm/d)
01/07/2018	6
02/07/2018	3
30/07/2018	3
Total rainfall	12 mm

(Single station data)

July 2018 - Temperature		
	Date	Temperature
Highest temperature	29/07/2018	38°C
Lowest temperature	01/07/2018	23°C
Average temperature	38°C/28°C	

(Source: Accuwethear website)

References

- The United Nations World water Development Report-2017
- "Neerindri" by DHAN Foundation
- Innovative Technology on Treatment of Wastewater-Decentralized WastewaterTreatment system (DEWATS) by CURE
- State of Environment by CSE

For Suggestion/Comments please write us on

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