



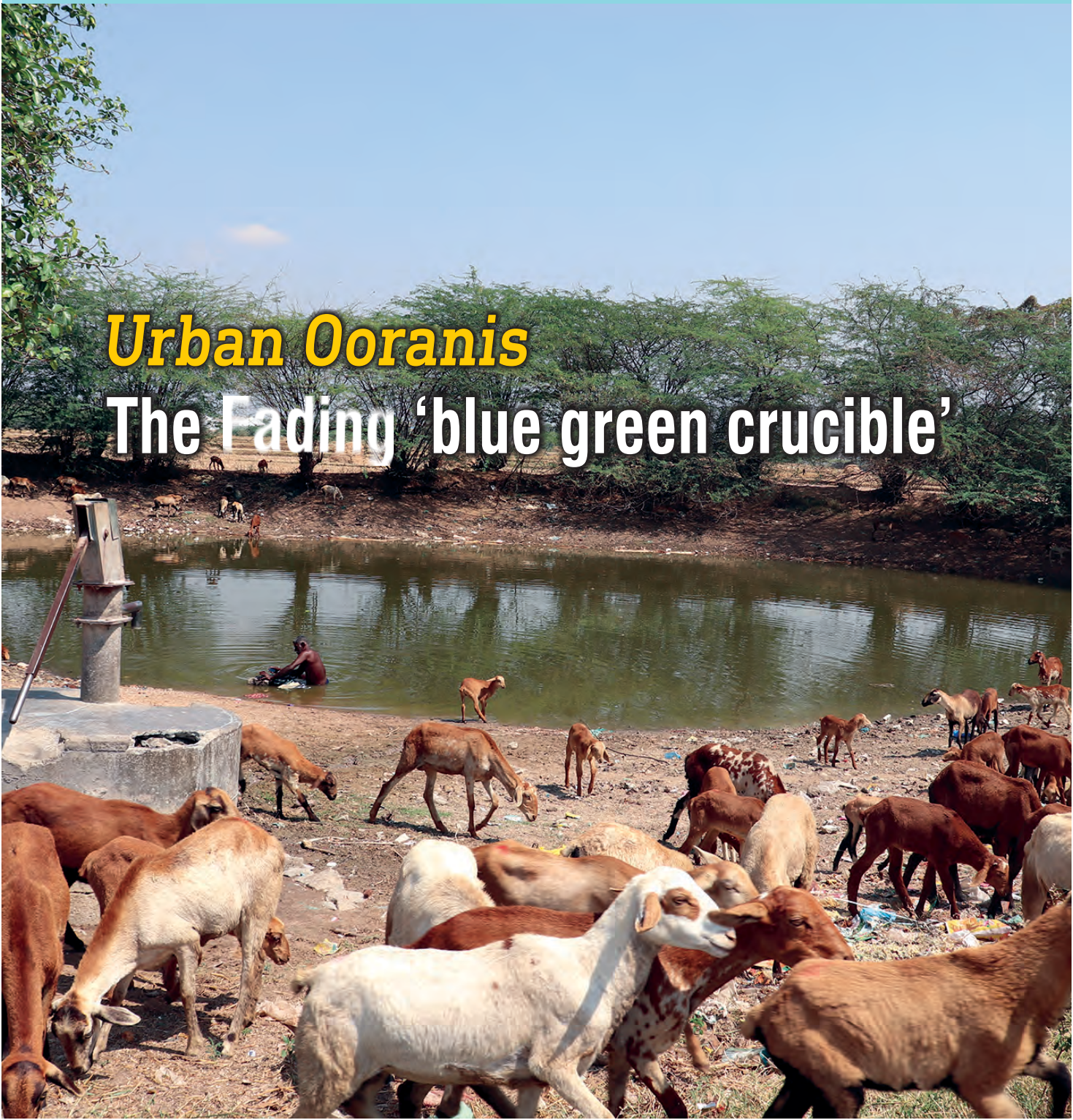
April 2019

# Water Watch

Quality Matters

**Urban Ooranis**

**The Fading 'blue green crucible'**





It is a wetland developed by mother 'nature' in a 'waste stabilisation pond' at Koodal Pudhur, Madurai. The pond is fed by raw sewage and septage whenever the inflow of sewage or septage is higher than the holding capacity of pumping station. The oorani is lined by stone masonry in the southern side and remains unlined in rest of the sides. It is not fenced. To avoid trespass, dry Prosopis are placed around the pond. Madurai corporation has to design the stabilisation pond as per the standards. It should be lined in all the directions and should be sealed at the bottom to avoid ground water pollution. The natural wetland that has formed in the oorani should be supported by providing artificial wetland spaces.



## Contents

1. Ooruni: The drinking water heritage	1
2. Thasi oorani	3
3. Sokkaaye Oorani	4
4. Kaluvadiyan oorani	5
5. Karuppayee oorani	6
6. Perspectives on Urban Ooranis	7
7. Let us converse about the crucible	9
8. Vandiyur Updates	10
9. Baseline Assessment - Water Quality Analysis	10



**Centre for Urban Water Resource (CURE)  
Water Knowledge Centre  
DHAN Vayalagam (Tank) Foundation**

1A, Vaidyanathapuram East  
Kennet Cross Road

Madurai 625 016. Tamil Nadu, INDIA

Tel.: +91 452 2302500; Fax: 2602247

Email: dhancure@ghan.org

# Ooruni: The drinking water heritage

ஊருணி நீர்நிறைந்த தற்றே உலகவாம்  
பேரறி வாளன் திரு. - குறள் 215

The wealth of men who love the 'fitting way,' the truly wise, is as when water fills the **pond** that village needs supplies. – *Kural 215*

## Kural Explanation

The wealth of that man of eminent knowledge who desires to exercise the benevolence approved of by the world, is like the full waters of a **pond**.

This thirukkural reflects the significance of 'Ooranis – Drinking water ponds' during the ages of Thiruvalluvar (dated variously from 4th century BCE to 5th century CE). Kulam, kuttai, kundam, kuttam, kundu, valayam and oorani are some of the traditional ponds that were dug by local communities, landlords, kings and kingsmen for various purposes such as domestic uses, drinking, livestock needs, fishing, agriculture, washing clothes etc. Every pond was designed based on the functionality, topography and demand. Hamlets were established over the dugout soil of these ponds.

Few hamlets/  
villages  
were

also named after these ponds (Sekanoorani, Karuppayurani, and Kaloorani).

'Ooruni' which turned into 'Oorani' is a term in Tamil language used for 'drinking water pond'. Ooruni (oorum neer) meaning 'filtered sub surface water that springs up', is the safest drinking water source for villages. These are dugout pond below ground surface, to harvest the rainwater runoff from the catchment and store it for drinking purpose. As most of the region of Tamil Nadu falls in non-perennial river basin and rain-fed region, every hamlet has minimum an oorani and a kulam (domestic water pond). Ooranis are generally excavated in rectangular or square to a depth of about 2-5 meters below ground level. The size depends upon drinking water demand of the communities. Ooranis not only harvest the surface flow but also the subsurface flow. Runoff from the catchment flowing through feeder channel and surplus from the adjacent irrigation tanks fills the oorani. Harvested water is used for drinking purpose almost round the year. As the water collected from oorani is turbid, communities use *Strychnos potatorum* (Thethankottai) seeds to coagulate the suspended matter, which in fact allows the clogs to settle at the bottom. Other indigenous practices also exist among villagers.

Though various communities socially structured their ooranis with their indigenous knowledge, Nagarathar communities in Chettinad region are excellent example for community ownership on water bodies, especially ooranis. They are known for their oorani architecture, functionalities and maintenance. Following are the brief description about components of oorani,

**Feeder channel** is the most critical component of oorani that ensures the source of water. In primitive stages feeder channels entered into the oorani through open cuts. As it led to erosion, sliding, difficulty in regulation of inflow leading to damage in bunds, inlet structure was constructed. A slow sand filter is provided at the inlet point which filters the storm water run-off effectively. Shutter was also provided in inlet structure to regulate the flow. Oorani with unregulated inlet has an







outlet structure such as waste weirs, conduits to release the surplus water. The surplus water either feeds neighbouring tanks or connects with the storm water drainage.

**Stepped excavations** are carried out at different levels to store the harvested water. The stepped dug outs are designed for optimal utilisation of water so that people can collect water even in lean season and also to harvest subsurface flow. The sides of the ooranis are either stone pitched or remain unlined.

**Ghats or steps (padithurai)** are provided in one or more sides for accessing the oorani and collecting water. A small trench that holds lime (Calcium Carbonate) water is placed after three steps. This trench acts as a disinfectant. People wash their legs in this trench before entering the oorani. Consolidated soil ramps are also provided in few ooranis instead of Ghats. But ramps are usual in livestock ponds. Ghats not only ensure easy access but also makes maintenance easier.

**Fences** are provided around oorani to protect water from entry of animals and to indicate travellers that the oorani is used for drinking so that they won't pollute the pond by bathing, washing and defecating at the premises.

**'Sumaithangi Kal'** (Load bearing stone) are add-ons in ooranis. It is a horizontal stone slab balanced on two vertical stone posts. Women who carry more than one water pot used this structure to load and unload.

**Dug out well** constructed near or inside the oorani are evidences of monsoon failure. These wells were source

of drinking water during dry spells. Usually the oorani water is muddy. These dug wells having natural filter media provide safe drinking water and avoid direct withdrawal of water from oorani.

**Social capital** Communities in village uses different strategies to restore and maintain the oorani. Communities invest their common fund on goat rearing, fish farming, lotus farming, etc. The income generated from these common activities are invested on ooranis.

Apart from the structural perspective there is a social structure that protects the oorani from deterioration and pollution. In prior to monsoon showers, community involves in 'kudi maramathu' in which they restore oorani by activity such as feeder channel clearance, desilting, weeding, strengthening bunds, repairing Ghats, etc. The belief system such as 'the deity' in the premises of oorani protects the oorani from pollution. 'Sami ottam' (guard of god) is a social belief system built by the communities to protect the catchment area from open defecation and pollution.

Madurai, the temple city, established their civilisation in the banks of Vaigai and Grithumal has constructed many ooranis and settled around it. Madurai Corporation which had more than 90 ooranis is currently having just 21 ooranis. Urban expansion has moved the civilisation towards 'Centralisation'. Communities for their drinking water needs, has shifted from ooranis towards integrated river water projects, packaged drinking water and reverse osmosis filtered ground water. Most of the urban kids answer 'taps' as the source of their drinking water. In this context, 'this issue of water watch' focuses on ooranis of Madurai city, its status, its relevance for the future and action towards it.

## Thasi oorani



9°57'47.9"N, 78°10'50.6"E

### Location

Thasi oorani is the only oorani in Madurai corporation that was still in use in month of April. The oorani with an area of 0.71 acres is part of Narasingham village. It is currently called as 'Sudukaattu oorani' (Grave yard oorani) as there is a grave yard, just opposite to the tank.

### Source and conveyance

The current source of water is irrigation water from Periyar Main Canal. Irrigation water from sluice that feeds 'Thulukkan Kanmoi' first fills Thasi oorani and the surplus feeds the Thulukkan irrigation Tank. As the Thulukkan tank is fed with sewage and not desilted for more than a decade, the local communities blocked the outlet of the Thasi oorani and raised the storage level for extended usage.

### Structural description

The oorani is excavated for a depth of 5 meters in stepped manner. The deepest excavation is lined with brick masonry. Ghat is present in the eastern side of the oorani but the deepest steps are completely deteriorated. This makes the accessibility bad as the water level goes down. The bund around the oorani are elevated more than a meter from existing ground level.

### Functional description

As there is no sewage infestation, the quality of water is better and so the local communities use this oorani for domestic purposes. Deeper excavations and absence of ramps restricts livestock from accessing the oorani. People from grave yard use this oorani water for ritual purposes.

### Description of Infection

Though the bunds are planted with tree saplings under MGNRGA scheme, Prosopis infestation in the bunds



are suppressing the growth of the plantation. Except for the deepest excavation, rest of the area is covered by lotus which has been leased for flower harvest. The income from lease is used for village development and occasionally used for oorani restoration. A small permanent shed has been constructed (to place dead bodies), encroaching the periphery of the oorani.

### Recommendations


The bund of oorani should be cleared from Prosopis infestation. Desilted soil from oorani should be used for strengthening bunds. Native trees should be planted along the same. The damaged steps of only Ghat shall be repaired. As the MGNRGA activities in Narasingham is laudable, they can be involved in restoration activities. A portion of income generated from lotus flower harvest should be invested back on the oorani for regular maintenance.





support of Ex- ward (56) counsellor and Gajendrapuram locales in July, 2018. Prosopis and reeds were cleared and fenced. About 30 native tree saplings such as Kadambam, Marutham, Neem, Pungai, etc. were planted in two sides of the ororani. The third side was planted with banana. The ororani is good example for creating green space in ororanis. A deep narrow pit was dug to store surplus water flowing from pumping station of ‘Integrated Cauvery drinking water project’ established in 2015-16. This stored surplus water is used for watering plants. The devotees and local people takes care of plants and water it. The overall restoration cost was about 11 lakhs.

### Sokkaaye Oorani

 9°53'17.0"N, 78°08'38.5"E

#### Location

Sokkaaye oorani is the only ororani that has been restored in a better fashion. The ororani with 1.4 acreage is located along Chinthamani road at Gajendrapuram. The ororani was renovated as a sidekick activity of Pandi muneeswarar Temple construction.

#### Restoration description

Mr.Thirupathirajan and Mr.Arumugam, trustees of Pandi muneeswarar Temple said that, “it’s an order from the deity itself, that the ororani should be restored”.

Before restoration the ororani was intensively infested by prosopis, reed and dumped by solid waste disposals. Post restoration the ororani became clean and green. The ororani restoration was initiated by the temple trustees with

#### Source and conveyance

In the past the ororani received its source from panayur channel but the channel was completely encroached by urban establishments. Storm water runoff from neighbouring roads and water falling directly on the water spread area are the current sources. As the catchment is minimal water harvested is also minimal.

#### Structure


An access Ghat in the north of the ororani is highly damaged. It was not taken into account during restoration. There are six ground water pumps in the ororani premises laid by city corporation. The pumped water is used for domestic supply to the nearby area.

#### Recommendations

Reconnecting the inlet source or tracing alternative feeder channels to harvest water to the ororani is the critical component to be intervened for better utilisation of the ororani. Only if the source of water is ensured, the deep excavation will be justified and will lead for better landscaping.



## Kaluvadiyan oorani

 9°53'35.0"N, 78°08'14.2"E

### Location

Kaluvadiyan oorani is located besides Kaluvadiyan Kamatchi temple. This oorani having water spread of 0.68 acres is the only oorani that exists amongst three ooranis in Mela Anuppanadi. The other two ooranis were converted into primary health care centre and government school respectively. Before three decades the oorani was used for domestic purposes by the same communities that resides today.

### Description of Infection

The oorani that received storm water from the catchment is currently receiving sewage flowing through its feeder channel. The raw sewage disposed is generated from the households around. Part of oorani was infested by reed and dumped with solid waste. Corporation has installed a pump setup to transfer sewage against slope from the oorani once it gets filed.

During rainy season (October 2018), the oorani was filled and the adjacent residential colony were inundated. Residents of this colony suffered from water borne diseases. The oorani water spread area has drastically shrunk from 0.68 acres to 0.27 acres. The major encroachers are Kaluvadiyan Kamatchi temple and local papad makers. There are information boards placed by temple authorities around the oorani stating that 'As per High Court Madurai Bench's order W.P.No. 8142/2011, Legal action will be taken against people who are disposing sewage or solid waste in the oorani that belongs to the temple'. But there is a case in National Green Tribunal regarding ownership of the oorani between Madurai City corporation and the temple authorities.

### Recommendations


Madurai South Tahsildar should demarcate the oorani boundary and evict the encroachments immediately. As the oorani has lost its storage capacity due to filthy disposals, it should be desilted and deepened so that during heavy rainfalls, the locales will not suffer due to inundation. Followed by it Madurai Corporation should come forward for installation of underground drainage system or should think of some decentralised alternatives such as Decentralised Wastewater Treatment System (DEWATS), reed bed system, constructed wetlands, etc. to treat the sewage locally before disposing into the oorani. The oorani should be fenced to avoid encroachment and sufficient dumper bins should be provided to dispose, collect and manage solid waste effectively.







## Karuppayee oorani

 9°56'01.4"N, 78°10'39.8"E

### Location

It is inappropriate to write 'karuppayee oorani is located in Karuppayurani village' because the village itself is named after the oorani. Oldest member of the village said the story behind the name. The story is, "A shepherd woman who came with her goat for grazing to this region found a spring. When she started to dig it, portable water sprang out. The glad women went back to her village and informed about the spring. The community that suffered due to drinking water scarcity decided to convert the spring into an oorani. The community dug the oorani and established their settlement over the excavated soil. The women and her family settled near to the oorani till her last breath. The villagers out of gratitude named the oorani after her name 'Karuppayee'. From that day onwards, the oorani is called as 'Karuppayee Oorani'. Since the village has established themselves based on Karuppayee oorani, the village was also named as Karuppayurani".

### Source and conveyance

The oorani receives its source from one of the sluice of 9th branch of Periyar Main canal. The irrigation water from the canal fills a 0.20 acres small pool and the surplus of the pool is carried away through a channel and fed into Karuppayee oorani. The surplus channel from the pool has been encroached by the settlers. Therefore, the oorani has lost its source. Before 5 years, the panchayat

head brought water from a tertiary canal which is flowing beside the oorani. Nevertheless, it was a temporary solution. Surplus water flowing from pumping station of 'Integrated Cauvery drinking water project' and rainfall falling directly on the water spread area are the sources of water to the oorani.

### Structural description

The oorani is excavated for a depth of 3 meters and lined by stone masonry in all four directions. But the wall in the southern side was collapsed recently. Access Ghats are provided in two sides (east and north). It was said that there was a well near to the oorani which was used to fetch water in summers. But the well was abandoned and sealed post a suicide.

### Description of Infection

The oorani is dysfunctional due to solid waste disposal. These disposals polluted the water in the oorani and serves as a ground for aquatic weeds. Space around the oorani premises are used as cow sheds. Washes of cow dung and urine pollutes the oorani. Recently, a Vinayagar temple was constructed by a community inside the oorani specially to establish their authority over the oorani.

### Recommendations

The oorani should be declared as 'living heritage'. Tahsildar should take necessary action against encroachers of feeder channel and oorani, bring back to its original dimension. Strong social discipline should be established to avoid disposing cattle waste and solid waste. The stone wall in the south direction should be reconstructed and strengthened wherever necessary.



# Perspectives on

## Urban Ooranis

- Every oorani has either a dug well, hand pump, overhead tank, integrated Cauvery water pumping station, ground water pumping station or plastic storage tank adjacent to it. In which dug well and hand pump are dysfunctional in most of the ooranis (Ayyachi oorani, silayaneri oorani). This shows that how the source of drinking water of Madurai, has moved from the oorani, a 'community owned' 'decentralised' water harvesting 'surface water' system to either 'government driven' 'centralised' 'powered' pipe network supply or 'private' driven 'commercial' packaged 'treated ground water'. Dysfunctional wells and hand pumps shows how deeper the ground water table is.
- Ooranis in Madurai not only received their water sources from their catchment area but also from irrigation canals. Majority of the ooranis that receive water from irrigation canal are better both functionally and structurally (Naripadappu, Thasi oorani, Keelapanangadi Vannan Pallam). But the ooranis that received water from catchment area has lost its feeder and further infested by Prosopis (Sokkayee oorani, Senthii oorani, Ayyachi oorani). It shows that probability of encroaching unlined channel is higher than lined one and dependable sources encourages the community to conserve the water bodies.
- Sewage entering the tank cascade not only infects irrigation tanks but also the ooranis linked to it (Kaloorani, Nallathangal oorani). All the ooranis that are closely surrounded by settlements are infested by sewage disposals and serves ground for reed infestation (Kathakinaru oorani, Semboorani, Kaluvadiyan oorani). It reflects that centralised communities prefer disposing their

waste in waterbodies whenever government fails to implement waste management plans for them.

- Karuppayee oorani and Kaluvadiyan oorani were encroached in name of temple expansion. As the temple is owned by specific community, the community invests on oorani infrastructure and temple to establish their ownership or supremacy over the space. These indicates how temples based social structures that preserved ooranis over centuries has turned against oorani itself.
- Similar to irrigation tanks, ooranis were are also converted into public infrastructure such as health care centres, veterinary hospital, parks, schools, panchayat offices, etc. It shows that government sees waterbodies as one of the 'purampoku' (waste) land and the local communities prioritize the amenities and services over waterbodies conservation.
- Naripadappu Oorani in Valar Nagar is a private oorani belonging to Mr.Dhiraviyam pillai whose great grandfather constructed this oorani for consumption of agricultural labourers worked in his 26 acres farm land. As





Jackals roamed in the area prior to oorani establishment, he named it as Naripadappu. Oorani is filed post irrigating the agricultural land. Whenever there is a shortage in irrigation at later stages, the oorani water is used. At present, Mr.Dhiraviyam holds just 3 acres. Therefore, he feels that the oorani is no more profitable, despite fish rearing. He is planning to fill up the dugout and convert it into residential plot.

- Seventy-six years old grandmother from Alattur while sharing her memory of Ayyachi oorani said, “Whenever the oomachikulam tank starts filling, Alattur villagers desilt and clean the feeder channel of Ayyachi oorani. When the surplus water of the irrigation tank starts to feed the oorani, we women catch ‘Ayirai meen’ (spiny loach) using our saree. We use the oorani water for both drinking and cooking. Steamed rice and Kulambu (Curry) made out of the oorani water smells great and tastes better even after a day. Those days are no more”. Ayyachi oorani is one of the few ooranis which was completely ignored by villagers. Traces of bund is the only indicator to recognise it as oorani.

Above inferences leads us two major questions. The first is,

### What made the people to ignore their ooranis?

- Population growth, non-creation of new water bodies, drudgery in collection, government investments on perennial and centralised water supplies, technology towards ground water extraction, shift in livelihoods, innovations on water treatment systems made other

water supplies dependable ultimately pulled communities away from conserving their own ooranis.

- “Even caste plays critical role in negligence of ooranis” says an elder grandfather from Karuppayurani. He adds, ‘There were separate ponds and ooranis for each community such as Vannan pallam (washermen pond) and Kosavankundu (Potter’s pond). Post-independence, water bodies were declared common for all. Community tussled both in active and passive way to establish right over the oorani. This tussle got stretched to the extent of making oorani ‘dysfunctional’. In context where a single community had upper hand over the oorani, used the space as burial ground or cremation yard.

The second question is, **Are these traditional ooranis immaterial in this urbanised, centralised, ground water dependent, commercialised water supply system?**

UN-Water proposes the following definition of water security:

“The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.”

Are our urban communities water secure? If so how long will this security last?

The evolutionary shift in drinking water source from ‘oorani’ to ‘packaged drinking water’ indicates how good we are in extraction and pollution and how worse we are in water harvesting. How many more mega projects such as Integrated Cauvery drinking water project, Vaigai drinking water project, Periyar drinking water project we are going to plan for and invest in?

Apart from roof water harvesting structures at home, regardless of its perfect installation, what are the other water harvesting structures created by the government or the communities for their present and future?

Only silence persists.





biodiversity. A biodiversity in which Homo sapiens are merely a strand and not the web'. The memories of 'Ayirai meen Kulambu' not only talks about our cuisine but also about the biodiversity that we lost over few decades.



### What next?

'Policy initiatives to declare urban ooranis as 'wetlands', demarcating, evicting encroachments and fencing ooranis as per survey records, formation of localised 'Oorani wetland conservation council', installing decentralised waste management technologies for sewage fed ooranis, taking legal action against polluters, converting dysfunctional ooranis as community infrastructure, swimming pools, parks, and groves.....



Pause.

Let us sincerely begin 'the conversation' about urban oorani with multiple stakeholder at different levels. A people (local) owned, multi-dimensional and democratic conversation.



As the issues faced by ooranis are diversified, the conversations should be designed to absorb the grass root realities. Academia collaborating with grassroots institutions, should come forward to conduct research on techno-economic viabilities of redesigning oorani for redefined purposes. The economic evaluation should incorporate environmental economics in it. Ultimately, it is important to understand whether the dysfunctional ooranis are just another 'porampoku (wasteland)' or worthy 'public asset' to conserve?

Biodiversity thriving in natural wetlands developed at sewage filled urban ooranis, indicates that ooranis are crucibles that can make something better out of the worse. It is our responsibility to put sincere efforts, to make out the best out of this fading 'blue green crucible'.

## Let us converse about the crucible

We have seen the human side of the urban ooranis. It doesn't stop there.

'Sparrows quenching their thirst, kingfishers diving into, frogs and snakes wetting at shallows, crane meditating in stillness, wobbling grebes, floating touch-me-nots, charming water primerose, fingerlings and tadpoles, dogs and cattle taking a bath in hot mid-day' are some of the visuals of Urban ooranis.

Theses visuals hit harder stating 'ooranis are not just water pool. It's an ecosystem. An ecosystem that supports

# Vandiyur Updates

DHAN Foundation in collaboration with HCL Foundation has established a stall in 'Chithirai Expo' organized by The Department of information and public relation. It is one of the initiative of Project REVIVAL, an initiative to restore the irrigation tanks in Vandiyur Cascade. This 'play and learn' has multiple activities that creates 'water literacy' among the society.

It had diversified activities focusing on themes such as ecosystem classification, traditional waterbodies and its conservation, ground water depletion, water loses in public conveyance system, daily household consumption, water pollution, water scarcity and biodiversity. It also had a model of Vandiyur Tank in which people suggested the components to be established in their 'Dream Vandiyur'.

Visitors, especially kids, youth and women actively participated and reflected their comments. Some of the teachers who visited the stall, encouraged the team to conduct such stalls in school to create water literacy among the future minds. Here the glimpses of the stall



# Baseline Assessment Water and Scenario Analysis

A spatial temporal assessment of the Madurai urban water quality to provide an understanding of the relative condition of water quality in different sources of water supplies such as Lorry water, Corporation water, Groundwater, Surface water which are all utilised for drinking purpose. In order to cover all four zones, we collected the drinking water sample in the each zone under corporation boundary.

To understand the trend of the water quality, we sampled the same location what we done on June 2018. The Locations are

1. Sellur - Zone-I;
2. Pudhur - Zone-II;
3. Thepakulam - Zone-III;
4. Arapalayam - Zone-IV

## Packaged drinking water- CAN water Supply



## Water supply through Pipe Network- Corporation Supply







# Zone 1 - Corporation Water

<b>TOTAL DISSOLVED SOLIDS</b> 301 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.6 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 140 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 140 mg/l 	<b>CALCIUM (Ca)</b> 32 mg/l 	<b>MAGNESIUM (Mg)</b> 14 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0.016 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 3 mg/l 	<b>CHLORIDE (Cl)</b> 40 mg/l 
<b>FLUORIDE (F)</b> 0.4 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 15 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0.07 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.</p>			



# Zone 1 - Ground Water

<b>TOTAL DISSOLVED SOLIDS</b> 1302 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.9 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 420 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 460 mg/l 	<b>CALCIUM (Ca)</b> 80 mg/l 	<b>MAGNESIUM (Mg)</b> 62 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 12 mg/l 	<b>CHLORIDE (Cl)</b> 360 mg/l 
<b>FLUORIDE (F)</b> 1.4 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 75 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0.011mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>It is observed that water is hard because of the presence of Calcium and Magnesium. Total dissolved solids(TDS) exceeds acceptable limit. It does not have direct health effects but solids which cause higher 'TDS' may be harmful to human health. Higher level of fluoride in drinking water may cause bone diseases and dental Fluorosis. This hard water is <b>not</b> recommended for drinking. If there is no other source of drinking water, then it shall be consumed.</p>			



Within acceptable limits



Within Permissible limits



Exceeds permissible limits

\*Permissible limit are acceptable in the absence of alternate sources.

Bureau of Indian Standards recommends that acceptable limits to be implemented.



## Zone 1 - Packaged Can Water

<b>TOTAL DISSOLVED SOLIDS</b> 56 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.6 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 24 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 24 mg/l 	<b>CALCIUM (Ca)</b> 5 mg/l 	<b>MAGNESIUM (Mg)</b> 3 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 1.5 mg/l 	<b>CHLORIDE (Cl)</b> 12 mg/l 
<b>FLUORIDE (F)</b> 0.2 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 1 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.



## Zone 2 - Corporation Water

<b>TOTAL DISSOLVED SOLIDS</b> 252 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.9 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 128 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 120 mg/l 	<b>CALCIUM (Ca)</b> 24 mg/l 	<b>MAGNESIUM (Mg)</b> 14 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 4 mg/l 	<b>CHLORIDE (Cl)</b> 32 mg/l 
<b>FLUORIDE (F)</b> 0.4 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 13 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.



Within acceptable limits



Within Permissible limits



Exceeds permissible limits





## Zone 2 - Ground Water

<b>TOTAL DISSOLVED SOLIDS</b> 290 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 8.2 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 140 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 24 mg/l 	<b>CALCIUM (Ca)</b> 19 mg/l 	<b>MAGNESIUM (Mg)</b> 62 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 4 mg/l 	<b>CHLORIDE (Cl)</b> 40 mg/l 
<b>FLUORIDE (F)</b> 1.4 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 16 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

It is observed that concentration of magnesium and Fluoride exceeds acceptable limits. Higher level of fluoride in drinking water may cause bone diseases and dental Fluorosis. This water is **not** recommended for drinking. If there is no other source then it shall be consumed for drinking.



## Zone 2 - Packaged Can Water

<b>TOTAL DISSOLVED SOLIDS</b> 56 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 6.9 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 16 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 20 mg/l 	<b>CALCIUM (Ca)</b> 3 mg/l 	<b>MAGNESIUM (Mg)</b> 3 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 0 mg/l 	<b>CHLORIDE (Cl)</b> 16 mg/l 
<b>FLUORIDE (F)</b> 0.2 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 4 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.



Within acceptable limits



Within Permissible limits



Exceeds permissible limits



## Zone 3 - Corporation Water

<b>TOTAL DISSOLVED SOLIDS</b> 182 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.6 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 96 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 80 mg/l 	<b>CALCIUM (Ca)</b> 16 mg/l 	<b>MAGNESIUM (Mg)</b> 10 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 3 mg/l 	<b>CHLORIDE (Cl)</b> 20 mg/l 
<b>FLUORIDE (F)</b> 0.4 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 11 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.</p>			



## Zone 3 - Ground Water

<b>TOTAL DISSOLVED SOLIDS</b> 1232 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.5 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 560 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 240 mg/l 	<b>CALCIUM (Ca)</b> 48 mg/l 	<b>MAGNESIUM (Mg)</b> 29 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 8 mg/l 	<b>CHLORIDE (Cl)</b> 200 mg/l 
<b>FLUORIDE (F)</b> 1.2 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 67 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0.07 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>It is observed that Total dissolved solids(TDS), Total Alkalinity, Total Hardness, Fluoride exceeds, acceptable limit. It does not have direct health effects but solids which cause higher 'TDS' may be harmful to human health. This hard water is <b>not</b> recommended for drinking. If there is no other source of drinking water, then it shall be consumed.</p>			



Within acceptable limits



Within Permissible limits



Exceeds permissible limits





## Zone 3 - Packaged Can Water

<b>TOTAL DISSOLVED SOLIDS</b> 19 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 6.7 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 6 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 6 mg/l 	<b>CALCIUM (Ca)</b> 2 mg/l 	<b>MAGNESIUM (Mg)</b> 1 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 0 mg/l 	<b>CHLORIDE (Cl)</b> 4 mg/l 
<b>FLUORIDE (F)</b> 0.2 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 1 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.



## Zone 4 - Corporation Water

<b>TOTAL DISSOLVED SOLIDS</b> 196 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.7 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 96 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 80 mg/l 	<b>CALCIUM (Ca)</b> 16 mg/l 	<b>MAGNESIUM (Mg)</b> 10 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 3 mg/l 	<b>CHLORIDE (Cl)</b> 32 mg/l 
<b>FLUORIDE (F)</b> 0.8 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 9 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0.03 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>

All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.



WITHIN ACCEPTABLE LIMITS



WITHIN PERMISSIBLE LIMITS



EXCEEDS PERMISSIBLE LIMITS



## Zone 4 - Ground Water

<b>TOTAL DISSOLVED SOLIDS</b> 647 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 7.7 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 312 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 260 mg/l 	<b>CALCIUM (Ca)</b> 56 mg/l 	<b>MAGNESIUM (Mg)</b> 29 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 5 mg/l 	<b>CHLORIDE (Cl)</b> 88 mg/l 
<b>FLUORIDE (F)</b> 0.8 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 26 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0.08 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>It is observed that water is hard because of the presence of Calcium and Magnesium. Total dissolved solids(TDS) exceeds permissible limit. It does not have direct health effects but solids which cause higher 'TDS' may be harmful to human health. This water is <b>not</b> recommended for drinking.</p>			



## Zone 4 - Packaged Can Water

<b>TOTAL DISSOLVED SOLIDS</b> 63 mg/l 	<b>TURBIDITY</b> 0 NTU 	<b>pH</b> 6.8 	<b>TOTAL ALKALINITY as CaCO<sub>3</sub></b> 20 mg/l 
<b>TOTAL HARDNESS as CaCO<sub>3</sub></b> 12 mg/l 	<b>CALCIUM (Ca)</b> 1.6 mg/l 	<b>MAGNESIUM (Mg)</b> 2 mg/l 	<b>IRON (Fe)</b> 0 mg/l 
<b>FREE AMMONIA (NH<sub>3</sub>)</b> 0 mg/l 	<b>NITRITE (NO<sub>2</sub>)</b> 0 mg/l 	<b>NITRATE (NO<sub>3</sub>)</b> 1 mg/l 	<b>CHLORIDE (Cl)</b> 12 mg/l 
<b>FLUORIDE (F)</b> 0.2 mg/l 	<b>SULPHATE (SO<sub>4</sub>)</b> 6 mg/l 	<b>PHOSPHATE (PO<sub>4</sub>)</b> 0 mg/l 	<b>WATER IS CRYSTAL CLEAR &amp; FREE OF ODOUR</b>
<p>All the drinking water parameters are within the acceptable limits. Therefore the water is recommended as safe for drinking.</p>			



Within acceptable limits



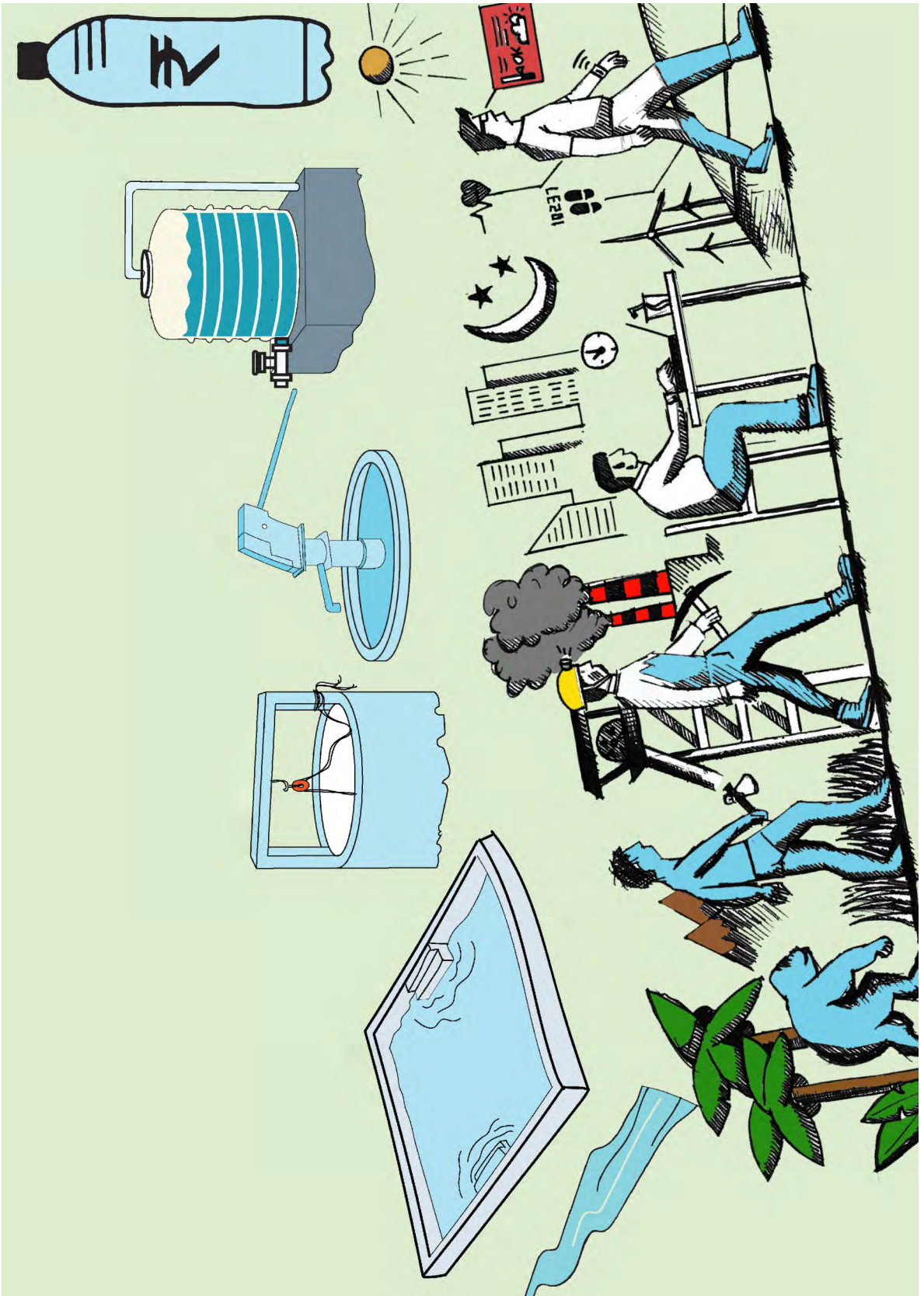
Within Permissible limits



Exceeds permissible limits



# ECOTOON



# Meteorological Updates

## Rainfall Data

**Station Name:** IMD Station, Madurai

**Device:** Automated rain gauge.

**Average Annual rainfall for Madurai:** 840mm

### April 2019 - Rainy days

Date	Intensity(mm/d)
19/04/2019	04
20/04/2019	05
Actual Rainfall	09 mm
Normal Rainfall	74 mm
<b>% Departure</b>	$\frac{09 - 74}{74} \times 100 = -88\%$



## Temperature Data

	Temperature	Humidity
High	41 °C (16 Apr, 14:30)	92% (16 Apr, 02:30)
Low	25 °C (1 Apr, 05:30)	25% (1 Apr, 14:30)
Average	33 °C	61%



\* Reported 1 Apr 02:30 — 30 Apr 23:30, Madurai. Source: CustomWeather, © 2019

We sincerely acknowledge the Laboratory

**Water Quality Testing Laboratory**  
*Water Watch Centre*  
*The DHAN Academy*  
*T. Malaipatti, Thenkarai (BO)*  
*Mullipallam (SO), Melakkal via*  
*Madurai 625 207.*

*For Suggestion/Comments please write us on*



**Centre for Urban water Resources (CURE)**  
**Water Knowledge Centre**  
**DHAN Vayalagam (Tank) Foundation**  
1A, Vaidyanathapuram East, Kennet Cross Road  
Madurai 625 016. Tamil Nadu, INDIA  
Tel: +91 452 2302500 Fax: 2602247  
Email: dhancure@ghan.org, Website: www.dhan.org