Rediscovering the Hydrology and Floods in Chennai and CMA

S Janakarajan Ph.D
Former Professor, Madras Institute of Development Studies (MIDS)
President,
South Asia Consortium for Interdisciplinary Water Resources Studies (SaciWATERs), Hyderabad
srinijanak@gmail.com

KNOW MORE
NO MORE NEGLECT
IT’S NOW OR NEVER
FLOODS AND DROUGHTS – COMMON FEATURES IN URBAN INDIA
KEY ISSUES

• Unusual heavy rainfall years leading “floods” is becoming common in India / Chennai - 1977, 1985, 2005, 2015, 2023

• The recent floods in Chennai are associated with climate change: Are we hiding behind climate change for all our blunders committed so far?

• To what extent conventional wisdom followed by the State have yielded to mitigate floods and droughts? What lessons have been learnt from the past extreme events?

• Although, each one of these floods are unique in their own way, the impact is devastating and increases year after year. The current flood is considered the worst in the last 47 years. Will we see more devastating floods in future?

• What should be done with a view to making the city of Chennai flood resilient?

• How to convert disaster into an opportunity?
Understanding the urban India / Chennai

Key Challenges

- Mindless urban expansion and increasing scarcity for land
- Myopic land use planning – Ill conceived urban floods
- High demographic pressure, High population density and Decreasing per-capita drainage space
- Rising slum population
- Rapid industrialization
- Vanishing permeable surface and Increasing surface runoff and Declining carrying capacity of the city and CMA
- Vanishing flood plains, flood buffers, wetlands, water bodies and Natural drains
- Increasing intersectoral demand for water
- Poor waste management: Solid waste, Industrial waste, Liquid waste, Bio-medical waste, E-waste and Building-waste
Population density in Chennai and the CMA 2020

Source: CMWSSB
Projected population density for the year 2050 in Chennai and CMA

Source: CMWSSB
Please remember

A bad / myopic urban planning and a mere development centric approach can be disastrous to ecology and environment, which eventually put enormous pressure on the entire economy, present as well as future generations.

A mere promulgation of laws will guarantee nothing if policy implementation and monitoring mechanisms are weak.

Can we justify all that CMDA is doing? Why not??
Land Use Pattern Change & Encroachment of Water bodies

Study from care earth trust – 150 wetlands in Chennai area only 15% left

<table>
<thead>
<tr>
<th>Land use (Sq.km)</th>
<th>1980</th>
<th>1991</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built –up</td>
<td>47.62</td>
<td>152.33</td>
<td>402.10</td>
</tr>
<tr>
<td>Wetlands</td>
<td>186.30</td>
<td>159.41</td>
<td>71.05</td>
</tr>
</tbody>
</table>

Source: Care earth trust
Land cover information in 2012 and in 2024 estimated

Source: Vijayalakshmi Rajendran, Toshiyuki Kaneda
Negative impacts of such drastic changes in land use – losing vegetative cover

- Decreasing / disappearing per capita drainage surface
- Losing permeable surface
- Increasing surface runoff / urban floods
- Creation of urban heat islands
Understanding flood

• Flood is a hydrological - FLOW concept
• A Pond or a lake when it stores water we call them water bodies (Pond or lake)
• But if the same lake or pond receives water after it is encroached for purposes of constructing industries, hotels or houses, we call it flood (many examples)
• Hydrologically, floods may occur due to over flowing water from water bodies such as rivers, lakes, ocean etc.
What should do we aim at?
Normative Concern

• Integrated urban water management as a strategy for long-term solution for climate induced urban floods and droughts

• What to integrate?
  • Integrate droughts and floods - Integrate the conditions of too much water with too little water – floods and droughts
  • Water security – flood mitigation – climate resilience
  • Rediscover and rejuvenate thousands of water bodies around Chennai

• Go with nature – protect natural capital - enlarge the lung space
What is the best way to go ahead for Chennai with objective Reasoning?
First of all, Understand the fundamentals of urban world – the Chennai and its PU areas

- Location – coastal mega city – population of over 10 million
- Rainfall – changing conditions and characteristics
- Understand Drainage system and drainage density
- Use and abuse of drains, including SWDs
- Understand the water sheds and water endowment
- Understand the Hydro-geography / Waterscape
- Elevation
- Understand and Respect the given slope and LECZ
- SLR
- Ecological hot spots – Get the inventory
WHAT WILL HAPPEN TO CHENNAI?

Most parts of Chennai is under Low Elevation Coastal Zone, which is 10 m and below
## ELEVATION LEVELS OF DIFFERENT PARTS OF THE CHENNAI CITY

<table>
<thead>
<tr>
<th>Name of the Zone</th>
<th>Average elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly vulnerable zones</strong></td>
<td></td>
</tr>
<tr>
<td>Thiruvottiyur</td>
<td>2.79</td>
</tr>
<tr>
<td>Manali</td>
<td>2.67</td>
</tr>
<tr>
<td>Thandiarpettai</td>
<td>3.85</td>
</tr>
<tr>
<td>Royapuram</td>
<td>3.93</td>
</tr>
<tr>
<td>Sholinganallur</td>
<td>2.90</td>
</tr>
<tr>
<td>Perungudi</td>
<td>3.86</td>
</tr>
<tr>
<td><strong>Moderately vulnerable zones</strong></td>
<td></td>
</tr>
<tr>
<td>Thiru vika Nagar</td>
<td>5.93</td>
</tr>
<tr>
<td>Anna nagar</td>
<td>7.48</td>
</tr>
<tr>
<td>Teynampet</td>
<td>5.12</td>
</tr>
<tr>
<td>Kodambakkam</td>
<td>8.87</td>
</tr>
<tr>
<td>Adyar</td>
<td>5.39</td>
</tr>
<tr>
<td><strong>Safe Zones</strong></td>
<td></td>
</tr>
<tr>
<td>Valasaravakkam</td>
<td>12.59</td>
</tr>
<tr>
<td>Alandur</td>
<td>10.91</td>
</tr>
</tbody>
</table>

North Chennai is going to be very badly affected.

ECR and OMR will be more vulnerable.

Source: GCC

Professor S Janakarajan
Ennore area in 2030, with moderate cuts in emissions and moderate luck. Image credit: www.climatecentral.org
North Chennai in 2030, with moderate cuts in emissions and moderate luck. Image credit: www.climatecentral.org
IT Corridor in 2030, with moderate cuts in emissions and moderate luck. Image credit: www.climatecentral.org
IT Corridor in 2030, with moderate cuts in emissions and moderate luck. Image credit: www.climatecentral.org
Acknowledge and protect the UPSTREAM – DOWNSTREAM WATERSHEDS
Chennai Metropolitan Area – Urban rivers

There are three main rivers and one canal

**Cooum River** - Runs through the centre of the CMA

**Adyar River** - Flows in the southern part of the CMA region

**Kosasthalaiyar** - Flows in the northern part of the region

**Buckingham Canal** - An 8-km long stretch of which runs parallel to the coastline links the rivers Cooum & Adyar
Total area directly draining into the City of Chennai and CMA – 15,383 sq km
RIVER MOUTHS and sea-level rise

• Kosasthalaiyar confluences in the Bay of Bengal at Ennore Creek where the width of the river mouth is 120 m (Maximum)
• Cooum has the mouth width of 150 m near the madras University
• Adayar river has a mouth width of 300 m at the foreshore estate
• Buckingham canal has a mouth width of 100 m at Muttukkadu 100 but the canal is supposed to go on up to Chidambaram

Source: N.Ramasamy, "Macro Drainage System in Chennai Metropolitan Area", paper presented in a Seminar on Second Master Plan for Chennai Metropolitan Area, 2026 –Avenues and Opportunities Proceedings and Recommendations, CMDA, Govt of Tamil Nadu, 2008
WATER BODIES IN TIRUVALLUR AND KANCHEEPURAM DISTRICTS
The basic idea

- Conserve runoff water
- Conserve water / rainfall at source

Such an approach will help

- Flood and drought mitigation
- Climate resilience
Therefore, Most Important:

- Need to adopt an Integrated urban land and water management (IULWM) approach which involves coordinated management of land and water.
- This approach will help a great deal to conserve water as well as contribute to a great extent urban flood control.
- The motivation is to ensure and maximize economic and social welfare without compromising on the sustainability of ecosystems and the environment.
Summary of way forward

What the Govt should do?

• Master Plans need to be revisited – declare ecological hot spots
• Link urban land and water – to draft a city Master Plan?
• Master plans should be combined with drainage master plans – no ad hoc construction of SWDs
• No layout approval shall be allowed without the drainage master plan
• Hold water at source – conservation runoff – Benefits
  • Flood mitigation; Climate resilience; Will help to build climate smart cities
• Tank restoration, desilting and deepening and doubling the capacity
• Restoration, protections and continuous monitoring of rivers and flood plains
• NBS within the city and CMA - Water detention ponds / constructed wetlands - temple tanks - green parks, urban forests, green roofs, mangroves
• Utmost care for protection of natural wetlands – both inland and coastal
Summary of way forward

Legal
- Enforcing flood proofing and drainage proofing land use policy for all new land developers
- Strict enforcement of laws against encroachments on water bodies, rivers and streams
- Enforcing norms for STPs – for maintaining waste-water treatment standards
- Limiting the impervious surface in all residential, commercial and industrial complexes - create room for flood buffers
- Rainwater harvesting mandatory in all residential, commercial and industrial complexes

Individuals, Industries and institutions
- Be water positive – Water that falls on your roof and on your land is your water – save it, own it and use it;
- Don’t abuse water and learn to live with excess water
Go with Nature

Design with Nature

Respect Rivers and Water Bodies
Velachery 1955 & 1971
USA Army Service Toposheet & ISO Toposheet

Velachery 1971 & 2010
ISO Toposheet & 2010 Google imagery

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Disappeared Tanks

Anagaputhur & Pallavaram 1955 & 1971

Anagaputhur & Pallavaram 1971 & 2010
Ambattur Tank in 1955
Un-encroached

Water spread area of the tank is 4.58 sq km
Ambattur Tank in 2010 Encroached and bifurcated

Water spread area of the tank is 1.91 sq km
Kodongaiyur Tank 1955

Kodongaiyur Tank 1971

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Villivakkam tank 1971
Villivakkam tank
At present
THANK YOU

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