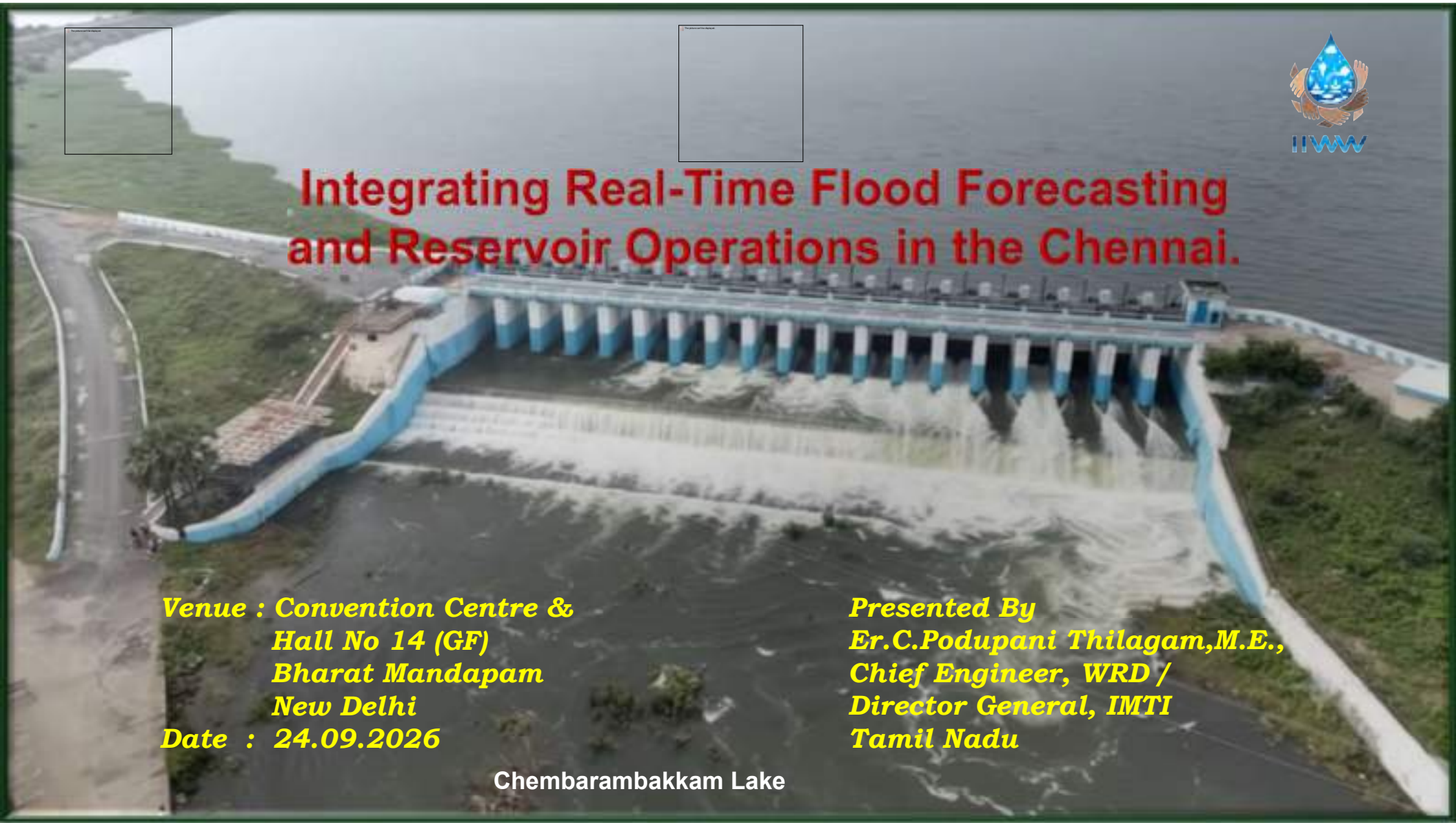
Integrating Real-Time Flood Forecasting and Reservoir Operations in the Chennai.



Venue : Convention Centre &
Hall No 14 (GF)
Bharat Mandapam
New Delhi
Date : 24.09.2026

Presented By
Er.C.Podupani Thilagam,M.E.,
Chief Engineer, WRD /
Director General, IMTI
Tamil Nadu

Chembarambakkam Lake

The Chennai Basin

A Metropolitan region where water supply and flood moderation share by the same reservoirs

The 2015 flood exposed the limits of conventional practice of Reservoir operation



Delayed forecasting

Climate Change
Intensified short duration, high intensity rainfall



Manual gate operation

Intense Northeast Monsoon rainfall generates rapid inflows



Weak decision support

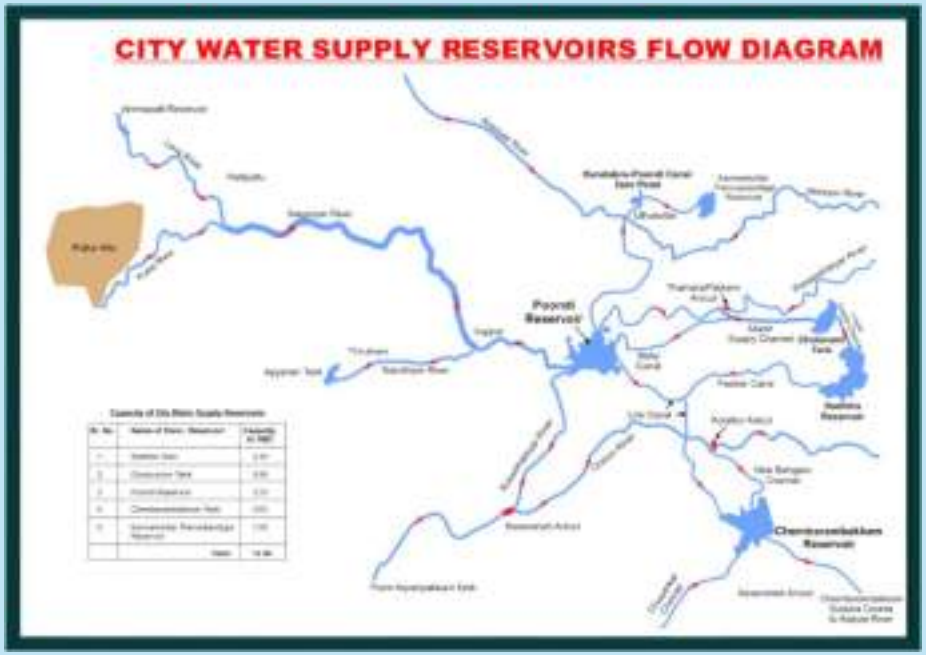
Rapid Urbanization, Encroachment and Limited Drainage capacity


erry service' opens at Ripon Build





The Gap in Conventional Practice





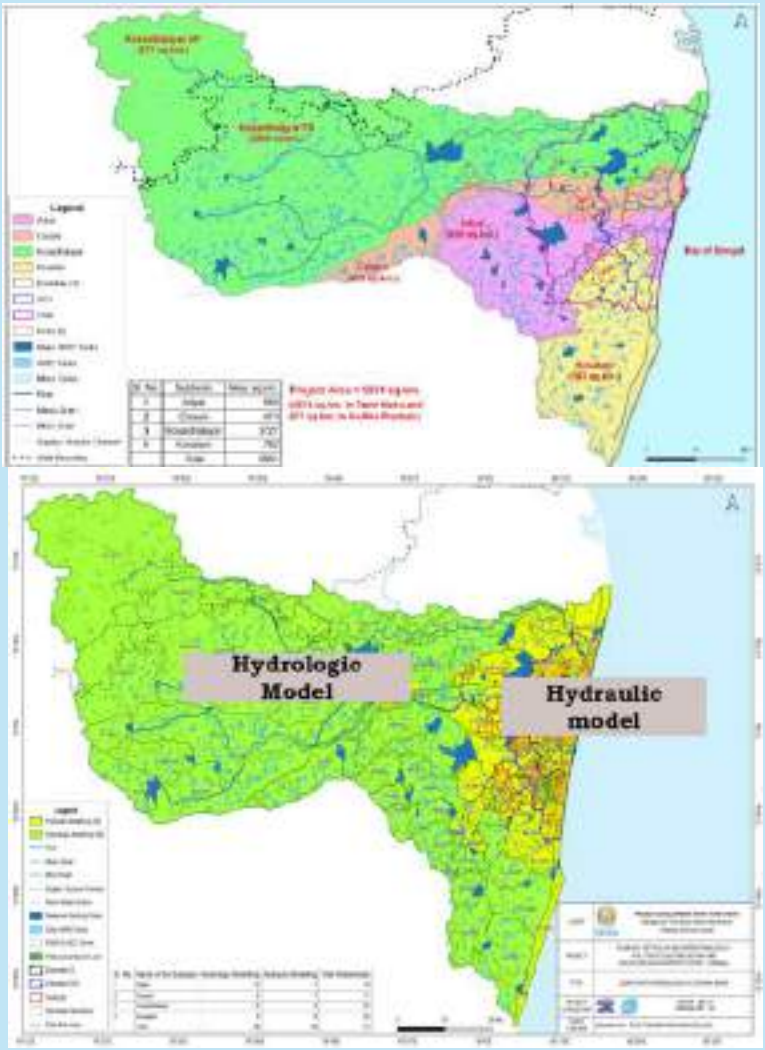




- Design based on historical records
- Uncertain inflow and flood magnitude
- Reservoirs operation in isolation

Design assumptions and operating methods that no longer match present hydrological behavior

Early Warning System's Framework





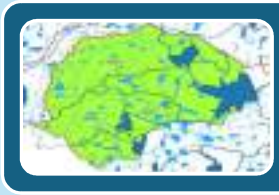
Chennai Real Time Flood Forecasting System (CRTFFS) and Realtime Data Acquisition System(RTDAS)– an integrated **Decision Support System (DSS)** for the Administrators, Disaster Managers, WRD, Local Bodies and Public.



Reservoir Operation System – SCADA based City Reservoir Flood gate operation



Components – Real-Time data from IoTs, Rainfall Forecasts, Rainfall-Runoff Model for tank inflow forecasts, River Hydraulics – 1D mode, Inundation model- 2D & Storm Water Network, Web DSS.



Region of Interest: Chennai Basin Covering **~ 5000 sq. km**.

- 4 River Basins – Kosasthalayar, Cooum, Adayar, Kovalam
- Covering 5 Districts – Chennai, Tiruvallur, Kancheepuram, Chengalpattu, Ranipet

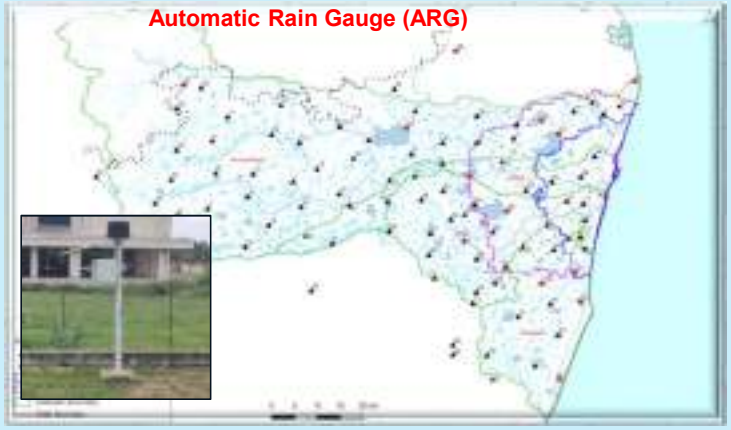


Objectives

1. Tank inflow forecasting – 4 major reservoirs, 2. Water level at critical location in the river, 3. Street inundation forecasting across Greater Chennai Corporation, 4. Spatial Decision Support System (SDSS) & Flood Alerts, 5. In-House Capacity building

Real Time Data Acquisition in Chennai Basin

Automatic Rain Gauge (ARG)



GSM/ GPRS Communication

ARG - 78 sites

AWS - 14 sites

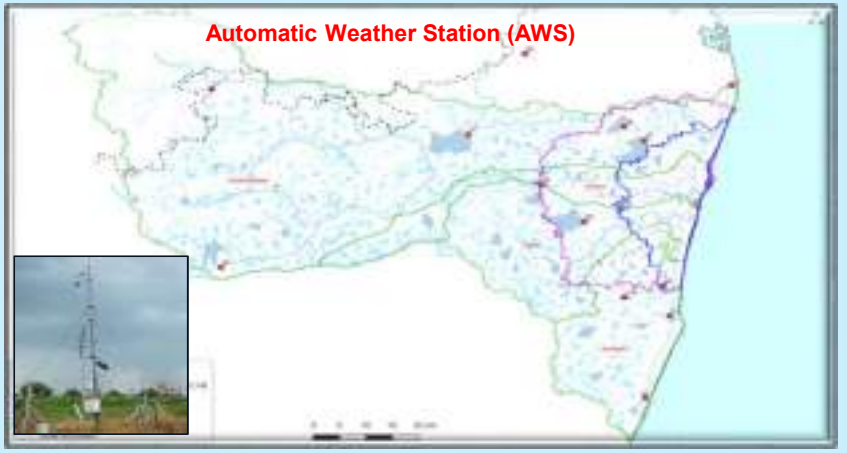
AWLR - 141 sites (149 No.)

Gate Sensors - 3 sites (42 No.)

Satellite Communication

ARG	- 21
AWS	- 06
AWLR	- 17
AWLR, AWS	- 03
AWLR, GS	- 03
Total	- 50

Automatic Weather Station (AWS)



Reservoir Gate Sensors (by WRD)

Automatic Water level Recorders (AWLR)







Redhills Lake



Chembarambakkam Lake



Nandambakkam Checkdam



Poondi Lake

Status of RTDAS - Field sensors







AWLR – Shaft Encoder in Lakes (80 Nos)



AWS (14 Nos)

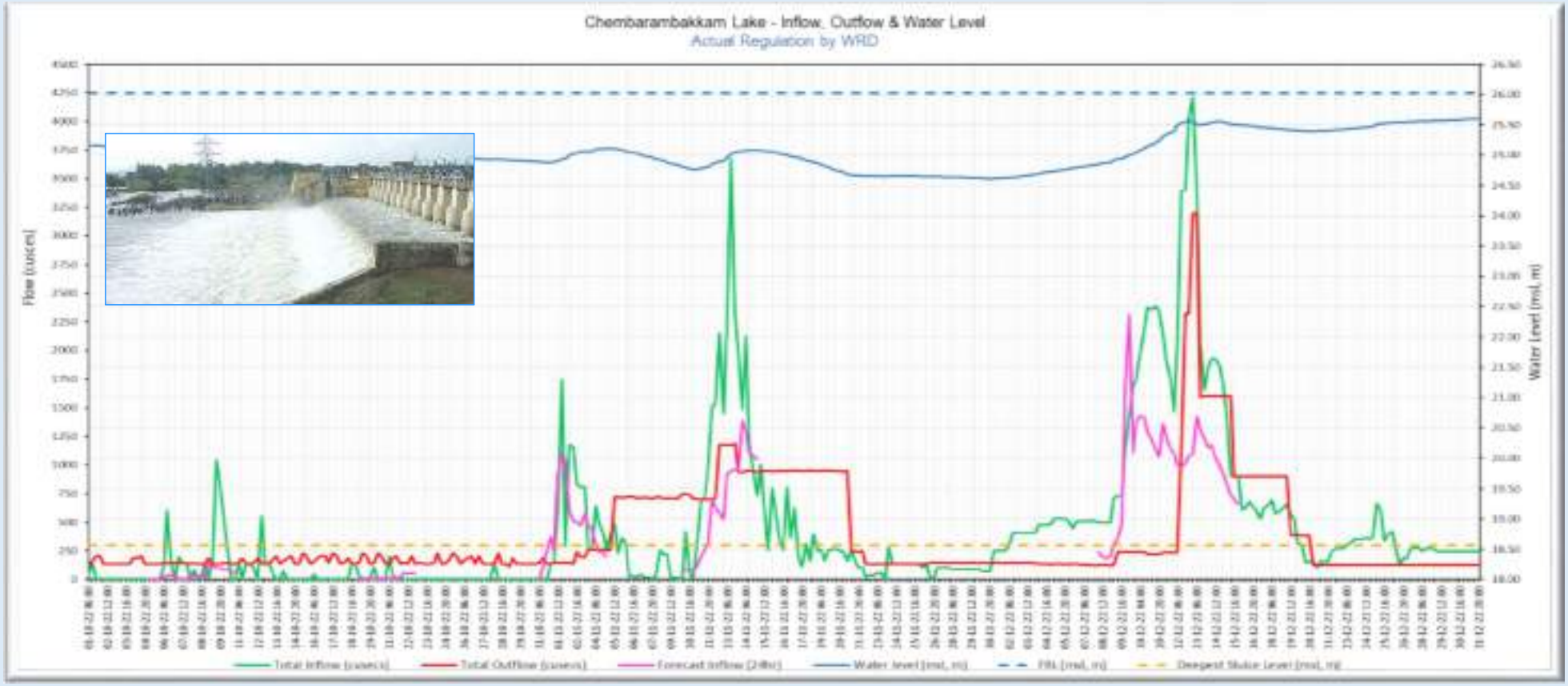


ARG (78 Nos)



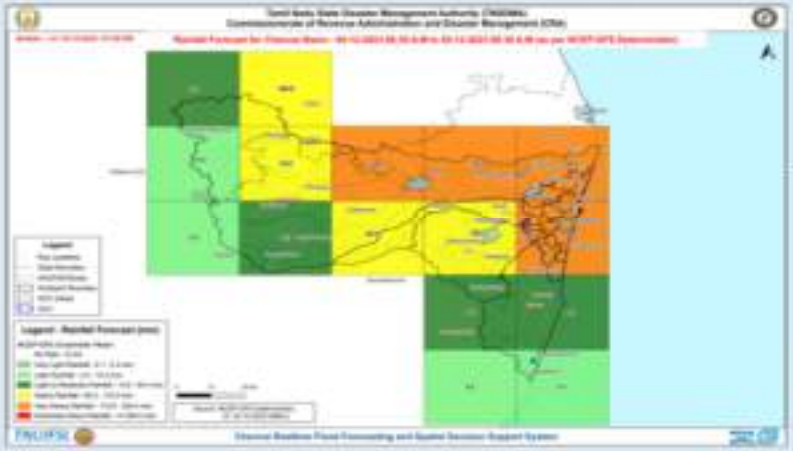
AWLR – Radar in Lakes (22Nos), Rivers (43 Nos)

Chembarambakkam Lake Operation - 2022



Rainfall forecast for 05-12-2023 by CRTFF-NCEP-GFS

Forecasted on **03-12-2023**



Forecasted on **04-12-2023**



IMD Classification for Rainfall Intensity

Legend - Daily Rainfall (mm)

- No Rain - 0 mm
- Very Light Rainfall - 0.1 -2.4 mm
- Light Rainfall - 2.5 - 15.5 mm
- Light to Moderate Rainfall - 15.6 - 64.4 mm
- Heavy Rainfall - 64.5 - 115.5 mm
- Very Heavy Rainfall - 115.6 - 204.4 mm
- Extremely Heavy Rainfall >= 204.5 mm

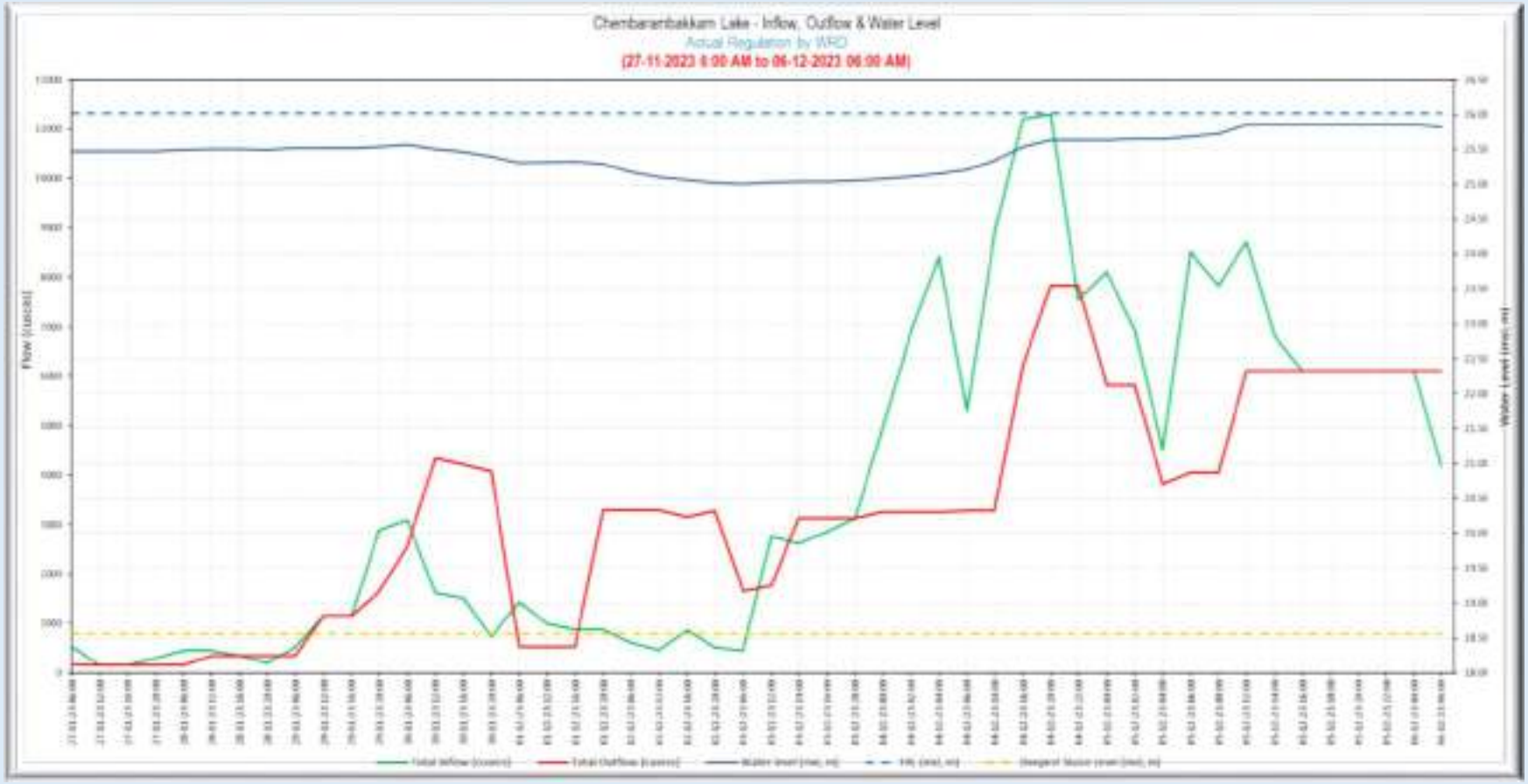
- CRTFF prediction (2 days advance) : 50 to 160 mm/ day
- CRTFF prediction (1 day advance) : 95 to 225 mm/day
- Actual Rainfall in Chennai City : 120 to 250 mm/day
- Actual Rain at Nungambakkam : 238 mm mm /day

Fairly reliable Rainfall Forecasts were issued to WRD, GCC and CRA. WRD moderated the reservoir releases using the rainfall forecasts.

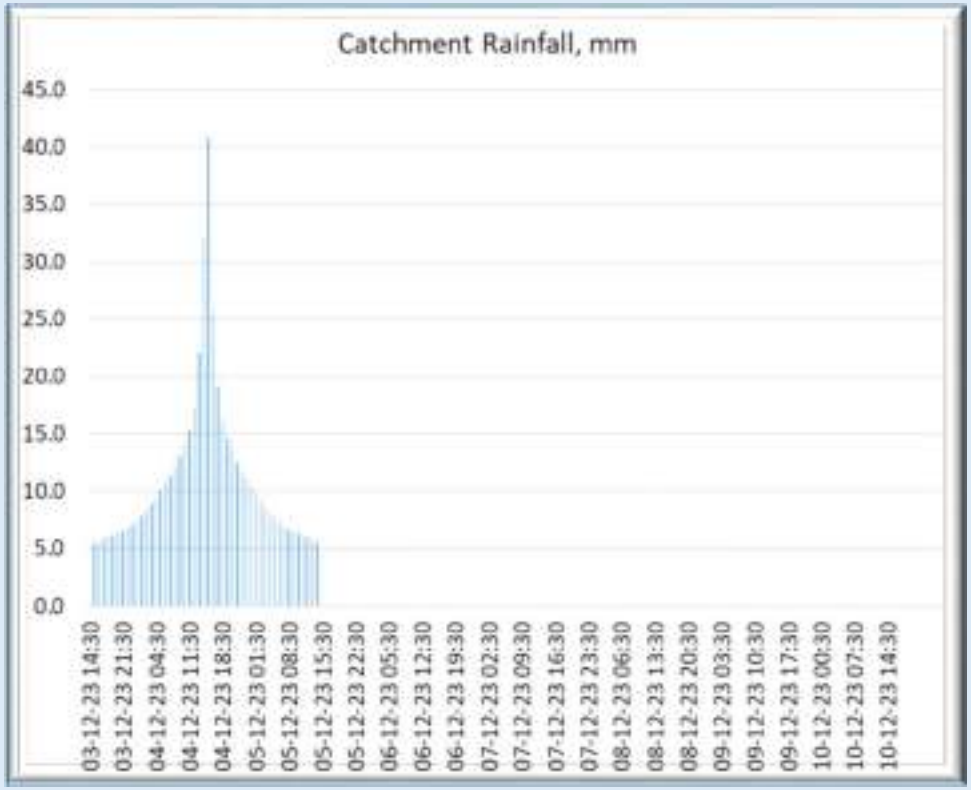
Actual Rainfall 05-12-2023

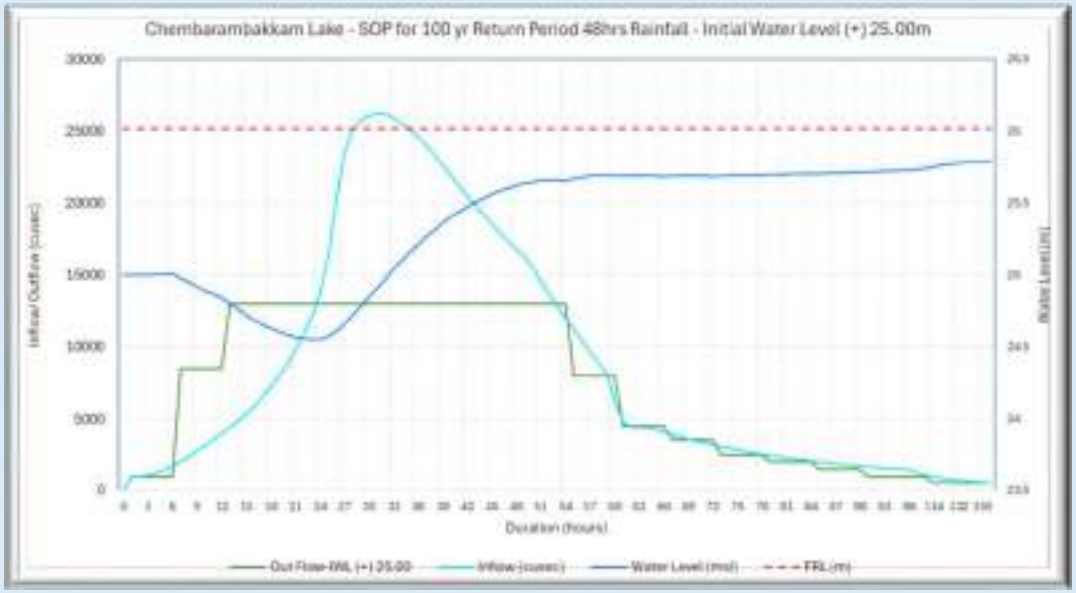


Chembarambakkam Lake Operation – Michaung Cyclone 2023

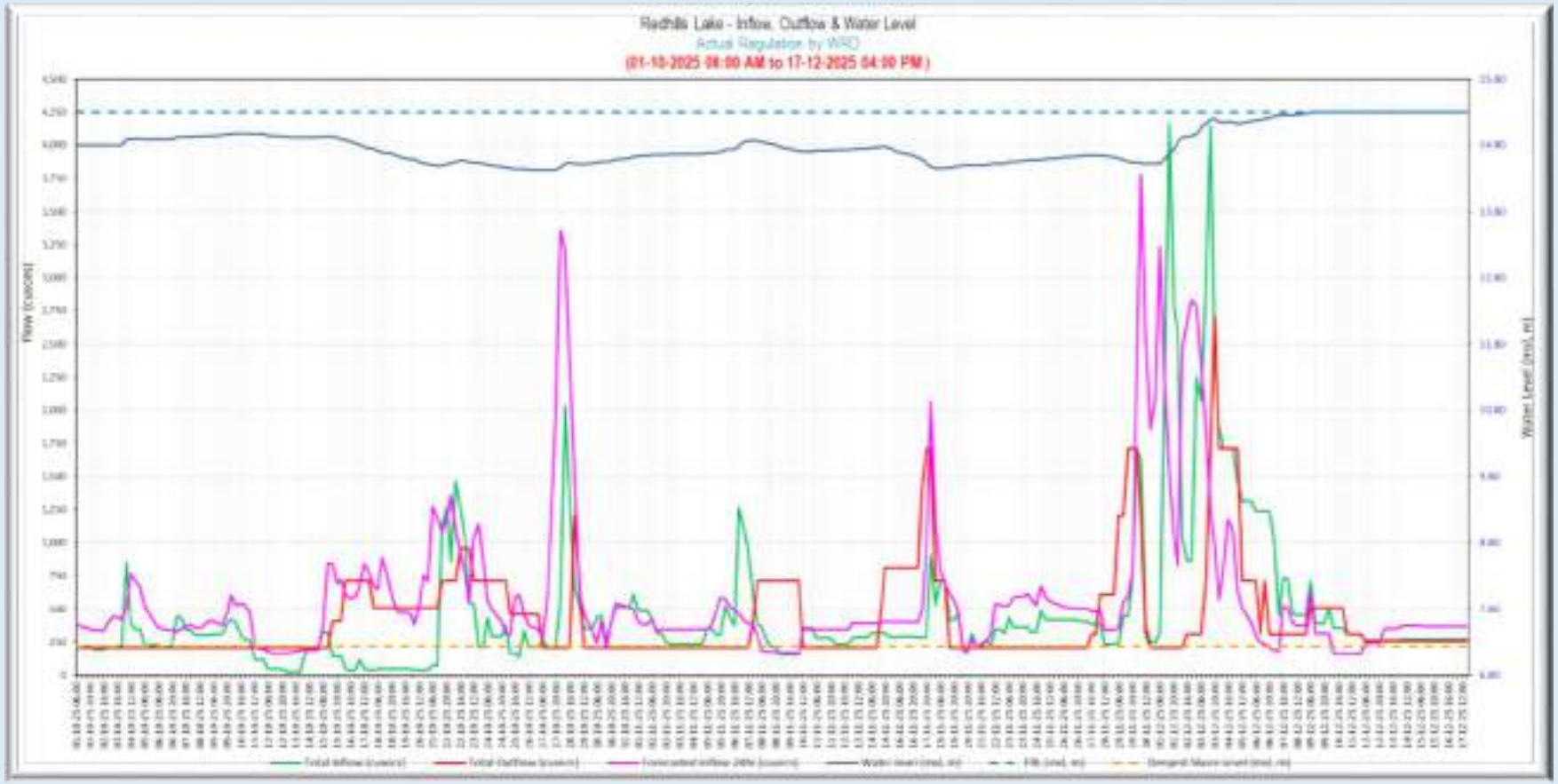


Lake Operation Guidance System (LOGS) - Chembarambakkam Lake





Redhills Lake Operation - NEM 2025



Synergy between CWC efforts and C-RTFF

- Similar conceptualization as to CWC inflow forecasts – but adopts a refined methodology with enhanced basin representation, incorporating a larger number of tanks and improved physical characterization of catchments
- Removes the need for a base station, as the entire catchment is explicitly represented within the hydrological model.
- Implements continuous, season-long validation at 4-hourly intervals, enabling capture of intra-day peak flows and robust assessment of low-flow performance
- Integrates coupled 1-D and 2-D hydrodynamic modeling, including the storm water drain network for realistic flow routing
- Utilizes both deterministic and ensemble rainfall forecasts, strengthening inflow predictions and uncertainty awareness





Forecasting and Warning

Converting hydro-meteorological data into lead time for operational decisions

RTFF

Real-Time Flood Forecasting

- Integrates water-level recorders, rainfall monitoring, telemetry and flood modelling
- Predicts reservoir inflow and downstream flood conditions
- Enables precautionary operation before critical thresholds are reached

RTDAS

Data Acquisition & SCADA

- Automated monitoring of rainfall, levels, inflow, gate opening and discharge
- SCADA provides monitoring and control for reservoir regulation
- Feeds a centralised Integrated Control Command Centre

PRE

Pre-Emptying of Reservoirs

- Seasonal forecasts guide storage regulation before intense rainfall
- Creates additional flood cushion capacity in advance
- Balances water conservation against flood preparedness

Forecast-informed operation reduces sudden emergency discharges during peak inflow — the failure mode most damaging to downstream communities.



Benefits of Integrated System

- Proactive flood mitigation
- Optimized reservoir storage and water security
- Evidence-based and transparent decision-making
- Consistent performance during extreme events

Policy and Institutional Enablers

Statutory backing, basin-level coordination and urban planning acting together

1	**Dam Safety Act, 2021**	Statutory framework for inspection, surveillance, operation and periodic safety evaluation; mandates Emergency Action Plans, risk assessment and comprehensive safety review.
2	**Coordinated reservoir operation**	Storage, discharge scheduling, gate regulation and flood cushion managed collectively across the basin using real-time inflow forecasts.
3	**Data sharing across agencies**	Exchange among dam authorities, meteorological agencies, water resources departments and disaster management institutions, with national and international best practice.
4	**Flood Mitigation Master Plan for Chennai Metro**	JICA prepared the flood mitigation master plan for Greater Chennai Metropolitan area of about 6000 sq. km.
5	**Chennai City Master Plan**	Macro drainage improvement, restoration of waterways, protection of natural drainage channels and regulation of development in flood-prone areas.

Conclusion

- RTFF provides forecasting and lead time
- RTDAS ensures real-time, reliable data
- SCADA enables controlled execution
- DSS ensures safe, optimal decisions
- Integrated RTFF–RTDAS–SCADA system strengthens flood resilience
- Safety reassessed for today's hydrology
- Supports safe, transparent, and data-driven reservoir operations
- Scalable model for other river basins in Tamil Nadu