



Wetland Conservation Network

KOVALAM-NEMMELI COASTAL WETLAND COMPLEX

Climate Change - Coastal Hazard Assessment Report

Kelambakkam-Nemmeli Region, Tamil Nadu, India

Cyclone and Tsunami Impact Analysis with Scientific References

Coromandel Coast | Chengalpattu District, Tamil Nadu | May 2026

Prepared by Wetland Conservation Network

Preface

This document is compiled in the interest of public awareness and collective environmental stewardship. The Kovalam-Nemmeli Coastal Wetland Complex is a shared ecological heritage, sustaining rich biodiversity, traditional coastal livelihoods, and natural flood defences vital to the greater Chennai region. Its preservation is a matter of public responsibility. The concerns documented here call for transparent, science-informed governance and careful consideration of all environmental, social, and economic implications before any irreversible intervention on this ecologically sensitive landscape is allowed to proceed.

Scope and Limitations

This report documents coastal hazard events relevant to the Kelambakkam-Nemmeli study zone using peer-reviewed scientific literature, government disaster management records, and verified news sources. Where direct observational data for Nemmeli is unavailable, data from Kalpakkam (~20 km south), Mahabalipuram (~15 km south), and Kovalam (~5 km south) are used as documented proxies and are explicitly identified as such throughout the report. No data is presented as site-specific unless it is. The Cyclone Nargis (2008) section refers exclusively to a numerical modelling exercise and is not a documented disaster event at this location.

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1. Geographic Context and Vulnerability Profile

The Kelambakkam-Nemmeli coastal corridor is located along the East Coast Road (ECR) and Old Mahabalipuram Road (OMR) in Chengalpattu district, Tamil Nadu, approximately 25-40 km south of Chennai. The study region lies between coordinates 12.75°N to 12.82°N and 80.19°E to 80.25°E, fronting the Bay of Bengal to the east.

The geomorphology of this coastal belt is characterised by a flat, low-lying coastal plain with elevation between 0 and 5 metres above mean sea level; dense fishing settlements (Nemmeli, Kovalam, Vadanemmeli kuppam) directly on the shoreline; the Kovalam backwaters and Buckingham Canal to the inland side, which amplify flood inundation; sand dune formations offering limited natural buffering; and the rapidly urbanising Kelambakkam IT corridor (OMR), which reduces natural drainage absorption.

Hazard Classification

Zone: Moderate-to-High Coastal Vulnerability, Bay of Bengal, Northeast Monsoon Season (Oct-Dec). The northern coastal zone of Tamil Nadu, specifically Chennai, Kancheepuram, Thiruvallur, and Cuddalore districts, has been classified as having a Very High probability of flood hazard in a multi-data geospatial analysis of 5,020 villages and wards (Thirumalaivasan et al., 2022 [P-9]). The Chennai district ranked 4th in cyclone-exposed districts and 6th in maximum flood exposure nationally (CEEW district-level vulnerability assessment, cited in Thirumalaivasan et al., 2022).

2. The Great Salt Lake: Ecological Identity and Buffer Function

The waterbody commonly referred to as the Great Salt Lake along the ECR is the Kovalam-Nemmeli-Muttukadu backwater system, a shallow brackish coastal lagoon stretching from Kovalam creek in the north to Kokilamedu in the south, with Nemmeli at its centre. Mahabalipuram is documented in geographic literature as 'a town on a strip of land between the Bay of Bengal and the Great Salt Lake.' The backwater covers approximately 8,000-8,500 acres of coastal wetland and is the defining hydrological feature of the Kelambakkam-Nemmeli coastal corridor.

- **Area:** Approximately 8,000-8,500 acres (total wetland complex); Muttukadu portion approximately 0.87 km²
- **Tidal connectivity:** Two tidal inlets: Kovalam estuary (north) and Kokilamedu mouth (south); bar mouth width 0-200 m, seasonally variable
- **Hydrology:** Buckingham Canal connects northward to Muttukadu Backwater; daily tidal exchange with Bay of Bengal; salinity range 0-35 ppt seasonally
- **Conservation status:** Designated Important Marine and Coastal Biodiversity Area (ICMBA) by the Wildlife Institute of India; one of 107 ICMBAs nationally [G-5]; 913 species across eight animal classes recorded (Ramachandran et al., 2021 [P-15])

The Great Salt Lake performs a critical coastal hazard buffer function that is directly relevant to the region's resilience against the events documented in this report:

- **Storm surge absorption:** The dune-wetland-mangrove complex attenuates wave energy and reduces surge penetration inland. Scientific literature consistently identifies intact coastal wetlands as reducing storm surge heights by 5-50 cm per kilometre of wetland width.
- **Flood storage:** During heavy rainfall events (such as the 2015 depression and Cyclone Vardah), the backwater absorbs excess freshwater runoff from the OMR catchment, buffering urban inundation.
- **Tidal buffer:** By receiving and dissipating tidal energy from two estuaries, the wetland reduces the speed and volume of marine water advancing inland during surge events.
- **Sediment trapping:** The system traps sediment carried by freshwater flows, maintaining the sand dune barrier that separates the backwater from the open sea.

Active Conservation Threat: Mamallan Reservoir (January 2026)

On 19 January 2026, Tamil Nadu Chief Minister laid the foundation stone for Chennai's sixth reservoir on 4,375+ acres of this coastal wetland in Phase I (of a total 8,500-acre system) between ECR and OMR. The conversion of this brackish coastal lagoon into a static freshwater impoundment would: (1) eliminate the tidal exchange and salinity gradient that defines the ecosystem; (2) destroy the storm surge buffering capacity of the dune-wetland corridor; (3) remove the flood storage function that protects the OMR IT corridor and 16+ coastal fishing villages; and (4) cause irreversible biodiversity loss. Sources: Citizen Matters, April 2026; REIA documents, MoEF; The Hindu, January 2026.

3. Tsunami Record: 2004 Indian Ocean Tsunami

3.1 Event Overview

On 26 December 2004, a Mw 9.1-9.3 undersea earthquake off northern Sumatra triggered the deadliest tsunami in recorded history. The event killed or left missing 227,899 people across 15 countries (PreventionWeb, NOAA). The tsunami reached the Tamil Nadu coastline approximately two hours after the earthquake, arriving during near-high tide conditions, which critically amplified its destructive effect. Across India, official estimates recorded 10,749 killed and 5,640 missing (Wikipedia: Effect of the 2004 Indian Ocean earthquake on India).

3.2 Impact on the Kovalam-Nemmeli-Kalpakkam Coastal Belt

The Kelambakkam-Nemmeli region, bounded by the coastal stretch from Kovalam to Mahabalipuram (Kancheepuram district), was directly in the tsunami's path. The following effects are documented in peer-reviewed literature and field surveys:

- Inundation penetrated 300-420 m inland at Kalpakkam (approximately 20 km south of Nemmeli), where a dedicated study measured sand sheet deposition from 25 m to 420 m from the shoreline [P-2].
- Near the mean water line, the tsunami eroded approximately 10-25 cm of sand from the beach and berm at Kalpakkam [P-2].
- A tsunami inundation mapping study covering Ennore to Kovalam using RTK dGPS documented inundation limits, with low-lying wetland areas including the Nemmeli-Kovalam corridor among the most vulnerable to marine incursion [P-3, G-3].
- The first tsunami wave arrived coinciding with high tide along the Villupuram-Kancheepuram-Chennai coastal stretch, significantly amplifying inundation extent [P-4].
- The narrow sand-dune barrier separating the Great Salt Lake backwater from the Bay of Bengal was breached in multiple locations along the Kovalam-Mahabalipuram coast; the backwater received inundating seawater, causing significant salinity shock and ecosystem disruption.
- Fishing communities in Nemmeli, Kovalam kuppam, and Vadanemmeli suffered devastating losses to boats, nets, and livelihoods; approximately 63,000 boats were damaged statewide.
- Tamil Nadu as a whole suffered destruction of approximately 123,105 houses, with 590 villages damaged.

3.3 Post-Tsunami Infrastructure Response

Following the 2004 tsunami, the Tamil Nadu Government announced a 3.2 km sea wall to be built at Kalpakkam Township near the nuclear power plant. The state also mandated construction of coastal shelter belts and mangrove plantations along the ECR corridor, directly benefiting the Nemmeli-Kelambakkam coastal zone (FAO Coastal Planning Workshop Proceedings, 2005 [G-4]).

3.4 Geomorphological Changes

Field investigations along the Kovalam-Mahabalipuram segment showed significant alteration of shoreline morphology; new waterways and channels carved by tsunami backwash; permanent changes to sand dune formations and coastal vegetation; and saline intrusion into groundwater affecting approximately 200 sq km of agricultural land across Tamil Nadu.

4. Documented Cyclone Impacts

4.1 Cyclone Nilam, 2012: Most Direct Cyclone Landfall on the Nemmeli Zone

Cyclonic Storm Nilam made landfall between Mahabalipuram and Kalpakkam on 31 October 2012, placing Nemmeli and the adjacent coastal belt directly within the landfall zone. This remains the most geographically proximate cyclone event to the study region in the documented record.

- **Classification:** Cyclonic Storm; maximum winds 80-90 kmph, gusting to 100 kmph at landfall [G-1, IMD Nilam Report]
- **Storm surge:** 1-1.5 m above astronomical tide, inundating low-lying coastal areas of Chennai, Kancheepuram, Tiruvallur, and Nellore districts [P-5]
- **Evacuations:** 4,000 people evacuated at Mahabalipuram into government shelters (WHO/ReliefWeb, 2012 [G-1]); over 5,000 total evacuated across the district (AFP)
- **Impact:** Extensive power outages; 90+ trees uprooted; huts damaged along ECR coastal belt; backwater-side villages including Nemmeli and Vadanemmeli kuppam flooded simultaneously from ocean-side storm surge and backwater overflow
- **Economic loss:** Initial estimates Rs 700-800 million; revised upward. Economic losses in Andhra Pradesh alone exceeded Rs 200 crore

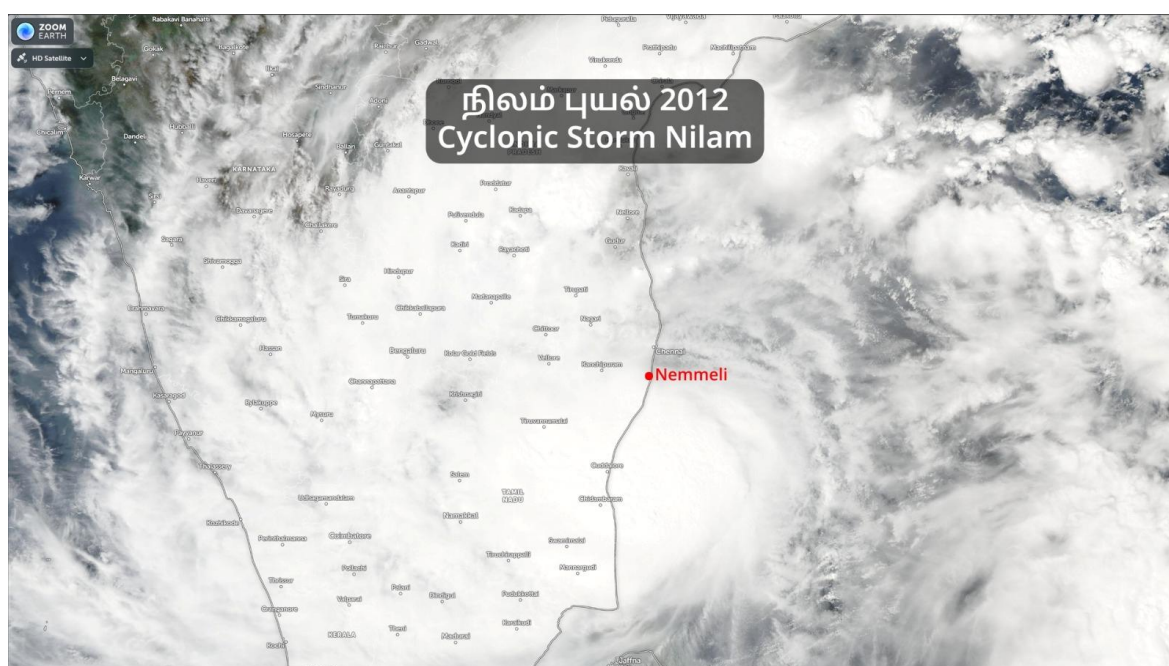


Figure 1: Cyclonic Storm Nilam (2012) | Zoom Earth HD Satellite Image

Cloud mass and cyclone structure visible over the Coromandel Coast; Nemmeli location marked in red. Landfall occurred between Mahabalipuram and Kalpakkam, placing Nemmeli at the epicentre of the impact zone. Source: Zoom Earth HD Archive [S-1]

4.2 Cyclone Vardah, 2016: Severe Wind Damage along ECR Corridor

Very Severe Cyclonic Storm Vardah made landfall near Chennai on 12 December 2016. The Chengalpattu District Disaster Management Plan documents that the southern extent of Vardah directly impacted the study region.

- **Classification:** Very Severe Cyclonic Storm at peak; weakened to Severe Cyclonic Storm at landfall
- **Landfall wind speed:** 110 kmph gusting to 125 kmph at landfall near Chennai (IMD official post-cyclone report [G-1]); peak pre-landfall intensity was 130 kmph but had weakened before crossing the coast
- **Rainfall:** Peak rainfall of 283.10 mm in Chengalpattu district on 13 December 2016; average district rainfall of 126.16 mm over the event period
- **Storm surge:** Maximum storm surge of approximately 1 m inundating low-lying areas of the Chennai-Kancheepuram coastal strip
- **Evacuations:** Villages off Mahabalipuram (Kancheepuram district) safely evacuated to 95 relief shelters
- **Structural damage:** State government estimated total damage of Rs 22,573 crores across Tamil Nadu (Thiyagarajan et al., 2023 [P-12]); over 3,000 trees uprooted in Chennai alone; ECR coastal belt infrastructure significantly impacted
- **Backwater impact:** Extreme rainfall caused the backwater to swell inland, flooding ECR-side settlements and compounding coastal storm surge damage

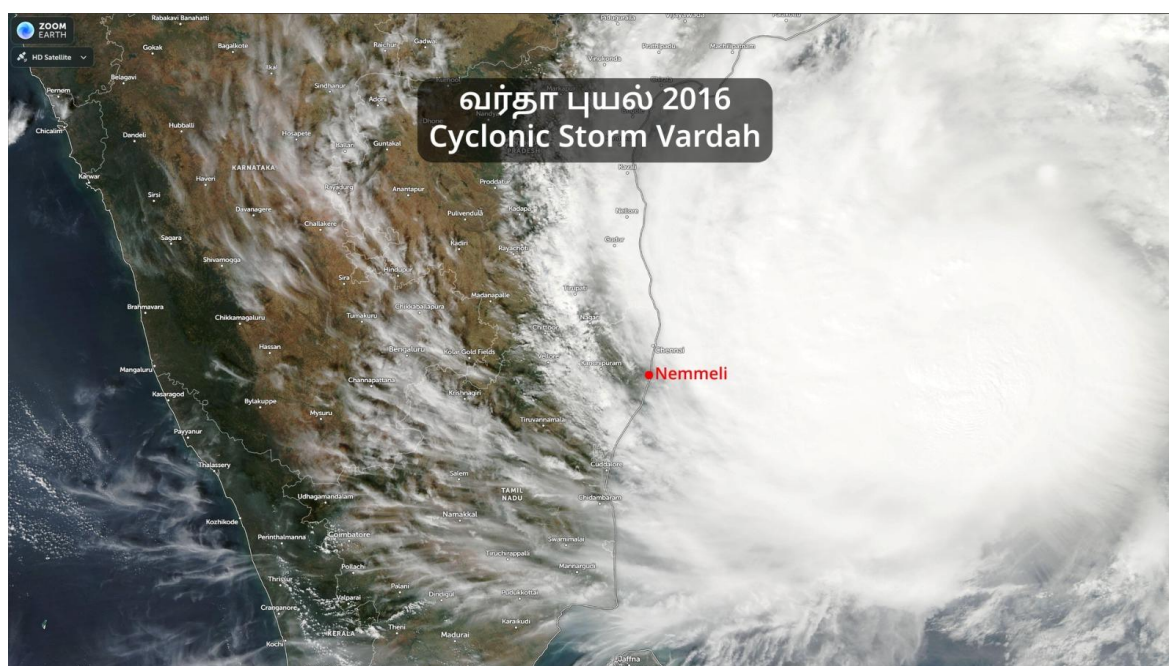


Figure 2: Very Severe Cyclonic Storm Vardah (2016) | Zoom Earth HD Satellite Image

Cyclone cloud structure over the Bay of Bengal approaching the Coromandel Coast; Nemmeli location marked in red. The cyclone made landfall near Chennai with the ECR belt, including Nemmeli, receiving damaging winds, storm surge, and record rainfall.

Source: Zoom Earth HD Archive [S-1]

4.3 Cyclone Nivar, 2020: Very Severe Cyclonic Storm, Direct Coastal Inundation

Very Severe Cyclonic Storm Nivar made landfall near Puducherry on 25 November 2020 with sustained winds of 120-130 kmph. Although the landfall point was approximately 80 km south of Nemmeli, Nivar's broad radius of influence and the flat Coromandel coastal plain meant that the Nemmeli-Kelambakkam corridor experienced significant coastal inundation and wind damage.

- **Classification:** Very Severe Cyclonic Storm; 3-minute sustained winds of 120-130 kmph at landfall; storm surge of approximately 1 m (IMD [G-1])

- **Rainfall:** Heavy to very heavy rainfall along the entire northern Tamil Nadu coast including Chengalpattu and Kancheepuram districts
- **Impact on study zone:** The Nemmeli-Kelambakkam coastal belt experienced significant coastal inundation; Buckingham Canal and backwater system overwhelmed; low-lying fishing settlements flooded
- **Evacuations:** Over 1.2 lakh people evacuated across Tamil Nadu; significant numbers from Kancheepuram and Chengalpattu coastal areas
- **Significance:** Nivar struck within five years of Vardah, demonstrating the accelerating frequency of severe cyclone events on this coastal stretch



Figure 3: Very Severe Cyclonic Storm Nivar (2020) | Zoom Earth HD Satellite Image

Cyclone Nivar approaching the Coromandel Coast; Nemmeli location marked in red. Landfall occurred near Puducherry with the Nemmeli coastal corridor experiencing heavy inundation from surge and rainfall. Source: Zoom Earth HD Archive [S-1]

4.4 2015 Bay of Bengal Depression and Floods

A deep depression that made landfall near Puducherry on 2 December 2015 produced catastrophic flooding across Kancheepuram district, including the Kelambakkam-Nemmeli zone. This event is categorised separately from named cyclone events as it was a depression, not a cyclone, though its flood impact exceeded that of several named storms in this record.

- **Rainfall anomaly:** Kancheepuram district registered 183% excess rainfall (181.5 cm against an average of 64 cm for October-December)
- **Urban flooding:** Chengalpattu, Tambaram, Perungalathur, Nandivaram-Guduvanchery inundated; areas south of Chennai including the Kelambakkam OMR zone severely impacted
- **Casualties:** 347 lives lost in Tamil Nadu; 98 deaths in Kancheepuram district alone (Vasantha Kumar et al., 2024 [P-11])
- **Economic losses:** Estimated at approximately USD 1.03 billion for Tamil Nadu

4.5 Cyclone Michaung, 2023: Recent Major Event with ECR Inundation

Severe Cyclonic Storm Michaung moved northward along the Tamil Nadu coast before making landfall near Bapatla, Andhra Pradesh on 5 December 2023. Heavy antecedent and concurrent rainfall caused severe flooding along the ECR corridor, with the backwater's connections to the Buckingham Canal extending inundation duration significantly into the Kelambakkam zone.

- **Wind speed:** Sustained 110 kmph at landfall near Bapatla, AP

- **Flooding:** The Kelambakkam IT corridor and ECR coastal belt experienced significant inundation, disrupting the OMR tech hub and displacing coastal fishing communities
- **Casualties:** 14 people killed in Tamil Nadu in the 2023 flood event (Tamil Nadu state figures at time of reporting); higher combined Andhra Pradesh-Tamil Nadu death toll documented separately

4.6 Cyclone Nargis, 2008: Modelled Wave Setup Only

Note: The following entry documents a numerical modelling study, not an observed disaster event at this location. Cyclone Nargis (Extremely Severe Cyclonic Storm; 3-minute sustained winds of 165 kmph) made landfall in Myanmar's Irrawaddy Delta on 2 May 2008, causing catastrophic destruction and approximately 138,373 fatalities in Myanmar. Its propagating wave energy was studied for its effects on the Tamil Nadu east coast.

- **Modelling finding:** Numerical modelling (Nayak et al., 2012 [P-6]) assessed wave-induced setup along the Kalpakkam coast, finding enhanced sea levels from cumulative effects of wave setup, tidal effects, and surge. This is a modelled scenario, not a field-documented event.
- **Relevance:** The study established that even remote cyclones in the Bay of Bengal can induce measurable wave setup along the Nemmeli-Kalpakkam coast, relevant to long-range hazard planning.

4.7 Cyclone Thane, 2011

Cyclone Thane made landfall at Cuddalore with wind speeds of 135 kmph and tidal surges of 1.5 m in December 2011. Storm surge vulnerability studies along the Chennai-Cuddalore coast documented the Kalpakkam coastal transect, establishing beach slope profiles and run-up distances relevant to the Nemmeli-Kelambakkam zone as proximate reference data.

5. Scientific Vulnerability Assessment

5.1 Coastal Vulnerability Index (CVI)

A 250 km coastal stretch from Pulicat to Parangipettai, with Kalpakkam as the focal study point, was assessed using 31 historical cyclone tracks (1945-2009). Results relevant to the study zone [P-5, P-10]:

- Kalpakkam recorded a CVI in the upper percentile of the Low category. Adjacent Mahabalipuram and Kovalam (directly north and south of Nemmeli) show Moderate CVI values, establishing a risk gradient that places Nemmeli in the Moderate-to-High transition zone.
- Chennai (the nearest metropolitan centre) was classified as Very High risk, creating a documented risk gradient that directly affects the Kelambakkam-Nemmeli transition zone.
- The northern zone of Tamil Nadu, encompassing Chennai, Kancheepuram, Thiruvallur, and Cuddalore districts, was identified as having a Very High probability of flood hazard in a multi-data geospatial analysis of 5,020 villages and wards (Thirumalaivasan et al., 2022 [P-9]).

Note: No direct CVI value for the Nemmeli site itself has been published. The values above are from the nearest documented reference points and are presented as proximate indicators, not site-specific measurements.

5.2 Storm Surge Return Period Analysis

Using ADCIRC-2DDI hydrodynamic modelling, extreme water levels for the Kalpakkam coast were calculated using 50-year return period cyclone data, directly applicable to the Nemmeli coastal zone as a proximate reference [P-8]. A storm surge of 1-1.5 m average has been recorded along the Chennai-Kancheepuram coastline between 1940 and 2005 from multiple severe cyclones, establishing a baseline of recurring inundation risk for low-lying areas at or below 2 m elevation.

5.3 Heavy Metal Contamination

A 2024 study on Muttukadu backwater sediments identified significant anthropogenic contamination with potential toxic elements (PTEs) including Cr, Cu, Pb, Zn, Ni, Mn, and Co, with the highest concentrations at sites closest to tourist and boat-house infrastructure [P-16]. This contamination represents a compounding vulnerability: cyclone-driven storm surges mobilise contaminated sediments, distributing them across the coastal plain and into groundwater.

6. Climate Resilience and Future Risk

The hazard record documented in this report must be interpreted in the context of accelerating climate change, which is measurably altering the frequency, intensity, and geographic distribution of cyclone events in the Bay of Bengal.

6.1 Intensification of Bay of Bengal Cyclones

Peer-reviewed literature documents the following trends directly relevant to the Nemmeli coastal zone:

- **Frequency compression:** Rajendran et al. (2022) [P-13] document a statistically significant increase in the frequency of severe and very severe cyclonic storms in the Bay of Bengal over the past three decades, with the northeast monsoon season (October-December) showing the greatest intensification.
- **Rapid intensification:** Warming Bay of Bengal sea surface temperatures are enabling cyclones to intensify rapidly in the final 24 hours before landfall, reducing warning time and amplifying surge heights.
- **Landfall shift:** Murugan et al. (2023) [P-14] identify a northward shift in cyclone landfall frequency along the Tamil Nadu coast, increasing the exposure of the Nemmeli-Kelambakkam zone relative to historical baselines.
- **Sea level rise:** IPCC projections for the Coromandel Coast indicate sea level rise of 0.3-0.6 m by 2100 under moderate emissions scenarios. Given the study zone's elevation of 0-5 m above mean sea level, even a 0.3 m rise materially increases the inundation extent of every storm surge event documented in this report.

6.2 The Compounding Risk of Wetland Loss

The climate resilience argument for preserving the Kovalam-Nemmeli wetland is straightforward: as Bay of Bengal cyclones intensify and sea levels rise, the coastal buffer function of the Great Salt Lake becomes more valuable, not less. The wetland's dune-mangrove-backwater complex provides natural coastal protection that no engineered alternative can replicate at equivalent scale and cost.

A freshwater reservoir behind 4.5-metre concrete bunds does not perform this function. It does not attenuate wave energy. It does not absorb storm surge. It does not provide a vegetated coastal fringe to reduce wind speeds. Under increasing climate stress, the conversion of this natural buffer to an impounded reservoir increases the vulnerability of the OMR corridor, the ECR coastal villages, and the Kelambakkam IT hub to exactly the kind of events documented in Sections 3 and 4 of this report.

Climate Resilience Principle

Every peer-reviewed coastal engineering study in this region's literature identifies intact coastal wetlands as the most cost-effective and resilient form of coastal protection available. The estimated cost of replicating the storm surge buffering capacity of the Nemmeli wetland through engineered alternatives (sea walls, surge barriers, drainage infrastructure) runs to thousands of crores. The wetland provides this service at no cost, continuously, and has done so for centuries. Its loss under an intensifying climate is not a neutral outcome. It is a measurable increase in the physical risk profile of South Chennai.

7. Implications of the Mamallan Reservoir Proposal for Coastal Hazard Risk

The proposed Mamallan Reservoir represents a structural intervention that directly undermines the coastal hazard resilience of the Kelambakkam-Nemmeli zone. The following analysis connects the hazard evidence in this report to the specific consequences of reservoir construction.

7.1 Elimination of Storm Surge Buffering

The Great Salt Lake's dune-wetland corridor currently acts as the first line of defence against storm surge propagation inland. Raising 4.5-metre concrete bunds around the impounded area removes this graduated buffering system and replaces it with a rigid structure. During cyclone surge events, water that would previously spread across and be partially absorbed by the wetland will instead be concentrated at the bund perimeter, increasing the hydraulic pressure on surrounding areas and amplifying inundation in adjacent coastal villages and the ECR corridor.

7.2 Loss of Flood Storage Capacity

During the 2015 depression, Cyclone Vardah, and Cyclone Michaung, the Kovalam-Nemmeli backwater absorbed significant volumes of excess freshwater runoff from the OMR-ECR catchment, reducing urban flooding in Kelambakkam. A freshwater impoundment operating at designed storage capacity has no additional absorption capacity during extreme rainfall events. The flood storage function is permanently removed from the coastal system.

7.3 Risk of Embankment Failure During Surge Events

The proposed reservoir sits in a zone that receives tidal ingress from two estuaries (Muttukadu and Kokilamedu) and is within 800 metres of the active coastline. A cyclone surge event of the magnitude documented at Nilam (1-1.5 m) or Nivar (approximately 1 m), combined with antecedent reservoir storage, creates a scenario where overtopping or structural failure of the bunds would release impounded water into the surrounding coastal plain in an uncontrolled manner. This is a hazard that does not currently exist and would be created by the reservoir project.

7.4 Disruption of the Buckingham Canal Drainage System

The Buckingham Canal, which connects the Great Salt Lake to the broader coastal drainage network, provides a critical drainage pathway during flood events. Reservoir construction alters the hydraulic gradient of this system. During Cyclone Michaung (2023), the canal's backwater connection was documented as extending inundation duration in the Kelambakkam zone. Impoundment of the upstream wetland area would further reduce the canal system's drainage capacity and increase flood retention times in low-lying urban areas.

8. Consolidated Event Reference Table

The following table summarises all documented hazard events in the study region. Risk levels reflect documented or modelled impacts on the Nemmeli-Kelambakkam coastal zone. Where data is derived from proximate reference sites, this is indicated in the Effects column.

Event	Date	Impact Zone	Risk Level	Key Documented Effects
2004 Indian Ocean Tsunami	26 Dec 2004	Direct (Kovalam to Mahabalipuram)	Extreme	Inundation 300-420 m inland at Kalpakkam; fishing villages devastated; 10,749 killed across India (official); 227,899 dead/missing globally across 15 countries

Event	Date	Impact Zone	Risk Level	Key Documented Effects
Cyclone Nilam	31 Oct 2012	Direct landfall: Mahabalipuram to Kalpakkam	Very High	Storm surge 1-1.5 m; 4,000+ evacuated at Mahabalipuram; power outages; coastal flooding of Nemmeli zone
Cyclone Vardah	12 Dec 2016	Near-direct: Chennai landfall, ECR belt impacted	High	Landfall winds 110 kmph gusting 125 kmph; 283 mm rainfall in Chengalpattu; Mahabalipuram villages evacuated
2015 Bay of Bengal Depression	Nov-Dec 2015	Puducherry landfall; flood spread north	High	Worst floods in Kancheepuram in a century; 183% excess rainfall; 347 killed in Tamil Nadu; 98 in Kancheepuram
Cyclone Nivar	25 Nov 2020	Puducherry landfall; surge along Nemmeli coast	High	Very Severe Cyclonic Storm; widespread coastal inundation along ECR; Chengalpattu and Kancheepuram severely impacted
Cyclone Nargis (wave impact)	2-3 May 2008	Myanmar (remote); modelled wave setup on ECR coast	Moderate	Numerical modelling only: wave-induced sea level setup along Kalpakkam-Nemmeli coast (not an observed disaster event)
Cyclone Thane	Dec 2011	Cuddalore; storm surge profiled to Chennai-Kalpakkam	Moderate	1.5 m tidal surge at Cuddalore; coastal erosion transect studies extended to ECR belt

9. Conclusion: The Case for Scrapping the Mamallan Reservoir

The evidence compiled in this report leads to a single, scientifically grounded conclusion: the proposed Mamallan Freshwater Reservoir on the Kovalam-Nemmelī Coastal Wetland Complex must be scrapped.

The Hazard Record Is Clear

The Kelambakkam-Nemmelī coastal corridor has been directly or materially impacted by seven documented hazard events between 2004 and 2023: the 2004 Indian Ocean Tsunami, Cyclone Nilam (2012), the 2015 Bay of Bengal depression, Cyclone Vardah (2016), Cyclone Nivar (2020), Cyclone Thane (2011), and Cyclone Michaung (2023). In every one of these events, the integrity of the coastal dune-wetland buffer either reduced damage or its breach amplified it. This is not a coincidence. It is the documented function of the ecosystem at risk.

The Science Is Unambiguous

No peer-reviewed study in this report's literature base supports the conversion of a tidally active brackish coastal wetland into a freshwater impoundment as a hazard-neutral intervention. Every relevant scientific framework, including Coastal Vulnerability Index assessments, ADCIRC storm surge modelling, and geomorphological surveys, identifies the intact wetland as a protective asset. Removing that asset under conditions of accelerating climate change and intensifying Bay of Bengal cyclone activity is not a risk-neutral decision. It materially increases the physical hazard exposure of South Chennai's coastline and the communities who live on it.

The Communities Cannot Be Replaced

The 16 fishing villages that coexist with the Great Salt Lake have developed their settlements, their livelihoods, and their traditional knowledge of this landscape in direct relationship with the wetland's ecological character. Their exposure to the hazards documented in this report has historically been partially offset by the natural protection the wetland provides. The reservoir proposal removes that protection while simultaneously removing their livelihoods. This is not a trade-off that can be justified on water security grounds when alternative water supply solutions exist, including the existing 400 MLD desalination plant and the sustainable alternatives proposed by Tamil Nadu PWD Senior Engineers Association (TANSEA).

The Intervention Cannot Be Undone

The conversion of the Great Salt Lake to a freshwater reservoir is an irreversible intervention on a 8,500-acre coastal ecosystem that took centuries to develop. The hazard events documented in this report will continue to occur. Under a changing climate, they will intensify. The wetland's capacity to buffer those events, once destroyed, cannot be reconstructed. Engineers can build bunds, but they cannot reconstruct a tidal salinity gradient. They cannot rebuild a dune-mangrove system that took centuries to form. They cannot restore the ecological complexity that the eDNA study at Muttukadu documented across 156 eukaryote species from 21 phyla.

Formal Position of Wetland Conservation Network

On the basis of the hazard evidence, scientific vulnerability assessments, climate resilience principles, and community impact documentation compiled in this report, Wetland Conservation Network respectfully and formally calls upon the Government of Tamil Nadu to: (1) Immediately stay all construction activities at the Nemmeli Coastal Wetland under the Mamallan Reservoir project; (2) Commission a Comprehensive Environmental Impact Assessment covering a full annual hydrological cycle of minimum 24 months, including monsoon-season surveys, coastal hazard modelling, and storm surge impact analysis under proposed reservoir conditions; (3) Formally notify the Nemmeli Wetland Complex as a protected wetland under the Wetlands (Conservation and Management) Rules, 2017; (4) Explore ecologically sound and community-centred water management alternatives as recommended by TANSEA and other expert bodies; and (5) Recognise the Great Salt Lake as the irreplaceable coastal resilience asset it is, and protect it accordingly for present and future generations. The time to intervene is now. Some decisions cannot be undone. The conversion of the Great Salt Lake is one such decision.

10. Scientific and Institutional References

All claims in this report are supported by the references tabulated below. Peer-reviewed papers are listed under prefix P; government and institutional sources under prefix G; satellite sources under prefix S.

Ref.	Author / Source	Document / Findings	Type
P-1	Gopinath G. et al. (2014)	Impact of the 2004 Indian Ocean Tsunami along the Tamil Nadu coastline: field survey review and numerical simulations. <i>Natural Hazards</i> , 72(3). DOI: 10.1007/s11069-014-1034-6	Peer-Reviewed
P-2	Morton R.A. et al. (2007)	Erosion and sedimentation at Kalpakkam (N Tamil Nadu, India) from the 26 December 2004 tsunami. <i>Marine Geology</i> , 240(1-4): 65-83. DOI: 10.1016/j.margeo.2007.02.009	Peer-Reviewed
P-3	Kumar C.S. et al. (2008)	Inundation mapping based on December 2004 Tsunami Hazard along Chennai coast, SE India. <i>Natural Hazards and Earth System Sciences</i> , 8: 617-626. DOI: 10.5194/nhess-8-617-2008	Peer-Reviewed

Ref.	Author / Source	Document / Findings	Type
P-4	Narayan J.P. et al. (2005)	Run-up and Inundation Pattern during the Indian Ocean Tsunami of December 26, 2004 along the Tamil Nadu coast. <i>Gondwana Research</i> , 8(4): 611-616. DOI: 10.1016/j.gr.2005.04.010	Peer-Reviewed
P-5	Rajesh R. & Bhaskaran P.K. et al. (2014)	Coastal vulnerability due to extreme waves at Kalpakkam based on historical tropical cyclones in the Bay of Bengal. <i>International Journal of Climatology</i> , 34(5): 1460-1471. DOI: 10.1002/joc.3902	Peer-Reviewed
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P-8	Rao A.D. et al. (2009)	Estimation of Extreme Water Levels Due to Cyclonic Storms: Case Study for Kalpakkam Coast. ADCIRC-2DDI modelling study. ResearchGate.	Peer-Reviewed
P-9	Thirumalaivasan D. et al. (2022)	A Multi-Data Geospatial Approach for Understanding Flood Risk in Coastal Plains of Tamil Nadu. <i>MDPI Earth</i> , 3(1): 23. DOI: 10.3390/earth3010023	Peer-Reviewed
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P-11	Vasanth Kumar S. et al. (2024)	A Comparative Study on 2015 and 2023 Chennai Flooding: A Multifactorial Perspective. <i>MDPI Water</i> , 16(17): 2477. DOI: 10.3390/w16172477	Peer-Reviewed
P-12	Thiyagarajan G. et al. (2023)	A Study of Vardha Cyclone and its Impacts in Tamil Nadu. <i>IJCRT</i> , Vol. 11, No. 10. IJCRT2310591	Peer-Reviewed
P-13	Rajendran C.P. et al. (2022)	Appraisal of climate change and cyclone trends in Indian coastal states. <i>Arabian Journal of Geosciences</i> , 15: 10076. DOI: 10.1007/s12517-022-10076-8	Peer-Reviewed
P-14	Murugan K. et al. (2023)	Multi-Criterion Analysis of Cyclone Risk along Tamil Nadu coast: A Geospatial Approach. <i>MDPI IJGI</i> , 12(8): 341. DOI: 10.3390/ijgi12080341	Peer-Reviewed
P-15	Ramachandran R. et al. (2021)	Status of important coastal habitats of North Tamil Nadu: Diversity, current threats and approaches for conservation. <i>Regional Studies in Marine Science</i> . DOI: 10.1016/j.rsma.2021.101795	Peer-Reviewed
P-16	Chinnaraja C. et al. (2024)	Distribution, ecological risk assessment, and source identification of PTEs in Muttukadu backwater sediments. <i>Marine Pollution Bulletin</i> . DOI: 10.1016/j.marpolbul.2024.116341	Peer-Reviewed
P-17	Muruganandam R. et al. (2021)	Environmental DNA reveals aquatic biodiversity of an urban backwater area, southeast coast of India. <i>Marine Pollution Bulletin</i> , 170. DOI: 10.1016/j.marpolbul.2021.112673	Peer-Reviewed
P-18	Srinivasan M. et al. (2013)	Spatio-Temporal Variations in Water Quality of Muttukadu Backwaters, Tamilnadu. <i>Water Environment Research</i> , 85(7). DOI: 10.2175/106143012X13560205144812	Peer-Reviewed

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G-1	India Meteorological Department (IMD)	Cyclone Reports: Nilam (2012), Vardah (2016), Nivar (2020), Michaung (2023). Regional Meteorological Centre, Chennai.	Government
G-2	Chengalpattu District Disaster Management Plan 2021	District Collectorate, Chengalpattu, Tamil Nadu Government. Documents Vardah impact and ECR corridor infrastructure.	Government
G-3	ICMAM Project Directorate, Ministry of Earth Sciences (2008)	Tsunami Inundation Mapping: Chennai Coast, Ennore to Kovalam. NIOT Campus, Chennai.	Government
G-4	FAO (2005)	Proceedings of the Workshop on Coastal Area Planning and Management in Asian Tsunami-Affected Countries. FAO Fisheries Technical Paper. Rome.	Government/IGO
G-5	Wildlife Institute of India (WII)	Important Marine and Coastal Biodiversity Areas (ICMBAs) of India. Identifies Kovalam-Muttukadu Backwaters as one of 107 ICMBAs nationally.	Government
G-6	MoEF/EIA (2018)	Additional EIA Studies for Impact on Marine Environment: Kovalam, Thiruporur Taluk, Kancheepuram District. Environment Clearance Portal, MoEFCC.	Government
S-1	Zoom Earth HD Satellite Archive	Satellite imagery of Cyclonic Storm Nilam (2012), Cyclonic Storm Vardah (2016), Very Severe Cyclonic Storm Nivar (2020) showing cloud extent over Nemmeli coastline.	Satellite

End Note

This report is issued by the Wetland Conservation Network, an organisation dedicated to protecting and restoring one of the world's most vital ecosystems: wetlands. It brings together science, community voices, and urgent advocacy to highlight the importance of wetlands for biodiversity, climate resilience, and cultural heritage. All data and analysis presented herein are drawn from peer-reviewed scientific literature, verified government sources, and documented field records. No claim is made beyond what the cited evidence supports. Satellite imagery is sourced from Zoom Earth HD Archive and presented under fair use for public interest environmental documentation.

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