Environmental Audit Report

Post Restoration of Gunduperumbedu Lake

Submitted to

TITAN COMPANY

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Report Prepared by

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Chapter 1: Introduction

Titan Company Limited, incorporated in 1984 as a joint venture of the Tata Group and Tamil Nadu Industrial Development Corporation (TIDCO), is engaged in the manufacturing and sale of watches, jewellery, eyewear, fragrances, lifestyle products and other accessories. The company's Corporate Social Responsibility (CSR) policy focuses on education and extends support to initiatives that address local developmental needs and issues of national importance.

Gunduperumbedu Lake, located in Gunduperumbedu village, Sriperumbudur taluk, Kanchipuram district, Tamil Nadu was taken up for restoration addressing the issues related to sediment accumulation, reduced storage capacity, damaged hydraulic structures and declining groundwater recharge potential. As part of its CSR initiative, Titan Company Limited undertook the restoration activities in partnership with the National Agro Foundation (NAF) a public charitable trust working in the areas of agriculture and rural development. The restoration of the lake was carried out during the period October 2024 to September 2025.

1.1 Background and Need for the Study

An Environmental Impact Assessment (EIA) study was carried out in September 2024 to establish the baseline status of enviro-social components in and around the lake prior to its restoration. As a part of the study, recommendations and suggestions to achieve the objectives stated in the Detailed Project Report (DPR) were made. In order to assess the effectiveness and outcomes of the restoration, TITAN has engaged Eco Services India Private Limited, a NABET accredited EIA consultant Organization to conduct a post- restoration environmental audit to assess the projected structural and functional benefits of the restoration process. This study aims to validate the effectiveness of the restoration efforts, identify the environmental concerns, if any and suggest a way forward to ensure the sustainability of the restored lake ecosystem.

1.2 Objectives of the Study

The objectives of the study are:

- To assess the environmental condition post restoration.
- To compare pre-restoration and post-restoration data and validate the effectiveness of the restoration.
- To assess the socio-economic impacts/benefits on the beneficiary community.
- To propose measures for continued environmental management and monitoring.

- To propose an action plan for deriving a long-term environmental, ecological and socio-economic benefits of the lake restoration.

1.3 Scope of the EIA Study

- Reconnaissance survey and inspection of the lake and its surroundings.
- Current environmental status in respect of air, noise, water, soil, biodiversity and socio-economic components.
- Comparative analysis of pre and post restoration environmental conditions.
- Assessment of post-restoration environmental impacts.
- Preparation of Post-Restoration Environmental Management Plan, Maintenance and Monitoring Plan.

1.4 Methodology

The overall methodology employed for the study is presented in Figure 1.1.

Figure 1.1: Study Methodology

1.5 Summary of Environmental Management Plan suggested - Restoration Phase

The summary of environmental management measures suggested during the restoration phase as part of the EIA study undertaken prior to the lake restoration is as follows:

The following restoration activities/ environmental management measures have been taken as the yardstick to conduct the post restoration environmental audit.

- Scheduled dredging and de-weeding during designated hours using well-maintained equipment.

- Erosion and sediment control measures such as phased de-silting and de-weeding, proper disposal of weeds and debris and monitoring of water quality parameters.

- Utilization of dredged silt for embankment strengthening, protection and reuse of topsoil, safe disposal of waste and restoration of natural land contours to prevent erosion.

- Removal of invasive species, plantation of native species, establishment of mud mounds and micro-catchments to support wildlife.

- Conducting public awareness programs, involving local communities in the restoration activities, employment for local workers and maintenance of access to the lake.

Chapter 2: Overview of Lake Restoration and Interventions

The chapter provides an overview of the restoration activities carried out.

2.1 Site Description

The lake lies in the Adyar sub basin of the Palar river basin. Administratively, it is located in Gunduperumbedu village, Sriperumbudur taluk and Kancheepuram district. The adjoining areas on the north and west, show residential developments and are surrounded on all other sides by agricultural fields. The satellite image of the lake is shown in Figure 2.1 and its environmental setting is given in Table 2.1.

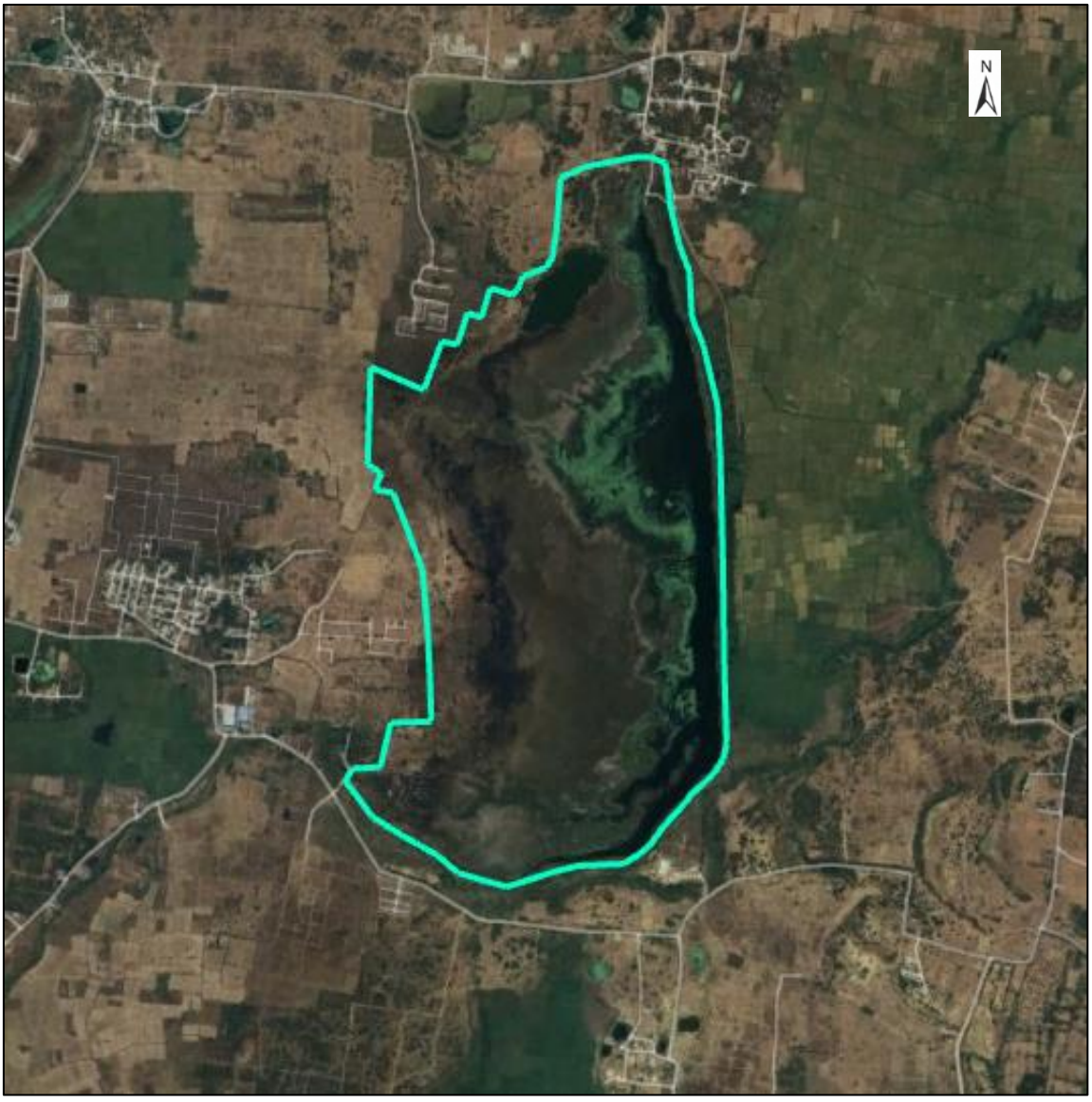


Figure 2.1: Satellite Image of the Guduperumbedu Lake
Source: Google Earth (2024)

Table 2.1: Environmental Setting of the Lake

S.No	Feature	Details
1.	Geographical Co-ordinates	Centre of the Lake
	Latitude	12°54'14.97"N
	Longitude	79°58'6.38"E
2.	Lake elevation in MSL	47 to - 85m
3.	Topo Sheet Number(s)	57P/13 and 66D/01
4.	Survey Number(s)	501 of Gunduperumbedu village, Sriperumbudur taluk and Kancheepuram district.
5.	Upstream Lakes	Vallam Lake (3.58 km, West) Oddankaranai Lake (1.38 km, West) Eraiyur Lake (1.58 km, South West) Kannanthangal Lake (1.03 km, West) Perinjambakkam Lake (1.11 km, South) Oragadam Lake (3.58 km, South West)
6.	Downstream Lakes	Vellarai Lake (1.74 km, North East) Venkadu Lake (1.03 km, North East) Alagoor Lake (1.45 km, East) Pallur Lake (3 km, East) Mahanyam Lake (3.29 Km, North East) Manimangalam Lake (6.36 Km, East)

2.2 Overview of Restoration Measures Implemented

2.2.1 De-silting and De-weeding

A total of 1,10,000 m^3 of earth has been removed to restore and enhance the water-holding capacity of the lake. De-silting has been carried out by excavating 122 pits, each of dimensions 50 m length, 30 m breadth and 0.6 m depth. The hydraulic features of the lake before and after de-silting are presented in Table 2.2. The photographs of the lake before, during and after de-silting are in Figure 2.2.

Table 2.2 Hydraulic features of Gunduperumbedu Lake (Before and After De-siltation)

Feature	Details as per Records
Capacity of the tank as per tank memoir	34.01 MCUM
Capacity of the tank before restoration/desilting	25.00 MCUM
Capacity of the tank after excavation	26.10 MCUM

2.2 a): Drone image of the lake prior to restoration

2.2 b): Drone image of the lake during restoration

2.2 c): Drone image of the lake after restoration

The lake bund was infested with invasive mesquites and the water was overrun with aquatic weeds prior to restoration. As a part of the restoration activities, de-weeding of both the lake and the bund has been done. The removed weeds have either been composted or safely buried. The photographs of the lake and its surrounding areas before restoration and after restoration are in Figure 2.3

2.3 a): Lake and its surrounding invested with weeds before restoration

2.3 b): Lake and its surrounding post de-weeding

2.2.2 Strengthening of the Bund

Clearing of invasive plants on the Bund: The mesquites on the existing bund have been cleared.

Formation of Bund: Utilizing the excavated soil, strengthening of the bund over a length of 2,871 m has been done. As per the norms of the Water Resources Department (WRD), the soil deposition along the bund has been done with a thickness ranging from 1.3 to 2.0 m.

Compaction of Bund: Compaction work has been carried out using a vibratory roller at every 0.3 m layer. Photographs of the bund before, during and after restoration are given in Figure 2.4.

Figure 2.4 a): Bund formed using excavated soil

Figure 2.4 b): Consolidation of the Bund in progress

Figure 2.4 c): Bund after restoration

Construction of Toe Wall: A toe wall of about 500 m length has been constructed to enable stone pitching near the sluice gates and the weir to ensure stability.

Stone Pitching: Large aggregates have been laid in a staggered pattern with mortar pointing to strengthen the embankment and protect it from erosion. However, the quality of the work does not appear to be good. In many spots the aggregates have fallen and the base wall of the sluice gates are broken. Photographs of the toe wall and the stone pitching carried out are shown in Figure 2.5.

Figure 2.5 a): Toe wall constructed at the base of the Bund

Figure 2.5 b): Stone pitching done near the sluice gates and weir

2.2.3 Renovation of Tank Structures

The lake restoration activities as per the DPR include re-construction of the surplus weir and three sluice gates to regulate water level and control outflow to the downstream lakes. The layout showing the tank structures renovated is shown in Figure 2.6.

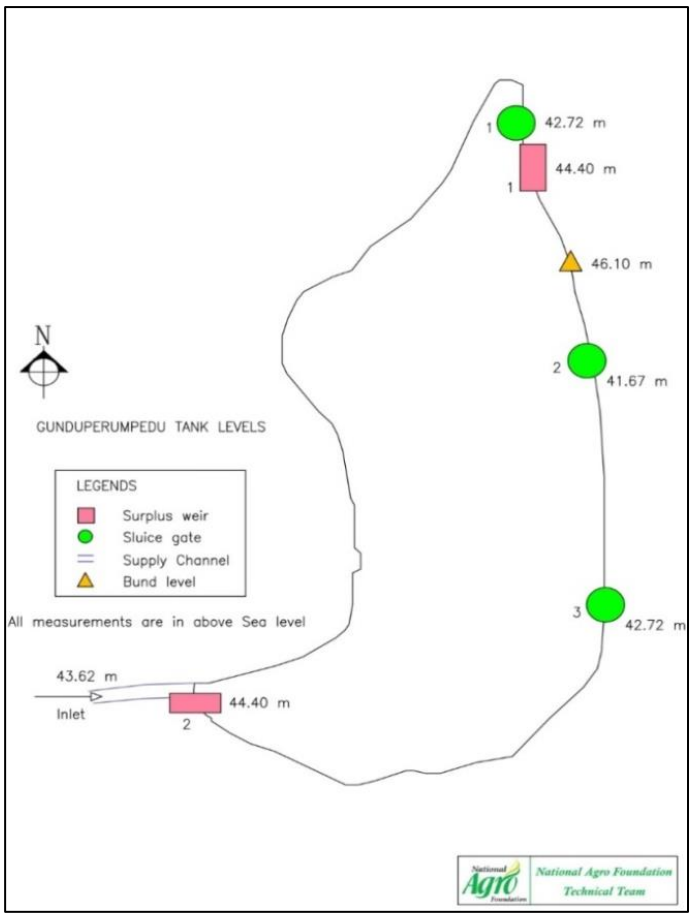


Figure 2.6: Layout showing the tank structures proposed for renovation

2.2.4 Access to the Lake

An RCC walkway at the northern end of the lake, which provides access to the sluice gates, was found to be damaged requiring urgent attention. The surplus weir and the walkway have been renovated, thereby restoring access to the lake and the sluice gates. De-weeding, de-silting and removal of invasive plant species have also been carried out. Additionally, two mud mounds have been built in the lake, probably to enhance the aesthetic value and ecological features. No appreciable benefits of these structures were visible during the field study.

2.2.5 Biodiversity

Native species have been planted in the newly formed bund and the mud mounds to promote biodiversity. The photographs of the tank structures and the walkway before and after renovation is shown in Figure 2.7

Weir before restoration

Weir after restoration

Walkway before restoration

Walkway after restoration

Sluice gate before restoration

Sluice gate after restoration

Figure 2.7: Photographs of the tank structures before and after restoration

2.3 Lake Morphology and Hydraulic features post restoration

The restoration works carried out have improved the morphology and hydraulic features of the lake. De-silting of sediments has restored the natural depth to about 3.2 m. The lake's water retention capacity has increased from 25.00 MCUM to 26.10 MCUM after restoration. According to the project proponent, the de-silting was limited up to 3.2 m to avoid disturbing the hydrogeological stability and to comply with the Water Resources Department (WRD) guidelines.

2.4 Flood Control and Water Level Regulation

Renovation of the tank structures has improved the lake's ability to regulate water level. The surplus weir enables safe discharge of excess water during and post heavy rainfall episodes and thereby prevents overtopping of the bund. The sluice gates facilitate controlled release of water to the agricultural fields (Ayacut area) and lakes downstream. Thus, the strengthened bund and renovated tank structures help manage runoff, reduce flood risk and help maintain stable water levels in the lake.

An automatic water level recorder (Figure 2.8) has been installed by the Revenue Administration and Disaster Management Department, Water Resources Department of Tamil Nadu to continuously monitor fluctuations of water level in the lake. This system enables accurate and real-time recording of water levels, facilitating effective management of inflow and outflow through the sluice gates and surplus weir. The recorded data also assists in flood monitoring and long-term assessment of the lake's hydrological performance.

Figure 2.8: Automatic water level recorder installed at the lake

Chapter 3: Pre and Post Lake Restoration Environmental Status - a comparison

3.1 Baseline versus post-restoration

The chapter details the assessment of the land use, physical environment, biodiversity and socio-economic conditions based on field surveys and available data. A comparison of the baseline environmental conditions prior to the restoration with that post the process is presented in the following sections.

3.2 Land Use and Land Cover

Restoration of the lake was completed in September 2025. The land use and land cover assessment was carried out using drone images of the lake and its surrounding areas, supported by field observations.

3.2.1 Comparative Study

The drone images of the lake before and after the restoration are shown in Figure 3.1 and the comparison of land use and land cover before and after restoration is given in Table 3.1

Figure 3.1 a): Drone image of the lake before restoration

Figure 3.1 b): Drone image of the lake after restoration

Table 3.1: Comparison of land use and land use and land cover before and after restoration

S.No	Feature	Before restoration	After restoration
1.	Water Spread Area	The water spread appeared irregular due to sediment deposition and uncontrolled spread of weeds.	The water spread area of 162 ha is clearly defined with visible lake boundary and strengthened bund, indicating improved structural stability of the lake and better delineation of the lake bed.
2.	Vegetation Cover	Dense natural vegetation and aquatic weeds within the lake and along its margins, indicating the spread of invasive species and their unmanaged growth.	The spread of the invasive species around the lake is visibly reduced due to de-weeding as a part of the restoration works.
3.	Agricultural Land Use	Agricultural land use in the surrounding areas less visible, with large portions	Agricultural plots in the surrounding areas appear clearly demarcated

		covered by natural vegetation.	indicating improved land utilization of lake water for irrigation.
4.	Lake Boundary	The lake boundary not clearly visible due to the presence of vegetation and the slumped bund.	The lake boundary is clearly visible with exposed lake bed and a strengthened bund exhibiting the physical extent of the lake.

3.3 Physical Environment

3.3.1 Air Environment

Air quality was assessed at Gunduperumbedu and Oddankaranai villages, where baseline study was conducted prior to the restoration. The details of the sampling locations, photographs taken during sampling and the comparative results are provided in Annexure I.

The air quality analysis indicated that the concentrations of all monitored parameters viz., PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO were within the permissible limits specified under the National Ambient Air Quality Standards (NAAQS), 2009 by the CPCB. A slight reduction in particulate matter concentrations (PM_{10} and $PM_{2.5}$) was observed during the post-restoration period compared to the pre-restoration period, at both the sampling locations. Graphical representation of the results is shown in Figure 3.2. The concentrations of Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) were much lower than the NAAQS limits, with CO levels below the detection limit at both locations.

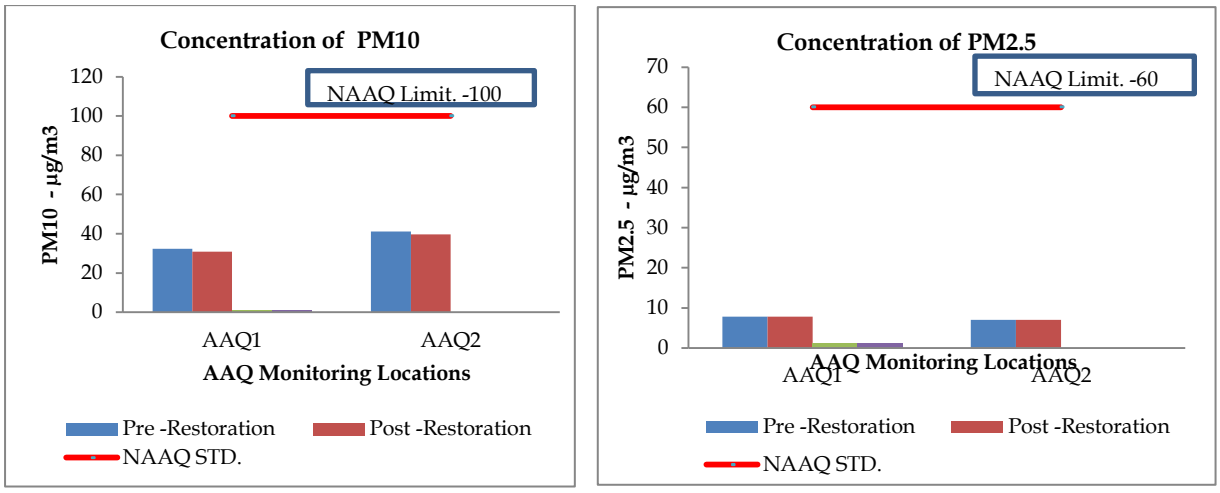


Figure 3.2: Graphical representation of PM_{10} and $PM_{2.5}$ before and after restoration

The relatively good air quality observed in the study area can be attributed to the predominantly residential land use and the absence of major industrial activities or other significant emission sources within the 2 km radius of the study area.

3.3.2 Noise Level

Ambient noise levels were measured in the same residential and sensitive locations where baseline noise levels were recorded prior to the restoration. The details on the sampling locations, photographs taken during the study and the comparative results are provided in Annexure - II.

The baseline ambient noise levels recorded during the pre-restoration and post-restoration periods were compared with the standards specified under the Noise Pollution (Regulation and Control) Rules, 2000 to assess the prevailing noise levels at the select locations. Graphical representation of the results are shown in Figure 3.3

The results indicate that the noise levels at all four sampling locations remained within the permissible limits for both daytime and night time. While the daytime noise levels ranged from 47.5 to 52.4 dB(A) during the pre-restoration period they were 49.0 to 52.0 dB(A) during the post-restoration period. Similarly, night time noise levels ranged from 39.0 to 42.0 dB(A) in the pre-restoration period and 39.2 to 42.7 dB(A) in the post-restoration period.

Overall, the noise levels in the study area are relatively low. The low noise levels can be mainly attributed to local residential activities and minimal vehicular movement. No major industrial or commercial noise sources were noticed within the 2 km radius of the study area.

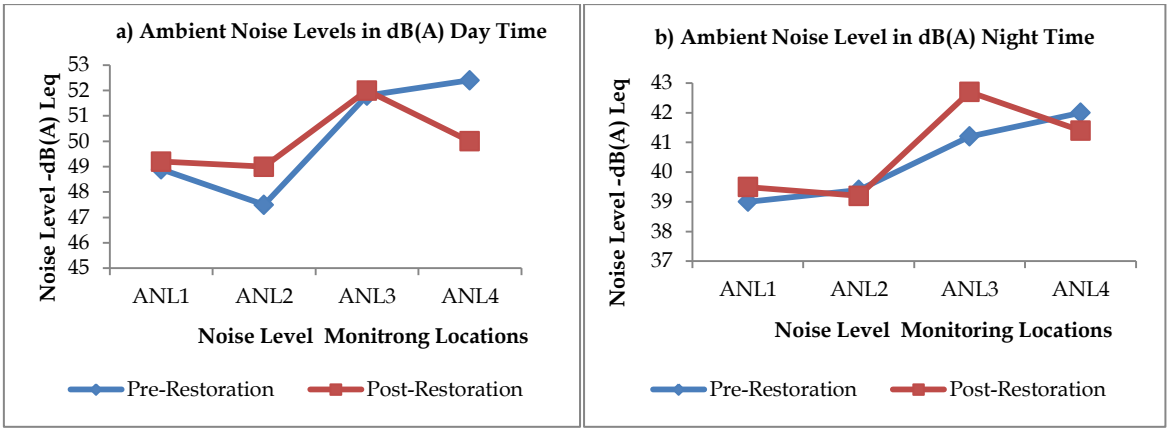


Figure 3.3: Comparison on Pre –Restoration and Post -Restoration Noise level (Day and Night Levels)

3.3.3 Water Environment

Inlet Channel Water Quality

Surface water sampling was carried out at locations within the lake and the inlet channels where pre restoration baseline quality was assessed earlier. The details of the sampling locations, photographs taken during sampling and the analytical results of water quality are provided in Annexure III**.**

The water quality at the lake inlet channel (SW5) shows elevated levels of Total Dissolved Solids (TDS) at 475 mg/L, Sodium at 86 mg/L, Chloride at 150 mg/L and Sulphate at 42 mg/L. These concentrations are significantly higher compared to the lake water values.

Stagnant wastewater was observed in the vicinity of Jintech Engineering, located upstream of the lake near the inlet water channel. The water quality at this location shows higher concentration of dissolved salts, including TDS at 1,470 mg/L, Sodium at 206 mg/L, Chloride at 332 mg/L and Sulphate at 548 mg/L. Higher values of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) were also recorded at this location along with marked bacterial contamination as indicated by a Total Coliform count of 210 MPN/100 mL and a Faecal Coliform count of 31 MPN/100 mL.

The stagnant wastewater is localized, as observed during the site assessment. During monsoon there is a possibility of this wastewater entering the inlet channel through surface runoff.

Lake Water Quality

The comparison of lake water quality at all sampling locations indicates noticeable variations between the pre- and post-restoration period as captured below:

i) pH

The pH values across all sampling locations ranged from 6.8 to 7.37, indicating near-neutral conditions in both the periods. Such conditions are suitable for most aquatic organisms.

ii) Colour, Turbidity and Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and Electrical Conductivity (EC)

Parameters such as colour, turbidity and TSS showed slight decrease post-restoration indicating improved water clarity. Similarly, EC and TDS were moderately reduced at most locations. This can be attributed to the de-silting

activities carried out as part of the restoration as well as the dilution effect post monsoon.

iii) Dissolved Oxygen (DO)

A notable variation was observed in dissolved oxygen (DO) levels. DO concentrations increased from 3.9–4.2 mg/L during the pre-restoration period to 5.8–6.2 mg/L post-restoration, indicating improved aeration and reduced organic load during monsoon along with de-weeding carried out as part of the lake restoration works. De-weeding appears to have improved the oxygen exchange between the water surface and the atmosphere and reduced the oxygen consumption for the decomposition of excessive aquatic biomass.

iv) Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)

The BOD and COD values also showed a decline post restoration. COD values decreased from 28–57 mg/L in the pre-restoration period to 14–19 mg/L post-restoration, indicating a reduction in organic pollution and improved water quality.

v) Nutrient Levels and Ions

Nutrient levels, particularly phosphorus, showed a general decrease post-restoration. Major ions such as sodium, potassium, chloride and sulphate also exhibited lower concentrations post-restoration. De-silting and de-weeding carried out as part of the lake restoration must have removed nutrient-rich sediments and accumulated organic matter from the lake bed, thereby reducing the internal nutrient load.

vi) Total Coliform and Faecal Coliform

Microbiological analysis indicated the presence of Total Coliform and Faecal Coliform, both during the pre- and post-restoration. Relatively higher counts were observed post-restoration. This increase in contamination from human and animal wastes may be attributed to surface runoff carrying faecal contaminants, activities such as bathing, animal washing, bird droppings and open defecation in the lake vicinity.

The comparison of pre- and post-restoration water quality indicates an overall improvement in the physico-chemical characteristics of the lake water. Restoration measures such as desilting, de-weeding and renovation of tank structures have enhanced water circulation, reduced internal organic load and improved parameters such as DO, TSS, TDS, BOD and COD. However, the presence of coliform indicates the need for behavioral changes in the surrounding community.

Based on the above observations, the lake water quality can be said to generally meet the CPCB Designated Best Use Water Quality Criteria under the following categories:

- **Class C:** Drinking water source with conventional treatment
- **Class D:** Propagation of wildlife and fisheries
- **Class E:** Irrigation, industrial cooling, and controlled waste disposal purposes.

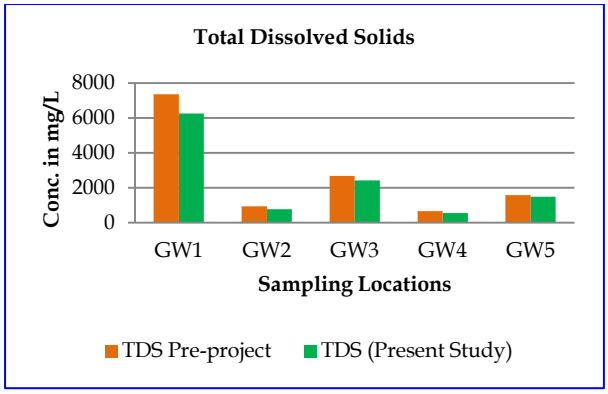
c. Ground Water Quality

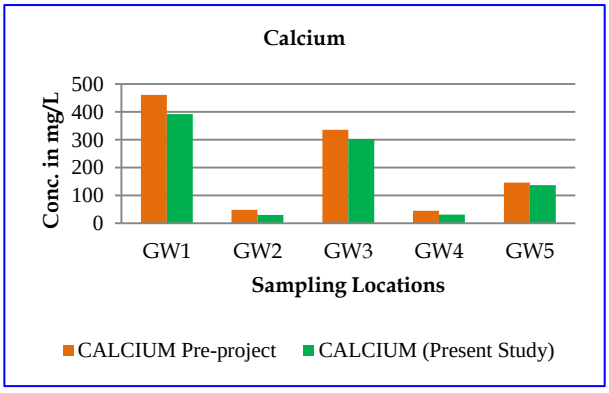
Ground water sampling was done at locations around Gunduperumedu Lake where pre restoration baseline study was done. The details of the sampling locations, photographs taken during sampling and the water quality data are provided in Annexure IV**.**

The comparison of groundwater quality around the restored lake area (GW-1 to GW-5) shows noticeable variations between the pre- and post-restoration periods. Graphical representation of the results is shown in Figure 3.4

The pH ranged from 5.93 to 7.61, indicating a slightly acidic to near-neutral groundwater conditions with no major changes before and after restoration. Total Dissolved Solids (TDS) decreased post restoration (e.g., GW-1: 7350 to 6250 mg/L; GW-3: 2686 to 2420 mg/L).

Major ions such as Sodium, Potassium, Calcium, Magnesium and Chloride generally showed slight decrease post restoration. Sulphate concentration also decreased across all sampling locations. These changes are mainly influenced by improved water infiltration, groundwater recharge potential and post monsoon recharge effects.





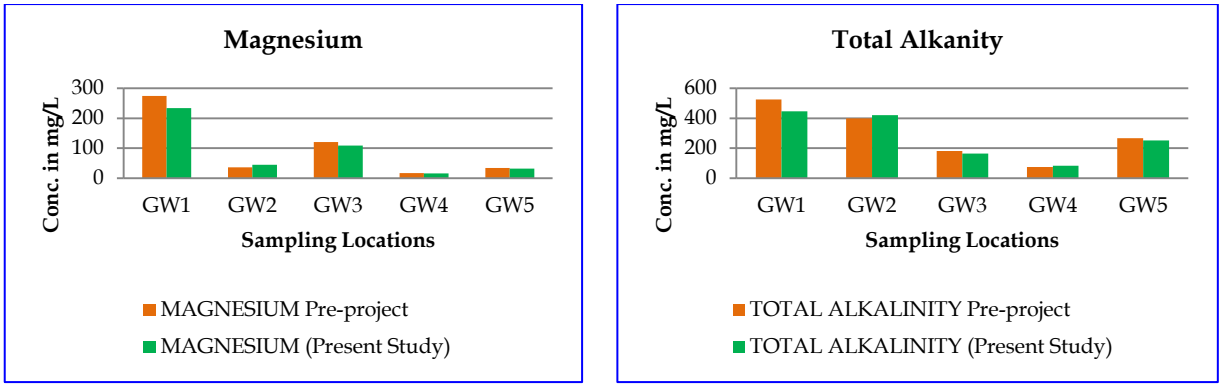


Figure 3.4: Graphical representation of ground water quality

Overall, the present scenario indicates improved groundwater quality around the restored lake area. However, a relatively higher mineral concentration at GW-1 and GW-3 was observed. Soil composition or mineral rich rock strata may contribute to the salinity in these wells.

3.3.4 Soil Environment

Soil sampling was carried out at locations around lake where baseline quality was assessed, during the pre-restoration. The details of the sampling locations, photographs taken during sampling and the analytical results are provided in Annexure V**.** The comparison of soil quality before and after restoration indicates that the lake restoration activities have influenced chemical characteristics of the soil in the study area.

The post restoration characteristics of the soil samples show decreased salinity and sodium. This may be due to the combined effect of rainfall and improved recharge capacity of the lake. Phosphorus and organic nitrogen varied in moderation, probably due to organic matter decomposition, runoff from the catchment area and microbial metabolism. Potassium and calcium levels remain relatively low when compared with ICAR recommended ranges, suggesting potential nutrient limitations that may affect agricultural productivity in the area. The physical properties of the soil including bulk density, particle density and porosity remained relatively stable during both pre- and post-restoration.

Overall, the findings suggest that lake restoration together with rainfall has improved soil salinity in the study area. Thus, the restoration appears to influence nutrient redistribution and maintenance of soil moisture in nearby lands.

3.4 Biological Environment

This section presents the status of the biological environment in terms of species diversity post restoration of the lake.

3.4.1 Aquatic Biodiversity

The lake supports a diversity of freshwater fishes including species such as *Channa striata, Channa punctata, Anabas testudineus, Labeo rohita, Mystus gulio* and others as listed in Table 1 of Annexure VI. With desilted deeper pools and improved water circulation, the aquatic environment now appears to offer better habitat conditions. Deeper water zones reduce temperature stress during summer and help maintain dissolved oxygen levels. Reduced silt load improves spawning grounds.

Fish species of economic importance such as Rohu and Catla may benefit from improved water quality and stable depth profiles. An increase in fish productivity directly supports piscivorous birds including kingfishers, cormorants and darters. Thus, the restoration promises to strengthen the aquatic food chain from primary productivity to higher trophic levels.

3.4.2 Avifaunal Enrichment

A total of 87 bird species was recorded in and around the lake during field study. These include resident species, local seasonal migrants and winter migratory visitors. The lists of birds sighted are listed in Table 2 of Annexure VI. The two mud mounds (150 m × 50 m × 3.4 m) created during de-silting have become raised zones within the lake (Figure 3.5). These may gradually evolve into microhabitats and serve as roosting sites for birds, as well as basking areas for reptiles like Bengal Monitor Lizard, Indian Flap-shelled Turtle, Garden Lizard and several skink species.

i) Wetland Birds

Species such as Purple Heron, Grey Heron, Great Egret, Little Egret, Eurasian Coot, Purple Swamphen and Pheasant-tailed Jacana depend on stable water edges for feeding and swimming. With the improved shoreline and more consistent water spread, the lake is expected to retain water for longer periods. Wading birds that depend on accessible prey in shallow zones are likely to benefit. Overall, the lake is beginning to function as a more reliable wetland habitat for birds.

ii) Waders and Migratory Visitors

Winter visitors including Green Sandpiper, Common Ringed Plover, Blyth's Reed Warbler and Barn Swallow are likely to benefit from exposed mudflats and insect-rich margins. The presence of near threatened species such as Oriental Darter

indicates that the lake supports fish, improved water quality and habitat structure. Such species are typically associated with relatively stable and functionally active wetland systems, suggesting an overall improvement in ecological conditions.

Figure 3.5: Mud mounds formed in the lake

iii) Woodland and Riparian Birds

Native species planted along the bund has enhanced habitat suitability for the following:

- Indian Golden Oriole
- Indian Paradise Flycatcher
- Sunbirds
- Babblers
- Bulbuls

As canopy development progresses, avian diversity is expected to increase.

3.4.3 Reptile Habitat

Reptilian species documented in the area include the Bengal Monitor Lizard, Indian Flap-shelled Turtle, Garden Lizard and several skink species. These reptiles depend on a combination of stable banks, basking sites (Avery, 1982 and Heatwole and Taylor (1987) and access to prey.

Bund consolidation and stone pitching have reduced erosion and embankment collapse. This creates safer basking surfaces for turtles and lizards (Avery, 1982 and Heatwole and Taylor (1987). Stable shorelines reduce the risk of burrow destruction for skinks. Increased fish and amphibian presence also improves prey availability for larger reptiles and birds. A list of reptiles sighted is in Table 3 of Annexure VI.

3.4.4 Riparian Vegetation and Plantation

A total of 1,006 trees were planted along the bund and peripheral zones, including Arjuna, Pungan, Neem, Naval, White Silk Cotton and Indian Ash. Riparian plantation contributes to:

- Soil binding and slope stability
- Microclimatic regulation
- Carbon sequestration
- Pollinator support
- Nesting and habitat creation

Species such as Arjuna are particularly beneficial in wetland margins, providing strong root systems that bind soil while supporting bird nesting. As these plantations mature, canopy development will significantly improve microclimatic conditions and enhance habitat complexity. The list of surviving tree species counted is in Table 4 of Annexure VI.

3.4.5 Structural Rehabilitation and Ecological Safety

The reconstruction of damaged sluices and repairing of the surplus weir have improved hydraulic reliability. Controlled flow reduces the risk of embankment breach which can otherwise cause sudden habitat destruction.

3.4.6 Ecological Role

The restored lake now functions as:

- Freshwater biodiversity node within an agricultural landscape
- Seasonal habitat for migratory birds
- Fish-supporting wetland system
- Groundwater recharge structure
- Micro-climate resilience buffer

Drone image comparison before and after restoration clearly demonstrates increased water spread area and structured embankments, indicating ecological revival rather than superficial improvement.

3.4.7 Ecological Recovery Indicators

The restoration of Gunduperumbedu Lake has resulted in tangible ecological benefits as below

- Improved water collection and hydro period
- Enhanced fish breeding
- Strengthened food web dynamics
- Increased bird foraging and nesting opportunities

- Stabilised reptile habitat
- Strengthened riparian vegetation structure

The lake is transitioning from a silted, partially degraded tank to a functionally resilient freshwater ecosystem.

References

- Avery, R.A. (1982). Field Studies of Body Temperatures and Thermoregulation. In: Gans, C. & Pough, F.H. (eds.), Biology of the Reptilia, Vol. 12. Academic Press, pp. 93–98.
- Heatwole, H. & Taylor, J. (1987). Ecology of Reptiles. Surrey Beatty & Sons, pp. 104–112.

3.4.8 Conclusion

The restoration and rehabilitation of Gunduperumbedu Lake demonstrates how the rejuvenation of a degrading water body can lead to beneficial ecological transformation. The integration of de-silting, bund strengthening, hydraulic renovation and plantation has improved the hydrological stability, habitat diversity and biodiversity support. The lake is transitioning from a silted, degraded seasonal tank to a functionally resilient freshwater ecosystem. Proper management and ecological monitoring will further consolidate its role as a vital environmental asset in the region.

3.5 Socio-Economic Environment

The primary survey was conducted on 24.02.2026 in the villages surrounding the Gunduperumbedu Lake falling within the immediate influence zone to assess the existing socio-economic conditions and to understand the community perception on the lake restoration.

3.5.1 Methodology

A total of 30 respondents and key stakeholders including village leaders, officials from the Water Resources Department (WRD), Panchayat representatives, school teachers, Anganwadi workers and local institutional representatives were interviewed. Photographs taken during the primary survey and stakeholder consultation are shown in Figure 3.6.

3.5.2 Sample Characteristics

A total of 30 total respondents were interviewed, of whom 19 were female and 11 were male. Agriculture and daily wage labour are the predominant sources of livelihood in the area**.** The income level of a majority of respondents varied between Rs. 5,000 and Rs. 10,000 per month.

3.5.3 Results of the Primary Survey

The results of the primary survey reflecting the post-restoration socio-economic conditions are presented below:

- A shift in cropping pattern from single crop to double crop (Irubogam) pattern due to reliable water availability resulting in increased agricultural productivity and improved income levels.
- Increased water levels in wells and bore wells.
- A noticeable increase in fish population was reported by the locals. The fishes provide both food and income to the local community.
- The strengthening of the lake bund has improved accessibility around the lake area.
- The lake water is not used for drinking purposes, with the community relying on alternative sources such as the Anjeneyar temple kulam for potable water. However, the lake is actively used for bathing, washing of clothes and livestock activities which are common practices among the local population. These activities, while beneficial for daily needs, contribute to the influx of organic contaminants into the lake and influencing its microbiological quality.

Figure 3.6 a) Photographs of household survey and Focussed Group Discussion

Figure 3.6 b) Photographs of Stakeholders Survey
WRD Assistant Engineer and Union Leader

3.5.4 Stakeholder Consultation - Observations and Suggestions

Stakeholder consultations were held through direct interactions and discussions with key stakeholders. The major observations and suggestions from the stakeholders are:

- Improved water retention capacity of the lake
- Increase in agriculture productivity
- No encroachments around the lake area
- Future scope for recreational development around the lake area
- Need for improved drinking water facilities, including installation of RO systems near existing water sources.
- Need to bring about behavioural changes among the community to prevent direct contamination of lake water. Photographs of washing activities observed in the lake shown in Figure 3.7.

Figure 3.7: Photographs of washing activities observed in the lake

Chapter 4: Environmental Audit

4.1 Anticipated Impacts versus Actual Impacts

The anticipated environmental impacts during the restoration phase were identified from the data and discussions presented in chapter 4 of pre-restoration EIA study. A comparison of the findings and observations detailed in the pre- and post-restoration reports reflects the extent to which the predicted impacts align with the actual status observed after restoration. The outcome of this exercise is captured in Table 4.1.

The significance of the post restoration benefits have been categorised on a scale of minus 5 to 5 based on the magnitude, extent, duration and importance of the changes brought about by the restoration efforts. In this scale, a rating of 5 is taken as very high benefit indicating a long-term and widespread effect on key environmental components such as water quality, biodiversity and livelihood. A rating of 4 is taken as high benefit indicating considerable environmental or socio-economic benefit. A rating of 3 is taken as moderate benefit indicating noticeable but localized benefits; while a rating of 2 is taken as low benefit indicating benefits with limited temporal influence. A rating of 1 is taken as negligible benefit indicating insignificant or no measurable deviation from baseline conditions.

Whereas on the negative side, a rating of minus 5 is taken as very high negative impact indicating significant, long-term and widespread adverse effects on the environmental quality or public health. A rating of minus 4 is taken as high negative impact indicating major adverse impacts with considerable environmental or socio-economic consequences. A rating of minus 3 is taken as moderate negative impact indicating noticeable but localized or medium-term adverse effects. A rating of minus 2 is taken as low negative impact indicating minor adverse impacts with limited influence, while a rating of –1 is taken as negligible negative impact indicating insignificant or no measurable adverse change from baseline conditions.

Table 4.1: Comparison of Anticipated and Actual Benefits

Air Environment			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
De-silting and De-weeding	Improved air quality through enhanced vegetation and reduced odour	PM_{10} and $PM_{2.5}$ levels reduced slightly compared to pre-restoration period; All air quality parameters are within NAAQS limits.	1 Negligible Benefit
	Reduction in odour due to removal of silt and weeds.	No odour issues reported during post-restoration survey.	2 Low Benefit
Planting of Native Species	Carbon sequestration / Improvement in Air Quality over time	Long-term benefits expected as vegetation matures.	3 Moderate Benefit
Noise Level			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
Habitat improvement	Conducive environment for birds and other animals	Noticeable increase in avifauna	3 Moderate Benefit
Water Environment			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
De-silting and De-weeding	Increased water storage capacity and better infiltration	Increase in storage capacity from 25.00 MCUM to 26.10 MCUM	4 High Benefit
	Improved water quality. Reduced nutrient load, lower algal bloom potential, improved infiltration and downstream water quality	Reduction in TSS, TDS and turbidity, decrease in BOD and COD and increase in DO from 3.9–4.2 to 5.8–6.2 mg/L	5 Very High Benefit

Strengthening of Embankment & Renovation of Tank Structures	Improved water level regulation and delineation of the lake boundary	Increase in storage capacity from 25.00 MCUM to 26.10 MCUM	4 High Benefit
	Improved ground water recharge	Reduction in TDS and major ions in groundwater; improved recharge conditions as observed by many among the stakeholders	**5** Very High Benefit
Influence of Inlet Channel	Contamination of the lake from runoff	High TDS, COD, BOD and coliform observed in the vicinity of the inlet channel - Potential risk during monsoon	- 4 High Negative Impact
Human Activities	Increased accessibility	Increase in Total and Faecal Coliform due to bathing and livestock activities	- 4 High Negative Impact
Land Environment			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
De-silting and De-weeding	Improved soil/sediment quality and enhanced agricultural productivity.	Reduction in soil salinity and sodium levels; improved soil moisture due to recharge; moderate variation in nutrients. Improved irrigation potential, shift towards double cropping pattern	5 Very High Benefit
	Removal of invasive species; improving land condition.	Removal of mesquites and improved land usability along bund and surrounding areas.	3 Moderate Benefit
Strengthening of Embankment and Renovation of Tank Structures	Reduced erosion and improved land stability.	Stabilized bund, reduced erosion and sediment loss, improved structural integrity of lake boundary.	4 High Benefit

Ease of Access and Biodiversity Conservation	Soil stabilization through plantation	Improved vegetation cover, root systems aiding soil binding and reduced erosion.	3 Moderate Benefit
Biological Environment			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
De-silting and De-weeding	Improved aquatic habitat and biodiversity	Presence of diverse fish species such as *Channa*, *Labeo rohita*, *Mystus* indicating improved aquatic ecosystem. Documentation of 87 bird species including resident and migratory birds	5 Very High Benefit
Strengthening of the Embankment	Better habitat for fauna and flora	Better habitat for fauna and flora	5 Very High Benefit
Renovation of Tank Structures	Improved water flow and habitat connectivity	Improved hydrological conditions supporting aquatic and riparian ecosystems.	5 Very High Benefit
Creation of Mud Heaps / Habitat Features	Development of microhabitats	Creation of mud mounds appear to be acting as roosting and nesting sites for birds and reptiles.	5 Very High Benefit
Planting of Native Species	Improved biodiversity and habitat	Plantation of native trees enhancing habitat for birds, pollinators and small fauna.	5 Very High Benefit
Socio-Economic Conditions			
Project Activity	**Anticipated Benefit**	**Actual Benefit**	**Rating**
De-silting and De-weeding	Improved water availability for irrigation and fisheries	Increased water availability; noticeable increase in fish population supporting	5 Very High Benefit

		local livelihood	
		Community still dependent on alternative sources for drinking water	1 Negligible Benefit
Strengthening of Embankment and Renovation of Tank Structures	Improved water management and reduced flood risk; increased agricultural productivity	Reduced risk of overflow and flooding; improved irrigation reliability; Shift from single crop to double crop (Irubogam);	5 Very High Benefit
	Improved Groundwater Recharge	Increase in water levels in wells and bore wells as reported by the local community.	5 Very High Benefit
Ease of Access	Improved accessibility and community use	Improved access to the lake and the surrounding	3 Moderate Benefit

The overall assessment of benefits indicates that the restoration has resulted in high positive impacts on water, biological and socio-economic environment, while air and noise impacts remain negligible. Certain localized negative impacts, particularly related to water contamination require targeted management interventions.

4.2 Environmental Management Measures implemented

The implementation status of the Environmental Management Plan (EMP) measures proposed during the pre-restoration EIA study has been assessed based on field observations, monitoring results and stakeholder interactions. Table 4.2 presents the component-wise findings recorded during the study.

Table 4.2: Environmental Management Plan (EMP) – Implementation Status

Component	Measures Suggested	Implementation Status
Air Environment	Tree plantation in catchment and along bund to act as green buffer and reduce dust levels	**Partially Implemented –** Tree plantation in the vicinity of the lake noticed during the site visit.
	Source collection of Solid Waste and avoidance of open burning in surrounding villages.	**Implemented –** No open burning was observed in the immediate vicinity of the lake. However, instances of burning were noticed upstream (Figure 4.1) near certain industrial areas; this may pose a potential risk to water quality during monsoon runoff.  **Figure 4.1: Photographs of Open Burning near industrial areas**
	Adoption of phased approach for de-silting and de-weeding to minimize	**Implemented** – De-silting has been carried out by excavating 122 pits measuring 50 m length, 30 m breadth and 0.6 m depth.

	sudden changes in water quality	
	Prevention and control of sewage inflow, industrial discharge and runoff into the lake.	**Needs Improvement –** Evidence of potential contamination from inlet channels and increased domestic usage indicates that existing control measures require a serious review by the local authorities and lake management bodies. These aspects fall beyond the scope of implementation by M/s Titan Company Private Limited.
	Finalization of dredging depth in consultation with Water Resources Department to avoid excessive sediment removal and hydrological changes.	**Implemented –** De-silting has restored the natural depth of the lake (about 3.2 m) in consultation with the officials of the Water Resources Department.
Land Environment	Utilization of an estimated 1,05,000 m^3 of dredged material/silt for strengthening of embankment, creation of mud mounds and filling of low-lying areas along the periphery	**Implemented –** Dredged material has been effectively utilized for bund strengthening and formation of mud mounds
	Adoption of safe disposal methods for removed weeds such as composting or mulching to prevent odour issues and emissions	**Implemented –** Unsafe disposal of weeds and removed shrubs were not evident during the site visit.
Biological Environment	Endemic vegetation shall be preserved as far as possible; prioritizing the protection of native species over the removal of invasive ones.	**Implemented –** Invasive species have been removed while retaining native vegetation within the lake and surrounding areas.

		 **Figure 4.2: Photographs of native trees retained along the bund**
	Native plant species shall be reintroduced for enhancing habitat suitability to support local wildlife.	**Partially Implemented –** Native plantation has been undertaken; further improvement may be planned considering the low survival rate of planted saplings. A total of 1,006 saplings were planted, of which 428 have survived indicating a survival rate of 43%.
	Creation of habitat features such as mud mounds.	**Partially Implemented –** Mud mounds measuring 150 m length, 50 m Breadth and 3.4 m depth have been created to providing suitable nesting and roosting habitats for bird species. Additional strengthening of plantation activities will enhance habitat quality and overall ecological benefits.
	Conservation of nearly threatened species *Terminalia arjuna* (Arjuna Tree) to be carried out.	**Implemented –** A total of 210 *Terminalia arjuna* have been planted as part of the restoration activities

	Plantation of vetiver grass along the lake bund for enhancing soil stability, controlling erosion and improving water quality as insisted in the NOC issued by the District Collector.	**Not Implemented** – Vetiver plantation along the strengthened bund was not observed during the site visit. Non-compliance of the order issued by a Government authority may be viewed seriously. This has to be attended to, on priority.
Social Environment	Local infrastructure such as roads and access paths shall be improved as part of the restoration project.	**Implemented** – Access to the lake has been improved through development of pathways and bund strengthening, facilitating better connectivity for local users.
	Awareness programs shall be conducted about the importance of the lake ecosystem and the benefits of restoration.	**Partially Implemented** – General awareness exists among the local community; such programs need to be organized regularly by the local body; extending them to school children in higher classes would be beneficial for the community.
	Routine inspection of tank structures and channels shall be conducted to identify maintenance needs and prevent potential structural failures.	**Not Implemented** – The tank structures were found to be damaged highlighting poor quality of civil work. Stone pitching along the bund has fallen off in some locations. These observations highlight the need for routine inspection and preventive maintenance.
	Formation of local committees for participatory lake management and decision-making	**Implemented –** A lake management committee is formed to oversee lake management activities. However, a clear SOP on Community participation and institutional framework shall be provided for effective management and decision making.
	Monitoring of benefits such as agricultural productivity, livelihood improvement and community satisfaction	The actual benefits of the restoration with respect to agricultural productivity require at least one additional year of monitoring to generate reliable data on crop yield from the farmers during both the cropping seasons post-restoration.

4.3 Audit Findings and Summary

1. Bund Integrity and Accessibility

Cracks were observed along the lake bund, which may lead to seepage and compromise structural stability. The bund, which also serves as a pathway, is covered with weeds, resulting in reduced accessibility and usability. This affects the intended function of the restored bund as a safe and functional access route for the locals. Photographs of the bund after restoration and its present status are shown in Figure 4.3.

Figure 4.3: Photographs of the bund after restoration and its present status

2. Functionality of the Tank Structures

Sluice gates were found to be rusted and not fully functional. Use of sand filled bags (Figure 4.4) for regulating water flow was observed.

Figure 4.4: Photograph showing use of sand filled bags to regulate water flow

3. Domestic Activities in the Lake

Activities such as clothes washing, bathing and livestock washing were observed, contributing to increased coliform levels and potential contamination.

4. Inlet Water Quality Concerns

Evidence of potential contamination from inlet channels poses a risk to lake water quality, particularly during monsoon.

5. Low Survival Rate of Planted Saplings

The survival rate of planted saplings was observed to be around 43%, limiting the effectiveness of the restoration.

The post-restoration assessment indicates that the project has achieved significant positive development, particularly in regard to water quality, storage capacity, ground water recharge and biodiversity enhancement. Socio-economic benefits such as improved irrigation and increased agricultural activity are also encouraging. However, certain gaps persist. These include localized water contamination risks, low survival rate of plantation done and limited awareness and monitoring mechanisms. Strengthening of pollution control measures, community engagement and long-term monitoring are essential to sustain the benefits of the restoration.

Chapter 5: Summary and Conclusion

5.1 Summary

A post restoration audit of Gunduperumbedu Lake located in Gunduperumbedu village, Sriperumbudur taluk and Kancheepuram district was carried out. Overall, the restoration process appears to have resulted in improvement across multiple aspects including hydrological, social and ecological conditions. The major observations made during the audit are summarized below.

- The volume of water in the lake has increased from 25.00 MCUM to 26.10 MCUM after restoration.
- De-silting at strategic locations in the lake is bound to improve ground water recharge. It is recommended that recharge studies shall be carried out by the concerned authorities to monitor the recharge of ground water. Also, periodic de-silting shall be carried out.
- De-silting has improved the lake water quality and is bound to provide better habitat for aquatic species. Periodic de-silting is recommended for long-term benefits of the restoration.
- The strengthening of the bund and the renovation and repair carried out in hydraulic structures such as weir and sluice gates are likely to give additional stability to the bund and reduce risks associated with seepage and erosion. However, the damaged civil works and stone pitching at present questions the quality of workmanship and the highlights the need for preventive/routine maintenance.
- The renovated weir, replacement of sluice gates carried out during restoration may help in better management of flow during floods.
- The renovated weir has been designed for effective control of discharge of water. However, the use of sand filled bags to control the flow is not an appropriate hydraulic engineering practice and has to be discouraged.
- As per land use analysis, the lake boundaries are better defined now and removal of invasive vegetation has improved the aesthetics of the area. Efforts shall be taken to maintain the same.
- Environmental parameters related to air, water and noise have improved as reflected by the analytical results. Indicative parameters such as dissolved oxygen, BOD, COD, TDS and turbidity have shown improvement post restoration.
- Increase in avifaunal activity was observed likely due to better habitat conditions.

- Response from the community in the vicinity of the lake suggests that restoration has provided extended irrigation possibility and increased water availability. As an indicator of this, the local community informed a shift in cropping pattern which has doubled.
- The lake is used for domestic and livestock-related activities such as bathing, washing of clothes and animal cleaning; however, these practices likely to contribute to organic contamination and may affect the microbiological water quality.
- To ensure the long-term benefits of the restoration identified gaps such as inlet water contamination, low plant survival, regrowth of aquatic and terrestrial weeds, preventive maintenance of tank structures and limited community engagement and institutional coordination shall be addressed.

5.2 Conclusion

The restoration of Gunduperumbedu Lake stands as a demonstration of sustainable environmental stewardship and corporate responsibility by Titan Company Private Limited. The project has delivered measurable improvements in hydrology, water quality, biodiversity and socio-economic conditions, thereby reinforcing the effectiveness of the restoration approach adopted.

From a technical perspective, the interventions such as de-silting, bund strengthening and renovation of hydraulic structures have resulted in increased storage capacity which may lead to improved groundwater recharge and efficient management of the lake for downstream uses. The positive ecological outcome includes improved aquatic habitats and increased avifaunal diversity. In addition, the socio-economic benefits such as improved irrigation reliability, increased agricultural productivity (double cropping pattern) and livelihood support have strengthened the company's engagement for the benefit of the local communities.

There is an urgent need to prepare Standard Operating Practices (SOP) including a maintenance schedule for all the initiatives undertaken. The long term success and sustainable benefits of the project will be achieved only if SOP are prepared and followed meticulously. In absence of this the long term sustainability of the tank will be at risk.

Annexures

Annexure I
Air Quality – Sampling and Result of Analysis

Sampling stations were selected in accordance with IS 5182 (P-14) 2000 and National Ambient Air Quality Standards (NAAQS, 2009) by CPCB. Accordingly, two stations were established in Guunduperumbedu and Oddankarani villages for ambient air quality monitoring; both situated within a 2 km radius as illustrated in Figure 1 and listed in Table 1. Photographs taken during ambient air quality monitoring are presented in Figure 2.

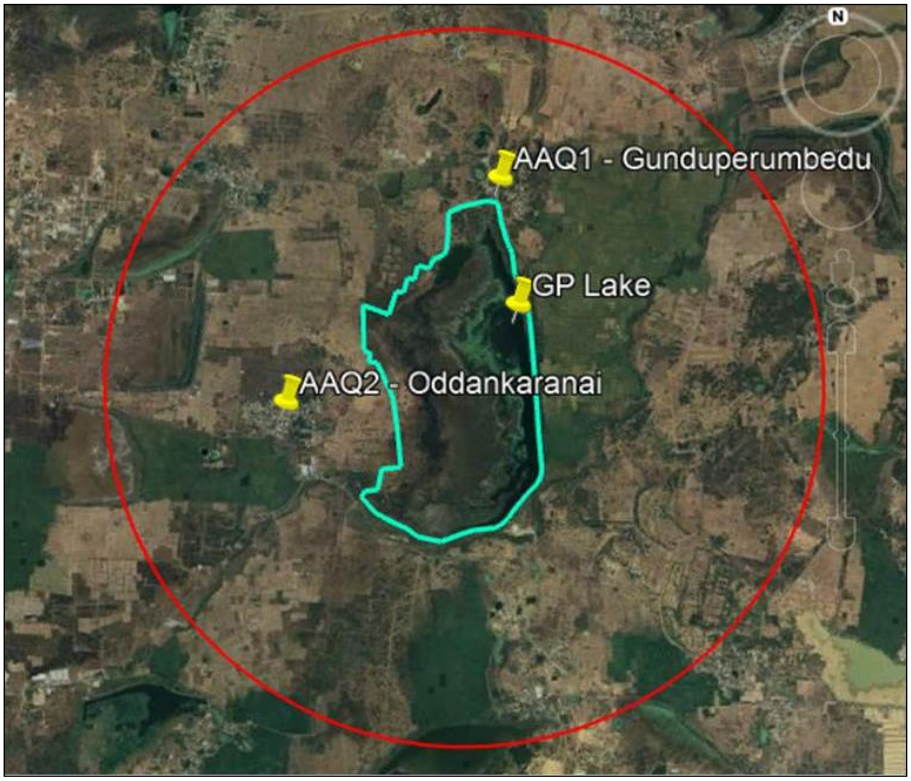


Figure 1: Ambient Air Quality Monitoring Stations

Table 1: Ambient Air Quality Monitoring Stations

Location Code	Name of the Location	Direction from Project Site	Distance from Project Site	Justification or Selection of Station
AAQ1	Gunduperumbedu Village	North (N)	0.20 km	Sensitive location due to proximity to human settlements and Residential areas
AAQ2	Oddankarani Village	West (W)	0.55 km	


Figure 3: Air Quality Sampling

The comparative results before and after restoration is presented in Table 2. All measured parameters were compared with the National Ambient Air Quality Standards (NAAQS) prescribed by the Central Pollution Control Board (CPCB, 2009).

Table 2: Comparison of Ambient Air Quality in select villages before and after Restoration

Location Code	Name of the Location	Period	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO
			($\mu g/m^3$)				(mg/m^3)
AAQ1	Gunduperumbedu village	Pre-Restoration	32.4	7.8	4.5	13.9	BDL (DL:1.14)
		Post - Restoration	30.9	7.0	4.5	12.4	BDL (DL:1.14)
AAQ2	Oddankaranai village	Pre-Restoration	41.1	10.3	6.9	16.0	BDL (DL:1.14)
		Post - Restoration	39.6	10.0	6.4	14.5	BDL (DL:1.14)
CPCB –NAAQ Standards			**100**	**60**	**80**	**80**	**4**
Method of Measurement		IS:5182					Electro-chemical Sensor Method
			Part 23	Part 24	Part 2	Part 6	

Note: BDL - Below Detection Limit; DL - Detection Limit.

Annexure II
Noise Level – Sampling and Result of Analysis

Monitoring locations were selected based on their proximity to noise sources and sensitive receptors in the area. Sampling was carried out in locations as illustrated in Figure 1 and as listed in Table 1. The photographs taken during the baseline assessment are presented in Figure 2.

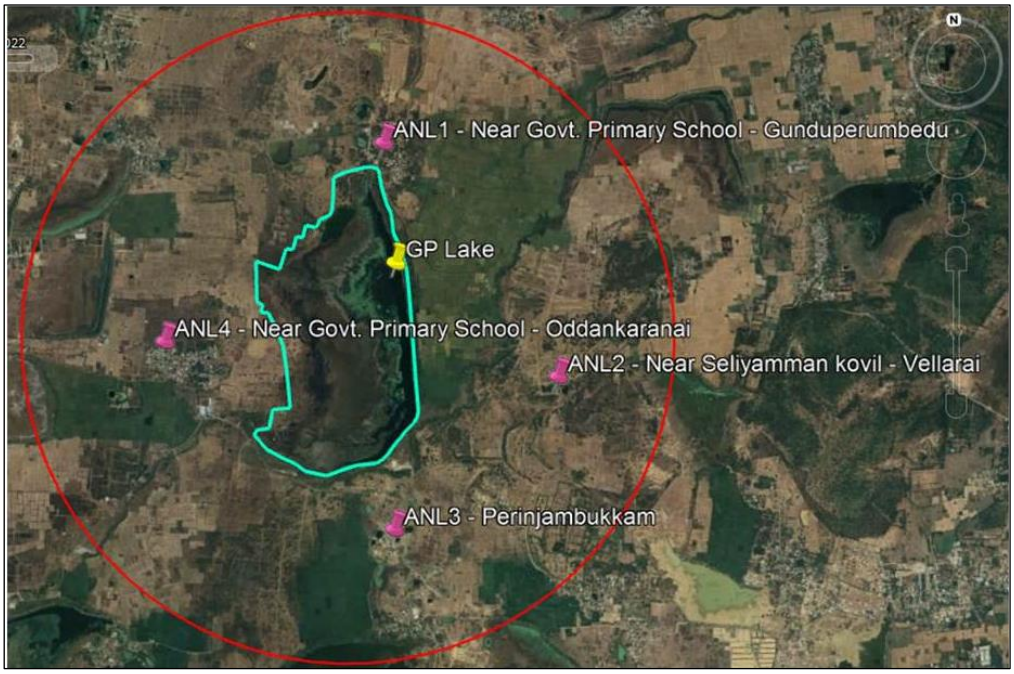


Figure 1: Ambient Noise Level Monitoring Stations

Table 1: Ambient Noise Level Monitoring Stations

Location code	Name of the Location	Direction from Lake	Distance from Lake	Category of Area/Zone
ANL1	Near Govt. Primary School - Gunduperumbedu village	North (N)	0.2 km	Silent
ANL2	Near Govt. Primary School - Vellarai	East (E)	0.9 km	Silent
ANL3	Perinjambakkam	South (S)	0.5 km	Residential
ANL4	Oddankarani village	West (W)	0.6 km	Residential


Figure 2: Noise Level Monitoring

Ambient Noise Level – Results

The comparative results of ambient noise before and after restoration are presented in Table 2, while the ambient noise quality standards prescribed under the Noise Pollution (Regulation and Control) Rules, 2000 are provided in Table 3.

Table 2: Comparison of Ambient Noise Level before and after Restoration

Location Code	Name of the Location	Noise levels in dB(A)			
		Day Time Leq		Night Time Leq	
		Pre-Restoration	Post-Restoration	Pre-Restoration	Post-Restoration
ANL 1	Near Govt. Primary School - Gunduperumbedu village	48.9	49.2	39.0	39.5
ANL 2	Near Govt. Primary School - Vellarai	47.5	49.0	39.4	39.2
ANL 3	Perinjambukkam	51.8	52.0	41.2	42.7
ANL 4	Oddankarani village	52.4	50.0	42.0	41.4
Note: Noise Levels were assessed per IS 9989: 1981 - Assessment of Noise with respect to Community Response					

Table 3: Ambient Noise Quality Standards

Category of Area	Limits in dB (A) Leq	
	Day Time (6 am – 10 pm)	**Night Time (10 pm – 6 am)**
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone*	50	40
Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, and courts.		

Annexure III

Surface Water Quality – Sampling and Result of Analysis

Water samples were collected in locations as illustrated in Figure 1 and the GPS Coordinates of the sampling locations are given in Table 1. The photographs taken during the sampling activities are presented in Figure 2. Four samples were collected from the lake (SW1 to SW4), one from the inlet channel (SW5) and another near the industrial outlet in the northwest (SW6). Sampling at location SW6 was done to rule out the possibility of effluents from the industry entering the lake.

The collected samples were analyzed in the laboratory for various physical, chemical, and biological parameters following standard analytical methods prescribed by Bureau of Indian Standards (BIS), APHA Standard Methods and other recognized analytical procedures.

Figure 1: Water Quality Sampling Locations

Figure 2a: Water Quality Monitoring at the Inflow Channel Industrial Drainage

Figure 2b: Water Quality Monitoring in the Lake

Table 1: Geographical Coordinates of Water Sampling Locations

Sample code	Sampling Location	GPS Coordinates	
		Latitude	Longitude
SW-1	South (Proximity to Solid waste dumping)	12.89672°N	79.96694°E
SW-2	East (Outfall)	12.90188°N	79.97142°E
SW-3	North East (Outfall)	12.91255°N	79.96965°E
SW-4	North West	12.91195°N	79.96698°E
SW-5	South West (Lake Inlet)	12.89996°N	79.95962°E
SW-6	South West (Industrial wastewater outlet)	12.90012°N	79.95927°E

#SW- Surface water

The water quality results are presented in Table 2 and compared with CPCB's designated best use Water Quality Criteria for Surface water.

Table 2: Comparative analysis on Surface Water Quality Pre and Post Restoration Period

Parameters	Location Code	SW-1		SW-2		SW-3		SW-4		SW-5		SW-6	
	Period/Unit	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)
Colour	Hazen	15	8	10	7	13	10	14	8	9	8	66	38
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Temperature	°C	25.9	27.6	25.9	28.1	26	27.9	26.2	27.7	26.2	28	26.5	27.7
pH @ 25°C	-	6.8	7.37	7.25	6.87	6.81	6.87	7.33	7.16	6.92	7.02	6.66	6.88
Electrical Conductivity	°C	708	548	616	534	598	456	490	458	838	770	2200	2345
Dissolved Oxygen	mg/l	4	6.1	4.2	6	4.1	6.2	4	6	3.9	5.8	3	5.5
Turbidity	NTU	7	6	1	2	3	2.2	6	2	4	4.1	13	7.1
Total Suspended Solids	mg/l	15.4	12.8	2.2	4.2	6.6	4.6	13.2	4.2	8.8	9	28	15.4
Total Dissolved Solids	mg/l	438	340	356	310	348	265	278	260	516	475	1380	1470
Ammonical Nitrogen	mg/l	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
Nitrite	mg/l	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
Nitrate	mg/l	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
Phosphorus	mg/l	0.34	0.29	0.39	0.24	1.1	0.81	0.75	0.31	0.81	0.46	1.5	0.89
Chemical Oxygen Demand	mg/l	28	19	31	14	32	16	57	18	22	16	84	40
BOD	mg/l	5	3.8	6	2.8	7	3.2	10	3.5	5	5	20	9
Sodium	mg/l	105	62	82	54	78	35	51	26	118	86	320	206
Potassium	mg/l	5.4	4.1	6.4	5	6.2	4.3	5.5	3	5.6	4.5	7.8	17
Calcium	mg/l	39	35	32	31	32	31	24	51	52	52	79	156
Magnesium	mg/l	15	13	10	13	11	8.3	7	8.3	17	14	30	50
Carbonate	mg/l	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Bicarbonate	mg/l	170	145	129	133	113	117	162	121	186	197	157	251
Chloride	mg/l	129	109	110	94	93	76	61	73	151	150	189	332
Sulphate	mg/l	22	25	26	29	45	32	22	19	46	42	639	548
Fluoride	mg/l	0.54	0.64	0.61	0.37	0.54	0.3	0.61	0.36	0.9	0.56	3.8	1.03
Boron	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
Dissolved Iron	mg/l	0.2	0.25	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	0.32	0.16	0.35	0.2
Total coliform	MPN/100ml	170	240	140	210	120	170	130	140	150	140	280	210
Faecal coliforms	MPN/100ml	21	34	26	26	21	20	17	17	25	21	84	31

Annexure IV
Ground Water Quality – Sampling and Result of Analysis

The sampling locations are highlighted in the satellite imagery shown in Figure 1 and the geographical coordinates are provided in Table 1. The groundwater quality was evaluated by analysing various physicochemical and bacteriological parameters in accordance with IS 3025 and APHA (24th Edition) standard methods.

Figure 1: Ground Water Sampling Locations

Table 1: Geographical Coordinates of Ground Water Sampling Locations

S. No.	Sample code	Location	GPS Coordinates	
			Latitude	Longitude
1	GW-1	Thathanoor Village	12.902004°N	79.958834°E
2	GW-2	Perinjambakkam Village	12.894208°N	79.976618°E
3	GW-3	Near Gunduperumedu Lake	12.914900°N	79.969970°E
4	GW-4	Kolathur Village	12.921154°N	79.982048°E
5	GW-5	Gunduperumedu OHT Borewell Water	12.915752°N	79.969466°E

#GW – Ground Water

The Ground Water Quality results are presented in Table 2 and compared with Drinking Water Quality Standards.

Table 2: Comparative analysis on Ground Water Quality Pre and Post Restoration Period

S.No.	Parameters	Location Code	GW-1		GW-2		GW-3		GW-4		GW-5	
		Period	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)
		Unit										
1	Colour	Hazen	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH @ 25°C	-	7.41	7.41	7.27	7.61	6.33	6.21	5.93	5.95	7.05	6.64
4	Electrical Conductivity @ 25°C	°C	12255	10420	1595	1560	4688	4220	1129	990	2674	2514
5	Turbidity	NTU	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
6	Total Dissolved Solids	mg/l	7350	6250	940	760	2686	2420	664	550	1576	1482
7	Nitrite as NO_2	mg/l	BDL(DL:0.5)	BDL(DL:0.1)	BDL(DL:0.5)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
8	Phosphate as PO_4	mg/l	0.22	0.18	0.78	0.41	BDL(DL:0.01)	BDL(DL:0.01)	0.06	BDL(DL:0.01)	0.32	0.3
9	Chemical Oxygen demand	mg/l	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)
10	Biochemical oxygen Demand	mg/l	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
11	Sodium as Na	mg/l	269	230	178	118	317	285	49	34	184	172
12	Potassium as K	mg/l	27	24	19	9.2	33	30	5	2	19	17.8
13	Calcium as Ca	mg/l	461	392	49	30	336	302	45	31	146	137
14	Magnesium as Mg	mg/l	274	234	37	45	121	109	17	16	34	32
15	Total Alkalinity as CaCO3	mg/l	525	446	399	422	182	164	76	84	268	252
16	Carbonate as CO_3	mg/l	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
17	Bicarbonate as HCO_3	mg/l	525	446	399	422	182	164	76	84	268	252
18	Chloride as Cl	mg/l	463	394	300	210	534	482	86	66	307	288
19	Sulphate as SO_4	mg/l	5524	4696	95	84	1215	1094	395	342	705	662
20	Fluoride as F	mg/l	1.72	1.46	1.44	1.33	1.18	1.06	0.72	0.69	1.18	1.1
21	Boron as B	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
22	Iron as Fe	mg/l	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)	BDL(DL:0.08)
23	Total coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
24	*Faecal coliforms*	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Annexure V
Soil Quality – Sampling and Result of Analysis

Soil sampling was carried out at locations around lake where baseline quality was assessed, during the pre-restoration EIA study in order to assess variations in soil quality and to do a comparative analysis. The details of the sampling locations are highlighted in the Satellite Imagery in Figure 1 and the geographical coordinates are given in Table 1. The collected soil samples were analysed for various physico-chemical parameters as per the standard methods. The photographs taken during soil sampling are presented in Figure 2.

Figure 1: Soil Sampling Locations

Table 1 : Geographical Coordinates of Soil Sampling Locations

S. No.	Sample code	Location	Geographical Coordinates	
			Latitude	Longitude
1	SQ-1	South West (Inlet of the Lake)	12.89886°N	79.96294°E
2	SQ-2	West (Center of the Lake)	12.90322°N	79.96758°E
3	SQ-3	North West	12.91171°N	79.96644°E
4	SQ-4	East (Agricultural Land)	12.91138°N	79.97159°E

The soil quality results are presented in Table 2 and compared with ICAR Soil Health Assessment Standards.

Figure 3.20: Photographs of Soil Sampling

Table 2: Comparative analysis on Soil Quality Pre and Post Restoration Period

S.No.	Parameters	Location Code	SQ-1		SQ-2		SQ-3		SQ-4		ICAR SOIL HEALTH ASSESSMENT STANDARDS
		Period	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	Pre-project	Post-project (Present Study)	
		Unit									
1	pH	-	7.48	7.38	6.15	4.89	5.05	4.98	5.11	5.91	5.0 – 8.0
2	Electrical Conductivity	umhos/cm	7291	4304	1604	248	79	162	116	294	<4000
3	Available Phosphorous as P	mg/kg	12.7	11.3	10.8	13.5	10.1	17	16.8	15.2	10 - 30
4	Sodium as Na (Soluble)	mg/kg	1730	1261	198	40	32.2	18	18.2	42	200- 500
5	Potassium as K(Soluble)	mg/kg	14	13	16	5.4	10.5	4.4	11.3	6.7	150-250
6	Calcium as Ca (Soluble)	mg/kg	235	171	31.6	17	41.3	9.2	22	22.6	1000-2000
7	Magnesium as Mg (Soluble)	mg/kg	256	140	31.8	7.9	4.8	4.7	7.2	11	100-300
8	Organic Nitrogen	mg/kg	254	396	940	454	3720	996	1880	690	--
9	Organic Carbon	%	0.14	0.2	0.48	0.29	1.97	1.1	0.99	0.64	0.5-0.75
10	Cation Exchange Capacity (CEC)	meq/100g	10.9	26	1.45	13.2	0.5	20	0.35	17.2	--
11	Bulk Density	g/cm^3	1.42	1.39	1.38	1.4	1.18	1.23	0.95	1.02	--
12	Particle Density	g/cm^3	2.65	2.62	2.63	2.65	2.61	2.61	2.6	2.62	--
13	Porosity	%	46.4	46.8	47.5	47	54.8	53	63.5	61	--
14	SAR	meq/100g	5.88	5.5	1.88	0.64	0.4	0.39	0.27	0.58	<10
15	**Soil Texture**		Loam	Sandy Loam	Loam	Loam	Sandy Loam	Sandy Loam	Loam	Loam	--
	Clay	%	21.9	19	24.3	20	11.2	10	21.3	16	--
	Silt	%	30.9	27	29.9	32	32.8	38	28.6	32	--
	Sand	%	47.2	54	45.8	48	56	52	50.1	52	--

Note: ICAR SOIL STANDARDS - Assessment of Soil Health and Preparation of Soil Health Card ICAR-Indian Institute of Soil Science Nabi Bagh, Berasia Road, Bhopal -462038 (M.P.)

Annexure VI
List of Flora and Fauna

Primary survey of Flora and Fauna in the lake and its immediate surrounding was done and the list of fishes, avifauna, reptiles and the native plant species observed are listed in Table 1, Table 2, Table 3 and Table 4, respectively.

Table 1: List of fishes observed in the Gunduperumbedu Lake

S.No	Scientific Name	Vernacular Name	IUCN Category
1	*Anabas testudineus*	Panangkottai meen	LC
2	*Channa punctata*	Koravai	LC
3	*Channa striata*	Viral meen	LC
4	*Chanos chanos*	Kulla kendai	LC
5	*Ctenopharyngodon idella*	Kulla kendai	LC
6	*Cyprinus carpio*	Kendai	VU
7	*Glossogobius giuris*	Ulluvai	LC
8	*Labeo catla*	Korangu kendai	LC
9	*Labeo rohita*	Rogu kendai	LC
10	*Mystus gulio*	Keluthi	LC
11	Oreochromis mossambicus	Jilebi	LC
12	Oreochromis niloticus	Jilebi	LC
VU – Vulnerable, LC – Least Concerned			

The lists of birds observed are tabulated in the Table 2.

Table 2: List of Avifaunal assemblages observed in the Gunduperumbedu Lake

S.No	Scientific Name	Common Name	IUCN Category
1	*Lonchura punctulata*	Scaly-breasted Munia	LC
2	*Ardea purpurea*	Purple Heron	LC
3	*Ardea cinerea*	Grey Heron	LC
4	*Accipiter badius*	Shikra	LC
5	*Milvus migrans*	Black Kite	LC
6	*Haliastur indus*	Brahminy Kite	LC
7	*Alcedo atthis*	Common Kingfisher	LC
8	*Halcyon smyrnensis*	White-throated Kingfisher	LC
9	*Merops orientalis*	Asian Green Bee-eater	LC
10	*Merops philippinus*	Blue-tailed Bee-eater	LC

11	*Coracias benghalensis*	Indian Roller	LC
12	*Dinopium benghalense*	Black-rumped Flameback	LC
13	*Psittacula krameri*	Rose-ringed Parakeet	LC
14	*Lalage melanoptera*	Black-headed Cuckooshrike	LC
15	*Dendrocygna javanica*	Lesser Whistling Duck	LC
16	*Anas poecilorhyncha*	Indian Spot-billed Duck	LC
17	*Tachybaptus ruficollis*	Little Grebe	LC
18	*Columba livia*	Rock Pigeon	LC
19	*Spilopelia chinensis*	Spotted Dove	LC
20	*Centropus sinensis*	Greater Coucal	LC
21	*Clamator coromandus*	Chestnut-winged Cuckoo	LC
22	*Clamator jacobinus*	Pied Cuckoo	LC
23	*Eudynamys scolopaceus*	Asian Koel	LC
24	*Hierococcyx varius*	Common Hawk-Cuckoo	LC
25	*Cypsiurus balasiensis*	Asian Palm Swift	LC
26	*Apus affinis*	Little Swift	NT
27	*Lewinia striata*	Slaty-breasted Rail	LC
28	*Gallinula chloropus*	Eurasian Moorhen	LC
29	*Fulica atra*	Eurasian Coot	LC
30	*Porphyrio poliocephalus*	Purple Swamphen	LC
31	*Amaurornis phoenicurus*	White-breasted Waterhen	LC
32	*Oriolus kundoo*	Indian Golden Oriole	LC
33	*Artamus fuscus*	Ashy Woodswallow	LC
34	*Aegithina tiphia*	Common Iora	LC
35	*Dicrurus macrocercus*	Black Drongo	LC
36	*Dicrurus leucophaeus*	Ashy Drongo	LC
37	*Terpsiphone paradisi*	Indian Paradise Flycatcher	LC
38	*Lanius cristatus*	Brown Shrike	LC
39	*Corvus splendens*	House Crow	LC
40	*Corvus macrorhynchos*	Large-billed Crow	LC
41	*Orthotomus sutorius*	Common Tailorbird	LC
42	*Prinia sylvatica*	Jungle Prinia	LC
43	*Prinia socialis*	Ashy Prinia	LC
44	*Prinia inornata*	Plain Prinia	LC
45	*Acrocephalus dumetorum*	Blyth's Reed Warbler	LC
46	*Hirundo rustica*	Barn Swallow	LC
47	*Pycnonotus luteolus*	White-browed Bulbul	LC

48	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC
49	*Pycnonotus cafer*	Red-vented Bulbul	LC
50	*Burhinus indicus*	Indian Thick-knee	LC
51	*Vanellus indicus*	Red-wattled Lapwing	LC
52	*Charadrius hiaticula*	Common Ringed Plover	LC
53	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	LC
54	*Metopidius indicus*	Bronze-winged Jacana	LC
55	*Tringa ochropus*	Green Sandpiper	LC
56	*Gelochelidon nilotica*	Gull-billed Tern	LC
57	*Anastomus oscitans*	Asian Openbill	LC
58	*Anhinga melanogaster*	Oriental Darter	NT
59	*Microcarbo niger*	Little Cormorant	LC
60	*Phalacrocorax carbo*	Great Cormorant	LC
61	*Phalacrocorax fuscicollis*	Indian Cormorant	LC
62	*Ixobrychus flavicollis*	Black Bittern	LC
63	*Nycticorax nycticorax*	Black-crowned Night Heron	LC
64	*Egretta garzetta*	Little Egret	LC
65	*Ardeola grayii*	Indian Pond Heron	LC
66	*Bubulcus coromandus*	Eastern Cattle Egret	LC
67	*Ardea alba*	Great Egret	LC
68	*Ardea intermedia*	Medium Egret	LC
69	*Phylloscopus trochiloides*	Greenish Warbler	LC
70	*Dumetia hyperythra*	Tawny-bellied Babbler	LC
71	*Argya affinis*	Yellow-billed Babbler	LC
72	*Gracupica contra*	Indian Pied Starling	LC
73	*Acridotheres tristis*	Common Myna	LC
74	*Muscicapa dauurica*	Asian Brown Flycatcher	LC
75	*Copsychus fulicatus*	Indian Robin	LC
76	*Copsychus saularis*	Oriental Magpie-Robin	LC
77	*Saxicola caprata*	Pied Bushchat	LC
78	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	LC
79	*Leptocoma zeylonica*	Purple-rumped Sunbird	LC
80	*Cinnyris asiaticus*	Purple Sunbird	LC
81	*Cinnyris lotenius*	Loten's Sunbird	LC
82	*Lonchura malacca*	Tricolored Munia	LC
83	*Gymnoris xanthocollis*	Yellow-throated Sparrow	LC
84	*Motacilla maderaspatensis*	White-browed Wagtail	LC
85	*Ploceus philippinus*	Baya Weaver	LC

86	*Anthus rufulus*	Paddyfield Pipit	LC
87	*Turdoides striata* *(Argya striata)*	Jungle Babbler	LC
88	*Plegadis falcinellus*	Glossy Ibis	NT
LC – Least Concerned, NT– Near Threatened			

White-throated Kingfisher (*Halcyon smyrnensis*)

Flock of Cotton Pygmy Geese (*Nettapus coromandelianus*)

Little Grebe (T*achybaptus ruficollis*)

Little Egret (*Egretta garzetta*)

Black-headed Ibis (*Threskiornis melanocephalus*)

White-browed Wagtail (*Motacilla maderaspatensis*).

Figure 1: Avifauna observed in the Gunduperumbedu Lake

Table 3: List of Reptiles observed in the Gunduperumbedu Lake

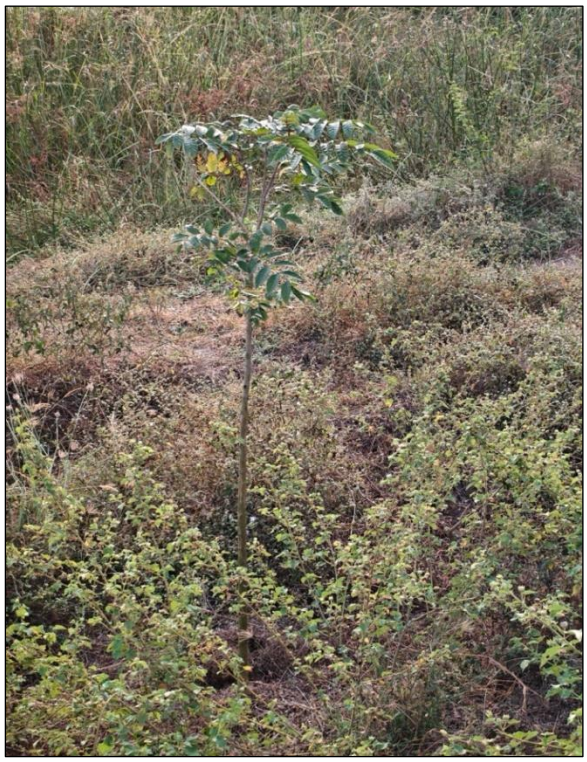
S.No	Scientific Name	Common Name	IUCN Category
1	*Varanus bengalensis*	Bengal Monitor Lizard	LC
2	*Lissemys punctata*	Indian Flap-shelled Turtle	LC
3	*Eutropis carinata*	Common Indian Skink	LC
4	*Eutropis macularia*	Bronze Grass Skink	LC
5	*Lygosoma punctatum*	Snake Skink	LC
6	*Calotes versicolor*	Oriental Garden Lizard	LC
7	*Sitana ponticeriana*	Fan-throated Lizard	LC
8	*Hemidactylus spp.*	Common House Gecko	NE
LC – Least Concerned, NE- Not Evaluated			

Table 4: List of plant species observed in the Gunduperumbedu Lake

S.No	Scientific Name	Common Name	IUCN Category
1.	*Annona squamosa*	Custard Apple	LC
2.	*Bauhinia racemosa*	Bidi Leaf Tree	LC
3.	*Borassus flabellifer*	Palmyra	LC
4.	*Ehretia pubescens*	Long Coriander	LC
5.	*Ficus racemosa*	Country Fig	LC
6.	*Pleiospermium alatum*	Winged Naringi	LC
7.	*Pongamia pinnata*	Indian Beech	LC
8.	*Senna auriculata*	Tanner's Cassia	LC
9.	*Senna siamea*	Siamese Senna	LC
10.	*Walsura trifoliata*	Three-Leaf Walsura	LC
11.	*Ziziphus jujuba*	Bel	LC
12.	*Terminalia catappa*	Indian Almond	LC
13.	*Albizia lebbeck*	Indian Siris Tree	LC
14.	*Artabotrys hexapetalus*	Ylang-ylang vine	LC
15.	*Sesbania sesban*	Common Sesban, River Bean	LC
16.	*Ficus hispida*	Opposite leaf Fig	LC
17.	*Calophyllum inophyllum*	Alexandrian Laurel	VU
18.	*Psidium guajava.*	Kadam Tree	LC
19.	*Calotropis gigantea*	Erukku Plant	LC
20.	*Syzygium cumini.*	Naval Tree	LC
LC – Least Concerned, VU - Vulnerable			

Alexandrian Laurel
(Calophyllum inophyllum)

Kadam Tree
(Psidium guajava)



African mahogany
(Swietenia macrophylla)

Common Sesban / River Bean
(*Sesbania sesban)*

Figure 2: Plant species observed in the Gunduperumbedu Lake