

Tamil Nadu Sustainably Harnessing Ocean Resources and Blue Economy (TN-SHORE)

(with the financial support from the World Bank)

Environment and Social Management Plan

for

Blue Flag Beach Certification of Marina Beach, Chennai



July, 2024

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Environmental and Social Management Plan

Executive Summary

The Environment and Social Management Plan (ESMP) for the Blue Flag Beach Certification of Marina Beach, Chennai, has been developed as part of the Tamil Nadu Sustainably Harnessing Ocean Resources and Blue Economy (TN-SHORE) project. This initiative, supported by the World Bank, aims to enhance the resilience and sustainable utilization of coastal resources by integrating various sectors to promote a resilient and circular blue economy, empower local livelihoods, and enhance environmental governance.

The ESMP follows a thorough Environmental and Social Due Diligence (ESDD) that identified potential environmental and social impacts associated with the development activities at Marina Beach. The plan outlines a comprehensive strategy to mitigate these impacts while ensuring sustainable development practices that adhere to both national and international standards, focusing on preserving ecological integrity, promoting community safety, and enhancing visitor experience.

Key components of the ESMP include detailed strategies for managing pollution, developing sustainable infrastructure, safeguarding human health and safety, ensuring inclusive benefits for community groups with a focus on gender equity, and preparing for natural and anthropogenic hazards through an elaborate disaster management plan. The plan also emphasizes stringent waste management protocols, advanced technological solutions, and rigorous management practices to minimize environmental impacts and enhance safety measures.

Additionally, the ESMP includes a robust monitoring and evaluation system to assess the effectiveness of the mitigation measures and adapt strategies as necessary. This ensures that the project not only aims to achieve Blue Flag certification but also sets a benchmark for sustainable coastal management, integrating ecological preservation with economic and social development.

Through adherence to the outlined measures and promoting continuous improvement, Marina Beach is set to become a model of sustainable development. This initiative will contribute positively to the broader goals of Tamil Nadu's sustainable growth, setting a precedent for environmental and social governance in coastal management.

1.0 Project Overview and Findings of ESDD

1.1 Project overview

The Government of Tamil Nadu has launched a project entitled Tamil Nadu - Sustainably Harnessing Ocean Resources and Blue Economy (TN – SHORE) with partial funding support from the World Bank. The project aims to enhance the resilience and sustainable utilization of coastal resources through a multi-pronged approach. It envisions a holistic integration of various sectors to drive a resilient and circular blue economy, empower local livelihoods, and enhance capacities for a greener future. One of the sub-projects identified is obtaining Blue Flag Programme for Marina Beach, Chennai.

The Blue Flag Programme, an esteemed international eco-label, is dedicated to promoting sustainable development in freshwater and marine areas. It has garnered recognition for its rigorous standards that integrate environmental management, water quality, safety, and environmental education. This holistic approach has been instrumental in promoting synergy between the tourism and environmental sectors at various levels, from local to national.

In alignment with its commitment to environmental sustainability and tourism development, the Government of Tamil Nadu has embarked on an ambitious initiative to attain Blue Flag certification for ten select beaches under the Beach Environment & Aesthetics Management Services (BEAMS) programme. Marina Beach, is one of the selected beaches for this esteemed certification.

1.2 Objective and context of ESMP

The main objective of an ESMP is to list out the mitigation measures for potential negative impacts of various sub-project activities and designate responsible entities for the same. An ESDD to understand the likely environmental and social impacts and risks has been prepared. Based on the outcome of the ESDD, an Environmental and Social Management Plan (ESMP) to deal with issues and appropriate mitigation measures to address the impacts is prepared for each of the sub-project activities.

The perspective of a management plan is the outcome of the ESDD exercise carried out for the sub-project activities. The ESDD indicated potential effects on the baseline social and environmental nature of the project area. Although targeted at achieving environmental management, water quality, safety, and environmental education through sustainable development, the

project includes various construction activities to create permanent fixtures in the zone. A separate ESMP is therefore required for each of the sub-project activities.

An ESMP for an eco-labelled beach is a document that specifies the actions that will be taken to reduce the environmental and social effects of a project. It is a crucial tool for making sure that beach development is sustainable and that the requirements of the neighbourhood are taken into account.

The potential environmental and social impacts of the beach development project should be assessed, and subsequent mitigation strategies should be defined in this management plan. To achieve this, a monitoring and evaluation plan is necessary to track the effectiveness of the mitigation measures. This plan should also consider engaging the local community and addressing their concerns related to the Marina Beach development activities.

The environmental and social impacts due to beach development have been considered in ESMP for the Marina Beach Blue Flag Beach development and operation including the major ones identified in the ESSD which are described below. It is to be noted that the beach is operational except during the monsoon months of October-December.

1. Impacts on Environmental quality: Beach development and usage will generate solid waste and a mechanism has to be developed to deal with solid waste pollution. Spillage from the Bio-digester unit can contaminate the ground water and to be dealt meticulously.

2. Impacts on Human health and safety: The labour involved in the establishment of facilities may be exposed to bacterial contamination while dealing with clearance of solid waste and cleaning the toilets. Further, the visitors, are exposed to pathogenic bacterial contaminated seawater when they wet their legs in the seawater. The source of contamination is flow from the adjoining Cooum river in the months of January and February. Further, freak waves occurring occasionally and rip currents can lead to drowning of human in contact and at times death.

3. Impacts on the Gender: Labour and visitors may be subjected gender-based violations which is serious violation of human rights, sexual harassments, protection issues, etc.

1.3 Sub-Project Description

Located in Chennai City, Tamil Nadu, the Marina Beach (Figure 1) is a coastal marvel that stretches approximately 12 km, making it the longest beach in India and the second longest in the world. Extending from Besant Nagar in the south to Fort St. George in the north, the beach is renowned for its vast expanse of sandy shoreline. The beach's width varies between 300 and 437 meters for infrastructure development, while the intertidal zone spans about 30 meters. Geographically, the beach is positioned between 13° 3' 36.568" N and 80° 17' 12.723" E, covering a total area of 0.87 sq.km. Of this, a designated area of 0.14 sq. km (143,000 sq. m) is designated for the proposed infrastructure development (Figure 2). Marina Beach is a popular destination, attracting an average of 30,000 visitors on weekdays and up to 50,000 visitors on weekends and public holidays.

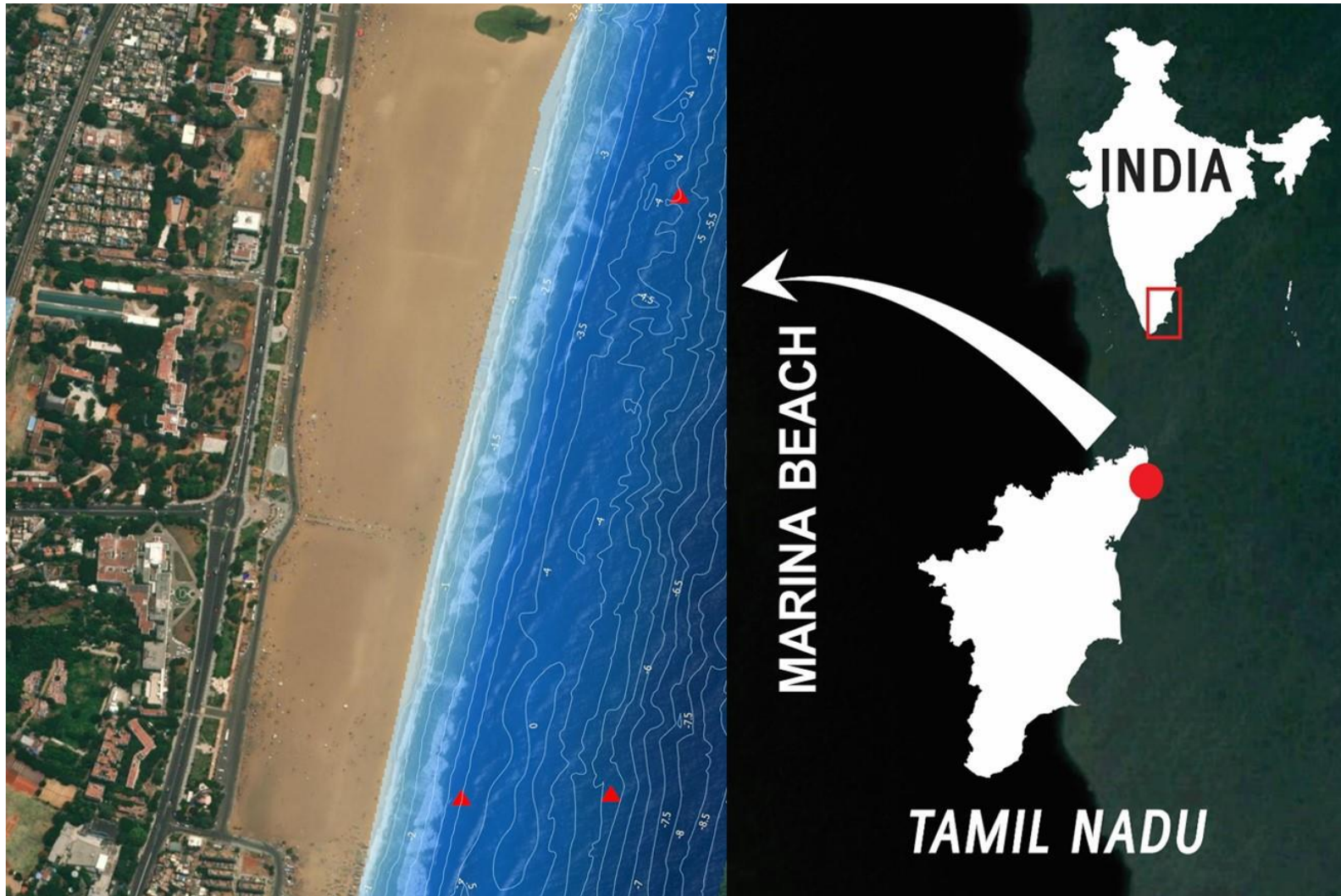


Fig. 1: Location of Marina Beach, Chennai, Tamil Nadu for Proposed Blue Flag Beach Development



Fig.2 Proposed zonation for Blue Flag Certification area

1.4 Proposed Interventions/ Activities and Intended Outcomes

The Marina Beach Blue Flag project encompasses a comprehensive suite of interventions and activities aimed at enhancing the environmental, social, and economic aspects of the beach. These are designed to meet the stringent criteria required for Blue Flag certification, thereby ensuring the sustainable development of the beach area. The proposed interventions are categorized into the following areas:

I. Pollution Abatement Services:

- a. **Site-Specific Interventions:** Implementation of targeted measures to address and mitigate pollution sources, including beach litter, debris, plastics, solid waste, and wastewater.
- b. **Mechanized Beach Cleaning:** Utilization of walk-behind machines for efficient and regular cleaning of the beach to maintain high cleanliness standards.
- c. **Wastewater Management:** Installation of BIO-Digester/BIO-Tank Units, including Grey Water Treatment Plants and Fluidized Aerobic Bio-Reactors, to treat and manage wastewater effectively.
- d. **Solid Waste Management Plan:** Development and execution of a comprehensive plan for the collection, segregation, recycling, and disposal of solid waste generated on the beach.

II. Infrastructure Facilities Development:

- a. **Beach Planning and Zoning:** Strategic planning and zoning of Marina beach area to optimize usage and minimize environmental impact.
- b. **Infrastructure Development:** Construction of essential facilities such as toilet blocks, changing rooms with shower panels, bamboo-made items and structures (e.g., seating benches, umbrellas), a 40 KW solar power plant, purified drinking water facilities, LED landscape lighting, beach access pathways, and an amphibious wheelchair.
- c. **Safety and Information Infrastructure:** Installation of beach safety and information flags, a CCTV system, a control room, a site office, water rescue equipment, first aid and safety equipment, environment education displays, do's and don'ts kiosks, and a beach layout map and information board.

III. Environmental Education Events:

Organization of events and activities aimed at raising awareness and educating visitors and the local community about environmental conservation and sustainable practices.

IV. Data Collection for Blue Flag Criteria Compliance:

- a. **Pre-Field Screening:** Initial assessment to identify potential environmental and social issues.
- b. **Beach Suitability Assessment Survey (BSAS):** Comprehensive survey covering parameters such as geology, geomorphology, ecosystem, pollution, socio-economic factors, facilities, and other relevant issues.
- c. **Preparation of Geomorphological & CRZ Maps:** Creation of detailed maps to understand and manage the coastal zone effectively.
- d. **Ecology/Environmental Evaluation and Impact Assessment:** Assessment of the ecological and environmental impacts of the proposed interventions.
- e. **Safety & Risk Assessment:** Analysis of bathymetry, wave studies, currents, and biodiversity impact to ensure the safety of beachgoers.
- f. **Beach Water Quality Testing (BWQT):** Regular monitoring of beach water quality for physical, chemical, and biological contamination.

V. Obtaining Blue Flag Beach Certification:

Completion of all necessary steps and fulfilment of the 33 criteria stipulated for Blue Flag certification. The implementation of these interventions is expected to result in the following outcomes:

- a. **Enhanced Cleanliness:** Achieving an "A++ Category (Outstanding)" cleanliness level for the newly developed Blue Flag beach.
- b. **Biodiversity Conservation:** Effective mechanisms to be in place to protect and conserve beach vegetation and associated biodiversity.
- c. **Marine Litter Reduction:** Reduction of marine litter by 80% to 85% from existing levels, with conversion/safe disposal mechanisms for marine litter.
- d. **Water Quality Monitoring:** Regular monitoring and maintenance of bathing water quality to ensure safety and hygiene.

- e. Safe Recreational Areas:** Clear demarcation of safe areas for bathing, swimming, and other recreational activities.
- f. Economic Development:** Income generation and livelihood development for local communities through enhanced tourism and the development of eco-labelled beach recreational facilities of international standards.
- g. Increased Visitor Numbers:** Over 200% increase in visitors for beach recreational activities, leading to revenue generation and alternate livelihoods for local fishermen communities.

These interventions and outcomes are aligned with the SDGs and are aimed at establishing Marina Beach as a model of sustainable and responsible coastal tourism.

1.5 ESDD findings and key impacts to be addressed

ESDD provides details on screening carried out to assess the environmental and social impacts likely to occur. The ESDD has analysed the E & S impacts arising due to the planned activities and it was found that the activities lead to low to moderate E&S impacts. The screening of potential activities associated with the Blue Flag certification of Marina Beach has identified few environmental and social risks and impacts that need to be addressed. These are summarised below:

1. Environmental Risks and Impacts:

- i. Pollution and Hazards Due to Storage and Wastes:** The management of waste and storage of materials during construction may pose environmental hazards if not properly handled.
- ii. Leakage from the Bio-digester unit can cause ground water pollution and release of Gas can harm the person maintaining the unit.**

2. Social Risks and Impacts:

- i. Gender:** The project should consider the gender-specific impacts and ensure equitable participation and benefits for both men and women. It would strictly ensure non-prevalence of Gender based violations
- ii. Labour, OHS and HS:** The influx of labour during construction should be managed to ensure fair working conditions and minimize social disruptions.

3. Environmental and Social Standards:

These are a set of ten benchmarks set by the World Bank for achieving a minimal social and environmental standard during project execution. They ensure inclusion of good management practices of international/national standard to achieve sustainability, good governance, accountability, inclusiveness and transparency. These Environmental and Social Standard (ESS) are

ESS 1: Assessment and Management of Environmental and Social Risks and Impacts;

ESS 2: Labour and Working Conditions;

ESS 3: Resource Efficiency and Pollution Prevention and Management;

ESS 4: Community Health and Safety;

ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;

ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;

ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;

ESS 8: Cultural Heritage;

ESS 9: Financial Intermediaries; and

ESS 10: Stakeholder Engagement and Information Disclosure.

The following ESS categories are relevant and suggested mitigation measures.

Table: ESS Applicability analysis and recommended management measures/plans

ESS	Recommended Management Plans	Applicability
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Precautionary steps to avoid environmental damages while carrying out all the activities and briefing the people involved on non-engagement of Gender-based violence or Harassment Safety from waves: Warning boards for occasional freak waves. Signage for rip currents, uneven terrain. Watch towers and trained lifeguards stationed across the designated area. The safe bathing zone is demarcated well with the aid of visible lines and buoys. First-aid kit, safety gears for swimming.	Applicable
ESS2: Labour and Working Conditions	Adopting labour management rules and instructions to prevent Occupational Health issues and adopting safety norms especially to avoid injuries while using manual or electric tools; Promoting gender equality and also preventing GBV	Applicable
ESS3: Resource Efficiency, Pollution Prevention and Management	Adopting prescribed solid waste management practices including disposing of solid wastes at designated places Polluted seawater: Regular water quality monitoring and display of results in the beach information board. Managing waste from beachgoers, as well as potential runoff from nearby sources of pollution. Gas and Liquid leakage from Bio-digestor unit to be checked and arrested at the earliest. Use of solar-based power to improve energy conservation	Applicable
ESS 4: Community Health and Safety	Cultural and social environment is included in the baseline details, for proper monitoring and assessment in the DPR document (Environmental and Social Safeguards Monitoring Plan)	Applicable
ESS 5: Land Acquisition, Restrictions on Land use and Involuntary Resettlement	The project is in an area that is under the control of the Government and land acquisition is not involved. There is no resettlement required for the execution of the project.	Not Applicable

ESS	Recommended Management Plans	Applicability
ESS 6: Biodiversity conservation and Sustainable Management of Living Natural resources	The project area does not fall within any Environmentally Sensitive Area.	Not applicable
ESS 7: Indigenous Peoples Historically Underserved Tradition Local Communities	No indigenous people or tribal live in the area	Not Applicable
ESS 8: Cultural Heritage	Cultural sites are located far away from the mangrove areas	Not Applicable
ESS 9: Financial Intermediaries	No financial compensation etc., involved	Not Applicable
ESS 10: Stakeholder Engagement and Information Disclosure	A stakeholder consultation was carried out during site screening. A feedback mechanism is in place to address any grievances of the stakeholders (including beach goers).	Applicable

This ESMP encapsulates a comprehensive approach to managing the identified risks and ensuring sustainable project execution. The mitigation measures outlined above are designed not only to address the immediate impacts but also to promote long-term environmental stewardship and social well-being. Through diligent monitoring, proactive stakeholder engagement, and adherence to international standards, this plan sets the foundation for Marina Beach to not only achieve Blue Flag certification but also to serve as a model for sustainable coastal management. As we move forward, it is imperative that all parties involved remain committed to these principles, ensuring that the transformation of Marina Beach contributes positively to the community, the environment, and the broader goals of Tamil Nadu's sustainable development.

2.0 Environmental and Social Management Plan (ESMP)

2.1 Sub-project activities for ESMP

The ESMP outlines a comprehensive strategy for managing and mitigating environmental and social impacts associated with the designated projects along Marina Beach. The plan is structured to address specific aspects of the project through detailed sub-plans, each tailored to meet the stringent requirements of environmental sustainability and social responsibility. The sub-project activities encompassed in this plan include:

- 1. Development Activities Plan:** Focuses on integrating environmental sustainability and community safety standards right from the design and pre-construction phases through to construction. This plan ensures all developmental activities align with established environmental and safety protocols.
- 2. Pollution Management Plan:** Specifies measures for the prevention, control, and management of pollution throughout the construction and operational phases. This includes detailed strategies for managing waste, treating greywater, and handling bio-digestion outputs effectively.
- 3. Human Health and Safety Plan:** Addresses potential health and safety risks to workers and the community, detailing preventive measures and emergency response strategies to maintain safety at all times.
- 4. Monitoring and Evaluation Plan:** Essential for ensuring that all ESMP activities are carried out as planned and are effective in mitigating environmental and social impacts throughout the project lifecycle.
- 5. Implementation and Supervision Arrangements:** Defines the roles and responsibilities of the implementing agencies and supervisory mechanisms to ensure adherence to the ESMP.
- 6. Reporting:** Outlines the requirements for documentation and reporting on the ESMP's implementation, ensuring transparency and accountability in meeting the environmental and social governance standards.

Each component of the ESMP is designed to comprehensively address the specific risks and impacts associated with the project, ensuring effective management and mitigation across all phases of project development and operation.

2.2 Development Activities Plan

This section outlines the proactive measures to mitigate potential negative impacts during the design, pre-construction, and construction stages of the Marina Beach project. These measures are detailed in Table 2.1, which summarizes the ESMP for development activities, ensuring compliance with environmental, safety, and community standards.

Table 2.1: Environmental and Social Management Plan for developmental activities

Activity	Applicable ESS category	Potential Negative Impacts	Mitigation Measures	Responsible Entity	Inclusion in ToR and Bid Documents
Mechanized cleaning of Beaches with walk behind machine	ESS2: Labour and Working Conditions	Accidental injury to the operator and/or to other workers	Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws.	Contract or or	To be included in ToR and bid documents.
Bio-Digester/ Bio-Tank Unit	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions ESS3: Resource Efficiency, Pollution Prevention and Management	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	- Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. - Include fail-safe sewage	Design Team and operator	To be included in ToR and bid documents.

	ESS 4: Community Health and Safety		storage and treatment solutions to handle system breakdowns without environmental contamination. ▪ Establish protocols for the segregation, handling, and proper disposal of waste. Include measures for hazardous waste.		
Solid Waste Management Plant	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions ESS3: Resource Efficiency, Pollution Prevention and Management ESS 4: Community Health and Safety	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	▪ Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. ▪ Include fail-safe sewage storage and treatment solutions to handle system breakdowns without environmental contamination. ▪ Establish protocols for the segregation, handling, and proper disposal of waste. Include measures for hazardous waste.	Design Team and operator	To be included in ToR and bid documents.

Toilet Blocks Facilities	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	- Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. - Include fail-safe sewage storage and treatment solutions to handle system breakdowns without environmental contamination. - Establish protocols for the segregation, handling, and proper disposal of waste.	Design Team and operator	To be included in ToR and bid documents.
Solar power plant facility (40 KW)	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions	Storage of batteries in closed rooms may cause occupational dangers	Sufficient space is required to keep the solar batteries so that access becomes easy for maintenance work without any hazard	Facility Operator	To be included in ToR and bid documents.
		Water required to clean solar panels	Minimal water should be used to clean the solar panels while in operation because of the accumulation of dust and bird droppings		

		Disposal of electrical equipment	Switchgears, transformers, Cables, batteries, Trays etc. wear and tear should be disposed of properly		
		Disposal of electronic equipment	Control panels, Electronic hardware, and solar panels etc. wear and tear should be disposed of properly		
Site development and components construction/ installation	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS 6: Biodiversity conservation and Sustainable Management of Living Natural resources	▪ Loss of trees, biodiversity ▪ Access route or nesting/ feeding grounds	▪ No. of trees felled, saplings planted and survival rate of saplings raised for compensatory plantation should be strictly monitored and recorded. ▪ There are no records of turtle nesting or any other ecologically sensitive areas (ESA) in the selected location, but any chance finding should be reported to the relevant authority and area marked.	Contract or and Facility Operator	To be included in ToR and bid documents.

This table encapsulates the comprehensive strategies implemented to mitigate potential adverse impacts during the development activities for the Blue Flag certification of Marina Beach. These strategies are designed to ensure the

project adheres to high environmental and social standards, promoting sustainable development and minimizing disruptions to the local community.

2.3 Pollution Management Plan

This section outlines the comprehensive strategies and measures implemented to manage and mitigate pollution at Marina Beach, ensuring adherence to both environmental standards and Blue Flag certification requirements. The plan is organized by components, each addressing specific pollution concerns associated with the operational and construction phases of the beach's development. Here, we detail the respective approaches for grey water treatment, bio-digestion, and solid waste management to safeguard the coastal ecosystem and public health.

2.3.1 Grey Water Treatment Plant

This section of the ESMP details the operational guidelines and management measures for the Grey Water Treatment Plant (GWTP) to ensure its efficient functioning and compliance with environmental standards (Table 2.2)

Table 2.2: Environmental and Social Management Plan for operation of Grey Water Treatment Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Legal and Regulatory Compliance	Ensure all required clearances from relevant departments are obtained prior to operation commencement, including consent for operation from the State Pollution Control Board and approval of the attached quality testing lab.	Facility Operator	TNDOE
Contamination from Treated Water Reuse	Utilize treated water for non-potable applications such as gardening and flushing. Maintain BOD/TSS below 10 mg/L and Total Coliform below 230 MPN/100 ml. Regular testing of water quality to ensure compliance with SPCB/CPCB standards.	Facility Operator	TNDOE
Improper Disposal of Sludge	As the GWTP design does not anticipate sludge production, ensure all wastewater is effectively treated without residual sludge.	Facility Operator	TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Inadequate Monitoring of GWTP Operation	Maintain an operations log with detailed records of inflow and outflow quantities, water quality at entry and exit points, and compliance with treatment specifications.	Facility Operator	TNDOE
Untrained Staff	Provide comprehensive training for all staff on GWTP operations and maintenance. Display Standard Operating Procedures (SOPs) prominently at the plant, including emergency procedures.	GWTP supplier	TNDOE
Safety Hazards	Equip the facility with fire extinguishers and ensure all workers use necessary Personal Protective Equipment (PPE). Store all biodegradable cleaning agents and detergents securely on raised platforms in a secured storeroom.	Facility Operator	TNDOE

The implementation of these measures is designed to mitigate potential environmental and social impacts associated with the operation of the Grey Water Treatment Plant (GWTP), ensuring the sustainability and safety of the water treatment processes at Marina Beach. The facility operator, in collaboration with TNDOE, will monitor these practices to adapt and respond to any operational challenges promptly.

2.3.2 Plan for Bio-digester

The details of ESMP for the operation of the Bio-digester along the designated stretch of Marina Beach, focusing on mitigating potential environmental and safety risks associated with its operation. Table 2.3 summarizes the ESMP for operation of Bio-digester at the identified stretch of Marina Beach

Table 2.3: Environmental and Social Management Plan for Bio-digester Operation

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Legal and Regulatory Compliance	Use only DRDO-approved biogas technology, which does not require additional clearances prior to operation.	Facility Operator	TNDOE
Biogas Bag Integrity		Facility Operator	TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
	Use high-quality, fiber-reinforced PVC bags (minimum 850 g/m ³) to prevent leaks.		
Site Selection Efficiency	Ensure the site is adequately sized and located to optimize the bio-digester's performance and facilitate maintenance.	Facility Operator	TNDOE
Gas Leak Risks	Perform daily inspections for leaks; use soap water for detection and install a flame arrestor to prevent fire risks. Prohibit smoking and open flames near the digester.	Facility Operator	TNDOE
System Pressure	Maintain a higher internal pressure in the biogas system than the external environment to prevent negative pressure risks.	Facility Operator	TNDOE
Management of Digester Effluent	Manage effluent by partial drying followed by composting on-site to prevent environmental contamination.	Facility Operator	TNDOE
Utilization of Generated Biogas	Equip with appropriate biogas-utilizing devices based on the expected gas output to ensure efficient use.	Facility Operator	TNDOE
Flood Risk Management	Implement flood safety measures, including the installation of an upside-down 'T' pipe with a gate valve to safely release biogas in flood scenarios.	Facility Operator	TNDOE

Each mitigation measure is designed to address specific operational risks associated with the bio-digester, ensuring that the system operates safely, efficiently, and in compliance with environmental standards. The Facility Operator, in collaboration with TNDOE, will oversee and monitor the implementation of these measures to adapt and respond to any operational challenges promptly.

2.3.3 Plan for Solid Waste Treatment

The details of the operational strategies and environmental management practices for the Solid Waste Treatment Plant at the identified stretch of Marina Beach, designed to minimize environmental and social impacts. The management plan (Table 2.4) integrates advanced waste processing

technologies and rigorous monitoring protocols to ensure compliance with environmental regulations and sustainability goals.

Table 2.4: Environmental and Social Management Plan for operation of Solid Waste Treatment Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Inadequate legal and regulatory clearances	Obtain all necessary clearances from relevant authorities prior to operation.	Facility Operator	TNDOE
Contamination from leachates and waste spillage	Conduct regular maintenance of waste management units and leachate tanks. Perform soil and water testing around the site and address any identified leaks by transferring leachates to a nearby water treatment plant.	Facility Operator	TNDOE
Deterioration of air quality from dust	Minimize dust during waste handling and transport using water sprays. Implement a preventive maintenance program for transport vehicles and ensure strict adherence to personal protective equipment protocols by all workers.	Facility Operator	TNDOE
Odours from waste storage and transport	Regularly clean tipping areas and waste vehicles. Cover transported waste and process it promptly. Store non-operational waste in covered roll-on/off containers.	Facility Operator	TNDOE
Noise during operations	Restrict operational hours to daytime to minimize disturbance to local wildlife and community. Maintain regular upkeep of machinery to reduce noise levels.	Facility Operator	TNDOE
Worker health and safety	Ensure all workers use proper personal protective equipment and provide them with first aid kits and regular health check-ups.	Facility Operator	TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Community inconvenience	Maintain open lines of communication with the community. Establish channels for grievance redressal and feedback through various platforms including social media, the project's website, email, and a dedicated telephone line. Actively monitor, evaluate, and document all complaints and feedback.	Facility Operator	TNDOE

The implementation of these measures is aimed at ensuring that the Solid Waste Treatment Plant operates efficiently without adversely impacting the local environment or community. Regular monitoring and adaptive management strategies will be employed to address any emergent issues during the plant's operation.

2.4 Human Health and Safety Plan

The Human Health and Safety Plan outlines the strategic measures designed to safeguard occupational and community health throughout the development and operational phases of the project. This plan addresses both potential positive and negative impacts, ensuring that comprehensive safety protocols are followed.

2.4.1 Potential Impact on Occupational Health and Safety

Positive Impacts:

The adoption of prefabricated structures, environmentally friendly materials, and modern operational methods ensures a high standard of safety at the treatment plants and associated facilities. Designs incorporate disaster mitigation elements to create a secure working environment.

Negative Impacts:

Construction phases may present safety risks due to unrestricted site access, the use of improper machinery, and insufficient safety gear. Additionally, poor waste management and storage practices could lead to environmental pollution and attract vermin, potentially increasing disease transmission and ecological disruption. To mitigate these risks, the project includes comprehensive measures such as:

- Providing personal protective equipment to all staff.

- Employing skilled personnel trained in the operation of machinery and waste management.
- Installing first aid stations equipped with necessary medical supplies.
- Designing facilities to optimize ventilation and natural light, thus preventing occupational health issues related to poor air quality and visibility.

These proactive strategies are intended to minimize safety risks and ensure a safe working environment, with no significant negative impacts anticipated due to the stringent adherence to health and safety standards.

2.4.2 Potential Impact on Community Health & Safety

Positive Impacts:

The project's infrastructure is designed to enhance the local environment and public health, aligning with sustainable development goals. The facilities will serve not only as functional amenities but also as educational resources for the community, promoting healthier and more sustainable living practices.

Negative Impacts:

During Construction, potential risks include inadequate safety measures that could lead to accidents and environmental contamination. Poorly designed waste management systems could result in health hazards from increased pathogen exposure in water sources.

During Operation, the misuse of raw materials might degrade product quality and safety, posing health risks to the community. Recognizing these risks, the plan includes:

- Strict control measures to prevent unauthorized access to construction sites.
- Rigorous quality control in material selection and handling to prevent contamination.
- Enhanced safety signage, lifeguard provisions, and public health education to mitigate risks associated with recreational beach activities.

In summary, while the project aims to significantly benefit community health and environmental conditions, it also establishes robust monitoring and

emergency response systems to swiftly address any arising issues, thereby ensuring ongoing community safety and well-being.

2.5 Plan for Infrastructure Management

The ESMP focuses on the management of infrastructure related to the Solar Energy Plant at Marina Beach. Effective management is critical to ensuring that infrastructure supports the project's sustainability goals while minimizing environmental and social impacts.

2.5.1 ESMP for Operation of Solar Energy Plant

The operation of the Solar Energy Plant is guided by comprehensive management practices detailed in Table 2.5, designed to mitigate potential negative impacts associated with the plant's daily operations.

Table 2.5: Environmental and Social Management Plan for Operation of Solar Energy Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Storage of batteries in closed rooms may cause occupational hazards.	Ensure all battery storage areas are well-ventilated to facilitate safe access and maintenance activities.	Facility Operator	TNDOE
Water usage for cleaning solar panels.	Use minimal water to clean solar panels, addressing the accumulation of dust and bird droppings efficiently.	Facility Operator	TNDOE
Disposal of electrical equipment	Dispose of electrical components such as switchgears, transformers, cables, and battery trays in a scientifically approved manner.	Facility Operator	TNDOE
Disposal of electronic equipment	Ensure that electronic items such as control panels and solar panels are disposed of following environmental safety standards.	Facility Operator	TNDOE

These measures are designed to ensure the Solar Energy Plant operates within the stipulated environmental and safety standards, thereby supporting the project's overall sustainability objectives. Regular monitoring and updates to these practices will be conducted by the TNDOE to adapt to technological advancements and regulatory changes, ensuring ongoing compliance and safety.

2.6 Plan for Physical Forces

2.6.1 Disaster Management Plan (DMP)

The Disaster Management Plan (DMP) for Marina Beach is designed to safeguard human life, protect the environment, and ensure the security of the infrastructure against a variety of hazards. The plan is structured to be dynamic, accommodating changes in environmental conditions, infrastructure updates, and regulatory requirements through regular reviews and updates. Some of the Key Elements of the Disaster Management Plan is given in Table 2.6

Table 2.6: Disaster Preparedness and Response Strategies:

Hazard Category	Preparedness Actions	Response Actions
All hazards	• Ensure all workers are equipped with personal protective equipment • Formulate an emergency response team involving local government, emergency services, and community representatives. • Designate clear roles and ensure effective communication channels. • Display emergency contact numbers prominently. • Provide accident insurance for all staff and workers.	○ Maintain a detailed log of all accidents and near-miss incidents. ○ Implement a communication system for timely alerts and updates during emergencies.
Natural Hazards (Cyclones, Storm Surges, Earthquakes)	• Integrate cyclone-resistant features in structures • Complete all civil works before monsoon	○ Activate immediate relief actions as directed by local authorities ○ Shut off utilities in the event of an earthquake

Hazard Category	Preparedness Actions	Response Actions
	- Follow local administration's evacuation guidelines. - Minimize material storage during high-risk seasons. - Incorporate earthquake-resistant design and train staff in earthquake preparedness.	and evacuate to safe areas.
Anthropogenic Hazards (Accidents, Fires, Electric Shocks)	- Maintain updated first-aid kits - Train staff in handling machinery safely and providing first aid - Keep fire extinguishers accessible and conduct regular fire drills - Ensure all electrical systems meet safety standards and train staff in electrical safety.	- Provide immediate medical attention as needed. - Implement safety measures to prevent fire spread or electrical hazards, especially in flood scenarios. - Ensure biogas and waste treatment facilities have emergency protocols to handle gas leaks and explosions.
Specific Hazards (Drowning)	Station lifeguards and safety equipment at strategic locations along the beach Regularly inspect and maintain safety and rescue gear.	Ensure readiness of rescue operations to respond to incidents of drowning or sea-related accidents efficiently.

Key Elements of the DMP:

- i. **Comprehensive Coverage:** The plan addresses a wide range of hazards, both natural and anthropogenic, ensuring thorough preparedness and effective response strategies.
- ii. **Stakeholder Involvement:** Involves various local stakeholders, including government officials, emergency services, and community representatives, ensuring a coordinated and efficient emergency response.
- iii. **Regular Updates and Training:** Emphasizes the importance of regular plan updates and continuous training for staff to handle emergency situations effectively.

iv. Infrastructure Resilience: Focuses on incorporating disaster-resilient features in facility design and infrastructure to mitigate the impact of disasters.

This Disaster Management Plan aligns with the overarching objectives of the ESMP, focusing on proactive risk management and swift, effective responses to safeguard the well-being of the beach's users and the integrity of its environment. Regular training, drills, and updates to the plan ensure preparedness for any emergency, minimizing potential impacts on both human life and the environment.

2.7 Monitoring and evaluation of ESMP implementation

Effective implementation of the ESMP is essential to achieving the project's sustainability goals. Monitoring and Evaluation (M&E) play a pivotal role in this process by ensuring that the ESMP adheres to its objectives, successfully mitigates environmental and social impacts, and remains responsive to the needs and expectations of stakeholders. Continuous M&E activities are integrated throughout the project lifecycle, from planning through to post-implementation, facilitating timely adjustments and ensuring the long-term effectiveness of the ESMP.

Objectives of Monitoring and Evaluation:

- **Effectiveness Assessment:** Evaluate the efficiency of implemented mitigation measures to ensure they effectively reduce environmental and social impacts.
- **Capacity Building:** Monitor the progress of capacity-building initiatives designed to enhance understanding and compliance with the ESMP among all project participants.

a. Regulatory requirements for monitoring

Waste treatment facilities are mandated to regularly monitor the quality of their effluent and emissions. This data must be reported to the State Pollution Control Board (SPCB) at designated intervals. These reports are crucial for the SPCB to oversee compliance with environmental standards and to conduct periodic inspections to assess the operational efficacy and environmental impact of the facilities.

b. Monitoring Schedule

The comprehensive monitoring plan for the ESMP is detailed in Table 2.6, which outlines the frequency and responsibility for monitoring various environmental and social parameters.

Table 2.6: Environmental and Social Safeguards Monitoring Plan

Key aspect	Locations, Parameters, Indicators	Frequency of Monitoring	Responsibility
Monitoring at Construction Stage			
Biodiversity	No. of trees felled, saplings planted, survival rate of saplings	Six-monthly	TNDOE
Construction safety/ Community Grievances	No. and nature of worksite accidents and near-miss incidents	Monthly Quarterly Six-monthly	Contractor, TNDOE
	No. of community grievances raised and addressed	Monthly Quarterly Six-monthly	Contractor TNDOE
Capacity Building	No. of awareness programs for workers, community	Monthly Quarterly Six-monthly	Contractor TNDOE
Monitoring at Operation and Maintenance Stage			
Water Quality	Compliance with standards for pH, TDS, DO, Salinity, etc.	Weekly Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Emissions (Solid Waste)	Compliance with emissions standards	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Solid Waste Management	Type, Volume/Weight, treatment details of solid waste	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Sludge Quality (Bio-digester)	Volume and quality of treated sludge	Weekly Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Occupational Safety and Health	No. and nature of worksite accidents and near-miss incidents	Weekly Monthly Quarterly Six-monthly	Beach Facility Operator TNDOE

Key aspect	Locations, Parameters, Indicators	Frequency of Monitoring	Responsibility
Public Safety and Health	No. of community grievances, drowning incidents, fatalities	Monthly Quarterly Six-monthly	Beach Facility Operator TNDOE

This structured approach to M&E ensures that all potential impacts are carefully monitored and managed, contributing to the project's overall success and sustainability.

2.8 Implementation and Supervision arrangements

The Tamil Nadu Department of Environment (TNDOE) serves as the primary implementation agency for the Environmental and Social Management Plan (ESMP), operating under the directives of the TN SHORE project management authorities. The TNDOE is tasked with the meticulous application of the mitigation strategies outlined in the ESMP. This includes the careful implementation of the biodiversity management plan, which may be adapted or expanded based on ongoing assessments of field conditions.

In addition, a dedicated budget for the implementing ESMP and other blue flag beach activities are recommended in the DPR (**Chapter 5 Infrastructure Development & Budget**). Section 5.3 of the DPR provided the budgets for various Infrastructures (including bio-digester, grey water treatment plant, Solid Waste Management, shelterbelt plantation etc.) required for the implementation of the ESMP and other blue flag beach activities. Table for the Beach Monitoring and Maintenance is also provided in the section 5.5., ensuring that it is integrated yet distinctly itemized within the overall project financial framework. This structured approach facilitates focused supervision and continuous adaptation of the ESMP to meet environmental and social goals effectively, thereby ensuring the project aligns with sustainable development objectives.

2.9 Reporting

The implementing agency is responsible for preparing comprehensive reports following the completion of each project component. These reports must document the adherence to the prescribed measures within the ESMP and are to be submitted to the TN SHORE project authorities for review. Additionally, the reports should include detailed disclosures to stakeholders regarding the progress of the activities undertaken. This transparency is vital for maintaining stakeholder engagement and ensuring accountability throughout the project's lifecycle.