KERALA SOLID WASTE MANAGEMENT PROJECT (KSWMP)

ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

VOLUME II

PART A: ENVIRONMENTAL MANAGEMENT FRAMEWORK

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Prepared by

SUCHITWA MISSION

GOVERNMENT OF KERALA

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List of Abbreviations

Abbreviation	*Expansion*
AEWA	African-Eurasian Migratory Water Birds
AMASR	Ancient Monuments and Archaeological Sites and Remains Act
APD	Assistant Project Director
ASI	Archeological Survey of India
BDW	Biodegradable Wastes
BMC	Biodiversity Management Committee
BMW	Biomedical Wastes
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
BP	Bank Procedures
BPL	Below Poverty Line
C&D	Construction and Demolition
CBD	Convention on Biological Diversity
CBMWTF	Common Biomedical Waste Treatment Facility
CBO	Community-Based Organization
CC	Climate Change
CKC	Clean Kerala Company Ltd.
CMS	Conservation of Migratory Species
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CRZ	Coastal Regulation Zone
CVCA	Critically Vulnerable Coastal Areas
CWRDM	Centre for Water Resources Development and Management
D-ESDU	District Environmental and Social Development Unit
DPC	District Planning Committee
DPMC	District Project Management Consultant
DPMU	District Project Management Unit
DPR	Detailed Project Report
DTP	Directorate of Town Planning
DWMP	Disaster Waste Management Plan
EA	Environmental Assessment
EAP	Externally Aided Project
ECoP	Environmental Codes of Practice
EE	Environmental Engineer
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EPR	Extended Producer Responsibility
ESA	Environmentally Sensitive Areas
ESAR	Environmental Assessment Report
ESDU	Environmental and Social Development Unit
ESF	Environmental Framework

Abbreviation	*Expansion*
ESHS	Environmental and Social Health & Safety
ESMF	Environmental and Social Management Framework
ESZ	Eco-sensitive Zone
ETP	Effluent Treatment Plant
FAQ	Frequently Asked Questions
FAR	Floor Area Ratio
FGD	Focus Group Discussions
FSI	Floor Space Index
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GIS	Geographic Information System
GoI	Government of India
GoK	Government of Kerala
GRC	Grievance Redressal Committee
Ha	Hectares
HCI	Health Care Institutions
HCU	Health Care Unit
HDPE	High-Density Poly Ethylene
HH	Households
HKM	Haritha Keralam Mission
HKS	Haritha Karma Sena
HL	Hazard Line
HR	Human Resources
HSS	Haritha Sahaya Sthapanam
HTL	High Tide Line
ICB	International Competitive Bidding
IDU	Internal Documents Unit (The World Bank)
IEC	Information Education Communication
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IMA	Indian Medical Association
IMAGE	Indian Medical Association Goes Eco-Friendly
IPF	Investment Project financing
ISR	Initial Screening Report
IT	Island Territories
ITEWS	Indian Tsunami Early Warning System
IUCN	International Union for Conservation of Nature
KEIL	Kerala Enviro Infrastructure Ltd.
KGP	Knowledge, Governance and Policy
KIIFB	Kerala Infrastructure Investment Fund Board
KLSUB	Kerala State Landuse Board
KSBB	Kerala State Biodiversity Board
KSDMA	Kerala State Disaster Management Authority
KSIDC	Kerala State Industrial Development Committee
KSPCB	Kerala State Pollution Control Board
KSWMP	Kerala Solid Waste Management Project
LB	Local Body (Urban or Rural)

Abbreviation	Expansion
LDPE	Low-Density Poly Ethylene
LFG	Landfill Gas
LGI	Local Government Institution
LSGI	Local Self Government Institution
LTL	Low Tide Line
LULC	Land use and Land Classification
M&E	Monitoring and Evaluation
MA	Multilateral Agencies
MCF	Material Collection Facility
MoEFCC	Ministry of Environment, Forests and Climate Change
MPA	Multi-phase Programmatic Approach
MRF	Material Recycling Facility
NBDW	Non-biodegradable Wastes
NCB	National Competitive Bidding
NDZ	No Development Zone
NEP	National Environmental Policy
NGO	Non-Governmental Organization
NMA	National Monuments Authority
NOC	No Objection Certificate
NPDM	National Policy on Disaster Management
O&M	Operations and Maintenance
OD	Operational Directives
OHS	Occupational Health and Safety
OP	Operational Policies
PAF	Project Affected Family
PAP	Project Affected Person
PAP	Program Action Plan
PCB	Pollution Control Board
PCR	Physical Cultural Resources
PCRMP	Physical Cultural Resources Management Plan
PD	Project Director
PDO	Program Development Outcome
PIU	Project Implementation Agency
PMC	Project Management Consultant
PMU	Project Management Unit
POP	Persistent Organic Pollutants
PPP	Public-Private Partnership
PWD	Public Works Department
QA	Quality Assurance
RMP	Risk Management Plan
RRF	Resource Recovery Facility
SAPCC	State Action Plan on Climate Change
SBM	Swachch Bharat Mission
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SEC	Sensitive Environmental Components
SEIAA	State Environmental Impact Assessment Authority
S-ESDU	State Environmental and Social Development Unit

Abbreviation	*Expansion*
SHC	Stakeholder Consultations
SPMC	State Project Management Consultant
SPMU	State Project Management Unit
SPMU	State Project Management Unit
STP	Sewage Treatment Plant
SUP	Single Use Plastics
SW	Solid Waste
SWD	Storm Water Drains
SWM	Solid Waste Management
TA	Technical Assistance
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
ToR	Terms of Reference
TPD	Tons per Day
TSDF	Treatment Storage and Disposal Facility (for Hazardous Wastes)
TSS	Total Suspended Solids
ULB	Urban Local Body
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UT	Union Territories (of the Government of India)
WB	The World Bank
WGEEP	Western Ghats Ecology Expert Panel
WLPA	Wildlife Protection Act
WTP	Water Treatment Plant

ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

PART A: ENVIRONMENTAL MANAGEMENT FRAMEWORK

This is Volume II: ESMF, Part A EMF - for KSWMP. Part A presents the EMF for the project. This is based on the Baseline Environmental Analysis, Impact Assessment, and analysis of applicable Regulatory Framework presented in Volume I Strategic Environmental Assessment for KSWMP. As the project will be jointly co-financed by the World Bank and the AIIB; AIIB has agreed to apply the environmental management measures described in this Environmental Management Framework (EMF).

CHAPTER 1. ASSESSMENT OF PROBABLE IMPACTS DUE TO SUBPROJECTS

1.1 Subproject Typology

The KSWMP project is envisaged to support waste management sector in Kerala across three components:

- Component 1: investments focussing on Project Management, Capacity Building, Technical Assistance to state, and Urban Local Bodies (ULBs).
- Component 2: City Level investments including (a) decentralized waste management (b) collection and transportation of waste (c) community and city level treatment biodegradable processing facilities (d) Material recovery and resource recovery facilities for processing non-biodegradable treatment facilities, (e) COVID-19 supporting activities including (i) Routine public space cleaning/sanitization, procurement of protective gears, and equipment for sanitation workers, (ii) Financial support to existing HKS and Kudumbashree women Stakeholder Groups (SHGs) engaged for ongoing waste collection services.
- Component 3: Regional facilities including Sanitary Landfill facilities for rejects/inerts of municipal solid wastes, Dumpsite improvement, treatment, and disposal facilities for biomedical waste and C&D waste.

Type of subprojects under KSWMP include:

1. Awareness and Capacity Building for Waste Management: Information, Education Communications campaigns – meetings, training, media (print, visual) - to increase awareness of citizens, Local Bodies, various community-based organizations (CBOs), and other institutional stakeholders; training for monitoring and technical support in various aspects of waste management.
2. Preparation of ULB - wise Solid Waste Management (SWM) Plan (Plan preparation with stakeholder consultations)
3. Collection and Transportation of Wastes
   a) Collection and Transportation of Biodegradable and Non-biodegradable Wastes (purchase and use of appropriate vehicles for collection of both biodegradable and non-biodegradable wastes, C&D and biomedical wastes from households, up-gradation of existing vehicles, commercial and institutional premises, public places; route planning/scheduling and management using geo-tracking systems, sweeping, vehicle maintenance)

b) Development and Improvement of Non-biodegradable Waste Collection and Recycling Facilities (construction and operation of Material Collection Facilities (MCFs) and Material Recycling Facilities (MRFs), route planning and scheduling for collection and to transport to recycling facilities, disposal of rejects/inerts.

4. Bioremediation of Existing Dumpsites (following legacy waste management guidelines of Central Pollution Control Board, mining of wastes, stabilization of fresh waste if any on-site using any treatment technology, *insitu* stabilizing of legacy waste using biocultures and aeration (lift and windrow turn), screening and shredding of wastes, storage and transport of retrieved materials for recycling/reuse, capping and closure of full or portion of the site depending on the situation (not advised by MoEFCC except in case of exceptional circumstances), leachate treatment, site peripheral development to prevent wastes and leachate overflows including peripheral drains to collect leachate and stormwater drains, gas collection, covered shed for installing mechanical devices for segregating and bailing recyclables, buffer development, monitoring arrangements)
5. Development of Wet Waste Treatment Facilities
    a. Support for Household Level Treatment Facilities (supply of appropriate units, technical support, and guidance for environmental management and monitoring)
    b. Upgradation of Community-Level Treatment Facilities (upgrading existing facilities with leachate treatment and good management of wastes, segregated waste management, odor/pest control, buffers where required, end-to-end solutions, technical support, and monitoring)
    c. Development of New Community Level Treatment Facilities (development of treatment facilities and associated infrastructure: biogas, aerobic composting, etc., technical support and monitoring)
    d. Upgradation of Centralised Treatment Facilities ((upgrading existing facilities with leachate treatment and good management of wastes, segregated waste management, odor/pest control, buffers where required, end-to-end solutions, technical support, and monitoring)
    e. Development of New Centralised Treatment Facilities (development of treatment facilities and associated infrastructure: biogas, aerobic composting, etc., technical support and monitoring)
6. Development of Sanitary Landfill Facilities for Rejects /Inerts (development of disposal facilities (sanitary landfill) and associated infrastructure (base sealing, landfill phasing, drainage layers, and leachate management, waste placement, peripheral infrastructure like access, roads, leachate collection, gas venting and collection, reuse)
7. Development of Regional Construction and Demolition (C&D) Waste Management Facilities (development of segregation and recycling facilities for a different type of C&D wastes, and associated infrastructure)
8. Development of Regional Biomedical Waste (BMW) Management Facilities (development of segregated storage, treatment of biomedical wastes (different tyes) as per Biomedical Waste Management Rules, 2016 (including all or some of these: segregated storage of wastes in color-coded bags, collection and transport, shedder, autoclave or disinfection mechanisms, needle crushers, incinerator, air pollution control system, effluent treatment plant, waste and ash storage area & disposal facility, vehicle wash, treatment/equipment room, and peripherals) of Government of India (GoI). and associated infrastructure)

9. Support to COVID 19 response
   (i) medical waste management, including collection, treatment, and safe disposal, as per national regulations, (ii) waste management services - safe and hygienic, (iii) cleaning and sanitization of public spaces and government offices, hospitals, community-level waste recycling, and processing facilities daily, (iv) providing goods and protective equipment like gears, masks, chemicals/disinfectants, etc. for protecting workers of ULBs, and (v) awareness generation and sensitization activities to promote safe practices and social norms for containing the infection spread.
   (In each case above, all or few among the following will be required: vehicle parking, weighing of waste, daily cover and peripheral storages, generators, cut off drains, buffer, office spaces, facilities for workers (including rest areas, toilets/wash), tyre cleaning, security, fencing, safety measures, contingency plans, post-closure plans, technical support, and monitoring)

1.2 Impact Assessment Methodology

The methodology to assess the impacts at the subproject level is presented here. Impacts are assessed based on Magnitude, Duration, and Significance of the impacts and sensitivity of the receptors.

1.2.1 Magnitude and Duration of Impacts

The assessment of magnitude is undertaken in two steps. Firstly, the key issues associated with the KSWMP are categorized as beneficial or adverse. Secondly, potential impacts shall be categorized as High, Average, Low, or negligible based on consideration of the parameters such as:

- Temporal extent (duration) and the likelihood of the potential impact;
- The spatial extent of the potential impact;
- Reversibility of the Impact;
- Legal standards and established criteria.
- Likelihood of the impacts

The magnitude of the potential impacts of KSWMP is identified according to the categories outlined in ***Table 1***.

Table 1: Aspects for Determining the Magnitude of Impacts

Aspects	Large	Medium	Small	Negligible/Nil
Duration of the potential impact	Long term (more than 20 years)	Medium Term Lifespan of the Program (5 years)	1 to 2 years or Less than the lifespan of the program	Temporary with no detectable potential impact
Spatial extent of the potential impact	Regional – much beyond project boundaries	Beyond immediate Program components, site boundaries or local area	Within program boundary	A specific location within program component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact (including positive impact) is effectively permanent, requiring	Potential impact requires a year or so with some interventions to return to baseline	Baseline returns Naturally or with limited intervention within a few months	Baseline remains constant

Aspects	Large	Medium	Small	Negligible/Nil
	considerable intervention to return to baseline			
Legal standards and established professional criteria	Against national/approved standards and or international guidelines/obligations	Complies with limits given in national standards but not confirming to international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Commonly occurs under typical operating or construction conditions (Certain)	Usually seen occurring under most situations (Likely)	Occurs under abnormal, exceptional or emergency conditions (Occasional)	Unlikely to occur

1.2.2 Sensitivity of Receptor

The sensitivity of a receptor shall be determined based on a review of the population (including proximity/ numbers/ vulnerability) and the presence of features on the site or the surrounding area. The criteria for determining receptor sensitivity of the program's potential impacts are outlined in ***Table 2***.

Table 2: Criteria for Determining Sensitivity

Sensitivity Levels	*Description*
High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal/limited opportunities for mitigation.
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

1.2.3 Significance of the impact

The significance of potential impacts is established using the impact significance matrix shown in ***Table 3*** below.

Table 3: Assessment of Significance of Negative and Positive Impacts

		Sensitivity / Vulnerability / Importance of Resource / Receptor		
		Low	**Medium**	**High**
Magnitude of Negative Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major
Magnitude of Positive Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

1.2.4 Potential Key Environmental Impacts

Project investments are expected to develop an effective SWM system, Improved BMW management system, and C&D Waste management system in Kerala. This is most essential for the environmental upkeep and health of the people of this sensitive landmass geography. Hence, it is envisaged that the project would lead to positive impacts, including pollution prevention, increased resilience to the impacts of climate-induced natural hazards such as flooding, improved primary health, improvement in the socio-economic conditions, and its forward linkages.

Currently, the waste management services in the State are mostly not environmentally appropriate and lead to negative externalities. The project aims to bring in an improvement in this situation; targeting the entire SWM value chain starting with the preparation of SWM Plan and awareness creation/capacity-building efforts. Thus, the implementation of the project would minimize the environmental pollution scenario in the State as it targets all major waste generators. It also aims to reduce the mixing of biomedical wastes with solid waste by ensuring its treatment and disposal and envisages resource efficiency by recycling C&D wastes which are usually dumped and mixed with other wastes, or used to fill low lying areas. Positive impacts of the project far outweigh the negative externalities of continuing the existing scenario where there is minimal waste collection or processing; with most wastes leaking into the sensitive environment and lessening the resilience and creating unsolicited health impacts.

The project will, however, result in construction and operation stage negative environmental impacts which can be managed effectively by incorporating the required infrastructure and mechanisms.

Expected negative impacts during the *pre-construction / planning stage and construction stage* include (i) impacts on receptors due to poor siting of facilities and site development, (ii) increase in noise, odor, dust, impacts on air quality or safety risks due to construction/installation activities (treatment, disposal, recycling facilities), construction of maintenance facilities for collection and transportation equipment/fleet, bioremediation, (iii) temporary water quality impacts resulting from possible drainage and leachate pollution from facilities created / under improvement as part of the project or due to labor camps; (iv) impacts related to the movement of vehicles including increased congestion, and conflicts with pedestrian movements; (v) hindered access/temporary changes in access to, and the use of, public spaces during construction/excavation works; (vi) Occupational health and safety of workers, and (vii) public health risks due to improper site management, waste/debris, sludge, excavated silt/muck management, or lack of attention to labor management.

Expected negative impacts during the *operation and maintenance* stage will depend on the type of subprojects and the technology to be deployed. This may include (i) increase in noise, dust, odor impacts on air quality or safety risks due to O&M activities (treatment, disposal, recycling facilities), collection and transportation, (ii) temporary water quality impacts resulting from possible drainage and leachate pollution due to operations; (iii) impacts related to the movement of vehicles including increased congestion, and conflicts with pedestrian – other vehicular movements; and (iv) public health risks due to improper management of treated waste, and disposal of rejects and inerts, slurry or other by-products, safety risk due to poor operation and maintenance of facilities like Biogas units, (v) Occupational health and safety of workers involved in

O&M and of communities nearby in case of hindrance in operations, (vi) visual blight due to SWM transportation and operations.

The mechanism to predict the potential and mostly typical impacts on the key environmental parameters of sub-project areas is presented here. This is based on the baseline physical, environmental conditions, assessment of project components/sub-components, and activities viz a viz the baseline and sensitivities.

1.2.4.1 Environmental Impacts during Pre-construction / Construction Activities

Impacts on Air

Positive Impacts:	***Negative Impacts:***
▪ Planning and designing facilities in full compliance with existing regulations and guidelines, (dust screening, no open dumping or burning, better facility, and activity management) and monitoring arrangements would result in overall better environmental effects and avoids reputational risks. ▪ Currently, the waste is either dumped in the open, water bodies, or open dumping yards. Air pollution due to dumpsite gas emission, odor, and dust from dumped waste is enormous. The same is the case with existing centralized and decentralized community facilities that are not managed well. In the absence of proper management of wastes, gases, rejects, and inerts; emissions pollute the air. Improved facilities would result in managing such air pollution. ▪ It is estimated that current GHG emission from municipal solid waste in all 93 ULBs in terms of the amount of CH4 generated from decomposable material is 16.33 Gg and total methane emission from solid waste disposal is 16331.84 Tonnes of CH4 (Global warming potential of CH4 is 21). Total GHG Emission from Solid Waste Disposal in the given year (2019) is 342968.7Tonnes CO2e. It is to be noted that the total GHG emissions of around 3.9 million tons during last 15 years (2006 to 2019) are mainly due to non-processing of organic fraction of the waste and can be avoided through the treatment of waste to recover energy (bio methanation) or resources (compost – aerobic treatment). ▪ Also, currently, wastes are collected and transported in open vehicles, which results in emissions. The emissions may also include greenhouse gases (GHGs) from engine fuel combustion (exhaust emissions) and evaporation and leaks from vehicles (fugitive	▪ Site development for waste treatment and disposal facilities (clearing of vegetation, leveling, site preparation) would result in localized small scale dust emissions. Dust generated from the above activities will also have impacts on crops, livestock, and mainly; on population in densely developed areas. ▪ Movement of vehicles mainly along unpaved roads, carrying construction materials, and small construction activities and biomining of dumped wastes may result in construction stage impacts on air: dust, gas emissions, and odor. ▪ Diesel Generator (DG) sets will be used during the construction of the project in emergency conditions. Emissions from DG sets likely to impact air quality. ▪ Storage or stocking of construction materials including soil would result in localized air pollution due to emitted dust. ▪ Mining operations of metal and gravel for construction material will emit dust and other particulate matter

Positive Impacts:	Negative Impacts:
emissions) and other emissions. Improved collection and transportation of wastes would eliminate this pollution. ▪ SWM planning would aim at the long term reduction of air pollution associated with the system ▪ For Biomedical Wastes, there is only one CBMWTF for the entire state of Kerala. Considering the capacity and accessibility constraint, currently, a significant portion of the biomedical waste is being dumped on open land or being burnt. The current practice of open dumping/burning of the biomedical waste containing heavy metals is likely to contribute to the discharge of dangerous gases and particulates into the environment. These include polynuclear aromatic hydrocarbons, polychlorinated dibenzofurans, polychlorinated dibenzo-para-dioxins polychlorinated biphenyls, hydrogen, lead, mercury, cadmium, chlorobenzenes, particulate matter, and chlorophenols. The open dumping of the waste will result in pathogens and other carcinogenic gases released into the atmosphere and will result in acid rain, greenhouse gas (GHG) emissions, smog formation criteria, stratospheric ozone depletion, and carcinogenic and noncarcinogenic air toxics. Planning for CBMWTF's in Kerala to manage the biomedical waste will aim at mitigating the negative environmental externalities due to the present practice of open dumping/burning of the biomedical wastes. ▪ There is no C&D waste managing facility in Kerala. Developing a new C&D waste Management facility would reduce air emissions, mainly dust and particles	

Impacts on Water

Positive Impacts:	Negative Impacts:
▪ Planning and designing facilities in full compliance with existing regulations and guidelines, (drainage, leachate management, better storage, site management) and monitoring arrangements would result in overall better water quality and avoids reputational risks.	▪ Siltation of waterways due to modifications to surface water flow and drainage patterns ▪ Stored construction materials and C&D wastes including sand when exposed to rains might result in turbidity in site runoff. and blockage of waterways. ▪ Washing of vehicles involved in site-level works might result in localized water pollution.

Positive Impacts:	***Negative Impacts:***
▪ Currently, the waste (solid/ C&D and mixed) is either dumped in the open, water bodies, or open dumping yards. Pollution of water bodies around and water sources like wells due to leachate and site drainage is detrimental to the health and environment. The same is the case with existing centralized and decentralized community facilities that are not managed well. In the absence of proper collection and treatment; leachate from all treatment facilities and dump yards pollutes water sources/waterbodies. Improved facilities with leachate treatment improve the water quality of water bodies around. Bioremediation and recycling of dumping yard and closure reduce the number of wastes exposed to rains and thereby reduces pollution due to runoff from legacy wastes. ▪ Better facilities with improved site management with drainage including storm runoff cut-off from waste handling areas and diverted/managed would reduce pollution of nearby water bodies. ▪ Also, currently, solid wastes are collected and transported in open vehicles from which leachate drips while carrying wet waste. This creates odor and nuisance especially in dense roads and for residences along the roadways. Improved vehicles for the collection and transportation of wastes with leachate collection arrangements would eliminate this pollution. ▪ Overall SWM planning would aim at long term reduction of water pollution associated with the system. ▪ The current practice of the open dumping of biomedical waste from facilities not connected to the existing CBMWTF results in pathogens and chemicals contaminating the groundwater or surface water; along with general wastes. Harmful chemicals present in biomedical waste such as heavy metals can also cause serious water pollution. By planning for the collection and treatment of biomedical wastes, negative environmental externalities due to the present practice of open dumping/burning of the biomedical waste can be minimized.	▪ Biomining works would result in oozing out if retained moisture/rainwater or leachate polluting nearby water bodies and generating foul odor from polluted water. ▪ Construction of treatment facilities might require more consumption of water. ▪ The construction camps and other site facilities such as offices and warehouses will generate wastewater/sewage which may impact the water bodies due to the run-off in monsoon. ▪ Other possible causes of water contamination include accidental leakage or spillage of fuels, oils, and other chemicals, and waste effluents released from construction sites. These effluents can potentially contaminate the drinking water sources of the area and can also be harmful for the natural vegetation, cultivation fields, water bodies, and aquatic flora and fauna. ▪ After the completion of the construction activities, the left-over construction material, debris, spoils, scraps, and other wastes from workshops, and campsites can potentially create hindrance and encumbrance for the local communities in addition to blocking natural drainage and or irrigation channels. ▪ Biomining of the dumpsite and the sanitary landfill construction sub-projects will have an additional impact on the groundwater from the leachate discharge. The impact will be more pronounced in the ULB's of low lands which have a relatively high water table; if drainage and leachate management are not well planned. ▪ Worker camps without appropriate wastewater discharge may pollute nearby water sources. Potable water needs of worker camps can result in increased pressure on freshwater resources in the project or camp area.

Impacts on Land / Soil

Positive Impacts	***Negative Impacts***
▪ Planning and designing facilities in full compliance with existing regulations and guidelines, (drainage, leachate management, better storage, site management) and monitoring arrangements would result in overall better soil quality and avoids reputational risks ▪ Contaminants from the dumped (mixed) waste pollute the soil currently. Removal of dumped wastes would improve the soil quality and retrieves land for future use. ▪ Better waste treatment and disposal improves the land value and socio-economic status of communities around the existing dumping yards ▪ Leachates and waste flying out from current SWM collection vehicles pollute the land around. Plastics makes the land impermeable. Covered vehicles for the collection and transportation of wastes would eliminate this pollution ▪ SWM planning would aim at long term reduction of land pollution, and usability of available land resources ▪ Soil pollution is caused by uncollected bio-medical waste (infectious waste, discarded medicines) being dumped in the open. The heavy metals in the ash generated due to the open burning of the waste also contaminates the soil. Common waste treatment facilities for biomedical wastes reduces its regional spread and thus contaminating effects.	▪ Site modifications, excavations, and development might result in localized disruption of land profile and more utilization of topsoil in case of greenfield facilities ▪ Soils (including topsoil) in the construction area and agricultural/grazing land nearby will be prone to pollution from the construction sites, workers camps, and other material storage areas ▪ Fuel and hazardous material storage (including Batteries – due to electrolyte) for certain construction/operation activities and their handling are also potential sources for soil and water pollution. Improper siting, storage and handling of fuels, lubricants, chemicals, and hazardous materials, and potential spills may result in hazards and impact the soil and water quality. ▪ Biomining of the dumpsite and the sanitary landfill construction sub-projects will have an impact on the soil contamination from the leachate discharge. The impact will be more pronounced in the ULB's with alluvium soil and Kari soil. ▪ Contaminated sand and materials from biomining and other construction activities if not managed well might mean shifting of pollution from one parcel of land to another ▪ Waste generated during the construction phase includes Construction and Demolition (C&D) Wastes, excess construction material such as sand and soil, faulty/damaged parts, metal scraps, cardboard boxes and containers, and cotton swaths from workshops, and domestic solid waste from construction offices and camps. After the completion of the construction activities, the left-over construction material, debris, spoils, scraps, and other wastes from workshops, and campsites can potentially create hindrance and encumbrance for the local communities. ▪ Washing of vehicles involved in site-level works might result in localized land pollution. ▪ Movement of vehicles carrying materials and equipment for construction might disrupt land profile and loosen soil temporarily, ▪ Construction of treatment and disposal facilities might result in the utilization of more land resources.

Positive Impacts	Negative Impacts
	▪ Land modifications and Construction of common/regional facilities and landfills might disrupt land profile and downstream impacts; more so in Kalpetta, Manathavadi, Sulthan Bathery, Mannarkad, Kattappana, and other towns near the Western Ghats

Impacts on Fauna / Flora

Positive Impacts	Negative Impacts
▪ Planning and designing facilities in full compliance with existing regulations and guidelines, (on siting, protection of biodiversity and sensitive habitats, no disturbance to fauna/flora) and monitoring arrangements would result in overall better biodiversity, natural habitats and avoids reputational risks. ▪ Developing good facilities would prevent impacts on sensitive ecosystems such as wetlands, lagoons, and other natural resource areas; overall contributing to better living conditions for flora/fauna ▪ Better management of biomedical wastes reduces negative impacts on fauna/flora such as bites, cuts, and bruises	▪ Improper siting of facilities near sensitive areas might impact vulnerable flora/fauna ▪ Clearing of vegetation for construction activities may lead to disturbance to natural habitats (wetlands, forest areas, lagoons, etc.). Clearing of surface vegetation in quarry sites and burrow sites may lead to the loss of land/ natural habitats. The large scale construction activities in the proposed core area and related roads and transmission lines would involve the movement of vehicle and people, digging of soil, material loading, and erection of towers and stringing of conductors, etc. will create an impact of the local nesting birds and arboreal animals by shifting the nesting sites. ▪ There may be cutting of trees or removal green cover to construct treatment or disposal facilities. ▪ Construction activities might render dump yards/greenfield sites unsafe for fauna which feeds on wastes, if not controlled ▪ Loss of important fauna and flora and disturbance to animal migration routes due to construction works ▪ Changes to aquatic ecosystems due to siltation of waterways, dumping of wastes/construction rejects into water bodies, changes to speed and volume of water flow ▪ ULBs located in the vicinity of Protected Areas will be more sensitive to such impacts: Sulthan Bathery (near Wayanad WLS), Mannarkad (near Silent Valley NP), Wadakkancherry (near Peechi-Vazhani WLS), Ottapalam (near Chulannur Peafowl WLS), Kattappana (near Idukki WLS), Kothamangalam (near Thattekadu WLS), Cherthala, Alappuzha, Vaikom, Maradu, Thripunithura, Kochi, Paravoor, Kodungallur (near Vembanad-Kole Wetland/Ramsar site), Kollam (near

Positive Impacts	Negative Impacts
	Ashtamudi Wetland and Sasthamkotta Lake - Ramsar sites) ▪ Kalpetta, Manathavadi, Sulthan Bathery, Mannarkad, Kattappana, and other towns near the Western Ghats are also prone to such impacts

Impact of Noise

Positive Impacts	Negative Impacts
▪ Planning and designing facilities in full compliance with existing regulations and guidelines on siting and noise generation and control and monitoring arrangements would result in overall better noise standards and avoid reputational risks. ▪ Well managed waste management services with considerations for noise prevention and management minimizes noise levels making it comfortable for workers and neighbors	▪ Localized increase in noise and vibration is expected in areas close to construction areas and quarries from where the material for construction is sourced ▪ Noise will be produced by vehicular movement, excavation machinery, concrete mixing, and other construction activities, Vehicles transporting construction material, Handling of construction material, Diesel run engines of construction machinery such as excavation machines, concrete mixer, etc., Welding and cutting operation of metals, Pile driving activities during construction of the heavy structure ▪ Sensitive receptors such as hospitals, schools, religious places, and crowded market areas are particularly vulnerable to increased noise levels. ▪ Noise generated from diesel engines etc. could result in the movement of mobile faunal species away from the area of operation. This is important in the case of wetlands, sensitive ecosystems with fauna/flora visitation, or occurrence.

Other Impacts on People / Communities

Positive Impacts	Negative Impacts
▪ Planning and designing facilities in full compliance with existing regulations and guidelines and monitoring arrangements would result in an overall better environment, livability and heath, and avoids reputational risks. ▪ Openly dumped wastes in dumping yards and small plots/road verges are huge receptacles of rainwater encouraging the growth of flies and mosquito larvae, impacting the health of the city population. Better management of wastes reduces negative health impacts on the communities and ragpickers	▪ Improper siting and lack of following guidelines/regulations might impact vulnerable communities nearby ▪ Construction and Biomining activities might cause visual blight. ▪ Construction activities may pose health and safety hazards to the workers at site especially due to hazardous substances, lifting and handling of heavy equipment, operating machinery, and electrical equipment, working near water/slush (common in coastal marshy areas/areas near wetlands) or at height and more. Inappropriate handling or accidental spillage/leakage of substances including fuel,

Positive Impacts	Negative Impacts
▪ Availability of segregated recyclable wastes outside the dumping yards in MCFs/MRFs would reduce health impacts on ragpickers ▪ Well planned SWM and C&D facilities following safety and safeguards would reduce occupational health hazards on SWM workers ▪ Scavengers and rag pickers who mine the waste from open dumping are susceptible to the health and safety risks from the needle and broken glass prick injury, inhalation of toxic fumes, contraction of infectious diseases from the biomedical waste that is currently openly dumped. The open dumping of the waste is also leading to negative externalities such as health and safety impacts, a decrease in the land values to the communities in the vicinity of the dumpsites. These will be avoided by providing centralized collection and treatment facilities.	oil, asphalt, cement can potentially lead to safety and health hazards for the construction workers as well as the local community. ▪ Regular cleaning and approved pest control measures to be adopted: Biopesticides / biological control shall be adopted. Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used ▪ Occupational health and safety hazards related to demolition and decommissioning of existing structures as well as construction activities include the following: exposure to asbestos, dust including silica and lead, chemicals, sunlight, diesel engine exhaust emissions, fire, frequent exposure to loud noise and heat, use of vibrating tools, frequent or excessive manual handling of loads, stress and fatigue. Potential accident hazards for workers include accidents due to the worker - vehicular conflicts in the construction site including the uncontrolled movement of vehicles, heavy moving parts of large mechanized equipment and vehicles; falls (from heights); trench collapse; scaffold collapse; sinking in slushy earth, accidents due to sharp tools and electric tools strewn around on-site, unmanaged construction material and wastes on-site as a result of poor housekeeping, electric shock, and arc flash/arc blast; failure to use proper personal protective equipment; and repetitive motion injuries. ▪ In the absence of a local workforce and very high wages for the local workforce; the construction sector in Kerala is mostly dominated by migrant laborers. Most of the laborers are temporarily settled in Kerala, in poor living conditions. It becomes necessary often for the contractors to provide camps/labor accommodation in *insitu* labor camps or rented premises near construction sites. Such camps are usually in the form of minimal living areas with less ventilation, light, amenities, health care, or emergency facilities made of cheap materials with less climate adaptability or resilience. Without adequate facilities for healthy living, such camps end up as breeding grounds of pests and disease vectors. Population pressure due to labor

Positive Impacts	Negative Impacts
	influx may lead to expanded use of natural resources, such as forests and aquatic resources. Local communities may also face security Issues due to migrant workforce/labor camps

1.2.4.2 Environmental Impacts during Operation and Maintenance Activities

Impacts on Air

Positive Impacts	Negative Impacts
▪ Positive impacts of better operated SWM and C&D facilities on air; in terms of gaseous emissions, odor, and dust are enormous when compared to open dumping. Also, open dumps of mixed wastes often catch fire resulting in health impacts on nearby communities and workers. Proper management of wastes thus positively impacts the air quality. ▪ The emissions may also include greenhouse gases (GHGs) from engine fuel combustion (exhaust emissions) and evaporation and leaks from vehicles (fugitive emissions) and other emissions. Improved collection and transportation of wastes would eliminate air pollution. ▪ In a well-managed SWM system, Landfill gases are collected and treated through proper systems thus improving air quality. ▪ Common Biomedical Waste Treatment facilities following good practices and regulations will have a positive impact on the air environment compared to the baseline of opening dump/burning by reduced gaseous emissions, odor, and dust when compared to open dumping. Proper management of biomedical wastes thus positively impacts the air quality.	▪ Dust can include nuisance dust, hazardous dust (e.g., containing asbestos or silica), and bioaerosols (i.e., particles in the air consisting wholly or partially of microorganisms). Bioaerosols are of particular concern to the health of waste workers and have been the source of reduced pulmonary function and increased respiratory disease for those in immediate proximity to waste sweeping and collection activities ▪ Fugitive dust emissions from the operation of SWM facilities (managing wastes, sieving, landfilling, etc.) will also have impacts on crops, livestock near treatment facilities, and mainly; on population in densely developed areas. ▪ Emissions of fugitive dust, bio-aerosols are quite common from operational activities viz. waste transportation, receipt, unloading, processing, and storage. ▪ Emission from Waste Hauling, Landfill Equipment & Emergency DG Sets: PM, NOx, SOx, and CO emitted from waste hauling equipment, landfill equipment's and DG sets used for backup power supply during operations will impact air quality. ▪ Generation of Landfill gas from SLF Operations: Landfill gas (LFG) primarily comprising of methane (~60percent) and carbon dioxide ~30percent) is likely to be produced from the anaerobic decomposition of the biodegradable organic waste components in the SLF. These gases are identified as greenhouse gases (GHGs) and its uncontrolled release can contribute to global climate change if not properly managed. Further, the subsurface migration of LFG from the MSW site also has the potential to lead to the uncontrolled venting of such gases at adjoining private properties. ▪ Considering that the landfill will primarily comprise of inerts of non-biodegradable nature any possible generation of large volumes of LFG is unlikely. The use of methane generated by the landfill for power will avoid Carbon Dioxide and Methane emission. Also with the project design taking into an account

Positive Impacts	Negative Impacts
	controlled passive venting of LFG any potential air quality impact to this regard is not considered to be of major significance. ▪ Movement of vehicles mainly along unpaved roads, carrying wastes for daily processing and disposal may result in O&M stage impacts on air: dust, gas emissions, and odor. However, proper planning of movement routes and collection system would manage this impact. ▪ Storage or stocking of soil for daily cover in landfills might result in localized air pollution due to emitted dust. ▪ Typical odor-causing compounds documented from waste treatment facilities are ammonia, Sulphur compounds, nitrogen compounds, and volatile organic compounds (VOCs). ▪ Odors during Composting: Specifically, during composting operations, the following are key impacts: Under aerobic conditions, a well-aerated composting pile, the main gaseous product of composting and mulching is carbon dioxide, and the organics are characterized by an earthy or woody odor. The most common gas compounds contributing to odors from aerated static pile composting of organics containing biosolids include dimethyl sulphide, dimethyl disulphide, dimethyl trisulfide, carbon disulphide, and benzothiazole. These chemicals can be toxic, although in open-air (aerobic) composting situations; they are not present in high enough concentrations to be considered a health risk, per studies conducted, yet they can cause temporary discomfort to facility workers or neighborhoods in the vicinity. Under anaerobic conditions, when the biodegrading materials do not receive sufficient air due to inadequate aeration of stagnation of composting piles methane is generated, and this is accompanied invariably by the production of strong and foul odors. These odors are caused by the generation of ammonia, volatile amines (when the degrading organics have high nitrogen content), hydrogen sulphide and VOCs. ▪ The waste processing facilities may be sources of particulate matter in the atmosphere. The highest concentrations of particulate matter from waste processing facilities, occur during pre-treatment (shredding and mixing of waste) of fresh organics and the turning of biodegrading organics and can be higher under warm and dry climatic conditions. Gravel and unsurfaced access roads and earthmoving equipment, including withdrawing turners and other machinery, during operation can

Positive Impacts	Negative Impacts
	also be sources of particulate matter at composting facilities. ▪ The principal types of particulate matter of concern to the community are biological particulate matter, PM10 (size range < 10 µm), PM2.5 (size range < 2.5 µm) deposited matter, and total suspended particulate matter (TSP) that are present at composting and related organics-processing facilities. The human health effects of different-sized airborne particulate matter differ. Larger particles PM10 are trapped in the nose and throat, whereas smaller particles (PM2.5) penetrate the lungs and are associated with a range of respiratory ailments. Typically, labor working in composting facilities are often exposed to high levels of particulate matter (for short periods) if certain design features are not employed and key operational measures such an adequate occupational health and safety measures are undertaken to safeguard themselves from continuous inhalation. ▪ Biogas generation in bio methanation projects: Uncontrolled emission of biogas generated during the decomposition of organics can pose a fire risk and other potential hazards to humans. Biogas generated from the decomposition of 'mixed residual waste containing putrescible organics' is likened to the biogas generated in landfills. Thus the principal key pollutants of concern arising from the decomposition of 'mixed residual waste containing putrescible organics' are methane, nitrogen oxides (NO2 and NO), sulfuric acid mist (H2 SO4), sulfur oxides (SO3 and SO2), and non-methane volatile organic compounds (NMVOC). These pollutants are of concern because they can be toxic or highly odorous at quite low concentrations. ▪ Leachate: Putrescible organics tend to generate leachates that need careful management, substances such as food and kitchen waste contain high moisture that generates leachate without extra water being added. Other organic matter such as garden materials, wood, and fibrous materials generally form leachates only when additional water (including rainfall) is introduced. Under anaerobic conditions, the chemical properties of leachate can be acidic and can lead to the dissolution of metals and metallic compounds that may be present in organics. Under aerobic conditions, alkaline leachates can be formed from organics with low carbon/high nitrogen ratios, such as food and animal organics. Stockpiles of raw organics and processed organics have the potential to pollute waters,

Positive Impacts	Negative Impacts
	because leachate may be generated when the stockpiled organics contain excessive moisture, exposure to rainfall or if stockpiled organics are not sufficiently aerated or turned impacts are elevated. Such stockpiles may also exacerbate odor related impacts as excessive moisture will tend to cause the stockpiled organics to become anaerobic if not managed competently and produce acidic leachate. ▪ During the operation phase, the sources of fugitive dust are due to the movement of biomedical waste carrying trucks to and from the processing plant. ▪ The gaseous pollutants, particulate matter, Nitrogen Oxides NO and NO2, HCl, Total Dioxins and Furans, Hg and its compounds may be emitted from various operations ▪ There is also a likelihood of odor emissions due to the decay of the anatomical parts if stored for more than 48 hrs

Impacts on Water

Positive Impacts	Negative Impacts
▪ Operation of properly developed covered SWM facilities with cut off drains would minimize contaminated runoff or leachate from polluting the water sources. ▪ Landfills with proper leachate collection and treatment prevent contamination of water bodies. ▪ Collection Transportation system with no-drip arrangements and leachate collection system would prevent contamination of water sources ▪ Properly designed common biomedical waste treatment facility will reduce leachate of the pathogens and hence will reduce the contamination of groundwater or surface water. The treatment of wastewater generated using ETP will mitigate the impacts due to the heavy metals/other contaminants.	▪ Stored cover materials including sand when exposed to rains might result in turbidity in site runoff. ▪ Washing of vehicles involved in the collection, transportation of wastes, and in the treatment/disposal yard might result in localized water pollution. ▪ Daily operations of SWM facilities might necessitate more consumption of water. ▪ Leachate from waste piles caused by exposure to precipitation and from residual liquids in the waste itself may contain organic matter, nutrients, metals, salts, pathogens, and hazardous chemicals. If allowed to migrate, leachate can contaminate soil, surface water, and groundwater potentially causing additional impacts such as eutrophication and acidification of surface water and contamination of water supplies. They can be high in nutrients; this makes them favorable host media for bacteria and other microorganisms and gives leachate a high biological oxygen demand (BOD) and increases its pollutive nature. ▪ Potential groundwater contamination is envisaged from the generation of leachate that is formed as infiltrating water migrates through the waste material extracting water-soluble compounds and particulate matter. ▪ Leachates from composting and related organics-processing facilities have the potential to pollute

Positive Impacts	Negative Impacts
	groundwater and surface water bodies (such as rivers, creeks, and other waterways). ▪ Surface water run-off from composting and material collection facilities can cause unacceptable loads of sediment and suspended solids in receiving waters, while surface water run-on can lead to excessive generation of leachate Unvegetated exposed areas are a likely source of suspended sediment in surface water. ▪ The water during the operation will be required mainly for Floor & Vehicle washing, venturi scrubber, boiler blowdown, and domestic use. Treated water can be reused for scrubbing, gardening, washing vehicle. The water used during the operation has the potential to contaminate soil and groundwater resources if not treated using the ETP.

Impacts on Land / Soil

Positive Impacts	Negative Impacts
▪ Prevention of waste dumping and ensuring its treatment would have positive impacts on land; more so in case of managed biomedical/infectious wastes. By preventing land dumping of wastes, new better-managed systems for treatment/disposal will avoid more contamination of soil/land. ▪ Better waste treatment and disposal improves the land value and socio-economic status of communities around the existing dumping yards ▪ Covered vehicles for the collection and transportation of wastes would eliminate land pollution due to air blown/leaked wastes.	▪ Landfill works might result in localized site modification and more utilization of topsoil ▪ Washing of vehicles involved in SWM operations and maintenance of facilities might result in localized land pollution. ▪ Movement of vehicles carrying waste materials might disrupt land profile and loosen soil temporarily. ▪ Small quantities of hazardous waste may also be generated mainly from the vehicle and facility maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; materials used to absorb oil and chemical spillages for spill control; machine/engine filter cartridges; oily rags, spent oils and filters, contaminated soil, sharps as in broken tools and others). Such waste must be responsibly disposed to avoid adverse environmental, human health, and aesthetic impacts. Inappropriate disposal of these wastes can lead to soil and water contamination as well as health hazards for the local communities, livestock, and aquatic and terrestrial fauna/flora. ▪ Accumulated e-waste in the site needs to be separated and channelized to suitable agencies - collection center or dealer of the authorized producer or dismantler or recycler or through the designated take-back service provider of the producer to authorized dismantler or recycler with proper records. Else, this might pollute the land/soil.

Positive Impacts	Negative Impacts
	▪ Rejects, inerts including ash generated during treatment processes may contaminate soil if not properly disposed

Impacts on Fauna / Flora

Positive Impacts	Negative Impacts
▪ Better operation and maintenance of SWM services reduces negative impacts on fauna/flora such as bites, cuts, and bruises while moving around unsegregated waste heaps	▪ Improper operations near sensitive areas might impact vulnerable/threatened flora/fauna ▪ Impact on Avifauna: The landfill will provide a source of food. The number and abundance of bird species at the site may increase and scavenger bird species may increase. If birds feed on contaminants present in the waste, the effects of bio-accumulation may spread across enormous distances and affect the stock of birds that live and breed far away from the project area. This impact is temporary in duration, with no long term effects. They will be minimized by the application of daily cover to the active waste area. ▪ Impact on Aquatic Ecology: Surface runoff during monsoon from the operation of the landfill has the potential of leachate contaminating the receiving surface water bodies thereby impacting their aquatic ecology.

Impacts on People / Communities

Positive Impacts	Negative Impacts
▪ Better O&M of waste management facilities reduce negative health impacts on the city population, communities living near dumpsites, and ragpickers. Having a common biomedical facility with carefully designed occupational health and safety measures will have positive impacts on the occupational health and safety of the workers. Preventing the dumping of biomedical waste will avoid rag pickers/scavenger's exposure to pathogens and other infectious waste. ▪ Availability of segregated recyclable wastes outside the dumping yards would reduce health impacts on ragpickers ▪ Well planned waste management facilities following safety and safeguards would reduce occupational health hazards on SWM workers ▪ Clearing of unmanaged dumps reduces the risk of fire on communities and workers	▪ Improper siting and lack of following guidelines/regulations during O&M might impact vulnerable communities nearby ▪ Waste treatment, Landfill operations, and biomining activities might cause visual blight ▪ Quality of end products might become poor in case there is no control over wastes received for processing. It is necessary to weigh and examine incoming waste to assure that there are no toxic substances. ▪ Possible causes of fires at composting and related organics processing facilities include spontaneous combustion, sparks from works activities such as welding, lightning strikes, cigarettes, the build-up of particulate matter near engine manifolds, and exhaust pipes of processing equipment, bushfires, and arson. ▪ The key occupational health and safety impacts during the handling of the solid waste and C&D wastes include a) Health

Positive Impacts	Negative Impacts
	impacts of exposure to a variety of harmful materials of waste-related pollutants, b) Accidental spillage and collision by moving vehicles, c) Accidents, injuries, Cut & Bruises during handling of wastes, d) Exposure to pathogens and vectors, and airborne dust, de Falls from heights and into trenches, f) slip of heavy pieces of C&D wastes, g) chemical exposure ▪ The key occupational health and safety impacts during the handling of biomedical waste include a) health impacts of exposure to the pathogens, b) prick injury, (c) inhalation of toxic fumes.

1.2.5 Observations

From the above discussion on environmental impacts due to the proposed facilities, the following could be inferred:

- Positive impacts of proposed improvement in SWM services in Kerala far outweigh the negative impacts during construction and operation stages

- Since key project activities of SW treatment are limited to small parcels of land in its towns, impacts during construction and operations are localized and minimal. The project seeks to mitigate the current impacts on the State due to extensive dumping of wastes over the years.

- Proper siting, planning, designing, and implementation of the system following existing regulations and good practices can avoid, mitigate, and manage negative impacts which are mainly limited in magnitude and duration.

Summary of Key positive and negative impacts and the significance of negative impacts before and after mitigation measures is presented here.

Table 4: Summary of Impacts and their Significance before and after Mitigation

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance of Positive Impacts	Significance Prior to Mitigation of Negative impacts	Negative Impacts after Considerations in the Long-Term Plan/ Mitigation
A. Significant Environmental Impact Related to Project Siting/Initiation									
Land cover and land use changes due to greenfield facilities	Long term	Local	No	Certain	Low	Medium	Minor Positive[1]	Moderate negative	Minor Negative
Land cover and land use changes due to dumpsite remediation and removal of dumping practice	Long term	Regional	No	Certain	High	High	Major positive	Minor Negative	Major Positive
Impact on natural vegetation	Medium term	Local	Yes	Certain	Medium	Low	Minor Positive	Minor negative	Minor Positive [2]
Siltation, Drainage congestion, and waterlogging	Long term	Local but beyond project footprint	Yes	Likely	Medium	Low	Minor Positive	Minor negative	Minor Positive
B. Environmental Impacts during Project Implementation [3]									
Impacts on Air (dust and PM emissions due to the operation of construction equipment, transport, excavation of topsoil)	Short term	Local	Yes	Certain	Medium	Low	Negligible Positive	Moderate negative	Minor negative

[1] Removal of dumps spread throughout the state is a definitive positive impact
[2] Project ensures green cover and green belt - with indigenous trees; using high dense plantation; whereas wild growth only will be removed for construction
[3] Positive Impacts are minor or negligible considering construction activities

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance of Positive Impacts	Significance Prior to Mitigation of Negative impacts	Negative Impacts after Considerations in the Long-Term Plan/ Mitigation
Noise due to the operation of construction equipment	Short term	Local	Yes	Likely	Medium	Low	Negligible Positive	Negligible negative	Negligible negative
Impact on water environment (Siltation of waterways; Degradation of surface water quality s; impact on the groundwater from the leachate discharge – for biomining and sanitary landfill)	Long term	Local and Beyond project footprint	No	Certain	High	High	Major Positive	Minor Negative	Major Positive[4]
Impacts on Soil (Sediments, Top Soil, soil contamination)	Short term	Local and Beyond project footprint	No	Certain	High	High	Minor Positive	Major Positive	Major Positive[5]
Solid wastes and hazardous wastes	Short term	Local	Yes	Certain	Medium	High	Minor Positive	Moderate negative	Minor negative
Impact on the air, water and land environment due to Primary and Secondary Storage, Collection, Transport of Waste	Long term	Local	Yes	Certain	Medium	Low	Minor Positive	Minor negative	Minor Positive

[4] *Current practice of crude open dumping generates leachate continuously; mostly during rains (half a year). No drains or leachate treatment. Remediaon and improvements will contribute to positive impact*

[5] *Current practice of crude open dumping generates leachate continuously and contaminates land with toxic other unsegregated wastes. Remediation and improvements will contribute to positive impact*

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance of Positive Impacts	Significance Prior to Mitigation of Negative impacts	Negative Impacts after Considerations in the Long-Term Plan/ Mitigation
Impacts on ecosystems, flora, and fauna	Long term	Local but beyond project footprint	No	Certain	Medium	Medium	Major Positive	Minor negative	Minor Positive[6]
Site clearance and restoration (greenfield sites only)	Short term	Local	Yes	Certain	Medium	Low	Negligible Positive	Minor negative	Minor Positive
Occupational health and safety including Labour Management	Short term	Local	Yes	Certain	Medium	Medium	Major Positive	Moderate negative	Minor negative
Impacts due Labor influx on the Environment	Short term	Local	Yes	Certain	Medium	Medium	Negligible Positive	Minor negative	Minor negative
Socio-economic impact on the local population	Long term	Local	NA	Certain	Medium	Medium	Major positive	Negligible negative	Moderate Positive[7]
C. Environmental Impacts during Post Project Period / O&M Period									
Impact on air environment (odor, PM emissions)	Long term	Local and beyond project footprint	No	Certain	Medium	Medium	Major Positive	Moderate negative	Minor Positive
Impact on the water environment – run-off impacting the surface water bodies	Long term	Local and beyond project footprint	No	Certain	Medium	Medium	Major Positive	Negligible negative	Moderate Positive

[6] *Improved SWM improves nearby ecosystems and encourage fauna /floral growth and visitations*
[7] *Improved SWM practices and dumpsite remediation would support social and economic wellbeing of the populace more so; for communities around existing dump yards*

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance of Positive Impacts	Significance Prior to Mitigation of Negative impacts	Negative Impacts after Considerations in the Long-Term Plan/ Mitigation
Impact on Biological environment	Long term	Local	Yes	Likely	Medium	Medium	Major positive	Medium negative	Major Positive
Occupational Health and Safety	Long term	Local	Yes	Certain	Medium	Medium	Negligible Positive	Moderate negative	Minor negative
Socio-economic impacts on population	Long term	Local	Yes	Likely	Small	Low	Major positive	Negligible negative	Moderate Positive
Changes in land use pattern	Long term	Local	No	Certain	Medium	Medium	Moderate Positive	Minor negative	Minor Positive

1.3 Regulatory Gap Assessment – Environmental Regulations / Policies

The following table presents the regulatory gap assessment – National State / Laws and World Bank Safeguard Policies and Environmental Health and Safety Standards.

Table 5: Comparison of National Policies / Standards and Bank's Operational Policies on Safeguards and EHS Standards

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management
1.	OP 4.01 Environmental Assessment, WBG EHS and Bank Policy on Information Disclosure; EHS Guidelines for Construction Materials,	• National Environment Policy, 2006	Both OP 4.01 and NEP 2006 aims at mainstreaming environmental concerns into all developmental activities and conservation of resources. (No Gap)
		• Environmental Impact Assessment (EIA) Notification-2006, 14th Sep-2006, as amended in 2009 and 2016	The OP4.01 requires EA for projects which would have an impact on the environment – also applicable for Waste Management Projects.

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management
	Extraction, Noise limits, EHS Guidelines Wastewater and Ambient Water Quality, Sector-Specific Guideline for Healthcare Facilities		As per EIA notification; EIA is required for (new & expansion) Common Municipal Waste Management Facilities (Category B), Biomedical Waste Management Facility (Category B), Thermal Power Plants (Plants using municipal solid non-hazardous waste as fuel) Cat B: <20 MW Cat A: > 20 MW) Common hazardous waste treatment, storage and disposal facilities (TSDFs) Category A: All integrated facilities having incineration &landfill or incineration alone Category B: All facilities having landfill only. Category B projects will become Category A; if located near sensitive areas. Thus national regulation requires screening, scoping, categorization, and EIA preparation of major treatment and disposal facilities. Gap: Moderate impact subcomponents such as Plan preparation, collection, and transportation, construction of MCFs, MRFs, etc. may not require specific mitigation measures and can be managed by indicative EMPs. To bridge the Gap EMF shall incorporate screening, categorization of projects into high, moderate, low impacts, the conduct of EIAs for high and moderate impact projects, use of site-specific or indicative EMPs for various category projects based on impacts.
		Environmental Protection Act, 1986 and subsequent amendments • Air (Prevention and Control of Pollution) Act, 1981; • Water (Prevention and Control of Pollution) Act, 1974, for Pollution-Prevention-and-Management; • The Noise Pollution (Regulation And Control) Rules, 2000, & Noise limits for Automobiles & DG Sets • Municipal Solid Waste (Management & Handling) Rules, 2016 (MSW Rules) • Hazardous Wastes (Management, Handling, and Trans-boundary Movement) Rules, 2016. • The E-Waste (Management) Rules, 2016, • Plastic waste Management Rules, 2016 • Construction & Demolition, Waste Management Rules, 2016 incorporating	To comply with both National & WB guidelines: Waste Management projects shall comply with various rules on waste management by the Government of India. For Waste Management projects which have Environmental Clearance (with the concurrence of State PCBs), it is not required to get Consent to Establish under Air & Water Act prior to construction; but need Consent to Operate before starting operations. General EHS Guidelines IFC recommends that Emissions should not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources. WHO Guideline stipulates standards for 5 types of Air Pollutants. Air Quality standards: GoI stipulated standards for more number of pollutants (secondary parameters) like Pb, CO, NH3, C6H6, BAPs, As, Ni. For effluent discharged from HCFs, IFC stipulates standards for some more parameters like Cd, Cr, Pb, Hg, Chlorine, Phenols, Total Coliform, PCDD/F; whereas BMW Rules provide a standard for Bio-Assay Test. Common parameters like pH, TSS, Oil and grease, BOD, and COD are recommended by both though the permissible limit for a couple of the parameters (BOD, TSS) varies. Stack height to be kept has been defined by CPCB for DG Sets (based on capacity) and other point sources. National norm and IFC gives similar directive on Leachate Management. SWM Rules also stipulate standards for treated leachates for discharging into Inland surface water, Public sewers, Land disposal.

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management
		• Batteries (Management and Handling) Rules, 2001 • (Kerala) Environment Department -Ban on single-use plastic items in the State, wef. 1.1.2020- GO MS No 6, 2019 Envt dt:27.11.2019 and other related orders • Kerala Solid Waste Management Policy • General Standards for Discharge of Environmental Pollutants – Effluents • Schedule II of the Bio-medical Waste Management Rules, 2016 provides standards for effluent generated from HCFs, CBMWTFs before discharge into the sewer • Schedule II of Solid Waste Management Rules, 2016 set up for treated leachates from Waste Management facilities	Bio-medical Waste Management Rules, 2016 also recommend a minimum 30mt height of Stack for incinerator Basis for deciding the height of stack i.e. point source has been provided in General EHS Guidelines (Environmental) of IFC1. Standards for vehicular emission is not provided in IFC EHS guidelines. Emission Parameters for Incinerator (BMW): IFC defines standards for a greater number of emission parameters (like HF, CO, Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni) than GoI norm WB EHS suggests better management of wastes and occupational health and safety. National regulations and technical guidance ensure this.

Siting Parameters for Landfills	WBG EHS	National Guidelines, CPHEEO 2016
Habitation	250m	500m
River	Perennial stream - 300 meters downgradient - *unless* diversion, culverting or channeling is economically and environmentally feasible to protect the stream from potential contamination	100m from Flood Plain
Ponds, Lakes water Bodies		200m
Canal, Drain (non-meandering)		30m
Highway, Rail		500m from C-line
EQ zone	-no significant seismic risk within the region of the landfill which cause destruction of berms, drains or other civil works, or require unnecessarily costly engineering measures; otherwise, side slopes should be adjusted accordingly to prevent failure in the event of seismic activity - No fault lines or significantly fractured geologic structure should be present within 500 meters	500m from the fault line
Flood prone area	Landfills should be sited outside of a floodplain subject to 10-year floods and, if within areas subject to a 100- year flood, amenable to an economic design which would eliminate the potential for washout	Not permitted
Water Table (highest)	Groundwater's seasonally high table level (i.e., 10 year high) should be at least 1.5 meters below the proposed base of any excavation or site preparation to enable landfill cell development	Bottom liner-2m from HWT
Airport	1.6 to 3km	20m (or 10-20m with NOC)

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management
			Private or public drinking, irrigation, or livestock water supply wells located downgradient: - 500 meters (unless alternative water supply sources are readily and economically available and their development is acceptable to regulatory authorities and local communities) - landfill boundaries should be located outside of the 10-year groundwater recharge area for existing or pending water supply development Topography, Geology: -Landfills should be located in gently sloped topography, amenable to development using the cell & leachate drainage slope of about 2% - no underlying limestone, carbonate, fissured or other porous rock formations WBG EHS Guidelines states that: "When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment" Gap: Standards suggested by certain Rules with respect to EHS. Screening, Categorisation & EIA are required. The design shall be as per the guidance in various rules and technical guidelines of GoI and WBG EHS. In case of discrepancy in any standards, the more stringent standard to be adopted & proper explanation shall be provided in case it is not possible. EMF shall suggest including the requirements Air / Water/Soil quality monitoring during pre-construction, construction, and Operation Stages.
		• National Resource Efficiency Policy, 2019 (Draft)	Gaps: Considering International Good Practices and Bank's internal guidance, the gap exists with regard to resource efficiency, climate change, and community health and safety issues. To bridge the Gaps, project design shall focus on resource efficiency (with respect to plastic and C&D waste recyclables, converting wastes into useful compost/slurry and useable energy, reducing greenhouse gases released by open dumping). Requirements related to climate change resource efficiency and community health and safety shall also be incorporated in EIA ToRS and EMPs.
		• Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	No-Gap regarding vehicles, to minimize air/noise impacts, using vehicles with registration, and PUC certificates are included in the ESMPs.
		• The Building and Other Construction Workers (Regulation of Employment And Conditions Of Service) Act, 1996 • Contract Labour (Regulation &Abolition) Act 1970	World Bank EHS and IGP notes suggest compliance with good practices on OHS, workers, and labor camps. National / State regulations also confirm these requirements comprehensively. All contractors have to comply with these.

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management
		• Minimum Wages Act 1948, Payment of Wages Act 1936 • Child Labour (Prohibition & Regulation) Act 1986, • Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979	Gaps: Community Health and Safety; need to be incorporated as per WB requirements. To bridge the Gaps in OCHS, EIA shall evaluate such impacts on community health and safety and all ESMPs will include this requirement. Labour Management Procedures shall be included.
		• Right to Information Act 2005	Gaps: WB requirements on consultation and information disclosure suggests consultation and disclosure of safeguards documents. To achieve this, EMF shall incorporate detailed requirements for stakeholder consultation for Plan and safeguards document preparation and disclosure of documents (including translated (Malayalam) summary).
2.	OP 4.04 Natural Habitats	• Biological Diversity Act, 2002, • Wildlife Protection Act 1972 (WLPA) • Kerala Conservation of Paddy Land and Wetland (Amendment) Act, 2018 • The Kerala Biological Diversity Rules, 2008.	Provisions of the National acts meet the OP 4.04 requirements. To bring this in more clearly in safeguards management; Exclusion criteria mentioned for Stage 1: Screening, suggests no activity which would result in conversion or degradation of natural habitats. It excludes protected areas, wildlife sanctuaries, and Environmental Sensitive areas. It suggests ESMF consider Natural Habitats in EIAs and EMPs and suggests including institutional capacities for managing Natural Habitats / Biodiversity areas.
3	OP 4.09 Pest Management	Insecticide Act 1968 and Rules 1971 Draft Bill on Pesticide management, 2020 introduced in Rajya Sabha in March 2020 Circular issued by Government of Kerala on "Working instructions for enforcement of quality control of Quality Control of Seeds, Fertilizers, and Pesticides", Ref: GO (Rt) No. 624/2018/Agri	Both National / State regulations & WB Policy regulate the import, registration process, manufacture, sale, transport, distribution, and use of insecticides (pesticides), training to prevent risk to human beings or animals and for all connected matters, throughout India. Gaps: The WBG Policy & EHS suggests no use of banned pesticides (by WHO / National / State rules) and the need for safe handling of pesticides. To bridge the Gap, the EMF shall include the need for pest management as per WB Policy and WHS, no use of banned pesticides and guidelines for safe use of Pesticides (also in indicative ESMPs for various types of subprojects)
4	OP 4.11 Physical Cultural Resources (PCR)	Ancient Monuments and Archaeological Sites and Remains Act, 1958; Kerala Municipal Building Rules	Provisions from the act meet the OP 4.11 requirements regarding known historical monuments. Gap: WB Policy considers cultural values and physical resources valuable to the community also as important. To bridge the Gap: The Guidance Manual shall provide Physical Cultural Resources Management Framework – including identification of PCRs, consultations. Chance find procedures shall be included in EMSP.

Sl. No	Bank's Safeguard OPs/Standards	Equivalent National Environmental Policy and Regulations	Policy Gaps and its redressal: Waste Management

It is derived from this analysis that, to bridge the gap and provide more clarity on environmental assessment, the EMF shall incorporate exclusion criteria/screening to avoid irreversible impacts, categorization of projects into high, moderate, low impacts, the conduct of EIAs for high and moderate impact projects, use of site-specific or indicative EMPs for various category projects based on impacts.

Moderate impact subcomponents such as Plan preparation, collection, and transportation, construction of MCFs, MRFs, etc. may not require specific mitigation measures and can be managed by indicative EMPs.

The design shall be as per the guidance in various rules and technical guidelines of GoI and WBG EHS. In case of discrepancy in any standards, the more stringent standard to be adopted and proper explanation shall be provided in the ESIA (which will be cleared / advised by the Bank) in case it is not possible. EMF shall suggest including the requirements Air / Water/Soil quality monitoring during pre-construction, construction, and Operation Stages. Guidance for incorporating environmental considerations in design either by following the National Technical Guidelines or Environmental Codes of Practices will be useful.

To bridge the gaps concerning resource efficiency, climate change, and community health and safety issues, project design shall focus on resource efficiency (concerning plastic and C&D waste recyclables, converting wastes into useful compost/slurry and useable energy, reducing greenhouse gases released by open dumping). Requirements related to climate change resource efficiency and community health and safety shall also be incorporated in EIA ToRS and EMPs.

To bridge the gap, on Occupational and Community Health and Safety, EIA shall evaluate such impacts on community health and safety and all ESMPs shall include this requirement. Labour Management Procedures shall be included.

WB policies require consultation and information disclosure of safeguards documents. To achieve this, EMF shall incorporate detailed requirements for stakeholder consultation for Plan and safeguards document preparation and disclosure of documents (including translated (Malayalam) summary).

To bring this in more clearly in safeguards management; Exclusion criteria mentioned for Stage 1: Screening, suggests no activity which would result in conversion or degradation of natural habitats. It excludes protected areas, wildlife sanctuaries, and Environmental Sensitive areas. It suggests EMF consider Natural Habitats in EIAs and EMPs and suggests including institutional capacities for managing Natural Habitats / Biodiversity areas. Gaps: The WBG Policy & EHS suggests no use of banned pesticides (by WHO / National / State rules) and the need for safe

handling of pesticides. To bridge the Gap, the EMF shall include the need for pest management as per WB Policy and WHS, no use of banned pesticides and guidelines for safe use of Pesticides (also in indicative ESMPs for various types of subprojects)

WB Policy considers cultural values and physical resources valuable to the community also as important in addition to nation/state-protected monuments. Hence, the Guidance Manual of EMF shall provide Physical Cultural Resources Management Framework – including identification of PCRs, consultations. Chance-find procedures shall be included in EMSP.

CHAPTER 2. ENVIRONMENTAL MANAGEMENT FRAMEWORK

The Environmental Management Framework (EMF) has been prepared to assist in the screening, assessment, management of environmental risks of the project at an early stage in project planning and integrate mitigation hierarchy during the subproject design, implementation and operation. The framework will help provide specific guidance on the policies and procedures to be followed for environmental assessment along with the roles and responsibilities of the implementing agencies. A systematic methodology has been provided in the subsequent sections that can be followed along with engineering and institutional interventions required for the sub-project activities for effective integration of the environmental considerations and safeguards.

The objective of EMF is to frame guidelines and procedures to address the environmental impacts associated with the implementation of this whole project. The specific objectives are as follows:

- Ensure that the environmental management plans are aligned with the requirements of the country system as well as with the World Bank safeguard requirements
- Outline the process to identify and assess the environmental risks/ impacts/ issues relevant to the proposed project
- To establish clear procedures and methodologies for the environmental screening, review, approval, and implementation of sub-projects to be financed under the Project
- to ensure that mitigation measures are designed to effectively mitigate the potential adverse environmental impacts
- To specify appropriate roles and responsibilities at the national, state and municipal levels, taking into consideration the law on federalization, and outline the necessary reporting procedures, for managing and monitoring environmental concerns related to sub-projects
- Strengthen the institutional capacity of the PIU and PMU on safeguard compliance.

2.1 Methodology Adopted for EMF Preparation

The EMF has been prepared based on environmental and social assessments which involved the gathering of data through both primary and secondary sources. The steps followed in developing the EMF are provided below:

- Establishment of the baseline (describing the relevant physical, biological, and socioeconomic Conditions) through assessment of the study area and solid and biomedical waste management through desk research, surveys, and discussions with stakeholders. This also included desk research of similar bank operations to understand probable social and environmental impacts.
- Defining the legal/regulatory framework that will influence the implementation of the proposed projects and sub-projects and included a review of national and state-level acts and policies applicable to the proposed project. It also attempted to identify existing gaps in the current implementation practices associated with the proposed project activities, so that they can be addressed during implementation.

- Carrying out stakeholder consultations with all relevant stakeholders those who have been identified through stakeholder and institutional analysis: these include government, communities, and institutions. The consultation process has been carried out at State, district, and ULB levels. The objective of the consultation sessions is focused to improve the project's interventions about the environment and social management and to seek views from the stakeholders on the environmental and social issues and the ways these could be resolved. (Details of stakeholders consulted are presented in ***Section 3.7***)
- Identifying the impacts of the activities supported by the project on the environment and the society to feed into the development of mitigation measures for any negative impacts. (The results of the above steps have been included in Volume I: SEA).
- Defining the framework for management and mitigation methods to manage the impacts, and for improving stakeholder capacities to manage the project.
- Preparing the monitoring plan to oversee the implementation of management and mitigation methods
- Discussing the existing grievance redressal mechanism and citizen engagement measures and defining the proposed mechanisms for the project.
- Identifying the institutional capacity building and training requirements for implementing the mitigation measures
- Preparing an estimated budget to undertake the provisions of the EMF.

2.2 EMF Adoption Framework

The EMF adoption framework is presented in the following ***Figure 1*** which is detailed in the subsequent sub-sections.

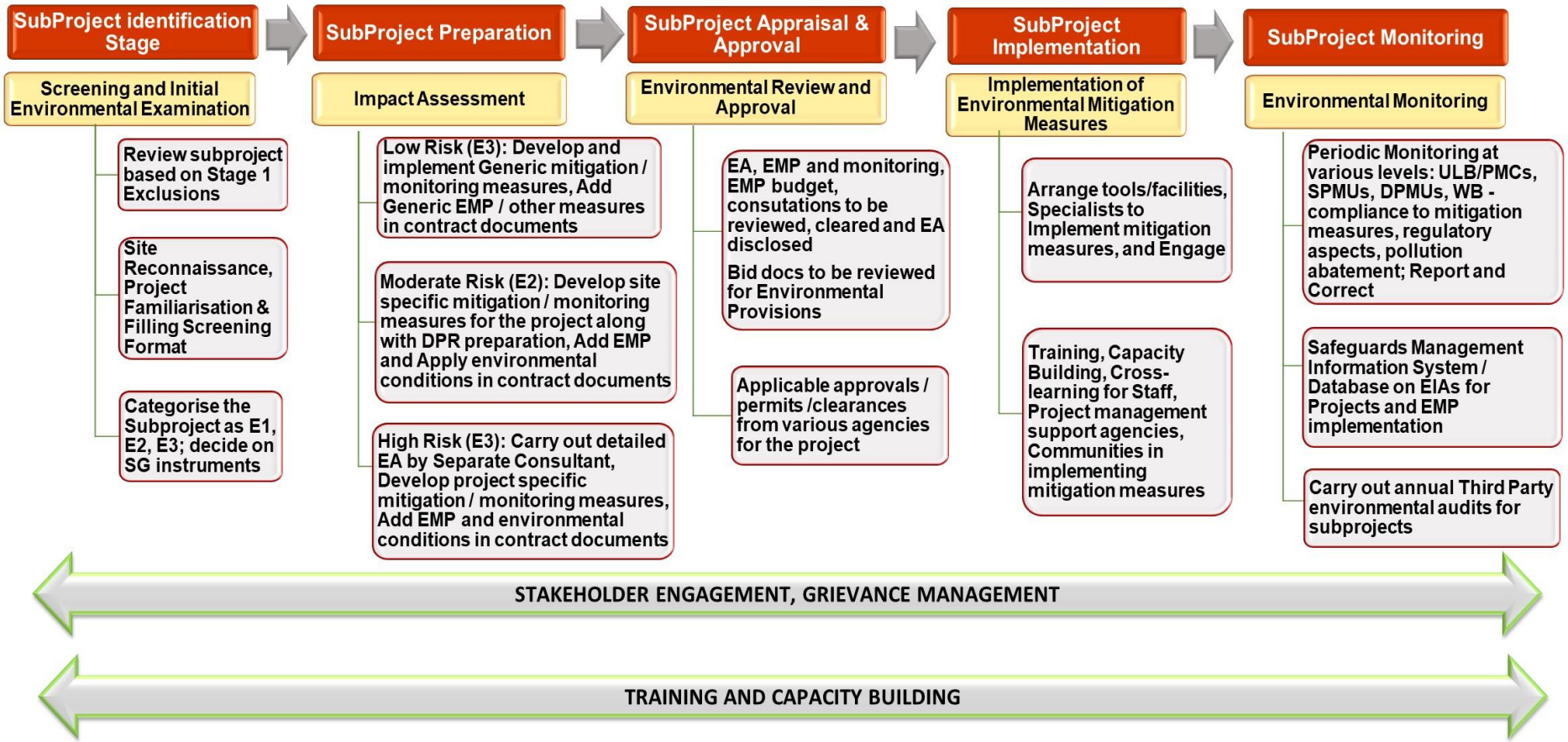


Figure 1: EMF Adoption Framework

2.3 Subproject Identification: City / Town level Plan for Solid Waste Management

The project envisages that each city shall prepare a Solid Waste Management Plan, to guide the improvement of the existing system based on existing rules (mainly SWM Rules 2016), applicable guidelines, and acts/ laws. The plan shall detail out the proposed plan for sweeping, Segregation, Storage, Collection, Transport, Treatment, and Disposal of varied streams of Solid Wastes (both BDW and NBDW); from various bulk / individual generators. The plan shall be for the next 30 years; with sub plans and targets for every five years. This shall also discuss a) institutional responsibilities (for planning, implementing, operating, maintaining facilities) including the role of CBOs, ragpickers, private sector, individual households / commercial/institutional stakeholders for various components; and b) financial planning (for both capital and O&M expenses) for the plan period including the source of funding, user fees, etc. This shall also include a plan for disaster waste management.

At this stage, the environmental aspects of SWM shall be well integrated into the proposed plan in compliance with WB policies. For this, it is proposed to prepare an Environmental Impact Assessment of the proposed plan and Environmental Management Plans for expected impacts shall be arrived at. The development of the SWM system and services shall follow the plan thus prepared.

2.3.1 Screening Mechanism during Sub-project Identification / Initiation

At the subproject initiation state, project sites shall be screened for potential impacts due to proposed developments. The two-stage Screening process is suggested. Stage 1: Screening based on lists of activities not permissible under KSWMP; Stage 2: Detailed Screening Checklist to outline the impacts of permissible activities.

Stage 1: Exclusions to be considered during the Sub-Project Identification Stage

Considering the World Bank Policies and safeguard requirements, KSWMP **will not** support sub-projects which will involve the following:

Table 6: List of Non-permissible Activities under KSWMP

Sl No:	*Non-permissible Activities*
1	Projects in sites/locations which should be excluded as per prevailing Rules / Laws, near Natural Habitats and Forests: (i) any construction in demarcated Forest areas or protected areas or their buffers, (ii) landfills, not confirming to siting criteria as per SWM Rules 2016, or (iii) treatment facilities for Solid Waste, Biomedical Wastes and C&D Wastes not conforming to Pollution Control Boards siting criteria for specific industry (various types of treatment plants) types (where mitigation measures are not possible).
2	Projects which would involve decontamination of hazardous waste dumpsites or those would potentially result in further pollution of sensitive areas
3	Projects involving (i) any impact on or due to Dams or embankments or (ii) purchase, storage and use of Banned Pesticides

Such projects will be excluded during the Project Identification stage itself. PIU/ Line Department shall scrutinize the project for any of the above activities/components and avoid taking up such subprojects for implementation. PIU should maintain a record of such subprojects excluded from KSWMP following this ***Stage 1: Exclusions List.***

Stage 2: Initial Environmental Examination (IEE)

The environmental examination of each sub-projects under KSWMP will be undertaken to determine the anticipated environmental impact and opportunities based on which the appropriate safeguard instrument for mitigating the negative impacts and enhancing the positive impacts will be ascertained. The requirement of the safeguard instrument will be based on the project categorization and will constitute either of (a) comprehensive Environmental Impact Assessment; or (b) Limited Environmental Assessment confined to the project area and (c) use of Environmental Management Plan (EMP). The safeguard instrument will be determined by the Bank's environmental safeguard policies in conjunction with the Government of India's regulatory requirements. The IEE will be undertaken by the safeguard specialist of the PIU and will comprise of a combination of the literature review, stakeholder consultations, and the site reconnaissance survey.

The key steps involved in the process are briefly outlined below.

- Step 1: Conduct reconnaissance site visits for ground-truthing and screening, Ascertain ***Stage 1: Exclusion***
- Step 2: Ascertain the presence of any environmentally sensitive areas as detailed in ***Stage 2: Screening Criteria***
- Step 3: Confirm the applicability of regulations and whether any of the sub-projects are prohibited as per the existing law/regulations in the proposed sites
- Wherein the proposed activity is restricted and change has been made in project design to avoid such prohibitions, Step 1 needs to be performed again
- Step 4: Revisit the screening checklist and ascertain outcomes of the screening checklist. Undertake the detailed screening process for the proposed investments in consultation with the line department/s
- Step 5: Determine the project category based on screening and the appropriate safeguard document to be prepared to incorporate necessary mitigation measures.

The PIUs and Line Departments shall have detailed topographic maps of all the proposed subproject sites with details of ecologically sensitive areas, habitat areas, Reserve Forest, Wildlife Sanctuary, coastal regulation zones, etc. to undertake screening exercise.

PIU (and/or SPMU / DPMU) shall organize a meeting with all the Line Departments and the concerned officials of the Pollution Control Board, State Environment & Forest Department, SCZMA, and other agencies before starting the process to gain a better understanding of the clearance process.

The outcome of this screening process will help prioritize the various investments and where required, start the clearance process on-time e.g. project sites (in particular requiring Forest / CRZ / other clearances). Projects for which the clearance process may be longer can be sequenced/phased later in the overall project implementation plan. However, the clearance processes for such projects/sites shall be initiated at the earliest. This shall help ensure that no subprojects are impacted due to delays in the clearance procedures and regulations.

PIU shall submit duly checked and signed screening forms to Safeguards Specialists at SPMU / DPMU. Based on the initial environmental examination undertaken, details provided by PIU, and discussions with various agencies concerned, Environmental Specialists of the SPMU / DPMU would undertake project categorization.

2.3.2 Categorization of the Projects

Depending on the type of investments and nature of activities, proposed subprojects will have varying impacts on the environment. Hence, the type and extent of environmental assessment to be carried out to identify and mitigate the impacts also largely depends upon the complexities of project activities and exact locations. It is important to identify the probable impacts and plan for mitigation measures early on, to manage them effectively. To facilitate effective screening, the subprojects are grouped into different categories – E1, E2, and E3 linked to extent and severity of impacts (depending on the type of activities and locational characteristics) and regulatory requirements. So, based on the screening process undertaken, Environmental Specialists of the SPMU would undertake project categorization. They would classify subproject into E1, E2, E3 as per severity and extent of environmental impacts

The E1, E2, and E3 categories are defined as follows: Subprojects that may have major environmental impacts; thus, necessitating Environmental Impact Assessment (EIA) are categorized as E1. The proposed subproject is classified as E1 if it is likely to affect Sensitive Environmental Components (SEC) such as those mentioned in ***Table 6*** below. Those projects/activities, which require CRZ and/or environmental clearance as per the CRZ 2019 notification and EIA notification published by the MoEFCC will also be categorized as E1. This is to streamline and integrate the preparation of EIAs as required for these clearances to avoid duplication of efforts. Any subproject involving any activity related to a critical natural habitat as per WB Policy OP 4.04 will also be categorized as E1.

Such subprojects would require detailed site and activity-specific Environmental Assessment, project impact identification, and specific mitigation measures to take care of anticipated negative impacts in addition to improving environmental performance, ensure environmental sustainability and climate resilience/adaptation.

Table 7: Sensitive Environmental Components

Sl. No	Sensitive Environmental Components
1.	Areas like National Parks, Sanctuaries, Biosphere Reserves, etc. protected under Wildlife Protection Act, 1972; including Tiger reserves, Elephant Reserves
2.	Ecologically Sensitive Zone (Western Ghat) and Ecological Sensitive Areas
3.	Migration route of wildlife / Wildlife Corridors
4.	habitat for migratory species; Breeding and spawning ground of species (including seasonal); Coral Reefs
5.	Delineated CRZ Areas as per CRZ Notification
6.	Estuary, Creeks, natural drainage system, Rivers, Natural lakes, swamps, Marine ecosystem, Ramsar Sites
7.	Forests and Mangrove Forests / Mangrove Covers
8.	Important Bird and Biodiversity Area (IBA)
9.	Archaeological monuments/sites, Religious, heritage historic sites, and cultural properties
10.	Scenic areas, Hill /mountains, Areas of scientific and geological interests

Sl. No	Sensitive Environmental Components
11.	Seismically and geologically active areas
12.	Tribal Settlements
13.	Defense installations, especially those of security importance and sensitive to pollution
14.	Airport and other sensitive installations

Subprojects that are expected to have only moderate environmental issues are categorized as E2. A project is categorized as E2 if its potentially adverse environmental impacts are less adverse (in spread and severity) than those of E1. These impacts are mostly generic and in most cases, mitigation can be designed more readily than for E1 projects. Although the scope of assessment for an E2 project is project-specific and examines the project's potential negative and positive environmental impacts, it recommends measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. Sub Projects that are expected to have no environmental issues are categorized as E3 projects. Hence no environmental assessment is required for an E3 project beyond screening. For such projects, IEE and Generic EMP shall be used and shall be modified as per site/project details. It is expected that the design of these subprojects also incorporates measures to improve environmental performance. Sample / Indicative EMPs provided in Volume II can be used as guidance for preparing / adopting mitigation or management measures under all three categories.

Table 8: Environmental Categorization of Projects

Proposed Subproject Categories	Description	
	Extent of Environmental impacts	**Type of Projects and Management Tools**
E1	Significant	Projects with significant negative impacts including those which require EIA / CRZ clearance as per national regulations (Category A or B as per EIA notification and those which need CRZ clearance at National Level), and those which might impact sensitive environmental components including natural habitats. Project-specific detailed EA preferably by an independent agency. In case the DPR consultant undertakes the EIA; this will be reviewed by an independent consultant for better alignment with project details. WB requirements and national/state laws and regulations are to be followed (in case of inconsistency between them, the more rigorous requirements will apply). Specific mitigation/monitoring measures including those to improve environmental performance, ensure environmental sustainability and climate resilience/adaptation.
E2	Moderate	Projects with moderate impacts (and those which will not require EIA clearance and may require CRZ clearance at State level). Project-specific EA along with the DPR. Project-specific EMP including measures to improve environmental performance, sustainability, and climate resilience/adaptation. WB requirements and national/state laws and regulations are to be followed (in case of inconsistency between them, the more rigorous requirements will apply).
E3	Minimal	Projects with minimal negative impacts. Screening Report with measures to improve environmental performance, sustainability, and climate resilience/adaptation; and generic EMP

Based on the above indicative categorization of key subprojects is presented in the following ***Table 8***.

Table 9: Indicative Environmental Category of Subproject Types

Sl. No	Type of Sub-Projects	Probable Categorization *
A.	***Decentralized Biodegradable Waste Management Facilities***	
1	*Household and Institutional level Composting and Biogas Technologies*	*E3*
2	*Community-level Composting and Biogas Technologies*	*E2*
B.	***Centralized Biodegradable Waste Management Facilities***	
1	*In-vessel composting, aerated static pile composting*	*E2*
2	*Bio-methanation to electricity & bio-methanation to Compressed Bio-Gas*	*E1*
C.	***Non-Biodegradable Waste Management Facilities***	
1	*Improvement and Deployment of Material Collection Facilities (MCFs)*	*E3*
2	*Material Recovery Facilities (MRF)/Resource Recovery Facilities (RRF)*	*E2*
3	*Refuse Derived Fuel*	*E1*
D.	***Bio Remediation: Biomining & Closure***	*E1*
E.	***Land Fill***	*E1*
F.	***Collection and Transportation of waste (assessment at ULB level)***	*E3*
G.	***Common Solid Waste Management Projects*** *(involving a combination of Treatment & Disposal facilities above) or cluster level large facilities involving more than Two ULB**s***	*E1*
H.	***SWM Plan Preparation*** (Technical Assistance)	*E2*
I.	***Common Biomedical Waste Management Facilities***	*E1*
J.	***Biomedical Waste Collection, Transportation and/or Support to improve cleaning, disinfection, hygiene of Workers***	*E2*
K.	***General cleaning, disinfection activities***	*E3*

* Note: This is only an indicative categorization based on project types. However, actual categorization shall consider project activities/components (as it would differ based on requirements), and its impact and spread in the environment, locational sensitivities (***Table 6***) and regulatory requirements. Also, in case a subproject has more than one among these subcomponents, the higher category applicable for any subcomponent would be considered as the category for the subproject as a whole.

As per World Bank Policies, ESMF applies to the entire project; also, to linked activities or associated facilities. All subprojects and linked / associated facilities shall also be categorized, impacts identified and mitigation measures and monitoring planned and implemented.

2.4 Project Preparation

2.4.1 Preparation of Terms of Reference for Environmental Assessment

The subproject categorization as elaborated in the earlier section will be used as guidance by the executing agency in formulating the terms of reference for the applicable safeguard instrument. The executing agency will consult with the ULB's in formulating the terms of reference. Experienced consultants will be employed by the executing agency for preparation of the EIA and DPR for the E2 projects, and specialized environmental assessment reports for the E1 category projects. For the E3 category projects, generic EMSP will be contextualized for the project by the executing agency and the ULB. The EMPs shall be included in the bid documents and guide the contractor to prepare Contractors EMP at the start of implementation for effective environmental management of the subproject and reporting.

2.4.2 Environmental Impact Assessment (EIA)

EIA evaluates a project's potential environmental risks and impacts in the project area of influence, examines the alternatives (minimum three; including no project scenario), identifies measures to mitigate the environmental impacts, and improvement of benefits throughout project implementation. Wherever feasible, preventive measures would be undertaken.

- The borrower is responsible for carrying out the EIA as outlined in the EMF and national regulations. EIA shall start by the preparation of draft project documents (DPRs)/ Feasibility Report (after pre-feasibility report) ideally so that the findings/avoidance/mitigation/management measures can be incorporated early on into the design.
- In the case of E1 projects, the environmental assessment may be undertaken by consultants other than DPR consultants based on an agreed ToR to ensure independence in the assessment of the impacts. If the environmental assessment for E-1 projects are being undertaken by DPR consultants for better integration with project design or considering the lack of available additional firms/expertise for a certain type of projects; it is recommended to employ independent consultants (suitably selected as per expertise required considering the subproject details) to review the same before approval and to ensure that all critical issues of environmental management are addressed in the project. Based on the outcome of consultations and survey results, mitigation plans as needed depending upon the nature and scale of impact will be prepared. The outcome of consultations will be incorporated into the mitigation plan or designs. The draft mitigation plans will be disclosed, and consultation will be held with the stakeholders including communities to explain a) the proposal, b) alternatives considered, c) expected impacts, d) content of the mitigation plans, e) process involved in the implementation of mitigation plans, f) responsibility of various institutions involved, g) grievance mechanisms, h) explanations on their comments/queries. Minutes of the stakeholder consultations would be presented in the EIA. The Guidance Manual of this EMF presents detailed requirements and guidance for effectively analyzing, assessing, and incorporating the requirements for natural habitats, physical cultural resources, and pest management in project screening and EIAs.

- The opinion of the stakeholders and public shall be incorporated in the project through specific public consultations (preferably two public consultations; one at the start of the EA process and other; on the Draft Report) with prior notice.
- Also, the draft EIA shall be made available in a public place in English and local language – Malayalam - well; accessible to affected groups and local NGOs.
- Implications of the available legislation and regulatory requirements and the requirements of the operational policies of the World Bank are also to be reviewed as part of the EIA. The EIA report shall meet the requirements of national and state-level legislation and disclosure requirements of the World Bank. Necessary clearances shall be obtained for EIA, before the start of work; as applicable.
- EIA report shall include an Executive summary, Introduction / Project background, Project Description including review of (three) alternatives (including no-project scenario), Review of Legislations, Baseline environmental conditions, Impact Evaluation, Public consultation details, Management and Monitoring Plan, implementation EIA Budget.
- Draft final reports along of the EIA along with observations/comments of the Technical Review Committee (which will include Safeguards review) or Safeguards specialist will be forwarded to the Executing Agency / World Bank for its review, comments and clearance as applicable (E-1 subprojects / or any special projects will be sent to SPMU and the World Bank for review and clearance; E2 projects will be cleared by SPMU, while E3 will be cleared by DPMUs. The consultant's contract shall have adequate provisions to ensure that they would incorporate all the comments and finalize the EIA report.
- The final version of all EIA and EMP in English with a non-technical summary in the local language – Malayalam, shall be disclosed as per applicable disclosure policy; in the websites of the executing agency/relevant departments and will be made available in places accessible to the local people. Final EIAs for E1 projects shall be sent to the Bank for clearance and disclosure.
- Considering the multiplicity of subprojects and PIUs, it is important to develop a Management Information System which will help schedule and alert the relevant project authorities at various levels on the need to prepare EIAs well in advance before procurement initiation.

2.4.3 Environmental Management Plan (EMP)

- The management plan shall consider various activities proposed under the project and provide management measures to be followed for different phases of implementation, along with the responsibility allocation for implementation and monitoring plan.
- Apart from addressing the issues, management measures shall also explore enhancement opportunities and their inclusion in project components shall be ensured.
- The management measures identified shall be made part of the project components and shall be included in the bid documents appropriately.
- Indicative Environmental Management Plans for various subprojects/activities expected are provided in the Guidance Manual of the EMF. Also refer respective sections on Natural Habitats, Pest management, and Physical Cultural Resources which will help in the preparation of subproject EMPs.

- The cost for implementation of the management measures, the institutional arrangements for monitoring, etc shall be included in the project cost.
- For construction / EHS impacts; guidance includes The World Bank Group General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to construction and can be downloaded via the following link.

https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

World Bank EHS guidelines applicable to Waste Management can be downloaded and used as international best practices from https://www.ifc.org/wps/wcm/connect/5b05bf0e-1726-42b1-b7c9-33c7b46ddda8/Final%2B-%2BWaste%2BManagement%2BFacilities.pdf?MOD=AJPERES&CVID=jqeDbH3

WBG EHS Guidelines and the sector guidance WBG Environmental Health and Safety Guidelines for Health Care Facilities.

As the project includes developing guidelines and systems for COVID-19 related waste management, sanitization, and public hygiene practices to be rolled out across all urban areas. This activity would be informed by available guidelines on the COVID response E&S documents.

(https://worldbankgroup.sharepoint.com/sites/wbunits/opcs/Pages/pc/Operations-COVID19-Coronavirus-Information-03092020-081859/Overview-03092020-081941.aspx)

For quick guidance, a tabulated summary of key environmental impacts and mitigation/management measures for probable types of subprojects/project components are provided in **Table 4**. This is just indicative and shall be updated and used as per probable impacts linked to project details and locational characteristics.

2.4.4 Cost for Mitigation Measures including Monitoring Plan

The EMP Cost shall be integrated into the Detailed sub-Project Report (DPR) and sub-project bid documents. This shall include cost for all mitigation measures and monitoring required during various stages of the project. Details on including these costs for mitigation measures in the cost tables of the contract shall be presented in EIA. Executing Agency should ensure the preparation and implementation of Contractors-EMP and the inclusion of EMP cost in contract documents.

2.4.5 Proposed Institutional Mechanism and Reporting Requirements for Subprojects

Successful implementation of safeguards in subprojects can be ensured by defining the role of various officials in its implementation. EMP for each of the subprojects should present the institutional responsibilities and time frame for implementation of mitigation measures and monitoring.

2.5 Project Implementation

Project Implementation starts with inviting bids from the potential implementation partners for each of the subprojects identified. Right from the RFP preparation stage for inviting the bids, it is important to incorporate environmental conditions, so that the contractors are aware of

and are prepared with adequate finances and institutional set up to ensure implementation of environmental enhancement measures and safeguards.

2.5.1 Incorporating EMP into Contract Documents

This subsection provides guidelines on the integration of the EMP /Indicative EMP documents into the contract documents. With the revision to the World Bank's Standard Bidding Documents in January 2017, Environmental Health and Safety (ESHS) requirements are well defined in the bid documents. Also, an ESHS Performance Security has been incorporated into the requirements (in Standard Bid Format) from potential bidders for the implementation of works under project financing. This revision incorporates changes to enhance environmental, social, health, and safety performance during all stages of the subproject.

ESHS Performance Security

Depending on the associated risk of the subprojects, an ESHS Performance Security, of 1-3percent of the total contract value shall be maintained as per the Guidance provided supplementing the World Bank's Standard Bidding Document. The total performance security for contracts will typically be 10 percent of the total contract value of which 3 percent should be allocated to the ESHS performance security, while; where a contract has performance security of 20 percent the ESHS performance security is to be maintained at a maximum of 5 percent of the total contract value.

The Environmental Specialists and procurement team of the project executing agency will be required to work together closely to ensure that the ESHS aspects are incorporated in the bidding document. Comprehensive MIS database developed by the project which tracks the project progress and aligns the same with the environmental safeguard implementation such as EIA report preparation, procurement of relevant clearances, EMP implementation will help the executing agency to effectively supervise and monitor all subprojects.

The environmental engineers at the executing agency need to align the language in the EIA/EMP reports with that of bid documents. Adequate E&S staffing should be part of the EMPs that are incorporated into contract documents for construction contractors and DBOT contractors and for site-specific plans to be developed by the contractors.

The budget for complying with the EMP needs to be worked out for each sub-project by working out the cost of implementing each EMP mitigation measure. Where this is not possible, the provision of a minimum of 3 percent of the sub-project cost needs to be earmarked for complying with the EMP. The contractor is required to provide a costing at a minimum within this amount in his BOQ, listing itemized values for EMP implementation. The language should indicate that the contractor will be required to provide an itemized costing with the BOQ within this allocation.

For large scale contracts that are assessed as high risk during environmental screening, it is also requested for the contractors to have the following certifications in the Eligibility and Qualifications Subsection, in Section III of the Standard Bidding Documents, under Contractor Requirements.

- Registration with ISO 14001 (Environmental Management)
- Registration with ISO 45001/ OSHAS 18000/ or equivalent on (Occupational Health and Safety Management)

- If not already registered, must be willing to register as such before requesting mobilization amount or any other payment for the contract

2.5.2 Onsite implementation of EMP

The contractor shall implement all the EMP measures applicable for the project right from the pre-construction stage and EMP implementation is part of their responsibility as per procurement conditions. This shall be discussed with site engineers and workers and record on its implementation shall be maintained. SPMUs and DPMUs will be supported by specialized consultants to support safeguard requirements (as part of PMC). PIU, with the support of PMC, will monitor the implementation of EMP measures during implementation monitoring and report to DPMU / SPMU. The contractors / NGOs / CBOs who would be implementing the projects on-site shall have environmental, health, and safety specialists (of required qualification to manage that aspect of SWM) for onsite implementation of EMP.

2.6 Monitoring and Evaluation

2.6.1 Sub-Project Monitoring

SPMU / DPMU shall monitor all projects that it finances to ensure conformity to standards during construction, operation, and maintenance. Monitoring of Environmental components will be carried out through environmental compliance reports that form part of Quarterly Progress Reports. Based on the a) verification of progress reports and field visits, b) E&S compliance reports, and c) compliance with other loan disbursement conditions, subsequent installments will be disbursed. Monitoring of safeguards shall be carried out through the state Environmental and Social development Unit (S-ESDU) and District- Environmental and Social development Unit (D-ESDU).

S-ESDU shall ensure that the D-ESDUs make adequate internal arrangements to monitor the EMP/SMP implementation quarterly, receive regular monitoring and progress report from PIUs/PMCs, and in turn submit regular progress reports including environmental compliance reports to The World Bank. The model format for the preparation of the EMF compliance report is provided in The Guidance Manual. Also, the status of compliance to Agreed Actions of previous World Bank missions can be discussed in the QPR. SPMU will undertake quarterly field visits to those projects which are under implementation to review the implementation of environmental safeguards and the findings will be shared with respective implementing agencies for their follow-up. The non-compliance and their remedial measures will be highlighted in these reports which will be communicated and followed-up. Safeguards document preparation and implementation during subproject implementation will be followed up and monitored through the Safeguards Information Management System (SGIMS) which will be integrated with the overall project MIS. This will be developed by the SPMU as part of the project.

2.6.2 Construction Supervision and Quality Control

Technical Support Consultants and Construction Supervision and Quality Control Consultants will also be hired to supervise work quality during preparation and

implementation. They will also have a dedicated Environment, Health, and Safety officer to monitor EMP implementation, labor management, and occupational health and safety risks. For projects involving Natural Habitats, Quality Assurance Consultants will also monitor the implementation of mitigation measures through experts with specialization in biodiversity conservation and management.

2.6.3 Annual Environmental Audit

SPMU will undertake annual audits of its portfolio to review the status of EMF compliance. The audit will focus on the process followed for the categorization and approval of E & S reports disclosures and related aspects. Also, in case of any non-compliance to EMF, the scope of the subsequent audit will cover its examination and suggestion on remedial. The audit will also be based on field visits to all ongoing E-1, and S-1 projects and sample E-2 and S-2 projects to verify the implementation on the ground and solicit feedback from the affected people and other stakeholders. The audit will be carried out every year for the activities completed until the previous financial year. The draft report shall be forwarded to the World Bank for review and suggestions; and upon approval after incorporating the comments, the final audit report will be disclosed. The Terms of Reference for EMF Audit is presented in The Guidance Manual. The Auditors shall:

- Support the SPMU / DPMU in preparing the audit plan.
- Prepare compliance reports for sub-project activities in line with EMF guidelines and other statutory requirements as applicable through scheduled or unscheduled audits.
- Conducting random field visits and review compliance, especially in environmentally or socially sensitive areas.
- Review the performance of the project through an assessment of periodical monitoring reports submitted by the line departments, DPMUs, and SPMUs.
- Share audit findings with the SPMU to aid in timely decision making and adopting appropriate mitigation action/s, if necessary.

SPMU will review these audit reports and identify technical, managerial, policy, or regulatory issues with regards to the compliance of the EIA and EMP reports. The identified technical issues will be duly incorporated in the subsequent projects, policy and regulatory issues will be debated internally by the SPMU and DPMUs and determine the need for appropriate interventions. These interventions/action plans will be communicated to PIUs for actions. These interventions may include appropriate revision of institutional aspects, monitoring mechanism, revision/updating of EMF document, or suitable analytical studies to influence policy or programs of the State. The audit observations/recommendations will be complied with and followed-up as part of monitoring by SPMU through its DPMUs.

This, EMF ensures the following monitoring and reporting requirements:

- Reporting on Safeguards / EMPs: Monthly (or as and when required) Implementation Report by Contractor to PIU; Monthly Supervision Report by PIU / PMC to DPMU, Quarterly report by DPMU to SPMU (based on a monthly report by

PIUs/PMCs, Monitoring report by Quality assurance Consultants and quarterly supervision by DPMU),

- An annual visit to sample sites by SPMU (including accompanying the World Bank Missions),
- Safeguards monitoring report by Quality Assurance Consultants along with monitoring of Civil Works when the works are ongoing and at work exit/operations.
- Annual Environmental Audit for select projects (all E1, S1, and select E2, S2) by independent consultants,
- Detailed Management Information System linking project details, scheduling, and documentation to the EIA process and EMF implementation will support the SPMU in effectively guiding the preparation of safeguard instruments, supervision, and monitoring.

2.7 Public Consultation and Stakeholder Participation

Public consultation shall be carried out at various stages of the project preparation. As part of the environmental assessment, consultations will be carried out through the use of appropriate instruments including Focus Group Discussions (FGDs), stakeholder consultations, etc. Specific consultations will be held near the sites proposed to seek opinions/suggestions of the hosts and the communities involved. The outcome of consultations will be incorporated as appropriate in the designs and mitigation plans. As part of such consultations, the draft Mitigation Plans will also be presented and explained to the people on the content and process of the implementation of the plans. This would ensure 'buy-in' for the projects by the host communities, project-affected/involved communities, all line departments, and other agencies concerned; and lead to foster project ownership by them, which is essential for the success of the subprojects. Public consultation requirements, the process to be followed, reporting mechanism, and other relevant details are provided in this EMF. The PIUs shall also hold consultations at District, Block, Panchayat, and local/community level as applicable to facilitate the involvement of stakeholders and solicit feedback on sub-project identification/selection, preparation/design, implementation plans and other such key elements of project delivery. Key stakeholders such as project affected persons, opinion makers, experts, and different department personnel shall be consulted. Stakeholder involvement mechanisms are/will be central to the design and implementation of the project and provide opportunities for information sharing, consultation, and collaboration measures. While consultations during the planning stage ensure participation in site selection and design, consultations during the implementation phase encourage community feedback for more participatory monitoring. Guidance for this purpose has been laid out in this EMF; to ensure proper consultation and involvement of key stakeholders during key stages of sub-project preparation and implementation.

2.7.1 Public Disclosure

The following documents shall be disclosed in the Offices and websites of the SPMU, DPMUs, and PIUs/ULBs.

a. EMF for KSWMP
b. Approved EIA reports in English
c. A non-technical summary of EIA and EMF in the local language; namely Malayalam,
d. EMP other safeguards documents

e. Annual E & S Audits

2.7.2 EMF and Technical Assistance (TA) activities

This section discusses the applicability of EMF for Technical Assistance (TA) studies/activities/plan preparations undertaken with support from World Bank Loan: SWM Plans, preparatory studies/research activities are expected to be undertaken under KSWMP, which may be important for the successful implementation of this program or to ensure sustainable future activities. When Plans, feasibility, or DPRs are prepared, the corresponding EIA and EMP preparation will be undertaken following the EMF requirements after Screening and categorization. The outputs and reports of these studies will be submitted for the Bank's review and endorsement. These will be approved by the competent authorities as outlined earlier for each category of projects and disclosed. These will be prepared in a manner consistent with EMF for KSWMP sub-projects. However, the implementation of these RAPs / EMPs may be taken up as and when they are implemented depending upon the circumstance and are not subject to the Bank's supervision.

Subproject Cycle and Environmental Safeguard requirements, with institutional responsibility and tools to be used, are presented in following ***Figure 2.***

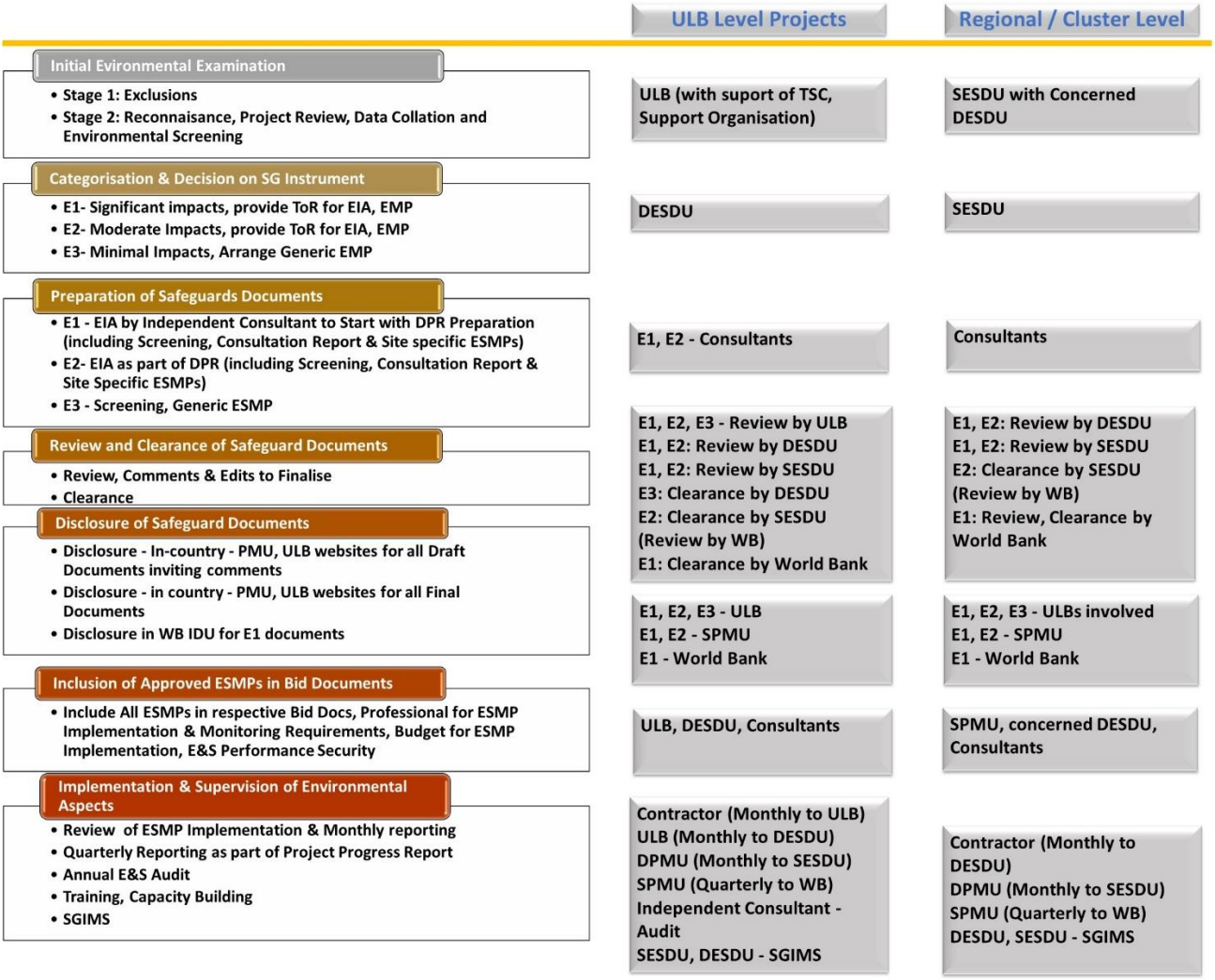


Figure 2: Environmental Safeguards Requirements during the Sub-project Cycle

Thus, Provisions in the EMF for safeguards management include:

- Dedicated Environmental Engineers and Biodiversity Specialists at all levels: Contractor, PIU, PMC, SPMU, DPMUs for EIA preparation, approval, disclosure, supervision and reporting,
- Reporting on Safeguards / EMPs: Monthly (or as and when required) Implementation Report, by Contractor to PIU; Monthly Supervision Report by PIU / PMC to DPMU, Quarterly report by DPMU to SPMU (based on a monthly report by PIUs/PMCs, Monitoring report by Quality assurance Consultants and quarterly (or as required) supervision by DPMU),
- Safeguards monitoring report by Quality Assurance Consultants along with monitoring of Civil Works when the works are ongoing and at work exit/operations stage,
- Annual Environmental Audit for select projects (all E1, S1, and select E2, S2) by independent consultants, and
- Capacity building and cross-learning for Environmental Management.

CHAPTER 3. INSTITUTIONAL FRAMEWORK AND BUDGET FOR EMF ADOPTION

A three-layered arrangement comprising of State Project Management Unit (SPMU), District Management Units (DPMU) and ULBs, is being proposed as the institutional framework for the service delivery under the KSWMP program. While LSGD will be the implementing agency for the KSWMP program, Suchitwa Mission under the LSGD will be functioning as the Program management unit (SPMU) at the state level. District Level offices of Suchitwa Mission will function as DPMUs. PMUs and ULBs will ensure the implementation of the safeguard requirements in this EMF.

3.1 Proposed Institutional Framework at State, Project Levels

Proposed institutional framework for the safeguard management for KSWMP is presented in the below ***Figure 3***:

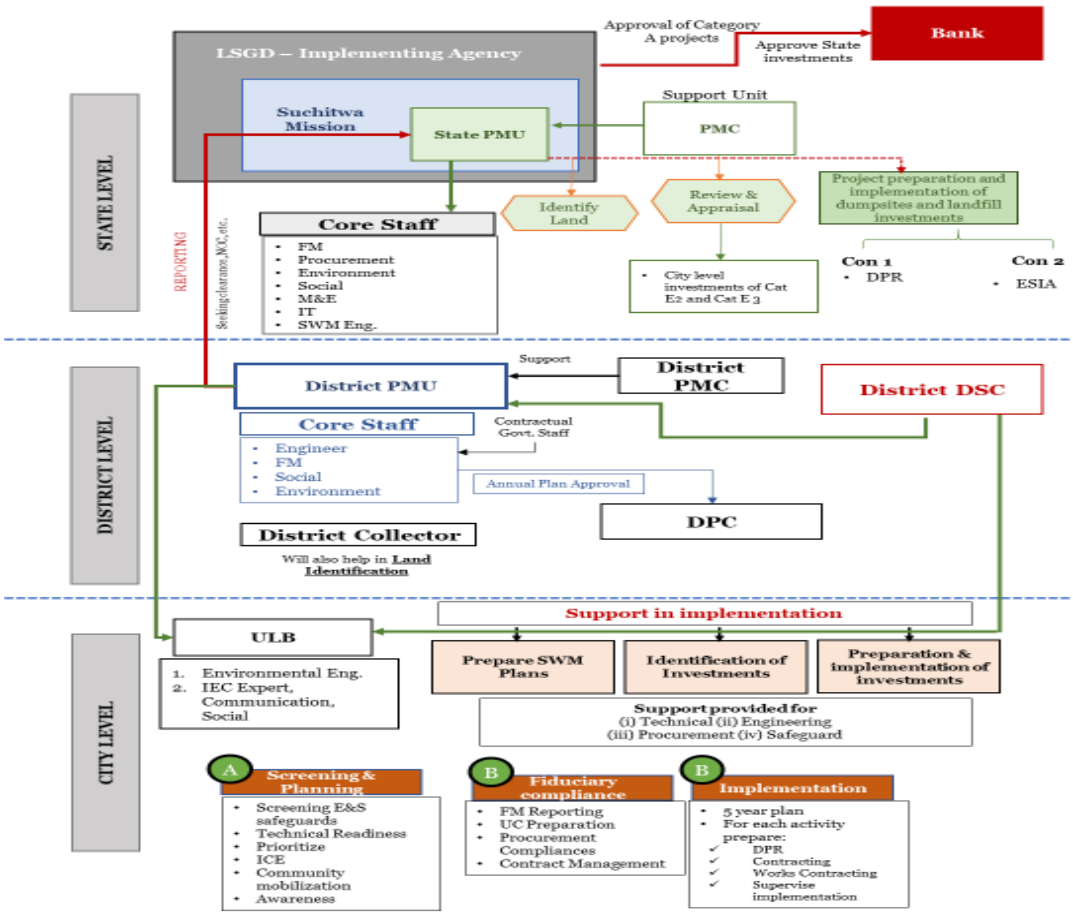
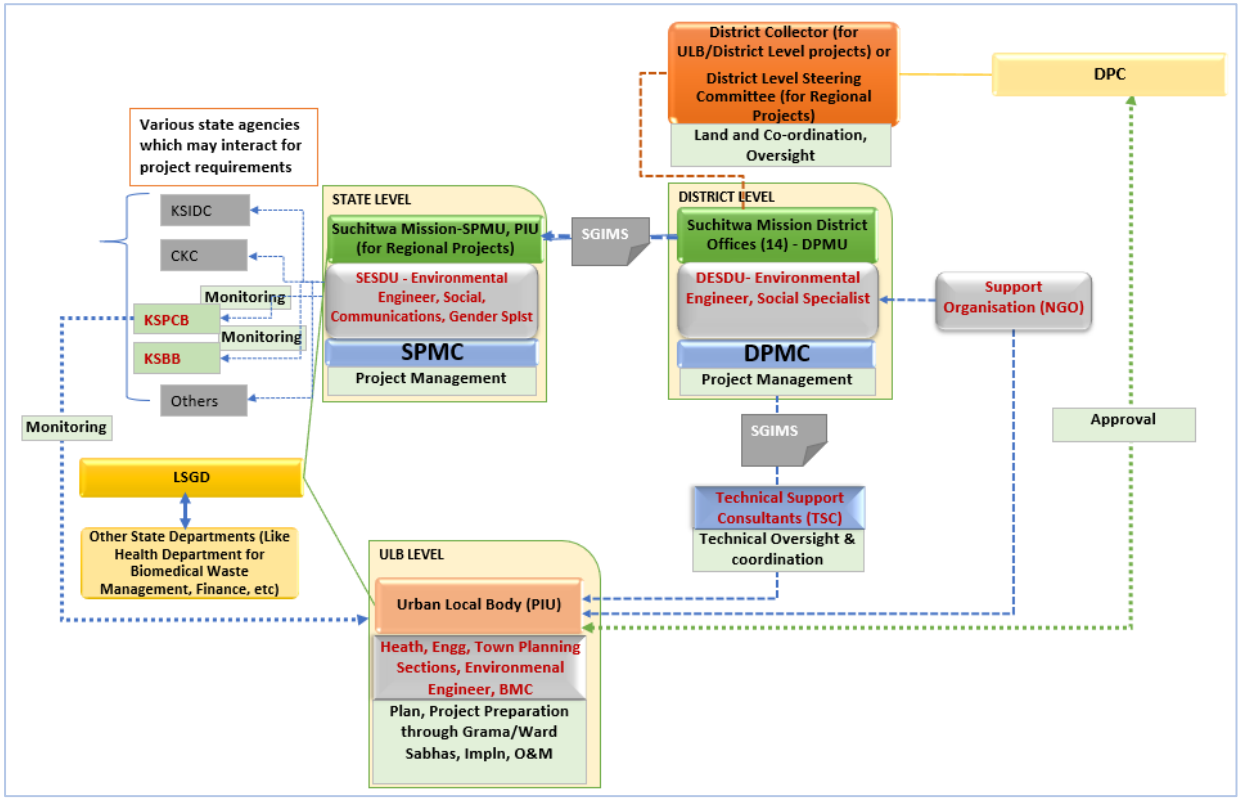


Figure 3: Institutional Framework for KSWMP

3.2 Proposed Institutional Framework for Safeguards Management under KSWMP

Proposed Institutional Framework for Safeguards Management for KSWMP is presented here.



LEGEND			
LSGD	Local Self Government Department, Government of Kerala	DPC	District Planning Committee
ULB	Urban Local Body	DPMU	District Project Management Unit
PIU	Project Implementing Agency	DPMC	District Project Management Consultant
SPMU	State Project Management Unit	DESDU	District Environmental and Social Development Unit
SPMC	State Project Management Consultant	BMC	Biodiversity Management Committee
SESDU	State Environmental and Social Development Unit	KSIDC	Kerala State Industrial Development Corporation
SGIMS	Safeguards Information Management System	KSBB	Kerala State Biodiversity Board
TSC	Technical Support Consultants	CKC	Clean Kerala Company
NGO	Non-Governmental Organisation	KSPCB	Kerala State Pollution Control Board

Figure 4: Proposed Institutional Framework for Safeguards Management for KSWMP

3.2.1 Overview of Proposed Units to manage Safeguards at Various Levels

The program activities will be overseen by SPMU established in SM which operates through DPMUs at each District. SPMU will have a State Level Environmental and Social Development Unit (S-ESDU) with District level ESDUs (D-ESDU) in each DPMU. S-ESDU will have an Environmental Engineer, a Social Development Specialist, Gender Specialist, and Communications Specialist to support the implementation of the ESMF during project implementation. The S-ESDU will coordinate with the technical unit and M&E Unit of the SPMU to mainstream the ESMF (comprising of EMF, TDF-SMF, and RPF) in the preparation, implementation, and monitoring and reporting. More specifically will be responsible for monitoring the indicators on gender and citizen engagement. The SPMU will also be the focal point for the communication with the Bank on the safeguard aspects of the program. D-ESDU will have an environmental engineer and a social development cum

communication specialist. Attached to D-ESDU, a District level Support Organization will be mobilized for an outreach program, social mobilization, and other software activities to build a partnership with the community through the life of the sub-project cycle. At ULB level a Project Implementation Unit (PIU) will be formed with representatives of Engineering and Health Sections who will together manage the Waste Management, Sanitation, public health-related activities, and required infrastructure.

All the sub-projects will go through a) a comprehensive environment and social screening, b) identification of risks and impacts, c) conducting environment and social impact assessment based on the risks and impacts identified, d) preparation of the environment and social management plans such as ESMP- TDP- and Resettlement Action Plan, as required, and e) implementation and monitoring of the environment and social management plans and f) capacity building and IEC campaigns during the sub-project cycle. This will be co-ordinated by concerned ESDU at the state and district level with the support of PIU, Technical Support Consultants, and Support Organizations.

3.2.2 Safeguards Management for ULB Level Components

Technical support for preparation and implementation of safeguards instruments at the ULB level will be provided by district-level TSCs hired by each DPMU, which will include environmental engineers (preferably with qualifications and experience in SWM), natural habitat/biodiversity specialists for projects near Natural Habitats, social cum communication experts (preferably with experience in SWM). The Terms of Reference for TSCs will include the scope of work to ensure compliance with ESMF, and to support screening and categorization of the subprojects using the screening tools presented in the ESMF. The results of the screening will be forwarded to the D-ESDU for confirmation on the categorization and issuance of ToR for the preparation of safeguard instruments. In the case of subprojects that may impact Natural Habitats, the Biodiversity Management Committee of the ULB will review the screening and guide the ToR preparation. The Support Organisation will be overall responsible for various IEC activities for sensitizing the communities and undertaking consultations as part of the citizen engagement plan for wider acceptance of the proposed investments. They will facilitate the integration of community needs, carry out Free Prior Informed Consultation required to prepare the DPRs and Safeguard Instruments.

Safeguard documents pertaining to E1 category investments will be prepared by independent consultants other than the TSC who is in charge of DPR preparation. For E2 projects TSC will prepare the ESIAs as part of DPR preparation. For E3 projects, TSC will compile the filled-in screening Formats and applicable Indicative ESMP and will submit to DESDU for approval and records. ESIAs of E1 and E2 subprojects will be sent to S-ESDU after reviewing by D-ESDU. ESIAs of E2 projects will be cleared by S-ESDU; while those of E1 category projects or any special projects/under any special circumstances will be sent to the World Bank for review and clearance after reviewing by S-ESDU.

Each contractor / DBOT operator will have an environmental / EHS expert who will

supervise the implementation of ESMP at sub-project level. The PIU Engineers, Health officer, and support organization will directly supervise the contractor / DBOT operator and guide the implementation of ESMPs with TSC support. The PIUs will support and co-ordinate for government approvals and statutory clearances. The PIU will submit the compliance reports on clearances, permits, and environmental and social safeguards to D-ESDU.

3.2.3 Safeguards Management for Regional Level SWM / C&D and Biomedical Waste Management

Regional level projects may involve one or more than one District / ULB. For coordination purposes, it is required to form a Committee for the sub-project, to be chaired by the District Collector within whose jurisdiction the site is located. This committee will have representatives from each participating ULB and concerned officials from District Pollution Control Boards, Town Planning Department, and others. This committee will place the DPR including the safeguards documents at the respective District Planning Committees for approval. S-ESDU will be responsible for screening the regional subprojects and the DPRs including safeguard documents will be prepared by TSC other than for E1 category projects for which an Independent agency will be hired. The Support organization will be responsible for various IEC activities for sensitizing the communities and undertaking consultations as part of the citizen engagement plan for wider acceptance of the proposed investments.

For sub-projects both at the ULB level and regional level, when a RAP is required, the ESDU at the state level will coordinate with the Revenue Department to ensure that the required resources are committed for the preparation of RAP. The social development expert at the DPMU will coordinate with the district level empanelled SIA unit to carry out the SIA to prepare the RAP following the RPF.

The safeguard instruments (i) screening, (ii) ESIA, (iii) ESMP, (iv) RAP will be included in bidding documents, and other procurement documents, after the clearance procedure mentioned above.

3.2.4 Monitoring and Reporting

For effective management of safeguards, the project (SPMU) will prepare a Safeguards Information Management System (SGIMS) for monitoring ESMF compliance and recording the improvements in environmental and social parameters. This will be updated daily by PIU and DESDU and will be continuously monitored and reviewed by SESDU. SIGMS reports will be sent to the Bank every quarter so that the Bank could effectively track E2 and E3 projects as well. The indicators will include parameters on the environment and social inclusion, citizen engagement, behavior change, enterprise development, land required, the livelihood of the vulnerable, labor compliance, GBV, and GRM. Thematic monitoring, Annual Environment Audit, and Social Audit will be carried out. The ICT tool developed to track the implementation of the sub-project scheme cycle and action plans on real-time and geo-referenced will be the source of data for reporting on compliance. The progress report will include monthly concurrence monitoring, thematic reports, and annual compliance of EMF, TDF-SMF, and RPF. Environmental and Social Experts of D-ESDU shall i) undertake a monthly

visit to subprojects to ensure compliance with ESMPs, TDP-RAP and guide and support PIUs/TSC/Support Organization/contractors to oversee safeguards management, ii) review monthly progress reports by PIUs to resolve any issues, and iii) prepare quarterly progress reports on ESMF implementation (based on the monthly reports of PIUs and their observations during monthly visits) and submit to S-ESDU, iv) join the field visits undertaken by S-ESDU and the WB as part of the monitoring of the subprojects. The WB will also review, monitor, and guide ESDU as part of the mission and special technical visits as required and support in training the ESDU specialists and PIUs. Annual Environmental and Social Audit will be carried out for all E1 projects, sample E2 and E3 projects to monitor ESMF compliance during preparation and implementation.

3.2.5 Safeguard Information System

Detailed Management Information System linking project details, scheduling, and documentation of the EIA process and EMF implementation will support the SPMU in the effective preparation of safeguard instruments, supervision, and monitoring.

Upon project commencement, the safeguards specialist of SPMU shall prepare a datasheet in tabular format and maintain an MIS to track all requisite safeguards instruments for sub-projects. This Project Info-Table or MIS shall be continuously updated as and when each subproject starts or as required. The decision to start preparations for each subproject shall be conveyed to the SPMU safeguards specialists and/or procurement plan for each quarter shall be shared well in advance to initiate screening, categorization, and preparation of EIAs. Each DPMU shall update and send safeguards monitoring systems for their district as part of the quarterly progress report sent to SPMU.

3.3 Capacity Building

SPMU envisages capacity building for all other agencies involved including DPMUs, PIUs (including Line Departments, Local Bodies, Statutory Boards, Public Undertakings applicable or each subproject), and Potential Private Operators, PMCs, and Contractors to ensure that the EMF is effectively operationalized. This will be accomplished by organizing sensitization programs, workshops, and training programs, which will be coordinated and anchored through training institutions and experts.

The ESDU will be responsible for overall state and district level training on ESMF, organize workshops to promote cross-learning, document good practices, coordinate production of IEC material for the outreach program. The environment and social experts of DPMU will be responsible for coordinating the activities of the support organization, prepare and implement district-level capacity building programs for all stakeholders.

The expertise of the World Bank also will be availed for capacity building exercise. Orientation programs on the various aspects like environmental aspects, Project Management and Engineering, and Public Health will be conducted. EMF training will be specially structured and delivered to PIUs. Discussants can include line departments and Pollution Control Boards. EMF training includes EIA methods, new land acquisition, and R&R act, preparation and implementation of EMP and RAPs, consultations and public hearing, regulatory requirements, EMF adoption, and compliance, sustainable SWM Planning, Technologies, and Service

Standards, Implementation, and operations, climate change resilience, mitigation, and adaptation, etc.

Indicative details of the training program are presented in ***Table 9***. This will be elaborated, and a proper training plan and schedule/module will be devised by SPMU/DPMUs through the support of national training institutions.

SPMU will make a conscious effort to mainstream the environmental aspects of other main training programs under this project. The Environment Specialists at SPMU will provide technical assistance in the planning and design of the safeguard / environmental aspects of activities, including reviews and training. The training programs will aim at orienting the personnel towards value addition and enhancement benefits of proper management of environmental issues. SPMU will also enhance the capacity of its staff and Environmental managers in environmental safeguards, technical aspects of the proposed sub-projects, through orientation programs, training, exposure visits to similar projects implemented, courses, and participation in both national and international training courses and seminars/workshops. It is also suggested to organize workshops during years 2, 4, and at the end of the Project for cross-learning between the project experiences of DPMUs/PIUs.

The World Bank specialists shall provide adequate training to SPMU / DPMU safeguard specialists thrice during the project duration: well-spaced to update the new techniques, practices and to effect cross-learning. Through this, the SPMU / DPMU safeguard specialists can attain the necessary guidance to train the subproject staff.

Besides, Safeguards specialists at SPMU and DPMU shall provide training to safeguards staff of PIUs, PMCs, and the contractors at the start of each subproject and mid-term during its implementation. This includes training on EMP implementation and safeguards management during various sub-project stages; including during work closeout/work exit. One such training shall be for PIUs or DPMUs to learning from each other's experiences and good practices.

The proposed safeguard support, training/capacity building activities for EMF implementation will be supported through the ***Component 1*** of KSWMP at an **estimated cost of INR 72.7 Crores (USD 9.6 Million), for 5 Years of the Project.**

Table 10: Outline of the Proposed Capacity Building Program on KSWMP (2020 – 2025)

Sl No	Training Programs and Modules	Contents	Presenter/s	Frequency and Duration, Location	Targeted Participants
A	***State Level Training Programs organized by SPMU***				
1	**KSWMP Safeguards On-boarding**	- World Banks Safeguards Policies and Concept of EMF, Project Cycle - Applicable regulations and Sensitivities: National, State, Local/others	The World Bank Reputed EIA training Organisations	One-day interactive (Year 1: Before Project initiation; Year 2: Before Start of activities; Year 3: Mid Term Corrective) Location: At Delhi / Thiruvananthapuram/ Kochi	SPMU Project Director / other Staff, Safeguards (E&S) Experts, DPMU Safeguards Experts (E&S), PMCs
2	**State Level Orientation Program**			Two days interactive (First Three modules – together in a day; fourth module on the second day) (Year 1: After Project Kick-off; before initiating implementation), Year 2: At the start of Subproject work initiation; Year 3: Year – After Implementation initiation)	SPMU/DPMU and PIU / Local Body staff, PMCs (if onboarded) technical review committee members Module 4 (Day 2): Environmental Specialists (preferably attends both modules)
	Module 1: About KSWMP Program	- About SWM in Kerala; existing and proposed system; and involvement of the State, ULBs, and The World Bank (including Financing Instrument) - Technical and Financial Aspects - Project Implementation Set up	SPMU Project Director / Assistant Project Director		
	Module 2: EMF and the Project Cycle and Regulatory Aspects	- World Banks Safeguards Policies and Concept of EMF - Applicable regulations: National, State, Local/others - Project Cycle of KSWMP - EMF incorporation in Project Cycle during Identification (Screening, Categorization), Preparation, Appraisal, Implementation (Monitoring, Audit)	The World Bank, Reputed National EIA training Organisations and/or Kerala Institute of Local Administration (hiring adequate experts)		
	Module 3: Overview of Locations and Project Activities; Impacts	- Overall Project Locations - Expected impacts: activity-wise - Need for mitigation/management	Reputed National EIA training Organisations, and/or Kerala Institute of Local Administration Forests, Department of Environment,		

Sl No	Training Programs and Modules	Contents	Presenter/s	Frequency and Duration, Location	Targeted Participants
			Pollution Control Board		
	Module 4: Sub-project level Environmental Assessments, Generic Mitigation / Management measures, Institutional Aspects, budget (Case studies)	- EIA: EA process, Identification of Environmental Impacts, Impact Identification Methods, Identification of Mitigation Measures, Formulation of Environmental Management Plan, Climate Change adaptation and mitigation Plans, Implementation, and Monitoring, Institutional Mechanism - SIA: R&R policies and procedures, National & World Bank Requirements, LA process, Identification of PAPs, Social Entitlement Frameworks, Social Impact Assessment, RAP Techniques Beneficiary Assessments, IPPF	Reputed National EIA training Organisations and/or Kerala Institute of Local Administration (hiring adequate experts)		
2	**Implementation Experience Sharing Program**			One day; interactive Year 2 - end, Year 4 - start and at the close of the Project (Year 5) – near implementation completion stage	SPMU, DPMUs, and PIU / Local Body staff, PMCs, technical review committee members, CBOs, Contractors, *et al* as applicable
	Module 1: Experience Sharing on EMP Implementation	- Experiences on implementation of EMF in implemented projects - Best Practices-Site visits to project towns/sites	Environmental and Biodiversity Specialists of SPMU; DPMUs with support of PMCs		
	Module 2: Review of Audit Results	- Discussion on the results of the annual audit on EMF	EMF Audit Consultants		
	Module 3: Stakeholder Participation and Community Engagement	- Stakeholder Analysis - Participation models in various projects by CBOs, Communities, Individuals, Private parties, PIUs	ULB/PIU, PMC		
	Module 4: Best Practices Showcase	- Site visit to select projects to display best practices in any field/aspect	Environmental and Biodiversity Specialists of SPMU; DPMUs with support of PMCs		
C	***District Level Training Programs organized by DPMUs***				
I	EMP Implementation	Module 1: Environmental Enhancement and Occupational Health and Safety - Clearance / permits / regulatory aspects - Occupational Health & Safety Training	Reputed National EIA training Organisations and/or Kerala	One day; Every Year, starting from Second	PIU staff, Contractors, Line

Sl No	Training Programs and Modules	Contents	Presenter/s	Frequency and Duration, Location	Targeted Participants
		- Staff & Labour Code of Conduct - HIV/AIDS prevention Training, Best hygiene practices - Emergency Response System - Behavioral Training - Implementation of EMP provisions Module 2: Review of Subproject Level Environmental Actions - Review of Environmental Actions at each sub-project - Lessons learned - Course Corrections	Institute of Local Administration (hiring adequate experts)		departments, PMCs

Modules for training may be developed keeping in the needs of the various target groups/stakeholders. A more comprehensive plan on training and capacity building will be included in the Operations Manual for the project. This may further be finetuned by SPMUs / PMCs after onboarding. Other training on SWM may be conducted through State Level Training Institutes like KILA. A module on EMF / Safeguards implementation shall be included at least project technical / capacity-building efforts. These training covering all suggested modules may also be temporally clubbed with other Project training/capacity building exercises.

3.3.1 Subproject Monitoring: Environmental Management

The environment management instruments guide monitoring and evaluation parameters and describe the institutional arrangements to facilitate the 'process' and 'progress' monitoring.

Designated Environment Specialists at various levels shall be responsible for overseeing compliance of the sub-projects to Bank safeguards, GoI regulations, and applicable EMF guidelines. They shall also review regularly the timely implementation of environment provisions as per the EMF, EMP, where applicable. The monitoring and reporting will be done by line departments/implementing agencies to SPMU, which in turn will be reporting to NPMU.

The following aspects shall be monitored and reported as per the frequency provided in ***Table 10*** below. Corrective actions shall be initiated in a planned manner as appropriate to ensure compliance with the EMF/EMP measures.

Table 11: Monitoring Schedule

Sl.No.	Particulars	Frequency	Reporting Responsibility	Monitoring responsibility
Input Monitoring				
1	EMF Compliance/Status Report, including screening results, the status of conduct of EIA/SIA and actions taken for compliance	Monthly/ Quarterly	PIU, Environmental Experts at DPMUs, PMC	SPMU - Project Director and Environmental Specialists
2	Environment site visit report	Quarterly	PIU/PMC, Environmental Experts	DPMU - Project Director and Environmental Specialists
3	Regulatory clearances - Environment	Quarterly	PIU/PMC, Environmental Experts	DPMU - Environmental Specialists
4	Community consultations	Quarterly	DPMU & PIU Environmental Experts PMC support	SPMU - Project Director and Environmental Specialists
5	Grievance redressal	Monthly/ Quarterly	DPMU & PIU Experts PMC support	SPMU - Project Director and Environmental Specialists
Output / Outcome Monitoring				
1	Water Quality of Waterbodies near Dumpsites remediated	Yearly Twice (Pre and Post monsoon)	PIU, Environmental Experts at DPMUs, PMC	SPMU - Project Director and Environmental Specialists
2	Air Quality near SWM facilities	Quarterly	PIU, Environmental Experts at DPMUs, PMC	SPMU - Project Director and Environmental Specialists
3	Area of Polluted land (dumpsites) remediated and brought to reuse	Annually	DPMUs	SPMU
4	No: of ULBs (District Wise) with Treatment	Annually	DPMUs	SPMU

Sl.No.	Particulars	Frequency	Reporting Responsibility	Monitoring responsibility
	(Biodegradable, non-biodegradable) and scientific Disposal Facilities covering entire solid waste generated			
5	No of Hospitals, Health Care Units / Laboratories covered by BMW Management Facilities developed	Annually	DPMUs	SPMU
6	Quantity of C&D Waste Treated and recycled/reused in project facilities developed	Annually	DPMUs	SPMU
7	No: of incidents (all types covered under Systematic incident Reporting Tool (SIRT) in various project sites (during Construction and O&M)	Quarterly	PIU	DPMU/SPMU
8	Grievances on environmental pollution issues related to project facilities	Quarterly	PIU	DPMU/SPMU

3.3.2 Reporting Formats

Reporting formats shall be developed by SPMU to get progress and results data of the project from the field. This will also help in synchronizing and streamlining reporting requirements from the various DPMUs to the SPMU.

3.4 Budget for EMF Implementation

To effectively implement the environmental management measures suggested as part of the EMF, necessary budgetary provisions will be made in the DPRs for the individual subprojects. The tentative budget for each of the projects should include environmental management costs along with the good engineering practices and cost of environmental and resettlement monitoring.

As presented in ***sub-section 5.5.1***, the budget for complying with the EMP needs to be worked out for each sub-project by working out the cost of implementing each EMP mitigation measure. Where this is not possible, the provision of a minimum of 2 percent of the sub-project cost needs to be earmarked for implementing EMP measures. Also, provision for ESHS performance security is made to ensure EMP implementation.

All administrative costs for implementing the EMF shall be budgeted for as part of the budget for human resources and other facilities while preparing the budget for PIU and PMU establishment and operations.

Drawing from the project experience and current indicative costs of **Category A** projects the following ***Table 11*** provides a rough estimation of costs for safeguard management and EMF implementation. All safeguards instruments have been inbuilt into the project modality and will be financed through the project and detailed project cost tables will include the necessary costs accordingly.

The associated cost to implement EMPs as well as training for project staff, contractors, etc. have been integrated into the project budget. The project will ensure that all works contracts will include the EMP, and the cost of implementing the EMP will be identified as an item in the Bill of Quantities.

The budget for EMF implementation has been calculated based on assumed rates for safeguards management for a State level program extending across its all districts. This should be made part of overall program costs for KSWMP to ensure smooth implementation of environmental aspects including safeguards management through the use of this framework. The budget is worked out for 5 years.

Table 12: Proposed Budget for EMF Implementation

Sl NO	*Proposed Safeguards Management Activity*	*Quantity*	*Unit Rate (INR) or Rate/Year*	*No: of years*	*Total Cost (INR)*	*Total Cost (USD)*[8]	*Assumptions*
1	**Safeguard Personnel**						
a	Environmental & Biodiversity Specialists, S-ESDU	2	1800000	5	18000000	240000	4 specialists @ Rs 150000 per specialist per month for 3 years
b	Environmental & Biodiversity Specialists, D-ESDUs	28	1200000	5	168000000	2240000	2 Specialists each for all States and UTs; Rs 100000 per specialist per month for 3 years
c	Environmental Engineers at ULBs	40	150000	5	30000000	400000	Considered sharing between roughly 1 to 2 ULBs
2	**Training / Capacity Building**						
a	Safeguards Onboarding	3	200000	3	600000	8000	One day; Three years; select audience-intensive training
b	State Level Orientation	3	500000	3	1500000	20000	Two days; Three years, all-district groups, PIUs
c	Experience Sharing	3	800000	3	2400000	32000	One day, a larger audience, 3 years
d	District Level Training	56	50000	56	2800000	37333.33	One day, 4 years, all districts
3	**Supervision, SG Coordination**						
a	Project screening by PIUs	100	30000	-	3000000	40000	around 6 projects per district for 14 districts, 6 for SPMU, & for SWM Planning / others

[8] INR to USD Conversion: Rs 75 per USD

Sl NO	Proposed Safeguards Management Activity	Quantity	Unit Rate (INR) or Rate/Year	No: of years	Total Cost (INR)	Total Cost (USD)[8]	Assumptions
b	Co-ordination and Travel for Safeguards Management by PMU (including site verifications, discussions, compliance monitoring, review committee meetings)	15	200000	5	15000000	200000	lumpsum per year
4	**Preparation of SG Instruments**						
a	Preparation of Safeguards Instruments	62	3000000	-	186000000	2480000	Minimum 4 high / moderate risk projects requiring clearances, each district / and for cluster projects by SPMU (may be included in the total cost if EPC contract depending on the choice of implementation mechanism)
5	**Other safeguards Support**						
a	QA/QC and Project Management Consultants for States	1	3000000	4	12000000	160000	lumpsum per year; starting year 2 (4 yrs)
b	Project Management Consultants (for coordinating Safeguards Management) (SPMC, DPMC)	1	3000000	5	15000000	200000	lumpsum per year (5 yrs)
c	Annual Environmental Audit	1	5000000	4	20000000	266666	Every year starting year 2 (4 yrs)
	Sub Total				474300000	632400	
12	**Contingencies**						
	Contingencies & Miscellaneous; including overall coordination and planning, emergencies	15 percent			71145000	948600	
13	**EMP Monitoring Costs** (1 % of cost for investments approx. incl. contingency costs) (For eg: leachate quality, air and noise emissions in the ESMP of Composting, and	1 percent			182382000	2400000	Approx. 1 percent cost is considered as projects are not known. Rest of EMP cost will be covered in subproject ESIA EMP budget.

Sl NO	Proposed Safeguards Management Activity	Quantity	Unit Rate (INR) or Rate/Year	No: of years	Total Cost (INR)	Total Cost (USD)[8]	Assumptions
	stack monitoring and groundwater quality in the ESMP of Anaerobic Digestors, Air (Gas), water (leachate), emissions from Landfill etc.)						Institutional costs are already added above for various specialists/travel etc. *
	Grand Total				727827000	9672600	
					Say 72.7 crores INR	**Say 9.6 Million USD**	

* Monitoring activities in EMP will be finalized at the EIA stage; based on project locations and project types and impacts. The budget for this will be part of each subproject costing. The team feels that since specific costing for monitoring activities recommended in various Indicative EMPs cannot be estimated at this stage; since subprojects are not yet identified. However, based on a similar experience, one (1) percent of the investment cost is added here for monitoring. Besides, EMP monitoring costs will be included in individual ESIAs – EMP and additional mitigation/monitoring shall be the contractor's responsibility.

3.5 The Roles and Responsibilities of the World Bank

The World Bank project task team, specifically the environmental specialists, will provide close supervision and necessary implementation support by reviewing and providing guidance on conducting the screening, and the preparation of relevant safeguard instruments as well as providing training for SPMU/DPMU specialists; as presented here:

- Undertake prior review and provide feedback on suggested safeguards instruments, review of monitoring updates and other relevant safeguards documents,
- Review, clearance of safeguards documents as per ESMF,
- Participate in regular missions to review overall safeguards performance and provide further implementation support,
- Share knowledge on technologies and best practices,
- Guide on handling complaints and grievances from a technical standpoint,

Provide training support on the Bank's safeguard policies and safeguard requirements of the project.

CHAPTER 4. GRIEVANCE REDRESSAL, CONSULTATIONS AND INFORMATION DISCLOSURE

4.1 Grievance Redress Mechanism

Government of Kerala offers local level, state level, face to face, telephonic and online complaint registration services: (i) Chief Ministers Public Grievance Redressal Cell- network connecting more than 10000 officials (offices) equipped with Modern technology to receive petitions from the public, (ii) The Local Self Government Department offers a complaint icon on its website (https://pglsgd.kerala.gov.in/) for citizens to submit online complaints, (iii) Citizen's Call Centre (CCC) is a single-window, IT-enabled facility of Government that enables Government to Citizen (G2C) interface- includes consumer toll-free helpline for all government services, and (iv) ULB websites also have a complaint icon which has many options but it does not have an option for SWM or sanitation.

The assessment indicates that citizens are not aware of the systems available and for SWM related matters, they approach Ward Councilor or Municipal office to submit physical complaints. While there are gaps in people's awareness and actual use of the existing systems, other key gaps include lack of a system for tracking, response time, redressal time, and closure of grievance. The project will strengthen the system and augment it with a toll-free number so that it is accessible by all including women and vulnerable groups. The response mechanism for environmental safeguards related complaints, labor-related complaints, and gender-based violence cases are also mandated in the project. Here too the priority will be to review, strengthen, and augment the existing systems. All complaints (received through any means) to be digitally recorded so that they can be tracked. The results indicator will target 80 percent of the complaints registered resolved within 30 days.

The project requires a dedicated SWM GRM with the following features: online and offline option to file a complaint, user-centric categorization, alert generation, response, and escalation flow. Each complaint must have an option to use a toll-free, online, and written complaint to designated personnel. All complaints (received through any means) to be digitally recorded so that monthly records can be generated for analysis and review.

GRM to capture the following:

a. SWM Services
b. Governance, Transparency, and Accountability of ULBs
c. GBV Response
d. Labour Compliances

Guidelines for GRM:

a. Contact information of Complaint important for sending alerts and tracking feedback (email mandatory for web-based complaint and mobile phone mandatory for toll-free number complaint)
b. Date for the response or assigning of complaint to be inbuilt and not discretionary
c. The system must have an inbuilt annually updated Calendar where only working days are counted
d. The complaint should only be closed after confirmation from the complainant

e. Complaint categories to be them practical, understandable and complainant/user-centric
f. GRM system to be widely advertised so people are aware of it.
g. Monthly Reporting by PMU on total complaints, resolved, pending. Also, the mode used to file the complaint (handwritten, toll-free, online), the profile of complainant (location and gender), number of days taken for resolution, complaint category wise break up of the number of complaints received.
h. In the first year of implementation, PMU will review the GRM system in terms of outreach, volume, response, and resolution rate, complaint satisfaction rating, etc.

Inclusion of women in grievance redress committees to help female stakeholders raise and address grievances.

The Grievance Redress Mechanism will be based on a dedicated Toll-Free number to track complaints and ensure accessibility to women and vulnerable. This includes register, resolution, and closing the compliant within a stipulated time frame. Community concerns will generally be addressed during the project preparation stage through information dissemination, the transect walk, and community consultations. In addition to the project-specific Grievance Redress Mechanism, given in the ***ESMF Vol II Part B: TDF-SMF***, the following redress mechanism is also available to the Project Affected Persons and other aggrieved parties. The project will support vulnerable groups in getting required support on their grievances as presented in TDF-SMF.

- Form committee at LSGD with the following members – Project Director, State level Officials from Revenue, Tribal, Women and Child Welfare, and Labour departments. Ensure presence of designated Environmental Specialist, and Social Specialist at SPMU as principal coordinator for GRM to formally sort, review, record, process and report on Grievance Redressal.
- Put up 'Public Information Boards' at key sub-project locations displaying the details of contact persons/agencies for lodging the grievance/complaint.
- Develop the systems, formats to record and report.
- Train the officers on the GRM handling
- Ensure information on GRM to the communities during DPR preparation

At each project site, there will be information boards on mechanisms to register grievances on environmental and site safety aspects, details of contact officials, and mechanisms to inform D-ESDU and then S-ESDU if unresolved; and schedule for addressing grievances at each level.

Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-

service. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org

4.2 Stakeholder Consultation Framework

This section describes the stakeholder consultation process that needs to be undertaken during the detailed assessments of the project activities.

4.2.1 Need for Consultations

Stakeholder consultation as part of the preparation of this ESMF was to document the concerns of the stakeholders with specific reference to the project planned interventions. The consultation meetings were organized basically for two important purposes, i.e., (1) to share project objectives and proposed project interventions with the identified stakeholder groups and (2) to consult with the stakeholders and document their concern, with particular reference to social and environmental impacts of the proposed project interventions. Besides, consultations will be carried out as part of the SWM plan preparation and DPR/EIA preparation for subprojects.

At the subproject stage, to understand the expected project benefits/risks and people's perception of the project, field visits will be conducted to different places within the planned project jurisdiction. In the process of assessment, the mapping of stakeholders will be done in the visited areas to understand how the project is going to impact these stakeholders.

The DPMU under the guidance of the SPMU through the ULBs will consult all key stakeholders on the project safeguard documents (for category E1, S1, E2, S2 projects) during the process of assessment. The Stakeholder Consultation will provide a summary of the proposed project´s objectives. Stakeholder analyses and consultations will be used to identify the requirements, priorities, concerns and conflicts, development risks, and opportunities. Consultation, participation, and disclosure will ensure that information is provided and feedback on the proposed design is sought early, right from the preparation phase, so that the views/preferences of stakeholders including potential beneficiaries and affected person can be adequately considered, and continue at each stage of the activity preparation, processing, and implementation. Meaningful stakeholder consultation and participation are part of the activity preparation and implementation strategy.

4.2.2 Stakeholders to be Consulted

The key stakeholders to be consulted during project activity preparation and implementation include:

1. Project beneficiaries, and project-affected persons
2. Elected representatives, community leaders, and representatives of community-based organizations; business and industrial associations, etc.,
3. Relevant local NGOs;
4. Local government and relevant government agencies, including the authorities responsible for land acquisition, protection and conservation of forests and environment, archaeological sites, religious sites, and other relevant government departments (regulatory, administration and infrastructure services related)

5. Residents, shopkeepers, business people, farmers (owners and workers) who live and work alongside the canal embankment and near sites where facilities will be built; custodians, and users of socially and culturally important buildings;
6. Vulnerable groups, women groups, etc.

At the minimum, the proponent must meet with the principal stakeholders to inform them about the proposed project activity and to solicit their views about it. More extensive consultations are required for specific project activities that have significant impacts. The methods and results of the consultations shall be documented in the ESIA Report.

All consultations need to be a two-way dialogue to inform the stakeholders about the potential impacts (positive/negative) and obtain their feedback and views about the project activities and the proposed mitigation measures. All consultations need to be inclusive of all groups and gender, transparent and documented.

The implementing agencies will conduct meaningful consultations with all relevant stakeholders who are directly or indirectly affected. For this purpose, SPMU/DPMU will prepare a consultation plan with all stakeholders. The proceedings and outcomes of these consultations will be recorded. For the EIA, the PIU with consultant support prepare participant list/attendance, summarize how the consultations were conducted, key topics discussed, and the decisions arrived at. The comments and suggestions will be recorded and how these have been addressed will be detailed in the EIA report. These decisions will be incorporated into the EIA and EMP. Photographic records and signatures of participants will be recorded in the EIA report.

The implementing agencies will inform stakeholders and communities about the project activities, obtain their views, and hear their comments and complaints. Through periodic consultations with the local community, PIU/DPMU will engage them in project planning, implementation, and monitoring. Consultations will be conducted in an atmosphere that is conducive to the project development and beneficial to the community and local population. The PMU and PIAs will ensure that the consultations are free of coercion and intimidation, are gender-inclusive, and tailored to the needs of disadvantaged and vulnerable groups. All relevant stakeholders will be informed in advance about the timing and format of the consultations. This will be done through advertisements in local newspapers and / or written letters to the district magistrates, representatives of relevant departments, heads of the local village councils, representatives of urban local bodies, and NGOs in the vicinity of the project sites. During the consultations, information about the project, its rationale, scope, benefits, and costs, including potential environmental and social impacts and mitigation measures, will be presented by the SPMU/DPMU/ULB.

During project implementation, safeguards experts will have informal discussions with the locals residing in the vicinity of the proposed project activity sites. They will note the grievances, if any, due to construction. The purpose of consultations is to give factual information about the project to the stakeholders and to clarify misconceptions if any. This process helps in enhancing local ownership and ensures smooth project implementation in the long run.

A variety of approaches can be adopted, and stakeholders should be consulted throughout the project implementation. At a minimum, the following consultation activities should be conducted. This is indicative and agencies can also adopt more effective methods and approaches, which are locally appropriate.

Table 13: Details of Stakeholder Consultations required on Environmental Aspects

Project Stage	Consultation Activities	Remarks
Project activity preparation	Household-level consultations through sample questionnaire surveys on service levels, needs, priorities for project / SWM Plan preparation	At the start of the project - during the detail designing stage
	Consultation with all line departments) and other Government Establishment as well as private agencies	At the start of the project - during the detail designing stage
	Focus group discussions with people residing/working near the project sites	During the visits to project sites
	Consultations with affected persons	At various stages since the beginning especially during EIA, implementation, monitoring, O&M
Activity Implementation	Focus group discussions with the people residing/working near the project sites	During the ESMP monitoring at worksites including E&S Audit
	Informal discussions with the construction workers and construction supervision staff (contractor, consultants, and PIU)	During the ESMP monitoring at worksites E&S Audit
	Informal discussions with commuters and the general public along the roads near which works are implemented or SWM Collection/Transportation activities are carried out	During the ESMP monitoring at worksites E&S Audit

4.3 Information Disclosure

4.3.1 Procedure Information Disclosure Procedures

Project-related information shall be disclosed through a public consultation and making relevant documents available in public locations. The project agencies and associated line departments shall provide relevant safeguards information promptly, in an accessible place, and the manner and language understandable to affected persons and other stakeholders. For illiterate people, other suitable communication methods will be used.

The draft ESMF report has to be discussed with the project agencies before making it available at the offices of SPMUs. A concise summary of the project and draft ESMF report (in the local language - Malayalam), providing all necessary details of proposals, implementation arrangements, project locations, likely issues and mitigation, and monitoring measures and grievance redress mechanism, shall be made available to the stakeholders. This should also provide contact information of the project agency. This summary shall also be displayed at the notice boards of SPMU, DPMUs (District Collectorate) and related line departments, State and District Libraries, Local body offices, and other public places. During project implementation, relevant information about any major changes to the project scope will be shared with beneficiaries, affected persons, vulnerable groups, and other stakeholders.

The following documents shall be made available at the offices of SPMU, District Collectors Office, State and District Libraries, Local Body office, and other public places for public reference and shall also be uploaded on respective websites.

1. Summary of project (in English and local language - Malayalam)
2. Draft ESMF Report (in English; translated summary in Malayalam)
   Once the draft is finalized after consultation with the stakeholders including the implementing agencies, the following documents will be made available at offices of SPMU/DPMU, offices of the ULBs, DM's Office, State and District Libraries, other public places for public reference and shall also be uploaded on respective websites.
3. Final ESMF Report (in English); with translated summary (Malayalam)
4. Updated/amended ESMF (in English)
5. Corrective action plan prepared during project implementation (English)
6. Semi-annual Environmental Monitoring Reports (English)

The following documents will be submitted to the World Bank for disclosure on Bank's external website. SPMU will send written endorsement to The World Bank for disclosing these documents:

1. Draft ESMF (with translated summary);
2. Final ESMF (with translated summary); (including RAP, LMP, and TDP (in English & local language - Malayalam)
3. A new or updated ESMF and corrective action plan prepared during project implementation, if any; and
4. Environmental monitoring reports

4.3.2 Information to be disclosed

Table 14 below specifies the type of information to be disclosed and frequency of dissemination:

Table 14: Information Disclosure Matrix

Topic	Documents to be Disclosed	Frequency	Where
Environmental Impact Assessment	ESIA, ESMP, RAP, LMP, TDP	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	World Bank's external website. On the website of SPMU, The borrower would make the EIA, EMP, RAP, LMP, TDP available at a place accessible to displaced persons and local NGOs, in a form, manner, and language that are understandable to the PAPs in the following offices: Local PIU office - ULB District Collectors Office State and District Libraries Office of the contractor
Grievances	Grievance redressal process	The continuous process throughout the project cycle.	World Bank's website. On the web sites of ULB, SPMU, and DPMU Hard copies in the local language in the following offices: District Collectors Office ULB Office Office of the contractor PAPs to be informed on one to one contact

Topic	Documents to be Disclosed	Frequency	Where
Public Consultation	Minutes of Formal Public Consultation Meetings	Within two weeks of meeting	On the web sites of ULB, SPMU, and DPMU Hard copies in the local language in the following offices: District Collectors Office ULB Office Office of the contractor

In addition to the information specified in ***Table 14***, the following information shall also be displayed/disseminated, wherever applicable.

1. Project-specific information needs to be made available at each contract site through public information kiosk
2. Project information brochures shall be made available at all the project sites as well as the office of SPMU / PIU.
3. Reports and publications, as deemed fit, shall be expressly prepared for public dissemination e.g., English versions of the ESIA, ESMP, and Executive Summary in the local language.
4. Wherever civil work will be carried out aboard will be put up for public information which will disclose all desired information to the public, for greater social accountability.
5. All information will be translated into the local language and will be disclosed to the public through the Local Body, District Magistrate's office, concerning project offices, websites of SPMU.

4.4 Status of Consultations and Disclosure of this ESMF

Various consultations were conducted during the preparation of this EMF. Focus Group a) Discussions with institutional stakeholders and commercial units, b) questionnaire-based surveys of sample households (1222 households) in around ***13 percent of all ULBs*** under the project, c) waste quantification at different types of generators, and characterization/sampling studies in 5 select cities ***(5 percent of ULBs)*** covering all geographic regions (180 household samples and 144 non-domestic establishment samples – 3 days) d) detailed study to ascertain the condition of existing dumpsites in 18 ULBs ***(20 percent of ULBs*** *with 3 percent overlap with ULBs selected for other two studies****)***. Thus, around 30 percent of the Project ULBs were studied and data analyzed to ascertain at waste generation and composition, current practices, issues and impacts of the current system, and opportunities for improvement.

Sample Survey of Generators

Survey and assessment of sample ULBs *(Refer to Chapter 3 of Volume I (A))*

Summary of the profile of selected ULBs is detailed below:

a. Selected 12 ULBs are distributed across 9 out of 14 districts in Kerala, providing for significant spatial representation at 64percent.
b. Of the 12 ULBs sampled (13percent of the total ULBs in Kerala)

i. 5 are in the North administrative zone, 4 in South, and 3 in Central zone9 respectively.
ii. 9 ULBs are local economic development centers catering to small and medium-scale industries, including trading and other service sectors like medical tourism.
iii. 5 ULBs have a strong heritage character (pilgrimage/religious tourism centers) with a significant floating population footprint.
v. 4 ULBs are coastal towns; 5 spread across plains; 1 in flood plains and 2 in hill regions.
vi. Peri-Urban Development: Rapid urbanization and peri-urban development in 4 ULBs can impact solid waste generation.
vii. Proximity to Regional Integrated SWM projects: 6 ULBs.
viii. Population: The population distribution of towns in comparison with the proportional population representation parameter is with minor aberrations. There are 5 towns with less than 50,000 population, 5 between 50,000 and 1 lakh population, and 2 above 1 lakh population.
ix. In terms of population coverage, ~11.5percent of the State's urban population (6.2 million excluding 3 major Corporations - Trivandrum, Kozhikode, Kochi) is covered by the sampled towns.
iv. 3 of the selected 12 ULBs, viz. Alappuzha, Kalpetta, and Kasaragod are district headquarters.

For sampling, the property tax assessment database of Information Kerala Mission (IKM) was used in consultation with ULB authorities. The purpose was to distribute different categories of establishments and the magnitude/ impact across the study towns. The 18 different assessment categories were finally were aggregated into three broad categories for analysis (viz. households, commercial and institutional) and presented below. In each ULB, at least 100 generators were identified and distributed across categories. In all, around 1222 generators were surveyed, amounting to nearly 0.5percent of the total generators in the 12 ULBs. Surveys and consultations were carried out from December 2019 to February 2020.

Table 15: Stakeholder Groups consulted across categories in Sample Towns

ULB	Household	Commercial	Institution	Total
Alappuzha	62	29	19	110
Aluva	63	25	12	100
Attingal	51	30	21	102
Feroke	51	32	18	101
Guruvayur	50	34	18	102
Kalpetta	65	30	5	100
Kasaragod	52	37	11	100
Kothamangalam	63	25	11	99
Perinthalmanna	50	30	20	100
Thalassery	52	32	16	100
Varkala	51	30	21	102
Neyyattinkara	51	41	14	106
Grand Total	**661**	**375**	**186**	**1222**

[9] Fourteen (14) districts of Kerala are grouped into 3 Administrative Zones; North (Kasaragod, Kannur, Wayanad, Kozhikode) , Central (Malappuram, Palakkad, Thrissur, Ernakulam, Idukki) and South (Kottayam, Kollam, Thiruvananthapuram, Alappuzha, Pathanamthitta)

Survey respondents were adequately sensitized and well-informed in association with ULB officials about the proposed socio-economic survey, waste generation, and characterization assessment. Questionnaires prepared for survey comprised the following sub-sections:

a. Respondent profile
b. Waste generation, storage and segregation practices
c. Composting &/ recycling practices
d. Waste disposal practices
e. Level of satisfaction and service delivery
f. Awareness and interest levels on SWM
g. Disaster-related Vulnerability and Climate Change (SWM Impact)
h. Cost Recovery for Enhanced / Better services
i. Per capita generation assessment (for 7 days)

Detailed list of stakeholders consulted and surveyed across sample project towns for SEA ESMF is presented in ***Annexure V of Volume I***. Results have been discussed in ***Chapter 3 of Volume I.***

Discussions with Institutional Stakeholders

Details of various discussions with State Level agencies/stakeholders are presented in ***Annexure VI of Volume I of this Report.***

State Level Consultation Meetings on ESMF

1. State Level Orientation Meet

State Level Orientation meet on the project and EMF was organized on November 13, 2018. The World Bank policies and the safeguard requirements were explained to various State and city level Stakeholders during this Orientation meeting.

2. State Level Consultation on ESMF

A state-level consultation workshop was organized by the LSGD on 5/02/2020 the findings of the field survey on quantity and quantity of waste, citizens' perception of SWM services rendered, assessment of existing and potential technologies for SWM and assessment of regulatory framework, and to present the proposed Framework for Environmental Management.

More than 70 persons including state government officials from LSGD, Environment Department and SPCB, district officials (Planning officers and Suchitwa Mission district coordinators), Mayors/Chairpersons of Project ULBs actively participated in the workshop. The workshop endorsed the findings of the assessments and proposed recommendations. LSGD will prepare a state SWM Strategy as per national SWM Rules, 2016 based on the recommendation and detailed assessments. The strategy will have a dedicated plastic waste management action plan to comply with national PWM Rules, 2016.

4.5 Discussions on Draft ESMF

Stakeholder consultations at State and Regional Levels will be conducted to discuss the Draft EMF after the lockdown imposed due to COVID 19. Suggestions on this will be incorporated to finalize the ESMF and disclose the same. The major outcomes of (final) stakeholder consultations on ESMF will be listed and how these have been incorporated will be explained.

4.6 Conclusion

This ESMF document for KSWMP, presented in two volumes (Volume I and II) will act as the guidance document for the management of Environmental aspects and safeguard management for all components of the project. This is a living document and shall be updated, if required; following the consultations, approval, and disclosure requirements of the World Bank.

EMF GUIDANCE MANUAL

Section I: Layout of the EMF Guidance Manual

Following sections of this Manual are as below:

Section II: presents the Environmental Screening Form
Section III: presents the Documentation Formats
Section IV: presents Sample Terms of References for EIA, Environmental Experts at Project Management Units, Environmental Audit
Section V: presents Guidance for Environmental Consultations
Section VI: presents Indicative Environmental Management Plans and Monitoring Plans
Section VII: presents Environmental Codes of Practice
Section VIII: presents Physical Cultural Resources Management Framework
Section IX: presents Guidance on Natural Habitat Management Plan Preparation

Section II: Environmental Screening Form

INITIAL ENVIRONMENTAL EXAMINATION
(to be prepared for each subproject)

Checklist to be followed for Environmental Screening during the Initial Environmental Assessment Stage has been provided below:

Subproject Details

Name of Subproject:	
Subproject Components:	
Subproject Location (City / Town/ Village with ward numbers):	

Stage 1: Exclusion List

Is the Project Excluded from Consideration due to the following:

Sl No:	***Non-permissible Activities***
1	Projects in sites/locations which should be excluded as per prevailing Rules / Laws, near Natural Habitats and Forests: (i) any construction in demarcated Forest areas or protected areas or their buffers, (ii) landfills, not confirming to siting criteria as per SWM Rules 2016, or (iii) treatment facilities for Solid Waste, Biomedical Wastes and C&D Wastes not conforming to Pollution Control Boards siting criteria for specific industry (various types of treatment plants) types (where mitigation measures are not possible).
2	Projects which would involve decontamination of hazardous waste dumpsites or those would potentially result in further pollution of sensitive areas
3	Projects involving (i) any impact on or due to Dams or embankments or (ii) purchase, storage and use of Banned Pesticides

(Do not proceed to Stage 2; if the subproject is Excluded as per Stage 1 Exclusion List)

Stage 2: Environmental Screening Checklist

Project Details		
Sl.No	**Components**	**Details**
1	Project components	
2	Details of Components (main components including collection and transportation, decentralized household solid waste management, community-level solid waste management, centralized non-biodegradable waste management facilities, centralized biodegradable waste management facilities, sanitary landfills, biomining of dumpsites, including for Linked activities / associated facilities)	
3	Location of the Project Sites & Current Landuse (Provide information for all sites involved in the project; including for Linked activities / associated facilities), any historic land use (related to heritage, or contamination) Site Survey No:/s (attach map) with ownership details, Geographical co-ordinates of the site location [including any off-site sub-components (attach map) Also, mention disaster zones? (Earthquake, Cyclone, etc.)	

4	Land Area proposed to be used: Location wise (in sq km / sq m)	
5	Quantity of Water Required for Construction and Annual Operations with Details of Source/s	
6	Power Required and Source of Power	

Baseline Environmental Conditions

Sl. No	*Environmental Aspects*	*Yes*	*No*	*Details*
1	Is the project site located on or adjacent to any of the following (Provide Distance to these features in meters/kilometers)			
(i)	Critically Vulnerable Coastal Areas (CVCAs), Eco-sensitive Areas (ESAs)			
(ii)	Cultural Heritage site, Protected monuments - listed by ASI/State			
(iii)	Natural Forests / Protected Areas / Bio-Reserves Is the subproject in an eco-sensitive or adjoining an eco-sensitive area, with any schedule 1 species? If Yes, which is the area?			
(iv)	Other Wetlands/ Mangrove/ Estuarine Region			
(v)	Natural Habitat areas, roosting / nesting areas, spawning areas, breeding areas; areas with natural features like waterfalls, sacred groves			
(vi)	Other Sensitive Environmental Components listed in EMF			
(vii)	Drinking water source, upstream and downstream uses of rivers, etc			
(viii)	Low-lying areas/areas of Tidal Influence (provide CRZ details)			
(ix)	Sensitive Receptors – a) Habitations / Households / Hostels, other special areas, etc. b) School c) Religious Places d) Tourist Areas			
2	Is the site in Critical / Over Exploited Ground Water Block. Provide the level of the groundwater table			
3	Is the site vulnerable to major natural or induced hazards such as Landslides, Flooding, Storm surge, Severe wind damage, Earthquakes, Fire, Explosion, Other (specify)			
4	Describe the type of soil and vegetation on site			
5	Is the site present in the flood plains as recorded in the last 100 years. Provide the HFL level of the site/region			
6	Existing pollution/contamination or degradation on site			
7	Any other remark on baseline condition			

Anticipated Environmental Impacts: Impacts on Air, Noise, Land, Geology, and Soils

Sl. No	*Impacts on Land / Soil Environment*	*Yes*	*No*	*Remarks*
8	Total extend of land to be covered/built			
9	Total extend of land where the waste will be dumped openly / or expected to get contaminated by waste or leachate/material storage			
10	Extend of Land to be remediated			
11	Extend of land expected to be under green belt			
12	Will the proposed project cause the following on Land / Soil:			

Sl. No	Impacts on Land / Soil Environment	Yes	No	Remarks
(i)	Impact on Surrounding Environmental Conditions including Occupation on Low lying lands/flood plains			
(ii)	Substantial removal of Top Soil (mention area in sqm)			
(iii)	Any degradation of land / eco-systems expected due to the project?			
(iv)	Loss or impacts on Cultural/heritage areas/properties			
(v)	Does the project activity involve cutting and filling/ blasting etc?			
(vi)	Will the project cause physical changes in the project area (e.g., changes to the topography) due to excavation, earthwork, or any other activity?			
(vii)	Will the project involve any quarrying/ mining etc?			
(viii)	Will the project / any of its component contaminate or pollute the Land?			
(ix)	Will the project contribute to any long term significant adverse (negative), large scale, irreversible, sensitive impact at a regional scale or area broader than the project sites?			
(x)	Will the Project or related activities cause negative impacts on the land in combination with other anticipated / existing projects in the region?			

Sl. No	Impacts on Air and Noise Environment	Yes	No	Remarks
13	Will the project cause or increase air pollution due to dust and / or vehicle emissions?			
14	Will the project cause or increase pollution due to GHG emissions?			
15	Will the project cause or increase odor nuisance?			
16	Is there a potential for release of toxic gases or accident risks (eg: potential fire outbreaks)			
17	Will the project generate or increase noise levels which will impact surrounding biodiversity or communities?			

Sl. No	Impacts on Water Environment	Yes	No	Details
18	Will the activities proposed at the site(s) impact water quality (surface or ground) – leachate, runoff, wastes deposition, erosion?			
19	Will the activities proposed at the site(s) impact water resource availability and use - leachate, runoff, wastes deposition, erosion?			
20	Chances of Pollution of Water bodies/groundwater wells, nearby or downstream			
21	Will the activities proposed at the site(s) hinder natural drainage			
22	Will the activities proposed at the site(s) decrease permeability/rainwater percolation			

Sl. No	Impacts on Biodiversity and Host Communities	Yes	No	Remarks
23	Will the project necessitates cutting of Trees / Loss of Vegetation			

Sl. No	Impacts on Biodiversity and Host Communities	Yes	No	Remarks
24	Will the project necessitate substantial removal of Top Soil (mention area in sqm)			
25	Any degradation of land / eco-systems expected due to the project?			
26	Will the project result in Health & Safety Risks in the neighborhood including the release of toxic gases, leachate, accident risks			
28	Potential Noise, Light Pollution/movements causing disturbance to nearby habitats/communities			
29	Potential disruption to common property, accessibility, traffic disruptions, conflicts, or disruption to the local community within the subproject area?			

This Screening sheet must be completed for each of the proposed sites by respective cities/towns and forwarded to the Environment Specialist in Respective DPMU / SPMU along with the following enclosures.

Enclosures: Provide maps with the geographical location of the project; and an appropriately-scaled map clearly showing the project area and project sites with land use, existing buildings, infrastructure, vegetation, adjacent land use, utility lines, access roads, and any planned construction, and any other information to describe the project, locations and possible impact as required.

Project Categorisation and Need for Safeguards Instruments, Oversight

Project Category	□ *E1* □ *E2* □ *E3*
Key Reasons	
Safeguards Instruments Required	a) E1: Project-specific EIA (impact assessment considering the project details & location) by Independent Consultant (with signed/sealed Screening Form, Consultations, EMP, Budget, Responsibilities) b) E2: Project-specific EIA by DPR Consultant (with signed/sealed Screening Form, Consultations, EMP, Budget, Responsibilities) **c)** E3: signed/sealed Screening Form, Consultations, EMP, Budget, Responsibilities
Additional Responsibilities Expected (such as i) Specialists to be hired for Physical/Cultural resources, Natural Habitats/others, etc for EIA preparation, and/or supervision), ii) Consultations, iii) any other aspect	

Status	*Agency / Official*	*Name, Signature with Date and Seal*
Prepared by	PIU or ULB (project in-charge)	
	Environmental Engineer	
Checked, Categorised as ___ (E1, E2, E3) & ToR issued by:	DESDU / SESDU	
	Environmental Specialist	

Section III: Documentation Formats

A. Model Format for EMF Compliance Reporting

- The objective of these guidelines is to assist the PIU or the borrower in preparing the project compliance report, the documents the Environmental issues encountered in the sub-project, and the compliance of the EAR recommendations.

- The sub-project compliance report shall have an exclusive section on the Environmental Issues of the projects and provide the following information.

Project Name :				**Loan / Disbursement No :**	
Borrower / State/UT				**PMC Consultant :**	
Environmental Issues encountered	**Mitigation Measures**			**Residual Issues Any**	
A. Environmental Issues	As per EA	Implemented	Cost in Rs.	Description	Responsibility
1.					
2.					
3.					
4.					
5.					
Issues not identified in IEE/Screening a. b.c.					
C. Status of the Regulatory Clearances	Obtained	Not Obtained – Reason for Delay and Expected Time	Remarks		
1.					
2					

B. Format for Quarterly Reporting on Environmental Aspects

Sl No:	*Projects which will be financed during the Quarter*	*Status of Detailed Project Report (Ex: Final / Expecting Design Change)*	*E&S Classification as per EMF*	*Proposed Safeguard Instrument (Ex: Independent EIA, EIA by DPR Consultant, Indicative EMP)*	*Status of Stakeholder Consultations*	*Status of Approval of SG Instrument*	*Remarks (incl. issues/ probable delay in finalizing etc)*	*Next Steps*
1								
2								
3								
4								
5								
Status of agreed Actions on Environmental Safeguards								
1	Action 1	Responsibility	Time Schedule	Status				
2	Action 1	Responsibility	Time Schedule	Status				

C. Incident Reporting Format

(Fill blanks)

KSWMP – INCIDENT REPORTING

Reporting Period: ----------(Month) to ---------- (Month), ---------- (Year)

Sl NO	**Sub Project Name**	**Severe Incidents**		**Serious Incidents**		**Indicative Incidents**	
		No:	**Type**	**No:**	**Type**	**No:**	**Type**
1							
2							
3							
4							
5							
6							

The project has reported _____ **(no:s)** Occupational Health and Safety (OHS) incidents since its start. Of these, _____ **(no:s)** are classified as SEVERE, _____ **(no:s)** as SERIOUS, and _____ **(no:s)** as INDICATIVE. During this period, the Team checked with all PIUs and relevant contractors and consultants if any OHS incidents occurred, either reported or not yet reported. The mission found _____ **(no:s)** new incidents occurred during this supervision period.

Name of Reporting Officials with Designation:

Date:

Section IV: Sample Terms of References (ToRs)

D. ToR for Preparing Solid Waste Management Plans for Project ULBs

01. Introduction to KSWMP

The Government of Kerala (GoK) intends to utilize financial support from the World Bank for Kerala Solid Waste Management Project (KSWMP) which aims to strengthen the institutional and service delivery systems for Solid Waste Management (SWM) services in urban areas in Kerala. The project will cover reforms at state and city/town levels to improve the institutional systems for service delivery and climate resilience of medium-small (less than 100,000 population) towns in Kerala. The proposed geographical coverage at this stage includes all ULBs. The identified ULBs constitute approximately 65 percent of the urban population spread across the 14 districts of the State.

To provide safe, sustainable, and environmentally friendly solid waste management services at ULBs', it is envisaged that the SWM plan is developed for each ULB.

02. Objectives of the Consultants Service

The key objective of this assignment is to prepare ULB specific long term solid waste management plan through a participatory approach in coordination with concerned ULBs, the public, and other concerned stakeholders.

The specific objectives of this assignment are:

- To identify the existing practices and issues of solid waste management in the ULB
- To identify the appropriate approach and technology for effective and sustainable SWM specific to the ULB
- To establish a sound institutional framework implement, operate and supervise the solid waste management program
- To plan continuous education and awareness campaigns for sustainable SWM

03. Description of the Tasks

Step 1: Preparation of Baseline City Profile

The team shall prepare the profile of the Town / City under consideration based on available secondary data. This shall include a description of the city in terms of its area, physiography and climatic characteristics, socioeconomic characteristics, slum population, tourism, and other industries, the administrative structure of the local body (including its existing set up for Solid Waste management)

Step 2: Review of Policies, Regulations, and Guidelines

Step 1 entails a detailed review and analysis of the national, state, and ULB level laws, rules, policies, programs, and guidance related to SWM. The study shall prepare a list of all mandatory and recommended actions required as per SWM Rules, 2016 and other applicable rules, policy guidance, NGT directions and shall ensure that the SWM plan is developed in adherence to all the possible regulatory requirements and World Bank's safeguard policies and the Environmental Management Framework (EMF) for KSWMP.

Step 3: Review of Existing Solid Waste Management in the City

The team shall describe the existing SWM in the city/town including the amount of waste generated, the projected growth of waste generation for the next 30 years' time span, generator wise waste quantities, composition/characteristics of the waste based on available data. As part of this task, current waste segregation, storage at source, street sweeping, primary collection, transportation, secondary collection and transport, treatment, and disposal facilities shall be discussed for all streams of waste (Wet and Dry). Current practices of reduce/recycle reuse also shall be discussed. Other infrastructure including tools used, and material or vehicle depots or maintenance facilities, are available for treatment/disposal facilities and its present condition shall also be discussed. Besides, institutional (who does what) and financial aspects of waste management need discussion here; including current operating costs (Collection cost per ton per day, treatment/disposal costs).

The assessment should identify deficiencies or gaps that need to be bridged to meet legal obligations and requirements of World Bank Safeguard. Gaps with respect to human resources, institutional capacity, infrastructure, financial resources, inclusiveness in service provision, conducive regulatory framework, availability of essential data, land availability, stakeholder willingness, awareness levels, as well as information, education, and communication (IEC) needs of the community should also be identified.

Assessment of current situation should focus on-

- ✓ Demographic details(which includes sex-disaggregated data), number of households, socio-economic classes and different pockets of differing classes and slums if present, institutional and commercial establishments, population growth pattern, historical waste generation data (available data), major generators in the city under different land use/occupancies, major industries/ commercial units (who extends support through CSR)
- ✓ Sample surveys to understand waste quantities (Waste Quantification studies), Waste Characteristics Study (physical and chemical composition of waste)
- ✓ Inventory of human resources at various levels in the ULBs, Haritha Karma Sena etc.
- ✓ Inventory of equipment, bins, vehicles, and available land for municipal solid waste management (MSWM) facilities, Review of allotted or demarcated land by Town Planning Department (if any) and suitability of the land and equipment/vehicles considering the waste quantities, characteristics, climate, and other sensitivities
- ✓ Storage at Source and Segregation: Details of waste storage at source and source segregation (including the number of fractions in which waste is segregated); type of segregated storage and bins types; no: of days of storage at source, space availability for storage, and impacts/issues
- ✓ Primary Collection System in Practice: Door-to-door collection frequency and type of collection (vehicles used, bins used for collection, type of waste collectors, mechanism of the collection), collection from community bins or any other method, requirements of collectors, percentage of coverage under each collection method including gap analysis, no: and type of equipment and PPEs provided and used, arrangements for contingencies or emergencies
- ✓ Street Cleaning: Frequency of street sweeping, coverage of key areas, public spaces and roads, inclusiveness of slums and informal settlements, and safety provisions, type of sweeping equipment's, no: of sweepers involved, no: and type of equipment and PPEs provided and used, arrangements for contingencies or emergencies
- ✓ Secondary Storage: Secondary storage (if any) in covered street bins, containers, masonry, concrete bins, enclosures, open waste storage sites, or any other method, bin-population ratio, or no secondary storage (direct transportation of waste), arrangements for public places, contingencies or emergencies
- ✓ Transportation: Type and number of vehicles used, quantity and percentage of waste transported each day in covered vehicles and open vehicles, frequency of transportation from secondary storage sites, percentage of manual loading as against mechanical loading, no:

of drivers, support staff and workers involved, vehicle cleaning/washing/maintenance facilities, no: and type of equipment and PPEs provided and used, arrangements for contingencies or emergencies

- ✓ Processing of Waste: Location and type of processing, Quantity, and percentage of waste processed, technology adopted, percentage of residual waste sent to a disposal site, the realization of revenues from the processing facility, beneficiaries of the revenues, no: of workers involved, support of NGOs / CBOs, no: and type of equipment and PPEs provided and used, arrangements for contingencies or emergencies
- ✓ Disposal of Waste: Details on sanitary landfill available, designated site, and capacity of the landfill, the volume of the current cell and expected life, the quantity of waste deposited annually at the landfill (over the life of the landfill); Identifying the location of existing dump sites and issues with these sites; Land availability for SWM as per city development plan or city master plan, historic struggles, and actions related to SWM
- ✓ Financial Assessment: The budgetary allocations and actual annual expenditure on SWM services in relation to total revenue budget of the municipal authority; Cost per tonne of various components of SWM service; Salary of workers/staff, vehicle hire charges in a year, Assessment of tax or user fees levied for providing SWM service (even for special services like collecting from marriage halls, other bulk generators) and extent of cost recovery
- ✓ Plans for improvement of SWM in the future, allocations, and funding support if any
- ✓ Public-private partnership (PPP) status in providing services, the extent of private sector participation (PSP) in delivery of service, and cost benefits or quality of service derived
- ✓ Involvement of community participation in SWM with an overview of the kind of community engagement, the outreach services, the number of men and women, the activities in engaging communities
- ✓ kind of information, education, and communication (IEC) material developed, whether they target a particular aspect of SWM and whether the message is gender-sensitive (not merely reinforcing stereotyped roles of men and women)
- ✓ Assessment of Social Impacts: Estimate the impacts of the existing waste management system on the informal sector of SWM system and waste pickers, either negatively (hygienic impacts) or positively (revenues for the informal sector); impacts on host communities (near dumping yard), impacts on municipal workers, contingent workforce, HKS/Kudumbashree/others; livelihood aspects of street sweepers and other service providers in the supply chain, in particular, how they operate, their incomes, interests in working as a group (such as SHG), occupational health and safety; etc.
- ✓ Assessment of Environmental and Health Impacts: Impacts on the environment and public health due to existing waste management practices, impact on groundwater, air, soil, fauna/flora/wetlands, water bodies or other sensitive features;
- ✓ Assess existing SWM facilities and related land use issues and old dumpsite closure issues; Analyze gaps (including socioeconomic and gender-related disparities that may exist) focusing on deficiencies of the existing system by reflecting all issues mentioned above; Compare the current situation with Service Level Benchmarks (SLBs) prescribed by the Government of India and recommendation given for KSWMP

Step 4: Stakeholder Consultation for Planning

SWM has a direct relation with the community and other waste generators. Due to the number of institutions and stakeholders involved in SWM, it is important that the SWM plan, which aims to bridge the gaps or improve the level of service, is developed through a consultative process. Stakeholders' views, including their willingness to participate and get engaged for the service, should be considered. SWM Plan shall ensure that women, as important providers of SWM services as well as beneficiaries of these services, shall be adequately involved in the stakeholder consultations and decision-making processes as detailed out in ESMF for the project. Consultations shall be conducted at the minimum during the start of the Plan preparation Process, and Discussion on Draft Plan. Discussions and surveys can be conducted as required to prepare the plan.

Step 5: Preparation of Draft Solid Waste Management Plan

Draft SWM Plan should be prepared based on identified gaps, future population projections and waste generation rates, current and future quality and quantity of waste (based on changing lifestyles and economic status), inputs from stakeholders, financial situation, and technological options for treatment and disposal based on the local considerations and choice of the stakeholders, improvement in the institutional setup and / or support required for implementation and operations, considering the technical capabilities of the local body.

The assessment should prepare its draft short term and long term SWM plan, considering the provisions of the local Municipal Act, SWM Rules, NUSP, SLBs, and other regulatory requirements and ESMF prepared for the project. The size of the ULB, projected waste generation rate, waste characterization, geographical location, climatic conditions, hydrogeological conditions, and environmental, social, and economic considerations have an impact on the selection of appropriate systems and technologies for processing and disposal of waste. Contingency plan ad Disaster Management Plan shall be developed, and integration of the city plan/facilities with regional facilities shall be detailed out.

Requirements for equipment, vehicles, staffing, land revenues, etc., for providing door-to-door collection, street cleaning, secondary storage, transportation, processing (centralized/decentralized facilities with the percentage of the population to be covered through each), and final disposal of waste should be outlined. Waste minimization or reduction, waste reuse, and waste recycling practices (3Rs) have a significant impact on the waste composition and quantities of waste to be handled and disposed-off. ULBs should, therefore, have a plan for an effective IEC campaign to promote the concept of 3Rs to minimize waste generation.

The institutional framework for providing SWM services and its monitoring and supervision through ULB departments and/or PPP needs to be planned. Duties of the responsible staff should be detailed out and disclosed to the general public. Capacity building needs of staff and the need for management information system shall be analyzed.

Step 6: Schedule for Implementation

An implementation plan, indicating allocation of resources and specifying timelines (for every 5 years) should be prepared. Sub plans and targets (technical, financial, institutional incl. capacity building, monitoring) for every five years shall be detailed. The implementation plan should address institutional strengthening; proposal by ULBs for raising financial resources through rationalizing taxes and supported by user fees as per the requirement; and obtaining government grants and rollout. The institutional and financial operating plan should be an integral part of the SWM plan. PPP for infrastructure development and service delivery may be fully explored during this exercise.

Step 6: Environmental and Social Impact Assessment (ESIA) of the SWM Plan

ESIA of the proposed SWM plan shall be conducted as per ESMF (Applicability to TA components). This includes an assessment of the impacts of proposed plan components and detailing the mitigation measures for each, budget for implementation of mitigation measures, monitoring responsibilities, and consultations.

Step 7: ULBs' Approval for Solid Waste Management Plan and Implementation

The consultant shall present the draft SWM Plan to the elected body / Council of the ULB to seek approval and to officially formalize the Final Plan. ULBs should be made aware of the

short term and long-term actions and should also approve the financial plan for the implementation of these actions.

04. Outputs / Deliverable

Deliverable is a Final SWM Plan for the ULB

05. Expected Team Composition

The following are the Key experts expected. In addition to Key experts, support staff of required qualifications and experience may be used.

Key Experts	Basic Requirements	Time input
Team leader/ Solid Waste Management expert	Team Leader/SWM expert should hold at least a master's degree in Civil/Environmental Engineering with 15 years' experience in urban planning, civil engineering, and solid waste management projects. Should have expertise in developing SWM strategies and action plans, conducting SWM baseline assessment, preparing and implementing technical and financial viable SWM approach including 3R principles (Reduce, Reuse, and Recycling), knowledge on technical suitability of various SWM treatment technologies for dry and wet wastes, and disposal options. Should have experience in estimating and costing SWM infrastructure. The expert should also be fully conversant with applicable regulations, and safeguard policies of the World Bank.	3 Months
Institutional and financial Management Expert	Should hold master's in business administration or finance, with 20 years' experience in infrastructure planning in the municipal context. Should have experience and expertise in working out financial details (Phased) for infrastructure projects and institutional analysis.	2 months
Environmental Specialist	Environmental Specialist should hold master's degree in environmental engineering/planning with 10 years' work experience in a related field. Experience in impact assessment and mitigation planning for solid waste management projects will be necessary. Experiences in preparation of EIA-EMP of various projects including SWM projects will be essential. The specialist should be fully conversant with the safeguard policies of the World Bank and the regulatory regime of GoI.	2 Months
Social Safeguard Specialist and Community Engagement Specialist	Master's Degree in Social Science/ Social Work/ Sociology or similar discipline with 10 years of demonstrated experience in designing and implementing social assessment programs in large scale urban infrastructure projects involving solid waste management. The specialist should have working experience on issues on vulnerable communities and gender. Shall have wide experience in handling consultations with multiple stakeholders. The specialist should also be fully conversant with the safeguard policies of the World Bank and safeguard the requirement of GoI.	3 Months

06. Duration for the Assignment

Duration of the proposed assignment is 3 months

E. ToR for Preparing EIA for Category E1 Sub Projects

Scope of Work

The following are the tasks to be performed by the consultants while conducting Environmental Assessment for the project including nature, scale, and magnitude of impacts that the project is likely to cause on the environment.

Task 1 Project Overview

A succinct description of the proposed project shall be provided covering: (a) status analysis of the baseline scenario and existing solid waste management practices across the value chain (b) description of each of the proposed components, activities and sub-activities. The task shall also bring out the rationale, the need for the proposed project, and list out the various benefits of project implementation. As part of this activity, the consultant shall provide necessary maps to scale.

Task 2 Data Assimilation: Primary, Secondary

The consultants shall review various earlier studies such as feasibility and detailed project reports, etc., of the project and understand the project and various aspects associated with the same. This shall provide a base to formulate the environmental surveys necessary for the project and assessing the impacts of the same.

Task 3 Legislative and Regulatory Considerations

A review of the legal and regulatory provisions applicable to the project shall be carried out in this task. The objective of the review is to bring out the legal and policy issues to be addressed in the project at various stages of project development such as planning, design, execution, and operation. In addition to the national and local regulations, the WB operational policies and its applicability to the projects need to be reviewed and a detailed gap assessment with the country legislations and the methodology to bridge the gaps needs to be presented

The review shall thus provide a complete list of regulatory formalities required for the project and various clearances required from different regulatory agencies including the State Pollution Control Board.

Task 4 Preparation of Environmental Profile

The first activity under this task would be the determination of the project influence area based on the expected impact/influence of the project over the region. In the case of regional/ cluster level projects like regional landfills or centralized treatment facilities for multiple ULBs, the project influence area can be assumed as regional. Impacts over project region shall be considered for analysis and an appropriate region of influence shall be selected as project influence area. This must ideally include natural/physical boundaries and must be expanded to coincide with the nearest administrative boundary to ensure mitigation actions are implemented.

An environmental profile of the project influence area shall be prepared, based on appropriate primary and secondary surveys and field investigations. The objective of this profile is to establish existing environmental conditions of the project area, in terms of air, water, noise, soil and other environmental parameters, which should form the basis for the prediction of impacts due to proposed project activities. As part of this, the environmentally sensitive land uses (protected natural areas, areas of ecological value, sensitive receptors like schools, hospitals, etc) would also be identified and plotted on a map to scale.

The extent and duration (at least one season for rapid assessment and the three seasons for full detailed assessment) of surveys shall be judiciously decided by the consultant as per requirements of the environmental regulations applicable in India and guidelines of international funding agencies. The profile prepared shall be adequate to predict the impacts of the project and shall cater to the requirements of obtaining necessary environmental clearances from the authorities. The profile shall essentially include all physical, ecological and socio-economic components of the project environment and bring out the salient and sensitive features of the same. Important aspects such as reserve forests, national parks, major water bodies, structures of archaeological/historic importance, and other environmental resources (if any) shall be identified and salient features of the same shall be presented.

Task 5 Determination of Potential Impacts and Analyses of Alternatives

Based on the environmental profile of the project area prepared above and the proposed project activities discussed under Activity 1, the consultants shall carry out environmental screening to determine the nature of impacts and level of Environmental Assessment to be carried out. As part of this task, it is also required to understand the possible cumulative impacts and evaluate whether cumulative impact assessment is required, as part of the ESIA (particularly for Category E1 subprojects). Refer endnote of this ToR for steps involved in CIA process.

An analysis of various project alternatives, including the 'Project' and 'No Project' scenario shall be brought out and impacts shall be analyzed for each scenario. Based on the above analysis the best alternative that causes minimum or no impact shall be recommended for implementation.

Task 6 Stakeholder Consultations

The consultants shall carry out consultations with experts, NGOs, Forest Department (if applicable) and other selected Government Agencies and other stakeholders to (a) collect baseline information, (b) obtain a better understanding of the potential impacts (c) appreciate the perspectives/concerns of the stakeholders, and (d) secure their active involvement during subsequent stages of the project as appropriate.

Consultations shall be preceded by a systematic stakeholder analysis, which would (a) identify the individual or stakeholder groups relevant to the project and environmental issues, (b) include expert opinion and inputs, (c) determine the nature and scope of consultation with each type of stakeholders, and (d) determine the tools to be used in contacting and consulting each type of stakeholders. A systematic consultation plan with attendant schedules will be prepared for subsequent stages of project preparation as well

as implementation and operation, as required. Where community consensus is required in respect of proposed mitigation measures for impacts on community assets including water bodies, places of worship, etc., specific plans for modification/relocation, etc have to be disclosed and consensus obtained.

Task 7 Development of an Environmental Management Plan / Determination of Mitigation measures

Using the outputs of the above tasks, the consultants shall develop an implementable Environmental Management Plan (EMP) for the project.

Methodology to be adopted for key tasks above:

Environmental Scoping

1. Environmental scoping shall be undertaken to identify the environmental hot spots along the project corridors, project relevance to climate change and determine the level of environmental analysis required for the EA. The consultant shall carry out a preliminary analysis to assess the nature, scale, and magnitude of the impacts that the project is likely to cause on the environment. In case of significant environmental impacts encountered (may apply to the entire project/specific project interventions/specific locations), The consultants shall explore possible alternatives to the project and/or project components in a consultative manner.

The scoping exercise shall be supported through secondary and reconnaissance surveys and, stakeholder consultations on the existing environment scenario. As part of the exercise, the consultants shall:-

- Identify sensitive locations in the project area including regionally or nationally recognized environmental resources and sensitive receptors including manmade land uses and activity areas like hospitals, schools, etc.
- Establish baseline environmental quality concerning air, water, and noise at sensitive receptors.
- List and map common property resources such as roadside trees; forests, large water bodies; and major physical cultural properties, etc. Identify Human settlement, physical infrastructure, and project activities that would result in severance.

The consultants shall also appraise the project in terms of substantial greenhouse gas reduction potential and substantial need for adaptation to possible climate change effects.

Project Environmental Assessment

- Existing Environment and Baseline Conditions: Baseline assessment shall be carried out based on the outcome of Environmental Scoping carried out for the project. The baseline conditions shall be established through detailed primary level field surveys. The specific tasks under this include the following:
    - Data Collection: Data shall be collected on relevant physical, biological, and socio-economic conditions to establish the current environmental status of the project area. The data collection should be undertaken to arrive at meaningful information that will facilitate the assessment of impacts and preparing the management plans. Broadly, the following form of the data categories shall be covered
    - The current land uses at the proposed project site and the study area using maps

plotted to an appropriate scale, covering lakes/ponds and their uses, forests and its classification, ecologically sensitive areas (sanctuaries, national parks, wildlife corridors, identified areas of nesting, mangroves and/or of interest of migratory birds, etc.), prominent landmarks, sensitive receptors, community severance, village settlements, agricultural lands, pasture, and barren lands, various categories of CRZ areas if any, etc.

- Physical – Geology/hydrogeology, topography, soils, climate and meteorology (with emphasis on critical season considering water bodies and air quality), ambient air quality, surface and groundwater hydrology, existing sources of air emissions, existing water quality status of water bodies of importance.
- Biological and Ecological assessment covering water bodies, fauna, flora, ecologically sensitive areas (perceived as well as officially listed).
- Critical areas of environmental importance shall be identified as an output of the current environmental status of the project sites
- *Impact Prediction:* The Consultant shall identify positive and negative impacts likely to result from the proposed project, interpreting "environmental" throughout the EA to include socio-economic impacts as well as impacts on the natural environment. All the project activities during pre-construction, construction, and operation phases shall be considered to assess the impacts. The impact assessment shall necessarily cover the "no action" alternative in the analysis. The consultants shall regularly interact with the technical team of the project to share the findings of the impact assessment. The assessment of environmental impacts shall necessarily cover (but not limited to) the following:
- Impacts on the surface water bodies
- Impact on the groundwater – both in terms of the quantity as well as the potential impact of contamination
- Impact on the air quality
- Impacts on topography and surface drainage due to the proposed project activities in the project area,
- Community and cultural severance identified through consultations
- Expected impacts on the land use patterns at and around the proposed project facilities/components
- Impact on ecologically sensitive features including spawning areas in creeks/estuarine areas, etc.
- Assess the change of stream course due to diversion channels to construction intake structures and its impact on downstream users
- Impact on Socio-economic aspects of the projects area
- The noise and air quality-related impacts during the construction period on sensitive receptors shall be assessed
- Impact on Trees, public utilities, and other community structures, cross overs, etc to be assessed.
- Any impacts that are irreversible and/or cannot be avoided or mitigated should be identified
- Assessment of the impacts on climate change

Environmental Management Plan

The EMP should suggest ways/options for mitigating the negative impacts of the project, the preventive measures necessary. Where required, EMP shall include community consensus for the mitigation measures proposed. The EMP shall identify the means/agency responsible for the implementation of the same and recommend a suitable monitoring mechanism for the EMP. The EMP shall be in the form of contract covenants and shall provide detailed cost estimates converted into BOQ items wherever necessary and applicable for implementation of the same. The consultant shall also recommend an appropriate institutional mechanism as per the requirements of EMP. The consultant shall prepare a detailed EMP covering the measures to mitigate and/or minimize the negative impacts, including the implementation arrangement and a monitoring plan for the same with site-specific requirements. EMP shall cover the following details:

Management/Mitigatory / Enhancement measures:

a) For each of the significant negative impacts, the consultant should recommend measures to eliminate or mitigate the impact. In case it is not possible to mitigate an impact, the cost of damage shall be estimated and adequate compensatory measures shall be recommended.

b) Consultants shall recommend enhancement measures for incorporation in the design for attaining energy efficiency, reuse of treated water, control of water leakage, energy generation, etc.

c) The mitigatory measures should necessarily contain conceptual designs wherever necessary. Project interventions including civil works shall be planned to take into account climate change effects. (for example; buildings will be built above maximum probable tide levels, and designed to withstand high wind, storm surge, and rising sea levels). The consultants should also specify neighborhood committees to supervise the effective implementation of the proposed mitigatory measures.

d) Budget Estimates: The EMP budget estimates shall be prepared for each of the project components and the shall be integrated with the overall project cost estimates and the relevant costs shall be included in the BOQ provisions. The cost (capital and recurring) of all the mitigation measures and the responsible parties for implementation should be identified and shall be translated into BOQ items. Wherever possible the measures should be drafted as contract clauses, which can be incorporated in construction/operational phase agreements

e) Monitoring Plan: The Consultant should specify the types of monitoring needed for potential environmental impacts during construction and operation. As in the case of the mitigation plan, requirements should be specific as to what is to be monitored, how and by whom along with reporting formats and recommendations if any Cost estimates are necessary and where monitoring reports are to be prepared, the recipient responsible for review and any corrective action should be identified. The monitoring plan should be supplemented with a detailed schedule of implementation of EMP measures.

f) Institutional Arrangement to Manage Environment Impacts Effectively: The consultants shall identify institutional/organizational needs to implement the recommendations of the project EA and to propose steps to strengthen or expand if

required. This may extend to new agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance, training, and budgeting.

Public Disclosure

The consultants are to provide support and assistance to the Client in meeting the disclosure requirements, which at the minimum shall meet the WB policy on public disclosure. The consultants shall prepare a plan for in-country disclosure, specifying the timing and locations; translate the key documents, such as the EA Summary in the local language (Malayalam); draft the newspaper announcements for disclosure, and help the client to place all the EA reports in the client's website.

Endnote: Assessment of Cumulative Impacts

1. The ToR for the CIA should specify 5 steps as follows:

- **Step 1**: Describe the proposed project, it's setting, and other projects and activities that may give rise to cumulative effects. The consultant will use EIA and other available documents. This cumulative impact assessment will need to sequence planned developments of the project in and ancillary and regional infrastructure development in the time horizon of the project. The consultants will need to propose geographic and temporal boundaries for the CIA based on the screening of potential impacts on key environmental components. The geographic context should include administrative boundaries or watersheds.
- **Step 2**: Identify key project-related contributions to cumulative effects on selected resources of concern, such as groundwater, biodiversity, and the livelihood of local communities.
- **Step 3**: Assess the level of cumulative effects.
- **Step 4**: Determine the significance of cumulative effects.
- **Step 5**: Provide recommendations: Analyze reasonable, feasible options for mitigating or avoiding contribution to any significant cumulative effects, following the national legal system related to the cumulative impact assessment (or the lack thereof)).

Tasks:

Step 1: Describe the development and its setting.

2. **Project Description**. The first step in the CIA is to describe the project and its phases, including key components that may give rise to cumulative effects. This will include the following:
   - Phases and timing of the project;
   - Description of the scheme and project area of influence;
   - Description of offsite facilities including transportation, access roads;
   - Identify environmentally sensitive areas, including protected areas, key stakeholders and affected people.

3. **Past, present, and probable future projects.** Once project issues have been identified, analyze past, present, and probable future projects and activities within a defined temporal and spatial framework. The evaluation of other projects and activities should consider the following:
   - Include those projects of known footprint that can be assessed;
   - Consider a time frame that extends backward to a pre-development scenario and forwards as realistically as possible;

- Include projects that are approved, awaiting approval, announced or under design;
- Include those projects whose environmental and social impacts and contribution to cumulative effects can be reasonably predicted, particularly projects with direct impacts on water resources, land and biodiversity; and,
- Discuss pending projects with regulators and incorporate the concerns of affected stakeholders.

Prepare a map or schematic of all existing and planned projects with the basic information on location, resource intake, discharges, ancillary infrastructure, operation, etc..

- Define geographic and temporal boundaries for the CIA based on the screening of potential impacts on key environmental components. The geographic context could include administrative boundaries or watersheds. It is noted that there might be different contexts for each Valued Ecosystem Component (VEC - see below). The definition will also need to include the scale of maps and other tools to present data that will be collected during the study.

4. **Define VECs**. If the ESIA already exists it should have already identified some key issues of concern associated with the construction, operation, and decommissioning of the project. Typical VECs to include in hydroelectric development impacts include the following:
   - Impacts on water resources (water use, quality, quantity);
   - Impacts on biodiversity and wildlife;
   - Impacts on land use;
   - Loss of archaeological and cultural resources;
   - Impacts of wastes on the environment;
   - Impacts on air quality;
   - Impacts on the livelihood of local communities;
   - Visual Impacts.

5. The VECs should be defined based on the assessment of impacts on the above aspects and consultations with stakeholders. VECs could be (but are not limited to): water resources, land erosion, wildlife, cultural resources, air quality, etc. Each VEC will need to have indicators, thresholds, historical trends on the status of the VEC in the time-frame proposed.

Step 2: Identify key project-related contributions to cumulative effects on selected resources of concern.

6. The CIA should identify key impacts of project activities throughout all phases (construction, operation, and decommissioning) in conjunction with other projects and activities. The following questions should be answered:

   - Are other projects and activities in the defined project area affecting the VECs?
   - Do the effects of the project overlap or increase the effects on the resource?
   - Do the effects of the project have a potential to affect the long-term sustainability of the resource?

Step 3: Assess the level of cumulative impacts.

7. The next step in the CIA process is to assess the level of cumulative impacts. This uses a similar methodology to that employed in the EIA, but the difference is that it assesses the impacts of other projects and activities, in addition to the project in a defined spatial and

temporal framework. For each resource/issue in question, the cumulative effects should consider typical components of an EIA assessment – extent, frequency, duration, magnitude, uncertainty, and probability. Techniques will need to rely on qualitative data and already available quantitative data; no significant fieldwork for quantitative data collection is envisaged.

Step 4: Determine the significance of cumulative impacts.

8. Once the cumulative impacts are determined, their significance must be considered relative to an established threshold limit, an established legal guideline or policy, or a qualitative assessment based on professional opinion and consultation. In any case, the significance of the cumulative impacts must be defensible. The significance of the cumulative impacts and the contribution of the project must be subsequently evaluated by project decision-makers. The consultant will need to define the level of "significance" or scale and apply it consistently. The significance should be assessed across past, present, and future projects on the trends of each VEC. The significance of the project interventions' contribution to the cumulative impacts should be defined in one of the following ways:

   - The project has a measurable effect on the resource;
   - The project acts in conjunction with the effects of past present or future projects and activities; and
   - The project in conjunction with other projects and activities shifts the resource to an unacceptable level or exceeds a threshold such that the impact is considered significant, in that:
     - The project's contribution to cumulative effects is responsible for exceeding the threshold and therefore is significant or,
     - The project is contributing to the effects of other projects and activities and the project contribution may or may not be significant, depending on the level of the contribution.

Step 5: Formulate recommendations.

9. The CIA should conclude whether the contribution, if any, to the cumulative impacts by the project is significant or not. An action plan (with time, institutional responsibilities, budget) should be developed based on this conclusion, and clearly define what mitigation measures need to be incorporated into the project Environmental Management Plan, and what mitigation/environmental management measures should be carried out above the project level. The management plan will be in three parts: (i) management plan for additional measures needed to be included in the project that has not been included in the EIA; (ii) recommended measures for the future projects in the area; and (iii) measures addressing needs for institutional and legal frameworks and acquisition of knowledge. The recommendations will need to also include proposed adaptive management approaches for impacts that still will have a high level of uncertainty or lack sufficient information for an adequate assessment.
10. Mitigation/environmental management measures that are needed but beyond the scope of the project, will be presented to relevant (government) agencies/entities in the form of a workshop and finalized based on the views by the agencies. Their endorsement/acknowledgment on the recommendations from the CIA should be sought.

F. ToR for Environmental Experts Project Management Units (PMUs)/Project Implementation Units / ULBs

a) ToR for Environmental Specialists at PMU

Introduction

The objective of this project is to enhance and strengthen the institutional capacity of the urban local government system in Kerala to deliver services and perform governance functions more inclusively and efficiently. The program enables the LBs to catch up with the current urbanization trend in the State by ensuring the urbanized areas and selected urbanizing local governments have proper administrative and service delivery systems and procedures in place to function effectively.

The project would be coordinated by a State Project Management Unit (PMU). The PMU will have a full-time environmental expert to oversee, plan, and co-ordinate the environmental aspects, and safeguards management during project planning and implementation stages.

Geographical Coverage

The Project will cover all ULBs of Kerala. Many of the ULBs in Kerala are located in coastal areas, flood plains, hazard-prone areas, near forests areas, heritage areas, estuaries, rivers, and other eco-sensitive areas; mostly with high water table; (ii) environmental issues associated with waste management sector (including solid waste, biomedical waste, and C&D waste) are significant and none of the ULBs have effective solutions for this sector; (iii) there are important pollution impacts from unsegregated openly dumped solid waste; triggering the demand for effective environmentally appropriate end-to-end solutions. Considering the geographical disposition, the density of population, and environmental characteristics of the state and its urban areas, it is important to have a strategic understanding of the region and the focus sectors. It is proposed that the PMU undertake a Strategic Environmental Assessment (SEA) of the State; with a focus on the waste management sector. Based on the findings of the SEA, an Environmental Management Framework (EMF) will have to be prepared and followed to ensure the effective management of environmental aspects during all stages.

Objectives of engaging Environment Expert

Roles and Responsibilities

- Co-ordinate the Preparation of the SEA-EMF
- Prepare and Disclose the EMF including guidelines for impact identification (for goods, works and consultancy contracts), project screening checklist, broad mitigation plans, guidance to prepare detailed impact assessment for projects, supervision mechanisms, monitoring requirements, training/capacity building needs, and budgetary provisions in contracts. This shall comply with all National / State regulations, local bylaws and guidance, and the World Bank Operational Policies and Safeguards requirements.

- Review the investment proposals (sub-projects) and ensure that environmental issues are properly addressed by the development of a project-specific environmental analysis including (but not limited to) land use, natural habitats, pest management, physical/cultural resources, forests, the safety of dams, public consultations, and occupational health and safety
- Oversee the preparation of Environmental Impact Assessment (EIA) with Environmental Management Plans (EMPs), Monitoring Plan and Training needs and inclusion of Environmental Management Plan and budget requirements in Contract documents to facilitate the implementation of mitigation measures.
- Provide expert guidance to the beneficiaries in the preparation and successful implementation of the project environmental assessment instruments/documentation, including preparation of environmental impact/risk assessments and environmental management plans
- Provide expert advice to the PMU team with regards to strategies and approaches to effectively and efficiently comply with relevant World Bank environmental safeguard operational policies and requirements
- Coordinate and share information with World Bank project staff and consultants providing environmental safeguard cross-support
- Carry out site supervision visits during the implementation of sub-projects and other activities related to the Project
- Ensure that safeguards documents are prepared on time and disclosed well in time before the start of works and that all required clearances/permits/licenses are obtained for projects. This shall comply with all National / State regulations, local bylaws/ guidance, and World Bank Safeguards requirements
- Conduct/co-ordinate Stakeholder consultations and consensus-building as outlined by the EMF and required by National / State regulations and World Bank guidelines
- Manage the environmental consulting firm engaged for specific projects.
- Ensure the contractor has environmental experts in their team, prepare and follow Contractors Environmental Management Plans (C-EMP); as outlined in EMF and maintain required permits/licenses/incident and grievance registers
- Monitor the fulfillment of the project-specific environmental requirements and environmental safeguards policies with respect to all project activities, in all direct and indirect contracts; ensure proper reporting by monitoring agencies at various levels (district/site), and maintain database and follow-up
- Assist and advise local bodies from time to time in monitoring and managing contractors' activities that may have environmental impacts, if any. Conduct random audits for EMF compliance during various project stages
- Develop, undertake and support training programs on Environmental monitoring and management arrangements developed in the Project
- Report the status and progress of institutional arrangements and functioning of environmental arrangement along with any impacts that should be addressed. These should be reflected in the Project Progress Report to be submitted to the Deputy Project Director / Project Director
- Ensure that environmental assessment is an integral part of the planning of all project supported schemes

- Ensure development/procurement and availability of IEC materials supporting the environmental management framework to selected LSGs, relevant functionaries, and community institution partners
- Ensure including the necessary activities related to the environmental safeguards, such as training, studies, etc. in the project procurement plan if relevant;
- Assist PMU in operationalizing the methods, procedures, and systems for introduction of environment compliance practices into the existing systems of the LSGs
- Ensure that all legal and regulatory provisions relevant to the environmental safeguards are satisfactorily met through the project processes.
- Ensure that environmental assessment is an integral part of the planning of all project supported schemes
- Facilitate the creation and documentation of experiences, lessons learned, case studies, success stories, etc.

Reporting Requirements

The Environment Expert will report to the Deputy Project Director / Project Director KSWMP. He / She will effectively:

- Maintain full documentation of safeguards requirements and status of the same; for projects under different stages of planning and implementation,
- Coordinate the preparation and updation of Safeguards Information Management System
- Submit the report on random audits on EMF Compliance during various project stages to the Deputy Project Director / Project Director of the PMU,
- Prepare and submit monthly progress report containing the list of activities planned for the reporting period, progress towards the target and the result of targeted activities shall be furnished to DPD/PD,
- Carry out any other tasks assigned by the Deputy Project Director / Project Director from time to time.

Duration of Project

5 years

Qualification

Master's Degree in Environmental Engineering / Environmental Planning with a Bachelor's Degree in Civil Engineering preferred.

Civil Engineers with experience in developing infrastructure for Solid Waste Management, and / or those with qualifications in Environmental Planning / Environmental Studies/ Environmental Sciences may be considered on a case to case basic; based on experience and supporting qualifications.

Experience

- The environmental specialist must have at least 10 years of working experience of which 5 years in the field of environmental activities as a consultant or working in an institution that deals with environmental concerns; preferably in waste management.
- The environmental specialist must be fully conversant with the National / State / Local regulatory requirements on the environment, technical guidelines and

infrastructure provision and aware of the environmental rules and regulations of the World Bank and must have completed, or involved in the preparation of, the environmental impact study of at least two infrastructure projects. The expert must have preferably demonstrated sound technical expertise in international good practices on environmental safeguards.

- Working experience, especially in environment-related activities for World Bank / other Bilateral/Multilateral Development Banks, will be an added advantage.
- Proficiency in computer applications including MS office.
- Excellent written and oral communication skills in English & Malayalam.
- Ability to work efficiently and effectively in a multidisciplinary team. Good interpersonal skills and prior experience in efficient stakeholder consultations and consensus building in Kerala would be an added advantage.

Duty Headquarters

The duty headquarters of the Environment Expert will be at Project Management Unit, Thiruvananthapuram (or in District Project Management Units). The Expert will be required to travel frequently within and outside the State for project purposes.

Duration:

Appointment to the post will be on a contract basis initially for one year and likely to be extended based on the performance. Engagement of Environment Expert will be on a full-time basis.

b) ToR of Environmental Engineer/Expert at PIU/ULB

Introduction

KSWMP aims at enhancing and strengthening the institutional capacity of the urban local government system in Kerala to deliver services and perform governance functions more inclusively and efficiently. The program enables the LBs to catch up with the current urbanization trend in the State by ensuring the urbanized areas and selected urbanizing local governments have proper administrative and service delivery systems and procedures in place to function effectively. The project would be coordinated by a State Project Management Unit (PMU), and District PMUs. The PMUs will have a full-time environmental expert to oversee, plan and co-ordinate the environmental aspects, and safeguards management during project planning and implementation stages. Also, it is proposed to have Project Implementing Units (PIUs) at each participating ULB. PIU /ULB will have an Environmental Engineer who will coordinate with various stakeholder agencies and citizens and oversee the preparation of safeguard documents and implementation of environmental measures during project implementation and operations.

Geographical Coverage

The Project will cover all ULBs of Kerala. Many of the ULBs in Kerala are located in coastal areas, flood plains, hazard-prone areas, near forests areas, heritage areas, estuaries, rivers, and other eco-sensitive areas; mostly with high water table; (ii) environmental issues associated with waste management sector (including solid waste, biomedical waste, and C&D waste) are significant and none of the ULBs have

effective solutions for this sector; (iii) there are important pollution impacts from unsegregated openly dumped solid waste; triggering the demand for effective environmentally appropriate end-to-end solutions.

Objectives of engaging Environment Engineer at PIU/ULB

Roles and Responsibilities

- Co-ordinate the environmental aspects of the SWM Plan preparation and subproject implementation at local / site level
- Screening (Stage 1 & 2) and categorization of projects based on field visits and discussions. For this; they shall co-ordinate and get guidance from the specialists in PMU. Integrate findings of the screening and assessments (where applicable) in the sub-project selection and/or design process.
- Coordinate with consultants and contractors on the preparation of Environmental Impact Assessment (EIA) with Environmental Management Plans (EMPs), Monitoring Plan and inclusion of Environmental Management Plan and budget requirements in Contract documents to facilitate the implementation of mitigation measures.
- Support and co-ordinate for Government approvals and statutory clearances to ensure adoption of Environmental and Social safeguards, submit the relevant documents/ reports for the adopting and compliance of the ESMF, as required.
- Assist in securing of “Enter Upon Permissions and Land alienation" for other Government lands and processing the private land acquisition proposals with District Administration. Verify and certify the sites are free of encumbrances[10] and all required permissions are received before handing over the site to the contactors for construction; in coordination with social expert/support organisation.
- Provide expert advice to the PIU/ULB team with regards to mitigation measures to effectively and efficiently comply with National / State laws and relevant World Bank environmental safeguard operational policies and requirements
- Carry out site supervision visits during the preparation and implementation of sub-projects and other activities related to the Project;
- Work with consultants / contractors to ensure that safeguards documents are prepared on time and disclosed well in time before the start of works and that all required clearances/permits/licenses are obtained for projects. This shall comply with all National / State regulations, local bylaws/ guidance, and World Bank Safeguards requirements.
- Lead/conduct/co-ordinate Stakeholder consultations and consensus-building as outlined by the EMF and required by National / State regulations and World Bank guidelines
- Manage the environmental consulting firm engaged for specific projects at the local level
- Oversee the contractors team, and ensure that they have environmental experts in their team, prepare and follow Contractors Environmental Management Plans (C-

[10] Encumbrance free land in India is legally recognized as land not having any formal or informal claims.It is considered Encumbrance free when all utilities (if any) are shifted before handing over to the contractor.

EMP); as outlined in EMF and maintain required permits/licenses/incident and grievance registers

- Monitor the fulfillment of the project-specific environmental requirements and environmental safeguards policies for all project activities, in all direct and indirect contracts; ensure proper reporting by monitoring agencies at various levels (district/site), and maintain database and follow-up
- Assist the local body from time to time in monitoring and managing contractors' activities that may have environmental impacts, if any. Conduct random audits for EMF compliance during various project stages
- Ensure during the day-to-day functioning that the ESMF, and ESMPs are implemented by contractors/others concerned properly in their respective sub-projects
- Report the status and progress of environmental mitigation measures as required & follow up with contractors for the submission of monthly reports
- Ensure that environmental assessment is an integral part of the planning of all project supported schemes and co-ordinate with PIU/ULB procurement team to ensure that bid documents include ESMPs cleared at respective levels as per ESMF or report on non-inclusion of this to DPMU
- Guide PMUs on type of IEC materials and consultation requirements supporting the environmental management framework appropriate for the site and neighbors
- Assist PMU in operationalizing the methods, procedures, and systems for introduction of environment compliance practices into the existing systems of the LSGs
- Ensure that all legal and regulatory provisions relevant to the environmental safeguards are satisfactorily met through the project processes
- Facilitate the creation and documentation of experiences, lessons learned, case studies, success stories, etc.
- Providing safeguard inputs/onsite compliance of safeguards into the MIS
- Take required actions on-site, including the application of contractual remedies, on contractors when needed
- Provide required update/data/information/ monthly reports to the PMU on ESMF implementation.

Reporting Requirements

The Environment Engineer will report to the Project Head of the PIU.

Duration of Project

5 years (and continues during Operations)

Qualification & Experience

Master's or bachelor's degree in Civil / Environmental Engineering; with a minimum of 8 years of working experience.

Preference will be for those with - experience in waste management / municipal projects, expertise in managing on-site works and contractors, good written and oral communication skills in English & Malayalam, and ability to work efficiently and effectively in a multidisciplinary team. Good interpersonal skills and prior experience in

efficient stakeholder consultations and consensus building in Kerala would be an added advantage.

Duty Headquarters

The duty headquarters of the Environment Engineer will be at respective PIU / ULB.

G. ToR for Environmental Audit

- **Objectives**
  - To audit the conformity of environmental categorization of projects with respect to the categorization prescribed in the EMF.
  - To audit the compliance of the environmental aspects of approved projects, which are under implementation and its adherence with the EMP; and,
  - Review and comment on how the recommendations of the previous audit have followed so far.
- **Outline of the tasks to be carried out:**

  The selected Consultant will essentially provide services to SPMU as required, for the following tasks.

  a. Audit the Environmental Categorisation of Projects:

  The consultants will audit the conformity of the environmental categorization of projects based on the EMF. The consultants will also review the adequacy of screening procedures to identify the possible issues; considerations of incorporating the environmental issues identified during the screening process into the engineering designs and action plans.

  This audit will cover all the E1 category projects and 25 percent of the E2 projects (or E2 projects of special importance).

  b. Auditing the compliance of the Projects:

  The consultants shall

  - Cover the compliance aspects regarding the agreed process at different stages of project development as well as the technical content of the EAs/EMPs. Such an exercise shall include the effectiveness of translating the EMPs into contract conditions and technical specifications.
  - Critically review and report the compliance on Bank's recommendations during various supervision missions;
  - Undertake field visits to ascertain actual level of compliance in implementing the EMPs;
  - Audit and confirm that the payment of compensation and assistance has been paid following EMF procedures wherever payment of compensation and assistance is involved for the projects affected people,
  - Undertake field visits to interact with the beneficiaries on a sample basis to assess their levels of satisfaction with the process followed in delivering the entitlements;
  - Review the process followed for redressing the grievances filed by the affected people.
  - Review and confirm that the disclosure of documents has been carried out following the established procedures; and,

- Review the internal monitoring followed by SPMUs / DPMUs in managing the environmental impacts during the implementation of the sub-projects and suggest suitable measures for improving the process as needed.
- The consultant will audit the compliance of environmental aspects during construction, operation, and maintenance of projects approved under KSWMP, across all categories and different sub-project locations. The selection of the sub-project shall be approved by SPMU before the commencement of the Audit. The audit will be carried out in the presence of the representatives of DPMUs/ Implementing Agencies.

c. Adequacy of the EMP

The consultant will audit the adequacy of the EMP and recommend practicable measures to include/improve the management measures and the agency responsible for carrying out the measures wherever found inadequate. The consultant will also document the best practices and possible environmental enhancement measures with respect to the audited projects. Apart from documenting the good practices, we shall discuss the deviations in following the EMF and corrective measures (project level and in overall process).

d. Reporting

The consultant shall review the status report submitted by the PMUs / Implementing Agencies on the implementation of EMP and the process adopted by design consultants in identification and mitigation measures while preparing the DPRs. To report on the adequacy and timely submission of the Quarterly Progress Reports including the process involved in addressing the risk management.

e. Documentation

The consultant shall document the good practices and lessons on Environmental Safeguards implementation and management in the sub-projects.

f. Implementation of Audit Suggestions

During subsequent audits after the initial audit; the consultant would review the status of implementation of audit findings and suggest improvement opportunities and timelines for implementation if delayed. In case of non-compliance, the consultants need to undertake a follow-up visit after giving sufficient time (depending on the type of corrective measures) for the agency responsible to take corrective actions.

g. Preparation of Audit Report

The findings of the review and audit should be summarized in a tabular form to include compliance, noncompliance, best practices, and enhancement measures along with the name of the agency responsible and schedule for each of the above. This matrix should be provided as an attachment to the main report.

Section V: Guidance on Consultations

Public consultation shall be carried out at various stages of the project preparation. As part of the environmental assessment; consultations will be held by appropriate instruments including focus group meetings, stakeholder consultations, etc. Specific consultations will be held around the sites proposed for different facilities to seek the stakeholders (including host communities, various agencies, NGOs, CBOs, and others interested) support for those sites. The outcome of consultations will be incorporated as appropriate in the designs and mitigation plans. As part of such consultations, the draft Mitigation Plans will also be presented and explained to the people on the content and process of the implementation of the plans. For all the projects prepared by other agencies that are proposed to be funded under KSWMP, public consultation shall be carried out with the public and other stakeholders before initiating the bidding process and SPMU will monitor whether such consultations are carried out.

Public consultation for consensus building is typically a four-stage process of:

(1) Awareness generation
(2) Perceptions assessment
(3) Consensus building, and
(4) Agreement finalization

At the first stage of awareness generation, the affected communities are provided information and made aware of the project activities and their likely impacts. The team responsible for the consultation process may suggest at this stage itself some of the options available to address these impacts. Several methods and techniques can be adopted for public consultations. Some of these include:

(1) Public hearings
(2) Public meetings
(3) Informal small group meetings
(4) General public information meetings
(5) Operating field offices
(6) Local planning visits
(7) Information brochures and pamphlets
(8) Field trips and site visits
(9) Public displays
(10) Model demonstration projects
(11) Material for mass media
(12) Response to public inquiries
(13) Press release inviting comments
(14) Workshops
(15) Advisory committees
(16) Task forces
(17) Employment of community residents
(18) Community interest advocates
(19) Ombudsman or representative
(20) Environmental impact statement reviews by the public

The project team responsible for the consultation process has to determine which technique or consultation is most appropriate at a particular stage considering local conditions or the consultation and consensus-building process.

In the second stage, the views and perceptions of the affected communities regarding the project activities, its implications, and also the options to address them are carefully assessed

and documented. Due to the discussions within and outside the communities, unforeseen impacts, and mitigation options emerges. By this time the opinions of the local communities become quite evident. The opinion leaders also become visible and the areas of agreement and disagreement also start emerging. The next step of consensus building is critical and has to be delicately handled. In most projects, it will be found that while most people agree on a majority of the issues, it is the few issues of disagreement that can create maximum problems. Sometimes these few points of disagreement even decide the fate of a project. The team responsible for the consultation process has to very carefully ensure that each of the points of disagreement is resolved most amicably. Sometimes, if a point of disagreement does not have major implications it may be useful to just leave it as unresolved and document it. The unresolved issue may also be left to be addressed at a later date when more information, experience, and understanding is available. Finally, the consensus built has to be translated into commitments and allocation of responsibilities. These commitments may be recorded in any form of agreement that the concerned stakeholders are comfortable with.

PUBLIC CONSULTATION

Purpose	• To discuss and seek opinion/suggestion from the public/ stakeholders / their representatives • To avoid future problems and ensure smooth implementation of the project
Projects	• All projects involving site requirements (pumping stations, lift stations, STPs, etc), and resettlement.
Responsibility	• To be jointly conducted by SPMU and PIU
Timeline	• For Sites – before finalizing the site/ before bidding. • For resettlement - before the preparation of Resettlement Action Plans
Methodology	
Intimation to public	• Notice (to be published in any National/ vernacular newspaper) • Notice at the Municipal office • Display boards (at important junctions) • Pamphlets (hand distribution)
Information for intimation	• Sub- Project scheme and area of extent • date and venue of the meeting, • last date for receiving objections/suggestions. • Contact person and Venue where project information material will be available
Participants	• General Public, Project affected Persons (PAPs), Stakeholders, Local leaders, NGOs, etc
Materials to be distributed/ circulated:	• A non-technical executive summary may be prepared to contain the following: • Brief description of project activities and components involved • Sub-project benefits, area, and extent of project activities • Expected impacts from the sub-project/ component • Proposed management measures
Post public consultation action:	• Review of suggestions and opinions from the public • Suitable incorporation either in the design or in the management measures. • Recording the meeting and the proceedings and forward to the O/o SPMU in the format provided.

H. Format for Documenting Public Consultation

Consultation Stage:

Name of the town :

Project :

Date :

Venue :

Advertisement published in Newspapers :

National :

Vernacular :

Date of Advertisement :

Composition of the Stakeholder Consultation Panel:

Number of Stakeholders / Participants :

Discussion during the public hearing :

Sl.No	***Issues raised***	***Response of the borrower to the issues***	***Comments***
1)			
2)			
3)			
4)			
5)			

Action taken based on the opinion received during public consultations:

Signature of the Borrower

Enclosures.

1. Scanned copy of the newspaper clippings, photos of the meeting, attendance (with Contact numbers, signature of attendees)

Section VI: Indicative Environmental Management Plans and Monitoring Plans

I. Common Permits Required for Works as per Environmental Legislation

Guidance on permits and clearances required for various works are presented here. PIU is advised to update the clearance/permit requirements and standards applicable to the project area/activity at the start of the subproject preparation.

Sl. No	*Law / Regulation / Guidelines*	*Applicability (Yes/No)*	*Relevance*	*Implementing / Responsible Agency*
1.	The EIA Notification, 2006 & subsequent amendments	Applicable to Common Solid Waste Management Facilities	Environmental Clearance to be secured before initiation of any work on the project site (Category B; but may become Category A if General Conditions are met)	SEIAA/MoEFCC
2.	The Water (Prevention and Control of Pollution) Act, 1974	Yes	Consent to Establish and Consent to Operate to be obtained during the construction phase and operation of waste recycling/disposal facilities	State Pollution Control Board
3.	The Air (Prevention and Control of Pollution) Act. 1981	Yes	Consent to Establish and Consent to Operate to be obtained during the construction phase and operation of waste recycling/disposal facilities	State Pollution Control Board
4.	Forest (Conservation) Act, 1980	Yet to identify at subproject level	Forest Clearance will be required if diversion of forest land is involved in the subproject	State Forest Department, MoEFCC
5.	Coastal Regulatory Zone Notification, 2019	Yet to identify at subproject level	CRZ clearance will be required If the subproject area is located within the designated coastal regulatory zone	MoEFCC/ KCZMA
6.	Wild Life Protection Act, 1972	Yet to identify at subproject level	Wildlife Clearance will be required if the subproject site is located within or close to the protected area	National / State Board of Wildlife
7.	Tree felling permission	Yet to identify at subproject level	If felling of trees as defined in Kerala Preservation of Trees Act, 1986 is involved	Forest Dept. GoK
8.	Ancient Monuments and Archaeological Sites & Remains Act 1958	Yet to identify at subproject level	Permission is required if any archaeological site in the vicinity of subproject site	Archaeological Survey of India, State Dept. of Archaeology
9.	The Motor Vehicle Act. 1988	Yes	All vehicles used for construction and operation will need to comply with the provisions of this act and should have valid Pollution Under Control Certificate (PUC).	State Motor Vehicles Department

Sl. No	Law / Regulation / Guidelines	Applicability (Yes/No)	Relevance	Implementing / Responsible Agency
10.	Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016	Yes	Hazardous waste (used oil from DG Sets) is likely to be generated during the construction and operation stage. Hence, authorization under the purview of the rule shall be requiring.	State Pollution Control Board

Sl.No:	NoC Requirement	Process
1	NOC for National Highway (NH)	PIU/PMU to take permission for NH cutting; through application/letter to NH Division, Executive Engineer
2	NOC from Road / Public Works Department	PIU/PMU to take permission for road cutting; through application to Division, or Executive Engineer
3	NOC for Water Source	Application to Water Resource Department/Water Authority, Ground Water Board, or Irrigation Department (as applicable) of the corresponding State depending on the jurisdiction.
4	NOC for Railway division	PMU to take NoC for crossing Railway lines for any utilities if required; by applying for Divisional Railway Manager
5	NOC for Electricity Division	Application to Executive engineer, Electricity supply division/ Electricity Board in case of shifting of power utilities, or near transformers, etc.
6	NOC for Forest land/ Tree Cutting	Application to concerned Divisional Forest Officer
7	Construction of Road (Road Subproject, haul/service roads)	PWD (R&B), NH or ULB regarding the construction of road
8	Shifting of Water Supply Pipeline	Application to Drinking Water &Sanitation Department or Water Authority, Water Resources Department as the case may be
9	Shifting of BSNL tower (telecommunications)	Application to General Manager, BSNL
10	NOC for groundwater abstraction	Obtain a permit from Regional Director of CGWA (Groundwater Authority) http://cgwanoc.gov.in/LandingPage/GuidelinesonlineFilling/steps_for_online_filling_of_application-19012015.pdf
11	Use of Diesel Generator sets at any stage during the project cycle.	Contractor to take consent from SPCB under Air Act
12	Using Forest Land	Contractor to take necessary approvals from the State Forest Department in case of land appropriation of forest land

Sl.No:	NoC Requirement	Process
13	Permission for temporary traffic diversions, hindrances	PMU / PIU to take Permission from Traffic Police Commissioner office for traffic management
15	PUC for Vehicle	Obtain Pollution under Control certificate from the motor vehicle department of respective State through its authorized agents, for all construction machinery and vehicles.
16	Tree Cutting Permission	SPMU/Line Department to get permission from the State Forest Department under the Forest Conservation Act, 1980
17	Plants such as Crushers and/or Batching plant	Concerned Contractor to ensure that crushers / batching plants used for construction purposes under this project have a permit from SPCB
18	Storage, handling and transport of hazardous material/s, equipment and storage yards	Concerned Contractor to ensure that requisite permit is sourced from SPCB under Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989
19	Location/ layout of workers camp	Concerned Contractor to get approval from SPCB under Environment Protection Act, 1986 and layout to be approved by site engineer before start of camp construction
20	Discharges from Labour Camp	Concerned Contractor to get approval from SPCB under Water (Prevention and Control of Pollution) Act, 1974

J. Indicative Environmental Management Plans (EMPs) and Monitoring Plans

Indicative EMPs and Monitoring Plans for various types of subprojects expected under KSWMP are provided here. These shall be either directly used for E3 Projects – which contractor can update based on site condition and guide the preparation of site-specific EMPs for E1 and E2 during EIA preparation. These are provided as stand-alone EMPs so that the PIUs do not miss key aspects and can directly use these and adapt to site and project details. (It is difficult to provide single ESMP including all types of subprojects. Hence, separate ESMP for each project type is provided so that the subprojects can use it after updating it based on site conditions. Use of indicative (generic) or site-specific ESMP in Contract doc will be decided on a case to case basis at subproject level; based on risk levels/mode/type of contracting / bidding). These are based on existing regulations and international best practices. These are also supported by detailed mitigation measures presented in ECoPs in Section 09. In case there is a conflict with the standards here and that in applicable regulations, the more stringent shall be followed. In addition to these mitigation measures, site-specific EMPs shall also include environment enhancement measures such as (but not limited to) reducing the non-permeable area by proper design, rainwater recharge, harvesting and reuse, tertiary treatment of leachate using DEWATS and reusing it for the green belt, washing, etc. Considering the possible pest related issues, as the project deals with wastes and improvements to dump sites, OP 4.09 Pest Management is triggered. In addition to the Stage 1: Exclusion Criterion on projects which deals with the use of Banned Pesticides, EMP also include guidance to manage pests/rodents, flies.

In addition to these EMPs, Physical Cultural Resources Management framework and Natural Habitat Management Framework also have been included in Section 08 and 09 respectively of this report to guide the preparation of relevant plans if such aspects are encountered in the project.

K. Indicative EMP for Collection and Transportation of Solid Waste

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for Primary and Secondary Storage, Collection, Transport of Waste***			
1	Pollution and health and safety risks due to mixed/unsegregated waste *(Air, Water, Land Pollution, impacts on flora/fauna/humans and visual blight)*	▪ Plan for suitable sizes, materials, type and placement of storage bins, Collection schedule and mechanism for all areas, Eco-sensitive areas, special conditions like events, disasters, festivals and tourism at each category of premises / each locality so that activities do not result in pollution ▪ Closed type containers for wet waste; distinctive bins for wet & dry waste should be used for storage and collection of waste. ▪ In areas prone to flooding, suitable high plinths/platform shall be arranged for keeping bins	PIU	DPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ As per SWM Rules, 2016, there should be three bins at each point/location for the storage of wet (covered), dry and domestic hazardous waste. Domestic Biomedical Waste to be collected or disposed-off as per guidance from the State or agreed with ULB		
2	Lack of awareness to communities on proper waste storage, collection, transportation *(Socio-economic)*	▪ Arrange awareness generation attempts for communities through Ward Sabhas, Pamphlets, media/ other means ▪ Include CBOs / NGOs, institutions (schools, other agencies) for awareness generation	PIU	DPMU
	Lack of inclusion of socio-economically well-deserved a section of the population *(Socio-economic)*	▪ Special awareness camps for housing areas of well-deserved sections of the population on storage of wastes	PIU	DPMU
B	**Implementation Stage and Operation/ Maintenance Stages**			
1	***Storage of Wastes***			
1	Pollution and health and safety risks due to overflowing, inappropriate, improperly placed and poorly maintained bins *(Air, Water, Land Pollution, impacts on flora/fauna/humans and visual blight)*	▪ Awareness to communities on usage and maintenance of appropriate bins ▪ Standard Operating Protocols for the collection agency and C&T workers on flagging inappropriate bins/usage ▪ Ensure proper daily collection of wet waste, once a week collection of dry wastes and hazardous wastes, drop off centers for e-waste, bulk dry recyclable wastes ▪ Support by making available suitable receptacles (closed bins of required size) for deserving communities ▪ Instructions to provide bins (preferably in such a way as to prevent visual blight) in high platforms above flood level and to secure them to prevent bins getting washed away during floods, rains ▪ Spot checks on placement, use, cleanliness of bins to avoid water accumulation during non-use periods ▪ Arrange Grievance mechanisms	PIU, PCB	DPMU
2	• Operational difficulties and use of more resources for segregation after collection *(Socio-economic)* • The low value for recyclables due to mixing up with wet waste and difficulties for ragpickers to collect recyclable fraction *(Socio-economic)* • Odor and leachate from putrescible material affecting the entire waste *(Air and Soil) and* • Visual blight *(Socio-economic)*	▪ Enforce waste segregation through awareness drives, media campaigns, other measures ▪ Provide three bins in collection cart: for Wet waste, dry waste, and unsegregated wastes or schedule collection timings separately ▪ Arrange mechanical segregation of wastes at the treatment point in case the treatment mechanism requires segregated waste ▪ Sensitize communities to reduce reuse and recycle wastes	PIU, PCB	DPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
3	• Multiple handling of waste after collection resulting in health impacts for community and workers *(Health and safety)* • Impacts on Health and safety of Workers due to sharps like glass, needles, broken tools, etc *(Health and safety)*	▪ Avoid secondary storage of wet waste. It shall be directly transported to a treatment facility. Else closed containers of dry waste shall be offloaded at designated areas from where it can be directly lifted by suitable vehicles (without tipping on land) and transferred to the treatment facility. ▪ No waste shall be allowed on the ground during collection, transfer; No double handling of wastes ▪ Dry waste may be stored in approved MCFs / RRFs as per SWM plan ▪ Awareness of Health impacts on workers ▪ Health insurance coverage for workers ▪ Enforce the use of Personal Protective Equipment by Ragpickers/workers/others engaged in collection and transportation	PIU, PCB	DPMU
4	Waste accumulation at premises due to Hartals, operating agency-related issues, disasters, emergencies *(Air, Water, Land pollution; Odour, Fly nuisances creating health impacts, visual blight)*	▪ Provide facilities to store wastes for a week in case of emergencies ▪ Prepare alternate Disaster Waste Management Plan (DWMP) for each town and make provisions to implement in case of urgency	PIU	DPMU
2	***Collection and Transportation activities***			
1	Waste leakage from collection system resulting in open burning, dumping *(Air, water, land, Fauna/Flora, Health impacts)*	▪ Ensure proper record keeping of waste collected and transported ▪ Weighbridge level record keeping and monitoring at the tipping point	PIU	DPMU
2	Impacts due to vehicle movement (*Health and safety of workers, communities)*	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely processing & disposal of waste shall be carried out by vehicles and should transfer waste only in the specified Secondary Collection Point or	PIU	DPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		secondary collection vehicle or treatment disposal yards planned. No waste shall be disposed of in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas.		
3	Accidents and breakdown of collection and vehicles *(Air, water, land, Fauna/Flora, Health impacts)*	▪ Include mechanisms/protocols for Waste transfer and transport in case of accidents/emergencies in DWMP for the town, including direct transfer (without double handling; no waste on the ground), use of PPEs by personnel, cleaning protocols, etc. ▪ Drivers shall have a valid driving license, and shall be well trained on defensive driving ▪ All vehicles to carry First Aid kit and driver to be trained for the same ▪ Vehicles shall carry information to contact authorities in case of any mishaps / fast driving, transport of wastes without cover, etc. ▪ Fit vehicles with highly audible reversing alarms and mirrors and check at least daily and maintained in good working order. ▪ Allow only authorized and competent workers to operate the vehicles; ▪ Plan collection routes to avoid times of high-pedestrian activities	PIU	DPMU
4	Inaccessibility of collection and transport vehicles to some waste storage areas / during certain occasions or emergencies causing its accumulation and pollution *(Air, water, land, Fauna/Flora, Health impacts)*	▪ Arrange proper vehicles based on road widths, appropriateness, slopes, eco-sensitivity at each location (such as hand carts for narrow roads, auto three-wheelers for most areas accessible; direct collection by picking (using appropriate tools) wastes on beaches, dunes, etc without disturbance of dunes/flora, fauna)	PIU with PCB	DPMU
5	Information to property owners/occupiers on collection schedule to prevent waste accumulation in premises *(Air, water, land, Fauna/Flora, Health impacts)* Idling of collection vehicles in front of houses/collection areas result in emissions *(Air emissions: CO, CH4)*	▪ Households shall be informed about the collection schedule: kerbside collection (whistling/bells), Door to Door collection, drop off facilities, etc. ▪ Households shall be instructed to make the waste available at the right time without delay ▪ Collection vehicles shall be well maintained with PUC certifications and periodic checks	PIU, PCB	DPMU
6	Poor cleaning and maintenance of vehicles and bins *(Odour and fly menace; Air impacts: PM2.5, PM10, SO2, NOx, & CO)*	▪ All vehicles/containers used for collection, transportation of wet wastes shall be cleaned every day while those used for collection, transportation of dry wastes shall be cleaned every next day (for containers used in same collection/transport vehicle as wet waste; cleaning shall be carried out every day) ▪ There shall be proper maintenance and cleaning workshop/yard for collection and transport vehicles (and bins) with cut off drains and mechanism (package unit) to treat wastewater; greenbelt of 3-6m around with layered canopy trees ▪ All vehicles used for C&T shall be checked for pollution norms (PUC) and only those within approved norms shall be used	PIU, PCB	DPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ No leakage of leachate is allowed from any waste carrying vehicles. All vehicles shall have a leachate collection tank or other arrangements, irrespective of its type and carrying capacity. ▪ Leachate shall be treated at leachate treatment plant at the treatment or disposal yard ▪ Regular cleaning and approved pest control measures to be adopted: Biopesticides / biological control shall be adopted. Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used		
7	Collection and Transportation of wastes in overloaded and open vehicles *(Air, Odour nuisances; spills and littering impacts on Air, Water, Land)*	▪ All C&T vehicles shall carry only approved a load of weight as per SOP ▪ Regular cleaning of roads & drains and removal of collected waste. ▪ All Collection / Transport vehicles shall be covered. ▪ Ensure provisions of SWM Rules 2016 for all collection Transportation activities	PIU, PCB	DPMU
8	Plying of vehicles through kutcha / unsurfaced roads and idling *(Air pollution: SPM, CO, CO2)*	▪ Vehicle movement shall be well planned – through topped roads. ▪ In case of necessity to move through Kutcha roads, ensure sprinkling of water to suppress dust before and after the movement of the vehicle	PIU, PCB	DPMU
9	Impacts of operation and maintenance *(Community and Worker Health and Safety)*	▪ Hazard Identification & Risk Assessment analysis shall be prepared for all activities of C&T related activities and mitigation measures shall be implemented for all significant risks identified. ▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented ▪ The manager shall listen and act to the manpower related grievances. ▪ Workers shall be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Proper training shall be provided regarding the maintenance of Health ▪ First aid facility shall be available at an accessible place ▪ Tie-up with the local hospital shall be done to provide an ambulance to handle emergency cases if required ▪ Routine inspections, housekeeping, and maintenance shall be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Provide non-slippery work areas	PIU; Labor Commissioner	DPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		Workers involved in all aspects of C&T shall be provided with proper rest areas, with water, First Aid facilities within quick reach ▪ Appropriate fire and safety standards/facilities/equipment / mock drills and familiarization shall be ensured for all stages of storage, collection, and transportation ▪ DG sets if used for C&T/maintenance etc; shall have valid consents from pollution control authorities and shall have in-built arrangements to reduce air emissions ▪ Proper handing over procedure shall be prepared and used so that all concerns are taken when the operator changes during/.after operations period ▪ A set of workers (Municipal / private / HKS) shall be kept ready for emergencies/contingencies. ▪ Measures such as deferred timings and stretch break to be adopted ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent		

Environmental Monitoring Plan for Collection and Transportation of Solid Waste

- Verification and spot checks once every 6 months of (a) primary storage at Sample towns (repeat for a different set of towns) (a) vehicles used, if they are closed vehicles and not overloaded (b) Spillage of waste, Health, and pollution due to overflowing, inappropriate, improperly placed and poorly maintained bins; including water, soil tests at large storage areas (institutional, event, commercial)
- Record keeping and Spot checks of the PCU certificates of the vehicles used for transportation
- Spot checks for inspecting the vehicles including brakes, mirrors, lights, windscreen, windscreen wipers, washers, indicators, horn, rear horn, exhaust, tyres and seat belt
- Grievance register – on rash driving, vehicle movement in overloaded condition or without cover, spillage from vehicles, etc.
- Water Quality Tests
    - Drinking-Water parameters IS 10500 (2012): for Ground Water wells near (100m) of the Maintenance yard / Workshop – Once Pre and Post monsoon (max four nearby wells)
    - Physicochemical parameters including heavy metal (Cd, Cr, Cu, Fe, Ni, Pb, and Zn) and microbiological parameters in groundwater (100 to 200 m) and leachate samples four samples twice a year – pre and post-monsoon near Maintenance yard

L. Indicative EMP and Monitoring Plan for Composting [11] of Biodegradable waste

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for treatment of the biodegradable waste***			
1	Absence / Delay in Permissions for Developing the facility and associated works as per National regulations	▪ Required permissions for Land, setting up the facility and assessments conducted for facility development as per existing Laws, Regulations; including for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labor Laws, before the start of works on site	Contractor	PIU
2	Requirements for Preliminary water Assessments	▪ A comprehensive hydrological investigation of both the site and the surrounding surface water and groundwater regime needs to be conducted before site establishment. The investigation should identify the groundwater flow pathways for all aquifers on-site, assess the vulnerability of the groundwater underneath and adjacent to the facility, and establish whether systems to prevent groundwater pollution need to be set up. ▪ A water pollution remediation plan should be developed if pollution of groundwater, surface water, or the subsoil is confirmed in the preliminary water assessment of the site or is identified by external monitoring.	DPR consultants	PIU
2	Dust impacts due to Site Preparation and heavy construction *(Air Pollution and Visual Blight)*	▪ Plan to Provide temporary high screen around the site before the start of work to curtail dust emissions	Contractor	PIU
3	Material sourcing, transport, and stacking of construction materials *(Occupational Health and Safety issues and Air noise pollution)*	▪ Prior intimation to neighbors on proposed construction activities, timings, emergency contacts, grievance mechanism ▪ Prior intimation to nearby Primary Health Centre on work activities need for medical support, emergency support needs, type of laborers on-site and labor camp if any ▪ Materials shall be sourced only from approved quarries ▪ Material shall be transported only in closed trucks with PUC certificates, with water sprinkling if required to curtail dust emissions. ▪ The driver should be with the required license and follow speed regulations ▪ Materials shall be transported preferably through well-surfaced roads. If road it kuchcha, water sprinkling shall be done to prevent dust emission before and after truck passes ▪ Material transport and unloading activities should not result in noise disturbance to locals and should be during day time	Contractor	PIU

[11] *Not Windrow Composting or Pit Composting. In KSWMP only Aerated static pipes or Bin composting are suggested*

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Materials shall not be spread around on site. It shall be properly stored/stacked following good housekeeping practices (labeling, properly arranged); in covered sheds to prevent loss of strength and loss of material. Material storage shall not result in any harm to workers or visitors. ▪ Provide vehicle wheel wash area on site ▪ Workers to be provided with Personnel Protection Equipment (PPE) including safety boots, jackets, ear muffs, gloves. ▪ Proper rest area on site shall be provided with water, first aid, toilets		
4	The layout of Labour camp *(Impacts on Sir, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters) ▪ It should not be provided on-site if it is an existing Waste or Sewage Treatment facility or an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and livable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, and waste collection/management systems, etc ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security	Contractor	Site engineer of PIU, Labour Commissioner, PCB
5	Loss of tree cover *(Impacts on Fauna, Flora)*	▪ Clearing and grubbing to be done only on the required surface & just before the start of activity on that section. In the case of the time gap, water should be sprinkled regularly until the start of the next activity. ▪ Avoid tree felling as much as possible. Follow national regulation / applicable procedures for the replanting of trees. Tree felling permission shall be obtained from the forest department / local body under applicable Acts. ▪ Compensatory plantation shall be planned to be undertaken at prescribed rates (preferably 10 times of the number of trees cut) ▪ Plan to use native species in consultation with the communities, Forest Department, Local Bodies	PIU	SPMU
6	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc especially in case of laying any support facilities	▪ Ensure site selection based on the screening checklist and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimise, Mitigate, Reduce. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board, SCZMA ▪ Identify appropriate government site to avoid land acquisition and resettlement impacts	PIU	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	(Impact on Flora, Fauna)			
7	Nuisance hazards to neighboring areas *(Impacts on Community)*	▪ Ensure proper design and adequate compound wall; high screen during construction, buffer zones and thick green belt to comply with SWM Rules, 2016 and other PCB requirements	Contractor	PIU
8	Flooding of the site during excessive rainfall *(Disaster Prevention)*	▪ Ensure that the facility is constructed above the HFL levels ▪ Plan to provide cut off drain around the facility and proper stormwater management (including reuse, recharge) for the area nearby to prevent flooding of nearby properties	Contractor	PIU
B	**Construction / Implementation stage**			
Site Development				
1	Site Access closure *(Community health and safety)*	▪ All public access to the site via adequate fencing and signage which prohibit public access completely, to avoid risk to the public. ▪ The site entrance will include adequate signage indicating the details of the proposed subproject, implementing agencies, etc as well as safety signage to keep public away. ▪ A fence shall be erected to cover the entire perimeter of the facility using cost-effective fence materials consisting of chain link fence fabric, concrete post, etc. as specified in the Technical Specifications to ensure, animals and the public are unable to access the site. ▪ To avoid land disturbance and movement, the fence shall generally follow the contour of the ground. ▪ Grading shall be performed where necessary to provide a neat appearance	Contractor	PIU
2	Vegetation clearance for site development *(Impact on flora, fauna)*	▪ Clearing and grubbing should be avoided beyond that which is directly required for construction activities. ▪ The next activity to be planned/started immediately, to avoid dust generation and soil erosion during monsoon. ▪ Turfing/ re-vegetation to be started soon after completion of embankment	Contractor	PIU
3	Soil Erosion from site leveling due to the loose earth being left out from construction before the onset of monsoon *(Impact on the air environment and noise environment)*	▪ Plan the activities so that no bare/loose earth surface is left out before the onset of monsoon. For minimizing soil erosion, the following preventive measures are to be taken: ▪ Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of sub-base layer, scarification, etc. ▪ Topsoil from borrow area, debris disposal sites, construction site to be protected /covered for soil erosion. ▪ Debris due to excavation for foundations, dismantling of existing cross drainage structure shall be removed from the watercourse immediately.	Contractor	PIU
4	Alteration of drainage during site development	▪ Diversions should be constructed during the dry season, with adequate drainage facility, and will be completely removed before the onset of monsoon. ▪ Debris generated due to the excavation of foundation or due to the dismantling of the existing structure should be removed from the watercourse. Debris should be reused or disposed of	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	(impact on the water environment)	properly in the designated area as suggested by the local authority. Garland drains shall be provided around the debris to prevent erosion ▪ Silt fencing has to be provided on the mouth of discharge into natural streams. ▪ Continuous drain (lined/unlined) is provided obstruction if any, to be removed immediately.		
5	Runoff and drainage *(Water environment)*	▪ The only minimal site works during monsoon ▪ Throughout monsoon uninterrupted continuous drain to be functional. ▪ Lined drain to be provided at build-up locations for quick drainage. ▪ Increased runoff due to increased impervious surface is countered through the increased pervious surface area through soak pits.	Contractor	PIU
Construction of the plant				
1	Impact on the land environment due to the loss of topsoil *(Land environment, flora)*	▪ All areas of cutting and all areas to be permanently covered will be stripped to a depth of 150mm and stored in the stockpile. ▪ Topsoil shall be safeguarded from erosion and will be reused as follows. ▪ Covering all borrow areas after the excavation is over ▪ Development of greenery ▪ Refer ECoP	Contractor	PIU
2	Impact due to the vehicular movement (*Air and noise environment)*	▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient air quality standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided.	Contractor	PIU
3	Impact due to the use of construction equipment *(Air environment and disturbance due to noise)*	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats. ▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites within 150 m of sensitive receptors and settlement areas construction to be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.	Contractor	PIU
4	Impact on the water environment during the construction activities	▪ Construction work close to water bodies should be avoided during monsoon. ▪ Labour camps are to be located away from water bodies. ▪ Car washing/workshops near water bodies are to be avoided.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	(Water environment)			
5	Disposal of Debris and Spoil *(Land, Water)*	▪ All debris and residual spoil material including any left earth shall be disposed only at locations approved by the engineer for such purpose and subjected to the following clauses: ▪ The contractor shall obtain the approval from the relevant Local Authority and other government agencies (as required) for disposal and spoil at the specified location, as directed by the Engineer ▪ Land that will be selected for disposal should also require written consent from the landowner ▪ The debris and spoil shall be disposed-off in such a manner that; o waterways and drainage paths are not blocked o the disposed material should not be washed away by runoff and o should not be a nuisance to the public ▪ All material that is reusable or recyclable shall be used for such purposes either by the contractor or through dealers. ▪ The debris and residual spoil material including any left earth shall be used, to refill the burrow areas as directed by the engineer, subjected to laying of topsoil as per recommendations for conservation and reuse of topsoil provided below. ▪ Excavated earth materials and all debris materials shall be disposed of immediately without allowing to stockpile at identified locations for debris disposal, recommended by the engineer. During transportation, dispose-off materials should be covered with tarpaulin. When stockpiled, it should be covered and with a garland drain. ▪ If approved by the engineer, the contractor can dispose the debris and spoil as a filling material provided that the contractor can ensure that such material is used for legally acceptable purposes and disposed in an environmentally acceptable manner	Contractor	PIU
6	Transport and Storage of construction materials *(Accidents, Nuisance, and Spills, Air pollution)*	▪ The contractor should avoid over-loading of the trucks that transport material to construction sites. ▪ During transportation, materials should be covered with tarpaulin. ▪ Peak hours inroads with moderate to high traffic should be avoided. ▪ The contractor shall minimize possible public nuisance due to dust, traffic congestion, air pollution, etc., due to such haulage; ▪ If local roads are used, routes are to be selected based on the truckload; loads should be divided to prevent damages to local roads and bridges. ▪ Speed limits as nationality stipulated for haulage must be maintained ▪ All vehicles used for haulage should be in good condition. ▪ If there are damages to local roads and other utilities due to hauling inroads caused by the contractor. The contractor shall attend to repair all damaged infrastructure/ roads if needed through relevant authorities	Contractor	PIU
7	Soil erosion during site preparation *(Land, water environment)*	▪ Debris material shall be disposed-off in such a manner that waterways, drainage paths would not get blocked. ▪ Drainage paths associated with the infrastructure should be improved/erected to drain rainwater properly.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Silt traps will be constructed to avoid siltation into waterways where necessary. ▪ To avoid siltation, drainage paths should not be directed to streams, other water bodies, and sea directly and they should be separated from streams / other water bodies/sea ▪ Barricades such as humps will be erected at excavated areas for culverts, silt traps, toe walls, filling and lifting with roper signboards, as some work in these sections will have to be stopped during heavy rains due to heavy erosion. ▪ To prevent soil erosion in these excavated areas, a proper earth drain system should be introduced. ▪ Embankment slopes, slopes of cuts, etc. shall not be unduly exposed to erosive forces. These exposed slopes shall be graded and covered by grass or other suitable materials per the specifications. ▪ All fills backfills and slopes should be compacted immediately to reach the specified degree of compaction and establishment of proper mulch. ▪ Work that leads to heavy erosion shall be avoided during the rainy season. If such activities need to be continued during the rainy season prior approval must be obtained from the Engineer by submitting a proposal on actions that will be undertaken by the contractor to prevent erosion. ▪ The work, permanent or temporary shall consist of measures as per design or as directed by the engineer to control soil erosion, sedimentation, and water pollution to the satisfaction of the engineer. Typical measures include the use of berms, dikes sediment basins, fiber mats, mulches, grasses, slope drains, and other devices. All sedimentation and pollution control works and maintenance		
8	Pollution of Soil and Water via Fuel and Lubricants *(Soil, Water)*	▪ The contractor shall ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance, and refueling site shall be located away from the canal that is adjacent to the site by least 200m away. ▪ The contractor shall ensure that all vehicle/machinery and equipment operation, maintenance, and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not further contaminate the ground. ▪ The contractor shall arrange for collection, storing, and disposal of oily wastes to the pre-identified disposal sites in line with Hazardous Waste Management Rules.	Contractor	PIU
9	Siltation into water bodies *(Water, Land)*	▪ The contractor shall take measures to prevent the siltation of water bodies because of construction work including, construction of temporary/permanent devices to prevent water pollution due to siltation and increase of turbidity. These shall include the measures against erosion highlighted in this EMP ▪ Construction materials containing small/fine particles shall be stored in places not subjected to flooding and in such a manner that these materials will not be washed away by runoff. ▪ Temporary soil dumps should be placed at least 200m away from all water bodies If temporary soil piles are left at the site for a long time those piles should be covered with thick polythene sheets	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ All fills backfills and slopes should be compacted immediately to reach the specified degree of compaction and establishment of proper mulch		
10	Community Safety	▪ At all times the site will restrict the entry of public on to the site. ▪ Safety signboards and signboards prohibiting entrance and risks should be displayed at all necessary locations. ▪ The contractor should obtain Third-party insurance to compensate for any damages, injuries caused to the public or laborers during the construction period. ▪ All construction vehicles should be operated by experienced and trained operators under supervision. ▪ Trenches should be progressively rehabilitated once work is completed. ▪ Material loading and unloading should be done only within the project site. ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.	Contractor	PIU
11	Safety of Workers	▪ Contractor shall comply with the requirements for the safety of the workers as per the ILO Convention No. 62 and Safety & Health Regulations of the Factory ▪ The contractor shall supply all necessary safety measures at the site- including the provision of First Aid Kids, Fire extinguishers. ▪ Signage providing instructions on first aid management, emergency contact, and emergency operating procedures in local languages. ▪ Basic onsite safety training should be conducted for all laborers during the EMP training before the start of the construction activities. ▪ The training to laborers should also include a brief on the risks of working on an open dumpsite. ▪ The contractor should obtain Third-party insurance to compensate for any damages, injuries caused to laborers during the construction period. ▪ Protective footwear and protective goggles should be provided to all workers employed on the mixing of materials like cement, concrete, etc. ▪ Welder's protective eye-shields shall be provided to workers who are engaged in welding works. ▪ Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing compaction, or concrete mixing operation. ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
C		**Operation& Maintenance Phase**		
1	Management of Incoming feedstock *(Odor, quality, nuisance)*	▪ Incoming feedstocks should only include segregated Municipal Solid Waste, the site will not accept any material categorized as any other form of waste, including medical waste, sludge, and biosolids. ▪ Gross pollutant trap wastes that consist of material such as silt and sediments, and from high-risk locations such as industrial areas, contaminated sites and surrounds or the cleanup of industrial or road accidents should not be permitted into the facility. ▪ Feedstock, oversized materials, screened contaminants and finished compost products should be stored in a separate designated area at the facility to avoid cross-contamination. ▪ Feedstocks should be incorporated into the windrow upon receipt at the compost site, (or if not practicable, within 24 hours of receipt) to avoid the generation of odor (excluding untreated timber, pallets and other feedstocks that are not subject to rapid decomposition). ▪ Stockpiles of feedstock should be managed in a contained manner if not immediately incorporated to the windrow/pile on an impermeable surface, large plastic bins with vents are recommended to prevent the occurrence of fire, and the generation of dust and or odor. ▪ Residual waste and/or incoming feedstocks that are unsuitable for use in the composting process should be categorized following national classification of waste – including industrial and commercial waste and waste soil), before being removed offsite and transported to a suitably licensed facility to receive and/or dispose of that waste. ▪ Feedstocks should be source segregated before receipt at the facility and only contain organic waste	Facility operator	PIU
2	Impacts due to vehicle movement *(Air, water, safety)*	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely processing & disposal of waste shall be carried out by vehicles and should transfer waste only in the specified Secondary Collection Point or secondary collection vehicle or treatment disposal yards planned. No waste shall be disposed-off in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas.	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
3	Transportation of wastes in overloaded and open vehicles *(Air, Odor nuisances; spills and littering impacts on Air, Water, Land)*	▪ All vehicles shall carry only approved a load of weight as per SOP ▪ Regular cleaning of roads & drains and removal of waste. ▪ All Transport vehicles shall be covered. ▪ Ensure provisions of SWM Rules 2016 for all collection Transportation activities	Facility operator	PIU
4	Plying of vehicles through kutcha / unsurfaced roads and idling *(Air pollution: SPM, CO, CO2)*	▪ Vehicle movement shall be well planned – through topped roads. In case of necessity to move through Kutcha roads, ensure sprinkling of water to suppress dust before and after the movement of the vehicle	Facility operator	PIU
5	Air Emissions – VOC's and Odor during composting *(Air environment)*	▪ Putrescible or municipal waste should be incorporated into the composting process the day it is delivered, as soon as possible after it is received. Other feedstocks should be used as quickly as possible. ▪ The amount of feedstock stored on-site should be limited to less than one week of requirements where possible. ▪ Water absorption into the feedstock, which restricts access to air and leads to anaerobic conditions, should be prevented. This can be done by providing protection from rain and appropriate stormwater and groundwater controls and monitoring to ensure waterlogging does not occur. ▪ Very wet or fluid wastes should be contained in vessels fitted with lids. ▪ Odor control equipment may be installed to remove or destroy the odorous components of emissions from the composting process. Such equipment may also be applied to the vents of buildings enclosing operations such as feedstock handling. Suitable control devices include enclosures, bio-filters, wet scrubbers, chemical scrubbers, carbon absorption beds, or afterburners. ▪ For windrow composting: ○ Always ensure windrows are aerated, either by forced aeration of static piles or timely regular turning of windrows to maintain and monitor windrow temperatures to prevent the generation of anaerobic conditions. ○ Ensure windrows are of a manageable size so that surface-to-volume ratios are maximized for passive aeration. ▪ Contaminated water may be high in organic material and become anaerobic, thus it should not be allowed to accumulate on the site except in leachate collection ponds. ▪ Leachate ponds must be aerated to reduce stagnation and resulting odors from this source.	Facility operator	PIU
6	Management of wastewater *(Water, Land environment)*	▪ Any contaminated stormwater and leachate should be minimized via process management so there is no excess wastewater requiring discharge from the premises. ▪ All contaminated stormwater/leachate should be contained on the site and stored for re-use in the process – with or without treatment. This will decrease the dependency on freshwater.	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Avoid run-off from any particularly wet waste feedstock by storing it undercover or in a contained manner where necessary. ▪ To avoid a significant run-off, control the water added to the materials – during premixing, storage, and processing – to the moisture requirements of the process. ▪ Blend wetter feedstocks with drier ones to provide an appropriate moisture content in the initial heap. ▪ Water exceeding process needs should be stored for use in the drier months ▪ The collection pit may need to be supplemented by a separate tank or pond and should be treated immediately via the usage of the mobile leachate treatment system. ▪ Wastewater discharged should comply with the World Bank Group Environmental Health and Safety Guidelines for the solid waste management facilities. ▪ Clean Stormwater systems should be equipped with an interception pit to retain any floating solids or silt that may have by-passed the bunded system. ▪ The pit should be regularly inspected after rain to confirm that any discharge is clean. ▪ The facility operator is responsible for ensuring no pollution occurs in the receiving environment of any water discharge and discharge requirements meet the World Bank Group requisite wastewater discharge guidelines as per the World Bank Group Environmental Health and Safety Guidelines for the solid waste management facilities. ▪ Set-up fresh compost heaps on an organic base, such as dry wood chips, or straw, with high water absorbency. ▪ Maintain vegetative filter strips of fully composted material around compost heaps to absorb leachate run-off and to divert stormwater run-on		
7	Dust emissions during the operation *(Air environment, disturbance to communities and workers, health impacts)*	▪ During operations, sprinkling water regularly where there is a possibility of generation of dust. ▪ Vehicles within the facility to be restricted to a speed limit of say 40km/hr	Facility operator	PIU
8	Exhaust emissions *(Air environment, disturbance to communities and workers, health impacts)*	▪ No idling of vehicles on site. Regular maintenance of heavy equipment used at the site and waste hauling vehicles to ensure their exhaust emissions meet the emissions standards prescribed	Facility operator	PIU
9	Risk of fire due to conditions leading to spontaneous combustion *(Air environment, disturbance to communities and workers, health impacts, safety issues)*	▪ For composting, avoid conditions that can lead to spontaneous combustion (e.g. moisture between 25 – 45 percent and temperatures above about 93ºC. ▪ Design the facility for access by firefighting equipment, including clear aisles among windrows and access to an adequate water supply. ▪ Ensure workers are briefed of fire hazard management ▪ The following activities should be implemented to prevent fires from occurring at the facility ○ adequate fire-fighting equipment should be made available on-site and stored in an	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		accessible, ○ all operating staff should be trained and able to manage fire outbreaks at any part of the facility. ○ clear signage should be established to inform workers and the public that flammable liquids are not permitted on the site. This should be reinforced by advice to customers at the gatehouse and inspection of loads at the organic reception area. ○ Approved quantities of combustible contaminants that have been separated from the organics received for processing and are destined for recycling (such as tires and plastic bottles) should be stockpiled in small piles or windrows. ○ all fuels or flammable solvents for operational use should be stored in an appropriately ventilated and secure store. This store should be located away from the reception, storage, and processing areas. ○ all flammable liquids should be stored within a bund that can hold 110% of the volume of the flammable liquids stored there so that any release of raw or burning fuel cannot cause a fire in the combustible organics present on the site or have an impact on contaminating stormwater.		
10	Impact on the ambient noise quality during the operations *(Noise disturbance, health impacts on communities, workers, fauna)*	▪ Strictly adhering to designated working hours (day time); Sensitizing construction truck drivers and equipment operators to switch off idle engines; ▪ Using modern, well-maintained and regularly serviced vehicles; ▪ Ensuring that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels. ▪ Provision of earmuffs and ear protection to workers and employees in high noise areas	Facility operator	PIU
11	Occupational health and safety impacts of the workers during the operation of the aerated pile and support facilities: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be following international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
12	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Environmental Monitoring Plan

Phase	*Impacts*	*Parameters to monitor*	*Frequency*	*Number of samples*
Construction	**Emissions**			
	Air Emissions/GHG	Fugitive dust	Daily / Quarterly	-
		Criteria pollutants (SOx, NOx, CO)	Biannually	One sample per stack
	Noise	Noise levels	Weekly	One sample per location
	WW Generation	Effluent from construction activities (concrete curing, mixing, dust suppression...)	Biannually	Two samples per location
	Accidental Releases	Chemicals, oils and fuel spills	Daily	-
	Other Impacts			
	Visual intrusion	Ensure the effective implementation of mitigation measures	Weekly	Photographs per location
	Health Safety Hazards	Medical records, documentation of injuries and accidents, Health and safety assessments	Monthly	An adequate amount of health and safety surveys
Operation	**Emissions**			
	Air Emissions	Criteria pollutants (SOx, NOx, CO)	Annually	One sample per stack
		Biofilter operation	Quarterly	-
	Odors	Composting operation parameters(pH, C/N ratio, temperature, and moisture content)	Weekly	-
	Noise	Excess noises	Quarterly	One reading per location
	WW Generation from Leachate treatment unit	BOD, COD, TSS, total nitrogen, total phosphorus, Salmonella, Ammonia	Biannually	One sample
	Compost quality	Compost quality – parameters to be monitored (pH, C/N, moisture content, heavy metals, bacteriological content, maturity level, and grade)	Quarterly	12 single samples (5–10L per sample) at 12 different spots of compost pile; which should be then mixed and divided into 4 separate samples (4L each).

M. Indicative EMP and Monitoring Plan for Centralised and / or Community / Market Level Biomethanation (Anaerobic Digestion) of Biodegradable waste

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for treatment of the biodegradable waste***			
1	Selection of Technology and Site	▪ Site and Technology to be selected keeping in mind the air emissions, gas, odor, leachate, quantities which can be treated, segregation requirement, site suitability, sensitive receptors, site safety aspects including soil types, presence of lineaments, fractures, etc.		
2	Absence / Delay in Permissions for Developing the facility and associated works as per National regulations	▪ Required permissions for Land, setting up the facility and assessments conducted for facility development as per existing Laws, Regulations; including for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labour Laws, before the start of works on site	Contractor	PIU
3	Dust impacts due to Site Preparation *(Air Pollution) and Visual Blight due to heavy construction*	▪ Plan to Provide temporary high screen around the site before the start of work to curtail dust emissions	Contractor	PIU
4	Material sourcing, transport, and stacking of construction materials *(Occupational Health and Safety issues and Air noise pollution)*	▪ Prior intimation to neighbors on proposed construction activities, timings, emergency contacts, grievance mechanism ▪ Prior intimation to nearby Primary Health Centre on work activities need for medical support, emergency support needs, type of laborers on-site and labor camp if any ▪ Materials shall be sourced only from approved quarries ▪ Material shall be transported only in closed trucks with PUC certificates, with water sprinkling if required to curtail dust emissions. ▪ The driver should be with the required license and follow speed regulations ▪ Materials shall be transported preferably through well-surfaced roads. If road it kuchcha, water sprinkling shall be done to prevent dust emission before and after truck passes ▪ Material transport and unloading activities should not result in noise disturbance to locals and should be during day time ▪ Materials shall not be spread around on site. It shall be properly stored/stacked following good housekeeping practices (labeling, properly arranged); in covered sheds to prevent loss of strength and loss of material. Material storage shall not result in any harm to workers or visitors. ▪ Provide vehicle wheel wash area on site ▪ Workers to be provided with Personnel Protection Equipment (PPE) including safety boots, jackets, ear muffs, gloves. ▪ Proper rest area on site shall be provided with water, first aid, toilets	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
5	The layout of Labour camp *(Impacts on Sir, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters) ▪ Camp should not be provided on-site if it is an existing Waste or Sewage Treatment facility or an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and livable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, and waste collection/management systems, etc ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security (Refer ECoP)	Contractor	Site engineer of PIU, Labour Commissioner, PCB
6	Loss of tree cover *(Impact on Fauna / Flora)*	▪ Clearing and grubbing to be done only on the required surface and just before the start of activity on that section. In case of a time gap, water should be sprinkled regularly until the start of the next activity. ▪ Avoid tree felling as much as possible. Follow national regulation / applicable procedures for the replanting of trees (in case of replanting is required by the communities). Tree felling permission shall be obtained from the forest department / local body under applicable Acts. Minimal disturbance to fauna, follow applicable good practices to preserve their nests while cutting big trees; as per good practices and community ethos ▪ Compensatory plantation shall be planned to be undertaken at prescribed rates (preferably 10 times of the number of trees cut) ▪ Plan to use native species in consultation with the communities, Forest Department, Local Bodies	PIU	SPMU
7	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc especially in case of laying any support facilities	▪ Ensure site selection based on the screening checklist and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimise, Mitigate, Reduce, Offset. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board, SCZMA ▪ Identify appropriate government site to avoid land acquisition and resettlement impacts	PIU	SPMU
8	Nuisance hazards to neighboring areas *(Air, Odor, Communities)*	▪ Ensure proper design and adequate compound wall; high screen during construction, buffer zones to comply with SWM Rules, 2016, and other PCB requirements ad good practices. A green belt must be provided around all bio-methanation facilities considering safety, air emissions and odor	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
9	Flooding of the site during excessive rainfall *(Water, Soil Contamination downstream)*	▪ Ensure that the facility is constructed above the HFL levels ▪ Plan to provide cut off drain around the facility and proper stormwater management (including reuse, recharge) for the area nearby to prevent flooding of nearby properties and to prevent stormwater from washing the treatment facility	Contractor	PIU
B	**Construction / Implementation stage**			
Site Development				
1	Site Access closure *(Safety of communities)*	▪ All public access to the site via adequate fencing and signage which prohibit public access completely, to avoid risk to the public. ▪ The site entrance will include adequate signage indicating the details of the proposed subproject, implementing agencies, etc as well as safety signage to keep public away. ▪ A fence shall be erected to cover the entire perimeter of the facility using cost-effective fence materials consisting of chain link fence fabric, concrete post, etc. as specified in the Technical Specifications to ensure, animals and the public are unable to access the site. ▪ To avoid land disturbance and movement, the fence shall generally follow the contour of the ground. ▪ Grading shall be performed where necessary to provide a neat appearance	Contractor	PIU
2	Vegetation clearance for site development *(Land, Flora / Fauna impacts)*	▪ Clearing and grubbing should be avoided beyond that which is directly required for construction activities. ▪ The next activity to be planned/started immediately, to avoid dust generation and soil erosion during monsoon. ▪ Turfing/ re-vegetation to be started soon after completion of embankment ▪ Topsoil removal to follow ECoP conditions	Contractor	PIU
3	Soil Erosion from site leveling due to the loose earth left out from construction before the onset of monsoon *(impact on the Air environment and Noise environment)*	▪ Plan the activities so that no bare/loose earth surface is left out before the onset of monsoon. For minimizing soil erosion, the following preventive measures are to be taken: ▪ Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of sub-base layer, scarification, etc. ▪ Topsoil from borrow area, debris disposal sites, construction site to be protected /covered for soil erosion. ▪ Debris due to excavation for foundations, dismantling of existing cross drainage structure shall be removed from the watercourse immediately. When stockpiled, debris should be covered and with a garland drain. ▪ Suitable engineered or vegetative protection of soil if further exposed to erosion (like disturbed ravines)	Contractor	PIU
4	Impact on the land environment due to the loss of topsoil	All areas of cutting and all areas to be permanently covered will be stripped to a depth of 150mm and stored in the stockpile. Topsoil shall be safeguarded from erosion and will be reused as follows. ▪ Covering all borrow areas after the excavation is over	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Development of greenery		
5	Alteration of drainage during site development *(Impact on the Water Environment)*	▪ Diversions should be constructed during the dry season, with adequate drainage facility, and shall be completely removed before the onset of monsoon. ▪ Debris generated due to the excavation of foundation or due to the dismantling of the existing structure should be removed from the watercourse. When stockpiled, debris should be covered and with a garland drain. ▪ Continuous cut off – stormwater drain (lined/unlined) shall be provided. Obstruction if any, to be removed immediately. Silt fencing has to be provided on the mouth of discharge into natural streams.	Contractor	PIU
6	Runoff and drainage impacting the water environment	▪ The minimal site works during monsoon ▪ Throughout monsoon uninterrupted continuous drain to be functional. ▪ Lined drain to be provided at build-up locations for quick drainage. ▪ Increased runoff due to increased impervious surface is countered through the increased pervious surface area through soak pits. ▪ The site drainage if possibly contaminated with waste, leachate shall be set to treatment lagoon (constructed wetland) on-site or leachate treatment plant for treatment ▪ Treated water shall be reused on-site for greenbelt	Contractor	PIU
7	Material Stacking *(Safety impacts)*	▪ Materials shall be well stacked in closed or covered facilities considering the need to retain the strength of materials like concrete, and to prevent damage ▪ Stacking area shall be well marked, well-lit during the night and pasted with reflectors with proper signages ▪ Proper housekeeping shall be followed		
8	Soil erosion during site preparation *(Land / Water Impacts, Safety of Communities)*	▪ Debris material shall be disposed of in such a manner that waterways, drainage paths would not get blocked. ▪ Drainage paths associated with the infrastructure should be improved/erected to drain rainwater properly. ▪ Silt traps will be constructed to avoid siltation into waterways where necessary. ▪ To avoid siltation, drainage paths should not be directed to streams, other water bodies, and sea directly and they should be separated from streams / other water bodies/sea ▪ Barricades such as humps will be erected at excavated areas for culverts, silt traps, toe walls, filling and lifting with roper signboards, as some work in these sections will have to be stopped during heavy rains due to heavy erosion. ▪ To prevent soil erosion in these excavated areas, a proper earth drain system should be introduced. ▪ Embankment slopes, slopes of cuts, etc. shall not be unduly exposed to erosive forces. These exposed slopes shall be graded and covered by grass or other suitable materials per the specifications. ▪ All fills, backfills, and slopes should be compacted immediately to reach the specified degree of compaction and establishment of proper mulch.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Work that leads to heavy erosion shall be avoided during the rainy season. If such activities need to be continued during the rainy season prior approval must be obtained from the Engineer by submitting a proposal on actions that will be undertaken by the contractor to prevent erosion. ▪ The work, permanent or temporary shall consist of measures as per design or as directed by the engineer to control soil erosion, sedimentation, and water pollution to the satisfaction of the engineer. Typical measures include the use of berms, dikes sediment basins, fiber mats, mulches, grasses, slope drains, and other devices. All sedimentation and pollution control works and maintenance		
Construction of AD facility				
1	Impact due to the vehicular movement *(Air and noise environment)*	▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient Air Quality Standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates as required ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided.	Contractor	PIU
2	Impact due to the use of construction equipment *(Air and noise environment)*	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats. ▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites near sensitive receptors and settlement areas, works shall be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.	Contractor	PIU
3	Impact due to washing water and outflow from construction activities *(Water Contamination)*	▪ Construction work close to water bodies should be avoided during monsoon. ▪ Labour camps are to be located away from water bodies. ▪ Car washing/workshops near water bodies are to be avoided. ▪ Contaminated water from construction activities carrying soil, cement wash, etc shall not be allowed to flow out of the site. It shall be contained and treated on site.	Contractor	PIU

4	Disposal of Debris and Spoil
	(Water and Land contamination, Safety, Nuisance to Communities)
		▪ All debris and residual spoil material including any left earth shall be disposed only at locations approved by the engineer for such purpose and subjected to the following clauses:
		  ▪ The contractor shall obtain the approval from the relevant Local Authority and other government agencies (as required) for disposal and spoil at the specified location, as directed by the Engineer
		  ▪ Private or any government land that will be selected for disposal require written consent from the landowner
			Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ The debris and spoil shall be disposed in such a manner that; o waterways and drainage paths are not blocked o the disposed material should not be washed away by runoff and o should not be a nuisance to the public ▪ All material that is reusable or recyclable shall be used for such purposes either by the contractor or through dealers. ▪ Debris/earth shall be stored in a covered manner; sprinkled with water ▪ The debris and residual spoil material including any left earth shall be used, to refill the burrow areas as directed by the engineer, subjected to laying of topsoil as per recommendations for conservation and reuse of topsoil provided below. ▪ Excavated earth materials and all debris materials shall be disposed immediately (at the end of each day's work) without allowing to stockpile at identified locations for debris disposal, recommended by the engineer. During transportation, materials should be covered with tarpaulin. ▪ If approved by the engineer, the contractor can dispose the debris and spoil as a filling material provided that the contractor can ensure that such material is used for legally acceptable purposes, disposed in an environmentally acceptable manner		
5	Transport of construction materials *(Air, Noise, Water, land, Safety impacts)*	▪ The contractor should avoid over-loading trucks that transport material to construction sites. ▪ During transportation, materials should be covered with tarpaulin. ▪ Peak hours inroads with moderate to high traffic should be avoided. ▪ The contractor shall minimize possible public nuisance due to dust, traffic congestion, air pollution, etc., due to such haulage; ▪ If local roads are used, routes are to be selected based on the truckload; loads should be divided to prevent damages to local roads and bridges. ▪ Speed limits as nationality stipulated for haulage must be maintained ▪ All vehicles used for haulage should be in good condition. ▪ If there are damages to local roads and other utilities due to hauling inroads caused by the contractor. The contractor shall attend to repair all damaged infrastructure/ roads if needed through relevant authorities ▪ Materials shall be well stacked in closed or covered facilities considering the need to retain the strength of materials like concrete, and to prevent damage ▪ Stacking area shall be well marked, well-lit during the night and pasted with reflectors with proper signages ▪ Proper housekeeping shall be followed	Contractor	PIU
6	Pollution due to Fuel and Lubricants *(Soil, Water contamination, Safety Hazards)*	▪ The contractor shall ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance, and refueling site shall be located away from any canal or waterbody that is adjacent to the site by least 200m away. ▪ The contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not further contaminate the ground.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ The contractor shall arrange for collection, storing, and disposal of oily wastes to the pre-identified disposal sites in line with Hazardous Waste Management Rules. ▪ Fuel storage shall be with approval if quantities stored is above approved limits and should be stored as per existing regulations ▪ Fuel shall not spill during storage, transport, or transfer to storage areas ▪ Adequate containment – high platforms, plates, collection mechanisms shall be ensured to prevent any contamination of nearby soil, water environment. Any contaminated soil shall be disposed of in a hazardous waste treatment facility with proper approvals. ▪ Material storage near fuel storing areas shall be thoroughly considered the safety aspects (fire possibilities).		
7	Siltation due to works *(Water, Soil impacts)*	▪ The contractor shall take measures to prevent the siltation of water bodies because of construction work including, construction of temporary/permanent devices to prevent water pollution due to siltation and increase of turbidity. These shall include the measures against erosion highlighted in this EMP ▪ Construction materials containing small/fine particles shall be stored in places not subjected to flooding and in such a manner that these materials will not be washed away by runoff. ▪ Temporary soil dumps should be placed at least 200m away from all water bodies. If temporary soil piles are left at the site for a long time those piles should be covered with thick polythene sheets ▪ All fills backfills and slopes should be compacted immediately to reach the specified degree of compaction and establishment of proper mulch	Contractor	PIU
8	Unsafe site operations *(Public Safety)*	▪ At all times the site will restrict the entry of public on to the site. ▪ Safety signboards and signboards prohibiting entrance and risks should be displayed at all necessary locations. ▪ The contractor should obtain Third-party insurance to compensate for any damages, injuries caused to the public or laborers during the construction period. ▪ All construction vehicles should be operated by experienced and trained operators under supervision. ▪ Trenches should be progressively rehabilitated once work is completed. ▪ Material loading and unloading should be done only within the project site.	Contractor	PIU
9	Accidents on site *(Safety of Workers, Communities)*	▪ Contractor shall comply with the requirements for the safety of the workers as per the ILO Convention No. 62 and Safety & Health Regulations of the Factory ▪ The contractor shall supply all necessary safety measures at the site- including the provision of First Aid Kids, Fire extinguishers. ▪ Signage providing instructions on first aid management, emergency contact, and emergency operating procedures in local languages & details on the project at the entry to the site. ▪ Basic onsite safety training should be conducted for all laborers during the EMP training before the start of the construction activities. ▪ The training to laborers should also include a brief on the risks of working on an open dumpsite.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ The contractor should obtain Third-party insurance to compensate for any damages, injuries caused to laborers during the construction period. ▪ Protective footwear and protective goggles should be provided to all workers employed on the mixing of materials like cement, concrete, etc. ▪ Welder's protective eye-shields shall be provided to workers who are engaged in welding works. ▪ Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing compaction, or concrete mixing operation. ▪ Repeat safe practices during daily toolbox meetings ▪ No unauthorized entry to the site shall be allowed. The site shall be enclosed in a proper compound wall with manned / security posted at entry. In case of unauthorized entry, a security person shall inform the contractor/police / ULB asap. ▪ No access to heights or trenches shall be allowed. Ladders or ropes should be in the folded condition during non-work hours restricting entries to others ▪ All heights, trenches to be guarded by roper safety barricading and nets as appropriate to prevent falls. ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
10	Occupational health and safety impacts of the workers during the construction of biomethanation and support facilities: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Measures such as deferred timings and stretch breaks to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be following international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
C		**Operation& Maintenance Phase**		
1	Management of Incoming feedstock *(Quality issues on products- overall Health and Safety aspects)*	▪ Incoming feedstocks should only include Municipal Solid Waste- biodegradables, the site will not accept any material categorized as any other form of waste, including medical waste, sludge, and biosolids. ▪ Gross pollutant trap wastes that consist of material such as silt and sediments, and from high-risk locations such as industrial areas, contaminated sites and surrounds or the cleanup of industrial or road accidents should not be permitted into the facility. ▪ Stockpiles of feedstock should be managed in a contained manner if not immediately incorporated to the biodigester on an impermeable surface, large plastic bins with cover and vents are recommended to prevent the occurrence of fire, and the generation of dust and or odor.	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Residual waste and/or incoming feedstocks that are unsuitable for use in the AD process should be categorized following national classification of waste – including industrial and commercial waste and waste soil), before being removed offsite and transported to a suitably licensed facility to receive and/or dispose of that waste. ▪ Feedstocks should be source segregated before receipt at the facility and only contain organic waste ▪ Instructions of the technology provider shall be followed		
2	Impacts due to vehicle movement *(Air, Heath impacts)*	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely processing & disposal of waste shall be carried out by vehicles and should transfer waste only in the specified Secondary Collection Point or secondary collection vehicle or treatment disposal yards planned. No waste shall be disposed of in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas.	Facility operator	PIU
3	Transportation of wastes in overloaded and open vehicles *(Air, Odour nuisances; spills and littering impacts on Air, Water, Land)*	▪ All vehicles shall carry only approved load of weight as per SOP ▪ Regular cleaning of roads & drains and removal of waste. ▪ All Transport vehicles shall be covered. ▪ Ensure provisions of SWM Rules 2016 for all collection Transportation activities	Facility operator	PIU
4	Plying of vehicles through kutcha / unsurfaced roads and idling (*Air pollution: SPM, CO, CO2)*	▪ Vehicle movement shall be well planned – through topped roads. In case of necessity to move through Kutcha roads, ensure sprinkling of water to suppress dust before and after the movement of the vehicle	Facility operator	PIU
5	Odor issues	▪ The anaerobic digester should be airtight with sealant and other inflating bags. ▪ The amount of feedstock stored on-site should be limited to less than one week of requirements where possible. ▪ Water absorption into the feedstock, which restricts access to air and leads to anaerobic conditions, should be prevented. This can be done by providing protection from rain and	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	(Air, Water, Health and Safety impacts, Nuisance to Communities)	appropriate stormwater and groundwater controls and monitoring to ensure waterlogging does not occur. ▪ Very wet or fluid wastes should be contained in vessels fitted with lids. ▪ Leachate ponds must be aerated to reduce stagnation and resulting odors from this source.		
6	During the operation phase, wastewater/leachate will be generated from the unit or waste storage area *(Leachate impacting the ground and surface water bodies; leading to fly and odor menace)*	▪ Wastewater and leachate generation should be minimized via process management so there is no excess wastewater requiring discharge from the premises. The technology provider's instructions must be followed. ▪ Avoid run-off from any particularly wet waste feedstock by storing it undercover or in a contained manner where necessary. ▪ Any leachate generated shall be channelized through lined drain only ▪ The lined leachate collection pit may need to be supplemented by a separate lined tank and should be treated immediately via the usage of the mobile/stationary leachate treatment system. Additional containment is for storing leachate and treated leachate in case of emergencies or inability to run the facility or reuse during floods or other such events ▪ Wastewater discharged should comply with national regulations and the World Bank Group Environmental Health and Safety Guidelines for solid waste management facilities. ▪ Regular cleaning and approved pest control measures to be adopted: Biopesticides / biological control shall be adopted. Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Facility operator	PIU
7	Impact on soil due to the Slurry and sludge produced during the waste processing in the digester *(Impacts on water, soil, odor nuisance and visual blight to communities)*	▪ There shall be suitable containment for slurry as well (even for emergency storage). It should be in a separate lined tank with cover and gas vent. ▪ The processed slurry will be used as manure only after Physico-chemical testing and complying with the norms of manure for crops or green belt ▪ The digester effluent (sludge) needs to be partially dried and then composted or used as manure after tests to rule out contamination ▪ There shall be adequate area and mechanism to dry sludge		
8	Dust emissions during the operation *(Air environment, impacts on health)*	▪ During operations, sprinkle water regularly where there is a possibility of generation of dust. ▪ Vehicles within the site to be restricted to a speed limit of say 40km/hr	Facility operator	PIU
9	Exhaust emissions *(Air environment, impacts on health)*	▪ No idling of vehicles on site. Regular maintenance of heavy equipment used at the site and waste hauling vehicles to ensure their exhaust emissions meet the emissions standards prescribed	Facility operator	PIU
10	Gas leaks and negative pressure in the biogas plant (Safety risks)	▪ Ensure that in normal operations the pressure inside the biogas system is always greater than the outside pressure. ▪ Each day the whole biogas system should be checked for irregularities (tears or cracks in the bag or hoses, tightness of hose clamps).		

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ All connections should be sprayed with soap water mixture so that any leaks can be detected by the presence of bubbles. ▪ Make provision for a 'flame arrestor' device in the gas pipe. In case of fire, it will prevent the flame from traveling down the gas pipe into the gas storage bag and causing an explosion. ▪ No smoking or open flames should be allowed near biogas digesters, especially when checking for gas leaks.		
11	Risk of fire due to conditions leading to spontaneous combustion *(Worker and Community Health and Safety)*	▪ Where possible collect biogas for use or treatment (e.g. energy recovery or flaring); even when there is energy recovery, provide additional facility to flare in case of emergencies ▪ Design the facility based on fire norms, National Building Code – Fire Safety, KMBR fire safety requirements and shall have adequate access by firefighting vehicles and equipment, including clear aisles and access to adequate stored water for fire-fighting at all times. ▪ Ensure workers are briefed on fire hazard management ▪ Provide signages and safety instructions in different languages (English, Hindi, Malayalam) at places readable for workers ad communities. ▪ The following activities should be implemented to prevent fires from occurring at the facility o adequate fire-fighting equipment should be made available on-site and stored in an accessible, o all operating staff should be trained and able to manage fire outbreaks at any part of the facility, o clear signage should be established to inform workers and the public that flammable liquids are not permitted on the site. This should be reinforced by advice to customers at the gatehouse and inspection of loads at the organic reception area. o Approved quantities of combustible contaminants that have been separated from the organics received for processing and are destined for recycling (such as tyres and plastic bottles) should be stockpiled in small piles or windrows. This shall be shifted every day to recycling/disposal facilities for such wastes. o all fuels or flammable solvents for operational use should be stored in an appropriately ventilated and secure store. This store should be located away from the reception, material storage, and processing areas. Spillage should be prevented by all means and spills if any shall be well-contained. o all flammable liquids should be stored within a bund that can hold 110% of the volume of the flammable liquids stored there so that any release of raw or burning fuel cannot cause a fire in the combustible organics present on the site or have an impact on contaminating stormwater. o Any contaminated soil shall be scraped and disposed in hazardous waste TSDF after requisite approvals. o Suitable facilities to utilize biogas produce or convert into energy shall be arranged to prevent flaring	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
12	Impact on the ambient noise quality during the operations *(Health impacts and nuisance)*	▪ Strictly adhering to designated working hours (day time); Sensitizing construction truck drivers and equipment operators to switch off idle engines; ▪ Using modern, well-maintained and regularly serviced vehicles; ▪ Ensuring that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels. ▪ Provision of earmuffs and ear protection to workers and employees in high noise areas ▪ Prohibit noise-generating activities between 6PM to 7AM.	Facility operator	PIU
13	Occupational health and safety impacts of the workers during operations: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be following international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
14	Safety Risks in case of Floods	▪ In case of floods, safety measures must be taken in advance so that the gas can escape in case the digester and/or the gas storage tank are flooded. ▪ Follow the instructions of the facility provider/operator. Usually; an upside-down 'T' pipe should be placed at the highest vertical point in the gas pipeline above the gas outlet from the digester. A vertical pipe and a gate valve should be joined to the stem of the upside-down 'T' pipe. The gate valve can then be opened to release the biogas if a flood threatens to cover either the digester or the gas storage tank.		
15	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Environmental Monitoring Plan

Sl. No	Particulars	Monitoring frequency	Duration of monitoring	Important Parameters for monitoring
I	Air quality			
	Ambient air monitoring			
1	Project premises	Once in a month	24 hourly sample	RSPM, SPM, SO2, Nox
2	Stack monitoring	Once in 6 months	Grab	SPM, SO2, NO_x, HC, CO
II	Water and wastewater quality			
1	Water quality			

Sl. No	Particulars	Monitoring frequency	Duration of monitoring	Important Parameters for monitoring
i	Groundwater at two locations (up-gradient, downgradient)	Once in a month	Grab	As per KSPCB requirement
2	Wastewater quality			
i	The effluent at the outlet of the Treatment Plant	Once in a month	Grab	As per KSPCB requirement
III	Soil quality			
1	Within project premises at 1 location	Once in six months	Composite sample	As per KSPCB requirement
2	Ecological preservation and up-gradation	Seasonal	Visual observations	Survival rate
IV	Noise monitoring			
1	Project premises	Once in six months	Day and night	As per KSPCB requirement

N. Indicative EMP and Monitoring Plan for Sanitary Landfill for Disposal of Rejects and Inerts

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for Sanitary Landfill***			
1	Siting Considerations - Habitation within 500 m from the landfill boundaries	▪ Declaration of No development Buffer Zone after the landfill location is finalized	ULB	SPMU
2	Groundwater contamination- Plan for Leachate Monitoring Program	▪ Any leachate to be disposed will need to comply with the Disposal Standards for Treated Leachate as specified in the SWM Rules 2016, Annexure-II	Contractor, DPR consultants	ULB, SPMU
3	Risk of fire, explosion, and contribution to greenhouse gases	▪ Design Landfill Gas Management System including vents ▪ Fire Safety Plan & Emergency Plan to be prepared: ○ Banning smoking in all areas of the sanitary landfill. ○ Handling material on fire as well as setting fire to materials on the landfill are strictly forbidden. ○ Waste that has been unloaded in the filling area has to be examined visually for potential fire sources (glowing ash or glowing burning remains). If fire sources are located, these have to be neutralized with cover material immediately. ○ All mobile equipment or vehicles should be furnished with a fire extinguisher. ○ Fireline and Control procedures	Contractor, DPR consultants	ULB, SPMU
4	Substandard construction operation and closeout	▪ Prepare Construction and O&M Manual for Landfill ▪ Prepare Waste Acceptance and Screening Procedure and signages on this ▪ (i) Prepare closure and post-closure plan following the CHPEEO Manual or any internationally recognized good practices on closure and post-closure of landfills	Contractor, DPR consultants	ULB, SPMU
5	Requirements for Preliminary site and water Assessments	▪ Preliminary site investigations shall be conducted as required by regulations and technical designing ▪ Ensure structural stability of soils, lineaments, and factures and any impacts on the surrounding like induced soil piping ▪ A comprehensive hydrological investigation of both the site and the surrounding surface water and groundwater regime needs to be conducted before site establishment. The investigation should identify the groundwater flow pathways for all aquifers on-site, assess the vulnerability of the groundwater underneath and adjacent to the facility, and establish whether systems to prevent groundwater pollution need to be set up. ▪ A water pollution remediation plan should be developed if pollution of groundwater, surface water, or the subsoil is confirmed in the preliminary water assessment of the site or is identified by external monitoring.	DPR consultants	ULB, SPMU
6	Absence / Delay in Permissions for Developing the Landfill and associated works as per National regulations	▪ Required permissions for Land, setting up the Landfill and assessments conducted for Landfill development as per existing Laws, Regulations; including for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labour Laws, before the start of works on site	Contractor	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
7	Dust impacts due to Site Preparation (*Air Pollution) and Visual Blight* due to heavy construction	▪ Secure the site upon possession with gated compound wall and manned security ▪ Plan to Provide temporary high screen around the site before the start of work to curtail dust emissions	Contractor	ULB, SPMU
8	Material sourcing, transport, and stacking of construction materials before construction *(Occupational Health and Safety issues and Air noise pollution)*	▪ Prior intimation to neighbors on proposed construction activities, timings, emergency contacts, grievance mechanism ▪ Prior intimation to nearby Primary Health Centre on work activities need for medical support, emergency support needs, type of laborers on-site and labor camp if any ▪ Materials shall be sourced only from approved quarries ▪ Material shall be transported only in closed trucks with PUC certificates, with water sprinkling if required to curtail dust emissions. ▪ The driver should be with the required license and follow speed regulations ▪ Materials shall be transported preferably through well-surfaced roads. If the road is *kuchcha*, water sprinkling shall be done to prevent dust emission before and after truck passes ▪ Material transport and unloading activities should not result in noise disturbance to locals and should be during day time ▪ Materials shall not be spread around on site. It shall be properly stored/stacked following good housekeeping practices (labeling, properly arranged); in covered sheds to prevent loss of strength and loss of material. Material storage shall not result in any harm to workers or visitors. ▪ Provide vehicle wheel wash area on-site (with wash water reuse) ▪ Workers to be provided with Personnel Protection Equipment (PPE) including safety boots, jackets, ear muffs, gloves. ▪ Proper rest area on site shall be provided with water, first aid, toilets	Contractor	ULB, SPMU
9	The layout of Labour camp *(Impacts on Air, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters) ▪ It should not be provided on-site if it is an existing Waste or Sewage Treatment facility or an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and livable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, fuel for cooking and waste collection/management systems, etc ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security	Contractor	Site engineer of ULB, SPMU, Labour Commissioner, PCB

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		(Refer ECOP)		
10	Loss of tree cover *(Impacts on flora, Fauna)*	▪ Clearing and grubbing to be done only on the required surface & just before the start of activity on that section. In the case of the time gap, water should be sprinkled regularly until the start of the next activity. ▪ Avoid tree felling as much as possible. Follow national regulation / applicable procedures for the replanting of trees if replanting is essential. Tree felling permission shall be obtained from the forest department / local body under applicable Acts. Take care of fauna, nests in case of large trees as per good practices and community ethos ▪ Compensatory plantation shall be planned to be undertaken at prescribed rates (preferably 10 times of the number of trees cut) ▪ Plan to use native species in consultation with the communities, Forest Department, Local Bodies	PIU	ULB, SPMU
11	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc especially in case of laying any support facilities *(Impacts on Flora, Fauna, communities)*	▪ Ensure site selection based on the screening checklist and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimise, Mitigate, Reduce. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board, SCZMA	PIU	ULB, SPMU
12	Contamination of groundwater due to leaching *(Impacts on water and land)*	▪ Ensure appropriate design provisions (based on hydrogeological aspects as well) are made for liners, line drains, leachate collection and treatment facilities to prevent percolation of leachate	Contractor	ULB, SPMU
13	Nuisance hazards to neighboring areas *(Dust emissions, Visual blight, other disturbances)*	▪ Ensure proper design and adequate compound wall; high screen during construction, buffer zones and thick green belt to comply with SWM Rules, 2016 and other PCB requirements	Contractor	ULB, SPMU
14	Reduced land values in nearby areas and impacts aesthetics affected *(Socio-economic impacts, visual blight)*	▪ Adequate buffer zones shall be planned and beautification scheme ▪ Discuss with town Planning Department and Local Body for demarcating a no-development zone around the facility	PIU along with the town planning department	ULB, SPMU
15	Flooding of the landfill site during excessive rainfall *(Land, water environment, Health)*	▪ Ensure that the facility is constructed above the HFL levels and 2.0 m above growth water level as suggested by SWM Rules 2016 ▪ No depths/excavations shall be left open. All trenches must be closed or provided with proper drainage so that floodwater does not fill in ▪ Plan to provide cut off drain around the facility and proper stormwater management (including reuse, recharge) for the area nearby to prevent flooding of nearby properties ▪ Flood water should not mix with any site drainage or leachate	Contractor	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
B		**Construction / Implementation stage**		
		Site Development		
1	Vegetation clearance for site development *(Impacts on flora, fauna)*	▪ Clearing and grubbing should be avoided beyond that which is directly required for construction activities. ▪ The next activity to be planned/started immediately, to avoid dust generation and soil erosion during monsoon. ▪ Turfing/ re-vegetation to be started soon after completion of embankment	Contractor	ULB, SPMU
2	Soil Erosion from site leveling due to the loose earth being left out from construction before the onset of monsoon *(impact on-air environment and noise environment)*	▪ Plan the activities so that no bare/loose earth surface is left out before the onset of monsoon. For minimizing soil erosion, the following preventive measures are to be taken: ○ Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of sub-base layer, scarification, etc. ○ Topsoil from borrow area, debris disposal sites, construction site to be protected /covered for soil erosion. ○ Debris due to excavation for foundations, dismantling of existing cross drainage structure shall be removed from the watercourse immediately. When stockpiled, debris should be covered and with a garland drain.	Contractor	ULB, SPMU
3	Alteration of drainage during site development *(impact on the water environment)*	▪ Diversions should be constructed during the dry season, with adequate drainage facility, and will be completely removed before the onset of monsoon ▪ Debris generated due to the excavation of foundation or due to the dismantling of the existing structure should be removed from the watercourse ▪ Silt fencing has to be provided on the mouth of discharge into natural streams ▪ Continuous drain (lined/unlined) is provided obstruction if any, to be removed immediately.	Contractor	ULB, SPMU
4	Runoff and drainage *(Water environment)*	▪ Minimal site works during monsoon ▪ Throughout monsoon uninterrupted continuous drain to be functional. ▪ Lined drain to be provided at build-up locations for quick drainage. ▪ Increased runoff due to increased impervious surface is countered through the increased pervious surface area through rainwater recharge.	Contractor	ULB, SPMU
		Construction of Landfill (including cells, LFG extraction, leachate collection, and treatment system)		
1	Impacts due to the loss of topsoil *(Land environment)*	All areas of cutting and all areas to be permanently covered will be stripped to a depth of 150mm and stored in the stockpile. Topsoil shall be safeguarded from erosion and will be reused as follows. a) Covering all borrow areas after the excavation is over a) Development of greenery Refer ECOP	Contractor	SPMU
2	Impacts due to the vehicular movement *(Air and noise environment)*	▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient air quality standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided.	Contractor	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
3	Impact due to the use of construction equipment *(air and noise environment)*	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats. ▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites within 150 m of sensitive receptors and settlement areas construction to be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.	Contractor	ULB, SPMU
4	Soil contamination and groundwater contamination from Leachate (Land and Water Environments, Health impacts)	▪ Install a drainage layer underneath the processing area to provide adequate leachate drainage. This may consist of a bed of coarse material such as wood chips, or the processing platform such as a concrete pad ▪ Permanently incorporate a drainage layer designed to withstand the loading, working, and removal of material. ▪ The storage areas of the facility should have a leachate barrier system that forms a secure barrier between the groundwater, soil, and substrata ▪ Design and maintain the slope and orientation of leachate drains such that free drainage of leachate to a collection drain is facilitated and ponding of leachate is avoided; shape the piles and windrows to maximize runoff and hence reduce infiltration	Contractor	ULB, SPMU
5	Impact during construction activities *(Water environment)*	▪ Construction work close to water bodies should be avoided during monsoon ▪ Labour camps are to be located away from water bodies. ▪ Vehicle washing/workshops near water bodies are to be avoided. ▪ Contaminated water from construction activities carrying soil, cement wash, etc shall not be allowed to flow out of the site. It shall be contained and treated on site.	Contractor	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
6	Occupational health and safety impacts of the workers and communities during the construction of landfill and support facilities: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover	Facility operator	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, landfill compactors, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, landfill compactors, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police. ▪ A work permit system will be implemented for all works related to working at heights (typically when working over 2m and above) and for hot jobs; · ▪ All works related to working at heights will be undertaken only during the daytime when sufficient sunlight is available; ▪ Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as handrails and toe boards to prevent materials from being dislodged will be done; ▪ All excavation activities will be conducted in supervision of the site contractor; ▪ Proper signage and lights will be provided in places of excavated areas.		
C		**Operation& Maintenance Phase**		
1	Waste leakage from Loading waste rejects and inerts *(Air, water, land, Fauna/Flora, Health impacts)*	▪ Ensure proper record keeping of waste collected and transported ▪ Weighbridge level record keeping and monitoring at the tipping point ▪ Padded reject collection area or unloading platform with lined drains to collect leachate if any	Landfill operator	ULB, SPMU
	Pest and Vector Menace	▪ Develop and implement the Rodent and Fly Control Plan	Landfill operator	ULB, SPMU
2	Impacts due to vehicle movement *(Air, Water environment, Health)*	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles	Landfill operator	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Timely processing & disposal of rejects/inerts shall be carried out by vehicles and should transfer waste only in the specified area. No waste shall be disposed of in any place other than the designated area; including water bodies, coasts/forests or sensitive areas.		
3	Transportation of rejects/inerts in overloaded and open vehicles *(Air, Odour nuisances; spills and littering impacts on Air, Water, Land)*	▪ All vehicles shall carry only approved load of weight as per SOP ▪ Regular cleaning of roads & drains and removal of any spillovers. ▪ All Transport vehicles shall be covered. ▪ Ensure provisions of SWM Rules 2016 for all collection Transportation activities	Landfill Operator, PCB	ULB, SPMU
4	Plying of vehicles through kutcha / unsurfaced roads and idling (air pollution: SPM, CO, CO2)	Vehicle movement shall be well planned – through topped roads. In case of necessity to move through Kutcha roads, ensure sprinkling of water to suppress dust before and after the movement of the vehicle	Landfill Operator, PCB	ULB, SPMU
5	Nuisance due to odor and influx of insects, rodents, flying birds	▪ Provide adequate buffer zone around the landfill site/treatment site and other facilities with thick vegetative cover. ▪ No waste shall be allowed to be landfilled. ▪ Rejects/inerts shall be deposited at the designated place and waste shall not be allowed to accumulate near the reception pad or area. ▪ Odor management measures including odor filters, aromatic buffers/ other buffers for preventing fly menace, PPEs for workers ▪ Regular cleaning and approved pest control measures to be adopted: Biopesticides / biological control shall be adopted. Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Landfill operator	ULB, SPMU
6	Bird menace at the waste disposal facility.	▪ Avoid open dumping of waste or rejects / inerts including in and around the site premises. Provision for safe storage of rejects and inerts (for at least one week) on sites in case of emergencies to be arranged. ▪ In case of breakdown or maintenance, intake shall be stopped and be diverted to the emergency containment area	Landfill operator	ULB, SPMU
7	Air emission of toxic gases from the landfill site *(Air environment, the health of communities and workers)*	▪ Placing of gas vents and construction of the gas compression station with adequate capacity to receive the maximum flow of gas. ▪ Performing trials to collect the gas early during the landfill operation and before the cell is filled. This can significantly reduce odor impact. ▪ Keeping the integrity of the system by lining system and final cover of the landfill properly by ensuring adequate placing, adhering to waste filling plan, avoid overloading landfill cells, and regular evacuation of leachate and gas. ▪ The strict maintenance schedule for the degassing system should be prepared and followed by the project operator	Landfill operator	ULB, SPMU
8	Dust emissions during the operation- PM 10 *(Air environment, Health)*	▪ During operations, sprinkle water regularly wherever there is a possibility of generation of dust. ▪ Vehicles within the landfill to be restricted to a speed limit of say 20km/hr ▪ Dust control within the Landfill Footprint (Active Areas) – temporary access roads within the landfill footprint will be watered, as required, to prevent dust problems;	Landfill operator	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Dust control outside landfill footprint – permanent concrete or asphalt and gravel or rock-surfaced roads outside the landfill footprint will be watered periodically to mitigate dust. Soil surfaced roads will require more frequent watering; and ▪ Using Leachate for Dust Control – leachate may be used for dust control depending on its concentration. However, leachate will only be used on daily cover or waste within the landfill footprint		
9	Exhaust emissions *(Air environment)*	▪ No idling of vehicles on site. Regular maintenance of heavy equipment used at the site and waste hauling vehicles to ensure their exhaust emissions meet the emissions standards prescribed	Landfill operator	ULB, SPMU
10	Odor generation during operations *(Air, a nuisance to communities and workers)*	▪ Daily soil covers to compacted material or rejects to manage odors. Rejects with a strong odor to be covered immediately they are emptied from delivery vehicles ▪ Control and manage leachate treatment plants to minimize odor. ▪ Adhere to air quality regulations with quarterly air quality monitoring Maintenance of the buffer zone, green belt, and protective berms	Landfill operator	ULB, SPMU
11	Noise generation during operations *(Impacts on Noise environment, Nuisance to workers, communities)*	▪ Strictly adhering to designated working hours (day time); Sensitizing construction truck drivers and equipment operators to switch off idle engines; ▪ Using modern, well-maintained and regularly serviced vehicles; ▪ Ensuring that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels. ▪ Provision of earmuffs and ear protection to workers and employees in high noise areas	Landfill operator	ULB, SPMU
12	Leachate and Runoff from activities *(Soil contamination and groundwater contamination)*	▪ Install a drainage layer underneath the processing area to provide adequate leachate drainage. This may consist of a bed of coarse material such as wood chips, or the processing platform such as a concrete pad ▪ Permanently incorporate a drainage layer designed to withstand the loading, working, and removal of material. ▪ The storage areas of the facility should have a leachate barrier system that forms a secure barrier between the groundwater, soil, and substrata ▪ Design and maintain adequate slope and orientation such that free drainage of leachate to a collection drain is facilitated and ponding of leachate is avoided; reduce infiltration – all surfaces prone to leachate accumulation shall be lined ▪ Store leachate in aboveground storage tanks; suitably protected against flooding or leaks; provide addition emergency containment or storage	Landfill operator	ULB, SPMU
13	Occupational health and safety impacts of the workers during operations: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles.	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks &	Facility operator	ULB, SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	• Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic		

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		control is required with the support of police. ▪ A work permit system will be implemented for all works related to working at heights (typically when working over 2m and above) and for hot jobs; · ▪ All works related to working at heights will be undertaken only during the daytime when sufficient sunlight is available; ▪ Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as handrails and toe boards to prevent materials from being dislodged will be done; ▪ All excavation activities will be conducted in supervision of the site contractor; ▪ Proper signage and lights will be provided in places of excavated areas.		
14	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Environmental Monitoring Plan for sanitary landfill

Strategy for environmental monitoring for the Landfill site.

Baseline following parameters shall be established for one year before construction of the landfill.

Parameter	***Frequency***	***Description***
Hydrology	-	Groundwater depth, variation, flow direction
Groundwater quality	Monthly	Minimum 3 samples from each aquifer analyzed every month for drinking water parameters
Surface water quality	Monthly	Minimum 3 samples from nearby drain monthly for relevant wastewater parameters
Landfill gas	Monthly	Sampling and analysis for Methane, H2S, and other landfill gases.
Dust	Monthly	PM10 - At noon, during hot/dry/windy days
Odor	Monthly	Inside Landfill site and at 200m intervals from boundary to nearby inhabitation.
Noise	Monthly	Peak Noise analysis at the site and nearby Inhabitation.
Vegetative Cover	Seasonal	Mapping of vegetative cover shall be done.
Leachate	-	From Existing waste dumps or landfills near the new site. (At least 6 samples below the existing waste dumps).
Waste Characterization	-	Waste from all sources shall be assessed for composition, physical, chemical, biological, toxic and geotechnical properties.
Soil	-	Sub-soil beneath the base of landfill for permeability and soil properties

Operational Phase and Post closure Monitoring:

Post closure care at the landfill site shall be done for a minimum of fifteen years in line with the following:

1. Groundwater quality (upgradient and downgradient): Groundwater quality up to 2km radius shall be periodically monitored covering different seasons in a year, summer, monsoon, and post-monsoon period.
2. Surface water quality: Surface water that can be contaminated by runoff from the landfill site shall be monitored.
3. Leachate quality before and after treatment: Treated Leachate quality shall be monitored periodically to meet the quality standards set in the SWM Rules, 2016 for leachate disposal.
4. Gas quality within the landfill: Maintaining and operating the landfill gas collection system to meet the standards.
5. Ambient air quality in and around the landfill: Ambient Air Quality in and around the landfill site shall be monitored periodically to meet the standards prescribed by CPCB for Industrial Area.

   Apart from the above environmental parameters, during operation and post-operation care, the following shall also be monitored.
6. **Integrity and effectiveness of the final cover:** Final cover is to be inspected 2 to 4 seasons to check vegetation growth, removal of undesirable species, erosion of slope, any cracks in the liner, ponding, etc for immediate rectification. At least one inspection during or immediately after monsoon is to be carried out.
7. **Leachate Collection System:** The system consists of leachate collection pipes, valves, pumps & manholes. Regular inspection of manholes & pipes will be carried out for checking the deposition of sediment, clogging of pipes, etc.
8. **Landfill Gas Collection System -** Gas vents will be inspected for clogging of the openings by birds or insects. Also, verticality will be observed to determine if the settlement has compromised the seal between the vent boot and the geo-membrane and if there is a seepage conduit formed around the vent for erosive sediments carrying run-off. Gas vents and adjacent areas which require maintenance will be reported to the original design configuration, re-using the existing materials to the extent possible

Detailed Monitoring Plan that shall be adopted during Operation and Post closure phase of the landfill is given in the table below:

Frequency of Monitoring During Operation Phase and Post Closure*

Sl.No	Parameters	Frequency	Locations
1.	Air Quality Monitoring		
a)	Ambient Air	Monthly /bimonthly up to 4 years, Seasonal (Except Monsoon) Beyond 4 years	Landfill site, About four locations at 120m around the Landfill
b)	Landfill gas	Monthly /bimonthly up to 4 years, Twice a year Beyond 4 years	Project Site
2.	Noise Monitoring	Twice a year	Landfill site, And four locations around the Landfill
3.	Ground Water Quality	Three times in a year (Summer, monsoon & Post-monsoon)	Minimum 4 Locations (1 up gradient and 3 down gradient)
4.	Surface Water Quality	Bimonthly	Nearby surface water in the downstream side
5.	Leachate quality	Monthly /bimonthly up to 4 years, Twice a year Beyond 4 years	Within Landfill, Leachate tank, and after treatment.
6.	Landfill cover/ Vegetation	Quarterly	Project Site

*- The final location, frequency, and parameters to be monitored will vary from place to place and shall be finalized in conjunction with an expert based on the topography of the area and layout of the landfill.

O. Indicative EMP and Monitoring Plan for Remediation of Existing Open Dumpsites

After remediation, retrieved land may be used to construct MCF, MRF, RRFs, or treatment plants if contamination levels are negligible. Sanitary landfill cells may be accommodated on-site if suitable. Also, part of the inerts or rejects from biomining may need to be capped in a portion of land. For treatment plant and sanitary landfill, corresponding EMPs shall be used. ECoPs in Section 07 shall also be referred to for environmental guidelines to construct and operate MCF/MRF/RRF and for sanitary landfills.

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Planning and Pre-Construction Stage**		
1	***Planning for biomining facility***			
1	Site Access Closure	▪ The total cessation of dumping in the site will be implemented before any works. ▪ All public access to the site, including waste pickers and scavengers should be prohibited via adequate fencing/compound wall, manned security, information to communities around and signage which prohibit public access completely, to avoid risk to the public. ▪ The site will be fully closed to any SWM operation and appropriate signage must be established at the site entrance to indicate that the waste dump has been closed from the operation. ▪ To avoid land disturbance and movement, the fence/compound wall shall generally follow the contour of the ground. ▪ Grading shall be performed where necessary to provide a neat appearance	ULB	SPMU
2	Site assessments including soil boring, auger and test pit, or standard penetration tests for assessing the contamination of the waste – *impact on air quality, odor, water contamination due to leachate, health and safety impacts of the people working in the site assessment*	▪ Carry out site assessments as per Guidelines for Biomining of Legacy waste Dumpsites of CPCB ▪ Assess the depth of contamination or the depth to which the site need remediation (to minimize impacts due to legacy waste and leachate) and type of remediation required by conducting bore and auger test and test pit, or standard penetration tests or other suitable means ▪ Provision of appropriate PPE's to the team undertaking the site assessments ▪ Ensure that waste samples are taken in a manner that does not greatly disturb the matrix of the existing waste mound. Ensure proper barricades while working on the pit and proper backfilling of test pits ▪ Care should be maintained, especially when working on the slopes to ensure further failures do not occur due to the height of the mound. ▪ Plan for machinery operated which will be operated by skilled operators at all times. ▪ Arrange adequate PPEs full-body suits, masks helmets, boots and gloves, and heat protection equipment to avoid exposure with raw decomposing waste material, which can be at higher temperatures.	Technical consultant, ULB	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Excavation work shall be planned and scheduled with information to concerned authorities and host communities – to follow a sequenced manner, to avoid ad-hoc exposed areas of the waste mound		
3	Absence / Delay in Permissions for Developing the biomining facility and associated works as per National regulations	▪ Required permissions for undertaking biomining at the existing dumpsite and assessments conducted for undertaking biomining as per existing Laws, Regulations; including for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labor Laws, before the start of works on site	Contractor, ULB	SPMU
4	Dust impacts due to Site Preparation *(Air Pollution) and Visual Blight due to excavation*	▪ Plan to Provide temporary high screen, buffers around the site before the start of work to curtail dust emissions ▪ Arrange a green belt as early as possible on the area of the site with no / less dump. Schedule use of bioremediation soil/compost from site to grow the green belt (preferably fast-growing thick canopies of indigenous trees, shrubs in layers)	Contractor	SPMU
5	Material sourcing, transport, and stacking of construction materials *(Occupational Health and Safety issues and Air noise pollution)*	▪ Prior intimation to neighbors on proposed construction activities, timings, emergency contacts, grievance mechanism ▪ Prior intimation to nearby Primary Health Centre on work activities need for medical support, emergency support needs, type of laborers on-site and labor camp if any ▪ Materials shall be sourced only from approved quarries ▪ Material shall be transported only in closed trucks with PUC certificates, with water sprinkling if required to curtail dust emissions. ▪ The driver should be with required license and follow speed regulations ▪ Materials shall be transported preferably through well-surfaced roads. If road it kuchcha, water sprinkling shall be done to prevent dust emission before and after truck passes ▪ Material transport and unloading activities should not result in noise disturbance to locals and should be during day time ▪ Materials shall not be spread around on site. It shall be properly stored/stacked following good housekeeping practices (labeling, properly arranged); in covered sheds to prevent loss of strength and loss of material. Material storage shall not result in any harm to workers or visitors. ▪ Provide vehicle wheel wash area on site ▪ Workers to be provided with Personnel Protection Equipment (PPE) including safety boots, jackets, ear muffs, gloves. ▪ Proper rest area on site shall be provided with water, first aid, toilets	Contractor	SPMU
6	The layout of Labour camp *(Impacts on Air, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters) ▪ It should not be provided on-sites it is a waste dumping yard compound	Contractor	Site engineer of SPMU, Labour Commissioner, PCB

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Camp must not be provided in an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and livable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, and waste collection/management systems, etc ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security (Refer ECOP)		
7	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc. especially in case of providing support facilities *(Impacts on Fauna / Flora)*	▪ Ensure site selection for support facilities or activities based on the screening checklist and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimize, Mitigate, Reduce. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board, SCZMA ▪ Identify appropriate government site to avoid land acquisition and resettlement impacts ▪ Covered and well-marked storage area for excavated wastes and washing, segregation of the same are to be arranged near the dump	Contractor	SPMU
8	Contamination of groundwater due to leaching.	▪ During the excavation, ensure appropriate design provisions (based on hydrogeological aspects as well) are made for liners, lined drains for leachate collection and leachate treatment facilities to prevent percolation of leachate. Wherever excavated material is stored, it shall be kept on the platform with garland drain to collect leachate and direct it to the treatment plant	Contractor	SPMU
9	Nuisance hazards to neighboring areas	▪ Ensure proper design and adequate compound wall; high screen during construction, buffer zones and thick green belt to comply with SWM Rules, 2016 and other PCB requirements ▪ In case of waste mound and site edges are sliding or unsafe; provide engineered retention walls.	Contractor	SPMU
B	**Construction / Implementation stage**			
Implementation of biomining of the dumpsite				
1	Impact due to the vehicular movement *(Air and noise environment)*	▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient air quality standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided.	Facility operator	SPMU
2	Impact due to the use of construction equipment	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats.	Facility operator	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	(Air and Noise)	▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites within 150 m of sensitive receptors and settlement areas construction to be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.		
3	Impact during the construction activities *(water environment)*	▪ Construction work close to water bodies should be avoided during monsoon. ▪ Labour camps are to be located away from water bodies. ▪ Vehicle washing or maintenance near water bodies are to be avoided. ▪ Contaminated water from construction activities carrying soil, cement wash, etc shall not be allowed to flow out of the site. It shall be contained and treated on site.	Facility operator	SPMU
4	Leachate and Runoff from biomining activities *(Soil contamination and groundwater contamination)*	▪ Provide site cut off drain around the site to divert off stormwater from entering the site, washing the same and contaminating downstream resources ▪ Ensure stormwater drains well led to drain outlets on roads adjoining the dump yard ▪ Provide leachate drains – lined – from probable leachate pool areas (based on site geography or slope) and carry it to the leachate treatment area ▪ Provide tertiary treatment of leachate and site stormwater in a constructed wetland in the site or other arrangements. Treated water/leachate shall be stored for reuse in greenery or for wash purposes (Initiate green belt development on-site parts which will not be impacted by biomining activities) ▪ The quality parameters for recycling and reuse applications must be BOD/TSS less than 10 mg/L and Total Coliform less than 230 MPN/100 ml in treated water. The treated water quality needs to be tested at prescribed regular intervals. The treated water quality needs to comply with the latest standards prescribed by the KSPCB/CPCB. ▪ The storage areas of the facility should have a leachate barrier system that forms a secure barrier between the groundwater, soil, and substrata ▪ Design and maintain the slope and orientation of leachate drains such that free drainage of leachate to a collection drain is facilitated and ponding of leachate is avoided; shape the piles and windrows to maximize runoff and hence reduce infiltration ▪ Provide channels to collect leachate around heaped waste windrows (for air contact or enhancing natural drying) and provide cut off drain around all work areas with collection facility for leachate at the lower gradient and channelizing to the leachate treatment plant	Facility operator	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Plan the works on-site only during non-rainy seasons and to complete the works before rains ▪ The storage areas of the facility should have a leachate barrier system that forms a secure barrier between the groundwater, soil, and substrata ▪ Design and maintain the slope and orientation of windrows of mined wastes and/or leachate drains such that free drainage of leachate to a collection drain is facilitated and ponding of leachate is avoided; shape the piles of mined waste and waste windrows to maximize runoff and hence reduce infiltration; ▪ Store leachate aboveground storage tanks, and provide for emergency containment additionally		
5	Soil decontamination activities (impact on leachate, odor)	▪ Decontaminate the soil / stabilized layers remaining after sieving out wastes using windrow and bio culture or appropriate means ▪ Vegetative layer using contaminant absorptive root varieties like Vetiver may be tried on soil and along the edge of the green belt or floating wetlands may be deployed in water channels nearby to maximize absorption of leachate in the soil by root-zone phytoremediation. ▪ Soil and water testing shall be done and changes in contamination shall be noted.		
6	Excavation of waste from the waste mound *(Health and safety impacts)*	▪ The contractor will ensure that waste excavation is conducted in a manner that does not greatly disturb the matrix of the existing waste mound. ▪ Care should be maintained, especially when working on the slopes to ensure further failures do not occur due to the height of the mound. ▪ Machinery operated for excavation should be operated by skilled operators at all times. ▪ Workers working on machinery and site during excavation should be geared with full-body suits preferably of fluorescent color, masks helmets, boots and gloves, and heat protection equipment to avoid exposure with raw decomposing waste material, which can be at higher temperatures. Proper harness and toes shall be used considering slipping possibility on wastes. ▪ Excavation work shall be carried out in a sequenced manner, to avoid ad-hoc exposed areas on the waste mound ▪ In case of the waste mound and site edges are sliding or unsafe; provide engineered retention walls or string boundaries. ▪ When stockpiled, wastes mined out should be covered and with garland drain to collect leachate and channelize it to the leachate treatment plant.	Facility operator	SPMU
7	Transportation of wastes or retrieved or other material in overloaded and open vehicles *(Air, Odour nuisances; spills and littering impacts on Air, Water, Land)*	▪ All vehicles shall carry only approved load of weight as per SOP ▪ Regular cleaning of roads & drains and removal of spills if any. ▪ All Transport vehicles shall be covered ▪ Ensure provisions of SWM Rules 2016 for all waste / retrieved material Transportation activities	Facility operator	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
8	Spreading and compaction of waste *(Safety)*	▪ Follow technical details suggested by the contractor ▪ The active working face should be minimized as much as practical an appropriate size is about 2 to 3 times the width of the compactor vehicle. ▪ Waste should be spread and compacted in layers not greater than 0.6m (2ft.) after compaction. ▪ Compaction of the waste should be on a slope of about 20-30% as guided via the permissible levels and worked from the bottom of the slope to the top	Facility operator	SPMU
9	Occupational health and safety impacts of the workers during the construction of support facilities: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals. ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms;	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police. ▪ A work permit system will be implemented for all works related to working at heights (typically when working over 2m and above) and for hot jobs; · ▪ All works related to working at heights will be undertaken only during the daytime when sufficient sunlight is available; ▪ Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as handrails and toe boards to prevent materials from being dislodged will be done; ▪ All excavation activities will be conducted in supervision of the site contractor; ▪ Proper signage and lights will be provided in places of excavated areas.		
10	Capping of part of bio mined yard with rejects and inerts	In the absence of other facilities like landfills to take care of rejects/inerts; these have to be closed and capped in a small portion of the retrieved site. These shall be compacted and capped scientifically within a designated area, as per the following activities: ▪ Provision of retaining wall ▪ Provision of a geosynthetic liner of compacted clay or amended soil (k <10- cm/sec) of 60 cms thickness, or as per design ▪ Provision of drainage layer with gravel of about 45 cms thickness with HDPE perforated pipes for venting of gas, ▪ Provision of the surface layer (30 cm thick topsoil) for vegetation and erosion control, ▪ Leachate collection system with sump and pump ▪ Leachate treatment as per the required disposal standards for post-closure period ▪ Provision of surface drains all around the final closure area ▪ Landscaping of the closed landfill with vegetation growth, wall creepers, etc.	Contractor/Facility Operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Post closure monitoring		
11	Construction of new facilities in retrieved land	▪ Refer Corresponding EMPs: for Landfill, Treatment Plants, and ECoPs in Section 07.		
12	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU
C		**Operation& Maintenance Phase**		
1	Impacts due to vehicle movement for new activities: MCF/MRF, RRFs, Treatment plant, landfill cell *(Air, water environment, a nuisance to communities, Health impacts)*	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely transfer and disposal of retrieved material shall be carried out by vehicles and should transfer materials only to designated areas as per design ▪ No waste or material shall be disposed in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas.	Facility operator	SPMU
2	Exhaust emissions *(Air impacts)*	▪ No idling of vehicles on site. ▪ Regular maintenance of heavy equipment used at the site and waste hauling vehicles to ensure their exhaust emissions meet the emissions standards prescribed	Facility operator	SPMU
3	Plying of vehicles through kutcha / unsurfaced roads and idling *(Air pollution: SPM, CO, CO2)*	▪ Vehicle movement shall be well planned – through topped roads. In case of necessity to move through Kutcha roads, ensure sprinkling of water to suppress dust before and after the movement of the vehicle	Facility operator	SPMU
4	Odor *(Nuisance, Air)*	▪ Daily soil covers to compacted wastes to manage odors. ▪ Waste with a strong odor to be covered immediately they are emptied from delivery vehicles; ▪ Control and manage leachate treatment plant to minimize odor.	Facility operator	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Adhere to air quality regulations with quarterly air quality monitoring Maintenance of the buffer zone and protective berms ▪ Provide buffers screens to curtail odor from reaching surrounding communities		
5	Impact on the ambient noise quality during the operations *(Noise, nuisance to sensitive receptors, health impacts)*	▪ Strictly adhering to designated working hours (day time); Sensitizing construction truck drivers and equipment operators to switch off idle engines; ▪ Using modern, well-maintained and regularly serviced vehicles; ▪ Ensuring that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels. ▪ Provision of earmuffs and ear protection to workers and employees in high noise areas	Facility operator	SPMU
6	Occupational health and safety impacts of the workers: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of materials/rejects • Allergies from pathogen and airborne dust *(Air environment, Health impacts)*	▪ All centers of labor contact points shall be provided with First Aid and other related activities. ▪ Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. ▪ An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. ▪ Adequate manpower manager staff shall listen and act upon the manpower related grievances. ▪ Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles ▪ Provide non-slippery work areas ▪ Proper training will be provided regarding the maintenance of Health ▪ Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; ▪ First aid facilities will be available at accessible places. More than one first aid station if the site is large ▪ Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps ▪ Routine inspections, housekeeping, and maintenance will be carried out at regular intervals ▪ Measures such as deferred timings and stretch break to be adopted ▪ Secure all installations from unauthorized intrusion and accident risks; ▪ Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted ▪ Ensure the visibility of workers through their use of high visibility vests when working in or	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back -up alarms; ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover ▪ Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent ▪ While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. ▪ While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. ▪ Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
7	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Environmental Monitoring Plan for biomining of the dumpsite

Monitoring media/parameters	Items and parameters	Frequency	Location
Leachate	• pH • Biological Oxygen Demand- BOD • Chemical Oxygen Demand-COD • Nitrogen (Ammonia, Nitrate, Nitrite) • Oxidation-Reduction Potential- ORP • Electrical Conductivity-EC • Total Organic Carbon (TOC) Dioxins	Quarterly	1 point per leachate pond
Gas Accumulation at Disposal Site	• Oxygen (O2) • Nitrogen (N2)	Gas monitoring should be conducted at least twice a day for about 7 consecutive days' post-	North, South, East, Center, and West (5 points) on top of closed mound) 8 points,

Monitoring media/parameters	Items and parameters	Frequency	Location
	• Methane (CH2) • Carbon anhydride (CO2) • Hydrogen sulphide (H2S) • Temperature	closure. Then onwards 4 times, monthly or as stipulated in the detailed monitoring plan as appropriate to the site.	North, South, East, West and 3 additional midpoints around the perimeter of the base
Soil subsidence	The topographic level at the top of the disposal site	Bi-Annually	Top of the closed mound
Groundwater quality	Parameters will be defined and sampling, preservation, and analysis of water will be carried out following those stipulated in the subsections below and Standards Methods for Testing Water and wastewater, 21st edition, published by American Public Health Association (2005).	Quarterly	8 points
Surface water quality		Quarterly	6 points. 2 upstream and 4 downstream

Groundwater Monitoring:

- Wells for groundwater monitoring should be installed to determine the rate and direction of flow, permeability, and if groundwater contamination is occurring. The monitoring wells should be installed: (a) Above the gradient of the site to monitor background/baseline water quality; (b) down Below the gradient of the site (areas that may have been impacted by the dumpsite), and (c) Areas between the site and any other possible sources of contamination.
- For an open dumpsite classified as large (over 10feet in height and 500m in surface area covered) it is recommended that at least 8 sampling wells should be installed: 2-3 up the gradient, and 3- 5 down gradient. For analysis purposes, it is important to install and sample wells before the dumpsite remediation to determine the background quality of the groundwater. This will help establish a statistical baseline against which future measurements are taken to determine contamination or trends in the analysis.
- Monitoring should be conducted at regular frequencies to observe any changes in the quality of the groundwater downgradient of the landfill that may indicate contamination. Standards for monitoring frequencies and criteria are stipulated in the table above.
- Parameters that are at minimum monitored are Arsenic, Cyanide, Selenium, total organic carbon (TOC), Barium, Hardness (as CaCO3), Silver, total dissolved solids (TDS), Sodium, Manganese (dissolved), Magnesium, chemical oxygen demand (COD), Cadmium, Sulfate (SO4-), Potassium, Iron, Calcium, Electrical Conductivity, Lead, VOCs, Chloride, Bicarbonate (HCO3-)), Sodium, pH, and Chromium.

P. Indicative EMP for Common Bio-Medical Waste Treatment and Disposal Facility

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for Centralized Biomedical Waste Treatment Facility (CBMWTF)***			
1	Absence / Delay in Permissions for Developing the Centralized Biomedical waste Treatment (CBMWT) facility and associated works as per National regulations, WBG EHS on Health Care Facilities	▪ The design shall follow BMW Rules, 2016, and Revised CPCB Guidelines for Common Biomedical Waste Treatment Facilities. Suggested Treatment mechanism for different fractions of BMW and WBG EHS Guidelines for Health Care Facilities ▪ Obtain requisite permissions for Land, assessments for the CBMWTF as per Biomedical waste management rules, 2016 and other Regulations; for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labour Laws, before the start of works on site	Contractor	PIU
2	Weighbridge and Record-Keeping and arrangements for other waste types	▪ The facility shall plan a weighbridge and record-keeping of incoming biomedical waste type ▪ Bio-medical waste shall not be mixed with other wastes. Bio-medical waste shall be segregated into containers/bags at the point of generation as per their respective categories. ▪ Bio-medical waste shall not be stored for more than 48 hr	Contractor	PIU
3	Dust impacts due to Site Preparation (Air Pollution) and Visual Blight due to construction	▪ Plan to Provide temporary high screen around the site before the start of work to curtail dust emissions	Contractor	PIU
4	Transportation of materials for construction of the facility (dust emissions, Occupational Health and Safety issues and Air, noise pollution)	▪ Plan movement of vehicles through well-surfaced roads. In case of dusty/unsurfaced roads, arrange to sprinkle water before and after movement ▪ Consider less honking and noise levels especially near settlements and sensitive areas ▪ Drivers shall have licenses and should ensure safe driving ▪ Vehicles shall be well maintained and with valid Pollution under Control Certificates	Contractor	PIU
5	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc	▪ Ensure site selection based on the Rules, screening checklist, and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimise, Mitigate, Reduce, Offset. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board ▪ Identify appropriate government site to avoid land acquisition and resettlement impacts	PIU	SPMU
6	The layout of Labour camp *(Impacts on Sir, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp and health check-ups shall be arranged ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters)	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ It should not be provided on-site if it is an existing Waste or Sewage Treatment facility or an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and liveable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, and waste collection/management systems, etc. Separate facilities shall b ensured for male and female workers. ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security		
7	Loss of tree cover	▪ Clearing and grubbing to be done only on the required surface & just before the start of activity on that section. In case of a time gap, water should be sprinkled regularly until the start of the next activity. ▪ Avoid tree felling as much as possible. Follow national regulation / applicable procedures for the replanting of trees. Tree felling permission shall be obtained from the forest department / local body under applicable Acts. ▪ Compensatory plantation shall be planned to be undertaken at prescribed rates (preferably 10 times of the number of trees cut) ▪ Plan to use native species in consultation with the communities, Forest Department, Local Bodies	Contractor	PIU
B	**Construction / Implementation stage**			
	Site Development and construction of the facility			
1	Vegetation clearance for site development	▪ Clearing and grubbing should be avoided beyond that which is directly required for construction activities. ▪ The next activity to be planned/started immediately, to avoid dust generation and soil erosion during monsoon. ▪ Turfing/ re-vegetation to be started soon after completion of embankment	Contractor	PIU
2	Soil Erosion from site leveling due to the loose earth being left out from construction before the onset of monsoon (impact on the air environment and noise environment)	▪ Plan the activities so that no bare/loose earth surface is left out before the onset of monsoon. For minimizing soil erosion, the following preventive measures are to be taken: ▪ Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of sub-base layer, scarification, etc. ▪ Topsoil from borrow area, debris disposal sites, construction site to be protected /covered for soil erosion. ▪ Debris due to excavation for foundations, dismantling of existing cross drainage structure shall be removed from the watercourse immediately.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
3	Alteration of drainage during site development (impact on the water environment)	▪ Stormwater shall be diverted away from the site through peripheral drains ▪ Diversions should be constructed during the dry season, with adequate drainage facility, and will be completely removed before the onset of monsoon. ▪ Debris generated due to the excavation of foundation or due to the dismantling of the existing structure should be removed from the watercourse. ▪ Silt fencing has to be provided on the mouth of discharge into natural streams. ▪ Continuous drain (lined/unlined) is provided obstruction if any, to be removed immediately.	Contractor	PIU
4	Impact on the air and noise environment due to the vehicular movement	▪ The site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation. ▪ The approach and or internal roads shall be concreted or paved to avoid the generation of dust particles due to vehicular movement and shall be so designed to ensure the free movement of vehicles and other machinery. ▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient air quality standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided. ▪ Regular checking and maintenance of vehicles should be ensured (valid PUC) ▪ For long-distance transportation overhaul routes to be judiciously selected ▪ No parking outside the plant premise, Earmarked areas for parking vehicles within the premise ▪ Smooth movement of incoming & outgoing vehicles/trucks	Contractor	PIU
5	Impact on the air from and noise environment due to the use of construction equipment	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats. ▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites within 150 m of sensitive receptors and settlement areas construction to be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.	Contractor	PIU
6	Impact on the water environment during the construction activities	▪ Construction work close to water bodies should be avoided during monsoon. ▪ Labour camps are to be located away from water bodies.		PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Car washing/workshops near water bodies are to be avoided. ▪ Proper cut off drains to check runoff from the site	Contractor	
C		**Operation& Maintenance Phase**		
1	Storage and Collection of BMW	▪ The collection and transportation of bio-medical waste shall be carried out in a manner to avoid any possible hazards to human health and the environment. ▪ The wastes shall be segregated and securely stored color-coded containers in Health Care Units as per the provisions of the Bio-medical Waste Rules, 2016 without spillage or disturbance due to pests, rains/flooding, movement, or other factors. Follow plastic Ban prevailing in the State and use approved materials ▪ Health care units shall be trained to store the waste as per BMW Rules 2016 ▪ All types of segregated biomedical waste from different hospitals shall be collected daily. The segregated waste will be brought to the common collection point within the hospital premises. It is then weighed and loaded into the trucks.	Health Care Units, Facility Operator	PIU
2	Transportation of biomedical waste (dust emissions, Occupational Health and Safety issues and Air, noise pollution)	▪ Movement of vehicles shall be through well-surfaced roads. In case of dusty/unsurfaced roads, arrange to sprinkle water before and after movement ▪ The bio-medical waste collected in colored containers shall be transported to the CBWTF in a fully covered vehicle. ▪ Vehicles shall be dedicated to the transportation of biomedical waste only. ▪ The vehicle provided shall be covered and secured against accidental opening of the door, leakage/spillage, etc ▪ Vehicles shall be with separate cabins for driver/staff and biomedical waste cabin in the vehicle. ▪ The base of the waste cabin of the vehicle shall be leak-proof and easy to wash. ▪ The inner surface of the waste cabin is made of smooth surfaces to minimize water retention. ▪ The vehicles are properly labeled with the symbol of Biohazard as per schedule IV of the BMW (M&H) Rules, 2016, and display the name, address, and telephone number of the company. ▪ The waste cabin has sufficient opening from the rear so that Bio-Medical waste can be easily loaded and unloaded. ▪ The vehicles have to be provided with the First Aid Kit to handle emergencies. ▪ Mobile phones are given at all the vehicles for effective supervision and monitoring of collection and transportation work	Facility Operator	PIU
3	Storage of untreated waste (Impacts on Soil, Air, Water, other components, infections)	▪ The proposed CBMWTF shall have a storage area above the flood level. The storage building shall be an enclosed structure with sufficient ventilation. ▪ The biomedical waste can be directly stored in dumper containers with lids of suitable size. The storage area will be at the entry point of the CBWTF to unload and store all biomedical wastes that have been transported to the facility by vehicle.	Facility Operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
4	Storage of treated waste (Impacts on Soil, Air, Water, other components, infections)	▪ After autoclaving, the wastes shall be segregated and stored in the treated waste storage area. ▪ Plastic waste, metals, the glass will be stored separately. ▪ Waste having recycle value will be sold to registered or authorized recyclers	Facility Operator	PIU
5	Air emissions from the vehicular emissions and operation of the incinerator and other equipment at the facility	▪ The height of all the stacks will be as per the statutory requirement. Incinerator stack will have a stack monitoring facility (SMF) consisting of sampling port-hole, platform, and access ladder. ▪ Adequate spares of critical components of dust collection systems will be kept to ensure trouble-free operations and continuous compliance to emission norms. ▪ Transport vehicles will be properly maintained to reduce air emissions. ▪ Vehicles will be periodically checked for pollutant emissions against stipulated norms. ▪ Idle running of vehicles will be minimized during material loading/unloading operations. • Air Pollution Control System (APCS) will be for final flue gasses trapping. The unit will further bring down the pollution level in emission within specified limits set out by the Pollution Control Board. The venturi scrubber and droplet separator shall be provided as one unit. A lean concentration of NaOH solution and water will be used to neutralize the flue gasses/solutions. • Ambient Air Monitoring shall be ensured for various parameters at the site and surroundings. Respirable dust samples shall be collected and analyzed periodically to ensure that the dust concentration limit is contained within the allowable limits • Water Dumpers, sprinklers are deployed for water spraying. • Tree plantation around the facility area and along the roads.	Facility operator	PIU
6	Odor issues during the operations	▪ It shall be ensured that the total time taken from the generation of bio-medical waste to its treatment, which also includes collection and transportation time, shall not exceed 48 hours. ▪ During transportation, the containers should be covered to prevent exposure of the public to odors and contamination. ▪ Good housekeeping practices. ▪ Dilution of odor concentration by spraying appropriate disinfectants, odor control agents ▪ Plantation of trees to reduce the odor and to carry out the process in a closed room for controlling/minimizing odor	Facility operator	PIU
7	Impacts due to vehicle movement	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to friction	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ For long-distance transportation overhaul routes to be judiciously selected. The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely processing & disposal of waste shall be carried out by vehicles and should transfer waste only in the specified Secondary Collection Point or secondary collection vehicle or treatment disposal yards planned. No waste shall be disposed of in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas. ▪ Regular checking and maintenance of vehicles should be ensured (valid PUC) ▪ No parking outside the plant premise, Earmarked areas for parking vehicles within the premise ▪ Smooth movement of incoming & outgoing vehicles/trucks shall be ensured; without conflicts with other land uses/activities.		
8	Impact on water environment during the operation of incinerator and autoclave, ETP	▪ Wastewater generated from air pollution control devices/ vehicle and floor wash etc. shall be treated in in-house ETP and shall be reused in APCDs. ▪ Proper and sufficient sanitary facilities will be provided to workers to maintain hygienic conditions at the site. The sewage is disposed of by the septic tank followed by a soak pit. ▪ Philosophy of maximum use of treated wastewater within the plant should be adopted to minimize consumptive water requirements and to achieve “zero” effluent discharge from the plant. ▪ Adequate spares for effluent collection, handling, treatment, and disposal system shall be maintained. ▪ Proper housekeeping shall be adopted to prevent spillages and contaminated surface runoff going to stormwater drains. ▪ The performance of the ETP must be closely monitored to assess the effluent loads from the facility, considering the heavy rainfall in the region and to assess the impacts due to biomedical waste disposal at the site. ▪ Modulator construction of the ETP to be considered to enable add-on of modules at a later date without disrupting operations.	Facility operator	PIU
9	Noise emissions from the vehicular movement and operation of the incinerator, DG set	▪ Prepare Noise Mitigation Plan (NMP) which addresses management and mitigation strategies to prevent an environmental nuisance caused by construction/demolition/ recycling activities impacting ambient noise levels. ▪ To control the noise regular preventative maintenance of equipment to be carried out. Regular and proper maintenance of noise-generating machinery to avoid noise increase ▪ Equipment to be kept and maintained in proper condition to keep the noise level within 75 dB(A). ▪ Periodical monitoring of noise will be done to adopt corrective actions wherever needed including maintaining equipment well, providing acoustic enclosures	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ Earplugs, earmuffs to be made available to workers during the operational hours ▪ Maintain records of equipment/machinery maintenance ▪ Equipment to be provided with padding and noise calming mechanisms to reduce noise output or if feasible high noise-producing activities may be in special noise-dampening enclosures ▪ Maintain records of monitored noise levels and complaints on noise ▪ Comply with Consent conditions issued by State Pollution Control Boards / PCCs and concerned authority ▪ The provision of green belt and plantation would further help in attenuating noise. ▪ Comply with Consent conditions issued by State Pollution Control Boards / PCCs and concerned authority		
10	Impact on the land and water environment due to the solid waste (ash, sludge from ETP) generation from the facility	▪ Cut off drains shall prevent rainwater from passing through the site, flood effects, and ensure no wastes or materials from the site contaminates the environment ▪ Solid wastes shall be generated in the form of Incineration ash from Incinerator, ETP sludge from the ETP process, and used oil from the plant utility. Following steps shall be taken: ○ Incineration Ash from incinerator will be temporarily stored at ash storage pit and finally, it will be disposed to the nearest authorized TSDF site. ○ ETP sludge will be sent to authorized TSDF site ○ Used oil will be properly stored and it will be re-used as lubricants in the machinery within the premises only. ○ Record of solid waste generation and disposal shall be maintained. ○ All necessary precautions shall be taken during handling, loading, and unloading of solid waste.	Facility operator	PIU
11	Sanitary Landfill	• If the project includes a landfill for disposal of incinerated ash, it can use the ESMP on Landfills in this Document	Facility Operator	PIU
12	Microbiology & Biotechnology waste and other medical waste.	• Disinfection at source by chemical treatment or Autoclaving/microwaving followed by mutilation/shredding and after treatment final disposal in secured • Waste sharps - Disinfection by chemical treatment or destruction of the needle and tip cutters autoclaving/microwaving followed by mutilation/shredding and after treatment final disposal in a secured landfill or designated concrete waste sharp pits. • Discarded Medicine and Cytotoxic Drugs shall be disposed of in a secured landfill or incineration. Infectious Solid Waste shall be disinfected by chemical treatment or Autoclaving followed by shredding and after treatment final disposal in through registered or authorized recyclers • Chemical Waste: Chemical treatment and discharge into • drains meeting the norms of Biomedical Rules and solids disposed of in secured landfill	Facility Operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
13	Fire Safety (Health and Safety, risks to properties, communities, workers)	▪ Proper risk assessment and Disaster management plan (DMP) and Emergency Response plan shall be in place. ▪ A well-laid firefighting system and fire extinguishers to be installed as per fire safety norms. ▪ Regular fire safety training shall be conducted. ▪ Road/Fire Safety Week/National Safety Day/ Safety Week Celebrations are observed to improve safety consciousness.	Facility Operator	PIU
14	Occupational health and safety impacts of the workers: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants. • Accidental spillage by moving vehicles. • Cut & Bruises during handling of Waste. • Allergies from airborne dust	▪ Adequate protection measures to be provided against occupational health hazards ▪ All workers shall be given necessary training in handling the biomedical waste and treatment equipment before joining their job. Pre-placement medical examination, periodic examination, and immunization for all the workers shall be provided. ▪ All worksites, laborers/employees shall follow WHO/WB/CPCB/SPCB/State /ULB guidelines on works, heath, and sanitation during COVID 19 • All centers of labor contact points shall be provided with First Aid and other related activities. • Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. • Material handling shall be with proper care. While materials are being dumped, no person shall be allowed near dumpers or skips • An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. • Adequate manpower manager staff shall listen and act upon the manpower related grievances. • Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles • Provide non-slippery work areas • Proper training will be provided regarding the maintenance of Health • Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; • First aid facilities will be available at accessible places. More than one first aid station if the site is large • Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps • Routine inspections, housekeeping, and maintenance will be carried out at regular intervals • Measures such as deferred timings and stretch break to be adopted • Secure all installations from unauthorized intrusion and accident risks;	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		• Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back -up alarms; • Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and well known to, and easily understood by workers, visitors, and the general public as appropriate; • All workers shall be registered as per prevalent labor laws (including a workforce of subcontractors) and provided insurance cover • Workers and their kith and kin shall be suitably informed about the registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent • While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. • While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. • Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
15	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Q. Indicative EMP and Monitoring Plan for Construction and Demolition (C&D) Waste Processing Facility

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
A		**Pre-Construction/Activity or Planning Stage**		
1	***Planning for C&D waste processing facility***			
1	Absence / Delay in Permissions for Developing the C&D waste storage and processing facility and associated works as per National regulations	▪ Required permissions for Land, assessments for the C&D waste processing facility as per C&D waste management rules, 2016, Regulations; including for associated infrastructure, DG Sets, Consent to Establish; and other licenses including those as per Labour Laws, before the start of works on site	Contractor	PIU
2	Weighbridge and Record-Keeping and arrangements for other waste types	▪ The facility shall plan a weighbridge and record-keeping of incoming wastes – type wise - and outgoing materials ▪ Soil shall be accepted only on confirmation - certificate on non-hazardous content shall be produced at source or entry gate (if bring-in system) ▪ Tube lights, asbestos, batteries, mercury-containing wastes, etc; (if encountered) will not be allowed into the C&D facility. In case these find the entry, these shall be stored in appropriate receptacles in designated areas of the site pending collection by an authorized waste contractor. There shall be an agreement with TSDF / other facility providers for their disposal	Contractor	PIU
3	Dust impacts due to Site Preparation (Air Pollution) and Visual Blight due to construction	▪ Plan to Provide temporary high screen around the site before the start of work to curtail dust emissions	Contractor	PIU
4	Transportation of C&D waste (dust emissions, Occupational Health and Safety issues and Air noise pollution)	▪ Material shall be transported only in closed trucks with PUC certificates, with water sprinkling if required to curtail dust emissions. ▪ The driver should be with the required license and follow speed regulations ▪ Materials shall be transported preferably through well-surfaced roads. If the road is kuchcha, water sprinkling shall be done to prevent dust emission before and after truck passes ▪ Material transport and unloading activities should not result in noise disturbance to locals and should be during day time ▪ Materials shall not be spread around on site. It shall be properly stored/stacked following good housekeeping practices (labeling, properly arranged); in covered sheds to prevent loss of strength and loss of material. Material storage shall not result in any harm to workers or visitors. ▪ Provide vehicle wheel wash area on site ▪ Workers to be provided with Personnel Protection Equipment (PPEs) including safety boots, jackets, ear muffs, gloves. ▪ Proper rest area on site shall be provided with water, first aid, toilets	Contractor	PIU
5	Design / Layout finalization	▪ Location to be preferably in industrial areas; 200m from industrial/commercial property, 100 m from the bank or high water mark of	PIU	SPMU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		any watercourse or wetland/pond/lake, 150 meters of the right-of-way boundary of a public highway; 50 meters from any other adjacent property; not in CRZ areas or flood plains, other protected areas, sensitive receptors. Provide setbacks as suggested by PCB ▪ Layout to include Weighbridge, office, employee amenities, truck and vehicle parking, waste receiving and storage area, waste processing section: crushing, screening, washing, grading, processed material storage yard; water treatment facilities, material and spares store, value-added products manufacturing area, etc. ▪ Site and surroundings shall be considered while planning, so that nearby sensitive receptors are not / minimally impacted by air (mainly dust), water, and noise pollution ▪ Provide offices, employee amenities closer to any sensitive receptors; provide thick green belt around the facility ▪ Processing or recycling site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation. ▪ The approach and or internal roads shall be concreted or paved to avoid the generation of dust particles due to vehicular movement and shall be so designed to ensure the free movement of vehicles and other machinery. ▪ Provisions of a weighbridge to measure the quantity of waste brought at the landfill site, fire protection equipment, and other facilities as may be required shall be provided. ▪ Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided and Safety provisions including health inspections of workers at landfill sites shall be carried out made. ▪ To prevent pollution from processing or recycling operations, the following provisions shall be made, namely: ▪ Provision of stormwater drains to prevent stagnation of surface water; ▪ Provision of paved or concreted surface in selected areas in the processing or recycling facility for minimizing dust and damage to the site. ▪ Prevention of NOISE pollution from processing and recycling plant ▪ provision for treatment of effluent if any, to meet the discharge norms as per Environment (Protection) Rules, 1986. ▪ Work Zone air quality at the Processing or Recycling site and ambient air quality at the vicinity shall be monitored. ▪ The measurement of ambient noise shall be done at the interface of the facility with the surrounding area, i.e., at the plant boundary. ▪ Buffer Zone to be maintained around the facility as per rules or in consultation with PCB		

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
6	Nearness/disturbance to sensitive areas such as forests, wildlife habitations, etc	▪ Ensure site selection based on the screening checklist and the master plan of the region, to avoid sensitive areas. Follow mitigation hierarchy – Avoid, Minimise, Mitigate, Reduce, Offset. Obtain requisite permissions from respective authorities such as Department of Environment and Forests, Pollution Control Board ▪ Identify appropriate government site to avoid land acquisition and resettlement impacts	PIU	SPMU
7	The layout of Labour camp *(Impacts on Sir, Water, Land, Fauna/Flora, Socio-economic)*	▪ Labour camp layout, design and material/fire safety plan shall be approved by site engineer before start of construction of the camp ▪ Nearby health center shall be informed about the labor camp ▪ Materials used for the camp shall be safe (from corrosion, fire/flood/other manmade and natural disasters) ▪ It should not be provided on-site if it is an existing Waste or Sewage Treatment facility or an area prone to Hazards ▪ Camp should be adequately at higher plinth levels to prevent water intrusion ▪ Rooms shall be of appropriate sizes with adequate ventilation and livable temperature/other conditions and facilities like proper beds, storage areas, common kitchen when the wood is not used as a fuel (better to use LPG) ▪ Proper facilities shall be provided at the camp including food and common entertainment facilities, crèche, toilets with proper septic tanks, washing area, wastewater, and waste collection/management systems, etc ▪ The camp shall be planned to be maintained in good clean hygienic conditions and shall have outdoor seating areas, greenery, security	Contractor	PIU
8	Loss of tree cover	▪ Clearing and grubbing to be done only on the required surface & just before the start of activity on that section. In case of a time gap, water should be sprinkled regularly until the start of the next activity. ▪ Avoid tree felling as much as possible. Follow national regulation / applicable procedures for the replanting of trees. Tree felling permission shall be obtained from the forest department / local body under applicable Acts. ▪ Compensatory plantation shall be planned to be undertaken at prescribed rates (preferably 10 times of the number of trees cut) ▪ Plan to use native species in consultation with the communities, Forest Department, Local Bodies	Contractor	PIU
B	**Construction / Implementation stage**			
	Site Development and construction of the facility			
1	Vegetation clearance for site development	▪ Clearing and grubbing should be avoided beyond that which is directly required for construction activities. ▪ The next activity to be planned/started immediately, to avoid dust generation and soil erosion during monsoon.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Turfing/ re-vegetation to be started soon after completion of embankment		
2	Soil Erosion from site leveling due to the loose earth being left out from construction before the onset of monsoon (impact on the air environment and noise environment)	▪ Plan the activities so that no bare/loose earth surface is left out before the onset of monsoon. For minimizing soil erosion, the following preventive measures are to be taken: ▪ Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of sub-base layer, scarification, etc. ▪ Topsoil from borrow area, debris disposal sites, construction site to be protected /covered for soil erosion. ▪ Debris due to excavation for foundations, dismantling of existing cross drainage structure shall be removed from the watercourse immediately.	Contractor	PIU
3	Alteration of drainage during site development (impact on the water environment)	▪ Stormwater shall be diverted away from the site through peripheral drains ▪ Diversions should be constructed during the dry season, with adequate drainage facility, and will be completely removed before the onset of monsoon. ▪ Debris generated due to the excavation of foundation or due to the dismantling of the existing structure should be removed from the watercourse. ▪ Silt fencing has to be provided on the mouth of discharge into natural streams. ▪ Continuous drain (lined/unlined) is provided obstruction if any, to be removed immediately.	Contractor	PIU
4	Impact on the air and noise environment due to the vehicular movement	▪ Processing or recycling site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation. ▪ The approach and or internal roads shall be concreted or paved to avoid the generation of dust particles due to vehicular movement and shall be so designed to ensure the free movement of vehicles and other machinery. ▪ Vehicles and machinery are to be maintained so that emission conforms to National Ambient air quality standards. ▪ All vehicles and machinery should obtain Pollution Under Control Certificates ▪ HORN PROHIBITION signpost to be erected. ▪ Rumble strips/speed breaker to be provided. ▪ Regular checking and maintenance of vehicles should be ensured (valid PUC) ▪ For long-distance transportation overhaul routes to be judiciously selected ▪ No parking outside the plant premise, Earmarked areas for parking vehicles within the premise ▪ Smooth movement of incoming & outgoing vehicles/trucks	Contractor	PIU
5	Impact on the air from and noise environment due to the use of construction equipment	▪ Mixing equipment should be well sealed and be equipped with a dust-removal device. ▪ Operators should wear dust masks, ear protection, and hard hats.	Contractor	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ▪ Labor to be provided masks / PPEs. ▪ Construction site prone to dust generation shall have fencing to arrest dust spreading into neighboring sensitive land uses ▪ Noise standards at construction machines are to be strictly monitored to prevent exceeding of GOI noise standards. ▪ Workers in the vicinity of strong noise to wear protectors and their working time should be limited as a safety measure. ▪ In construction sites within 150 m of sensitive receptors and settlement areas construction to be stopped from 22:00 to 06:00. ▪ Machinery and vehicles should be maintained to keep their noise to a minimum. ▪ Noise barrier shall be constructed at all noise-sensitive locations.		
6	Impact on the water environment during the construction activities	▪ Construction work close to water bodies should be avoided during monsoon. ▪ Labour camps are to be located away from water bodies. ▪ Car washing/workshops near water bodies are to be avoided.	Contractor	PIU
C		**Operation& Maintenance Phase**		
1	Presence of hazardous material such as bitumen, asbestos in the incoming waste	▪ C&D waste processing facility shall inspect each waste load before unloading debris ▪ shall accept only C&D Debris - no industrial waste shall be accepted at the C&D facility unless otherwise approved received from concerned authority. No industrial effluent/wastes are to be accepted at the facility ▪ The waste should be segregated and stored in different heaps as far as possible so that their further gradation and reuse is facilitated ▪ Hazardous material disposal to be done in consultation with SPCBs/PCCs under HW Management Rules 2016. Examples of C & D waste that are classified as hazardous include lead, tars, adhesives, sealants, asbestos		PIU
2	Dust emissions from loading and transporting C&D waste on Vehicles *(Air, water, land, Fauna/Flora, Health impacts)*	▪ Ensure that the waste is transported in covered vehicles. ▪ Ensure proper record keeping of waste collected and transported ▪ Weighbridge level record keeping and monitoring at the project site	Facility operator	PIU
3	Impacts due to vehicle movement	▪ The movement route shall be scheduled for each vehicle. ▪ Enforce speed limits applicable and make drivers aware of this ▪ Vehicles movement shall be tracked by Health Supervisors to ensure keeping up to schedule; preferably using GPS ▪ Clean fuel shall be used in vehicles. Any adulterated fuel shall be avoided. There shall be periodic emission tests for vehicles ▪ Provision of Personal Protective Equipment such as face mask, gloves, nose masks & goggles to all workers in C&T vehicles, Maintenance yards ▪ Proper lubrication shall be provided to minimize squeaking noise due to	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		friction ▪ Honking shall be minimized to eliminate any possible discomfort to the nearby people. ▪ For long-distance transportation overhaul routes to be judiciously selected. The most optimum route is planned with minimum no. of vehicles with the help of GIS mapping and apps for the general public ▪ Traffic will be managed at the site by providing adequate space for parking of vehicles ▪ Timely processing & disposal of waste shall be carried out by vehicles and should transfer waste only in the specified Secondary Collection Point or secondary collection vehicle or treatment disposal yards planned. No waste shall be disposed of in any place other than the designated area; including water bodies, coasts/forests, or sensitive areas. ▪ Regular checking and maintenance of vehicles should be ensured (valid PUC) ▪ No parking outside the plant premise, Earmarked areas for parking vehicles within the premise ▪ Smooth movement of incoming & outgoing vehicles/trucks		
4	Dust emissions from unloading operations at the facility	▪ Areas to be earmarked for delivery/deposition of C&D wastes ▪ a sheet cover over the debris: over designated transport vehicles at waste processing sites ▪ Signboards to be displayed indicating do's & don't's ▪ dust (fugitive emissions suppression systems in place): Water sprinklers to be sprayed at all unloading points. ▪ For containing fugitive emissions (dust) also refer to CPCB's report: Inventorization of Railway Sidings and Guidelines for their Environment Management weblink: http://cpcb.nic.in/upload/NewItems/NewItem_216_Report_Invent_Railway Sidings.pdf	Facility operator	PIU
5	Noise emissions from the operation of the equipment	▪ Prepare Noise Mitigation Plan (NMP) which addresses: management and mitigation strategies to prevent an environmental nuisance caused by construction/demolition/recycling activities impacting ambient noise levels. ▪ To control the noise regular preventative maintenance of equipment to be carried out. regular and proper maintenance of noise-generating machinery to avoid noise increase ▪ Periodical monitoring of noise will be done to adopt corrective actions wherever needed ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours a day without hearing protection ▪ Earplugs to be made available to workers during the operational hours	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		▪ Besides the above it is preferable Operators prepare: Noise Mitigation Plan (NMP) which addresses management and mitigation strategies to prevent an environmental nuisance caused by activities impacting ambient noise levels. Other initiatives include ▪ Maintain records of equipment/machinery maintenance ▪ Equipment to be provided with padding and noise calming mechanisms to reduce noise output or if feasible high noise-producing activities may be in special noise-dampening enclosures ▪ Maintain records of monitored noise levels ▪ maintain records of complaints on noise ▪ Comply with Consent conditions issued by State Pollution Control Boards / PCCs and concerned authority ▪ Plantation activities: Plantation in the applied area helps to reduce the propagation of noise outside the core zone. ▪ Comply with Consent conditions issued by State Pollution Control Boards / PCCs and concerned authority		
6	Exhaust emissions	▪ No idling of vehicles on site. Regular maintenance of heavy equipment used at the site and waste hauling vehicles to ensure their exhaust emissions meet the emissions standards prescribed ▪ Diesel use in equipment / gensets / vehicle movement generate emissions. Necessary pollution control measures to be adopted to reduce emissions	Facility operator	PIU
7	Impact on water environment during the operations	▪ Adopt ZERO effluent discharge system ▪ Wastewater should be treated and reused in the facility for dust suppression system/sprinklers. ▪ All wash down of vehicles and equipment will take place in designated areas and wash water will be treated for reuse within the plant for suppression of dust	Facility operator	PIU
8	Wastes and rejects	• Remove salvageable items from the waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc. are also used as fill/capping material, wherever possible • Waste material and rejects from the facility shall be stored in special skips. These may be reused as landfill covers if suitable and hence need to be transported to the landfill • When stored, these shall be within berms, without allowing spillage and covered to hold dust emissions	Facility operator	PIU
9	Occupational health and safety impacts of the workers: • Health impacts of exposure to a variety of harmful materials of waste-related pollutants.	• All centers of labor contact points shall be provided with First Aid and other related activities. • Emergency Preparedness plans shall be prepared and implemented for all manpower working centers and its field extension centers. • Material handling shall be with proper care. While materials are being	Facility operator	PIU

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
	• Accidental spillage by moving vehicles. • Cut & Bruises during handling of Waste. • Allergies from airborne dust	dumped, no person shall be allowed near dumpers or skips • An Environment Health & Safety policy shall be prepared and implemented throughout the activities area. • Adequate manpower manager staff shall listen and act upon the manpower related grievances. • Workers will be provided with PPE such as face mask, gloves, shoes, nose masks & goggles • Provide non-slippery work areas • Proper training will be provided regarding the maintenance of Health • Workers shall be provided with rest areas, toilet facilities (with septic tanks), food, and water in a hygienic environment (with proper handwash). Provide clean eating areas where workers are not exposed to hazardous or noxious substances; • First aid facilities will be available at accessible places. More than one first aid station if the site is large • Tie-up with the local hospital / Primary Health Centre (or responsible JHI) will be arranged to provide an ambulance to handle emergency cases if required and for regular health checkups. Arrange daily health checkup for workers working on waste heaps • Routine inspections, housekeeping, and maintenance will be carried out at regular intervals • Measures such as deferred timings and stretch break to be adopted • Secure all installations from unauthorized intrusion and accident risks; • Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back -up alarms; • Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall follow international standards and well known to, and easily understood by workers, visitors, and the general public as appropriate; • All workers shall be registered as per prevalent labor laws (including workforce of subcontractors) and provided insurance cover • Workers and their kith and kin shall be suitably informed about the		

Sl No	Probable Negative Impacts	Mitigation Measures	Implementation Responsibility	Monitoring Responsibility
		registration, other details of workers, and insurance details and provide contact details of contractors person/insurance agent • While using heavy machinery like JCB, cranes, etc, inform workers on possible dangers and prevent going near operating / movement areas. Flagmen should be arranged on-site with a whistle. • While using heavy machinery like JCB, cranes, etc, inform communities to prevent children and others from going near operating / movement areas. • Flagmen shall be arranged if work is near schools, hospitals, major roads, and traffic control is required with the support of police.		
10	Pest / Vermin Control (Odour, flies, rodent / other pest menaces)	▪ Regular cleaning and approved pest control measures to be adopted ▪ Biopesticides / biological control shall be followed. ▪ Banned pesticides/insecticides shall not be used. ▪ Workers shall be made aware of storage and use of pest control measures and PPEs to be used	Contractor	PIU

Section VII: Environmental Codes of Practice

This section presents the Environmental Codes of Practices (ECoP) developed to support the KSWMP program. The ECoPs provide guidelines for environmental management of certain project activities including which are seen to be of limited extent of impacts/risk, temporary and reversible, and readily managed with good practices during the implementation of the proposed project interventions. The ECoPs will be considered while planning and designing facilities, included in bidding and contract documents as appropriate and its implementation will be closely monitored during implementation. The Contractors can use these while preparing and implementing Contractors EMP at work start.

In case of overlap of the provisions of this guidance with Indicative EMPs, the more stringent among these most suitable to the site conditions and activities shall be adopted. The provisions of both EMP and ECoPs shall be integrated while preparing site/activity specific EMPs and design guidelines.

This could be modified and changed in line with the changing situation or scope of the activities, and/or change or updating existing regulations/policies; subject to close consultation with the World Bank and clearance of the revised ECoPs.

ECoP 01: Guidance on Tree Plantation and Green belt

Tree plantation is advised for developing a green belt for various environmental infrastructure and area development. It helps in overall environmental benefits in the area owing to its forward and backward linkages and environmental functions. The Contractor shall:

- plant trees growing up to 10 m or above in height with perennial foliage around various appurtenances of the proposed subprojects, undertake the planting of trees in appropriate encircling rows around the subproject site preferably in three stories of scented flowering shrubs and trees. Planting the aromatic flowering in case of SWM facilities in front of trees has an advantage - as the tree trunks are normally devoid of foliage up to a height of 3 m, and it may be useful to have shrubbery in front of the trees to give coverage to this portion, in addition to the dust and odor arresting properties (cost is Rs 350 per sq ft),
- Grow fast-growing local tree species in consultation with the local communities, Forest Department and Local Bodies, Preference for fast-growing techniques (like Miyawaki: Miyawaki method of tree plantation helps grow saplings ten times faster, and the forest is 30 times denser than a natural one; maybe through crowd foresting - (at least 3-5m wide; A green belt of 3-5 m widths will be required. - Cost @ Rs. 400 to 700/Sq.m - Planting 5-6 ft tall plants, digging pits (1m x 1m x 1m) and watering and taking care for 1 year) using soil and compost produced in the site itself, and straw from local areas to prevent evaporation from the soil,
- Compensatory Afforestation shall be at the rate of 10 times of the trees cut or as per prevailing local norms,
- Preferably same varieties of trees as are cut; shall be used for afforestation,
- Saplings with a height of around 1m shall be used for planting,
- Compost from SW / locally developed bone meal etc; and in use pesticides/insecticides/weedicides may be used instead of chemicals,
- This activity will generate local employment opportunities as well for preparing such manure / and natural pesticides and for maintaining the plantations.

- Saplings grow bags shall not be of plastics – coir/coconut shells/ other degradable or reusables (like clay) shall be used
- Planters shall be given adequate protection considering the site is associated with SW disposal

The tree plantation shall be done at a spacing of 2.5 x 2.5 m. Also, space-efficient multi-layered modern forestry options may be tried. The maintenance of the plantation area shall also be done by the project proponent preferably with community participation. The treated wastewater and the manure generated by composting of solid waste shall be used for the greenbelt development.

ECoP 02: Guidance on Improvement of Existing Decentralised Waste Treatment Facilities and Provision of new ones

Existing centralized Waste Management Facilities are mainly of two types: Household Level Treatment facilities and Community Level Waste Treatment Facilities. Household Level treatment units include Home Biogas Units, Compost Pots – different variants of different materials; typologies, Compost Pits, pipe composting, etc. Community Level units include Biomethanation / Biogas units, Vermi Compost Facilities, Windrow Composting Facilities, and Thumboormuzhi Model Aerobic Composting.

Under KSWMP, improvements to household and community level facilities may be taken up.

Household Level Composters and Biogas Units

While improving household units (no improvement to pipe/pit/windrow composting will be considered under the project); the following environmental codes shall be considered

- Wastes shall be well segregated and stored at the household – biodegradables, non-biodegradables, domestic hazardous, and domestic biomedical wastes. This shall be stored in separate color-coded bins – covered bin for biodegradables. Glass, plastics, metals, and hazardous materials need to be prevented from going into composters as it could contaminate the finished compost quality making it unsuitable for consumption as a soil-enriching agent. It is also a health and safety risk for those who operate the unit. It is, therefore, recommended to use only segregated biodegradable waste for composting.
- Household-level treatment shall be allowed only in households with available plot area to maintain the facility without odor, worms, and flies affecting the residents or neighbors
- Treatment units shall be placed in well-aerated areas to dissipate the foul odor
- Instructions of the manufacturer shall be followed for better performance
- Treatment units shall be protected from rains; and placed on a high platform above the usual flood water level. The platform shall have cut off drains to prevent stormwater from affecting the composter. There shall be spill collection for waste spill and leachate. If composting is carried out in a covered area, the leachate generation potential reduces significantly. Therefore, in a wet region like Kerala, composting should be promoted only in covered areas. Further, leachate production can be reduced by adding an alternate layer of dry leaf/sawdust/old compost/ash/fertile soil, etc. Leachate will be absorbed by that media and will finally help in the acceleration of natural degradation in a faster manner.
- Bigger sizes of the waste need be cut or shredded into small pieces for easy decomposition
- Mix inoculum/bio culture appropriately

- Remove of stabilized compost (in case of composters) / sludge (in case of biogas units) from the system at regular interval
- Leachate collection and recirculation system (for letting the leachate back into the composting process) shall be ensured
- Rejects and inerts shall be preferably provided to the ULB for disposal without burning
- Provide a green shrubbery/plant belt around the composting unit
- Use odor reduction mechanism suggested by the technology provider
- No waste shall be heaped around the composter
- Composter shall have reflectors / proper support system to ward off disturbances; thus preventing chances for wastes and leachate on ground
- Compost shall be used/sold after value addition. For this, CBOs or HKS may support
- No compost shall be thrown on roads, canals or common areas even if infested with vermin
- Compost and by-products shall be stored neatly in the high platform above usual flood level
- Biogas plants at a household level require up to 1 sqm of area (but sufficient space shall be left around for safety ad servicing) and are suitable in lowland, midland, and highland regions; provided, these are kept on a raised platform in high water table regions and are adequately reinforced to withstand flooding or any other natural calamity.
- Safety of household biogas plants shall be checked periodically; preferably by a service provider or specially trained HKS / CBOs
- Gas must be vented off / flared if not used
- No combustibles shall be stored near a biogas unit
- In case of floods, safety measures must be taken in advance so that the gas can escape in case the digester and/or the gas storage tank are flooded.
- Follow the instructions of the facility provider/operator. Usually; an upside-down 'T' pipe should be placed at the highest vertical point in the gas pipeline above the gas outlet from the digester. A vertical pipe and a gate valve should be joined to the stem of the upside-down 'T' pipe. The gate valve can then be opened to release the biogas if a flood threatens to cover either the digester or the gas storage tank
- Proper pest control of the premises is essential, especially near household level treatment units. Facilities should have fly / mosquito-proof nets.
- The Government must certify and sell products that can make the composting process faster. Also, facilities to check compost quality shall be in place. The government must arrange a monitoring system.
- Inspection of the system once in a fortnight to ensure smooth operations and take remedial action in case of foul odor or rodent issue or any other problem
- Regular cleaning and approved pest control measures to be adopted: Biopesticides / biological control shall be adopted. Banned pesticides/insecticides shall not be used.
- Workers shall be made aware of storage and use of pest control measures and PPEs to be used

Community Level Biogas Units, Bin Composting, Aero bins

- The processing facilities greater than >5TPD capacity require the following permissions:
  - Authorization under SWM Rules, 2016
  - Permit under the Kerala Municipal Building Rules for plant

- Use only well segregated wet waste for Biogas generation. As per Rule (4) of SWM Rules, 2016, waste segregation into biodegradable and non-biodegradable is mandatory for waste generators.
- Follow manufacturer's instructions
- Biogas units shall be placed in well-aerated areas to dissipate foul odor and to allow gas dissipation and safe flaring
- Treatment units shall be protected from rains; and placed on a high platform above the usual flood water level. The platform shall have cut off drains to prevent stormwater from affecting the composter. There shall be spill collection for waste spill and leachate
- Leachate collection and recirculation system (for letting the leachate back into the composting process) shall be ensured. This is mandatory as per Schedule II (B) of Rule 16 of SWM Rules 2016. The Rules suggest leachate recirculation in case of composting. In case of disposal into surface water, sewer, or land, it is to be treated adequately before its disposal. (Schedule II A and B of SWM Rules, 2016). As the facility (mainly bin composting) is recommended to be in a covered shed, the leachate generation potential shall be significantly reduced. Leachate production can be reduced by adding an alternate layer of dry leaf/ sawdust / old compost/ ash/ fertile soil etc. leachate will be absorbed by that media and the BOD load will be reduced and will finally help in acceleration of natural degradation in a faster manner. The leachate may be collected and stored in a chamber and transferred to the nearest STP for co-processing, once in a month. In absence of any nearby STP, a leachate treatment facility is to be constructed within the facility. Considering the smaller quantity, a simple anaerobic tank with soak pit may be constructed as a minimum level of treatment. This can be constructed below GL for avoiding bad odor, fly nuisance, etc. if the water table is suitable.
- Rejects and inerts shall be preferably provided to the ULB for disposal without burning. Ensure that ULB is disposing rejects and inerts in sanitary landfills or other suitable facilities depending on the type of rejects and inerts so that no pollution is caused by its disposal. Only if there is agreement on proper final reject / inert disposal shall facilities be improved and new ones provided.
- It is important to provide suitable green belt (3 to 6 m) around the facilities; preferably in different layers; with fast-growing species; with aromatic blooms
- As per Rule 11 (l), The state Urban Development Department has to notify the buffer zone for the solid waste processing and disposal facilities > 5 TPD in consultation with the State Pollution Control Board.
- Use odor reduction mechanism suggested by the technology provider
- No waste shall be heaped around the biogas plant
- Biogas unit shall have sufficient lighting and reflectors
- Suitable flooring (non-slippery) shall be provided and no waste or leachate shall touch the ground.
- No slurry or leachate or sludge shall be thrown on roads, canals, drains, or common areas even if infested with vermin. Around 1000-1200 liters of slurry is produced per ton of feedstock, that needs to be treated using adequate filtration methods.
    - Biogas generation will be - 0.4 to 0.6 m^3/kg (Methane- 50 - 75%, Carbon dioxide- 25-50%, Nitrogen- 0-10%, Hydrogen- 0-1%, Hydrogen Sulfide- 0-3%). It may be noted that Methane is a greenhouse gas with a global warming potential of 21. A well-framed implementation mechanism should be executed to ensure that 100% of the units utilize the biogas as a fuel or power and do not release it in the unabated form to the

atmosphere. Gas must be vented off / flared if not used; though not recommended. Before the improvement or construction of new facilities, there shall be a proper agreement for use of compost, biogas rather than flaring or disposing. Compost can be used as cover material in landfill as it is stabilized, or in farms, kitchen gardens. Biogas can be used for the electrification of market areas, cooking for hotels, heating water, etc.

- By-products and materials shall be stored neatly in the high platform above usual flood level
- Safety of biogas plants shall be checked periodically; preferably by a service provider or specially trained HKS / CBOs
- No combustibles shall be stored near biogas unit
- In case of floods, safety measures must be taken in advance so that the gas can escape in case the digester and/or the gas storage tank are flooded.
- Follow the instructions of the facility provider/operator. Usually; an upside-down 'T' pipe should be placed at the highest vertical point in the gas pipeline above the gas outlet from the digester. A vertical pipe and a gate valve should be joined to the stem of the upside-down 'T' pipe. The gate valve can then be opened to release the biogas if a flood threatens to cover either the digester or the gas storage tank
- Proper pest control of the premises is essential, especially near household level treatment units. Facilities should have fly/mosquito-proof nets.
- Power is required for waste refinement, shredding/crushing and slurry formation, gas scrubbing (~10 kWh for 1 TPD plant) 1200 liters for 1 TPD plant
- Up to 1 TPD, 2 semi-skilled persons, to inspect the waste, refinement, water addition, etc., for mixing and for overall cleanliness and management of the site. As per Rule 15 (zd), the ULB shall ensure that the operator of a facility provides personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear, and masks to all workers handling solid waste and the same are used by the workforce. Proper signages shall be provided. Workers shall be informed of project details and emergency contact numbers and details displayed in English, Hindi, Malayalam at site entry.
- There shall be office facility and worker facilities on-site including wash, drinking water, first aid, etc.
- Cattle dung to enhance the biodegradation process
- Maintenance of the biodigester and filter system, power generator, shredder, etc. and replacement of some plastic or rubber parts of the machinery
- It is a less labor-intensive method where the plant can be managed by the trained staff if they follow the standard operational guidelines properly. Hence, the main requirements are in terms of training of the staff to operate the system and regular inspection and monitoring of the performance to tackle the problems, if any.
- Should meet the FCO norms if the compost is to be used for farming purposes for vegetables or edible crops. Currently, there is no provision for any kind of system to check for the quality of compost produced.
- As per the Water Act, 1974 and the Air Act, 1981, the ambient water quality and ambient air quality around the plant area should be maintained and the standards should be complied with.
- There shall be proper maintenance of records of all inputs – outputs on site: a) Waste reaching the site, b) Materials like sawdust, leaves, inoculum, cow dung, odor suppressants used and other support material like fuel for DG sets, c) Rejects and inerts

sent to landfill for disposal, d) Slurry, sludge produced and dried / Leachate treated and disposed of/ reused) compost or other by-products produced, sold, stored.

- As per SWM Rules, 2016 the operator of the plant (Local Body) should file Annual Report to KSPCB in the format given in the Rules, on the status of management of waste performed during the reporting period.

ECoP 03: Guidance on Improving Collection and Transportation of Wastes

- The term "solid waste collection and transportation " is taken to include the initial storage of segregated waste at the household, shop or business premises, the loading, unloading, and transfer of waste, and all stages of transporting the waste with minimum manual handling, without touching the ground until it reaches its final destination – a treatment plant or disposal site. The waste segregated at source should never get mixed during primary /secondary stages and hence the vehicles should be designed with separate containers for segregated waste. The sweeping of streets and public places, the cleaning of open storm drains and the removal of these wastes are also included in solid waste collection and transportation.
- Box type carts, manual loading-trucks currently used in Kerala for handling MSW results in manual and multiple handling of waste and unhygienic loading practices. A good system should ensure no manual lifting of waste above shoulder level – loading height of vehicles should preferably be 1.2 m. Bins /containers of size above 40 liters (single crew)/60 liters (two men crew) should be handled mechanically for transfer from primary collection to secondary storage or transfer directly to the vehicle. Exposure of waste should be minimized during collection, transfer, and transportation. Larger sized bins (above 60 lit) may be wheeled (EN standard).
- The secondary stage may use secondary storage (community Bin storage) or direct transfer from the primary collection vehicle (Containerized carts/Mini tippers) to Refuse collectors with low height loading hopper.
- If secondary storage is suggested, no static containers are recommended. Portable containers with lid should be used, and they should be distributed according to anticipated waste volumes and monitored closely so that containers that are overfilled can be supplemented by additional containers. The containers should be lifted /emptied mechanically to vehicles like dumper placers, refuse compactors.
- A preferred option for Kerala where secondary storage is generally not acceptable (low public acceptance /space constraints) is to have a direct transfer of organic fraction (bin-less) and secondary storage of dry waste (MCF) with drop off facility

ECoP 04: Guidance on Improving existing MCFs, MRFs, RRFs

- MCF facility can be set up at a decentralized level in each city to enable waste collectors or generators to deposit the non-biodegradable waste collected from the doorstep or at a centralized location in cities where a door-to-door collection of biodegradable and non-biodegradable waste through compartmentalized vehicles are in practice.
- MCFs are only material collection points while MRFs are recycling facilities that need more space. Also, regional level recycling facilities or RRFs may be set up.
- The number and density of MCFs, MRFs, and RRFs shall be accordingly determined as part of the SWM plan for the city. It is important that these should not become pockets of unmanaged waste and thus poor hot spots of wastes in the city. Each city shall plan

diligently how to store and send their dry wastes, without allowing it to pile up and thus create unsafe-unhygienic pockets in the neighborhoods.

- Segregated waste from all MCFs shall be sent to MRFs / RRFs daily. There should be space to store an additional 7 days of waste in these facilities considering emergencies.
- MRFs shall have covered reception area, segregation area, manpower to segregate the waste manually/semi-mechanically, shredding machine, and baling machine, weighing machine, etc.
- There should be a storage area for storing segregated components of recyclables, space for record-keeping, and arrangements for periodic sale of recyclables to rate contracted recyclers/scrap dealers and delivery of shredded and bailed non-recyclable combustible fraction of waste to Clean Kerala Company.
- Various components of recyclables should be segregated, stored separately, and passed on to the recycling industry at a predetermined contracted rate. Material meant for different uses should be safely stored until picked up by State agencies to prevent fire hazards. Non-recyclable combustible waste could be stored separately as a field stock for cement kilns or WTE plants proposed to be set up by the State.
- In large cities, automation/semi-mechanization could be introduced at the city level to facilitate expeditious segregation of recyclables.
- There should be bailing machine and shredder, cleaning and drying facilities for dry waste, pressure system, etc. as per the functional needs as decided in the SWM Plan.
- Power requirements 10Kwh (for 1 baling machine and 1 plastic shredder), worker requirements (10 manpower (0.5-1 TPD facility) and water shall be made available at each facility
- Materials shall be stored in a segregated manner and alternate entry is required for loading/transfer
- Adequate material ramps, loading equipment, etc are required to minimize workers handling the sharps and wastes
- Workers shall be provided with PPEs and safety gear, first aid, and emergency medical facilities. All workers shall be registered under relevant labor laws.
- Storage facilities shall be above high flood levels
- Required numbers and types of Firefighting equipment shall be provided
- For various types of wastes and risks shall be arranged and workers and neighbors must be trained to use them
- There should be adequate space around the facilities considering the need to operate fire fighting vehicles/equipment
- Large MRFs and RRFs shall be provided with greenbelt, to act as a break line of fire. Small MCFs shall be provided with at least plant shrubbery around for the same purpose.
- Water from washing space and hand wash of workers shall be treated appropriately and reused for shrubbery/greenbelt.
- There should be adequate light and ventilation in the facility at all times
- Signages and emergency contact numbers shall be well provided as appropriate and fire force shall be informed about such facilities in the city and their risk of fire.

ECoP 05: Guidance on Quarry management

Quarry management is important considering the land disturbances and disaster-proneness in Kerala. The Contractor/Concessionaire shall use materials from the existing and licensed

quarry only. In case any new quarries are opened by the agency, it will secure permissions for the same and shall follow the rehabilitation plan.

- The objective of the rehabilitation program is to return the quarry sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing quarry sites in a stable condition should be a fundamental requirement of the rehabilitation process. This could be achieved by filling the quarry/quarry floor to approximately the access road level.
- It is important to plan restoration from the outset and coordinate restoration with quarrying activities. In addition to the bio-diversity issues, land planning considerations are also taken into account when defining a rehabilitation project in order both to preserve the environment and to generate income for the local communities. In this framework quarry rehabilitation often leads to the creation of wetlands and nature reserves or recreation areas.
- Special quarry rehabilitation plans should be specified according to the location and shaping of the mining slopes after exploitation and overburdened dump, with different subsequent uses e.g. forest, meadow, waterbody, etc., the re-greening and replanting methods.
- Other criteria which should be followed for the rehabilitation of quarry sites are as given below:
    - Quarries will be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then slopes will be smoothed and depression will be filled in such a way that it looks more or less like the original ground surface.
    - During works execution, the Contractor/Concessionaire shall ensure the preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; reestablishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff, and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people nearby. Once the works are completed, and at their own expense, the contractor shall restore the environment around the worksite to its original splits.
    - To create a safe environment under the terms of the Mines and Quarries Act the faces have to be reduced to a naturally stable slope or be adequately fenced to prevent access to the top and bottom of the faces. Such a fence must be of height as prescribed under the Mines Act with a barbed wire top strand designed to exclude the public from the quarry area. Depending on the location of the site presence of a permanent lake is considered to be a satisfactory alternative to a fence.
    - Appropriate plant species for the planting program have to be selected in consultation with the ecological consultant and local forest department. Depending on the limitations on the availability of appropriate plant material, harsh growing conditions (lack of irrigation and hot summer), and ongoing quarry rehabilitation operations there may be a substantial loss of plantation and the planting program may have to be continued for over 3–5 years. As plantings are progressively established they should be monitored before undertaking the next stage to ensure maximum plant survival rates.

- The quarry or quarry immediate surroundings should be developed as a low maintenance reserve, with significant areas of native trees and shrubs and areas of longer grass and tussocks forming the open spaces. Walkways around the quarries may be constructed. Provision for a future drive-in picnic area and car parking area may be developed.

ECoP 06: Guidance on Siting & Layout of Construction Camp

Siting

Based on the following guidelines Contractor/Concessionaire shall identify the location of the construction site. The Contractor shall:

- Locate the construction camps in areas that are acceptable from an environmental, cultural, or point of view.
- Consider the location of construction camps away from communities to avoid conflict in using natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities.
- Submit to the Site Engineer for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, before the development of the construction camps.
- Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities to maintain effective surveillance over public health and security matters
- The construction camps will be located at least 500 m away from habitations at identified sites. These shall not be on agricultural lands or near sensitive habitats. The living accommodation and ancillary facilities for labor shall be erected and maintained to standards and scales approved by the resident engineer.
- Not within 1000m of either side of locations of Forest areas.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 300 feet of pools, sinkholes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps will not endanger any domestic or public water supply.
- All sites must be graded, ditched, and rendered free from depressions such that water may get stagnant and become a nuisance.
- If the site is in an area not habitable for the people – such as SW dumping yard / Septage / Sewage Treatment plant area; the labor camp must not be provided there considering the health impacts it may have on the works or their families.

Layout

The Contractor/Concessionaire during the progress of work will provide, erect, and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the Client. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing. Safe drinking water should be provided to the dwellers of the construction camps.

Adequate washing and bathing places shall be provided and kept in clean and drained conditions. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the workforce. Adequate space standards must be maintained and hot bedding should be avoided to ensure safe stay during emergencies like COVID 19. WHO guidance on COVID 19 considerations for camps must be followed.

The camp layout shall be prepared and got approved by the Site engineer who will check for its impacts. Only after his approval shall the camp construction commence.

Facilities

Construction Camp Facilities

Lack of proper infrastructure facilities, such as housing, water supply, and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.

The Contractor shall provide the following facilities in the campsites:

- Adequate housing for all workers
- Safe and reliable water supply. Water supply from deep tube wells of 300 m depth that meets the national standards
- Separate latrines and bathing places for males and females with total isolation by the wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons, one urinal for 15 workers, and one washbasin for 15 workers or as per local building by-laws (Kerala Municipal Building Rules(KMBR)).
- Hygienic sanitary facilities and sewage management. Provide Treatment facilities for sewerage of toilet and domestic wastes (preferably portable septic tanks which can be emptied into a septage treatment facility as and when full)
- Stormwater drainage facilities. Both sides of roads are to be provided with shallow drains to drain off stormwater to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention of stormwater flow from the whole site. Channel all discharge from the silt retention pond to natural drainage via a grassed swale at least 20 meters in length with a suitable longitudinal gradient.
- Paved internal roads. Shall have grass/vegetation coverage to be made of the use of topsoil that there is no dust generation from the loose/exposed sandy surface. Pave the internal roads of at least with bricks or porous materials to suppress dust and to work against a possible muddy surface during monsoon. This will help in water penetration and recharge as well. Preferably with loose-jointed concrete blocks that can be reused.
- Provide in-house community/common entertainment facilities dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
- Management of wastes is crucial to minimize impacts on the environment. Ensure proper collection and disposal of solid wastes within the construction camps
- Insist waste separation by source; organic wastes in one pot with a lid and inorganic wastes in another pot at the household level.
- Store inorganic wastes in a safe place within the house and clear organic wastes daily to waste collectors. Establish waste collection, transportation, and disposal systems with the manpower and equipment/vehicles needed.

- Dispose organic wastes in the waste dumping yard – in a bin composting system and manage it daily. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, are not attracted. If space is available away from water bodies, one may dig a large hole or use a bin to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition of wastes. Cover the bed of the pit with an impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. Take care to prevent odor generation as well. Encompass the waste dumping place by fencing and tree plantation to prevent children from entering.
- Provide fuel; probably arrange common kitchens. Illegal sourcing of fuelwood by construction workers will impact the natural flora and fauna. Provide fuel to the construction camps for their domestic purpose, to discourage them to use fuelwood or other biomass.
- Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them from using biomass for cooking.
- Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punitive measures for wildlife protection.
- There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.
    - Provide adequate health care facilities within construction sites,
    - Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint full-time designated first-aid or nurse,
    - Provide ambulance facility for the laborers during an emergency to be transported to nearest hospitals,
    - Initial health screening of the laborers coming from outside areas/ migrant laborers, Provide health camps in coordination with nearby Primary Health Centre / Clinic,
    - Train all construction workers in basic sanitation and health care issues and safety matters and on the specific hazards of their work,
    - Provide HIV awareness programming, including sexually transmitted infections (STI) and HIV information, education and communication for all workers regularly,
    - Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing,
    - Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon,
    - Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers,
    - Place display boards at strategic locations within the camps containing messages on best hygienic practices.

- Inadequate safety facilities to the construction camps may create security problems and fire hazards. The contractor shall provide appropriate security personnel (police/home guard or private security guards) and enclosures to prevent unauthorized

entry into the camp area even after work hours until the site is fully handed over to ULB, after which ULB shall maintain security person during operations for the same purpose.

- Maintain register to keep a track on a headcount of persons present in the camp at any given time,
- Encourage the use of flameproof material for the construction of the labor housing/site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones,
- Provide the appropriate type of firefighting equipment suitable for the construction camps,
- Display emergency contact numbers clearly and prominently at strategic places in camps,
- Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors,
- Encourage kitchen plantations or greenery around the camp.
- Site Restoration: Restoration of the construction camps to original condition requires demolition of construction camps.
    - The Contractor shall Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates after the construction work
    - Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed,
    - Give prior notice to the laborers before demolishing their camps/units,
    - Maintain the noise levels within the national standards during demolition activities,
    - Different contractors shall be hired to demolish different structures to promote recycling or reuse of demolished material,
    - Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site, Clean sludge from septic tanks; dismantle the tanks and dispose or shift to another site; Pit shall be covered and compacted with soil and leveled
    - Handover the construction camps with all built facilities as it is if the agreement between both parties (contractor and land-owner) has been made so,
    - Restore the site to its condition before commencement of the works or to an agreed condition with the landowner,
    - Not make false promises to the laborers for future employment in O&M of the project.
- Day Crèche Facilities: At every construction site, provision of a day crèche shall be worked out to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a structurally safe hut of fireproof materials, for use of children under the age of 6 years belonging to such women. Huts shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean. There shall be two maidservants (or aayas) in the satisfaction of local medical, health, municipal, or cantonment authorities. Where the number of women workers is more than 25 but less than 50, the Contractor/Concessionaire shall provide with at least one room space (size as per KMBR) and one maidservant to look after

the children of women workers. The size of crèches shall vary according to the number of women workers employed. The crèche shall have facilities for dormitory, kitchen, indoor and outdoor play area. It is better to have arrangements made by the ULB to arrange facilities for bigger children (of 3 years and above) in nearby Anganwadi if it is nearby. Schools shall be attached to these crèches so that children are not deprived of education while mothers are engaged in construction work

ECoP 07: Guidance on Topsoil Management

Disturbance due to Land clearing and earthworks

- Topsoil is the uppermost layer of soil capable of growing and supporting vegetation. Topsoil contains the essential microorganisms, nutrients, organic matter, and physical characteristics necessary to grow and sustain permanent vegetation. Stripping, stockpiling, and reusing topsoil on construction projects is essential for proper reclamation of disturbed areas.

The Contractor shall

- It is recommended to strip and store topsoil for reuse. Topsoil is recommended on all disturbed sites and slopes 2H:1V or flatter, or as a planting medium for plantings or nursery stock. Topsoil may be added to a rock mulch to enhance slope protection and provide soil medium for seed germination and plant growth. Topsoil can be mixed with organic material such as compost or manufactured soil amendments to improve the growing capability of seeded and planted vegetation,
- Strip the topsoil to a depth of 15 cm and store in stockpiles of height not exceeding 2m,
- Stockpiling should be limited to less than 6 months so that there is no loss or disruption of microorganisms. The use of microorganism inoculates may be necessary to re-establish microorganisms in topsoil material that has been stockpiled for more than 9 months,
- To the extent practicable, aboveground vegetation, including litter, should be mixed or otherwise incorporated into the topsoil before excavation. Topsoil should be excavated from the existing roadway shoulder to a depth of 6 inches. For new alignments, topsoil should be excavated to the depth it exists and stockpiled,
- If topsoil is stockpiled before placement, the top 1 foot of the stockpile material should be mixed with the remainder of the stockpile to ensure that living organisms are distributed throughout the topsoil material at the time of final placement,
- Topsoil stockpiles shall not be made near / along drainage lines. It shall be protected from erosion,
- Provide cut-off drains channels and silt bunds around the topsoil stockpiles to prevent erosion of topsoil,
- Spread the topsoil to maintain the Physico-chemical and biological activity of the soil. The stored topsoil will be utilized for covering all disturbed area and along with the proposed plantation sites,
- Before the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers for better water penetration and revegetation,
- Organic material such as wood bark or fiber, grass hay, or grain straw shall not be mixed in topsoil unless nitrogen fertilizer is included.

Disturbance due to vehicular movement

- Vehicular movement outside the right of way of roads or temporary site access roads will disturb topsoil and fertility.

The Contractor shall

- Vehicle access roads shall be marked clearly and movement shall be restricted to these roads.
- Topsoil of such accessways shall be collected and stored for reuse, before initiating movement.

ECoP 08: Guidance on Traffic Control and Safety during Construction

Traffic Management Practices

The traffic on roads has increased manifold and most of the roads are expected to operate at their maximum capacity soon. Under the circumstances, the existing methods of maintenance and construction which compromise safety and cause delay are no longer acceptable and a change in work procedures and method have become inevitable. Under the existing method of maintenance and reconstruction, the traffic is invariably diverted over unprepared shoulders or forced to use part of the existing roads under maintenance. This increases vehicle operating costs and a reduction in safety besides causing environmental pollution. Therefore, the existing work procedure and contract conditions are required to be changed to provide for proper management of traffic during the execution of work. The traffic management strategies to be used at traffic control zones must include the following fundamental principles:

(i) Make traffic safety an integral and high priority element of every project
(ii) Avoid inhibiting traffic as much as possible
(iii) Guide drivers in a clear and positive way
(iv) Perform routine inspection of traffic control elements and traffic operations
(v) Give care and attention to roadside safety

Traffic Control Devices

The primary traffic control devices used in work zones are signs, delineators, barricades, cones, pylons, pavement markings, and flashing lights. The following general rules should apply to all traffic control devices within the traffic control zone.

(i) Comprehension: All traffic control devices should be capable of being easily understood. A particular device must convey one and only one meaning. Good and clean condition of the device aids comprehension.

(ii) Visibility and Stability: Devices should be within the cone of vision of the driver and be placed such that it allows adequate time at the average approach speed or the desired speed through the traffic control zone. All traffic control devices should be visible by day and night, at these speeds and under the usually prevailing climatic conditions. They should be kept properly aligned and legible at all times. Foliage or any other obstruction should not be allowed to impede the view of these devices, nor should wind, road dirt, or the like be allowed to obscure their face. The traffic control devices must be able to resist the local wind pressure, rain, and the vibrations, etc. of the passing traffic but these should not act as rigid obstacles in the event of a collision;

(iii) Installation and Removal: All traffic control devices should be installed for the minimum required time. Traffic control devices by their nature are a hindrance to the normal traffic flow

and should be removed immediately after the need, being met by these is fulfilled. Existing devices like signs or lane markings should be removed during the temporary works and reinstated thereafter or covered while the temporary devices are in operation. The installation and removal of the temporary traffic control devices and the reinstatement of the pre-existing or new (where the scheme improves the road) traffic control devices must, therefore, be meticulously supervised to ensure the minimum period when there are no signs or markings

Signs

The road construction and maintenance signs fall into the same three major categories as do other traffic signs, which are Regulatory Signs, Warning Signs, and Direction (or Guidance) Signs. The IRC: 67 (Code of Practice for Road Signs) provides a list of traffic signs. Where possible, the size, colors, and placement of sign shall conform to IRC: 67. This also covers signs that are not included in IRC: 67 but are considered desirable to aid drivers' comprehension of the route through the road works. Each sign should be well located so that its message is seen and is clear, which will be assisted if the surroundings are devoid of "unnecessary" signs and other clutter. These signs should be of retroreflective sheets of high-intensity grade or engineering grade depending upon the importance of the road as directed by the Engineer.

ECoP 09: Guidance on Sanitary Landfills [12]

As per the requirements of the SWM rules 2016, irrespective of the method of processing adopted, a certain portion of the rejects will have to be sanitary landfilled. The percentage and the quality of the rejects going to the landfill will change based on the processing method adopted. E.g. Composting will result in about 20-30% rejects, Composting along with RDF will result in about 15-25%, while the WTE plants may result in 15-20% of waste going to the landfill.

Sanitary landfills are facilities for the final disposal of MSW on land, designed and constructed to minimize the impacts on the environment and human health. The SWM Rules, 2016 provide comprehensive regulations on the siting, design, and operations of the sanitary landfill.

Based on the waste generation rate, it is estimated that Total waste o be landfilled in the next 30 years will be Cumulative Waste going to SLF- 2021- 2051@ 20% is 12080993 Metric Tonnes and land required for 30-year SLF is 335.50 acres.

The wastes that are permitted to be disposed in the sanitary landfill are:

a) Non-biodegradable and inert waste (by its nature or through pre-treatment)
b) Commingled waste (mixed waste) not found suitable for waste processing
c) Pre-processing and post-processing rejects from waste processing plants
d) Non-hazardous waste not being processed or recycled.

Sanitary landfilling is not allowed for the following waste streams in the MSW:

a) Biodegradable waste or garden waste (composted preferably)
b) Dry recyclables (recycled preferably)

[12] *UMC Global 2020, Technology assessment for solid waste management in Kerala, submitted to The World Bank*

c) Hazardous waste (needs hazardous waste sites with special containment).

Duties and responsibilities of local authorities:

a. Stop dumping of mixed waste as soon as the timeline as specified in Rule 23 for setting up and operationalization of sanitary landfill is over;
b. Allow only the non-usable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill and the sanitary landfill sites shall meet the specifications as given in Schedule–I, however, every effort shall be made to recycle or reuse the rejects to achieve the desired objective of zero waste going to landfill;
c. Investigate and analyze all old open dumpsites and existing operational dumpsites for their potential of biomining and bioremediation and where ever feasible, take necessary actions to biomine or bioremediate the sites;
d. In absence of the potential of biomining and bioremediation of dumpsite, it shall be scientifically capped as per landfill capping norms to prevent further damage to the environment.

Technical details of Sanitary landfill (SLF)

SLF is the final destination of the waste rejects. It is required irrespective of the processing system adopted. The optimum capacity for economical operations is about 200 TPD of waste going to the Landfill. The technical details are standardized and need to be followed as per the SWM 2016 Rules. The detailed technical and constructional aspects are given below separately.

Site selection for a landfill

The selection of a suitable site for sanitary landfill is governed by the strategy identified in the state SWM policy and the MSWM plan of the ULB. The SWM Rules, 2016 provides criteria for the location of sanitary landfills. CPCB's guidelines for the selection of site for landfilling should be used as a guiding document. It is apparent that, in Kerala, finding a site is a major task as the state itself is very small and habitation is spread all along the roads.

Criteria for Identifying Suitable Land for Sanitary Landfill Sites

Sl.No.	Place	Minimum Siting Distance
1	Coastal regulation, wetland, critical habitat areas, sensitive eco-fragile areas, and flood plains as recorded for the last 100 years	Sanitary landfill site not permitted within these identified areas
2	Rivers	100 m away from the flood plain
3	Pond, lakes, water bodies	200 m
4	Non-meandering water channel (Canal, drainage, etc.)	30 m
5	Highway or railway line, water supply wells	500 m from centre line
6	Habitation All landfill facilities	500 m
7	Earthquake zone	500 m from fault line fracture*
8	Flood prone area	Sanitary landfill site not permitted
9	Water table (highest level)	The bottom liner of the landfill should be above 2 m from the highest water table

Notes

* The urban local bodies (ULBs) located in seismic zone 4 and zone 5 should consult the seismic fault map before finalizing the site for the sanitary landfill. They should also ensure that when the sanitary landfill is designed, the seismic factors are taken into consideration in determining the stability of the landfill structure.

** In a special case, a landfill site may be set up within 10–20 km away from the airport or airbase if there is no objection certificate from the civil aviation authority or air force as the case may be.

Site Layout

The proposed site layout of a sanitary landfill (SLF) will need all the infrastructure facilities to be provided at the site, which is as follows

1. Entrance Gate
2. Compound wall
3. Security Cabin
4. Roads
5. Weighbridge
6. Administration building
7. Site drainage facilities
8. Worker's Restroom
9. Workshop
10. Plantation
11. Fire fighting vehicle
12. Leachate collection & Treatment facilities
13. Landfill gas collection/monitoring and management system

A proper entrance gate will be required at the site along with a security gate and compound wall all around so that there will be no free entry for people and animals. All internal roads within the property leading to the sanitary landfill will be blacktop roads having a two-carriage width of 3.5 m each. To ensure site safety and security, a security cabin at the landfill will also be required. An administrative building must be provided for the landfill supervisors and clerical staff. The parking facility will have to be provided at the main entrance gate for cars and two-wheelers. The weighbridge facility with the adjacent room will have to be maintained to keep a record of the waste quantities coming into the site for processing as well as that being landfilled at the site.

Landfill Layout

The Landfill will be designed taking into consideration the lay of the land. The existing slope will have to be judiciously used in preparing the base of the landfill.

Landfill Gas Management Plan

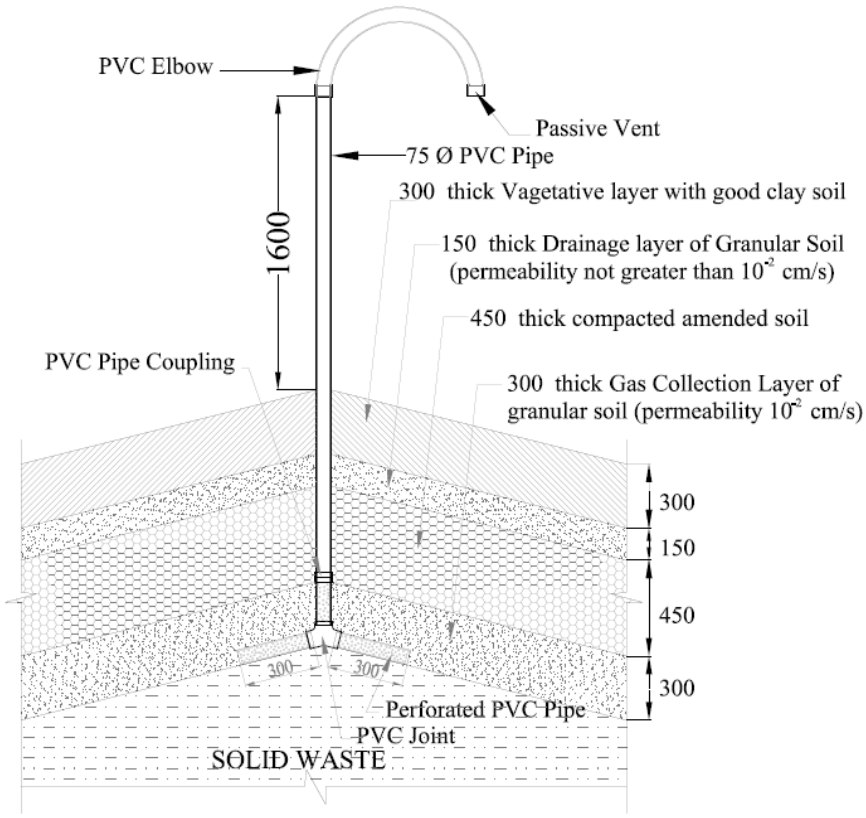
The gas management strategies should follow the following three plans,

- Controlled Passive Venting
- Uncontrolled Release
- Controlled Collection and Treatment

Controlled Passive Venting

As per CPHEEO Manual of SWM, controlled passive venting is recommended for all MSW landfills. MSW Landfills are supposed to receive the inert part of the treated waste and hence no biodegradation is expected as such from the site. As a result, the odor is expected to be minimal from the landfill cells. Controlled passive venting will be done by the installation of passive gas vents at regular intervals as per the engineering design. A typical passive gas venting system is shown here.

FIGURE: TYPICAL PASSIVE GAS VENTING SYSTEM



Uncontrolled Release of Gas

As per MSW Manual only small (less than 100 tons per day), shallow (less than 5 m deep), and remotely located landfills, should uncontrolled release be allowed. In such cases, landfill gas monitoring will be adopted at all sites and remedial measures (such as flaring) undertaken if the gas concentrations are above acceptable limits.

Controlled Collection and Treatment

Controlled collection and treatment/use will be adopted only after the feasibility of such a system is established and proven by an agency having experience in this area. In the case of the proposed project only controlled passive venting will be adopted and no treatment of the landfill gas would be undertaken.

Surface Runoff Management System

The design scheme would be formulated to cater to all the stormwater that would be accumulated during the precipitation in the entire waste management facility. For this purpose peripheral drains along the road and internal drain adjoined to the different individual facilities would be constructed. The drains will be with respect to the finished ground level wherever possible and/ or provided with sufficient longitudinal slopes to enable the gravity flow of water. A desilting chamber will be provided to separate the silt particles, earth, and soils. The supernatant shall be recycled within the facility for landscaping or disposed of.

Leachate Management Plan

The leachate estimation has to be done taking into account the rainfall and the evaporation rates of the area. The basic assumption considered is that before the rainy season, the landfill will be covered with an intermediate cover of 450 mm soil to prevent any ingress of water. The working front will be kept to its minimum resulting in low to moderate leachate formation. The leachate has to be calculated by using the water balance method. A proper Leachate collection system must be provided to carry the Leachate into the Leachate collection tank. The leachate will travel through the gravel fill into the lateral pipes. These will carry the Leachate to the header pipes from where it will be taken to the tank

Design of Leachate Collection System

The main components of the leachate collection system are the drainage layer and conveyance system. The leachate conveyance system is a network of pipes by which the leachate is collected through perforated HDPE pipes and collected in a sump. The other design parameter, which governs the leachate collection is the spacing between the pipes. The leachate generation is primarily a function of precipitation and it is directly proportional to rainfall intensity and surface area.

Spacing of Pipes

As suggested by the USEPA Manual, the pipe spacing could be determined by the Mound Model. In the Mound Model, the maximum height of fluid between two parallel drainage pipes is equal to,

$$h_{\max} = \frac{L\sqrt{c}}{2}\left[\frac{\tan^2\alpha}{c} + 1 - \frac{\tan\alpha}{c}\sqrt{\tan^2\alpha + c}\right]$$

Where C = Q/k
hmax = Maximum Hydraulic Depth (30 cm)
L = Distance between the Pipes
k = Permeability of Drainage Layer
Q = Inflow Rate for unit area
α = Slope

Leachate collection system

The leachate collection system is a network consisting of HDPE feeder pipes and header pipes. The pipes are HDPE perforated pipes with sufficient strength (minimum 6 kgf) and are safe from particulate and biological clogging and deflections. The main header pipe shall be connected to the leachate collection sump. The purpose of the leachate collection sump is to collect the leachate from the entire landfill daily.

Leachate treatment

The leachate should be treated by the on-site leachate treatment plant

Follow existing national regulations and guidelines on landfill management

ECoP 10: Guidance on Buildings to house treatment, packaging and support facilities

- The building shall be suitably designed to avoid cross-contamination and to encourage the hygienic atmosphere for workers.
- The coverage area and height of the plant shall commensurate with the processing capacity and the setting of the equipment.
- The flooring of the plant shall be non-slippery, anti-corrosive, fully vitrified industrial grade, wear-resistant, and have adequate slope. The floor shall facilitate the water to discharge and avoid the standing water, and will be easy to clean and disinfect with cleanliness easily maintained, and coved at the junctions with walls.
- The walls, roofs, and ceilings inside the plant will be made from non-poisonous, light-colored, waterproof, mold-resistant, not loose, and easy to clean materials. the roofs or ceilings and the fixtures shall prevent the formation of dust and condensation and loose miscellaneous matters falling off.
- The doors and windows of the workshops will be made from strong materials that are light-colored, smooth, easy to clean and disinfect, waterproof, and anti-corrosive and fabrication should be rigorous.
- The plant exit, discharge outlets connected externally and ventilation areas shall be installed with the facilities which are dustproof, pest-proof, and rodent preventative.
- The pitch bottom of drainage will be arc-shaped to facilitate the cleaning, and the drainage pipe shall be equipped with a seal water unit to resist the spoilage of foreign odor and rodent-proof grids. The drainage system shall have non-return value settings that stop the solid wastes from entry. Any pipes and drainage shall be ensured with the free flow and non-standing water.
- The designated areas for hand wash, cleaning, and disinfection of equipment, which should not jeopardize the operations.
- Separate areas will be used for storing disinfectant, detergent, packaging, and trash to avoid cross-contamination.
- No hazardous material shall be used for construction or operations; including Asbestos
- Fire safety shall be ensured as per the regulation and Building permits and Consents shall be arranged as required

ECoP 11: Guidance on Biomining and Bioremediation

National Green Tribunal has directed to follow biomining and bioremediation of MSW legacy waste dumpsites in India; as against capping. Indore model of biomining has been suggested as the model to follow. [13]

Introduction and Objective

The purpose of the Site Contamination Audit (SCA) is to identify actual and potential site contamination as well as the proliferation of contaminants across the area of the contaminated site. Contaminated land, such as solid waste open dumpsites and poorly managed solid waste managing facilities, emit hazardous substances such as heavy metals to the soil, toxic leachate, noxious and volatile landfill gas and a host of other contaminants which in turn pose conditions that are hazardous to public health and for the environment and need to be managed with proper remedial actions and environmental management tools. A site contamination audit ensures such sites are evaluated on the pollution linkage and facilitates in establishing the level of risk posed to public health and the environment and the key actions required to manage and/or mitigate the risk.

Current conditions of Physical Site Characteristics:

Site environment parameters such as baseline study of heavy metals[14] in surface and subsurface soils and water, rainfall, soil type, surface hydrology, topography, wind direction, etc. shall be studied before starting the biomining project. The overall aim is to provide a more comprehensive description and understanding of the local site characteristics and to develop a current and historical description of the area. The physical site characteristics need to be established following the "Guidelines for Disposal of Legacy Waste (Old Municipal Solid Waste)" published by CPCB in February 2019, international best practices / WBG EHS; as appropriate. Besides, standard penetration tests, soil boring and auger and trial pits, or similar appropriate tests shall be arranged to understand the extent of contamination to device a better remediation strategy.

Process and Required Components of an SCA

The SCA process will include a site inspection and discussions with the personnel managing the waste management facility and residents who are informed about the site and its history and conditions. The site inspection will examine vegetation stress, key ecological receptors, leachate breakout, and signs of contamination discharge. Surrounding land uses will also be considered. Drinking water sources and wells will be noted using published well records correlated to site observations. The proximity of the site to surface water bodies or sensitive habitats (e.g., wetlands) should also be identified. The SCA needs to include the following information at the minimum.

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[13] *a) http://archived.greentribunal.gov.in/Display_file_judgement.aspx?ID=401047*
b)https://greentribunal.gov.in/sites/default/files/news_updates/REPORT%20BY%20CPCB%20IN%20OA%20NO.%20514%20of%202018.pdf

[14] *In case heavy metal contamination is expected, batch leach tests can be conducted to know the heavy metal concentrations in the contaminated soil. A series of column tests can estimate the migration rates of different contaminants through the soil. These transport parameters can input for fluidyn-POLLUSOL model to estimate the migration of leachate from the landfill site to the surrounding water bodies.*

- **An Outline of Facility Characteristics:** Present a current and historical description of the site and surrounding characteristics at a radius as outlined below for and its facilities should be developed, particularly the areas of concern- like contaminant sources and discharge points. Visual inspections, facility records reviews, and discussions with informed personnel are to be employed for this purpose. Also, above and below ground structures should be reviewed as possible sources of contaminant migration. Previous uses of the site and surrounding land uses should also be considered. The site inspection should also document the natural integrity of the surrounding environment, the condition of the facility, it's set up and ancillary facilities, presence of unauthorized activities such as waste scavenging and piggeries on-site, encroachments, and conditions such presence of animals and vectors in the site and other nuances.
  The volume of waste to be determined through a contour survey (Total Station Survey) and site measurements. Drone mapping of heap volumes at different stages is most cost-effective and recommended.

- **Current conditions of Physical Site Characteristics:**
  Site environment parameters such as baseline study of heavy metals in surface and subsurface soils and water, rainfall, soil type, surface hydrology, topography, wind direction, etc. shall be studied. The overall aim is to provide a more comprehensive description and understanding of the local site characteristics and to develop a current and historical description of the area. The physical site characteristics need to be established following the "Guidelines for Disposal of Legacy Waste (Old Municipal Solid Waste)" published by CPCB in February 2019, international best practices / WBG EHS; as appropriate. Also, standard penetration tests, soil boring and auger and trial pits, or similar appropriate tests shall be arranged to understand the extent of contamination to device a better remediation strategy.

- **Identification of Contaminates and their characteristics:**
  Contaminants to air, surface water, groundwater, and soil that may be present at the site must be identified. Their quantities and concentrations are to be estimated by visual inspections and scientific testing. Sampling locations should be spread out around the immediate vicinity of the site and spread out at different points locations along the minimum study area radius. initial baseline survey of surface and subsurface soils and waters and also leachate present, to check for heavy metals and toxics if any. Samples should be analyzed by a NABL or MOEF certified laboratory.

  The characterization of the contamination (i.e., degree, nature, estimated extent, and media affected) and site conditions (i.e., geological, ecological, hydrogeological and hydrological) should be established to develop a remedial action plan including long term monitoring timelines and parameters.
  Through the identification of contamination characteristics, the assessment should aim to do the following:
  - to target and delineate the boundaries of identified contamination;
  - to define, in greater detail, site conditions to identify all contaminant pathways, particularly for possible risk assessment;
  - to provide contaminant and other information necessary to finalize environmental quality remediation criteria or risk assessment; and

- to provide all other information required to develop a remedial action plan and input to specifications and tender documents.

- **Requirements for the Remedial Action Plan**
  Post the assessment of the degree of contamination on-site, a corresponding remediation criterion has to be determined for the site, a qualified person must prepare a Remedial Action Plan (RAP) detailing the methodology for achieving these criteria as well as the proposed remedial action. The Remedial Action Plan must include the following information:
  - include contact information, including names of key personnel, consultants, contractors, telephone, mail, fax, and email contacts, physical addresses;
  - summarize all data on contaminants identified during the site investigation(s) and annex test results;
  - identify contaminants of concern and the media affected;
  - identify the proposed clean-up/mitigation criteria and method(s) by which they have been derived;
  - identify, quantify and characterize the materials to be treated/removed;
  - summarize remedial options evaluated and the method used to select the preferred remedial strategy;
  - describe the selected clean up method and its technical feasibility;
  - detail an implementation plan, including a schedule;
  - discuss control measures to minimize fugitive air emissions, surface water control, worker health, and safety;
  - identify the fate of residual contaminants; and
  - identify remedial verification and long-term monitoring plans; following best international practices also to reduce contamination affecting nearby uses in the future.

Key points:

- The booming activities and preparatory activities shall follow the “Guidelines for Disposal of Legacy Waste (Old Municipal Solid Waste)” published by CPCB in February 2019, international best practices / WBG EHS; as appropriate. In addition, standard penetration tests, soil tests, boring and auger and trial pits, batch leach tests or column tests or similar appropriate tests shall be arranged to understand the extent of contamination to device a better remediation strategy.
- Biomining methods include Tractor Tiller, Trench method, Cone Method, windrow, Thin Layer Method, etc. More appropriate may be the Cone method for legacy waste and window for relatively fresh waste.
- Leachate channelization and treatment facility shall be set up before starting the biomining works. Works shall take place only during the non-monsoon period; and there shall be suitable precautions to prevent any rainwater disturbing the operations (like seasonal unexpected rains, stormwater, runoffs from other sources). In the case of sites near Septage treatment plants, the possibility of collecting and sending leachate there for treatment may be discussed. Untreated leachate may be tested for pH, TDS, TSS, BOD, COD, Oil and Grease.
- Ballistic separator and trommel may be used for screening. Screened fractions into which waste is segregated include RDF, inert, Compost, and C&D wastes.

- There are various remediation technologies for contaminated MSW sites[15]. This includes Permeable reactive barrier (PRB), Electrokinetic (EK) Remediation, EK+PRB, BioEK, Microbial Remediation, In-Situ Injection Treatment, Nano zero-valent iron Micro and nanobubble, Phytoremediation. Among these while many are expensive and involve long procedure; Phytoremediation using forestry, grassland treatment, sunflower plantation, etc have been reported successful in many studies. [16] There are some studies on the use of Vetiver for Phytoremediation especially for leachate from MSW dump yards in Kerala[17]. Depending on the technical feasibility, this may be tried along with mulching and other options for habitat restoration in case of dumpsites which are not to be used for other purposes. This technique also helps reduce a considerable volume of leachate.
- In case the site is contaminated with heavy metals or if it is near sensitive receptors that may get further polluted or disturbed during the remediation process; it then requires a greater degree of technical detailing and remediation, not possible within the scope and period of this project. Other activities on the land this retrieved also shall depend on the extent of contamination so that there is no future negative impact on the workers or the public. For example; while it may be possible to use the land to construct sanitary landfills, use for MRFs/MCFs or treatment plants, other associated

[15] *Ye, Jianshe & Chen, Xiao & Chen, Chao & Bate, Bate. (2019). Emerging Sustainable Technologies for Remediation of Soils and Groundwater in a Municipal Solid Waste Landfill Site -- A Review. Chemosphere. 227. 10.1016/j.chemosphere.2019.04.053.*

[16] *Phytoremediation, a means of remediation and rehabilitation for a contaminated land using green plants, has emerged as a viable alternative site remediation method for MSW landfills and dumpsites due to its large treatment area and capability to treat contaminants distributed spatiotemporal variably throughout the shallow soil layers (Nagendran et al., 2006; Pathak et al.,2012; Lamb et al., 2014; Reddy et al., 2017). Mechanisms of phytoremediation include (Pathak et al., 2006; Jones et al., 2006; Nagendran et al., 2006): (1) phytoextraction, where plants (e.g., Thalaspi, Alyssum and Brassica) take up contaminants from soil or water, then translocate and accumulate them into roots or harvestable shoots; (2) phytofiltration, where plants absorb contaminants from contaminated surface water; (3) phytostabilization, where contaminants (metal and organic) are immobilized in the soil by means of sorption (binding), precipitation, and complexation by the deep or fibrous root systems of the plants; (4) phytovolatilization, where contaminants are converted to volatile form and released into the atmosphere via evapotranspiration process of the plants; (5) phytodegradation, where organic contaminants are converted to less harmful substances by the plants; and (6) Rhizofiltration, where plant roots growing in polluted water precipitate and concentrate metals (Cu, Hg, Pb, Zn). Major categories of contaminants from a solid waste landfill (Kjeldsen et al., 2002; Han etal., 2016) can all be removed by phytoremediation…...Major categories of contaminants from a solid waste landfill (Kjeldsen et al., 2002; Han etal., 2016) defined in Introduction can all be removed by phytoremediation. COD and NH+ in landfill leachates can be efficiently reduced by either forestry or grassland treatment system (Jones et al., 2006). COD, nitrogen and phosphorous in an anaerobic MSW landfill in the north of Italy were remediated by sunflower with removing efficiencies of 50%, about 100% and 100%, respectively (Garbo et al., 2017). Heavy metals from Kuchyňky landfill leachate were removed by mushroom species (P. ostreatus as a bioaccumulator) (Vaverková et al., 2017). Sites contaminated with both organic and heavy metals were also effectively treated with native species such as Switchgrass and Little Bluestem (Reddy et al., 2017).*

[17] Ash, Peter etal, 2016. Managing former landfill sites a case study of eco-restoration from Kochi, Kerala, Green chemistry & technology letters, vol 1, no 1, November 2015, pg 82-85 DoI: 10.18510/gctl.2015.1113.
Available at:
https://www.researchgate.net/publication/292971714_managing_former_landfill_sites_a_case_study_of_ecorestoration_from_kochi_kerala
Accessed on: 02 March 2020

infrastructure, etc. on the retrieved portion shall be encouraged only if there is no harmful contamination which may affect the health of workers /users.

- Any type of facility to be developed on retrieved land shall consider the stability of the retrieved land.
- WBG EHS Guidelines: Environmental on Contaminated Land shall be followed: https://www.ifc.org/wps/wcm/connect/63bee22a-3eda-43f3-82de-a959c6ceaf49/1-8%2BContaminated%2BLand.pdf?MOD=AJPERES&CVID=ls4Y3K7

ECoP 12: Guidance on COVID 19

a) Sanitation and Waste Management Activities under COVID 19

GoK has made Sanitation and COVID waste management the responsibility of ULBs and has issued many guidelines to support them in its implementation.

Follow the guidelines by GoK, CPCB, WB, and WHO; specific attention requested on the following:

- Facilities for cleaning – with soap and water - shall be arranged for easy access of the workers; and sanitizers if approved types shall be provided
- Workers shall be provided with sufficient quantities of appropriate Personnel Protective equipment such as boots, gloves, masks, etc.
- Social distancing or 'Break the Chain' guidance shall be followed
- There shall be changing and washing/scrubbing areas for workers. Existing facilities in ULBs may be converted for such use.
- Waste collection receptacles for used PPEs shall be made available
- ULB shall tie-up with the Common Biomedical Waste Management Facility or any such facility in nearby large hospital/medical college for disposal facility for storage and disposal of biomedical wastes, PPEs
- ULB shall arrange a closed vehicle managed by a single driver-operator- who can collect wastes from homes under quarantine and direct transport to the disposal facility
- Disinfectants purchased for cleaning shall be approved / not banned by international and national bodies.
- For areas that need extensive cleaning using detergents, disinfectants, and water, arrange collection of used water and treatment using mobile / package Effluent Treatment Plant. Detergent and disinfectant bottles and containers shall be sent to MCF/recyclers
- There shall be continuous health monitoring of workers involved in these efforts and immediate appropriate health care or quarantine if found infected.
- Insurance / financial support shall be arranged for the workers for treatment.

b) Clauses for Inclusion in Civil works Contracts:

- *Clauses already part of contract/bidding documents being used need not be duplicated.*
- *The primary/main contractor will be responsible for ensuring these, even if one or more sub-contractors are used for completing the civil works.*
- *The contractor to put in place measures to avoid or minimize the spread of the transmission of COVID-19 and/or any communicable diseases that may be associated with the influx of temporary or permanent contract-related labor.*

- *Any suspect case of COVID19 should be tested as per the national/state guidelines issued by the Health and Family Welfare Ministry/Departments and precautions/protocol to be followed for the infected worker and his/her co-workers.*

1.	**General Obligations of the Contractor**
▪ To take all necessary precautions to maintain the health and safety of the Contractor's Personnel. ▪ To depute a health and safety officer at site, who will have the authority to issue directives to maintain the health and safety of all personnel authorized to enter and or work on the site and to take protective measures to prevent accidents, including the spread of COVID19. ▪ To ensure, in collaboration with local health authorities, access to medical help, first aid and ambulance services are available for workers/laborers, as and when needed.	
2.	**Labor**
▪ No child labor and/or forced labor at the construction site for all works. ▪ Equal pay/wage for men and women laborers. ▪ Provide health and safety training/orientation on COVID19 to all workers and staff and other employees of the sub-contractor (tips on cough etiquette, hand hygiene, and social distancing). ▪ Prepare a detailed profile of the project workforce, key work activities, schedule for carrying out such activities, different durations of contract and rotations, confirmed addresses of the labor and any underlying health conditions that increase the risk of severe infection, to facilitate tracking of workers in case of COVID-19 exposure. ▪ All laborers to be provided with photo ID cards for accessing the construction site. ▪ All laborers engaged at the construction site to be provided with the required Personal Protection Equipment (PPE) – safety helmet and shoes, secured harness when working at heights, electrical gloves, eye protection for welding, etc., without which entry to the construction site shall not be allowed. ▪ Concerning COVID19, masks, adequate hand washing/ sanitization, clean drinking water and sanitation facilities to be provided at the construction site. ▪ All workers/labor to be regularly checked for symptoms before allowing entry to the worksite. ▪ Paid leave to be mandatorily given if labor contacts COVID-19 and/or any other contagious disease while working at the construction site or in the labor camp. ▪ Steps necessary to prevent labor harassment, including sexual harassment, gender-based violence, and any discrimination based on religious, political, and/or sexual orientation.	
3.	**Labor Camps (only when labor camps are established)**
▪ Contractor to provide hygienic living conditions and safe drinking water. ▪ Separate toilets for males and females and adequate hand washing/sanitization facilities. ▪ Small creche and/or play areas for children with a helper, when labor is away at work. ▪ Fireproof wiring and good quality electricals to be used inside the camp. ▪ Cooking gas and/or electric/induction plate to be provided for each labor household. ▪ Monthly/weekly health checkup to be organized at the camp for all labors/family. ▪ Organize an awareness campaign for social distancing and general health and hygiene.	
4.	**Involuntary Resettlement Related (Only When Relevant)**
▪ No forced eviction of any squatter and/or encroacher at the construction site. ▪ Such matter to be informed in writing to the concerned authorities and the World Bank for appropriate action as per the environment and social standard (ESS5).	
5.	**Greenfield/New Constructions – Permits / Environment and Social Management Plan (ESMP)**
▪ No use of Asbestos or components/fixtures having asbestos. ▪ Comply with all applicable national/state permits. ▪ For greenfield projects involving the construction of new buildings and/or adding new floors and/or constructing a new section/wing in an existing building (hospitals, laboratories, isolation wards, and quarantine facilities), and ESMP to be prepared by the contractor, as per works specifications.	
6.	**Construction Management in Upgrading of Existing Buildings**

▪ For all contracts involving the upgrading of existing buildings (adding rooms, wards, halls, treatment and isolation areas, medication rooms, operation theaters, intensive care units, laboratories, etc.), follow the Construction Management Framework prepared for the India COVID-19 Project and included in the project's Environmental and Social Management Framework (ESMF), along with following various guidelines issued by the Government of India, WHO best practices, etc. ▪ Maintain a roster of workers/staff at the work site indicating their health condition and symptoms and ensure screening procedures (non-physical temperature measurement) at work sites. ▪ Depute and assign monitoring and reporting responsibilities on environmental management, health, and personnel safety. ▪ Preventing a worker from an affected area or who has been in contact with an infected person from returning to the site for 14 days or (if that is not possible) isolating such workers for 14 days. ▪ Place posters and signages at/around the site, with images and text in local languages relating to personal safety, hygiene, and COVID-19 symptoms and guidelines. ▪ Ensuring handwashing facilities supplied with soap, disposable paper towels and closed waste bins exist at key places throughout the site, including at entrances/exits to work areas; where there is a toilet, canteen or food distribution, or provision of drinking water; in worker accommodation; at waste stations; at stores; and in common spaces. ▪ Segregate lunch hours at the worksite of workers to maintain social distancing. ▪ Designated separate space for storing construction material. ▪ Securing the construction site with entry only for authorized personnel and disinfecting of the worksite to be undertaken at close of work every day or as may be required. ▪ Any medical waste produced during the care of ill workers should be collected safely in designated containers or bags and treated and disposed of following relevant requirements (e.g., Biomedical Waste Rules-2018, WHO).	
7.	**Grievance Redress Mechanism (GRM)**
▪ Contractor to establish and widely advertise (within labor camps and at the construction site) a GRM. Workers to be informed of their rights for reporting a workplace condition that is not safe or healthy for them and poses an imminent risk of contracting COVID-19 without any reprisal/penalty. ▪ GRM to have provisions for receiving, registering, following up, and resolution system for any complaint/grievance received during the construction period. ▪ A complaints register will always be maintained at the site office and responsibilities allotted to a sufficiently senior official for complaint redress.	

Section VIII: Physical Cultural Resources Management Framework

It is important to adopt a precautionary approach to ensure that project activities do not affect important Physical Cultural Resources (PCRs). Hence, the provision of methodology for the screening of sites and incorporation of mitigation measures in EMF is deemed important. Besides, additional PCRs (chance finds) may be encountered during site clearance or excavation activities associated with the construction of structures. At the project level, hence it is important to develop a PCR Management Plan (PCRMP) that identifies what measures shall be taken to protect these cultural resources, based on the framework provided in this section. The plan should also address measures to monitor downstream erosion of physical cultural sites and implement measures to protect these sites. Chance Find Procedures, which identify the measures to be taken if PCRs are encountered, are also outlined here.

01. Applicable policies

Various National and State level policies/laws and rules are applicable for heritage preservation. Besides, international guidance and world Bank operational policy on PCRs are applicable here. Key facts/guidance are listed here.

Policy / Act	***Description***
Ancient Monuments and Archaeological Sites and Remains Act 1958; India updated as per Ancient Monuments and Archaeological Sites and Remains (Amendments and Validation) Act, 2010 Responsible Agency: Ministry of Culture; NMA with ASI	Declares certain monuments/sites as being of "national importance". Stipulates conservation of cultural and historical remains found in India. (i) 100m radius is "prohibited" area – no construction or reconstruction. Repairs allowed. (ii) A 200m radius is a "regulated" area (structures can be constructed by archaeological officers with due sanctions from a competent authority). Protection, maintenance, and conservation managed by Archaeological Survey of India (ASI)
Ancient Monuments Protection Act, 1904 Responsible Agency: Ministry of Culture, Government of India	Gives central government the authority to protect and conserve monuments, particularly those privately owned, through the acquisition of rights. Specifies agreements to be made between GoI and monument/site owner for the transfer of rights for protection.
The Kerala Ancient Monuments and Archaeological Sites and Remain Act, 1969 (No.26 of 1969); The Ancient Monuments And Archaeological Sites and Remains (Amendment And Validation) Ordinance, 2010 No. 1 Of 2010	To provide for the preservation of ancient monuments and archaeological sites etc.

World Bank Operational Policy

World bank OP/BP 4.11 states that PCRs may not be known or visible; therefore, a project's potential impacts on PCRs must be considered at the earliest possible stage of the project planning cycle. This policy addresses PCRs, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. PCRs may be located in urban or rural settings and may be above or below ground, or underwater. Their cultural interest may be at the local, provincial or national level, or within the international community. PCRs are important as sources of valuable scientific

and historical information, as assets for economic and development, and as integral parts of a people's cultural identity and practices.

Other International Guidance:

Guidance	***Description***
UNESCO Operational Guidelines for the Implementation of the World Heritage Convention, 2013. Responsible Agency: Ministry of Culture with ASI; NMA	To facilitate the implementation of the World Heritage Convention, Requires the establishment of boundaries, buffer zones (where necessary), management systems and sustainable use for effective protection of listed sites and to maintain their "Outstanding Universal Value". There are 38 such sites in India. The Western Ghats, also known as the Sahyadri Mountains, a mountain range along the western side of India and one of the world's ten 'Hottest biodiversity hotspots' (sub-cluster nomination). A total of thirty-nine properties (including national parks, wildlife sanctuaries, and reserve forests) were designated as World Heritage Sites – twenty in the state of Kerala, ten in Karnataka, five in Tamil Nadu and four in Maharashtra.

02. Project Activities Impacts and Mitigation measures

Some of the subproject activities may be proximal to locally or regionally important PCRs and may affect the cultural spirit of the communities. Some activities might require site clearance, minor excavations, and construction closer to settlements and PCRs in the project areas.

This EMF includes the screening framework, process to prepare PCRMP while finalizing the interventions at each location. The EMP describes procedures to identify such properties, and mitigate and manage impacts in the case, such properties are impacted. Cultural resources (properties), if any would not be disturbed through avoidance of these. At the project preparation stage, it is important to prepare an inventory of PCRs and prepare the PCRMP in case project screening identifies such possibilities. The methodology to prepare the PCRMP is provided in the following section. This EMF also includes procedures to handle chance finds.

Table A Presents the indicative project activities, impacts, and mitigation measures for inclusion in PCRMP.

Table A: Guidance on Possible Impacts on PCRs and Mitigation Measures

Stage	***Activity***	***Impact***	***Mitigation Measures***
Design Stage	Layout of Facilities in proximity to PCR	Physical, Cultural disturbances to PCRs due to siting activities near or upstream	▪ PCR Inventorization and Consultation with Community and official stakeholders (including local bodies) during EA ▪ Prepare alternate design to avoid sitting of structures /activities near PCR ▪ Prepare designs appropriate to nearby PCRs: (b) Prescribe the position, height, size, design, materials, color and screening and otherwise regulate the external appearance of structures and other

Stage	Activity	Impact	Mitigation Measures
			works above ground within the controlled area ▪ Prepare mitigation measures in case unavoidable and consult and agree with the community and all relevant authorities
Pre-Construction Phase	Site Clearance	Physical and Cultural impacts of cleared material strewn around PCRs	▪ Follow proper stacking of cleared material in areas away from PCR and ensure site housekeeping
		Instructions to workers on chance finds	▪ Training/instructions to workers on chance finds and heritage around at Day 1 toolbox or earlier before site work start
		Dust pollution due to the removal of cleared material from the site	▪ Transport cleared material from the site to designated treatment/disposal points through routes which are well surfaced and away from PCRs
		Chance Find of idols, histo-culturally important property	▪ Discussion with local informants before staring activities on-site / during EA ▪ Site examination with user group/communities before initiating pre-construction activities ▪ Chance find procedures to be followed
		Disturbances due to culturally inappropriate labor and activity scheduling near PCRs	▪ Labour and activity scheduling near PCRs to follow timelines and other aspects in consonance with any local beliefs/nuances
		Disturbance to trees or important vegetation	▪ Barricades and instructions to avoid disturbance to key / peripheral trees and vegetation. ▪ Reforestation (at 4 times rate) in case of disturbance to vegetation in nearby areas outside the control area of PCR
	Transport and stacking of materials and Tools	Stacking of tools and material around PCRs	▪ Minimal stacking of materials ▪ Follow proper covered / safe stacking in areas away from PCR, and ensure signages (with reflectors), site housekeeping
		Dust pollution due to the transport of material to the site	▪ Transport material to site through routes which are well surfaced and away from PCRs
Construction and Operation Phase	Excavation or material sourcing (borrow/quarry sites)	Chance Find of histo-culturally important property (idols, structures, potteries, stone tools, fossils, and bones, etc)	▪ Discussion with informants and Site examination with user group/communities before initiating construction activities ▪ Chance find procedures to be followed ▪ Barricading the area, watch, and vigil till authorities are notified and taken charge ▪ Photo documentation if allowed and directed by authorities
		Structural and cultural disturbances to PCRs	▪ Plan to minimize disturbances in consultation with communities and authorities

Stage	Activity	Impact	Mitigation Measures
		due to construction activities	▪ Repairs, provision of retaining walls and other supports
		Disturbances due to culturally inappropriate labor and activity scheduling near PCRs	▪ Labour and activity scheduling near PCRs to follow timelines and other aspects in consonance with any local beliefs/nuances
		Erosion and slippage affecting downstream PCRs	▪ Proper site planning to avoid erosion, slippage ▪ Adopting indigenous knowledge to prevent erosion and slippage ▪ Protective measures like fencing / retaining walls, barricading of downstream PCRs
		Impacts on downstream water-based culturally important activities due to construction upstream	▪ Maintaining downstream ecological flow while constructing upstream ▪ Provide treatment of leachate/wastewater in the site itself and reuse treated wastewater
	Transport and stacking	Physical and Cultural impacts of construction and Demolition waste material strewn around PCRs	▪ Follow proper stacking of wastes in areas away from PCR and disposal at agreed points as per time chart, and ensure site housekeeping
		Dust pollution and odor due to transport of material to site and wastes from site	▪ Transport material to sites and wastes to designated treatment/disposal points through routes which are well surfaced and away from PCRs ▪ Proper odor control measures
	Community health and safety	Impacts on communities during PCR related religious/cultural activities due to noise levels, poor site housekeeping, and activity management, labor influx	▪ Scheduling of activities in consultation with communities ▪ Provide greenbelt and buffer around the activity area ▪ Preference to local community workforce ▪ Facilities (sanitation, stay) to laborers away from PCRs ▪ Training to laborers to minimize impacts on PCRs and dependent communities ▪ Barricades around construction sites, display of warning boards, fire control, reflectors, etc. for safety ▪ Proper work close out strategy and its execution
		Accidents affecting PCRs during construction or operations (for eg: erosion affecting PCRs due to breakage of bunds)	▪ Prepare and execute Emergency Response Plan and train communities, authorities

03. Preparation of Physical Cultural Resources Management Plan

The objective of the PCRMP is to prevent any inadvertent loss of physical and cultural resources during project construction and operation. The development of a PCRMP is to be

made an integral part of the Environmental Impact Assessment process. Typically, the plan includes measures for avoiding or mitigating any adverse impacts on physical cultural resources, provisions for the management of chance finds, any necessary measures for strengthening institutional capacity, a monitoring system to track the progress of these activities, and takes into account the country's overall policy framework, national legislation and institutional capabilities regarding physical cultural resources.

In the case of a major subproject in a culturally sensitive area, which requires substantial archaeological investigations during project implementation, consideration should be given to instituting a program of independent monitoring and review. Whenever it is considered possible for project-related activities to encounter archaeological or paleontological sites or artifacts, the contractors should be required to follow procedures outlined by the World Bank regarding chance finds.

1. Project Screening

Project activities near (200m radius) to the listed archaeological sites or important monuments shall not be permitted

For all other PCRs, culturally important tangible or intangible assets, PCRMP shall be prepared and mitigation hierarchy to be followed.

The PCRMP can constitute either (i) a section of the Environmental Management Plan or (ii) may be part of the recommendations of the completed EA.

PCR component of the EA shall include (a) an investigation and inventory of PCRs likely to be affected by the project; (b) documentation of the significance of such PCRs; and (c) assessment of the nature and extent of potential impacts on these resources.

The Management Plan should clearly:

- Schedule the implementation of the proposed PCR mitigating measures and PCR monitoring, if any, taking into account the weather pattern, and identify roles and responsibilities for such implementation;
- Identify procedures for handling chance finds, including the role and responsibilities of the cultural authorities and the contractor;
- Identify procedures for addressing PCR impacts that may occur during implementation but were not predicted in the impact assessment.

Sections of the PCRMP are as below:

1. Applicable Policy, Legal and Regulatory Framework

This section should contain a reference to the following, including identification of any implications for the PCR component of the EA, such as special standards or requirements:

- The World Bank's EA policy OP/BP 4.01 and the PCR policy OP/BP 4.11;
- Sections of national EA laws, regulations and guidelines relating to PCR;
- Sections of the national environmental conservation strategy, if any, relating to PCR;
- National, state/provincial or local legislation and regulations relating to:
    - Antiquities, including sale and export;
    - Procedures for addressing chance finds, in terms of ownership and requirements by the contractor and cultural authorities;
    - Archaeology, including the issue of permits;

- Relevant authorities charged with PCR identification, protection and management, their powers, the legal basis for their authority, and their actual capacity;
- PCR-related conventions and treaties to which India is a signatory;
- Sites in the state / nearby areas listed as World Heritage Sites according to the UNESCO World Heritage Convention, or included in UNESCO's 'tentative' list under the same convention;
- Sites currently listed by other international agency in the field of PCR such as the World Monuments Fund, or ICOMOS, as being of national or international importance;
- Any national or provincial registers of PCR maintained by accredited authorities in India.

2. Baseline Data

It is important to understand the baseline PCRs in the region and specifically, the earmarked sites while preparing the project-specific Environmental Assessment. The Terms of Reference (TORs) for PCRMP or EA / EIA shall propose spatial and temporal boundaries for the on-site collection of baseline data on PCRs potentially affected by the project, and specify the types of expertise required for the PCR component of the EA.

The EA baseline data should include an investigation and inventory of physical cultural resources likely to be affected by the project. The data should consider all types of PCR that might be impacted, covering:

a. Living-culture PCR, as well as historical, archaeological and paleontological PCR;

b. Natural and human-made PCR;

c. Movable and immovable PCR;

d. Unknown or invisible PCR.

The baseline data section should include maps showing PCR baseline data within the potential impact areas. Since many local PCRs are not documented or protected by law, consultation is an important means of identifying such resources, documenting their presence and significance, assessing potential impacts, and exploring mitigation options. The data collection activity should involve consultations with concerned authorities, potentially affected communities, and non-governmental organizations. Potential data sources might include cultural authorities, national or provincial PCR registers, universities and colleges, public and private PCR-related institutions, religious bodies, and local PCR NGOs. Sources at the community level typically include, for example, community leaders and individuals, schools, religious leaders, scholars, PCR specialists, and local historians.

Also, the EA should detail the cultural significance or value attributed by the concerned or affected parties to the PCR identified in the baseline. This will normally not be expressed in monetary terms, but rather should explain the nature of the cultural significance, for example, whether it is religious, ethnographic, historic, or archaeological. In the case of PCR of archaeological, architectural, paleontological or other scholarly or scientific value, the EA should provide an assessment of the relative importance of the PCR in this regard locally, nationally and/or internationally.

3. Component Planning and Design based on Analysis of Alternatives

A detailed description of the project components, supported by location/layout/site maps, construction plans, and operation details of each activity and development proposed is essential to evaluate the impacts. It should describe the activities associated with pre-construction, construction, and operation phases including material sourcing and staking, transport, labor, work schedule, and impacts on nearby PCRs due to each activity.

Selection of alternate locations designs or arrangements shall be considered in case any PCR related issues are identified. Alternatives shall aim at avoiding or minimizing the impacts on PCRs.

4. Impact Assessment

The EA should specifically describe the nature and extent of the potential impacts. The PCR components of the EA must align with any PCR-related impacts in other reports, to ensure that elements of living culture are not overlooked in the assessment stage. The impact assessment should also consider the possibility of accidents during construction/rehabilitation and operations which might affect PCR, which might call for special precautionary measures and emergency responses.

5. Capacity Assessment

The EA should assess the borrower's capacity for implementing the proposed mitigating measures and managing chance finds, and where appropriate, recommend capacity-building measures. Capacity to implement the Plan, particularly to identify and manage PCR related impacts, on-site training, institutional strengthening, inter-institutional collaboration, and rapid-response capacity for handling chance finds shall be augmented if found necessary.

6. Mitigation Measures

Consultations with concerned and affected parties must be conducted on the proposed mitigation measures relating to PCR impacts. Agreements must be reached, and evidence of such agreements should be included in the EA.

The following mitigation measure is essential: (i) Avoidance or mitigation of identified adverse impacts; (ii) Provisions for chance finds; (iii) Measures for strengthening institutional capacity; and (iv) Monitoring systems to track the progress of these activities. The EA process should check whether the recommended mitigation measures might themselves have environmental impacts (e.g. paved access roads). The cost implications of implementing proposed mitigation measures shall be included in the costing table and finally in the bid documents.

All necessary and adequate care shall be taken to minimize the impact on cultural properties (which includes cultural sites and remains, places of worship including temples, mosques, churches, and shrines, etc., graveyards, monuments and any other important structures as identified during design and all properties/sites/remains notified under the Ancient Sites and Remains Act. No work shall spill-over to these properties, premises, and precincts. All utilities and common property resources likely to be affected due to the project will be relocated with prior approval of the concerned agencies before the start of construction. Similarly, cultural properties whose structure is likely to get affected will be relocated at suitable locations, as desired by the community before construction starts.

Local community needs to be contacted and discuss relocation aspects, siting as well as their maintenance.

7. Timing/Schedule

The PCRMP shall be in place two months before the onset of site construction works for the main project site.

04. Chance Find Procedures

Chance Finds Procedure to guide the management of any accidental discoveries of histo-cultural resources while implementing the project is presented here.

All fossils, coins, articles of the value of antiquity, structures, and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer (Officer in Charge of the site) of such discovery and carry out the Engineer's instructions for dealing with the same, waiting which all work shall be stopped. The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work on the site.

If the Contractor discovers archaeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a nightguard shall be arranged until the responsible local authorities or the designated authority of the Ministry of Culture take over;
- Notify the Project Environmental Officer who in turn will notify (in writing) the responsible local authorities and the designated authority of the Ministry of Culture immediately (within 24 hours or less);
- Responsible local authorities and the designated authority of the Ministry of Culture would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the Ministry of Culture. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, and economic values;
- Decisions on how to handle the finding shall be taken by the responsible authorities and designated authority of the Ministry of Culture. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration, and salvage;
- Responsible authorities may also communicate to the project in-charge or Environmental Officer the emergency handling measures to collect and preserve certain PCRs even before they arrive at the location to plan a detailed preservation mechanism. (Eg: This may include directions to collect potteries/stone tools/fossils in

cloth bags bearing the provenance of the find and its exact location, depth and the total area to which it is evidenced or to collect bones and organic materials collected by the help of a spoon/spool in steel and kept covered in aluminum foil; avoiding direct body contact; or as appropriate)

- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

- For Chance Found Flora / Fauna
  - Training to Project Officials and workers on-site recce for PCRs before Site clearance and excavation
  - The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.
  - If any wild animal or rare species (fauna/flora) is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same.
  - The Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures if required in consultation with the forest officials.
- Construction works could resume only after permission is granted from the responsible local authorities or the designated authority of the Ministry of Culture concerning the safeguard of the heritage / other chance finds;
- These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.

Section IX: Guidance on Preparing Natural Habitat Management Plan

For the long term sustainability of the project and its environment, it is important to ensure conservation the natural habitats. Hence, the provision of methodology for the screening of sites and incorporation of mitigation measures in EMF is deemed important. Also, specific sub-projects may have impacts beyond the project boundary on the natural habitats and biodiversity of the region. As per stage 1: Exclusions; all subprojects which may result in conversion or degradation of critical natural habitats and Forests are excluded. However, considering the eco-sensitivity of Kerala, it is proposed to develop Natural Habitat Management Plan (NHMP) at the subproject level as part of EMP in case it is found through EA that its area of influence (maybe beyond the project boundary) includes any recognized or unrecognized natural habitat as a sensitive receptor. The plan suggests measures to be implemented to protect natural habitats and to monitor the impacts during construction and operations stages.

01. Applicable policies

Various National and State level policies/laws and rules are applicable for Biodiversity management. Besides, the World Bank operational policy on natural habitat is applicable here. Key facts are as below:

Policy / Act	***Description***
Wildlife Protection Act, 1972	The Wildlife Protection Act, 1972 has allowed the government to establish several Protected Areas like National Parks and Sanctuaries over the past 37 years, to protect and conserve the flora and fauna and their habitat. Prior recommendation of National Board for Wildlife (NBWL) will be required • in case any activity is proposed within the boundaries of Protected area • in case any project requiring Environmental Clearance (under the purview of EIA Notification 2006 and its subsequent amendments) is located within the eco-sensitive zone around a Wildlife Sanctuary or National Park or in absence of delineation of such a zone, within a distance of 10 km from its boundaries
Forest (Conservation) Act, 1980	The Indian Forest Act (1927) was amended in 1980 in an attempt to check the rapid deforestation occurring throughout India and the Forest (Conservation) Act, 1980 came into existence. At the state level, the government was empowered to declare reserves and protected forests and was also given the authority to acquire land for extension and preservation of the forests. Forest (Conservation) Rules, 2003 explain the procedure for procuring clearance for diversion of forest land for non-forest purpose. Prior Forest Clearance under the purview of this act will be requiring in case use/diversion (for long term or short term) of forest land is involved in the project.
Wetlands (Conservation and Management) Rules, 2017	Wetlands (Conservation and Management) Rules, 2017 are promulgated under Environmental (protection) Act, 1986 for prohibiting reclamation and degradation through drainage and landfill, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alteration (water withdrawal and changes in inflow and outflow), over-exploitation of their natural resources resulting in loss of biodiversity and disruption in ecosystem services provided by wetlands by conservation of wetlands. The rules shall apply to the wetlands or wetlands complexes of following types-

Policy / Act	*Description*
	(a) wetlands categorized as 'wetlands of international importance' under the Ramsar Convention (b) wetlands as notified by the Central Government, State Government and Union Territory Administration **Section 4** of the rule elaborates Restrictions of activities in wetlands which includes solid waste dumping and any construction of a permanent nature
Kerala Preservation of Trees Act, 1986	The act states that No person shall, without the previous permission in writing of the authorized officer, cut, uproot or burn, or cause to be cut, uprooted or burnt, any tree as defined by the act. Prior permission for tree felling to be secured in case the felling of the tree (as defined in the act) is involved in the project.
Kerala Conservation of Paddy Land and Wetland (Amendment) Act, 2018	The Kerala Conservation of Paddy Land and Wetland Act, 2018 is intended to conserve the paddy land and wetlands and restrict their conversion or reclamation, to promote growth in the agriculture sector and sustain the ecological balance. Permission from State Govt. shall be requiring in case any facility is proposed on paddy land/wetlands (as documented in revenue records).
Kerala Biological Diversity Rules, 2007	Constitutes Kerala Biodiversity Board under section 22 of the Act, and Biodiversity Management Committee (BMC)– a committee constituted by the local bodies under subsection (1) of section 41 of the Act. The board with the committees is in charge of preparing the strategy for managing habitats and databases on biodiversity in the State among other functions. Board will designate areas as biodiversity heritage sites in consultation with ULBs and frame guidelines to manage them. BMC constituted at each local body consist of a Chairperson and not more than six members nominated by the local body including women / tribal/ representative other subject matter experts. The Grama Panchayat/Municipality/Corporation levels Biodiversity Management Committees shall strive to mainstream biodiversity conservation concerns in the development planning process at the local level.

World Bank Operational Policy

World bank OP/BP 4.04 promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats.

The OP mentions that wherever feasible, Bank-financed projects are sited on lands already converted (excluding any lands that in the Bank's opinion were converted in anticipation of the project). The projects involving the significant conversion of natural habitats will be supported only if there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g., strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. In projects with natural habitat components, project preparation, appraisal, and supervision arrangements include appropriate

environmental expertise to ensure adequate design and implementation of mitigation measures

Project Impacts and Mitigation measures

Some of the subproject activities may be proximal to locally or regionally important natural habitats and may affect the cultural spirit of the communities. Some activities might require site clearance, minor excavations, and construction near-natural habitats in the project areas.

This EMF includes the screening framework, process to prepare NHMP while finalizing the interventions at each location. At the project preparation stage, it is important to prepare the NHMP as part of EIA in case project screening identifies the possibility of an impact on natural habitat. This shall be prepared in consultation with the Biodiversity Management Committee of the ULB. The methodology to prepare the NHMP is provided in the following section. Biodiversity of the area shall be studied as part of Environmental Assessment and NHMP shall be included as part of EMP. It is suggested that the biodiversity expert of SPMC shall review the biodiversity management plan while reviewing the EIA.

Guidelines

The need to protect wetlands, other ecological habitats in and around the site not only from the direct impacts of works like drainage networks, excavation and site modifications (whether intended or not) but also from activities that would reduce waterlogged areas is critically important, as these areas provide key ecological services and also serve as habitat for a wide range of aquatic species and migratory avifauna. Overall improvement in land and drainage could impact the biodiversity around.

The World Bank OP 4.04 in conjunction with the national policies, will be referenced in assessing the impacts on the biodiversity and environment management plan will be developed for avoidance or mitigation of threats to biodiversity arising from their operations as well as incorporate sustainable management of renewable natural resources. The following activities will be carried out for assessing biodiversity and project impacts on it:

- Site walk of the proposed project area, study of flora and fauna, areas of significant biodiversity value, critical habitat assessment, etc;
- Baseline studies shall be carried out comprising a combination of literature review, desktop analysis, stakeholder engagement and consultation, in-field surveys for the proposed project area, and its project area of influence. Literature review shall include sources such as peer-reviewed journals, regional assessments, national or regional planning documents such as National Biodiversity Strategy and National Plan (NBSAP) and Local Biodiversity Action Plans (LBAPs), existing assessments, and studies in the project site and its area of influence, web-based data such as provided in the International Union for Conservation of Nature (IUCN) Red list, etc;
- Stakeholder discussions consultations and engagement shall consider project-affected communities, government officials, academic and research institutions, any indigenous species, recognized external experts for biodiversity attributes of concern, national and international NGOs, etc. BMC in each ULB shall be involved in reviewing the screening checklist for projects. In case the impact assessment identifies biodiversity/habitat disturbances, mitigation measures shall be reviewed by concerned BMCs.

- Spatial data and landscape mapping shall include land classification and land use maps, satellite imagery or photographs, vegetation type and ecosystems maps, rare fauna /flora, etc.

Once the impacts on biodiversity are evaluated, appropriate mitigation measures will be suggested. The proposed mitigation plan shall consider:

- Identification and mitigation of any direct and indirect project-related impacts on biodiversity including significant residual impacts. It shall consider habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution;
- If there will be any complexity of predicting impacts of biodiversity during the assessment step, mitigation measure will be proposed which will be updated with changing conditions and project lifecycle;
- Cutting of trees or any other change to natural habitat shall be carried out after consultations with relevant stakeholders including affected communities. Appropriate plantation shall be taken up giving more importance to native/indigenous species in consultation with BMC, Forest Department, and other relevant stakeholders including hosts.
- The mitigation measures will be designed to achieve no loss of biodiversity – precautionary measure to avoid direct impacts; mitigation actions for other impacts:
    - Avoid or minimize impacts on biodiversity throughout the project
    - Implement measures to avoid habitat fragmentation such as biological corridor
    - Restore habitat during and/ or after operations

  Projects which may result in conversion or degradation of natural habitats are excluded from KSWMP (Stage 1 Exclusions).

  Indicative NHMP is presented here. This shall be suitably modified to include location-specific impacts and mitigation measures once the sites and interventions are identified.

Possible Threats	Major Impacts	Suggested Mitigation Measures	Responsible Agencies
Deposition of silt/earth derived from site clearing, excavations on natural habitat areas/wetlands	• Damage to wetland habitats, ponds, water bodies • Change in land use pattern • Reduction in wetlands/natural areas	• Do not allow silt/earth disposal in wetlands, nearby water bodies or low lying areas • Identifying alternate disposal sites and material stacking areas and arrange for adequate cover and covered transportation	Contractor, ULB

Possible Threats	Major Impacts	Suggested Mitigation Measures	Responsible Agencies
Draining out of wetlands along with the reduction of waterlogged areas through the improved drainage network	• Damage to wetland habitats through drying of wetlands • Reduction in aquatic biodiversity • The threat to nesting and feeding of resident avifauna and impacts on migratory bird species • Encroachment on drained out wetlands • The threat to small ponds, wetlands in and near villages and associated impact on economic returns from these to the poor and vulnerable population	• Prepare GIS-based inventory • Inventorying the smaller ponds and wetlands that serve ecological purposes to precede site/drainage works • Mapping should cover smaller and lesser-known wetlands and not be confined only to larger water bodies and/or those wetlands that are legally protected • No link and main drains to pass through existing wetlands and wherever required an alternative route to be developed • If there is any outfall of main drains within 200 m of an existing wetland, take regular samples (3 months) for assessing drain water quality • Undertake water quality tests for established large water bodies/wetlands nearby to check for residual pesticides/ chemicals • Low lying ponds with important economic uses, such as fishing and/or cultivation of aquatic plants and local village/temple ponds serving the community should not be drained or polluted due to subproject activities, the main exception being small pits often contaminated with stagnant water and rubbish and are a potential or actual health hazard. • Identify possible engineering interventions required for controlling the inlet/outlet of drains to ensure necessary levels of water in the wetlands • Wherever required install sluice gates or other hydraulic interventions to regulate required flow and maintain water quality in rehabilitated drains	Contractor, ULB
Impacted habitats due to project activities	• Due to increased amount of nutrients/organic matter through cut off drains and leachate drain weeds and other invasive species may invade and disrupt native plant communities • A decline in fish population and other aquatic fauna • Drained out wetlands	• Ensure that wetlands/ponds/lakes that may get drained are restored • Boundary delineation and demarcation • Restore damaged wetlands, ponds, low-lying areas, habitats, as required, by creating a buffer, cut off drains, desilting (if earth deposition), blocking channels that drain the wetlands, etc. • Increase monitoring arrangements for water quantity, quality and biodiversity parameters • Eliminate invasive species and reintroduce native biodiversity	ULB, BMC, Contractor

Possible Threats	Major Impacts	Suggested Mitigation Measures	Responsible Agencies
		• Habitat restoration if required to be undertaken in consultation with technical experts and consultation with BMC and Forests • Monitor treated leachate and site stormwater drain outflow and provide tertiary treatment for these or reuse / recycle	
Disturbances to Fauna Flora due to site activities and associated activities	• Fauna/flora moving out of the areas nearby disrupting overall ecology • Accidents to animals/birds	• Green belt and buffer for key habitat areas and the site • Information to households regarding the site activities and restrictions to domesticated animals entry to the site • Green belt to provide considerably good habitat for birds/other species preferably in three stories with quick lush growth (like Miyawaki) using native species	Contractor

Section X: Guidance on Pest Management

This sections presents the status of pesticides ban in India and Kerala, in addition to the pesticides banned by the World Health Organisation. The project SPMU Environmenral specialst shall maintain an updated list from time to time, and advice the subprojects on purchase of peticides which are not banned. The project shall develop relevant literature and pamphlets for distribution with list of banned chemicals (update the lists as required). Preferance shall be on use of biological means / biopesticides. The DPMU and ULBs shall coordinate with District Health Office (and Agriculkture Department as they regularly update the details) on identifying and using appropriate means of pest management. During EIA preparation, this shall be ascertained by consultants and the same shall be incorporated. Training shall be organised through appropriate agency on this for project environmental specialists. The following shall be considered:

- Develop and distribute guidelines on safe use of approved pesticides/insecticides and monitor: Emphasize avoiding use of broad-spectrum pesticides, chemicals that wipe out useful insects etc. Use recommended dose and concentration of pesticides. Do not support sale and use of banned fertilizers, pesticides, insecticides etc.
- Provide, as required, available bio-control agents: Use existing provisions of line departments or state bio-control labs for this purpose.
- Awareness building, Identification of biomethods, Training, Monitoring and evaluation and Process documentation.

Status of Pesticide Bans:

As of October 2019, 318 pesticides were registered in India, twelve with some restrictions on their use. Four of these pesticides are WHO toxicity class Ia (extremely hazardous) compounds (bromadiolone, captafol, phorate, phosphamidon) while fourteen are WHO toxicity class Ib (highly hazardous) compounds (beta-cyfluthrin, carbofuran, coumatetralyl, cyfluthrin, dichlorvos, edifenphos, methomyl, monocrotophos, oxydemeton-methyl, propetamphos, sodium cyanide, tefluthrin, triazophos and zinc phosphide).

There are also 95 registered pesticides of WHO class II hazard, Thirty-three class III (slightly hazardous) pesticides and 48 class U (unlikely to present acute hazard) pesticides are registered. Three fumigants are registered: aluminium phosphide, DD mixture (dichloropropene and dichloropropane), and methyl bromide. Although not classified by the WHO, aluminium phosphide is extremely toxic after self-poisoning, with a case fatality often exceeding 50% after ingestion of the previously common 56% 3 g tablets. An additional 117 non-fumigant pesticides registered for use in India are not yet classified by the WHO for toxicity, and five pesticides listed by the WHO as obsolete are also registered for use.

Since 1989, 39 pesticides have been banned nationally including ten HHPs. In 2015, the Indian government set up the Anupam Verma Committee to review the continued use of 66 pesticides that have been banned or restricted for farming use in other countries. In 2016, it recommended a ban on 13 pesticides, phasing out of 6 pesticides by 2020, and further review of 27 pesticides in 2018. The Ministry of Agriculture partially implemented the recommendations in August 2018, banning 10 pesticides, placing restrictions on 2, and scheduling six bans for 2020 including several WHO Class Ia HHPs. Two pesticides had been

recommended for a complete ban but were only restricted: sodium cyanide and trifluralin. DDT (dichlorodiphenyltrichloroethane) was not banned and its sole permitted use by the Ministry of Health was maintained.

Endosulfan was banned by the Supreme Court of India in May 2011, with the final stocks disposed of or exported by January 2017. According to the Department of Chemicals and Petrochemicals, no more endosulfan was produced domestically after the ban. As might be expected, an increase in the use of pesticides which have the same applications as endosulfan was also reported, including the WHO class II organophosphate insecticides profenofos, chlorpyriphos, and acephate.

Kerala permanently banned endosulfan in October 2005 and 14 other pesticides in January 2011 – two WHO class Ia, four class Ib, five class II, two class III and one listed by the WHO as obsolete. Bans for some of these pesticides have now been announced by the Central Government: methoxy ethyl mercuric chloride and methyl parathion in 2018 and phorate and triazophos in 2020. However, nine pesticides banned in Kerala remain in use nationally with no plans for regulatory action (anilofos, atrazine, carbofuran, edifenphos, monocrotophos, paraquat dichloride, profenofos, thiobencarb and tricyclazole.

Date	Territory	Pesticide banned	State bans
1974	National	parathion (ethyl parathion)	
1989	National	dibromochloropropane, pentachloronitrobenzene, toxaphene	
1990	National	endrin	
1996	National	aldrin, chlordane, heptachlor	
2001	National	aldicarb, chlorbenzilate, dieldrin, ethylene dibromide, maleic hydrazide, trichloroacetic acid	
2005	National	(dalapon, ferbam, formothion, nickel chloride, paradichlorobenzene, simazine, warfarin)	
2005	Kerala		DDT, endosulfan
2007	National	benzene hexachloride, calcium cyanide, copper acetoarsenite, ethyl mercury chloride, menazon, nitrofen, paraquat dimethyl sulphate, pentachlorophenol, phenyl mercury acetate, sodium methane arsonate, tetradifon	
2011	Kerala		anilofos, atrazine, carbofuran, edifenphos, methoxy ethyl mercuric chloride, methyl parathion, monocrotophos, oxythioquinox, paraquat, phorate, profenofos, thiobencarb, triazophos, tricyclazole
2011	National	endosulfan	
2007 to 2012	National	chlorofenviphos, metoxuron	
2013	National	lindane	
2014	National	(sirmate)	
2018	National	benomyl, carbaryl, diazinon, fenarimol, fenthion, linuron, methoxy ethyl mercuric chloride, methyl parathion, thiometon, tridemorph	

2020	National	alachlor, dichlorvos, phorate, phosphamidon, triazophos, trichlorfon	

Comparative analysis of prohibited pesticides in India (Govt. of India list as on 29.02.2020) with reference to the WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009

Sl. No.	Name of Banned Pesticides	WHO Class*	Mainly used as	Comparison of hazardous effects of the pesticides	
				in **The Gazette Of India : Extraordinary [Part II—Sec. 3(II)]**	in **WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009**
1.	Acephate	II (Moderately hazardous)	Insecticide	**i.** Causes endocrine disruption, toxic to honey bees and banned in 32 countries.	**i.** Causes pupillary constriction, muscle cramp, excessive salivation, sweating, nausea, dizziness, laboured breathing and convulsions (*ICSC 748*). **ii.** Effects the nervous system and blood (*ICSC 748*).
2.	Atrazine	III (Slightly hazaradous)	Herbicide	**i.** Causes endocrine disruption and banned in 37 countries.	**i.** Possibly carcinogenic to humans (*IARC* 53). **ii.** Causes eye redness, pain and toxic to aquatic organisms (*ICSC 99*)
3.	Benfuracarb	II (Moderately hazardous)	Insecticide	**i.** Metabolites of the products have proven to be more toxic and banned in 28 countries. **ii.** Prone for ground water contamination.	Not available
4.	Butachlor	III (Slightly hazaradous)	Herbicide	**i.** Toxic to aquatic organism including fish and banned in 31 countries. **ii.** Prone for leaching.	Not available
5.	Captan	U (Unlikely to present acute hazard)	Fungicide	**i.** Toxic to aquatic organism including fish and banned in 6 countries. **ii.** Included in Tier-I screening final list of US-EPA Endocrine Disruptor Screening Programme.	**i.** Causes skin and eye redness, vomiting, Diarrhea and toxic to aquatic organisms (*ICSC 120*)
6.	Carbendazim	U (Unlikely to present acute hazard)	Fungicide	**i.** Product is foetotoxic and teratogenic and banned in 29 countries. **iii.** Risk is associated to pregnant women and presence of toxic impurities.	**i.** Causes eye redness and toxic to aquatic organisms (*ICSC 1277*).
7.	Carbofuran	Ib (Highly hazardous)	Insecticide	**i.** Extremely toxic and banned in 63 countries. **ii.** Included in Tier-I screening final list of US-EPA Endocrine Disruptor Screening Programme.	**i.** Causes pupillary constriction, muscle cramp, excessive salivation, dizziness, vomiting, laboured breathing, unconsciousness (*ICSC 122*).

Sl. No.	Name of Banned Pesticides	WHO Class*	Mainly used as	Comparison of hazardous effects of the pesticides	
				in **The Gazette Of India : Extraordinary [Part II—Sec. 3(II)]**	in **WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009**
				iii. Also toxic to honey bees, aquatic organisms and birds.	**ii.** Toxic to aquatic organisms (*ICSC 122*). **iii.** Hazardous to the environment and special attention should be given to soil organisms, bees and birds (*ICSC 122*).
8.	Chlorpyriphos or Chlorpyrifos	II (Moderately hazardous)	Insecticide	**i.** Product is an organophosphate and is neurotoxic and banned in 31 countries. **ii.** Included in Tier-I screening final list of US-EPA Endocrine Disruptor Screening Programme.	**i.** Causes pupillary constriction, muscle cramp, excessive salivation, muscle twitching, convulsions, dizziness, sweating, laboured breathing, unconsciousness (*ICSC 851*). **ii.** Very toxic to aquatic organisms (*ICSC 851*). **iii.** Hazardous to the environment and special attention should be given to birds and bees(*ICSC 851*).
9.	2,4-D	II (Moderately hazardous)	Herbicide	**i.** Contains carcinogenic dioxin and banned in 3 countries. **ii.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP).	**i.** Causes skin and eye redness, headache, nausea, weakness, cough, sore throat, abdominal pain, burning sensation, diarrhea and harmful to aquatic organisms (*ICSC 33*).
10.	Deltamethrin	II (Moderately hazardous)	Insecticide	**i.** The product falls under category 1 of European Union prioritization of Endocrine Disrupting Chemicals. **ii.** Product is toxic to honey bees.	**i.** Causes skin and eye redness, Numbness of tongue and lips, abdominal pain, vomiting, excessive salivation, muscle twitching, unconsciousness, convulsions and very toxic to aquatic organisms (*ICSC 247*).
11.	Dicofol	II (Moderately hazardous)	Acaricide	**i.** Product is banned in 45 countries. **ii.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP). **iii.** Product is highly toxic to aquatic organisms including fish.	**i.** Causes skin and eye redness, convulsions, cough, dizziness, headache, nausea, vomiting, weakness and very toxic to aquatic organisms (*ICSC 752*).
12.	Dimethoate	II (Moderately hazardous)	Insecticide	**i.** It is organophosphorus compound and its metabolites are highly toxic and banned in 31 countries. **ii.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP).	**i.** Causes eye redness and pain, pupillary constriction, muscle cramp, excessive salivation, sweating, nausea, dizziness, laboured breathing, weakness and very toxic to aquatic organisms (*ICSC 417*).

Sl. No.	Name of Banned Pesticides	WHO Class*	Mainly used as	Comparison of hazardous effects of the pesticides	
				in **The Gazette Of India : Extraordinary [Part II—Sec. 3(II)]**	in **WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009**
					ii. Toxic to aquatic organisms and may be hazardous to the environment, special attention should be given to bees and birds.
13.	Dinocap	II (Moderately hazardous)	Acaricide, Fungicide	**i.** Product has reports of teratogenic concerns and banned in 28 countries. **ii.** Toxic to aquatic organisms including fish.	**i.** Causes laboured breathing, skin redness, nausea, vomiting and very toxic to aquatic organisms (*ICSC 881*).
14.	Diuron	III (Slightly hazaradous)	Herbicide	**i.** There is report on contaminant 3,3,4,4' tetra chloro azo benzene (TCAB) and banned in 1 country i.e., Mozambique. **ii.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP). **iii.** Toxic to aquatic organisms including fish.	Not available
15.	Malathion	III (Slightly hazaradous)	Insecticide	**i.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP). **ii.** Product is eco toxic and banned in 2 countries.	**i.** Causes pupillary constriction, muscle cramp, excessive salivation, sweating, dizziness, laboured breathing, unconsciousness, abdominal cramps, diarrhea, nausea (*ICSC 172*). **ii.** Toxic to aquatic organisms and may be hazardous to the environment, special attention should be given to bees (*ICSC 172*).
16.	Mancozeb	U (Unlikely to present acute hazard)	Fugicide	**i.** Level of Ethylenethiourea, (ETU) is a concern from toxicity point of view and banned in 1 country. **ii.** Toxic to aquatic organisms including fish.	**i.** Irritant to skin on multiple exposures, causes cough, sore throat, eye redness and pain, diarrhea, nausea, vomiting and toxic to aquatic organisms (*ICSC 754*).
17.	Methomyl	Ib (Highly hazardous)	Insecticide	**i.** Toxic to honey bees, silk worms, birds, and aquatic organisms. **ii.** Acceptable Daily Intake (ADI) is very low i.e. 0-0.02mg/kg body weight and ARfD is 0.02 mg/kg body weight. **iii.** Included in Tier 1 screening final list of Endocrine Disruption Screening Program (EDSP). **iv.** It is banned in 41 countries.	**i.** Causes eye redness and blurred vision, pupillary constriction, muscle cramp, excessive salivation, sweating, dizziness, laboured breathing, unconsciousness, abdominal cramps, diarrhea, nausea (*ICSC 177*). **ii.** Toxic to aquatic organisms and may be hazardous to the environment, special attention should be given to bees (*ICSC 177*).

Sl. No.	Name of Banned Pesticides	WHO Class*	Mainly used as	Comparison of hazardous effects of the pesticides	
				in **The Gazette Of India : Extraordinary [Part II—Sec. 3(II)]**	in **WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009**
18.	Monocrotophos	Ib (Highly hazardous)	Insecticide	**i.** There are reports of accidental poisoning and of its misuse. **ii.** Daily Intake (ADI) is very low i.e., 0.0006 mg/kg body weight and ARfD is 0.002 mg/kg body weight. **iii.** It is banned in 112 countries. **iv.** Toxic to honey bees and aquatic organisms and birds.	**i.** Causes pupillary constriction, muscle cramp, excessive salivation, headache, sweating, dizziness, laboured breathing, unconsciousness, abdominal cramps, diarrhea, nausea (*ICSC 181*). **ii.** Toxic to aquatic organisms causing long-term effects in the aquatic environment (*ICSC 181*). **iii.** May be hazardous to the environment, special attention should be given to bees, birds and mammals (*ICSC 181*).
19.	Oxyfluorfen	U (Unlikely to present acute hazard)	Herbicide	**i.** Possible human carcinogen. **ii.** Falls under Tier 1 screening second list of Endocrine Disruption Screening Program (EDSP). **iii.** It is banned in 02 countries. **iv.** Toxic to aquatic organisms including fish.	Not available
20.	Pendimethalin	II (Moderately hazardous)	Herbicide	**i.** Causes thyroid follicular cell adenoma. **ii.** It is banned in 02 countries. **iii.** It is highly toxic to aquatic organisms including fish.	Not available
21.	Quinalphos	II (Moderately hazardous)	Insecticide	**i.** The product is an organophosphorus compound and is highly toxic to mammal and aquatic organisms. **ii.** It is banned in 30 countries.	Not available
22.	Sulfosulfuron	*Not in the WHO list*	Herbicide	**i.** The product is resistant against the target weed and banned in 1 country.	Not available
23.	Thiodicarb	II (Moderately hazardous)	Insecticide	**i.** Highly toxic to mammals, honey bees and aquatic organisms. **ii.** Banned in EU, UK and Mozambique.	Not available
24.	Thiophanate-methyl	U (Unlikely to present acute hazard)	Fungicide	**i.** The product falls under Tier 1 screening second list of Endocrine Disruption	**i.** The product has low acute toxicity *(JMPR 2008*).

Sl. No.	Name of Banned Pesticides	WHO Class*	Mainly used as	Comparison of hazardous effects of the pesticides	
				in **The Gazette Of India : Extraordinary [Part II—Sec. 3(II)]**	in **WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009**
				Screening Program (EDSP). **ii.** It is toxic to earthworm. **iii.** Its resistance is common in many fungal species.	**ii.** Use on crops may give rise to residues of carbendazim (*JMPR 2008*).
25.	Thiram	II (Moderately hazardous)	Fungicide	**i.** Metabolites M1 and NDMA is a concern. Level of Ethylenethiourea, (ETU) is a concern from toxicity point of view and banned in 28 countries. **ii.** Toxic to aquatic organisms and birds.	**i.** Causes skin and eye redness, cough, sore throat, dizziness, headache and toxic to aquatic organisms (*ICSC 757*).
26.	Zineb	U (Unlikely to present acute hazard)	Fungicide	**i.** Level of Ethylenethiourea, (ETU) is a concern from toxicity point of view and banned in 32 countries. **ii.** Toxic to aquatic organisms including fish.	**i.** Causes skin and eye redness, abdominal cramps, vomiting, diarrhoea and very toxic to aquatic organisms causing long term effects in the aquatic environment (*ICSC 350*).
27.	Ziram	II (Moderately hazardous)	Fungicide	**i.** The product falls under Tier 1 screening second list of Endocrine Disruption Screening Program (EDSP). **ii.** Level of Ethylenethiourea, (ETU) is a concern from toxicity point of view and banned in 1 country.	**i.** Causes skin irritation and eye redness, cough, sore throat, abdominal cramps, vomiting, and very toxic to aquatic organisms (*ICSC 348*).

Guidance on Safe Use of Pesticides

General safety precautions while handling pesticides

- When handling the pesticide products during opening of the package, mixing and preparation of the spray
- When spraying the pesticide
- When disposing the pesticide solution and containers

General Precautions to be taken:

- **Protective Gears**
- The operator should wear a protective hat and face shield or goggles.
- Do not eat, drink or smoke while working
- Wash hands and face with soap and water after spraying and before eating, smoking or drinking. Shower or bath at the end of every day's work and wear new clean clothes
- Wash overalls and other protective clothing at the end of every working day in soap and water and keep them separate from the rest of the family's clothes.
- If the insecticide touches the skin, wash off immediately with soap and water

- Change clothes immediately if they become contaminated with pesticides.
- Inform the supervisor immediately if one feels unwell.
- Absorption of pesticides occurs mainly through the skin, lungs and mouth. Specific protective clothing and equipment given below must be worn in accordance with the safety instructions on the product label.
- Protective clothing and equipment to be used
- Broad-brimmed hat (protects head, face and neck from spray droplets).
- Face-shield or goggles (protects face and eyes against spray fall-out).
- At the end of the days' work during IRS activities, the inside of the spray pump should be washed and any residual pesticides should be flushed from the lance and nozzle.
- Face mask (protects nose and mouth from airborne particles).
- Rubber Gloves
- The store room should have a prominently displayed mark of caution used for poisonous or hazardous substances. It should be kept locked.
- Boots (protected feet)

▪ **Storage**

- Pesticides storehouses must be located away from areas where people or animals are housed and away from water sources, wells, and canals.
- They should be located on high ground and fenced, with access only for authorized persons. Containers, bags, or boxes should be well stacked to avoid the possibility of spillage. The principle of .first expiry first out should be followed.
- However, there should be easy access for pesticides delivery vehicles and, ideally access on at least three sides of the building for fire-fighting vehicles and equipment in case of emergency

▪ **Transportation**

- Pesticides should be transported separately. It should NOT be transported in the same vehicle as items such as agriculture produce, food, clothing, drugs, toys, and cosmetics that could become hazardous if contaminated.
- Pesticide container should be loaded in such a way that they will not be damaged during transport, their labels will not be rubbed off ad they will not shift and fall of the transport vehicle onto the rough road surface
- Vehicles carrying pesticides should predominantly display warning signs and notices
- The pesticide load should be checked at intervals during transportation, and any leaks, spills, or other contamination should be cleaned up immediately using accepted standard procedures. In the event of leakage, while the transport vehicle is moving, the vehicle should be brought to a halt immediately so that the leak can be stopped and the leaked product cleaned up. Containers should be inspected upon

▪ **Disposal of leftover Pesticides:**

- The rinsing water should be collected carefully in containers/clearly marked drums with a tightly fitted lid. This should be used to dilute the next day's tank loads or disposed properly by the supervisor at disposal sites like pits or digs, preferably in a hazardous waste disposal facility.
- Never pour the remaining pesticides into rivers, pools, or drinking water sources.

- Decontaminate containers where possible. For glass, plastic, or metal containers this can be achieved by triple rinsing, i.e. part-filling the empty container with water three times and emptying into a bucket or sprayer for the next application.
- All empty packaging should be returned to the supervisor for safe disposal according to national guidelines.
- Never re-use empty insecticide containers.
- It shall be the duty of manufacturers, formulators of pesticides, and operators to dispose of packages or surplus materials and washing safely to prevent environmental or water pollution.
- The packages shall be broken and buried away from habitation, but preferably disposed in a hazardous waste disposal facility
- The used packages shall not be left outside to prevent their re-use.
- The expired stock should be returned to the manufacturer for disposal as per guidelines preferably through the incineration process.
- The chemical efficacy should be tested before the disposal of expired pesticides to find out the possibility of usage. The efficacy and active ingredient percentage of pesticides are tested and certified by the authorized testing laboratory.