Initial Environmental Examination

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INDIA: Proposed Integrated Urban Flood Management for the Chennai - Kosasthalaiyar Basin Project

Prepared by Greater Chennai Corporation (GCC) for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 2 June 2021)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	$0.0137
$1.00	=	₹72.854

ABBREVIATIONS

ADB	–	Asian Development Bank
AAQ	–	Ambient Air Quality
CGWB	–	Central Groundwater Board
CMA	–	Chennai Metropolitan Area
CRZ	–	Coastal Regulation Zone
CMRL	–	Chennai Metro Rail Limited
CPCB	–	Central Pollution Control Board
CRO	–	Complaint Receiving Officer
DPR	–	Detailed Project Report
EA	–	Executing Agency
EAC	–	Expert Appraisal Committee
EC	–	Environmental Clearance
EHS	–	Environmental Health and Safety
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan;
EMR	–	Environmental Monitoring Report
ES	–	Environmental Specialist
ESS	–	Environmental and Social Safeguards
GoI	–	Government of India
GoTN	–	Government of Tamil Nadu
GCC	–	Greater Chennai Corporation
GRM	–	Grievance Redress Mechanism
IA	–	Implementing Agency
IBAT	–	Integrated Biodiversity Assessment Tool
IEE	–	Initial Environmental Examination;
IUFMCKB	–	Integrated Urban Flood Management for the Chennai-Kosasthalaiyar Basin
IUCN	–	International Union for Conservation of Nature
LPM	–	Liters Per Minute
MLD	–	Million liters per day
MAWS	–	The Municipal Administration and Water Supply Department
MFF	–	Multi-Tranche Financing Facility
MRTS	–	Mass Rapid Transit System
MOEF&CC	–	Ministry of Environment, Forest and Climate Change
NOC	–	No Objection Certificate
NH	–	National Highways
NGO	–	Non-Governmental Organization
NAAQ	–	National Ambient Air Quality
O&M	–	Operation and Maintenance
PIU	–	Project Implementation Unit;
PSC		Project Support Consultants
PWD	–	Public Works Department
PMU	–	Project Management Unit

PPTA	–	Project Preparatory Technical Assistance
RCC	–	Reinforced Cement Concrete
REA	–	Rapid Environmental Assessment Checklist
SEIAA	–	State Environmental Impact Assessment Authority
SEMP	–	Site-Specific Environmental Management Plan
SO	–	Safeguards Officer
SOP	–	Standard Operating Procedures
SEMP	–	Site environmental management plan
SPS	–	Safeguard Policy Statement, 2009
STP	–	Sewage Treatment Plant
SWPS	–	Storm Water Pumping Station
TMP	–	Traffic Management Plan
TNPCB	–	Tamil Nadu Pollution Control Board
TNSCZMA	–	Tamil Nadu State Coastal Zone Management Authority
WHO	–	World Health Organization
WTP	–	Water Treatment Plant

WEIGHTS AND MEASURES

°C	–	Degree Celsius
km	–	kilometre
LPCD	–	litres per capita per day
m	–	metre
MLD	–	million litres per day
mm	–	millimetre
km^2	–	square kilometer

NOTE

In this report, "$" refers to United States dollar.

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EXECUTIVE SUMMARY

Chennai, located on the coromandel coast of the Bay of Bengal, and is the fourth-largest metropolitan area in India, with an estimated population of 10.7 million. Watershed area in Chennai has been divided into 4 major water basins (i) Kosasthalaiyar, (ii) Cooum, (iii) Adyar, and (iv) Kovalam. Greater Chennai Corporation (GCC) together with the state Public Works Department (PWD) are the responsible departments/ organizations in maintaining the infrastructure for the disposal of the storm water in GCC area, spread over 426 km^2. The floods that occurred in the past were severe along the waterways of Adyar, Cooum, Kosasthalayar Rivers, Buckingham Canal and also along the Pallikaranai Marshland. Chennai region has also been battered by incessant heavy rainfall during the year 2015 causing water stagnation and inundation. To address the issues relating to water stagnation and inundation, as a first step, the GCC has initiated the improvement of storm water drainage system in Adyar and Cooum basins with financial support from the World Bank, the project is in the verge of completion. A similar project for the Kovalam basin is contemplated with financial support from the KfW. For the Kosasthalaiyar basin, GCC proposed the “Integrated Urban Flood Management for the Chennai-Kosasthalaiyar Basin (IUFMCKB) Project” for implementation, with the financial assistance of Asian Development Bank (ADB).

The Project. Kosasthalaiyar River Basin is located in the northern part of Chennai consisting of an area of 127.80 km^2 covering GCC administrative zones 1, 2, 3, and 7 (fully covered) and 6 and 8 (partially covered). The project area has been divided into eleven (11) watersheds based on the topography and natural flow patterns. The total length of the existing storm water drain is 280 km, of which 105 km length of drain is in good condition which will be retained. The remaining 175 km of drain is required to be rehabilitated due to inadequate hydraulic carrying capacity. Apart from the existing drain (280 km), new drain for a length of 588 km have been proposed. Necessary interlinking of water bodies through the existing or proposed drain has also been considered to maintain the water balance and achieve maximum water storage within the Kosasthalaiyar drainage basin. In addition, improvements to four out of seven macro drains/surplus canals of total length 11 km in the project area, which are managed by the Public Works Department (PWD) are also included in the ADB funded project for improvement. Improvement of remaining 3 macro drains / surplus canals of total length 18 km will be implemented PWD, for which DPR has already been prepared. The size of storm water drains range from a minimum of 600 mm (wide) x 750 (deep) mm to maximum of 7,000 mm x 2500 mm. Concrete rectangular drains with a cover slab have been proposed.

In the project area (Kosasthalaiyar drainage basin), the eastern portion of the north Buckingham-Canal watershed is lower than the canal bed level, hence an existing pumping station equipped with 2 nos. of 10 HP pumps having a capacity of 2833 LPM each and 3m diameter sump was constructed near Kargil Nagar to pump the rainwater into Buckingham Canal during floods. Based on the detailed analysis, it was found that existing pumps are very old and does not have sufficient capacity to pump the rainwater during floods. Hence, an additional pumping station comprising of 3no’s higher capacity pumps are proposed in Kargil Nagar. Based on the detailed analysis, a new storm water pumping station has been proposed at Ernavoor to avoid flood inundation.

Project implementation arrangements. The Municipal Administration and Water Supply Department (MAWS) of GOTN is the state-level executing agency. Greater Chennai Corporation (GCC) is the implementing Agency (IA) for this project. A Project Management Unit (PMU) has been established in GCC headed by Commissioner, GCC as a Project Director (PD) and comprising of dedicated full-time staff from GCC for the overall project and financial management. A Project Implementation Unit (PIU) has been established in the storm water drainage department

of GCC which will be headed by Project Managers (Chief Engineer and Superintending Engineer) and comprising of dedicated full-time staff of the GCC for the day-to-day implementation of the project. An Executive Engineer in PIU shall be the nodal person for safeguards implementation who will be supported by a dedicated Environmental Officer to ensure compliance with EMP. The PIU will be supported by Project Support Consultant (PSC). Environmental Expert of the PSC will assist PIU (Environmental Officer) in the implementation of the project in compliance with EMP and will carry out all necessary tasks.

Screening and assessment of potential impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment as described in ADB's Safeguard Policy Statement (SPS), 2009. As per the GoI EIA Notification, 2006, this project does not require EIA study or environmental clearance. Project area is along the coromandel coast of the Bay of Bengal, and some components fall within the Coastal Regulation Zone. Project therefore requires clearance / no objection certificate from TNSCZMA. GCC already submitted application to TNSCZMA and is currently under process. Works falling under CRZ are confined to 11 of total 46 contract packages under the project. No works will be initiated in CRZ packages until the clearance/no objection is obtained from TNSCZMA.

Categorization. The potential environmental impacts of the project have been assessed using ADB Rapid Environmental Assessment (REA) Checklist for Urban Development. The proposed project is not likely to have any significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Potential impacts are mostly site-specific and in most cases mitigation measures can be designed with uncomplicated measures commonly used at construction sites and known to civil works contractors. Based on the assessment and ADB Safeguard Policy Statement (SPS), the project is classified as Environmental Category "B" and mandated an Initial Environmental Examination (IEE).

Description of the Environment. The Kosasthalaiyar River Basin covers an area of 127.80 km^2 and located in the northern part of GCC. The topography is characterized by flat terrain and is found sloping gently from west to east direction. In the project area, the summer season starts in the month of May with maximum temperatures around 38°C to 42°C and winter season starts in January, with maximum temperatures around 18°C to 20°C. The project area gets most of its seasonal rainfall from the north-east monsoon, which starts from mid-September to mid-December. The most prevailing winds in the project area is the South westerly, between the end of May to end of September and the North easterly during the rest of the year. The average annual rainfall is about 1,400 mm. The project area has different types of land use patterns that affects the runoff. The most predominant land-use pattern is residential (41.62 km^2), which is followed by commercial cum residential (20.61 km^2), Industrial (19.52 km^2), water bodies (13.71 km^2) and CRZ area (3.19 km^2). In the central and eastern portion of the project area, calcareous gritty sandstone and clay are present, alluvium in the predominant formation is found along the Kosasthalaiyar river course. The project area is free of forest areas; there are no eco-sensitive areas located within or near the project area for a radius of 10 km.[1] Pulicat Lake (located at an aerial distance of 21 km) and the Guindy National Park (10 km) are the nearest protected areas located within 50 km of project area. Project area drains into Ennore creek on the coromandel coast of the Bay of Bengal. Ennore Creek was once a biodiversity hotspot and now highly degraded due to various human activities. As per Census 2011, the population in the project area

[1] As per the MoEF&CC, 10km radius is chosen as a study area for the infrastructure projects undergoing environmental clearance.

is 25,79,645. The project area is well connected by NH 5 (Chennai-Kolkata Highway), NH 718 (Tirupathi Highway), SH 56 (Thiruvottiyur-Ponneri), Outer Ring Road and Chennai bypass road.

Potential environmental impacts and mitigation measures. Potential negative impacts were identified especially those concerning pre-construction, construction and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. The project is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented because: (i) the components will involve construction works with minimal impacts and it is very much localized. (ii) project area is mostly urban and peri urban nature, although due to its coastal location careful attention needs to be paid to minimizing disruption to coastal ecosystem; and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation, desilting and earth movements.

This project will positively contribute to improve the situation along the coast and Ennore creek that receives storm water / runoff from the project area. The project will improve quality of water flowing into the creek. Besides desilting of canals and drains and providing proper storm water drainage system, the proposed project design also considers minimizing the silt and sewage flow in the system. Water quality of Kosathaliayar River, Surplus channels, Buckingham and Ennore creek will be tested pre, during and post construction and operation phase to monitor the changes in water quality as per the baseline condition.

Potential impacts during construction are considered significant but temporary and there are well-developed methods to mitigate the same. Various measures are suggested to avoid sediment and contaminated flow into the coastal water during the construction. Moreover, works in the CRZ area will be initiated only after obtaining due permission from TNSCZMA. Storm water drain works will be constructed along public roads in an urban area congested with settlements, people activities and traffic. Therefore, these works will have significant impacts arising mainly from the disturbance of residents, commercial establishments and traffic due to construction work; safety risk to workers, public and nearby buildings due to trench excavations in the road, especially in narrow roads; access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well-developed methods of mitigation that are suggested in the Environmental Management Plan (EMP).

The proposed construction activities likely to generate 2 million cubic meters of surplus earth, which shall be recycled to the maximum, the remaining surplus earth will be disposed/ dumped in the Kodungaiyur dumping yard, which is owned and maintained by GCC. Project is also estimated to generate nearly 150,000 m3 of sediment/desilted material from the storm water drains and surplus canals. Sediment quality analysis indicate that material is not hazardous and will be disposed at the solid waste dumping sites owned by GCC. During the construction, confirmatory tests will be conducted, and the reuse of dried and non-hazardous silt/sediment for beneficial purposes will be explored and implemented, and the surplus will be disposed off at the solid waste facilities.

Environmental Management Plan (EMP). This draft IEE includes an Environmental Management Plan (EMP) which describes and addresses the potential impacts and risks identified in the environmental assessment. The EMP includes proposed mitigation measures, environmental monitoring and reporting requirements, capacity development and training

measures, implementation schedule, cost estimates, and performance indicators. This draft IEE and the corresponding EMP will be included in the bidding and contract documents with specific provisions requiring Contractors to (i) comply with all other conditions required by ADB; and (ii) to submit a site-specific environmental management plan (SEMP), including (a) proposed sites/locations for construction work camps, storage areas, hauling roads, laydown areas, disposal areas for solid and hazardous wastes; (b) specific mitigation measures following the approved EMP; (c) monitoring program as per SEMP; and (d) budget for SEMP implementation. A copy of the EMP and approved SEMP will be kept on-site during the construction period at all times.

The budget for EMP implementation includes costs for compensatory tree plantation, monitoring of ambient air quality, noise level measurements, water quality and sediment/silt quality. For compensatory tree plantation (planting of 3040 trees for the loss of 304 trees in the 1:10 ratio (as per the general directions of the High Court, Chennai)), it was decided to remit the budget to the Park Department (a wing in the GCC), who will plant and maintain the trees in the spaces available in the Public Parks (maintained by the GCC), which shall be monitored and recorded by the PSC and the PIU. Tree transplantation option shall be explored to minimize the loss of trees. The observations shall be included in the SEMR, which will be submitted to the ADB. The implementation costs of mitigation measures are covered separately under a civil work contract. Each contractor shall have an Environmental Safeguards Officer to support the contractors responsible for implementing the applicable mitigation measures given in EMP. Environmental Expert in PSC and Executive Engineer acting as nodal person for ESS in PIU are responsible for monitoring the EMP implementation.

Consultation, disclosure and grievance redress mechanism. The stakeholders were involved during the environmental assessment activities through discussions conducted on-site and by public consultations. The views expressed by stakeholders were incorporated in the IEE and project design. This draft IEE will be made available to the public through the ADB and GCC websites. The consultation process will continue during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A Grievance Redress Mechanism (GRM) is described within this draft IEE to ensure that public grievances are addressed quickly.

Monitoring and Reporting. Contractors has to submit a monthly EMP implementation report to PIU. PIU, with the assistance of PSC, will monitor the compliance of the Contractor, prepare a Quarterly Progress Report (QPR) and Semi-annual Environmental Monitoring Report (SEMR) and submit to ADB. The status of environmental safeguards implementation, issues, and corrective actions are to be clearly reported to ADB in these reports. The PMU will oversee and ensure the implementation and compliance. ADB will post the SEMR on its website.

Conclusions and Recommendations. As per ADB SPS 2009, this project is classified as environmental category B and does not require further Environmental Impact Assessment. This IEE is prepared based on the Detailed Project Report (DPR). However, during implementation this IEE shall be updated by PSC in discussion with PIU to reflect any changes, amendments and will be reviewed and approved by PIU. This draft IEE shall be part of tender documents. The final IEE report will incorporate results of any changes and additional baseline monitoring as required (e.g., air, noise, surface water quality) and will be submitted to ADB for approval.

I. INTRODUCTION

A. Background

1. Chennai, capital city of southern Indian state of Tamil Nadu, is located the coromandel coast of the Bay of Bengal and is the fourth-largest metropolitan area in India, with an estimated population of 10.7 million. It is one of India's fastest-growing major cities, with well diversified economy growing at about 6% annually. Chennai is the largest exporting hub in India, and located in the East Coast Economic Corridor, the city is a key player in the state and national economies. Chennai is a concentration of people, business and industries, infrastructure, and public institutions with a population density of about 26,000 persons per square kilometer (km^2). Watershed area in Chennai has been divided into 4 major water basins namely, (i) Kosasthalaiyar, (ii) Cooum, (iii) Adyar, and (iv) Kovalam. Greater Chennai Corporation (GCC) together with the state Public Works Department (PWD) are the responsible departments/ organizations in maintaining the infrastructure for the disposal of the storm water in GCC area, spread over 426 km^2. The floods that occurred in the past were severe along the waterways of Adyar, Cooum, Kosasthalayar Rivers, Buckingham Canal and also along the Pallikaranai Marshland. Chennai region has also been battered by incessant heavy rainfall during the year 2015 causing water stagnation and inundation. To address the issues relating to water stagnation and inundation, as a first step, the GCC has initiated the improvement of storm water drainage system in Adyar and Cooum basins with financial support from the World Bank, the project is in the verge of completion. A similar project for the Kovalam basin is contemplated with financial support from the KfW. For the Kosasthalaiyar basin, GCC proposed the "Integrated Urban Flood Management for the Chennai-Kosasthalaiyar Basin (IUFMCKB) Project" for implementation, with the financial assistance of Asian Development Bank (ADB).

2. The anticipated outcome of the proposed ADB funded IUMFCKB Project is "climate and disaster resilience in the Chennai-Kosasthalaiyar river basin strengthened" and the proposed outputs are:

(i) **Output 1**: Climate-resilient urban flood protection infrastructure improved in the Chennai–Kosasthalaiyar river basin. This will include structural measures such as: (i) construction of 588 kilometers (km) of new storm water drains; (ii) rehabilitation or replacement of 175 km of storm water drains; (iii) improvements of 11 km stretches in the Ambattur, Ariyallur, Kadappakkam, and Korattur channels to enhance water-carrying capacity; (iv) construction of one new water-pumping station and the upgrading of one existing pumping station; (v) construction of 23,000 catchpits at regular intervals in roadside drains to recharge the groundwater aquifer; and (v) rehabilitation of four disaster relief camps to be gender-responsive and socially inclusive. The proposed storm water drainage system features climate-resilient design to cope with intensifying rainfall and higher sea level rise. Infiltration pits will boost groundwater recharge in paved areas of a region at risk of water scarcity.

(ii) **Output 2**: Urban flood preparedness and pandemic resilience of the GCC and project communities enhanced. This will include the following nonstructural measures: (i) GCC endorsement of guidelines on integrating flood hazard zoning with spatial plans and land-use, building, and development regulations; (ii) the establishment of the baseline flood resilience index to identify the flood vulnerability, target priority interventions, and establish a framework for continuous improvement in the whole of Chennai City; (iii) the operationalization of a flood citizen observatory with a software platform to obtain real-time information in flood

areas, water levels, and damage; (iv) GCC endorsement of a manual for green infrastructure design including rainwater harvesting; (v) knowledge enhancement in the community, including for women, of the benefits of green infrastructure; (vi) raised beneficiary awareness of flood risks and impacts and the links that connect flooding, solid waste management, house sewerage connections, and the protection of waterbodies, including activities specifically targeting women; (vii) improved GCC staff capacity to plan and design storm water drainage systems in coordination with the management of solid waste and flood risk; and (viii) the establishment of integrated flood and pandemic risk management systems in flood-prone urban low-income communities through Japan Fund for Poverty Reduction (JFPR) Grant: (a) gender-responsive Water, Sanitation and Hygiene (WASH) and Infection Prevention and Control (IPC) measures and practices for 65 schools and 17 community health centers, (b) an inclusive surveillance system with eight mobile diagnostic labs for COVID-19 and other communicable diseases and four mobile water quality testing labs for IPC, and (c) gender-responsive and integrated community response plans for epidemics and flood disasters.

(iii) **Output 3**: **Measures for sustaining operation and maintenance of storm water drainage system established in GCC**. This will include: (i) performance-based incentives (PBIs) for zonal offices linked to operational efficiency and the sustainability of storm water drainage systems; (ii) a plan formulated to improve the sustainable and inclusive O&M of storm water drainage systems; (iii) a road map for enhancing municipal resource mobilization by the GCC; (iv) improved knowledge of GCC staff on the sustainable O&M of drainage systems with the management of solid waste and flood risk; and (v) improved knowledge and skills of desilting and conservancy workers on cleaning and maintaining storm water drainage systems. The PBIs will be awarded based on a reporting system and database of key performance indicators for all zonal offices that will be established by 2023, with the focus on improving GCC management of drainage systems with timely maintenance services. The incentive payments will be used for additional activities supportive of the project's objective. The Sustainable Operation and Maintenance Improvement Plan will enable the GCC to ensure proper O&M of the created assets during the life of the project, based on the newly established asset management system and the experiences of PBI program. The Road Map for Enhanced Municipal Resource Mobilization will provide a strategic implementation plan to improve revenue management in its revenue coverage, valuation, liability, collection, and taxpayer services; strengthen information interlinkage with other utilities; and promote digital transformation with enhanced data analytics.

1. Purpose of this IEE Report

3. ADB requires the consideration of environmental issues in all aspects of the bank's operations, and the requirements for environmental assessment as described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using Rapid Environmental Assessment (REA) Checklist for Urban Development (refer **Appendix 1**). The potential negative impacts were then identified in relation to pre-construction, construction and operation phases of the proposed storm water drainage project and the results of assessment shows that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented. Thus, this Initial Environmental Examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category 'B' project. This IEE is based on the Detailed Project Report (DPR) prepared by GCC through an external DPR consultant.

4. The IEE report is based mainly on field reconnaissance surveys and secondary sources of information. Field sample surveys conducted for silt, surface water quality, and groundwater quality. For all the relevant ambient parameters, a suitable environmental monitoring program has been developed as part of the Environmental Management Plan (EMP), which will require the Contractor to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the basis to ensure no degradation will happen during project implementation. Stakeholder consultation was an integral part of the IEE and will continue throughout the project implementation.

B. Report Structure

5. This Report contains the following elevan (11) sections including the executive summary at the beginning of the report:

(i) Executive summary
(ii) Introduction
(iii) Description of the project
(iv) Analysis of alternatives
(v) Policy, legal and administrative framework
(vi) Description of the environment
(vii) Anticipated environmental impacts and mitigation measures
(viii) Public consultation and information disclosure
(ix) Grievance redress mechanism
(x) Environmental management plan, and
(xi) Conclusion and recommendation.

II. DESCRIPTION OF THE PROJECT

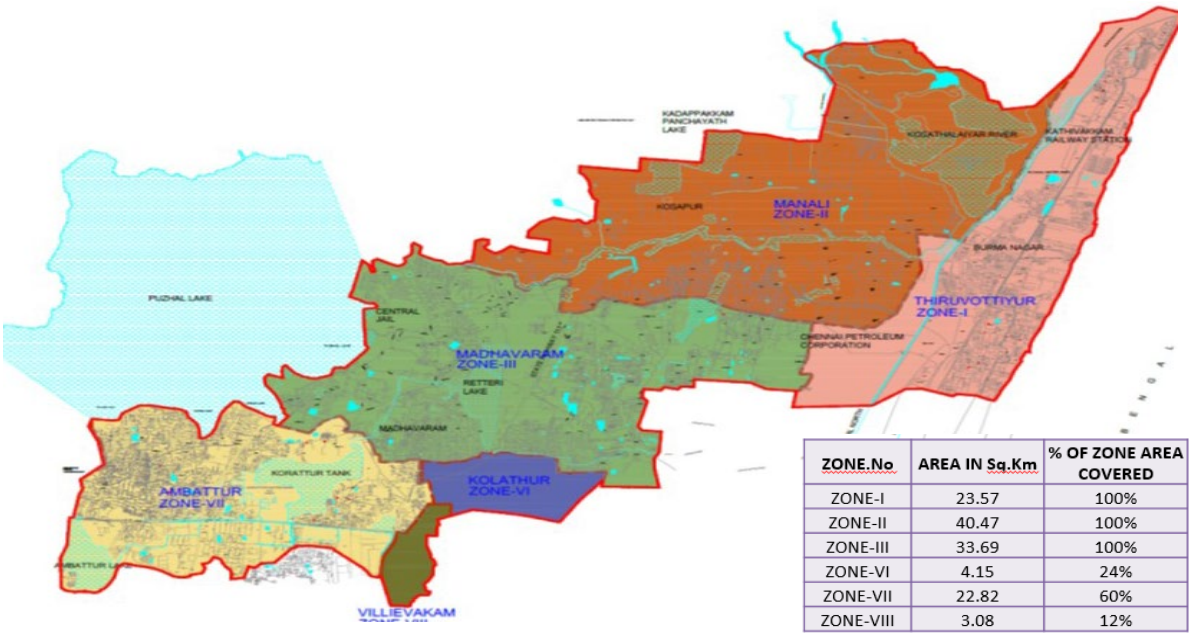
A. Project Area

6. Kosasthalaiyar River is a west to east flowing river, and it is one of the three rivers that flow through Chennai metropolitan area. This river originates near Kaveripakkam Lake, which is an irrigation tank fed by Palar Anicut in Vellore District. The river flows in northeast direction and confluences with Bay of Bengal via Ennore Creek. Kosasthalaiyar River basin extends to an area of 3,757 km^2 in the northern most districts of Vellore, North Arcot, Thiruvallur and Chennai in Tamil Nadu and Chittor district of neighboring Andhra Pradesh. The catchment area in North Arcot District has a branch near Kesavaram Anicut, flows through Chennai city as Cooum River and the main Kosasthalaiyar River flows to the Poondi reservoir. Its northern tributary, Nagari River, originates in Chittoor district of Andhra Pradesh and joins the main river in the backwaters of Poondi reservoir. From the Poondi reservoir, the river flows through Thiruvallur District, enters the Chennai metropolitan area, and joins the sea at Ennore creek.

7. The part of the Kosathalaiyar river basin that is located within the greater Chennai area is called as Chennai-Kosathalaiyar basin, which is the project area of the proposed IUFMCKB Project. Figure 1 shows the Kosathalaiyar river basin and the project area, and Figure 2 shows the project areas with GCC zones. The project area is the extended area of Chennai, that is formed part of Greater Chennai Corporation in 2011. Project area is located towards northern part of Chennai consisting an area of 127.80 km^2 (30% of GCC area) covering following GCC administrative zones: Zone I (Thiruvottiyur, 23.57 km^2), Zone II (Manali, 40.47 km^2), Zone III (Madhavaram, 33.69 km^2), Zone VI (Thiru vi ka nagar, partly, 4.15 km^2), Zone VII (Ambattur. Partly, 22.82 km^2) and Zone VIII (Anna Nagar, partly, 3.1 km^2).

Figure 1: Kosasthalaiyar river basin and project area

Figure 2: Location and GCC zones in the project area



ZONE.No	AREA IN Sq.Km	% OF ZONE AREA COVERED
ZONE-I	23.57	100%
ZONE-II	40.47	100%
ZONE-III	33.69	100%
ZONE-VI	4.15	24%
ZONE-VII	22.82	60%
ZONE-VIII	3.08	12%

B. Existing Storm Water Drainage Facilities

8. The storm water drainage system in project area comprises of about 280 km of storm water drains, that include roadside collector drains and main drains that convey the storm water into canals and water bodies, and ultimately into the Bay of Bengal. There are a number of lakes in the project area, such as North Ambattur Lake, Korattur Lake, Puzhal Lake, Retteri Lake, etc., and canals (Buckingham canal and lake surplus channels that carry overflow/surplus downstream) that form part of overall storm water / flood management system. Drains currently are connected to following water bodies at various locations: Puzhal lake, Retteri Lake, Madhavaram Periyathopu, Puzhal surplus, Kosasthalaiyar river, Buckingham Canal, Ennore Creek and the Bay of Bengal. Lakes are connected with surplus channels, that carry surplus overflow downstream and discharge into a lake or canal or ultimately into Bay of Bengal. Storm water that is collected from the project areas ultimately reaches the Bay of Bengal.

9. Some of the localities in the project area, especially near Buckingham canal are, low lying, and therefore pumping facilities are established in areas such as Kargil Nagar and Eranvoor to pump the accumulated storm water into Buckingham canal. Buckingham canal discharges into Ennore creek that is connected to the Bay of Bengal. In this project, the surplus canals connecting (Ambattur Lake, Korattur Lake, Kadapakkam Lake and Ariyalur Lake) have been considered for renovation/ restoration. The details of existing drains in the project area are given in the following:

10. **Table 1**. Entire storm water drainage system is managed by GCC, except the canals that fall under the jurisdiction of Public Works Department (PWD) of the Government of Tamil Nadu.

Table 1: Existing Drain Details in Project Area

Description	Length (km)
Total length of road network in the ULB	1315
Total length of the existing drains	280
Existing Length of the drains in good condition	105
Existing Length of the drains to be rehabilitated	175

C. Existing Sewerage and Solid Waste Management

11. Of the total 127.80 km^2 of project area of Chennai-Kosasthaiyar Basin, nearly 76% (96.78 km^2) of the area is covered with the sewerage system. Sewerage system is already proposed for the remaining area. Detailed project report (DPR) has been prepared for 12.14 km^2 and is ready for execution, while DPR is under preparation for an area of 18.88 km^2. There are 3 sewage treatment plants of total capacity 250 MLD in operation, and another 31 MLD STP is under construction. Chennai Metro Water Supply and Sewerage Board (CMWSSB) is continuously expanding the treatment capacity to meet its demand. Except part of Manali area (Edayanchavadi, Sadayankuppam and Kadapakkam), the remaining areas will be covered by sewerage schemes. Even left out areas of Manali will also be included in the UGSS proposals in the year 2021. Due to lack of sewerage system in part of the project area, wastewater is illegally discharged into storm water drains at various locations, polluting the receiving water bodies. The proposed provision of sewerage system will prevent the entry of wastewater into drainage system.

12. At present GCC is having an effective solid waste management system. However, the people living nearer the surface water bodies and the commercial pockets existing near surface water bodies are having tendency to dump solid waste near the water bodies. Therefore, the following measures are proposed to avoid disposal of solid waste into drains and canals.

(i) Major and micro drains are designed as box type drain with cover on top which will prevent dumping of solid waste in drains.
(ii) Fencing on both sides of major surplus canals sections where required
(iii) Provision of screens at discharge points in drains to control solid waste entry
(iv) Public awareness programs have been proposed to ensure public co-operation for proper waste disposal.

D. Issues in Existing Storm Water Drainage System

13. The SWD facilities in Kosasthalaiyar Basin has the following basic problems.

(i) Rapid urbanization and increase in population has direct impact on the natural drainage course (shrinking of drains), due to this during incessant rain, flood occurs in the surroundings
(ii) Natural drain course from several lakes/tanks up to discharge end are observed to be missing.
(iii) Natural flow of the water in the drains are obstructed by the presence of the wild vegetation/ weeds
(iv) Some of the areas does not have sewerage system. Sewage & storm water gets mixed up which stagnates in the low-lying areas
(v) Lack of side drains along the roads causes flooding/ ponding of water
(vi) Due to improper drainage network, overflow of several drains occur during the rain. Due to this, roads in several locations are being badly affected and damaged

(vii) The existing pumping station located at Kargil Nagar is equipped with two nos. of 10 HP pumps having capacity of 2833 litres per minute (LPM) each and 3m diameter sump was constructed to pump the local rain water during floods. Based on the assessment, the existing pumps are very old and not having sufficient capacity to pump the rain water during floods

(viii) Due to the encroachments, the canal connecting Retteri north surplus (Canal) and the Puzhal surplus (Canal) has been shrunken and the flow of water has been completely stopped, due to this Retteri lake experiencing severe floods during monsoon season

(ix) Open drains that presently convey sullage are silted up hindering free flow of rainwater from the catchments areas. Stagnation of water because of siltation / blockage is creating health related problems due to mosquito breeding, fly nuisance etc.

(x) Flow of sewage / septic tank effluent and industrial effluents in some open drains also creates health risk to the citizen.

(xi) Dumping of debris & wastages into the Canals and lakes causing obstruction to free flow of rain water finally leading to overflowing and flooding of adjacent areas.

E. Floods in the Project Area

14. The Kosasthalaiyar basin in GCC is located on Coromandel Coast off the Bay of Bengal. This region has been battered by incessant heavy rainfall causing water stagnation and inundation. In year 2005, project area continued to receive heavy rains, recording 241 mm in 24 hours on 28th October 2005, and 320 mm in 24 hours on 2nd December 2015. Total annual rainfall in 2005 and 2015 is 2,431.5 mm and 2,313.6 mm. GCC has been faced the problem of floods in many low - lying areas of the Kosasthalaiyar basin. Locations of inundated areas are shown in Figure 3. Due to inundation, there was heavy damages to structures, household articles and there was no food and power supply to the local people. Information regarding the flood-prone areas was collected by physical verification on-site, interacting with the local people and with the officials of GCC. About 121 flooding /inundation hot spots have been identified.

Figure 3: Flood Prone Areas

F. Cause behind Flooding

(i) Poor coverage of drains i.e., only 8% are covered with effective drains at present.
(ii) Poor condition of existing drains i.e., out of total 280 km drains, only 110 km are structurally and hydraulically suitable.
(iii) Poor maintenance
(iv) Topographical issues, most of the area is plain and low lying, and the manmade boundaries such as rail lines, Buckingham canal, etc. criss-cross the area, further affecting the drainage and leading to flooding and water logging.

G. Proposed Storm Water Drain Components

15. Towards developing a comprehensive storm water drainage system in Chennai City, the Detailed Project Report (DPR) has been prepared for providing Integrated Storm Water Drains in the four major basins during the year 2014. In first stage, works have been commenced in Adyar and Cooum basins with World Bank funding under Tamil Nadu Sustainable Urban Development Project (TNSUDP). Now, GCC intends to take up the Kosasthalaiyar basin for implementation.

Table 2: Salient features of the project

Sl. No.	Details	Information
1	Area of Greater Chennai Corporation	426 km^2
2	Catchment Area considered in Kosasthalaiyar Basin within Corporation based on topography	127.80 km^2
3	Population of project area (2011 Census)	2.58 million
4	Ground elevation range (MSL)	-0.41 to 26.96 m
5	Total road network (based on surveys conducted)	1,315 km

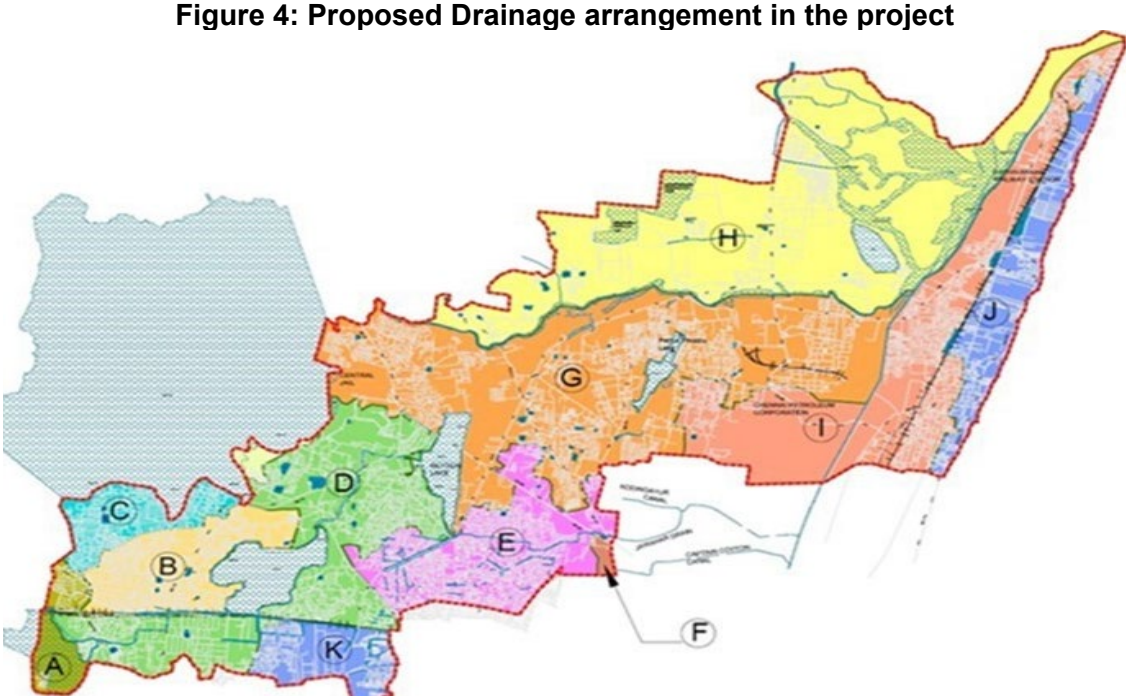
Sl. No.	Details	Information
6	No. of major and minor water bodies	8 Nos + 66 Nos.
7	Water ways (River/ Canal)	7 Nos + 5 Nos.
8	Average Annual Rainfall	1,317.7 mm
9	Highest rainfall recorded in the year (2015) in a day	320 mm
10	Severely affected Flood Prone Area	11.27 km^2
11	% of area severely vulnerable to flood	8.82%
12	Total Estimated Project Cost (GCC+PWD Component)	INR 26140.6 million
13	Total Annual O&M Cost	INR 382.6 million
14	Project Implementation Agency	Greater Chennai Corporation
15	Total Number of Packages	46
16	Total Project Implementation Period	36 Months

16. **Proposed Storm Waste Management System.** The project area spread over 127.8 km^2, has been divided into 11 storm water drainage zones (watersheds). These watersheds have different characteristics of their own having different types and land use pattern that affect the runoff. They have different soil characteristics, different permeability and flood absorption characteristics. Entire project area drains into Bay of Bengal mainly through Kosasthalaiyar River. The details of the watersheds are given in the following table.

Table 3: Watersheds in Kosasthalaiyar Basin

Sl.no	Watershed	Catchment area (km^2)	Discharge Point	Figure 4 reference
1	North Ambattur	2.06	Ambattur Lake	A
2	Korattur Lake	8.32	KoratturLake &Kolathur Lake	B
3	Puzhal South	3.38	Puzhal Lake	C
4	Retteri Lake	17.07	Retteri Lake	D
5	Retteri South Surplus	9.43	Buckingham Canal	E
6	Captain Cotton Canal West	0.29	Buckingham Canal	F
7	Puzhal Surplus South	29.52	Madhavaram Periyathoppu Lake to Kosasthalaiyar River	G
8	Puzhal Surplus North	31.23	Kadapakkam Lake, Ariyalur Lake, Sadayankuppam Lake to Kosasthalaiyar River	H
9	North Buckingham canal	16.64	North Buckingham canal	I
10	North Coast Watershed	6.14	Bay of Bengal	J
11	Otteri Nallah Watershed	3.72	Otteri Nallah/drain	K
	Total	**127.8**		

Figure 4: Proposed Drainage arrangement in the project



17. Storm water system is designed adopting a 2-year return period to handle higher precipitation under extreme rainfall events, sea level rise in vulnerable coastal areas, and storm surges from cyclones. The proposed storm water drainage system features climate-resilient design to cope with intensifying rainfall and higher sea level rise. Infiltration pits are proposed to l boost groundwater recharge in paved areas of a region at risk of water scarcity. Off 280km of the existing storm water drains, nearly 105 km length is in good condition and those which are hydraulically adequate will be retained. The remaining 175 km of existing drain will be rehabilitated or replaced. New storm water drains for a length of 588 km constructed to cover the uncovered areas, this includes necessary interlinking of water bodies within the project area through the existing or proposed drains have also been considered to maintain the water balance and achieve maximum water storage within the Kosasthalaiyar drainage basin. Proposed project components are presented in the following Table 4. Watershed-wise proposals to improve existing and construction of new drains is given in Table 5.

Table 4: Proposed Project Components

Sl.no	Watershed	Quantity
1	Construction of new drains of size range of 0.60 x 0.75m to 7.00 x 2.50m for a length of 588 km	588 km length Drain sizes varies from 0.60 (wide) x 0.75m (deep) to 7.00 (wide) x 2.50 m (deep)
2	Rehabilitation and/or replacement of existing storm water drains, including desilting as required	175 km length
3	Improvement of Ambattur, Korattur, Kadappakkam, and Ariyallur canals to enhance water carrying capacity including desilting as required	11 km long canal stretches
4	Construction of energy-efficient water-pumping stations at Kargil Nagar and Eranavoor	2 numbers

Sl.no	Watershed	Quantity
5	infiltration pits constructed at regular intervals in roadside drains to recharge the groundwater aquifer	23,000 numbers

Table 5: Watershed wise Drain Summary

Watershed Name	Existing network length (km)	Retained network length (km)	Total Proposed Network			Total Network Length (km)
			Redesigned	New Drains network Length (km)	Total (km)	
	Length (km)	Length (km)	network Length (km)	network Length (km)		
North Ambattur -A	9.69	5.71	3.94	2.64	6.58	12.29
Korattur Lake – B	23.15	8.56	14.59	50.71	65.30	73.86
Puzhal South – C	6.59	1.16	5.49	36.07	41.56	42.72
Retteri Lake – D	66.59	24.39	42.20	88.59	130.79	155.18
Retteri South Surplus - E	39.36	14.02	25.34	98.03	123.37	137.39
Captain Cotton Canal West - F	0.3	0	0.3	1.67	1.97	1.97
Puzhal Surplus South - G	51.19	17.79	33.40	119.17	152.57	170.36
Puzhal Surplus North - H	8.39	2.3	6.09	67.03	73.12	75.43
North Buckingham canal - I	50.80	20.83	29.97	69.94	99.91	120.74
North Coast Watershed – J	8.69	1.97	6.72	46.29	53.01	54.98
Otteri Nallah - K	15.12	8.27	6.85	8.42	15.27	23.54
Total	**279.87**	**105.00**	**174.89**	**588.56**	**763.45**	**868.45**
			Total Proposed Network = 763.45			

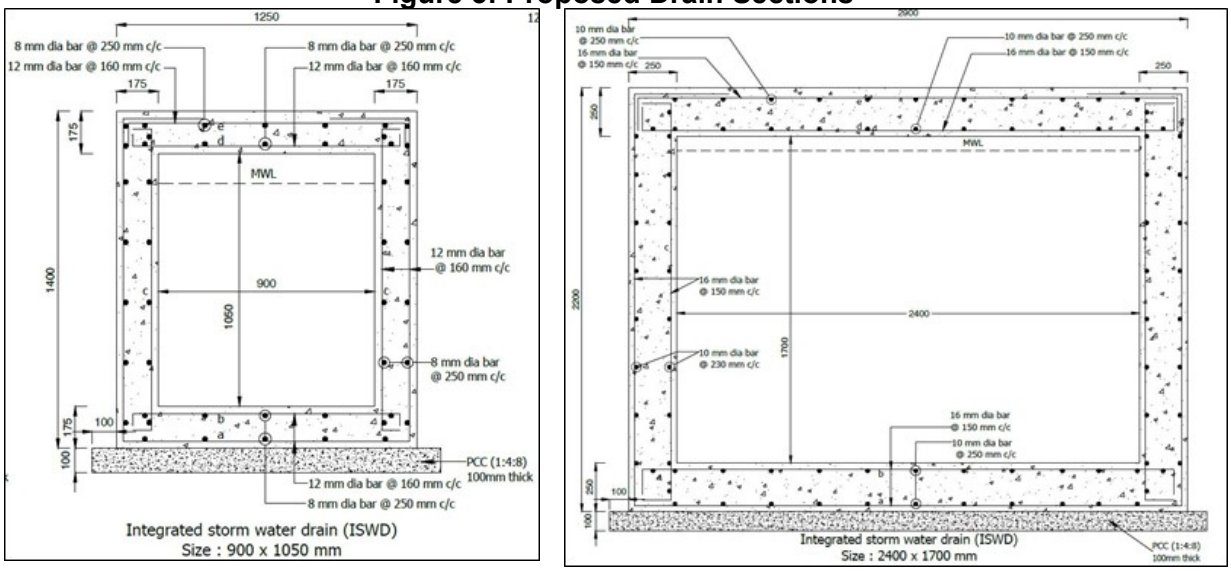
Source: Final DPR of Kosasthalaiyar ISWD

1. Proposed Type of Drains

18. It is proposed to construct drains in reinforced cement concrete (RCC) - M-20 grade of concrete with reinforcement. Size of drain varies and will be based on discharge capacities. The stability and other structure analysis have been carried while adopting the sections. The size of drains ranges from a minimum of 600 mm (wide) x 750 mm (deep) to a maximum of 7000 mm (wide) x 2500 mm (deep). Most of the newly proposed drains are along the roadsides. Reconstruction/augmentation of existing drains has been proposed which were found inadequate. Closed drains are proposed along roadsides for sizes ranging from 600 mm x 750 mm to 2500 mm x 2500 mm. Open drains are proposed for sizes above 2500 mm x 2500 mm.

19. For closed drains, RCC cover slabs are proposed with heavy-duty FRC (fiber reinforced concrete) inspection door for maintenance at an equal interval of about 10 m. The inspection door has been provided in close spacing for easy access for maintenance and desilting. Other components are the construction of silt catch pits and silt catch pits with rainwater harvesting structures, fencing on both sides of open drains to prevent dumping of solid wastes where needed, gratings in closed drains for entry of surface flow and to prevent the entry of solid wastes into the system, etc.

Figure 5: Proposed Drain Sections



2. Proposed Storm Water Pumping Stations

20. The existing storm water (drainage) pumping capacity at Kargil Nagar will be enhanced with an additional pumping station with 3 nos. having higher capacity pumps. A new storm water pumping station is proposed to avoid flood in Ernavoor. Storm water drains in Kargil Nagar and Ernavoor will be extended to the pumping stations. Adequate and accessible government owned vacant land is available on the bank of Buckingham canal (1,100 m^2 available, while 550 m^2 required at both sites) where the pumping stations are proposed. In both the pumping stations, storm water will be discharged to Buckingham Canal through pumping.

Location of proposed storm water pumping station at Kargil Nagar

Location of proposed storm water pumping station at Eranavoor

3. Proposed Surplus Canals Works

21. To improve the overall storm water drainage system in the project area, four out of seven surplus canals / macro drains in the project area, managed by PWD, is also proposed for improvement as part of this ADB funded Project. Total length is 11.25 km, and details are given in below table. Improvement works related to remaining three surplus canals (Retteri Surplus, 2.01 km; Puzhal Surplus, 12.23 km and Thanikachalam Drain, 3.62 km) will be undertaken by the PWD for which DPR has already been prepared by the PWD. The details of the canals are given in the following Table 6. Improvements proposed for each surplus canal is discussed below.

Table 6: Surplus Canals Proposed for Improvement

Sl No.	Major Surplus Canal	Connecting Lake		Length (km)
		From	To	
1	Ambattur Surplus Canal	Ambattur	Korattur Lake	5.79
2	Korattur Surplus Canal	Korattur	Retteri Lake	2.13
3	Kadapakkam Surplus Canal	Kadapakkam Lake	Ariyalur Lake	0.68
4	Ariyalur Surplus Canal	Ariyalur Lake	Puzhal Surplus	2.65
Total				**11.25**

(i) **Ambattur Surplus Canals**: It carries the surplus water from Ambattur Lake to Korattur Lake. Presently this canal is lined with RCC and at some sections it has stone masonry and unlined. In addition, there are some missing links. This Canal is hydraulically analysed and found inadequate at some stretches and suggested trapezoidal RCC M30 sections size varying from 5 to 10 m wide.

(ii) **Korattur Surplus Canals:** It carries the surplus water from Korattur Lake to Retteri Lake. The average width is 40 m, and it is unlined in most of the stretches. This Canal is hydraulically analysed and found inadequate at some sections due to reduction of the section because of silting. It is proposed to de-silt this Canal to the depth of 1 to 2m to arrive the design section and strengthen sides with RCC M30 retaining walls.

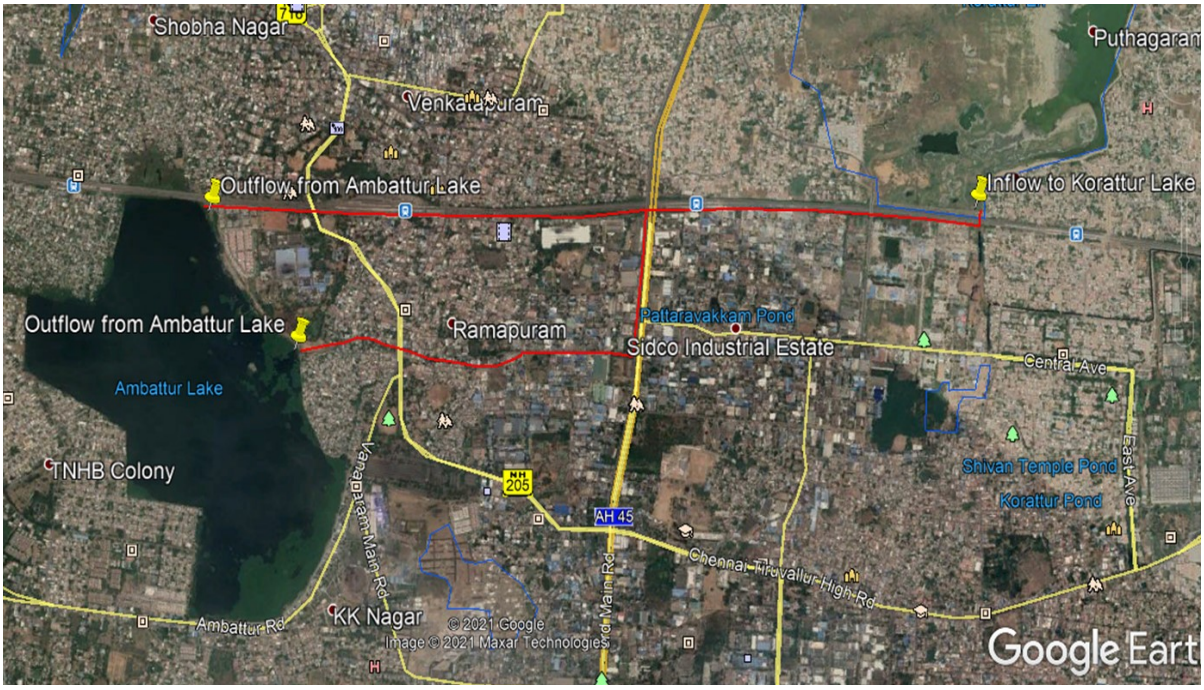
(iii) **Kadapakkam and Ariyalur Surplus Canals**: These two canals will carry surplus water from Kadapakkam Lake to Puzhal Surplus Canal via Ariyalur Lake. The existing earthen link between Kadapakkam Lake and Ariyalur Lake at present, shall be developed to a fully lined channel. From Ariyalur Lake to Puzhal surplus,

presently, this canal is unlined, earthen and in irregular shape. It is proposed to de-silt this Canal to the depths of 1 to 2m to arrive at the design section and strengthen sides with RCC retaining walls.

Ambattur Surplus Canal

Korattur Surplus Canal

Ambattur Surplus Canal Outfall to Korattur Lake



Korattur Lake Inflow and Outflow

Kadapakkam and Ariyalur Surplus Canal (Inflow and Outflow)

22. **Design Considerations**. The macro drains/surplus canals connecting major lakes will consist of different section size of RCC retaining walls. The selection of the section size to be built

will be based on discharge capacities. These sections have been constructed by M-30 grade of concrete with reinforcement. The stability and other structure analysis have been carried while adopting this section. These section sizes ranges from a minimum of 4000 mm x 2000 mm to a maximum of 30,000 mm x 2,000 mm. Open drains with both side retaining walls with RCC base is proposed. In addition, the following interventions are proposing for new construction:

(i) Surplus canals are proposed to strengthen with RCC side walls and it is recommended to close / plug the illegal industrial effluent connections during construction of RCC walls and notify the pollution control board for further necessary action
(ii) All the proposed roadside drains are to be constructed using RCC M20 grade concrete and sidewalls for surplus canals shall be constructed using RCC M30.
(iii) If road width is less than 3 m and in newly added villages and undeveloped areas, Kerb & Gutter is proposed.

23. **Associated facilities**. Of the seven macro drains / surplus canals, four are being improved under this Project and the remaining three surplus canals/ macro drains namely Retteri Surplus (2.01 km), Puzhal Surplus (12.23 km) and Thanikachalam Drain (3.62 km) will be improved by the PWD of GOTN. PWD has already the DPR has been prepared. As per the SPS "associated facilities" are those that are not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project". These surplus canals already exist and proposed improvements although required, may not be essential for the viability of the ADB project.

H. Implementation Schedule

24. The IUFMCKB project in Kosasthalaiyar Basin of Greater Chennai Corporation will be implemented by the Storm Water Drain Department of the Greater Chennai Corporation. Project area covers GCC Zones of I, II, III and part of Zones VI, VII & VIII. Entire scope of work under the project is split into 46 construction packages, which are further into 3 phases based on the severity of flood prone areas and topography i.e., upstream to downstream. Upstream locations are proposed under Phase 1 and downstream locations are proposed under Phase 2 and 3. All phases are being implemented simultaneously Details of phases and packages are given in the following table. Based on the volume of work in each package, the construction period varies between 24 to 36 months. Bidding process is almost completed, and construction is likely to start soon.

Table 7: Bidding document (Package wise) information

Packages	Work details	Length in km
Package 1	Construction of integrated storm water drain in North Ambattur Watershed	6.6
Package 2	Construction of integrated storm water drain in North Korattur Lake watershed	47.6
Package 3	Construction of integrated storm water drain in Korattur Lake Watershed	17.9
Package 4	Construction of integrated storm water drain in Puzhal South Watershed	14.6
Package 5	Construction of integrated storm water drain in Puzhal South Watershed	22.6
Package 6	Construction of integrated storm water drain in Retteri Lake Watershed	30.6
Package 7	Construction of integrated storm water drain in Retteri Lake Watershed	26.0
Package 8	Construction of integrated storm water drain in Retteri Lake Watershed	46.1
Package 9	Construction of integrated storm water drain in Retteri Lake Watershed	5.2

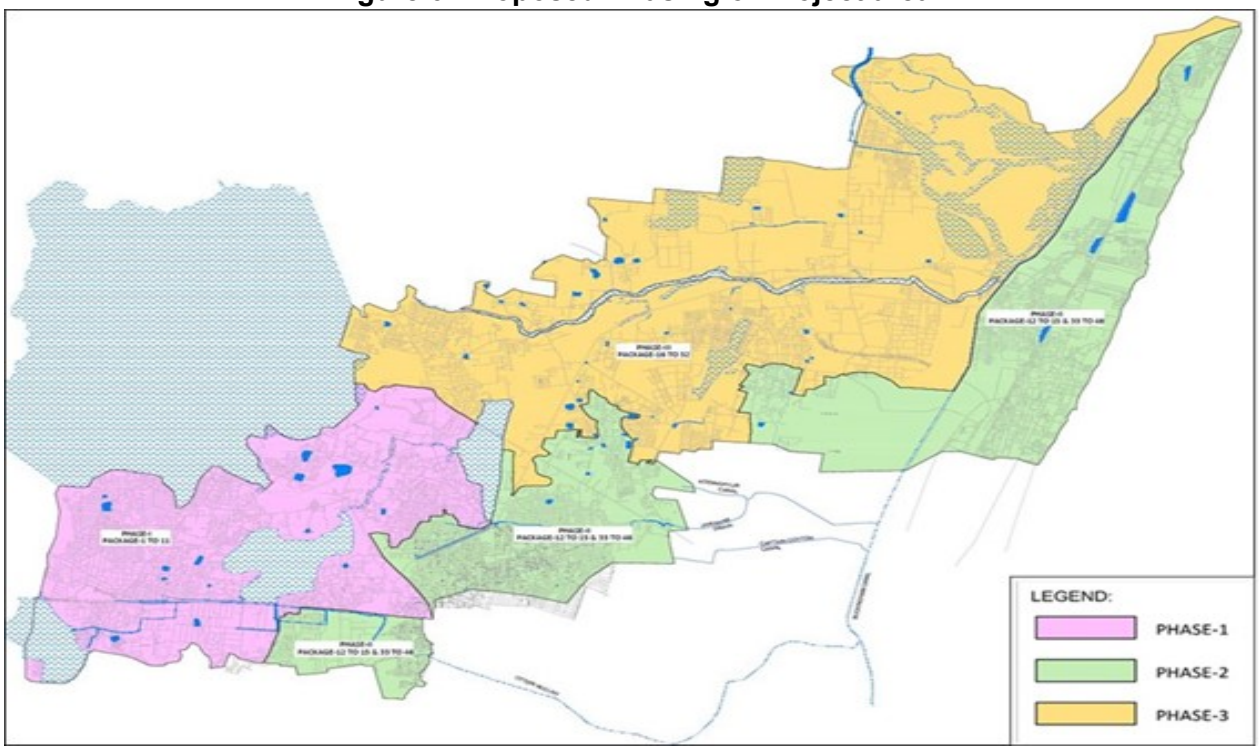
Packages	Work details	Length in km
Package 10	Construction of integrated storm water drain in Retteri Lake Watershed	17.6
Package 11	Construction of integrated storm water drain in Retteri Lake Watershed	4.0
Package 12	Construction of integrated storm water drain in Retteri South Surplus Watershed	13.0
Package 13	Construction of integrated storm water drain in Retteri South Surplus Watershed	32.8
Package 14	Construction of integrated storm water drain in Retteri South Surplus Watershed	34.7
Package 15	Construction of integrated storm water drain in Retteri South Surplus Watershed and Captain Cotton Canal Watershed	44.6
Package 16	Construction of integrated storm water drain in Puzhal Surplus South Watershed	13.5
Package 17	Construction of integrated storm water drain in Puzhal Surplus South Watershed	14.5
Package 18	Construction of integrated storm water drain in Puzhal Surplus South Watershed	11.9
Package 19	Construction of integrated storm water drain in Puzhal Surplus South Watershed	26.9
Package 20	Construction of integrated storm water drain in Puzhal Surplus South Watershed	4.3
Package 21	Construction of integrated storm water drain in Puzhal Surplus South Watershed	13.1
Package 22	Construction of integrated storm water drain in Puzhal Surplus South Watershed	16.0
Package 23	Construction of integrated storm water drain in Puzhal Surplus South Watershed	9.8
Package 24	Construction of integrated storm water drain in Puzhal Surplus South Watershed	14.4
Package 25	Construction of integrated storm water drain in Puzhal Surplus South Watershed	14.3
Package 26	Construction of integrated storm water drain in Puzhal Surplus South Watershed	13.2
Package 27	Construction of integrated storm water drain in Puzhal Surplus North Watershed	11.4
Package 28	Construction of integrated storm water drain in Puzhal Surplus North Watershed	15.6
Package 29	Construction of integrated storm water drain in Puzhal Surplus North Watershed	9.7
Package 30	Construction of integrated storm water drain in Puzhal Surplus North Watershed	20.4
Package 31	Construction of integrated storm water drain in Puzhal Surplus North Watershed	10.9
Package 32	Construction of integrated storm water drain in Puzhal Surplus North Watershed	13.4
Package 33	Construction of integrated storm water drain in North Buckingham Canal Watershed	9.1
Package 34	Construction of integrated storm water drain in North Buckingham Canal Watershed	13.0
Package 35	Construction of integrated storm water drain in North Buckingham Canal Watershed	12.4
Package 36	Construction of integrated storm water drain in North Buckingham Canal Watershed	16.0

Packages	Work details	Length in km
Package 37	Construction of integrated storm water drain in North Buckingham Canal Watershed *(Pumping Station PS1)*	32.7
Package 38	Construction of integrated storm water drain in North Buckingham Canal Watershed *(Pumping Station PS2)*	14.5
Package 39	Construction of integrated storm water drain in North Coast Watershed	9.0
Package 40	Construction of integrated storm water drain in North Coast Watershed	13.4
Package 41	Construction of integrated storm water drain in North Coast Watershed	16.9
Package 42	Construction of integrated storm water drain in North Coast Watershed	12.0
Package 43	Construction of integrated storm water drain in Otteri Nalla Watershed	15.8
Package 44	Improvement to Ambattur and Korattur canals in Kosasthaliyar basin in the extended areas of Greater Chennai Corporation	
Package 45	Improvement to Kadappakkam and Ariyallur canals in Kosasthaliyar basin in the extended areas of Greater Chennai Corporation	
Package 46	Constructing catch pits with rainwater harvesting structures in existing storm water drains in Kosasthaliyar basin in the extended areas of Greater Chennai Corporation (Package 46)	

Table 8: Proposed Project Phases and Construction Period

Sl No.	Phase	Construction Period (Months)		
		36	**30**	**24**
1	Number of Packages in Phase 1(11No.s)	2	3	6
2	Number of Packages in Phase 2 (18No.s)	2	6	10
3	Number of Packages in Phase 3 (17No.s)		4	13
	Total	**4**	**13**	**29**

Figure 6: Proposed Phasing of Project area



III. ANALYSIS OF ALTERNATIVES

25. The SPS requires an analysis of project alternatives to determine the best method of achieving project objectives (which is providing an improved climate resilient urban flood protection infrastructure in the project area of Chennai–Kosasthalaiyar river basin) while avoiding or minimizing environmental impacts. Alternative analysis provides opportunity to integrate environmental considerations into early stages of project, so that adverse environmental impacts can be avoided or minimized by various alternatives. It also provides opportunity to study various options vis a vis costs, provides a logical base, via transparent process, assist in decision making, gaining public support and ultimately in project approvals and timely implementation.

26. Various alternatives are examined for this urban drainage improvement project are presented below.

A. 'No Project' Alternative

27. Project area is spread over 127.80 sq. km and is situated on the coromandel coast of the Bay of Bengal. Due to its coastal location, and it's almost flat topography, and is vulnerable to water logging and flooding during rains. Anthropogenic activities, inadequate infrastructure and rapid urbanization and increase in population has further aggravated the situation. The existing storm water drainage network inadequate and under capacity and covers only a part (8%) of the study area. While the total road network is 1,315 km, the length of existing drains is just 280 km, and of which more than 60% of the drains are not hydrologically or structurally suitable and are in the need of rehabilitation and improvement. Some of the localities in the project area are low lying. About 11 sq. km, which is about 9% of the project areas is considered as severely vulnerable to floods. Obstruction to flow caused by missing links, blockages due to heavy silt and vegetation growth in the drain section, discharge of sewage into storm water drains, lack of roadside drains and overflowing drains due to inadequate capacity, lack of adequate capacity of pumping facilities in low lying areas and disposal of solid waste into drains are some of the issues faced by the drainage system in the project area.

28. Although project area has a good number of major and minor water bodies, river and canals, due to lack of proper connections, and the water holding capacity of the study area has been reduced over the period, and this is also identified as one of the reasons for flooding and water logging. In project area, 121 flooding /inundation hot spots have been identified.

29. This region, including the project area, has been experiencing heavy rains of late. On October 28, 2005, project area received record rainfall of 241 mm in just 24 hours due to incessant rains. Again in 2015, this record has been broken, and a very high rainfall of 320 mm is received just in 24 hours on December 2, 2015. Total annual rainfall in 2005 and 2015 is 2,431.5 mm and 2,313.6 mm. Given lack of proper infrastructure compounded by a very high rainfall, GCC has been faced the problem of floods. Due to inundation, there was heavy damages to structures, household articles and there was no food and power supply to the local people. The cost of relief rehabilitation including infrastructure repairs and restoration in the event of flooding is also enormous.

30. No project alternative meant maintenance of status quo in the project area in terms of its urban drainage and flood projection infrastructure. It is, therefore, the 'no project scenario', meant not only continuation of above problems but also further decline in living conditions and overall quality of life of pipe living in the project area. Therefore, 'no project alternative' is rejected.

B. Project Location Alternative

31. Project area – Chennai-Kosasthalaiyar basin is one of the four major basins in Chennai City, and GCC initiate projects to comprehensively develop storm water drainage system covering all basins. As a first step, the GCC has initiated the improvement of storm water drainage system in Adyar and Cooum basins with financial support from the World Bank, the project is in the verge of completion. A similar project for the Kovalam basin is contemplated with financial support from the KfW. This project with ADB financial support will improve the storm water drainage infrastructure and address issues inter alia relating to water stagnation and inundation the Kosthalaiyar basin.

32. Proposed repair, rehabilitation and desilting works of existing drains (175 km) and surplus canals (11 km) will be conducted within the existing footprint of the facilities. Existing drains are mostly located along the roads. New drains of 588 km are proposed along the roads in the town within the road right-of-way (ROW). Sites for two pumping stations - at Kargil Nagar and Eranavoor are selected based on the technical considerations (lowest level and availability of discharge point) on a government owned vacant land. At Kargil Nagar, where there is already a pluming station, the new one will be constructed adjacent to the existing pumping station, and on a vacant government land.

C. Design Alternatives

33. At present, entire project area drains into Bay of Bengal mainly through Kosasthalaiyar River. Proposed project design follows the existing natural drainage system completely and is divided 11 storm water drainage zones (watersheds) to account for site specific design in terms of land use, soil characteristics, water retention capacity etc., Outlet discharge points are defined by natural drainage pattern. Pumping systems are avoided, except in two places where the natural ground level is lower than the canal level.

34. A 2-year return period to handle higher precipitation under extreme rainfall events, sea level rise in vulnerable coastal areas, and storm surges from cyclones is adopted. Infiltration pits are proposed to boost groundwater recharge. Various other measures are included in design to achieve maximum water storage within the Kosasthalaiyar drainage basin.

35. Concrete drains are proposed with appropriate grade of concrete and reinforcement. Drains are designed with appropriate covers, inspection doors, silt catch pits, rainwater harvesting structures, fencing on both sides of open drains to prevent dumping of solid wastes where needed, gratings in closed drains for entry of surface flow and to prevent the entry of solid wastes into the system, etc. Design improvements will plug illegal industrial effluent connections.

IV. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

D. ADB Safeguard Policy Statement, 2009

36. ADB SPS[2] requires borrowers to meet a set of requirements (Safeguards Requirements 1) when delivering environmental safeguards for projects supported by ADB. The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Hence, the project is requires to comply with these requirements. Summary of the step-by-step process is discussed below in this section.

37. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A**. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.
(ii) **Category B**. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for projects classified as Category A. An initial environmental examination (IEE) is required.
(iii) **Category C**. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
(iv) **Category FI**. A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary.

38. **Environmental Management Plan.** PMU has prepared an EMP and included in Section VIII of this IEE report, as required for category B projects. The EMP shall describe and address the potential impacts and risks identified by the environmental assessment. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks. The EMP shall include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.

39. **Public Disclosure.** PMU shall submit the following documents to ADB for disclosure on ADB website so affected people, other stakeholders, and the public can provide meaningful inputs into the project design and implementation:[3]

(i) Final or updated IEE upon receipt; and

[2] ADB. 2009. *Safeguard Policy Statement*. Manila.
[3] Per ADB SPS, 2009, prior to disclosure on ADB website, ADB reviews the "borrower's/client's social and environmental assessment and plans to ensure that safeguard measures are in place to avoid, wherever possible, and minimize, mitigate, and compensate for adverse social and environmental impacts in compliance with ADB's safeguard policy principles and Safeguard Requirements 1-4."

(ii) Environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

40. **Consultation and Participation.** The GCC/PMU shall carry out meaningful consultations[4] with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. The consultation process and its results are to be documented and reflected in the environmental assessment report.

41. **Grievance Redress Mechanism.** GCC/PMU shall establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The grievance mechanism shall be scaled to the risks and adverse impacts of the project.

42. **Monitoring and Reporting.** GCC/PMU shall monitor, measure, and document the progress of implementation of the EMP. If necessary, GCC/PMU will identify the necessary corrective actions, and reflect them in a corrective action plan. GCC/PMU will prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with implementation of the EMP, and compliance issues and corrective actions, if any.

43. **Unanticipated Environmental Impacts.** Where unanticipated environmental impacts become apparent during implementation, GCC/PMU shall update the environmental assessment and EMP, or prepare a new environmental assessment and EMP, to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

44. **Pollution Prevention and Control Technologies.** During the design, construction, and operation of the project, the GCC/PMU will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India and Government of Tamil Nadu regulations differ from these levels and measures, the GCC/PMU will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

45. **Occupational Health and Safety.** GCC/PMU shall ensure that workers are provided with a safe and healthy working environment, considering risks inherent to the sector and specific classes of hazards in the project work areas, including physical, chemical, biological, and radiological hazards. PMU shall ensure to take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and

[4] Per ADB SPS, 2009, meaningful consultation means a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

46. **Community Health and Safety.** The GCC/PMU shall ensure to identify and assess the risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the project, and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. GCC/PMU shall ensure to apply preventive and protective measures for both occupational and community health and safety consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines.[5] PMU shall also adhere to necessary protocols in response to emerging infectious diseases such as the corona virus disease (COVID-19) consistent with the guidelines of relevant government healthcare agencies and the World Health Organization.

47. **Physical Cultural Resources.** GCC/PMU is responsible for siting and designing the project to avoid significant damage to physical cultural resources. Such resources likely to be affected by the project will be identified, and qualified and experienced experts will assess the project's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process. The chance finds procedure or protocol included in this IEE shall be used as mandatory guide for the contractor.

48. **Environmental Audit.** When a project involves existing activities or facilities, GCC/PMU is responsible to ensure that relevant external experts will perform environmental audits to determine the existence of any areas where such project may cause or is causing environmental risks or impacts. If the project does not foresee any new major expansion, the audit constitutes the environmental assessment for the project.

49. Based on the SPS 2009 requirements, this project "Proposed Integrated Urban Flood Management for the Chennai - Kosasthalaiyar Basin" has been categorized as "B" and accordingly this IEE has been prepared to address the potential impacts, in line with the recommended IEE content and structure for Category "B" projects.

E. National Environmental Laws

50. **Environmental assessment.** The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994) sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as 'A' or 'B' depending on the scale of the project and the nature of its impacts.

51. **Category A** projects require EC from the central Ministry of Environment, Forests and Climate Change (MoEF&CC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF&CC prepares comprehensive Terms of Reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF&CC considers the recommendation of the EAC and provides the EC if appropriate.

[5] World Bank Group, 2007. *Environmental, Health, and Safety General Guidelines*. Washington, DC.

52. **Category B** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study) and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category 'A' if it is located in whole or in part within 10km from the boundary of protected areas, notified areas or interstate or international boundaries.

53. Per the EIA Notification, 2006, the proposed project components do not fall under the ambit of the EIA Notification 2006, and therefore EIA study and environmental clearance requirement do not apply to this project. The project will not require environmental clearance either from SEIAA (at state level) or from MoEFCC (at central level).

54. **Applicable environmental regulations.** Besides EIA Notification 2006, there are various other acts, rules, policies, and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in Table 9.

Table 9: Applicable Environmental Regulations

Law	Description	Requirement
Environment (Protection) Act, 1986 and CPCB Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	To comply with applicable notified standards
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	The act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under this Act. Under this law, it is mandatory to obtain consent from Tamil Nadu State Pollution Control Board (TNPCB) for discharge from construction activities.	No wastewater discharge anticipated from this storm water drainage project; no permission/clearance required under this Act The contractor should obtain consent from TNPCB for discharge from construction activities. Application has to be submitted online at http://tnocmms.nic.in/OCMMS/
Noise Pollution (Regulation and Control) Rules, 2000 and amended	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the CPCB Ambient Noise Standards. (see rule 3[1] and 4[1])
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles);	Equipment and machinery such as diesel generators, hot mix plants, wet mix plants, stone crushers, etc. if installed for construction to comply with applicable emission standards.

Law	Description	Requirement
The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008	It provides for regulation and control of indiscriminate disposal of Hazardous waste; and its sound management to reduce risks to environmental and human health Applicable if project deals with generation/ handling/ storage/ processing of hazardous waste which should take cognizance of the provisions/schedules of these Rules and obtain authorization from the TNSPCB.	Not applicable
Municipal Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing, and disposal.	The solid waste generated at proposed facilities shall be managed and disposed of by following the SWM Rules
Construction and Demolition (C & D) Waste Management Rules, 2016	Rules to manage construction and waste resulting from construction, re-modelling, repair and demolition of civil structure. Rules define C & D waste as comprising of building materials, debris resulting from demolition / re-modelling or repairs	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules
Central Ground Water Authority, Notification, 1997	It provides for regulation and control of ground water development and management	Permission for the extraction of Groundwater for construction purposes from Central Groundwater Board (CGWB)
Tamil Nadu State Ground Water (Development and Management) Act, 2003	This Act is to protect groundwater resources and provide safeguards against groundwater overexploitation, and to ensure its planned development and management; notifies areas for development, regulation and control of groundwater; prohibits sinking of wells and groundwater transport in notified areas without prior permission of the designated authority; requires all wells to be registered	Groundwater abstraction in any of the notified areas will be subject to the provisions of this Act.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon the equal opportunity and fair treatment and shall not discriminate concerning aspects of the employment relationship,	**Appendix 2** provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in the construction of civil works.

<table>
<tr><th>Law</th><th>Description</th><th>Requirement</th></tr>
<tr><td></td><td>including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.</td><td></td></tr>
<tr><td>Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979</td><td>Act is applicable to any establishment that employs 5 or more inter-state migrant workers through an intermediary (who has recruited workers in one state for employment at an establishment situated in another state).</td><td>Contractor for subprojects to register with the Labour Department in case of hiring of inter-state migrant workers. Adequate and appropriate amenities and facilities to be provided to workers including housing, sanitation, portable water, medical aid, traveling expenses from home to work place, etc.</td></tr>
<tr><td>Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996</td><td>It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health and welfare</td><td>This act is applicable for safeguarding the construction labours/ workers engaged in this subproject.</td></tr>
<tr><td>Coastal Regulation Zone (CRZ) Notification, 2018 dated 18/01/2019.</td><td>This notification under the Environment (Protection) Act, 1986 supplements the law on-site clearance by declaring certain zones as CRZ and regulates activities in these zones.

Permission from Coastal Regulation Zone authority is required for construction works in CRZ. Storm water drain is allowable activity in most of the CRZ zones, but permission will be required.

Definition of each zone that is falling under the project area is given below as per the CRZ Notification:

CRZ II - shall constitute the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban</td><td>Following project components are falling in the CRZ and will require prior permission for construction works.
<table>
<tr><th>Sl.no</th><th>Project Details in CRZ area</th><th>CRZ area</th><th>Length/ Area/No's</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Storm water drains</td><td>CRZ II</td><td>59.059 km</td></tr>
<tr><td>CRZ IVA</td><td>0.451 km</td></tr>
<tr><td>CRZ IVB</td><td>1.210 km</td></tr>
<tr><td>2</td><td>Storm water Pumping Stations at Kargil Nagar and Ernavoor</td><td>CRZ II</td><td>979 m^2 (489.5 m^2 each)</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Stormwater Outfall/ Discharge Points</td><td>CRZ II</td><td>6 nos</td></tr>
<tr><td>CRZ IVA</td><td>9 nos</td></tr>
<tr><td>CRZ IVB</td><td>14 nos</td></tr>
</table>
Accordingly, application in the prescribed format (Form 1, refer Appendix 16) and CRZ map[6] (as per the CRZ notification 2019) has</td></tr>
</table>

[6] Anna University, Chennaim, is one of the authorised agencies for preparing CRZ maps. As per the request from the

Law	Description	Requirement
	areas, which are substantially built-up with a ratio of built-up plots to that of total plots being more than 50 per cent and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply, sewerage mains, etc. CRZ IVA - The water area and the sea-bed area between the Low Tide Line up to twelve nautical miles on the seaward side shall constitute CRZ-IV A. CRZ-IV B areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from the mouth of the water body at the sea up to the influence of tide, i.e., salinity of five parts per thousand (ppt) during the driest season of the year.	been prepared and submitted to the Tamil Nadu State Coastal Zone Management Authority (TNSCZMA) for approvals/ clearance
Ancient Monuments and Archaeological Sites and Remains Acts, 1958, its Rules, 1959 and notification, 1992. Ancient Monuments and Archeological Sites and Remains (Amendment and Validation) Act, 2010	This act provides, inter alia, for the preservation of ancient and historical monuments and archaeological sites and remains of national importance • Notifies 100m around the monument as a prohibited area and 100 to 300m as a regulated area for construction works; • No excavation/construction work is allowed within 100m of the boundary of the protected monument; • Requires prior permission of National Monument Authority (NMA) for taking up works within 300m of the boundary of protected monuments	There are no protected monuments in project area. Not applicable to the project.

GCC, Anna university have conducted DGPS survey and marked the HTL, LTL on the CRZ map of 1:4000 scale (as per the approved CZMP).

55. **Costal Regulation Zone.** The areas located along the coast are designated as Coast Regulation Zones as per the CRZ Notification 2019 (superseding 2011 Notification). CRZ map of the project area is shown in:

56. **Figure 19**: The view of discharge outfall into Sea and Creek. Anna University, Chennai, is one of the authorized agencies for preparing CRZ maps in the country. As per the request from the GCC, Anna University has conducted the mapping exercise, for the purpose of clearance / no objection from Tamil Nadu Coastal Zone Management Authority (TNCZMA). Of the total 127.8 km^2 area, about 2.5 percent (3.19 km^2) fall under the CRZ. Some sections of the storm water drain, storm water pumping stations (at Kargil nagar and Ernavoor) and discharge/ outfall locations are located in CRZ II, CRZ IVA and CRZ IVB.

(i) CRZ II. Few sections of the Storm water drains proposed in the settlements located near the coast/ Bay of Bengal comes under the CRZ-II. The proposed (i) storm water pumping stations located at Kargil Nagar and Ernavoor, (ii) Storm water drain for a length of 59.059km and (iii) 6 storm water discharge points comes under the CRZ II.

(ii) CRZ IVA. As per the proposed storm water network design, it is planned to discharge the collected storm water through the existing discharge points to the sea (Bay of Bengal). Arrangements for the storm water discharge already has been included in the Ennore Expressway that runs along the coast. Sufficient drain provision has been included every 500m intervals in this road. In this project the existing drain outfall facility has been proposed to be utilized. Due to the erosion some of the drains are heavily silted and it shall be desilted for a length of 0.451 km. Hence, as per the CRZ notification 2019, the proposed activity comes under the CRZ IVA and mandated CRZ clearance.

(iii) CRZ IVB. As per the proposed design, improvements are required in the CRZ IVB for a length of 1.210 km, this includes siltation of the clogged drains (existing Drains) and 14 outfall/ discharge locations. Few of the outfalls in the Ennore Creek is indicated in the following map.

57. **Status of CRZ clearance.** GCC has submitted an application (Form 1) to District Coastal Zone Management Authority (DCZMA) in December 2020. DCZMA conducted the meeting in February 2021, after then forwarded the application to state-level TNCZMA for clearance. The state level meeting of TNCZMA is likely to be conducted in April 2021 to issue the clearance. No works will be started in CRZ until the TNCZMA clearance is obtained, and any conditions, if any imposed by TNCZMA are complied with. Of the total 46 packages proposed under the Project, components in CRZ are in 11 packages (Package numbers 27, 32, 34, 35, 36, 37, 38, 39, 40, 41 and 42). Works in these packages will be initiated only after clearance.

58. **Clearances/permissions to be obtained by the Contractor.** The following table shows the list of clearances/permissions required for project construction.

Table 10: Clearances and Permissions required for Construction - GCC

S. No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Responsible
1	Construction of storm water drains, pumping stations	TNSCZMA	Clearance under the Coastal Regulation Zone Notification 2011	PIU & PSC

S. No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Responsible
	and discharge points in CRZ area			
2	Tree Cutting	GCC	Clearances from the respective Regional Deputy / Joint Commissioner, GCC for cutting of trees.	PIU & PSC

Table 11: Clearances and Permissions required for Construction - Contractor

1	Regulatory permits (license and insurance)__required concerning applicable labour laws	Government of Tamil Nadu Labour Department	Permits obtained by the contractor shall be periodically examined and validity is ensured.	Contractor
2	Hot mix plants, Crushers and Batching plants	TNPCB	Consent to establish and consent to operate under the Air Act, 1981	Contractor
3	Discharges from construction activities	TNPCB	Consent to establish and consent to operate under Water Act, 1974	Contractor
4	Storage, handling and transport of hazardous substances	TNPCB	Hazardous Wastes (Management and Handling) Rules. 1989 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Contractor
5	Sand mining, quarries and borrow areas	Department of Geology and mining, GoTN	Tamil Nadu Minor Mineral Concession Rules, 1959 (corrected up to 31.3.2001)	Contractor
6	For establishing new quarries and borrow areas	MOEF&CC	Environmental clearance under EIA Notification 2006	Contractor
7	Groundwater Extraction	Public Works Department	(Groundwater) Tamil Nadu Groundwater Development and Management Act 2000	Contractor

59. **ADB SPS Requirements.** During the design, construction, and operation of the project, the PMU and PIU will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health, and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When the Government of India regulations differ from these levels and measures, the PMU and PIU will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 12: WHO Ambient Air Quality Guidelines

Parameters	Averaging Period	Guidelines Value in µg/m^3
Sulfur Dioxide (SO_2)	24-hour 10 minutes	125 (Interim Target-1) 50(Interim Target-2) 20(Guidelines) 500(Guidelines)
Nitrogen Dioxide (NO_2)	1-Year 1-hour	40 (Guidelines) 200 (Guidelines)
Particular Matter PM_{10}	1-Year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20(Guidelines)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50(Guidelines)
Particular Matter $PM_{2.5}$	1-Year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10(Guidelines)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (Guidelines)
Ozone	8-hour daily Maximum	160 (Interim Target-1) 100 (Guidelines)

Table 13: World Bank Group's EHS Noise Level Guidelines

Receptor	One Hour Leq (dBA)	
	Daytime 07.00-22.00	Night Time 22.00 – 07.00
Residential, Institutional educational	55	45
Industrial, Commercial	70	70

Table 14: Water Quality Standard as per WHO

Group	National Standards for Drinking Water			WHO Guidelines for Drinking-Water Quality, 4th Edition, 2011	Applicable Per ADB, SPS
	Parameter	Unit	Max. Concentration Limit		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	None	6.5 – 8.5
	Color	Hazen Units	5 (15)	None	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	None	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01

Group	National Standards for Drinking Water			WHO Guidelines for Drinking-Water Quality, 4th Edition, 2011	Applicable Per ADB, SPS
	Parameter	Unit	Max. Concentration Limit		
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Barium	mg/l	0.7	None	0.7
	Sulphate	mg/l	200 (400)	None	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Anionic Detergents	mg/l	0.2 (1.0)	None	0.2 (1.0)
	Phenolic Compounds	mg/l	0.001(0.002)	None	0.001(0.002)
	Residual Chlorine	mg/l	0.2	5	0.2
Microbial	E-coli	MPN/100ml	Must not be detectable in any100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
indicator	Total Coliform	MPN/100ml			

V. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

60. **Data collection and stakeholder consultations.** Data for this study has been collected through a comprehensive literature survey, field monitoring, discussion with stakeholder agencies, and field visits to the proposed subproject sites. The literature survey broadly covered the following:

(i) Project details, reports, maps, and other documents prepared by DPR consultants,
(ii) Discussions with ADB Consultants, GCC, DPR Consultants, and other relevant government agencies
(iii) Secondary data from previous project reports and published articles, and
(iv) The literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

61. Field monitoring survey and a secondary source of information broadly covered (i) Ambient air quality monitoring, (ii) Noise levels/ quality monitoring (iii) Silt sampling, (iv) Surface water sampling, (v) Groundwater sampling and (vi) Flora and Fauna assessment.

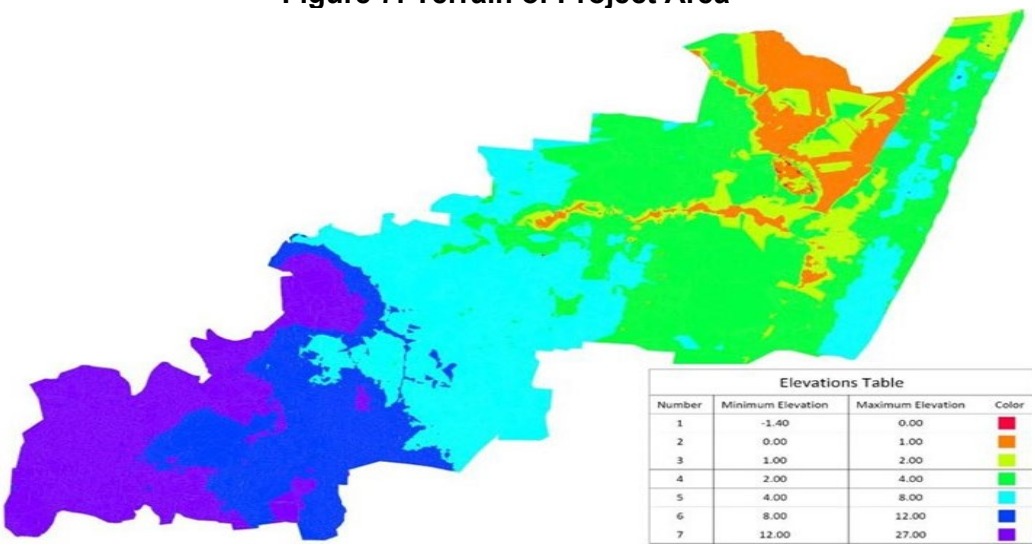
62. **Ocular inspection.** Several visits to the project sites and field monitoring surveys were made during the IEE preparation. The purpose of the inspection is to assess the existing environment (physical, biological, and socioeconomic) and gather information concerning the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine demographic information, existing service levels, stakeholder needs, and priorities.

B. Physical Environmental Component

1. Topography of the Project Area

63. The Kosasthalaiyar basin is situated in the northern part of GCC, from latitudes 13°05’40” to 13°12’50” and Longitudes from 80°08’20” to 80°19’20”. Located on the coromandel coast of Bay of Bengal, the project area is characterized by flat terrain and sloping gently from west to east direction, towards Bay of Bengal. The elevation ranges between 0.27 m below mean sea level (msl) to + 27 m above mean sea level. msl. Elevation map is shown in the Figure 7.

Figure 7: Terrain of Project Area

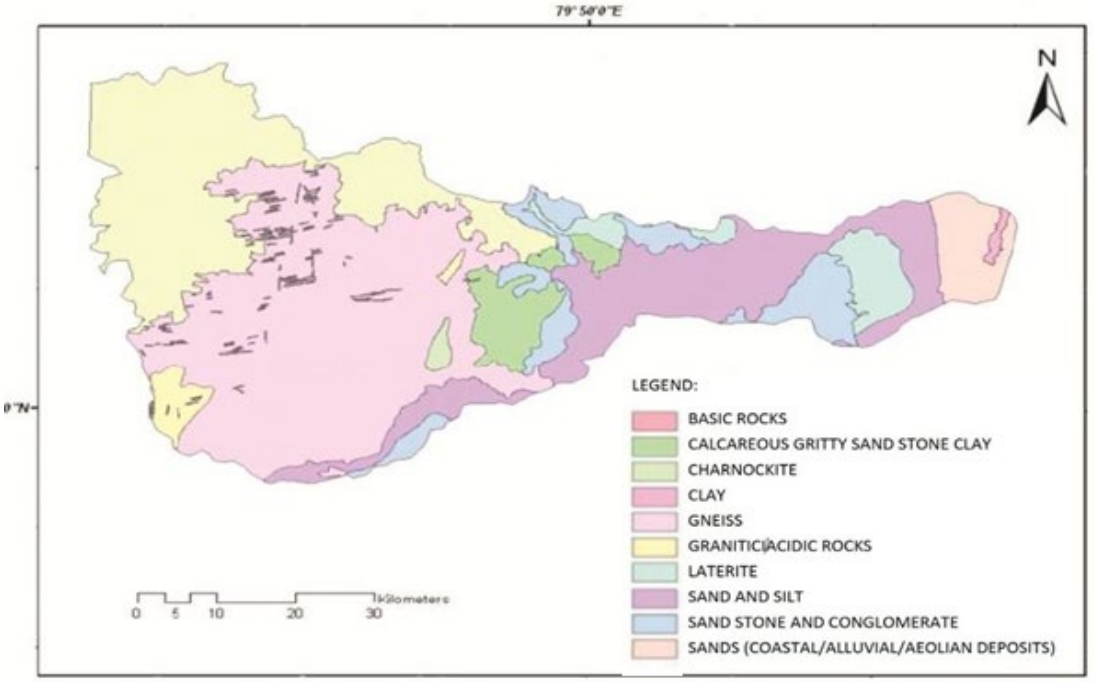


2. Geology and Soils

64. The Kosasthalaiyar River basin has varied geology. The western part is underlain by hard crystalline rocks (Precambrian) while the eastern part contains sedimentary rocks, alluvium, and Laterite. Numerous dolerite dyke is traversing in the western part of the study area. Laterite rocks are present in the northeastern portion, while calcareous gritty sandstone and clay are present in the central and eastern portion, Alluvium in the predominant formation along the river course.

65. Sand and clay are predominant within the project area. Standard penetration tests were conducted at proposed pumping station locations to determine the safe bearing capacity of the soil. Safe bearing capacity was determined as 10.36 T/m^2 at Kargil Nagar pumping station and 12.86 T/m^2 at Eranavur pumping station. Trial pits samples were collected at proposed storm water drain alignments to determine the soil properties such as Natural moisture content, Specific gravity etc. Specific gravity was found in the range of 2.35 to 2.66. Natural moisture content in the soil was found in the range of 17 to 40%.

Figure 8: Geology of the Kosasthalaiyar Basin



3. Hydrogeology

66. The project area is underlain by both porous and fissured formations. The important aquifer systems are constituted by i) unconsolidated & semi-consolidated formations and ii) weathered fissured and fractured crystalline rocks. The porous formations in the project area include sandstones and clays of Jurassic age (Upper Gondwana), marine sediments of Cretaceous age, Sandstones of Tertiary age and Recent alluvial formations. Groundwater occurs under phreatic to semi-confined conditions in the inter-granular pore spaces in sands and sandstones and the bedding planes and thin fractures in shales. Kosasthalaiyar riverbed is one of the major sources of water supply to urban areas of Chennai city and to the industrial units. The thickness of weathered zone is in the range of 2 to 12 m.

4. Climate

67. Chennai city has a tropical wet and dry climate. Chennai city lies on the thermal equator and is also coastal, which prevents extreme variation in seasonal temperature. For most of the year, the weather is hot and humid. The hottest part of the year is late May and early June with maximum temperatures around 38°C to 42°C. The coolest part of the year is January, with minimum temperatures around 18°C to 20°C.

5. Rainfall

68. The Chennai city gets most of its seasonal rainfall from the north-east monsoon, from mid-September to mid-December. Most of the precipitation occurs in the form of one or two cyclones caused due to depressions in Bay of Bengal. The southwest monsoon rainfall is highly erratic and summer rains are negligible. The average annual rainfall is 1200 mm. Annual, maximum daily rainfall and rainfall intensity from 1971-2016 is presented in Table 15. The maximum amount of

monthly rainfall (1104.2 mm) occurred in November 2015 and maximum amount of daily rainfall (320 mm) occurred on 2 December 2015.

Table 15: Rainfall Data

Year	Rainfall in mm/hour												Max One day Rainfall	Total Annual Rainfall
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec		
1971	23	**0**	56	18	13	30	74	49	44	**501**	307	109	230.5	1224.5
1972	36	**0**	**0**	**0**	82	53	92	52	121	**445**	175	410	138	1465.4
1973	**0**	**0**	**0**	**0**	2	18	29	219	71	205	155	**272**	92.8	971.8
1974	22	**0**	**0**	**0**	35	137	106	140	148	106	**230**	2	79.2	926.2
1975	**0**	**0**	**0**	**0**	**0**	53	163	332	200	337	**539**	0	160	1623.4
1976	**0**	**0**	**0**	**0**	**0**	114	168	246	51	424	**841**	33	359	1877
1977	3	**0**	**0**	**0**	7	107	6	170	143	525	**615**	13	134.3	1588.3
1978	1	6	**0**	**0**	**0**	38	177	81	239	108	302	**725**	189.3	1676.7
1979	6	**0**	12	**0**	112	4	77	64	167	182	**621**	126	112.2	1371.1
1980	**0**	**0**	**0**	**0**	**0**	24	172	169	39	127	**609**	196	216.6	1336
1981	33	**0**	**0**	**0**	40	54	153	87	192	**295**	103	144	92.3	1101.7
1982	7	0	**0**	7	2	111	85	148	121	176	**252**	13	144.5	922
1983	**0**	**0**	**0**	**0**	**0**	8	123	342	244	264	80	**410**	235.5	1470.8
1984	37	386	**0**	**0**	**0**	55	121	33	240	111	**567**	126	258.4	1676.4
1985	84	**0**	**0**	37	11	53	170	78	111	108	**625**	108	146.6	1385
1986	195	69	**0**	**0**	**0**	54	0	0	53	**275**	130	69	91	844.2
1987	12	**0**	38	16	**0**	54	21	119	49	0	0	**218**	64	527
1988	**0**	**0**	**0**	23	17	13	56	181	91	55	**419**	158	164	1013
1989	**0**	**0**	**0**	**0**	10	39	67	27	99	59	**382**	143	94	826
1990	5	11	9	**0**	265	70	98	73	143	**458**	330	66	147	1528.2
1991	17	**0**	**0**	**0**	**0**	276	80	76	137	402	**698**	2	228	1688
1992	**0**	**0**	**0**	**0**	**0**	**0**	72	85	129	75	**164**	161	92	695
1993	**0**	**0**	**0**	**0**	48	31	59	185	47	326	**344**	263	100	1303.4
1994	5	13	**0**	**0**	32	7	70	120	63	**503**	449	345	275	1607.2
1995	92	**0**	12	**0**	235	13	88	160	254	**311**	178	0	121	1343.4
1996	**0**	**0**	**0**	10	5	**688**	32	104	207	387	363	401	330	2196.6
1997	52	**0**	**0**	**0**	**0**	57	8	104	383	452	**1442**	471	277	2969
1998	**0**	**0**	**0**	**0**	10	13	69	75	53	220	**377**	148	130	964.5
1999	**0**	**0**	**0**	4	36	82	4	89	88	191	203	15	62	712
2000	10	**0**	**0**	69	12	24	88	53	66	**428**	351	261	135	1362
2001	10	**0**	**0**	69	48	24	88	35	70	**427**	104	0	135	874.5
2002	**0**	**0**	**0**	**0**	**0**	29	124	131	117	**279**	132	18	67	875
2003	**0**	**0**	4	3	**0**	14	104	101	117	**174**	69	71	78	655.9
2004	19	**0**	**0**	**0**	243	45	31	26	213	266	**323**	2	129	1168.4
2005	**0**	**0**	**0**	93	26	36	87	131	196	**756**	579	480	241	2383
2006	**0**	**0**	4	41	**0**	130	44	126	149	**555**	263	7	142	1319
2007	**0**	12	**0**	**0**	5	77	248	**337**	50	235	85	317	157	1366
2008	75	5	152	**0**	**0**	127	83	158	149	357	**553**	0	148	1659
2009	15	**0**	**0**	**0**	**0**	36	5	17	96	0	**523**	207	145	899.1
2010	**0**	**0**	**0**	**0**	251	110	244	**286**	84	161	211	240	143	1586.2
2011	**1**	67	0	54	4	77	72	249	214	229	**434**	108	90	1508.4
2012	16	**0**	**0**	**0**	**0**	39	83	64	150	**324**	86	154	95	915.7
2013	**0**	42	17	**0**	1	99	169	174	165	**235**	89	36	65	1025.8

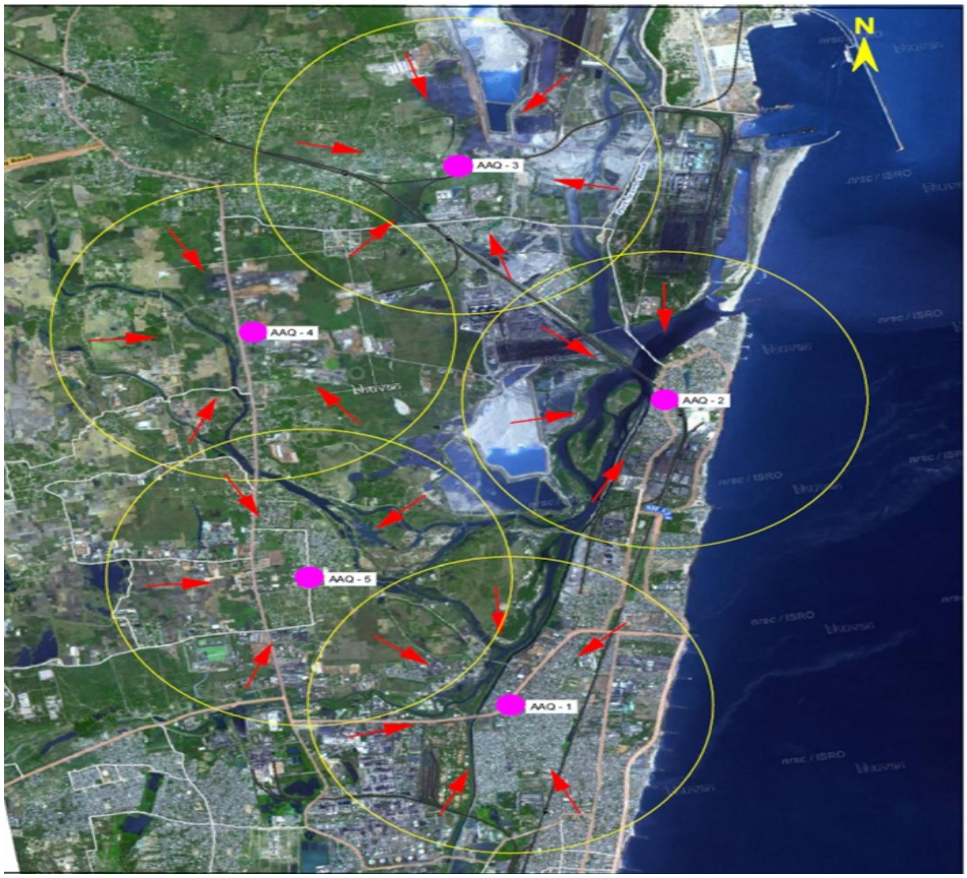
Year	Rainfall in mm/hour												Max One day Rainfall	Total Annual Rainfall
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec		
2014	**0**	4	**0**	**0**	16	74	81	111	80	**314**	206	165	91	1049.8
2015	4	**0**	**0**	36	14	47	178	202	74	161	**1104**	441	320	2261.6
2016	**0**	**0**	**0**	**0**	191	115	25	16	**256**	12	39	218	107	872.9

Source: IMD, Chennai Max Rainfall Min Rainfall

6. Air Quality

69. The objective of the baseline air quality study was to assess the existing air quality of the project area. This will also be useful for assessing the conformity to standards of the ambient air quality during the construction and operation of the proposed project. The majority of the study area represents residential, mixed residential, industrial, water bodies and commercial land use.

Figure 9: Location of Air Sampling Points



70. Based on the land-use pattern, 24 –hours Ambient Air Quality (AAQ) monitoring has been conducted at 5 locations and analyzed for the key parameters including SO_2, NO_2, PM_{10}, $PM_{2.5}$, O3, CO, and NH_3. AAQ Sampling locations are shown in Figure 9. The outcome of the analysis is presented in Table 16.

71. It was observed that the PM_{10} was in the range between 61 to 112 µg/m^3. The observed values exceed the 24 hours limit of 100 µg/m^3 in three locations namely AAQ-1, AAQ-2 and AAQ-

3. The high concentration of PM_{10} was due to the road dust generated due to the hectic vehicular traffic in Manali High Road and Tiruvotriyur-Ponneri Road. $PM_{2.5}$ was found to be within 60 µg/m^3 for 24 hours monitoring at all locations. Similarly, the SO_2 and NO_2 concentrations were observed to be within the limits of 80 µg/m^3.

Table 16: Air Sampling Locations

S. No	Location of Sampling points	Parameters covered	Date of Sampling
1	(AAQ-1) Manali high road - Kalaignarnagar, Tiruvoittyur	SO_2, NO_2, PM_{10}, $PM_{2.5}$, Ozone, CO, Ammonia, Lead	22nd and 23rd April, 2019 for 24 Hours monitoring
2	(AAQ-2) St. Joseph's Matriculation Higher Secondary School, Kathivakkam		
3	(AAQ-3) Near Zuari Cement Grinding Unit – Athipattu		
4	(AAQ-4) Near Ashok Leyland Technical Centre – Vallur		
5	(AAQ-5) Manali New Town		

Table 17: Air sampling Test Results (Apr 2019)

S.No.	Parameter	Unit	Averaging Period	NAAQ standard Values µg/m^3	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5
1	PM_{10}	µg/m^3	24 hours	100	112	103	107	61	73
2	$PM_{2.5}$	µg/m^3	24 hours	60	57	42	42	19	27
3	SO_2	µg/m^3	24 hours	80	14	11	17	9	11
4	NO_2	µg/m^3	24 hours	80	30	27	23	14	19

Source: Draft DPR for Eco-restoration of Ennore Creek prepared by Voyants Solutions Pvt Ltd. 2019.
BDL: Below Detection Limit, DL: Detection Limit

7. Noise Quality

72. The main objective of noise monitoring in the study area is to establish the baseline noise levels and to assess the impact of the total noise expected to be generated during the construction and operation of the project. Noise monitoring locations are shown in Figure 10. Ambient noise was measured at 5 locations for 24 hours duration on 10 June 2019 to determine the ambient noise quality around the project area. The results are shown in Table 18. From the inference, it is evident that the ambient noise level around the study area is well within the stipulated limit as per the Noise Pollution (Regulation and Control) Rules 2000 as well as World Bank Group's EHS Noise Level Guidelines.

Figure 10: Noise Monitoring Locations

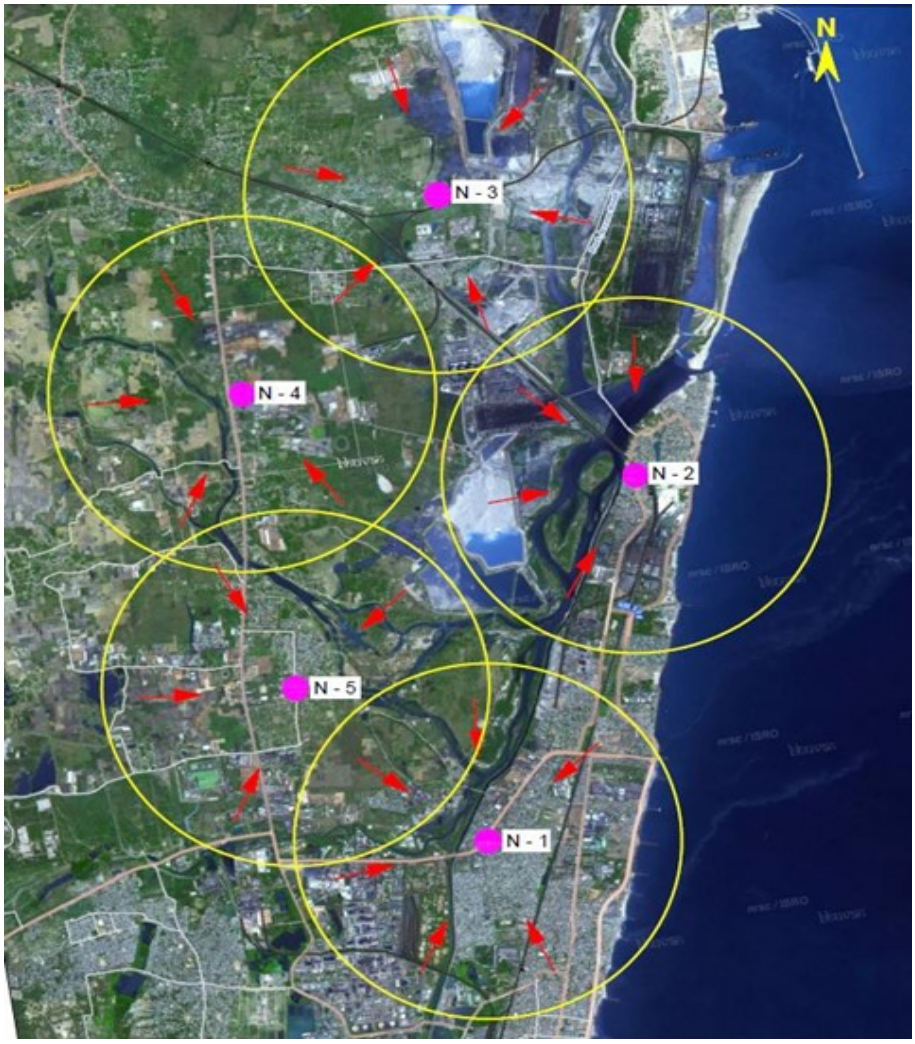


Table 18: Ambient Noise Monitoring (June 2019) – Inference

Sl No.	Location	Type of Area	Test Results (dB(A) Leq)		Permissible Limits (Leq dB(A)	
			Day time	Night Time	Day Time (07.00 -22.00)	Night Time (22.00 – 07.00)
1	Location 1 - Near Nivedha School, Tiruvottriyur	Silence Zone	46.2	39	50	40
2	Location 2 - Near St. Joseph's School, Kathivakkam	Silence Zone	47.6	39.2	50	40
3	Location 3 - Near Zuari Cement, Athipattu	Industrial Zone	64.3	56.4	75	70
4	Location 4 - Near Ponneri-Thiruvottriyur Road, Vallur	Commercial Area	58.5	54.1	65	55
5	Location 5 - Near Ayyakovil Street, Manali	Commercial Area	55.6	53.4	65	55

Source: Draft DPR for Eco-restoration of Ennore Creek prepared by Voyants Solutions Pvt Ltd.,2019

8. Sediment/Silt Analysis of Surplus Canals/ Drains

73. It is proposed desilt the surplus canals of accumulated bottom silt where required to maintain the hydraulic capacity. Sediment analysis was conducted to assess the characteristic and disposal measure of the excavated sediments. Sediment sampling locations are shown in Figure 11. The test results are given in Table 19. An estimated 100,000 m^3 of sediment/silt is likely to be generated from the proposed works. Samples were collected from various points (Figure 11) and analysed in the laboratory for various parameters.

Figure 11: Locations of Sediment Samples

74. Sediment samples are analysed for 13 parameters such as Colour, Texture, Phosphate (PO_4), Sodium (Na), Nitrate, Iron (Fe), Chromium (Cr), Manganese (Mn), Lead (Pb), Zinc (Zn), Copper (Cu), Nickel (Ni), Cobalt (Co). From the test results, it is observed that heavy metals such as Lead (Pb), Chromium (Cr) are found below the detectable limit. Test results indicate that there are no hazardous elements present beyond the prescribed limits as per Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules, 2008 - Central Pollution Control Board (CPCB). Test Results of Sediment Analysis in surplus canals and major lakes are enclosed in Appendix 9.

Table 19: Sediment Sampling Test Results (Jan 2018)

Sl.no	Sampling locations	Parameters										
		Colour	Texture	Phosphate (PO_4)	Sodium (Na)	Nitrate	Iron (Fe)	Manganese (Mn)	Zinc (Zn)	Copper (Cu)	Nickel (Ni)	Cobalt (Co)
		-	-	mg/Kg	mg/Kg	mg/Kg	%	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
1	Ambattur Surplus	Black & Brown	Clay	388	267	866	1.53	209.84	42.9	33.7	44.71	13.15
2	Korattur Surplus	Grey	Clay	311	498	382	2.09	205.09	25.5	14.46	31.34	17.99
3	Puzhal Surplus - 1	Brown	Clay	333	784	288	2.09	218.46	20.28	12.37	30.48	16.11
4	Puzhal Surplus - 2	Brown	Clay	850	747	248	2.08	124.47	47.94	15.97	35.62	14.42
5	Puzhal Surplus - 3	Pale Grey	Loam	51.6	1963	342	330.2	351.38	30.75	5.5	20.69	16.06
6	Ambattur Lake - 1	Dark Brown	Clay	173	239	118	1.62	314	53.4	42.94	26.8	7.37
7	Ambattur Lake - 2	Brown	Clay	164	381	162	1.47	267	39.7	49.32	32.1	10.4
8	Ambattur Lake - 3	Brown	Clay	66.5	185	84.6	1.32	295	30.72	41.9	35.7	6.35
9	Ambattur Lake - 4	Brown	Clay	81.8	829	174	1.39	239	37.6	44.5	31.8	10.5
10	Korattur Lake - 1	Brown	Clay	120	353	154	1.84	198	54.9	19.4	29.7	16.2
11	Korattur Lake - 2	Brown	Clay	74.9	266	98.4	1.92	254	42.9	16.4	22.47	19.1
12	Korattur Lake - 3	Brown	Clay	136	253	106	1.61	164	36.3	21.1	26.4	15.7
13	Korattur Lake - 4	Brown	Clay	23.3	676	148	1.47	161	61.2	19.7	33.9	11.7
14	Retteri Lake - 1	Brown	Clay	85.3	292	114	1.46	264	44.32	37.8	42.4	12.9
15	Retteri Lake - 2	Brown	Clay	124	502	146	1.27	324	52.6	31.6	42.4	9.46
16	Retteri Lake - 3	Brown	Clay	143	184	92.4	1.36	298	45.32	25.8	39.1	10.9
17	Retteri Lake - 4	Brown	Clay	814	272	124	1.47	198	51.2	32.4	32.5	8.51

Sl.no	Sampling locations	Parameters										
		Colour	Texture	Phosphate (PO_4)	Sodium (Na)	Nitrate	Iron (Fe)	Manganese (Mn)	Zinc (Zn)	Copper (Cu)	Nickel (Ni)	Cobalt (Co)
		-	-	mg/Kg	mg/Kg	mg/Kg	%	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 (Schedule II (See rule 3(I))	-	-	-	-	20000 (class C)	-	5000 (class B)	20000 (class C)	5000 (class B)	5000 (class B)	5000 (class B)

9. Ground Water Quality

75. The purpose of this study is to assess the groundwater quality characteristics in the project area. The groundwater samples were collected at 5 locations covering the study area. The following table illustrates the justification behind choosing the sampling locations.

Table 20: Ground Water Sampling Locations

Sl No.	Location	Justification for Sampling Locations
1	Ambattur (Hand Pump)	Due to Sullage / Sewage / effluent discharge from the cluster of industries
2	Pattaravakkam	Due to Sullage / Sewage / effluent discharge from the cluster of industries
3	Retteri	Due to the densely populated residential area and to assess contamination if any
4	Manali	Due to fly ash and industrial effluent discharge from Thermal Power Plants and Fertilizer Industries
5	Buckingham Canal near Ennore	Due to fly ash and industrial effluent discharge from Thermal Power Plants and Fertilizer Industries

Figure 12: Locations of Ground Water Samples

76. Summary of Groundwater analysis is presented in Table 21. The test results are compared with the drinking water standard (IS 10500) for the parameters viz pH, Total dissolved solids, Sulphate (SO_4), Chloride (Cl^-), Iron (Fe) and Lead (Pb). Groundwater sample collected from Ambattur Hand Pump indicates a high concentration of TDS (1,064mg/l) and Chloride (255 mg/l). Both the parameters exceed the stipulated limits of 500 mg/l and 250 mg/l respectively. In Pattaravakkam, the groundwater samples indicate high concentration of TDS (1812mg/l), Chloride (570 mg//l) and Sulphate (387mg/l) Groundwater sample collected from Retteri shows, high concentration of TDS (1,318mg/l), Chloride (350mg/l) and Sulphate (230 mg/l). Groundwater quality at Manali indicate high concentration of TDS (2,648 mg/l), Chloride (716 mg/l) and Sulphate (207 mg/l). Groundwater sample collected at Ennore shows a high concentration of TDS (1,098 mg/l). Based on the analysis outcome, it is evident that the groundwater should be treated before consumption.

Table 21: Ground Water Samples – Test Results (Jan 2018)

S.No.	Parameters	Units	Ground Water Sample Location					
			Ambattur (Hand pump)	Pattaravakkam	Retteri	Manali	Ennore	Acceptable Limit IS 10500:2012
1	pH @ 25°C	-	6.8	7.7	7.3	6.7	7.2	6.5-8.5
2	Total Dissolved Solids	mg/l	1064	1812	1318	2648	1098	500
3	Iron as Fe	mg/l	0.05	0.08	0.06	0.09	0.05	0.3
4	Chloride as Cl^-	mg/l	255	570	350	716	250	250
5	Fluoride as F	mg/l	0.2	0.21	0.24	0.21	0.23	1
6	Nitrate as NO_3	mg/l	32.4	0.24	17.7	194	76.8	45
7	Sulphate as SO_4	mg/l	104	387	230	207	129	200

10. Surface Water Quality

77. The purpose of this study is to assess the surface water quality characteristics in the project area. Out of eight major lakes in the project area, four lakes (Ambattur, Korattur, Retteri, and Puzhal) are located on upstream of the Kosasthalaiyar Basin. The Kosasthalaiyar River in the project area is a seasonal river, at the time of sampling it was completely dry and hence water samples has not been collected.

(i) **Ambattur Lake** is a rain-fed reservoir, which reaches maximum levels during the monsoon seasons. The catchment area of the lake is 2.06 km^2. In November 2008, the lake experienced high water level, causing flood and damages to the encroached settlements, which was then removed by the GCC. It also caters to the drinking water needs of the Chennai city after Poondi and Chembarambakkam Lake. Ambattur Lake is one of a chain of three water bodies, including the Korattur Lake and the Retteri / Madhavaram Lake, where surplus water from one lake is transported to another.

(ii) **Korattur Lake**, (also known as Vembu Pasumai Thittu), spread over 400 ha (4 km^2) and It is located to the north of the Chennai–Arakkonam railway line. The catchment area is 8.32 km^2. It is one of the largest lakes in the western part of the Chennai city. The water from the lake had been supplied to Chennai residents for a brief period when there was a shortage in the late 1970s. However, over the years, the lake has been contaminated with sewage and industrial effluents from surrounding areas such as Pattaravakkam, Athipet and Ambattur Industrial estate.

(iii) **Retteri Lake** is located at Kolathur area in Chennai. The lake has surface area of 700 acres (280 ha). It has a catchment area of 17.07 km^2. This lake was neglected for several decades; it gets inflows from Red Hills reservoir and Korattur Lake. The Water Resources Department (WRD) has decided to improve Rettai Eri along with water bodies in Ambattur and Korattur area.

(iv) **Puzhal Lake**, also known as the **Red Hills Lake**, is located in Red Hills, Chennai. It lies in Thiruvallur district of Tamil Nadu state. It is one of the rain-fed reservoirs from where water is drawn for supply to Chennai City. The reservoir was originally a small tank with a capacity of 500 million cubic feet (mcft) and two masonry weirs, built using locally available laterite stones, then functioned as surplus weirs to release excess water from the water body. In 1997, the storage capacity of the water reservoir was increased to 3,300 mcft and the depth to 21.20 ft to cater to the drinking water needs of Chennai and to store Krishna River water received from Andhra Pradesh through Poondi Reservoir and the Sholavaram Tank.

78. Surface water samples has been collected from the water bodies as listed in the Table 22 and analyzed for its physic chemical characteristics. The results from the analysis are furnished in Table 23. The results were compared with the Schedule VI - General Standards for Discharge of Environmental Pollutants - Part A by CPCB.

79. From the test results, it was observed that the surface water collected from Ambattur, Korattur and Retteri lakes comply with IS 2296 – Class C – Drinking water with conventional treatment followed by disinfection. The water sample collected from Thanikachalam drain has high content of BOD, Iron (Fe), Sulphide (S). Water sample from Puzhal Surplus has high content of BOD, Iron (Fe), Sulphide, Manganese (Mn). Water sample collected from Harikrishnapuram pond has high content of Total dissolved solids, Iron (Fe), Chloride (Cl), BOD, Sulphide (S), Manganese (Mn). Water sample from Kosasthalaiyar Water Shed has High content of TDS, Iron (Fe), Chloride (Cl), and Manganese (Mn). Water sample from Buckingham Canal near Ennore has very high content of TDS, Iron (Fe), Chloride (Cl), Sulphate (SO_4).

80. **Inference:** Ambattur, Korattur and Retteri surface water can be used for drinking water purposes with proper treatment as the test results are within prescribed limits. In Thanikachalam drain, due to sullage discharge, the BOD concentration was observed to be high. Similarly, due to industrial effluent discharge from thermal power plants and fertilizer industries located closed to Ennore, high content of TDS, Iron (Fe), Chloride (Cl), Manganese (Mn) are observed in Kosasthalaiyar Water Shed and Buckingham Canal. Test Results of Surface Water Quality is enclosed in Appendix 9.

Table 22: Surface Water Sampling Locations

Sl No.	Location	Reference
1	Ambattur Lake	AMB-SURF-001 to AMB-SURF-004
2	Korattur Lake	KOR-SURF-001 to KOR-SURF-004
3	Retteri Lake	RET-SURF-001 to RET-SURF-004
4	Thanikachalam Drain	RET-SURF-001
5	Puzhal Surplus – 1	PUZL-SURF-001
6	Puzhal Surplus – 2	PUZL-SURF-002
7	Kosasthalaiyar watershed	KOS-SURF-001
8	Buckingham Canal near Ennore	ENN-SURF-001
9	Surapet Lake	SURA-SURF-001
10	Harikrishnapuram Pond	HAR-SURF-001

Figure 13: Surface water Quality Locations in Google maps

Table 23: Surface Water Test Results (Jan 2018)

Sl.no	Location	pH @ 25°C	Iron	Chloride	Fluoride	Nitrate	Sulphate	3 days BOD @ 27°C	Oil & Grease
		-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	Surapet Lake	7.8	0.19	175	0.26	2.3	46.9	<2	<2
2	Thanikachalam Drain	6.9	5.6	380	0.21	0.56	91.4	80	<2
3	Puzhal Surplus 1	6.9	2.4	250	0.23	1.9	103	40	<2
4	Puzhal Surplus 2	7.3	1.6	425	0.26	24.1	63.3	6	<2
5	Harikrishnapuram Pond	7.1	14.7	1000	0.28	2.8	43.3	120	<2
6	Kosasthalaiyar Watershed	7.7	0.11	1600	0.2	0.81	339	<2	<2
7	Buckingham Canal near Ennore Creek	6.8	1.8	15828	0.22	7.5	2165	8	<2
8	Ambattur Lake 1	7.5	0.48	181	0.26	BDL	92.9	<2	<2
9	Ambattur Lake 2	7.5	0.42	177	0.26		97.4	<2	<2
10	Ambattur Lake 3	7.5	0.38	175	0.27	0.4	91.5	<2	<2
11	Ambattur Lake 4	7.4	0.49	184	0.24	2.7	93.9	<2	<2
12	Korattur Lake 1	7.4	0.54	249	0.31	0.16	109	<2	<2
13	Korattur Lake 2	7.4	0.51	237	0.26	BDL	101	6	<2
14	Korattur Lake 3	7.5	0.49	239	0.24	BDL	102	<2	<2
15	Korattur Lake 4	7.5	0.47	239	0.26	0.56	98.8	7	<2

Sl.no	Location	pH @ 25°C	Iron	Chloride	Fluoride	Nitrate	Sulphate	3 days BOD @ 27°C	Oil & Grease
		-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
16	Retteri Lake 1	7.5	0.5	223	0.24	3.1	99.5	<2	<2
17	Retteri Lake 2	7.6	0.39	181	0.21	BDL	90.4	<2	<2
18	Retteri Lake 3	7.6	0.36	200	0.24	BDL	91.8	<2	<2
19	Retteri Lake 4	7.4	0.62	124	0.26	0.11	104	7	<2

*Acceptable Limit as per IS 2296:1962 – Class C (Surface Water as drinking water source)

Table 24: Water Quality Standards in India (source IS 2296:1992)

Characteristics	Designated best use#				
	Class A	Class B	Class C	Class D	Class E
Dissolved Oxygen (DO)mg/l, min	6	5	4	4	-
Biochemical Oxygen demand (BOD) mg/l, max	2	3	3	-	-
Total coliform organisms MPN/100ml, max	50	500	5,000	-	-
pH value	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.0-8.5
Colour, Hazen units, max.	10	300	300	-	-
Odour	Un-objectionable			-	-
Taste	Tasteless	-	-	-	-
Total dissolved solids, mg/l, max.	500	-	1,500	-	2,100
Total hardness (as $CaCO_3$), mg/l, max.	200	-	-	-	-
Calcium hardness (as $CaCO_3$), mg/l, max.	200	-	-	-	-
Magnesium hardness (as $CaCO_3$), mg/l, max.	200	-	-	-	-
Copper (as Cu), mg/l, max.	1.5	-	1.5	-	-
Iron (as Fe), mg/l, max.	0.3	-	0.5	-	-
Manganese (as Mn), mg/l, max.	0.5	-	-	-	-
Chlorides (as Cu), mg/l, max.	250	-	600	-	600
Sulphates (as SO_4), mg/l, max.	400	-	400	-	1,000
Nitrates (as NO_3), mg/l, max.	20	-	50	-	-
Fluorides (as F), mg/l, max.	1.5	1.5	1.5	-	-
Phenolic compounds (as C_2H_5OH), mg/l, max.	0.002	0.005	0.005	-	-
Mercury (as Hg), mg/l, max.	0.001	-	-	-	-
Cadmium (as Cd), mg/l, max.	0.01	-	0.01	-	-
Selenium (as Se), mg/l, max.	0.01	-	0.05	-	-
Arsenic (as As), mg/l, max.	0.05	0.2	0.2	-	-
Cyanide (as Pb), mg/l, max.	0.05	0.05	0.05	-	-
Lead (as Pb), mg/l, max.	0.1	-	0.1	-	-
Zinc (as Zn), mg/l, max.	15	-	15	-	-
Chromium (as Cr^{6+}), mg/l, max.	0.05	-	0.05	-	-
Anionic detergents (as MBAS), mg/l, max.	0.2	1	1	-	-
Barium (as Ba), mg/l, max.	1	-	-	-	-
Free Ammonia (as N), mg/l, max	-	-	-	1.2	-
Electrical conductivity, micromhos/cm, max	-	-	-	-	2,250

Characteristics	Designated best use#				
	Class A	Class B	Class C	Class D	Class E
Sodium absorption ratio, max	-	-	-	-	26
Boron, mg/l, max	-	-	-	-	2

Source: CPCB
 # Designated best use classification:
Class A: Drinking water source without conventional treatment but after disinfection
Class B: Outdoor bathing (organized)
Class C: Drinking water source after conventional treatment and disinfection
Class D: Propagation of wildlife and Fisheries
Class E: Irrigation, industrial cooling, controlled waste disposal

C. Biological Environment

81. To profile biological environmental of the project area, a walk-through survey was carried out in the project area, including of all the major water bodies, such as lakes, and the coastal zone. These walkthrough surveys were conducted in September (1st and last week) and October 2020 1st and 3rd week). The location of the major lakes in the project area is given in the Figure 14. The project area includes habitats such as the terrestrial ecosystem, the freshwater ecosystem, the urban terrain ecosystem and the fragmented scrub jungle ecosystem. The type of ecosystem, both the flora and fauna in the project area were estimated on the basis of visual observation, photo and video evidence. Secondary literature / published documents / reports available on all these habitats were reviewed. The findings of the floral the survey is given in the Table 25. Floral species recorded in the project area includes Macrophytes, Herbs/weeds/climbers, Shrubs and Trees.

82. **Flora.** Of the seven lakes surveyed, three lakes fall under the peri-urban limit (neither rural nor urban), the Ariyalur Lake, Kadapakkam Lake and the Sadayankuppam Lake. Four lakes, the Ambattur Lake, Korattur Lake, Retteri Lake, Madhavaram Periyathoppu fall under the urban limit, along all the four lakes the land use is dominated by residential and industrial. The water is clear and the macrophytes species diversity was more in Ariyalur Lake, Kadapakkam Lake and the Sadayankuppam Lake. Of the 73 floral species identified, 10 species are macrophytes, 35 species of herbs and climbers, 10 species of shrubs and 18 species of trees. Comparative Assessment of Floral species between the Lakes is presented in:

83. Table 26. The Ariyalur Lake and Kadapakkam Lake had the maximum species diversity (Table 27) and the Sadayankuppam Lake, though small in size had good vegetation cover, this lake is within 100 mts from the Kosasthalaiyar river and the tidal influence is observed within 80 mts from the lake. The presence of species like *Nelumbo nucifera, Nymphaea pubescens* and *Nymphaea nouchali* in all the three lakes indicate the water quality in good and can be used for drinking with minor treatment. It is also observed that none of the identified floral species are categorized as endangered species.

84. **Fauna.** Faunal species recorded include butterflies, fishes, amphibians, reptiles, birds and mammals. Detailed list of Fauna in the project area is attached in **Appendix 9.** The Ariyalur Lake, Kadapakkam Lake and Korattur Lake had good numbers of macro fauna compared to the other lakes, all the three lakes represented more than 54 species of birds of the 61 species recorded all together, which shows the availability of habitat and the food for these species. The enhancement of these lakes will still attract more flora and fauna to these regions. The conservation status of all the identified faunal species is listed in the:

85. **Table 28**, 3 species of butterflies and 7 species of snakes listed as Near Threatened and all the other species are not categorized under endangered species. The presence of the various faunal species indicates a healthy eco system in the project areas.

Figure 14: Major Lakes in Project Area

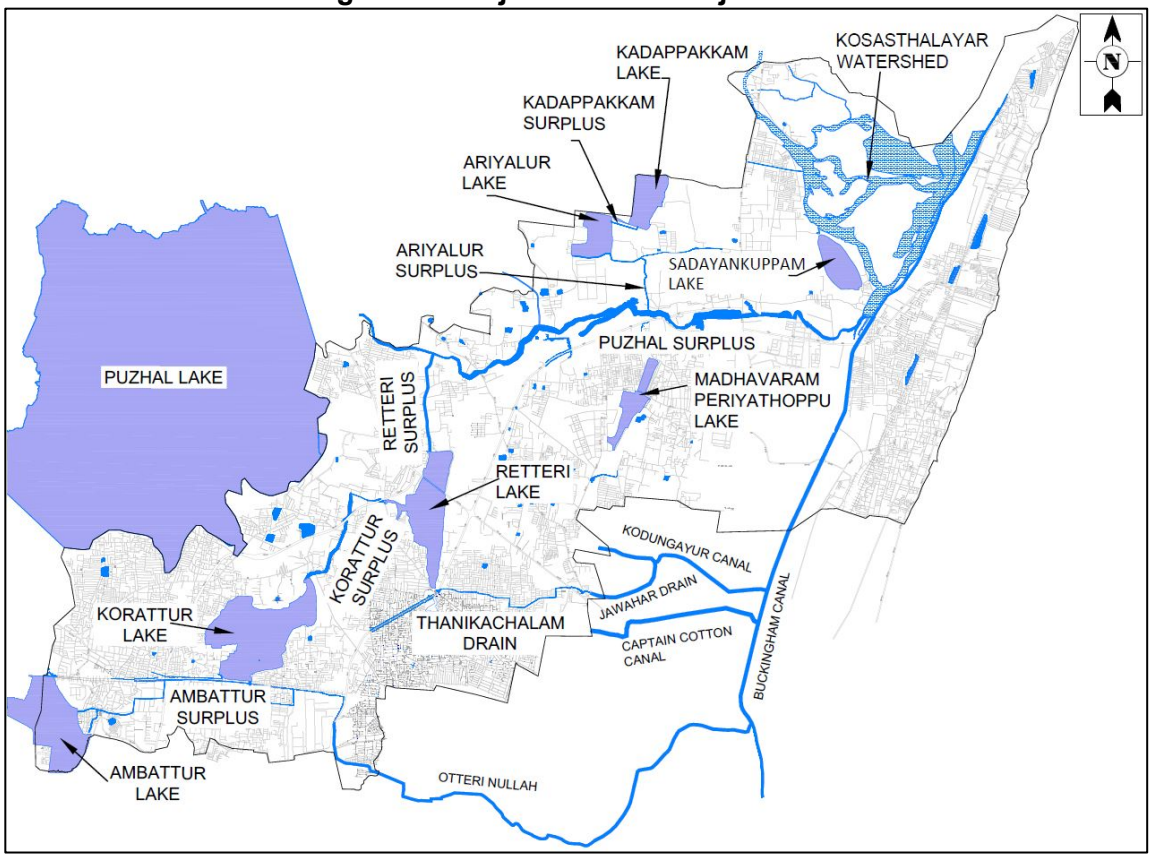


Table 25: List of Floral Species in the Project area and their conservation status

S. N	Botanical Name	Habit	Common Name	Local Name	IUCN / Wildlife Protection Act 1972 - Status
1	*Abutilon indicum*	H	Indian Mallow	Paniyaratutti	LC
2	*Abrus precatorius*	C	Rosary Pea	Kundumani	LC
3	*Acalypha Indica*	H	Indian Acalypha	Kuppaimeni	LC
4	*Achyranthes aspera*	H/W	Prickly Chaff Flower	Nayuruvi	LC
5	*Alternanthera philoxeroides*	M	Alligator Weed	Ponnaganni	LC
6	*Albizia saman*	T	Rain Tree	Amaivagai	LC
7	*Aponogeton natans*	M	Floating Lace Plant	Kotti kizhangu	LC
8	*Azadirachta indica*	T	Neem	Vepamaram	LC
9	*Borassus flabellifer*	T	Toddy Palm	Panai maram	LC
10	*Brachiaria distachya*	H/W	Water Grass	Erumaipul	LC

S. N	Botanical Name	Habit	Common Name	Local Name	IUCN / Wildlife Protection Act 1972 - Status
11	*Cassia auriculata*	S	Mature Tea Tree	Avaram	LC
12	*Cassia occidentalis*	H	Senna	Payaverai	LC
13	*Cassia hirsuta*	H/W	Thagara Chedi	Thagara chedi	LC
14	*Calotropis gigantean*	S	Giant Milkweed	Erukkuchedi	LC
15	*Catharanthus roseus*	H	Rosy Periwinkle	Nithyakalyani	LC
16	*Chloris barbata*	H/W	Purple Finger Grass	Sevaragupul	LC
17	*Clitorea arborea*	C	Butterfly Pea	Sangu pushpam	NE
18	*Coccinia grandis*	C	Ivy Gourd	Kovaikai	LC
19	*Cynodon dactylon*	H	Aragampullu	Aragampullu	NE
20	*Cocos nucifera*	T	Coconut Palm	Tennimaram	LC
21	*Croton bonplandianum*	H	Ban Tulasi	Reilpoondu	LC
22	*Datura innoxia*	H/W	Trumpet Flower	Umathai	LC
23	*Delonix regia*	T	Flamboyant	Mayil kondrai	LC
24	*Dactyloctenium aegyptium*	H/W	Egyptiantoe grass	Mathangaipul	NE
25	*Eclipta prostrata*	H	False Daisy	Karasilangani	LC
26	*Eichornia crassipes*	AH	Water Hyacinth	Water hyacinth	LC
27	*Eichornia crassipes*	M	Water Hyacinth	Akasa tamarai	NE
28	*Euphorbia corrigioloides*	H	Centipede Plant	Pooran chedi	LC
29	*Ficus benghalensis*	T	Indian Banyan	Alamaram	LC
30	*Ficus racemosa*	T	Indian Fig Tree	Atathi	LC
31	*Ficus religiosa*	T	Bodhi Tree	Arasa Maram	LC
32	*Gloriosa superba*	H	Glory Lily	Chenkanta	LC
33	*Hibiscus rosa-sinensis*	S	Chembaruthi	" "	LC
34	*Hygrophila auriculata*	H	Marsh Barbel	Nirmulli	LC
35	*Ipomoea aquatica*	M	Water Morning Glory	Sarkaraivalli	LC
36	*Ipomoea carnea*	S/W	Morning Glori	Neyveli kaatamanakku	LC
37	*Jasminum angustifolium*	H	Wild Jasmine	Kaadumalli	LC
38	*Jatropha curcas*	S	Physic Nut	Kattamanakku	LC
39	*Jatropha gossypifolia*	S	Belly Ache Bush	Siria Amanakku	LC
40	*Lantana camara*	S/W	Wild Sage	Unni chedi	LC
41	*Lennea coromandelica*	T	Indian Ash Tree	Odyamaram	LC
42	*Malachra capitata*	H	Brazil Jute	Kattu vendai	LC
43	*Mangifera indica*	T	Mango Tree	Maamaram	LC
44	*Mimosa pudica*	H	Touch Me Not	Thottaisurungi	LC
45	*Morinda pubescens*	T	Morinda Tree	Mannanunai	LC
46	*Nelumbo nucifera*	M	Indian Lotus	Thamarai	LC
47	*Nymphaea pubescens*	M	Pink Water-Lily	Alli	LC
48	*Nymphaea nouchali*	M	Blue Water-Lily	Alli	LC
49	*Operculina turpethum*	H	Morning Glory	Paganrai	LC
50	*Oxystelma secamone*	H	Needle Milkweed	Oosipaalai	LC
51	*Passiflora foetida*	C	Passion Flower	Siruppunaikkali	LC
52	*Pedalium murex*	H/W	Sand Murex	Aanainerinji	LC
53	*Perotis indica*	H	Indian Comet Grass	Kudiraival pullu	LC
54	*Pongamia pinnata*	T	Indian Beech	Punga maram	LC
55	*Polygonum glabrum*	H	Knotweed	Attalaree	LC
56	*Polyalthia longifolia*	T	Asoka Maram	Nettilingam	LC

S. N	Botanical Name	Habit	Common Name	Local Name	IUCN / Wildlife Protection Act 1972 - Status
57	*Phyllanthus amarus*	H	Ground Gooseberry	Keelanelli	LC
58	*Phyla nodiflora*	H	Creeping Lip Plant	Potutalai	LC
59	*Phyllanthus reticulatus*	S	Black Gooseberry	Inki pazham	LC
60	*Pistia stratiotes*	M	Water Lettuce	Antarattamarai	LC
61	*Prosopis juliflora*	ST/W	Algaroba bean	Kattukaruvai	LC
62	*Psidium guajava*	T	Common Guava	Koyya	LC
63	*Ricinus communis*	S	Castor oil Plant	Amanakku	LC
64	*Salvadora persica*	T	Toothbrush Tree	Peru-vila	LC
65	*Spirodela polyrhiza*	M	Duck Weed	Paasi	LC
66	*Tamarindus indica*	T	Tamarind	Puli Maram	LC
67	*Thespesia populnea*	T	Indian Tulip Tree	Poovarasu	LC
68	*Turnera ulmifolia*	H	Yellow Alder	Cheravathali	LC
69	*Typha angustata*	A/W	Indian Reed Mace	Sambu	LC
70	*Tridax procumbens*	H	Tridax Daisy	Vettukkaaya-thalai	LC
71	*Vitex negundo*	S	Chaste Tree	Nochi	LC
72	*Wolffia globosa*	M	Duck Weed	Paasi	LC
73	*Ziziyphus oenoplia*	S	Jackal jujube	Surai Ilantai	LC

T – Tree ST-Small Tree S – Shrub H – Herb C-Climber W-Weed A-Aquatic; LC – least concern, NE = not evaluated

Table 26: Summary on comparative Assessment of Floral species between the Lakes

Flora	Floral Assessment of Lakes						
	Ambattur	Korattur	Retteri	Madhavaram	Ariyallur	Kadapakkam	Sadayankuppam
Macrophytes	5	8	5	4	9	9	6
Herbs/ weeds /climbers	23	29	21	28	31	33	29
Shrubs	8	9	8	8	9	10	8
Trees	11	15	13	13	16	14	13

Table 27: Summary on comparative Assessment of Macro-fauna between the Lakes

Macro Fauna	Macro Fauna Assessment of Lakes						
	Ambattur	Korattur	Retteri	Madhavaram	Ariyallur	Kadapakkam	Sadayankuppam
Butterflies	23	26	18	19	27	25	18
Dragonflies	9	11	8	7	11	12	9
Damselflies	4	5	3	2	5	5	4
Amphibians	7	7	6	5	6	6	5
Fishes	10	13	9	9	14	16	12
Reptiles	14	22	16	19	21	20	16
Birds	42	54	36	41	59	60	58
Mammals	6	6	5	5	6	6	5

Table 28: List of Faunal Species in the Project area and their Conservation Status

S. N	Scientific Name	Common Name	IUCN / Wildlife Protection Act 1972 -Status
	Butterflies		

S. N	Scientific Name	Common Name	IUCN / Wildlife Protection Act 1972 -Status
1	*Acraea terpsicore*	Tawny Coster	LC
2	*Ariadne merione*	Common Castor	LC
3	*Euploea core*	Common Crow	LC
4	*Everes lacturnus*	Indian Cupid	LC
5	*Euchrysops cnejus*	Gram Blue	LC
6	*Eurema hecabe*	Common Grass Yellow	NE
7	*Euploea core*	Common Indian Crow	LC
8	*Catochrysops strabo*	Forget-Me-Not	LC
9	*Catopsilia Pomona*	Common Emigrant	NE
10	*Castalius rosimon*	Common Pierrot	NE, Schedule I - Part IV
11	*Danaus genutia*	Striped Tiger	LC
12	*Danaus chrysippus chrysippus*	Plain Tiger	LC
13	*Hypolimnas misippus*	Danaid Eggfly	LC
14	*Hypolimnas bolina*	Great Eggfly	LC
15	*Hypolimnas misippus*	Danaid Eggfly	LC
16	*Jamides celeno celeno*	*Common Cerulean*	LC
17	*Junonia almana*	Peacock Pansy	LC
18	*Junonia hierta*	Yellow Pansy	LC
19	*Junonia lemonias*	Lemon Pansy	LC
20	*Junonia orithya*	Blue Pansy	LC
18	*Lampides boeticus*	Pea Blue	LC
19	*Melanitis leda leda*	*Common Evening Brown*	LC
20	*Papilio polytes polytes*	*Common Mormon*	LC
21	*Pachliopta aristolochiae*	Common Rose	LC
22	*Papilio demoleus demoleus*	*Lime Butterfly*	LC
23	*Phalanta phalantha*	Common Leopard	LC
24	*Spindasis vulcanus*	Common Silverline	LC
25	*Tirumala Septentrionis*	Dark Blue Tiger	LC
26	*Ypthima baldus*	Common Five-ring	LC
27	*Zizula hylax*	Tiny Grass Blue	LC
	Dragonfly and Damselflies		
1	*Acisoma panorpoides*	Trumpet Tail	LC
2	*Brachythemis contaminata*	Ditch Jewel	LC
3	*Crocothemis servilia*	Red Marsh Skimmer	LC
4	*Diplacodes trivialis*	Ground Skimmer	LC
5	*Diplacodes Nebulosa*	Black Tipped Ground Skimmer	LC
6	*Ictinogomphus Rapax*	Common Clubtail	LC
7	*Orthetrum cancellatum*	Black Tailed Skimmer	LC
8	*Pantala Flavescens*	Wandering Glider	LC
9	*Rhyothemis variegata*	Common Picture Wing	LC
10	*Tramea limbata*	Black Marsh Trotter	LC
11	*Trithemis aurora*	Crimson Marsh Glider	LC

S. N	Scientific Name	Common Name	IUCN / Wildlife Protection Act 1972 -Status
12	*Trithemis pallidinervis*	Long-Legged Marsh Glider	LC
13	*Coenagrion puella*	Azure Damselfly	LC
14	*Copera Marginipes*	Yellow Bush Dart	LC
15	*Copera Vittata*	Blue Bush Dart	LC
16	*Enallagma annexum*	The Northern Blue	LC
17	*Lestes sponsa*	Emerald Damselfly	LC
	Fishes		
1	*Channa punctatus*	Spotted Snakehead	LC
2	*Esomus danricus*	Flying Barb	LC
3	*Etroplus maculates*	Orange Chromide	LC
4	*Etroplus suratensis*	Green Chromide	LC
5	*Gambusia affinis*	Mosquitofish	LC
6	*Glossogobius giuris*	Tank Goby	LC
7	*Heteropneustes fossilis*	Stinging Catfish	LC
8	*Macrognathus pancalus*	**Indian** Spiny Eel	LC
9	*Mystus keletius*	Kelethi	LC
10	*Notopterus notopterus*	Bronze Fetherback	LC
11	*Oreochromis mossambica*	Tilapia	LC
12	Pethia conchonius	Rosy Barb	LC
13	*Puntius chola*	Swamp Barb Or Chola Barb	LC
14	*Puntius filamentosus*	Black-Spot Barb	LC
15	*Puntius vittatus*	Greenstripe Barb	LC
16	*Pseudosphromenus cupanus*	Spiketail Paradisefish	LC
17	*Trichopodus trichopterus*	Three Spot Gourami	LC
	Amphibians		
1	*Bufo melanosticus*	Common Indian Toad	LC
2	*Erphlyctis hexadactylus*	Indian Pond Frog	LC
3	*Enallagma annexum*	The Northern Bluet	LC
4	*Euphlyctis hexadactylus*	Indian Pond Frog	LC
5	*Euphlyctis cyanophlyctis*	Skipper Frog	LC
6	*Polypedates maculates*	Common Tree Frog	LC
7	*Rana tigrina*	Common Frog	LC
	Reptiles		
1	*Lissemys punctata*	Flapshell Turtle	LC
2	*Hemidactylus frenatus*	House Gecko	LC
3	*Hemidactylus brook*	Brook's Gecko	LC
4	*Hemidactylus leschenault*	Bark Gecko	LC
5	*Mabuya carinata*	Keeled Grass Skink	LC
6	*Mabuya macularia*	Little Skink	
7	*Riopa punctata*	Spotted Supple Skink	LC
8	*Catotes versicolor*	Common Garden Lizard	LC
9	*Sitana ponticeriana*	Fan Throated Lizard	LC

S. N	Scientific Name	Common Name	IUCN / Wildlife Protection Act 1972 -Status
	Snakes		
1	*Ahaetulla nasuta*	Common Vine Snake	NE, Schedule IV
2	*Amphiesma stolatum*	Buff Striped Keelback	LC
3	*Atretium schistosum*	Split Keelback	LC
4	*Bungarus caeruleus*	Common Krait	NE, Schedule II
5	*Calliophis melanurus*	Slender Coral Snake	LC
6	*Dendrelaphis tristis*	Bronzeback Tree Snake	NE, Schedule IV
7	*Eryx conicus*	Common Sand Boa	NE, Schedule IV
8	*Indotyphlops braminus*	Brahminy Blind Snake	NE, Schedule IV
9	*Lycodon aulicus*	Indian Wolf Snake	LC
10	*Naja naja*	Indian Cobra	LC
11	*Oligodon taeniolatus*	Streaked Kukri Snake	NE, Schedule IV
12	*Ptyas mucosus*	Indian Rat Snake	LC
13	*Xenochrophis piscator*	Checkered Keelback	NE, Schedule II
	Mammals		
1	*Cynopterus sphinx*	Short-Nosed Fruit Bat	LC
2	*Funambulus palmarum*	Indian Palm Squirrel	LC
3	*Herpestes Edwardsii*	Grey Mongoose	LC
4	*Rattus norvegicus*	Field Mouse	LC
5	*Rattus rattus*	House Rat	LC
6	*Suncus murinus*	House Shrew	LC

NE - Near Evaluated, LC - Least Concerned

1. Protected Areas

86. There are no protected areas such as national parks, wildlife sanctuaries etc. in or adjacent to the project area. To profile the nearest protected areas, 50 km radius from the project site were screened using the Integrated Biodiversity Assessment Tool (IBAT). Pullicat Lake and Guindy National Park are the two protected areas located within 50 km of the project area (Figure 15). Pullicat Lake's nearest point is at about 21 km north and Guindy National Park is about 10 km south from the project boundary. Salient features of these protected areas are given below. The project will not interfere or influence the catchment area of Pullicat Lake, since the project area is far from the catchment of the Pullicat Lake and also the existing topography doesn't support it (Kosasthalaiyar basin drains towards the east). The Guindy National park is restricted to the urban environment, and is far away from the project area, and receives water needs from the Cooum basin catchments. No likely interference due to project.

(i) **Guindy National Park (GNP).** Spread over 2.70 km^2, this national park located in the heart of Chennai, and is the 8th smallest national park in India and one of the very few national parks situated inside a city. Though park is urban limits, it is well protected and managed. Park boasts 350 species of plants include shrubs, herbs, climbers, and grasses, there are more than and over 24 variety of trees, including the sugar-apple, *Atlantia monophylla, wood-apple, Annona squamosa, Atlanta monoplylla, Feronia limonia, Azadirachta indica* and many others are found in this park. The park and the diverse vegetation provide an ideal habitat for over 150 species of birds. 9 species of amphibians, 14 species of mammals, 3 species of

tortoise and turtles 60 species of spiders and 60 species of butterflies. About one-sixth area of the park is left as open grass land to preserve the habitat for blackbucks.

(ii) **Pullicat Lake.** Spread over 450 km^2 area in Tamil Nadu and Andhra Pradesh states, this is the second largest brackish-water eco-system in the country next to Chilika Lake in the State Orissa. The boundary of lake is at about 21 km from the project area. The Pullicat Lake was once permanently connected with the Ennore estuary. A total of 180 species of floral species are reported from Pullicat Lake, of which 6 species are mangroves and 35 species are mangrove associated. Ornithologically rich, 115 species of birds are listed from both water (aquatic) as well as land (terrestrial) in the Pullicat Bird Sanctuary. Six species of water birds; Great Thick-knee Esacus recurvirostris, Black-Tailed Godwit Limosa limosa, Eurasian Curlew Numenius arquata, Painted Stork Mycteria leucocephala, Spot-billed Pelican Pelecanus philippensis and Black-headed Ibis Threskiornis melanocephalus were categorised as “Near Threatened” according to the International Union for Conservation of Nature (IUCN) Red List. Five species of raptors Black-winged Kite Elanus caeruleus, Oriental Honey Buzzard Pernis ptilorhynchus, Shikra Accipiter badius, Brahminy Kite Haliastur Indus and Whitebellied Sea eagle Haliaeetus leucogaster were categorized as “Schedule I” according to the Wildlife Protection Act 1972. The Migratory species come to Pullicat from many habitats in India and other countries during different times of the year, due to seasonal limitations in factors such as food, sunlight, and temperature.

Figure 15: Protected Areas located within 50 km radius of the Project Area

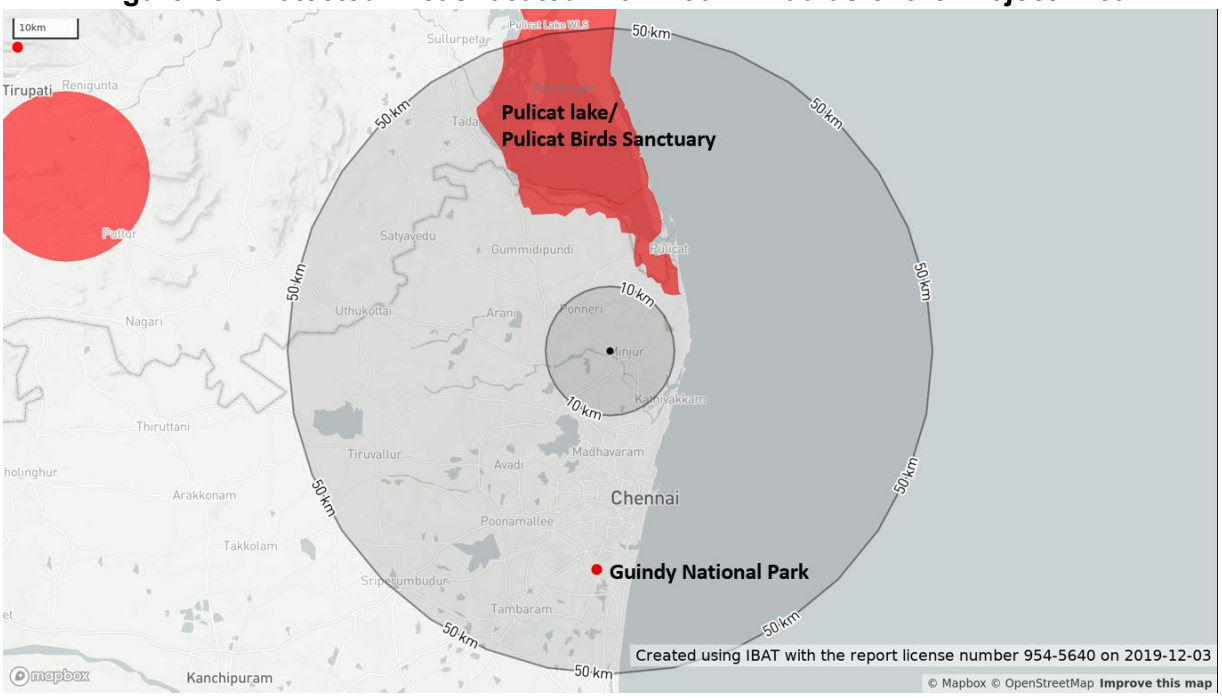
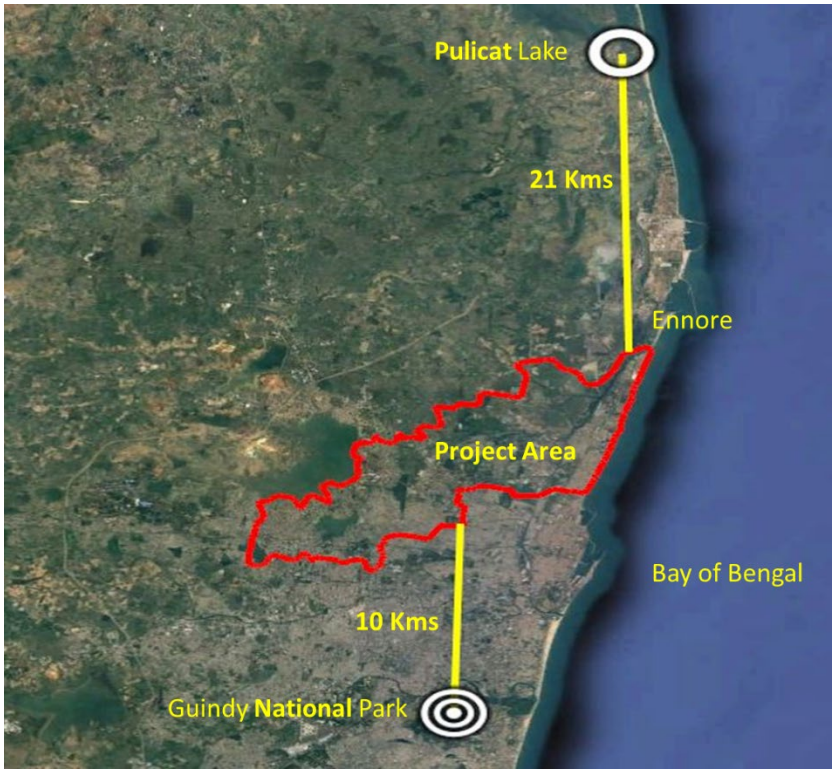


Figure 16: Distance of Pullicat Lake and Guindy National Park from the project area



87. Protected Species within 50 km Buffer Area. Potential occurrence of Critically Endangered (CR) / Endangered Species (EN), Near Threatened (NT) species listed in the IUCN Red List from IBAT screening is presented in **Table 29**. Except the birds and terrestrial species listed, others are marine animals have a larger home range. The potential occurrence is influenced by the two protected areas that are within this 50 km buffer of the project area.

Table 29: List of Species based on 50 km Buffer from the Project site (IBAT)

S. N	Scientific Name	Common Name	Habit	IUCN Status	Inference
1	*Eretmochelys imbricata*	Hawksbill Turtle	Terrestrial, Marine	CR	No influence on this species home range
2	*Glyphis gangeticus*	Ganges Shark	Marine, Freshwater	CR	No influence on this species home range
3	*Carcharhinus hemiodon*	Pondicherry Shark	Marine	CR	No influence on the species home range
4	*Carcharhinus longimanus*	Oceanic Whitetip Shark	Marine	CR	project site is away from this species home range
5	*Sphyrna lewini*	Scalloped Hammerhead	Marine	CR	project site is away from this species home range
6	*Sphyrna mokarran*	Great Hammerhead	Marine	CR	No influence on this species home range
7	*Pristis zijsron*	Green Sawfish	Marine	CR	project site is away from this species home range

S. N	Scientific Name	Common Name	Habit	IUCN Status	Inference
8	*Rhina ancylostoma*	Bowmouth Guitarfish	Marine	CR	No influence on this species home range
9	*Rhynchobatus australiae*	Bottlenose Wedgefish	Marine	CR	No influence on the species home range
10	*Rhynchobatus laevis*	Smoothnose Wedgefish	Marine	CR	No influence on the species home range
11	*Glaucostegus granulatus*	Sharpnose Guitarfish	Marine	CR	project site is away from this species home range
12	*Glaucostegus obtusus*	Widenose Guitarfish	Marine	CR	project site is away from this species home range
13	*Glaucostegus thouin*	Clubnose Guitarfish	Marine	CR	No influence on the species home range
14	*Pristis pristis*	Largetooth Sawfish	Marine	CR	No influence on this species home range
15	*Gyps bengalensis*	White-rumped Vulture	Terrestrial	CR	Rarely sighted in Pullicat and well away from the site
16	*Sarcogyps calvus*	Red-headed Vulture	Terrestrial	CR	Rarely sighted in Pullicat and well away from the site
17	*Gyps indicus*	Indian Vulture	Terrestrial	CR	Rarely sighted in Pullicat and well away from the site
18	*Glaucostegus typus*	Giant Guitarfish	Marine	CR	No influence on the species home range
19	*Balaenoptera musculus*	Blue Whale	Marine	EN	No influence on this species home range
20	*Manis crassicaudata*	Indian Pangolin	Terrestrial	EN	Not recorded within the 50km radius
18	*Rhincodon typus*	Whale Shark	Marine	EN	No influence on this species home range
19	*Isurus oxyrinchus*	Shortfin Mako	Marine	EN	No influence on this species home range
20	*Anoxypristis cuspidata*	Narrow Sawfish	Marine	EN	Marine species
21	*Pristis clavata*	Dwarf Sawfish	Marine	EN	Marine species
22	*Eusphyra blochii*	Winghead Shark	Marine	EN	Marine species
23	*Stegostoma tigrinum*	Zebra Shark	Marine	EN	Marine species
24	*Aetobatus flagellum*	Longhead Eagle Ray	Marine	EN	Deep water species, far away from site
25	*Aetomylaeus maculatus*	Mottled Eagle Ray	Marine	EN	Deep water species, far away from site
26	*Aetomylaeus vespertilio*	Ornate Eagle Ray	Marine	EN	No influence on this species home range
27	*Mobula tarapacana*	Sicklefin Devilray	Marine	EN	No influence on this species home range
28	*Mobula thurstoni*	Bentfin Devilray	Marine	EN	Marine species, deep waters
29	*Isurus paucus*	Longfin Mako	Marine	EN	Marine species, deep waters

S. N	Scientific Name	Common Name	Habit	IUCN Status	Inference
30	*Acropora rudis*		Marine	EN	Marine species, deep waters
31	*Mobula kuhlii*	Shortfin Devilray	Marine	EN	Marine species, deep waters
32	*Lamiopsis temminckii*	Broadfin Shark	Marine	EN	Marine species, deep waters
33	*Alopias pelagicus*	Pelagic Thresher	Marine	EN	Marine species, deep waters
34	*Lindernia minima*		Freshwater	EN	No record within range of the project area
35	*Holothuria scabra*	Golden Sandfish	Marine	EN	Marine species, deep waters
36	*Holothuria lessoni*	Golden Sandfish	Marine	EN	Marine species, deep waters
37	*Thelenota ananas*	Prickly Redfish	Marine	EN	No influence on this species home range
38	*Sypheotides indicus*	Lesser Florican	Terrestrial	EN	Visitor, not resident and no influence
39	*Calidris tenuirostris*	Great Knot	Terrestrial Marine	EN	Rarely sighted
40	*Sterna acuticauda*	Black-bellied Tern	Terrestrial	EN	Visitor, not resident and no influence
41	*Neophron percnopterus*	Egyptian Vulture	Terrestrial	EN	Rarely sighted in Pullicat, which is far from the site and has no influence on the species
42	*Aquila nipalensis*	Steppe Eagle	Terrestrial	EN	Rarely sighted in Pullicat, which is far from the site and has no influence on the species
43	*Lonchura oryzivora*	Java Sparrow	Terrestrial	EN	Rarely sighted to far from the site
44	*Mobula mobular*	Spinetail Devil Ray	Marine	EN	Not sighted within the 50km range, No influence on this species home range
45	*Acentrogobius veliensis*		Marine	EN	Marine species, deep waters
46	*Oceanites oceanicus*	Wilson's Stormpetrel	Terrestrial Marine	EN	Rarely sighted at Pullicat
47	*Fregetta tropica*	Black-bellied Storm-petrel	Terrestrial Marine	EN	Rarely sighted at Pullicat

2. Coastal Areas

88. Project area is located along the coromandel coast of the Bay of Bengal. Project area slopes towards the coast, and the Kosathalaiyar River drains into the Bay of Bengal via Ennore Creek. Ennore creek is the north most tip of the project area. Figure 17 shows the coastal location of the project area.

89. **The Ennore Creek** (estuary) is at the tail end of the project, it is a shallow water body influenced by tidal fluctuations, and the depth of the creek is up to 2 - 3 m. The Northern region of the estuary harbors very less mangroves and more saltmarsh areas, the Southern region is the tail end of the Kosasthalaiyar River, which has tidal mudflats, mangroves, salt marsh and the coastal wetland. Once a thriving mangrove forest, this habitat has drastically changed from mangrove and saltmarsh ecosystem to degraded and fragmented habitats. Mangrove patches highly fragmented, disturbed and growth stunted due to heavy siltation and salinity. One mangrove species and 56 mangrove associate and coastal vegetation species is recorded; details of the species list are attached in **Appendix 9**. 30 species of crabs and 36 species of Mollusca species were identified of which 24 species were gastropods and 15 species were bivalves. More than 100 species of water and terrestrial birds around the Ennore estuary has been listed by many bird watchers and researchers.

90. All the species were not totally dependent on the estuary they use the estuary environment for roosting, foraging and as a seasonal stop-over site on migrations. Most of the species were from the adjacent villages and urban areas. Some common species recorded were herons, egrets, sandpipers, whistlers and kingfisher. Migratory birds visiting Pullicat lake visit Ennore estuary as well. Similar to Pullicat lake five species of water birds; Black-Tailed Godwit Limosa limosa, Painted Stork Mycteria leucocephala, Spot-billed Pelican Pelecanus philippensis and Black-headed Ibis Threskiornis melanocephalus were categorized as “Near Threatened” according to the International Union for Conservation of Nature (IUCN) Red List. Five species of raptors Black-winged Kite Elanus caeruleus, Oriental Honey Buzzard Pernis ptilorhynchus, Shikra Accipiter badius, Brahminy Kite Haliastur indus and White bellied Sea eagle Haliaeetus leucogaster were categorised as “Schedule I” according to the Wildlife Protection Act 1972. The above listed bird species rarely visit the Estuary except Painted Stork, Spot-billed Pelican, Shikra, Brahminy Kite and White bellied Sea eagle, details of the species list is attached in **Appendix 9**. There are no endemic and endangered species in this area,

91. A total of 61 km of length of drain (both existing and proposed) falling in the CRZ area, mostly in CRZ II. Besides, as the project areas topographically drains into Bay of Bengal directly or via Kosasthalaiyar River, Buckingham canal and Ennore Creek, some outfalls and discharge locations are falling within the CRZ. At all locations, water channels/canals already exist albeit in poor condition and siltation. As per Notification, CRZ-II is the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas, which are substantially built-up. CRZ-IV B areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from the mouth of the water body at the sea up to the influence of tide.

92. Both the pumping stations are located in CRZ II. Four outfalls are existing in the Ennore estuary, and there are 13 outfalls into the Bay of Bengal are not direct outfalls into the sea, they either drain on the rocks (sea wall) or extend along the beach and drain along the rocks. Very few and sparse vegetation was observed along and near the outfalls either in the Ennore estuary or the beach, the outfalls were elevated from the mean sea level. In Ennore estuary, mangroves were about 500 m away from the discharge point on the opposite side. Common coastal plants like *Cassia occidentalis*, *Canavalia cathartica*, *Canavalia maritima*, *Calotropis gigantean*, *Acalypha indica*, *Achyranthes aspera*, *Ricinus communis*, *Tephrosia p*urpurea and *Triumfetta rhomboidea* and sea weeds like *Enteromorpha compressa*, *Enteromorpha flexuosa*, and Gracillaria *foliifera* were identified near the outfalls along Ennore estuary and the sea and which were found in very few numbers and are neither ecologically or economically important. Crab species like Uca annulipes and *Neoepisesarma tetragonam* were identified, which were not economically important species.

93. The species diversity within the outfall area is very less, neither rare, nor of significance in terms of economic or ecological value. Along the outlets draining into the sea crossing the Ennore road, the diversity was dominated by crustacean and molluscan species, very less or no diversity was observed on the outfall areas of the proposed landfall site. Barnacles and sea weeds were observed in the sea wall built along the shore. The upper shore habitats, along the Ennore road are residential and industrial development, topography was loose sand; no or less vegetation and no macro fauna were recorded. Changes to beach morphology, changes to water quality, damage to coastal structures or deposition within the outfall region is not expected and the storm water outfall will not alter the Benthic Intertidal Ecology, if few changes happen, it will be temporary and short term.

Figure 17: View of Ennore Estuary, Kosasthalaiyar River and Buckingham canal

Figure 18: The Coastal Zone Management Plan Map

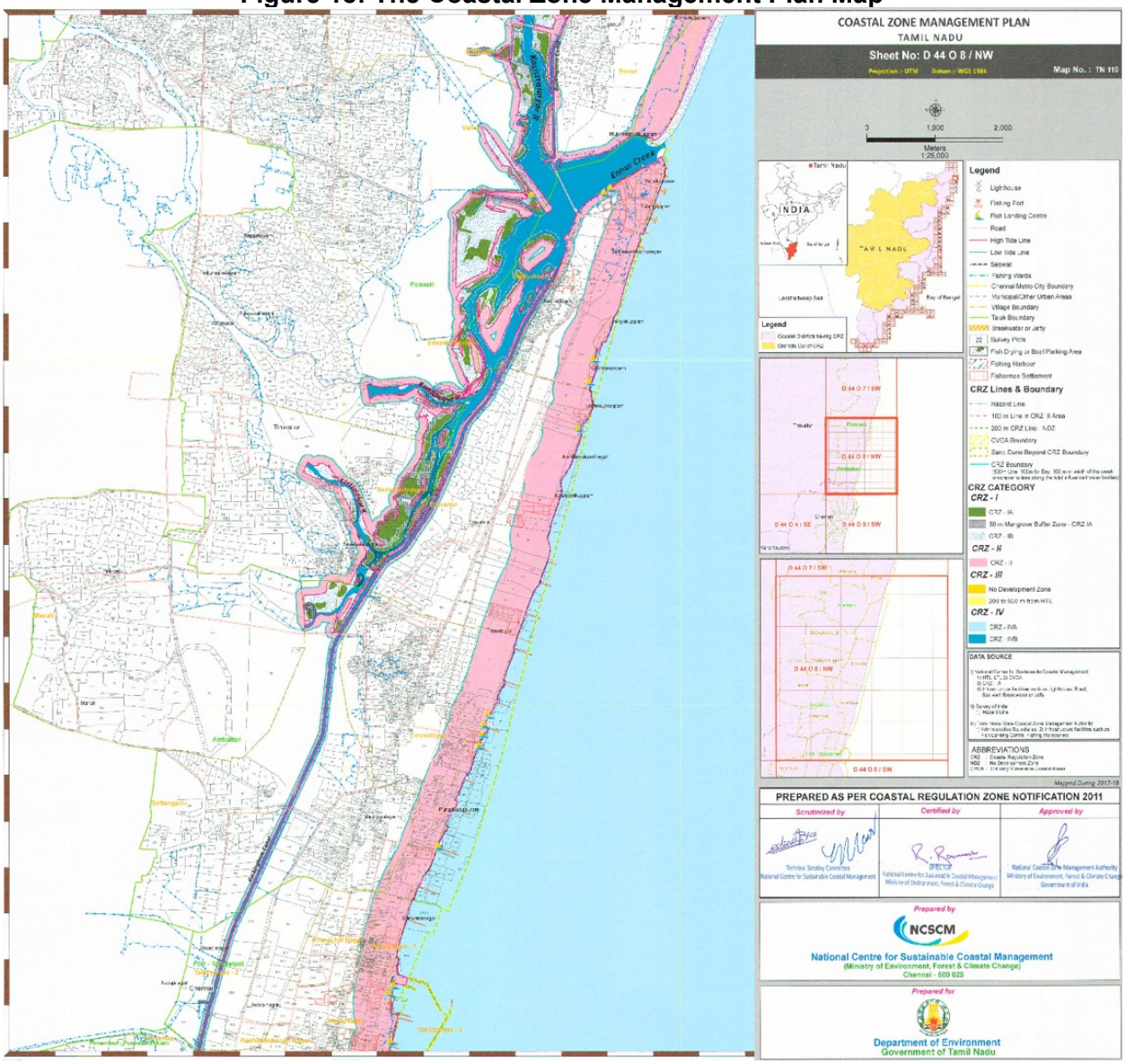


Figure 19: The view of discharge outfall into Sea and Creek

D. Socio-economic Environment

1. Demography

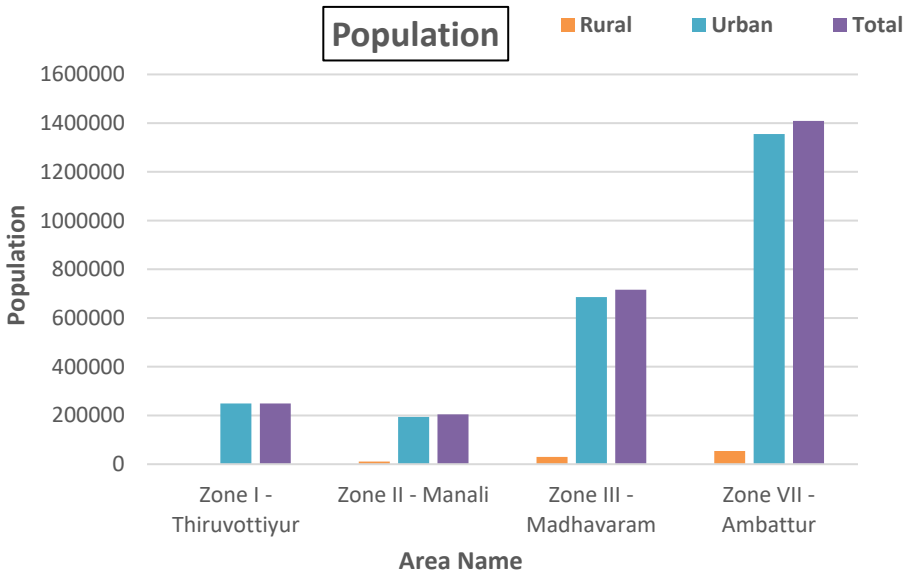
94. As per census 2011, the population in the Kosasthalaiyar River Basin is 2,579,645. The detail of the population distribution is given in the **Table 30** Within the project area, the urban population is observed to be high in the Zone VII Ambattur and low in Zone II Manali. Rural population is nil for Zone I Tiruvottiyur and high in Zone VII Ambattur. Nearly 3.68% and 96.32% lives in rural and urban areas respectively.

Table 30: Socio-economic data (Census 2011)

Area Name	House holds			Total Population			% of urban population	Woman Headed Family
	Rural	Urban	Total	Rural	Urban	Total		
Zone I-Thiruvottiyur	0	63,862	63,862	0	249,446	249,446	100%	14,459
Zone II-Manali	2,368	19,359	21,727	10,602	194,146	204,748	95%	4,246

Area Name	House holds			Total Population			% of urban population	Woman Headed Family
	Rural	Urban	Total	Rural	Urban	Total		
Zone III-Madhavaram	7,802	146,365	154,167	30,148	685,901	716,049	96%	4,158
Zone VII-Ambattur	13,518	227,729	241,247	54,085	1,355,317	1,409,402	96%	178,434
Total	**23,688**	**457,315**	**481,003**	**94,835**	**2,484,810**	**2,579,645**	96%	**201,297**
Percentage (%)	**4.92**	**95.08**	**100**	**3.68**	**96.32**	**100**		**7.80**

Figure 20: Rural and Urban Population in Project area



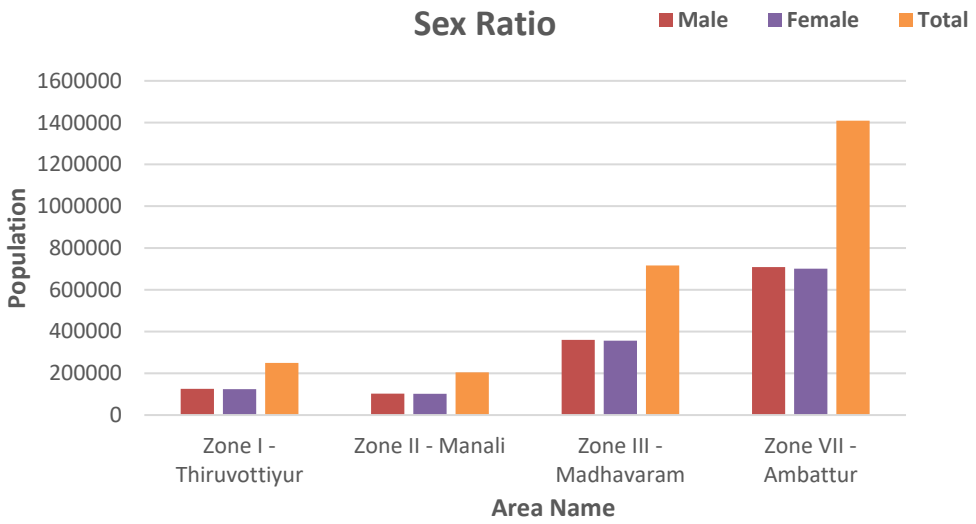
2. Sex Ratio

95. Among the total population, sex ratio is 989 females for 1000 males. Sex disaggregate population is given in the following table.

Table 31: Sex Ratio

Area Name	Sex Ratio		
	Male	Female	Total
Zone I - Thiruvottiyur	125,393	124,053	249,446
Zone II - Manali	102,924	101,824	204,748
Zone III - Madhavaram	359,947	356,102	716,049
Zone VII - Ambattur	708,486	700,916	1,409,402
Total	**1,296,750**	**1,282,895**	**2,579,645**
Percentage (%)	**50.27**	**49.73**	

Figure 21: Sex Ratio in Project Area



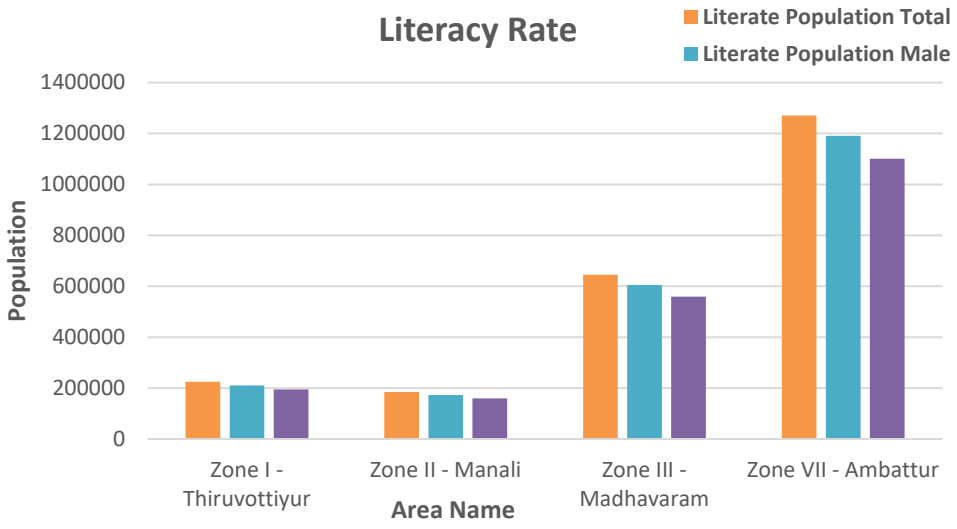
3. Literacy

96. Among the total population, 90.17% is educated out of which male literacy rate is 93.70% and women literacy rate is 92.47%. Within the project area, Zone VII Ambattur has highest literate population and Zone II Manali has lowest literate population.

Table 32: Literacy Rate in the Project Area

Area Name	Literate Population			Illiterate Population
	Total	Male	Female	
Zone I – Thiruvottiyur	224,925	210,755	194,875	24,521
Zone II – Manali	184,621	172,990	159,956	20,127
Zone III - Madhavaram	645,661	604,984	559,401	70,388
Zone VII - Ambattur	1,270,858	1,190,794	1,101,071	138,544
Total	**2,326,065**	**2,179,523**	**2,015,303**	**253,580**
Percentage (%)	**90.17**	**93.70**	**92.47**	**9.83**

Figure 22: Literacy rate details in Zone I, II, III and VII areas



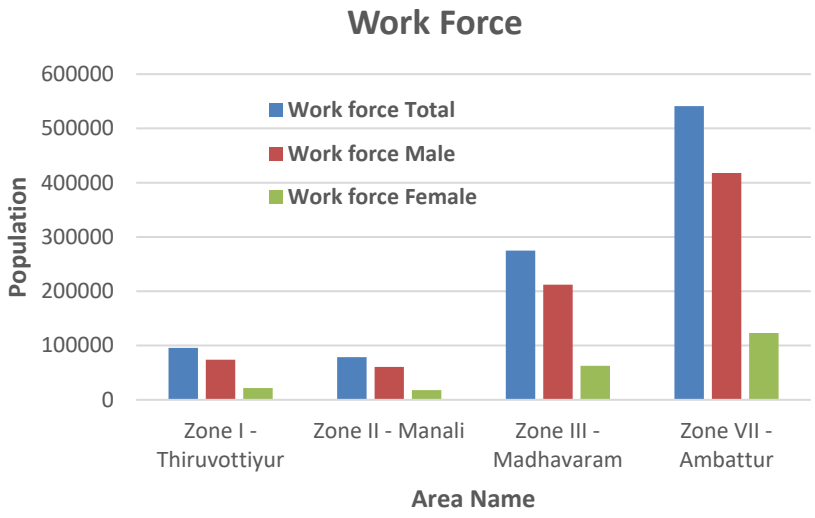
4. Work Force

97. Highest workforce population is in Zone VII Ambattur and lowest work force population is in Zone II Manali. Among the total work force, male and female work force are 77.23% and 22.77% respectively.

Table 33: Work Force

Area Name	Work force		
	Total	Male	Female
Zone I - Thiruvottiyur	95,756	73,950	21,806
Zone II - Manali	78,597	60,699	17,898
Zone III - Madhavaram	274,872	212,277	62,595
Zone VII - Ambattur	541,032	417,826	123,206
Total	**990,257**	**764,752**	**225,505**
Percentage (%)		**77.23**	**22.77**

Figure 23: Work Force in Project Area



5. Land Use

98. The project area has various types of land use patterns. Watershed wise land use details are given in the **Table 34**. The land use pattern was dominated by the residential (41.62 km^2), followed by commercial cum residential (20.61 km^2), Industrial (19.52 km^2), Water bodies (13.71 km^2) and CRZ area (3.19 km^2). CRZ area is in two watershed basins of North Buckingham canal zone and North coast watershed zone.

Figure 24: Land Use Map Chennai Metro Area (Source CMDA Database)

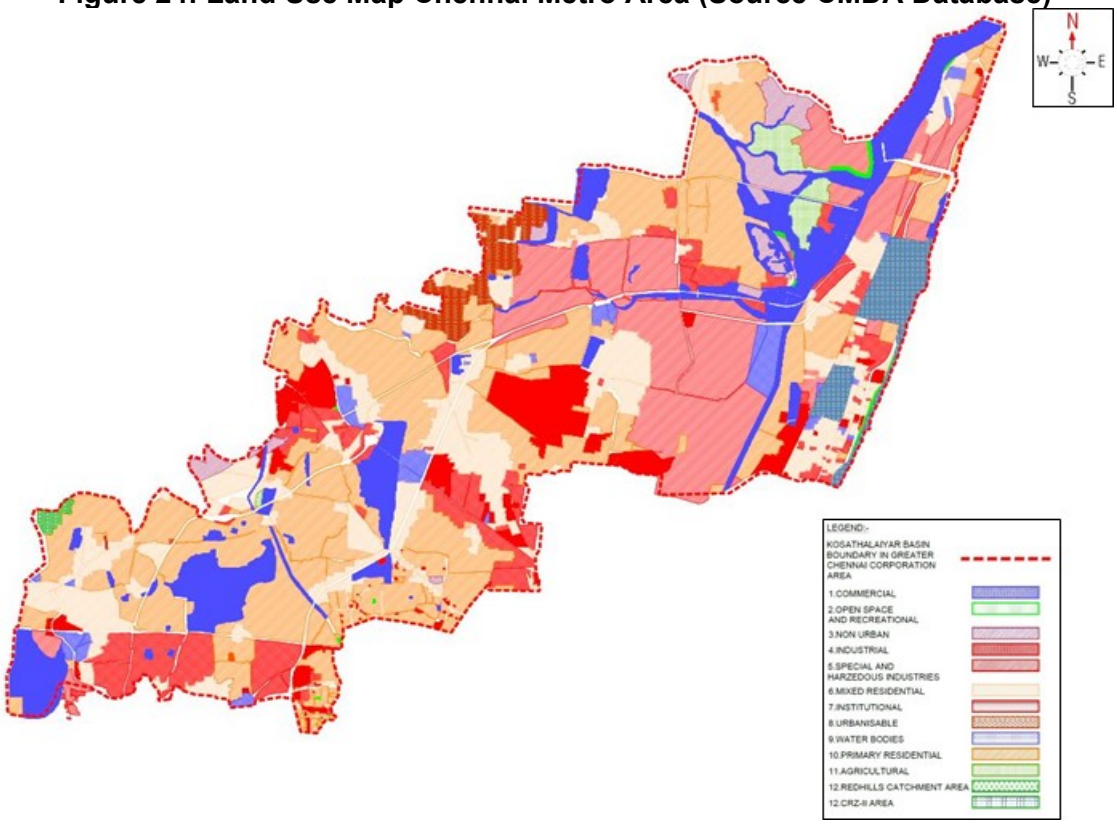


Table 34: Watershed wise Land use Details

Sl. No.	Descriptions	North Ambattur Zone	Korattur Lake Zone	Puzhal South Zone	Retteri Lake Zone	Retteri South Surplus Zone	Captain Cotton Canal West Zone	Puzhal Surplus South Zone	Puzhal Surplus North Zone	North Buckingham canal Zone	North Coast Watershed Zone	Otteri Watershed Zone	Total
1	Commercial	0.0211	1.21		0.306	0.008		1.633		0.24	0.011		3.43
2	Open Space & Recreational				0.005	0.009		0.004	0.175				0.19
3	Urbanisable							0.02	2.185				2.21
4	Non-Urban				0.417	0.037			2.1404				2.59
5	Industrial		1.48		3.514	1.524	0.165	0.934	7.155	0.8074	1.6703	2.27	19.52
6	Special and Hazardous Industries		0.14		0.307			4.027	0.965	6.136	0.7845		12.36
7	Mixed Residential	0.31	0.93	0.446	2.476	1.565	0.099	9.633	1.9643	2.8331	0.3541		20.61
8	Institutional	0.023	0.02	0.011	0.258	0.535	0.026	3.818		1.081			5.77
9	Water bodies	1.359	3.59	0.356	2.209	0.259		0.959	4.526	0.335	0.1196		13.71
10	Primary Residential	0.336	0.95	2.555	7.537	5.499		8.493	9.5883	4.2785	0.9211	1.46	41.62
11	Agriculture				0.041				2.531				2.57
12	CRZ-II Area									0.919	2.2694		3.19
	Total (km^2)	**2.05**	**8.32**	**3.37**	**17.07**	**9.44**	**0.29**	**29.52**	**31.23**	**16.63**	**6.13**	**3.73**	**127.77**

6. Transport and Traffic

99. There are four types of main roads in the project area that provide regional and local connectivity namely National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District Roads (ODR).

(i) NH 5 Chennai – Kolkata Highway
(ii) NH 716 Chennai – Tirupathi Highway
(iii) SH 56 – Thiruvottiyur – Ponneri State Highways
(iv) Inner Ring Road (IRR)
(v) Chennai Bypass Road

100. National Highways and State Highways are connected by the internal roads. These include Thiruvottiyur high road, Manali high road, Madhavaram high road, Ennore high road, etc., Sub Urban rail transport exist in Zone 7 (Ambattur) and Zone 1 (Thiruvottiyur). Metro rail proposal from Chennai Airport to Zone 3 Madhavaram is under process. Google Map indicating the major roads and sub urban rail transport in the project area as shown in Figure 25.

Figure 25: Major Roads in Project Area

7. Water Supply

101. For providing potable water supply to the project area, CMWSSB is operating Water Treatment Plant (WTP) at Kilpauk, Redhills, and Surapattu. Both surface water and groundwater has been sourced to meet the water demand. Information about the WTP's are given in the following table.

Table 35: Treatment Capacity of Water Treatment Plants

Sl No.	Water Treatment Plants	Treatment Capacity (MLD)
1	Kilpauk	270
2	Redhills	300
3	Surapattu	14
	Total	**584**

102. Piped water supply system exists in Zone I (Thiruvottiyur) and Zone VII (Ambattur) of the project area. In Zone II (Manali) and Zone III (Madavaram) areas, construction of piped water supply system is in progress. (*Source: Tamil Nadu Urban Flagship Investment Program (TNUFIP) - Providing Comprehensive Water Supply Scheme to Mathur, Madipakkam, Jalladampettai and Uthandi in Chennai City*).

8. Sewerage System

103. Out of 127.80 km^2 of the project area, nearly 96.78 km^2 area is covered with the sewerage system (work is commissioned and in operation). For the remaining 31.02 km^2, DPR is prepared and ready for execution for 12.14 km^2 and DPR is under preparation for an area of 18.88 km^2. In Kodungaiyur, 3 STP units having an individual capacity of 110 MLD, 70 MLD and 70 MLD is in operation. In Thiruvottiyur, 31 MLD STP is under construction. Sewerage System status is within the project area, which is presented in Table 36.

Figure 26: Sewerage System details in the study area

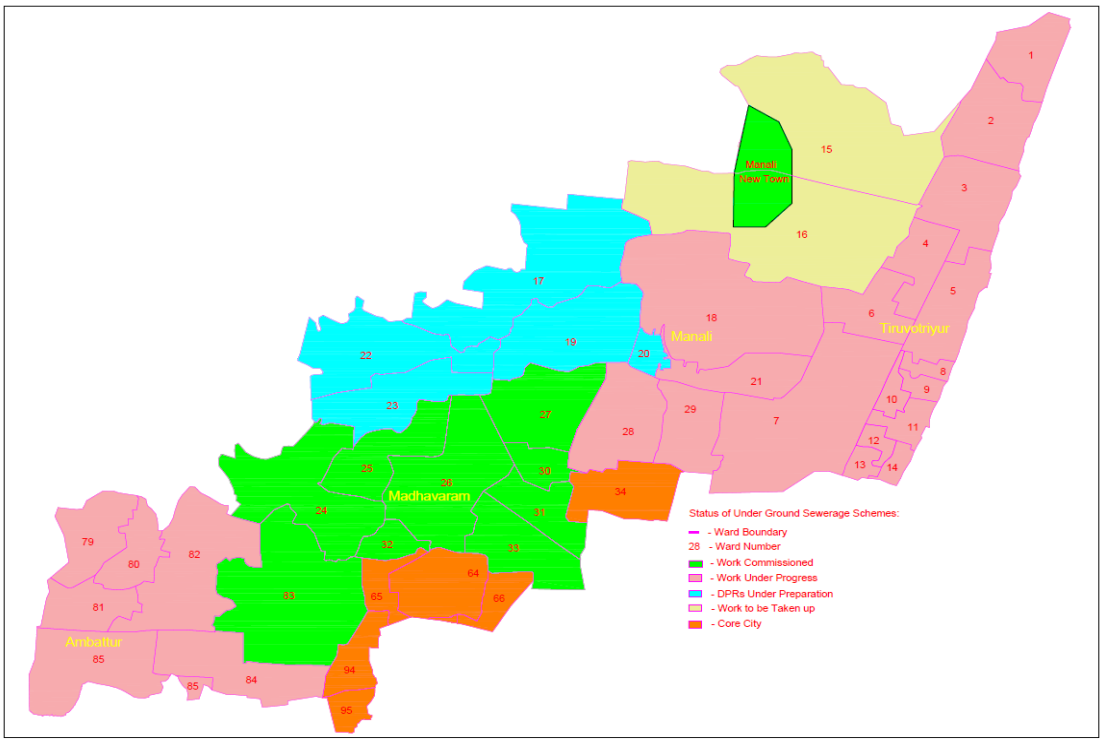


Table 36: Sewerage System details in the study area

Sl No.	Zone No.	Area Name	Area in km^2	UGD Covered Area				
				Work to be taken up	Work Commissioned	Work Under Progress	DPR under preparation	Total
1	Zone I	Thiruvottiyur	23.57			23.57		23.57
2	Zone II	Manali	40.47	12.14		16.19	12.14	40.47
3	Zone III	Madhavaram	33.69		26.95		6.74	33.69
4	Zone VI	Thiru-vi-ka Nagar	4.15		4.15			4.15
5	Zone VII	Ambattur	22.82		2.28	20.54		22.82
6	Zone VIII	Anna Nagar	3.1		3.10			3.10
		Total	**127.80**	**12.14**	**36.48**	**60.30**	**18.88**	**127.80**
	Percentage of Coverage			**10%**	**29%**	**47%**	**15%**	**100%**

9. Industry

104. The project area is known for industrial activities; small and medium scale manufacturing industries are functioning in Ambattur Industrial Estate. There are more than 16,940 small scale Industries, notable among them being food, wood, textile, chemical, engineering, non - metallic and leather industries. In Thiruvottiyur, major industries are Chennai Petroleum Corporation Limited (CPCL), Madras Fertilizers Limited (MFL), Toshiba Limited, Manali Petro Chemicals Limited, SRF Limited, Ashok Leyland, Hinduja Foundries, Gulf Lubricants limited, Madras Rubber Factory Limited, etc. The project area also boasts of the Ennore Thermal Power Station and the Avadi Tank Factory. The project area has 16 Industrial Estates, all in operation, of which the Government has developed 11 industrial estates and 5 by Private Organizations. There are 1926 industrial units. These units are further classified into Red, Orange, and Green based on their intensity of pollution. For the disposal of hazardous solid wastes, the TNPCB has identified a landfill site at Manalur.

10. Cultural and Heritage sites

105. Project is area is devoid of any notable or important archaeological, historical and/cultural places. There are no protected monuments or places either protected by Archeological Survey of India or by State Archeological Department. The project area does not have any places of notable tourism importance.

11. Subproject Site Features

106. Features of the selected subproject sites are presented in the following Table 37:

Table 37: Subproject Site Features

Infrastructure	Location and Environmental Features
Existing Drains to be	Maya street, Ambattur, Zone-VII, N 13.116567, E 80.157998 Mahaveer nagar 4th cross street, Puzhal, Zone-III, N 13.172314, E80.204449

Infrastructure	Location and Environmental Features	
demolished and Reconstruction		
	Maya street lies in residential area of Ambattur, Zone-VII and proposed drain will be constructed in the right side of the road. Nearby landmarks are Ambattur Sub Urban Railway station and Chennai bypass road (Perungalathur to Puzhal) exist at a distance of 750m and 660m respectively. There are no environmentally sensitive areas located nearby the proposed drain.	Mahaveer nagar 4th cross street lies in residential area of Puzhal, Zone-III and proposed drain will be constructed in the right side of the road. Nearby landmarks are NH-45 (Guntur Chennai Highway) exist at a distance of 700m. There are no environmentally sensitive areas located nearby the proposed drain.
Existing drains Retained	TNHB 26th street, Korattur, Zone-VII, N 13.108910, E 80.186407 Pattravakkam Aavin diary road, Zone-VII, N1 3.109301, E 80.170422	
		
	TNHB 26th street, Korattur, Zone-VII lies in residential area and the drain exist in left side of the road. Nearby landmark of Korattur bus stop exist at a distance of 450m. There are no environmentally sensitive areas located nearby the existing drain.	Pattravakkam Aavin diary road, Zone-VII, exist in SIDCO industrial estate and the drain exist in right side of the road. Nearby landmark of Telephone exchange road exist at a distance of 750m. There are no environmentally sensitive areas located within or nearby the existing drain.
Proposed Drains	National Highway – 5 (Near Madhavaram), Zone-III; N 13.131906, E80.237519 Siva Parvathi Nagar main road, Zone-VI; N13.125566, E80.218956	
		

<table>
<tr><th>Infrastructure</th><th colspan="2">Location and Environmental Features</th></tr>
<tr><td></td><td>National Highway–5 (Near Madhavaram), Zone-III lies in commercial area and proposed drain will be constructed in the right side of the road under the foot path. Nearby landmark are Madavaram MTC Bus Depot and Moolakadai Market Bus Stop at a distance of 150m and 450m respectively. There are no environmentally sensitive areas located nearby the proposed drain.</td><td>Siva Parvathi Nagar main road, Zone-VI lies in residential area and proposed drain will be constructed in the left side of the road. Nearby landmark of Redhills road exist at a distance of 70m. There are no environmentally sensitive areas located nearby the proposed drain.</td></tr>
<tr><td rowspan="3">Surplus Drains</td><td>Ambattur Surplus Drain. Total length of the drain is 5.79km. This canal links Ambattur lake with Korattur lake. It traverses through the railway line (in-between the settlements). There are no environmentally sensitive areas located nearby. The surplus drain is seasonal, which remains dry during the summer season. The proposed interventions includes,
Removal of silt
Modifying existing bed to design bed level
Construction of RCC side walls 
View of Ambattur Surplus drain</td><td>Korattur Surplus Drain. Total length of the drain is 2.13km. This canal links Korattur lake with Retteri lake. It traverses through the Chennai Bypass Road (Connecting Perungalathur to Puzhal). There are no environmentally sensitive areas located nearby. The surplus drain is seasonal, which remains dry during the summer season. The proposed interventions includes,
Widening of canal,
Modifying existing bed to design bed level
Removal of silt, weeds
Construction of RCC side walls 
View of Korattur Surplus drain</td></tr>
<tr><td>Kadapakkam Surplus Drain. The total length of the drain is just 0.68km (680m); It connects Kadapakkam lake with Ariyalur lake. It traverses through agriculture land, the surplus drain is seasonal, which remains dry during the summer season. There are no environmentally sensitive areas located nearby.
Removal of silt, weeds
Modifying existing bed to PWD bed levels</td><td>Ariyalur Surplus Drain. The total length of the drain is 2.65km; It connects Ariyalur lake with the Kosasthalaiyar river. It traverses through agriculture land; The surplus drain is seasonal, which remains dry during the summer season. There are no environmentally sensitive areas located nearby.
Removal of silt, weeds
Modifying existing bed to PWD bed levels</td></tr>
<tr><td>Storm Water Pumping</td><td colspan="2">Kargil Nagar Pumping Station is located in Zone I, Ward No 7. (N13.174695, E80.291116)</td></tr>
</table>

<table>
<tr><th>Infrastructure</th><th colspan="2">Location and Environmental Features</th></tr>
<tr><td rowspan="3">Station at Karghil Nagar</td><td colspan="2">The nearest residential area/ settlement is located at a distance of 100m from the proposed Pumping Station (PS)There are no environmentally sensitive areas located within or nearby the pumping station site. However, the proposed PS site falls under the CRZ II, due to the tidal influence in the Buckingham canal, which is located less than 15m. The storm water collected in the Kargil nagar pumping station will be discharged into the Buckingham Canal.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Existing SWPS at Karghil Nagar</td><td>Proposed SWPS Site</td></tr>
<tr><td rowspan="3">Storm Water Pumping Station at Ernavoor</td><td colspan="2">Eranavoor Pumping Station is located in Zone I, Ward No 4. (N13.190405, E80.302826)
The nearest residential area/ settlement is located at a distance of 30m from the proposed Pumping Station (PS). There are no environmentally sensitive areas located within or nearby the pumping station site. However, the proposed PS site falls under the CRZ II, due to the tidal influence in the Buckingham canal, which is located less than 15m. The storm water collected in the Eranavoor pumping station will be discharged into the Buckingham Canal.</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">Proposed SWPS Site at Eranavoor</td></tr>
</table>

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

107. The potential environmental impacts of the proposed storm water drain project, and its components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

108. Screening of potential environmental impacts is categorized into four categories considering project phases: location impacts and design impacts (pre-construction phase), construction phase impacts and operations and maintenance phase impacts.

(i) **Location impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.
(ii) **Design impacts** include impacts arising from Investment Program Design, including technology used, the scale of operation/throughout, waste production and ancillary services.
(iii) **Construction impacts** include impacts caused by site clearing, earthworks, machinery, vehicles, and workers. Construction site impacts include erosion, dust, noise, traffic congestion, and waste production.
(iv) **O&M impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

109. Screening of environmental impacts has been based on the impact magnitude (negligible/moderate/severe – in the order of increasing degree) and impact duration (temporary/permanent).

110. This section of the IEE, reviews possible project-related impacts, to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the project's area of influence.

111. The ADB Rapid Environmental Assessment Checklist in http://www.adb.org/documents/adb-environmental-assessment-guidelines has been used to screen the project for environmental impacts and to determine the scope of the IEE.

112. In the case of this project (i) most of the individual elements involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with stormwater drain facilities are already considered in the design; (iii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iv) being mostly located in an urban area, will not cause direct impact on biodiversity values. The project will be in properties held by the GCC and access to the project location is through public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-Construction Impacts – Design and Location

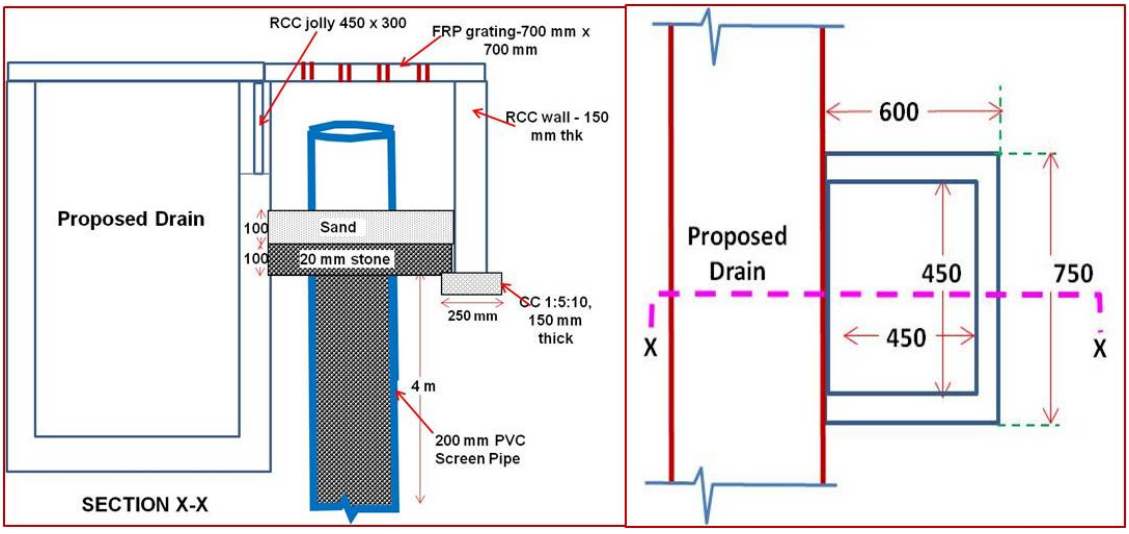
113. **Design of the Proposed Components**. Technical design of the (i) storm water drain network, and (ii) storm water pumping stations, follows the relevant standards and provides a robust system, which is easy to operate, sustainable, efficient and economically viable. Project includes following design considerations:

(i) **Prevention of flooding.** Rainfall data of 46 years are collected and based on that the storm water drainage system of micro drains are designed to handle the maximum rainfall of 70 mm/hour for 2 years return period. Macro drains and surplus canals connecting all major lakes are designed to handle the maximum rainfall of 106 mm/hour for 5 years return period.

(ii) **Groundwater recharge and silt control.** Rainwater harvesting through constructing catch pits and rainwater harvesting structures are proposed in the storm water drainage network. Catch pits at every 10m interval and Rainwater harvesting structure along with a silt catching pit will be provided at every 30m interval in the proposed/rehabilitated drains. The provision includes FRC Grating Cover with frame and coarse sand for filter media inside the pit.

(iii) **Sediment Control**. For control of sediments, it is proposed to construct a sediment trap at the confluence point of the drain with the water body so that the sediments are deposited in the silt trap and settle over there which can be removed periodically. Additional silt traps will be provided at the point where the cross-drainage confluence and the silt from these silt traps shall be periodically removed.

Figure 27: Catch pit section with RWH structure in Storm Water Drain



(iv) **Prevention of solid waste dumping into drains.** Micro drains will be constructed as box type drain in RCC with a cover on top, which will curtail dumping of solid waste in drains. Major macro drains belonging will be constructed as open drains with both side cover in MS frame with wire mesh to avoid dumping of solid waste.

114. **Safety in maintenance.** Inspection doors will be provided at an interval of 10m to facilitate maintenance activities by machinery.

115. **Traffic Loads and People access to micro drains.** Micro drains shall be constructed as box type drain in RCC with a cover on top, which can also take traffic loads.

116. **Storm water-pumping stations**. It is proposed to construct two storm water pumping stations that will receive storm water from the catchment area via the drain network and pump to North Buckingham Canal as per the design. The pumping station will consist of a storm water sump or suction well to receive storm water, vertical turbine pumps in the sump to pump out, and electrical panel board for operation of pumps above the ground (the height will be fixed based on the HFL). A generator set will also be provided at each pumping station of the required size. In order to protect the pump house from flooding, the electrical motor control and power panels will be fixed in an elevated level.

117. At these pumping stations, the operation involves accumulation of incoming storm water in the sump and then pumping out as the storm water level reaches the designed operating depth. The water level in the sump rises before the pumping cycle starts, and as the pumping is performed the water level goes down, registering its lowest depth at the end of the pumping of a cycle. During the monsoon period, this cycle of rising and lowering will continue throughout the day and night, however, the duration between successive pumping cycles will significantly vary depending on the storm water generation/intensity of rainfall.

118. Storm water pumping stations will require an uninterrupted power supply for operation. Disruption in power supply will lead to the process upset and result in the stagnation of storm water in low-lying areas. Following measures are integrated into design and contracts to ensure efficient operation:

(i) Ensuring continuous uninterrupted power supply, including a back-up facility (such as a generator)
(ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility
(iii) Necessary training to GCC staff dealing with the pumping station.

119. Proposed pumping stations are located at Kargil Nagar and Ernavoor, adjacent to the eastern portion of the North Buckingham Canal. The proposed site is surrounded by vacant land and the nearest settlement area/ residential area is at about 100m from the Kargil Nagar site and 30m from the Ernavoor site.

120. **Noise from pumping operations**. Proposed pumping stations are located at Kargil Nagar and Ernavoor, adjacent to the eastern portion of the North Buckingham Canal. The proposed site is surrounded by vacant land and the nearest settlement area/ residential area is at about 100m from the Kargil Nagar site and 30m from the Ernavoor site. The operation of pumps and motors and diesel generators is a major source of the noise. As the pumping stations are located in the vacant areas, noise generated from pump stations cannot have continuous negative impacts on the surrounding population. High noise levels can affect the health of operators and staff at the facilities, and therefore, noise levels need to be maintained within and outside the plant at acceptable levels. The internal noise level in a room measured at a distance of 1m from these pump sources typically will be in the range from 80 dB (A) to 100 dB (A).

(i) Procure good quality latest technology vertical turbine pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m (refer tender specification for make)
(ii) Use acoustic enclosures – manufacturer specified, for all pumps, motors

(iii) Procure only CPCB approved generators with low emission and low noise fitted with acoustic enclosures
(iv) Provide sound mufflers for ventilators in the plant rooms soundproof doors
(v) Provide earplugs to workers.

121. **Energy Efficiency**. To optimize the power consumption, it is proposed to use low noise and energy-efficient pumping systems.

122. **Tree cutting at selected project sites**. It is estimated to cut/remove 304 trees located adjacent to the micro/macro drains, which belong to species such as *Pongamia Pinnata* (Pungai), *Azadirachta Indica* (Neem Tree) and *Cocos Nucifera* (Coconut Tree). Adequate precaution will be taken during implementation to minimise the tree cutting. Tree transplantation option shall be explored to minimize the loss of trees. However, when tree cutting is unavoidable, a note with necessary details of the project, trees & photos and justification for tree cutting needs to be submitted to the respective Regional Deputy/ Joint Commissioner, GCC, for obtaining tree cutting permission. Tree cutting will be carried out by the Parks Department, GCC before the start of work.

123. **Compensatory Plantation.** Plant and maintain 10 trees for each tree that is removed. Trees shall be planted in the nearby parks belongs to GCC and are furnished in **Appendix 10**.

Table 38: List of Species for Compensatory Tree Plantation

Scientific Name	Local Name	Habit	Planting Zones
Saline tolerant species			
Calophyllum inophyllum	Punnai	T	Kosasthalaiyar and Buckingham canal bunds
Pongamia pinnata	Pungai	T	
Terminalia catappa	Naattu Badaam	T	
Thespesia populnea	Poovarasu	T	
Salvadora persica	Peruvilla	T	
Vettiveria zyzanioides	Vettiver	G	
Cleradendrum inerme	Peenari	S	
Caesalpinia bonduc	Kalichchikkai	S	
Terrestrial Species			Places of no saline Influence
Albizia lebbeck	Vaagai	T	
Albizia odoratissima	Karuvaagai	T	
Azadirachta indica	Veppam	T	
Aegle marmelos	Vilvam	T	
Barringtonia acutangula	Neerkadambu	T	Places of no saline Influence
Bauhinia tomentosa	Vellai mandaarai	T	
Bauhinia purpurea	Mantharai	T	Places of no saline Influence
Bauhinia recemosa	Athi	T	Places of no saline Influence
Butea monosperma	Porasu, Murukku	T	
Couroupita guianensis	Cannonball	T	
Crataeva adansonii	Mavalingam	T	
Cassia fistula	Sarakondrai	T	
Dalbergia lanceolaria	Erigei, Nalvellangu	T	
Diospyros ebenum	Karungali	T	
Ixora pavetta	Chulundu	T	
Morinda citrifolia	VellaiNuna	T	
Mimusops elengi	Magizham	T	
Millingtonia hortensis	Mara Malli	T	

Scientific Name	Local Name	Habit	Planting Zones
Peltophorum pterocarpum	Perunkonrai	T	
Putranjiva roxburghii	Irukolli	T	
Saraca indica	Asokan		
Terminalia arjuna	Neer Marudhu	T	
Terminalia bellirica	Thani, Thandri	T	
Vettiveria zyzanioides	Vettiver	G	

124. **Impacts on Biological Environment.** The project is unlikely to change or influence biological environment, flora and fauna of the region as most of the area falls under the urban and peri-urban regions. The influence of the linking canal and the trees, herbs and shrubs cleared for the purpose is minimal. The project is expected improve the overall drainage and flood system and will interconnect the water bodies within the project area, which will meet the environmental water need within and around the project area. This in turn will contribute positively to biodiversity of the region. Project will improve the microclimatic conditions in long-term and can contribute to mitigating the climate change impacts. Project is unlikely to cases any structural changes in long run, such as change in the topography, geology, soil, temperature and vegetation, and combination of any of these components.

125. Project area is located on the Coromandel coast of the Bay of Bengal, and due to topography, the storm water ultimately flows into sea. The project will not alter this situation. In the existing condition, high siltation and entry of wastewater into coastal water are some of the main issues that affected the coastal areas, including the current highly degraded state of Ennore Creek. This project will positively contribute to improve the situation. Nearly 60 km of storm water drain network, 2 pumping station and some discharge points fall within the CRZ area, and works cannot be initiated until the clearance from TNSCZMA is obtained.

126. Project is unlikely to have any significant impacts on Ennore Creek which is located on the far end of the project area, and that receives storm water / runoff from the project area. Ennore Creek was once a biodiversity hotspot and now highly degraded due to various urban and industrial activities in the surroundings. Any changes in water quality of creek during and after monsoon and cyclonic events including, temporary increases in the concentration of more pollutants and toxics levels, will affect the coastal estuarine ecosystems. The project however likely to have positive impact on the creek as it will improve quality of water flowing into the creek. Besides desilting of canals and drains and providing proper storm water drainage system, the proposed project design also considers minimizing the silt flow in the system (via silt traps) that ultimately ends up in inland and/or coastal waters. With the sewerage projects planned and implemented by CMWSSB in the project area, and with strict enforcement to prevent illegal wastewater entry into the storm water drains, the project will benefit the terrestrial and coastal environment greatly in a long run.

127. There may be physical impacts on coastal habitats due to erosion and deposition associated with frequency and volume of runoff that alters estuarine habitat. As stated above, this project will avoid excess siltation, and therefore this impact is likely to be insignificant. Sediments will be trapped along the drains and removed. There is no excess sediment load carried during heavy flood from the project area that may have impact on the benthic diversity of the estuary. Since the ecological system is already under huge stress due to the industrial and domestic pollution, the project will improve the existing condition positively.

128. The sudden discharge of fresh water into the estuarine system may cause short term impact and shock on the estuarine biodiversity. This impact is unlikely as the proposed project

will not alter the flow volumes from the baseline condition. Project will only facilitate smooth functioning of the existing system, by provision of new drains, repairing of existing drains, and restoring connections etc. In fact, the proposed system will avoid sudden discharge of fresh water into estuary or coastal waters, as it will enhance the holding capacity of inland water bodies and streamline the functioning of the drainage system. There will be less likelihood of flooding, and no requirement of sudden discharge via pumping during monsoons.

129. Water quality of Kosasthalaiyar River, Surplus channels, Buckingham and Ennore creek will be tested pre, during and post construction and operation phase to monitor the changes in water quality as per the baseline condition.

130. **Utilities**. The site preparation for construction may result in loss or relocation of certain utilities and amenities namely telephone lines, electric poles, and wires, water, and sewer lines, if exists within the proposed project locations may require to be shifted. People dependent upon these utilities and amenities may experience inconvenience and economic loss. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with the GCC will

(i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during the construction phase;
(ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services, and
(iii) Contractor to provide prior (at least 1 week) information to public on likely utility service disruptions, and contingency measures to be put in place.

131. **Social and Cultural Resources – Chance find protocol**. Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will occur in project sites construction of drains and pumping stations. Although Chennai has rich history and heritage, the project areas which is an extended area of the Greater Chennai Corporation in its northern limits, is not known to have places of archeological or historical or cultural importance. Therefore, potential of discovering such remains may be very low. However, following protocol will be in place to account for any chance finds. GCC and its contractor needs to follow chance find protocol to ensure that any chance finds are recognized, and measures are taken to ensure they are protected and conserved.

(i) Construction contractors should follow chance find measures in conducting any excavation work
(ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work
(iii) Stop work immediately to allow further investigation if any finds are suspected;
(iv) Inform archaeological department / ASI if a find is suspected and take any action that they require to ensure its removal or protection in situ.

132. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas**. Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites that are to be considered will not promote instability and destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposal near water bodies.

133. **Site selection of sources of materials**. Significant quantities of coarse aggregate and fine aggregate will be required for construction works. The contractor should procure these materials only from the approved quarries. The contractor should, to the maximum extent possible, procure material from existing quarries, and the creation of new quarry areas should be avoided as far as possible. If new quarries are required then the contractor will be responsible for obtaining all permissions and clearances, including environmental clearance for mining. The contractor should factor the time required for obtaining clearances including the conduct of EIA if required under the law. It will be the construction contractor's responsibility to verify the suitability and legal status of all material sources and to obtain the approval of the Department of Geology and Mining and local revenue administration, as required.

B. Construction Impacts

134. Civil Works include the construction of stormwater drains along roadsides and stormwater pumping stations at Kargil Nagar and Ernavoor. These works will be confined to sites, and construction will include general activities like site clearance, excavation, construction of drains, disposal of surplus earth and creation of concrete structures for stormwater pumping stations with electromechanical installations. Since these works are confined to the sites, there is no direct or significant interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps, etc., will have negative impacts, which need to be avoided or mitigated properly. Drains will be constructed by the open cut method. Open cut trenching method of construction of drain involves trench excavation in the road, construction of drains, refilling with the excavated soil and disposal of surplus earth. All drains will be of RCC with size range from 0.60 x 0.75 m to 10.0 x 2.0 m. Proposed Drain sizes are given in the following table.

Table 39: Proposed Drain sizes

Sl No.	Drain Size (m)	Length (km) (new + rehabilitation / replacement)
1	0.6X0.75	146.49
2	0.9x0.9	310.30
3	0.9x1.05	1.48
4	0.9x1.2	0.18
5	1.2x1.2	29.23
6	1.5X0.9	71.51
7	1.5x1.5	62.34
8	1.8x1.5	22.54
9	1.8x1.8	16.97
10	2X1.5	12.10
11	2x2	24.51
12	2x3	0.54
13	2.5x1.5	0.37
14	2.5x2	8.99
15	2.5x2.5	1.52
16	3X1.5	1.90
17	3X2	13.33
18	3x2.5	0.06

Sl No.	Drain Size (m)	Length (km) (new + rehabilitation / replacement)
19	3x3	1.17
20	3.5X2	2.42
21	3.5x2.5	0.23
22	4X2	5.86
23	5x2	10.64
24	5X2.5	3.20
25	5x3	1.27
26	6x2	7.43
27	7X2	0.51
28	7x2.5	1.23
	Total length	**758.34**

135. Earthwork excavation will be undertaken by machine (backhoe excavator) and include danger lighting and using sight rails and barricades. The work will also be supplemented manually where there is no proper working area (e.g., very narrow streets) for the backhoe excavators. Excavation and digging of trenches during construction had the potential to cause erosion and cave-ins thereby causing soil erosion, silt runoff and unsettling of street surfaces. Unorganized disposal of the excavated earth can disturb the street surface and decrease the aesthetic and economic values of the area. The activity will be a discomfort to the road users and inhabitants.

136. During construction, precautionary measures will be taken; proper backfilling trenches will be done. Temporary access, diversions, and signboards for pedestrians will be provided. Surplus excavated earth will be disposed to Kodungaiyur dumping yard.[7]

137. **Site Preparation.** The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:

(i) Limiting the surface area of erodible earth material exposed by clearing and grubbing;
(ii) Conservation of top soil and stock piling and
(iii) Carry out necessary backfilling of pits resulting from uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.

138. **Sources of Materials**. The source of water for construction shall be arranged by the Contractor through the Tamil Nadu Water and Drainage Board and/or GCC. About 4,50,000 cum amount of sand and about 8,90,000 cum of coarse aggregate will be required for this project, which will be sourced from approved quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or leveling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation.

[7] Owned and managed by Chennai Corporation.

It will, therefore, be important to ensure that construction materials for this project are obtained from government-approved licensed quarries only, to ensure these controls are in place. The contractor should avoid new borrow pits/quarries as far as possible, if necessary, all the permissions, including the conduct of environmental assessment, and environmental clearance as necessary shall be obtained before the start of quarrying activity. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

(i) Obtain construction materials only from government-approved quarries with prior approval of PIU
(ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval
(iii) Contractor to submit to PIU every month documentation on material obtained from each source (quarry/ borrow pit)
(iv) Avoid the creation of new borrow areas, quarries, etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, including Environmental Clearance (EC) prior to approval by PIU.

139. **Disposal of excess earth/ surplus materials and debris.** The proposed construction activities), shall generate an estimated 2 million cubic meters of surplus earth and debris. The possibilities of recycling the surplus earth for the construction purposes shall be explored, and unutilized surplus earth materials, will be disposed / dumped in the Kodungaiyur dumping yard (which is owned and managed by Chennai Corporation). Zone wise the estimated quantity of the surplus materials/ excess earth is given in the following table.

Table 40: Zone wise Surplus Earth Quantity

Sl.no	Zones	Quantity in cu.m
1	Zone A	15,302
2	Zone B	161,186
3	Zone C	75,957
4	Zone D	321,020
5	Zone E	281,585
6	Zone F	5,617
7	Zone G	180,204
8	Zone G -P	310,663
9	Zone H	76,779
10	Zone H - P	140,566
11	Zone I	286,342
12	Zone J	108,071
13	Zone K	51,716
Total		**2,015,007**

140. Proposed desilting of drains and surplus canals is likely to generate nearly 150,000 m^3 of sediment/silt. As per the sediment analysis presented in Description of the Environment Section, silt/sediment does not contain hazardous materials. It can be reused in construction purposes or the excess shall be disposed in the Kodungaiyur dumping yard and Perungudi Dump Yard of GCC. However, during the construction, the property of sediment shall be rechecked, if it is found to be hazardous, it will be disposed at a hazardous waste disposal site authorized by TNPCB.

(i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in **Appendix 3**)

(ii) As far as possible utilize the debris, silt and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.
(iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately (Kodungaiyur dumping yard and Perungudi Dump Yard of GCC are the identified dumping areas for the project).
(iv) Surplus soil may be used as daily cover / intermediate cover at the dump site
(v) Monitoring the quality sediment/silt generated from desilting activity for presence of hazardous substances and follow the suitable method as per the quality; hazardous material should be disposed at hazardous waste disposal facility approved by TNPCB.

141. **Air Quality**. Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Significant quantities of earthwork will be conducted spreading all over the project area. 30% of the excavated soil will be reused for filling the trenches. Also, emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and an increase in the concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites like storm water pumping stations etc. will be mainly during the initial construction phase of earthwork, as the site is confined, dust can be effectively controlled with common measures. Dust generation will be significant during drain construction along the roads. An increase in dust/ particulate matter in ambient air is detrimental and may have adverse impacts on people and the environment. To mitigate the impacts, contractors will be required to:

1. For all construction works

(i) Provide a dust screen around the construction sites of storm water pumping stations.
(ii) Damp down the soil and any stockpiled material on-site by water sprinkling.
(iii) Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition
(iv) Apply water before levelling or any other earth-moving activity to keep the soil moist throughout the process
(v) Cover the soil stocked at the sites with tarpaulins
(vi) Control access to the work area, prevent unnecessary movement of the vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation
(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate, etc.,) when transported by open trucks.
(viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area
(ix) Clean wheels and undercarriage of haul trucks before leaving the construction site
(x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have valid pollution under control (PUC) certificate

2. For all linear (drain/surplus drain) works

(i) Barricade the construction area using hard barricades (of 2 m height) on both sides
(ii) Initiate site clearance and excavation work only after barricading of the site is done
(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.,), to the barricaded area
(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area
(v) Undertake the work section wise, a 500m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones
(vi) Conduct work sequentially - excavation, drain construction, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done.
(vii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement, and wind will generate dust from the backfilled section.

142. **Desilting and Handling of Sediment/silt**. The project requires desilting of existing drains and surplus canals to remove the accumulated bottom sediment. As the silt is mixed with the water, handling and transport of silt/sediment in semi-solid / slurry form will lead to spillage of contaminated water/slurry and may contaminated land and nearby water bodies. Although sediment does not contain hazardous substances, poor condition of existing drains with accumulated water, potentially mixed with wastewater in some places, may present hazardous conditions for removal of sediment/silt. Surplus canals are seasonal and flow only during rains, works will be certainly conducted in the dry season. Following measures are suggested to avoid environment and health impacts:

(i) Desilting process of surplus canals shall be conducted during the no flow season only
(ii) Prior to desilting process, the drains shall be allowed dry so that there is no standing water on silt / sediment
(iii) Do not conduct manual desilting process, use appropriate equipment / implements
(iv) Desilting shall be conducted in small sections, accumulated water, if any shall not be pumped out, but pumped to adjoining section within the same drain
(v) Desilting process shall be conducted in such a way that water content of the silt/sediment is low, so that contaminated water is not spilled during the loading, transport and unloading process. The excavated sludge shall be placed temporary in dry areas / desilted portion / banks of the canal/ drain, which will allow the water content in the sludge to drain back to the canal; in no case contaminated water is allowed to flow outside the drain/canal
(vi) Workers shall be provided with appropriate PPE's; masks with oxygen cylinders shall be made available at the site, which shall be utilised during emergency.

143. **Surface Water Quality**. Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate the water quality of the receiving water bodies and streams/rivers. There are eight major lakes (Ambattur, Kolathur, Korattur, Retteri, Madhavaram Periaythoppu (Mathur), Sadanyankuppam, Ariyalur, Kadapakkam) and Puzhal Lake (outside GCC Boundary) and 71 minor lakes in and around the project area. Surface runoff from

the project area ultimately drains into Kosasthalaiyar watershed and dispose into Ennore Creek. Runoff from the construction areas, which may contain silt and chemical traces that must not enter the river and the water bodies. The Impact will be temporary, and but needs to be mitigated. Contractor will be required to:

(i) All earthworks are conducted during the dry season to prevent the problem of soil/silt run-off during rains
(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
(iii) Prioritize the re-use of excess spoils and materials in the construction works. If spoils will be disposed off, only designated disposal areas shall be used;
(iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
(vi) Store fuel, construction chemicals, etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management
(vii) Dispose of any wastes generated by construction activities in designated sites; and
(viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).

144. **Surface and Groundwater Quality**. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. State Ground and Surface Water Resources Data show that areas close to Chennai coast having ground water table below 2 to 3m during rainy season and 4 to 5m during rest of the year. In the project area, the groundwater table is deeper than the anticipated excavation depth and therefore this impact is not envisaged. However, during the rains, water will be collected in open pits and trenches. The water collected in excavated pits will contain silt and disposal of this in drainage Canals lead to silting. To avoid this the contractor needs to implement the following measures:

(i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of the work area
(ii) Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose off only clarified water into drainage Canals/streams after sedimentation in the temporary ponds
(iii) Consider safety aspects related to pit collapse due to accumulation of water.

145. **Management of flood and drainage during construction works.** As per the implementation schedule the project construction period is between 24 to 36 months, during which the construction shall face minimum 2 monsoon seasons. Project area has almost flat terrain, and flood prone. Works involves repair and rehabilitation of existing 175 km drains and 11 km length of four surplus canals. The improvement works may interfere with the storm water and flood management system of the project areas, especially during the rains. Following measures shall be implemented:

(i) Contractor in coordination with GCC to plan and schedule the existing drains rehabilitation and surplus canal works duly considering the flood management aspect

(ii) Plan existing drains rehabilitation and surplus canal works during dry season and ensure that works are complete before the onset of monsoon
(iii) If the full works cannot be completed within one dry season (which is likely as the construction period is at least 2 years), works shall be conducted section-wise so that surplus canals and/or existing drains are put into operation prior to onset of monsoon; work sections shall be cleared of construction materials, debris and any obstructions creating for construction shall be removed
(iv) To safeguard works and avoid flood/ water logging, the contractor will prepare a suitable site-specific temporary drainage management plan (including emergency response, clean-up kit and trained personnel, to assist with mitigating the damage) and will implement the same.

146. **Impacts on Biological Environment.** Most of the project area is characterized by urban and semi urban areas. About 2.5 percent of the area is in coastal regular zone, including. The Ennore Creek into which project area drains, joining ultimately the Bay of Bengal. Proposed drains works are mostly located along the roads, and these works are unlikely to cause any impacts on biological environment. About 60 km of drain work is located in CRZ II, which is basically already developed areas. Two pumping stations are also located in CRZ, in a vacant land along Buckingham canal. There are also some works located close to the sea CRZ IVA and IVB, but these are just fraction of total works – about 1.6 km length at various places. These are mainly to connect to the discharge point. Works in the CRZ will be implemented only after obtaining clearance from the TNSCZMA, and GCC will comply with conditions, if any laid down by TNSCZMA.

147. The construction phase will involve a series of activities that can potentially cause topsoil erosion and sedimentation, especially during the monsoon. Flooding or silt laden runoff, which may also be contaminated due to mixing of construction materials and spills, generated from construction may increase the silting and contamination of water bodies. Runoff can wash sediments into the Ennore creek and can alter the water quality. Sediments play an important role in elemental cycling in the aquatic environment, Sediment deposition creates habitats for aquatic life, and while too much sediment can be detrimental can cause poor water quality and algal blooms. Measures already provided under Surface water quality such as avoiding works during monsoon, protecting sites to avoid runoff, and management of runoff and flood during monsoon, etc. will minimize the water quality and sediment issues. Presence of workforce, materials and machinery in coastal zone, especially near the Ennore Creek, may disturb/damage the environment, flora and fauna, if due care is not taken. Following measures need to be implemented:

(i) No works in the CRZ shall be until clearance under CRZ Notification, 2019 is obtained and complied with conditions, if any, stipulated therein.
(ii) Implement all measures suggested to manage surface water runoff and quality during the construction works
(iii) Where necessary, before the monsoon measures actions like, diversion ditches can be created in order to intercept and slow down the speed of runoff into the Creek; small, compacted soil berms can be created to intercept runoff and reduce erosion and sediment transport and can reduce the area of water displacement.
(iv) Conduct monitoring of sediment and water quality in water bodies and creek as per EMP
(v) Do not use heavy equipment on the coastal zone; use machinery to the minimum possible extent, and restrict the movement to drain/work area
(vi) Do not place / store materials, waste or debris in the coastal zone

(vii) Do not remove vegetation or trees
(viii) Create awareness among the workers and staff on the coastal environment sensitivity and ensure no damage/disturbance to flora and fauna.

148. **Generation of Construction Wastes/debris.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels, and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

(i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in **Appendix 3**)
(ii) Solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to the designated solid waste disposal site; create a compost pit at designated sites for disposal of biodegradable waste; non-biodegradable waste shall be collected separately and disposed to approve designated areas.
(iii) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of in disposal sites approved by TNPCB
(iv) Prohibit burning of construction and/or domestic waste
(v) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins and create awareness to use the dust bins.
(vi) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that the site is properly restored before issuing of construction completion certificate.

149. **Noise and Vibration Levels**. The sensitive receptors are the general population in these areas. An increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for drain construction, operation of construction equipment, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have an impact on nearby buildings. This impact is negative short-term, and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in the least disturbance
(ii) Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and
(iii) Maintain maximum sound levels not exceeding 80 decibels (dB (A)) when measured at a distance of 10 m or more from the vehicles.
(iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity
(v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach
(vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

150. **Accessibility and Traffic Disruptions**. Excavation along the roads for drain construction, hauling of construction materials and operation of equipment on-site will cause traffic problems. There are four types of roads in the project area that provide regional connectivity viz National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District Roads (ODR). Drains are proposed along:

(i) NH 5 Chennai – Kolkata Highway
(ii) NH 716 Chennai – Tirupathi Highway
(iii) SH 56 – Thiruvottiyur – Ponneri State Highways
(iv) Inner Ring Road (IRR),
(v) Chennai bypass road.

151. National Highway and State Highways carry considerable traffic, followed by other roads. Drains will also be constructed along the internal main roads that provide connectivity within the city. These include Thiruvottiyur high road, Manali high road, Madhavaram high road, Ennore high road, etc., these roads also carry a considerable flow of traffic and are centres of commercial activities. Internal roads in the project area are narrow, and in outer areas roads are comparatively wide. As the drains are proposed to be constructed within the road carriageway, it will disrupt traffic in one-lane. Works related to all the remaining components (storm water pumping stations) will be confined to the selected sites, therefore there is no direct interference of these works with the traffic and accessibility.

152. Hauling of construction material, equipment, construction waste, etc., to and from the work site may increase the road traffic on local roads. This will further inconvenience the local community and road users. The potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

1. Drain Construction

(i) Prepare a traffic management plan for drains works along the roads
(ii) Provide safe and clearly marked lanes for guiding road users.
(iii) Provide safe and clearly marked buffer and work zones
(iv) Provide adequate measures that control driver behaviour through construction zones.
(v) The primary traffic control devices used in work zones shall include signs, delineators, barricades, cones, pylons, pavement markings and flashing lights.
(vi) Advance traffic updates/ information on communication systems for users of affected roads.
(vii) Efforts will be given to divert traffic to roads wide enough to accommodate extra traffic
(viii) Prepare a drain construction implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in a sequential way so that public inconvenience is minimal
(ix) Plan the drain work in coordination with the traffic police; provide temporary diversions, where necessary and effectively communicate with the general public

(x) Avoid construction work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience
(xi) Undertake the work section wise, a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones
(xii) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from the site/ or brought to the as and when required
(xiii) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period
(xiv) Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided
(xv) Provide pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access.
(xvi) Inform the local population 1-week in advance about the work schedule
(xvii) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.
(xviii) Keep the site free from all unnecessary obstructions;
(xix) Warn the road user clearly and sufficiently in advance. Notify affected public by public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services
(xx) At work site, public information/caution boards shall be provided including contact for public complaints.

2. Hauling (material, waste/debris, and equipment) activities

(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except near delivery sites
(ii) Schedule transport and hauling activities during non-peak hours;
(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
(iv) Drive vehicles in a considerate manner
(v) Notify affected public by public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/complaints.

153. **Socio-Economic – Income.** Sites for Storm water Pumping Station (SWPS) components are carefully selected in government-owned vacant lands and therefore there is no requirement for land acquisition or any resettlement. Blocking of access to the business/livelihood activities, especially during drain construction along the roads, may impact the income of households. However, given the alignment of drain within the road carriageway, and also the measures

suggested for ensuring accessibility during drain construction, no notable impact is envisaged. Some shops and other premises along the roads may lose business income if the access will be impeded by the excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio-cultural places, etc., will cause inconvenience to the public. Implementation of the following best construction measures will avoid the disturbance to reduce the inconvenience and disturbance to the public. Resettlement and social issues are being studied in a parallel resettlement planning study of this project.

(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;
(ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches
(iii) Barricade the construction area and regulate the movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around
(iv) Control dust generation
(v) Employee best construction practices, speed up construction work with better equipment, increase the workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools;
(vi) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
(vii) Provide signboards for pedestrians to inform the nature and duration of construction works and contact numbers for concerns/complaints.

154. **Socio-Economic – Employment**. Manpower will be required during the 36-months construction stage. This can result in the generation of temporary employment and an increase in local revenue. Thus, potential impact is positive and short-term. The Contractor will be required to:

(i) Employ local labour force as far as possible
(ii) Comply with labour laws.

155. **Occupational Health and Safety**. It is estimated to have 250 construction labours/ workers. Workers need to be mindful of the occupational hazards which can arise from working in confined areas such as trenches, working at heights, near the heavy equipment operating areas, etc. Potential impacts are negative and short-term but reversible by adopting suitable mitigation measures. The Contractor will be required to:

(i) Follow all national, state and local labour laws (an indicative list is given in **Appendix 2**);
(ii) Develop and implement site-specific occupational health and safety (OHS) Plan which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training[8] for all site

[8] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and

personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health, and Safety Guidelines[9].

(iii) Ensure that qualified first-aid personnel/specialist is available at all times in the project site. Equipped first-aid stations shall be easily accessible throughout the sites

(iv) Secure all installations from unauthorized intrusion and accident risks

(v) 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

(vi) 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

(vii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas

(viii) Ensure moving equipment is outfitted with audible back-up alarms

(ix) 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

(x) Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

(xi) Provide supplies of potable drinking water

(xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances

(xiii) COVID-19. WHO has declared COVID-19 as a pandemic which has affected entire world including India. In view of the prevailing COVID-19 pandemic, the contractors and workers would need to take additional measures to avoid the spread of the disease and shall follow various guidelines/guidance notes issued by the national/state government, WHO, ILO, World Bank/IFC from time to time. As described in these guidelines, the Contractors shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to GCC and PSC for approval. A brief guidance on "To Do" List prepared from these documents is provided in **Appendix 14**.

156. **Community Health and Safety**. Drain construction along the roads and narrow streets and hauling of equipment and vehicles have the potential to create safety risks to the community. Trench excavations without any proper protection may endanger the close-by buildings. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collisions with pedestrians. The potential impact is negative but short-term and reversible by mitigation measures. The contractor will be required to:

(i) Confine work areas; prevent public access to all areas where construction works are on-going through the use of barricading and security personnel

monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

[9]http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES

(ii) Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation
(iii) Minimize the duration of time when the drain trench is left open through careful planning; plan the work properly from excavation to refilling and road relaying
(iv) Control dust pollution – implement dust control measures as suggested under air quality section
(v) Ensure appropriate and safe passage for pedestrians along with the work sites
(vi) Provide road signs and flag persons to warn of on-going trenching activities.
(vii) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency)
(viii) Enforce strict speed limit (20 kmph) for plying on unpaved roads, construction tracks
(ix) Provide temporary traffic control (e.g., flagmen) and signs where necessary to improve safety and smooth traffic flow
(x) Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided to ensure that vehicles join the road in a safe manner.
(xi) At sensitive locations particularly where there are schools and markets close to the road, awareness of safety issues will be raised through neighbourhood awareness meetings
(xii) All drivers and equipment operators will undergo safety training
(xiii) Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

157. **Safety Requirements for Deep Trench works**. Deep trench works should be carried out as per the instructions received from the PSC. The following safety mitigation measures should be adopted:

(i) Sides of excavation shall be inspected by PSC during the course of excavation from time to time and after every rain, storm or other hazard-increasing occurrence and protection against slides and cavings shall be increased, if necessary
(ii) Complete information on the underground structures (such as water pipelines, sewers, gas mains, electrical conduit system and other civic facilities) should be collected before doing the excavation work. Proper precautions shall be taken to prevent accident to the workmen engaged in excavation work and calamities for the general public
(iii) Where medical facilities (including hospitals) are not available nearby, first-aid kit should be available. This shall be kept at a conspicuous place in the charge of trained person(s). The kit shall be recouped periodically.
(iv) Labors shall be instructed to use safety devices and appliances provided to them whenever it is necessary to do so
(v) Labors who are not aware of the hazards peculiar to the work shall not be permitted to proceed with the work without being properly instructed.
(vi) Safety helmets shall be worn by all persons entering trench where hazards from falling stones, timber or other materials exist
(vii) Appropriate safety footwear (rubber boots, protective covers, etc.,) shall be worn by labours who are engaged in work requiring such protection
(viii) All trenches in soil more than 1.5 m deep shall be securely shored and timbered.
(ix) All trenches in friable or unstable rock exceeding 2 m in depth shall be securely shored and timbered

(x) Where the sides of trenches are sloped but not to within 1.5 m of the bottom, the vertical sides shall be shored and the shoring shall extend at least 30 cm above the vertical sides. When open spaced sheathing is used, a toe board shall be provided to prevent material rolling down the slope and falling into the part of the trench with vertical walls.

(xi) Shoring and timbering shall be carried along with the opening of a trench but when conditions permit, protection work, such as sheet piling may be done before the excavation commences.

(xii) Approved quality of sal wood shall be used for shoring and timbering a trench. Any other structural material having strength not less than that of sal wood may also be used for the purpose.

158. **Construction Camps.** The contractor may require to set up construction camps – for the temporary storage of construction material (cement, aggregates, steel, fixtures, fuel, lubricants, etc.,), and stocking of surplus soil, and may also include separate living areas for migrant workers. The contractor will, however, be encouraged to engage local workers as much as possible. Operation of work camps can cause temporary air, noise and water pollution, and may become a source of conflicts, and the unhealthy environment if not operated properly. Potential impacts are negative but short-term and reversible by mitigation measures. The contractor will be required to:

(i) Consult PIU before locating project offices, sheds, and construction plants;

(ii) Select a campsite away from residential areas (at least 100 m buffer shall be maintained) or locate the campsite within the existing facilities of GCC offices

(iii) Avoid tree cutting for setting up camp facilities

(iv) Provide a proper fencing/compound wall for campsites

(v) The campsite shall not be located near (100 m) water bodies, flood plains flood-prone/low lying areas, or any ecologically, socially, archeologically sensitive areas

(vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit

(vii) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers

(viii) Camps shall be provided with proper drainage, there shall not be any water accumulation

(ix) Provide drinking water, water for other uses, and sanitation facilities for employees

(x) Prohibit employees from cutting of trees for firewood; the contractor should provide cooking fuel (cooking gas); firewood is not allowed

(xi) Train employees in the storage and handling of materials which can potentially cause soil contamination

(xii) Wastewater from the camps shall be disposed of properly either into the sewer system; if the sewer system is not available, provide on-site sanitation with a septic tank and soak pit arrangements

(xiii) Recover used oil and lubricants and reuse or remove from the site;

(xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in the local market

(xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and

(xvi) On completion of works, the camp area shall be cleaned and restored to pre-project conditions and submit a report to PIU; PIU to review and approve camp clearance and closure of worksite.

C. Operation and Maintenance Impacts

159. Operation and Maintenance (O&M) of the storm water drainage system during defect liability period (DLP) and after DLP will be carried out by Contractor and GCC respectively. Operation impacts of storm water drains include:

(i) Contamination of storm water due to the mixing of sewage or industrial wastewater
(ii) Clogging of drains due to deposition of eroded soil, improper cleaning.

160. **Contamination of storm water due to the mixing of sewage or industrial wastewater:** To enhance the drain water quality, it is necessary to divert/avoid the sewage water entering into the drains. The proposed storm water drain is designed to prevent the entry of sewage or industrial wastewater. However, in some area though UGSS exists, individual house connections are yet to be provided, for those cases, there are possibilities in which the proposed storm water drain may be used. Hence, GCC should have an appropriate mechanism in monitoring and controlling the same. GCC should take necessary measures to avoid the sullage/sewage intrusion into the drain by implementing house service connection to all households within the project area. However, during the construction of storm water drains, to avoid spilling of sullage/sewage, rider sewers or diversion of an existing connection to nearby manholes are proposed. The contractor and GCC needs to check the water quality monitoring at regular intervals as prescribed in the Environmental Monitoring Program.

161. **Regular maintenance**: To enhance the drain water quality, regular maintenance should be considered by de-silting the drain prior to monsoon, clearing of vegetation along the drain, immediate repairing of damaged structures and conducting awareness programs to the people residing next to project drains.

162. **Clogging of drains due to deposition of eroded soil, improper cleaning:** Storm drains become clogged by deposition of silt and sand that form pools in which debris and other solid materials accumulate. Storm drains are sometimes misused as a receptacle for rubbish, waste building materials, ashes and other solid wastes deposited in them through inspection door or unauthorized openings. To avoid solid waste dumping into the stormwater, drain, the major and micro drains are designed as box type drain in RCC with a cover on top and inspection door at every 10 m interval to remove the accumulated silt/debris. In closed drains, super sucker machines are used to remove the accumulated silt/ debris. Major surplus canals where open drains exist with retailing wall, machineries such as amphibian vehicle and robotic excavators are used to remove the accumulated silt/debris/hyacinth.

163. Micro drains will be constructed as box type drain in RCC with a cover on top which will curtail dumping of solid waste in drains. Major macro drains belonging to Greater Chennai Corporation will be constructed as open drains with both side cover in MS frame with wire mesh to avoid dumping of solid waste.

164. **Solid waste management.** At present, GCC is having an effective solid waste management system. However, the people living nearer to water bodies and the commercial

pockets that exist near Water bodies are tending to throw solid waste into the water bodies. Therefore, the following practices are proposed in the SWD of the Kosasthalaiyar Basin.

(i) Major and Micro drains are designed as box type drain in RCC with a cover on top which will prevent dumping of solid waste in drains.
(ii) Major surplus canals where open drains exist with retailing wall, fencing on both sides of the canal is proposed to avoid solid waste disposal.
(iii) Major surplus canals where open drains exist without retailing wall, retaining wall and fencing on both sides of the canal is proposed to avoid solid waste disposal.
(iv) Rainwater will flow into drains through FRP gratings to screen the solid waste from entering into drains.
(v) Public awareness programs have been proposed to ensure public co-operation for proper waste disposal.

165. **Disaster management and Emergency Response.** The study area is a coastal city, and is vulnerable to various disasters, and most profound is water logging and flooding during rains. GCC has prepared a Disaster Management Plan in 2017 to assist and guide all the stakeholders in disaster management. The plan follows the approaches suggested in Sendai Framework for Disaster Risk Reduction, 2015-2030. Plan covers 28 disasters grouped in 5 subgroups including both natural and manmade disasters. Disaster management systems at Chennai district level includes District Disaster Management Committee, Disaster Management Teams, Crisis Management Groups, Emergency Operation Centre, Site Operation Centres, and modalities of involvement of army and other defense forces, NGOs and other institutions. Pre monsoon preparedness activities are conducted at various levels, and Indian Mereological Department rain, flood and cyclone warnings are integrated into the system. Control rooms established to monitor the activities, especially during monsoon. Overall, a robust disaster management system exists in Chennai. Under Output 2 of this project, it is also proposed to further enhance capacity of GCC and communities in urban flood preparedness in the project area.

D. Associated Facilities

166. As stated earlier, three macro drains / surplus canals in the project area are proposed to be improved by PWD either with state funds or with external financial support. These drains are: Retteri Surplus (2.01 km), Puzhal Surplus (12.23 km) and Thanikachalam Drain (3.62 km). PWD has already the DPR has been prepared. As per the SPS “associated facilities” are those that are not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project”. These surplus canals already exist and proposed improvements although required, may not be essential for the viability of the ADB project. Therefore, these are not considered as associated facilities.

167. The improvement works proposed by PWD for improvement of surplus canals is similar to improvements proposed for surplus canals under the ADB funded IUFMCKB Project. The project sites are also located in the same project area – Chennai – Kosathalaiyar River basin. In terms of compliance with government laws and regulations, works proposed by PWD does not attract EIA Notification, 2006, and therefore, will not require an EIA study or environmental clearance. As per the CRZ notification 2019, some of the proposed works fall under the coastal regulation zone (CRZ). A section of the existing Puzhal surplus canal is traversing through CRZ 1B. Hence any improvement in that section shall attract CRZ clearance. It also has few storm water discharge locations within the CRZ 1B. For the works located in the CRZ, prior clearance/no objection from the Tamil Nadu State Coastal Zone Management Authority (TNSCZMA) is required.

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

168. The active participation of stakeholders including the local community, NGOs, etc., in all stages of project preparation and implementation, is essential for the successful implementation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

169. Most of the main stakeholders have already been identified and consulted during the preparation of this IEE, and any others that are identified during the project implementation will be brought into the process in the future. Primary stakeholders of the subproject are the residents, owners/ tenants of the commercial establishments who live and work near sites where facilities will be built (stormwater drain network and pumping stations), government and utility agencies responsible for the provision of various services in the project area. Secondary stakeholders are the NGOs working in the area, community representatives, the beneficiary community in general, government agencies, TNSCZMA, Government of Tamil Nadu.

170. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design, and construction. The project proposal is formulated by Greater Chennai Corporation in consultation with the public representatives in the project area to suit their requirements.

B. Stakeholders Consultation during Project Preparation

171. Stakeholders were consulted via a city-level consultation meeting and a several focus ground discussions during the project preparation to disseminate project information and also to elicit the feedback. Details of these consultation meetings are provided below:

1. City-level Stakeholder Consultation Meeting

172. The stakeholder consultation meeting was held on 06.11.2017 at conference hall of Greater Chennai Corporation. It was attended by all relevant officials from GCC, PWD, CMWSSB, TNEB & TNUIFSL, NGO's, Members from various associations, Residents & General public from relevant zones. Details of Participants and the minutes of the meeting are given **Appendix 8**.

173. The meeting was chaired by the Dr.D. Karthikeyan I.A.S., Commissioner, Greater Chennai Corporation and welcome note was given by Superintending Engineer (SWD) GCC. The presentation started with the DPR consultant elaborating the details of the drains and alignments. The DPR consultant explained the project background, present and future scenario of the project, general arrangement of proposed canals and improvement proposal for the water bodies with relevant photographs and animations. The consultant described water logging areas and the narrow stretches of the outlets and inlets in various locations of the project area. Various benefits like flood management, ground water recharging, reduction in water logging, removal of encroachments, etc. were put forth in the meeting.

Dr. Karthikeyan I.A.S., Commissioner, Greater Chennai Corporation chairing the session.

DPR consultants explaining the project

174. After the PowerPoint presentation, the Commissioner, Greater Chennai Corporation invited the stakeholders to give their suggestions and comments on the project. Feedback forms were distributed to the audience of the meeting to give their suggestions and comments on the project. Majority of stakeholders appreciated the project. The format of feedback form formulated in a view to provide full freedom for the stakeholders to register their comments/suggestions. The feedback forms collected from stakeholders and are given in the **Appendix 8**. The details of the queries raised by the stakeholder and the replies are given in below.

(i) **Queries raised by Arropor Iyakkam (NGO)**

Sl. No	Queries raised by Arropor Iyakkam (NGO)	Response by Superintending Engineer (SE)
1.	Construction of the Drains should be provided to carry the capacity of the Storm Water during rainy seasons	The drains were designed scientifically based on the past 46 year's rainfall data. The capacity of the drains shall carry the water during rainy days.
2.	RCC drains shall be replaced by brick wall drains and with earthen base so that the water will percolate inside the ground.	RCC drains were selected based on the standards approved by Ministry of urban planning and the same has been used for ISWD drains of Adyar and Cooum basin. There will be provision of sunken wells and kerb and gutters provisions once in 30 mts along the drains to ensure, ground water percolations.
3.	Prevention of illegal sewer into storm water drains.	Illegal sewers will be prevented, once the CMWSSB covers certain areas with underground drainage, individual household connections are still not made in certain places. Once the work is completed, illegal sewer will not be allowed to let into storm water drains.
4.	If any encroachments found along the narrowed sections/mouth of the canals will be removed.	If any encroachments found along the narrow junction of outlet and mouth of drains will be removed and the affected families will be mitigated as per ADB guidelines.
5.	Whether the design considers the invert levels of the area.	Detailed studies were conducted, and modelling exercises were carried out by the DPR consultants to ensure flow and invert levels of the drains and the MFL bed levels and drain levels of water bodies.

(ii) **Query raised by Uravagal (NGO)**

Sl. No.	Queries raised by Uravagal (NGO)	Response by DPR Consultant
1.	How the displaced people will be mitigated.	The Social Safeguard Specialist of DPR consultant explained that the displaced and project affected families will be mitigated as per ADB policy framework.

(iii) **Query rose by 4M trust (NGO)**

Sl. No.	Queries raised by 4M trust (NGO)	Response by DPR Consultant
1.	How the displaced people will be provided alternate houses and mitigated?	The Social Safeguard Specialist of DPR consultant explained that the project affected families and displaced families shall be resettled, rehabilitated and mitigated as per ADB policy framework.

(iv) **Queries raised by consulting firms**

Sl. No.	Queries raised by Consulting firms	Response by DPR Consultant
1	What arrangements will be made for removal of trees along the drains	The Environmental Specialist of the DPR Consultant explained that for trees identified along the drains, detouring plans will be suggested and if any tree identified for felling, compensatory tree plantation will be made at the rate of 1: 10.

(v) **Queries raised by Public**

Sl. No.	Queries raised by Public	Response by DPR Consultant
1	What arrangements will be made to avoid water logging problem in Kargil nagar areas?	For the Kargil area and other similar surrounding places, the design team has proposed for a storm water pumping stations at few locations to avoid water logging.
2	Whether the DPR will consider providing solutions to water logging areas?	The DPR Consultant explained that all water logging areas were identified and studied along with the Flood study made by Anna University and incorporated in the design to prevent areas from water logging during rainy season and flood time.
3	Whether people will be removed from existing houses without prior intimation	The Social Safeguard Specialist of DPR consultant explained that the project affected families and displaced families shall be resettled, rehabilitated and mitigated as per ADB policy framework with prior intimation.

175. The meeting was concluded with final note from the Commissioner, GCC to proceed further for the preparation of Final DPR incorporating all feasible and viable comments given by various stakeholders presented in the meeting. The Superintending Engineer presented the Vote of Thanks and the meeting winded up with positive perception of the stakeholders.

2. Focus Group Discussions

176. Focus-group discussions (FGDs) with affected persons and other stakeholders were conducted to learn their views and concerns.

177. A number of FGDs were conducted in November and December 2020 in the project, details of which are provided below. It was observed that people are willing to extend their cooperation, as the proposed project will provide storm water drainage system, enhance basic infrastructure service levels and overall living standards of the public. The public expressed their concern regarding the safety, traffic issues, disturbance utilities during construction. Stakeholders suggested that damaged roads if any due to drain construction will be restored immediately to minimize the public inconvenience. The majority of the stakeholders appreciated the project and requested to complete the construction within a short period. Details of the FGDs are given in the **Appendix 15.** Further consultations were hampered by the ongoing coronavirus (COVID-19) pandemic and as such additional formal consultations will be undertaken once it is safe to do so and before construction commences.

Table 41: Focus Group Discussion in the Project Area

Sl.no	Phase	Date	Location of FGD	Participants			
				Total	M	F	O
1	1	01-11-2020	Sivaprakasam Nagar, Surapattu	26	20	6	-
2		07-11-2020	Sivaprakasam nagar South, Surapattu	12	8	4	-
3		08-11-2020	Arul Nagar, Surapattu	27	21	6	-
4	2	08-11-2020	Vijayalakshmipuram, Ambattur	10	6	4	-
5		18-11-2020	Rajaji Nagar, Surapattu	10	-	-	10
6		18-12-2020	Ondikuppam, Kaladipet	21	6	15	-
7	3	20-12-2020	Annai Sivagami Nagar, Ennore	21	14	7	-
8		20-12-2020	TKP, Nagar, Ernavur	16	0	16	-
9		26-12-2020	Velayudham Nagar, Tiruvottiyur	16	12	4	-

FGD conducted at Sivaprakasam Nagar, Surapattu

FGD conducted at Vijayalakshmipuram, Ambattur

178. **Future Consultations.** Consultations and information disclosure will be continued throughout the implementation. Prior to the start of construction, PIU will conduct information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, GCC websites, etc,). Constant communication will be established with the affected communities to redress the environmental issues likely to face during the construction phase. Neighborhood level meetings will be organized at important/sensitive locations as required to consult the people and receive their feedback on EMP implementation. Given the current COVID19 pandemic situation, consultations will strictly follow COVID19 appropriate procedures with all safety measures prevailing at the time. Large community group meetings will not be conducted. Consultation via virtual modes will be employed. The contractor will provide prior public information (in Tamil and English) about the construction work in the area, once in 7 days before the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in **Appendix 4**). At the worksites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure

179. An executive summary of the IEE will be translated in Tamil and made available at the offices of PMU, PIU and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. An electronic version of the IEE in English and Executive Summary in Tamil will be placed on the official website of the Greater Chennai Corporation after approval of the IEE by ADB. Stakeholders will also be made aware of the grievance register and redress mechanism. IEE will also be disclosed on ADB website. Information disclosure will continue throughout project implementation. Semi-annual Environmental Monitoring Reports (SEMR) will be posted on ADB and GCC websites for public disclosure.

180. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and plans. Prior to the start of construction, the PIU will issue Notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction sites for the information of the general public.

181. Local communities will be continuously consulted regarding the location of construction camps, access and hauling routes and other likely disturbances during construction as required. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

VIII. GRIEVANCE REDRESS MECHANISM

A. Common Grievance Redress Mechanism

182. Project Grievance redressal Mechanism (GRM) will be established at three levels and will cover both environment and social issues. The GRM will be established to evaluate, and facilitate the resolution of affected persons concerns, complaints, and grievances related to social and environmental issues related to the project in a time bound manner. GRM will be accessible, inclusive, gender-sensitive and culturally appropriate for receiving and facilitating the resolution of affected persons' grievances related to the project.

183. The GRM will be disclosed to the affected communities and households prior to the mobilization of contractors for the project. The PIU safeguard officers will be responsible for registration of grievances, disclosure and communication and timely resolution of grievances. A complaint register will be maintained at field unit and PIU level with details of complaint lodged, date of personal hearing, action taken, and date of communication sent to complainant. Contact details and the process of grievance redressal will be disclosed to the project affected communities through leaflets. Sample grievance registration form is given in the **Appendix 5**.

184. Affected persons will have the flexibility of conveying grievances/suggestions by submitting the grievance/suggestion in writing, through telephone call to Executive Engineer, PIU safeguards officer or by writing in the complaints register at the Division Office or by submitting grievance/suggestion by email to GCC.

B. Grievance Redressal Process

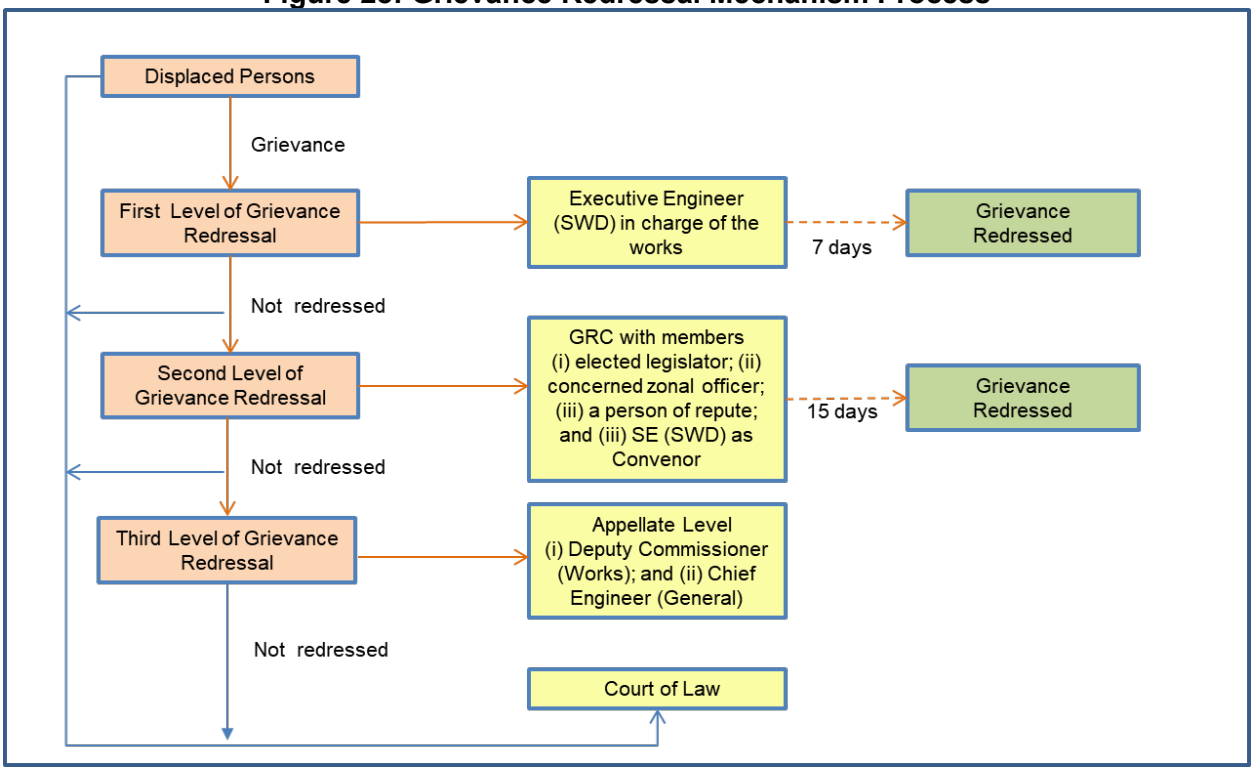
185. In case of grievances that are immediate and urgent in the perception of the complainant, the Executive Engineer on-site will provide the most easily accessible or first level of contact for quick resolution of grievances. Contact phone numbers and names of the concerned Executive Engineer, PIU safeguard officers and contractors will be displayed at all construction sites at visible locations. The second level will be a four-member committee with the Superintending Engineer (SWD), GCC acting as its convenor. Third level will be the appellate level with the Chief Engineer (General) and Deputy Commissioner (Works).

(i) **1st Level Grievance.** The phone number of the site in charge Executive Engineer should be made available at the construction site signboards. The contractors and field unit staff can immediately resolve grievances onsite and seek the advice of the Executive Engineer as required and resolve grievances within seven days of receipt of a complaint/grievance.

(ii) **2nd Level Grievance.** All grievances that cannot be redressed within seven days at field level will be reviewed by the GRC at PIU level comprising of 4-members, with preferably one member being a woman. The committee will have any one elected member of the legislature, concerned zonal officer, a person of repute and standing in locality, nominated by the Commissioner, GCC and the Superintending Engineer (SWD) acting as its convenor.

(iii) **3rd Level Grievance.** All grievances that cannot be redressed within 15 days at PIU level, will be placed before the Chief Engineer (General), who will consult the Deputy Commissioner (Works) in grievance resolution.

Figure 28: Grievance Redressal Mechanism Process



186. **Court of Law**: Despite the project GRM, an aggrieved person shall have access to the country's legal system at any stage and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

187. **ADB Accountability Mechanism**: In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission (INRM). The complaint can be submitted in any of the official languages of ADB's developing member countries.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

188. An Environmental Management Plan (EMP) has been developed to provide mitigation measures to reduce negative impacts to acceptable levels.

189. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between PMU, PIU, PSC, and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of the implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

190. The Contractor will be required to submit to PIU, for review and approval, a Site Environmental Management Plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, laydown areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to the approval of SEMP.

191. The Contractors shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to GCC and PSC for approval. A brief guidance on “To Do” List prepared from these documents is provided in **Appendix 14.**

192. A copy of the EMP/approved SEMP will be kept on-site during the construction period at all times. The EMP included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

193. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures outlined in the approved SEMP; and (ii) implement any corrective or preventive actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of the SEMP. The contractor shall allocate budget for compliance with these SEMP measures, requirements, and actions.

194. The potential environmental impacts, proposed mitigation measures, and responsible agencies for implementation and monitoring are furnished in the following Tables.

Table 42: Design Stage Environmental Impacts and Mitigation Measures

Activity	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Monitoring and cost for column
Storm Water Drain	Prevention of flooding	Micro drains are designed to handle the maximum rainfall of 70mm/hour for 2 years return period. Macro drains and surplus canals connecting all major lakes are designed to handle the maximum rainfall of 106mm/hour for 5 years return period	DPR Consultant / PIU	Project Cost
	Groundwater recharge	Silt catch pits with rainwater harvesting structure will be constructed along the drains at every 30 m interval.	DPR Consultant / PIU	Project Cost
	Sediment Control	For control of sediments, it is proposed to construct a silt catch pit at 10m interval so that the sediments are deposited in the silt catch pit and settle over there, which can be removed periodically.	DPR Consultant / PIU	Project Cost
	Prevention of solid waste into drains	i. Micro drains will be constructed as box type drain in RCC with a cover slab on top which will curtail dumping of solid waste in the drains. ii. Major drains belonging to Greater Chennai Corporation are open canals and will be provided with chain link fencing side cover in MS frame with wire mesh to prevent dumping solid waste.	DPR Consultant / IU	Project Cost
	Safety in maintenance	Inspection doors will be provided at an interval of 10m to facilitate maintenance activities only by machineries.	DPR Consultant / PIU	Project Cost
	Traffic Loads and People access in micro drains	Micro drains shall be constructed as box type drain in RCC with a cover slab on top which can also take traffic loads due to vehicular movements.	Design Consultant / PIU	Project Cost
	Tree cutting	i. Minimize removal of trees by adopting to site condition and with appropriate alignment ii. Obtain prior permission for tree cutting	DPR Consultant / PIU	Project Cost
Storm Water Pumping Station	Noise	i. Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m ii. Use acoustic enclosures – manufacturer specified for all pumps, motors iii. Procure only CPCB approved generators with low emission and low noise fitted with acoustic enclosures iv. Provide sound mufflers for ventilators in the plant rooms and soundproof doors v. Provide earplugs to workers	DPR Consultant / PIU	Project Cost

Activity	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Monitoring and cost for column
	Energy Consumption	i. Using low-noise and energy-efficient pumping systems	DPR Consultant / PIU	Project Cost

Table 43: Pre- construction Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
Submission of updated EMP / SEMP; EMP implementation and reporting	Unsatisfactory compliance with EMP	i. Appoint EHS Supervisor to ensure EMP implementation ii. Submission of updated EMP/ SEMP prior to starting of work, ii. Timely submission of monthly monitoring reports including documentary evidence on EMP implementation such as photographs iii. SEMP documents shall include information about tree cutting, construction of labour camps, storage areas, hauling roads, regulatory permissions, disposal areas for solid and hazardous wastes, sensitive features like schools and hospitals	Contractor	PSC/PIU	Contractor costs
Utilities	Telephone lines, electric poles, and wires, water lines within the proposed project area	i. Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during the construction phase; and iii. Require contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services. iv. Contractor to provide prior (at least 1 week) information to public on likely utility service disruptions, and contingency measures to be put in place	Contractor in coordination with PSC/PIU	PSC/PIU	Contractor costs
Construction of labour camps, stockpile areas, storage areas,	Conflicts with the local community; disruption to traffic flow and	i. Prioritize areas within or nearest possible vacant space in the project location. ii. If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in the destruction of property,	Contractor to finalize locations in consultation and approval of PSC/PIU	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
and disposal areas.	sensitive receptors	vegetation, irrigation, and drinking water supply systems. iii. Do not consider residential areas. iv. Take extreme care in selecting sites to avoid direct disposal of excavated earth / demolition waste to a water body which will cause inconvenience to the community. ii. For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.			
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and waterlogging, and water pollution.	i. Obtain construction materials only from government-approved quarries with prior approval of PIU ii. PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval iii. Contractor to submit to PIU the documentation every month with the details of the material obtained from each source (quarry/ borrow pit) v. Avoid the creation of new borrow areas, quarries, etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, including Environmental Clearance (EC) prior to approval by PIU	Contractor to prepare a list of approved quarry sites and sources of materials with the approval of PSC/PIU	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
Consents, permits, clearances, NOCs, etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	i. Obtain all necessary consents, permits, clearance, NOCs, etc. prior to the award of civil works. ii. No works shall be commenced until CRZ clearance is obtained (Packages with CRZ: 27, 32, 34, 35, 36, 37, 38, 39, 40, 41 and 42) iii. Ensure that all necessary approvals for construction to be obtained by the contractor are in place before the start of construction iv. Acknowledge in writing and provide a report on compliance of all obtained consents, permits, clearance, NOCs, etc.	Contractor	PSC/PIU	Contractor cost
Chance finds	Damage / disturbance to artifacts	Contractors to follow these measures in conducting any excavation work • Create awareness among the workers, supervisors, and engineers about the chance finds during excavation work • Stop work immediately to allow further investigation if any finds are suspected. • Inform Tamil Nadu Archaeological Department if a find is suspected and taking any action they require to ensure its removal or protection in situ.	Contractor	PSC/PIU	Contractor Costs

Table 44: Construction Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH and S), core labour laws, applicable environmental laws, etc.	Contractor	PSC/PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
Generation of silt/soil	Land and water pollution due to silt/disposal	(i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in **Appendix 3**) (ii) As far as possible utilize the debris, silt and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc. (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately (Kodungaiyur dumping yard and Perungudi Dump Yard of GCC are the identified dumping areas for the project). (iv) Surplus soil may be used as daily cover / intermediate cover at the dump site (v) Monitoring the quality sediment/silt generated from desilting activity for presence of hazardous substances, and follow the suitable method as per the quality; hazardous material should be disposed at hazardous waste disposal facility approved by TNPCB	Contractor	PSC/PIU	Contractor cost
Desilting works	Environmental pollution and occupation health and safety	(i) Desilting process of surplus canals shall be conducted during the summer season for the storm water and surplus canals. no flow season only (ii) Prior to desilting process, the drains shall be allowed dry so that there is no standing water on silt / sediment (iii) Do not conduct manual desilting process, use appropriate equipment / implements (iv) Desilting shall be conducted in small sections, accumulated water, if any shall not be pumped out, but pumped to adjoining section within the same drain (v) Desilting process shall be conducted in such a way that water content of the silt/sediment is low, so that	Contractor	PSC/PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		contaminated water is not spilled during the loading, transport and unloading process. The excavated sludge shall be placed temporary in dry areas / desilted portion / banks of the canal/ drain, which will allow the water content in the sludge to drain back to the canal; in no case contaminated water is allowed to flow outside the drain/canal (i) This process shall generate sludge. The excavated sludge shall be stored temporary in dry areas near the banks of the canal/ drain, which will allow the water content in the sludge to drain back to the canal, then the sludge, will be packed in the gunny bags or cloth bags to prevent mixing and flowing into the drain. The desilting process shall be conducted mechanically by Robotic excavator and Amphibian Vehicle (manual desilting process shall be avoided). This also helps in further dewatering of the sludge, which will reduce the weight. The packed gunny bags are then transported to designated dumping locations. Currently some of the identified dumping grounds are Perungudi Dump Yard and Kodungaiyur Dump Yard. During the process, the Workers shall be provided with appropriate PPE's; masks with for safety. Oxygen cylinders and first aid kit shall be made available at the site, which shall be utilised during emergency.			
Air Quality	Dust, and emissions (carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.) from construction vehicles, equipment, and	**For all construction works** i. Provide a dust screen around e construction sites of storm water pumping stations. ii. Damp down the soil and any stockpiled material on-site by water sprinkling; iii. Stabilize surface soils where loaders, support equipment, and vehicles will operate by using water and maintain surface soils in a stabilized condition iv. Apply water prior to levelling or any other earth-moving activity to keep the soil moist throughout the process v. Cover the soil stocked at the sites with tarpaulins	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
	machinery used for drain construction	vi. Control access to the work area, prevent unnecessary movement of the vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation vii. Use tarpaulins to cover the loose material (soil, sand, aggregate, etc.,) when transported by open trucks; viii. Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area ix. Clean wheels and undercarriage of haul trucks prior to leaving the construction site x. Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have valid pollution under control (PUC) certificate **For Drain works** i. Barricade the construction area using hard barricades (of 2 m height) on both sides ii. Initiate site clearance and excavation work only after barricading of the site is done iii. Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.,), to the barricaded area iv. Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area v. Undertake the work section-wise, a 500m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones vi. Conduct work sequentially - excavation, drain construction, backfilling; testing section-wise (for a			

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		minimum length as possible) so that backfilling, stabilization of soil can be done. vii. Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement, and wind will generate dust from the backfilled section.			
Surface water quality	Mobilization of settled silt materials and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality.	i. All earthworks are conducted during the dry season to prevent the problem of soil/silt run-off during rains ii. Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; iii. Prioritize the re-use of excess spoils and materials in the construction works. If spoils will be disposed off , only designated disposal areas shall be used; iv. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; v. Place storage areas for fuels and lubricants away from any drainage leading to water bodies; vi. Store fuel, construction chemicals, etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management vii. Dispose of any wastes generated by construction activities in designated sites; viii. Conduct surface quality inspection according to the Environmental Management Plan (EMP).	Contractor	PSC/PIU	Contractor costs
Surface and Groundwater quality	Water accumulation in trenches/pits	i. As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of the work area ii. Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose off only clarified water into drainage	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		Canals/streams after sedimentation in the temporary ponds iii. Consider safety aspects related to pit collapse due to accumulation of water			
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	i. Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in the least disturbance; ii. Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and iii. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. iv. Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; v. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; vi. Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.	Contractor	PSC/PIU	Contractor costs
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging	i. Prepare and implement a Construction Waste (spoils) Management Plan (refer **Appendix 3**) ii. As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads, etc., iii. Avoid stockpiling any excess spoils at the site for a long time. Excess excavated soils should be disposed off to approved designated areas immediately	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
	materials, empty containers, spoils, oils, lubricants, and other similar items.	iv. If the disposal is required, the site shall be selected preferably from barren, infertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive land uses v. Solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to the designated solid waste disposal site; create a compost pit at designated sites for disposal of biodegradable waste; non-biodegradable waste shall be collected separately and disposed to approved designated areas. vi. Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off in disposal sites approved by TNPCB; vii. Prohibit burning of construction and/or domestic waste; viii. Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dustbins. ix. Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that the site is properly restored prior to issuing of construction completion certificate			
Management of flood and drainage during construction works	Impact on the construction site, materials and labours	i. Contractor in coordination with GCC to plan and schedule the existing drains rehabilitation and surplus canal works duly considering the flood management aspect ii. Plan existing drains rehabilitation and surplus canal works during dry season and ensure that works are complete before the onset of monsoon iii. If the full works cannot be completed within one dry season (which is likely as the construction period is at least 2 years), works shall be conducted section-wise so that surplus canals and/or existing drains are put into operation prior to onset of monsoon; work sections shall be cleared of	Contractor to prepare site specific temporary drainage management plan in consultation with PSC/PIU	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		construction materials, debris and any obstructions creating for construction shall be removed iv. To safeguard works and avoid flood/ water logging, the contractor will prepare a suitable site-specific temporary drainage management plan (including emergency response, clean-up kit and trained personnel, to assist with mitigating the damage) and will implement the same v.			
Biological environment	Adverse impacts on Creek and coastal / terrestrial ecosystems due to construction works	i. No works in the CRZ shall be until clearance under CRZ Notification, 2019 is obtained and complied with conditions, if any, stipulated therein. ii. Implement all measures suggested to manage surface water runoff and quality during the construction works iii. Where necessary, before the monsoon measures actions like, diversion ditches can be created in order to intercept and slow down the speed of runoff into the Creek; small, compacted soil berms can be created to intercept runoff and reduce erosion and sediment transport and can reduce the area of water displacement. iv. Conduct monitoring of sediment and water quality in water bodies and creek as per EMP v. Do not use heavy equipment on the coastal zone; use machinery to the minimum possible extent, and restrict the movement to drain/work area vi. Do not place / store materials, waste or debris in the coastal zone vii. Do not remove vegetation or trees viii. Create awareness among the workers and staff on the coastal environment sensitivity, and ensure no damage/disturbance to flora and fauna	Contractor	PSC/PIU	Contractor costs
Accessibility and traffic disruptions	Traffic problems and conflicts near project	**Drain Construction** i. Prepare a traffic management plan for drains works along the roads	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
	locations and haul road	ii. Prepare a drain construction implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in a sequential way so that public inconvenience is minimal iii. Plan the drain construction in coordination with the traffic police; provide temporary diversions, where necessary and effectively communicate with the general public iv. Avoid construction work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience v. Undertake the work section wise, a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones vi. Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. vii. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the site as and when required viii. Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and wider/deeper drains; i deep trenches are excavated with slopes, the roads may render completely unusable during the construction period ix. Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to			

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided x. Provide pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access. xi. Inform the local population 1-week in advance about the work schedule xii. Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. xiii. Keep the site free from all unnecessary obstructions. xiv. Notify affected public by public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services xv. At the worksite, public information/caution boards shall be provided including contact for public complaints **Hauling (material, waste/debris, and equipment) activities** i. Plan transportation routes so that heavy vehicles do not use narrow local roads, except near delivery sites ii. Schedule transport and hauling activities during non-peak hours; iii. Locate entry and exit points in areas where there is low potential for traffic congestion; iv. Drive vehicles in a considerate manner v. Notify affected public by public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/complaints.			

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
Socio-Economic Loss of access to houses and business	Loss of income	i. Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations; ii. Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches iii. Barricade the construction area and regulate the movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around iv. Control dust generation v. Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work. vi. Employee best construction practices, speed up construction work with better equipment, increase the workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools; vii. Consult businesses and institutions regarding operating hours and factoring this in work schedules; and **viii.** Provide signboards for pedestrians to inform the nature and duration of construction works and contact numbers for concerns/complaints.	Contractor	PSC/PIU	Contractor costs
Socio-Economic - Employment	Generation of temporary employment and an increase in local revenue	i. Employ local labour force as far as possible ii. Comply with labour laws	Contractor	PSC/PIU	Contractor costs
Occupational Health and Safety	Occupational hazards which	i. Follow all national, state and local labour laws (an indicative list is given in **Appendix 2**);	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
	can arise during work	ii. Develop and implement site-specific occupational health and safety (OH and S) Plan which shall include measures such as (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OH and S, training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health, and Safety Guidelines. iii. Ensure that qualified first-aid specialist is provided at all times in the project area. Equipped first-aid stations shall be easily accessible throughout the sites; iv. Secure all installations from unauthorized intrusion and accident risks v. Provide OH 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; vi. 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; vii. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; viii. Ensure moving equipment is outfitted with audible back-up alarms; ix. 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; and			

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		x. Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. xi. Provide supplies of potable drinking water; xii. Provide clean eating areas where workers are not exposed to hazardous or noxious substances			
COVID 19 response	Spread of infection which causes serious symptoms like difficulty in breathing, chest pain and loss of speech or movement. If not treated it will lead to death	i. Taking cognizance of situation at time of mobilization, the Contractor shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to GCC and PSC for approval. ii. The preparation of C-R&MP shall consider guidance of Government of India, World Health Organization, International Labour Organization, International Financial Corporation and World Bank's interim guidance note etc. The key points on COVID Response and Management measures is at **Appendix 14**. iii. The contractor shall submit a weekly monitoring and progress report to GCC and PSC.	Contractor	PSC/PIU	Contractor costs
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	i. Confine work areas; prevent public access to all areas where construction works are on-going through the use of barricading and security personnel ii. Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of road side excavation iii. Minimize the duration of time when the drain trench is left open through careful planning; plan the work properly from excavation to refilling iv. Control dust pollution – implement dust control measures as suggested under air quality section v. Ensure appropriate and safe passage for pedestrians along with the worksites vi. Provide road signs and flag persons to warn of on-going trenching activities.	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		vii. Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency) viii. Enforce strict speed limit (20 kmph) for plying on unpaved roads, construction tracks ix. Provide temporary traffic control (e.g. flagmen) and signs where necessary to improve safety and smooth traffic flow x. Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided to ensure that vehicles join the road in a safe manner. xi. At sensitive locations particularly where there are schools and markets close to the road, awareness of safety issues will be raised through neighborhood awareness meetings xii. All drivers and equipment operators will undergo safety training xiii. Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.			
Safety Requirements for Deep Trench works	Accidents, and risk hazard	(i) Sides of excavation shall be inspected by PSC during the course of excavation from time to time and after every rain, storm or other hazard-increasing occurrence and protection against slides and cavings shall be increased, if necessary (ii) Complete information on the underground structures (such as water pipelines, sewers, gas mains, electrical conduit system and other civic facilities) should be collected before doing the excavation work. Proper precautions shall be taken to prevent accident to the workmen engaged in excavation work and calamities for the general public (iii) Where medical facilities (including hospitals) are not available nearby, first-aid kit should be	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		available. This shall be kept at a conspicuous place in the charge of trained person(s). The kit shall be recouped periodically. (iv) Labors shall be instructed to use safety devices and appliances provided to them whenever it is necessary to do so (v) Labors who are not aware of the hazards peculiar to the work shall not be permitted to proceed with the work without being properly instructed. (vi) Safety helmets shall be worn by all persons entering trench where hazards from falling stones, timber or other materials exist (vii) Appropriate safety footwear (rubber boots, protective covers, etc.,) shall be worn by labours who are engaged in work requiring such protection (viii) All trenches in soil more than 1.5 m deep shall be securely shored and timbered. (ix) All trenches in friable or unstable rock exceeding 2 m in depth shall be securely shored and timbered (x) Where the sides of trenches are sloped but not within 1.5 m of the bottom, the vertical sides shall be shored and the shoring shall extend at least 30 cm above the vertical sides. When open spaced sheathing is used, a toe board shall be provided to prevent material rolling down the slope and falling into the part of the trench with vertical walls. (xi) Shoring and timbering shall be carried along with the opening of a trench but when conditions permit, protection work, such as sheet piling may be done before the excavation commences. (xii) Approved quality of sal wood shall be used for shoring and timbering a trench. Any other structural material having strength not less than that of sal wood may also be used for the purpose.			
Work Camps and worksites	Temporary air and noise	i. Consult PIU before locating project offices, sheds, and construction plants;	Contractor	PSC/PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
	pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	ii. Select a campsite away from residential areas (at least 100 m buffer shall be maintained) or locate the campsite within the existing facilities of GCC offices iii. Avoid tree cutting for setting up camp facilities iv. Provide a proper fencing/compound wall for campsites v. Campsite shall not be located near (100 m) water bodies, flood plains flood-prone/low lying areas, or any ecologically, socially, archeologically sensitive areas vi. Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit vii. Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers viii. Camps shall be provided with proper drainage, there shall not be any water accumulation ix. Provide drinking water, water for other uses, and sanitation facilities for employees x. Prohibit labours from cutting of trees for firewood; The contractor should provide cooking fuel (cooking gas); use of firewood is not allowed xi. Train employees in the storage and handling of materials which can potentially cause soil contamination xii. Wastewater from the camps shall be disposed off properly either into the sewer system; if the sewer system is not available, provide on-site sanitation with a septic tank and soak pit arrangements			

Field	Anticipated Impact	Mitigation Measures	Implementing agency	Monitoring Responsibility	Cost and Source of Funds
		xiii. Recover used oil and lubricants and reuse or remove from the site; xiv. Manage solid waste according to the following preference hierarchy: reuse, recycling, and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in the local market xv. Remove all wreckage, rubbish, or temporary structures which are no longer required; and xvi. At the completion of work, the camp area shall be cleaned and restored to pre-project conditions, and submit a report to PIU; PIU to review and approve camp clearance and closure of worksite			
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	i. Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and ii. All excavated roads shall be reinstated to the original condition. iii. All disrupted utilities restored iv. All affected structures rehabilitated/compensated v. The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. vi. All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regressed using the guidelines set out in the re-vegetation specification that forms part of this document. vii. The contractor must arrange the cancellation of all temporary services. viii. Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	Contractor	PSC/PIU	Contractor costs

Table 45: Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Monitoring responsibility	Cost and Source of Funds
Storm Drains	Mixing of Sewage or industrial water	i. Commissioning of the underground sewerage system with proper connection to be given ii. Prevention of illegal discharge of industrial water by monitoring environmental water quality parameters	PIU (GCC) in coordination with CMWSSB	PMU	PMU
	Regular Maintenance	i. Desilting the drain prior to monsoon ii. Clearing of vegetation along the drain iii. Immediate repairing of damaged structures iv. Conducting awareness program to the people residing next to storm drains	Contractor (Till DLP) and PIU	PMU	Operating Costs
	Maintenance	It shall be ensured drains are not clogged. The following practices should be adopted in maintaining storm water drains: i. Drains shall be regularly inspected and cleaned especially prior to monsoons. ii. All damaged or missing drain covers should be replaced immediately iii. Rubbish and silt that have been removed from the drainage system should not be left alongside the drain and shall be immediately disposed off in a pre-identified site with necessary precautions. iv. It shall be ensured that the Environmental, Health, and Safety Guidelines of the World Bank (Generic and Water & Sanitation) have adhered to relevant activities during operation. v. Avoid mixing wastewater from the household, commercial, industrial and other establishments. vi. Provision for connecting domestic liquid waste to the sewerage system is to be made during drain construction to avoid mixing of wastewater. vii. Periodical monitoring shall be carried out and sources of wastes/ effluent etc. are to be identified. GCC may initiate action to ensure proper linking of such connections to other waste disposal systems and it shall be ensured that the drains carry only the rainwater. viii. In case of any industrial effluent identified, necessary action be taken in coordination with the TNPCB.	Contractor (Till DLP) and PIU	PMU	Operating Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Monitoring responsibility	Cost and Source of Funds
	Tree Planting & Protection (It is estimated to cut 304 trees located in the Storm water drain alignment)	i. As per the High Court Order as a compensatory measure in the ration of 1:10, 3040 trees have to be planted. GCC (Storm Water Department) has decided to handover the compensatory plantation to Park Department (another wing of GCC) for which the estimated amount will be remitted to the Park Department. Tree transplantation option shall be explored to minimize the loss of trees. ii. The growth and survival of planted trees shall be ensured and monitored by the ESS, PSC and the PIU. The survival status shall be recorded monthly and it will be included in the SEMR, which will be submitted to the ADB	Contractor (Till DLP) and PIU	PMU	Operating Costs
	Solid waste Management	i. Provide additional bins in critical locations ii. Ensure frequent collection and disposal of waste iii. Carry out periodical awareness programs to educate the public/stakeholders iv. Prevention of dumping of wastes inside the water body through continuous monitoring. v. Provide the required number of bins at strategic locations around the lakes and the solid wastes generated shall be regularly collected through existing arrangements & manpower available with the GCC. vi. Provide Signage's to create awareness and conduct IEC activities. Display boards carrying the messages of DO's and Don'ts	Contractor (Till DLP) and PIU	PMU	Operating Costs

Table 46: Construction Stage Environmental Monitoring Plan – Storm water drains and Surplus canal

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Ambient air quality	92 location (Sensitive locations, especially in the downwind direction along the alignment and water bodies);	PM_{10}, $PM_{2.5,}$ NO_2, SO_2, CO	Once before Start of construction and yearly 3-times during the construction period for 3 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (92 x 3 x 3 = 828 samples x Rs.8000/- per sample = Rs.66,24,000)

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Ambient noise	92 location (Wherever the contractor decides to locate the equipment yard and at sensitive locations such as school, hospitals, etc. along the alignment)	Day time and night time noise levels (Noise level on dB (A) scale)	Once before Start of construction and yearly 3-times during the construction period for 3 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (92 x 3 x 3 = 828 samples x Rs.3500/- per sample = Rs.28,98,000)
Surface water quality	92 sampling location representing water quality in the drain, lakes, river	Parameters for Surface water quality standards (IS; 2296) Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb for groundwater.	Once before Start of construction and yearly 2-times during the construction period for 3 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (92 x 2 x 3 = 552 samples x Rs.6500/- per sample = Rs.35,88,000)
Silt/ Sediment quality	46 sample location in the existing drains/ surplus canals where silt accumulated	Pb, SAR and Oil & Grease, monitoring silt for the presence of toxic metals	Once in a year (after monsoon) during the construction period for 3 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (46 x 1 x 3 = 138 samples x Rs.7000/- per sample = Rs.9,66,000)
COVID 19	Construction camps/ labour camps and working areas	Common symptoms including Fever, Dry cough and Tiredness.	Daily	Contractor	As per the COVID Response and Management Plan (C-R&MP) prepared by the contractor under the guidance of ESS, PSC
Tree plantation	Public Parks (Areas where plantation is being done)	Survival rate of the plant species	Quarterly	Park Department	Cost for compensatory plantation 3040 (trees) * 1200 (plantation cost per tree sapling including 3 maintenance) = Rs 36,48,000

Table 47: Operation Stage Environmental Monitoring Plan - Storm water drains and surplus canals

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Surface water quality	46 sample location representing water quality in the drain, lakes, river	Parameters for Surface water quality standards (IS; 2296). Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb for groundwater.	Yearly once during the Defect Liability Period (DLP) for 2 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (46 x 1 x 2 = 92 samples x Rs.6500/- per sample = Rs.5,98,000)
Silt quality	46 location in the drains where silt accumulated	Pb, SAR and Oil & Grease, monitoring silt for the presence of toxic metals	Yearly once during the Defect Liability Period (DLP) for 2 years	Contractor	Cost for implementation of monitoring measures responsibility of contractor (46 x 1 x 2 = 92 samples x Rs.7000/- per sample = Rs.6,44,000)

B. Implementation Arrangements

195. Executing Agency (EA) for the project is the Municipal Administration & Water Supply (MAWS) Department of GoTN and GCC is the IA. A PMU reporting to the MAWS Department shall be established within GCC and a PIU shall be established in the storm water drain department of GCC. The PMU shall ensure EMP is implemented as agreed while the PIU shall have overall responsibility for implementing environmental safeguards by monitoring and ensuring compliance with ADB's Safeguards Policy and government requirements, obtaining the right of way clearances and ensuring integration of environmental safeguards in all documents, particularly in tender documents. PIU shall also prepare and submit to ADB periodic environmental safeguards monitoring reports. One Executive Engineer in the PIU shall be the nodal officer for environmental and social safeguards who will be responsible to oversee all safeguards related activities. PIU shall have an Environmental Unit headed by a dedicated environmental officer appointed to manage project's compliance with environmental safeguards requirements of ADB SPS. He will be supported by the environmental expert and the environmental safeguards support staff of the PSC. Each contract package shall have the contractor's environmental safeguards officer and safety engineer/ accident prevention officer for regular site supervision and management of EHS during construction. The individual roles and responsibilities for environmental safeguards implementation at PIU, PSC and Contractors' level are further described below.

196. **Environmental Officer at PIU with support from field engineers of PIU:** Key tasks and responsibilities of the Environmental Officer, PIU for this subproject include the following:

(i) Oversee preparation of IEEs; confirm existing IEEs/EMPs are updated based on detailed designs.
(ii) Ensure that EMPs are included in bidding documents and civil works contracts
(iii) Provide oversight on environmental management aspects of the project and ensure EMPs are implemented by contractors.
(iv) Facilitate and ensure compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g., location clearance certificates, environmental clearance certificates, etc.), as relevant.
(v) Supervise and provide guidance to the contractor to properly carry out the environmental monitoring as per the monitoring plan.
(vi) Review, monitor, and evaluate the effectiveness with which the EMPs are implemented, and recommend corrective actions to be taken as necessary
(vii) Consolidate monthly environmental monitoring reports for different packages and submit semi-annual monitoring reports to ADB (see the format in **Appendix 7**).
(viii) Ensure timely disclosure of final IEEs/EMPs in locations and ensure accessible to the public
(ix) Address any grievances brought about through the grievance redress mechanism in a timely manner.
(x) Review and finalize project environmental category.

197. **Environmental Expert of PSC with support from Environmental Safeguards Support Staff of PSC:** Key role of Environmental Specialist and Environmental safeguard support staffs for this subproject include the following:

(i) Assist in prepare / update REA checklist

(ii) Assist in identification of sites/components in compliance with exclusion criteria and project environmental selection guidelines
(iii) Assist in update / prepare IEE report
(iv) Provide guidance and oversee work of EHS supervisor
(v) Assist in conduct public consultation & information disclosure
(vi) Monitor the implementation of EMP by contractor; report effectiveness and identify the need for corrective actions; work closely with Environmental Officer of PIU
(vii) Assist in review monthly EMP implementation reports submitted by contractors
(viii) Oversee and provide guidance to contractors on environmental monitoring (air, noise, etc.)
(ix) Assist in preparing semi-annual Environmental Monitoring Reports
(x) Assist in grievance redress and ensure redress
(xi) Provide regular on-site training programs to contractors site staff and supervisors.

198. **Civil works contracts and contractors**. EMPs are to be included in bidding and contract documents and verified by the PIU. The contractor will be required to appoint an environment safeguards officer and a safety engineer/accident prevention officer to ensure Environment, Health and Safety (EHS) requirements are adequately implemented as per the EMP during civil works. Contractors are to carry out all environmental mitigation and monitoring measures outlined in their contract.

199. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including:

(i) Proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes;
(ii) Specific mitigation measures following the approved EMP;
(iii) Monitoring program as per SEMP;
(iv) Site specific OHS plan in accordance with the Health and Safety Plan (COVID 19) and
(v) Budget for SEMP implementation. No works are allowed to commence prior to approval of SEMP.

200. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times. The EMP included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

201. The PIU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with:

(i) All applicable labor laws and core labor standards on
    a. prohibition of child labor as defined in national legislation for construction and maintenance activities;
    b. equal pay for equal work of equal value regardless of gender, ethnicity, or caste; and
    c. elimination of forced labor; and with
(ii) The requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.

202. **Prohibited investment activities**. Pursuant to ADB's SPS 2009, ADB funds may not be applied to the activities described on the ADB Prohibited Investment Activities List set forth at **Appendix 5** of the ADB SPS 2009.

C. Training Needs

203. The following Table presents the outline of the capacity building program to ensure EMP implementation. These capacity building and training will be conducted at the offices of PMU and PIU by the environmental safeguards experts of PSC, which are part of project implementation set-up, and therefore no separate or additional costs are envisaged. Adequate costs are already considered in the project's capacity building program. The detailed program and specific modules will be customized for the available skillset after assessing the capabilities of the target participants and the requirements of the project by the PMU.

Table 48: Outline Capacity Building Program on EMP Implementation

Description	Target Participants and Venue	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement - Government of India and Tamil Nadu applicable safeguard laws, regulations and policies including but not limited to core labour standards, OH and S, etc. - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project At PMU	Included in the overall program cost
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures -Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) - Traffic management plan - Site clean-up and restoration	All PIU staff, contractor staff, and consultants involved in the subproject. At PIU	To be conducted by PSC at the PIU office; part of project implementation cost
3. Contractors Orientation to Workers (1/2 day) - Environment, health, and safety in project construction	Once before initiation of work, and thereafter regular briefing every month once. A daily briefing on safety prior to the start of work All workers (including unskilled laborers)	Contractors' EHS officer to conduct the program, with the guidance of PSC

D. Monitoring and Reporting

204. Immediately after mobilization and before commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as

detailed in the EMP are undertaken. The contractor should confirm that the staff for EMP implementation (EHS supervisor) is mobilized. PIU will review and approve the report and permit commencement of works.

205. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. PSC will monitor, review and advise contractors for corrective actions if necessary. A quarterly report summarizing compliance and corrective measures, if any, taken will be prepared by PSC team at PIU and submitted to PMU. During operation, PIU will conduct management and monitoring actions as per the operation stage EMP and submit to PMU an annual report.

206. Based on PIU Quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit a semi-annual Environmental Monitoring Report (EMR). Once concurrence from the ADB is received the report will be disclosed on, GCC websites.

207. ADB will review project performance against the commitments as agreed in the legal documents (loan and project agreements etc,). The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

E. EMP Implementation Cost

208. Most of the mitigation measures require the contractors to adopt good site practices, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. The costs which are specific to EMP implementation and are not covered elsewhere in the projects are given below.

Table 49: Cost Estimates to Implement the EMP

Sl.no	Management Activities	Qty	Rate (Rs.)	Cost (Rs.)	Remarks
A	**During Construction Phase**				
1	Compensatory plantation with tree guards wherever necessary after the completion of the activity (plantation of 3040 trees and landscaping works) including maintenance during O&M	3040	1200	36,48,000	Included in EMP Cost
2	Monitoring of Baseline parameters for Drains and surplus canal (ambient air quality, Ambient noise levels, water quality (surface and groundwater), soil quality etc)			1,40,76,000	Refer Environmental Monitoring Plan
	Sub Total-A			**1,77,24,000**	
B	**During the Operational Phase**				
3	Monitoring of Baseline parameters for Drains and surplus canals (ambient air quality, Ambient noise levels, water quality (surface and groundwater), soil quality etc)			12,42,000	Refer Environmental Monitoring Plan
	Sub Total-B			**12,42,000**	
C	**Capacity Building**				

Sl.no	Management Activities	Qty	Rate (Rs.)	Cost (Rs.)	Remarks
4	Orientation workshop for officials involved in the project implementation on ADB Safeguards Policy Statement and environmental assessment process	LS		5,00,000	
5	Induction course to contractors, preparing them for environmental management plan (EMP) implementation and environmental monitoring requirements related to mitigation measures; and taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during implementation	LS		5,00,000	
	Sub Total-C			**10,00,000**	
	Total Cost for Compensatory Plantation, Baseline parameters during construction, Environmental parameters during operation and Capacity Building			**1,99,66,000**	

X. CONCLUSION AND RECOMMENDATIONS

209. The process described in this document has assessed the environmental impacts of all elements of the proposed storm water drainage project in Zone 1, 2, 3, 6, 7 and 8 of Greater Chennai Corporation. As per the ADB SPS 2009 requirements, this project has been categorized as “B”. The proposed storm water drain project components does not fall under the ambit of the EIA Notification 2006, and therefore EIA Study or EC is not required for the subproject. Project area is along the coramondel coast of the Bay of Bengal, and some components fall within the Coastal Regulation Zone. Project therefore requires clearance / no objection certificate from TNSCZMA. GCC already submitted application to TNSCZMA and is currently under process. Works falling under CRZ are confined 11 of total 46 contract packages under the project. No works will be initiated in CRZ packages until the clearance/no objection is obtained from TNSCZMA.

210. Baseline environmental monitoring conducted for (i) Air quality shows a significant increase in the PM_{10} at Tiruvoittyur, Kathivakkam and Athipattu, the observed values are 112, 103 and 107 µg/m^3 respectively. Other Key air quality parameters are observed to be well within the limits. (ii) Ambient Noise levels around the study area is well within the stipulated limit as per the Noise Pollution (Regulation and Control) Rules 2000 as well as World Bank Group’s EHS Noise Level Guidelines, (iii) Silt analysis for the samples collected from the drains and surface water bodies (tanks/ lakes) shows the metal content is less than the detectable limits, (iv) Groundwater quality shows high concentration of TDS, chloride and sulphites for the samples collected from the project area including Ambattur, Pattaravakkam, Retteri, Manali and Ennore, (v) Surface water quality in the Ambattur, Korattur and Retteri lakes comply to IS 2296 – Class C – Drinking water with conventional treatment followed by disinfection. However, the samples collected from Kosasthalaiyar Water Shed and Buckingham Canal shows very high concentration of TDS, Iron (Fe), Chloride (Cl) and Manganese (Mn).

211. Based on the project design and the existing baseline environmental conditions, all potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Mitigation measures have been developed to reduce negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result, significant measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. It is estimated to remove/cut 304 trees located within the alignment ROW, tree transplantation options shall be explored. However, for the loss of trees a compensatory afforestation of 3040 trees shall be planted. Various design-related measures suggested for providing plantation of trees in available space at GCC Parks and water bodies, standard operating procedures for operation and maintenance; imparting necessary training for GCC staff; and providing the necessary safety measures including adequate response measures to COVID-19 during implementation.

212. This project will positively contribute to improve the situation along the coast and Ennore creek that receives storm water / runoff from the project area. Ennore Creek was once a biodiversity hotspot and now highly degraded due to various human activities. The project will improve quality of water flowing into the creek. Besides desilting of canals and drains and providing proper storm water drainage system, the proposed project design also considers minimizing the silt and sewage flow in the system. Water quality of Kosasthalaiyar River, Surplus channels, Buckingham and Ennore creek will be tested pre, during and post construction and

operation phase to monitor the changes in water quality as per the baseline condition. Various measures are suggested to avoid sediment and contaminated flow into the coastal water during the construction. Moreover, works in the CRZ area will be initiated only after obtaining due permission from TNSCZMA.

213. The site selected for Storm water pumping stations are located near North Buckingham Canal. The land is owned by GCC. The nearest house is located at a distance of 30m from the site boundary. Considering the current and future development, various measures are included in the subproject design, including sensitive layout design by maintaining adequate distance from the boundary, so that the pumping station is located within the project site. Both the pumping station sites (at Kargil Nagar and Ernavoor) are situated on government-owned vacant land, and storm water drains will be laid on the public roads. Therefore, project does not involve any private land acquisition.

214. The proposed construction activities likely to generate 2 million cubic meter of surplus earth, which shall be recycled to the maximum, the remaining surplus earth will be disposed/ dumped in the Kodungaiyur dumping yard, which is owned and maintained by GCC. Project is also estimated to generate nearly 150,000 m^3 of sediment/deslited material from the storm water drains and surplus canals. Sediment quality analysis indicate that material is not hazardous and will be disposed at the solid waste dumping sites owned by GCC. During the construction, confirmatory tests will be conducted, and reuse of dried and non-hazardous silt/sediment for beneficial purposes will be explored and implemented, and the surplus will be disposed off at the solid waste facilities.

215. Storm water drain works will be constructed along public roads in an urban area congested with people, activities, and traffic, project is likely to significant impacts during construction. Impacts mainly arise from the construction dust and noise; from the disturbance of residents, businesses, traffic by the construction work, safety risk to workers, public and nearby buildings due to trench excavations, especially in narrow roads, dust, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well-developed methods of mitigation that are suggested in the EMP.

216. Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the operation and maintenance manual and standard operating procedures developed for all the activities.

217. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PMU. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the Environmental Management Plan.

218. Stakeholders were involved in developing the IEE through face-to-face discussions, on-site meetings, and a city level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. Focus group discussions are conducted at nine locations. It was observed that people are willing to extend their cooperation, as the proposed project will provide storm water drainage system, enhance basic infrastructure service levels and

overall living standards of the public. The consultation process will be continued during project implementation to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation. The project's grievance redress mechanism will provide the citizens with a platform for redressing their grievances, and describes the informal and formal Canals, period, and mechanisms for resolving complaints about environmental performance.

219. The EMP will assist the project agencies and contractors in mitigating the environmental impacts and guide them in the environmentally sound execution of the proposed project. A copy of the updated EMP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with or any deviation from the conditions set out in this document shall constitute a failure in compliance. The prepared Draft IEE will be made available at public locations and will be disclosed to a wider audience via the PMU, GCC and ADB websites.

220. The citizens of Chennai City will be the major beneficiaries of this subproject. The new storm water drainage system will collect storm water from those areas served by the network rapidly and flood mitigation, storm water storage at water bodies, recharge the groundwater level through recharge wells, rainwater harvesting pits, etc., In addition to improved environmental conditions, the subproject will improve the overall public health in the project area. Diseases of poor sanitation, such as diarrhea and dysentery, should be reduced, so people should spend less on healthcare and lose few working days due to illness, so their economic status should also improve, as well as their overall health.

221. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines, drains works, pumping stations and discharge points in CRZ area require permission from Tamil Nadu State Coastal Zone Management Authority (TNSCZMA) before construction. No works in CRZ area shall be initiated until clearance is obtained. This IEE shall be updated by PIU during the implementation phase to reflect any changes, amendments and will be reviewed and approved by PMU.

Urban Development

Rapid Environmental Assessment (REA) Checklist

Instructions:
(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.
(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country /Project Title:	IND: Proposed Integrated Urban Flood Management for the Chennai - Kosasthalaiyar Basin
Sector Division:	Urban Development and Water Division

Screening Questions	Yes	No	Remarks
A. Project Siting			
Is the project area…			
□ Densely populated?	Yes		Kosasthalaiyar project area lies in the expanded areas of GCC and it is densely populated. The total population is 25.80 Lakhs (2011 census). The density of the population is 20,187 / km^2.
□ Heavy with development activities?	Yes		It is a developing area; Urban expansion is considerable.
□ Adjacent to or within any environmentally sensitive areas?	Yes		There are two critical habitat areas located within 50km radius of the project area (i) Pulicate Bird Sanctuary is located at a distance of 21 km away from the north boundary of the project area. (ii) Guindy National Park exists at a distance of 10 km away from the south boundary of the project area. However, as per MoEF&CC guideline for assessing biodiversity, the identified critical habitats are away from 10km buffer from the project area
□ Cultural heritage site	Yes		The project area is around 127.80 km^2 and hence the chances of heritage sites are possible. However as per the inventory conducted for the surface drainage, it is evident that there is no ASI identified, or cultural heritage of local importance has been observed
□ Protected Area	Yes		Both the critical habitats (Pulicat Bird Sanctuary and Guindy National Park) are declared protected areas. However, it is more than 10km buffer from the project area (as per the stipulated guideline from MoEF&CC)
□ Wetland		No	Pulicat lake is not considered under wetland category

Screening Questions	Yes	No	Remarks
□ Mangrove	Yes		Mangroves exist at a distance of 5km away from the north boundary of the project area.
□ Estuarine		No	Not applicable
□ Buffer zone of protected area		No	Not applicable
□ Special area for protecting Biodiversity		No	Not applicable
□ Bay		No	Not applicable
B. Potential Environmental Impacts			
Will the Project cause…			
Impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		No	No such impact is envisaged. This storm water project is designed without any intervention of other services and has logical disposal arrangements.
Deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed.		No	The proposed project falls under the storm water drain construction for the locations where it was badly hit by the flooding and stagnation of rain water during monsoon.
degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)		No	No such impact is anticipated.
dislocation or involuntary resettlement of people		No	This project does not involve resettlement.
degradation of cultural property, and loss of cultural wetlands and wild lands, coastal zones, watersheds and forests)		No	No such impact is anticipated.
occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their wetlands and wild lands, coastal zones, watersheds and forests)		No	No such impact is anticipated.
water resource problems (e.g., depletion/degradation of available water supply, deterioration for surface and ground water quality, and pollution of receiving waters		No	Does not arise as the proposed project is to improve the water quality of the receiving water bodies through proposed drains. Groundwater quality through rainwater harvesting structures are improved.
air pollution due to urban emissions		No	Air pollution due to dust is suppressed by sprinkling water during construction. Emissions from vehicles / machineries will be controlled by periodical checking to comply TNPCB standards.
social conflicts between construction workers from other areas and local workers		No	No such impact anticipated; Local communities in the vicinity of the project area would be employed as much as possible.

Screening Questions	Yes	No	Remarks
road blocking and temporary flooding due to land excavation during rainy season	Yes		Complete road blocks are not envisaged; however, in narrow roads, traffic may be diverted but access will be ensured for pedestrians. All necessary precautions will be taken to prevent flooding during construction; flooding is unlikely as work will mostly be conducted during dry season..
noise and dust from construction activities	Yes		Micro drains will be constructed along the road sides and hence noise generating activities will be minimal and temporary. Dust generation is possible during excavation. However the entire excavation area is continuously wet during the entire excavation period and dust is supressed at the source itself.
traffic disturbances due to construction material transport and wastes	Yes		Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities.
temporary silt runoff due to construction	Yes		The deposited silt from the road will be removed and disposed along with the excavated soil. Earthworks will not be conducted during rains;
hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation		No	Not applicable.
water depletion and/or degradation		No	Not applicable.
overpaying of ground water, leading to land subsidence, lowered ground water table, and salinization		No	Not applicable.
contamination of surface and ground waters due to improper waste disposal		No	Does not arise as waste generated will be disposed daily to designated disposal locations.
pollution of receiving waters resulting in amenity losses, fisheries and marine resource depletion, and health problems		No	Not applicable.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title : **IND: Proposed Integrated Urban Flood Management for the Chennai - Kosasthalaiyar Basin**
Sector : **SAUW**
Subsector : **Urban Development and Water Division**
Division/ Department

Screening Questions		Score	Remarks[10]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	The project area is affected by severe floods in the year 2005 and 2015 and hence the project on storm water drain has been proposed
	Would the project design (e.g., the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Yes, being a storm water drain project, the hydro meteorological parameters are considered during the drain network designing
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	1	Yes, the life of project may get affected due to the weather conditions. However, it is designed as per the CPHEEO norms for better stability and endurance
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	No, climate change will not have much impact on the maintenance. However routine maintenance including de-silting the drain prior to monsoon, clearing of vegetation along the drain, immediate repairing of damaged structures are anticipated
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g., annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	Yes, the life of project may get affected due to the weather conditions.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1

[10] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result **of Initial Screening (Low, Medium, High):** Medium

Other Comments: The proposed storm water drain project, will prevent flooding and stagnation of rainwater, which is a major issue faced by the local community during the monsoon season.

Prepared by: Greater Chennai Corporation (GCC)

SALIENT FEATURES OF MAJOR LABOR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN CONSTRUCTION OF CIVIL WORKS

(i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during employment.

(ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on the satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act applies to all establishments employing 10 or more employees.

(iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in the harness of the worker; (c) payment of PF accumulation on retirement/death, etc.

(iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.

(v) Contract Labour (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same is required to be provided by the Principal Employer by Law. The principal employer is required to take a Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act applies to the establishments or Contractor of the principal employer if they employ 20 or more contract labor.

(vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is scheduled. Construction of Buildings, Roads, Runways are scheduled employment.

(vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid when it will be paid and what deductions can be made from the wages of the workers.

(viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training, and promotions, etc.

(ix) Payment of Bonus Act, 1965 - The Act applies to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and a maximum of 20 % of wages to employees drawing Rs. 3,500/- per month or less. The bonus to be paid to employees getting Rs. 2,500/- per month or above up to Rs.3, 500/- per month shall be worked out by taking wages as Rs.2, 500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for applicability of the Act.

(x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946 - It applies to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for the regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in the Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act applies to an establishment that employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc

(xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at a rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace, etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

- The Spoil Management Plan should be site-specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site/road should be restored to the original condition.

I. Spoils information

The spoil information contains the details like a) The type/material, b) Potential contamination by that type, c) Expected volume (site/component specific), d) Spoil Classification, etc.

II. Spoils management

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions are taken d) Volume of contaminated spoil, if present, d) Suggested reuse of disposal of the spoil

III. Documentation

The volume of spoil generated (site-specific, date-wise), site disposed of, reuse/disposal details should be documented properly.

Public Information Notice Template

Public Announcement
Providing Integrated Storm Water Drains for Kosasthalaiyar Basin in Greater Chennai Corporation

Under this project, works are being conducted by xxxx Contractor to provide storm water drain network in Chennai.

As part of this, works for storm water drain network will be taken up in -------- road----/ street/ lane ……. From……to (provide dates).

We request you to kindly co-operate for smooth implementation of the works.

We also request you to drive vehicles / pedestrians to walk carefully

Inconvenience caused is regretted.

PSC - Contact No.
PIU - Contact No.
Contractor – Contact no.

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Tamil and English)

The _____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date	Place of registration	Project Town Project:			
Contact information/personal details					
Name		Gender	* Male * Female	Age	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or updates on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action was taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER:

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Monitoring Items	Compliance
Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)	
EHS supervisor appointed by the contractor and available on site	
Construction site management plan (spoils, safety, schedule, equipment etc.,) prepared	
Traffic management plan prepared	
Dust is under control	
Excavated soil properly placed within minimum space	
Construction area is confined; no traffic/pedestrian entry observed	
Surplus soil/debris/waste is disposed of without delay	
Construction material (sand/gravel/aggregate) brought to the site as and when required only	
Tarpaulins used to cover sand and other loose material when transported by vehicles	
After unloading, wheels and undercarriage of vehicles cleaned prior to leaving the site	
No AC pipes disturbed/removed during excavation	
No chance finds encountered during excavation	
Work is planned in consultation with traffic police	
Work is not being conducted during heavy traffic	
Work at a stretch is completed within a day (excavation, pipe laying and backfilling)	
Pipe trenches are not kept open unduly	
Road is not completely closed; work is conducted on edge; at least one line is kept open	
Road is closed; alternative route provided and the public informed, information board provided	
Pedestrian access to houses is not blocked due to pipe laying	
Spaces left in between trenches for access	
Wooden planks/metal sheets provided across trench for pedestrian	
No public/unauthorized entry observed in worksite	
Children safety measures (barricades, security) in place at works in residential areas	
Prior public information provided about the work, schedule and disturbances	
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs, etc)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard and safe construction practices	
Deep excavation is conducted with landslip/protection measures	
First aid facilities are available on-site and workers informed	
Drinking water provided at the site	
Toilet facility provided at the site	

Monitoring Items	Compliance
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet and bath facilities provided	
Contractor employed local workers as far as possible	
Workers camp set up with the permission of PIU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

_____

Sign off

_____	_____
Name	**Name**
Position	**Position**

SAMPLE SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

A. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number
1. PSC			
2. PMU			
3. PIUs			
4. Consultants			

- Overall project and subproject progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M)[11]	Contract Status (specify if underbidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

B. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS

[11] If on-going construction, include %physical progress and expected date of completion.

Package No.	Subproject Name	Statutory Environmental Requirements[12]	Status of Compliance[13]	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish[14]

C. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

D. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise Implementation Status

Package Number	Components	Design Status (Preliminary Design Stage/Detailed Design Completed)	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
			Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as an appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

[12] Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)
[13] Specify if obtained, submitted and awaiting approval, application not yet submitted.
[14] *Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.*

- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:

(i) **Grievance Redress Mechanism.** Provide information on the establishment of a grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).
(ii) **Complaints Received during the Reporting Period.** Provide information on the number, nature, and resolution of complaints received during the reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

- Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
- Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
- Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
- Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
- Confirm spill kits on site and site procedure for handling emergencies.
- Identify any chemical stored on site and provide information on storage conditions. Attach photograph.
- Describe the management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
- Describe the management of solid and liquid wastes on-site (quantity generated, transport, storage, and disposal). Provide photographs.
- Provide information on barricades, signages, and on-site boards. Provide photographs.
- Checking if any activities are being taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)[15]

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						

[15] Attach Laboratory Results and Sampling Map/Locations

Construction Phase						
Operational Phase						

E. Overall Compliance with EMP

No.	Sub-Project Name	EMP Part of Contract Documents (Y/N)	EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

F. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

- Brief description of the approach and methodology used for environmental monitoring of each subproject.

G. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

- Brief discussion on the basis for monitoring
- Indicate the type and location of environmental parameters to be monitored.
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and analysis of results concerning baseline data and statutory requirements.

As a minimum, the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)			
			$PM_{2.5}$ µg/m^3	PM_{10} µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3

Water Quality Results – Surface Water

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)			
			pH	DO mg/L	BOD mg/L	Fecal Coliform

Water Quality Results – Ground Water

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)						
			pH	TDS	Total Hardness	Sulphate	Chloride	Fe	Pb

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)						
			pH	TDS	Total Hardness	Sulphate	Chloride	Fe	Pb

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Government Standard)	
			Day Time	Night Time

SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.
- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of the environmental site inspection report
- Other

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name

Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER CONDITION:
_____

INITIAL SITE CONDITION:
_____

CONCLUDING SITE CONDITION:

Satisfactory _____Unsatisfactory _____Incident _____Resolved _____Unresolved _____

INCIDENT:
Nature of
incident:_____

Intervention Steps:
_____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition Yes [ ] No [ ]

Signature
_____

Sign off

_____	_____
Name	**Name**
Position	**Position**

STAKEHOLDER CONSULTATION

The stakeholder consultation meeting was held on 06.11.2017 at the conference hall of Greater Chennai Corporation. The meeting was chaired by the Dr. D. Karthikeyan I.A.S., Commissioner, Greater Chennai Corporation. It was attended by all relevant officials from GCC, PWD, CMWSSB, TNEB & TNUIFSL, NGOs, Members from various associations, Residents & General public from relevant zones.

Photographs - Stakeholders Meeting

Dr. Karthikeyan I.A.S., Commissioner, Greater Chennai Corporation chairing the session.

VOYANTS Consultants (DPR consultants) explaining the project.

NGOs and Consultants participation

Public participation in the meeting

Public expressing views to the Commissioner, GCC

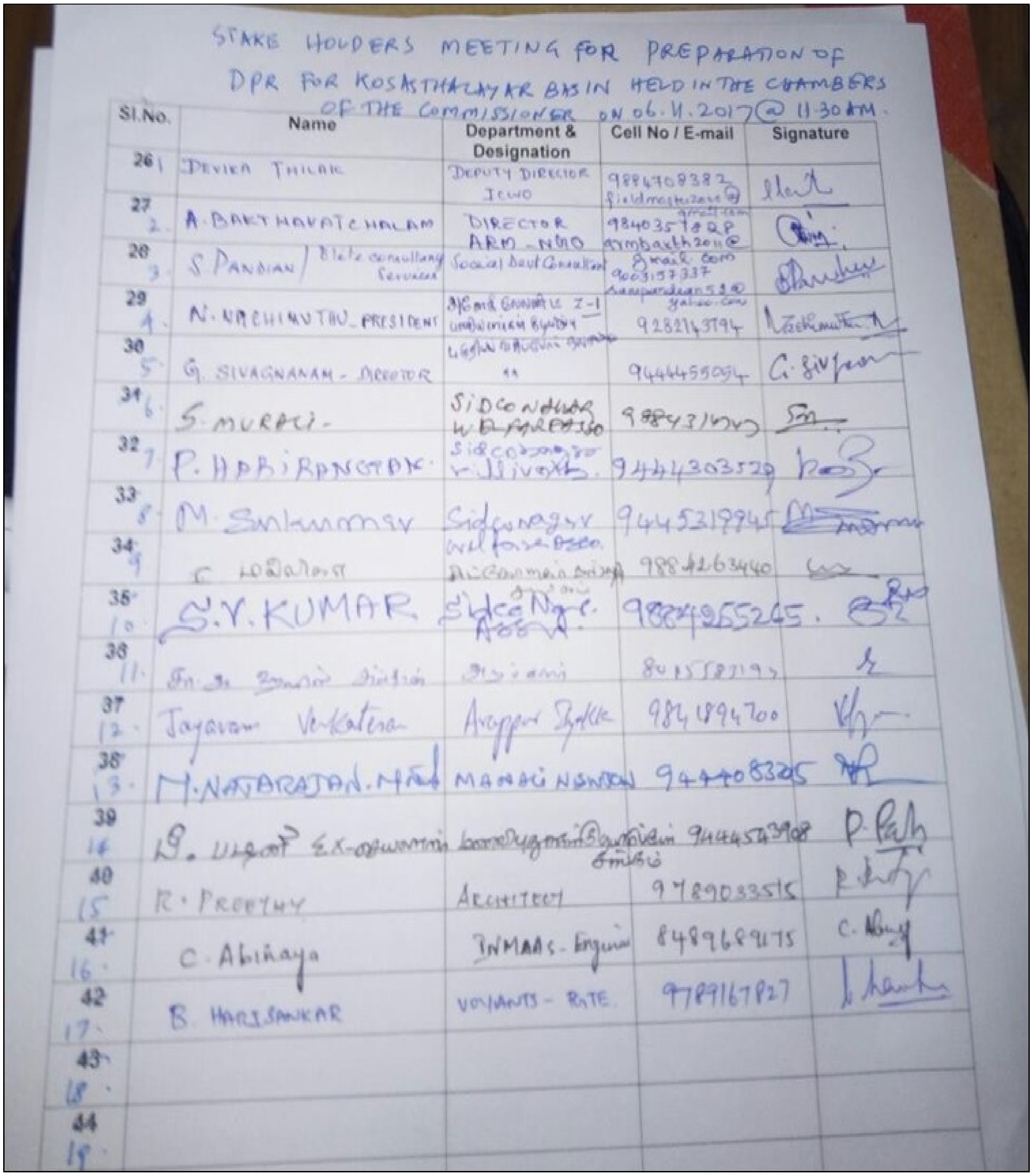
Participants expressing their views

Attendance - Stakeholders Meeting

FOR PREPARATION OF DPR FOR

~~KOSASTHALAYAR DPR~~ STAKEHOLDERS & VILLIVAKKAM TANK MEETING TO BE HELD IN THE CHAMBERS OF THE COMMISSIONER ON 06.11.2017 AT11.00 A.M.

Sl.No.	Name	Department & Designation	Cell No / E-mail	Signature
1.	V. VIJAYA	Social Specialist VOYANTS Consultant	9444236943 vvijayapat@gmail.com	[signature]
2.	M. Ragupathi	NGO 4M Trust	7395984433 ragupathiew@gmail.com	[signature]
3.	A. BAKTHAVATCHALAM	DIRECTOR ARM-NGO	9840351828 armbaktha2041@gmail.com	[signature]
4.	DEVIKA THILAK	DEPUTY DIRECTOR ICWO - NGO	9884708382 fieldmaster2000@gmail.com	[signature]
5.	S. PANDIAN / Elite Consultancy Services	Social Devt. Consultant	9003157397 sampandian51@yahoo.com	[signature]
6.	M. MURUGAN	Head - Urban Devpt & Engg. INMAAS Pvt. Ltd.	9894239840	[signature]
7.	Indumathi B	Urban Planner INMAAS	indumathi@inmaas.com	[signature]
8	V. Paulsathi	Engineer INMAAS P. Ltd	7010176377 paul@inmaas.com	[signature]
.	S. MURALI.	SIDCO NAGAR WELFARE ASSO	9884317747	[signature]
9.	P. HARIRANGAN.	Sidco [illegible] villivakkam	9[illegible]3035[illegible]	[signature]
10.	M. Sukumar	Sidconagar welfare Association	9445319940	[signature]
11.	C. [illegible]	[illegible]	9884263440	[signature]
12.	S.V. KUMAR	Sidco Nagar Welf. Assn.	9884255265	[signature]
13.	[illegible]	[illegible]	8015583194	[signature]
14.	Jayaram Venkatesan	Arappor Iyakkam	9841894700	[signature]
15.	பி - பழனி	[illegible]	9444543908	[signature]
16.	M. NATARAJAN	MANALI NANBAN	9444083205	[signature]
17.	C. Abinaya	INMAAS - Consultant	8489689175	[signature]
18.	R. PREETHY	CONSULTANT ARCHITECT	9789033515	[signature]
19.	A. Solaimalai	Vadapalani	9841614085	[signature]



STAKE HOLDERS MEETING FOR PREPARATION OF DPR FOR KOSASTHALAYAR BASIN HELD IN THE CHAMBERS OF THE COMMISSIONER ON 06.11.2017 @ 11.30 AM.

Sl.No.	Name	Department & Designation	Cell No / E-mail	Signature
26 1	DEVIKA THILAK	DEPUTY DIRECTOR ICWO	9884708382 fieldmaster2... @gmail.com	[illegible]
27 2.	A. BAKTHAVATCHALAM	DIRECTOR ARM - NGO	98403578?? arimbakth20..@gmail.com	[illegible]
28 3.	S. PANDIAN / State consultancy Services	Social Devt Consultant	9003157337 sampandian51@yahoo.com	[illegible]
29 4.	N. NACHIMUTHU - PRESIDENT	[illegible]	9282143794	[illegible]
30 5.	G. SIVAGNANAM - DIRECTOR	〃	9444455094	[illegible]
31 6.	S. MURALI -	SIDCO NAGAR WELFARE ASSO	98843??????	[illegible]
32 7.	P. HARIRANGAN	Sidco nagar [illegible]	944430352?	[illegible]
33 8.	M. Sivakumar	Sidconagar welfare asso.	9445319945	[illegible]
34 9.	C. [illegible]	[illegible]	9884263440	[illegible]
35 10.	S.V. KUMAR	Sidco Ngr. Assn.	9884955245.	[illegible]
36 11.	[illegible]	[illegible]	80155?8?19?	[illegible]
37 12.	Jayaram Venkatesan	Arappor Iyakkam	9841894700	[illegible]
38 13.	M. NATARAJAN. [illegible]	MANALI NAGAR	9444083325	[illegible]
39 14.	[illegible] EX-[illegible]	[illegible]	9444543908	P. [illegible]
40 15.	R. PREETHY	ARCHITECT	9789033515	[illegible]
41 16.	C. Abinaya	INMAAS - Engineer	8489689175	C. [illegible]
42 17.	B. HARISANKAR	VOYANTS - RITE	9789167827	[illegible]
43 18.				
44 19.				

Minutes of the Meeting held on 06.11.2017 in the Commissioner's Conference Hall, First Floor, Ripon Buildings for the Following Assignment :

Stakeholder Consultation Meeting for Revised Detailed Project Report for Integrated Storm Water Drains for the Kosasthalaiyar Basin.

In the Chair : Dr. D. Karthikeyan, I.A.S.,
Commissioner, Greater Chennai Corporation

List of Participants

1. Mr. Govinda Rao, I.A.S., Deputy Commissioner (Works) /GCC
2. Mr. M. Pugazhendhi, Principal Chief Engineer/GCC
3. Mr. L. Nandakumar, Superintending Engineer, SWD, Spl Projects/GCC
4. Mr.E. Ayyanar Bharathi, Superintending Engineer, CMWSSB
5. Mr. Seralathan, Superintending Engineer, TNEB
6. Mr. Jamaluddin, Asst. Executive Engineer, PWD
7. Mr. D. Selva Pandian, Senior Assistant Vice President/TNUIFSL
8. Mr. U. Vijayaraghavan, Senior Manager/TNUIFSL
9. Mr. A. Bakthavatchalam, Director ARM-NGO
10. Mr. S. Pandian, Elite Social Consultancy Services
11. Ms. Nandhini, Uravugal, NGO
12. President, Ashok Leyland Officers Resident Association
13. Members, Sidco nagar Welfare Association
14. Mr. Harish Sultan, Arapor Iyakkam
15. Mr. Jayaram Venkatesan, Arapor Iyakkam
16. Members, Manali New Town Association
17. Residents of Villivakkam
18. Mr. B.R. Saravanamurthy , Executive Engineer/SWD/GCC
19. Mr. B. Sivakumar, Executive Engineer/SWD/GCC
20. Voyant Consultants

Voyants Solutions Pvt. Ltd., has given detailed power point presentation and explained the details of the drains and the water bodies inside the project area. The project background, present and future scenario of the project, general arrangement of proposed canals and improvement proposal for the water bodies were explained. The water logging areas and the narrow stretches of the outlets and inlets in various locations of the project area was explained. Various benefits like flood management, reduction in water logging, removal of encroachments, etc were put forth in the meeting.

Suggestions/Comments of Stakeholders

After the PowerPoint presentation, the Commissioner, Greater Chennai Corporation has invited the stakeholders to give their suggestions and comments on the project. The details of the queries raised by stakeholders and replies made in the DPR preparation stage are given below.

I.Clarifictions sought by Arappor Iyakkam (NGO)

1. Construction of the drains should be enough to carry the required volume of the storm water during rainy seasons.
2. RCC drains shall be replaced by brick wall drains and with earthen base so that the water will percolate inside the ground.
3. Prevention of illegal sewer into storm water drains.
4. If any encroachments found along the narrow sections/mouth of the canals that has to be removed.
5. Whether all the water bodies will be integrated into ISWD project.
6. Whether the design considers the invert levels of the area.

The Superintending Engineer/SWDD has explained that

- The drains were designed scientifically based on the rainfall data analysis for the past 30 year's rainfall data. The capacity of the drains shall carry the water during rainy days.
- RCC drains were selected based on the standards approved by Ministry of Urban Development Department and he explained that the same has been used for Integrated Storm Water Drains for Adyar and Cooum basin as brick wall drains collapse easily and allowing sewer to mix with rainwater.
- There will be provision of sunken wells and gutters provisions once in 30m along the drains to ensure ground water percolations.
- Illegal sewers will be prevented, once the GCC covers certain areas with underground drainage, individual household connections are still not made in certain places. Once the work is completed, illegal sewer will not be allowed to let into rain water drains.
- If any encroachments found, along the narrow junction and mouth of drains, they will be removed and the affected families will be mitigated as per ESMF guidelines.
- Detailed studies were conducted to ensure maximum number of water bodies to integrate with ISWD project and rest of them will be retained as rain water storage/recharge tanks.
- Detailed studies were conducted and modelling exercises were carried out by the DPR consultants to ensure smooth flow of storm water by maintaining proper invert levels of drain connected to water bodies.

II. Clarifications sought by Uravugal (NGO)

1. The mitigation measures of displaced people

➢ The Social Safeguard Specialist of the consultant has explained that the displaced and project affected families will be mitigated as per ESMF policy framework.

III.Clarification sought by 4M trust (NGO)

1. The accommodation details and methodology of the displaced people alternate houses provisions.

➢ The Social Safeguard Specialist of the consultant has explained that the project affected families and displaced families shall be resettled, rehabilitated and mitigated as per ESMF policy framework.

IV.Queries raised by Residential Associations

1. Whether all the inlets and outlets of the water bodies were studied.

➢ The DPR Technical expert explained that all the inlets and outlets were studied in detail and proposals has been prepared for additional number of inlet and outlet for the water bodies.

2. What arrangements will be made for removal of trees along the drains

➢ The Environmental Specialist of the consultant has explained that for trees identified along the drains, realignment will be suggested and if any tree identified for felling, compensatory tree plantation will be made at the rate of 1; 10 ratio.

3. What arrangement will be made for enhancement of existing lakes.

➢ The consultants have explained that for major water bodies, deepening and desilting proposals were recommended. For minor tanks bund improvement and walk paths will be recommended.

V. Queries raised by Public

1. What arrangements will be made to avoid water logging problem in Kargil nagar areas?
2. Whether the DPR will consider providing solutions to water logging areas?
3. Whether people will be removed from existing houses without priror intimation

➢ The Consultant Technical expert has explained that all water logging areas were identified and studied along with the Flood Inundation studies

made by Anna University and incorporated in the design to prevent areas from water logging during rainy season and flood time.

- For the Kargil Nagar area and other similar surrounding places, the design team has proposed for a storm water pumping station at few locations to avoid water logging.

- The Social Safeguard Specialist of the consultant has explained that the project affected families and displaced families shall be resettled, rehabilitated and mitigated as per ESMF policy framework with prior intimation.

The meeting was concluded with final note from the Commissioner that consultant has to proceed further for the preparation of Final DPR incorporating all feasible and viable comments given by various stakeholders presented in the meeting.

The Superintending Engineer presented the Vote of Thanks and the meeting winded up with positive perception of the stakeholders.

Executive Engineer/SWD

Superintending Engineer/SWD

Principal Chief Engineer

Deputy Commissioner (Works)

Commissioner

Feedback Forms - Stakeholders Meeting

(2)

FEEDBACK FORM

Stakeholders Meeting

Greater Chennai Corporation

Storm Water Drains Department

Preparation of Revised Detailed Project Report for Providing Integrated Storm Water Drains for the Kosasthalaiyar Basin

Date; 06/11/2017 Venue: Greater Chennai Corporation Time: 11.00 am

Name: Devika thilak

Gender : *Male / Female*

Address and Contact No: Deputy director ICWD - NGO.
Cell:- 9884708382

1. Whether the project has been explained to you in detail?
   Yes / No
2. Whether you welcome the project which benefits your locality?
   Yes / No
3. Whether the project will benefit you?
   Yes / No
4. If Yes, in what way the project will benefit you?
   Integrating the drains along the Kosasthalaiyar basin is welcomeable project. the low laying areas will be benefited
5. Any other Comments / Views / Suggestions (if any)
   The canals inlet and outlets shall be widened.
   Some of the tanks the mouth is encroached with settlements.

Signature

(3)

FEEDBACK FORM

Stakeholders Meeting

Greater Chennai Corporation

Storm Water Drains Department

Preparation of Revised Detailed Project Report for Providing Integrated Storm Water Drains for the Kosasthalaiyar Basin

Date; 06/11/2017 Venue: Greater Chennai Corporation Time: 11.00 am

Name: Siva Kumar

Gender : *Male / Female*

Address and Contact No: No-6, Perumal Theppam St, Madhavaram.

1. Whether the project has been explained to you in detail?
   Yes / No
2. Whether you welcome the project which benefits your locality?
   Yes / No
3. Whether the project will benefit you?
   Yes / No
4. If Yes, in what way the project will benefit you?
   The area will be free from Water logging.
5. Any other Comments / Views / Suggestions (if any)
   Encradments along water tanks (Minor) shall be removed

Sivakumar
Signature

4

கருத்து கேட்பு படிவம்

கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சி

ஒருங்கிணைந்த மழைநீர் வடிகால் *பிரிவு*

கொசஸ்தலையார் பகுதிக்கான ஒருங்கிணைந்த மழை நீர் வடிகால் விரிவான திட்ட அறிக்கை தயாரித்தல்

இடம் : பெருநகர சென்னை மாநகராட்சி *அலுவலகம்*

தேதி : 06/11/2017 நேரம் : காலை 11. 00 மணி

பெயர்: S. மல்லிகா

பாலர் : ஆண் / பெண்

முகவரி மற்றும் தொலைபேசி: SIDCO Nagar குடியிருப்பு போர் நலக்கழகம் 9884963440

1. இத்திட்டம் குறித்து விரிவாக விளக்கப்பட்டதா ? ஆம் / இல்லை
2. இத்திட்டத்தை வரவேறீர்களா? ஆம் / இல்லை
3. இத்திட்டம் தங்களுக்கு பயனுள்ளதா உள்ளதா? ஆம் / இல்லை
4. ஆம் எனில் எவ்வாறு?

   இத்திட்டம் செயல்படுத்தப்பட்டால் எங்கள் பகுதிக்கு நல்லதொரு தீர்வாக அமையும்.

5. தங்களது கருத்து மற்றும் ஆலோசனைகள் (ஏதாவது இருப்பின்)

   கால்வாய்கள் அகலப்படுத்தப்பட வேண்டும்.

   அருகில் இருக்கும் தொழிற்சாலை கழிவுகள் கலக்கப்படுவது தவிர்க்க வேண்டும்.

S. மல்லிகா.
கையெழுத்து

(6)

கருத்து கேட்பு படிவம்

கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சி

ஒருங்கிணைந்த மழைநீர் வடிகால் *பிரிவு*

கொசஸ்தலையார் பகுதிக்கான ஒருங்கிணைந்த மழை நீர் வடிகால் விரிவான திட்ட அறிக்கை தயாரித்தல்

இடம் : **பெருநகர சென்னை மாநகராட்சி** *அலுவலகம்*

தேதி : 06/11/2017 நேரம் : காலை 11. 00 மணி

பெயர்: மேரி

பாலர் : ஆண் / பெண்

முகவரி மற்றும் தொலைபேசி: கோர்கில் நகர், திருவொற்றியூர்

1. இத்திட்டம் குறித்து விரிவாக விளக்கபட்டதா ? ஆம் / இல்லை
2. இத்திட்டத்தை வரவேறீர்களா? ஆம் / இல்லை
3. இத்திட்டம் தங்களுக்கு பயனுள்ளதா உள்ளதா? ஆம் / இல்லை
4. ஆம் எனில் எவ்வாறு?
   இத்திட்டத்தை மிகொண்டு வருவதால் எங்கள் பகுதி மழைநீர் சூழாமல் இருக்கும் என நம்பிக்கை அளித்துள்ளது
5. தங்களது கருத்து மற்றும் ஆலோசனைகள் (ஏதாவது இருப்பின்)
   மழைநீரை இயந்திரம் மூலமாக வெளியேற்ற வேண்டும்.

மேரி
கையெழுத்து

Newspaper clippings on Stakeholders Meeting

கொசஸ்தலை ஆற்றில் 74 நீர்நிலைகள் இணைப்பு

கழிவுநீர் கலப்பதை கண்டறிய, 'ஸ்மார்ட் மீட்டர்'

– நமது நிருபர் –

கொசஸ்தலை ஆற்று படுகையில் உள்ள, 74 நீர்நிலைகளை ஒன்றோடு ஒன்று இணைத்து, மழை நீரை சேமிக்க, மாநகராட்சி புதிய திட்டம் தயாரித்துள்ளது. இந்த திட்டத்தில், கழிவுநீர் கலப்பதை கண்டறிய, 'ஸ்மார்ட் மீட்டர்' பொருத்த முடிவு செய்யப்பட்டு உள்ளது.

சென்னை மாநகராட்சி விரிவாக்க பகுதிகளில், ஒருங்கிணைந்த மழைநீர் வடிகால் அமைக்க, 4,100 கோடி ரூபாய்க்கு மதிப்பீடு தயாரிக்கப்பட்டுள்ளது.

இதில், 1,100 கோடி ரூபாய் செலவில் கூவம், அடையாறு நீர்பிடிப்பு பகுதிகளில், 326 கி.மீ., நீளத்திற்கு, மழைநீர் வடிகால் அமைக்கும் திட்டத்திற்கு, உலக வங்கி நிதி அளித்தது.

கருத்து கேட்பு

அம்பத்தூர், வளசரவாக்கம், ஆலந்தூர் மண்டலங்கள் பயன்பெறும் இத்திட்ட பணிகள், தற்போது முடியும் நிலையில் உள்ளன.

சோழிங்கநல்லூர், பெருங்குடி மண்டல பகுதிகள் மற்றும் கோவளம் நீர்பிடிப்பு பகுதி ஒருங்கிணைந்த மழைநீர் வடிகால் திட்டத்திற்கு, ஜெர்மன் வளர்ச்சி வங்கி நிதி அளிக்க உள்ளது.

திருவொற்றியூர், மணலி, மாதவரம் ஆகிய மண்டலங்களில், ஒருங்கிணைந்த மழைநீர் வடிகால் அமைக்கும் பணிகளுக்கு, ஆசிய வளர்ச்சி வங்கி அல்லது தனியார் வங்கியிடம் கடன் பெற்று, இத்திட்டத்தை செயல்படுத்த முடிவு செய்யப்பட்டு உள்ளது.

இந்த திட்டத்திற்கு, விரிவான திட்ட அறிக்கை தயாரிக்கப்பட்டு உள்ளது. ரிப்பன் மாளிகையில் நேற்று, இந்த திட்டத்திற்கான கருத்து கேட்பு கூட்டம் நடந்தது.

கொசஸ்தலை ஆறு நீர்பிடிப்பு பகுதிகளில், ஒருங்கிணைந்த மழைநீர் வடிகால், மொத்தம், 426 கி.மீ., நீளத்திற்கு அமைக்கப்பட உள்ளது.

இந்த வடிகால் திட்டத்தில், மொத்தம், 74 நீர்நிலைகள் ஒன்றுடன் ஒன்று இணைக்கப்படும். மழைக்காலங்களில், மழைநீர் வடிகால் மூலம் இந்த நீர்நிலைகள் நிரம்பிய பிறகே, உபரிநீர் கொசஸ்தலை ஆற்றுக்கு செல்லும்.

மழைநீர் வடிகாலில் கழிவுநீர் கலந்து வந்தால், அதை நீர்நிலையின் நுழைவு பகுதியிலேயே கண்டறியவதற்கு வசதியாக, ஸ்மார்ட் மீட்டர் பொருத்தப்படும்.

நீரில் கழிவுநீர் கலப்பு தன்மை கூடினால், இந்த மீட்டர் மூலம், ஒருங்கிணைந்த கண்காணிப்பு மற்றும் கட்டுப்பாட்டு மையத்திற்கு தானாக தகவல் கிடைக்கும். மேலும், கழிவுநீர் கலந்து வரும் பாதை, தானாக மூடிக் கொள்ளும்.

மூன்று ஆண்டுகள்

கழிவுநீர் கலப்பதை அதிகாரிகள் தடுத்து நிறுத்திய பின், நீர்நிலைக்கு நீர் செல்லும். இந்த நவீன தொழில்நுட்பம், சென்னையில் முதல் முறையாக, இந்த, 74 நீர்நிலைகளுக்கு செயல்படுத்தப்பட உள்ளது.

இத்திட்டத்தில், நீர்நிலைகளில் குப்பை விழாமல் தடுக்க வேலி அமைப்பது, நடைபாதை அமைப்பது போன்ற பணிகளும் செய்யப்பட உள்ளன.

இத்திட்டத்திற்கு நிதி அளிக்கும் நிறுவனம் முடிவானதும், அடுத்த கட்ட பணிகள் துவங்கும் என்றும், திட்டம் பயன்பாட்டிற்கு வர, இரண்டு முதல் மூன்று ஆண்டுகள் ஆகும் என்றும், மாநகராட்சி அதிகாரிகள் தெரிவித்தனர்.

கொரட்டூர் ஏரி கால்வாய் அகலமாகிறது!

கொரட்டூர் ஏரி நிரம்பி உபரிநீர், ரெட்டை ஏரிக்கு செல்லும். ரெட்டை ஏரியில் இருந்து வெளியேறும் உபரிநீர், கொசஸ்தலை ஆறு வழியாக கடலுக்கு செல்லும். கொரட்டூர் ஏரியில் இருந்து, ரெட்டை ஏரிக்கு செல்லும் கால்வாய், தற்போது பல இடங்களில், 10 அடி அகலத்தில் மட்டுமே உள்ளது.

இதனால், மழைக்காலங்களில் குடியிருப்பு பகுதிகளுள் தண்ணீர் புகுந்துவிடுகிறது. இப்பிரச்னைக்கு தீர்வாக, கொரட்டூர் ஏரியில் இருந்து ரெட்டேரி வரை, 20 அடி அகலத்திற்கு, ஒரே சீரான கால்வாய் அமைக்கவும் மாநகராட்சி திட்டம் வகுத்துள்ளது.

The Dinamalar Newspaper dated 07.11.2017

Environmental Quality Monitoring Test Results

Groundwater Test Results

TEST REPORT

Report Number and date	**CTL/CH/N-9616/2017-18 & 07.02.2018**		
Sample Number	**N-9616/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Ground Water**		
Sampling Location	Ambattur (Handpump) (Sample ID: AMB-GRD-001)		
GPS Reading	13° 6'26.79"N, 80° 9'13.11"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	6.8	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	< 2	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1064	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	0.05	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	255	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.20	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	32.4	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	104	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	< 2	-	-
18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	< 4	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	0.36	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	1.19	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit
Note: IS 10500:2012 (Drinking Water Specification)
REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Rajmmm

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9617/2017-18 & 07.02.2018**		
Sample Number	**N-9617/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Ground Water**		
Sampling Location	Pattaravakkam (Sample ID: PAT-GRD-001)		
GPS Reading	13° 6'41.30"N, 80°10'1.73"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permisstible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.7	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	< 2	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1812	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	0.08	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	570	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.21	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	0.24	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	387	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	< 2	-	-

18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	< 4	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.08)	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	BDL(DL:0.01)	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit, DL - Detection limit

Note: IS 10500:2012 (Drinking Water Specification)

REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9622/2017-18 & 07.02.2018**		
Sample Number	**N-9622/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Ground Water**		
Sampling Location	Retteri (Sample ID: RET-GRD-001)		
GPS Reading	13° 7'48.21"N, 80°12'59.40"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.3	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	< 2	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1318	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	0.06	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	350	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.24	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	17.7	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	230	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	< 2	-	-
18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	< 4	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	1.3	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.08)	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.20	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit
Note: IS 10500:2012 (Drinking Water Specification)
REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9628/2017-18 & 07.02.2018**		
Sample Number	**N-9628/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Ground Water**		
Sampling Location	Manali (Sample ID: MAN-GRD-001)		
GPS Reading	13°10'2.98"N, 80°15'47.32"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	6.7	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	< 2	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	2648	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	0.9	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	1.3	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	0.32	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	0.09	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	716	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.21	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	194	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	207	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	< 2	-	-

18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	< 4	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	9.0	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.08)	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.11	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit, DL - Detection limit

Note: IS 10500:2012 (Drinking Water Specification)

REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

SILT Sampling Results

TEST REPORT

Report Number and date	**CTL/CH/N-9618/2017-18 & 07.02.2018**		
Sample Number	**N-9618/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Silt**		
Sampling Location	Ambattur Surplus (Sample ID: AMB-SILT-001)		
GPS Reading	13° 6'51.79"N, 80° 9'58.09"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	2 Kg	**Sampling Method**	CTL/MSP/5.7/002
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Packed Condition
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS
1	Colour	Physical Observation	-	Black and brown
2	Texture	FAO Method(Page No.25)2007	-	Clay
3	Phosphate as PO_4	IS 10158-1982 (RA.2003)	mg/kg	388
4	Sodium as Na		mg/kg	267
5	Nitrate	FAO Method 2007	mg/kg	866
6	Iron as Fe	EPA 3050B-1996 ((Rev-2)/EPA 7380 - 1986	%	1.53
7	Chromium as Cr	EPA 3050B–1996 (Rev-2)/EPA 7190-1986	mg/kg	BDL(DL:5.0)
8	Manganese as Mn	EPA 3050 B-1996 (Rev.2)/EPA 7460-1986	mg/kg	209.84
9	Lead as Pb	EPA 3050B–1996 (Rev-2)/EPA 7420-1986	mg/kg	BDL(DL:5.0)
10	Zinc as Zn	EPA 3050B – 1996 (Rev -2)/EPA 7950 - 1986	mg/kg	42.90
11	Copper as Cu	EPA 3050B-1996 (Rev -2)/EPA 7210-1986	mg/kg	33.70
12	Nickel as Ni	EPA 3050B-1996 (Rev -2)/EPA 7520 – 1986	mg/kg	44.71
13	Cobalt as Co	EPA 3050B-1996 (Rev -2)/EPA 7200 – 1986	mg/kg	13.15

BDL - Below Detection Limit; DL - Detection Limit

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

Report Number and date	**CTL/CH/N-9620/2017-18 & 07.02.2018**		
Sample Number	**N-9620/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Silt**		
Sampling Location	Korattur Surplus (Sample ID: KOR-SILT-001)		
GPS Reading	13° 8'27.73"N, 80°11'47.67"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	2 Kg	**Sampling Method**	CTL/MSP/5.7/002
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Packed Condition
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS
1	Colour	Physical Observation	-	Grey
2	Texture	FAO Method(Page No.25)2007	-	Clay
3	Phosphate as PO_4	IS 10158-1982 (RA2003)	mg/kg	311
4	Sodium as Na		mg/kg	498
5	Nitrate	FAO Method 2007	mg/kg	382
6	Iron as Fe	EPA 3050B-1996 ((Rev-2)/EPA 7380 - 1986	%	2.09
7	Chromium as Cr	EPA 3050B–1996 (Rev-2)/EPA 7190-1986	mg/kg	BDL(DL:5.0)
8	Manganese as Mn	EPA 3050 B-1996 (Rev.2)/EPA 7460-1986	mg/kg	205.09
9	Lead as Pb	EPA 3050B–1996 (Rev-2)/EPA 7420-1986	mg/kg	BDL(DL:5.0)
10	Zinc as Zn	EPA 3050B – 1996 (Rev -2)/EPA 7950 - 1986	mg/kg	25.50
11	Copper as Cu	EPA 3050B-1996 (Rev -2)/EPA 7210-1986	mg/kg	14.46
12	Nickel as Ni	EPA 3050B-1996 (Rev -2)/EPA 7520 – 1986	mg/kg	31.34
13	Cobalt as Co	EPA 3050B-1996 (Rev -2)/EPA 7200 – 1986	mg/kg	17.99

BDL - Below Detection Limit; DL - Detection Limit

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9624/2017-18 & 07.02.2018**		
Sample Number	**N-9624/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Silt**		
Sampling Location	Puzhal Surplus - 1 (Sample ID: PUZL-SILT-001)		
GPS Reading	13°10'32.83"N, 80°12'8.64"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	2 Kg	**Sampling Method**	CTL/MSP/5.7/002
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Packed Condition
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS
1	Colour	Physical Observation	-	Brown
2	Texture	FAO Method(Page No.25)2007	-	Clay
3	Phosphate as PO_4	IS 10158-1982 (RA2003)	mg/kg	333
4	Sodium as Na		mg/kg	784
5	Nitrate	FAO Method 2007	mg/kg	288
6	Iron as Fe	EPA 3050B-1996 ((Rev-2)/EPA 7380 - 1986	%	2.09
7	Chromium as Cr	EPA 3050B–1996 (Rev-2)/EPA 7190-1986	mg/kg	BDL(DL:5.0)
8	Manganese as Mn	EPA 3050 B-1996 (Rev.2)/EPA 7460-1986	mg/kg	218.46
9	Lead as Pb	EPA 3050B–1996 (Rev-2)/EPA 7420-1986	mg/kg	BDL(DL:5.0)
10	Zinc as Zn	EPA 3050B – 1996 (Rev -2)/EPA 7950 - 1986	mg/kg	20.28
11	Copper as Cu	EPA 3050B-1996 (Rev -2)/EPA 7210-1986	mg/kg	12.37
12	Nickel as Ni	EPA 3050B-1996 (Rev -2)/EPA 7520 – 1986	mg/kg	30.48
13	Cobalt as Co	EPA 3050B-1996 (Rev -2)/EPA 7200 – 1986	mg/kg	16.11

BDL - Below Detection Limit; DL - Detection Limit

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Rajkumar

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9625/2017-18 & 07.02.2018**		
Sample Number	**N-9625/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Silt**		
Sampling Location	Puzhal Surplus - 2 (Sample ID: PUZL-SILT-002)		
GPS Reading	13°10'50.51"N, 80°15'15.39"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	2 Kg	**Sampling Method**	CTL/MSP/5.7/002
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Packed Condition
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS
1	Colour	Physical Observation	-	Brown
2	Texture	FAO Method(Page No.25)2007	-	Clay
3	Phosphate as PO_4	IS 10158-1982 (RA2003)	mg/kg	850
4	Sodium as Na		mg/kg	747
5	Nitrate	FAO Method 2007	mg/kg	248
6	Iron as Fe	EPA 3050B-1996 ((Rev-2)/EPA 7380 - 1986	%	2.08
7	Chromium as Cr	EPA 3050B–1996 (Rev-2)/EPA 7190-1986	mg/kg	BDL(DL:5.0)
8	Manganese as Mn	EPA 3050 B-1996 (Rev.2)/EPA 7460-1986	mg/kg	124.47
9	Lead as Pb	EPA 3050B–1996 (Rev-2)/EPA 7420-1986	mg/kg	BDL(DL:5.0)
10	Zinc as Zn	EPA 3050B – 1996 (Rev -2)/EPA 7950 - 1986	mg/kg	47.94
11	Copper as Cu	EPA 3050B-1996 (Rev -2)/EPA 7210-1986	mg/kg	15.97
12	Nickel as Ni	EPA 3050B-1996 (Rev -2)/EPA 7520 – 1986	mg/kg	35.62
13	Cobalt as Co	EPA 3050B-1996 (Rev -2)/EPA 7200 – 1986	mg/kg	14.42

BDL - Below Detection Limit; DL - Detection Limit

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

Surface water Test Results

TEST REPORT

Report Number and date	**CTL/CH/N-9619/2017-18 & 07.02.2018**		
Sample Number	**N-9619/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Surface Water**		
Sampling Location	Surapet Lake (Sample ID: SURA-SURF-001)		
GPS Reading	13° 8'27.84"N, 80°11'23.74"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/S.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:
The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.8	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	24	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	676	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.1)	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	BDL(DL:0.1)	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	0.19	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	175	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.26	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	2.3	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	46.9	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	< 2	-	-
18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	< 4	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	0.13	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.08)	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.21	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit
Note: IS 10500:2012 (Drinking Water Specification)
REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9621/2017-18 & 07.02.2018**		
Sample Number	**N-9621/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Surface Water**		
Sampling Location	Thanikachalam Drain (Sample ID: RET-SURF-001)		
GPS Reading	13° 7'52.21"N, 80°14'16.50"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	6.9	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	236	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1496	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	26.8	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	38.9	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	10.8	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	5.6	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	380	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.21	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	0.56	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	91.4	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	80	-	-

18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	268	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	5.1	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	10.6	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 2$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	0.05	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	0.21	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.29	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit

Note: IS 10500:2012 (Drinking Water Specification)

REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9623/2017-18 & 07.02.2018**		
Sample Number	**N-9623/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Surface Water**		
Sampling Location	Puzhal Surplus - 1 (Sample ID: PUZL-SURF-001)		
GPS Reading	13°10'32.83"N, 80°12'8.64"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/5.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results:

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	6.9	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	76	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1102	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	14.4	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	21.2	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	5.8	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	2.40	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	250	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.23	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	1.9	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	103	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	40	-	-
18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	146	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	2.0	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	1.2	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	0.12	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.29	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit
Note: IS 10500:2012 (Drinking Water Specification)
REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

END OF REPORT

For Chennai Testing Laboratory Pvt ltd

A. Rajkumar

Authorised Signatory

TEST REPORT

Report Number and date	**CTL/CH/N-9626/2017-18 & 07.02.2018**		
Sample Number	**N-9626/17-18**		
Customer Name & Address	**M/s. Voyants Solutions Pvt. Ltd.,**		
	No. 323, Level 4, Diamond Dune, Poonamallee High Road, Aminjikarai, Chennai - 600029		
SAMPLE DETAILS			
Sample Description By Customer	**Surface Water**		
Sampling Location	Puzhal Surplus - 2 (Sample ID: PUZL-SURF-002)		
GPS Reading	13°10'50.51"N, 80°15'15.39"E		
Sampling Date	23.01.2018	**Sampled By**	Chennai Testing Laboratory Pvt. Ltd.,
Quantity Received	5 Litres	**Sampling Method**	CTL/MSP/S.7/001
Date of Receipt	23.01.2018	**Sample Condition**	Good & Received in Plastic Container
Analysis Starting Date	24.01.2018	**Analysis Completion Date**	06.02.2018

Test Results

The above sample tested as received, and results are as follows:

S. NO	PARAMETERS	METHOD	UNITS	RESULTS	Limits As per IS 10500:2012	
					Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate source
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.3	6.5 - 8.5	No relaxation
2	Suspended Solids	2540-D- APHA 22nd Ed.2012	mg/l	50	-	-
3	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1352	Max. 500	Max. 2000
4	Total Residual Chlorine	IS 3025 (Part 26)-1986 (R.2003)	mg/l	BDL(DL:0.1)	-	-
5	Ammonical Nitrogen as N	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	1.1	-	-
6	Total Kjeldahl Nitrogen as N	4500-N-B,C-APHA 22 nd Ed. 2012	mg/l	1.6	-	-
7	Free Ammonia as NH_3	4500-NH_3-B,C-APHA 22nd Ed.2012	mg/l	0.38	-	-
8	Hexavalent Chromium as Cr^{6+}	3500-Cr-B-APHA 22 nd Ed. 2012	mg/l	BDL(DL:0.01)	-	-
9	Cyanide as CN	4500-CN-C,E-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
10	Iron as Fe	IS 3025 (Part 53)-2009	mg/l	1.6	Max. 0.3	No relaxation
11	Chloride as Cl^-	IS 3025 (Part 32)-1988 (R.2009)	mg/l	425	Max. 250	Max. 1000
12	Fluoride as F	IS 3025 (Part 60)-2008	mg/l	0.26	Max. 1.0	Max. 1.5
13	Nitrate as NO_3	IS 3025 (Part 34)-1988 (R.2003)	mg/l	24.1	Max. 45	No relaxation
14	Sulphate as SO_4	IS 3025 (Part 24)-1986 (R.2009)	mg/l	63.3	Max. 200	Max. 400
15	Phenolic Compounds as C_6H_5OH	IS 3025 (Part 43)-1992 (R.2009)	mg/l	BDL(DL:0.001)	Max. 0.001	Max. 0.002
16	Boron as B	IS 3025 (Part 57)-2005	mg/l	BDL(DL:0.1)	Max. 0.5	Max. 1.0
17	Biochemical Oxygen Demand (BOD) 3 days @ 27°C	5210-B APHA 22 nd Ed. 2012	mg/l	6	-	-

18	Chemical Oxygen Demand (COD)	5220-B- APHA 22 nd Ed. 2012	mg/l	24	-	-
19	Oil & Grease	5520-O&G-B APHA 22 nd Ed. 2012 (Partition Gravimetric Method)	mg/l	< 2	-	-
20	Dissolved Phosphate as P	4500-P-B,D-APHA 22 nd Ed. 2012	mg/l	0.64	-	-
21	Sulphide as S	4500-S^2-F-APHA 22 nd Ed. 2012 (Iodometric Method)	mg/l	BDL(DL:0.01)	Max. 0.05	No relaxation
22	Bio – Assay (Zebra Fish) Test	IS 6582 (Part 2): 2001	-	$T_f = 1$	-	-
23	Arsenic as As	3114-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max.0.01	Max. 0.05
24	Cadmium as Cd	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.002)	Max. 0.003	No relaxation
25	Copper as Cu	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.02)	Max. 0.05	Max. 1.5
26	Lead as Pb	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
27	Mercury as Hg	3112-B-APHA 22nd Ed. 2012	mg/l	BDL(DL:0.001)	Max. 0.001	No relaxation
28	Nickel as Ni	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	Max. 0.02	No relaxation
29	Zinc as Zn	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.08)	Max. 5	Max. 15
30	Manganese as Mn	3111 B APHA 22 nd Edition 2012	mg/l	0.19	Max.0.1	Max. 0.3
31	Selenium as Se	IS 3025 (Part 56)-2003(R.2009)	mg/l	BDL(DL:0.005)	Max. 0.01	No relaxation
32	Vanadium as V	3111-B-APHA 22nd Ed.2012	mg/l	BDL(DL:0.01)	-	-

BDL - Below Detection Limit; DL - Detection limit

Note: IS 10500:2012 (Drinking Water Specification)

REMARKS: The Sample does not meet the requirement of IS 10500:2012 with respect to the parameter "Manganese".

*****END OF REPORT*****

For Chennai Testing Laboratory Pvt ltd

A. Raj

Authorised Signatory

List of Parks for Tree Plantation

GREATER CHENNAI CORPORATION / PARKS DEPARTMENT

MAINTENANCE OF PARKS DETAILS

Sl. No.	Zone	Division	Name / Location of the Park	Area in M²
1	1	5	Hansa Garden Park / Ajax TVT	1411.5
2	1	5	Alcargo Near Park	1012
3	1	5	Sakthipuram Park	3040
4	1	11	Shanmuganar Park	2074
5	2	15	Block no 26 CPS- 10	1000
6	2	15	Block no 29 CPS- 9	1699.47
7	2	15	Block no 63 CPS- 7	768.32
8	2	15	Manali puthu nagar CPS- 8 (Sadayankuppam) park	830
9	2	16	Block no 90 CPS - 3	778.12
10	2	16	Block no 134&135 CPS - 1	985.54
11	2	16	Block no 78 CPS - 5	301.5
12	2	16	Manali puthu nagar CPS- 4 (Sadayankuppam)+D362 park	1088
13	2	17	Vadaperumpakkam park	300
14	2	17	Thirupathy Devasthanam nagar park	1534
15	2	18	Vimalapuram II street park	501.76
16	2	18	CPCL IV street park	225
17	2	18	Nedunchezhiyan street park	2482.04
18	2	19	Lake view apartment park (Kamarajar Salai)	832
19	2	19	MMDA 34th street park	243.36
20	2	20	Lake view park (Chinna mathur salai)	1925
21	2	21	Jalagandamariamman koil street park	835
22	2	19	MMDA II Main road park	16362
23	3	22	Macro Marvel 1st cross st	1008
24	3	22	Macro Marvel 2nd cross st	504
25	3	22	Gurushanthi Nagar Park	958.91
26	3	23	Ambattur Red Hills Parks	3000
27	3	24	DG Nagar	1288
28	3	25	Srinivasa nagar main road	3317
29	3	25	Collector nagar	1638
30	3	25	Pathmavathy Nagar Park	973
31	3	26	Secretariate Colony Park	1210
32	3	28	Padmagiri Nagar Park	4340
33	3	28	Krishna Nagar park and childrens playfield	500
34	3	30	Ring Road Park	1780
35	3	30	VRD Nagar Park	3375
36	3	30	Sivasakthi Nagar 2nd Main Road	830
37	3	30	RC Flats Arul nagar park	1000
38	3	31	KKR Nagar 1st Main road Park	4035
39	3	31	KKR Nagar 2nd Main road Park	4315
40	3	31	RC Flats osr park, Near sidco, MTH road	350
41	3	32	Teachers Colony 4th Cross St Park	3450

42	3	32	Teachers Colony 6th Main Rd Park	732
43	3	33	Thanikachalam Nagar B Block Park	1221
44	3	33	Selvam Nagar Park	743
45	3	33	VGP Nagar Park	1000
46	7	79	Ram Nagar park	220
47	7	79	Lenin Nagar Park	418
48	7	79	Gandhi main Road Park	611
49	7	79	Childrens Park, Park street	1040
50	7	80	Thangal Eri Park	17000
51	7	80	Bharathi Nagar Park	550
52	7	81	Thiruvenkadam Nagar Park	3300
53	7	81	Krishnapuram Park	3000
54	7	81	secretriate colony Park	4000
55	7	82	Hindustan Colony Park	2000
56	7	83	Sri Ranga Nagar Park	786.24
57	7	83	Sastha Nagar Park	580.5
58	7	83	Subulakshmi Nagar park	1407.4
59	7	83	TNHB 61st st	2400
60	7	83	Thamaraikulam Park	4398
61	7	84	K.R Nagar Park	1751
62	7	84	TNHB 4th st park	1923.75
63	7	86	Gopal swamy nagar park	440
64	7	86	Sindhu Nathi Park	1300
65	7	86	Children Park at the junction of Bharathi Street(Kalidasan Street)	700
66	7	86	VGN Cosmo Polis Park	2989
67	7	86	Chelliamman Koil Pond Park (Including Pond)	8800
68	7	86	Thamirabharani Park - 1	1269
69	7	86	Thamirabharani Park - 2	855

GPS Co-ordinates of Affected Trees

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T1	13.22446	80.27869
T2	13.21284	80.27909
T3	13.2128	80.27943
T4	13.20866	80.27334
T5	13.20866	80.27334
T6	13.21069	80.2737
T7	13.21161	80.27213
T8	13.21155	80.27237
T9	13.21148	80.27255
T10	13.21135	80.27318
T11	13.21134	80.27328
T12	13.21119	80.27238
T13	13.21138	80.27215
T14	13.2093	80.27173
T15	13.20907	80.27173
T16	13.20889	80.27166
T17	13.20883	80.27295
T18	13.20889	80.27297
T19	13.20921	80.27302
T20	13.21017	80.27339
T21	13.20826	80.27704
T22	13.20843	80.27449
T23	13.2088	80.27458
T26	13.20772	80.2773
T27	13.20613	80.27754
T28	13.20453	80.27714

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T29	13.20414	80.27946
T30	13.20594	80.27527
T31	13.20593	80.27522
T32	13.20592	80.27522
T33	13.2066	80.27402
T34	13.20637	80.27396
T35	13.20633	80.27395
T36	13.20624	80.27393
T37	13.20605	80.27388
T38	13.20267	80.2761
T39	13.20261	80.27609
T40	13.20249	80.27607
T41	13.20141	80.27594
T42	13.20137	80.27595
T43	13.20056	80.27582
T44	13.20866	80.19966
T45	13.20866	80.19966
T46	13.20124	80.27919
T47	13.2012	80.27942
T48	13.2012	80.27942
T49	13.2012	80.27942
T50	13.2012	80.27942
T51	13.20256	80.27876
T52	13.20258	80.27843
T53	13.20359	80.27891
T54	13.19793	80.27492
T55	13.19794	80.27485

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T56	13.18385	80.28319
T57	13.18328	80.28426
T58	13.19206	80.26936
T59	13.19238	80.25364
T60	13.19262	80.25167
T61	13.1871	80.23929
T62	13.18458	80.2377
T63	13.18429	80.23673
T64	13.18388	80.23592
T65	13.10722	80.15331
T66	13.11333	80.14834
T67	13.10402	80.15497
T68	13.10402	80.155
T69	13.10381	80.15624
T70	13.1016	80.15973
T71	13.11129	80.18188
T72	13.1109	80.18198
T73	13.11088	80.18197
T74	13.11133	80.18241
T75	13.11017	80.18713
T76	13.11017	80.18708
T77	13.11092	80.18638
T78	13.11746	80.16604
T79	13.12032	80.16681
T80	13.12004	80.16692
T81	13.12195	80.16737
T82	13.12356	80.16803

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T83	13.12383	80.16817
T84	13.1244	80.16827
T85	13.12462	80.16834
T86	13.12495	80.16834
T87	13.12651	80.16949
T88	13.123298	80.16839
T89	13.12254	80.16452
T90	13.12274	80.16454
T91	13.12447	80.15977
T92	13.12112	80.160187
T93	13.1211	80.16017
T94	13.121043	80.16016
T95	13.12092	80.15966
T96	13.120878	80.15945
T97	13.12089	80.1593
T98	13.12088	80.1585
T99	13.12028	80.15854
T100	13.12007	80.15878
T101	13.12008	80.16014
T102	13.12019	80.16013
T103	13.12164	80.15873
T104	13.11995	80.15789
T105	13.11958	80.15782
T106	13.1193	80.15772
T107	13.11909	80.15765
T108	13.11894	80.15756
T109	13.12039	80.15518

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T110	13.12029	80.15532
T111	13.12018	80.15542
T112	13.12109	80.15223
T113	13.12118	80.15217
T114	13.12139	80.15219
T115	13.12796	80.15376
T116	13.12829	80.15372
T117	13.13169	80.15386
T118	13.13429	80.154
T119	13.13525	80.1551
T120	13.1353	80.15517
T121	13.13566	80.15608
T122	13.13567	80.15612
T123	13.13581	80.15713
T124	13.13422	80.15836
T125	13.13152	80.16183
T126	13.13209	80.16661
T127	13.13209	80.16672
T128	13.13608	80.17056
T129	13.13606	80.17063
T130	13.13872	80.1707
T131	13.14034	80.16976
T132	13.14028	80.16972
T133	13.13784	80.16734
T134	13.13563	80.16644
T135	13.13501	80.16623
T136	13.13314	80.1658

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T137	13.13275	80.16571
T138	13.13914	80.17317
T139	13.13583	80.21031
T140	13.13696	80.21085
T141	13.1379	80.21039
T142	13.13776	80.21037
T143	13.13772	80.21036
T144	13.12925	80.21472
T145	13.12924	80.2148
T146	13.12883	80.21481
T147	13.12873	80.21477
T148	13.1287	80.21474
T149	13.12823	80.21482
T150	13.1187	80.20842
T151	13.11785	80.21122
T152	13.11791	80.21163
T153	13.11793	80.21219
T154	13.12236	80.21225
T155	13.12251	80.21226
T156	13.12316	80.21223
T157	13.12303	80.21417
T158	13.12258	80.21471
T159	13.12079	80.21478
T160	13.12054	80.2148
T161	13.1205	80.21478
T162	13.11779	80.21381
T163	13.1073	80.20078

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T164	13.10865	80.20067
T165	13.10589	80.19932
T166	13.10593	80.19935
T167	13.10596	80.19944
T168	13.10593	80.19967
T169	13.10593	80.19973
T170	13.10593	80.19986
T171	13.10512	80.19865
T172	13.10129	80.199
T173	13.10094	80.19928
T174	13.10062	80.19935
T175	13.09964	80.20094
T176	13.10139	80.20208
T177	13.13829	80.23408
T178	13.13656	80.23431
T179	13.14316	80.23391
T180	13.14431	80.23337
T181	13.14355	80.23404
T182	13.14436	80.23365
T183	13.14434	80.2337
T184	13.14468	80.23338
T185	13.14467	80.23371
T186	13.14467	80.23371
T187	13.1447	80.23378
T188	13.1449	80.23314
T189	13.14475	80.23305
T190	13.14475	80.23305

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T191	13.14541	80.2336
T192	13.14565	80.23373
T193	13.14547	80.23387
T194	13.1456	80.23378
T195	13.1455	80.23346
T196	13.145397	80.23333
T197	13.14581	80.23325
T198	13.14578	80.23318
T199	13.14631	80.23309
T200	13.14643	80.23345
T201	13.1464	80.23336
T202	13.1464	80.23336
T203	13.146413	80.2334
T204	13.14666	80.23765
T205	13.14666	80.23765
T206	13.14736	80.23783
T207	13.14736	80.23783
T208	13.1474	80.23779
T209	13.14705	80.23815
T210	13.14705	80.23815
T211	13.14705	80.23815
T212	13.14367	80.23877
T213	13.14356	80.23845
T214	13.14353	80.23845
T215	13.14451	80.23945
T216	13.1451	80.23969
T217	13.14514	80.23969

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T218	13.14531	80.2397
T219	13.14532	80.23978
T220	13.14554	80.23984
T221	13.14742	80.24483
T222	13.14748	80.24491
T223	13.1455	80.24549
T224	13.1455	80.24549
T225	13.14592	80.2453
T226	13.14622	80.24537
T227	13.14601	80.24553
T228	13.14557	80.24315
T229	13.14557	80.24315
T230	13.14557	80.24315
T231	13.14557	80.24315
T232	13.14957	80.23895
T233	13.14975	80.23577
T234	13.1497	80.23513
T235	13.15169	80.23343
T236	13.15138	80.23991
T237	13.15321	80.24144
T238	13.1591	80.23382
T239	13.15726	80.24037
T240	13.15971	80.24271
T241	13.15477	80.24312
T242	13.1548	80.24395
T243	13.15497	80.24385
T244	13.15491	80.24385

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T245	13.15491	80.24385
T246	13.15522	80.24372
T247	13.15593	80.244
T248	13.15646	80.24388
T249	13.15646	80.24388
T250	13.15668	80.24394
T251	13.15815	80.24391
T252	13.15815	80.24391
T253	13.15815	80.24391
T254	13.15845	80.24404
T255	13.15845	80.24404
T256	13.1585	80.24401
T257	13.15911	80.24382
T258	13.15911	80.24382
T259	13.15911	80.24382
T260	13.16019	80.24372
T261	13.16056	80.24369
T262	13.16056	80.24369
T263	13.16095	80.24372
T264	13.1619	80.24502
T265	13.16212	80.24501
T266	13.16212	80.24501
T267	13.16212	80.24501
T268	13.16212	80.24501
T269	13.16212	80.24501
T270	13.16212	80.24501
T271	13.16234	80.24511

TREE ID.	LATITUDE (NORTH)	LONGITUDE (EAST)
T272	13.16238	80.24506
T273	13.16361	80.245
T274	13.16401	80.2452
T275	13.16498	80.24433
T276	13.16423	80.23973
T277	13.16447	80.23886
T278	13.16461	80.23871
T279	13.15165	80.24707
T280	13.15165	80.24707
T281	13.16164	80.25271
T282	13.16164	80.25271
T283	13.16181	80.25288
T284	13.17339	80.25046
T285	13.17339	80.25046
T286	13.17339	80.25046
T287	13.17309	80.25035
T288	13.17309	80.25035
T289	13.16834	80.23326
T290	13.16876	80.23954
T291	13.16885	80.2395
T292	13.16792	80.23963
T293	13.1671	80.23953
T294	13.15864	80.22559
T295	13.15982	80.228
T296	13.15895	80.22744
T297	13.15876	80.22739
T298	13.15831	80.2274
T299	13.15799	80.22725
T300	13.15766	80.22707
T301	13.15766	80.22704
T302	13.15736	80.22691
T303	13.15302	80.22799
T304	13.14843	80.2316

CRZ clearance – Application Form

PROJECT INFORMATION DETAILS

1. PROJECT DETAILS

A. Project Name

B. Survey No./ Village/ Co-ordinates

C. District

D. State

E. Whether the proposal is for (Select relevant field)

(i) Fresh Clearance under CRZ

(ii) Amendment to an already issued CRZ clearance

(iii) Extension of validity of an already issued CRZ clearance

F. Name of the Applicant

G. Address of the Applicant

H. Contact details (Telephone nos. and e-mail address)

I. Cost of the project (Rs in crores)

2. BENEFITS OF THE PROJECT

A. Details of Project Benefits

B. Employment Likely to be Generated (Yes/No)

If Yes

(i) Total Manpower Requirement

(ii) Permanent Employment (Numbers)

(iii) Temporary Employment (Numbers)

(iv) Temporary Employment- During Construction (Numbers)

(v) Temporary Employment- During Operation (Numbers)

3. DESCRIPTION OF THE PROJECT UNDER CONSIDERATION (Select the Category of the project):

A. Resort / Buildings / civic amenities

(i) Total area/Built-up area (in sqm.)

(ii) Height of structure

(iii) FSI ratio

(iv) Name of concerned town planning authority/ Panchayat etc.

(v) Details of provision of car parking area

Coastal Roads / Roads on Stilt

(i) Area of land reclamation

(ii) Estimated quantity of muck/earth for reclamation

(iii) Traffic carrying capacity

(iv) Dimensions of road

C. Pipelines from thermal power blow down

(i) Length of pipeline

(ii) Length traversing CRZ area

(iii) Depth of excavation
(iv) Width of excavation
(v) Length of pipeline from seashore to deep sea
(vi) Depth of outfall point from surface of sea water
(vii)Temperature of effluent above ambient at disposal point

D. Marine Disposal of Treated Effluent through pipelines

(i) Location of intake/ outfall
(ii) Depth of outfall point
(iii) Length of pipeline
(iv) Length traversing CRZ area
(v) Depth of excavation
(vi) Width of excavation
(vii) Length of pipeline from shore to deep sea/creek
(viii) Depth of outfall point from surface of water
(ix) Depth of water at disposal point
(x) BOD, COD, TSS, oil and grease, heavy metals in the effluent

E. Facility for storage of goods/chemicals

(i) Name of chemical
(ii) End use of the chemical
(iii) No. of tanks for storage
(iv) Capacity of tanks

F. Offshore structures

(i) Exploration or development
(ii) Depth of sea bed
(iii) No. of rigs
(iv) No. of platform
(v) Details of group gathering stations

G. Desalination Plant

(i) Capacity of desalination
(ii) Total brine generation
(iii) Temperature of effluent above ambient at disposal point
(iv) Ambient salinity
(v) Disposal point

H. Mining of atomic minerals

(i) Capacity of mining
(ii) Type of mineral to be extracted
(iii) End use of the mineral
(iv) Government order for mining lease/exploration and approved mining plan details
(v) Extent of mining lease area

I. **Sewage Treatment Plants**

(i) Capacity

(ii) Total area of construction

(iii) Compliance of effluent parameters as laid down by cpcb/spcb/other authorised agency

(iv) Whether discharge is in sea water/creek?

If yes

- Distance of marine outfall point from shore/from the tidal river bank
- Depth of outfall point from sea water/river water surface
- Depth of seabed/riverbed at outfall point

J. **Lighthouse**

(i) Total ground area of foundation/platform

(ii) Height of the structure

K. **Wind Mills**

(i) Capacity (MW)

(ii) Height of the windmill

(iii) Diameter of the windmill

(iv) Length of blade

(v) Speed of rotation

(vi) Transmission lines (overhead or underground)

L. **Others**

(i) Please specify with salient features

(ii) Upload relevant Documents (upload PDF only)

4. **PROJECT LOCATION AS PER CRZ CLASSIFICATION** (If project site falls in different/multiple CRZ categories the same may also be elaborated)

5. **CLAUSE OF CRZ NOTIFICATION UNDER WHICH PROJECT IS A PERMISSIBLE /REGULATED ACTIVITY**

6. **MANDATORY FIELDS FOR PROJECT ASSESSMENT**

A. **CRZ map in 1:4000 scale indicating HTL, LTL demarcation and distance of the nearest project boundary** (in meters) **from HTL to be stated**

(i) Upload Map (kml file)

B. **Project layout superimposed on CRZ Map 1:4000 scale with classification of project location including other notified ESAs prepared**

(i) Upload Map (kml file)

C. **CRZ map 1:25000 scale covering 7 km radius around Project site**

(i) Upload Map (kml file)

7. **PROJECT LOCATED IN** (Select Type)

(i) Non eroding Coast

(ii) Low and Medium eroding coast

(iii) High eroding Coast

8. **DETAILS OF FOREST/ MANGROVES LAND INVOLVED (YES/NO)**

   IF YES

   (i) Detail of area diverted

   (ii) Forest clearance to be submitted (Upload document)

   (iii) No. of trees to be cut under the project

   (iv) Compensatory afforestation plan to be submitted (Upload document)

9. **DISTANCE OF PROPOSED PROJECT FROM ESA/MARINE PARK/ WILD LIFE SANCTUARY**

   (i) Within 10 kilometre radius from the project site (Yes/No)

   If YES

   - Permission from NBWL to be submitted (Upload document)

10. **NOC OR CONSENT TO ESTABLISH FROM STATE/UT POLLUTION CONTROL BOARDS OBTAINED (YES/NO)**

    If YES

    (i) Copy of NOC to be provided (Upload document)

    (ii) Conditions imposed to be stated (Upload document)

11. **Environment Impact Assessment (EIA) studies (relevant fields to be filled)**

    A. Terrestrial studies:

    (i) Summary details of EIA (Terrestrial) Studies

    (ii) Upload Recommendation made in EIAs (Upload document)

    (iii) State period of Study

    B. Marine Studies

    (i) Summary details of EIA (Marine) Studies

    (ii) Upload Recommendation made in EIAs (Upload document)

    (iii) State period of Study

12. **DISASTER MANAGEMENT PLAN / NATIONAL OIL SPILL DISASTER CONTINGENCY PLAN (if applicable)**

13. **PROJECT INVOLVING DISCHARGE OF LIQUID EFFLUENTS:**

    (i) Capacity of Sewage Treatment Plant

    (ii) Quantity of effluent generated

    (iii) Quantity of effluent treated

    (iv) Method of treatment and disposal

14. **PROJECT INVOLVING DISCHARGE OF SOLID WASTE:**

    (i) Type of solid waste

    (ii) Quantity of solid waste generated

    (iii) Method of disposal

    (iv) Mode of transport

15. **WATER REQUIREMENT in kilo litres per day (KLD)**

    (i) Quantity of water required

    (ii) Source of water

(iii) If Ground water (Upload a copy of approval from Central Ground Water Authority or other authorised body)

(iv) If other Source (Upload a copy of permission from competent authority)

(v) Mode of transport

(vi) Commitment of water supply (Upload document)

16. DETAILS OF WATER TREATMENT AND RECYCLING (If any) (Multiple Entries Allowed)

Type/ Source	Quantity of Waste Water Generated (Kilos Litre per Day)	Treatment Capacity (Kilos Litre per Day)	Treatment Method	Mode of Disposal	Quantity of Discharged Water (Kilos Litre per Day)	Quantity of Treatment Water used in Recycling/Reuse (Kilo Litre per Day)

17. DETAILS OF RAINWATER HARVESTING

(i) No. of Storage tanks

(ii) Total capacity of tanks

(iii) No. of Recharge Pits

(iv) Capacity of pits

18. ENERGY REQUIREMENT AND SOURCES

(i) Total Power Requirements (kwh)

(ii) Source

(iii) Upload Copy of Agreement (upload pdf only)

(iv) Stand by Arrangement (Details)

19. ENERGY EFFICIENCY/SAVING MEASURES

(i) Source/Mode

(ii) Details of savings

20. RECOMMENDATION OF STATE COASTAL ZONE MANAGEMENT AUTHORITY

(i) Upload Copy of CZMA recommendations (Upload pdf only)

(ii) Compliance status of the Conditions Imposed

21. WHETHER PROPOSAL ATTRACTS EIA NOTIFICATION, 2006. (Yes/No)

If YES,

(i) the category thereof

(ii) Status of proposal for EC (as applicable)

22. SOCIAL AND ENVIRONMENTAL ISSUES AND MITIGATIONS MEASURES SUGGESTED INCLUDING BUT NOT LIMITED TO R&R, WATER, AIR, HAZARDOUS WASTES, ECOLOGICAL ASPECTS, ETC. (Brief Details to be Provided)

23. DETAILS OF COURT CASES Whether there is any Court Cases pending against the project and/or land in which the project is proposed to be set up? **(Yes/No)**

If Yes, Pending or Disposed (Select relevant)

(i) Name of the Court (Supreme Court, High Court, National Green Tribunal)

(ii) Case No.

(iii) Case Details

(iv) Orders/Directions of the court, if any and its relevance with the proposed project (Upload document)

24. ADDITIONAL INFORMATION, If any

UNDERTAKING: It is certified that the information given above are true to the best of my knowledge and belief and nothing contravening the provisions of CRZ Notification, 2011 has been concealed therefore.

Name and Signature of the applicant:

Date:

Integrated Biodiversity Assessment Tool

IBAT

Integrated Biodiversity Assessment Tool

WORLD BANK GROUP BIODIVERSITY RISK SCREEN

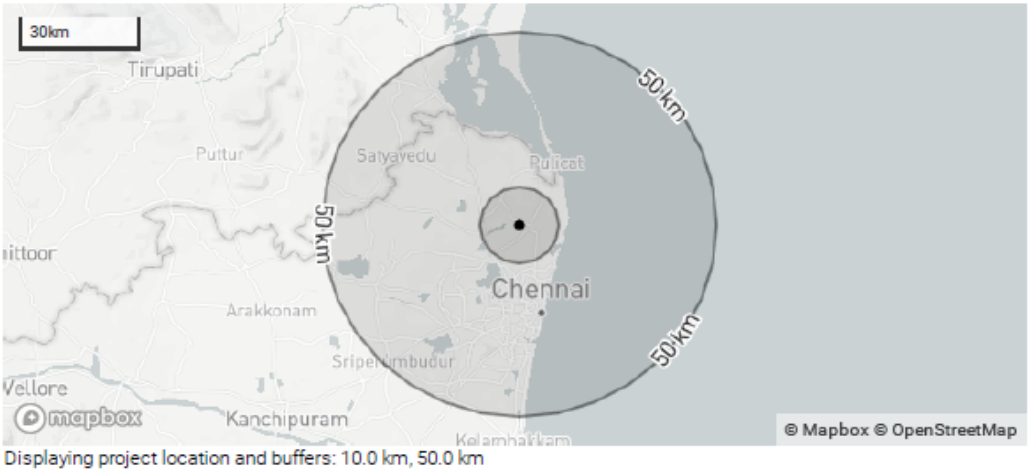
Report generated on 03/12/2019 by Ninette Pajarillaga under the license number 954-5640 held by ADB. www.ibat-alliance.org

Project Name: IND IUFMCKBP

Location: [13.3, 80.2]

Overlaps with:

Protected Areas	3
Key Biodiversity Areas	1
IUCN Red List	39
Critical Habitat	Likely



Displaying project location and buffers: 10.0 km, 50.0 km

WORLD BANK GROUP

This report is based on IFC Performance Standard 6 (PS6) but applies to World Bank Environmental and Social Standard 6 (ESS6)

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About this report

IBAT provides initial screening for critical habitat values. Performance Standard 6 (PS6) defines these values for critical habitat (PS6: para. 16) and legally protected and internationally recognized areas (PS6: para. 20). PS6 will be triggered when IFC client activities are located in modified habitats containing "significant biodiversity value," natural habitats, critical habitats, legally protected areas, or areas that are internationally recognized for biodiversity. References to PS6 and Guidance Note 6 (GN6) are provided to guide further assessment and detailed definitions where necessary. Please see https://www.ifc.org/ps6 for full details on PS6 and GN6.

The report screens for known risks within a standard 50km buffer of the coordinates used for analysis. This buffer is not intended to indicate the area of impact. The report can be used to:

- Scope risks to include within an assessment of risks and impacts
- Identify gaps within an existing assessment of risks and impacts
- Prioritize between sites in a portfolio for further assessment of risks and impacts
- Inform a preliminary determination of critical habitat
- Assess the need for engaging a biodiversity specialist
- Identify additional conservation experts or organizations to inform further assessment or planning

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment as described in PS6 and GN6. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

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Priority Species

Habitat of significant importance to priority species will trigger critical habitat status (See PS6: para 16). IBAT provides a preliminary list of priority species that could occur within the 50km buffer. This list is drawn from the IUCN Red List of Threatened Species (IUCN RL). This list should be used to guide any further assessment, with the aim of confirming knownor likely occurrence of these species within the project area. It is also possible that further assessment may confirm occurrence of additional priority species not listed here. It is strongly encouraged that any new species information collected by the project be shared with species experts and/or IUCN wherever possible in order to improve IUCN datasets.

IUCN Red List of Threatened Species - CR & EN

The following species are potentially found within 50km of the area of interest.
For the full IUCN Red List please refer to the associated csv in the report folder.

Species name	Common name	IUCN Category	Group
Glyphis gangeticus	Ganges Shark	CR	CHONDRICHTHYES
Carcharhinus hemiodon	Pondicherry Shark	CR	CHONDRICHTHYES
Pristis zijsron	Green Sawfish	CR	CHONDRICHTHYES
Rhina ancylostoma	Bowmouth Guitarfish	CR	CHONDRICHTHYES
Rhynchobatus australiae	Bottlenose Wedgefish	CR	CHONDRICHTHYES
Rhynchobatus laevis	Smoothnose Wedgefish	CR	CHONDRICHTHYES
Glaucostegus granulatus	Sharpnose Guitarfish	CR	CHONDRICHTHYES
Glaucostegus obtusus	Widenose Guitarfish	CR	CHONDRICHTHYES
Glaucostegus thouin	Clubnose Guitarfish	CR	CHONDRICHTHYES
Pristis pristis	Largetooth Sawfish	CR	CHONDRICHTHYES
Gyps bengalensis	White-rumped Vulture	CR	AVES

Species name	Common name	IUCN Category	Group
Sarcogyps calvus	Red-headed Vulture	CR	AVES
Gyps indicus	Indian Vulture	CR	AVES
Glaucostegus typus	Giant Guitarfish	CR	CHONDRICHTHYES
Balaenoptera musculus	Blue Whale	EN	MAMMALIA
Cuon alpinus	Dhole	EN	MAMMALIA
Manis crassicaudata	Indian Pangolin	EN	MAMMALIA
Rhincodon typus	Whale Shark	EN	CHONDRICHTHYES
Isurus oxyrinchus	Shortfin Mako	EN	CHONDRICHTHYES
Sphyrna lewini	Scalloped Hammerhead	EN	CHONDRICHTHYES
Sphyrna mokarran	Great Hammerhead	EN	CHONDRICHTHYES
Anoxypristis cuspidata	Narrow Sawfish	EN	CHONDRICHTHYES
Pristis clavata	Dwarf Sawfish	EN	CHONDRICHTHYES
Eusphyra blochii	Winghead Shark	EN	CHONDRICHTHYES
Aetobatus flagellum	Longhead Eagle Ray	EN	CHONDRICHTHYES
Aetomylaeus maculatus	Mottled Eagle Ray	EN	CHONDRICHTHYES
Aetomylaeus vespertilio	Ornate Eagle Ray	EN	CHONDRICHTHYES
Isurus paucus	Longfin Mako	EN	CHONDRICHTHYES

Species name	Common name	IUCN Category	Group
Acropora rudis		EN	ANTHOZOA
Lamiopsis temminckii	Broadfin Shark	EN	CHONDRICHTHYES
Tor khudree	Black Mahseer	EN	ACTINOPTERYGII
Lindernia minima		EN	MAGNOLIOPSIDA
Holothuria scabra	Golden Sandfish	EN	HOLOTHUROIDEA
Holothuria lessoni	Golden Sandfish	EN	HOLOTHUROIDEA
Thelenota ananas	Prickly Redfish	EN	HOLOTHUROIDEA
Sypheotides indicus	Lesser Florican	EN	AVES
Sterna acuticauda	Black-bellied Tern	EN	AVES
Neophron percnopterus	Egyptian Vulture	EN	AVES
Aquila nipalensis	Steppe Eagle	EN	AVES

Restricted Range Species

There are no restricted range species to show for this report.

IBAT

Biodiversity features which are likely to trigger Critical Habitat

Protected Areas

The following protected areas are found within 10.0 km and 50.0 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance	Recommendation
Guindy	50.0 km	Assess for critical habitat
Pulicat Lake	50.0 km	Assess for biodiversity risk
Pulicat Lake Bird	50.0 km	Assess for biodiversity risk

Key Biodiversity Areas

The following key biodiversity areas are found within 10.0 km and 50.0 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance	Recommendation
Pulicat Lake	50.0 km	Assess for critical habitat

Species with potential to occur

Area Taxonomic group	Total assessed species	Total (CR, EN & VU)	CR	EN	VU	NT	LC	DD
CHONDRICHTHYES	72	40	11	12	17	17	6	9
AVES	289	13	3	4	6	16	260	0

Area Taxonomic group	Total assessed species	Total (CR, EN & VU)	CR	EN	VU	NT	LC	DD
MAMMALIA	70	9	0	3	6	3	53	5
ANTHOZOA	6	2	0	1	1	1	2	1
ACTINOPTERYGII	583	7	0	1	6	8	527	41
MAGNOLIOPSIDA	76	2	0	1	1	1	72	1
HOLOTHUROIDEA	32	7	0	3	4	0	14	11
REPTILIA	43	3	0	0	3	0	35	5
LILIOPSIDA	135	2	0	0	2	0	130	3
AMPHIBIA	19	0	0	0	0	0	19	0
INSECTA	45	0	0	0	0	0	44	1
HYDROZOA	2	0	0	0	0	0	2	0
MALACOSTRACA	24	0	0	0	0	0	22	2
GASTROPODA	114	0	0	0	0	0	110	4
POLYPODIOPSIDA	9	0	0	0	0	0	9	0
BIVALVIA	12	0	0	0	0	0	10	2
CHAROPHYACEAE	8	0	0	0	0	0	7	1
ARACHNIDA	1	0	0	0	0	0	1	0

Country-level summary

Coming soon

Recommended Experts and Organizations

For projects located in critical habitat, clients must ensure that external experts with regional expertise are involved in further assessment (GN6: GN22). Clients are encouraged to develop partnerships with recognized and credible conservation organizations and/or academic institutes, especially with respect to potential developments in natural or critical habitat (GN6: GN23). Where critical habitats are triggered by priority species, species specialists must be involved. IBAT provides data originally collected by a large network of national partners, while species information is sourced via the IUCN Red List and affiliated Species Specialist Groups. These experts and organizations are listed below. **Please note that this is not intended as a comprehensive list of organizations and experts. These organizations and experts are under no obligation to support any further assessment and do so entirely at their discretion and under their terms. Any views expressed or recommendations made by these stakeholders should not be attributed to the IFC or IBAT for IFC partners.**

Relevant national or regional organizations

IBAT integrates information developed by a global network of conservation agencies, organizations and experts. These efforts are coordinated by the IBAT Alliance (BirdLife International, Conservation International, IUCN and UNEP-WCMC) who compile and maintain this information as globally standardized databases. The local partners most relevant to the area of analysis are:

Wild Bird Society of Japan Address: Maruwa Building, 3-9-23 Nishi-Gotanda, Shinagawa-ku, Tokyo 141-0031, JapanWeb: http://www.wbsj.org/

BirdLife Asia Regional Office Address: 354 Tanglin Road, #01-16/17, Tanglin International Centre, Singapore 247672 Email: singapore.office@birdlife.org Web: http://www.birdlife.org/asia

Directory for Species Survival Commission (SSC) Specialist Groups and Red List Authorities

URL: http://www.iucn.org/about/work/programmes/species/who_we_are/ssc_specialist_groups_and_red_list_authorities_directory/

Health and Safety Plan (COVID 19)

Project Number: 49107- 009

June 2020

IND: Integrated Urban Flood Management for Chennai - Kosasthalaiyar Basin Project

Prepared by Greater Chennai Corporation (GCC) for the Asian Development Bank.

CONTENTS

1. Project Rationale

1. Kosasthalaiyar River Basin is located in the northern part of Chennai, India consisting of an area of 127.80 km^2 covering Greater Chennai Corporation (GCC) administrative zones 1, 2, 3, 7 & 8. The project area has been divided into eleven (11) watersheds based on the topography and natural flow patterns. The total length of the existing storm water drain is 280km, of which 105km length of drain is in good condition which will be retained. The remaining 175km of drain is required to be rehabilitated due to inadequate hydraulic carrying capacity. Apart from the existing drain (280 km), new drain for a length of 588 km have been proposed. Necessary interlinking of water bodies through the existing or proposed drain has also been considered to maintain the water balance and achieve maximum water storage within the Kosasthalaiyar drainage basin. In addition, the macro drains/surplus canals managed by PWD (3 canals) and GCC (4 canals) along with necessary rainwater harvesting structures are also being considered as part of this Integrated Urban Flood Management Project. GCC intends to take up the proposed Integrated Urban Flood Management for the Chennai-Kosasthalaiyar Basin for implementation, which shall be financed by the Asian Development Bank (ADB) through Multi-Tranche Financing Facility (MFF).

2. **Institutional Setup.** Municipal Administration and Water Supply Department (MAWS) of GoTN acting through the Greater Chennai Corporation (GCC) are the Executing Agency (EA). A Project Management Unit (PMU) will be established in GCC headed by a Project Director and Project Manager. GCC is the Implementing Agency (IA) for this project. A Project Implementation Unit (PIU) will be established in GCC which will be headed by a Project Manager. PIU will be assisted by Project Support Consultant (PSC).

3. To hasten the implementation of the project it has been decided to split the project into 42 packages under 3 phases. GCC has decided to invite the bid for Phase 1 in the month of June 2020. For which all the necessary project documents including the DPR's, safeguard documents, bid documents and project estimations are almost in the verge of completion.

2. Ongoing Corona Virus Disease (COVID-19) Crisis

4. **About COVID-19**. Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. At this time, there are no specific vaccines or treatments for COVID-19.[16] However, precautions can be implemented to prevent and slow down the transmission of the virus.

5. **Common Symptoms of Corona Virus Disease**[17]

COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization.
Most common symptoms:

- fever.
- dry cough.

[16] World Health Organization. https://www.who.int/health-topics/coronavirus#tab=tab_1
[17] World Health Organization. https://www.who.int/health-topics/coronavirus#tab=tab_3

- tiredness.

Less common symptoms:
- aches and pains.
- sore throat.
- diarrhea.
- conjunctivitis.
- headache.
- loss of taste or smell.
- a rash on skin, or discoloration of fingers or toes.

Serious symptoms:
- difficulty breathing or shortness of breath.
- chest pain or pressure.
- loss of speech or movement.

6. The first case of the COVID-19 pandemic in the Indian state of Tamil Nadu was reported in the month of March 2020. Followed by that the Government of Tamil Nadu have taken initiatives in containing the spread of the virus, however, at present situation it is second highest number of confirmed cases in India after Maharashtra. After a serious of lockdown and enforcement of 144, the economic activity in the state has come to standstill, hence it has been decided to give relaxation in the non-containment zones to continue the business (outdoor works) provided with Standard Operating Procedures (SOP's) and Guidelines with specific actions. Similar approach shall be adopted for the containment zones as soon as the COVID infection level declines.

7. As per the WHO statement "one can reduce the chances of being infected or spreading COVID by taking simple precautionary measures". In line with WHO, various guidelines/guidance notes/ SOP's were issued by the national/state government, ILO and World Bank/IFC from time to time to avoid the spread of diseases.

3. Need for Health and Safety Plan for COVID 19

8. In view of this various guidelines/guidance notes/ SOP's published by the state and central government (Ministry of Health and Family Welfare (MoHFW), and Ministry of Housing and Urban Affairs (MoHUA)), ILO, WHO and World Bank/IFC, the GCC have initiated the preparation of Health and safety plan (H&S Plan) for the Integrated Urban Flood Management Project to prevent the spread of COVID 19 infection to the project staffs, contractors and construction workers and visitors. The H&S Plan sets out guidance on how to work safely. It gives practical considerations of how this can be applied in the workplace. Accordingly, key guidelines has been prepared

- General Guideline (applicable for all)
- Guideline for Contractors
- Guideline for Workers

3.1 General Guidance

- Identity Cards will be issued to everyone entering the construction area. Periodic tailgate sessions will be arranged to review site protocols in view of highly dynamic scenarios ensuring social distancing norms.
- Mandatory Thermal Scanning of everyone entering and exiting a construction site will be done may be done by using thermal scanners.

- Provision for hand wash & sanitizer (touch free) will be made at all entry and exit points and common areas. Everyone will be required to wash & sanitize his/her hands before entering the site. Same procedure to be followed after exiting the premise.
- Avoid large gatherings or meetings. Maintain at least 1 metre (3 feet) distance from persons, especially with those having flu-like symptoms, during interaction.
- For conducting Site Meetings
    - Only absolutely necessary meeting participants should attend
    - Attendees should be at least 1 metre apart from each other
    - Rooms should be well ventilated / windows opened to allow fresh air circulation
    - Consider holding meetings in open areas where possible

- Everyone entering the site area should mandatorily wear a face mask.
- Hand gloves should be used by the workers who are handling material coming from outside
- There will be a strict ban on Gutka, Tambaku, Paan etc. on site and spitting shall be strictly prohibited.
- Food should be consumed at designated areas only ensuring social distancing.
- Post lunch, waste should be disposed off by individuals in designated bins and the area should remain clean.
- Entire construction sites including site office, labour camp, canteens, pathways, toilets, entry / exit gates will be disinfected on a daily basis.
- Housekeeping team should be provided with necessary equipment.
- There will be a total ban on non-essential visitors at sites.
- Hospitals/clinics in the nearby area, which are authorized to treat COVID-19 patients, should be identified and list provided with contact number and should be available at site all the time.
- A doctor will be present periodically (at least once a week) at site on allotted time for any medical assistance.
- Appropriate signage at construction site spelling out safety practices in the language which is understood by all, like Tamil, Hindi (for migrant workers), to be displayed.
- For any confusion, clarification and update, everyone should approach designated authority (Project Implementation Unit and Project Support Consultants) or rely on an authentic source.

3.2 Guideline for Workers

- All workers to report some time earlier before the start of the shift. An attendance register has to be maintained for each shift. Masks are mandatory and social distancing[18] of at least 1m to be followed in the holding area. The focal point to provide information update.
- The workers need to wash their hands thoroughly (for at least 20-30 seconds) with soap or use sanitizers just before reporting screening. Adequate provision for hand washing, soaps, sanitizers needs to be made at the reporting location. Hand gloves mandatory for teams who are screening workmen, conducting medical check-up, disinfection

[18] https://www.mohfw.gov.in/pdf/SocialDistancingAdvisorybyMOHFW.pdf

- Health screening to be done for all workers in the shift - including temperature monitoring using a non-contact thermometer. Any worker reporting with temperature higher than 37.3°C shall be sent to the isolation quarters and periodic observation be made.
    - In case the worker shows symptoms of the pandemic (including COVID-19), the procedures as laid down by the national and state laws need to be followed for testing, quarantine of at least 14 days or hospitalization, depending upon individual case.
    - All the co-workers in the shift, and other persons with known contact history in the construction site should be quarantined for a period of at least 14 days, followed by regular checkups/ observation/ examinations as laid down by the national and state laws.
- The workers found fit need to proceed to work with all required personal protective equipment, e.g., masks, gloves, goggles, boots, helmets, harness, etc.
- The workers be encouraged to avoid contact with co-workers as far as possible and wash their hands at regular intervals.
- Lunch/meal break be staggered into two so that workers proceed for lunch/meal at different times.
- There needs to be a provision of separate drinking bottles/cups for each worker, and these need to be cleaned thoroughly after meals.
- Proper hand washing arrangement (water/soaps/sanitizers) needs to be ensured at eating locations. Hand washing facilities are ideally to be located within 5m of toilets and at close range of eating space.
- The workers returning to the shift after lunch/meal break need to thoroughly wash their hands and follow the same procedure as that followed at the start of the shift.
- At the close of shift, the workers need to thoroughly wash their hands with soap/sanitizers etc.
- The PPE should be thoroughly washed/cleaned/sanitized (depending upon the type of PPE) after the shift ends.
- The meal timings should be phased in each shift. *There should be a difference of about 1 hour between two shifts* and the sensitive areas of the workplace should be cleaned / sanitized as far as possible.
- The time between two shifts should be used for cleaning and sanitizing machines, hand tools and areas of regular contact – grab handles, control levers, steering wheels, control panels, etc. shall be regularly cleaned, and at the end of shifts used across shifts (or continuous operations) where operators/helpers change.

3.3 Guideline for Contractors

- Site specific risk assessment needs to be undertaken and emergency preparedness plan be prepared for all sites, including camp sites and construction sites.
- Protocols for medical treatment, etc. should be prepared/followed, including for reporting, referral, treatment and discharge as per national and state laws and other guidelines.
- A health and safety officer to be deployed as the focal point at all project sites, and wherever, the same is not in place, urgent action needs to be taken by the contractor to recruit someone.
- Register for all the workers needs to be maintained, along with their health records. Prepare a profile of the workforce considering the following: i) Total number of

workers who live in the labor camps; ii) Total number of workers who commute from their houses; iii) Number of male and female workers.

- Limit the number of workers on site at any one time to minimize contact, including exploring operations for multi-shift working rotation.
- Entry/exit to the site should be documented. Transport vehicles used during construction activities to carry construction materials should be sanitized on regular basis (at least once a day).
- Hygienic living conditions need to be ensured in the camp sites with regular/daily cleaning, adequate hand washing facilities. Adequate provision for solid waste management needs to be provided.
- Provide health and safety training/orientation on COVID19, or any other pandemic, to all workers and staff. *Some initiatives could be like training family members of construction workers to stitch masks and gloves to augment PPE.*
- Ensure adequacy of necessary supplies of energy, water, food, medical supplies, cleaning equipment, PPE (both for regular use and those for medical exigencies) etc.
- Quarantine and isolation facilities should be established in the camps (WHO Guidelines). The isolation facilities should have separate and dedicated toilets with proper arrangement for cleaning and removal of faeces.
- Any medical waste produced during the care of ill workers should be disposed as per the national and state laws or relevant guidelines (e.g., WHO guidelines from time to time). PPE used for medical treatment/care purposes should be stored securely and kept separate from other waste. Current WHO recommendations are to clean utility gloves or heavy duty, reusable plastic aprons with soap and water and then decontaminate them with 0.5% sodium hypochlorite solution after each use. Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused;
- Incentivize workers lodging in the local community to move to site accommodation.
- The community should be made aware, through posters etc., of procedures put in place at site to address issues related to COVID-19. This should include all measures being implemented to limit or prohibit contact between workers and the community.

3.3.1 Additional guidance for good practice for Contractors:

- Follow national orders/circulars/guidelines issued from time to time
- Apply the guidelines/guidance notes referred in the document
- Practice the Daily Drill and General Guidance.
- Camp sites and construction sites may require different approaches to avoid spread of COVID-19. Special care to be taken for supply chain related vehicles, personnel and material.
- Provide Contactless attendance system

3.3.2 Emergency protocol in case of detection of symptoms of COVID 19 to be observed by Project Manager of Contractor

- Immediate shift worker to isolation room. Inform the PSC/ PIU.
- Call for a doctor.
- Keep worker under observation for a few days in isolation room. In case of doubt act per advice of local doctor.

- COVID testing shall be arranged as per instruction of Doctor and if so advised by
- Doctor move worker to Hospital.
- Prevent rumors and take strict action against those who spread it.

3.3.3 Guideline for Material, Tools, Machinery, Vehicles etc.

- At all points of time, easy access to parking should be ensured
- All vehicles and machinery entering the premises should be disinfected mandatorily by spraying
- All construction material arriving at site should be left idle for 3 days before use to ensure safe usage
- Non-touch garbage bins with biodegradable garbage bags should be installed for waste collection at all common access areas
- Wipe down interiors and door handles of machines or construction vehicles, the handles of equipment and tools that are shared, shall be cleaned with a disinfectant prior to use

4. COVID Response and Management Plan (C-R&MP)

9. As described in these guidelines, the Contractors shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to GCC and PSC for approval.

4.1 Roles and Responsibilities

10. Responsibilities for implementing COVID Response and Management Plan

Sl.no	Designation	Responsibility
1	Contractor (health and safety officer)	• Preparation of COVID Response and Management Plan (based on the guidelines given in the H&S Plan) • Overall responsibility of ensuring compliance of procedure and precautions in C-R&MP • To submit daily compliance report to PIU/PSC
2	Project Support Consultant (EHS Officer)	• To coordinate efforts on behalf of Engineer in Charge and ensure compliance of these SOPs/ guidelines given in the C-R&MP. • To submit a daily confirmation report of compliances (submitted by the contractor) to PIU
3	Project Implementation Unit	• To exclusively look after the implementation of all the precautions and procedure at work site and labor camps • Review the confirmation report (submitted by the PSC) and suggest for improvements • Update the PMU with respect to the implementation of COVID Response and Management Plan.

11. The various guidelines / interim notes for construction sites have been prepared by several institutions and organizations, some of which are listed below:

a) The Ministry of Home Affairs and Ministry of Health and Family Welfare, Government of India issued several Orders/Circulars/Guidelines from time to time to be followed by the State governments, sectors and individuals :- (https://www.mha.gov.in/notifications/circulars-covid-19, https://www.mha.gov.in/sites/default/files/PR_ConsolidatedGuidelinesofMHA_28032020_0.pdf , https://www.mohfw.gov.in/. Further, amendments to these orders are updated from time to time on https://www.mha.gov.in/media/whats-new,
b) ILO's Guidance: Considerations for employment intensive works in response to COVID 19 (April 12, 2020): https://www.ilo.org/wcmsp5/groups/public/---edema/documents/publication/wcms_741669.pdf
c) WB's ESF/Safeguards interim note: COVID-19 considerations in construction/civil works projects (April 7, 2020)
d) WHO's guidelines: Getting your workplace ready for COVID-19 (March 03, 2020) https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf; Water, sanitation, hygiene, and waste management for the COVID-19 virus (March 19, 2020) https://www.who.int/publications-detail/water-sanitation-hygiene-and-waste-management-for-covid-19; Rational use of personal protective equipment (PPE) for coronavirus disease (March 19, 2020): https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3-eng.pdf .
e) IASC Interim Guidance: Scaling-Up Covid-19 Outbreak Readiness and Response Operations in Humanitarian Situations, Including Camps and Camp-Like Settings (March 17, 2020) https://interagencystandingcommittee.org/other/interim-guidance-scaling-covid-19-outbreak-readiness-and-response-operations-camps-and-camp
f) IDB's Guidance for infrastructure projects on COVID-19 https://www.idbinvest.org/en/download/9625
g) IFC Guidance: Workers' accommodation: processes and standards (2009) http://documents.worldbank.org/curated/en/604561468170043490/pdf/602530WP0worke10Box358316B01PUBLIC1.pdf

Focus Group Discussion

Sivaprakasam Nagar, Surapattu in Ambathur municipal area in Zone 7 on Sunday the 1st November 2020

The residents of Sivaprakasam Nagar of I to III streets participated and the local residential welfare organization had organized the meeting at one of its residential complexes. Women and men from across the streets participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 65 minutes.

The residents had initially spirited arguments over the current conditions of the draining of flood water and their experiences in addressing the problem over the past 5 years. They stressed the need for an integrated approach involving water, drainage, and electricity authorities in laying an appropriate system for drainage. Their main contention was to provide a drain that least affected their structures, and their movement in the event of flood.

GAP Activities – Waste disposal

The discussion was slowly brought to focus on GAP activities with a prime poser on the residents' waste disposals. The residents primarily rely of Corporation's local agents for collection of wastes and the collection is on alternative days. However, only 50% of the local population dispose their wastes through this mode and another half of them just throw the wastes at streets on their whims. This have made the locality prone to issues of water logging and mosquito menace at times of rains. They seem to have no adequate knowledge on clogged drains and its impact on floods. They said that there were no clogged drain and water during flood drains out in a day. Nevertheless, the nearby lake used to be clogged with these wastes due to rainwater and this local water body is slowly deteriorated by these wastes. The residents suggested to provide big dustbins in more places in the locality to prevent throwing waste at streets as the time of current system of collecting wastes does not suit to most of the local population.

Rainwater harvesting

The residents conveyed during the discussion that almost all the houses have made rainwater harvesting facility at their compounds and each independent house have plants and trees besides growing trees in their streets.

Flood impact

As for the flood warning system, the group informed that there were no preventive planning or advanced information for them. They were unaware and the group felt that often there were only adhoc measures and no permanent measures seemed to be undertaken. However, they were not much affected by floods and the flood water used to drain in a day.

Roads were much damaged during flood and they were repaired after an agitation by the residents. At the nearby junction at ESSAR petrol bunk, the water stagnated like a tank and the local people held an agitation and later, it was cleared, and the road got repaired.

Non-domestic activities

There are no major or small industries in the locality. A petrol bunk is on the main road – Redhill road – located within a km. There are 1 or 2 shops for a street. There has been no park and the group demanded for a park. They said that a nearby government vacant land may be improved into a park.

The residents represented the group are primarily belong to middle and upper middle class. Some of the retired and serving government officers also reside in this locality. They expressed that they had no issues in respect of earning opportunities and livelihood.

Observations

A major observation during the discussion was that the residents have been split in their opinions in respect of their participation in any community activities. Most of the time, when

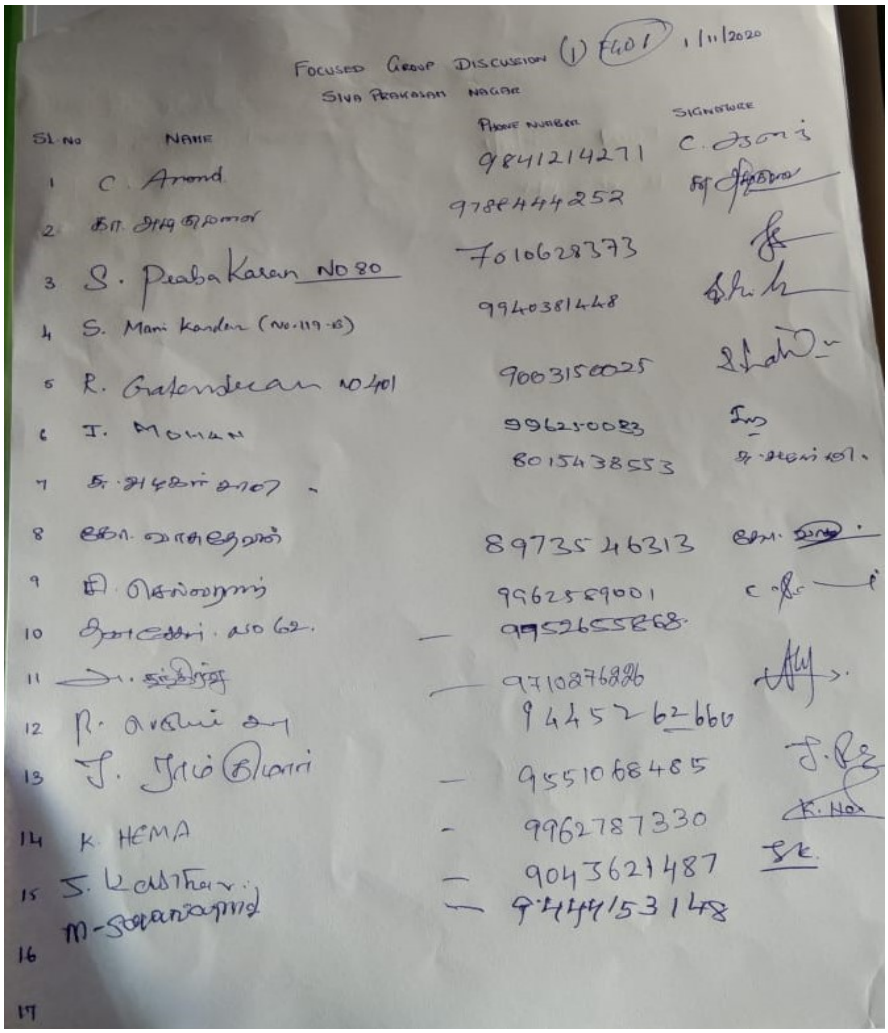
the concept of community participation is raised, there prevailed deep silence and a very few have appreciated such initiatives. The local association also experienced difficulties in bringing the people together for any public cause.

There is absence of positive attitude towards their participation in waste disposals and flood warning systems and the group agreed to initiate motivation and awareness campaign among them on these aspects.

Building confidence and cooperation

However, there were lot many questions and clarifications raised at the meeting as the Engineers from the corporation were present during the discussion. They asked about the width and depth of the drain, the formation of the drain in reference to the width and height of the road, possibility of draining stagnated water from the vacant land, the damages for the houses due to laying of the drain and ensuing compensation etc. The engineers have responded to their queries and in the process have gained their confidence and cooperation for the project. The local association has assured their cooperation and guidance in availing local support.

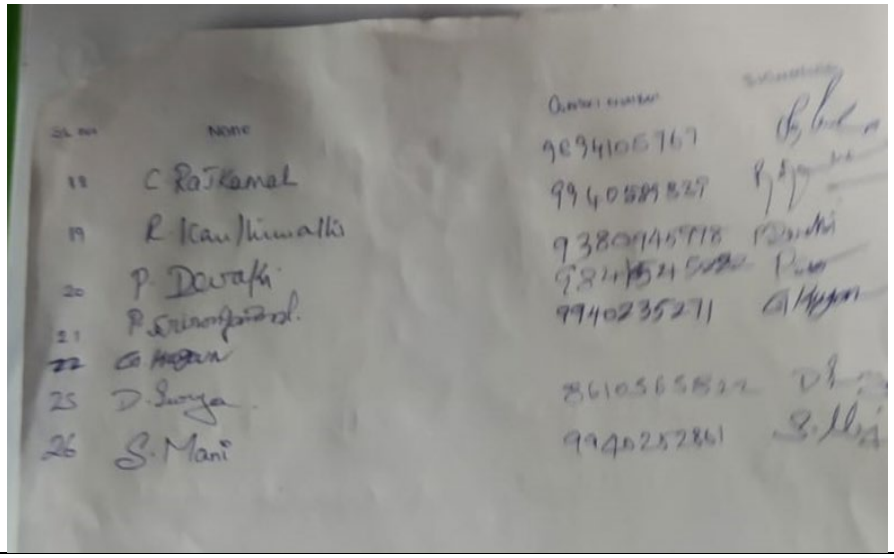
List of participants



FOCUSED GROUP DISCUSSION (1) FGD1 , 1/11/2020

SIVA PRAKASAM NAGAR

Sl.No	NAME	PHONE NUMBER	SIGNATURE
1	C. Anand	9841214271	C. அனந்த்
2	[illegible]	9788444252	
3	S. Prabakaran NO 80	7010628373	
4	S. Mani Kandan (No.119-B)	9940381448	
5	R. Gatendiran NO 401	9003150025	
6	I. Mohan	9962500823	
7	[illegible]	8015438553	
8	[illegible]	8973546313	
9	[illegible]	9962559001	
10	[illegible]	9952655868	
11	[illegible]	9710276826	
12	R. [illegible]	9445262666	
13	J. [illegible]	9551068485	
14	K. HEMA	9962787330	
15	S. Kasthuri	9043621487	
16	M-Saravanapriya	9444153148	
17			



Sl.No	NAME	PHONE NUMBER	SIGNATURE
18	C Rajkamal	9894106767	
19	R [illegible]	9940589829	
20	P. Dowaki	9380945778	
21	P. [illegible]	9940235271	
22	[illegible]		
25	D. Soniya	8610565829	
26	S. Mani	9940252861	

Arul Nagar, Surapattu in Ambathur area in Zone 6 on Sunday the 8th November 2020

The residents of Arul Nagar of I to IV streets along with representatives from its cross streets participated and the local residential welfare organization had organized the meeting at a residence. women and men from across the streets participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 40 minutes. The residents – the owners and tenants belonging to middle class – reside there for over 10 years. Both men and women in the area go for work and have a regular income of an average of Rs 10000/m.

The session started with usual greetings and introduction of each other and the participants had quickly gone into the main discussion with a detailed description on how the flood water receded over a day.

GAP Activities - Flood in the area

Arul Nagar did not have any flood threat even in 2015 flood where Chennai experienced heavy flood. All the water drained in a day. Flood water used to stagnate only in the low-lying area – particularly the second street and water would remain there for 3 days. Around 10 houses usually get affected and people from these houses could not come out for 3 days. They also lose work and subsequently income for these three days. However, people could stay at home and they need not be evacuated. They did not respond adequately for any cleaning or other expenses due to flood.

Health issues

Participants conveyed through their discussion that there were no major health issues in their locality due to rain and floods. Usually, there are mosquitos' risk. Children and elders suffer from seasonal fever and they are bothered for 3-5 days and after treatment, they used to be well. There are also not much medical expenses. People are well aware about Corona and practice wearing mask etc.

Damages to roads and pond

Participants reflected during the discussion that during flood and rains, there were heavy damages to their roads and they were not commutable at all for a few days. As roads are at high levels compared to ground level, water gets stagnated and roads are broken. Water gets overflowed. There are many vacant plots and water gets stagnated in these plots due to high raised roads.

There are only 4 streets in the locality and all the streets get damaged and especially the2 ND street is worst affected. Persons, especially children fall frequently in these stagnated waters and get hurt. Roads are not also immediately repaired. It takes more time and even if repaired, they are mere patch works and there are no permanent solutions for the roads damaged.

The pond located in the area also used to be damaged during floods. Due to floods, the soils by the side of the pond were flooded and consequently, the pond has lost its strength and shape. The nearby lakes are not cleaned and they are full of wastes, plants and bushes.

The discussion on flood warning arrangements revealed that actually there was no such practices and people get to know about rains and floods only through TV and radio broadcast. As there is no flood so far, they did not bother about listening to flood warnings in the broadcast.

State of drains

Drains issues arise only during rainy days. Drainage connections are not provided to all houses. But all have applied for connections. In the second cross street, there is no road and no drain. As drains are not adequately cleaned, rain water overflows and stagnates for 4-5 days. After drainage works, roads works are not taken up. Similarly, after metro works, roads are not repaired. This prevents smooth water drain during rains.

Garbage disposal

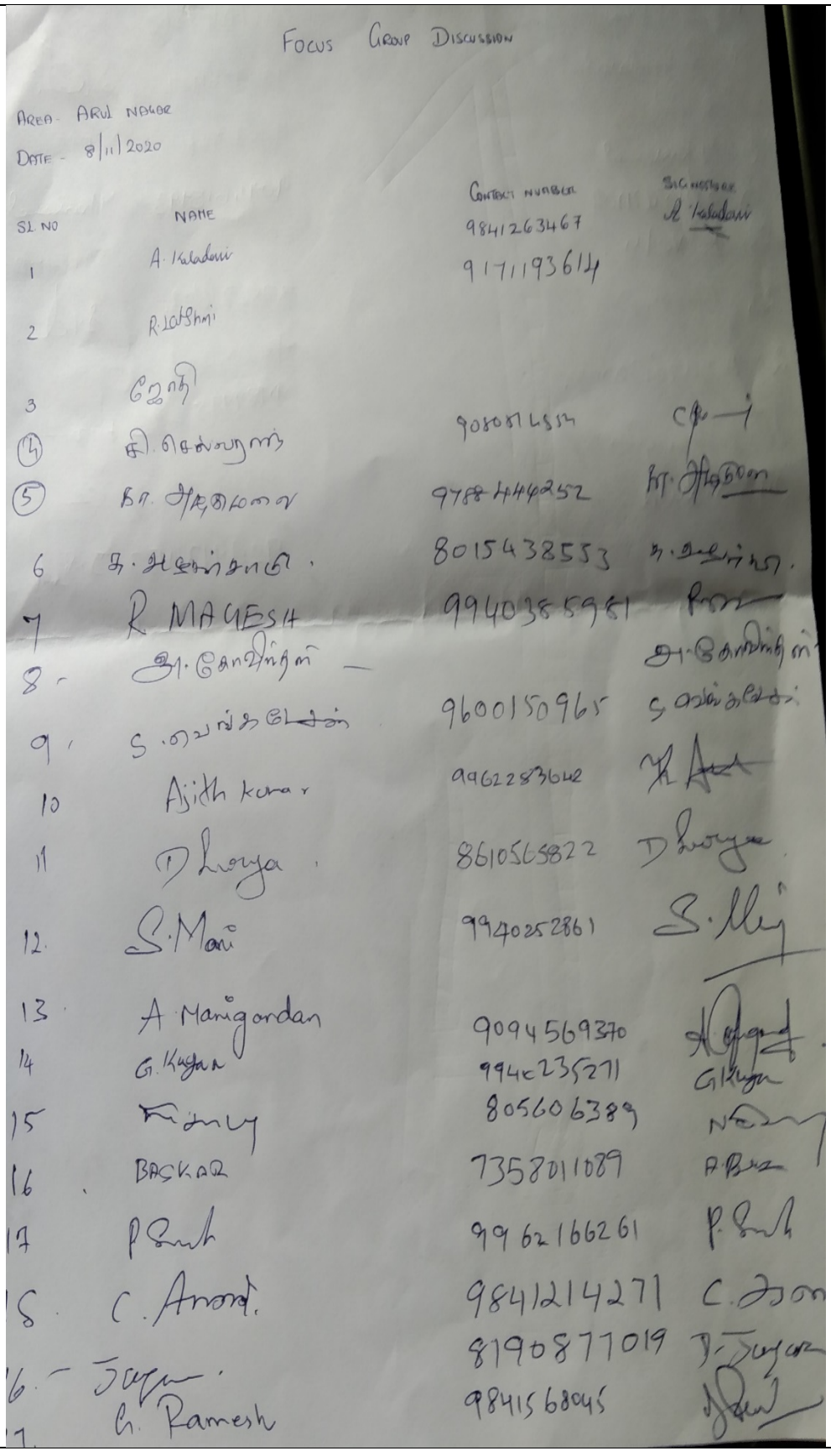
Garbage is cleaned regularly but people also throw domestic wastes outside; sometimes the sweepers did collection only for a few houses and left. Therefore, sometimes garages are burnt during the day. During rain, garbage gets washed over. Due to heaps of garbage, sometimes, rainwater is blocked around it. Earlier, as Surappattu was panchayat, the local people came forward to clear this garbage. Now, they expect the GCC to do everything.

Non-domestic activities

There are no major or small industries in the locality. There are 1 or 2 shops for a street. There has been no park or playground. One private school is in the adjoining street and there is no government school nearby.

Participants' recommendation

The participants requested the GCC officials present in the FGD to facilitate frequent cleanings of drains. They insisted that the government need to clean and widen the lake in the locality. They also have promised to help in getting details of owners of the vacant plants to dispose wastes. They also have assured their support to the officials when drain works are taken up. They also have plans to expedite planting of trees by lake bunds.

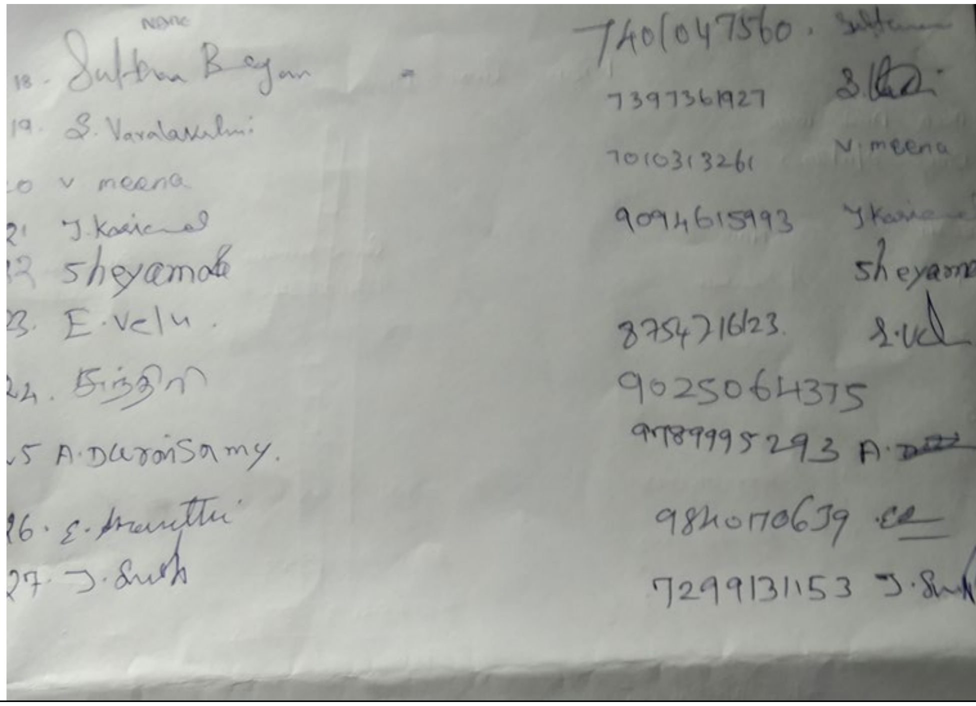


FOCUS GROUP DISCUSSION

AREA - ARUL NAGAR

DATE - 8/11/2020

SL NO	NAME	CONTACT NUMBER	SIGNATURE
			R Valadevi
1	A. Valadevi	9841263467	
2	R. Lakshmi	9171193614	
3	[illegible]		
4	[illegible]	9080816514	
5	[illegible]	9788444252	
6	[illegible]	8015438553	
7	R MAGESH	9940385981	
8	[illegible]		
9	[illegible]	9600150965	
10	Ajith kumar	9962283642	
11	D Lavanya	8610565822	D Lavanya
12	S. Mani	9940252861	
13	A Manigandan	9094569370	
14	G. Kugan	9940235271	
15	[illegible]	8056063893	
16	BASKAR	7358011089	
17	[illegible]	9962166261	
18	C. Anand	9841214271	
16	[illegible]	8190877019	
17	G. Ramesh	9841568045	



Name	Phone	Signature
18. Sultana Begam	7401047560	[illegible]
19. S. Varalakshmi	7397361927	[illegible]
20 V meena	7010313261	V meena
21 J. Kaviarasi	9094615993	[illegible]
22 sheyamala		sheyama[illegible]
23. E. Velu.	8754716123.	[illegible]
24. சந்திரா	9025064375	
25 A. Duraisamy.	9789995293	A. [illegible]
26. E. [illegible]	9840170639	[illegible]
27. J. [illegible]	7299131153	J. [illegible]

Rajaji Nagar, Tiruvotriyur in Zone 1 on Sunday the 18th November 2020

The transgender residents of Rajaji Nagar across the streets I -V participated and the local residential welfare organization had organized the meeting at a residence.10 transgenders from across the streets participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 60 minutes. The transgenders numbering over 50 reside there for more than 10 years. These TG women in the area go mainly for alms from the shops and a few of them were in sex work earlier. They do not have any regular income and thrive on public functions and charity. Their average income is much low indicating their living conditions below poverty level.

The session started with an introduction by the facilitator on the objective of the FGD and immediately, the participants began to narrate their woes due to floods and Corona. Their main contention had been that they received less care and initiation from the local bodies and primarily they needed livelihood support.

GAP Activities – Impact of floods

During heavy floods like the one in 2015, flood invaded their areas up to the first floor. Flood and rain water rain water used to stagnate around waist deep as the Sathyamoorthy nagar main road get blocked. As their streets are lower than the main roads, flood water used to flow downside and stagnates in their streets.

Almost all the houses in the area get affected. To be safe during flood, families go and stay out for more than a week. No electricity would be available for 4 days. All switch boxes got repaired.

The locality is surrounded by a number of industrial units and their wastes also cause damages to the roads during flood. Whenever flood water stagnates, it used to mix with oil due to local petroleum factories and the ground gets oily and black for more than a week and it would be dangerous even to tread on the road. Local industrial units do not help much but the local leaders provide support during such disasters.

For more than a week, water stagnated and people evicted from their houses for 10-12 days. Flood is robbing their routine and their normal life is seriously affected as they have to be away for weeks together till normalcy is restored. They lose work for about 3-4 weeks and they depend on local support and the local community is also willingly support them.

Already there is paucity of work due to their lack of skills and their main livelihood interests are phenol production, provision stores, petty shops and flower sales. Especially, transgender here are willing to take up catering. They also pleaded for corporation's vacant shops for their economic activities.

Flood warnings are given and street plays are held to spread its awareness. Information and alert messages are received from the govt.

Health and awareness on Corona

Due to flood and rain, children and elders suffer from fever and cold. And they take treatment at the nearby municipal hospital. There are also health camps regularly held particularly for Corona. No Transgenders in this locality are affected by Corona. They used to wear regularly mass and maintain social distance. In local medical camps, they are given masks and sanitizers. NGOs had given dry ration and vitamin tablets during the pandemic. Neighbours also came for help.

Waste Disposal

Earlier, the corporation maintained two baskets – one for non-disposable trash and the another for biodegradable trash. Now, the garbage is cleared once in a week; that too the garbage collection time has been between 10 -12 noon where most of the people would have gone for work. Hence, people nowadays throw their wastes by road side. They requested the local authorities to change the time of collection to 7.30 to 9.30 am.

The Drains

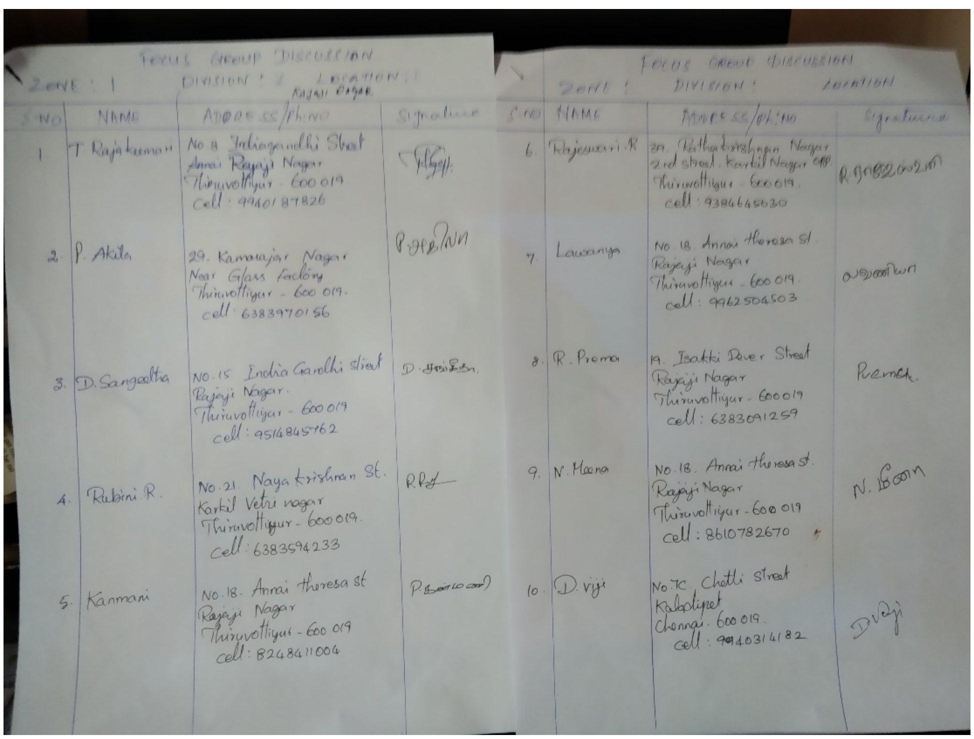
Drains in the locality here were constructed a year ago but, they were not connected to the canal and hence water gets stagnated. The canal is also small and is neither repaired and nor maintained. Blockages are found.

Non-domestic activities

The locality is surrounded by a number of industrial units and petroleum units, KCP/fertilizer factories, IOC are around the area, within 5 km. The air is much polluted with gas smell.

There is one park but it escapes from water stagnation. Every street has one or two petty shops. There are no other public utilities nearby.

The participants neither have any awareness nor they evince any interest in training on flood time awareness.



FOCUS GROUP DISCUSSION

ZONE : 1 DIVISION : LOCATION : RAJAJI NAGAR

S.NO	NAME	ADDRESS/PH.NO	Signature
1	T. Rajakumari	No 8 Indiragandhi Street Annai Rajaji Nagar Thiruvottiyur - 600 019 cell : 9940187826	[illegible]
2.	P. Akila	29. Kamarajar Nagar Near Glass factory Thiruvottiyur - 600 019. cell : 6383970156	[illegible]
3.	D. Sangeetha	NO. 15 India Gandhi street Rajaji Nagar. Thiruvottiyur - 600 019 cell : 9514845762	[illegible]
4.	Rubini R.	No. 21. Naya krishnan St. Kargil Vetri nagar Thiruvottiyur - 600 019. cell : 6383594233	R Raj
5.	Kanmani	No. 18. Annai theresa st Rajaji Nagar Thiruvottiyur - 600 019 cell : 8248411004	[illegible]

FOCUS GROUP DISCUSSION

ZONE : DIVISION : LOCATION

S.NO	NAME	ADDRESS/PH.NO	Signature
6.	Rajeswari R	29. Rathakrishnan Nagar 2nd street. Kargil Nagar opp. Thiruvottiyur - 600 019. cell : 9384645630	[illegible]
7.	Lavanya	No 18. Annai theresa st. Rajaji Nagar Thiruvottiyur - 600 019. cell : 9962504503	[illegible]
8.	R. Prema	19. Isakki Dover Street Rajaji Nagar Thiruvottiyur - 600 019 cell : 6383091259	Prema.
9.	N. Meena	No. 18. Annai theresa st. Rajaji Nagar Thiruvottiyur - 600 019 cell : 8610782670	[illegible]
10.	D. viji	No. 7C. Chetti Street Kaladipet Chennai - 600 019. cell : 9940314182	D Viji

Velayudham nagar, in Tiruvotriyur zone 1on Tuesday the 26th December 2020

The participants are primarily the persons with disability (PWD) along with their representatives and the local PWD welfare organization had organized the meeting at a residence. Women and men from across the streets participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 75 minutes. The participants reside there for over 10 years. Both men and women participants go for low-income work and have an average of Rs 6000/m.

The session despite the efforts of the facilitator has mainly revolved around the participants' livelihood and government apathy to this vulnerable groups. Yet there were some solid and valuable information for the GCC to provide an environment friendly support to the PWD. This report focused only on flood and rain water issues.

PWD Families

The participants have experienced many physical and mental disabilities and all of them suffer from either of the disabilities like locomotors defects, visual impairment, paralysis, speech impairment. Each family has on an average has 3-5 members. Most of the PWD population have engaged in low income yielding works such as tailoring, cooli works, petty shops. Very few are working as teachers and auto drivers. Their average monthly earnings are around INR6000-8000.

GAP Activities - Flood in the area

During flood or rain, the drains become full. As there is no proper and adequate drainage facility in the area. It overflows and becomes stinky. No metro water is accessible during rain or flood times. Flood water stagnates for more than a week. The corporation is not making any attempt to drain them. Only, we, the local population on public health interest, remove stagnated water with some private arrangements.

During flood times, all the houses and shops get inundated. Houses and shops are also damaged by the flood water. Even street animals flooded into the house. There won't be electricity for a week and this further hinders their free movement. Tiles on top of rain water drain line becomes slippery during rainy or flood season and it makes difficult for the PWD to walk freely. Each family need to spend thousands of rupees to clear the damages due to flood every time.

Flood information and evacuation notices used to be given in advance. But for the PWD such information or notices become meaningless as there is no support from authorities for the disabled to move immediately. Most of them either need to crawl or to be carried away due to their disabilities. Just a piece of information has served no purpose for their safety. Similarly, there is no temporary shelters by any government that are disabled friendly for the purpose.

Health issues

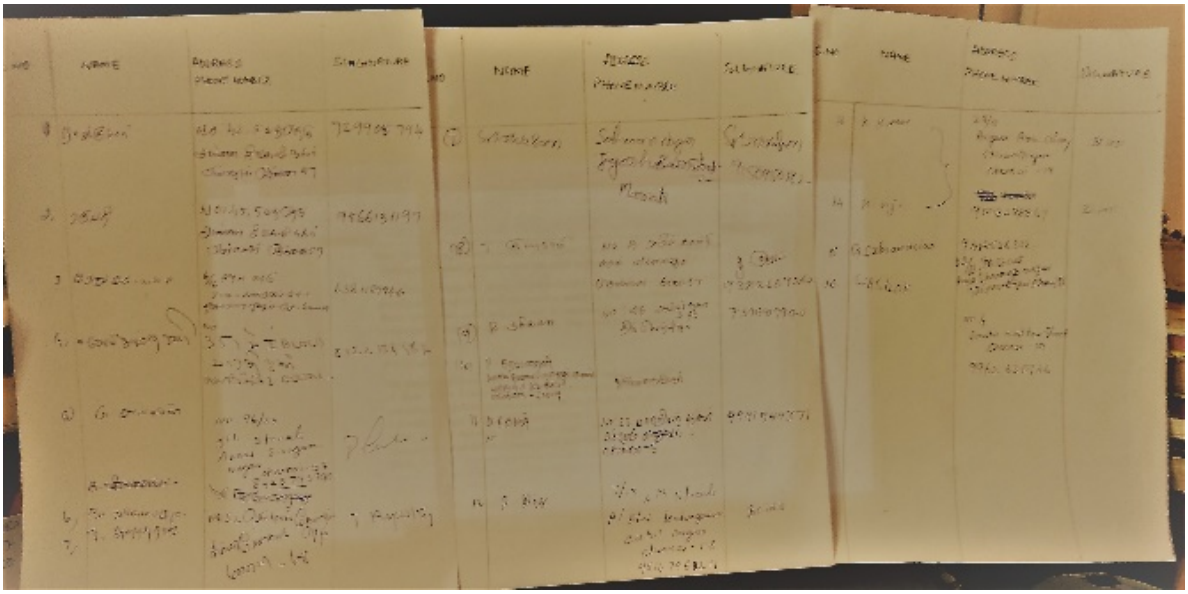
All these grave and pathetic situations cause both children and elders to acquire infections and fever. However, the nearest government hospital does not have facilities to receive and treat the PWD. PWD have to seek private clinics for any such immediate treatment. The same situation prevailed during COVID19 pandemic. COVID 19 pandemic and the lockdown days have made them suffered most. Virtually, they have had no work and hence no income at all. Even the government support through rations and incentives did not reach many of them. Relief came only from an NGO December 3 movement. One among their elders died out of COVID19 infection.

Non-domestic activities

There are no major or small industries in the locality. There are 1 or 2 shops for a street. There are parks and community halls in the vicinity of their locality but neither is differently abled friendly.

Participants' recommendation

Engineers need to take every step and precaution while relaying the ramps so that ramps become smooth and not bumpy to help the disabled easily cross across.



Ondikuppam, in Ward 14 of Zone Kaladipet area in Zone 1 on Sunday the 18th December 2020

The residents of Ondikuppam from across 1-5 streets and nearby block 19 participated in the focus group discussion and assembled. There were 21 men and women from across these streets participated in the discussions. One of the participants is a member of domestic workers welfare board. The discussion lasted for the 40 minutes. The residents numbering over 200 households reside there for long. Each household has 3-5 members. These residents go mainly for fishing and fish sales. Their average earner income is around INR 6000/-.

During COVID19, they faced severe livelihood issue. There were about 200 patients in the area and all got recovered. Every week, health camps were regularly held twice on Sundays and Wednesdays.

GAP Activities – Impact of floods

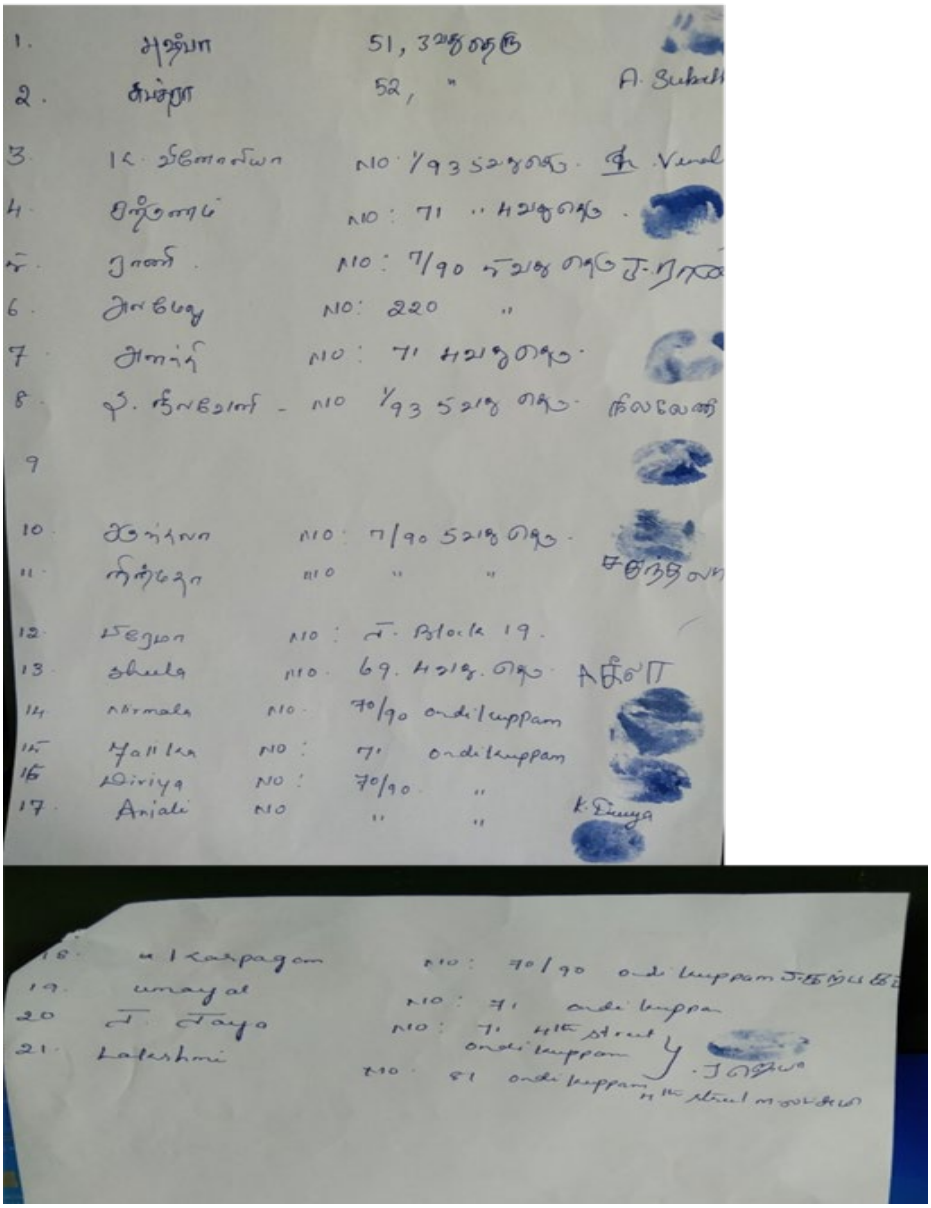
During floods and in recent cyclone, water stagnates at knee deep almost in all streets. The area gets flooded because of high level roads and low-lying houses. Existing drain and flood water gets mixed up. They do not have regular flow and gets stagnated. Water stagnation remains continuously for 4-5 days during flood. All their houses get damaged. However, they stay behind at their houses only. People used to suffer from fever and cough. Particularly, elders become very sick. They have good facility in the nearby UPHC and they used to avail its services.

Usually, they do not get any flood warnings. They used to get the news through TVs. Both the GCC and local MRL unit provide relief services during flood.

Local corporation agents visit regularly by 8.30 am and collect wastes – both the degradable and non-degradable wastes. There are no waste disposals outside. However, there are mosquitos and people suffer from fever. GCC used to spray mosquito fog frequently.

There is a government schools and a park within a KM radius. Water does not stagnate in these places and gets drained.

The participants expressed pleasure on the information that the GCC is to lay drains. They assured the Corporation officials all the support for the construction of storm water drains. They insisted that their elders needed Old Age Pension.



TKP, Nagar, Ernavur area in Tiruvotriyur zone on Sunday the 20th December, 2020

The residents of TKP Nagar participated in the FGD held at the residence. 18 women and men from across the streets of TKP nagar participated in the discussions. The gathering had an in-depth discussion that lasted for more than an hour.

People and their work

People mostly here belong to fishing community. About 110 families are here with an approximate 550 population. Each family has 5-6 members. Workers here are mostly wage earners; waste iron traders and construction workers. Women are mostly domestic maids. Most of these families did not have any work for the past 7 continuous months due to corona. Their average monthly earnings are reportedly Rs 8000/-

GAP Activities

During rainy days water gets stagnated for more than 20 days. Rain water also gets into the houses and mixed with drain water and make the houses nasty. People especially the children and elders used to get sick and they get treated at nearby Tsunami quarters hospital.

All streets have cement roads and there is no drainage. As the streets are narrow, there is no possibility of regular septic tank cleaning. The septic tank lorry cannot enter into the streets and they need a long hose pipe. Therefore, they need to spend more money at Rs 200-250/feet. The common 8 toilets – 4+4 for men and women- available at nearby Nethaji nagar is also closed due to Corona.

Waste disposal

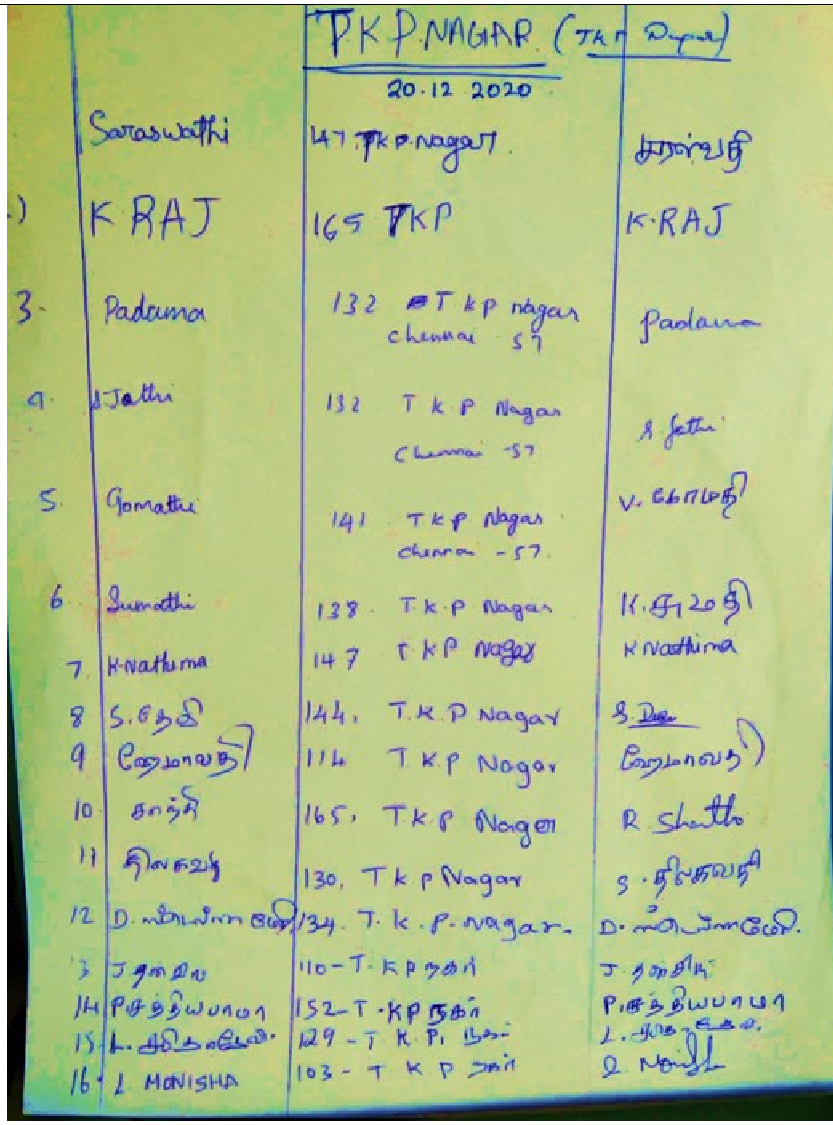
The segregated garbage is collected daily by the corporation agents

It is reported that already there was a sanction for drainage at a cost of Rs 50 lakhs.

The area has heavy sea erosion. People do get due flood warning and they make all adequate precautions.

Non-domestic activities

A school is at Ernavoor. No bank is nearby. No other public utilities are reported by the participants.



TKP NAGAR (TKP [illegible])

20.12.2020

	Saraswathi	147 TKP Nagar	[illegible]
2	K RAJ	165 TKP	K.RAJ
3.	Padama	132 T kp nagar chennai 57	Padama
4.	S Jothi	132 T.K.P Nagar Chennai 57	S. Jothi
5.	Gomathi	141 TKP Nagar chennai -57.	V. [illegible]
6.	Sumathi	138. T.K.P Nagar	K. [illegible]
7.	K.Nathima	147 TKP Nagar	K Nathima
8	S. [illegible]	144, T.K.P Nagar	S. [illegible]
9	[illegible]	114 T K.P Nagar	[illegible]
10	[illegible]	165, TKP Nagar	R Shanthi
11	[illegible]	130, Tkp Nagar	S. [illegible]
12	D. [illegible]	134. T.k.p. nagar.	D. [illegible]
13	J [illegible]	110-T.KP [illegible]	J. [illegible]
14	P. [illegible]	152-T.KP [illegible]	P. [illegible]
15	L. [illegible]	129-T.K.P [illegible]	L. [illegible]
16	L. MONISHA	103-TKP [illegible]	L. Monisha

Annai Sivagami Nagar, Ennore, in Tiruvotriyur area in Zone 1 on Sunday the 20th December 2020

The residents of Annai Sivagami Nagar across the streets I -X participated and the local residents' organization had organized the meeting at Angala Parameswari temple complex. 16-21 men and women from across the ten streets participated in the discussions. It lasted for about 60 minutes.

The session started with an introduction by the facilitator on the objective of the FGD and immediately, the participants thronged into a fascinated discussion with a handful of participants enlisting their woes and worries during rainy days. Their main contention had been that the local body did not seem to have any interest in serving their area siting instances of wastes dumped eighth and eleventh streets and difficulties in getting regular drinking water.

There are around 2000 families in Annai Sivagami nagar having a family size of 5-7 members. The families engage in occupations like driving, tailoring, constructions, wage earning, loading and unloading works as well as domestic work.

Impact of flood

In rain and flood times, residents of Annai Sivagami nagar have horrible experiences. They used to float under waist full of water for a week. They are asked to stay at the local school for 3 days. No government people would come there for any help. Local leader with his influence, pump out the water and clear roads. Drain water gets mixed with flood water and make the places very nasty and dirty. There are no proper ways for the rain water to flow out. The sea level is low and as there are no regular passages, hence the water gets stagnated. Due to this, people irrespective of age used to suffer and there were lot of complaints with footsore, headache, allergy and fever.

During flood only local leaders have supported them immediately and they reported that they did not receive anything from the govt. Similarly, during corona days too, the local leaders and charities only distributed rice, egg and bread

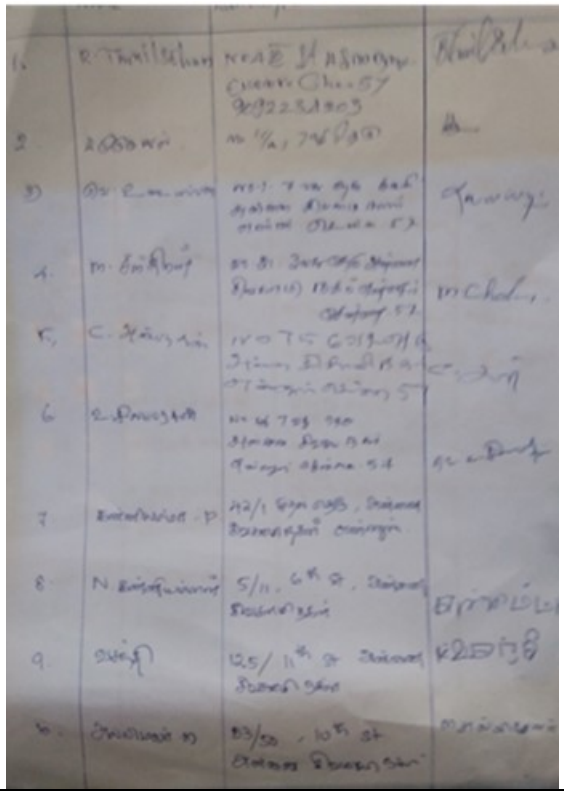
Water and sanitation issues

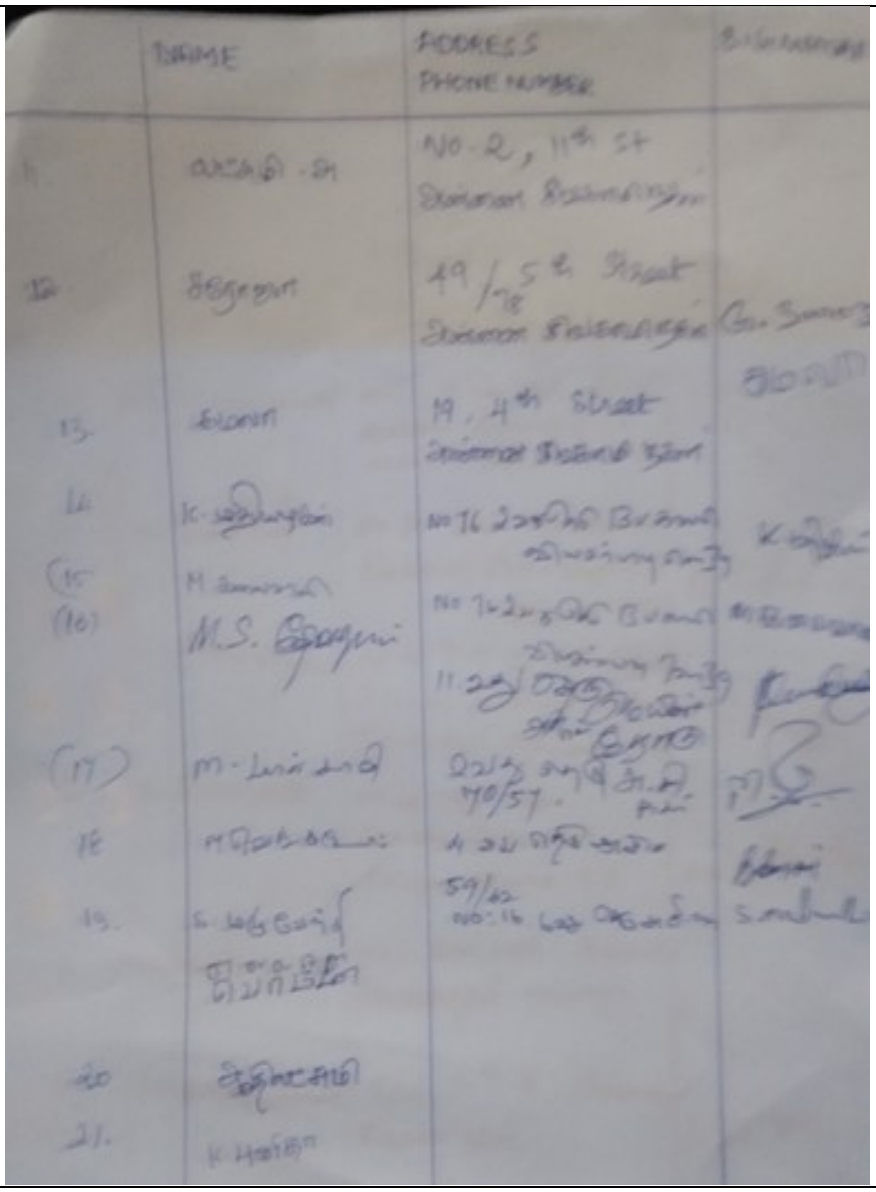
Local area water is found to be not usable due to local chemical companies. These companies also cause pollution in the air and people used to have breathing trouble at times. Drinking water is available through corporation tanks taps on alternate days. Even this facility is not available at 11th street. Water taps got often repaired and water gets stagnated. Even a municipal toilet built in the street is yet to be opened. Open defecation is prevalent. Sewerage connection is also not given. No proper planning seems to be found.

Waste disposal are poor in the area. Lot of shops throw their wastes at the street end. Nearby area and market are stinking. Clearance of wastes by municipal lorry is not adequate. Manpower shortage is much and one trip by lorry is inadequate.

The participants have enlisted the following issues at the area:

- Water line is to be provided and adequate water is not available
- Sewage line needs to be properly laid connecting all streets
- Road side shops needs to be removed to clear the wastes
- Mosquito issues
- Fallen trees are not yet removed and they bar smooth traffic
- About 20 tons garbage is generated and need planned disposal
- No adequate public toilets and the existing ones are not proper and some of them are also not opened
- Any representation on these issues elicited no responses from the government





Sivaprakasam nagar South, Surapattu in Ambathur zonal area on Sunday the 8th November 2020

The residents of Sivaprakasam nagar south comprising a main road, eight sub streets and 3 cross streets participated and the local residential welfare organization had organized the meeting at the president's yard. 12 women and men participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 40 minutes. The residents – the owners and tenants belonging to middle class – reside there for over 10 years. Both men and women in the area go for work and have a regular income of an average of Rs 10000/m.

The session started with usual greetings and introduction of each other, and the participants had quickly gone into the main discussion with a detailed description on how the flood water receded over a day.

GAP Activities - Flood in the area

Sivaprakasam nagar south did not have any major threat even in 2015 flood when Chennai experienced heavy flood. All the water drained away in a day. During rain, sumps get overflowed. The water stagnates because the roads or laid over and above and due to this, the roads become higher than the houses. This prevents flow of water and hence water stagnates for a day. Nearly 10 houses used to get affected. However, people could stay at home and they need not be evacuated. During these times, snakes and insects used to go around and threaten the inmates venturing out. Children and elders need to be careful.

Health issues

Participants conveyed through their discussion that there were no major health issues in their locality due to rain and floods. Usually, there are mosquitos' risk. During these rainy days, children get cold and become feverish. Participants also informed that there were not much medical expenses. People are well aware about Corona and practice wearing mask etc.

Damages to roads

Rain used to wash away the surface and the roads remain uneven and unmotorable. The discussion on flood warning arrangements revealed that actually there was no such practices and people get to know about rains and floods only through TV and radio broadcast. As there is no flood so far, they did not bother about listening to flood warnings in the broadcast.

Garbage disposal

Garbage is cleaned regularly but there is shortage of manpower. It is said that for every 250 houses, there needs to be a pair of workers to collect garbage. But this is not happening. Currently, the workers do not visit all houses and they collect only for the first 5 houses in every street and then they leave the area as the cart is full. The sanitary contractor who participated in the meeting informed that they needed to represent these facts and assured that he would take this matter to the corporation officials. During rain, garbage gets washed over. Due to heaps of garbage, sometimes, rainwater is blocked around it.

Non-domestic activities

There are no major or small industries in the locality. There are 1 or 2 shops for a street. There has been no park or playground. One private school is in the adjoining street and there is no government school nearby.

Recommendations

It is important first to identify slope areas and then start building the drains suitably. Otherwise, the project will become a failure. Drains would not be overflowed if the nearby water station go on pumping the excess water non stopping. The corporation engineer who participated in the discussion assured the participants that he would talk to the metro water board in this regard.

Participants also assured that they would replace the felling trees after the construction of drains through planting more saplings.

Thangal lake park, Vijayalakshmipuram in Ambathur municipal area in Zone 7 on Saturday the 7th November 2020

The residents from Vijayalakshmipuram and Abhiramapuram around the park area participated and the local social activist had organized the meeting at the Thangal lake park. 10 women and men participated in the discussions. The gathering began its discussion by 11 am and it lasted for the next 40 minutes with rain interruptions in between.

Actually, the residents gathered slowly and over the course of the discussion there were adequate numbers of participants. The facilitator had to take more time to provide confidence among the participants about the nature of the project and the purpose of group discussion as they first never believed that the corporation would hold such meetings.

Then the gathered residents had started gradually the discussion and they cited that the park on which the meeting was being conducted was once a lake. The side by roads were raised and such steps would result only in more water stagnation during rain. They stressed the need for quick response and remedies from the corporation to address drain issues.

GAP Activities – Waste disposal

Residents complained that around the Thangal lake area, waste disposal is not adequately carried on. There used to be heavy garbage collections remain on the streets. In rainy days this garbage is flooded into drains and drains get blocked. Rainwater enters into the houses and make homes unclean and unsafe. However, the water drains out in a day.

Flood impact

As for the flood warning system, the group informed that there were no preventive planning or advanced information for them However, they were not much affected by floods and the flood water used to drain in a day, particularly in main roads.

There are actually no drains in many of the streets. Therefore, the rain water used to stagnate around the houses. In some streets, though drains are available, all of them are dumped and blocked with wastes and garbage, particularly there are many hairs thrown into the drains and they mainly block the wholes and it has been very difficult to remove them as it used to whirl around the water passage for long.

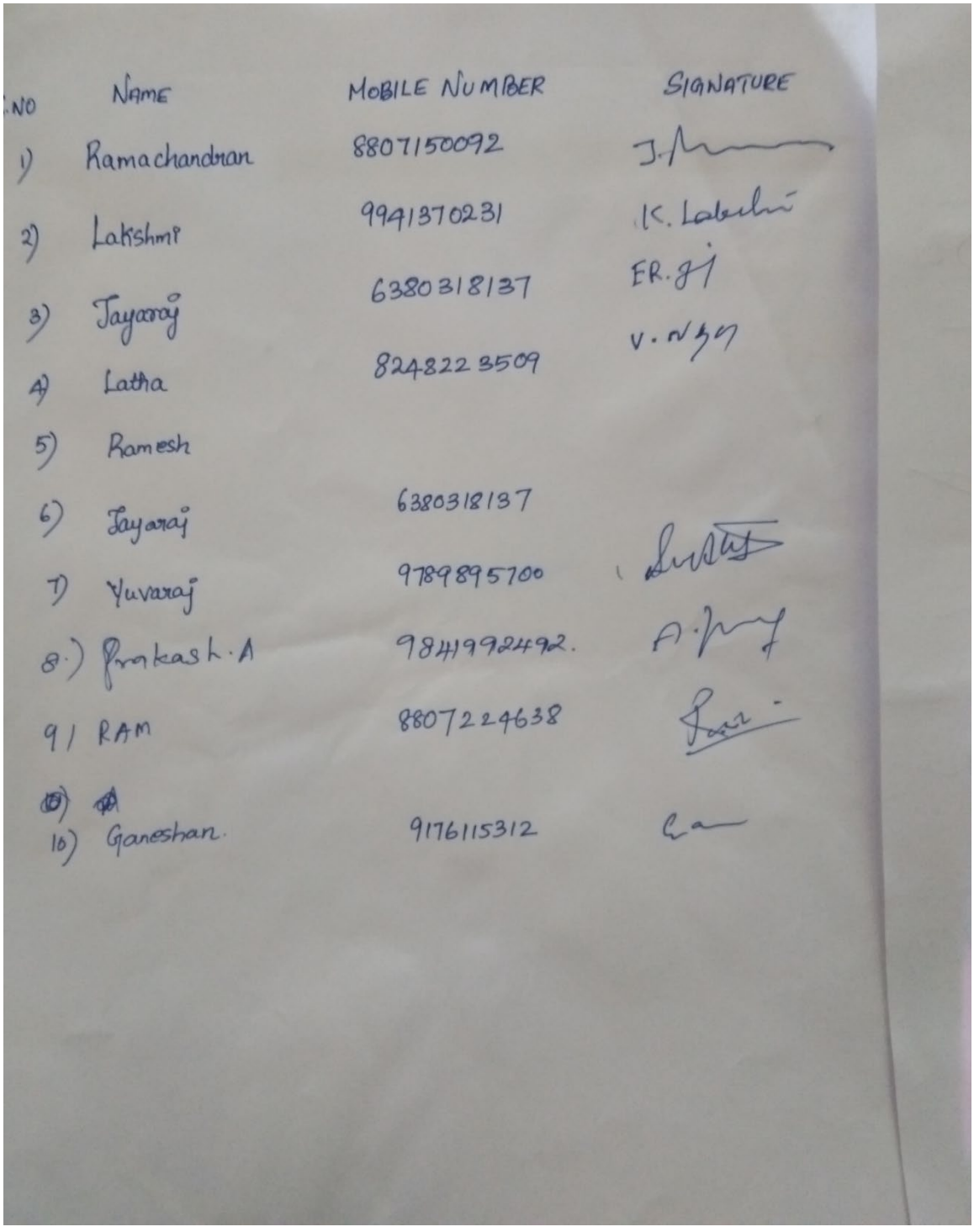
All the catchment areas around the park are invariably encroached and despite many complaints, there is no action by the authorities. Such encroachments also stand in the way of drain flow. The drains laid near Abhiramapuram down lanes themselves are encroached. Occasionally, the residents face shortage of drinking water. The water taps emit bad odor and the first 7 minutes water is full black and dirt making people the most discomfort.

Non-domestic activities

There are no major or small industries in the locality. There are 1 or 2 shops for a street. Schools are also nearby. The residents represented the group are primarily middle class. They expressed that they had no issues in respect of earning opportunities and livelihood.

Recommendations

At least once in a week the accumulated roadside garbage /wastes need to be removed as they heavily cause for mosquito breeding.



S.NO	NAME	MOBILE NUMBER	SIGNATURE
1)	Ramachandran	8807150092	
2)	Lakshmi	9941370231	
3)	Jayaraj	6380318137	
4)	Latha	8248223509	
5)	Ramesh		
6)	Jayaraj	6380318137	
7)	Yuvaraj	9789895700	
8)	Prakash.A	9841992492.	
9)	RAM	8807224638	
10)	Ganeshan.	9176115312	

FORM 1 (CRZ Application Form)

Form - I

FORM – I

I. BASIC INFORMATION

S. No.	Item	Details
1	Name of the project	Construction of Integrated Storm Water Drains (ISWD) in "Kosasthalaiyar River Basin" within GCC Limits, Chennai District towards the Proposed Flood Mitigation Measures to Extended Greater Chennai Corporation (GCC) Area
2	Location or Site Alternatives under consideration	Kathivakkam, Ernavoor, Sadayankuppam, Thiruvottiyur, Sathangadu, and Manali Villages within Greater Chennai Corporation (GCC).
	Village	
	Tehsil	Thiruvottiyur Taluk
	District	Chennai District
	State	Tamil Nadu
3	Size of the project (In terms of Total Area)	Total length of storm water drain – 763 km (61.077 km in CRZ Area & 701.923 km in Non CRZ Area). Pumping stations (PS) – 2 nos.(in CRZ Area)

SUPERINTENDING ENGINEER i/c
STORM WATER DRAIN DEPARTMENT
GREATER CHENNAI CORPORATION

<table>
<tr><td>4</td><td>CRZ Classification of the Area</td><td>The part of the project components falls under the CRZ–IB, CRZ – II, CRZ –IVA & CRZ –IVB classification and the details are given below:
<table>
<tr><th>S. No.</th><th>Project Details in CRZ Area</th><th>CRZ – Classification</th><th>Length / Area / Nos.</th></tr>
<tr><td rowspan="4">1.</td><td rowspan="4">Storm Water Drains</td><td>CRZ – I B</td><td>0.357 km</td></tr>
<tr><td>CRZ – II</td><td>59.059 km</td></tr>
<tr><td>CRZ – IVA</td><td>0.451 km</td></tr>
<tr><td>CRZ – IVB</td><td>1.210 km</td></tr>
<tr><td>2.</td><td>Storm Water Pumping Station – I</td><td rowspan="2">CRZ – II</td><td>489.5 Sq.m</td></tr>
<tr><td>3.</td><td>Storm water Pumping station – II</td><td>489.5 Sq.m</td></tr>
<tr><td rowspan="4">4.</td><td rowspan="4">Outfall</td><td>CRZ – II</td><td>6 Nos.</td></tr>
<tr><td>CRZ – IB</td><td>3 Nos.</td></tr>
<tr><td>CRZ – IVA</td><td>9 Nos.</td></tr>
<tr><td>CRZ – IVB</td><td>14 Nos.</td></tr>
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<tr><td>5</td><td>Expected Cost of the Project</td><td>
<table>
<tr><th>S.No</th><th>Zone</th><th>Amount (in crores)</th></tr>
<tr><td>1</td><td>CRZ Zone</td><td>226.62</td></tr>
<tr><td>2</td><td>Non – CRZ</td><td>2291.38</td></tr>
<tr><td></td><td>Total</td><td>2,518</td></tr>
</table></td></tr>
<tr><td>7</td><td>Registered address</td><td>M/s. Greater Chennai Corporation
The Ripon Building
Chennai – 600 0036.</td></tr>
<tr><td>8</td><td>Address for correspondence:
Name
Designation
Address
Pin code

E-mail,
Telephone No. / Fax No.</td><td>
The Superintending Engineer
Greater Chennai Corporation
The Ripon Building
Chennai – 600 0036.

seswd@chennaicorporation.gov.in
044 25619315</td></tr>
</table>

II. ACTIVITY

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies etc.)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	The proposed project is Construction of Integrated Storm Water drains in the extended Greater Chennai corporation as part of flood mitigation measures. Therefore the proposed project will prevent rainwater stagnation and flooding during heavy rainfall in the project area. The project activity involves Construction of Storm Water Pumping Station (2no's), Construction of Storm Water Drain for a length of 763 km (CRZ – 61.077 km and Non CRZ – 701.923 km). The storm water drains will be laid along the existing road sides only. Hence, there is no change in land use.
1.2	Details of CRZ classification as per the approved Coastal Zone Management Plan?	Yes	The part of the project components falls under the CRZ – IB, CRZ – II, CRZ –IVA, CRZ –IVB classification. The project area and the project a component falls in map no. TN 110 of approved Coastal Zone Management Plan, Tamil Nadu (Sheet No: D 44 O 8 / NW). Also, we have obtained the CRZ Map indication HTL and LTL demarcated by Institute of Remote Sensing, Anna University, Chennai and the copy of the same is enclosed as Annexure - V.

<table>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>S. No.</th><th>Project Details in CRZ Area</th><th>CRZ – Classification</th><th>Length / Area / Nos</th></tr>
<tr><td rowspan="4">1.</td><td rowspan="4">Storm Water Drains</td><td>CRZ – IB</td><td>0.357 km</td></tr>
<tr><td>CRZ – II</td><td>59.059 km</td></tr>
<tr><td>CRZ – IVA</td><td>0.451 km</td></tr>
<tr><td>CRZ – IVB</td><td>1.210 km</td></tr>
<tr><td>2.</td><td>Storm Water Pumping Station – I</td><td rowspan="2">CRZ – II</td><td>489.5 sq.m</td></tr>
<tr><td>3.</td><td>Storm water Pumping station – II</td><td>489.5 sq.m</td></tr>
<tr><td rowspan="4">4.</td><td rowspan="4">Outfall</td><td>CRZ – II</td><td>6 Nos</td></tr>
<tr><td>CRZ – IB</td><td>3 Nos</td></tr>
<tr><td>CRZ – IVA</td><td>9 Nos</td></tr>
<tr><td>CRZ – IVB</td><td>14 Nos</td></tr>
</table>
</td></tr>
<tr><td>1.3</td><td>Whether located in CRZ – I area?</td><td>Yes</td><td>The part of storm drain falls in the CRZ – IB.
The storm water collected through storm water drain from the catchment area will be discharged and connected to the Groynes along Bay of Bengal/ Kosasthalaiyar river basin/pond/B.Canal by gravity.</td></tr>
<tr><td>1.4</td><td>Whether located within the hazard zone as mapped by Ministry of environment and Forest/ National Disaster management Authority?</td><td>No</td><td>-</td></tr>
<tr><td>1.5</td><td>Whether the area prone to cyclone, tsunami, tidal surges, seduction, earth quake etc.?</td><td>Yes</td><td>The project area i.e. extended area of GCC recently affected by floods & cyclones. The proposed project will be a mitigation measures i.e. draining of excess storm water during flood & cyclones. Also, in the year 2004, Tsunami has occurred due to the earthquake in the Indian Ocean with the magnitude of 9.1.</td></tr>
<tr><td>1.6</td><td>Whether the area prone for salt water ingress?</td><td>No</td><td>The project area is within the Greater Chennai Corporation and part of the project area is situated</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>in shores of the Bay of Bengal. There is no possibility of salt water intrusion depending on the ground water aquifer and abstraction levels in the nearby areas.</td></tr>
<tr><td>1.7</td><td>Clearance of existing land, vegetation and buildings?</td><td>No</td><td>The project proposal will be executed only in the road sides of Corporation area. Hence, Clearance of ground shrubs and bushes at the site will be carried out.</td></tr>
<tr><td>1.8</td><td>Creation of new land uses?</td><td>No</td><td>Not applicable</td></tr>
<tr><td>1.9</td><td>Pre-construction investigations e.g. bore holes, soil testing?</td><td>Yes</td><td>The Geotechnical investigation has been carried out for the establishment of pumping station (PS I & PS II). The copy of the same is enclosed as Annexure – III.</td></tr>
<tr><td>1.10</td><td>Construction works?</td><td>Yes</td><td>The project component of Integrated storm water drains involves
• Construction of storm water Pumping Station (2 nos),
• Construction of Storm Water Drains of length –763 km for collection of storm water from the catchment area (127.80 Sq.Km).
The Rain Water runoff gets drained through proposed Storm Water Drain network which has its final outfall into the Bay of Bengal via channel, Buckingham Canal and Kosathalaiyar river -running across the project area.
Out of which, the following components are falls under the CRZ zone.
<table>
<tr><th>S. No.</th><th>Project Component</th><th>Length / Nos</th></tr>
<tr><td colspan="3">Storm water drainage total length – 763 km</td></tr>
<tr><td>1.</td><td>Storm water drainage in CRZ area</td><td>61.077 km</td></tr>
</table>
</td></tr>
</table>

			2. Storm water drainage in Non CRZ area: 701.923 km Storm water pumping stations 3. Storm water pumping station in CRZ area: 2 No's
1.11	Demolition works?	No	Nil
1.12	Temporary sites used for construction works or housing of construction workers?	No	Local laborers from nearby areas will be hired for the work.
1.13	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	Earthwork excavation work will be required for construction of storm water pumping station and storm water drain. The cut and fill process will be essential for some extent in the site. Finally, the site will be leveled. 2 nos. of pumping stations will be constructed to pump the storm water drain.
1.14	Underground works including mining or tunneling?	Yes	The construction of Storm water drains will be executed based on the existing natural slope for conveyance of storm water. There will not any mining or tunneling works.
1.15	Reclamation works?	No	Nil
1.16	Dredging?	No	Nil
1.17	Offshore structures?	No	Nil
1.18	Production and manufacturing processes?	No	The project is Construction of Integrated storm water drains in the extended areas of Greater Chennai corporation. Hence production and manufacturing process is nil.
1.19	Facilities for storage of goods or materials?	Yes	Construction material such as Cement, Sand, Bricks, and steel will be Stored in storage/handling yard in Non-CRZ zone area within in Greater Chennai corporation and separated by enclosures/barricades. Cement will

			be separately stored under cover in bales. Sand will be stacked under tarpaulin cover.
1.20	Facilities for treatment or disposal of solid Waste or liquid effluents?	Yes	During construction of the storm water drain, the excavated earth will be used for backfilling and leveling within the project site. The excess earth will filled in low lying areas of Greater Chennai Corporation.
1.21	Facilities for long term housing of operational workers?	No	The project will be done by local available workers.
1.22	New road, rail or sea traffic during construction or operation?	No	There will not be any activities like roads or rails traffic due to the proposed project.
1.23	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc.?	No	The construction of storm water drain will be carried out along the existing roads without change in any alignments of the roads and rails.
1.24	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	There will not any closure or diversions of existing transport routes. Also, there will not be any change in traffic movements.
1.25	New or diverted transmission lines or pipelines?	Yes	The proposed project is Construction of integrated storm water drains schemes which consist of storm water network to collect/convey the storm water from the Catchment areas. There will not be any new or diverted transmission line or pipeline.
1.26	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses	No	No impoundment, damming, converting, realignment or other changes to the hydrology of water courses or aquifers.

	or aquifers?		
1.27	Stream crossings?	No	There will not be any stream crossing.
1.28	Abstraction or transfers of water from ground or surface waters?	No	There will not any ground water abstraction in the project site. During Construction, water requirement will be met through private tanker water supply / tanker water supply by the contractors.
1.29	Changes in water bodies or the land surface affecting drainage or run-off?	No	Proposed project is disposal of storm water. Stilt trap will be provided to preserve the top soil and suspended solids in the runoff into the drain. The water will meet the standards prescribed by TNPCB/CPCB.
1.30	Transport of personnel or materials for construction, operation or decommissioning?	Yes	There would be transportation of construction materials and personnel to the site. The same will be transported through the existing road facility.
1.31	Long-term dismantling or decommissioning or restoration works?	No	Nil
1.32	Ongoing activity during decommissioning which could have an impact on the environment?	No	Nil
1.33	Influx of people to an area in either temporarily or permanently?	Yes	There will be a daily movement of local labors for construction work in project site during construction phase.
1.34	Introduction of alien species?	No	Nil
1.35	Loss of native species or genetic diversity?	No	There will not be any loss of native species or genetic diversity. Only the ground shrubs and bushes will be removed.
1.36	Any other actions?	No	Nil

2. *Use of Natural resources for construction or operation of the Project (Such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):*

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	No	Nil
2.2	Water (expected source & competing users) unit: KLD	Yes	Construction Phase: About 30-40 KLD of water will be required during the peak construction phase and it will be sourced through private tankers arranged by the contractor.
2.3	Minerals (MT)	No	Nil
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	The material required for the construction such as Cement, aggregate, sand and brick will be sourced through local available vendors.
2.5	Forests and timber (source – MT)	No	Nil
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	The power requirement for Operating & Maintenance of the Pumping Station (2 no's) will be met through TNEB.
2.7	Any other natural resources (use appropriate standard units)	No	Nil

3. *Use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.*

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	No	There will not be use of any hazardous materials.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	The proposed project will decrease the occurrence of disease or affect disease vectors in the project area. The project proposal will avoid stagnation of storm water in the street, thereby avoiding the occurrence of disease.
3.3	Affect the welfare of people e.g. by changing living conditions?	No	The proposed project will prevent the project area from the flood and water stagnation. The living conditions will be improved. Socio economic conditions of nearby areas will improve due to local employment (direct and in-direct). Moreover, this project will provide employment to local laborers during the construction and operational phases.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Not Applicable.
3.5	Any other causes	No	Nil

4. *Production of solid wastes during construction or operation or decommissioning (MT/ month)*

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Nil
4.2	Municipal waste (domestic and or commercial wastes)	No	During Construction, the excavated earth and construction debris will be used for backfilling and leveling the project site.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules).	No	There will not be handling of hazardous waste in the project site.
4.4	Other industrial process wastes.	No	Nil
4.5	Surplus product	No	Nil
4.6	Sewage sludge or other sludge from effluent treatment	No	Not applicable
4.7	Construction or demolition wastes	Yes	The excavated earth and construction debris will be used for backfilling and leveling the project site. The excess earth will be dumped in the Kodungaiyur dump site.
4.8	Redundant machinery or equipment	No	Nil
4.9	Contaminated soils or other materials	No	Nil
4.10	Agricultural wastes	No	Nil
4.11	Other solid wastes	No	Nil

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	There will not be any kind of major emissions from the proposed project activity in CRZ area. The DG set (1 no. of 750 kVA & 1 no. of 500 kVA) will be installed in pumping station as a power backup source. The DG sets will be operated only during the monsoon season where continuous power failure will happen. However, the adequate Stack height with acoustic enclosure will be provided as control measures as per CPCB norms.
5.2	Emissions from production processes	No	Nil
5.3	Emissions from materials handling including storage or transport	Yes	There will not be major emission from material handling, storage and transport. Necessary steps will be taken to control vehicular emissions. Transportation of material that are easily wind borne will be covered by a sheet made of either jute or tarpaulin and by regular water sprinkling will control the dust emissions.
5.4	Emissions from construction activities including plant and equipment.	Yes	Emissions from construction activities will be reduced by using well maintained machineries and equipment's and the accumulation of particulate matter in the atmosphere will be suppressed by sprinkling of water in the dust prone areas at regular intervals.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Adequate dust suppression measures will be implemented at regular intervals to mitigate the dust nuisance during construction phase of the

			project.
5.6	Emissions from incineration of waste	No	Nil
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	Nil
5.8	Emissions from any other sources	No	Nil

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	The operation of the equipment will be limited to non-peak hours. The Ready Mix Concrete (RMC) will be used for construction purpose.
6.2	From industrial or similar processes	No	Nil
6.3	From construction or demolition	Yes	There will be no construction activity during night hours. Noise during the construction activities will be kept minimum by proper and regular maintenance of construction machineries and will maintain maximum sound levels not exceeding 75 decibels (dBA) from the construction activities. All the workers working the construction sites will be provided with Personal Protective equipment.
6.4	From blasting or piling	No	No blasting is involved. Isolated footing will be provided and hence the impact of noise and vibration will not have significant impact of noise and vibration.
6.5	From construction or operational traffic	Yes	During construction activities, care will be taken as explained above to reduce the impacts

			due to movement of construction vehicles, while operational traffic will not contribute much towards noise.
6.6	From lighting or cooling systems	No	Nil
6.7	From any other sources	No	Nil

7. *Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:*

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage ofhazardous materials	No	There is no handling and storage of hazardous materials.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of Discharge)	No	There is no discharge of sewage or other effluents to water or the land.
7.3	By deposition of pollutants emitted to air into the land or into water	No	Nil
7.4	From any other sources	No	Nil
7.5	Is there a risk of long term buildup of pollutants in the environment from these sources?	No	Nil

8.Risk of accidents during construction or operation of the Project, which could affect human or the environment

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use	No	There is no storage and use of hazardous substances in the project.

	or production of hazardous substances		
8.2	From any other causes	No	Nil
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	No	The proposed project is flood mitigation measure project to extended Greater Chennai Corporation.

9. *Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activates in the locality*

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
9.1	Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.), Housing development, Extractive industries, Supply industries and Other	No	The proposed project is construction of storm water drain in GCC area i.e. within the developed area only.
9.2	Lead to after-use of the site, which could have an impact on the environment	No	The project will have only positive impacts on the environment. The proposed project will prevent flood and rain water stagnation in the project area.
9.3	Set a precedent for later developments	No	Nil

9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	No	Nil

III. ENVIRONMENT SENSITIVITY

S.No.	Areas	Name/ Identity	Aerial distance (within 15 km) of Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value.	No	Nil
2	Areas which are important or sensitive for ecological reasons – Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	Bay of Bengal lies in Eastern direction from the Project area. The Kosasthalaiyar river & Ennore Creek lies in Eastern direction from the Project area.
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	No	Nil
4	Inland, coastal, marine or underground waters	Yes	Bay of Bengal lies in Eastern direction from the Project area. The Kosasthalaiyar river & Buckingham Canal lies in Eastern direction from the Project area.
5	State, National boundaries	No	Nil
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	Yes	Chennai is well connected by road, rail and air. The East Coast Road passes through the project area. Nearest Railway Station is (Chennai Ennore Railway station 0.5 Km), Nearest Major Road is (Manali High Road –

			0.3 Km)
7	Defence installations	No	Nil
8	Densely populated or built-up area	Yes	The project area is located within the Greater Chennai Corporation. In the project area around 30 lakhs people reside in Thirvottiyur, Manali, Madhavaram and part of Ambattur (population per 2011 census).
9	Areas occupied by sensitive man-made land uses *(hospitals, schools, places of worship, community facilities)*	Yes	The surrounding areas have land uses such as commercial zones and residential settlements. The proposed project will prevent the Chennai corporation area from flood and rain water stagnation during heavy rainfall.
10	Areas containing important, high quality or scarce resources *(Ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*	No	Nil
11	Areas already subjected to pollution or environmental damage. *(Those where existing legal environmental standards are exceeded)*	No	Nil
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (*Earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)	Yes	There will be significant effect of Tsunami, Cyclone, Tidal surges, Earthquake, etc in the project area. In the year 2004, Tsunami has occurred due to the earthquake in the Indian Ocean with the magnitude of 9.1.

"I hereby given undertaking that the data and the information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance given, if any, to the project will be revoked at our risk and cost."

Date:

Place:

SUPERINTENDING ENGINEER
STORM WATER DRAIN DEPARTMENT
GREATER CHENNAI CORPORATION

Signature of the Applicant