Missing Links Storm Water Drainage Project for the Core City Areas of Greater Chennai Corporation

Environmental Impact Assessment Report

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Prepared by

Greater Chennai Corporation

Contents

List of Tables

Annexures (Attached Separately)

Annexure I - Environmental Screening
Annexure II - Stakeholder Consultation

1 Executive Summary

1.1 Introduction

Government of Tamil Nadu received funding from the World Bank towards Tamil Nadu Sustainable Urban Development program (TNSUDP) to improve the delivery of urban services. The provision of missing link Storm Water Drains to selected core city areas of Greater Chennai Corporation (GCC) is one of the sub-projects proposed to be implemented by the Greater Chennai Corporation (GCC). This component is coordinated by Government of Tamil Nadu with Tamil Nadu Urban Infrastructure Financial Services Ltd. (TNUIFSL), Chennai as the fund Manager. This sub project is proposed to be implemented along the roadsides and doesn't involve any Land Acquisition and required land is owned by the GCC.

1.2 Project Description

The Storm Water Drainage project for the selected areas of GCC proposed to be taken up under the TNSUDP involves construction of missing link storm water drains in the core city project area. This project proposed to be implemented in Seven Zones of the GCC. The total length of the drains to be constructed is about 45 Km including both Missing link (11.949 Km) and rehabilitation (Demolition & Reconstruction) (32.934 Km). RCC cast-in-situ rectangular drains have been proposed for the construction.

This sub-project involves 43 contract packages including Missing Link storm water drains, rehabilitation of existing/unsized/dilapidated existing storm water drains and improvements. The Administrative zones covered under this sub-project are as below:

Table 1: Details of Zones proposed for Missing Links Storm water drain construction

Zone No.	Number of Stretches	Length (km)	Missing link drain Length (km)	Rehabilitation (Demolition & Reconstruction) Length (km)
IV	28	7.063	1.438	5.625
V	15	6.300	0.000	6.300
VI	23	5.774	0.800	4.974
VIII	23	5.763	0.375	5.388
IX	22	7.443	2.246	5.197
X	17	5.010	2.660	2.350
XIII	16	7.530	4.430	3.100
Total	144	44.883	11.949	32.934

1.3 Applicability of ESMF

Projects proposed under TNSUDP shall be implemented with necessary safeguards addressing the environmental and social concerns of the development activity. The requirements for ensuring environmental and social safeguards are proposed conforming to the guidelines issued by TNUIFSL titled “Environmental and Social Management Framework for TNSUDP”.

The project as per the ESMF is categorized as E2 category with lesser impacts than E1 projects and requires Environmental assessment to be carried out and management measures are prepared and has no Social Impact along the 11.949 km proposed.

1.4 Environmental Screening and Assessment (ESA)

The ESA was carried out with an objective to identify and assess the environmental impacts arising out of implementation of the missing link storm water drains construction and to prepare Environmental Management Plan (EMP) to mitigate the identified impacts. The ESA involved screening of the project, quantitative and qualitative surveys to collect the relevant information, field visits to the project area, catchment areas.

1.4.1 Environmental Regulatory Requirements

A review of National, State, Regional and World Bank environmental laws, rules and regulations relevant to the proposed missing links SWD project indicates that in addition to the safeguard policies of the Bank and construction safety requirements.

1.4.2 Baseline

Chennai city is underlain by various geological formations from ancient Archaeans to recent Alluviums and the climate is generally hot and humid. The ambient air quality ranges between a high of 175µg/m3 at Thiruvottiyur to a low of 8 µg/m3 at NEERI CSIR campus. The noise levels are generally high in commercial areas and the soil/sediment quality in the city reflects that there is no toxic element present beyond to the safe limits. Ground water with a pH of 7.4-7.9, electrical conductivity 780-1288 µmho/cm, Total Dissolved Solids of 580-910 mg/l, total and calcium hardness of 260-482 mg/l and 168-340 mg/l, the ground water quality is within the prescribed standards.

1.4.3 Assessment of Impacts

The major impacts of the project are expected to be during the construction phase leading air and noise quality deterioration, Health and Safety impacts to the works and local communities, traffic diversion and utility shifting, access to private properties, solid waste dumping and disposal of excavated silt from the existing aged drains.

No tree cutting is expected in this project. The storm water drain alignment in this missing link SWD project will be taken in such away that tree cutting are avoided. However under unavoidable circumstances, in this project it is proposed to carry out compensatory plantation of 10 times for one tree to be removed for which orders will be obtained from Deputy Commissioner/Works.

1.4.4 Environmental Management Plan (EMP)

In summary, the expected impacts are of small scale, temporary and site specific depending on the implementation of the project and will not exceed the construction and major environmental norms. To mitigate the identified impacts, an Environmental Management Plan has been prepared along with specific cost estimate for implementation.

Management measures are essential for mitigation of the impacts during construction activities for providing improvements to drains. The important management measures that need to be adhered to include.

i. Proper planning of works by the contractors and GCC.
ii. Coordination with respective line departments for shifting of utilities prior to start of work / during construction.
iii. Prior intimation to residents before start of work.
iv. Providing temporary access to adjacent structures wherever required.
v. Providing necessary PPEs to the labourers.
vi. Ensuring safe disposal of construction and demolition wastes.
vii. Managing air emissions & noise levels during construction activity.
viii. In case of any tree cutting during construction, compensatory plantation at ten times the trees cut shall be implemented by the GCC.
ix. Coordination with traffic department by the contractors and the GCC to manage traffic disruptions during the construction period.
x. Procurement of raw material from approved quarries, valid consent for batch mixing plants are to be ensured during construction.
xi. Ensuring availability of EHS person by the contractor.

A summary of key EMP measures are provided below in Table 2 and a detailed EMP has been prepared which will form part of the contract document.

Key Environmental Management Measures proposed in the ISWD in expanded areas of Chennai Corporation

Sl. No	*Potential Impact*		*Mitigation Measures*	*Responsible Agencies*
1.0			***DESIGN PHASE MEASURES***	
1.1	*Prevention of flooding*		*The drains shall be constructed to handle the maximum rainfall of 68 mm/hr.*	*Contractor/ GCC*
1.2	*Rainwater Harvesting & Recharge structures*	*i)*	*Rain water harvesting structure along with silt catching pit (600 X 600 x 600 mm) shall be constructed along the drains at every 30 m interval as per the standards prescribed on the Chennai Corporation Storm Water Schedule of rates.*	*Contractor/ GCC*
		ii)	*Ground water recharging structures Rain water Harvesting well of 1200 mm dia will be constructed in the lands available in the project area*	
1.3	*Sediment Control*		*For control of sediments silt catch pit is provided at 10 m interval so that the sediments are deposited in the silt trap and settle over there which will be removed periodically.*	*Contractor/ GCC*
1.4	*Prevention of solid waste into drains*	*i)*	*Micro drains shall be constructed as box type drain in RCC with cover slab on top which will curtail dumping of solid waste in drains.*	*Contractor/ GCC*
		ii)	*Major micro drains belonging to Corporation of Chennai will be provided with fencing with MSframe with wire mesh to avoid throwing of solid waste..*	
1.5	*Safety in maintenance*		*Inspection doors shall be provided at an interval of 10m to facilitate removal of silt using machineries.*	*Contractor/ GCC*
2.0	***PRE-CONSTRUCTION STAGE AND CONSTRUCTION PHASE***			
2.1	*Appointment and Mobilization of Environment & Safety Officer*	*i)*	*The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will be mobilized prior to start of works.*	*Contractor*
		ii)	*PMC will dedicatedly work and ensure implementation of Environmental Management Plan including Occupational,*	

			Health and Safety measures during the project Implementation.	
2.2	*Clearances*	*i)*	*All clearance required for Environmental aspects during construction shall be ensured and made available before start of work.*	*Contractor/ GCC*
		ii)	*For setting–up of Batching Plant, D.G Sets, Consent to Establish and Consent to Operate will be obtained from Tamil Nadu Pollution Control Board (TNPCB) prior to start of work and conditions be complied.*	
		iii)	*If contractor intends to procure construction materials from existing units, then the approvals for the concerned units shall be ensured prior to start of work*	
		iv)	*The permits to be obtained by the contractor (including Labour Licence, Labour Insurance, etc) shall be examined by GCC and validity be ensured.*	
		v)	*All clearance required from all departments and Environmental aspects shall be ensured and made available before start of work. For trees identified for cutting, obtain prior permission from the Deputy Commissioner (Works), GCC prior to commencement of work to plant 10 trees as compensation in the parks available in the project area..*	
2.3	*Identification of Quarries*		*The contractor will procure from approved quarries for sourcing of the materials for construction.*	*Contractor*
2.4	*Water for construction*		*The contractor shall source water for construction after proper permission from agency concerned.*	*Contractor*
2.5	*Labour requirements*	*i)*	*Wherever possible, the contractor may use skilled/unskilled labour as required; drawn from local communities.*	*Contractor*
		ii)	*All applicable labour regulation will be complied by the contractor.*	
		Iii)	*Labourer's shall be provided orientation of ESMP requirements and COVID related regulations*	
		iv)	*Strict adherence to avoid child labour of any form of work should be followed at the construction site and camp sites.*	

2.6	*Tree Cutting*	*i)*	*Minimise tree cutting*	*Contractor / GCC*
		ii)	*Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars) as required..*	
		iii)	*Take adequate care to determine root protection zone and minimize root loss.*	
		iv)	*Fallen / cut trees shall be removed from the construction sites before commencement of construction*	
		v)	*Under take compensatory plantation in nearby areas at the rate of 10 trees for each tree proposed to be cut. This will have to be monitored and reported to TNUIFSL*	
2.7	*Utility Relocation*	*i)*	*Identify the common utilities that would be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc*	*GCC / Concerned departments/ Contractor*
		ii)	*Prior to works / shifting of utilities concerned line departments and citizens shall be made well aware of proposed works (through discussions/meetings, display boards) and possible disturbances due to utility shifting*	
		iii)	*Affected utilities shall be relocated through the concerned line departments before construction starts*	
		iv)	*All safeguards against accidents shall be taken while shifting utilities, including (but not limited to) hard protective barricading of full work space, notice to road users and communities, traffic management, PPEs to protect workers from all incidental issues including (but not limited to) electric shocks, hit, fall, vehicular conflicts following Good International Industry Practices and Word bank EHS.*	
		v)	*Wherever the entry and exit to houses/establishments are affected due to construction activities, alternate temporary but safe ramp arrangement for crossing over shall be provided without causing access/safety issues. Adequate provision shall be made to collect complaints from community / road users and resolve the*	

			same immediately (notice board with contact details of GCC executive engineer; complaint box, log book etc.)	
		vi)	*Shifted utilities or construction materials shall not cause any disturbance to communities / road users. They shall be well stacked safely with flags / reflectors for easy visibility and transported as early as possible without causing any accidents / spills & stored at pre-agreed (before start of works) disposal / storage point as directed by GCC.*	
		vii)	*All hazardous material / e-waste including existing asbestos material (eg: as in old pipes) or electric cables etc. shall be managed as per hazardous/e-waste management rules (as directed & arranged by GCC prior to start of works). No such material shall be dismantled / broken on site or allowed to cause any accident.*	
2.8	*Baseline parameters*	*i)*	*Base line parameters shall be recorded and ensured conformance till the completion of the project*	*Contractor / GCC*
		ii)	*The contractor shall undertake periodical monitoring of air, water, and noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of monitoring plan shall be prepared.*	
		iii)	*Adequate measures shall be taken and checked to control any pollution and report be sent to the Engineer*	
2.9	*Planning of temporary Traffic arrangements and pedestrian safety*	*i)*	*Temporary diversion shall be provided with the approval of the engineer. Detailed traffic control plans shall be prepared and submitted to the engineers for approval, one week prior to commencement of works*	*Contractor / GCC*
		ii)	*The traffic control plan shall contain details of temporary diversion of traffic, details of arrangements for construction under traffic, details of traffic arrangement after cessation of wok each day, SIGNAGES and plan for information dissemination to community/road users, safety measures for transport of hazardous materials and arrangement of flagmen.*	

		iii)	*Special consideration will be given to the preparation of the traffic management plan and housekeeping / work area management plan for safety of pedestrians and workers at night.*	
		iv)	*Construction shall be taken up phase –wise so that sections are available for traffic.*	
		v)	*The Contractor will also disclose to the local community about diversion in traffic routes and pedestrian access arrangements with assistance from ULB. Proper signages / info boards shall be arranged prior to works providing emergency contacts etc*	
2.10	*Excavations*	*i)*	*All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized.*	*Contractor*
		ii)	*The excavation shall conform to the lines, grades, side slopes and levels shown in the drawing or as directed by the engineer*	
		iii)	*While planning or execution the contractor shall take all adequate precautions against soil erosion, and take appropriate drainage measures to keep the site free of water.*	
		iv)	*Proper signages on excavations; side protections to avoid slip, drip, fall shall be provided.*	
2.11	*Water Pollution from Construction Wastes*	*i)*	*Avoid mixing of wastewater from household, commercial, industrial and other establishments, by regular monitoring, punitive actions and provision of services.*	*Contractor*
		ii)	*Provision for connecting domestic liquid waste to sewerage system is to be made during drain construction to avoid mixing of waste water.*	
		iii)	*Periodical monitoring shall be carried out and sources of wastes/ effluent etc., are to be identified by the GCC. 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 rain water.*	
		iv)	*In case of any industrial effluent identified, necessary action be taken in co-ordination with the TNPCB.*	

2.12	*Temporary flooding during construction activity.*	*i)*	*Desilting activity shall be scheduled during non-flooding season. Silt shall be stored near site for dewatering in case there is sufficient space and/or transported immediately in covered skips with water collection arrangements to the disposal / storage point agreed with GCC. This shall be well stored with cut off drains / covers as appropriate considering the characteristics of the silt & disposal area. NO disturbance shall be harmed to communities due to desilting, storage, transport or disposal of silt*	*Contractor/ GCC*
		ii)	*Dewatering with proper drainage arrangements to be made, to avoid the overflowing of existing drains due to construction activity.*	
2.13	*Prevention of accidents*	*i)*	*Prevention of accidents involving human beings, animals or vehicles falling or accidents during construction period. This needs to be ensured with proper barricading, signage boards, reflectors on barricades and adequate lighting etc. Any loose earth near / around pits shall be checked and attended to in order to prevent slumps.*	*Contractor*
		ii)	*The project Engineer-in-charge of GCC will plan and direct the contractor to execute the work progressively so that the length of the open excavated trench is minimized in order to reduce possible accidents.*	
		iii)	*Communities and road users shall be well informed about the work through media, signboards at and ahead of the workspace; discussions /meetings and their concerns shall be attended to and resolved with involvement of GCC engineer in charge.*	
		iv)	*All precautions shall be taken to avoid accidents due to works*	
2.14	*Work-zone safety Management*	*i)*	*Temporary barricades shall be provided to delineate construction zone as well material stacking areas. The construction site and the labour facility shall be appropriately barricaded to prevent entry and accidental tress-passing of workers, staff and others into the construction sites.*	*Contractor*

		ii)	*All operational areas shall be access controlled. Watch and ward facilities at all times shall be provided by the contractor.*	
		iii)	*Proper retro reflective warning signage will be installed on the access road next to the construction site about movement of construction machinery and vehicles.*	
		iv)	*In excavations for longitudinal surface road drains, culverts etc., a high visibility warning and retro reflective signage shall be displayed in Tamil and English.*	
		v)	*Entry of unauthorized persons should be prevented. Excavations will be adequately barricaded and well lit – with signages/info boards.*	
		vi)	*There shall be adequate lighting arrangement at night and adequate barricading to prevent mishaps after construction activity ceases for the day*	
		vii)	*A readily available first aid unit with necessary supplies, drinking water, resting shed, sanitation etc shall be made available in every work zone*	
2.15	*Barricading site*		*The construction area should be barricaded at all times with adequate marking, flags, reflectors, lighting, etc. for safety of general traffic movement, workers and pedestrians.*	*Contractor*
2.16	*Drainage flow*	*i)*	*Alternate arrangement like diversion of the drainage is ensured to allow the natural flow.*	*Contractor / GCC*
		ii)	*It shall be ensured that none of the construction activities affect the natural flow of the drainage.*	
2.17	*Storage of materials*	*i)*	*No construction materials should be stored on the road, on top of or beside drains and footpaths, or on any other public area as this may restrict public access to these utilities.*	*Contractor / GCC*
		ii)	*The contractor shall identify the site for temporary use of land for construction sites/storage of construction materials, etc.,*	
		iii)	*Site for storage of construction materials to be identified without affecting the traffic and other common utilities, and the quality of the construction materials.*	
		iv)	*Construction materials should only be stored and prepared on the site if they do not*	

			obstruct the road or any surrounding public utility. Construction materials should only be transported to the worksite as and when required for construction	
2.18	*Using of modern machineries*		*Using of modern machineries such as JCBs, backhoes etc., shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents.*	*Contractor*
2.19	*Dust Pollution Near settlements*	*i)*	*All earthworks will be protected in manner acceptable to the Engineer to minimize generation of dust*	*Contractor*
		ii)	*Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction*	
		iii)	*Un paved haul roads near / passing through residential and commercial areas to be watered thrice a day.*	
		iv)	*Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage.*	
		v)	*Sprinkling of water to be done at regular intervals at places of work to protect the near by inhabitants and road users.*	
2.20	*Material Handling at site*	*i)*	*All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles*	*Contractor*
		ii)	*Cement bags will be stored and emptied in covered area to control fugitive dust emissions.*	
		iii)	*While handling and emptying cement bags, workers will wear masks, hand gloves and protective goggles.*	
		iv)	*Trolley may be used for transferring of material from one place to another place.*	
2.21	*Protection of Residential / sensitive receptors.*	*i)*	*Wherever necessary, time period, barrier requirements, and other pollution / impact control for construction activities may be finalized in consultation with sensitive receptors like schools, religious places, shrines, community centers, grave yards, lakes/water bodies etc.,*	*Contractor*
		ii)	*Periodic maintenance and calibration of construction equipment's/ vehicles to meet*	

			applicable CPCB emission standards and noise levels.	
		iii)	*Contractor to ensure regular dust suppression measures by way of standard and efficient water sprinkling through water tankers at these designated sensitive receptors*	
		iv)	*Adequate barricading and safety measures to protect sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction.*	
2.22	*Vehicular noise pollution at Residential / sensitive receptors.*	*i)*	*Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas.*	*Contractor*
		ii)	*Stationary construction equipment will be kept at least 500m away from sensitive receptors.*	
		iii)	*All possible and practical measures to control noise emissions during drilling shall be employed. The GCC may direct to take adequate controls measures depending on site conditions.*	
2.23	*Noise from vehicles, plants and equipment*	*i)*	*Use of less noise generating cutting equipment's, provide personal protective equipment's such as ear plugs/muffs and other safety measures to labourers. In addition the concrete mixture to be used for construction works will be prepared in a location away from the locality to minimize the noise generated from the machinery.*	*Contractor*
		ii)	*Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.*	
		iii)	*Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.*	

2.24	*Location of Labour camp Accommodation*	*i)*	*Consult GCC before locating project offices, sheds, camps, and construction plants*	*Contractor*
		Ii)	*Labour camp shall be planned & the plan shall be approved by GCC engineer in charge & TNUIFSL. Setting up of labour camps if any needed to be done as per all applicable rules/regulations. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws and applicable regulations shall be ensured..*	
		iii)	*The contractor shall also guarantee the following:* *The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction.* *The construction of the camp will commence only upon the written approval of the Engineer. It will be difficult to construct labour camps near work sites which are in the congested parts of the city.*	
		iv)	*Adequate toilets, wash (COVID 19 related hygiene facilities), Storage, First Aid, rest area, Water/Food facilities shall be made available to the workers at each work site.*	
		v)	*Select a camp site away from residential areas (at least 100 m buffer shall be maintained) or locate the camp site within the existing facilities of ULB*	
		vi)	*Avoid tree cutting for setting up camp facilities*	
		vii)	*Provide a proper fencing / compound wall for camp sites*	
		viii)	*Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas*	
		ix)	*The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing.* *Camp shall be well constructed and maintained to provide healthy and safe*	

living environment for workers. Fire and electric safety shall be ensured.

x) Supply of sufficient quantity of potable water (as per IS) in every work place/labor camp site at suitable and easily accessible places and regular maintenance of such facilities.

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

xii) 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 much as possible to use portable ready to fit-in reusable cabins with proper ventilation) and safe materials for all extreme weather conditions; thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers

xii) The camp shall be designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is provided in all toilets and urinals.

xiii) Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws and applicable regulations shall be ensured. The contractor shall also guarantee the following:

xiv) Provide drinking water, water for other uses, and sanitation facilities for employees. Adequate water supply is to be provided in all toilets and urinals

xv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities.

xvi Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed

xvii) Train employees in the storage and handling

of materials which can potentially cause soil contamination

xviii) Recover used oil and lubricants and reuse or remove from the site

xix) The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer

xx) Where feasible, manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; ULB shall ensure proper segregated storage, collection, transport, treatment and disposal of all wastes following the SWM / C&D waste Rules 2016.

xxi) Adequate toilets, wash (COVID 19 related hygiene facilities), Storage, First Aid, rest area, Water/Food facilities shall be made available to the workers at each work site.

All toilets shall have septic tank / sewage disposal facility as directed by regulations / building rules. Portable / mobile toilets if provided shall have adequate septic tanks which are emptied at STPs/ FSTPs at regular intervals so as not to cause any disturbance to workers / communities. Health checkups shall be arranged and COVID 19 precautions as directed by GoI, GoTN & WHO shall be followed in the camp.

xxii) Separate toilets/bathrooms are to be provided for women, wherever required, and shall be screened from those for men (marked in Tamil language)

xxiii) Adequate health care is to be provided for the work force during the entire phase. Inform nearest PHC regarding the work camp & get trainings/ orientations, COVID guidance etc.,

xxiv) Remove all wreckage, rubbish, or temporary structures which are no longer required

xxv) At the completion of work, camp area shall be cleaned and restored to pre-project conditions

2.25	*HIV/AIDS Prevention Measures*	*i)* *ii)*	*Necessary HIV/AIDS prevention measures will be taken at labour camp* *HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer*	*Contractor*
2.26	*Stock-yards*	*i)* *ii)* *iii)* *iv)* *v)* *vi)* *vii)*	*Contractor in consultation with GCC shall identify the site for temporary use of land storage of construction materials. These sites shall not cause an inconvenience to local population / traffic movement.* *Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary.* *Location for stockyards for construction materials will be identified sufficiently from water course and separated from the labour camps.* *Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of nearby land, water body, nearby storm water drain & underground sewerage pipes.* *Enclosed storage for fuel with non-permeable flooring, and safety signages* *Inflammable materials shall not be stored near residences/ schools, etc. Contractor shall cover material stockpiles with tarpaulin or other materials.* *Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. Necessary training and awareness program shall be carried out to make the labourers aware about hazardous nature of substances*	*Contractor*
2.27	*Fuel storage and refueling areas*	*i)*	*The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and*	*Contractor*

			refueling sites are not located near rivers and irrigation canal/ponds	
		ii)	*All location and lay-out plans of such sites, collection and disposal methods for the spent oil and grease will be finalized in consultation with the Engineer*	
		iii)	*Refuelling shall be done in such a fashion that oil/diesel spillage does not contaminate the soil.*	
		iv)	*Oil and grease traps will be provided at fuelling locations, to prevent contamination of water.*	
2.28	*Information Dissemination and Communication Activities*	*i)*	*Prior to construction activity, information dissemination will be undertaken by contractor at the project site.*	
		ii)	*The contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language (Tamil), wherever required or as suggested by the Engineer. Informatory boards shall be well visible & safely erected & shall inform communities/road users of the woks and probable safety concerns and the emergency contact numbers (of site engineer, ambulance, police fire, electricity department / others) for the workers and the communities.*	
		iii)	*Details of nodal officer with telephone numbers will be displayed for registering compliant/grievances by stakeholder/general public.*	
		iv)	*Information boards will also be setup at the sites of construction camps and labour camps, plants and stockyard site.*	
2.29	*Covid 19 control measures*	*i)*	*Construction sites operating during the Covid-19 pandemic need to ensure they are protecting their WORKFORCE and minimising the risk of spread of infection.*	
		ii)	*SOPs and guidelines issued by GOI and GoTN from time to time to prevent spread of Covid19 be adhered to during sub-project implementation*	
2.30	*Accessibility to connecting roads and*	*i)*	*Contractor will provide safe access through temporary bridges / walkways to the adjacent residences/ buildings wherever necessary*	*Contactor*

	adjacent structures		*especially during construction of drains.*	
		ii)	*Residents / Local community will be informed 3 days prior to start of construction.*	
		iii)	*The Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The Contractor will also ensure that the existing accesses will not be disturbed without providing adequate provisions*	
		iv)	*The Contractor will take care that the cross roads are taken up one after one in such a sequence so that traffic movement in any given area not get affected much.*	
2.31	*Transporting Construction Materials*	*i)*	*All vehicles delivering fine materials like aggregate, cement, earth, sand, etc., to the site will be covered by Tarpaulin to avoid spillage of materials and wind- blown dust from the top of vehicles.*	*Contactor*
		ii)	*Roads used by vehicles of the contractor or any of his subcontractor or suppliers of materials will be cleared of all dust/mud or other extraneous materials dropped by such vehicles.*	
		iii)	*To the extent possible the contractor will transport materials to the site in non- peak hours.*	
2.32	*Pollution from Construction Wastes*	*i)*	*All waste arising from the project is to be disposed of by the contractor in dumpsites designated by GCC.*	*Contractor*
		ii)	*The engineer shall certify that all liquid wastes disposed of from the sites meet the discharge standard.*	
		iii)	*Avoid stockpiling any excess spoils at the site for more than a day. Excess excavated soils should be disposed to approved designated areas immediately;*	
		iv)	*All arrangements for covered transportation during construction including dismantling and clearing debris, will be planned and implemented by the Contractor in consultation with the Engineer.*	
2.33	*Pollution from Fuel and*	*i)*	*Contractor will ensure that all vehicle/machinery and equipment operation,*	*Contractor*

	Lubricants		*maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas.*	
		ii)	*In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage.*	
		iii)	*Contractor will arrange for collection, storing and disposal of oily wastes as directed by the Engineer*	
2.34	*Operation of construction equipment and vehicles*	*i)*	*The Contractor will confirm the following: All plants and equipment used in construction shall strictly conform to the MoEFCC/CPCB noise standards*	*Contractor*
		ii)	*All vehicles and equipment used in construction will be fitted with exhaust silencers.*	
		iii)	*Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.*	
		iv)	*Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum.*	
		v)	*Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use.*	
		vi)	*Noisy construction activities during the night hours will be avoided near sensitive receptors like health centers and hospitals.*	
		vii)	*Ensure that all the construction equipments / machineries are maintained properly, and have a valid PUC certificate and operated by*	

			drivers holding valid license	
2.35	*Flora and Chance found Fauna*	*i)*	*The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.*	*Contractor/ GCC*
		ii)	*If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same.*	
		iii)	*The Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.*	
2.36	*Chance Found Archaeological Property*	*i)*	*All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation.*	*Contractor/ GCC*
		ii)	*The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped.*	
		iii)	*The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.*	
2.37	*Disposal of oil and grease*		*A suitable site should be identified for safe disposal / without contaminating the source, in relatively low lying areas away from the waterbodies etc., as approved by the Engineer & as per specific procedures.*	*Contractor/ GCC*
2.38	*Personal Safety*	*i)*	*Adequate precautions shall be taken to prevent work site accidents including from*	*Contractor*

Measures for Labour		*the machineries. All machineries used shall confirm to the relevant Indian standards Code and shall be regularly inspected by the Engineer*
	ii)	*Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil.*
	iii)	*Protective footwear and protective goggles to all workers employed to be provided for all works as required, including mixing of materials like cement, concrete etc.*
	iv)	*Welder's protective eye-shields shall be provided to workers who are engaged in welding works.*
	v)	*Ear plugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation.*
	vi)	*The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc., to workers and staffs.*
	vii)	*The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No.62 as far as those are applicable to this contract.*
	viii)	*Adequate safety measures for workers during handling of materials at site are to be taken up.*
	ix)	*Safety vests (fluorescent) will be used by workers when on construction site*
	x)	*The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 & Code on Occupational Safety, Health and Working Conditions, 2018 and World Bank EHS are adhered to.*
	xi)	*The contractor shall not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any*

			form.	
		xii)	*Woman will not be employed on the work of painting with products containing lead in any form*	
2.39	*Risk from Electrical Equipment(s)*	*i)*	*The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that*	*Contractor*
		ii)	*No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.*	
		iii)	*All necessary fencing and lights will be provided to protect the public in construction zones.*	
		iv)	*All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer*	
2.40	*First Aid*	*i)*	*The contractor shall arrange for: A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules / relevant legislation in every work zone*	*Contractor*
		ii)	*Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital*	
2.41	*Informatory Signs and Hoardings*	*i)*	*The contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language (Tamil) and any other appropriate language understandable to workers/communities, wherever required or as suggested by the Engineer.*	*Contractor/ GCC*
		ii)	*Informatory boards shall be well visible & safely erected & shall inform communities/road users - of the works and probable safety concerns and the emergency contact numbers (of site engineer, ambulance, police fire, electricity department / others) for the workers and the communities*	
2.42	*Disposal of Desilted/*	*i)*	*Wastes generated may be considered for suitably reuse in the proposed construction,*	*Contractor / GCC*

	excavated material, construction and other waste.		*subject to the suitability of the materials with the approval of the engineer. The C&D wastes from dismantling of existing drains, existing bituminous surface debris etc may be considered for the paving of cross roads, access roads and paving works in construction camps, traffic diversion roads, haulage routes etc.,*	
		ii)	*Feasibility of reuse will be decided on case to case basis by the Engineer.*	
		iii)	*Unutilized debris materials shall be suitably disposed off by the contractor in dumpsites designated and conveyed to the contractor formally by GCC*	
		iv)	*Silt shall be transported immediately in covered skips with water collection arrangements to the disposal / storage point agreed with GCC. This shall be well stored with cut off drains / covers as appropriate considering the characteristics of the silt & disposal area. NO disturbance shall be caused to communities due to desilting, storage, transport or disposal of silt.*	
		v)	*The following shall be ensured during silt disposal*	
		vi)	*The storage or disposal does not impact natural resources or drainage courses*	
		vii)	*No communities/road or area users, endangered / rare flora is impacted by such dumping*	
		viii)	*Should be located away from settlements so as not to cause any pollution or disturbance; or natural habitats including rivers, wetlands, other water bodies, forests etc. Preferably, designated area shall be in the downwind side of non-residential areas*	
		ix)	*avoid disposal on productive land should be located with the consensus of the local community, in consultation with the engineer*	
		x)	*All vehicles delivering material to the site shall be covered and with water collection arrangements to avoid water/material spillage*	
2.43	*Emergency*	*i)*	*Emergency numbers will be displayed at the*	*Contractor*

	Management		*construction sites and camp site,*	
		ii)	*First-Aid boxes will be made available at construction site and camp site.*	
	Incident Reporting	*iii)*	*Fire extinguishers for petroleum oil fire and electrical fire will be made available at camp site, fuel storage site, construction site etc*	
		iv)	*Train the labourers to take necessary measures during any emergencies in construction and inform the Engineer, others, etc and provide facility for the same*	
		v)	*Designated vehicles, which can be used as ambulance will be available at construction site at all the time in case of any mishap during construction*	
		vi)	*Entry of unauthorized persons should not be prevented*	
		vii)	*The contractor will maintain an Incident Register at the work site and labour camp recording all incidents with details type of incidents (indicative/ severe/ serious), cause of the incident, action taken, etc.*	
		viii)	*All incidents shall be reported to TNUIFSL in the subsequent reporting and fatalities shall be reported immediately.*	
2.43	*EHS personnel*		*Contractor shall have EHS personnel to supervise/monitor all works as per this EMP and all national/state regulations and requirements, and report to GCC on EMP & OHS on a weekly basis, for GCC's monthly reporting to TNUIFSL.*	*Contractor*
2.44	*Clearing of construction camps and restoration*		*On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, & restored to pre-project conditions*	*Prospective contractor*
2.45	*Project implementation*		*It shall be ensured that the Environmental, Health and Safety guidelines of World Bank are adhered to as applicable for activities during construction.*	*Contractor / GCC*
3.0	***OPERATION PHASE***			
3.1	*Maintenance*	*i)*	*It shall be ensured by the GCC that drains are not clogged.*	*GCC*
		ii)	*The following practices should be adopted*	

			in maintaining storm water drains: *Drains shall be regularly inspected and cleaned especially prior to monsoons with suitable safety precautions/PPEs; preferably using mechanical means following the country regulation: Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013*	
		iii)	*All damaged or missing drain covers should be replaced immediately.*	
		iv)	*Debris and silt shall be mechanically removed and all workers shall be provided with PPEs and safety considerations (for communities & workers) while removing. Silt removed from the drainage system should not be left alongside the drain and shall be immediately stored/disposed in pre-identified appropriate site with necessary precautions/safeguards following all regulations and without pollution or disturbance to people, biodiversity.*	
		v)	*It shall be ensured that the Environmental, Health and Safety guidelines of World Bank (Generic and Water & Sanitation) are adhered to relevant activities during operation*	
3.2	*Impairment of receiving water quality due to mixing of waste water*	*i)*	*Avoid mixing of wastewater from household, commercial, industrial and other establishments, by regular monitoring, punitive actions and provision of services.*	*GCC*
		ii)	*Provision for connecting domestic liquid waste to sewerage system is to be made during drain construction to avoid mixing of waste water.*	
		iii)	*Periodical monitoring shall be carried out and sources of wastes/ effluent etc., are to be identified by the GCC. 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 rain water.*	
		iv)	*In case of any industrial effluent identified, necessary action be taken in co-ordination with the TNPCB.*	
3.3	*Nuisance due*	*i)*	*Ensure timely desilting of drains*	*GCC*

	to clogging of drains, formation of mosquito breeding grounds etc.,	*ii)*	*Create awareness among the people not to throw garbage and other waste into the drains*	
3.4	*Disposal of storm water*	*i)*	*Mixing of wastewater from households, commercial, industrial and other establishments will be avoided through improved sewerage system in the project area through periodical monitoring of water quality.*	*GCC*
		ii)	*Possibility of reusing the storm water for secondary uses with minimum treatment shall be explored and implemented*	
3.5	*Tree Planting & Protection*	*i)*	*Plantation of trees shall be carried out along the proposed streets or any other place possible like parks in the near by areas if resorted to tree cutting with the permission of Deputy Commissioner (Works), GCC*	*GCC*
		ii)	*Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered wherever necessary*	
		iii)	*Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years for the afforested trees. Survival status shall be monitored on monthly basis by Engineer in-charge and reported to Deputy Commissioner (Works), GCC.*	
3.6	*Flood management*		*Flood management system may be developed with forecasting and warning to protect areas prone to flooding and action be taken as necessary, like bailing out of water, relocation of residents to other locations etc.*	*GCC*
3.7	*Solid waste Management*	*i)*	*Provide additional bins in critical locations*	*GCC*
		ii)	*Ensure frequent collection and disposal of waste*	
		iii)	*Carryoutperiodicalawarenessprogrammesto educatethepublic/stakeholders*	
3.8	*Illegal Sewer line in Storm Water Drain*	*i)*	*Greater Chennai Corporation and CMWSSB have jointly taking action for plugging of sewer*	

			connections illegally letting into storm water drain	
		ii)	*Fines are imposed against the peoples who are letting sewer into the storm water drain as per Government Order issued by Government of Tamil Nadu*	
3.9	*Safety requirements during maintenance*		*Follow country regulation on Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.* *A competent person should carry out a risk assessment and make recommendations on safety and health measures before undertaking work in confined space.* *Allow only certified workers to work in the confined space.* *Provide adequate ventilation.* *Isolate the confined space.* *Monitor the air quality throughout the entire working period by means of a gas detection device.* *A person should be stationed outside the confined space to monitor the weather condition and keep communication with the workers inside.* *if required ensure the use of approved breathing apparatus* *Appropriate emergency procedures shall be formulated to deal with serious or imminent danger.* *Instructions, training and advice shall be provided to all workers to be working within a confined space.* *Follow all labour laws; ensure PPEs, insurance, first aid, quick medical support etc, for the workers.*	*GCC*

In addition, in this project the following proposal are made

- Groundwater recharge through construction of Silt catch pits at 10m interval and recharging structures at 100m in the proposed storm water drainage network.

- Construction of sediment trap at the confluence point of drain with the water body is proposed, so that the sediments are deposited in the silt trap.
- Design of box type drains in RCC with cover on top,
- MS frame with wire mesh for major drains,
- flow of storm water through FRP gratings
- and public awareness programs to minimize the solid waste deposits in the drains & regular disposal of wastes accumulated.

A detailed environmental management plan has been developed (above) integrating these aspects and also the measures monitoring the implementation of EMP.

A budget of about Rs.22872000/- met out from the provision made in the estimate and in the lump sum in the cost estimate and it is included in the project cost and it has been provided for the EMP measures of the project.

The EMP shall be implemented by the GCC through Project Management consultant and monthly reports will be submitted to TNUIFSL who will report based on this to the Bank.

1.5 Social Impact Assessment

There is no social impact anticipated in this project and hence rehabilitation & resettlement are not proposed. The project does not require Social Impact Assessment and Resettlement Action Plan is not envisaged.

1.6 Implementation Monitoring / GRC

GCC has proposed to take up the Missing links Storm Water Drainage (SWD) project to selected stretches through its Storm Water Drain Department. The project is divided into 43 packages at an estimated project cost of Rs.11993 Lakhs (119.93 Crore). The Environmental Management Plan identified for the construction will be included in the bid documents for ensuring implementation of the environmental safeguards. The management measures identified for the operation phase will be taken up by the GCC upon completion of construction activities.

GCC has proposed to engage Project Management Consultants (PMC) for managing the missing links SWD Project for the core city areas of GCC. The PMC will include Environmental specialists as part of the team to monitor the day to day activities.

The GCC will have a two level Grievance Redressal Mechanism (GRC) to handle the grievances of the project affected persons if any and for all the grievances relating to the implementation of missing links Storm Water Drain project.

The project level GRC will have The Zonal Officer /Assistant Commissioners of GCC, Any one elected representative, a person who is publicly known in the local area and Superintending Engineer (SWD) (Convener). The Appellate level GRC will constitute Deputy Commissioner (Works) and Regional Deputy / Joint Commissioners (Central/South/North) Superintending Engineer/SWD, Concerned MLA

GCC shall submit monthly reports on the status of compliance with the ESMF requirements to TNUIFSL to World Bank.

2. Introduction

Government of Tamil Nadu has proposed to implement the World Bank supported Tamil Nadu Sustainable Urban Development program (TNSUDP) to improve the delivery of urban services. The provision of Storm Water Drains (SWD) to selected areas of Corporation of Chennai is one of the sub-projects proposed to be implemented by the Corporation of Chennai. This component is coordinated by Government of Tamil Nadu with Tamil Nadu Financial Services Ltd. (TNUIFSL), Chennai as the fund Manager. This sub-project is proposed to be implemented in the roadsides and required land is owned by the Corporation of Chennai and canals and doesn't involve any Land Acquisition.

The Greater Chennai Corporation (GCC) has expanded its area during 2011 by adding adjacent local bodies. Chennai city is divided into 200 divisions/wards , in 15 zones. In order to provide missing links storm water drains to the selected areas of Core city of Greater Chennai Corporation, a Detailed Project Report has been prepared. This project proposed to be taken up under Tamil Nadu Sustainable Urban Development Project (TNSUDP) which intends to cover selected stretches or streets in zones 4, 5, 6, 8, 9, 10 and 13 respectively at an estimated cost of Rs.119.93 crores. The details of the stretches in the respective zones are presented in below Table 3.

Table 3: Details of Zones proposed for Missing Links Storm Water Drain construction

Zone No.	Number of Stretches	Length (km)	Length of missing link drain (km)	Rehabilitation (Demolition & Reconstruction) Length (km)
4	28	7.063	1.438	5.625
5	15	6.300	0.000	6.300
6	23	5.774	0.800	4.974
8	23	5.763	0.375	5.388
9	22	7.443	2.246	5.197
10	17	5.010	2.660	2.350
13	16	7.530	4.430	3.100
Total	144	44.883	11.949	32.934

2.1 Environmental and Social Management Framework (ESMF)

Projects proposed under TNSUDP shall be implemented with proper safeguarding measures on the environmental and social concerns of the development activity. The requirements for ensuring environmental and social safeguards have been stipulated in the TNUIFSL's Environmental and Social Management Framework exclusively prepared for TNSUDP.

The proposed missing links SWD to selected streets of GCC involve construction of missing link storm water drainage network and rehabilitation of the existing drains along the road sides to facilitate free flow of storm water to subsequent drains. This will also facilitate the discharge of storm water into the feeder drains and to the macro drains/outfalls in the catchment. This project is expected to cause minor impacts temporarily during construction like traffic management, access issues etc and during operation, might cause issues related to maintenance of drains, disposal of silt, flooding issues etc.

Hence this project is categorised under E2 category as per ESMF, which has much lesser impacts than E1 projects. The E2 project is similar to the Category B project of World Bank Safeguard Policy and require Environmental assessment to be carried out and management measures be prepared.

2.2 Environmental Assessment for Missing Link SWD to selected streets of GCC

Objective: The objective of this ESA for missing links SWD to selected streets of GCC is to identify and assess the environmental impacts arising out of implementation of the missing links Storm Water Drain Construction and to prepare necessary Environment Assessment Reports and mitigate the impacts through Environmental Management Plan (EMP).

Scope: The scope of this Environmental Assessment (EA) is to study the base line of Environmental status of the project area, assess the impacts arising from the project implementation, prepare management plan and making necessary provision in cost estimates and bid documents.

This EA is prepared in line with the Environmental Management Framework (ESMF) of TNUIFSL specifically evolved for the proposed Tamil Nadu Sustainable Urban Development Project (TNSUDP).

2.3. Methodology

In the screening stage, it is decided whether particular project is required to decide whether an EA is required and focus on projects most likely to have significant impacts, those where impacts are uncertain and those where environmental management input is likely to be required. In the present scenario, the storm water drainage system projects are excluded from the Environmental Clearance (As per Ministry of Environment and Forests (MoEF) Notification issued on 14th September 2006). However, there is a need of environmental assessment prior to undertake any developmental activity to predict the environmental impacts, if any, due to implementation of the proposed activity and for eliminating or lessening the impact.

Quantitative and Qualitative surveys were conducted and relevant information was collected, analyzed and compiled to prepare Environmental and Resettlement Action Plans, wherein the issues before, during and post project implementation will be addressed in view of environmental and social impacts owing to the proposed implementation of the project.

The primary baseline information was collected during the field trips at the project catchment areas, macro drains etc. and data was collected through observation.

As far as scope of the EIA is concerned, five environmental components viz., land, air, water, biodiversity and social & aesthetic and the proposed project activities under the missing link storm water drain project in the respective zones of GCC have been taken into consideration for impact assessment.

2.4 Structure of the ESA Report

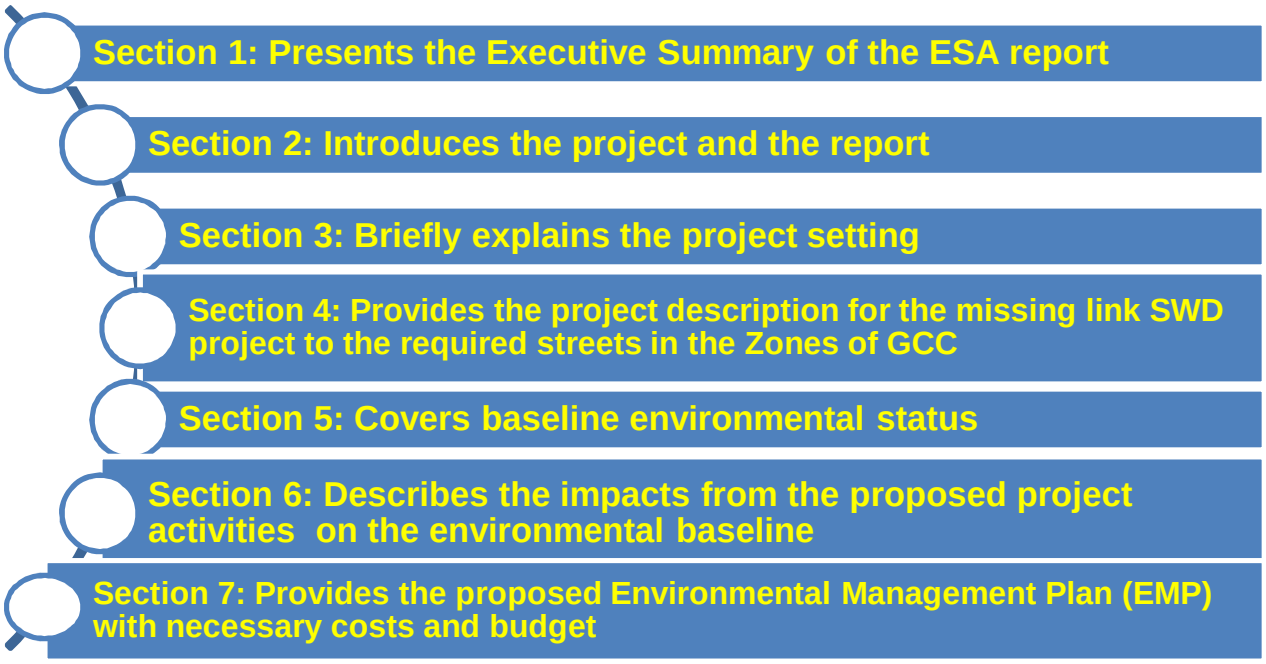


Figure 1

3. Background and Study Area

Chennai city is the Capital city of the State of Tamil Nadu. Chennai is the fourth largest metropolitan city in India with an area of 174 sq.km and a population of 4.68 million (as per census 2011). GCC is responsible for provision of civic amenities within Chennai including provision of Storm Water Drains (SWD).

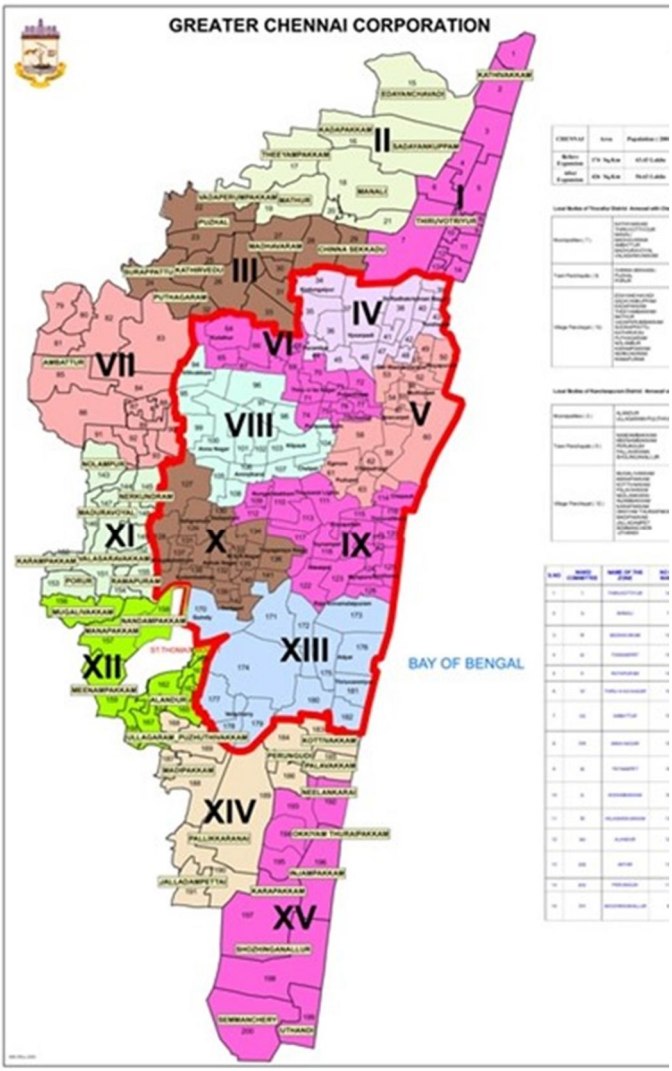


Figure 2 : Administrative Boundary Map of GCC

As many as nine municipalities, eight town panchayats and twenty-five village panchayats have been brought under the Greater Chennai Corporation limits, raising the city population from 46.81 lac to 62.2 lac (as per 2011 census). Merger of the expanded area has resulted in an increase in the area of corporation from 174 sq. sm. to 426 Sq. Km.

According to the present status, Greater Chennai Corporation is divided into fifteen (15) administrative zones out of which eight (8) zones namely Thiruvottiyur, Manali, Madhavaram, Ambattur, Valasaravakkam, Alandur, Perungudi and Shozinganallur fall in the expanded areas and remaining seven zones are in old city area. The administrative boundary map of GCC is presented as Figure 2.

The present population is estimated at 80 Lakh with floating population of 10 lakh daily.

The core city and extended area of GCC is presented in Figure 3 below:

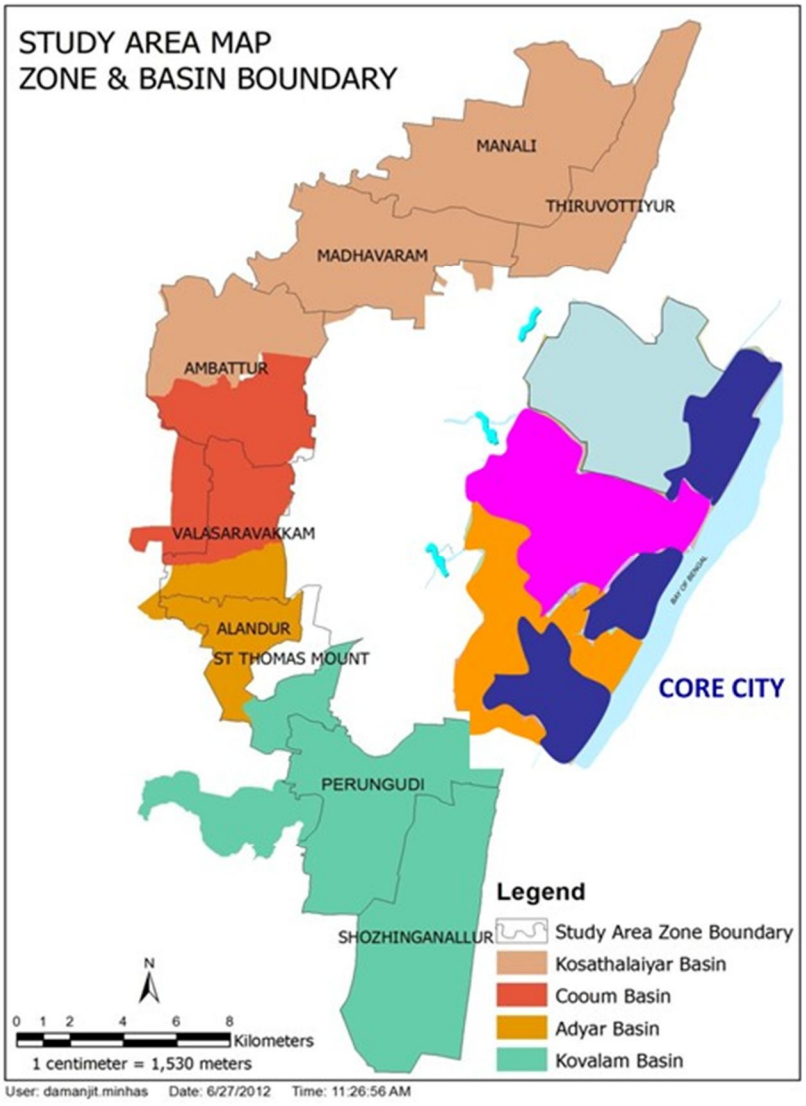


Figure 3 GCC jurisdiction showing Core city and extended areas

Geography: Chennai is a sea side city where the sea is an ecstasy in blue, hugging the second largest beach in the world. From the sky, it looks neat with majestic long straight roads and the silvery streams meandering through the city. Dotted with clumps of trees and a low skyline, it is a sprawling city.

Chennai is divided into four broad regions: North, Central, South and West. North Chennai is primarily an industrial area. Central Chennai is the commercial heart of the city and includes an important business district, Parry's Corner. South Chennai and West Chennai, previously mostly residential, are fast becoming commercial, home to a growing number of information technology firms, financial companies and callcentres. The city is expanding quickly along the Old Mahabalipuram Road and the Grand Southern Trunk Road (GST Road) in the south and towards Ambattur, Koyambedu and Sriperumbudur in the west.

Chennai, sometimes referred to as the "Gateway to South India", is located on the south–eastern coast of India in the north–eastern part of Tamil Nadu on a flat coastal plain known as the Eastern Coastal Plains. Its average elevation is around 6.7 metres (22 ft), and its highest point is 60 m (200 ft). Two rivers meander through Chennai, the Cooum River through the centre and the Adyar River to the south. A part of the Adyar River forms a tidal creek before joining the sea.

A third river, the Kosasthalaiyar, flows through the northern fringes of the city before draining into the sea at Ennore. Adyar and Cooum rivers are heavily polluted with effluents and wastes from domestic, commercial and industrial sources. The state government periodically removes silt and pollution from the Adyar River, which is less polluted than the Cooum. A protected estuary on the Adyar forms a natural habitat for several species of birds and animal. The Buckingham Canal runs parallel to the coast, linking the two rivers. The Otteri Nullah, an east–west stream, runs through north Chennai and meets the Buckingham Canal at Basin Bridge. Several lakes of varying size are located on the western fringes of the city. For the planning of storm water drains, the expanded areas of GCC were divided into the following basins covering the zonal areas:

- Kosathalaiyar Basin - Zone I, II, III & part of Zone VII
- Cooum Basin- Part of Zone VII & part of Zone XI
- Adayar Basin- Part of Zone XI & part of Zone XII
- Kovalam Basin - Part of Zone XII, Zone XIV & Zone XV

Topography: Chennai is a low-lying area and the land surface is almost flat. The even topography of the land throughout the area makes it difficult to render the sub- divisions into natural regions. It rises slightly as the distance from the seashore increases average elevation of the town is not more than 7 m above mean sea level and the average slope varies at less than 0.7 m per Km, while some localities are just at sea level and drainage in such area remains a serious problem. The drainage topography and the influence of upstream catchments on flooding issues in GCC is presented in Figure 4 below

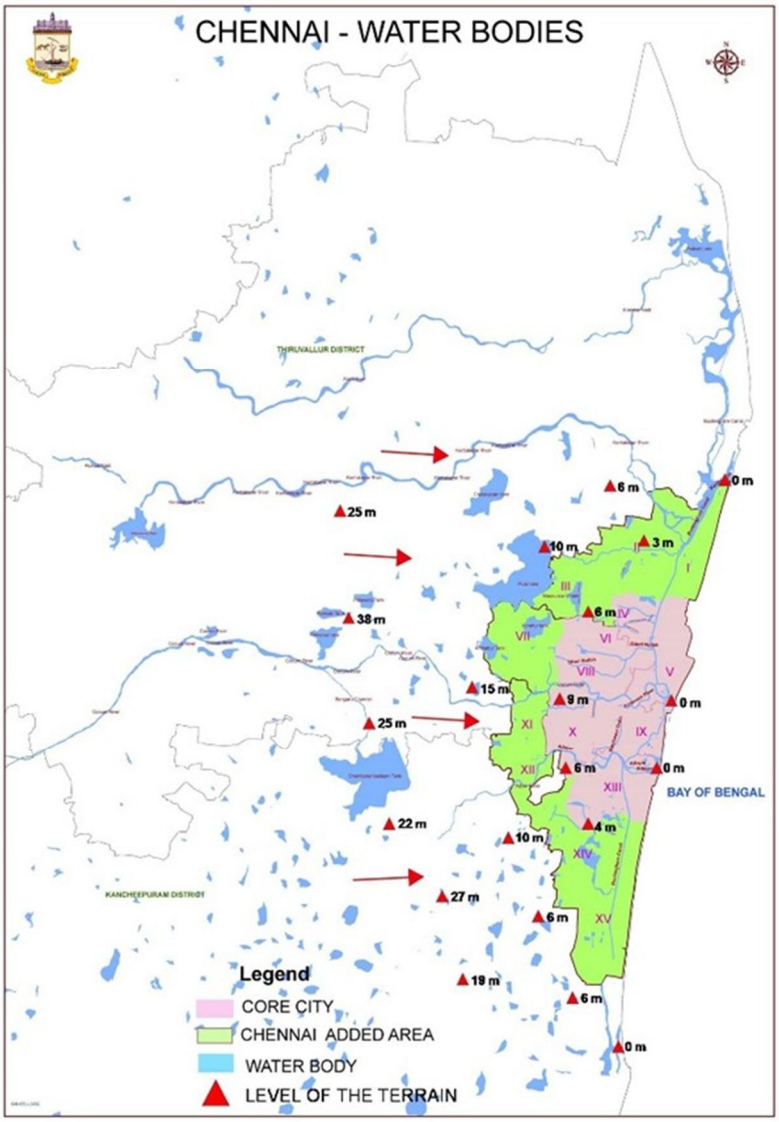


Figure 4 Influence of Upstream water catchments in flooding issues in GCC

Soil Condition: Chennai's soil is mostly clay, shale and sandstone. The city is classified in into three regions based on geology and as sandy areas, clayey areas and hard rock areas. Sandy areas are found along the river banks and coasts such as Thiruvanmiyur, Adyar, Kottivakkam, Santhome, George Town, Tondiarpet and the rest of coastal Chennai. Here rainwater runoff percolates quickly through the soil. Clay underlies most of the city including T. Nagar, West Mambalam, Anna Nagar, Perambur and Virugambakkam. Areas of hard rock include Guindy, Perungudi, Velachery, Adambakkam and a part of Saidapet. In clayey and hard rock areas, rainwater percolates slowly, but it is held by the soil for a longer time.

Climate: Chennai has a tropical climate, specifically a tropical wet and dry climate. The city lies on the thermal equator and is also on the coast, which prevents extreme variation in seasonal temperature. The weather is hot and humid for most of the year. The hottest part of the year is late May to early June, known locally as Agni Nakshatram ("fire star") or as Kathiri Veyyil, with maximum temperatures around 35–400C. The coolest part of the year is January, with minimum temperatures around 15– 220C. The lowest temperature recorded is 13.80C and the highest recorded temperature is 45 0 C.

The average annual rainfall is about 1350 mm. The city gets most of its seasonal rainfall from the north–east monsoon winds, from mid–October to mid–December. Cyclones in the Bay of Bengal sometimes hit the city. The highest annual rainfall recorded was around 3250 mm in 2015. Prevailing winds in Chennai are usually south westerly between April and October and north easterly during the rest of the year.

Greater Chennai Corporation (GCC): The Corporation of Chennai (previously Madras) is the Oldest Municipal Institution in India established on the 29th September 1688. A charter was issued on the 30th December, 1607 by East Indian Company constituting the "Town of Fort St. George" and all the territories thereunto belonging, not exceeding the distance of ten miles from the Fort, into a Corporation.

The Parliamentary Act of 1792 gave the Corporation power to levy Municipal Taxes in the City. The Municipal administration properly commenced from the Parliamentary Act, 1792 making provision for the good order and administration of the city. The Municipal Act has been amended introducing from time to time major changes in the constitution and powers of the Corporation. The Madras Municipal Corporation Act, 1919 (as amended) provides the basic statutory authority for the administration now. The Council of 200 councillors is headed by the Worshipful Mayor and Council meets ordinarily once in a month. The executive wing is headed

by the Commissioner. There are Deputy Commissioners and various Heads of Departments and 15 Zonal Officers at present.

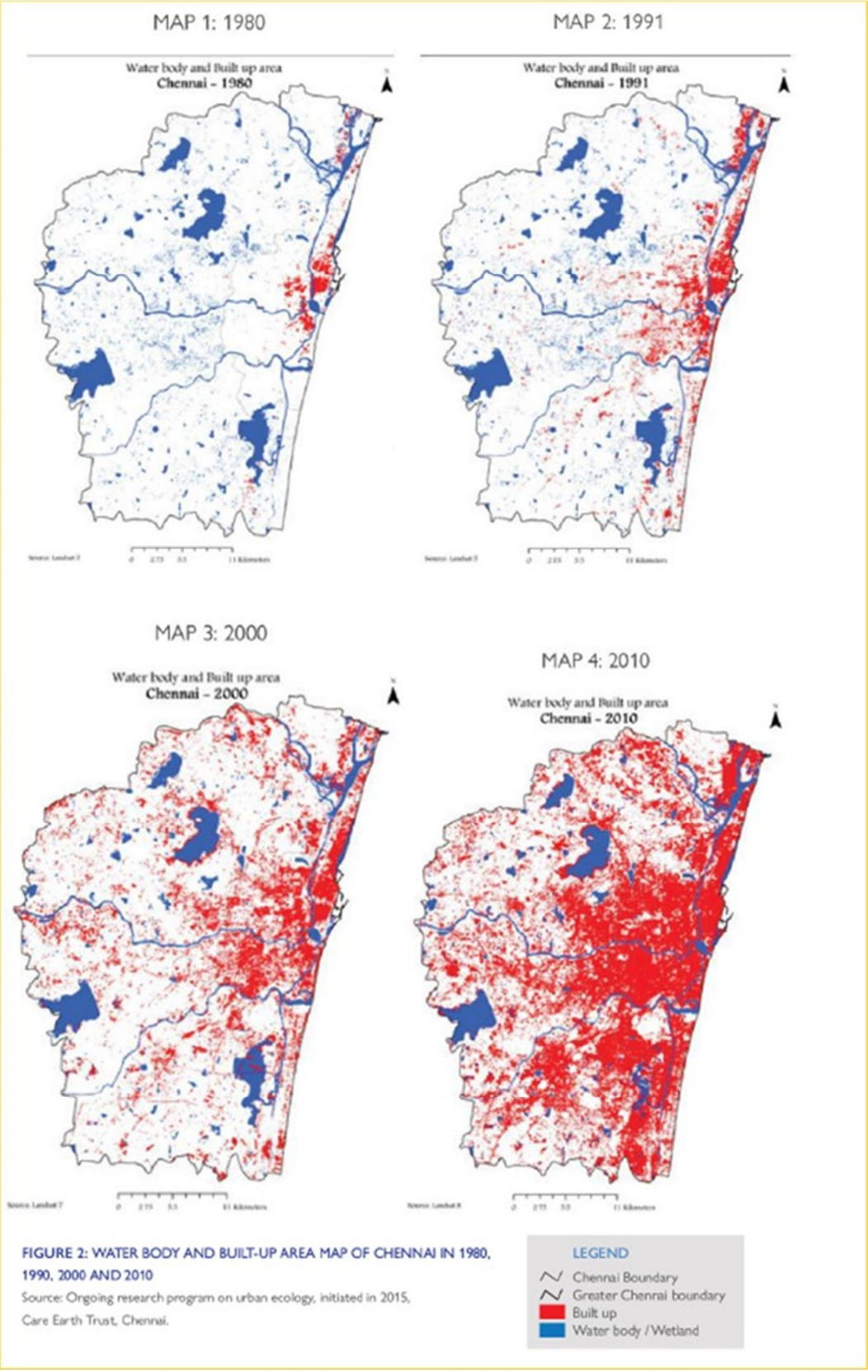


Figure 5 Densification of GCC area

3.1 Existing Situation

Greater Chennai Corporation developed and maintains a Storm Water Drain network of 2071 km in the city. Rainwater runoff gets drained through the Storm Water Drain network & canals and reaches the Sea Via five Waterways-Otteri, Nullah, Buckingham Canal, Adyar River, Cooum River and Kosathalaiyar River - running across the city. Existing storm water drains maintained by GCC is presented in Table 4.

Zone	No. of Drain	Length in Km
I	422	73.13
II	216	47.00
III	266	76.91
IV	383	115.49
V	344	97.19
VI	491	137.42
VII	846	212.25
VIII	587	163.25
IX	628	156.37
X	709	196.68
XI	1445	236.08
XII	943	193.22
XIII	514	132.09
XIV	863	172.13
XV	180	37.14
Total	8835	2071

The total drains in the study area are broadly divided into two groups:

- Macro Drains
- Micro Drains

3.1.1 Macro Drains

Macro Drains for Chennai are defined as the drains that are maintained by PWD. There are 16 Macro drains in addition to the four waterways namely Kosathalaiyar, Cooum Adyar rivers and Buckingham Canal as presented in Table 5 below:

Sl. No.	Drainage Basin	Zone No.	Ward No.	Name of Canal	Length (Km)
1	North Basin	IV , VI & VIII Existing Macro drains in GCC	69,67,72 to 75,46,47 & 96	OtteriNullah	8.700
2	Central Basin	VIII	105,106,107&103	Virugumbakkam Canal	6.36
3	South Basin	XIII	178	Velachery – Pallikaranai Channel	2.76
4	Kosasthalaiyar	I, II & III	4, 6,15 to 19&22	Puzhal Surplus Canal	15.13
5	Kosasthalaiyar	III	23	Retteri Surplus Canal	1.95
6	Kosasthalaiyar	III	26 & 23	Thanikasalam Canal	3.55
7	Kosasthalaiyar	III & VII	24, 25 &83	Korattur Surplus Canal – 1	2.55
8	Kosasthalaiyar	VII	82, 84 & 85	Ambattur Surplus Canal	4.76
9	Kosasthalaiyar	III		Madhavaram Right Bank Canal	2.87
10	Cooum	VII	83	Korattur Surplus Canal – 2	1.93
11	Cooum	VII		Virugambakkam – Arugambakkam Canal	1.10
12	Adyar	XII	156 & 157	Porur Surplus Canal (Manapakkam Canal)	4.46
13	Adyar	XII		Kolapakkam Canal	1.76
14	Kovalam	XII & IVX	165 & 168	VeerangalOdai	2.00
15	Kovalam	XIV	187 & 188	Keelkattalai Canal	4.07
16	Kovalam	XV	198 & 200	Arasankazhani Canal	4.00
			Total		67.95 Kms

3.1.2 Micro Drains

Micro drains for Chennai are defined as the drains which are solely maintained by Greater Chennai Corporation. They consist of the drains in the individual trunk drains, branch mains and subsidiary street drains. There are Seventy four (74) major drains in this category. Out of these 74 drains, Forty Three (43) are closed drains and 31 are open drains.

These micro drains besides collecting the storm water from their own catchment receive discharge of minor drains joining them at various places of their reach. Some of the minor drains join micro drains, some of them join the major waterways depending upon the topography and situation and some are devoid of proper outfall and connectivity.

The drains are mostly constructed in CC or brick masonry and some are covered with footpaths running over them.

Micro open drains in the project area are 31 in numbers. Greater Chennai Corporation maintains 31 canals which include 16 canals in the old city and 15 canals in the expanded areas. These Canals criss crossing across the Chennai City.

Sl. No.	Zone No	Dn. No.	Name of the Canal
1	I	1,2&10	Captain Cotton canal & Link Canal (Connecting Captain Cotton Canal and Kodungaiyur Canal)
2	I	1,2&10	Kodungaiyur Canal
3	I	1	ThamaraiKulam Canal
4	II	15	Old Napalayam Canal
5	II	15	Thulasi Nagar Canal
6	II	15	ManaliPudur TNHB Canal
7	II	15	PeriyaEatchankuzhi Canal
8	II	16	Kadapakkam Lake Surplus Canal
9	II	18&20	MadhavaramManali Lake Canal
10	III	35&36	Vyasarpadi Canal
11	III	38	Ekangipuram Canal
12	IV	52	Jawahar Canal
13	V	63& 64	TVS Canal
14	V	76,77&118	Trustpuram
15	VII	109	Nungambakkam Canal

Sl. No.	Zone No	Dn. No.	Name of the Canal
16	VII, VIII& IX	108, 114, 139 & 116	Mambalam Canal
17	VIII		Nandanam Canal
18	VII	91& 92	AmbatturSidco Canal
19	VII	88,89 & 90	PadiKuppam Canal
20	IX	136	Reddikuppam Canal
21	IX	140	Chellammmal canal
22	IX	132	Jafferkhanpet Canal
23	IX	130& 131	MGR Canal
24	IX	140	Guindy Industrial Estate Canal
25	VII & IX	91,143 &144	Nolambur Canal
26	X	141	Raj Bhavan
27	XI & XII	151,152, 153, 155,156,157	Nandambakkam Canal
28	XII	162 &165	Adambakkam Canal
29	XIV	190	Large Lake Link Canal
30	XIV	188	Pallikaranai Canals
31	XV	194	Secretariat Colony Canal

Table 6 – Micro Open Canals

3.1.3 De-silting of Storm Water Drains and Canals

The de-silting operations of Storm Water Drains are done by the respective zones. The de-silting of Storm Water Drain is done in a cyclic manner and is carried out twice in a year. This activity is being carried out in a weekly programmed manner throughout the year either with the use of departmental de-silting gang or through contract labours.

The removed silt is cleared immediately and transported to the designated place through departmental vehicles. Some of the Storm Water Drains passing through the dense populated areas, commercial areas and areas devoid of sewers always carry sewage.

De-silting of such kind of drains is very difficult. To overcome this kind of problems, presently GCC is providing silt trap arrangements inside the Storm Water Drains and remove the collected silt of sludge from the trap either by pumping or with the use of

hand tool. The drain which requires replacement of inspection chamber covers structural repairs are also carried out as and when required. The in-let chambers and entry (chute) pipes are cleaned periodically.

3.2 Need for the Missing Links SWD

- ✓ Historical records have shown that there was several catastrophic flooding in Chennai in the years 1943, 1978, 1985, 2002 and 2005 caused by heavy rain associated with cyclonic activity. These events of catastrophic flooding were found to be attributable several factors including the change in land use. Flooding of less catastrophic nature occurs regularly in low-lying areas of the extended city because of inadequacy or inoperativeness of the local drainage infrastructure.
- ✓ In 1976, Heavy flood and submergence was observed in the areas close to Adyar, Kovalam and Kosasthalaiyar river basins.
- ✓ In 1985, Floods in Adyar was observed with a flood discharge of 63,000 cusecs and the submergence of flood plains in Adyar and Kovalam basin.
- ✓ In 1996, Floods in Adyar, Cooum, Kovalam and Kosasthalaiyar rivers were observed. Poondi reservoir was surpluses with a flood discharge of 80000 cusecs leaving floods in Adyar, Cooum and Kosasthalaiyar basins.
- ✓ In 2015, a 100 year occurrence rainfall of 32 cm in a single day on 02.12.2015 has caused heavy inundation in and around the Chennai city and its suburbs areas and more than 50,000 persons were to be evacuated from the low lying areas. These floods have caused heavy damages to infrastructure of the city and loss of lives. Flood inundation photographs are shown below:
- ✓ After the unprecedented rainfall during 2015 North East Monsoon which caused inundation in almost all the part of extended area and in core city, The Hon'ble Late Chief Minister of Tamil Nadu in the floor of the assembly has announced a mega project to construct Integrated Storm Water Drain Network in extended areas of Greater Chennai Corporation at a cost of Rs.4034 crore in the Adyar and Cooum, Kosasthalaiyar and Kovalam river basins.
- ✓ In the first phase, Government of Tamil Nadu accorded Administrative Sanction on 02.01.2015 vide G.O.(Ms)No.1, dated 02.01.2015 for construction of Integrated Storm Water Drain to a length of 406 km at a cost of Rs.1385.48 crore to cover full area in Zone 11 (Valasaravakkam) and part of Zone 7 (Ambattur) and Zone 12 (Alandur) under "Adyar-Cooum" Basin Integrated storm water drain network scheme with World Bank fundingunder Tamil Nadu Sustainable Urban Development Project (TNSUDP) and all the works have been completed.

Zone 4 - Vyasarpadi

Zone 10 (T. Nagar)

Zone 4 (Tondiarpet)

Zone 13 (Velachery)

Zone 4 (Tondiarpet)

Zone 13 (Velachery)

During the North East Monsoon 2017, all these areas have witnessed a phenomenal decrease in rain water inundation locations and people living in these localities have very much appreciated the storm water drain work carried out by Government / Greater Chennai Corporation. The project has been commenced during the year 2016 end and completed by the March 2019, with good quality standards and all other norms as prescribed by World Bank. The project execution and the functionality of the drains are hightly appreciated by the World Bank in various AIDE MEMOIREs.

For other two basins, viz, Kovalam and Kosasthalaiyar, GCC intends to take up for implementation soon. Kovalam Basin works are in progress under KfW German Development Bank. Kosasthalaiyar Basin works are to be taken up under Asian Development Bank funding.

In this regard, GCC intends to integrate the existing storm water drains in various locations by providing additional drains and rehabilitation of existing drains Demolition and reconstruction for the missing links between the drains. A study has been conducted to find the missing links in various locations and explored the feasibility to join the links with the existing drains or with the existing water bodies wherever possible to prepare a detailed project report based on the design explored for construction of such drains.

The extended areas of GCC are developing rapidly. GCC completed the construction of Integrated Storm Water Drains (ISWD) for the areas in core city falling under Adyar and Cooum basin funded by World Bank. A comprehensive SWD network has been created to avoid flood inundation during the monsoon rainfall periods. The Chennai core city (area: 174 sq km) has already been covered with a drainage network, implemented in the year 2014 under JnNURM.

In the Core city area, some of the old existing drains are in dilapidated condition and in some places there are missing links in the existing storm water drains and in very few locations they are not connected to disposal. Hence, the roads and streets located in such areas are facing frequent flooding/inundation, during monsoon season/heavy rains. To resolve these issues, GCC has prepared a detailed project report (DPR) for providing missing link storm water drain. In order to overcome the flooding and inundation and resultant impacts, these missing links and age old dilapidated drains are proposed to be rehabilitated or reconstructed through this project to ensure inundation free.

3.3 Objectives

Objective is to undertake an environmental assessment of the proposed subproject and prepare Environmental Management Plan, with cost estimates for implementation, institutional responsibility for implementation, monitoring and reporting of Environmental Management Plan.

4. Project Description

The existing drainage network in Greater Chennai Corporation has many missing links due to which flooding is occurring in certain areas. As such based-on ground Condition and initial assessment by officials of GCC a list of Missing links SWD were identified. Hence to ensure an Integrated SWD network,there is a need to provide the drains for the missing links connecting the Upstream & Downstream drains & to serve unserved areas.

4.1 Study Area

The study area covers 6 Zones of the Greater Chennai Corporation, Zones covered in the study area are, Zone 4 – Tondiarpet, Zone 6 - Thiru Vi Ka Nagar, Zone 8 - Anna Nagar, Zone 9 - Teynampet, Zone 10 – Kodambakkam, Zone 13 – Adyar. The list of various missing link drains proposed are detailed below:-

S. No	Zn No.	Dn No	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
1	IV	38	Nethaji Nagar Market Street	900x900	205	D&R	Nethaji Nagar Main Road
2	IV	38	Nethaji Nagar Main Road	900x900	240	D&R	Vinoba Nagar
3	IV	36	Thiruvalluvar Nagar 4th Main Road	900x900	55	D&R	Thiruvalluvar Nagar 5th Main Road
4	IV	36	Thiruvalluvar Nagar 1st cross street.	900x900	110	D&R	TVK 2nd Link Road
5	IV	36	MKB Nagar 18th west cross st	900x900	288	Link	West Avenue service Road
6	IV	37	MKB Nagar 2nd main road west dn 36	900x900	230	D&R	18th west cross st MKB Nagar
7	IV	44	Thiruvalluvar street	900x900	320	D&R	Jawahar Canal

S. No	Zn No.	Dn No	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
8	IV	44	Thiruvalluvar Lane	900x900	70	Link	Kattabomman Street
9	IV	44	Rajangam Street	900x900	100	Link	Maa Poo si 1st street
10	IV	44	Mathiyalagan street	900x900	170	Link	Rajangam Street
11	IV	44	NSK street	900x900	125	Link	Rajangam Street
12	IV	45	Sundaram 3rd street	900x900	210	D&R	Sundaram Main Road
13	IV	45	Giramiyar street	900x900	170	D&R	
14	IV	45	B B Road 1st street	900x900	60	D&R	B B Road
15	IV	45	B B Road 2nd street	900x900	80	D&R	B B Road
16	IV	45	B B Road 3rd street	900x900	165	D&R	B B Road
17	IV	45	Balamurugan street	900x900	320	D&R	Melpatti ponnappan Street
18	IV	45	Sriram nagar	900x900	125	D&R	Melpatti ponnappan Street
19	IV	45	Ganesapuram Main Road	900x900	215	D&R	Dr Ambedkar Collage Road
20	IV	46	Palla 1 to 4 streets	900x900	1200	D&R	Muthu Street
21	IV	46	Moorthingar Road (from paravai park to CMS moorthingar road) at western side	900x900	200	Link	Chennai Middle School
22	IV	47	K.H.Road	900x900	350	D&R	Sathyamurthy St
23	IV	47	Sathyamurthy street	900x900	225	D&R	Motchaporan 2nd Street
24	IV	47	Motchapuram 2nd St	900x900	180	Link	B Canal
25	IV	47	Meenambal Nagar 4th st	900x900	150	Link	Meenambal Nagar Cross st
26	IV	47	Meenambal Nagar 5th st	900x900	155	Link	Meenambal Nagar Cross st
27	IV	47	Thyagappast	900x900	250	D&R	Kannan Street
28	IV	47	Ekambaram St	900x900	255	D&R	Kannan Street

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
29	IV	47	Kannan St	900x900	450	D&R	Jewanmul sowcar street
30	IV	47	Jawanmulsowcarst	1200x 1200	270	D&R	Kannan Street
31	IV	47	Meenambal Nagar Cross st	900x900	120	D&R	Meenambal Nagar Cross 6th st
32	V	49	Kappal Polu Street (from Jn of Sollaiappan Street to BalaArunachalam street)	600x750	410	D&R	Bala Arunachalam street
33	V	50	Mannarsamy Koil Street (From East Kalmandapam Road to Andiyappan Street)	900x900	600	D&R	Andiyappan Street
34	V	51	N.N. Garden 8th Lane (N.N.Gardern 8th Lane to Narassiar Street)	600x750	300	D&R	Narassiar Street
35	V	53	Kathbada Main Road (From TH Road Service Road to existing drain at kathbada Road)	900x900	600	D&R	Kathbada Road
36	V	58	Vepery High Road (North Side) (from Madox street to Sydenahams road)	900x900	750	D&R	Sydenahams road
37	V	58	Jothi Venkatchalam Street (from vepery high road to EVR Salai)	900x900	600	D&R	EVR Salai
38	V	58	Valliammal Road (from Alagappa Road to Ritherdon road)	900x900	300	D&R	Ritherdon road
39	V	60	Mooker Nallumuthu street (from Mooker Nallumuthu street to Prakasam salai)	600x750	450	D&R	Prakasam salai

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
40	V	60	Jaffer Sarang Street (from Jaffer Sarang Street to Mannady street)	600x750	290	D&R	Mannady street
41	V	60	RajajiSalai (from Clive Battery to NRT Bridge)	1200x1200	400	D&R	NRT Brid
42	V	61	Kennet lane (from Gandhi Irwin road to Patheon road)	600x750	300	D&R	Patheon road
43	V	61	Montieth Road	900x900	250	D&R	
44	V	62	SingannaChetty Street (from Guruvappa Street to Wallers street)	900x900	350	D&R	Wallers street
45	V	63	Begam Sahib 2nd, 3rd & 4th Street	600x750	400	D&R	GP Road
46	V	63	Burrah Sahib Street	600x750	300	D&R	Chellapillayar Street
47	VI	78	Asthabujam street	900x900	475	Link	Choolai High Road
48	VI	78	Angallamankoil street	1200x1200	290	D&R and Link	Choolai High Road
49	VI	72	Brightons Road	900x900	280	Link	Otteri Nallah
50	VI	76	Venkatesabaktha street	900x900	260	Link	Perambur Barracks Road
51	VI	76	Sachidanandam street	900x900	160	Link	Perambur Barracks Road
52	VI	70	Govindan street	900x900	265	Link	Cooks Road
53	VI	71	Jamaliya Link road	900x900	170	D&R and Link	Perambur High Road South
54	VI	70	Perambur High road South	1500x1500	880	D&R and Link	Cooks Road

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
55	VI	72	Basin powerhouse Road	900x900	450	Link	Pulianthope high Road
56	VI	70	Madhavaram high road	900x900	375	D&R and Link	Eganajipuram High “Road
57	VI	65	Senthilnagar 13 th street	900x900	140	Link	Paper Mills Road
58	VI	69	Bunder garden 1 st street	900x900	170	D&R and Link	Madhavaram High Road
59	VI	69	Bunder garden 2nd street	900x900	210	Link	Madhavaram High Road
60	VI	69	Neelam garden	900x900	230	D&R and Link	Madhavaram High Road
61	VI	68	Maduraisamy madam	1200x 1200	510	D&R and Link	Pallavan Salai
62	VI	65	Srinivasanagar 1st main road	1200x 1200	30	D&R and	Paper Mills Road
63	VI	65	Venus nagar 1st main road	900x900	10	D&R and Link	Paper Mills Road
64	VI	66	Karthick street	900x900	20	D&R and Link	Paper Mills Road
65	VI	66	Sakthivinayagarkoil street	900x900	120	D&R and Link	Paper Mills Road
66	VI	66	Lakshmannagar east street	900x900	60	D&R and Link	Paper Mills Road
67	VI	66	Jawaharnagar 6th main road	1200x 1200	12	D&R and Link	Paper Mills Road

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
68	VI	68	State Bank colony road	900x900	370	D&R and Link	Madhavaram High Road
69	VI	68	Paper mills road	1200x 1200	287	D&R and Link	Eganajipurin Gigh “Road
70	VIII	94	South Jagannathan Nagar 1st Main Road	900x900	660	D&R and Link	Redhills Villivakkam Road
71	VIII	94	South Jagannathan Nagar 2nd cross Street	900x900	175	D&R and Link	Redhills Villivakkam Road
72	VIII	94	Periyar Nagar Main Road	900x900	310	D&R and Link	Redhills Villivakkam Road
73	VIII	94	South Jagannathan Nagar 3rd Main Road	900x900	400	D&R and Link	Redhills Villivakkam Road
74	VIII	95	Mannadi Othavadai Street	900x900	300	D&R and Link	Seeyalam Canal
75	VIII	95	Agathiar Nagar 31st Street	900x900	275	D&R and Link	Agathiyar nagar 7 th street to TVS canal
76	VIII	95	Kumaraswamynagar 1st main road	1200x 1200	310	D&R and Link	Kumarasamy nagar
77	VIII	95	Thiruvenkadiah 1st Street	900x900	125	D&R and Link	MTH Road
78	VIII	95	North Thirumalai Nagar 2nd Street	900x900	190	D&R and Link	Dr. Ambedkar Road (ICF)

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
79	VIII	95	South ThirumalaiNagar 1st Street	900x900	120	D&R and Link	Dr. Ambedkar Road (ICF)
80	VIII	95	South ThirumalaiNagar 3rd Street	900x900	120	D&R and Link	Dr. Ambedkar Road (ICF)
81	VIII	95	South ThirumalaiNagar Main Street	900x900	200	D&R and Link	Dr. Ambedkar Road (ICF)
82	VIII	101	C Block 6th,7th and 8th street.	900x900	265	D&R and Link	Anna Nagar 2nd main road
83	VIII	105	Perumalkoil garden	900x900	80	Link	Perumal Koil Street
84	VIII	105	Kalkinagar	900x900	200	D&R and Link	SA Staff colony 7th street
85	VIII	105	Duraipillai street	900x900	150	D&R and Link	Mariamman Koil Street
86	VIII	105	Ashoka street	900x900	268	D&R and Link	Water tank road near A Block
87	VIII	105	MMDA colony Main road	900x900	400	D&R and Link	Thirukuralam Street
88	VIII	108	Padmanaba Nagar Main Road	900x900	260	D&R and Link	Tamilasu Veedi st
89	VIII	108	Padmanaba Nagar 2nd main Road	900x900	260	D&R and Link	Tamilasu Veedi st
90	VIII	105	Jaganathan 1st main road	900x900	130	Link	Flowers Road

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
91	VIII	105	Vinayagapuram 2nd street.	900x900	165	Link	100feet road
92	VIII	94	Sidconagar 2nd main road	1200x 1200	400	D&R and Link	Kumarasa Canal
93	IX	109	Khan Street	600x750	236	Link	Choolaimedu High Road
94	IX	110	Kodambakkam High Road Service Road North	900x900	75	D&R	Mahalinga-puram Main Road
95	IX	111	Pattulas Road	900x900	10	D&R	Anna Salai
96	IX	111	Club House Road	900x900	15	D&R	Anna Salai
97	IX	112	New Vellalar street	900x900	160	Link	Vellalar Street
98	IX	112	Vellalar street	900x900	240	Link	N.S.K. Salai
99	IX	112	Sivan koil cross street	900x900	140	Link	Sivan Koil Street
100	IX	113	Thirumallaipillai road	900x900	150	Link	Habibulla Road
101	IX	113	Shenoy road	900x900	300	D&R	Tank Bund Road
102	IX	113	Dharmapuram main Road	900x900	300	D&R	Bala muthu krishnan Street
103	IX	115	Devaraj street	900x900	365	D&R	Triplecane High Road
104	IX	117	South boag road	1200x 1200	1162	D&R	Habibulla Road
105	IX	118	Cathedral Road	900x900	900	D&R	TTK Road
106	IX	119	V.M.Street	900x900	600	D&R	Avvai shanmugam Salai
107	IX	120	Dr.Natesan Road	900x900	300	D&R	Besant Road
108	IX	121	Dr.Radhakrishanansalai	900x900	520	Link	Dr. Radhakrishnan Salai

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
109	IX	122	Cenataph road	900x900	870	D&R	Charmers Road
110	IX	122	Turnbulls road	900x900	100	Link	Habibulla Road
111	IX	123	Rama Rao Road	600x750	200	Link	Habibulla Road
112	IX	124	R.K.Mutt Road	900x900	250	Link	Santhome High Road
113	IX	125	KamarajarSalai	1200x 1200	250	Link	Kaneeswar Pogoda Street
114	IX	126	Devanathan Street	900x900	300	D&R	St.Marys Road
115	X	127	Vinayagam street	900x900	200	D&R	Kamarajar Salai
116	X	128	West Vanniar Street	1200x 1200	220	D&R	Thiruvalluvar 2nd Street
117	X	128	Srinivasa Street	1200x 1200	180	D&R	West Vanniar Street
118	X	129	Senthilandavar street	900x900	160	D&R	K K Salai
119	X	129	Arunachalam road (western side)	1200x 1200	1000	Link	Kamarajar Street Gandhi Nagar
120	X	130	West Sivan Koil Street	900x900	110	D&R	Arcot Road
121	X	130	Gangaiammankoil street (saligramam)	900x900	190	D&R	Nerkundram Pathai
122	X	130	South perumalkoil street	900x900	200	D&R	Pillayar Kovil Street
123	X	138	Anna Main Road (South side)	1200x 1200	950	D&R	MGR Canal Connectivity drain
124	X	138	Ashok pillar road (southern side)	1200x 1200	400	Link	100 Feet Road
125	X	132	Saidapet road	900x900	300	D&R	100n feet Road

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
126	X	133	V.O.C.Nagar 1st Main Road	900x900	300	D&R	Arcot Road
127	X	133	Palayakkaran Street	900x900	300	D&R	Arcot Road
128	X	142	West Jones Road	900x900	500	D&R	Kanniyamman Koil Street
129	XIII	172	Lake View Road From Clri Compound To South 'B' Canal	1500x 1500	500	Link	South B Canal
130	XIII	173	Cresent Avenue,East Kesavaperumal	900x900	600	D&R	Central B Canal
131	XIII	173	DGS salai (From Petrol bunk to Janagi MGR college)	900x900	150	Link	Adyar River
132	XIII	174	Velachery Main Road (Near Halda junction)	900x900	515	Link	Adyar River
133	XIII	174	Velachery Main Road (From Castle apartment to Bye pass signal)	900x900	400	D&R	Velachery Lake
134	XIII	175	Thiruvenkadam street,K.B.Nagar 3rd main road	900x900	600	D&R	South B Canal
135	XIII	175	Govindarajapuram 1st street, 2nd street	600x750	335	Link	South B Canal
136	XIII	175	K.B nagar 3rd cross street	1200x 1200	1200	D&R	South B Canal
137	XIII	175	Gandhi nagar 1st Cresent park road	900x900	300	D&R	Adyar River
138	XIII	177	MGR Nagar 9th Street	600x750	320.00	Link	Veerangal Odai
139	XIII	178	Bhel Sakthi Nagar main road	600x750	170	Link	Verangal Odai
140	XIII	178	Orandiamman Koil main road	600x750	450	Link	Velachery Lake

S. No.	Zn No.	Dn. No.	Name of the Road	SWD size required (mm)	Length (m)	Link or D&R	Disposal point of the purpose same
141	XIII	179	Tansi Nagar 15th Street,16th Street	900x900	270	Link	Pallikaranai Marsh land
142	XIII	179	Natarajan Street,Gandhi Road,Thiruveethi amman koil st, VGP avenue, Seethapathy Nagar 2nd cross street.	900x900	1500	Link	South B Canal
143	XIII	179	LIC colony 1st street	600x750	70	Link	South B Canal
144	XIII	179	Seshadripuram 3rd cross street	600x750	150	Link	Pallikarunai Marsh land
			Total		**44883 m**		

Table 7 Various missing link drains proposed

Most of the Missing link drains are proposed along the roads. Reconstruction/Augmentation of existing drains, which were found inadequate, has been proposed in this project. RCC rectangular cast-in-situ drains have been proposed for construction.

Other components are construction of cross drainage works, Rainwater Harvesting structures, Silt catch traps, preventing dumping of solid wastes in the canals to prevent entry of solid wastes into the system, etc.

The Detailed Project Report has been prepared for providing missing links Storm Water Drain in the core city of Greater Chennai Corporation which covers the Zones Viz. Zone 4 (Tondiarpet), Zone 5 (Royapuram), Zone 6 (Thiru. Vi. Ka Nagar), Zone 8 (Anna Nagar),Zone 9 (Teynampet), Zone 10 (Kodambakkam) and Zone 13 (Adyar) by undertaking a technical, financial, economic, environmental and social studies of the project area.

The proposals include the demolition and reconstruction of the existing storm water drain system in dilapidated conditions and the damaged drains constructed decades ago with brick and mortar and also providing missing link drains in the missing links portion so as to establish a integrated storm water drain network wherever the link is missing it is proposed to establish an effective and integrated drainage system with

disposal of rain water to the already existing SWD network in the project area, so as to avoid water logging problem and to effect improvement in the drainage system and overall health of the inhabitants.

4.2 Missing Link SWD proposals as per the DPR and Costing

The following Table 8 present the proposed missing storm water drain links in the Core city area of Greater Chennai Corporation (GCC) and costing for construction respectively.

Sl. No	Zone No.	Length(km)	Cost for missing link drain construction (Lakhs)	Cost for Demolition and Reconstruction (Lakhs)	Total cost (Lakhs)
1	4	7.063	357.94	1426.74	1784.68
2	5	6.300	0.00	1476.33	1476.33
3	6	5.774	196.60	1619.42	1816.02
4	8	5.763	91.72	1387.60	1479.32
5	9	7.443	546.68	1418.86	1965.54
6	10	5.010	688.80	832.60	1521.40
7	13	7.530	1079.60	870.40	1950.00
	Total	44.883	2961.34	9031.95	11993.29

Table 8 - Proposed missing storm water drain links

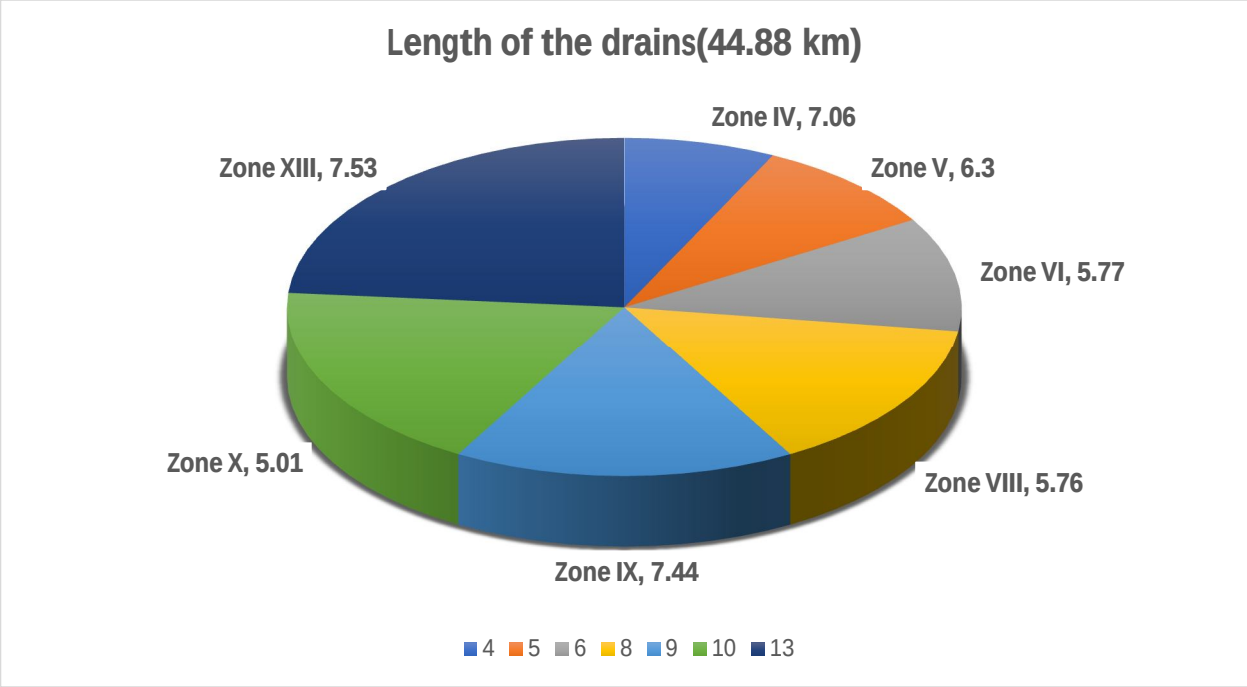


Figure 6 Zone wise distribution of Missing Link storm water drains in Core city areas of GCC

The cost for construction missing link drains are presented in Figure 6 and breakup of zone wise costs proposed for the project is presented in Figure 3.

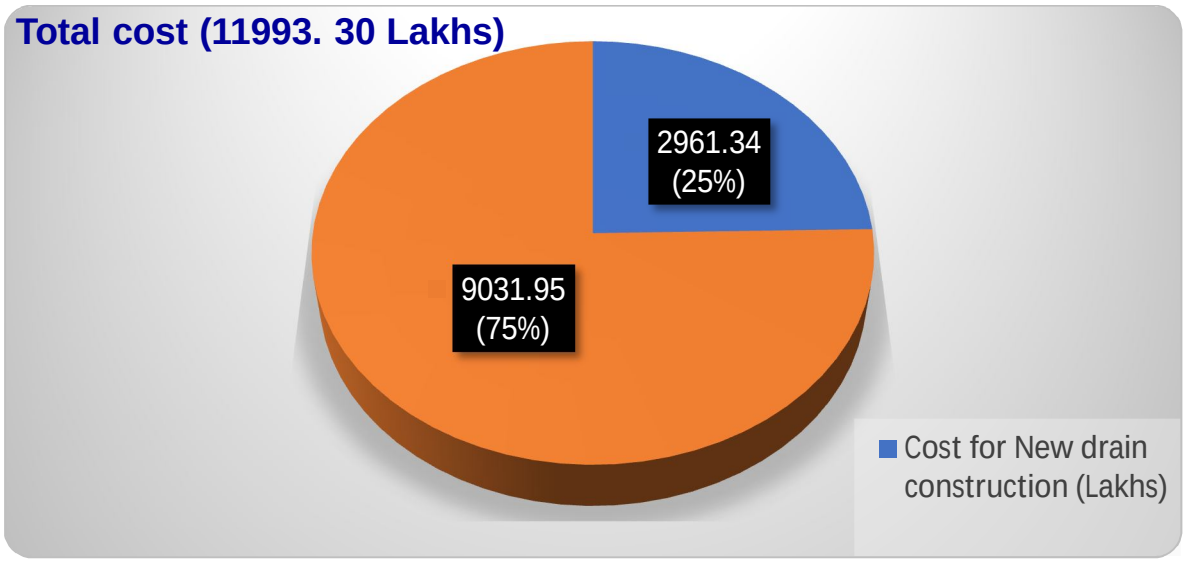


Figure 7 Breakup of Project cost for the Construction of missing link SWDs in core city areas of GCC

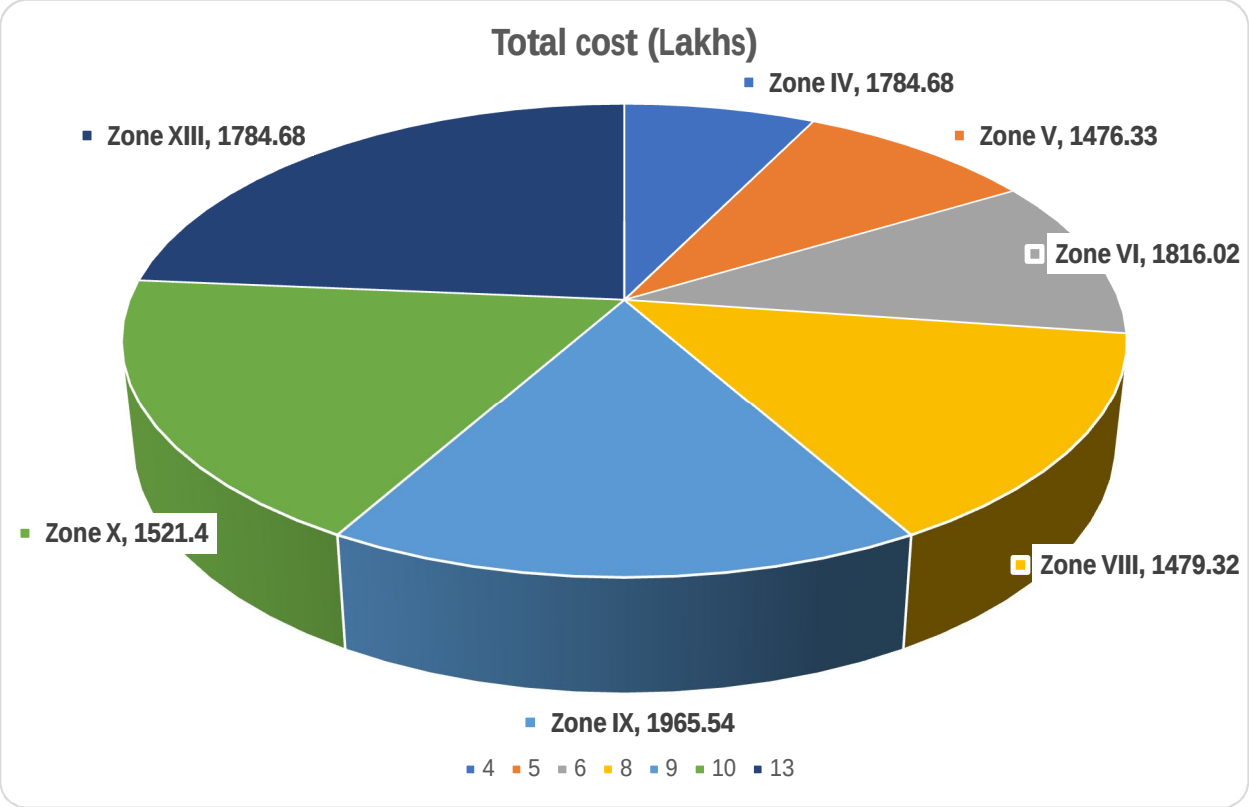


Figure 8 Zone wise breakup of Project cost for the Construction of missing link SWDs in core city areas of GCC

The zone wise break up cost for construction missing link drains and rehabilitation of existing drains are presented in Figure 8 and 9 respectively below:

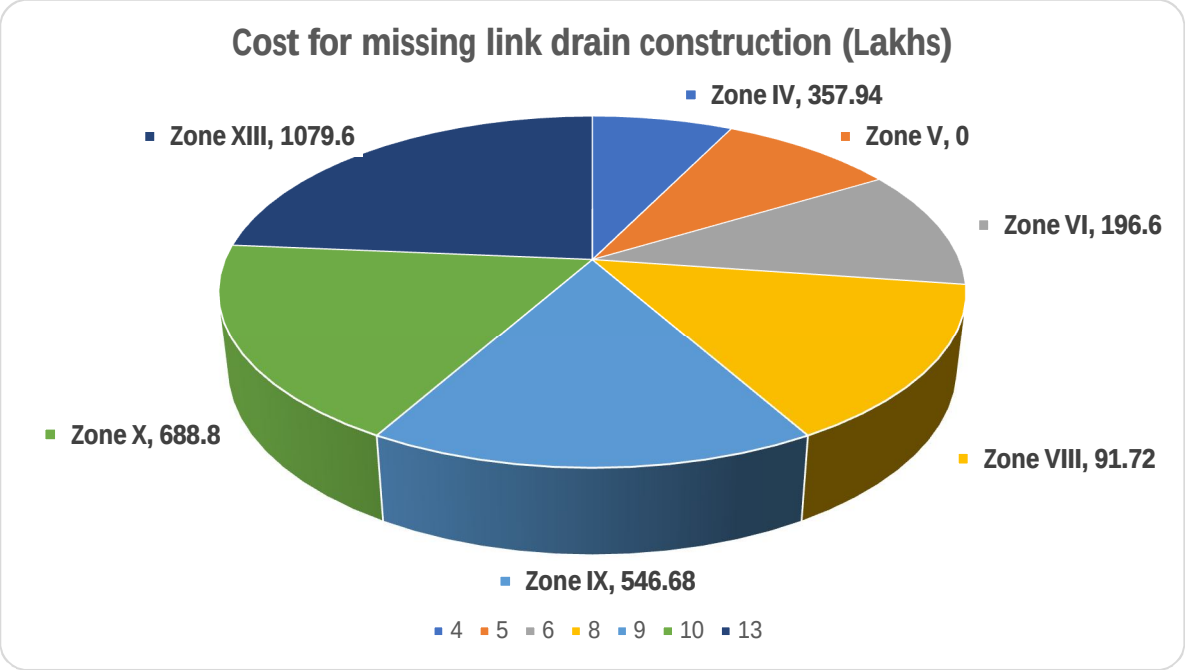


Figure 9 Zone wise breakup of Project cost for the Construction of missing link SWDs in core city areas of GCC

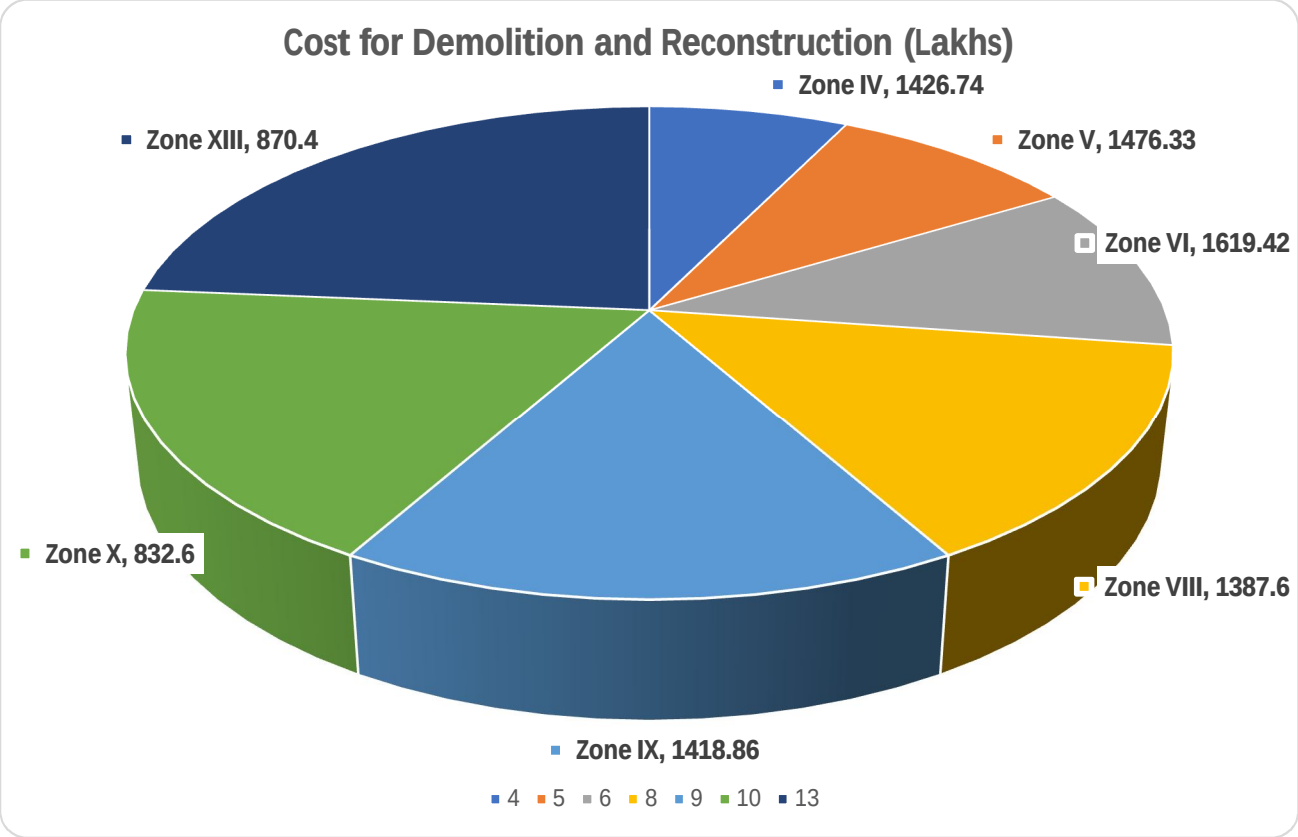


Figure 10 Zone wise breakup of Project cost for the Construction of Rehabilitation of missing link SWDs in core city areas of GCC

The layout of proposed missing link of drains along with the present status of the streets in various zones are presented in the Maps

5. View of Environmental Regulatory Requirements Policies & Guidelines

Environmental Impact Assessment (EIA)

The major impacts of the project are expected to be during the construction phase leading air and noise quality deterioration, Health and Safety impacts to the works and local communities, traffic diversion and utility shifting, access to private properties, back flow of water from the canals, solid waste dumping and disposal of excavated silt from the drains.

The project is expected to lead to cutting trees in the construction area of the proposed drains. The project proposes to carry out compensatory plantation of 10 times the trees that may be lost due to the project.

The National, State, Regional and World Bank Environmental Laws, Rules and Regulations relevant to the proposed Missing link SWD project of Greater Chennai Corporation are provided below:

S.No.	Acts National	Relevance to TNUDF Projects
1.	Wildlife Protection Act, 1972	This Act seeks to protect wildlife, by creating protected areas and controlling trade in wildlife products. Project activities that cross over into protected area regimes then requisite permission must be obtained. The SWD to selected areas to GCC does not involve any such areas and hence not applicable.
2.	Water (Prevention And Control of Pollution) Act, 1974 and Tamil Nadu Water (Prevention and Control of Pollution) Rules, 1974	Under this law, it is mandatory to obtain consent Tamil Nadu State Pollution Control Board (TNPCB) for outlets for discharge of effluents for any municipal projects. Establishment of Batch Mixing Plants for construction requires consent from TNPCB.
3.	The Water (Prevention And Control of Pollution) Cess Act,1977	This Act provides for levy and collection of a cess by local authorities on water consumed by persons or industries to augment resources for Pollution Control Boards. Establishment of Batch Mixing Plants for construction requires consent from TNPCB.

4.	Forest (Conservation) Act,1980	Projects with activities falling in reserved forest areas need a clearance from MoEF . The project area does not involve any forest area and not applicable.
5.	Air (Prevention and Control of Pollution) Act 1981 and Tamil Nadu Air (Prevention of Control ofPollution) Rules 1983	These laws address the prevention and control of air pollution. Under section 21 of this Act, it is mandatory to obtain consent from Pollution Control Board to establish or operate any industrial operation. Applicable, to maintain ambient air quality criteria during construction. Consent is to be obtained for establishment of batch mixing plant.
6.	Environment (Protection) Act, 1986	Popularly known as EP Act, it is an umbrella legislation that supplements existing environmental regulations. This law essentially links pollution and natural resource issues. Salient features of the Act are the following: • Section 6 empowers the Government of India to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other environmental pollutants • Section 7 prohibits operations that emit pollutants in excess of standards • Section9regulateshandlingofhazardous substances and identifies persons responsible for discharges and pollution prevention General provisions of the act are applicable.
7.	Manufacture, Storage and Import of Hazardous Chemicals Rules,1989 (MSIHC Rules, 1989)	According to these rules, the user of hazardous chemicals has to follow procedures as stipulated in the rules to prevent and control hazards from such chemicals and to ensure safety and permission has to be obtained from the authority concerned for suchactivity. Not applicable to the project.
8.	Hazardous Waste (Management, Handling and Transboundary Movement) Rules 2016	General provisions of the rules to follow the guidelines for handling and disposal of hazardous wastes are applicable to GCC.
9.	Solid waste (Management &	This notification by Ministry of Environment and Forest lays down the methods of handling Municipal Solid Waste

	Handling) Rules 2016	(MSW) and its scientific disposal. Provisions of the rules are applicable for the waste generated from the project activities.
10.	The Noise Pollution (Regulation and Control) Rules,2000	The ambient noise levels in any area/zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule. The provisions are applicablefor the project during construction.
11.	EIA Notification, dt 200 (S.O.1533(E), dt.14/09/2006) OR draft EIA notification 2020 upon final notification by MoEFCC	The notification specifies that prior environmental clearance is required for the projects listed in the schedule of the notification before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity.This project does not attract this notification.
12.	Wetlands (Conservation and Management) Rules, 2010	The rules lists the list of wetlands that need to be protected like those covered under Ramsar Convention, those in UNESCO heritage site, those which are ecologically sensitive etc and prohibits the certain activities within such wetlands. The project does not involve any such areas and hence not applicable.
13.	Coastal Regulation Zone (CRZ) Notification, 2011 (S.O.19(E),dt. 06/01/2011). CRZ Notification 2019 published by Govt., and upon final notification	This notification under Environment (Protection) Act, 1986 supplements the law on site clearance by declaring certain zones as CRZ and regulates activities in these zones. The project area does not involve areas under CRZ, and hence the SWD activities in the project area do not attract the provisions of this notification.
14.	Plastic waste (Management&handling) Rules2016	This rules provides guidelines for manufacturer of plastic bags with respect to thickness (40microns), labelling of plastic bags and prohibits availability to consumers free of cost. Further, these rules lay the responsibility of disposal of these wastes in scientific manner with the municipalities/ urban local body. The provisions are applicable to GCC.

15.	Construction and Demolition Waste Management Rules, 2016	This rules prescribes safe disposal and management of construction and demolition wastes. The wastes generated from the project during construction shall be in compliance with the rules.
16.	Prohibition of Manual Scavengers and their Rehabilitation Act, 2013 (No. 25 of 2013)	This act prohibits construction of insanitary latrines and employment or engaging of manual scavenger for the purpose of manual scavenging. The project is only storm water drainage however, considering the spirit of the act, to avoid manual cleaning of the chambers and to facilitate maintenance by machineries, Inspection doors are provided at 10m intervals.
	Operational Policies and Directives of the World Bank	
	OP/BP 4.01 - Environmental Assessment	Operational Policy 4.01 (OP 4.01) is one of the ten safeguard policies of the World Bank, which prov ides the Environmental Assessment (EA) guidance for the lending operations. The OP 4.01 requires the borrower to screen projects upstream in the project cycle for potential impacts. Thereafter, an appropriate EA approach to assess, minimize/ enhance and mitigate potentially adverse impacts is selected depending on nature and scale of project. The EA needs to be integrated in the project development process such that timely measures can be applied to address identified impacts. The policy requires consultation with affected groups and NGOs to recognise community concerns and the need to address the same as part of EA. TNUIFSL has adopted the principles of the above policy and has evolved a management framework to address the environmental issues in its lending operations.

There are many national legislations on labour, migrants and safety which are applicable to the project.

The environmental permission identified to be obtained is as below.

Sl. No.	Clearance/ Consents Requirement	Statute under which clearance/permission is required	Statutory Authority	Obtained By	Supervision By
1.	Cutting of trees		Deputy Commissioner (Works), GCC	PIU/GCC	PIU/ GCC
2	Hot mix plant, Crusher and Batch Mix Plant	Air (Prevention and Control of Pollution) Act, 1981 & Water (Prevention and Control of Pollution) Act, 1974	TNPCB	Contractor	PIU/ GCC
3	Traffic Management and Regulation during construction and maintenance	National Road Safety Policy + Guidelines of Indian Roads Congress	Traffic Police Department and ULB	Contractor	PIU/ GCC
4	Permission for Withdrawal of Groundwater for Construction	Guidelines to Regulate and Control Ground Water Extraction in India, 2019	CMWSSB	Contractor	PIU/ GCC
5	Permission for disposal of C&D wastes	Construction and Demolition Waste Management Rules, 2016	GCC	Contractor	PIU/ GCC

Necessary provision has been made in the bid document for adhering the working condition of the laborer as per as per regulatory requirement legistations. and for necessary insurance for the labor engaged for the work.

Other **legislations** that are also applicable for the construction activity are indicated below.

(i) Workmen Compensation Act, 1923

(ii) Payment of Wages Act, 1936

(iii) Child Labor (Prohibition and Regulation) Act, 1986

(iv) Public Liability Insurance Act, 1991, as amended

(v) Maternity Benefit Act, 1951

(vi) Contract Labour (Regulation and Abolition) Act, 1970

(vii) Minimum Wages Act, 1948

(vii) Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996

(viii) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979

(ix)The Occupational Safety, Health and Working Conditions Code, 2020 No. 37 of 2020

Process for obtaining permission for tree cutting:

A note shall be submitted by the SWD Department to the Deputy Commissioner (Works), GCC with details of the project, trees, photos of the trees and a justification on the need for tree cutting.

Deputy Commissioner (Works), GCC after review of the details submitted accords approval and forwards the note to the Parks Department of GCC.

The Parks Department shall carry out tree cutting after which works shall be initiated.

6. Baseline Environmental Status - Environmental Management Plan.

6.1.Baseline Environmental Status

Geology: Chennai is underlain by various geological formations from ancient Archaeans to recent Alluviums. It can be grouped into three viz. (i) Archaean Crystalline Metamorphic rocks (ii) Upper Gondwanas comprised of sandstones, siltstones and shoals, tertiary (Eocene to Pliocene) sandstones and (iii) coastal and river Alluvium. (Source: Chennai Master Plan II; Vol. i).

Meteorology of the region: The meteorological data of the Chennai region includes temperature, relative humidity, wind speed, wind direction and rainfall which has been referred from a report submitted to Chennai Corporation.

Temperature: The region is within tropical semi-arid region. The climate is generally hot and dry. It is characterized with seasonal variations of cool season (winter) from November to February, hot season (summer) from March to mid-June and rainy season from mid-June to October. The mean monthly temperature is in the range 33.1 – 37.6°C, while in winter temperatures fluctuates between 28.1 – 30.6°C.

Relative Humidity: The mean annual humidity is 75.2% and highest percentage of humidity are observed during October to January and moderate in winter.

Winds: The predominant wind direction observed is from West-Northwest to East-Southeast. Whereas monsoon winds (west-south west) prevail during June-September with a mean wind speed of 11.8 kmph.

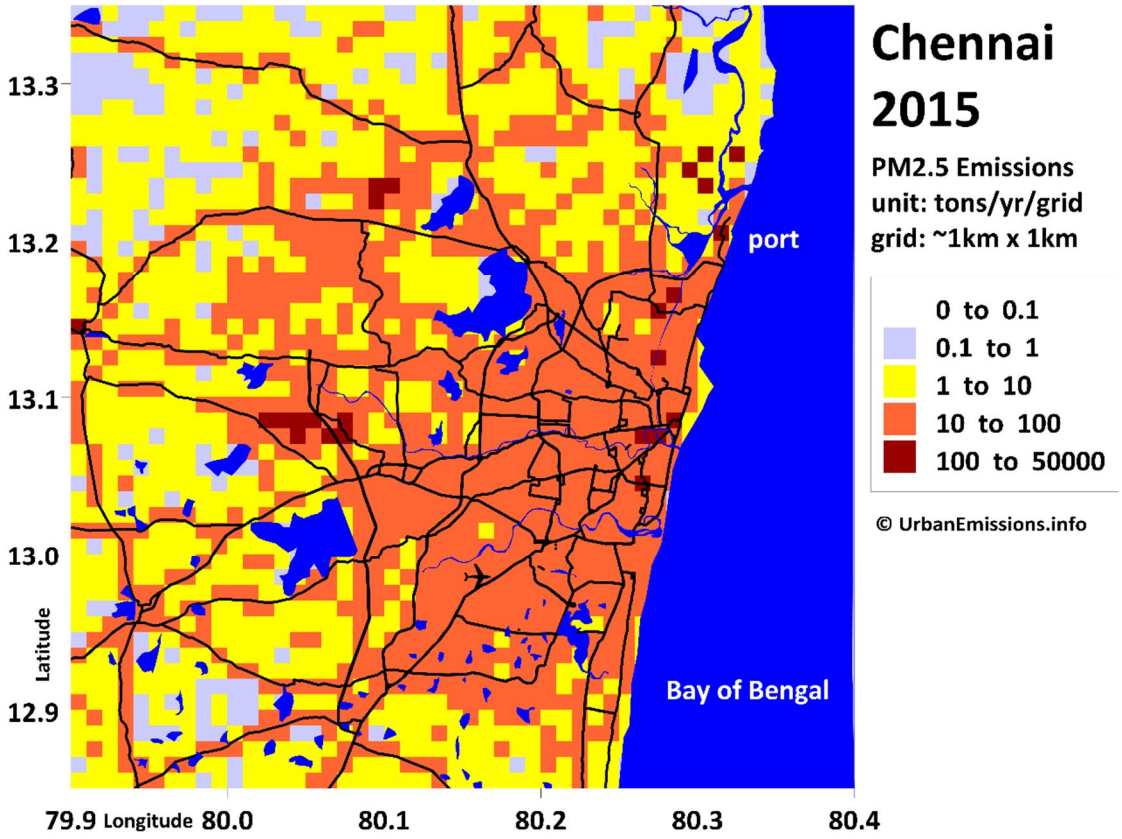
Rainfall: It has been recorded that Chennai receives 715mm of average rainfall mainly during north east monsoon during October to December. The mean annual rainfall is 1350 mm.

Land use: The existing land use pattern in the project area is provided in Table below.

S.No.	Land Use Type	Total Area in Sq.m
1	Agriculture Land	1717716.234
2	Built up	915576.239
3	Canal	89712.11
4	Drain	155664.75

5	Industry	4665847.128
6	Island	682.45
7	Lake	358.431
8	Lake	633553.548
9	Open space	5808306.18
10	Open Space with Grass	11961.133
11	Open Space with Tree	1033189.986
12	Play Ground	4060500.295
13	Public and Semi Public	825355.627
14	Railway Line	53659.623
15	RIVER	1074832.089
16	Road	8794916.559
17	Settlement	25397749.02
18	Tank	653318.724
19	Tree	1998813.128
20	Total Area	57891713.26

Air Environment: The ambient air quality monitoring data has been collected from Central Pollution Control Board (CPCB) website for Chennai Corporation area for the year 2015 and 2020. The average values obtained are presented in below figure. Air quality data collected from TNPCB during Jan 2020 to Aug 2020 is presented as Annexure.



The Air Quality sampling locations of Chennai area comprise of Residential and Industrial Category. The residential category includes Madras Medical College and NEERI CSIR Campus and Industrial Category includes, Thiruvottiyur, Kathivakkam and Manali area. The air quality monitoring results are interpreted as below:

The annual average concentration of Suspended Particular Matter levels in industrial area of Chennai Corporation was measured 174 µg/m3 which is well under the CPCB standard of 500 µg/m3 and the annual average concentration of Respirable Suspended Particular Matter was found as 74 µg/m3 against the standards of 150 µg/ m3.

Noise Pollution: The noise level survey conducted by the TNPCB reveals that noise level exceeded the limits mostly in commercial areas, mainly due to vehicular movement. During festive seasons in Chennai, the noise levels were noted high and particularly during Deepavali it exceeded 120 dB. (Source: Chennai Master Plan II; Vol. i)

Necessary provision has been made in the EMP Plan and will be enclosed in the bid document for carrying out the necessary tests for Air quality and Noise quality, dust prevention and for using of water from the regulated places.

Soil: Soil pH was recorded in the range of 8.1-8.5. As far as Total Organic carbon is concerned it was recorded in the range of 1486-3200 mg/kg while Total nitrogen was recorded in the range of 320- 912 mg/kg. Another nutrient, total phosphorous was recorded in the range of 129-352 mg/kg. Sodium and potassium was also recorded in the range of 90-312 mg/kg and 56-160 mg/kg respectively. Three heavy metals were also analysed and concentration of these metals was found well below to the standards. Above soil/sediment quality reflects that there is no toxic element present beyond to the safe limits prescribed by national/international agency thus excavated soil and sediment can be safely disposed of at suitable location.

S. No	Parameters	Virugambakkam Arumbakkam Canal	Adayar River	Gerugampakkam	TVS Canal
Physico-Chemical					
1	pH	8.2	8.4	8.3	8.4
2	Total Organic	1486	3200	1682	1552
	Carbon (mg/kg)				
3	Total Nitrogen (mg/kg)	355	912	610	320
4	Total Phosphorous (mg/kg)	142	352	241	145
5	Sodium (mg/kg)	220	312	280	138
6	Potassium (mg/kg)	56	160	110	58
Heavy metals					
7	Iron	3.4	3.4	2.8	2.1
8	Lead	0.26	0.97	0.30	0.61
9	Chromium (mg/kg)	BDL	0.01	BDL	BDL

Ground Water Quality: As reflected from the above results, pH of the collected ground water samples was recorded in the range of 7.4-7.9 shows slightly alkaline nature. As far as electrical conductivity is concerned, it was recorded in between 780- 1288 µmho/cm while Total Dissolved Solids were recorded in the range of 580-910 mg/l. Total and calcium hardness of ground water was also recorded in the range of 260-482 mg/l and 168-340 mg/l respectively. Fluoride and nitrate which are the two important

parameters as far as ground water quality is concerned were also recorded within the permissible limit of BIS 10500.

S. No	Parameters	Results			
		Virugambakkam Arumbakkam Canal	Adayar River	Gerugampakkam	TVS Canal
1	pH	7.4	7.8	7.6	7.5
2	Electrical Conductivity (µmho/cm)	1288	1242	820	900
3	TDS (mg/l)	910	890	590	680
4	Total Hardness (mg/l)	480	482	264	304
5	Calcium Hardness (mg/l)	340	322	182	222
6	Fluoride (mg/l)	0.29	0.36	0.21	0.18
7	Nitrate (mg/l)	2.4	1.2	0.9	1.4

Flora and Fauna: The most commonly found trees in project area are Azadirachta indica, Thespesia populnea, Acacia auriculiformes, Acacia planifrons, and Sacred trees like Ficus religiosa and Ficus benghalensis) are also present in the project area. Other common trees include Tamarindus indica, Pongamia Pinnata Peltophorum, Albizia saman, Mango, Badam. Shrubs and herbs included Clarotropis gigantea, Jatropha, Lantana camera, Abutilon indicum, Hibiscus, Achyranthes aspera, Sida acuta, Tridax procumbens, etc. The project will be taken up without affecting the trees by diverting the alignment of the trees. At the most care will be taken to protect the existing greenery. In unavoidable cases, after cutting the trees, 10 times of the trees cut will be planted at different location as per council resolution and it will be maintained by GCC.

Among fauna, different species of butterflies (Eurema hecabe, Catopsilia puranthe, Aceraea violae, Hypolimnas missippus), Argiope sp. Spider, Snails, mammals (Palm squirrels, House rats, field rats, grey mongoose), birds (Crow pheasant, house crow, common myna, Red-vented bulbul, Little comorant, pond heron, white throated King-fisher), amphibians (Common Indian toad, Frog) and reptiles (Garden lizard, Monitor Lizard, Rat snake) have been recorded.

Flooding in Chennai: During the rainy season, Greater Chennai Corporation including expanded area , faces inundation problem and experiences flood toll at number of

locations. With the references, records, verification on site, interacting with the local people inferences are drawn that large portion is affected due to rain and water logging. Due to heavy rains and floods, the infrastructure (roads, drains etc.,) are damaged and need repairs and strengthening works.

The reasons of flooding are three-fold. Most of the existing waterways are silted and their flow channels and banks are obstructed with encroachments and structures. Dumping of solid wastes in the canals also contributes to water stagnation and flooding of nearby areas. Similar is the case with the reservoirs and tanks. Secondly several of the areas under tanks and their Anicut have been developed as residential neighborhoods over the years. Thirdly the geological structure particularly in the south-west is not conducive to water infiltration.

In 1976, Heavy flood and submergence was observed in the areas close to Adyar and Kosathalaiyar river banks. Flood water could not enter the ultimate disposal point, the sea, due to the prevalence of High Tide effects then.

In 1985, Floods in Adyar was observed with a flood discharge of 63,000 Cusecs and the submergence of encroached flood plains.

In 1996, Floods in Adyar, Cooum and Kosasthalaiyar rivers were observed. Poondi reservoir was surpluses with a flood discharge of 80000 cusecs.

In 1996 the Karanodai Bridge collapsed.

In 2005, a 100 years recurring rainfall of 40 cm in a day caused heavy inundation in and around the Chennai city and its suburban areas and more than 50,000 persons had to be evacuated from the low lying areas.In 2008 and 2010, due to heavy rainfall, several low-lying areas of Chennai were flooded.

In 2005,2008,2010,2015 due to heavy rainfall, several areas of GCC were flooded.

Some Photographs showing flooding impacts in Chennai flood

2005 Flood

2008 Flood

2010 Flood

2015 Flood

2015 Flood

2017 Flood

2020


Network 24-Nov-2020 10:36:50 am IST
Local 24-Nov-2020 10:36:49 am IST
12°59'31.586"N 80°11'17.81"E
1st Street
Alandur
Chennai
Tamil Nadu

7. Assessment of Impacts

The proposed project is intended for better management of the hydrological situation and management of storm water, improvement of drainage and to prevent flooding in the low lying areas of the project area. However, the developmental activities which may be considered under the project both during under construction and operational phases may have some temporary or negligible impacts on various components of the environment. The baseline situation and the proposed activities have been analysed for identifying the impacts from the project implementation.

1. Cleaning and Cutting – Air quality may get affected due to construction works and noise levels may increase during operation of machinery.
2. Excavation and Filling Operations – Generation of wastes from excavation, demolition & reconstructions of drains and other construction wastes.
3. No Tree Cutting is identified by GCC; however this needs to be examined during implementation.
4. Shifting of utilities including water supply and sewerage lines, street lights and electricity posts are envisaged.
5. Traffic disruptions will be caused due to construction activitiy.
6. Access to adjacent facilities may be disturbed during construction of drains.
7. Health and Safety impacts to the labourers involved in construction.

Project Activities	Components of Environment										
		Air				Biodiversity		Social & Aesthetic			
	Land	Air Quality	Noise	Surface Water	Ground Water	Flora	Fauna	Resettlement & Land acquisition	Road and Traffic issues	Health and safety	Any damage to Public & sensitive
Clearing and Cutting	☐	☐	☐	X	X	☐	X	☐	☐	☐	X
Excavation & Filling	☐	☐	☐	☐	X	X	X	X	☐	☐	X

Operations											
Disposal of Excavated silt	□	X	X	□	X	□	X	X	X	X	X
Demolition and Reconstruction	□	X	X	□	□	□	□	□	X	X	X
Construction Camps	□	X	X	□	X	X	X	X	X	X	X
Disposal of Storm water	□	X	X	□	X	X	X	X	□	□	X

Phase wise project activities **Pre Construction Stage and Construction stage**	Potential Negative Impacts
Clearing and Cutting	▪ Loss of top soil ▪ Vegetation loss due to cutting of small shrubs ▪ Increase of irrespirable suspended particulate matters & dust in surrounding ambient air ▪ Noise & vibration disturbances of fauna and local population during cutting of trees ▪ During clearing and cutting ,there may be some hindrance in traffic due temporary increased machinery traffic ▪ There may be little impacts on health's due to Increase of irrespirable suspended particulate matters and noise level
Excavation & Filling Operations	▪ Loss of top soil ▪ Increase of irrespirable suspended particulate matters & dust in surrounding ambient air ▪ Noise vibration disturbances of fauna and local population during cutting of tress ▪ Spillage of oil and other substances during the civil works

	▪ During excavation, there may be some hindrance in traffic due temporary increased machinery traffic ▪ There may be little impacts on health's due to Increase of irrespirable suspended particulate matters ▪ Disturbance to existing utilities like HSCs for water supply & sewerage
Demolition & reconstruction of drains	▪ Increase of respirable suspended particulate matters & dust in surrounding ambient air ▪ Noise & vibration disturbances of fauna and local population during cutting of tress ▪ Spillage of oil and other substances during the civil works ▪ During excavation, there may be some hindrance in traffic due temporary increased machinery traffic ▪ There may be little impacts on health's due to increase of irrespirable suspended particulate matters ▪ Soil & water contamination due to improper disposal of excavated material, construction and demolition wastes
Disposal of Excavated silt	▪ Soil and water contamination due to improper disposal of excavated material, construction and demolition wastes ▪ Clogging of drains due to improper disposal of excavated material, debris during demolition and reconstruction and demolition. ▪ Loss of vegetation at dumping yard
Utilities Shifting	▪ Utilities will be identified and it will be shifted with proper care. ▪ There are no asbestos pipe shifting in this project
Construction of labour Camps	▪ Impacts on surrounding due to improper drainage, sanitation facilities, solid waste management facilities during the use of temporary ▪ Construction sites (camps, machinery sites, storage facilities etc.)

Operational Phase	
Disposal of Storm water	▪ Contamination of storm water due to mixing of sewage or industrial waste water ▪ Clogging of drains due to deposition of eroded soil, improper cleaning ▪ Formation of misquotes breeding grounds ▪ Foul smell

Potential Impact on trees:

Trees can be harmed by construction work in several ways. Any break or tear in a tree's bark disrupts the flow of vital fluids and exposes wood to invasion by disease and decay microorganisms, which the tree must then expend energy to deal with. A trunk wound does not always cause corresponding loss of branches or foliage, so the consequences may not be fully apparent. But a large wound in the trunk of a tree is serious-it cannot be repaired and will almost certainly result in future decay and loss of stem strength.

In this project the construction of Missing link storm water drain is demolition and reconstruction and in this portions no trees to be removed and on inspection it is found that the alignment of the missing link storm water drain can be taken without removal of tree.

However under unavoidable circumstances if a tree is found to be removed it is proposed to plant 10 trees as compensation for removal and will be planted in the nearby parks of the project area and will be carried out from the provisions made for shifting of utilities in the estimate.

No clearance is required for this project. The alignment of the missing link proposed Storm Water Drain will be taken in such a way that there is no cutting of trees is required. If any trees has to be removed during construction request will be made to Deputy Commissioner (Works) for removal of tree and for this ten trees will be planted has compensation through Parks Department and the cost will be met in the provisional sum made in the estimate for shifting of utilities (1%).

Utilities in the alignment

The project location is in the core city of GCC and the service Departments utilities such as water supply pipe lines, sewerage pipe lines, electricity cables, communication network cables and street lights cables will fall in the alignment of the proposed storm water drain. If any of the utilities are to be removed during construction of storm water drain, it will be requested to the concerned Departments for shifting of the utilities and the expenditure to be incurred will be met from the provisions made for shifting of utilities in the estimate.

There are no asbestos shifting in this project.

The other impacts that may arise during the implementation of the missing links storm water drainage project are

- Traffic issues due to excavation and construction activity
- Safety issues due to excavation
- Solid waste dumping
- Disposal of excavated earth / silt

8. Analysis of Alternatives

GCC area has natural drainages Kosasthalayar; Adyar and Cooum rivers pass through the City and the Buckingham Canal runs parallel to the coast, linking the rivers. Number of natural canals criss-crosses the GCC area and several lakes of varying size are located in the GCC limit. Due to city's flat terrain with average elevation of 6.7 metres (22 ft), rapid urbanization and lack/inadequate storm water drain network to connect with natural drainages such as rivers, canals and lakes has resulted in regular local flooding during monsoon.

Option 1: No construction of storm water drains linkages. This will results in periodic flooding in urbanized area shall results in property damages. Stagnation of water shall results in health related problems including spread of vector borne diseases such as Dengue and Malaria.

Option 2: Complete reconstruction and development of alternate roads of existing storm water drain 2,071 km and 45 km additional SWD as part of missing link is not feasible considering the urbanization and large requirements, traffic, environmental, social and financial aspects.

Option 3: Option of completing the connectivity of SWD of 45 km by reconstruction the existing Storm water drain of about 33 Km which are in dilapidated condition constructed of and missing link SWD for about 12 Km in low lying areas. Thus all existing drains will be connected in a network

Considering the feasibility and least environmental and social impacts Option 3 was selected. To mitigate the expected adverse environmental and social impacts, an Environmental Management Plan including EMP Cost has been prepared.

The likely adverse impacts on various environmental components, viz., Land, Air, Water, Biodiversity and Social & Aesthetic have been assessed. Based on the identified impacts' potential, the management practice to be followed for minimizing and mitigating the impacts on the surround environment, the activity wise Environment Management Plan is drawn. In summary, the expected impacts are of small scale, temporary and site specific depending on the implementation of the project and will not exceed the construction and major environmental norms. The EMP will be form part of the contract document.

9. Environmental Management Plan

Management measures are essential for mitigation of the impacts during construction activities for providing improvements to drains. The important management measures that need to be adhered to include.

xii. Proper planning of works by the contractors and GCC.
xiii. Coordination with respective line departments for shifting of utilities prior to start of work / during construction.
xiv. Prior intimation to residents before start of work.
xv. Providing temporary access to adjacent structures wherever required.
xvi. Providing necessary work place facilities, safe work environment and PPEs to the labourers.
xvii. Ensuring safe disposal of construction and demolition wastes.
xviii. Managing air emissions & noise levels during construction activity.
xix. In case of any tree cutting during construction, compensatory plantation at ten times the trees cut shall be implemented by the GCC.
xx. Coordination with traffic department by the contractors and the GCC to manage traffic disruptions during the construction period.
xxi. Procurement of raw material from approved quarries, valid consent for batch mixing plants are to be ensured during construction.
xxii. Ensuring availability of EHS person by the contractor.
xxiii. Regular awareness of communities & workers
xxiv. Ensuring all safety provisions to avoid all accidents and for emergency and disaster management,

The expected impacts are temporary and site specific mostly during on the implementation of the project and can be mitigated by following all applicable national/state regulations, World Bank EHS, ESMF / EMP guidance.. To mitigate the identified impacts an Environmental Management Plan has been prepared along with specific cost estimated for implementation. A detailed EMP is provided in Table given below. The EMP will be form part of the contract document.

Considerations made in the project for Minimising Impacts

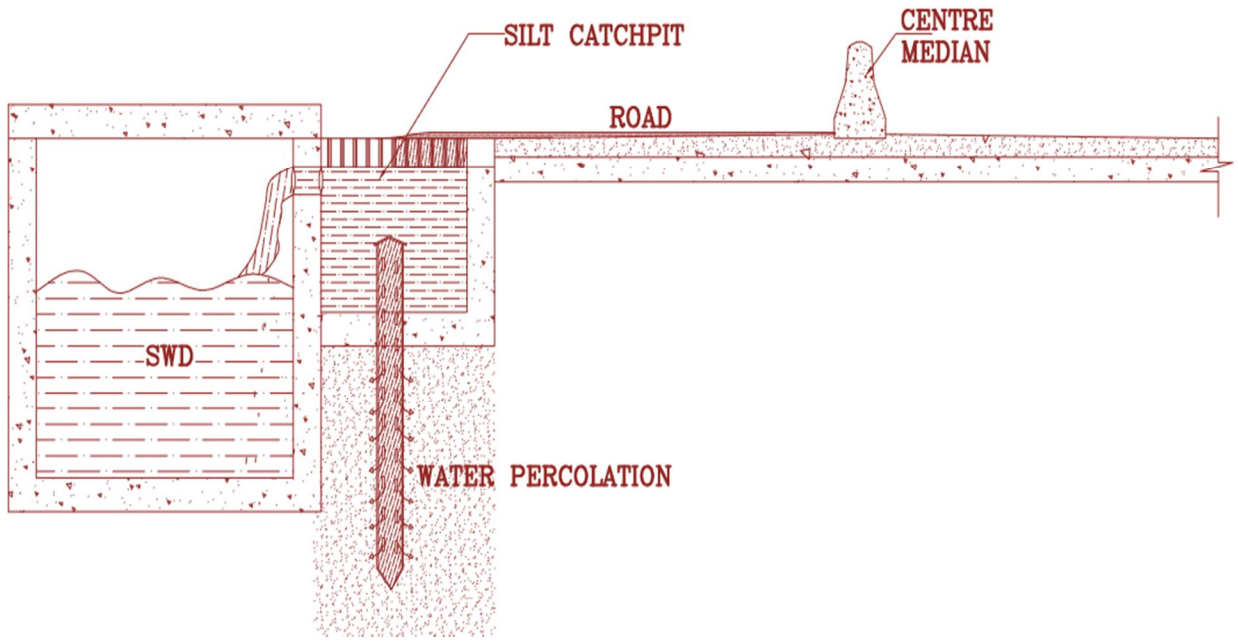
Key Environmental Management Measures proposed in the ISWD in expanded areas of Chennai Corporation

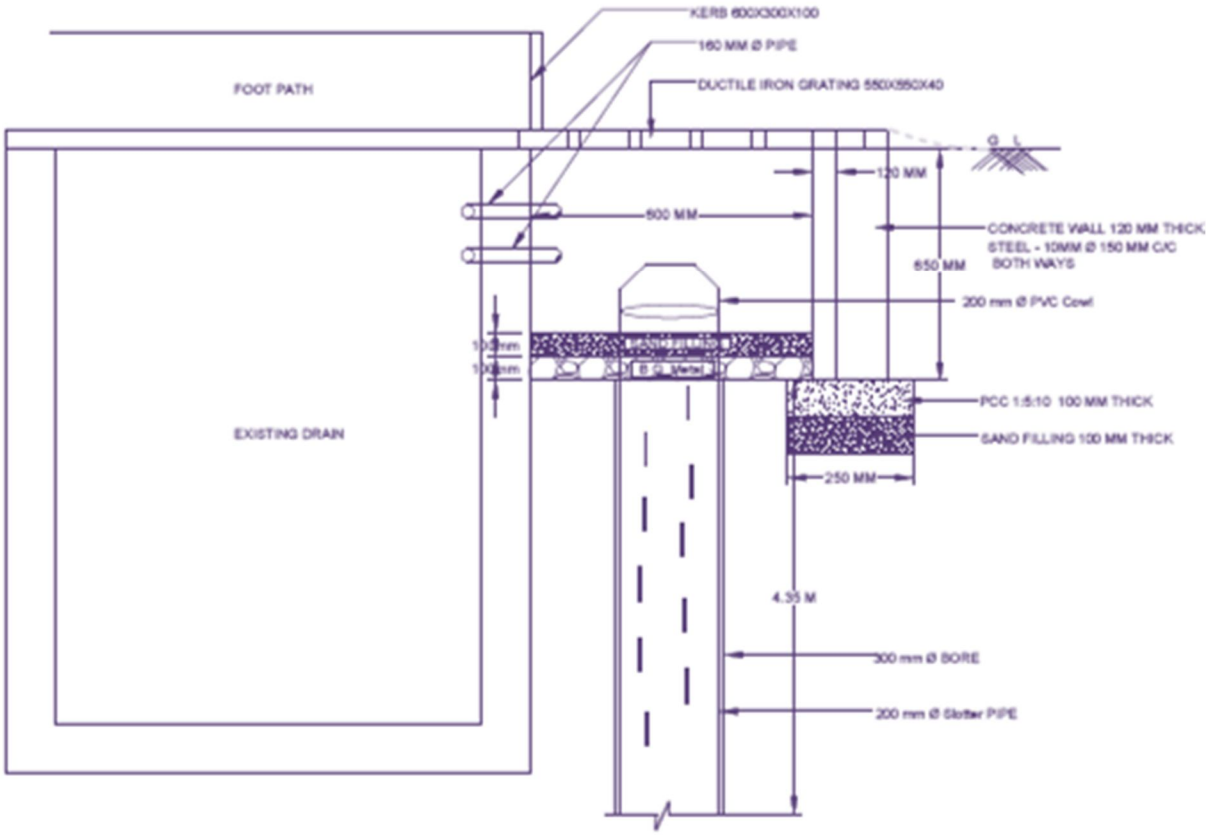
9.1.1 Groundwater recharge through Rainwater Harvesting

GCC has envisaged rainwater harvesting through constructing silt catch pits and recharging structures in the proposed storm water drainage network. Silt catch pit with Rain water harvesting structure will be provided at every 30 m interval in the drains.

It is also proposed to construct ground water recharging well (Rain Water Harvesting Well) of inner size 1200 mm Dia. and 4500 mm deep in the lands available in the project area.

There will be considerable increase in the Ground Water Table due to the measures to be taken up under the project as per the below figure





Model

Rain Water Harvesting structure
Aavin Diary Colony – Zone 7

Rain Water Harvesting structure
Mogappair Thirumangalam Road

The basic objective of the provision of missing links storm water drains to the selected areas in core city of GCC is to avoid the flooding and inundation and for proper disposal of storm water. Hence it is proposed to provide storm water drains in the missing link portions in the selected administrative zones with full coverage. The narrow streets and lanes are provided with one side drains to minimise impacts.

9.1.2 Sediment Control

For control of sediments, it is proposed to construct silt catch pit at every 10 m interval, so that the sediments are deposited in the silt trap and settle over there which can be removed periodically

Mechanical Cleaning

Greater Chennai Corporation has procured 6 nos of Vehicle mounted High Capactiy suction cum jetting machine with recycling facility for desilting the storm water drains.

9.1.3 Solid Waste Management

At present GCC is having an effective management system in solid waste management. However, the people living nearer to the SWD's and the commercial pockets situating near to SWDs are having tendency to throw solid waste into water bodies. Therefore, the following are proposed in the missing links SWD in the project areas in the core city of GCC.

Micro drains are designed as box type drain in RCC with cover slab on top which will curtail dumping of solid waste in drains.

In the SWD, rain water will flow into drains through silt catch pit with FRP gratings to screen the solid waste from entering into drains.

Public awareness programs have been proposed through IEC activities for proper waste disposal, to ensure public co-operation.

9.1.4 Access Difficulty

It has been proposed to provide access ramp to the individual houses for movement during construction of storm water drain for which provision has been made in the estimates for providing temporary access to the houses.

9.1.5 Public Awareness

Public play a major role in the successful functioning of proposed storm water drain. Periodical awareness programs have been proposed to deal with the various aspects that are to be considered to improve the local public awareness by involving individually or with the voluntary organization groups.

9.1.6 Disposal of excavated earth / silt /C&D waste

It is envisaged that a large quantity of silt, excess earth and construction & demolition waste would be generated from the project implementation. These wastes will be conveyed to the existing dumping yards at Kodungaiyur and Perungudi. Necessary provision for conveyance has been made in the cost estimate. The vehicles conveying earth and other wastes will be covered to avoid spilling of respirable suspended particulate matter & dust in the ambient air. Asbestos waste does not exists.

9.1.7 Traffic Management Measures

- Traffic Diversion

During the construction stage of storm water drain, traffic diversion or management may be required in any of the following conditions.

- ✓ If density of traffic is more in the construction site
- ✓ If road width is lesser for traffic due to width of drains especially for arterial drains
- ✓ Criticality of junction when drain crosses a junction
- ✓ Local significance

- Planning the works

The complexity of traffic diversion or management differs from scheme to scheme but the main objective is to maximise the safety of work force, publics living nearby and the travelling public and the second objective is to keep traffic flowing as freely as possible. So the traffic management should be a safe system of work for both operatives and road users.

During the planning stage of works the following points should be noted.

- ✓ Intimation to the public living or shops available adjoining the construction site.
- ✓ Attention must be paid to the needs of pedestrians. This applies especially in the vicinity of bus stops, shops, where larger numbers of people with physical/mental impairments may be expected.
- ✓ Construction works should be undertaken in the minimum time, taking up the minimum of road space, but without compromising safety. Where practicable, additional resources or time- reducing techniques should be considered.
- ✓ There must always be liaison with the Authority concerned to avoid concurrent works in close proximity.
- ✓ Period of execution based on the area specific. For example if an educational institution is present the works may be planned during holidays.

- ✓ Transport authorities to be informed to plan their stops and routes if diverted
- ✓ There should be always liaison with traffic police and other emergency services

- Designing Traffic management

- ✓ Before execution minimum lateral (sideways) clearance should be given between moving traffic and work space
- ✓ Outer boundary of work space should be provided with barricading as specified in the SOR of GCC
- ✓ Barricading should be visible in day and night and also adjacent to running traffic lane should be lined with traffic cones.

- ✓ Adequate working space should be provided around the workplace to allow temporary works
- ✓ If density of traffic is more in construction road and the road is two way at least 5.5 m width should be maintained. If not possible a single way traffic may be enrooted on other possible way by providing proper indication on the entrance of road or before the diversion way. For one way traffic at least 3.5 m clearance should be given for heavy vehicle or public transport, but. Car only traffic may be maintained with 2.5 m width. Adequate warnings of narrow lanes must be given with proper sign board.
- ✓ For construction of drains in the major roads the points discussed above is applicable along with the sign to vehicles to restrict the speed within 30 kmph while crossing construction site and sign indicating " no overtaking" may be erected during working hours.
- ✓ If road width is less than required i.e., at least 2.5 m for one way traffic during the period of construction , the road can be closed and traffic diverted along a suitable diversion road after according concurrence with traffic police and road authorities.
- ✓ For crossing of drains through culverts in major roads, push through technology is suggested. But if the culvert crosses through open excavation proper closing of traffic is required for crossing road.
- ✓ Proper diversion board indicating the "Road ahead is closed" the nature of work going ahead with authority name should be placed before the entrance of road with advance warning of diversion should be place before 100m of diversion with arrow sign for diversion before 3 from the diversion road..
- ✓ A proper vehicle restraint and pedestrian barrier with proper signage board should be placed on either side of culvert crossing.

9.1.8 Tree cutting and Compensatory Plantation

- Tree Cutting:
  - ✓ The presence of trees adjacent to the drains/ canals and the vulnerable trees from the drain construction activity are considered as nil.
  - ✓ Adequate precaution shall be taken during implementation to avoid the tree cutting and the alignment of the storm water drain will be taken without removal of tree.. .
  - ✓ However, when tree cutting is unavoidable, note with necessary details on the project and trees & photos and justification for tree cutting shall be submitted by the SWD Department to the respective Deputy Commissioner (Works) and permission will be obtained.
  - ✓ Tree cutting shall be carried out by the Parks Department of the GCC prior to start of work.
- Compensatory plantation:
- Provision has been made in the cost estimate for plantation at ten times for the one tree removed and will be met from the provision made for shifting of the utilities in the estimate.
- The compensatory plantation after completion of the drain construction, will be carried out through Parks Department which will also carry out the maintenance activities of the plantation if tree cutting made during unavoidable circumstances.
- List of suggested species of trees for the compensatory plantation is provided in the Annexure II.

9.1.9 Utilities near the alignment

Construction of storm water drains will need planning, co-ordination with departments concerned and careful implementation to ensure that the infrastructure facilities are not disturbed. Wherever required the utilities fouling with alignment need to be shifted in co-ordination with the departments concerned, prior to start of works it will be requested to the concerned

Departments for shifting of the utility and the cost for will be me in the provision made for shifting of the utilities in the estimate.

House service connection of water supply and sewerage pipe lines that may get disturbed during construction of drains will be replaced immediately by the contractor through the concerned service Departments.

Transmission lines/ pumping main are present in the middle of the road and hence not disturbed by the construction activity of storm water drain.

9.1.10 Safety requirements for maintenance of drains

The inspection doors are provided at a distance of 10 m to facilitate maintenance only through machineries and equipments avoiding manual entry.

However in case of any need for manual maintenance the following shall be ensured.

- Follow country regulation on Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.
- A competent person should carry out a risk assessment and make recommendations on safety and health measures before undertaking work in confined space.
- Allow only certified workers to work in the confined space.
- Provide adequate ventilation.
- Isolate the confined space.
- Monitor the air quality throughout the entire working period by means of a gas detection device.
- A person should be stationed outside the confined space to monitor the weather condition and keep communication with the workers inside.
- if required ensure the use of approved breathing apparatus
- Appropriate emergency procedures shall be formulated to deal with serious or imminent danger.

- Instructions, training and advice shall be provided to all workers to be working within a confined space.
- Follow all labour laws; ensure PPEs, insurance, first aid, quick medical support etc, for the workers.

9.2 Environmental Management Plan for SWD

The management measures which are to be implemented during various stages of implementation of the proposed SWD to selected areas of Greater Chennai Corporation have been provided .The general Environmental, Health and Safety guidelines of World Bank shall also be applied for relevant stage and activities in implementing the project.

Key Environmental Management Measures proposed in the ISWD in expanded areas of Chennai Corporation

Sl. No	*Potential Impact*		*Mitigation Measures*	*Responsible Agencies*
1.0			***DESIGN PHASE MEASURES***	
1.1	*Prevention of flooding*		*The drains shall be constructed to handle the maximum rainfall of 68 mm/hr.*	*Contractor/ GCC*
1.2	*Rainwater Harvesting & Recharge structures*	*i)*	*Rain water harvesting structure along with silt catching pit (600 X 600 x 600 mm) shall be constructed along the drains at every 30 m interval as per the standards prescribed on the Chennai Corporation Storm Water Schedule of rates.*	*Contractor/ GCC*
		ii)	*Ground water recharging structures Rain water Harvesting well of 1200 mm dia will be constructed in the lands available in the project area*	
1.3	*Sediment Control*		*For control of sediments silt catch pit is provided at 10 m interval so that the sediments are deposited in the silt trap and settle over there which will be removed periodically.*	*Contractor/ GCC*
1.4	*Prevention of solid waste into drains*	*i)*	*Micro drains shall be constructed as box type drain in RCC with cover slab on top which will curtail dumping of solid waste in drains.*	*Contractor/ GCC*
		ii)	*Major micro drains belonging to Corporation of Chennai will be provided with fencing with*	

			MSframe with wire mesh to avoid throwing of solid waste..	
1.5	*Safety in maintenance*		*Inspection doors shall be provided at an interval of 10m to facilitate removal of silt using machineries.*	*Contractor/ GCC*
2.0	***PRE-CONSTRUCTION STAGE AND CONSTRUCTION PHASE***			
2.1	*Appointment and Mobilization of Environment & Safety Officer*	*i)*	*The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will be mobilized prior to start of works.*	*Contractor*
		ii)	*PMC will dedicatedly work and ensure implementation of Environmental Management Plan including Occupational, Health and Safety measures during the project Implementation.*	
2.2	*Clearances*	*i)*	*All clearance required for Environmental aspects during construction shall be ensured and made available before start of work.*	*Contractor/ GCC*
		ii)	*For setting–up of Batching Plant, D.G Sets, Consent to Establish and Consent to Operate will be obtained from Tamil Nadu Pollution Control Board (TNPCB) prior to start of work and conditions be complied.*	
		iii)	*If contractor intends to procure construction materials from existing units, then the approvals for the concerned units shall be ensured prior to start of work*	
		iv)	*The permits to be obtained by the contractor (including Labour Licence, Labour Insurance, etc) shall be examined by GCC and validity be ensured.*	
		v)	*All clearance required from all departments and Environmental aspects shall be ensured and made available before start of work. For trees identified for cutting, obtain prior permission from the Deputy Commissioner (Works), GCC prior to commencement of work to plant 10 trees as compensation in the parks available in the project area..*	
2.3	*Identification of Quarries*		*The contractor will procure from approved quarries for sourcing of the materials for construction.*	*Contractor*
2.4	*Water for construction*		*The contractor shall source water for construction after proper permission from agency concerned.*	*Contractor*
2.5	*Labour requirements*	*i)*	*Wherever possible, the contractor may use skilled/unskilled labour as required; drawn from local communities.*	*Contractor*
		ii)	*All applicable labour regulation will be complied by*	

			the contractor.	
		Iii)	*Labourer's shall be provided orientation of ESMP requirements and COVID related regulations*	
		iv)	*Strict adherence to avoid child labour of any form of work should be followed at the construction site and camp sites.*	
2.6	*Tree Cutting*	*i)*	*Minimise tree cutting*	*Contractor / GCC*
		ii)	*Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars) as required..*	
		iii)	*Take adequate care to determine root protection zone and minimize root loss.*	
		iv)	*Fallen / cut trees shall be removed from the construction sites before commencement of construction*	
		v)	*Under take compensatory plantation in nearby areas at the rate of 10 trees for each tree proposed to be cut. This will have to be monitored and reported to TNUIFSL*	
2.7	*Utility Relocation*	*i)*	*Identify the common utilities that would be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc*	*GCC / Concerned departments/ Contractor*
		ii)	*Prior to works / shifting of utilities concerned line departments and citizens shall be made well aware of proposed works (through discussions/meetings, display boards) and possible disturbances due to utility shifting*	
		iii)	*Affected utilities shall be relocated through the concerned line departments before construction starts*	
		iv)	*All safeguards against accidents shall be taken while shifting utilities, including (but not limited to) hard protective barricading of full work space, notice to road users and communities, traffic management, PPEs to protect workers from all incidental issues including (but not limited to) electric shocks, hit, fall, vehicular conflicts following Good International Industry Practices and Word bank EHS.*	
		v)	*Wherever the entry and exit to houses/establishments are affected due to construction activities, alternate temporary but safe ramp arrangement for crossing over shall be provided without causing access/safety issues. Adequate provision shall be made to collect complaints from community / road users and resolve the same immediately (notice board with contact*	

			details of GCC executive engineer; complaint box, log book etc.)	
		vi)	*Shifted utilities or construction materials shall not cause any disturbance to communities / road users. They shall be well stacked safely with flags / reflectors for easy visibility and transported as early as possible without causing any accidents / spills & stored at pre-agreed (before start of works) disposal / storage point as directed by GCC.*	
		vii)	*All hazardous material / e-waste including existing asbestos material (eg: as in old pipes) or electric cables etc. shall be managed as per hazardous/e-waste management rules (as directed & arranged by GCC prior to start of works). No such material shall be dismantled / broken on site or allowed to cause any accident.*	
2.8	*Baseline parameters*	*i)*	*Base line parameters shall be recorded and ensured conformance till the completion of the project*	*Contractor / GCC*
		ii)	*The contractor shall undertake periodical monitoring of air, water, and noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of monitoring plan shall be prepared.*	
		iii)	*Adequate measures shall be taken and checked to control any pollution and report be sent to the Engineer*	
2.9	*Planning of temporary Traffic arrangements and pedestrian safety*	*i)*	*Temporary diversion shall be provided with the approval of the engineer. Detailed traffic control plans shall be prepared and submitted to the engineers for approval, one week prior to commencement of works*	*Contractor / GCC*
		ii)	*The traffic control plan shall contain details of temporary diversion of traffic, details of arrangements for construction under traffic, details of traffic arrangement after cessation of wok each day, SIGNAGES and plan for information dissemination to community/road users, safety measures for transport of hazardous materials and arrangement of flagmen.*	
		iii)	*Special consideration will be given to the preparation of the traffic management plan and housekeeping / work area management plan for safety of pedestrians and workers at night.*	
		iv)	*Construction shall be taken up phase –wise so that sections are available for traffic.*	
		v)	*The Contractor will also disclose to the local community about diversion in traffic routes and*	

			pedestrian access arrangements with assistance from ULB. Proper signages / info boards shall be arranged prior to works providing emergency contacts etc	
2.10	*Excavations*	*i)*	*All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized.*	*Contractor*
		ii)	*The excavation shall conform to the lines, grades, side slopes and levels shown in the drawing or as directed by the engineer*	
		iii)	*While planning or execution the contractor shall take all adequate precautions against soil erosion, and take appropriate drainage measures to keep the site free of water.*	
		iv)	*Proper signages on excavations; side protections to avoid slip, drip, fall shall be provided.*	
2.11	*Water Pollution from Construction Wastes*	*i)*	*Avoid mixing of wastewater from household, commercial, industrial and other establishments, by regular monitoring, punitive actions and provision of services.*	*Contractor*
		ii)	*Provision for connecting domestic liquid waste to sewerage system is to be made during drain construction to avoid mixing of waste water.*	
		iii)	*Periodical monitoring shall be carried out and sources of wastes/ effluent etc., are to be identified by the GCC. 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 rain water.*	
		iv)	*In case of any industrial effluent identified, necessary action be taken in co-ordination with the TNPCB.*	
2.12	*Temporary flooding during construction activity.*	*i)*	*Desilting activity shall be scheduled during non-flooding season. Silt shall be stored near site for dewatering in case there is sufficient space and/or transported immediately in covered skips with water collection arrangements to the disposal / storage point agreed with GCC. This shall be well stored with cut off drains / covers as appropriate considering the characteristics of the silt & disposal area. NO disturbance shall be harmed to communities due to desilting, storage, transport or disposal of silt*	*Contractor/ GCC*
		ii)	*Dewatering with proper drainage arrangements to be made, to avoid the overflowing of existing drains due to construction activity.*	
2.13	*Prevention of accidents*	*i)*	*Prevention of accidents involving human beings, animals or vehicles falling or accidents during*	*Contractor*

			construction period. This needs to be ensured with proper barricading, signage boards, reflectors on barricades and adequate lighting etc. Any loose earth near / around pits shall be checked and attended to in order to prevent slumps.	
		ii)	*The project Engineer-in-charge of GCC will plan and direct the contractor to execute the work progressively so that the length of the open excavated trench is minimized in order to reduce possible accidents.*	
		iii)	*Communities and road users shall be well informed about the work through media, signboards at and ahead of the workspace; discussions /meetings and their concerns shall be attended to and resolved with involvement of GCC engineer in charge.*	
		iv)	*All precautions shall be taken to avoid accidents due to works*	
2.14	*Work-zone safety Management*	*i)*	*Temporary barricades shall be provided to delineate construction zone as well material stacking areas. The construction site and the labour facility shall be appropriately barricaded to prevent entry and accidental tress-passing of workers, staff and others into the construction sites.*	*Contractor*
		ii)	*All operational areas shall be access controlled. Watch and ward facilities at all times shall be provided by the contractor.*	
		iii)	*Proper retro reflective warning signage will be installed on the access road next to the construction site about movement of construction machinery and vehicles.*	
		iv)	*In excavations for longitudinal surface road drains, culverts etc., a high visibility warning and retro reflective signage shall be displayed in Tamil and English.*	
		v)	*Entry of unauthorized persons should be prevented. Excavations will be adequately barricaded and well lit – with signages/info boards.*	
		vi)	*There shall be adequate lighting arrangement at night and adequate barricading to prevent mishaps after construction activity ceases for the day*	
		vii)	*A readily available first aid unit with necessary supplies, drinking water, resting shed, sanitation etc shall be made available in every work zone*	
2.15	*Barricading site*		*The construction area should be barricaded at all*	*Contrac*

			times with adequate marking, flags, reflectors, lighting, etc. for safety of general traffic movement, workers and pedestrians.	*tor*
2.16	*Drainage flow*	*i)*	*Alternate arrangement like diversion of the drainage is ensured to allow the natural flow.*	*Contractor / GCC*
		ii)	*It shall be ensured that none of the construction activities affect the natural flow of the drainage.*	
2.17	*Storage of materials*	*i)*	*No construction materials should be stored on the road, on top of or beside drains and footpaths, or on any other public area as this may restrict public access to these utilities.*	*Contractor / GCC*
		ii)	*The contractor shall identify the site for temporary use o land for construction sites/storage of construction materials, etc*	
		iii)	*Site for storage of construction materials to be identified without affecting the traffic and other common utilities, and the quality of the construction materials.*	
		iv)	*Construction materials should only be stored and prepared on the site if they do not obstruct the road or any surrounding public utility. Construction materials should only be transported to the worksite as and when required for construction*	
2.18	*Using of modern machineries*		*Using of modern machineries such as JCBs, backhoes etc., shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents.*	*Contractor*
2.19	*Dust Pollution Near settlements*	*i)*	*All earthworks will be protected in manner acceptable to the Engineer to minimize generation of dust*	*Contractor*
		ii)	*Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction*	
		iii)	*Un paved haul roads near / passing through residential and commercial areas to be watered thrice a day.*	
		iv)	*Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage.*	
		v)	*Sprinkling of water to be done at regular intervals at places of work to protect the near by inhabitants and road users.*	
2.20	*Material Handling at site*	*i)*	*All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles*	*Contractor*
		ii)	*Cement bags will be stored and emptied in covered*	

			area to control fugitive dust emissions.	
		iii)	*While handling and emptying cement bags, workers will wear masks, hand gloves and protective goggles.*	
		iv)	*Trolley may be used for transferring of material from one place to another place.*	
2.21	*Protection of Residential / sensitive receptors.*	*i)*	*Wherever necessary, time period, barrier requirements, and other pollution / impact control for construction activities may be finalized in consultation with sensitive receptors like schools, religious places, shrines, community centers, grave yards, lakes/water bodies etc.*	*Contractor*
		ii)	*Periodic maintenance and calibration of construction equipment's/ vehicles to meet applicable CPCB emission standards and noise levels.*	
		iii)	*Contractor to ensure regular dust suppression measures by way of standard and efficient water sprinkling through water tankers at these designated sensitive receptors*	
		iv)	*Adequate barricading and safety measures to protect sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction.*	
2.22	*Vehicular noise pollution at Residential / sensitive receptors.*	*i)*	*Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas.*	*Contractor*
		ii)	*Stationary construction equipment will be kept at least 500m away from sensitive receptors.*	
		iii)	*All possible and practical measures to control noise emissions during drilling shall be employed. The GCC may direct to take adequate controls measures depending on site conditions.*	
2.23	*Noise from vehicles, plants and equipment*	*i)*	*Use of less noise generating cutting equipment's, provide personal protective equipment's such as ear plugs/muffs and other safety measures to labourers. In addition the concrete mixture to be used for construction works will be prepared in a location away from the locality to minimize the noise generated from the machinery.*	*Contractor*
		ii)	*Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.*	

		iii)	*Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.*	
2.24	*Location of Labour camp Accommodation*	*i)*	*Consult GCC before locating project offices, sheds, camps, and construction plants*	*Contractor*
		Ii)	*Labour camp shall be planned & the plan shall be approved by GCC engineer in charge & TNUIFSL. Setting up of labour camps if any needed to be done as per all applicable rules/regulations. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws and applicable regulations shall be ensured..*	
		iii)	*The contractor shall also guarantee the following:* *The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction.* *The construction of the camp will commence only upon the written approval of the Engineer. It will be difficult to construct labour camps near work sites which are in the congested parts of the city.*	
		iv)	*Adequate toilets, wash (COVID 19 related hygiene facilities), Storage, First Aid, rest area, Water/Food facilities shall be made available to the workers at each work site.*	
		v)	*Select a camp site away from residential areas (at least 100 m buffer shall be maintained) or locate the camp site within the existing facilities of ULB*	
		vi)	*Avoid tree cutting for setting up camp facilities*	
		vii)	*Provide a proper fencing / compound wall for camp sites*	
		viii)	*Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas*	
		ix)	*The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing.* *Camp shall be well constructed and maintained to provide healthy and safe living environment for workers. Fire and electric safety shall be ensured.*	
		x)	*Supply of sufficient quantity of potable water (as per IS) in every work place/labor camp site at suitable and easily accessible places and regular*	

maintenance of such facilities.

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

xii) 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 much as possible to use portable ready to fit-in reusable cabins with proper ventilation) and safe materials for all extreme weather conditions; thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers

xii) The camp shall be designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is provided in all toilets and urinals.

xiii) Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws and applicable regulations shall be ensured. The contractor shall also guarantee the following:

xiv) Provide drinking water, water for other uses, and sanitation facilities for employees. Adequate water supply is to be provided in all toilets and urinals

xv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities.

xvi Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed

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

xviii) Recover used oil and lubricants and reuse or remove from the site

xix) The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer

xx) Where feasible, manage solid waste according to the following preference hierarchy: reuse, recycling and

			disposal to designated areas; ULB shall ensure proper segregated storage, collection, transport, treatment and disposal of all wastes following the SWM / C&D waste Rules 2016.	
		xxi)	*Adequate toilets, wash (COVID 19 related hygiene facilities), Storage, First Aid, rest area, Water/Food facilities shall be made available to the workers at each work site.* *All toilets shall have septic tank / sewage disposal facility as directed by regulations / building rules. Portable / mobile toilets if provided shall have adequate septic tanks which are emptied at STPs/ FSTPs at regular intervals so as not to cause any disturbance to workers / communities. Health checkups shall be arranged and COVID 19 precautions as directed by GoI, GoTN & WHO shall be followed in the camp.*	
		xxii)	*Separate toilets/bathrooms are to be provided for women, wherever required, and shall be screened from those for men (marked in Tamil language)*	
		xxiii)	*Adequate health care is to be provided for the work force during the entire phase. Inform nearest PHC regarding the work camp & get trainings/ orientations, COVID guidance etc.,*	
		xxiv)	*Remove all wreckage, rubbish, or temporary structures which are no longer required*	
		xxv)	*At the completion of work, camp area shall be cleaned and restored to pre-project conditions*	
2.25	*HIV/AIDS Prevention Measures*	*i)*	*Necessary HIV/AIDS prevention measures will be taken at labour camp*	*Contractor*
		ii)	*HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer*	
2.26	*Stock-yards*	*i)*	*Contractor in consultation with GCC shall identify the site for temporary use of land storage of construction materials. These sites shall not cause an inconvenience to local population / traffic movement.*	*Contractor*
		ii)	*Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary.*	
		iii)	*Location for stockyards for construction materials will be identified sufficiently from water course and*	

			separated from the labour camps.	
		iv)	*Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of nearby land, water body, nearby storm water drain & underground sewerage pipes.*	
		v)	*Enclosed storage for fuel with non- permeable flooring, and safety signages*	
		vi)	*Inflammable materials shall not be stored near residences/ schools, etc. Contractor shall cover material stockpiles with tarpaulin or other materials.*	
		vii)	*Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. Necessary training and awareness program shall be carried out to make the labourers aware about hazardous nature of substances*	
2.27	*Fuel storage and refueling areas*	*i)*	*The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites are not located near rivers and irrigation canal/ponds*	*Contractor*
		ii)	*All location and lay-out plans of such sites, collection and disposal methods for the spent oil and grease will be finalized in consultation with the Engineer*	
		iii)	*Refuelling shall be done in such a fashion that oil/diesel spillage does not contaminate the soil.*	
		iv)	*Oil and grease traps will be provided at fuelling locations, to prevent contamination of water.*	
2.28	*Information Dissemination and Communication Activities*	*i)*	*Prior to construction activity, information dissemination will be undertaken by contractor at the project site.*	
		ii)	*The contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language (Tamil), wherever required or as suggested by the Engineer. Informatory boards shall be well visible & safely erected & shall inform communities/road users of the woks and probable safety concerns and the emergency contact numbers (of site engineer, ambulance, police fire, electricity department / others) for the workers and the communities.*	
		iii)	*Details of nodal officer with telephone numbers will be*	

			displayed for registering compliant/grievances by stakeholder/general public.	
		iv)	*Information boards will also be setup at the sites of construction camps and labour camps, plants and stockyard site.*	
2.29	*Covid 19 control measures*	*i)*	*Construction sites operating during the Covid-19 pandemic need to ensure they are protecting their WORKFORCE and minimising the risk of spread of infection.*	
		ii)	*SOPs and guidelines issued by GOI and GoTN from time to time to prevent spread of Covid19 sbe adhered to during sub-project implementation*	
2.30	*Accessibility to connecting roads and adjacent structures*	*i)*	*Contractor will provide safe access through temporary bridges / walkways to the adjacent residences/ buildings wherever necessary especially during construction of drains.*	*Contact or*
		ii)	*Residents / Local community will be informed 3 days prior to start of construction.*	
		iii)	*The Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The Contractor will also ensure that the existing accesses will not be disturbed without providing adequate provisions*	
		iv)	*The Contractor will take care that the cross roads are taken up one after one in such a sequence so that traffic movement in any given area not get affected much.*	
2.31	*Transporting Construction Materials*	*i)*	*All vehicles delivering fine materials like aggregate, cement, earth, sand, etc., to the site will be covered by Tarpaulin to avoid spillage of materials and wind-blown dust from the top of vehicles.*	*Contact or*
		ii)	*Roads used by vehicles of the contractor or any of his subcontractor or suppliers of materials will be cleared of all dust/mud or other extraneous materials dropped by such vehicles.*	
		iii)	*To the extent possible the contractor will transport materials to the site in non- peak hours.*	
2.32	*Pollution from Construction Wastes*	*i)*	*All waste arising from the project is to be disposed off by the contractor in dumpsites designated by GCC.*	*Contractor*
		ii)	*The engineer shall certify that all liquid wastes disposed off from the sites meet the discharge standard.*	
		iii)	*Avoid stockpiling any excess spoils at the site for*	

			more than a day. Excess excavated soils should be disposed off to approved designated areas immediately;	
		iv)	*All arrangements for covered transportation during construction including dismantling and clearing debris, will be planned and implemented by the Contractor in consultation with the Engineer.*	
2.33	*Pollution from Fuel and Lubricants*	*i)*	*Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas.*	*Contractor*
		ii)	*In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage.*	
		iii)	*Contractor will arrange for collection, storing and disposal of oily wastes as directed by the Engineer*	
2.34	*Operation of construction equipment and vehicles*	*i)*	*The Contractor will confirm the following:* *All plants and equipment used in construction shall strictly conform to the MoEFCC/CPCB noise standards*	*Contractor*
		ii)	*All vehicles and equipment used in construction will be fitted with exhaust silencers.*	
		iii)	*Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.*	
		iv)	*Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986.* *Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum.*	
		v)	*Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use.*	
		vi)	*Noisy construction activities during the night hours will be avoided near sensitive receptors like health centers and hospitals.*	
		vii)	*Ensure that all the construction equipments/ machineries are maintained properly, and have a*	

			valid PUC certificate and operated by drivers holding valid licence	
2.35	*Flora and Chance found Fauna*	*i)*	*The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.*	*Contractor/ GCC*
		ii)	*If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same.*	
		iii)	*The Engineer will report to the near by forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.*	
2.36	*Chance Found Archaeological Property*	*i)*	*All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation.*	*Contractor/ GCC*
		ii)	*The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the SC's instructions for dealing with the same,waiting which all work shall be stopped.*	
		iii)	*The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.*	
2.37	*Disposal of oil and grease*		*A suitable site should be identified for safe disposal / without contaminating the source, in relatively low lying areas away from the waterbodies etc., as approved by the Engineer & as per specific procedures.*	*Contractor/ GCC*
2.38	*Personal Safety Measures for Labour*	*i)*	*Adequate precautions shall be taken to prevent the work site accidents including from the machineries. All machineries used shall confirm to the relevant Indian standards Code and shall be regularly inspected by the Engineer*	*Contractor*
		ii)	*Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil.*	

		iii)	*Protective footwear and protective goggles to all workers employed to be provided for all works as required, including mixing of materials like cement, concrete etc.*	
		iv)	*Welder's protective eye-shields shall be provided to workers who are engaged in welding works.*	
		v)	*Ear plugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation.*	
		vi)	*The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc., to workers and staffs.*	
		vii)	*The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No.62 as far as those are applicable to this contract.*	
		viii)	*Adequate safety measures for workers during handling of materials at site are to be taken up.*	
		ix)	*Safety vests (fluorescent) will be used by workers when on construction site*	
		x)	*The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 & Code on Occupational Safety, Health and Working Conditions, 2018 and World Bank EHS are adhered to.*	
		xi)	*The contractor shall not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.*	
		xii)	*Woman will not be employed on the work of painting with products containing lead in any form*	
2.39	*Risk from Electrical Equipment(s)*	i)	*The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that*	*Contractor*
		ii)	*No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.*	
		iii)	*All necessary fencing and lights will be provided to protect the public in construction zones.*	
		iv)	*All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good*	

			working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer	
2.40	*First Aid*	*i)*	*The contractor shall arrange for:* *A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules/ relevant legislation in every work zone*	*Contractor*
		ii)	*Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital*	
2.41	*Informatory Signs and Hoardings*	*i)*	*The contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language (Tamil) and any other appropriate language understandable to workers/communities, wherever required or as suggested by the Engineer.*	*Contractor/ GCC*
		ii)	*Informatory boards shall be well visible & safely erected & shall inform communities/road users of the woks and probable safety concerns and the emergency contact numbers (of site engineer, ambulance, police fire, electricity department / others) for the workers and the communities*	
2.42	*Disposal of Desilted/ excavated material, construction and other waste.*	*i)*	*Wastes generated may be considered for suitably reuse in the proposed construction, subject to the suitability of the materials with the approval of the engineer. The C&D wastes from dismantling of existing drains, existing bituminous surface debris etc may be considered for the paving of cross roads, access roads and paving works in construction camps, traffic diversion roads, haulage routes etc.,*	*Contractor / GCC*
		ii)	*Feasibility of reuse will be decided on case to case basis by the Engineer.*	
		iii)	*Unutilized debris materials shall be suitably disposed off by the contractor in dumpsites designated and conveyed to the contractor formally by GCC*	
		iv)	*Silt shall be transported immediately in covered skips with water collection arrangements to the disposal / storage point agreed with GCC. This shall be well stored with cut off drains / covers as appropriate considering the characteristics of the silt & disposal area. NO disturbance shall be caused to communities due to desilting, storage, transport or disposal of silt.*	
		v)	*The following shall be ensured during silt disposal*	
		vi)	*The storage or disposal does not impact natural resources or drainage courses*	

		vii)	No communities/road or area users, endangered / rare flora is impacted by such dumping	
		viii)	Should be located away from settlements so as not to cause any pollution or disturbance; or natural habitats including rivers, wetlands, other water bodies, forests etc. Preferably, designated area shall bein the downwind side of non-residential areas	
		ix)	avoid disposal on productive land should be located with the consensus of the local community, in consultation with the engineer	
		x)	All vehicles delivering material to the site shall be covered and with water collection arrangements to avoid water/material spillage	
2.43	Emergency Management	i)	Emergency numbers will be displayed at the construction sites and camp site,	Contractor
		ii)	First-Aid boxes will be made available at construction site and camp site.	
	Incident Reporting	iii)	Fire extinguishers for petroleum oil fire and electrical fire will be made available at camp site, fuel storage site, construction site etc	
		iv)	Train the labourers to take necessary measures during any emergencies in construction and inform the Engineer, others, etc and provide facility for the same	
		v)	Designated vehicles, which can be used as ambulance will be available at construction site at all the time in case of any mishap during construction	
		vi)	Entry of unauthorized persons should not be prevented	
		vii)	The contractor will maintain an Incident Register at the work site and labour camp recording all incidents with details type of incidents (indicative/ severe/ serious), cause of the incident, action taken, etc.	
		viii)	All incidents shall be reported to TNUIFSL in the subsequent reporting and fatalities shall be reported immediately.	
2.43	EHS personnel		Contractor shall have EHS personnel to supervise/monitor all works as per this EMP and all national/state regulations and requirements, and report to GCC on EMP & OHS on a weekly basis, for GCC's monthly reporting to TNUIFSL.	Contractor
2.44	Clearing of construction camps and		On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively	Prospective contract

	restoration		*sealed off and the site left clean and tidy, at the contractor's expenses, & restored to pre-project conditions*	*or*
2.45	*Project implementation*		*It shall be ensured that the Environmental, Health and Safety guidelines of World Bank are adhered to as applicable for activities during construction.*	*Contractor / GCC*
3.0	***OPERATION PHASE***			
3.1	*Maintenance*	*i)*	*It shall be ensured by the GCC that drains are not clogged.*	*GCC*
		ii)	*The following practices should be adopted in maintaining storm water drains:* *Drains shall be regularly inspected and cleaned especially prior to monsoons with suitable safety precautions/PPEs; preferably using mechanical means following the country regulation: Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.*	
		iii)	*All damaged or missing drain covers should be replaced immediately.*	
		iv)	*Debris and silt shall be mechanically removed and all workers shall be provided with PPEs and safety considerations (for communities & workers) while removing. Silt removed from the drainage system should not be left alongside the drain and shall be immediately stored/disposed in pre-identified appropriate site with necessary precautions/safeguards following all regulations and without pollution or disturbance to people, biodiversity.*	
		v)	*It shall be ensured that the Environmental, Health and Safety guidelines of World Bank (Generic and Water & Sanitation) are adhered to relevant activities during operation*	
3.2	*Impairment of receiving water quality due to mixing of waste water*	*i)*	*Avoid mixing of wastewater from household, commercial, industrial and other establishments, by regular monitoring, punitive actions and provision of services.*	*GCC*
		ii)	*Provision for connecting domestic liquid waste to sewerage system is to be made during drain construction to avoid mixing of waste water.*	
		iii)	*Periodical monitoring shall be carried out and sources of wastes/ effluent etc., are to be identified by the GCC. 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 rain water.	
		iv)	*In case of any industrial effluent identified, necessary action be taken in co-ordination with the TNPCB.*	
3.3	*Nuisance due to clogging of drains, formation of mosquito breeding grounds etc.,*	*i)*	*Ensure timely desilting of drains*	*GCC*
		ii)	*Create awareness among the people not to throw garbage and other waste into the drains*	
3.4	*Disposal of storm water*	*i)*	*Mixing of wastewater from households, commercial, industrial and other establishments will be avoided through improved sewerage system in the project area through periodical monitoring of water quality.*	*GCC*
		ii)	*Possibility of reusing the storm water for secondary uses with minimum treatment shall be explored and implemented*	
3.5	*Tree Planting & Protection*	*i)*	*Plantation of trees shall be carried out along the proposed streets or any other place possible like parks in the near by areas if resorted to tree cutting with the permission of Deputy Commissioner (Works), GCC*	*GCC*
		ii)	*Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered wherever necessary*	
		iii)	*Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years for the afforested trees. Survival status shall be monitored on monthly basis by Engineer in-charge and reported to Deputy Commissioner (Works), GCC.*	
3.6	*Flood management*		*Flood management system may be developed with forecasting and warning to protect areas prone to flooding and action be taken as necessary, like bailing out of water, relocation of residents to other locations etc.*	*GCC*
3.7	*Solid waste Management*	*i)*	*Provide additional bins in critical locations*	*GCC*
		ii)	*Ensure frequent collection and disposal of waste*	
		iii)	*Carryout periodical awareness programmes to educate the public/stakeholders*	
3.8	*Illegal Sewer line in Storm Water Drain*	*i)*	*Greater Chennai Corporation and CMWSSB have jointly taking action for plugging of sewer connections illegally letting into storm water drain*	

		ii)	*Fines are imposed against the peoples who are letting sewer into the storm water drain as per Government Order issued by Government of Tamil Nadu*	
3.9	*Safety requirements during maintenance*		*Follow country regulation on Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.* *A competent person should carry out a risk assessment and make recommendations on safety and health measures before undertaking work in confined space.* *Allow only certified workers to work in the confined space.* *Provide adequate ventilation.* *Isolate the confined space.* *Monitor the air quality throughout the entire working period by means of a gas detection device.* *A person should be stationed outside the confined space to monitor the weather condition and keep communication with the workers inside.* *if required ensure the use of approved breathing apparatus* *Appropriate emergency procedures shall be formulated to deal with serious or imminent danger.* *Instructions, training and advice shall be provided to all workers to be working within a confined space.* *Follow all labour laws; ensure PPEs, insurance, first aid, quick medical support etc, for the workers.*	*GCC*

9.3 Benefits of the project

The 60 lakhs people living in the project area will be benefited by the implementation of this project with reduction in inundation related issues.

Economic Benefits: Direct economic benefits such as the costs for the restoration of damaged roads, engaging earth work excavators, cost of pumping and associated fuel costs, the cost of materials such as sand bags, restoring cross drainages, small bridges etc will be reduced. Further, the cost of cash and kind reliefs to flood affected population, loss of livestock, and other structures will be reduced after implementation of SWD Project.

Further, indirect benefits such as improved health status of population due to

reduced risk of exposure to water borne diseases such as malaria, dengue and resultant health impacts.

9.4 Environmental Monitoring Plan

To monitor the extent of environmental impact of the proposed /implemented project, the contractor has to periodically monitor the ambient environmental quality along the proposed project area. The monitoring requirement for the different environmental components is presented in table below:

Air Quality Monitoring	
Project stage	Construction
Parameter	PM10, PM2.5, SO2, NOx, CO and Pb
Sampling Method	Use method specified by CPCB for analysis
Standards	Ambient Air Quality Standards, CPCB, 1994, Air (Prevention and Control of Pollution) Act,1981
Frequency	Once every season except monsoon during construction period
Duration	As per CPCB guidelines for monitoring
Location	Sensitive locations, especially in the downwind direction along the alignment.
Measures	Wherever air pollution parameters increase above specified standards, additional measures as decided by the engineer shall be adopted
Implementation	Contractor through approved monitoring agencies
Supervision	GCC or Through PMC
Water quality Monitoring	
Project stage	Construction & Operation period (as agreed)
Parameter	Parameters for Surface water quality standards (IS; 2296) Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb for groundwater.
Sampling Method	Grab sample to be collected and analysis as per Standard Methods for Examination of water and Waste water.
Standards	Indian standards for Inland Surface Water (IS; 2296, 1982) and for ground water

	Drinking water (IS; 10500,1991)
Frequency	Once every season during construction and during operation period.
Duration	Grab sampling
Location	Locationsrepresentingwaterqualityinthedrainandgroundwaterquality
Measures	At locations of variation in water quality/increased pollution, remedial measures to be adopted/all inflow channels shall be checked for pollution loads
Implementation	Contractor through approved monitoring agencies
Supervision	GCC or Through PMC
Noise Level Monitoring	
Project stage	Construction
Parameter	Noise levels on dB (A) scale.
Special guidance	• Free field at 1 m from the equipments whose noise level are being determined. • Equivalent noise levels using an integrated noise level meter kept at a distance of 15m from edge of pavement
Standards	National Ambient Air Quality Standards in respect of Noise, Noise Pollution (Regulation and Control) Rules, 2000
Frequency	Seasonal during construction period.
Duration	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged
Location	• Wherever the contractor decides to locate the equipment yard. At sensitive locations such as school,hospitalsetcalongthealignment.
Measures	Incaseofnoiselevelscausingdisturbancetothesensitiverceptors,managementmeasuresassuggestedintheEMPshallbecarriedout.
Implementation	Contractor through approved monitoring agencies
Supervision	GCC or Through PMC
Soil Quality Monitoring	
Project stage	Construction & Operation (as agreed)
Parameter	Soil quality parameters (Pb, SAR and Oil & Grease, monitoring silt for

	presence of toxic metals , etc)
Sampling Method	• Sample of soil collected to be acidified and analysed using absorption spectrophotometer
Standards	Threshold for each contaminated set by IRIS database of USEPA until national standards are promulgated
Frequency	• During the pre monsoon post monsoon seasons each year for the entire construction and operation phase
Duration	Grab sampling
Location	• At sample locations in the receiving water bodies, at the places of dumping silt, excavated earth.
Measures	At location of increased in pollution levels, source shall be identified and measures adopted.
Implementation	Contractor through approved monitoring agencies
Supervision	GCC or Through PMC

Apart from the above mentioned monitoring requirements, any major accidents /spillage during bulk transport of hazardous materials by the contractor, depending on the type of spillages / accidents, the parameters to be monitored will be decided by the engineer and should be carried out by the contractor through approved monitoring agencies and supervised by the Implementing agency at their own cost.

9.5 Formats for Reporting

Formats for reporting / monitoring the progress / parameters achieved will be finalized in consultation with the Engineer and will be reported to TNUIFSL to World Bank.

9.6 Environmental Compliance Report

The contractor shall submit a monthly progress report as per the reporting format approved by the Engineer on the status of the implementation of the EMP and get it duly approved by the Engineer for its compliance and for proceeding with the work. The Engineer and the Environmental and Social Safeguard (ESS) Manager, who will have access and authority to monitor the status based on the same and for which necessary facilities shall be made by the contractor.

9.7 Cost Estimates for Environmental Management Plan

The budget proposed for implementation of environmental management measures proposed in the construction of missing link SWD to selected areas (missing links) of GCC given below. The cost of Environmental management will be provided in the estimate.

Sl. No	Management Activities	Unit	Rate	Amount, (Rs.)	Reference to BOQ / Estimate
A.	**Design Phase**				
1	Cost for construction of Silt Catch Pit (SWD 29)	Nos	13985	33294436.24	Provision made in the Estimate
2	Cost for construction of Rain Water Harvesting Structure (SWD 30)	Nos	27197	36567659.63	Provision made in the Estimate
3	Cost for shifting of utilities	LS	1%	14325610.82	Provision made in the Estimate
B.	**During Construction Phase**				
1.	Sprinkling of water on the exposed site and dust suppression barriers to minimize the generation of dust and respirable suspended particulate matters	20000/-	Per month	860000	Provision made in the Estimate
2.	Compensatory plantation after the completion of the activity (plantation of 10 trees and landscaping works) including maintenance during O&M	LS	-	500000	Provision made in the lump sum.
3.	Provision of temporary barriers and proper signage for avoiding traffic congestion including traffic	LS	-	2820000	Provision made in the Estimate

	management measures				
5.	Provision of Proper drainage, sanitation along with water supply and temporary camps for habitation of labours	LS	-	800000	Included in conditions of contract
6.	Provision for temporary ramp arrangements to cross drains during execution	considered in the main project cost		10900000	Provision made in the Estimate
9.	Environmental Monitoring				
(i).	8 hourly Air Quality Monitoring (2 Monitoring stations in project area) four times during construction period (Total No. of Samples at 8Nos. Two stations =32)	Market Rate	Rs. 15000/ sample	480000	Provision made in the bill of quantities.
(ii).	Noise level Monitoring twice in a day (at 5 locations including construction sites) six times during construction period	Market Rate	Rs.500 for each monito ring	600000	Provision made in the bill of quantities
(iii).	Water Quality Monitoring (at 2 Monitoring station per water shed in the project area) twelve times during construction period (Total No. of Samples at 4 per watershed . TOTAL= 168	Market Rate	Rs. 10000/ sample	1680000	Provision made in the bill of quantities.
(iv).	Soil Quality Monitoring (10 stations per watershed of the project area including the silt dumping area,	Market Rate	Rs. 8000/ sample	1680000	Provision made in the bill of quantities

	three times during construction period (Total No. of Samples at 30 nos. per water shed =210)				
C.	**During Operational Phase**				
10.	Lead for disposal of wastes / silt from the drains	considered in the Operation and maintenance cost	LS	1000000	Provision made in the bill of quantities
11.	**Environmental Monitoring**				
(i).	Water Quality Monitoring (at 3 Monitoring stations in the project area) twice after construction period (Total No. of Samples at 6Nos.per zone= 36)	Market Rate	Rs. 10000/ sample	360000	Will be met under GCC fund.
(ii).	Soil Quality Monitoring (4 stations of the project area including the silt dumping area, once after construction period (Total No. of Samples at 4Nos.per zone=24)	Market Rate	Rs. 8000/ sample	192000	Will be met under GCC fund.
12.	**Training programs for the labourers**	LS		500000	Will be met under GCC fund.
14.	**Public Awareness and Capacity Building**	LS	-	500000	Will be met under GCC fund.
	Total			22872000	

9.8 Stake Holder Consultation

Stake holders meeting for the missing link project under World Bank under TNSUDP was conducted in various streets with the stake holders, CMWSSB, Local Resident Welfare Association and the Resident Public extensively.

All the Resident Welfare Association, Resident Public and other stake holders have accepted the proposals of the construction of missing link storm water drain for relieving of rain water stagnation in various streets in Zone 4,5,6,8,9,10 and 13. RWH have requested for avoiding rain water stagnation.

It was explained in detail about the project of missing link storm water drain that the project was taken up for free flow of rain water to the disposal storm water drain and to the major water ways and that the work will be carried out following the EMP measures as specified on the Indian Standards and all the safety measures to the public.

All the public has appreciated and welcomed the project of missing link storm water drain and that this will prevent rain water stagnation.

9.9 Implementation Monitoring / GRC

GCC has proposed to take up the Missing links Storm Water Drainage (SWD) project to selected stretches through its Storm Water Drain Department. The project has a total of 43 packages at an estimated project cost of Rs. 11993 Lakhs (119.93 crores). The Environmental Management Plan identified for the construction will be included in the bid documents for ensuring implementation of the environmental safeguards. The management measures identified for the operation phase will be taken up by the GCC upon completion of construction activities under Revenue fund.

GCC has proposed to engage Project Management Consultants (PMC) for managing the missing links SWD Project for the core city areas of GCC. The PMC will include Environmental and Social safe gaurd specialists as part of the team to monitor the day to day activities.

The GCC will have a two level Grievance Redressal Mechanism (GRC) to handle the grievances of the project affected persons if any and for all the grievances relating to the implementation of missing links Storm Water Drain project.

The project level GRC will have The Zonal Officer /Assistant Commissioners of GCC, Any one elected representative, A person who is publicly known in the local area and Superintending Engineer (SWD) (Convener). The Appellate level GRC will

constitute Deputy Commissioner (Works) and Regional Deputy / Joint Commissioners (Central/South/North) Superintending Engineer/SWD. GCC shall submit monthly reports on the status of compliance with the ESMF requirements to TNUIFSL.

Missing Link Storm Water Drain has been proposed after extensive study of existing storm water drain and missing link portions in 144 locations scattered in Zone 4, 5, 6, 8, 9 & 13 where disposal are connected to the existing storm water drain which has been finalized after repeated request from Resident Welfare Association, MLA's of the proposal location.

Annexures (Attached Separately)

Annexure I - Environmental Screening

Annexure II- Stakeholder Consultation