

Initial Environmental Examination

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**IND: Tamil Nadu Urban Flagship Investment Program
– Providing Comprehensive Water Supply Scheme to
Mathur, Madipakkam, Jalladampettai and Uthandi in
Chennai City**

Prepared by Chennai Metropolitan Water Supply and Sewerage Board of the Government of Tamil Nadu for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 11 May 2018)

Currency unit	–	Indian rupee (₹)
₹1.00	–	\$0.015
\$1.00	=	₹67.09

ABBREVIATIONS

ADB	–	Asian Development Bank
CMSC	–	construction management and supervision consultant
CMWSSB	–	Chennai Metropolitan Water Supply and Sewerage Board
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DPR	–	detailed project report
EAC	–	expert appraisal committee
EHS	–	environmental, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ESS	–	environmental and social safeguards
IEE	–	initial environmental examination
MFF	–	multitranchise financing facility
NOC	–	no objection certificate
OHS	–	occupational health and safety
OHT	–	overhead tank
PIU	–	program implementation unit
PMU	–	program management unit
REA	–	rapid environmental assessment
ROW	–	right-of-way
SPS	–	Safeguard Policy Statement
STP	–	sewage treatment plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNUFIP	–	Tamil Nadu Urban Flagship Investment Program
TNUIFSL	–	Tamil Nadu Urban Infrastructure Financial Services Limited
UGT	–	underground tank
ULB	–	urban local body
WHO	–	World Health Organization
WTP	–	water treatment plant
WDS	–	water distribution station

WEIGHTS AND MEASURES

°C	degree Celsius
km	kilometer
lpcd	litres per capita per day
m	meter
MLD	million liters per day
mm	millimeter
km ²	square kilometer

NOTE

In this report, "\$" refers to United States dollars.

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EXECUTIVE SUMMARY

The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance. TNUFIP is aligned with the following impacts: (i) universal access to basic water and sanitation services achieved, (ii) world-class cities and industrial corridors across the State developed, and (iii) water security, reduced vulnerability to climate change in urban areas, and enhanced share of renewable energy achieved. TNUFIP will have the following outcomes: livability and climate resilience in at least ten cities in priority industrial corridors enhanced.

The TNUFIP is structured under three outputs: (i) climate-resilient sewage collection and treatment, and drainage systems developed in at least eight cities; (ii) water supply systems in at least five cities improved with smart features; and (iii) institutional capacity, public awareness, and urban governance strengthened. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB) via its multitranche financing facility (MFF).

The Subproject. Chennai is the fourth largest Metropolitan city in India. In 2011, the Chennai City has been expanded to 426 square kilometers (km²) from 176 km² by the annexure of 42 adjacent Urban Local Bodies. The entire erstwhile Chennai city had been provided with water supply and sewerage facilities. Hence CMWSSB has proposed to provide water supply and sewerage facilities in all the 42 added areas of Chennai city on par with erstwhile Chennai City. In the expanded Chennai city, at present water supply scheme has been completed in 9 added areas and in 27 added areas water supply schemes are under implementation. For the balance 6 added areas DPR for water supply scheme has been prepared. Now, under the TNUFIP, it is proposed to provide water supply schemes in 4 added areas namely Mathur, Madipakkam, Jalladampettai and Uthandi having an extent of 2.98 km², 3.40 km², 2.28 km² and 3.41 km² respectively totalling to 12.07 km². The total road infrastructures available in the above four locations is around 207 km. The components of proposed water supply scheme includes: (i) water distribution station (WDS) at Mathur Zone II, which include 200 kl (kiloliter) capacity underground tank (UGT), and 1200 kl capacity overhead tank (OHT), and a pump house, (ii) WDS at Madipakkam, which include 900 kl UGT, 5,000 kl OHT and a pump house, (iii) WDS at Jalladampettai, which include 200 kl UGT, 1,300 kl OHT, and a pump house, (iv) WDS at Uthandi, which include 200 kl UGT, 800 kl OHT, and a pump house, (v) distribution network of total length 219.80 km of ductile iron (DI) pipes of diameter 100-900 millimeters (mm) covering all four water supply schemes, and (vi) 23,716 house service connections.

Since it is proposed to source treated water from the existing water treatment plants, subproject proposals do not include source or treatment infrastructure. The subproject will essentially tap treated water from the existing water mains carrying water from the treatment plants, and supply to the subproject areas.

Project implementation arrangements. The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) is the state-level executing agency. A program management unit (PMU) will be established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from CMWSSB), and comprising dedicated full-time

staff from TNUIFSL for overall project and financial management. Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) is the project implementing agency (PIA) for this subproject. A program implementation unit (PIU) will be established in CMWSSB headed by a Chief Engineer and comprising dedicated full-time staff of the CMWSSB for day-to-day implementation of the subproject. PIU is assisted by Construction Management and Supervision Consultant (CMSC) in implementation. Environmental and social safeguards (ESS) managers in PMU/TNUIFSL will coordinate all the safeguard related activities of the subproject and will ensure the compliance with EMP and environmental assessment and review framework (EARF). Environmental Specialist of the CMSC will assist PIU in implementation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks.

Screening and Assessment of Potential Impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As per the Government of India Environmental Impact Assessment (EIA) Notification, 2006, this subproject do not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment (REA) Checklist for Sewerage. The potential negative impacts were identified in relation to pre-construction, construction and operation.

Categorization. Based on results of the assessment and ADB Safeguard Policy Statement (SPS), 2009, the subproject is classified as environmental Category B, subproject potential adverse environmental impacts are less adverse than those of category A, and are site-specific, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

Description of the Environment. Subproject components are located in outer areas of Chennai City which are added to Chennai Corporation limit in 2011. Subproject included water supply distribution schemes in the areas of Mathur, Madipakkam, Jalladampettai and Uthandi. Mathur is located in the northern outskirts of Chennai City, while the rest three are located in the southern outskirts. Uthandi area abuts the Bay of Bengal Coast. Subproject components include UGT, OHT, laying of conveying main from conveying main to UGT, laying of distribution network in the entire streets of subproject area. Water distribution mains will be laid along the edge of public roads, within the road carriage way, and UGT and OHT will be constructed on identified government owned vacant lands which are located in residential areas. Since the Mathur is in the status of Town Panchayat and Madipakkam, Jalladampettaia and Uthandi areas are in the status of Village Panchayat prior to merger with Chennai city, most of the roads and streets are narrow and are moderately populated. Within the project area there are no sensitive areas like forest or protected areas or nationally important/protected monuments. No eco sensitive areas are located in the subproject area. Pallikaranai Marsh Land, a wetland, is located outside the subproject area of Madipakkam. No works are located in the wetland area.

Potential Environmental Impacts and Mitigation Measures. The subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented because: (i) the components will involve straightforward construction and operation, so impacts will be mainly localized; (ii) there are no significant sensitive environmental features in the project sites, although careful attention needs to be paid to minimizing disruption to population of urban area and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation and earth movements.

Providing comprehensive water supply scheme will ensure adequate supply of clean and good quality of treated water for the entire community thereby enhancing the quality of life of the residents in the sub project area. Hence, the subproject is likely to have numerous positive impacts on the environment and public health. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Water Supply Head works are located within the project area and water will be received and supplied throughout the day and therefore no impact envisaged. Due to design considerations and land constraints, headwork sites are located near residential areas.

No new source augmentation and Water Treatment Plant is included in the subproject as it is proposed to utilize the available water from the existing two 100 million liters per day (MLD) capacity Desalination plants at Minjur and Nemmeli. According to technical studies, existing capacity is adequate to meet the water demand of the subproject area. The water supply for Mathur will be made from Madhavaram Booster station which receives water from existing 100 MLD Minjur Desalination Plant. For Madipakkam, Jalladampettai and Uthandi, water supply will be made from 100 MLD existing Nemmeli desalination plant. Quality of water from the desalination plants and at receiving points are checked by the Quality Assurance wing of CMWSSB daily per Indian drinking water standards/World Health Organization (WHO) norms. The treated water quality from these plants is in compliance with the WHO and Indian standards.

Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. Various measures suggested includes buffer around the pumping stations, imparting necessary training; safety and personal protection equipment for workers, etc.

Potential impacts during construction are considered significant but temporary, and are common impacts of construction in urban areas, and there are well developed methods to mitigate the same. Except laying of conveying main and distribution main, all other construction activities (UGT, OHT and pumping stations) will be confined to the selected sites, and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material from the existing government licensed mining areas, occupation health and safety aspects. Laying of pipe line will be conducted along the edge of public roads in an urban area congested with people, activities and traffic. Most of the Chennai city area has high density population, very narrow roads and congested with traffic, people and activities. Therefore water pipe laying will have significant impacts arising mainly: from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to trench excavations in the road; access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

Environmental Management Plan. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels, along with the delegation of responsibility to appropriate agency. As stated above, various design related measures are already included in the project design. During construction, the EMP includes mitigation measures such as (i) proper planning of pipe laying works to minimize the public inconvenience (ii) barricading, dust suppression and control measures; (iii) traffic

management measures for works along the roads and for hauling activities; (iv) provision of walkways and planks over trenches to ensure access will not be impeded; and (iv) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

The EMP is included in the bid and contract documents to ensure compliance to the conditions set out in this document. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per EMP. No works are allowed to commence prior to approval of SEMP. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times.

Consultation, Disclosure and Grievance Redress Mechanism. The stakeholders were involved in developing the IEE through discussions on-site and a public consultation workshop at project area level, after which views expressed were incorporated into the IEE and in the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB, CMWSSB and TNUIFSL websites. The consultation process will be continued during program implementation. A grievance redress mechanism (GRM) is described within the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting. Contractor will submit a monthly EMP implementation report to PIU. PIU will monitor the compliance of Contractor, prepare a Quarterly Environmental Monitoring Report and submit to PMU. The PMU will oversee the implementation and compliance, and will submit semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on CMWSSB and TNUIFSL websites.

Conclusions and Recommendations. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. Subproject do not include any source augmentation or treatment facilities, as the treated water is sourced directly from the existing water treatment plants (desalination plants). These are existing related facilities to the subproject project, and environmental audit indicate no notable issues of concern, these facilities have necessary permits/licenses and the water produced meets the drinking water standards (IS 10500).

This IEE shall be updated by PIU during the implementation phase to reflect any changes, amendments and will be reviewed and approved by PMU.

I. INTRODUCTION

A. Background

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance.

2. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB) via its multitranche financing facility (MFF). The executing agency is the Department of Municipal Administration and Water Supply (MAWS) of the State acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) who will establish a program management unit (PMU). The urban local bodies (ULBs) will be the implementing agencies for projects and will establish program implementing units (PIU).

3. TNUFIP is aligned with the following impacts: (i) universal access to basic water and sanitation services achieved; (ii) "world-class" cities and industrial corridors across the state developed; and (iii) water security, reduced vulnerability to climate change in urban areas, and enhanced share of renewable energy achieved. The investment program will have the following outcome: livability and climate resilience in at least 10 cities in priority industrial corridors enhanced. The TNUFIP is structured under following three outputs:

- (i) **Output 1: Climate-resilient sewage collection and treatment, and drainage systems developed in at least eight cities.** This includes (i) 187 million liters per day (MLD) of new and 155 MLD of rehabilitated sewage treatment capacity developed, with solar power systems installed for STP operations on a pilot basis; (ii) treated wastewater reused for industrial purposes in selected areas; (iii) 2,810 kilometers (km) of sewage collection pipelines constructed, with 426,600 households connected; (iv) 173 sewage pumping stations with a combined capacity of 6,390 kilowatts (kW) constructed; (v) 20 all-female community water and sanitation committees formed; and (vi) climate-resilient drainage and flood management systems (250 km of tertiary and 50 km of primary and secondary drains) established in selected cities.¹
- (ii) **Output 2: Water supply systems in at least five cities improved with smart features.** This includes (i) smart water supply distribution systems (1,520 km pipelines) established within 110 new district metered areas (DMAs) to reduce NRW and provide regular water supply, with 100% of households (total of 171,000) connected; (ii) 120 km of transmission mains built; (iii) 30 pump stations (1,530 kW capacity) constructed; and (iv) 40 water storage reservoirs (combined capacity of 70 million liters), covering Chennai, Coimbatore, Cuddalore, Tiruppur, and Thoothukudi.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes (i) establishing within CMA (a) a new state-level urban data and governance improvement cell, and (b) a new project design and management center; and (ii) implementing (a) state-wide performance-based

¹ The eight cities are Ambur, Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, Tirupur, and Vellore. Drainage systems are proposed in Chennai, Cuddalore, and Thoothukudi.

urban governance improvement program for Tamil Nadu's 135 cities to improve revenue, financial management, administration, service delivery, gender mainstreaming, wastewater reuse, and fecal sludge management; and (b) public awareness campaigns on water conservation, sanitation, and hygiene in project cities. The program will intensify the capacity building of key urban institutions and continue providing incentives for urban governance improvement. Project design consultants will be recruited by the PMU to prepare new projects in subsequent tranches that meet ADB requirements.

4. **Scope of Project 1.** Tranche 1 is representative of MFF investments and will support subprojects in 6 cities (Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, and Vellore). Outputs of tranche 1 include:

- (i) **Output 1: Climate-resilient sewage collection and treatment, and drainage systems developed in six cities.** This includes (i) five new STPs with a combined treatment capacity of 165 MLD constructed, including one STP with a 2-megawatt solar photovoltaic system installed to power its operations; (ii) one STP (37 MLD capacity) rehabilitated; (iii) 8,000 cubic meters treated wastewater reused per day; (iv) 1,860 km of new sewage collection pipelines constructed, with 100% households connected (297,547 households); (v) 124 pump/lift stations (combined capacity of 4,473 kW) constructed; and (vi) 12 all-female community water and sanitation committees formed. The breakdown by city is: (i) new Tirunelveli—sewage collection system and 32 MLD STP (to supply treated wastewater for industrial reuse) constructed;² (ii) new Coimbatore sewage collection system and 30 MLD STP, with a 2-megawatt solar photovoltaic system, constructed;³ (iii) new Tiruchirappalli—sewage collection system with 30 MLD STP constructed and existing 37 MLD STP rehabilitated; (iv) new Vellore—sewage collection system and 50 MLD STP constructed; (v) new Chennai—sewage collection systems constructed in four areas in Chennai; and (vi) new Rajapalayam sewage collection system and 21 MLD STP constructed. In addition, in each city, two all-female community water and sanitation committees will be formed.
- (ii) **Output 2: Water supply systems in one city improved with smart features.** Four areas in Chennai will have (i) 275 km of distribution pipelines constructed, with 100% metered connections (30,800 households) in 20 newly established DMAs to manage and reduce NRW;⁴ (ii) 11 km of new transmission pipes constructed; (iii) nine new storage reservoirs (four underground and five overhead) of combined capacity of 11 million liters constructed; and (iv) five pump stations (combined capacity of 230 kW) constructed.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes (i) establishing within CMA (a) a new state-level urban data and governance improvement cell, (b) a new project design and management center, and (c) a state-wide performance-based urban governance improvement program implemented for all 135 cities to improve financial management (audited accounts), municipal revenues (taxes and user fees), municipal administration (filling vacancies), and gender mainstreaming (gender

² Tirunelveli signed a purchase agreement for treated effluent from the proposed STP with an adjoining industrial park.

³ This pilot project will (i) produce 90% of the STP's energy requirement; (ii) reduce 72% of annual energy charges; and (iii) avoid 3,400 tons of carbon dioxide equivalent of emissions per year.

⁴ Smart water features in Tranche 1 include online automatic pressure sensors and flow meters, 100% household metered connections using DMA-based distribution management, and energy-efficient water pumps.

action plan);⁵ and (ii) public awareness campaigns on water conservation, sanitation, and hygiene implemented. Governance improvement and awareness consultants will support output 3.

5. Chennai city is the capital of Tamilnadu and is the fourth largest metropolitan city in India. The water supply and sewerage facilities are existing in Chennai city for more than a century. In 2011, the Chennai City has been expanded to 426 km² from the existing 176 km² by the merger of 42 adjacent Urban Local Bodies having a population of 67.27 Lakhs (as per 2011 Census). The entire erstwhile Chennai city had been provided with water supply and sewerage facilities. Hence, Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has proposed to provide water supply and sewerage facilities in all the 42 added areas of Chennai city on par with erstwhile Chennai City. In the expanded Chennai city, at present providing Water Supply Scheme had been completed in 9 added areas and in 27 added areas Water Supply schemes are under implementation. For the balance 6 added areas, DPRs for providing Water Supply Scheme has been prepared. Now, under AMRUT and ADB financial assistance, it is proposed to take up the Water Supply Schemes in 4 added areas namely Mathur, Madipakkam, Jalladampettai and Uthandi covering an extent of 12.03 km² having road infrastructures for a total length of about 213 km. Subproject includes the following components: (i) water distribution station (WDS) at Mathur Zone II, which include 200 kl capacity underground tank (UGT), and 1200 kl capacity overhead tank (OHT), and a pump house, (ii) WDS at Madipakkam, which include 900 kl UGT, 5,000 kl OHT and a pump house, (iii) WDS at Jalladampettai, which include 200 kl UGT, 1,300 kl OHT, and a pump house, (iv) WDS at Uthandi, which include 200 kl UGT, 800 kl OHT, and a pump house, (v) distribution network of total length 219.80 km of ductile iron (DI) pipes of diameter 100-900 mm covering all four water supply schemes, and (vi) 23,716 nos. house service connections. It is proposed to supply water from the existing 100 MLD capacity Desalination plants at Minjur and Nemmeli. By implementing this water supply scheme, the public of Mathur, Madipakkam, Jalladianpet and Uthandi will get protected water supply thereby the environmental and health condition of about 1.10 Lakh population residing in the sub project area will be improve.

B. Purpose of this Initial Environmental Examination Report

6. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment checklist for water supply (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

7. This IEE is based on the detailed project report prepared by CMWSSB. The IEE was based mainly on field reconnaissance surveys and secondary sources of information. No field monitoring (environmental) survey was conducted, however, the environmental monitoring program developed as part of the environmental management plan (EMP) will require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the

⁵ Details are in the Facility Administration Manual and Attached Technical Assistance Report (accessible from the list of linked documents in Appendix 2).

basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE.

C. Report Structure

8. This report contains the following ten sections including the executive summary at the beginning of the report:

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

II. DESCRIPTION OF THE PROJECT

A. Project Area

9. Chennai City, capital of Tamil Nadu, has been expanded from 176 km² to 426 km² by annexing the 42 adjacent local bodies during the year 2011. Since then CMWSS Board has initiated action to provide water supply schemes and underground sewerage schemes in all the newly added 42 (erstwhile) local bodies on priority basis as well as to other areas within Chennai Metropolitan Area. The population of the expanded Chennai city is about 6.73 million as per 2011 census. Under the present project proposal it is proposed to provide water supply schemes to Mathur, Madipakkam, Jalladampettai and Uthandi covering an extent of about 12.07 km². The total length of road in the project area is about 214 km. The present water supply scheme proposal includes: (i) construction of head works, (ii) construction of UGT and OHT, (iii) laying of conveying main from transmission main to UGT, and (iv) laying of distribution network for a total length of 219.80 km.

B. Existing Water Supply System

10. The entire core Chennai city has 176 km² of water supply distribution system. For equitable distribution of water supply, Core Chennai has been divided in to 16 zones and each zone has its independent headwork, which receives water from dedicated supply source. Similarly, the entire 42 added areas are designed as independent water supply zones and each zone receives water from the dedicated source through the existing Transmission main running along the added area.

11. The existing water supply system in subproject areas namely Mathur, Madipakkam, Jalladampettai and Uthandi are developed by Village panchayats and are mostly supplied with ground water as source. Apart from this treated water from CMWSSB source is being supplied through mobile lorry supply and through water tanks erected at required places.

12. In Mathur, a part of the area was developed by Madras Metropolitan Development Authority (MMDA layout area) and in these area water supply infrastructures like UGT, OHT, Pumphouse and distribution system were provided during the development of the layout. The

existing source of water for this Headwork is from 300MLD Water Treatment Plant. With the existing 21 lakh liters capacity UGT, 10.50 lakh litre OHT and pumphouse structures are still in good condition, these infrastructure have been proposed to supply water to parts of the area. Currently, there are about 5,050 house service connections in the area. Regarding the distribution pipeline, the existing pipes of various sizes ranging from 100 mm to 300 mm dia and 24.50 km long have been deemed replaceable with new Ductile Iron pipes. The rest of the Mathur area does not have any organized water distribution system. In these areas, potable water is being supplied through 3,000 litre capacity HDPE tanks provided at vital locations which are being filled with water lorries daily. In addition, ground water is being extracted from bore wells and pumped into localized small capacity elevated water tanks and distributed through 50 mm to 90 mm dia PVC pipes and supplied through public stand posts.

13. In Madipakkam, water supply is being maintained by CMWSSB utilizing the water supply infrastructure already developed by the erstwhile Madipakkam Village Panchayat. The source of water is from bore wells and also through mobile water supply from CMWSSB source. Ground Water is pumped from bore wells to the existing small capacity localized small OHTs having capacities ranging from 0.6 LL to 1.0 LL. Water stored in these overhead tanks is being distributed through 50mm to 90 mm dia PVC pipes and supplied through stand post. Apart from this, most of the houses have their own sources such as open wells and bore wells to cater to their daily requirements.

14. The existing source of water supply for Jalladampettai is from open wells and bore wells with hand pumps. Ground water is being pumped into the localized small capacity overhead tanks with capacities ranging from 0.6 LL to 1.0 LL. Water stored in these overhead tanks is being distributed through 2" to 4" dia PVC pipes for a length of 25 km and water is being supplied through stand posts. Apart from this, treated water is being supplied from CMWSSB source through 3,000 litres capacity HDPE tanks placed at vital points of streets and water is being filled daily.

15. In Uthandi, CMWSSB maintains the water supply with the existing infrastructure already developed by the erstwhile Uthandi Village Panchayat. The source of Water is from bore wells. Water is pumped from bore wells to the existing smaller capacity localized OHTs with distribution system consist of smaller size PVC pipes for a length of 9.77 km and distributed through stand posts.

C. Proposed Water Supply Scheme

16. CMWSSB takes on the water supply scheme for the expanded area in a phased manner. Out of the 42 added areas of Chennai City, water supply scheme has been completed in Thiruvottiyur, Kathivakkam, Ambattur, Maduravoyal, Valasaravakkam, Porur, Alandur, Meenambakkam and Injambkkam. In the 27 added areas, water supply schemes are under progress. For the remaining 6 added areas namely Mathur, Madipakkam, Jalladampettai, Neelankarai, Uthandi and Semmancheri, DPR has been prepared. For these 6, it is proposed to takeup the work in Mathur, Madipakkam, Jalladianpetai and Uthandi under AMRUT/ ADB financial assistance.

17. Water demand for the four sub project areas is at 25.68 MLD for the intermediate year and 36.47 MLD for the ultimate year. The existing Minjur and Nemmeli desalination plants will be utilized to meet aforementioned demand, as the two plants have sufficient capacity to meet the ultimate demand of subproject areas.

18. CMWSSB is the agency responsible for providing water supply and sewerage schemes in the Chennai Metropolitan Area. CMWSSB is also the implementation agency for this subproject. Detailed project report for the proposed water supply scheme has been prepared by CMWSSB.

D. Proposed Project

19. The following table shows the nature and size of the various components of the subproject. Water supply scheme is designed for Mathur, Madipakkam, Jallaadampettai and Uthandi as separate water supply zones. Each zone has its own UGT to receive water from designated source, overhead tank and distribution pipeline. The scheme has been designed to supply water at the rate of 150 liters per capita per day. The distribution system is designed in such a way that minimum residual head available at the consumer end is at 12 m pressure. Water supply for Mathur area is proposed to be supplied from Minjur Desalination plant. The desalination plant at Minjur was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSSB had entered in to a Bulk Water Purchase Agreement (BWPA) with M/S Chennai Water Desalination Limited (M/s CWDL). The product water is being purchased by CMWSSB and supplied to the north Chennai areas. Water supply for Madipakkam, Jalladampettai, and Uthandi areas are proposed to be supplied from desalination plant at Nemmeli, maintained by CMWSSB. The treated water from Nemmeli desalination plant has been conveyed through 1000 mm dia transmission main to supply Southern parts of Chennai city including subproject areas.

Table 1: Proposed Water Supply Subproject Components

Infrastructure	Function	Description	Location
Water Distribution Station (WDS)	To receive adequate quantity of water from designated source and provide un interrupted supply to the project area.	Mathur Zone I: Existing water distribution station (comprises of an underground tank, overhead tank and pump houses to be utilized) will be utilized; existing old pumping machinery will be replaced under the subproject. Mathur Zone II: Construction of: <ul style="list-style-type: none"> • 200kl capacity underground tank (UGT), and • 1200kl capacity overhead tank (OHT) • Pump house with pumping machinery (Source of treated water: 8.20 MLD water from existing 100 MLD desalination plant at Minjur through existing 600 mm dia pipe at Kamarajarsalai from Madhavaram Booster).	Zone-I: Existing WDS at MMDA Layout, Kamarajar 2 nd Main road Zone-II proposed at CPCL at layout
		Madipakkam: Construction of <ul style="list-style-type: none"> • 900kl capacity UGT, and • 5,000kl capacity OHT • Pump house with pumping machinery (Source of treated water: 20.13 MLD of water from existing 100 MLD desalination plant at Nemmeli through existing 800 mm dia pipe at Velachery main road)	WDS proposed at vacant site belongs to GCC at Velachery main road.
		Jalladampettai: Construction of <ul style="list-style-type: none"> • 200 kl capacity UGT, and • 1,300kl capacity OHT • Pump house with pumping machinery 	WDS proposed at Raghavendra colony main road

Infrastructure	Function	Description	Location																																																				
		<p>(Source of treated water: 4.70 MLD of water from existing 100 MLD desalination plant at Nemmeli through existing 800 mm dia pipe at Velachery main road)</p> <p>Uthandi: Construction of</p> <ul style="list-style-type: none"> • 200kl capacity UGT, and • 800kl capacity OHT • Pump house with pumping machinery <p>(Source of treated water: 3.45 MLD of water from existing 100 MLD desalination plant at Nemmeli through existing 1000 mm dia pipe on East Coast Road)</p>	WDS proposed at Gangaianman Koil street																																																				
Distribution network	Distribution of protected water at consumer end at 12.0 m (Minimum) residual head	<p>Total length of Distribution system: 219.80 km; Size: 100-900 mm dia: Material: Ductile pipe</p> <p><i>Mathur:</i> Distribution system in Mathur consist of Ductile Iron pipes of dia ranging from 100 mm to 500 mm for a length of 51.99 km.</p> <p><i>Madipakkam:</i> Distribution system in Madipakkam consist of Ductile Iron pipes of dia ranging from 100 mm to 900 mm for a length of 96.17 km.</p> <p><i>Jalladampettai:</i> Distribution system in Jalladampettai consist of Ductile Iron pipes of dia ranging from 100 mm to 450 mm for a length of 36.15 km.</p> <p><i>Uthandi:</i> Distribution system in Uthandi consist of Ductile Iron pipes of dia ranging from 100 mm to 400 mm for a length of 35.48 km.</p> <table border="1"> <thead> <tr> <th>Dia mm</th><th>Length (m)</th><th>%</th><th>Material</th></tr> </thead> <tbody> <tr><td>100</td><td>163268</td><td>74.29</td><td>DI</td></tr> <tr><td>150</td><td>24484</td><td>11.14</td><td>DI</td></tr> <tr><td>200</td><td>14565</td><td>6.63</td><td>DI</td></tr> <tr><td>250</td><td>4579</td><td>2.05</td><td>DI</td></tr> <tr><td>300</td><td>4349</td><td>1.95</td><td>DI</td></tr> <tr><td>350</td><td>1910</td><td>0.87</td><td>DI</td></tr> <tr><td>400</td><td>540</td><td>0.25</td><td>DI</td></tr> <tr><td>450</td><td>1087</td><td>0.49</td><td>DI</td></tr> <tr><td>500</td><td>121</td><td>0.05</td><td>DI</td></tr> <tr><td>600</td><td>2000</td><td>0.90</td><td>DI</td></tr> <tr><td>900</td><td>2900</td><td>1.30</td><td>DI</td></tr> <tr><td></td><td>219803</td><td></td><td></td></tr> </tbody> </table>	Dia mm	Length (m)	%	Material	100	163268	74.29	DI	150	24484	11.14	DI	200	14565	6.63	DI	250	4579	2.05	DI	300	4349	1.95	DI	350	1910	0.87	DI	400	540	0.25	DI	450	1087	0.49	DI	500	121	0.05	DI	600	2000	0.90	DI	900	2900	1.30	DI		219803			Distribution system pipes will be laid along the edge of the roads in the project areacoveringMathur, Madipakkam, Jalladampettai and Uthandi,These four added areas of Chennai city is moderately populated.
Dia mm	Length (m)	%	Material																																																				
100	163268	74.29	DI																																																				
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House service connections	Supply water to the individual premises	<p>23,716no,s (domestic& commercial)</p> <ul style="list-style-type: none"> • Mathur: 7407 Nos. • Madipakkam – 10294 Nos • Jalladampettai -4044 Nos • Uthandi – 1971 Nos 	Provision has been given from distribution main to property boundary.																																																				

Figure 1: Map showing Water Distribution Network in Mathur

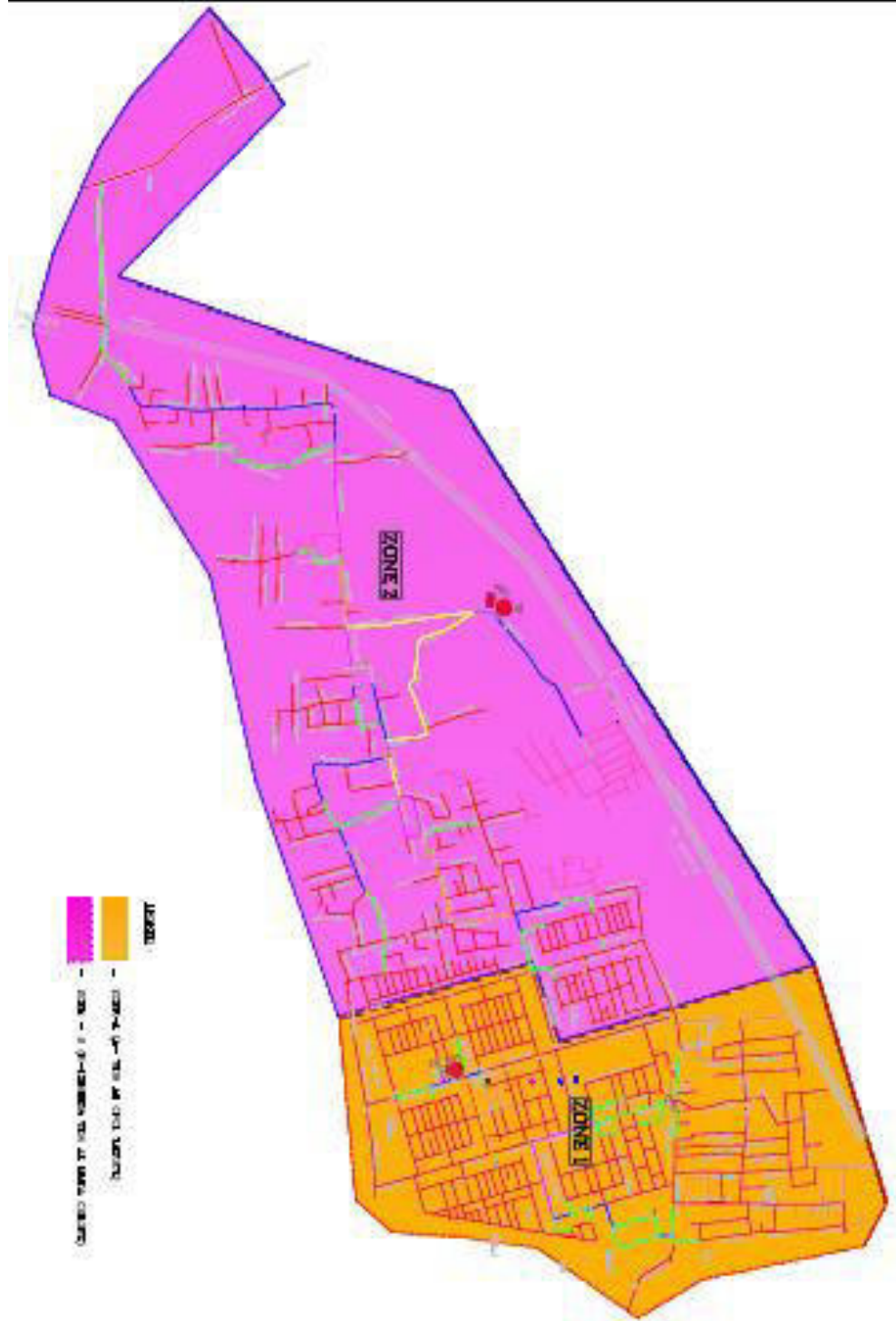


Figure 2: Map showing Water Distribution Network in Madipakkam



Figure 3: Map showing Water Distribution Network in Jalladampettai

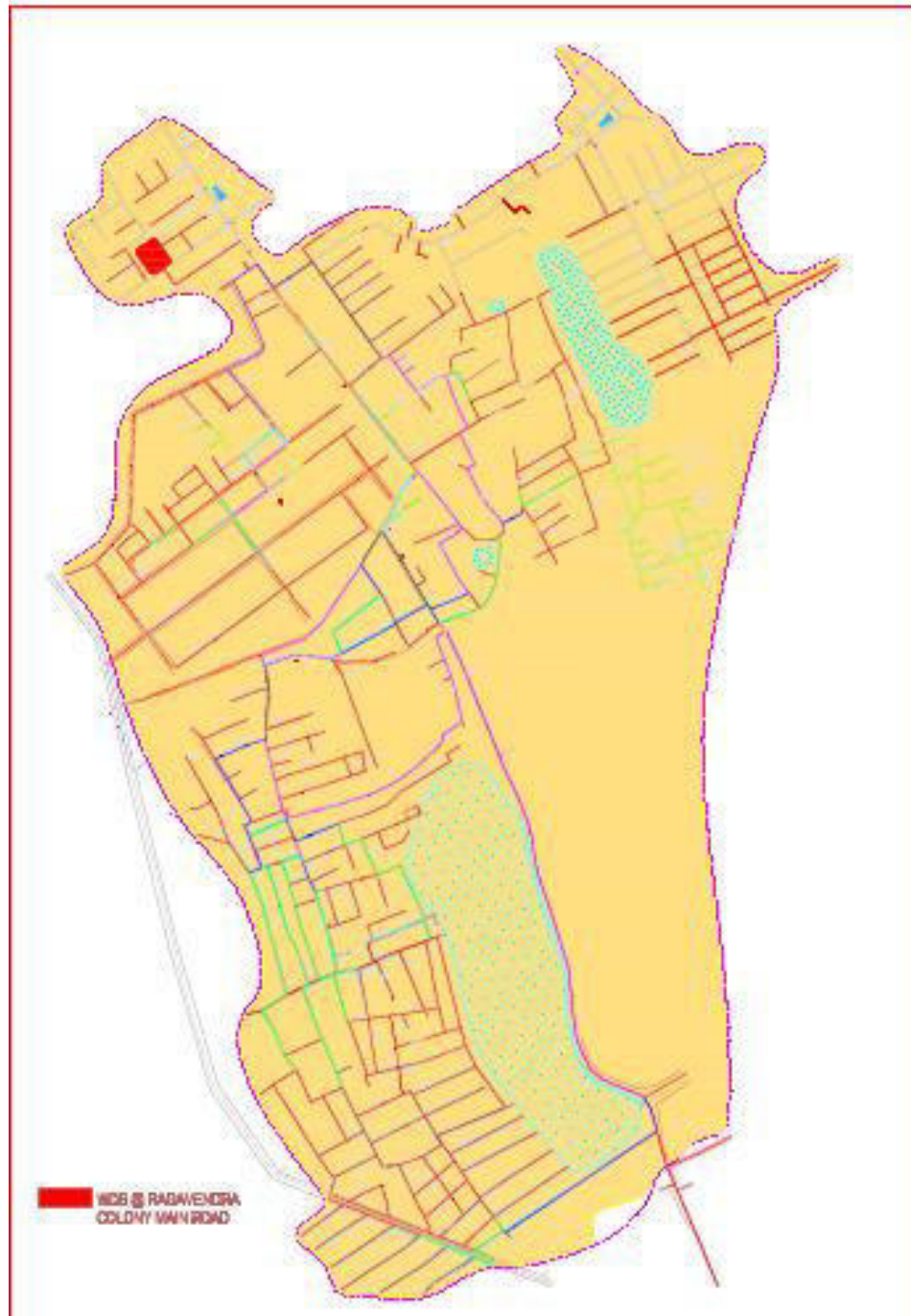


Figure 4: Map showing Water Distribution Network in Uthandi



E. Implementation Schedule

20. Bids for water supply schemes will be invited in February 2018, and the contract will be awarded by July 2018. Construction is likely to start in Aug 2018, and will take about 24 months to complete.

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

21. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

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

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

23. **Environmental Management Plan.** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

24. **Public Disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

- (i) final or updated IEE upon receipt; and
- (ii) environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

B. National Environmental Laws

25. **Environmental Assessment.** The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition)

may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

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

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

28. None of the components of this water supply scheme subproject falls under the ambit of the EIA Notification 2006, and, therefore EIA Study or Environmental Clearance is not required for the subproject.

29. **Applicable Environmental Regulations.** Besides EIA Notification 2006, there are various other acts, rules, policies and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in Table 2.

Table 2: Applicable Environmental Regulations

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require Consent to Establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and Consent to Operate (CTO) before commissioning.	No new water treatment plant (WTP) proposed in the subproject. The desalination plant at Minjur was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSS Board had entered in to a Bulk Water Purchase Agreement (BWPA) with M/S Chennai Water Desalination Limited (M/s CWDL). As per the BWPA, all the statutory clearances have been obtained by M/s CWDL for this plant. The Nemmeli desalination plant with 100 MLD capacity was established after getting necessary CRZ permission and environmental clearance from concerned authorities during the year 2008. For this plant, consent to operate has been issued by TNPCB and is valid up to 31 st March-2018 as per norms. The plant is under operation as per TNPCB norms. The existing desalination plants are established after getting necessary CRZ permission and environmental clearance from concerned authorities. The CTO obtained from TNPCB for existing Desalination plants and is valid up to 31.03.2018.
Environment (Protection) Act, 1986 and	Emissions and discharges from the facilities to be created or refurbished or augmented shall	To comply with applicable notified standards

Law	Description	Requirement
CPCB Environmental Standards.	comply with the notified standards	
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the noise standards.
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	<ul style="list-style-type: none"> - Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTO from TNPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO. 	Generators comply with applicable emission standards
Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities shall be managed and disposed in accordance with the SWM Rules
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, remodeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works, , which will need to be followed by the project.

30. **Clearances/Permissions to be Obtained by Contractor.** Following table shows the list of clearances/permissions required for project construction. This list indicative and the contractor

should ascertain the requirements prior to start of the construction, and obtain all necessary clearances/permission prior to start of construction.

Table 3: Clearances and Permissions Required for Construction

No.	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
1	Tree Cutting	Department of Forest and District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	Program Implementation Unit (PIU)	Program Implementing Agency (PIA) and Program Management Unit (PMU)
2	Hot mix plants, Crushers and Batching plants	Tamil Nadu Pollution Control Board (TNPCB)	Consent to establish and consent to operate under Air Act, 1981	Contractor	PIU
3	Sand mining, quarries and borrow areas	Department of Geology and mining, Government of Tamil Nadu	Not applicable Contractor to obtain material from the existing government licensed mines / quarries; Contractor will require prior approval of PIU for obtaining material from a particular source. PIU to review and approve only existing licensed mines	Contractor	PIU
4	New quarries and borrow areas	Ministry of Environment, Forest and Climate Change (MOEFCC)	Not applicable No new quarries/borrow areas will be created for the subproject.	Contractor	PIU
5	Groundwater extraction	Public Works Department	(Groundwater) TamilNadu Groundwater Development and Management Act 2000	Contractor	PIU
6	Disposal of bituminous wastes	TamilNadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU
7	Temporary traffic diversion measures	-	MoRTH 112 SP 55 of IRC codes	Contractor	PIU

31. **ADB SPS Requirements.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines (both General Guidelines and sector specific guidelines of water and sanitation projects to be referred,

http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines). These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 4: WHO Ambient Air Quality Guidelines

WHO Ambient Air Quality Guidelines ^{7, 8}		
	Averaging Period	Guideline value in $\mu\text{g}/\text{m}^3$
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM_{10}	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $\text{PM}_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 5: WHO Noise Level Guidelines

Noise Level Guidelines ⁵⁴		
Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational ⁵⁵	55	45
Industrial; commercial	70	70

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

32. **Data Collection and Stakeholder Consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

33. The literature survey broadly covered the following:

- (i) Project details, reports, maps, and other documents prepared by CMWSSB
- (ii) Discussions with Technical experts, public and other relevant government agencies
- (iii) Secondary data from previous project reports and published articles, and
- (iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from government agencies and websites.

34. **Ocular Inspection.** Several visits to the project sites were made during IEE preparation period in 2017 to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed sites and scale of the proposed project. A separate study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

B. Physical Resources

1. Location, Area and Connectivity

35. Tamil Nadu is one of the most urbanized states in India, and Chennai is the fourth largest and populous Metropolitan City in India. Chennai City (formerly known as the Madras City) is about 400 years old, founded during the beginning of 17th Century A.D. Gradually, the city blossomed into one of the four major cities in the Indian sub-continent next to Delhi, Mumbai and Kolkata. Chennai City is situated in the North East of Tamil Nadu on the coast of Bay of Bengal. Chennai city is bound by the Northern Latitude of 12° 59' 10" and 13° 08' 50" and Eastern longitudes of 80° 12' 10" and 80° 18' 20". Chennai city has a long coastal line of 43.0 km from Kathivakkamin North to Uthandi in South along Bay of Bengal.

36. The jurisdiction of Chennai has been expanded from 174 km² to 426 km² in the year 2011, covering three Revenue Districts namely Chennai, part of Thiruvallur and Kancheepuram District. At present, Chennai Metropolitan Water Supply and Sewerage Board provides services through 15 area offices and 200 depot offices. The population of Chennai City, per 2011 census population, is 6.67million. The subproject areas have the following population per 2011 census: (i) Mathur (27,674), (ii) Madipakkam (35,752), (iii) Jalladampettai (19,100), and (iv) Uthandi (5,037).

37. Chennai is a major transportation hub for road, rail, air and sea transport connecting major cities inland and abroad. Chennai is one of the major educational centre in India with a number of colleges and research institutions.

2. Geology

38. The Geology of Chennai comprises mostly of clay, sediment rocks and sand stone. Based on geology, the city has been classified into sandy area, clayey area and hard-rock area. Sandy

areas are found along the coastal area and river banks like Thiruvannamiyur, Adayar, Santhome, Kottivakkam, George Town, Kathivakkam, Thiruvottiyur and the rest of coastal regions. Most of the interior part of the city like T.Nagar, West Mambalam, Anna Nagar, Perambur and Virugambakkam are covered with clayey soil. Guindy, Velachery, Adambakkam and part of Saidapet are hard-rock areas.

39. The sub project areas covering Mathur, Madipakkam, Jalladampettai and Uthandi are mostly clayey areas. The ground water table in most part of Chennai city is at about 4.0 to 5.0 m below GL. There is no incidences of land subsidence in the project area.

3. Topography

40. Chennai city is a plain terrain and the land surface is almost flat with contour ranges from 2.0 m to 10.0 m above MSL. It rises slightly as the distance from sea shore increases but the average latitude of the city is not more than 7.0 m above MSL and the average slope varies from 0.70 m per km whereas some parts are just at sea level. City terrain slopes from 1:5000 to 1:10000.

4. Seismology

41. Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone-II, -III, -IV and -V. Of these, Zone V is the most seismically active region, while zone II is the least. The sub project area is in Moderate Damage Risk Zone III and as per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the project region is in MSK VII or less which indicates moderate intensity.

5. Weather and Climate

42. The geographical location determines the weather and climate. Being close proximity to sea shore and thermal equator, weather in Chennai is relatively consistent with less variation in seasonal temperature. The weather in Chennai is mostly hot and humid. Chennai has three major seasons namely summer, monsoon and winter. April to June is the hottest months in Chennai with a temperature of 38^o to 42^oC. However the cool breeze at night comes as a relief to the residents of Chennai.

43. Chennai experiences two monsoons namely South-West monsoon from June to September and North-East monsoon from October to December. The average rain fall during South-west monsoon is 440 mm and during North-East monsoon is about 760 mm. The average rainfall throughout the year is about 1200 mm. Winter season in Chennai is from November to February.

Table 6: Rainfall in the Catchment Areas of the City Reservoirs

Year	Rainfall (mm)		Difference (%)
	Normal (30 years average)	Actual	
2012	1293.42	981.8	-24.09
2013	1297.5	1064.87	-17.93
2014	1286.21	1025.8	-20.25
2015	1273.17	2155.23	69.28
2016	1308.05	837	-36.03

Source: India Meteorological Department (IMD).

6. Air Quality

44. Tamil Nadu Pollution Control Board (TNPCB) regularly monitors the ambient air quality of Chennai through a network of eight ambient air quality monitoring stations established under the National Air Quality Monitoring Programme (NAMP). Samples are collected for 24 hours basis twice a week, and are for the Respirable Suspended Particulate Matter (RSPM) (RSPM is particulate matter less than 10 microns) and gaseous pollutants such as Sulphur dioxide (SO₂) and Nitrogen dioxide (NO₂). According to TNPCB annual report 2015-2016, the parameters such as SO₂, NO₂ recorded well within the standards including industrial areas. The average values of RSPM exceeded the standard in some monitoring stations, located mostly in the core Chennai, which is mainly attributed to construction related dust, road dust and vehicle emissions. Following table shows the air quality monitoring data of Manali monitoring station, which is located close (<3 km) to the subproject area of Mathur located in the north of Chennai. All the monitored parameters (SO₂, NO₂ and RSPM) are well within the standards.

Table 7: Air Quality 2015-2016
(annual average concentrations of air pollutants)

Monitoring Location	Category	SO ₂ (µg/m ³)			NO ₂ (µg/m ³)			RSPN (µg/m ³)		
		Max	Min	Average	Max	Min	Average	Max	Min	Average
Manali	Industrial	19	10	14	23	13	17	79	17	43
NAAQ standard	Industrial, residential, rural and other areas	50			40			60		

Source: Annual Report & Annual Accounts, 2015-2016, TNPCB.

7. Hydrology

45. Two major rivers meander through Chennai City - Adyar and Cooum. A third river, Kosasthalayar, flows through the northern fringes of Chennai City before draining into the Bay of Bengal at Ennore. The Buckingham canal flows parallel to the coast linking Cooum and Adyar rivers. The Kosasthalaiar River flows close to the northern boundary of Mathur subproject area. The Uthandi subproject area is located along the Bay of Bengal Coast in the southernmost part of Chennai City. Rainwater from Mathur area drains into Mathur Eri located nearby. Rain water from Madipakkam and Jalladampettai drains into Pallikaranai marsh. Rain water from Uthandi drains into Buckingham canal.

C. Ecological Resources

46. **Guindy National Park.** In 1978, a 270.57 ha land area was declared as a National Park and has come to play a significant role in the ecological environment of Chennai. Guindy National Park lies towards the South Western corner of Chennai. The terrain is rather flat gently sloping towards the south to two tanks - Appalankulam and Kathankulam which, together, occupy 30 hectares of land. There is a small duck pond towards the north of the Park and Bogi pond just outside the National park limits. Soil type varies from red to red gravelly. Alluvium dominates most of the area. So far, over 350 species of plants have been found including trees, shrubs, climbers, herbs and grasses. The national park is located outside the project area and about 4 km from nearest project location in Madipakkam.

47. **Pallikaranai Marsh Land.** The is one among the few remaining wetlands located inside Chennai City. It falls under Perungudi and Pallikaranai villages in the Kancheepuram district of

Tamil Nadu, within Chennai city. The wetland is rich with 61 species of flowering plants. The Pallikaranai Marsh Land is located outside the project area and is more than 0.2 Km from nearest project location in Madipakkam.

48. **Nanmangalam Reserve Forest.** Nanmangalam Reserve Forest is a protected area located in the southern part of Chennai, about 24 km from the city centre. It is located at Medavakkam on Velachery High Road between Velachery and Tambaram. The total area of the Reserve forest is 320 Hectares. The forest is popular among bird watchers and is home to about 85 species of birds. Red Wattled Lapwing, Crested Honey Buzzard, Grey Partridge, Coucal, Indian Eagle-Owl, White-breasted Kingfisher, Pied Kingfisher, Southern Bush Lark and Red-Whiskered Bulbul are commonly seen birds in the area. The Nanmangalam Reserve Forest is located outside the project area and more than 2 km from nearest project location in Jalladampettai.

49. **Mangroves in the Adyar Estuary.** The Adyar River rises in the Chembarambakkam Tank and runs 20 Km before entering city limits. It then runs about 5 km in the city before its estuary opens out to the sea. In what is essentially a salty lagoon, there are several islands, the largest of them called Quibble Island. These backwaters are called Adyar Creek, distinct from the Adyar River and its broad estuary with a narrow silted mouth due to the sand bank created by the currents ever since the Harbour's groynes were built. The Adyar Estuary, with its remaining islands and mangrove stands on the southern bank, is an area that offers river, marsh, woods, backwaters, islets, sea and open ground which have at times hosted over 150 species of birds as well as small wildlife, including jackals, foxes, wild cats, snakes and other reptiles. The mangroves in the Adyar estuary is located outside the project area and more than 8 km from nearest project location in Manapakkam.

50. **Ennore Creek.** Ennore Creek is a backwater located in Ennore, Chennai along the Coromandel Coast of the Bay of Bengal. It is located in the zone comprising lagoons with salt marshes and backwashers, submerged under water during high tide and forming an arm of the sea with opening to Bay of Bengal at the creek. The zone is spread over an area of 4 km² and the creek covers an area of 2.25 km². It is located 20 km north of the city centre and 2.6 km south of the Ennore Port, and the creek area stretched 3 km into the sea and 5 km along the coast. The creek is nearly 400 m wide, elongated in Northeast-Southwest direction and merging with the backwater bodies. Once a flourishing mangrove swamp, the creek has been degraded to patches in the fringes mainly due to human activities in the region. The Ennore creek is located outside the project area and more than 9 km from nearest project location in Mathur.

D. Economic development

1. Land Use

51. Total geographical area under Chennai city is 426 km². Per the Master Plan prepared by CMDA, the land use pattern of Mathur, Madipakkam, Jalladampettai and Uthandi is furnished below.

Figure 5: Land Use Pattern in Subproject Area

2. Infrastructure

52. **Transport and Traffic.** Road development, public transport services and suburban rail transport are recognized as essential for the urban system to efficiently function. In Chennai, the urban rail network development is carried out by the Southern Railway. The suburban and city railway transportation system is maintained by MRTS and CMRL. The major arterial & sub-arterial road corridors and other roads are developed and maintained by National Highways Authority of

India, Highways and the local bodies concerned, respectively. The Chennai Traffic Police looks after traffic management and enforcement in the Greater Chennai Area. The District Police is in charge of the remaining Chennai Metropolitan Area. The Metropolitan Transport Corporation administers public bus transport.

53. **Water Supply and Sewerage System.** The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), constituted in 1978, is vested with the responsibility of promoting and securing the planned development of water supply and sewerage services, creation, operation and maintenance of the needed infrastructure and implementation of perspective plans to meet both current and future requirements in the areas falling under Chennai Metropolitan Area.

54. **Sources of Drinking Water for Chennai City.** Since its inception in 1978, the growth in the Board's water supply operations have seen a manifold increase. After the expansion of Chennai City in 2011, the water supply scheme completed 9 added areas namely Thiruvottiyur, Kathivakkam, Ambattur, Maduravoyal, Valasaravakkam, Porur, Alandur, Meenambakkam and Injambakkam. The total length of the distribution network in Chennai city is about 6,697 Km and water is being distributed through 74 distribution stations. 27 areas in the Chennai City water supply schemes are under progress. The present proposal aims to apply the water supply schemes covering the remaining 6 areas namely, Mathur, Madipakkam, Jalladampettai and Uthandi. Neelankarai and Semmencheri work will be taken up shortly after confirmation of site for WDS.

55. For providing potable water to the city, CMWSSB operates water treatment plants in Kilpauk, Redhills, Chembarambakkam, Surapattu and Vadakuthu and desalination plants in Minjur and Nemmeli.

Table 8: Treatment Capacity of Water Treatment Plants

Water Treatment Plants	Treatment Capacity (MLD)
Kilpauk	270
Redhills	300
Chembarambakkam	530
Vadakuthu	180
Surapattu	14
Desalination plants at Minjur (On DBOOT basis)	100
Desalination plants at Nemmeli	100
Total	1494

56. Chennai city draws water from surface sources, ground water and desalination plants to meet its water requirement.

57. **Surface Water.** The reservoirs at Poondi, Cholavaram, Redhills (Puzhal) and Chembarambakkam near Chennai city, Veeranamlake in Cuddalore district and the Telugu Ganga Project are the main surface water sources for Chennai city.

Table 9: Storage Capacity of Reservoirs Supplying Water to Chennai

No.	Reservoir	Storage Capacity (Mcft)
1	Poondi	3,231
2	Redhills (Puzhal)	3,300
3	Chembarambakkam	3,645
4	Cholavaram	881

No.	Reservoir	Storage Capacity (Mcft)
5	Veeranam	1,465
	Total	12,522

58. **Desalination Plants.** Chennai City is mainly dependent on rainfall during monsoon for surface water availability. Scarcity in the amount of rainfall leads to acute shortages in reservoir levels and affects water supply to Chennai City. The non-availability of perennial rivers near Chennai adds to the challenge. To address the growing water demand, the Government has established two desalination plants with a capacity of 100 MLD each which are currently operational at Minjur and Nemmeli. These plants contribute substantially for city water supply. In addition, CMWSSB is in the process of establishing another 150 MLD capacity desalination plant at Nemmeli and 400 MLD desalination plant at Perur, South of Chennai city.

59. **Ground water.** CMWSSB uses ground water to supplement other sources. The amount of extraction varies with need. Groundwater extraction from the aquifers at Tamaraiakkam, Poondi and Neyveli can go up to 150 MLD.

60. **Sewerage services.** CMWSSB provides sewerage services to Chennai City, including waste water treatment, reuse of treated water and power generation from Sewage Treatment Plants. Sewage Treatment Plants at Chennai have an installed capacity of 764 MLD.

61. The Chennai City sewerage system is 4,250 km long. Sewage generated from houses and other buildings is collected through 250 sewage pumping stations. The city's sewage system is divided into 5 zones, with independent zonal collection, conveyance, treatment and disposal facilities. The collected sewage from pumping stations is treated in 12 sewage treatment plants.

Table 10: Capacity of Sewage Treatment Plants

No.	Treatment Plant	Capacity (MLD)
1	Nesapakkam (3 units : 23+40+54 mld)	117
2	Kodungaiyur (3 units : 110+80+80 mld)	270
3	Koyambedu (3 units : 34+60 +120 mld)	214
4	Perungudi (2 units : 79+72 mld)	151
5	Alandur (1 unit : 12 mld)	12
	Total - 12 units	764

Table 11: Sewage Treatment Plants under Construction

No.	Location	Capacity (MLD)
1	Thiruvottiyur	31
2	Sholinganallur-I	18
3	Sholinganallur-II	54
	Total	103

3. Agriculture

62. Agriculture is the prime profession that helps in the overall development of the State economy. Tamil Nadu occupies 7% of the Nation's population, 4% of the land area and 3% of the water resources at all India level. The total geographical area of CMA is 1189 km² of which the net sown area is 26% of the geographical area of CMA. CMA covers the area of Chennai district, Ambathur, Puzhal, Poonamallee and Sholavaram blocks of Tiruvallur district and parts of Chitlapakkam block of Kancheepuram district. No crop is cultivated in Chennai district and in the

Metropolitan area of Kancheepuram District. The CMA that comes under Tiruvallur district has cultivable area of paddy, pulses and oil seeds.

4. Industry

63. Chennai Metropolitan Region (including adjoining districts) is endowed with a diversified and balanced economic base. The region has attracted sizeable investments including Foreign Direct Investment (FDI) in Manufacturing, and has a thriving services base with well-developed Information Technology, Financial Services, Education and healthcare sectors. Implementation of proposed trunk infrastructure initiatives including the Chennai- Bengaluru Industrial Corridor, Ring Roads and Projects identified under GOTN's agenda for infrastructure development could stimulate investment and engender growth. These strengths reflect in the region's high historical economic growth: cumulative district GDP (at constant prices) of Chennai and adjoining districts grew at a Compound Annual Growth Rate (CAGR) of 11% during fiscal year 2005-2012. Chennai has a thriving manufacturing base with globally competitive Automotive and Electronic hardware clusters operating in its vicinity.

64. **Automotive Sector.** Chennai is often referred to as the Detroit of Asia, given the strong presence of automotive, and auto components manufacturers around the city. Chennai has a market share of around 30% of India's automobile industry and 35% of its auto components industry. A 60-km long automotive corridor, stretches from Gummidipoondi, in north of Chennai to Malaraimalai Nagar, in the south and passes through Tiruvallur, Sriperumbudur and Oragadam and is home to several global scale automotive manufacturing facilities of large auto majors. With a cumulative capacity of close to 1.4 million cars annually, Chennai region is one of the largest automotive hubs globally.

64. **Electronics Manufacturing.** Chennai has also emerged as an Electronic Manufacturing Service (EMS) hub of India with multinational corporations setting up their manufacturing planning particularly along the EMS corridor which stretches from Sriperumbudur to Oragadam. Chennai is among the largest electronics hardware exporter in India, accounting for 45% of the total electronic hardware exports in 2010-2011.

65. **Services – Information Technology.** Since the 1990s Software development and business process outsourcing have emerged as a major drive of Chennai's economic growth. Several major software services companies have global software development centers in the city. Chennai is the second largest exporter of IT and IT enabled Services in the country behind Bangalore. The IT corridor, on Old Mahablipuram Road houses several technology parks and stretches from TIDEL park in Taramani to SIPCOT IT park in Siruseri. Several Special Economic Zones (SEZs) have also been developed along the GST road including the MEPZSEZ, Mahindra World city, Shriram's Gateway SEZ, Estancia SEZ. ETL Infrastructure and India land SEZ.

66. **Banking and Financial Services.** With a growing financial sector skill base, Chennai is home to offshore and business continuity operations of several banks and financial institutions. The City is home to operations of several financial institutions.



67. **Healthcare.** Chennai is referred to as the Health Capital of India and is increasingly becoming a favored destination of medical tourists and over 6 lakh tourists visit the State annually. In addition, health care institutions in Chennai are estimated to attract over 200 international visitors every day.

66. **Higher Education and Research.** Chennai is home to many educational and research institutions owned by different agencies ranging from Central Government to state Government to State Government to private institutions. Institutions for different major studies such as engineering, arts and science, law, medical, management, polytechnic, Vocations and research are present in the city.





E. Cultural Resources - Protected Monuments

66. Chennai, formerly known as Madras, is a 400 year old historical city. Location on Coromondal coast of Bay of Bengal, it is the India's fourth largest city and is the capital of Tamil Nadu state. Chennai has a rich culture and long history. The present day city of Chennai started as an English settlement known as Fort St. George. The region was then a part of Vijayanagara Empire. Chennai boasts of a long history from the English East India Company, through the British rule to its evolution in the late 20th century as a services and manufacturing hub for India. There are several protected historical monuments in Chennai, however, none of these protected monuments are located in the subproject area.

F. Subproject Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Water Distribution Station comprising of existing UGT, OHT and Pumphouse for Mathur Water Supply Scheme, Zone-I	<p>Existing WDS at MMDA layout at Kamarajar 2nd street</p> <p>In Mathur, for a part of the area developed by Tamil Nadu Housing Board (TNHB) water supply scheme has already been provided. The existing distribution system was laid more than 30 years ago. Hence it is proposed to replace the existing distribution system considering the present water demand.</p> <p>Since the existing UGT, OHT and pump house are in good condition, it is proposed to utilize the same. Since the existing pumping machineries served its life, it is proposed to replace the same considering the present water demand. The nearest house property is located about 50 m from the WDS site</p>	
Water Distribution Station for Mathur Water Supply Scheme, Zone-II at CPCL layout.	<p>In Mathur the remaining part of the area are covered under Zone-II. It is proposed to provide WDS comprising of new UGT, OHT and Pumphouse in the vacant land belongs to CPCL. The nearest house property is located about 150 m from the WDS site</p>	

Infrastructure	Location and Environmental Features	Site Photograph
Water Distribution Station for Madipakkam Water Supply Scheme,	For Madipakkam area, the WDS comprising of new UGT, OHT and Pumphouse is proposed in the vacant land located on Velachery Main Road. The nearest house property is located about 200 m from the site	
Water Distribution Station for Jalladampettai Water Supply Scheme,	The vacant site for Jalladampettai water supply scheme is located at Raghavendra colony main road in which WDS comprising of new UGT, OHT and Pumphouse is proposed. The nearest house property is located about 50 m from the site.	
Water Distribution Station for Uthandi Water Supply Scheme,	The vacant site for Uthandi water supply scheme is located at Gangaianman Koil Street in which WDS comprising of new UGT, OHT and pumphouse is proposed. The nearest house property is located about 50 m from the site.	
Feeder and Distribution lines	<p>The distribution main, feeder main and conveying main will be laid along the edge of the streets and roads without affecting the existing infrastructures. Before commencing the pipe laying work, necessary road cut restoration charges will be paid to the concerned Department (GCC, State Highways etc.,) and permission will be obtained to cut open the road. On completion of the pipe laying work, the roads will be properly filled and consolidated with excavated earth and intimated to the concerned Department. The restoration of road will be carried out by the concerned Department.</p> <p>Main roads in the subproject area carry considerable traffic. These roads also centers of commercial activities. Internal roads in the project area are narrow, except in the newly developing residential layout</p>	
		

Infrastructure	Location and Environmental Features	Site Photograph
	<p>which comparatively have wide roads. Pipes are also to be laid across some of the arterial roads. Hence, provision for trenchless technology method has been included in the estimates for Mathur WSS, Jalladampettai WSS and Uthandi WSS to avoid open cut excavation across the busy Highway roads like 100 feet Road in Mathur, ECR in Uthandi and Velachery main Road near Jalladampettai. In other busy roads, work will be taken up during non-traffic hours/ night hours without much hindrance to the free flow of traffic.</p>	
		
		
		

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

67. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

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

- (i) **Location impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.

- (ii) **Design impacts** include impacts arising from Investment Program design, including technology used, scale of operation/throughput, waste production, and ancillary services.
- (iii) **Construction impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
- (iv) **O&M impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

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

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

71. The ADB rapid environmental assessment checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asphas been used to screen the project for environmental impacts and to determine the scope of the IEE.

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

A. Pre-Construction Impacts – Design and Location

72. **Design of the Proposed Components.** Technical design of the (i) Water Distribution Station including UGT, OHT and pumphouse (ii) distribution network including house connections, follows the relevant national planning and design guidelines, focusing on providing a robust system which is easy to operate, sustainable, efficient and economically viable.

73. **Water Source and Treatment Facility.** No new Water Treatment Plant is proposed in the subproject as it is proposed to utilize the available source of water from existing Minjur desalination plant for Mathur, From Nemmeli desalination plant for Madipakkam, Jalladampettai and Uthandi. Details are provided below:

- (i) The Water demand for Mathur for the Intermediate year 2035 and ultimate year 2050 is 6.71 MLD and 8.22 MLD respectively. This will be met out from existing 100 MLD Minjur desalination plant.
- (ii) The Water demand for Madipakkam for the Intermediate year 2035 and ultimate year 2050 is 12.71 MLD and 20.12 MLD respectively. This will be met out from existing 100 MLD Nemmeli desalination plant.
- (iii) The Water demand for Jalladampettai for the Intermediate year 2035 and ultimate year 2050 is 3.72 MLD and 4.55 MLD respectively. This will be met out from existing 100 MLD Nemmeli desalination plant.

- (iv) The Water demand for Uthandi for the Intermediate year 2035 and ultimate year 2050 is 2.43 MLD and 4.33 MLD respectively. This will be met out from existing 100 MLD Nemmeli desalination plant.

74. **Future Development.** Master Plan for the water supply and sewerage sector for the period 2020 to 2050 has been prepared by CMWSSB. In the Master Plan, detailed proposal for enhancing the water sources and the treatment capacity over a period of time in a phased manner have been given. Accordingly, when the water demand of the area reaches the capacity of respective water treatment plants (WTPs), the capacity will be enhanced suitably as detailed in the master plan. Following this Master Plan, CMWSSB is currently in the process of developing a 150 MLD desalination plant (for which already tender invited for construction under evaluation).

75. **Due diligence of existing related facilities – desalination plants.** Sustainability of new water supply infrastructure and realization of intended purpose (supplying of adequate quantity of safe drinking water at acceptable standard) and benefits (improved environmental conditions, public health etc.,) would accrue only with provision of adequate quantity of good quality of treated water to feed into the proposed distribution system in the subproject area. Therefore as per the ADB safeguard policy statement 2009, these existing related facilities for the subproject need to be in compliance with the ADB SPS requirements. As stated above, the existing Minjur and Nemmeli desalination plants have adequate capacity to meet the ultimate water demand of subproject area. Existing plants are functioning with required government and permits/licenses, and the water produced by these plants meet the drinking water standards (Appendix 10).

- (i) **Minjur Desalination Plant.** The desalination plant at Minjur of 100 MLD capacity was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSSB entered into a Bulk Water Purchase Agreement (BWPA) with M/S Chennai Water Desalination Limited (M/s CWDL) and the period of agreement is 25 years. As per the BWPA, all the statutory clearances like environmental clearance, CTO etc., have been obtained by M/s CWDL for this plant. Only the product water is being purchased by CMWSSB and supplied to north Chennai areas. The treated water quality is monitored by the quality assurance wing of CMWSSB at the receiving point for all the quality parameters as per IS: 10500. The quantity of water received is measured by the water meter fixed at the receiving point.
- (ii) **Nemmeli Desalination Plant.** The existing 100 MLD capacity desalination plant at Nemmeli owned, operated and maintained by CMWSSB. This plant was established by CMWSSB after getting necessary CRZ permission and environmental clearance from concerned authorities during 2008. For this plant, necessary consent to operate has been obtained from TNPCB and valid up to 31st March 2018 and the plant is under operation as per TNPCB norms. Treated Water from all the treatment plants are tested regularly by the Quality Assurance wing of CMWSSB. The quality parameters are analyzed daily at these laboratories. Further the quality parameters are monitored jointly by CMWSSB and Greater Chennai Corporation (GCC) fortnightly.
- (iii) Both the plants are under operation in compliance with existing environmental regulations and no gaps are noticed. Environmental audit of the plants, along with copies of clearances, consents, and water quality monitoring data is attached in Appendix 10.

76. **Site for Water Distribution Stations:** For the proposed water supply schemes, the following sites were identified. Sites selected are government owned vacant unused lands. There are no trees or sensitive environmental features in any of the sites.

- (i) **Mathur WSS Zone II.** Proposed site is located at CPCL layout, Kosappur road. Site is vacant, devoid of any trees or notable vegetation. It is away from the residential area
- (ii) **Madipakkam WDS.** Site for Madipakkam WDS is located along Velachery main road located away from residential areas. Site is vacant, devoid of any trees or notable vegetation.
- (iii) **Jalladampettai WDS.** Site for Jalladampettai WDS is located along Raghavendra Colony Main Road; site is located close to residential area. Site is vacant, devoid of any trees or notable vegetation.
- (iv) **Uthandi WDS.** Site for Uthandi WDS is located at Gangai Amman Koil Street, close to residential area. Site is vacant; there are few mature trees, but these will not be cut for construction of WDS.

77. Following design related measures are included in the WDS designs to minimize noise nuisance, and improve safety and aesthetics:

Measures for Water Distribution station

- (i) Maintain maximum buffer distance from residential area side to the pump house;
- (ii) Develop green buffer zone around the facility with trees in multi rows as per the land availability to improve aesthetical appearance
- (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metalised grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes.
- (iv) HSC pumps of suitable rating, with low noise level during operation and high strength-corrosion resistant heavy duty construction shall be proposed.
- (v) Diesel Generators shall be provided for all WDS for pumping during long period of electricity supply interruption.
- (vi) Develop standard operating procedures / operational manual for operation and maintenance of WDS; this shall include measures for emerge situations; and
- (vii) Provide training to the staff in SOPs and emergency procedures

78. **Noise from Pumping Operations.** Operation of pumps and motors and diesel generators is a major source of noise. As the WDS are located in the residential areas, with few located very close to the houses, noise generated from pump house can have continuous negative impacts on the surrounding population. High inside noise levels can affect the health of operators and staff at the facilities, and therefore, noise levels needs to be maintained within and outside the plant at acceptable levels. To eliminate the issue, it is proposed to provide

- (i) Procure good quality latest technology pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1m⁶
- (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise
- (iii) Use acoustic enclosures – manufacturer specified, for all DG sets, pumps, motors
- (iv) Procure only CPCB approved generators to meet air emission and noise level requirements
- (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors

⁶ Indian Standards require to maintain the noise level of 70 dBA or less during night time. However, in case of STPs/WTPs/Water Supply Head works, where heavy duty pump sets are to be installed and the noise levels may even exceed 80 decibels at 1 m distance, noise level will be measured at the time of commissioning the units and necessary mitigation measures such as noise barriers will be installed if required.

- (vi) Provide ear plugs designated for noise reduction to workers working within the pumphouse of WDS where the noise level will be within 80dB. Noise level will be limited to 45 dB outside the pumphouse and at the boundary of WDS.

79. **Energy Efficiency.** Project area is mostly plain and gently sloping ground, it is therefore difficult to maintain minimum head of 12.0 m throughout the project area. Hence it is proposed to construct the OHT with a staging height of 17.0 M which will cover the entire project area. Supplying water through OHT will be more beneficial rather than pumping directly from the pumping station. This optimized the energy consumption.

80. To optimize the power consumption, the hydraulic design shall follow optimal approach, and the following also considered in design and selection of pumping systems. According to Manual for the Development of Municipal Energy Efficiency Projects in India (jointly developed by Bureau of Energy Efficiency (BEE) and International Finance Corporation in 2008), energy savings, at minimum, of 25% to 40% is possible with appropriate measures. The following measures shall be considered and incorporated into the subproject designs:

- (i) Using low-noise and energy efficient pumping systems
- (ii) Efficient Pumping system operation

81. Pallikarnani Marsh Land. This wetland is located just outside the subproject area of Madipakkam. None of the project components or proposed pipelines are located in the wetland area. Subproject areas of Jalladampettai and Madipakkam also form part of its large catchment area, and the water from these areas during rains drain into the wetland. Entry of silt of laden runoff into wetland will have negative impacts, and therefore following measures are to be implemented:

- (i) No earthworks should be conducted during the rains in general, and in particular no earth work to be conducted in subproject areas of Jelladampettai and Madipakkam during rains;
- (ii) Stockpiled material and earth/soil shall be properly covered with tarpaulins; bunds, silt traps/fences, etc.;
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; it shall be ensured that no silt laden runoff or traces of fuels, lubricants or chemicals used in construction drains into Pallikaranai marsh;
- (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (v) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management;
- (vi) No workers camp sites, storage areas etc., shall be located close to the wetland (< 1 km);
- (vii) Conduct water quality monitoring of wetland during construction phase, according to the environmental management plan (EMP).

82. **Tree Cutting at Selected Project Sites.** As presented in the baseline profile of subproject sites, there are no notable tree cover in the project sites, therefore no tree cutting envisaged. Following measures will be implemented if need arises to compensate for the loss of tree cover.

- (i) Minimize removal of trees by adopting to site condition and with appropriate layout design of civil structures;
- (ii) Obtain prior permission for tree cutting; and
- (iii) Plant and maintain 10 trees for each tree that is removed.

83. **Utilities.** Telephone lines, electric poles and wires, water lines, drains, if exists within the proposed project locations may require to be shifted. All the selected project sites are vacant and unused government lands/ GCC lands and hence there are no notable existing utilities. Water pipelines are proposed along the edge of the road, where there are no utilities. In the outer areas where there is adequate earthen shoulder along the road carriage way, water main can be accommodated in the shoulder. In such cases, the work may require shifting of utilities on the shoulder. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with the City Corporation will:

- (i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during construction phase; and
- (ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

84. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location, but at least 100 m away from residential areas, groundwater wells and surface water bodies. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near forest areas, water bodies, or in areas.

85. **Site selection of sources of materials.** Significant quantities of coarse aggregate and fine aggregate will be required for construction works. Contractor should procure these materials only from the quarries permitted/licensed by Department of Geology and Mining. Contractor should procure material from existing quarries.

86. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will occur in project sites for foundations, laying pipelines, and for construction of underground storage tanks. Although Chennai city is an historical city, there are no archeologically or historically recognized sites or places close to project sites or within the project area. There are no known sites or areas potential for containing archaeological or historical remains, and risk of uncovering them is low. During implementation of water supply scheme CMWSSB will follow chance find protocol to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved:

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

B. Construction Impacts

87. Main civil works in the subproject include laying of water main and construction of underground tank and overhead tank at the identified sites.

88. UGT, OHT and pump house works will be confined to sites, and construction will include general activities like site clearance, excavation for foundations, and creation of concrete structures will be one of the major construction activities for this project, as many of the subproject components will be fixed to concrete plinths and most will be housed in buildings with at least some concrete structural elements. Most such structures will be constructed from reinforced concrete, where steel reinforcing rods and bars are placed and attached by hand to create an interior skeleton for the foundations, walls, columns, plinths, etc, and heavy-duty metal and timber/plywood formwork is bolted around the outside to build a mould into which pre-mixed concrete is poured. Once the concrete has set, the formwork is removed, and the concrete surface is finished by masons by hand if necessary. Some buildings, such as the pump station, facilities, etc., may be constructed from brick work, in which case this work will be done using standard house-building techniques. Since these works are confined to the boundary of identified sites, there is no direct or significant interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc., will have negative impacts, which needs to be avoided or mitigated properly.

89. Subproject also include linear works (laying of about 219.8km of water mains along the roads). This covers entire Mathur, Madipakkam, Jalladampettai and Uthandi area of extended areas of Chennai city. Distribution mains will be laid covering all the roads. House service connections will be provided from the distribution main to households for all premises. Water mains will be laid by open cut method.

90. Open cut trenching method of water main laying involves trench excavation in the road, placing pipe in the trench, jointing and testing, and refilling with the excavated soil. Proposed pipes for conveying main and distribution main is Ductile Iron (DI) pipes. The diameter of distribution main ranges from 100 mm to 900 mm, of which more than 90% of the distribution main are of size between 100 mm and 200 mm. According to the design for laying the water main, excavation will be made such that there will be a cushion of minimum 1.0 m above the crust of the pipe to top of the road surface. The width of the trench excavation along the roads will vary from 0.50 m to 1.30 m. Earth work excavation will be undertaken by machine (backhoe excavator) and include danger lighting and using sight rails and barricades. The work will also be supplemented manually where there is no proper working area (e.g., very narrow streets) for the backhouse excavators. Even though trenches are shallow for laying water main, due to nature of soil, there is risk of collapse of trenches and/or damage to surrounding buildings, safety risk to pedestrians and traffic. Necessary precautions such as bracing / shoring and strutting in the trench will be provided for trenches of more than 1.50 m deep. The normal working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Excavated soil will be used for refilling the trench after placing the water main and therefore residual soil after pipe laying and refilling is not significant. About 90-95% of the excavated earth will be reused for refilling the trenches and the remaining excess soil will be disposed safely in the low lying areas of nearby CMWSSB land.

91. Although water pipe line laying work involves quite simple techniques of civil work, the invasive nature of excavation in the urban area where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration, however, needs to be mitigated. For laying water main in arterial roads trenchless technology will be adopted if necessary without causing any hindrance to the movement of traffic.

92. Mathur, Madipakkam, Jalladampettai and Uthandi are erstwhile Village Panchayats. The above areas are characterized by moderately populated residential areas with narrow streets and roads. The above areas are now added with Chennai city. Water main will extend to all residential and developed areas.

93. Anticipated impacts during the construction phase are discussed below along with appropriate mitigation measures to avoid, minimize or mitigate those impacts to acceptable levels.

94. **Sources of Materials.** Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or leveling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Chennai city the construction sand is normally obtained from PWD approved quarry at Palar (about 57 km from the city). Gravel and aggregate is available locally from Pallavaram and nearby areas in Kancheepuram District (about 20 km from the city). Contractor should not create/use any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

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

95. **Air Quality.** Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Significant quantities of earthwork will be conducted in the subproject, spread all over the project area. Nearly 10,00,000 m³ of earthwork is anticipated from the subproject, and 90-95% of which will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites for UGT, OHT etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. Dust generation will be significant during pipe laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

For all construction works

- (i) Provide a dust screen (6 m high) around the construction sites of WDS;
- (ii) Damp down the soil and any stockpiled material on site by water sprinkling - (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the

- day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;
- (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition;
 - (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
 - (v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens;
 - (vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation
 - (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;
 - (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area, minimize the drop height when moving the excavated soil;
 - (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site;
 - (x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate; and
 - (xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties.

For Pipe Laying Works

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

96. Immediate Road Restoration after Refilling the Trench. Excavation and refilling activities disturb the top soil, and under the influence of wind, traffic, pedestrians, and other activities etc., produces dust. There is large potential to generate significant quantities of dust after refilling the trench, and prior to road relaying. It is a common practice not to restore the road immediately after refilling the trench so as to allow sufficient time for the refilled material to

stabilize naturally. Given the dry and windy conditions, and heavy traffic and other activities along the roads, the refilled trenches with loose top soil along the roads will generate maximum dust, and create very unhealthy conditions. Moreover, as the barricades/dust screens will be removed after the trench is refilled, there will be absolutely nothing to control the dust generation. Dust control activities like wetting of top soil will not be effective given the site conditions. It is therefore necessary to restore/relay the road surface immediately or take suitable steps to arrest the dust. Soil consolidation technique shall be used so that road can be restored immediately. Immediately consolidate the backfilled soil and upon consolidation hand over the road to GCC for restoring the road and relaying the surface so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic. Backfilled trench without any road restoration is a major source of dust.

97. Surface Water Quality. Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate water quality of the receiving water bodies and streams/rivers. Project area receives rainfall during southwest and northeast monsoon seasons, between June/July to November/December. Rain water from Mathur area will drain into Mathur Eri located nearby. Rain water from Madipakkam and Jalladampettai drains into Pallikaranai marsh. Rain water from Uthandi drains into Buckingham canal. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter these water courses. Impact will be temporary, and but needs to be mitigated. Construction contractor will be required to:

- (i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains;
- (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100 m);
- (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
- (iv) Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies; it shall be ensured that no silt laden runoff or traces of fuels, lubricants or chemicals used in construction drains into Pallikaranai marsh
- (v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells;
- (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management;
- (vii) Dispose any wastes generated by construction activities in designated sites; and
- (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP);

98. Surface and Groundwater Quality. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. In the project area, groundwater table is much deeper than the anticipated excavation depth and therefore this impact is not envisaged. However during the rains, water will be collected in open pits and trenches. The water collected in excavated pits will contain silt and disposal of this in drainage channels lead to silting. To avoid this the contractor needs to be implement the following measures:

- (i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area;

- (ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds; and
- (iii) Consider safety aspects related to pit collapse due to accumulation of water.

99. **Generation of Construction Wastes.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Total earthwork excavation will be nearly 10,00,000 m³, of which nearly 90% -95% will be reused, and the remaining 1,00,000-50,000 m³ of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

- (i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix 4);
- (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.;
- (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately;
- (iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should be located away from residential areas, forests, water bodies and any other sensitive land uses;
- (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable/recyclable material shall be collected separately and sold in the local recycling material market;
- (vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed-off via licensed (by TNPCB) third parties;
- (vii) Prohibit burning of construction and/or domestic waste;
- (viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins; recycle waste material where possible; and
- (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate.

100. **Noise and Vibration Levels.** The noise from the electrical motors and pumps will not exceed 80 dba at 1.0 m distance. All the pumping machineries are housed inside the pump house. The entire headwork site is proposed to be provided with compound wall of 2.50 m height. Hence there will not be much noise and vibration felt outside the WDS.

101. The water distribution station sites are located within habitations, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. During construction stage increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for laying of pipe, operation of construction equipment, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have impact on nearby buildings. The construction contractor will be required to:

- (i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors;
- (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor;
- (iii) Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s;
- (iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage;
- (v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; and
- (vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

102. **Accessibility and Traffic Disruptions.** Excavation along the roads for laying of distribution pipeline, hauling of construction materials and operation of equipment on-site will cause traffic problems. Water mains are proposed along the edge of roads and streets. Hence there will not be much disturbance for the free flow of traffic. The following major roads are to be laid with water main in the subproject area:

- (i) Kamarajar Salai, Mathur;
- (ii) Madipakkam main Road, Madipakkam; and
- (iii) East Coast Road (ECR), Uthandi.

103. Above main roads carry considerable traffic. These roads are also centers of commercial activities. Internal roads in the project area are narrow, except in the newly developing residential layout which comparatively have wide roads. Pipes to be laid across some of the arterial roads. Hence, provision for trenchless technology method has been included in the estimates for Mathur WSS, Jalladampettai WSS and Uthandi WSS to avoid open cut excavation across the busy Highway roads like 100 feet Road in Mathur, ECR in Uthandi and Velachery main Road near Jalladampettai. In the above major roads trenchless technology will be adopted for laying the pipe line across the roads. In other Greater Chennai Corporation (GCC) maintained busy roads, work will be taken up during non-traffic hours/ night hours without much hindrance to the free flow of traffic.

104. Works related to all the remaining components (UGT, OHT and Pump house) will be confined to the selected sites, therefore there is no direct interference of these works with the traffic and accessibility.

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

Laying of distribution system:

- (i) Prepare pipe laying work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being

- undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal;
- (ii) Plan the pipe laying work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public;
 - (iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience
 - (iv) Undertake the work section wise: a 100 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones;
 - (v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required;
 - (vi) Limit the width of trench excavation as much as possible by adopting best construction practices;
 - (vii) Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided;
 - (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access;
 - (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before start of work;
 - (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum;
 - (xi) Keep the site free from all unnecessary obstructions;
 - (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television services; and
 - (xiii) At work site, public information/caution boards shall be provided including contact for public complaints.

Hauling (material, waste/debris and equipment) activities

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours; (peak hours 7 to 10 a.m. and 4 to 7 p.m.);
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Drive vehicles in a considerate manner; and
- (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

106. **Socio-Economic – Income.** Sites for all projects components are carefully selected in government owned/GCC/CMWSSB vacant lands and therefore there is no requirement for land acquisition or any resettlement. Blocking of access to the business / livelihood activities, especially during pipeline laying along the roads, may impact the income of households. However,

given the alignment of pipeline within the road carriage way, and also the measures suggested for ensuring accessibility during pipe laying works, notable but temporary impact is envisaged. Some shops and other premises along the roads may lose business income if the access will be impeded by excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio cultural places etc., will inconvenience public. Implementation of the following best construction measures will avoid the disturbance reduce the inconvenience and disturbance to the public.

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

107. **Socio-Economic – Employment.** Manpower will be required during the 24-month construction stage. This can result in generation of temporary employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to employ local labour force as far as possible.

108. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in confined areas such as trenches, working at heights, near the heavy equipment operating areas etc.,. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Follow all national, state and local labor laws (indicative list is in Appendix-2);
- (ii) Develop and implement site-specific occupational health and safety (OHS) Plan which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-

related accidents.⁷ Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines.⁸

- (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites;
- (iv) Secure all installations from unauthorized intrusion and accident risks;
- (v) Provide OHS orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (vii) Ensure the visibility of workers through their use of high visibility vests and other PPEs when working in or walking through heavy equipment operating areas;
- (viii) Ensure moving equipment is outfitted with audible back-up alarms;
- (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
- (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively;
- (xi) Provide supplies of potable drinking water; and
- (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.

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

- (i) Confine work areas; prevent public access to all areas where construction works are on-going through the use of barricading and security personnel;
- (ii) Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation;
- (iii) Minimize the duration of time when the trench for laying pipe is left open through careful planning; plan the work properly from excavation to refilling and road relaying;
- (iv) Control dust pollution – implement dust control measures as suggested under air quality section;
- (v) Ensure appropriate and safe passage for pedestrians along the work sites;

⁷ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

⁸ IFC World Bank Group. [Environmental, Health and Safety Guidelines 101](#).

- (vi) Provide road signs and flag persons to warn of on-going trenching activities;
- (vii) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency);
- (viii) Enforce strict speed limit (20-30 kmph) for plying on unpaved roads, construction tracks;
- (ix) Provide temporary traffic control (e.g. flagmen) and signs where necessary to improve safety and smooth traffic flow;
- (x) Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided with the aim of ensuring that vehicles join the road in a safe manner;
- (xi) At sensitive locations particularly where there are schools and markets close to the road, awareness of safety issues will be raised through neighbourhood awareness meetings;
- (xii) All drivers and equipment operators will undergo safety training; and
- (xiii) Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

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

- (i) Consult PIU before locating project offices, sheds, and construction plants;
- (ii) 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 City Corporation
- (iii) Avoid tree cutting for setting up camp facilities;
- (iv) Provide a proper fencing/compound wall for camp sites;
- (v) 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
- (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
- (vii) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like galvanized iron sheets, tarpaulins, etc., shall not be used as accommodation for workers;
- (viii) Camp shall be provided with proper drainage, there shall not be any water accumulation
- (ix) Provide drinking water, water for other uses, and sanitation facilities for employees; drinking water should be regularly tested to confirm that drinking water standards are met
- (x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed;
- (xi) Train employees in the storage and handling of materials which can potentially cause soil contamination;

- (xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements; (100 m away from surface water body or groundwater well)
- (xiii) Recover used oil and lubricants and reuse or remove from the site;
- (xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable/recyclable waste shall be collected and sold in local market;
- (xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site.

C. Operation and Maintenance Impacts

111. Operation and Maintenance of the water supply system will be carried out by CMWSSB. Operation will involve receiving water in the UGT from source, pumping of water to the OHT, supply of water from OHT to the distribution system and supply to individual households through house service connection.

112. **Distribution network.** During the system design life (15/30 years for mechanical/civil and pipeline components) it shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

113. There will be no environmental risks from the operation of the water supply system. Water supply for Mathur area is proposed to be supplied from Minjur Desalination plant. The desalination plant at Minjur was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSSB had entered into a Bulk Water Purchase Agreement (BWPA) with M/s Chennai Water Desalination Limited (M/s CWDL) for a period of 25 years. As per the BWPA, all the statutory clearances have been obtained by M/s CWDL for this plant. The plant was commissioned on 25 July 2010. The product water is purchased by CMWSSB and supplied to the north Chennai areas. As such the operation and maintenance of plant is vested with M/s CWDL. In Minjur desalination plant the rejects from the plant are monitored through SCADA and also by random physical verification by TNPCB. Product water quantity is monitored through meters fixed in the delivery main. The product water is re mineralized and chlorinated as per IS:10500 before conveyed to the distribution system. Regarding the safety in handling and storage of chemicals, safety officer of the plant is responsible.

114. Water supply for Madipakkam, Jalladampettai, and Uthandi areas are proposed to be supplied from the desalination plant at Nemmeli owned and maintained by CMWSSB. The Nemmeli desalination plant, with 100 MLD capacity, was established after getting necessary CRZ permission and environmental clearance from concerned authorities during the year 2008. For this plant, necessary consent to operate has been obtained from TNPCB valid up to 31st March 2018 per norms. The plant is under operation as per TNPCB norms. The treated water from Nemmeli desalination plant has been conveyed through 1000 mm dia transmission main to supply Southern parts of Chennai city. In Nemmeli desalination plant the rejects are collected at

random by TNPCB and quality monitored. In Nemmeli the quantity of water is being monitored through meter fixed at 100 MLD pump house at Nemmeli. The product water is re mineralized and chlorinated as per IS:10500 before conveyed to the distribution system. Regarding the safety in handling and storage of chemicals, safety officer of the plant is responsible. The noise level in the desalination plant is well within the permissible level. Disinfection is being carried out in the water distribution stations using Bleaching powder/Hypochloride solution/chlorine gas so as to maintain residual chlorine within the prescribed level. Safety in storage and handling of chemicals are ensured by the departmental staffs as per norms.

115. The water quality is being monitored daily by the Quality assurance wing of CMWSSB and also by Greater Chennai Corporation authorities jointly with CMWSSB every fortnight in the distribution system at various locations

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

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

117. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject are: residents, shopkeepers and businesspeople who live and work near sites where facilities will be built (UGT and OHT), government and utility agencies responsible for provision of various services in project area. Secondary stakeholder are: NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, TNUIFSL, Government of Tamil Nadu and the ADB.

B. Public Consultation

118. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

1. Consultation during Project Preparation

49. The subproject proposal is formulated by CMWSSB in consultation with the public representatives in the project area to suit their requirements and as per Central Public Health and Environmental Engineering Organisation (CPHEEO) norms.

50. Focus-group discussions with the local public and other stakeholders were conducted to learn their views and concerns. General public and the people residing along the project activity areas were also consulted. A project area level consultation workshop was conducted with the public representatives and prominent citizens, NGOs, etc., on 20 December 2017 (details are enclosed at Appendix 9).

51. It was observed that people are willing to extend their cooperation as the proposed project will provide protected water supply for their households which will enhance basic infrastructure

service levels and overall living standard of the public. Also they are expecting that the work should be implemented at the earliest. Public demanded for advance notice before construction and proper warning signs along the construction area to avoid inconvenience and the project completed within the stipulated contract period. The road should be restored properly after the pipe laying work completed.

2. Consultation during Construction

52. Prior to start of construction, PIU will conduct information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings ,as required, will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area, once 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in Appendix 8). At the work sites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure

119. Executive summary of the IEE will be translated in Tamil and made available at the offices of PMU and PIU and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Tamil will be placed in the official website of the TNUIFSL and CMWSSB after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

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

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

VII. GRIEVANCE REDRESS MECHANISM

122. A common GRM will be in place to redress social, environmental or any other project related grievances. The GRM described below has been developed in consultation with stakeholders. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per project entitlement matrix, and program management unit (PMU) and concerned CMWSSB will ensure that their grievances are addressed.

123. Affected persons will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaints register in ULB or PIU or CMWSSB offices. PIU Safeguards officer will have the responsibility for timely grievance redress on safeguards and gender issues and for registration of grievances, related disclosure, and communication with the aggrieved party.

124. GRM provides an accessible, inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected persons' grievances related to the project. A two-tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a grievance redress committee (GRC) will be established in PIUs; Deputy Construction Manager, along with support Engineer – Construction supervision (non-key expert) and Environmental safeguard Assistant (non-key expert) of Construction Management and Supervision Consultant (CMSC) will be responsible for creating awareness among affected communities and help them through the process of grievance redress, recording and registering grievances of non-literate affected persons.

125. GRM aims to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. All grievances – major or minor, will be registered. Documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. PIU will also be responsible for follow-through for each grievance, periodic information dissemination to complainants on the status of their grievance and recording their feedback (satisfaction/dissatisfaction and suggestions).

126. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel of the CMSC and CMWSSB will resolve the issue on site, and any issue that is not resolved at this level will be dealt at PIU head level for immediate resolution. Should the CMWSSB fail to resolve any grievance within the stipulated time period, the unresolved grievances will be taken up at PMU level. In the event that certain grievances cannot be resolved even at PMU level, particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc., they will be referred to the grievance redress committee (GRC) headed by the Managing Director, CMWSSB. Any issue which requires higher than district level inter-departmental coordination or grievance redress, will be referred to the State level Steering Committee.

127. GRC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the complaint-filing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/unresolved grievances received.

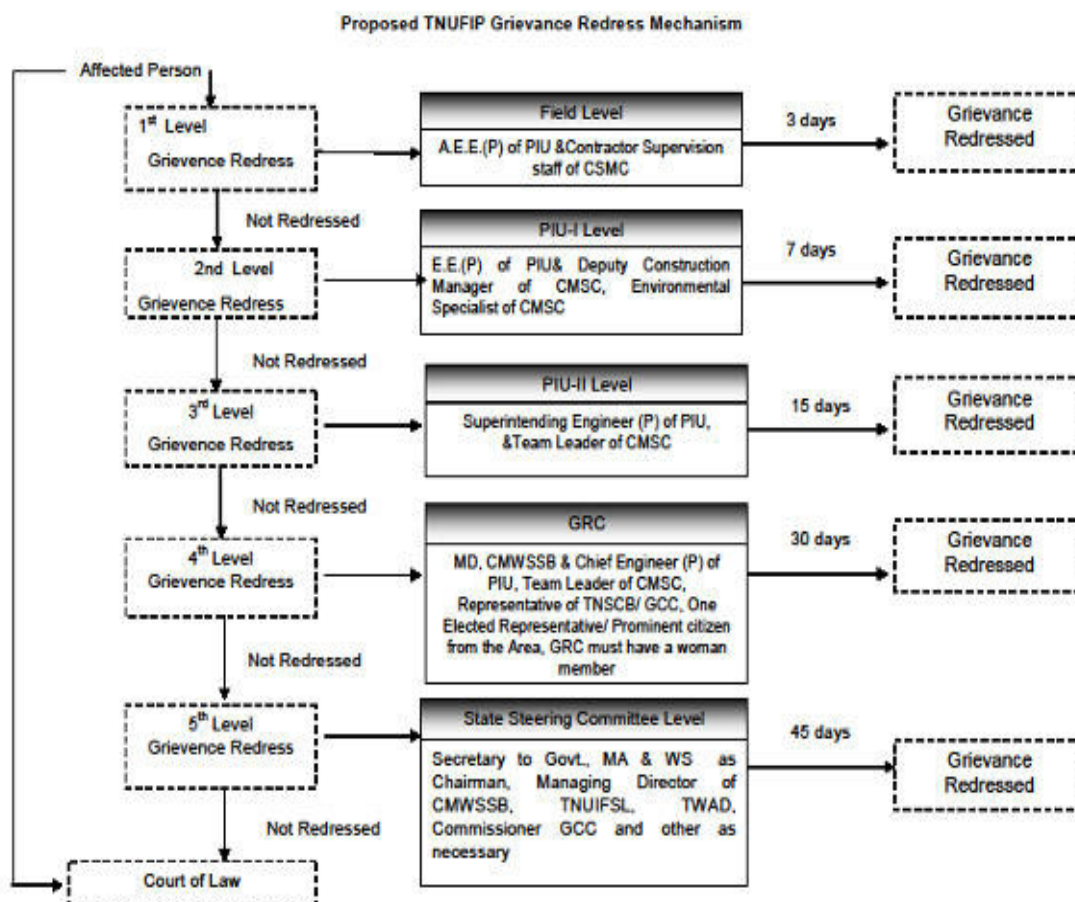
128. **Composition of Grievance Redress Committee.** GRC will be headed by the Managing Director, CMWSSB, and members include: Chief Engineer (P), team leader of CMSC, representative of TNPCB, one elected representative/prominent citizen from the area, and a representative of affected community. GRC must have a women member.

129. **State Level Steering Committee** will include Secretary to Government, MA&WS Department as chairman, member include Managing Directors of TNUIFSL, CMWSSB, TWAD Board, Commissioner, GCC and others as necessary.

130. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC/SSC, will be all locations of sites within the Chennai city where subproject facilities are proposed.

131. The multi-tier GRM for the project is outlined below (Figure 6), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration. The implementing agencies/ULBs shall issue notifications to establish the respective PIU level grievance redress cells, with details of composition, process of grievance redress to be followed, and time limit for grievance redress at each level.

Figure 6: Proposed TNUFIP Grievance Redress Mechanism



CMSC = Construction Management and Supervision Consultant, CMWSSB = Chennai Metropolitan Water Supply and Sewerage Board, GRC = grievance redress committee, PIU = program management unit, TNUIFSL = Tamil Nadu Urban Infrastructure Financial Services Limited, TWADB = Tamil Nadu Water and Drainage Board.

132. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of CMSC) and submitted to PMU.

133. **Information Dissemination Methods of the Grievance Redress Mechanism.** The PIU, assisted by CMSC will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU, offices, ULB notice boards and on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB. A sample grievance registration form has been attached in Appendix 3.

134. **Periodic Review and Documentation of Lessons Learned.** The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

135. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the respective PIU. Cost estimates for grievance redress are included in resettlement cost estimates.

136. **Country legal procedure.** An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

137. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

138. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.

139. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL, PMU, CMWSSB, PIU, consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted

for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

140. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEP. No works are allowed to commence prior to approval of SEMP.

141. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times. The EMP included in the bid and contract documents to ensure compliance to the conditions set out in this document.

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

143. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

Table 12: Design Stage Environmental Impacts and Mitigation Measures
(included in Detailed Project Report)

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Water distribution station	Noise nuisance, safety issues due to operation in residential areas	<ul style="list-style-type: none"> (i) Maintain maximum buffer distance from residential area side to the pump house; (ii) Develop green buffer zone around the facility with trees in multi rows as per the land availability to improve aesthetical appearance (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metallised grating/grill work shall be provided over the sections (or full cross section if required) where workers will stand/work for inspection and repair/operation and maintenance (O&M) purposes. (iv) HSC pumps of suitable rating, with low noise level during operation and high strength-corrosion resistant heavy duty construction shall be proposed. (v) Diesel generators shall be provided for all water distribution station (WDS) for pumping during long period of electricity supply interruption. (vi) Develop standard operating procedures/operational manual for operation and maintenance of WDS; this shall include measures for emerge situations (vii) Provide training to the staff in standard operating procedures (SOPs) and emergency procedures 	Chennai Metropolitan Water Supply & Sewerage Board (CMWSSB)	Project Costs
Water distribution system	Contamination of water supply, occupation health and safety of workers, etc.	<ul style="list-style-type: none"> (i) Water main shall be laid away from sewer main and drains (at least 1 m, wherever possible); (ii) In all cases, the water main should be laid above sewer main depth. (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) (iii) In unavoidable cases, where water mains are to be laid close to storm water drains, covering pipe shall be provided. 	CMWSSB	Project Costs
Pump house	Noise	<ul style="list-style-type: none"> (i) Procure good quality latest technology pumps that guarantee controlled noise at a level of around 70 dB(A) at a distance of 1 m. Noise level will be limited to 45 dB at boundary. Boundary of WDS for Mathur, Madipakkam, Uthandi and Jalladampettai are away from sensitive area. (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise (iii) Use diesel generator sets with acoustic enclosures. (iv) Procure only Central Pollution Control Board (CPCB) approved generators with low emission and low noise fitted with acoustic enclosures 	CMWSSB	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs to workers		
Pump house	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation	CMWSSB	Project Costs
	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment, (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	CMWSSB	Project Costs

Table 13: Pre Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated EMP / SEP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Environmental, Health and Safety (EHS) Supervisor by CMSC to ensure EMP implementation (ii) Submission of updated EMP/ SEP (iii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs	Contractor	Contractor cost
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services.	Contractor in coordination with PIU	Project cost-
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at	Contractor to finalize locations in consultation and approval of PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
		least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 50 m away from sensitive locations like settlements, ponds/lakes or other water bodies.		
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Obtain construction materials only from the existing government approved quarries with prior approval of PIU (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit) (iv) No new borrow areas, quarries etc., shall be developed for the project	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	Contractor cost
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	Contractor and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.
Chance finds	Damage/disturbance to artifacts	(i) Construction contractors to follow these measures in conducting any excavation work <ul style="list-style-type: none"> Create awareness among the workers, supervisors and engineers about the chance finds during excavation work Stop work immediately to allow further investigation if any finds are suspected; Inform Archaeological Survey of India / State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ. 	Contractor and PIU	Contractor cost
Works in Jelladampettai and Madipakkam	Degradation of water quality of Pallikaranai Marshland due to entry of silt laden runoff	(i) No earthworks should be conducted during the rains in general, and in particular no earth work to be conducted in subproject areas of Jelladampettai and Madipakkam during rains (ii) Stockpiled material and earth/soil shall be properly covered with tarpaulins; bunds, silt traps/fences, etc.,	Contractor and PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
		(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; it shall be ensured that no silt laden runoff or traces of fuels, lubricants or chemicals used in construction drains into Pallikaranai marsh (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management (vi) No workers camp sites, storage areas etc., shall be located close to the wetland (< 1 km) (vii) Conduct water quality monitoring of wetland during construction phase, according to the environmental management plan (EMP).		

Table 14: Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Environmental Management Plan (EMP) Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	For all construction works (i) Provide a dust screen (6m high) around the construction sites of pumping and lifting stations (ii) Damp down the soil and any stockpiled material on site by water sprinkling; (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens.	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>(vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation</p> <p>(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; minimize the drop height when moving the excavated soil.</p> <p>(viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area</p> <p>(ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site</p> <p>(x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate</p> <p>(xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties</p> <p>For pipe laying works</p> <p>(i) Barricade the construction area using hard barricades (of 2 m height) on both sides</p> <p>(ii) Initiate site clearance and excavation work only after barricading of the site is done</p> <p>(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area</p> <p>(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area</p> <p>(v) Undertake the work section wise: a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones</p> <p>(vi) Conduct work sequentially - excavation, Pipe laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done.</p> <p>(vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust.</p> <p>(viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.</p> <p>(ix) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.</p>		
Surface water quality	<p>Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality.</p> <p>Ponding of water in the pits / foundation excavations</p>	<p>(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains</p> <p>(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100 m)</p> <p>(iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;</p> <p>(iv) Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies; it shall be ensured that no silt laden runoff or traces of fuels, lubricants or chemicals used in construction drains into Pallikaranai marsh</p> <p>(v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells)</p> <p>(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management</p> <p>(vii) Dispose any wastes generated by construction activities in designated sites;</p> <p>(viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>	Contractor	Contractor cost
	Water accumulation in trenches/pits	<p>(i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area</p> <p>(ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds</p> <p>(iii) Consider safety aspects related to pit collapse due to accumulation of water</p>	Contractor	Contractor cost
Noise Levels	Increase in noise level due to earth-moving	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	and excavation equipment, and the transportation of equipment, materials, and people, and vibration	<p>which will result in least disturbance; especially near schools and other sensitive receptors</p> <p>(ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and</p> <p>(iii) Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.</p> <p>(iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage</p> <p>(v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p> <p>(vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times religious and cultural festivals.</p>		
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	<p>(i) Prepare and implement a Construction Waste Management Plan (Appendix 4)</p> <p>(ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,</p> <p>(iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately</p> <p>(iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should located away from residential areas, forests, water bodies and any other sensitive land uses</p> <p>(v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market</p> <p>(vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties;</p> <p>(vii) Prohibit burning of construction and/or domestic waste;</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins. recycle waste material where possible.</p> <p>(ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate</p>		
Accessibility and traffic disruptions	Traffic problems and conflicts near project locations and haul road	<p>Pipe laying works</p> <p>(i) Prepare a pipe laying work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal; prepare traffic management plans for each section (Appendix 5)</p> <p>(ii) Plan the pipe laying work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public</p> <p>(iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience</p> <p>(iv) Undertake the work section wise: a 100m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones</p> <p>(v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required</p> <p>(vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper excavation; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period</p> <p>(vii) Leave spaces for access between mounds of soil to maintain access to the houses / properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>(viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access.</p> <p>(ix) Inform the affected local population about the work schedule a week before, and a day before to start of work</p> <p>(x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.</p> <p>(xi) Keep the site free from all unnecessary obstructions;</p> <p>(xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</p> <p>(xiii) At work site, public information/caution boards shall be provided including contact for public complaints</p> <p>Hauling (material, waste/debris and equipment) activities</p> <p>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites</p> <p>(ii) Schedule transport and hauling activities during non-peak hours (peak hours 7 a.m. to 10 a.m. and 4 p.m. to 7 p.m.);</p> <p>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</p> <p>(iv) Drive vehicles in a considerate manner</p> <p>(v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</p>		
Socio-Economic Loss of access to houses and business	Loss of income	<p>(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;</p> <p>(ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches</p> <p>(iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around</p> <p>(iv) Control dust generation</p> <p>(v) Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work.</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vi) Employee best construction practices, speed up construction work with better equipment, increase workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools; (vii) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (viii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		
Socio-Economic – Employment	Generation of temporary employment and increase in local revenue	(i) Employ local labour force as far as possible (iii) Comply with labor laws	Contractor	Contractor cost
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Follow all national, state and local labour laws (indicative list is in Appendix 2); (ii) Develop and implement site-specific occupational health and safety (OHS) Plan which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents. ^a Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines. ^b (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites; (iv) Secure all installations from unauthorized intrusion and accident risks (v) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas; (viii) Ensure moving equipment is outfitted with audible back-up alarms; (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p> <p>(xi) Provide supplies of potable drinking water;</p> <p>(xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances</p>		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<p>(i) Consult PIU before locating project offices, sheds, and construction plants;</p> <p>(ii) 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 City Corporation</p> <p>(iii) Avoid tree cutting for setting up camp facilities</p> <p>(iv) Provide a proper fencing/compound wall for camp sites</p> <p>(v) 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</p> <p>(vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit</p> <p>(vii) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers</p> <p>(viii) Camp shall be provided with proper drainage, there shall not be any water accumulation</p> <p>(ix) Provide drinking water, water for other uses, and sanitation facilities for employees; drinking water should be regularly tested to confirm that drinking water standards are met</p> <p>(x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed</p> <p>(xi) Train employees in the storage and handling of materials which can potentially cause soil contamination</p> <p>(xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>sanitation with septic tank and soak pit arrangements (100 m away from surface water body or groundwater well)</p> <p>(xiii) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market</p> <p>(xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and</p> <p>(xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site</p>		
Work Camps and worksites	<p>Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants</p> <p>Unsanitary and poor living conditions for workers</p>	<p>(i) As far as possible located the camp site within the work sites; if any camp to be established outside these, then select a camp site away from residential areas (at least 100 m buffer shall be maintained)</p> <p>(ii) Avoid tree cutting for setting up camp facilities</p> <p>(iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around</p> <p>(iv) 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</p> <p>(v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit</p> <p>(vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of liveability at work camps are maintained at the highest standards possible at all times;</p> <p>(vii) Consult PIU before locating project offices, sheds, and construction plants;</p> <p>(viii) Minimize removal of vegetation and disallow cutting of trees</p> <p>(ix) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers</p> <p>(x) Camp shall be provided with proper drainage, there shall not be any water accumulation</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(xi) Provide drinking water, water for other uses, and sanitation facilities for employees (xii) Prohibit employees from cutting of trees for firewood; contractor should be provide proper facilities including cooking fuel (oil or gas; fire wood not allowed) (xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiv) Recover used oil and lubricants and reuse or remove from the site (xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site.		
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	Contractor	Contractor cost
Temporary economic impacts	Disruption to vendors, hawkers on right-of-way (ROW) during sewer laying works	Contractor is required to provide notice to the shop owners of the need to shift kiosk/wares displayed on ROW as soon as the work plan is ready, with minimum 7 working days. No works can be commenced unless 100% shifted in sections ready for implementation.	CC and PIU	Contractor / PIU

- ^a Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.
- ^b IFC World Bank Group. [Environmental, Health & Safety Guidelines101](#).

Table 15: Construction Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of construction stage EMP including dust control, noise control, traffic management, and safety measures. Site inspection checklist to review implementation is appended at Appendix 6	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	4 locations (locations 50 m downwind direction near WDS work sites in the sub project area);	PM ₁₀ , PM _{2.5} , NO ₂ , SO ₂ , CO	Once before start of construction Quarterly (yearly 4-times) during construction (2 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (36 samples x ₹5000/- per sample = ₹180,000)
Ambient noise	4locations (locations near water distribution station);	Day time and night time noise levels	Once before start of construction Quarterly (yearly 4-times) during construction (2 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (36 samples x 1500 per sample = 54,000)
Surface water quality	4 locations (1 point each in Periaithope lake near mathur Buckingham canal near uthandi and in MadipakkamEri, and Pallikaranai marsh. located in the project area	pH, Oil and grease, Cl, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before start of construction Half yearly during construction (2 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
					(20samples x 4000 per sample = 80,000)

Table 16: Operation Stage Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of treated water quality from water treatment plant at receiving point of WDS	Inlet pipe to UGT	Residual chlorine and TDS,	Daily	CMWSSB	CMWSSB Operating Cost
Monitoring the water quality at outlet point of WDS	Outlet of OHT	Residual chlorine and TDS,	Daily	CMWSSB	CMWSSB Operating Cost
Monitoring the water quality at various points in the distribution system	Various locations in the distribution system	Residual chlorine	Daily	CMWSSB	CMWSSB Operating Cost

CMWSSB = Chennai Metropolitan Water Supply and Sewerage Board, OHT = overhead tank, TDS = total dissolved solids, UGT = underground tank, WDS = water distribution station.

B. Implementation Arrangements

144. The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu acting through the Tamil Nadu Urban Infrastructure Financial Services Ltd. (TNUIFSL) is the state-level executing agency. A program management unit (PMU) will be established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from CMWSSB), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. A Project Steering Committee headed by Principal Secretary, MA&WS, and members include managing directors of TNUIFSL, CMA, and Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) will be established.

145. The implementing agency for this subproject is Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB). A program implementation unit (PIU) will be established in CMWSSB headed by Chief Engineer (CMWSSB) and comprising dedicated full-time staff from engineering and other departments of CMWSSB. PIU under the CMWSSB will be responsible for planning, implementation, monitoring and supervision, and coordination of all activities of subproject. A Construction, Management and Supervision Consultant (CMSC) will be appointed to assist PIU in day-to-day implementation of the subproject.

146. **Safeguards Compliance Responsibilities.** Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL will have overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers report to Vice President in the Projects Wing. ESS Managers (TNUIFSL) will report to the Head, Projects Division. At CMWSSB, The Assistant Executive Engineer in-charge of the project, who will coordinate safeguard tasks at CMWSSB. As expert support is available to CMWSSB via CMSC, and the role of Assistant Executive Engineer will be mainly to coordination, overseeing the implementation of safeguard tasks, grievance redress and reporting.

147. **PMU Safeguard Responsibilities.** Key tasks and responsibilities of the ESS Manager (Environment), for this subproject include the following:

Detailed Project Report finalization and Bidding stage:

- (i) Ensure that all design related measures of the EMP are included designs
- (ii) Ensure that EMP is included in bidding documents and civil works contracts including requirement for Environmental, Health and Safety (EHS) supervisor with the contractor
- (iii) Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labour laws and core labour standards
- (iv) Ensure that staff required for implementation of EMP (EHS officer) is included in the bid requirements
- (v) Ensure that EMP cost is included in the project cost
- (vi) Prior to invitation of bids and prior to award of contract ensure that all clearance/permissions as required for implementation of subproject are in place to the extent possible

Construction stage:

- (i) Prior to start of construction:
 - Ensure that all necessary clearances/permissions/licences, including that of contractor's are in place prior to start of construction
 - provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by PIUs and contractors

- (ii) Oversee and provide guidance to the PIU to properly carry out the environmental monitoring as per the EMP
- (iii) Oversee grievance redress mechanism to address any grievances brought about in a timely manner; ensure that records are properly maintained
- (iv) Consolidate quarterly environmental monitoring reports from PIU and submit semi-annual monitoring reports to ADB
- (v) Oversee site closures to ensure that all work / facility sites are restored properly prior to issuing work completion certificate to the contractor

148. **Operation stage.** Ensure that operation of water supply system developed under the subproject is in compliance with all government regulations, standards and conditions.

149. **PIU Safeguard Responsibilities.** Key tasks and responsibilities of the PIU assisted by CMSC for this subproject include the following:

Detailed Project Report finalization and Bidding stage:

- (i) Include design related measures of the EMP in the project design and DPR;
- (ii) Include EMP in the bidding documents and civil works contracts, including requirement of staff (EHS supervisor) with contractor for EMP implementation;
- (iii) Provide necessary budget in the project as IEE for EMO Implementation;
- (iv) Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labour laws and core labour standards including:
 - (a) Labour welfare measures and provision of amenities;
 - (b) prohibition of child labour as defined in national legislation for construction and maintenance activities;
 - (c) equal pay for equal work of equal value regardless of gender, ethnicity, or caste;
 - (d) elimination of forced labour;
 - (e) the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.
- (v) In the pre-bid meeting, provide insight into EMP measures, and overall compliance requirements to the bidders;
- (vi) Obtain all clearance/permissions as required for implementation of subproject, prior to invitation of bids and/or prior to award of contract / prior to construction as appropriate.

Construction stage:

- (i) Identify regulatory clearance requirements and obtain all necessary clearances prior to start of construction; ensure construction work by contractor is conducted in compliance with all government rules and regulations including pollution control, labour welfare and safety etc.;
- (ii) Prior to start of construction organize an induction course for the training of contractors, preparing them on EMP implementation, environmental monitoring, and on taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (iii) Ensure contractor compliance with staff resources as per the IEE/EMP/Bid;
- (iv) Guide contractor on updating EMP/preparing site environmental plan at the start of the project;

- (v) Update IEE and EMP; ensure that IEE reflects the final design being implemented by contractor;
- (vi) Conduct public consultation and information disclosure as necessary;
- (vii) Take necessary action for obtaining rights of way;
- (viii) Supervise day-to-day EMP implementation on site by contractor, including the environmental monitoring plan;
- (ix) Supervise ambient environmental monitoring by contractors;
- (x) Take corrective actions when necessary to ensure no environmental impacts;
- (xi) Submit quarterly environmental monitoring reports to PMU;
- (xii) Conduct continuous public consultation and awareness;
- (xiii) Address any grievances brought about through the grievance redress mechanism in a timely manner as per the EMP;
- (xiv) Monitor Contractor's compliance with the measures set forth in the EMP and any corrective or preventative actions set forth in a safeguards monitoring report that the PMU will prepare from time to time;
- (xv) Implement corrective or preventative actions in case of non-compliance or new/unanticipated impacts;
- (xvi) Inform PMU promptly in case if any significant impacts surfaces, which were not identified in the IEE and develop necessary corrective actions as necessary and ensure implementation by the contractors; include all such impacts and suggested actions in the quarterly environmental monitoring reports;
- (xvii) Implementation grievance redress system, and undertake appropriate actions to redress the complaints; ensure that complaints/grievances are addressed in a timely manner and resolutions are properly documented;
- (xviii) Review and approve monthly progress reports submitted by Contractor on EMP compliance;
- (xix) Prepare quarterly environmental monitoring reports and submit to PMU/TNUIFSL; and
- (xx) Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB.

Operation stage:

- (i) Conduct environmental management and monitoring activities as per the EMP;
- (ii) Ensure that conveyance system constructed and operated with all necessary clearances and approvals, and compliance with standards and conditions

83. Contractor's Responsibilities.

Bidding stage:

- (i) Understand the EMP requirements and allocate necessary resources (budget, staff, etc.); and
- (ii) Understand the regulatory compliance requirements related to labour welfare, safety, environment etc.

Construction stage:

- (i) Mobilize EHS Supervisor prior to start of work;
- (ii) Prepare SEMP and submit to PIU;
- (iii) Ensure that all regulatory clearances (both project related and contractor related) are in place prior start of the construction work;
- (iv) Confirm with PIU availability of rights of way at all project sites prior to start of work;
- (v) Prepare and submit:

- (a) Construction waste management (CWM) plan (sample is in Appendix 4);
- (b) Traffic management plan (sample is in Appendix 5);
- (c) OHS Plan, pollution control plan, dust emergency response plan.
- (vi) Implement the mitigation measures as per the EMP including CWM and traffic management plan;
- (vii) Follow the EMP measures/guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.;
- (viii) Implement EMP and ensure compliance with all the mitigation and enhancement measures;
- (ix) Conduct environmental monitoring (air, noise, water etc.,) as per the EMP
- (x) Undertake immediate action as suggested by PIU to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (xi) Submit monthly progress reports on EMP implementation to PIU;
- (xii) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU and CMSC; and
- (xiii) Comply with applicable government rules and regulations.

C. Training Needs

150. The following Table 17 presents the outline of capacity building program to ensure EMP implementation. These capacity building and trainings will be conducted at the offices of PMU and PIU by the environmental safeguards specialist of PMU/PIU and their consultants, which are part of project implementation set-up, and therefore no separate or additional costs are envisaged. Adequate costs are already considered in project's capacity building program. The detailed program and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the PMU.

Table 17: Outline Capacity Building Program on Environmental Management Plan Implementation

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement - Government of India and Tamil Nadu applicable safeguard laws, regulations and policies including but not limited to core labor standards, occupational health and safety (OHS), etc. - Incorporation of environmental management plan (EMP) into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project At program management unit (PMU) (combined program for all program implementation unit or PIU)	-	Included in the overall program cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures - Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) -- Chance find (archaeological) protocol - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up and restoration	All PIU staff, contractor staff and consultants involved in the subproject At PIU	-	To be conducted by CMSC at the PIU office; part of project implementation cost
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work All workers (including unskilled laborers)	-	Contractors' EHS officer to conduct program, with guidance of CMSC

D. Monitoring and Reporting

151. Immediately after mobilization and prior to commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor should confirm that the staff for EMP implementation (EHS supervisor) is mobilized. PIU will review, and approve the report and permit commencement of works.

152. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. CMSC will monitor, review and advise contractors for corrective actions if necessary. Quarterly report summarizing compliance and corrective measures, if any, taken will be prepared by CMSC team at PIU and submitted to PMU (Report format is at Appendix 7). During operation, PIU will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU annual report.

153. Based on PIU quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit semi-annual environmental monitoring report (SEMR). Once concurrence from the ADB is received the report will be disclosed on TNUIFSL and CMWSSB websites.

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

155. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

E. Environmental Management Plan Implementation Cost

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

Table 18: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A.	Implementation staff						
1	EHS Supervisor	Construction	per month	24	35,000	8,40,000/-	Civil works contractor
	Subtotal (A)					8,40,000/-	
B.	Mitigation Measures						
1	Provision for tree cutting and compensatory plantation measures (1:10 ratio replantation)	Construction	Per tree	10	1,000	10,000	Project costs (PIU)
2	Preparation of plans traffic management plan, waste (spoils) management plan etc.), traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	3,00,000	Civil works contractor
	Subtotal (B)					3,10,000/-	
C.	Monitoring Measures						
1	Air quality monitoring	Construction	per sample	36	5,000	180,000	Civil works contractor
2	Noise levels monitoring	Construction	Per sample	36	1,500	54,000	Civil work contractor
3	Surface water monitoring	Construction	Per sample	20	4,000	80,000	Civil work contractor
	Subtotal (C)					314,000/-	
D.	Capacity Building						
1.	Training on EMP implementation	Pre-construction				-	Part of PIU and PMU , consultant tasks
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite				-	Civil works contractor cost
	Subtotal (D)						
	Total (A+B+C+D)					₹ 1,464,000/-	

Contractor Cost - 6,14,000/-
 PIU Cost - 10,000/-
 CMSC Cost - 8,40,000/-
 Total - 14,64,000/-

IX. CONCLUSION AND RECOMMENDATIONS

157. The process described in this document has assessed the environmental impacts of all elements of the proposed water supply subproject covering Mathur, Madipakkam, Jalladampettai and Uthandi in Chennai City. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure.

158. No new water treatment plant is included in the subproject. Water treated from CMWSSB's existing WTPs will be utilized as it has sufficient capacity to meet water demand from the subproject area. Due diligence conducted during the IEE indicated that the existing two WTPs (Minjur and Nemmeli Desalination Plants), which will supply treated water to the subproject area are functioning well and in compliance with all required government licenses and permits. Water produced from the facility complies with drinking water standards.

159. All new water distribution stations consisting of underground tanks, overhead tanks and pump houses, are situated on government owned vacant land parcels, and water feeder and distribution mains will be laid along the edge of the public roads. Therefore subproject does not involve any private land acquisition.

160. Except pipe laying works, all other construction activities will be confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Pipe line works will be conducted along edge of public roads in an urban area congested with people, activities and traffic, subproject is likely to significant impacts during construction. Impacts mainly arise from the construction dust and noise; from the disturbance of residents, businesses, traffic by the construction work, safety risk to workers, public and nearby buildings due to deep trench excavations, especially in narrow roads, dust, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

161. Once the new system is in place, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the O&M manual and standard operating procedures to be developed for all the activities. Pre-audit will be carried out prior to operation of the scheme.

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

163. Stakeholders were involved in developing the IEE through face-to-face discussions. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via CMWSSB and ADB websites. The consultation process will be continued during project implementation, as required, to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation.

164. The project's grievance redress mechanism will provide the citizens with a platform for redress their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

165. The EMP will assist the project agencies and contractor in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project. A copy of the updated EMP/ SEP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site, to ensure compliance to the conditions set out in this document.

166. The citizens of the sub projects area of Mathur, Madipakkam, Jalladampettai and Uthandi are the major beneficiaries of this subproject. The new water supply system will provide safe drinking water of acceptable standard for the public which will improve the over-all public health in the project area. Diseases due to poor water quality, such as Cholera, diarrhoea and dysentery will be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

167. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment.

168. This IEE shall be updated by CMWSSB during the implementation phase to reflect any changes, amendments.

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Water supply

Instructions:

- ☐ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Sustainable Development and Climate Change Department.
- ☐ This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- ☐ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- ☐ Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

Country/Project Title: **India / Tamil Nadu Urban Flagship Investment Program– Providing Comprehensive Water Supply Scheme to Mathur, Madipakkam, Jalladampettai and Uthandi In Chennai City**

Sector Division: **Urban Development and Water Division**

Screening Questions	Yes	No	Remarks																				
A. Project Siting Is the project area...																							
<ul style="list-style-type: none"> Densely populated? 	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/>	<p>Core Chennai city areas are very densely populated. Added areas are comparatively less dense. Sub project areas are part of the added areas of Chennai city. As core Chennai city is already saturated, developments are taking place in the added areas including present sub project area. The entire core Chennai city has already been provided with water supply and sewerage facilities. It is proposed to provide water supply facilities in the entire 42 added areas of Chennai city on par with core city. Accordingly providing water supply and sewerage infrastructures in some parts of added areas are in various stages of implementation. As part of the water supply proposal, now it is proposed to extend the water supply facilities in the Subproject area covering Mathur, Madipakkam, Jalladampettai and Uthandi. The Extent, Population and Density of the sub project area is furnished below:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: center;">Area</th> <th style="text-align: center;">Extent in Hect</th> <th style="text-align: center;">Population (2020) in thousand</th> <th style="text-align: center;">Population density per Hect</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Mathur</td> <td style="text-align: center;">297</td> <td style="text-align: center;">33521</td> <td style="text-align: center;">112</td> </tr> <tr> <td style="text-align: center;">Madipakkam</td> <td style="text-align: center;">340</td> <td style="text-align: center;">35752</td> <td style="text-align: center;">105</td> </tr> <tr> <td style="text-align: center;">Jalladampettai</td> <td style="text-align: center;">228</td> <td style="text-align: center;">19016</td> <td style="text-align: center;">84</td> </tr> <tr> <td style="text-align: center;">Uthandi</td> <td style="text-align: center;">340</td> <td style="text-align: center;">8940</td> <td style="text-align: center;">26</td> </tr> </tbody> </table>	Area	Extent in Hect	Population (2020) in thousand	Population density per Hect	Mathur	297	33521	112	Madipakkam	340	35752	105	Jalladampettai	228	19016	84	Uthandi	340	8940	26
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Mathur	297	33521	112																				
Madipakkam	340	35752	105																				
Jalladampettai	228	19016	84																				
Uthandi	340	8940	26																				
<ul style="list-style-type: none"> Heavy with development activities? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	It is a developing area; urban expansion is considerable																				
<ul style="list-style-type: none"> Adjacent to or within any environmentally sensitive areas? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-																				
<ul style="list-style-type: none"> Cultural heritage site 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-																				

Screening Questions	Yes	No	Remarks
• Protected Area	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Wetland	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Mangrove	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Estuarine	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Buffer zone of protected area	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Special area for protecting biodiversity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
• Bay	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
B. Potential Environmental Impacts Will the Project cause...			
▪ Pollution of raw water supply from upstream waste water discharge from communities, industries, agriculture and soil erosion runoff	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Does not arise as the subproject areas are proposed to be supplied with desalinated water.
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No historical or cultural sites in the subproject area
▪ hazard of land subsidence caused by excessive ground water pumping?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ground water will not be extracted for providing water supply
▪ social conflicts arising from displacement of communities ?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ delivery of unsafe water to distribution system?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ inadequate protection of intake works or wells, leading to pollution of water supply?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ over pumping of ground water, leading to salinization and ground subsidence?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ excessive algal growth in storage reservoir?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ increase in production of sewage beyond capabilities of community facilities?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ inadequate disposal of sludge from water treatment plants?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ impairments associated with transmission lines and access roads?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Screening Questions	Yes	No	Remarks
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ dislocation or involuntary resettlement of people	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ social conflicts between construction workers from other areas and community workers?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ noise and dust from construction activities?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Noise and dust may occur during construction period. But it is only temporary. Suitable mitigation measures will be adopted to contain noise and dust pollution
▪ increased road traffic due to interference of construction activities?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Increase in road traffic may occur in some areas. But it is only temporary in nature.
▪ continuing soil erosion/silt runoff from construction operations?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ Accidental leakage of chlorine gas?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Safety officer has been posted for both the desalination plants and will be responsible for the safety and mitigation measures.
▪ excessive abstraction of water affecting downstream water users?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ competing uses of water?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ increased sewage flow due to increased water supply	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Steps has been taken to provide underground sewerage system in the sub project area
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

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

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labour (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs.3,500/- per month or less. The bonus to be paid to employees getting Rs.2,500/- per month or above up to Rs.3,500/- per month shall be worked out by taking wages as Rs.2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

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

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

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

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

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

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Tamil and English)

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

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

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

FOR OFFICIAL USE ONLY

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

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

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

I. Spoils information

The spoil information contains the details like (i) the type/material, (ii) Potential contamination by that type, (iii) Expected volume (site/component specific), and (iv) Spoil Classification etc.

II. Spoils management

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

III. Documentation

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

SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for TMP around the Water Supply Scheme Implementation Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties; and
- (v) addressing issues that may delay the project.

B. Operating Policies for Traffic Management Plan

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

- (i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance;
- (ii) Inhibit traffic movement as little as possible;
- (iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone;
- (iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary;
- (v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones;
- (vi) Train all persons that select, place, and maintain temporary traffic control devices.
- (vii) Keep the public well informed; and
- (viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A5.1** illustrates the operating policy for TMP for the construction of water pipes along various types of roads.

C. Analyze the Impact Due to Street Closure

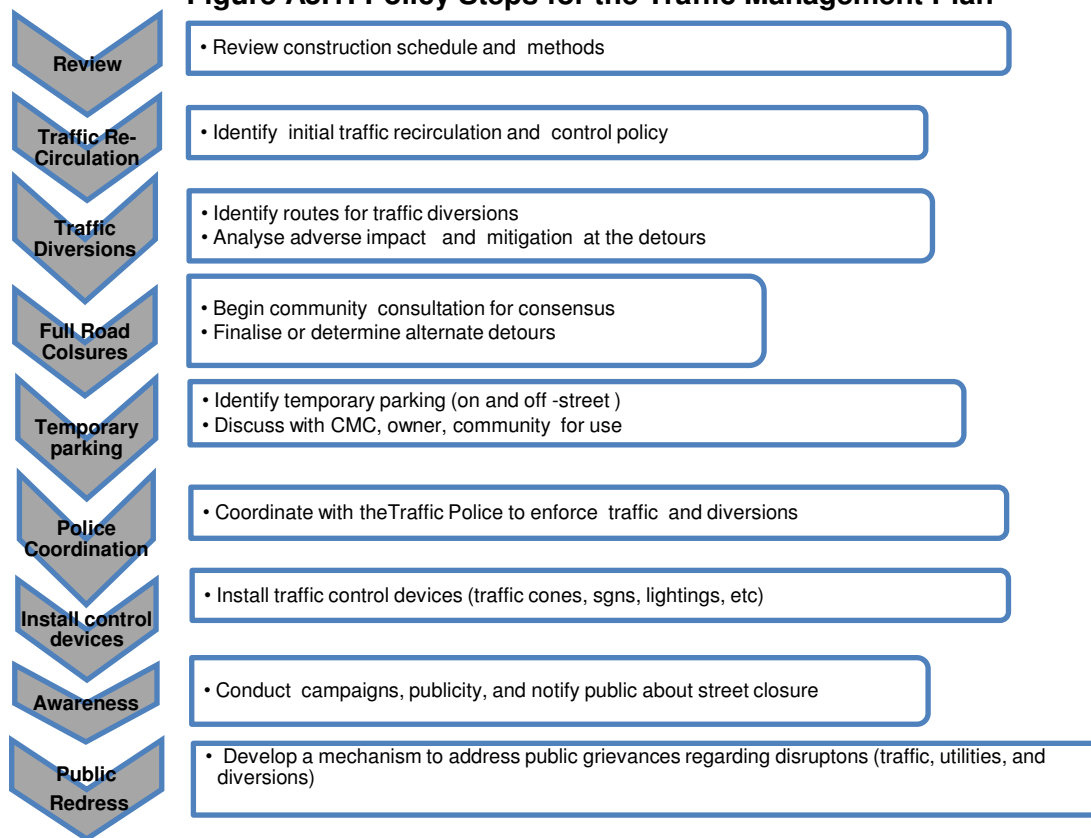
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- (i) approval from the Greater Chennai Corporation/Highways/Public Works Department (PWD) to use the local streets as detours;
- (ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (iv) determining if additional traffic control or temporary improvements are needed along the detour route;
- (v) considering how access will be provided to the worksite;

- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A5.1: Policy Steps for the Traffic Management Plan



D. Public awareness and notifications

6. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for

this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:

- (i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- (ii) defensive driving behaviour along the work zones; and
- (iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) explain why the brochure was prepared, along with a brief description of the project;
- (ii) advise the public to expect the unexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- (vi) indicate the office hours of relevant offices.

E. Install traffic control devices at the work zones and traffic diversion routes

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be

cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12. **Figure A5.2 to Figure A5.6** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

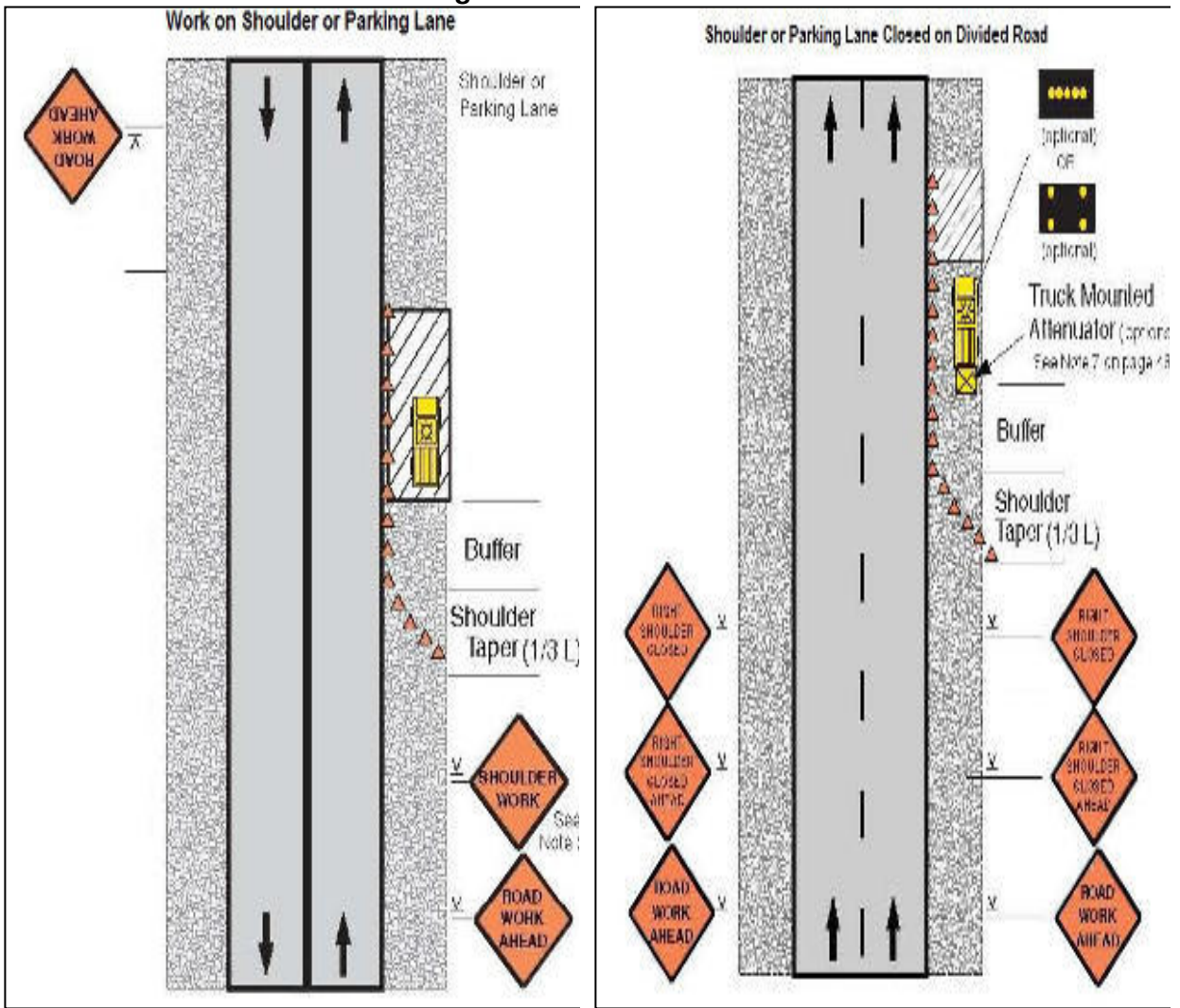
- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Street closure with detour

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

Figure A5.2 and A5.3: Work on Shoulder or parking Lane and Shoulder or Parking Lane Closed on Divided Road



Work in Travel Lane
(Maintaining Two-way Traffic, 35 MPH or Less)

OR

See Note 2

ROAD WORK AHEAD

ROAD NARROWS

Shifting Taper (1/2 L)

Buffer

Shifting Taper (1/2 L)

10' MIN

10' MIN

25'

Buffer

Shifting Taper (1/2 L)

See Note

ROAD WORK AHEAD

Lane Closure on Road with Low Volume
(No Flagger, Traffic Self Regulating, 35 MPH or Less)

ROAD WORK AHEAD

ONE LANE ROAD AHEAD

100'

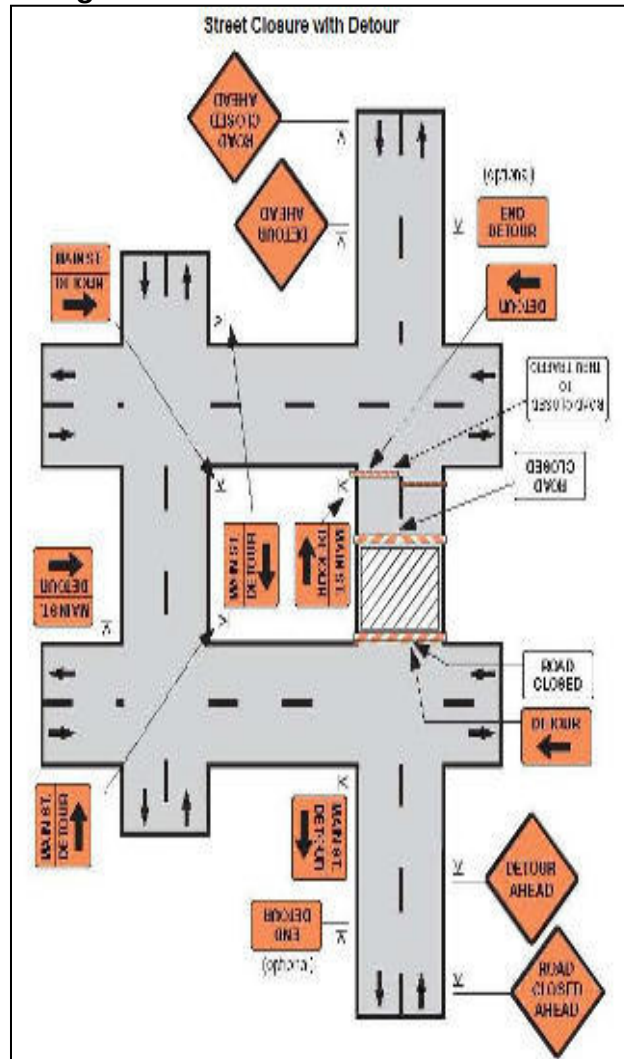
Buffer (optional)

Taper 50' MIN to 100' MAX

ONE LANE ROAD AHEAD

ROAD WORK AHEAD

Figure A5.6: Street Closure with Detour



SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name: Providing comprehensive Water Supply Scheme to Mathur, Madipakkam,
Jalladampettai and Uthandi in Chennai City

Contract Number: CNT/WSS/NCB/AMRUT-ADB/002/2017-18

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

WEATHER: _____

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

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

Monitoring Items	Compliance
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs etc)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard and safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	
Toilet facility provided at the site	
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet and bath facilities provided	
Contractor employed local workers as far as possible	
Workers camp set up with the permission of PIU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

Sign off

Name
Position

Name
Position

QUARTERLY REPORTING FORMAT FOR CMWSSB/PROGRAM IMPLEMENTATION UNIT**1. Introduction**

- Description of sub-project implemented by PIU
- Environmental category of the sub-project
- Details of site personnel and/or consultants responsible for environmental monitoring
- Sub-project status

No.	Sub-Project Name	Subproject status	List of Works	Progress of Works
		Design <input type="checkbox"/> Pre-Construction <input type="checkbox"/> Construction <input type="checkbox"/> Operational Phase <input type="checkbox"/>		

2. Compliance status with National/ State/ Local statutory environmental requirements

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

3. Compliance status with environmental loan covenants, if any

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

4. Compliance status with the environmental management and monitoring plan

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.
- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:

- What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries;
- If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
- adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
- Are their designated areas for concrete works, and refuelling;
- Are their spill kits on site and if there are site procedure for handling emergencies;
- Is there any chemical stored on site and what is the storage condition?
- Is there any dewatering activities if yes, where is the water being discharged;
- How are the stockpiles being managed;
- How is solid and liquid waste being handled on site;
- Review of the complaint management system;
- Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary Monitoring Table

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

Overall Compliance with EMP

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

5. Approach and methodology for environmental monitoring of the project

- Brief description on the approach and methodology used for environmental monitoring of each sub-project.

6. Monitoring of environmental impacts on project surroundings (ambient air, water quality and noise levels)

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

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

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Government Standard)
----------	-----------------	---------------	--

			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

7. Summary of key issues and remedial actions

- Summary of follow up time-bound actions to be taken within a set timeframe.

8. Appendixes

- Photos
- Summary of consultations conducted, if any
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

PUBLIC INFORMATION NOTICE TEMPLATE

Public Announcement
Chennai Metropolitan Water Supply & Sewerage Board
Providing water supply scheme to Mathur, Madipakkam, Jalladampettai and Uthandi
in Chennai City

Under this project, works are being conducted by xxxxxxxx Contractor to provide water supply scheme for Mathur, Madipakkam, Jalladampettai and Uthandi in Chennai city

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

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

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

Inconvenience caused is regretted.

PIU - Contact No.

Contractor – Contact no.

**STAKEHOLDER CONSULTATION/FOCUSSED GROUP DISCUSSION FOR PROVIDING
WATER SUPPLY SCHEME TOMATHUR, MADIPAKKAM, JALLADAMPETTAI AND
UTHANDI**

1. At the outset of the meeting, Area Engineers welcomed the stakeholders, CMWSSB officials and representatives from various Welfare Association.
2. Superintending Engineer (P&D), CMWSSB, Chennai, briefed about the background of the proposed project and details of fund sanctioned under AMRUT and ADB.
3. Executive Engineer (P&D) explained the salient features of project area informing the geographical area, total length of streets, Population for 2011 and 2050, length of distribution pipeline, location of water distribution station, water demand, source of water for the project area.
4. The stakeholders were also informed about the location of water distribution station where proposed UGT, OHT and pump house proposed.
5. Further, the stakeholders were welcomed for opinions and suggestions regarding the project proposals.
6. Stakeholders in general welcomed the project proposal and appreciated the initiative undertaken to inform the public and seek opinions from them through stakeholders consultation meeting.
7. Various general public association / individuals have given their feedbacks in writing. Representation of about 12 Nos for Mathur, 20 Nos for Madipakkam 6 Nos for Jalladampettai and 6 Nos for Uthandi were received during the stakeholders meeting.
8. The details of the questions raised by the general public association/public and clarification provided by CMWSSB Engineers are summarized in the Tables 1, 2, 3, and 4.
9. The attendance of stakeholders, photographs of stakeholders consultation meeting, notices/ pamphlets issued to public, salient features, are enclosed in the Annexure.

Table A9.1. Stakeholder Consultation/Focussed Group Discussion for Providing Water Supply Scheme To Mathur

No.	Name/Designation Address	Queries/Suggestion /Opinion	Clarification
1	Mr.Kesavan, No.58, Ambedkar street, Manali.	-	.
2	Mr.TamaraiKannan, No.2/10, Kamarajar street Mathur	We welcome the water supply scheme to Mathur. Complete the scheme within the time frame.	The project will be completed within 24 months.
3	Mr.A.Pandian, 3 rd main road, MMDA colony, Mathur.	-	
4	Mr.M. Mohanaraj, 3 rd main road, TNHB colony, MMDA ,Mathur.	-	
5	Mr. S. Chowdhri. Ponnamankoil street, Mathur	Provide sewerage scheme to Mathur soon.	The DPR is under preparation for Mathur UGSS.
6	Mr. R. Jayakumar , MMDA, Mathur	-	
7	Mr. K.Karunakaran, MMDA, Mathur	-	
8	Mr.Elumalai No.2/55 Kamarajar street PeriyaMathur, Manali.	We requested to provide water supply scheme to our division 19, Mathur. Implement the water supply scheme quickly.	The project will be completed within 24 months.
9	Mr.K.Parthiban, 2/89 Kamarajar street PeriyaMathur, Manali.	We request to provide water supply scheme & house service connection to our area soon.	The project will be completed within 24 months.
10	Mr.B.Thirugnanam TNHB Mathur, Manali.	We request TNHB scheme to be taken over by CMWSSB. Main Road should have both sides sewer connection. Manali area should be sewage line work to be taken up very fast.	The DPR is under preparation for Mathur UGSS.
11	Mr.K.Prarathaman, MMDA Mathur,	We thank to CMWSSB for providing water supply scheme to Mathur.	
12	Mr.G.Santhoshkumar, Perumalkoil street Mathur,	We thank to CMWSSB for providing water supply scheme to Mathur.	

Table A9.2. Stakeholder Consultation/Focussed Group Discussion for Providing Water Supply Scheme to Madipakkam

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
1	The president Madipakkam North East resident welfare Association Rajaji Nagar main road, Sadasiva Nagar Madipakkam.	The water pressure should be maintained based on the earth level . (Low & high) Capacity of storage tank and laying of pipes should be in accordance with the population. The present population of Madipakkam is now double the quantum of 2011 census population as shown in the form. The commencement and completion of the project should be on war footing basis, since it is being laid afresh, till such time residents may suffer for drinking water . Thanks for extending all co-operation.	In the design of distribution system the ground level is considered. The residual pressure of 12m is maintained at all nodes. Capacity of reservoir is designed considering the ultimate population for the year 2050. The work will be completed within the contract period of 24 months.
2	Mr. A. Wajith Khan Madipakkam.	As per the Association views above .	
3	Mr. V. Seetharaman Madipakkam.	As per the Association views above.	
4.	Mr. K.Pakkiriswamy Madipakkam.	As per the Association views above	
5	R. Sumathy Sadasiva Nagar Madipakkam.	As per the Association views above	
6	Mr. K.Anaikutty Ram nagar south Madipakkam.	As per the Association views above	
7	C. Bhargavi Rajaji Nagar Madipakkam.	As per the Association views above	
8	Mr. S.Nagarajan Sadasiva Nagar Madipakkam.	As per the Association views above In Madipakkam area storm water drain has been constructed above the road level .the houses are below the road level. The storm water drain are in front side of the houses. While giving House service connection consider the above points.	The house service connection will be given with covering pipe of the MDPE pipe while crossing the storm water drain.
9	Mr. E. Kalyanasundaram Sadasiva Nagar Madipakkam.	As per the Association views above	
10.	Mr. V. Shanmugam Mahalakshmi Nagar Madipakkam.	Implement the water supply scheme soon . Public will get Metrowater at the earliest.	The work will be completed within the contract period of 24 months
11	Mr. S. Jayakumar Sathsangam street, Madipakkam.	Implement the water supply scheme soon. Provide pipe with good quality. The road should be restored properly after the pipe laying work completed. Implement the scheme properly with proper supervision so that public will be benefited by the scheme. Provide sewerage scheme to Madipakkam soon.	The work will be completed within the contract period of 24 months. Good quality of pipe will be used for this scheme. The road restoration will be done by Corporation of Chennai after completion of pipe laying work .The work will be executed with proper

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
			supervision of Engineers. The preparation of DPR is under progress for Madipakkam. The UGSS will be taken up soon.
12	Mr. R. Dayalan Eswarankoil street, Madipakkam.	Implement the water supply scheme as quickly as possible. We request to provide sewerage scheme to Madipakkam soon.	The work will be completed within the contract period of 24 months. The preparation of DPR is under progress for Madipakkam. The UGSS will be taken up soon.
13	Mr. Tamiloli Ponniammankoil street, Madipakkam.	In ward no.187, Kulakari street is extended. Provide water main to the entire street .The road are with up and down .The water pressure should be maintained uniformly since the roads are not uniform level .	Water main will be provided to the entire length of Kulakari street. In the design of distribution system the ground level is considered. The residual pressure of 12m is maintained at all nodes.
14	Mr. K. Krishna moorthy Ram Nagar, Madipakkam.	The stakeholders consultation is very useful. The water pressure should be maintained uniformly since the roads are not uniform level . Please inform the public before execution of work in each street. Supervision of work can be done by welfare association also with permission. Try to avoid shortage of source of water in future.	In the design of distribution system the ground level is considered. The residual pressure of 12m is maintained at all nodes. Before start of work in each street the public will be informed .
15	Mr. S.Narayanasamy Ram Nagar, Madipakkam	The stakeholders consultation is very useful. Implement the water supply scheme as quickly as possible. While execution of project the welfare association views can be considered by the Engineer . Thanks for giving this opportunity.	The work will be completed within the contract period of 24 months.
16	Mr. S.Sethuraman Karthikeyapuram Madipakkam	We welcome the Madipakkam water supply scheme. Implement the in Co-ordination with other service department. The present & ultimate population for the year 2050 considered is low. Please ensure equitable distribution of water in all the streets	The water supply scheme will be implanted in co-ordination with other service departments. The population projection for the year 2050 is as per the Master plan. The design of distribution system has been done considering the equitable distribution of water in all the streets.
17	Mr. M.Arumugam, Govindasamy Nagar 3rd street , Madipakkam	The water supply project should be completed as quickly as possible. Old worn out pipes should be removed. Is Nemili project –II completed. If not try to complete soon	The work will be completed within the contract period of 24 months. Old pipes will be removed. 100MLD desalination plant is completed. For 150 MLD desalination plant tender

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
			invited and under evaluation.
18.	Mr. S. Gnanavel., Rajarajeswari Nagar , Madipakkam	Provide 5.00 LL UGT near Sheela Nagar. From the proposed Site near dumping yard the possibility of getting equitable distribution of water upto Erikari street is less. Please provide UGT at one more site	The site at Corporation dumping yard is finalised. The design is done in such a way that the residual pressure of 12m is maintained at all nodes.
19	Mr. C.Lakshminarayanan Govindasamy Nagar 3rd street , Madipakkam	We thank for getting fund for this project. We are happy to know that the work will be stated within 6 months and completed within 3 years. We are happy to know that from 50.0LL OHT of 17m staging height the tail end area also get 12m residual pressure . We are happy to know that for Madipakkam water supply ₹67.00 crores allotted and Ductile Iron pipes will be provided for distribution main .	
20	Mr. A.Ravi. Thanthai Periyar nagar, Madipakkam	We request to include the following streets in the Madipakkam water supply scheme. 1. Avvaiyar street 2. Agathiyar street 3. Elngovan street 4. Kambar street 5. Kannapiran street 6. Bharatiyar street 7. Bharathidasn street 8. SDS street 9. Koil street 10. Jayalalitha street 11. Anna street 12. Kamarajarstret 13. MGR street 14. Nehru street 15. Madipakkam main road 16. Velachery main road 17. Indra street 18. Thiruvallurvar street 19. Nesamani street 20. kannadasan street	The 20 streets mentioned in the list are included in the Madipakkam water supply scheme.

Table A9.3. Stakeholder Consultation/Focussed Group Discussion for Providing Water Supply Scheme to Jalladampet

No.	Name/Designation Address	Queries/Suggestion /Opinion	Clarification
1	Mr.E.Jayaprakash. Selvavinayagarkoil street, Thiruvalluvar Nagar Jalladampet	We welcome the water supply scheme.	.
2	Mr.M.kumar Nesavallar Nagar Jalladampet	Our long pending request to provide water supply scheme to Jalladampet is now fulfilled. We request to complete the scheme as quickly as possible.	The project will be completed within the contract period of 24 months.

No.	Name/Designation Address	Queries/Suggestion /Opinion	Clarification
3	Mr.R. Sekar Nesavallar Nagar Jalladampet	We welcome the water supply scheme. We request to consider the present population instead of 2011 population. We thank CMWSSB for providing water supply scheme to Jalladampet .	The population is projected for the design period of 30 years taking 2020 as base year . The design is done for the ultimate year population of 2050.
4	Mr.A. SamuecDurai Nesavallar Nagar Jalladampet	Very good plan for people. Try to process soon.	The project will be completed within the contract period of 24 months.
5	Mr.P. Mohan Padmavathi Nagar Jalladampet	We request to start and complete the work within the span time. There is no sewerage line in our street. All sewage water is on stagnating road only. Please rectify .	The project will be completed within the contract period of 24 months. The preparation of DPR is under progress for sewerage scheme to Jalladampet.
6	Mr.S. Subramanian Sadagopan Nagar Sannadi street Jalladampet	The project implementation period 3 years is too long. Kindly do it at the earliest. We cannot take 2011 population strength in 2017.	The project will be completed within the contract period of 24 months. The population is projected for the design period of 30 years taking 2020 as base year . The design is done for the ultimate year population of 2050.

Table A9.4. Stakeholder Consultation/Focussed Group Discussion for Providing Water Supply Scheme to Uthandi

No	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
1	Mrs S. Surya Kantha VGP layout , Phase – I Uthandi.	The network map required. In the EIA report consider not to cutting the trees. Please include in the contract to consider the Association/ Community suggestions . We like to Know whether the terrain and actual round condition include Aqua recharging designation of the city Master plan prepared by CMDA.	The network plan will be provided at the time of execution. The existing trees will not be cut during the laying of pipe. The water main will be laid one side of road.
2	Mr .B.Eswaran VGP layout , Phase – I Uthandi.	Network plan required and it should consider the available road width with due consideration to built up area of today and the trees. Has EIA considered tree cutting and what are the major environmental mitigation measures proposed. Have you considered the terrain and actual round condition include Aqua recharging designation of the city Master plan prepared by CMDA. Please consider the community participation in the project implementation and construction management.	Will be included in the IEE report

No	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
		Kindly include the above as one of the conditions in the tender conditions under general conditions of contract.	
3	Mr. K.Santhanam VGP layout , Phase – I Uthandi.	We thank the department for this initiation of facility. The following points were discussed and you were very kind enough to here patiently. Grateful if you would kindly consider doing water supply and sewerage work simultaneously. Include the one of the office bearer of association for the future meeting and finalising the project implementation so a so have good co-ordination in execution of the project. Inform the street reaches well in advance before start digging. A tripartite MOU between Govt body, Contractor and welfare Association .	Water supply work will be started immediately on award of contract.
4	Mr. R. Arivazhagan VGP layout , Phase – I Uthandi.	Residents should have access contract conditions including drawing so that residents can ensure proper implementation. Along with water supply drainage should also be implemented simultaneously in order to minimize in convenience to the public &optimise the project cost.	Water supply work will be started immediately on award of contract.
5	Mr. M. Sankar Senkaniamman Koil street Uthandi.	We welcome water supply scheme to Uthandi.	
6	Mr. K.Kasi Senkaniamman Koil street Uthandi.	We welcome water supply scheme to Uthandi.	

STAKEHOLDERS MEETING FOR MATHUR WSS HELD ON 20.12.2017


S.NO	NAME & ADDRESS	PHONE NO	SIGNATURE
1	2/1. Perumalkoil St mathur ch - 68 G. Sowthi Shankar	9360938008	G. Sowthi
2	K. PRATHABAN NO 624 44-5 MATHUR MMDA Ch-68	9381044442	K. Prathaban
3	B. Thiruganamo. Plot No: 3555 (L/G 2) MMDA mathur 68	90870 24750	B. Thiruganamo
4	K. Arthiban Ex. MC 2/99 Namavaiyalar Salai Periyathur Marali ch: 68	7397484019	K. Arthiban
5	K. Elumalai Ex. President 2/55 Namavaiyalar Salai Periyathur Marali ch: 68	9840534351	K. Elumalai
6	K. Lakshmi GURON 2/29 MMDA MMDA Ch-68	9299742575	K. Lakshmi
7	S. Panchikonda Brown Day Div-19	9844141965	S. Panchikonda
8	V. Kesavan 155 Ambelbar Street Marali ch: 68	9962169382	V. Kesavan
9	S. Chowdhury 11/55 Periyathur Koll St Periyathur Ch: 68	9677229904	S. Chowdhury
10	R. Jayakumar 4682, Mathur MMDA - Ch. 68	9444131882	R. Jayakumar
11	K. THAMARASELVAN/Dore DMD. St. 2/110, Jeyamangal St, 1st, MATHUR Ch-68	9840611569	K. Thamaraselvan

9444


9884
75500

9444







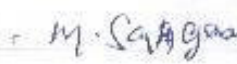
STAKEHOLDERS MEETING FOR MADIPAKKAM WSS HELD ON 20.12.2017

S.NO	NAME & ADDRESS	PHONE NO	SIGNATURE
18)	C. Lakshminarayanaiah, 7, Govindarajapuram, Vengal Rao 5th Cross St Madipakkam	9944322025	
19)	A. Ravi Kiveliassen	9789882116	Ravi
20)	B. Bhoo Palan	90476800 85	B. Bhoo Palan
21)	S. Mohan Reddy Kiveliassen	8939729605	S. Mohan Reddy
22)	L. G. Srinivasan	9840327758	L. G. Srinivasan
23)	B. S. Srinivasan B. S. Srinivasan B. S. Srinivasan	9283131446	B. S. Srinivasan
24)	D. S. Srinivasan D. S. Srinivasan D. S. Srinivasan	9841966911	D. S. Srinivasan
25)	L. S. Srinivasan L. S. Srinivasan L. S. Srinivasan	7356667101	L. S. Srinivasan
26)	P. S. Srinivasan P. S. Srinivasan P. S. Srinivasan	9500612259	P. S. Srinivasan
27)	D. S. Srinivasan D. S. Srinivasan D. S. Srinivasan	9941434571	D. S. Srinivasan
28)	A. S. Srinivasan A. S. Srinivasan A. S. Srinivasan	9841938277	A. S. Srinivasan

STAKEHOLDERS MEETING FOR JALLADAMPETTAI WSS HELD ON 20.12.2017

S.NO	NAME & ADDRESS	PHONE NO	SIGNATURE
①	S. SUBRAMANIAN CRPRA NO. 10 SANNAPPA STREET SANNAPPA NAGAR JALLADAMPETTAI, CH	94400-41677	
②	அன்பு. சசனி 19125 அலக அழகர் சாலை அலகர் சாலை, அ.க.க.	9444350169 7600080169	அன்பு. சசனி
③	M. Glenn 19125 அலக அழகர் சாலை ADMC	9840820301	M. 17
④	E. JAYARAMAN (EXM) 19125 அலக அழகர் சாலை அலகர் சாலை	9941846562	E. Jayaraman
5	அன்பு. சசனி - அ.க.க. அலகர் சாலை	9841555023	அன்பு. சசனி
6)	P. Mohan 2/148A, Maganahalli street, padmavathi Nagar Jalladampettai - 100	9962504364	P. Mohan
7)	A. SAMUEL DURAI 191 - JALLADAMPETTAI [REPORTER]	9841353525	A. Samuel

STAKEHOLDERS MEETING FOR UTHANDI WSS HELD ON 20.12.2017

S.NO	NAME & ADDRESS	PHONE NO	SIGNATURE
1.	R. ARIVAZHAGAN Plot NO: 231, II nd main Rd V.G.P. Layout, Phase I, 600119	9884003275	
2.	K. SANTHANAM PLOT NO: 281, Thilakam St, V.G.P. Layout Phase I, Chennai - 600119	9500079997	
3.	Mrs. S. Sanyal Kancha Plot NO: 685, Thiruvananthapuram V.G.P. Layout Phase I, Chennai - 600119	9840327540	
4.	PESWARAN. 2, NILA ST, V.G.P. Layout (P2) UTHANDI.	9760251184	
5.	J. Senthil Kumar No. 7, 3 rd Cross Eck Uthandi	8056206944	
6.	K. Kasi Uthandi CH 119.	9444728369	
7.	M. Saragani Uthandi CH 119.	9841257978	



சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்

மக்கள் கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சிக்குட்பட்ட மடிப்பாக்கம் மற்றும் ஐல்லடியான் பேட்டை பகுதிகளுக்கான ஒருங்கிணைந்த குடிநீர் திட்டத்திற்காக விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

இத்திட்டத்திற்கான மக்கள் கருத்து கேட்பு கூட்டம் 20.12.2017 அன்று காலை 11.00 மணி முதல் 1.00 மணி வரை "எண்.1, இராஜீவ் காந்தி சாலை (SRP TOOLS அருகில்) கொட்டிவாக்கம், சென்னை - 600 041-ல்" அமைந்துள்ள சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியத்தின் (CMWSS Board) பகுதி அலுவலகம் -14ல் நடைபெற உள்ளது. பொது மக்கள் இக்கூட்டத்தில் கலந்து கொண்டு தங்களின் மேலான கருத்துக்களை பதிவு செய்யுமாறு கோரப்படுகிறது.

மேற்பார்வை பொறியாளர்
(திட்டம் மற்றும் வடிவமைப்பு)



**சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்
மக்கள் கருத்து கேட்பு கூட்டம்**

பெருநகர் சென்னை மாநகராட்சிக்குட்பட்ட உத்தண்டி பகுதிக்கான ஒருங்கிணைந்த குடிநீர் திட்டத்திற்காக விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

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மேற்பார்வை பொறியாளர்
(திட்டம் மற்றும் வடிவமைப்பு)



சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்
மக்கள் கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சிக்குட்பட்ட மாத்துார் பகுதிக்கான குடிநீர் திட்டத்திற்காக விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

இத்திட்டத்திற்கான மக்கள் கருத்து கேட்பு கூட்டம் 20.12.2017 அன்று காலை 11.00 மணி முதல் 1.00 மணி வரை ”எண்.162 நெடுஞ்சொழியன் சாலை, மணலி, சென்னை – 600 068-ல்” அமைந்துள்ள சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியத்தின் (CMWSS Board) பகுதி அலுவலகம் -2ல் பொது மக்கள் கலந்து கொண்டு தங்களின் மேலான கருத்துக்கான பதிவு செய்யுமாறு கோரப்படுகிறது.

மேற்பார்வை பொறியாளர்
(திட்டம் மற்றும் வடிவமைப்பு)



ஜல்லடியான் பேட்டை – குடிநீர் திட்டம்
Water Supply Scheme to Jalladianpet

முக்கிய அம்சங்கள் (Salient Features)

கூ எண்	திட்ட கூறுகள் (Project Components)	ஜல்லடியான் பேட்டை (Jalladianpet)
1	புவியியல் பரப்பளவு (ச.கி.மீ) (Geographical area (sq.km))	2.26
2	தெருக்களின் மொத்த நீளம் (Total length of streets (Kms))	41.0
3	மக்கள் தொகை – 2011 Census Population - 2011	19,100
4	மக்கள் தொகை - 2050 Projected Population - 2050	30,169
5	குடிநீர் விநியோக குழாய்களின் நீளம் (கி.மீ) (Length of the distribution pipe line (Kms))	39.50
6	குடிநீர் விநியோக குழாய்களின் அளவு (மி.மீ) Size of distribution main (mm)	100-450
7	கீழ் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Underground Tank Capacity (ML)	0.20
8	மேல் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Over Head Tank Capacity (ML)	1.30
9	குடிநீர் ஆதாரம் Source of Water	நெமலி கடல் நீரை குடிநீராக்கும் திட்டம் Nemmeli Desalination Plant



மடிப்பாக்கம் – குடிநீர் திட்டம்
Water Supply Scheme to Madipakkam

முக்கிய அம்சங்கள் (Salient Features)

வ எண்	திட்ட கூறுகள் (Project Components)	மடிப்பாக்கம் (Madipakkam)
1	புவியியல் பரப்பளவு (ச.கி.மீ) (Geographical area (sq.km))	9.60
2	தெருக்களின் மொத்த நீளம் (Total length of streets (Kms))	89.00
3	மக்கள் தொகை – 2011 Census Population - 2011	35,752
4	மக்கள் தொகை - 2050 Projected Population - 2050	1,29,812
5	குடிநீர் விநியோக குழாய்களின் நீளம் (கி.மீ) (Length of the distribution pipe line (Kms))	96.89
6	குடிநீர் விநியோக குழாய்களின் அளவு (மி.மீ) Size of distribution main (mm)	100-900
7	கீழ் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Underground Tank Capacity (ML)	0.90
8	மேல் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Over Head Tank Capacity (ML)	5.00
9	குடிநீர் ஆதாரம் Source of Water	நெமலி கடல் நீரை குடிநீராக்கும் திட்டம் Nemmeli Desalination Plant



மாத்தூர் - குடிநீர் திட்டம்
Water Supply Scheme to Mathur

முக்கிய அம்சங்கள் (Salient Features)

வ எண்	திட்ட கூறுகள் (Salient Features)	மாத்தூர் (Mathur)
1	புவியியல் பரப்பளவு (ச.கி.மீ) (Geographical area (sq.km))	4.11
2	தெருக்களின் மொத்த நீளம் (Total length of streets (Kms))	50.0
3	மக்கள் தொகை - 2011 Census Population - 2011	27,674
4	மக்கள் தொகை - 2050 (Projected Population - 2050)	53,012
5	குடிநீர் விநியோக குழாய்களின் நீளம் (கி.மீ) (Length of the distribution pipe line (Kms))	49.90
6	குடிநீர் விநியோக குழாய்களின் அளவு (மி.மீ) Size of distribution main (mm)	100-500
7	கீழ் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Underground Tank Capacity (ML)	0.20
8	மேல் நிலை நீர்தேக்கத் தொட்டியின் கொள்ளளவு (மில்லியன் லிட்டர்) Over Head Tank Capacity (ML)	1.20
9	குடிநீர் ஆதாரம் Source of Water	யிஞ்சுர் கடல் நீரை குடிநீராக்கும் திட்டம் (Minjur Desalination Plant)

Table A9.5. Site Details Of Mathur, Madipakkam, Jalladampettai And Uthandi Water Supply Scheme

No	Location	Name of the village	Survey No	Land extent required	OwnerShip	Classification of Land
1	MMDA Layout - Kamaraj II Street	Mathur	Details	61mx 49m	CMWSSB	existing head works
2	CPCL layout	Mathur	129 & 132	58m x 39m	CPCL	CPCL
3	Velachery main road	Madipakkam	101/198	35 m X 35 m	GCC	Dump site
4	Raghavendra Colony main Road	Jaladampettai	236/61 - 1B 2A	2000Sqm	Revenue Dept	Tharisu
5	Gangaiammankoi Ist	Uthandi	35/1	70m X 70 m	Revenue Dept	NanjaiTharusu

Photographs of Stakeholders Consultation Meeting held on 20 December 2017 for Mathur Water Supply Scheme

Photographs of Stakeholders Consultation Meeting held on 20 December 2017 for Madipakkam Water Supply Scheme



Photographs of Stakeholders Consultation Meeting held on 20 December 2017 for Jelladampettai Water Supply Scheme



Photographs of Stakeholders Consultation Meeting held on 20 December 2017 for Uthandi Water Supply Scheme



ENVIRONMENTAL AUDIT OF EXISTING 100 MLD CAPACITY DESALINATION PLANT OF CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD AT NEMMELI

I. Introduction

1. Under the ADB funded Tamil Nadu Urban Flagship Investment Program (TNUFIP), it is proposed to develop water supply facilities (Construction of Underground tank, Overhead tank, conveying main, water distribution system, etc.) in Mathur, Madipakkam, Jalladampettai and Uthandi. Since adequate capacity water treatment facility is already available for the Chennai City, no new Water Treatment Plants (WTPs) are proposed for the subproject area. Sustainability of new water supply infrastructure and realization of intended purpose (supply of safe drinking water at an acceptable standard) and benefits (improved environmental conditions, public health etc.) would accrue only with a properly functioning of treatment facility. Therefore, the existing desalination plant is an associated facility as per the ADB Safeguard Policy Statement 2009. Compliance with the environmental safeguards will ensure the subproject sustainability.

2. The objectives of this study report are to (i) assess the compliance of the existing desalination plant with country's environmental regulatory framework; (ii) improve environmental performance, as required, through monitoring the effectiveness of the management system; and (iii) increase the CMWSSB's knowledge of its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

3. Water supply for Mathur area is proposed to be supplied from Minjur Desalination plant. The desalination plant at Minjur was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSS Board had entered in to a Bulk Water Purchase Agreement (BWPA) with M/S Chennai Water Desalination Limited (M/s CWDL) and the period of agreement is 25 years. As per the BWPA, all the statutory clearances have been obtained by M/s CWDL for this plant. The plant was commissioned on 25.07.2010. The product water is being purchased by CMWSSB and supplied to the north Chennai areas. As such the operation and maintenance of plant is vested with M/s CWDL.

4. Water supply for Madipakkam, Jalladampettai, and Uthandi areas are proposed to be supplied from desalination plant at Nemmeli maintained by CMWSSB. The Nemmeli desalination plant with 100 MLD capacity was established after getting necessary CRZ permission and environmental clearance from concerned authorities. For this plant, necessary consent to operate has been obtained from TNPCB and the plant is under operation as per TNPCB norms. The treated water from Nemmeli desalination plant has been conveyed through 1000 mm dia transmission main to supply Southern parts of Chennai city.

II. Description of the Nemmeli Desalination Plant

Location	Nemmeli in South of Chennai City Latitude: 12° 42' 13.26"N Longitude: 80° 13' 30.27"E
Start of operation (year)	Inaugurated on 22 Feb 2013
Owned by	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB)
Contact person and designation	Chief Engineer, O&M-II
Capacity	100 million liters per day (MLD)
Process	Process Description

	<p>The process scheme comprises of the following system:</p> <ul style="list-style-type: none"> • Intake system • Pre-treatment system consist of flash mixer, flocculator and lamella clarifiers • Advanced pre-treatment System consist of Disc filters and Ultra filtration system • RO system • Post treatment system • Reject Storage & Disposal System • Chemical Storage & Dosing System <p>System: The intake system shall consists of sea water open pipeline intake at a distance of 1000m from the shore line where the availability of clear water is at a depth of 10m for receiving raw feed water to the plant. An intake filtering device ((SC-101) has been provided at the outlet of the intake pipe.</p> <p>Intake Chamber: Sea water is drawn at the rate of 265.44 MLD into an underground RCC intake chamber (T-101), having a roof slab projecting 300 mm above finished ground level</p> <p><u>Pre-treatment System:</u> The sea water intake pump discharge of 100% water passed into flash mixing tank and Lamella clarifier and the clarified water shall be directed to the existing sedimentation tank A flash mixing tank is provided in the upstream of the flocculation tank to dose the coagulant ferric chloride.</p> <p><u>Degritt Storage Tank:</u> Clear water free from large and heavy suspended solids from settling in the Lamella and shall passes through RCC duct into a degritt storage tank.</p> <p><u>Advanced Pre-treatment System:</u></p> <p>Disc Filters: 30 sets of Disc filters (DF-201-1-30) having a micron rating of 100μ are placed in two rows, each row having 15 sets of disc filter and UF skids in the structural steel closed building. Each Disc filter set is provided with 4 filters. The capacity of each set of disc filter skid and UF skid is 365 m³/h. Normally these disc filters will operate automatically in sequential mode at the predefined filtration and backwash sequence and frequency and the same can be adjusted based on the feed quality total suspend solids at any point of time. Normal backwash sequence is as follows: Water required for each filter- 80 m³/h Duration of backwashing – 15 secs /each filter per backwash cycle Backwash frequency -12 – 15 cycles per day</p> <p>Ultra Filtration: From the each set of disc filter the filtered water shall flow to the dedicated UF skid. Similar to the disc filters, there shall be 30 sets of UF skids (UF-201-1-30). Each UF skid contains 4 trains and each train shall have 30 membranes. The complete system shall thus contain a total number of 3600 membranes. UF will process the disc filter outlet water to high quality UF permeate having silt density less than 3 with an overall recovery of 90% from the combination of disc filters and UF trains.</p> <p><u>Reverse Osmosis:</u> The RO section comprises of:</p> <ul style="list-style-type: none"> • Cartridge Filters • RO High Pressure Pumps • Reverse Osmosis Skid
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- Energy Recovery Device – Pressure Exchanger
- Suck back Tank Arrangement
- Product water storage Tank
- Chemical Dosing
- Chemical Cleaning system
- Flushing System

Post Treatment:

The post treatment unit comprises of following sections

- Re-carbonation section,
- Remineralization section
- Degassing and potable water Storage

Reject Storage and Disposal System:

The UF reject, backwash from the UF skids, reject from pressure exchanger and backwash outlet from disc filter are collected in the UF cum RO reject tank of capacity 3007 m³ from where it is mixed along with sludge water from filtering cum settling basin (SB -101), bypass line from the degrittied storage tank and sludge from sedimentation tank (ST- 410) and pumped at 6860 m³/h and 5 bar head by 4 nos (2W+2S) rejects water transfer pumps (P-501A-D) of capacity 3430 m³/h into the offshore disposal system outfall comprising of under sea bed 1200 mm diameter.

Units and Size/Capacity

Intake piping system: - Pipeline 1600mm dia, MOC: HDPE, Capacity 11000m³/h, pipeline laid below seabed. Gravity flow. Intake located at around 1KM from shore at a depth of 10M.

Intake pumps: 4nos, 2nos operating and 2nos standby capacity of 5500m³/h each. MOC- Super Duplex (SS)

Lamella Clarifier: Treatment capacity 12000m³/h, MOC: concrete tank, capacity -1600m³.

Backwash water collection tank:

MOC: Concrete tank, capacity - 1400m³

Clarifier forwarding pumps: 2nos, one operating and one stand by MOC: Super Duplex (SS), capacity:1400m³/h each.

Clarified water collection tank:

MOC: Concrete tank, capacity- 4500m³

Raw water pumps: 4nos, 2nos operating and 2nos standby capacity-5400m³/h each.

MOC: Super Duplex (SS)

Disc filters: 120nos, size 100microns filter, Capacity-100m³/h each with backwashing facility.

MOC: poly propylene.

Ultra Filtration (UF) system: 30 skids, each skid has 120 UF membranes (Total 3600 UF membranes). Membrane material polysulfonate and casing PVC.

Capacity/skid: 395m³/h, with back washing facility.

UF Back wash pumps-4nos, capacity-700m³/h, all operating as required.

MOC- Super Duplex (SS)

Dual Media Filter (DMF) system: Filter vessels-5nos, MOC: Carbon steel with rubber lining. Capacity - 280m³/h with air scoring and backwashing facility.

Air scoring blowers: 2nos, Capacity-1900m³/h

Backwash pumps: - 3nos, Capacity -700m³/h, 2nos operating and one standby, MOC: - Super Duplex (SS).

DMF feed pumps: 3 nos, Capacity-700m³/h. 2nos operating and one stand by, MOC: Super Duplex (SS).

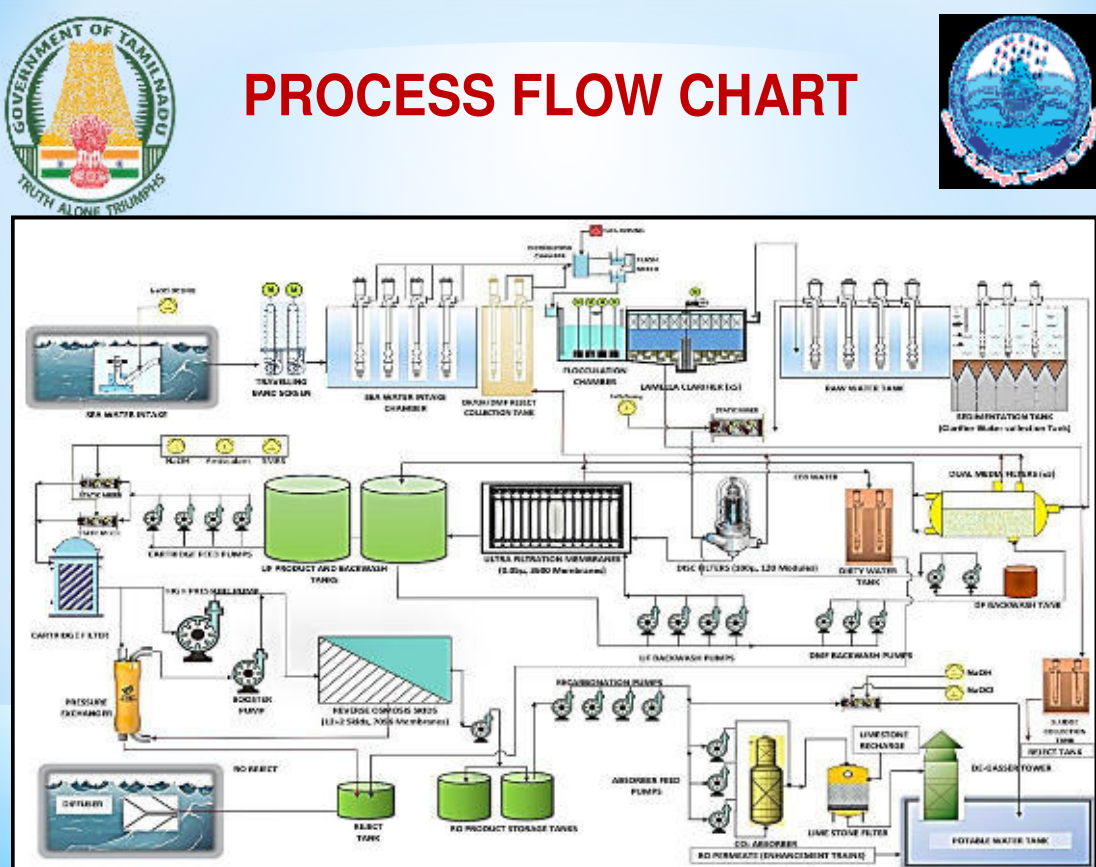
UF and DMF filtrate collection tank: 2nos Capacity-13800m³/h each, MOC: Carbon steel with epoxy paint coating.

Cartridge filters feed pumps: 4nos, 3nos operating and 1 standby, Capacity-3600m³/h.

Cartridge filters: 15nos, capacity-771m³/h, MOC: Duplex (SS). Load with 180nos ,5 Micron cartridge elements.

Reverse Osmosis (RO) Trains: 14nos, each of capacity 350m³/h
 RO High Pressure pumps: Capacity-350m³/h, one number/train+ 1 standby Total -15 pumps, MOC: Super Duplex (SS),
 High pressure piping- MOC: Duplex (SS),
 High pressure Valves- MOC: Super Duplex (SS),
 Circulating pumps-15Nos ,14nos operating and 1standby,
 Capacity: 421m³/h, MOC: Super Duplex (SS),
 Permeate Suck back tanks-14 nos, Capacity-13m³/h, MOC: FRP,
 Permeate piping - MOC: SS316L
 Permeate pumps: 15Nos ,14nos operating and 1 standby, Capacity-350m³/h, MOC: SS316L.
 Energy recovery devices: 15sets, each set consisting of 10nos, Capacity-50m³/h, MOC: Ceramic rotor.
 RO permeate storage Tanks: 2 nos, Capacity - 9000m³ each,
 MOC: carbon steel with epoxy paint coating.
 Recarbonation feed pumps: 4Nos, 2nos operating and 2nos standby, Capacity-2100 m³/h, MOC: SS316L.
Post treatment system: Consisting of 1no recarbonisation tower, 2Nos of CO₂ storage tanks of capacity-30tons each, 5 nos Lime stone filters,2Nos blowers.
 Absorber feed booster pumps: 3Nos ,2nos operating and 1 standby, capacity-680m³/h, MOC: SS316L.
Reject Tank: 1no, MOC: carbon steel with epoxy paint coating,
 Capacity-3000m³.
Out fall piping: 1No,1200mm Dia, HDPE pipe with super Duplex MOC diffuser located in sea at around 500m from shore. Diffuser with multiple nozzles.

Process at Nemmeli Desalination Plant (Schematic)



Treatment efficiency and water quality parameters	Treatment Efficiency-99% Potable water quality parameters as per ISO 10500 attached and plant process waste water.
Wastewater (effluent disposal)	Brine from plant disposed, Through 1200mm HDPE pipe through diffuser at around 500m from shore.

View of Desalination Plant



III. Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	Desalination Plant at Nemmeli
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant ^a N/A = not applicable (state justification)
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	Environmental clearance obtained for this project. The copy of the same is enclosed
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in WTPs will require clearance from TN Pollution Control Board .and Directorate of Industrial Health and Safety	N/A No chlorine used or stored in the Desalination Plant
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TNPCB	CTO obtained and valid up to March 2018.
Air (Prevention and Control of Pollution) Act	Consent to operate from TNPCB	CTO obtained and valid up to March 2018.

Law, Rules, and Regulations	Description and Requirement	Desalination Plant at Nemmeli
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant ^a N/A = not applicable (state justification)
of 1981, Rules of 1982 and amendments.		
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Waste disposal standards	N/A
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	No source of noise
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers	Training and proper PPEs are required
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	Desalination Plant is operated by the contractor. No child labour are engaged.

^a Compliant = There is sufficient and appropriate evidence to demonstrate that the particular regulatory requirement has been complied with; non-compliant = clear evidence has been collected to demonstrate the particular regulatory requirement has not been complied with.

5. Water supply for Mathur area is proposed to be supplied from Minjur Desalination plant. The desalination plant at Minjur was constructed based on "Design, Build, Own, Operate and Transfer (DBOOT) basis". CMWSS Board had entered in to a Bulk Water Purchase Agreement (BWPA) with M/S Chennai Water Desalination Limited (M/s CWDL) for a period of 25 years. As per the BWPA, all the statutory clearances have been obtained by M/s CWDL for this plant. The plant was commissioned on 25.07.2010. The product water is being purchased by CMWSSB and supplied to the north Chennai areas. As such the operation and maintenance of plant is vested with M/s CWDL. In Minjur desalination plant the rejects from the plant are monitored through SCADA and also by random physical verification by TNPCB. Product water quantity is monitored through meters fixed in the delivery main. The product water is re mineralized and chlorinated as

per IS 10500 before conveyed to the distribution system. Regarding the safety in handling and storage of chemicals, safety officer of the plant is responsible.

6. The water quality from both the desalination plants are monitored at the delivery point by the Quality assurance wing of CMWSSB for quality parameters as per IS:10500. Further water quality is monitored in the distribution system jointly by CMWSSB and Greater Chennai Corporation every fortnight.

7. As the Nemmeli desalination plant is under operation as per Environmental guidelines no

8. CAP is required at present

IV. Institutional Arrangement

Parameter	Desalination Plant
Operations	Continuous operation; involves mechanical and electrical operation; No interference is required in operation of Desalination plant.
Manager per shift	Personnel at Desalination plant are available in 3 shift
Public health Engineer on-site	
Estimated number of technical employees on-site per shift	Plant Manager – 1No Process Head- 2 Nos Electrical Engineer- 1 No Mechanical Engineer- 1 No Electrician- 12 Nos in 3 shift Mechanic- 16 Nos in 3 shift Chemist- 4 Nos Shift engineers- 4 Nos Helper- 16 Nos in 3 shifts Field Worker- 12 Nos in 3 shifts
Estimated number of laborers on-site per shift	
Frequency of water quality monitoring (raw)	Daily. Once in Four hours
Frequency of water quality monitoring (treated)	Daily. Once in Four hours
Frequency of waste discharge monitoring	Daily. Once in shift
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	Yes.

No.11-99/1008-1A-III
Government of India
Ministry of Environment and Forests
(1A-III Division)

Paryavaran Bhavan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated the 23rd December, 2008

SE/10-11

20.3.09 Sub: Setting up of 100MLD seawater reverse osmosis plant at Nemmeli and Krishnankaranai village, Cehngalpattu Taluk, Kancheepuram District, Chennai by M/s Chennai Metro Water Supply and Sewerage Board - Environmental clearance - regarding.

Reference is invited to letter No.20474/EC3/2608-1, dated 21.10.2008 from Environment and Forests Department, Government of Tamil Nadu on the above subject.

2. The project involves setting up of 100 MLD seawater reverse osmosis plant at Nemmeli and Krishnankaranai village, Cehngalpattu Taluk, Kancheepuram District, Chennai. Major plant units involves offshore seawater intake and onshore pumping station. Pre-treatment - sedimentation cum disc filters and UF membrane, RO and pressure exchangers, intermediate storage tanks, chemical dosing system, recarbonation and remineralisation system, power distribution, electric, instrumentations, services and auxiliary facilities, product water quality will be as per IS 10500-1991, power requirement will be 20 MW. Seawater intake will be at 1000 m (1600 mm dia HDPE) with intake head from shore (approximate water depths 10 m), and reject outfall at 600 m (1200 mm dia) from shore (approximate water depth 8 m) with diffuser. Seabed is widely covered with sandy clay till 2.5km from shore and with coarse sand from 2.5 km to 3.5 km. Seawater TDS varies from 36,200 to 40,000 ppm. 6860m³/hr brine would be discharged from the plant. About 50 m³/day sewage will be generated and planned to be in used for green belt. The RO building area and the drains will have rainwater harvesting structure. The estimated cost of the project is Rs.840.17 crores. About 22.85 crores is earmarked for pollution control measures.

3. The proposal was considered by Expert Appraisal Committee at its meeting held on 25th and 26th November, 2008 and has recommended. Tamil Nadu State Coastal Zone Management Authority has recommended the project for clearance in its 46th meeting held on 28.8.2008 from Coastal Regulation Zone angle.

4. Taking into the above facts, this Ministry hereby accords clearance to the above proposal under the provisions of the Coastal Regulation Zone, Notification, 1991 subject to effective implementation of the following environmental safeguards and conditions:-

A. SPECIFIC CONDITIONS:

- To provide stability to the marine out fall system even during cyclonic conditions appropriate anchor shall be provide.
- The pipelines both intake and outlet shall not cause any hindrance to the movement of the local communities including the fishermen.
- A continuous and comprehensive post-project marine quality monitoring programme shall be taken up. This shall include monitoring of water quality, sediment quality and biological characteristics.
- It shall be ensured that there is no displacement of people, houses or fishing activity as a result of the project.
- The marine biodiversity shall be monitored and the report submitted twice in a year to the Ministry of Environment and Forests/State Pollution Control Board.
- In order to reduce the effect of high saline discharge an efficient dispersion model shall be carried out by reputed scientific institute and the recommendations implemented.

- vii) Due to desalination process the concentration of toxic trace metals may increase. Therefore, the effluent may be properly treated by suitable methods to remove toxic trace metals and other contaminants, if it exceeds the CPCB limits before discharging into the coastal waters. Periodical monitoring shall be carried out to assess the concentration of toxic trace metals in the reject water.
- viii) The temperature of the effluent shall also be within the permissible limit. A moored data buoy shall be maintained in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters (such as salinity, temperature, DO, current etc.). Periodical monitoring of these parameters during the construction and commencement of the plant becomes essential to undertake corrective measures if needed.
- ix) The high saline reject water may be periodically monitored for the physicochemical and toxic trace metal contents through appropriate standard procedures.
- x) The sludge shall be disposed of in a secured landfill as per Pollution Control Board guidelines.
- xi) No sand dunes shall be disturbed.
- xii) The pipelines shall not disturb the movement of fishing vessels or fishermen.
- xiii) All the conditions stipulated by Environment and Forests Department, Government of Tamil vide their letter No.20474/EC3/2008-1, dated 21.10.2008 shall be effectively implemented.
- xiv) No Objection Certificate from the Tamil Nadu State Pollution Control Board shall be obtained before initiating the project.
- xv) It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No groundwater shall be tapped in the project area falling in Coastal Regulation Zone.
- xvi) The camps of labour shall be kept outside the Coastal Regulation Zone area. Proper arrangements for cooking fuel shall be made for the labour during construction phase so as to ensure that mangroves, coral reefs, if any are not cut/destroyed for this purpose.
- xvii) The recommendations made in the Environmental Management Plan as contained in the Environment Impact Assessment report of the project, shall be effectively implemented.
- xviii) The entire stretch of the pipelines shall be buried underground except at the booster pumping station, which will be properly fenced and the station would be manned round the clock.
- xix) Markers shall be installed at every 30 m along the pipeline route to indicate the position of the line.

B. GENERAL CONDITIONS:

- (i) Construction of the proposed structures shall be undertaken meticulously conforming to the existing Central/local rules and regulations. All the construction designs/drawings relating to the proposed construction activities must have approvals of the concerned State Government Department/Agencies.
- (ii) A separate Environment Management Cell with suitably qualified staff to carry out various environment related functions shall be set up under the charge of a Senior Executive who will report directly to the Chief Executive of the Company.
- (iii) The funds earmarked for environment protection measures shall be maintained in a separate account and there shall be no diversion of these funds for any other purpose. A year-wise expenditure on environmental safeguards shall be reported to this Ministry's Regional Office at Bangalore.
- (iv) Full support shall be extended to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central/State Pollution Control Board by the project proponents during their inspection for monitoring

purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.

- (v) In case of any deviation or alteration in the project including the implementing agency, a fresh reference shall be made to this Ministry for modification in the clearance conditions or imposition of new one for ensuring environmental protection. The project proponents shall be responsible for implementing the suggested safeguard measures.
- (vi) This Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.
- (vii) This Ministry or any other competent authority may stipulate any other additional conditions subsequently, if deemed necessary, for environmental protection, which shall be complied with.
- (viii) A copy of the clearance letter shall be marked to the concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.
- (ix) State Pollution Control Board shall display a copy of the clearance letter at the District Industries Center and Collector's Office/ Tehsildar's Office for 30 days.
- (x) The project proponent shall advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen at website of the Ministry of Environment & Forests at <http://www.envfor.nic.in>.
- (xi) The project proponents shall inform Regional Office, Bangalore as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of work.
- (xii) Budgetary break up for Environmental Management Plan for the project shall be mentioned.
- (xiii) Any appeal against this environmental clearance shall lie with the National Environment Appellate Authority, if preferred, within a period of 30 days as prescribed under Section 11 of the National Environment Appellate Act, 1997.

5. The above mentioned stipulations will be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous Chemicals (Manufacture, Storage and Import) Rules, 1989, Hazardous Wastes (Management and Handling) Rules, 1989 the Coastal Regulation Zone Notification, 1991 and its subsequent amendments and the Public Liability Insurance Act, 1991 and the Rules made thereunder from time to time. The project proponents shall also ensure that the proposal complies with the provisions of the approved Coastal Zone Management Plan of Tamil Nadu and the Supreme Court's order dated 18th April, 1996 in the Writ Petition No.664 of 1993 to the extent the same are applicable to this proposal.

(Dr. A. Senthil Veli)
Additional Director

To
The Secretary,
Environment Department,
Government of Tamil Nadu,
Secretariat, Chennai - 600 009.

Copy to:

1. The Chief Conservator of Forests (Central), Regional Office (Southern Zone), Ministry of Environment and Forests, Kendriya Sadan, IVth Floor, Environment & Forests Wings, 17th Main Road, II Block, Koramangala, Bangalore - 560 034.
2. The Chief Town & Country Planner, Government of Tamil Nadu, Chennai.
3. The Chairman, Tamil Nadu State Pollution Control Board, 100, Anna Salai, Guindy, Chennai - 600 032.
4. Principal Secretary, Environment and Forests (EC.3) Department, Secretariat, Chennai-9.
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-office Complex, East Arjun Nagar, Delhi -32.
6. The Managing Director, Chennai Metro Water supply and Sewerage Board, Chennai.
7. DIG (SU), Regional Office Cell, Ministry of Environment and Forests, New Delhi.
8. Guard File.
9. Monitoring Cell.
10. Director (Ef), Ministry of Environment & Forests, New Delhi.

(Dr. A. Senthil Vel)
Additional Director



TAMILNADU POLLUTION CONTROL BOARD



CONSENT ORDER NO. 170823403461 DATED: 08/09/2017.

PROCEEDINGS NO.F.0689MMN/OL/DEE/TNPCB/MMN/A/2017 DATED:
08/09/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT -M/s. CMWSSB-DESALINATION PLANT, S.F.No. 273/2b, 274/1b2, 274/2, 275/1b, 275/2, 276/1b, 276/3 of Nemmeli village & 67-4C1a of Krishnankaranai Village, NEMMELI village, Tirupporur Taluk and Kancheepuram District - Renewal of Consent for the operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) -Issued- Reg.

REF: 1.CTO Proc. No. T5/TNPCB/F.20789/MMN/RL/W&A/2013 dated: 20/02/2016,
2.OCMMS Appl.No. 3403461 for RCO dated 06/09/2017.
3.FIR.No: F.0689MMN/RL/DEE/MMN/2016 dated 06/01/2016.

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to:

The Managing Director

M/s.CMWSSB-DESALINATION PLANT,

S.F.No. 273/2b, 274/1b2, 274/2, 275/1b, 275/2, 276/1b, 276/3 of Nemmeli village & 67-4C1a of Krishnankaranai Village,
NEMMELI village,
Tirupporur Taluk,
Kancheepuram District.

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2018

S. INDIRAGANDHI (Digitally signed by S.INDIRAGANDHI)
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
MARAIMALAI NAGAR

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

1. This renewal of consent is valid for operating the facility for the manufacture of products (Col. 2) at the rate (Col. 3) mentioned below. Any change in the products and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
Product Details			
1.	Drinking Water	100	MLD
By-Product Details			
1.	Nil	0	NA
Intermediate Product Details			
1.	Nil	0	NA

2. This renewal of consent is valid for operating the facility with the below mentioned emission/noise sources along with the control measures and/or stack. Any change in the emission source/control measures/change in stack height has to be brought to the notice of the Board and fresh consent/Amendment has to be obtained.

I Point source emission with stack :				
Stack No.	Point Emission Source	Air pollution Control measures	Stack height from Ground Level in m	Gaseous Discharge in Nm ³ /hr
1	DG Set - 100 KVA	Acoustic enclosures with stack	9.0	
2	Fire Fighting Diesel Engine	Stack	5.0	
II Fugitive/Noise emission :				
Sl. No.	Fugitive or Noise Emission sources	Type of emission	Control measures	
1.	DG Set - 100 KVA	Noise	Inbuilt acoustic enclosures	

POLLUTION PREVENTION PAYS

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TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

1. The unit shall monitor the sea water & marine environment at the outfall point with online monitoring system for quality and quantity monitoring and to link the same to CARE Air Centre, TNPCB, Chennai by providing data uploading facility.
2. The unit shall ensure that discharge of RO rejects back to the sea through uniform distribution so that any sudden increase on TDS concentration into the sea.
3. The unit shall completely stop discharges through shore and it shall mix the gland leak and other process water with the RO reject and discharge into sea through the RO reject discharge point so as to avoid any complaint.
4. The unit shall ensure that periodical monitoring shall be carried out to assess the concentration of toxic trace metals in the reject water.
5. The unit shall maintain moored data buoy in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters.
6. The unit shall ensure the intake and outfall activities in the seashore shall not cause any hindrance to the fishing activity and movement of boats etc.
7. The unit shall comply with the conditions imposed by MoEF GOI with the EC issued dated 23.12.2008.
8. The unit shall comply with all the conditions stipulated in the consent to operate issued to the unit.
9. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit the consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.

S. INDIRAGANDHI Digitally signed by S. INDIRAGANDHI
Date: 2017.09.13 12:13:53 +05'30'
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
MARAIMALAI NAGAR

To
The Managing Director,
M/s.CMWSB-DESALINATION PLANT,
East Coast Road, Sulerikadu Village, Thiruporur Taluk, Kancheepuram District,
Pin: 603104

Copy to:

1. The Commissioner, TIRUPORUR-Panchayat Union, Tirupporur Taluk, Kancheepuram District .
2. Copy submitted to the Member Secretary, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
3. Copy submitted to the JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
4. File

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

- 1.The unit shall maintain stack attached to the diesel engine and acoustic measures to the DG set and ensure that the emission satisfy the Ambient Air Quality / Emission /Ambient Noise level standards prescribed by the Board.
- 2.The unit shall maintain moored data buoy in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters.
- 3.The unit shall ensure the intake and outfall activities in the seashore shall not cause any hindrance to the fishing activity and movement of boats etc.
- 4.The unit shall comply with the conditions imposed by MoEF GOI with the EC issued dated 23.12.2008.
- 5.The unit shall comply with all the conditions stipulated in the consent to operate issued to the unit.
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S. INDIRAGANDHI Digitally signed by S. INDIRAGANDHI
Date: 2017.09.13 12:52:40+05'30'
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
MARAIMALAI NAGAR

To
The Managing Director,
M/s.CMWSSB-DESALINATION PLANT,
East Coast Road, Sulerikadu Village, Thiruporur Taluk, Kancheepuram District,
Pin: 603104

Copy to:

- 1.The Commissioner, TIRUPORUR-Panchayat Union, Tirupporur Taluk, Kancheepuram District .
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POLLUTION PREVENTION PAYS

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No.11-59/2005-IA-III
Government of India
Ministry of Environment and Forests
(IA-III Division)

Paryavaran Bhavan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated the 26th October, 2006

Sub: CRZ clearance for setting up of 100 MLD Desalination Plant and allied activities at Kattupalli Village, Ponneri Taluk, Tiruvallur District, Tamil Nadu by M/s Chennai Water Desalination Limited, Chennai - regarding.

Reference is invited to Government of Tamil Nadu, Environment and Forests (EC.3) Department's letter No. 29248/EC.3/2005-1, dated 29.10.2005 on the above subject and Tamil Nadu Pollution Control Board, Chennai's letter No.T16/TNPCB/F.34693/orange/2005, dated 26.10.2005 according to No Objection Certificate to the proposal. Information furnished vide letter No.CWDL/MoEF/2005-06/93, dated 2.1.2006, No.CWDL/MoEF/2005-06/105, dated 10.1.2006, No.CWDL/MoEF/2005-06/111, dated 13.1.2006, No.CWDL/MoEF/2005-06/129, dated 18.1.2006, No.CWDL/MoEF/2005-06/135, dated 25.1.2006, No.CWDL/MoEF/2005-06/145, dated 2.2.2006, No.CWDL/MoEF/2005-06/147, dated 11.2.2006, No.CWDL/MoEF/2005-06/150, dated 15.2.2006, No.CWDL/MoEF/2005-06/169, dated 8.3.2006 and No.CWDL/CMFRI/807/2006, dated 15.7.2006 from M/s Chennai Water Desalination Limited was also considered. Similarly, the HTL/LTL map prepared by National Institute of Oceanography prepared and duly superimposed the project site on the map was also considered.

2. The project involves construction of 100 MLD seawater desalination plant in Minjur, Chennai. The total area of land involved for the project is around 24.5 ha. The project falls in the Survey Nos.1/3B4B2 & 1/4A1(P) & 330/1 & 330/2. The components of the project that falls in Coastal Regulation Zone area include:-

- a) Pipeline for drawing of the seawater of 237 MLD (10000m³/hr) through an intake system comprising of intake head and submarine pipeline. The intake system has 2 X 1000 mm long, 1,600 m dia long HDPE buried pipeline. The transport to the project site on land is also through buried pipeline.
- b) Pump house.
- c) Pre-treatment including flocculation-coagulation, gravity settling, two steps filtration, ultra-filtration and chemical dosing.
- d) Desalting of seawater using reverse osmosis.
- e) Discharge of brine of 137 MLD (5700m³/hr) with 70 PSU through 1 X 1400 mm dia HDPE submarine pipeline and diffuser ports outfall system into the sea.
- f) Related electrical and mechanical installations.

- 2 -

3. As per the proposal, the seawater would be drawn by gravity flow from the sea through a seawater intake head and pipeline laid on the sea bed or sharing with North Chennai Thermal Power Station seawater intake which is drawn from Ennore Port basins. A capture tower will be installed at the shore end in order to avoid the entry of sand and floating debris. The water will be pre-filtered through rotating filters and chlorinated by applying a dose of sodium hypochlorite in the underwater intake channel and in the pump aspiration chamber.

4. The seawater will then be filtered in two stages i.e. through the sand filters and anthracite filters. Sulphuric acid addition is made to reduce the pH of seawater and prevent precipitation of carbonates and bicarbonates, as well as to generate sufficient CO_2 for post treatment with dolomite. Sodium bisulfite dosing is added in order to eliminate residual chlorine from the dose of sodium hypochlorite. It is proposed to set up an ultra filtration unit to prevent fouling in the reverse osmosis membrane. The plant will also be equipped with fire prevention system, communications system and laboratory.

5. The land fall point of the water intake pipeline will be located approximately at latitude $13^\circ 19' 01''$ N and longitude $80^\circ 20' 25''$ E (WGS 84). The region inland of the project area is a plain and barren land with thorny bushes and sparse wild vegetation. On the eastern side of the area, we have a long and nearly straight coastline that is exposed to an open sea, the Bay of Bengal. This coastal region comprises of fairly wide beaches with well defined foreshore, elevated backshore and with small dunes at some places. Main plant is located 500 metres from HTL.

6. Taking into the above facts, this Ministry hereby accords clearance to the above proposal under the provisions of the Coastal Regulation Zone, Notification, 1991 subject to effective implementation of the following environmental safeguards and conditions:-

A. SPECIFIC CONDITIONS:

- i) The marine biodiversity should be monitored and the report submitted twice in a year to the Ministry of Environment and Forests/State Pollution Control Board.
- ii) In order to reduce the effect of high saline discharge an efficient dispersion model proposed by 3 dimensions studies by IIT should be incorporated in the installation.
- iii) The discharge ports and diffusers should be designed to withstand the extreme current, wind and wave actions observed during October-December.
- iv) Due to desalination process the concentration of toxic trace metals may increase. Therefore, the effluent may be properly treated by suitable methods to remove toxic trace metals and other contaminants. If it exceeds the CPCB limits before discharging into the coastal waters. Periodical monitoring should be carried out to assess the concentration of toxic trace metals in the reject water.
- v) The temperature of the effluent should also be within the permissible limit. A moored data buoy should be maintained in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters (such

-3-

as salinity, temperature, DO, current etc.). Periodical monitoring of these parameters during the construction and commencement of the plant becomes essential to undertake corrective measures if needed.

- vi) The high saline reject water may be periodically monitored for the physicochemical and toxic trace metal contents through appropriate standard procedures.
- vii) The sludge should be disposed of in a secured landfill as per Pollution Control Board guidelines.
- viii) No sand dunes will be disturbed.
- ix) The pipelines should not disturb the movement of fishing vessels or fishermen.
- x) All the conditions stipulated by Environment and Forests (EC.3) Department, Government of Tamil Nadu as contained in their letter No.29248/EC.3/2005-1, Dated 29.10.2005 should be effectively implemented.
- xi) All the conditions stipulated by Tamil Pollution Control Board vide their letter No.T16/TNPCB/E.34693/Orange/2005, dated 26.10.2005 should be effectively implemented.
- xii) It should be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No groundwater should be tapped in the project area falling in Coastal Regulation Zone.
- xiii) All conditions stipulated by CMFRI relating to discharge of the saline effluents should be complied with.
- xiv) The camps of labour should be kept outside the Coastal Regulation Zone area. Proper arrangements for cooking fuel should be made for the labour during construction phase so as to ensure that mangroves, coral reefs, if any are not cut/destroyed for this purpose.
- xv) The recommendations made in the Environmental Management Plan as contained in the Environment Impact Assessment report of the project, should be effectively implemented.
- xvi) The entire stretch of the pipelines should be buried underground except at the booster pumping station, which will be properly fenced and the station would be manned round the clock.
- xvii) Markers should be installed at every 30 m along the pipeline route to indicate the position of the line.

B. GENERAL CONDITIONS:

- (i) Construction of the proposed structures should be undertaken meticulously conforming to the existing Central/local rules and regulations. All the

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construction designs/drawings relating to the proposed construction activities must have approvals of the concerned State Government Department/Agencies.

- (ii) A separate Environment Management Cell with suitably qualified staff to carry out various environment related functions should be set up under the charge of a Senior Executive who will report directly to the Chief Executive of the Company.
- (iii) The funds earmarked for environment protection measures should be maintained in a separate account and there should be no diversion of these funds for any other purpose. A year-wise expenditure on environmental safeguards should be reported to this Ministry's Regional Office at Bangalore.
- (iv) Full support should be extended to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central/State Pollution Control Board by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.
- (v) In case of any deviation or alteration in the project including the implementing agency, a fresh reference should be made to this Ministry for modification in the clearance conditions or imposition of new one for ensuring environmental protection. The project proponents should be responsible for implementing the suggested safeguard measures.
- (vi) This Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.
- (vii) This Ministry or any other competent authority may stipulate any other additional conditions subsequently, if deemed necessary, for environmental protection, which should be complied with.
- (viii) A copy of the clearance letter should be marked to the concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.
- (ix) State Pollution Control Board should display a copy of the clearance letter at the District Industries Center and Collector's Office/ Tehsildar's Office for 30 days.
- (x) The project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which should be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the Gujarat State Pollution Control Board and may also be seen at website of the Ministry of Environment & Forests at <http://www.envfor.nic.in/>.

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- (xi) The project proponents should inform Regional Office, Bangalore as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of work.
- (xii) Budgetary break up for Environmental Management Plan for the project should be mentioned.

7. The above mentioned stipulations will be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous Chemicals (Manufacture, Storage and Import) Rules, 1989, Hazardous Wastes (Management and Handling) Rules, 1989 the Coastal Regulation Zone Notification, 1991 and its subsequent amendments and the Public Liability Insurance Act, 1991 and the Rules made thereunder from time to time. The project proponents should also ensure that the proposal complies with the provisions of the approved Coastal Zone Management Plan of Tamil Nadu and the Supreme Court's order dated 18th April, 1996 in the Writ Petition No.664 of 1993 to the extent the same are applicable to this proposal.

Dr. N.H. Hosabettu
(Dr. N.H. Hosabettu)
Director

To

M/s Chennai Water Desalination Limited,
Door No.9, Plot No.16, Manjulai, 1st Main Road,
Kalaimagal Nagar, Ekkattuthangal,
Chennai - 600 097.

Copy to:

1. The Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office (Southern Zone) Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, 1 Block, Koramangala, Bangalore - 560034.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 110032.
3. The Secretary to Government, Environment and Forests (EC.3) Department, Government of Tamil Nadu, Secretariat, Chennai - 600 009.
4. The Chairman, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032.
5. DIG (SU), Regional Office Cell, Ministry of Environment & Forests, New Delhi.
6. Guard File.
7. Monitoring Cell.
8. Director (EI), Ministry of Environment & Forests, New Delhi.

Dr. N.H. Hosabettu
(Dr. N.H. Hosabettu)
Director



TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170818558134

DATED: 22/04/2017.

PROCEEDINGS NO.F.0589AMB/OL/DEE/TNPCB/AMB/W/2017 DATED: 22/04/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – M/s. CHENNAI WATER DESALINATION LTD , S.F.No. 13B,4B2 &1/4A1(P), 330/1&2, KATTUPALLI village, Ponneri Taluk and Tiruvallur District - Renewal of Consent for the operation of the plant and discharge of sewage and/or trade effluent under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act 6 of 1974) – Issued- Reg.

REF: 1.PROCEEDINGS NO.T2/TNPCB/F.0589AMB/RL/AMB/W&A/2016 DATED: 13/05/2016
2.IR.No : F.0589AMB/OL/AE/AMB/2017 dated 18/04/2017

RENEWAL OF CONSENT is hereby granted under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act, 6 of 1974) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Manager
M/s.CHENNAI WATER DESALINATION LTD,
S.F.No. 13B,4B2 &1/4A1(P), 330/1&2,
KATTUPALLI Village ,
Ponneri Taluk ,
Tiruvallur District .

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2019

[Signature]
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
AMBATTUR

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD
SPECIAL CONDITIONS

1. This renewal of consent is valid for operating the facility for the manufacture of products/byproducts (Col. 2) at the rate (Col 3) mentioned below. Any change in the product/byproduct and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
Product Details			
1.	Reverse Osmosis treated sea water	100	MLD

2. This renewal of consent is valid for operating the facility with the below mentioned outlets for the discharge of sewage/trade effluent. Any change in the outlets and the quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Outlet No.	Description of Outlet	Maximum daily discharge in KLD	Point of disposal
Effluent Type : Sewage			
1.	Sewage	8.0	On Industrys own land
Effluent Type : Trade Effluent			
1.	Trade Effluent (RO Reject)	137.0	Reverse Osmosis Reject is discharged into sea through pipeline

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்குத் துறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

1. The unit shall dispose the sewage through septic tank followed by soak pit.
2. The Unit shall ensure that the production shall be within the consented quantity.
3. The Unit shall continue to upload online continuous monitoring of outfall sampling readings to the CARE Air centre.
4. The unit shall monitor the quality of sea water at the outfall point / marine environment (at the diffuser point) regularly to know the effectiveness of dispersion and submit the report on regular basis.
5. The project activity shall not affect the coastal eco system including the marine flora and fauna.
6. The unit shall continue to develop green belt in and around the unit's premises.
7. The unit shall remit the water cess as decided by the Board.
8. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.

[Signature]
 District Environmental Engineer,
 Tamil Nadu Pollution Control Board,
 AMBATTUR
 22/11/17

To
 The Manager,
 M/s.CHENNAI WATER DESALINATION LTD,
 Kattupalli village, Ponneri Taluk, Thiruvallur District,
 Pin: 601203

Copy to:

1. The Executive Officer, MINJUR-Town Panchayat, Ponneri Taluk, Tiruvallur District .
2. Copy submitted to the Member Secretary, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
3. Copy submitted to the JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
4. File

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு தீறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170828558134

DATED: 22/04/2017.

PROCEEDINGS NO.F.0589AMB/OL/DEE/TNPCB/AMB/A/2017 DATED: 22/04/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT -M/s. CHENNAI WATER DESALINATION LTD , S.F.No. 13B,4B2 &1/4A1(P), 330/1&2, KATTUPALLI village, Ponneri Taluk and Tiruvallur District - Renewal of Consent for the operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) -Issued- Reg.

REF: 1.PROCEEDINGS NO.T2/TNPCB/F.0589AMB/RL/AMB/W&A/2016 DATED: 13/05/2016
2.IR.No : F.0589AMB/OL/AE/AMB/2017 dated 18/04/2017

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Manager
M/s.CHENNAI WATER DESALINATION LTD,
S.F.No. 13B,4B2 &1/4A1(P), 330/1&2,
KATTUPALLI village,
Ponneri Taluk,
Tiruvallur District.

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2019

[Signature]
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
AMBATTUR

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! நுழை தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

- This renewal of consent is valid for operating the facility for the manufacture of products (Col. 2) at the rate (Col. 3) mentioned below. Any change in the products and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
Product Details			
1.	Reverse Osmosis treated sea water	100	MLD

- This renewal of consent is valid for operating the facility with the below mentioned emission/noise sources along with the control measures and/or stack. Any change in the emission source/control measures/change in stack height has to be brought to the notice of the Board and fresh consent/Amendment has to be obtained.

I Point source emission with stack :				
Stack No.	Point Emission Source	Air pollution Control measures	Stack height from Ground Level in m	Gaseous Discharge in Nm ³ /hr
1	DG set of 1500KVA	Acoustic enclosures with stack	23.5	
II Fugitive/Noise emission :				
Sl. No.	Fugitive or Noise Emission sources	Type of emission	Control measures	
1.	DG set of 1500KVA	Noise	Stack with acoustic enclosure	

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! ஐறம் தூய்மை வாழ்வுக்கு !



TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

1. The unit shall ensure that the emission from the DG set shall satisfy the AAQ/emission standards prescribed by the Board.
2. The Unit shall ensure that the production shall be within the consented quantity.
3. The Unit shall continue to upload online continuous monitoring of outfall sampling readings to the CARE Air centre.
4. The unit shall monitor the quality of sea water at the outfall point / marine environment (at the diffuser point) regularly to know the effectiveness of dispersion and submit the report on regular basis.
5. The project activity shall not affect the coastal eco system including the marine flora and fauna.
6. The unit shall continue to develop green belt in and around the unit's premises.
7. The unit shall remit the water cess as decided by the Board.
8. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.

[Signature]
**District Environmental Engineer,
 Tamil Nadu Pollution Control Board,
 AMBATTUR**

To
 The Manager,
 M/s.CHENNAI WATER DESALINATION LTD,
 Kattupalli village, Ponneri Taluk, Thiruvallur District,
 Pin: 601203

Copy to:

1. The Executive Officer, MINJUR-Town Panchayat, Ponneri Taluk, Tiruvallur District .
2. Copy submitted to the Member Secretary, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
3. Copy submitted to the JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
4. File

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு புறம் தூய்மை வாழ்வுக்கு !





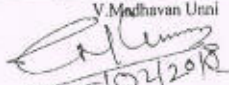
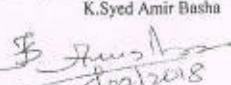
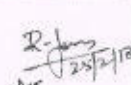
POWERTEC ENGINEERING PVT. LTD.

100 MLD SEA WATER DESALINATION PLANT				
MINJUR TAMILNADU				
	Specification	09/03/18		
	As per IS 10500:1991			
			UNIT	Remarks
Lab Result at PWT outlet:				
TDS	500	456	mg/l	
pH	6.5 - 8.5	8.31	0.60	
Residual Free chlorine	0.2mg/l Minimum	0.40	mg/l 2	
Turbidity	5	0.72	NTU	
Colour	5	2	Hz	
Odour	Un objectionable	Un objectionable	-	
Taste	Agreeable	Agreeable	-	
Temperature	-	28.4	°C	
Boron	1	0.93	mg/l	
Total Hardness (as CaCO ₃)	300	62	Mg/l	
Calcium as Ca	75	20.6	mg/l	
Magnesium as Mg	30	2.52	mg/l	
Total Alkalinity	200	58	mg/l	
LSI	Positive	+0.05		
Max sea water turbidity		9.5	NTU	

For POWERTEC ENGINEERING PVT. LTD

R. S. Loganathan

Authorized Signatory

WABAG		10M35/DIL/LAB/006-2 10M35 Laboratory Daily Report			
DATE: 25.02.2018					
DATE:	22.06.2016	Potable Water Quality			
REV No:	2				
S.No	Parameters	Units	Limit	Report	
1	pH	-	6.5-8.5	8.26	✓
2	Conductivity	μS/cm	..	923	
3	Total Dissolved solids	mg/l	< 500	480	✓
4	Turbidity	NTU	5	0.11	
5	Temperature	°C	..	29.2	
6	Free Residual Chlorine	mg/l	0.2-1	0.5	
7	Total Hardness (as CaCO ₃)	mg/l	300	74	✓
8	Calcium Hardness (as CaCO ₃)	mg/l	75	60	
9	Magnesium Hardness (as CaCO ₃)	mg/l	..	14	
10	Chloride (as Cl)	mg/l	250	236	✓
11	Total Alkalinity(CaCO ₃)	mg/l	200	58	
12	Iron (as Fe)	mg/l	0.3	0.01	
13	Boron (as B)	mg/l	1.0	0.43	✓
14	Fluoride (as F)	mg/l	1.0	0.01	
15	Sulphate(as SO ₄)	mg/l	200	11.01	-
16	Nitrate (as NO ₃)	mg/l	45	6.00	
17	LSI	-	Positive	+ 0.02	✓
REMARKS:					
Chief Chemist		Manager-Operation		Head-Operation	
Name A. Azmathullah Khan		V. Madhavan Unni		K. Syed Amir Basha	
Sign 		Sign 		Sign 	
DD/MM/YYYY 25/02/2018		25/02/2018		25/02/2018	
				 CMWSSB	