

**IMPROVEMENTS TO EXISTING WATER SUPPLY SCHEME FOR
KANCHEEPURAM CITY MUNICIPAL CORPORATION
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT**

OCTOBER 2023

Prepared by

Kanchipuram City Municipal Corporation

LIST OF ACRONYMS

ASI	Archaeological Survey of India
DPR	Detailed Project Report
E&S	Environmental and Social
ESIA	Environmental and Social Impact Assessment Report
ESMP	Environmental and Social Management Plan
GLSR	Ground Level Service Reservoir
GOI	Government of India
GoTN	Government of Tamil Nadu
GRC	Grievance Redressal Committee
LL	Lakh Litres
LMP	Labour Management Plan
KM	Kilo Metre
MA&WS	Municipal Administration and Water Supply
MoEF & CC	Ministry of Environment and Forest & Climate Change
OHT	Over Head Tank
PIA	Project implementation Agency
PIU	Project Implementation Unit
PMC	Project Management Consultant
ROW	Right of Way
SEP	Stakeholder Engagement Plan
STP	Sewerage Treatment Plant
SWM	Solid Waste Management
TNCRUDP	Tamil Nadu Climate Resilient Urban Development Project
TNUIFSL	Tamil Nadu Urban Infrastructure Financial Services Limited
ULB	Urban Local Body
WB	World Bank

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EXECUTIVE SUMMARY

Introduction & Background

Kancheepuram served as the historical capital of Pallavas during 6th to 8th century AD. Later, it became the citadel of Cholas, Vijayanagar Kings, the Mughals and the British. The town has been the Centre of Tamil learning, culture and of religious importance for centuries. Since time immemorial, the town is known for its fine silk sarees in the country. It is a place of international tourism importance because of the magnificent temples of unique architectural style and beauty, that heralds the glory of the Dravidian culture. Adi Shankaracharya established his Episcopal seat viz. Kamakotipeetam in Kancheepuram.

Kancheepuram municipality was expanded by adding Sevilimedu Town Panchayat, Orikkai, Nathapettai & Thenambakkam Village Panchayats. Existing Water Supply Scheme for Kancheepuram is not sufficient to serve the present water demand. The existing distribution system covers only around 50% of total road network and OHTs are of small capacities with less staging height (6m to 9m). Hence a new water supply scheme including source is required.

Description of the project

The existing water supply for Kancheepuram is dependent on River Palar as source of water. Infiltration galleries at Tiruparkadal, Infiltration wells in Orikkai and Venkadapuram and Bore wells in Thenambakkam are the sources of water for Kancheepuram. From the Tiruparkadal source which is located 35 kms from Kancheepuram (Three Nos. of Collector wells), water is received at Vegavathi Booster station located inside the city in a 5.75 LL sump. The water is transmitted by gravity through 600mm diameter PSC Pipes.

From Orikkai Source which is located 5 km from Kancheepuram, water is received from Three nos. of Infiltration wells and 7 nos. of Borewells in 1.50 LL and 0.75 LL Sumps respectively at Orikkai Headwork's. From Venkadapuram Source which is located 5 kms from Kancheepuram, water is received from seven no's. of Infiltration wells out of which Four nos. of infiltration wells are working. The water is received at 0.50 LL Ground Level Service Reservoir (GLSR) at Venkadapuram Headwork's.

From Thenambakkam Source, water is received from Seven no's of Borewells out of which 4 no's of borewells are working. The water is received at 0.75 LL GLST at Thenambakkam Headwork's. There are 97 OHTs existing in Kancheepuram with capacities ranging from 0.10 LL to 20.00 LL and with staging height varying from 6m to 12m. Out of the Existing 97 OHTs, 4 OHTs are of 9m Staging Height, 9 Nos. of OHTs are of 12m Staging Height, the remaining 84 OHTs are of staging height from 6m to 7.5m.

Based on the structural condition, staging height, capacity 10 existing OHTs of 7.5m to 12m staging height with capacities from 2.00 LL to 20.00 LL are proposed to be retained. Other existing OHTs and sumps have not been considered in planning and design of proposed water

supply scheme. Micro details of water distribution system like diameter, pipe lengths etc for each ward are not available with corporation. Existing water distribution system in Kancheepuram is very old and was laid with mostly AC & PVC pipes for a length of 205 Km. At present 31,180 House Service Connections exists in Kancheepuram.

Need for the project:

Existing water supply system is very old. Pumping mains are of small sizes and there is frequent pumps repair issues as well. During flood situation it is difficult to operate at headwork's which would be under inundation. Old distribution system is with AC and PVC pipes, covering around 50% of existing road length and OHT's are of under and staging height is less (6m) and in poor condition, unable to cater the water demand with required pressure. The water demand for year 2025 itself is estimated as 44.88 MLD and the existing system does not meet even the present water demand. Hence a new water supply scheme became necessary for Kancheepuram.

Proposed Water Supply Improvement:

At present 25.5 MLD of water at the rate of 102 lpcd once in two days, is supplied to the project area. For the proposed project, water supply demand has been estimated at the rate of 135 lpcd for permanent population and at the rate of 45 lpcd for floating population. The total water requirement for ultimate year (2055) has been estimated as 60.36 MLD.

Proposed Project Components:

Sl.No	Description
(i)	Proposed New Components
1	Source & Headworks
a	Construction of Collector Wells - 3 Nos. at Thirupparkadal including Pump House, Foot Bridge, Control Room, Generator Room, Stand Post, Pumping Main, etc.
b	Construction of Sump, Pump room and Generator Room near Existing Headworks at Vegavathi Booster
c	Providing Pumpsets to Proposed Headworks at Thirupparkadal & Vegavathi Booster
d	Providing Interconnection Pumping Main from Venkadapuram Head Works to Orikkai and from Orikkai Headworks to Vegavathi
2	Providing Distribution System with HDPE Pipes (450.71 Km)
3	Providing Feeder Mains from Sump to OHTs (33.27 Km)
4	Providing Flow control Valve, Sluice Valve, Electromagnetic Flow Meter & Chamber - For Distribution System
5	Construction of OHTs (1.5 LL - 2 Nos ; 2 LL - 1 No ; 3 LL - 1 No ; 5 LL - 4 Nos ; 6 LL - 1 No ; 7 LL - 5 Nos)

6	Construction of PCB for Palar and Vegavathi River crossings
7	Providing House Service connections (55240)
8	Road restoration with cement concrete 1:4:8, 7.5 cm thick, using 20 mm HBS metal and cement concrete 1:2:4 , 10 cm thick using 20 mm HBS including cost of all materials laying, curing, etc., complete
9	Providing Complete SCADA system for water supply system (Pressure Sensor, Quality Sensor, Monitoring and control units) including VFD for Pumpsets
(ii)	Rejuvenation / Replacement of Existing Components
10	Replacement of Pumpsets at existing Headworks at Thirupparkadal, Venkadapuram & Orikkai
11	Replacement of Gravity Main from Thirupparkadal to Proposed Sump at Vegavathi Booster station (29.786 km)

Legal and regulatory framework:

This Environmental and Social Impact Assessment (ESIA) Report is prepared based on the World Bank's Environmental and Social Framework.

This project is proposed under the new Tamil Nadu Climate Resilient Urban Development Program (TNCRUDP), which is funded by the World Bank under Municipal Administration and Water Supply (MA&WS) Department. This program is based on Program-for- Results (PforR) and the World Bank is presently carrying out Environmental and Social Systems assessment (ESSA).

Baseline Environment and Social

The baseline information about the project area is carried out through a secondary environmental survey along with the data from the various information resources and through primary survey for project area for the attributes of the ambient environment. The project related baseline data on climate, meteorology, land usage, water, air, noise, soil, flora, fauna and social profile of local population and environmental parameters like air, water, noise and soil have been collected and included in the report. The social survey was carried out along the pumping main for collection of social baseline data. The collected baseline data help to understand the existing environmental conditions and socio-economic characteristics of the study area. It is required to compare and assess the impacts on Environmental and Social (E&S) aspects caused during the project life cycle.

Climate

Kanchipuram has a tropical climate (Köppen Aw), which is generally healthy. Temperatures reach an average maximum of 37.5 °C (99.5 °F) between April and July, and an average minimum of 16 °C (60.8 °F) between December and February. Relative humidities of between 58% and 84% prevail throughout the year. The humidity reaches its peak during the morning and is lowest in the evening. The relative humidity is higher between November and January and is lowest throughout June.

Most of the rain occurs in the form of cyclonic storms caused by depressions in the Bay of Bengal during the northeast monsoon. Kanchipuram receives rainfall from both Northeast Monsoon and Southwest Monsoon. The highest single day rainfall recorded in Kanchipuram is 450 millimetres or 17.72 inches on 10 October 1943. The prevailing wind direction is south-westerly in the morning and south-easterly in the evening. In 2015, Kanchipuram district registered the highest rainfall of 182 centimetres or 71.65 inches in Tamil Nadu during Northeast Monsoon season. On 13 November 2015, Kanchipuram recorded a mammoth 340 millimetres or 13.39 inches of rain, thereby causing severe flooding.

Climate data for Kanchipuram, Tamil Nadu													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	29.1 (84.4)	31.2 (88.2)	33.4 (92.1)	35.6 (96.1)	38.2 (100.8)	37.2 (99.0)	35.2 (95.4)	34.7 (94.5)	34.1 (93.4)	32.1 (89.8)	29.3 (84.7)	28.5 (83.3)	33.2 (91.8)
Average low °C (°F)	19.2 (66.6)	19.8 (67.6)	22.0 (71.6)	25.4 (77.7)	27.3 (81.1)	27.0 (80.6)	25.9 (78.6)	25.4 (77.7)	24.8 (76.6)	23.7 (74.7)	21.6 (70.9)	19.9 (67.8)	23.5 (74.3)
Average rainfall mm (inches)	25 (1.0)	6 (0.2)	4 (0.2)	19 (0.7)	59 (2.3)	77 (3.0)	108 (4.3)	173 (6.8)	132 (5.2)	185 (7.3)	209 (8.2)	107 (4.2)	1,104 (43.4)
Source: Climate-Data.org													

Humidity

High relative humidity is between 58% and 84% prevail throughout the year. Relative humidity is maximum in the morning and minimum in the evening. Higher rates of relative humidity are observed between November and January i.e., 83% to 84%. In the months of June, the humidity is lower i.e., around 58%. Average relative humidity in the morning and evening 74% and 64%.

Groundwater

The estimation of ground water resources for the Kancheepuram district by CGWB has shown that of the thirteen blocks in the district, two blocks (Uthiramerur and Lattur) are over exploited and two blocks (Sittampur and Thirukalukunram) are under “Critical” category. The shallow alluvial aquifer along Palar and Cheyyar rivers serve as an important source of drinking water between Kancheepuram to Ayyapakkam and Chengalpattu to Tambaram. The dug wells in hard rock terrain tapping the entire weathered residuum are capable of yielding 30-100 m³ /day requiring the installation of 3 - 5 HP pumps for extraction of groundwater. G

round water potential of the project area including the Kancheepuram Corporation and source location, falls under “Safe” category.

Soil Environment

Soils have been classified into 1) clayey soil, 2) red sandy or red loamy soil 3) Red sandy brown clayey soil and 4) Alluvial soil. Of the above soils brown clayey soil is the most predominant, covering more than 71 percent of the areal extent of Kancheepuram district. Alluvial soils are found on the banks of Palar, Cheyyar and other rivers. The river alluvium is transported and is seen in coastal area of this district. Sandy coastal alluvial (arenaceous soil) occurs along the seacoast as a narrow belt.

Ecological Environment:

The study involved in the collection of primary data by conducting a survey in the field, examination of floral and faunal records in previously published reports and records. Analysis of the information is the view of the possible alteration in the environment of the project site. For the survey of fauna, both direct and indirect observation methods were used. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Hence this proposed project is not envisaged to have any impact on the surrounding flora and fauna.

Baseline Environmental Monitoring

Primary survey for baseline environment was carried out in the project area as part of the environmental and social impact assessment during the month of April '23 and details of the assessment are provided below. Further secondary published sources also used for the baseline assessment.

Baseline monitoring was carried out at 10 locations in the project area. The sampling locations were selected near the proposed project sites, water source and availability of ground water source.

SO₂ concentration was in the range between 5.2 mg/l to 6.8mg/l, NO_x concentration was in the range between 15.1 mg/l to 26.2mg/l. PM₁₀ levels were in the range between 52.7 mg/l - 65.8 mg/l, PM_{2.5} was in the range between 21.9 mg/l – 33.7 mg/l. It was observed that at for all the sampling locations, the ambient air quality was within the stipulated limits as per the NAAQM standard.

The noise levels in the project area are observed between 58.8 dB(A) to 64.3 dB(A). Except Brahmanar Street in Thenambakkam, the noise levels recorded for all locations are well within the CPCB standards for commercial areas, but exceeding the standards for residential areas. Necessary mitigation measure for noise control measures during project implementation is included in the ESMP.

History and Culture

There are about 31 monuments and sites in Kancheepuram district. Out of which seven monuments are present within the Kancheepuram limits. The city's historical monuments include the Kailasanathar Temple, Vaikunta Perumal Temple, Piravathanesvara temple, Iravathanesvara temple, Jvarahesvara temple, Mathangesvara temple, and Muktesvara temple which are protected by the AMASR Act, 1958. Kancheepuram is home to several temples and 11 temples including the above are being proposed for inclusion in the UNESCO. None the project sites identified for locating the proposed OHTs are located within the regulated boundary of protected monuments and hence no impact is anticipated from the construction of new OHTs. However, a section of the proposed pipeline alignment for feeder main (1.314km) for three existing OHTs and distribution network (29.84Km) near the monuments fall within the regulated boundary which involve activities of low risk. Applicable permission will be obtained prior to start of construction in the relevant section and conditions if any would be complied. During construction adequate precautions will be taken not to cause any disturbance to the temples and other religious structures. Further during construction if any chance finds encountered, then necessary management measures as identified in the ESMP would be implemented.

Site specific Environmental features:

All the OHTs sites are free from encumbrances and owned by Government agencies/departments. All the OTH site is located in habituated area, surrounded by residential buildings. All the roads have access roads, and there is no tree cutting involved. There are no environmentally sensitive areas present within or in the vicinity of the project site. Construction of compound wall is proposed for all the proposed OHTs for protection of the resource and project component.

Social Profile:

According to 2011 census, the district had population of 11.18 lakh, which is about 1.54% of the total State population, in which 5,62,309 were Male and 5,95,910 were Female. In rural areas it was 5,66,361 and in Urban it was 5,51,858. The total main workers of the district was 3,90,785 persons forming 41.9% of total population. Of this, 2,85,207 were male workers and 1,05,578 were Female workers and 2,00,585 were from rural. Among the main workers 1,90,200 were from Urban and 29,981 were of cultivators and 65,988 of Agricultural labourers and 22,965 of Household industry and rest in other activities i.e 2,71,851.

Potential Environmental and Social Impacts and Mitigation Measures.

Environmental and social impact assessment is required for any infrastructure projects to identify and assess the environmental and social issues that are involved in the project execution and operation, suggest necessary changes in design and ensure that suggested mitigation measures are taken care adequately in the formulation, execution and day-to-day operation of the project. The ESIA is also required to sensitize the implementation team of

the project to the various environmental and social issues that are likely during the project construction and operation stages.

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 project designs. Various measures suggested for the control of air pollution due to construction including: developing tree cover; closed facilities; standard operating procedures for operation and maintenance; 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, 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.

Analysis of Alternatives

The alternative analysis is mainly aimed to mitigate the adverse social & environmental impacts in the project and make technically feasible and economic & financially viable alternative.

The expected positive and negative impacts to be relatively associated with the different factors and conditions were integrated and the overall impact for the project was calculated. Based on which the infrastructure alternative is finalized is the best alternative considering all the factors including Social and Environmental factors.

Environmental & Social Management Plan (ESMP)

ESMP is prepared for this project to address the environmental, social and health & safety impacts caused by the project activities. The ESMP details out mitigation measures, responsibilities, monitoring methods, indicators and frequency during the project cycle. The implementation of ESMP will be closely monitored along the parameters like air, water, noise, soil, ecology, health, safety, etc ensure compliance to all applicable Environmental, Social and Health & safety standards throughout the whole project cycle. Based on the findings of the monitoring process, corrective measures will be taken during the project construction and operation as appropriate.

Stakeholder Consultation and Disclosure

Stakeholder Consultation was held at Kancheepuram Corporation on 30.11.2022, under the chairmanship of Hon'ble Mayor, Kancheepuram Corporation and the Respected Council members along with officials of Kancheepuram Corporation and the following suggestions were given during the presentation.

Sl.No	Comments/Suggestions	Action Taken
1	It was suggested to ascertain the sand depth at Tiruparkadal for the proposed source.	The sand depth was ascertained at Thiruparkadal and a detailed hydro geological study was done to confirm the source sustainability and availability.
2	It was suggested that the sand depth at kavungampallam near Orikkai may have good depth for proposing infiltration wells and the same may be studied.	The sand depth was ascertained, and the existing wells are being utilised at Orikkai, since the entire gap in demand is taken from Thiruparkadal, No new wells are proposed at orikkai.
3	One of the council members suggested to study and utilize the existing siphon well at Vegavathi booster station and propose for revamping.	The existing siphoning well was studied, it was observed that the well is in dilapidated condition and hence it is not considered in design.
4	It was suggested to design the HSC connections in such a way that the flow control valve and flow meters are tamper proof.	The HSC connections are designed with provisions for Protection box in order to avoid tampering of assets.
5	Cost for utility shifting and reconstruction of culverts was suggested to be included in the estimate after conducting a survey of the culverts.	A provision for shifting of underground utilities and unforeseen items have included in the DPR costing.

Grievance Redress Mechanism.

A grievance redress mechanism (GRM) is described within the ESIA Report to ensure any public grievances are addressed quickly.

Institutional Mechanism

Project Management Unit (PMU)

A PMU in TNUIFSL jointly with the Directorate of Municipal Administration will be established. PMU will have dedicated Environmental and Social Safeguards specialists.

Project Implementation Unit (PIU)

The PIU will be established in the Kancheepuram City Municipal Corporation for implementation of this project. PIU shall have officials trained in EHS designated as Environmental Officer & Social Safeguards Officers.

PIU will supervise activities of Environmental and social safeguards, ESHS for ensuring adoption and compliance of ESMP and report to TNUIFSL.

Project Management Consultants (PMC)

A PMC will be appointed and will assist the PIU in the implementation of the project. The PMC will have dedicated Environmental, Social, Gender and ESHS specialists and will implement the ESMP. Preparation of periodical progress reports, flag critical issues to the PIU and PMU are the scope of the PMC.

Contractor

Contractor will appoint ESHS personnel & safety officer who along with the Project Manager will be responsible for implementation of the Environmental and Social management plan and submit the compliance report to PMC/PIU.

Project Benefit

Providing drinking water to all the citizens is the prime responsibility of the ULB. This sub project will benefit all households who are already connected and newly connected. This sub-project is total replacement of distribution system will have direct impact on the quantity and quality of the water supply to the citizens.

CHAPTER-1 INTRODUCTION AND BACKGROUND

1.1 Background of the project

Kancheepuram served as the historical capital of Pallavas during 6th to 8th century AD. Later, it became the citadel of Cholas, Vijayanagar Kings, the Mughals and the British. The town has been the Centre of Tamil learning, culture and of religious importance for centuries. Since time immemorial, the town is known for its fine silk sarees in the country. It is a place of international tourism importance because of the magnificent temples of unique architectural style and beauty that heralds the glory of the Dravidian culture. Adi Shankaracharya established his episcopal seat viz. Kamakotipeetam in Kancheepuram.

Kancheepuram Municipality expanded by adding Sevlimeedu Town Panchayat, Orikkai, Nathapettai & Thenambakkam Village Panchayats. Existing Water Supply Scheme for Kancheepuram is not sufficient to serve the present water demand. In this regard, SSG CONSULTANTS, Chennai was appointed as consultants for the preparation of DPR for Providing Improvements to Existing Water Supply Scheme to Kancheepuram City Municipal Corporation.

1.2 Objective

The objective of this project is to provide improvements to the existing water supply system by source improvement & provide distribution system and meet the gap in water supply demand to provide equitable supply to the entire Kancheepuram City Municipal Corporation.

1.3 Project area

Kancheepuram Municipality was expanded by adding Sevlimeedu Town Panchayat, Orikkai, Nathapettai & Thenambakkam Village Panchayats to form Kancheepuram City Municipal Corporation.

Table 1.1 Administrative details of Kancheepuram City Municipal Corporation

S. No	Details	Erstwhile municipality	Added areas	Total
1	Area (Sq.km)	11.72	24.42	36.14
2	Population (2011)	164384	69969	234353
3	Wards covered (No.s)	33	18	51

Source: KCMC

1.4 Brief description of the study area

Kancheepuram district is located on the East Coast of Tamil Nadu and is adjacent to the Bay of Bengal in the east, bounded by Chennai and Thiruvallur district to its north, Vellore in the west, and Villupuram district in the south. Kancheepuram lies between 11 degrees to 12 degrees to the North latitudes and 77 degrees and 28 minutes to 78 degrees and 50 minutes to the East longitudes.

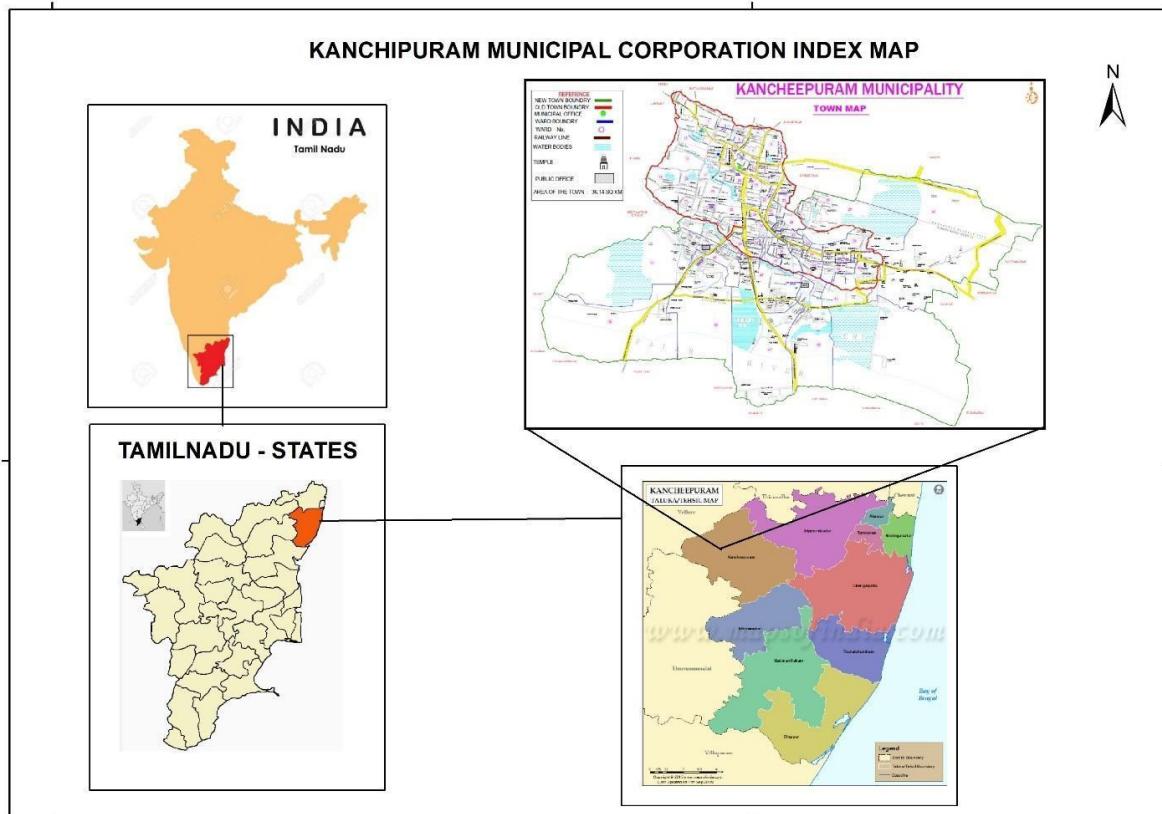


Figure 1.1 Index map of the study area

Existing water supply

Existing water supply system

Kancheepuram Municipality was expanded by adding Sevlimeedu Town Panchayat, Orikkai, Nathapettai & Thenambakkam Village Panchayats. Existing Water Supply Scheme for Kancheepuram is not sufficient to serve the present water demand.

At present 25.5 MLD of water at the rate of 102 lpcd once in two days, is supplied to the project area from the existing sources. The details of existing water supply scheme are described below

The existing water supply for Kancheepuram is received from four sources namely a) Tiruparkadal b) Orikkai c) Venkadapuram d) Thenambakkam. Tiruparkadal is located 35 kms from Kancheepuram and the water is received from three nos. of infiltration galleries and received at Vegavathi booster sump of capacity 5.75 LL through gravity main of 600mm dia PSC. From Orikkai Source which is located 5 kms from Kancheepuram, water is received from Three Nos. of Infiltration wells and 7 Nos. of Borewells in 1.50 LL and 0.75 LL Sumps respectively at Orikkai Headworks. From Venkadapuram Source which is located 5 kms from Kancheepuram, water is received from Seven Nos. of Infiltration wells out of which Four Nos. of infiltration wells are working. The water is received at 0.50 LL GLSR at Venkadapuram Headworks. From Thenambakkam Source, water is received from Seven Nos of Borewells out of which 4 Nos. of borewells are working. The water is received at 0.75 LL GLST at Thenambakkam Headworks.

Water is distributed through 97 OHTs existing in Kancheepuram with capacities ranging from 0.10 LL to 20.00 LL and with staging height varying from 6m to 12m.



Figure 2.1 Headwork's at Thirupparkadal

Table 1.2 Details of existing water supply sources in KCMC

S. No	Source	Source & method of drawal/location	Drawal quantity (MLD)
1	Tiruparkadal – 35 Kms	Infiltration galleries at Palar River	16.75
2	Orikkai - 5 km	Infiltration wells & bore wells at Palar River	5.50
3	Venkadapuram – 5 Kms	Infiltration wells/ River Palar	2.00
4	Thenambakkam – 5 Kms	Bore wells	1.25
5	Borewells & local sources	Borewells & local sources	3.20

2.2 Existing service reservoir/OHTs and sumps in Kancheepuram

There are 97 existing OHTs in Kancheepuram with capacities ranging from 0.10 LL to 20.00 LL and with staging height varying from 6m to 12m. Out of the Existing 97 OHTs, 4 OHTs are of 9m Staging Height, 9 Nos. of OHTs are of 12m Staging Height, the remaining 84 OHTs are of staging height from 6m to 7.5m.

Based on the structural condition, staging height, and water holding capacity, 10 existing OHTs of 7.5m to 12m staging height with capacities from 2.00 LL to 20.00 LL are proposed to be

retained. Other existing OHTs and sumps have not been considered in planning and design of proposed water supply scheme.

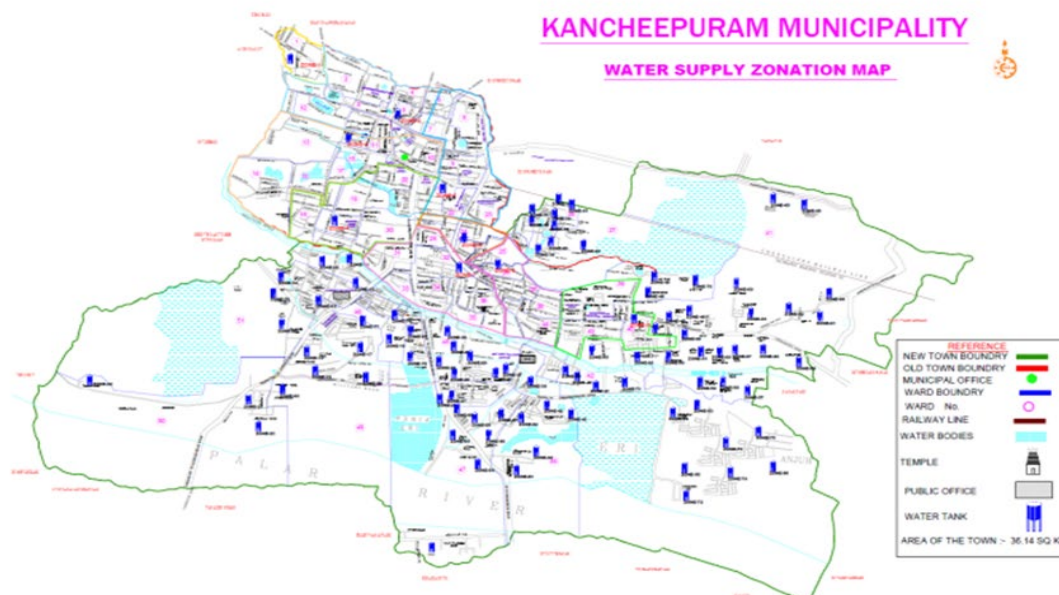


Figure 2.2 Existing water supply zone map

Table 1.3 Details of existing OHTs & Capacity

S. No	Capacity (Lakh Litres)	No of OHTs	Total capacity (LL)
1	20	3	60
2	10	3	30
3	8	1	8
4	4	1	4
5	2	4	8
6	1.5	1	1.5
7	1	13	13
8	0.6	19	11.4
9	0.5	1	0.5
10	0.3	41	12.3
11	0.1	10	1
Total		97	149.7

Source: Detailed Project Report

Table 1.4 Details on existing status of water supply

S.No	Description	Details
1.	Source of Water Supply	River Palar
2.	Water Supply Service Level	102 LPCD
3.	OHTs/SRs	97 no's, Capacities vary from 0.10 LL to 20.00 LL with 6m to 12m staging height.
4.	Distribution System	AC and PVC pipes
5.	Length of Distribution system	205 Km

1.6 Proposed water supply

Palar River is considered as a source of water supply for the proposed water supply scheme. The river is located at the southern boundary of the project area. Owing to availability of water throughout the year and availability of maximum sand depth to extract sub-surface water through collector well, at a distance of 35 Km upstream of Palar, at Tiruparkadal it is identified to locate the headworks at this location. It is proposed to construct 3 Collector wells and 4 nos of Infiltration wells at Thiruparkadal which will be the main source of water for proposed water supply scheme.

1.7 Need for the project

- Existing system is very old
- Pumping mains are of small sizes and frequent pumps repair issues
- During flood situation the headwork's get submerged and it will be very difficult to operate it
- OHTs are of under size and staging height is less (6m) and in poor condition, unable to cater the water demand.
- Existing distribution system consists mostly of AC/PVC pipes covering around 50% length of the total road network.

The water demand for the year 2025 is estimated as 44.88 MLD and the existing system does not meet even the present water demand and hence the proposed system has to be designed to take care of the entire water demand of the project area.

CHAPTER-2 DESCRIPTION OF THE PROJECT

2.1 Salient features of Proposed Water supply improvement scheme:

The project providing improvements to water supply system in Kancheepuram City Municipal Corporation involves source improvements at Tiruparkadal, construction of one sump, laying of feeder mains, construction of OHTs, & distribution system, providing HSCs and SCADA for the entire scheme.

Salient features of the proposed improvement to the water supply scheme in Kancheepuram City Municipal Corporation are as below.

Table 2.1 Project Components

Sl.No	Description
(i)	Proposed New Components
1	Source & Headworks
a	Construction of Collector Wells - 3 Nos. at Thirupparkadal including Pump House, Foot Bridge, Control Room, Generator Room, Stand Post, Pumping Main, etc.
b	Construction of Sump, Pump room and Generator Room near Existing Headworks at Vegavathi Booster
c	Providing Pumpsets to Proposed Headworks at Thirupparkadal & Vegavathi Booster
d	Providing Interconnection Pumping Main from Venkadapuram Head Works to Orikkai and from Orikkai Headworks to Vegavathi
2	Providing Distribution System with HDPE Pipes (450.71 Km)
3	Providing Feeder Mains from Sump to OHTs (33.27 Km)
4	Providing Flow control Valve, Sluice Valve, Electromagnetic Flow Meter & Chamber - For Distribution System
5	Construction of OHTs (1.5 LL - 2 Nos ; 2 LL - 1 No ; 3 LL - 1 No ; 5 LL - 4 Nos ; 6 LL - 1 No ; 7 LL - 5 Nos)
6	Construction of PCB for Palar and Vegavathi River crossings
7	Providing House Service connections (55240)
8	Road restoration with cement concrete 1:4:8, 7.5 cm thick, using 20 mm HBS metal and cement concrete 1:2:4 , 10 cm thick using 20 mm HBS including cost of all materials laying, curing, etc., complete
9	Providing Complete SCADA system for water supply system (Pressure Sensor, Quality Sensor, Monitoring and control units) including VFD for Pumpsets

(ii)	Rejuvenation / Replacement of Existing Components
10	Replacement of Pumpsets at existing Headworks at Thirupparkadal, Venkadapuram & Orikkai
11	Replacement of Gravity Main from Thirupparkadal to Proposed Sump at Vegavathi Booster station (29.786 km)

2.2 Design criteria

The following design criteria are adopted for planning and design of proposed water supply system to Kancheepuram.

2.2.1 Design period

A design period of 30 years been considered for design of the scheme as recommended by CPHEEO. The various phases for the project are as given below.

Table 2.2 – Adopted Population for different design periods

Sl. No	Stage	Year
1.	Base year	2025
2.	Intermediate year	2040
3.	Ultimate year	2055

Source: Computed

The design life of various components of the system shall be considered as follows:

Pipeline Works and Civil Structures - 30 years

Mechanical & Electrical items - 15 years

2.2.2 Population Projections

Population forecast has been done using standard projection methods viz. Arithmetical Increase Method, Geometric Increase Method and Incremental Increase Method as specified by CPHEEO manual. Considering the growth trend in the Erstwhile Kancheepuram Municipality, Arithmetic Method is considered for projecting the population with the reason that, the increase in population density per sq.km per decade approximately matches with the projected population density in arithmetic method. Hence final projected population is as follows:

Table 2.3 Population Projection for various periods across different methods

S.No	Method of Projection	Population [Nos.]			
		2021	2025	2040	2055
1	Arithmetic Method	267315	280499	329942	379385
2	Incremental Increase Method	264465	278446	340729	418570
3	Geometric Progression Method	277950	299590	411618	599545

4	Line of Best Fit Method	335667	366949	534655	829878
5	Exponential Method	298240	333529	550821	1025497
6	Growth Rate Method	330578	368469	533653	709447

Source: KCMC

2.2.3 Water Demand Assessment

Water supply demand has been calculated at the rate of 135 lpcd for permanent population and at the rate of 45 lpcd for floating population. Floating population has been taken at rate of 10% of 45 LPCD. Losses have been considered as 10% of net water requirement. The total water requirement for ultimate year has been estimated as 60.36 MLD.

2.2.4 Collector Well with Radial Arms cum Pump house

Sub-surface water is proposed to be withdrawn from collector well. Collector well is designed for 30 years of water demand. Pump house is mounted on collector well for operation of pumps and other machinery. For both raw water pumps at Collector Well (proposed) and clear water pumps at Booster Station(proposed) the same design criteria has been adopted.

2.2.5 Pumps and Pumping Machinery

2.5.5.1 Pumps

- a) At collection well cum pump house : Vertical Turbine Pumps
- b) Clear water pumps : Horizontal Split Centrifugal

2.5.5.2 Duration of Pumping

The pumping operation for both raw water pumps at Collector Well (to pump to Booster Station) is considered as 23 hours whereas clear water pumps at Booster Station (to pump to OHTs/SRs) is also considered as 23 hours in a day.

2.5.5.3 Standby for Pumping Machinery

up to 15 kW - 100%
More than 15 kW - 50%

2.2.6 Raw Water and Clear Water Pumping Main

For design of Raw water and clear water pumping mains, techno economic analysis was carried out considering various pipe sizes, head loss, pipe capital cost, annual interest of interest, pumps cost, power cost etc. DI K7 is proposed for raw water main and DI-k7 is proposed for clear water feeder mains.

2.2.7 Water Distribution System

Water is supplied into the pipe network usually by gravity and for computational purpose; all demands on the system are assumed to occur at the junction nodes. Pressure is one of the main concerns in a water distribution system. The overall objective of a distribution system is to deliver quality water to the consumer at adequate residual pressure and achieve maximum coverage at minimum cost. The proposed distribution system is designed to achieve 100% coverage (with respect to Roads & Households) for the town.

2.5.7.1 Pipe Network Layout

Pipelines have been proposed on one side of the roads.

2.5.7.2 Residual Pressure

Generally, distribution system is designed for minimum residual pressure at ferrule point. The recommended minimum residual pressure for households at each level of multi-storied building as per CPHEEO is shown in Table below. The distribution system has been designed for a minimum residual pressure of 7 m at consumer end in the distribution system for the distribution zones.

2.5.7.3 Pipe Material & Sizes

HDPE pipe material been chosen for distribution pipelines with pipe sizes ranging from 100 mm to 315 mm diameter whereas greater than 315mm, DI K7 pipes are proposed while design of distribution network. The network solution has been worked out on the basis of Hazen William's formula for head loss considering 'C' value of 140 corresponding to HDPE pipes while design of distribution network.

2.5.7.4 Network Design Methodology

Hydraulic design of distribution network has been carried out using Bentley's Water GEMS v8i software. Water GEMS software has been preferred as it possess several advantages over the other hydraulic modeling software (LOOP, EPANET etc.). The salient features of Water GEMS software include Scenario Management, Extended Period Simulation (EPS) for water quality analysis, Optimization of Pipe Network, Terrain extraction for evaluation of ground levels, Nodal demand estimation as per land use, Cost & Energy estimation for the system, Criticality analysis for isolation segments, Visualization of model results as far design is concerned.

2.2.8 Service Reservoirs (SRs)

Service reservoirs allow fluctuations in demand to be accommodated without loss of hydraulic gradient. The elevation, location and the capacity are the factors considered for service reservoirs while designing the distribution system for the town.

2.5.8.1 Location & Elevation

New service reservoirs (OHT/ELSRs) are proposed at locations such that minimum residual pressure of 17 m shall be achieved at consumer end/each node of the distribution network of the particular zone been served. For the proposed service reservoirs, staging height of 17 m has been considered to achieve the desired pressure.

2.5.8.2 Storage Capacity

Storage capacity of the service reservoirs has been considered at 1/3rd of daily water demand (three fillings per day) or value obtained from the analysis of mass balance curve, whichever is higher. New service reservoirs of various capacities have been considered in the proposed scheme.

2.2.9 SCADA

To automate the water supply operations with supervisory control and data acquisition (SCADA) system, there are various levels to which this can be done. Complete remote operation of all plant and equipment including remote pumping stations, pipeline valves etc from a central control centre.

Complete remote operation of all plant and equipment at each water treatment works from a control centre at that works, with remote monitoring of all other operational activities (pumping stations operations, pipeline pressures and flows and valves status), but with actual operation except at the water treatment works carried out manually.

Remote monitoring of all water supply functions within a district at a central control centre but with all operational functions carried out manually on instruction from the central control centre. In all cases, it will be necessary to establish an effective communications system. The most economic would be to use existing cell-phone systems, but if these are not available consideration could be given to using a satellite-based system.

2.3 Proposed improvements to water supply scheme

2.3.1 Source of water for proposed water supply scheme

At present 25.5 MLD of water at the rate of 102 lpcd once in two days, is supplied to the project area. For the proposed project, water supply demand has been estimated at the rate of 135 lpcd for permanent population and at the rate of 45 lpcd for floating population. The total water requirement for ultimate year (2055) has been estimated as 60.36 MLD. The gap between the existing sources and ultimate requirement is 34.86 mld. Thus, the additional source is necessary to fulfil the ultimate requirement.

For the proposed water supply scheme, Palar River is considered as source of water supply. The river is located at the southern boundary of the project area. Owing to availability of water throughout the year and availability of maximum sand depth (14m-16m) to extract sub-surface water through collector well, at a distance of 35 Km upstream of Palar, at Thirupparkadal is adopted as main source of water for proposed water supply scheme. The source is sustainable in normal seasonal condition.

The additional sources of 3 nos. of collector wells and 4 nos. of Infiltration wells is identified and confirmed at Thiruparkadal in river Palar. Therefore, the above confirmed collector well sources and Infiltration well sources may be utilized to fullfill the total ultimate demand for Water supply improvement scheme to Kancheepuram Corporation in Kancheepuram district has suggested and recommended. **However, in this proposal, only 3 collector wells are included in order to meet only the Intermediate demand and the Infiltration wells shall be constructed in the future to meet the ultimate demand.**

2.3.2 Distribution System

Considering the topography, physical barriers, land availability, One Hundred DMAs are proposed in Twenty Four Zones of water distribution systems for supplying water to the project area. A proposed length of distribution system 450.71Km.

2.3.3 District Metered Areas (DMAs)

One Hundred District Metered Areas (DMAs) have been proposed in entire project area. Details of DMAs in each zone are shown in table below. A total of One Hundred DMAs with Provisions for Bulk Meter, flow control valve and Sluice valves have been proposed.

2.3.4 Service Reservoirs/ OHTs:

Existing 10 OHTs are proposed to be retained. In addition 14 new OHTs are proposed to be constructed. Details of the project OHTs are provided below.

Table 2.4 Details of OHTs – Erstwhile Municipality

Kancheepuram – Core City / Erstwhile Municipality							
Location	Zone. No	Zone Area	OHT Proposed / Existing	Staging	Ward Covered	Wards provided with Floating Population	Capacity of OHT LL
				(m)		(45 LPCD)	
Core City	1	Mandapatheru	Existing	12	11(29%),12,13,14,15,36,37		20.000
	2	Jawaharlal Nehru Market	Existing	12	3,4,5,6,7(90%),8,9(74%)	5,6,7	20.000
	3	Near Oli mohammed	Proposed	17	1,2	1,2	6.000
	4	Bus Stand	Existing	9.5	7(10%),17(70%),18,19,20(44%)		10.000
	5	Pattala theru	Existing	11.5	25,28,29(49%)	25	8.000
	6	Rajaji Market	Existing	7.5	20(56%)		10.000
	7	Upperikulam	Existing	11.5	9(26%),10,11(71%),16,17(30%)	10	10.000
	8	Viladi Kovil Theru	Proposed	17	33(78%),34,35(65%)		7.000
	9	Yothothakari street	Existing	12	23,24,29(51%),30,31,32,33(22%),35(35%)		20.000

Table 2.5 Details of OHTs – Added Areas

Kancheepuram - Added Areas						
Location	Zone. No	Zone Area	OHT Proposed / Existing	Staging	Ward Covered	Capacity of OHT LL
				(m)		
Sevlimeedu	10	Sevlimeedu Pallikooda Theru	Existing	12	42 (60%)	2.000
	11	Gem Nagar	Existing	12	41, 42(15%)	4.000
	12	Dr. Ambedkar Nagar	Proposed	17	43,42(25%),44(15%),45(4%)	5.000
	13	Pallavan Nagar	Existing	12	40(55%)	2.000
	14	Dharmalingeshwar Nagar	Proposed	17	38,39	7.000
	15	Vanavil Nagar	Proposed	17	40(45%),44(85%)	5.000
Orikkai	16	Arasunagar	Proposed	17	45(96%),48	7.000
	17	Orikkai Prathana Salai	Proposed	17	46,50(44%)	5.000
	18	Perasiriyar Nagar	Proposed	17	47,49(77%),50(9%)	7.000
Thenambakkam	19	Vishnu Nagar	Proposed	17	49(23%),51(60%),50(3%)	3.000

	20	Madura Mettur	Proposed	17	50(44%)	1.500
	21	Thenambakkam Colony	Proposed	17	51(40%)	1.500
Nathapettai	22	Periyar Nagar	Proposed	17	26, 27(45%)	5.000
	23	Mettu Colony	Proposed	17	27(55%)	2.000
	24	Thirukalimedu Annasalai	Proposed	17	21,22	7.000

2.3.5 House Service Connections:

Every household is proposed to have water supply service connection with MDPE pipe 20mm out diameter. For domestic and commercial establishments Woltman model with removal mechanism water meters with meter protection box are proposed. HSCs proposed are 55240 nos.

Proposed HSCs for domestic and commercial establishments are as follows.

Table 2.6 Breakup of House Service Connection

		Domestic	Commercial	Slum	Total
Existing		31573	649	882	33104
Proposed		51995	649	2596	55240

2.3.6 SCADA

SCADA system has been proposed for water supply systems of Kancheepuram areas. The system consists of ultrasonic bulk flow meters for the OHTs, collector wells, infiltration wells, Water level transducer for Sumps & OHTs and Pressure transducer in water distribution system. The suggested control and monitoring mechanism through SCADA are as follows.

1. Independent PLC Panel with HMI and UPS shall be installed at Collector well pump house and Zonal pump house to control and monitor as above. Level feedback of collection well shall be communicated to Collector well pump house to control the pumps and respective OHSR's level shall be communicated to Zonal pump house to control the pumps.
2. Independent PLC/RTU panel shall be provided at OHSR's to control the inlet valve based on OHSR level and monitor the OHSR outlet flow and Level of the container.
3. In DMA's Battery-operated flow meter shall be provided to monitor the flow at DMA's entry point.
4. The PLC panels shall send/receive signals from SCADA server and Flow meters at DMA's will send signals at pre-set time interval.
5. PC based SCADA server with software shall be installed at central location.

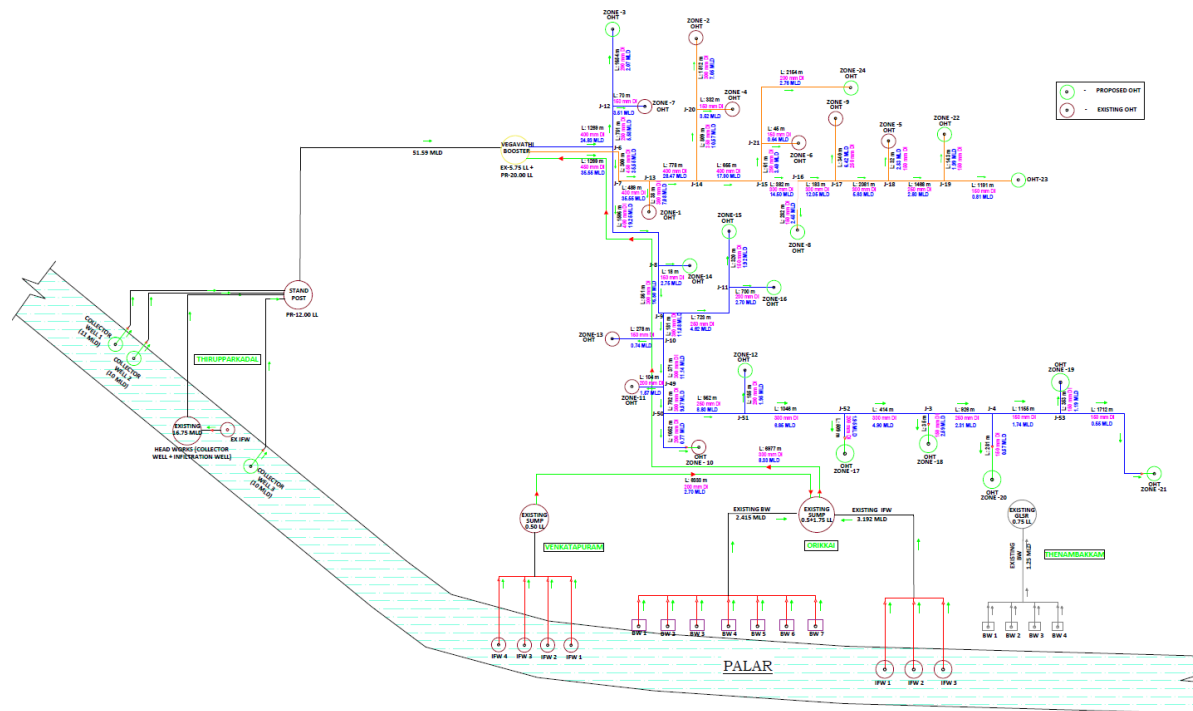


Figure 2.3 : Flow Diagram of the proposed Improvements to water supply to Kancheepuram Corporation



Figure 2.4 Map Showing Proposed Zones with OHT Locations & Feeder Alignment

Moreover, PWD is now constructing sub-surface dyke/ checkdam in River Palar at Thiruparkadal village and the proposed source is located within 500m downstream of the checkdam. Since, the structure that is built in an aquifer with the intention of obstructing the natural flow of ground water, thereby raising the ground water level and increasing the amount of water stored in the aquifer. Acting as an underground barrier impermeable to water, the checkdam controls the groundwater flow in an aquifer and raises the water table.

Table 2.7–Calculation of Palar Potential in Thiruparkadal reach/source

Parameters	Units
Length of the reach	10000 m
Average width of the River	1100 m
Average saturated sand thickness during lean period ie February to August	7 m
Specific yield	20%
Ground water potential	$10000 \times 1100 \times 7 \times 0.2 = 15,400,000 \text{ M}^3 = 15,400 \text{ ML}$
Available MLD during lean period ie February to August	$15400/210 = 73 \text{ MLD}$
Extraction of the existing and proposed head works	60.36 MLD
Balance available potential in normal seasonal condition	10.16 MLD

Source quality: The quality of water at the source has been assessed for all the parameters of drinking water. The results are provided in Annexure 10. It has been observed that the quality at the source location meets the permissible standards for drinking water and there are no traces of pollution in the source location.

During floods the surface water quality in river Palar may get impacted due to increased turbidity. However, this sub-project is drawing sub-surface water below 14m depth and no impact is envisaged on the source quality.

Climate Resilience

The project has been prepared considering sustainability at times of extreme events. The headworks have been designed taking into account the MFL of the source river. Further, the sub-project is drawing sub-surface water below 14m depth and no impact is envisaged on the source quality.

The source sustainability analysis has been carried out and the water supply @ 135 lpcd is ensured to all the house service connections.

Climate resilience of the project has been carried out based on various extreme situations and is provided in Annexure 2

CHAPTER-3 LEGAL AND REGULATORY FRAMEWORK

In this section, the prevailing key National, State level laws, rules, policies, Acts, notifications pertaining to environmental, climate change and social aspects have been reviewed for their applicability to the proposed Improvements to Water Supply for Kancheepuram City Municipal Corporation and provided in the following table.

Table 3.1: National and State Regulations on Environmental, Climate Change and Social

S.No.	Acts/ Rules/ Regulations	Description	Relevance to sub-project
1.	Wildlife Protection Act, 1972	This Act seeks to protect wildlife, by creating protected areas and controlling trade in wildlife products. Project activities that cross over into protected area regimes then requisite permission must be obtained.	Not Applicable.
2.	Water (Prevention And Control of Pollution) Act, 1974 and Tamil Nadu Water (Prevention And Control of Pollution) Rules, 1974	These laws seek to control pollution of water and enhance the quality of water. Under this law, it is mandatory to obtain consent for discharge of effluents and pay consent fees to Tamil Nadu State Pollution Control Board (TNPCB) for any municipal projects causing water pollution.	Applicable. Activities involving emission of pollutants like establishing batch mixing plants require consent from TNPCB.
3.	The Water (Prevention And Control of Pollution) Cess Act, 1977	This Act provides for levy and collection of a cess by local authorities on water consumed by persons or industries to augment resources for Pollution Control Boards.	Provisions are applicable.
4.	Forest (Conservation) Act, 1980	Forest (Conservation) Act, 1980 was enacted to halt rapid deforestation and governments cannot de-reserve forest land or direct that it be used for non-forest purposes.	Not Applicable. The project does not attract the provisions.
5.	Air (Prevention and Control of Pollution) Act 1981 and Tamil Nadu Air (Prevention of Control of Pollution) Rules 1983	These laws address the prevention and control of air pollution. Under section 21 of this Act, it is mandatory to obtain consent from Pollution Control Board to establish or operate any industrial operation.	Applicable. Activities involving emission of pollutants like establishing batch mixing plants require consent from TNPCB.

6.	Environment (Protection) Act, 1986	Popularly known as EP Act, it is an umbrella legislation that supplements existing environmental regulations. This law essentially links pollution and natural resource issues.	Applicable.
7.	Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (MSIHC Rules, 1989)	These rules aim at providing control for the generation, storage and Import of hazardous chemicals. According to these rules, the user of hazardous chemicals has to follow procedures as stipulated in the rules to prevent and control hazards from such chemicals and to ensure safety and permission has to be obtained from the authority concerned for such activity. The list of chemicals and threshold limits of handling falling under the purview of these rules is provided in the schedule to the rules.	Applicable. Hazardous chemicals (Chlorine gas) if any stored/used for the project attracts the provisions.
8.	Hazardous and Other Wastes Management Rules, 2016	This law addresses handling of hazardous and other wastes that fall under specified schedules and necessitates authorization for such facilities from State Pollution Control Board. Projects attracting these rules will have to follow the guidelines for handling and disposal of hazardous wastes. Measures include storage on a paved surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to TNPCB approved vendor.	Applicable. During the construction and during operation, wastes and used oils will be generated which shall be stored and disposed as per the requirements of the rules.
9.	Public Liability Insurance Act, 1991	This act provides for providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith.	Applicable.
10.	Bio Medical Waste Management Rules, 2016	This notification by MoEF & CC lays down the method of collection of hospital waste, its transportation and disposal based on scientific methods.	Not applicable.
11.	Fly Ash Notification, 2021	This notification necessitates use of fly ash for various construction activities like road laying, road and flyover embankments, shoreline protection structures in coastal districts, building	Not Applicable.

		construction projects etc within 300 kms from the lignite or coal based thermal power plants.	
12.	Solid waste Management Rules 2016	This notification by Ministry of Environment and Forest lays down the methods of handling Municipal Solid Waste and its scientific disposal. Establishing a facility for disposal requires authorisation from State Pollution Control Board.	Applicable. Solid wastes from the construction/ labour camps are to be handled in compliance with the provisions of the rules.
13.	The Noise Pollution (Regulation and Control) Rules, 2000	The ambient air quality standards in respect of noise for different areas/zones namely industrial, commercial, residential or silence areas/zones are specified in the Schedule of these rules. An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area/zone as per these rules.	Provisions are applicable. The noise levels (during construction and during operation of pumping stations) shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.
14.	EIA Notification, dt 2006 (S.O.1533(E), dt.14/09/2006) and subsequent amendments	The notification specifies that prior environmental clearance is required for the projects listed in the schedule of the notification before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity. The Schedule of the notification lists eight broad categories of projects that require prior environmental clearance.	Not Applicable.
15.	Wetlands (Conservation and Management) Rules, 2017	The rules list the wetlands that needs to be protected like those covered under Ramsar Convention, those in UNESCO heritage site, those which are ecologically sensitive etc.	Not Applicable. There are no such wetlands within the project area.
16.	The National Green Tribunal Act, 2010	This act provides for establishment of National Green Tribunal for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including	Provisions are applicable.

		enforcement of any legal right to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental. The National Green Tribunal established under this act is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues. The Tribunal shall not be bound by the procedure laid down under the Code of Civil Procedure, 1908, but shall be guided by principles of natural justice.	
17.	E-Waste (Management and Handling) Rules, 2016	The rules prescribe procedures for manufacture, collection, dismantling, recycling, and disposal of electronic wastes and requires authorisation of the State Pollution Control Board for the same.	Provisions are applicable. E-wastes generated during construction and O&M will be handled as per the rules.
18.	Coastal Regulation Zone (CRZ) Notification, 2019	This notification under Environment (Protection) Act, 1986 supplements the law on site clearance by declaring certain zones as CRZ and regulates activities in these zones. Projects attracting this notification shall obtain CRZ clearance for implementation from the authority as required.	Not applicable.
19.	Plastic waste (Management & handling) Rules 2016	This rules provides for collection, segregation, processing, treatment and disposal of the plastic waste in an environmentally sound manner, restriction on thickness of plastic sheet or like, prohibition on identified use, extended producer responsibility, marking and labelling requirement, registration of manufacturer, producer, importer, brand owner and plastic waste processor, reducing the plastic waste generation.	Provisions are applicable. Plastic wastes generated during construction and O&M will be handled as per the rules.
20.	The Building and Other Construction Workers (Regulation of Employment and	An Act to regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measure and for other matter	Applicable.

	Conditions of Service) Act, 1996	connected therewith or incidental thereto.	
21.	Prohibition of Employment as Manual Scavengers and their Rehabilitation Bill 2012	This act prohibits construction of insanitary latrines and employment or engaging of manual scavenger for the purpose of manual scavenging. No person, local authority or any agency shall, from such date as notified by the State Government (which shall not be later than one year from the date of commencement of this Act), engage or employ, either directly or indirectly, any person for hazardous cleaning of a sewer or a septic tank.	Provisions are applicable.
22.	National Action Plan on Climate Change	India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change.	Provisions are relevant to this project.
23.	Energy Conservation Act, 2001	Aims to reduce specific energy consumption in different sectors and sets up a specialized Bureau of Energy Efficiency to institutionalize energy efficiency measures, monitoring, and measurement at plant and macro-levels.	Provisions relevant to this project.
24.	Energy Conservation Building Code (ECBC)	The Energy Conservation Act 2001 that was passed by the Indian Parliament empowered the Central Government to prescribe an Energy Conservation Building Code (ECBC). This code applies to new commercial buildings with a connected load of 100 kW & more or contract demand of 120 kVA or more; Introduces passive design features such as daylight requirements and shading provisions; Introduces provisions of installing Renewable Energy Systems; Sets minimum energy efficiency standards for design and construction; Encourages energy efficient design or retrofit of buildings .	Provisions relevant to this project.

25.	The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010	<p>The Rules designate areas within a radius of 100 m and 200 m from the “protected property/ monument/ area” as “prohibited area” and “regulated area” respectively. Hence, no permission for construction of any public projects or any other nature shall be granted in the prohibited areas of the protected monument and protected area. In respect of regulated area, the competent authority may grant permission for construction, reconstruction, repair and renovation based on recommendation of the National Monument Authority duly taking note of heritage bye-laws, which shall be prepared in respect of each protected monument and protected areas.</p>	<p>There are about 31 monuments and sites in Kancheepuram district. Out of which seven monuments are present within the Kancheepuram limits. The city's historical monuments include the Kailasanathar Temple, Vaikunta Perumal Temple, Piravathanesvara temple, Iravathanesvara temple, Jvarahesvara temple, Mathangesvara temple, and Muktesvara temple which are protected by the AMASR Act, 1958. Kancheepuram is home to several temples and 11 temples including the above are being proposed for inclusion in the UNESCO. None the project sites identified for locating the proposed OHTs are located within the regulated boundary of protected monuments and hence no impact is anticipated from the construction of new OHTs. However, a section of the proposed pipeline alignment for feeder main (1.314km) for</p>
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			<p>three existing OHTs and distribution network (29.84Km) near the monuments fall within the regulated boundary which are of low risk. Applicable permission will be obtained prior to start of construction in the relevant section and conditions if any would be complied. During construction adequate precautions will be taken not to cause any disturbance to the temples and other religious structures. Further during construction if any chance finds encountered, then necessary management measures as identified in the ESMP would be implemented.</p>
26.	<p>The Right to Fair Compensation and transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR)</p>	<p>The Act provides for enhanced compensation and assistances measures and adopts a more consultative and participatory approach in dealing with the Project Affected Persons.</p> <p>This act came into effect on 1 January 2014 and the Land Acquisition Act, 1894 stands repealed. The Act lays down procedures for estimating fair compensation of the affected families (and not just the titleholders) due to land acquisition, rehabilitation and resettlement.</p>	<p>Provisions of this Act is relevant to this project.</p>

		The Act is notified by the GoTN on 21 September 2017 (G.O. Ms. No. 298, Revenue & Disaster Management (LA-I(1), 20th September 2017).	
27.	The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006	It grants legal recognition to the rights of traditional forest dwelling communities.	Provisions are applicable for relevant projects.
28.	The Child Labour (Prohibition and Regulation) Amendment Act, 2016. The Child Labour (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. Child can help his family or family enterprise, which is other than any hazardous occupations or processes set forth in the Schedule, after his school hours or during vacations.	Applicable.
29.	The Occupational Safety, Health And Working Conditions Code, 2020	This code consolidates and amends the laws regulating the Occupational safety and health and working conditions of the persons employed in an establishment. The Act replaces 13 old central labour laws like The Factories Act, 1948, The Building and other Construction Workers Act, 1996, The Mines Act, 1952, The Inter-State Migrant Workmen Act, 1979, etc	Applicable. Stipulations of the code are to be complied with during construction.
30.	Code on Wages, 2019	The Code on Wages seeks to regulate wages & bonus payments in all employments. The code subsumes four existing acts namely, The Equal Remuneration Act, 1976, The Minimum Wages Act, 1948, The Payment of Bonus Act, 1965, The Payment of Wages Act, 1936.	Applicable. Stipulations of the code are to be complied with during construction.
31.	Workmen Compensation Act, 1923.	The Act provides for compensation by the employer to their workmen in case of injury by accident arising out of and during employment.	Applicable.
32.	State Regulations		

33.	Chennai Metropolitan Area Ground water (Regulation) Amendment Act, 2002	This amendment to the original act was made to impose provision of rainwater harvesting in every building either private or government to augment ground water storage in such manner as may be prescribed. The act also mentions that water bodies, including ponds, lakes, tanks and the like, whether public or private should be used only for the purpose of storage of water and not for any other purposes. These provisions are also included in the Panchayats Act and the Municipal Act.	Provisions are applicable
34.	The Tamil Nadu Preservation of Private Forest Act, 1949	Guidelines for extraction of trees from non-forest area stipulates that permission for tree cutting shall be taken from State Forest department	Applicable.
35.	The Tamil Nadu Hill Areas (Preservation of Trees) Act, 1955	This Act regulates the cutting of trees and cultivation of land in hill areas of Tamil Nadu, (Coonoor, Kodaikanal, Kotagiri, Ootacamund, Yercaud). Any tree cutting in these areas requires permission from the Committee under this Act.	Not Applicable.
36.	The Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 and Rules 2015 notified by GOTN.	The Street Vendors Act came into force on March 5, 2014, and seeks to protect the livelihoods of street vendors while regulating street vending. The Act recognizes street vendors of different types including mobile (moving) vendors, stationary (vending from a particular place), natural markets (spaces where buyers and sellers traditionally congregate), vendors with temporary built-up structures, hawkers, peddlers and squatters. It provides for regulation of street vendors, defines the rights and duties of street vendors and requires definition of designated vending zones, issue of certificates of vending and identity cards to street vendors, and proposes vending fees and maintenance charges. Under the Act, each state government is required to define the public purpose for which a	Applicable if the project components are involved in the designated vending zones and if affects the street vendors, temporarily /permanently.

		<p>street vendor may be evicted and the manner of relocation, manner of giving notice, and provides for a dispute resolution mechanism. As per the Act, planning and regulation of street vending is to be undertaken at town level by the Town Vending Committee. The Act also provides for social audit of the activities of the Town Vending Committee.</p> <p>This act that specifically aims to protect the rights of urban street vendors and to regulate street vending activities. It provides for Survey of street vendors and protection from eviction or relocation; issuance of certificate for vending; provides for rights and obligations of street vendors; development of street vending plans; organizing of capacity building programmes to enable the street vendors to exercise the rights contemplated under this Act; undertake research, education and training programmes to advance knowledge and understanding of the role of the informal sector in the economy, in general and the street vendors, in particular and to raise awareness.</p>	
37.	State Green Committee/District Green Committee	To consider the cutting of trees in public places and public offices. Ref G.O.(Ms).no.38 dated 02.07.2021 of the Environmental Climate Change and Forest (FR.13)Department, Government of Tamil Nadu	Applicable. Wherever tree cutting is envisaged, permission to be obtained.
38.	Occupational, Safety, Health and Working Conditions (Tamil Nadu) Rules 2022.	This draft rules notified on 11.04.2022	Applicable. Stipulations of the code are to be complied with during construction.

39.	Code on Wages (Tamil Nadu) Rules, 2022	This draft rules notified on 11.04.2022	Applicable. Stipulations of the code are to be complied with during construction.
	CLIMATE CHANGE		
40.	National Action Plan On Climate Change (30.06.2008) TNSAPCC, 31.03.2015	India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. India, in 2008, has set up National Action plan on climate change (NAPCC) which outlined policies aimed at sustainable growth and dealing with climate change concerns effectively. NAPCC outlines eight national missions to address various adaptation and mitigation measures pertaining to Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Water, Sustaining Himalayan Ecosystem, Green India, Sustaining Agriculture, Strategic Knowledge on Climate Change.	Provisions are applicable.
41.	Energy Conservation Act, 2001	Aims to reduce specific energy consumption in different sectors, and sets up a specialized Bureau of Energy Efficiency to institutionalize energy efficiency measures, monitoring, and measurement at plant and macro-levels.	Provisions applicable.
42.	Energy Conservation Building Code:	The Energy Conservation Act 2001 that was passed by the Indian Parliament, empowered the Central Government to prescribe an Energy Conservation Building Code (ECBC). ECBC was launched in 2007 on a voluntary basis by the Bureau of Energy Efficiency (BEE and was revised in 2017. ECBC sets minimum energy efficiency standards for design and construction encouraging energy efficient design or retrofit of buildings without constraining the building function, comfort, health, or the productivity of	Not Applicable.

		the occupants and appropriate regard for economic considerations. Mandatory Scope Covers commercial Buildings having their Connected Load of 100kW and above or contract demand 120kVA and above and is ECBC is recommended for all new buildings and additions to existing buildings with the total load exceeding 200KW or 120kVA.	
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3.1 Applicable Standards for Base line Parameters

The applicable standards for baseline parameters are provided in this section. The CPCB standards are adopted for establishing baseline

Table 3.2 Applicable National Ambient Air Quality Standards (NAAQS)

S. No	Parameters	Industrial area, Residential, Rural and Other Area
1	Sulphur Dioxide (SO ₂)	80 µg/m ³ (24 hours)
2	Nitrogen Dioxides as NO ₂	80 µg/m ³ (24 hours)
3	Particular Matter (PM ₁₀)	100 µg/m ³ (24 hours)
4	Particular Matter (PM _{2.5})	60 µg/m ³ (24 hours)
5	Ozone (O ₃)	180 µg/m ³ (8 hours)
6	Lead (Pb)	1.0 µg/m ³ (24 hours)
7	Carbon Monoxide	4.0 µg/m ³ (01 hour)
8	Ammonia (NH ₃)	400 µg/m ³ (24 hours)
9	Benzene (C ₆ H ₆)	05 µg/m ³ (Annual)
10	Benzo (a) Pyrene	01 ng/m ³ (Annual)
11	Arsenic (As)	06 ng/m ³ (Annual)
12	Nickel (Ni)	20 ng/m ³ (Annual)

Source: Central Pollution Control Board

B. AMBIENT NOISE STANDARDS

Ambient Noise level standards have been notified by the MoEF vide Gazette Notification dated 26th December 1989 and also in the Schedule III of the Environmental (Protection) Rules 1986. It is based on the 'A' weighted equivalent noise level (Leq) and presented below.

Table 3.3 National Ambient Noise Standards

Category of Zones	Leq in dB(A)
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	Day *	Night +
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone **	50	40

* Day Time is from 6.00 AM and 9.00 PM.
+ Note –2 :Night Time is reckoned between 9.00 PM and 6.00 AM
** Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

Source: Central Pollution Control Board

C. INDIAN STANDARDS FOR DRINKING WATER (IS 10500:2012)

Table 3.4 Standards for Drinking Water

Group	National Standards for Drinking Water (IS 10500:2012)		
	Parameter	Unit	Max. Concentration Limit
Physical	Turbidity	NTU	1 (5)
	pH		6.5 – 8.5
	Color	Hazen units	5 (15)
	Taste and Odor		Agreeable
	TDS	mg/l	500 (2,000)
	Iron	mg/l	0.3
	Manganese	mg/l	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)
	Cadmium	mg/l	0.003
	Chromium	mg/l	0.05
	Cyanide	mg/l	0.05
	Fluoride	mg/l	1 (1.5)
	Lead	mg/l	0.01
	Ammonia	mg/l	0.5
Chemical	Chloride	mg/l	250 (1,000)
	Barium	mg/l	0.7
	Sulphate	mg/l	200 (400)
	Nitrate	mg/l	45
	Copper	mg/l	0.05 (1.5)
	Total Hardness	mg/l	200 (600)
	Calcium	mg/l	75 (200)
	Zinc	mg/l	5 (15)
	Mercury	mg/l	0.001
	Aluminum	mg/l	0.1 (0.3)
	Anionic detergents	mg/l	0.2 (1.0)
	Phenolic compounds	mg/l	0.001(0.002)

	Residual Chlorine	mg/l	0.2
Microbial indicator	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample
	Total Coliform	MPN/100ml	

Table 3.5 Inland Surface Water Standards

Parameter	Unit	IS:2296 – 1982 Inland Surface Water standards				
		A	B	C	D	E
pH	---	6.5 – 8.5				
EC	µs	-	-	-	1000	2250
Color	Pt-Co	10	300	300	-	-
Odor	--	Agreeable	-	-	-	-
TSS	mg/l	-	-	-	-	-
TDS	mg/l	500	-	1500	-	2100
Turbidity	NTU	-	-	-	-	-
Alkalinity as CaCO ₃	mg/l	-	-	-	-	-
Chloride as Cl ⁻	mg/l	250	-	600	-	600
Sulphate as SO ₄ ⁻²	mg/l	400	-	400	-	1000
Nitrates as NO ₃	mg/l	20	-	50	-	-
Hardness as CaCO ₃	mg/l	300	-	-	-	-
Calcium as CaCO ₃	mg/l	200	-	-	-	-
Magnesium as CaCO ₃	mg/l	100	-	-	-	-
Sodium as Na	mg/l	-	-	-	-	-
Potassium as K	mg/l	-	-	-	-	-
Fluoride as F	mg/l	1.5	1.5	1.5	-	-
Iron as Fe	mg/l	0.3	-	50	-	-
DO	mg/l	6	5	4	4	
COD	mg/l	-	-	-	-	-
BOD at 27°C	mg/l	2	3	3	-	-
A – Drinking water without conventional treatment but after disinfection B – Outdoor bathing (organized) C – Drinking water source with conventional treatment followed by disinfection D – Propagation of wild life, fisheries						

STANDARDS FOR DG SET

Standards Guidelines for control of Noise Pollution from Stationary Diesel Generator (DC) Sets.

a) Noise Standards for DG 001s (15-50(1 ICI A)

The total sound power level, LW, of a DG set should be less than $94+10 \log_{10} (\text{KVA})$, dB(A), at the manufacturing stage, where KVA is the nominal power rating of a DG Set.

This level should fall by 5 dB (A) every five years, till 2001 i.e., in 2002 and then in 2007.

b) Mandatory acoustic enclosure/acoustic treatment of room for stationary DG sets (5 KVA and above)

Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the room acoustically. The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB (A). Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side. it may not be possible to check the performance of the acoustic enclosure acoustic treatment. Under such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferable in the night time. The measurement for Insertion Loss may be done at different points at 0.5m from the acoustic enclosure/room and then average.

The DG set should also be provided with proper exhaust muffler with Insertion Loss of minimum 25 dB (A).

c) Guidelines for the manufactures/Users of DG sets (5 KT .4 and above)

- The manufacturer should offer to the user a standard acoustic enclosure of 25 dB(A) Insertion Loss and also a suitable exhaust muffler with Insertion Loss of 25 dB(A).
- The user should make efforts to bring down the noise levels due to the DG set: outside his premises. Within the ambient noise requirements by proper siting and control measures.
- The manufacturer should Mulish noise power levels of the unlicensed DG sets as per standards prescribed under (A)
- The total sound power level of a DG set, at the user's end shall be within 2 dB (A) of the total sound power level of the DG set, at the manufacturing stage as prescribed under (A).
- Installation of a DG set must be strictly in compliance with the recommendations of the DG set manufacturer.
- A proper routing and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

d) Stack Height:

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

$$H = h + 0.2 \times \sqrt{KVA}$$

H = Total Height of the stack in meter

h = Height of the building in meters where the generator set is installed

ÖKVA = Total generator capacity of the set in KVA

Based on the formula some of calculated Stack Height standards for D.G. Sets

For Generator Sets Total Height of stack in meter

50 KVA Ht. of the building + 1.5 meter

50-100 KVA Ht. of the building + 2.0 meter

100-150 KVA Ht. of the building + 2.5 meter

150-200 KVA Ht. of the building + 3.0 meter

200-250 KVA Ht. of the building + 3.5 meter

250-300 KVA Ht. of the building + 3.5 meter

The certification of space design for DG sets must be done by any one of the following.

- Automotive Research Association of India, Pune
- National Physical Laboratory, New Delhi
- Naval Science & Technology Laboratory, Visakhapatnam
- Fluid Control Research Institute, Palghat
- National Aerospace Laboratory, Bangalore

The norms for emissions from D.G. sets have been given by Central pollution control board; these have been given in below Table.

Table 3.6 Emission limits for Noise

Capacity of diesel engines	Date of implementation	Emission Limits G/kw-hr) for				Smoke limit (light absorption coefficient, m ⁻¹)(at full load)	Test cycle	
		NO ₂	HC	CO	PM		%	Factors
Upto 19 KW	1.7.2003	9.2	1.3	5.0	0.6	0.7	100	0.05
	1.7.2004	9.2	1.3	3.5	0.3	0.1	75	0.25
> 19 kw upto 50 kW	1.7.2003	9.2	1.3	5.0	0.5	0.7	50	0.30
	1.7.2004	9.2	1.3	3.5	0.3	0.7	25	0.30
>50kW upto 260 kw	1.7.2003	9.2	1.3	3.5	0.3	0.7	10	0.10
>260 kW upto 800kW	1.7.2004	9.2	1.3	3.5	0.3	0.7		

Source: CPCB Norms, The Environment (Protection) Second Amendment Rules, 2002, vide notification G.S.R. 371(E), dated 17th May, 2002, at serial no. 94 (paragraph 1 & 3).

3.6 Clearances / Permissions

Table 3.7.1 Clearance to be obtained by KCMC (PIU)

S. No	Proposed activity	Statutory authority	Applicable legislation	Status
1	Highway crossings for laying of pipes.	NH, SH	National Highways Rules 1957	To be applied
2	Power sanctions and charging	TNEB	TAMIL NADU ELECTRICITY SUPPLY CODE (as amended up to 31-12-2009)	To be applied
3	Traffic diversion for Construction of collection system, Machine holes, pumping mains etc.,	Deputy Commissioner of Police - Traffic Kancheepuram	MoRTH 112 SP 55 of IRC codes	To be applied

4	Delineation of land for construction for OHTs	District collector	Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972),	Total sites cleared –NOC to be obtained for all 14 OHT sites
5	Pipe Carrying bridges construction across Palar and Vegavathi Rivers	Public Works Department		To be applied
6	Withdrawal of water from the source (WUC Clearance)	Public Works Department		To be applied
7	Laying of pipeline for feeder main and distribution network near protected monuments	ASI, Chennai	The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010	To be applied

Table 3.7.2 Clearance to be obtained by the Contractor

Sl. no.	Construction Activity	Statutory Authority	Statute under which clearance is required	Implementation	Supervision
1	Labour Licence and all other statutory work permits including Contract Labour & Interstate Migrant Worker License (if any)	- The Contract Labour (Regulations & Abolition) Act, 1970 - The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 - Directorate of Industrial Safety and Health (DISH), GoTN.	Tamil Nadu Labour Department	Contractor	KCMC/PMC
2	Workmen compensation Insurance / Accident Insurance, EPF and ESIC (as applicable)	Tamil Nadu Labour welfare Fund Act	Tamil Nadu Labour Department	Contractor	KCMC/PMC
3	Hot mix plants,	Tamil Nadu	Consent to	Contractor	KCMC/PMC

Sl. no.	Construction Activity	Statutory Authority	Statute under which clearance is required	Implementation	Supervision
	Crushers and Batching plants	Pollution Control Board (TNPCB)	establish And consent to operate under Air Act, 1981	r	
4	Discharges from construction activities	TNPCB	Consent to establish and consent to operate under Water Act, 1974	Contractor	KCMC/PMC
5	Sand mining, quarries and borrow areas	Department of Geology and mining, Government of Tamil Nadu	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	KCMC/PMC
6	Ground water extraction	Tamil Nadu Groundwater Development and Management Act 2000	Water Resources Department, Government of Tamil Nadu	Contractor	KCMC/PMC
7	Temporary traffic diversion measures	MoRTH 112 SP 55 of IRC codes	Traffic Police, Kancheepuram	Contractor	KCMC/PMC

CHAPTER – 4 ENVIRONMENTAL AND SOCIAL BASELINE

This chapter presents the baseline data required to understand the environmental, ecological attributes and socio-economic characteristics of the project area. The baseline includes climate, meteorology, topography, geology, hydrology, drainage, rainfall, land usage, water, air, noise, soil, flora, fauna and social profile of local population. Primary survey for Environmental baseline was conducted in the project area during the month of April '23 and results are included in this chapter.

4.1 Methodology

The environmental and social baseline information has been collected from the primary and secondary sources and E&S screening of all the project sites and alignments.

The desk review of the available documentation and reports of this project is carried out including DPR. The survey in the study area have been conducted to identify the Potential Temporary Economic Impact's type and duration of impacts, nature of impacts etc. Also, the additional data will be collected from relevant websites, online as well as offline. Data thus collected from the secondary sources- published and unpublished literature, government documents, reports, etc are reviewed.

The secondary information collected from different sources include the Ministry of Environment, Forest and Climate Change (MOEF&CC), Census of India 2011, District Census Handbook, Geological Survey of India, Indian Meteorological Department, State Pollution Control Board (SPCB), Water Resources Department, PWD, tourism and other relevant departments of the state and Central governments. The data sources are indicated in the following Table.

Table 4.1. Sources of E&S baseline data

S.No.	Attribute	Parameter	Source of Data
1	Land use /cover	Land use patterns	Satellite Imagery
2	Geology	Rock formation and mineral profile	Geological Survey of India and project site study
3	Air, water, noise, soil	As per relevant standards	Primary Survey in project area and from relevant department's websites.
4	Meteorology	Temperature, cloud, wind, etc.	IMD Chennai office and other studies.
5	Ecology	Existing terrestrial flora and fauna	Various sources.
6	Socio-economic aspects	Socio-economic characteristics	Census of India, 2011; District Hand Book, Primary survey in project area/ alignment.
7	E&S Screening	In source, clear water main, feeder main alignments, all	Carried out the during the month May 2023

S.No.	Attribute	Parameter	Source of Data
		proposed OHT sites, booster sump site, and other related project components	

4.2 Features

The features such as climate, topography, geology, drainage, vegetative cover of Tamil Nadu state, Kancheepuram District is described in following sections.

A. Tamil Nadu state

4.2.1 Climate

The winter season in the project area commences early in December and continues till middle of March. The cold weather is pleasant. Under the Köppen climate classification the greater part of Tamil Nadu falls under Tropical Savanna climate and a smaller portion of the state falls under Humid subtropical climate; the climate of the state ranges from dry sub-humid to semi-arid. The summer season in Tamil Nadu is between the month of March to May and is characterized by intense heat and scant rainfall across the state.

Tamil Nadu is heavily dependent on monsoon rains, and thereby is prone to droughts when the monsoons fail. The state has distinct periods of rainfall, which are the advancing monsoon period, South-west monsoon (from June to September) with strong southwest winds, the North-east monsoon (from October to December), with dominant northeast winds, and the Dry season (from January to May). The normal annual rainfall of the state is about 945 mm (37.2 in) of which 48% is through the North East monsoon, and 32% through the South West monsoon.

4.2.2 Topography

The western, southern and the north-western parts are hilly and rich in vegetation. Tamil Nadu is the only state in India which has both the Western Ghat and the Eastern Ghat mountain ranges which meet at the Nilgiri hills. The Western Ghats dominate the entire western border with Kerala, effectively blocking much of the rain bearing clouds of the South West Monsoon from entering the state. The eastern parts are fertile coastal plains. The northern parts are a mix of hills and plains. The central and the south-central regions are arid plains.

Tamil Nadu has a coastline of about 1076 km which is the country's second longest coastline. Tamil Nadu falls mostly in a region of low seismic hazard with the exception of the western border areas that lie in a low to moderate hazard zone. The western, southern and the north-western parts are hilly and rich in vegetation.

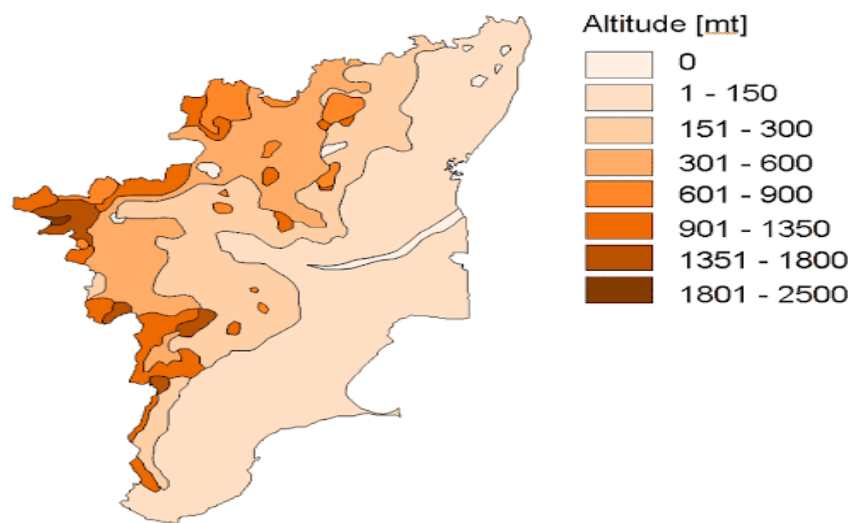


Figure 4.1 Topography map of Tamil Nadu state

4.2.3 Geology

Geological description of an area provides the information on the earth formation, the rocks of which it is made, the structure of those rocks and their occurrence in the area. Geologically, the Tamilnadu state comprises of Crystalline rocks of Archaean to late Proterozoic age occupying over 80% of the area of the state, while the rest is covered by the Phanerozoic sedimentary rocks mainly along the coastal belt and in a few inland river valleys. The hard rock terrain comprises predominantly of Charnockite and Khondalite groups and their migmatitic derivatives, supracrystal sequences of Sathyamangalam and Kolar groups and Peninsular Gneissic Complex (Bhavani Group), intruded by ultramafic-mafic complexes, basic dykes, granites and syenites. The sedimentary rocks of the coastal belt include fluvial, fluvio-marine and marine sequences, such as Gondwana supergroup (Carboniferous to Permian and Upper Jurassic to Lower Cretaceous), marine sediments of Cauvery basin (Lower Cretaceous to Paleogene), Cuddalore/ Panambarai Formation (Mio-Pliocene) and sediments of Quaternary and Recent age. Geologically, the study area comes under Charnockite gneiss and Pyroxene granulites and also coastal sediments and alluvium.

4.2.4 Hydrogeology

Nearly 73% of the total area of the state is occupied by a variety of hard and fissured crystalline rocks like charnockite, gneisses and granites. The depth of open wells varies from 6 to 30 mbgl, while the depth of borewells generally varies from 30 to 100 m. The sedimentary formations consist of sand stones, limestones and shales whereas Quaternary sediments in the State are represented by older alluvium and recent alluvium and coastal sands. In the Cauvery delta, the artesian pressure ranges between 4.5 m to 17 mbgl with free flow upto

270 m³/hr. The yield of wells in the alluvium varies from 27 to 212 m³/hr. The yield of wells in the fissured formation varies from 7 to 35 m³/hr.

4.2.5 Drainage

Drainage details out the river systems and the pattern formed in the form of watersheds such as streams, rivers, and lakes in the region. Also, it describes the direction of flow and the route it takes from its entry into any region till the exit into the adjacent region. The drainage pattern in Tamil Nadu is developed by the river Palar and Cheyyar and its tributaries. The drainage pattern in general is sub-dendritic and radial. All the rivers are seasonal and carry substantial flows during the monsoon period. River Palar, a major river that works as a drain for the district originates from Western Ghats in Karnataka state, and discharges in Bay of Bengal near Pudupattinam. The Cheyyar, a tributary of Palar River originates from the Jawadhu hills of Tiruvannamalai district. It has a north easterly flow in Kancheepuram district and confluences with the Palar near Pazhayaseevaram. Other seasonal rivers like Korattalaier and Tandiar drain from the district partly on the northern and southern parts respectively.

4.2.6 Forest

Tamil Nadu is located in the southernmost state of the Indian peninsula and is spread over 130,058sq.km, which constitutes 3.96 % of the area of the country. It lies between latitude 8°05' and 13 ° 34' North latitudes and 76 ° 14' and 80 ° 21' East longitudes. The Tamil Nadu State of Forest gives a detailed view of the health of the forest cover of the State based on the Forest Survey of India (FSI) and India State of Forest Report (ISFR) 2015 assessment. The State has a spectrum of nine major forest types ranging from wet evergreen forest to moist deciduous, dry deciduous, sholas, grasslands and scrub forest. The Western Ghats, the longest hill range in the state is one of the 25 global hotspots of biodiversity and one of the three mega centres of endemism in India. The forest and tree cover of the State is about 30,952 sq. km which constitutes 23.80% of the total geographical area of the State.

B. Kancheepuram district

4.3 Kancheepuram district

Kancheepuram district is located on the East Coast of Tamil Nadu and is adjacent to the Bay of Bengal in the east, bounded by Chennai and Thiruvallur district to its north, Vellore in the west, and Villupuram district in the south.

4.3.1 Climate

Kancheepuram district generally experiences hot and humid climatic conditions (tropical climate). During the summer season, the maximum temperature is 37.6 degrees and the minimum is 20.1 degree Celsius. During the winters, the maximum and minimum temperature is 28. 7 and 19.8 degree Celsius respectively. The average high and average low

temperatures throughout the year are 37.5 and 20.4 respectively. Relative humidity of between 58% and 84% prevail throughout the year. The humidity reaches its peak during the morning and is lowest in the evening. The relative humidity is higher between November and January and is lowest throughout June.

Table 4.2. Temperature details Kancheepuram district (1991 – 2021)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Temperature °C (°F)	23.6 (74.5)	25 (77.1)	27.5 (81.5)	30 (86)	31.8 (89.3)	30.9 (87.6)	30.1 (86.2)	29.3 (84.8)	28.7 (83.6)	27 (80.5)	25.1 (77.1)	23.8 (74.9)
Min. Temperature °C (°F)	19 (66.1)	19.5 (67.1)	21.9 (71.5)	25.4 (77.7)	27.4 (81.3)	27.1 (80.8)	26.5 (79.7)	25.8 (78.4)	25.2 (77.3)	23.8 (74.8)	21.9 (71.4)	20.2 (68.4)
Max. Temperature °C (°F)	29 (84.2)	31.5 (88.8)	34.4 (93.9)	36.4 (97.6)	38 (100.4)	36 (96.8)	35 (95)	34 (93.2)	33.3 (92)	31.2 (88.2)	29.1 (84.4)	28.1 (82.6)

Source: Climate data.org

4.3.2 Rainfall

The district receives the rain under the influence of both south east and northeast monsoons. Most of the precipitation occurs in the form of cyclonic storms caused due to the depressions in Bay of Bengal chiefly during the northeast monsoon period. The southwest monsoon rainfall is highly erratic and summer rains are negligible.

The normal annual rainfall over the district varies from 1105 mm to 1214 mm. It is the minimum in the western and northwestern parts of the district around Uthiramerur (1105 mm) and it is the maximum around Kovalam (1214.2mm).

The average rain fall in Kancheepuram is 1159.4mm.

Table 4.3. Rainfall in Kancheepuram Corporation

Actual Rainfall in mm								Normal Rainfall (2022) in mm
2015	2016	2017	2018	2019	2020	2021	2022	
2256.6	990.5	1191.7	833.0	1051.17	1258.4	1698.1	1404.6	1159.4

4.3.3 Topography

Kancheepuram is located about 75 km from Chennai. It has an average elevation of 81 m. The topography is almost plain, with no major geological formation. There are no notable mineral resources available in and around the town. Types of soil found in Kancheepuram are red loam, lateritic soil, black soil, sandy coastal alluvium and red sandy soil. Clay, with some loam, clay, and sand, are suitable for use in construction.

4.3.4 Relative humidity

Kancheepuram district experiences high relative humidity, which ranges between 58% and 84% prevail throughout the year. Relative humidity is maximum in the morning and minimum in the evening. Higher rates of relative humidity are observed between November and January i.e., 83% to 84%. In the months of June, the humidity is lower i.e., around 58%. Average relative humidity in the morning and evening 74% and 64%. The minimum and maximum temperature are 20°C & 37°C. The daytime heat is oppressive, and the temperature is as high as 43°C.

4.3.4 Cloud cover

Generally light clouds are observed in winter mornings. During pre-monsoon and the post-monsoon evenings the skies are either clear or lightly clouded. But in post-monsoon mornings as well as monsoon morning heavy clouds are commonly observed. The skies are light to moderately clouded in the evening time throughout the year.

4.3.5 Wind speed direction

The available data indicate the trend of wind speed direction during pre-monsoon, monsoon, post monsoon and winter season in a year. The wind rose diagram is given in the Figure 4.3

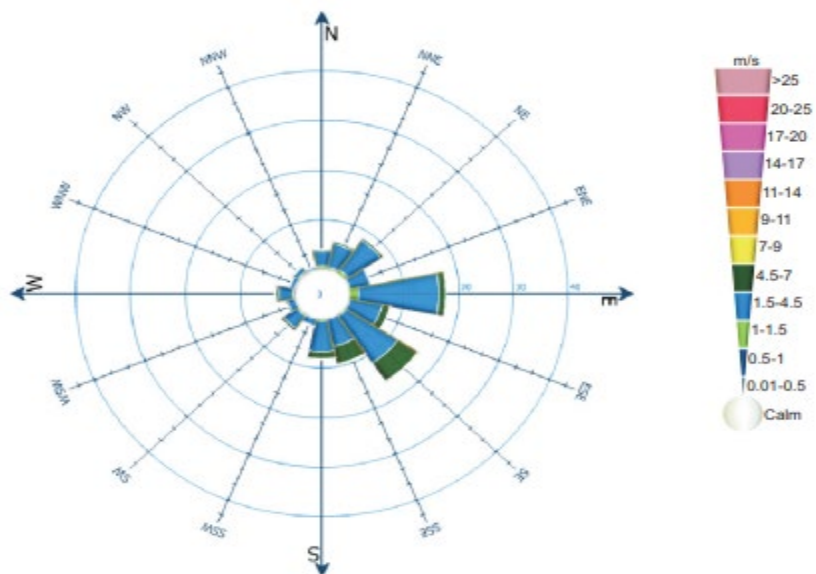


Figure 4.3. Windrose diagram

4.3.6 Hydrogeology

The district is underlain by both sedimentary and fissured formations. The important aquifer system in the district is constituted by 1) unconsolidated and semi consolidated formations and 2) weathered, fissured and fractured crystalline rocks.

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
KANCHEEPURAM DISTRICT, TAMIL NADU
HYDROGEOLOGY

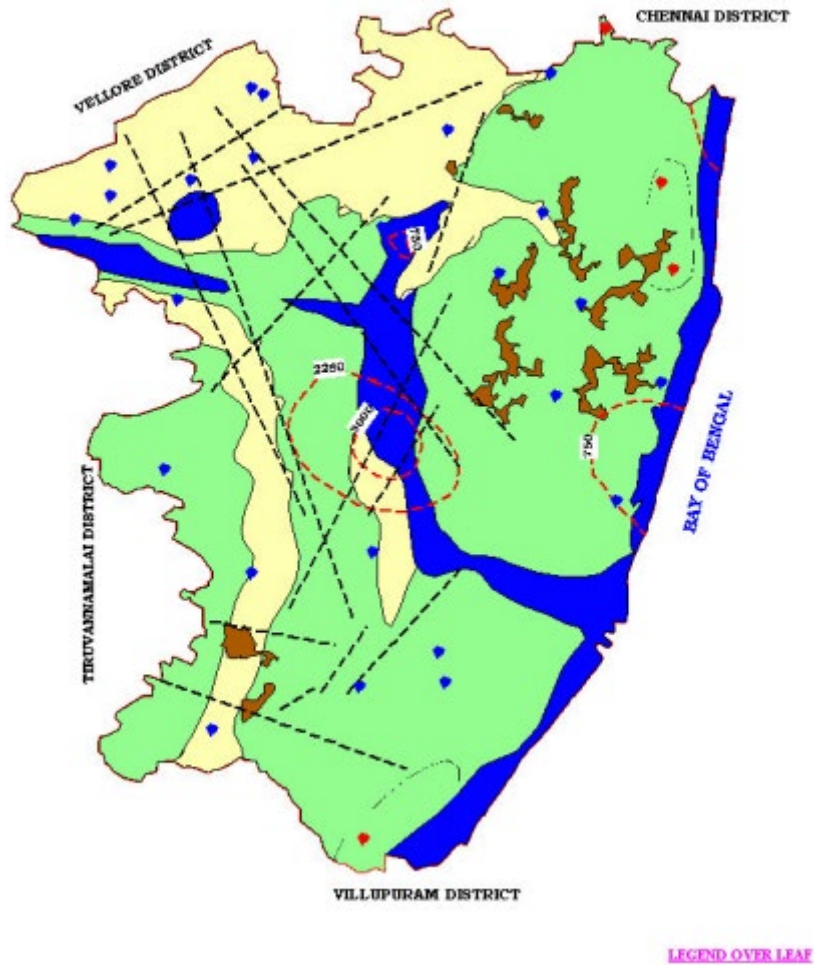


Figure 4.2 Hydrogeological map

In Kancheepuram Corporation area, the topography of the terrain is plain. The geological formation is Alluvium followed by granitic Gniess and charnokite. The trend of the formation strike direction is North East – South west and dipping towards south east. The Alluvium thickness ranging from 9m to 15m and followed weathered formation varying from 5m to 6m below the Alluvium. The winter and summer water levels are ranging from 2m to 3m and 18m to 24 m respectively.

In PALAR RIVER – ORIKKAI TO SEVILIMEDU AREA the topography of the Terrain is plain. The geological formation is Alluvium followed by granitic Gniess and Charnockite. The trend of the formation strike direction is North East – South west and dipping towards south east. The Alluvium thickness ranging from 5m to 10m and followed weathered formation varying from 2m to 3m below the Alluvium. The winter and summer water levels are ranging from Bed level to 0.50m and 1.50m to 2m respectively.

4.3.7 Groundwater level

Tamil Nadu State Ground and Surface Water Resources Data Centre, WRD, Government of Tamil Nadu jointly with Central Ground Water Board (CGWB) determine the status of ground water level for each tehsil every year and publish the findings once in four years after monitoring the important wells.

The estimation of ground water resources for the Kancheepuram district by CGWB has shown that of the thirteen blocks in the district, two blocks (Uthiramerur and Lattur) are over exploited and two blocks (Sittamur and Thirukalukunram) are under “Critical” category. The shallow alluvial aquifer along Palar and Cheyyar rivers serve as an important source of drinking water between Kancheepuram to Ayyapakkam and Chengalpattu to Tambaram. The dug wells in hard rock terrain tapping the entire weathered residuum are capable of yielding 30-100 m³ /day requiring the installation of 3 - 5 HP pumps for extraction of groundwater. Ground water potential of Kancheepuram Corporation, the project area, falls under “Safe” category.

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
KANCHEEPURAM DISTRICT, TAMIL NADU
DEPTH TO WATER LEVEL
 POSTMONSOON (JANUARY-2007)

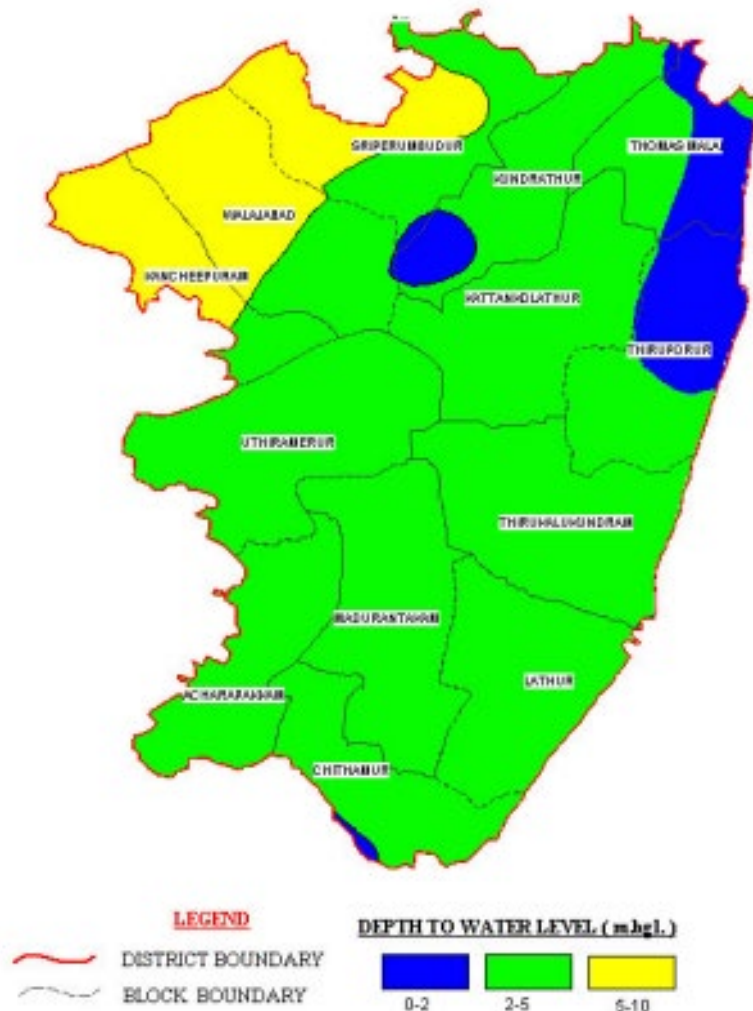


Figure 4.4 Groundwater level of Kancheepuram district

4.3.8 Soil type

Soils have been classified into 1) clayey soil, 2) red sandy or red loamy soil 3) Red sandy brown clayey soil and 4) Alluvial soil. Of the above soils brown clayey soil is the most predominant, covering more than 71 percent of the area of Kancheepuram district. Alluvial soils are found on the banks of Palar, Cheyyar and other rivers. The river alluvium is transported and is seen in the coastal area of this district. Sandy coastal alluvial (Arenaceous soil) occurs along the seacoast as a narrow belt.

4.4 Baseline Monitoring

Primary survey for baseline was carried out in the project area as part of the environmental and social impact assessment during the month of April '23 and details of the assessment are provided below.

Table 4.4. Environmental Baseline Monitoring - Sampling Locations

Sampling Location	Latitude	Longitude	Environmental Monitoring with respect to Ambient air quality, ambient noise levels, soil quality surface and groundwater
Near Collectorate ground	12.822506	79.69801	Air, Noise, Groundwater
Thirukalimedu	12.826983	79.721707	Air, Noise, Groundwater, Surface water, surface water(project site)
Shri Vallabacharys baithak, Orikkai	12.812141	79.718783	Air, Noise, Groundwater, Soil
Arasu nagar	12.803137	79.710504	Air, Noise, Groundwater
Nathapettai lake	12.836082	79.73737	Air, Noise, Groundwater, surface water, soil
Vasantham nagar	12.792979	79.715623	Air, Noise, Groundwater
Perasiriyar nagar	12.809781	79.70859	Air, Noise, Groundwater
Thenambakkam	12.805059	79.734204	Air, Noise, Groundwater
Near Dharmalingeshwar temple tank	12.825543	79.695947	Air, Noise, Groundwater
Olimohammedpettai	12.856897	79.692095	Air, Noise, Groundwater

Criteria for selection of sampling locations:

The sampling locations have been identified based on the proximity to the proposed project sites, OHTs capacity and the headworks' and availability of surface / ground water. For ground water locations with borewell's currently being used by locals have been identified. Most of the locations were predominantly residential.





Figure 4.5: Photos of Sampling Location

4.4.1 Ambient Air Quality Monitoring

The prime objective of the baseline air quality study was to assess the existing ambient air quality of the project area as per MoEF&CC guidelines. The procedure adopted for the study is illustrated below

3.1.1 Parameters for Sampling & Sampling Frequency

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the Air quality surveillance programme has been based on the following considerations

- Meteorological parameters on synoptic scale
- Topography of the study area
- Representatives of regional background air quality for obtaining baseline status
- Representatives of likely impact areas.

Ambient Air Quality Monitoring (AAQM) stations were set up at 10 locations with due consideration to the above mentioned points. AAQM locations were selected in downwind, cross wind and upwind direction of the proposed project sites and near the headworks.

At each sampling station monitoring was carried out for a frequency of 24 hrs during study period. The common air pollutants namely Particulate Matter (PM_{10} , $PM_{2.5}$), Sulfur dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO) were sampled on 8/24 hourly and results were averaged to 24 hours to meet the requirements of the MoEF&CC and compared with the NAAQM standard stipulated by the CPCB.

The existing concentration levels of air pollutants of concern, as mentioned above, are presented in Table 4.5. The observed values were compared with the standards as prescribed by Central Pollution Control Board (CPCB) for Industrial, Residential and Rural zone.

Table 4.5 Ambient Air quality monitoring – Monitoring Data

Parameters	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	AAQ9	AAQ10	Unit	CPCB Standards
Particulate Matter (Size Less than 10 gm) or PM ₁₀	57.4	62.5	65.8	54.2	68.1	52.7	59.1	63.4	56.6	65.1	µg/m ³	100
Particulate Matter (Size Less than 2.5 gm) or PM ₂₅	28.1	30.7	32.2	21.9	30.6	23.2	27.4	30.9	25.1	33.7	µg/m ³	60
Sulphur dioxide (SO ₂)	6.3	5.7	6.8	5.7	6.3	5.2	5.2	6.3	6.8	5.7	µg/m ³	80
Nitrogen Dioxide (NO ₂)	19.8	20.5	24.7	18.3	26.2	15.1	20.6	22.4	19.1	23.9	µg/m ³	80

Source: Primary Survey, 2023.

Note:

1. AAQ1-Collectorate Ground Thaiyar Kullam. AAQ2-Thirukalimedu AAQ3-Shri Vallabachara Baithak Orikkai. AAQ4-Arasu Nagar. AAQ5-Vasantham Nagar. AAQ6-Nathapettai Lake. AAQ7-Perasiriyar Nagar AAQ8- Brahmanar Street ThenambakkamAAQ9- Dharmalingaeshwar Temple Tank AAQ10- Olimohammedpettai

2. In all the above locations parameters like Ammonia (NH₃), Ozone (O₃), Ozone (O₃), Benzene (C₆H₆), Benzo (a) Pyrene (particulate phase only), Lead (Pb), Arsenic (As) and Nickel (Ni) were found to be below Detectable limits.

a) Particulate Matter <2.5µm and <10µm

Particulate Matter <2.5µm were observed to be in high concentration at AAQ10 (Olimohammedpettai) & Particulate Matter <10µm were observed to be in high concentration at AAQ5 (Vasantham Nagar), both the locations are highly populated when compared to other monitoring locations. The 24-hourly average values of Particulate Matter <2.5µm & Particulate Matter <10µm were compared with the National Ambient Air Quality Standards and found that all sampling stations recorded values within the applicable limits of residential and rural area limits for all locations in study area.

b) Sulfur Dioxide

The 24 hourly average values of SO₂ were compared with the National Ambient Air quality standards and it was found that the recorded values, of all the monitored locations, were much lower than the applicable limit of 80µg/m³ for residential and rural areas.

c) Oxides of Nitrogen

The 24 hourly average values of NO_x were compared with the national ambient air quality standards and it was found that all the sampling stations recorded values much lower than the applicable limit of 80 µg/m³ for residential and rural areas.

d) Carbon Monoxide

The 8 hourly average values of CO were compared with the national ambient air quality standards and it was found that all the sampling stations recorded values much lower than the applicable limit of 4 mg/m³ for residential and rural areas.

Other monitoring parameters such as heavy metals, benzene and ammonia were found to be below detection limit.

4.4.2 Noise Quality

Baseline noise levels have been monitored in the study area, using portable Noise Level Meter. Keeping in view the land use pattern, random locations for noise level monitoring were identified for the assessment. The land use pattern includes residential areas covering settlements, schools, bus stands, hospital, community properties, commercial areas, etc., the day levels of noise have been monitored. The sampling locations for noise were identified close to the proposed component sites. The noise sampling locations and results are presented in **Table 4.6**.

Table 4.6 Noise Monitoring - Monitoring Data

S.No	Location of Sampling	Day time results dB(A) Leq
1	Collectorate Ground Thaiyar Kullam.	61.5
2	Thirukalimedu.	58.8
3	Shri Vallabachara Baithak Orikai.	63.6
4	Uthiramerur Road Arasu Nagar.	62.3
5	Ayyampettai Vasantham Nagar.	64.2
6	Kamakshi Nagar Nathapettai Lake.	61.9
7	Perasiriyar Nagar	62.4
8	Brahmanar Street Thenambakkam	64.3
9	Dharmalingaeshwar Temple Tank	63.5
10	Olimohammedpettai	62.2
CPCB Standards for Residential Area (Maximum)		55

The noise levels observed in some of the rural areas are primarily owing to vehicular traffic and other anthropogenic activities. The day equivalents during the study period are ranging between 58.8 dB (A) to 64.3 dB (A). From the results, the day time noise levels in all the locations were exceeding the ambient noise standards for residential area. Necessary mitigation measure with noise control measures during project implementation is included in the ESMP.

4.4.3 Soil Quality

The study on soil quality establishes the baseline characteristics of the soil in the study area surrounding the project site. The study has been addressed with the following objectives.

- To determine the baseline characteristics
- To determine the soil characteristics of proposed project site.
- To determine the impact of industrialization/urbanization on soil characteristics
- To determine the impacts on soils from agricultural productivity point of view.

Criteria Adopted for Selection of Sampling Locations

For studying the soil types and soil characteristics, sampling locations were selected near to the site to assess the existing soil conditions representing various land use conditions and geological features. The homogenized soil samples collected at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to laboratory for analysis. The important physical, chemical parameter concentrations were determined from all samples. The soil sampling results are given in **Table 4.6**.

Table 4.7 Soil monitoring data

S. No	Test Parameters	Results	
		Shri Vallabacharya Baithak — Orikkai (S1)	Near Nathapettai Lake (S2)
1.	pH @ 25°C	7.90	8.46
2.	Density	1.5 g/cc	1.2 g/cc
3.	Moisture Content	4.2 %	10.3%
4.	Conductivity @ 25°C	216 micromhos/cm	340 micromhos/cm
Texture			
5.	Clay	46.3%	65.7 %
6.	Sand	53.1 %	33.2%
7.	Silt	0.6 %	1.1 %
8.	Water Holding Capacity	40.9 %	47.4 %
9.	Phosphorus as P	371 mg/kg	BDL (DL 1.0 mg/kg)
10.	Sodium as Na	779 mg/kg	1498 mg/kg
11.	Potassium as K	1112 mg/kg	1031 mg/kg
12.	Calcium as Ca	5002 mg/kg	3333 mg/kg
13.	Magnesium as Mg	3853 mg/kg	2521 mg/kg
14.	Iron as Fe	23529 mg/kg	13801 mg/kg
15.	Zinc as Zn	58.2 mg/kg	23 mg/kg
16.	Manganese as Mn	265 mg/kg	26.3 mg/kg
17.	Nickel as Ni	12.4 mg/kg	12.7 mg/kg
18.	Chromium as Cr	27.4 mg/kg	17.0 mg/kg
19.	Copper as Cu	26.5 mg/kg	19.7 mg/kg
20.	Cadmium as Cd	BDL (DL: 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
21.	Aluminium as Al	9772 mg/kg	9192 mg/kg
22.	Organic Carbon	0.2 %	0.1 %
23.	Organic Matter	0.3%	0.2 %
24.	Total Nitrogen as N	166 mg/kg	352 mg/kg

- The pH values in the study area are varying from 7.90 to 8.46 indicating that the soils are falling in normal to saline class.
- Based on the electrical conductivity, the soils are classified into 4 groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study area is varying from 216 to 340 μ s indicating that soils falling under normal category.
- The organic carbon influences the soil in respect to color, physical properties, supply of available nutrients and absorptive capacity. The main source of soil organic carbon is plant tissue while animals are the subsidiary source. Though

organic carbon is a small part of mineral soils, it plays a vital role in the productivity and conditioning of soils. It serves as source of food for soil bacteria and fungi which are responsible for converting complex organic materials into simple substances readily used by the plants. In association with clay and calcium, it helps to form the aggregates of soil particles to produce the crumb structure. The organic carbon in the study area is varying from 0.1 to 0.2% which is in low range.

- The other important parameters for characterization of soil for irrigation are N,P,K. Nitrogen, Phosphorus and Potassium are known as primary nutrients, Calcium, Magnesium and Sulphur as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance and not on their relative importance.
- Available Nitrogen encourages the vegetative development of plants by imparting a healthy green colour to the leaves. It also controls, to some extent, the efficient utilization of phosphorus and potassium. Its deficiency retards growth and root development, turns the foliage yellowish or pale green, hastens maturity, causes the shriveling of grains and lowers crop yield. Excess nitrogen produces leathery and sometimes crinkled and dark green leaves with succulent growth. It also delays the maturation of plants, impairs the quality of crops like barley, potato, tobacco, sugarcane and fruits and increases susceptibility to diseases and causes “lodging” of cereal crops by inducing an undue lengthening of the stem internodes. The available Nitrogen as N in the study area is varying from 166 to 352 kg/ha which indicates that samples are falling in Low range.
- Available Phosphorus influences the vigor of plants and improves the quality of crops. It encourages the formation of new cells, promotes root growth (particularly the development of fibrous roots) and hastens leaf development, formation of grains, and the maturation of crops. It also increases resistance to disease and strengthens the stems of cereal plants, thus reducing their tendency to lodge. If phosphorus is deficient in the soil, plants fail to make a quick start, do not develop a satisfactory root-system, remain stunted and sometimes develop a tendency to show a reddish or purplish discoloration of the stem and foliage. In the study area available Phosphorus is varying from 371 mg/ha.
- Available Potassium enhances the ability of the plants to resist diseases, insect attacks, and cold and other adverse conditions. It plays an essential part in the formation of starch and in the production and translocation of sugars, and is thus of special value to carbohydrate rich crops, e.g. sugarcane, potato and sugar beet. The increased production of starch and sugar in legumes fertilized with potash benefits the symbiotic bacteria and enhances the fixation of nitrogen. Vegetables and legumes are particularly heavy consumers of potassium. Deficiency of potassium produces the characteristic ringing of alfalfa leaves, reddish brown discoloration of cotton leaves, curbing of leaf margins of potato, and intraveinal chlorosis and flaring of maize leaves. The available potassium in the study area is

varying between 1031 to 1112 mg/kg which indicates that the samples are falling in Low range and two samples in medium range.

4.4.4 Groundwater Quality

The ground water samples were drawn from the hand pumps and open wells being used by the local people. The water samples collected from the above locations were analyzed for important major and minor ions and the analytical results of the groundwater samples were compared with IS: 10500 - 2012 drinking water standards and the results are shown in Tables 4.7.

Table 4.8 Groundwater Monitoring – Monitoring data

Sl. No	Test Parameters	Sample baseline locations and Results										Requirement/limit As per IS:10500/2012	
		GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW9	GW10	Desirable	Permissible
1.	Colour	5 Hazen	5 Hazen	5 Hazen	5 Hazen	5 Hazen	5 Hazen	5 Hazen	5 Hazen	10 Hazen	5 Hazen	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	-	-
3.	Turbidity (NTU)	Less than 0.5 NTU	1.1 NTU	1.4 NTU	6.8 NTU	Less than 0.5 NTU	1.78 NTU	Less than 0.5 NTU	2.40 NTU	2.94 NTU	1.4 NTU	1	5
4.	pH at 25°C	7.89	7.52	7.96	7.68	7.73	8.34	8.44	8.52	8.34	8.42	6.5 – 8.5	No relaxation
5.	Temperature	29°C	29°C	28°C	28°C	29°C	27°C	27°C	27°C	27°C	27°C	-	-
6.	Conductivity @ 25°C	1799 pmhos/cm	3490 pmhos/cm	1483 pmhos/cm	1915 pmhos/cm	936 pmhos/cm	2260 pmhos/cm	1940 pmhos/cm	1700 pmhos/cm	1868 pmhos/cm	1802 pmhos/cm	*2250	-
7.	Total Dissolved Solids	1136 mg/l	2163 mg/l	852 mg/l	1082 mg/l	582 mg/l	1460 mg/l	1180 mg/l	1168 mg/l	1188 mg/l	1470 mg/l	500	2000
8.	Total Suspended Solids	BDL (DL :1.0 mg/l)	3 mg/l	4 mg/l	12 mg/l	BDL (DL :1.0 mg/l)	4 mg/l	BDL (DL :1.0 mg/l)	14 mg/l	8 mg/l	14 mg/l	-	-
9.	Total Solids	1136 mg/l	2166 mg/l	856 mg/l	1094 mg/l	582 mg/l	1464 mg/l	1180 mg/l	1182 mg/l	1196 mg/l	1484 mg/l	-	-
10.	Total Alkalinity as CaCO ₃	547 mg/l	813 mg/l	435 mg/l	346 mg/l	330 mg/l	298 mg/l	435 mg/l	458 mg/l	344 mg/l	378 mg/l	200	600

11.	Acidity as CaCO ₃	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 ring/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL 1.0 mg/l)	-	-
12.	Total Hardness as CaCO ₃	130 mg/l	288 mg/l	342 mg/l	260 mg/l	258 mg/l	340 mg/l	300 mg/l	364 mg/l	490 mg/l	500 mg/l	200	600
13.	Calcium as Ca	26 mg/l	50 mg/l	71 mg/l	66 mg/l	54 mg/l	112 mg/l	51 mg/l	82 mg/l	131 mg/l	108 mg/l	75	200
14.	Magnesium as Mg	16 mg/l	40 mg/l	40 mg/l	23 mg/l	30 mg/l	15 mg/l	42 mg/l	39 mg/l	40 mg/l	56 mg/l	30	100
15.	Chloride as Cl	198 mg/l	591 mg/l	180 mg/l	325 mg/l	84 mg/l	513 mg/l	317 mg/l	225 mg/l	278 mg/l	333 mg/l	250	1000
16.	Fluoride as F	1.08 mg/l	1.59 mg/l	0.48 mg/l	0.16 mg/l	0.40 mg/l	0.571 mg/l	1.61 mg/l	0.83 mg/l	0.92 mg/l	0.83 mg/l	1.0	1.5
17.	Nitrate as NO ₃	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	2.50 mg/l	1.20 mg/l	15.25 mg/l	28 mg/l	5.56 mg/l	8.2	45
18.	Total Nitrogen	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)	7.7 mg/l	6.73 mg/l	23.73 mg/l	34.31 mg/l	11.22 mg/l	-	-
19.	Sulphate as SO ₄	56 mg/l	126 mg/l	47 mg/l	69 mg/l	12 mg/l	46 mg/l	44 mg/l	70 mg/l	80 mg/l	70 mg/l	200	400
20.	Total Phosphate as P	BDL (DL :0.01 mg/l)	BDL (DL :0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	0.331 mg/l	BDL (DL:0.01 mg/l)	-	-
21.	Lead as Pb	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	-	-
22.	Total Chromium as Cr	0.025 mg/l	0.022 mg/l	0.024 mg/l	0.028 mg/l	0.021 mg/l	0.061 mg/l	0.042 mg/l	0.0347 mg/l	0.061 mg/l	0.064 mg/l	0.05	No relation
23.	Iron as Fe	0.384 mg/l	0.408 mg/l	0.679 mg/l	0.337 mg/l	0.331 mg/l	0.901 mg/l	0.740 mg/l	0.742 mg/l	0.787 mg/l	0.986 mg/l	0.3	No relation
24.	Manganese as Mn	0.015 mg/l	0.027 mg/l	0.010	0.013	0.035	0.022	0.017	0.211	0.046	0.064	-	-

				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l		
25.	Zinc as Zn	0.089 mg/l	0.026 mg/l	0.038 mg/l	0.429 mg/l	0.038 mg/l	0.056 mg/l	0.045 mg/l	0.055 mg/l	0.186 mg/l	0.123 mg/l	-	-
26.	Aluminum as Al	0.206 mg/l	0.494 mg/l	0.160 mg/l	0.147 mg/l	0.540 mg/l	0.397 mg/l	0.426 mg/l	0.366 mg/l	0.306 mg/l	0.328 mg/l	-	-
27.	Mercury as Hg	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	-	-
28.	Total Arsenic as As	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	-	-
Discipline: Biological													
29.	<i>Escherichia coli</i>	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	Absent/100m1	-	-
30.	Total Coliform	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	Present/100m1	*50 MPN /100 ml	--

Source: Monitoring details, 2023.

Note: GW1-Near Collectorate Ground GW2-Thirukalimedu. GW3-Shri Vallabacharya Baithak - Orikkai GW4-Arasu Nagar Orikkai GW5-Vasantham Nagar GW6-Near Nathapettai Lake. GW7-Perasiriyar Nagar GW8-Thenambakkam. GW9-Near Dharmalingeshwar Temple Tank GW10- Olimohammedpettai

**Indicates the cpcb designated best use water quality criteria*

- The pH limit fixed for drinking water samples as per IS: 10500-2012 Standards is 6.5 to 8.5 beyond this range the water will affect the mucus membrane and or water supply system. During the study period, the pH was varying for ground waters from 7.52 to 8.5, indicating that they are in acceptable limits.
- The desirable limit for total dissolved solids as per IS: 10500 are 500 mg/l whereas the permissible limits in absence of alternate source are 2000 mg/l, beyond this palatability decreases and may cause gastro intestinal irritation. In ground water samples collected from the study area, the total dissolved solids are varying from 582 to 2163 mg/l. Except for Thirukaiedu the TDS of all other samples were above the permissible limits,

- The desirable limit for chloride is 250mg/l as per IS: 10500 whereas the permissible limit of the same is 1000 mg/l beyond this limit taste, corrosion and palatability are affected. The Chloride levels in the groundwater samples collected in the study area were ranging from 60mg/l to a maximum of 250 mg/l. Chloride levels of all samples were below the desirable limits.
- The desirable limit as per IS:10500 for hardness is 200 mg/l whereas the permissible limit for the same is 600 mg/l. Beyond this limit encrustation in water supply structure and adverse effects on domestic use will be observed. In the ground water samples collected from the study area, the hardness is varying from 130 to 500 mg/l. In GW1 – Near Collectorate Ground total hardness was below the desirable limits whereas the remaining locations, the hardness was above the desirable limits and below the permissible limits.
- Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However, the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. If the fluoride content is less than 0.6 mg/l it causes dental carries, above 1.5 mg/l it causes staining of tooth enamel, higher concentration in range of 3 - 10 mg/l causes fluorosis. In the ground water samples of study area, the fluoride value were in the range of 0.16 to 1.61 mg/l.
- Heavy metal chromium values were high with compared standards in GW5-Vasantham Nagar, GW8-Thenambakkam and GW9-Near Dharmalingeshwar Temple Tank. Lead, Mercury and arsenic was found to be below detection level in all monitoring location.
- Overall all the samples collected from the study area were found to be fit for human consumption; however the hardness, dissolved solids and most of groundwater samples seem to be above acceptable limit but well within the permissible limits.

4.4.5 Surface Water Quality

Surface water samples were collected from different sources within the study area for depicting the baseline status of the study area. The water samples were analysed for important major and minor ions and the analytical results of the surface water results were compared with IS 2296 – 1982 standards and the results are shown in Table 4.8.

Table 4.9 Surface water Monitoring – Monitoring data

Sl. No	Test Parameters	Results	
		SW1: Thirukalimedu	SW2 : Nathapettai Lake
1.	Colour	55 Hazen	30 Hazen
2.	Odour	Agreeable	Agreeable
3.	Turbidity (NTU)	64 NTU	19.8 NTU
4.	pH at 25°C	7.15	8.75
5.	Temperature	28°C	27°C
6.	Conductivity @ 25°C	1487 pmhos/cm	1218 pmhos/cm
7.	Total Dissolved Solids	789 mg/l	790 mg/l
8.	Total Suspended Solids	155 mg/l	24 mg/l
9.	Total Solids	944 mg/l	814 mg/l
10.	Total Alkalinity as CaCO ₃	309 mg/l	229 mg/l
11.	Acidity as CaCO ₃	BDL (DL :1.0 mg/l)	BDL (DL :1.0 mg/l)
12.	Total Hardness as CaCO ₃	178 mg/l	166 mg/l
13.	Calcium as Ca	43 mg/l	24 mg/l
14.	Magnesium as Mg	17 mg/l	26 mg/l
15.	Chloride as Cl	245 mg/l	207 mg/l
16.	Fluoride as F	1.47 mg/l	0.98 mg/l
17.	Nitrate as NO ₃	BDL (DL :1.0 mg/l)	4.09 mg/l
18.	Total Nitrogen	2.56 mg/l	9.30 mg/l
19.	Sulphate as SO ₄	24 mg/l	29 mg/l

Sl. No	Test Parameters	Results	
		SW1: Thirukalimedu	SW2 : Nathapettai Lake
20.	Total Phosphate as P	1.051 mg/l	0.448 mg/l
21.	Dissolved Oxygen	4.4 mg/l	6.50 mg/l
22.	BOD @ 27°C for 3 days	28 mg/l	9 mg/l
23.	COD	140 mg/l	55 mg/l
24.	Lead as Pb	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
25.	Total Chromium as Cr	0.023 mg/l	0.051 mg/l
26.	Iron as Fe	0.609 mg/l	1.020 mg/l
25.	Manganese as Mn	0.189 mg/l	0.049 mg/l
27.	Zinc as Zn	0.055 mg/l	0.035 mg/l
28.	Aluminum as Al	0.220 mg/l	0.740 mg/l
29.	Mercury as Hg	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
30.	Total Arsenic as As	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31.	<i>Escherichia coli</i>	Absent/100m1	Absent/100m1
32.	Total Coliform	Present/100m1	Present/100m1

Surface water pH, chloride, fluoride and hardness, DO and BOD are meeting the Class 'A' norms. hence, overall the Surface water is Class 'A' as per IS: 2296 - 1982.

4.5 History and Culture

Kanchipuram is one among the ancient cities of South India. Kancheepuram is a place of great importance all over the world due to its large number of temples and world famous silk industry. Kanchipuram is hailed as the cultural capital of Tamilnadu and is held in great reverence. This land of temples is famous pilgrim spot and has lots of famous temples including Sakkiwarar Temple, Vaikunta Perumal Temple, Kailasanatha Temple, Ekambareswarar Temple, Kamakshi Amman Temple. One of the four seats of Sri Adi Shankaracharya the Kanchi Kamakoti Peetham is situated here. Kanchi is also famous for its finest silk fabrics and saris with zari work.

Kanchipuram has been ruled by the Pallavas, the Medieval Cholas, the Later Cholas, the Later Pandyas, the Vijayanagara Empire, the Carnatic kingdom, and the British, who called the city "Conjeeveram".

There are about 31 monuments and sites in Kancheepuram district. Out of which seven monuments are present within the Kancheepuram limits. The city's historical monuments include the Kailasanathar Temple, Vaikunta Perumal Temple, Piravathanesvara temple, Iravathanesvara temple, Jvarahesvara temple, Mathangesvara temple, and Muktesvara temple which are protected by the AMASR Act, 1958. Kancheepuram is home to several temples and 11 temples including the above are being proposed for inclusion in the UNESCO. None the project sites identified for locating the proposed OHTs are located within the regulated boundary of protected monuments and hence no impact is anticipated from the construction of new OHTs. However, a section of the proposed pipeline alignment for feeder main (1.314km) for three existing OHTs and distribution network (29.84Km) near the monuments fall within the regulated boundary which involve activities of low risk. Applicable permission will be obtained prior to start of construction in the relevant section and conditions if any would be complied. During construction adequate precautions will be taken not to cause any disturbance to the temples and other religious structures. Further during construction if any chance finds encountered, then necessary management measures as identified in the ESMP would be implemented.

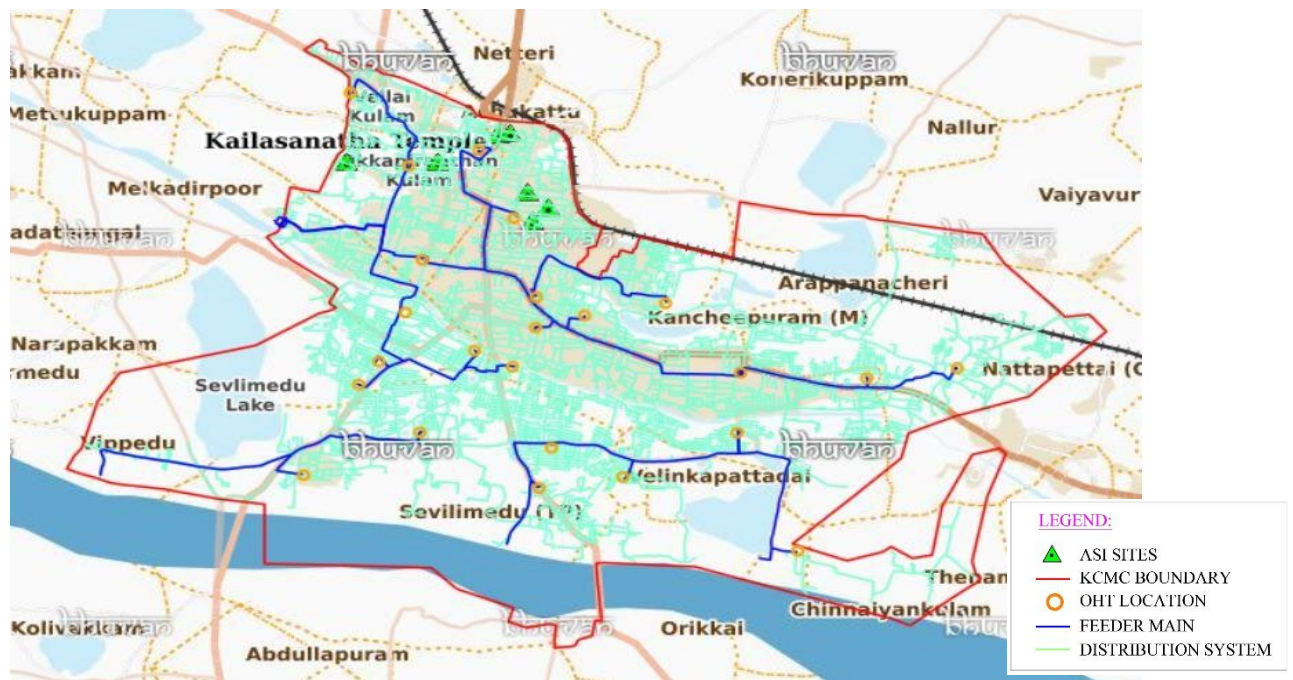


Figure 12: Protected Monuments in project area

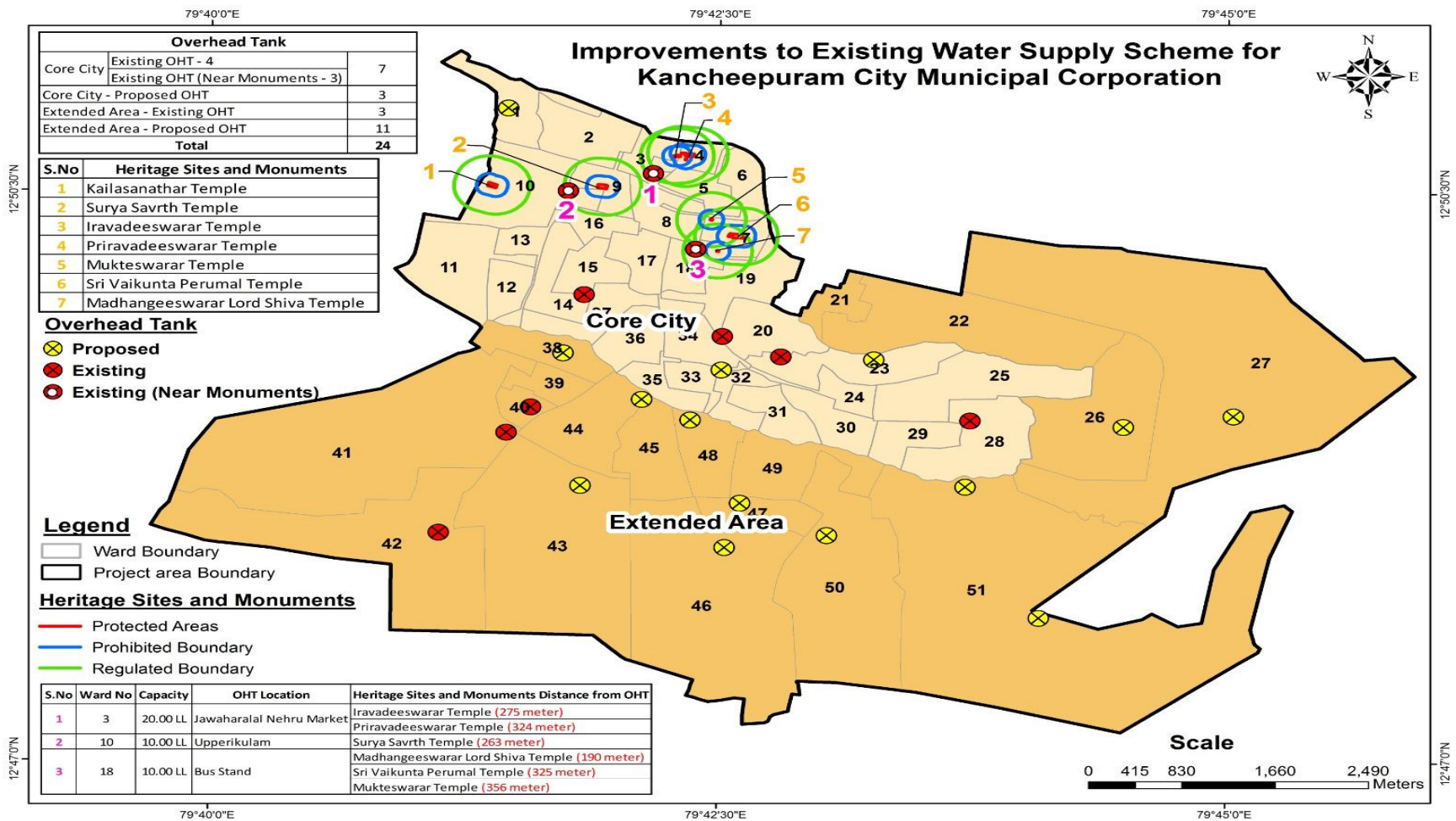


Fig 13: Existing OHTs near Monuments.

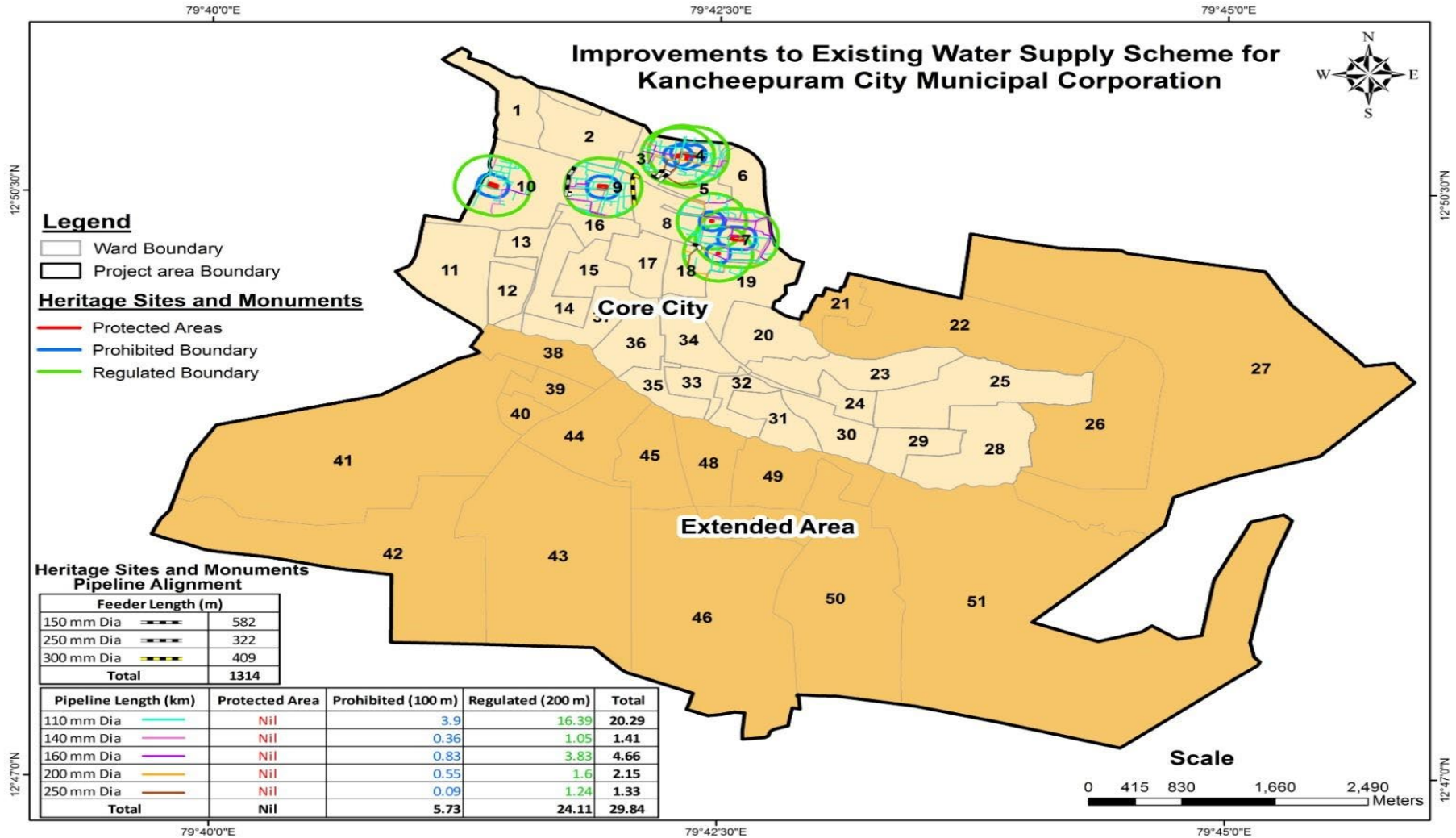
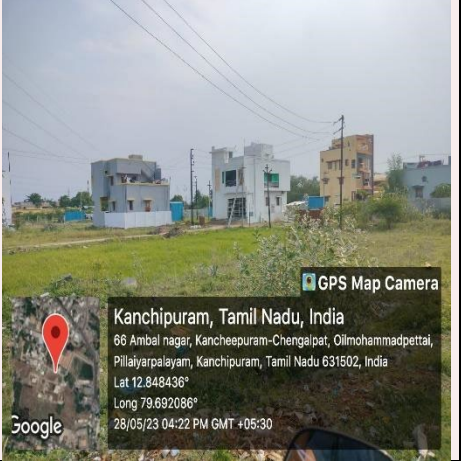


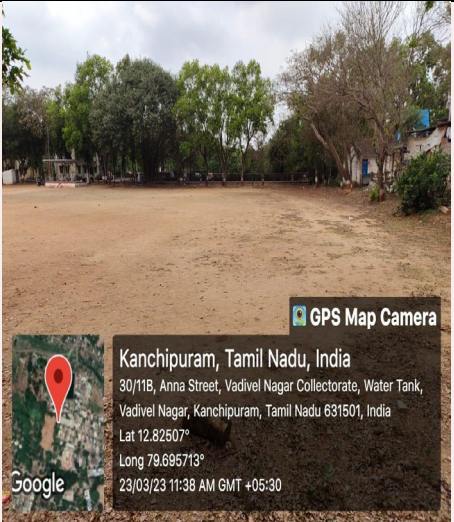

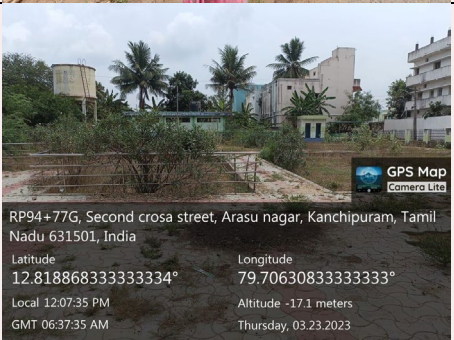


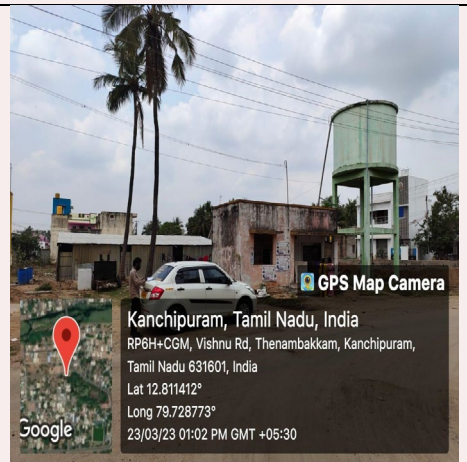



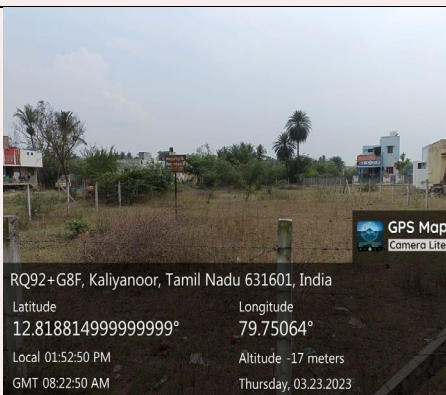

Fig 14: Pipeline alignments near Monuments

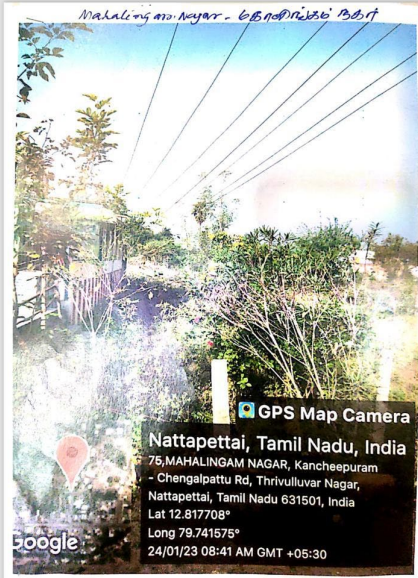

4.6 Site specific Environmental features:

S. N O	INFRASTRUCTURE	DETAILS	LOCATION & ENVIRONMENTAL FEATURE	SITE PHOTOGRAPH
1	Distribution	OHTs	Oli Mohammed zone- The site belongs to KCMC. The OHT area is located in a residential area. The nearest residential building is about 50m away from the OHT location. There is road access to the site. The site is vacant and there is no tree cutting involved. It is proposed to provide compound wall around the site.	 GPS Map Camera Kanchipuram, Tamil Nadu, India 66 Ambal nagar, Kancheepuram-Chengalpat, Oilmohammadpettai, Pillaiyarpalayam, Kanchipuram, Tamil Nadu 631502, India Lat 12.848436° Long 79.692086° 28/05/23 04:22 PM GMT +05:30
2			Vilakadi Kovil Theru - The site belonging to KCMC. The site is vacant and there are residences at a distance of 15m. There is road access to the site. The site is vacant and there is no tree cutting involved. It is proposed to provide compound wall around the site.	 GPS Map Camera RPFS+9FJ, Vilakadi Koil St, Ennaikaran, Kanchipuram, Tamil Nadu 631501, India Latitude 12.823373333333333° Longitude 79.70855833333333° Local 11:01:08 AM Altitude -11.2 meters GMT 05:31:08 AM Thursday, 03.23.2023
3			Ambedkar Nagar - The site belongs to KCMC. The site has road access and there are residences at about 50m. The site is vacant and there is no tree cutting involved. It is proposed to provide compound wall around the site.	 GPS Map Camera Kanchipuram, Tamil Nadu, India RM6W+FO, Gem Nagar, Kanchipuram, Tamil Nadu 631502, India Lat 12.811547° Long 79.697092° 23/03/23 11:20 AM GMT +05:30

4			<p>Dharmalingeshwar zone - The site belongs to KCMC. The proposed area is vacant ground with trees along the boundary. The earmarked portion is vacant and no tree cutting is proposed. Road access is available to the site and there are residential buildings at about 50m. Compound wall is proposed to separate the site from nearby landuse.</p>	 <p>GPS Map Camera</p> <p>Kanchipuram, Tamil Nadu, India 80/11B, Anna Street, Vadivel Nagar Collectorate, Water Tank, Vadivel Nagar, Kanchipuram, Tamil Nadu 631501, India Lat 12.82507° Long 79.695713° 23/03/23 11:38 AM GMT +05:30</p>
5			<p>Vanavil Nagar - The proposed site belongs to KCMC. Clearance of shrubs in the proposed area is to be done before starting construction. The proposed site is surrounded by residential buildings (at 15m) and has road access. Construction of compound wall is proposed for the site.</p>	 <p>GPS Map Camera</p> <p>Kanchipuram, Tamil Nadu, India RPC3+577, Gandhi Nagar, Thalyar Kullam, Kanchipuram, Tamil Nadu 631501, India Lat 12.82074° Long 79.702658° 23/03/23 11:49 AM GMT +05:30</p>
6			<p>Arasu Nagar - The site belongs to KCMC. Existing OHT is available near the proposed area. The proposed site is located in a corner of the park and surrounded by residential buildings (at 20m distance). Road access is available to the site. Compound wall is proposed to separate the site from nearby landuse.</p>	 <p>GPS Map Camera Lite</p> <p>RP94+77G, Second crossa street, Arasu nagar, Kanchipuram, Tamil Nadu 631501, India Latitude 12.818868333333334° Longitude 79.70630833333333° Local 12:07:35 PM Altitude -17.1 meters GMT 06:37:35 AM Thursday, 03.23.2023</p>
7			<p>Prathana Salai - The site belongs to KCMC. There is an existing OHT, Anganwaadi, Primary health centre and an under-construction temple in the site. Residences are located at about 50m. Adequate vacant land is available for the proposed construction of OHT.</p>	 <p>GPS Map Camera</p> <p>Kanchipuram, Tamil Nadu, India Uthramerur Main Rd, Arasu Nagar, Thandavaraya Nagar, Kanchipuram, Tamil Nadu 631601, India Lat 12.805175° Long 79.7093° 23/03/23 12:15 PM GMT +05:30</p>

			Compound wall is proposed to be constructed around the site. During construction adequate precautions are to be taken to prevent public entry and the site is to be cordoned from the Anganwadi and PHC.	
8			<p>Perasiriyar nagar - The site belongs to KCMC. The proposed site is surrounded by residential buildings (@20m) and road access is available. There is an existing OHT within the site. Adequate vacant land is available for the proposed construction of OHT and there is no tree cutting.</p> <p>Compound wall is proposed to be constructed around the site.</p>	
9			<p>Vishnu Nagar - The site belongs to KCMC. Existing OHT and Primary health centre are within the site. The OHT will be constructed in the vacant area earmarked and no tree cutting involved. The nearest residence is at around 50m. Temporary labor sheds are present nearby the proposed site due to the road expansion work. There is LT line near the site and hence adequate precautions are to be taken during construction. Road access is available for the site. Compound wall is proposed to be constructed around the site.</p>	

10			<p>Madura Mettur - The site belongs to KCMC. The proposed OHT will be constructed in the vacant area earmarked and no tree cutting involved. Nearest residence is at around 15m and road access is available. OHT is existing within the site hence adequate precaution is to be taken not to disturb the OHT. Compound wall is proposed to be constructed around the site.</p>	 <p>53/A Rajiv Gandhi Nagar Madura Mottur, Thandavaraya Nagar, Orikkai, Tamil Nadu 631502, India</p> <p>Latitude 12.806256666666664° Longitude 79.71744166666667°</p> <p>Local 12:36:17 PM Altitude -5.4 meters</p> <p>GMT 07:06:17 AM Thursday, 03.23.2023</p>
11			<p>Thenambakkam Colony The site belongs to KCMC. The site is vacant and no tree cutting involved. Nearest residence is at around 50m. Road access is available to the site. Compound wall is proposed to be constructed around the site.</p>	 <p>RQ92+G8F, Kaliyanoor, Tamil Nadu 631601, India</p> <p>Latitude 12.818814999999999° Longitude 79.75064°</p> <p>Local 01:52:50 PM Altitude -17 meters</p> <p>GMT 08:22:50 AM Thursday, 03.23.2023</p>
12			<p>Mettu Colony - The site belongs to KCMC. The site identified is vacant and no tree cutting involved. Nearest residence is at around 100m. Road access is available to the site. Compound wall is proposed to be constructed around the site.</p>	 <p>Kanchipuram, Tamil Nadu, India</p> <p>69, Thirukaalimedu Rd, பாலாஜி நகர், Thirukaalimedu, Kanchipuram, Tamil Nadu 631501, India</p> <p>Lat 12.826289° Long 79.721535°</p> <p>23/03/23 02:27 PM GMT +05:30</p>

13			<p>Periyar Nagar - The site belongs to ULB.</p> <p>There is an existing OHT which is functional.</p>	 <p>12.Periyar Nagar (Mahalingam Nagar) Scanned with CamScanner</p>
14			<p>Thirukkalimedu Annasalai - The site belongs to KCMC. The site identified is vacant. Nearest residence is at around 30m. Road access is available to the site. Compound wall is proposed to be constructed around the site.</p>	

4.7 Socio-economic profile of Kancheepuram District

4.7.1 Project Area

Kancheepuram Erstwhile Municipality and Added areas (wards 1 to 51 of Kancheepuram City Municipal Corporation) spreads in a total area of 36.14 sq.m with population of 2,34,353 as per 2011 census. The decadal populations of Kancheepuram are given below:

Table: 4.10 Decadal population of Kancheepuram district

Location/year	1971	1981	1991	2001	2011
Kancheepuram- Core City	110657	130926	144955	153140	164384
Orikkai			3138	4607	12638
Nathapettai			9923	10111	19883
Thenambakkam			4415	9357	13994
Sevlimeedu			13433	16125	23454

4.7.2 Connectivity

Kancheepuram is well connected to other major cities of the country via regular flights. The nearest airport is 52 km away, Chennai (National & International Airports) Airports.

Kancheepuram Railway Station serves as the principal railway station of the city of Kancheepuram. The station is a part of the Chennai railway division of the Southern Railway zone, Walajabad block, St.Thomas Mount block and Chengalpattu taluk (covers Thirukaukundram block and Thiruporur block) and are well connected with Chennai and South districts of Tamil Nadu.

4.7.3 Economy

Kancheepuram is a major contributor to the state economy, accounting for over 5% of the state GDP. The share of the district has steadily grown over time towards 6%. The per capita income is high and both urban and rural incomes are comfortably above state levels. Agriculture is the predominant occupation of most of the work force. At the same time, proximity to Chennai has seen the emergence of heavy industrialization, with many large automobile, electronic and other manufacturers setting up shop here. Kancheepuram is historically significant to Tamil Nadu and is a major Tourist Hub, while IT services have also opened offices in the capital city of the same name.

Kancheepuram is a traditional centre of silk weaving and handloom industries for producing Kanchipuram Sarees. In 2005, "Kanchipuram Silk Sarees" received the Geographical Indication tag, the first product in India to carry this label. The silk trade in Kanchipuram began when King Raja Raja Chola I (985–1014) invited weavers from Saurashtra, Gujarat to migrate to Kanchi. The craft increased with the mass migration of weavers from Andhra Pradesh in the 15th century during the Vijayanagara rule. Kancheepuram is fondly called as the silk city and the silk industry here is a major contributor to the economy.

4.7.4 Social structure

Scheduled Castes and Scheduled Tribes accounted for 23.71% and 1.03% of the population respectively.

4.7.5 Literacy Level

The district has recorded the highest literacy rate of 84.5% as compared with the State literacy rate of 80.1%.

4.7.6 Occupational pattern

The district had a total of 1,006,245 households. There were a total of 1,673,814 workers, comprising 74,761 cultivators, 162,494 main agricultural labourers, 41,149 in household industries, 1,088,974 other workers, 306,436 marginal workers, 14,582 marginal cultivators, 110,020 marginal agricultural labourers, 13,583 marginal workers in household industries and 168,251 other marginal workers. The total number of Taluks are 13.

CHAPTER-5 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

This section identifies and assesses the potential changes in the environment and social aspects that could be expected from the proposed project. The proposed project activities would create impact on the environment in two distinct phases i.e., construction and operation phases. Impacts are identified, predicted and evaluated based on the analysis of the information collected from following:

- Project information (as discussed in Chapter-2) and
- Baseline information and site visits of the study area (as discussed in Chapter-4)

This section also describes mitigation measures, which have been suggested for the adverse impacts likely to be caused due to activities of both construction and operation phases of the project. The details of the activities and their impacts have been worked out in the following sections. 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.

5.1 Identification of likely impacts

Screening of potential environmental and social 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, discharge specifications, pollution sources and ancillary services.

(iii) Construction impacts include impacts caused by site clearing, earthworks, machinery, vehicles, workers, occupational health and safety. 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.

This section of the ESIA reviews possible project-related impacts, in order to identify Issues requiring further attention and screen out issues of no relevance. The Environmental and Social Screening format are provided in the Annexure 1.

In the case of this project most of the individual elements involve simple construction and operation, so impacts will be mainly localized and not greatly significant negative impacts. 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 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.

5.2 Design & Location impacts

Design of the Proposed Components. The Central Public Health and Environment Engineering Organization (CPHEEO) manual suggests a design period of 15/30 years. The water supply components were designed following the recommendations of the CPHEEO manual for water supply and treatment.

- Impacts arise from the design of the project including the technology used, scale of operation, waste production, discharge specification, pollution sources and ancillary services.
- Impacts associated with the planning mainly depend on the site selection. Location impacts include on-site biophysical array and encroachment / impact either directly or indirectly on adjacent environments. It also includes the impacts on the people who might lose their properties or livelihoods due to the development of the proposed site.
- Construction works in the Kancheepuram City Municipal Corporation area, the pipelines are to be laid on or along the roads in the unused vacant land adjacent to the roads within the project area. In the narrow roads (where there is no vacant land adjoining road), pipelines will be buried within the road right of way. However, considering the narrow and busy lanes, temporary impacts are likely during the construction stage.

Sources of Materials. For the construction work, the required materials like coarse aggregate and fine aggregate will be obtained from the permitted / licensed quarries by the Department of Geology & Mining, Government of Tamil Nadu. 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 from Kancheepuram City Municipal Corporation;
- (ii) Kancheepuram City Municipal Corporation to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval;

- (iii) Contractor to submit to Kancheepuram City Municipal Corporation on a monthly basis documentation on material obtained from each source (quarry/borrow pit) and
- (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 Kancheepuram City Municipal Corporation.

5.3 Site Selection of Construction Work Camps, Stockpile Areas, Storage Areas, and Disposal Areas

Priority is to locate these near the project location, but it shall be at least 100m 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, dust, noise etc. It is also intended to prevent any social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near forest areas, water bodies, or its nearby areas. The contractor will prepare a Construction ESMP (CESMP) including Labour Camp Plan and Waste Management Plan prior to construction and submit it to KCMC.

5.4 Noise from pumping operations

The noise from pumping operations is applicable only in the source location. Some pumping stations are located nearby residences and necessary mitigation measures will be provided to control noise from pumping operations. The noise from pumping operations is limited for this project.

Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise, use acoustic enclosures – manufacturer specified, for all pumps, motors. Procure only Central Pollution Control Board (CPCB) approved generators to meet air emission and noise level requirements. Provide sound mufflers for ventilators in the plant rooms; and sound proof doors. Provide ear plugs designated for noise reduction to workers.

5.5 Energy Efficiency

The entire quantity of water proposed to be drawn from Palar River in Tirupparkadal is pumped to Standpost near the source. From the standpost the water is reaching by gravity. The clear water is transmitted for a distance of 39 km by gravity. From the booster station, again the water is pumped to the existing and proposed OHTs, and water will be distributed by gravity to the beneficiaries. Hence this project is predominantly based on gravity and is energy efficient.

To optimize the power consumption, the hydraulic design shall follow optimal approach and the following is 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 have been considered and incorporated into the subproject designs wherever possible:

- Using low-noise and energy efficient pumping systems
- Energy Efficient Motors and Pumps
- Installation of Variable Frequency Drives (VFDs) and energy efficient than conventional starters, this will ultimately reduce the energy cost. This VFD will take care of fluctuations in pumping of water at source locations in terms of extreme variations.

Utilities

The utilities that are located above the ground level and below the ground level will be shifted after obtaining necessary permission from the competent authority.

5.6 Construction impacts

Impact on Air Quality. During the construction period, the impacts on air quality are mainly due to the material movement and the actual construction activities. Due to material movement air quality over the immediate influence area will be affected though, not in significant levels. There will be an increase in the dust levels. In order to reduce the dust emissions in the construction area due to material transport and construction activities, provisions should be made for sprinkling of water on all the roads in the area of improvement. It should be ensured that

- (i) construction debris is removed daily;
- (ii) construction requiring street closings should be performed during off-peak hours;
- (iii) Idling of delivery trucks or other equipment should not be permitted during periods of unloading or when they are not in active use;
- (iv) low emission construction vehicles should be used wherever possible; and
- (v) As soon as construction is over the surplus earth should be utilised to fill up low-lying areas. In no case, loose earth should be allowed to pile up in the streets.

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

Air Pollution during Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transports, 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 90-95% of the earthwork 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 underground tank (UGT), OHT, etc., will be mainly during the initial construction phase of earthwork, as the site is confined, dust can be effectively controlled with common measures. Dust generation will be significant during 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:

(i) For all construction works

- (a) 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;
- (b) 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;
- (c) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
- (d) Cover the soil stocked at the sites with tarpaulins and surround by dust screens;
- (e) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation;
- (f) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;
- (g) 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;
- (h) For sections involving controlled blasting, ensure that adequate cover is provided to prevent emission of dust during controlled blasting.
- (i) Clean wheels and undercarriage of haul trucks prior to leaving construction site;
- (j) Ensure that all the construction equipment, machinery is fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate; and
- (k) No vehicles or plants to be left idling at site generators to be at placed maximum distance from properties.

(ii) For pipe laying works

- (a) Inform the residents likely to be affected by the works in the locality about the upcoming pipe laying works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience.
- (b) For sections where the controlled blasting is proposed, the residents are provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive, precautionary,

mitigation and emergency response measures being taken to address their concerns.

- (c) The project staff from the PIU, consultants and contractors would undertake a survey of structures (including videography and/or photography) lying within the area of influence of blasting from the impacts (preferably in the presence of the owners of the said structures) during pre- and post-blasting situations to assess and/or ascertain regarding the damages, if any, caused to the structures because of blasting activities.
- (d) Barricade the construction area using hard barricades (of 2 m height) on both sides;
- (e) Initiate site clearance and excavation work only after barricading of the site is done;
- (f) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.), to the barricaded area;
- (g) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area;
- (h) 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;
- (i) The section proposed for blasting shall be supervised by properly trained staff to ensure no movement of pedestrians, motorized or non-motorized vehicles, and residents takes place during blasting within the area of influence.
- (j) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting.
- (k) Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock;
- (l) Ensure that adequate precautions are taken to avoid flying debris post blasting (such as covering the trench with sturdy metallic sheets having sufficient weights to absorb the blast waves);
- (m) 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;
- (n) 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 backfilling, this will avoid stocking of material, and minimize the dust; and
- (o) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from the backfilled section. Road restoration shall be undertaken immediately.

Excavation and refilling activities disturb the topsoil, 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 topsoil 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 topsoil 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 techniques shall be used so that roads can be restored immediately.

While obtaining permission for the proposed clear water transmission mainly from NH, SH roads, the necessary restoration charges will be paid and accordingly the respective department will restore their roads.

5.6.1 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 odour and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Earthwork excavation in the road will be reused for levelling the roadside and earth excavation from other locations will be safely disposed by KCMC along with C&D wastes .

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) Avoid stockpiling any excess spoils at the site for a long time. Excess excavated soils should be disposed to corporation lands;
- (iii) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive land uses;
- (iv) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable and be handled in consultation with PIU in compliance with regulatory requirements. non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market;
- (v) Prohibit burning of construction and/or domestic waste;
- (vi) Ensure that wastes are not haphazardly thrown in and around the project / work sites; provide proper collection bins, and create awareness to use the dustbins; recycle waste material where possible; and

Conduct site clearance and restoration to original condition after the completion of construction work; KCMC to ensure that site is properly restored prior to issuing of construction completion certificate.

5.7 Surface Water Quality

Runoff from the excavated areas and material and waste soil stocks likely to contain silt, and this silt runoff will deteriorate the water bodies due to silting. Large-scale silting is likely to lead to flooding. This impact will however be considered only during the rainy season. These potential impacts are temporary and are of short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Kancheepuram city municipal corporation on designated disposal areas;
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; and
- (v) Dispose any wastes generated by construction activities in designated sites; and
- (vi) Conduct surface water quality inspection according to the ESMP.

Aquatic Environmental Impacts. Palar is a non-perennial river and is mostly dry. Based on the review of secondary information, there is no movement/ migration of fish species/ fish breeding ground or endangered fish species/ aquatic animals found in the River Palar. Hence the proposed headworks and construction of PCBs are not envisaged to have any impact on the aquatic environment.

Measures for pipe carrying bridges:

Pipe carrying bridges are proposed across River Palar and River Vegavathi for conveying the transmission mains. Following measures shall be ensured to prevent any impact on the surface water quality during construction.

- (i) The pipe carrying bridges shall be constructed during non-monsoon period.
- (ii) Adequate care shall be taken to avoid deposition/ disposal of construction waste / accidental spillage of construction material into the river.
- (iii) While laying the foundation for piers, coffer dam shall be constructed for each pier foundation in order to provide water free regime for speedy construction of piers for pipe carrying bridge.
- (iv) Supporting piers for pipe carrying bridge shall be designed not to obstruct the flow.
- (v) Foundation of pillars shall not be above the bed level.
- (vi) Personal protective equipments shall be ensured to the labourers and supervising officials.
- (vii) Labourers shall be provided with periodical training on emergency preparedness.
- (viii) On completion of pier construction, coffer dam shall be removed and river bed shall be restored to its original condition.

- (ix) Permission shall be obtained from PWD for construction of PCBs and conditions stipulated therein shall be complied with during construction. .

5.7.1 Water Treatment Plant.

No water treatment plant is proposed for this project as the source is drawl of subsurface water from River Palar through Collector Wells and Infiltration Wells. After required disinfectant the water will be supplied to the beneficiaries.

5.8 Noise and Vibration Levels.

The water distribution station sites are located within habitations, where there are houses, schools and hospitals, religious places and businesses. During the construction stage, an increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads and controlled blasting for removal of hard rocks in sites and along the alignment for the purpose of 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 explosives for controlled blasting and pneumatic drills, will have an 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 within the limits as prescribed by the prevailing Indian regulations and standards;
- (iv) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sites or section of alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimise such impacts.
- (v) Horns should not be used unless it is necessary to warn 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.
- (vii) All the controlled blasting, shall be done by an approved and licensed Explosive contractor after submitting a blasting plan to PIU.

5.9 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 OHTs. There are several temples and other religious sites in the project town. In addition, there are seven protected monuments within the project town. None of the sites identified for construction of OHTs fall within the regulated boundary of the monuments. However, a section of the proposed pipeline alignment for feeder main

(1.314km) for three existing OHTs and distribution network (29.84Km) near the monuments fall within the regulated boundary which involve activities of low risk. Applicable permission will be obtained prior to start of construction in the relevant section and conditions if any would be complied. During construction adequate precautions will be taken not to cause any disturbance to the temples and other religious structures. Further during construction if any chance finds encountered, then necessary management measures as identified in the ESMP would be implemented to ensure they are protected and conserved.

Construction contractors follow these measures in conducting any excavation work.

- Conduct training to impart knowledge and create awareness among the workers, supervisors and engineers about the significance of archaeological, paleontological and geological aspects and the applicable Indian Treasure Trove Act, 1878 and chance found during excavation work.
- The fossils, coins, articles of value of antiquity, human skeletal and other remains or things might be exposed during construction activities. In such situation, stop the work, do not remove and damage any article
- Stop work immediately to allow further investigation if any finds are suspected and take any action they require to ensure its removal or protection in situ.
- Inform the concerned authority (Archaeological Survey of India) immediately to take-action per referred Act and recommence the work after receiving written permission; and Also, prevent any type of impact on the cultural heritage, monument, etc..

5.10 Accessibility and Traffic Disruptions.

The main roads in the KCMC carries 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. In other corporation maintained busy roads, work will be taken up during non-traffic hours/ night hours without much hindrance to the free flow of traffic. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (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;
- (iii) locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) keep the site free from all unnecessary obstructions;
- (v) drive vehicles in a considerate manner;
- (vi) coordinate with City Traffic Office for temporary road diversions and necessary provision of traffic aids if transportation activities cannot be avoided during peak hours;
- (vii) notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints;
- (viii) provide planks across trenches in front of businesses, and ensure works are

- (ix) completed quickly to avoid disruption; and avoid full street closure.

5.11 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. To ensure that water will not pond in pits and voids near subproject location, the construction contractor will be required to conduct excavation works on non-monsoon season.

5.12 Socio-Economic – Income.

Sites for all project components are carefully selected in government owned lands. However, few temporary shops are located in the roadside that are like to be affected due to the proposed raw water transmission line. For the loss of the livelihood, compensation has been estimated and mention in the resettlement plan. During the project implementation, blocking of access to the business / livelihood activities are envisaged, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline is within the road carriage way, and also the measures suggested for ensuring accessibility during pipe laying works are notable but temporary impact is envisaged. Some shops and other premises along the roads may lose business income if the access will be impeded due to excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio cultural places etc., will cause inconvenience to the public. Implementation of the following best construction measures will avoid the disturbance 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) Employ 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.

5.12.1 Socio-Economic – Employment.

Manpower will be required during the 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:

- (i) Employ local labour force as far as possible;
- (ii) If available, secure construction materials from local market;

5.12.2 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 labour laws
- (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; follow international standards such as the World Bank Group's Environment, Health and Safety Guidelines;
- (iii) Ensure that qualified first aid trained professional is deployed 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) Provide supplies of potable drinking water;
- (xi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and
- (xii) Disallow worker exposure to noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
- (xiii) A separate health and safety plan has been prepared to respond to ongoing coronavirus disease (COVID-19) pandemic, which would be implemented by the contractor in addition to the provisions outlined here.

5.12.3 Community Health and Safety.

Excavations along the roads & 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;
- (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.

5.12.4 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 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) 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 KCMC;

- (ii) avoid tree cutting for setting up camp facilities;
- (iii) provide a proper fencing/compound wall for camp sites;
- (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
- (v) separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
- (vi) camp shall be provided with proper drainage, there shall not be any water accumulation;
- (vii) 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;
- (viii) prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); firewood not allowed;
- (ix) train employees in the storage and handling of materials which can potentially cause soil contamination;
- (x) 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);
- (xi) recover used oil and lubricants and reuse or remove from the site;
- (xii) 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;
- (xiii) remove all wreckage, rubbish, or temporary structures which are no longer required; and 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.

5.13 Operation and Maintenance Impacts

The main O&M activities of the proposed infrastructure will be detection and repair of leaks and pipe bursts. These are, however, likely to be minimal as proper design and selection of good quality pipe material should mean that leaks are minimal. Leak repair work will be similar to the pipe laying work as earlier explained. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

1. Recurrence of blockage and leakage problems. Although impact is likely to be minimal due to new and well-designed efficient system; it should be ensured that leak detection and restoration time is minimized to the extent possible.

2. To ensure that water delivered to consumers at all times meets the drinking water standards, the following measures are suggested:

- (i) Preparation and implementation of a water quality surveillance as part of the project to ensure that supplied water meets the drinking water standards; and

(ii) Surveillance program will be organized to ensure the water quality of the consumer water.

3. SCADA systems and DMAs are proposed in the project. The parameters like pressure reduction, leakage, pollution etc will be captured in the system. This system will help to zero in on the issues and speedy redressal.

5.14 Social Impact Assessment

Project components and social impacts: Components wise social impacts are explained in detail in the following Table.

Table 5.1: Project Components and Social Impacts Matrix

Project Area	River intake in Palar @ Tiruparkadal	Construction of Over Head Tanks and Sump	Laying of Feeder Main	Distribution system and provision of house service connections	SCADA & DMA arrangements
Kancheepuram City Municipal Corporation					
Description	<p>Water will be drawn by constructing 3 Collector Wells and 4 Infiltration Galleries.</p> <p>The water will be conveyed through a pipe carrying bridge.</p>	<ul style="list-style-type: none"> It is proposed to construction one Standpost with 25LL @ Tiruparkada in the existing head works. It is proposed to construction of 25LL sump @ Vegavathi in the existing booster station site Construction of OHTs at 14 locations with varying capacities. 	Laying of Feeder main for 34.576 km.	<ul style="list-style-type: none"> Providing distribution system for about 429.522km. Providing 55240 metered house service connections. Other allied components are replacement of pump sets at various locations. 	

Social Impacts	<p>The source is 500 m from the river boundary. The standpost is proposed in the existing head works site belong to Kancheepuram City Municipal Corporation. The sites are free from encumbrances and there are no social impacts.</p> <p>No IR impacts.</p>	<p>All the sites are owned by ULB. All the sites are free from encumbrances hence no social impacts.</p> <p>No IR impacts</p>	<p>Proposed in SH & MDR and within the RoW. Hence no IR Impacts.</p>	<p>Distribution networks pipelines are proposed to existing pipeline (proposed to be abandoned) and HSCs will be transferred and provided afresh.</p> <p>No IR impacts.</p>	
Risk Assessment	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk

5.15 Social Screening Survey

The social screening survey was carried out on 20-02-2023 to identify the social impacts in the project. This include screening of all the project sites proposed and existing ones to be utilised for the project.

To identify the social impact the following screening processes were involved:

- Reconnaissance of the sub-project areas and their surroundings;
- Discussion with the residents in the locality;
- Identification of the major sub-project activities, and
- Preliminary assessment of the impacts of these activities on the ecological, physico-chemical, and socio-economic environment of the sub-project surrounding areas
-

The outcome of the survey are as follows:

New construction will avoid/minimize involuntary resettlement impacts. There is no permanent/temporary land acquisition in the implementation of the subproject components. The length of the distribution system is 205 kilometers and the distribution is through AC and PVC pipes through the 10 existing OHT and 14 proposed OHTs reaching through 31,180 House Service Connections.

Visit to the source area at Thirupparkadal where the 3 collector wells and 4 infiltration wells are set up, and the OHT located 1.5 kilometer away reveals that there are no social impact. From the OHT to the Vegavathi booster sump located 25 kilometres away also no specific social impacts were observed as the pipelines are laid in the National highway therefore with no social impact on any specific groups.

Table 5.2 Identifying probable impact in the different project components

Sub Project Component	Details	Scope of Land acquisition and Social Impact
Extraction of water from the source at a distance of 35 kilometers upstream of Palar at Thirupparkadal	3 Collector Wells 4 Infiltration Wells Thirupparkadal of Palar District	No social Impact identified as most of the pipelines are proposed to be laid in the highway.
Existing OHT	10 OHT	No social impacts were identified
14 New OHT		
	Oli Mohammad	The site belongs to ULB. It is a vacant land. No issues identified.
	Viladi Kovil Theru	The site belongs to ULB. This site is in a main road in a residential area. This site has adequate space for construction of OHT.

	Ambedkar Nagar	<p>The site belongs to ULB.</p> <p>The site is in a residential area.</p> <p>There is a public toilet in the site.</p> <p>The OHT can be constructed without disturbing the public toilet.</p>
	Dharmalingeshwar	<p>The site belongs to ULB.</p> <p>This is the open space, located in the Collectorate ground.</p> <p>No issues for construction of OHT.</p>
	Vanavil Nagar	<p>The site belongs to ULB.</p> <p>This site is located near a canal, outside the canal boundary.</p> <p>No issues for construction of OHT.</p>
	Prathana Salai	<p>The site belongs to ULB.</p> <p>There is an anganwadi centre, PHC and a temple in the site proposed.</p> <p>There is also an existing OHT which is in dilapidated condition.</p> <p>It is suggested to demolish the existing OHT and construct the new one.</p> <p>As the area proposed in in the entrance (in front) of PHC and angawadi centre.</p>
	Arasunagar	<p>The site belongs to ULB.</p> <p>There is a park which is currently not in use. However, there are residential areas surrounding this site.</p> <p>It is suggested to conduct a public consultation process prior to implementation of the project.</p>
	Perasiryar Nagar	<p>The site belongs to ULB.</p> <p>This site is a park located behind a school; however, it is not functional.</p> <p>It is suggested to conduct a public consultation process with the school management committee (SMC) prior to implementation of the project</p>
	Vishnu Nagar	<p>The site belongs to ULB.</p> <p>This is a vacant land.</p> <p>There are two PHC in the locally. One is a newly constructed PHC and the other is a maternity clinic which is not functional because of lack of space.</p> <p>And because of the highway work there is a labout shed.</p> <p>However, there is enough space for setting up OHT.</p>
	Madura Mettur	The site belongs to ULB.

		This is a small and congested site surrounded by residential area. It is not an accessible area and hence it this site can be reconsidered. There is a need for public consultation for using this land.
	Thenambakkam Colony	The site belongs to ULB. There is an existing OHT and a functional Ration Shop. There is also adequate space and need for a new OHT.
	Periyar Nagar	The site belongs to ULB. There is an existing OHT which is functional. As this area is in the core city, there is an increased demand for water and hence this site can be considered. No issues identified.
	Mettu Colony	The site belongs to ULB. No issues identified
	Thirukkalimedu	The site belongs to ULB. This is a vacant land.

5.16 Public Consultations

Consultations with the Elected Representatives during DPR preparation.

Consultations during ESIA preparation

During the environmental and social screening for all the sites and alignments FGDs were held various locations and outcomes are summarised below.

Focus group discussion were conducted in areas where there were issues identified in the following settlements, (i) Prathana Salai, (ii) Arasu Nagar and (iii) Madhura Meetur.

- (i) In Prathana Salai, discussions were carried out with the Anganwadi Teacher, General public accessing the PHC. The participants suggested that they need an OHT because of water scarcity. However, they wanted the old OHT to be demolished and reconstructed in the same place as the old OHT and not in the newly proposed areas. The reasons cited were that the entrance for the PHC and anganwadi centre will be blocked and the children and patients will suffer during the construction work. Hence it was proposed to conduct a public consultation prior to the implementation of the project.

- (ii) In Madura Mettur, discussion with women in the area reveals that area is congested and not accessible and it is not ideal to construct an OHT. Therefore, the public requested for an alternate location for setting up OHT.
- (iii) In Arasunagar, discussion with residents reveal that there is an unused park in the residential area in the site located in a residential area. People wanted to have a public consultation regarding the usage of the park before finalizing the place. It is therefore suggested to conduct a public consultation

Consultation during Implementation

Consultation with stakeholders is a continuous activity throughout the project cycle for smooth implementation of the project. Hence KCMC has proposed to engage the stakeholders at relevant stages during construction and a strategy has been prepared and enclosed in Annexure 6.

CHAPTER 6 ANALYSIS OF ALTERNATIVES

6.1 Source for Proposed Water Supply Scheme

For the proposed water supply scheme Palar River is adopted as source of water supply. Thirupparkadal is located around 35 km from the project area.

Two alternatives were explored for sourcing water for this water supply project. Considering the pros and cons, second alternative has been chosen. The sources options and its pros & cons is explained in the following table.

Table 6.1 Analysis of Alternatives for Water Supply Source:

S.No.	Alternative No.	Description	Pros	Cons
1	Alternative 1	Drawing the required quantity of water from available local sources (Sevlimeedu, Orikkai & Thenambakkam) by proposing Infiltration wells	The source is very near, Located at the southern boundary of the city	Since the sand depth is in the range of 7m, only Infiltration wells can be proposed, which results in a increased numbers of construction of wells
2	Alternative 2	Drawing the required quantity of water from Thirupparkadal (At the Upstream of Ongoing Checkdam) by proposing Collector wells	Since the Proposed wells are located in the Upstream of Ongoing Checkdam, the potential and availability of water is ensured.	The Source is located 30kms from the city

6.2 Distribution System

Hydraulic design of distribution network has been carried out using Bentley's Water GEMS software. Water GEMS software is preferred as it possess several advantages over the other hydraulic modeling software (LOOP, EPANET etc.). The salient features of Water GEMS software include EPS (Extended Period Simulation), Optimization of Pipe Network, Terrain extraction for levels, Nodal demand estimation as per land use, Scenario Management, Cost & Energy estimation for the system, Criticality analysis for isolation segments, Visualization of model results as far design is concerned.

Hydraulic zoning has been done in the design of distribution system is to ensure that water is distributed effectively throughout the town with optimum service coverage of the service reservoir. Demarcating the operating Zones/ District Metering Areas (DMAs) for the town has been done considering various factors such as service reservoir location and capacity, population served and existing topography.

Considering the topography, physical barriers, land availability, Sixty Eight DMAs are proposed in Twenty Four Zones of water distribution systems for supplying water to the project area

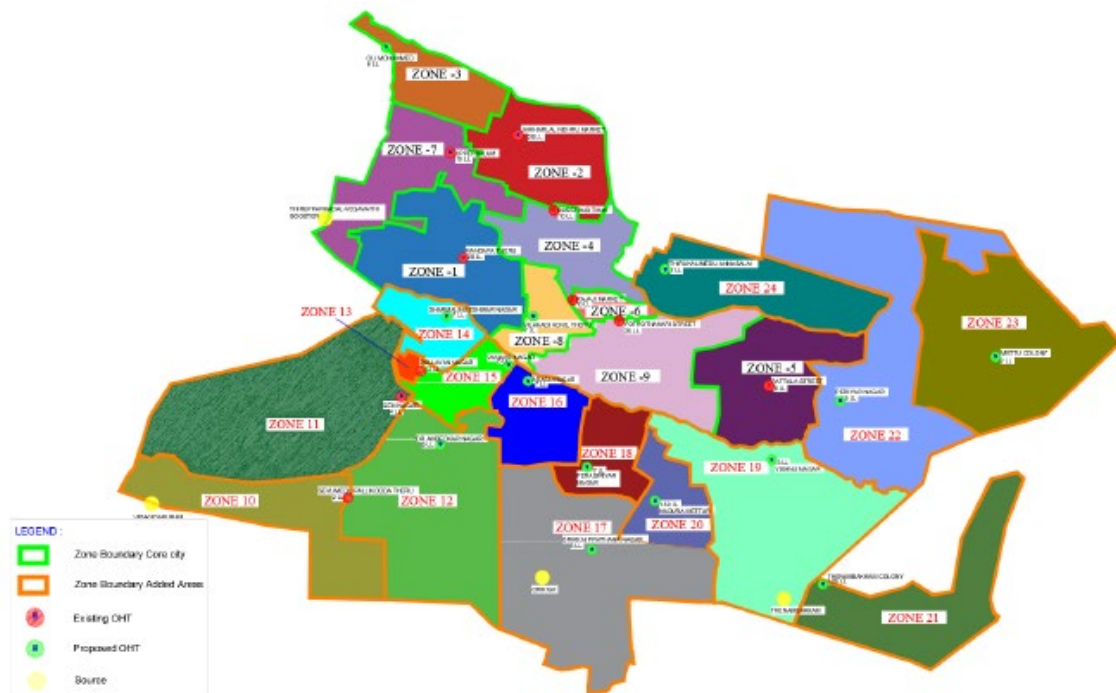


Figure 6.1 Figure showing proposed Zones with OHT Locations

6.3 District Metered Areas (DMAs)

One Hundred District Metered Areas (DMAs) have been proposed in entire project area. Details of DMAs in each zone are shown in table below. A total of One Hundred DMAs with Provisions for Bulk Meter, flow control valve and Sluice valves have been proposed.

6.4 Land Availability

Town Planning section of the ULB and consultants identified government vacant lands for the proposed water supply scheme. The lands records were verified and made site visit to all identified lands.

Alignment Option

The pipeline alignment from source to Kancheepuram city is about 30 kilometres, the alignments is finalised by avoiding NHAI roads. Hence, the permission from NHAI and resultant cost for laying across and along of pipelines is nil.

Tree cutting is avoided in this project.

CHAPTER-7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Objectives

The ESMP is developed to mitigate the adverse E&S risks and impacts of project providing improvements to existing water supply for Kancheepuram City Municipal Corporation. It explains the mitigation measures, responsibility, implementation phase, monitoring method, monitoring indicators and frequency during pre-construction, construction, operation and decommissioning phases. The Contractor supervised by KCMC is mainly responsible for the implementation of plans during the project life cycle. The project specific ESMP is provided in Table 7.1.

Table 7.1. Environmental and Social Management Plan
I - Environmental and Social Management Plan (ESMP)

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
Pre-construction phase							
1.1	Engineering design and alternative analysis	<p>All National/State Regulatory requirements shall be followed, and Guidances as applicable</p> <p>Ensure that the investigation and analysis of alternative engineering design and technologies, and the route location of the proposed pipeline network (the project) cause minimum environmental and social risk and impact during the project cycle;</p> <p>Ensure the activities like trenching, excavation, pipes joint welding result into minimum or no loss to ecosystem; and</p> <p>Alternatives in terms of cost effectiveness, low maintenance, minimum and area for pipeline route selected along the existing roads for the project will cause minimum E&S impact.</p> <p>For reducing energy consumption, evaluate use of low-noise and energy efficient pumping systems, efficient Pumping system operation, and Installation of Variable Frequency Drives (VFDs). Energy efficient lights, fans etc in all facilities will be considered.</p> <p>Construction of compound wall around project sites, chain-link mesh above with climbers and creepers are proposed to act as screen.</p> <p>Tree cover, shrubs having dense foliage (depending</p>	PIU/PMC, Contractor	Design/Pre-construction	Review the performance of design and technology and route decided for the project; and Consult the experts and learn from the experiences gained from such projects elsewhere	<p>Minimum E&S risk and impact;</p> <p>Minimum or no impact on local ecology, water bodies and forest;</p> <p>Minimum impact on land and local communities ; and cost effective and O&M efficient.</p>	Periodically

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		upon space availability) along the compound wall of project facilities is proposed.					
1.2.	Visual impacts	<p>Ensure that the design of the water pipeline causes no visual impact to the landscape, local scenery and sustain the aesthetic importance in project area;</p> <p>Ensure construction of pipeline without obstruction to natural topography and flow of water into / in the water bodies;</p> <p>Maintain limit on the outdoor security lighting for unobtrusive sight to people; and disturbance to biodiversity</p> <p>Make use of local material and appropriate construction techniques.</p>	PIU/PMC, Contractor	Design and construction phase	Review detailed layout plan; and site inspection	<p>Visual measures are addressed in layout plan; and</p> <p>No visual impact due to construction of structures at pumping house in project.</p>	Monthly
1.3	Utility relocation	<p>Identify the common utilities to be affected such as telephone cables, electric cables, electric poles, water pipelines, public water taps, etc; and</p> <p>Seek prior approval and inform the concerned agencies for utilities shifting before construction starts.</p>	PIU/PMC, Contractor/ Authority of concerned utilities	Pre-construction phase	Review detailed layout plan and site inspection	Utilities shifted in time where necessary	One time
1.4.	Permits and approvals	<p>Obtain all permits and approvals required for the Project during pre-construction, construction, operation and decommissioning phases.</p> <p>These shall be made available from the TNPCB, PWD, and other line departments including but not limited to National/State highways, Traffic, Police, Telecom, Electricity, etc and regulators of the State and Central governments as applicable and from ULBs.</p> <p>Obtain prior permission for tree cutting.</p>	PIU/PMC, Contractor	Before construction commences	Keep record of all permit, approvals and authorizations	Permits and approvals are available	One to two times

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		Ensure that all necessary approvals for construction to be obtained by contractor like labour licence / labour insurance are obtained before start of construction.	Contractor				
1.5	Source of Materials	<p>Obtain construction materials only from government approved quarries with prior approval of PIU/PMC.</p> <p>PIU/PMC to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval.</p> <p>Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit)</p> <p>No new borrow areas, quarries etc., shall be developed for the project;</p>	PIU/PMC, Contractor	Pre-Construction and Construction Phase	Records, approvals	Approvals available	Periodically
1.6.	Material storage and portable office cabin	<p>Storing the pipeline fittings and associated materials;</p> <p>Establish a suitable place for site camp at the start of the civil works, which will allow for site offices may/may not be as safe portable cabin with toilets and rest areas.</p>	Contractor/ PIU/ PMC	Pre-construction	Site inspection	<p>Location and its access; and</p> <p>Basic facilities and civic amenities.</p>	Semi-annually
1.7.	Labour accommodation and facilities	<p>Identify the suitable building in terms of location, sufficient area, access, security, basic amenities, etc.</p> <p>Follow all relevant provisions of the Contract Labour (Regulation and Abolition) Act, 1970, Good International Industry Practices, the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act (Central),1996- and State Rules, ILO</p>	Contractor	During Pre-construction	<p>Visual inspection;</p> <p>Consultations with labour, and local communities nearby;</p> <p>Site inspection;</p>	<p>All the facilities available as per law and standards;</p> <p>Assess the satisfaction</p>	Every day

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>convention 62-Safety provisions (Building) Convention and applicable laws for rented labour accommodation;</p> <p>The location, layout and basic facility provision for labour accommodation will be reviewed by the Project Engineer / PIU and suggestions to be communicated to the contractor prior to the construction;</p> <p>Maintain necessary living accommodation and ancillary facilities in functional, safe and hygienic conditions;</p> <p>Provide adequate number of toilets and bathing area (separate for females/males), kitchen, safe fuel/ LPG for cooking and uncontaminated water for drinking, cooking and washing;</p> <p>Drinking water provided to the labourers shall be tested 3 monthly;</p> <p>Cooking shall be in a separate area: no cooking shall be permitted inside rooms;</p> <p>Prohibit employees from cutting of trees for firewood; fire wood not allowed;</p> <p>Labour accommodation and temporary shade near work sites shall provide protection from heat, rain, flooding, insects, snakes and mosquitoes. It should have adequate provisions for emergency such as accidents, disasters, fire safety, security, etc;</p> <p>Adequate health care is to be provided for the workforce;</p>			<p>Facilities made available;</p> <p>Type of illness and its causes; and</p> <p>Discussions about the level of health awareness and safety precautions taken by the workers while working on the work site.</p>	<p>level of labourers;</p> <p>Cordial relation between labour and local communities ;</p> <p>Easy access of first-aid box with required medicine and accessories at each working site, labour accommodation, labour and office to workers all the time; and</p> <p>Arrangement made with the Doctors at the nearest government</p>	

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>Ensure adequate water supply in all toilets and urinals; Provide separate toilets/ bathrooms for women laborers and shall be screened from those for men and marked in vernacular language.</p> <p>The contractor shall provide separate garbage bins for wet and dry waste in the camps and ensure that these are regularly emptied, treated and disposed off in ULB SWM facilities as per regulations.</p> <p>Provide first aid medical kit at labour accommodation, temporary labour shed and work site; train the labour for usage of items in case of injury, emergency, coordinate with nearest government and private medical centers and tie-up for the medical services, display the contact number of ambulance service, medical doctor(s) and keep a vehicle for emergency travel all the time;</p> <p>As per provisions of WHO and MOHFW guidelines of COVID-19, sanitizer, soap, mask, etc. should be made available in sufficient quantity and its use by the workers mandatorily and maintain social distancing all the time;</p> <p>Ensure medical tests and treatment of COVID-19 positive cases immediately; and</p> <p>Maintain the required data and documents at site and regularly submit the compliance report to the PIU.</p>				health and medical center/ private clinic.	
1.8	Public disclosure	Ensure timely and full project information dissemination through distribution of prior notice, pamphlet in local language, oral communication, meetings, websites, etc.	PIU/PMC, Contractor	Pre-construction	No of Consultations carried during the months	Methods used for public	One time

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
				phase/continuous		disclosure; and Project awareness.	
1.9	Grievances redressal system	<p>Establish the efficient grievance redressal mechanism and accordingly constitute the grievance redressal committee (GRC) as outlined in the ESIA project level with representatives of all the stakeholders as members, including women and vulnerable groups of local communities;</p> <p>Ensure the wider publicity of procedure, functioning and availability of GRC since the inception of the project;</p> <p>All the grievances received shall be acknowledged and proper recording and tracking should be carried out;</p> <p>GRC will adjudicate the complaints in 6-8 weeks depending upon the severity of case;</p> <p>Convenor will be the coordinator for organizing GRC meetings as required, writing the proceedings, minutes of meeting, informing the aggrieved party about the decision of GRC, etc;</p>	PIU /PMC, Contractor	Project life cycle	<p>Review the proceeding and minutes of meetings; and</p> <p>Consultations with the members of GRC.</p>	<p>GRC established;</p> <p>GRC meetings held;</p> <p>Number of cases received and resolved;</p> <p>Decision taken within a timeframe; and</p> <p>Court case filed or withdrawn.</p>	Monthly or as required
1.10	Sensitive Areas	The sensitive areas like Schools, hospitals to be provided with suitable noise barriers and safety measures, prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement during construction and their effectiveness to be checked.	PIU/PMC, Contractor	Pre-construction phase	Site inspection	<p>Location and its access; and</p> <p>Basic facilities and civic amenities.</p>	Periodically

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
Construction and operation phases							
2.1.	Labour mobilization	<p>Obtain site management and labour plan approval from the Engineer/PIU; and</p> <p>Accordingly, mobilize the labour on worksite for the laying of pipeline, OHTs, and construction of headworks, pipe carrying bridges, etc.</p> <p>Contractor shall prepare a Labour Management Plan which shall be reviewed by the Engineer in charge of PIU and approved.</p>	Contractor, PMC/PIU	Construction phase	Review site management and labour plan; and Site inspection	Number and date of labour mobilization; and Date of starting works.	Periodically
2.2	Appointment and Mobilization of Environment & Safety Officer	<p>The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will be mobilized prior to start of works.</p> <p>ESO will dedicatedly work and ensure implementation of Environmental Management Plan including Occupational, Health and Safety measures and report during the project implementation and O&M.</p>	Contractor	Pre-Construction Phase	Review reports and records	No compliance at site	One time
2.3	Submission of updated environmental & social management plan (ESMP)/ ESMP implementation and reporting	<p>Contractor shall prepare contract and site specific ESMP including : For OHTs near parks, schools etc, location wise Occupational Health & Safety, Community Health & Safety plans shall be prepared by the contractor as part of the updated ESMP.</p> <p>Site specific Hazards may be identified prior to start of works shall be done and be included in the updated ESMP.</p> <p>Contractor to prepare SEP, LMP, WMP as required.</p> <p>Contractor to carry out HIRA /Hazard identification before starting works, OHS, Waste & sludge Management, Plan, trainings, green belt for all facilities, work permit for</p>	Contractor/ PMC	Project cycle	Review of reports and records	Compliance at the site	One-time / As and when need arises

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>excavations, work under water including lighting, type of PPEs & hazard assessment, confined spaces work on heights, trench/ excavated area management, lighting, restoration of roads after laying pipes, flag men, and lighting for large equipment's, works under / near water. All workers staff to be trained in OHS during emergencies & heat waves.</p> <p>Submission of updated ESMP to the PIU/PMC prior to start of construction.</p> <p>Supervisor to ensure ESMP implementation.</p> <p>Timely submission of monthly monitoring reports including documentary evidence on ESMP implementation such as photographs.</p>					
2.4.	Site clearance and tree cutting	<p>Identify the number of trees that will be affected with girth size and species type. Avoid tree cutting and loss of vegetation, shrubs, grasses, etc. to the maximum extent possible;</p> <p>Trees where necessary shall be removed from the construction site before commencement of construction with prior permission from the concerned department and other authority as applicable;</p> <p>Compensatory plantation for every tree cut by way of re-plantation at ten times the trees cut;</p> <p>Growth and survival of trees planted shall be ensured and monitoring should be conducted at least for 3 years. Survival rate of plants shall be reported to the PIU/PMC on monthly basis;</p>	Contractor, PIU/PMC	Construction phase	Review site management and labour plan; and Site Inspection.	<p>No tree cutting Minimum vegetation loss;</p> <p>Number and species of trees cut and replanted; and</p> <p>Survival of number and species of trees planted.</p>	Monthly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		Contractor shall develop plantation program for the site					
2.5.	Site preparation	<p>Disturbance to land surface contours to be kept to minimum;</p> <p>Maintain the natural drainage pattern existing onsite;</p> <p>Adequate drains and slopes to be laid across the proposed project site prior to start of excavation work to ensure adequate cross drainage; and</p> <p>Ensure that the earmarked operational area for laying of pipeline and OHTs is barricaded with specific access (entry and exit) points.</p> <p>Barricading of the earmarked sites, besides the safety, will limit the disturbances or construction impacts to the adjacent areas within the premises.</p> <p>Necessary precautions such as bracing / shoring in the trench will be provided for trenches of more than 1.2 m deep or as required based on site conditions.</p>	Contractor, PIU/PMC	Beginning of construction	Site inspection	<p>Natural drainage maintained; and</p> <p>Minimum excavation for drainage and levelling</p>	One time and periodically
2.6	Site Camp	<p>Locate the suitable place for site camp at the start of civil works for the labours at a place approved by the PIU;</p> <p>Provide water and/or other facilities at the site camp;</p> <p>Establish a suitable safe site office that may/may not be in portable cabin at the start of the civil works in the land provided; and</p> <p>Designate the area beyond the boundary of the site as No-Go areas for all personnel on site.</p>	Contractor, PIU/PMC	Prior to start of construction	<p>Review approved site camp and site office layout; and</p> <p>Site inspection</p>	Approved site plan layout; and Area outside the site camp and site office designated as No-go area.	Once

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		No vehicles, machinery, materials and people shall be permitted in the No-Go area at any time without the permission.					
2.7	Barricading working site	<p>Ensure that the construction site should be barricaded at all time with adequate marking, flags, reflectors, adequate lighting etc. to isolate it from other operating areas; and</p> <p>Barricade the pipeline route and identified construction areas at OHT sites prior to construction activities.</p>	Contractor	Prior to start of construction	Site inspection	Proper barricading in place; and Accident or casualty reported	One time
2.8	Stakeholder consultations	<p>Undertake detailed mapping and analysis of key stakeholders. Based on the stakeholder analysis, stakeholder engagement plan is prepared that will be updated as required;</p> <p>Ensure that stakeholder including impacted persons are consulted and made aware about the project's purpose, risks/ impacts, mitigation measures and time- frame; and</p> <p>Maintain the records and documentation of the procedure followed and the output of stakeholder engagement.</p>	Contractor/ PIU/PMC	Construction phase	Consultations with local communities, beneficiaries, and other stakeholders	<p>Awareness level of stakeholders, particularly the local communities , beneficiaries of the proposed water supply; and</p> <p>Perception of local communities, about the project and its impact and mitigation measures.</p>	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
2.9	Traffic management	<p>Route for use by construction traffic within site to be planned with proper signage, flagman, barriers and safety to minimize encountering of workers with vehicles as per National Road Safety Policy 2010. Route for movement of heavy machinery shall be designated to avoid the soil compaction in other areas;</p> <p>All vehicles deployed at site shall be certified for pollution under control (PUC), undertake regular maintenance of vehicles; and drivers shall have valid driving licence and not under intoxication during any work activity</p> <p>Transportation of construction material shall be as much as feasible scheduled in night when the traffic is minimum; or else have adequate traffic management ensured with the help of Traffic Police and additional flagmen/support</p> <p>Holding area shall be provided within the site for vehicles waiting to deliver loads at site to avoid queuing outside the site;</p> <p>Ensure that the vehicles follow speed norms of the traffic department; and</p> <p>Investigate and respond to complaints about traffic.</p>	Contractor, PIU/PMC	Construction phases	Review traffic management plan; and Site inspection	<p>Implementation of traffic management plan adequately;</p> <p>Number of complaints received; and</p> <p>Incidence of accidents</p>	
2.10	Accessibility to adjacent land uses	<p>Leave spaces for access between mounds of soil / material to maintain access to the houses / properties; access to any house or property shall not be blocked completely; safe alternate arrangements, at least to maintain pedestrian access at all times to be provided</p> <p>Provide pedestrian access in all the locations; provide safe wooden/metal planks with safety rails over the open</p>	Contractor, PIU/PMC	Construction phases	Site Inspection	Number of grievances received	Periodically

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>trenches at each house / facility to maintain the access, and ensure its usability and safety at all times.</p> <p>Inform the affected local population about the work schedule a week before, and a day before to start of work</p> <p>Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.</p> <p>Keep the site free from all unnecessary obstructions;</p> <p>Notify affected public-by-public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/complaints.</p> <p>At work site, public information/caution boards shall be provided including contact for public complaints</p>					
2.1 1.	Construction material and machinery	<p>Modern machineries such as JCBs, poclain, road roller, etc. shall be used to increase work efficiency and minimize the construction period; Usage if such equipment shall follow all safety norms esp. near schools, traffic, and shall be supported by trained flagmen with whistles etc.</p> <p>Ensure that material transported is properly covered with Tarpaulin, etc. or sprinkled with water as required</p> <p>Schedule material deliveries after daylight hours; and</p> <p>Identify and repair minor leaks and prevent machineries/equipment failures.</p>	Contractor, PIU/PMC	Construction phase	Review the material procurement detail; and Site inspection	<p>Noise level and working of heavy machineries in order; and</p> <p>Construction material and its transportation follow the norms.</p>	

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
2.1 2	Construction material storage	<p>Ready mix concrete (RMC) may be outsourced and contractor shall identify designated covered area for storage of construction material such as pipeline fittings, etc. with proper marking and measures to avoid dust emissions; and impact of submergence/floods</p> <p>Construction material stored in open shall be covered in order to avoid wind-blown dust emissions;</p> <p>Ensure and maintain record of proper stacking, loading and unloading of material and provide sufficient space for the movement of heavy vehicles inside the yard;</p> <p>Ensure handling the construction material safely by the labour;</p>	Contractor, PIU/PMC	Construction phase	<p>Site inspection; and</p> <p>Review the material record maintained.</p>	<p>Clean and organized storage site; and</p> <p>Incidence of injury in loading, unloading and handling the material.</p>	Periodically
2.1 3	Construction of Head works	<p>No appreciable change to the river course shall occur due to diversion channel and intake structures.</p> <p>The cofferdam shall be provided for construction of head work without any disturbance of river water flow.</p> <p>Ensure that the stream is not obstructed, affecting the downstream users due to cofferdams, or any disturbance due to works etc.</p> <p>Establish the baseline water quality prior to initiation of construction and to be periodically monitored.</p> <p>After completion of work, ensure the restoring of river bed to its natural shape free from any debris or construction junk material that may obstruct the flow.</p>	Contractor, PIU/PMC	Construction phase	<p>Site inspection; and</p> <p>Review the material record maintained.</p>	<p>No appreciable change to the river course.</p> <p>Number of complaints received;</p>	Periodically
2.1 4	Construction works (concrete,	Use ready-mix concrete outsourced for the works on OHTs to the maximum extent possible; and	Contractor	Construction phase	Site inspection	Incidence of mixing concrete on	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
	Cement, etc.)	If required, ensure that cement is mixed on mortar boards or other impermeable surfaces and not directly on the ground				working site; Visible concrete on site; and Contamination of water and soil.	
2.15	Top soil protection	<p>Topsoil removed prior to commencement of construction activities shall be stored (stockpile not higher than 2 meter) separately and reused for backfilling and landscape development within the project area;</p> <p>Keep topsoil stockpiles in an area protected from the wind and water;</p> <p>Land disturbance shall be restricted to the footprint of the project components and remaining area will be kept undisturbed to the extent possible;</p> <p>Ensure suitable control of run-off during the construction phase to prevent erosion of topsoil on adjacent land and undeveloped portions of the site; and</p> <p>All excavations should be closed at the earliest before the start of rainy season.</p>	Contractor, PIU/PMC	Construction phase	<p>Site inspection; and</p> <p>Assessment of disturbed (project components construction area) and undisturbed area.</p>	<p>Incidence of erosion;</p> <p>Storage and uses of top soil; and</p> <p>Topsoil erosion on adjacent land.</p>	Regularly
2.16	Noise from vehicles and machineries	<p>Servicing of all vehicles, machinery, power generating equipment shall be done regularly as per the manufacturer's guidelines and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced;</p> <p>All machines to be used shall conform to the relevant</p>	Contractor, PIU/PMC	Construction phases	<p>Review of monitoring records</p> <p>Random Noise measurements</p>	<p>Level of noise generated; and</p> <p>Number of registered complaints</p>	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>Indian Standards (IS), will be free from patent defect, kept in good working order, properly maintained and inspected regularly;</p> <p>Acoustic enclosure measures will be provided during operation to reduce noise level of machinery and DG set;</p> <p>Construction activities shall be carried out in a planned manner restricting high noise generating construction activities only during daytime;</p> <p>Contractor will maintain the proper record for all the construction vehicles which shall have the valid fitness certificate, NOC, insurance, etc.</p> <p>Ensure noise levels within the permissible limit; Regular monitoring of noise shall be conducted at sites during the operations of machines and equipment; and Technicians/mechanics working on noise generating machineries will use PPEs such as ear plug, muffler, etc.</p>					
2.1 7.	Dust emissions	<p>Avoid clearing of vegetation unless absolutely necessary;</p> <p>Trucks carrying construction material shall be adequately covered with tarpaulin sheet to avoid the dust pollution and the material spillage;</p> <p>DG set shall have adequate stack height as per TNPCB requirement;</p> <p>Dust levels will be controlled, through spraying of water where feasible from water tankers fitted with pressurized fine spray;</p> <p>Maintain all generators, vehicles, vessels and other</p>	Contractor	Construction phase	<p>Site inspection;</p> <p>Incidence of dust plumes; and</p> <p>Review of dust emission control measures.</p>	<p>Emission from construction site;</p> <p>Incidence of dust plumes observed;</p> <p>Dust mitigation measures followed; and</p>	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>equipment in good working order to minimise exhaust fumes; and</p> <p>Locate soil stockpiles in sheltered areas where they are not exposed to the erosive effects of wind, water/floods.</p>				Number of complaints received.	
2.18.	Air quality	<p>Maintain all vehicles, DG sets/generators and other equipment in good working condition to minimise GHG emission, exhaust fumes, etc.;</p> <p>Avoid excavation, handling and transport of materials which may generate dust under high wind conditions or when a visible dust plume is present;</p> <p>Water sprinkling, cover dumping and stockpiles of loose material with plastic sheets or nets, particularly in windy conditions should be used to reduce airborne dust at construction sites; and</p> <p>Prevent burning, fire, use of wood for cooking in the project sites to avoid air contamination.</p>	Contractor	Construction phases	<p>Site inspection;</p> <p>Incidence of air pollution; and</p> <p>Review of fuel emission control measures.</p>	<p>Fuel emission from vehicles;</p> <p>Air pollution mitigation measures followed; and</p> <p>Number of complaints received.</p>	Regularly
2.19	Measures of handling existing Asbestos Cement pipes	<p>Contractor shall ensure that the existing asbestos cement pipes are not disturbed during construction. In case any need arises during construction,</p> <ul style="list-style-type: none"> Asbestos management plan shall be prepared by the contractor in line with the Hazardous wastes management rules, 2016 and got approved from PIU. Labourers shall be made fully aware of the risks involved and be provided training to handle hazardous wastes. 	Contractor, PIU/PMC	Construction phases	<p>Site inspection;</p> <p>Review of measures and records</p>	Incidence of damage to AC pipes	Regularly
2.20.	Underground water	Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a manner that spillage of fuels and lubricants will not contaminate the ground water.	Contractor	Construction & operation phases	<p>Site inspection; and</p> <p>Review of spillage control</p>	Fuel or lubricant spillage; and	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>Workforce will be trained about environmental pollution aspect and activities should stop immediately and resume only when problem is resolved; and</p> <p>Faulty equipment, vehicles and other source of possible oil and lubricant contamination should be repaired on priority and must be kept in good condition all the time.</p>			measures	Underground water pollution mitigation measures followed.	
2.2 1	<p>Protection of lakes/ water bodies/</p> <p>Surface water quality</p>	<p>Contractor shall ensure that all vehicle/ machinery and equipment operation, maintenance and refueling will be carried out in such a manner that spillage of fuels and lubricants will not contaminate the waterbodies and construction of pipe carrying bridges across the rivers/ waterbodies;</p> <p>Storage of fuel and lubricants shall be away from waterbodies.</p> <p>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>Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;</p> <p>Waterbodies need to be cordoned off by using protective barriers such as green cloth and subsequently plantation; and</p> <p>Install temporary silt traps, oil traps, or sedimentation basins, swales along the water leading to the water bodies;</p> <p>Dispose any wastes generated by construction activities</p>	Contractor	Construction phases	Site inspection; and Review of spillage control measures.	<p>Fuel or lubricant spillage; and</p> <p>Changes in water quality</p> <p>water pollution mitigation measures followed.</p>	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>in designated sites as per C&D Waste Management Rules, 2016;</p> <p>Construction works shall be restricted during the monsoon seasons.</p> <p>Conduct surface water quality inspection in line with the Environmental Monitoring Plan</p> <p>In case of waterlogging, water shall be pumped out during the construction of pipelines., with adequate safe precautions to workers, communities</p>					
2.2 2	Measures for pipe carrying bridges	<p>Pipe carrying bridges are proposed across River Palar and River Vegavathi for conveying the transmission mains. Following measures shall be ensured to prevent any impact on the surface water quality during construction.</p> <ul style="list-style-type: none"> • The pipe carrying bridges shall be constructed during non-monsoon period. • Adequate care shall be taken to avoid deposition/ disposal of construction waste / accidental spillage of construction material into the river. • While laying the foundation for piers, coffer dam shall be constructed for each pier foundation in order to provide water free regime for speedy construction of piers for pipe carrying bridge. • Supporting piers for pipe carrying bridge shall be designed not to obstruct the flow. • Foundation of pillars shall not be above the bed level. 	Contractor	Construction phase	Site inspection; and Review of measures.	<p>Changes in water quality</p> <p>water pollution mitigation measures followed.</p>	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<ul style="list-style-type: none"> Personal protective equipments (also suitable for works in and under water) shall be ensured to the labourers and supervising officials. Labourers shall be provided with periodical health checkup and training on emergency preparedness. On completion of pier construction, coffer dam shall be removed and river bed shall be restored to its original condition. <p>Permission shall be obtained from PWD and any other authority as required for construction of Pipe Carrying Bridges and conditions stipulated therein shall be complied with during construction.</p>					
2.2 3	Protection of archaeological and heritage sites Work near temples	<p>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 OHTs. There are several temples and other religious sites in the project town. In addition, there are seven protected monuments within the project town. None of the sites identified for construction of OHTs fall within the regulated boundary of the monuments. However, a section of the proposed pipeline alignment for feeder main (1.314km) for three existing OHTs and distribution network (29.84Km) near the monuments fall within the regulated boundary. Applicable permission shall be obtained prior to start of construction in the relevant sections and conditions if any would be complied.</p> <p>During construction adequate precautions will be taken not to cause any disturbance to the temples and other religious structures. It shall be ensured that issues like</p>	Contractor, PIU /PMC	Construction phases	Site inspection; and Actions taken by the workers, PIU and ASI.	Discovery of archaeological/ paleontological material; Level of awareness among workers; and Protection and reporting of identified material when discovered.	When occurrence of chance finding

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>vibration impacts, dust and safety, other pollution issues are not caused to such structures.</p> <p>Further during construction if any chance finds encountered, then necessary management measures as identified in the ESMP would be implemented to ensure they are protected and conserved.</p> <p>Construction contractors follow these measures in conducting any excavation work.</p> <ul style="list-style-type: none"> • Contractor will prepare a work plan for heritage areas before start of work/any activities. • Conduct training to impart knowledge and Create awareness among the workers, supervisors and engineers about the significance of archaeological, paleontological and geological aspects and the applicable AMASR Act 2010 and Indian Treasure Trove Act, 1878 and chance found during excavation work. • The fossils, coins, articles of value of antiquity, human skeletal and other remains or things might be exposed during construction activities. In such situation, stop the work, do not remove and damage any article • Stop work immediately to allow further investigation if any finds are suspected and take any action they require to ensure its removal or protection in situ. • Inform the concerned authority (Archaeological Survey of India) immediately to take-action per referred Act and recommence the work after receiving written permission; and Also, prevent any 					

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>type of impact on the cultural heritage, monument, etc.</p> <ul style="list-style-type: none"> Chance found flora, fauna shall be immediately reported to Engineer and concerned officials & actions suggested by them shall be taken and report submitted to PIU 					
2.24	<p>Safety of workforce</p> <p>Occupational Health - facilities to the labourers</p>	<p>Adequate precautions shall be taken to prevent the accidents from the machineries. All machines shall confirm to the relevant Indian Standards Code and shall be regularly inspected for its working condition; Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil.</p> <p>Provide job specific safety induction training, including environmental awareness and ensure daily toolbox talk to workers at the working area;</p> <p>Technical experts / design engineers to Check if discharge / supply pipes are as per specifications, and review any chances of burst. Awareness shall be given to workers and road/road side users on such safety aspects. Design changes should be approved prior to implementation Design changes need to be validated and signed off by engineer Pressure testing procedure should be approved by supervising Engineer Excavations to be backfilled prior to testing or barricaded to keep out members of the public</p> <p>Ensure availability and mandatory use of PPEs at the site;</p> <p>Use of protective footwear and protective goggles by the workers involved in mixing of materials like cement, concrete etc. at sites;</p>	Contractor, PIU/PMC	Construction phases	Site inspection; and Observation of workers with PPE and safety measures while working on work site.	<p>Quantity and timely supply of PPEs;</p> <p>Awareness level about the use of PPEs; and Incidence of injury, accident, infirmity.</p>	Everyday

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>Use of earplugs by the workers exposed to loud noise, and those engaged in crushing, compaction, concrete mixing operations;</p> <p>Ensure sufficient quantity of all PPEs, necessary safety appliances such as safety goggles, helmets, boots, safety belts, ear plugs, mask, etc. to workers and staffs;</p> <p>For workers working at elevated levels (@6 feet) like in OHTs, ensure adequate fall protection system like guardrails, equipments including safety harness, safety nets etc and safe working platform are provided.</p> <p>Adequate measures and care to be taken while approaching any open water bodies for construction of bridges. Ensure railing around such sites are intact and in good condition; and</p> <p>The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) and applicable laws of India and Tamil Nadu state as applicable.</p> <p>All labourers shall be provided periodical training on day to day work, equipment handling, emergency preparedness, managing heat stress during construction.</p> <p>Contractor shall have tie-up with nearby hospitals for periodical health checks of the labourers and for emergency.</p>					

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>Names of such hospitals be displayed at prominent location.</p> <p>Health check up of all newly appointed staff be done once through these hospitals followed by 6 monthly check up.</p>					
2.25	Work-zone safety Management	<ul style="list-style-type: none"> • Temporary barricades shall be provided to delineate construction zone as well material stacking areas. The construction site and the labour facility shall be appropriately barricaded to prevent entry and accidental trespassing of workers, staff and others into the construction sites. • Ensure adequate fall protection system like guardrails, safety nets etc and safe working platform are provided. • All operational areas shall be access controlled. Watch and ward facilities at all times shall be provided by the contractor. • Adequate signages shall be provided indicating the work and type of precautions required. • Proper retro reflective warning signage will be installed on the access road next to the construction site about movement of construction machinery and vehicles. • In excavations for longitudinal surface road drains, culverts etc., a high visibility warning and retro reflective signage shall be displayed in vernacular language and English. • Entry of unauthorized persons should be prevented. 	Contractor, PIU/PMC	Construction phase	Site inspection	<p>Availability of safety measures</p> <p>Absence of safety Incidents</p>	Every day

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<ul style="list-style-type: none"> • Excavations will be adequately barricaded and well lit – with signages/info boards. • There shall be adequate lighting arrangement at night and adequate barricading to prevent mishaps after construction activity ceases for the day. • A readily available first aid unit with necessary supplies, drinking water, resting shed, sanitation etc shall be made available in every work zone. • On Confined Spaces (all confined spaces as may be required for laying pipes, or utility shifting or crossing other utilities, works under river): • Contractors shall identify, assess and manage the risk of entering and working in a confined space or in oxygen poor environments. Including the following: <ul style="list-style-type: none"> - Signage on the confined spaces - A Confined Space Register - Confined space entry permit system - Carrying out a confined space entry risk assessment before entering - Safe entry and exit points <ul style="list-style-type: none"> - Hazards and controls when working in the confined space including Ventilation (natural and mechanical) - Safe emergency response procedures including the need for an emergency rescue plan tailored for each entry into a confined space and that is focused on allowing safe recovery without putting the responder at risk - Training and competency 					

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<ul style="list-style-type: none"> - Isolation of potentially hazardous services (like water, gas, electricity etc.) prior to entry - PPE such as Self-Contained Breathing Apparatus (SCBA) - Air testing and monitoring before entry and then during the work - Communication protocols - Undertake targeted awareness using appropriate language and formats on entering and working in confined spaces 					
2.2 6	Removal of rock during excavation	<p>(i) During excavation for works, wherever removal of rock is identified, alternatives like drilling and chiselling, controlled blasting etc will be examined and the suitable technology shall be finalised depending upon the site conditions. Following measures for ensuring safety shall be ensured during controlled blasting.</p> <p>(ii) Carryout controlled blasting in consultation with PIU so that blasting activities with the least potential to generate impacts are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors.</p> <p>(iii) Permission shall be obtained from The District Collector for controlled blasting for excavation. Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation.</p> <p>(iv) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan.</p> <p>(v) Blasting shall be done through a licensed Explosive Contractor only</p> <p>(vi) For controlled blasting, explosives including blasting caps shall be transported to the blasting site only through exclusive vehicle in safe manner in</p>	Contractor, PIU/PMC	Construction phase			

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage.</p> <p>(vii) Cost for implementation of mitigation measures and liability are the responsibility of contractor.</p> <p>(viii) Proper prior notice will be issued to the Residents before Commencing project activity works Schedule</p> <p>(ix) Proper information will be Given to Police Officials</p> <p>(x) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic.</p> <p>(xi) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast.</p> <p>(xii) Contractor shall ensure necessary precautions / protection (like excavated earth, sand-filled bags, etc) to reduce noise levels, etc., Sites shall be provided with necessary shields all around.</p> <p>(xiii) Minimum Explosive will be used for Control Blasting for Residential areas</p> <p>(xiv) After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation.</p> <p>(xv) The contractor shall be responsible for any and all damage to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with his use of explosives.</p> <p>(xvi) The contractor shall do the activities after obtaining the blasting permission from District Collector.</p>					

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>(xvii) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from KCMC and traffic police.</p> <p>(xviii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the pipeline alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts.</p>					
2.27	Exposure to electrical equipment	<p>The Contractor shall take all required precautions to prevent danger from electrical equipment at pumping room, etc. and ensure that:</p> <p>No material will be so stacked or placed as to cause danger or inconvenience to any person or the public;</p> <p>All necessary fencing and lights will be provided in construction area;</p> <p>Deactivation and proper grounding of live power equipment and distribution lines to be ensured before initiating work;</p> <p>All energized electrical devices to be marked with warning signs. Use the symbol of danger as warning of high electricity voltage or current flow on cable boxes or where required to avoid any incidence of current shock or electrocution; and</p> <p>Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits.</p>	Contractor, PIU/PMC	Construction phase	<p>Site inspection;</p> <p>Observation of power supply system; and</p> <p>Electricity safety precaution taken by workers while working on work site.</p>	Incidence of current shock, injury, electrocution	Daily

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
2.28	Fire Safety	<p>Ensure that no fires are permitted on or adjacent to site;</p> <p>Ensure that no smoking is permitted on the working site;</p> <p>Ensure that sufficient and certified fire fighting equipment are placed and maintained on the site;</p> <p>Equip all fuel stores and waste storage areas with fire extinguishers;</p> <p>Ensure that all workforce and staff on site are aware of the location of fire fighting equipment on the site; and</p> <p>Conduct training program on use of extinguishers, sand, etc. for fire-fighting and ensure that they are trained in its operations.</p>	Contractor	Project life cycle	<p>Inspect Attendance register for fire fighting training conducted; and</p> <p>Observation of fire extinguishers and certificate at the sites.</p>	<p>Number of Fire incidents;</p> <p>Certified extinguishers in appropriate locations; and</p> <p>Workers knowledge to operate the fire extinguisher</p>	When required
2.28	Emergency response to manage cyclone and other disaster conditions	<p>Contractor shall ensure efficient communication system in place which will be required during occurrence of any natural / manmade hazard;</p> <p>Evacuation plan shall be in place for the site;</p> <p>Evacuation plan or route is displayed clearly through signs or picture at prominent places within the sites;</p> <p>Ensure effective coordination within the workforce and concerned departments and display contact number of concerned persons at prominent places; and</p> <p>Conduct training program and mock drills to workers to deal with the disaster situations due to occurrence of cyclones and tsunami.</p>	Contractor, PIU/PMC	Project life cycle	<p>Inspect attendance register for training program; and Inspect fire extinguishers and certificate</p>	<p>DMP in place;</p> <p>Communication system inexistence;</p> <p>Display of evacuation route;</p> <p>Capacity of workers to manage; and</p> <p>Disaster and emergency situations</p>	When required

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
2.29	Demolition of existing structures from proposed OHT site (if required)	<p>Prior to carrying out any building demolition, detailed building appraisal by means of surveys and appropriate assessments shall be carried out.</p> <p>Safe Screens and covered walkway is to be provided for protection of the public during the demolition of buildings to isolate the demolition site from the public, & prevent dusts, falling objects and preventing unauthorized access and trespassing.</p> <p>Metal scaffolds may be used for top down demolition. Both bamboo scaffolds and metal scaffolds may be acceptable provided that they are erected according to the Construction Sites (Safety) Regulations and the codes of practices on scaffolding safety.</p> <p>Concrete breaking, handling of debris and hauling process are main sources of dust from building demolition. Dust mitigation measures complying with the Air Pollution Control (Construction Dust) Regulations shall be adopted to minimize dust emissions.</p> <p>Silent type power mechanical equipment shall be used to reduce noise impact as much as practicable or possibilities of engaging man power with light dismantling tools with PPE are studied and engaged.</p> <p>Debris waste and other materials shall not be thrown, tipped or shot down from a height where they are liable to cause injury to any person on or near the site.</p> <p>Disposal of debris has to be controlled and to be reused in line with C&D Waste Management Rules 2016 as guided by & with due permissions from local authority. Wasted</p>	Contractor, PIU/PMC	Construction phases	Site Inspection; Review of waste management plan; disposal registers	Air quality, noise level;	When required

[illegible]

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
3.1	Site clearance and rehabilitation/ Post-construction clean-up	<p>Remove all construction equipment, vehicles, surplus materials, site office facilities, temporary fencing, structures and other items from the project site including source, pipe carrying bridges, OHTs and camps;</p> <p>Clean up and remove any spills and contaminated soil in the appropriate manner;</p> <p>Do not bury discarded materials on site or on any other land not designated for this purpose;</p> <p>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.</p> <p>Level the disturbed area and restore to a condition resembling its natural profile; and</p> <p>Ensure site is fully clean and tidy before the exit and prior to its handover to the officer of PIU and other authorized persons.</p>	Contractor	After completion of construction phase and operation phase	<p>Site inspection; and</p> <p>Review of record of activities upon completion of construction phase and commissioning phase</p>	<p>Restoration of construction sites in original condition; and</p> <p>Sites are fully rehabilitated prior to commissioning of project</p>	Weekly
4. Operation and Maintenance phase							
4.1	Operation and maintenance of distribution system	<p>(i) Get all required Permits for Operations</p> <p>(ii) Establish regular maintenance program, including:</p> <ul style="list-style-type: none"> Regular cleaning of grit chambers and lines to remove grease, grit, and other debris that may lead to water backups. Cleaning should be conducted more frequently for problem areas Inspection of the condition of storage reservoirs (OHT's) and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or 	KCMC	Operation and Maintenance phase	Site inspection	Nil grievances/ incidents	Regularly

S. No.	Aspect	Mitigation measures	Responsibility	Implementation phase	Monitoring method	Monitoring indicator	Frequency
		<p>seals; frequent line blockages; lines that generally flow at or near capacity; and</p> <ul style="list-style-type: none"> Monitoring of water flow to identify potential inflows and outflows To check for the probable fine silt that may go with water in future to be examined. <p>(iii) Develop an Emergency Response System for the water system leaks, burst and overflows, etc. Separate plan shall be developed for locations near heritage monuments.</p> <p>(iv) Provide all necessary personnel protection equipment to workers / O&M staff.</p> <p>(v) Prepare Safety plan in operating the network including Chemical handling and implement.</p> <p>(vi) Provide necessary training to the O&M staff in safe handling of the water supply system and maintenance activities.</p> <p>(vii) Carryout regular monitoring of the distribution water quality and in case of any quality concerns, treatment shall be ensured so that it is in line with Water Quality prescribed by authorities for use.</p> <p>(viii) Applicable permits if any applicable for the O&M activities shall be listed and be monitored for validity. (Source, chemicals handling, waste disposal, O&M contractor permits etc)</p> <p>(ix) Necessary ESHS measures to be included in the O & M contract scope.</p> <p>(x) Contractor shall report to PIU every quarter or as required on water quality & EHS during O&M</p>					

I - Monitoring and Evaluation

The E&S experts of the PMC will review the updated ESMP and sub-plans submitted by the contractor and will ensure that such plans are in line with the applicable laws and regulations. The experts will supervise the implementation of plans and will report on the E&S safeguard status and performance under the project. The internal monitoring reports will at minimum include, but may not be limited to the following:

- Reporting period and context;
- Summary of project status;
- Regulatory compliance;
- Institutional set up and manpower management status;
- Environmental, social, health and safety of workers and local communities;
- Implementation status of ESMP, SEP, WMP;
- Quality of Water at Source & Quality of Water Supplied near source, and at the consumers to check if it as per prescribed water quality as per regulations, guidance
- Monitoring of waste disposal and management;
- Monitoring of environmental attributes (air, water, noise) and social mitigation measures (e.g. compensation to impacts at replacement value);
- Complaints and grievances redressal; and
- Stakeholder engagement and community development activities.
- Labour Management

Contractors EHS person shall ensure ESMP implementation on all work days. Contractor shall report weekly to PIU on ESMP. PMC & PIU Engineers also shall visit the sites & supervise ESMP implementation. PMC shall prepare the internal monitoring report and submit it to the PIU every month, and PIU to submit a monthly report to TNUIFSL. Details of schedule of activities are given in Table 8.2 and indicative budget for construction phase is reflected in Table 8.3.

Schedule of activities

S.No.	Schedule of activities	Responsibility	Time line
1	Obtain required permits and licenses	PIU/Contractor	Prior to Pre- construction
2	Designate the Convenor (Engineer/PIU)	PIU	Pre- construction
3	Constitute the GRC& disclose in all the project work sites and zonal offices.	PIU	Pre- construction
4	Mobilization of EHS officer	Contractor	Prior to construction
5	Mobilization of one environment expert	PMC	During construction
6	Mobilization of one social expert	PMC	During construction
7	Environmental & Social Safeguards Monitoring	PMC	During construction

III- Environmental Monitoring Plan

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

Stage Wise Environmental Monitoring Plan

Project Stage: Construction Air Quality Monitoring

A	Parameter	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and Pb
B	Sampling Method	Use method specified by CPCB for analysis
C	Standards	National Ambient Air Quality Standards 2009, Air (Prevention and Control of Pollution) Act,1981 Or relevant CPCB standards/guidelines
D	Frequency	Once every season except monsoon during construction period
E	Duration	As per CPCB guidelines for monitoring
F	Location	Sensitive receptors especially in the downwind direction along the network alignment, residences, schools, hospitals etc around OHT sites and heritage monuments .
G	Measures	Wherever air pollution parameters increase above specified standards, additional measures as decided by the engineer shall be adopted
H	Implementation	Contractor through approved monitoring agencies
I	Supervision	PIU/PMC

Project Stage: Construction & operation and maintenance -Water Quality Monitoring

A	Parameter	Parameters for Surface water quality standards (IS; 2296) Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb for groundwater. Drinking water quality in Labour camp.
B	Sampling Method	Grab sample to be collected and analysis as per Standard Methods for Examination of water and Wastewater.
C	Standards	Indian standards for Inland Surface Water (IS; 2296, 1982) and for Drinking water (IS; 10500,2012) Or relevant CPCB standards / guidelines
D	Frequency	Once every season during construction and during operation period.
E	Duration	--
F	Location	Suitable location within project area (preferable headworks, waterbodies near OHT sites, network alignment, pipe carrying bridges, and drinking water in labour camps,))
G	Measures	At locations of variation in water quality/increased pollution, remedial measures to be adopted /all inflow channels shall be checked for pollution loads
H	Implementation	Contractor through approved monitoring agencies
I	Supervision	PIU/PMC

Project Stage: Construction & Operation - Noise Level Monitoring

A	Parameter	Noise levels on dB (A) scale
B	Sampling Method	Free field at 1 m from the equipment whose noise level are being measured Equivalent noise levels using an integrated noise level meter kept at a distance of 15m from edge of pavement
C	Standards	National Ambient Air Quality Standards in respect of Noise, Noise Pollution (Regulation and Control) Rules, 2000
D	Frequency	Seasonal during construction period
E	Duration	Reading to be taken at 15 seconds interval for 15 minutes every hour and then average out for analysis
F	Location	Near the OHT sites. Wherever the contractor decides to locate the equipment yard. At sensitive locations such as schools, hospitals, heritage monuments etc along the alignment
G	Measures	In case of noise levels causing disturbance to the sensitive receptors, management measures as suggested in the ESMP shall be carried out.
H	Implementation	Contractor through approved monitoring agencies
I	Supervision	PIU/PMC

Project Stage: Construction & Operation - Soil Monitoring

A	Parameter	Soil quality parameters (Pb, SAR and Oil & Grease, monitoring silt for presence of toxic metals , etc)
B	Sampling Method	Sample of soil collected to be acidified and analyzed using absorption Spectrophotometer
C	Standards	Threshold for each contaminated set by IRIS database of USEPA until national standards are promulgated
D	Frequency	During the pre-monsoon post monsoon seasons each year for the entire construction and operation phase
E	Duration	Grab sampling
F	Location	At sample locations in the receiving water bodies, at the places of dumping silt, excavated earth
G	Measures	At the location of increased pollution levels, sources shall be identified and measures adopted.
H	Implementation	Contractor through approved monitoring agencies
I	Supervision	PIU/PMC

The EMOP report as per the frequency & parameters provided above comparing with the baseline conditions provided in the ESIA to be submitted by the Contractor to PIU and PIU will submit the same to TNUIFSL. Outcome of the monitoring of various parameters if indicate higher values or values above the standards /baseline conditions necessary mitigation measures to be proposed. These mitigation measures shall be implemented and same should be implemented in the monthly progress report.

IV Cost Estimate for Environmental and Social Management Plan

The estimated ESMP implementation cost comprises EMP as well as Compensation for the social impacts. The indicative budget for ESMP is provided in the following table.

The ESMP costs are under two heads, one is already covered in the Detailed Project Report and cost provisions are made. Secondly, ESMP costs as per the outcome of ESIA.

ESMP Cost as per DPR

S. No	Description	Rate of BOQ's	Unit Cost	Quantity	Total cost in RS
1	Feeder main and Distribution System				
a	Barricading and other safety measures (hard barricading with reflectors, lighting)	Connecting main, Gravity Main, Feeder Main, Distribution System (Included in BOQ)		149706 - RM	
		Connecting main, Gravity Main, Feeder Main, Distribution System (Included in BOQ)		349312 - RM	
b	Restoration of cut open trenches	Gravity Main, Feeder Main, Distribution System (Included in BOQ)		381975 -RM	
c	Carting and de carting excess Earth	Connecting main, Gravity Main, Feeder Main, Distribution System, OHTs (Included in BOQ)		23645.14 - CUM	
TOTAL					

Estimate as per ESIA study

S.No.	E&S monitoring parameters	Frequency	Responsibility	Total Cost in Rs.
1	Organize meetings with line departments.	Bi-annual	PIU	
2	Workshop on E&S safeguards and on-job training as identified.	Annually	PIU/PMC	

3	Use of IEC material and use of media channel to create public awareness on waste management	Regularly	Contractor	
4	Consultations with stakeholders regularly	Regularly	PIU/PMC/ Contractor	
5	Meetings of GRC	As and when required.	PIU	
6	Air quality monitoring	Quarterly	PMC/ Contractor	
7	Surface water quality monitoring	Quarterly	PMC/ Contractor	
8	Ground water quality monitoring	Quarterly	PMC/ Contractor	
9	Soil quality monitoring	Bi-annual	PMC/ Contractor	
10	Noise quality monitoring	Quarterly	PMC/ Contractor	
11	Wind speed and direction	Bi-annual	PMC/ Contractor	
12	Tree Plantation/ Greenbelt Development at project sites	One time/ plus lump sum	PMC/ Contractor	
Total				

Total Estimated ESMP Cost

S. No	Item	Cost in Rs.
1	Cost as per DPR	
2	Cost as per ESIA Study	
	Total Cost	

CHAPTER-8 STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESSAL MECHANISM

Stakeholder's engagement is an integral part of developing an understanding about the project and the associated risks and impacts as perceived by the public. It helps in planning and setting up priorities for project management. SEP has been prepared and is provided in Annexure 6.

8.1 Public disclosure

Stakeholder Consultation was held at Kancheepuram City Municipal Corporation on 30.11.2022, under the chairmanship of Hon'ble Mayor, Kancheepuram Corporation and the Respected Council members along with officials of Kancheepuram corporation and the following suggestions were given during the presentation.

- It was suggested to ascertain the sand depth at Thirupparkadal for the proposed source.
- It was suggested that the sand depth at kavungampallam near orikkai may have good depth for proposing infiltration wells and the same may be studied.
- One of the council members suggested to study and utilize the existing siphon well at vegavathi booster station and propose for revamping.
- It was suggested to design the HSC connections in such a way that the flow control valve and flow meters are tamper proof.
- Cost for utility shifting and reconstruction of culverts was suggested to be included in the estimate after conducting a survey of the culverts.

8.2. Public consultation

Public consultation is a continuous process throughout the project planning, preparation, implementation, and monitoring stages. The sustainability of any infrastructure development project depends on the participatory planning in which public consultation plays a major role. Experiences indicate that environmental and social impacts, particularly the involuntary resettlement generally causes numerous problems for the affected population. Such problems may be reduced to a great extent if people are properly informed and consulted about the project, its impacts, mitigation measures allowed to make meaningful choices or preferences. This helps to reduce the sense of insecurity and impacts to the project which otherwise are likely to occur during project implementation. The overall objective of the consultation process and SEP is to minimize, mitigate or offset negative impact of the project and make people aware about the rationale and positive impacts of the impact.

The practical measures will be taken through a consultative process to make the stakeholders as partners in project planning, implementation and monitoring stages. One way to help satisfy stakeholder concerns and promote transparency is to involve project affected stakeholders in monitoring the implementation of mitigation measures or other environmental and social impact related activities. The stakeholders will be informed about relevant policies, laws, types and severity of impacts, entitlements for compensation and mitigation measures through the proper communication channel, verbally or distribution of

pamphlets in local language with required details. Once consultations have taken place, stakeholders will want to know which of their suggestions have been taken on board, what risk or impact mitigation measures will be put in place to address their concerns. Such information will be disseminated in time and regularly. The consultations shall be arranged with the beneficiaries, potential temporary economic impacts and other stakeholders to understand and solicit their views about risk and impact due to the project at the pre-construction stage.

Stakeholders Engagement

Concept presentation was held at TNUIFSL on 01.12.2022 and the suggestions provided during the presentation and the action taken are mentioned below,

Table 8.1 Stakeholder Consultations: Suggestions and Response

Sl. No	Suggestions	Response
1.	It was suggested to remove the Clear water Transmission Loss (1%) (Since it is already included in Distribution losses).	Incorporated in DPR
2.	Population projection method was suggested to be made same for both core city & added areas	Incorporated in DPR
3.	It was suggested to perform confirmatory boreholes for ascertaining the sand depths for proposed sources.	Incorporated in DPR. Detailed Hydrogeological Report attached as annexure.
4.	The Estimate is suggested to be revised under two separate heads namely for New proposals and Revamping of existing components.	Incorporated in DPR
5.	Supply from all sources were suggested to be received in a new common sump and supplied to all OHTs via feeder mains	Incorporated in DPR. Common Sump Proposed at Vegavathi.
6.	It was suggested to replace the existing AC pipes in Gravity main from Thirupparkadal to Vegavathi and to propose new pipeline for combined supply from existing Infiltration Galleries and Proposed Collector Wells.	Incorporated in DPR

Presentation to World Bank officials at Kancheepuram City Municipal Corporation

Concept presentation was held at Kancheepuram City Municipal Corporation on 06.12.2022 for representatives and officials from the World Bank and the following suggestions were given during the presentation.

Table 8.2 Comments and Suggestions of World Bank and Response

Sl. No	Suggestions	Response
1.	It was suggested to collect the baseline data for service connections and sources.	Baseline data for Sources have been collected.
2.	Source confirmation tests like Trial bore wells, yield test, drawdown tests were suggested to be conducted during summer	Detailed Hydrogeological Investigations were carried out. However, Drawdown Tests will be

	season (Lean period)	conducted during summer season
3.	The consultants were requested to collect the rainfall data and consider the impacts during low rainfall.	Collected and incorporated in the DPR
4.	Contingency plans for extreme events were suggested to be prepared in later stages of DPR.	Incorporated in the DPR
5	It was suggested to include bulk water supply for institutions and industries if the availability is in surplus.	Since the available source is just sufficient to meet the ultimate demand, bulk supply is not considered.
6	The implementation schedule for execution of the project has to be prepared.	Incorporated in the DPR.

Stakeholders Engagement during Project implementation

Stakeholder engagement is planned as a continuous process throughout the construction stage for dissemination of project information and for smooth implementation of the project. Plan for stakeholder engagement is provided in Annexure 6.

8.3. Grievance Redress Mechanism

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. Two tier GRM shall be constituted.

Grievance Redress Committee (GRC)

1. 1st level grievance redress: Comprises of
 - PIU Site Engineer
 - Safeguard Specialists from PMC
 - Contractors site engineer & EHS. To resolve issues on-site in consultation with each other.
2. 2nd Level grievance redress: The Project level GRC shall be constituted with three persons (preferably one of them as woman).

The Executive Engineer at project level, the Convenor for the project, will be designated as the Secretary, who will coordinate with all the members, convene meetings and perform other activities required to ensure the efficient grievance redressal system. Such meetings will be held as per requirements. The GRC would assist in amicable settlement of issues/complaints raised by the aggrieved person/ Potential Temporary Economic Impacts without any interruption to the project implementation. As referred, the Executive Engineer of PIU, Team Leader and Safeguard Specialists of PMC, Project Manager and the EHS officer will also act as the community liaison officers (CLOs). They will inform the Potential Temporary Economic Impacts, workers and other stakeholders / public about the set-up of GRC, its constitution, functioning and procedure to address their project related E&S concerns and complaints. They will conduct consultations with the Potential Temporary Economic Impacts

and other stakeholders regularly to keep them informed about the project progress and future activities, as required. The Project Manager supported by the EHS Officer stationed at the project site will be the first contact person for the Potential Temporary Economic Impacts and local residents, who will try to settle the concerns of people immediately. The Project Manager will report to the EE/PIU and PMC, who will help, and initiate actions required to resolve the complaints received orally or in writing. The cases not resolved within one or two weeks will be referred to the GRC for taking decision within the four weeks or stipulated time as deemed appropriate. The concerns of any aggrieved person or issues of Potential Temporary Economic Impacts regarding the compensation at replacement value, income restoration and other losses and adverse impact will be examined and decided in consultation with the GRC members.

The concerns and complaints of the labourers will be directly redressed by the Project Manager of the Contractor. The cases not being resolved by the Project Manager or the higher management of the contractor will be presented to the GRC to settle the same with a consultative approach.

The EE designated as the Secretary will report to the SE, who in turn will report to the Chief Engineer, KCMC about the status of complaints and performance of GRC regularly. The CE supported by the EE will be overall responsible for resolving the grievances of potential temporary economic impacts and any other stakeholders amicably within a timeframe.

The phone numbers of these personnel and addresses will be disclosed on the hoardings fixed at prominent public places and will be shared with the GRC members. Potential temporary economic impacts and other stakeholders usually communicate grievances orally and those submitted in writing will be logged in the register maintained at the CLO office. The grievances form in Tamil and English including the details of Complaint Receiving Officer (Convenor) will be made accessible at public places.

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 and submitted to TNUIFSL. A Sample Grievance Registration Form has been given in the Annexure 5.

CHAPTER-9 INSTITUTIONAL AND IMPLEMENTATION MECHANISM

9.1 Implementation of proposed project and institutional arrangement

The implementation arrangement for this project is

Project Management Unit (PMU)

A PMU in TNUIFSL jointly with the Directorate of Municipal Administration will be established. PMU will have dedicated Environmental and Social Safeguards specialists.

Project Implementation Unit (PIU)

The PIU will be established in the Kancheepuram City Municipal Corporation for implementation of this project. PIU shall have officials trained in EHS designated as Environmental Officer & Social Safeguards Officers.

PIU will supervise activities of Environmental and social safeguards, ESHS for ensuring adoption and compliance of ESMP and report to TNUIFSL.

Project Management Consultants (PMC)

A PMC will be appointed and will assist the PIU in the implementation of the project. The PMC will have dedicated Environmental, Social, Gender and ESHS specialists and will implement the ESMP. Preparation of periodical progress reports, flag critical issues to the PIU and PMU are the scope of the PMC.

Contractor

Contractor will appoint ESHS personnel & safety officer who along with the Project Manager will be responsible for implementation of the Environmental and Social management plan and submit the compliance report to PMC/PIU.

CHAPTER-10 PROJECT BENEFITS

The water supply project, in respect of which considerable public and social resources are being used, form a basic infrastructure for the country and an indisputable indicator of civilization and development. The works cover a number of substantial social needs and aim to improve the quality of life and to protect public health and the environment.

10.1 Upgrading the quality of life

The quality of life and the hygienic conditions in the areas where the system operates have already improved. The operation of the water supply system has relieved these areas to a great extent from previous problems that were caused and non-availability of good quality water uniformly across all places due to urban development, industrial growth and pollution of water resources,. The water supply scheme provides a healthier lifestyle and more appropriate way to manage water resources. It addresses the additional water demand of institutions like hospitals, schools, cinema theatre, hotels, industries etc, ensures the availability of water sustainably irrespective of the season throughout the year, minimises social imbalance due to equitable supply thereby enhancing hygienic condition of public and above all, ensures protected water supply at affordable cost.

10.2 Preserving the natural environment

Though the project town has substantial residential, commercial and industrial developments already occurred in the absence of the adequate basic infrastructure such as Water supply and underground sewerage system. Implementation of comprehensive water supply system would definitely prevent indiscriminate use of ground water resource, and sustainable distribution of water helps protect water sources, enhance the natural environment.

10.3. Economic development and tourism

The most significant advantage of the system is maintaining sustainable development, the protection of the environment and improvement of the quality of life, with a further impact on the development of tourism and the economy in general.

10.4. Standard of living

As a result of the above, the system contributes to further development and increase of the standard of living of the City. Considering all the above advantages, there is no doubt that if we all cooperate, ourselves and our children will enjoy a better quality of life in the years to come and that we will secure a better environment to the forthcoming generations.

ANNEXURES

ANNEXURE-1 Environmental, Climate Change and Social Screening Format

Date: _____

Contact Person: _____

Name of ULB: _____

Background and Objective: Suggest to add a few brief sentences on the objective of this Screening and how it will be used.

Project Details		Details	
S.no	Components		
1	Project Objective and components	The objective of the project is to provide water supply to the beneficiaries.	
2	Details of Alignment / Components (main components including construction activities)	(i)	Proposed New Components
		1	Source & Headworks
		a	Construction of Collector Wells - 3 Nos. at Thirupparkadal including Pump House, Foot Bridge, Control Room, Generator Room, Stand Post, Pumping Main, etc.
		b	Construction of Sump, Pump room and Generator Room near Existing Headworks at Vegavathi Booster
		c	Providing Pumpsets to Proposed Headworks at Thirupparkadal & Vegavathi Booster
		d	Providing Interconnection Pumping Main from Venkadapuram Head Works to Orikkai and from Orikkai Headworks to Vegavathi
		2	Providing Distribution System with HDPE Pipes (450.71 Km)
		3	Providing Feeder Mains from Sump to OHTs (33.27 Km)
		4	Providing Flow control Valve, Sluice Valve, Electromagnetic Flow Meter & Chamber - For Distribution System
		5	Construction of OHTs (1.5 LL - 2 Nos ; 2 LL - 1 No ; 3 LL - 1 No ; 5 LL - 4 Nos ; 6 LL - 1 No ; 7 LL - 5 Nos)
		6	Construction of PCB for Palar and Vegavathi River crossings

		7	Providing House Service connections (55240)
		8	Road restoration with cement concrete 1:4:8, 7.5 cm thick, using 20 mm HBS metal and cement concrete 1:2:4, 10 cm thick using 20 mm HBS including cost of all materials laying, curing, etc., complete
		9	Providing Complete SCADA system for water supply system (Pressure Sensor, Quality Sensor, Monitoring and control units) including VFD for Pumpsets
		(ii)	Rejuvenation / Replacement of Existing Components
		10	Replacement of Pumpsets at existing Headworks at Thirupparkadal, Venkadapuram & Orikkai
		11	Replacement of Gravity Main from Thirupparkadal to Proposed Sump at Vegavathi Booster station (29.786 km)
3	<p>Location of the Project Sites (all sites including alignment of networks, other structures like pumping stations; offices, locations where treated wastewater, sludge & C&D wastes will be disposed/reused directly, any other)</p> <p>Current Land use (Provide information for all sites involved in the project), any historic land use (related to heritage, or contamination)</p> <p>Site Survey No:/s (with ownership),</p> <p>Geographical coordinates of the site</p>	<p>Location of the project site:</p> <p>The location is Kancheepuram City Municipal Corporation administrative area and source at Palar River in Tiruparkadal.</p> <p>Proposed 14 OHT sites belonging to KCMC. Existing 10 OHTs sites belonging to KCMC.</p> <p>.</p>	

Proposed Resource Use

Resource Use				
Sl. no	Proposed Resources	Area/Quantity	Unit	Details
(i).	Land Area proposed to be used: Location wise (in sq km / sq m)			
(ii).	Estimated energy consumption for the project activities – Source wise			

(iii).	Estimated usage of water quantity for the project: Groundwater and Surface water?			Proposed additional withdrawal of 34.86MLD sub Surface water source in River Palar.
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Baseline Environmental Conditions

Sl.no	Environmental Aspects	Yes	No	Details (mention distance to these features in meters/kilometres, and quantities in g/kg/T as applicable. Also mention if any project components excluded / regulated based on location/activities as per National / State regulations& need permits/follow guidance)
1	Is the project site located on or adjacent to any of the following (Provide information for all sites and alignment of the project components/subcomponents, associated activities; mention distance to these features in meters/kilometres)			
i)	Critically Vulnerable Coastal Areas, Eco-sensitive Areas		√	
ii)	Cultural Heritage site, Protected monuments	√		There are protected monuments like Kailasanathar Temple, Jvarahareshwara Temple, Sri Matangeswara Temple, Vaikunta Perumal Temple, etc are situated in the project area. However, the project sites fall outside the 300m boundary of the protected monuments. However, during construction, adequate precautions will be followed as in the ESMP.
iii)	Natural Forests / Protected Areas Is the project in an eco-sensitive or adjoining an eco-		√	

	sensitive area or its demarcated buffers? If Yes, provide details.			
iv)	Any other Wetlands/ Mangrove/ Estuarine Region?		√	
v)	Any Natural Habitat areas, areas with natural features such as the Coasts, Lakes/ other water bodies?		√	
vi)	Any other Sensitive Environmental Components?		√	
vii)	Any Residences, schools, hospitals, sensitive receptors?	√		The project area consists both residential and commercial entities.
viii)	Any culturally – socially important paths, areas/religious occupancies, sacred groves, burial grounds, tourist or pilgrim congregation areas, borders, etc?	√		There are temples and protected monuments present in the project area.
ix)	Any Drinking water source, upstream and downstream uses of rivers, etc which may be impacted by proposed discharge of treated sewage / sludge from water supply or sewage treatment plant?		√	
x)	Any Low-lying areas prone to flooding/areas of Tidal Influence used as part of the Project or near the project components?		√	
xi)	Details of Surface water quality at intake point or Disposal point of treated sewage			The water quality at the intake point has been analysed and are found to be complying with the drinking water standards. Water quality details are provided in Annexure 10 of the ESIA.
xii)	Any areas affected by other disasters?		√	
2	Groundwater: Is the site in Critical / Over Exploited condition?		√	
3	Is the area disaster-prone? If yes; list all disaster zone categories applicable		√	

4	Describe the soil and vegetation on site			<p>The project involves construction of new collector& infiltration wells, borewell, pipe carrying bridges, laying of feeder mains, construction of new OHTs distribution network & HSCs, and providing SCADA.</p> <p>Lines will be laid at the edges of the road and the sump/OHT sites are proposed in the sites belonging to KCMC. All the project sites earmarked are vacant and clear from vegetation. No tree cutting required.</p>
5	Is the site area and condition suitable for proposed development?	√		
6	Describe existing pollution/contamination or degradation in the site(s)		√	
7	Near Dams, Barrages		√	
8	Any other remark on baseline condition?		√	

Anticipated Environmental Impacts: Impacts on Land, Geology and Soils

Sl.no	Impacts	Yes/ May create	No	Details (mention distance to these features in meters/kilometres, and quantities in g/kg/T as applicable. Also mention if any project components is excluded / regulated based on location/activities as per National / State regulations & need permits/follow guidance)
8.	Will the proposed project cause the following on Land / Soil?			
i)	Impact on Surrounding Environmental Conditions including Occupation on Low lying lands/flood plains		√	

ii)	Substantial removal of Top Soil (mention area in sqm)		√	
iii)	Any degradation of land / eco-systems expected due to the project?		√	
iv)	Loss or impacts on Cultural/heritage properties/precincts, features		√	
v)	Does the project activity involve cutting and filling/ blasting etc?	√		During pipe laying, soil cutting and filling activities will be carried out. Blasting for hard rock removal is not identified. However, if encountered during construction, measures identified in the ESMP will be followed.
vi)	Will the project cause physical changes in the project area (e.g., changes to the topography) due to earth filling, excavation, earthwork or any other activity?		√	No change in topography anticipated. During pipe laying, excavation, refilling of soil, road restoration will be carried out
vii)	Will the project involve any quarrying/ mining etc?		√	
viii)	Will the project / any of its component contaminate or pollute the Land? (for example sludge, disposal of untreated sewage/bypass)		√	
ix)	Pre-existing contamination on site/s		√	

Impacts on Water Environment

Sl.no	Impacts	Yes/ May Create	No	Details (mention distance to these features in meters/kilometres, and quantities in g/kg/T as applicable. Also mention if any project components is excluded / regulated based on location/activities as per National / State regulations & need permits/follow guidance)
9	Will the subproject or its components cause any of the following impact on Water sources (Quantity or Quality):			
i)	Will the activities proposed at the site(s) impact water quality (surface or underground) and water resource availability and use? Will this sub-project involve the dredging of water bodies, sea, canals, etc.		√	
ii)	Impacts on Water Resources		√	
iii)	Pollution of Water bodies/ground water nearby or downstream		√	
iv)	Will the project affect the river /cannel flow pattern, stream pattern or any other irrigation canal?		√	Temporarily during construction. And will be restored to the original condition after completion of the work
v)	Will the project result in stagnation of water flow or pondage or weed growth due to increased pollution/siltation		√	

Impacts on Biodiversity and Host Communities

Sl.no	Environmental Impacts	Yes/ May Create	No	Details (mention distance to these features in meters/kilometres,
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				and quantities in g/kg/T as applicable. Also mention if any project components is excluded / regulated based on location/activities as per National / State regulations & need permits/follow guidance)
10	Will the subproject or its components cause any of the following impacts on Biodiversity or the neighbourhood			
i)	Will the project necessitates cutting of? Trees / Loss of Vegetation		√	No tree cuttings involved in the project.
ii)	Will the project result in Health & Safety Risks in the neighbourhood including the release of toxic gases, accident risks		√	
iii)	Potential risk of habitat fragmentation due to the clearing activities? (e.g. Hindrance to the local biodiversity like disturbing the migratory path of animals/ birds etc.)		√	
iv)	Potential Noise and Light Pollution or disturbance to surrounding habitats/communities		√	
v)	Potential disruption to common property, accessibility, traffic disruptions, conflicts or disruption to the local community within the subproject area?		√	

Impacts due to Storage and Wastes: Pollution and Hazards

Sl.no	Type	Yes	No	Details (mention distance to these features in meters/kilometres, and quantities in g/kg/T as

				applicable. Also mention if any project components is excluded / regulated based on location/activities as per National / State regulations & need permits/follow guidance)
11	Will the subproject or its components cause any impact due to storage of materials, wastes or pollution due to releases during various project activities			
i)	Will the project use or store dangerous substances (e.g., large quantities of hazardous chemicals/ materials like Chlorine, Diesel, Petroleum products; any other?	√		Diesel will be used by vehicles for excavation during construction phase.
ii)	Will the project produce solid or liquid wastes; including construction/demolition wastes (including dredging, de-weeding wastes, muck/silt, dust, sludge, C&D wastes, hazardous wastes (such as asbestos from existing network), e-wastes (from equipment)); polluted liquids?	√		Waste generated from the project will be handled as per the WMP which will be prepared by the contractor. C&D waste if any will be handled by KCMC as per the provisions of C&D waste Rules.
iii)	Will the project cause or increase air pollution or odour nuisance?		√	During construction increase in dust particles may generate due to excavation activities and demolition of old structures. Proper dust control measures to be provided e.g. water sprinkling.
iv)	Will the project generate or increase noise levels which will impact surrounding biodiversity or communities?		√	The major source of noise in the proposed project are horizontal split case centrifugal pumps proposed in existing Booster station. These may not contribute for the cumulative effect due to the existing noise levels as

				the pumps selected in the way that they will not produce noise levels more than 40-50 db.
v)	Will the project generate or increase visual blight or light pollution?		√	
vi)	Will the project cause water pollution? (of water bodies/ groundwater)?		√	
vii)	Will the project involve dangerous construction activities which may be a safety concern to workers/ host communities		√	
viii)	Is there a potential for release of toxic gases or accident risks (e.g. potential fire outbreaks)		√	
12	Describe any other features of the project that could influence the ambient environment		√	

Baseline Climate Data		
13. Project Area Baseline		Note: Please provide details for ULB and also site. Please provide quantitative information where relevant.
i)	Agro climatic zone	North Easter Zone
ii)	No of Water Bodies in the ULB area	
iii)	Name of the River(s) in the ULB	River Palar
iv)	Proximity to River (kms)	The construction of the collection well and infiltration wells will be within the River Palar
v)	Proximity to Sea (kms)	About 60km (Bay of Bengal)
vi)	Proximity to hilly terrains (kms)	About 65km (Jawadu Hills)
vii)	High Flood Level of the River	
viii)	Flooding Events (Years) (Based on historic data of extreme flood events and future projections based on available analysis)	2015, 2021, 2022
ix)	Flooding hotspots in the ULB	There are low lying areas in KCMC like Bharathi Nagar, Varadarajapuram, Pachiappan slum, Orikkai which are vulnerable to flooding.
x)	Available Water sources (Surface / ground)	Infiltration wells and Borewells from Palar & local sources.
xii)	Groundwater Level and potential zone	5-10 m. bgl ¹ , Safe Zone
xiii)	Normal Temperature & long-term average; trends in changes in temperature	The temperature ranges between 20°C & 37°C.
xiv)	Rainfall trends & long-term average	The city receives an average of 1159.4mm of rainfall annually.
xv)	Land Use	
xvi)	% of Green Cover in the ULB area	

¹ District Ground water Brochure Kancheepuram District, 2007

xvii)	% of Water Bodies/Rivers				
xviii)	Seismic Zone		Seismic Zone III		
xix)	Coverage rain water harvesting structures (in %)				
	a) Residential				
	b) Commercial & Institutional				
	c) Government/ULB				
xx)	RWH in buildings – Mandating byelaws				
xxi)	Frequency of drought in study area. Does the area face water scarcity? Please provide details.		The city faced drought during 2016-17 due to shortfall in rains. (182 mm lesser than the annual average)		
xxii)	Frequency and intensity of cyclones in study area.		No		
14	Climate Change Impacts in project area				
(i)	Climate signal Please select the relevant signals	Climate hazard Please select the relevant hazards	Yes	No	Details
	<input type="checkbox"/> Sea level rise <input type="checkbox"/> Frequency of tropical storms <input type="checkbox"/> Intensity of tropical storms <input type="checkbox"/> Higher precipitation amounts <input type="checkbox"/> Shifting seasons <input type="checkbox"/> Higher temperatures <input type="checkbox"/> Less precipitation <input type="checkbox"/> Lower temperatures <input type="checkbox"/> Others	<input type="checkbox"/> Salt water intrusion		√	
		<input type="checkbox"/> Flooding of the coast		√	
		<input type="checkbox"/> River flood	√		Flood in River Palar
		<input type="checkbox"/> Bank erosion (sea/river)		√	
		<input type="checkbox"/> Flash flood (heavy rain)		√	
		<input type="checkbox"/> Landslides		√	
		<input type="checkbox"/> Forest/Bush fires		√	
		<input type="checkbox"/> Water shortage/drought	√		Drought in 2016-17 due to shortfall in rains
		<input type="checkbox"/> Effects of heat	√		Heat wave (temperature above 40°C) during the years 2016-2018
		<input type="checkbox"/> Effects of cold		√	

		<input type="checkbox"/> Effects of winds		√	
		<input type="checkbox"/> Effects of air quality		√	
		<input type="checkbox"/> Effects of storm surge		√	
		<input type="checkbox"/> Soil quality/land degradation		√	
		<input type="checkbox"/> Others		√	
ii)	Energy consumption for the project? Will the project result in GHG emission?			√	
iii)	Will the project affect any other water or other user? (downstream intake points of Water Supply projects, downstream water use by people, animals; irrigation)			√	The potential yield of the source has been evaluated and finalised.
iv)	Is the project located in exploited ground water block?			√	The project area is in safe zone.
v)	Is the project area vulnerable to temperature fluctuations and drought?	√			
vi)	Is the site vulnerable to hazards such as Earthquakes, Landslides, Flooding, Storm surge, Severe wind damage, Fire, Explosion, Other (specify)	√			There are low-lying areas in the city which are vulnerable to flooding.
vii)	Will the project result in generation of wastes / by-product?	√			Construction waste.
viii)	Will the project impact the water resource availability (surface/ ground water) and use (effluent/sewage disposal, bypasses from STPs/PS, leachate, runoff, wastes deposition, erosion)			√	
ix)	Will the project cause flooding of adjoining low lying areas			√	
(x)	Will the project impact water quality or quantity in natural/constructed Lakes, or ponds			√	

Project Environmental Enhancement Measures

Sl.No	Enhancement Measures	Yes	No	Details
15	Has the subproject design considered environmental enhancement measures?			

i)	Energy conservation measures/ energy recovery options incorporated in subproject design? Quantify the reduction in CO ₂ emission from the sub-project.	√		
ii)	Has the project considered alternate /renewable energy?		√	
iii)	Has the project considered waste minimization (waste reuse/recycle options/circular economy)		√	
iv)	Rainwater harvesting, water recycling and other water resource enhancement measures proposed in the project?		√	
v)	Does the project include measures for prevention of wastage of water resource?	√		Metering and SCADA proposed will result in efficient monitoring of water supply distribution and prevent wastage of water.
vi)	What waterbody conservation/ drinking water source improvements/drought management options are being proposed?		√	This is a water supply improvement project aiming to meet the drinking water requirement.
vii)	Design Considerations for protection of project components from extreme events - flood, drought, other natural disasters	√		Headworks has been designed considering MFL.
vii i)	Greenbelt development proposed for the project?	√		Greenbelt is proposed in the project sites based on the availability of space
ix)	Is the sub-project including design elements to strengthen infrastructure resilience? If so what?	√		
x)	Has the project considered nature-based solutions and if so what?		√	
xi)	Is the sub-project combining infrastructure and nature-based solutions? If so how?		√	

xii)	What design considerations is the project including to mitigate heat island effect?	√		Greenbelt is proposed in the project sites based on the availability of space
xii i)	What design considerations is the project including to preserve and expand green cover?		√	
Land Use, Resettlement, and/or Land Acquisition				
Sl.no	Components	Yes	No	Details
1	Does the project involve acquisition of private land?		√	All the sites are owned by ULB/Government. No private land acquisition in envisaged in this project
2	Alienation of any type of Government land including that owned by Urban Local Body?	√		Yes
3	Clearance of encroachment from Government/ Local body Land?		√	
4	Clearance of squatters/hawkers from Government/ Local Body Land?		√	
5	Number of structures, both authorized and/or unauthorized to be acquired/ cleared/		√	
6	Number of households to be displaced?		√	
7	Village common properties to be alienated Pasture Land (acres) Acquisition / burial ground and others specify?		√	
8	Existing land uses on and around the project area (e.g., community facilities, agriculture, tourism, private property) will be affected?		√	
9	Will the project result in construction workers or other people moving into or having access to the area (for a long-time period and in large numbers compared to permanent residents)?		√	
10	Are financial compensation measures expected to be needed?		√	

Loss of Crops, Fruit Trees, Household Infrastructure and livelihood

Sl.no	Components	Yes	No	Details
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11	Will the project result in the permanent or temporary loss of the following?			
11.1	Crops?		√	
11.2	Fruit trees? Specify with numbers		√	
11.3	Petty Shops		√	
11.4	Vegetable/Fish/Meat vending		√	
11.5	Cycle repair shop		√	
11.6	Garage		√	
11.7	Tea stalls		√	
11.8	Grazing		√	
11.9	Loss of access to forest produce		√	
11.10	Any others - specify		√	
Welfare, Employment, and Gender				
12	Is the project likely to provide local employment opportunities, including employment opportunities for women?	√		
13	Is the project being planned with sufficient attention to local poverty alleviation objectives?	√		
14	Is the project being designed with sufficient local participation (including the participation of women) in the planning, design, and implementation process?	√		
Historical, Archaeological, or Cultural Heritage Sites				
15	Historical heritage site(s) require excavation near the same?		√	
16	Archaeological heritage site(s) require excavation near the same?		√	
17	Cultural heritage site(s) require excavation near the same?		√	
18	Graves or sacred locations require excavations near the same?		√	

Tribal Population/Indigenous People				
19	Does this project involve acquisition / alienation of any land belonging to Tribal people?		√	
20	Will the project lead to displacement / other adverse impacts on tribal / indigenous people?		√	
Beneficiaries				
21	Population proposed to be benefitted by the proposed project	Approx. no.:		116387
22	No. of Females proposed to be benefitted by the proposed project	Approx. no.:		57984
23	Vulnerable households /population to be benefitted ²	Approx. no.:		
24	No. of Families to be benefitted	Approx. no.:		

Date: _____

Signature and name of the Borrower

Authorised Signatory

Note: This Screening sheet must be completed for each of the proposed subproject along with the DPR and ESIA Report.

Indicative Enclosures:

1. Provide maps with the geographical location of the project; Google maps with project sites and project alignment
2. An appropriately scaled map clearly showing the project area and project sites with land use, existing buildings, infrastructure, vegetation, adjacent land use, utility lines, access roads and any planned construction, and
3. Any other information to describe the project, locations and possible impact as required.
4. Provide relevant maps on flooding hotspots, LULC, etc
5. Land details for the project sites with (i) extent available and required, (ii) location, (iii) survey numbers, (iv) FMB extract, (v) current land use, land use classification (vi) land ownership, alienation/acquisition status, (vii) certificate giving availability of

²Vulnerable PAPs are those living below poverty line, SC / ST families and women headed households, Widows, Physically Challenged persons; Elderly persons above the age of 60 years among the affected families.

sites required for the project by the borrower, (viii) location photographs with Geo-coordinates of all project sites and alignment.

Annexure 2 Climate Resilience of the Improvements to existing water supply in Kancheepuram City Municipal Corporation

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
A: Types of Damages due to Flood in Drinking Water Supply Systems						
1	Intake structure	a	Flood water enters the pump house	Keep the Operating platform level for the raw water pumps above Highest Flood Level with a free board	The bunds of the both the sides of the Banks are proposed as part of check dam which is under construction. The collector well and infiltration wells proposed is about 700m downstream of the check dam.	The contractor to prepare Monsoon preparedness plans/SOPs for O&M stage.
		b	Approach bridge to intake well submergence and damaged	Keep Approach bridge to intake well also above HFL with sufficient free board	The bunds of the both the sides of the Banks are proposed as part of check dam which is under construction. The collector well and infiltration wells proposed is about 700m downstream of the check dam.	Inspect after floods recede and rectify where necessary
		c	Clogging of ports due to excessive silting and debris	Provide screens over ports	Not applicable	Not applicable
		d	Siltation caused due to flooding may bury the intakes		Not applicable	No applicable

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
		e.	Erosion around structure		Since the depth of the proposed wells are in range of 14 to 16m, hence erosion possibilities are minimal	Check after floods recede and make up the eroded portion
		f.	Destruction of intake due to floods	Check safety of foundation depth against scour depth	The foundations depths are checked and are sustainable & climate resilient	If completely damaged
2	Infiltration well in river beds to draw subsurface water	a.	Tilting of well	Check safety of foundation depth against scour depth		Check after floods recede and rectify
		b.	Submerged well may receive contaminated water		Since the drawal of water is sub-surface, and top of the well is designed considering MF, there is no intrusion of contaminated water is envisaged.	Check after floods recede and empty contaminated water and disinfect
3	Water treatment plant in flood plain and inundation may:	a.	Damage open tanks	Provide protection wall if the WTP is located in flood plain	<ol style="list-style-type: none"> 1. Water Supply source is subsurface and not WTP is proposed. 2. No open tanks are proposed in this project. 	
		b.	Damage to electrical systems		Installation of transformers etc is away from the river and the electrical systems	Post floods the contractor to check the anchors and pedestals.

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
					are provided with proper anchoring and pedestals of the pipe. This does not arise.	
		c	Increased turbidity of raw water		Does not arise, since this is a subsurface source.	
		d	Contaminated raw water due to floods		Not applicable.	Standard Operating Procedure for monsoon period will be followed.
4	Service reservoirs	a	They are located at elevated places and may not be affected		17m staging height, with the raft foundation is kept as per the road level. Hence may not be affected.	
5	Pump houses, specially positive suction pumps	a	Likely to be flooded from surface water entering pump house	If positive suction pumps are provided catch drain has to be provided at entrance to pump house to prevent entry of flood water into pump house	All the pumping arrangement for infiltration wells and collector wells are placed above the HFL. In Vegavathi booster station, the pumps rooms Finished Floor Level is above the existing road level. In addition, peripheral drains are available for the booster	

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
					station site, to drain the storm water.	
		b .		Provide a dewatering pump within pump house	Dewatering arrangements will be made during maintenance. Depends on field conditions.	Operate the dewatering pump
6	Power supply and electrical controls	a .	Power supply likely to be interrupted and equipment damaged	Provide Diesel generating sets at least for 50 % pumping capacity	100 % capacity diesel gensets are proposed in headworks and booster station.	Preventive maintenance done for the control equipment
7	Water distribution networks	a .	Piping and appurtenances (e.g., fire hydrants, valves, and stream crossings) can suffer impacts and be washed out by fast-flowing floodwater if any streets are flooded	In the streets which are likely to be flooded, Provide anchorages for Piping and appurtenances specially at stream crossings.	Only fire demand is considered in the design. Pipe carrying bridges (PCBs) are designed with pile foundations for gravity/feeder mains from the sump.	Inspect after the floods recede and rectify.
8	Disruption of approaches to water supply system	a .	Floods may cut roads and access to pump houses, reservoirs, power supply station etc. This in turn may affect operations	Identify alternate approaches to system components in case any streets are expected to be damaged due to floods	No extreme flood events in Kancheepuram. However, if experienced, alternative approaches to the systems will be explored and mitigated. SOP is provided in the EPRP.	Inspect after the floods and rectify the damaged streets.

<i>Sn o</i>	<i>Component</i>	<i>#</i>	<i>Expected Climate risk /damage</i>	<i>Recommended Design Measures</i>	<i>Sub project specific climate resilience</i>	<i>Recommended O&M Measures</i>
	components					
B: Types of Damages due to Drought in Drinking Water Supply Systems						
9	Intake structure	a	River levels in Drought may expose the inlets which should be completely submersible so that air may not enter the suction pipe.		Since the source is subsurface water, this does not arise. A checkdam is under construction in the downstream of the source, the water availability will be sustainable. This is in addition to the source sustainability analysis carried out for designing the head works.	Coordinate with upstream WRD authorities to release the water required for drinking water to ensure that pumping is not stopped.
		b	impacts of flood during drought episodes,	increase sedimentation on intakes		Provide scouring arrangements to the intake well
		c		Alternatively design an open well with only operating platform for pumps above Highest flood level and pumps below can draw water till the minimum submergence level. Enclosed sketch	Not applicable	

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
		d .	In dry weather the water level falls below the lowest inlet	Construct a weir across the river for maintaining some storage of water for dry period	Weir is already under construction by PWD/WRD in the downstream from this source .	if weir is not constructed , same is to be done in O&M period
		e .	In the case of shallow and broad rivers summer flows may be beyond intake			an approach channel is constructed every year, so that sufficient quantity of water may reach the intake even in dry period.
		f.	In case of rivers which meander or change their water course, intake may become dry	Construct a weir across the river for maintaining some storage of water for dry period		If not done originally, Construct a weir across the river for maintaining some storage of water for dry period
		g .	Drought may cause fall in the water level in the storage reservoir and pumps will not be having required submergence and pumping operations will stop		VFD is proposed for Collector wells which will take care of this situation.	Pumping of dead storage water into the well has to be done with temporary barge mounted pumps
10	Water treatment plant	a .	Reduced availability of raw water may reduce output capacity		Not applicable	Take steps to restrict supplies
11	Service reservoirs	a .	Reduced availability of water may reduce		Since the source is subsurface water, this does not arise. A checkdam is	take steps to restrict supplies and provide tanker supply. Provide an item in

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
			storage in Service reservoirs		under construction in the downstream of the source, the water availability will be sustainable. This is in addition to the source sustainability analysis carried out for designing the head works.	BOQ for payment of tanker supplies
12	Redundancy in WSS	a .	Most project ULBs have the flexibility to source water from bore wells when its surface water source is impaired, which happens during severe drought		The proposed source drawal is subsurface. There are 550 mini power pumps & 691 borewells fitted with handpumps are available in the ULBs, which can be used as alternative source in case of severe drought.	Switch over to available ground water sources such as borewells / hand pumps
		b .			Conjunctive use of groundwater/surface water to	Conjunctive surface/ groundwater development is being promoted in some ULBs by encouraging roof/rain water harvesting at household level
		c .				Operational staff to be trained for operations during emergency
13	Power supply and	a .	Frequent power fluctuations may reduce pumping	Provide Diesel generating sets at least for 50 % pumping capacity	100 % capacity Diesel gensets are proposed for	Preventive maintenance done for the control equipment

Sn o	Component	#	Expected Climate risk /damage	Recommended Design Measures	Sub project specific climate resilience	Recommended O&M Measures
	electrical controls		capacity and damage the controls		source as well as in the booster station.	
14	Distribution network	a .	Reduced availability of water may result in intermittent supply and low pressures leading to possible contamination specially at water pipes crossing drains	Provide casing pipes for crossing of water lines through drains	Wherever the water supply pipelines are going below the drains /sewer lines, encasing provisions are made.	Check for residual chlorine in dry period for ensuring safety of water
C: Types of Damages due to Wind in Drinking Water Supply Systems						
15	Intake structure	a .	Possibility of high speed winds damaging doors and windows		Wind loads as per IS 875 part 3 has been considered in structural design.	
16	Water treatment plant	a .	High speed winds will cause power shutdown	Provide Diesel generating sets at least for 50 % pumping capacity		
17	Service reservoirs	a .	Wind speeds beyond design winds especially in coastal region may damage the structure	Design to conform to relevant IS code	Wind loads as per IS 875 part 3 has been considered in structural design.	
18	Power supply and electrical controls	a .	Power fluctuations will affect pumping hours and hence reduced supply of water	Provide Diesel generating sets at least for 50 % pumping capacity	100% diesel gensets are proposed	

Annexure 3- Land records, FMB sketch

KCMC - WSS LAND RECORDS SUMMARY															
S.NO	LOCATION	ZONE	CAPACITY	SITE CORNER CO-ORDINATES								AREA NAME	LAND EXTENDED AVAILABLE (Sq.m)	LAND EXTENDED REQUIRED (Sq.m)	CLASSIFICATION
				1		2		3		4					
				LATITUDE	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE	LONGITUDE				
1	Oli mohammed (Alter)	3	6.00LL	12.848589*	79.691717*	12.848500*	79.691989*	12.848220*	79.691944*	12.848309*	79.691623*	Pillaiyar Palayam	600	500	PARK
2	Vilakadi kovil Theru	8	7.00LL	12.823429*	79.708649*	12.823356*	79.708641*	12.823372*	79.708529*	12.823437*	79.708545*	Vilakadi kovil Street	785	525	MUNICIPAL LAND
3	Ambedhkar Nagar (Indhra Nagar)	12	5.00LL	12.811571*	79.697399*	12.811734*	79.697416*	12.811605*	79.697110*	12.811750*	79.697136*	Sevilimedu	570	440	GRAMANATHAM
4	Velayutham Nagar (Dharmalingeshwarar nagar)	14	7.00LL	12.825578*	79.690313*	12.825443*	79.690276*	12.825192*	79.690931*	12.825091*	79.690856*	Sevilimedu	800	525	PARK
5	Vanavil Nagar	15	5.00LL	12.820754*	79.702806*	12.820876*	79.702854*	12.821065*	79.702246*	12.821205*	79.702314*	Sevilimedu	1226	440	PARK
6	Arasu Nagar	16	7.00LL	12.819016*	79.706480*	12.818961*	79.706703*	12.818768*	79.706375*	12.818647*	79.706652*	Arasu Nagar Park	1295	525	PARK
7	Prathana salai (Gandhi nagar)	17	5.00LL	12.805141*	79.709125*	12.805319*	79.709008*	12.805446*	79.709213*	12.805246*	79.709356*	Orikkai	720	440	PARK
8	Perasiyiray Nagar	18	7.00LL	12.809837*	79.709990*	12.810093*	79.710014*	12.810119*	79.710476*	12.809813*	79.710479*	Orikkai	1605	525	PARK
9	Vishnu Nagar	19	3.00LL	12.811550*	79.728992*	12.811703*	79.728969*	12.811538*	79.728783*	12.811697*	79.728771*	Vishnu Kanchi	462	300	PARK
10	Madhura mettur	20	1.50LL	12.806283*	79.717620*	12.806331*	79.717482*	12.806098*	79.717556*	12.806157*	79.717406*	Annai Kasthuribai Nagar	360	245	PARK
11	Thenambakkam Colony	21	1.50LL	12.797974*	79.734360*	12.797883*	79.734574*	12.797806*	79.734534*	12.797838*	79.734386*	Thenambakkam	410	245	PARK
12	Periyar nagar (Mahaalingam Nagar)	22	5.00LL	12.817642*	79.741409*	12.817643*	79.741045*	12.817755*	12.817755*	12.817798*	12.817798*	Periya Thottam	816	440	PARK
13	Mettu Colony (Maruthi Nagar)	23	2.00LL	12.818814*	79.750637*	12.818779*	79.750767*	12.818331*	79.750657*	12.818297*	79.750524*	Mettu Colony	900	270	PARK
14	Thirukallimedu	24	7.00LL	12.826224*	79.721359*	12.826211*	79.721878*	12.825975*	79.721350*	12.826078*	79.721865*	Arapanan Cheri	2253	525	PARK





Scanned with CamScanner



காஞ்சிபுரம் ஊர்நீர் தீட்டுக்கு
உதவ்வதில் லே.கே.சி.
செவ்வியல் துறை

செய்து கொடுத்திருக்கிறார்.

சென்னை, 19.12.2019

[illegible]

சென்னை, 15.05.2019

உதாரணம்: $f(x) = x^2 - 2$ இன் $\sqrt{2}$ மற்றும் $-\sqrt{2}$ ஆகியவைகள் \mathbb{Q} இல் இருந்து வெளியே உள்ளன.

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$$A_{\text{eff}} = A_0 + A_1 \sin(\theta) + A_2 \sin(2\theta) + \dots$$

Winnipeg, 25th May 1912

10. 11. 1954

[illegible]

$\frac{d}{dt} \left(\frac{\partial L}{\partial \dot{x}} \right) = \frac{\partial L}{\partial x}$

[illegible][illegible]

12-10/2020 10/20/2020

David R. [unclear]

$$f(x) = \frac{1}{2} \ln \frac{1+x}{1-x} \quad \text{for } |x| < 1$$

Downloaded from <http://ajphaphysocpharm.com/> on November 10, 2015

District : Kancheepuram

செவிலி அலுவலர் (S.A.)

5. Vanavil Nagar

Taluk : Kancheepuram

Survey No : 256/2

Village : Sevillimadu - A

[54]



Area : Hect 00 Ares 10.50

Scale : 1 : 270

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Date of Issue: 25-05-2023 14:02:28

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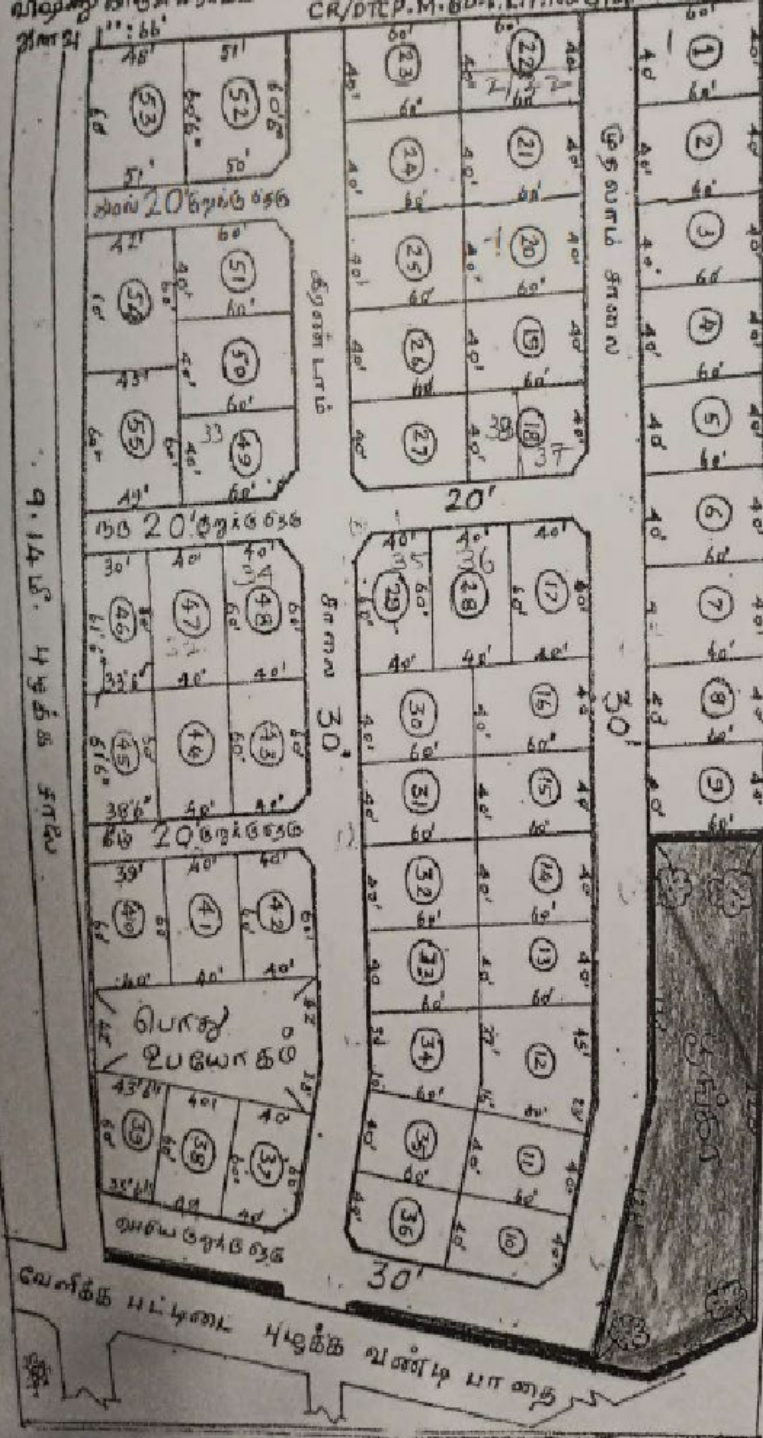
Survey and Settlement Department, Government of TamilNadu

குறிப்புகள்

வானவில் நகர்

காஞ்சி வட்டம்
விழ்வு தாண்டி திராமம்
நிலை 24

தி/பி/எண். 256-2 விரகம் த. மண்டல 2 வாரியம்
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CR/DTP.M.80-1, L.P.No. 31 துணை அபிவிருத்தித் துறையில்



தேசிகா - 20,300 A. 1/4
காஞ்சி வட்டம் வானவில் நகர்
குடியிருப்போர் நலத் துறை

3008/13
தலைவர்

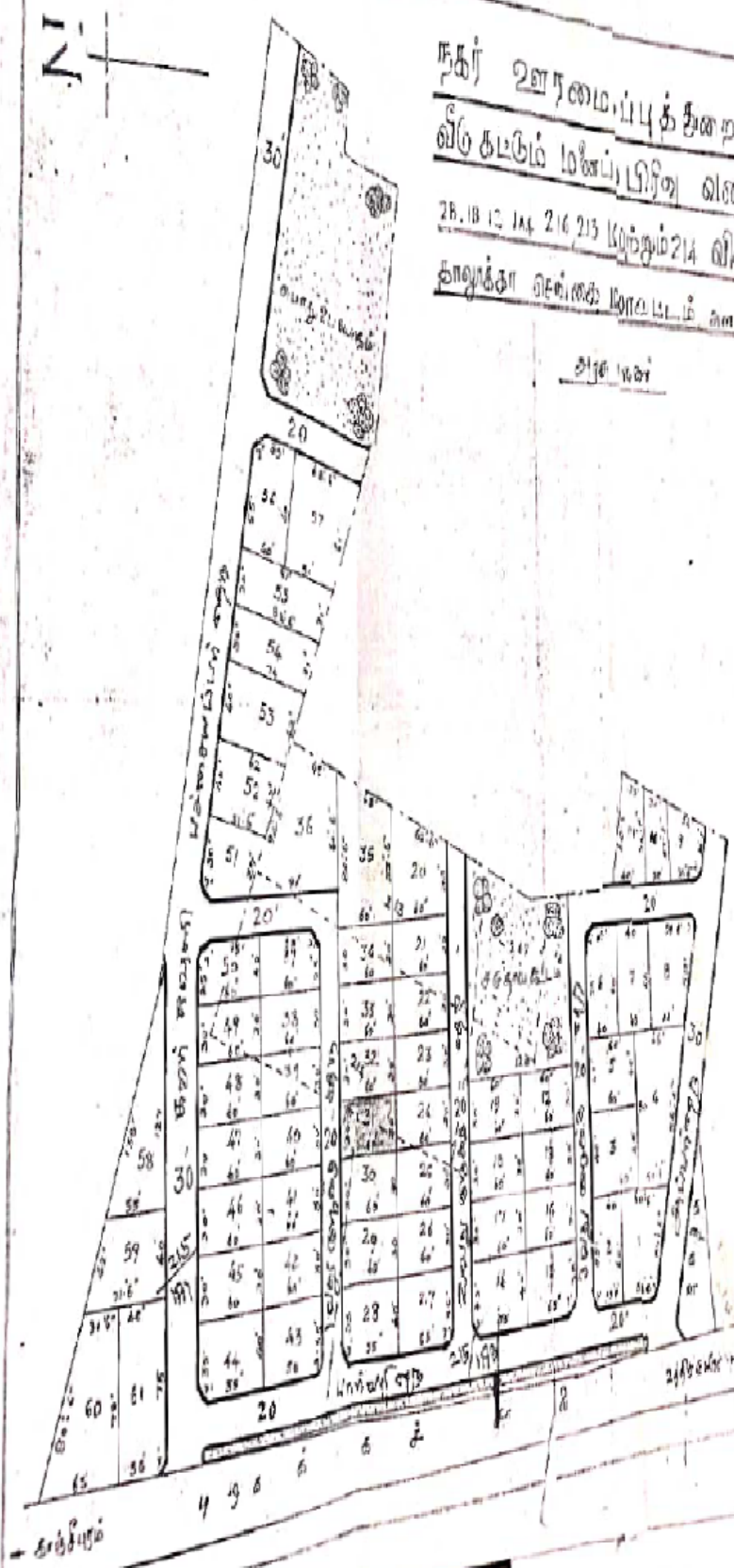
வேளிக்கை பட்டியல்
முடிக்க வண்டி பாதுகா

6.Arasu Nagar

நகர் உள்துறை, புத்தூதரின் இயற்புதல் பெற்ற
வீடுகடும் மனைப்பிரிவு விரைப்படம் சில சீ.எங்கள் 215/1, 216/2

215, 18, 12, 1A4, 216, 215 மற்றும் 214 விரிந்து தர்த்து சீரமைக் காத்திரம்
தாலுக்கா சென்னை மாவட்டம் கிளவு அங்குலம் 16.20

சுற்றுகள்



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3	0	-	24	8	1325	44	5	1325
4	1	1845	25	0	1845	44	6	1845
5	1	-	24	5	1845	44	6	1845
6	0	2387	27	0	2387	47	6	2387
7	-	-	28	0	2387	48	6	2387
8	1	1845	29	0	1845	49	6	1845
9	0	1845	30	0	1845	50	0	1845
10	0	1845	31	0	1845	51	0	1845
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14	0	1845	35	0	1845	55	0	1845
15	0	1845	36	0	1845	56	0	1845
16	0	1845	37	0	1845	57	0	1845
17	0	1845	38	0	1845	58	0	1845
18	0	1845	39	0	1845	59	0	1845
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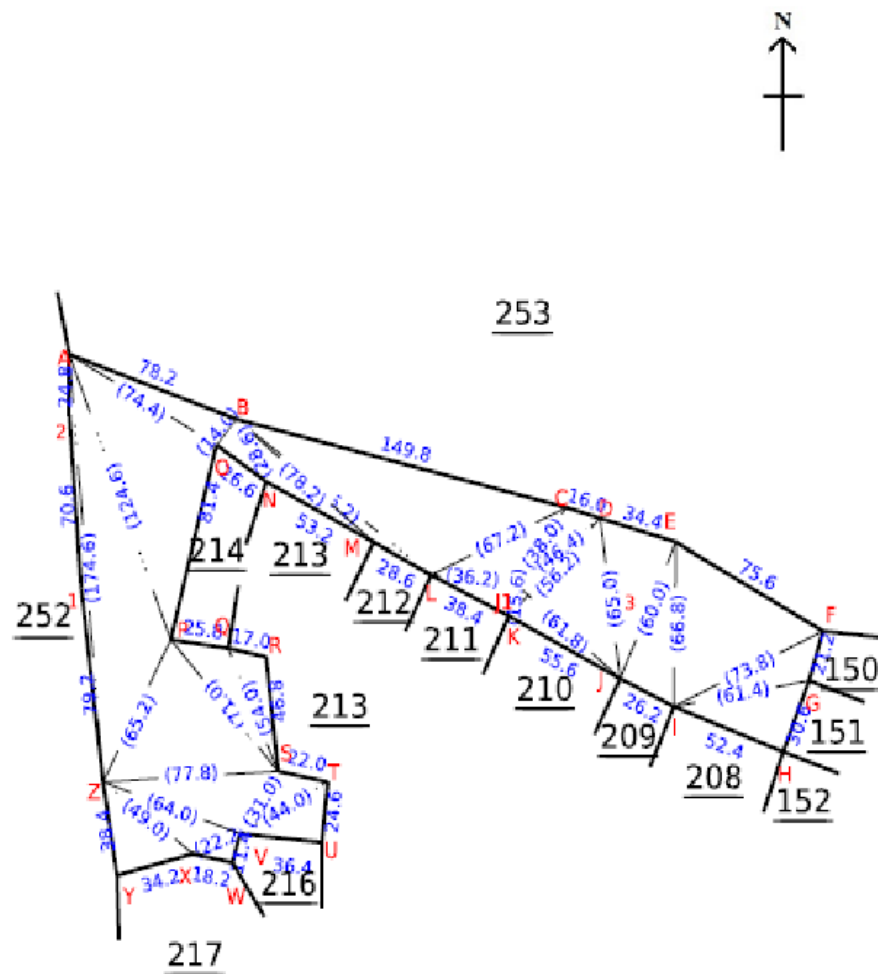
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6. Arasu Nadar

[56]



Scale : 1 : 2489

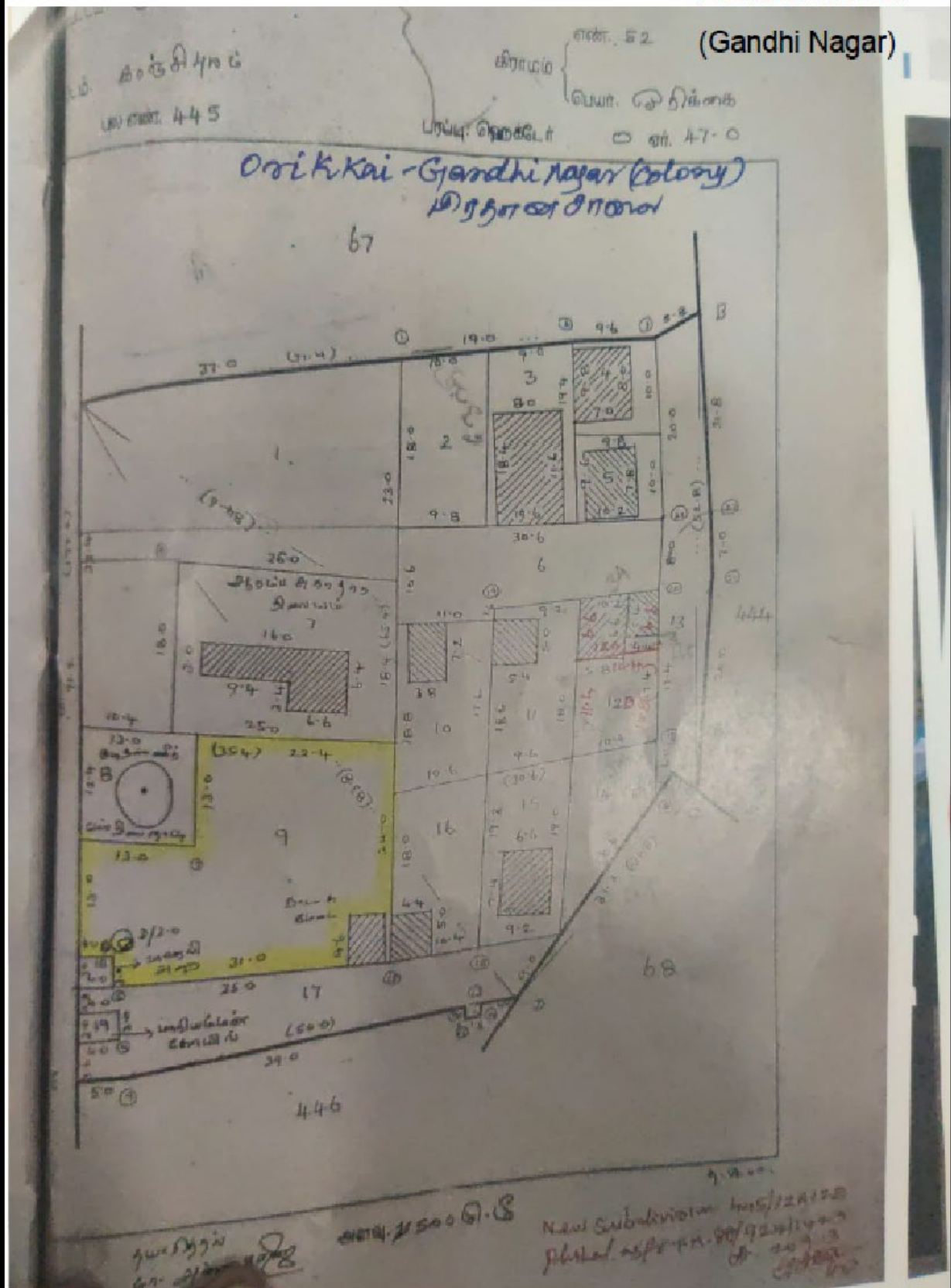


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7.Prathana Salai

(Gandhi Nagar)



9.Vishnu Nagar



9. Vishnu Nagar

District : Kancheepuram

Taluk : Kancheepuram

Village : Vishnu Kanchi - A

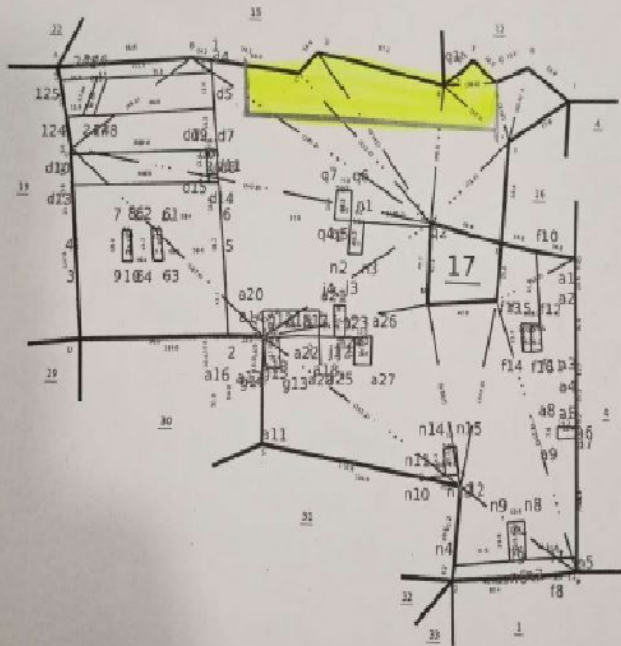
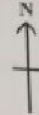
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Survey No : 18

Area : Hect 00 Ares 18.71

Scale : 1 : 3156



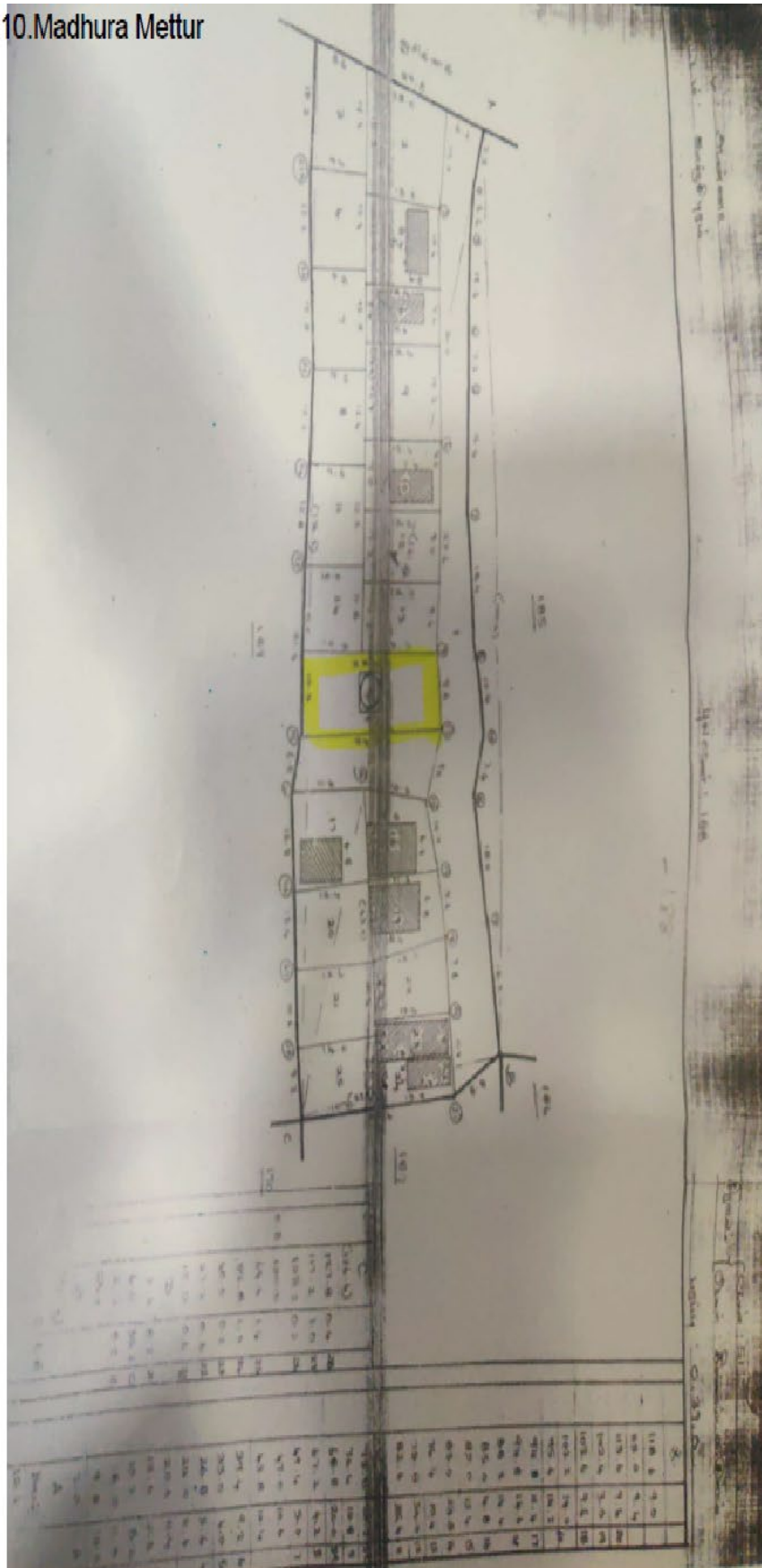
Date of Issue: 25-05-2023 14:08:25

Survey and Settlement Department, Government of TamilNadu

Data Digitally Signed By
BHUVANESWARAN MOHANDASS
260 fv.13



10.Madhura Mettur



Annexure 4 Public Information Notice Template

Public Announcement
Providing Improvement to existing Water Supply Scheme for Kancheepuram City
Municipal Corporation

Under this project, works are being conducted by xxxx Contractor to provide water supply system in Kancheepuram Corporation.

As part of this, works for laying pipeline / distribution 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.

ANNEXURE 5 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

ANNEXURE 6 Stakeholders Engagement Plan

Pre-Construction

Various stakeholders have been consulted during the project preparation and the comments & suggestions received have been suitably incorporated in the project design.

During Construction

The engagement with the project stakeholders will be continued as required during the project implementation and the strategy is provided as below.

Stakeholder Engagement and Information Disclosure Strategy				
Project: Water Supply Improvement Scheme in Kancheepuram City Municipal Corporation – <i>construction of Overhead Tanks, Laying of feeder main, distribution network, House Service Connections</i>				
Target stakeholders	Information to be disclosed	Proposed engagement & disclosure method	Timing of Engagement	Responsible Parties
1. Project Affected Persons- impacted by temporary economic or physical displacement- tenants/ hawkers/ vendors on alignments	<ul style="list-style-type: none"> Project design details, alignments and their impacts Provisions for compensating economic and physical displacement, timelines for completing rehabilitation Communication on final rehabilitation/ compensation approved by govt. Grievance mechanism in place 	<ul style="list-style-type: none"> FGDs and small group consultations Print-Newspaper, Newsletter / leaflets/ Pamphlet Radio information capsules 	<ul style="list-style-type: none"> At least twice- before & after compensating During alignment/ OHT works 	<ul style="list-style-type: none"> PIU/ PMC Contractor
Households / people residing along alignment of feeder main lines or in proximity to OHT sites	<ul style="list-style-type: none"> Project design details, planned alignments and their impacts Design and site alternatives explored for impact minimization 	<ul style="list-style-type: none"> Newsletters/ pamphlets/ flyers Focus group discussions 	<ul style="list-style-type: none"> Continuous, as required in construction stage One week prior to start of construction in the respective stretches 	<ul style="list-style-type: none"> PIU/ PMC Contractor

Stakeholder Engagement and Information Disclosure Strategy				
Project: Water Supply Improvement Scheme in Kancheepuram City Municipal Corporation – <i>construction of Overhead Tanks, Laying of feeder main, distribution network, House Service Connections</i>				
Target stakeholders	Information to be disclosed	Proposed engagement & disclosure method	Timing of Engagement	Responsible Parties
	<ul style="list-style-type: none"> ● Accidents and road safety/ traffic management issues and measures planned to be in place; ● Information on likely disruptions to services and arrangement during construction including its duration and likely timings ● Management of air and noise pollution; Disruption to services and arrangement during construction ● Community and Occupational Safety measures planned for; ● Excavation works-sludge/ earth disposal plans ● Labour management plans/ proposed camp sites ● Grievance mechanism process 	<ul style="list-style-type: none"> ● TV-Radio-Print- Digital based information dissemination ● Helpline/ Toll-free numbers displayed at project locations and prominently accessed areas ● Suggestion boxes at site offices 	<ul style="list-style-type: none"> ● 	
Other Interested Parties: <ul style="list-style-type: none"> ● Resident Welfare Associations (RWAs) ● Elected Reps of Municipal Corporation ● Civil Society Organisations 	<ul style="list-style-type: none"> ● Project design details, planned alignments and their impacts ● Design and site alternatives explored for impact minimization 	<ul style="list-style-type: none"> ● One-on-one meetings ● Formal Small group meetings ● Open forums and Town-hall meetings for RWAs and ERs 	<ul style="list-style-type: none"> ● Continuous, as and when required during construction 	<ul style="list-style-type: none"> ● PIU/ PMC ● Contractor

Stakeholder Engagement and Information Disclosure Strategy				
Project: Water Supply Improvement Scheme in Kancheepuram City Municipal Corporation – <i>construction of Overhead Tanks, Laying of feeder main, distribution network, House Service Connections</i>				
Target stakeholders	Information to be disclosed	Proposed engagement & disclosure method	Timing of Engagement	Responsible Parties
<ul style="list-style-type: none"> • Print and Tele Media • Staff of Line departments • Service providers and duty bearers • Staff of Municipal Corporations • Community / Religious leaders • Regulatory agencies 	<ul style="list-style-type: none"> • Accidents and road safety/ traffic management issues and measures planned to be in place; • Information on likely disruptions to services and arrangement during construction including its duration and likely timings • Community and Occupational Safety measures planned for OHT constructions and transmissions; • Excavation works-sludge/ earth disposal plans • Labour management plans/ proposed camp sites • Grievance mechanism process 	<ul style="list-style-type: none"> • Formal presentations to closed groups like regulators, service providers and duty bearers 		
Civil Works Contractor, staff & subcontractors	<ul style="list-style-type: none"> • Project design details, alternatives, planned alignments and their impacts • Baseline information on environmental and social aspects • Project's induced environmental and social risk • Accidents & road safety/ traffic management measures planned • Orientation on EHS provisions 	<ul style="list-style-type: none"> • Provisions in Bid/ contract documents • One-on-One and formal small group meetings/ discussions • Formal presentations/ training to contractors project management team 	<ul style="list-style-type: none"> • Once, at the time of contract signing and orientation during pre-construction phase • Periodic briefings and orientation at site • Feedback as and when required on site and monitoring reports 	<ul style="list-style-type: none"> • PIU/ PMC • Contractor

Stakeholder Engagement and Information Disclosure Strategy				
Project: Water Supply Improvement Scheme in Kancheepuram City Municipal Corporation – <i>construction of Overhead Tanks, Laying of feeder main, distribution network, House Service Connections</i>				
Target stakeholders	Information to be disclosed	Proposed engagement & disclosure method	Timing of Engagement	Responsible Parties
	<ul style="list-style-type: none"> • Sexual harassment provisions and requirements • Labour Management Procedures • Orientation on RAP implementation and requirements • ESIA requirements and measures proposed • Grievance mechanism proposed under the project, requirements • Feedback on consultant/ contractor implementation and supervision reports 			

S. No.	Aspect	Mitigation measures	Responsibility	Implementation stage	Monitoring method	Performance Indicator	Frequency
1	Public disclosure	Placement of hoarding at public and prominent places indicating in English and Tamil language project details, name and contact number of Convenor and the Contractor.	Convenor/Contractor	Pre-construction phase	No. of hoardings and locations chosen	Effectiveness of message communicated	Once
2	Grievance Redressal Conduct consultations with the POTENTIAL TEMPORARY ECONOMIC IMPACTs, beneficiaries, local communities and other stakeholders	Understand the perception of stakeholders, the positive and negative impact of the project; Analyse the concerns and issues of POTENTIAL TEMPORARY ECONOMIC IMPACTs, local communities and	PMC E&S experts, Contractor EHS officer/ Project Manager and Convenor of PIU	Project life cycle beginning from the early stage of pre- construction	Site observations, Review of available documents; Support or opposition of stakeholders in project activities; Project progress level;	Procedure followed for conducting consultation; No. of meetings/ consultations held; No. of participants in each meeting; Profile of participants such as male and female;	

		<p>other stakeholders;</p> <p>Address the concerns raised as per ESMP provisions; and Implementation of project with a Gender responsive Approach.</p>			And Consultations conducted with stakeholders.	<p>Type and severity of issues raised; Response and action taken;</p> <p>Awareness level about the project;</p> <p>Temporary loss of POTENTIAL TEMPORARY ECONOMIC IMPACTs compensated Favourable social atmosphere towards project and support to participation in project activities; and</p> <p>Increased engagement in terms of number and level of stakeholders and women in the project activities.</p>	
3.	Effective functioning of GRC	Resolve the E&S related complaints and disputes in a time	GRC members headed by the authority	Project life cycle beginning from the early stage of pre- construction.	Site inspections; Consultations held with	Adequacy of information & dissemination about the GRC and its	Whenever required

		bound manner amicably without any cost.			POTENTIAL TEMPORARY ECONOMIC IMPACTs, and other stakeholders; Project related E&S complaints received in writing or verbally.	objectives among the stakeholders; No. of GRC meetings held and timeframe; GRC members present in each meeting; No. of complaints/grievances received and resolved; Time taken; Satisfaction of affected parties; and Court cases filed or withdrawn.	
4.	Organize meetings with line departments to seek project support as required	Coordination and meetings with the line departments, namely District Administration, SPCB, PWD, Traffic Police, GCC/ ULBs/ Town Panchayat and line agencies; Understand the role of line	CE, EE/ PIU, PMC	Project Planning stage onwards	Review the feedback of participants of the meeting; Date, time, and venue fixed as per suitability of other departments;	No. of officials participated in the meetings and signed the attendance sheet; Relevant information shared; Comments/suggestions offered, Effectiveness of meeting in project	Semi annually

		department and support envisaged for project implementation and operation; and obtain an update related to POTENTIAL TEMPORARY ECONOMIC IMPACTs, beneficiaries and other stakeholders.			Communicate d information in advance (letter signed by the CE/EE of the PIU); Presentation about the project (PPT), including objectives of the meeting, expectations from the participants; and Q&A details.	implementation and operation; Improved communication, coordination helpful in project activities; Increased understanding about the project related tasks; and Other facilitation roles.	
5.	Public awareness about the project	Organize public events and engage all stakeholders like related government departments, local communities, beneficiaries of the project, women's group,	PIU, PMC, Contractors	Pre-construction stage and onwards	Review the public awareness activities undertaken; Feedback of target groups to assess the effectiveness of such activities.	People understand importance of project and need for environmental and social sustainability;	Semi annually

		NGOs in project areas.					
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Stakeholder engagement format

S.No.	Activities	Details of Meetings/Consultations
1.	Officials who conducted meetings and consultations with the PAPs and other stakeholders in project villages	
2.	Name of locations and number of person participated	
3.	Profile of stakeholders (shopkeepers, residents, women, officials from other department, etc. as applicable)	
4.	Date of meetings/ consultations held	
5.	Issues and demands raised by the PAPs and other stakeholders	
6.	How these problems and demands are being solved?	

ANNEXURE -7 Waste management plan

S. No.	Aspect	Mitigation measure/Procedure	Responsibility	Implementation	Monitoring methods	Performance indicators	Frequency
1.	Up keep of storage/yard	Dispose-off the waste from the material storage to the designated site; and Ensure regular collection and removal of refuse and litter from the working site, office, labour accommodation, etc.	Contractor	Construction phase	Visual Inspection	Incidence of contamination	Daily
2.	Labour accommodation	Place sufficient number of garbage bins/containers at prominent locations of the project working sites and labour accommodations; Ensure emptying the garbage bins and dispose-off from the labour accommodation regularly in a hygienic manner; Dispose-off domestic waste water into drainage; Ensure sufficient number of bathing and ablution facilities in	Contractor	Construction phase	Visual inspections; and Records of waste disposal.	Incidence of staff not using facilities; and Incidence of pollution.	Daily

		<p>labour accommodations, sheds, and all the site staff;</p> <p>Create awareness about the importance and safe disposal of waste at work sites, labour accommodation and surroundings among the workers; and</p> <p>Impart training about handling the different types of wastes, waste management, including hazardous waste.</p>					
3.	Waste management measures	<p>Collect all waste bins, containers from all sites;</p> <p>Collect recyclable wastes separately and arrange for its collection by the authorized vendor;</p> <p>Prevent littering and pollution by construction staff at work sites by providing bins or waste bags in sufficient locations;</p> <p>Provide separate bins/containers for hazardous</p>	Contractor	Throughout project life cycle	<p>Regular audits of the CWMP implementation;</p> <p>Visual inspection of waste collection and disposal; and</p> <p>Construction areas for littering</p>	<p>CWMP in place;</p> <p>Extent to which CWMP is complied with;</p> <p>Presence of litter; Extent of filling rubbish bins;</p> <p>Total volume of general and hazardous waste storage</p>	Daily/ weekly as applicable

		<p>materials and mark these clearly;</p> <p>Store hazardous / polluting materials on impermeable ground until disposed-off or collected by the authorized vendor;</p> <p>Do not allow any burning or burying of waste on site; and Disposal of rubble and other waste construction materials at the designated site.</p>				<p>capacity on sites;</p> <p>Extent of waste segregation; and</p> <p>Frequency of waste collection and disposal</p>	
4.	Disposal of residual construction debris, excess soil and other materials	<p>The contractor shall identify the site for debris and waste disposal that should be finalized prior to start of the earthworks;</p> <p>Apply good practices and minimize the construction debris by the optimum use of material;</p> <p>Reuse the excavated soil and other material in backfilling, landscaping, filling low lying area and public places. Yet the unused residue of soil and</p>	Contractor	Construction phase	<p>Audit of excess and residual construction material disposal records and data; and</p> <p>Visual inspection.</p>	<p>Excavated soil and other wastes visible; and</p> <p>Cleanliness and maintenance of sites.</p>	Daily and regularly.

		<p>sedimentation left will be disposed of;</p> <p>Ensure that disposed waste do not cause soil and ground water pollution;</p> <p>Contractor should ensure that designated landfill site should be located in non-residential area at least 1000 meter away so that residents, flora and fauna are not impacted;</p> <p>Regularly clean up concretes piled during construction;</p> <p>Sweep / rake / stack excess aggregate / stone chip / gravel / pavers into piles;</p> <p>Emptied cement and other material bags, containers and unusable bins sold to a licensed vendor;</p> <p>Dispose excess and residual waste to the designated site;</p>					
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		<p>The training should be imparted to all staff about the effects of waste and litter and follow the appropriate disposal procedures; and</p> <p>Construction waste at site should be handled as per Construction and Demolition Waste Management Rules, 2016.</p>					
5.	Hazardous waste disposal	<p>Ensure that contaminants (including cement) are not placed directly on the ground to prevent runoff reaching the water resources;</p> <p>Ensure that the spillage of fuels, oil, lubricants collected does not contaminate the soil and water;</p> <p>Ensure the training work force about environmental pollution and its management;</p> <p>Ensure disposal of hazardous waste at the designated site by the authorized vendor and prevention of pollution therein;</p>	Contractor	Construction and operation phases	<p>Audit of hazardous material disposal records and data; and</p> <p>Visual inspection of hazardous materials handling, storage areas and disposal practices.</p>	<p>Incidence of non-compliance with safety procedures concerning hazardous waste material;</p> <p>Availability of spillage kits;</p> <p>Incidence of spillage of hazardous materials on site; and</p>	Daily or as required

		<p>Ensure hazardous materials such as solvent based paints, fuel, cleaning and polishing chemicals are handled with extreme precaution during their storing, transportation, and usage. Such material should be stored on impervious space/ floor;</p> <p>Ensure that only trained workers are involved in collection, storage, and disposal process; All precautions, safety and health measures are followed;</p> <p>Dispose of non- recyclable and recyclable metal objects through authorized vendor; and</p> <p>Regularly audit the records maintained for hazardous and other waste generated and disposal to designated site.</p>				Evidence of leaks and contamination of soil and water	
6.	Closure and rehabilitation of construction and labour sites	Contractor to restore the original condition of the site prior to demobilization;	Contractor	After completion of the civil works in construction phase	Physical verification of the site as well as items listed in	Clean and clear site; Site rehabilitated;	Onetime

		<p>Upon works completion, clear all structures, rubbish, fill-in and seal all the pits and trenches;</p> <p>Remove all construction equipment, vehicles, equipment, waste and surplus materials, temporary fencing and other items from the site;</p> <p>Clean up and remove any spills and contaminated soil in the appropriate manner; Do not bury discarded materials on site or any other land not designated for this purpose;</p> <p>Handover the completed construction site and the sites used for materials to rage and labour accommodations and sheds will be handed over; and</p> <p>Handover the project site after completion of operation phase.</p>			<p>the records of contractor; and</p> <p>Rehabilitation measures conducted after completion of construction and operation works.</p>	<p>and</p> <p>Original condition of construct ion and other sites restored</p>	
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Annexure 8 Labour Management Plan

LMP shall be prepared by the contractor following the requirements of the ESS2 on Labour and Working Conditions. The LMP is a living document, which is initiated early in project preparation, and is reviewed and updated throughout development and implementation of the project. Outline for LMP is provided below which is indicative and shall be made specific to the sub-project.

Description	Mitigation Measures	Responsibility	
		Implementation	Supervision
Applicable Laws	The contractor should ensure the compliance of applicable Indian Labour Laws such as Factories Act 1948, Building and Other Construction Workers Act 1996, Inter State Migrant Workmen Act 1979, Contract Labour (Regulation & Abolition) Act 1970, Workmen Compensation Act 1923, Child Labour (Prohibition & Regulation) Act 1986, Minimum Wages Act 1948, Employee State Insurance Act 1948, Employees Provident Fund Act 1991, Payment of Wages Act 1936, Payment of Bonus Act 1965, Equal Remuneration Act 1976, Payment of Gratuity Act 1972 and other International Labour organization conventions as ratified by India.	Contractor	PIU/PMC
Applicable Licences	Labour Licence and all other statutory work permits including Contract Labour & Interstate Migrant Worker License. Workmen compensation Insurance / Accident Insurance, EPF and ESIC.	Contractor	PIU/PMC
Site layout	The location of the site, design and basic facility provision in the labor accommodation will be reviewed and approved by the PIU prior to the construction;	Contractor	PIU/PMC
Facilities	Maintain necessary living accommodation and ancillary facilities in functional and hygienic conditions;	Contractor	PIU/PMC

	<p>Provide adequate number of toilets separate for men and women workers, bathing area, kitchen, safe fuel/LPG for cooking and uncontaminated water for drinking, cooking and washing;</p> <p>Ensure adequate water supply in all toilets and urinals;</p> <p>The labour camp should have protection from heat, rain, flooding, insects, snakes and mosquitoes.</p> <p>It should have adequate provisions for emergency such as fire safety, security, etc;</p> <p>Require the non-discrimination and harassment and should be socialized/basis for training, and covers potential ethnic discrimination.</p>		
Health and Safety	<p>Provide first aid medical kit at labour accommodation;</p> <p>train the labour for usage of items in injury, emergency, coordinate with nearest government and private medical centers for the medical services, display the contact number of medical doctor(s) and keep a vehicle for emergency travel all the time;</p> <p>necessary HIV/AIDS prevention measures will be taken at labour camp;</p> <p>HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer;</p>	Contractor	PIU/PMC

	<p>Where feasible, manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; ULB shall ensure proper segregated storage, collection, transport, treatment and disposal of all wastes following the SWM / C&D waste Rules 2016;</p> <p>remove all wreckage, rubbish, or temporary structures which are no longer required;</p>		
Labour use	<p>The total number of workers to be employed on the project, and the different types of workers: direct workers, contracted workers, temporary or seasonal workers and community workers.</p> <p>(Where numbers are not yet firm, an estimate should be provided)</p> <p>broad description and an indication of the likely characteristics of the project workers e.g. local workers, national or international migrants, female workers, workers between the minimum age and 18;</p> <p>details of the migrant workers, labour camp location should be shared with local Police station as per regulatory norms.</p>	Contractor	PIU/PMC
Grievance	<p>Establish a mechanism for grievance redressal for both direct and contract labourers, disclose contact details of officials concerned.</p>	Contractor	PIU/PMC

	Sign boards and GRC name boards should be written in local, multilingual languages and English at the labour camp.		
Policies and Procedures	<p>Provide workers with contracts with fair terms and conditions</p> <p>Require the contractor to preferentially engage unskilled local workforce from the local communities</p> <p>Make all contracted workers to follow the rules for on-site behaviour (with colleagues) and conduct in the community.</p> <p>Conduct induction and toolbox talks outlining expected conduct and local community values.</p> <p>Introduce disciplinary measures for violations and misbehaviours.</p> <p>Set the minimum age of project workers eligible for any type for work.</p> <p>Train the labour for environmental protection, occupational and community health and safety and gender equality.</p> <p>Follow the equal wages policy without any discrepancies or gender partialities.</p> <p>Ensure minimum legal labour standards as per ILO regulations (child/forced labour, no discrimination, working hours, minimum wages) are met with.</p>	Contractor	PIU/PMC

	Contractors shall implement codes of conduct concerning employment and workforce behaviour (including but not limited to safety rules, zero tolerance for substance abuse, environmental sensitivity of the area, dangers of sexually transmissible diseases and HIV/AIDS, gender equality and sexual harassment, respect for the beliefs and customs of the populations and community relations in general).		
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Annexure 9 Immediate Incident Notification Form

Any Major Incident occurring on the Construction site of the Sub-Projects or caused by the Construction activities shall be reported by the Contractor/ Borrower / PIA to the Project Executing Agency (PEA) as soon as possible and not later than 24 hours after the incident occurred.

Definition of Major Incident:

Any social, labour, health and safety, security or environmental incident or accident having or which would reasonably be expected to have a negative impact on the Project. This may include explosions, fires, spills or workplace accidents which result in serious or multiple injury or major pollution. Any Injury of any employee (of Contractor or subcontractors/ suppliers) that causes loss of working time (Loss Time Injury) is considered as a major Incident.

Guidance for Accidents and Incidents Reporting

1 Basic Information

- *date, time, weather / lighting / conditions*
- *statement of facts*
- *details of deaths, injuries, damage, immediate losses*
- *details of witnesses*
- *details of whether scene was secured / photographed*
- *details of any item tested / sampling / sent for testing / removed from scene*
- *details of person leading investigation*
- *time lapse between accident and investigation*

Basic data should be clear, unambiguous, and factual (i.e. free from interpretation). Any gaps in the data should be highlighted and addressed in the investigation.

2 Investigation

- *reconstructed timeline of events, with the incident/accident in the mid-point, and linked events streamed either side, with clear identification of individuals/teams/third parties (e.g. contractors) that are linked and therefore require interviewing*
- *robust but sensitive questioning of witnesses and linked individuals/third parties to*
- *clarify facts, assist with timeline reconstruction and advance the investigation. Statements/ notes of interviews to be included.*

The investigation must follow the facts, witnesses and linked individuals/third parties and the timeline, and not be constrained by the incident/accident event in isolation.

In case publications on the event are available, these should be attached to the report (e.g. press articles, online articles, radio and TV- spots).

3 Analysis

- *using basic data, interview outcomes and reconstructed timeline, identification of:*
 - *immediate causes*
 - *underlying causes (actions in the past that have allowed or caused undetected unsafe conditions/acts)*
 - *root causes (generally organisational/management failings, sometimes not directly/ obviously in relation to accident/incident regarding location/time)*
 - *identification of absent/inadequate/failed/unused risk identification,- management- and control measures, reference/gap analysis against relevant national legislation and against the international standards as applicable and agreed upon for the Project*
- *conclusions and summary of root causes and underlying causes for the accident/incident.*

Analysis must be sufficiently rigorous to go wherever the investigation has led. Identification of root, underlying and immediate causes must be sufficiently credible and robust to withstand third-party scrutiny.

4 Way forward

- *for EACH root cause, underlying and immediate cause, a corrective/preventive action is required (these may be numerous and interlinked)*
- *for EACH action, a named person with sufficient resource to deliver upon it and a clear timeline (action plan) is required. In addition, a named person should have overall responsibility for monitoring / reporting on progress (with timelines).*
- *demonstration, that all actions together will prevent recurrence; evidence that current risk assessments/procedures have been revised to reflect this*
- *details of communications to stakeholders, to include a concise summary of the investigation, including the action plan, and lessons learned.*
- *details of ongoing support and assistance to those impacted directly or indirectly by the accident.*

Types of reportable injury

The death of any person

All deaths to workers and non-workers, with the exception of suicides, must be reported if they arise from a work-related accident, including an act of physical violence to a worker.

Specified injuries to workers

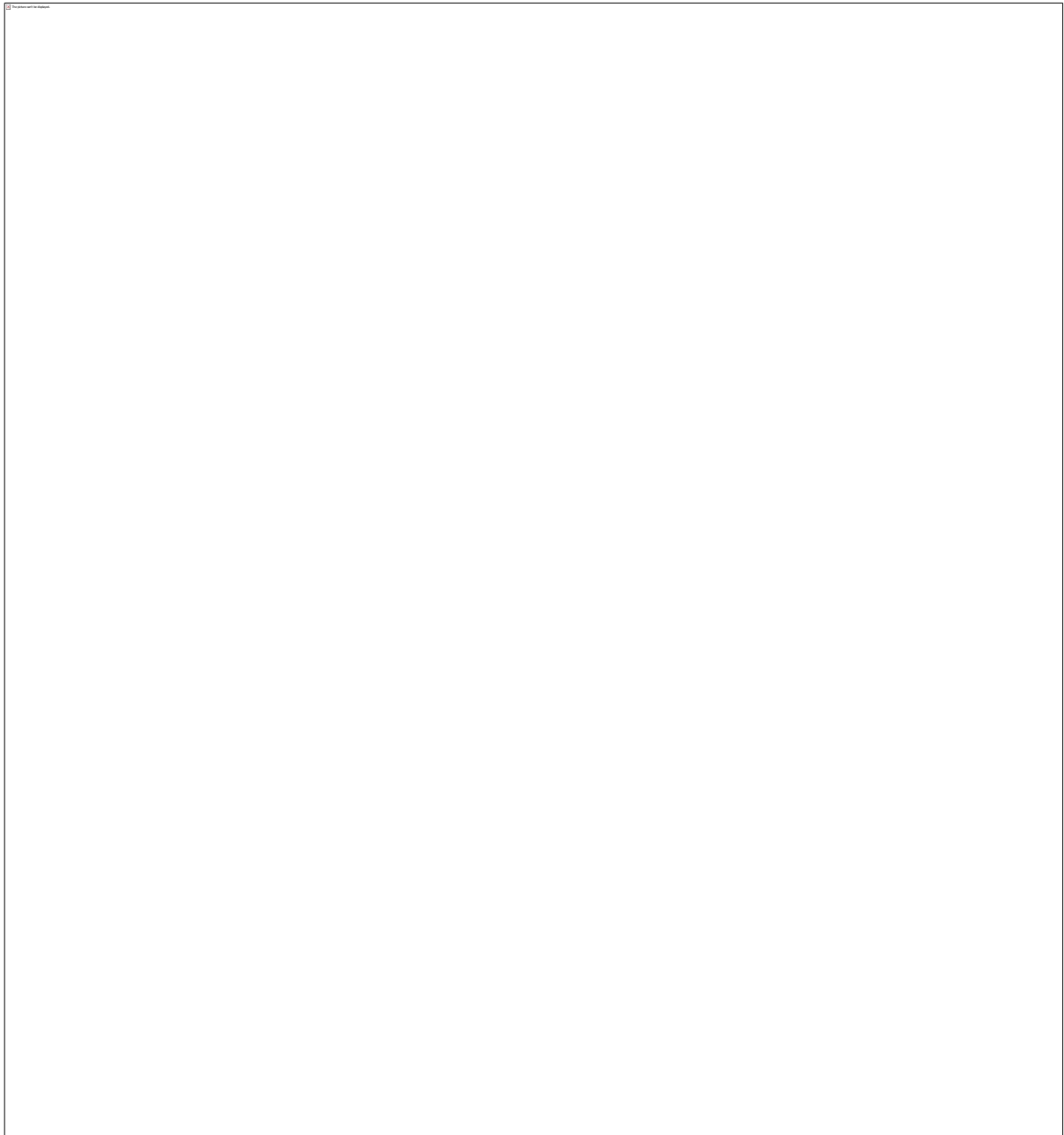
- fractures, other than to fingers, thumbs and toes
- amputations
- any injury likely to lead to permanent loss of sight or reduction in sight
- any crush injury to the head or torso causing damage to the brain or internal organs
- serious burns (including scalding) which:
 - covers more than 10% of the body
 - causes significant damage to the eyes, respiratory system or other vital organs
- any scalding requiring hospital treatment
- any loss of consciousness caused by head injury or asphyxia
- any other injury arising from working in an enclosed space which:
 - leads to hypothermia or heat-induced illness
 - requires resuscitation or admittance to hospital for more than 24 hours

Source: <http://www.hse.gov.uk/riddor/reportable-incidents.htm>

IMMEDIATE INCIDENT NOTIFICATION							
1. Incident Details							
Project Company		Date of incident					
		Time of Incident					
Location of incident		Type of Incident	Environmental	<input type="checkbox"/>			
			Injury	Workforce	<input type="checkbox"/>		
				Public/Local community	<input type="checkbox"/>		
			Social incident (e.g. violent labor unrest)	<input type="checkbox"/>			
2. WHAT HAPPENED							
Brief description of incident							
3. INJURED WORKERS							
Employee / Contractor	Sex	Age	Job Title / Description	Time with company	Cause	Injury Type (Major / Fatal)	
4. INJURED MEMBERS OF PUBLIC							
Name	Sex	Age	Community	Place of Residence	Cause	Injury Type (Major / Fatal)	
5. ENVIRONMENTAL INCIDENT							
Type (Spill / Gas Release)	Total Loss (Litres /kg)			Cause		Damage	

6. WITNESSES TO INCIDENT			
Name	Sex	Place of Residence	Description of incident
7. OTHER RELEVANT INFORMATION			
Have the authorities been informed?		Yes	<input type="checkbox"/> No <input type="checkbox"/>
<i>Please provide further information here</i>			
Media attention?		Yes	<input type="checkbox"/> No <input type="checkbox"/>
<i>Please provide further information here</i>			
Any effects off-site?		Yes	<input type="checkbox"/> No <input type="checkbox"/>
<i>Please provide further information here</i>			
Photographs taken? <i>(please include them in this report)</i>		Yes	<input type="checkbox"/> No <input type="checkbox"/>
Date			
Which immediate corrective actions have been taken after the accident? By whom?			
<i>Please describe here if the accident lead to changes into the works organisation or process, if specific equipment has been acquired/mobilised, if protection measures were implemented, if works have stopped etc.</i>			
Person completing form:			
Name and position:			
Contact details:	Phone	Email	

Annexure 10 Source Water Quality





TEST WATER BEFORE TASTE

TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

District Level Water Testing Laboratory

TWAD Board, IB Campus, Kancheepuram-631 502.

Phone: 044-27235449

TEST REPORT

Doc.No: DWTL/FORM/7.8/01

Test Report No: 33182	Report Issue Date : 15.09.2022
Invoice Details: 4545/Dt.12.09.2022/Amt.Rs.1180	

S.No	Parameters	Test Method	Unit	Result	Specification as per IS 10500 : 2012	
8	Appearance	Physical observation	-	Clear	-	-
9	Colour	APHA 23rd Edition 2017 4500 H-B	Hazen	Colourless	-	-
10	Odour	IS 3025 Part 5 1983	-	Agreeable	Agreeable	Agreeable
11	Turbidity	APHA 23rd Edition 2017 - 2150 B	NTU	-	1	5
12	Total Dissolved Solids	APHA 23rd Edition 2017 - 2540 C	mg/L	1090	300	2600
13	Conductivity	APHA 23rd Edition 2017 - 2310 B	μ S/cm	762	-	-
14	pH - Alkalinity	IS 3025-Part 23-1983	mg/L	-	-	-
15	Calcium	APHA 23rd Edition 2017 - 3500 Ca B	mg/L	-	75	200
16	Magnesium	APHA 23rd Edition 2017 - 3500 Mg B	mg/L	-	30	100
17	Sodium	APHA 23rd Edition 2017 - 3500 Na B	mg/L	-	-	-
18	Potassium	APHA 23rd Edition 2017 - 3500 K B	mg/L	-	-	-
19	Iron	APHA 23rd Edition 2017 - 3500 Fe B	mg/L	0.00	0.3	1
20	Manganese	APHA 23rd Edition 2017 - 3500 Mn B	mg/L	-	0.1	0.3
21	Ammonia	APHA 17th Edition-1989- 4500 NH3C	mg/L	0.00	0.5	0.5
22	Nitrite as NO ₂	APHA 23rd Edition 2017 - 4500-NO2 B	mg/L	0.00	-	-
23	Total Phosphate as PO ₄	APHA 23rd Edition 2017 - 4500 P- D	mg/L	0.2	-	-
24	Tidys	APHA 23rd Edition 2017 - 4500 O - B	mg/L	-	-	-

.....End of the report.....

Remarks: The above sample confirmed to the IS:10500:2012 Drinking water specification for the above tested parameters.

S. Balamurugan
15/9/22
Authorised Signatory
S.Balamurugan - Assistant Engineer

Note:

- 1 The test result relate only to items tested.
- 2 The test report shall not be reproduced anywhere except in full and in the same format without the permission of the laboratory
- 3 Unless informed by customer, the test items will not be retained for more than 15 days from the date of issue of the test report
- 4 The Result applied to the sample as Received basis.

Annexure 11 Environmental Audit of Existing Water Supply Scheme

1. Water Supply Source

At present, as per JJM norms the population and demand is raised. Based on the population, at present the total ultimate demand is 60.36 MLD. The existing sources available at present in Kancheepuram corporation is 25.50 mld against the total ultimate requirement of 60.36 mld. The gap between the existing sources and ultimate requirement is 34.86 mld. Thus, the additional source is necessary to fulfil the ultimate requirement.

Due to the above circumstances, Palar river source is contemplated for the above water supply scheme for potable and sustainable source as a long-term measure. By considering the hydrogeological investigation, remote sensing techniques, river morphology, flow details of river palar and data of existing head works at river palar a detailed study has been carried out in Thiruparkadal area in river palar. Probing works has been carried out in the above areas and based on sand probing results trial borewells and confirmatory borewells have been drilled in these locations. In this area the soil samples are collected and analysed. On analysing the lithology of trial bore and confirmatory bore holes in different locations, it is ascertained that this area is feasible for providing Collector wells and Infiltration wells for required extraction. In Thiruparkadal zones are more favourable to create 3 nos. of new collector well as source. Since, the sand depth available is up to 14 to 16m from bed level.

Based on the Ultimate population and present water level conditions the above recommended 3 nos. of collector wells, cumulative yield may get 31.00 mld only against the total proposed requirement of 34.86 mld (the expecting yield of the 1 No. of Collector well with 16m depth is 11 mld and 2 nos. of collector wells with 10m sand depth is 10 mld each).

The above recommended 3 nos. of collector wells may not fulfil the total proposed requirement; hence it is necessary to identify and propose the 4 nos. of Infiltration wells at Thiruparkadal area in Palar river stretch to fullfill the gap of 3.86 mld. Based on the above, the sand probing, trial bore holes and Confirmatory bore holes was drilled and confirmed the suitable location to create 4 nos. of infiltration wells.

The additional sources of 3 nos. of collector wells and 4 nos. of Infiltration wells is identified and confirmed at Thiruparkadal in river Palar. Therefore, the above confirmed collector well sources and Infiltration well sources may be utilized to fullfill the total ultimate demand for Water supply improvement scheme to Kancheepuram Corporation in Kancheepuram district has suggested and recommended. The source is sustainable in normal seasonal condition.

Moreover, PWD is now constructing subsurface dyke in river palar at Thiruparkadal village. Since, the structure that is built in an aquifer with the intention of obstructing the natural flow of ground water, thereby raising the ground water level and increasing the amount of water stored in the aquifer. Acting as an underground barrier impermeable to water, it controls the groundwater flow in an aquifer and raises the water table.

Source Water Quality: The source location for the sub-project is same as the existing source for water supply to Kancheepuram Corporation. The water withdrawn is being supplied after disinfection. The quality has been assessed and the results are provided in Annexure 10. From the results the source quality is observed to be within the permissible standard for drinking water. Hence no treatment is proposed for improvement of water quality.

2. Existing Infrastructure:

The existing water supply infrastructure has been reviewed in detail for their condition, structural stability, meeting the water supply requirements, and the following have been concluded.

- **Headworks:** There are no shutdown during floods reported so far, this is due to the fact the intake structures, pipe carrying bridge are above bund level.
- **Pumping mains:** Gravity main from tiruparkadal faces frequent leaks and it is proposed to be replaced in this project.
- **Distribution System:** Micro details of water distribution system like diameter, pipe length etc for each ward/area are not available with ULB. As informed by ULB, the distribution system is old and was laid with AC & PVC pipes for a length of 205 Km, covering 50% of the road length. At present 31180 nos of water HSC exist in Kancheepuram. All the existing 205 km of distribution networks pipes are proposed to be replaced and totally 450.71km of distribution network is proposed for this project. There is no any associated risk involved in the proposed replacement of pipes as the existing pipes will be abandoned and new pipelines will be laid along the existing pipelines.
- **Over Head Tanks:** Providing water supply to the Kancheepuram City Municipal Corporation project utilises existing OHTs in this scheme. There are 97 OHTs existing in Kancheepuram with capacities ranging from 0.10 LL to 20.00 LL and with staging height varying from 6m to 12m. Out of the Existing 97 OHTs, 4 OHTs are of 9m Staging Height, 9 Nos. of OHTs are of 12m Staging Height, the remaining 84 OHTs are of staging height from 6m to 7.5m. OHTs are of under size and staging height is less (6m) and in poor condition, unable to cater the water demand. Based on the structural condition, staging height, capacity, 10 existing OHTs of 7.5m to 12m staging height with capacities from 2.00 LL to 20.00 LL are proposed to be retained. Other existing OHTs and sumps have not been considered in planning and design of proposed water supply scheme. (Detailed analysis is available in the chapter 4 of Vol I of the DPR). In addition 14 new OHTs have been proposed to be constructed in this sub-project.

Regulatory Requirements

Permission for source:

- Proposed activities: For withdrawal of sub-surface water under this sub-project, Water Utilisation Committee Clearance to be obtained from WRD/PWD. Further for constructing 3 pipe carrying bridges WRD/PWD clearance to be obtained.

Safety requirements in O&M:

The drinking water is being disinfected by liquid chlorination by the Corporation prior to distribution. The residual chlorine level for drinking water is being adopted for distribution. However, records need to be maintained by the operating staff for the use of necessary PPEs & residual chlorine levels.