

Appendix 7.1 Environmental and Social Conditions Relevant to the Project

A7.1.1 Pollution

(1) Air Pollution

For the EIA study, ambient air quality monitoring surveys were carried out from March to May 2012 at eight locations set up in an area of 10 km radius around the proposed project site. The results of these surveys are summarized in Table A7.1.1.

Table A7.1.1 Ambient Air Quality around Proposed Project Site

Location	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)		SO ₂ (µg/m ³)		NO _x (µg/m ³)		CO (µg/m ³)	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Near Plant Site	49.9	40.9	18.5	12.8	10.7	8.6	14.2	10.7	514	383
Thiruporur	51.5	42.4	19.5	13.8	10.8	8.2	13.6	11.0	527	390
Alathur	47.3	41.4	17.3	13.9	9.8	8.3	13.3	10.4	481	373
Pudunemmenkuppam	46.0	37.8	17.4	12.9	9.6	7.5	13.7	9.7	495	365
Thiruvidanthai	44.7	36.7	16.1	12.4	10.2	7.9	13.5	10.0	486	371
Kelambakkam	52.5	45.2	19.5	15.1	10.4	8.6	14.8	11.4	536	394
Nenneli	40.0	32.7	14.6	11.0	9.9	8.2	13.8	10.2	489	368
Tandalam	43.6	36.3	15.4	11.8	9.8	8.2	13.1	10.4	497	377
Range	32.7-52.5		11.0-19.5		7.5-10.8		9.7-14.8		365-536	
Standards	100		60		80		80		2,000	

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

Based on the table, the EIA report concluded that the concentrations of the ambient air pollutants of PM₁₀, PM_{2.5}, SO₂, NO_x and CO were within the air quality standards for Industrial, Rural, Residential and Other areas of the Central Pollution Control Board (CPCB).

(2) Water Pollution

For the EIA study, ground and surface water quality monitoring surveys were carried out in 2012 at four and two locations, respectively, that were set up in an area of 10 km radius around the proposed project site, as shown in Table A7.1.2. The results of these surveys are summarized in Table A7.1.3.

Table A7.1.2 Water Quality Monitoring Location

		Location	Distance from Project Site (km)	Direction from Project Site
Groundwater	GW1	Alathur	5.0	SW
	GW2	Thiruporur	4.7	MW
	GW3	Pudunemmelikuppam	1.9	SSW
	GW4	Thiruvidanthai	6.9	NNE
Surface Water	SW1	Pattipulam	2.7	SSW
	SW2	Vada Nemmeli	4.6	NNE

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

Table A7.1.3 Ground and Surface Water Quality around Proposed Project Site

Parameters	Unit	IS:10500 Limits	GW1	GW2	GW3	GW4	SW1	SW2
pH	-	6.5-8.5 (NR)	7.4	7.5	7.3	7.6	7.9	7.9
Color	Hazen	5 (25)	2	3	2	2	2	2
Taste	-	Agreeable	Ag	Ag	Ag	Ag	51,600	51,800
Odor	-	U.O	U.O	U.O	U.O	U.O	-	-
Conductivity	µS/cm	\$	1,601	1,676	104	1,568	-	-
Turbidity	NTU	5 (10)	1	2	1	1	-	-
TDS	mg/l	500 (2000)	1,040	1,080	65	1,015	33,540	33,670
Total Hardness	mg/l	300 (600)	473	497	39	640	7,013	7,059
Total Alkalinity	mg/l	200 (600)	485	350	22	510	145	150
Calcium as Ca	mg/l	75 (200)	160.5	165	10.2	85	690	700
Magnesium as Mg	mg/l	30 (100)	17.5	20.5	5.3	40	1,285	1,290
Residual Chlorine	mg/l	0.2 Min	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Boron	mg/l	1	0.01	0.02	<0.01	0.02	0.04	0.05
Chloride as Cl	mg/l	250 (1000)	140.2	235	10.2	85	17,359	17,458
Sulphate as SO ₄	mg/l	200 (400)	86.5	112.2	6.1	120	0.1	650
Fluorides as F	mg/l	1.0 (1.5)	0.9	0.8	0.5	0.7	620	2
Nitrates as NO ₃	mg/l	45 (NR)	30.2	35	11.2	36	2	3.5
Sodium as Na	mg/l	\$	145	150	6.2	65	3	8524
Potassium as K	mg/l	\$	15.6	16	0.6	14	8,500	350
Phenolic compounds	mg/l	0.001 (0.002)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanides	mg/l	0.05 (NR)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anionic Detergents	mg/l	0.2 (1.0)	<0.1	<0.1	<0.1	<0.1	Absent	Absent
Mineral Oil	mg/l	0.01 (0.03)	<0.01	<0.01	<0.01	<0.01	-	-
Cadmium as Cd	mg/l	0.01 (NR)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic as As	mg/l	0.01 (NR)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper as Cu	mg/l	0.05 (1.5)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead as Pb	mg/l	0.05 (NR)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese as Mg	mg/l	0.1 (0.3)	0.01	0.04	<0.01	0.02	-	-
Iron as Fe	mg/l	0.3 (1.0)	0.06	0.04	0.02	0.05	0.03	0.03
Chromium as Cr ⁺⁶	mg/l	0.05 (NR)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Selenium as Se	mg/l	0.01 (NR)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc as Zn	mg/l	5 (15)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum as Al	mg/l	0.03 (0.2)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury as Hg	mg/l	0.001 (NR)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pesticides	mg/l	Absent	Absent	Absent	Absent	Absent	Absent	Absent
E. Coli	-	Absent	Absent	Absent	Absent	Absent	-	-
Total Coli forms	MPN/100	10	<2	<2	<2	<2	<2	<2
DO	mg/l	\$	-	-	-	-	5.5	5.6
BOD	mg/l	\$	-	-	-	-	<3	<3
COD	mg/l	\$	-	-	-	-	<5	<5
Phosphates as PO ₄	mg/l	\$	-	-	-	-	0.1	0.1
Oil and Grease	mg/l	\$	-	-	-	-	<1	<1
SAR	-	\$	-	-	-	-	44.17	44.15

Note: Values in parenthesis are 'Permissible limit in the absence of Alternate source'. NR: No relaxation, \$: Limits not specified, UO: Un-Objectionable, Ag-: Agreeable, SAR: Sodium Absorption Ratio

IS: 10500 (the standard prescribes the requirements for the essential and desirable characteristics required to be tested for ascertaining the suitability of water for drinking purpose)

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water

According to the table, the ground water and surface water surveyed are discussed as follows:

- TDS (Total Dissolved Solid), Hardness (CaCO₃), Total Alkalinity and Calcium (Ca) showed higher values than the Indian Standard for safe drinking water of IS 10500 in the wells other than the GW3.
- TDS (Total Dissolved Solid), Hardness (CaCO₃), Calcium (Ca) and Magnesium (Mg) showed higher values than the Indian Standard for Safe Drinking Water of IS 10500 in both surface water and ground water.

(3) Waste

Specific information and data on waste management systems around the proposed project have not been identified by the relevant reviews.

(4) Soil Characteristics

For the EIA study, soil samples were collected for analysis from eight locations of 10 km radius around the proposed project site as shown in Table A7.1.4; the results have been summarized as follows.

Table A7.1.4 Soil Quality Monitoring Location

	Location	Distance from Project Site (km)	Direction from Project Site
S1	Near- Plant Site	0.0	-
S2	Thiruporur	4.7	NW
S3	Aalathur	5.0	SW
S4	Pudunellikuppam	1.9	SSW
S5	Thiruvidanthal	6.9	NNE
S6	Kelambakkam	9.2	NNW
S7	Nemmeli	1.2	NW
S8	Thandalam	3.2	W

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

- pH of soil samples ranged from 7.8 to 8.1
- Electrical Conductivity (EC) of the soil samples varied from 144 to 280 μ mhos/cm
- Phosphorus (P) values ranged between 28.2 kg/ha and 78.0 kg/ha
- Nitrogen (N) values ranged between 38.0 kg/ha and 65.0 kg/ha
- Potassium (K) values ranged between 0.06 kg/ha and 0.20 kg/ha

(5) Noise

For the EIA study, noise levels were monitored at eight locations of 10 km radius around the proposed project site; the results have been summarized in Table A7.1.5.

Table A7.1.5 Noise Level around Proposed Project Site

	Location	Distance from Project Site (km)	Direction from Project Site	Zone	L ₁₀	L ₅₀	L ₉₀	L _{eq}	L _{day}	L _{night}	L _{dn}
N1	Near- Plant Site	0.0	-	Residential	44.3	40.4	36.7	41.4	42.2	38.6	45.7
N2	Thiruporur	4.7	NW	Residential	47.7	43.8	40.1	44.8	45.6	42.0	49.1
N3	Aalathur	5.0	SW	Residential	45.8	41.9	38.2	42.9	43.7	40.1	47.2
N4	Pudunellikuppam	1.9	SSW	Residential	45.1	41.2	37.5	42.2	43.0	39.4	46.5
N5	Thiruvidanthal	6.9	NNE	Residential	46.2	42.3	38.6	43.3	44.1	40.5	47.6
N6	Kelambakkam	9.2	NNW	Residential	48.3	44.4	40.7	45.4	46.2	42.6	49.7
N7	Nemmeli	1.2	NW	Residential	45.5	41.6	37.9	42.6	43.4	39.8	46.9
N8	Thandalam	3.2	W	Residential	44.9	41.0	37.3	42.0	42.8	39.2	46.3

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

- The day-night noise level (L_{dn}) near the proposed project site was observed as 45.7 dB(A).
- The noise levels observed were within the acceptable levels as per the standards of Central Pollution Control Board (CPCB).

(6) Subsidence

Specific information and data on ground subsidence in and around the proposed project have not been identified by the relevant reviews. However, the proposed project site is a flat near the sea beach sandy areas.

(7) Offensive Odor

Specific information and data on offensive odor in and around the proposed project have not been identified by the relevant reviews. However, by considering the following circumstances, it is considered that there is no offensive odor in and around the project area as the proposed project site is a flat and open area adjoining sandy beach in the East (easy to disuse if there are some odor from ECR traffic exhaust gasses and crematory activities).

- The East Coast Road (ECR) is located on the west side of the proposed project site.
- Small crematory facilities are situated on the North West side in the proposed project land.
- Nemmeli Panchayat (Village) is located next to the proposed project site.

A7.1.2 Natural Conditions

(1) Climate

1) Temperature, Rainfall and Humidity

Table A7.1.6 and Table A7.1.7 show meteorological data in Chennai and the project site, respectively.

Table A7.1.6 Meteorological Data in Chennai (1971-2000)

Month	Mean Temperature (°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Daily Minimum	Daily Maximum			Hail	Thunder	Fog	Squall
Jan	20.9	28.8	22.5	1.3	0	0	0.3	0
Feb	22	30.5	2.2	0.4	0	0.1	0.2	0
Mar	23.8	32.5	4	0.3	0	0.2	0.1	0
Apr	26.4	34.3	7.7	0.6	0	0.7	0	0
May	27.9	36.8	43.9	1.4	0	1.8	0	0.1
Jun	27.5	36.9	55.9	4	0	3.3	0	0.2
Jul	26.3	35	100.3	6.9	0	3.3	0	0.1
Aug	25.7	34.3	140.4	8.5	0	4.6	0	0.1
Sept	25.5	33.9	137.3	7.1	0	5.4	0	0
Oct	24.5	31.8	278.8	10.6	0	5.9	0	0
Nov	23	29.6	407.4	11.7	0	2.8	0	0
Dec	21.9	28.5	191.1	6.3	0	0.7	0	0
Annual	24.6	32.8	1,391.5	59.1	0	28.8	0.7	0

Source: Regional Metrological Centre in Chennai, India Metrological Department:
(<http://www.imd.gov.in/section/climate/extreme/chennai2.htm>)

Table A7.1.7 Meteorological Monitoring Data in the Proposed Project Site (2013)

Month (2013)	Temperature (°C)		Relative Humidity (%)		Total Rainfall (mm)
	Max	Min	Max	Min	
Aug.	37.5	23.7	100	28	73
Sept.	36.8	22.9	100	34	89
Oct.	36.3	22.6	100	21	121

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

2) Wind

Table A7.1.8 shows wind data in Chennai, and it can be evaluated that the prevailing wind direction in Chennai is from South to South-West.

Table A7.1.8 Wind Pattern (India Meteorological Department (IMD), Chennai)

Season	Month	First Predominant Wind		Second Predominant Wind		Calm Condition in %	
		0830	1730	0830	1730	0830	1730
Pre-monsoon	Mar.-Jun.	S	S	SSW	SSW	10.3	1.7
Monsoon	Jul.-Sept.	SSW	SSW	SW	S	10.5	8.2
Post-monsoon	Oct.-Dec.	NNE	E	N	NE	21.0	25.0
Winter	Jan.-Feb.	NE	S	NNE	E	31.0	16.7
Annual		SSW	S	SW	SSW	15.8	12.9

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

(8) Geology

The Detailed Project Report for the project (Feb. 2014) summarizes that subsoil of the proposed project site is made up of three distinct layers as shown in Table A7.1.9.

Table A7.1.9 Geology of the Proposed Project Site

Layer	Depth (m)	SPTs (standard penetration tests)- N Value
Grayish Silty Fine Sand	0.0 -10.0/13.0	10 - 64
Brownish Silty Sand	10.0-13.0	7 - 9
Soft Disintegrated Rock	13.0/15.0-19.0	>100
Hard Rock	17.0-23.0	-

Source: Detailed Project Report (DPR) for the Project, Feb. 2014, AECOM for Chennai Metro Water

(9) Earthquake and Tsunami Disaster

1) Earthquake

Table A7.1.10 shows a list of earthquakes/earth tremors of more than magnitude 5 in Tamil Nadu State since 1807.

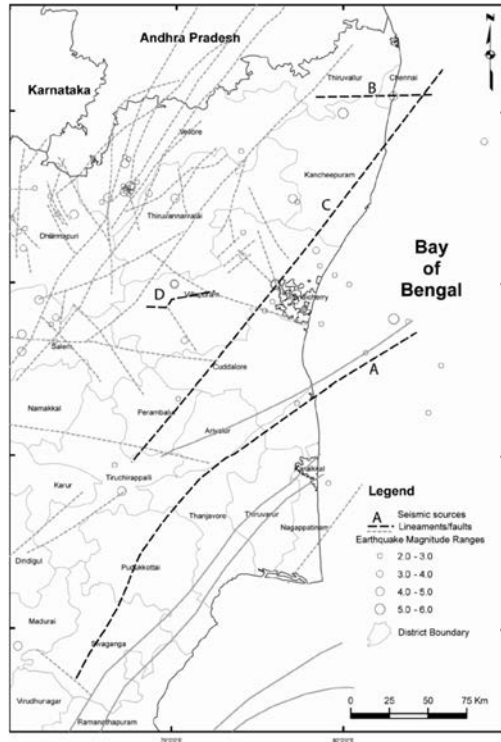
Table A7.1.10 Earthquakes/Earth Tremors of >5 Magnitude in Tamil Nadu State Since 1807

No.	Year/Month/Date	Latitude	Longitude	Magnitude	Location
1	1807/12/10	13.1000	80.3000	5.0	Chennai (Off the Coast)
2	1816/09/16	13.1000	80.3000	5.0	Chennai (Off the Coast)
3	1822/01/29	12.0000	79.0000	5.0	Thirukkivilur, Villupuram
4	1822/01/29	12.5000	79.7000	5.0	Vandavasi, Thiruvannamalai
5	1823/03/02	13.0000	80.0000	5.3	Sriperumpudur, Chennai
6	1859/01/03	12.5000	79.0000	5.0	Polur, Thiruvannamalai
7	1865/08/02	12.7000	78.7000	5.0	Vaniyambadi, Vellore
8	1867/07/03	12.0000	79.6000	5.7	Vikkiravandi, Villupuram
9	1882/02/28	11.4600	76.6000	5.7	Ooty, Nilgiris
10	1900/02/08	10.8000	76.8000	6.0	South West of Walayar, Coimbatore
11	1972/07/29	11.0000	77.0000	5.0	Northeast of Coimbatore
12	2001/09/25	11.8600	80.3000	5.6	40 km east of Pondicherry (Off the coast)

Source: Seismic Hazard Assessment Based on Attenuation Relationship for Tamil Nadu State, India, Dr. S. Rajarathnam, Dr. G.P. Ganapathy & Mr. R. Muthukumar, Centre for Disaster Mitigation and Management, Anna University, Chennai (<http://nidm.gov.in/idmc/Proceedings/A1%20Earthquake/A1-35-RAJARATHNAM.pdf>)

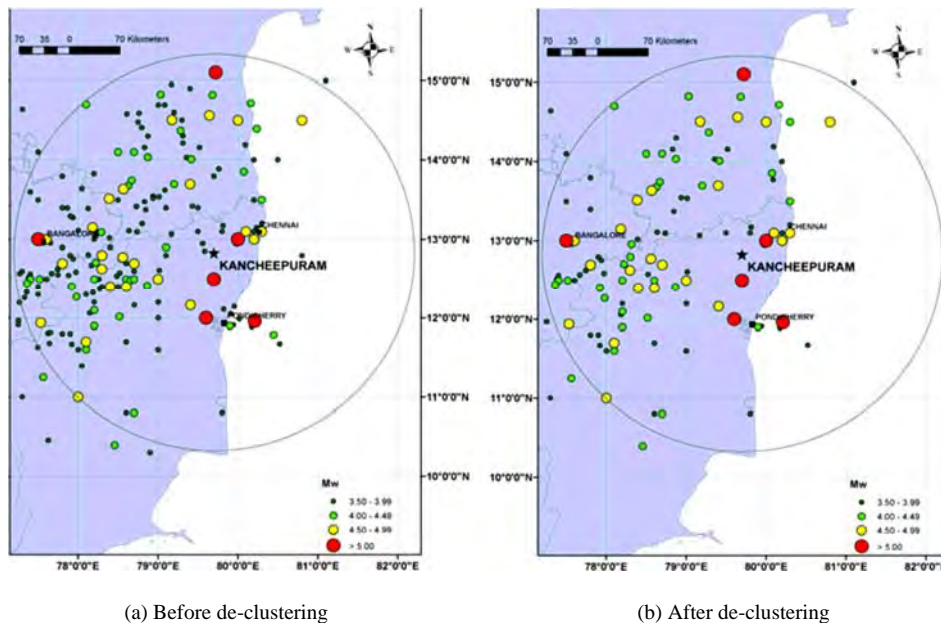
Chennai area including Kancheepuram District (where the proposed project site is located) is in Zone III (Moderate Seismic Hazard) classified by the Bureau of Indian Standard.

Figure A7.1.1 and Figure A7.1.1 show seismic sources and faults in Chennai area and seismicity around Kancheepuram, respectively.



Source: First level seismic microzonation map of Chennai city - a GIS approach G.P. Ganapathy Centre for Disaster Mitigation and Management, VIT University, Vellore, 21 Feb. 2011, Natural Hazards and Earth System Sciences

Figure A7.1.1 Seismic Sources and Faults in Chennai Area



Source: Seismic Hazard at the Historical Site of Kancheepuram in Southern India Ornthammarath, T., Lai, C.G., Menon, A., Corigliano, M., Dodagoudar, G.R. and Gonavaram, K. K. The 14th World Conference on Earthquake Engineering Oct. 12-17, 2008, Beijing, China

Figure A7.1.2 Seismicity around Kancheepuram

2) Tsunami

Detailed Project Report (DPR) and the EIA report for the project summarized tsunami disaster in Chennai are as follows.

- The occurrence of a Tsunami along the Indian coast is an extremely rare event with a very low frequency of less than once in 500 years.
- One such tsunami event was witnessed on 26th Dec. 2004 (Indian Ocean earthquake at Sumatra) along the Tamil Nadu coast.
- From records of tide gauge data during the 2004 tsunami event, the run up due to tsunami at different stretches along the coast was observed to vary between 1 m and 3.5 m.
- The water level rise due to this Tsunami near the project region was around 2.0 m and the run-up crossed over the highway (ECR).
- Eye-witness accounts say that each high tsunami wave that approached the coast was like a solitary surging / tidal bore wave, and the rise in water level near the coast due to such surging wave existed for a short duration of nearly 30 minutes.

(10) Protected Areas

Table A7.1.11 shows a list of protected areas in Tamil Nadu State; among which, the nearest such areas from the proposed project site are Guindy National Park (more than 30 km north of the site) and Vedanthangal Bird Sanctuary (more than 50 km south-west of the site).

Table A7.1.11 Protected Areas in Tamil Nadu State

S. No.	Name of the National Park / Sanctuary/ Conservation Reserve	Year	Area (km ²)	District (s)
National Parks	1. Mudumalai National Park	1990	103.23	Nilgiris
	2. Indira Gandhi National Park	1989	117.10	Coimbatore
	3. Mukurthi National Park	1990	78.46	Nilgiris
	4. Guindy National Park	1976	2.82	Chennai
	5. Gulf of Mannar Marine National Park	1986	526.02	Ramanathapuram & Thoothukudi
Wildlife Sanctuaries	1. Mudumalai Wildlife Sanctuary	1940	217.76	Nilgiris
	2. Indira Gandhi Wildlife Sanctuary	1976	841.49	Coimbatore
	3. Mundanthurai Wildlife Sanctuary	1962	582.08	Tirunelveli
	4. Kalakad Wildlife Sanctuary	1976	223.58	Tirunelveli
	5. Grizzled Squirrel Wildlife Sanctuary	1988	485.20	Virudhunagar
	6. Point Calimere Wildlife Sanctuary	1967	17.26	Nagapattinam
	7. Vallanadu Blackbuck Sanctuary	1987	16.41	Thoothukudi
	8. Kanyakumari Wildlife Sanctuary	2002	457.78	Kanyakumari
	9. Vedanthangal Birds Sanctuary	1996	0.30	Kanchipuram
	10. Karikili Birds Sanctuary	1989	0.61	Kanchipuram
	11. Pulicat Lake Birds Sanctuary	1980	153.67	Tiruvallur
	12. Vettangudi Birds Sanctuary	1977	0.38	Sivagangai
	13. Kanjirankulam Birds Sanctuary	1989	1.04	Ramanathapuram
	14. Chitragudi Birds Sanctuary	1989	0.48	Ramanathapuram
	15. Udayamarthandapuram Birds Sanctuary	1991	0.45	Tiruvarur
	16. Vaduvoor Birds Sanctuary	1996	1.28	Tiruvarur
	17. Koonthankulam - Kadankulam Birds Sanctuary	1994	1.29	Tirunelveli
	18. Karavetti Birds Sanctuary	1999	4.54	Perambalur
	19. Vellode Birds Sanctuary	1997	0.77	Erode
	20. Melaselvanoor -Kilaselvanoor Birds Sanctuary	1998	5.93	Ramanathapuram
Conservation Reserve	1. Tirupudaimarudhur Birds Conservation Reserve	2005	0.03	Tirunelveli

Source: State of Environment Atlas of Tamil Nadu 2006, SoE Cell and ENVIS Centre Department of Environment, Government of Tamil Nadu

In addition, the following forest and biodiversity sites are located around Chennai metropolis.

- Palikaranai Marsh Land (235 km²): This area falls under Perungudi and Pallikaranai in the Kanchipuram District villages and about 20 km south in the Chennai Metropolitan Area.
- Nanmangalam Reserve Forest (320 ha): A protected area located at Medavakkam on Velachery High Road between Velachery and Tambaram and about 24 km of the southern part of Chennai center

(Source: State of Environment Report of Chennai Metropolitan Area 2013 ENVIS Centre Government of Tamil Nadu)

The Marsh land and Forest exist more than 20 km from the proposed project site.

(11) Ecosystem

1) Mangrove

According to the “State of Environment Atlas of Tamil Nadu 2006, SoE Cell and ENVIS Centre Department of Environment, Government of Tamil Nadu”, mangroves in Tamil Nadu State have been confirmed as follows.

- Spread over 35 km² in Chidambaram, Cuddalore, Nagapattinam, Ramanathapuram and Thanjavur (Muthupet).
- In Cuddalore, mangroves are found in Pitchavaram and located about 225 km south of Chennai. Pitchavaram mangroves are bathed in the Vellar-Coleroon estuarine complex and spread to an area of 1,100 ha.
- The Pitchavaram area consists of 51 islets (small and large), which are traversed by numerous creeks, gullies, channels and canals.

In addition, “the State of Environment Report of Chennai Metropolitan Area 2013 ENVIS Centre Government of Tamil Nadu” notes that mangrove stands on the southern bank of the Adyar Estuary of Adyar River.

Those mangroves exist more than 30 km from the proposed project site.

2) Turtle Nesting Areas

In Tamil Nadu, five species of sea turtles (Olive Ridley, Loggerhead Turtle, Hawksbill Turtle, Green Turtle and Leatherback Turtle) have been reported as follows.

- Olive Ridley (arribada) nests sporadically along northern Tamil Nadu coast and high nesting was observed along Nagapattinam and Chennai coasts.
- Olive Ridley is classified under Schedule I of the Wildlife Act of India.
- One such location is the Chennai coast between the Neelankarai-Napier Bridge stretch.
- The other turtle nesting areas are the coasts between Tranquebar and Pazhayaru, Mamallapuram and Chennai and Point Calimere and Nagapattinam.
- Turtle nesting was reported during December to February and also during April to June.

- Olive Ridleys nest along the Chennai coast between January and March.

(Source: “State of Environment Atlas of Tamil Nadu 2006, SoE Cell and ENVIS Centre Department of Environment, Government of Tamil Nadu”, State of Environment Report of Chennai Metropolitan Area 2013 ENVIS Centre Government of Tami Nadu)

3) Coral Reef

In Tamil Nadu State, coral reefs are found in the Gulf of Mannar and the Palk Bay located in more than 200 km south of the proposed project site in Perur.

(Source: “State of Environment Atlas of Tamil Nadu 2006, SoE Cell and ENVIS Centre Department of Environment, Government of Tamil Nadu”)

(12) Marine Environment

The marine (seashore and offshore) environment around the proposed project site and in Chennai coast have been summarized in the EIA report for the project as shown in Table A7.1.12.

Table A7.1.12 Marine Environment around the Proposed Project Site

Item	Description
Wind	<ul style="list-style-type: none"> • Wind speed varies between 7 to 11 knots throughout the year • During Apr., May, Jun. and Dec. the wind speed varies around 10-11 knots • During the remaining months, wind speeds vary between 7 and 9 knots. • During Apr. to Sept., the morning wind mostly prevailed from SW and W, and during Nov. to Feb., it mostly prevailed from NW.
Storm	<ul style="list-style-type: none"> • In total, 58 storms had crossed within 300 km from the project region, and the occurrence of storms in this region are more frequent in Oct. and in Nov.
Tide	<ul style="list-style-type: none"> • MHWS (Mean High Water Spring): 1.15m • MHWN (Mean High Water Neap): 0.84 m • MSL (Mean Sea Level): 0.65 m • MLWN (Mean Low Water Neap): 0.43 m • MLWS (Mean Low Water Spring) : 0.14 m
Current	<ul style="list-style-type: none"> • During the measurement period, the maximum current speed recorded was 0.33 m/s. • The current direction was shifting with tides showing the variation within the sector of 330°-90°.
Waves	<ul style="list-style-type: none"> • The significant wave height varies between 0.5 m and 1.0 m during Feb. to Apr. • Between 1m and 3 m during May to Sept. • Between 1m and 2 m during rest of the year • The zero crossing period of the waves varied between 5 s. and 8 s.
Salinity	<ul style="list-style-type: none"> • Between 32.0 ppt. to 34.5 ppt. throughout the year.
Temperature	<ul style="list-style-type: none"> • Between 27°C and 30°C throughout the year.
Littoral drift	<ul style="list-style-type: none"> • The sediment transport rates were high in May and Dec. and low in Mar. • The littoral drift was towards north from Apr. to Oct. and towards south during the remaining months of the year.
Bathymetry	<ul style="list-style-type: none"> • At offshore, the seabed shows a steep gradient of 1:70 till 7 m depth. • And the water depth is 4 m at 225 m, 5 m at 340 m, 7 m at 520 m, 8 m at 66 m, 9 m at 83 m, 10 m at 1,040 m, 11 m at 1,360 m, 12 m at 1,890 m, 13 m at 2,160 m, 14 m at 2,460 m, 15 m at 2,720 m and 16 m at 2,950 m.
Seismic survey Result	<ul style="list-style-type: none"> • The shallow seismic study reveals that the sub-seabed consists of a sedimentary layer such as sand and clay up to few meters below the seabed. • The submerged and buried rocks are also noticed within the study region.
Side scan survey Result	<ul style="list-style-type: none"> • The analyzed records reveal that the seabed is generally covered by sandy clay, clayey sand, coarse sand with scattered rocky outcrops.

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

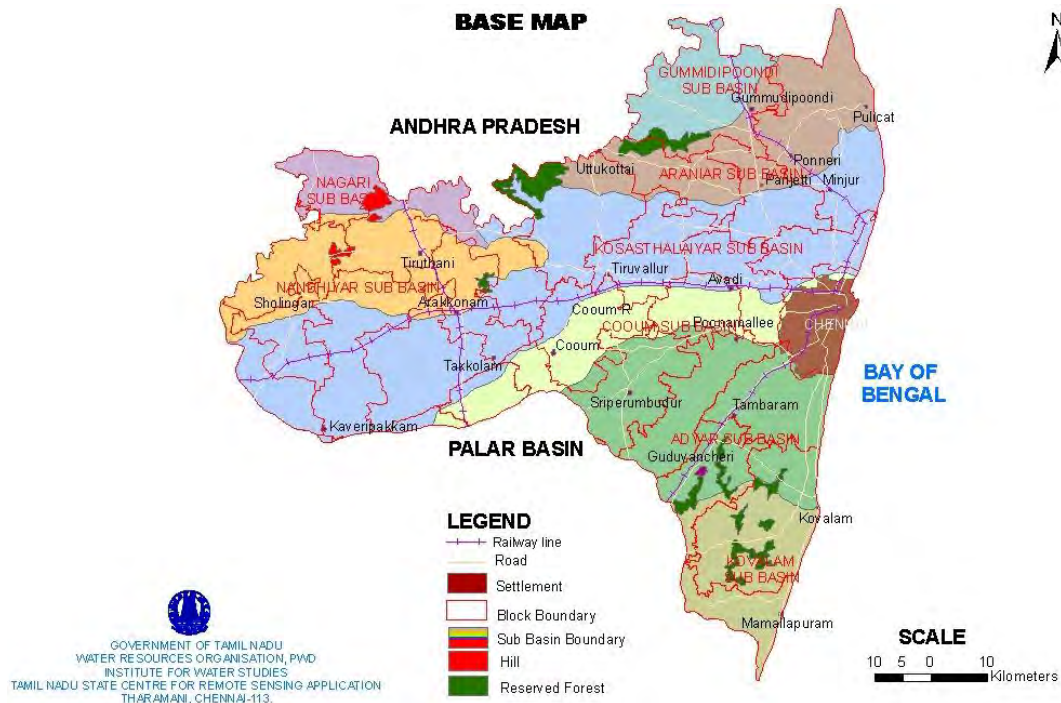
(13) Hydrology

Figure A7.1.3 shows six river basins of the Chennai Region of Water Resources Organization of Tamil Nadu. Among those, the Chennai basin is located in the North-East area of the region. In addition, Figure A7.1.4 shows eight sub-basins in the Chennai basin.



Source: Public Works Department, Government of Tamil Nadu (<http://www.wrd.tn.gov.in/images/Region-CHN-E.jpg>)

Figure A7.1.3 River Basins in Chennai Region



Source: Tamil Nadu State Centre for Remote Sensing Application, Institute for Water Studies, Public Works Department, Government of Tamil Nadu

Figure A7.1.4 Sub-Basins in Chennai Basin

The proposed project site is located in the Kovalam sub-basin in the Chennai Basin between Adyar River and Palar River in the Chennai region. Administratively, the site is in the Kancheepuram District, which is located in the Chennai River Basin.

(14) Flora and Fauna

1) Flora

Table A7.1.3 shows a list of critically endangered and endangered flora species found in Tamil Nadu State.

Table A7.1.13 Critically Endangered and Endangered Flora Species in Tamil Nadu State

Flora	Scientific Name	
Critically Endangered Species	<i>Actinodaphne lanata</i>	<i>Meteoromyrtus wynaadensis</i>
	<i>Berberis nilghiriensis</i>	<i>Nothopegia aureo-fulva</i>
	<i>Cinnamomum walaivarens</i>	<i>Paphiopedilum druryi (Drury's Paphiopedilum)</i>
	<i>Dipterocarpus bourdillonii</i>	<i>Pittosporum viridulatum</i>
	<i>Elaeocarpus gaussenii</i>	<i>Poeciloneuron pauciflorum</i>
	<i>Eugenia singampattiana</i>	<i>Pseudoglochidion anamalayanum</i>
	<i>Ficus angladei</i>	<i>Syzygium courtallense</i>
	<i>Hildegardia populifolia</i>	<i>Uleria salicifolia</i>
	<i>Hopea erosa</i>	<i>Valeriana leschenaultii</i>
	<i>Hygrophila madurensis</i>	<i>Vateria indica</i>
	<i>Memecylon sisparens</i>	-
Endangered Species	<i>Actinodaphne bourneae</i>	<i>Hopea utilis</i>
	<i>Actinodaphne salicina</i>	<i>Humboldtia bourdillonii</i>
	<i>Anacolosia densiflora</i>	<i>Humboldtia vahliana</i>
	<i>Ardisia blatterii</i>	<i>Hydrocotyle conferta</i>
	<i>Atuna indica</i>	<i>Isonandra villosa</i>
	<i>Atuna travancorica</i>	<i>Ixora saulierei</i>
	<i>Byrsophyllum tetrandrum</i>	<i>Kingiodendron pinnatum</i>
	<i>Chionanthus linocieroides</i>	<i>Koiloceras calycinum</i>
	<i>Cinnamomum chemungianum</i>	<i>Kyllinga pluristaminea</i>
	<i>Cinnamomum filipedicellatum</i>	<i>Lindernia minima</i>
	<i>Cinnamomum wightii</i>	<i>Litsea beddomei</i>
	<i>Cleistanthus travancorensis</i>	<i>Litsea nigrescens</i>
	<i>Cryptocarya anamallayana</i>	<i>Melicope indica</i>
	<i>Cyathea crinita</i>	<i>Melicope lunu-ankenda</i>
	<i>Cycas circinalis</i>	<i>Memecylon flavescens</i>
	<i>Cynometra travancorica</i>	<i>Memecylon subramanii</i>
	<i>Dalbergia congesta</i>	<i>Microtropis densiflora</i>
	<i>Decalepis hamiltonii</i>	<i>Nostolachma crassifolia</i>
	<i>Dimorphocalyx beddomei</i>	<i>Orophea thomsoni</i>
	<i>Dipterocarpus indicus</i>	<i>Palaquium ravii</i>
	<i>Drypetes porteri</i>	<i>Polyalthia rufescens</i>
	<i>Dysoxylum malabaricum (White Cedar)</i>	<i>Popowia beddomeana</i>
	<i>Elaeocarpus blascoi</i>	<i>Psychotria globicephala</i>
	<i>Eugenia discifera</i>	<i>Psychotria macrocarpa</i>
	<i>Eugenia floccosa</i>	<i>Psyrax ficiformis</i>
	<i>Eugenia indica</i>	<i>Rotala ritchiei</i>
	<i>Euonymus paniculatus</i>	<i>Shorea roxburghii (White Meranti)</i>
	<i>Euonymus serratifolius</i>	<i>Shorea tumbuggaia</i>
	<i>Euphorbia santapauii</i>	<i>Sophora wightii</i>
	<i>Farmeria indica</i>	<i>Symplocos anamallayana</i>
	<i>Fimbristylis crystallina</i>	<i>Symplocos barberi</i>
	<i>Glochidion pauciflorum</i>	<i>Symplocos nairii</i>
	<i>Glochidion sisparens</i>	<i>Symplocos oligandra</i>
	<i>Glochidion tomentosum</i>	<i>Syzygium beddomei</i>
<i>Goniothalamus rhynchantherus</i>	<i>Syzygium microphyllum</i>	
<i>Homalium jainii</i>	<i>Syzygium myhendrae</i>	
<i>Hopea glabra</i>	<i>Syzygium parameswaranii</i>	
<i>Hopea parviflora</i>	<i>Tarenna monosperma</i>	
<i>Hopea ponga</i>	-	

Source: International Union for Conservation of Nature (IUCN)

In addition, the vegetation in the proposed project site identified by the EIA report is shown below.

- The project area is widely dominated by *Casuarina litorea* trees and sparsely populated with *Veelikkaruvai (Prospopis juliflora)*, *Ipomea pes caprae*, *Pandanus odoratissimus*, *Catharanus rouseus*, *Thespesia populnea*, *Cocos nucifera*, *Borassus flabellifer*, *Azadirachta indica*, *Pedalium sp.*, *Calotropis gigantean* and *Spinifex littoreus*.
- Especially, the front face of the site towards the sea face is fully planted with *Casuarina litorea* tree. Plantations were grown and maintained by the Department of Forest, Government of Tamil Nadu.

2) Fauna

Table A7.1.14 shows a list of critically endangered and endangered fauna species found in Tamil Nadu State.

Table A7.1.14 Critically Endangered and Endangered Fauna Species in Tamil Nadu State

Fauna	English Name	Scientific Name	
Critically Endangered Species	Birds	Spoon Billed Sandpiper	<i>Eurynorhynchus pygmeus</i>
	Mammals	Large Rock Rat	<i>Cremnomys elvira</i>
	Reptiles	Hawksbill Turtle	<i>Eretmochelys imbricata</i>
	Amphibians	Anamalai Flying Frog	<i>Rhacophorus pseudomalabaricus</i>
		Kerala Indian Frog	<i>Indirana phrynoderma</i>
		Griet Bush Frog	<i>Raorchestes griet</i>
		Large Ponnudi Bush Frog	<i>Raorchestes ponnudi</i>
	Fish	Sushil's Bush Frog	<i>Raorchestes sushili</i>
		Pondicherry Shark	<i>Carcharhinus hemiodon</i>
	Endangered Species	Mammals	Blackbuck
Nilgiri langur			<i>Presbytis johni</i>
Lion Tailed Macaque			<i>Macaca silenus</i>
Nilgiri tahr			<i>Nilgiritragus hylocrius</i>
Servant mouse			<i>Mus famulus</i>
Salim Ali's Fruit Bat			<i>Latidens salimalii</i>
Reptiles		Perrotet's Vine Snake	<i>Ahaetulla perroteti</i>
		Boulenger's Dasia	<i>Dasia subcaerulea</i>
		Indian Kangaroo Lizard	<i>Otocryptis beddomii</i>
		Travancore Hills Thorntail Snake	<i>Platyplectrurus madurensis</i>
		Tamil Nadu Earth Snake	<i>Rhinophis travancoricus</i>
Fish		Aruli Barb	<i>Dawkinsia arulius</i>
		Tambraparini Barb	<i>Dawkinsia tambraparniei</i>
		Nilgiri Danio	<i>Devario neilgherriensis</i>
		Cardamon Garra	<i>Garra hughi</i>
		Kalakad Stone Carp	<i>Garra kalakadensis</i>
		Anamalai Sucker Catfish	<i>Glyptothorax anamalaiensis</i>
		ray-finned fish	<i>Glyptothorax housei</i>
		Zig Zag Sucker Fish	<i>Homaloptera montana</i>
		Lipped Algae Eater	<i>Horabiosia joshuai</i>
		Curcuma barb	<i>Hypselobarbus curmuca</i>
		Nilgiri Barb	<i>Hypselobarbus dubius</i>
		Korhi barb	<i>Hypselobarbus micropogon</i>
		Hump Backed Mahseer	<i>Hypselobarbus mussullah</i>
		Broadfin Shark	<i>Lamiopsis temminckii</i>
		Chennai Sawfin Barb	<i>Pethia sharmai</i>
		Round Tailed Killer Catfish	<i>Pterocryptis wynaadensis</i>
		Nukta	<i>Schismatorhynchus nukta</i>
		Great Hammerhead	<i>Sphyrna mokarran</i>
		Black Mahseer	<i>Tor khudree</i>
		Malabar Mahseer	<i>Tor malabaricus</i>
Spiders		Parambikulam Large Burrowing Spider	<i>Haploclastus kayi</i>
		Beautiful Parachute Spider	<i>Poecilotheria formosa</i>
		Reddish Parachute Spider	<i>Poecilotheria rufilata</i>

Source: Critically Endangered Animal Species of India, 2011 MoEF, International Union for Conservation of Nature (IUCN)
In addition, the small animals in the proposed project site identified by the EIA report are as follows.

- Dead shells of gastropod and bivalve mollusks are largely found washed on the shore line.

3) Marine Biodiversity

The marine (seashore and offshore) biodiversity around the proposed project site and in Chennai coast have been summarized in the EIA report for the project as shown in Table A7.1.15

Table A7.1.15 Marine Biodiversity around the Proposed Project Site

Item	Description
Floral Diversity	<ul style="list-style-type: none"> Varies from 21 to 29 species. Most dominant species are: Bacillariophyceae (Diatoms) formed the major group followed by Dinophyceae (Dinoflagellates) and Cyanophyceae (blue-green algae). Phytoplankton population analyzed at various stations showed that their numerical abundance varied from 68 to 103 nos./ml. As many as 55 species of phytoplankton (net and unit samples put together) represented by 3 diverse groups namely, diatoms (43 species consisting of 34 centrales and 9 pennales), dinophyceans (11) and chlorophyceae (1). There were relatively fewer (46) species in the unit samples.
Zooplankton	<ul style="list-style-type: none"> Fluctuates from 38 to 44 species. Zooplankton mostly consists of <i>Coryceas danae</i> (13.5% to 8.7%), <i>Paracalanus parvus</i> (7.2% to 2.0%), <i>Oithona brevicornis</i> (6.8% to 0.6%), <i>Coryceas catus</i> (6.8% to 1.8%) and Copepod stages (5.6% to 1.9%).
Benthos	<ul style="list-style-type: none"> Benthic faunal population in an environment depends on the nature of the substratum and the organic matter content of the substratum. Sediment characteristics are of coarse to medium sand, the numerical abundance of benthic fauna varied between 80 and 170 nos/m² mainly consisting of amphipods, polychaetes, bivalves and mysids. Intertidal benthos: Numerical abundance varied between 30 to 75 nos/m². Generally, in a project area without pollution/stress/disturbance, the Shannon diversity values and Margalef's richness indices are higher in the range of 2.5 to 3.5, whereas it is low in the project area-which can be attributed to nature of sediment-which is sand in the area.
Microbiology	<ul style="list-style-type: none"> The study indicated that there is no microbiological pollution. Bacterial densities were higher in the sediment samples than those in the water samples, which can be attributed to rich organic content in sediment and lesser residence time of microorganisms in the water than the sediments.
Turtles	<ul style="list-style-type: none"> Observed during February and March 2012, and devoid of nesting during the Survey period (July 2013).

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

A7.1.3 Social Conditions

(1) Demographic Situation and Community

1) Population and Household

The EIA report summarizes the population and household around the proposed project site by reviewing the District Census Hand Book 2011 as shown in Table A7.1.16. However, the site reconnaissance confirmed that there is no household in the proposed project site.

Table A7.1.16 Population and Household around the Proposed Project Site

Particulars		0-3 km	3-7 km	7-10km	0-10km (Total)
Population	Male (People)	1,974	18,994	16,031	36,999
	Female (People)	1,848	18,470	15,928	36,246
	Total (People)	3,822	37,464	31,959	73,245
	Density (People/km ²)	336	717	557	605
Household	Household (Number)	1,009	9,190	7,762	17,961
	Average /Household (People)	3.79	4.08	4.12	4.06

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

2) Social Structure

The EIA report summarizes the social structure around the proposed project site by reviewing the District Census Hand Book 2011 as shown in Table A7.1.17.

Table A7.1.17 Social Structure around the Proposed Project Site

Particulars		0-3 km	3-7 km	7-10 km	0-10 km (Total)
Scheduled Caste (SC)	Population (People)	203	14,864	9,973	25,040
	% to the Total Population	5.31	39.68	31.21	34.19
Scheduled Tribe (ST)	Population (People)	124	398	240	762
	% to the Total Population	3.24	1.06	0.75	1.04
SC and ST	Total Population (People)	327	15,262	10,213	25,802
	% to the Total Population	8.56	40.74	31.96	35.23
Total Population		3,822	37,464	31,959	73,245

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

3) Literate and Literacy Rate

The EIA report summarizes the literate and literacy rate around the proposed project site by reviewing the District Census Hand Book 2011 as shown in Table A7.1.18.

Table A7.1.18 Literate and Literacy Rate around the Proposed Project Site

Particulars		0-3 km	3-7 km	7-10 km	0-10 km (Total)
Population	Male (People)	1,974	18,994	16,031	36,999
	Female (People)	1,848	18,470	15,928	36,246
	Total (People)	3,822	37,464	31,959	73,245
Literate	Male (People)	1,546	15,125	12,489	29,160
	Female (People)	1,206	12,357	10,487	24,050
	Total (People)	2,752	27,482	22,976	53,210
Literacy Rate	Male (%)	56.18	55.04	54.36	54.80
	Female (%)	43.82	44.96	45.64	45.20
	Average Male Literacy to the total population (%)	40.45	40.37	39.08	39.81
	Average Female Literacy to the total population (%)	31.55	32.98	32.81	32.84
	Total Literacy Rate (%)	72.00	73.36	71.89	72.65

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

4) Occupational Structure

The EIA report summarizes the occupational structure around the proposed project site by reviewing the District Census Hand Book 2011 as shown in Table A7.1.19.

Table 7.1.19 Occupational Structure around the Proposed Project Site

Particulars		0-3 km	3-7 km	7-10 km	0-10 km (Total)
Total Population (People)		3,822	37,464	31,959	73,245
Total Workers		1,402	14,378	12,660	28,440
Work Participation Rate (%)		36.68	38.38	39.61	38.83
Main Workers	Number (People)	1,319	10,588	10,440	22,347
	% of Main Workers to Total Population	34.51	28.26	32.67	30.51
Marginal Workers	Number (People)	83	3,790	2,220	6,093
	% of Marginal Workers to Total Population	2.17	10.12	6.95	8.32
Non-Workers	Non-Workers	2,420	23,086	19,299	44,805
	% of Non-Workers to Total Population	63.32	61.62	60.39	61.17

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

(2) Land Use

The EIA report summarizes the land use around the proposed project site by reviewing the District Census Hand Book 2001 as shown in Table A7.1.20.

Table A7.1.20 Land Use around the Proposed Project Site

Particulars		0-3 km	3-7 km	7-10 km	0-10 km (Total)
Forest Land (Ha)		0	390	1,151	1,541
Land under Cultivation	Irrigation Land (ha)	238	1,188	1,611	3,037
	Un Irrigated Land (ha)	164	1,389	1,073	2,626
Cultivable Waste Land (ha)		208	1,016	554	1,779
Are not Available for Cultivation (ha)		528	1,244	1,350	3,122
Total Area		1,138	5,228	5,740	12,105

Source: EIA Report for Proposed 400 MLD Sea Water Reverse Osmosis Desalination Plant at Perur Along ECR, Chennai, Tamil Nadu, India, AECOM for Chennai Metro Water (Simplified by JICA Survey Team)

(3) Archaeological Cultural site

Table A7.1.21 shows a list of protected monuments in Chennai Metro.

Table A7.1.21 Protected Monument in Chennai Metro

Category	Name of Monument / Site
Protected by Archaeological Survey of India (ASI)	Arsenal
	Big Ware house
	Chaplian's House
	Clive's House
	Garrison Engineer's Depot
	Guard Room
	King's Barrack
	Last House On The Left Of 'Snob' Alley'
	Nursing Sister's House
	Old British Infantry Officer's Mess
	Rampart, Gates, Bastion, Pavilions With Vaulted Chambers and Water Cisterns Underneath: Moat And Defense Walls All Round With Glacis To the Extent Of The Existing Barbed Wire Fence
	St. Mary's Church
	Wellesley's House
	David Yale and Joseph Hynmer's Tomb
Old Town Wall	
Protected by Tamil Nadu, the State Department of Archaeology (TNSDA)	Memorial Pillar

Source: State of Environment Report of Chennai Metropolitan Area, 2013, ENVIS Centre, Department of Environment, Government of Tamil Nadu

In addition, near the proposed project site there are two archaeological sites as follows

- Tiger Cave: 7 km south of the proposed project site.
- A group of Monuments at Mahabalipuram: (UNESCO World Heritage, Inscription in 1984) 11 km south of the proposed project site.

Appendix 7.2 International Treaty on Environment

International Conventions/Treaties/Protocols in the field of Environment to which India is a party are summarized in Table A7.2.1.

Table A7.2.1 International Convention/Treaty/Protocol on Environment

Field	International Convention/Treaty/Protocol	Year (ratified/signed)
Hazardous waste	Basel Convention on Trans-Boundary Movement of Hazardous Substances 1991-92.	1992
International resources	Antarctic Treaty (Washington, 1959)	1983
	United Nations Convention on the Law of the Sea (Montego Bay, 1982)	1994
	International Tropical Timber Agreement (Geneva, 1983)	1996
Global climate	Vienna Convention on Ozone Depleting Substances.	1991
	Montreal Protocol	1992
	Framework Convention on Climate Change	1992
	Kyoto Protocol 1992	2002
Marine pollution	International Convention for the Prevention of Pollution from Ships 1973	1986
	International Convention on Civil Liability for Oil Pollution Damage 1969 (effective from June 19, 1975).	1987
	Protocol to the International Convention on Civil Liability for Oil Pollution Damage, 1969.	1987
	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 (effective from October 16, 1978).	1990
	Protocol to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971.	1994
Wildlife	Convention on Biologic Diversity	1992
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington D.C.	1976
	Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (The Ramsar Convention).	1982
	Convention relative to the Preservation of Fauna and Flora in their Natural State, London 1936	1939
	International Convention for the Regulations of Whaling (Washington, 1946)	1981
	International Plant Protection Convention (Rome, 1951)	1952
	Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)	1982
	Convention on the Conservation of Antarctic Marine Living Resources (Canberra, 1980) 1992	1985
Environmental Planning	Convention to Combat Desertification 1992, 1994	1996
Other environmental fields	Convention concerning the Protection of Workers Against Ionising Radiation (Geneva, 1960)	1975
	Protection (of Industrial Workers) Against Hazards of Poisoning Arising from Benzene	1991
	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Brussels, 1975).	1963
	Convention on the Protection of World Cultural and Natural Heritage (Paris, 1972)	1977

Source: Handbook on National Environmental Legislation and Institutions in India (2002), Handbook on International Environmental Agreements: An Indian Perspective (2006)

Appendix 7.3 Environmental Impact Assessment (EIA) System in India

Under the Environmental (Protection) Act (1986), a revised Environmental Impact Assessment (EIA) notification (S.O. 1533 (E), 14th Sept. 2006) was brought out by MoEF, which stipulates prior Environmental Clearance (EC) systems, categorization of projects and activities subject to EIA, and EIA processes and so on, as summarized below.

A7.3.1 Prior Environmental Clearance (EC)

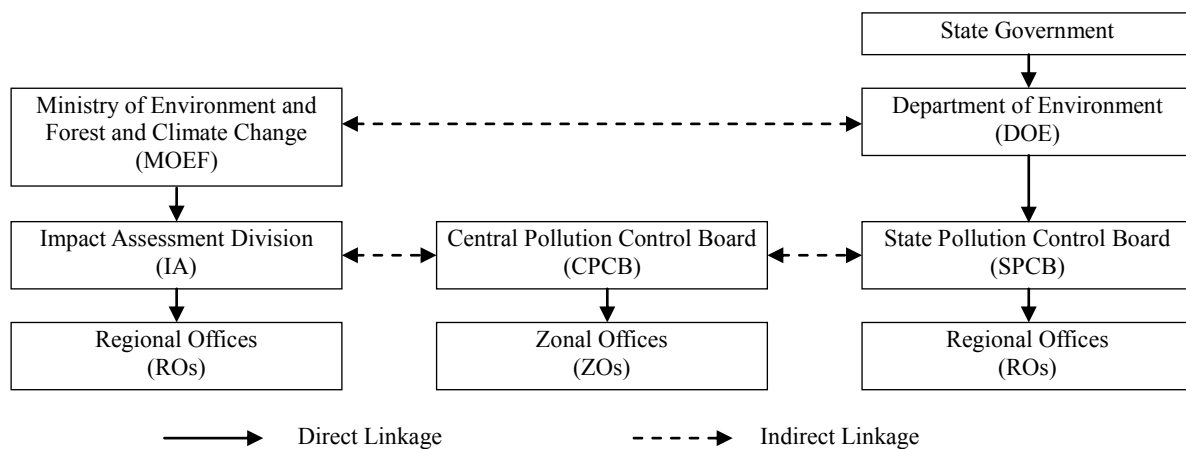
Before any construction work or preparation of land, except for securing the land, the following projects or activities shall require prior environmental clearance (EC) from the concerned regulatory authority.

- All new projects or activities listed in the Schedule to the notification.
- Expansion and modernization of existing projects or activities listed in the Schedule to this notification with the addition of capacity beyond the limits specified for the concerned sector, i.e., projects or activities that cross the threshold limits given in the Schedule after expansion or modernization.
- Any change in the product-mix in an existing manufacturing unit included in the Schedule beyond the specified range.

A.7.3.2 Administrative Framework

The EC process is a two-tier system involving both central and state authorities as shown in Figure A 7.3.1.

At the central level, the Impact Assessment Division (IA) of MOEF, Regional Offices of MoEF and Central Pollution Control Board (CPCB) are three important institutions, whereas SPCBs and State Departments of Environment (DOE) are working at the province level.



Source: Ministry of Environment, Forest and Climate Change

Figure A7.3.1 Relationship Diagram of Entities Involved in EIA Process

A7.3.3 State Level Environment Impact Assessment Authority (SEIAA)

A State Environment Impact Assessment Authority (SEIAA) is constituted by MoEF under the Environment (Protection) Act (1986) that acts as the Authority for issuance EC for category B projects and activities in the State. SEIAA is composed of three members including a Chairman and a Member Secretary nominated by the State Government.

In Tamil Nadu State, as of March 2016, Tamil Nadu Environmental Impact Assessment Authority has been constituted by MOEF with the Notification No. S.O. 2199 (E), New Delhi, dated 12th August 2015.

A7.3.4 Categorization of Projects and Activities

Projects and activities are categorized into Category A and Category B, which are specified in the SCHEDULE, "List of Project or Activities Requiring Prior Environmental Clearance", attached in the Notification (S.O. 1533 (E), 14th Sept. 2006).

Table A7.3.1 summarizes relevant authority for issuance of EC and relevant committee to recommend for the authority for the issuance by the project category.

Table A7.3.1 Environmental Clearance and Authority by Project Category

Project	Authority for Issuance of Environmental Clearance (EC)	Committee to Recommend
Category A	Ministry of Environment, Forest and Climate Change (MoEF)	Expert Appraisal Committee (EAC)
Category B	State Environment Impact Assessment Authority (SEIAA)	State Expert Appraisal Committee (SEAC)

Note : Category A and B are stipulated in the Schedule List, SEIAA is constituted by MOEF under the Environment (Protection) Act (1986), EAC and SEAC are constituted by MOEF

Source: EIA notification MOEF (tabulated by JICA Study Team)

With regard to Category 'B', at the screening stage of EIA process, such a project or activity is scrutinized by the concerned State level Expert Appraisal Committee (SEAC) for determining whether or not the project or activity requires further environmental studies for preparation of an EIA for its appraisal prior to the grant of EC depending up on the nature and location specificity of the project.

- Category B1: Projects requiring an EIA report
- Category B2: Remaining projects and not requires an EIA report.

For categorization of projects into B1 or B2 except item 8 (b) (Townships and Area Development Projects), MoEF issues appropriate guidelines from time to time.

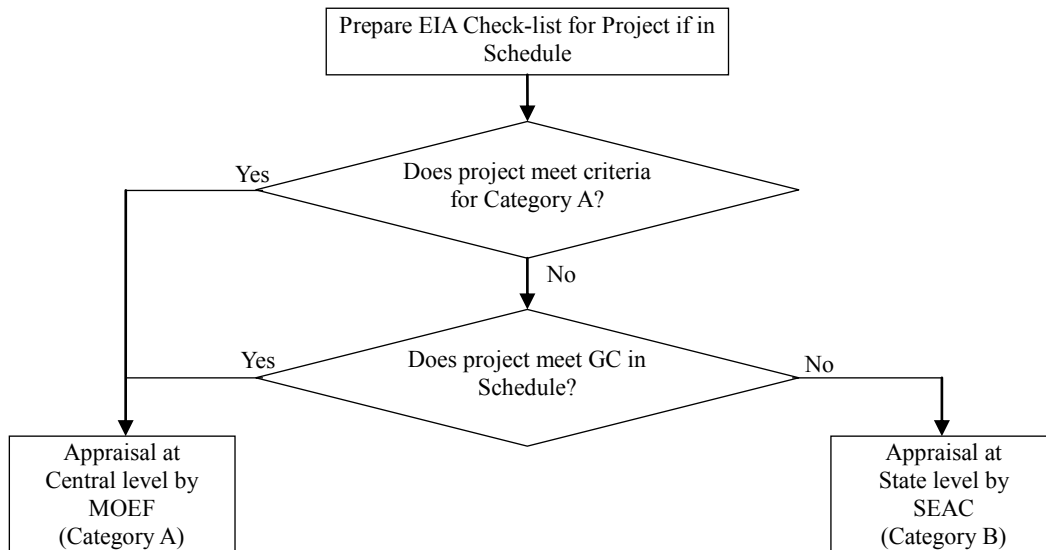
A7.3.5 General Condition (GC)

"General Condition (GC)" is stipulated in the EIA Notification that for any project or activity specified in "Category B" will be treated as "Category A" if located in whole or in part within 10 km from the boundary of the following.

- Protected areas notified under the Wild Life (Protection) Act, 1972

- Critically polluted areas as notified by the Central Pollution Control Board (CPCB) from time to time
- Notified Eco-sensitive areas
- Inter-State boundaries and international boundaries

Figure A7.3.2 shows the categorization flowchart at the screening of the EIA process.



GC: General Condition, SEAC: Expert Appraisal Committee

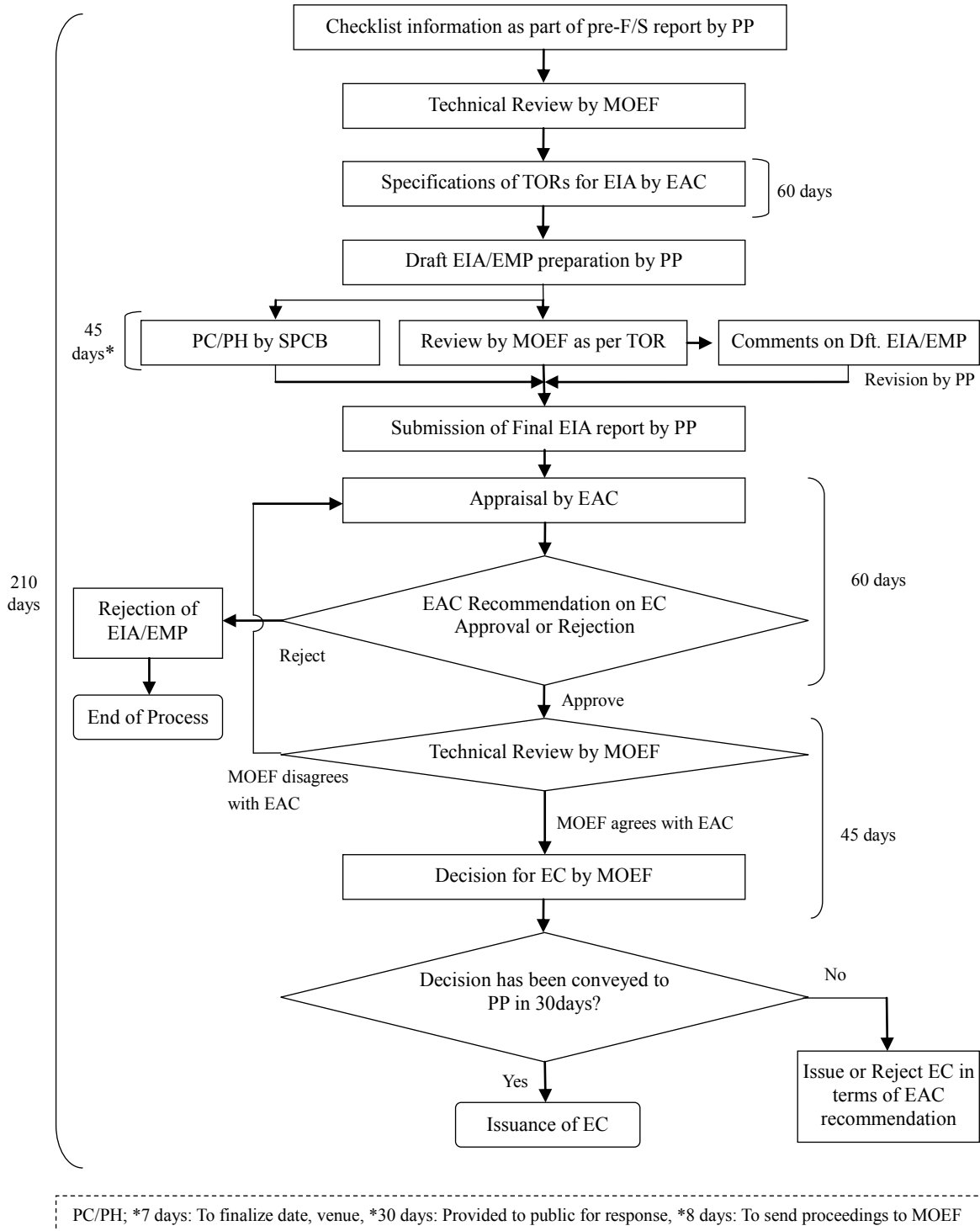
Source: Notification No.S.O. 1533 (E), 14th Sept. 2006 MoEF, Environmental Impact Assessment (Revised Environmental Clearance Process), Dr. Subrahmanyam, Advisor, 16th May 2014 MOEF (modified by JICA Study Team)

Figure A7.3.2 Flowchart of Categorization at Screening of EIA Process

A7.3.6 EC Process in EIA System

In accordance with the EIA notification (2006) MOEF, three different EC processes are identified in the EIA system of India by projects and activities classified as “Category A” or “Category B” as follows, which are illustrated in Figure A 7.3.3, Figure A 7.3.4, and Figure A 7.3.5, respectively.

- EC Process for Category A Projects (Central Level)
- EC Process for Category B Projects excluding Buildings (State Level)
- EC Process for Category B Projects for Buildings (State Level)

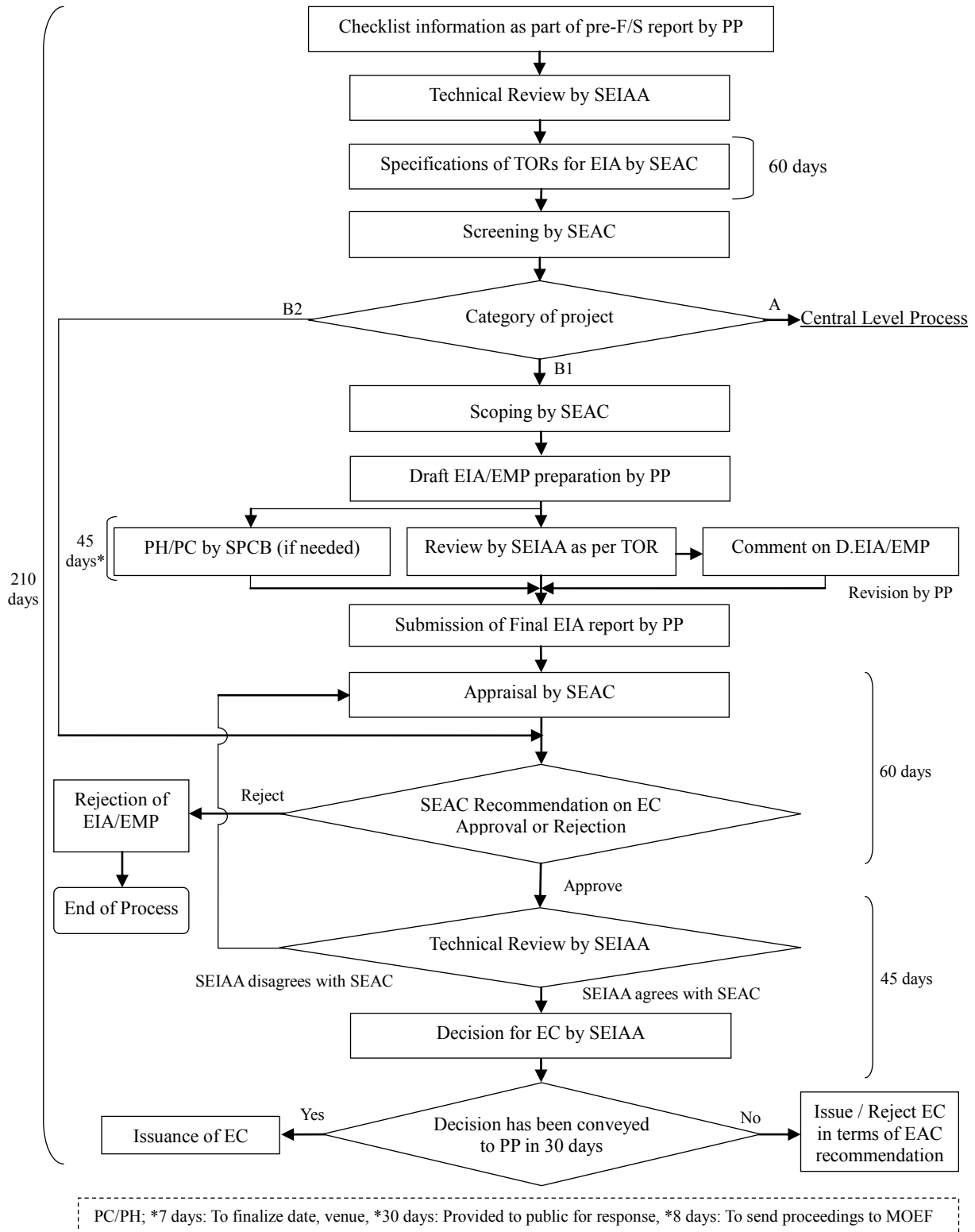


EAC: Expert Appraisal Committee
 EC: Environmental Clearance
 EMP: Environmental Management Plan

PC/PH: Public Consultation/Public Hearing
 PP: Project Proponent
 SPCB: State Pollution Control Board

Source: Notification No. S.O. 1533 (E), 14th Sept. 2006 MOEF, Environmental Impact Assessment (Revised Environmental Clearance Process), Dr. Subrahmanyam, Advisor, 16th May 2014 MOEF (modified by JICA Study Team)

Figure A7.3.3 EC Process for Category A Projects (Central Level)

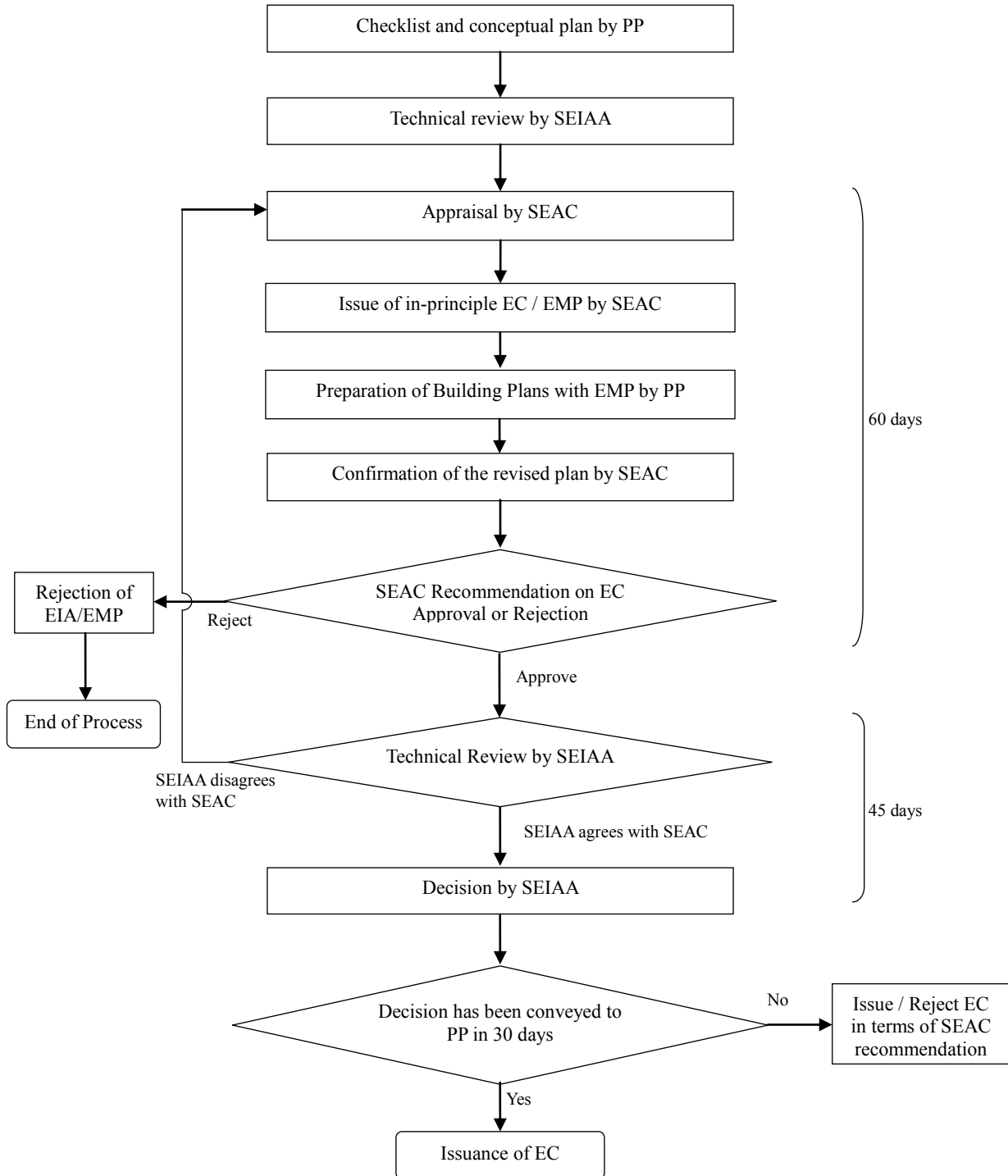


EC: Environmental Clearance
 EMP: Environmental Management Plan
 PC/PH: Public Consultation/Public Hearing
 PP: Project Proponent

SEAC: State level Expert Appraisal Committee
 SEIAA: State Level Environment Impact Assessment Authority
 SPCB: State Pollution Control Board

Source: Notification No. S.O. 1533 (E), 14th Sept. 2006 MOEF, Environmental Impact Assessment (Revised Environmental Clearance Process), Dr. Subrahmanyam, Advisor, 16th May 2014 MOEF (modified by JICA Study Team)

Figure A7.3.4 EC Process for Category B Projects excluding Buildings (State Level)



EC: Environmental Clearance
 EMP: Environmental Management Plan
 PP: Project Proponent

SEAC: State level Expert Appraisal Committee
 SEIAA: State Level Environment Impact Assessment Authority
 SPCB: State Pollution Control Board

Source: Notification No. S.O. 1533 (E), 14th Sept. 2006 MOEF, Environmental Impact Assessment (Revised Environmental Clearance Process), Dr. Subrahmanyam, Advisor, 16th May 2014 MOEF (modified by JICA Study Team)

Figure A7.3.5 EC Process for Category B Projects for Buildings (State Level)

Appendix 7.4 Land Acquisition and Resettlement Systems in India

A7.4.1 Legal and Institutional Framework

(1) Policy, Act, Rules and Ordinance on land acquisition and Resettlement

Land acquisition and Resettlement in India is regulated by the following relevant laws and regulations.

- National Policy on Resettlement and Rehabilitation for Project Affected Families (2003 MORD 2004)
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules, 2014
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules, 2015
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Ordinance, 2014
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Second Ordinance, 2015

(2) Official Entities for Land Acquisition and Resettlement

At the central level, the nodal Ministry of India in charge of the land acquisition and resettlement is the Ministry of Rural Development (MORD).

In addition, appropriate governments which handle land acquisition and resettlement are specified in the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Act 2013) as follows.

- Land situated within the State: State Government.
- Land situated within Union territory (except Puducherry): Central Government.
- Land situated within Union territory of Puducherry: Government of union territory of Puducherry
- Land for public purpose in more than one State-Central Government in consultation with State Government or Union territories.

At the State level, according to the Manual under Right to Information Act, 2005, Revenue Department, each state has a Revenue Department which is the custodian of all lands and is concerned with all land disposals. The Revenue Department administers all the Government lands including those vested with the various departments of the state government. The work relating to land assignment, land acquisition, alienation of land, updating and maintenance of Land Revenue Records, Grant of Pattas (Legal documents for land ownership), Land Reforms, Land Ceiling, Levy and collection of Urban Land Tax are looked after by the Revenue Department.

Under a Revenue Department, a Land Administration Department is organized which deals with various important Revenue subjects such as Assignment (cultivable land / house site), Lease, Transfer of land, Alienation, Acquisition, Estate/Inam Abolition Acts, Cinematograph Act, Eviction of encroachments in Government lands, Irrigation etc., Government lands are allotted to private Individuals, Government Departments and Quasi Government Organizations by way of Lease, Transfer, Alienation, Land Acquisition and Assignment.

(3) Compensation

Compensation for land owners are specified in the First Schedule of the Act (2013). Namely, component of compensation package in respect of land acquired under the Act (2013) shall constitute the minimum compensation package to be given to those to tenants in a proportion to be decided by the appropriate government.

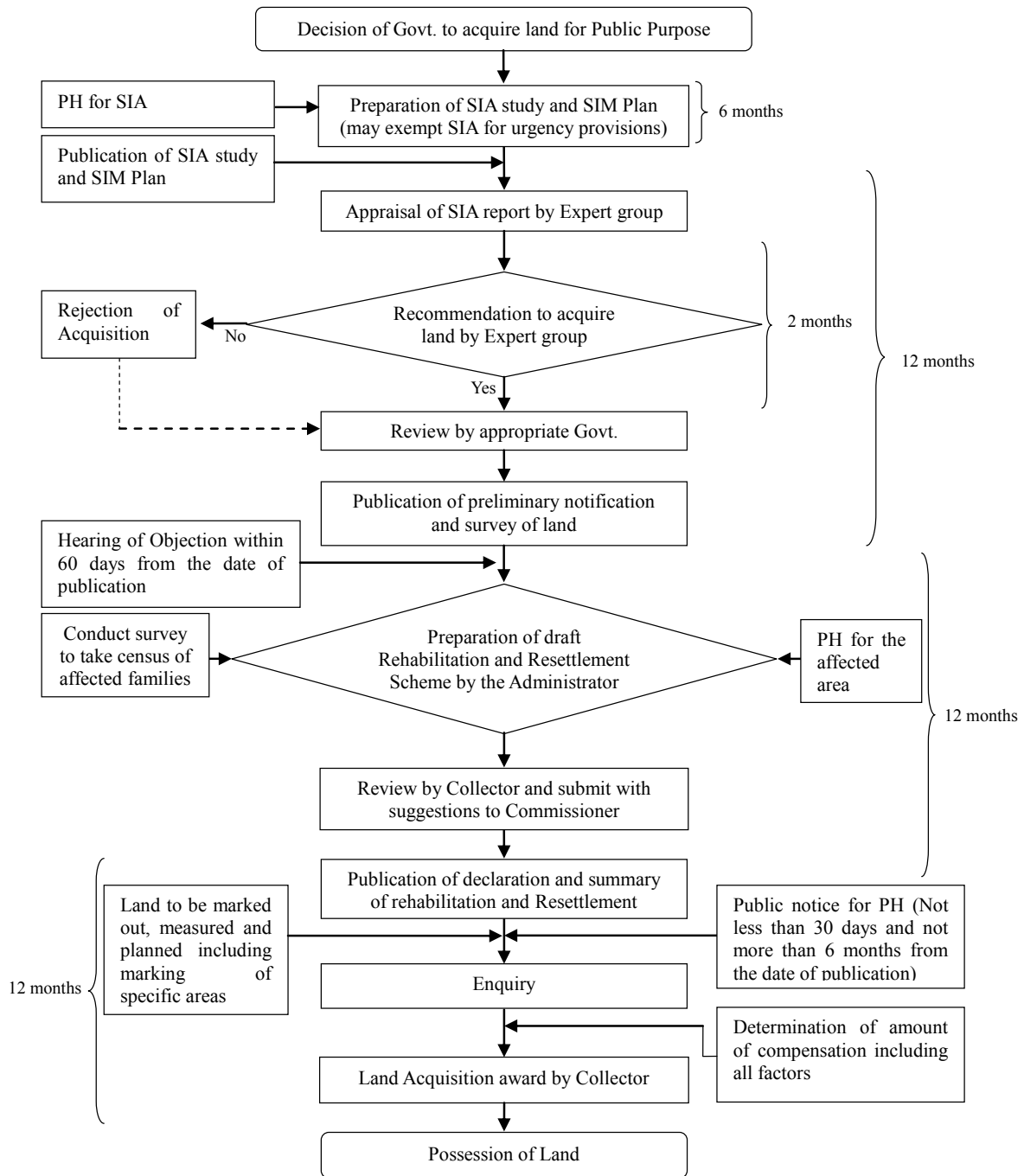
(4) Social Impact Assessment (SIA) and EIA

In accordance with the Act (2013), Social Impact Assessment (SIA) is required for land acquisition and resettlement. For SIA, the Act (2013) specifies that “whenever EIA is carried out, a copy of the SIA report shall be made available to the Impact Assessment Agency authorised by the Central Government to carry out EIA.

However, the Act (2013) notes that where land is proposed to be acquired invoking the urgency provisions, the appropriate government may exempt undertaking of the SIA study.

A7.4.2 Procedures for Land Acquisition and Resettlement

Based on the Act (2013), the procedures for land acquisition and resettlement can be depicted as shown in Figure A 7.4.1



SIA: Social Impact Assessment
 SIM: Social Impact Management
 PH: Public Hearing

Appropriate Govt.:
 Land situated within the State: State Govt.
 Land situated within Union territory (except Puducherry): Central Govt.
 Land situated within Union territory of Puducherry: Govt. of union territory of Puducherry
 Land for public purpose in more than one State-Central Govt. in consultation with State Govt. or Union territories.

Source: Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 27th Sep. 2013

Figure A 7.4.1 Land Acquisition, Rehabilitation and Resettlement Process

Appendix 7.5 Environmental and Social Conditions around the Transmission Pipeline Routes

Chain Name	Chain No.	Distance from Starting Point in Perur (km)	Construction Method	Location/Road Name	Land Use		Road Width (m)	River/Rail crossing points	Remarks
					Right side	Left side			
Chainage of Main Transmission Pipeline Route (Perur to Porur)									
CH	0	0	Open cut	Perur desalination plant	Perur desalination plant	Perur desalination plant		No	-
CH	50	0.05	Pipe Jacking (Chainage 20 - 80)	East Coast Road	East Coast Road	East Coast Road	12	No	-
CH	150	0.15	Open cut	Perur Road	Residential building	Commercial building	7	No	-
CH	250	0.25	Open cut	Perur Road	Garden	Residential building	7	No	-
CH	250-950	0.95	Open cut	Perur Road	Vacant land	Vacant land	7	No	-
CH	950-1450	1.45	Open cut	Gandhi Road	Vacant land	Vacant land	7	No	-
CH	1500	1.5	Open cut	Gandhi Road	Proposed Transmission main bridge	Proposed Transmission main bridge	7	Yes	Buckingham canal crosses
CH	1500-1900	1.9	Open cut	Gandhi Road	Vacant land	Vacant land	7	No	-
CH	1900-2050	2.05	Open cut	Gandhi Road	Salt Swamp	Salt swamp	7	No	-
CH	2050-2150	2.15	Open cut	Gandhi Road	Vacant land	Vacant land	7	No	-
CH	2250	2.25	Open cut	Rajiv gandhi Expressway	Salt Swamp	Salt swamp	7	No	-
CH	2250-2650	2.65	Open cut	Rajiv gandhi Expressway	Salt Swamp	Salt swamp	7	No	-
CH	2750	2.75	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	7	No	-
CH	2850	2.85	Open cut	Rajiv gandhi Expressway	Vacant land	Building	7	No	At approx. 0.28 km there is a culvert
CH	2950	2.95	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	7	No	-
CH	3050	3.05	Open cut	Rajiv gandhi Expressway	Temple	Building	7	No	-
CH	3050-4050	4.05	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	7	No	At approx. 3.88 km there is a culvert
CH	4150	4.15	Open cut	Rajiv gandhi Expressway	Residential building	Shed	7	No	At approx. 4.08 km and 4.12 km there is a culvert
CH	4250	4.25	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	7	No	-
CH	4300	4.35	Open cut	Rajiv gandhi Expressway	Commercial building	Vacant land	7	No	-
CH	4300-4650	4.7	Open cut	Rajiv gandhi Expressway	Agriculture land	Agriculture land	7	No	-
CH	4750	4.75	Open cut	Rajiv gandhi Expressway	Pond	Pond	7	No	At approx. 4.72km there is a culvert
CH	4750-4900	4.9	Open cut	Rajiv gandhi Expressway	Agriculture land	Agriculture land	7	No	-
CH	4900-5500	5.5	Open cut	Rajiv gandhi Expressway	Agriculture land	Agriculture land	7	No	At approx. 4.91 km, 4.97km and 4.98 km, 5.28km and 5.39km there is a culvert
CH	5600	5.6	Open cut	Rajiv gandhi Expressway	Commercial building	Pond	7	No	-
CH	5700	5.7	Open cut	Rajiv gandhi Expressway	Industrial building	Vacant land	7	No	-
CH	5700-5900	5.9	Open cut	Rajiv gandhi Expressway	Residential building	Residential building	7	No	Congested area, construction should be done during night time
CH	6000	6	Open cut	Rajiv gandhi Expressway	Residential building/ School	Residential/Commercial building	7	No	
CH	6000-6300	6.3	Open cut	Rajiv gandhi Expressway	Residential/Commercial building	Residential/Commercial building	12	No	At approx. 6.28 km there is a culvert. Congested area, construction should be done during night time
CH	6300-6600	6.6	Open cut	Rajiv gandhi Expressway	Residential/Commercial building	Residential/Commercial building	12	No	Congested area, construction should take during night time
CH	6600-6900	6.9	Open cut	Rajiv gandhi Expressway	Residential/Commercial building	Residential/Commercial building	12	No	
CH	7000	7	Open cut	Rajiv gandhi Expressway	Commercial building	Commercial building	12	No	
CH	7100	7.1	Open cut	Rajiv gandhi Expressway	Commercial building	Residential/Commercial building	12	No	
CH	7200	7.2	Open cut	Rajiv gandhi Expressway	Residential building	Industrial building	12	No	
CH	7200-7700	7.7	Open cut	Rajiv gandhi Expressway	Vacant land	Residential and commercial building	12	No	
CH	(7-9)	7.9	Open cut	Rajiv gandhi Expressway	Vacant land	Commercial building	12	No	
CH	8000	8	Open cut	Rajiv gandhi Expressway	Vacant land	Commercial building	12	No	
CH	8150	8.15	Open cut	Rajiv gandhi Expressway	Residential building	Residential building	12	No	
CH	8450	8.45	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	12	No	

Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
CH	8600	8.6	Open cut	Rajiv gandhi Expressway	Residential buiding	Residential/Commercial building	12	No	
CH	8700	8.7	Open cut	Rajiv gandhi Expressway	Industrial building	Vacant land	12	No	-
CH	8800	8.8	Open cut	Rajiv gandhi Expressway	Building	Residential building	12	No	-
CH	9000	9	Open cut	Rajiv gandhi Expressway	Vacant land	Agriculture land	12	No	At approx. 8.87 km there is a well
CH	9000-9400	9.4	Open cut	Rajiv gandhi Expressway	Vacant land	Commercial building	12	No	At approx. 9.33 km there is a culvert
CH	9600	9.6	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	12	No	-
CH	9600-9800	9.8	Open cut	Rajiv gandhi Expressway	Building	Vacant land	12	No	-
CH	9900	9.9	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	12	No	-
CH	9900-10450	10.45	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	12	No	At approx. 10.29 km there is a culvert
CH	10450-10650	10.65	Open cut	Rajiv gandhi Expressway	Vacant land	Apartments	12	No	-
CH	10650-11000	11	Open cut	Rajiv gandhi Expressway	Vacant land	Vacant land	12	No	At approx. 10.72 km, 10.87 km and 10.95 km there is a culvert
CH	11300	11.3	Open cut	Rajiv gandhi Expressway	Vacant land	Industrial building	12	No	-
CH	11300-11700	11.7	Open cut	Rajiv gandhi Expressway	Vacant land along with few shops	Vacant land	12	No	At approx. 11.42km, 11.56 km and 11.63 km there is a culvert
CH	11700-11900	11.9	Deep Excavation for crossing Veeranam pipeline	Rajiv gandhi Expressway	Factory	Commercial building	5.5	No	At approx. 11.8 km there is a culvert
CH	11900-12100	12.1	Open cut	Rajiv gandhi Expressway	Industrial building	Vacant land	5.5	No	-
CH	12100-12300	12.3	Open cut	Senkanmal village	School	Vacant land	5.5	No	-
CH	12300-12500	12.5	Open cut	Senkanmal village	Vacant land	Industrial/Commercial buiding	5	No	-
CH	12600	12.6	Open cut	Senkanmal village	Vacant land with a shop	Commercial building	6	No	-
CH	12700	12.7	Open cut	Senkanmal village	Residential/Commercial building	Building	6.5	No	At approx. 12.63km there is a culvert
CH	12700-13000	13	Open cut	Senkanmal village	Vacant land	Vacant land with few huts	6	Yes	At approx. 12.75 km, 12.94 km there is a culvert. Canal passes
CH	13000-13200	13.2	Open cut	Senkanmal village	Vacant land	Vacant land	5.5	No	-
CH	13300	13.3	Open cut	Senkanmal village	Vacant land with a building	Vacant land	5.5	No	-
CH	13300-13500	13.5	Open cut	Senkanmal village	Kohinoor Garden	Vacant land	5.5	No	At approx. 13.47 km there is a culvert
CH	13500-13700	13.7	Open cut	Senkanmal village	Vacant land with a building	Vacant land	5.5	No	At approx. 13.6 km there is a culvert
CH	13700-13900	13.9	Open cut	Senkanmal village	Vacant land with a building	Coconut plantation	5.5		
CH	14000	14	Open cut	Velichi	Building	Vacant land	5.5	No	-
CH	14000-14200	14.2	Open cut	Velichi	Vacant land	Vacant land	5.5	No	-
CH	14200-14850	14.8	Open cut	Velichi	Vacant land	Vacant land	5.5		At approx. 14.26 km, 14.72 km and 14.84 km there is a culvert
CH	14850-15000	15	Open cut	Velichi	Vacant land	Building	5.5	No	-
CH	15000-15400	15.4	Open cut	Velichi	Vacant land	Vacant land	4	No	At approx. 15.03 km, 15.19 km there is a culvert
CH	15400-18300	18.3	Open cut	Velichi	Reserve forest	Reserve forest	4	No	At approx. 15.73 km, 15.94 km, 16.85 km and 18.29 km there is a culvert
CH	18300-18700	18.7	Open cut	Velichi	Reserve forest	Building	4	No	At approx. 18.37 km, 18.65 km there is a culvert
CH	18700-19350	19.35	Open cut	Velichi	Residential/Commercial building	Residential/Commercial building	4-upto 19.05 km 7-upto 19.35 km	No	At approx. 19.16 km there is a culvert
CH	19350-19700	19.7	Open cut	Major district Road-Mambakkam	Vacant land with well motor room	Vacant land with a shed and a motor room	7	No	-
CH	19700-20200	20.2	Open cut	Major district Road-Mambakkam	Vacant land	Vacant land	7	No	At approx. 19.76 km, 19.96 km there is a culvert
CH	20200-20500	20.5	Open cut	Major district Road-Mambakkam	Vacant land with a bulding	Vacant land with well and motor room	7	No	At approx. 20.25 km, 20.33 km and 20.39 km there is a culvert
CH	20500-20700	20.7	Open cut	Major district Road-Mambakkam	Rubi Engineerng College	Rubi Engineering College	7	No	-
CH	20800	20.8	Open cut	Major district Road-Mambakkam	Vacant land with coconut plantation	Vacant land	7		At approx. 20.8 km there is a culvert
CH	20800-21000	21	Open cut	Major district Road-Mambakkam	Vacant land	Vacant land	7	No	-
CH	21000-21400	21.4	Open cut	Major district Road-Mambakkam	Building	Residential/Commercial building	7	No	At approx. 21.05 km, 21.15 km, 21.19 km, 21.24 km, 21.28 km and 21.4 km there is a culvert

Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
CH	21400-23250	23.25	Open cut	Major district Road-Mambakkam	Forest land	Forest land	7	No	At approx. 21.9 km, 22.18 km, 22.26 km, 22.47 km, 22.53 km, 23.03 km, 23.2 km there is a culvert
CH	23350	23.35	Open cut	Major district Road-Mambakkam	Forest land	Institutional building	7	No	At approx. 21.68 km and 21.74 km there is a culvert
CH	23350-23650	23.65	Open cut	Major district Road-Mambakkam	Forest land	Vacant land	7	No	At approx. 23.58 km there is a culvert
CH	23750	23.75	Open cut	Major district Road-Mambakkam	Vacant land	Mango plantation	7	No	At approx. 23.67 km there is a culvert
CH	23750-24250	24.25	Open cut	Major district Road-Mambakkam	Vacant land with a building	NA	7	No	At approx. 24.23 km there is a culvert
CH	24250-24400	24.4	Open cut	Major district Road-Mambakkam	Vacant land with few buildings	Commercial building and a well	7	No	At approx. 24.34 km there is a culvert
CH	24400-25450	25.45	Open cut	Major district Road-Mambakkam	Vacant land	Vacant land	7	No	At approx. 24.58 km, 24.85 km, 25.13 km, 25.32 km and 25.44 km there is a culvert
CH	25450-25900	25.9	Open cut	Major district Road-Mambakkam	Residential/Commercial building	Vacant land	7	No	At approx. 25.86 km there is a culvert
CH	25900-26600	26.6	Open cut	Medavakkam-Mambakkam Road	Forest land	Forest land	6	No	At approx. 26.05 km there is a culvert
CH	26600-26750	26.75	Open cut	Medavakkam-Mambakkam Road	Coconut plantation	Residential/Commercial building	6	No	-
CH	26750-27100	27.1	Deep Excavation for crossing Veeranam pipeline	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	6	No	-
CH	27100-27350	27.35	Open cut	Medavakkam-Mambakkam Road	Mango Plantation	Industrial building	6	No	-
CH	27450	27.45	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Industrial building	6	No	-
CH	27550	27.55	Open cut	Medavakkam-Mambakkam Road	Vacant land	Residential/Commercial building	6	No	-
CH	27550-27750	27.75	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	6	No	-
CH	27750-28000	28	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Pond	6	No	-
CH	28000-28150	28.15	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	6	No	-
CH	28250	28.25	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Vacant land	6	No	-
CH	28350	28.35	Open cut	Medavakkam-Mambakkam Road	Pond and temples	Temples	7	No	-
CH	28450	28.45	Open cut	Medavakkam-Mambakkam Road	Vacant land	Pond	7	No	-
CH	28450-28600	28.6	Open cut	Medavakkam-Mambakkam Road	Vacant land with a building	Coconut plantation	7	No	At approx. 28.43 km and 28.6 km there is a culvert
CH	28700	28.7	Open cut	Medavakkam-Mambakkam Road	Vacant land	Vacant land	7	No	At approx. 28.7 km there is a culvert
CH	28700-28900	28.9	Open cut	Medavakkam-Mambakkam Road	Vacant land with dugwells	Industrial building	7	No	-
CH	28900-29250	29.25	Open cut	Medavakkam-Mambakkam Road	Vacant land	Vacant land	7	No	At approx. 29.08 km there is a culvert
CH	29250-29400	29.4	Open cut	Medavakkam-Mambakkam Road	Commercial building	Industrial building	7	No	-
CH	29400-29650	29.65	Open cut	Medavakkam-Mambakkam Road	Industrial building	Vacant land	7	No	At approx. 29.47 km, 29.54 km there is a culvert
CH	29750	29.75	Open cut	Medavakkam-Mambakkam Road	Tata consultancy Services	Vacant land	7	No	At approx. 29.67 km there is a culvert
CH	29850	29.85	Open cut	Medavakkam-Mambakkam Road	Coconut plantation	Residential building	7	No	-
CH	29850-30000	30	Open cut	Medavakkam-Mambakkam Road	Princess Dr. K Vasudevan College of Engineering	Residential/Commercial building	7	No	At approx. 29.97 km there is a culvert
CH	30100	30.1	Open cut	Medavakkam-Mambakkam Road	Agriculture land	Vacant land	7	No	-
CH	30100-30300	30.3	Open cut	Medavakkam-Mambakkam Road	Vacant land	Residential/Commercial building	7	No	At approx. 30.14 km and 30.21 km there is a culvert
CH	30300-30800	30.8	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	7	No	-
CH	30900	30.9	Open cut	Medavakkam-Mambakkam Road	Vacant land	Vacant land and a well	7	No	-
CH	31000	31	Open cut	Medavakkam-Mambakkam Road	Industrial building	Residential/Commercial building	7	No	At approx. 30.94 km there is a culvert
CH	31000-31200	31.2	Open cut	Medavakkam-Mambakkam Road	Agriculture land	Residential building	7	No	-
CH	31200-31400	31.4	Open cut	Medavakkam-Mambakkam Road	Vacant land	Vacant land	7	No	At approx. 31.38 km there is a culvert
CH	31550	31.55	Open cut	Medavakkam-Mambakkam Road	Residential building	Residential/Commercial building	7	No	-


Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
CH	31650	31.65	Open cut	Medavakkam-Mambakkam Road	Building	Coconut plantation	7	No	-
CH	31650-33300	33.3	Open cut	Medavakkam-Mambakkam Road	Forest land	Forest land	7	No	At approx. 31.65 km, 31.98 km, 32.82 km there is a culvert
CH	33300-33450	33.45	Open cut	New Agaram Road	Residential/Commercial building	Kovilamcheri village	NA	No	-
CH	33450-33600	33.6	Open cut	New Agaram Road	Pond	Garden	7	No	At approx. 33.55 km there is a culvert
CH	33700	33.7	Open cut	New Agaram Road	Vacant land	Vacant land	7	No	-
CH	33700-34000	34	Open cut	New Agaram Road	Residential/Commercial building	Residential/Commercial building	7	No	At approx. 33.71 km there is a culvert
CH	34000-34250	34.25	Open cut	New Agaram Road	Vacant land	Industrial building	7	No	-
CH	34250-34450	34.45	Open cut	New Agaram Road	Pond	Commercial building and a garden	7	No	-
CH	34450-34600	34.6	Open cut	New Agaram Road	Well	NA	7	No	At approx. 32.96 km there is a culvert
CH	34600-35000	35	Open cut	New Agaram Road	Agriculture land	Agriculture land	7	No	At approx. 34.86 km there is a culvert
CH	35000-35200	35.2	Open cut	New Agaram Road	Residential/commercial building	Vacant land with few houses	7	No	At approx. 35.18 km there is a culvert
CH	35200-35350	35.35	Open cut	New Agaram Road	Vacant land	Eshwari temple and buildings	7	No	-
CH	35350-36000	36	Open cut	New Agaram Road	Residential/Commercial building	Residential/commercial building	7	No	-
CH	36000-36250	36.25	Open cut	New Agaram Road	Residential/commercial building	Residential/commercial building	7	No	-
CH	36350	36.35	Open cut	Agaram Road	Vacant land	Residential/Commercial building	7	No	-
CH	36350-37000	37	Open cut	Agaram Road	Residential/Commercial building	Residential/Commercial building	7	No	-
CH	37000-37950	37.95	Open cut	Agaram Road	Residential/Commercial building	Residential/Commercial building	7-upto 37.5 km 20- upto 37.95 km	No	-
CH	38050	38.05	Open cut	Camp Road	Vacant land	Commercial building	20	No	-
CH	38050-38300	38.3	Open cut	Camp Road	Residential/Commercial building	Industrial building	20	No	-
CH	38300-38650	38.5	Open cut	Camp Road	Vacant land	Vacant land with a shop	20	No	-
CH	38650-38850	38.85	Open cut	Camp Road	Commercial building	Industrial building	20	No	-
CH	38950	38.95	Open cut	Camp Road	Residential building	Vacant land	20	No	-
CH	39050	39.05	Open cut	Camp Road	Petrol bunk	Commercial building	20	No	-
CH	39150	39.15	Open cut	Camp Road	Vacant land with a house	Vacant land	20	No	-
CH	39150-39350	39.35	Open cut	Camp Road	Commercial/Industrial building	Commercial building	20	No	-
CH	39450	39.45	Open cut	Camp Road	Commercial building	Bharath University	20	No	-
CH	39450-41000	41	Open cut	Camp Road	Commercial building	Commercial building	20-upto 40.6 km 8-upto 41km	No	Congested area, construction should be done during night time
CH	41000-42050	42	Open cut	Kamaraj Garden Street	Commercial/Industrial building	Commercial/Industrial building	8-upto 41.15 km 20-upto 42.05 km	No	
CH	42050-42250	42.25	Open cut	Kamaraj Garden Street	Commercial building	Institutional building	20	No	
CH	42300	42.3	Open cut	Kamaraj Garden Street	Commercial building	Commercial building	20	No	
CH	42300-42600	42.6	Open cut	Kamaraj Garden Street	Commercial building	Institutional building	20-upto 42.5 km 10-upto 42.6 km	No	
CH	42600-43150	43.15	Open cut	Kamaraj Garden Street	Commercial building	Industrial building	10-upto 42.85 km 30-upto 43.15 km	No	
CH	43150-43700	43.7	Open cut	Kamaraj Garden Street	Tamparam Railway quarters area	Madras Christian College	30	No	
CH	43700-43900	43.9	Open cut	Kamaraj Garden Street	Tamparam Railway quarters area	Commercial building	30	No	

Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
CH	43900-44050	44.05	Open cut	Kamaraj Garden Street	NA	Commercial building	20	No	
CH	44050-44250	44.25	Pipe Jacking (Chainage 44110-44250)	Tambaram flyover	Tambaram flyover	Tambaram flyover	14	Yes-Tambaram Railway track	
CH	44250-44450	44.45	Open cut	Tambaram-Mudichur-Sriperumbudur Road	Commercial/Institutional building	NA	14	No	
CH	44450-44600	44.6	Open cut	Tambaram-Mudichur-Sriperumbudur Road	Residential/Commercial building	Residential Quarters	14	No	
CH	44600-44900	44.9	Open cut	Kakkan Street	Commercial building	Residential/Commercial building	10	No	
CH	45000	45	Open cut	Kakkan Street	Institutional building	Hospital	10	No	
CH	45100	45.1	Open cut	Gandhi Road	Commercial building	Commercial building	6	No	
CH	45200	45.2	Open cut	Kishkintha Road	Vacant land	Vacant land	6	No	
CH	45300	45.3	Open cut	Kishkintha Road	Vacant land with a house	Institutional building	6	No	-
CH	45300-45650	45.65	Open cut	Thiruneermalai road	Vacant land	Cemetery	6	No	-
CH	45650-46600	46.6	Open cut	Thiruneermalai road	Residential/Commercial building	Residential/Commercial building	6	No	-
CH	46600-46850	46.85	Open cut	Thiruneermalai road	Residential/Commercial building	Vacant land and a temple	6	No	-
CH	46850-47300	47.3	Open cut	Thiruneermalai road	Vacant land	Vacant land	6	No	-
CH	47300-47550	47.55	Open cut	Thiruneermalai road	Vacant land	Vacant land	10	No	-
CH	475500-47800	47.8	Pipe Jacking approx. from 47.75 km	Thiruneermalai road	Industrial building	Vacant land	10	No	-
CH	47800-48100	48.1	Pipe Jacking approx. till 47.85 km	Thiruneermalai road	Chennai to bangalore service road	Vacant land	6	No	At approx. 48.04 km there is a culvert
CH	48200	48.2	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Building	6	No	-
CH	48550	48.55	Open cut	Service road of Chennai Bypass Road	Lake	Lake	6	No	At approx. 48.48 km there is a culvert
CH	49600	49.6	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land	6	No	At approx. 48.57 km, 48.84 km, 48.9 km, 49.37km, 49.52 km there is a culvert
CH	49700	49.7	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Residential/commercial building	6	No	-
CH	49700-50100	50.1	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land	6	No	-
CH	50900	50.9	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land with few buildings	6	No	At approx. 50.48 km, 50.59 km there is a culvert
CH	51000	51	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Residential/Commercial building	6	No	-
CH	51200	51.2	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land	6	No	At approx. 51.05 km there is a culvert
CH	51550	51.55	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Residential/commercial building	6	No	At approx. 51.37 km there is a culvert
CH	51550-51750	51.75	Open cut	Service road of Chennai Bypass Road	Adyar river	Adyar river	6	No	Bridge
CH	51850	51.85	Open cut	Service road of Chennai Bypass Road	Adyar river	Bushes with few huts	6	No	Bridge
CH	53050	53.05	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land	6	No	At approx. 52.01 km, 52.14 km, 52.28 km, 52.54 km, 52.74 km, 52.47 km and 52.94 km there is a culvert
CH	53150	53.15	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Commercial building	6	No	At approx. 53.06 km there is a culvert

Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
CH	53150-54000	54	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land with few buildings	6	No	At approx. 53.36 km, 53.62 km, 53.68 km, 53.77 km and 54 km there is a culvert
CH	54600	54.6	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land	6	No	At approx. 54.02 km, 54.25 km, 54.4 km there is a culvert
CH	54700	54.7	Pipe Jacking	Chennai Bypass Road	Veeranam water pipe culvert line	Veeranam water pipe culvert line	6	No	-
CH	55800	55.8	Open cut	Kundrathur main road	Residential/Commercial building	Residential/Commercial building	6	No	Congested area, construction should be done during night time
CH	55900	55.9	Open cut	Kundrathur main road	Vacant land	Residential/Commercial building	6	No	
CH	57000	57	Open cut	Kundrathur main road	Residential/Commercial building	Residential/Commercial building	6	No	
CH	57000-57500	57.5	Open cut	Kundrathur main road	Commercial/Industrial building	Commercial/Industrial building	6	No	
CH	57500-58200	52	Open cut	Kundrathur main road	Residential/Commercial building	Residential/Commercial building	12	No	
CH	58400	58.4	Open cut	Kundrathur main road	Commercial/Industrial building	NA	12	No	
CH	58700	58.7	Open cut	Kundrathur main road	Commercial/Industrial building	Commercial/Industrial building	12	No	
CH	58800	58.5	Open cut	Mount Poonamall road	Residential/Commercial building	Residential/Commercial building	12	No	
CH	58950	58.9	Open cut	Mount Poonamall road	Commercial building	Commercial building	25	No	
CH	59150	59.15	Open cut	Mount Poonamalle road	Commercial building	Commercial building	25	No	
CH	59250	59.25	Open cut	Mount Poonamalle road	Vacant land	Porur lake area	25	No	
CH	59250-59600	59.6	Deep Excavation form approx. 59.55 km	Service road of Chennai Bypass Road	Residential/Commercial building	Porur lake area	25	No	
CH	59700	59.7	Deep Excavation approx. upto 59.65 km	Service road of Chennai Bypass Road	Veeranam water pipe culvert line	Burial ground	5	No	-
CH	59900	59.9	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Vacant land with few houses	5	No	-
CH	59900-60150	60.15	Open cut	Service road of Chennai Bypass Road	Chennai to bangalore service road	Porur head works	5	No	-
CH	60220	60.22	Open cut	Service road of Chennai Bypass Road	Porur head works	Porur head works	NA	No	-
Chainage of Transmission Pipeline Route (branch line)									
CH0	0	0	Open cut	Medavakkam-Mambakkam Road	Sithalapakkam lake	Residential building	14	No	-
	0-8	0.8	Open cut	Medavakkam-Mambakkam Road	Sithalapakkam lake	Vacant land	14	No	At approx. 0.1 km there is a culvert
	9	0.9	Open cut	Medavakkam-Mambakkam Road	Sithalapakkam lake	Residential building	14	No	-
CH1	0	1	Open cut	Medavakkam-Mambakkam Road	Vacant land	Residential/Commercial building	14	No	-
	2	1.2	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	14	No	-
	2-5	1.5	Open cut	Medavakkam-Mambakkam Road	Commercial building	Commercial building	14	No	-
	5-9	1.9	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	14	No	-
CH2	1	2.1	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Residential/Commercial building	14	No	-
	1-3.5	2.35	Open cut	Medavakkam-Mambakkam Road	Commercial/Industrial building	Vacant land with drainage	14	No	-
	3.5-6	2.6	Open cut	Medavakkam-Mambakkam Road	Vacant land	Industrial building	14	No	-
	6-9	2.9	Open cut	Medavakkam-Mambakkam Road	Vacant land	Residential building	14	No	-
CH3	0	3	Open cut	Medavakkam-Mambakkam Road	Vacant land	Residential building	14	No	-
	0-1.5	3.15	Open cut	Medavakkam-Mambakkam Road	Vacant land	Wastage area	14	No	-
	1.5-3	3.3	Open cut	Medavakkam-Mambakkam Road	Shops	Vacant land	14	No	-

Chain	Chain No.	Distance from	Construction	Location/Road Name	Land Use		Road Width (m)	River/Rail	Remarks
	3-9	3.9	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Industrial building	14	No	Congested area, construction should be done during night time
CH4	0	4	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Industrial building	14	No	
	0-5	4.5	Open cut	Medavakkam-Mambakkam Road	Residential/Commercial building	Commercial/Industrial building	14	No	
	5-9.5	4.95	Open cut	Medavakkam-Mambakkam Road	Shops	Commercial/Industrial building	14	No	
NA-Not Available, CH-Chainage									

Appendix 7.6 Response from CMWSSB to TNCZMA on Sea Turtles



CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD
 No. 1, Pumping Station Road, Chintadripet, Chennai-600 002.
 MANAGING DIRECTOR

Lr.No.CMWSSB/SE(Desal)/400MLD Desal Plant/Spl/2015 Dated 26.10.2015

To
 The Member Secretary,
 Tamil Nadu State Level Coastal Zone
 Management Authority & Director of
 Environment,
 No.1, Jennis Road, Panagal Building,
 Ground Floor, Saidapet, Chennai 15.

Sir,
 Sub: CMWSSB – Setting up of 400 MLD SWRO Desalination Plant at Perur – CRZ
 clearance requested from State Level Coastal Management Authority – Certain
 details called for – Reply furnished – Early clearance requested – Reg.

Ref: Lr.No.RC.No.P1/790/2015 dated 08.10.2015 from the Director, Department
 of Environment for 400 MLD Desalination Plant.

**

Further to the reference cited above, the required details / documents for the proposed
 400mld Desalination Plant at Perur are detailed as follows along with necessary enclosures for
 taking further action by Tamil Nadu State Coastal Zone Management Authority (TNSCZMA).

Sl.No.	Details called by TNSCZMA	Reply of CMWSSB
1	A detailed turtle nesting conservation plan in and around the project area.	The Report is furnished in Annexure I
2	A report on the impact of eco system due to intake and outfall pipelines shall be furnished and the mitigation measures taken on the adverse impacts shall be furnished.	The Report is furnished in Annexure II
3	As CMWSSB has already constructed a desalination plant at Nemmeli, a report on the functioning of the said plant with reference to the conditions imposed in the Environmental Clearance should be furnished.	The existing 100MLD SWRO Desalination Plant at Nemmeli has been constructed and being under Operation & Maintenance as per the conditions imposed in the Environmental Clearance given by Ministry of Environment and Forest, Gov. The analysis report details of the dispersal of the reject disposed

Sl.No.	Details called by TNSCZMA	Reply of CMWSSB
4	Baseline data of the Nemmeli Plant, details of the 600MLD plant being constructed by Reliance on Rann of Kutch and other relevant baseline study reports shall be furnished to enable a comparison and obtain learning	<p>from this Plant are furnished in Annexure III.</p> <p>The intake and outfall pipes of the existing 100 MLD Plant is 1040 m and 680 m away from the shore. As per the analysis report of the plant furnished in Annexure III, it is observed that the salinity of the reject reaches 2 ppt above ambient level within 50 m from the discharge point and also noticed that the ambient level of 38 ppt is reached within a radius of 100 m from the discharge point.</p> <p>As per the modeling report, submitted in the EIA Report already, on dispersion of reject from the existing 100 MLD Desal Plant as well as the proposed 150 MLD and 400 MLD plants, it is observed that there is no merging between the outfalls. Further, the study also shows that the brine reject discharged into the shoreline do not reach the shore and there will be no shoreline connection and no contaminations of the water near the coast. And also noticed that there is no recirculation of water discharged into the intake.</p> <p>As per the available data regarding the desalination plants at Reliance Industries in Rann of Kutch, Gujarat (of 600 MLD capacity), the following are observed:</p> <p>The Total capacity of Desalination Plants at Reliance is 400 MLD only.</p> <ol style="list-style-type: none"> 160 MLD Plant is Thermal Desalination based on MED and is in operation for more than 5 years. And balance 240 MLD is as below <ol style="list-style-type: none"> 168 MLD RO based Desalination plant – under construction 72 MLD Thermal Desalination plant on MED – under construction <p>The said two plants as stated under point</p>

ANNEXURE-I
Turtle nesting conservation plan around the Project area

Background

Tamil Nadu has a coastal length of 1076 km (13% of the country's coastline) and a continental shelf of approximately 41,412 sq.km, and is one of the leading states in marine fish production. The State has a fishermen population of 1.05 million of which 0.20 million fishermen are actively engaged in fishing from 591 marine fishing villages scattered along 13 coastal districts.

The Chennai Metropolitan Development Authority (CMDA) is the nodal agency responsible for planning and development of Chennai Metropolitan Area, which is spread over an area of 1,189 Sq. km, covering the Chennai district and parts of Tiruvallur and Kanchipuram districts. The CMDA has drafted a second Master Plan that aims to develop satellite townships around the city. The city's contiguous satellite towns include Mahabalipuram in the south, Chengalpattu and Maraimalai Nagar in the southwest, and Sriperumpudur, Arakkonam, Kanchipuram and Tiruvallur to the west.

Chennai has 25.6 km of sea coast which is flat and sandy for about a km. from the shore. The Coast in Kanchipuram district under which the present site comes, has 87 Km of sea coast wherein 44 fishing villages with 2 major and 37 minor fish landing centers exist. The proposed site is 43 KM away from Chennai city.

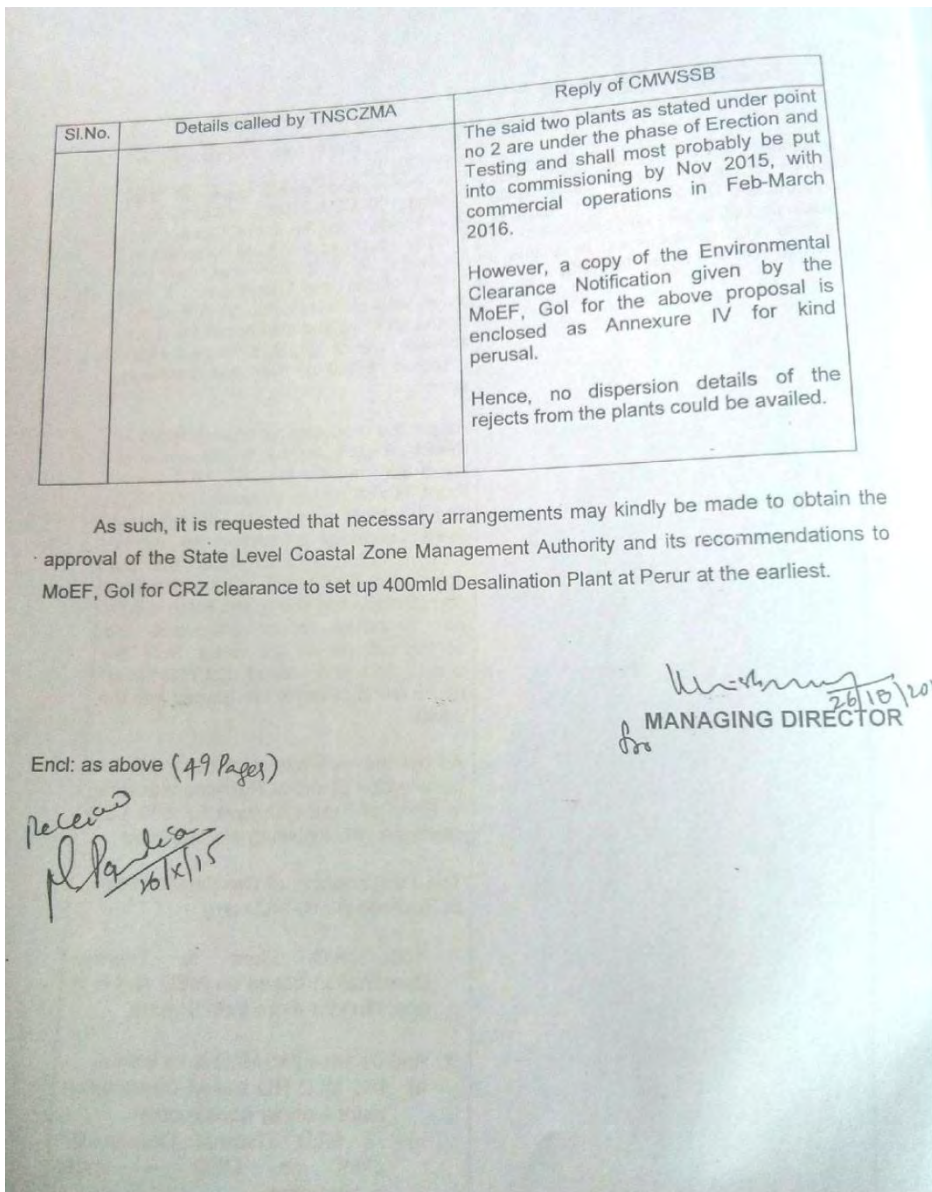
Chennai coast is characterized by fairly wide sandy beaches like the Marina, Elliot's, Neelangarai beach, Thiruvanniyur and Valmiki Nagar beaches. The sand texture is soft and suitable for sea turtle nesting.

Turtles of Indian waters

Five of the seven known species of sea turtles: Leatherback turtle (*Dermochelys coriacea*), Hawksbill turtle (*Eretmochelys imbricate*), Loggerhead (*Caretta caretta*), Green turtle (*Chelonia mydas*) and Olive Ridley turtle (*Lepidochelys olivacea*) are reported from the Indian waters. Except for the Loggerhead turtle, all four other species are known to nest along the coast of mainland and the Bay Islands of India.

Sea turtle population

Four species of sea turtles; olive ridley, hawksbill (*Eretmochelys imbricate*), green turtle (*Chelonia mydas*), and leatherback turtle (*Dermochelys coriacea*) were recorded during the course of various studies conducted along the Indian coast. Olive Ridley turtles, the smallest and the most numerous of the seven species are famously known for their unique behavior of forming enormous nesting aggregations - a phenomenon known as "arribada" (Spanish for arrival).



Tamilnadu and Andhra Pradesh coasts are considered as the migratory pathways of Olive Ridley's for approaching mass nesting in Odisha.

The three main rookeries or turtle nesting beaches along the 480 km stretch of Odisha coast are the Gahirmatha rookery (Bustard, 1976), between the Brahmini and Baitarani, located north of Paradip; the rookery at the Devi river mouth, about 100 km south of Gahirmatha (Kar, 1982) and the rookery located 320 km south of Gahirmatha, near the mouth of Rushikulya river (Pandav et. al., 1994). The Olive Ridley population in Orissa is of global significance since it is one of the major mass nesting rookeries in the world, along with Mexico, and Costa Rica .

Olive Ridley nests sporadically along northern Tamil Nadu Coast and high nesting was observed along Nagapattinam and Chennai Coasts. The Other turtle nesting areas are the coasts between Tranquebar and Pazhayaru, Mahabalipuram and Chennai and Point Calimere and Nagapattinam. Sea turtles congregate on the eastern coastal waters by November – December and nesting is usually between January and end March with peak nesting happening in February.

Sea Turtle Surveys and Monitoring by Research Organisations and NGO's

Surveys and documentation of sea turtles in India began at two sites, namely Gahirmatha in Orissa, and Chennai (Madras) in Tamil Nadu. In Chennai (Madras), monitoring of status and threats (and hatchery programs for conservation) was initiated by the Madras Snake Park Trust, surveyed much of the Indian coast over the next few years.

Sea turtle monitoring in Chennai has been nearly continuous over the last forty years thanks to the efforts of the Madras Snake Park Trust (1973 –1976), Central Marine Fisheries Research Institute (1977-1981), Tamil Nadu Forest Department (1982 – till now) and Students Sea Turtle Conservation Network (SSTCN) from 1988 till the present.

Protection and Intelligence Gathering -- Staff Strength and Distribution

Each year, during the turtle nesting season, a volunteer group establishes a hatchery at Neelangarai, and every night from end-December through end-March, the same 7 km stretch of beach is patrolled. Since 2009 the Marina stretch too is being monitored making the total length covered 14 km with an additional hatchery in Marina (This area is 42 KM from the Project site).

Every weekend during the season, members of the general public and school and college students from Chennai and other places accompany volunteers on 'turtle walks' where they learn about sea turtles and marine conservation.

Over the years more than 25,000 people have participated in the walks. Many student members have been motivated to pursue careers in ecology, ecotourism, wildlife management and conservation.

Fishermen Communities -- Participation in Protection of Species

Although the fishermen communities were initially suspicious and sometimes hostile towards the work of conservation volunteers every night, their shift in attitude to that of support has been quite dramatic especially in the Marina stretch. The people from the community who used to poach eggs have become protectors of nests. Some even call volunteers' mobile phones to inform them that there is a nest that they need to pick up. It is noteworthy that the fishermen expect nothing in return for their help. If wild nests hatch and hatchlings stray towards the bright lights on the beach, fishermen often call volunteers or our hatchery supervisor (a fisherman himself) for help to track down and release hatchlings before they are picked off by dogs and crows.

Street theatre programmes are organised for fishing communities to spread the message about the need to protect sea turtles and preserve the biodiversity in the ocean.

Threats to sea turtle

The major threats to the sea turtles are:

- i. Fishing by trawlers and Gill netters in nearshore and offshore coastal waters is a vital obstacle for the sea turtles. They are hurt and killed by slashing of propellers of mechanical boats. Most of the turtles including mating pairs die due to suffocation when they are entangled in trawl nets and gill nets. (This is not applicable to this project)
- ii. Artificial lighting from anchoring vessels, ports, harbours, fishing jetties and other coastal developmental activities are known to have impacts on breeding, nesting and hatching as light is known to greatly disorient them while moving. (The project has no plan to use lights in the beach)
- iii. Introduction of improved beach landing crafts and settlement of migratory fishermen from neighboring states on important nesting beaches resulting in destruction of nesting habitats. (Not applicable to this project)
- iv. Oil spills and marine pollution will inevitably occur in the event of large port being set up.
- v. Changes in the land use pattern of coastal areas in the vicinity of important nesting as well as mass nesting beaches such as beach loss and beach modification, beach littering, casuarinas plantation neat the High Tide Line (HTL), increased lighting in the beaches have been reported have significant impacts. Similarly, changes in the sea use pattern such as increasing fishing activities, increasing ship/boat activities because of developmental activities around breeding grounds, feeding and developmental habitats as well as migratory paths etc. have their influence on sea turtles and their habitats.

- vi. Human poaching of turtle eggs and predation of eggs by other animals are the most common activities that result in the loss of turtle population.

Identification of the exact non-breeding grounds of Olive Ridleys nesting

Though Olive Ridleys spend almost six months in a year in the coastal waters off Odisha, till recently nothing was known about the area where they spend the remaining six months. Recovery of 22 turtles tagged in Odisha from Sri Lanka and Gulf of Mannar during this study indicates that this could possibly be the non-breeding grounds for the ridleys migrating to the Odisha coast every winter. Although the tagged turtles have been recovered all around Sri Lanka, most of the recoveries are made from Gulf of Mannar and the west coast of Sri Lanka. Satellite telemetry studies can provide definite answers about olive ridleys non-breeding area. However, with the existing tag returns it is clear that olive ridleys are migrating from as far south as Sri Lanka to breed in Odisha.

Also it is understood that area near Nagapattinam is favored place for nesting and the same is approx. 200 km from the proposed site.

Nesting survey was carried out fortnightly in the stretch between Neelankarai and Uthandi by WWF-India personnel. The survey was conducted from January to March 2012. A total of 6 Olive Ridley nests were recorded during the survey. Uthandi is about 19.2 KM away from the proposed Project site. Hence, the stretch along the proposed site does not have any impact on turtle nesting .

Further, a beach stretch of 50 km from Mahabalipuram to Pondicherry was monitored by WWF-India personnel and a resource person. The nesting survey was carried out on a fortnightly basis and nesting information was recorded. Mahabalipuram is about 9.8 KM away from the proposed Project site and hence the proposed plant does not have any impact on turtle nesting.

During the survey conducted by Indomer along the above said stretches between Neelankarai and Mahabalipuram from February to March 2012, 44 nests of Olive Ridley turtles were observed. The maximum number of nests was observed during 2nd week of February and March 2012 and some areas recorded higher nesting activity, ranging between 12 and 17 nests.

Further , during the survey conducted by the Volunteers of Students Sea Turtle Conservation Network (SSTCN) from January to February 2014, in the stretch between Neelangarai in south and Napier Bridge in North (which is 21 KM away from the Project site) , 332 nests were observed which is comparatively higher than the observations made during the previous years.

Already one 100 MLD SWRO Desalination plant is operating at the same place for last three years and **so far no such turtle nesting has been reported so far.**

In spite of **no impact** observed on the nesting of Olive Ridley Turtle along the stretch of the proposed Project site, CMWSS Board will extend support to Forest Department/ Students Sea Turtle Conservation Network (SSTCN) for the conservation of Olive Ridley Turtles as required.

Impact of Proposed desalination plant on turtle population

The intake and outfall are proposed at 1000 m and 650 m from the shoreline which is beyond the "active zone" of the turtle population. While intake of seawater is expected not to cause any impact on the turtle population because of its location offshore some 650 m away from the coast. Further the intake head is provided with the screens / trash bars to prevent its entry into the same.

Outfall is designed with a multiple port diffuser for faster mixing and dilution of the brine which is expected to have a salinity of 71ppt i.e. 33 ppt higher than the ambient seawater. This increase in salinity gets reduced to 1.0 ppt within 100 m distance from the outfall. The modeling study conducted also confirms that the rate of mixing of brine reject is very effective for outfall located at 650 m distance offshore.

The brine from the desalination plant will only have a higher quantity of salt and it may not bring any adverse effect on the breeding population.

Onshore impacts:

The turtles select sandy beaches for nesting and they normally lay their eggs beyond the HTL. The area where LFP is to be located is free from any nests possibly because of high sand dunes present near the HTL. The backshore region is having 8 to 10 m high sand dunes. The top of intake and outfall pipelines are to be buried almost 1.0 m from the sea bed surface and once they are laid they will not interfere with nesting as the turtles usually dig 30 to 50 cm deep to lay their eggs. So far no reports have been published on the mass nesting of Olive Ridley or other species in this area.

Mitigation

It is proposed to have the pipe laying activity in non-mating season and also the lighting towards the coast should be of low intensity. It is also advisable to avoid Casuarina plantation near the HTL as the sand dunes are very stable and sufficiently high to be a good barrier for natural disasters like tsunami and cyclones.

Appendix 7.7 Meeting Minutes for the 1st Stakeholders Meeting

MINUTES OF THE STAKEHOLDERS MEETING CONDUCTED BY CHIEF ENGINEER (O&M) II REGARDING THE PROPOSED 400 MLD DESAL PLANT AT PERUR ON 8.7.2016

PRESENT:

1. Chief Engineer III, CMWSSB.
2. Superintending Engineer (Desal)
3. Executive Engineer (Desal)
4. President, Nemmeli Village Panchayat
5. Block Development Officer, Thiruporur
6. Village Administrative Officer, Thiruporur
7. Representative from Arulmigu Alavandar Trust
8. Representative from Study Team of JICA
9. Local Public of Nemmelikuppam

**

At the outset, the Executive Engineer (Desal) welcomed the gathering and explained the purpose of the meeting and briefly enlightened the details of the project and requested the local public to offer their opinion and suggestions for the proposed 400 MLD Desal Plant at Perur. Subsequently, the Superintending Engineer (Desal) outlined the necessity of the proposed 400 MLD & 150 MLD Desalination Plants in addition to the existing 100 MLD Desalination Plant at Nemmeli with details of the units proposed to be set up under this project.

The following points were discussed in detail.

- a) The local public welcomed the proposed project and in general, agreed to extend their cooperation for the successful completion of the project.
- b) The local public informed that the protection given for the shore erosion which caused damage to their houses during execution of existing 100 MLD Desalination Plant was not of sufficient relief and requested to provide protection in the form of construction of dyke for a length of approximately 300 m before commencement of construction works for

the new project. SE (Desal) accepted their demand of providing necessary protective system to the seashore of the village which will be consulted with implementation team of the project.


- c) The local public further informed that the boats and fishing net arrangements are likely to be damaged during dredging for laying intake pipeline and requested to provide necessary compensation for attending the defects and to protect their livelihood. SE (Desal) assured them that these will be considered during the execution of the project.
- d) The President, Nemmelikuppam Village has enquired about the process of laying the intake / outfall pipeline work whether it will be above the sea bed or below the sea bed. SE (Desal) informed that the intake / outfall pipeline will be laid below the sea bed by conventional dredging method during non season time which usually exists for a period of three to four months. The local public requested to consider providing necessary protection in the form of dyke during pipe laying work to avoid further soil erosion at shore near their village.
- e) It was also informed that there are 4 burial grounds existing in this site for a total extent of 1.85 acres. Out of which 3 clustered burial grounds for an extent of 1.32 acres located on the north side are accessible from the east & west side and 1 burial ground for an extent of 0.53 acres located on the south side is accessible from south east side.
- f) Based on the request of the locals, the officials inspected the eroded shore and the existing burial ground (3 clustered) located in the site earmarked for the proposed plant.
 - (i) The local public requested to restore the damaged concrete platform of the temple due to soil erosion by waves subsequent to the construction of 100 MLD Desalination Plant
 - (ii) With regard to 3 cluster burial ground, the local public represented that the path leading to this burial ground is presently from shore only. The locals requested CMWSSB that this path may be rested with them to perform funeral rites. EE (Desal) informed that

CMWSSB will construct a compound wall around the plant leaving the existing burial grounds. The public insisted to allocate full stretch of land along East / West encompassing the burial ground which would also allow other commuters to enter the burial ground from the western end. SE (Desal) informed that the land belongs to Alavandar Trust and has been allotted for this project on "long term lease basis" by the Government. Hence, this is to be decided in consultation with Alavandar Trust, GoTN and local Revenue Department officials.


The meeting ended with vote of thanks given by CE (O&M) II.

Sd/.....20.07.2016
CHIEF ENGINEER (O&M) II i/c

/t.c.f.b.o./

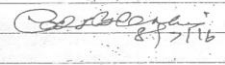
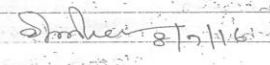


S.E (Desal)
20⁷/₁₆


Appendix 7.8 Participant List for the 1st Stakeholders Meeting



METRO WATER

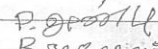
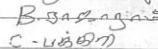
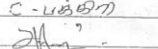
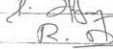
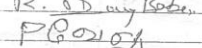
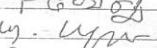
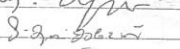
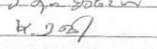

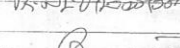
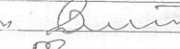
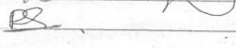



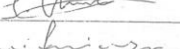
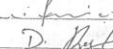
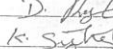
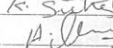
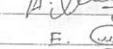
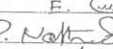
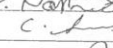
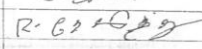
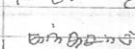
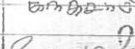
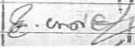


7

S.No	Name / Division	Village / Division	Signature / மொத்தியை	Department
1.	V. Sivalaram Manager.			Operations
2.	V.N. Parimala	BEBO (VP) Tirupurur		R.O. Dept
3.	E. R. JEEDEE	V. P. S.		



METRO WATER

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S.No	Name / Division	Village / Division	Signature / மொத்தியை
1.	Abbu	Nemmeli	
2.	Rajaram	Village	
3.	Bakkani	"	
4.	Amirayyagan	"	
5.	R. Dailly Babu	Nemmelikuppam	
6.	P. Balu	Nemmelikuppam	
7.	B. BASKARAN	nemmelikuppam	
8.	B. Alagban	"	
9.	A. S. S. S.	"	
10.	P. S. S. S.	"	
11.	P. S. S. S.	"	
12.	S. DESHVARAN	Nemmelikuppam	
13.	P. Raju	"	
14.	D. Raju	"	
15.	S. S. S. S.	"	
16.	G. R. THIRAKOTY	Nemmelikuppam	
17.	J. V. JAY	"	
18.	M. K. S. S.	"	
19.	D. K. S. S.	"	
20.	K. S. S. S.	"	
21.	A. AKASH	"	
22.	E. Mohan	"	
23.	P. MATHANKUMAR	"	
24.	C. S. S. S.	"	
25.	C. S. S. S.	"	
26.	C. S. S. S.	"	
27.	C. S. S. S.	"	
28.	L. S. S. S.	"	

Appendix 7.9 Meeting Minutes for the 2nd Stakeholders Meeting

MINUTES OF THE STAKEHOLDERS MEETING CONDUCTED BY
SUPERINTENDING ENGINEER (DESAL) REGARDING THE PROPOSED
400 MLD DESAL PLANT AT PERUR ON 18.8.2016.

PRESENT:

1. Superintending Engineer (Desal)
2. Executive Engineer (Desal)
3. President, Nemmeli Village Panchayat
4. Representative from Arulmigu Alavandar Trust
5. Representative from Study Team of JICA
6. Local Public of Soolerikattu Kupam

**

At the outset, the Executive Engineer (Desal) welcomed the gathering and explained the purpose of the meeting and briefly enlightened the details of the project and requested the local public to offer their opinion and suggestions for the proposed 400 MLD Desal Plant at Perur. Subsequently, the Superintending Engineer (Desal) outlined the necessity of the proposed 400 MLD & 150 MLD Desalination Plants in addition to the existing 100 MLD Desalination Plant at Nemmeli with details of the units proposed to be set up under this project and requested the public to offer their views & issues.

The following points were discussed in detail:

- a) The local public welcomed the proposed project and in general, agreed to extend their cooperation for the successful completion of the projects taken up by CMWSS Board.
- b) The local public informed that due to the implementation of two new desalination plants, their livelihood may get affected and requested to provide permanent employment opportunities per person per family. SE (Desal) assured that suitable action will be taken to place this issue before the Government through CMWSS Board.

c) It was also requested that a relief amount of Rs.300 / day totaling to Rs.9000/ month has to be given to all the members of the Fisherman Cooperative Society of Soolerikattu Kupam. Further, the villagers had also requested that the Education Fee (school as well as college levels) for the students belonging to their community has to be borne by the Govt. SE (Desal) assured that suitable action will be taken to place this issue before the Government through CMWSS Board.

d) It was further informed that the protection given for the shore erosion which caused damage to their houses during execution of existing 100 MLD Desalination Plant was not of sufficient relief and requested to provide sufficient protection before commencement of construction works for the new projects. SE (Desal) accepted their demand of providing necessary protective system to the seashore of the village which will be provided in consultation with implementation team of the project.

e) The local public further informed that there are chances of further shore erosion in their village due to the implementation of the new plants, which may result in vacating this area completely. Hence, they have requested to provide alternative arrangements for their settlement by Government at free of cost. SE (Desal) assured that suitable action will be taken to place this issue before the Government through CMWSS Board.

f) The President, Nemmeli Village has enquired about the process of laying the intake / outfall pipeline work whether it will be above the sea bed or below the sea bed. SE (Desal) informed that the intake / outfall pipeline will be laid below the sea bed by conventional dredging method during non season time which usually exists for a period of three to four months. The local public requested to consider providing necessary protection in the form of dyke during pipe laying work to avoid further soil erosion at shore near their village.

g) It was also informed by local that there are 4 burial grounds existing in this site for an extent of 1.85 acres. Out of which 3 clustered burial grounds located on the north side are accessible from the east & west side and 1 burial ground located on the south side is accessible from south east side. It was also confirmed that there are no other burial grounds than the existing four burial grounds. EE (Desal) informed that CMWSSB would construct a compound wall around the plant leaving the existing burial grounds with suitable pathway for the burial grounds.

h) The local public also requested on the following:

- i) to provide proper storm water drain upto the sea to drain out the rain water during the monsoon period to protect their village from flooding / stagnation of water.
- ii) allotment of land to an extent of 6 acres and 30 cents to the local public from the Alavandar Trust as already approved during 1983 and to issue patta for all the houses in the Soolerikattu Kupam.
- iii) To facilitate to complete the construction of Community Hall which was stopped by the Alavandar Trust at present.

In this regard, SE (Desal) informed that suitable action will be initiated to address the above issues with the concerned Departments.


The meeting ended with vote of thanks given by SE (Desal)

Sd/.....18.08.2016
SUPERINTENDING ENGINEER (DESAL)

E.C.J.O.



17/8/16
EE/Desal.

Appendix 7.10 Participant List (2nd Stakeholders Meeting)



METRO WATER
 Details of Participants during
 the Stakeholders Meeting conducted at Inebitady,
 Nemmeli on 18.8.2016.

Sl. No.	Sl. No.	Sl. No.	Sl. No.
1	K. E. Maniyan	2	K. E. Nagarajan
2		3	
3		4	
4		5	
5		6	
6		7	
7		8	
8		9	
9		10	
10		11	
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20		21	
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22		23	
23		24	
24		25	
25		26	
26		27	
27		28	
28		29	
29		30	



METRO WATER
 Details of Participants attended during
 the Stakeholders meeting conducted at Inebitady,
 Nemmeli on 18.8.2016.

Sl. No.	Sl. No.	Sl. No.	Sl. No.
1	S. D. Balraj	2	S. Raju
2	V. Loganathan	3	S. Loganathan
3	S. Loganathan	4	S. Loganathan
4	R. Venkadesan	5	R. Venkadesan
5	K. R. Loganathan	6	K. R. Loganathan
6	J. J. J. J.	7	J. J. J. J.
7	B. Balraj	8	B. Balraj
8	P. P. P. P.	9	P. P. P. P.
9	S. S. S. S.	10	S. S. S. S.
10	S. S. S. S.	11	S. S. S. S.
11	S. S. S. S.	12	S. S. S. S.
12	S. S. S. S.	13	S. S. S. S.
13	S. S. S. S.	14	S. S. S. S.
14	S. S. S. S.	15	S. S. S. S.
15	S. S. S. S.	16	S. S. S. S.
16	S. S. S. S.	17	S. S. S. S.
17	S. S. S. S.	18	S. S. S. S.
18	S. S. S. S.	19	S. S. S. S.
19	S. S. S. S.	20	S. S. S. S.
20	S. S. S. S.	21	S. S. S. S.
21	S. S. S. S.	22	S. S. S. S.
22	S. S. S. S.	23	S. S. S. S.
23	S. S. S. S.	24	S. S. S. S.
24	S. S. S. S.	25	S. S. S. S.
25	S. S. S. S.	26	S. S. S. S.
26	S. S. S. S.	27	S. S. S. S.
27	S. S. S. S.	28	S. S. S. S.
28	S. S. S. S.	29	S. S. S. S.
29	S. S. S. S.	30	S. S. S. S.

Appendix 7.11 Monitoring Form (Draft)

1. Pre-Construction Phase (Tree cutting)

The latest results of the below monitoring items shall be submitted to the lenders as part of Progress Report throughout the pre-construction phase.

1.1 Air Pollution

- Exhaust Gases

Date		Type of Construction Vehicles/Equipment	Fleet/Registration Number	Exhaust Gases Discharge Conditions				Frequency
(Day, Month, Year)				Items	Yes	No	If Yes, Measures Taken	Daily
				Black Smoke				
				White Smoke				
				Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

If any problem arises, such vehicles and equipment to be sustained to use or be replaced by appropriate ones.

- Soil Dust (Dry Season only)

Date		Location	Dust and dried sandy soil stirred up by construction activities				Frequency
(Day, Month, Year)		Construction Site including access roads	Items	Yes	No	If Yes, Measures Taken (such as water supplying)	Daily
			Dusts				
			Dried Sandy Soil				
			Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

1.2 Land Acquisition/Resettlement (Progress of the tree cutting)

Items	Implementation (as of :)			Frequency
Cutting Schedule	1. As scheduled ()	2. Delayed (months)	3. Postponed ()	Once/week
Total Value of Trees	1. Decided (Rs)	2. Under evaluation ()	3. No action ()	
Budget Allocation	1. Allocated by ()	2. Under discussion ()	3. No action ()	
Compensation to Land owner	1. Compensated ()	2. Under preparation ()	3. No action ()	
Auction for tree cutting	1. Conducted (when)	2. Under preparation ()	3. No action ()	
Waste Management	1. Properly Managed ()	2. Under preparation ()	3. No action ()	

Progress of the preparation and implementation shall be submitted to CMWSSB monthly

2. Construction Phase Monitoring Form

The latest results of the below monitoring items shall be submitted to the lenders as part of the Quarterly Progress Report throughout the construction phase.

2.1 Air Pollution

- Exhaust Gases

Date (Day, Month, Year)	Type of Construction Vehicles/Equipment	Fleet/Registration Number	Exhaust Gases Discharge Conditions				Frequency
			Items	Yes	No	If Yes, Measures Taken	
			Black Smoke				Daily
			White Smoke				
			Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.
 If any problem arises, such vehicles and equipment to be sustained to use or be replaced by appropriate ones.

- Soil Dust (Dry Season only)

Date (Day, Month, Year)	Location	Dust and dried sandy soil stirred up by construction activities				Frequency
		Items	Yes	No	If Yes, Measures Taken (such as water supplying)	
	Construction Site including access roads	Dusts				Daily
		Dried Sandy Soil				
		Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

2.2 Water Quality

- On-site toilets

Date (Day, Month, Year)	On-site Toilet Number/location	Sewerage water Conditions				Frequency
		Items	Yes	No	If Yes, Measures Taken	
		Black (sewage)water leakage				Daily
		Bad odor				
		Emergency of Flies				
		Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

- Turbidity (Seawater Turbidity during installation of intake/outfall pipelines)

Date (Day, Month, Year)	Location of installation of Intake/outfall (GPS position)	Turbid water Conditions				Frequency
		Items	Yes	No	If Yes, Measures Taken	
	Intake () Outfall () GPS Position	Silts				Daily
		Sea sands				
		Bottom sediments				
		Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

2.3 Soil Contamination

- Oil and Fuel leakage (spill)

Date (Day, Month, Year)	Type of Construction Vehicles/Equipment	Fleet/Registration Number	Oil/Fuel Leakage Conditions				Frequency
			Items	Yes	No	If Yes, Measures Taken	
			Engine oil				Daily
			Hydric power unit oil				
			Fuel				
			Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.
 If any problem arises, such vehicles and equipment to be sustained to use or be replaced by appropriate ones.

2.4 Wastes

- Construction wastes and debris

Waste Composition	Waste Quantity (ton/month)	Transportation, Disposal/Treatment Methods (Specify: ex. Registered Service Provider, Officially final disposal site, registered treatment facility (or company))	Frequency

	Transport	Disposal	Treatment	Remarks
Construction Debris				Once/Month
Surplus Soil				
Toxic and chemical Waste				
Other (specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

2.5 Noise and Vibration

- Noise from Construction Vehicles and Equipment

Visual Inspection Date	Type of Construction Vehicles/Equipment	Fleet/Registration Number	Condition of Silencer equipped with construction vehicles/Equipment				Frequency
			Items	Yes	No	If Yes, Measures Taken (such as water sprinkling)	
(Day, Month, Year)			Properly Equipped			Daily	
			Damaged				
			Large noise discharge				
			Others (Specify)				

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

If any problem arises, such vehicles and equipment to be sustained to use or be replaced by appropriate ones.

2.6 Ecosystem

- Turbidity

(same format specified in 1.2 Water Quality)

- Environmental Education on Marine ecosystems and Sea Turtles

Date	Venue	Agenda	Lecturer	Number of Participants	Materials paraded	Frequency
(Day, Month, Year)				Community ()		Twice/year
				Worker/Labor ()		
				Others (Specify)		
				Total ()		

Participant list and educational materials shall be attached

- Sea Turtles Sightings

Item	Sighting Report					Frequency
Sea turtles	Time/Date	Place (In or around Perur DSP construction site)	Sighted by whom (ex, Villager, Worker/labor, rumor and others)	Description of the Sighting	Actions taken to the sightings	In the event of Sighting*
					See the Actions on Sea Turtle Sightings (specified below)	

*During egg laying season of sea turtles, hearing survey on the sighting shall be done in the surrounding communities twice of the season

- Actions on Sea Turtle Sightings

Item	Sighting Report			Frequency
Actions on Sea turtle sighting	Construction Suspension Periods	Records of the announcements	relevant entities contacted)	In the event of Sighting

2.7 Living and Livelihood

- Seawater Turbidity during installation of intake/outfall pipelines

(same format specified in 1.2 Water Quality)

- Pipelines installation schedules and Installation (Construction) Management

Date	Location	Management				Compensati on budget and status (Specify)	Frequency
		Type Space used (1. Paddy Field, 2. Farmland, 3. Others ())	Area (m ²)	Duration of use	Condition of the Space		
(Day, Month, Year)						Daily during the installation	

2.8 Social Infrastructure and Services

- Road Traffic

Date	Location	Construction Vehicle Management				Frequency
		Traffic Control (Specify the details)				Daily
		Time Restriction	Avoidance of Rush	Avoidance of Rush	Others (Specify)	

			Hour	Hour		
(Day, Month, Year)						

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

- Commercial Activities (for the transmission pipelines installations)

Date	Location	Management				Frequency
		Traffic Control (Specify the details)				
		Diversion Route	Time Restriction	No Control	Others (Specify)	
(Day, Month, Year)						Daily during the installation

- Meetings with surrounding Communities (for the transmission pipelines installations)

Date	Location /Community	Meeting Venue	Number of Participants	Agenda	Opinions Requests	Countermeasures	Frequency
(Day, Month, Year)			Community ()				Where necessary
			Officials ()				
			Others (Specify)				
			Total ()				

Participant list and meeting minutes shall be attached

2.9 Risks of Infectious diseases such as HIV/AIDS

- Health and Sanitation Education

Date	Venue	Agenda	Lecturer	Number of Participants	Materials paraded	Frequency
(Day, Month, Year)				Community ()		Once/year
				Worker/Labor ()		
				Others (Specify)		
				Total ()		

Participant list and educational materials shall be attached

2.10 Working Conditions/Work safety for the construction

- Personnel Protective Equipment (PPE)

Date	Monitoring Item	If any problems, measures taken	Frequency
(Day, Month, Year)	PPE: such as Helmet, Gloves, Masks, shoes) -		Daily

Log Book: to be prepared and recorded by contractor(s) which is submitted to CMWSSB monthly.

2.11 Accidents

- Meetings with surrounding Communities (for the transmission pipelines installations) for Traffic Safety
 (same format specified in 2.9 Health and Sanitation Education)

3. Operation Phase Monitoring Form

The latest results of the below monitoring items shall be submitted to the lenders on biannual basis for the first two years of operation.

3.1 Water Quality

- Raw Seawater and Potable Water (as specified in Table 6.3.5 of the JICA study report)

No.	Seawater	Raw seawater	Potable water	Frequency
1	Silt Density Index	✓		Daily
2	pH	✓	✓	Daily
3	Total Dissolved Solids	✓	✓	Daily
4	Temperature	✓	✓	Daily
5	Electrical conductivity	✓	✓	Daily
6	Turbidity	✓	✓	Daily
7	Residual chlorine	✓	✓	Daily
8	Boron content	✓	✓	Daily
9	Langelier index	-	✓	Daily
10	Oxidation-reduction potential	-	-	Daily
11	Alkalinity	-	✓	Daily

Operational Monitoring Report on the Raw Seawater and Potable Water monitored at DSP can be attached

- Brain Concentration

Date	Sampling Location	Brain Concentration (ppt)	Remarks	Frequency
				Daily

- Domestic Water (Sewerage Treatment Plant in DSP)

Monitoring Item	Method	If any negative results, measures Taken (Ex: Stop STP operation, Stop DSP operation, respire work, pesticide inputs and others)	Frequency
Bad Odor	Visual Inspection (Common sensation)		Once/month
Water Leakage	Visual Inspection		
generation of flies	Visual Inspection		
Other necessary actions to be monitored as per the instruction and manuals on the operation and maintenance of aerated waste water treatment facilities (STP) is to be installed.			Once/month (or instructions of the contractor of STP)

3.2 Ecosystem

- Environmental Education on Marin ecosystems and Sea Turtles

Date	Venue	Agenda	Lecturer	Number of Participants	Materials paraded	Frequency
(Day, Month, Year)				Community ()		Once/year
				Worker/Labor ()		
				Others (Specify)		
				Total ()		

Participant list and educational materials shall be attached

- Sea Turtle

Sea turtle	Sighting Report					Frequency
	Time/Date	Place (In or around Perur DSP)	Sighted by whom (ex, Villager, Worker/labor, rumor and others)	Description of the Sighting	Actions taken to the sightings (Ex: report to relevant authorities or NGOs, warning to workers/labours, suspend of the construction and Others),	In the event of Sighting

- Sea Turtles Sightings

Item	Sighting Report					Frequency
	Time/Date	Place (In or around Perur DSP site)	Sighted by whom (ex, Villager, Worker/labor, rumor and others)	Description of the Sighting	Actions taken to the sightings	In the event of Sighting*
Sea turtles					See the Actions on Sea Turtle Sightings (specified below)	

*During egg laying season of sea turtles, hearing survey on the sighting shall be done in the surrounding communities twice of the season

- Actions on Sea Turtle Sightings

Item	Sighting Report			Frequency
	Construction Suspension Periods	Records of the announcements	relevant entities contacted)	In the event of Sighting
Actions on Sea turtle sighting				

4. EIA Monitoring format for EIA and CZMAs Recommendations (Draft as reference)

4.1 Construction Phase

Environmental Items	Monitoring Items	Parameters	Frequency	Recommended by	Monitoring Results
Water Quality	Changes in the selected physiochemical parameters	Salinity, temperature, DO, current etc.	Periodically	Kancheepuram District CZMA*	
General Environment	Site conditions	Any adverse impacts on the coast	Every Year	Tamil Nadu State CZMA*	

*: MOEF may request any environmental monitoring activities as supplementary conditions in the issuance of CZR clearance for the Perur DSP by referring the EIA report and those recommendations from the CZMAs.

4.2 Operation Phase

Environmental Items	Monitoring Items	Parameters	Frequency	Recommended by	Monitoring Results
Water Quality	Seawater & Sediment Quality	Nutrients and heavy metals	Each season: April (Fair Weather), July (SW monsoon) and November (NE monsoon)	EIA Report	
Ecosystem	Marine Benthic Fauna	Benthic fauna composition	Each season as indicated above	EIA Report	
Ecosystem	Intake entrapment of marine fauna	Screens on pump stations and effectiveness of management measure	Each season as indicated above	EIA Report	
Ecosystem	Entrainment of marine fauna	Abundance of fauna within the pond/storage sump/well	Each season as indicated above	EIA Report	
Ecosystem	Seawater outfall	Abundance and distribution of both phytoplankton and zooplankton	Each season as indicated above	EIA Report	
Ecosystem		Abundance and distribution of benthic animal communities	Each season as indicated above	EIA Report	
Water Quality/ Ecosystem	Post-project marine quality	Marine quality including water quality and biological characteristics.	Continuous	Kancheepuram District CZMA*	
Ecosystem	Marine biodiversity	Not specified	Twice in a year	Kancheepuram District CZMA*	
Water Quality	Reject water	Concentration of toxic trace metals	Periodical	Kancheepuram District CZMA*	
Water Quality	Changes in the selected physiochemical parameters	Salinity, temperature, DO, current etc.	Periodical during the construction and operation phases	Kancheepuram District CZMA*	
Water Quality	The high salinity reject water (may be monitored through appropriate standard procedures)	Physiochemical and toxic trace metal contents	Periodical (May be)	Kancheepuram District CZMA*	
Water Quality	Marine water	Parameter is not specified/ to be monitored at the outfall area	Every Quarter	Tamil Nadu State CZMA*	
General Environment	Site conditions	Any adverse impacts on the coast	Every Year	Tamil Nadu State CZMA*	
Ecosystem	Impact on the corals*, marine organisms, Turtle nesting etc.	Corals**, marine organisms, Turtle nesting etc.	Not specified (to be monitored by experts)	Tamil Nadu State CZMA*	

*: MOEF may request any environmental monitoring activities as supplementary conditions in the issuance of CZR clearance for the Perur DSP by referring the EIA report and those recommendations from the CZMAs.

** : Corals have not been observed around Perur seashore and offshore (See Appendix 7.1 of JICA Report)

Appendix 7.12 Proposed and Recommended Environmental Monitoring Plans

Items	Monitoring Items	Parameters	Locations	Period and Frequency	Responsible Organization	Cost	Remarks	Proposed or Recommended by
Pre- Construction Phase (For Tree Cutting in the Perur DSP project site)								
Air Pollution	Exhaust Gases	Discharge conditions of exhaust gases (Black/white gases) of dump trucks, other trucks and heavy equipment	Motor Pools of Construction Site	Daily	Contractors	Included in Tree Cutting Cost	Visual Inspection	JICA Study
Air Pollution	Soil Dusts	Soil dusts diffusions by construction works	Construction Site	Daily (Dry Season only)	Contractors	Included in Tree Cutting Cost	Visual Inspection	JICA Study
Land Acquisition/ Resettlement	Plan for the tree cutting in the site	Cutting Schedules, Total value of the trees, Budget allocations, compensation to the landowner, auction of tree cutting for pulps, waste management.	Construction site and others	Once/week	Contractors/ CMWSSB	Included in Tree Cutting Cost	Preparation of Tree Cutting Action Plan	JICA Study
Construction Phase								
Water Quality	Changes in the selected physiochemical parameters	Salinity, temperature, DO, current etc.	Vicinity of the effluent discharge	Periodically	(CMWSSB)*	(Prepared by CMWSSB) *	A moored data buoy shall be maintained	Kancheepuram District CZMA*
General Environment	Site conditions	Any adverse impacts on the coast	Construction Site and the Coast	Every Year	(CMWSSB)*	(Prepared by CMWSSB) *	A system shall be evolved for a close and continuous monitoring during the construction phase through reputed institutions such as NCSCM, Anna University, Chennai/NIOT, Chennai /IIT. To take mitigation measures on the event of any adverse impacts on the coast.	Tamil Nadu State CZMA*
Air Pollution	Exhaust Gases	Discharge conditions of exhaust gases (Black/white gases) of dump trucks, other trucks and heavy equipment	Construction Site	Daily	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Air Pollution	Soil Dusts	Soil dusts diffusions by construction works	Construction Site	Daily (Dry Season only)	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Water Quality	On-site toilets	Back (sewage) water leakage (overflow), bad odour, emergence of vector flies and de-sludge activities)	Construction Site	Once/month	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Water Quality	Turbidity	Turbid seawater	Seawater around Intake/Outfall Pipelines installation	Daily	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Soil Contamination	Oil and Fuel leakage	Oil and Fuel leakage conditions (from Engine, hydraulic power units and fuel tanks) of dump trucks, other trucks and heavy equipment	Construction Site	Daily	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Wastes	Construction Wastes	Waste composition, quantity, transportation and treatment methods	Construction Site	Once/month	Contractors	Included in the project Coast	-	JICA Study
Noise and Vibration	Vehicle and Equipment Noise	Silencer conditions of dump trucks, other trucks and heavy equipment	Construction Site	Daily	Contractors	Included in the project Coast	Visual inspection (common sensation)	JICA Study
Ecosystem	Turbidity	Turbid seawater (during installation of intake/outfall pipelines)	Seawater around Intake/Outfall Pipelines installation	Daily	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Ecosystem	Marine ecosystem and sea turtles.	Implementation environmental education on marine ecosystem and sea turtles.	Construction site and surrounding communities	Twice/ year	Contractors /CMWSSB	Included in the project Coast	-	JICA Study

Items	Monitoring Items	Parameters	Locations	Period and Frequency	Responsible Organization	Cost	Remarks	Proposed or Recommended by
Ecosystem	Sea turtles	Information on Sea turtle sightings in and around the seashore in Perur	Construction site	In the event of Sightings	Contractors /CMWSSB	Included in the project Coast	-	JICA Study
Ecosystem	Actions on sea turtle sighting	Construction suspensions periods, records of the announcements and relevant entities contacted	Construction site and surrounding communities	In the event of Sightings	CMWSSB	Included in the project Coast	-	JICA Study
Living and Livelihood	Turbidity	Turbid seawater (during installation of intake/outfall pipelines)	Seawater around Intake/Outfall Pipelines installation	Daily for the installation period	Contractors	Included in the project Coast	Visual Inspection	JICA Study
Living and Livelihood	Construction Management	Pipelines installation schedules and Installation (Construction) Management	Seawater around Intake/Outfall Pipelines installation	Daily for the installation period	Contractors	Included in the project Coast	-	JICA Study
Social Infrastructure and Services	Road Traffic	Implementation of construction vehicle management plans (time restrictions to avoid rush hours and days of surrounding roads	Construction site	Daily	Contractors	Included in the project Coast	-	JICA Study
Social Infrastructure and Services	Commercial Activities	Implementation of commercial area road traffic controls (diversion routes, time restriction) for the instauration of transmission pipelines	Construction site	Daily	Contractors	Included in the project Coast	-	JICA Study
Social Infrastructure and Services	Meetings	Implementation of meetings with communities	Construction site and surrounding communities	Where necessary	CMWSSB/ Contractors	Included in the project Coast	-	JICA Study
Risk of infectious diseases such as HIV/AIDS	Health and Sanitation	Implementation of Health and Sanitation education on STD.	Construction site and surrounding communities	Once/ year	CMWSSB/ Contractors	Included in the project Coast	-	JICA Study
Working Conditions/ Work Safety	Personal Protective Equipment (PPE)	Utilization of PPE by workers/labors	Construction site	Daily	Contractors	Included in the project Coast	-	JICA Study
Accidents	Traffic Safety	Implementation of Traffic safety education	Construction site and surrounding communities	Once/ year	CMWSSB/ Contractors	Included in the project Coast	-	JICA Study
Operation Phase								
Water Quality	Seawater & Sediment Quality	Nutrients and heavy metals	Near Seawater	Each season: April (Fair Weather), July (SW monsoon) and November (NE monsoon)	(CMWSSB)*	(Prepared by CMWSSB) *	Sediment samples collected from sides at risk of pollution	EIA Report
Ecosystem	Marine Benthic Fauna	Benthic fauna composition	Water outfall region	Each season as indicated above	(CMWSSB)*	(Prepared by CMWSSB) *	-	EIA Report
Ecosystem	Intake entrapment of marine fauna	Screens on pump stations and effectiveness of management measure	DSP	Each season as indicated above	(CMWSSB)*	(Prepared by CMWSSB) *	-	EIA Report
Ecosystem	Entrainment of marine fauna	Abundance of fauna within the pond/storage sump/well	DSP	Each season as indicated above	(CMWSSB)*	(Prepared by CMWSSB) *	-	EIA Report
Ecosystem	Seawater outfall	Abundance and distribution of both phytoplankton and zooplankton	Near the outfall	Each season as indicated above	(CMWSSB)*	(Prepared by CMWSSB) *	-	EIA Report
Ecosystem		Abundance and distribution of benthic animal communities	near the outfall	Each season as indicated above	(CMWSSB)*	(Prepared by CMWSSB) *	-	EIA Report

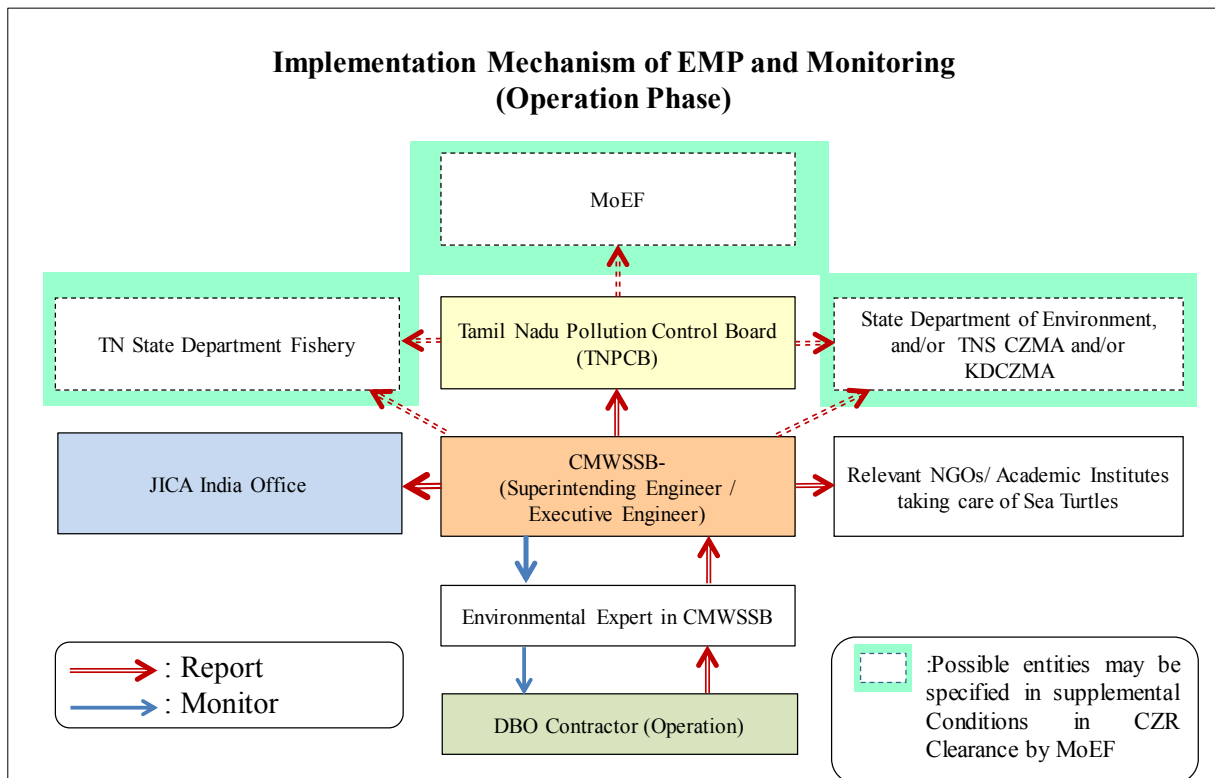
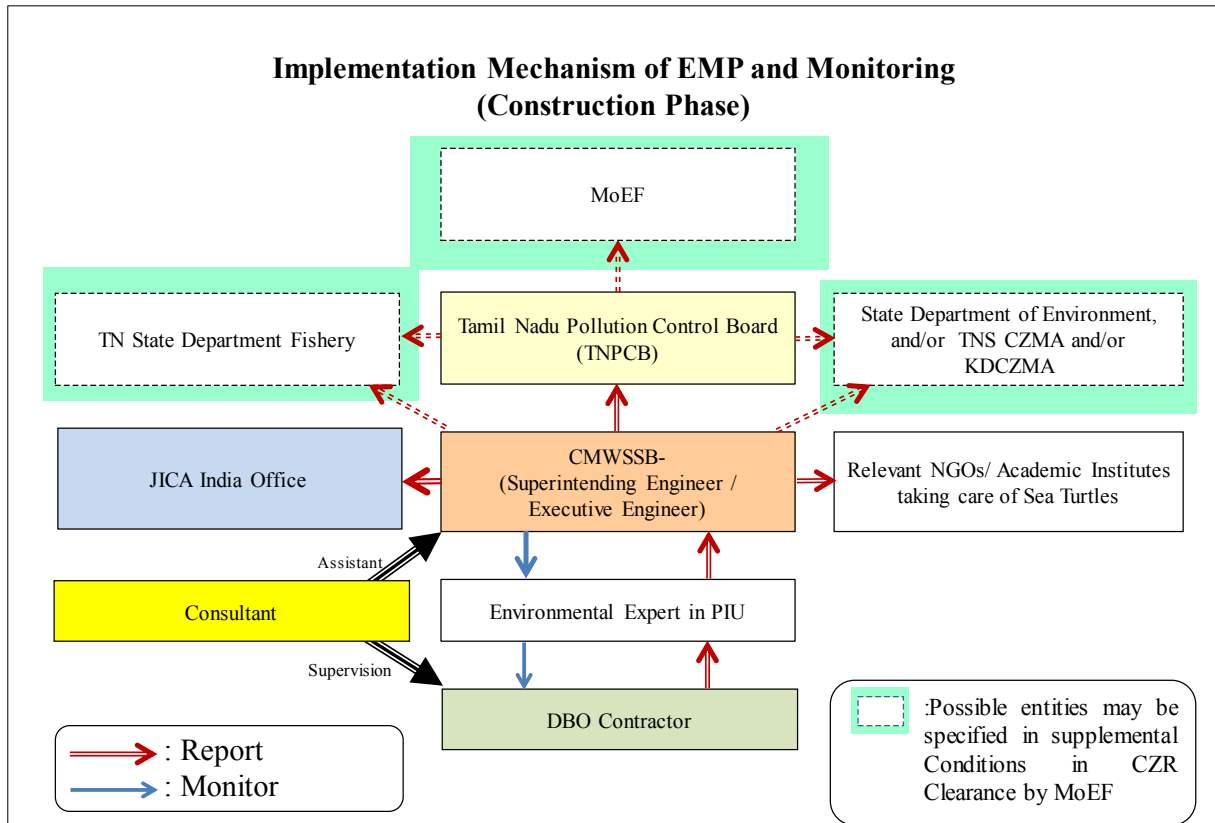
Items	Monitoring Items	Parameters	Locations	Period and Frequency	Responsible Organization	Cost	Remarks	Proposed or Recommended by
Water Quality/ Ecosystem	Post-project marine quality	Marine quality including water quality and biological characteristics.	Not specified	Continuous	(CMWSSB)*	(Prepared by CMWSSB) *	-	Kancheepuram District CZMA*
Ecosystem	Marine biodiversity	Not specified	Not specified	Twice in a year	(CMWSSB)*	(Prepared by CMWSSB) *	-	Kancheepuram District CZMA*
Water Quality	Reject water	Concentration of toxic trace metals	Not specified	Periodical	(CMWSSB)*	(Prepared by CMWSSB) *	-	Kancheepuram District CZMA*
Water Quality	Changes in the selected physiochemical parameters	Salinity, temperature, DO, current etc.	Vicinity of the effluent discharge	Periodical during the construction and operation phases	(CMWSSB)*	(Prepared by CMWSSB) *	A moored data buoy shall be maintained	Kancheepuram District CZMA*
Water Quality	The high salinity reject water (may be monitored through appropriate standard procedures)	Physiochemical and toxic trace metal contents	Not specified	Periodical (May be)	(CMWSSB)*	(Prepared by CMWSSB) *	-	Kancheepuram District CZMA*
Water Quality	Marine water	Parameter is not specified/ to be monitored at the outfall area		Every Quarter	(CMWSSB)*	(Prepared by CMWSSB) *	-	Tamil Nadu State CZMA*
General Environment	Site conditions	Any adverse impacts on the coast	Construction Site and the Coast	Every Year	(CMWSSB)*	(Prepared by CMWSSB) *	A system shall be evolved for a close and continuous monitoring during the operation phase through reputed institutions such as NCSCM, Anna University, Chennai/NIOT, Chennai /IIT. To take mitigation measures on the event of any adverse impacts on the coast.	Tamil Nadu State CZMA*
Ecosystem	Impact on the corals*, marine organisms, Turtle nesting etc.	Corals**, marine organisms, Turtle nesting etc.		Not specified (to be monitored by experts)	(CMWSSB)*	(Prepared by CMWSSB) *	-	Tamil Nadu State CZMA*
Water Quality	Water Quality	Raw seawater and Potable water as specified in Table 6.3.5 of the JICA Study Report	DSP	Daily	DSP Operator	Included in Operation Cost	-	JICA Study
Water Quality	Water Quality	Brine Concentration	The nearest Beach	Daily	DSP Operator	Included in Operation Cost	-	JICA Study
Water Quality	Domestic water	Back (sewage) water leakage (overflow), bad odour, emergence of vector flies of Sewerage Treatment Plant (STP)	DSP	Once/month	DSP Operator	Included in Operation Cost	Visual inspection	JICA Study
		STP effluent water quality in accordance with instructions as suggested by the STP construction contractor.	DSP	Once/month	DSP Operator	Included in Operation Cost	Operational Inspection	JICA Study
Ecosystem	Marine ecosystem and sea turtles	Implementation environmental education on marine ecosystem and sea turtles.	DSP surrounding communities	Once/ year	DSP Operator /CMWSSB	Included in Operation Cost	-	JICA Study
Ecosystem	Sea turtles	Information on Sea turtle sightings in and around the seashore in Perur	DSP and surrounding communities	In the event of Sightings	DSP Operator /CMWSSB	Included in Operation Cost	-	JICA Study
Ecosystem	Sea turtles	Actions (Records of the announcements and relevant entities contacted) taken	DSP and surrounding communities	In the event of Sightings	CMWSSB	Included in Operation Cost	-	JICA Study

*: MOEF may request any environmental monitoring activities as supplementary conditions in the issuance of CZR clearance for the Perur DSP by referring the EIA report and those recommendations from the CZMAs.

**:. Corals have not been observed around Perur seashore and offshore (See Appendix 7.1 of JICA Report)

Appendix 7.13 Implementation Mechanism of EMP and Monitoring (Draft)

ATTACHMENT 2-2 (1)



Appendix 7.14 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)															
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) Y	(a) <u><Sea Water Desalination Plant (DSP)></u> An EIA report for the Sea Water Desalination Plant (DSP) was prepared by CMWSSB on Jul. 2014 which was submitted to the Kancheepuram District Coastal Zone Management Authority (KDCZMA) (on Mar. 2015) and the Tamil Nadu State Coastal Zone Management Authority (TNSCZMA) (on Sept. 2015) because that the project is proposed to be constructed in the Coastal Regulation Zone (CRZ) of the Ministry of Environment, Forest and Climate Change (MoEF). Namely the Project located in CRZ III is required to obtain a CRZ Clearance of CZM system from MoEF based on CRZ Notification 2011. <u><Transmission Pipelines></u> The transmission pipelines are included in the Check list of application for CRZ clearance prepared and submitted by CMWSSB. Based on the provisions stipulated in the notifications, environmental clearances required for the Project composed of DSP and Transmission Pipelines (TPs) are summarized in the following table. Thus, only CRZ clearance is required for the Project. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Clearance</th> <th>DSP located in CRZ</th> <th>DSP located out of CRZ</th> <th>TPs installed in CRZ</th> <th>TPs installed out of CRZ</th> </tr> </thead> <tbody> <tr> <td>EC</td> <td>Not Required*</td> <td>Not Required*</td> <td>Not Required*</td> <td>Not Required*</td> </tr> <tr> <td>CRZ</td> <td>Required</td> <td>Required**</td> <td>Required</td> <td>Not Required</td> </tr> </tbody> </table> *: Water supply projects are not listed in the Schedule (project list requiring prior EC) in the Revised EIA Notification **: Intake/outfall pipelines are to be constructed in CRZ as necessary facilities of DSP Note: As for the distribution pipelines, environmental and social considerations for distribution pipelines are to be the same as the transmission pipelines.	Clearance	DSP located in CRZ	DSP located out of CRZ	TPs installed in CRZ	TPs installed out of CRZ	EC	Not Required*	Not Required*	Not Required*	Not Required*	CRZ	Required	Required**	Required	Not Required
				Clearance	DSP located in CRZ	DSP located out of CRZ	TPs installed in CRZ	TPs installed out of CRZ											
EC	Not Required*	Not Required*	Not Required*	Not Required*															
CRZ	Required	Required**	Required	Not Required															
(b) <u><Sea Water Desalination Plant (DSP)></u> Not yet. Both KDCZMA and TNSCZMA accepted the EIA report, but a CRZ Clearance from MoEF will be obtained by March, 2017. The following actions have been taken by CMWSSB as of Nov, 2016. <ul style="list-style-type: none"> - CMWSSB applied to MoEF for the CRZ Clearance on 18th Oct. 2016 through the MoEF portal site with soft copies of necessary documents for the application including the EIA report (Proposal No. IA/TN/MIS/59770/2016). - The application was accepted by MoEF on 7th Nov. 2016 (the Acceptance Letter of F. No. 11-37 2016). - According to CMWSSB, the Superintending Engineer visited MoEF at Delhi on 11th Nov. 2016 to submit hardcopies of the EIA report and other necessary documents, as requested in the Acceptance Letter, for the CRZ clearance for the Project. - After the submission, a presentation on the project at MoEF is required to be made by CMWSSB for the issuance. (As of Nov 2016, CMWSSB is waiting for an official communication on the presentation from MoEF.) <u><Transmission Pipelines></u> Not applicable																			

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)																																					
				<p>(c) <u><Sea Water Desalination Plant (DSP)></u> KDCZMA made a total of 14 recommendations (supplemental conditions) to the TNSCZMA on Apr. 2015. And then TNSCZMA made a total of 13 recommendations to MoEF on Jan. 2016 for the CRZ Clearance. There is possibility that MoEF requests any supplementary conditions in the issuance of the CZR clearance for the Perur DSP by referring the EIA report and those recommendations from the CZMAs. <u><Transmission Pipelines></u> Not applicable</p>																																					
				<p>(d) <u><Sea Water Desalination Plant (DSP)></u> After getting the CRZ Clearance from MoEF, a No Objection Certificate (NOC) is to be obtained from Tamil Nadu State Pollution Control Board (TNPCB). <u><Transmission Pipelines></u> Not applicable</p>																																					
	(2) Explanation to the Local Stakeholders	<p>(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?</p>	<p>(a) Y (b)-Y</p>	<p>(a) <u><Sea Water Desalination Plant (DSP)></u> According to CRZ notification (2011), public hearing/consultation is not required in the process. However, the 1st Stakeholders Meeting was held on 8th July 2016 by CMWSSB as follows.</p> <table border="1"> <tr> <td colspan="2">Date: 8th July, 2016</td> <td colspan="2">Time: 11:45-12:30</td> <td colspan="2">Venue: Community hall, Perur</td> </tr> <tr> <td>Participants</td> <td>CMWSSB</td> <td>Land Owner</td> <td>Local Official</td> <td>JICA Study Team</td> <td>Local People</td> <td>Total</td> </tr> <tr> <td>Number</td> <td>4</td> <td>1</td> <td>3</td> <td>1</td> <td>29</td> <td>38</td> </tr> </table> <table border="1"> <tr> <td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Main Discussion Points</td> <td colspan="2">Opinions from the Village people</td> <td colspan="2">Countermeasures by CMWSSB</td> </tr> <tr> <td colspan="2">Shore erosion caused damage to their houses during execution of the 100 MLD desalination plant in Nemmeli. Hence they requested to provide dykes for a length of 300m approx. for protection before commencement of construction work for the new project.</td> <td colspan="2">Superintending Engineer (SE) accepted their demand and will be consulting with the implementation team of the project to provide necessary protection.</td> </tr> <tr> <td colspan="2">Boats and fishing nets are likely to get damaged during dredging for laying of intake pipeline.</td> <td colspan="2">It will be taken into consideration during execution of the project.</td> </tr> <tr> <td colspan="2">Public insisted to allocate full stretch of land along East/West encompassing the burial ground which would also allow other commuters to enter burial ground from western end. And also requested to restore the damaged concrete platform of the temple due to soil erosion by waves during the construction of the 100MLD desalination plant in Nemmeli.</td> <td colspan="2">SE informed that land belongs to Alavandar Trust and has been allotted for this project on "Long term lease basis" by the Government. Hence, this is to be decided in consultation with the Alavandar Trust, GoTN and local Revenue department officials.</td> </tr> </table>	Date: 8 th July, 2016		Time: 11:45-12:30		Venue: Community hall, Perur		Participants	CMWSSB	Land Owner	Local Official	JICA Study Team	Local People	Total	Number	4	1	3	1	29	38	Main Discussion Points	Opinions from the Village people		Countermeasures by CMWSSB		Shore erosion caused damage to their houses during execution of the 100 MLD desalination plant in Nemmeli. Hence they requested to provide dykes for a length of 300m approx. for protection before commencement of construction work for the new project.		Superintending Engineer (SE) accepted their demand and will be consulting with the implementation team of the project to provide necessary protection.		Boats and fishing nets are likely to get damaged during dredging for laying of intake pipeline.		It will be taken into consideration during execution of the project.		Public insisted to allocate full stretch of land along East/West encompassing the burial ground which would also allow other commuters to enter burial ground from western end. And also requested to restore the damaged concrete platform of the temple due to soil erosion by waves during the construction of the 100MLD desalination plant in Nemmeli.		SE informed that land belongs to Alavandar Trust and has been allotted for this project on "Long term lease basis" by the Government. Hence, this is to be decided in consultation with the Alavandar Trust, GoTN and local Revenue department officials.	
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	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	<p>(a) <u><Sea Water Desalination Plant (DSP)></u> Initially, another site in Pattipulam Village (several km South from Perur site) was selected for the DSP project.</p> <p>However, due to encroachment in the site insisted the ownerships of such areas, there is an appeal pending in the High Court Madras regarding the ownership of the identified land and hence the land will be spared to CMWSSB “as is here is” condition.</p> <p>Including this site in Pattipulam, total 4 sites were selected as alternative site. However, by evaluations of social considerations of each site, the site at Perur village has been selected.</p> <p><u><Transmission Pipelines></u> The pipelines are planned to be constructed under the existing roads.</p>
2 Pollution Control	(1) Air Quality	<p>(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken?</p> <p>(b) Do chlorine concentrations within the working environments comply with the country’s occupational health and safety standards?</p>	<p>(a) N (b) Y</p>	<p>(a) <u><Sea Water Desalination Plant (DSP)></u> Chlorine is planned to be used as required for disinfection of the product water and for shock chlorination as follows.</p> <ul style="list-style-type: none"> - Chlorine will be supplied as liquefied gas in 900 kg drums. - The unloading of chlorine drums from transport trucks will occur within the chlorine building, thereby reducing the risk of a chlorine leak occurring outside the building. - The system will be configured as a vacuum gas draw system with vacuum valves connected directly to the chlorine drums. - Those operation and maintenance on the Chlorine and Chlorination is subject to IS 4263 (Code of Safety for Choline) and IS 10553 (Chlorination equipment requirements) as safety measures. <p>With above mentioned steps, there will be no possibility of air pollution caused by usage of chlorine.</p> <p><u><Transmission Pipelines></u> Booster pump stations are not planned to be constructed, chlorine is not utilized.</p> <p>(b) <u><Sea Water Desalination Plant (DSP)></u> The chlorine utilize plan and the facilities have been designed in accordance with relevant regulations and standards in India as follows.</p> <ul style="list-style-type: none"> - IS 4263 (the latest edition Code of Safety for Chlorine) - IS 10553 (Part 1) 1983 (Requirements of Chlorination equipment for its safe operations). <p><u><Transmission Pipelines></u> Not applicable</p>

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	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) Y	(a) <u><Sea Water Desalination Plant (DSP)></u> Waste water management in operation phase is proposed in DPR as follows <ul style="list-style-type: none"> - Pre-Treatment Waste Water: Waste Water will be generated in the pre-treatment system (Lamella settlers – settled sludge, DAF float, Filter backwash from gravity dual media filters) all the discharges will be directed to the ocean via the outfall. - Membrane CIP Wastewater: After neutralisation, wastewater will be directed to the ocean via the outfall, for the same a neutralization tank has been provided in the design. - Domestic Sewage: Domestic sewage waste will be treated independently from all other liquid wastes. A dedicated sewage treatment package plant will be used to treat this waste to a standard suitable for re-use for irrigation or similar. For the same an STP (Stabilization Pond) is proposed within the plant premises. <u><Transmission Pipelines></u> Not applicable
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) <u><Sea Water Desalination Plant (DSP)></u> The following waste management has been proposed in DPR <ul style="list-style-type: none"> - Screenings: Screenings will be flushed from the screens into wire baskets and the wash water from the screens will be returned upstream of the screens, and the screenings will be disposed of to a municipal landfill. - Limewater Clarifier Waste: The waste from the limewater clarifier will be dewatered and trucked from the site as a solid. - Spent Membranes: Spent membranes will be disposed of to a credited inert landfill which will need to be rinsed with fresh water (or permeate) prior to disposal. In addition, as for sludge, approximately 60-70 ton/day depend on suspended solid concentration in sea water inlet during the operation is predicted in the check list for CRZ clearance application. As well, with regard to domestic waste, the following are explained in the check list for CRZ clearance application, <ul style="list-style-type: none"> - During operation/ construction phases, domestic waste of about 0.3 ton per month is envisaged to be generated from about 150 temporary sheds. - According to Nemmeli DSP, solid waste is suitably disposed by local solid waste service providers hired by DSP operator. In addition, according to CMWSSB, trees planted in the Perur site will be cut before starting the construction of DSP and may be utilized as pulp trees. <u><Transmission Pipelines></u> Not applicable

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	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) <u><Sea Water Desalination Plant (DSP)></u> Noise levels of 85 -110 dB (A) are generated from pumping station, power generation and RO pumping facilities. However, those facilities are planned to be covered and installed in specific buildings of the plant. In addition, the DSP is planned to be constructed in a broad vacant land of about 87 acres. Therefore, it is predicted that the Noise levels in outside of the buildings can be reduced to the national noise standard of 75 dB (day)/ 70 dB (night) in Industrial area (Noise Pollution (Regulation and Control) Rules 2000) in the surrounding environment. <u><Transmission Pipelines></u> Not applicable
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) <u><Sea Water Desalination Plant (DSP)></u> Due to Sea water desalination plant (DSP), extraction of groundwater is not planned. <u><Transmission Pipelines></u> Not Applicable
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) <u><Sea Water Desalination Plant (DSP)></u> Such protected areas have not been identified in the surrounding area of the project site in Perur. <u><Transmission Pipelines></u> The pipelines are planned to be constructed under the existing roads.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic	(a) N (b) N (c) N (d) N	(a)(b)(c)(d) <u><Sea Water Desalination Plant (DSP)></u> In the proposed project site, such ecosystems are not identified. Intake and outfall pipelines are proposed to be designed to protect marine environment (flora and fauna) as follows - Deep Water Intake having velocity cap and screen is proposed (The intake velocity is limited to 0.15 m/s and the bar screen of 0.3 m width is installed) - Port riser type is proposed because its brine diffusion efficiency is the best among all types of Outfall Diffuser - Chlorine can be maintained less than 0.02 ppm as recommended in the EIA report (2014) as follows • Chlorine (Cl ₂) dosing rate to intake sea water is designed to be 1 ppm maximum. • Residual Cl ₂ concentration will be approximately 0.5ppm at the outlet of pretreatment system by consuming Cl ₂ in the intake and pretreatment processes. • Discharge Cl ₂ concentration will be 0.15 ppm = (210*0.5+470*0)/680. (Pretreatment discharge water = 210 MLD, RO Brine = 470MLD, Total = 680MLD) • To protect the RO membrane from chlorine attack, Sodium Bisulfite (SBS) is injected for removing Cl ₂ at the inlet of the RO membrane. Accordingly the brine has no chlorine as calculated in above equation. • Usually injected amount of SBS in the RO feed water shall be sufficient enough for safety reason. • So, the brine contains an excess SBS which can reduce the Cl ₂ concentration in the discharge. During normal operation, the Cl ₂ concentration of the discharge from DSP can be maintained less than 0.2 ppm. Sea turtles' nesting activities around Perur can be summarized as follow.

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		environments, such as aquatic organisms?		<ul style="list-style-type: none"> - Sea Turtles of Olive Ridley have been observed around seawater body in the Tamil Nadu State. - It can be considered that offshore sea around Perur is a migratory route of the Olive Ridley. - Most observations are typically within 15 km of mainland shores in protected, relatively shallow marine waters (22 - 55 m deep) and Olive Ridleys are occasionally found in open waters. (Source: Olive ridley sea turtle, Wikipedia)¹ - In the Perur DSP project, however, the intake pipe is planned to be installed in a distance of 1,140m at the sea depth of 10m and the outfall pipe is planned to be installed in a distance of 1,760m at the sea depth of 12m. - Based on above recognitions, therefore, the surrounding area of intake and outfall pipes are considered out of the sea turtle migratory route. - Nesting and egg laying activities of Olive Ridley have mostly been observed in northern part from the Madras Crocodile Bank Trust located at approximately 3km north of the Perur DSP site, and southern part from Mahabalipuram located at approximately 10km south of the Perur DSP site. - It can be considered that such nesting and egg-laying activities on seashore around Perur have been discouraged due to impacts caused by developments and human activities (habitats, Fishery, especially lighting in the night) in the area (Source: Head Curator of Madras Crocodile Bank Trust) <p><u><Transmission Pipelines></u> The pipelines are basically planned to be constructed under the existing roads including the following river and lake crossings.</p> <ul style="list-style-type: none"> - Buckingham Canal (not protected area: used for a Salt Lake for producing salts): the pipeline is planned to be installed along a bridge road over the canal. - Porur lake and other ponds (not protected area): the pipelines are planned to be installed under existing roads along the lake and ponds.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	<p>(a) <u><Sea Water Desalination Plant (DSP)></u> Due to Sea water desalination plant (DSP), extraction of groundwater and surface water are not planned.</p> <p><u><Transmission Pipelines></u> The pipelines are planned to be constructed under the existing roads by open cut method and jacking method, which include 159 Culverts, 2 river crossing points (See above column), lake/pond (Either side of the transmission pipeline route). However, no impact at all is predicted for the operation. Impacts during installation phase are limited with short periods.</p>
4 Social Environment 4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A	<p>(a) <u><Sea Water Desalination Plant (DSP)></u> The proposed project site for DSP including the land for substation is a basically vacant land of a religious and charitable Trust ownership which is planned to be leased for 30 years to CMWSSB.</p> <p>Therefore, no land acquisitions and involuntary resettlements are predicted by the DSP construction.</p> <p><u><Transmission Pipelines></u> Transmission pipelines are planned to be constructed under the existing roads by open cut method and jacking method. Therefore, no land acquisitions and involuntary resettlements are predicted by the pipeline installations</p>

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		given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(i) N/A (j) N/A	(b) (c)(d)(e)(f)(g)(h)(i)(j) <u><Sea Water Desalination Plant (DSP)></u> Not applicable <u><Transmission Pipelines></u> Not applicable
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	(a) N (b) N	(a) <u><Sea Water Desalination Plant (DSP)></u> Due to the fact that fishery is active in the surrounding village of Nemmeli, therefore designs of sea water intake facilities and outfall facilities including brine outfall quality are considered not to provide negative impacts on the marine ecosystem and fishery activities during operation phase as follows. <ul style="list-style-type: none"> - Laying of submarine pipelines - Deep Water Intake having velocity cap and screen is proposed (The intake velocity is limited to 0.15 m/s and the bar screen of 0.3 m width is installed) - Port riser type is proposed because its brine diffusion efficiency is the best among all types of Outfall Diffuser Possible recruitments of surrounding people are predicted during construction and operation phases as labours and

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				workers. <u><Transmission Pipelines></u> The pipelines are basically planned to be constructed under the existing roads
				(b) <u><Sea Water Desalination Plant (DSP)></u> Due to DSP, extraction of groundwater and surface water is not planned. <u><Transmission Pipelines></u> Extraction of groundwater and surface water is not planned for the pipelines under the existing roads.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) <u><Sea Water Desalination Plant (DSP)></u> Around the proposed project site there are two archaeological sites as follows - Tiger Cave: 7km south. - Group of Monuments at Mahabalipuram (UNESCO World Heritage, Inscription in 1984): Located in about 10km south from Perur. No impact is predicted to those sites by the proposed project. On the other hand, there are two burial grounds including individual grave stones, the paths (access roads), crematories and tube wells of which total areas are 1.85 acres. Those areas of burial grounds are planned to be excluded from the proposed project. Those burial grounds including other relevant facilities are occupied in the project land which belongs to the Religious and charitable Trust (the land owner) maintained by Hind Religion & Charitable Endowment (HR&CE) department of Tamil Nadu Government. <u><Transmission Pipelines></u> The pipelines are basically planned to be constructed under the existing roads
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N	(a) <u><Sea Water Desalination Plant (DSP)></u> The proposed site in Perur is a vacant and flat land of about 87 acres where facing a sandy sea coast on East side in which four (4) water reservoir tanks (each 9,000m ³ capacity with about 15m height) are planned to be constructed in the project site. Intake and outfall pipelines are planned to be buried by trench method. According to CRZ Clearance application by CMWSSB, the plant has been proposed 90 m into onshore and well grown Casuarina Trees along the shore have been retained as they will act as barrier for the plant. In addition, Tamil Nadu Coastal Zone Management Authority has recommended that "the proponent shall implement the Green Belt as envisaged in EIA report". Therefore, no negative impact on the landscape is predicted in the site. <u><Transmission Pipelines></u> The pipelines are basically planned to be constructed under the existing roads. Therefore, no negative impact on the landscape is predicted by the pipelines.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a)N/A (b)N/A	(a) <u><Sea Water Desalination Plant (DSP)></u> Specific ethnic minorities and indigenous peoples to be protected have not been existed around the proposed project site. <u><Transmission Pipelines></u> The pipelines are basically planned to be constructed under the existing roads.
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?		(b) <u><Sea Water Desalination Plant (DSP)></u> Not applicable <u><Transmission Pipelines></u> Not applicable
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) (b) (c) (d) <u><Sea Water Desalination Plant (DSP)></u> and <u><Transmission Pipelines></u> Work conditions and safety can be managed in compliance with the following act and rule of the Government of India. - The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 - The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules, 1998 In addition, the Bureau of Indian Standards published "Safety colours and safety signs - Code of Practice (First Revisions) on December 2005 In DPR, occupational health and safety, as well, Safety, Health Working conditions and Environmental are proposed to be implemented.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce	(a) Y (b) Y (c) Y (d) Y	In general, the construction of the proposed DSP and the installation of the pipelines will be carried out by the relevant laws, regulations and norms in India (a) <u><Sea Water Desalination Plant (DSP)></u> and <u><Transmission Pipelines></u> (a)-1 Air Quality - Exhaust Gas: Countermeasure 【Utilization of well-maintained construction vehicles and equipment, daily visual inspection of exhaust gases of those vehicles and equipment】 - Dust: Countermeasure 【Daily visual inspection of dust diffusions on-site and necessary water spraying (during dry season only)】 (a)-2 Water Quality - Human Waste: Countermeasure【Sanitation facilities are subject to "Act and Rule on Working Condition and Work

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?		<p>Safety in India”. Leaching pit and/or septic tank methods as temporary sanitation facilities shall be established a minimum safe distance recommended by WHO (at least 30 m from the nearest water source and 2 m from the groundwater table). Septic tank septage disposed to sewage systems is subject to the Standards for Discharge of Sewages of the Water (Prevention and control of pollution) act, 1974 India】</p> <ul style="list-style-type: none"> - <u>Turbid seawater</u> (caused by installation of Intake/outfall Pipelines): Countermeasures【Utilization of Silt screens/fences and short period construction management】 <p>(a)-3 Wastes</p> <ul style="list-style-type: none"> - <u>Surplus soil</u> : Countermeasure【Management by back-filling】 - <u>Construction waste, debris and Industrial waste</u> :Countermeasure【waste management by the use of relevant industrial waste collection and treatment companies】 - <u>Toilet sludge</u> : Countermeasure【Periodical de-sludge by the use of public services or service providers】 - <u>Waste oil</u> (from hydraulic systems and etc.): Countermeasure【Collection and treatment by such wastes collection companies】 <p>(a)-4 Soil Contamination</p> <ul style="list-style-type: none"> - <u>Spilled Oil and Fuel</u> (from Construction vehicles and Equipment): Countermeasure【Periodical inspection of such trucks and equipment. Stopping lane and load and unload position management. Spilled oil and fuel management as waste. Oil spills are subject to the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2008】 <p>(a)-5 Noise and Vibration</p> <ul style="list-style-type: none"> - <u>Noise</u>: Countermeasure 【Utilization of well-maintained construction vehicles and equipment. Daily visual inspection of silencers of those vehicles and equipment】 - <u>Vibration</u>: Countermeasure 【An “Earth Auger” is planned to be utilized for DSP piling of which vibration level is relatively small (50 dB* to 62 dB* at the position of 7 m). (*Ministry of the Environment of Japan)】 <p>(b) <Sea Water Desalination Plant (DSP)></p> <ul style="list-style-type: none"> - <u>Marin Ecosystem</u> (Turbid seawater caused by installation of Intake/outfall Pipelines): Countermeasures【Utilization of Silt screens/fences, short period construction management, visual inspection during the installation, environmental education to labors/workers and communities】 - <u>Sea turtles</u>: Countermeasures【suspension of installation works during egg laying seasons of sea turtles, sighting reports, environmental education to labors/workers and communities】 <p><Transmission Pipelines></p> <ul style="list-style-type: none"> - No adverse impact on natural environment is expected since the pipelines are basically planned to be constructed under the existing roads. <p>(c) <Sea Water Desalination Plant (DSP)></p> <ul style="list-style-type: none"> - <u>Living and Livelihood</u> (Fishery activity impacts caused by installation of Intake/outfall Pipelines): Countermeasure 【Turbid seawater management (utilization of silt screens/fences) and visual inspection, monetary compensations for fisheries if there is any negative impacts during the installations, shorter installation schedule

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)																																						
				<p>management, meetings with surrounding communities】</p> <p><Transmission Pipelines></p> <ul style="list-style-type: none"> - Living and Livelihood (Temporary use of paddy fields and farm lands during the installations): Countermeasures【Road traffic management including diversion routes and time restrictions, compensations for the utilization to landowners even though short utilization period】 <p>(d) <Sea Water Desalination Plant (DSP)></p> <ul style="list-style-type: none"> - Road traffic congestions: Traffic congestion of ECR by increase in the numbers of the dump trucks and other trucks (24 - 33 dump trucks/day in gross and 6 - 8 other trucks/day in gross for the 42-month construction period) is predicted for the 42-month construction phase (minor impacts): Countermeasures【Road traffic management including time restrictions to avoid rush hours and days】 <p><Transmission Pipelines></p> <ul style="list-style-type: none"> - Transmission pipelines are basically planned to be installed under the existing roads by the open-cut construction methods. - 0.4 - 0.6 dump truck/day/km and 0.2 - 0.3 heavy equipment/day/km in gross are operated for the 48-month installation work 																																						
5 Others	(2) Monitoring	<p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p>	<p>(a) Y (b) Y (c) Y (d) Y</p>	<p>(a) (b) <Sea Water Desalination Plant (DSP)></p> <ul style="list-style-type: none"> - As per the recommendations from CZMAs, the following monitoring are to be done by CMWSSB. <table border="1"> <thead> <tr> <th>CZMA</th> <th>Monitoring Activity</th> <th>Frequency</th> <th>Submitted to</th> </tr> </thead> <tbody> <tr> <td rowspan="5">Kancheepuram District (KDCZMA)</td> <td>Post-project marine quality including water quality and biological characteristics.</td> <td>Continuous</td> <td>Not specified</td> </tr> <tr> <td>Marine biodiversity</td> <td>Twice in a year</td> <td>MoEF/TNPCB</td> </tr> <tr> <td>Concentration of toxic trace metals in the reject water</td> <td>Periodical</td> <td>Not specified</td> </tr> <tr> <td>A moored data buoy shall be maintained in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters (salinity, temperature, DO, current etc.).</td> <td>Periodical during the construction and operation phases</td> <td>Not specified</td> </tr> <tr> <td>The high salinity reject water may be periodically monitored for the physiochemical and toxic trace metal contents through appropriate standard procedures.</td> <td>Periodical</td> <td>Not specified</td> </tr> <tr> <td rowspan="3">Tamil Nadu State (TNSCZMA)</td> <td>Marine water at the outfall area</td> <td>Every Quarter</td> <td>TNSCZMA</td> </tr> <tr> <td>Periodical report on the site conditions so as to take mitigation measures on the event of any adverse impacts on the coast</td> <td>Every Year</td> <td>TNSCZMA</td> </tr> <tr> <td>Impact on the corals*, marine organisms, Turtle nesting etc. should be evaluated and monitored through experts (ecologists).</td> <td>Not specified</td> <td>Not specified</td> </tr> </tbody> </table> <p>*: Corals have not been observed around Perur seashore and offshore Source: JICA Study Team based on recommendations from KDCZMA and TNSCZMA</p> <ul style="list-style-type: none"> - In EIA report, post project monitoring activities are proposed as follows <table border="1"> <thead> <tr> <th>Monitoring</th> <th>Purpose</th> <th>Parameter</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>Seawater & Sediment Quality</td> <td>To monitor impacts on seawater and sediment quality</td> <td>Measurements of levels of nutrients and heavy metals in</td> <td>Each season April (Fair Weather), July (SW</td> </tr> </tbody> </table>	CZMA	Monitoring Activity	Frequency	Submitted to	Kancheepuram District (KDCZMA)	Post-project marine quality including water quality and biological characteristics.	Continuous	Not specified	Marine biodiversity	Twice in a year	MoEF/TNPCB	Concentration of toxic trace metals in the reject water	Periodical	Not specified	A moored data buoy shall be maintained in the vicinity of the effluent discharge to continuously monitor the changes in the selected physiochemical parameters (salinity, temperature, DO, current etc.).	Periodical during the construction and operation phases	Not specified	The high salinity reject water may be periodically monitored for the physiochemical and toxic trace metal contents through appropriate standard procedures.	Periodical	Not specified	Tamil Nadu State (TNSCZMA)	Marine water at the outfall area	Every Quarter	TNSCZMA	Periodical report on the site conditions so as to take mitigation measures on the event of any adverse impacts on the coast	Every Year	TNSCZMA	Impact on the corals*, marine organisms, Turtle nesting etc. should be evaluated and monitored through experts (ecologists).	Not specified	Not specified	Monitoring	Purpose	Parameter	Frequency	Seawater & Sediment Quality	To monitor impacts on seawater and sediment quality	Measurements of levels of nutrients and heavy metals in	Each season April (Fair Weather), July (SW
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Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)			
						water and sediment samples collected from sides at risk of pollution	monsoon) and November (NE monsoon)
				Marine Benthic Fauna	To determine the composition and distribution of major groups of fauna	Benthic fauna composition in the water outfall region	Each season as indicated above
				Intake	To determine the incidence of entrapment and mortality of marine fauna	Screens on pump stations and effectiveness of management measure	Each season as indicated above
					To determine the impact of entrainment within and external ponds/storage sump/well to assess the loss of fishery	Record abundance of fauna within the pond/storage sump/well	Each season as indicated above
				Seawater outfall	To determine the effect of increased temp/salinity on the plankton	Monitor abundance and distribution of both phytoplankton and zooplankton near the outfall	Each season as indicated above
						Monitor abundance and distribution of benthic animal communities near the outfall	Each season as indicated above
				- MoEF may request any environmental monitoring activities as supplementary conditions in the issuance of CZR clearance for the Perur DSP. If to do so, CMWSSB shall conduct such monitoring activities requested by MoEF.			
				<u><Transmission Pipelines></u> Not applicable			
				(c) <u><Sea Water Desalination Plant (DSP)></u> and <u><Transmission Pipelines></u> - CMWSSB has the grievance redressal mechanisms and E-governance - Deployment of an environmental expert in PIU is proposed by JICA Study - An analytical laboratory is planned to be set up in the Perur DSP. Those functions above can be utilized for organizing the monitoring system in CMWSSB.			
				(d) <u><Sea Water Desalination Plant (DSP)></u> - CRZ Notification stipulates the post clearance monitoring which is required to be submitted half yearly compliance reports in respect of the stipulated terms and conditions of the clearance to regulatory authorities. - In the official CRZ clearance process for the DSP in Perur, KDCZMA and TNSCZMA have made recommendations in which several monitoring activities have been included as shown above. - The EIA report has proposed that the results of monitoring shown above can be reported to the relevant authority annually or as required which could include MoEF, State Department of Environment, State Department of Fishery, and State Pollution Control Board.			
				<u><Transmission Pipelines></u> Not applicable			

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a)N/A	(a) Not applicable
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Project is planned to be constructed in Tamil Nadu State of the Indian territory. RO systems are planned to be used for the DSP which will not discharge high concentration of CO ₂ and other greenhouse gases as well as ozone-depleting compounds.

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Organizational Structure

CMWSSB STAFF STRENGTH

**CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD STAFF STRENGTH
PARTICULARS AS ON 01.02.2016**

Sl. No.	Designation	Method of appointment	GROUP	Sanctioned Strength	Operating Strength	No. of Vacant Post
1	Managing Director	I.A.S.	A	1	1	0
2	Executive Director	I.A.S.	A	1	1	0
3	Finance Director	IA & AS	A	1	0	1
4	Engineering Director	Promotion	A	1	0	1
5	Chief Engineer	Promotion	A	5	2	3
6	Chief Controller of Finance	Promotion	A	1	0	1
7	General Manager	Deputation	A	1	1	0
8	Internal Auditor	Deputation	A	1	0	1
9	Superintending Engineer (1 S.E. Deputed to CMRL)	Promotion	A	17	16	1
10	Controller of Finance	Promotion	A	2	2	0
11	Financial Analyst	Direct	A	1	1	0
12	Industrial Relations Manager	Direct/ Promotion	A	1	0	1
13	Staff Manager	Deputation / Promotion	A	1	0	1
14	Public Relations Manager	Deputation	A	1	1	0
15	Deputy Controller of Finance	Deputation / Direct	A	7	2	5
16	Information Technology Manager	Promotion	A	1	1	0
17	Data Processing Manager	Direct/ Promotion	A	1	1	0
18	Executive Engineer	Promotion	A	57	48	9
19	Hydrogeologist	Promotion	A	1	0	1
20	Grievance Redressal & Facilitation Officer	Direct/ Promotion	B	1	1	0
21	Senior System Analyst	Direct/ Promotion	B	1	0	1
22	Chief Analyst	Promotion / Direct	B	1	0	1
23	Medical Officer	Deputation	B	1	1	0
24	Assistant Executive Engineer (Civil & Mech)	Promotion	B	132	77	55
	Assistant Executive Engineer (Electrical)	Promotion	B	29	27	2
25	Chief Chemist / Water Analyst	Promotion	B	7	4	3
26	Deputy Hydrogeologist	Promotion	B	2	0	2
27	Senior Accounts Officer / Senior Admv. Officer	Promotion	B	25	10	15
	Senior Accounts Officer	Direct	B	12	9	3
28	Deputy Public Relations Manager	Transfer /Promotion/ Deputation	B	1	0	1
29	System Analyst (2 Post kept in abeyance)	Direct/ Promotion/ transfer	B	3	1	2

Source: CMWSSB

Sl. No.	Designation	Method of appointment	GROUP	Sanctioned Strength	Operating Strength	No. of Vacant Post
30	Assistant Engineer (Civil/Mech)	Direct & transfer	B	262	187	75
31	Assistant Engineer (Electrical)	Direct & transfer	B	118	58	60
32	Junior Engineer (Civil/Mech)	Promotion	B	88	47	41
33	Junior Engineer (Electrical)	Promotion	B	40	53	-13
34	Assistant Hydrogeologist	Direct / transfer	B	6	2	4
35	Technical Officer	Direct & Promotion	B	1	1	0
36	Accounts / Admv. Officer	Promotion	B	37	36	1
37	Programmer	Direct/Promotion/transfer	B	10	6	4
38	Junior Accounts / Junior Admv. Officer	Promotion	B	130	7	123
39	Assistant Water Analyst / Chemist	Direct / transfer	B	20	0	20
40	Depot Manager Grade-I	Promotion	B	22	16	6
41	Steno Typist Grade-I	Promotion	C	7	6	1
42	System Operator	Direct/ Promotion/transfer	C	18	13	5
43	Photographer	Direct	C	1	0	1
44	Technical Assistant/ Technician	Direct	C	3	1	2
45	Steno Typist Grade-II	Promotion	C	20	20	0
46	Overseer	(Absorbed from T.Panchayat)	C	1	1	0
47	Draughtsman-cum-Surveyor	Direct / transfer	C	65	9	56
48	Electrical Operator (HT)	Direct / transfer	C	171	16	155
49	Electrical Operator (LT)	Promotion	C	46	43	3
50	Lab Technician Grade-I	Promotion	C	11	6	5
51	Lab Technician Grade-II	Direct / transfer	C	15	0	15
52	Pharmacist	Other Method	C	1	1	0
53	Assistant	Promotion	C	100	42	58
54	Librarian	Direct	C	1	0	1
55	Depot Manager Grade-II	Promotion	C	88	38	50
56	Electrician	Promotion	C	128	92	36
57	Junior Assistant (Newly Merged post) (242 + 35)	Promotion/ Direct/transfer	C	277	89	188
58	Junior Assistant *	Promotion/ Direct/transfer	C	27	27	0
59	Steno Typist Grade-III *	Direct	C	13	13	0
60	Data Entry Operator*	Direct/transfer	C	6	6	0
61	Typist & Typist Grade-I *	Direct/transfer	C	11	11	0
62	Depot Manager * <i>NO TECH</i>	Direct/transfer	C	35	35	0
63	Driver	Direct/transfer	C	67	19	48

Source: CMWSSB

Sl. No.	Designation	Method of appointment	GROUP	Sanctioned Strength	Operating Strength	No. of Vacant Post
64	Telephone Operator	Direct/transfer	C	4	2	2
65	Motor Cycle Messenger (manned by LMV Driver)	Direct/transfer	C	1	0	1
66	Sewer Superintendent	Promotion	C	100	0	100
67	Fitter Grade-II ^	Direct and promotion	C	2	2	0
68	Fitter	(Absorbed from T.Panchayat)	C	1	1	0
69	Mechanic Gr.II ^		C	1	1	0
70	Pump Operator I & II		C	10	2	8
71	Electrical Pumpsman		C	154	2	152
72	Chloronome Operator	transfer	C	8	3	5
73	Filter Operator	transfer	C	17	3	14
74	Pipeline Fitter (Gr.I &II) ^	(Absorbed from T.Panchayat)	C	3	3	0
75	Lift Operator	Direct / transfer	D	1	1	0
76	Record Assistant	Direct / Promotion	D	45	11	34
77	Office Assistant	Direct	D	102	24	78
78	Switch Board Operator	(Absorbed from T.Panchayat)	D	2	2	0
79	Wireman	(Absorbed from T.Panchayat)	D	1	1	0
80	Electrical Helper	(Absorbed from T.Panchayat)	D	2	2	0
81	Sweeper / Scavenger / Sanitary Worker	Direct	D	15	9	6
82	Watchman / Gurkha Watchman	Direct	D	50	29	21
83	Tahsildar (Regular -2 + Retired - 9)	Deputation		11	9	2
84	Field Assistant/Sub Ins. Survey	Deputation		2	0	2
Total Staff Strength				2695	1215	1480
85	Labour Establishment (Field Worker/Sewer Worker / Maistry / Cleaner)	Direct	D	4552	1847	2705
86	Driver (HMV)		C	101	46	55
Grand Total				7348	3108	4240

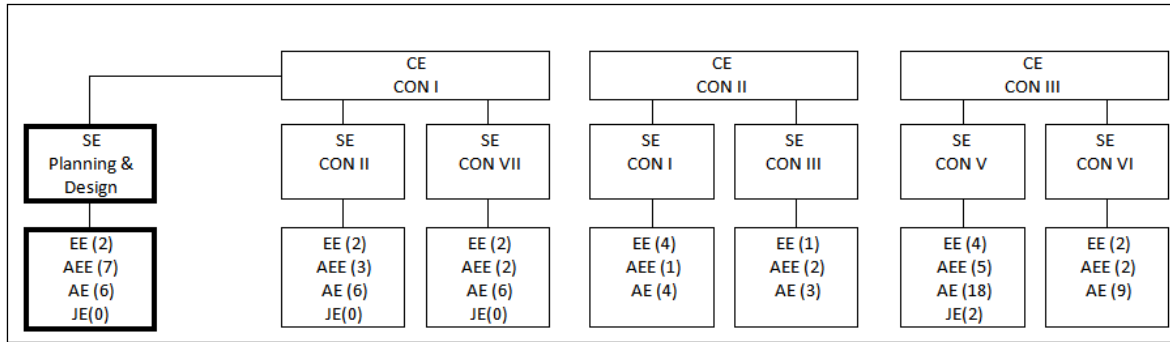
* Resultant vacancies will be merged with Newly Created Junior Assistant Post

^ Post will be abolished when the incumbent retires accordingly vide B.P.No.15/2007, Dated 26.07.2007

Temporary Appointment

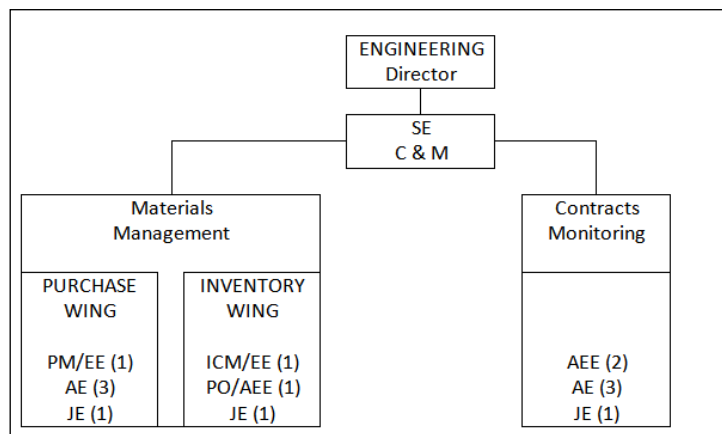
Nodal Officer 1
Law Officer 1
Assessors (Retd. COC) 10

Source: CMWSSB



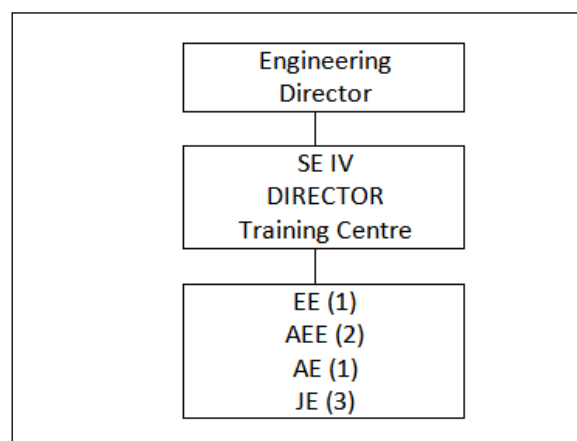
Source: JICA Study Team

Figure A9.1.2 Project Construction/Works Function



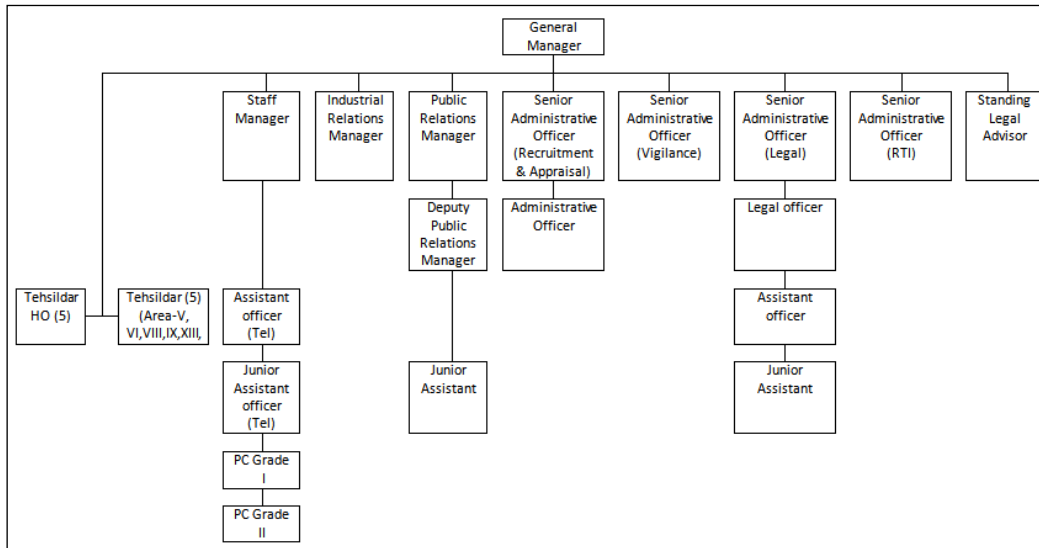
Source: JICA Study Team

Figure A9.1.3 Contracts and Project Monitoring Function



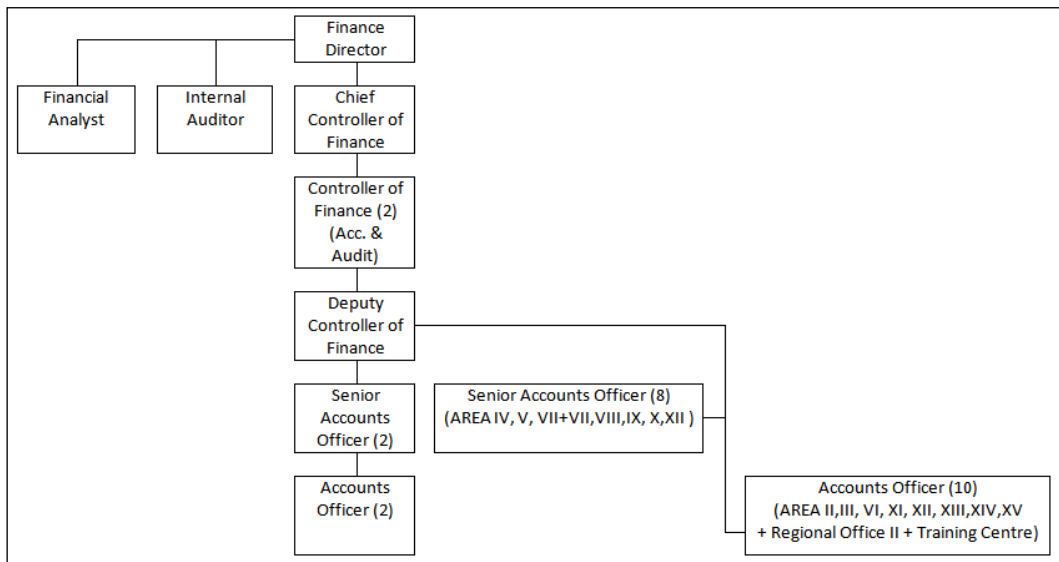
Source: JICA Study Team

Figure A9.1.4 Training Function



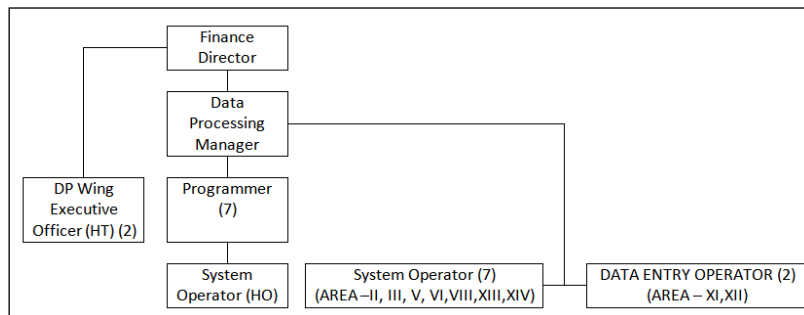
Source: JICA Study Team

Figure A9.1.5 Personal, Administration and Vigilance Function



Source: JICA Study Team

Figure A9.1.6 Finance and Accounts Function



Source: JICA Study Team

Figure A9.1.7 Information Technology Function

Appendix 9.2 Decision Making

Table A9.2.1 Review Meetings in CMWSSB

Chaired By	Participants	Periodicity	Agenda
PRINCIPAL SECRETARY Dept. of MAWS	Managing Director Engg. Director All CE's All SE's	Quarterly	Financial & Physical progress review of all Projects Funding for new projects
MINISTER Dept. of MAWS CHAIRMAN, Board of Directors	Principal Secretary to Government, Dept. of MAWS Principal Secretary to Government, Finance Department Managing Director, CMWSSB Commissioner, Corporation of Chennai Executive Director, CMWSSB Finance Director, CMWSSB Engineering Director, CMWSSB Member Secretary, CMDA Managing Director, TWAD Board General Manager CMWSSB	Bi-Monthly	Various – CMWSSB matters
MAYOR Corporation of Chennai	Managing Director CE (O & M – I) CE (O & M – II) All SE's All EE's	Pre- Monsoon	Flood preparedness Drought preparedness Social disease outbreak preparedness
MANAGING DIRECTOR	CE (O & M – I) All SE's All EE's	Twice per month Daily Alternate day	O & M issues Customer complaint monitoring Poor monsoon -water crisis Adequate monsoon -sewerage
	CE (O & M – II) All SE's All EE's	Once per month	O & M - T & T issues
	CE (O & M – II) Concerned SE & EE	Once per month	Visit to review work at problematic site
MANAGING DIRECTOR	CE (Cons – I, II, III) All SE's All EE's All Project Contractors	Once per month	Financial & Physical progress review of each Project – external issues
	Engg. Director Finance Director CE (Cons – I, II, III) All SE's All EE's	Once per month	Financial & Physical progress review of each Project – internal issues Special review of slow moving projects Special review of projects nearing completion

Chaired By	Participants	Periodicity	Agenda
	Engg. Director Contracts & Monitoring Team Concerned CE, SE, EE	Twice per month	Contract issues – new and old projects
	Engg. Director Planning and Design Team Concerned CE, SE, EE	Once per month	Planning and Design issues
	Engg. Director Director Training EE	Once per month	Past performance Future Plans Issues
	Engg. Director All CE's All SE's	Once per month	Special initiative meeting
	Finance Director General Manager	Once per month	Financial health review of CMWSSB
	General Manager P & A Team	Once per month	Land acquisition by CMWSSB Legal issues HR issues- pay/promotions/ recruitment/retirements etc.
CE (O&M – I)	All SE's All EE's	Trice per month	O & M issues Customer complaint monitoring Poor monsoon -water crisis Adequate monsoon -sewerage
SE's (O&M) (N, S, C, NE, SW)	Respective Area EE's	Weekly	O & M issues Customer complaint monitoring Flood preparedness Drought preparedness Social disease outbreak preparedness Poor monsoon -water crisis Adequate monsoon -sewerage
EE's (O&M)	Respective Depot Engineers Customers	Twice per month	Customer complaints
CE (O&M – II)	Concerned SE & EE	Two days per month Twice /Trice per month	O & M - T & T issues of all WTP's/STP's Visit to review work at problematic site
SE (O&M – T&T)	Concerned EE's	Twice per month	O & M - T & T issues
SE (Desalination)	Concerned EE's DBOOT Contractor	Once per month	Production issues
EE	Concerned WTP/STP Team	Weekly	O & M - T & T production preventive maintenance review
CE (Con –I, II, III)	Concerned SE's & EE's	Every 3 days	Site inspection
SE (Con – I,II,III,V,VI,VII)	Concerned EE's	Daily Alternate day	Progress review Site inspection
EE (Con)		Daily	Site inspection Report progress / issues to SE every evening

Source: JICA Study Team

Appendix 9.3 CMWSSB Procurement Process

Table A9.3.1 Procurement Procedure Sequence

S.No	Activity	Time-line (Average)
1.	Normally, bid documents are prepared by Consultant using government approved CMWSSB 'Standard Bidding Document'; alternatively, funding agency's prescribed documents are used.	15-20 days
2.	Documents are checked by Superintending Engineer –DESALINATION (SE-Desal), verified by Superintending Engineer – Contracts and Monitoring (SE-C&M) plus Chief Engineer (O&M-II) and approved by Engineering Director(ED)	10 days
3.	Bid Documents are uploaded by SE-C&M and his team on GoTN web site; anyone from the public is allowed to download; there is no password, no restriction is imposed to raising Pre-Bid queries. Note: For the DSP 150 MLD Project, a recent change to the existing process is the introduction of Rupee One Hundred Thousand (INR 100,000.00) fee, to be paid by bidders in order to participate in pre bid meeting and submission of tenders. The amount is in admission to the bid security amount. Anyone can raise queries and all are answered and uploaded on the web site for general viewing and free download.	Prebid meeting 10 days of announcement
4.	All answers, along with addendum (if any), are uploaded by SE-C&M and his team on GoTN web site	20-30days
5.	In case of any 'submission date extension', SE-C&M and his team announce the change through print, and electronic media	Bids opening 90 days of bid announcement
6.	An independent three member 'Tender Scrutiny Committee' (TSC) is constituted (1 SE + 1 EE + 1 Dy. Controller of Finance). They witness the complete bidding process, prior to the award of contract, and are required to make observations on the process and to sign each document.	
7.	Bids received are opened on the specified date and time by SE-C&M and his team, in the presence of bidders, TSC and Consultant; the bid opening process is videographed.	0.5 day
8.	'Pre-Qualification' process is not carried out separately. Technical bid evaluation includes 'Pre-Qualification'	
9.	Technical evaluation is carried out by SE-C&M and his team assisted by Consultant.	60-90 days
10.	SE-C&M prepares the agenda for the 'Tender Committee' (TC); General Manager presents the findings of the technical evaluation to the TC. [Tender Committee comprises Principal Secretary Finance (GoTN), MD-CMWSSB, Executive Director-CMWSSB, Finance Director-CMWSSB, Engineering Director-CMWSSB and General Manager is the Convener].	TC meeting called within 05-07 days
11.	After deliberations, TC presents the findings to the Board of Directors, recommending the list of bidders whose financial bids can be opened for their decision to approve/reject.	1-2 days after TC meeting
12.	Only Technically responsive bidders are informed about the financial bid opening date and time.	3-5 days after Board meeting
13.	Financial bids are opened by SE-C&M and his team, supported by Consultant, in the presence of TSC and invited bidders; the financial bid opening process is videographed.	0.5 day
14.	All monetary values are openly declared.	
15.	After financial evaluation exercise is completed, including the negotiation process, SE-C&M, through GM presents the findings to the TC. TC recommends the successful bidder for the decision to the CMWSS Board of Directors for their approval.	Financial evaluation, 45-60 days
16.	SE-C&M issues the award of contract to the successful bidder.	1-2 days

S.No	Activity	Time-line (Average)
17.	Complete details of the bid results are consolidated per month and declared for mass consumption in 'GoTN Tender Bulletin', which is a weekly publication.	
18.	After the successful bidder has furnished the performance guarantee and signed the contract, security deposits are refunded to the unsuccessful bidders along with unopened financial bids (if any).	15-20 days
19.	In case of rejection at any stage, retendering is ordered and all bidders are informed, without specifying any reason.	

Notes:

For externally funded projects, the procedure and documents prescribed by the funding agency are utilised; JICA's Standard Bidding Documents and procedure will be followed for JICA funded project.

At CMWSSB, presently, time-range for any procurement process to be completed is 290-320 days; since JICA's concurrence will be needed after 'Activity S. Nos.' 2, 11 and 15, an additional time of 75 days can be added to this time-range.

Appendix 9.4 Project Implementation - Procedures and Decision Making Process

Table A9.4.1 Project Approval Process

STEP	Activity	Action Time	Remarks
1	Preparation of Scheme/ DPR by Desalination Wing CMWSSB, using services of AECOM Consultants	5 months	Process completed
2	Engineering Director gives TECHNICAL approval; documents presented to Board of Directors, CMWSSB submits to GoTN for ADMINISTRATIVE approval.	3 months	
3	Scheme/ DPR documents submitted to Principal Secretary, Municipal Administration & Water Supply Department (MA&WSD) for Government of Tamil Nadu's (GoTN) ADMINISTRATIVE Approval.	3 months	GOVERNMENT ORDER (GO) yet to be issued granting ADMINISTRATIVE & FINANCIAL approval for the Scheme/DPR. Awaiting Y/L agreement signing, GO will be issued as a parallel process.
a.	Scheme/ DPR documents submitted by Principal Secretary, (MA&WSD) to Principal Secretary, Department of Finance (GoTN) for FINANCIAL concurrence.		
b.	Scheme/ DPR documents submitted by Principal Secretary, (MA&WSD) to MINISTER (MA&WSD) for overall concurrence. REWORD as		
c.	MINISTER (MA&WSD obtains ADMINISTRATIVE & FINANCIAL concurrence of the Scheme from the CHIEF MINISTER (GoTN)		
4	Scheme/DPR documents submitted to Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) for 3 rd party Technical Review	6 months	3 rd party Technical Review/ proof checking of DPR documents is carried out by Tata Consulting Engineers (TCE) (Completed) MA&WSD, GoTN will decide any future involvement of TNUIFSL on the project.
5	CMWSSB submits DPR documents to Ministry of Urban Development (MoUD) of Government of India (GoI) for i) Obtaining Government of India (GoI) consent ii) Processing Loan Agreements with JICA	6months	Process coincides with Step 3 above CMWSSB Officials accompanied by AECOM Consultant, present the DPR to CPHEEO for review CPHEEO – Central Public Health and Environmental Engineering Organization is the technical wing of MoUD
a.	MoUD forwards DPR to CPHEEO for review and appraisal		
b.	Appraised DPR forwarded to Department of Economic Affairs, Ministry of Finance, GoI to award sanction as a guarantor.	3 months	Followed up by team of CMWSSB staff
6	JICA Preparatory Study	11 months	
7	Signing of Tripartite agreement between GoTN-GoI-JICA		Targeted for December 2016
8	Project Implementation	42 months	CMWSSB – Executing Agency TNUIFSL – Nodal Agency for routing project finances and carries out physical and financial progress review (only if GoTN decides to use their services).

Source: JICA Study Team

Table A9.4.2 Project stage-wise decision making

Planning Phase

S. No.	Activities	Types of Decision/s required to be taken (Decision/s with respect to)	Decision by
1	Project conceptualization	<ul style="list-style-type: none"> ○ Can the project be done? ○ Should the project be done 'In-house (by SE-P&D)' or to be outsourced? 	CMWSS Board
2	Pre & feasibility study of the project	<ul style="list-style-type: none"> ○ What are the major deliverables? ○ Approve funds for pre/feasibility study ○ Concept and basic economics ○ Possible sources of raw water resource 	CMWSS Board
3	Administrative approval of the project	<ul style="list-style-type: none"> ○ Type of technology- options ○ Decision to continue ○ 'In-house (SE-P&D)' or to be outsourced DPR work ○ Approve funds for DPR 	CMWSS Board + GoTN
4	Preparation/updation of the Detailed Project Report(DPR)	<ul style="list-style-type: none"> ○ Functional design ○ Life cycle financial analysis ○ Risk analysis of the project ○ Identified works, prepared schedule, and estimated costs (DPR) ○ Phasing of works, cost and its timing 	CMWSS Board + GoTN + GoI-CPHEEO

Pre-Implementation Phase

5	Updation of the Detailed Project Report(DPR)	<ul style="list-style-type: none"> ○ Correction of Master Plan with respect to water allocation ○ Revised length of transmission, its alignment; added distribution network ○ Enhanced costs thereof ○ Mitigation measures – EMP and its costing 	CMWSS Board + GoTN + GoI CPHEEO
6	Technical and Financial Sanctioning of the DPR	<ul style="list-style-type: none"> ○ Approval sought for revised detailed project report ○ Approval of a communication plan and delivery method describing the information needed by stakeholders ○ Whether or not to continue with existing Consultant ○ LOAN AGREEMENT (L/A) - Economic considerations/repayment options 	CMWSS Board + GoTN + GoI CPHEEO + Funding Agency
7	Project Initiation	<ul style="list-style-type: none"> ○ Formation of Steering Committee and operations ○ Formation of PIU work group and its operations ○ Type of training –new skills, knowledge for Staff ○ Developing procedures for getting work done 	CMWSS Board + GoTN

Procurement Phase

S. No.	Activities	Types of Decision/s required to be taken (Decision/s with respect to)	Decision by	
			Current	Proposed
8	Procurement of the Consultant	<ul style="list-style-type: none"> ○ Approval sought for engaging ‘Project Management(PM) / Design Supervision(DS)’ Consultant ○ Quality control by third party arranged by PM/DS Consultant ○ Approval of PQ criteria, Bid document ○ Approval of Award of contract 	CMWSS Board of Directors	P.D.-P.I.U. (Decision maker) + CMWSS Board of Directors (Approvers)
9a	Project-Procurement CP-1	<ul style="list-style-type: none"> ○ Procurement method- EPC, DBOT, etc. ○ Approval of PQ criteria, Bid document ○ Approval of evaluation results ○ Finalization of the negotiated contract 	CMWSS Board of Directors	P.D.-P.I.U. (Decision maker) + CMWSS Board of Directors (Approvers)
9b	Project-Procurement CP-2, & 3	<ul style="list-style-type: none"> ○ Procurement method –BT, etc. ○ Approval of PQ criteria, Bid document ○ Approval of evaluation results ○ Finalization of the negotiated contract 	CMWSS Board of Directors	P.D. –P.I.U. (Decision maker) + CMWSS Board of Directors (Approvers)

Implementation Phase

10	Execution and Controlling/ Overview of project progress	<ul style="list-style-type: none"> ○ Approval for ‘Go ahead’ ○ Finalised working drawing ○ Approval of quality management plan ○ Approval of construction schedule; ○ Issues identified - physical and financial monitoring; corrective action as needed ○ Approval of contract variations- change in cost due to change in design ○ Termination /blacklisting of defaulters (if any) ○ Settlement of arbitrations (if any) 	CE (Const)	P.D. - P.I.U + Steering Committee
11	Closure	<ul style="list-style-type: none"> ○ Releasing final deliverables, approval of final bill ○ Approval of ‘Completion Report’ including lessons-learned studies ○ Releasing project resources-staff/equipment demobilisation 	CE (Const)	P.D. - P.I.U + Steering Committee

Source: JICA Study Team

Steering Committee facilitates as and where needed

Appendix 9.5 Organizational Strengthening Plan

A9.5.1 CMWSSB Business Plan

The business plan integrates plans for addressing the technical challenges, customer satisfaction, financial sustainability and organizational improvements for effective water supply and sewerage management and its monitoring.

The plan also sets out baseline for the performance of CMWSSB, its priorities and aims for the future. The business plan will be a guide to implementation of projects and reforms to be undertaken by CMWSSB. In addition, the Business Plan would provide a basis for additional resource mobilization to enhance the credit worthiness of CMWSSB.

Background

CMWSSB serves the fifth largest metropolis in India serving a population of 6.727 million. To cope with the rapid growth and urbanization, more so since the last six years, CMWSSB aims to develop comprehensive infrastructure to not only cater to existing demands of water supply and sewerage management etc. but also to meet future demands.

To address these challenges on a sustained basis, CMWSSB need to develop a long term (20 years) and a five year business plan to not only manage the treatment, transmission, distribution of water along with a collection, treatment, plus disposal facilities, but also to establish a sustainable and sound management system for the water supply and sewerage sector.

Objectives of Business Plan

Business objectives are the ends that CMWSSB has set out to achieve. These objectives and plans, are determined by balancing the requirements of the various stakeholders (Government, elected representatives, public/customers, employees etc.). The objectives of CMWSSB are thus a blend of various interests of these stakeholder groups. These set objectives are:

- To improve customer satisfaction on quality of services as well as value for money
- Full realization/recovery of water and sewerage bills
- Establish a mechanism to ensure full recovery of O&M cost of water supply and sewerage management in next 5 years;
- Generate revenue to adequately meet the cost of O&M costs (manpower, electricity, chemicals, etc.). in next 10 years
- Full recovery of cost of water supply and sewerage management (O&M, Depreciation, Interest, other charges) by CMWSSB in 20 years (by 2035)

Vision, Mission and Goals

VISION STATEMENT (EXAMPLE): Produce ample superior quality water, vigilantly maintaining water and wastewater infrastructure, and providing responsive and efficient customer-oriented service

in a cost-effective and innovative manner emphasizing responsible environmental stewardship and compliance with all regulatory requirements.

MISSION STATEMENT (as in Citizen's Charter): Our Mission is to enhance the health and quality of life for citizens in Chennai City by providing them adequate supply of clean and good quality of water and safe disposal of sewage/waste water at reasonable price.

In its endeavours to achieve the objectives indicated in the Mission Statement, Metrowater being customer driven will be guided by the following:

- * Feedback from consumers*
- * Delivering excellence in products and services*
- * Doing business with ethics and integrity*
- * Continuous endeavour to improve quality of service.*

Goal - CMWSSB has set itself the goal of providing 24x7 self-sustainable, safe drinking water supply, sewerage collection, treatment, enhanced reuse of treated waste water for pollution free rivers and sea by the year 2035.

Based on internal discussions, technical, financial and institutional goals have been established. These include the following:

Short term goals: Short term goals address immediate operational parameters such as procurement, coverage etc. over the next three-five years (by 2020). This mainly includes:

- Expansion of water supply network for an improved coverage raising it from the current 65 % to 95%.
- Expansion of sewerage network for improved coverage raising it from the current 65 % to 85%.
- Increased capacity of WTPs with the addition of 3067 MLD and STPs with the addition of 591MLD by 2020.
- Recovery of O&M costs (staff salaries, electricity, chemicals, normal repair and maintenance) to be increased to 100%.
- Asset management system will be in place and operational
- Automated Customer grievance management system linked to MIS will be in place.

Medium term goals: These are goals, which are targeted during next seven-eight years, especially for coverage, infrastructure development, potential PPP/outsourcing arrangements, O&M sustainability etc. To include:

- Expansion of water supply network for improved coverage to rise from 95 % to 100%.
- Expansion of sewerage network for improved coverage of 100% of design population.
- Increased capacity of WTPs and STPs (adequate for the design population of 2023)
- Recovery of O&M costs (staff salaries, electricity, chemicals, normal repair and maintenance) to be sustained at 100%.

- Fully operational asset management system will support the decision making.
- Improved reuse of treated water, will be enhanced from the existing 5% to 20%

Long- term goals: The long-term goals have been set for a period of about 20 years (say by 2035).

This includes

- Increased capacity of STPs with the addition of 470 MLD by 2035
- 100 % sustained realization/recovery of water bills and sewerage bills
- Increased Customer satisfaction to grading level of 'Very Good'.
- Recovery of total cost of O&M (operational as well as capital component)
- Improved reuse of treated water to 40%

The business plan is developed to address expansion/improvement of CMWSSB to meet shortcomings in the institutional, operational and financial aspects. Thus, the assessment focuses on institutional/governance, financial capabilities and human resources.

- 1) *The institutional component* focuses on mapping of the existing division of responsibilities between various entities for the provision of water supply and sewerage management services, decision making process, transparency, accountability at various levels, public participation and infrastructure elements covered in the operational assessment.

Current level of achievement of service outcome and targets for key performance indicators have been indicated in Table below.

Table A9.5.1 Goals and Service Outcomes

S. No.	Indicators	GoI* standard	Current	Target	2035
			** 2015-16	*** 2020	
Water Supply					
1.	Network cover for general households - %	100	60	95	100
2.	Per capita supply - lpcd	135	110	135	135
3.	Extent of metered water connections - %	100	10	50	100
4.	Supply duration - hours	24	6	24	24
5.	Quality of water supplied - %	100	100	100	100
6.	Un-accounted water - %	20	30	20	10
7.	O & M cost recovery - %	100	85	100	100
8.	Collection efficiency - %	90	80	90	90
9.	Customer complaint redressal efficiency	80	80	80	80
10.	Customer satisfaction – Fair/ Good / Very Good	-			V Good
11.	Rain water harvesting - %	80	80	100	100
Sewerage					
12.	Coverage of toilets - %	100	100	100	100
13.	Coverage of sewerage network - %	100	50	85	100
14.	Collection efficiency of sewerage network - %	100	90	100	100
15.	Treatment and disposal adequacy - %	100	100	100	100
16.	Quality of treated sewerage - %	100	100	100	100
17.	Recycling and reuse - %	20	5	20	20
18.	Customer complaint redressal efficiency	80	80	80	80
19.	Collection efficiency - %	90	75	100	100
20.	Cost recovery of O&M - %	100	75	100	100
21.	Customer satisfaction – Fair/ Good / Very Good	-			V Good

Source: *Handbook of Service Level Benchmarking (MoUD, GoI)

Source: ** & ***CHENNAI DISTRICT GAZETTE (L&G-2/2124/2015, Dated 10.03.2016)

Source: CMWSSB

- 2) *The Financial Assessment* focuses on a set of key financial indicators which have been derived using the financial data, based on the audited account. Table below presents these indicators. The indicators are utilized to assess the performance with regards to resource mobilization, fund utilization, financial performance and collection efficiencies.

Table A9.5.2 Key Financial Indicators

		2011-12	2012-13	2013-14	
	KEY FINANCIAL INDICATORS	Value	Value	Value	UNIT
A	Resource Mobilization				
1	Sources of Funds				
a	Share of Own Sources (Sale of Water) in Total Revenue Income (RI)	45%	43%	37%	%
b	Share of Revenue Grants & Subsidies in Total RI	22%	29%	36%	%
c	Share of Water and Sewerage Tax in Total Revenue Income	20%	18%	16%	%
2	Growth in Total Revenue Income (over previous year)		15%	18%	% p.a.
a	Growth in Revenue from Sale of Water		9%	1%	%
b	Growth in Revenue from Grants & Subsidies		50%	46%	%
c	Growth in Revenue from Water and Sewerage Tax		4%	4%	%
3	Per Capita Total Revenue Income (per person)	785.9	903.2	1,011.4	Rs p.a./ per person
4	Per Capita Revenue from Sale of Water (per connection)	4,583.9	4,168.9	4,178.3	Rs p.a./ connection
5	Per Capita Revenue from Sale of Water (per person)	353.3	386	369.3	Rs p.a./ per person
B	Fund Application (Expenditure)				
1	Uses of Funds				
a	Share of Establishment Expenditure in Total Revenue Expenditure (RE)	61%	56%	49%	%
b	Share of O & M Expenditure in Total Revenue Expenditure	39%	44%	51%	%
2	Growth in Total Revenue Expenditure (over previous year)		11%	15%	%
a	Growth in Establishment Expenditure (over previous year)		3%	-0.1%	%
b	Growth in O&M Expenditure (over previous year)		24%	34%	%
C	Ratio Analysis (Expenditure vs Revenue)				
a	Revenue Expenditure to Revenue Income	1.27	1.23	1.20	
b	Establishment Expenditure to Revenue Income	0.77	0.69	0.59	
c	O&M Expenditure to Revenue Income	0.50	0.54	0.61	
d	O&M Expenditure to Income from Sale of Water	1.11	1.26	1.68	
e	O&M Expenditure to Revenue Income less Grants & Subsidies	0.64	0.76	0.96	
D	Liability Management				
1	Per Capita Liability				
a	Outstanding Debt (Long Term Borrowings) per Capita population served	2,037	1,947.8	1,793.6	Rs
b	Outstanding Non-Debt Liability per Capita	6,568.5	7,545.2	8,222.8	Rs
c	Total Outstanding Liability per Capita	8,605.5	9,493.0	10,016.3	Rs
2	As a Proportion of Revenue Income				
a	Outstanding Debt to Revenue Income	2.59	2.16	1.77	
b	Outstanding Non-Debt Liability to Revenue Income	8.36	8.35	8.13	
c	Total Outstanding Liability to of Revenue Income	10.95	10.51	9.90	
3	As a Proportion of Own Revenue Income (Sale of Water)				
a	Outstanding Debts to Own Revenue Sources	5.77	5.05	4.86	
b	O/S Non- Debt Liability to Own Revenue Sources	18.59	19.55	22.27	
c	Total O/S Liability to Own Revenue Sources	24.36	24.59	27.13	
4	Non-Debt Liability as % of Total Liability	76%	79%	82%	%
5	Debt Servicing Ratio (Debt Service Charges/Revenue Income)	18%	16%	13%	%

E Performance Indicators					
1	Operating Ratio (Revenue Expenditure to Revenue Income)	1.27	1.23	1.20	Ratio
2	Per Capita Own Income	353.33	386.04	369.25	Rs
	Growth in per Capita Own Income (per person)		9.3%	-4.3%	%
3	Per Capita Grant	174.65	261.86	364.02	Rs
	Growth in Per Capita Grant		49.9%	39.0%	%
4	Per Capita Total Revenue Income	785.95	903.19	1,011.4	Rs
	Growth in Per Capita Total Revenue Income		14.9%	12.0%	%
5	Per Capita Establishment Expenditure	607.45	624.54	594.01	Rs
	Growth in Per Capita Establishment Expenditure		2.8%	-4.9%	%
6	Per Capita O & M Expenditure	391.36	486.54	621.77	Rs
	Growth in Per Capita O & M Expenditure		24.3%	27.8%	%
7	Per Capita Revenue Expenditure	998.81	1,111.1	1,215.8	Rs
	Growth in Per Capita Revenue Expenditure		11.2%	9.4%	%
F Efficiency Indicators					
1	Revenue Collection Performance				
a	Growth in Revenue from Sale of Water (over previous year)		9%	1%	%
b	Growth in Revenue from Water and Sewerage Tax (over previous year)		4%	4%	%
2	Revenue from Sale of Water per Connection	4,583.9	4,168.9	4,178.3	Rs
3	No. of CMWSSB Staff per 1000 persons (Population served)	0.46	0.46	0.44	Nos.
4	Total Revenue Income per CMWSSB staff	17,01,119	19,54,888	23,00,023	Rs
5	Revenue from Sale of Water per CMWSSB staff	7,64,748	8,35,542	8,39,728	Rs

Source: JICA Study Team

The above have been derived from the audited accounts for 2011-12, 2012-13 and 2013-14 as below:

Table A9.5.3 Audited Accounts

BALANCE SHEET

Description	2011-12	2012-13	2013-14
	Rs. Crores	Rs. Crores	Rs. Crores
Liabilities			
Contributions	12,31,77,46,006.59	14,23,71,92,420.59	14,83,67,67,957.74
Grants From Government	14,85,62,26,487.53	19,39,42,18,304.53	25,07,97,07,963.53
Long Term Borrowings	13,70,31,54,271.00	13,10,29,67,530.00	12,67,68,55,900.00
Deferred Credits & Deposits	8,61,16,93,016.41	8,12,07,56,329.36	8,85,18,71,344.21
Current Liabilities	8,40,04,00,691.80	9,00,42,63,346.87	9,35,01,00,184.77
Total	57,88,92,20,473.33	63,85,93,97,931.35	70,79,53,03,350.25
Non-Debt Liabilities	44,18,60,66,202.33	50,75,64,30,401.35	58,11,84,47,450.25
Assets			
Fixed Assets	44,80,87,37,708.60	48,57,09,20,341.47	54,52,42,07,185.24
Current Assets, Loans, Advances & Deposits	9,16,25,98,524.72	9,69,97,69,907.31	8,85,50,68,031.58
Accumulated Deficit	3,91,78,84,340.01	5,58,87,07,682.57	7,41,60,00,000.00
Total	57,88,92,20,473.33	63,85,93,97,931.35	70,79,52,75,216.82

Profit & Loss Statement

Particulars			
Income			
Sale Of Water	2,37,68,35,424.21	2,59,68,63,064.30	2,60,98,74,945.9
Grants And Subsidies	1,17,48,37,500.00	1,76,15,43,079.24	2,57,28,73,582.0
Water And Sewerage Tax	1,03,69,22,939.27	1,07,41,00,144.95	1,11,41,64,866.3
Other Income	69,84,82,849.07	64,32,86,347.28	85,15,58,624.3
Provisions Written Back			
- Water Charges Unmetered	26,54,209.00	-	
- Taxes	1,17,89,284.00	-	
Revenue Income	5,28,70,78,712.55	6,07,57,92,635.77	7,14,84,72,018.49

Particulars	2011-12 Rs. Crores	2012-13 Rs. Crores	2013-14 Rs. Crores
Excess Of Expenditure Over Income	1,81,72,02,619.51	1,67,08,23,442.56	1,83,68,50,009.90
Total	7,11,87,24,825.06	7,74,66,16,078.33	8,98,53,22,028.39
Expenditure			
Operating & Maintenance Expenditure	2,63,26,64,783.57	3,27,29,76,874.34	4,39,47,02,929.6
Payments & Provision To Employees	1,58,66,19,840.67	1,53,71,34,601.60	1,57,26,93,648.3
Office Administrative Expenses	6,35,13,502.11	6,72,85,013.42	6,56,54,215.5
Prior Period Adjustment	32,64,58,390.18	24,16,57,034.69	39,21,29,922.6
Water Lorry Hire Charges	19,47,95,912.00	25,20,34,355.00	18,59,17,825.0
Depreciation			
Depreciation	1,30,14,94,303.31	1,38,43,37,397.28	1,46,37,66,926.5
Debt Service Charges	93,98,78,132.00	96,04,56,094.00	90,57,28,149.0
Provision For Doubtful Debts			47,28,412.0
- Water Charges Metered	7,32,99,961.22	1,76,79,585.00	
- Water Charges Unmetered	0	21,26,277.00	
- Taxes	0	1,09,28,846.00	
Total	7,11,87,24,825.06	7,74,66,16,078.33	8,98,53,22,028.39
Revenue Expenditure	6,71,89,66,473.66	7,47,42,24,335.64	8,59,31,92,105.80
Establishment Expenditure	4,08,63,01,690.09	4,20,12,47,461.30	4,19,84,89,176.24
CMWSSB Staff strength	3,108	3,108	3,108
Population served	67,27,000	67,27,000	70,68,000
No. of connections (Water Supply)	5,18,514	6,22,906	6,24,631
No. of connections (Sewerage)	6,11,275	7,35,608	7,71,168

Source: JICA Study Team

Above presented KEY FINANCIAL INDICATORS are clear indications that there exists a decline in growth in total revenue from sale of water and tax collection and increase in dependence on grants and subsidies. Indicators on Per capita Total Revenue Income, Per capita revenue from sale of water per connection and Per capita revenue from sale of water per person have to be used for benchmarking after a comparative study with other progressive cities, e.g. Surat.

Increase in Share of O & M Expenditure in Total Revenue Expenditure is an indicator of aging plant and equipment. Currently sale of water is not even covering the O&M expenditure. In spite of grants being 46% of revenue income, there is a shortfall of 20%, indicating that a major effort is needed to increase Revenue income by way of a revised strategy of revised tariff, more connections, more meters, more collection and reduced NRW. 15 % growth per annum in the share of Own Sources of Funds (Sale of Water) in Total Revenue Income (RI) has to be benchmarked.

Another benchmark has to be set to bring the Debt Servicing Ratio (Debt Service Charges/Revenue Income) to 6% (as is the Engineering Industry norm) by increase revenue to cover for revenue expenditure, reduce debt, increase grants and by using grants for capital investment only. The indicator is to be used for benchmarking after comparison with other progressive cities, e.g. Pune.

- 3) *The human resource component* focuses on preliminary assessment of staff capabilities (including qualifications) to determine whether present staffing meets the emerging (time based) needs of water supply and sewerage management operations including the requirements arising from diversification of technologies. As per plans the assessment focuses and preliminarily identify

redundancies, work load patterns in the staffing structure and assess overall changes needed in management structure and internal communications procedures. The identified staffing needs for management of expanded infrastructure have been developed. For existing staff, the training and capacity building requirements have been identified and presented in Section 9.4.7 of the main report.

Desired Scenario (Future) of Water Supply and Sewerage Management by CMWSSB

Sections 9.4.3 to 9.4.8 outline the required expansion and improvement in asset management, supporting operational and monitoring systems (i.e. SCADA, Centralized Control Unit), information technology systems, customer redressal system etc. to facilitate improved management. The “Master Plan for Water Supply and Wastewater Management for Chennai Metropolitan Area” outlines the required annual capacity increments including rehabilitation of existing infrastructure as well as expansion to meet the service requirements.

The financial strategy estimates the cost of capital investments required to expand as per goals as well as create the supporting infrastructure required. The investment plans in CMA for Water Supply, Sanitation and Sewerage are detailed out in appendix 4-1 (number may change) and 4-2 (number may change) respectively. The related capital expenditure is summarised below

Table A9.5.4 Capital Expenditure

Sector	Capital Expenditure (in million Rs. except "Total in million USD")				
	Total amount	Phase I	Phase II	Phase III	Phase IV
	(By 2050)	(By 2020)	(2020-2030)	(2030-2040)	(2040-2050)
Water Supply	222,784.18	19,243.52	144,379.80	57,508.78	1,652.00
Sanitation and Sewerage	100,524.86	6,576.92	38,562.42	50,491.23	5,189.29
Total	323,309.04	25,820.44	182,942.22	108,000.01	6,841.29
Total in million USD	4,854.49	387.69	2,746.88	1,621.62	102.72

* UDS1 = Rs 66.6

Source: Master Plan for Water Supply and Sewerage Sectors in Chennai Corporation and Rest of CMA, 2015

Steps for improved financial management will be taken for achieving the target of revenue income becoming higher than revenue expenditure. From a long term planning perspective, the tariff and tax rates will also include partial recovery of cost from customers. The Organizational Strengthening Action plan is being adopted by CMWSSB to achieve the desired goals.

A9.5.2 Proposal for Water and Sewerage tariff revision and collection system

(1) Water and Sewerage tariff revision

The general consensus in India is that tariff setting must focus on economic and financial viability, without losing sight of social affordability. The approach paper to the Ninth Five-Year Plan states that “Efforts will be made to enhance the financial viability of the water supply and sanitation sector through policies based on full cost recovery to permit resource mobilization... Subsidies, if required for the poorer sections of the urban society, should be selectively well targeted and transparent...”

Tariff setting by CMWSSB has to be based on the principle of ‘use more pay more’ to disincentivize excessive use or wastage of water. In cases where bulk connection is provided to a group housing society serving a number of residential premises, water charges have to be worked out as per residential unit-wise domestic rates.

Introducing calendarized payment timelines, metering of Bulk, Industrial and Special Domestic Customers, Spot Billing for Metered Customers are all measures that will go a long way to improve the revenue of CMWSSB. Further, as per the norm in other progressive cities, the sewerage charges should be levied at 60% of the water consumption charges. Special subsidies can be allowed to weaker sections of the society where water charges can be recovered on a standard consumption of 10 KL. per connection per day.

Therefore to enhance revenues it is proposed to create District Metering Areas (DMA), meter bulk, industrial consumers and special domestic consumers in multi-storeyed buildings with more than 3 floors (G+2). In the case of industrial / commercial customers, efficiencies of scale can be derived if there is spot billing (for metered consumers) and printing done centrally and through an outsourced agency (for unmetered consumers). Incentives for online payments / payments through mobile phones etc. have to be introduced to encourage collection levels.

(2) Water and Sewerage tariff collection system

Billing and collection are commercial functions which need to be separated out from Finance and Accounts, as a first action. CMWSSB has to outsource the collection work to a private agency to increase the collection rate and enhance efficiency. The outsourced works will include i) Renewal of household collection database, ii) (re)-design and update the software system, iii) carry out meter reading iv) collect charges and taxes, v) setup on-line help desk, vi) arrange SMS system for payment activities. Payment to the contracted agency would be made based on the revenue amount collected, and hence, a significant improvement in collection rate and amount can be expected. This will also pave the way for systematized billing and collection when the program of full metering is achieved. The outsourcing can be for an initial period of three-year.

A9.5.3 Proposal for CMWSSB's Asset Management System

The first stage of implementation of the asset management system for infrastructure would involve mapping the inventory of all available assets including location, age, quantity/value, and physical characteristics.

CMWSSB's water supply assets basically comprise of all the assets from the headwork's, treatment plant, sump, transmission mains, pumping mains, feeder mains, distribution mains and sub mains, including all valves, connections, meters and all related facilities for the efficient delivery service of water. There are also different types of fixtures related to the intake from groundwater, viz. bore wells, public taps open wells hand pumps, OH tanks. Sewerage system would have a similar list. More examples of assets include land and buildings which are of both types - remunerative assets and non-remunerative assets.

Operation and maintenance of such a vast water supply and sewerage system is as it is a big problem and adding to this is the admission by CMWSSB that it has limited documented information about the sizes, types, material and year of installation. As-built drawings are also scarce, as many of the lines are old, or have been laid out at different periods of time, under different projects and schemes. Considering that assets lose value over time as the system ages and deteriorates, O&M costs increase affecting customer service quality and without asset management, CMWSSB may be faced with excessive costs that it can no longer afford.

Development of the water supply and sewerage asset Geo-database, Consumer Mapping for Chennai Metropolitan Area, including Web/GIS based water supply and sewerage utilities will require a series of specialised activities. These have been tabulated below

Table A9.5.5 Asset Management System Activities

S.No.	Activity Description	Unit/Qty
	Development of Water utility Assets Database	
1	Procurement of High Resolution Satellite Image(WV-II 0.5mtr)	426 sq km
2	Processing & Geo-referencing of HRSI through GCP survey	426 sq km
3	Composition of Base Map (A3 size equivalent)	500 nos. (approx)
4	Mapping of supply water (6520 km)/ sewerage (3,994 km) utility assets covering the following	10514 km
	a. Collection/ collation & Compilation of records/ maps of existing water/ sewerage utility assets	
	b. Digitisation & Mapping of existing water/ sewerage utility assets	
	c. Field survey & ground truthing for verification of the maps/ data	
	d. Field Survey & collection of attribute data of the utility assets	
	e. Generation of Assets Database (tabulation)	
5	Valuation of assets (in consultation with the CMWSSB)	
6	Preparation of city wide water and sewerage utilities Web-enabled Geo-database in GIS environment including thematic mapping, shape/ style/ colour/ symbol, feature-attribute data linking	
7	Development of water and sewerage utility asset inventory maps & reports	
	Preparation of Consumer Database	
8	Door to door Household Survey for Data Collection in survey format & collection of GPS coordinates & Mapping for each legal/ illegal connections	Per Household (750000 nos. approx)

9	Preparation of Consumer Geo-database and integration with the water and sewerage utility Geo-database	
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After the development and piloting the above system, the above will require a further on-site support and facility management for an estimated time frame of three years (including Application/ Geo-database maintenance); a team of (two each) GIS professionals and Database Assistants will be needed to carry out this on-site support and facility management to cater to service contingencies.

A9.5.4 Proposal for Web based Management Information System (MIS)

CMWSSB has to develop a GIS-based Management Information System (MIS) for its water and sewerage utilities, fully computerizing as much of data as possible – physical, financial, human resources, operation and maintenance, customer connections, customer relations and customer care, complaints and redressal.

The overall scope will include the provision of Geographic Information Systems (GIS) support services to create detailed database for CMWSSB using high resolution (0.50 Meters or better resolution) satellite imagery, and overlay all infrastructure data like road, drain, water supply lines, sewer supply lines, over the base maps, in various layers. These databases are to be created using door-to-door household surveys and onsite physical surveying of assets. The master database thus created will be linked to GIS Compatible Web based Management Information System (MIS) to facilitate the process of revenue generation and proper management of assets. This would entail the following actions:

- Develop performance indicator for management of core services provided by CMWSSB.
- Preparation of up-to-date large-scale base map of CMA using high-resolution satellite imagery and ground based engineering survey techniques.
- Interpretation of high-resolution satellite imagery for capturing of building footprints, plot boundary, roads, major landmarks and other visible features.
- Incorporate information of utilities like water supply network and sewerage network (household level), as provided by CMWSSB.
- Detailed surveys for Water, Drainage pipelines (and sewerage, where it exists) through the conduct of on-site physical surveys as per format to be approved by CMWSSB officials to create the updated database of all assets that includes connection to each household.
- Study, design, develop, configure and implementation of web-GIS based MIS with various modules accessible by CMWSSB staff.
- Maintain data and system up to the completion of the project period and handholding period of six months after completion of the project.
- User training for both technical and end-user training.
- Preparation of Technical/ User Manual documentation.

The above development steps of GIS based MIS have been summarized below

1. Development of detailed SRS for CMA level Web GIS on water and sewerage utilities Management Information System
2. Development of Web GIS based Decision Support System covering the following
 - a) *Web GIS Application Modules*
 - b) *Mobile GIS Application Modules*
 - c) *Modification/ development & Integration of existing grievance redressal management application to facilitate Web/ Mobile GIS enabled grievance redressal mechanism*
 - d) *Development of application -Web GIS application Modules for billing/ collection reconciliation process management and integration with the existing Financial Management Information System (FMIS)*
3. Staff Training & Technology Transfer

It is proposed that the agency entrusted with developing the Asses management system should be asked to carry out the development and implementation of this GIS based MIS

A9.5.5 Proposed Non-Revenue Water (NRW) management plan

Due to the low metered rate and the flat rate charge to the unmetered customers, concept of NRW management has never been adopted by CMWSSB in recent times. The need to minimise NRW losses has become increasingly important therefore NRW Management plan for CMWSSB would include

1. Establish series of District Metering Area (DMA) all across CMA

The water service connections of commercial establishments, industrial & institutions and Domestic service connections through House Service Connection (HSC) to be considered.

2. Detect Leaks Acoustically

Acoustic leak detection is an important way that can identify and account for non-revenue water. A dynamic combination of acoustic leak sensors and innovative data analysis software enables proactive leak mitigation. Using a communication module with an integrated acoustic leak sensor, water providers can collect and analyze vibration patterns from anywhere in the distribution system. The acoustic leak detection system will allow optimizing the system performance with automatic daily surveying for distribution leaks. This will result in lower pipeline repair costs by finding and repairing leaks before they become costly main breaks. This also reduces the risk of bacteria and viruses entering the water supply through burst pipe. Pumping and treating less water, will in-turn prolong the life of the treatment and pumping facilities.

3. Perform District Metering Analysis

By grouping and aggregating data stored in an simple analytic software application, district metering can be performed via the following steps:

- Install the meter or meters that feed water into the district (i.e., the “master meter”).

- Identify the group of meters in the district and aggregate the total consumption of these meters on an interval-by-interval basis. Accrue the aggregated consumption of the district into a virtual meter.
- Compare the net consumption of the master meter (the measured input to the district) with the metered consumption of the aggregated district (the measured consumption within the district) on a time-synchronized interval-by-interval basis. Any difference between the net consumption of the master meter and the aggregated consumption of the virtual meter is considered NRW, which can include leaks.

Once the district metering analysis has been conducted and the analytics application has ranked the various districts according to severity, CMWSSB can prioritize where to look for leaks.

4. Manage Distribution System Pressure

To effectively manage pressure, it is important to comprehensively evaluate a service area and gain an understanding of its background losses before introducing pressure control. With a pressure management program, the distribution system can be broken down into pressure zones. Pressure is monitored at the inlet, average zone point and the critical zone point. The average zone point is a location that exhibits the average pressure rate for the zone. The critical zone point is a location where pressure is the lowest, usually the highest elevation in the zone.

5. Analyze Meter Tamperers

Persistent monitoring will say when the potential leak or tamper began, whether it is improving or getting worse. When reported over time, cases with higher incidents of theft and related NRW may be spotted for further investigation.

By taking the preceding five steps, CMWSSB can reduce NRW and thereby reduce the amount of water they have to pump and treat to meet current and future demand. This reduces the amount of energy required to pump the water, the amount of water lost and the amount of CO² produced.

A9.4.6 Proposal for Improved customer services system

The foremost task is to have a commercial orientation and outlook to the business of water supply and sewerage. A dedicated section for undertaking the “Commercial” function has to be established at CMWSSB. The ‘Citizens’ charter’ needs to be relooked and should represent CMWSSB commitment of towards standard, quality and time frame of service delivery, grievance redress mechanism, transparency and accountability.

Customer Service System:

The Customer Service System would provide relevant information to customers, process applications from customers, generate bills, distribute bills to customers, collect payments, and facilitate the grievance redressal. It would give the ‘customer and payment’ details, status, existing customer records, procedures related to applications for new connections, disconnection, and reconnections.

Simultaneous action is needed in devising a system to resolve customer complaints at the CMWSSB Depot office level itself. This will require a thorough study and evaluation of the existing public relations and complaint handling system including understanding the variety of complaints and the flow to resolve them. Accordingly, the need is to devise a simple software, operable from each of the 200 Depot Offices, for logging complaints which become visible to each concerned department for needful action and for recording progress at each stage.

For collections, CMWSSB has to outsource the collection work to a private agency to increase the collection rate and enhance efficiency. Further, handling customer queries through the use of this system should result in assimilation of, a) frequently asked questions, b) log of customer concerns, c) manner of handling irate customers and d) details of fire-fighting situations.

Customer Care Services: For the system to work and deliver the desired results, the staff had to be provided the requisite skills to be able to have customer orientation with desired spirit and enthusiasm and additionally have the skills to operate the system. The staff-customer interface will comprise a) understanding customer expectations, b) One-on-one customer interaction, c) communicating effectively, and d) telephone etiquettes.

There the 'Improved customer care system' will require the following actions:

1. Establishing a dedicated section for undertaking the "Commercial" function – Commercial Unit
2. A relook and probably redrafting the 'Citizens' Charter' for water supply, sewerage, water conservation and reuse
3. Thorough study and evaluation of the existing public relations and complaint handling system
4. Redefining roles, providing adequate and appropriate staff to resolve customer complaints at the Depot office level itself.
5. Customised 'Customer Service System' software and hardware put in place for use by staff of Commercial Unit
6. Outsourcing the collection work
7. Training of staff for them to provide the level of service needed

A9.4.7 Improved HR management and HR development Plan

(1) HR management

The key HRM management initiatives, towards organizational strengthening of CMWSSB are listed below.

- CMWSSB has to develop a business linked, objective 'Performance Management System' for the employees - driving accountability through a revised review mechanism. This should include organization level Key Result Areas and Key Performance Indicators, which have then to cascade down to the individual level.

- The currently prevalent O&M monitoring of a contractor-managed desalination unit requires techno-commercial & legal capabilities as against a pure technical monitoring; the need, however, is for developing internal capabilities of the O&M team by introducing appropriate manpower for monitoring the present and future desalination infrastructure.
- The existing quality assurance team and the hydro-geologist team require to be restructured and strengthened to ensure a revised focus on the aspect of quality assurance and water conservation
- The present C & M Cell has to be revamped to have a fresh outlook towards contracts and risk management for legal assessment of the tender / contract document.
- Strengthening of the Commercial team by i) demarcating the Revenue/ Commercial function from the F&A departments, and ii) improving focus on Billing & Collection by creating roles with dedicated responsibilities
- There is a need to creation a Stakeholder Engagement Cell for engaging in Customer Engagement Surveys before construction of a new project; this team will service the need for a dedicated PR, Branding and Marketing, for developing ads and outreach programmes for CMWSSB; thus modified roles & responsibilities and manpower have to be put in place to facilitate this transition.
- To keep pace with the present times it is essential to IT enable all F&A and HRM processes to reduce administrative hassles (Online Service Book, Leave Management System, Etc.) Strengthening of in-house IT Function by making the presence of IT Staff in all departments for resolution of User issues;

(2) HR Development

The following sets of actions are essential towards HR Development and capacity building of CMWSSB

- CMWSSB has to draft and introduce a new Human Resource Development Policy document for providing an impetus to the declining focus on capacity building. The CMWSSB HRD Policy, based on a strategic approach, would cover the policy framework, policy statement and objectives, HRD and Training strategy, and Implementation related aspects etc. to achieve a target of minimum 15 days ‘need based’ training to at least 50% of staff in a training year.
- The initiative taken in 1982 has once again got to be revived by developing the Training Centre into becoming a self sustaining “Centre of Excellence”. As a possible first action, a retired Head of one the Business Schools should be contracted by CMWSSB to head the Centre.
- Formulation and operation of human resources development plan: The list of training topics identified in the Table below forms the basis of the human resources development plan.

Table: A9.5.6 Training Titles and Estimated number of participants

1. Management Training

S.No	Course Title	Estimated number of participants		
		PIU	CMWSSB	Total
1.	Understanding leadership and management	6	20	26

S.No	Course Title	Estimated number of participants		
		PIU	CMWSSB	Total
1.	Understanding leadership and management	6	20	26
2.	Understanding project management concepts	8	50	58
3.	How to use MS Project / Primavera software for project management	8	50	58
4.	Understanding requirements of construction supervision (Project implementation)	17	50	67
5.	Understanding contract management process and risk management principles	10	30	40
6.	Contract administration and procurement procedures – FIDIC conditions	6	30	36
7.	Understanding JICA procurement procedures	7	8	15
8.	How to monitor and report physical & financial progress of work	18	35	53
9.	Land acquisition, resettlement and rehabilitation policies	10	40	51
10.	How to prepare a traffic management plan	9	30	39
11.	Financial accounting and management in Projects	6	23	29
12.	Understanding commercial banking operations and statutory requirements under IT Act (TDS) and Service Tax for contract management	6	50	56

2. Technical Training

1.	Urban water and sewerage management	Course part of CMWSSB Annual Training calendar		
2.	Construction of water supply and sewerage system - planning, norms, and institutional issues	Course part of CMWSSB Annual Training calendar		
3.	Operation and maintenance of water supply network	Course part of CMWSSB Annual Training calendar		
4.	Preventive maintenance of water and sewerage network	Course part of CMWSSB Annual Training calendar		
5.	Leak detection and loss management in the water supply network	Course part of CMWSSB Annual Training calendar		
6.	How to carry out topographical surveys, using total station equipment	Course part of CMWSSB Annual Training calendar		
7.	Quality Assurance Systems and TQM for Water Supply projects	Course part of CMWSSB Annual Training calendar		
8.	Quality control tests in field and laboratories	Course part of CMWSSB Annual Training calendar		
9.	Reorientation of computer skills with respect to updated versions of MS Office - MS Word and MS Excel, internet explorer, send e-mails and carry out electronic data transfer	Course part of CMWSSB Annual Training calendar		
10.	Performance and operating conditions of RO and nano-filtration technology for seawater desalination using Membrane Processes	11	50	61
11.	Reverse Osmosis Operation and Maintenance fundamental concepts about RO systems	11	50	61
12.	Reverse Osmosis Monitoring, Interpreting Water Analysis, Bio-fouling Control Recordkeeping, data interpretation and Reporting	11	50	61
13.	Operations Overview and Environmental Compliance Requirements	11	50	61
14.	How to use GIS and GPS	17	50	67
15.	Basic concept on how to use SCADA	5	15	20
16.	Concepts/ principles of 'Energy management audit'	5	50	55

3. Customized workshops

1.	Understanding elements and developing CMWSSB Quality Policy	3	16	19
2.	Tariff setting and revenue collection practices for	-	100	100

	CMWSSB			
3.	Concepts of asset management	-	18	18
4.	How to enter asset data, generate reports and manage asset e-register	-	120	120
5.	How to prepare an asset maintenance plan for CMWSSB	-	18	18
6.	Customized MIS operations for CMWSSB	15	50	65
7.	Complaint handling system and public relations for CMWSSB	-	100	100

4. Study Tours –

- i. In-Country exposure visits for 6 days (10 participants) @ 2 visits per year for 3 years; total participation 60 Nos.
- ii. Overseas exposure visits for 5 days (10 participants) @ 1 visit per alternate year over 5 years; total participation 30 Nos.

Each of these training topics have been translated into ‘Training profile sheets’ which serve as ‘Terms of Reference’ for those who are to deliver the training. At this early training planning stage, one needs to be open minded and flexible on aspects like duration, training methods etc. However, clear titles, precise training objectives and a short description of the key concept in key words, or indicative course contents, has been provided to avoid confusion when the modules are to be produced by training providers. Wherever ‘*Case Studies*’ have been suggested, it is expected that the training providers will assimilate ‘*best practices*’ globally and use them as a method of demonstration to the participants. The next section includes these Training profile sheets

Training profile sheets

TITLE
TARGET GROUP

OBJECTIVE / S

KEY CONCEPTS-

Understanding Leadership and Management

PIU: PD, PM, FM, select Dy PM -

CMWSSB: select CE, SE and EE; ED, GM

After the training the participants will be able to

1. develop a change management plan

2. find solutions to leadership issues at the work place

- What is leadership? The difference between leadership and management; Assessing leadership competencies and developmental needs; Articulate leadership vision, in light of the assessment, and consider the best way(s) to realize it
- Processes for establishing direction, aligning people, and motivating people to follow the vision
- Identifying different leadership style: Tasking, Encouraging, Steering, Entrusting
- Leading Effective Teams
- What is a team? The stages of team development: Forming, Storming, Norming, Performing, Adjourning
- Leading and maintaining effective, productive teams
- Evaluating team progress and coaching team members as necessary
- Building Relationships: How individual differences affect your ability to lead
- Identifying motivational patterns: How to be more influential by understanding motivational patterns; Using an understanding of individual differences to help manage conflict more effectively
- Ethics and Leadership: The definition of ethics and the link between ethics and trust; The role of ethical leadership and leadership; The difference between personal and organizational ethics; Discuss the effect of the triple constraint on ethics
- Negotiating Conflict; Major sources of conflict on project teams
- The five modes of handling conflict – Forcing, Smoothing,

	<ul style="list-style-type: none"> • Withdrawing, Compromising, Problem Solving • The difference between competitive negotiation and collaborative negotiation • Conflict scenarios and strategies for initiating conflict resolution • Power bases used in typical organizations • How to plan and conduct collaborative negotiation • Leading Change – Self’s Role in a changing organization; Predictable stages of adjusting to change; Appropriate leadership strategies for each stage • Developing a change management plan
	Mock exercises and Role Plays
DURATION	Three (3) Days
VENUE – Institute, Location	Indian Institute of Management, Bangalore
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation)	INR 19500 per head per day
	Source: JICA Study Team
TITLE	Understanding Project Management concepts
TARGET GROUP	PIU: PD, PM, FM, Dy PM - CMWSSB: CE, SE, select EE & AEE
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Understand the concepts 2. Apply project management principles 3. Use Project Management Planning Software
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Introduction to Project Management; What are “projects”?; Why project management? • The project life cycle; Influences on a project; Key stakeholders • Project management process groups; Project manager responsibilities • Project Initiation • Understanding the role of senior management • Needs Assessment; Project selection; Benefit/cost ratio; Present value and net present value • Building SMART objectives – Specific, Measurable, Agreed to, Realistic, Time-constrained • Developing Requirements; Project charters; Project Requirements Document • Project Planning; Scope planning; The work breakdown structure • Estimating; Schedule Planning • Network Diagrams – CPM; Speeding up the Schedule • Project Management Planning Software – PRIMAVERA / MS PROJECT (OVERVIEW ONLY – Software training covered separately) • Cost Planning • Responsibility Matrix; Resource Loading and Levelling; Risk Planning; Procurement • Planning; Communication and quality planning • Project Implementation; Baselines; Developing the project team; Organizations and team structures; Managing change; Managing Risk • Performance reporting; Assessing and monitoring project performance • Reserves; Earned value; Sunk costs • Project Closeout – Scope verification and acceptance; Administrative and contractual closure • Transferring lessons learned to current/future project • Case study
DURATION	Two (2) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Project Management Institute, NOIDA
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation)	INR 3500 per head per day
	Source: JICA Study Team

TITLE	How to use Primavera / MS Project software for project management
TARGET GROUP	PIU: All Dy PM, all FE CMWSSB: select EE & AEE
OBJECTIVE / S	After the training the participants will be able to 1. Understand the concepts 2. Confidently apply Primavera / MS Project software for project management in current works
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<p>Overview</p> <ul style="list-style-type: none"> • Building a Project plan. • Networking techniques for Time, Resource and Cost Scheduling – Tracking and Monitoring of projects • Multiple Project Management, Data interface with Excel • Project coordination and integration management • Tracking Progress • Assessing the quality of the project. • Communication <p>Software demonstration and application</p> <ul style="list-style-type: none"> • Activities, Calendars- Definition, Sequencing & Estimate Duration • How to Develop a Schedule Plan and Control • Network Analysis-CPM, PERT,PDM • How to Prepare Work Breakdown Structure (WBS) • How to update WBS • Constraints • How to Manage Cost in a Project • How to do Resource Planning and Cost Estimation • How to Prepare Resource Sheet • How to Apply Resource to each Activity • How to Define Resource Pool and to Allocate Resources • Filters and Grouping • How Material Resources are being allocated • Analyzing resources using Crashing, Stretching & Splitting • Earned Value Analysis • Method of Developing Different types of reports according to Industrial needs • Schedule in multiple Projects • Customization • Exercise Project <p>Practical exercises to reinforce topics covered</p>
DURATION	Four (4) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Project Management Institute, NOIDA
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation)	INR 3500 per head per day
Special requirements	One computer should be available per participant with Primavera / MS Project software

Source: JICA Study Team

TITLE	Understanding requirements of Construction Supervision (Project Implementation)
TARGET GROUP	PIU: PM, All Dy PM, all FE, CMWSSB: select SE's, select EE & AEE
OBJECTIVE / S	After the training the participants will be able to 1. Prepare a checklist / Do-list to follow when supervising projects 2. Implement best practices of construction supervision 3. Execute timely closure to the projects supervised
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Overview of contract documents • Roles of Employer, Engineer and Contractor, Contract Administration • Encumbrances at site, social and environment concerns • Specifications and standards • Quality control, testing procedures, recording of results

	<ul style="list-style-type: none"> • Quantity measurements and checks, recording of measurement • Variation Orders, fixing of rates • Liquidated Damages, Updating of Program, Extension of time • Determination of Contract • Dispute Resolution Mechanisms • Processing of IPCs and Final Payments • Supervision during Defect Liability Period • Case Study
DURATION	Two (2) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Engineering Staff College of India, Hyderabad
METHOD/S	Interactive presentations
COST (Indicative approximation)	INR 3000 per head per day
Source: JICA Study Team	
TITLE	Understanding Contract Management process
TARGET GROUP	PIU: PM, FM, All Dy PM, all FE, CMWSSB: select SE's, select EE & AEE, CoF, Dy. CoF
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Understand the concepts 2. Apply contract management principles to current / future projects
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Contract management definition; Description and uses of contracts; Client and Contractor perspectives • Teamwork—Roles and Responsibilities; Concept of agency; Types of authority; Privacy of contract; Contractor personnel • Concepts and Principles of Contract Law; Mandatory elements of a legally enforceable contract; Terms and conditions; Remedies; Interpreting contract provisions • Contracting Methods; Contracting methods—competitive and noncompetitive; Purchase cards, imprest funds or petty cash; Sealed bidding, two-step sealed bidding, competitive negotiation and competitive proposals; • Purchase agreements vs. contracts; Single-source negotiation vs. sole-source negotiation • Developing Contract Pricing Agreements; Uncertainty and risk in contract pricing • Categories and types of contracts; Incentive; Fixed-price; Time and materials; Cost-reimbursement ; Selecting contract types • Pre-award Phase: Buyer activities –Plan purchases and acquisitions; Plan contracting; Request response; Bid/no-bid decision; Bid or proposal preparation • Award Phase: Source selection process; Selection criteria: management, technical and price criteria; Evaluation standards, Evaluation procedures • Negotiation objectives; Negotiating a contract; Tactics and counter-tactics; Document agreement or walk away • Contract Administration: Key contract administration policies, Continued communication, Tasks for Client and Contractor • Contract analysis: Performance and progress; Records, files and documentation • Resolving claims and disputes • Termination • Case studies
DURATION	Three (3) days
VENUE – Institute, Location	National Institute of Management Studies, (NIMS) Chennai
METHOD/S	Interactive presentations, Practical working exercises
COST (Indicative approximation)	INR 1800 per head per day
Source: JICA Study Team	
TITLE	Contract administration and procurement procedures – FIDIC

		conditions
TARGET GROUP		PIU: PM, FM, select Dy PM, select FE, CMWSSB: select SE's, select EE & AEE, CoF, Dy. CoF
OBJECTIVE / S		After the training the participants will be able to
		1. Comprehend the various FIDIC conditions of contract
		2. Carry out procurement using FIDIC conditions of contract
KEY INDICATIVE OUTLINE	CONCEPTS- PROGRAMME	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Principles ○ Background to FIDIC Contracts ○ Harmonisation based on the type of project ○ FIDIC Family of Conditions of Contract ○ Principles and general review of the FIDIC Contracts • Features <ul style="list-style-type: none"> ○ Structure of the FIDIC contracts ○ Clauses and other documents in the Contracts for Construction and for Plant & Design-Build ○ Forms ○ Terms and definitions • User Friendliness <ul style="list-style-type: none"> ○ Design Responsibilities and Workmanship ○ Obligations and quality procedures for design and construction • Contract Preparation <ul style="list-style-type: none"> ○ Procedures during Construction ○ Project management procedures during construction ○ Financial Procedures ○ Procedures for variations and payment • Risk allocation <ul style="list-style-type: none"> ○ Works contract and service agreement discrepancies ○ Claims Procedures ○ Procedures for submitting and dealing with claims by the Employer and the Contractor ○ Dispute Resolution ○ The Dispute Adjudication Board and other dispute resolution procedures • Case Study
DURATION		Three (3) Days
VENUE – Institute, Location		In- house, CMWSSB Training Centre
FACULTY		By invitation from NICMAR (PUNE)
METHOD/S		Interactive presentations
COST (Indicative approximation)		INR 3500 per head per day
		Source: JICA Study Team
TITLE		Understanding JICA procurement procedures
TARGET GROUP		PIU: PD, PM, FM, All Dy PM, all FE, CMWSSB: select SE's, select EE & AEE, CoF, Dy. CoF
OBJECTIVE / S		After the training the participants will be able to
		1. Understand the concepts
		2. Apply JICA procurement principles to current / future projects
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE		<ul style="list-style-type: none"> • Definition; Description and uses; • Concepts and Principles of Contract Law with respect to JICA; Terms and conditions; Interpreting contract provisions • Contracting methods—competitive and non-competitive; Sealed bidding, two-step sealed bidding, competitive negotiation and competitive proposals; • JICA prescribed agreements vs. contracts; Single-source negotiation vs. sole-source negotiation • Categories and types of contracts; Incentive; Fixed-price; Time and materials; Cost-reimbursement ; Selecting contract types

	<ul style="list-style-type: none"> Contract Administration: Key contract administration policies, Continued communication, Tasks for Client and Contractor Contract analysis: Performance and progress; Records, files and documentation Termination Case studies
DURATION	One (1) day workshop
FACULTY	By invitation from JICA, New delhi
VENUE – Institute, Location	In- house, CMWSSB Training Centre
METHOD/S	Interactive presentations, Practical working exercises
COST (Indicative approximation)	INR 500 per head per day
	Source: JICA Study Team
TITLE	How to monitor and report physical & financial progress of work
TARGET GROUP	PIU: PM, FM, select Dy PM, select FE, CMWSSB: select SE's, select EE & AEE, CoF, Dy. CoF
OBJECTIVE / S	After the training the participants will be able to 1. Understand the need for progress monitoring and reporting 2. Monitor and report physical & financial progress of work in the prescribed form
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> Overview – principles Choice of Key Performance Indicators <ul style="list-style-type: none"> Traditional Physical Progress Measurement Limits Effort-Based KPIs Comparison Overall Physical Progress Index <ul style="list-style-type: none"> Weight Matrix Overall Physical Progress Equation 'S Curve' of the Overall Physical Progress Baseline to Measure Against <ul style="list-style-type: none"> Planned Baseline Ideal Baseline Comparison Visual Management Document Management System to view <ul style="list-style-type: none"> Construction equipment details, Meeting/Site visit reports Contract & Correspondence documents, Quality Reports, etc. Executive summary of progress details (including latest, location map, Linear & Numerical progress details) Following type of information from site office <ul style="list-style-type: none"> Contractor Schedule Work Progress Financial Progress Bill information Quality Maintenance details Customised reports <ul style="list-style-type: none"> Physical Progress Report – Quantity wise Physical Progress Bar Chart Financial Progress Report Bill payment status report 'S-curve report' Case Study Practical working exercises
DURATION	Three (3) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Engineering Staff College of India, Hyderabad
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation)	INR 3200 per head
	Source: JICA Study Team

TITLE	Land acquisition, resettlement and rehabilitation policies
TARGET GROUP	PIU: PM, FM, select Dy PM, select FE, CMWSSB: select SE's, select EE & AEE, CoF, Dy. CoF, select SAO
OBJECTIVE / S	After the Seminar the participants will be able to 1. Understand the statutes and clauses of LA act 2. Apply the guidelines in infrastructure projects
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • GoI & GoTN Land acquisition, resettlement and rehabilitation policies • Land Acquisition Act • Ownerships of land • Action necessary for acquisition depending on ownership of land <ul style="list-style-type: none"> ○ Private land ○ Government land ○ Defence land • Importance of accurate valuation • Role of CMWSSB officers in land Acquisition • Procedure and documentation • How to expedite the procedure
DURATION	One (1) day
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Administrative Staff College of India, Hyderabad
TRAINING METHODS	Interactive presentations, group discussions
COST (Indicative approximation)	INR 3000 per head per day
Source: JICA Study Team	

TITLE	How to prepare a Traffic Management Plan
TARGET GROUP	PIU: PM, select Dy PM, select FE, CMWSSB: select SE's, select EE & AEE
OBJECTIVE / S	After the training the participants will be able to 1. Comprehend the national (IRC & UTIPEC) and international guidelines 2. Understand the use and principles of traffic signs and design the same using IRC 67: 2012 3. Understand the use and principles of road markings and design the same using IRC 37
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Traffic management at construction zones • Safety at constriction zones • Traffic management measures at accident sites • Traffic management planning in urban areas, rural areas and intercity sections • Select and design urban street furniture such as bollards, guard rails and crash barriers • Design the bus stops and bus bays for urban conditions
DURATION	Two (2) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from Central Road Research Institute, New Delhi
TRAINING METHODS	Interactive presentations and practice sessions
COST (Indicative approximation)	INR 3000 per head per day
Source: JICA Study Team	

TITLE	Financial Accounting and Management in Projects
TARGET GROUP	PIU: PM, FM, select Dy PM, select FE, CMWSSB: select EE & AEE, CoF, select SAO
OBJECTIVE / S	After the training the participants will be able to 1. understand succinctly financial accounting concepts 2. comprehend different principles of financial accounting 3. Understand Generally Accepted Accounting Principles (GAAP) 4. Develop skills in analysing and interpreting financial and accounting information 5. Identify limitations of Financial Accounting
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Role of Financial Accounting

	<ul style="list-style-type: none"> ○ Principles of Financial Accounting ○ Importance of Financial Accounting ○ Benefits of Financial Accounting ○ Limitations of Financial Accounting
	<ul style="list-style-type: none"> ● Accounting Principles <ul style="list-style-type: none"> ○ Accounting Concepts and Conventions ○ Accounting Standards in India and International Accounting Standards
	<ul style="list-style-type: none"> ● Information for decision making both financial and non-financial
	<ul style="list-style-type: none"> ● Understanding and analysing the balance sheet, income statement and cash flow statement
	<ul style="list-style-type: none"> ● Planning, budgeting and cash flow forecasting
	<ul style="list-style-type: none"> ● Cash flow and working capital management
	<ul style="list-style-type: none"> ● Understanding and managing costs
	<ul style="list-style-type: none"> ● Break-even and contribution analysis
	<ul style="list-style-type: none"> ● Driving and monitoring divisional performance
	<ul style="list-style-type: none"> ● Preparing and evaluating capital project appraisals
	<ul style="list-style-type: none"> ● How to drive and monitor performance and create value
	<ul style="list-style-type: none"> ● Case studies
	<ul style="list-style-type: none"> ● Practice exercise
DURATION	Two (2) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from ASCI
TRAINING METHODS	Interactive presentations, Case studies, Example exercise
COST (Indicative approximation)	INR 3000 per head per day

Source: JICA Study Team

TITLE	Understanding commercial banking operations and statutory requirements under IT Act (TDS) and Service Tax for contract management
TARGET GROUP	PIU: PM, FM, select Dy PM, select FE, CMWSSB: select EE & AEE, CoF, select SAO, AO, JAO
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Conversant with different commercial practices and options 2. Efficiently use banking facilities 3. Facilitate compliance with tax rules
KEY CONCEPTS-	<ul style="list-style-type: none"> ● Commercial banking practices and procedures ● How to open an LC ● How to prepare BG's ● Procedure for encashing a BG ● Provisions relating to TDS under IT ACT and provisions of Service tax law
DURATION	Two (2) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from ASCI
TRAINING METHODS	Interactive presentations, Case studies, Example exercise
COST (Indicative approximation)	INR 3000 per head per day

Source: JICA Study Team

TITLE	How to operate MS Office including MS Word and MS Excel, internet explorer, send e-mails and carry out electronic data transfer
TARGET GROUP	PIU: select staff who are not conversant with computers CMWSSB: select staff who are not conversant with computers
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Connect computer hardware 2. Prepare letters and simple reports in MS Word 3. Tabulate information in MS Excel 4. Carry out web search and send emails/ transfer data 5. Use maintenance software
KEY CONCEPTS- INDICATIVE	<ul style="list-style-type: none"> ● Using Windows XP

PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Working in MS Word • Working in MS Excel • Zipping / Unzipping files & folders • Internet Technologies • anti virus software usage • Back up procedures • Exercises
DURATION	Five (5) Days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	National Informatic Centre (NIC), Chennai
TRAINING METHODS	Interactive presentations, Demonstrations, Example exercise
COST (Indicative approximation)	INR 1800 per head per day
Special requirements	One computer should be available per participant
<small>Source: JICA Study Team</small>	
TITLE	Construction of sewerage system - planning, norms, and institutional issues
TARGET GROUP	As per CMWSSB Annual training calendar
COST (Indicative approximation)	CPHEEO Sponsored
<i>OPTIONAL</i>	
OBJECTIVE / S	After the training the participants will be able to: <ol style="list-style-type: none"> 1. Understand concepts of Technical Planning, Management and Organization 2. Carry out selection of a management system 3. Practice the correct construction procedure
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Technical Planning <ul style="list-style-type: none"> ○ Route Selection ○ Sewer Design ○ Sewer Alignment ○ Estimating Works • Management and Organization <ul style="list-style-type: none"> ○ Project Cycle ○ Levels of Management ○ Administration and Logistics ○ Site Management • Appropriate Setting Out Methods <ul style="list-style-type: none"> ○ General Observations ○ The Centre Line ○ Ditching and Sloping • Construction Procedures <ul style="list-style-type: none"> ○ Site overview ○ Clearing ○ Earthworks ○ Embankments ○ Drainage ○ Culverts ○ Compaction ○ Erosion Protection
DURATION	Three (3) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from ESCI, Hyderabad
TRAINING METHODS	Presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 3200 per head per day
<small>Source: JICA Study Team</small>	
TITLE	How to carry out topographical surveys, using total station equipment
TARGET GROUP	As per CMWSSB Annual training calendar
COST (Indicative approximation)	CPHEEO Sponsored
<i>OPTIONAL</i>	
OBJECTIVE / S	After the training the participants will be able to

	<ol style="list-style-type: none"> 1. Familiar with every component of the Total Station equipment 2. Take measurement with the equipment 3. Collect and present survey data
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Total Station <ul style="list-style-type: none"> ○ Technology ○ Advantages of Total Station Surveying ○ Limitations • Equipment handling procedure <ul style="list-style-type: none"> ○ Components Used in Total Station Surveying ○ RTK Positioning • Measurements <ul style="list-style-type: none"> ○ Coordinate measurement ○ Angle measurement ○ Distance measurement • Data processing, recording and data presentation • Exercise - Practice session (each participant to practice)
DURATION	Two (2) days
VENUE – Institute, Location	IIT, Madras
TRAINING METHODS	Interactive presentations, Field Demonstration and practice sessions
COST (Indicative approximation)	INR 1300 per head per day
Source: JICA Study Team	
TITLE	Quality Assurance Systems and TQM for Water supply and Sewerage projects
TARGET GROUP	As per CMWSSB Annual training calendar
COST (Indicative approximation)	CPHEEO Sponsored
<i>OPTIONAL</i>	
OBJECTIVE / S	<p>After the training the participants will be able to</p> <ol style="list-style-type: none"> 1. Explain the meaning of total quality management (TQM) 2. Identify costs of quality 3. Apply tools for identifying and solving quality problems
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Overview • Elements of total quality management (TQM) • Customer-focused • Total employee involvement • Process-centered • Integrated system • Continual improvement • Fact-based decision making • Communications • TQM practices <ul style="list-style-type: none"> • cross-functional outcome • process management • supplier quality management • customer involvement • information and feedback • committed leadership • strategic planning • cross-functional training • employee involvement • How to implement Quality Assurance • Quality management plan • Quality metrics • Process improvement plan • Work performance information • Approved change requests • Quality control measurements • Quality Assurance Outputs • Requested changes • Recommended corrective actions • Project management plan updates

	<ul style="list-style-type: none"> • Quality Control Methods • Statistical Quality Control with sampling by attributes • Statistical Quality Control with sampling by variables • The seven tools: • Cause-and-effect diagram (also known as the “fishbone” or Ishikawa diagram) • Check sheet • Control chart • Histogram • Pareto chart • Scatter diagram • Stratification (alternately, flow chart or run chart) • Exercise to apply each of the above
	<ul style="list-style-type: none"> • Quality Audit • Why Audit? • What is an Audit? • Types of Audit • Internal and External Audits • The purpose of an Internal Audit System • The structure of an Internal Audit System • The basic approaches to Auditing • Organizing Audits: Management • Auditors • Exercise in Auditing
DURATION	Five (5) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from NICMAR (PUNE)
METHOD/S	Interactive presentations, Practical working exercises
COST (Indicative approximation)	INR 3300 per head per day
Source: JICA Study Team	
TITLE	Performance and operating conditions of RO and nano-filtration technology for seawater desalination using Membrane Processes
TARGET GROUP	PIU: PD, PM, Dy PM, and select FE, CMWSSB: select CE, SE’s, EE & AEE
OBJECTIVE / S	After the training the participants will be able to Understand practical concepts of products, design process, operation conditions of membrane systems and economics of the membrane desalting and water treatment applications
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • an introduction to membrane technology, • description of commercial membrane elements, • illustration of the membrane system design process • overview of systems operation.
DURATION	One (1) day
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from IIT, Madras and Perur Plant vendor
TRAINING METHODS	Presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 1300 per head per day
Source: JICA Study Team	
TITLE	Reverse Osmosis Operation and Maintenance fundamental concepts about RO systems
TARGET GROUP	PIU: PM, Dy PM, and select FE, CMWSSB: select CE, SE’s, EE & AEE
OBJECTIVE / S	After the training the participants will be able to Understand practical aspects of Operation and Maintenance of RO systems
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • water contamination, • membranes, • pressure vessels, • operation, • potential problems, • pre-treatment and

DURATION	<ul style="list-style-type: none"> chemical cleaning.
VENUE – Institute, Location	One (1) day
FACULTY	In- house, CMWSSB Desalination Plant Nemmeli/Minjur
TRAINING METHODS	By invitation from RO Nemmeli/Minjur DSP Operator, IITM and Perur Plant vendor
COST (Indicative approximation)	Presentations, Group discussions, Case studies
Source: JICA Study Team	INR 500 per head per day
TITLE	Reverse Osmosis Monitoring, Interpreting Water Analysis, Bio-fouling Control Recordkeeping, data interpretation and Reporting
TARGET GROUP	PIU: PM, Dy PM, and select FE, CMWSSB: select CE, SE's, EE & AEE
OBJECTIVE / S	After the training the participants will be able to apply basic and advanced understanding of operations to the new plant at Perur
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<p>Reverse Osmosis Monitoring</p> <ul style="list-style-type: none"> interpretation of data, <ul style="list-style-type: none"> permeate conductivity, feed pressures, cleaning and element replacement rates understanding of RO technology, monitoring and troubleshooting skills, understanding of performance trends <p>trend interpretation and actions required to correct problems</p> <p>Interpreting Water Analysis</p> <ul style="list-style-type: none"> source waters, contaminants, reading water analysis reports, evaluating scaling and fouling potentials <p>Bio-fouling Control</p> <ul style="list-style-type: none"> overview of bacteria, water characteristics, design and operational schemes that promote biofouling case studies
DURATION	One (1) day
VENUE – Institute, Location	In- house, CMWSSB Desalination Plant Nemmeli/Minjur
FACULTY	By invitation from RO Nemmeli/Minjur DSP Operator, IITM and Perur Plant vendor
TRAINING METHODS	Presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 500 per head per day
Source: JICA Study Team	
TITLE	Operations Overview and Environmental Compliance Requirements
TARGET GROUP	PIU: PM, Dy PM, and select FE, CMWSSB: select CE, SE's, EE & AEE
OBJECTIVE / S	After the training the participants will be able to apply basic and advanced understanding of operations to the new plant at Perur
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> Plant Description Influent Water Quality Product Water Quality Waste Stream Management Treatment Process Overview Operational Parameters <p>Environmental Compliance</p> <ul style="list-style-type: none"> Environmental Compliance Overview Parameters monitored - Temperature; pH; SDI; Conductivity; Turbidity; TOC; Barium; Boron; Bromide; Chloride; Alkalinity; Hydrogen; Carbonates; Strontium; Sulphates; Calcium; Magnesium; Sodium; Potassium; Total Bacteria; TDS; Colour; Iron; Metals; Total

	Coliform
	<ul style="list-style-type: none"> • Reporting Requirements • Facilities
DURATION	One (1) day
VENUE – Institute, Location	In- house, CMWSSB Desalination Plant Nemmeli/Minjur
FACULTY	By invitation from RO Nemmeli/Minjur DSP Operator, IITM and Perur Plant vendor
TRAINING METHODS	Presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 1300 per head per day
Source: JICA Study Team	
TITLE	How to use GIS and GPS
TARGET GROUP	PIU: All FE, CMWSSB: select AEE, AE / JE
OBJECTIVE / S	After the training the participants will be able to
	1. Comprehend the concept of GPS
	2. Use GIS techniques
	3. Confidently use the GIS and GIS equipment to record data
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • GPS <ul style="list-style-type: none"> ○ Basic concept of GPS ○ Structure <ul style="list-style-type: none"> ▪ Space segment ▪ Control segment ▪ User segment ○ Applications ○ Message format ○ Satellite frequencies ○ Demodulation and decoding ○ Navigation equations ○ Bancroft's method ○ Multidimensional Newton-Raphson calculations ○ Error sources and analysis ○ Accuracy enhancement and surveying ○ Augmentation ○ Precise monitoring ○ Equipment handling procedure • GIS <ul style="list-style-type: none"> ○ Applications ○ GIS techniques and technology ○ Relating information from different sources ○ GIS uncertainties ○ Data representation ○ Data capture ○ Raster-to-vector translation ○ Projections, coordinate systems, and registration ○ Spatial analysis with GIS ○ Slope and aspect ○ Data analysis ○ Topological ○ Geometric Networks ○ Hydrological ○ Cartographic ○ Map overlay ○ Geo-statistics ○ Address geo-coding ○ Reverse geo-coding ○ Multiple Criteria Decision Analysis ○ Data output and cartography ○ Graphic display techniques ○ Spatial Extract, Transform, Load (ETL) software ○ GIS data mining

	<ul style="list-style-type: none"> ○ OGC standards ○ Equipment handling procedure
	<ul style="list-style-type: none"> ● ‘MAP INFO’ TRAINING (OPTIONAL) <ul style="list-style-type: none"> ○ File operations (open & close MapInfo; transfer files between directories; add & delete files & workspaces) ○ Move around an open Mapper (pan, zoom, change scale, grabber etc.) ○ Examine & interpret data in a Mapper or browser view ○ Change the appearance of a map ○ Use of labelling & the I Tool; use of layer control ○ Carrying out simple queries (by attribute & by location) ○ Simple thematic mapping & graphing ○ Map layout; making & printing a map ○ Adding a field to a browser table; attribute data entry; computing the contents of a field ○ Importing data from a spreadsheet ○ Simple SQL queries ○ An integrating exercise ○ The underpinning principles of a GIS ○ Directories & folder structures ○ Difference between vector & raster data ○ The importance of coordinate & IDs ○ The difference between graphic features & their attributes ○ What is thematic mapping; main types; where & how to use ○ What are the main GIS functions
	<ul style="list-style-type: none"> ● Practical exercises to reinforce topics covered
DURATION	Three (3) Days
VENUE – Institute, Location	By invitation from Anna University, Chennai
TRAINING METHODS	Interactive presentations, Demonstrations, Example exercise
COST (Indicative approximation)	INR 1800 per head per day
Source: JICA Study Team	
TITLE	Concepts of Asset management
TARGET GROUP	CMWSSB: ED, GM, FD, select SE, EE, AEE, AE / JE
OBJECTIVE / S	After the Workshop the participants will be able to: <ol style="list-style-type: none"> 1. Understand the role asset management plays in supporting organizational strategy and objectives 2. Comprehend the principles of asset whole life costing 3. Describe the role of Risk Management in effective Asset Management 4. Measure the Asset Management performance
KEY CONCEPTS - INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> ● Introduction to Asset Management ● What is Asset Management? <ul style="list-style-type: none"> ○ The benefits of AM over traditional approaches ○ Asset Management Roles & Responsibilities ● Asset Management Policy <ul style="list-style-type: none"> ○ Outline an Asset Management Policy. ○ Relevance of Policies and Strategies ○ Overview of developing a policy ● Asset Management Strategy <ul style="list-style-type: none"> ○ What is an Asset Management Strategy? ○ Outline an Asset Management Strategy ○ Overview of Developing a Strategy ● Asset Management Planning <ul style="list-style-type: none"> ○ What is an Asset Management Plan? ○ Outline of an Asset Management Plan ○ Overview of developing a Plan ● Whole of Life Costing <ul style="list-style-type: none"> ○ Outline Whole of Life Costing principles ○ Total Cost of Ownership

	<ul style="list-style-type: none"> ○ Case Study – Replace v Repair ● Importance of Risk Management in Asset Management ● Importance of measuring Asset Management performance ● Benefits of a Structured Approach to Asset Management ● Case Study – Outline the benefits of AM
DURATION	One (1) day
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from ESCI and Customised Asset Management Software vendor
METHOD/S	Interactive presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 3000 per head per day
Source: JICA Study Team	
TITLE	How to enter asset data, generate reports and manage asset e-register
TARGET GROUP	CMWSSB: select SE, EE, AEE, AE / JE
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Understand the need for maintaining an asset register 2. Authenticate and enter correct data in the asset e-register 3. Generate customised and annual reports for management review
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> ● Overview of asset management software ● Basic data requirements ● Data fields and data entry requirements ● How to prepare and present customized /general reports ● Example exercises
DURATION	Two (2) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from vendor of Customised Asset Management Software
METHOD/S	Interactive presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 500 per head per day
Special requirements	One computer should be available per participant
Source: JICA Study Team	
TITLE	How to enter data, and generate MIS reports
TARGET GROUP	CMWSSB: select SE, EE, AEE, AE / JE
OBJECTIVE / S	After the training the participants will be able to <ol style="list-style-type: none"> 1. Enter data 2. Generate reports 3. Analyze results
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> ● Overview of MIS fields ● Basic data collection protocol ● Basic data entry requirements ● Data fields and data entry requirements ● How to prepare and present customized /general reports ● Example exercises
DURATION	Two (2) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from vendor of Customised MIS Software
METHOD/S	Interactive presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 500 per head per day
Special requirements	One computer should be available per participant
Source: JICA Study Team	
TITLE	Understanding public relations and operate complaint handling system for CMWSSB
TARGET GROUP	CMWSSB: select SE, EE, AEE, AE / JE (DM), JAO

OBJECTIVE / S	After the training the participants will be able to
	1. listen & log complaints; track the records during future references
	2. coordinate with the unit responsible for action
	3. access data
	4. communicate effectively so as to satisfy the customer
	5. understand the technicalities involved
	6. know about tariffs, billing and collection rules
	7. handle emergency situations
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	<ul style="list-style-type: none"> • Customer oriented communication skills • Basic computer data accessing skills • How to handle pressure situations • Telephonic conversations • Customer oriented communication skills • Basic computer data accessing skills
DURATION	Two (2) days
VENUE – Institute, Location	In- house, CMWSSB Training Centre
FACULTY	By invitation from ASCI, Hyderabad and vendor of Customised complaint handling system software
METHOD/S	Presentations, demonstrations and role plays
COST (Indicative approximation)	INR 3000 per head per day
Special requirements	Projection system, phone lines, one computer should be available per participant

Source: JICA Study Team

Table: A9.5.7 Per participant Per Day Cost when visiting the institute

All Figures in INR.

Institute	Per participant per day cost				Rounded off
	Institute Fee + Lodge + Board	D A*	Travel cost*	Total	
IIM (Bangalore)	17000	500	2000	19500	19500
PMI (NOIDA)	14000	500	5000	19500	19500
ESCI (HYD)	11000	500	2000	13500	13500
ASCI (HYD)	11000	500	2000	13500	13500
NICMAR (PUNE)	8000	500	2500	11000	11000
CRRRI (DEL)	5000	500	5000	10500	10500
IIT Madras (CHENNAI)	3000	0	0	3000	3000
ANNA University (CHENNAI)	2000	0	0	2000	2000
NIMS (CHENNAI)	3000	0	0	3000	3000
NIC (Chennai)	2000	0	0	2000	2000

*Although, TA, DA is slightly varying for the different levels, for budgeting purpose the highest figures have been considered

Source: JICA Study Team

Table: A9.5.8 Per participant Per Day Cost when faculty is invited (group of 2 faculty) for 3-5 day programmes

All Figures in INR

Institute	Visiting Faculty Fee Per day	Visiting Faculty TA + DA	Venue cost	Total	Per participant per day cost per (20 participants)	Misc. cost, Tea, snacks, stationery per day	Participant TA + DA	Total	Rounded Total
PMI (NOIDA)	60000	0	0	60000	3000	500	0	3500	3500
ESCI (HYD)	45000	9000	0	54000	2700	500	0	3200	3200
ASCI (HYD)	45000	9000	0	54000	2700	500	0	3200	3200
NICMAR (PUNE)	60000	0	0	60000	3000	500	0	3500	3500
CRRRI (DEL)	40000	9000	0	49000	2450	500	0	2950	3000
IIT Madras (CHENNAI)	25000	0	0	25000	1250	500	0	1750	1800
ANNA University (CHENNAI)	25000	0	0	25000	1250	500	0	1750	1800
NIMS (CHENNAI)	25000	0	0	25000	1250	500	0	1750	1800
NIC (Chennai)	25000	0	0	25000	1250	500	0	1750	1800

Source: JICA Study Team

Table: A9.5.9 Per participants Per Day Cost when faculty (group of 2 faculty) is invited for 1-2 day workshops

All Figures in INR

Institute	Visiting Faculty Fee Per day	Visiting Faculty TA + DA	Venue cost	Total	Per participant per day cost (25 participants)	Misc. cost Tea, snacks stationary	Participant TA + DA	Total	Rounded off
PMI (NOIDA)	75000	0	0	75000	3000	500	0	3500	3500
ESCI (HYD)	50000	6000	0	56000	2240	500	0	2740	3000
ASCI (HYD)	50000	6000	0	56000	2240	500	0	2740	3000
NICMAR (PUNE)	70000	0	0	70000	2800	500	0	3300	3300
CRRRI (DEL)	50000	6000	0	56000	2240	500	0	2740	3000
IIT Madras (CHENNAI)	18000	0	0	18000	720	500	0	1220	1300
ANNA University (CHENNAI)	18000	0	0	18000	720	500	0	1220	1300
NIMS (CHENNAI)	18000	0	0	18000	720	500	0	1220	1300
NIC (Chennai)	18000	0	0	18000	720	500	0	1220	1300
IN-House (CMWSSB Training Centre)	0	0	0	0	0	500	0	500	500

Source: JICA Study Team

Study Tours –

Table: A9.5.10 In-Country exposure visits for 6 days (10 participants)

Cost head	Per participant cost	Amount
Travel	20000	200000
Lodge & Board	24000	240000
Visit management charges	5000	50000
Total	49000	490000

Source: JICA Study Team

- Say INR 5,00,000/- per visit

Table: A9.5.11 Overseas exposure visits for 5 days (10 participants)

Cost head	Per participant cost	Amount
Travel (incl. local travel plus visa cost)	70000	700000
Lodge & Board (@ US\$ 120)	39000	390000
Visit management fee/charges	85000	850000
Total	194000	1940000

Source: JICA Study Team

- Say INR 20,00,000/- per visit

Table: A9.5.12 Summary of Training Cost

S. No.	Course Title	Training Provider	Estimated number of participants	Course duration (Days)	Per head Per day cost (INR)	Total INR
Management Training						
1.	Understanding leadership and management	IIM-Blr	26	3	19500	1521000
2.	Understanding project management concepts	PMI-Noida	58	2	3500	406000
3.	How to use MS Project / Primavera software for project management	PMI-Noida	58	4	3500	812000
4.	Understanding requirements of construction supervision (Project implementation)	ESCI-HYD	67	2	3000	402000
5.	Understanding contract management process and risk management principles	NIMS-Chennai	40	3	1800	216000
6.	Contract administration and procurement procedures – FIDIC conditions	NICMAR-Pune	36	3	3500	378000
7.	Understanding JICA procurement procedures	JICA	15	1	500	7500
8.	How to monitor and report physical & financial progress of work	ESCI-HYD	53	3	3000	477000
9.	Land acquisition, resettlement and rehabilitation policies	ASCI-HYD	51	1	3000	153000
10.	How to prepare a traffic management plan	CRRI-DEL	39	2	3000	234000
11.	Financial accounting and management in Projects	ASCI-HYD	29	2	3000	174000
12.	Understanding commercial banking operations and statutory requirements under IT Act (TDS) and Service Tax for contract management	ASCI-HYD	56	2	3000	336000
Sub Total A						5116500
Technical Training						
1.	Urban water and sewerage management	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
2.	Construction of water supply and sewerage system - planning, norms, and institutional issues	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
3.	Operation and maintenance of water supply network	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
4.	Preventive maintenance of water and sewerage network	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
5.	Leak detection and loss management in the water supply network	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
6.	How to carry out topographical surveys, using total station equipment	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
7.	Quality Assurance Systems and TQM for Water Supply projects	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
8.	Quality control tests in field and laboratories	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
9.	Reorientation of computer skills updated versions of MS Office	Course part of CMWSSB Annual Training calendar				CPHEEO sponsored
10.	Performance and operating conditions of RO and nano-filtration technology for seawater desalination using Membrane Processes	IITM-Chennai	61	1	1300	79300
11.	Reverse Osmosis Operation and Maintenance fundamental concepts about RO systems	DSP Operator	61	1	500	30500
12.	Reverse Osmosis Monitoring, Interpreting Water Analysis, Bio-fouling Control Recordkeeping, data interpretation and Reporting	DSP Operator	61	1	500	30500
13.	Operations Overview and Environmental Compliance Requirements	IITM-Chennai	61	1	1300	79300

14.	How to use GIS and GPS	ANNA University	67	3	1800	361800
15.	Basic concept on how to use SCADA	DSP Operator	20	1	500	10000
16.	Concepts/ principles of 'Energy management audit'	DSP Operator	55	1	500	27500
Sub Total B						618900

Customized workshops

1.	Understanding elements and developing CMWSSB Quality Policy	ASCI-HYD	19	1	3000	57000
2.	Tariff setting and revenue collection practices for CMWSSB	ASCI-HYD	100	1	3000	300000
3.	Concepts of asset management	ESCI-HYD	18	1	3000	54000
4.	How to enter asset data, generate reports and manage asset e-register	Software Vendor	120	2	500	120000
5.	How to prepare an asset maintenance plan for CMWSSB	ESCI-HYD	18	1	3000	54000
6.	Customized MIS operations for CMWSSB	Software Vendor	65	2	500	65000
7.	Complaint handling system and public relations for CMWSSB	Software Vendor	100	2	500	100000
Sub Total C						750000

Source: JICA Study Team

Study Tours –

- i. In-Country exposure visits for 6 days (10 participants) @ 2 visits per year for 3 years; total participation 60 Nos. i.e. 6 batches @ INR 5,00,000/- per batch = INR 30,00,000/-
- ii. Overseas exposure visits for 5 days (10 participants) @ 1 visit per alternate year over 5 years; total participation 30 Nos. i.e. 3 batches @ INR 20,00,000/- per batch = INR 60,00,000/-

Sub Total D = 90,00,000/-

Total Cost = Sub Totals A + B + C + D = 1,54,85,400/-

Table A.9.5.13A Organizational Strengthening Action Plan - Schedule

Activity Group	Actions	2016		2017				2018				2019				2020				2021				2022				
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
1 Autonomous business operations	Develop, Draft, get Board approval and implement cost-recovery policies - Tariff revision, 100% metering, incentive for metering, outsourcing billing and collection			■	■	■																						
	Frame policy to redefine mandate of existing departments and evolve new units to undertake new responsibilities				■	■	■	■	■	■	■	■	■	■														
	Redefine policy with revised administrative and financial powers at CE, SE & EE levels			■	■	■																						
	Develop and introduce human resource development policy			■																								
2 Business Planning	Define long term goals and targets (20 Years) of 'Service Level Indicators', assign responsibilities and communicate to those concerned			■	■					■				■				■				■				■		
	Define benchmaks, agree on annual, midium term and long term targets with respect to Key Financial Indicators, i.e. Revenue Income, Revenue Expenditure			■	■					■				■				■				■				■		
	Monitor progress on the basis of predefined periodicty, evaluate targets and carry out course correction					■				■				■				■				■				■		
3 Water and Sewerage tariff revision and collection system	Prepare and implement promotional campaign for individual house connection							■		■			■				■			■				■			■	
	Notify Consumers and campaign for mandatory water supply and sewerage connection, announcing incentives								■			■			■			■			■			■			■	
	Carry out door-to-door survey to collect data and prepare report on -									■	■	■	■	■	■													
	i) Status of installed water meters																											
	ii) Illegal and unauthorized connections																											
	iii) Other water connections (non-revenue generating)																											
	iv) Present revenue system (meter reading, billing, revenue collection...etc.)																											
	Study survey data report and develop metering implimentation plan																											
	Implement improved service delivery plan based on survey results																											
Design an improved revenue collection system and carry out pilot of the revamped payment system (to include outsourcing of part /all activities of revenue collection)																												
Carry out campaign against defaulters and illegal connections																												
Carry out enforcement of tariff collection 'Rules and Regulations'																												
4 Developing a reliable asset management system	Prepare list of assets of the existing water supply and sewerage facilities and operation offices, clarification of ownership, and asset evaluation																											
	Prepare asset inventory, integrated operation with information management system																											
	Run pilot to debug the system																											
	Establish asset management and operation within CMWSSB: linking financial management and O& M application (well programmed maintenance, proper timing of replacement of equipment)																											
	Build in-house capacity through handholding and helpdesk																											
5 Management information system (MIS)	Study the current management/monitoring practices (situational analysis and needs analysis)																											
	Prepare basic details of inventory of fields required for MIS - organization, operations, personnel, finance, assets, etc.																											
	Design MIS for water supply and sewerage works																											
	Develop, install and pilot test the MIS operations																											
	Prepare manual for MIS operations																											
	Establish and operationalize GIS database of water supply and sewerage facilities																											
	Establish periodicity of data collection / monitoring system																											
Implement data collection / monitoring system of water supply and sewerage network and at WTP/STP facilities																												

Table A.9.5.13 B Organizational Strengthening Action Plan

S.No	Activity Group	Key Actions	Current status	Responsible department/section in CMWSSB	Timeline	Performance Indicator	Lead Implementing Agency
1	Autonomous business operations	Develop, Draft, get Board approval and implement cost-recovery policies - Tariff revision, 100% metering, incentive for metering, outsourcing billing and collection	(a) A draft on Tariff revision has been prepared sought for GoTN approval. (b) Guezzette on Service level bench mark has been published vide L&G-2/2124/2015 dated 10.03.16	Finance Departement [FD]	Jan-17 to Sep-17	100% Metering.	CMWSSB
		Frame policy to redefine mandate of existing departments and evolve new units to undertake new responsibilities	-	Personnel & Administration Department [P&A]	Apr-17 to Mar-19	Approved policy	CMWSSB
		Redefine policy with revised administrative and financial powers at CE, SE & EE levels	Deligation of power with effect from 2010 and need updation on the same	P&A	Jan-17 to Sep-17	Policy on redefined delegation of powers	CMWSSB
		Develop and introduce human resource development policy	M/s Deliotte has prepared the human resource development policy, sought approval from Board.	P&A	Jan-17 to Mar-17	Approved policy	CMWSSB

2	Business Planning	Define long term goals and targets (20 Years) of 'Service Level Indicators', assign responsibilities and communicate to those concerned	To prepare the 20 years service level Indicators	Operations & Maintenance [O&M]	Jan-17 to Mar-22	Approved policy on Service Level indicators for 2035	CMWSSB
		Define benchmarks, agree on annual, medium term and long term targets with respect to Key Financial Indicators, i.e. Revenue Income, Revenue Expenditure	-	FD	Jan-17 to Mar-22	Medium / Long term objectives defined. Implementation of long term objectives already initiated and continues	CMWSSB
		Monitor progress on the basis of predefined periodicity, evaluate targets and carry out course correction	-	FD and O&M	Jul-17 to Sep-22	Updation of Medium and Long Term Business plan achieved based on targets set	CMWSSB
3	Water and Sewerage tariff revision and collection system	Prepare and implement promotional campaign for individual house connection	Promotion campaign is being carried out for expanded area in new water distribution network	O&M	Oct-17 to Jun-22	Short / Medium / Long term plans to be defined and targets to be achieved.	CMWSSB
		Notify Consumers and campaign for mandatory water supply and sewerage connection, announcing incentives	Not available	O&M	Jan-18 to Sep-22	Short / Medium / Long term plans to be defined and targets to be achieved.	CMWSSB
		Carry out door-to-door survey to collect data and prepare report on -	Survey to be conducted	FD and O&M			PMC
		i) Status of installed water meters	Existing details are available and needs updation	O&M	Jan-18 to Jun-19	Achievement of 100% metering, set annual targets to achieve the same	PMC

	ii) Illegal and unauthorized connections				Achiving 0% un-authorization connections	PMC
	iii) Other water connections (non-revenue generating)				Minimization of non-revenue generating connections	PMC
	iv) Present revenue system (meter reading, billing, revenue collection...etc.)		FD		Short / Medium / Long term objectives & targets to be set for achiving 100% efficieny	PMC
	Study survey data report and develop metering implementation plan		O&M	Jan-19 to Jun-19	Phased development plan for Implementation to achieve 100% metering	PMC
	Implement improved service delivery plan based on survey results		O&M	Apr-19 to June-20	Phased development plan for Implementation to achieve 100% coverage	PMC
	Design an improved revenue collection system and carry out pilot of the revamped payment system (to include outsourcing of part /all activities of revenue collection)	At present, CMWSSB is carrying out revenue collection through Depo office, Area office, Head office. No outsourcing is practiced.	FD	Jan-19 to Jun-19	Implementation of Pilot and phase wise implementation for target area	PMC and CMWSSB
	Carry out campaign against defaulters and illegal connections	Being carried out by CMWSSB	O&M	Jul-19 to Dec-22	Achiving 0% un-authorization connections	CMWSSB

		Carry out enforcement of tariff collection 'Rules and Regulations'	Being carried out by CMWSSB for Corporation area	O&M	Jan-20 to Dec-22	Regular Monitoring and 100% Consumer awareness	CMWSSB
4	Developing a reliable asset management system	Prepare list of assets of the existing water supply and sewerage facilities and operation offices, clarification of ownership, and asset evaluation	CMWSSB has assets information and needs updation	O&M	Jan-18 to Jun-21	Creation of Asset Map and functions to customize	PMC
		Prepare asset inventory, integrated operation with information management system	Not available	O&M	Jan-18 to Mar-22		PMC
		Run pilot to debug the system	-	O&M	Jan-19 to Jun-19	Implementation of Pilot and phase wise implementation for target area	PMC
		Establish asset management and operation within CMWSSB: linking financial management and O&M application (well programmed maintenance, proper timing of replacement of equipment)	-	FD and O&M	Jul-19 to Dec-22	Updation of Asset Managemnt System linking to O&M activities	PMC
		Build in-house capacity through handholding and helpdesk	-	O&M	Jul-19 to Dec-22	Establishment of Helpdesk	PMC
5	Management information system (MIS)	Study the current management/monitoring practices (situational analysis and needs analysis)	Existing information available and need updation	P&A	Jul-19 to Dec-22	Establishment of data management & analysis centre [MIS cell]	PMC & CMWSSB
		Prepare basic details of inventory of fields required for MIS - organization, operations, personnel, finance, assets, etc.	-	P&A	Jul-19 to Dec-22	Functional MIS database with customization tools	PMC

		Design MIS for water supply and sewerage works	-	P&A	Jul-19 to Dec-22		PMC
		Develop, install and pilot test the MIS operations	-	O&M and P&A	Jul-20 to Dec-20	Implementation of Pilot and phase wise implementation for target area	PMC
		Prepare manual for MIS operations	-	O&M and P&A	Jul-20 to Sep-20	Manual for MIS operations, customization & updation	PMC
		Establish and operationalize GIS database of water supply and sewerage facilities	-	O&M and P&A	Jul-20 to Dec-22	Functional GIS database to integrate with MIS	CMWSSB
		Establish periodicity of data collection / monitoring system	-	O&M	Jul-20 to Sep-20	GIS / MIS database updation, analysis & reporting	CMWSSB
		Implement data collection / monitoring system of water supply and sewerage network and at WTP/STP facilities	-	O&M	Jul-20 to Dec-22	Monitoring & Updation on regular basis	CMWSSB
6	Improved non-revenue water (NRW) management	Establish series of District Metering Areas (DMA)	-	O&M	Jan-18 to Jun-18	Comprehensive plan for District Metering Area (DMAs)	PMC
		Perform acoustic leak detection per DMA	-	O&M	Jul-18 to Dec-22	Leak Detection Activities to mitigate water loss due to leaks	PMC
		Identify NRW through district metering analysis	-	O&M	Oct-18 to Mar-22	NRW to be limited to set target to comply Plan for Service Level Indicators	PMC

		Analyze Meter Tamperers	-	O&M	Oct-18 to Mar-22	Achieving 100% tampering of meters through enforcement & consumer awareness	PMC & CMWSSB
		Manage Distribution System Pressure	-	O&M	Oct-18 to Mar-22	Minimum Residual Pressure of 7m to be achieved [CPHEEO]	PMC & CMWSSB
		Take corrective actions	-		Jul-19 to Sep-22	Monitor, Record, Analyze & Achieve	PMC
7	Improved customer services	Study and evaluate the existing public relations and complaint handling system	Complaint handling system is available	O&M	Jan-18 to Sep-18	Quality of services to be analyzed and benchmarks to be set	PMC
		Prepare water supply and sewerage specific REVISED 'Citizens' charter'	-	O&M	Oct-18 to Dec-18	Assessment of Value for Money in delivery of services	PMC
		Design a complaint handling system using the MIS based on Citizens' charter'	-	O&M	Jan-19 to Sep-19	Functional MIS linked complaint redressal system	PMC
		Prepare complaint handling system manual	-	O&M	Oct-19 to Dec-19	User friendly complaint handling system	PMC
		Implement the improved public relations strategy and 'complaint handling system'	-	O&M	Jul-19 to Dec-22	Average time taken to handle customer complaints / grievances	PMC
8	Improved HR	Establish Project Implementation Unit (PIU) {Board Resolution}	Yet to receive approval from Board	O&M	Oct-16 to Dec-16	Establishment of PIU	CMWSSB

management and Trainig Need Analysis (TNA) based HR development	Establish Desalination unit	Desalination Unit under O&M is functional and need capacity building	O&M	Apr-17 to Sep-17	Capacity building to handle Desalination Infrastructure	CMWSSB
	Strengthen quality assurance and water conservation function	-	O&M	Jul-17 to Dec-17	Quality Assurance & Feedback	CMWSSB
	Establish Commercial /Consumer Engagement Cell	-	O&M	Oct-17 to Mar-18	Establishment of Cell	CMWSSB
	Introduce IT enabled HRM processes	-	P&A	Jan-18 to Dec-18	Information Strategy and Plan prepared for IT enabled HRM process	PMC & CMWSSB
	Define Key Result Areas (KRA) & Key Performance Indicator's (KPI), introduce 'Performance Management System'; Carry out annual review	-	P&A	Jan-17 to Mar-22	IT based strategy and plan prepared for Performance Management System	PMC & CMWSSB
	Develop Training Centre into self-sustaining "Centre of Excellence"	Training Cell is functional and need capacity building	Training Centre [TC]	Jan-17 to Mar-18	Establishment of Centre of Excellence	CMWSSB
	Conduct trainings for PIU & CMWSSB staff		TC	Jan-17 to Dec-22	Training needs identified department wise and imparted training (in country & abroad). Training reports prepared & disseminated	PMC & CMWSSB

Appendix 10.1 Project Cost Estimated in the DPR

Item	Amount (million INR)
1. Construction of the seawater desalination plant	
1a. Seawater intake and brine discharge facilities	2,694
1b. Seawater intake pumping station	
1c. Seawater desalination facility	
(1) Pre-treatment process	(5,883)
(2) RO process	(7,592)
(3) Post-treatment process	(704)
1d. Product water tank and transmission pumping station	463
1e. Buildings (Administrative etc.)	3,854
1f. Roads, drains, landscaping and compound wall with fencing	95
1g. Land development for the plant sites	248
1h. Power receiving 110/11 KV substation	259
1i. TNEB Sub substation	310
1j. Product water transmission mains and water reservoir	748
Sub-total 1	22,849
2. Others	
2a. Erection @ 5% of E&M cost	621
2b. Testing and Commissioning @5% E&M cost	621
2c. Contractors overhead and profit @15%	2,699
2d. Provision for shifting of underground utilities for Product main @0.5% of 1d	19
2e. Provision for physical contingencies @3%	663
2f. Project management consultancy @3%	442
2g. WCT/Tax @5.5%	1,004
Sub-total 2	6,068
Grand total	28,917

Source: JICA Study Team

Appendix 10.2 Comparison of the Construction Costs in the DPR and the Study

Nondisclosure

Appendix 10.3 Details of the Project Cost

Nondisclosure

**Appendix 10.4 Operation and Maintenance Cost in Case of Operation Rate of 75%
(Production: 300 MLD)**

Nondisclosure

Appendix 10.5 Production Cost including Depreciation Cost in Case of Operation Rate of 75% (Production: 300 MLD)

Nondisclosure

Appendix 11.1 Terms of reference (TOR) of the consultancy services

Nondisclosure

Appendix 12.1 Conditions and Methodologies for Financial and Economic Analyses

Nondisclosure

Appendix 12.2 Financial Cost and Benefit

Nondisclosure

Appendix 12.3 Financial Analysis Results

Nondisclosure

Appendix 12.4 Financial Sensitivity Analysis

Nondisclosure

Appendix 12.5 Economic Cost and Benefit

Nondisclosure

Appendix 12.6 Economic Analysis Results

Nondisclosure

Appendix 12.7 Economic Sensitivity Analysis Results

Nondisclosure

Appendix 13.1 Risk management framework for the project

Risk Management Framework

Project Name: Chennai Seawater Desalination Plant Project (Perur Seawater Desalination Plant)

Country: Republic of India

Sector: Urban Water Supply

Officers in charge:

- Operational staff
- Engineering staff:
- Country office staff:

Potential project risks	Assessment
1. Stakeholder Risk	Probability: Low
(Description of risk) <u>Delay in the Project implementation due to conflicts with the land users of the project site</u>	Impact: High
<u>DSP site:</u> There are burial grounds on the DSP site. Users of the burial grounds may raise opposition to the Project. (There is no risk in land acquisition. CMWSSB and the land owner, who is a trust maintained by HR&CE Department, have already agreed to the lease of the land itself.)	Analysis of probability and impact: If a conflict arises with the stakeholders, it may lead to the project being stopped, but its probability is low. CMWSSB has already secured the land and is in talks with the land users. Transmission line will be installed in public roads in principle. Permissions for construction will be necessary but they will not generate any conflict.
<u>Transmission line:</u> Residents or businesses along the roads where the transmission lines will be installed may raise opposition to the Project.	Mitigation measures: The layout of the DSP has been planned in such a way so as to avoid any impact on the burial grounds. Stakeholder meeting by CMWSSB was already held at Perur. Monitoring plan and grievance redressal mechanism have been proposed in the Study.
	Action during the implementation: CMWSSB will continue to communicate with the stakeholders. CMWSSB will follow the monitoring plan and establish and maintain the grievance redressal mechanism with the assistance of project management consultant (PMC). When necessary, CMWSSB will consider giving compensation to the people affected due to the construction of the plant and transmission line.
	Contingency plan (if applicable): -
2. Executing Agency Risk	
2.1. Capacity Risk	Probability: Low (Middle, if the proposed mitigation measure is not taken)
(Description of risk) <u>Delay in the Project implementation due to incapability of the Project Executing Agency</u>	Impact: Middle
If the executing agency is not capable enough to handle daily works, timely decision makings, or coordination with relevant authorities, the project implementation may be seriously delayed. Such incapability may also lead to a dispute with the	Analysis of probability and impact: CMWSSB has experience of handling DSP projects but no experience in handling JICA loan project. Current decision making procedure and frequent personnel changes in important positions will probably affect the implementation efficiency.
	Mitigation measures: A dedicated unit for the Project, project implementation unit (PIU), has been proposed in the Study and CMWSSB has committed to its establishment. A decision-making plan has also been proposed. JICA will provide key PIU members with seminars on implementation procedures and rules in JICA loan projects prior to the Project.
	Action during the implementation:

<p>project management consultant (PMC) or the contractor on contractual or payment issues.</p>	<p>PMC will assist CMWSSB and PIU for timely and appropriate processes and decision makings. The Steering Committee will monitor the Project's progress and give instructions to CMWSSB for improvement when necessary. JICA will also monitor the progress.</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>2.2. (1) Governance Risk-1</p>	<p>Probability: Low (Middle, if the proposed mitigation measure is not taken)</p>
<p>(Description of risk) <u>Delay in the Project implementation due to complicated procedures required to conduct the project or unsuccessful coordination with other authorities/utilities</u></p> <p>The slow progress of any necessary external procedures or acquisition of approvals or permissions may delay the project. Permission for construction of roads and coordination with other utilities such as power supply, telecommunication, drainage, etc. are possible events that may cause such difficulties.</p>	<p>Impact: Middle</p> <p>Analysis of probability and impact: The Project will need various external procedures and coordination with other authorities/utilities. CMWSSB is not powerful enough to handle some of the procedures and coordination work smoothly and timely.</p> <p>Mitigation measures: Steering Committee (SC) for the Project has been proposed in the Study, and CMWSSB is committed to requesting the state government to formulate the committee. The committee will assist CMWSSB in any procedures or coordination work with the external authorities/utilities.</p> <p>Action during the implementation: CMWSSB will take a lead in the procedures or coordination without leaving them to the contractors. When they face difficulties, CMWSSB will immediately consult with key member(s) of the SC.</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>2.2. (2) Governance Risk-2</p>	<p>Probability: Low</p>
<p>(Description of risk) <u>Delay in the Project implementation due to incompleteness of the environmental procedure for the project</u></p> <p>Incompletion or slow progress of environmental procedure may delay the Project's implementation. For the Project, Coastal Regulation Zone (CRZ) clearance is necessary. Certificate on EIA is not needed.</p>	<p>Impact: Middle</p> <p>Analysis of probability and impact: Documents for CRZ clearance on the Project has already been transferred from CZMA to MoEF in May 2016. Probably, the clearance notification will be given before the commencement of the construction, but there is no evidence that MoEF has started the evaluation</p> <p>Mitigation measures: At present CMWSSB is waiting for communication from MoEF. CMWSSB will need to ask MoEF the current status of the evaluation to detect any problem or error if any.</p> <p>Action during the implementation: - (The notification must be obtained before the completion)</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>2.3. Fraud & Corruption Risk</p>	<p>Probability: Low</p>
<p>(Description of risk) <u>Corruption in the procurement procedure of PMC or the contractor</u></p> <p>If corruption happens at any process of the project, such as procurement procedures of the</p>	<p>Impact: High</p> <p>Analysis of probability and impact: CMWSSB is not deemed to be corrupted. If corruption happens and it is exposed, the Project may be stopped.</p> <p>Mitigation measures: All procurement processes will be conducted strictly complying with JICA's guidelines.</p> <p>Action during the implementation:</p>

<p>PMC or the contractor, would prevent implementation of the project.</p>	<p>JICA will monitor the procurement procedures of the PMC and the contractor through the concurrence processes. In the procurement of the contractors, PMC will assist and monitor the bidding procedures in compliance with JICA's guidelines.</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>3. Project Risk</p>	
<p>3.1. (1) Design Risk-1</p>	
<p>(Description of risk) <u>Delay in the Project due to technical or financial capability of the contractors</u></p> <p>Construction work may not be completed within the scheduled period if the contractor is not capable enough or the work volume of the contract package is too huge.</p>	<p>Probability: Middle</p> <p>Impact: Middle</p> <p>Analysis of probability and impact: A good number of water supply projects in India are facing similar problems due to local contractors' incapability. In the Project, contract packages for the transmission lines have such possibilities.</p> <p>Mitigation measures: Construction of the transmission lines has been divided into four (4) contract packages so that the size of the contract will be within local contractors' capabilities.</p> <p>Action during the implementation: In the PQ processes, financial and technical qualifications will be appropriately examined. The bid evaluation will take into account the technical proposals and examine feasibilities of the financial proposals carefully by the bidders.</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>3.1. (2) Design Risk-2</p>	
<p>(Description of risk) <u>Lower project's beneficial effects than expected due to lower water demand derived from external causes</u></p> <p>If the water demand is lower than projected, the operation rate of the Perur DSP will be lower than projected in the Study. It may lead to an evaluation that the Project is not generating beneficial effects as expected.</p> <p>Slow development of water distribution network in the CMA is another possible cause of such low production.</p>	<p>Probability: Middle</p> <p>Impact: Low</p> <p>Analysis of probability and impact: As production requirement to DSPs depends on climate conditions, the production of the Perur DSP will possibly be lower than expected. However, it is definite that the Project will contribute to satisfying people's water demand even if the production is lower. Water distribution networks in the corporation will be completed soon by CMWSSB, but those in the Rest of CMA will take time.</p> <p>Mitigation measures: The Project's benefit in lower production case has been examined and validated in the financial and economic analysis in the Study. Water demand projection took into account gradual expansion of the water distribution network in Rest of CMA.</p> <p>Action during the implementation: - (Accept the risk)</p> <p>Contingency plan (if applicable):</p> <p>-</p>
<p>3.2. Program & Donor Risk</p>	
<p>(Description of risk) <u>Lower projects beneficial effects than expected due to low operation rate for CMWSSB's financial reasons</u></p> <p>DSPs are more costly to operate than other conventional WTPs. If the water tariff is not raised to the level of secure operational cost recovery of DSPs, CMWSSB</p>	<p>Probability: Middle (High, if the mitigation measure is not successful)</p> <p>Impact: High</p> <p>Analysis of probability and impact: A similar situation exists in the existing Nemmeli DSP. Improvement in the metering rate and introduction of the volumetric tariff at a financially viable level are urgent issues.</p> <p>Mitigation measures: CMWSSB has already carried out a financial simulation to know the viable tariff level and prepared meter installation and tariff improvement plans. CMWSSB should achieve internal and external consensus on these plans.</p> <p>Action during the implementation:</p>

may keep the operation rate of the Perur DSP low regardless of unsatisfactory LPCD.	CMWSSB must insist on implementation of the metering and tariff improvement plans.
	Contingency plan (if applicable):
	The state government will need to provide CMWSSB with sufficient amount of subsidy to satisfy the water demand.
3.3.(1) Delivery Quality Risk-1	Probability: Low
(Description of risk)	Impact: Middle
<u>Lower project's beneficial effects due to frequent failure in quantity or quality of the DSP or the transmission line derived from insufficient O&M skill or management</u>	Analysis of probability and impact:
	The possibility of O&M failure is not high because it owns an existing DSP under the similar contract to the Project and another similar project will be commenced soon.
	Mitigation measures:
Incapability of O&M works may prevent the Project from generating the expected beneficial effects.	The Project will adopt DBO contract, where the O&M works will be conducted by the plant supplier. The contract will require the contractor to train CMWSSB staff to obtain general knowledge of the plant to enable O&M supervision.
	Action during the implementation:
	CMWSSB will recruit and assign their staff as trainees to learn necessary knowledge for the DSP's supervision.
	Contingency plan (if applicable):
	-
3.3. (2) Delivery Quality Risk-2	Probability: Low
(Description of risk)	Impact: High
<u>Lower project's beneficial effects due to serious damage to the facilities by natural disaster</u>	Analysis of probability and impact:
	If the plant is seriously damaged, people may face water shortage for a long time. Recovery or reconstruction of the plant will need huge investment.
	Mitigation measures:
The Project site was affected by Tsunami in 2004 Indian Ocean earthquake. If the DSP is damaged by a similar natural disaster and loses its functional capability or takes a long time to recover, the Project's beneficial effect will be lowered.	The ground level of the site has been determined at a higher level than the water level after the 2004 Tsunami.
	Action during the implementation:
	CMWSSB and PMC will supervise the contractor to satisfy the required ground elevation.
	Contingency plan (if applicable):
	-
4. Overall Risk Rating	Probability: Middle
(Overall comments)	Impact: Middle
If the countermeasures are implemented successfully, there will be no critical risk of high probability that may prevent serious delay of the Project or deteriorate the Project's beneficial effects. The key mitigation measures for the Project's implementation are the establishment of PIU with sufficient power in decision-making and SC to assist PIU . For the Project's beneficial impacts, improvement in metering ratio and introduction of volumetric tariff to recover the operation cost will be the key.	