



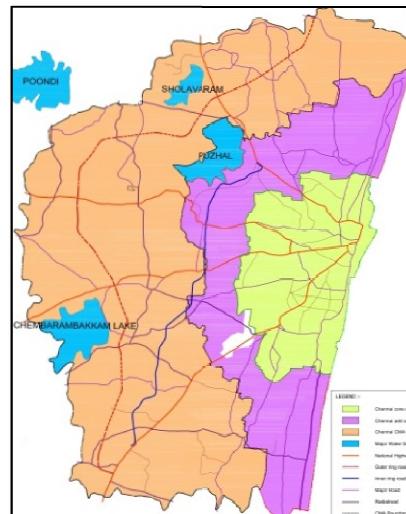
CHAPTER- VI

DEMAND ASSESSMENT (MODIFIED)

6.1. Introduction

With a territory size of just 1189 square kilometres (km^2), Chennai is a water-scarce city not because of lack of rainfall (1200 millimetres/year), but because of the limited land area where rainfall can be stored. One of the main concerns of the Government has been how to provide clean water to its po

pulation, which currently consumes about 0.9 billion litres of water per day. Chennai water need, conveyed water from the neighbouring state of Andhra



Pradesh

6.2. Demand Assessment

Figure 6 - 2 Demand Assesment

The population of project area for the respective horizon years are estimated and indicated in the Table 6.1

Table 6 - 1 Population Projected for Present, Base Year, Intermediate & Ultimate years

Description	2011	2015	2020	2035	2050
(Population In lakhs)					
Chennai Corporation	66.66	70.54	75.57	91.80	109.73
Rest of CMA	22.64	28.83	36.46	63.00	97.32
Total	89.31	99.37	112.04	154.80	206.84

6.3. Per Capita Water Supply

The consumption of water differs from City to City, Town to Town and Village to Village. The pattern of water distribution for domestic purposes is much higher in urban areas than rural areas. Therefore the per capita supply of water will vary from Chennai City and rest LBs of CMA areas.



The Per capita water supply of 150 lpcd is considered for adoption to Chennai Corporation. The rest of the CMA Areas are categorised into Urban and Rural, for the urban Area 135 lpcd up to Intermediate stage (2035) and 150 lpcd for Ultimate stage (2050), in respect of Rural area per capita water supply has been considered 55 lpcd to 110 lpcd till Intermediate year of 2035 and 70 to 135 lpcd for Ultimate years for adoption.

The habitation wise year wise per capita supply has been given in the [Annexure 6.1](#)

Accordingly the Demand has been arrived and given in the [Annexure 6.2](#):

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The pattern of water consumption exhibits in charts 1 to 6

Further this the water demand will be met out from the following sources viz Fresh water through piped supply at about 85% - 85% and local sources from respective dwellings and Recycled water at about 15%. ~~Out of 85% of fresh water source 90% shall be met out from piped water supply and 10% from local source of respective dwellings.~~ The per capita of supply pattern in each area is exhibited in the Charts (1 to 6) below.

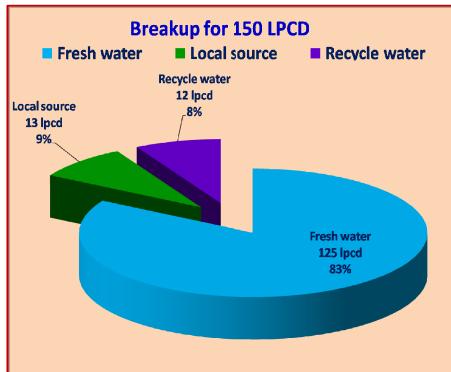


Chart.1.

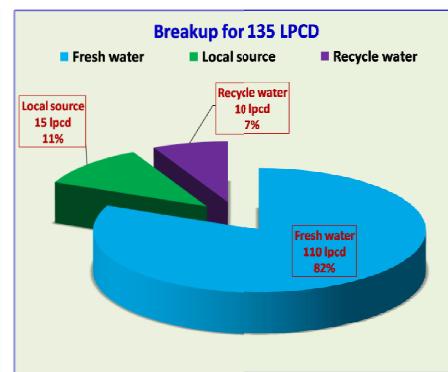


Chart.2.

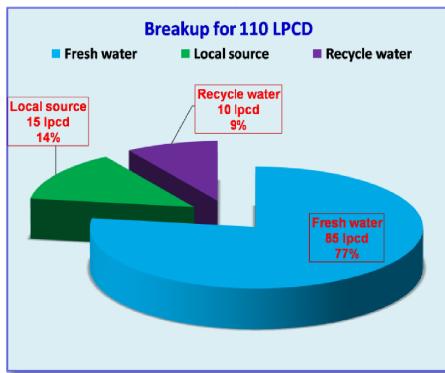


Chart.3.

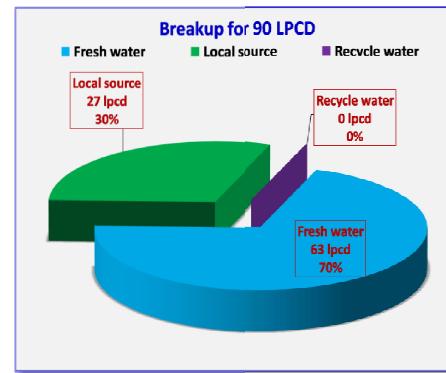


Chart.4.

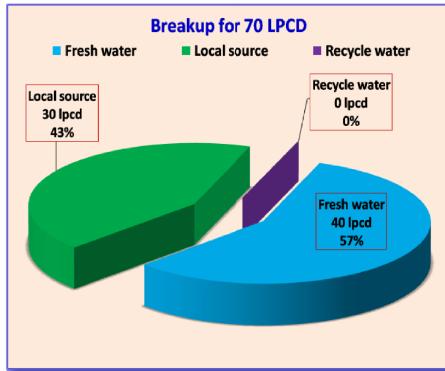


Chart.5.

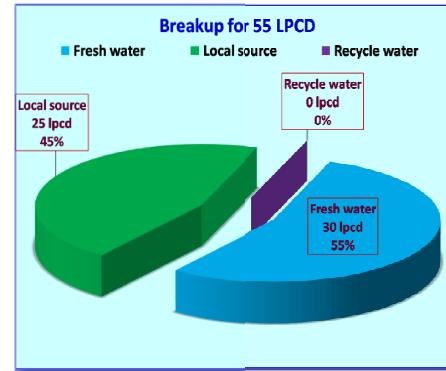


Chart.6.

Accordingly, Water Supply demand is arrived for each habitation and furnished in the annexure Annexure No 6.3

6.4. Water Supply Projected for Present, Base Year, Intermediate & Ultimate years

Table 6 - 2 Total Water Demand for Corporation and Rest of CMA

Description	2015	2020	2035	2050
	(in Mld)			
Chennai Corporation	922	1333	1702	2178
Rest of CMA	214	387	821	1568
Total	1136	1720	2523	3746

6.4.1. Water Supply

The Source for Water Supply to Chennai City is surface water drawn from the four lakes of Chennai viz, Poondi, Cholavaram, Red hills and Chembrambakkam lakes. All

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these four reservoirs are extremely shallow and subject to high evaporation and seepage losses amounting to about 40% of the total inflow of water.

Control of surface water sources and operation of Poondi-Cholavaram-Redhills and Chembrambakkam lakes are the responsibility of Water Resource Department (WRD) branch of the PWD of the Tamil Nadu State. Water impounded in Poondi, the largest of the four lakes, is transported via lined channels to Cholavaram, Red hills and Chembrambakkam.

Three brick – arch conduits conveyed water from Red hills Reservoir to the Kilpauk treatment plant. In Kilpauk, designed capacity of 270 MLD treatment plant is available. Due to high growth in population and less availability of water the city is facing tremendous water scarcity. The various industries operated their own ground water system which they have independently developed largely because of inadequate Metro Water Supply.

In order to cope up with the growing need of Chennai City, the sources have been augmented from distant sources viz, Surface water from Veeranam Lake and Surface Water from Kandaleru Reservoir in erstwhile Andhra Pradesh.

The desalination plant is becoming an important component for augmenting and diversifying available water sources. The CMWSSB have established two DSPs with capacity of 100 MLD each to expand its sources.

Ground Water from Minjur, Panjetti and Tamarapakkam areas in the Arani-Koratalayar River basin Northwest of the city is considerably more plentiful but this has not been used for domestic needs appreciably. Development of this ground water sources has benefitted mostly for industrial uses. It was originally designed to draw 100 MLD of Water from this River basin and due to the depletion of ground water; currently 25 MLD of water only is being drawn.

During 2004, under Chennai City Water Supply Augmentation Project-1, New Veeranam project was taken up. Under this project 190 MLD of raw water from Veeranam Lake near Sethiathope, situated in Cuddalore District at about 230 km. from Chennai City, is being pumped to about 20 km. through the pipeline to Vadakuthu for treatment, pumped the 180 MLD treated water from Vadakuthu for a distance of about 8 km. to the Break Pressure Tank at Kadampuliyur ridge point and then convey the water from this ridge point by gravity for about 200 km to the Water Distribution Station at Porur in Chennai.



The Scheme is not operational throughout the year, owing to lean flow of water in the Cauvery River and poor inflows into Veeranam Lake during dry period.

The present water use in CMA is given in the following table [6-3](#).

Table 6 - 3 The Present Water use in CMA

EXISTING FRESH WATER SUPPLY				
S. No	Particulars	Potential Yield (in MLD)	Available in good years (in MLD)	Present availability (in MLD) (as on October 2015)
1. SURFACE WATER SOURCES				
a)	Poondi, Red hills, Cholavaram _____ & _____ Chembarambakkam _____ lakes <u>(surface sources)</u>	200	125	75
b)	Telugu - Ganga Project	930	400	200
c)	Veeranam Lake Source	180	100	100
2. GROUND WATER/Sub Surface water				
d)	Northern well field / Southern _____ Coastal aquifer	100	25	25
e)	Sub Surface water sources in Rest _____ of CMA	32	32	32
3. SEA WATER DESALINATION				



f) Minjur DSP	100	100	100
g) Nemmeli DSP	100	100	100
Total	1642	882	632

In addition to the above water availability from local sources, such as open wells/_bore wells are about 110 MLD and 100 MLD in Chennai city and in rest of CMA respectively.

Table 6-3-1 Water Supply Demand for the design period

Description	2015	2020	2035	2050
	(in MLD)			
Chennai Corporation	922	1333	1702	2178
Rest of CMA	214	387	821	1568
Total	1136	1720	2523	3746

At present ~~632-600~~ MLD of fresh water is available from various sources in respect of Chennai City and 32 MLD of fresh water from surface sources in respect of rest of CMA. In addition the local sources such as open wells/_bore wells in individual residents, institutions etc. supplements the water demand to an extent of 110 MLD and 100 MLD for Chennai city and for Rest of CMA, respectively.

Table 6 - 4 Projected Demand vs Existing Supply

Year (1)	Total Demand (2)	Present Availability (3)	Gap (4)=(2-3)
	(in MLD)		
2015	1136	632	504
2020	1721	632	1089
2035	2522	632	1890
2050	3746	632	3114

There are widespread shortages of drinking water in various parts of the city. According to experts report, this problem could be attributed to the unsatisfactory patterns in the distribution systems, which are currently in practice in the city.

Further, it is not advisable to use fresh water for all purposes wasting the fresh water for non domestic purposes like gardening, car washing, floor cleaning, toilet flushing, etc., also be avoided considering the scarcity of fresh water sources in and around the city and on water conservation point of view. Hence, it is suggested water



supply shall of 3 categories viz Fresh water supply from the WTPs, Local Ground water sources (From open/_bore wells) and recycled waste water. Accordingly the percentage of each category with reference to per capita supply is as given below:

Table 6-4-1 Per capita Supply

per capita supply		Fresh water	Local source	Recycle water
lpcd	150	125	13	12
in %		83%	9%	8%
lpcd	135	110	15	10
in %		81%	11%	7%
lpcd	110	85	15	10
in %		77%	14%	9%
lpcd	90	63	27	0
in %		70%	30%	0%
lpcd	70	40	30	0
in %		57%	43%	0%

A detailed statement showing separately the fresh water demand, local sources, recycled water is given in the Annexure 6.4:

The Abstract statement for the entire project area about_source_deficits with reference to present supply level is given below:

Table 6 - 5 Source Deficits-Projected for the Horizon Years for the Project Area

Sl. No.	Year	Total Demand	Fresh Water	Local Domestic Sources	Recycled Water	Existing Fresh Water Supply	Deficit in Fresh Water
		(in MLD)					
1.	2.	3.	4.	5.	6.	7.	8. (4-7)
1	2015	1136	825	240	28	632	193
2	2020	1721	1259	251	157	632	627
3	2035	2522	1870	314	265	632	1238
4	2050	3746	2844	397	405	632	2212

Proposals for usage of local domestic sources in the various design years and for the enhanced utilisation of recycled water have been described in the main report.

Table 6 - 6 Development of sources to meet the projected fresh water demand

S.No	Description of sources	Existing Yield (mld)	Augmented Quantity	Total Yield that will be available after Augmentation (mld)
A) Surface Water Sources:-				
1	Local 4 Lake Sources (Internal)	125	75	200
2	Veeranam Lake Source	100	80	180



3	Telugu Ganga Project	400	530	930
5	New Mettur Project		700	700
6	External Sources			
a)	Madurantagam Lake		25	25
b)	Chengalpattu Lake		35	35
c)	Abandoned Quarries		10	10
d)	New surface storage projects		20	20
e)	Palar Source		30	30
7	Northern well fields	25	75	100
8	By Harvesting Rain Water in Off Stream Lakes		30	30
9	Existing Water sources in CMA (As per data collected)	32		32
Total Fresh water from surface sources		682	1610	2292
B) SEA WATER DESALINATION				
1	Minjur DSP	100		100
2	Nemmeli DSP	100	150	250
3	Peru DSP		400	400
Total DSP supply		200	550	750
Total Fresh water Supply		882	2160	3042
B) Ground Water Sources:-				
1	River Cauvery (Infiltration Wells near Thiruvudaimaruthur)*		80	80
-	LOCAL SOURCES	-	-	-
1	Source in Individual Dwellings (Bore wells & Open wells) in Chennai City	110	100	210
2	Source in Individual Dwellings (Bore wells & Open wells) in Rest of CMA	100	100	200
Total Ground Water sources		210	200	410
* To supplement Veeranam Source				

Table 6 - 7 Augmentation of Local Ground water Sources

S.No	Description of sources	Existing Yield (mld)	Augmented Quantity* (at the end of 2050)	Total Yield that will be available after Augmentation (mld)
LOCAL SOURCES				
1	Source in Individual Dwellings (Bore wells & Open wells) in Chennai City	110	100	210
2	Source in Individual Dwellings (Bore wells & Open wells) in Rest of CMA	100	100	200
Total Ground Water sources		210	200	410



*Augmentation of the ground water sources by various artificial recharge techniques have been given in the main report.

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To bridge gap between fresh water demand and supply, it is proposed to augment the water supply system by identifying additional sources to supplement the requirement to the Chennai Corporation and rest of CMA. The details are given in the Table below:



Table 6 - 8 Supply Management for Future Demand (Considering the supply during normal periods i.e. 882 mld)

Year	Fresh Water Demand	Supply during October 2015			Cumulative Qty. of Sources Developed	Total Sources available	Excess	Capacity of Sources to be Developed												
		Surface	DSP	Total				DSP	Surface Sources											
									Nemmeli	Perur	Telugu Ganga	Veeranam Sub Surface	By Harvesting Rain Water in Off Stream Lakes	New Mettur Project	OWN Sources Local 4 Lake Sources (Internal)	External Sources (Madurantikai / Chengalpattu / Abandoned Quarries / New surface storage Projects / Palai source)	Northern well fields	Total		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.			
-	-	-	-	(3+4)	col.16+ value above	(5+6)	(7-2)	-	-	-	-	-	-	-	-	-	Add. Col.9 to 17			
2020	1259	682	200	882	480	1362	103	150	-	150	80	-	-	75	-	25	480			
2025	1341	682	200	882	905	1787	446	-	400	-	-	-	-	-	-	25	425			
2030	1718	682	200	882	955	1837	119	-	-	-	-	-	-	-	25*	25	50			
2035	1870	682	200	882	1170	2052	182	-	-	180	-	-	-	-	35*	-	215			
2040	2041	682	200	882	1565	2447	406	-	-	-	15*	350	-	30*	-	395				
2045	2577	682	200	882	1950	2832	255	-	-	-	15*	350	-	20*	-	385				
2050	2844	682	200	882	2160	3042	198	-	-	200	-	-	-	10*	-	210				
-	-	-	-	-	-	TOTAL	150	400	530	80	30	700	75	120	75	2160				
-	#	Since Perur DSP will start producing 400 MLD Desal. water Supply from Telugu Ganga may be restricted to 150 MLD, during 2025-2030.										Total including existing sources				3042				
-	*	Additional sources to supplement the own source/DSP/TG/Mettur shall be developed as buffer and to be utilised during short fall in these sources.										Balance available over demand				198				

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Year	Fresh Water Demand in MLD	Supply during October 2015			Available Qty of Sources in MLD	Total Sources available	Excess	Capacity of Sources to be Developed												
		Surface	DSP	Total				DSP	Namakkal	Perur	Telugu-Ganga	Veeranam Sub-Surface	Harvesting Rain-Water In-Off Stream	New-Mettur Project	Own Sources	Local-4-Lake (Vellore)	Mudurantakam/ Chennai Ghatka/Ab andied Quarries/Ne w-surface storage	Northern well-Fields		
2020	1259	682	200	882	410	1292	83	150		130	80				75		25	+ 400	Add: 100 to 17	
2025	1341	682	200	882	835	1717	426		400								25	+ 150	Formatted	
2030	1718	682	200	882	885	1767	99									25*	25	+ 150	Formatted	
2035	1870	682	200	882	1150	2032	182		200							35*		+ 150	Formatted	
2040	2041	682	200	882	1545	2427	406								15*	350	30*	+ 150	Formatted	
2045	2577	682	200	882	1930	2812	255								15*	350	20*	+ 150	Formatted	
2050	2844	682	200	882	2160	3042	198		200							10*		+ 150	Formatted	
								TOTAL	150	400	530	80	30	700	75	120	75	+ 150	Formatted	
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Master Plan for Water Supply and Sewerage Sectors in
Chennai Corporation and rest of CMA

Final Report

TNUIFSL

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Volume - II

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NEW SOURCES IDENTIFIED WITH QUANTUM OF WATER FOR AUGMENTATION

6.4.2. Schedule of implementation of the various projects

The schedule of implementation of the various projects as mentioned in the Table 3.14 for the development of additional sources, based on the Demand of the respective years are given in the Table below.

Table 6 - 9 Suggested commissioning schedule of the proposed projects to meet the Additional & Fresh Water Demand

Sl. No.	Source	Quantity to be Augmented in MLD	Probable Year of commissioning
DSP sources			
1	Nemmeli	150	2020
2	Perur	400	2025
Surface / Ground water sources			
3	Telugu Ganga	530	2020, 2035, 2050
4	Veeranm sub surface (Cauvery sub surface)	80	2020
5	By harvesting rain water in off stream lakes	30	2040, 2045
6	New Mettur project	700	2040, 2045
7	Improvements in own 4 lake sources	75	2020
8	External sources (Madurantagam lake, Chengalpattu lake, Abandoned quarries, new surface storage projects and Palar source.)	120	2030, 2035, 2040, 2045, 2050
9	Improving Northern well fields	75	2020, 2025, 2030
		Total	2160

Sl. No.	Source	Quantity to be Augmented in MLD	Probable Year of commissioning
DSP sources			
1	Nemmeli	150	2020
2	Perur	400	2025
Surface/Ground water sources			
3	Telugu Ganga	530	2020, 2035, 2050
4	Veeranm sub surface (Cauvery sub surface)	80	2020
5	By harvesting rain water in off stream lakes	30	2040, 2045
6	New Mettur project	700	2040, 2045
7	Improvements in own 4 lake sources	75	2020
8	External sources (Madurantagam lake, Chengalpattu lake, Abandoned quarries, new surface storage projects and Palar source.)	120	2030, 2035, 2040, 2045, 2050

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9	Improving Northern well fields	75	2020, 2025, 2030
	Total	2160	

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6.5. Supply Management

Supply management is required to increase the supply of water from existing as well as alternate sources to meet more demand and an equitable distribution of water. The supply of water to the city can be consolidated by following methods

- Storing rain water/storm water runoff in lakes for fresh water addition/augmentation & use.
- Rainwater harvesting through bore well recharging and ground water recharging.
- Recycling of wastewater for indirect potable and non-potable applications.
- Public awareness for water conservation to use recycled waste water for watering garden/lawn/cleaning cars etc.,

6.6. Surface Water from Lakes

The water supply for Chennai is mainly derived from surface storage at Poondi, Red hills, Cholavaram and Chembarampakkam lakes which have been operational since the last century. Protected and partially protected catchment areas are well demarcated and gazetted and no pollution-causing activities are allowed in such areas. At present, half of the catchment areas are either encroached or misused by miscreants. These land area is considered to be protected and partly protected catchment. It is suggested that, there has to be an increasing emphasis on catchment management, to restore the original catchment for all the water sources.

The de-silting of existing Chennai lakes, removal of debris and scrubs, strengthening & heightening of bunds etc., shall facilitate to increase the capacity of the existing lakes. Similarly, the supply channels of



Figure 6 - 3 Cauvery Water Supply



upstream feeding tanks shall be restored and rehabilitated for free flow of water by minimising the transmission losses of seepage and wastages. The water storage can be increased in Cholavaram lake by raising the bund levels, to an extent of 1.0 TMC.

The safe yield of all lakes are reported to be 142 MLD as per previous study, the probability of increase of yield could be achieved is more to 200 MLD of water.

6.7. Cauvery water supply

6.8-6.7.1. Veeranam lake system

During 2004, under Chennai City Water supply Augmentation Project-1, New Veeranam project was taken up. Under this project 190 MLD of raw water from Veeranam Lake near Sethiathope, situated in Cuddalore District at about 230 km. from Chennai City, is being pumped to about 20 km. through the pipeline to



Figure 6 - 4. Veeranam Lake System

Vadakuthu for treatment, pumped the 180 MLD treated water from Vadakuthu for a distance of about 8 km. to the Break Pressure Tank at Kadampuliyur ridge point and then convey the water from this ridge point by gravity for about 200 km. to the Water Distribution Station at Porur in Chennai.

The Scheme is not operational throughout the year, owing to lean flow of water in the Cauvery River and poor supply into Veeranam lake during dry period.

6.9-6.7.2. Subsurface Water from Cauvery

In order to strengthen this Veeranam project to full designed capacity, a collector well is proposed near Tiruvidaimarudur in Cauvery river downstream of Trichy Town to draw sub surface water of 80 MLD and then pumped upto Kadampuliyur Ridge point after disinfection, then conveyed through the existing Veeranam main upto Chennai with suitable modifications in the pipe line and in the pumping equipment. This arrangement will also afford flexibility in the drawal of surface/_subsurface water, depending upon the availability of water in the lake, stabilise the yield from Veeranam Lake and will also stabilise the supplies during summer.

6.10-6.7.3. Augmentation of Water from Mettur Reservoir

In order to meet the growing needs of the Chennai city through new source of water supply, CMWSSB has already suggested for augmenting Chennai city water supply

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from river Cauvery, as a long term requirement. Keeping in view the growing requirements of the city and dependability of the supplies, —source for the 9.0 TMC Water Supply Augmentation Project for Chennai has been identified in River Cauvery and the proposal is in pipeline.

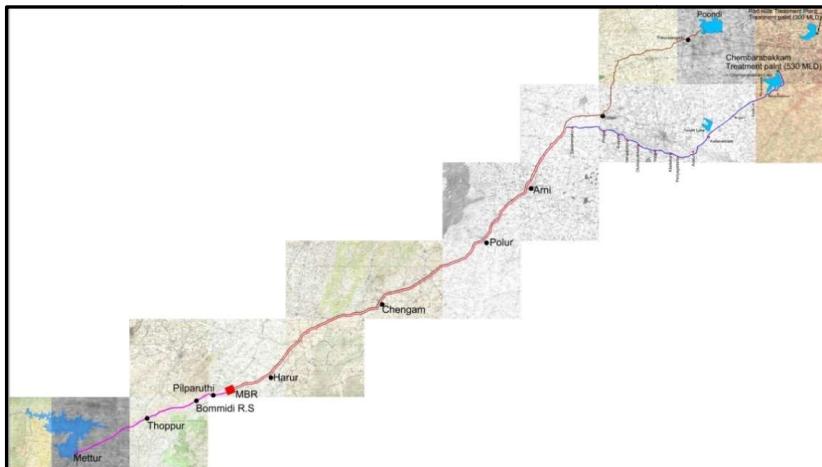


Figure 6 - 5 proposed alignment of transmission main from Mettur to Poondi / Chembrambakkam.

6.11.6.8 Desalination plant

Desalination is becoming an important component for augmenting and diversifying available water sources. The CMWSSB have established two DSPs with capacity of 100 MLD each to expand its availability of source. The process used is reverse osmosis and it has a capacity of 100 million litres per day (MLD). Additional 150 MLD and 400 MLD DSP are proposed to supplement the Chennai water supply need, at Nemmeli and Perur respectively

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6.12.6.9 Reclamation and Reuse of Renovated waste water

Faced with the strategic issue of water **security**, we would like to suggest the possibility of recycling wastewater (or used water) for non- domestic uses to reduce stress on the large scale fresh water consumption, after proper treatment of waste water, instead of discharging them to the sea. About 405 MLD of waste water after treatment is proposed to be utilised for non-domestic purposes as well for industrial need.

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The Table 6.10 indicates the probable location of the tertiary treatment plant and the quantity of waste water proposed to be re used after Tertiary Treatment.



Table 6 - 10 Tertiary treatment plant

SL. No.	Location of STP	Secondary Treatment Plant Capacity Mld	Tertiary Treated Plant Capacity in Mld
1	Perungudi	180	140
2	Nesapakkam	50	30
3	Koyambedu	205	100
4	Kodungaiyur	465	250
5	Thiruvottiyur	68.5	40
6	Sholinganallur	211	100
7	Chemrambakkam	90	40
8	Pallavaram	160	100
9	Selaiyur	45	30
10	Tambaram	35	10

From the above statistical figure, max requirement of Industrial requirement and non-domestic requirement of 265 Mld and 405 Mld for the years 2035 and 2050 will be met.

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Master Plan for Water Supply and Sewerage Sectors in
Chennai Corporation and rest of CMA

Final Report

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