

5.3 Water Supply Development Plan

5.3.1 Salaulim Water Supply Scheme

(1) System Development Plan

a. Expansion of the Treatment Plant

According to the Department of Water Resources, Government of Goa, the raw water source availability from Salaulim Dam for the water supply sector is 430,000 m³/day as listed in Table 52.1. This includes diverting 50,000 m³/day of water from Salaulim Dam to the Kale River for the Opa WSS. Figure 53.1 shows the relationship between the raw water requirement of the existing Salaulim and Opa WSSs and the raw water availabilities.

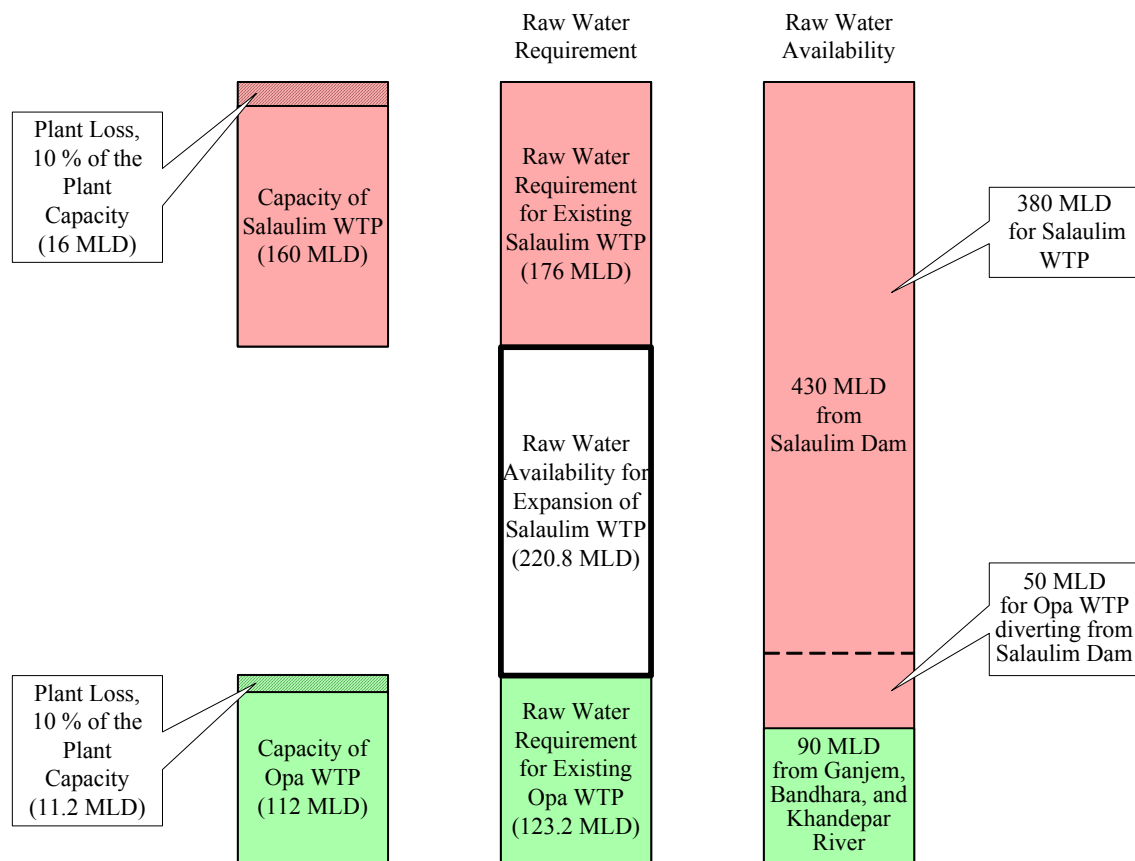


Figure 53.1 Relationship between Raw Water Requirement and Availability for Salaulim and Opa WSSs

The raw water requirement for the existing plants (which have capacities of 160,000 m³/day for the Salaulim WSS and 112,000 / m³day for the Opa WSS) is 299,200 m³/day, including plant loss of 10 %. On the other hand, the total raw water availability is 520,000 m³/day. The

remaining 220,800 m³/day can be used for expansion of the Salaulim WTP. Therefore the master plan recommends that the proposed capacity for the expansion of the Salaulim WTP is 200,000 m³/day.

b. Staged Development Plan

To meet the increased water demand, the water supply capacity of the Salaulim WTP will be expanded in two stages. Under the first stage the capacity will be expanded by 100,000 m³/day, to meet the daily maximum water demand in year 2018. The second stage also consists of an expansion of 100,000 m³/day. The staged expansion of the water supply capacity is shown in Figure 53.2.

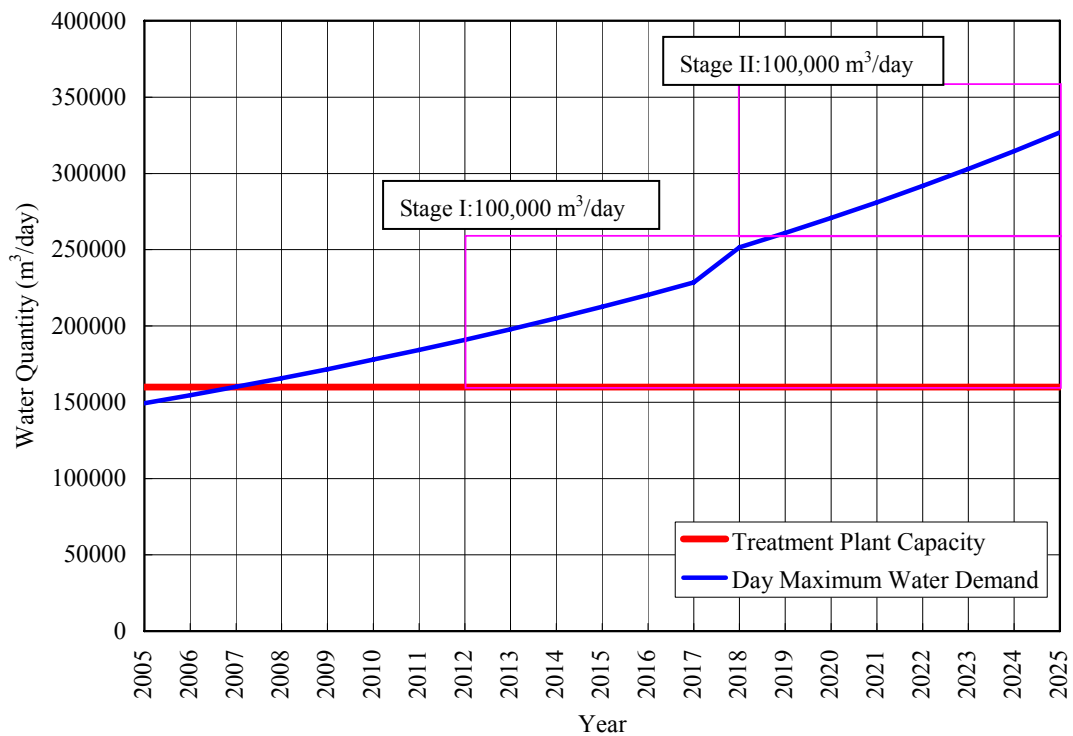


Figure 53.2 Staged Development Plan for the Salaulim WSS

c. Transmission Plan

As mentioned in Section 5.2, the study proposes that in 2025 the Salaulim WSS will be supplying treated water to six Talukas (Samguem, Quepem, Salcete, Mormugao, Ponda and Tiswadi). Figure 53.3 shows the schematic transmission plan for the Salaulim WSS.

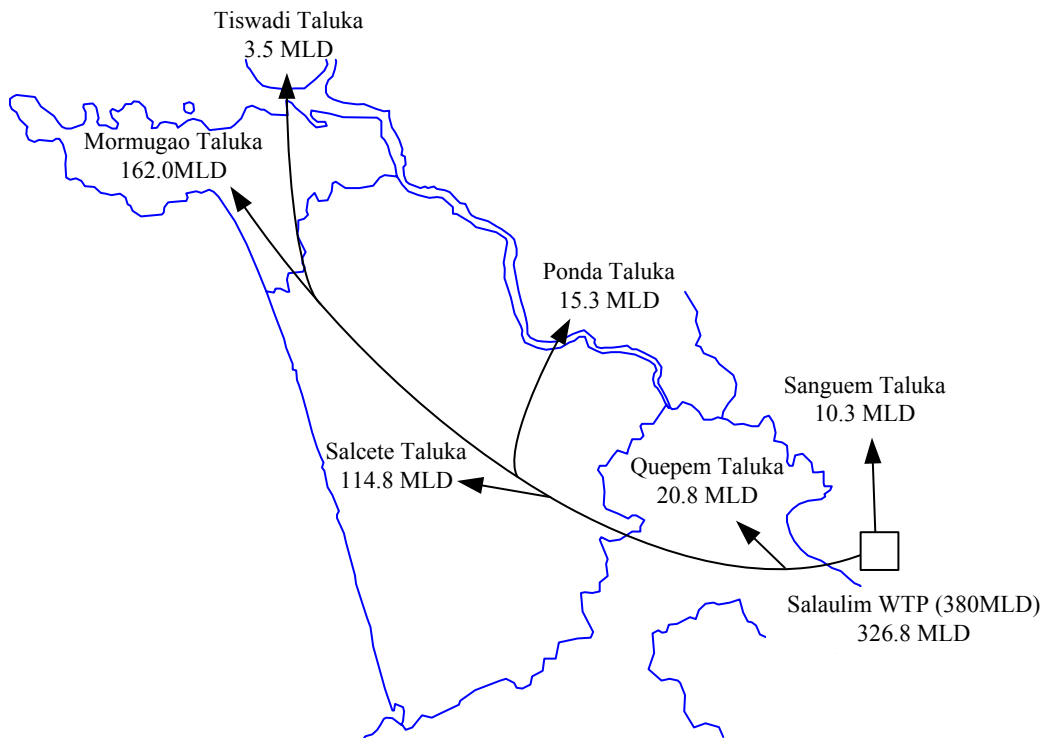


Figure 53.3 Schematic Transmission Plan for the Salaulim WSS

(2) Treatment Plant

a. Water treatment Plant Capacity

The existing capacity of the Salaulim WTP is 160 MLD. The master plan proposes an additional 200MLD of water treatment capacity to address water shortage.

b. Proposed Water Treatment process

The proposed treatment process for the new water treatment plant consists of contact aeration, coagulation basin, flocculation/sedimentation, sand filtration and chlorination. This process was designed with consideration of the raw water quality and existing process (See Figure 53.4).

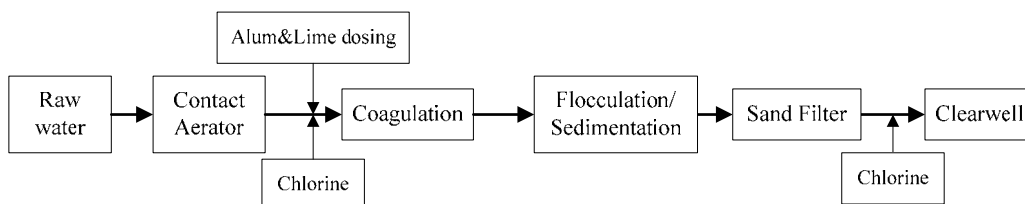


Figure 53.4 Proposed Water Treatment Process at Salaulim WTP

c. Implementation Schedule

The timeline for the implementation schedule for WTP is shown in Table 53.1. Rehabilitation and improvement of the existing WTP will be conducted in the stage I. Installation of chlorine safety equipment, replacement of equipment that has exceeded its design life, and installation of generator and flow meters will be conducted over this period. Other replacements will be undertaken as equipment exceeds its design life.

The new treatment plant will be constructed in two stages. The stage I of the plant will have a capacity of 100 MLD and will start operation in 2012. The stage II will have a capacity of 100MLD, will be constructed from 2016 to 2018, and will start operation in 2018.

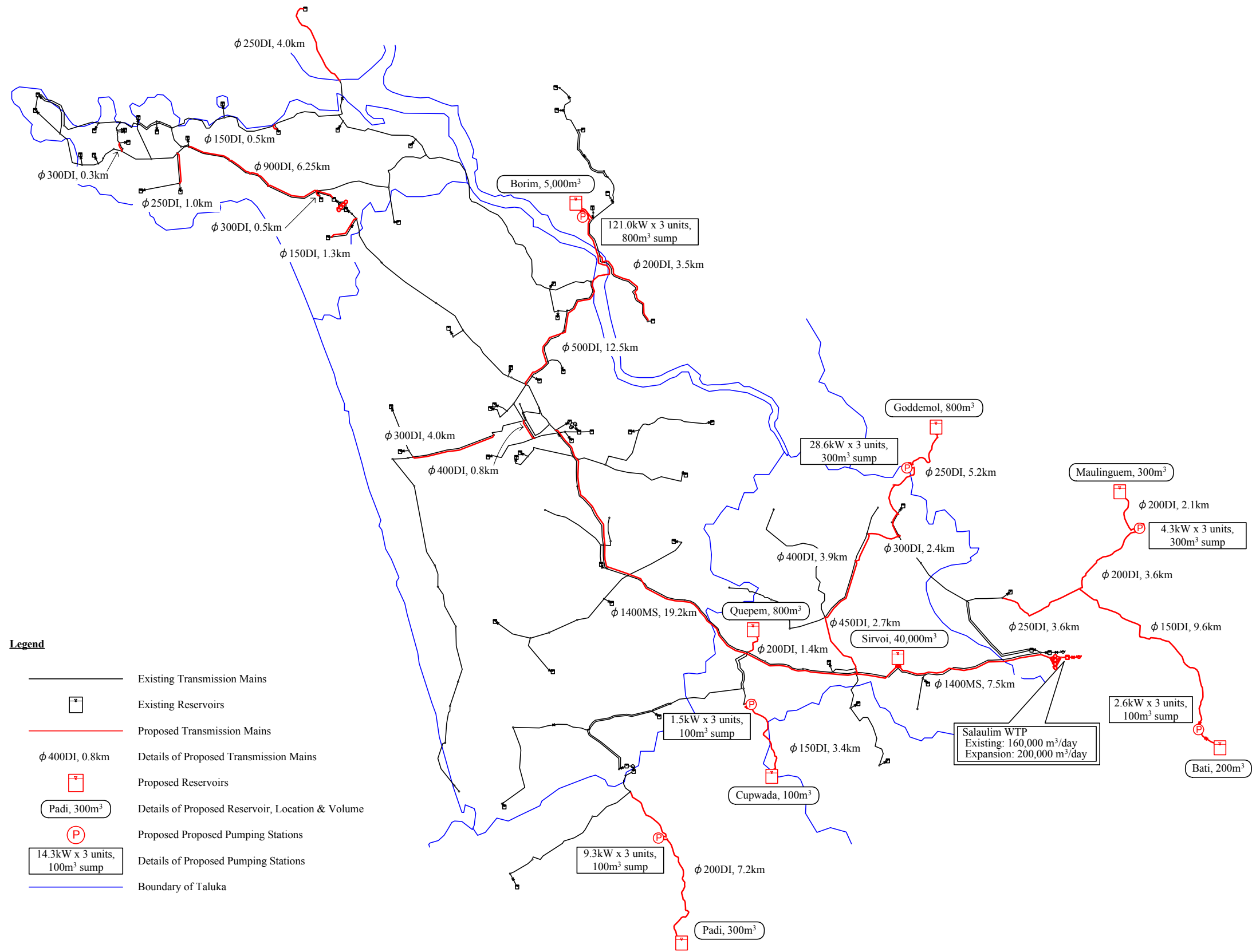
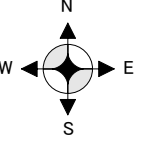
Table 53.1 Implementation Schedule for Salaulim WTP

Stage		Existing Plant	New Plant
Stage I	Components	<ul style="list-style-type: none"> - Installation of safety equipment - Replacement of raw water pumps and backwash pumps - Installation of generator and flow meters - Modification of coagulation process 	Expansion of 100 MLD
Stage II	Components	<ul style="list-style-type: none"> - Replacement of equipment which exceeds life time 	Expansion of 100 MLD

(3) Transmission System

a. Proposed Transmission System

To cover future service areas and to meet the increase in demand, the transmission system shown in Figure 53.5 is proposed and the necessary length of the transmission mains for each diameter is listed in Table 53.2. Calculation results performed using WaterCAD are attached in Volume IV Appendix M53 Results of Hydraulic Analysis.



Not to scale

Figure 53.5 Proposed Transmission System for the Salaulim WSS in 2025

Table 53.2 Proposed Transmission Mains for the Salaulim WSS

Material	Diameter (mm)	Length (km)
Mild Steel	1,400	26.7
Ductile Iron	900	6.25
	500	12.50
	450	2.70
	400	4.70
	300	7.20
	250	13.80
	200	14.30
	150	14.80
Total		102.95

b. Rehabilitation of the Existing Transmission System

The Salaulim WSS has a total length of 71.81 km asbestos cement (AC) pipelines installed before 1990 (Sector Status Study – WSS Goa, 2004) as the tapping pipelines from transmission mains to reservoirs. The Study proposes that the existing 71.81 km of AC pipelines will be replaced with ductile iron pipes.

The PWD is replacing the prestressed concrete (PSC) pipes of a diameter of 1,400 mm, which are laid from the Salaulim WTP to Margao with mild steel (MS) pipes, since pipe break accidents have occurred frequently because of poor quality of the pipe. The PWD has replaced about 10 km PSC pipes with MS pipes and the replacement of the remaining 11.3 km PSC pipes are under implementation. Therefore this replacement is not included in the master plan. However, the master plan includes the replacement of about 13.8 km of 1,200 mm PSC pipes from Margao to Verna Pumping Station.

In addition the master plan proposes the rehabilitation of about 4.2 km of the remaining PSC pipes, which represents 30 % of the pipelines with diameters greater than 600 mm.

(4) Reservoir

a. Proposed Reservoirs

To supply treated water to an expanded service area, construction of eight reservoirs (as listed in Table 53.3) is proposed. Locations and volumes of the proposed reservoirs are shown in Figure 53.5.

Table 53.3 List of Reservoirs Proposed for the Salaulim WSS

Location	Capacity (m ³)	Stage	Remarks
Sirvoi, Quepem	40,000	I & II	20,000 m ³ for Phase I and 20,000 m ³ for Phase II
Bati, Sanguem	200	I	with P/S (3 pump units of 2.6 kW and 100 m ³ sump)
Maulinguem, Sanguem	300	I	with P/S (3 pump units of 4.3 kW and 300 m ³ sump)
Guddemol, Sanguem	800	I	with P/S (3 pump units of 28.6 kW and 300 m ³ sump)
Padi, Quepem	300	I	with P/S (3 pump units of 9.3 kW and 100 m ³ sump)
Cupwada, Quepem	100	I	with P/S (3 pump units of 1.5 kW and 100 m ³ sump)
Quepem MCI, Quepem	800	I	-
Borim, Ponda	5,000	II	with P/S (3 pump units of 121 kW and 800 m ³ sump)

b. Rehabilitation of the Existing Reservoirs

The Salaulim WSS has 85 reservoirs except reservoirs at Salaulim WTP, Margao MBR and Verna MBR, as summarised in Table 53.4. A detailed list of the reservoirs is attached in Volume IV Appendix M31 Existing Water Supply System. Table 53.4 also identifies the reservoirs that need to be rehabilitated. Although the design life of the concrete structure is 50 years as mentioned in Section 5.1, this master plan assumes that about 20 percent of the existing reservoirs will be rehabilitated by 2025. This means that about 20 percent of the existing reservoirs are considered to be constructed before 1975. This is because the data of construction years of all reservoirs was not available.

Table 53.4 Number of Existing Reservoirs

Reservoir Volume (m ³)	Number of Reservoirs	
	Existing	to be rehabilitated
800 and above	27	5
500 - 650	8	2
400	6	1
300	24	6
200	3	1
150	11	2
100 and less	6	1
Total	85	18

Note: does not include the reservoirs at Salaulim WTP, Margao MBR and Verna MBR

(5) Pumping Station

a. Proposed Pumping Station

The master plan proposes the construction of six pumping stations, which will be accompanying the proposed reservoirs listed in Table 53.3.

b. Rehabilitation of the Existing Pumping Stations

The life span of the pumping equipment is assumed to be 15 years. Therefore, the pumping equipment in all the existing pumping stations should be replaced by 2025. Details are shown in Table 53.5.

Table 53.5 Pumping Equipment Replacement Details

Name of Station	Pumping Unit (pump and motor)		Name of Station	Pumping Unit (pump and motor)	
	Rated Output (kW)	No. of Units		Rated Output (kW)	No. of Units
Margao	214.2	3	Loutoulim	2.0	3
Verna	455.3	6	Raia	3.7	3
Balli	31.3	3	Nuven	15.7	3
Baida	5.9	3	Dabolim	2.6	3
Curtorim	16.5	3	Head Land Sada	16.9	3
Borda	2.3	2	Chicalim	2.8	3
Gavli Wada	10.4	3	New Vaddem	3.4	3
Camurlim	3.2	3	Mangor	14.0	3

(6) Distribution Pipeline and House Connection

a. Proposed Distribution Pipelines and House Connections

The proposed length of distribution pipelines were calculated by multiplying the number of

house connections to be installed (which reflects the increase in population served) by the unit pipeline length per connection (which is 14.26m as mentioned in section 5.1.2). Table 53.6 shows the proposed number of house connections and length of distribution pipelines.

Table 53.6 Proposed Number of House Connections and Length of Distribution Pipelines in the Salaulim WSS (incremental basis)

Year	2007	2008	2009	2010	2011	2012	2013
Distribution Pipeline (m)	41,242	42,032	42,790	43,602	44,267	45,138	46,011
Number of House Connection	2,892	2,948	3,001	3,058	3,104	3,165	3,227
Year	2014	2015	2016	2017	2018	2019	2020
Distribution Pipeline (m)	46,943	47,866	48,781	49,763	52,211	55,381	56,466
Number of House Connection	3,292	3,357	3,421	3,490	3,947	3,884	3,960
Year	2021	2022	2023	2024	2025	Total	
Distribution Pipeline (m)	57,426	58,505	59,613	60,722	61,875	964,710	
Number of House Connection	4,027	4,103	4,180	4,258	4,339	67,652	

b. Rehabilitation of the Existing Distribution Pipelines and House Connections

The life span of the distribution pipelines is assumed to be 50 years. It is planned that 2 % of the existing 1,425 km of distribution pipelines will be replaced every year. This will total 38 % from 2007 to 2025. As a result the existing 540 km of distribution pipelines will be replaced with new pipelines during the 19 years from 2007 to 2025.

The life span of house connections is assumed to be 10 years. It is planned that all 105,700 existing house connections will be replaced within 10 years. As a result about 229,000 house connections will be replaced during the 19 years from 2007 to 2025.

(7) Summary of the Planning

In conclusion, the components of the master plan for the Salaulim Water Supply WSS are summarised in Table 53.7. Figure 53.6 depicts the proposed Salaulim Water Supply System in 2025.

Table 53.7 Components of the Master Plan for the Salaulim WSS

Facility	Proposed		Rehabilitation/ Replacement
	Stage I	Stage II	
Treatment Plant	100,000 m ³ /day	100,000 m ³ /day	160,000 m ³ /day
Master Balancing Reservoir	20,000 m ³	20,000 m ³	-
Transmission Main	74 km	29 km	83 km
Reservoir	6	1	18
Pumping Station	5	1	16
Distribution Pipeline	965 km		540 km
House Connection	68,000		229,000

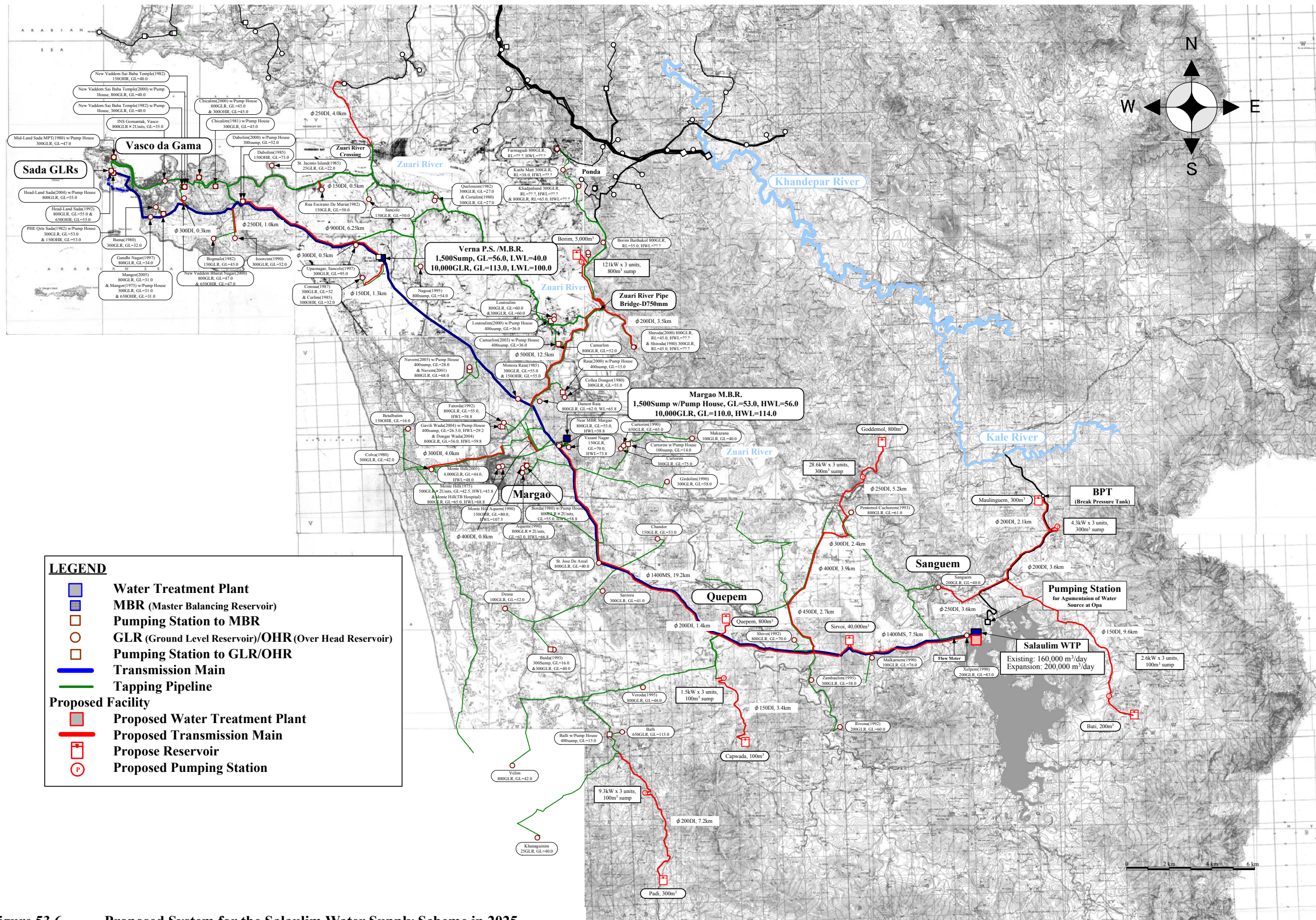


Figure 53.6 Proposed System for the Salaulim Water Supply Scheme in 2025