

4. Project Costs

Budgetary estimates for the proposed systems and components have been calculated and presented below. Cost data are based upon the best currently available information obtainable from local suppliers and contractors in Pondicherry and from similar projects conducted recently. Where necessary these data have been modified to reflect differences in design concepts or construction methods envisioned for the proposed facilities. All costs and prices reflect prices applicable in mid-2002.

Estimated construction costs for the storage system, pumping system and infiltration system have not been taken into account in this study as they shall entirely depend on the final implementation strategies. Moreover, as the total cost of these items is going to be less than 10% of the total project costs, their omission is not going to cause any significant difference in total project costs.

Consultancy, planning, designing and project supervision costs are not included in the costs below as these can be determined only upon finalization of the required and chosen implementation schedules and conditions of the proposed project.

The costs in this investigation are described in this section under three main headings:

1. Estimated Construction Costs,
2. Estimated Operation & Maintenance costs,
3. Estimated Implementation costs.

4.1 *Estimated construction costs*

Estimated construction cost of the sewerage system

The estimated costs for the construction of the wastewater collection and conveyance system to connect all of the units from Aurobhakti and Udyogam to the proposed CETP including supply of plumbing materials and construction of manholes and other related structures is:

Total length of wastewater collection and conveyance system: **300 m.**

Estimated cost of construction: **1,000/- Rs/m.**

Total estimated construction cost: Rs. 3,00,000/-.

Estimated construction cost of the Imhoff Tank

The estimated construction costs of the Imhoff tank of 30 m³/day capacity including supply of materials and construction in RCC and plain cement concrete (PCC), and related plumbing equipment is:

Treatment capacity of Imhoff tank: **220 PE**

Estimated cost of construction: **2,050/- Rs/PE.**

Total estimated construction cost: Rs. 4,50,000/-.

Estimated construction cost of the Root Zone Treatment system

The estimated construction cost of one module of 150 m² of reed bed area including:

- supply of materials and construction of the holding tank for the reedbed including inflow and outflow structures all in RCC,
- filling media consisting of graded and cleaned silica sands and gravels and planting of *Phragmites* spp. reeds,
- flow regulation and related plumbing devices,

is:

ITEM	Quantity	Rate	Amount
Holding tank for the reedbed	150 m ²	5,400 Rs/m ²	Rs. 8,10,000/-
Filling media	150 m ²	2,800 Rs/m ²	Rs. 4,20,000/-
Plumbing	L.S.		Rs. 50,000/-
TOTAL:			Rs. 12,80,000/-

Thus the total estimated construction cost for:

One RZT module of 150 m² is:	<u>Rs. 12,80,000/-.</u>
For three RZT modules (450 m²) is:	<u>Rs. 38,40,000/-.</u>
For four RZT modules (600 m²) is:	<u>Rs. 51,20,000/-.</u>

Estimated construction cost of the Sludge Drying system

The estimated construction cost of the sludge drying bed of 100 m² of reed bed area including:

- supply of materials and construction of the holding tank for the reedbed in masonry and PCC,
- filling media consisting of graded and cleaned silica sands and gravels and planting of *Phragmites* spp. reeds,
- related plumbing devices,

is:

Total extent of sludge drying system: **100 m².**

Estimated cost of construction: **3,400/- Rs/m².**

Total estimated construction cost is:

For 75 m² (required in beginning):	<u>Rs. 2,55,000/-.</u>
For 100 m² (final requirement):	<u>Rs. 3,40,000/-.</u>

4.1.1.1.1 Total estimated cost of fully completed ETP

The total estimated cost of the proposed fully completed ETP is **Rs. 68,741,000.00**. This is detailed below.

TOTAL ESTIMATED CONSTRUCTION COSTS OF FULLY COMPLETED ETP		
Sl. [-]	description [-]	Grand Total in INRs
1	COSTS FOR SCREEN & GRIT CHAMBER	371,600.00
2	COSTS FOR THE IMHOFF TANK	3,527,000.00
3	COSTS FOR THE TRICKLING FILTER	11,480,500.00
4	COSTS FOR THE DORTMUND TANK	1,351,200.00
5	COSTS FOR THE PIPES & EQUIPMENTS	1,646,000.00
6	COSTS FOR THE ROOTZONE TREATMENT SYSTEM	45,690,500.00
7	COSTS FOR THE SLUDGE DRYING BEDS	4,674,200.00
	TOTAL:	68,741,000.00

4.1.1.2 Estimated cost of the treated wastewater re-use system

4.1.1.2.1 Estimated cost of Storage Tanks

The estimated costs include supply of materials and construction of two storage tanks and related pumping and plumbing equipment. The total estimated costs are **Rs. 263,000.00**. This is detailed below and given in greater detail in annex 11.

Estimated cost of Storage Tanks

Sl. [-]	Description [-]	Grand Total in INRs
1	Earthwork	62,000.00
2	Construction works	186,000.00
3	Technical equipment	15,000.00
	TOTAL:	263,000.00

4.1.1.2.2 Estimated cost of Pumping and Desalination system

The estimated costs include supply of materials and construction of sheds including desalination and booster-pumping systems with related pumping and plumbing equipment. The total estimated costs are **Rs. 5,006,900.00**. This is detailed below and given in greater detail in annex 11.

Estimated cost of Pumping and Desalination system

Sl. [-]	Description [-]	Grand Total in INRs
1	Earthwork	900.00
2	Construction	174,000.00
3	Steel work	152,000.00
4	Technical equipment	4,680,000.00
	TOTAL:	5,006,900.00

4.1.1.2.3 Total estimated cost of the treated wastewater re-use system

The total estimated cost of the proposed treated wastewater re-use system is **Rs. 5,269,900.00**. This is detailed below.

Total estimated cost of the treated wastewater re-use system

Sl. [-]	Description [-]	Grand Total in INRs
1	COSTS FOR STORAGE TANKS	263,000.00
2	COSTS FOR DESALINATION PLANT AND BOOSTER PUMPS	5,006,900.00
	TOTAL:	5,269,900.00

4.1.1.3 Total estimated cost of Proposed Wastewater Management System

The total estimated cost of the fully complete proposed wastewater management system is **Rs. 822,65,620.00**. This is detailed below.

TOTAL ESTIMATED CONSTRUCTION COST OF PROPOSED WASTEWATER MANAGEMENT SYSTEM		
SI	Description	Grand Total
[-]	[-]	in INRs
1	TOTAL COSTS OF SEWERAGE WORKS	8,254,720.00
2	TOTAL COSTS OF WASTE WATER TREATMENT PLANT	68,741,000.00
3	TOTAL COSTS OF WASTE WATER PURIFICATION AND RE-USE	5,269,900.00
	<u>TOTAL</u>	<u>822,65,620.00</u>

4.1.2 Estimated operation & maintenance (O&M) costs.

Operation costs have been estimated on the basis of the electric power requirement of each system during one year. The unit for measuring power requirement is KW/h. The rate applied per KW/h is Rs. 5.00.

Maintenance and other running costs have been estimated as 5 and 10 % respectively of the estimated yearly costs of operation. This is in adherence to standard estimating practices.

Salaries of 5 staff for the management of the entire wastewater and storm-water management systems have been estimated as Rs. 1,80,000.00 totally per year. As these costs are barely 2 % of other total O&M costs they have not been referred to in the discussions below.

4.1.2.1 Estimated (O&M) costs of the sewerage system

4.1.2.1.1 Estimated yearly O&M costs of Pumping Stations cum Flow Equalization system

Minor pumping station – Pumping station II

The estimated yearly costs of O&M are **Rs. 131,800.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M costs - Minor pumping station – Pumping station II

descriptions	power consumption kWh/d	power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint. 5%	total cost INR/a
Pump station II	63	22,916	114,581	11,458	5,729	131,800.00

Major pumping station – Pumping station I cum Flow Equalization system.

The estimated yearly O&M costs are **Rs. 399,800.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M costs - Major pumping station – Pumping station I cum Flow Equalization system

descriptions	power consumption kWh/d	power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint. 5%	total cost INR/a
Pump station I (main pump station)	179	65,159	325,795	32,579	16,290	374,664
Air wash facility for main pump station	12	4,380	21,900	2,190	1,095	25,185
total			347,695	34,769	17,385	399,800.00

4.1.2.1.2 Estimated yearly total O&M costs of proposed sewerage system

The total yearly estimated O&M costs of the proposed sewerage system are **Rs. 531,600.00**. This is detailed below and given in greater detail in annex 11.

ESTIMATED YEARLY TOTAL O&M COSTS OF PROPOSED SEWERAGE SYSTEM

Sl.	Description	total cost INR/a
1	TOTAL ELECTRICITY COST FOR MAIN PUMP STATION	399,800.00
2	TOTAL ELECTRICITY COST FOR SUB-PUMP STATION II	131,800.00
	TOTAL:	531,600.00

4.1.2.2 Estimated yearly O&M costs of the Effluent Treatment Plant

4.1.2.2.1 Estimated yearly O&M cost of the Imhoff Tank

The estimated yearly O&M costs are **Rs. 2,600.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M cost of the Imhoff Tank

descriptions	power consumption kWh/d	Power consumption kWh/a	operational cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint 5%	total cost INR/a
Gravitation pump imhoff tank	1.1	418	2,089	209	104	2,400.00
Sludge pump I	0.1	35	174	17	9	200.00
total			2,263	226	113	2,600.00

4.1.2.2.2 Estimated yearly O&M costs of the Trickling Filter

The estimated yearly O&M costs are **Rs. 527,000.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M cost of the Trickling Filter

descriptions	power consumption kWh/d	power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint 5%	total cost INR/a
Pump I for trickling filter	126	45,832	229,162	22,916	11,458	263,500.00
Pump II for trickling filter	126	45,832	229,162	22,916	11,458	263,500.00
total			458,323	45,832	22,916	527,000.00

4.1.2.2.3 Estimated cost of the Dortmund Tank

The estimated yearly O&M costs are **Rs. 2,600.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M cost of the Dortmund Tank

descriptions	power consumption kWh/d	power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint 5%	total cost INR/a
Gravitation pump dortmund tank	1.1	418	2,089	209	104	2,400.00
Sludge pump II	0.1	35	174	17	9	200.00
total			2,263	226	113	2,600.00

4.1.2.2.4 Estimated yearly O&M costs of other related equipment at the ETP

The estimated yearly O&M costs are **Rs. 285,500.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly O&M costs of other related equipment at ETP

descriptions	power consumption kWh/d	Power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint 5%	total cost INR/a
Sludge pump III	0.1	35	174	17	9	200.00
Air wash facility for waste water treatment plant	36	13,140	65,700	6,570	3,285	75,500.00
Other equipment (lighting, measurement, etc.)	100	36,500	182,500	18,250	9,125	209,800.00
total			248,374	24,837	12,419	285,500.00

4.1.2.2.5 Estimated yearly total O&M costs of fully completed ETP

The total estimated yearly O&M costs of the proposed fully completed ETP are **Rs. 817,800.00**. This is detailed below and given in greater detail in annex 11.

Estimated yearly total O&M costs of fully completed ETP

Sl.	Descriptions	total cost INR/a
3	TRICKLING FILTER	527,000.00
4	DORTMUND TANK	2,600.00
5	IMHOFF TANK	2,600.00
6	OTHER RELATED EQUIPMENT	285,600.00
	total	817,800.00

4.1.2.3 Estimated yearly total O&M costs of the treated wastewater re-use system

4.1.2.3.1 Estimated total yearly O&M costs for Pumping and Desalination system

The estimated total yearly O&M costs are **Rs. 4,745,300.00**. This is detailed below and given in greater detail in annex 11.

Estimated total yearly O&M costs of Pumping and Desalination system

descriptions	power consumption kWh/d	Power consumption kWh/a	operation cost @ INR 5.00 per kWh INR/a	running cost 10%	rep & maint. 5%	total cost INR/a
Desalination plant	120	43,800	219,000	21,900	10,950	251,800.00
Booster pump for re-use	864	315,360	1,576,800	157,680	78,840	1,813,300.00
Booster pump for irrigation	1272	464,280	2,321,400	232,140	116,070	2,669,600.00
Other equipment (lighting, measurement, etc.)	5	1,825	9,125	913	456	10,500.00
total			4,126,325	412,633	206,316	4,745,300.00

4.1.2.4 Estimated yearly total O&M costs of Proposed Wastewater Management System

The estimated yearly total O&M costs of the fully complete proposed wastewater management system are **Rs. 6,094,600.00**. This is detailed below and given in greater detail in annex 11.

ESTIMATED TOTAL YEARLY O&M COSTS OF PROPOSED WASTEWATER MANAGEMENT SYSTEM

Sl.	Descriptions	total cost INR/a
1	TOTAL O&M COSTS FOR SEWERAGE SYSTEM	531,600.00
2	TOTAL O&M COSTS FOR IMHOFF TANK	2,600.00
3	TOTAL O&M COSTS FOR TRICKLING FILTER	527,000.00
4	TOTAL O&M COSTS FOR DORTMUND TANK	2,600.00
5	TOTAL O&M COSTS FOR TREATMENT PLANTS AND OTHER EQUIPMENTS	285,600.00
6	TOTAL O&M COSTS FOR WASTE WATER RE-USE	4,745,200.00
	total	6,094,600.00

4.1.3 Estimated implementation costs.

With reference to the proposed implementation schedule, it is convenient to split the estimated implementation costs of the proposed systems in two stages. The first stage consists of phases 1 and 2 of the development of the NSIT and the second stage consists of phases 3 & 4.

Additionally the estimated implementation costs may be divided into two categories estimated constructions costs and estimated yearly O&M costs.

4.1.3.1 Estimated implementation costs during 1st Stage

4.1.3.1.1 Estimated construction costs - 1st Stage

The estimated construction costs during the first stage are **Rs. 39,963,500.00**, about **49 %** of estimated total construction costs of the proposed wastewater management system. This is detailed below.

Estimated total construction costs of proposed Wastewater Management System – 1st Stage

SI [-]	description [-]	Grand Total in INRs
1	COST OF THE SEWERAGE SYSTEM:	8,254,700.00
2	COST OF SCREEN & GRIT CHAMBER	371,600.00
3	COST OF THE IMHOFF TANK	3,527,000.00
4	COSTS FOR THE ROOTZONE TREATMENT SYSTEM – 55%	25,129,800.00
5	COSTS FOR THE SLUDGE DRYING BEDS – 35%	1,635,900.00
6	COSTS FOR THE PIPES & EQUIPMENTS – 50%	823,000.00
7	COSTS FOR THE STORAGE TANKS – (IRRIGATION) - 50%	131,500.00
8	COSTS FOR BOOSTER PUMPS - (IRRIGATION)	90,000.00
	TOTAL:	39,963,500.00

4.1.3.1.2 Estimated O&M costs- 1st Stage

The estimated yearly O&M costs during the first stage are **Rs. 3,346,600.00**, about **8.4 %** of estimated total construction costs during the first stage. This is detailed below.

Estimated total yearly O&M costs of Proposed Wastewater Management System - 1st Stage

Sl.	Descriptions	total cost INR/a
1	TOTAL O&M COSTS FOR SEWERAGE SYSTEM	531,600.00
2	TOTAL O&M COSTS FOR IMHOFF TANK	2,600.00
3	TOTAL O&M COSTS FOR TREATMENT PLANTS AND OTHER EQUIPMENTS – 50 %	142,800.00
4	TOTAL O&M COSTS FOR WASTE WATER RE-USE - IRRIGATION	2,669,600.00
	total	3,346,600.00

Thus during the first stage of implementation of the proposed wastewater management system, the estimated construction and O&M costs would be:

Sl.	Descriptions	total cost	
1	TOTAL ESTIMATED CONSTRUCTION COSTS	39,963,500.00	INR
2	TOTAL ESTIMATED YEARLY O&M COSTS	3,346,600.00	INR/a

4.1.3.2 Estimated (additional) implementation costs during 2nd Stage

4.1.3.2.1 Estimated (additional) construction costs – 2nd Stage

The estimated (additional) construction costs during the second stage are **Rs. 42,302,000.00**, about **51 %** of estimated total construction costs of the proposed wastewater management system. This is detailed below.

Total estimated (additional) construction cost of proposed Wastewater Management System – 2nd Stage

Sl [-]	description [-]	Grand Total in INRs
	COSTS FOR THE ROOTZONE TREATMENT SYSTEM – 45%	20,560,700.00
	COST OF THE TRICKLING FILTER	11,480,500.00
	COST FOR THE DORTMUND TANK	1,351,200.00
	COSTS FOR THE SLUDGE DRYING BEDS – 65%	3,038,200.00
	COSTS FOR THE PIPES & EQUIPMENTS – 50%	823,000.00
	COSTS FOR THE STORAGE TANKS – (RE-CYCLING) - 50%	131,500.00
	COSTS FOR BOOSTER PUMPS - (RE-CYCLING)	90,000.00
	COSTS FOR THE DESALINATION PLANT	4,826,900.00
	TOTAL:	42,302,000.00

4.1.3.2.2 Estimated O&M costs- 2nd Stage

The estimated yearly O&M costs during the second stage are **Rs. 2,748,000.00** or about **6.5 %** of estimated total construction costs during the second stage. This is detailed below.

Estimated (additional) total yearly O&M costs of Proposed Wastewater Management System – 2nd Stage

Sl.	Descriptions	total cost INR/a
2	TOTAL O&M COSTS FOR TRICKLING FILTER	527,000.00
3	TOTAL O&M COSTS FOR DORTMUND TANK	2,600.00
5	TOTAL O&M COSTS FOR TREATMENT PLANTS AND OTHER EQUIPMENTS – 50%	142,800.00
6	TOTAL O&M COSTS FOR WASTE WATER RE-USE	2,075,600.00
	total	2,748,000.00

Thus during the second stage of implementation of the proposed wastewater management system, the (additional) estimated construction and O&M costs would be:

Sl.	Descriptions	total cost	
1	TOTAL ESTIMATED CONSTRUCTION COSTS	42,302,000.00	INR
2	TOTAL ESTIMATED YEARLY O&M COSTS	2,748,000.00	INR/a

