Infrastructure Development Department (IDD)

GOVERNMENT OF KARNATAKA

Institutional strengthening & Sector Inventory for PPP Mainstreaming in Directorate of Municipal Administration (DMA)

Preliminary Feasibility Report

Hosakote Town Municipal Council

Integrated Water Supply project for Hosakote Town

July 2012

ICRA Management Consulting Services Limited

Contents

Exhibits

Abbreviations and Acronyms

IDD	Infrastructure Development Department
DMA	Directorate of Municipal Administration
GoK	Government of Karnataka
IMaCS	ICRA Management Consulting Services Limited
INR	Indian Rupees
BWSSB	Bangalore Water Supply & Sewerage Board
TMC	Town Municipal Council
LPCD	Litres per capita per day
MLD	Million Litres per Day
MGD	Million Gallons per Day
MSW	Municipal Solid Waste
O&M	Operation & Maintenance
PPP	Public Private Partnership
DBOT	Design-Build-Operate-Transfer
STP	Sewage Treatment Plant
TT Plant	Tertiary Treatment Plant
ULB	Urban Local Body
MUDA	Mysore Urban Development Authority
SPV	Special Purpose Vehicle
TOR	Terms of Reference
FDI	Foreign Direct Investment
BWSSB	Bangalore Water Supply and Sewerage Board
NPV	Net Present Value

1. Introduction

1.1 Project Idea

The Government of Karnataka has identified Public Private Partnerships (PPPs) as one of the key elements of its infrastructure development strategy. To build capacity across various departments for conceptualizing, developing and implementing PPP projects, GoK, through its Infrastructure Development Department (IDD) has initiated an exercise for Institutional strengthening and developing sector level inventory for mainstreaming PPPs across a number of departments and sectors.

Under this initiative, the Department of Municipal Administration (DMA) has been identified as a nodal agency for urban infrastructure projects in Urban Local Bodies (ULBs) other than Bangalore Metropolitan Area and GoK has appointed Ms. ICRA Management Consulting Services Limited (IMaCS) to assist DMA in conducting pre-feasibility studies for five projects in urban sector context (with potential for replication in rest of the state).

Under this initiative, DMA, Hosakote Town Municipal Council (TMC) & IMaCS have taken up the concept to **explore feasibility of and Integrated Water Supply project including:**

Supply and distribution of treated water from Doddakere Lake for water demand/consumption for Hosakote City while supplementing the source of incoming water to the lake with tertiary treated reclaimed water from Bellandur Lake.

Hosakote is a taluk in Bangalore Rural District. Headquartered at the Hosakote town, it consists of 5 Hoblis - Anugondanahalli, Jadigenahalli, Kasaba, Nandagudi and Sulibele. Currently, Hosakote depends on ground water (borewells) as the main source of water supply. Due to depletion of rainfall year by year, overexploitation & less recharges, the yield from the borewells are diminishing considerably. In summer season, the water table goes much below thus creating scarcity of water. Hence, the ground water source is not dependable and there is an inevitable need to develop a project for alternate source of water supply.

For consensus building, meetings and discussions with IDD, DMA & Hosakote TMC were held to take a go-ahead on developing and exploring sustainability of the project.

1.2 Scope of Work

The scope of this report includes:

1. Assessing Preliminary Feasibility of the envisaged project which includes:
    a. Sector Profiling and identifying the need for reuse of recycled waste water for meeting water demand and its importance in developing countries.
    b. Profiling of Hosakote City and understand their water requirements and demands.
    c. Overview and profiling of Doddakere lake, Koramangala-Challaghatta STP and its infrastructure, to understand the supply side for the project
    d. Understanding the role and merits and demerits of PPP in reuse of recycled waste water treatment and its success key factors through case studies.
    e. Market Assessment through industry outlook and opportunities and demand projections

f. Preparation of preliminary financial model to explore the viability of the project on PPP mode in a sustainable manner.

g. Understanding the statutory and legal framework which prevails in this project and identifying the policy issues which may slow down the process of implementation of the project on PPP mode.

h. Identifying environmental and social impacts of the project and to suggest mitigation measures to overcome these impacts.

i. Preliminary recommendations of possible Project Structure & Project Development Framework; which includes, structure of PPP, identification of components for PPP, Benefits, risks and mitigation etc.

2. Laying the path for Way Forward which would include:

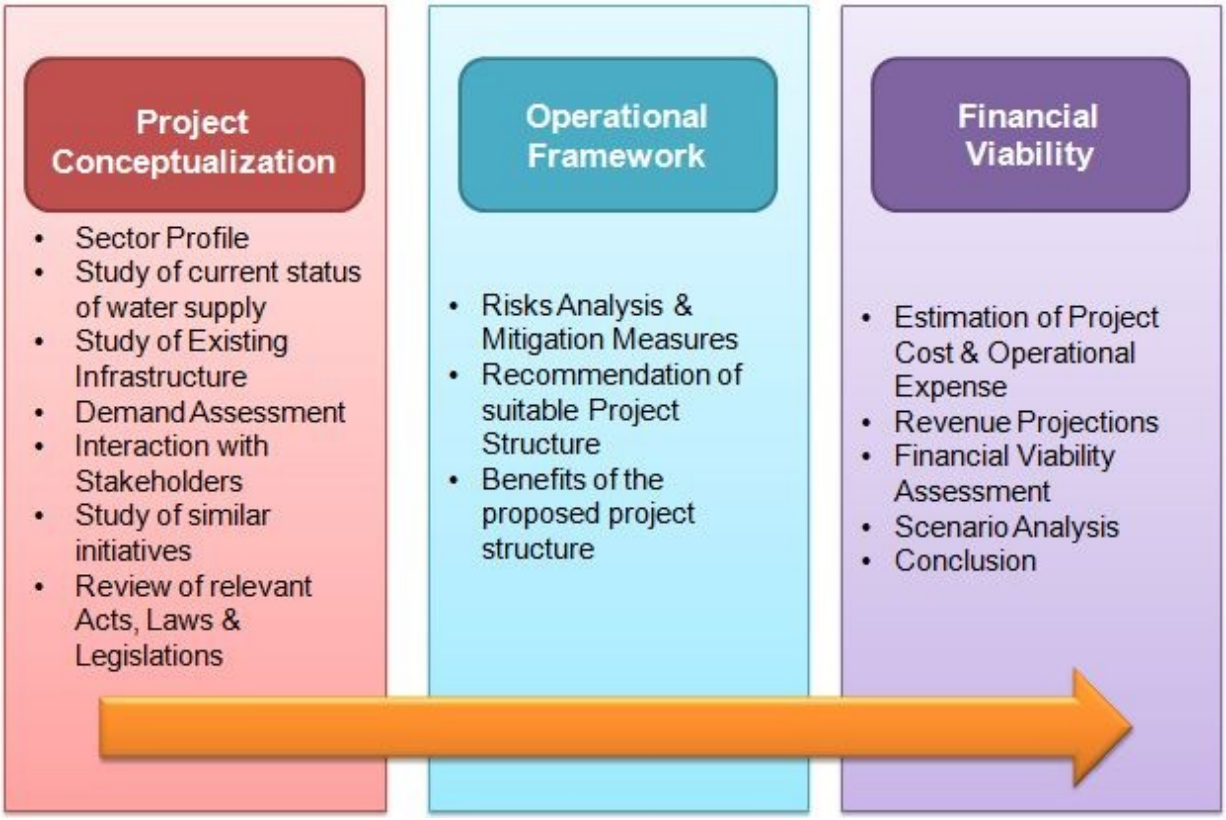
a. Prepare Procurement Plan for Selection of Transaction Advisors/ Technical Consultant for the project

b. Development of TOR for Transaction Advisor/ Technical Consultant

1.3 Approach

The approach adopted in assessing the feasibility of this project is as set out in Exhibit 1.1 Approach & methodology:

Exhibit 1.1 Approach & methodology



1.4 Methodology

1.4.1 Project Conceptualisation

- **Sector Profile**: Sector Profile details out the overview of the sector, key issues, need of project etc. As a part of secondary research, documents like Hosakote Action Plan, Hosakote Water Supply proposal in form of draft DPR, relevant acts & legislations, etc were reviewed and analysed to understand the regional profile. The consultations with various stakeholders were also done to get an in-depth understanding of various issues pertaining to the project.
- **Study of Existing Infrastructure & Demand Estimation**: In order to know the marketability of the project, analysis of demand supply scenario of project components were conducted.
- **Case Studies:** Case studies of similar project executed elsewhere were conducted to understand its various technical, legal and financial aspects.

1.4.2. Operational Framework

- **Risk Analysis**: Critical risk factors involved in the project, their impact & likelihood, and potential mitigation measures were analysed.
- **Project Structuring**: Various options for structuring the transaction, having varying possibilities of risks and liabilities for different parties of transaction were examined and the most suitable option has been recommended.

1.4.3. Financial Viability

Based on the data collection, analysis and discussions with stakeholders concerned, a preliminary financial model was prepared. Suitable assumptions regarding the cost, revenue and expenses were made. The financial feasibility analysis consists of:

- **Cost Estimation:** The cost of implementing the conceptualized project was derived. The base cost for O&M was arrived at after analyzing expenditure pattern for the similar projects which are already operational and industry inputs.
- **Revenue Projections:** Revenue projections were done based on projected demand and base price. An appropriate escalation was applied for the projection of revenue in upcoming years.
- **Financial Viability Assessment:** Financial analysis was undertaken to understand the project's potential to generate sufficient returns in order to make it a commercial venture. Net Present Value (NPV) at 15% discount rate was used as indicator to assess the project's viability.
- **Scenario Analysis:** The analysis of various cases like variation in revenue or project cost and corresponding Project NPV was done.

1.5 Study of earlier reports in this sector in the relevant area

Direct/ indirect reuse of re-cycled water arrangements are already in operation in various parts of the world. Snapshot on some of the projects is given below. (Details in subsequent sections)

The city of Windhoek (Namibia), for instance, faced severe water shortage in 1960s. Therefore, in 1968, the city adopted a water reclamation scheme from domestic wastewater to supplement the potable water to the city. The wastewater is treated in two separate, consecutive treatment plants to potable standard. The first is the conventional biological treatment plant at Gamams to treat raw wastewater, which is then discharged into a series of maturation ponds. From there, the effluent

gravitates directly to the water reclamation plant at Goreangab. The reclaimed water is blended in two steps. The first blending step takes place at the Goreangab treatment plant, where the reclaimed water is blended with conventionally treated surface water. The second blending step takes place in the bulk water system of Windhoek, where the blend from Goreangab is mixed with treated water from other sources.

The Tampa Water Resource Recovery Project, developed to satisfy the future water demands of both the city of Tampa and the West Coast Regional Water Supply Authority, involved the supplemental treatment of the Hookers Point Advanced Wastewater Treatment (AWT) Facility effluent to achieve acceptable quality for augmentation of the Hillsborough River raw water supply. A pilot plant was designed, constructed, and operated to evaluate supplemental treatment requirements, performance, reliability, and quality.

1.6 Report structure and contents

The report has been prepared based on information provided by Hosakote Town Municipal Council and is organised along the following sections:

1. Introduction (this section)
2. Sector profile
3. Hosakote City Water Supply
4. Case Studies and Best Practice
5. Project
6. Risk Analysis, Project Structuring and Bid Variable
7. Project Financials
8. Statutory & Legal Framework
9. Indicative environmental & social impacts
10. Way Ahead

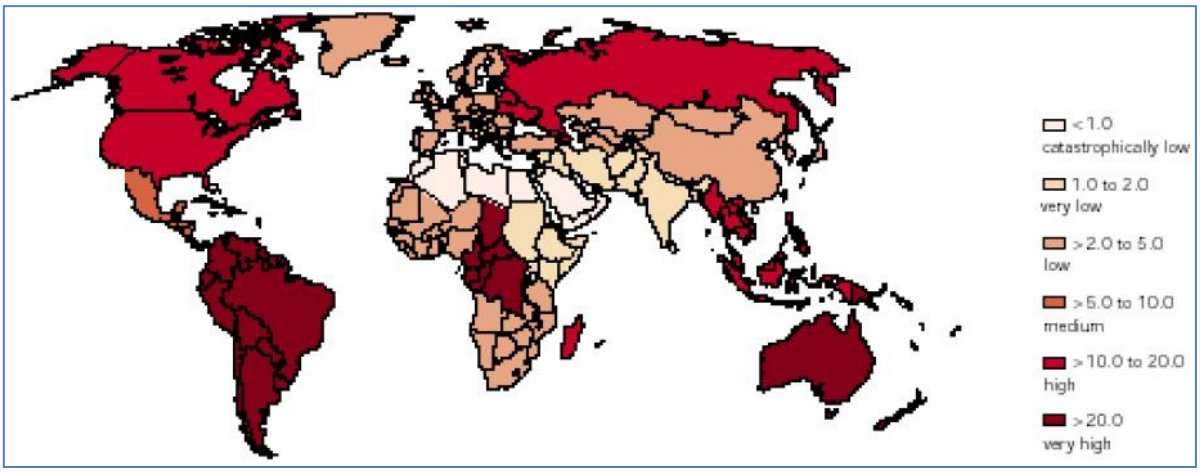
2. Sector profile

2.1 Sector overview

Water-related problems are increasingly recognized as one of the most immediate and serious environmental threats to humankind. Water use has more than tripled globally since 1950, and one out of every six persons does not have regular access to safe drinking water. Lack of access to a safe water supply and sanitation affects the health of 1.2 billion people annually (WHO and UNICEF, 2000). The latest Global Environment Outlook of the United Nations Environmental Programme (UNEP) reports that about one third of the world's populations currently live in countries suffering from moderate-to-high water stress, where water consumption is more than 10% of renewable freshwater resources. As Exhibit 2.1 Water availability in 2000 (Measured in terms of 1000m^3 per capita/year) shows, many countries in Africa and Asia have very low or catastrophically low water availability (UNEP, 2002a).

These problems may be attributed to many factors. Inadequate water management is accelerating the depletion of surface water and groundwater resources. Water quality has been degraded by domestic and industrial pollution sources as well as non-point sources. In some places, water is withdrawn from the water resources, which become polluted owing to a lack of sanitation infrastructure and services. Over-pumping of groundwater has also compounded water quality degradation caused by salts, pesticides, naturally occurring arsenic, and other pollutants. In urban areas, demand for water has been increasing steadily, owing to population growth, industrial development, and expansion of irrigated peri-urban agriculture. Population growth in urban areas is of particular concern for developing countries. Population growth is expected to occur in developing nations, as developed regions are projected to see their population decrease by 6% over the next 50 years. Meanwhile, the rural population is expected to stabilize at around 3.2 billion (from 2.97 billion today), indicating that the growing population will settle in urban areas (WHO and UNICEF, 2000). Many parts of the world are facing changes in climatic conditions, such as rainfall patterns, flood cycles, and droughts, which affect the water cycle.

Exhibit 2.1 Water availability in 2000 (Measured in terms of 1000m^3 per capita/year)



Source: UNEP, 2002a

India, a developing nation with increasing economic growth shows that population growth, urbanization, industrialization and water-intensive agriculture will act as drivers for increased water usage in future. It is expected that population of India would increase from 1.21 billion in 2011 to 1.66

billion by 2050; urban population would grow from 27.8% of the total population in 2011 to 55.2 % by 2050. Thus, the overall economic and population growth in India would put water stress on the road of success.

Exhibit 2.2 Comparison of Per Capita Clean Water Availability and Demand in India (1997–2050E)

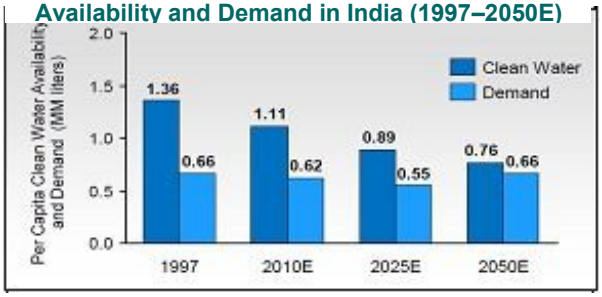
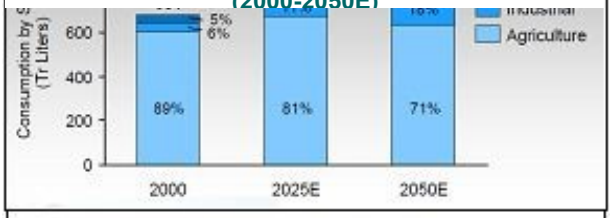


Exhibit 2.2 Comparison of Per Capita Clean Water Availability and Demand in India (1997–2050E) shows the comparison of per capita clean water availability in the future.

The estimated demand of water over the coming years shows the decreasing quantity of clean water and increasing demand of clean water. By 2050, it has been estimated that the demand of clean water would be equivalent to the availability of clean water, thus putting stress over other sectors.

Exhibit 2.3 Water Breakdown in India by Sector (2000-2050E)



Source: Grail Research, a division of Integreon, 2009

Exhibit 2.3 Water Breakdown in India by Sector (2000-2050E)**Error! Reference source not found.** shows the water breakdown in India by Sectors from 2000 to 2050. The graph shows the steep increase in the domestic & industrial use. Thus, it can be concluded that, the huge demand for clean water will be contested in future.

Faced with these challenges, there is an urgent need to improve the efficiency of water consumption, and to augment the existing sources of water with more sustainable alternatives. Consequently, reuse of recycled waste water becomes a potential solution to overcome the shortage of clean water availability.

2.2 City profile

Hosakote is a taluk in Bangalore Rural District. Headquartered at the Hosakote town, it consists of 5 Hoblis - Anugondanahalli, Jadigenahalli, Kasaba, Nandagudi and Sulibele. It is surrounded by Bangalore Urban district on its west and south west, Kolar on its east and north and Tamil Nadu State on its south. Agriculture, Apiculture and horticulture are primary occupations of people here, although the industrialization in the recent times in Hosakote and places around has thrown up new opportunities for the people.

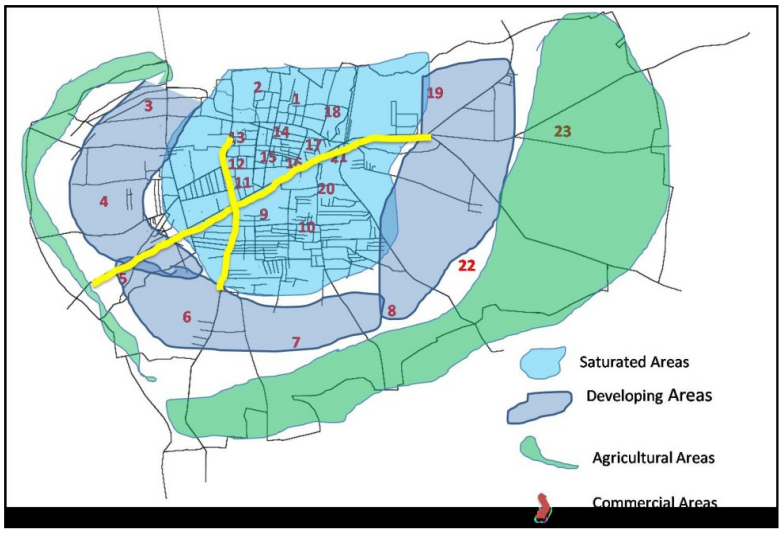
Hosakote town lies at the intersection of NH-4 and NH-207 and as such is a busy town with both resident and floating population. Lying on NH 4, and about 36 km from Bangalore City, Hosakote is well connected to Bangalore. The nearest railway stations to Hosakote are the Krishnarajapuram and Whitefield railway stations.

Topography of the town is a gentle slope towards the south, soil is loamy in characteristic. The average altitude of the town is 875 m above the MSL. The town is characterized by salubrious climate. The climate is hot during the month of March to April. The temperature of the town varies from minimum of 120°C to maximum of 370°C. Hosakote receives an average rainfall of 750 mm. As of 2011 India census, Hosakote had a population of 56,613.

The Hosakote town can be divided into 4 Zones, namely: 1) Saturated Zone, 2) Developing Zone, 3) Commercial Zone, and 4) Agricultural Zone. The distribution has been shown in Exhibit 2.4 Zone-wise distribution of Hosakote

Saturated Zone of Hosakote town comprises of the wards1,2,9,10,11,12,13,14,15,16,17,18,19 20 and 21 where population growth held up and infrastructure requirement is fulfilled. The population of the saturated zone is approximately 28800. Three slums are present in Ward No: 1, 19 and 21. Developing Zone of Hosakote Town comprises of areas of wards 3, 4, 5, 6, 7, 8 and 22. The population of developing zone is approximately 26,041. This is the area where more residential projects coming up and close to the National highway. Agricultural zone is the outskirts of town. Leafy vegetables, flowering plants especially roses and other vegetables are cultivated in this zone. Commercial areas of the town are on KG Road, Gangammagudi Road, and Ganagar Pette. The major commercial activities are proposed along NH 4 which is expected to extend along Chintamani road, Nandagudi Township and the proposed ring road.

Exhibit 2.4 Zone-wise distribution of Hosakote



Source: Hosakote Action Plan

2.3 Development Needs, Public needs & Planning Considerations

The projected water demand for Hosakote is around 16.65 MLD for the year 2027. At present, potable water is extracted from the bore wells. The depth of ground water for bore wells is decreasing continuously. The extracted water is not adequate to meet the current demand of 9.37 MLD of water for the present population against the current supply of 3.36 MLD. The Hosakote TMC wish to augment the water supply by: a) Lift irrigation- A minor lift irrigation project started to lift excess water from Yelemallappa Shetty tank to fill the Doddakere Lake at Hosakote, b) Establishment of 30 more bore wells under different schemes to ensure water supply to 100 lpcd.

The lift irrigation scheme is planned to pump untreated sewage from Yelumallappa shetty tank (which receives sewage from Bangalore to Dodakere lake, which is not advisable as it would pollute the Doddakere lake and due to depletion of ground water level to below 1000 ft, it is again not advisable to depend on ground water source for water supply, hence, an alternate water source needs to be identified.

2.4 Key Issues

The major issues related to water supply in Hosakote have been discussed under following headings:

Critical Ground water Source: The depth of the water table has reduced to more than 1000 feet in Hosakote TMC which is a major cause of concern to existing water supply regime.

Inadequate Supply: Water Supply is limited to 1 to 2 hours daily. Hosakote falls short of 6.19 MLD of water at 9.37 MLD current demands. The projected water demand for 2027 is 16.65 MLD. Also, as per GW Policy of GoK, Hosakote cannot continue to depend on ground water.

Service levels: Only 4271(about 40%) houses have access to household connections. Households depend on water tankers as an alternate source to meet daily drinking water demand.

Untreated Sewage from Yelumallapa Shetty Tank polluting Hosakote Lake: The scheme of pumping untreated sewage from Yelumallapa Shetty Tank to Hosakote Lake was inaugurated in 2005. Even while this scheme is functional, very little water is actually pumped in Hosakote Lake which is insufficient to fill the Lake and also pollutes the lake.

3. Hosakote City Water Supply

This section gives a description of existing water management in Hosakote town and the Water Demand.

3.1 Population Projection & Water Demand Analysis

The population of Hosakote town as per census 2011 is 56,613. Exhibit 3.1 Population Projection shows the projection of population using various methods.

Exhibit 3.1 Population Projection

Sl. No.	Year of Census	Population	Increase / Decrease in Population	Percentage Increase/Decrease
1.	1971	12163		
2.	1981	17538	5375	44
3.	1991	25516	7978	45
4.	2001	36333	10817	42
5.	2011	56613	20280	56
Total			44450	
Average			11113	47

Method	Present Year (2012)	Ultimate Year (2027)
Arithmetic Projection Method	57724	74393
Geometric Projection Method	**58837**	**104863**
Incremental Projection Method	57998	84727
Average	58186	87995

Considering previous decade's population of Hosakote town, it is observed that %age growth is from 42% to 56% per decade. Assuming similar growth for the future decades, and also since the State Government has nominated Hosakote town in Bangalore rural district for coverage under the scheme of Urban Infrastructure Development/ Counter magnets of Millennium Plus Cities, average growth rate of 47% is considered.

Hence, population considered by the end of 2012 & 2027 are 58837 & 104863 respectively. Exhibit 3.2 Projected Water Demand shows the present & future demand of Hosakote town.

Exhibit 3.2 Projected Water Demand

Year	Projected Population	Water Demand (MLD) @ 135 LPCD	Total Water Demand (MLD) including 15% losses
2012	58837	7.9	9.34
2013	61148	8.3	9.71
2014	63549	8.6	10.09
2015	66045	8.9	10.49
2016	68640	9.3	10.9
2017	71336	9.6	11.33
2018	74138	10.0	11.77
2019	77050	10.4	12.24
2020	80076	10.8	12.72
2021	83221	11.2	13.22

Year	Projected Population	Water Demand (MLD) @ 135 LPCD	Total Water Demand (MLD) including 15% losses
2022	86490	11.7	13.74
2023	89887	12.1	14.28
2024	93418	12.6	14.84
2025	97087	13.1	15.42
2026	100900	13.6	16.03
2027	104863	14.2	16.65

Hence, the present & projected ultimate water demands for year 2027 of Hosakote town are 9.37 MLD & 16.65 MLD respectively.

3.2 Present status of water supply at Hosakote

Hosakote has no surface water source and hence depends on ground water (bore wells) as the main source of water supply. There are around 84 nos. of bore wells with the average yield of 1000 GPH (approx.) fitted with power pumps. Present level of service of water supply is only 28 litres per capita per day on an average. Hosakote TMC supplies water for 1 hr, twice a day. Total water supply per day is **3.36 MLD**. Population depends on the water supply through private tankers to meet their additional daily requirement, which supplies water at Rs. 250 -300 per tank (4000 L).

Total distribution network available in the town is 45 Km, however, no detail information is available.

3.2.1 Water Treatment

The subsurface water is directly pumped from bore wells. The water from these bore wells is treated with alum for reducing the turbidity, before it gets pumped into overhead tanks (OHTs) for distribution.

3.2.2 Water Storage

Existing storage capacity in Hosakote town is 2.95 ML. Hosakote TMC has a storage capacity comprising of elevated service reservoirs and ground level reservoirs, which supplies water to all the 23 wards.

3.2.3 Service Connections

Hosakote supplies water to consumers through house service connection, public stand posts and public taps. No metered connection exists in Hosakote. Total no. of water connections is 6267 (out of which 4271 are HH connections).

3.2.4 Water Tariff and revenue collection

Exhibit 3.3 Water Tariffs shows the current water tariffs at Hosakote town. Current revenue collection is estimated at Rs 2 Million per year.

Exhibit 3.3 Water Tariffs

Type of Connection	Monthly Tariff (per month) in Rs.	Deposit (one time) in Rs.
Residential (old town)	45	1300
Residential (Extension)	45	2300
Commercial (old town)	90	1840
Commercial (new town)	90	2840

4. Case Studies and Best Practice

Before going into the project design, it is worth wile to review similar projects worldwide and adapt and cross check some of the key success factors for waste water recycle projects.

4.1 Overview of Waste Water treatment facilities

With ever growing population and rise in living standards, urbanization and industrialization, the demand of water has increased rapidly. The total supply of fresh water is itself limited by the nature and at the same time, drought, depletion of aquifers; deforestation and pollution have reduced the availability of good water. On the contrary, providing safe and sufficient drinking water and proper sewerage system remains as the challenging tasks for many developing countries particularly so, in urban areas. Water scarcity today afflicts 250 million people in 26 countries and over the next 20 years, the world's population will increase from six billion to an estimated 7.2 billion, while the average supply of water per person is expected to drop by one-third. By 2010, about 2.5 billion people in the world are projected to lack access to safe drinking water and 30 % of population in China, India, Mexico and U.S is expected to face severe water stress. To overcome the consequences of water scarcity, the concept of wastewater reuse might be thought of a solution besides rainwater harvesting and other conservation methods.

4.2 Instance of Wastewater reuse for potable purpose

Indirect potable reuse of treated wastewater may occur unintentionally, when wastewater is disposed into a receiving body of water that is used as a source of potable water supply. It can also be through planned schemes, such as that of Cerro del la Estrella sewage treatment plant in Mexico City. Here, treated wastewater which meets the criteria for potable reuse except for total dissolved solids, is diluted by water from other sources to meet this criterion, and used for potable purposes.

Direct potable reuse means adding treated wastewater directly into the normal drinking water distribution system. A classic example of wastewater reuse for direct potable purposes in an emergency happened in 1950s in the town of Chanute, Kansas, USA. The Nesho River in eastern Kansas served as the sole water source of Chanute. Due to continuous drought for five years, surface flow of the river ceased in 1956. After considering all other alternatives, the river was dammed just below the towns' sewage outfall, and the treated wastewater was used to fill the potable water intake pool. For five months, the city reused its sewage, circulating it some eight to fifteen times.

Exhibit 4.1 Examples of Potable Reuse Projects provides a summary of some potable reuse projects around the word. Other projects in the US have also implemented Indirect Potable Reuse (not included in

Exhibit 4.1 Examples of Potable Reuse Projects), such as the Gwinnett County Department of Public Utilities, Lawrenceville, Georgia; Inland Empire Utilities Agency, Chino, California; Water Campus, City of Scottsdale, Arizona; El Segundo, California; Tahoe-Truckee Sanitation Agency Water Reclamation Plant, Reno, Nevada; Loe J. Vander Lans Advanced Water Treatment Facility, Long Beach, California; and Northwest Water Resource Centre, Las Vegas, Nevada. All these projects have been supported by their communities and they follow the respective federal or state regulations related to recycled water.

The above evidences clearly indicate that wastewater is certainly a resource being rather called as a waste. By capturing the grey water internally or purchasing it from outside sources, the existing water

sources can be supplemented after necessary level of treatment, eventually reducing the water stress.

Exhibit 4.1 Examples of Potable Reuse Projects

Project	Treatment	Comments
Orange County Water District (OCWD), Water Factory 21, California, USA (1975-2004)	Lime clarification, recarbonation, multimedia filtration, granular activated carbon, filtration and chlorination. RO added in 1977. Advanced oxidation with hydrogen peroxide and UV added in 2001	• First project that used recycled water to maintain a seawater intrusion barrier. More than half the injected water flows inland and augments potable water supplies. The injected water reaches the nearest drinking water bore after 2 to 3 years. • Addition of RO in 1977 enabled injection of up to 50% of recycled water.
Denver Potable Water Demonstration Project, Colorado, USA (1985-1992)	Treatments tested included: high-pH lime clarification, sedimentation, recarbonation, filtration, selective ion exchange for ammonia removal, UV irradiation, activated carbon adsorption, RO, air stripping, ozonation, chlorine dioxide disinfection, Ultrafiltation and chloramination	• The project investigated different options for alternative water supplies and concluded that potable reuse is a viable option. • Pilot plant used unchlorinated secondary effluent from the Denver Wastewater Treatment Plant.
Upper Occoquan Sewage Authority (UOSA), Virginia USA (Since 1978)	Lime clarification Two-stage recarbonation Flow equalization Sand filtration Granular activated carbon Ion exchange Post carbon filtration Chlorination	• Full-scale project. Supplies about 50% of the population's water supply. During drought periods recycled water provides up to 90% of the reservoir inflow. • Recycled water is monitored by an independent water monitoring agency and is considered the most reliable source of water in the Occoquan system
The Chelmer Augmentati on Wastewater Reuse Scheme, Essex, England (Since 1997)	MF UV	• Recycled water discharged into the Chelmer River which is used to augment the Hanningfield reservoir. The reservoir storage time is up to 214 days • Monitoring of viruses and estrogens since 1996. Hormones in reservoir <LOD of 3 ng/L

4.3 Case studies

To learn from past experiences, we have taken up following two cases where waste water was re-cycled for direct/ indirect potable reuse:

1. Goreangab Water Reclamation Plant, Windhoek, Namibia

2. Tampa Water Resource Recovery Project, Florida, USA

Case study 1: Goreangab Water Reclamation Plant, Windhoek, Namibia

Windhoek is the capital city of Namibia. The city of Windhoek approached the limits of its conventional drinking water sources during the 1960s due to severe water shortage, as groundwater and surface water sources in the vicinity of the city had been fully harnessed. Therefore, in 1968, the city adopted a water reclamation scheme from domestic wastewater to supplement the potable water to the city. The scheme was well publicized and there has been no public opposition. The reclamation scheme was founded on the three basic premises for reclamation to succeed:

1. Diversion of industrial & other potentially toxic wastewater from main wastewater stream,
2. Wastewater treatment to produce an effluent of adequate and consistent quality, and
3. Effluent treatment to produce acceptable potable water.

The wastewater is treated in two separate, consecutive treatment plants to potable standard. The first is the conventional biological treatment plant (activated sludge process) at Gamams to treat raw wastewater. This wastewater is discharged into a series of maturation ponds, from where the effluent gravitates directly to the water reclamation plant at Goreangab. The water reclamation plant consists of alum coagulation, dissolved air floatation, lime dosing, sedimentation, sand filtration, breakpoint chlorination, activated carbon filtration, and final chlorination.

Up to the present, the reclaimed water is blended in two steps. The first blending step takes place at the Goreangab treatment plant, where the reclaimed water is blended with conventionally treated surface water, which ensures a minimum 1:1 dilution of reclaimed water. The second blending step takes place in the bulk water system of Windhoek, where the blend from Goreangab is mixed with treated water from other sources. It has been estimated that in future, the surface water supply at Goreangab will not have any significant benefit, due to its quality deterioration as well as its reduced contribution to the total flow.

To ensure water quality, an independent expert monitoring of system performance, a technical committee representing experts from five independent professional bodies convened three times a year for a detailed review of water quality. This procedure was discontinued since 1988 and replaced by a monitoring system by three independent laboratories. The treated wastewater, before reclamation, is also continuously monitored to ensure a consistent, high quality maturation pond effluent.

The Windhoek experience with wastewater reclamation to potable drinking water standard was an unqualified success during the last twenty-five years, which is of great significance to all arid and semi-arid regions of the world, as it demonstrates that:

- with proper care and diligence, water of acceptable quality can be consistently produced from domestic wastewater,
- if properly informed, consumers will fully accept this perhaps controversial option, wastewater reclamation for direct potable purpose is a practical option, not only for technologically advanced countries, but also for regions with relatively difficult access to advanced technology, management and operating skills.

Case study 2: Tampa Water Resource Recovery Project, Florida, USA

The Tampa Water Resource Recovery Project was developed to satisfy the future water demands of both the city of Tampa and the West Coast Regional Water Supply Authority. The project involved the supplemental treatment of the Hookers Point Advanced Wastewater Treatment (AWT) Facility effluent to achieve acceptable quality for augmentation of the Hillsborough River raw water supply. A pilot plant was designed, constructed, and operated to evaluate supplemental treatment requirements, performance, reliability, and quality (CH_2M Hill, 1993).

Source water for the pilot plant was withdrawn downstream from AWT Facility denitrification filters prior to chlorination. The pilot plant facility evaluated four unit process trains, all of which included preaeration lime treatment and recarbonation, and gravity filtration, followed by either (1) ozone disinfection, (2) reverse osmosis and ozone disinfection, (3) ultrafiltation and ozone disinfection, or (4) granular activated carbon (GAC) adsorption and ozone disinfection. The process train including GAC adsorption and ozone disinfection was selected for design.

The City of Tampa's industrial base is mostly food oriented. Inputs to the wastewater system were confirmed by a "vulnerability analysis". Tampa has an active pretreatment program, and there has been no interference with the plant's biological process since startup in 1978.

The design of the advanced treatment plant allows for rejection of water at any level of treatment and diversion back to the main plant. The use of a bypass canal for storage and mixing provides a large storage capacity and constant dilution of product water with canal and river water. Water can be diluted from the aquifer when river water is not available. Flood control gates allow canal to be flushed if a problem is detected. Canal water can be drawn through a "linear well field" along the canal to provide further ground water dilution. Five miles of canal and river provide additional natural treatment prior to the intake for the drinking water treatment plant.

4.4 Critical Success Factors

There were several supporting factors which can be considered to be the major milestones in the success of the above discussed project. Some of them have been discussed below:

For the Goreangab Water Reclamation Plant, the extreme shortage of drinking water due to drying out of groundwater & surface water in the vicinity of the city, and the presence of biological treatment plant at Gamams were the major contributing factors.

In the case of Tampa Water Resource Recovery Project, the presence of the Hookers Point Advanced Wastewater Treatment (AWT) Facility & increasing water demand of the city were the driving factors which resulted in to an initiative of recycling of treated wastewater for indirect reuse. Also, the industrial base mainly being food-oriented ensured non-contamination of wastewater with toxic pollutants.

In the context of Hosakote, the project seems to have the following necessary pre-requisites as go-ahead for the project:

1) Availability of sufficient water in Bellandur Lake
2) Sufficient capacity of Doddakere Lake
3) Increasing Potable Water Demand
4) Depleting Ground Water level

5. Project Brief

5.1 Project Objective

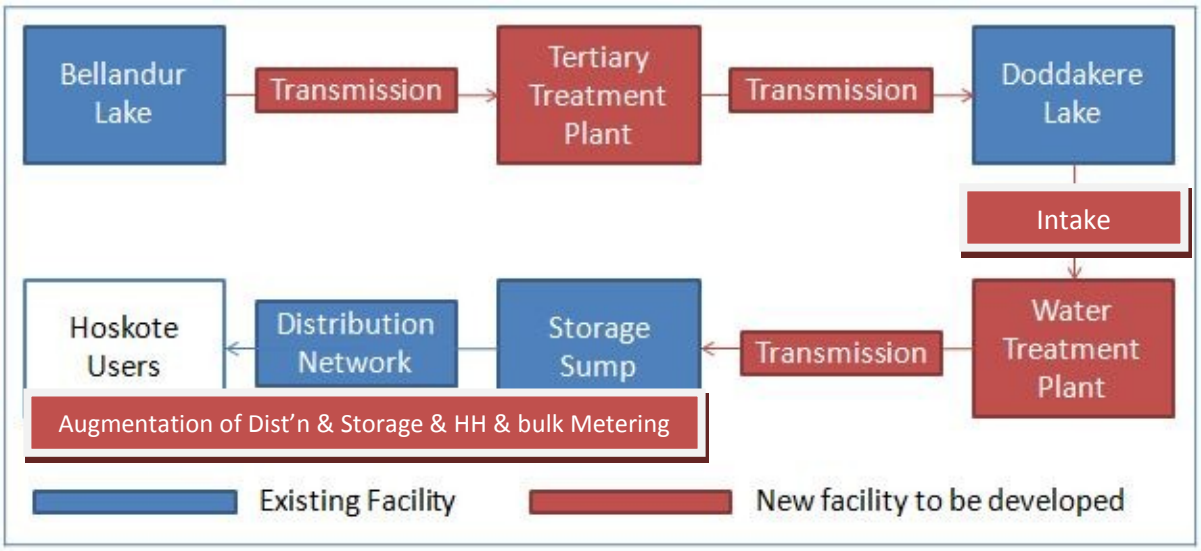
The primary objective of the project is to explore feasibility to cater to existing & future water demand of Hosakote City by providing treated water from Doddakere Lake while supplementing the source of incoming water to the lake with water from Bellandur Lake after tertiary treatment. Bellandur Lake receives water primarily from Koramangala-Challaghatta Sewage Treatment Plant (STP) which treats the sewerage to tertiary level. It addition, Distribution network and house to house connection is also envisaged to be augmented.

5.2 Description of the Project

5.2.1 Project Scope & Components

The scope of this project would involve transmission of secondary treated sewage water from the Bellandur Lake to Doddakere lake after further treating it to tertiary level at a Tertiary Treatment Plant (to be set up), setting up a Water Treatment Plant at the upstream of Doddakere lake to treat the water from Doddakere lake, and further augment the distribution infrastructure in Hosakote town. Exhibit 5.1 Project Scope**Error! Reference source not found.** captures the value chain and the scope of the project showing various components.

Exhibit 5.1 Project Scope



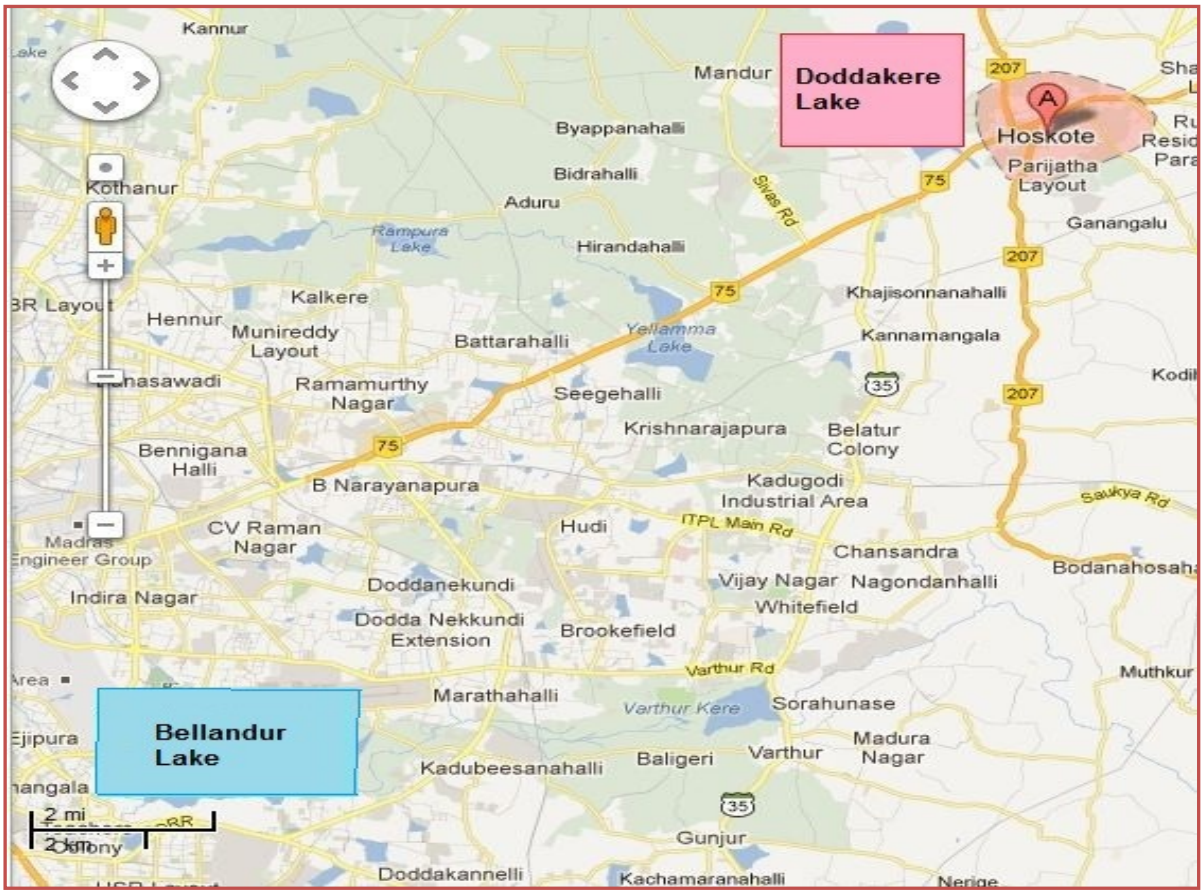
The detail of the scope of work needed for the project is as follows:

1. **Upstream of Doddakere Lake (for making source sustainable):**
    a. Construction, Operation and Maintenance of Intake at Bellandur lake, transmission line to Doddakere Lake (about 25 KM) and a TTP before discharging the water in Doddakere Lake.
    b. The Tertiary Treatment Plant would need to be designed to a capacity of 25 MLD. The Tertiary Treatment Plant would be located at the upstream of Doddakere Lake.
2. **Downstream of Doddakere Lake**
    a. Construction, Operation and Maintenance of Intake and Water Treatment plant

b. The Water Treatment Plant would need to be designed to an initial capacity of 17 MLD. The Water Treatment Plant would be located at the downstream of Doddakere lake (close to Hosakote town)

c. Transmission and distribution infrastructure (including metering) to supply water at consumer end.

Exhibit 5.2 Location of Bellandur Lake & Doddakere Lake



5.3 Description of the Site

5.3.1 The salient features of Doddakere Lake:

- Capacity - 802.14 mcft
- Catchment Area – 576.84 sq. miles

Storage Details:

- Live Storage – 721.93 mcft = 20442.781 ML
- Dead Storage – 80.21 mcft = 2271.294 ML
- Total Storage – 802.14 mcft = 22714.075 ML

Max flood discharge – 4684 cusecs

Bund (Earthen bund) Details:

- Length – 2172.61 m
- Top width – 7.5 m
- Height – 7.0 m

Doddakere Lake Photographs

5.3.2 Existing infrastructure at Koramangala and Challaghatta STP

Location and service coverage

Koramangala and Challaghatta sewage treatment plant treats the sewage generated in Koramangala and Challaghatta valleys of the Bangalore city at Belur Nagasandra village behind Bangalore Airport and discharges into Bellandur Lake. This treatment plant caters to a population of about 13, 00,000 (1991 census) over a drainage area of 8,858.83 Hectares. Photographs of Bellaundur Lake are shown below.

Bellandur Lake Photographs

Koramangala and Challaghatta STP capacity and Output parameters

Capacity & Technology

Primary treatment plant was established during 1974 and it was upgraded to Secondary level during 1990. The capacity of the treatment plant was 163 MLD and the treatment process adopted was Conventional Activated Sludge Process. Under Cauvery Water Supply Scheme (CWSS) Stage IV Phase I, one more treatment plant of 30 MLD capacity was established and Extended Aeration process was adopted. Since the flow into the plant was exceeding 163 MLD, Board has provided an additional module of 55 MLD capacity during 2006. Thus the total capacity of the treatment facility available is 248 MLD at K & C Valley.

Output Parameters

Exhibit 5.3 Water quality analysis from Koramangala - Challaghatta STP.

Exhibit 5.3 Water quality analysis from Koramangala - Challaghatta STP

Sl. No.	Parameter	Unit	Result
1. .	pH	pH Unit	7.2
2.	B.O.D (3 days @ 27^{o}C)	mg/L	7.0
3.	C.O.D	mg/L	60
4.	Total Suspended Solids	mg/L	6.0
5.	Total Phosphate	mg/L	0.58
6.	Total Kjedhal Nitrogen	mg/L	5.2
7.	Ammonical Nitrogen	mg/L	3.4

Source: Hosakote Water Supply proposed DPR

5.4 Interaction with Stakeholders

The key stakeholders that would play a role in implementing the above project include the following:

1. **Hosakote Town Municipal Council** – As the Urban Local Body in charge of Hosakote city, it is responsible for provision of water supply and sewerage services.
2. **Bangalore Water Supply & Sewerage Board**: BWSSB operates the Koramangala-Challaghatta STP.
3. **Karnataka Urban Water Supply & Drainage Board:** An implementing body for Water Supply and Under Ground Drainage schemes in 213 Urban areas of Karnataka except Bangalore city.
4. **Department of Municipal Administration** – Nodal agency for urban infrastructure projects in Urban Local Bodies (ULBs) other than Bangalore Metropolitan Area.

5.5 Studies and surveys already available

A Water Supply DPR is under preparation for supply of water to Hosakote Town with Doddakere Lake as source.

6. Risk Analysis, Project Structuring and Bid Variable

6.1 Risks Analysis & Mitigation

Critical risk factors, their impact and likelihood and potential mitigation measures are summarised in Exhibit 6.1 below. The focus of the risk assessment is from an investment perspective from the point of view of investors and lenders to the project SPV. The Concession agreement would be prepared to factor all aspects of the project structure discussed subsequently and would incorporate necessary features to address the risks as highlighted in the table below.

Exhibit 6.1 Risk factors, impact and mitigation measures

SI No.	RISK	IMPACT & LIKELIHOOD	Comments and Mitigation Measures
PRE-COMPLETION PHASE			
1	**Technology / Project Complexity Risk**	Impact : High Likelihood: Low	a) **Stringent pre-qualification:** There are very few Tertiary Treatment plants in India and the design to deliver the right quality and quantity of water can often be a challenge. Given the nature of the project, it is critical to have stringent pre-qualification criteria to ensure a minimum threshold of qualification of bidders, both from technical and financial standpoint. The pre-qualification criteria set for the project should enable a combination of healthy competition while ensuring threshold level of technical capability, execution prowess and demonstrated experience. The basic principles of the short listing process would be detailed in the contract documents. b) **Technical and financial risk is covered by government providing grand and technical oversight for the entire construction requirement**
2	**EPC Contractor – Technical**	Impact : High Likelihood: Low	
3	**EPC Contractor – Financial**	Impact : High Likelihood: Low	
4	**Regulatory /Statutory**	Impact : Medium Likelihood: Low	a) **Land for the project:** Appropriate location of land for the Tertiary treatment plant & Water Treatment Plant near the Doddakere Lake will be identified and the project will not require addressing any social issues including resettlement and rehabilitation. Availability and allocation of land for the project should be confirmed by Hosakote TMC. b) **Compliance and approvals -** The Project SPV would require clearance by the Karnataka Pollution Control Board. Hosakote TMC would need to coordinate and follow up on all clearances that would be required and this may be stated explicitly in the Concession Agreement c) **Obligations of service provider** – The obligations of service provider in terms of output quality of water from tertiary treated plant & water treatment plant should be explicitly stated in the Concession Agreement. In addition safeguards necessary for achieving desired quality of reject water from Tertiary Treatment Plant & Water Treatment Plant is also the responsibility of the private operator and needs to be

SI No.	RISK	IMPACT & LIKELIHOOD	Comments and Mitigation Measures
			stated as part of service obligations of the Service provider in the Concession Agreement
CONSTRUCTION PHASE			
5	**Time Overrun Risk**	Impact : Medium Likelihood: Medium	a) The Project SPV should consider fixed price EPC contracts to insulate it from cost escalation & time delays. b) The Concession Agreement should explicitly put the responsibility of site clearances and right of way on Hosakote TMC. c) An Independent Engineer should be appointed by Hosakote TMC to monitor report and certify progress during the construction stage.
6	**Cost Overrun Risk**	Impact : Medium Likelihood: Medium	
POST COMPLETION PHASE			
7	**Revenue Risk – volume**	Impact : High Likelihood: Medium	There is a significant risk and is however mitigated through the following measures: a) Hosakote TMC would create a repayment reserve account to compensate the Private Operator for volume of water supplied to consumers. b) With Ground water TDS levels in the estate generally high and other sources including tanker supply being more expensive, the risk of substitution with ground water is well mitigated.
8	**Revenue Risk – value**	Impact : High Likelihood: Medium	a) The Concession Agreement should specify the basis for escalation very clearly. It should be ideally linked to either a widely accepted index such as the WPI or a specific index linked to specific costs of the Project SPV including power costs, consumables and membranes. b) Further the periodicity of escalation should be kept as frequent (annual) as possible and specified in the Concession Agreement.
9	**O&M Risk**	Impact : Low Likelihood: Low	This can be mitigated by having stringent pre-qualification to ensure that private operator with adequate O&M capabilities get shortlisted.
OTHER RISKS			
10	**Force Majeure**	Impact : High Likelihood: Low	These involve risks beyond the project and arise due to uncertainty and variation in the factors listed. Part of this risk can be mitigated through appropriate hedging policies and insurance, part of this risk is intrinsic.
11	**Water Quality Risk**	Impact: High Likelihood: Low	The direct discharge of raw sewerage from Yelemallappa Shetty tank to Doddakere Lake may deteriorate the quality of water at Doddakere Lake & make it unfit for direct supply to water treatment plant. This risk shall be allocated to Govt. which should either stop the supply of raw sewerage or make arrangements to treat it to required level before discharging.
12	**Water Availability**	Impact: High Likelihood: Low	If there is not sufficient water at Doddakere Lake even after discharging required amount of tertiary treated water

SI No.	RISK	IMPACT & LIKELIHOOD	Comments and Mitigation Measures
	Risk		from Bellandur Lake due to percolation/evaporation losses or drawing excessive water from lake for irrigation purposes, the project will not run. The Govt. shall impose required restrictions in use of lake water for irrigation purpose. Also required water balancing of lake shall be done by private operator beforehand.
13	**Escalation in Project Cost Risk**	Impact: Low Likelihood: High	Since the project will require grant from Govt. to be feasible, the private operator might escalate the project cost to earn a higher value. This risk can be mitigated by having a technical and construction oversight from Govt. through KUWSDB.

6.2 Possible/Proposed PPP structure

Exhibit 6.2 Possible PPP structure below provides a summary of the possible structure for implementing the project through a Public Private Partnership mode.

Exhibit 6.2 Possible PPP structure

Type of PPP contract Design, Build, Operate and Transfer	**Hosakote TMC hand over the construction and O&M of water supply to Private Operator (on Rs per KL basis) and retains responsibility for end user Tariff Setting.**
Capital Investment in creating infrastructure including distribution network (DPR for the project needs to be prepared by Private operator and verified by Hosakote TMC/KUWSDB)	Grant from Govt.
Construction of Entire Project	Private Operator
DPR approval and Construction Monitoring	KUWSDB
O& M of Entire Infrastructure (including TTP, WTP & Dist'n network)	Private Operator
Tariff Setting at consumer end	Hosakote TMC
Billing and Collection from end-users	Private Operator
Bid Variable	Price of water per KL payable by Hosakote TMC to Private operator
Compensation	(Rs per KL quoted) x (Volume of Water supplied and metered at consumer end)

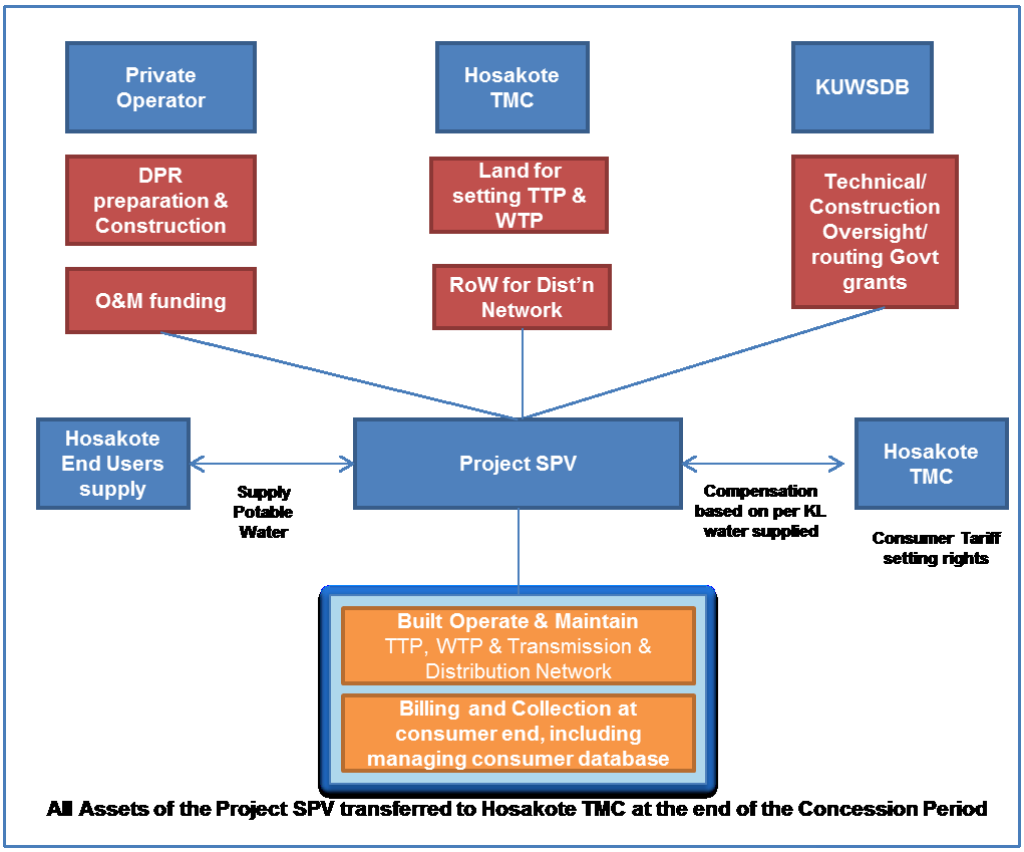
It is recommended that the project be implemented through **a Design, Build, Operate and Transfer PPP format as mentioned above**. Under this model, Hosakote TMC will provide a **15-year concession** to the Private Operator to Design, Build, Operate, Maintain and Transfer the network and supply Potable Water to Hosakote Town.

Government's support to Hosakote TMC to create a water repayment account would curb down the revenue risk for private player and would make the project more bankable.

6.2.1 PPP structure – Terms, institutional arrangements and Bid Variable

Error! Reference source not found.2 provide a schematic diagram of the institutional arrangements or the project.

Exhibit 6.3 Project Structure and Institutional Arrangement



The specific terms and conditions of the proposed PPP structure are detailed below:

1. Hosakote TMC wIll provide a 15-year concession to the Private Operator to Design, Build, Operate, Maintain and Transfer the network and supply Potable Water to consumers at Hosakote as specified in the scope of work defined in the previous section. During this period, Hosakote TMC will allow the private operator to use, rehabilitate, operate and maintain the existing assets of Hosakote TMC including the Doddakere Lake and existing storage infrastructure at Hosakote.
2. Hosakote TMC will provide land on nominal lease to the selected Private operator at the appropriate site near Doddakere Lake to construct the Tertiary Treatment Plant & Water Treatment Plant and Right-of-Way for setting up the transmission/distribution networks envisaged in the scope of work.
3. Other than the grant provided by the Govt. as mentioned in the section 'Project Financials', all investments (largely O&M, billing collection etc) in complying and meeting the outcomes of the scope of work specifed would be the responsibility of the private operator.
4. The Private Operator would be selected based on the lowest base rate per KL of treated Water supplied & metered to Hosakote consumers, for undertaking all the tasks envisaged in the Scope of Work specified above. The basis for escalation of this rate would be fixed and specified at the bidding stage. The escalation would be based on widely used index such as the Wholesale Price Index or a specific index agreed upon (e.g. increase in power cost) prior to bidding stage to reflect only the escalation in variables involved in the cost of treating water.

5. The private operator would be compensated on the basis of the volume of Water (meeting agreed quality specifications) supplied & metered by the private operator at the consumer end in Hosakote multiplied by the Rs/ KL (his quote) and escalation as defined in 5 above.
6. Hosakote TMC will transfer the right of billing / collection responsibility to private operator. However, TMC will retain the rigt to fix end user tariffs.
7. The Concession agreement would be between Hosakote TMC, KUWSDB and the Private Operator.
8. The private operator would set up and execute the project through a Special Purpose Vehicle created for the project. The project would be governed by a Governing Council that would comprise the Mayor (who woud be the Chair person of the Governing Council), Commissioner of Hosakote TMC, and KUWSDB representative.

Credit enhancement and other structuring features under consideration

A few additional structuring features and options would need to be considered at the stage of preparation of contract documents to make the project structure more attractive and address concerns of investors and lenders. Some of the initial proposals in this regard are described below:

Availability of Raw Water

There is an existing resolution from Bangalore Water Supply Sewerage Board to make 25 MLD water available from the outlet of Kormangala STP i.e. Belandur Lake for serving Hosakote's water demand.

Resolutions of Hosakote TMC reiterating their commitment

The process and the implementation arrangements for the project (relating to tariff policy and indexation, charges on volumetric basis, engagement of a private operator on a concession etc and the modalities of the bidding process) should be discussed and finalised through consultations with the Council prior to initiating the bid process. The necessary resolutions covering acceptance of bidding process, proposed project structure, tariff levels and indexation should be passed by the Council, prior to initiation of the bidding process.

Reserve for Debt service and O&M

As part of the lending and project agreements, the project SPV should be required to keep a cash reserve equivalent to 6 months of O&M and debt servicing requirement.

Contract review every 5 years

The project structure and contract agreement should provide for a review and negotiation of the contract every 5 years. This would involve a comprehensive review of the performance of the contract vis-à-vis initial plans in terms of service levels, tariff and indexation, revenues & costs of project SPV at the price per KL quoted by the private operator. Based on this review, Hosakote TMC and the private operator should have flexibility to review and revise the terms of the contract in a transparent and open manner. Such a contract review could also provide Hosakote TMC and the private operator to scale up the project in terms of increase in capacity and supply of potable Water.

6.2.2 Benefits of the proposed project structure

The proposed structure could potentially enable Hosakote TMC realise the following benefits:

1. **Hosakote TMC augments its water supply for potable purposes without any further extraction of groundwater.** Hosakote TMC which is currently unable to meet compete water demand of the city will be able to do so without any risk of depletion of groundwater table.

2. **Hosakote TMC retains its right to fix water tariffs.** Hosakote TMC retains right to end user customers charges.
3. **Hosakote TMC retains the right over the assets created including the Tertiary Treatment Plant & Water Treatment Plant, which would be transferred to Hosakote TMC at the end of the concession period.** Given that the project is being conceived on a concession model, the new project assets including the Tertiary Treatment Plant & Water Treatment Plant would be transferred to Hosakote TMC at the end of the concession period.
4. **Consumers get improved service levels at acceptable tariff.**
5. **The proposed compensation and project structuring focuses on making the project bankable and ensures appropriate risk allocation.** The proposed structuring involves the private operator providing clean drinking water to every household and get compensated on Rs per KL basis by the TMC.

7. Project Financials

7.1 Concept and Methodology

A preliminary financial model has been prepared to assess the Estimated Project Cost (from government's perspective), Estimated Revenues and the Project Returns (from Investors perspective). The Cost and Revenue assumptions were taken based on gross bulk estimate only to assess the feasibility of the project. However, it is recommended that the Project Financials may be firmed up only after preparation of the Detailed Feasibility Report for the project. The salient features of the preliminary financial model are highlighted in this section of the report.

The purpose of the Financial Analysis is to determine the financial viability of the investment in the project considering the cost of developing the project and the expected revenue stream over a period of time. It also provides estimated Rs per Kl for the defined scope of work, while ensuring that the developer gets a reasonable return on his equity.

7.2 Assumptions for Financial Analysis

7.2.1 Construction Period

It is assumed that development of project will take 2 years.

7.2.2 Concession Period

Concession period has been taken as 15 years.

7.2.3 Cost Assumptions

While calculating the project cost, the assumptions have been based on market feedback, other similar projects as well as IMaCS' own experience of advisory and project management consultancy. Escalation is taken at 5% of O&M cost in year 1.

7.2.4 Water Demand/ Supply Assumption

It is assumed that 80% of the treated water would be metered.

7.3 Summary of Financial Analysis Results

7.3.1 Cost Estimation

The estimated cost of the Project is Rs.976.9 Million. The details of the Project Cost estimation are set out in Exhibit 7.1 Estimated Project Costbelow.

Exhibit 7.1 Estimated Project Cost

Sl. No.	Cost Heads	Cost Estimate (Rs. Millions)
1.	Intake Infrastructure at Bellandur Lake	**50**
2.	Tertiary Treatment Plant (25 MLD)	**250**
	a. Civil Works	40
	b. Electrical and Mechanical	45
	c. Pre-treatment (Microfiltration / Ultrafiltation)	70
	d. TDS removal (Reverse Osmosis)	95
3.	Water Treatment Plant (17 MLD)	**85**
4.	Transmission Networks (39 km)	**407.9**
	a. Bellandur Lake - Doddakere Lake = 28 km	**340.9**

Sl. No.	Cost Heads	Cost Estimate (Rs. Millions)
	b. Doddakere Lake - WTP = 0.3 km	**3.1**
	c. WTP - Storage Reservoir = 10.7 km	**63.9**
5.	Intake Infrastructure at Doddakere Lake	**34**
6.	Distribution Network and Metering	**150**
	Total	**976.9**
Operation & Maintenance Cost @ 1st year of Operation		
1.	Tertiary Treatment Plant (25 MLD)	**35**
2.	Water Treatment Plant (17 MLD)	**9.3**
3.	Transmission Network (39 km)	**4.1**
4.	Distribution network/ Billing and collection	**15**
	Total	**63.4**

7.3.2 Tariff Revenue Stream

The private operator would be compensated on the basis of the volume of water (meeting agreed quality specifications) supplied and metered by the private operator to the consumers at Hosakote at the Rs/ KL (Bid Variable) and escalation as defined in Concession Agreement.

7.3.3 Scenario Analysis

The following section presents the Scenario Analysis which provides the variation in the Bid variable & corresponding Project NPV at 15% return in accordance with the variation in component of total project cost to be invested by private operator. The details of the same are as shown in Exhibit 7.2 Scenario Analysis

Exhibit 7.2 Scenario Analysis

Scenario	Scenario Description (all scenario assuming 100% capital grant)	Bid Variable (Water @ Rs. /KL)	Project NPV at 15% return (Rs Million)
Scenario 1	• Entire O & M (TTP, WTP & Dist'n) entrusted with private player	18.0	5.72
Scenario 2	• TTP's O & M is taken care by govt, and WTP & Dist'n by Private Player	8.0	1.15
Scenario 3	• Entire O&M taken by Private Player and Distribution Network Funding by Private Player	24	0.57

We recommend Scenario 1 (although with higher cost viz scenario 2) because TTP's O&M is vital in maintaining water quality of Hosakote Lake, and is suggested that this risk be taken by private player.

Hence, it can be seen that the Project NPV>0 at 15% discount rate at 18 Rs per KL.

7.4 Conclusion

O&M of the entire infrastructure to be created could be entrusted with the private operator at an estimated bid price of Rs. 18 per KL.

8. Statutory & Legal Framework

8.1 Applicable laws

Various state and central legislations/ acts governing the reuse of wastewater for have been reviewed for establishing the feasibility of the proposed project. A list of such legislations/ acts is set out below.

8.1.1. Central Legislations/ Acts:

- **Water (Prevention and Control of Pollution) Act 1974**

This Act aims at establishment of Central and State Pollution Control Board at the central level and also at state level for each state and giving powers to the members so as to enable them to carry out the purposes of the Act, which includes:

i. To inspect sewage or trade effluents, works and plants for the treatment of sewage and trade effluents and to review plans, specifications or other data relating to plant set up for the treatment of water, works for the purification thereof and the system for the disposal of sewage or trade effluents or in connection with the grant of any consent as required by this act.

ii. Lay down, modify or annual effluent standards for the sewage and trade effluents and for the quantity of receiving water (not being) water in an inter-state stream) resulting from the discharge of effluents and to classify waters in the state.

iii. To evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different region and more especially the prevailing flow characteristics of water in streams and wells, which render it impossible to attain even the minimum degree of dilution and other such functions.

Section 25/26 of the Water Act says that no industry or operator process or any treatment and disposal system can be established without the previous consent of the State Board and no industry or process can discharge sewage or trade effluent into a stream or well or sewer or land in excess of the standards & without the consent of the Board whoever contravenes the provisions of section 25 or section 26 of the Water Act shall be punishable with imprisonment for term which shall not be less than one and half year but which may extend to six years with fine under section 43/44 of the Water Act.

Source: Water (Prevention and Control of Pollution) Act 1974

- **National Water Policy**

The relevant sections of National Water Policy are given below:

Ground Water Development

7.2. Exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. The detrimental environmental consequences of overexploitation of ground water need to be effectively prevented by the Central and State Governments. Ground water recharge projects should be developed and implemented for improving both the quality and availability of ground water resource.

Private Sector Participation

13. Private sector participation should be encouraged in planning, development and management of water resources projects for diverse uses, wherever feasible. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing corporate management and improving service efficiency and accountability to users. Depending upon the specific situations, various combinations of private sector participation, in building, owning, operating, leasing and transferring of water resources facilities, may be considered.

Water Quality

14.2. Effluents should be treated to acceptable levels and standards before discharging them into natural streams.

Source: National Water Policy 2002

8.1.2. State Legislations/ Acts

The State formulated legislations/ Acts pertaining to waterfront development are as follows:

- **The Karnataka Ground Water (Regulation for Protection of Sources of Drinking Water) Act, 1999**

The Karnataka Ground Water (Regulation for protection of sources of Drinking water) Act, 1999 is to regulate the exploitation of ground water for the protection of public sources of drinking water and matters connected therewith and incidental thereto. This Bill is proposed to be enacted with several regulatory measures. Some of them are summarized below:

a) Sinking a well for the purpose of extracting or drawing water within a distance of 500 metres from a public drinking water source without obtaining permission of the appropriate authority is prohibited.
b) The Appropriate authority, in times of water scarcity may declare an area to be a water scarcity area for such period as may be specified in the order, but not exceeding one year at a time.
c) Upon declaration of any area as water scarcity area, the appropriate authority may order for restricting or prohibiting extraction for any purpose where such well is within 500 metres of the public drinking water source.
d) The Appropriate authority on the advice of the technical officer may declare a watershed as over exploited watershed.
e) The Appropriate authority shall have powers to prohibit sinking of wells in over exploited watersheds.
f) If the Appropriate authority is satisfied that any existing well in area of an over exploited watershed is already affecting any public drinking water source may prohibit the extraction of water from such well during the period from February to July every year and other incidental matters.

Source: The Karnataka Ground Water (Regulation for Protection of Sources of Drinking Water) Act, 1999

- **The Karnataka Municipal Corporations Act, 1976**

The Karnataka Municipal Corporations Act is to consolidate and amend the laws relating to the establishment of Municipal Corporations in the State of Karnataka. Some of the sections of the act relevant to the envisaged project are given below:

191. Payment to be made for water supplied. - Notwithstanding anything contained in any law, contract or instrument, for all water supplied under this Act payment shall be made at such rates, at such times and under such conditions as may be specified by bye-laws and different rates may be prescribed for supply of water for different purposes.

193. Supply of water for domestic purpose not to include any supply for certain specified purpose.- The supply of water for domestic purposes shall not be deemed to include any supply for any trade, manufacture or business;

194. Water supply for domestic purposes not to be used for non-domestic purposes. - No person shall, without the written permission of the Commissioner use or allow to be used for other than domestic purposes water supplied for domestic purposes

Source: The Karnataka Municipal Corporations Act, 1976

- **The Karnataka Urban Water Supply and Drainage Board Act, 1973**

This Act is to provide for the establishment of a Water Supply and Drainage Board and the regulation and development of drinking water and drainage facilities in the urban areas of the State of Karnataka. The Board shall be charged with the functions of providing financial assistance by way of loans and advances to the local authority in the State for assisting in providing for the following amenities, namely:-

i. Water supply and drainage for urban areas; and
ii. Other activities which are entrusted to the Board from time to time by the Government.

The Board shall perform all or any of the following functions, namely:

a) at the instance of the Government or a local authority:
   i. Investigating the nature and type of schemes that can be implemented in the area of any local authority for the provision of drinking water and drainage facilities;
   ii. Planning and preparing of schemes including schemes covering areas falling within the jurisdiction of more than one local authority for the purpose of providing the supply of drinking water or drainage facilities;
   iii. Executing such schemes under a phased programme for the provision of drinking water and drainage facilities within the areas of local authorities to which such schemes relate ;
   iv. Operation and maintenance of drinking water supply and drainage undertakings either wholly or in part and subject to such terms and conditions as the Government may specify;
   v. Levy and collection of water rates, fees, rentals and other charges in respect of such undertakings as the State Government may specify.
b) Providing technical assistance or giving advice to local authorities in the execution and maintenance of urban water supply and drainage works;
c) Establishing and maintaining schemes incidental to urban water supply and drainage such as testing of water, designing of plant for purification of water, conducting research relating to urban water supply and maintaining farm schemes;
d) Any other matter which is supplemental, incidental or consequential to any of the above functions.

- **The Karnataka Ground Water (Regulation and Control of Development and Management) ACT, 2011 *(Under Surveillance)***

This Act is to regulate and control the development and management of ground water and matters connected therewith or incidental thereto. Some of the sections of the act relevant to the envisaged project are given below:

11. Grant of permit to extract and use groundwater in the notified area.-

a) Subject to the provisions of any law relating to protection of public sources of drinking water, any user of ground water desiring to drill or dig a well in the notified area for any purpose either on personal or community basis shall apply to the authority for grant of permit for this purpose and shall not proceed with any activity connected with such drilling or digging unless a permit has been granted by the authority.
b) Every application under sub-section (1) shall be made in such form, shall contain such particulars and in such manner accompanied by such fee for different purposes like industrial, commercial entertainment, agricultural and domestic etc., and for different areas, as may be prescribed.
c) On receipt of an application under sub-section (1), if the Authority is satisfied that it shall not be against public interest to do so, it may grant subject to such conditions and restrictions as may be specified therein, a permit authorizing drilling or digging of a well for the extraction and use of groundwater. The conditions shall include mandatory provision of artificial recharge structures of appropriate size to be constructed by the applicant within a period as specified by the authority:
d) The decision regarding grant or refusal of their permit shall be intimated by the Authority to the applicant within a period of sixty days from the date of receipt of the application.

12. Registration of existing users in the notified areas.-

a) (1) Every existing user of groundwater in the notified area shall within a period of one hundred twenty days from the date of declaration, as notified area by the Government shall apply to the authority for grant of a certificate of a registration recognizing its existing use in such form and in such manner as may be prescribed.
b) On receipt of an application under sub-section (1), the Authority may, after such enquiry as it may deem fit and after satisfying itself, grant a registration certificate in such form, for such period and subject to such condition as may be prescribed.
c) The decision regarding the grant or refusal of the certificate of registration shall be intimated by the authority to the applicant within a period of thirty days from the date of receipt of the application.

Source: The Karnataka Ground Water (Regulation and Control of Development and Management) ACT, 2011

8.2 Key Issues and Suggestions in Legal & Regulatory framework and Tariff framework

- Ground Water extraction shall be restricted through policy intervention.

9. Indicative environmental & social impacts

9.1 Environmental Impacts

The current water demand of Hosakote is met by extraction of ground water leading to depletion of groundwater table. Provision of indirect reuse of recycled wastewater for potable purpose will inhibit rapid groundwater depletion and save it for future.

The other environmental benefit to using recycled water is the decrease in the pollution load on downstream water body by diverting treated wastewater.

9.2 Social Impacts

As groundwater is not a dependable source since it generally goes down in summer, this scheme would provide a reliable source of potable water.

Another impact would be Increase of the employment opportunities due to the new jobs created by the organizations directly connected to the operation and maintenance of the water & sewage treatment plants; water engineering companies; suppliers of systems, equipment and chemicals for wastewater treatment and water reuse.

9.3 Mitigation Measures

The project is a green initiative & does not pose any threat to environment or society and hence any mitigation measures are not required to be adopted.

10. Way Ahead

10.1 Project Development Framework

The key task for DMA / Hosakote TMC is to appoint a transaction advisor to carry out feasibility studies as well as to undertake bid process management on behalf of Hosakote TMC.

Project Development framework would involve:

1) Engaging a Transaction Advisor
2) Detail Feasibility Study
3) Take necessary Policy Sanctions
4) Project Structuring
5) Preparation of Bid Documents
6) Bid Process
7) Selection of Private Operator and Issuing Letter of Award (LoA)
8) Signing of Contract

10.2 Procurement Plan for further development

TOR for Transaction Advisor/ Technical Consultant and deliverables (Task, Deliverables, Timeline); Experience required for firm and experts for Transaction Advisor/ Technical Consultant Evaluation Matrix (This will be moderated by the Dept/ Agency/ IDD to remove any bias).

Activity/ Months	1	2	3	4	5	6	7
Appointment of Transaction Advisors (by Hosakote TMC)							
Preparation of Detailed feasibility Reports							
Project Structuring and Bid Documents preparation							
Bidding Process							
Selection of Developers and Issue of Letter of Award (LoA)							

10.3 Summary of Findings

The preliminary feasibility suggests that the project is doable from a Technical, Strategic and Viability View Point, with approximate bid tariff at 18 Rs per KL (indexed) for a 15 year concession, assuming 100% grant for capital investment. However there are few issues on which the Detailed Feasibility Study shall focus on:

1) Water Balancing for the Doddakere Lake
2) Assessing whether or not tertiary treatment of water from Bellandur Lake is required or not before discharging to Doddakere Lake by comparison of quality parameters of water in the two lake
3) Terms of Project Expansion with increasing water demand

Few aspects on which a detailed Feasibility Report should emphasise are:

1) Hosakote TMC's policy on selling Treated Water with pricing Premium
2) Restriction on Ground Water Abstraction
3) Cost of buying 2ndary treated sewage water from Bellandur Lake and its implications.

Disclaimer:

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