Infrastructure Development Department (IDD)

GOVERNMENT OF KARNATAKA

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

Preliminary Feasibility Report

Mysore City Corporation: Waste Water recycling & Reuse project

Tertiary treatment of secondary treated waste water from Kesare Sewage Treatment Plant to supply recycled water for Industrial use

June 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
KIADB	Karnataka Industrial Area Development Board
KUWSDB	Karnataka Urban Water Supply & Drainage Board
MCC	Mysore City Corporation
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
DBFOT	Design-Build-Finance-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
IRR	Internal Return Rate
NPV	Net Present Value

Executive Summary

The Government of Karnataka has identified Public Private Partnerships (PPPs) as one of the key elements of its infrastructure development strategy, and 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.

In view of the above, Infrastructure Development Department (IDD), GoK has appointed Ms. ICRA Management Consulting Services Limited (IMaCS) to assist DMA in developing five preliminary feasibility reports in urban sector context.

Under this initiative, DMA, Mysore City Corporation (MCC), & IMaCS have taken up a concept to explore supply of re-cycled waste water for serving industrial water demand/consumption for Mysore industries. This report presents the Preliminary Feasibility Study Report (PFR) for the proposed waste-water recycling project in Mysore.

Project Background

Mysore City receives water from mainly Cauvery River source with total intake capacity of 243MLD.

The population of Mysore is expected to be 15.3 lakh in the year 2024 against which, the total gross water demand works out to about 255 MLD.

Hence, city is going to face water shortage for purpose other than Domestic purpose.

Mysore has having six industrial estates whose water supply to the industrial area is currently managed by KIADB and MCC. Based on the data given by KIADB, the current industrial grade water demand in four industrial estates which are located in the North West part of the city is 10.6 MLD which will rise to 15.8 MLD by 2020.

Location of the industrial areas

In addition to this, based on our interactions with officials of KIADB, there is a plan to increase the industrial area from present 3000 acres to 7000 acres in future, which would result in incremental demand for industrial water.

Developing alternate arrangements for water supply is probably the only way to tackle the situation.

During initial interactions, MCC & Karnataka Indstrial Area Development Board (KIADB) expressed interest in evaluating PPP options for supplying bulk industrial grade water by tertiary treatment of sewage from existing Sewage Treatment Plant (STP) at Kesare to reduce pressure on ground water resources in the city and free up the potable water presently supplied to industries.

The project thus envisaged involves setting up a Tertiary Treatment Plant to further treat secondary treated sewage water from the Kesare STP to produce and supply Industrial Grade water to the existing Sump at Industrial estates to cater industrial water demand.

Stakeholders Involved

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

1. **Mysore City Corporation** – As the Urban Local Body in charge of Mysore city, and is responsible for provision of water supply and sewerage services. MCC operates the Kesare STP.
2. **Karnataka Industrial Areas Development Board** – Statutory organization established through KIAD Act of 1966 and is responsible for providing infrastructural facilities in industrial areas. KIADB currently supplies water from surface and underground sources to cater to a part of industrial water demand.
3. **Mysore Industrial Association** – Representative of the industrial units or the end users of the water supplied by the project.
4. **Department of Municipal Administration** – Nodal agency for urban infrastructure projects in Urban Local Bodies (ULBs) other than Bangalore Metropolitan Area.

Demand Cluster – KIADB Industrial Area

Mysore city has six industrial estates, out of which four industrial estates (namely Belagola, Hebbal, Hootagally and Belavadi industrial estates) are in the north-western part of the city. These four industrial estates cover around 3000 acres of land. These all industrial estates are located within radius of 7 kms from Mysore city. These estates have a total of 984 industrial units allotted.

Based on the data given by KIADB, the current demand of industrial grade water is about **10.6 MLD** which is estimated to increase to **15.8 MLD** by 2020.Table 1 gives details of industrial water demand and Table 2 summarises the present sources of water supply for Industries along with tariff.

Table 1 Industrial water demand

Demand	2012 (in MLD)	2020 (in MLD)
Total industrial Water Demand	11.8	17.8
Domestic Water Demand	1.2	2
Net Industrial Grade Water Demand	**10.6**	**15.8**

Source: KIADB

Table 2 Present sources of water supply

Current Source of water		Quantity (MLD) of Fresh water supplied	Rate (Rs per KL)
KIADB	**Bore wells**	0.9	20
	Surface water	2.8	25
MCC		3	18*
Privately owned Bore wells		3.3	
Net Supply/consumption		10	
Shortfall		1.8	

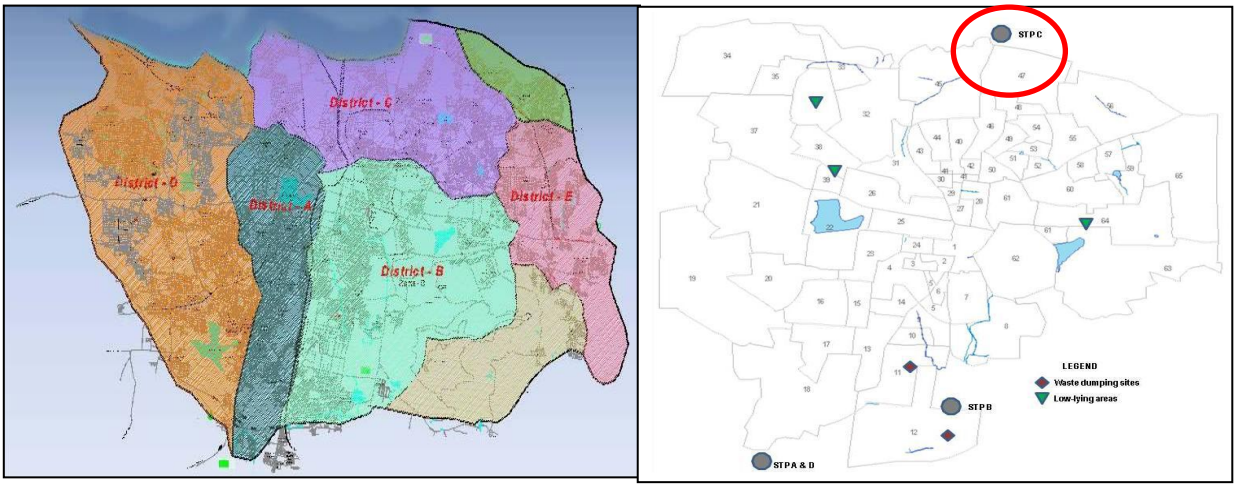
Source: KIADB
**Old Tariff. The revised water tariff (upto max slab rate of INR 52) which is effective from May 2012 as set by MCC has been given later in this report.*

Supply Point – Mysore Kesare STP

Kesare Sewage Treatment Plant is one of the three STPs functioning in Mysore and has been selected due to its proximity to the Industrial estate. It is located in the northern part of the city and caters to waste water from Waste Water District C which is about 30 sq. km (As given in pic below).

The Kesare STP is designed for an ultimate treatment capacity of 30 MLD. At present, the STP is getting utilized to treat only around 20 MLD of sewage water as one out of three feeder lines is broken and is under the process of rehabilitation & the inflow to STP is supposed to reach 30 MLD thereafter. The STP is based on Facultative Aerated lagoons process of treatment.

Drainage district zones & Existing STPs in Mysore city



Proposed Project

The project would involve setting up a Tertiary Treatment Plant (15 MLD) to further treat secondary treated sewage water from the Kesare STP to produce and supply Industrial Grade water to the existing Sump at Industrial estates.

PPP Structuring and Scope

Project Scope

The detail of the scope of work for the private operator is as follows:

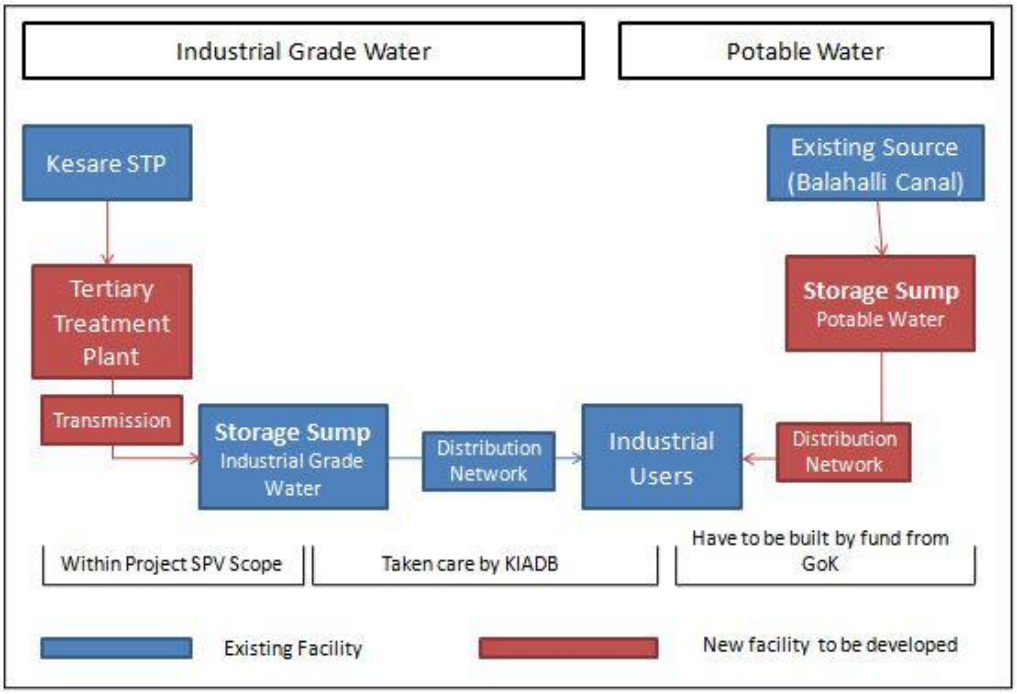
1. **Construction, Operation and Maintenance of Tertiary Treatment plant**
    a. This would comprise of a Tertiary Treatment Plant to take secondary treated water from Kesare STP as input and to produce Industrial Grade Water.
    b. The Tertiary Treatment Plant would need to be designed to an initial capacity of 15 MLD, with flexibility to scale up capacity to 25 MLD, if needed. The Tertiary Treatment Plant would be located at (or in the vicinity of) existing Kesare STP site.
2. **Construction, Operation and Maintenance of Transmission networks & Pumping Infrastructure**
    a. This would include a) Transmission line between the STP and TT Plant to convey Secondary Treated water to TT Plant and b) to convey bulk Tertiary Treated water from the TT Plant to Storage sumps of KIADB.

b. Pumps shall be installed to maintain the required flow/head.

c. Bulk Meters (to measure water quantity)/ Valves etc shall be a part of the scope of private operator.

The role of private operator would be to treat the secondary treated sewage water from the Kesare STP to industrial grade and supply it to the KIADB sump. However, separate arrangements will need to be done to account for the potable water demand of industries, which do not lie in the scope of the Project SPV. Table 3 captures the value chain and the scope of the project showing various components.

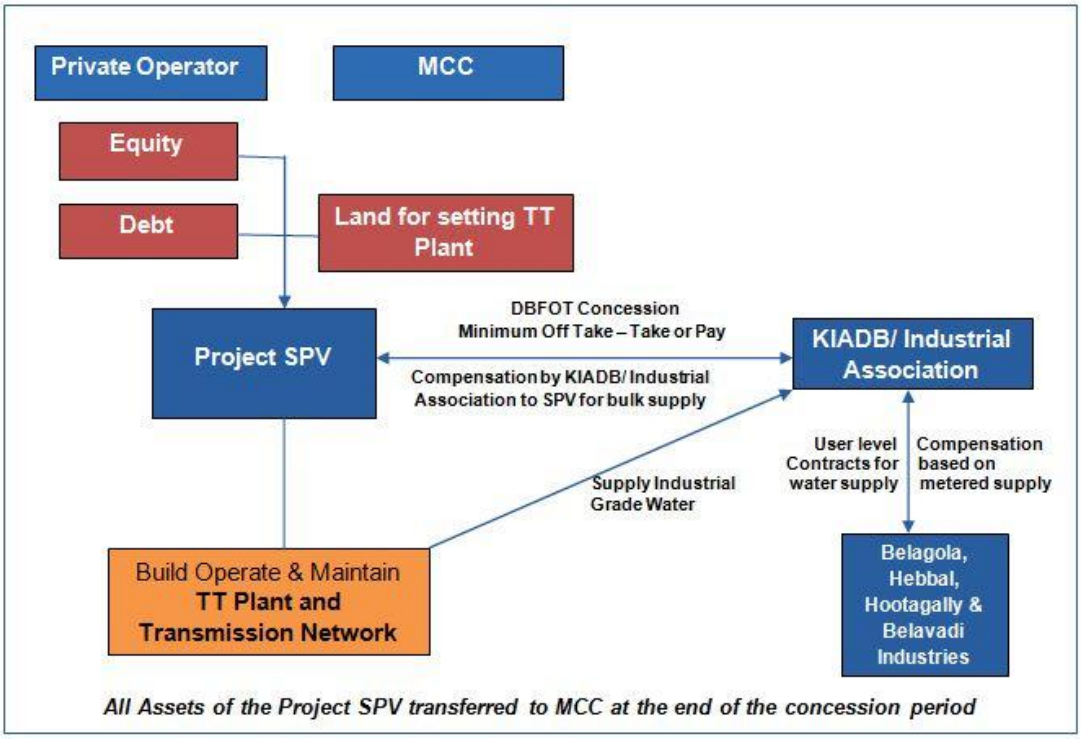
Table 3 Project Scope



Proposed PPP structure and responsibilities for private operator

It is recommended that the project be implemented through a **Design, Build, Finance, Operate and Transfer PPP format.** Table 4 below provides a snapshot of the proposed structure and institutional responsibilities.

Table 4 Project Structure and Institutional Arrangement



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

1. Tripartite Concession Agreement between MCC, KIADB and Private Operator would provide a 20-year concession to the Private Operator to Design, Build, Finance, Operate, Maintain and Transfer the network and supply Industrial Grade Water to Belagola, Hebbal, Hootagally and Belavadi Industrial areas through KIADB/ Industrial Association. During this period, MCC will allow the private operator to use, rehabilitate, operate and maintain the existing assets of MCC covering the Kesare Sewage Treatment Plant.
2. MCC will commit to a minimum input raw sewage quality. KIADB/ Industrial Association will provide a guarantee to the project SPV that industrial effluent (over and above the prevailing levels) will not be let into the input raw sewage. This is to ensure that the private operator and project SPV are protected against any increase in industrial contaminant levels in the raw sewage.
3. MCC will provide land on nominal lease to the selected Private operator within the site of (or) in the vicinity of Kesare STP to construct the Tertiary Treatment Plant and Right-of-Way for setting up the transmission networks envisaged in the scope of work.
4. All investments in complying and meeting the outcomes of the scope of work specifed would be the responsibility of the private operator.
5. The Private Operator would be selected based on the lowest base rate per KL of Industrial Grade Water supplied in bulk to KIADB/ Industrial Association, 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.

6. The private operator would be compensated on the basis of the volume of Industrial Grade water (meeting agreed quality specifications) supplied by the private operator to the KIADB sump at the Rs/ KL and escalation as defined in 5 above.
7. KIADB will retain the right to enter into contracts and the billing / collection responsibility with end users. This is due to the fact that KIADB already has contracts and is undertaking the billing and collection responsibility.
8. The Concession agreement would be between MCC, KIADB and the Private Operator and would include a Committed Off Take – Committed Assured Supply clause, whereby KIADB/(or through Industrial Association) would agree to taking a minimum quantity of water for which it would agree to a 'take-or-pay' commitment at the rate per KL quoted by the private operator. This commitment would be backed by a commitment of minimum assured supply by the private operator.
9. 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 7 member Governing Council that would comprise the Mayor (who woud be the Chair person of the Governing Council) and Commissioner of MCC, Development officer of KIADB and 2 nominees from Industrial association. Two members on the governing council including the Managing Director of the project would be the Private Operator's nominees on the Governing Council. The Governing Council would be supported by a Technical Oversight committee appointed by MCC.

Project Economics and Viability

It is assumed that development of project will take 2 years. Concession period (including construction period) has been taken as 20 years. While calculating the project cost, the assumptions have been based on market feedback, other similar projects as well as IMaCS' own experience of advisory in the Waste Water sector.

The estimated cost of the Project is Rs.41 Crore while the O&M cost is Rs. 6.2 Crore initially & is assumed to increase with escalation 5 % annually.

The key financial indicators for the project are summarized in Table below.

Table 5 Key Financial Indicators

Indicator	Value
Project IRR	16.7 % at 25 Rs / KL
Project NPV (@ 14%)	Rs. 7 crore

Thus the Project seems viable on a standalone basis and any capital assistance may not be required towards the Project by Govt. **Also, the estimated bid variable i.e. cost of water per KL comes out to be Rs. 25 which is quite lower than the current cost of Rs. 52/KL (max. slab) as set by MCC. This adds to the feasibility of the project.**

Risk Factors and Policy issues to be addressed

A detailed analysis of risk factors at various stages of the project is presented in the report. Critical risk factors in the project pertain to **Technical / Construction risk** and **Demand risk**.

- There are very few Tertiary Treatment plants in India and the design to deliver the right quality and quantity could be a challenge, given variations in secondary treated water quality. However, this is mitigated through an International Competitive Bidding process to facilitate selection of

capable operator. Stringent pre-qualfication criteria in terms of technical expeirence and financial strength is envisaged. MCC/KIADB may also appoint an Independent Project Engineer for monitoring and periodic review till the stage of project commissioning and stablisation.

- The bidding would determine a base tariff with clear guidelines for escalation of the same. The periodicity of escalation should be kept annual or once in two years as possible and specified in the Concession Agreement.

The revenue risk to a large extent be addressed in this case. Since the project SPV will sell water in bulk to KIADB, it could enter into a Take or Pay contract for a minimum Off Take quantity with KIADB / (or through industrial association).

Ground Water extraction for industrial purpose shall be restricted through policy intervention.

Portable water tariff shall be set above the industrial water tariff to avoid exploitation of portable water and to make this project successful.

Way ahead

Based on our review of the project from a technical, market and financial aspects, the project appears feasible at its preliminary design stage for implementation in the manner described above. More importantly, this project presents a very replicable template for the Government of Karnataka to tackle the growing crisis of excessive extraction of groundwater for industrial use and depleting ground water levels.

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

Next Steps towards appointment of Private Operator 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 LoI
8) Signing of Contract

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. The exercise envisages creation of sector level inventory of PPP projects, conduct pre-feasibility studies for 5 projects (with potential for replication in rest of the state), maintenance of an MIS on PPP projects in the sector.

In view of the above, Infrastructure Development Department (IDD), GoK has appointed Ms. ICRA Management Consulting Services Limited (IMaCS) to assist DMA in developing five projects in urban sector context.

Under this initiative, DMA, MCC, KIADB &IMaCS have taken up the concept to explore supply of re-cycled waste water for industrial water demand/consumption for Mysore industries.

Mysore is the second largest city in Karnataka with an estimated population of 9,83,000, and with waste water generated to the tune of 145 MLD. Mysore has an industrial area spread over 3000 acres with about 650 units functional. Current industrial water demand is met through water supplied from surface (Cauvery/canals) and underground (Bore well) sources through Mysore City Corporation (MCC), Karnataka Industrial Area Development Board (KIADB) and through private bore wells. With plans of expansion of the Industrial area and with increasing water demand for industrial water usage, there is an inevitable need to develop a project for Industrial water supply.

To cater to this current and increasing industrial water demand, this report explores the possibility of***scope for providing bulk industrial grade re-cycled water to Mysore industries through a PPP mode project by Tertiary treatment of water from Kesare Sewage Treatment Plant (STP)***. Benefit of such project is to help the State and the City to prioritise the use of fresh water for domestic consumption and thus fostering better water management in the region.

For consensus building, meetings and discussions with IDD, DMA, MCC, Industrial Association and KIADB 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 industrial use and its importance in developing countries.
    b. Overview and profiling of Mysore City and its infrastructure with respect to sewage treatment, to understand the supply side for the project

c. Profiling of Industrial estates In Mysore City and understand their water requirements and demands.

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.

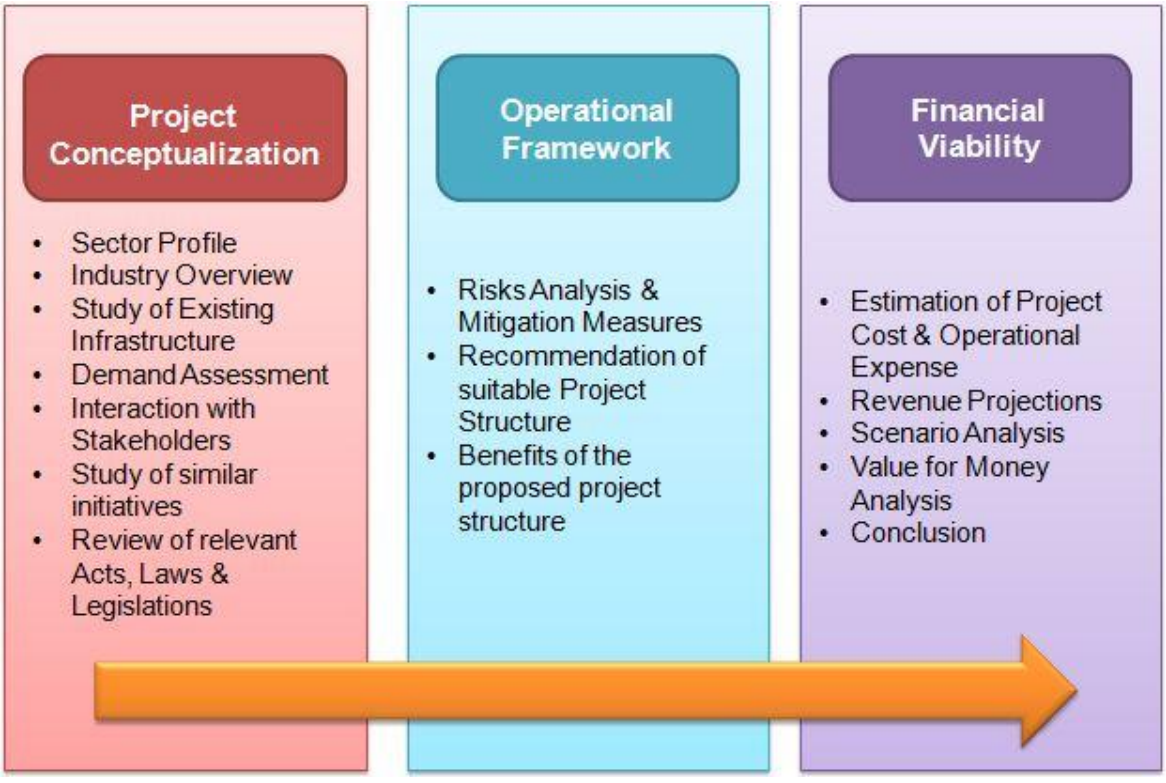
2. Laying the path for Way Forward which would include:

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 and methodology adopted in assessing the feasibility of this project is as set out below:



1.4 Methodology

1.4.1 Project Conceptualisation

- **Sector Profile and Industry Overview**: Sector Profile details out the overview of the sector, key issues, need of project etc. As a part of secondary research, documents like Mysore CSP, Mysore CDP, Sewerage DPR, 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. The identified sites were studied in order to understand its suitability potential for the envisaged project.
- **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.
- **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. Various financial indicators like Net Present Value (NPV), Internal Rate of Return (IRR) were analyzed to estimate the project's viability.
- **Scenario Analysis:** The analysis of various cases like variation in revenue or project cost and corresponding Project IRR was done.
- **Value for Money (VfM):** Based on VfM analysis results, it was analyzed whether the project is suitable to be undertaken under PPP framework or not.

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

Re-using 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 Chevron petroleum refinery located in Los Angeles, for instance, uses recycled water for cooling towers. Secondary effluent from the Hyperion Treatment Plant is treated to a tertiary level at West Basin's water reclamation plant, which is then sent to a satellite treatment plant at the refinery where it undergoes nitrification to reduce the ammonia content. This water is used by Chevron for cooling purposes.

The Tiwest Kwinana Pigment Plant, located at Western Australia significantly improved water use efficiency of Metropolitan Integrated Water Scheme Water Supply (MISWSS) by use of recycled water. Kwinana Water Reclamation Plant (KWRP) re-processes discharge water from the nearby Woodman Point Wastewater Treatment Plant for reuse by companies such as Tiwest, BP, CSBP, Wesfarmers and others. These cases have been discussed in detail in the section 3.8 of this report.

In India, Surat has explored a similar concept of prioritising fresh water usage for domestic purpose and supplying re-cycled waste water for Industrial water usage. The project was bidded out on PPP mode. However, the project has now been decided to be taken up on EPC rather than PPP mode of development.

1.6 Report structure and contents

The report has been prepared based on information provided by Mysore City Corporation (MCC) and Karnataka Industrial Area Development Board (KIADB) and is organised along the following sections:

1. Introduction (this section)
2. Sector profile
3. Mysore Industries and Waste Water Availability
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

Global Freshwater reserves are rapidly depleting and this is expected to significantly impact many densely populated areas of the world. It has been projected that freshwater rich regions across the globe going to face water scarcity if current reserves are not managed effectively.

Traditionally, India has been well endowed with large Freshwater reserves, but the increasing population and overexploitation of surface and groundwater over the past few decades has resulted in water scarcity in some regions. Growth of the Indian economy is driving increased water usage across sectors. Increased urbanization is driving an increase in per capita water consumption in towns and cities, which is also a factor for a change in consumption patterns and increased demand for water intensive agricultural crops and industrial products.

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 27.8percent of the total population in 2011 to 55.2 percent by 2050. Industrial contribution to the GDP is expected to increase from ~78 percent in 2000 to ~92 percent by 2015. Production of water-intensive crops is expected to grow by 80% between 2000 and 2050. *('India's Water Future to 2025-2050', International Water Management Institute; Data monitor; 'Dreaming with BRICs: The Path to 2050', Goldman Sachs Global Economics Paper No: 99).* Thus, the overall economic and population growth in India would put water stress on the road of success.

In a large developing country such as India, the links between water consumption across sectors complicates water management. The three main sectors which act as major consumers of water are agriculture, industries and households. To suffice the demands and needs of the growing population the usage of water has been increased. The increase in water consumption in agriculture sector is due to increase in domestic food grain demand, export of food grains and cash crops and demand for water-intensive crops. Consumption at household level has increased due to population growth, increased per capita water consumption and urbanization. Industrial water consumption has increased due to FDI in industrial sector, increase in agri-based and other water-intensive industries and investment in infrastructure development. *(Grail Analysis)*

Exhibit 2.2 shows the comparison of per capita clean water availability in the future.

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

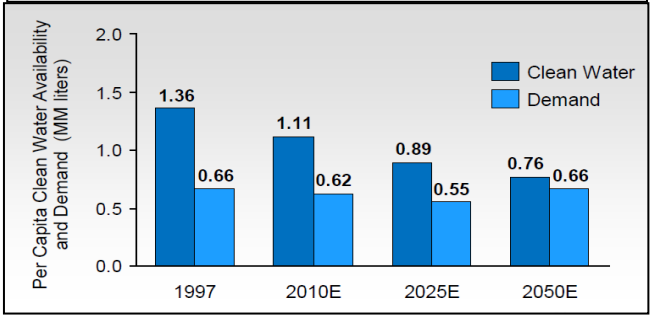
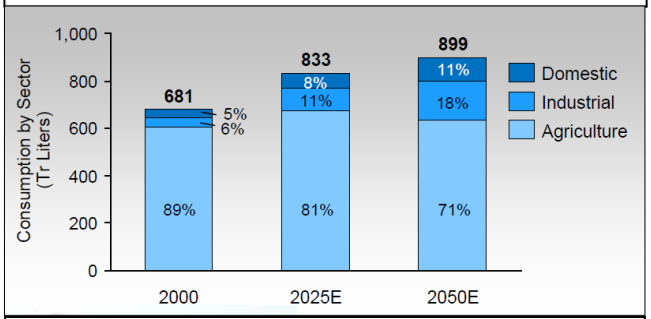


Exhibit 2.1 Water Breakdown in India by Sector (2000-2050E)



Source: Grail Research, a division of Integreon, 2009

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 2.1 shows the water breakdown in India by Sectors from 2000 to 2050. The graph shows the steep increase in the industrial use. The industrial sector demand is expected to be three times in 2050 of the existing share. This can be attributed to rapid industrialization and economic growth in India.

Thus, it can be concluded that, the huge demand for clean water in industries will be contested in future, as the clean water demand for domestic use would be equivalent to the clean water availability. Thus, there is a requirement for alternative sources and techniques to provide water to all the sectors.

Consequently, reuse of recycled waste water for industrial purpose becomes a potential solution to overcome the shortage of clean water availability.

2.2 Regional profile

Mysore is located at a distance of 135 km from Bangalore and is the second biggest city in State of Karnataka covering an area of 128 sq. km. It is located at 770 m above sea level between 12.18° N and 76.42° E. Mysore is and has been the historical capital of the Wodeyars. The city is known for its palaces and proximity to several other places of interest like Srirangapatna, Sivasamudram Falls, and Krishna Raja Sagara Dam.

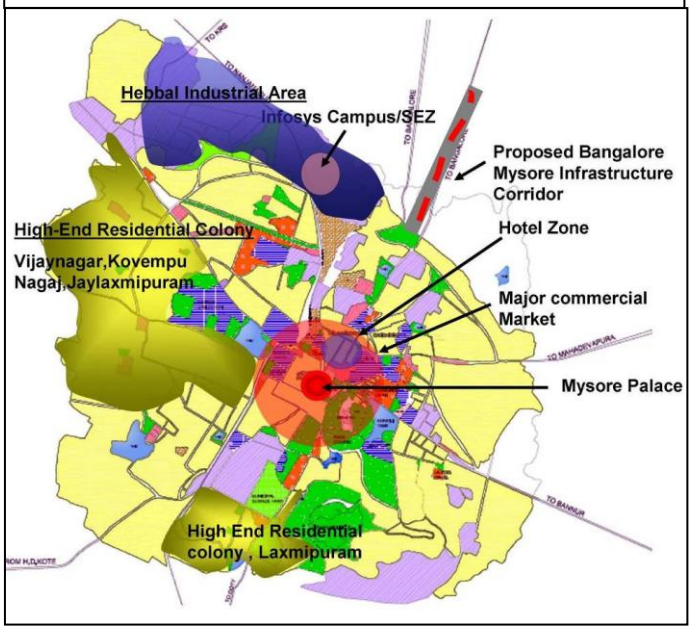
Mysore, the cultural capital of the State, has many educational, commercial, administrative centres and heritage monuments. Mysore is one of the Tier II cities for IT & ITES along with Mangalore, Hubli – Dharwad and Belgaum. Due to aggressive promotion by State Govt. of Karnataka, Mysore is fast catching up as the next IT Destination.

The Mysore Urban Development Authority (MUDA)area has increased from 7,569 hectares in 1995 to 12842 hectares in 2011, representing a growth of 70 per cent. This expansion is expected to continue unabated.

Future growth of Mysore will be determined by the Major development happening in the city. Exhibit 2.3 shows major areas of development in Mysore.

Mysore has always been at the forefront of industrial growth in Karnataka and has been aggressive in attracting investments.

Exhibit 2.3 Spatial development in Mysore



Source: Mysore City Report

In its efforts to develop a strategy for industrial growth and development, the State Government is concentrating on promoting the development of industries; in which Mysore already has a competitive edge because of its existing industrial base. Mysore plays a dominant role in certain business that have a direct relation to the investments the city has made in the past towards its culture, infrastructure, education, research institutions and agriculture. Mysore has been able to develop & attract considerable investments in the fields of :1) Handicraft Exports, 2) Agarbatti Manufacture and exports, 3) Beedi Manufacture and exports, 4) Agriculture Produce, 5) Automobile/Engineering Industry, 6) Food/Food related Industry, 7) Pharma, 8) Textiles, 9) IT & Telecom and 10) Tyre/Tube manufacturers.

At present Mysore and Bangalore accounts for more than 60% of the incense stick manufacture & exports.

2.3 Development Needs, Public needs & Planning Considerations

Mysore City receives water from mainly Cauvery River source with intake structures located at various locations downstream of Krishnarajasagara Reservoir (KRS). Presently three different schemes are in operation from Cauvery River source with intakes near Belagola, Hongally and Melapura.

The total capacity of Belagola source is 52.24 MLD, capacity from Hongally source is 90.92 MLD and capacity from Melapura source is 100.0 MLD, which sums up to a total of 243MLD.*(Source: DPR of 'Remodelling of Water Supply Distribution System' prepared by STUP Consultants)*

The population of Mysore has experienced a spike in the last 4 decades with the population increasing to 9.83 lakhs in 2011 (Census, 2011) from 2.54 lakhs in 1961 (Census, 1961). While the growth in the period from 1971to 1991 is due to the increase in heritage, culture, spiritual tourism and Mysore becoming a regular feature on the tourism circuit. Mysore has multiple industrial zones such as Hebbal, Metagalli, Belagola, Belavadi and Hootagally industrial areas. The growth in the decade of 1991 2001 and in the last five years is largely due to the growth of IT and ITeS industry in the city.

According to Mysore City Development Plan, the population of city is expected to grow with a trend as shown in the Exhibit 3.10. The population has been increasing at a compounded annual rate of 2.5% in the last two decades. Assuming the same rate of growth, the population at the year 2024 is expected to be 15.3 lacs.

As per the norms a per capita supply rate of 135 LPCD has been considered for working out the water demand for domestic use. Hence the net water demand for resident population for the year 2024 works out to 206.5 MLD.

Also, an average population of 1.0 Lakh has been considered as the tourist population and floating population. As per norms a per capita supply rate of 55 LPCD has been considered for floating population. Hence the net water demand for floating population works out to 5.50 MLD. In addition to above, an additional quantity of 0.50 MLD has been considered to meet water requirement for maintaining gardens, parks and 4 MLD has been considered as water requirement for educational, institutional and hospital demands.

Hence the total net water demand for the year 2027 is 216.5 MLD. As per the standards a transmission and distribution losses of 15.0% has been considered for arriving at the gross water demand. The gross water demand as worked out for the year (2024) is about 255 MLD.

The above water demand is domestic requirement of city only. In addition to above demands, there is additional water demand to meet fire fighting and industrial requirement. However, as discussed earlier, the total assured quantity of water source available is 243 MLD only. Clearly, there is going to be shortage of water and it will be difficult for MCC to cater the water needs of the city.

Mysore city has six industrial estates, out of which four industrial estates (namely Belagola, Hebbal, Hootagally and Belavadi industrial estates) are in the north-western part of the city. These four industrial estates cover around 3000 acres of land. These all industrial estates are located within radius of 7 kms from Mysore city. These estates have a total of 984 industrial units allotted. Pura Angarahally – Mysore Phase II and Koorgally – Mysore Phase III lie in the south-western side of the city.

The water supply to the industrial area in Mysore is currently managed by KIADB and MCC. Based on the data given by KIADB, the current industrial demand of water is 11.8 MLD which would go up to 17.8 MLD by 2020. Excluding the domestic water demand, the current industrial grade water demand is 10.6 MLD which will rise to 15.8 MLD by 2020.

In Belagola Industrial Area, the water supply is handled by Vani Vilas water works (KUWS&DB). The requirement of water for industrial purpose to Hebbal, Hootagally and Belavadi Industrial Area is met by tapping underground sources.

Of the total demand, nearly 3 MLD is met through MCC potable water supply. 3.7 MLD is supplied by KIADB which supplies water from both Surface Water& Ground Water sources. The remaining demand is met by extractingwater from 100 privately owned bore wells which accounts to around 3.3 MLD.

Based on our interactions with officials of KIADB, there is a plan to increase the industrial area from present 3000 acres to 7000 acres in future. Hence, it is foreseen that there could be an incremental demand of industrial water.

Developing alternate arrangements for water supply will be the only way to tackle the situation. Therefore, the provision of using recycled wastewater for industrial water needs would be a step in this regard.

2.4 Key Issues

The major issues related to water in Mysore City have been discussed under following headings:

Limited Water Supply for meeting industrial demand

Though the industrial demand for water is increasing rapidly with industrialisation, the supply of water to industrial areas is limited. Due to increased pressure on domestic water consumption, water supply to the industrial area has been delinked from the domestic water supply. After revision of water tariffs (w.e.f May 2012), MCC would now supply water at max slab of INR 52/KL viz. earlier rate of INR 18/KL. Also, ground water cannot be treated as a reliable source due to the rapid depletion of ground water table.

Depletion of groundwater table

According toGround Water Information Booklet of Mysore District, there is over exploitation of ground water resource in 73% area of Mysore. There are 222 dug wells and 3155 bore wells in the Mysore City as per third MI census. This over-exploitation has resulted in depletion of water levels. Artificial recharge measures are required to be taken up in these areas on priority basis.

Thus with increasing prioritization of freshwater usage for domestic purposes, industrial expansion and depletion of Ground Water, it becomes inevitable to explore alternate options for meeting industrial water need.

3. Mysore Industries and Waste Water Availability

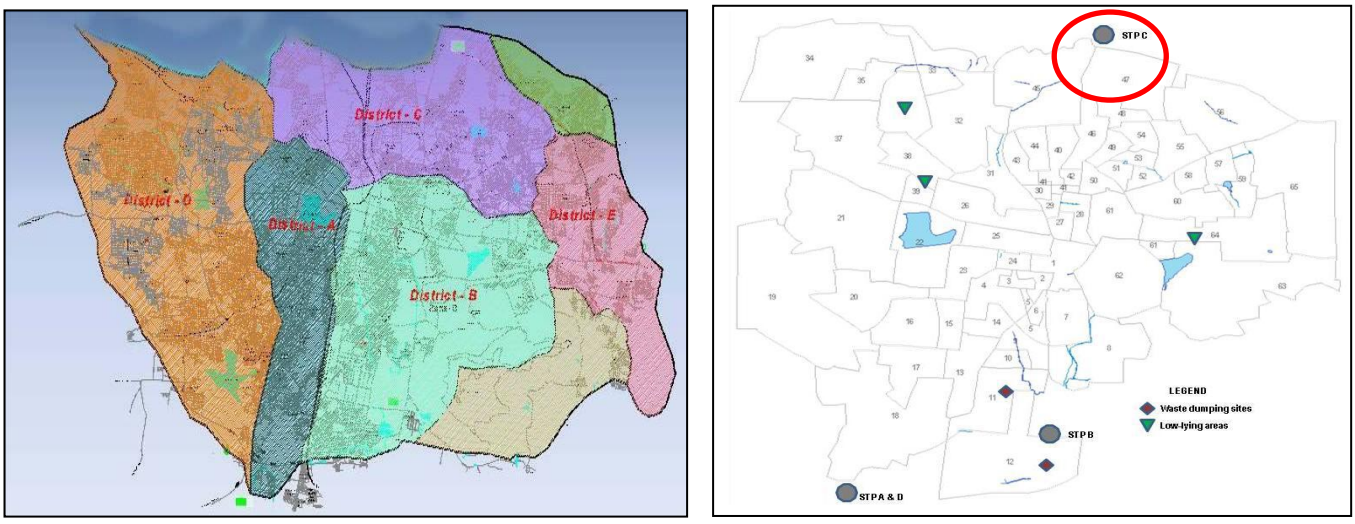
This section gives a description of existing Waste Water management in Mysore and Industrial Water Demand.

3.1 Waste water in Mysore City Corporation

Mysore is the second largest city in Karnataka and commonly known as City of Palaces and Gardens. Mysore is Karnataka's second most populous city with an existing population of 9,83,000(census 2011).

Mysore was one of the earliest cities to have underground drainage (UGD) in India. UGD system consists of about 740 km length with 30,000 manholes and is divided into five drainage districts namely A, B, C, D & E based on the topography of the City (shown in Exhibit 3.1). The districts A & D covering the drainage area of about 54 sq kms are serviced by a common sewage treatment plant located in Rayanakere. The capacity of this plant is 60 MLD. The drainage district B covers an area of around 34 sq kms is serviced by a treatment plant of capacity 67.65 MLD located at Vidyaranyapuram. **The drainage district C which covers an area of around 30 sq kms is serviced by a treatment facility of capacity 30 MLD located at Kesare.** The drainage district E cover an area of 11 sq. km does not have treatment facility. The present inflow to the STPs is about 145 MLD with the facultative aerated lagoons as the treatment process. 90% of the total population in the city is covered by the sewer system.

Exhibit 3.1Drainage district zones & Existing STPs in Mysore city



Source: Mysore City Report

3.2 Existing infrastructure at Kesare STP

3.2.1 Location and service coverage

Kesare Sewage Treatment Plant is one of the three STPs functioning in Mysore and has been selected due to its proximity to the Industrial estate. It is located in the northern part of the city and caters to waste water from District C. Raw sewage from MCC wards 30, 31, 32, 34, 38P, 39P, 42, 43, 44, 45P, 46, 47, 48, 49, 50, 51, 52, 53, 54, 59P, 60 and 61 flows into the Kesare STP. This area of about 30 sq km is largely residential and the network of about 434 km covers 75% of the area. The Kesare STP is spread over around 8.1 Ha (*calculated using Google Maps*).

3.2.2 Infrastructure and Demand Projection

Exhibit 3.2 below gives details about the existing sewerage system at District C & Exhibit 3.3 gives the projection of sewage generation at District C.

Exhibit 3.2 Existing Sewerage Infrastructure for District C

Component	Quantity	Units
Length of trunks	16.7	Km
Length of laterals	436	Km
Households connected	32500	No.
Treatment facility (At Kesare)	30	MLD
Area covered (Sq. Km)	30	Sq. Km
Treatment process	Facultative Aerated Lagoons	Type

Source: Mysore Sewerage DPR

Exhibit 3.3 Projection &sewage generation projection of District C

Year	Density per Sq.km	Projected population	Projected sewage generation
2011	13202	2,94,986	37.52 MLD
2026	14200	3,17,290	40.35 MLD
2041	16000	3,57,510	45.47 MLD

Source: Mysore Sewerage DPR

The projections above suggests that there would be adequate inflow of sewage into the STP at Kesare and would need a further enhancement in capacity by 15 MLD (i.e. to 45 MLD from existing 20 MLD) to cater to demand of 2041.

3.2.3 Kesare STP capacity and Output parameters

Capacity

The STP is designed for an ultimate treatment capacity of 30 MLD. At present, the STP is getting utilized to treat only around 20 MLD of sewage water as one out of three feeder lines is broken and is under the process of rehabilitation & the inflow is supposed to reach 30 MLD thereafter. The sewage after secondary treatment flows to Mirza channel.

Under Proposed DPR for Sewerage, there is a plan of setting up a new STP with capacity 15 MLD.

Technology

The STP is based on Facultative Aerated lagoons process of treatment.

Output Parameters

The average output quality of secondary treated sewage coming out of Kesare STP tested at various locations & on various days is given in Exhibit 3.4 below. Note that the values marked yellow are not within permissible range.

Exhibit 3.4 Water quality analysis from Kesare STP

Sample	Parameters								
	pH	BOD	COD	TS	TDS	Chloride	TSS	Nitrates	Phosphates
	5.5 to 9.0	**<30**	**<250**	**<2000**	**<2000**	**<450**	**<600**	**<40**	**<1**
31.01.2011									
P1-R	8.9	270	309	1586	1434	380	60	37	0. 13
P1-T	8.4	16	210	450	523	240	34	16	0. 12
P2-R	8.9	270	309	1586	1434	380	60	37	00. 13

Sample	Parameters								
	pH	BOD	COD	TS	TDS	Chloride	TSS	Nitrates	Phosphates
	5.5 to 9.0	<30	<250	<2000	<2000	<450	<600	<40	<1
P2-T	8.7	14	230	418	520	237	30	14	00. 10
08.06.2010									
P1-R	8.4	280	367	1410	1450	330	80	30	00.11
P1-T	7.0	15	190	530	540	236	30	18	00.10
P2-R	8.4	280	367	1410	1450	330	80	30	00.11
P2-T	6.8	13	186	470	537	238	28	19	00.11
03.05.2010									
P1-R	8.6	320	340	1670	1584	310	68	39	00. 16
P1-T	7.4	19	234	630	640	270	30	16	00. 14
P2-R	8.6	320	340	1670	1584	310	68	39	00. 16
P2-T	8.4	20	217	610	630	240	28	18	00. 11

Source: Mysore CSP

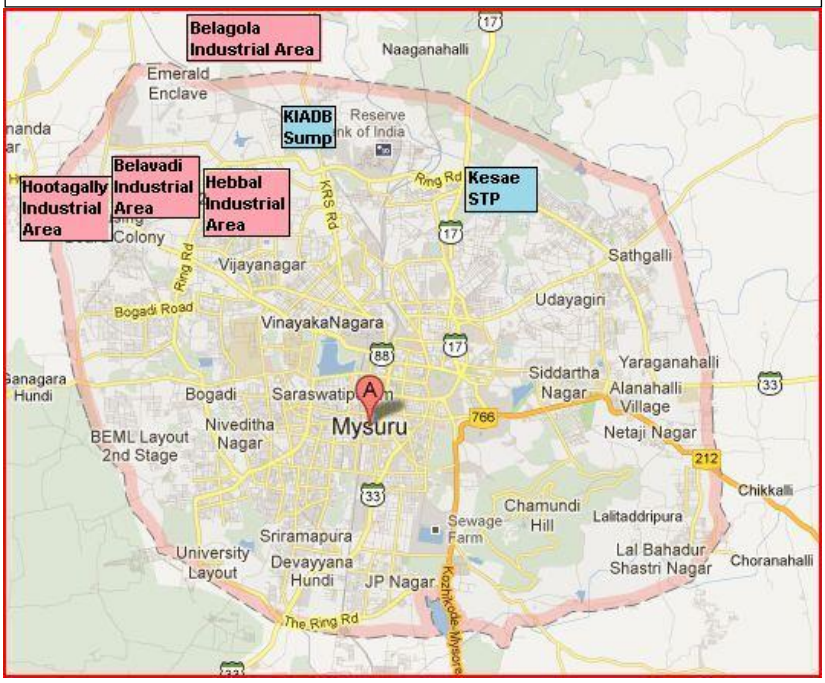
3.3 Industrial Estates in Mysore

The Karnataka Industrial Areas Development Board (KIADB) is a statutory organization established through KIAD Act of 1966 and is responsible for providing infrastructural facilities in industrial areas to promote industrial growth.

Mysore Industrial Cluster comprises of 6 Industrial Areas namely:

1. Belagola (Metagalli, General and Food)
2. Hebbal (General and Hebbal Electronic City)
3. Hootagally
4. Belavadi
5. Pura Angarahally – Mysore II Phase
6. Koorgally – Mysore III Phase

Exhibit 3.5Location of the industrial areas



Source: Google Maps

These all industrial estates are located within radius of 7 kms from Mysore city. Belagola, Hebbal, Hootagally and Belavadi industrial estates are on North-western part of the city whereas Pura Angarahally – Mysore Phase II and Koorgally – Mysore Phase III is in the south-western side of the

city. For the purpose of this study, the four industrial estates in north-west are taken into consideration for establishing water demand and future projections (locations displayed in Exhibit 3.6). Number of industrial units allotted in the respective four industrial estates and type of industries are given below in Exhibit 3.6 & Exhibit 3.7 respectively.

Exhibit 3.6 Details of the industrial areas

S.No.	Name of Industrial Area	Extent (In Acres)	No. of Units
1	Hebbal	1603	542
2	Hootagally	426	278
3	Belagola	519	116
4	Belavadi	238	48
	Total	**2786**	**984**

Source: List of industries provided by KIADB

Exhibit 3.7 Distribution of the industries under various categories

Type	No.
Steel & Foundry	20
Process House	100
Inorganic Chemicals, Dyes & Intermediates, Pesticides	40
Food Processing and Distillery	60
Textiles	1
General Engineering	100
Others	663
Total	**984**

Source: List of industries provided by KIADB

3.3.1 Demand side: Present status of water supply at KIADB Industrial Area

Based on the secondary data given by KIADB, the current demand of industrial grade water is about **10.6 MLD** which is estimated to increase to **15.8 MLD** by 2020. Exhibit 3.8 Industrial water demand summarises the industrial water demand and Exhibit 3.9 industrial water demand based on type of usage Exhibit 3.9 industrial water demand based on type of usage gives details of industrial water demand based on type of usage.

Exhibit 3.8 Industrial water demand

Demand	2012 (in MLD)	2020 (in MLD)
Total industrial Water Demand	11.8	17.8
Domestic Water Demand	1.2	2
Net Industrial Grade Water Demand	**10.6**	**15.8**

Exhibit 3.9 industrial water demand based on type of usage

Water Usage	Total Water Demand, MLD	
	Current	In 2020
Process	2.700	4.5
Boiler	0.300	0.5
Cooling	0.300	0.5

Water Usage	Total Water Demand, MLD	
	Current	In 2020
Domestic	1.200	2
Gardening	2.500	4
Others	1.500	3
Usage of water extracted from privately owned borewells	3.3	3.3
Total	**11.8**	**17.8**

Source: KIADB

The water supply to the industrial area in Mysore is currently managed by KIADB and MCC. Of the total current demand, nearly 3 MLD is met through MCC potable water supply. 3.7 MLD is supplied by KIADB which supplies both Surface Water & Ground Water. The remaining demand is met by extracting water from 100 privately owned bore wells which accounts to around 3.3 MLD. Exhibit 3.10 Present sources of water supply summarises the present sources of water supply.

Exhibit 3.10 Present sources of water supply

Current Source of water		Quantity (MLD) of Fresh water supplied	Rate (Rs per KL)
KIADB	**Bore wells**	1	20
	Surface water	2.8	25
MCC		3	18*
Privately owned Borewells		3.3	
Net Supply/consumption		10.3	
Shortfall		1.5	

Source: KIADB

**Old Tariff, tariff for the max slab rate has been revised to INR 52 per KL w.e.f May 2012*

The distribution network for the water supply has already been laid by KIADB and all the industrial units have water meter. KIADB supplies water at a rate of Rs. 20/KL (Surface Water) & Rs. 25/KL (Ground Water). The water tariff set by MCC is given in Exhibit 3.11 Water tariff as set by MCC.

Exhibit 3.11 Water tariff as set by MCC

Sl. No.	Volume (in Liters)	Rate per KL	
		Old Rates	New Rates*
1	8000	13.00	28.00
2	15000		36.00
3	18000		44.00
4	25000		
5	50000		
6	100000	14.00	52.00

Source: MCC

4. Case Studies and Best Practice

Before going into the project design, it is worth wile to review similar projects in India and 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 in Industries

Industries in Beijing have reclaimed water for a variety of processes. From 1978 to 1984 the percentage of reused industrial water rose from 46 to 72 percent. Manufacturing sectors, such as metal refining, metal products and chemicals, had higher than 80percent reuse. The experience of Beijing industry shows that water recycling can be less expensive than transporting water over long distances.

In California 94 acres of ponds and wetlands have been created to treat local wastewater. The starch-laden cattails thriving in the treatment marsh are being harvested and converted to ethanol which is then used to produce gasohol.

The above evidences clearly indicate that wastewater is certainly a resource being rather called as a waste. The industrial sector should be the major sector, which the ULBs have to focus to promote the reuse of wastewater not fit for drinking. By capturing the grey water internally or purchasing it from outside sources, industries can save money by using cheaper water, municipal utilities can reduce costs by providing smaller quantities of fully processed water, and other water resources can be saved for other purposes.

4.3 Case studies

To learn from past experiences, we have taken up following three cases where waste water was re-cycled and re-used for industrial consumption:

1. Surat Municipal Corporation (India)
2. Chevron Refinery (USA)
3. Tiwest JV (Australia)

Case study 1: Surat Municipal Corporation, Gujarat, India

Introduction

- Surat is a major commercial and trade centre in the state of Gujarat. Surat Municipal Corporation (SMC) is responsible to meet the potable as well as industrial water demand of Surat City,
- Pandesara is a notified industrial estate which was established by GIDC and falls within SMC limits and is spread over an area of about 2 sqkm. The Industrial estate is represented by its association, the Pandesara Industrial Estate Association.

Problem Description

- Current water demand at Pandesara is estimated at approximately 90 MLD, comprising about 75-80 MLD of process water requirement and 10-15 MLD of potable water demand.
- Of the total demand, nearly 50% (~45MLD) is met through SMC potable water supply. The remaining demand is met through private sources including borewells and water tankers.
- With the rapid increase in population of the city and a high rate of industrial growth, SMC was facing increased pressure to meet potable water requirement and industrial water demand was not being met completely.

Solution Proposed

- There is a Sewage Treatment plant at Bamroli which receives waste water from houses through a sewage network and processes it to secondary treatment.
- The solution SMC proposed involved setting up a Tertiary Treatment Plant to further treat secondary-treated sewage water from the Bamroli STP to produce and supply Industrial Grade water to the Pandesara industrial estate. This would enable SMC to reduce pressure on ground water resources in the city and free up potable water supplied to Pandesara Industrial area at present.

Economic Justification

- SMC could continue to retain the right to levy user charges and service the customers in Pandesara and assure required supply of water for industrial purpose without having to involve in any significant investment.

Environmental Justification

- Recycling the secondarily treated wastewater and using it for industrial purposes conserves fresh water for drinking and other potable uses. It benefits the ecosystem, including plants, fish and wildlife, because less fresh water is removed from streams, rivers and other bodies of water. Also extraction ground water could be minimised reducing rapid depletion of ground water level.

Recognition

- Though the project could not be executed even after successful bidding due to various reasons, the initiative received appreciation from many institutions and also promoted the study of scope of similar projects at other places.

Case study 2: Chevron Refinery, El Segundo, Ca, USA

Introduction

- The Chevron petroleum refinery located in El Segundo, Los Angeles, has an operating capacity of 270,000 barrels per day. It has been operating on the site since 1911 and focuses its production on transport fuels (petrol, diesel and aviation fuel).
- Since 1995 the site has used recycled water for cooling towers. In 2001 the site also began accepting recycled water for boiler feed.

Problem Description

- Los Angeles is heavily reliant on imported water from the Colorado River and water sources in the Sierra Nevada, with only moderate levels of groundwater available.
- The Colorado River supply in particular is under increasing demand as it provides water to a large number of west coast cities.
- In Los Angeles, the petroleum refineries are large users of water, primarily groundwater. Reducing this use will free groundwater for potable use and reduce the city's reliance on imported water.

Solution Adopted

- The local water district, West Basin Municipal Water District, has undertaken to encourage recycled water use in industry by providing "designer" water. Essentially this means West Bain provides six different types of recycled water to customers, of which Chevron uses three.
- Secondary effluent from the Hyperion Treatment Plant is treated to a tertiary level at West Basin's water reclamation plant. This water is sent to a satellite treatment plant at the refinery where it undergoes nitrification to reduce the ammonia content. 19 ML.day-1 of the nitrified Title 22 water is used by Chevron for cooling purposes.

Economic Justification

- Chevron have seen a $2.3m decrease in cooling water costs from taking recycled water, and a 10% decrease in water costs associated with boiler feed despite the higher costs of the water.
- Chemical treatment costs have decreased by 15 and 75% for the cooling towers and boilers respectively.
- There has also been an 85% reduction in the costs of energy onsite representing savings in the millions of dollars.

Environmental Justification

- The use of recycled water has reduced the pollution load from sewage discharge into Santa Monica Bay.

Recognition

- The boiler feed project won a Public Officials for Water and Environment Reform Award in 2001 for Chevron and the West Basin WMD.

The Future

- Chevron is currently planning an expansion of the El Segundo site. As part of this it has requested access to larger volumes of nitrified Title 22 water from 2009. West Basin is currently investigating the feasibility of expanding their recycled water operations.

Case study 3: Tiwest Joint Venture, Kwinana Pigment Plant WA, Australia

Introduction

- The Tiwest Kwinana Pigment Plant is located 30 km south of Perth, Western Australia, and is the final stage of the Tiwest Joint Venture, the world's largest fully integrated titanium dioxide producer.
- The Kwinana Plant now produces in excess of 100,000 tonnes of titanium dioxide pigment per annum, in a range of grades suitable for a wide variety of national and international marketing requirements.

Problem Description

- Given Tiwest's status as one of the largest users of scheme water in Western Australia (until 2002 it was in fact the largest), and a significant user of groundwater, any improvements in efficiency of water use that the company can effect, have the potential to impact positively on water resources and the environment.
- The Kwinana site has, as a result, significantly improved water use efficiency of Metropolitan Integrated Water Scheme Water Supply (MISWSS), with the 1991 Tiwest consumption of 60.67 kL/tonne of finished pigment product (FPP) being reduced almost two thirds, to 20.05kL/tonne FPP by year end 2005.

Solution Adopted

- Through its membership of Kwinana Industries Council (KIC), Tiwest was involved with 'Waterlink', a program launched to improve water efficiency and contribute to environmental management in the KIA. This resulted in the construction of Kwinana Water Reclamation Plant (KWRP), which re-processes discharge water from the nearby Woodman Point Wastewater Treatment Plant for reuse by companies such as Tiwest, BP, CSBP, Wesfarmers and others. It also facilitates a reduction of industrial water discharged into the Cockburn Sound by accepting approximately 6 ML a day of wastewater from these operations.

Economic Justification

- The use of recycled water required a capital investment in the construction of KWRP and represents an ongoing financial cost to the operations of Tiwest. The use of recycled water is intended for community benefit only.

Environmental Justification

- The KWRP project allows industry to co-dispose of industrial wastewater via Ocean outfall pipeline which significantly reduced the industrial water discharge into the Cockburn Sound.

Recognition

- Water Corporation, Certificate of Recognition as a Waterwise partner. CEPA Case Study 2007.
- Department of Water Government of Western Australia & Water Corporation. Highly Recommended. Category: Waterwise Business 2006.

The Future

- Tiwest Joint Venture is currently planning an expansion of the Kwinana Pigment Plant to produce 153,000 tonnes of titanium dioxide pigment per annum. This will increase the water consumption and could see the KWRP expanding its operations pending negotiations between the parties.

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 Chevron petroleum refinery, the presence of Hyperion Treatment Plant in the vicinity of the Refinery was a major contributing factor.

In the case of Tiwest Joint Venture, substantial demand of re-cycled quality water for the Kwinana Pigment Plant and limited groundwater availability were the driving factors which resulted in to an initiative of recycling of secondarily treated wastewater for reuse.

In case of Surat, both scarcity of water for Industrial consumption coupled with substantial demand for industrial grade water in vicinity of existing STP contributed as project enablers.

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

1) Existing STP near the Industrial Area
2) Increasing Industrial Water Demand
3) Depleting Ground Water level

5. Project

5.1 Project Objective

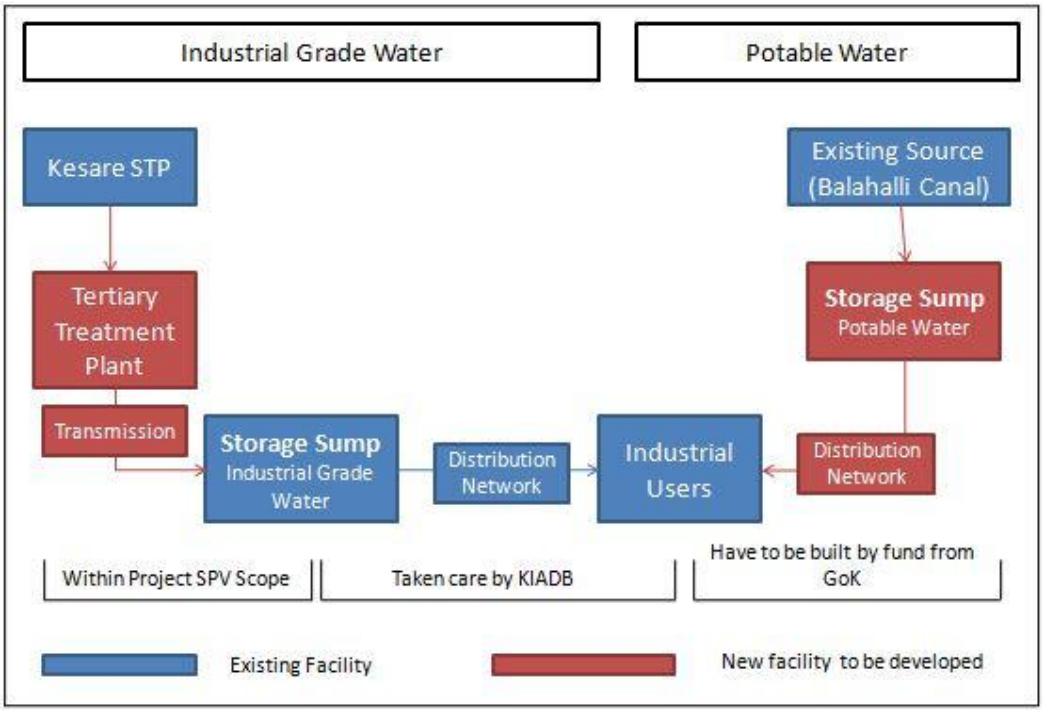
The primary objective of the project is to explore feasibility to cater to existing & future water demand of Industrial Estates of Mysore for further promotion of industrial growth by tertiary treating the secondarily treated waste water from Kesare STP and providing it for industrial use

5.2 Description of the Project

5.2.1 Project Scope & Components

The scope of this project would involve setting up a Tertiary Treatment Plant (15 MLD) to further treat secondary treated sewage water from the Kesare STP to produce and supply Industrial Grade water to the existing Sump at Industrial estates. Exhibit 5.1 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 for the private operator is as follows:

1. **Construction, Operation and Maintenance of Tertiary Treatment plant**
    a. This would comprise of a Tertiary Treatment Plant to take secondary treated water from Kesare STP as input and to produce Industrial Grade Water.
    b. The Tertiary Treatment Plant would need to be designed to an initial capacity of 15 MLD, with flexibility to scale up capacity to 25 MLD, if needed. The Tertiary Treatment Plant would be located at (or in the vicinity of) existing Kesare STP site.
2. **Construction, Operation and Maintenance of Transmission networks & Pumping Infrastructure**

a. This would include a) Transmission line between the STP and TT Plant to convey Secondary Treated water to TT Plant and b) to convey bulk Tertiary Treated water from the TT Plant to Storage sumps of KIADB.

b. Pumps shall be installed to maintain the required flow/head.

c. Bulk Meters (to measure water quantity)/ Valves etc shall be a part of the scope of private operator.

The role of private operator is restricted to further treat the secondary treated sewage water from the Kesare STP to industrial grade and supply it to the KIADB sump. However, separate arrangements will need to be done to account for the potable water demand of industries, which do not lie in the scope of the Project SPV. The detailed description of various components involved in the complete arrangement has been summarized In Exhibit 5.2 Project components & responsibility

Exhibit 5.2 Project components & responsibility

Project Component	Current Status	Institutional Responsibility
Industrial Grade Water Supply		
Construction of Tertiary Treatment plant	Not Existing	Private Operator
Operation and Maintenance of Tertiary Treatment plant	--	Private Operator
Construction of Transmission networks	Not Existing	Private Operator
Operation and Maintenance of Transmission networks	-	Private Operator
Ground storage sump	Already Existing	-
Distribution network at industrial estates	Already Existing	-
Establishment of water meter for every industrial unit	Already Existing	-
Maintenance, Supply, Billing & Collection of Industrial Grade Water to Industrial users from the existing sump	-	KIADB
Potable Water Supply		
Construction of new ground storage sump for potable water	Not Existing	Govt.
Construction of a new distribution system to supply potable water to industrial units	Not Existing	Govt.
Operation and Maintenance of a new distribution system to supply potable water to industrial units	Not Existing	KIADB
Establishment of water meter for every industrial unit	Not Existing	Govt.
Maintenance, supply, billing & collection of Potable Water to Industrial users	-	KIADB

5.3 Description of the Site

The Kesare STP is spread over around 8.1 Ha (*calculated using Google Maps*), and sufficient vacant land is available at proximity which can be used for setting up of tertiary treatment plant.

Exhibit 5.3 Location of Kesare STP

Source: Google Maps

5.4 Interaction with Stakeholders

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

5. **Mysore City Corporation** – As the Urban Local Body in charge of Mysore city, it is responsible for provision of water supply and sewerage services. MCC operates the Kesare STP and currently provides a portion of water supply to Industrial area, which falls within its limits.
6. **Karnataka Industrial Areas Development Board** – Statutory organization established through KIAD Act of 1966 and is responsible for providing infrastructural facilities in industrial areas.
7. **Mysore Industrial Association** – Representative of the industrial units or the end users of the water supplied by the project.
8. **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 Sewerage DPR has been prepared which has a component of 15MLD STP expansion at Kesare.

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

Sl 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.
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:** Land for the Tertiary treatment plant has already been identified within the Kesare STP and the project does not require any addressing social issues including resettlement and rehabilitation. Availability and allocation of land for the project within the Kesare STP should be confirmed by MCC. b) **Compliance and approvals -** The Project SPV would require clearance by the Karnataka Pollution Control Board. KIADB 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 tertiary treated water should be explicitly stated in the Concession Agreement. In addition safeguards necessary for achieving desired quality of reject water from Tertiary treatment plans is also the responsibility of the private operator and needs to be 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 MCC.
6	**Cost Overrun Risk**	Impact : Medium Likelihood: Medium	

Sl No.	RISK	IMPACT & LIKELIHOOD	Comments and Mitigation Measures
			c) An Independent Engineer should be appointed by KIADB to monitor report and certify progress during the construction stage.
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) Minimum Off Take contracts between KIADB and Private Operator that specify minimum Off Take for which there is a 'Take-or-pay' clause. To ensure buy-in, this should be backed by a 'Minimum supply' assurance clause by the Project SPV for the same amount. b) The end users already have contracts for water supply with KIADB. With Ground water TDS levels in the estate 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	a) 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	a) 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.

6.2 Possible PPP structures and preferred options

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

Exhibit 6.2 Possible PPP structure

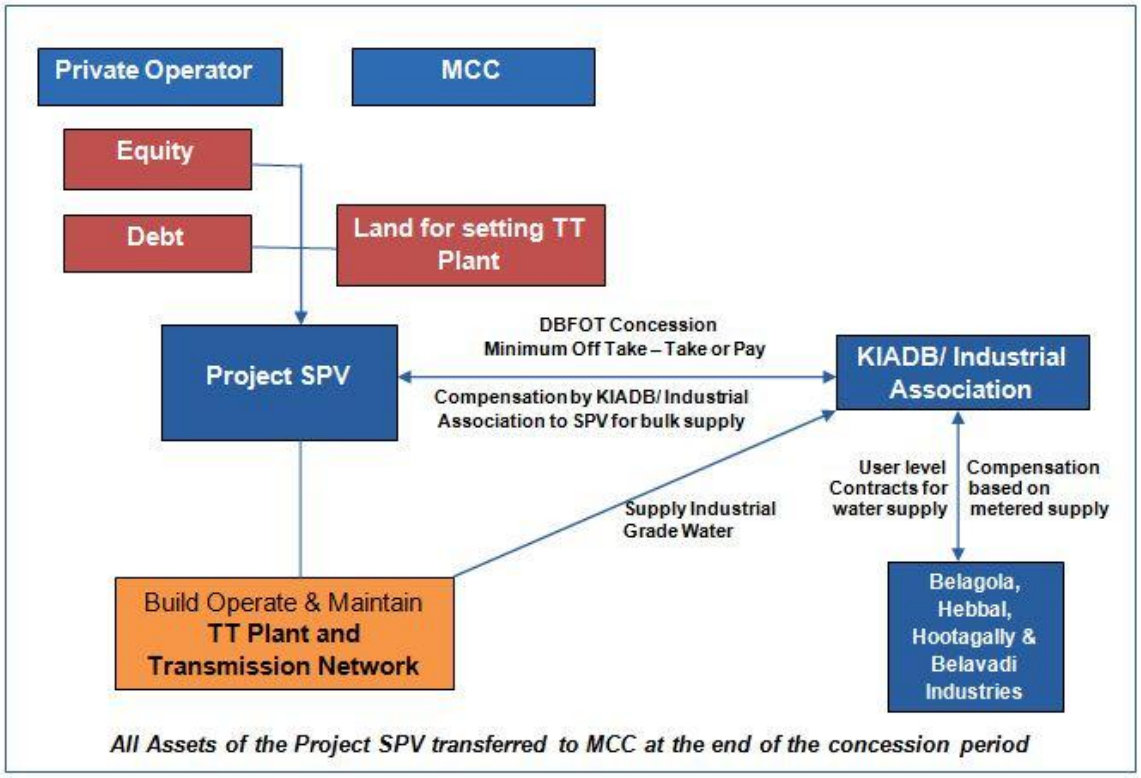
Type of PPP contract Design, Finance, Build, Operate and Transfer	**KIADB/ Industrial Association buys water in bulk from Private Operator and retains responsibility for end customer billing and collection**
Investment and O&M - Tertiary Treatment	Private operator
Investment and O&M - Transmission (Input and output to Treatment plant)	Private operator
Minimum off take and Take-or-Pay contract with Private Operator	KIADB/ Industrial Association
Tariff Setting, Billing and Collection from end-users	KIADB/ Industrial Association
Bid Variable	Price of Industrial Grade water per KL payable by MCC to Private operator

It is recommended that the project be implemented through **a Design, Build, Finance, Operate and Transfer PPP format as mentioned above**. Under this model, MCC will provide a **20-year concession** to the Private Operator to Design, Build, Finance, Operate, Maintain and Transfer the network and supply Industrial Grade Water to Belagola, Hebbal, Hootagally and Belavadi Industrial Estates.

We believe that this model would work better, given that the private operator would need to enter into a bulk contract with KIADB. Entering into a minimum off take and Take-or-Pay contract with KIADB for bulk supply would make the project more bankable.

PPP structure – Terms, institutional arrangements and Bid VariableExhibit 6.3 provides a schematic diagram of the institutional arrangements for the project.

Exhibit 6.3 Project Structure and Institutional Arrangement



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

1. Tripartite Concession Agreement between MCC, KIADB and Private Operator would provide a 20-year concession to the Private Operator to Design, Build, Finance, Operate, Maintain and Transfer the network and supply Industrial Grade Water to Belagola, Hebbal, Hootagally and Belavadi Industrial areas through KIADB/ Industrial Association. During this period, MCC will allow the private operator to use, rehabilitate, operate and maintain the existing assets of MCC covering the Kesare Sewage Treatment Plant.
2. MCC will commit to a minimum input raw sewage quality. KIADB/ Industrial Association will provide a guarantee to the project SPV that industrial effluent (over and above the prevailing levels) will not be let into the input raw sewage. This is to ensure that the private operator and project SPV are protected against any increase in industrial contaminant levels in the raw sewage.

3. MCC will provide land on nominal lease to the selected Private operator within the site of (or) in the vicinity of Kesare STP to construct the Tertiary Treatment Plant and Right-of-Way for setting up the transmission networks envisaged in the scope of work.
4. All investments in complying and meeting the outcomes of the scope of work specifed would be the responsibility of the private operator.
5. The Private Operator would be selected based on the lowest base rate per KL of Industrial Grade Water supplied in bulk to KIADB/ Industrial Association, 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.
6. The private operator would be compensated on the basis of the volume of Industrial Grade water (meeting agreed quality specifications) supplied by the private operator to the KIADB sump at the Rs/ KL and escalation as defined in 5 above.
7. KIADB will retain the right to enter into contracts and the billing / collection responsibility with end users. This is due to the fact that KIADB already has contracts and is undertaking the billing and collection responsibility.
8. The Concession agreement would be between MCC, KIADB and the Private Operator and would include a Committed Off Take – Committed Assured Supply clause, whereby KIADB/(or through Industrial Association) would agree to taking a minimum quantity of water for which it would agree to a 'take-or-pay' commitment at the rate per KL quoted by the private operator. This commitment would be backed by a commitment of minimum assured supply by the private operator.
9. 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 7 member Governing Council that would comprise the Mayor (who woud be the Chair person of the Governing Council) and Commissioner of MCC, Development officer of KIADB and 2 nominees from Industrial association. Two members on the governing council including the Managing Director of the project would be the Private Operator's nominees on the Governing Council. The Governing Council would be supported by a Technical Oversight committee appointed by MCC.

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:

Resolutions of MCC, KIADB and Industrial Association 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, MCC, KIADB 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 KIADB and the private operator to scale up the project in terms of increase in capacity and supply of Industrial Grade Water.

6.2.1 Benefits of the proposed project structure

The proposed structure could potentially enable KIADB & MCC realise the following benefits:

1. **KIADB augments its water supply for industrial purposes without any investments of its own.** KIADB will meet the industrial water needs without having to invest on any infrastructure facility.
2. **MCC would save fresh water for meeting potable water need.** Given that there is likely to be a significant increase in demand for potable water with growth in extended areas, this alternate source for serving the industrial water requirement would enable MCC to conserve potable water.
3. **KIADB retains its right to fix water tariffs.** KIADB retains right to end user customers charges in Industrial areas.
4. **MCC retains the right over the assets created including the Tertiary Treatment Plant, which would be transferred to MCC 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 would be transferred to MCC at the end of the concession period.
5. **Consumers get improved service levels at acceptable tariff.**
6. **The proposed compensation and project structuring focuses on making the project bankable and ensures appropriate risk allocation.** The proposed structuring involves the private operator selling water in bulk to KIADB/ Industrial Association with a minimum Off Take commitment. Since KIADB already has ongoing contracts with end users in Industrial areas and has a good collection record already, this approach makes the project more bankable and provides a win-win proposition for KIADB, private operator and end-users.

7. Project Financials

7.1 Concept and Methodology

A preliminary financial model has been prepared to assess the Estimated Project Cost, Estimated Revenues and the Project Returns. 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 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 includes study of different scenarios from the developer's perspective and to assess the receivables for KIADB from the developer 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 20 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.

7.3 Summary of Financial Analysis Results

7.3.1 Cost Estimation

The estimated cost of the Project is Rs.41 Crore. The details of the Project Cost estimation are set out in Exhibit 7.1 below.

Exhibit 7.1 Estimated Project Cost

Sl. No.	Cost Heads	Cost Estimate (Rs. Millions)
1	Tertiary Treatment Plant (20 MLD)	**300.0**
	a. Civil Works	48.0
	b. Electrical and Mechanical	54.0
	c. Pre-treatment (Microfiltration / Ultrafiltation)	84.0
	d. TDS removal (Reverse Osmosis)	110.0
2	Transmission Network	**110.0**
	a. Piping	102.1
	b. Accessories and Metering	7.9
	Total	**410.0**
Tertiary Treatment & Transmission O&M		62 initially & will increase with escalation 5 % annually

7.3.2 Tariff Revenue Stream

The private operator would be compensated on the basis of the volume of Industrial Grade water (meeting agreed quality specifications) supplied by the private operator to the KIADB sump at the Rs/ KL (Bid Variable) and escalation as defined in Concession Agreement. Minimum Take or Pay Agreement would help in Revenue Surety.

7.3.3 Viability Assessment (NPV, Project IRR)

The key financial indicators for the project are summarized in Exhibit 7.2 Key Financial Indicators below.

Exhibit 7.2 Key Financial Indicators

Indicator	Value
Project IRR	16.68 % at 25 Rs / KL
Project NPV (@ 14%)	Rs. 70.58 Mn

From the above it can be seen that the Project IRR is greater than the common benchmark of 15%, which is IRR that investors will most likely seek from such an investment. Thus the Project is viable on a standalone basis and any financial assistance would not be required towards the Project by Govt. to the private operator. Also, the estimated bid variable i.e. cost of water per KL comes out to be Rs. 25 which is quite lower than the current cost of Rs. 52/KL (max. slab) as set by MCC. This adds to the feasibility of the project.

7.3.4 Scenario Analysis

The following section presents the Scenario Analysis which provides the variation in the Project IRR in accordance with the variation in cost of the project as well as revenue from the project. The details of the same are as shown below in Exhibit 7.3.

Exhibit 7.3 Scenario Analysis

Variation in Project IRR		Revenue Variation				
		-20%	-10%	0%	10%	20%
Cost Variation	-20%	12.76%	16.62%	20.07%	23.26%	26.26%
	-10%	11.34%	14.99%	18.24%	21.22%	24.02%
	0%	10.11%	13.59%	16.68%	19.50%	22.13%
	10%	9.04%	12.38%	15.33%	18.01%	20.51%
	20%	8.10%	11.32%	14.15%	16.61%	19.10%

7.3.5 Value for Money Analysis

Value for Money analysis is done by comparing the financial outputs of two Models as mentioned below:

- **PPP Model:** When the project is being financed, owned and implemented by Private Sector Player
- **PSC Model:** When the project is being financed, owned and implemented by Government.

Public Sector Comparator (PSC) is used to make decisions by testing whether a private investment proposal offers value for money in comparison with the most efficient form of public procurement. The PSC estimates the hypothetical risk-adjusted cost if a project were to be financed, owned and implemented by government.

The assumptions considered for developing the PPP model and the summary of the respective financial indicators have been presented in the previous section. For developing the base PSC model, Cost of Capital i.e. estimated cost of market borrowings for the Government of Karnataka has been assumed to be 14%. Other assumptions remain identical to the PPP reference model in order to meaningfully compare the PPP and Public sector models.

Optimum allocation of risks associated with the project is perhaps the single most important step towards developing the contractual framework for any PPP project. The principle of allocating risk to the party best placed to handle the risk is presented below in Exhibit 7.4.

Exhibit 7.4 Quantitative Risk Matrix

Risks	Financial Impact	Risk Allocation (%) as per PPP Model	
		Concessionaire	Authority
Construction Cost Overrun	Cost overrun of 15%	100%	0%
Opex risk	Increase in O&M Cost by 15%	100%	0%

7.3.5.1 NPV of all Risks to be added onto the base PSC Model

Based on the quantitative risk analysis described previously, NPV of all risks has been calculated and has been added to the base PSC model developed for the project. This is to facilitate comparison between the PPP reference model and the PSC model so as to decide upon the appropriate development model for the project.

NPV of risks to be added back is as given in Exhibit 7.5.

Exhibit 7.5 NPV of all Risks to be added onto the base PSC Model

Risks	Financial Impact	NPV at Risk (INR Mn)	NPV of Risk to be added back (INR Mn)
Construction Cost Overrun	Cost overrun of 15%	-47.81	-47.81
Opex risk	Increase in O&M Cost by 15%	-49.34	-49.34
NPV of all transferred Risks to be added back to base PSC model			**-97.15**

Therefore INR (-) 97.15 Mn is the NPV to be added back to the base PSC model. The risk adjusted PSC reference therefore comes out to be INR (-) 97.15 Mn, i.e., the net cost to the government for implementing the project through KIADB is INR 97.15 Mn.

7.3.5.2 NPV of all retained Risks to be added onto the PPP Reference Model

Based on the above risk assessment framework, the NPV of risks to be added back to the PPP reference model is given in Exhibit 7.6 NPV of all Risks to be added onto the PPP Model.

Exhibit 7.6 NPV of all Risks to be added onto the PPP Model

Risks	Financial Impact	NPV at Risk (INR Mn)	NPV of Risk to be added back (INR Mn)
Construction Cost Overrun	Cost overrun of 15%	0	0
Opex risk	Increase in O&M Cost by 15%	0	0
NPV of all transferred Risks to be added back to PPP model			**0**

7.3.5.3 Statement of Value for Money

The Statement of Value for Money Analysis is given in Exhibit 7.7 Statement of Value for Money.

Exhibit 7.7 Statement of Value for Money

Indicator	INR Mn
NPV of cash flows to Government (PPP Reference)	0
NPV of retained risks to be added back to PPP reference	0
Risk Adjusted PPP Reference (A)	**0**
NPV of cash flows to Government (Base PSC Model)	0
NPV of Transferred risks to be added back to base PSC model	-97.15
Risk Adjusted PSC (B)	**-97.15**
Value for Money (A-B)	**97.15**

Therefore, based on the statement for value for money, it can be stated that implementing the project through PPP is more viable than the public sector option. The government stands to gain INR 97.15 Mn in present value terms if it chooses the PPP option over the public sector alternative. This shows that the private sector is better equipped to manage the risks associated with the project.

7.4 Conclusion

With the proposed structure, the project seems to be sustainable on a standalone basis without any financial support from Government.

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**

Section 13 of National Water Policy states that 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.

Source: National Water Policy 2002

8.1.2 State Legislations/ Acts

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

I. 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 as 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

II. 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

III. 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.

Source: The Karnataka Urban Water Supply and Drainage Board Act, 1973

IV. 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 for industrial purpose shall be restricted through policy intervention.
- Portable water tariff shall be set above the industrial water tariff to avoid exploitation of portable water and to make this project successful.

9. Indicative environmental & social impacts

9.1 Environmental Impacts

Recycling conserves fresh water for drinking and other potable uses. It benefits the ecosystem, including plants, fish and wildlife, because less fresh water is removed from streams, rivers and other bodies of water.

A significant portion of industrial water demand is current met by extraction of ground water leading to depletion of groundwater table. Provision of recycled wastewater for industrial use 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

The primary benefit of using recycled wastewater for industrial purpose would be the more availability of fresh surface water and ground water for potable purpose, which otherwise would have been used for meeting industrial demand.

Increase of the employment opportunities due to the new jobs created by the organizations directly connected to the operation and maintenance of the wastewater 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/MCC is to appoint a transaction advisor to carry out feasibility studies as well as to undertake bid process management on behalf of MCC.

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 MCC)							
Preparation of Detailed feasibility Reports							
Project Structuring and Bid Documents preparation							
Bidding Process							
Selection of Developers and Issue of 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 25 Rs per KL (indexed) for a 20 year concession. However there are few issues on which the Detailed Feasibility Study shall focus on:

1) Potable Water Supply in industrial areas (should it be included in Project's Scope?)
2) Inclusion of Kesare STP's O&M in Projects Scope
3) Terms of Project Expansion with Increasing industrial demand

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

1) Water Off Take Commitment and Agreement
2) MCC's policy on selling Treated Waste Water with pricing Premium
3) Restriction on Ground Water Abstraction.

Disclaimer:

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