

Initial Environmental Examination

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IND: Karnataka Integrated Urban Water Management Investment Program (Tranche 2) – Improvements for 24x7 Water Supply System – Distribution System for City Municipal Council, Udupi (PART A)

Package No: 02UDP01

CURRENCY EQUIVALENTS

(as of 11 May 2017)

Currency unit	–	Indian rupee (₹)
₹1.00	=	\$0.0149
\$1.00	=	₹67.090

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CTE	–	consent to establish
CTO	–	consent to operate
CMC	–	City Municipal Council
		Central Public Health and Environmental Engineering
CPHEEO	–	Organization
CPCB	–	Central Pollution Control Board
CRZ	–	coastal regulation zone
EHS	–	environmental, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
GLSR	–	ground level service reservoir
GRC	–	grievance redress committee
GRM	–	grievance redress mechanism
HDPE	–	high density polyethylene
IEE	–	initial environmental examination
IFC	–	International Finance Corporation
		Karnataka Integrated Urban Water Management Investment
KIUWMIP	–	Program
KSPCB	–	Karnataka State Pollution Control Board
		Karnataka Urban Infrastructure Development and Finance
KUIDFC	–	Corporation
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NGO	–	nongovernment organization
OHS	–	occupational health and safety
OHT	–	overhead tank
PIU	–	program implementation unit
		project management, design and construction supervision
PMDSC	–	consultant
PMU	–	program management unit
REA	–	rapid environmental assessment
RPMU	–	regional program management unit
SEIAA	–	State Environmental Impact Assessment Authority
SEMP	–	site environmental management plan
SPS	–	Safeguard Policy Statement
ULB	–	urban local body
VHPP	–	Varahi Hydal Power Project
WTP	–	water treatment plant

WEIGHTS AND MEASURES

dba	-	A-weighted decibel
cusec	-	cubic foot per second
m ³	-	cubic meter
°C	-	degree Celsius
dia	-	diameter
ha	-	hectare
kl	-	kiloliter
km	-	kilometer
m	-	meter
		microgram per cubic
µg/m ³	-	meter
ml	-	milliliter
mm	-	millimeter
MLD	-	million liters per day
km ²	-	square kilometer

NOTE

In this report, "\$" refers to US dollars.

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EXECUTIVE SUMMARY

The Asian Development Bank (ADB) funded Karnataka Integrated Urban Water Management Investment Program (KIUWMIP) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. Udupi 24x7 water supply distribution network subproject is one of the subprojects proposed in Tranche 2.

Categorization. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required. Udupi water supply subproject is classified as Environmental Category B as per ADB SPS, 2009 as no significant impacts are envisioned. Accordingly, this initial environmental examination (IEE) report has been prepared. The bulk water supply components proposed under the government funding are essential for successful operation of this package. Thus, due diligence for both ADB and government-funded components have been included in this IEE.

Subproject Scope. Subproject includes the following components: (i) clear water feeder mains of 24.543 kilometer (km) of diameter 100 millimeter (mm) to 355 mm to feed to new overhead tanks (OHT); (ii) 7 OHTs of total storage capacity 6.85 million liters (ML); (iii) distribution network of 321.487 km (diameter 63 mm to 450 mm); and (iv) replacement of 18737 existing meters (m) and providing new metered house service connections of 17715 for uncovered households. Distribution network pipes will be laid along existing road right-of-way (ROW) and OHTs will be constructed in government-owned lands. New water source from river Varahi about 38.5 kms from Udupi has been selected to meet shortage of water for summer four months. RCC Intake well, RCC Jackwell cum pump house and raw water pipe line for 38.5 Kms is proposed under AMRUTH Scope. Also it is proposed 45 MLD WTP near Halady to meet additional demand of Udupi under State fund.

Implementation Arrangements. Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) is the executing agency responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities are overseen by program management unit (PMU) established in its head office at Bangalore in coordination with its regional office (RPMU) in Mangalore. PMU and RPMU are staffed with technical, administrative and financial officials, including safeguards specialists, to manage and monitor program implementation. The implementing agencies are the respective urban local bodies (ULBs). For this package, the implementing agency is City Municipal Council (CMC) of Udupi. A program implementation unit (PIU) has been set up for implementation of day-to-day activities in the field. A consultant team, Project Management, Design and Construction Supervision Consultant (PMDSCS), assists PMU, RPMU and all PIUs in subproject planning and management, assures technical quality of design and construction, designs the infrastructure, and supervises construction including conducting all safeguards tasks.

Description of the Environment. The subproject components are located in Udupi urban area. No private land required for this subproject. There are no environmentally-sensitive areas such as protected areas, wetlands, mangroves, or estuaries in or near the subproject locations. The bulk water system component sites are located mostly outside the urban area – intake (KNNL) site is located on the bank of River Varahi, and water treatment plant (WTP) site is located around 6 km from the existing intake structure. WTP site located a directly purchased land but the area and its surroundings have already been developed and not considered environmentally-sensitive area. The transmission pipeline will be laid along roads right-of-way.

Source Sustainability. At present, River Swarna is the main source of water supply of Udupi and under a government funded bulk water supply project (partly funded by the central government funded AMRUT scheme and partly by Government of Karnataka funding), it is proposed develop an additional source (River Varahi) because the flow in River Swarna is very low during summer season (available only for duration of 101 days from February to May. The proposed new source, together with the existing, will ensure adequate water supply for Udupi throughout the year. The Varahi Hydal Power Project (VHPP) and an irrigation weir is located on the upstream site of proposed intake. VHPP discharges 1,100 cubic feet per second (cusec) of water into river course throughout year, of which 800 cusec is for irrigation use and remaining 300 cusec is available for drinking and river flow purposes. It is proposed utilize this available source mainly for the summer season to augment the water coming from River Swarna. At present, Kundapura is the only major town in the downstream of the proposed Udupi intake. Kundapura is also utilizing River Varahi with a total demand of 7.6 million liters per day (MLD) or 3.9 cusec. With Udupi's design demand of 48 MLD or 20 cusec, the combined demand of the two towns is 23.9 cusec or 7.97% of the available flow. Thus 92% of remaining flow or 74 cusec will be available for downstream users. Therefore, there are no significant impacts related to source sustainability or downstream impacts.

Potential Environmental Impacts. No significant impacts are anticipated either due to location or design of the subproject as the sites are selected and fixed ensuring components are not located in environmentally-sensitive areas. However due to the project sites being in urban areas and nature of open cut method for pipelaying works, unavoidable impacts include (i) health and safety hazards to workers during construction and operation, (ii) noise and dust from construction activities, (iii) increased road traffic due to interference of construction activities, (iv) soil erosion/silt runoff from construction waste soils, and (v) increased sewage flow due to increased water supply. These impacts during construction and operation can be mitigated through good and high-quality construction and operations and maintenance (O&M) practices. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be affecting small areas only.

Environmental Management Plan. The purpose of the environmental management plan (EMP) is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.

A copy of the updated EMP / SEMP must be kept on work sites at all times. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts, (ii) carry out all of the monitoring and mitigation measures set forth in the EMP, and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

Mitigation measures for identified impacts include: (i) implementing a health and safety plan and providing regular orientation to workers, (ii) noise-producing activities will be kept at minimum by using silencers and working during periods when it will be least affecting sensitive receptors, (iii) water spraying of surroundings to minimize dust, (iv) implementing traffic management plan in coordination with local traffic enforcers, (v) reuse of waste soils, and (vi) improving the sewerage system as part of KIUWMIP. Contractors will be providing planks to create access to ensure businesses are not affected.

Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to PMU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population. There will also be regular and periodic monitoring surveys for quality of water (at intake, reservoirs and at consumer end).

Consultation, Disclosure and Grievance Redress: The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB and KUIDFC websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and can participate in its development and implementation. A project-specific grievance redress mechanism is proposed and described in the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting. The PMU, RPMU, PIUs, consultants will be responsible for monitoring the contractors. PMSDC will submit monthly monitoring reports to RPMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

Permits and Clearances Required. Environmental Clearance requirement per Government of India Environmental Impact Assessment Notification is not applicable to this subproject. No environment-related statutory clearance or permissions required for ADB-funded components. The government-funded bulk water intake will require permission from Irrigation to use existing KNNL intake and while the WTP will not require clearance.

Conclusions and Recommendations. The citizens of the Udupi will be the major beneficiaries of this subproject as the environmental condition and over-all health of the community will be improved. With the improved bulk water supply, they will be provided with a constant supply of better quality water, piped into their homes. The replacement of old distribution lines shall avoid cross contamination and have positive benefit on health by avoiding diseases such as diarrhea and dysentery, resulting in less expenses on healthcare, improve working days and their economic status.

Based on the findings of the IEE, there are no significant impacts and the subproject as Category “B” is confirmed. No further study or detailed environmental impact assessment (EIA) is required to comply with ADB SPS (2009).

This IEE has been updated based on change in alignment and including the site-specific environmental management plan (SEMP). Final IEE based on completed detailed design for all sections will be submitted to ADB for review and web disclosure.

I. INTRODUCTION

A. Background

1. The Karnataka Integrated Urban Water Management Investment Program (KIUWMIP, the Program) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. The Program focuses on priority investments and institutional strengthening in water supply and sanitation within an integrated water resource management (IWRM) context.

2. The executing agency is the Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) and implementing agencies for the Investment Program will be respective urban local bodies (ULBs). Kundapura, Mangalore, Puttur, and Udupi are the four towns chosen to benefit from the Tranche 2 of the investment.

3. The expected outcome will be urban water resource management in four coastal towns (Kundapura, Mangalore, Puttur and Udupi) improved. The outputs are (i) UWSS infrastructure expanded and upgraded; (ii) water resource planning, monitoring and service delivery improved; and (iii) institutional capacity of KUIDFC and ULBs strengthened capacity. This initial environmental examination (IEE) is based on an assessment water supply projects within the project area i.e. Udupi.

Subproject Scope Subproject includes the following components: (i) clear water feeder mains of 24.543 kilometer (km) of diameter 100 millimeters (mm) to 300 mm to feed to new overhead tanks (OHTs); (ii) 7 OHTs of total storage capacity 6.85 ml; (iii) distribution network of 321.487 km (diameter 63 mm to 450 mm); and, (iv) replacement of 18,737 existing meters and providing new metered house service connections of 17,715 for uncovered households. Distribution network pipes will be laid along existing road right-of-way (ROW) and OHTs will be constructed in government-owned lands. New water source from river Varahi about 38.5 kms from Udupi has been selected to meet shortage of water for summer four months. RCC Intake well, RCC Jackwell cum pump house and raw water pipe line for 38.5 Kms is proposed under AMRUTH Scope. Also it is proposed 45 MLD WTP near Halady to meet additional demand of Udupi under State fund. Irrigation Department has allocated water for Udupi City. Handing over of KNNL intake to Udupi ULB is in process.

B. Background of Initial Environmental Examination

Categorization. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required.¹ Rapid environmental assessment using ADB's rapid

¹ Per ADB SPS, the environmental categorization and level of environmental assessment required for each category are as follows: (i) **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required. (ii) **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required. (iii) **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed. (iv) **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary

environmental assessment (REA) checklist for Water Supply Scheme components were conducted, and results of the assessments show that Udupi water supply subproject is classified as Environmental Category B as per ADB SPS, 2009. Accordingly, this IEE report has been prepared. The government-funded components are essential for successful operation of this subproject. Thus, due diligence for both ADB and government-funded components have been included in this IEE.

6. **Scope of the Initial Environmental Examination.** The IEE is prepared based on detailed engineering design of the subproject. Assessment of potential impacts are based on secondary sources of information and field reconnaissance surveys; no field monitoring (environmental) survey was conducted. Stakeholder consultation was an integral part of the IEE. The IEE will be updated/revised if there are changes in site/locations and design of component during design validation and preconstruction phase. It will also be updated/revised based on contractor's site-specific environmental management plan (EMP). The updated/revised IEE will be submitted to ADB for review and disclosure. No works will be conducted until ADB has cleared the updated/revised IEE.

7. **Report Structure.** This IEE was prepared following KIUWMIP's environmental assessment and review framework and ADB SPS, 2009.² The report comprises the following sections: (i) introduction, (ii) description of project components, (iii) policy and legal framework, (iv) description of the environment, (v) screening of potential environmental impacts and mitigation measures, (vi) public consultation and information disclosure, (vii) grievance redress mechanism, (viii) environmental management plan, and (ix) conclusion and recommendations.

II. DESCRIPTION OF THE PROJECT COMPONENTS

8. Udupi is located at a latitude of 13°33' N and longitude of 74°74' E. Situated at about 60 km north of the industrial hub Mangalore and about 422 km northwest of Bangalore. Udupi has the status of a City Municipal Council (CMC). Udupi is divided into 35 wards and spreading to an area of 69.28 square kilometers (km²). The population in Udupi is 125,350 according to the Census 2011.

A. Need for Infrastructure Improvement in Udupi

9. A detailed assessment of existing situation was carried out and it concludes that the present water production of 27.24 million liters per day (MLD), is insufficient to meet water demand of Udupi till the year 2031 as per national standards (Table 1). Besides Udupi town, this subproject investment also need to provide water supply covering 5 en-route villages, 5 outgrowth villages and 7 adjacent villages. The present inadequacy in the water supply system, is due to (i) mainly shortage in water source in summer season; (ii) increased water demand; and (iii) old and leaking distribution system, along with weak management system.

10. In order to meet required water demand of Udupi, an alternate water source from River Varahi is proposed under a government funded bulk water supply project³. The necessary

² The environmental assessment and review framework has been prepared in 2014 during KIUWMIP loan approval. This has been updated during Tranche 2 to include recent Government of India's environmental laws, rules and regulations and Tranche 2 project components.

³ In parallel, a bulk water supply improvement for Udupi is being undertaken under by government funding –partly under the central government funded scheme, Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and partly by the Government of Karnataka funding. Components proposed under AMRUT scheme include: (i) Rehabilitation of Existing intake channel and Jackwell at Bharathkal, Varahi River, (ii) Raw water pumping main of 864 mm dia 6.3 km from Bharathkal to Halady Proposed 45 MLD WTP, (iii) Clear Water Pumping Main 32.58 km from Halady WTP to existing GLSR Manipal (864 mm diameter), and (vi) construction of 45 MLD water treatment plant (WTP) near Halady is being taken up under the Government of Karnataka funding.

improvements and augmentation in water distribution system is proposed under the ADB funded KIUWMIP Tranche 2.

11. **Source Augmentation.** At present, River Swarna is the main source of water supply of Udupi. Per observations made under the previous ADB funded Karnataka Urban Development and Coastal Environmental Management Project (KUDCEMP) for Udupi water supply, based on the river flow records between 1989 and 1994, the flow in River Swarna is observed to be very low during summer season, from February to May. For 101 days during summer, the flow in the river is almost negligible. Following Table 1 shows the water demand and supply gap in Udupi for the no flow season of 101 days.

Table 1: Udupi Water Demand and Supply Gap

S. No.	Description	Unit	Base Year	Intermediate Year	Ultimate Year
1	Project years		2016	2031	2046
2	Available water storage capacity in Baje Barrage	million cubic meter (MCM)	1.890	1.890	1.890
3	Available water storage capacity in Shiroor Mutt Barrage	MCM	0.734	0.734	0.734
4	Total gross storage (2+4)	MCM	2.624	2.624	2.624
5	Evaporation losses @20%	MCM	0.525	0.525	0.525
6	Net water storage capacity	MCM	2.099	2.099	2.099
7	Maximum daily water supply available from storage during very low / no river flow period of 101 days	MCM	0.0208	0.0208	0.0208
8	Water supply rate during 101 days	million liters per day (MLD)	20.780	20.780	20.780
9	Total bulk water demand of Udupi	MLD	37.370	44.990	54.710
10	Supply-demand gap and additional bulk water requirement of Udupi	MLD	16.580	24.210	33.930
	Say		17.000	24.500	34.000
11	Total additional bulk water supply from alternate source including demand of enroute villages from Haladi to Baje (12 villages)	MLD	21.000	30.000	41.000

12. Therefore, under the government-funded project, it is proposed to draw (pump) 41 MLD of water for four summer months from a new source (River Varahi) to meet the demand of projected population till 2046. The proposed new source, together with the existing, will ensure adequate water supply for Udupi throughout the year. The Varahi Hydal Power Project (VHPP) and an irrigation weir is located on the upstream site of proposed intake. VHPP discharges 1,100 cubic feet per second (cusec) of water into river course throughout year, of which 800 cusec is for irrigation use and remaining 300 cusec is available for drinking and river flow purposes.

13. It is proposed to utilize existing abandoned lift irrigation scheme jack well for pumping raw water to Udupi (only civil structures). Government-funded bulk water supply project will fund replacement of pumping machineries and panels, transformers in the existing jack well and raw water main for 38 km from Jack well at Bharathkal to existing water treatment plant (WTP) at Baje. Figures 1 and 2, respectively show River Varahi and proposed intake location at Bharatkal, near Halady, Kundapur. Figure 3 shows the alignment of raw water main from intake to WTP and

Figure 4 shows the location of existing and proposed jackwell (KNNL) and WTP at 6 km from existing intake. The following are available information on the Varahi River source:

- Central Water Commission (CWC) has established river gauging station at Haladi in year 1984;
- Varahi Hydel Power Project (VHPP) located at Hosangadi about 19 km upstream of proposed intake / Jack Well site; VHPP, which releases an average tailrace discharge of 1,100 cubic feet per second (cusecs) every day;
- Karnataka Niravrai Nigam Limited (KNNL) constructed a weir at Siddapura, about 6.5 km downstream of VHPP. This weir will be about 13.5 km upstream of proposed intake/Jack well site. An irrigation project has been planned by KNPP with average discharge of 800 cusecs in the canal system;
- Even if the entire 800 cusecs is utilized for irrigation, the tailrace flow of remaining 300 cusecs will always be available in the river;
- The 2046 demand for Udupi is 41 MLD (for 4 months). This work out to be 20 cusecs, which is very small portion of tailrace flow of 300 cusecs; and
- At present, Kundapura is the only major town in the downstream of the proposed Udupi intake. Kundapura is also utilizing River Varahi with a total demand of 7.6 million liters per day (MLD) or 3.9 cusec. With Udupi's design demand of 48 MLD or 20 cusec, the combined demand of the two towns is 23.9 cusec or 7.97% of the available flow. Thus, 92% of remaining flow or 74 cusec will be available for downstream users. Therefore there are no significant impacts related to source sustainability or downstream impacts.

Figure 1: View of River Varahi at Bharathkal, Haladi

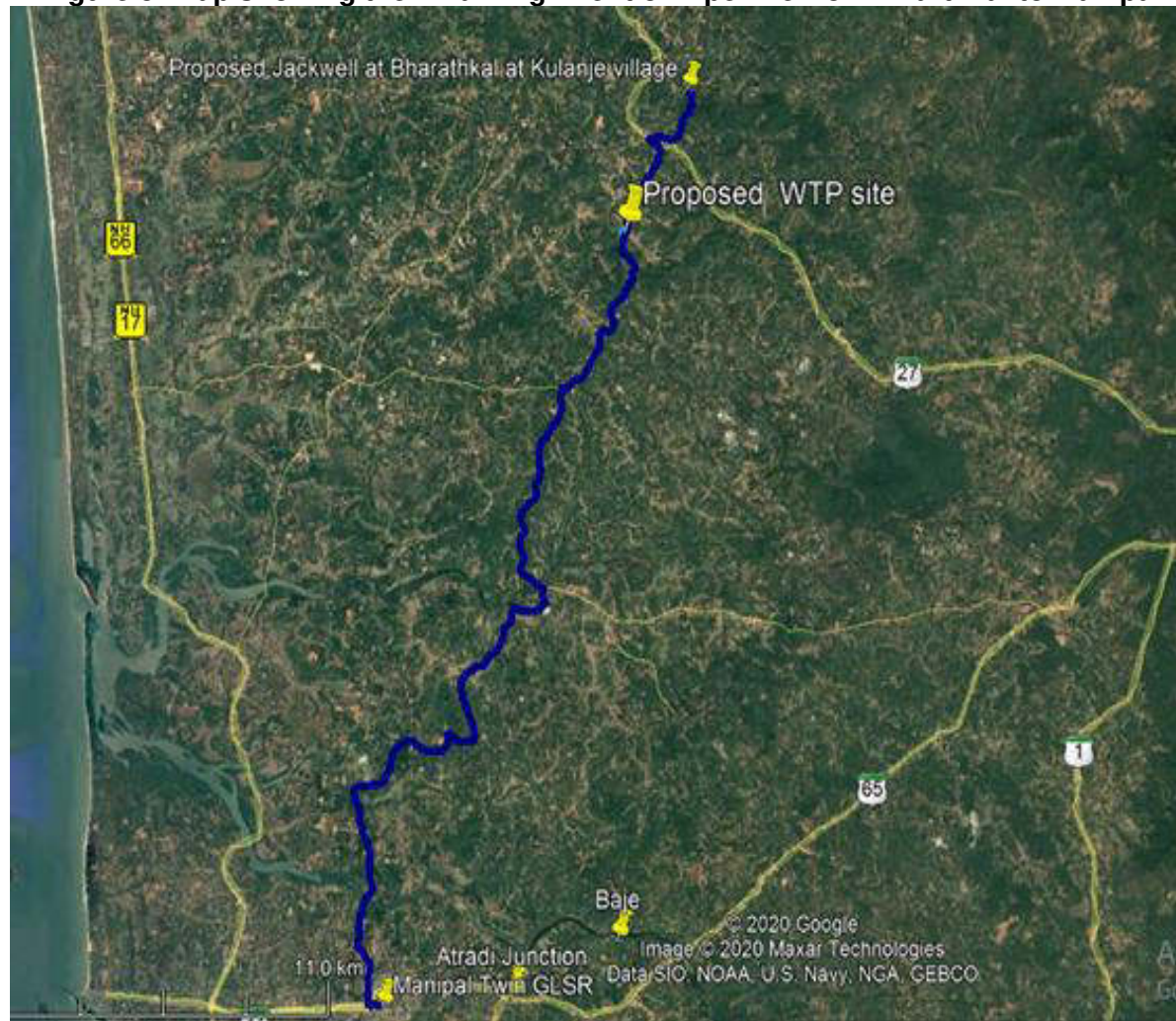


Figure 2: Location of Existing Jack Well at Bharathkal, Halady (Government-funded)



Source: Google Earth.

Figure 3: Map showing the Final Alignment of Pipe line from Bharthkal to Manipal



Source: Google Earth.

Figure 4: Location existing WTP with proposed Backwash and Sludge Management



Source: Google Earth.

14. **Water Distribution System.** KIUWMIP Tranche 2 will include the Udupi water distribution system. Uniform distribution will be ensured throughout the area by dividing the service area into zones. The total operational service area in Udupi is divided into 10 administrative water supply distribution zones and 7 water supply distribution subzones (Figure 5). It is required to have continuous distribution system in order to reduce the real losses in the system, which are going to be measured in the private operator contract.

15. **Service Reservoirs – Overhead Tanks.** KIUWMIP Tranche 2 will include the construction of 7 OHTs of total storage capacity of 6.85 ML. Figure 6 shows the location of proposed OHTs and feeder mains. Presently water supply for Udupi is carried out by 10 water storage reservoirs of 11.65 ml capacity including 9 OHTs and 1 ground level service reservoir (GLSR). Each zone is proposed to be supplied with water from storage cum balancing reservoirs, which would be fed by water from the proposed Master GLSR at Manipal. OHTs have been proposed at various locations. The capacity of the Master GLSR and OHTs has been arrived at by considering the demand of the zones to be served by the reservoirs in Udupi only and the demands of outgrowths and adjacent villages have not been considered. Independent feeder mains to all the existing OHTs are provided.

16. For efficient and equitable distribution of water, grid or loop pattern distribution networks keep dead ends to a minimum. For the scientific analysis of the non-revenue water it is proposed to create district metering areas (DMAs) for about 500 to 2,500 connections. Boundary valves shall define the DMA areas and the valve shall be on closed condition and shall be operated only in the case of emergency.

17. The pipes layout is planned along the existing streets and roads. A minimum clear cover of 1 m is proposed for the buried pipelines. Due to recent widening of roads and in order to avoid road cutting for house service connections, additional pipeline is required for both sides of the major and important roads. KIUWMIP Tranche 2 will include (i) clear water feeder mains of 24.543 km of diameter 100 mm to 300 mm to feed to new OHTs; and (ii) distribution network of 321.487 km (diameter 63 mm to 450 mm – High Density Poly Ethylene and DI pipe). Figures 7 and 8 provide the alignment of the pipe network.

18. **House Service Connections.** House service connections using MDPE pipes and withmultijet water meters have been proposed for the distribution system. KIUWMIP Tranche 2 will include replacement of 18,737 existing meters and providing new metered house service connections of 17,715 for uncovered households.

19. Table 2 provides details of the KIUWMIP Tranche 2 subproject components in Udupi based on the detailed engineering design of the subproject. Figure 5 to 46 provide details of layout and various designs of project, these maps and will be updated in the final IEE.

Table 2: Proposed Subproject Components

No.	Component	Details	Location
1	Clear water feeder main to feed treated water to overhead tanks (OHTs)	DI K7 1) 100mm- 3.132 km. 2) 150mm- 5.060 km 3) 200mm- 2.383 km 4) 250 mm- 1.041 km 5)300 mm- 7.166 km 6)350 mm- 2.982 km Di K9	For all 7 OHTs, government owned land parcels have been identified.

Figure 5: Location of Proposed Components

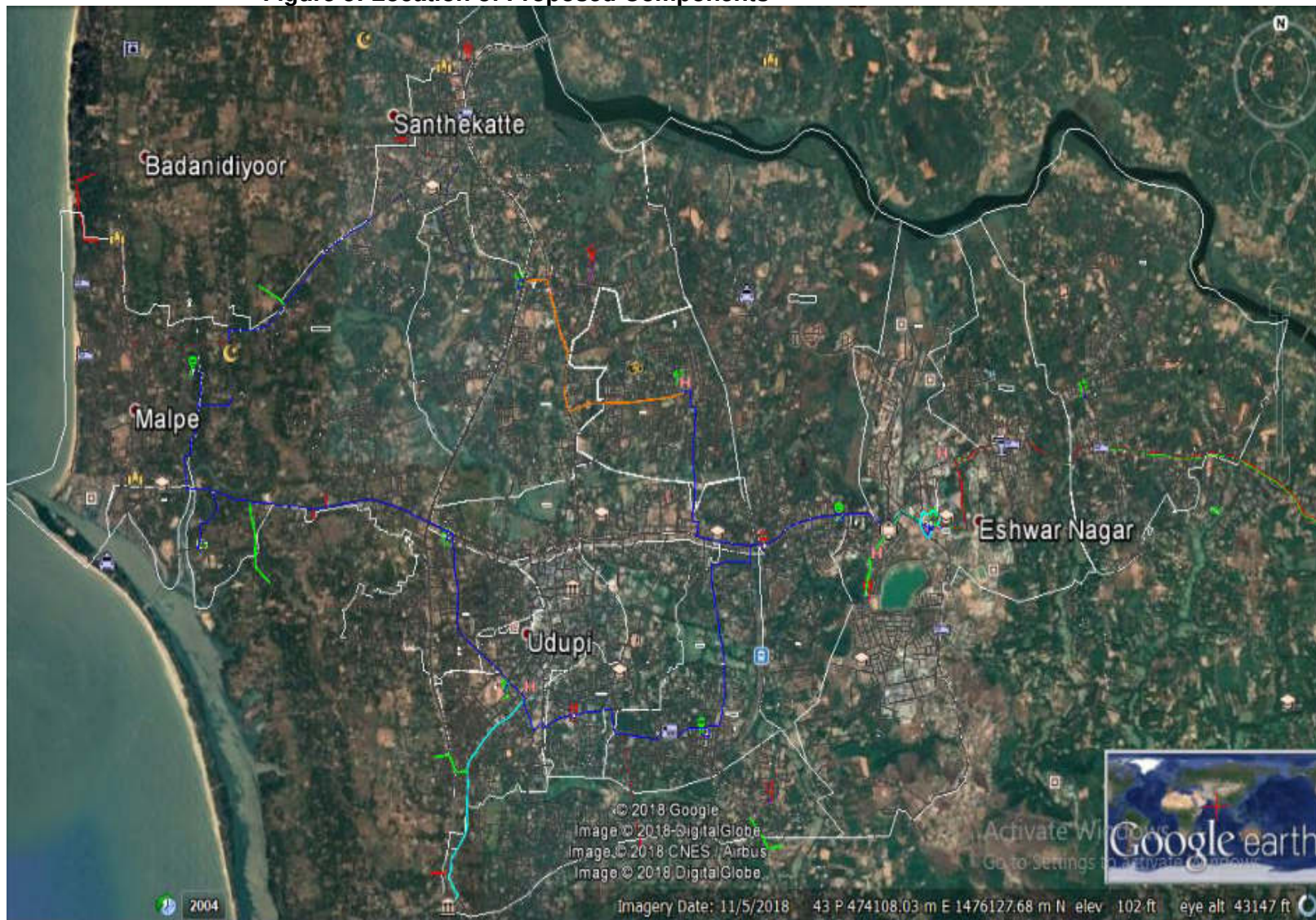


Figure 6: Distribution Mains Alignment

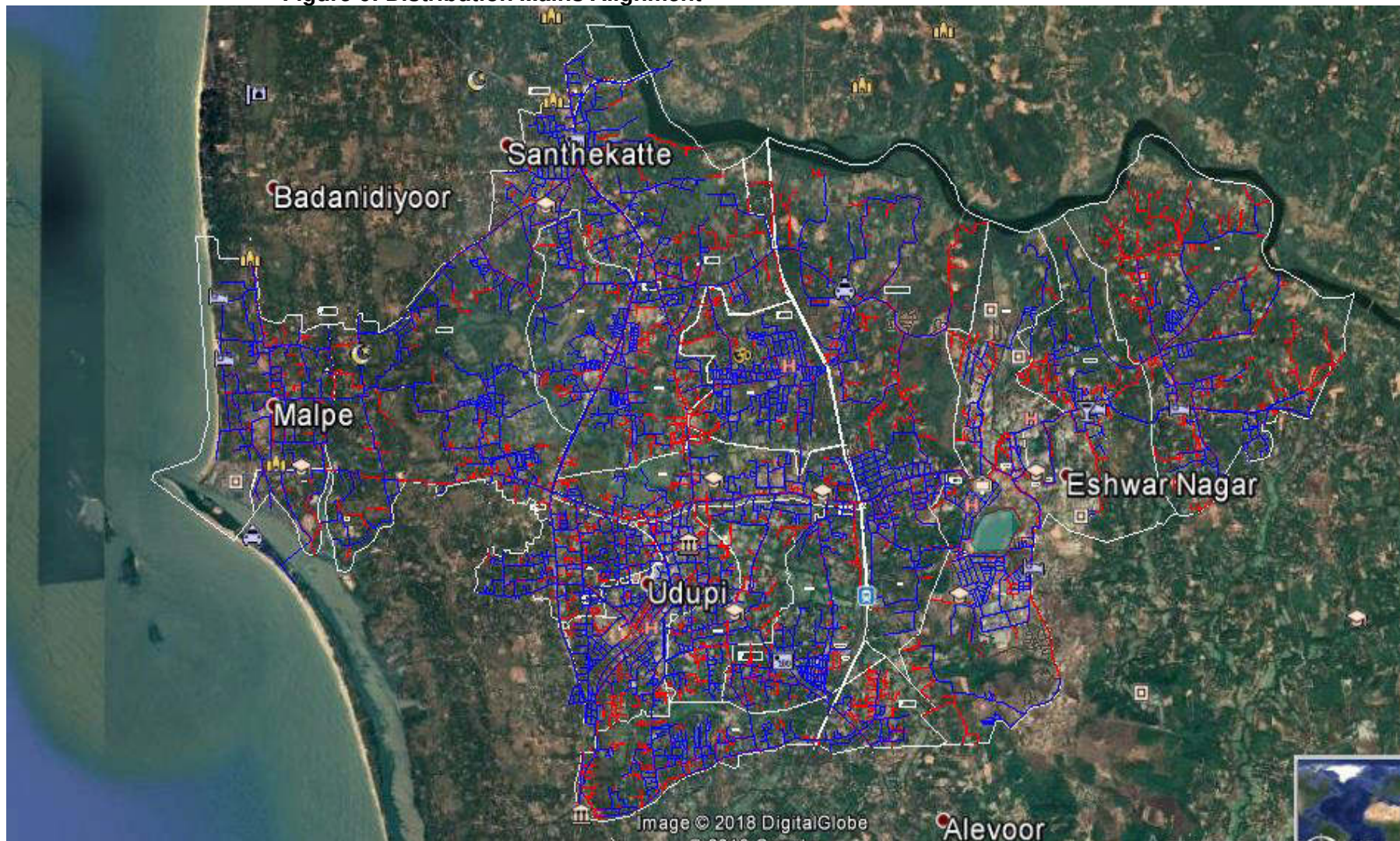


Figure 7: Proposed Water Treatment Plant Sites at Halady (Government-funded)

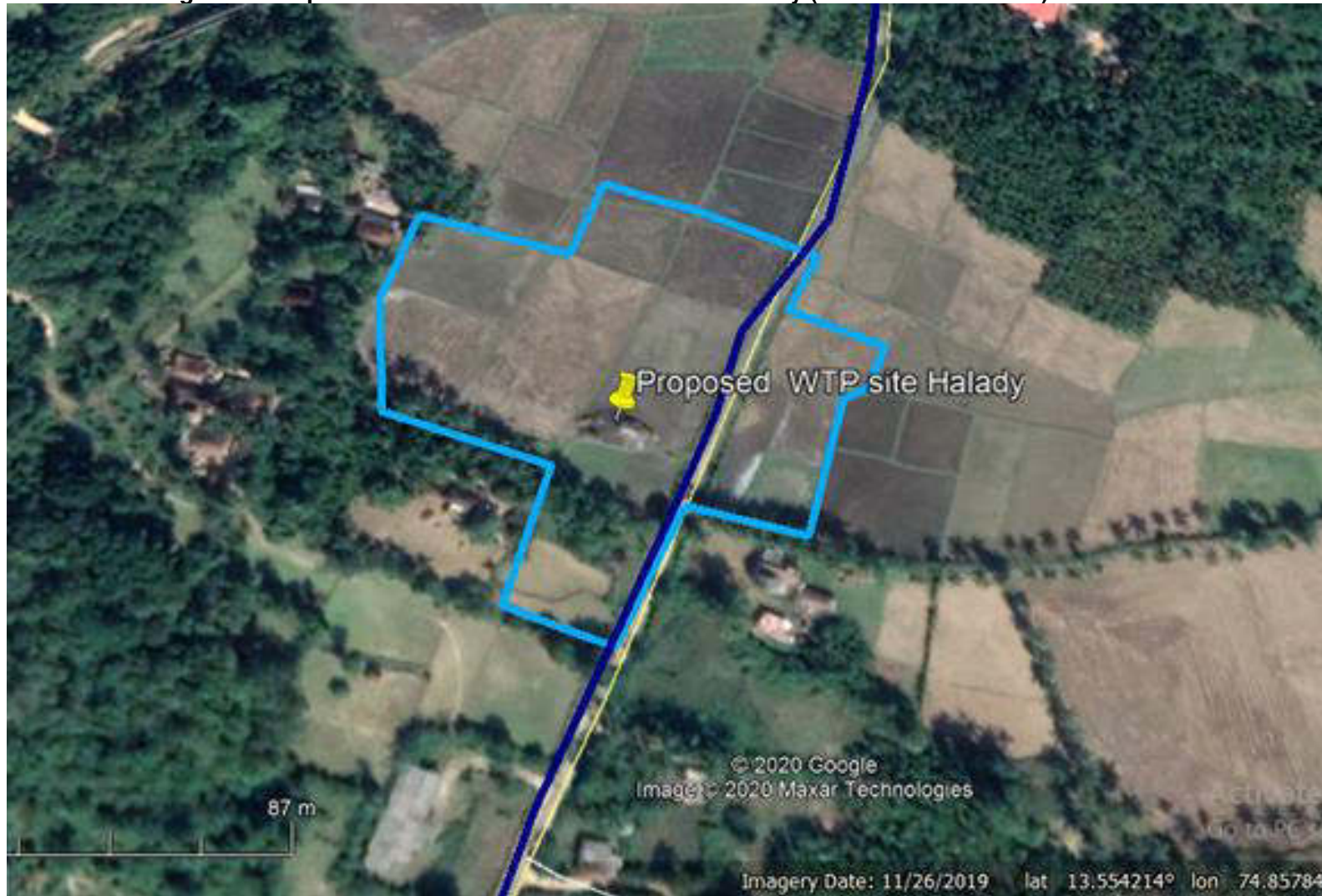
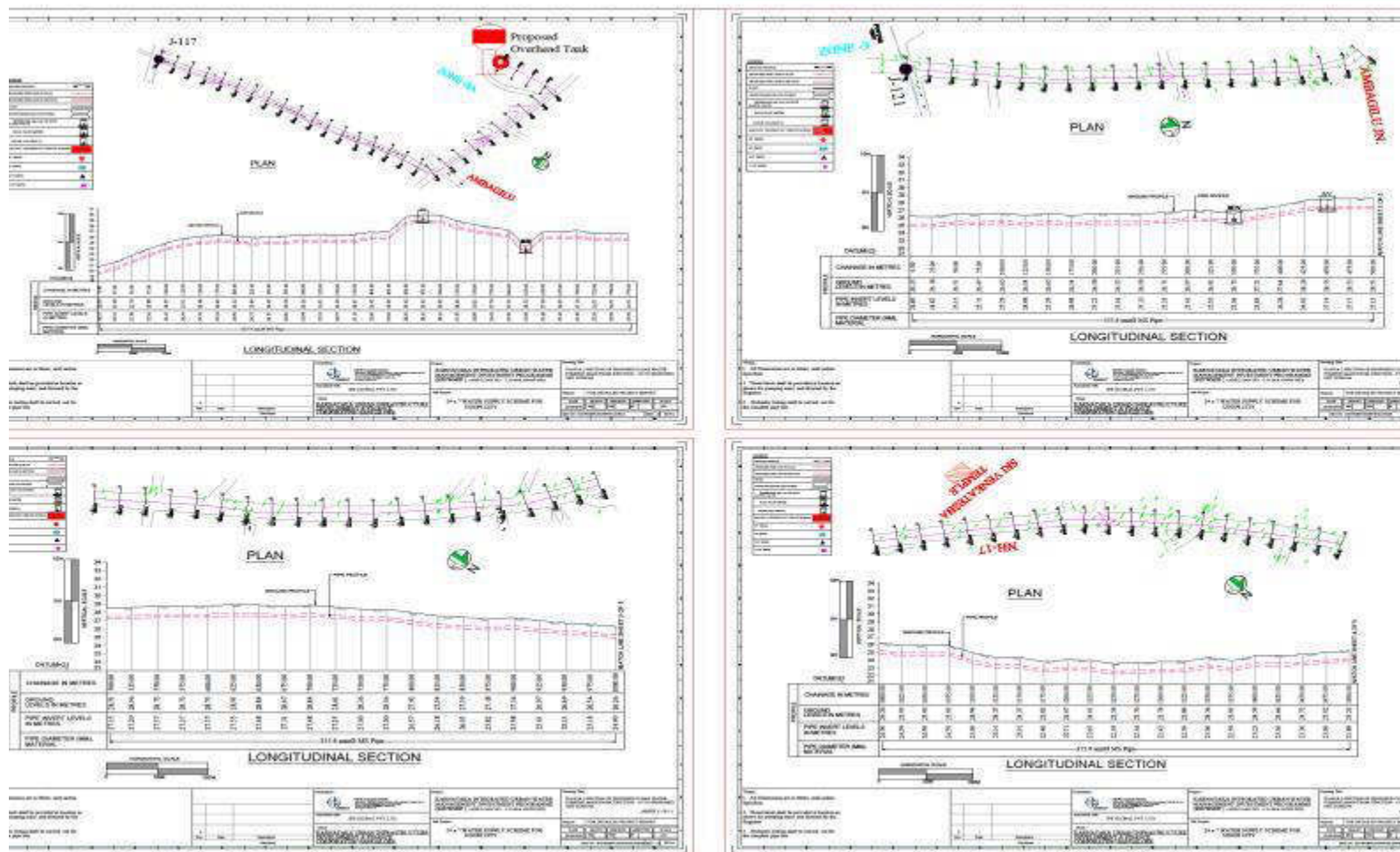
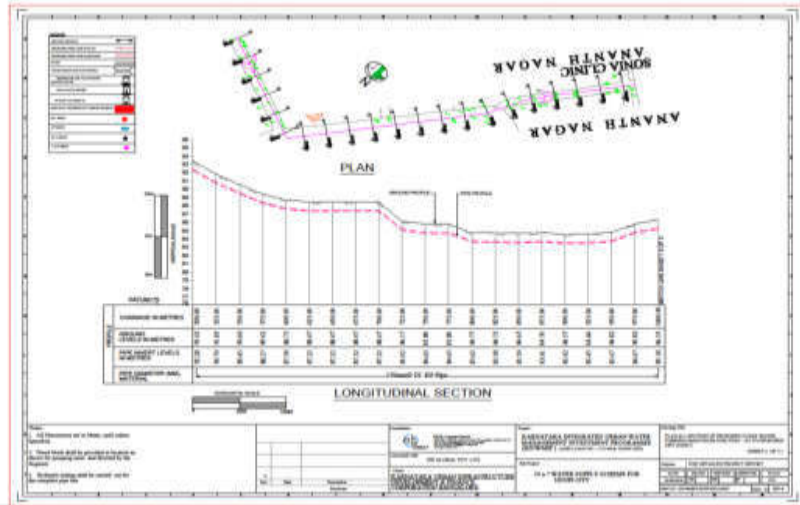
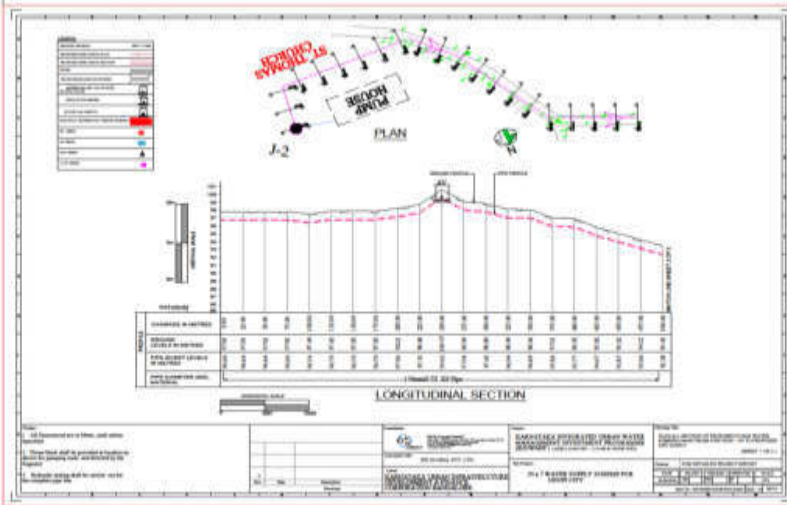
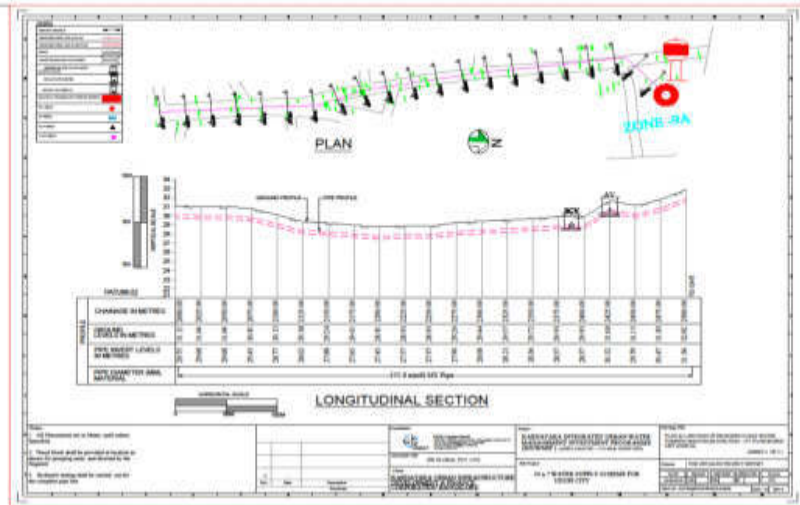
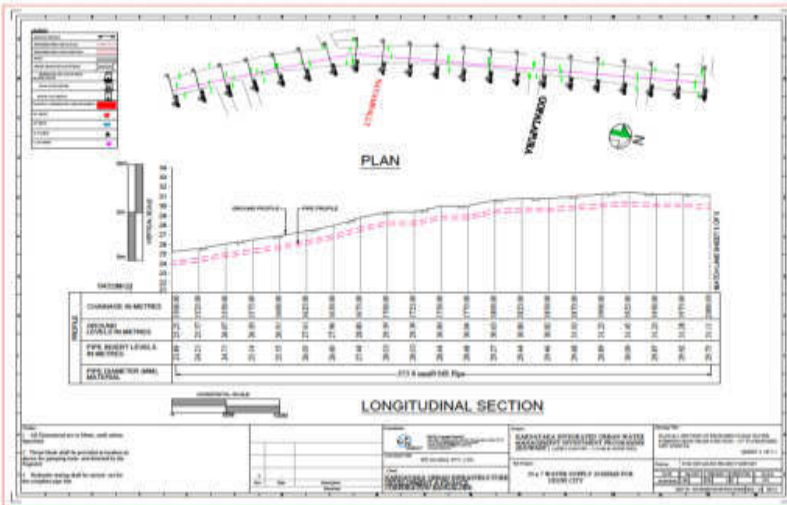


Figure 8: Layout Plan of 45 MLD WTP near Halady



Figure 9: Detailed Alignment and Profile of Transmission Main





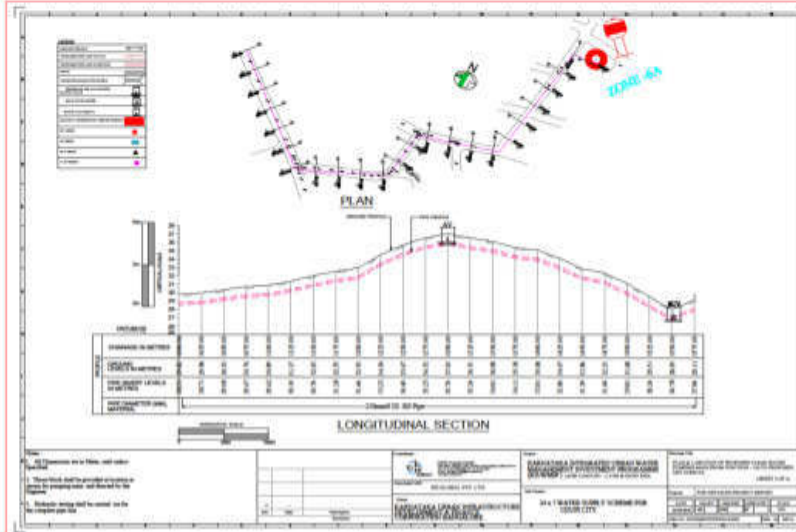
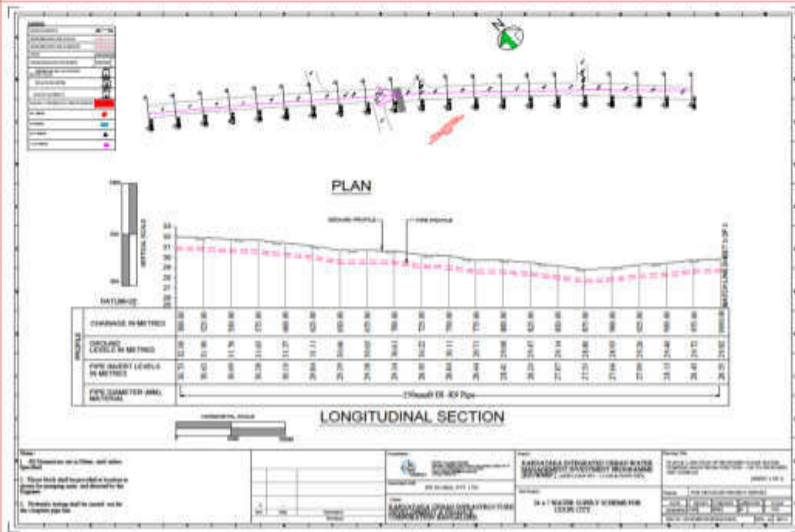
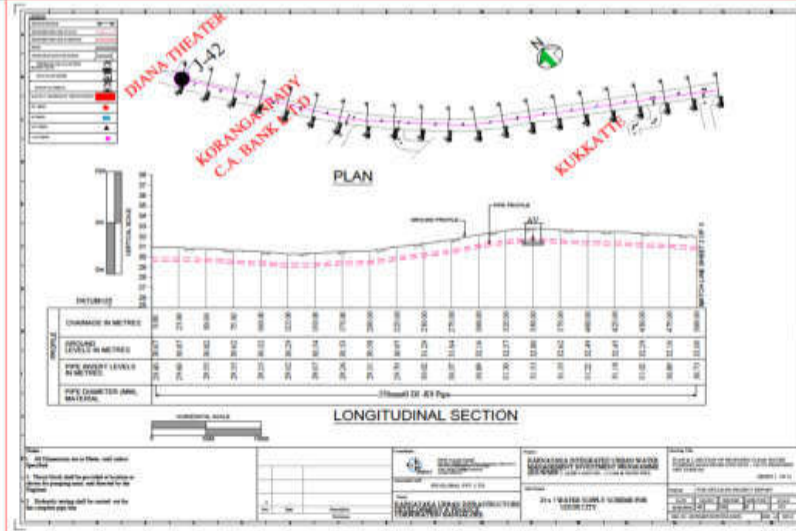
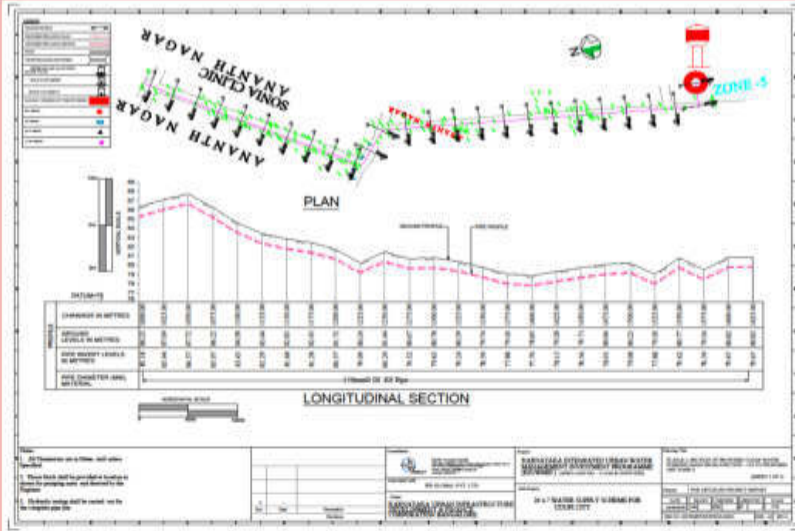


Figure 17: Proposed Layout Plan of OHT at Manipal Zone-3, Near Anganvadi)

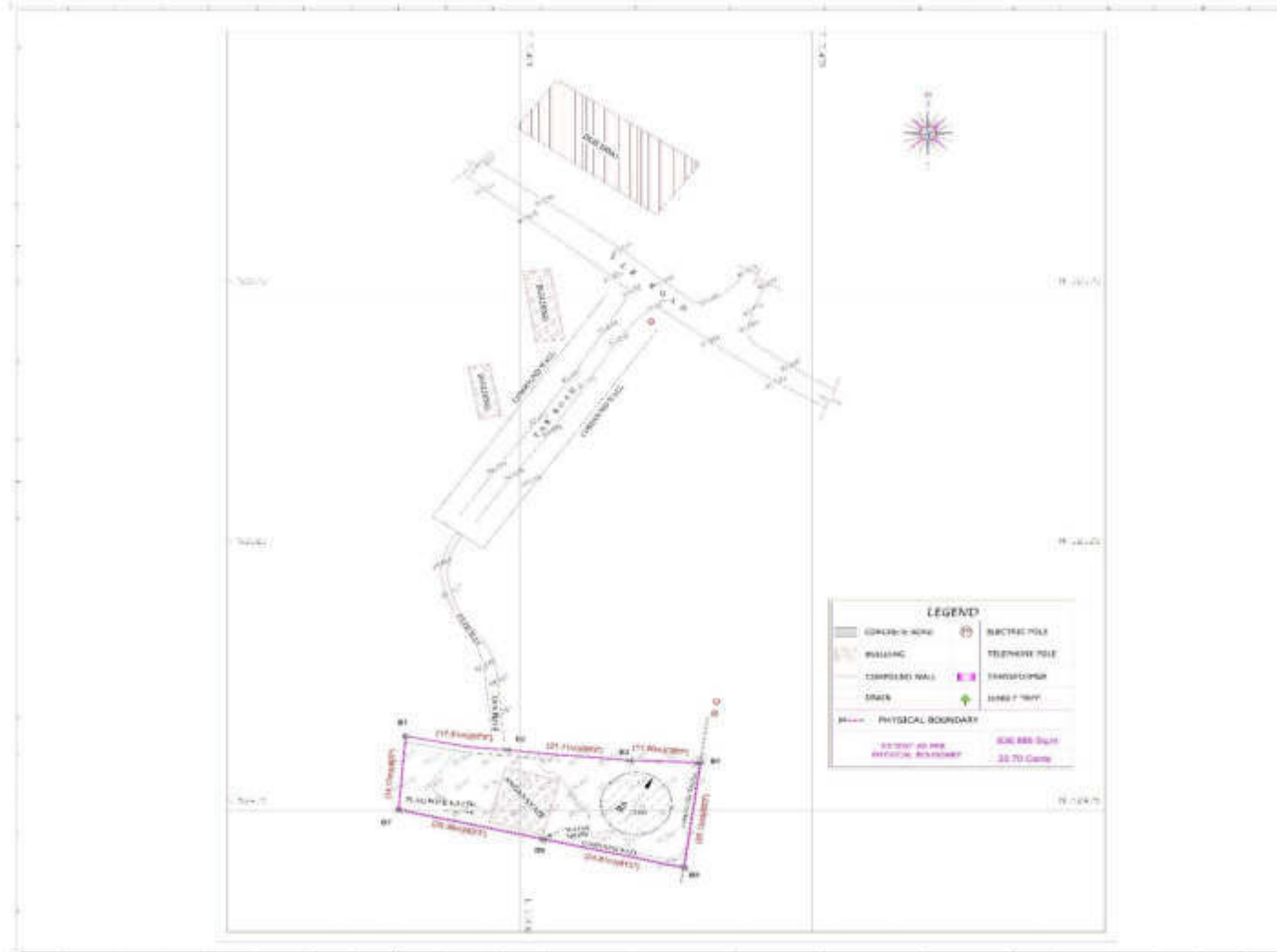


Figure 18: Sectional Plan and Elevation of OHT at Zone-3 OHT near Anganvadi Manipal

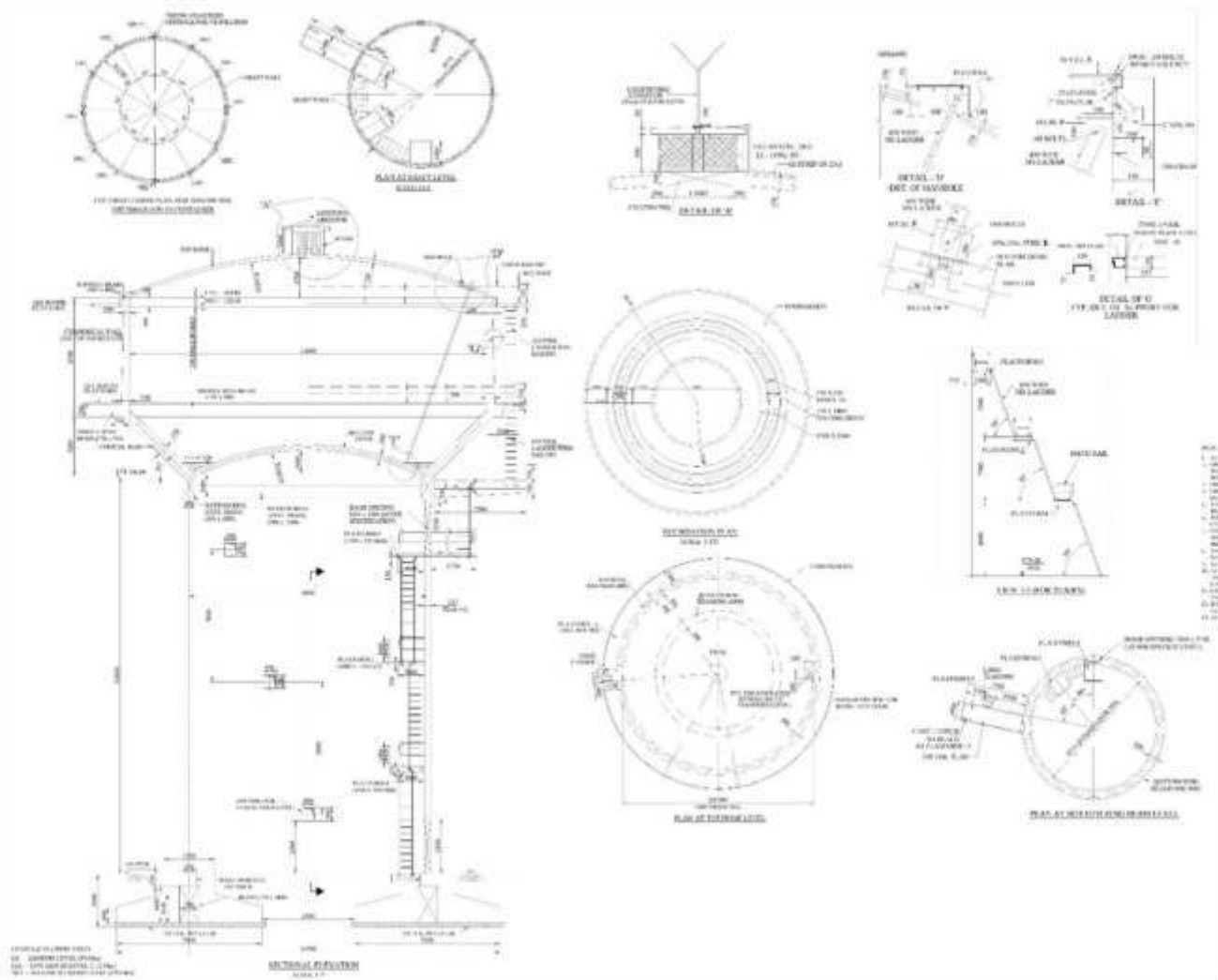


Figure 19: Proposed Layout Plan of OHT at Manipal Zone-5, Manipal

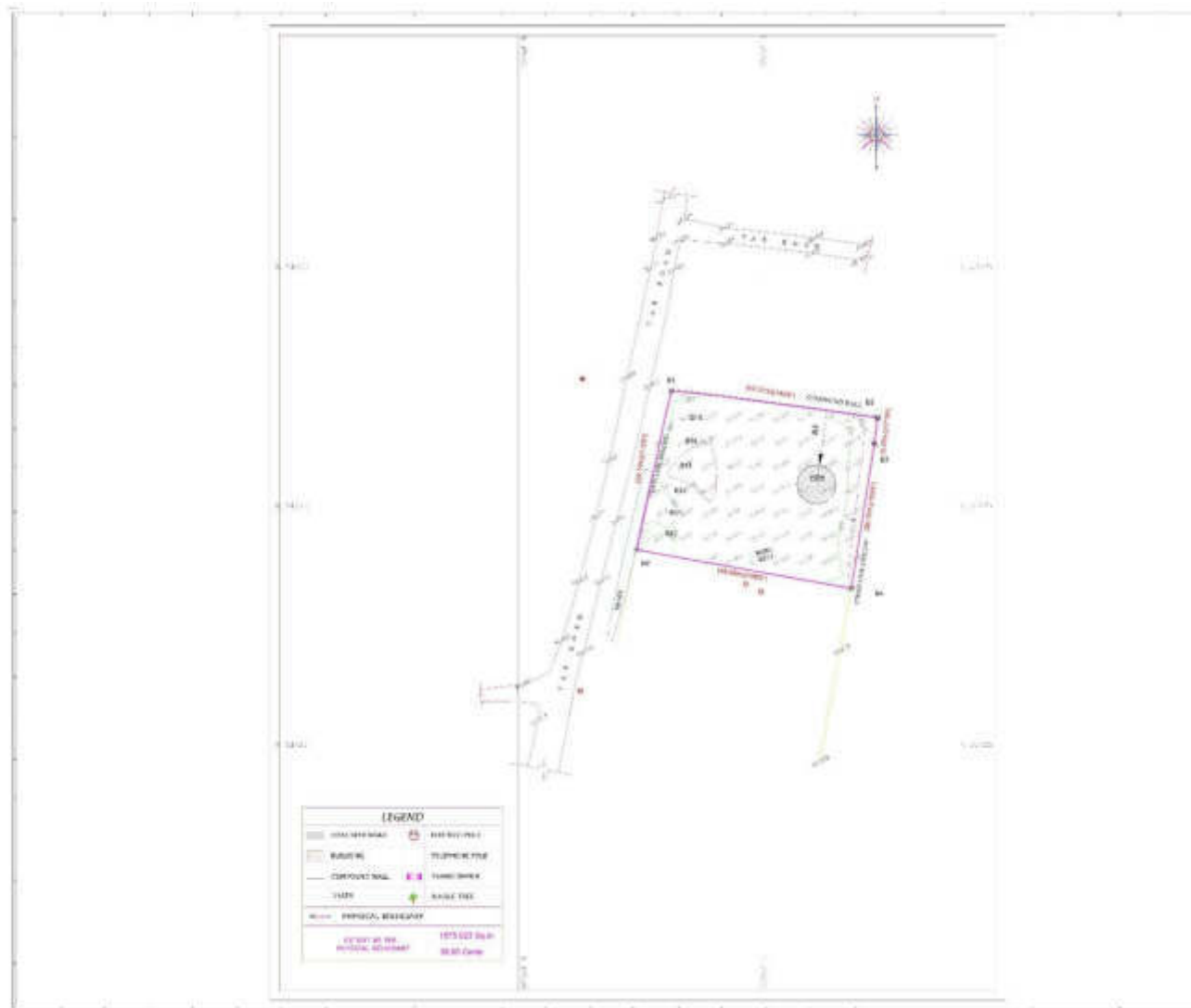


Figure 20: Sectional Plan and Elevation of OHT at Zone-5 OHT Manipal

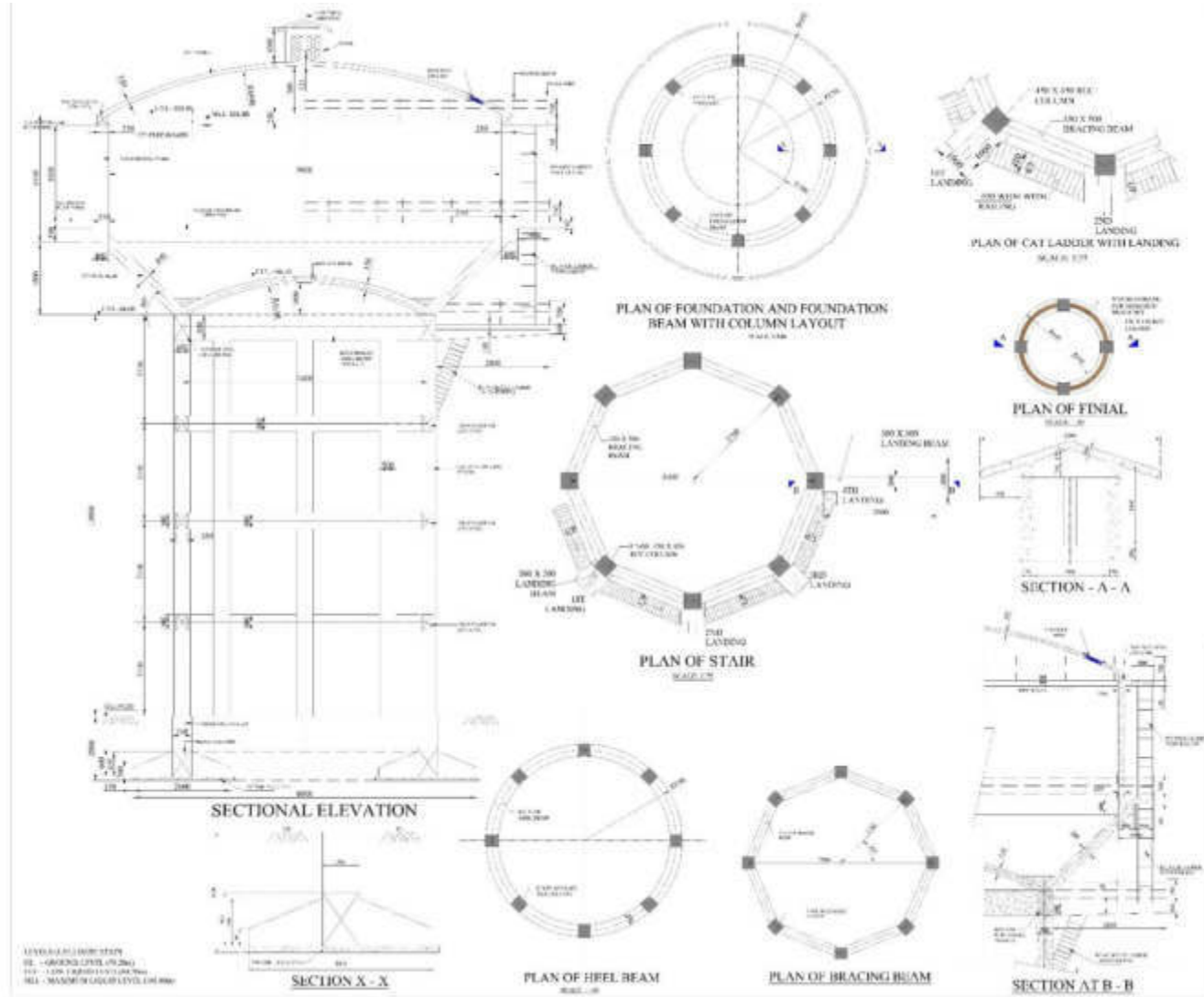


Figure 21: Proposed Layout Plan of OHT at Manipal Zone-6A, Manchi

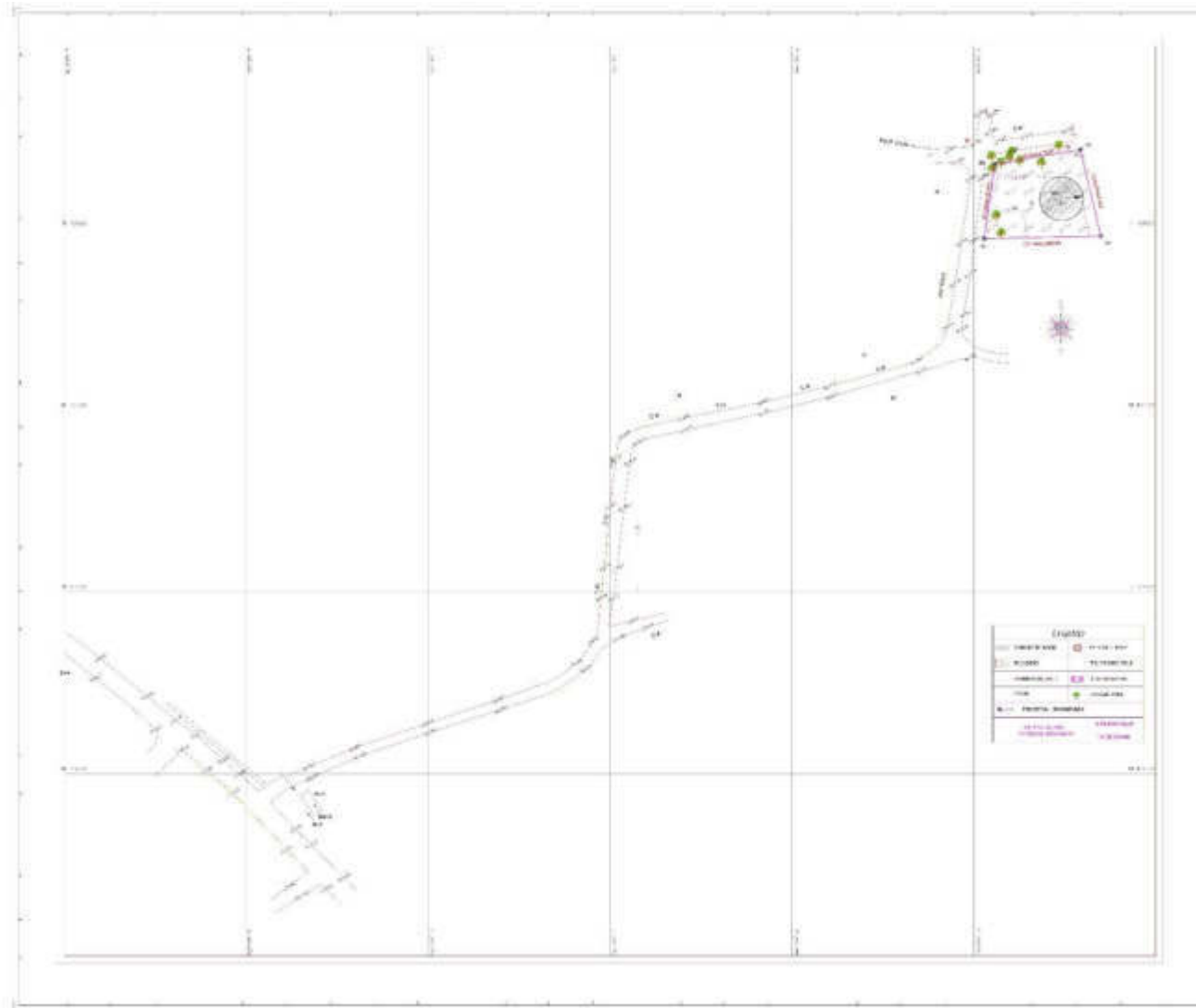


Figure 22: Sectional Plan and Elevation of OHT at Zone-6Aat Manchi

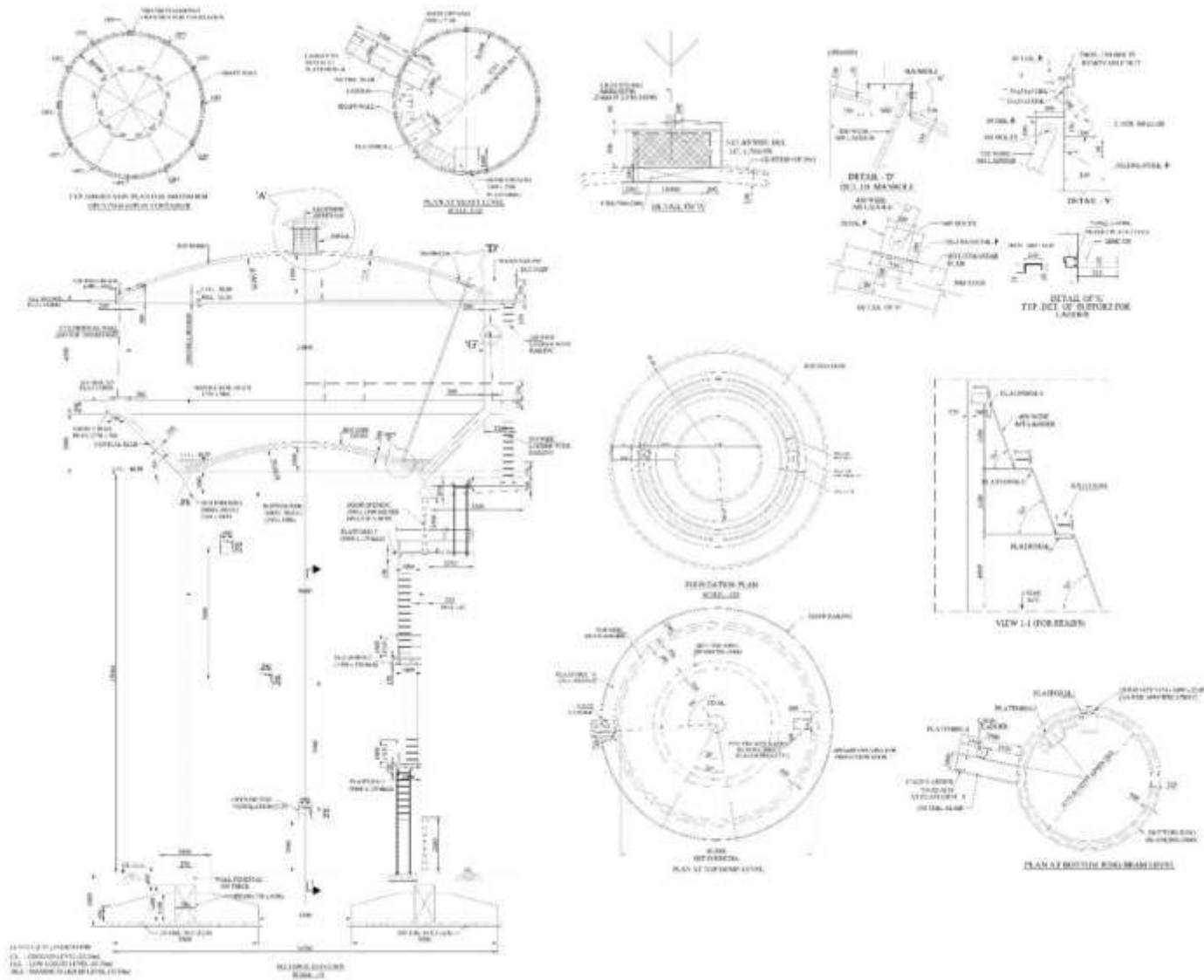


Figure 23: Proposed Layout Plan of OHT at 7B near Ammani Ramanna Shetty hall

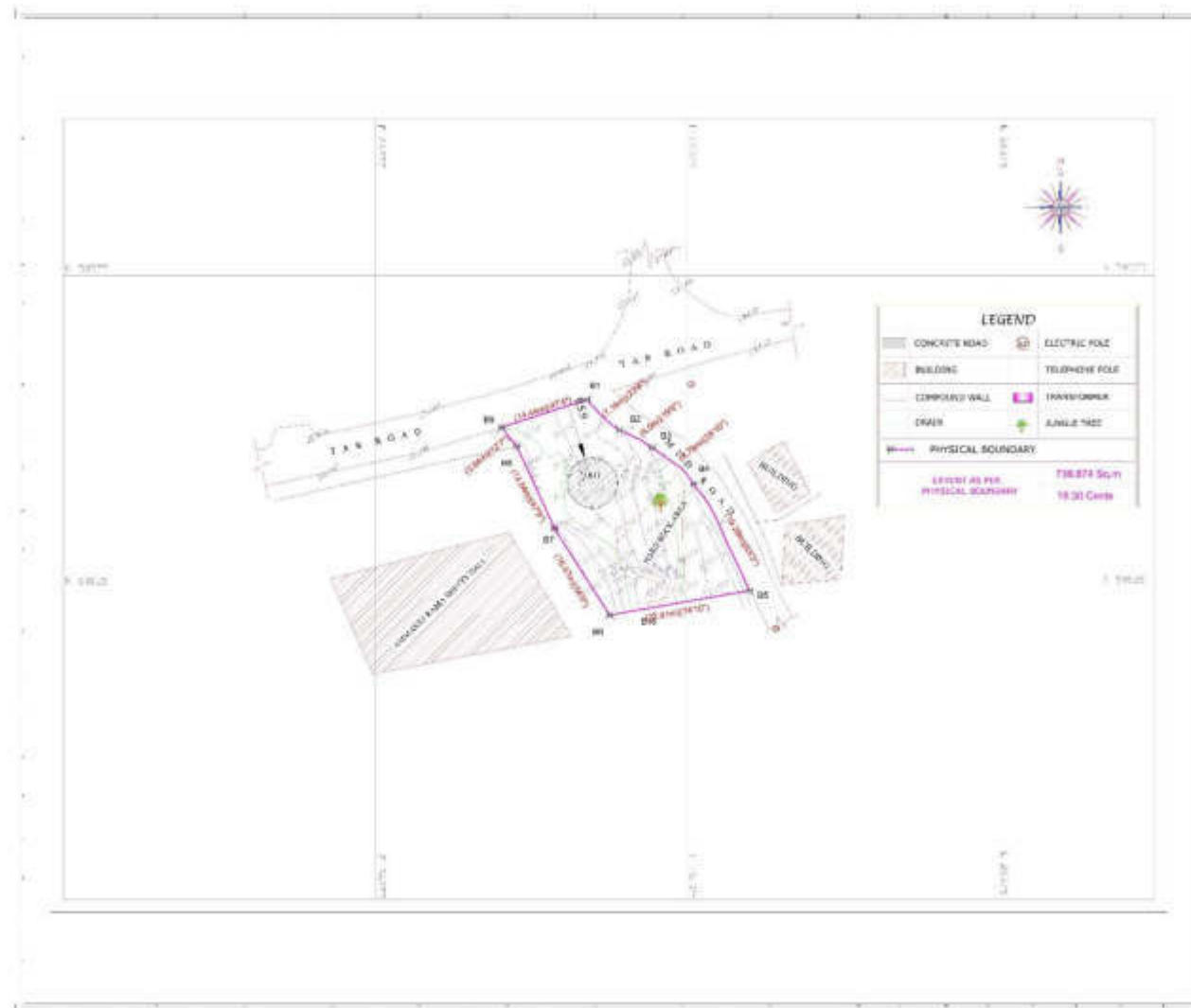


Figure 24: Sectional Plan and Elevation of OHT at Zone-7B near Ammani Ramanna Shetty hal

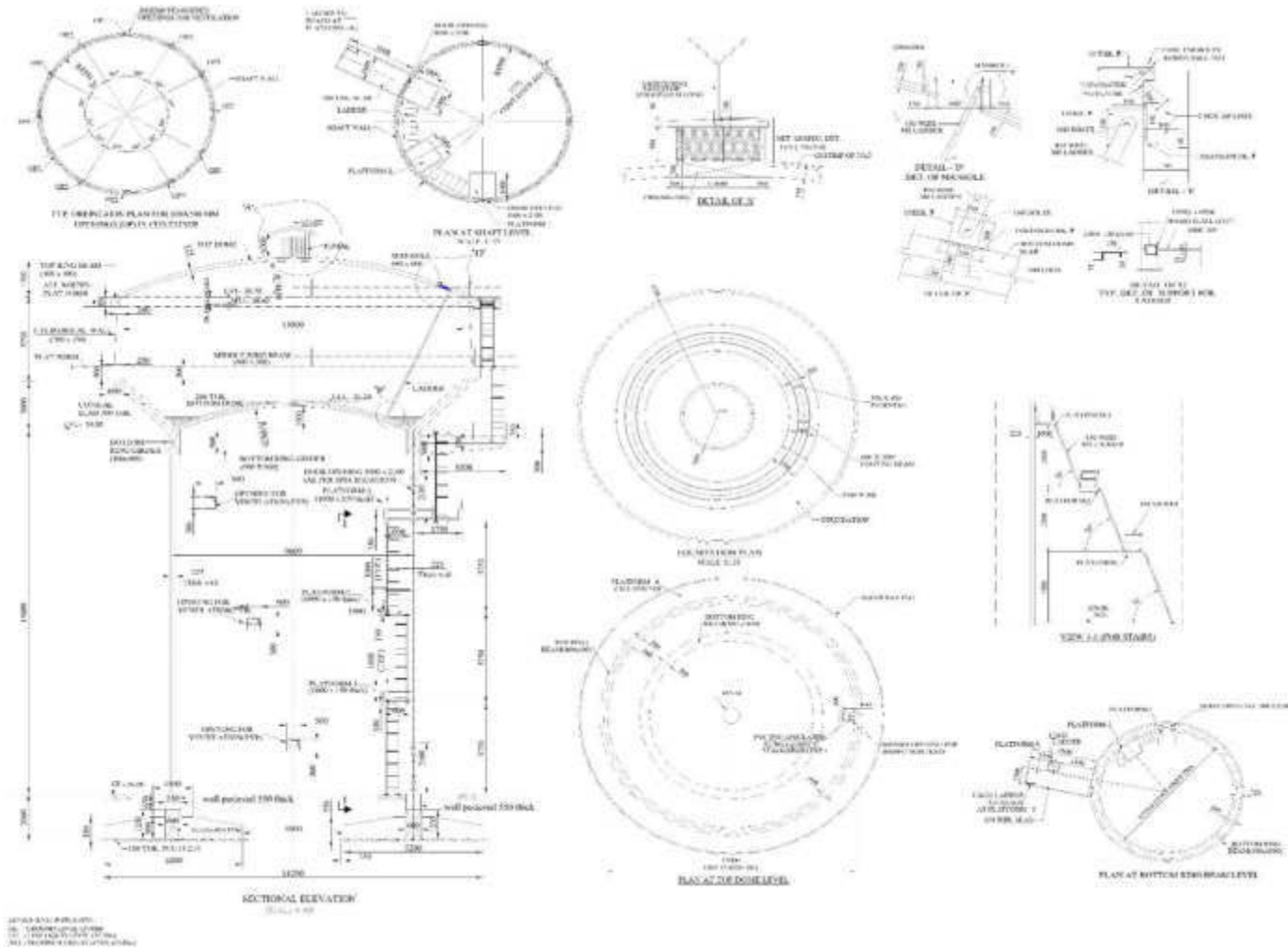


Figure 25: Proposed Layout Plan of OHT at 8A Kakkunje

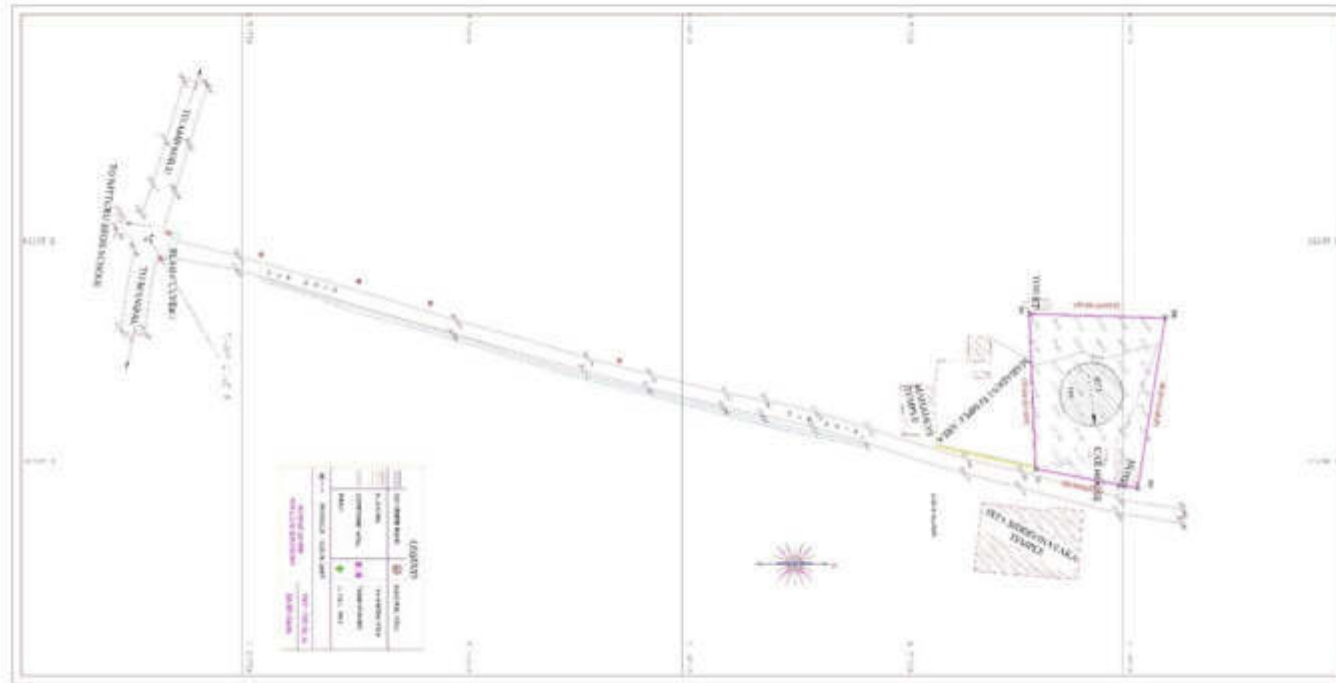


Figure 26: Sectional Plan and Elevation of OHT at 8A Kakkunje

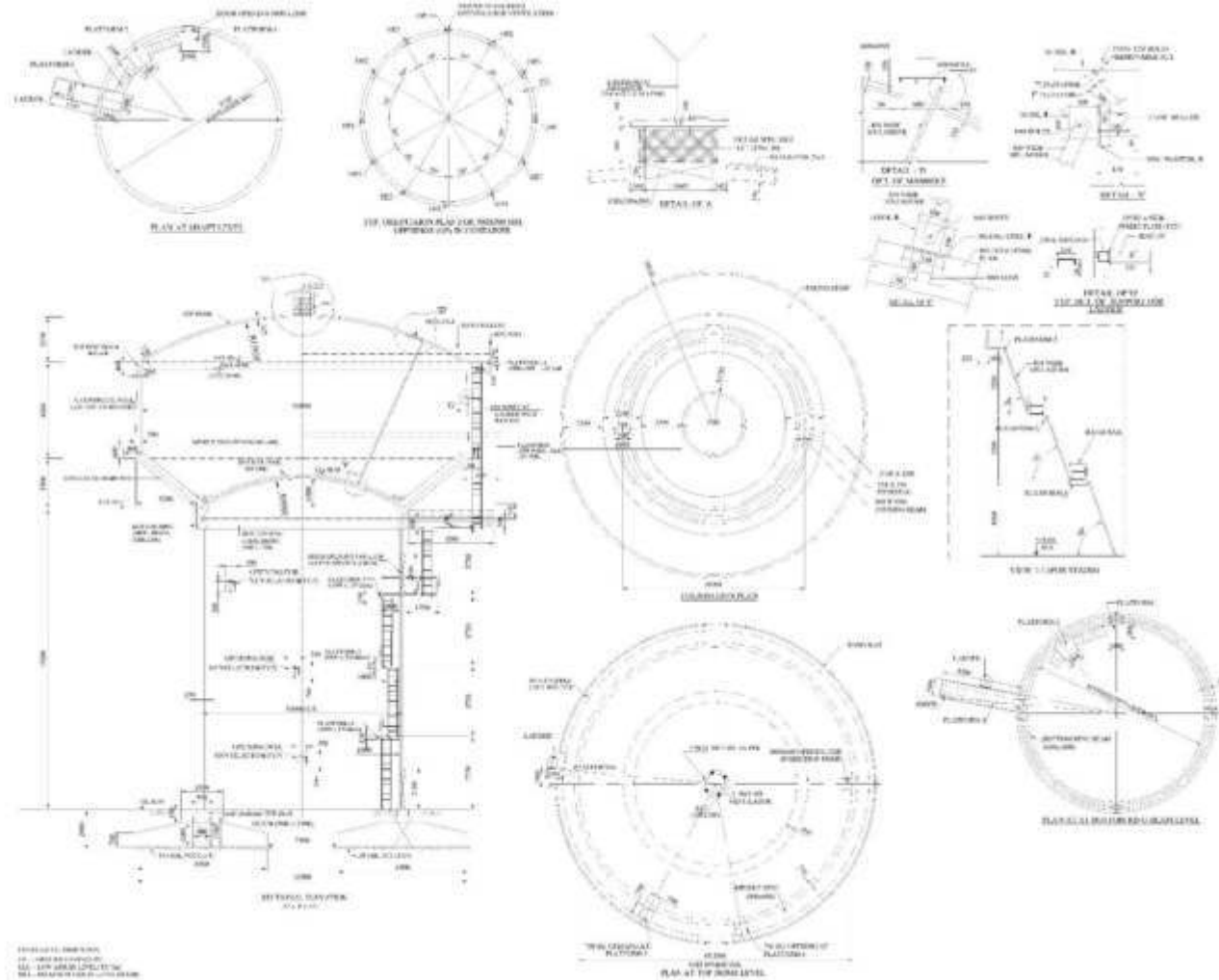


Figure 27: Proposed Layout Plan of OHT at 8B Indrali

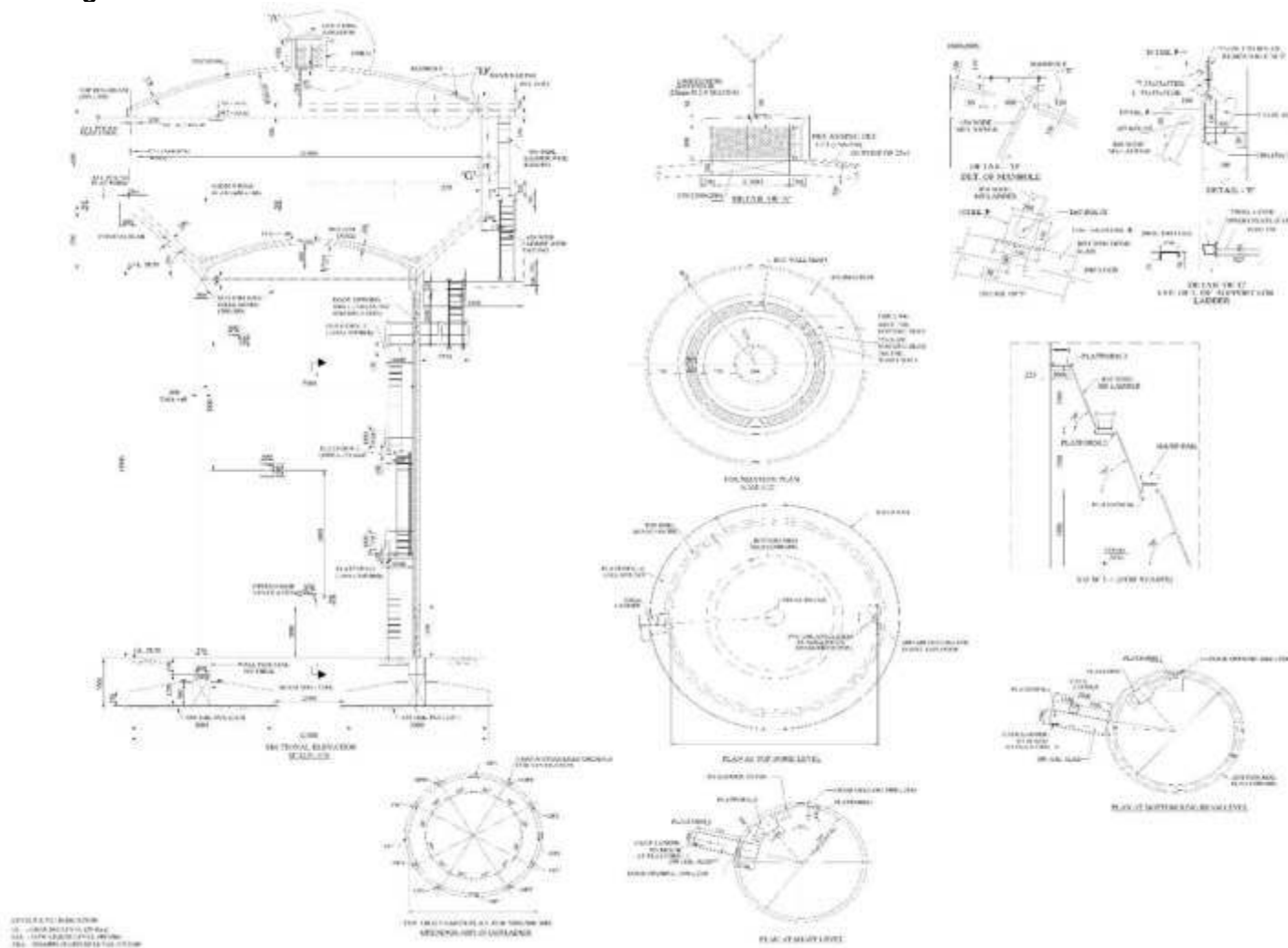


Figure 29: Proposed Layout Plan of OHT at 9A Santhekatte

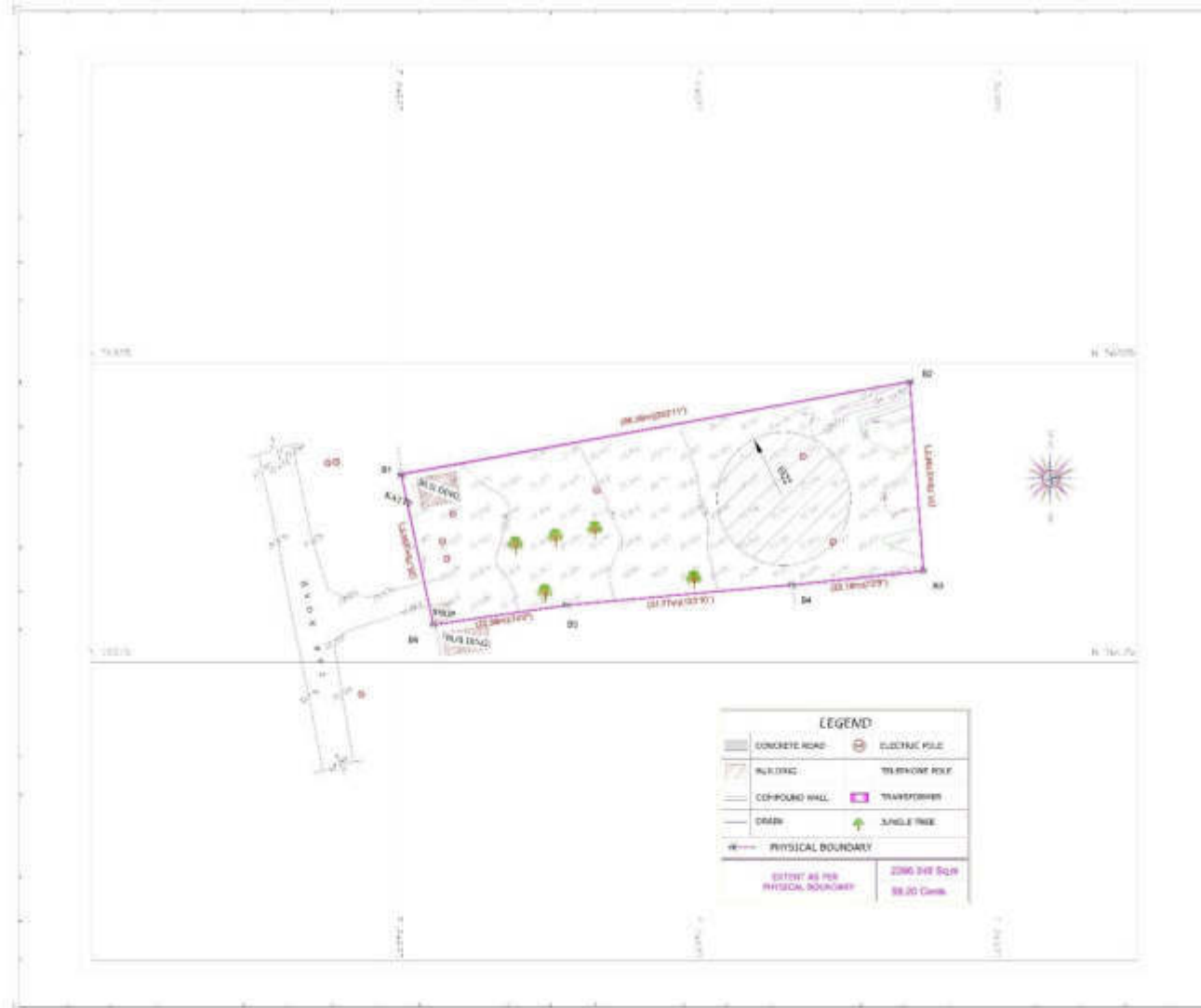


Figure 30: Sectional Plan and Elevation of OHT at 9A Santhekatte

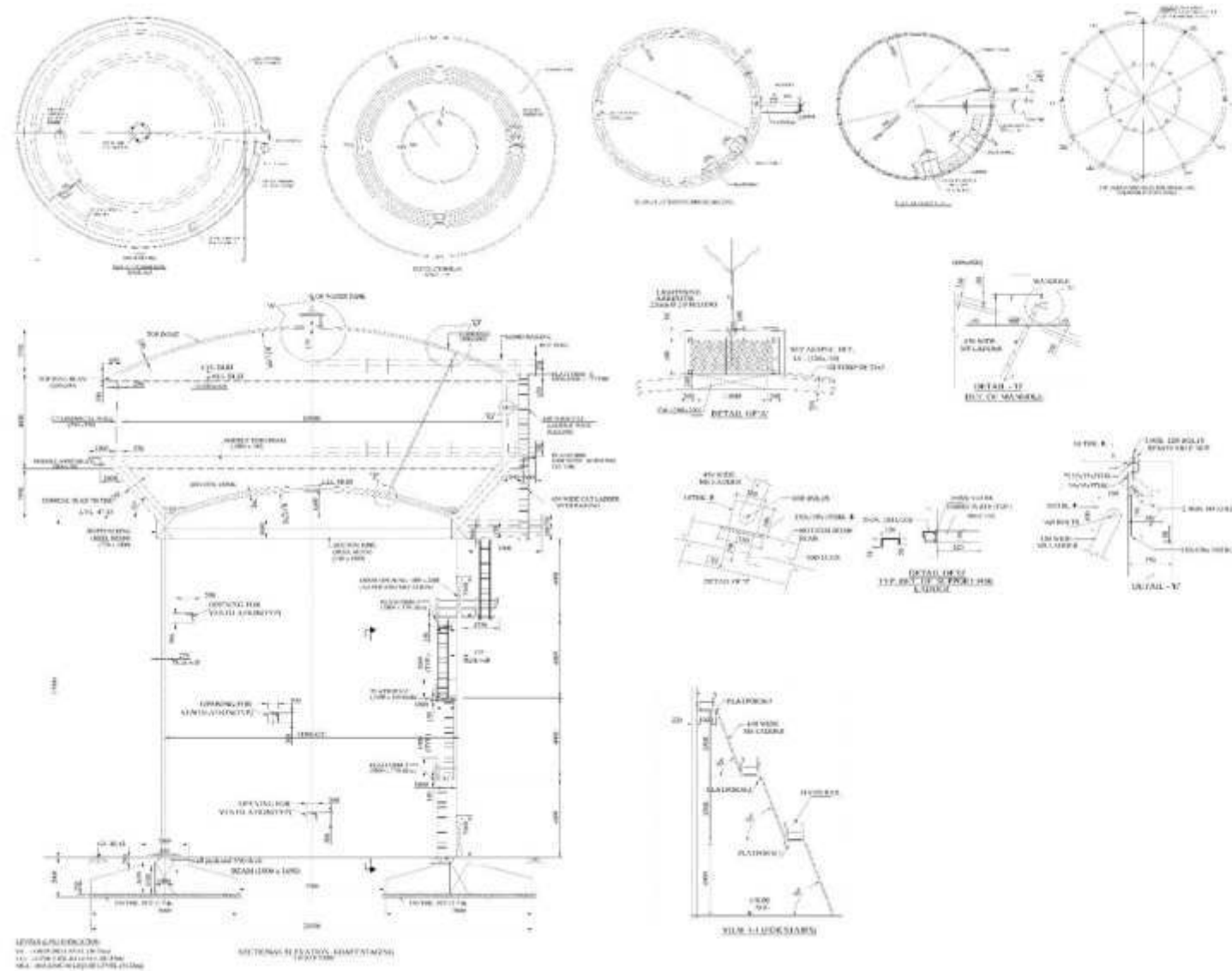


Figure 31: Existing and Proposed Clear Water Mains and Overhead Tanks

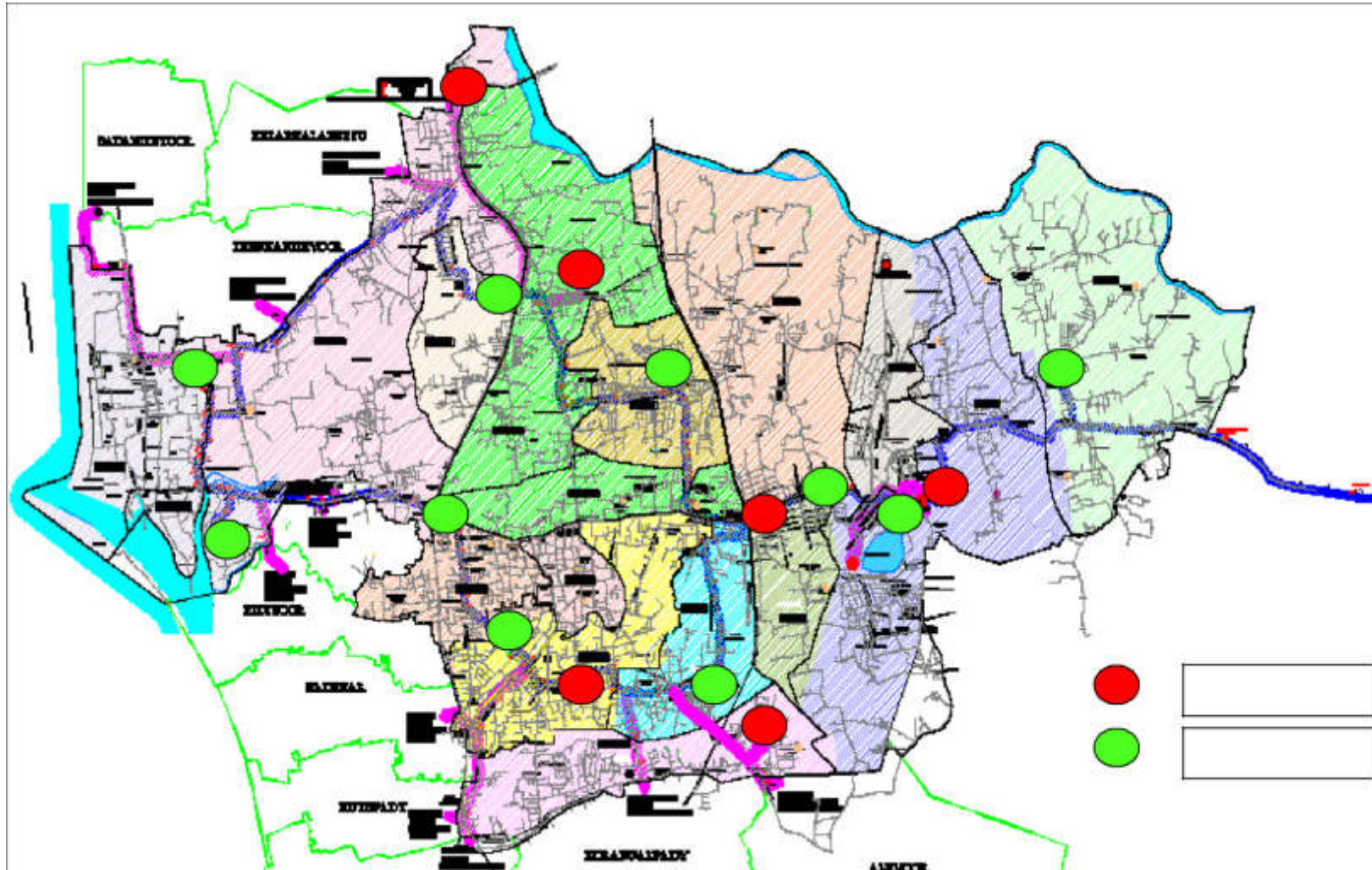
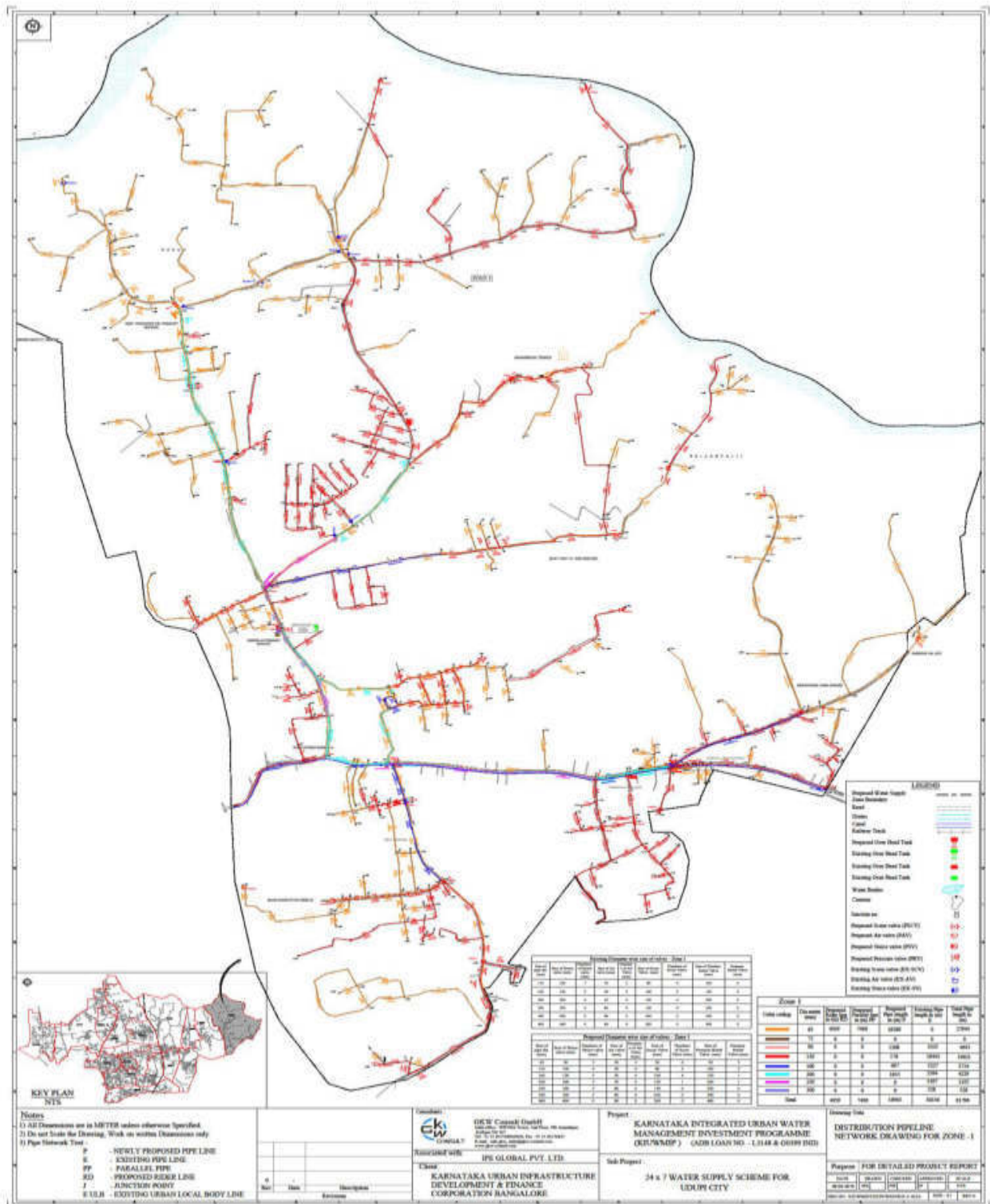
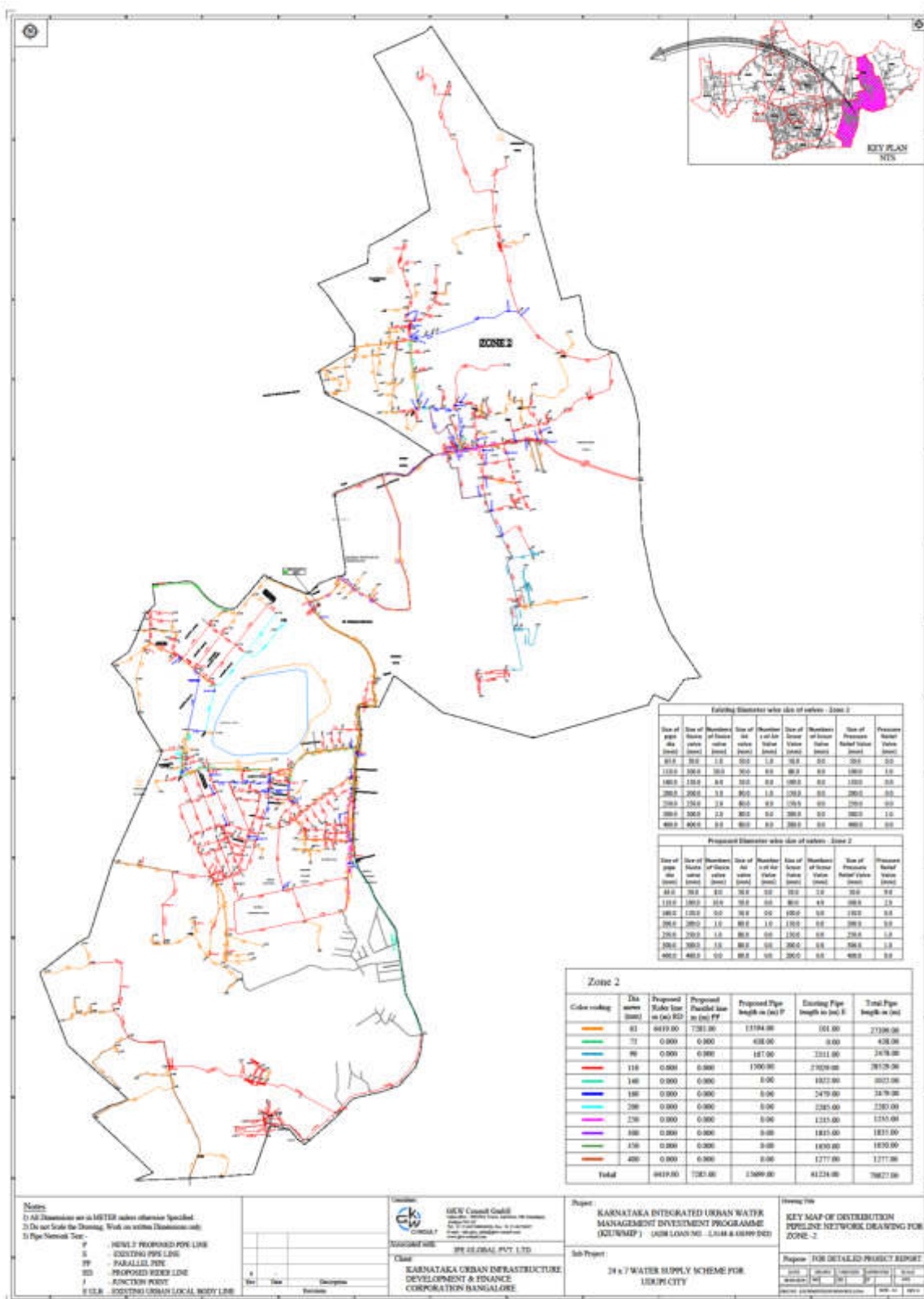
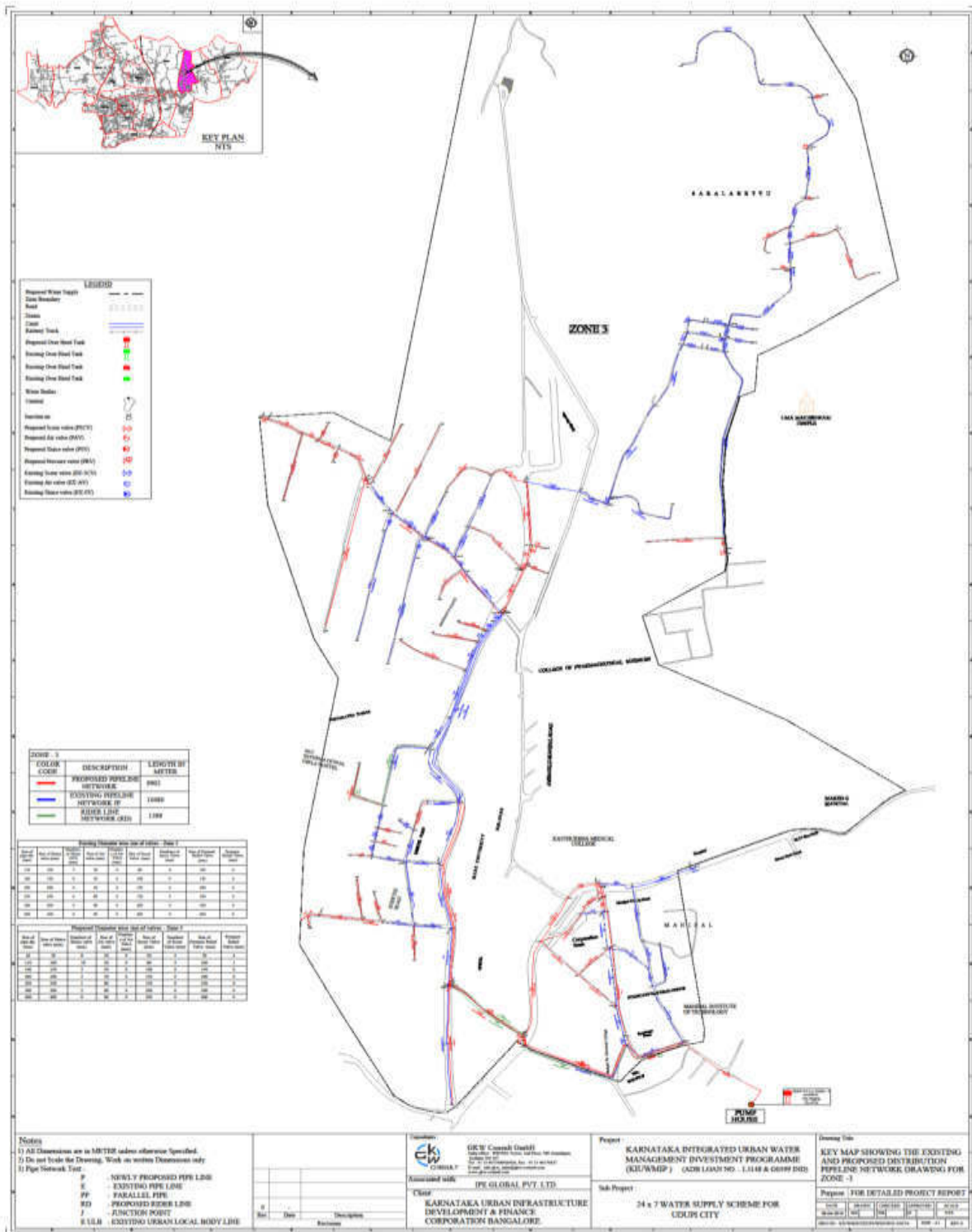


Figure 32: Existing and Proposed Distribution Lines: Zone 1







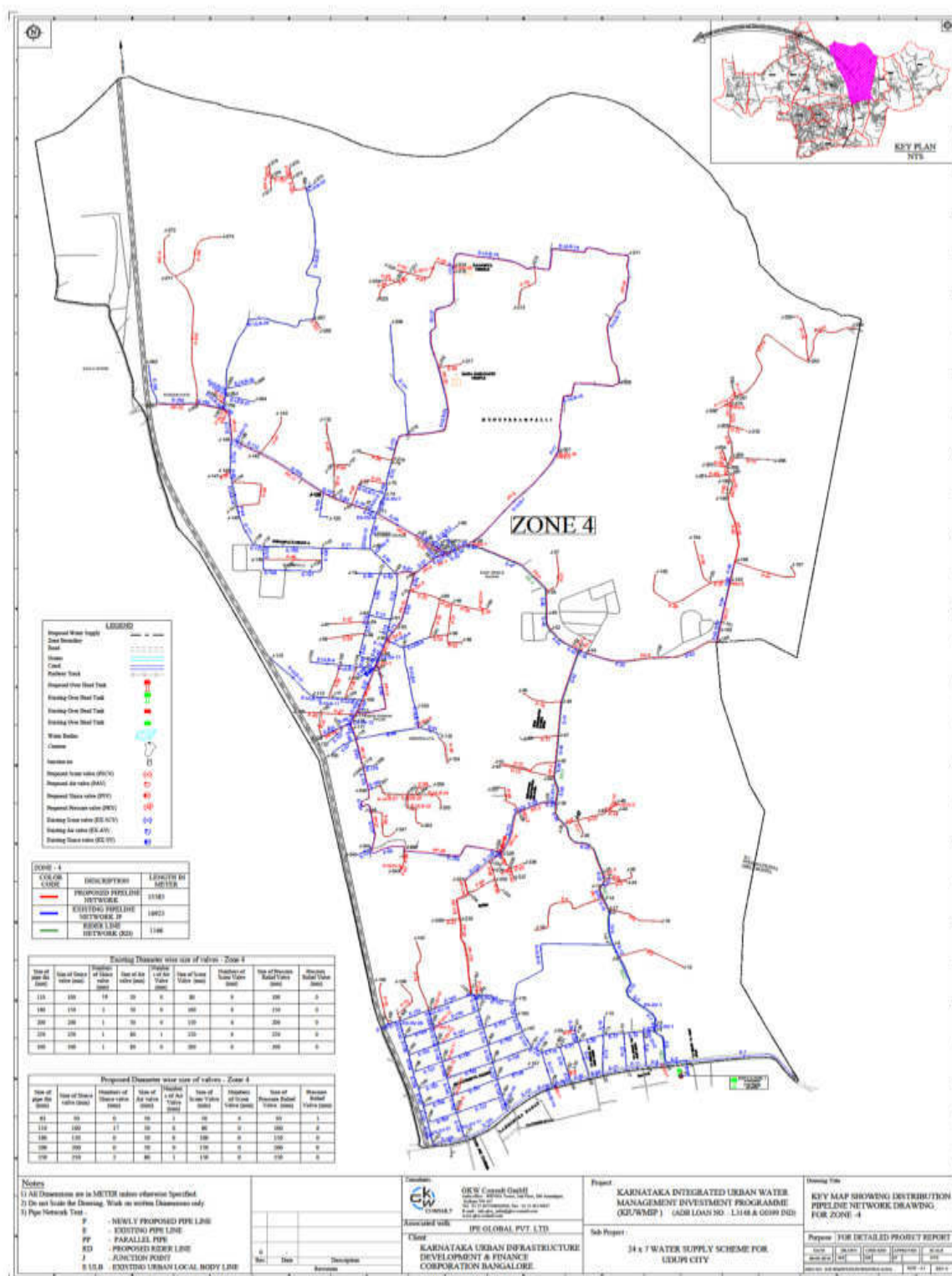


Figure 36: Existing and Proposed Distribution Lines: Zone 5

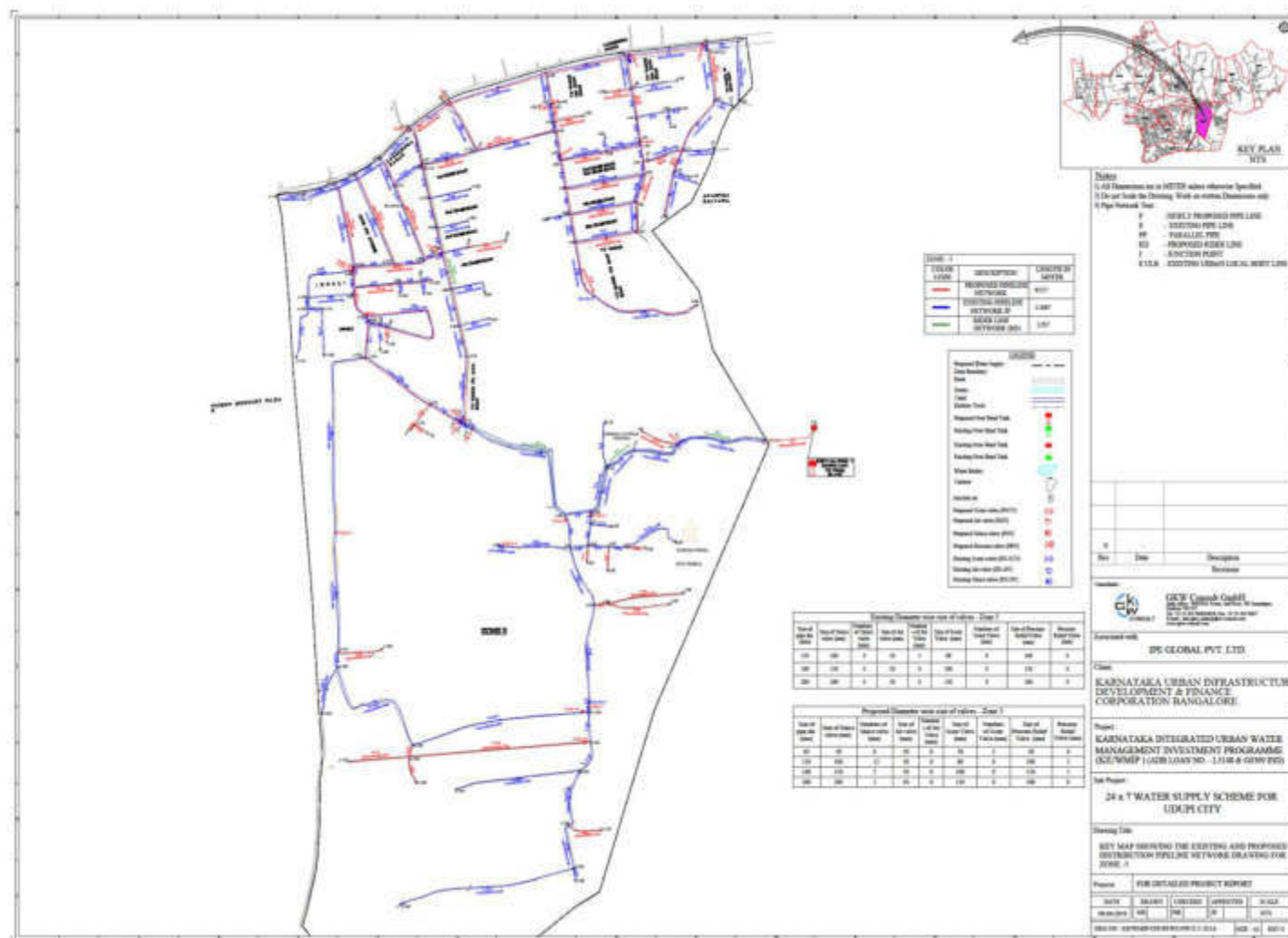


Figure 37: Existing and Proposed Distribution Lines: Zone 6

Figure 38: Existing and Proposed Distribution Lines: Zone 6A

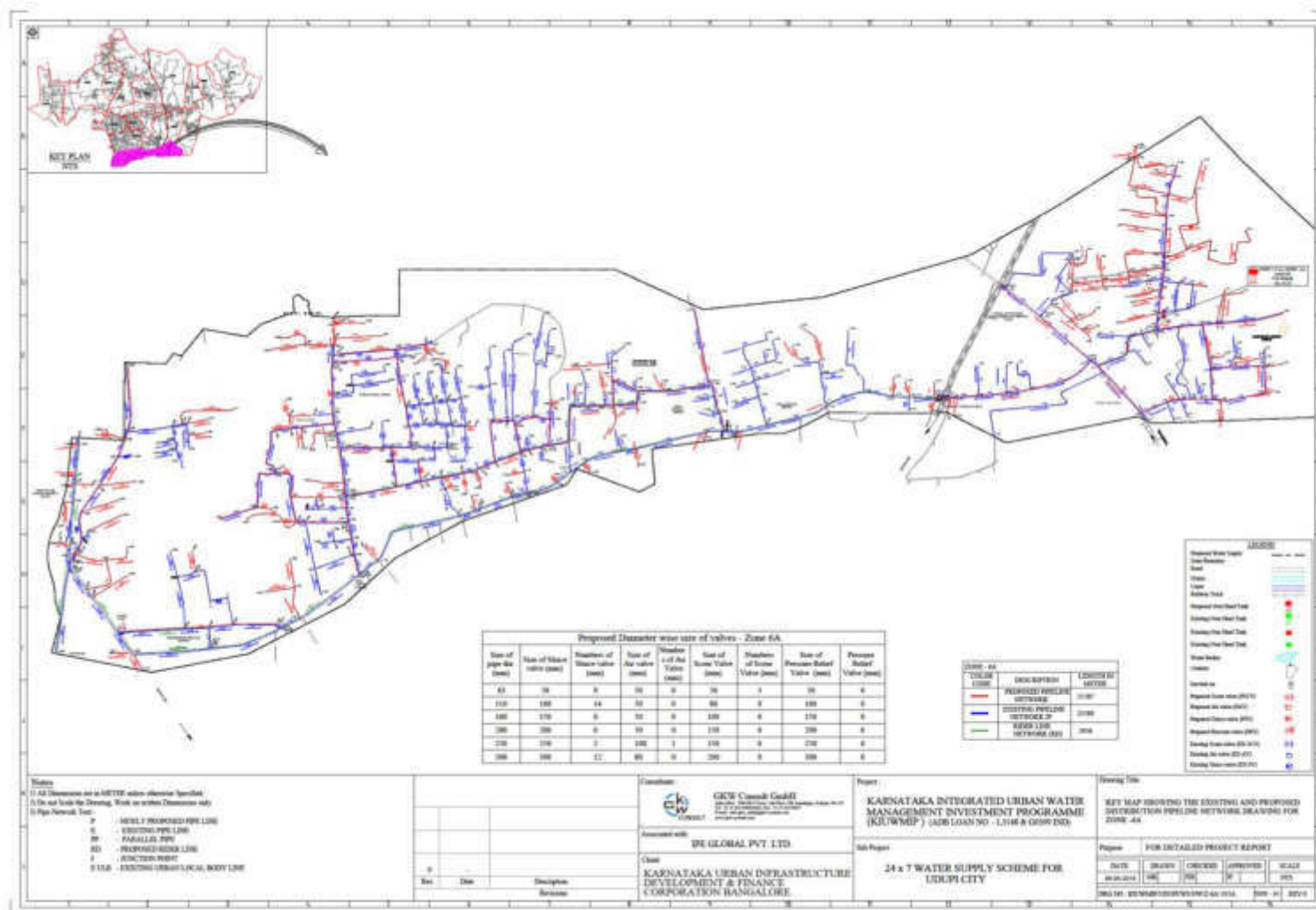


Figure 39: Existing and Proposed Distribution Lines: Zone 7

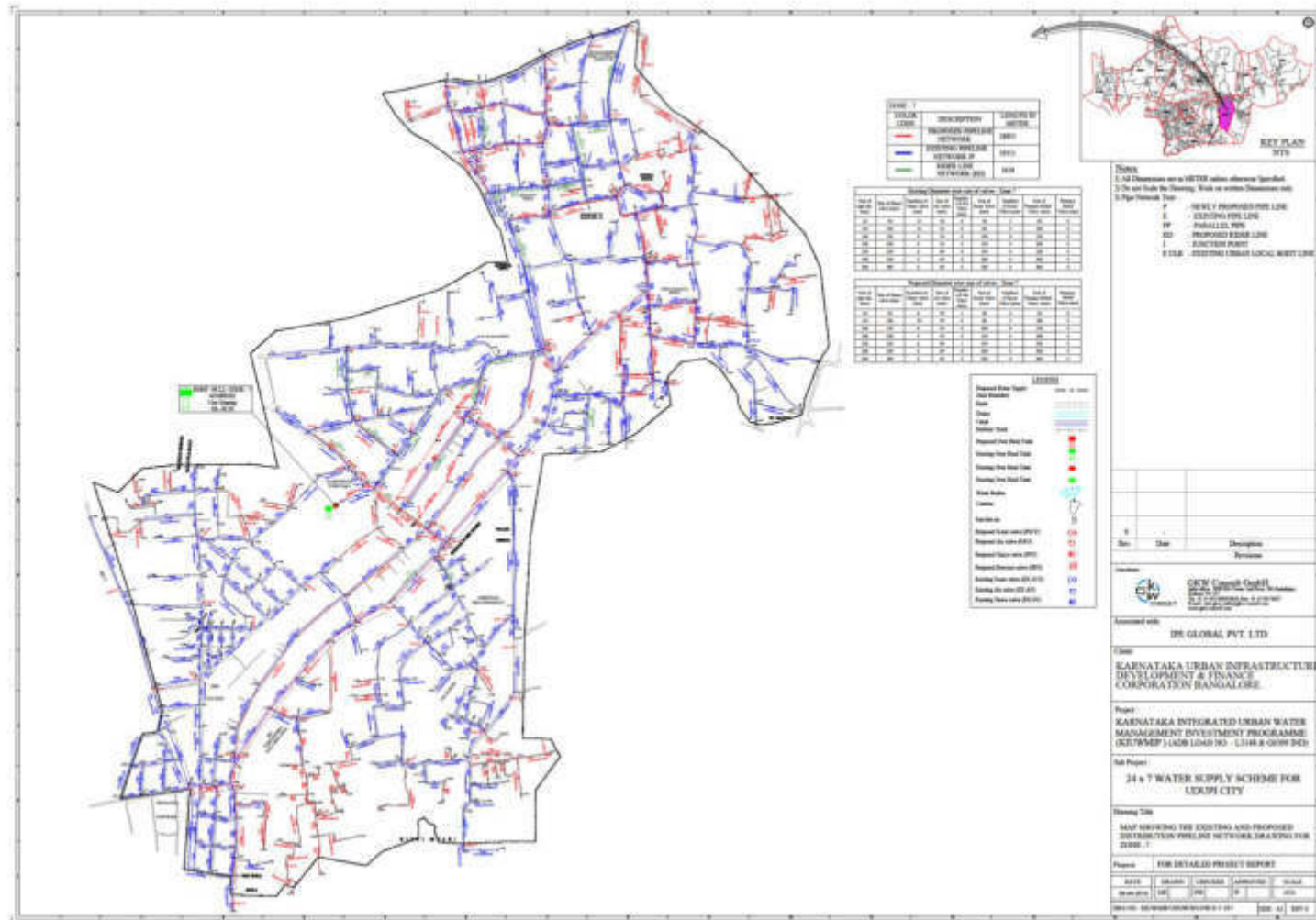


Figure 40: Existing and Proposed Distribution Lines: Zone 7A

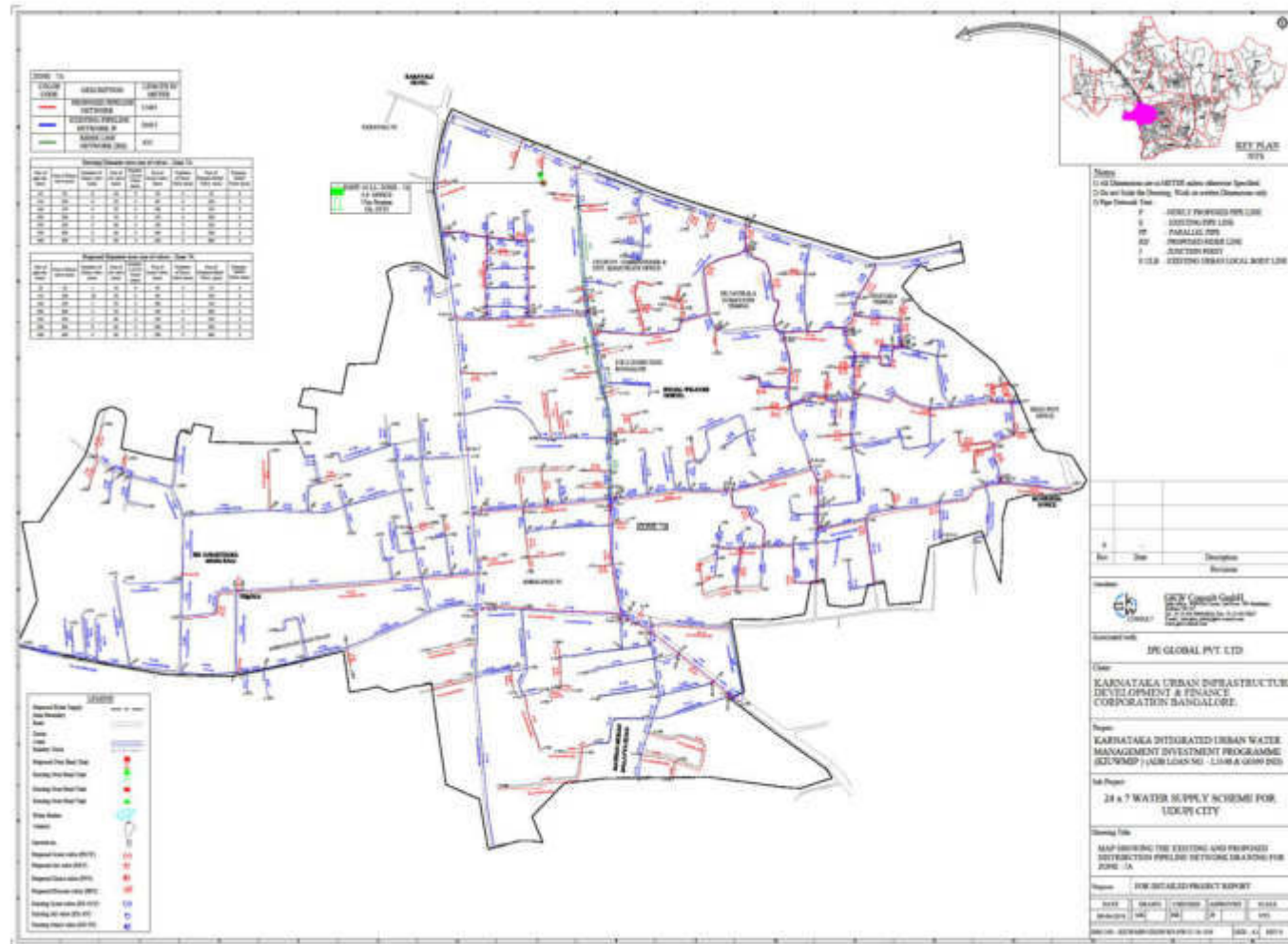


Figure 41: Existing and Proposed Distribution Lines: Zone 7B

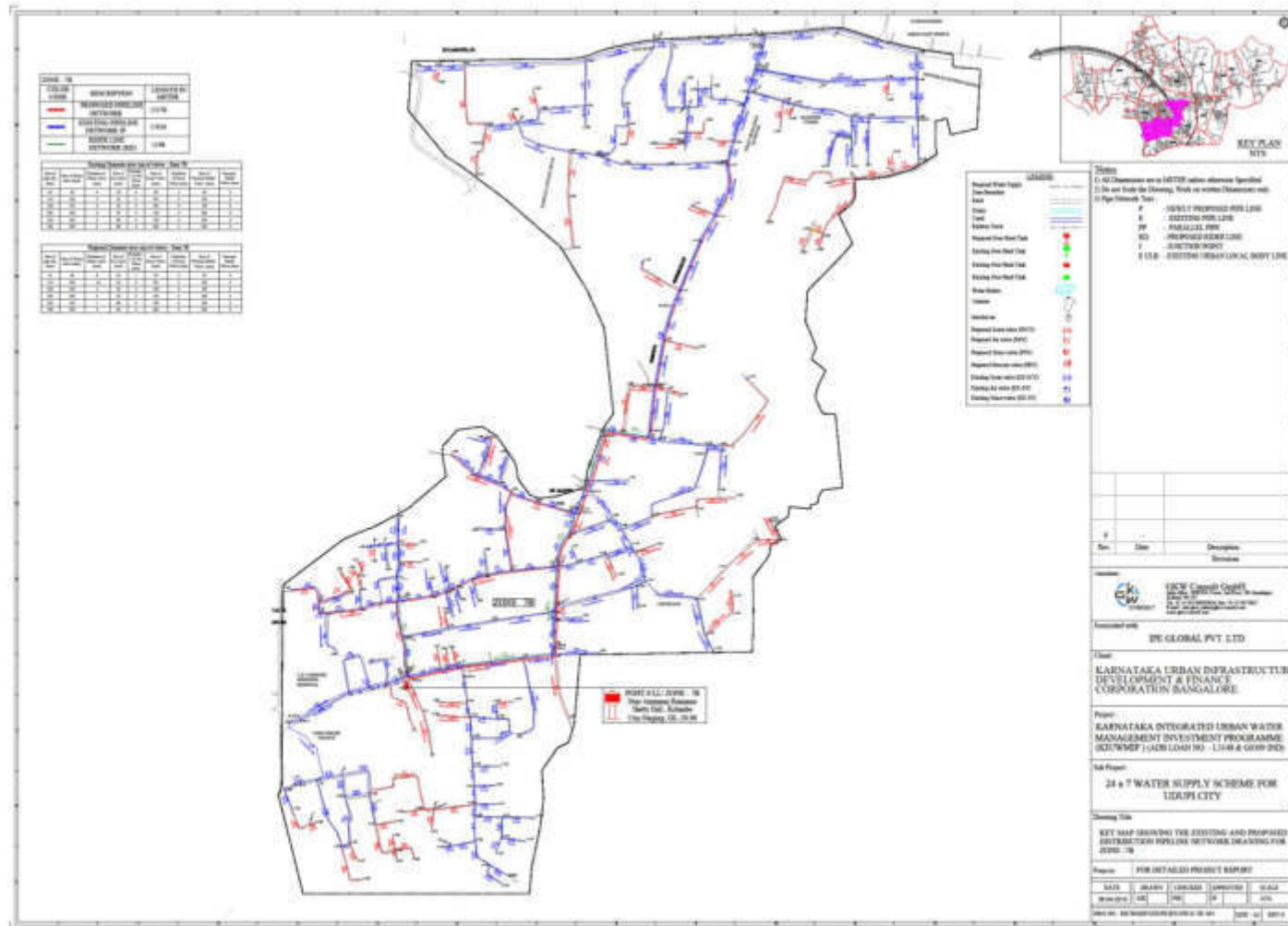


Figure 42: Existing and Proposed Distribution Lines: Zone 8



Figure 43: Existing and Proposed Distribution Lines: Zone 8A

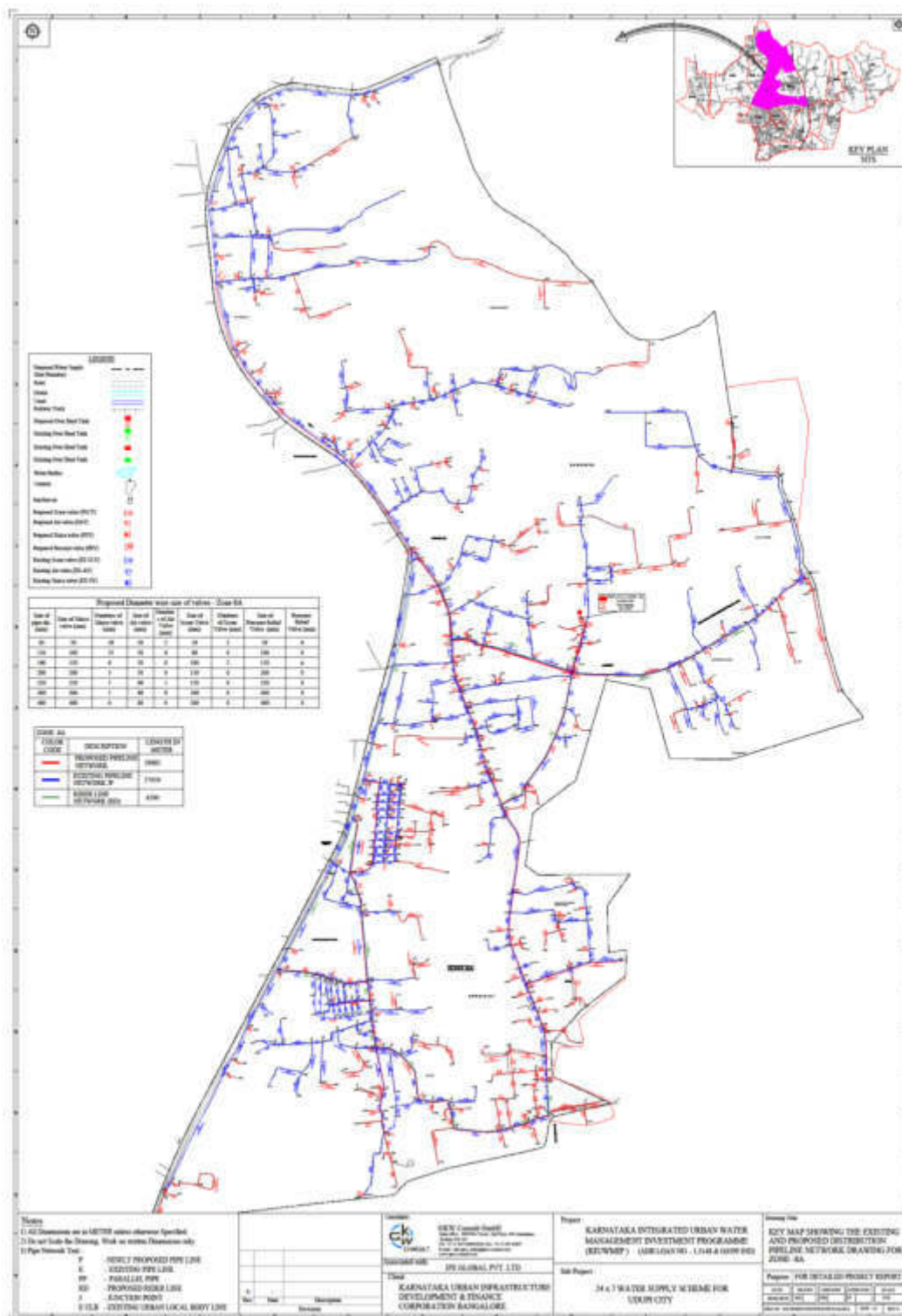


Figure 44: Existing and Proposed Distribution Lines: Zone 8B

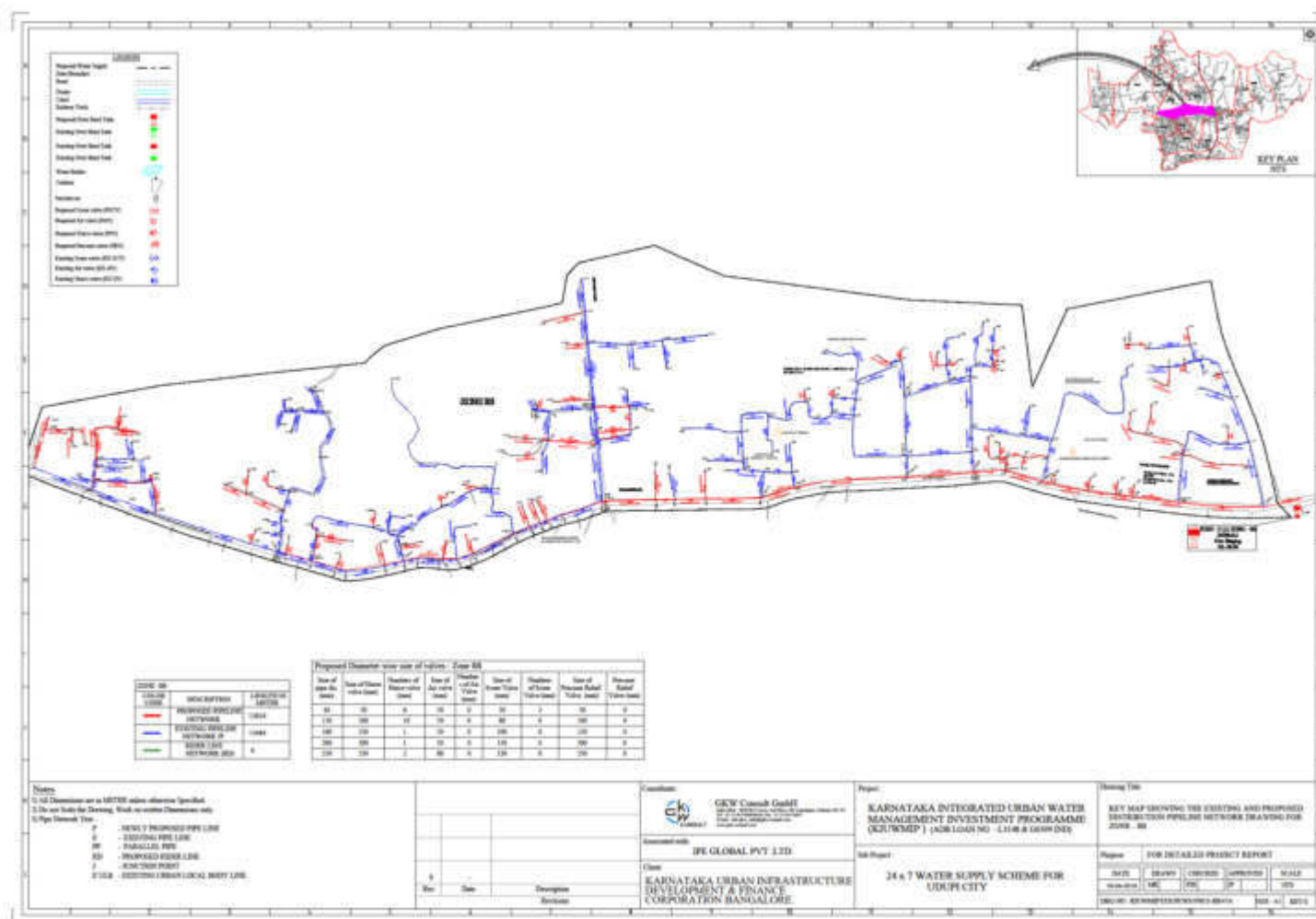


Figure 45: Existing and Proposed Distribution Lines: Zone 9

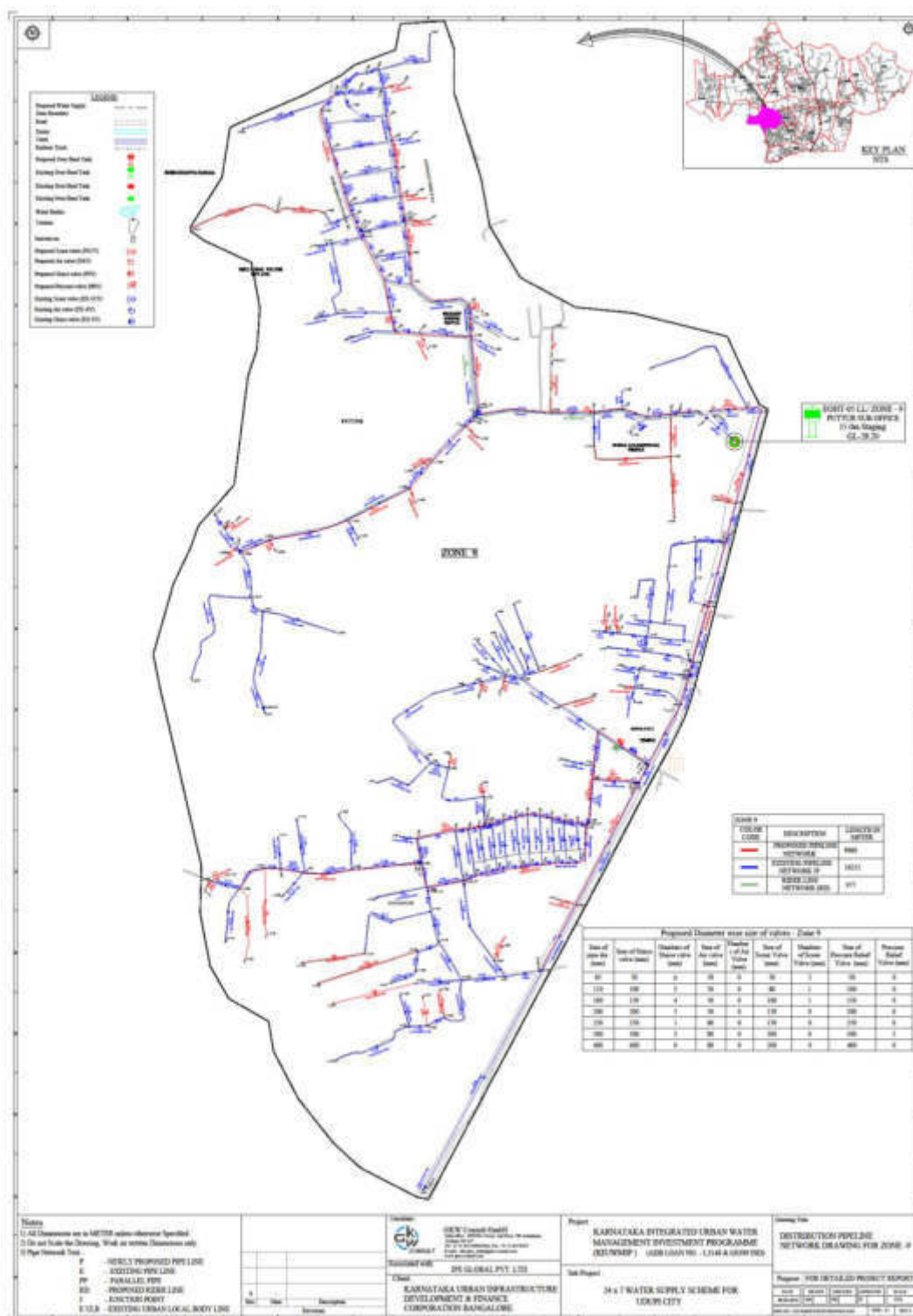
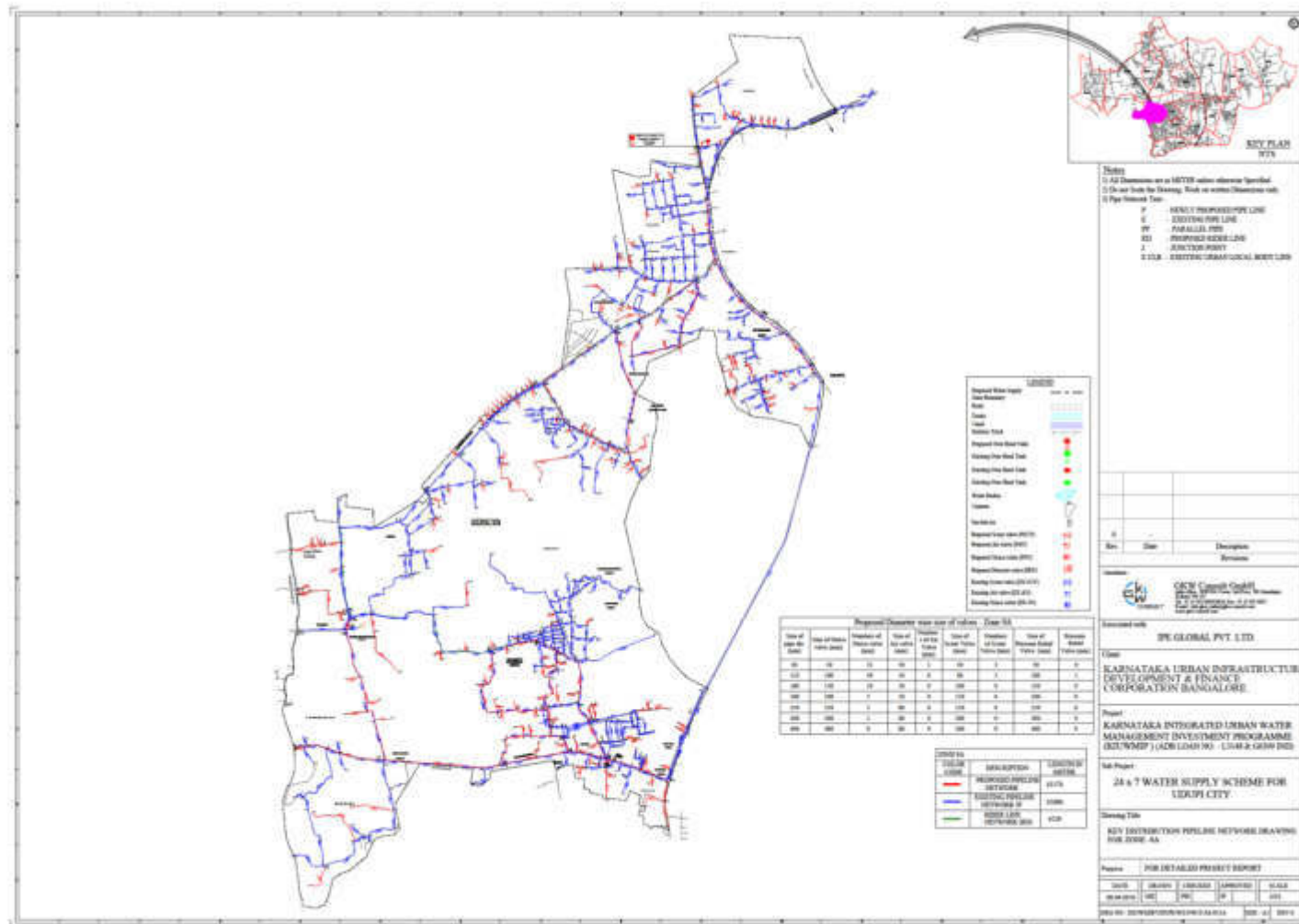


Figure 46: Existing and Proposed Distribution Lines: Zone 9A



B. Implementation Schedule

20. Project implementation schedule is given below. Construction work started in Oct 2019 and will be completed by August 2021.

Completion of Detailed Project Report	October 2017
Tender issue	March 2018
Contract Award	November 2018
Commencement of work	November 2018
Completion of work	August 2021 (33 months)

21. The bulk water component proposed under the government funding is also being implemented parallel to the distribution package under KIUWMIP. Details are given below:

Completion of Detailed Project Report	October 2017
Tender issue	July 2018
Contract Award	October 2018
Commencement of work	November 2018
Completion of work	August 2021 (33 months)

III. POLICY AND LEGAL FRAMEWORK

A. ADB Safeguard Policy Statement, 2009

22. ADB SPS, 2009 requires the consideration of environmental issues in all aspects of the Bank's operations and requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediary loans, and private sector investment operations.

23. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

- (i) **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- (ii) **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- (iii) **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- (iv) **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary

24. The ADB Rapid Environmental Assessment Checklist (General) in <http://www.adb.org/documents/guidelines/environmentalassessment/eaguidelines002.asp> was used to screen the project for environmental impacts and to determine the environment category. The complete checklist is given in Appendix 1.

25. ADB has classed this subproject as Category B and following procedure for multitranchise financing facility (MFF) loans has determined that one IEE will be conducted for each subproject, with a subproject being the water supply infrastructure improvements proposed in a subproject city.

26. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

27. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) For environmental category A projects, a draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and

- (iii) Environmental monitoring reports submitted by the Project Management Unit (PMU) during project implementation upon receipt.

28. During the design, construction, and operation of the project the pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World bank Environmental, Health, and Safety (EHS) Guidelines -General EHS Guidelines: Occupational, Health and safety ([www.ifc.org/ifcext/enviro.nsf/Content/ Environmental guidelines](http://www.ifc.org/ifcext/enviro.nsf/Content/Environmental%20guidelines)) and EHS Guidelines for water and sanitation will be followed (<http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERE>).

29. Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. Preventive and protective measures should be introduced according to the following order of priority:

- (i) Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc.;
- (ii) Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc.;
- (iii) Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.;
- (iv) Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE; and
- (v) Comply with: Child Labour (Prohibition and Regulation) Amendment Act, 2016; Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended from time to time from appropriate authorities; Trade Unions Act, 1926; The Building and Other Construction Workers (Regulation of Employment and conditions of Service Act) 1996 and the Cess Act of 1996; The Factories Act, 1948; and Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act 2013.

29. Following requirements of ADB SPS, PMO and RPMOs shall apply pollution prevention and control technologies and practices consistent with international good practice. When the Government of India regulations differ from these levels and measures, PMO shall achieve whichever is more stringent. Appendix 3, 4 and 5 provide applicable standards. If less stringent levels or measures are appropriate in view of specific subproject circumstances, PMO will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

B. Government Law and Policies

31. **Environmental Assessment.** The Government of India's EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

32. Category A projects requires environmental clearance from the Central Ministry of Environment, Forests and Climate Change (MOEFCC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the Ministry of Environment and Forest (MOEF) prepares

comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEF considers the recommendation of the EAC and provides the environmental clearance, if appropriate.

33. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

34. None of the components of this water supply improvement subproject in Udupi falls under the ambit of the EIA Notification 2006, and therefore Environmental Clearance is thus not required for the subproject.

35. **Environmental Rules, Laws, and Regulations.** Besides EIA Notification 2006, there are various other Acts, Rules, Policies and Regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. These regulations are listed in Appendix 2. Table 3 below presents a summary of environmental regulations and mandatory requirements applicable to the subproject.

Table 3: Applicable Environmental Regulations

Law	Description	Requirement
Environmental Impact Assessment (EIA) Notification, 2006	The EIA Notification of 2006 sets out the requirement for environmental assessment in India. This states that Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. Category A projects requires Environmental Clearance from the Ministry of Environment and Forest (MOEF). Category B projects require Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA).	Subproject is not a listed activity in Schedule I of this notification and hence environmental clearance is not required.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved through administering conditions imposed in consent issued under provision of the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge and the frequency of monitoring of effluents. Any component of the Project having the potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain consent to establish (CTE) under Section 25 of the Act from	None of the components in this subproject requires CTE or CTO under this act.

Law	Description	Requirement
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	<p>Karnataka State Pollution Control Board (KSPCB) before starting implementation and consent to operate (CTO) before commissioning. The Water Act also requires the occupier of such projects to take measures for abating the possible pollution of receiving water bodies.</p> <p>The projects having potential to emit air pollutants into the atmosphere have to obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from KSPCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.</p>	<p>For the project, the following will require CTE and CTO from KSPCB: if, (i) diesel generators; (ii) hot mix plants; and (iii) stone crushers, installed for construction.</p> <p>All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the KSPCB website (www.kspcb.gov.in).</p>
<p>Environment (Protection) Act, 1986 and CPCB Environmental Standards.</p> <p>Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.</p> <p>Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010</p>	<p>Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.</p> <p>Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.</p> <p>The Amendment Act designates areas within 100 m from the “protected property” as “prohibited area” and beyond that up to 200 m as “regulated area” respectively. No “construction” is permitted in the “prohibited area” and any “construction” in the “regulated area” requires prior permission of the Archaeological Survey of India (ASI). “Protected property” includes the site, remains, and monuments protected by ASI or the State Department of Archaeology and “construction” means the construction of any structure or building.</p>	<p>Appendix 3 provides applicable standards for ambient air quality and noise.</p> <p>Appendix 4 provides standards for discharge of effluents Appendix 3 and 4 respectively also provides a comparison of national standards and internationally recognized guidelines with respect to ambient air and noise, and effluent discharge. ADB SPS requires adoption of stringent values for project implementation.</p> <p>Appendix 3 provides applicable noise standards.</p> <p>There are no protected monuments near project area in Udupi. However, in case of chance finds, measures are suggested in Environmental Management Plan (EMP) to take prompt action to ensure its removal or protection in situ.</p>

Law	Description	Requirement
Land Acquisition Act of 1894	Private land acquisition is guided by the provisions and procedures in this Act. The District Collector or any other officer designated will function as the Land Acquisition Officer on behalf of the Government. There is a provision for consent award to reduce the time for processing if the land owners are willing to agree on the price fixed by the Land Acquisition Officer.	For Udupi Water Supply Scheme seven sites are required, and all are government land.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable to Udupi Water Supply Scheme as no mentioned activities are involved in the project
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to Udupi Water Supply Scheme as no wetlands presents in the project area.
Wildlife Protection Act, 1972	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	Not applicable to Udupi Water Supply Scheme as none of the project component will have any impact on wildlife or protected areas.
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prevents the use of forest land for non-forest	Not applicable to Udupi Water Supply Scheme as there is no

Law	Description	Requirement
Indian Drinking Water Standards	uses without the clearance from Ministry of Environment and Forests (MOEF), Government of India Gives details of the permissible and desirable limits of various parameters in drinking water as per the Bureau of Indian Standards	forest area within or adjacent to the project area. Appendix 5 provides drinking water standards http://cgwb.gov.in/documents/wq-standards.pdf
Karnataka Forest Act, 1963 and Karnataka Forest Rules, 1969	This Act makes the basis for declaration of Reserved Forests, constitution of village forest committees, management of reserved forests and penalties and procedures.	Not applicable to Udupi Water Supply Scheme as there is no forest area within or adjacent to the project area.
Karnataka Preservation of Trees Act, 1976 and Karnataka Preservation of Trees Rules, 1977	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Any person desiring to fell a tree shall apply in writing to the tree officer for permission in that behalf. It further defines clauses for planting adequate number of trees, planting in place of fallen/destroyed trees, preservation of trees and adoption of trees.	At one OHT site, there are 10 Trees, which needs to be cut. Compensatory plantation as stipulated in the tree cutting permission shall be adhered
Coastal Regulation Zone Notification - Ministry of Environment and Forests	This notification declared coastal stretches as Coastal Regulation Zone (CRZ) and restricts new construction, and industrial activities in the CRZ (landward side) include the following: (i) land area from High Tide Line (HTL) to 500 m on the landward side on the sea front, (ii) land area between HTL to 100 m or width of creek whichever is less on the landward side along the tidal influenced water bodies connected to sea, and (iii) land area between HTL and LTL. Notification defines CRZ in I, II, III, IV Categories based on the environmental sensitivity and existing development. The “developed area” within existing municipal limits or in other existing legally designated urban areas which are substantially built-up and has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains are defined as CRZ II.	Per the current subproject locations, none of the components are located in the CRZ. If any component falls in CRZ during implementation, permission / No Objection Certificate (NOC) will be obtained from the Karnataka Coastal Zone Management Authority (KCZMA) prior to start of work.

36. Clearance Requirements of Bulk Water Components Proposed under Government Funding. Environmental clearance requirement per Government of India Environmental Impact Assessment Act and its notifications are not applicable to this subproject. No environment-related statutory clearance or permissions required for ADB-funded components. The government-funded bulk water intake will require permission from Irrigation and while the WTP land will be acquired through direct purchase.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Environmental Profile of Udupi

1. Location

37. Udupi is located in Udupi District. Geographically, Udupi is located at a latitude of 13°33' N and longitude of 74°74' E. Udupi has the status of CMC. The City is divided into 35 wards and spreading to an area of 69.28 km². Udupi lies in Seismic Zone-III as per IS 1893-2002.

2. Topography, Soil and Geology

38. The coastal district Udupi of Karnataka state falls along the west coast of peninsular India and is separated from the rest of peninsula by towering high Western Ghats. The district lies between 13°04' and 13°59' North latitude and 74°35' and 75°12' East longitude covering an area of 3,575 km². It is about 88 km in length and about 80 km in widest part and is bounded by Uttara Kannada district in the North, by Shimoga and Chikamagalur district in the East and by Dakshina Kannada district in the South. The district is carved out of South Canara District during 1991. The district comprises administrative subdivisions Coondapur, Udupi and Karkala Taluks.

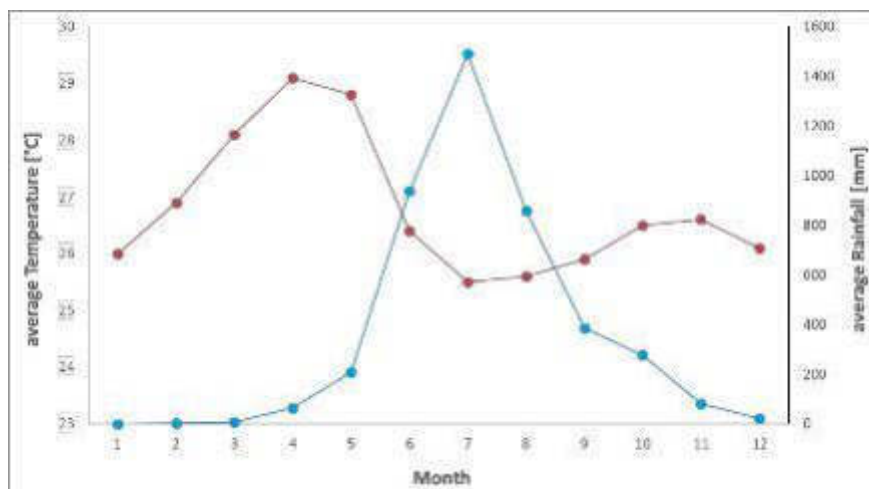
39. This coastal agro climatic west flow river basin is characterized by maritime climate. It covers parts of Mulki, Shirva, Swarna Yennehole, Madisala, Sita, Haladi, Chakravani, Kollur, Baindur and Sankadagudi hole sub basins. These rivers are perennial during normal rainfall years where as tributaries and smaller streams become dry during summer. The prevailing high gradient in the hilly terrain and heavy rainfall brings great volume of water in these rivers during monsoon.

40. There is no any major irrigation scheme in Udupi district. The minor irrigation schemes include both surface water and ground water schemes. The ground water schemes consist of Dug wells, Shallow and Deep tube wells, while surface water schemes include surface flow (tanks, anicuts, pick-ups, barrages) and lift irrigation schemes. Lift irrigation is the major irrigation practice. Water management practices like sprinkler irrigation is taking popularity in Udupi district.

3. Climate

41. The climate in Udupi is hot in summers and pretty comfortable in winter. During summers (from March to May) the temperature reaches up to 40°C and in winters (from December to February) it is usually between 32°C and 20°C. The monsoon period is from June to September with one of the rainfall averaging more than 4000mm every year and heavy winds. The average temperature and rainfall in Udupi is presented in the below Figure 9.

Figure 9: Average Temperature and Rainfall in Udupi



Source: Climate data.org, 2015.

42. The yearly mean temperature is 31.58°C and the total yearly rainfall comes up to 4,096.90 mm (Climate data.org, 2015). The construction schedule has considered the same for effective implementation.

4. Earthquake

43. Udupi lies in Seismic Zone-III as per IS 1893-2002. This zone is classified as Moderate Damage Risk Zone.

5. Physiographic

44. **Karnataka Coastal Region.** The Karnataka Coastal Region, which extends between the Western Ghats edge of the Karnataka Plateau in the east and the Arabian Sea in the west, covers Dakshina Kannada, Udupi and Uttara Kannada districts. This region is traversed by several ridges and spurs of Western Ghats. It has difficult terrain full of rivers, creeks, waterfalls, peaks and ranges of hills. The coastal region consists of two broad physical units, the plains and the Western Ghats. The coastal plains represent a narrow stretch of estuarine and marine plains. The abrupt rise at the eastern flanks forms the Western Ghats. The northern parts of the Ghats are of lower elevation [450 meters (m) to 600 m] as compared to Southern parts (900 m to 1,500 m). The coastal belt with an average width of 50 m to 80 km covers a distance of about 267 km from north to south. At certain places, the crest of adjoining Western Ghats reach the sea as close as 13 km near Karwar. The average height is generally 75 m from the mean sea level (msl). Although Udupi is a coastal town, none of the proposed subproject components are located in the coastal regulation zone.

6. Geomorphology and Soil

45. The district comprises of three distinct physiographic units viz., (i) narrow stretch of coastal tract, (ii) up land area, (iii) the hilly terrain. The coastal areas exhibit coastal beach, spits and creeks and backwater swamps with the surface features of sandy strips and linear troughs. The coastal parallel troughs are seen around Parampalli, Kota and Manur. The area adjoining the coastal stretch exhibits forested high hilly topography with deep valleys. Most part of the district is rugged terrain and demarcates areas with slopes of less than 2%, 2% to 5% and more than 5%. About 50.68% of the district falls under 2% to 5% slope and remaining fall under more than 5% slope. Most part of

Lateritic capped pediplains have an elevation ranging from 40 m to 60 m above msl. which is an important physiographic feature. Upland pediplain area intercepted with low hills between Western Ghats and the coast, which is moderately cultivated. Western ghats and forested area located on the eastern part of the district.

46. **Soil Type.** The district is covered with three types of soils (i) sandy soil covering the beaches and the adjoining stretches, (ii) yellow loamy soil, and (iii) red lateritic soil. The sandy soils are confined to a narrow strip of the coast having width ranging from less than 100 m to as much as a kilometer. These fine to medium texture sands are characterized by their extremely high rate of infiltration and act as a good recharge media for ground water. Yellow loamy soils are transported from origin and are found mostly along riverbanks and lower reaches of valleys. They are mostly used for tile industries. This soil type is very well suited for irrigation and shows good response to irrigation practices. Red lateritic soil is the most dominant soil type in the area. The texture of these soils varies from fine to coarse. The soil in the valleys and immediate slopes are rich in loam where as in upper slopes and pediplains are much coarser in nature. The degree of leaching undergone by this soil type is also variable.

7. Air Quality

47. There is no data on ambient air quality in Udupi, which is not subject to monitoring by the Karnataka State Pollution Control Board (KSPCB). Located close to coast with no major air polluting sources, generally the air quality in the area is good. Traffic is the only significant source of pollutant, so levels of oxides of sulfur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS). No field monitoring (environmental) survey was conducted during preparation of this IEE. However, the EMP includes an environmental monitoring program which will require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the basis to ensure no degradation will happen during subproject implementation.

8. Surface Water

48. There is only River Swarna in and around the city. This river is non-perennial. In summer season for four months there is no inflow in the river. River Varahi, flowing at about 37 km in northeast direction of Udupi, is a perennial river. Water quality monitoring of River Swarna is KSPCB and the water quality is classified as category C "Drinking water source after conventional treatment and disinfection". Table 4 shows the water quality of the river near existing intake location.

Table 4: Water Quality of Swarna River – Samples Taken at the Intake Point
(Date of Sampling: 27 February 2015)

NAME OF THE INDUSTRY :		M/s CMC, Udupi.				
SAMPLE COLLECTED BY :		AEO, Udupi				
DATE OF COLLECTION :		27.02.2015				
DATE OF RECEIPT :		27.02.2015				
SAMPLE NO & PARTICULARS OF SAMPLE COLLECTED:		1. Water Sample Collected at Intake point Hiriyaadka(1091) 2. Water Sample Collected at outlet of Treatment Plant(1092)				
Sl No.	Parameters Analysed	Unit	Standard		Results	
			*DL	**PL	Sample No.1091	Sample No.1092
1	pH	pH unit	6.5 -8.5	6.5 - 8.5	7.1	7.2
2	Hardness as CaCO ₃	mg/L	300	600	14	20
3	Calcium as Ca	mg/L	75	200	4	3
4	Magnesium as Mg	mg/L	30	100	1	3
5	Chloride	mg/L	250	1000	16	16
6	Sulphate	mg/L	200	400	1	1
7	Fluoride as F ⁻	mg/L	1	1.5	0.05	0.04
8	Total Dissolved solids	mg/L	500	2000	96	84
9	Iron as Fe	mg/L	0.3	1	BDL	BDL
10	Nitrate as NO ₃	mg/L	45	45	0.5	0.4

9. Groundwater

44. In general, the quality of ground water at certain depths in the sandy aquifer are found good and potable and in the adjoining areas covered by lateritic/weathered gneissic rocks, it is sweet to alkaline. The dug wells in the alluvial area generally yield saline water during summer months and get fresh water during monsoon periods. The water samples collected from the dug wells /shallower zones during May 2006 indicate the electrical conductivity value as 500 to 10,430 microgram per centimeter (μcm) at 25°C in the higher order and 200 μcm to 500 μcm in the lower order. The electrical conductivity in some of the deeper bore well located at places recorded as high as 18,830 μcm at 25°C is saline. Some parts of Udupi and Kundapura taluks have chloride concentration up to 4,000 milligrams per liter (mg/l). Some groundwater in the area is contaminated from the salinity of tidal recharge. This contamination is more pronounced in wells along the stream courses up to the distance where tidal effect extends. Further, Ground water in proximity to stream course is contaminated with seepage of domestic waste. As a general rule, groundwater withdrawal must be distributed in time and space and there should not be any concentration of wells to avoid saline water ingress.

Table 5: Groundwater Development in Udupi

Particulars	Details (ha m)
Net annual ground water availability	15073
Existing gross ground water draft for Irrigation	17088
Existing gross ground water draft for Domestic and Industrial Water supply	833
Existing gross ground water draft for all uses	19711
Allocation for domestic and industrial use for next 25 years	3712
Net ground water availability for future irrigation development	29590
Balance ground water irrigation potential available (ha)	50389

Source: Central Ground Water Board Report, December 2008.

10. Industry and Agriculture

49. Udupi region main activity is agriculture with paddy, coconut, areca nut (Areca catechu), and cashew are main crops. Rubber plantations and other commercial crops like sugarcane, ground nut are also undertaken in certain parts of the taluk. Udupi imports clay and manufactures Tiles and bricks. There are agro based units for paddy (rice), areca nut and tobacco processing. There is a port at the confluence of Panchagangolli river. Even though National Highway (NH) 17 and Konkan railway pass near this port, development of this port has not taken place. This port is considered mainly for fishing. The Department of Fisheries has proposed to take up new projects like a fish landing centre at Koderi in Udupitaluk, open type fishing harbour at Maravanthe, construction of breakwater at Shirur- Alvegadde, Gangolli, construction of jetty at Udupi Kodi, extension of the wharf at Alvekodi and improvements at Thenginagundi fish landing centres. These projects would be fully-funded from the state government funds.

11. Transportation

50. NH 66 passes through Udupi. Other significant roads include the State Highways to Karkala and Dharmastala and to Sringeri. The NH 66 provides a link to Mangalore and Karwar via Kundapur. Private as well as government buses connect Udupi to parts of Karnataka. Udupi has a railway station on the Konkan Railway. The nearest International Airport to Udupi is Mangalore International Airport, which is 50 km away. City and suburban transport is available for travel within Udupi and suburbs. The buses originate from the suburban bus stand (City Bus Stand). There are different route numbers. The nearest harbor/port to Udupi is Malpe, which is 5 km away, and Gangolli (Byndoor), which is 36 km away. The New Mangalore Port is 50 km away from Udupi. Udupi railway station is managed by the Konkan

Railways. It is about 4 km from Udupi and is on the Kanyakumari-Mumbai rail route. Direct trains are available to Bengaluru, Mumbai, New Delhi, Amritsar, Chandigarh, Pune, Ajmer, Jaipur, Rajkot, Ahmedabad, Okha. Cities like Mysore, Belgaum, Jodhpur, Agra, Thiruvananthapuram, Ernakulam, Kollam (Quilon) etc. also connected with Udupi. Konkan has a beautiful scenic view throughout its way.

B. Socio Cultural Resources

1. Demography

51. As of the 2011 India census, Udupi had a population of 165,401. Males constituted 51% of the population and females 49%. The average literacy rate was 93.89%, higher than the national average of 59.5%; male literacy was 86% and female literacy 81%. Eight percent of the population was under 6 years of age. Udupi, which previously had a City Municipal Council now has a City Municipal Council which came into existence in 1995. Areas around Udupi, such as Manipal, Parkala, Malpe, Udyavara and Santhekatte were merged to form the City Municipal Council. Udupi was carved out as a separate district from the erstwhile Dakshina Kannada district on 25 August 1997. Udupi, Kundapura and Karkala were bifurcated from the Dakshina Kannada District and the Udupi District was formed. Savita S. Kotian and Prakash T. Mendon of the Bharatiya Janata Party (BJP) are the current president and vice-president of the Udupi Zilla Panchayat, after the election held at the Zilla Panchayat on 7 August 2014. Tulu is the most widely spoken language in Udupi. Other languages spoken here include Konkani and Kannada. Muslims in Udupi speak Urdu Nawayathi and Beary Bashe.

52. **Sex Ratio.** In Udupi Municipal Council, Female Sex Ratio is of 1022 against state average of 973. Moreover, child sex ratio in Udupi is around 927, as compared to Karnataka state which has an average of 948.

53. **Literacy.** Literacy rate of Udupi City is 93.55 % higher than state average of 75.36 %. In Udupi, male literacy is around 95.94%, while female literacy rate is 91.22%.

2. History, Culture and Tourism

54. Udupi is notable for the Krishna Temple, Tulu Ashtamathas. is also known as Lord Parashurama Kshetra, and is famous for Kanakana Kindi. Udupi in Tulu, alternatively spelled as Udipi, also known as Odipu, is a city in the Indian state of Karnataka. A center of pilgrimage, Udupi is known as Rajata Peetha and Shivalli (Shivabelle). It is also known as the temple town. Bhuta Kola, Aati kalenja, Karangolu, and Nagaradhane are some cultural traditions of Udupi. The residents celebrate festivals such as Makara Sankranti, Krishna Janmashtami, Navaratri, Deepavali, Eid al-Adha, Eid al-Fitr and Christmas. Folk arts like Yakshagana are also popular. Rathabeedhi Geleyaru and Kalavrinda are local non-profit organizations, founded to encourage creative pursuits, especially those that keep alive the traditions of the region. Its primary focus has been historic dramas.

55. During the biennial Paryaya festival, the temple management is handed over to the next Matha. Each of the Ashtamathas (eight mathas) is headed by a Swami, who will be in charge of the pooja or worship of Lord Krishna, not to mention, the temple, during his 'Paryaya'. The Paryaya ceremony is held on 18 January on even years (like 2012, 2014 and so on), starting early in the morning at around 3 AM. During this festival there are representative tableau which gather near the entrance of the City (called 'Swagata Gopura' meaning the arc of welcome). Festivals like Makara Sankranti (the day the idol's prathisha was done), Ratha Saphthami, Madhwa Navami (the day on which the Acharya Madhwa disappeared while he was teaching his disciples, the exact place of which is still marked and visited by devotees, near the matha), Madhwa Jayanti (the birthday of the great saint Madhwacharya), Vijaya Dashami, Hanuma Jayanthi, Sri Krishna Janmashtami, Navaratri Mahotsava, Naraka Chathurdashi, Deepavali, Geetha Jayanthi, Daasara aradhanas, etc. are celebrated with grandiosity by the Paryaya Mutt every year.

56. Krishna Janmashtami is celebrated every year. During this festival groups of men wear 'Pili Vesha' (in Tulu; Huli vesha in Kannada), which literally means 'tiger costume'. They visit houses and shops around Udupi, to perform a rather unusual dance. There is a lot of enthusiasm among the participants and public. A yet another signature celebration is the Bhajana Saptaha Mahotsava, held in Sri Laxmi Venkatesha Temple, by the Goud Saraswat community. 'Saptaha' means 7 days and throughout these 7 days, Bhajans are sung, day and night by devotees. This event takes place every year during the month of August, starting from Nagara Panchami till the next Dwadashi. Rathothsava (Chariot Festival) is held in almost all occasions around Rathabeedi. A ratha (chariot) carries a 'utsava moorthi' of Lord Krishna. This chariot is pulled by devotees around Rathabeedi. Though, Rathothsava is common in the Hindu form of worshipping, Udupi is known for the multiplicity and beauty of the chariots and festivals. However, there are no protected monuments of History, culture, tourism.

C. Environmental Settings of KIUWMIP Tranche 2 Component Sites

57. There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the OHT sites selected are on government-owned vacant land parcels, and all the pipelines are proposed along the roads, where there is space along the ROW to lay the pipeline. There are few trees of local species in some OHT sites, which needs to be removed for the construction. There are no trees in the proposed pipeline alignment along the roads. Photographs of proposed OHT sites are provided in Tables 6, 7, and 8, respectively which show alignment of distribution and feeder main pipelines.

Table 6: Photographs of Proposed Sites

	
OHT Site at Manipal for Zone-3	OHT Site at Manapalla lake for Zone-5
	
Proposed OHT Site at Manchi for Zone-6B	Proposed OHT Site Near Ammani Ramanna Shetty hall, Kolambe Zone-7C
	
Proposed OHT Site at Kakkunje for Zone-8B	Proposed OHT Site at Indrali for Zone-8C
	
Proposed OHT Site at Santhekatte for Zone-9B	

Table 7: Photographs Showing Distribution Pipeline Alignment along the Roads



110 mm dia HDPE pipe Parkala Market road near Parkala Primary School. Road Width 9.5 m



110 mm dia HDPE pipe Herga temple road. Road Width 5.5 m



110 mm dia HDPE pipe Herga temple 1st cross road. Road Width 4.5 m



110 mm dia HDPE pipe Herga temple 2nd cross road. Road Width 4.5 m



110 mm dia HDPE pipe Golikatte road. Road Width 4.0 m



110 mm dia HDPE pipe Kattingere road. Road width 4.0 m



<p>110 mm dia HDPE pipe. Opp. Government High School Herga. Road width 3.5 m</p>	<p>110 mm dia pipe. Sheshadri road. Road width 3.5 m</p>
 <p>110 mm dia HDPE pipe. Kodange- Tulaja Bhavani Devi Katte road. Road width 3.5 m</p>	 <p>110 mm dia HDPE pipe. Sarlebetu Bhajana Mandir road. Road width 3.5 m</p>
 <p>110 mm dia HDPE pipe. Sarlebetu Manipal End Point road. Road width 3.5 m</p>	 <p>150 mm dia HDPE pipe. Manipal Alevoor road near Twin GLSR. Road width 9.5 m</p>
 <p>150 mm and 110 mm dia HDPE pipe. Mannampalla lake road. Road width 4.5 m</p>	 <p>200 mm and dia HDPE pipe. Manipal main road Near Syndicate Bank circle. Road width 16 m (Double road)</p>



110 mm HDPE pipe. Vidyarathna Nagara near sathkar Paradise Manipal . Road width 4.0 m



110 mm HDPE pipe. Vidyarathna Nagara cross road. Road width 3.5 m



110 mm HDPE pipe. Sagrinagabrahmasthan road. Road width 3.0 m



110 mm HDPE pipe. Sagrinole 2nd cross road. Road width 3.5 m



160 mm dia HDPE pipe.KK Hospital Road Doddannagudde. Road width 4.25



350 mm HDPE pipe. Gundibail Manipal Road. Road width 4.5 mm



110 mm HDPE pipe. V. M Nagar Road. Road width 4.5 m



300 mm HDPE pipe. Near Indrali bridge in Udupi- Manipal Road. Road width 7.5 m



300 mm HDPE pipe. Kalsanka junction in Udupi-Manipal road. Road width 18 m (Double road)



300 mm HDPE pipe. Maruti Vithika Road Udupi. Road width 9.0 m



300 mm HDPE pipe. Poornaprajna Road Udupi. Road width 4.0 m



300 mm HDPE pipe. Lambard Memorial Road Udupi. Road width 5.25 m



300 mm HDPE pipe. Kolambe Road Udupi. Road width 5.5 m



300 mm HDPE pipe. Chitpadi- Beedinagudde Road Udupi. Road width 4.0 m



300 mm HDPE pipe. Kolambe Road Udupi. Road width 3.0 m



300 mm HDPE pipe. Bhujanga Rao Road Udupi. Road width 3.5 m



300 mm HDPE pipe. Sharada Kalyan Mantap Road Udupi. Road width 5.5 m



300 mm HDPE pipe. Circute House Road near S. P office Udupi. Road width 5.75 m



350 mm HDPE pipe. Vishveshwarayya road Udupi.
Road width 4.25 m



350 mm HDPE pipe. NH 66 Service road Udupi.
Road width 4.5 m



350 mm HDPE pipe. Convent road Udupi. Road
width 8.0 m



110 mm HDPE pipe. NH 66 road near Hyndui
show room Udupi. Road width 12.0 m



350 mm dia HDPE pipe. Kalyanpura road Udupi.
Road width 7.25 m



350 mm and 110 mm dia HDPE pipe.
Santhekatte NH 66 Service road Udupi. Road
width 5.0 m



350 mm dia HDPE pipe. Malpe road. Road width 5.75 m



350 mm dia HDPE pipe. Infront of Canara Equipments Malpe road. Road width 5.0 m



350 mm and 110 mm dia HDPE pipe. Kodavuru road. Road width 5.5 m



350 mm dia HDPE pipe. Mudubettu road. Road width 4.5 m



200 mm dia HDPE pipe. Malpe- Udupi road. Road width 7.25 m



110 mm dia HDPE pipe. Diana- Kukkikatte road. Road width 6.5 m



300 mm dia HDPE pipe. Manchi Mulasthan road.
Road width 3.0 m

300 mm dia HDPE pipe. Vyvahar Garden road.
Road width 5.0 m

Table 8: Photographs of Clear Water Feeder Main Pipeline Alignment



150 mm dia DI- K9 pipe for Zone- 5 OHT. HUDCO colony road. Road width 6.25 m



150 mm dia DI- K9 pipe for Zone-5 OHT. HUDCO colony road. Road width 6.25 m



273.1 mm dia MS pipe Diana- Kukkikatte road. Road width 6.5 m



273.1 mm dia MS pipe. Kukkikatte- Manchi Mulasthan road. Road width 6.25 m



323.9 mm dia MS pipe. Kakkunje Road. Road width 4.75 m



323.9 mm dia MS pipe. Kakkunje High School cross road. Road width 4.75 m



355.6 mm dia MS pipe. Puttur Sri Durgaparameshwari temple road Udupi. Road width 5.75 m



355.6 mm dia MS pipe. NH 66 Service road Santhekatte Udupi. Road width 5.75 m

V. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Introduction

58. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact further.

59. As a general practice, an IEE should evaluate impacts due to the pre-construction (location, design), construction and operation phases of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed Udupi Water Supply Subproject to be funded under KIUWMIP Tranche 2.

- (i) **Location Impacts.** There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the OHT sites selected are on government-owned vacant land parcels, and all the pipelines are proposed along the roads, where there is space along the ROW to lay the pipeline. There are no trees in the alignment.
- (ii) **Design Impact.** Includes impacts arising from technology used and method for pipelaying works and construction of OHTs.
- (iii) **Construction Impacts.** Includes impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
- (iv) **O&M Impacts.** Include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams and occupational health and safety issues.

B. Pre-Construction Impact

60. **Location.** These Impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site. In case of water supply lines, no significant impacts are anticipated since the laying of water line will be along the already built up area. All the sites for OHT are proposed in government land and there is no need to procure any private land.

61. Proposed subproject sites are carefully selected to avoid encroachment into sensitive areas and minimize the impacts on people livelihoods and homestead. In the case of this project (i) most of the individual elements are relatively small and involve straight forward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the urban areas, will not cause direct impact on biodiversity values.

62. **Tree Cutting at Project Sites.** All sites are carefully selected, and layouts designed to minimize the tree cutting. Some of the subproject sites (OHTs) have trees, which need to be cut for project construction. Pipelines are proposed along the roads, at some places there are trees,

however, no tree cutting is envisaged for laying pipelines. Following measures need to be implemented to minimize and/or compensate for the loss of tree cover:

- (i) Further minimize removal of trees, if possible, by adopting to site condition and with appropriate layout design (OHT sites) and alignments (for pipelines);
- (ii) For any tree cutting that may be required, obtain prior permission from Forest Department; and
- (iii) Plant and maintain 10 trees for each tree that is removed.

63. The Udupi CMC should obtain all necessary clearances before the starting of the work. Pipelines crosses national highways, railways, at various locations as given below, which require permission from respective agencies.

- (i) At Indrali Railway over Bridge Chainage in between 690/8 and 690/9 , 300 mm dia distribution line HDPE pipe passing for 30 m length.
- (ii) At Kukkikatte Railway over bridge chainage in between 693/2 and 693/3, 273.1 mm dia MS clear water transmission main passing for 35 m span.
- (iii) At Korangrapadi Alevoor railway over bridge chainage in between 693/7 and 693/8, 110 mm dia rider line passing for 37 m span.
- (iv) In NH-66, 110 mm dia for 4,365 m, 150mm dia en-route village to Udyavara for 120 m, to Kadekar village for 220 m, 350 mm dia DI pipe for 435 m, 355.6 mm dia MS pipe for 2,145 m.
- (v) In NH-169A, 110 mm dia rider line for 855 m, 160 mm dia HDPE pipe for 677 m, 200 mm dia for 805 m, 250 mm dia for 250 m, 300 mm dia for 2,136 m, 150 mm dia DI pumping main for 230 m.
- (vi) SH-37, 110 mm dia 410 m, 273.1 mm dia gravity transmission main for 1,156 m and 150 mm dia for 368 m.

64. **Utilities.** During the installation stage of water lines, traffic and human activities like telephone lines, electric poles and wires, water lines within the proposed subproject locations may require to be shifted in few cases which will be temporarily interfered due to the operation of construction machineries. To mitigate the impacts due to relocation of the utilities, PIU will:

- (i) Identify and include locations and operators of these utilities in the detailed design documents during design validation phase and preconstruction phase to prevent unnecessary disruption of services during construction phase;
- (ii) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; and
- (iii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided.

65. **Site Selection of Construction Work Camps, Stockpile Areas, Storage Areas, and Disposal Areas.** If the work camp is planning to set up, priority is to locate these near the subproject locations. However, if it is deemed necessary to locate elsewhere, sites to be considered will not result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near the forest, water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings. Construction work camps shall be located at least 200 m from residential areas. Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff

into drains. The subproject is likely to generate soil from excavations, which needs to be disposed safely. The following measures should be considered for disposal of surplus/waste soil:

- (i) The excavated soil should be removed from construction area at the earliest for beneficial reuse such as land raising / filling of excavated areas.
- (ii) Soil should be covered with tarpaulin sheets during the transportation.
- (iii) Soil transportation should not be done during the peak hours and should be avoid narrow and heavy traffic routes and important religious or tourist sites.

66. **Site Selection of Sources of Materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be sites already permitted by Mines and Geology Department. If other sites are necessary, these would to be located away from population centres, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities.

67. For Udupi subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Karkala for stone aggregate. These are existing quarries and are licensed by Mines and Geology Department. The material from the existing quarries will be adequate for the subproject construction, and therefore no new quarry sites will be developed for the purpose.

C. Design Impact

68. These impacts arise from the design of the investment program, including technology used and method for pipe laying works and construction of OHTs.

69. **Design of the Proposed Components.** The Central Public Health and Environmental Engineering Organization (CPHEEO) manual suggests a design period of 30 years in general while designing the system for water supply components. Since, the packages are proposed to be implemented sequentially; theoretically, each of the system components should have a different design year. However, in order to maintain unanimity in the design period and design population, 2046 has been considered as the design year for all the system components. Accordingly, 2016 is the base year and 2031 the intermediate year to cross check the designs pertaining to intermediate demand. The rate of supply has been taken as 135 lpcd for 100% population.

70. **Distribution System Design.** Owing to topography, and residual pressure requirements at consumers ends, a pumping in the system cannot be avoided. Treated water will be pumped to OHTs and from there water will flow under gravity system to consumers. No design specific impacts envisaged.

71. The proposed distribution system will partially depend on the proposed bulk water supply project proposed under the government-funded project. If the project is unable to deliver water, the envisaged benefits of distribution system will not be realized fully. Due diligence of components of bulk water project discussed below.

D. Due Diligence of Government-Funded Components

72. As discussed in the previous chapters, a bulk water supply project with government funding (AMRUT) is also proposed in parallel with the distribution system improvement subproject under KIUWMIP Tranche 2 to comprehensively improve the water supply system in Udupi. The AMRUT-funded bulk water supply project will create a new source to provide adequate quantity of water throughout year.

73. As KIUWMIP Tranche 2-funded distribution network system will partially depend on this bulk water supply project. The main components proposed in the government-funded bulk water project include construction of jackwell cum pump house in Varahi River, raw water pumping mains, construction of WTP and clear water main. Statutory clearance requirements, source sustainability, and environmental performance of existing WTP are presented below:

1. Statutory Clearance Requirements

74. Environmental clearance requirement per Government of India's EIA Notification, 2006, is applicable to none of the project components proposed under the government-funded bulk water project. In Karnataka, WTPs do not require permit/consent from Karnataka State Pollution Control Board (KSPCB) either to establish or operate under the current legislations. Water abstraction and construction of jackwell require permission of Irrigation Department, and the proposed WTP site, which is located adjacent to existing WTP, is a private land, and is directly purchased. These permissions need to be obtained prior to start of construction. No other environmental related clearance or permissions required.

2. Source Sustainability

75. At present, River Swarna is the main source of water supply of Udupi, and under the government-funded bulk water supply project, it is proposed develop an additional source (River Varahi) because the flow in River Swarna is very low during summer season (available only for duration of 101 days from February to May). The proposed new source, together with the existing, will ensure adequate water supply for Udupi throughout the year. The Varahi Hydal Power Project (VHPP) and an irrigation weir is located on the upstream site of proposed intake. VHPP discharges 1,100 cusec of water into river course throughout year, of which 800 cusec is for irrigation use and remaining 300 cusec is available for drinking and river flow purposes. It is proposed utilize this available source mainly for the summer season to augment the water coming from River Swarna. At present, Kundapura is the only major town in the downstream of the proposed Udupi intake. Kundapura is also utilizing River Varahi with a total demand of 7.6 MLD or 3.9 cusec. With Udupi's design demand of 48 MLD or 20 cusec, the combined demand of the two towns is 23.9 cusec or 7.97% of the available flow. Thus 92% of remaining flow or 74 cusec will be available for downstream users. Therefore, there are no significant impacts related to source sustainability or downstream impacts.

76. **River Water Quality.** There are no major pollution sources like industries in the upstream side of the intake. Most of the villages and towns, however, along the river discharge domestic wastewater into the river without any treatment, although there is no such disposal point in the proximity of intake. A grab sample was collected from the intake and tested for quality. The raw water will be treated in the proposed WTP to drinking water standards and supplied to the consumers.

3. Environmental Audit of Water Treatment Plants (WTP)

77. At present, a 27 MLD WTP is under operation in Udupi. This was constructed in 2006 under the ADB funded KUDCEM Project. Existing WTP is operated and maintained by Udupi CMC. Besides, under the bulk water project, an additional 45 MLD WTP will be constructed around 6 km to the existing intake. There is another old WTP, which is also located in the same campus, is old and non-functional. Environmental audit of existing WTP is conducted (Environmental Audit report is presented in Appendix 11) during IEE preparation to assess the current environmental performance and identify issues of concern.

78. The audit identified some concerns which need to be addressed. At present, no backwash and sludge collection, treatment or disposal systems available at the existing WTP. Backwash along with sludge accumulated at different WTP units is disposed into open drains, which will join the natural water bodies. Under the bulk water project, a 45 MLD capacity WTP is proposed to be constructed. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton, and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. At present chlorination system is also not proper and lacks any proper safety measures. Therefore, it is important that the proper management and disposal of backwash and sludge generated from the existing and proposed WTPs, and safety in handling and application of chlorine is ensured. An action plan is suggested in the following Table 9 to ensure the compliance:

Table 9: Corrective Action Plan for Environmental Compliance of Water Treatment Plants

Concern	Action Required	Timeline	Responsible Agency and Funding Source
Poor backwash wastewater and sludge management – discharged untreated into natural drains	- Provision of backwash recirculation system – to avoid discharge and also to recover raw water -Provision of sludge collection, thickening, drying and reuse/disposal system	Corrective actions such as treatment of backwash water and sludge management system are included in the bulk water project	Udupi CMC / Government of Karnataka. This component is already included in the bulk water project. It is proposed to develop combined backwash recirculation and sludge management facilities for both the existing and new WTPs under the bulk water project.
Poor handling of chlorination system and lack of safety measures	Improvements to chlorination already included in the subproject.	Same as above	Udupi CMC / Government of Karnataka. This component is already included in the bulk water project. It is proposed to develop proper chlorination system, with all safety measures for both the existing and new WTPs under the bulk water project.

79. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. Subproject area is not a known area of archaeological potential, and therefore the risk is low. Nevertheless, construction contractor needs to follow these measures in conducting any excavation work:

- (i) Create awareness among the workers and supervisors about the chance finds during excavation work;
- (ii) Stop work immediately if any finds are suspected to allow further investigation; and

- (iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ.

E. Construction Impact

80. **Construction Method for Pipelaying Works.** The civil works for pipeline network projects include earthwork excavation trenches, pipe laying, installing valves, flow meters and data loggers, shifting of public utilities (if required) and providing house connections. Earthwork excavation will be undertaken by machine and include danger lighting and using sight rails and boning rods at every 100 m, while pipe laying works will include laying pipes at required gradient, fixing collars, elbows, tees, bends and other fittings including conveying the material to work spot and testing for water tightness.

81. The excavation is done in such a way that there will be a minimum depth of one meter. Sufficient care will be taken while laying, so that existing utilities and cables are not damaged, and pipes are not thrown into the trenches or dragged, but carefully laid in the trenches. Once they are laid, pipes will be joined as per specification and then tested for any cracks or leakages. The minimum working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features.

82. **Construction Method for Overhead Tanks.** Excavation will be done as per the execution drawing for excavation by adopting standard procedures by using excavators. Excavation will be carried out in methodical manner by providing proper approach roads with adequate slopes for machinery movement. Wherever the excavation is not possible by machines – manual excavation by workmen will be carried out.

83. Consolidation will be carried out by knowing the exact geo-technical characteristics of the site. Compaction and consolidation of earth will be carried out up to the desired level of consolidation by adopting standard procedures. The necessary compaction test will be conducted. Before carrying out any concreting works necessary approval of client/consultant in the pour card will be obtained. Bill of materials and Bar bending schedules as per the approved drawings will be prepared and kept ready.

84. The shuttering plates of proper sizes with proper finish or new plywood (waterproof) of adequate thickness will be used along with scaffolding pipes and clamps

85. At the time of placing concrete at every stage required test cubes will be taken and it will be kept under proper curing. These cubes will be tested in the site laboratory in the presence of client/consultant on 7/14/28 days sampling and testing shall be as per respective specification under the supervision of client/consultant. After completing concrete work required curing arrangements are kept ready. Curing will be carried out as per the IS. The de-shuttering of formwork of concrete surface will be as per IS 456 without any deviations.

86. After the completion of the super structure the required finishes viz. plastering, water proof plastering and other amenity works as per the specifications. Finally, the entire reservoir will be white washed besides application of necessary approved color shade.

87. Following Table 10 shows the details of construction activities involved in the subproject.

Table 10: Construction Activities for the Subproject

Component	Construction method	Likely waste generated
Water supply line	Trench excavation along the identified main roads of about 1 m plus pipe dia, but in some case, it may go deeper. A bed of sand/murum of 100 mm thick will be prepared at the bottom and pipes will be placed and joined. Excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface. Construction activity will be conducted along the roads and will cover most part of the city. The work will be conducted by a team of 5 workers at each site	154,763 m ³ of soil will be excavated; 90-95% will be utilized for refill; remaining soil (15,476 m ³) need to be disposed off This excess soil shall be used for filling if required or stored/ dumped in approved debris disposal site.
Water reservoirs	Excavation, compaction and consolidation of earth, bar bending, concreting, staging and finishing work, etc.	1,468.2 m ³ of soil will be excavated; 90% will be utilized for refill; remaining soil (1,46.82 m ³) need to be disposed off

m³ = cubic meter, dia = diameter, m = meter, mm = millimeter.

88. Although construction of the pipelines involve quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Udupi, where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration.

89. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; and (ii) any excavation done near sensitive area like school, religious places and house will be protected as per standard construction practices. These are discussed in detail in the following sections.

90. While trenching at densely populated areas like market place or layouts, roads with heavy traffics additional care has to be taken. Hard barricade should be mandatorily provided along with caution board and traffic diversion boards. Some of the densely populated area identified at Udupi are Manipal, Shivalli, Malpe, Parkala, Thenkapete, Siribeedu, Bailoor, Santhekatte, Kalyanpura, Kakkunje, Ambalpaday, Brahamagiri, Karavali Junction. Some narrow roads are Manchi Mulastana Road, Kakkunje school road, Kolambe Road, Bhujanga Rao road, Kodange- Tulaja Bhavani road, Saralebettu Bhajana Mandir road, Saralebettu manipal End point road, Vidyarathna Nagara cross road., Poornaprajna Road Udupi. Roadand/or located in busy commercial area. Therefore, full closure will be required in those stretches. Prior to starting of work, contractor should prepare Construction Management Plan. The Construction Management Plan should be site specific and has to submit every month before starting the work. The Construction Management Plan will include the method statement for construction works, Utility Management and Contingency Plan, Traffic Management Plan, Work camp and Labour Camp details, Safety measures taken for the workers and the public, etc.

91. The method statement for pipeline works should be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns. Method Statement is very important, particularly for pipe line works along the roads. Method Statement

can be prepared for each stretch (say 1 km) /specific site based on the project area. Method statement should be in a table format with appended site layout map and covers the following:

- (i) Work description;
- (ii) No. of workers (skilled and unskilled);
- (iii) Details of plant, equipment and machinery, vehicles;
- (iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing);
- (v) PPE (helmet, gloves, boots, etc.) details for each type of work;
- (vi) Details of materials at each site (type and quantity);
- (vii) Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure, etc.);
- (viii) Construction waste/debris generated (details and quantity);
- (ix) Detail the sequence of work process (step-by-step) including specific details of each work;
- (x) Contractor's supervision and management arrangements for the work;
- (xi) Emergency: Designate (a) responsible person on site, and (b) first aider;
- (xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading, etc.; and
- (xiii) The pipelines are to be laid along the roads. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc., and also into nearby open drains.

92. The following should be included in the site layout plan:

- (i) Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone;
- (ii) Location of temporary stockpiles and provision of bunds;
- (iii) Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil;
- (iv) Wetting of soil to arrest dust generation by sprinkling water; and
- (v) Waste/surplus soil and concrete debris utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU.

93. **Sources of Materials.** Significant amount of gravel, sand and aggregate, will be required for this subproject. The construction contractor will be required to:

- (i) Use quarry sites and sources permitted by Mines and Geology Department only;
- (ii) No new quarry sites shall be developed for the subproject;
- (iii) Verify suitability of all material sources and obtain approval of implementing agency; and
- (iv) Submit on a monthly basis documentation of sources of materials to PMDCSC.

94. **Air Quality.** It is most certain that work will be conducted during the dry season, so there is potential for creating dust from the excavation of dry soil, backfilling, transportation to disposal, and from the import and storage of sand/gravel for bedding. Emissions from construction vehicles, equipment, and machinery used for excavation and construction will also induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, Sulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

- (i) Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
- (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (iii) Bring materials (aggregates, sand, etc. gravel) as and when required;
- (iv) Use tarpaulins to cover sand and other loose material when transported by vehicles;
- (v) Clean wheels and undercarriage of vehicles prior to leaving construction site; and
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity.

95. **Noise Levels.** The soils are deep in the subproject area and therefore activities like rock cutting/blasting that generate high noise are not anticipated. In isolated areas where a hard stratum is encountered (especially for deep pipe lines in some locations requiring using of pneumatic drills, there will be high noise during the activity. Also, where the pipelines are required to be laid in the roadway, pneumatic drills will be used to break open the road surface. Pneumatic drills typically generate an equivalent noise of 82-98 A-weighted decibels (dBA), at 1 m distance from the activity. Increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials, and people. The sensitive receptors are the general population and socio-cultural institutions in the area. Noise will be for a short term (about 2-3 days at each location) thus impact is minimal and short-term. The construction contractor will be required to:

- (i) Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Construction work shall be limited to day light hours (6 AM to 6 PM);
- (iii) Provide prior information to the local public about the work schedule;
- (iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiseling;
- (v) Minimize noise from construction equipment/pneumatic drills by using silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor;
- (vi) Maintain maximum sound levels not exceeding 80 dbA when measured at a distance of 10 m or more from the vehicle/s; and
- (vii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach.

96. **Surface Water Quality.** The water source is River Swarna and River Varahi. There is no construction in river. Udupi receives high rainfall (4,096 mm). The South – West Monsoon winds brings rainfall from June to September while the North–East monsoon winds delivers further rainfall from October to December. Due to these reasons and also that excavation will not certainly be conducted during rains, there is no impact on drainage and surface water quality is envisaged. In unavoidable case of excavation during monsoons, there may be temporary impacts like flooding of construction sites, mixing of construction waste and material within the runoff, etc. This may lead to silting and blockage of drains and water bodies. Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality of the streams draining

the City. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets.
- (ii) Lay pipelines during dry season and closing of all trenches before rainy season and avoid any chances of collecting the water in the trenches or pumping.
- (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas (Appendix 6).
- (iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies
- (v) Provide temporary bunds for stockpiles and materials. Place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund.
- (vi) Dispose any wastes generated by construction activities in designated sites.
- (vii) Conduct surface quality inspection and monitoring.

97. **Groundwater.** Subproject activities do not interfere with groundwater regime, no groundwater abstraction proposed nor do the activities affect groundwater quality. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. To ensure that water will not pond in pits and voids near project location, the construction contractor will be required to conduct excavation works on non-monsoon season to the maximum extent possible.

98. **Landscape and Aesthetics.** The construction work is likely to generate considerable quantities of waste soil. The pipe laying work will generate surplus soil; as small diameter pipes are proposed it will generate only 5-10% as surplus as most of the soil will be used for refilling after the pipe is laid in trench. Indiscriminate disposal of the soil and waste, excess construction material, concrete, packing materials, containers, lubricants and oils may affect the local environment at the disposal location. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Prepare and implement Waste / Spoil Management Plan – it should present how the surplus Waste generated will temporarily stocked at the site, transported and disposed properly;
- (ii) Avoid stockpiling of excess excavated soils as far as possible;
- (iii) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers;
- (iv) Coordinate with Udupi CMC for beneficial uses of excess excavated soils or immediately dispose to designated areas;
- (v) Recover used oil and lubricants and reuse or remove from the sites;
- (vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (viii) Request PMU/PMDCSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

99. **Accessibility.** Transport infrastructure will be affected by the pipe laying work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate pipes alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Following roads require permission from traffic police: Manchi Mulastana Road, Kakkunje school road, Kolambe Road, Bhujanga Rao road, Kodange- Tulaja Bhavani road, Saralebettu Bhajana Mandir road, Saralebettu manipal End point road, Vidyarathna

Nagara cross road., Poornaprajna Road Udupi. Road, Parkala–Karkala road, Manipal –Udupi Road, Udupi Malpe road, Maruthi Vithika Road, Taluk Office Road, Hudco Colony Road, Santhekatte-Kalyanpura Road, Kakkunje-Manipal Road, and Diana- Kukkikatte road. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan pipeline work in consultation with the traffic police;
- (ii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
- (iii) Provide for immediate consolidation of backfilling material to desired compaction – this will allow immediate road restoration and therefore will minimize disturbance to the traffic movement;
- (iv) Schedule transport and hauling activities during non-peak hours;
- (v) Do not close the road completely, allow traffic to move on one line;
- (vi) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (vii) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
- (viii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints;
- (ix) Keep the site free from all unnecessary obstructions;
- (x) Drive vehicles in a considerate manner; and
- (xi) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 7.

100. Where ever road width is minimal, there will be temporary loss of access during the laying of pipes. Under those circumstances, contractor can adopt following measures:

- (i) Inform the affected local population two days in advance about the work schedule;
- (ii) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum; and
- (iii) Provide pedestrian access in all the locations until normalcy is restored.

101. **Impacts on Social Sensitive Areas.** Since the work is being conducted in an urban area, sensitive areas like schools, hospitals and religious centre, the excavation of trenches and pipe laying activity will create nuisance and health hazard to children and people with ailments. The measures suggested under various heads in this section will minimize the impact in general in all areas; however, special attention is necessary at these locations. Following measures shall be implemented in 250 m around the sensitive locations (schools, hospitals, and religious centers):

- (i) No material should be stocked in this area; material shall be brought to the site as and when required;
- (ii) Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles;
- (iii) No work should be conducted near the religious places during religious congregations;
- (iv) Material transport to the site should be arranged considering school timings; material should be in place before school starts;
- (v) Notify concerned schools, hospitals etc., 2 weeks prior to the work; conduct a 30-minute awareness program on nature of work, likely disturbances and risks and

- construction work, mitigation measures in place, entry restrictions and dos and don'ts; and
- (vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.

102. **Socio-Economic – Income.** All of the project components will be located in government land and existing ROW. Excavation of trenches and pipe laying work will obstruct access to residences/commercial buildings adjacent to the pipeline. Disruption of access to commercial establishments may affect livelihood. Since many of the roads are narrow, construction activities may also obstruct traffic. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

- (i) Leave space for access between mounds of excavated soil;
- (ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required;
- (iii) Consult affected businesspeople to inform them in advance when work will occur;
- (iv) Address livelihood issues, if any; implement the resettlement plan to address these issues;
- (v) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security;
- (vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints;
- (vii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;
- (viii) Prepare and implement spoils management plan; and
- (ix) Provide alternate sources of clean water until water supply is restored.

103. **Socio-Economic-Employment.** Manpower will be required during the construction period (36 months). This can result to generation of contractual employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor will be required to:

- (i) Employ local labor force to the maximum extent, if manpower is available; and
- (ii) Comply with labor laws.

104. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Comply with all national, state and local core labor laws (See Appendix 2 of this IEE);
- (ii) Develop and implement site-specific Health and Safety Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) Health and Safety Training⁴ for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

⁴ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include

(i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence, but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective, and the worker is competent at their job. The level of supervision and

- (iii) All trenches deeper than 1 m shall be protected with hard barricade to avoid safety risks to workers, public and nearby buildings/structures;
- (iv) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (v) Provide medical insurance coverage for workers;
- (vi) Secure all installations from unauthorized intrusion and accident risks;
- (vii) Provide supplies of potable drinking water;
- (viii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (ix) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (x) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (xi) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (xii) Ensure moving equipment is outfitted with audible back-up alarms;
- (xiii) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
- (xiv) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively; and
- (xv) Overall, the contractor should comply with International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines on Occupational Health and Safety (this can be downloaded from <http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2Boccupational%2Bhealth%2Band%2Bsafety.pdf?MOD=AJPERES>).

105. Health and safety plan in response to COVID-19 (attached as annexure 17)⁵ is an integral part of the environmental management plan (EMP).

- (i) The H&S plan may be updated as and when new guidelines are issued by the governments, and international organizations such as WHO and ADB.
- (ii) All the contractors be advised to prepare site-specific plan compliant with government circulars, guidelines and public health advisories, elaborating the arrangements and measures for implementation of the H&S plan.
- (iii) These site-specific plans should be shared with ADB after KUIDFC's approval. In accordance with the government guidelines, the respective agreed measures are in place before resumption of the specific activity at project sites and congregation of workers at the project site and camps. The implementation of the contractor's approved site-specific plans is properly monitored by the project consultants and the PMU/PIUs.

monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker

⁵ KUIDFC H&S Plan URL link (http://www.kuidfc.com/uploaded_documents/administration/SOP-H%20and%20S%20Plan%20Covid%20approved%20by%20MD%2015.5.2020.pdf)

106. Community Health and Safety. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites are along the roadways, hence safety risk to community is to be considered. The pipe line work may require trenches along the roads including in narrow streets; unprotected trench excavation may endanger the stability of nearby buildings/structures. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Provide hard barricading for all deep excavations that may require especially for pipe lines; identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work;
- (ii) Plan material and waste routes to avoid times of peak-pedestrian activities;
- (iii) Liaise with Udupi CMC in identifying risk areas on route cards/maps;
- (iv) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- (v) Provide road signs and flag persons to warn of dangerous conditions, for all work sites along the roads; and
- (vi) Overall, the contractor should comply with IFC EHS Guidelines Community Health and Safety (this can be downloaded from <http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2Bcommunity%2Bhealth%2Band%2Bsafety.pdf?MOD=AJPERES>).

106. Work Camps. Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Provision of proper living facilities and basic amenities (water, sanitation, fire safety, health and safety, etc) shall be ensured. The construction contractor will be required to comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_externalcorporate_site/ifc+sustainability/publications/publications_gpn_workers_accommodation).

- (i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located at least 200 m from residential areas.
- (ii) Minimize removal of vegetation and disallow cutting of trees.
- (iii) Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuse.
- (iv) The camp site should be adequately drained to avoid the accumulation of stagnant water.
- (v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination.
- (vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons.
- (vii) Train employees in the storage and handling of materials which can potentially cause soil contamination.
- (viii) Recover used oil and lubricants and reuse or remove from the site.
- (ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas.
- (x) Remove all wreckage, rubbish, or temporary structures which are no longer required.

- (xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.
- (xii) The work camp details should be included in the Construction Management Plan.

107. **Social and Cultural Resources - Chance Finds.** Subproject area is not a potential archaeological area and therefore no impacts envisaged. Nevertheless, the construction contractor will be required to:

- (i) Create awareness among the workers and supervisors about the chance finds during excavation work.
- (ii) Stop work immediately if any finds are suspected to allow further investigation.
- (iii) Inform archaeological agencies promptly if a find is suspected and take any action they require to ensure its removal or protection in situ.
- (iv) Adjacent to important religious sites, undertake excavation and construction work in such a way that no structural damage is caused to the building.

108. **Debris Disposal.** Prior to the commencement of works, contractor shall identify a debris disposal site in consultation with the Udupi CMC and adhering to following criteria:

- (i) The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities.
- (ii) Debris disposal site shall be at least 200 m away from surface water bodies.
- (iii) No residential areas shall be located within 100 m downwind side of the site.
- (iv) The site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.
- (v) The local governing body and community shall be consulted while selecting the site.

F. Operational and Maintenance Impacts

109. Operation and Maintenance of the water supply system will be carried out by the Udupi CMC. The system has a design life of 30 years, during which shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

110. Recurrence of pipe bursting and leakage problems can be managed by the leak detection and water auditing surveys. Udupi CMC will be required to ensure that the leakage rectification time is minimized.

111. Improper disposal of silt and debris removed from trenches could cause inconvenience to public. Silt and debris shall be collected in trucks and transported to the approved disposal site and or can be used as covering material for wastes being landfilled.

112. Recurrence of blockage and leakage problems. Although impact is likely to be minimal due to new and well-designed efficient system, it should be ensured that leak detection and restoration time is minimized to the extent possible.

113. Increased water supply will increase the sewage generation, which needs to be safely collected, treated and disposed. A comprehensive sewerage system to be developed.

G. Cumulative Impacts

114. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of a project or activity when added to other existing, planned, and/or reasonably anticipated future ones. The subproject is proposed to improve municipal water supply in Udupi, by providing new OHTs, distribution lines in currently uncovered areas, and to improving water distribution lines in the presently covered areas. Subproject is limited to improvement of water distribution system and therefore no notable cumulative impacts envisaged. During the construction work, dust pollution is anticipated from the subproject activities. This, combined with the other usual construction activities in urban areas, may increase the particulate matter concentration in ambient air. Dust control measures suggested in the EMP will minimize the dust generation from the subproject construction activities. Therefore, no significant impacts envisaged.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

115. In order to identify the adverse social impact of the project a joint site visit was carried out by the ULB engineers, Resettlement Specialist and design engineer of the consultant team from 10 October 2017 along the raw water pumping line and from 1 April 2016 to 9 August 2017 along the busy areas (commercial centers and narrow streets) of Udupi. Meetings and consultations with relevant Government Departments were carried out to assess the Project approach. The subproject is formulated in close consultation with public representatives of Udupi CMC, and accordingly the CMC passed a resolution for preparation of subproject (Appendix 8).

116. Public consultations through focus group discussions (FGDs) were held with project beneficiaries and project-affected people. Public consultation was conducted in the areas where pipes will be laid and the surrounding areas of all 7 OHTs' construction sites. The public consultations were conducted along with the Ward Councilors (Elected Representatives), ULB officers, PIU officers and Social Development Specialist of PMDCSC. A total 32 stakeholders in the subproject alignments were consulted. Of these, 11 were women. During the meeting local public and affected people shared their views to the project team. Following are the comments/suggestions of the participants:

- (i) The work should be completed within the shortest possible time as people of the project proposed locations are facing a lot of problems due to the absence of the proposed infrastructure at present;
- (ii) The local residence should be informed about the trenching at least one week before;
- (iii) Employment may be provided to the local skilled and semi-skilled laborers during the construction stage;
- (iv) Inconvenience and traffic disturbances due to construction work in the city should be minimized as far as possible; and
- (v) People are willing to cooperate to implement the project successfully.

A. Project Stakeholders

117. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- (i) Residents, shopkeepers and businesspeople near the work sites;
- (ii) Public representatives and prominent citizens of the City;
- (iii) Udupi CMC; and

- (iv) KUIDFC, Government of Karnataka.

118. Secondary stakeholders are:

- (i) Other concerned government institutions (utilities, regulators, etc.);
- (ii) NGOs and community-based organizations working in the affected communities;
- (iii) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- (iv) The beneficiary community in general; and
- (v) ADB as the funding agency.

B. Consultation and Disclosure up to Date

119. Public consultation meetings were conducted during the project preparation and design stages. Various forms of public consultations (consultation through ad hoc discussions on site) have been used to discuss the project and involve the community in planning the project and mitigation measures.

120. A Public consultation was conducted on 20 October 2016 in the surrounding areas of all 7 OHTs' construction sites and also distribution network areas to discuss the proposed project and likely environmental issues and mitigation measures. Various stakeholders – public representatives, officials from various agencies were participated in the workshop. The consultation meeting details including photographs are attached in Appendix 9. Consultations are also conducted along the raw water pipeline from intake to WTP, which is proposed under government-funded bulk water supply project. All participants supported the project, and opined that work should be conducted with minimum disturbances.

C. Future Consultation and Disclosure

121. Executive agency and implementing agency shall extend and expand the consultation and disclosure process significantly during implementation of the Investment Program.

122. **Consultation during Construction.** Prior to start of construction, PIU will conduct meaningful consultation⁶ and information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, websites etc.). A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Kannada and English) about the construction work in the area, once 7 days prior to the start of work and again a day before the start of work via pamphlets. At the work sites, public information boards will also be provided to disseminate project related information.

- (i) Public meetings with affected communities (if any) to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and

⁶ Meaningful consultation will: (i) be carried out on an ongoing basis throughout the project cycle; (ii) involve timely disclosure of relevant information. Affected peoples and stakeholders will have access to relevant project information prior to any decision-making that will affect them; (iii) be conducted free of intimidation or coercion; and (iv) be gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups

- (ii) Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

123. **Project Disclosure.** Executive summary of the IEE will be translated in Kannada and made available at the offices of PMU, RPMU, PIU, and Udupi CMC and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Kannada will be placed in the official website of the KUIDFC after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

124. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future. Prior to start of construction, the PIU will issue Notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction sites for the information of public.

125. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

- (i) Public information campaigns (via newspaper, TV and radio) to explain the project to the wider City population and prepare them for disruption they may experience once the construction program is underway;
- (ii) Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Kannada; and
- (iii) Formal disclosure of completed project reports by making copies available at convenient locations in the study cities, informing the public of their availability, and providing a mechanism through which comments can be made.

126. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon finalization and approval of ADB; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports (Appendix 10). Documents will also be available on the websites of KUIDFC and Udupi CMC.

VII. GRIEVANCE REDRESS MECHANISM

127. There will be several tiers for grievance redress process. Simple grievances for immediate redress will first be resolved at site by Contractor. If unaddressed for up to 7 days the complainants may go to PIU officer in ULB responsible for addressing resettlement/social issues. Resident engineer and the ULB will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at ULB and RPMU, will be posted at Contractor's and PMDCSC's site office in full visibility of public. Grievances of immediate nature should be resolved at site/ within ULB/PIU level within 15 days of registration of grievances.

128. A project GRM will cover the project's towns for all kinds of grievances and will be regarded as an accessible and trusted platform for receiving and facilitating project related complaints and grievances. The multi-tier GRM for the program will have realistic time schedules to address

grievances and specific responsible persons will be identified to address grievances and whom the displaced persons have access to interact easily.

129. Awareness on grievance redress procedures will be created through Public Awareness Campaign with the help of print and electronic media. The Safeguards Officer of RPMU will ensure that vulnerable households are also made aware of the GRM and assured of their grievances to be redressed adequately and in a timely manner.

130. There will be multiple means of registering grievances and complaints by dropping grievance forms in complaint/ suggestion boxes at accessible locations, or through telephone hotlines, email, post or writing in a complaint registrar book in ULB's project office. There will be complaint registrar book and complaint boxes at construction site office to enable quick response of grievances/ complaints for urgent matters. The name, address and contact details of the persons with details of the complaint / grievance, location of problem area, date of receipt of complaint will be documented. The RPMU's SO will be responsible at the project level for timely resolution of the environmental and social safeguards issues and registration of grievances, and communication with the aggrieved persons.

131. **Grievance Redressal Process.** There will be several tiers for grievance redress process. Simple grievances for immediate redress will first be resolved at site by Contractor. If unaddressed for up to 7 days the complainants may go to PIU officer in ULB responsible for addressing resettlement/social issues. Resident engineer and the ULB will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at ULB and RPMU, will be posted at Contractor's and PMDCSC's site office in full visibility of public. Grievances of immediate nature should be resolved at site/ within ULB/ PIU level within 15 days of registration of grievances.

132. All the Grievances that cannot be resolved at ULB/PIU within 15 days will be forwarded to the grievances redressal committee (GRC) headed by Deputy Project Director, RPMU at Subdivision level who will review and resolve within 15 working days of grievance being registered with assistance of the concerned PIU/ULB personnel if required. The grievances of critical nature and those cannot be resolved at GRC level should be referred to District Level Implementation Committee (DLIC) set up at district level headed by Deputy Commissioner who will review the grievances and to be settled within 30 days. All documents related to grievances, follow up action taken to resolve along with explanatory note on nature, seriousness and time taken for grievance redress shall be prepared by RPMU Social Development Officer and circulated to DLIC members at least a week prior to scheduled meeting. The decision taken at the DLIC level will be communicated to the complainant by Social Development Officer, RPMU through ULB/PIU

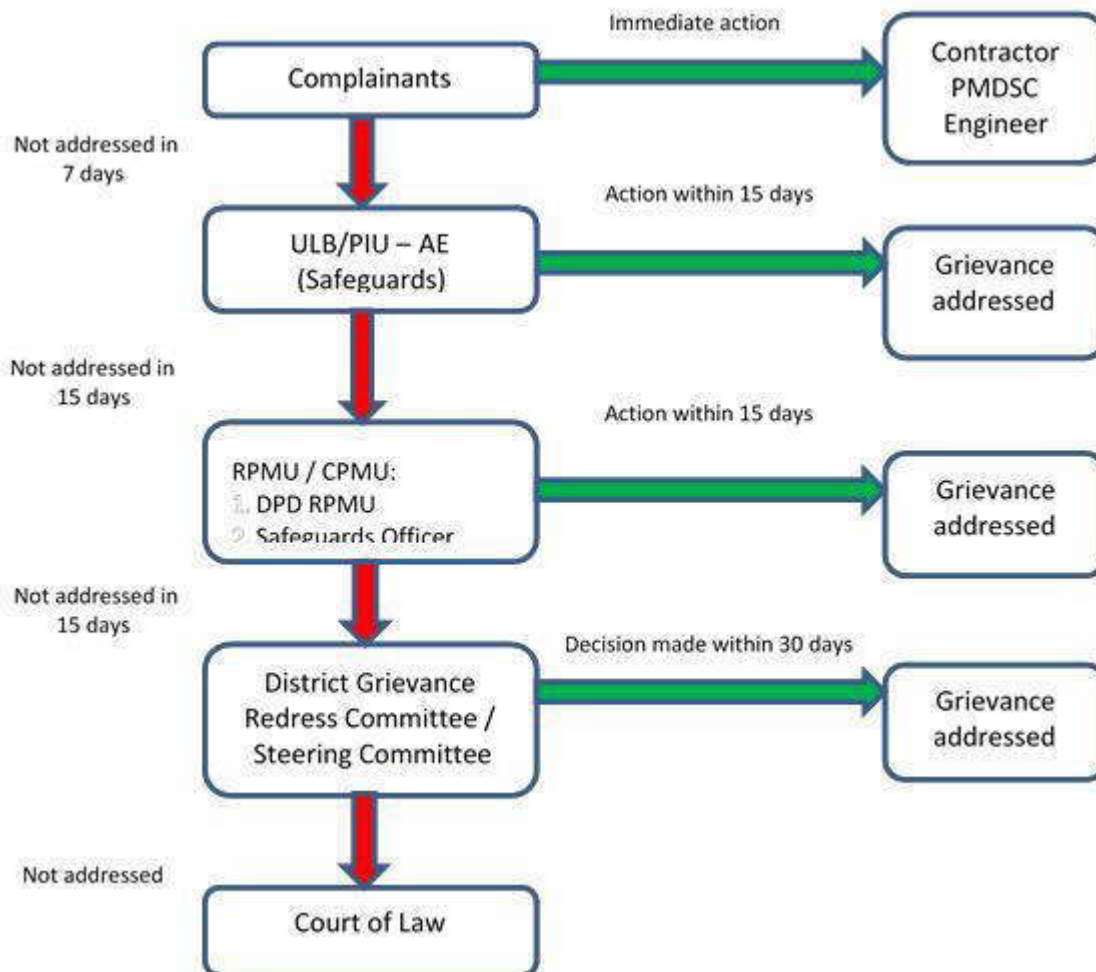
133. For any issues that remain unresolved by the GRC it is referred to DLIC at the District Level, and if the decisions taken at such meetings are not acceptable, the complainants /DPs can approach the Court of Law as per Government of Karnataka legal procedure.

A. Grievance Redress Committee Composition and Selection of Members

134. The GRC for the project will be headed by a Special Land Acquisition Officer/Assistant Commissioner of the concerned sub-Division as Chairman of the sub Division with members as follows: (i) ULB Commissioners/Chief Officer of the concerned ULB towns, (ii) Deputy Project Director as member Secretary and Convener, (iii) PMDCSC Engineer, (iv) Affected Community member/NGO, (v) Safeguards Officer of RPMU Mangalore will shoulder responsibility of keeping records of grievances/ complaints in details. Safeguards Officer will be responsible for coordinating with all GRC members and the displaced persons for grievance redressal. The grievances of critical nature and those cannot be resolved at Divisional level should be referred

to DLIC set up at District level they will determine the merit of each grievance and attempt to resolve the same within a month from the date of lodging of complaints. The decision of DLIC is final and cannot be contested in any other forum except in the Courts of Law.

135. Affected Person also can use the ADB Accountability Mechanism through directly contact (in writing) to the Complaint Receiving Officer (CRO) at ADB headquarters or to ADB Indian Resident Mission. The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will include in the project information document (PID) to be distributed to the affected communities, as part of the project GRM.

Figure 10: Grievance Redress Process

AE = Assistant Engineer, CPMU = City Program Management Unit, DPD = Deputy Project Director, PIU = Program Implementation Unit, PMDCSC = Project Management Design and Construction Supervision Consultant, RPMU = Regional Program Management Unit, ULB = urban local body.

136. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of PMDCSC) and submitted to PMU.

137. **Information Dissemination Methods of the Grievance Redress Mechanism.** The PIU assisted by PMDCSC Public Communication, Awareness, Resettlement and Rehabilitation Consultant (PCARRC) will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including, whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved, and the outcomes will be displayed/disclosed in the PIU, offices, ULB notice boards and

on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB.

138. **Periodic Review and Documentation of Lessons Learned.** The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

139. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the respective PIU. Cost estimates for grievance redress are included in resettlement cost estimates.

140. **Country legal procedure.** An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

141. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person can also use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

142. The purpose of the Environmental Management Plan (EMP) is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

143. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.

144. A copy of the updated EMP/SEMP must be kept on work sites at all times. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

145. For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts, (ii) carry out all of the monitoring and mitigation measures set forth in the EMP, and (iii) implement any corrective or preventative actions set out in safeguards

monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

146. Tables 11 to 13 shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation for 24x7 water supply distribution network. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. Table 14 shows the EMP to be implemented during project implementation and operation.

Table 11: Environmental Management Plan for Anticipated Impacts – Pre-Construction

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
Submission of updated environmental management plan (EMP)/site environmental plan (SEP); EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Safeguards (Environmental, Health and Safety or EHS) Engineer to ensure EMP implementation (ii) Submission of updated EMP/site-specific environmental management plan (SEMP) (iii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs	(i) once during design validation period (ii) once before start of construction (iii) monthly	Contractor	(i) mobilization of EHS engineer (ii) Submission of SEMP prior to start of works (iii) submission of monthly reports	PMDSC/PIU/RPMU/PMU/ULB	Contractor cost
Trees on project sites	Tree cutting	(i) Further minimize removal of trees, if possible, by adopting to site condition and with appropriate layout design (Overhead tank or OHT sites) and alignments (pipelines) (ii) For any tree cutting that may be required, obtain	(i) once during design validation stage (ii) once during	Contractor in collaboration with Urban local body (ULB)/Program Implementation Unit (PIU)	(i) Layout plan of OHTs (ii) tree cutting / pruning permission	PMDSC /RPMU/PMU	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		prior permission from Forest Department (iii) Plant and maintain 10 trees for each tree that is removed	approval process (iii) once after the approval process		(iii) Compensatory tree plantation as part of the project		
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents, during design validation phase and preconstruction phase, to prevent unnecessary disruption of services during construction phase (ii) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies before ground clearance; and (iii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	(i) once after design (ii) once before bid is tendered (iii) Once after design validation and discussion with respective agencies	ULB/PIU	(i) List of affected utilities and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), spoil management plan, and traffic management plan	PMD CSC /RPMU/PMU	No cost required. Mitigation measures are part of terms of reference (TOR) of PMU, design engineers, and supervising consultants.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
Social and Cultural Resources – Chance finds	Ground disturbance can uncover and damage archaeological and historical remains	(i) Create awareness among the workers and supervisors about the chance finds during excavation work (ii) Stop work immediately if any finds are suspected to allow further investigation (iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ.	(i) once in a month (ii) as and when required (iii) when above is initiated	Construction Contractor and Project Management, Design and Construction Supervision Consultant (PMD CSC)	Chance Finds Protocol	PMD CSC/PIU/RPMU/PMU	No cost required.
Construction work camps, hot mix plants , stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas;	(i) once before finalization of the location/area (ii) once before finalization of the location/area (iii) once before finalization of	Contractor to determine locations prior to beginning of construction works and to be reviewed and approved by PIU	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. (ii) Written consent of landowner/s (not lessee/s) for reuse of excess spoils to agricultural land	PMD CSC/RPMU/PMU	No cost required.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		<p>(iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community.</p> <p>(v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.</p>	the location/area (iv) once before finalization of the location/area				
Sources of Materials	Extraction of materials can disrupt natural land contours	(i) Use quarry sites and sources permitted by Mines	(i) once before sourcing of the materials	Contractor to prepare list of approved quarry sites and	(i) List of approved quarry sites and	PIU/RPMU/PMU	No cost required.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
	and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	and Geology Department only (ii) No new quarry sites shall be developed for the subproject (iii) Verify suitability of all material sources and obtain approval of implementing agency (iv) Submit on a monthly basis documentation of sources of materials to PMDCSC.	(ii) once every month (iii) once every month	sources of materials with the approval of PMDCSC	sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.		Mitigation measures are part of ToR of PMU, design engineers, and supervising consultants.
Consents, permits, clearances, NOCs, etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works. (ii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc. (iii) Include in detailed design drawings and documents all conditions and provisions if necessary	(i) once component-wise (ii) every month and as and when compliance is obtained (iii) once semi-annually	ULB/PIU and PMDCSC	Incorporated in final design and communicated to contractors.	RPMU/PMU	No cost required. Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PMU. Mitigation measures are part of TOR of PMU, design engineers, and supervising consultants.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
Method statement	Use of approved construction practices to minimize construction impacts	Method Statement should be in a Table format with appended site layout map and cover the following: (i) Work description (ii) Number of workers (skilled and unskilled) (iii) Details of plant, equipment and machinery, vehicles (iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing) (v) PPE (helmet, gloves, boots, etc.) details for each type of work (vi) Details of materials at each site (type and quantity) (vii) Risks/ hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to	Once when the statement is submitted and to be reviewed once in a month.	Contractor to prepare method statement for review and approval by PMDCSC / PIU prior to start of work.	Review of method statement and implementation of work	RPMU/PMU	No cost required.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		buildings, infrastructure etc.) (viii) Construction waste/debris generated (details and quantity) (ix) Detail the sequence of work process (step-by-step) including specific details of each work (x) Contractor's supervision and management arrangements for the work (xi) Emergency: Designate (i) responsible person on site, and (ii) first aider (xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc. (xiii) The pipelines are to be laid along the roads. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement					

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Implementation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc., and also into nearby open drains.					

Table 12: Environmental Management Plan for Anticipated Impacts – Construction

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
EMP Implementation Training	Impacts on the environment, workers, and community due to improper implementation of EMP	(i) Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc. (ii) appointment of Environment, Health and Safety (EHS) Engineer by	(i) once prior to the start of construction and as and when the project manage and key workers change (ii) once before the start of work	Construction Contractor / PIU / PMDCSC	(i) Certificate of Completion (Safeguards Compliance Orientation) (ii) Posting of Certification of Completion at worksites (iii) Posting of EMP at worksites	RPMU/PMU/UL B	Cost of EMP Implementation Orientation Training to contractor is responsibility of PMU. Other costs responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		contractor prior to start of work					
Air Quality	Emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) Consult with PIU/PMDSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; (iv) Clean wheels and undercarriage of vehicles prior to leaving construction site (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.	(i) once for each work site (ii) on a daily basis each area (iii) once each truck (iv) once each truck (v) once when the equipment is used SPM, RSPM, SOx, NOx Day and night time noise (dBA) Monitoring method As prescribed by Central Pollution Control Board Once before start of construction Quarterly (yearly 4-times) during construction period of 24 months – 90 times	Construction Contractor	(i) Location of stockpiles; (ii) Complaints from sensitive receptors; (iii) Heavy equipment and machinery with air pollution control devices; (iv) Certification that vehicles are compliant with Air Act	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during installation of pipelines can contaminate nearby surface water quality.	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets. (ii) Laying of pipelines during dry season and closing of all trenches before rainy season and avoid any chances of collecting the water in the trenches or pumping. (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas (Appendix 6). (iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies (v) Provide temporary bunds for stockpiles and materials (vi) Place storage areas for fuels and lubricants away from any drainage leading	(i) once every day during rainy days (ii) once every day during rainy days (iii) as and when required (iv) once in each work site and check every day on rainy days (v) once in each work site and check every day on rainy days (vi) once every month (vii) as and when required (viii) one in a month and every day during rainy days Water quality – standard parameters Once before start of construction	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) Number of silt traps installed along trenches leading to water bodies; (iii) Records of surface water quality inspection; (iv) Effectiveness of water management measures; (v) No visible degradation to nearby drainages, nallahs or waterbodies due to civil works	PMD/CSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		to water bodies. Storage structure should consider 110% capacity bund (vii) Dispose any wastes generated by construction activities in designated sites. (viii) Conduct surface quality inspection and monitoring.	Quarterly (yearly 4-times) during Construction (30 samples)				
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU/PMDSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Construction work shall be limited to day light hours (6 AM to 6 PM) (iii) Provide prior information to the local public about the work schedule; (iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the	(i) once for each work site (ii) every day at each work site (iii) as and when required at each work site (iv) as and when required drilling takes place (v) once before using each equipment (vi) as and when required	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels (See Appendix 3 of this IEE)	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		<p>rocks manually by chiseling;</p> <p>(v) Minimize noise from construction equipment/pneumatic drills by using silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and</p> <p>(vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</p> <p>(vii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p>	<p>(vii) every day at each work site</p> <p>Noise level Once before start of construction Quarterly (yearly 4-times) during construction period of 24 months – 90 times</p>				
Landscape and aesthetics	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed	<p>(i) Prepare and implement spoils management plan</p> <p>(ii) Avoid stockpiling of excess excavated soils;</p> <p>(iii) Coordinate with Udupi CMC for beneficial uses of</p>	<p>(i) once and update as and when required</p> <p>(ii) once every day at stockpile location</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Worksite clear of hazardous wastes such as oil/fuel</p>	PMDCSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
	concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (vii) Request PMU/PMDSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	(iii) once before disposal of soil (iv) once in a month where oil/lubricants are used (v) once every day (vi) once in a month (vii) once work is completed		(iiv) Worksite clear of any excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers		
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PIU/PMDSC the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of	(i) once when the service is disrupted (ii) once for the each area disrupted	Construction Contractor	Existing Utilities Contingency Plan	PMDSC/PIU/RPMU/PMU/UL B	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		unintentional interruption of service(iii) The public should be given notice at least three days in advance and any accidental breaking should be rectified immediately.	(iii) as and when required when the disruption is planned				
Accessibility	Traffic problems and conflicts near project locations and haul road	(i) Plan pipeline work in consultation with the traffic police (ii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; (iii) Provide for immediate consolidation of backfilling material to desired compaction – this will allow immediate road restoration and therefore will minimize disturbance to the traffic movement; (iv) Schedule transport and hauling activities during non-peak hours; (v) Do not close the road completely,	(i) once for each work site (ii) once for each work site. (iii) every day at all work fronts (iv) every day at all work fronts (v) every day at all work fronts (vi) as and when required (vii) as and when required	Construction Contractor	(i) Traffic route during construction works including number of permanent signages, barricades and flagmen on worksite (Appendix 7); (ii) Complaints from sensitive receptors; (iii) Number of signages placed at project location.	PMD/CSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		<p>allow traffic to move on one line;</p> <p>(vi) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;</p> <p>(vii) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;</p> <p>(viii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.</p>	<p>(viii) at all work sites once</p> <p>(ix) every day at the end of the day</p> <p>(x) every time vehicle is used</p> <p>(xi) once for each work site</p>				

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		(ix) Keep the site free from all unnecessary obstructions; (x) Drive vehicles in a considerate manner; (xi) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 7.					
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Prepare and implement spoils management plan (ii) Leave spaces for access between mounds of soil; and Provide walkways and metal sheets where required for people; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (v) Provide sign boards for pedestrians to inform	(i) once for each work site (ii) as and when required (iii) as and when required (iv) once at each work site/front (v) once for each work site	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Spoils management plan (iii) Number of walkways, signages, and metal sheets placed at project location.	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		nature and duration of construction works and contact numbers for concerns/complaints.					
Socio cultural resources	Disturbance to socio cultural resources (religious, educational, health care etc.), access disruptions etc.,	(i) No material should be stocked close to these areas; material shall be brought to the site as and when required. (ii) Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles (iii) No work should be conducted near the religious places during religious congregations (iv) Material transport to the site should be arranged considering school timings; material should be in place before school starts; (v) Notify concerned schools, hospitals etc., 2 weeks prior to the work; conduct a 30-minute awareness program on nature of work, likely disturbances and	(i) once at each work site (ii) as and when required (iii) as and when required (iv) as and when required (v) as and when required (vi) every day	Construction Contractor	(i) Visual site observations (i) Public complaints	PMD/CSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts (vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.					
Socio-Economic - Employment	Generation of contractual employment and increase in local revenue	(i) Employ local labor force to the maximum extent, if manpower is available; (ii) Comply with labor laws	(i) once at the beginning of start of construction (ii) everyday	Construction Contractor	(i) Employment records; (ii) Records of sources of materials (iii) Compliance to core labor laws (See appendix 2 of this IEE)	PMDSC/PIU/ RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Comply with all national, state and local core labor laws (See Appendix 2 of this IEE) (ii) Develop and implement site-specific occupational health and safety (OHS) Plan, and include in the Construction Management plan. The OHS plan will include measures such as: (a) excluding public from	(i) every day (ii) once before construction of each component of the water supply system (ii) every day (iii) once after employment renewed annual	Construction Contractor	(i) Site-specific OHS Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers	PMDSC/PIU/ RPMU/PMU/ ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		<p>the site; (b) ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose mask and ear plugs; (c) OHS Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;</p> <p>(iii) Provide medical insurance coverage for workers;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(v) Provide supplies of potable drinking water;</p> <p>(vi) Provide clean eating areas where workers are not exposed to</p>	<p>(iv) every day</p> <p>(v) as and when required</p> <p>(vi) as required</p> <p>(vii) once before starting of work and every month to the key workers changed</p> <p>(viii) when visitor visit the site as authorized by PIU</p> <p>(ix) as and when required</p> <p>(x) every day if fitted with alarms when such equipment is used.</p> <p>(xi) once after construction is completed and revisit and take action following incidents</p>		<p>are not exposed to hazardous or noxious substances;</p> <p>(vii) record of health and safety orientation trainings</p> <p>(viii) personal protective equipment;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(xi) permanent sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</p> <p>(xii) Compliance to core labor laws (See appendix 2 of this IEE)</p>		

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		hazardous or noxious substances; (vii) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and provide sign boards for hazardous areas	(xii) every day once (xiii) every day once				

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xiii) Overall, the contractor should comply with International Finance Corporation (IFC) EHS Guidelines on Occupational Health and Safety					
Response to COVID19 Pandemic	Occupational Health and Safety Hazards due	Design and implement measures in accordance with KUIDFC COVID19	Daily	Contractor		PMDCSC/PIU/RPMU/PMU/ULB	PMU/PIU

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
	to COVID19 pandemic	H&S Plan to prevent worker exposure.					
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<p>(i) Provide hard barricading for all deep excavations that may require especially for pipe lines; identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work</p> <p>(ii) Plan material and waste routes to avoid times of peak-pedestrian activities</p> <p>(iii) Liaise with Udupi CMC in identifying risk areas on route cards/maps</p> <p>(iv) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure</p> <p>(vi) Provide road signs and flag persons to warn of dangerous conditions, for all</p>	<p>(i) every day at each work site</p> <p>(ii) every day once</p> <p>(iii) every day as required</p> <p>(iv) once before commence of work at each work site and revisit during the each maintenance cycle</p> <p>every day once</p> <p>(vi) every day once</p>	Construction Contractor	<p>(i) Traffic Management Plan;</p> <p>(ii) Complaints from sensitive receptors</p>	PMDCSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		work sites along the roads (vi) Overall, the contractor should comply with IFC EHS Guidelines Community Health and Safety					
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located at least 200 m from residential areas. (ii) Minimize removal of vegetation and disallow cutting of trees (iii) Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuse (iv) The camp site should be adequately drained to avoid the accumulation of stagnant water (v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be	(i) once before locating the same (ii) once before setup of location (iii) every day once (iv) every day once (v) every day once (vi) once in the establishment of facility and every day maintenance (vii) once before start of work at each worksite and when there	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Drinking water and sanitation facilities for employees	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		<p>provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination</p> <p>(vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons</p> <p>(vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(viii) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p>	<p>is a change in key workers</p> <p>(viii) once every month</p> <p>(ix) every day once</p> <p>(x) as and when required with minimum of once per month</p> <p>(xi) one time once vacated</p> <p>(xii) once before setup and once before change in plan</p>				

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		(ix) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work. (xii) The work camp details should be included in the Construction Management Plan.					
Social and Cultural Resources	Risk of archaeological chance finds	(i) Create awareness among the workers and supervisors about the chance finds during excavation work (ii) Stop work immediately if any finds are suspected to allow further investigation (iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ. (iv) Adjacent to important religious sites, undertake excavation and	(i) once before construction and repeat when key workers are changed (ii) as and when required (iii) as and when required (iv) as and when required	Construction Contractor	Records of chance finds	PMD/CSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		construction work in such a way that no structural damage is caused to the building.					
Submission of EMP implementation report	Unsatisfactory compliance to EMP	(i) Appointment of EHS engineer to ensure EMP implementation (ii) Timely submission of monitoring reports including pictures	(i) once before start of construction and once after replacement (ii) monthly once	Construction contractor	Availability and competency of appointed EHS engineer Monthly report	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/ compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up.	(i) every day or as and when required (ii) every day or as and when required (iii) every day or as and when required (iv) every day or as and when required (v) once after vacating the camp (vi) once after	Construction Contractor	PMU/PMDSC report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	PMDSC/PIU/RPMU/PMU/ULB	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
		(vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regressed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PMU/PMDSC to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	vacating the site (vii) once after vacating the site and follow up as required till completion of task (viii) once after all above tasks are complete				

Table 13: Environmental Management Plan for Anticipated Impacts – Operation

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
Check for blockage and leakage problems	It may affect the water supply system	Effectiveness of leak detection and water auditing to reduce the water losses	As and when required	Operation and maintenance (O&M) Contractor/Udupi City Municipal Council (CMC)	No. of leaks detected Water auditing	Udupi CMC	CMC cost

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
reducing the water losses							
Repair works during O&M	Local disturbances during maintenance work	<p>Contractor shall inform shopkeepers, residents and road users of repair works in advance.</p> <p>If trenches are dug to locate and repair leaks or remove and replace lengths of pipe or illegal connections, the removed material will be replaced in the trench so there will be no waste. The refilled trench shall be re-compacted and brought to the original condition as soon as the repair works are over. Works shall be completed quickly at sensitive areas.</p> <p>Proper access shall be provided to the residents during the repair works</p> <p>If any major maintenance works is to be taken up contractor shall prepare and operate Health and safety plan to protect workers and public. Contractor may request police to divert traffic if necessary.</p>	As and when required	O&M Contractor / Udupi CMC	Timeline for each repair	Udupi CMC	CMC cost
Increase of sewage	Increased quantity of sewage leads to open area/drain and	Develop a comprehensive sewerage system	Every quarter	CMC, Udupi		Karnataka Urban Infrastructure Development and Finance	CMC cost

Field	Anticipated Impact	Mitigation Measures	Frequency	Responsible for Mitigation	Monitoring of Mitigation		Cost and Source of Funds
					Activity	Responsibility	
	creates health problems					Corporation (KUIDFC)/ Government of Karnataka	

Table 14: Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost
Pre- construction and Construction					
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of dust control, noise control, traffic management, and safety measures. Site inspection	Weekly during construction	Supervising staff and safeguards specialists of Project Management Design and Construction Supervision Consultant (PMD CSC) and Program Implementation Unit (PIU)	Part of PIU and PMDCSC terms of reference (TOR)
Ambient air quality	7 points (pipe laying – 4 and overhead tanks or OHTs – 3) See appendix 16 for locations maps	Particulate matter (PM) ₁₀ , PM _{2.5} , Sulphur Oxide (SO _x), Nitrogen Oxide (NO _x) Monitoring method as prescribed by Central Pollution Control Board (CPCB)	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	Cost of monitoring 90x 5000 = ₹450,000
Noise Level	7 points (pipe laying – 4 and OHTs – 3) See appendix 16 for locations maps	Noise level Day and night time noise (dBA) Monitoring method as prescribed by CPCB	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	90x2500 = ₹225,000
Water Quality	3 sites	CPCB standard parameters	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	30x10,000 = ₹300,000
Operation					
Monitoring of raw and treated water quality	Source, inlet and outlet of water treatment plant (WTP)	Drinking water parameters	Quarterly	Udupi City Municipal council (CMC) through accredited lab/ Karnataka State Pollution Control Board (KSPCB)	CMC operating costs