Udaipur Smart City Limited (USCL)

Udaipur Integrated Infrastructure Project

Project Information Memorandum

(Summary of Assignment & Expected deliverables from Selected Bidder)

For

Implementation of following projects in the city of Udaipur

(i) *Rehabilitation of Existing Sewers and Laying of New Sewerage Network using conventional and trenchless technologies and other associated works across Walled City Area of Udaipur city.*

(ii) *Rehabilitation, Up-gradation and Construction of water distribution network and domestic 24x7 water supply across Walled City Area of Udaipur city.*

(iii) *Rehabilitation, Up-gradation and Construction of power distribution network and domestic connections across Walled City Area of Udaipur city.*

(iv) *Construction of Underground Utility duct across Walled City Area of Udaipur city.*

(v) *Design and relaying of roads and side storm water drains across Walled City Area of Udaipur city.*

1. PROJECT BACKGROUND

1.1 Context: Smart Cities Mission

The need for overall urban improvement and development to sustain the economic growth momentum recently found its expression in the mandate of Smart Cities Mission (SCM) launched by the Government of India.

The Smart Cities Mission (SCM) of the Government of India is a bold initiative with an objective to develop cities with core infrastructure and decent quality of life for its citizens, a clean and sustainable environment and application of “Smart” solutions. The purpose of the SCM is to drive economic growth and improve the quality of life of people by enabling Area Based Development (ABD) through retrofitting and redeveloping of the infrastructure. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. This sort of a comprehensive development is expected to improve the quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities.

Udaipur city competed in the two stage selection process devised by Ministry of Urban development (MoUD), Government of India involving intra stage competition. On the basis of the scoring done by the MoUD, the top 20 cities have been selected for funding in the FY 2015-16 and Udaipur city stood sixteenth in the ranking.

1.2 Udaipur city

a. Regional setting

It has been the historic capital of the kingdom of Mewar of the former Rajputana dynasty. The city is a district head quarter of Udaipur district. Udaipur also serves as a market centre for smaller towns in the region. As of today, there are 17 urban centres comprising Municipal Corporation (UMC), municipalities, and census towns. The UMC is the only municipal corporation in the district. UMC has an area of 64 sq km after the city’s expansion, and is divided into 55 election and revenue wards. Within the Municipal limits of UMC lies the **“Walled City Area”** which is the city core and forms the oldest part of the Udaipur city. This “Walled City Area” is approximately 5% of the Municipal area (3.4 sq.km / 828 acres) and housing 20% of the city’s population.

Udaipur city is a part of Girwa tehsil of Udaipur district in southern Rajasthan, which is located at an altitude of 577 m from mean sea level. It is located at longitude 24.58°N and latitude 73.68°E. On its southwest state capital city of Jaipur, in west city of Kota, and in northeast city of Ahmedabad are located.

Udaipur is directly linked to major cities of India like New Delhi, Jaipur, Ahmedabad, and Mumbai through roads, railways, and air routes. It is located at a distance of about 450 km from Jaipur and 250 km from Ahmedabad on

National Highway 8. It also has the distinction of being the only city in the country to have both the East-West and North-South Corridors of the Golden Quadrilateral Highway Project passing through it. Udaipur is well connected to the major cities of India by land, rail, and air. The city lies on the Golden Quadrilateral National Highway (NH-8), midway between Delhi and Mumbai.

b. Water resources

The Rajasthan state constitutes 10% of the country"s area, but is bestowed with only 1.17% of its water resources. Ground water table all over the state is going down3. Major water resources for the city are lakes; Udaipur is dependent on its lake system, which is directly or indirectly the life source of the city in terms of surface water resources, tourism, and the ecosystem at large. The Udaipur lake system comprises lakes Pichola, Rang Sagar, Fateh Sagar, Swaroop Sagar, Badi, Madar, and Udai Sagar. All the lakes form a chain in the saucer shaped Udaipur valley. The inner Girwa plain of Udaipur is surrounded by the western and central hill, and its water drains into the Ahar River. Important lakes of this basin are Badi, Fateh Sagar, Pichola, Rang Sagar, and Swaroop Sagar.

c. Demography

Udaipur has witnessed multifold development in the last two decades. The city is a famous tourist attraction, with approximately 15 to 18 thousand tourists visiting it daily and is often called as the "Venice of the East", as well as the “Lake City". The city has witnessed considerable population growth in the last four decades while acting as a magnet city for the surrounding region.

Demographic indicators for District and City

2011	District	Udaipur City
Urban Population Rajasthan	30,68,420	4,51,735
Sex Ratio	958	925
Literacy Rate	61.8	90.66
Density Person/sqkm	262	70

The 2011 census population of the “Walled City Area” is 1,03,670 persons. The population density in the “Walled City Area” varies from approximately 4900 to 8300 persons per Ha.

d. Economic profile

Udaipur city has a diversified economic base. The four pillars of the city’s economy are tourism, education, administration and trade, and commerce and industrial sectors. The city is host to several state and regional public offices. These include the offices of the Director of Mines and Geology, Commissioner of Excise, Commissioner of Tribal Area Development, Hindustan Zinc Limited,

and Rajasthan State Mines and Mineral Corporation Limited. Other district-level offices include the Collectorate, Public Works Department, Public Health and Engineering Department, and Office of Senior Town Planner.

The service sector has contributed more than 90% of the total workforce of the city. The major tertiary sector activities are trade, commerce, tourism / services, health and education.

2. EXISTING INFRASTRUCTURE AND SERVICES

UMC, UIT and PHED together provide basic infrastructure facilities to the Udaipur city. UMC is responsible for providing basic services such as sewerage and sanitation (up to a certain extent, mainly O&M), SWM, streetlights, roads, housing, and basic services in slum areas within UMC jurisdictions. Public Health Engineering Department (PHED) is responsible for planning, designing, construction, operation, and maintenance of the water supply system. The Urban Improvement Trust (UIT) is responsible for the provision of sewerage facility in UIT areas. There is an overlap in service provisioning by UMC, UIT, and other parastatals at different levels.

a. Water supply

Lakes are the major sources of water supply in Udaipur city. Initially, the water supply scheme was commissioned from Pichola Lake as a source in 1968. The water supply scheme from Fatehsagar Lake as a source was subsequently commissioned in the year 1970. Further, in 1976, the Pichola Lake water supply scheme was augmented. During 1987, Badi Lake was considered for augmentation of the water supply scheme for the city. During 1988, when there was a drought, an emergency scheme for water supply was prepared, considering Jaisamand as the source. This scheme was commissioned in the year 1995 and was designed for 21 MLD. The water supply schemes from Pichola and Fatehsagar lakes were further augmented in 1996.

Another scheme was taken into consideration as a result from dewatering of Jhamerkotra mines in the year of 1996. Thus water from tube wells of Jhamarkotra mines played considerable role in water supply in the city. Water from 8 tube wells of Kharbadiya mines were pumped to Purohito ki Madri.

The Mansi Wakal I project was initiated in 2000, which has been completed recently. The gross storage capacity of the dam is 24.37 million cum with 50% dependability. 23.35 MLD water supply started in the year 2007-08. The state government sanctioned the Dewas Stage II project in the year 2005. It involved construction of Akodra dam having a net storage capacity of 8.15 M.cum, Madri dam having a net storage capacity of 2.39 M.cum, a tunnel from Madri dam 1.33 km, and a tunnel from Akodra dam 11.05

km. The net storage of both dams with 90% dependability is 10.84 M.cum, which will assure availability of water for the whole year.

There are total 77,835 water connections in the city including “Walled city area”, which include connection provided to domestic (metered and flat), industrial, institutional, commercial, and govt. buildings. At present, consumer connection is provided with GI pipes. These connection pipes are old and have point of water contamination. Hence, these connections need to be replaced. Almost, 50 per cent connections need replacement.

In the walled city area the distribution system very old, resulting in water leakages and sudden breakdowns. Due to undulating topography of the city, there are many low-pressure points affecting the water supply pressure at consumer end. The storage facilities need augmentation. The water is supplied at 2 to 3 day intervals in dry season. The daily water supply should be ensures.

Indicator	**Benchmark**	**Service level(2012)**
Coverage of water supply connections	100%	79%
Per capita water availability at consumer end	135 lpcd	124 lpcd
Extent of metering	100%	99%
Extent of NRW	15%	Not available
Continuity of water supply	24*7 hours	Every two days
Efficiency in redressal of complaints	80%	70%
Adequacy of treatment and quality of water supplied	100%	99%
Cost recovery	100%	29%
Collection of water charges	90%	83%

b. Sewerage system

Sewerage and sanitation is one of the key areas of concern for UMC. The city lacks an organised sewerage system and treatment facility.

The total area covered by the underground sewerage network in the city is 23.5 km, and entire city is divided in to three sewer zones. Only 13% of the population is directly connected to the sewerage network. The sewerage system in the city is managed by UMC and UIT. In the year of 1976 to 1985, the first sewerage scheme was introduced by PHED for the walled city area, having a network length of 21.30 km and covering an area of 4.93 sq km. The diameter of the sewer pipe ranges between 150-800 mm. The

internal network diameter ranges from 150 to 300 mm, while the trunk and outfall sewer line diameter ranges from 400 to 800 mm. The outfall sewer is laid from Suraj Pole to Manwa Kheda.

The sewerage network collects wastewater from the following areas of the city:

a) Chand Pole area
b) Ganesh Ghati
c) Bhupal Wadi
d) Delhi Gate
e) Hathi Pole
f) Shivaji Nagar
g) Shakti Nagar
h) Ashok Nagar
i) Subhash Nagar
j) Hiran Magri

The second scheme was implemented by UIT in 2004-05 and was aimed at the rejuvenation of lakes in old city and laying of the sewerage network. Length of the same was 23.50 km, covering an area of 3.18 sq km with 5 sewage pumping stations. The sewerage system in the catchment area of lakes consists of 3500-m-long sewers of diameters 150-350 mm and covering a population of about 10,000 in Amba Mata, Brahmapol, Lalghat, Navghat, and Chand Pole area. Chand Pole and Amba Mata are regular sewage pumping stations and other three pumping stations at Gariya Devra, Nag Nagri, Ramdwara, Maharaja Ghat are manhole lift stations. sewage is pumped from the Chand pole sewage pumping station through a 300-mm-diameter pumping main up to Jhatwadi (ridge line) from where it is flowing to Hathi pole through 400 mm dia. gravity sewer. Sewers are laid along the eastern and western bank of Pichola Lake, for a length of 9.3 km and 11.50 km respectively and rest 2.6 km. The sewer in the peripheral areas has a length of about 8.50 km, which is presently being maintained by UMC. For remaining area of lake periphery and upcoming development thereafter, sewer lines of about 60 km length has been taken up as a new project under National Lake Conservation Plan by Government of India.

On 30th March 2014, a 20 MLD sewage treatment facility has been established by Hindustan Zinc Limited started functioning. The project has been implemented through PPP. It is a wastewater recycling plant. The Hindustan Zinc limited is using the treated water for its industrial utilisation.

Key issues pertaining to sewerage works are:

a) Absence of planned underground sewerage network in the city
b) Existing sewerage system in the old city area is defunct and needs refurbishment
c) Fragmentation of responsibilities between UMC, UIT and PHED
d) Technical and coordination issues in operation and maintenance of the existing system
e) Lack of technical staff at UMC for maintaining the sewerage system

f) As per PHED, no new sewerage connections are issued after year 2010.
g) PHED charges 33 per cent of water user charges as a sewerage charges however collection of the same is not transferred to UMC.
h) There is no citizen charter system been defined and implemented.

c. Traffic and Transportation system

Udaipur city has ring radial model with linear growth system along corridors. The road network system within the city center and in periphery of the city center has a curvilinear road network. The city is well connected by national and state highways. National Highway (NH) -76, NH-76A and NH-8 pass through the city. National Highway Authority of India and Ministry of Road and Transport are responsible for maintenance of NH. State PWD department is responsible for maintenance of the state highways and major district roads that pass through the city. Role of UMC is to maintain urban roads within the limits of Municipal Corporation.

The Electrical Department of UMC manages street lights in the city. There are 28,246 street lights in the city, over a road length of 1585 km. The average spacing between street light is 56.11 meter which exceeds the standard norm of 30 meter. 63 percent roads in the city don"t have any street lighting facility. There is a need for installing new street lights for adequate illumination on roads.

Major modes of transportation include shared auto taxi, mini buses operated by private transporters, RSRTC buses, auto rickshaws and private cars, two wheelers. Share of two wheelers is more among private vehicles like any other city in India.

Issues and Key Challenges

- Lack of parking space at commercial, institutional and tourist areas: Large number of parking lots is encroached by informal activities and is also being used as solid waste dumps. Commercial areas in high density zones of the city don’t have adequate parking facilities resulting in congestion in streets, thus adversely affecting through traffic.

- Absence of mass transportation: Lack of good and public transport system in the city. Mainly 3 modes namely private bus, auto rickshaws, and shared auto cater the needs of people. Mini buses run by private operators don’t have any fixed schedule and are not reliable. Shared autos have well defined spots for loading and off loading passengers and in order to maximize profit they usually carry more passenger than their capacity.

- Vehicle growth: Rapid growth of vehicles is observed in the city and in absence of good mass public transportation system, it has increased exponentially.

Project 1 : Rehabilitation of Existing Sewers and Laying of New Sewerage Network using Conventional And Trenchless Technologies And Other Associated Works In The Walled City Area

1. The Area based development (ABD) envisions retrofitting and redeveloping **sewerage system** of the "Walled City Area" as most of the sewerage network in Walled City Area has outlived its life and become dysfunctional and leaking, thus, causing pollution in the lakes and leading to unhygienic conditions.

Not complete Walled City Area has been covered by the sewerage network and therefore new sewer shall be laid using Trenchless Technology so as to cause minimum inconvenience to the local residents.

The components of redeveloped sewerage system shall include the following:

1. Sewerage Network length of about 83 Kms
2. 100% House Service Connections (Approximately 19,303 Houses shall be covered)
3. Sewage Pumping Stations equipped with SCADA system (8 Nos. existing SPS for rehabilitation and up gradation).
4. Manholes with leakage detection sensors
5. Pumping mains
6. Other works as per scope of work

2. SCOPE OF WORK: REHABILITATION OF EXISTING SEWERS AND LAYING OF NEW SEWERAGE NETWORK USING CONVENTION AND TRENCHLESS TECHNOLOGIES AND ASSOCIATED WORKS IN THE WALLED CITY AREA

<u>The Existing sewerage system in walled city area</u>

1. Constructed by PHED: Initially PHED introduced the sewerage system in the city and they constructed sewerage network for 84.2 Ha area in the walled city in the year year 1976 - 78. The total length of the network is 21.5 km and has approximately 5000 house service connections. The colonies or areas served by the PHED scheme are:

   "Chand Pol Area, Shivaji Nagar, Ganesh Ghati, Shakti nagar, Bhupal Wadi, Ashok Nagar, Delhi Gate, Subhash Nagar, Hathi Pol,Hiran Magri Sector-3".

   The size of pipes in the sewerage system ranges from 150 mm to 300 mm, the existing system is in highly degraded stage and therefore the sewerage system in this area is proposed to be rehabilitated / redeveloped.

2. Constructed by Urban Improvement Trust (UIT), Udaipur: The portion / area of the walled city, known as the UIT area, where the workable sewerage system does exists. UIT built sewerage system of 23.5 kms length for the areas around the lakes in the year 2002-04, to avoid untreated sewage being discharged in to the lakes. The sewerage network

built under this scheme covers peripheral areas of lake Pichola as well as internal areas like Delhi Gate, Chandpole, etc. Approximately 6000 house service connections are provided through this system. The size of sewer is 150 mm only and therefore frequent overflows are observed in the UIT area.

Proposal for sewerage system for the walled city

Seeing the present condition of existing sewerage network condition, USCL has taken up the project for improving the waste water collection system by rehabilitating and redeveloping of the sewerage network. The entire Walled City Area is proposed to be covered under ABD by providing well designed and efficient sewerage network. The layout pattern and zoning of sewerage system is guided by:

a. Topography and existing important physical feature.
b. Existing Drainage Pattern and availability of land for Lift station / SPS and other appurtenances.
c. Existing and proposed layout with regard to right of way, width of road, traffic densities of roads and streets.

For designing the sewerage system, the walled city area has been divided in to various sewerage zones (five zones) and these are numbered as 10, 23, 24, 26 and 27. The ward numbers covered under these five sewerage zones are 5, 9, 10, 11, 12, 13, 14, 15, 41, 42, 43, 44, 45, 46, 47, 48, 49 and 52 i.e., in all 17 wards are covered.

The project design year has been kept as year 2048. The present population (year 2016) is about 1,11,892 persons and the projected population for the year 20148 is anticipated as 1,70,909 persons.

The proposed sewerage system consisting of small size sewers of dia. 200mm are generally laid in slopes of 1 in 120-200. The slopes provided in sewers for size 250 mm to 400 mm are in range of 1 in 250 to 1 in 600, where as for large size sewers in sizes 500 to 800 mm slopes provided are in the range of 1 in 500 to 1 in 1200. Obviously, as the sewer laying progresses the depth of sewer gradually increases. The sewer lines consisting of laterals (200 mm diameters), collecting sewers (250 mm to 300mm) and intercepting sewers 350mm to 400mm are anticipated to be laid at a maximum invert depth of 3.90 meter.

Regarding the initial sewer laying depth, as per manual it is proposed to lay the lateral sewer line with the starting depth as 0.9M but at places where the area is 100% habited/ plinth level of the houses permits required slope for house service connection pipe, even shallower depths are proposed at starting stretches so as to avoid greater depths of main sewer in narrow streets.

The details of diameter wise length of sewers proposed for the walled city area

are as under:

Rehabilitation of existing sewers by Pipe Bursting / CIPP Technology

Dia	Existing Length	Proposed Length
150mm	37690	0
200mm	7269	42756
250mm	552	2203
300mm	0	552
Total Length	**45511 Mtr**	**45511 Mtr**
	45.51 Km	**45.51 Km**

Laying of new sewer line by Trenchless Technology and open cut excavation

Dia	Length
200mm	34772
250mm	41
300mm	910
400mm	917
500mm	1155
800mm	152 (open cut excavation)
Total Length	**37947 Mtr**
	37.95 Km

Sewer Dia (mm)	Number of Manholes proposed in various sewerage Zones of the walled city area					
	Zone-10	Zone-23	Zone-24	Zone-26	Zone-27	TOTAL
200	473	1590	1850	919	405	**5237**
250	20	33	57	44	-	**154**
300	66	7	-	-	1	**74**
350	16	5	6	-	-	**27**
400	-	-	19	-	-	**19**
500	8	-	50	-	-	**58**
800	-	-	3	-	-	**3**
Total	**583**	**1635**	**1985**	**963**	**406**	**5572**

Approximately 19,300 House sewer connections are to be made under the project using u-PVC pipes and by construction of road side inspection chambers.

Sewage Pumping Stations

In order to keep the sewer laying depths to feasible limits and at the same time to keep the sewerage system running and to achieve the basic purpose of conveying the waste water to its treatment point lift station / sewage pumping stations (SPS) are to be constructed as per the requirement and existing ones are to be rehabilitated / upgraded. In the walled city area there are existing 2 Nos. Lift Stations and 6 Nos. MWP stations. The waste water from these lift stations / SPS shall be pumped to the nearby trunk sewer gravity mains for onward transmission to Sewage Treatment Plant site.

Project components

The various project components are as under:

- CCTV survey, de-silting and cleaning of the sewers which are to be rehabilitated.
- Providing, laying & jointing of RCC NP4, DWC and HDPE sewer pipelines for lateral, branch and trunk mains as per design.
- Rehabilitation of existing sewers by Pipe Bursting / CIPP Technology & new sewer line by Trenchless Technology in Udaipur Walled City.
- Precast manholes are proposed.
- Providing, laying & jointing of 110 mm PVC-U pipe line for collection of sewage from each house building line to street manhole.
- Construction of sewage pumping stations of required capacity complete with Electrical, Mechanical and Instrumentation parts and associated rising / pumping mains.
- Other associated works like diversion and bypass arrangements for waste water flows during construction in stretches, safety, etc.
- Operation and maintenance of the entire sewerage network system for 10 years.

Project 2 : Rehabilitation, upgradation and construction of water distribution network and domestic 24x7 water supply across walled city of Udaipur.

1. Objective

The Area based development (ABD) envisions improving drinking water service delivery, in terms of reliability and quality, in the walled city area in an efficient and sustainable way and aligned to Government of India Benchmarks:

i) Enhance the per capita water supply from 115 lpcd to 135 lpcd,
ii) Improving the frequency of water supply from once in 48 hours to once in 24 hours and gradually convert to 24x7 water supply system, and
iii) Reduce and limit Non Revenue Water (NRW) to 15%.

2. Existing water supply system

At present, the city relies on surface as well as ground water sources for its daily water needs. The water supply system in the city is dependent on surface water to a large extent. Fatehsagar Lake, Pichola Lake, Jaisamand, and Mansi Wakal dam are the major sources of water for the city.

Details of withdrawal from various sources are given under:

S.No.	Name of the source	Normal Drawal (MLD)	Drawal in lean period (MLD)
1.	Pichola Lake (including the incoming flows from Dewas-I)	19.50	10.0
2.	Fatehsagar Lake	13.50	2.0
3.	Jaisamand Lake	21.65	21.0
4.	Badi Lake	-	4.0
5.	Mansi Wakal Dam (Stage-I)	24.07	23.35
6.	TWs in Jhamarkotra and Kanpur mines	10.60	10
	Total =	**89.32**	**70.35**

The present water supply scheme covers Udaipur city as well as seven peripheral villages (i.e. Bedla, Bargaon, Bhuvana, Sobhaggar, Saveenkhera, Saveenaand Govardhan villas). The existing average production from all sources is **70 MLD** against the **demand** of **86 MLD**. This needs to be augmented.

3. Existing Water Transmission and treatment facilities

The entire city is divided into total 9 transmission and distribution zones. There are 38 water supply Sub zones at present. These water supply zones are divided into

Division-1 and Division-2, based on the area coverage. More distribution zones need to be defined and developed for growing outer areas of the city. These transmission and distribution zones are as follows:

i) Doodh Talai water supply zone
ii) Mansi Wakal water supply zone
iii) Patel Circle water supply zone
iv) Jhamar kotra water supply zone
v) Teetardhi water supply zone
vi) Neemachmata water supply zone
vii) Gulab bagh water supply zone
viii) Fatehsagar water supply zone
ix) Kanpur water supply zone

Presently the water supply to walled city area is being covered by two transmission zones, namely, Doodh Talai and Gulab Bagh water supply zones.

A. Doodh Talai Zone

The water treatment capacity at Doodh Talai is 16.49 MLD. The Clear Water Reservoir (CWR) of capacity 3672 KL at Doodh Talai WTP complex provide water supply to the following:

i) CWR (LZ) at Gulab Bagh having storage capacity of 1362 KL,
ii) OHSR at Kanwarpada having storage capacity of 500 KL and staging of 8 meters,
iii) OHSR at Purohiton Ki Haveli having storage capacity of 350 KL and staging of 8 meters,
iv) OHSR at Town Hall having storage capacity of 500 KL and staging 18 meters, and
v) OHSR at M.B.College having storage capacity of 700 KL and staging 18 meters.

The distribution of water is done through gravity pipes of diameters varying from 600 mm to 150 mm. The total gravity distribution length is approximately 5 Kms. There is en-route / booster pumping station at K.P.School having pump capacities of 5.80 KW and Head = 35 m.

Brief details of the existing distribution zones are as follows:

i) Under Command Area of CWR at Doodh Talai

This sub zone consists of namely Jagdish Chawk, Raoji Ka Hata, Boharawadi and Kishan Pole. Water is being directly conveyed from CWR [Capacity 3672 KL] to these above stated areas. The brief status of distribution system is as below:

Kishan Pole Zone:

Material	Diameter mm	Total length in m	
		Upto 2003	After 2006
AC	80	4924	
	100	1784	
	150	1018	
	200	82	
	250	1264	
DI	100		1430
	150	806	411

This region has low rise hills towards the southwest direction. The distribution zone is sloping towards northeast with a level difference of 18m. The pressure in the existing distribution system varies from 12m to 25m.

ii) **Ganesh Gati**

This sub zone consists of Ganesh Gati. This area is being fed by two OHSR's located at Kanwarpada [Capacity 500 kl] & Purohit Ki Haveli [Capacity 350 KL] respectively. The brief status of distribution system is as below:

Kanwarpada Zone

Material	Dia. mm	Total length in m	
		Upto 2003	After 2006
AC	100	832	
	150	75	
	200	863	
DI	100		952.5
	150		334
	200		505

The population density of this region is high. The distribution reservoirs are located in the west in low rise hills and the distribution zone is sloping towards the east The pressure in distribution zone varies from 15m to 32m and high pressure areas namely wazir pade, sularpada requires curtailment in the pressure by throttling.

iii) Town Hall

The distribution zone has two sub-zones namely zone A and zone B and it mainly encompasses the commercial area of the city. The ground slopes are gentle towards east with a level difference of 4 or 5 m and the pressure distribution is more or less uniform.

This zone is being fed by OHSR located at Town Hall [Capacity 500 KL] & MB College [Capacity 700 KL] respectively. The brief status of distribution system is as below:

Town Hall: Zone A

Material	Dia. mm	Total length in m	
		Upto 2003	After 2006
AC	80	1120	
	100	100	
	225	450	
DI	100	100	1400
	150	1200	600
	200	200	
	250	750	
	300	300	

Town Hall: Zone B

Material	Dia. mm	Total length in m	
		Upto 2003	After 2006
AC	25	60	
	80	714	
	225	476	
DI	100		5390
	150		800
	200	140	700
	250	260	
	300	20	

iv) M B College

This M B College is a well developed area with comparatively medium population density. The pressure range varies from 16m to 26m in the distribution zone.

Material	Diameter mm	Total length in m	
		Up to 2003	After 2006
AC	80	4863	
	100	3596	
	150	835	
DI	100	1320	4771.5
	150	1120	1470
	200		865
	300		62

B. Gulab Bagh Zone

The source for this supply zone is Pichola Lake. Raw water is pumped to Gulab Bagh RGF WTP, having installed Capacity 6.81 mld, through 03 No of pumps, viz., **(i)** 187.5 lps, 60 m head **(ii)** 94.7 lps, 62 m head, and **(iii)** 61.4 lps, 61 m.

The raw water, after treatment is stored in the CWR of Capacity 1362 KL and from there supplied to HZ & LZ GLSR's of capacity 1362 KL & 1362 KL's respectively. The water supply from high level GLSR covers areas like Kishan Pole, Govt. Press Area, Khanjipeer, Shivaji Nagar, and Agrasen Nagar and the low level GLSR covers areas like Brahmapuri, Delhi Gate, Bapu Bazar, Shakti Nagar, Suraj Pole, Udai Pole and Shikh Colony.

The length of the pipeline network is more than 900 km, and that of the transmission main is approximately 250 km.

There are many of the pumps in 30 pumping stations need to be replaced as the pumps are running below the desired optimum efficiency. Pumps in 20 pumping stations don't have efficiency more than 60%. There is no record of „unaccounted-for water". As informed, the distribution loss will be around 20% of the water supplied. Water is supplied at an interval of 2 days. Brief details of the existing distribution system are as below:

Material	Diameter mm	Length in m	
		Up to 2003	After 2006
AC	80	285	
	100	1431	
	150	375	
	300	808	
	450	960	
DI	100		1309
	150		66
	200		159

4. Scope of work

The urban renewal of Walled City Area, under Area Based Development (ABD), envisions providing "24x7 Smart Water Supply Services" to the beneficiaries. The project aims to undertake three basic improvements to improve the reliability and quality of water supply in the walled city area aligned to Government of India (GoI) benchmarks, Viz., **(i)** enhancing the per capita water supply from 115lpcd to 135 lpcd, **(ii)** improving the frequency of water supply from once in 48 hours to once in 24 hours and gradually migrating to 24x7 system, and **(iii)** reducing Non Revenue Water from to 15%.

The scope includes the Performance Based Management contract for Smart Water Supply Services in the service area, NRW Reduction and Management Service, initial establishment of DMAs and system expansion and management improvement and unforeseen works. The key elements of the scope are the:

(i) Study, Assets Mapping and Design of the entire water supply system in the service area,
(ii) Establishment of District Meter Areas ("DMA Establishment Works") including the installation of new connections for new customers inside the contract area and providing customer meters for existing connections;
(iii) System rehabilitation and augmentation by improving the pipe networks and service pipes, valves, flow meters, chambers etc., SCADA system as necessary ("System Rehabilitation Works"); and
(iv) "NRW reduction and Management Services (Operation and Maintenance of water supply Systems, Active leakage control etc).

The major components of this project include the following:

a. New Intake at Doodh Talai,
b. Replacement of pumps at Doodh Talai,
c. Renovation of existing pump house at Doodh Talai with heritage look,
d. Increase capacity of existing WTP at Doodh Talai from 3 Mld module to 10 Mld,
e. Construction of new CWR at Doodh Talai for 13.64 MLD capacity,
f. New rising main from Doodh Talai to CWRs,
g. Proposed GLSRs 6 Nos,
h. Creation of appropriate DMAs (District metering areas),
i. Proposed new Over Head reservoirs 5 nos,
j. Distribution network pipeline replacement (60 Km),
k. Leak detection equipment,
l. Water quality monitoring lab,
m. Ultrasonic bulk flow meters, and
n. Replacement of valves.

4.1. Study, assets mapping and design

The scope of work includes (but not limited to):

- Topographical survey and customer door-to-door survey of the entire contract service area;
- Detailed site investigations, updating of distribution network drawings, complete with all trial holes that might be required to verify pipe connections (and the consequent re-instatement of road, sidewalk or any other surface);
- Detailed engineering design of DMAs with boundaries; locating of existing boundary valves, functioning and tightness checks of existing boundary

valves, identification of location for additional boundary valves to be installed, and identification of locations where the pipes will be disconnected and capped.

- Selection of location for DMA inflow chamber;
- Identification of customer service connections that have to be re-located from a trunk or distribution main outside the DMA (or in a neighboring DMA) to a distribution main inside the DMA.
- Site survey for DMA inflow chamber location and location of underground assets
- Detailed design of:
  - all pipelines that have to be laid
  - location and installation details of new boundaries valves
  - DMA inflow chamber, complete with bypass and valve arrangements, connection to main outside and inside the DMA, all pipework and structural design, pressure reducing valve specifications
  - Standard design and map with location of all customer connections to be relocated
  - All other civil, mechanical, installation or plumbing works that might be required
- Submission of the complete detailed design to the Project Manager for approval.

A comprehensive assessment report describing the results of the above study and assessment shall be submitted to the project manager.

4.2. Service Improvement Plan (SIP)

1. Based on the findings from the Comprehensive Assessment, the Service Improvement Plan for the activities to be carried out during the Rehabilitation Period shall be prepared.
2. The objectives of the activities presented in the SIP include but are not limited to the following:
   a. To achieve the desired NRW Targets stipulated in the Contract
   b. To ensure an effective program of non-revenue water control including active leakage control by applying continuous and vigilant monitoring, leak detection and good quality and long lasting leak repair techniques;
   c. To ensure establishment of robust, proven utility management systems and processes including standard operating procedures for ensuring sustainable NRW control including planning, timely decision making, attending to emergencies.

d. To establish management information system so as to enable a) monitoring work progress and performance; and b) overall collection and disclosure of data related to water supply services in the service area.

4.3. Intake, WTP and CWR's

The scope of work involves design, supply, erection, testing, commissioning and O&M of the Intake cum Jack well in lake Pichola, associated pumping machinery and rising main / valves, etc.

The raw water from lake Pichola shall be pumped to the New / Proposed Water Treatment Plant (WTP) at Doodh Talai water works. The scope includes design and sizing of the WTP units and clear water reservoir including supply to O&M. All E&M&I equipments shall be designed and complete automation of the plant shall be carried out. The treatment technology shall be decided based on Techno-Commercial and CPHEEO manual quality norms / criteria. Map showing indicative layout plan of the proposed WTP is attached for reference purposes only.

4.4. District Metering Area (DMA) establishment

DMAs shall be established in accordance with the best design practices prevailing in the industry and has to be based on detailed investigations. After the DMA is established, a baseline inflow and pressure measurement shall be carried out which will later be used to calculate the leakage reduction performance. After leakage in a DMA has been reduced and initial leakage reduction works are completed, the level of leakage in the DMA must be maintained, until the end of the completion of works / handing over of the project to USCL, not exceeding limits of 15% with some tolerance.

As per preliminary assessment, approximately 14 DMA's are expected to be formed / established for NRW reduction and management services.

The scope of work per DMA includes:

i. Detailed site investigation and updating of the distribution network drawing;

ii. Topographic survey of the walled city / service area and door to household survey of the existing and potential new customers;

iii. Detailed DMA design, including: connecting mains to be laid, boundaries valves, DMA inflow chamber, pressure reducing valve arrangement and specifications just to mention the most important activities; detailed design shall be submitted to the Project Manager for approval;

iv. Construction of inflow chamber, complete with the installation of all pipework, bypass, valves, flow meter and strainer and pressure reducing valve; including supply of all required pipes, materials, fittings and equipment, as per the specifications; note that PRVs shall be installed

even if they will not be commissioned yet because of low pressure problems.

v. Execution of all other civil, mechanical, installation or plumbing works, including supply of all required pipes, materials, fittings and equipment required for DMA establishment;

vi. supply and installation of dual channel pressure and flow data logger at the inflow point, setting up of data transfer to Contractor's office and Client's office (GSM data transfer); supply and installation of respective software

vii. Execution of zero-pressure-test and execution of all subsequent investigations and works should the first zero-pressure-test have failed until the test is successfully performed.

viii. commissioning of PRV and controller

ix. Installation of Automated Meter Reading (AMR) meters

x. Preparation of as-built drawings.

4.5. Distribution system design & rehabilitation works

System Rehabilitation Works include the rehabilitation of pipe networks, valves and connection service pipes as necessary, installation of service connections to new customers inside the DMA. This might also require extension of a distribution main and laying of new distribution network inside the DMA and construction of OHR's so that new customers can be connected in the most effective way. The new distribution network may also be required to improve the coverage.

Sequentially the scope of work includes (but is not limited to):

a) Laying of additional main pipes required to connect new customers; applicable should in a part of the DMA several new customers apply for connections but no main pipe exists in the respective street. The scope includes:

   - Supply and installation of HDPE, uPVC or Ductile Iron pipelines and all fittings, including connection to the network, including detailed design, sand bedding, testing and disinfection, re-instatement of road, sidewalk or any other surface.

b) Installation for additionally required valves inside the DMA that might be required when a pipeline is laid or when the number and location of existing valves is inappropriate for leakage location purposes (e.g. step-testing). The scope includes:

   - Detailed design, supply and installation of sluice valves, complete with connection to the existing distribution network, complete with all fittings and materials required, including re-instatement of road and sidewalk surface.

c) Installation of service connections for new customers to (previously) existing mains or to newly laid mains. The scope of the item includes:

Detailed design, supply and installation of customer service connections for new customers, from (and including) the pipe saddle to the point of customer meter installation, complete with all fittings and materials required, including re-instatement of road and sidewalk surface.

4.6. Installation of AMR meters

The scope covers Supply, Installation and maintenance of AMR water meters of various sizes (15 mm to 100 mm) including Software, Hand Held Unit for Reading AMR Meters, and Water Meter Box with Operation and Maintenance for a post – installation period of 7 (Seven) years.

General Requirements for AMR Water Meter System are as follows, these requirements should in no way affect the battery life throughout O&M Period.

1. The water meters shall have the anti – magnetic properties / immunity, as specified in ISO: 4064 – 2014, when tested with385 mTesla to 400 m Tesla magnet is mandatory. For AMR system resistivity against application of magnet is not required.
2. The remote reading of AMR water meter needs two way communications. The remote readings of AMR water meter should be obtainable by either 'Walk by' or 'Drive by' methods.
3. The AMR trans-receivers shall be wireless and have IP 68 protection class i.e. no ingress of water after submerging AMR water meter for 48 hours under 3 meters of water column. AMR shall be obtainable even under submerged conditions & lid of the chamber closed.
4. The AMR trans-receivers shall be used (RF End units/ Wireless RF transmitter/Receiver) for communication and remote reading. It shall be either inbuilt or directly fitted on the water meter without wires. If the water meter & AMR trans-receivers are independent units then they must be from the same manufacturer
5. Remote readings of different water meters shall be obtained with single command. The remote readings shall have instant reading facility. The remote readings and dial readings of water meters shall match at all the times.
6. All A MR readings shall show the date and time of the reading recorded.
7. The AMR system shall have facility to detect the reverse flow in water meters readings on the Hand Held Device (HHU) i.e. AMR reading device and on computer screen.
8. The AMR system shall have the facility to record the abnormalities like application of very high consumptions, water leakages etc. along with necessary alarms in HHU and in software
9. The battery life of AMR water meter shall not be less than 7 (seven) years from successful installation of said AMR water meter along with its AMR system, the

battery life shall be calculated by considering the monthly remote reading. During remote reading the battery life and alert for replacement of battery if warranted of AMR water meter shall be displayed / indicated on HHU.

10. If the AMR communication frequency is using / operating on paid frequency band, then the AMR water meter manufacturer has to produce the valid copy of license issued by Govt. of India / Deptt. of Telecom (DOT), for using the said operating frequency band.
11. The manufacturer shall specify the frequency of the AMR operating system & shall possess the necessary license of said operating frequency, as per norms of Department of telecommunication, Govt. Of India issued by Government of India (GOI) / Department of Telecom (DOT).
12. The AMR water meter shall not get affected for its AMR functioning due to High Tension or High Voltage line concentration.
13. All the time electronic index of the water meter shall match with mechanical index.
14. AMR system should be compatible for up gradation to fixed network if required in future.
15. The pressure loss in the meter shall not be more than 0.63 bar as per ISO 4060-2014.
16. The register must be based on absolute encoder / counter. The system must read the register in 8 points per pulse to have clear reading of the first dial.
17. Wireless RF transmitter/Receiver must be sealed, have an antenna, battery and must be integral part of the water meter register forming IP 68 protection.
18. All AMR water meter systems to be provide pipework, fittings, valves, fittings, specials another associates auxiliaries as per IS-779: 1994 & ISO 4064 standards
19. All AMR water meters and accessories shall be manufactured from materials of adequate strength and durability. The materials which come in contact with water shall not create a toxic hazard, shall not support microbiological growth and shall not give rise to unpleasant taste or De-chlorination to water.
20. All AMR water meters shall be supplied with a tubular strainer in the inlet of meter, the total area of holes not less than twice the area of nominal bore of the pipe.

4.7. NRW reduction and management services

In all DMAs that have been established under the Contract, the Contractor has to take all necessary action, provide all required services and materials and carry out all works required to achieve the objective of the contract and reduce leakage in the contract area.

The following (non-exhaustive) list summarizes the activities the Contractor is normally expected to carry out:

a) NRW reduction will be done inside the DMAs established under this contract. No NRW reduction works shall be carried out prior to the approval of Service Improvement Plan;
b) Leak detection surveys (using all kind of equipment and technologies, from simple sounding with a listening stick to leak noise correlators and leak noise loggers as appropriate);
c) Pressure management: stabilizing, managing and reducing average DMA pressure using PRVs and controllers and various techniques as appropriate; when doing pressure reduction, the Contractor has to ensure that all customers in the DMA are still sufficiently supplied. Level of minimum pressure will depend on the type of housing and the general availability of tanks. Pressure management has to be done in close co-operation with the customers in the DMA to reduce the risk of complaints. All required customer information has to be recorded and maintained;
d) Leak repair on mains shall be done by any appropriate methodology, for example by installing repair clamps or replacing pipe sections, all material supply, installation and road re-instatement works are included;
e) Replacement of leaking service connection: if a leak is found on any part of the service connection, the entire connection including the pipe saddle shall be replaced;
f) Leak detection surveys, repairs and pressure fine-tuning shall be repeated and/or shall continue until an acceptable level of leakage is achieved. The acceptable level of leakage might vary from one DMA to the other, and to decide at which point the effort for further leakage reductions becomes prohibitively high;
g) Continuous flow and pressure data logging, transfer to his and the Employers office by GSM technology, leakage modeling for all operational DMAs on a quarterly basis for the calculation of the performance payments.
h) When the operating conditions permit; undertake establishment of the Target Night Flow Level (TNFL) in m3/h after completion of all leakage reduction activities in a DMA and continuous monitoring of inflow, pressure and minimum night flow to become aware of new leaks; and
i) Repeating of leak detection and repair should the minimum night flow exceed the tolerance limits.
j) Detecting illegal connections: Should the illegal connections found in a DMA it shall be reported to the Employer.

4.8. Performance measurement and monitoring

Performance will be measured in volumetric terms - the Non-Revenue Water (NRW) in the DMAs measured in m3 per year. A baseline measurement, to be carried out after DMA establishment and installation of customer meters, will serve as the basis for the NRW assessment. Each baseline measurement shall be carried out in accordance with the procedure outlines below.

The baseline measurement

The measurement will be done using the QI - QM method: QI stands for DMA inflow and QM for the metered consumption in the DMA (based on meter reading of all customer meters). The procedure in detail:

1. Carry out a quarterly DMA inflow measurement. Flow meter data to be logged with an electronic pressure logger using 5 minutes logging intervals.
2. Calculate the cumulative DMA inflow in the quarter of measurement: Q_I (m^3/quarter).
3. During the same period, carry out DMA average pressure measurement, pressure data to be logged with an electronic pressure logger using 5 minutes logging intervals. In the case of small DMAs the inflow pressure is considered to be at a similar level than the average Zone or DMA or DMA pressure. In case of larger DMAs, the Project Manager might order the execution of a pressure measurement at the average pressure location of the DMA.
4. Calculate the average baseline pressure over the quarter period P_B (m)
5. Read all customer meters at the end of every month and assess the cumulative consumption during the entire quarter of the measurement.
6. Calculate the total metered consumption of all customers in the DMA during the quarter and calculate the NRW volume in cubic meters and the NRW level in percentage term for the quarter. In cases where the customer meter was inaccessible during the visit of the meter reader, use a three-month average of billed consumption to calculate the average daily consumption.
7. Calculate NRW volume during the quarter : $N_v = Q_I - Q_E$ (m^3/quarter);
8. Calculate NRW level during the quarter $N_p = 100*Nv/Q_I$

4.9. Training and transfer of technology

At least 12 months before the completion of contract the training and transfer of all technology of Employers staff shall commence in order to enable them to take over DMA management, maintenance of pressure reducing valves, leak detection scheduling and execution, leak repair management and all other activities required to manage the DMA system and maintain the reduced leakage levels.

As part of the transfer of technology activities the service provider shall jointly with the Employers staff develop a medium term asset management strategy that is based on the findings and experience made during the duration of the contract. Strategy development shall be based on updated maps and pipe condition information, detailed burst records and all other information the contractor has collected in the course of the project. All this detailed background information shall be submitted to the Employer, either as part of the continuous reporting or, any additional information, together with the asset management strategy.

4.10. SCADA system

Local SCADA system with control at Master Control Centre shall be provided. The minimum requirement of the system are:

a. **To** automate, supervise & control all the water distribution system
b. Supervisory control of all valves, flow meters etc
c. All the control functions and control parameters at ICP.
d. HMI for operator

Project 3 : Rehabilitation, Up-gradation and Construction of power distribution network and domestic connections across Walled City Area of Udaipur city

BRIEF DISCRIPTION OF WORK:

The work to be carried out is a part of smart city mission,The package consists of replacement of Existing overhead HT,LT dis-tribution system with underground HT,LT cabling and providing of RING MAIN UNITS(RMU) for ring circuits,The existing Pole mount-ed distribution substation has to be replaced with state or art compact packaged substations Dry type with respect to site re-quirements,LT feeder pillars and distribution feeder pillars to be installed at various places and end user (Consumer) to be con-nected from these distribution feeder pillars The implementation of SACADA SYSTEM to the power distribution reduces the manual labour costs and smooths the operation with minimising the oper-ations and as such the current distribution system must be con-figured with SCADA network for the intention to process and con-trol the system through Wireless SCADA system.

The scope of work - This Section contains the Scope of work, Specifications of work, supple-mentary information and Drawings of proposed works that describe the Works to be procured. The scope of work is as follows:

1. A Detailed survey of the Proposed area and routes.
2. Preparing Engineering drawings, field data based on surveys, operational manual, etc.
3. Complete manufacture, including vendor testing & supply of all materials / equipments from the approved vendor or from his manufacturing units.
4. Receipt, storage, preservation and conservation of all equipments at the site.
5. Pre-assembly, if any, erection, testing and commissioning of all the equipment.
6. Performing reliability tests and performance guarantee tests on completion of installation and commissioning of equipments.
7. Loading, unloading and transportation of material as required.
8. Installation of 11KV grade cable of 3Cx185 Sqmm screened Aluminium conductor, XLPE insulated and armoured in the permanent underground RCC DUCT to be constructed on the road on both sides. Installation of One no. Standby cable of above size in HT system. (Length approx 60 KM)
9. Installation of SCADA compatible, 11KV, 630 Amp. SF6 insulated RMU having Three/Four Nos. Motorized load break Isolators (SCADA compatible) at T- off point. (Qty. Approx 64 Nos)

10. Installation of SCADA compatible, 11KV, 630/200 Amp. SF6 insulated RMU having two nos motorized load break isolators, one no. T- off Vacuum Circuit Breaker (VCB) at T-off point for private transformer. (Qty. Approx 36 Nos)

11. Installation of a compact substation (CSS) of 11/0.433 KV, 315/500/630KVA at every 450 to 500 meters on the road (Qty Approx 150 Nos). Specifications of CSS are as under

    a. 11KV, 630/200 Amp. SF6 insulated RMU having two Nos motorised load break isolator and one no. T-off Vacuum Circuit Breaker for transformer protection having self-powered numerical relays.

    b. 315/500/630 KVA as per requirement, 11/0.433 KV, 3ph, dry type distrib-ution transformer.

    c. LT feeder control panel having MCCBs and metering module for incoming and outgoing and all allied accessories (one incoming and four nos outgoing circuits).

    d. Weather proof, internal arc tested enclosure having three compartments for housing above mentioned equipment.

12. CSS will be equipped with state of art SCADA system for achieving the below mentioned functions.

    a. Complete remote wireless ON/OFF operation of 11KV VCBs, Isolators and LT MCCBs from central control room.
    b. Receiving Fault alarms and fault resetting from remote wireless system in the central control room.
    c. Data acquisition through wireless system from relays, meters, and other field equipments by use of energy management software. Collation of the data in the server at the central control room and generation of necessary reports.
    d. Operational Anti theft system in the doors of feeder pillars to generate automatic SMS alert upon unauthorised tampering.
    e. Entire SCADA must be enabled for the OFC cable communication also.

13. Supply of the LT power output from the CSS to the various LT Feeder Pillars/Distribution feeder pillars placed approx. 50 to 60 meters apart along the road on the footpath.One CSS will consists of 4 -6 feeder pillars. (Qty approx 1500 nos).

14. Looping of the feeder pillars/Distribution feeder pillar with 3.5C *185 Sq. mm. Aluminium Conductor, XLPE insulated armored underground cables to be laid in the permanent RCC DUCT constructed on both sides of the road. Installation of one no. standby cable of above size in LT System.(Approx length 85 KM).

15. The Feeder pillar/Distribution feeder pillar will comprise of MCCB as incomer and 3-phase HRC fuse sets as the outgoings to the various consumers (End Users).

16. Installation of the 2/4 core, 4/6/10 Sq. mm, LT underground cable(Size of the cables determined as not to overload the distribution system) as the service cable to the individual consumers(End Users) along the road. Laying of these service cables in the permanent underground cable trench/duct along the road. Subsequent laying of the service cable from the nearest point on the trench to the consumer premises, inside the underground heavy duty PVC pipes beneath removable paver blocks/duct (Length approx 550 KM).

17. Construction of the RCC foundation for the compact package sub station (CSS), RMU, LT feeder pillars/Distibution feeder pillars etc.

18. Earthing of CSS, feeder pillars, cable tray by maintenance free chemical electrode earthing as per relevant IS code. 2 nos of chemical electrode earthing per CSS (Qty approx 2000 Nos).Earthing to be done as per relevant and latest IS CODES

19. Removal of the existing street lighting system and replacing with wall mounted street lighting system.The average LUX of “30” has to be main-tained on the service road and the wall mount light with carriage accessory of required LED Wattage has to be placed in such a way that the average 30 LUX on road should be maintained uniformly. (Qty Approx 2500 Nos)

20. Dismantling and refilling of existing 11KV and LT overhead lines, transformer, DP, pole service cable, street lighting system on these roads and returning the same without any damage to AVVNL stores under receipt from AVVNL (length approx 85 km)

NOTE:- The above works to be done as per specifications and relevant IS CODES.

Project 4 : Construction of Underground Utility Duct across Walled city area of Udaipur city

1. OBJECTIVE AND STUDY CONDUCTED

The Municipal Utility Services laid in the roads will be permanent in nature & one will be maintained only through designed and designated service duct(s) provisions and not by digging the road in decade to come. The ABD envisions undergrounding of overhead electrical lines and accommodating other utilities like water, OFC and Gas pipeline by constructing an underground duct. The underground duct is proposed to be constructed in the road right of way in the Walled City Area.

The total road length, as measured from the topographical survey drawings, comes out to 99 kms out of which 6.6 kms lies in the UIT area. The road width varies from 1.0 m to 15 m in the project area. Road width plays an important role in ascertaining the type of duct cross-section and, as well, also helps in deciding how many utilities (Priority wise: Power / OFC / Water / Gas) can be carried in the undergrounded duct in that stretch. There may be case; feasibility of construction permits only one or two utilities, say, Power and OFC, to be undergrounded through a “pipe duct” by HDD method and the remaining utilities water and Gas are buried directly under the ground. In such narrow lanes, it’s quite possible that Power and OFC continue to remain above the ground, water pipeline is directly buried under the ground and the Gas pipeline laying is excluded and the consumers are served through LPG cylinders.

Now, in case of stretches where the road width is more than 4 metres, it is possible to underground all the four utilities by laying composite RCC duct on one side of the road and having branch ducts crossing the road at pre-designed intervals to serve the consumers at other side of the road.

However, for all the stretches having road width exceeding 8 meters, techno feasible economical analysis should be carried out for two options: (1) Composite RCC duct on both sides of the road, and (2) Composite RCC duct on one side of the road and having branch ducts crossing the road at pre-designed intervals to serve the consumers at other side of the road. Ease of providing connections to the consumers on either side of the road should also be kept in mind while carrying out such analysis.

It is to be noted that in addition to these four utilities there will a sewer line in all the roads / lanes of the city, laid either at the centre / on one side of the road / both sides of the road for width more than 8 meters.

Based on the road width, an analysis was carried out and categorization of roads has been done and the same is presented below:

1.	0.5 m ≤ RW < 2.0 m	Lanes, CC / Tiles	43 Kms	**<u>Proposals:</u>** Water pipe directly buried; Power (LT) / OFC, if undergrounded, shall be carried through pipe duct if space permits; Gas pipeline not considered at this stage.
2.	2.0 m ≤ RW < 3.0 m	Mix of CC and Bituminous	22 Kms	Water pipe directly buried; Power (LT) / OFC, if undergrounded, shall be carried through pipe duct / trench, if space permits; Gas pipeline not considered at this stage.
3.	3.0 m ≤ RW < 4.0 m	Mainly Bituminous	14.5 Kms	Water pipe directly buried; Power (LT) / OFC shall be carried through pipe duct or RCC trench; Gas pipeline not considered at this stage.
4.	4.0 m ≤ RW < 5.0 m	Mainly Bituminous	7.4 Kms	**(1)** Water pipe directly buried; Power (HT/LT) / OFC shall be carried through pipe duct or RCC trench; Gas pipeline not considered at this stage - ***for roads up to 4.0 m*** wide; **(2)** Water / HT / LT carried in composite RCC duct along one side of the road with provision made for Gas - ***for roads more than 4.5 m*** wide. Duct branching off at regular intervals to reach consumers on the other side of the road.
5.	5.0 m ≤ RW < 8.0 m	Mainly Bituminous	7.5 Kms	Water / HT / LT carried in composite RCC duct along one side of the road with provision made for Gas. Duct branching off at regular intervals to reach consumers on the other side of the road.
6.	8.0 m ≤ RW ≤15.0 m	Mainly Bituminous	5.5 Kms	**Option-1: (**Water / HT / LT carried in composite RCC duct along one side of the road with provision made for Gas. Duct branching off

				at regular intervals to reach consumers on the other side of the road. **Option-2:** (Water/HT/LT carried in composite RCC duct along both sides of the road with provision made for Gas. No duct branching and crossing.

During the field surveys, it was found that many lanes / roads while branching off from the main road are 3 to 4 m wide but after covering a certain distance narrow down to 1 to 2 m before exiting on the main wider road. In all such cases the duct cross-section has to be decided on the basis of the minimum road / lane width of that particular stretch.

The basic aim is to underground the utilities like Power and OFC on maximum length of the road and accommodate them in appropriate type of duct section. The possibility of none of the utilities being undergrounded is not ruled out in sections where the road / lane width is not even 1.5 m, however, this shall be dealt on case to case basis at the time of construction.

Based on our understanding and studying the project area, two typical / indicative composite RCC duct cross-sections have been developed to accommodate desired number of utilities and are annexed with PIM. Approximate clear sectional dimensions i.e., width x depth of these ducts sections are 2.51' x 2.25' (for H+LT+Water+OFC+Gas) and 2.51' x 2.0' (for LT+Water+OFC+Gas) respectively. Pipe duct system shall be developed depending upon the sizing requirements and site conditions.

2. SCOPE OF WORK: CONSTRUCTION OF UNDERGROUND UTILITY DUCT FOR ACCOMODATING VARIOUS MUNICIPAL UTILITIES IN THE WALLED CITY AREA

Mainly, following works are required to be undertaken by the bidder during the construction of underground composite ducting system; however, this does not limit the liability of the bidder in taking up other works required for successful completion of the works:

a. Site surveys and soil investigations

b. Typical duct designs proposed for various road stretches with road width varying from 1.0 m to 15.0 m and clearly stating the number of utilities that can be accommodated in each type of design cross-section. The design shall include inspection chamber locations and terminal points for duct bifurcations and connections to the consumers.

c. Methodology for providing utility connections to houses / commercial

establishments / other entities.

d. Design Duct crossings at designated places for carrying utilities to other side of the road, if the proposal of laying duct on one side of the road has been adopted.

e. **Optional analysis**: Duct along one side of the road Vs both side of the road; in terms of cost, ease / difficulty in providing house service connections and O&M.

f. Equipments and their specifications for detecting smoke / fire / Gas inside the duct and their ICT compatibility.

g. ICT based monitoring system.

h. Mechanical Infrastructure for accommodating and supporting the utilities inside the duct.

i. Dewatering and cleaning mechanism for the duct. Convenience in maintenance / operation of the utilities as well as the duct.

j. Last mile connectivity with over earth structures

k. Method statement for construction and erection of duct.

l. Shifting of utilities safely and restoring / relocating the same.

m. Grading the excavated bottom for placing the duct.

n. Trenching, backfilling, and compacting

o. Road cutting and demolition of footpaths, road side drains, etc and restoring the same.

p. Plain / RCC structures: includes in-situ construction as well as prefabricated RCC panels, members, etc.

q. Supply, fabrication and erection of mechanical equipments like cable trays, MS angles, fittings, etc.

A design whereby duct is situated only on one side of the road shall be preferred. Construction of underground duct shall preferably be carried along one side of the road only for carrying the various types of utilities. It is also required to carry the utilities to the other side of the road for providing connections to the consumers and to achieve this purpose the main duct shall bifurcate / have branch ducts at certain intervals. These branch ducts locations shall be decided based on the electrical feeder pillars location, water supply distribution points and OFC connection points. The cross section of branch ducts may be same or different from that of the main duct cross section and shall depend upon the size & number of the utilities crossing the road like the size of water pipe may be smaller than the main pipe located in the main duct and / or the branch duct may not be carrying HT line and instead only LT line shall be required for crossing the roads.

The underground ducts shall maintain suitable separation from the sewer manhole walls. The Construction of the duct shall be done in such a manner so that minimum obstruction is caused to the moving traffic.

The bidder is required to submit a design philosophy and drawings based on his practical experiences gathered in the past on similar type of projects demonstrating that he has sufficient capability to design and execute underground ducting projects with special focus on providing connections to the intermediate terminal points for further distribution of services to the consumers.

Construction of the duct

i. The underground utility ducting system shall be constructed in compliance with the technical specifications and requirement of the scope of work and site conditions.

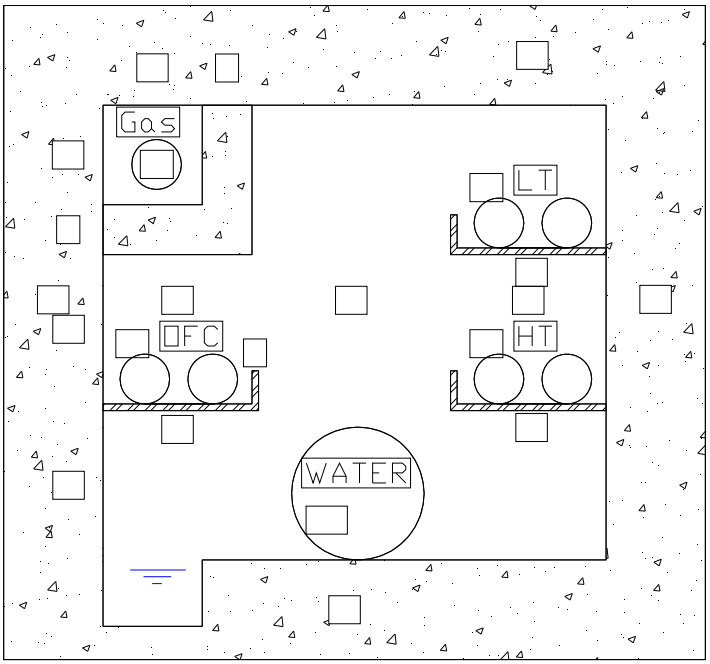
ii. Supply and installation of all materials necessary to construct and commission the underground ducting system as specified in the Standard Drawings and Plans.

iii. Proper Coordination should be there with PHED / USCL / AVNL / BSNL during installation of utilities in the underground duct.

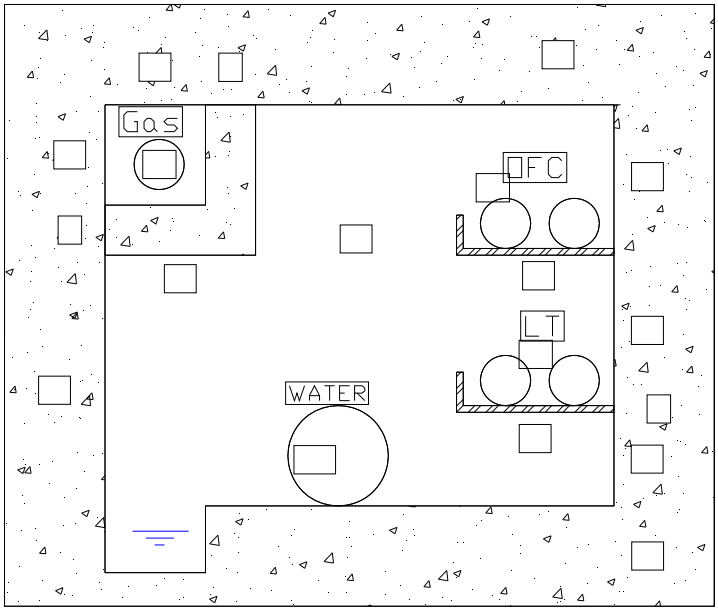
iv. After civil construction provide “as-built” information drawings to the USCL (hard & soft copy).

3. INDICATIVE CROSS SECTION DRAWINGS OF THE COMPOSITE RCC DUCT (REFER PAGE BELOW)

(a) Underground Duct Cross-section (typical)
accommodating Water, Gas, OFC, HT & LT cables.



(b) Underground Duct Cross-section (typical)
accommodating Water, Gas, OFC & LT cable.



Project 5 : Design and relaying of roads and road side storm water drains

1. OBJECTIVE

Roads perform certain basic functions in the built environment such as providing routes for vehicles and public transport, and accommodating utility services and drainage systems. The design of roads affects how successful it is in performing these functions, and it can also vitally affect the urban character of a neighbourhood and influence how people use the roads and interact with each other on it. Under the current project, the identified roads in Walled City Area have been taken up to the aspects of usable and friendly roads. It is proposed to undertake redesigning of the roads and side storm water drains, retrofitting of the footpath and roads, junction redesigning, etc amongst other improvements on the roads.

2. SCOPE OF WORK

The ABD envisions undergrounding of overhead electrical lines and accommodating other utilities like water, OFC and Gas pipeline by constructing an underground duct. The sewer line work shall also be simultaneously undertaken along with undergrounding of the utilities. It is anticipated that almost whole cross-section of the road shall have to be excavated except on those stretches where the works are being executed by trenchless method or stretches where the road width is more than 10 meters.

It is envisaged that around 81 Kms of the road shall be re-laid with Pavement Quality Concrete (PQC) and about 4 Kms will be surfaced with cobbled stones on the designated heritage walk routes. Along these road lengths, a section of about 1.0 wide shall be surfaced with Ferro cement covers to enable repair and maintenance of utilities accommodated inside the duct.

Since the whole cross-section of the road is required to be excavated, therefore, this provides an opportunity to consider redesigning the:

i. Road section and junctions,
ii. Extent to pedestrianism
iii. Road Furniture,
iv. Storm water road side drains.

Construction of road side drains shall be taken up along with road re-laying works. Road Construction technology involving use of Bio-degradable material shall be preferred.

As far as possible, guidelines prepared by the Government of India and statutory bodies such as Smart City Guidelines, National Disability Act, Hawkers & Vendors Act, National Urban Transport Policy, etc shall be followed.

These roads / streets will be designed by giving priority to pedestrians, will be disable friendly (in totality such that one should be able to demonstrate that a person on wheel chair would be able to move from one point – origin to the other point – destination on his own in the identified zone) thus achieving Universal Accessibility, making the neighbourhood cycle friendly, create designated spaces for Hawkers & Vendors as per the Central Government Act, provide for parking & incorporate Public Transport & a Shuttle service (Small open battery operated vans and e-rickshaws) so that Residents in the area could move in these thus avoiding the use of Private Vehicle for short distances of travel.

The Street will be designed & executed such that it is a place for Social interaction having appropriate Street Furniture (seating, dust bins, signage), Recreation Space, facilities such as a Modern Toilet, Information Kiosk, Wi Fi, appropriate Street Lighting, Public Art and could be compared to a Mall in open under the shade / canopy of trees.

Thus, to achieve this all the services below the surface Water supply, Storm Water, Sewerage, MSEB Cables, BSNL, Optical Fiber Cables, Gas Lines will be reorganised & relaid. The junction boxes on the streets of various utilities which are eyesores will be relocated & camouflaged / covered with aesthetically designed screens. It is expected that bidders who are showing interest for this work should understand the overall concept & spirit of this project and mobilize for delivering the highest quality of work from the overall execution to the last detail which will comply with vision of the Smart City Project.

Road Appurtenances

1) **Road marking signs**

   These shall include traffic signs, road markings, and safety barriers, pedestrian, railings, etc as per IRC: 35 and IRC: 67. Three types of road signs viz., mandatory / regulatory signs, cautionary / warning signs and informatory signs and their locations of signs shall conform to IRC: 67. The retro reflective sheeting shall be used on the signs. The colours shall be durable and uniform when seen in daylight or under normal headlights at night.

2) **Roadside drainage - storm water drains**

   The topography of the walled city area is undulating and accumulation of storm water does not take place in most of the project area and gravitates towards the lakes in the near vicinity. The storm water drain, design and construction shall be carried out in such a manner that the storm flows should ultimately find its way to the lakes / surface water bodies / rain water harvesting structures (existing / created). The design should ensure that storm water should not get mix with the sewage flows or Vice Versa.

3) Retrofitting of footpaths

The existing footpaths need to be retrofitted as per the design and drawings and providing user friendly and aesthetically appealing surface finish to the footpath along with Kerbs, shifting of utility boxes or camouflaging with signs and surfaces giving appealing looks.

4) Junction designing

The Junction design and related engineering countermeasures play a very important (but not only) role in the field of traffic safety. By creating a properly designed street junction, vehicle flow can be improved while simultaneously increasing pedestrian comfort and safety. Thus Junction redesigning becomes one of the important project for execution.

To achieve the above tasks, the following items are proposed to be undertaken in the project.

a) Footpath retrofitting with new kerb, new approved stamped concrete/paver block surfacing, parking spaces, provision of separate RCC type utility ducts.

b) Shifting and provision of new utility lines like water supply, sewer along with the chambers and electrical cables, feeder pillars, decorative street light poles etc.

c) Removal of the ramps, walls, compounds etc on the ROW of the road.

d) Provision of new RCC Storm water drains with RCC/ FRP heavy duty covers.

e) Provision of new ramps to access property, reconstruction of compound walls (wherever required) reconstruction of access steps to property etc.

f) Provision of cobbled finishes at junctions and other traffic calming elements like islands, raised pedestrian crossings, humps, rumble strips, sped breakers, etc.

g) Provisions of road crossing pipes and RCC duct at regular intervals and along the existing footpaths.

h) Relocation/ removal and reconstruction of existing small shops (to a scheme)

i) Construction of public lounge (public toilets)

j) Provision of Street furniture items (benches, sit outs, bollards, information kiosk, dustbins), Street Signage’s.

k) Provision of retaining walls along lakes / ponds abutting road formation.

5) Pavement

Proposed pavement shall be only of Rigid pavement type. Pavement design shall be as per IRC-58-2015 Guidelines for the design of Plain Jointed Rigid Pavements for Highways. Rigid pavement for new pavement or for widening and strengthening of the existing pavement shall be designed for a minimum design period of 30 years.