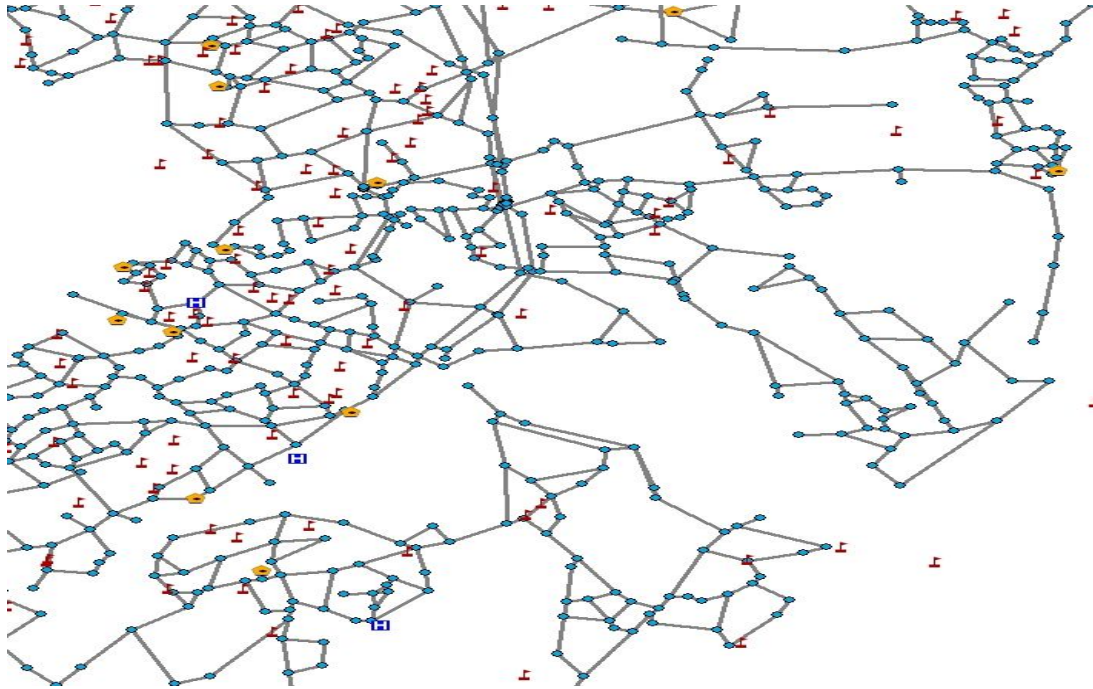


REPORT FOR AUDIT OF WATER SUPPLY SYSTEM OF MANDSAUR ALONG WITH SUITABLE MITIGATION PLAN

*(To be submitted under Reforms on Urban Services Improvement in Atal Mission
for Rejuvenation and Urban Transformation "AMRUT")*



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FOREWORD

With the growing population and reducing natural resources it is becoming challenge for the urban local bodies to provide and access to safe and potable water supply to every citizen. Having positive environment impact in the project area water supply system has to be designed with minimum obstruction to the natural resources by selecting the best source of water in the vicinity of project area.

It is the responsibility of respective urban local body to supply treated water at a desired rate and residual pressure is the responsibility of ULB. Accordingly, Municipal Council, Mandsaur intends to design and execute the water supply project with a horizon of 30 years. This report has been designed for supplying treated water @ 135 lpcd +15%UFW to the probable population of Mandsaurin next 30 years (i.e. 2047) which is estimated at 235500.

The water supply being made by the Municipal Council is being analysed for identification and auditing of losses in the operation and maintenance of water supply. The audit is being carried out primarily on following account,

- a) Losses in the Production and supply of water upto Storage reservoirs
- b) Losses in the storage and distribution of water upto consumer end
- c) Losses in the revenue of water supply
- d) Losses due to non-operation of electromechanical installation at desired efficiency resulting in excess power expenditure.

The above parameters are being analysed primarily to reduce the losses so as to keep them within permissible limits. This is also important for improvement of service deliverability alongwith financial health of ULB. In the light of water supply being executed under AMRUT this is an excellent opportunity to identify and take appropriate measures for the reduction in losses as described above.

As far as possible the data related to the operation and maintenance of existing water supply system has been taken from the Municipal Council. Any discrepancy may be brought immediately to the notice. Also the report is prepared for the approval and necessary action by the ULB and Govt. of Madhya Pradesh.

1.0 INTRODUCTION OF PROJECT AREA:-

Mandsaur is a city in the Malwa region and district of Madhya Pradesh state of central India. It is the administrative headquarters of Mandsaur District.

Origin of Name

The name Mandsaur evolved from Marhsaur, which originated from Marh and Saur (or Dasaur), two of the villages which merged in the town. The town was known as Dashapura in ancient times. The area was ruled by Dasharna people during Mahabharata period. It is probably Dasharna janapada which gave name Dashpur to the Mandsaur town. Some people also say that the name originated from Mandodri, wife of Ravana, as she was from this region. And the ancient name, dashpur, from dashanand, the other name of Ravana. This is so because in some places Ravana is worshiped.



Geography

The district has an area of 9,791 km². The district is part of the Malwa region, and is bounded by Neemuch District to the north, Rajasthan state to the east and west, and Ratlam District to the south. It is part of Ujjain Division.

Mandsaur District forms the northern projection of Madhya Pradesh from its western Division, i.e., Ujjain Commissioner's Division. It lies between the parallels of latitude 23° 45' 50" North and 25° 2' 55" North, and between the meridians of longitude 74° 42' 30" East and 75° 50' 20" East.

The district is an average-size district of Madhya Pradesh. It extends for about 142 km. from north to south and 124 km. from east to west.

Climate

The climate of this district is generally dry except in south-west monsoon. Year may be divided into four seasons. The cold season is from December to February. This is followed by the hot season from March to the middle of June. Thereafter the south-west monsoon season starts and continues up to about the middle of September.

The average annual rainfall in the District is 786.6 mm. The rainfall in the districts in the region round about Sitamau- Mandsaur- Malhargarh, and in general increases in the northern part of the district from the west towards the east. The heaviest rainfall in 24 hours recorded at any station in the district was 323.9 mm. at Garoth on 1945 June 29.

In the district there is rapid increase in temperatures after February. May is generally the hottest month with the mean daily maximum temperature at 39.80 °C and the mean daily minimum at 25.40 °C. Days are intensely hot in summer and hot dust-laden winds which blow during this season add to the discomfort. On individual days in the summer session and in June before the onset of the monsoon the day temperatures often go up above 45 °C. January is the coldest month, with the mean daily maximum temperature at 35.00 °C and mean daily minimum at 9.30 °C.

Industry

It is famous for large production of opium around the world. The slate pencil industry is the main industry of the district. Some parts of the district have also been proven by C-WET for establishment of wind farm. Now some wind farm industries has also been takes place in the district.

Divisions

The district is divided into four sub divisions and eight tehsils. The sub divisional headquarters are at Mandsaur, Malhargarh, Sitamau and Garoth. Where, Mandsaur, Malhargah, Garoth, Shamgarh, Dalauda, Bhanpura, Suwasra and Sitamau are eight tehsils of District.

Kindly verify the name of tehsils of Mandsaur after delimitation it has six tehsils and these are:-Mandsaur, Malhargarh, Sitmau, Suwasara+Shamgarh, Garoth+Bhanpura, Dalouda.

Vehicle number plates beginning with **MP-14** are identified as a registered vehicle under the properly followed rules and regulations.

Demographics

According to the 2011 census Mandsaur District has a population of 1,339,832, roughly equal to the nation of Mauritius or the US state of Maine. This gives it a ranking of 361st in India (out of a total of 640). The district has a population density of 242 inhabitants per square kilometer (630/sq m). Its population growth rate over the decade 2001-2011 was 13.19%. Mandsaur has a sex ratio of 966 females for every 1000 males, and a literacy rate of 72.75%.

Culture

Mandsaur is rich in archaeological and historical heritage But what makes it famous is the temple of Lord Pashupatinath located on the bank of Shivna. Its idol has parallel only in Nepal. The most common language is Malvi (Rajasthani and Hindi Mixed).

2.0 Existing water supply scenario:-

The water supply scheme of Mandsaur town was first introduced in 1936. Total installed capacity of the present water supply is almost 9.00 MLD. The inhabitants of the Town receive water at a maximum rate of 60 lpcd. Presently town is getting water mainly from Ramghat Barrage and Kalabhata Dam in Shivna River. Water from Kalabhata Dam is being discharged in Ramghat Barrage where raw water is being pumped from an Intake well to Water treatment plant. During the lean period (March - June) Municipal Council Mandsaur have to depend on underground water sources also for the water supply.

An intake well of 24 meter height and 10 meter diameter is constructed near Ramghat WTP in Shivna River at 1936. Apart from the existing water treatment plants of capacity 13.50 MLD a new treatment plant of capacity 15.75 MLD is proposed under on-going scheme of UIDSSMT.

Presently in Mandsaur seventeen Overhead Tanks are constructed or under construction with cumulative capacity 12950 KL, situated in different parts of town. A raw water pumping main of 600mm diameter and 200 meter is laid from Shivna River to TP at Ramghat. The detail of existing tanks is as follows:

Table 2.1 : Details of OHTs at Mandsaur.

S.No	Location	Capacity (KL)	Staging Ht. (m)
1.0	Ramghat SR	900	18
2.0	Ram Tekri	750	12
3.0	Sanjay Gandhi Udyan	900	18
4.0	Kityani	900	15
5.0	Dashrath Nagar	450	18
6.0	Balaganj	450	15
7.0	Janakpura	450	15
8.0	Gandhi Nagar	450	15
9.0	Meghdoot Nagar	450	15
10.0	Ridhyanand Nagar (500)	450	15
11.0	Abhinandan Nagar	450	18
12.0	New Abhinandan Nagar	450	18
13.0	Baser Colony	450	18
14.0	Kityani	1100	15
15.0	Narsinghpura	700	15
16.0	Kila	2600	15
17.0	Chandrapura	150	15
	Total	12950 KL	

The existing distribution system comprises of AC pipes having total length of approximately 80.00 Kms. The pipes are laid forty to fifty years back and not in good condition; hence it has been discarded in the proposed project.

In Mandsaur to upkeep the present water supply system there is only 15 numbers of unskilled labors/ valve man and 24 numbers of Skilled labors / operators are employed on contract or regular basis. After the implementation of the proposed project the prevailing employees shall be hired to the proposed project for the operation and maintenance of civil/pipe lines and hydraulic structures.

Apart from the above following works are being proposed in the ongoing project under UIDSSMT.

1. Intake structure alongwith Raw water pump house at Shivna River near Ramghat of 8 m diameter and 20 m height.
2. Raw water pumping main from intake structure at Ramghat on Shivna River to WTP comprising of DI-K9 600 mm diameter and 600 meter length.
3. Raw water conveyance gravity main from weir sluice at Sharvannallah to Ramghat Annicut of 600 mm diameter and 1300 meter length.
4. Water treatment plant at Ramghat water works site of capacity 15.75 MLD.
5. Clear water pumping mains/ feeder mains from Existing and Proposed WTP to different storage reservoirs of 23000m length having diameter 200 mm to 450 mm.
6. Following Overhead service reservoirs will be constructed in proposed augmentation:-
 - a. At Kityani of capacity 1100 KL with 15 m staging
 - b. At Narsingpura of capacity 700 KL with 15 m staging
 - c. At Kila of capacity 2600 KL with 15 m staging
 - d. At Chandrapura of capacity 150 KL with 15m staging
7. Pumping machinery at Intake Well and WTP
 - a. At existing intake well- 3 nos Vertical turbine pumps of capacity 57 HP each of 86 lps and 30m head.
 - b. At proposed intake well- 3 nos Vertical turbine pumps of capacity 67 HP each of 100 lps and 30m head.
 - c. At existing WTP - 3 nos Horizontal Centrifugal pumps of capacity 96 HP each of 100 lps and 50m head.
 - d. At proposed WTP- 3 nos Horizontal Centrifugal pumps of capacity 156 HP each of 100 lps and 570m head.
8. Electrical substation of 2 nos 500 KVA each at intake well and WTP
9. House Service connections to all connections in base year 2015.
10. Distribution system of 173.78 Km.

3.0 Population Forecasting

The population of the Mandsaur city for the past two decades is as follows,

Year	Population
1951	34541
1961	41870
1971	56988
1981	77603
1991	95758
2001	116505
2011	141667

The design population for the next 30 years has been forecasted as per the guidelines detailed out in CPHEEO manual on water supply & treatment taking into account the growth of population of past decades as looking to factors governing the future growth and development of the Mandsaur city like industrial, commercial, educational, social and administrative aspects, it is felt that the most suitable method for population projection will be Incremental Increase method.

Thus the probable population of Mandsaur in next 30 years has been estimated as below,

	Year	Population
	2017	154100
1 st Phase	2032	190800
2 nd Phase	2047	235500

4.0 Proposed Project

As per the proposed augmentation project, it is proposed to augment the capacity of existing Mandsaur water supply so as to suit the drinking water needs of the probable population of Mandsaur for next 30 years taking net supply rate as 135 lpcd. The population of Mandsaur for next 30 years (upto 2047) i.e., taking 2 year as execution period and 30 years as service period has been estimated as 235500 i.e., design population. Taking 135 lpcd as per capita demand, the net water requirement shall be 31.80 MLD. After accounting for 15% Transmission and Treatment losses, the raw water required shall be 37.45 MLD. It has three intake points on Shivna River and the water drawl is as follows:-

S.No.	Name of the Location	Capacity in Mcum	Capacity in MLD
1.0	Ram Ghat	0.40 Mcum	1.10 MLD
2.0	Kalabhata	3.96 Mcum	10.85 MLD
3.0	Khambar	0.283 Mcum	0.77 MLD
	Total	4.64 Mcum	12.72 MLD

From the above, the total storage capacity of existing sources is 4.64 Mcum. Assuming 30 % losses on account of seepage, evaporation and pilferage, the assured available quantity is 3.25 Mcum. From this the maximum water which can be supplied shall be 9.00 MLD. Thus there is a requirement of additional 28.45 MLD. So this project has been designed to augmenting the capacity of source of water upto 37.45 MLD to ensure the availability of water to the town @ 135 lpcd for next 30 years. The capacity of the scheme is 28.45 MLD. Chambal River has been adopted as source of water. The scheme shall incorporate the following components:-

a) Intake well and Raw water pumping station

Construction of intake well having diameter of 8.00 meters and height of 35.0 meters for drawl of 28.45 MLD raw water from Chambal River.

Supply and installation of 3 nos. 340 KW pumps along with all necessary electrical installation for drawl and pumping of 21.30 MLD raw water from Intake well to Treatment plant having 50% standby capacity. The Pump capacity is

being worked out taking into consideration the Stage I requirement of water quantity i.e., next 15 years requirement.

The details of pumps and motor is as follows:-

RAW WATER PUMP HOUSE

- i) Location : Chambal River
- ii) Capacity : 21.30 MLD
- iii) Total Discharge : 269 lps
- iv) Pumps : 3 Nos. 340.00 KW/180 m/455 HP/1220 KVA

(b) Raw water Pumping main

Providing, laying & jointing 600 mm diameter DI K-9 pipe from Intake well at Chambal River to existing Treatment plant at Ramghat having 53000.00 meters length for conveying 28.45 MLD raw water up to the design period.

In Stage II, i.e., after 15 years following works shall be carried out,

i) Supplying and installation of Raw water pumps for pumping of 28.45 MLD raw water from Chambal River to existing Treatment plant.

- a) Three nos. pumps of 579.00 KW having discharge of 359 lps and pumping head of 230.00 m with two working and one stand-by there-by providing 50% stand-by capacity.
- b) Each pumps shall have motor of 776.00 HP
- c) Step down transformer of 33KV/3.3 – 2080.00 KVA.

5.0 Water Auditing

The audit is being carried out in 3 parts namely,

a) Water Supply :

- a. Losses in the Production and supply of water upto Storage reservoirs : The present water production from all the sources is 29.25 MLD. This water is being conveyed upto water treatment plant via raw water pumping main. After Treatment the water is being pumped upto Mandsaur via Clear water feeder main comprising of 200 – 450 mm DI K-9 pipe 23000 m long. The pipe is in good condition and no leakages are being reported during operation and maintenance of water supply. The storage capacity of 17 nos. OHTs is 12950 KL. The water is supplied daily. There is no measuring device in water supply system. The losses are being tabulated in Table 1 which are approximately 30%.

Mitigation Measures in AMRUT

In order to reduce the losses upto 15% for the treatment and transmission of water it is proposed under AMRUT,

- i. to provide Bulk Flow meters in the Rising and Feeder mains at the in-flow and out-flow of Intake well, Water treatment plant and OHTs to measure the flow of water.
 - ii. To provide PLC SCADA for monitoring the Flow and pressure of water from Intake upto start of DMAs so as to immediately identify any leakages in the system and making good the same as soon as possible.
- b. Losses in the distribution of water from OHTs upto consumer end: There is no metering at the consumer end. The insufficient coverage of piped water supply system results in non-equitable water supply with inadequate pressure. In order to reduce the losses of Non-Revenue Water (NRW) upto 15% in the distribution of water it is proposed under AMRUT,
 - i. Apart from the existing 173780 m distribution network which is laid recently, it is proposed to provide piped water supply to 100% of the Municipal area by providing and laying of 110 mm to 355 mm HDPE, PE 100 PN 6 & 350 mm DI K-7 class pipe having total length of 25496 meters for distribution of water. The proposed strengthening of network is being designed for equitable water distribution @ 135 lpcd on minimum residual head of 7 m at 24 x 7 basis.

- ii. Provide water connections to each house holds. The town is having total number of households 28916 which shall be connected with piped water supply under UIDSSMT scheme. Municipal Council intend to reduce the number of Public Stand Post to the minimum (10-15) which shall also be metered.
- iii. Municipal Council, Mandsaur shall installed 28916 meters in UIDSSMT, to have accurate information of water supplied to the domestic water meters AMR compatible.

b) Losses in the revenue of water supply

Presently, there is no metering at the consumer end. The water is being supplied and billed to the consumer on approximation and lumpsum basis. Water is being supplied on alternate days, 1 hour each. However, there is no accurate information available on account of quantity of water supplied. The quantity of water supplied has been assessed @ 750 litres per connection of ½ inches for one hour.

The poor water supply distribution, inadequate information of quantity of water supplied and unavailability of dedicated man-power results in poor efficiency of revenue realization on account of water supply.

Mitigation Measures in AMRUT

Under AMRUT Municipal Council, Mandsoaur proposes,

- i. to install AMR compatible domestic water meters in all the water connections. The water tariff shall be as per the production cost of water. The production cost of water at the time of commissioning of water supply system after the works under AMRUT are completed is being worked out as Rs 4.38/KLL and accordingly Domestic rate of Rs 6.0/KLL and Non- Domestic rate of Rs 30.0/KLL is being proposed to be levied.
- ii. The operation and maintenance of water supply shall be done on contractual basis which will facilitate the Municipal Council to have dedicated staff for printing and delivering the Bills.
- iii. The Smart Metering shall help in collection /realization of bills by sending messages on registered mobile number and keeping record of Bill realization and arrears.

c) Losses due to non-operation of electromechanical installation at desired efficiency resulting in excess power expenditure.

Presently, Municipal Council is not keeping any record for the efficiency of motor and pumps. The water produced and supplied is being measured on a lumpsum basis and the consumption of power is being paid as per actual.

Mitigation Measures in AMRUT

- i. With the provision of PLC-SCADA alongwith Bulk flow meters from Intake to start of DMAs the exact information of water produced and supplied shall be available. The actual power consumption alongwith the power consumption as per the optimum efficiency of motor and pumps has been worked out (See Table 2). Municipal Council shall take suitable measures for achieving the optimum efficiency of existing motor and pumps by ensuring power supply 24 hours at desired frequency and voltage.
- ii. Also the operation and maintenance of entire water supply is proposed to be done by private operators who shall ensure running of motor and pumps at desired optimum efficiency of 70 – 75% for raw water and 75% - 80% or clear water pumping. The provisions of operation manual of CPHEEO shall be followed for operating and maintaining the pumps and pump-houses.