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"Studies On Water Supply Distribution System of Mungeli Town (C.G)"

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Abstract : **Water is essential for the existence of life on earth. Also the quality of water used by living beings is equally important. Therefore, in order to ensure the availability of sufficient quantity of good quality water, it is necessary to plan and build suitable water supply schemes for the town, existing water supply system in Mungeli town is not sufficient to fulfill the water demand of the residents of the town for day to day use. Once the project is completed and in use, the town shall benefit in the following ways- Sufficient quantity and good quality water for drinking, cooking, washing, cleaning etc. shall be available to the residents of the town, Water shall be available for sanitation purposes, which shall decrease the diseases and so boost overall health conditions in the community, Water shall be available for plants and gardens which shall help reduce the environmental pollution and increase the beauty of the town, Easy availability of water shall attract small and medium scale businesses and hence increase the economic growth of the town.**

Index Terms **–Water, Intake well, Raw Water Rising Main, Clear water Rising Main, Water Treatment Plant, Elevated Service Reservoir, Water supply Distribution network.**

I. INTRODUCTION

1.1 BACKGROUND

Municipal governments and other institutions in India, responsible for providing civic services are facing an acute shortage of capacity and resources, not with standing the Constitution (seventy-fourth) Amendment Act, 1992 on Municipalities.

With the foundation of the Republic of India in 1950, and consequent to reorganization of states. It was geographically the largest state until 2000. In 2000, the Chhattisgarh region was carved out to create a new state; even then it is the second largest state after Rajasthan. It covers 9.5% of the area (308,000 Sq. Km) and houses 6 per cent of the country's population (72.5 million).

These challenges place considerable pressure on municipal corporations which lack sufficient capacity to implement many of the investment programs according to plan. The heightened economic activities in urban areas create employment opportunities, education, health facilities and other social infrastructures; it attracts distressed rural population to cities. The growth of employment in urban areas is not accompanied by corresponding rise in the availability of urban amenities particularly housing stock compel them to live in slums, without adequate access to health or sanitation.

1.2 NEED OF THE PROJECT

Keeping in view the acute drinking water scarcity in the towns of Chhattisgarh, Urban Administration & Development Department, intends to execute a comprehensive and systematic Water Supply Scheme for the towns.

To achieve 100 % population coverage and ensure access to safe, adequate and equitable drinking water supply for all.

"It is essential to improve the existing service level of drinking water supply system for better health and living standard of residents by providing them potable and safe drinking water up to their doorstep for Ultimate estimated population of the respective Town till the year 2050.

With regards to the existing water supply system analysis which is catering the present water supply need of the town, there is the necessity for some new proposals and augmentation mainly Source and of some existing water supply components so that the demand for the town can be fulfilled for another 30 years (2050) of life span from the project implementing year consider as 2020. Under this program, towns have been identified for implementing (i) augmentation of the surface water source (intake and water treatment plant) as required. (ii) Up grading the existing inadequate distribution networks and expansion of the distribution system into un-served areas and (iii) optimization of present systems including reducing non-revenue water by regularizing unauthorized connections and stopping leakages.

1.3 SCOPE OF THE PROJECT

The scope of this project of preparation of water supply schemes includes

I) Problem Identification and development of source (surface source and/or ground water source or combined source Surface + Ground water)-The National Commission for Integrated Water Resources Development has made an assessment of the total freshwater resources of the country. The entire country has been divided into 24 major river basins and the water resource including the utilisable water has been estimated for each. The total catchment area is 3287260 km2, with 1952.87 km3/ yr. water resource, and 690.32 km3/ yr utilizable surface water. The Central Groundwater Board has estimated the dynamic fresh groundwater resources of the country as being 432 km3 per year of which 396 km3 is estimated to be utilizable. The annual utilisable water from surface and ground resources are (690 km3 and 396 km3) estimated to be 1086 km3 as against a total annual availability of 1953 km3. The increasing population along with the associated developmental activity has played havoc with freshwater sources the world over and India is no exception. The estimated utilizable freshwater resources of the country - both surface and groundwater put together - are 1086 km3 and are expected to be able to meet the demands up to the year 2050.

II) Provision of treatment units- Water treatment is the process of removing all those substances, whether biological, chemical or physical, that are potentially harmful in water supply for human and domestic use. This treatment helps to produce water that is safe, palatable, clear, colourless and odourless. Water also needs to be non-corrosive, meaning it will not cause damage to pipework. In urban areas, many people live close together and they all need water. This creates a demand for large volumes of safe water to be supplied reliably and consistently, and this demand is growing. As urban populations increase, there is a need to find new sources to meet the growing demand. If groundwater is available this can often be used with minimal treatment but any surface water source will need to be treated to make it safe. For towns and cities, the water supply is then best provided by large mechanized water treatment plants that draw water from a large river or reservoir, using pumps.

1.4 KEY STAGES OF THE PROJECT

For preparation of Detailed Project Report of water supply scheme,

- ✓ Reconnaissance survey, general plan and feasibility report.
- ✓ Detailed survey
- ✓ Preparation of plans and designs
- ✓ Cost estimation as per CG PHE/ PWD SOR

1.5 GENERAL PHYSICAL FEATURE

It has hot dry climate. It is Hot in summer. Mungeli summer highest day temperature is in between 29 °C to 45 °C .

TEMPERATURE

Average temperatures of January is 20 °C , February is 22 °C , March is 26 °C , April is 31 °C , May is 35 °C . Avg. Max. Temp of the town is 46.0 °C and avg. Min. Temp is around

TOPOGRAPHY

Mungeli is located at 22.07°N 81.68°E. It has an average elevation of 288 meters. (944 feet).

RAINFALL

The annual rainfall of Mungeli town is around 1157.1 mm. But general rainfall of a town is around 1478.0

DEMOGRAPHY

There are 21 wards in the town. The ward wise population distribution for the year 2011 is shown in the following table.

Table No. 1(Census population of the Town**)**

S.no.	Year	Population
1	1971	17097
2	1981	21245
2	1991	26340
3	2001	31613
4	2011	36450

Source: Census of India

Table No. 2- (Ward wise population)

Ward No.	Population as per 2011 Census	Ward No.	Population as per 2011 Census	Ward No.	Population as per 2011 Census
Ward No-1	1249	Ward No-8	1694	Ward No-15	1314
Ward No-2	1161	Ward No-9	1104	Ward No-16	949
Ward No-3	1533	Ward No-10	1287	Ward No-17	1921
Ward No-4	1338	Ward No-11	1018	Ward No-18	1678
Ward No-5	1412	Ward No-12	1698	Ward No-19	1859
Ward No-6	1720	Ward No-13	2403	Ward No-20	1677
Ward No-7	958	Ward No-14	1518	Ward No-21	1759
Total				**36450**	

II. OBJECTIVE FOR THE PROJECT

The objective of the Water Supply Improvement program is to provide an adequate and metered drinking water supply to all urban households by improvement and expansion of municipal infrastructure and services: related to water supply. The objective under water supply scheme is to cover entire town (including new/upcoming areas, up grading areas ,slums etc.) with 100% sustainable drinking water supply facilities.

The overall objective of the project is to improve existing service level of drinking water supply system. Habitants, who are living in unhygienic area, harm their health by drinking unsafe unwholesome water from locally constructed open storage facility. Hence, it is utmost and quite essential to improve their health and living standards by providing them potable and safe drinking water to their doorstep.

The main objectives of water distribution are as follows:

(1) To supply safe and adequate quantity of water to the consumers.

(2) To make water available within easy reach of the consumers so as to encourage the general cleanliness.

(3) To supply water equitably to the consumers with sufficient pressure so as to discharge the water at the desired location within the premises.

(4) To cunduct survey for water distribution.

(5) To analysis data of existing and proposed water supply system in which included source to distribution.

(6) To minimise the gap after calculation.

III. METHODOLOGY- A water supply project generally consists of a water collection unit, conveyance system, and units for treatment, purification, and distribution. It is necessary to plan, prepare, and design the entire water supply scheme before constructing the units. A proper plan will ensure that an efficient and economical system is finalized with minimum expenses. The scheme should be such that it can be constructed within the allotted budget while permitting future expansion. Following are the methods given below-

3.1. POPULATION DEMAND FORECAST- For population forecasting all five methods is adopted for Mungeli town

i. Arithmetical Progression method
ii. Geometrical progression method
iii. Incremental Increase method
iv. Graphical method
v. Geometrical Increase method.

Table No. 3.1. (All method for population forecast)

Sr.No.	Method/Year	2018	2018	2020	2035	2035	Unit
1.)	Arithmetical Progression method	36450	39837	40804	48062	55319	Souls
2.)	Geometrical progression method	36450	41544	43126	57078	75544	Souls
3.)	Incremental Increase method	36450	39974	41002	49001	57517	Souls
4.)	Graphical method	36450	58000	60000	65000	75000	Souls
5.)	Geometrical Increase method	36450	41627	43237	57470	76389	Souls
	AVERAGE POPULATION IN THE YEAR OF ALL FIVE METHOD WILL BE AS UNDER POPULATION	**36450**	**44197**	**45634**	**55323**	**67954**	**Souls**

While comparing forecasted population by different method, average population of all five methods is adopted for Mungeli town.

3.2. CALCULATION OF WATER DEMAND – Projected water demand (mld) (135lpcd +15% ufw)

Projected population and water demand of the town is shown below in table.

Table No. 3.2. (Projected population and water demand)

PROJECTED POPULATION (SOULS)				
Year	**2018**	**2020**	**2035**	**2050**
Mungeli Population	**44197**	**45634**	**55323**	**67954**
PROJECTED WATER DEMAND (MLD) (135LPCD +15% UFW)				
Year	**2018**	**2020**	**2035**	**2050**
Mungeli MLD	**7.02**	**7.25**	**8.79**	**10.79**

3.3. WATER TREATMENT PROCESS- Water treatment is the process of removing all those substances, whether biological, chemical, or physical, that are potentially harmful to the water supply for human and domestic use. This treatment helps to produce water that is safe, palatable, clear, colorless, and odorless. Water also needs to be non-corrosive, meaning it will not cause damage to pipework.

Following are the treatment process

i. Screening. ii. Aeration. iii. Coagulation and Flocculation. iv. Sedimentation. v. Filtration

vi. Chlorination. vii. Supplementary Treatment.

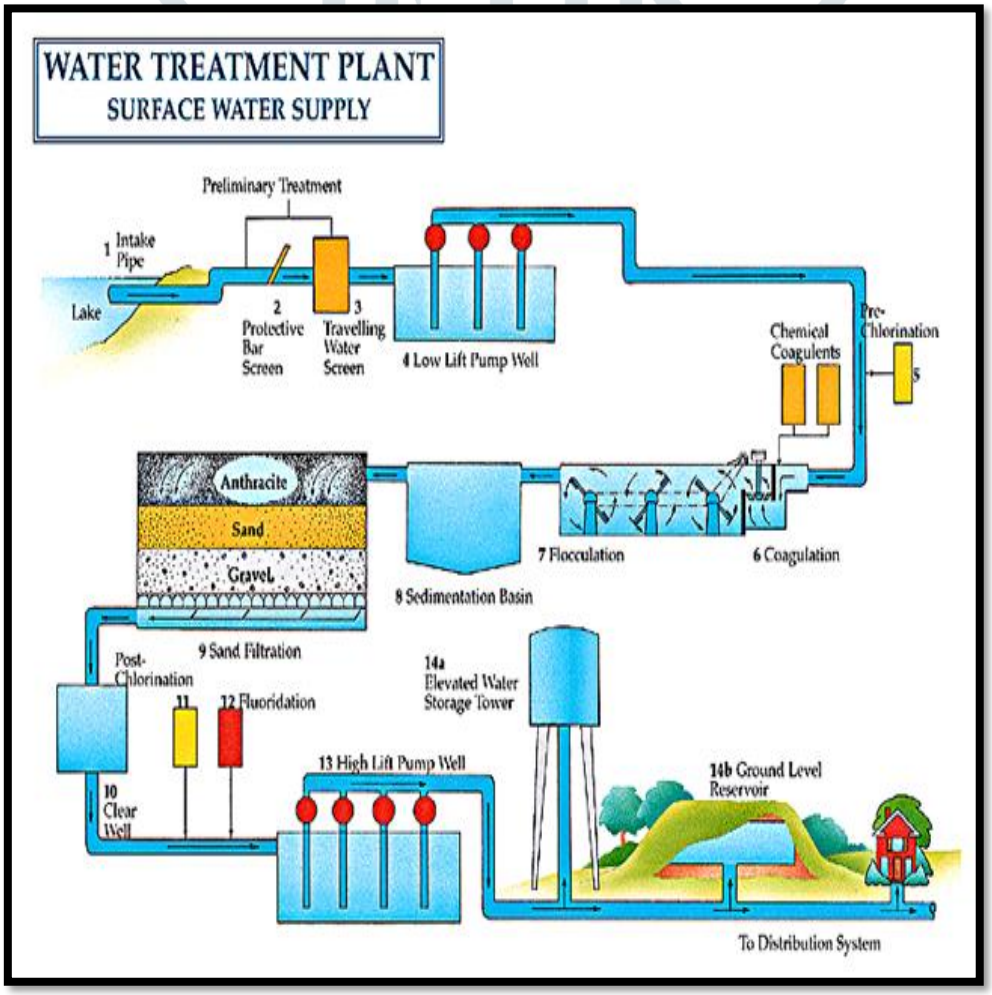

Figure No. 3.3. (Operations and processes of water treatment)

IV. SURVEY DATA ANALYSIS AND RESULTS

These water supply scheme of mungeli projects will improve the quality of life for families. They will reduce the daily burden of water collection that falls on women and children. The incidence of water related disease will decline The Project area of Mungeli town is 930 hectares excluding water bodies**.** It is proposed to lay down distribution network pipes covering whole municipal area by dividing it into appropriate zones.Table no. 3.6. (Survey data analysis)

Sr. No.	Description	Details
1	Name of Urban Local Body (ULB)	Nagar Palika Parishad, Mungeli District: Mungeli
2	Rate of Water Supply (lpcd)	Water supply (CPHEEO standards): 135 lpcd + Additional 15% UFW (23.82) = 158.82 lpcd
3	Project Cost	2510.42 Lacs
4	**Design Period in Year:** Immediate Stage Intermediate Stage Ultimate Stage	 2020 2035 2050
5	**Design Population in Soul:** Immediate Stage Intermediate Stage Ultimate Stage	 45634 55323 67954
6	**Water Demand in MLD: @135 LPCD + 15% UFW** Immediate Stage Intermediate Stage Ultimate Stage	 7.25 8.79 10.79
7	Source	**EXISTING:** Total 14 nos of Tube Wells with 150 mm dia. And 90m to 110 m depth **PROPOSED:** Agar River passing @ 12 km away from town. Anicut was constructed on river in Dindori village.This river is considered as a surface source. Intake well (with pump house) will be proposed at bank of Agar river.
8	Raw Water Pumps	**EXISTING:** Existing raw water pumps are at existing bore wells. Details of this pumps given as below. **Location** / **HP** / **Nos** At 990 KL ESR-1 bore wells: 7.5 HP (3), 5.5 HP (4) At 385 KL ESR-2 bore wells: 10 HP (1), 5 HP (1) At 567 KL ESR-3 bore wells: 10 HP (2), 7.5 HP (1), 5 HP (2) **PROPOSED:** 3(2W+1S) VT pump at intake well of 61 HP , head 54 m and discharge 58.24 LPS
9	Raw Water Rising Main	**EXISTING:** 50 mm GI pipe of total length 480 m. 100 mm ACP pipe of length 200 m

<table>
<tr><th>Sr. No.</th><th>Description</th><th>Details</th></tr>
<tr><td></td><td></td><td>200 mm ACP pipe of length 400 m
Total length of existing pipe line is 1080m.
PROPOSED:
Raw water rising main of 400 mm dia DI K-9 of total length 11355m</td></tr>
<tr><td>10</td><td>Water Treatment Plants</td><td>EXISTING:
Existing WTP is in town but that is not in working condition.
PROPOSED:
WTP is proposed of capacity 9.0 MLD</td></tr>
<tr><td>11</td><td>Clear Water Pumps</td><td>EXISTING:
2 nos of 25 HP at CWS of ESR-1, ESR-2 directly filled by tube well , 2 nos of 20 HP at CWS of ESR-3
PROPOSED:
3(2W+1S) HSCF pump at CWS of WTP of 41 HP , head 35 m and discharge 55.47 LPS</td></tr>
<tr><td>12</td><td>Clear Water Rising Main</td><td>EXISTING:
80 mm CI pipe from CWS-1 to ESR-1 of total length 20 m
200 mm dia DI K-9 from CWS-3 to ESR-3 of total length 864 m
50 mm GI pipe from bore wells to ESR-2 of total length 50m
PROPOSED:
100 mm dia DI K-9 of length 835m
150 mm dia DI K-9 of length 735m
200 mm dia DI K-9 of length 965m
250 mm dia DI K-9 of length 3640m
300 mm dia DI K-9 of length 90m
400 mm dia DI K-9 of length 1210m
Clear water rising main of total length 7475 m</td></tr>
<tr><td>13</td><td>Elevated Service Reservoir</td><td>EXISTING:
Detail of existing ESRs are as given below.
<table><tr><th>Ward</th><th>Capacity</th><th>Height</th></tr><tr><td>Zone-3 (Ward-13)</td><td>990 KL</td><td>15 m</td></tr><tr><td>Zone-4 (Ward-17)</td><td>385 KL</td><td>15 m</td></tr><tr><td>(Ward-14)</td><td>567 KL</td><td>need to be dismented</td></tr><tr><td>Zone-1</td><td>100 KL</td><td>12 m</td></tr></table>PROPOSED:
Detail of propose ESR is given below.
<table><tr><th>Ward</th><th>Capacity</th><th>Height</th></tr><tr><td>Zone-2 (Ward-08)</td><td>950 KL</td><td>15 m</td></tr><tr><td>Zone-4 (Ward-14)</td><td>600 KL</td><td>15 m</td></tr><tr><td>Zone-6 (Ward-21)</td><td>500 KL</td><td>15 m</td></tr></table></td></tr>
<tr><td>14</td><td>Distribution Network</td><td>Existing:
<table><tr><th>Dia (mm)</th><th>Length (m)</th></tr><tr><td>CI</td><td></td></tr><tr><td>250</td><td>1560.00</td></tr><tr><td>Total</td><td>1560 m</td></tr><tr><td>DI K7</td><td></td></tr></table></td></tr>
</table>

Sr. No.	Description	Details
		100 15879.11 150 3476.94 200 1208.15 250 105.84 300 388.9 350 258.48 **Total DI K-7 21317.42 m** **Total length 22877.42 m** **Proposed:** Proposed distribution network detail is given as below. **Dia (mm) Length (m)** **DI K7** 100 36243 150 5171 200 9088 250 1000 300 441 350 378 400 324 450 140 **Total 52785** Hence, from existing distribution network of CI & DI K-7 18271m length of network used in proposed scheme.
15	Cost Per Capita	Year Cost (Rs) Census (2011) 6887.00 Base (2020) 5501.00 Intermediate (2035) 4538.00 Ultimate (2050) 3694.00
16	Cost Per Ha.	Total Area Village 930 Ha. Total Project Cost 2510.42 Lacs Cost Per Hectare 2.7 Lacs
17	Cost Per Km.	Total length in KM 52.79 Km Total Project Cost Lacs. 2510.42 Lacs Cost Per KM 47.56 Lacs

V. CONCLUSIONS

Water is essential for the existence of life on earth. Also the quality of water used by living beings is equally important. Therefore, in order to ensure the availability of sufficient quantity of good quality water, it is necessary to plan and build suitable water supply schemes for the town. Existing water supply system in Mungeli town is not sufficient to fulfill the water demand of the residents of the town for day to day use. Once the project is completed and in use, the town shall benefit in the following ways.

- Sufficient quantity and good quality water for drinking, cooking, washing, cleaning etc. shall be available to the residents of the town.
- Water shall be available for sanitation purposes, which shall decrease the diseases and so boost overall health conditions in the community.
- Water shall be available for plants and gardens which shall help reduce the environmental pollution and increase the beauty of the town.
- Easy availability of water shall attract small and medium scale businesses and hence increase the economic growth of the town.

- When reviewing the new water supply scheme in the town, it is understood that the new water supply scheme is more efficient than the previous water supply scheme.
- According to 100 people ,The efficiency of the new water supply scheme is 90%
- The new water supply scheme has increased the amount of water.
- Due to the water supply scheme, water is coming to the town in one day.
- The Storage capacity of new water supply scheme is more than previous water supply scheme.

VI. Future Scope of Work

- For the similar township in the city as well as other locations in our country, this method and technology can be adopted.
- As the pollution level is increased in the future, the design of the treatment system can be expanded as per requirement.
- The design period of water carriage system is 30 years and Operation unit is 15-20 years. After that, the system can be replaced easily.
- It is the one of the largest project in our city, it can be model for similar and other projects.
- These technologies are easy for the installation and operation purpose with less Maintenance.
- Local people will get benefited in terms of their local amenities.
- Use of Modern Technology for better efficiency and efficacy, the new technology needs to be opted which results into reduction in cost and saving of land area.
- This method can be very important from economical point of view as well as efficiency of this method is very high.

VII. Acknowledgment

I would like to express my profound sense of deepest gratitude to my supervisor Dr. Vaishali Pendse, Associate Professor in the Department of Chemical Engineering, Raipur Institute of Technology, Raipur for the guidance, valuable support and the cooperation for providing necessary facilities and sources during project work.

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