

Emergency Water Supply Scheme for Ujjain City

S. S. RAGHUVANSHI*, Dr. T. A. SIHORWALA** and
S. K. SHRIVASTAVA***

274

85 EM

1. INTRODUCTION

Ujjain in Madhya Pradesh (population : 3.25 lacs) receives water supply from two rivers namely Kshipra and Gambhir having independent Treatment plants on both the sources. In a normal year, water supply of 50 MLD is required for the city, 27 MLD from Kshipra river and 23 MLD from Gambhir river. Due to erratic behaviour of rainfall in the year 1984, the required storage could not be built up. Further, post-monsoon flow could not be prolonged. This caused severe scarcity of drinking water in the City.

As a remedial measure supply from distant irrigation sources had to be brought which involved construction of Treatment works, conveyance system and pumping arrangement. The entire arrangement had to be completed in a record period of 28 days. In this remarkable feat of engineering, the entire staff of P.H. Dept. worked non-stop all round the clock, till the completion of the work. In this paper, the authors have narrated the details of the actual works carried out under the "SAHEB-KHEDI Emergency Water Supply Scheme".

2. WATER SCARCITY AND PLANNING

The city of Ujjain (population 3.25 lacs) receives water supply partly from

*Project Engineer, Project Circle Gambhir, PHED, Indore.

**Reader in Civil Engg, Deptt., S.G.S.I.T.S., Indore.

***Executive Engineer, PH Main, Division, PHED, Ujjain.

Written discussion on this paper invited before 15th November 1985.

rivers Kshipra and Gambhir, and partly from irrigation tanks. Rainy season of year 1984 recorded rainfall of about 100 Cms. in a duration of just 55 rainy days. The month-to-month rainfall figures are shown in Table 1.

Remaining days were practically dry. This resulted in failure of post monsoon recharge in the rivers. Malwa plateau has very shallow rivers underlain by impervious strata and also with exposed black cotton soil and as a result natural recharge of ground water source is poor. These water resources declined in the post monsoon season whereas eight months storage was needed to suffice till 30th June 1985. Winter rains came to rescue in previous years which had not supplemented storage during this year. Therefore strategy to combat drinking water scarcity had to be planned right from October 1984 month. To meet contingencies of water shortage plan of action comprised the following:

1. Imposing ban on withdrawing of storage water for irrigation.
2. Rationing of water supply.
3. Replenishing the existing storages from new potential in the catchments.
4. Harnessing ground water.
5. Optimising existing resources for flexibility of a water grid.
6. Conservation of water by systematic management of distribution system.

All above modes of resource management were adopted simultaneously to meet the challenge of drinking water

TABLE 1: RAINFALL DATA OF MONSOON OF 1984 FOR UJJAIN CITY

Month	Rainfall	Percentage
June 1984	Nil	Nil
July 1984	17.53 Cms.	17.4%
August 1984	81.085 Cms.	80.4%
September 1984	2.20 Cms.	2.2%
October 1984	Nil	Nil
November 1984	Nil	Nil
	100.815 Cms.	

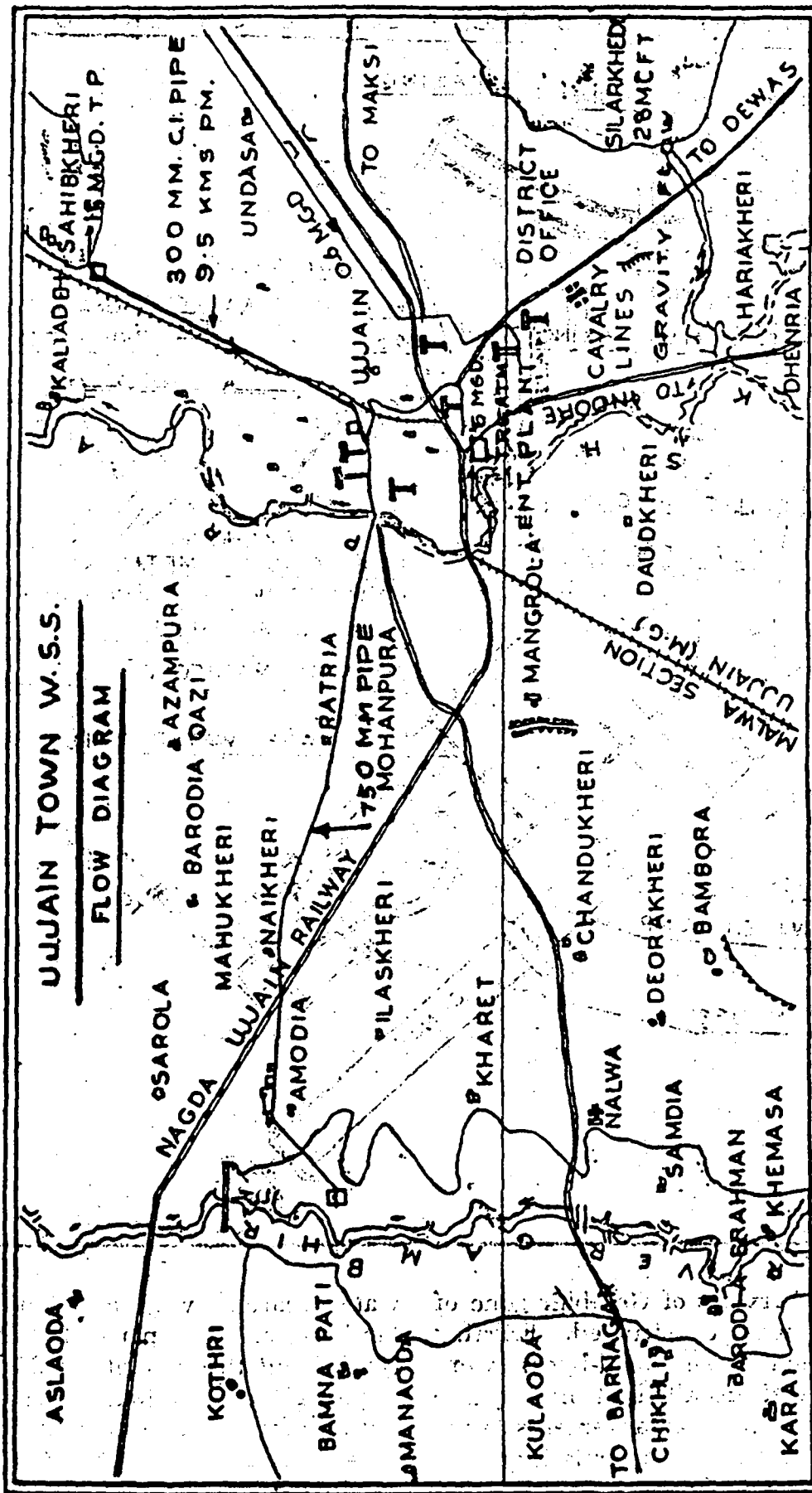
scarcity in Ujjain city. In order to pursue the inter departmental matters, help of District Administration, Revenue authorities and Administrative set-up of the department was sought. Watch over capacities of existing resources was kept and daily draw off from storage were plotted, position was monitored and information transmitted daily to Control Room. Contacts with Meteorological centres were made for any possibility of winter rains, but these could not be confirmed. At one point in March 1985, the situation was such that there was a water supply of only one month available in Gambhir river, which suggested alternative mode of supply to its zone on war-footing. Assembly and Lok Sabha elections were in the offing, which created re-awareness to the problem of water supply.

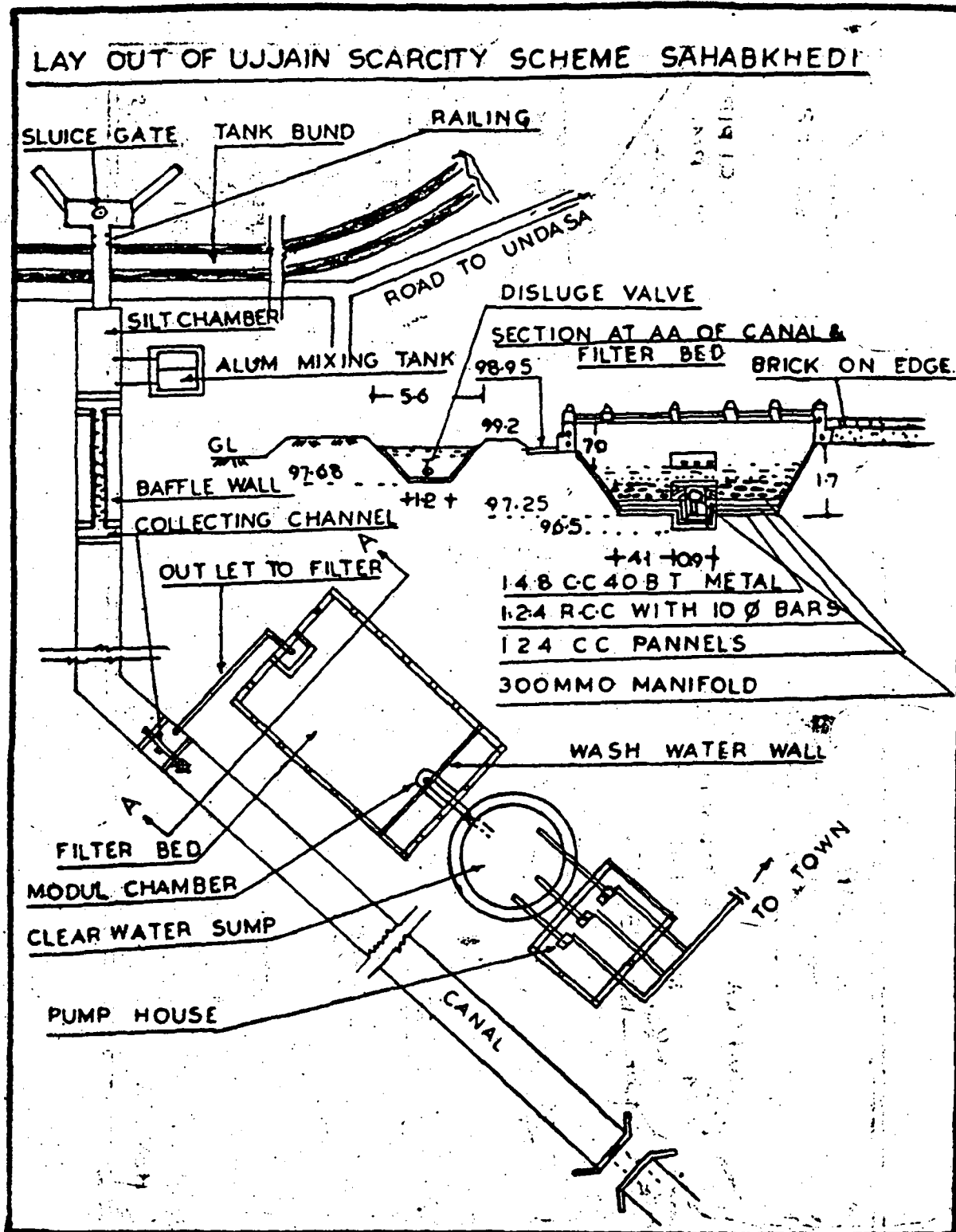
After Elections, water from a Silar-khedi irrigation tank was syphoned out and transferred into Kshipra river. Thus, only 50% of available quantity could be utilised.

Diversion of 27.24 lacs litres of water per day was also made by 50% overloading of Treatment plants at Undasa meant for Industrial water supply of Ujjain. This was achieved by adjusting the filter media and flow controllers and by over pumping into the system. The difficulties of distribution main (for being utilised as a feeder main) were sort-

ed out by operation of numerous valves in the supply periods. A sump and pumping arrangement were provided at the tail end of the distribution main and pumping was carried out to new zone of Rishinagar.

The period at the disposal of the department for observing codal formalities was very inadequate and hence situation was being reminded telegraphically from time to time to the Administrative set-ups. The department had to be geared up to "water war". Emergency scheme for drawing water from Sahebkhedi tank, 9.5 KMs away from Ujjain town, was planned. The net work of existing pipelines in city was tested, inter-connections were done in order to use them as a feeder main for supplying water to the deficit zone receiving water from Gambhir river. 300 mm dia. C.I. Pipe line laid along Gambhir profile in 1968, was dismantled, and simultaneously laying of these pipes from new source of Sahebkhedi tank to the city of Ujjain was started. Bottom of Canal of Irrigation department had to be modified as it was to be utilised as Settling tank with alum dosing arrangement. A medium rate non-conventional filter was constructed having under-drainage system and pumped back washing system. A sump and pump house with temporary structure were constructed. Similarly, a sump-cum-pumping station in the





vicinity of reservoirs of Gambhir zone of distribution was constructed. Existing pumps (which were stand-byes) were dismantled and installed at new pump house. The entire arrangements were completed, tested and commissioned in a record period of 28 days on 4th April 1985. This arrangement relieved drinking

water scarcity with a potential of 68.0 lac litres of water per day. The job was carried out throughout for 24 hrs. working for 28 days and had to be started without any formality of inauguration. Simultaneously, administrative meetings were conducted for implementation of scheme for conservation of water by minimising

distribution losses in intermittent (one time) supply. Consequently department saved nearly 305.0 million litres of water. This saving could further be released to public in the peak summer after 22nd May⁶ by maintaining two time supplies. The cost of Sahebkhedi emergency water supply scheme was only Rs. 32.00 lacs for entire work. The details of different aspects of scheme are discussed below:

The officials responsible for execution of the Sahebkhedi project worked day and night and even in one case the officer-in-charge was hospitalised with severe illness. This did not give any set back to the programming of the Emergency Scheme. All ground water resources of 119 wells and 64 tube wells were energised and relief to the isolated areas was given through transportation of water.

A proposal to provide permanent storage structure on Gambhir river is being considered separately.

3. DETAILS OF SAHEBKHEDI EMERGENCY WATER SUPPLY SCHEME

3.1 Conveyance line: Removing the old pipe-line and re-laying along new alignment:

There was an old pipeline of 15 KMs length, laid underground which was not in operation. This pipeline was dismantled departmentally on war footing. Meanwhile the tenders for construction of filter bed, clear water sump well, pump house and canal lining were invited.

The construction work of all above units was started on 8th March 1985. The work of laying of dismantled pipe-line was started departmentally.

3.2 Canal modified to serve as a settling tank:

Looking to the emergency aspects, a length of 200 metres of existing canal was selected for use as a settling tank. Its bottom was therefore lined with flag-stones. Detention period of 1½ hours only was provided. At inlet of canal opening, a baffle wall of length of 10 Mtrs was constructed for flash mixing and flocculation, supply then passed on to settling zone in the canal.

3.3 Filter Unit:

A filter unit to filter 6.80 MLD of water was constructed near the canal 1.5 metres below the ground level, so that water can be taken into sump by gravity and pumping could be avoided. The filter box is a medium rate non conventional unit. A pumped back wash arrangement was provided. A central manifold was 300 mm dia., with 40 mm dia. G. I. Pipe laterals and staggered orifices. Filtered water from manifold was connected to clear water pump. The back washing of filter is done with the help of the pump. The average area of filter is 104.0 Sqm, the rate of filtration 2740 litres/Sqm/Hr., and 6.8 MLD discharge.

3.4 Clear water sump:

A clear water sump-well (capacity of 25 minutes, i.e. 1,12,500 litres) 6 Mts.dia. and 4 Mts. depth below G.L. was constructed near the outlet of filter plant in which the filtered water is being collected.

3.5 Pump House:

A pump house of 7 M x 4 M was constructed for housing the pumping machineries.

3.6 Pumping sets:

Old pumping sets, which were in operative at the Gambhir water supply

TABLE 2: CHARACTERISTICS OF WATER SAMPLE OF SAHEBKHEDI TREATMENT PLANT

S. No.	Characteristics	Units	Permissible limits	Raw water	Settled water	Clear water
1.	Turbidity	Silica Scale	5.0	8.5	2.8	2.8
2.	Colour	Platinum Cobalt. Scale.	5.0	Nil	Nil	Nil
3.	Taste & Odour	—	Nothing Disagreeable.	Nil	Nil	Nil
4.	pH	—	7.0 to 8.5	8.4	8.2	8.0
5.	Total alkalinity	Mg/Litre	—	110	100	96
6.	Total hardness	"	300	74	68	66
7.	Chloride	"	250	24	22	22
8.	Nitrite	"	—	Nil	Nil	Nil
9.	Nitrate	"	2.0	Nil	Nil	Nil
10.	Total solids	"	50	120	80	30
11.	Dissolved solids	"	—	50	30	10
12.	Suspended solids	"	—	70	50	20
13.	MPN Counting per 100 ML.	Count	—	120	43	Nil
14.	Post Chlorination	Mg/Litre	—	—	—	1.0

system were shifted, after the necessary repairs to new pump house. The capacity of these two pumping sets is 6.80 MLD at 55 Mts. head, but since the total head involved was high, another sump-well and pumping station was constructed near the overhead reservoirs in Budhwariya area. Water is pumped at a head of 35 meters by two pumping sets of 6.8 MLD capacity from the sump of 1,12,500 litres capacity, 6 m.dia. and 4 m.depth.

3.7 Clear water pumping main :

A 300 mm dia., Class LA, C.I. pipe of 9.5 K.M. long pumping main was laid from Sahebkhedi filter plant to Ujjain town departmentally in 28 days.

3.8 The quality aspects of water from Sahebkhedi emergency water treatment plant are shown in Table 2.

4. CONCLUSION

The non-conventional filter has been working efficiently particularly when preconditioning of raw water is not problematic. The shallow depth of canal has efficient functioning in comparison to the deep settling tank. Pumped back wash system has brought economy by eliminating overhead tank, but the system requires careful operation.

5. ACKNOWLEDGEMENT

The authors express sincere gratitude to the staff who worked all round the clock for the completion of the scheme and commissioned it in just 28 eventful days.