भारत सरकार
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केन्द्रीय भूमि जल बोर्ड

GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

CENTRAL GROUND WATER BOARD

Artificial Recharge Plan for the Over Exploited Raver Taluka of Jalgaon District

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CENTRAL REGION, NAGPUR

जुलाई - 2016 / July - 2016

ARTIFICIAL RCHARGE PLAN AT A GLANCE

1.	Total Geographical Area of the Raver Block (Taluka)	942.60 km^2
	❖ Area occupied by Hard Rock (Basalt)	383.50 km^2
	❖ Area occupied by Soft Rock (Alluvium & Bazada)	559.10 km^2
2.	Major land use pattern	Agriculture particularly banana growing area
3.	Average Annual Rainfall (mm)	717 mm
4.	Major Drainage	Tapi River
5.	Area identified for Artificial Recharge *(considering average decadal (2005-14) post-monsoon water level more than 5 m bgl, long term post-monsoon water level trend, depth of weathering and lineaments)*	604.00 km^2
6.	Overall quality of groundwater	Suitable for domestic, industrial and irrigation use
7.	Availability of Surplus surface runoff (MCM)	14.42 MCM
8.	Surplus runoff considered for planning (MCM) *(70% of surplus surface runoff)*	10.09 MCM
9.	Runoff for RWH in Urban Household	0.209 MCM
10.	Sub-surface storage potential available (MCM)	530.49 MCM

11. Proposed Artificial Recharge & Water Conservation Plan

Item	**Perco-lation Tank**	**Check Dam**	**Recharge shaft**	**Water Conser-vation Structure**	**Roof Top Rain Water Harvesting (for 10% houses)**
❖ Proportionate Allocation of surplus runoff MCM)	1.23	0.44	8.34	0.09	0.209
❖ Feasible number of structures	6	15	139	6	6862
❖ Unit cost of structures (crores)	0.70	0.07	0.025	0.0025	0.0008
❖ Estimated Cost (Crores)	4.20	1.05	3.475	0.015	5.48
❖ Expected Recharge (MCM) (considering 85 % efficiency)	1.04	0.37	7.09	0.076	0.177

12.	Total estimated cost (Crores)	14.22 crores

Artificial Recharge Plan for the Over Exploited Raver Taluka of Jalgaon District

1. INTRODUCTION

Groundwater being most dependable source of water supply is under tremendous stress to meet the ever increasing demand of irrigation, industrial and domestic sector. The over exploitation of this resource has resulted in to decline in water levels in many part of the Country and many of the water assessment units are thus categorised as over-exploited blocks. The state of Maharashtra also faces the problem of groundwater over- development in some of the areas. Many talukas have been identified as Critical / Over-Exploited based on the ground water resources estimation based on GEC-97 Methodology. As per the latest groundwater resource assessment as on March 2011, 10 talukas have been identified as Over-Exploited.

Immediate remedial measures are therefore required to be taken up for converting these talukas into Critical / Semi-critical / Safe categories. The present artificial recharge plan has been prepared for the Raver taluka of Jalgaon district which will form the base for the future strategy.

2. LOCATION

Raver taluka lies on the northern part of Jalgaon district and lies between North latitude 21° 22' 38" to 21° 15' 13" and East longitude 75° 52' 44" to 75° 52' 58" in the foot hills of Satpura Hill ranges and covers an area of 980.66 sq.km. The population of the taluka is 3,12,082 persons as per 2011 census. There are 119 villages in the taluka. Raver taluka is famous for banana cultivation **(Fig 1a and 1b)**.

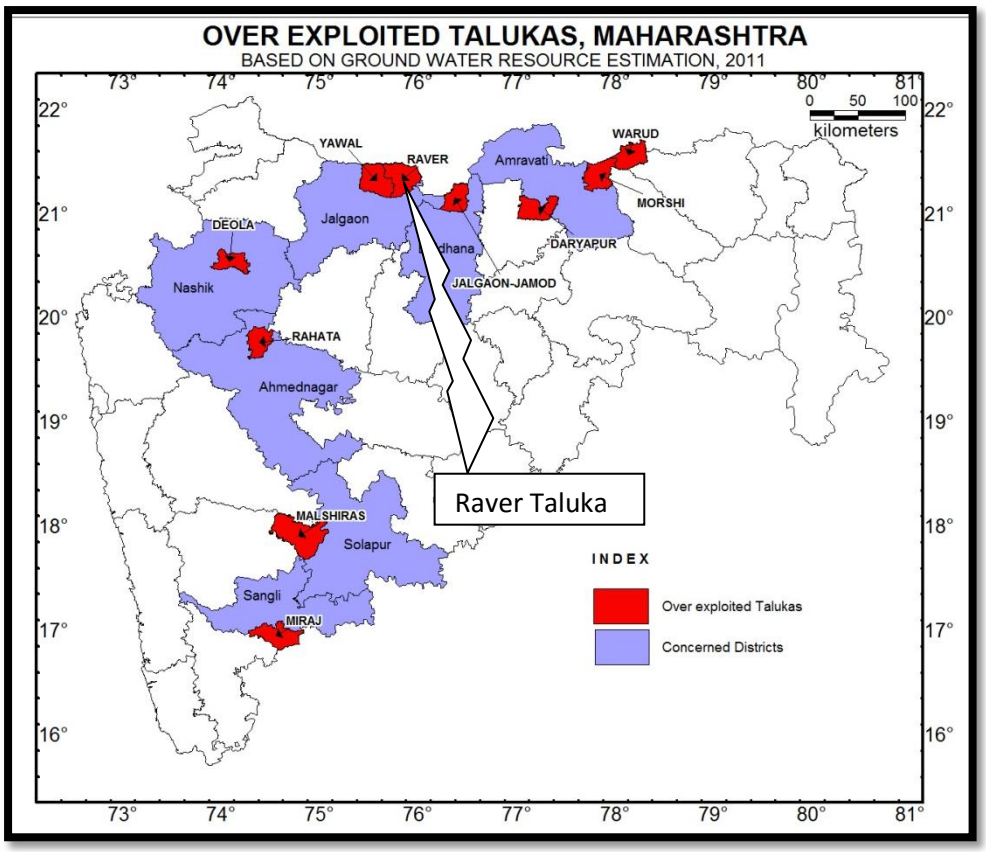


Figure1a: Location of Raver Taluka, Jalgaon District, Maharashtra

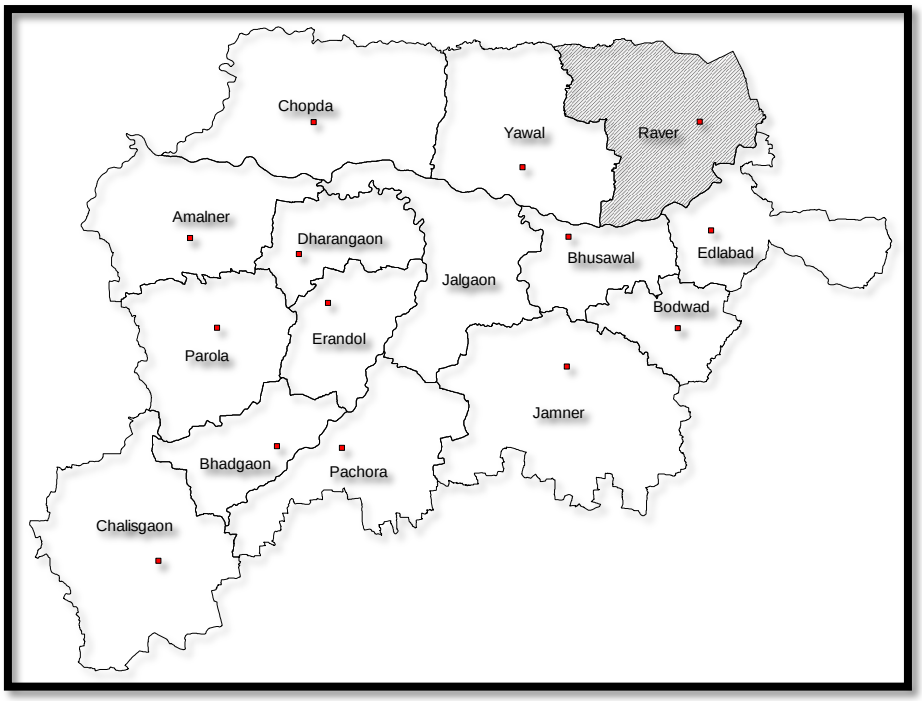


Figure1b: Location of Raver Taluka, Jalgaon District

3. PHYSIOGRAPHY & DRAINAGE

The taluka is broadly divided in to two physiographic units viz, the Satpura Hills in the north and the Tapi alluvial plains in the central & southern part. The taluka is mainly drained by the Tapi river that flows from east to west. The important tributaries of the Tapi River are PipalphataNadi, BokadNadi and Suki Nadi that flow from north to south(**Fig 2a)**. A digital elevation model of Raver taluka indicating the village boundaries is shown in **Fig. 2b**.

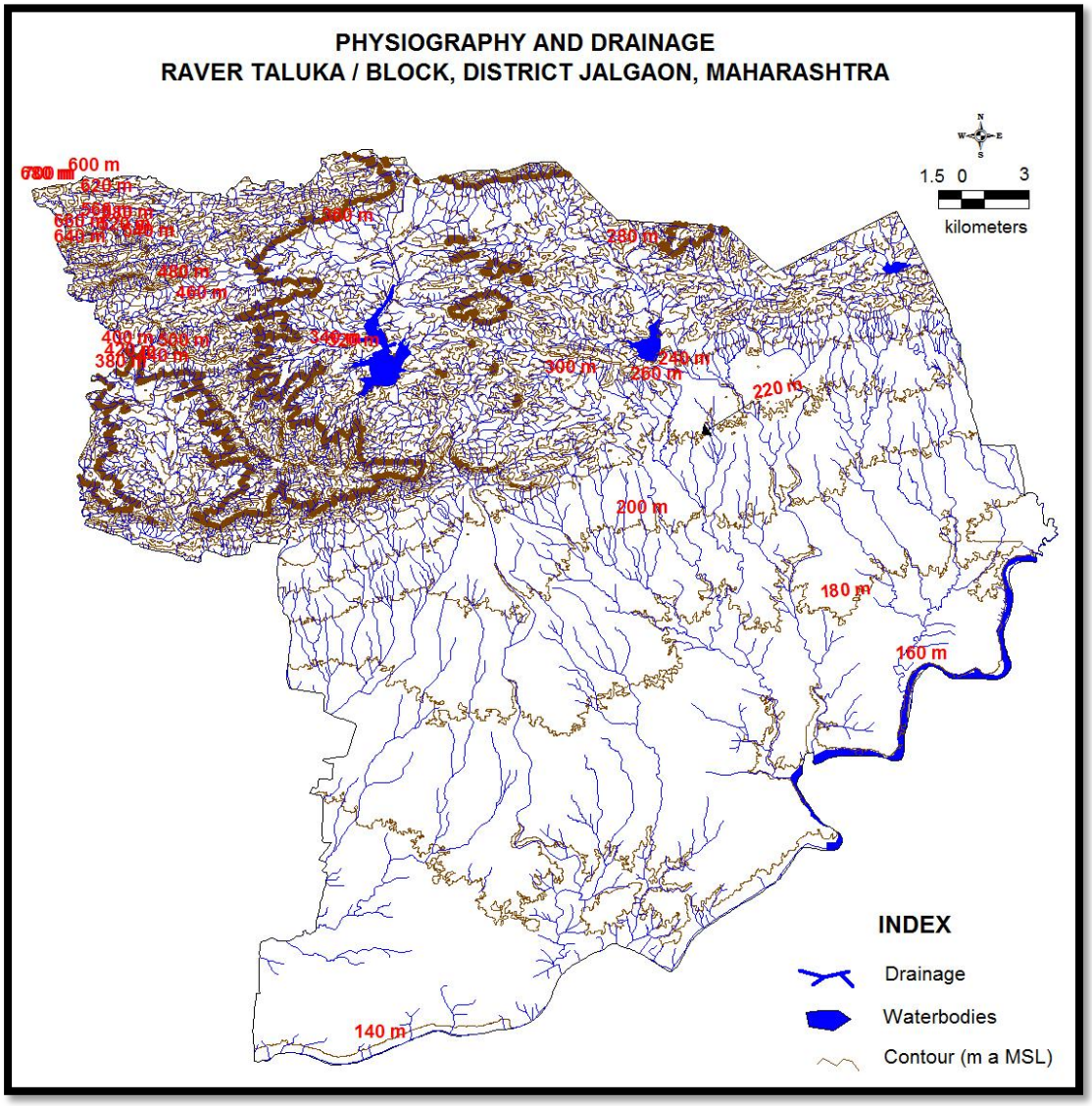


Figure2a: Physiography and Drainage, Raver Taluka

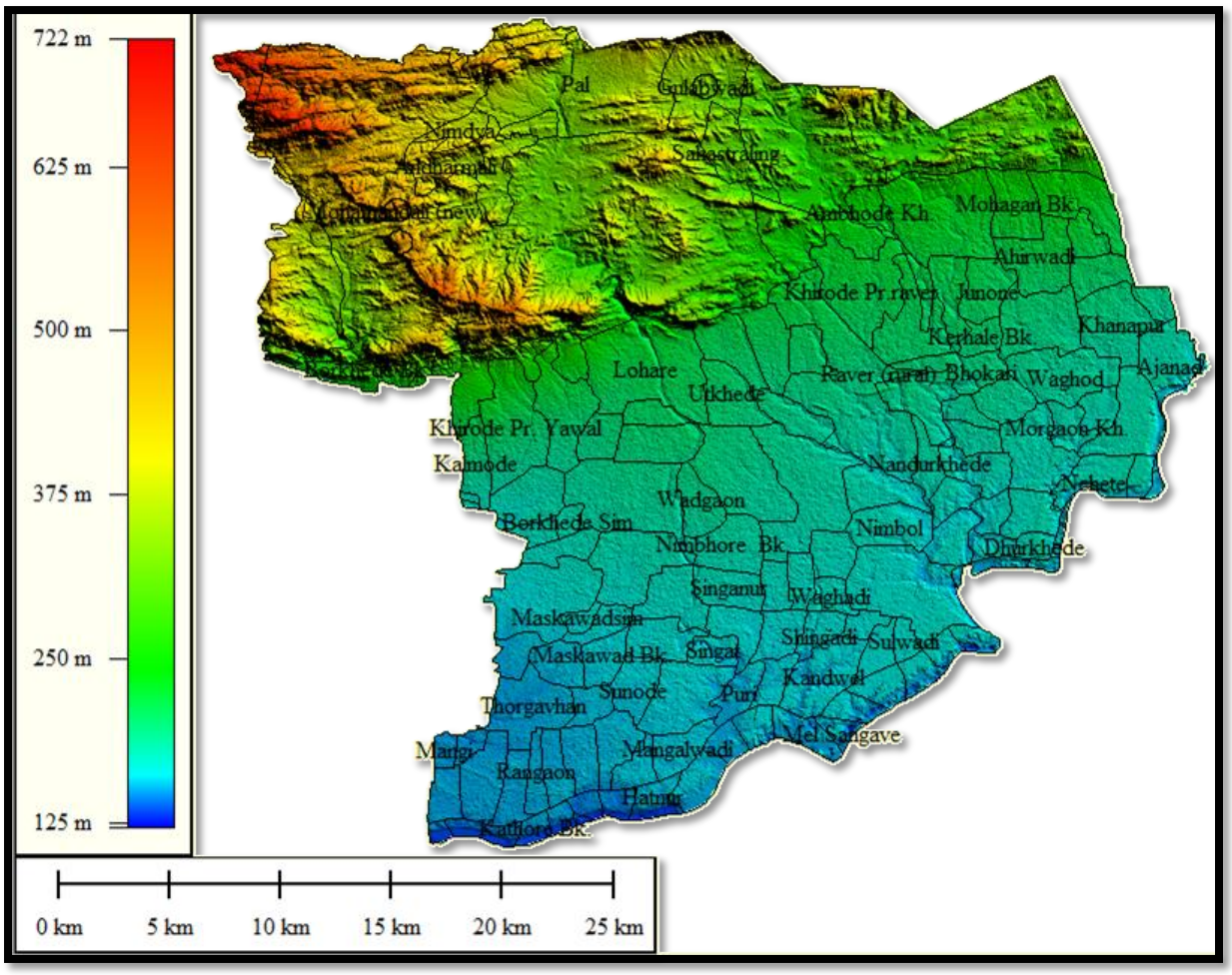


Figure2b: Digital Elevation Model, Raver Taluka

4. RAINFALL

The area receives rainfall due to the south-west monsoon and about 90% of the rainfall takes place during the months of June to September. The Taluka has a long-term normal rainfall of 717 mm with a coefficient of variation of 30%.

5. LAND USE PATTERN

The land use of the area prominently reflects significance of agriculture activity, with isolated scattered pockets of notified forest area and unmodified hilly forest. The double-crop (Kharif and Rabi) area is evenly distributed in the entire taluka while the horticultural activity (banana orchards) is significantly noticed and evenly distributed in entire alluvial area of the taluka.

6. HYDROGEOLOGY

Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age occurs in the northern part of the taluka where the ground water potential is not uniformly distributed due to inherent heterogeneity of the formation **(Fig.3)**. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth. At places potential zones are encountered at deeper levels in the fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined conditions.

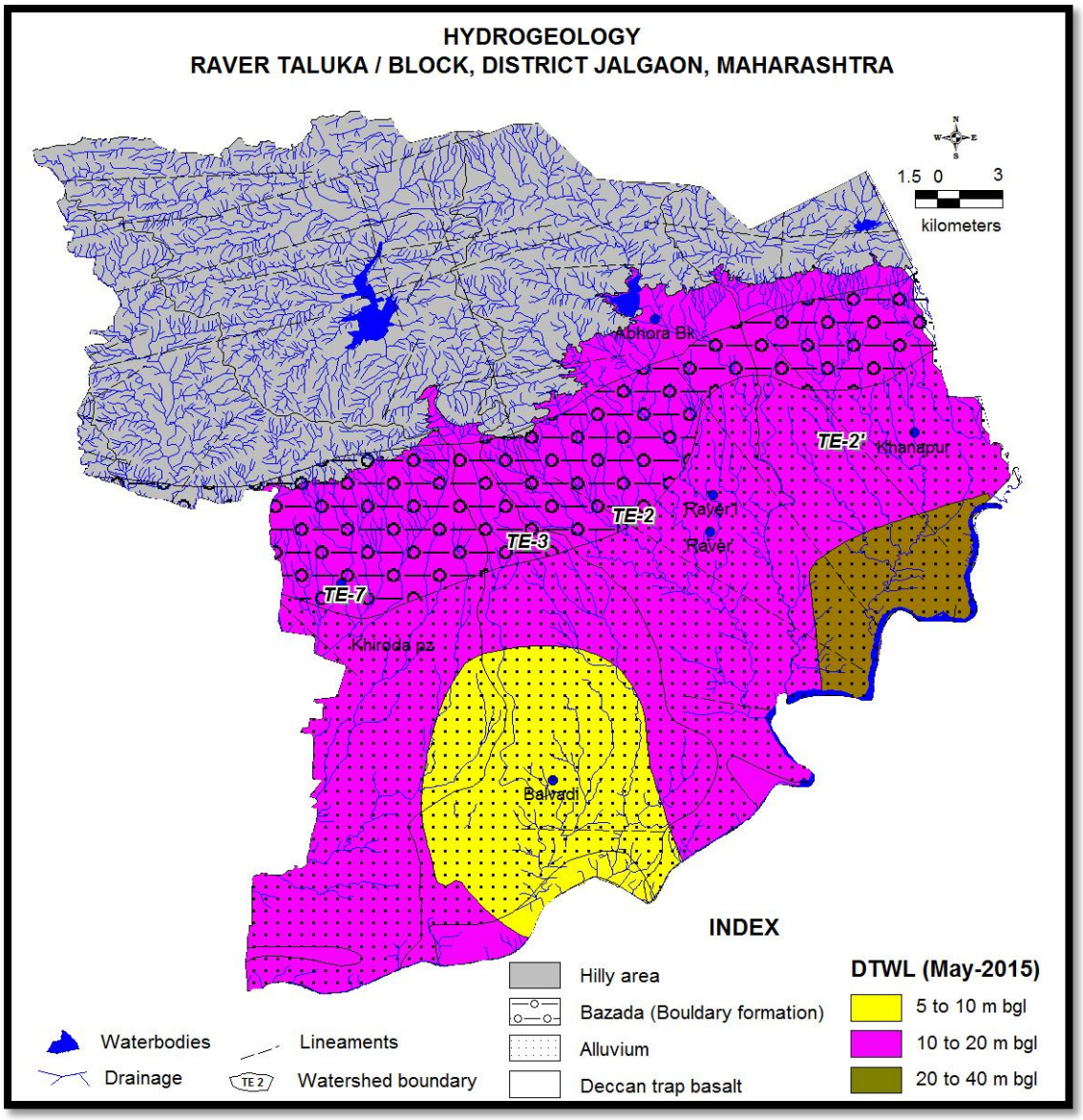


Figure 3: Hydrogeology, Raver Taluka

Central and Southern part of the taluka is underlain by Tapi Alluvium which can be subdivided into two sub units, i.e., the upper younger alluvium extending down to 70-80 m depth and the deeper older alluvium attaining a maximum depth of 217 m bgl. However, only upper 70-80 m of younger alluvium, having 2 to 5 layers of granular zones of sand and gravel ranging in thickness from 2 to 20 m, forms the potential aquifer. At deeper levels the alluvium is mostly clayey and does not form potential aquifer. Ground water in alluvium occurs under water table, semi-confined and confined conditions (**Fig. 3**).

7. GROUND WATER LEVEL SCENARIO

CGWB regularly monitors ground water levels in the taluka 4 times in a year during May, August, November and January through its network of Ground Water Monitoring Wells (GWMW). The depth to water levels (DTW) recorded during the pre-monsoon season in May (2014) ranges from 1.30 to 43.60 m bgl. In major part of the taluka pre-monsoon water levels are ranging between 20 and 40 m bgl. Deeper water levels of more than 40 m are observed in SW parts of taluka areas (Fig. 4).

The water levels recorded in post-monsoon season (Nov. 2014) are ranging from 4.00 to 32.40 m bgl. In major part of the taluka water levels are ranging between 10 and 20 mbgl. Deeper water levels of 20-40 and more than 40 m bgl are observed in SW parts of taluka areas (Fig. 5).

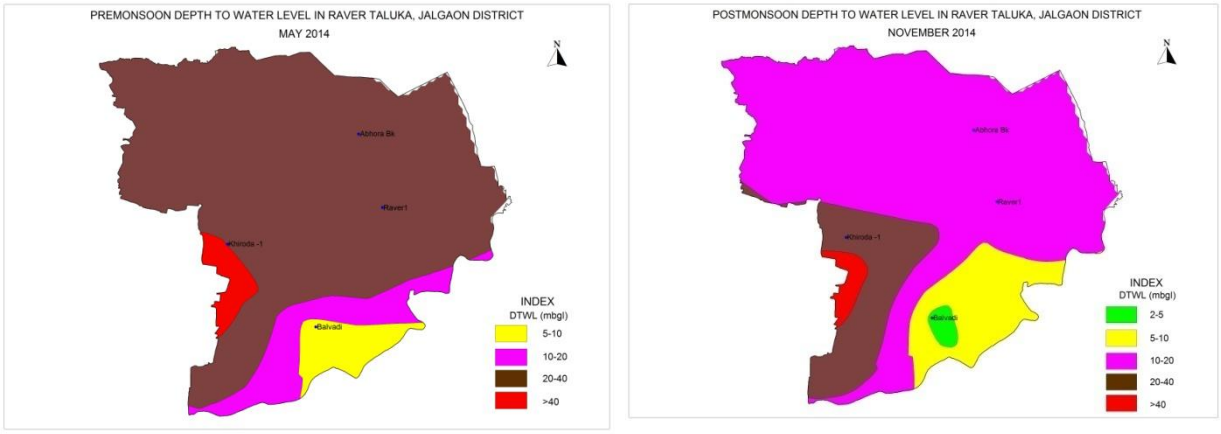


Fig 4 and 5: Pre and Post-monsoon (2014) Depth to Water Level, Raver Taluka

8. DYNAMIC GROUND WATER RESOURCE

Ground Water Resources Assessment for the year 2011 indicates Net Annual Ground Water Availability of 9752.98ham, draft for all uses is 12034.14 ham with irrigation being the major consumer withdrawing 11889.08 ham and stage of ground water development is also high about 123.39% **(Table 1)**. The taluka is categorised as Over Exploited. The comparison of 2009 and 2011 ground water resource assessment indicates that the stage of ground water development has increased from 117.69% in 2009 to 123.39% in 2011. So far none of the taluka has been notified by CGWA/SGWA for ground water regulation.

Table 1: Dynamic Ground Water Resources of Raver Taluka (As on March 2011)

S. No	Particulars	GW Resources (Ha.m)
1.	Net Annual Ground Water Availability	9752.98
2.	Existing Gross Ground Water Draft for irrigation	11889.08
3.	Existing Gross Ground Water Draft for domestic and industrial water supply	145.06
4.	Existing Gross Ground Water Draft for All uses	12034.14
5.	Provision for domestic and industrial requirement supply to 2025	152.19
6.	Net Ground Water Availability for future irrigation development	0.00
7.	Stage of Ground Water Development	123.39%
8.	Category of the Assessment Unit	Over-Exploited

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION MEASURES

Raver taluka is major banana growing area of Maharashtra. For cultivation of banana crop, huge amount of groundwater is required. This has led to over-exploitation of groundwater resources in the alluvial area from both the shallow and deeper aquifers. These practices are being continued since last few decades and stage of groundwater development in the taluka even exceeded more than 100% of its natural recharge which lead to heavy depletion of ground water level. The over development of ground water has brought the taluka in over exploited category. Therefore there is an urgent need for taking up artificial recharge and water conservation measures in the area.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

The various State Government Agencies like department of Agriculture, Irrigation, Forest have already taken up some water conservation / artificial recharge measures in Raver

taluka. However, a robust consolidated plan for artificial recharge measures are also required for converting the entire Over-Exploited Raver taluka into Critical / Semi-critical / Safe category.

11. FEASIBLE AREA FOR ARTIFICIAL RECHARGE OR CONSERVATION

The feasible area for artificial recharge to groundwater in Raver taluka has been identified based on the following criteria's.

1. Long term average decadal post-monsoon depth to water level (2005-2014)
2. Long term post-monsoon water level trend (2005-14)
3. Depth of weathering in the taluka
4. Lineaments in the area

Thematic layers are prepared for all the above mentioned four criteria's and are superimposed on one another to generate the integrated map for identification of the feasible area for artificial recharge. The long term water level data reveals the deepest water level of more than 40 m bgl. Water level contour map is prepared wherein 4 categories of observed water levels are made i.e. 5-10 m 10-20 m, 20-40m and more than 40 m bgl **(Fig. 6)**. The water level map reveals that an area of 604.00 sq.km is having depth to water level more than 5 m bgl.

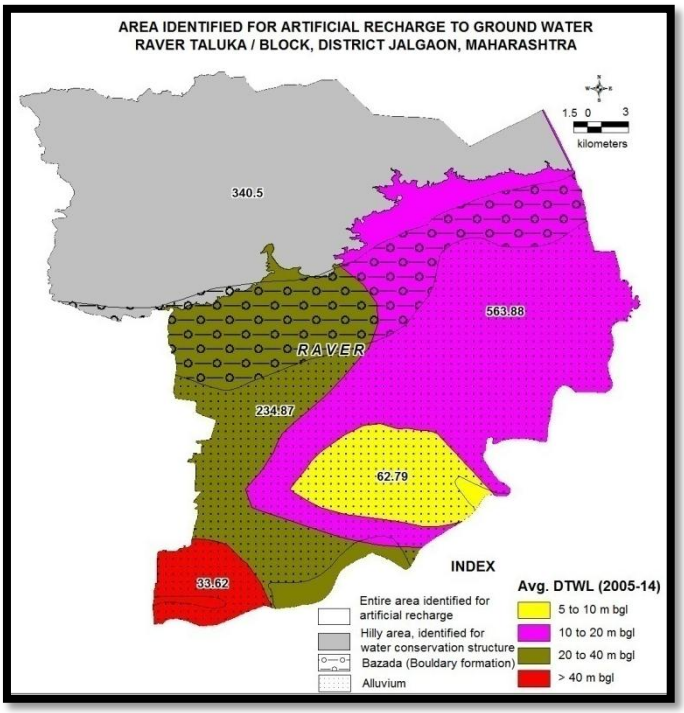


Fig 6: Average Decadal Post-monsoon depth to water level, Raver taluka

The long term water level trend map for the period 2005-2014 has been prepared and is shown in **Figure 7**. Both the rising and falling water level trend are classified into 2 units i.e. 0.0 to 0.2 m/year and 0.2 to 0.4 m/year. The area showing rising water trend has been excluded for taking up artificial recharge measures in the area and the area showing falling water level trend is only considered and recommended for artificial recharge to groundwater in Raver taluka **(Fig 7).**

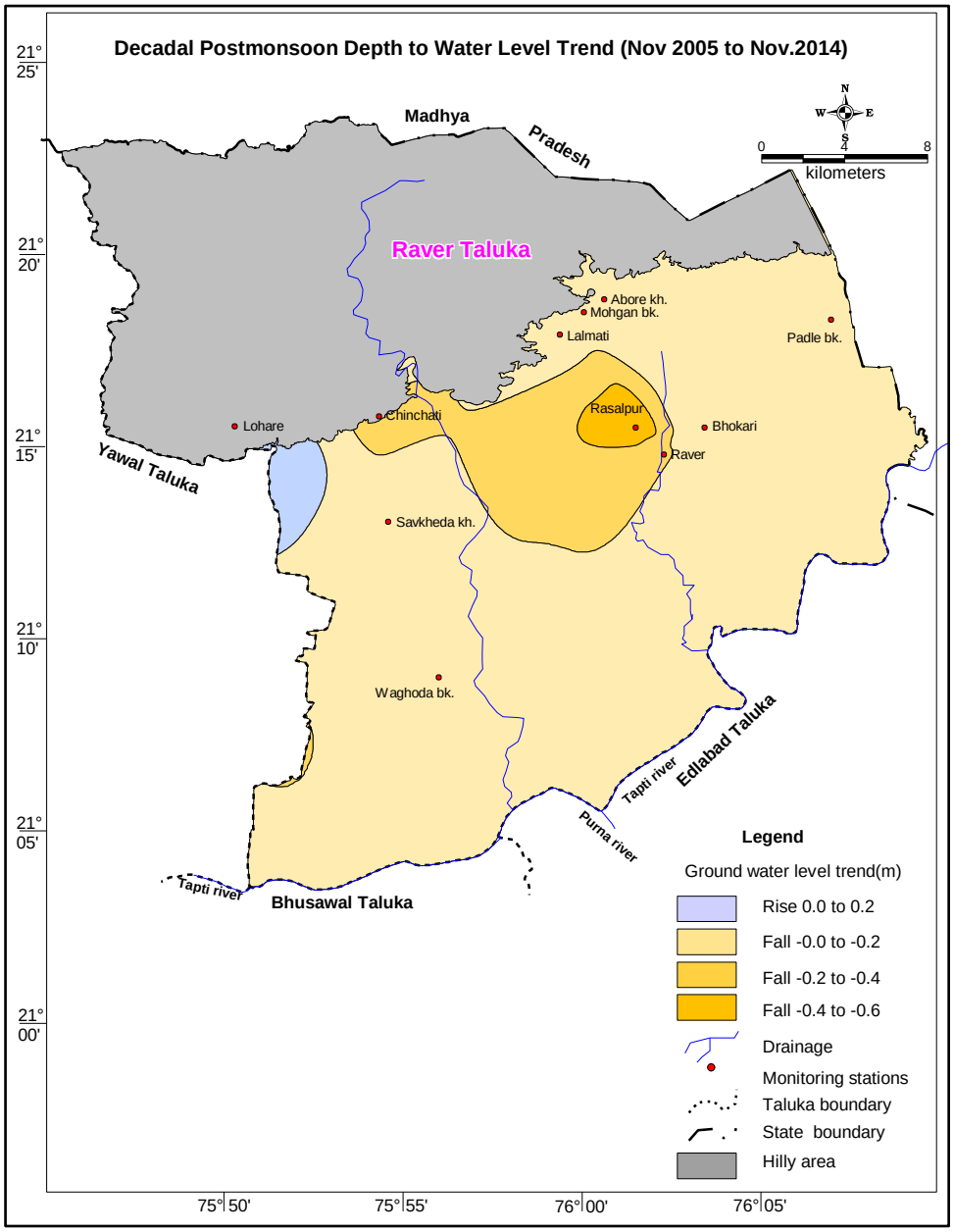


Figure 7: Map showing long term post monsoon water level trend (2005-14)

Based on the data available on depth of weathering form key wells established during the various hydrogeological studies in the area and also groundwater exploration data, a map showing area under various categories of depth of weathering has been prepared and considered for preparation of artificial recharge plan **(Fig. 8)**. The map reveals that most of the area of Raver taluka is having sufficient thickness of weathered zone varying from 10 to 35 m and therefore found feasible for artificial recharge to groundwater. Raver taluka is also traversed by few lineaments in its eastern part (**Figure 9)** indicating promising scope for artificial recharge in that area.

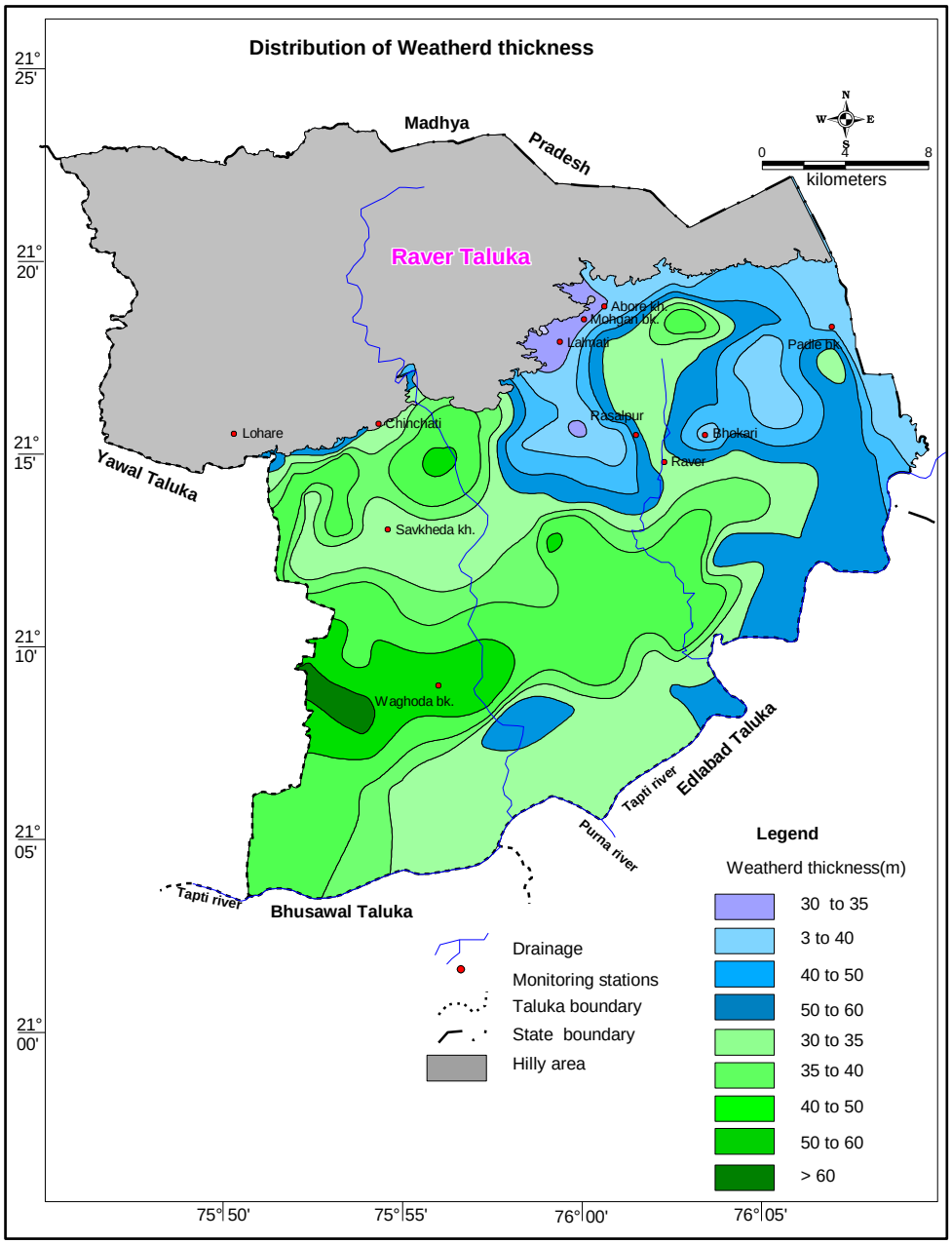


Figure 8: Map showing weathered thickness in Raver taluka

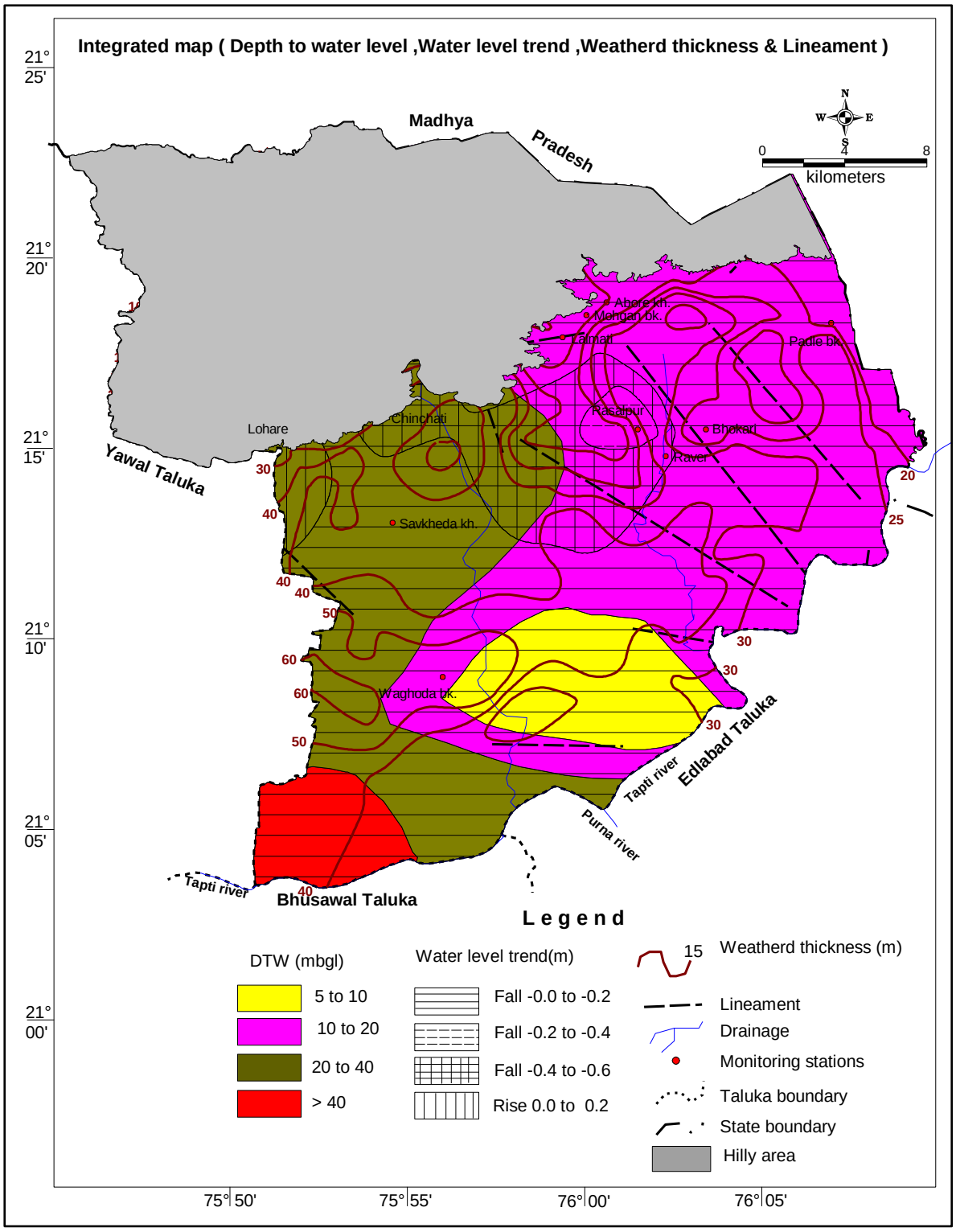


Figure 9: Integrated Map showing feasible area for artificial recharge to groundwater in Raver taluka

An integrated map containing all the layers i.e. depth to water level, water level trend and weathered thickness, lineaments is prepared and is shown in **Figure 9**. The map indicates that an area of 604 sq.km is identified for artificial recharge to groundwater.

12. AVAILABILITY OF SURPLUS SURFCE WATER FOR ARTIFICIAL RECHARGE OR CONSERVATION

The availability of non-committed surplus runoff as source water is one of the main requirements for any artificial recharge scheme. In India in general and Maharashtra in particular, the monsoon rainfall is the chief source of water which can be utilized for artificial recharge. Normally the surplus / non-committed monsoon runoff can be utilized as source water for artificial recharge scheme.

The rainfall received during northwest monsoon between June and September is the principal source of water in the state of Maharashtra. The actual availability of surface water in the area depends upon the rainfall incidences, climate, Physiography, land use and hydrogeology. These components vary drastically in space and time and is not uniform in the state of Maharashtra. Therefore basin and sub-basin wise availability of water and its utilization status is considered to depict the realistic scenario of source water availability. For this purpose the hydrological data available with the state government was collected and compiled basin wise for Godavari, Krishna and Tapi basins.

Raver taluka of Jalgaon district falls in Tapi river basin. The data collected from Irrigation Department, Government of Maharashtra reveals that Tapi river basin covers an area of 51940 sq. km. The basin has surplus surface water runoff availability of 1240 MCM. Based on this data, it is estimated that the proportionate per sq.km. availability of surplus surface water runoff is 0.0239 MCM. Thus the proportionate surplus surface water availability for Raver taluka comes out to be 14.42 MCM. For estimation of volume of water to be utilised for recharge, 70% of surplus water availability has been considered. Thus about 10.09 MCM surplus surface water can be considered for preparation and implementation of master plan for artificial recharge in the over-exploited Raver taluka and for estimation of number of structures required for augmentation of groundwater resource in the area. The estimated availability on surplus surface runoff in Morshi taluka is finalised in consultation with the State Government and hence confirmed for taking up artificial recharge measures in the taluka.

13. FEASIBLE ARTIFICIAL RECHARGE / CONSERVATION STRUCTURES

Hydrogeology, Physiography, climatic conditions and source water availability are the major factors which affect the selection of site, dimension of the artificial recharge scheme. The surface spreading techniques consisting of percolation tanks and cement plug/bund/check dam are most appropriate techniques in areas occupied by hard rocks. In alluvial areas i.e. alluvial part of Tapi and Purna basin, the percolation tanks in mountain fronts and recharge shaft in alluvial/bazada zone are the most feasible structures. Accordingly these structures have been recommended for artificial recharge to groundwater. Other structures like continuous contour trenches, gabion structures, nala bunds, village ponds etc. may also be taken up side by side which would be more appropriate for soil and moisture conservation. The underground bandharas or sub surface dykes are ground water conservation structures and hence can be taken up a site specific location to conserve the ground water. Beside this roof top rain water harvesting and storm water harvesting in public parks, play grounds are the most appropriate techniques as in urban areas most of the nala / river carries domestic sewage and non-availability of land for submergence.

Various artificial recharge studies on carried out by CGWB so far in the State of Maharashtra and the findings of the artificial recharges schemes implemented under Central Sector Scheme are highly helpful is preparation of plan for artificial recharge for any given area. The findings of these studies / schemes are considered in formulating the artificial recharge plan and are mentioned below.

- A percolation tank of 100 Thousand Cubic Metre (TCM) capacity (single filling) will actually store 200% more due to multiple fillings during monsoon. This will have gross storage capacity of 200 TCM. However, desilting of percolation tank on regular basis in 1-2 year before the onset of monsoon should be carried out for effective infiltration of stored water into the sub-surface.
- A check dam / cement plug of 10 TCM capacity (single filling) will actually store 300 % more due to multiple fillings in monsoon. This will provide gross storage of 30 TCM for check dam. However, it is also required to be desilted to maintain the storage capacity and recharge efficiency.
- A recharge shaft constructed in the stream / nala bed or along its bank so as to get the continuous water supply, on an average will recharge 1 TCM/day with 60 operational

days during monsoon and post-monsoon period.

- Unlike various water conservation schemes, percolation tank and check dam provide about 85% recharge to ground water out of total storage.
- With regard to the amount of surface water considered for planning the artificial recharge, it can be considered that 70 % storage would be through percolation tank and remaining by check dam and recharge shafts.

The number of recharge structures required to store and recharge the ground water reservoir have been worked out as follows

$$\text{No. Of structures} = \frac{\text{Total surface water considered}}{\text{Average gross capacity of Percolation Tank/Check Dam (considering multiple fillings)}}$$

Based on the above field findings, it is proposed to allocate about 70% of the surplus water (1.23 MCM) out of the total allocation for hard rock area (1.75 MCM) for construction of percolation tanks, about 25% surplus water for construction of check dam (0.44 MCM). The remaining 5% surplus available (0.09 MCM) water is proposed for allocation for construction of various water conservation structures like loose boulder structures, gabbion structures etc. The proportionate allocation of surplus surface water for the soft rock i.e. alluvium is estimated to be 8.34 MCM and it is proposed to recharge this quantum through the recharge shaft which is the only feasible artificial recharge structure in alluvium. The average recharge efficiency of artificial recharge structure is considered as 85% on safer side.

The tentative locations of proposed artificial recharge structures are shown in **Figure 10** and the detail of these locations are given in **Annexure-I**. The proposed recharge shafts are shown in cluster form due to large number of structures. The design of percolation tank, check dam, recharge shaft are presented as **Annexure-II**. However, the final design of the individual structures will be site specific and will be prepared based on the hydrogeological survey in consultation with the implementing agency.

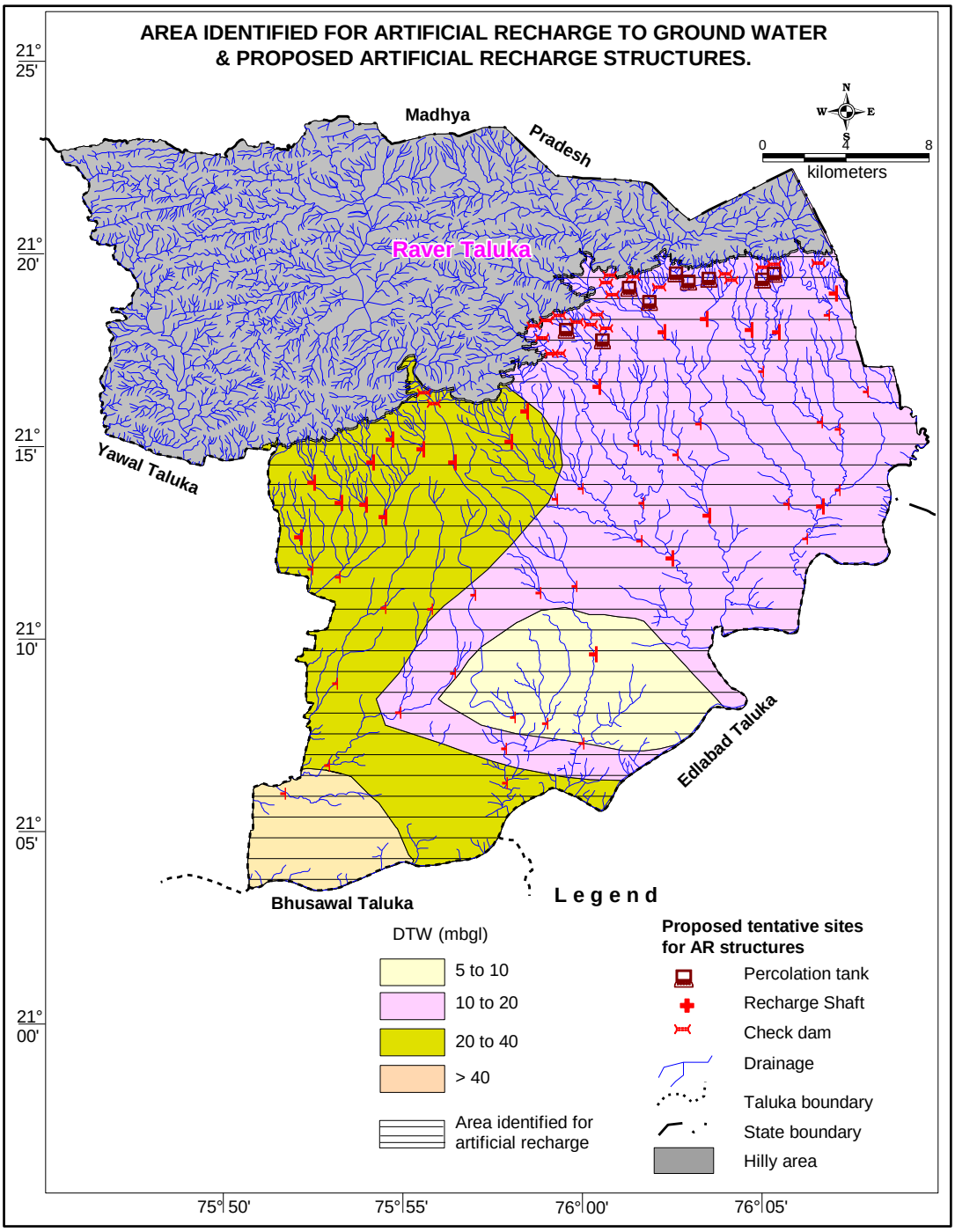


Figure 10: Tentative sites of Percolation Tank, Check Dam, Recharge Shaft and Water Conservation Structures, Raver Taluka

14. TENTATIVE COST ESTIMATES

For estimating the tentative cost for construction of various types of artificial recharge and water conservation structures, schedule of rates **(**SOR) of Government of Maharashtra available for the year 2011 have been considered. In the state of Maharashtra, SOR of each

district vary marginally from each other. It is estimated that the total expenditure to be incurred for construction of various water conservation and recharge structures will be Rs.14.22 crores (As per 2011 SOR). However, it is likely that the actual cost will vary depending upon the actual period of construction and location of sites which will be finalised after detailed hydrogeological consultation and survey by the implementing agencies.

Percolation Tanks

It is estimated that the total non-committed surplus surface water available for recharge is 1.23 MCM. To recharge the above quantum, it is estimated that 6 percolation tanks shall be required to be constructed in Raver taluka. Considering the recharge efficiency of 85%, it is expected that about 1.04 MCM of surface water shall be recharged. As per the SOR available for the year 2011, it is estimated that for construction of one percolation tank with average gross capacity of 200 TCM, Rs. 70 lakh will be required. Therefore the total expenditure involved for construction of 6 percolation tanks will be Rs. 4.20 crores. For enhancing the ground water recharge, it is proposed to utilise the stored water of the percolation tanks for irrigation of the surrounding areas.

Check Dams

It is estimated that about 0.44 MCM of surplus was can be made available for construction of check dams. Thus total 15 check dams can be constructed to recharge the proportionate allocated surplus water of 0.44 MCM. Considering the recharge efficiency of 85%, it is expected that about 0.37 MCM of surface water shall be recharged into sub-surface. The SOR available for the year 2011 indicate that for construction of one check dam with average gross capacity of 30 TCM, Rs. 7 lakh will be required. Therefore the total expenditure involved for construction of 15 check dams will be Rs. 1.05 crores.

Water Conservation Structures

After the allocation of surplus runoff water for the major structures like percolation tanks and check dams in the hard rock area of Raver taluka, the remaining quantum of surplus water can be conserved by means of feasible water conservation structures for soil and water conservation. Thus about 0.09 MCM of surplus water can be made available for water conservation structures. The feasible water conservation structures in the area are loose

boulder structure and gabbion structures. It is estimated that 6 nos. water conservation structures will be required to tap the 0.09 MCM of surplus runoff water of which about 0.076 MCM water can be conserved/recharged considering efficiency of 85%. These structures can be constructed on lower order streams i.e. streams of 1st and 2nd order. As per the SOR 2011, an approximate expenditure of Rs. 25000 will be required for construction of one water conservation structure. Therefore the total expenditure involved for construction of 6 water conservation structure will be Rs. 0.015 crores.

Roof Top Rain Water Harvesting

In this first phase, it is proposed to take up roof top rain water harvesting measures in the urban households of Raver Taluka. As per census 2011, there are about 68623 households in Raver taluka. It is assumed that about 10 % of the households i.e. 6862 households may have the average roof area of about 50 sq.m. Therefore, considering the average annual rainfall of 717 mm, average roof area of 50 sq.m and runoff coefficient of 0.85, the total rainwater harvesting potential generated in the urban households of Raver taluka is about 0.209 MCM.

For taking up roof top rain water harvesting and artificial recharge through individual household, it is proposed to recharge roof top runoff through a recharge pit having dimension of size 1m X 1m and having a depth of 1.50 m. The top 0.6 m portion of the pit will be open for pouring the harvested rainwater whereas the bottom portion of 0.90 m depth shall be filled with boulder, gravel and sand each having a thickness of about 0.30 m.

It is anticipated that about 85% of the harvested water shall be recharged. Thus about 0.177 MCM shall be recharged through adoption of rainwater harvesting in the urban households.

Recharge Shaft

The total area underlain by the soft rock i.e. alluvium in Raver taluka is 559.10 sq.km. Based on the earlier studies carried out by CGWB in the State of Maharashtra, Recharge shaft are the only suitable artificial recharge structures feasible in are underlain by the alluvium. The proportionate allocation of surface water availability for artificial recharge in alluvium area is 8.34 MCM of water and to recharge this quantum about 139 nos. recharge shafts will be required. It is proposed that all the recharge shafts will be constructed in the stream / nala

bed or along its bank to get the continuous water supply. Considering the recharge efficiency of 85%, about 7.09 MCM water will be recharged into subsurface.

The SOR available for the year 2011 indicate that for construction of one recharge shaft 2.5 lakh will be required thus the total estimated cost for construction of 139 recharge shaft will be Rs. 3.475 crores.

15. TIME SCHEDULE

After the release of funds, the proposed plan can be implemented within a stipulated time of 2-3 years by the implementing agency of concerned State Department, Government of Maharashtra.

Time schedule	Activity to be carried out
0 To 3 months	Finalization of sites for construction of artificial recharge / water conservation structures by the Implementing Agency
4 To 6 months	Finalization of designs / specifications and budget Estimation as per the Schedule of Rates by the Implementing Agency
7 To 20 months	Implementation of the project by the Implementing Agency
20 To 24 months	Preparation of report and report submission by the Implementing Agency
25 To 36 months	Impact Assessment by the Implementing Agency

Annexure - I

Tentative Locations of Proposed Artificial Recharge Structures in Raver Taluka of Jalgaon District

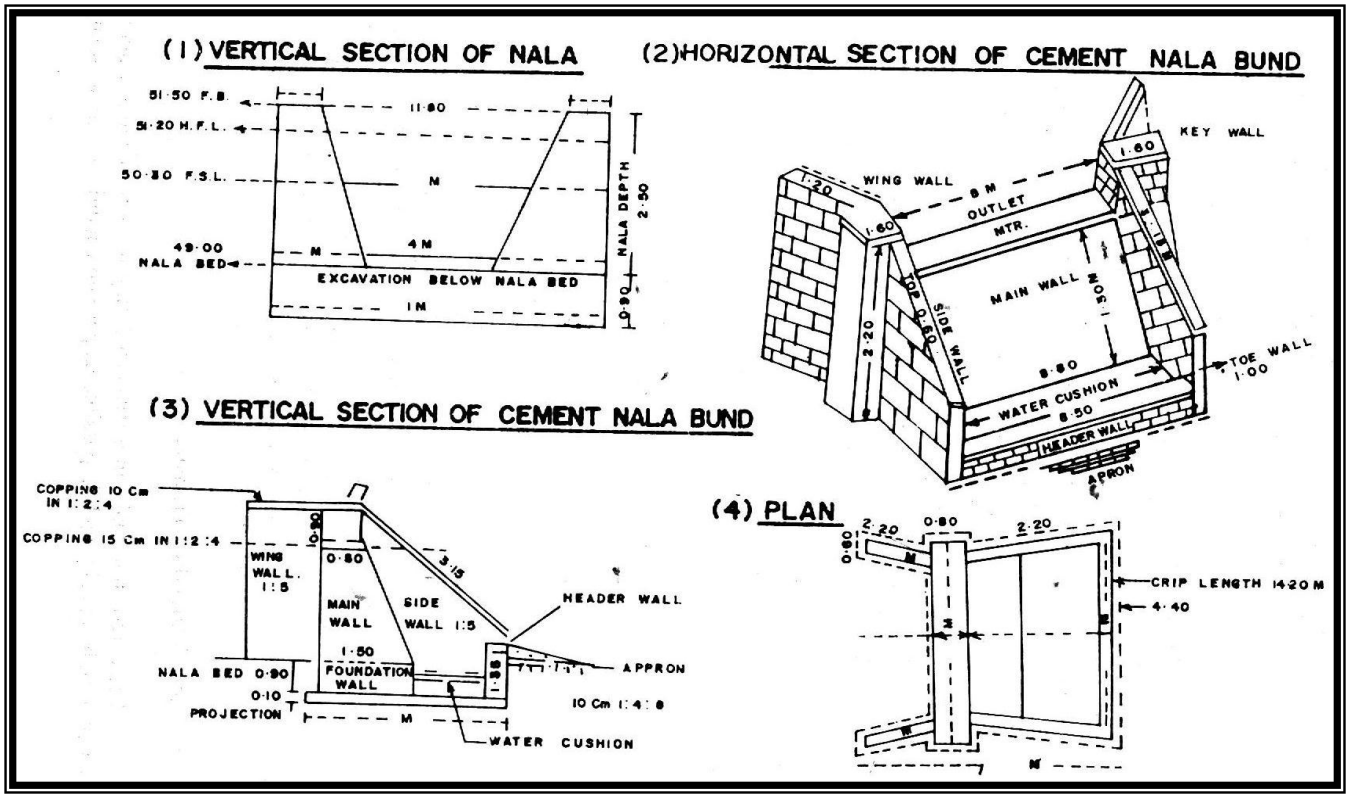
Sl. No.	District	Taluka	Structure	Village name	Long	Lat	Remarks
1	Jalgaon	Raver	PT	Pimpri	76.0584	21.3241	
2	Jalgaon	Raver	PT	Mohagan Bk.	76.0834	21.3237	
3	Jalgaon	Raver	PT	Ambhode Kh.	76.0309	21.314	
4	Jalgaon	Raver	PT	Lalmati	75.9922	21.302	
5	Jalgaon	Raver	PT	Ambhode Kh.	76.0213	21.3201	
6	Jalgaon	Raver	PT	Khirode Pr.raver	76.0091	21.2973	
7	Jalgaon	Raver	CD	Pimpri	76.0665	21.3244	
8	Jalgaon	Raver	CD	Lalmati	75.9834	21.3043	
9	Jalgaon	Raver	CD	Pimpri	76.0359	21.3187	
10	Jalgaon	Raver	CD	Pimpri	76.0693	21.3217	
11	Jalgaon	Raver	CD	Mohagan Bk.	76.0838	21.3273	
12	Jalgaon	Raver	CD	Padale Kh	76.0893	21.3286	
13	Jalgaon	Raver	CD	Padale Kh	76.1097	21.3291	
14	Jalgaon	Raver	CD	Jinsi	76.014	21.3155	
15	Jalgaon	Raver	CD	Lalmati	76.0041	21.3024	
16	Jalgaon	Raver	CD	Lalmati	75.9974	21.3035	
17	Jalgaon	Raver	CD	Forest	75.9777	21.3019	
18	Jalgaon	Raver	CD	Forest	75.9893	21.2901	
19	Jalgaon	Raver	CD	Lohare	75.9312	21.2682	
20	Jalgaon	Raver	CD	Forest	75.9266	21.273	
21	Jalgaon	Raver	CD	Forest	75.9723	21.2798	
22	Jalgaon	Raver	RS	Vivare Bk.	75.9968	21.1903	
23	Jalgaon	Raver	RS	Chunwade	75.8617	21.1007	
24	Jalgaon	Raver	RS	Thorgavhan	75.882	21.1126	
25	Jalgaon	Raver	RS	Maskawad Bk.	75.915	21.1355	
26	Jalgaon	Raver	RS	Dasanoor	75.9403	21.1526	
27	Jalgaon	Raver	RS	Singat	75.968	21.1336	
28	Jalgaon	Raver	RS	Puri	75.964	21.12	
29	Jalgaon	Raver	RS	Chinchol	75.9647	21.1052	
30	Jalgaon	Raver	RS	Kandwel	76.0001	21.1221	
31	Jalgaon	Raver	RS	SAVDA	75.8858	21.1484	(Cluster)
32	Jalgaon	Raver	RS	Rozode	75.8869	21.1944	
33	Jalgaon	Raver	RS	Rozode	75.8742	21.1976	
34	Jalgaon	Raver	RS	Savkhede Bk.	75.8986	21.2258	
35	Jalgaon	Raver	RS	Khirode Pr. Yawal	75.8874	21.2266	
36	Jalgaon	Raver	RS	Khirode Pr. Yawal	75.8748	21.2352	
37	Jalgaon	Raver	RS	Kalmode	75.8685	21.2116	
38	Jalgaon	Raver	RS	Savkhede Kh.	75.9077	21.2204	(Cluster)

39	Jalgaon	Raver	RS	Wadgaon	75.9497	21.1865	
40	Jalgaon	Raver	RS	Vivare Bk.	75.9801	21.1873	
41	Jalgaon	Raver	RS	Waghode Bk.	75.9297	21.1803	
42	Jalgaon	Raver	RS	Kochoor Bk.	75.908	21.1811	
43	Jalgaon	Raver	RS	Ajande	76.041	21.2024	
44	Jalgaon	Raver	RS	Punkhede	76.0583	21.221	(Cluster)
45	Jalgaon	Raver	RS	Khirwad	76.1039	21.2108	
46	Jalgaon	Raver	RS	Morgaon Kh.	76.1109	21.2249	
47	Jalgaon	Raver	RS	Khirwad	76.0952	21.2257	
48	Jalgaon	Raver	RS	Morgaon Bk.	76.1187	21.2319	
49	Jalgaon	Raver	RS	Khanapur	76.1106	21.2612	
50	Jalgaon	Raver	RS	Khanapur	76.1189	21.2583	
51	Jalgaon	Raver	RS	Khanapur	76.1319	21.2744	
52	Jalgaon	Raver	RS	RAVER	76.0436	21.2473	
53	Jalgaon	Raver	RS	Rasalpur	76.0541	21.2605	
54	Jalgaon	Raver	RS	Raver (rural)	76.0277	21.2264	(Cluster)
55	Jalgaon	Raver	RS	Bhatkhede	75.9997	21.2324	
56	Jalgaon	Raver	RS	Vivare Bk.	75.9876	21.2279	
57	Jalgaon	Raver	RS	Raver (rural)	76.0255	21.2512	(Cluster)
58	Jalgaon	Raver	RS	Raver (rural)	76.0069	21.2769	(Cluster)
59	Jalgaon	Raver	RS	Karjod	76.0835	21.2832	
60	Jalgaon	Raver	RS	Ahirwadi	76.0776	21.3013	
61	Jalgaon	Raver	RS	Ahirwadi	76.0902	21.3005	
62	Jalgaon	Raver	RS	Padale Bk.	76.1138	21.3074	
63	Jalgaon	Raver	RS	Khirode Pr.raver	76.0371	21.3004	
64	Jalgaon	Raver	RS	Pimpri	76.0569	21.3063	
65	Jalgaon	Raver	RS	Utkhede	75.966	21.253	
66	Jalgaon	Raver	RS	Kusumbe Kh.	75.9735	21.2662	(Cluster)
67	Jalgaon	Raver	RS	Lohare	75.9252	21.2497	
68	Jalgaon	Raver	RS	Lohare	75.911	21.2539	
69	Jalgaon	Raver	RS	Savkhede Bk.	75.9019	21.2442	
70	Jalgaon	Raver	RS	Lohare	75.94	21.2441	
71	Jalgaon	Raver	RS	Padale Kh	76.1167	21.3172	
72	Jalgaon	Raver	RS	Ajande	76.0268	21.2098	
73	Jalgaon	Raver	RS	Golwadi	75.9831	21.1309	
74	Jalgaon	Raver	RS	Waghadi	76.0052	21.161	
75	Jalgaon	Raver	RS	Rasalpur	76.0397	21.2709	
76	Jalgaon	Raver	RS	Khirode Pr.raver	76.0265	21.2774	
77	Jalgaon	Raver	RS	Raver (rural)	75.9957	21.2403	(Cluster)
78	Jalgaon	Raver	RS	Kusumbe Kh.	75.9845	21.2459	
79	Jalgaon	Raver	RS	Utkhede	75.9695	21.2354	
80	Jalgaon	Raver	RS	Vivare Kh	75.966	21.2112	
81	Jalgaon	Raver	RS	Chinawal	75.9184	21.2018	
82	Jalgaon	Raver	RS	Kumbharkhade	75.9355	21.2172	

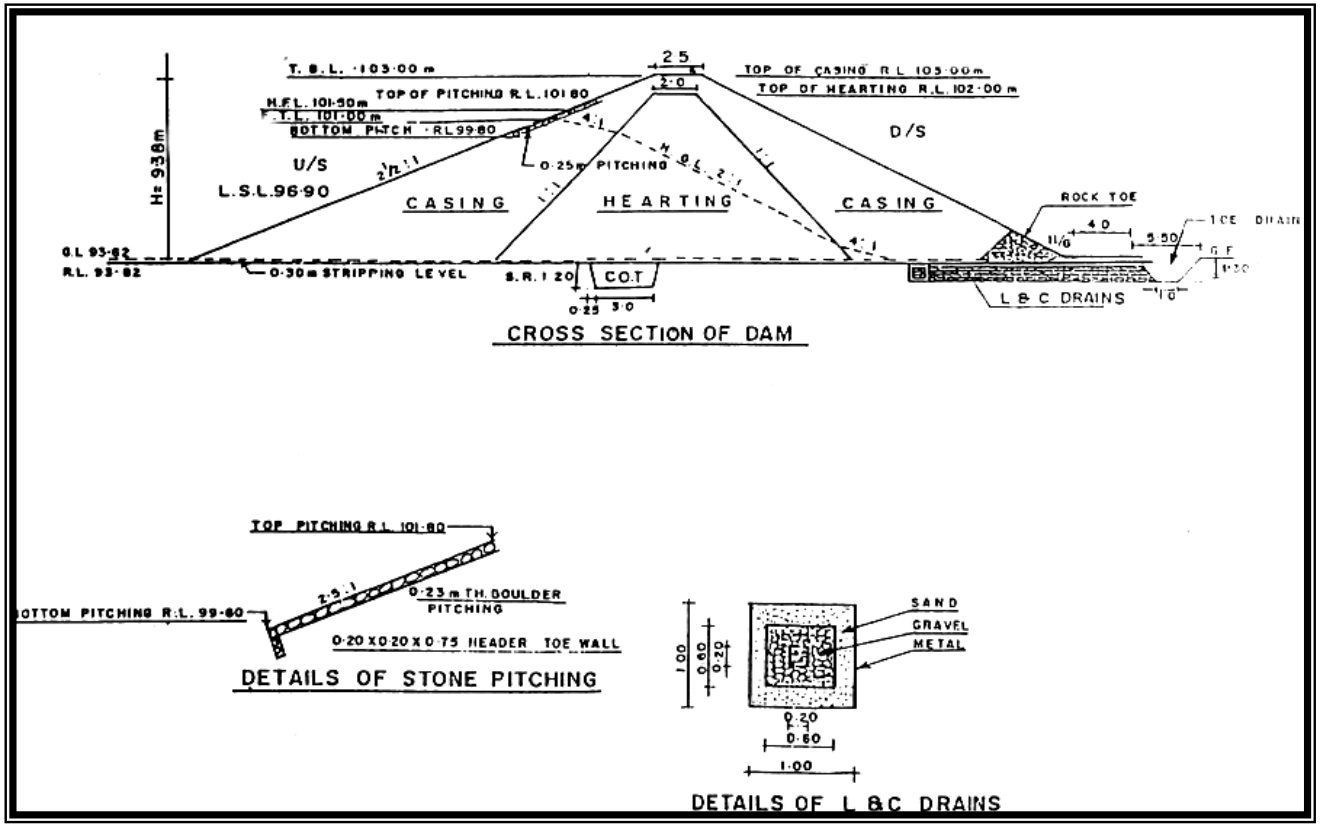
83	Jalgaon	Raver	RS	Nirul	76.1113	21.2865	
84	Jalgaon	Raver	RS	Munjalwadi	76.0087	21.2505	
85	Jalgaon	Raver	RS	Balwadi	75.978	21.1445	
86	Jalgaon	Raver	RS	Kandwel	76.0128	21.1289	
87	Jalgaon	Raver	RS	Nimbhore Sim	76.0711	21.1818	
88	Jalgaon	Raver	RS	Savkhede Bk.	75.8986	21.2258	Clusture points
89	Jalgaon	Raver	RS	Khirode Pr. Yawal	75.8874	21.2266	Clusture points
90	Jalgaon	Raver	RS	Khirode Pr. Yawal	75.8748	21.2352	Clusture points
91	Jalgaon	Raver	RS	Kalmode	75.8685	21.2116	Clusture points
92	Jalgaon	Raver	RS	Savkhede Kh.	75.9077	21.2204	Clusture points
93	Jalgaon	Raver	RS	Ajande	76.041	21.2024	Clusture points
94	Jalgaon	Raver	RS	Punkhede	76.0583	21.221	Clusture points
95	Jalgaon	Raver	RS	Morgaon Kh.	76.1109	21.2249	Clusture points
96	Jalgaon	Raver	RS	Raver (rural)	76.0069	21.2769	Clusture points
97	Jalgaon	Raver	RS	Ahirwadi	76.0776	21.3013	Clusture points
98	Jalgaon	Raver	RS	Ahirwadi	76.0902	21.3005	Clusture points
99	Jalgaon	Raver	RS	Khirode Pr.raver	76.0371	21.3004	Clusture points
100	Jalgaon	Raver	RS	Pimpri	76.0569	21.3063	Clusture points
101	Jalgaon	Raver	RS	Utkhede	75.966	21.253	Clusture points
102	Jalgaon	Raver	RS	Kusumbe Kh.	75.9735	21.2662	Clusture points
103	Jalgaon	Raver	RS	Lohare	75.9252	21.2497	Clusture points
104	Jalgaon	Raver	RS	Lohare	75.911	21.2539	Clusture points
105	Jalgaon	Raver	RS	Savkhede Bk.	75.9019	21.2442	Clusture points
106	Jalgaon	Raver	RS	Lohare	75.94	21.2441	Clusture points
107	Jalgaon	Raver	RS	Padale Kh	76.1167	21.3172	Clusture points
108	Jalgaon	Raver	RS	Waghadi	76.0052	21.161	Clusture points

Annexure-II

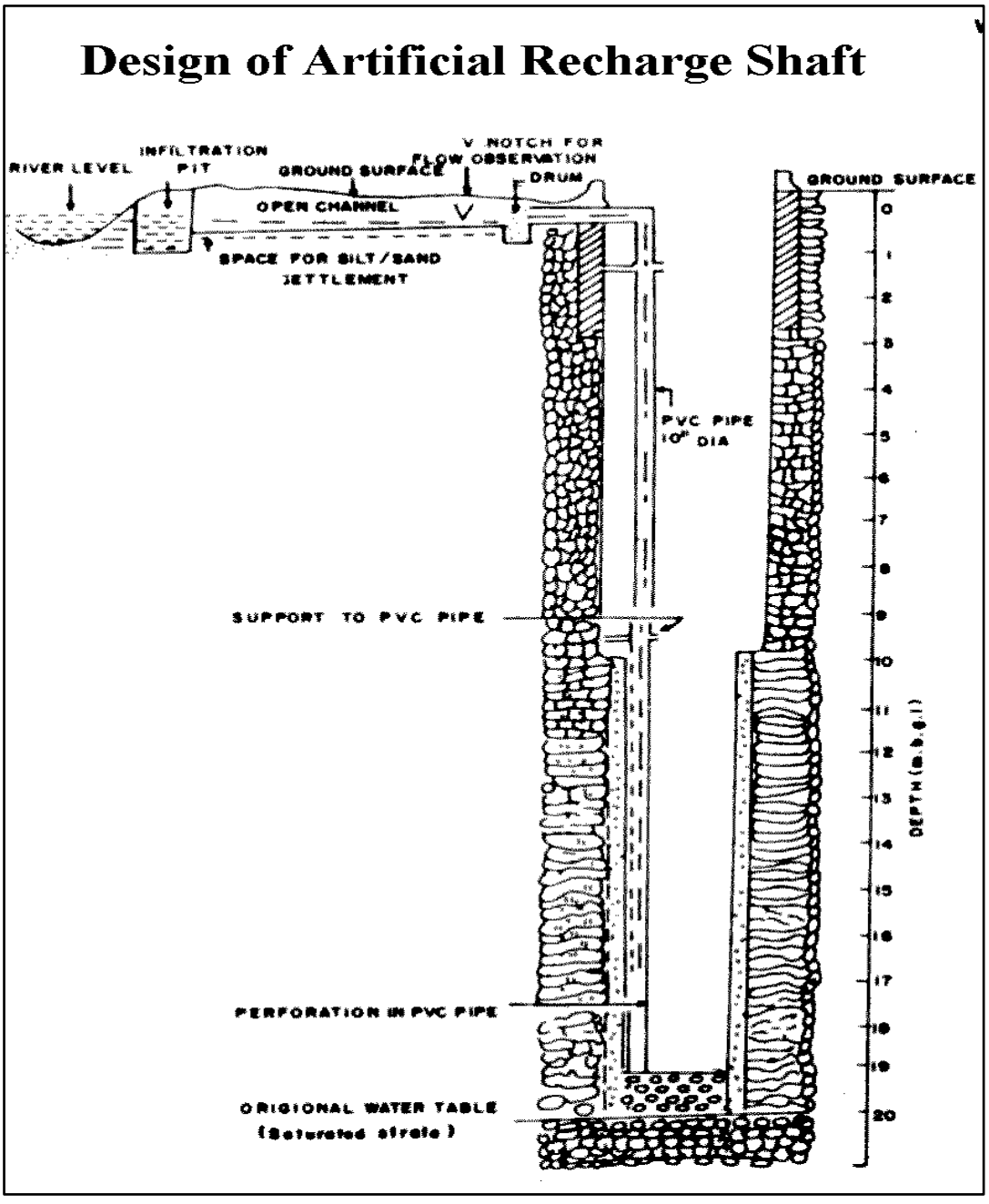
Design of Check Dam



Design of Percolation Tank

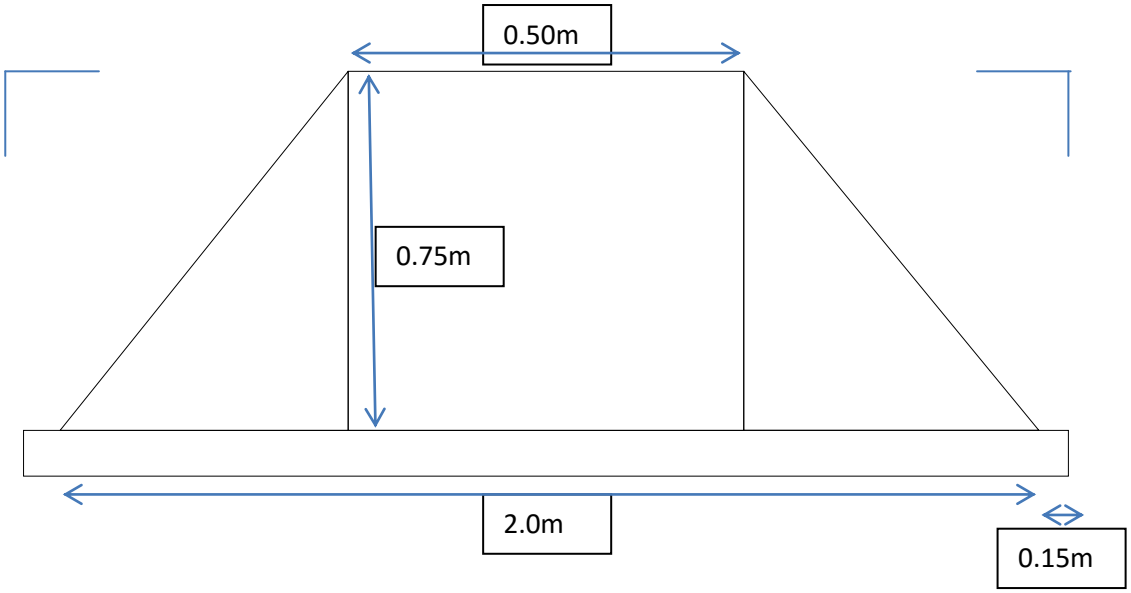


Design of Recharge Shaft



DESIGN OF WATER CONSERVATION STRUCTURES

Cross Section of Loose Boulder Structure



Cross Section of Gabbion Structure