केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga Rejuvenation

Government of India

Report

on

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

Bhokardan Taluka, Jalna District, Maharashtra

Part-II

मध्य क्षेत्र, नागपुर

Central Region, Nagpur

भारत सरकार
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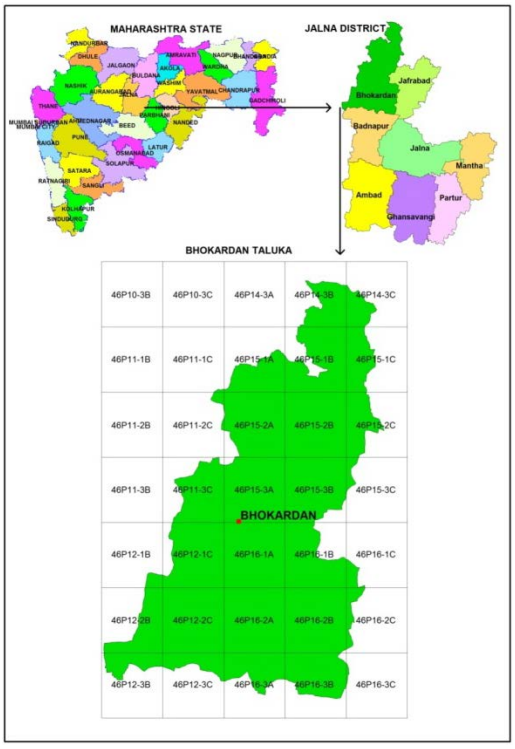
CENTRAL GROUND WATER BOARD

जल बचत जल संचय

Brief Report on Aquifer Maps and Ground Water Management Plan

जलभृत नक्शे तथा भूजल प्रबंधन योजना



BHOKARDAN
Taluka, **JALNA**
District,
Maharashtra
भोकरदन **तालुका** ,
जिला **जालना**, महाराष्ट्र

मध्य क्षेत्र, नागपुर/ Central Region, Nagpur
जून /June 2016

PART-II

BRIEF REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN, **BHOKARDAN TALUKA, JALNA DISTRICT,** MAHARASHTRA STATE

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PART-II

BRIEF REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN, **BHOKARDAN TALUKA, JALNA DISTRICT,** MAHARASHTRA STATE

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BRIEF REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN, **BHOKARDAN TALUKA, JALNA DISTRICT,** MAHARASHTRA STATE

1 BRIEF INTRODUCTION

In XII five year plan (2012-17), National Aquifer Mapping (NAQUIM) has been introduced to carry out detailed hydrogeological investigation on topo-sheet scale (1:50,000). Keeping in view the current demand vis-à-vis supply and futuristic requirement of water, Central Ground Water Board has taken up NAQUIM in prioritised areas covering Over-exploited, Critical and Semi-Critical talukas. Bhokardan taluka, categorised as Safe has been taken up on request of State Govt. to carry out detailed hydrogeological investigation by covering an area of 1273 sq.km. in the year 2013-14. The index map of the study area is presented **Fig. 1.1.**

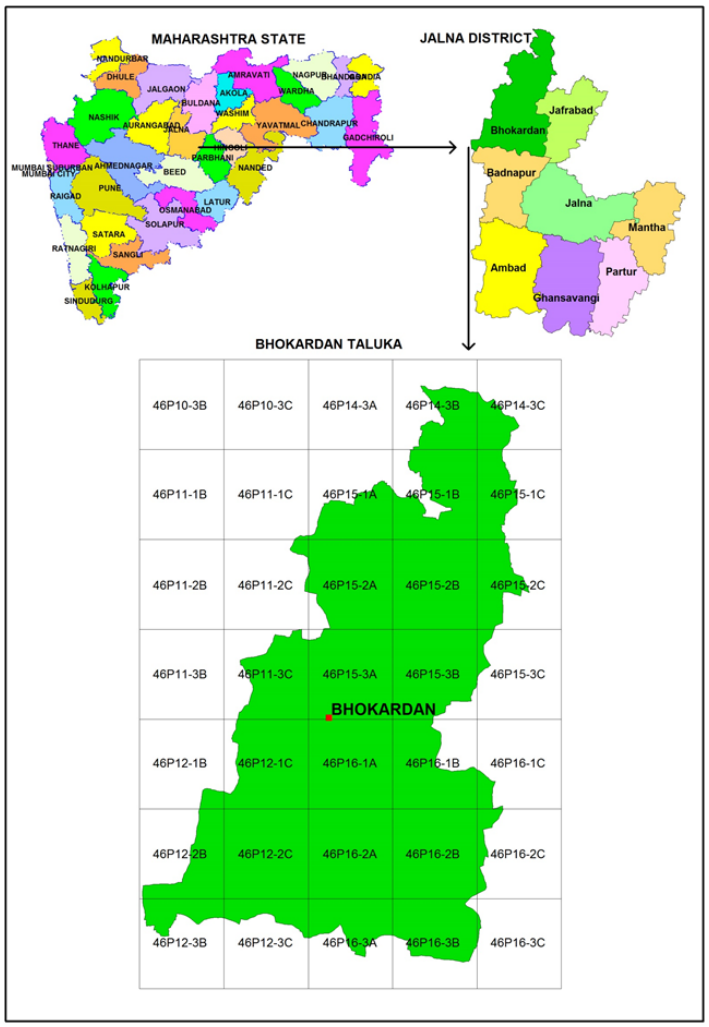


Fig. 1.1 Index map

2 SALIENT FEATURES

	BHOKARDAN
Area (sq.km.)	1273
Population (no.'s)	2,56,167
Rainfall (mm)	
i. Normal Annual Rainfall	641.6
ii. Rainfall Trend (mm/yr)	Falling@1.85 mm /yr
iii. Current Rainfall (2015)	627.80 (2% deficient)
Agriculture (sq.km.)	
i. Principal Crops	Cereals (478.00), Pulses (139.03) Cotton (485.00)
ii. Cultivable Area	899.73
iii. Net Sown Area	903.72
Irrigation Sources	
i. Ground water (sq.km.)	44.19
ii. GW drip irrigation (sq.km)	-
iii. Surface Water (sq.km.)	11.02
Data Utilised	
i. Key Observation Wells	46
ii. Exploratory & Observation Wells	11
iii. VES	
iv. GWQ sampling locations	50
Existing / Future Water Demands (MCM)	
Domestic	2.67 / 5.38 (2025)
Industrial	-
Irrigation	78.71
Water Level Behaviour	
Premonsoon WL (m bgl)	1.2 to 18.19
Postmonsoon WL (m bgl)	0.10 to 15.05
Premonsoon WL Trend	Rise – upto 0.55
(m /yr)	Fall – upto 0.38

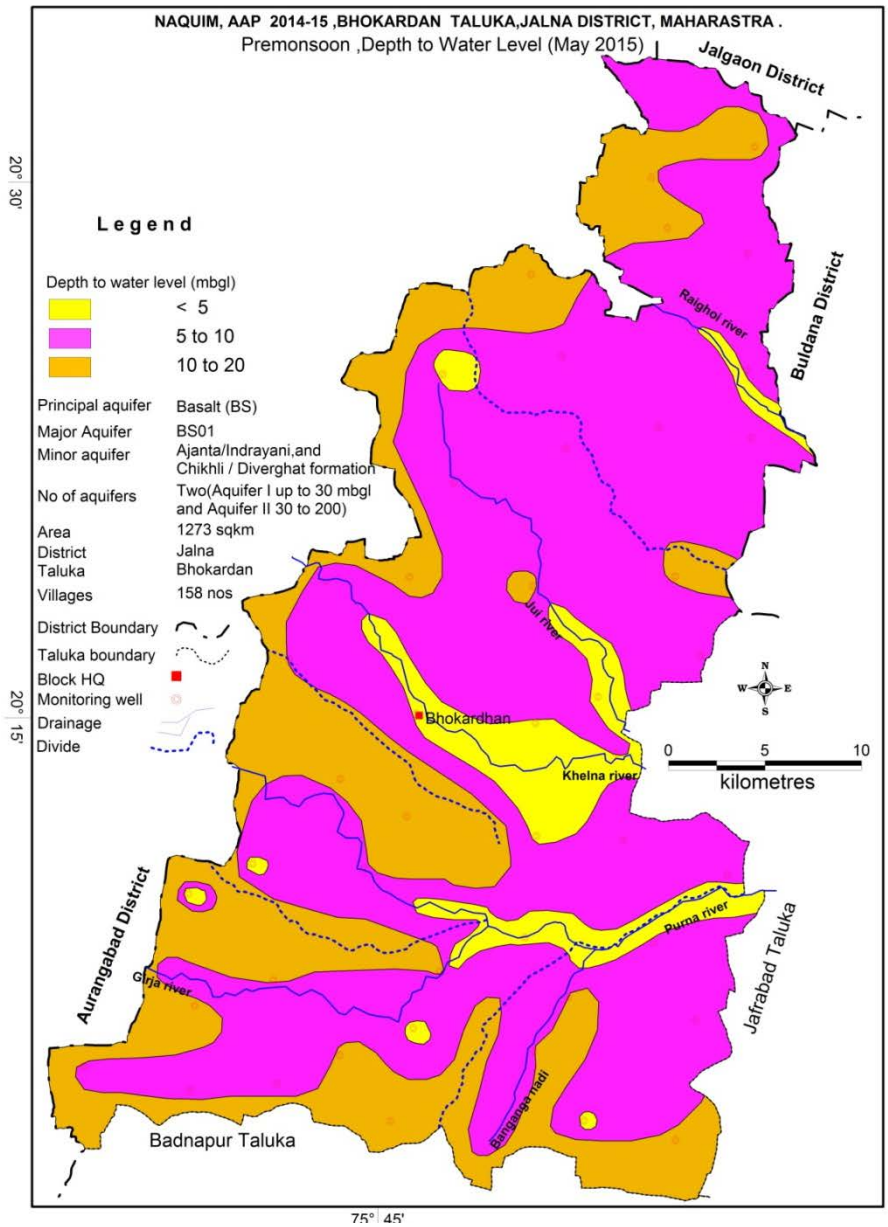


Fig. 2.1 Depth to water level map (May-2015)

3 AQUIFER DISPOSITION

	BHOKARDAN
3-D Aquifer Disposition	**Aquifer**: **Basalt**; Aquifer I - Weathered/Fractured Basalt: 5 to 30 m, Aquifer II - Jointed/Fractured Basalt: 35 to 145 m

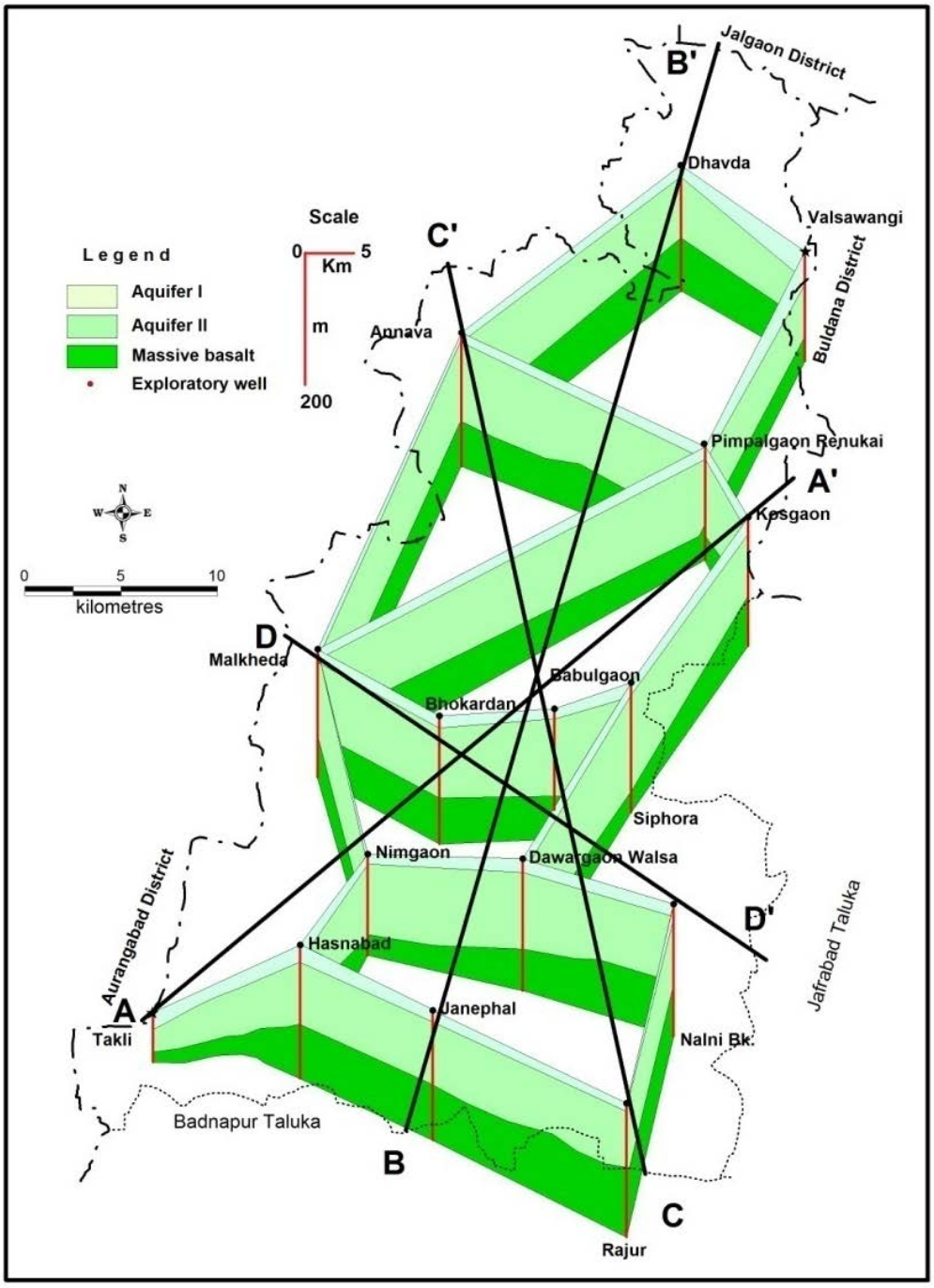
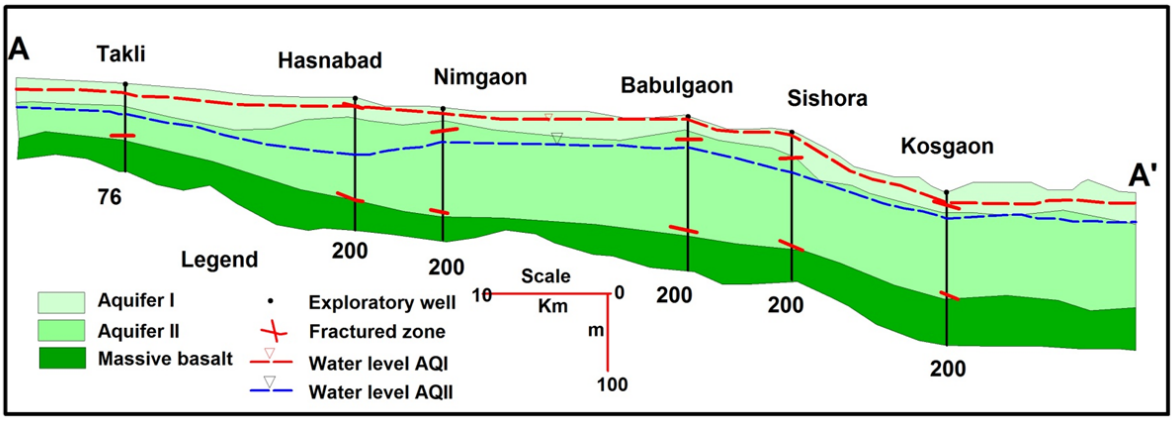
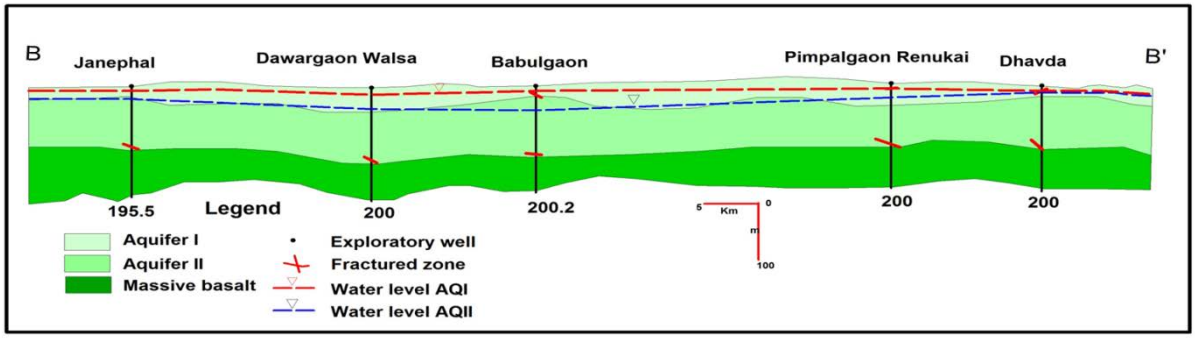
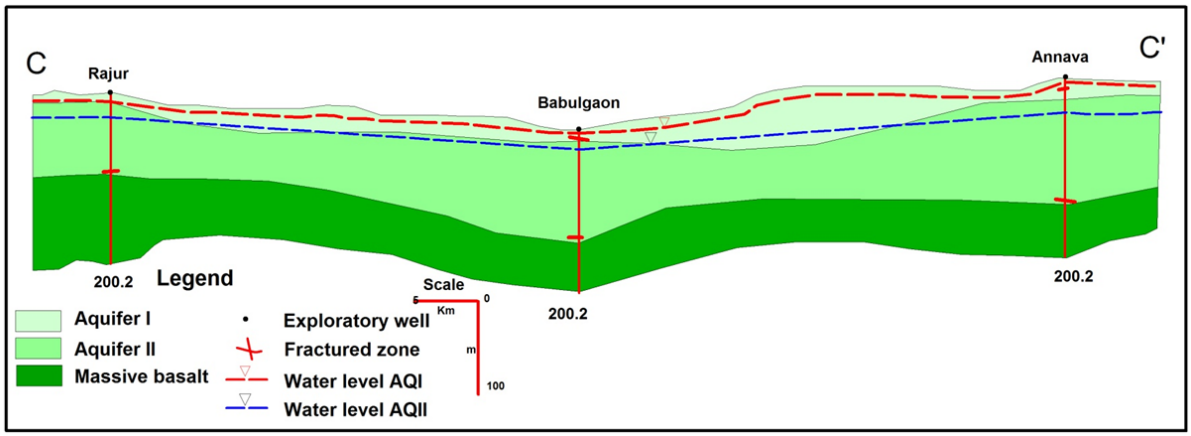


Fig. 3.1 Fence diagram







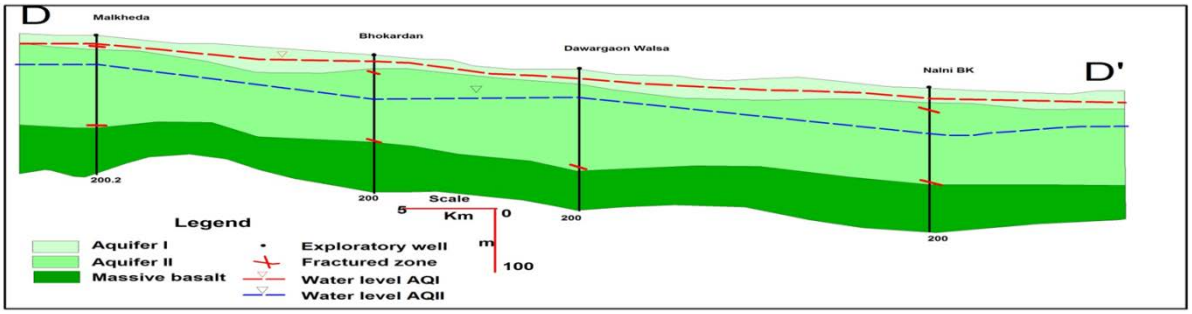


Fig. 3.1 (a-d) Cross sections

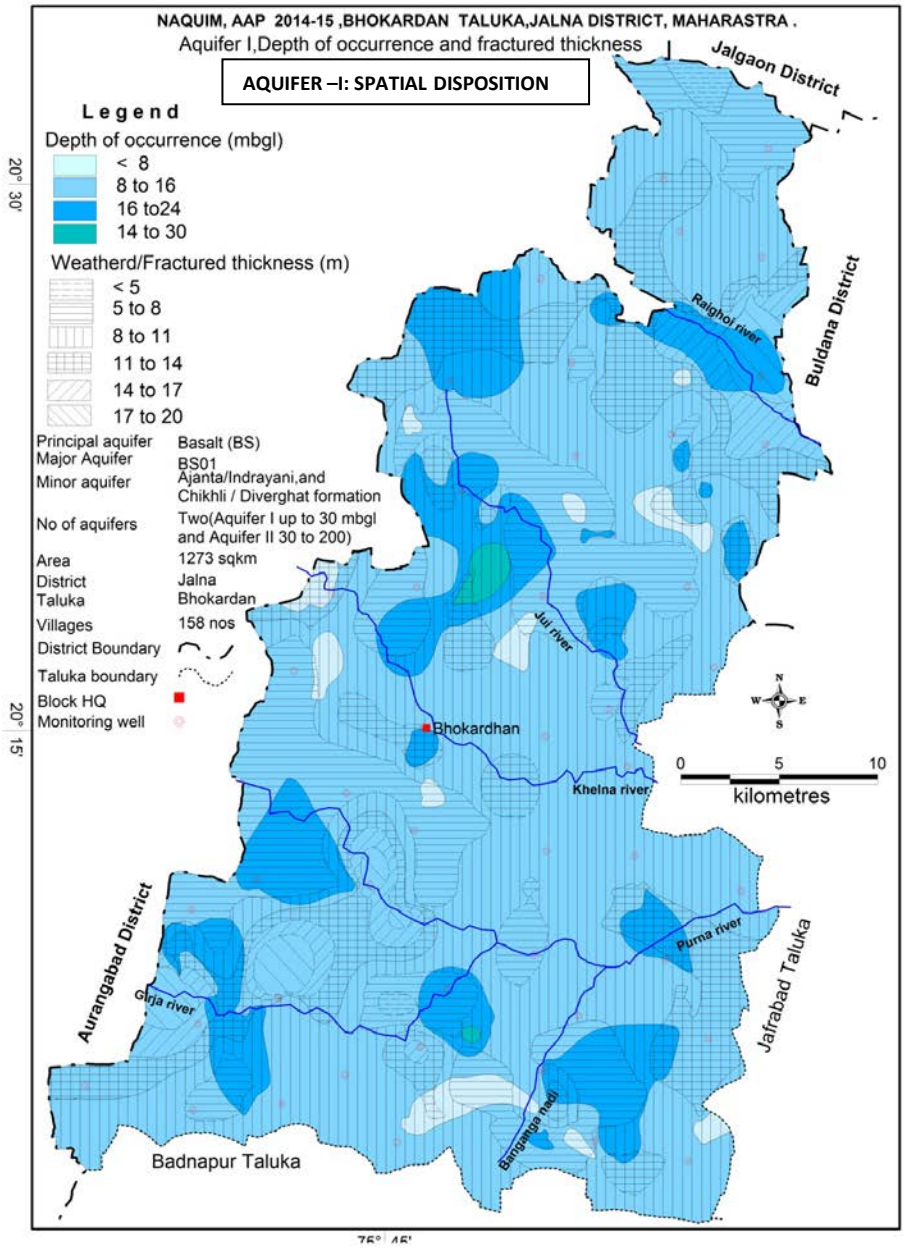


Fig. 3.2 Aquifer-I: Depth of Occurrence and fractured rock thickness

Aquifer –I Depth Range	**Upto 30 m**
Weathered/Fractured encountered	5 to 30 m
Fractured rock thickness	5 to 20 m
Yield range	10 to 50 m3/day
Water level (May-2015)	1.25 to 19 m
Specific capacity	90 to 270 lpm/m
Quality	Mainly Potable. Except High EC & Nitrate in almost all parts of Bhokardan
Aquifer Parameters	Transmissivity- 0.41 to 100 m2/day, Storativity/Sp. Yield- 0.02

Aquifer –II Depth Range	**30 – 200 m**
Fractured encountered	35 to 145 m
Fractured rock thickness	0.5 to 3 (m)
Yield range	10 to 100 lpm
Water level (May-2015)	11.4 to 90 m
Sustainability	0.5 to 2 hours
Quality	Potable
Aquifer Parameters	Transmissivity- 5-30 m2/day, Storativity- 0.0024 to 1.25 x 10^{-4}

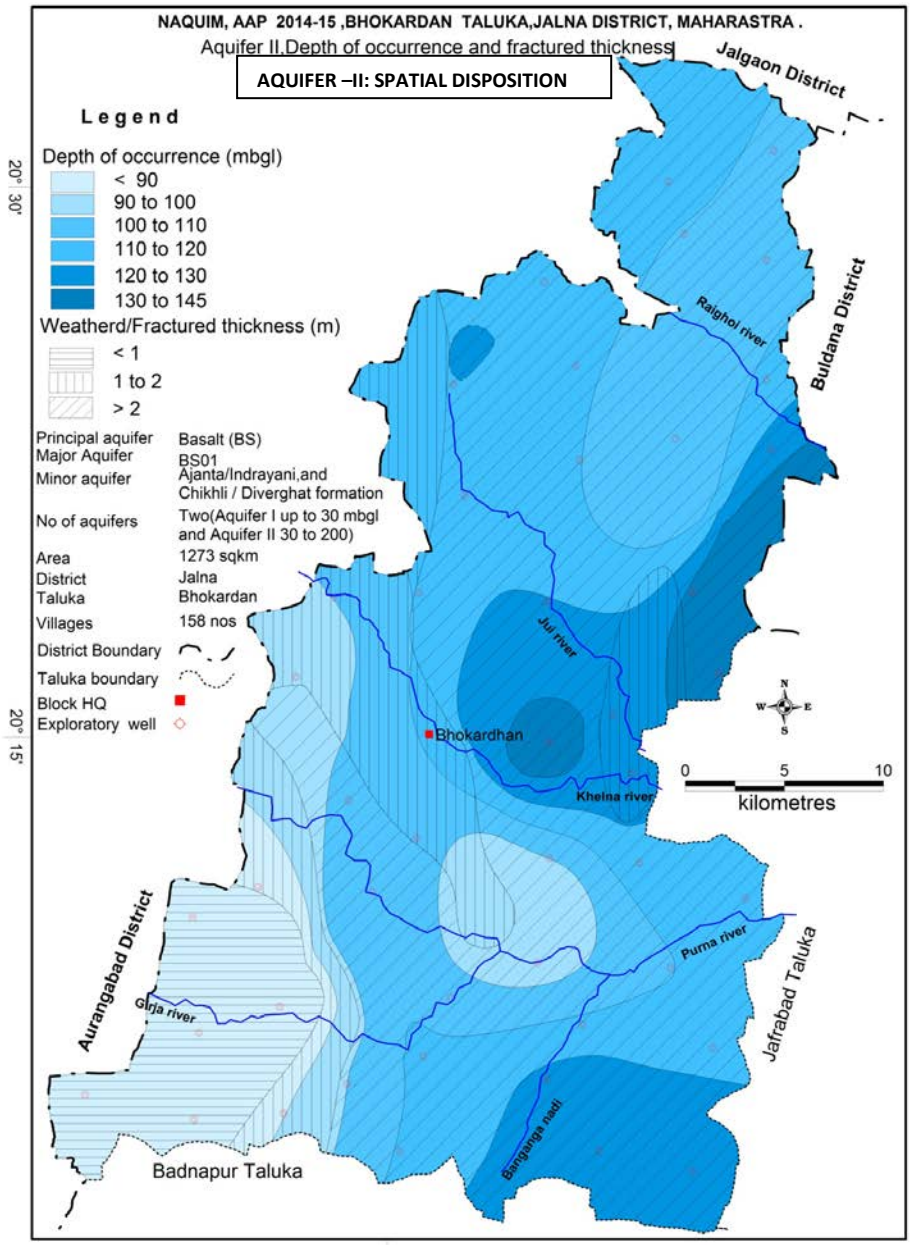


Fig. 3.3 Aquifer-II: Depth of Occurrence and fractured rock thickness

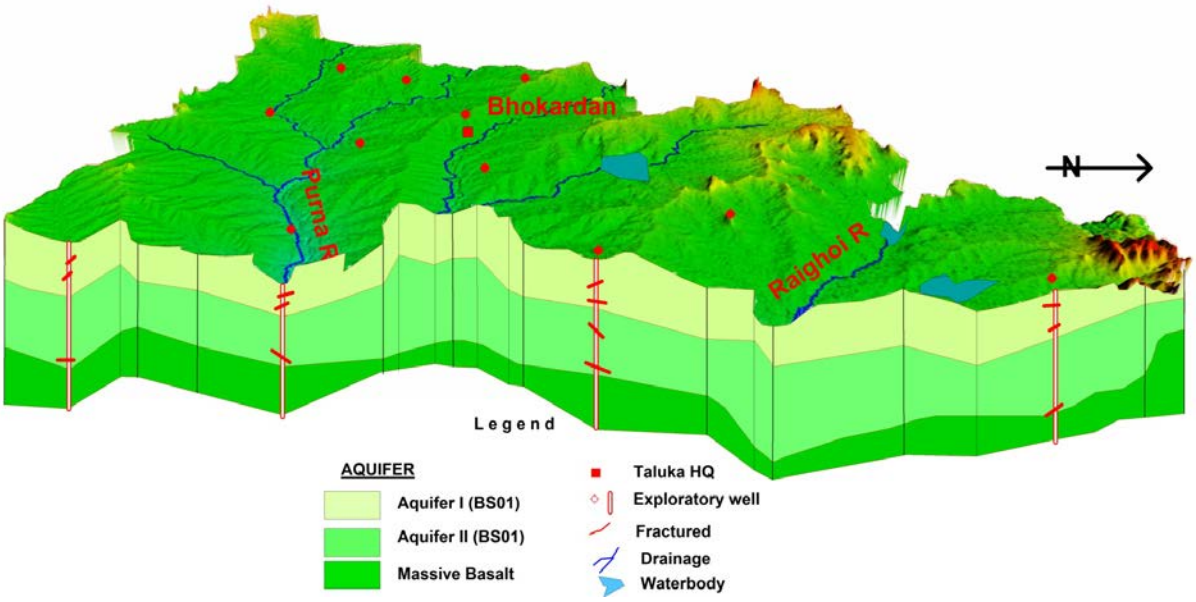


Fig. 3.3 3-D aquifer Disposition

Type of Aquifer	Formation	Depth range (mbgl)	SWL (mbgl)	Fractures / weathered Zones encountered (m bgl)	Fractures / weathered rocks Thickness (m)	Yield	Sp. Capacity	Aquifer parameter (Transmissivity – m^2/day)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	Deccan Trap-Weathered / Fractured Basalt	10-30	1.25-19.00 (May-2015)	5-30	5 to 20	10 to 50 m^3/day	90 to 270 lpm/m	-	0.02	Yes for both (except Nitrate affected villages for drinking)
Aquifer-II	Jointed/ Fractured Basalt	30-200	11.4-90 (May-2015)	35 to 145	0.5 to 3	10-100 LPM	0.5 to 2 hours	5-30	0.0024 to 1.25 x10^{-4}	Yes for both

4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

	BHOKARDAN
Aquifer wise Ground Water Resource availability and Extraction	
Ground Water Resource (MCM) **Aquifer –I:** upto 30 m Availability Withdrawal	 131.77 81.38
Ground Water Resource (MCM) **Aquifer –II:** 35 to 145 m Availability Withdrawal	 7.71
Present Category	Safe
Ground Water Related Issues	
Declining Water levels	Water scarcity in lean period, depends on groundwater
Limited deeper aquifer resources	7.71 MCM (Entirely depends on Dug wells)
Sustainability of unconfined aquifer	Drought prone area, sustainability of dugwells in lean period is very less (Tanker Fed)
GW based irrigation	Ground water irrigation in 193 Sq. km. double crop area

The study area forms part of Godavari Basin. Ground water draft during the period from 2008 to 2011 has been increased, but from 2011 to 2013, it is showing decrease in ground water draft due to change in irrigation practices and very limited agricultural activities in post-monsoon. Long term water level trend has shown declining water level trend. The major issues afflicting the areas are discussed below.

4.1 Declining Water Level Trends

The ground water exploitation has resulted also resulted in declining of water levels over the period of time. At present, the premonsoon declining water level trend of more than 0.20 m/year has been observed in about 182.29 sq.km whereas, postmonsoon declining water level trend of more than 0.20 m/year has been observed in about 493.10 sq.km area during 2006-15.

4.2 Water Scarcity (Drought Prone Taluka)

Bhokardan taluka comes under drought prone area with acute shortage of both drinking and agricultural purposes. Most of the villages are tanker fed right from December onwards. Only 193 sq. km area is covered by double crop area in southern part of the taluka all along catchment of Purna sub-basin.

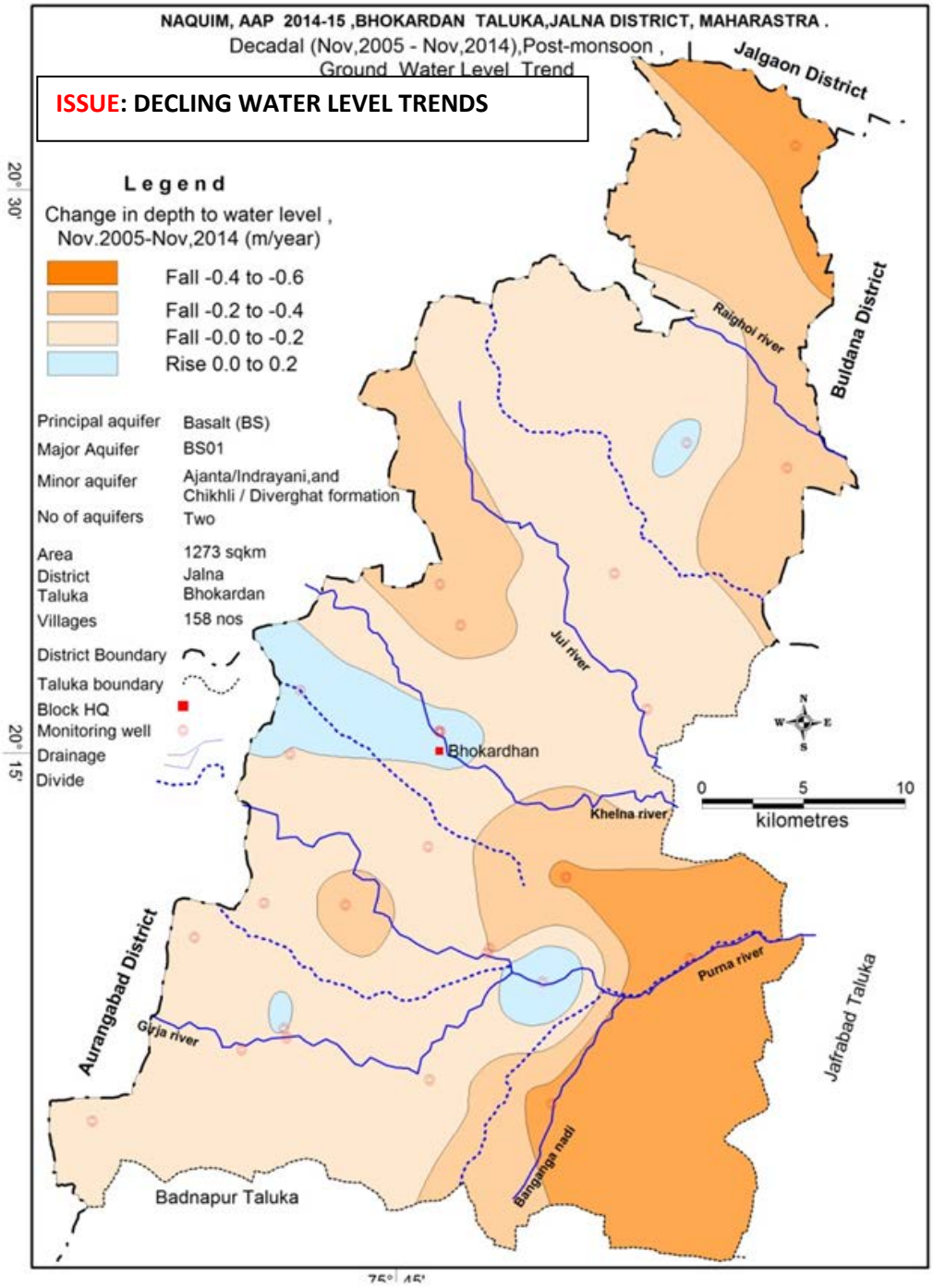


Fig. 4.1 Long term trend (post-monsoon)

5 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANAGEMENT INTERVENTIONS

5.1 Resource Enhancement by Supply Side Interventions	
Recharge Potential	26.02
Surface water requirement @ 75% efficiency	34.61
Availability of Surplus surface runoff	14.54
Surplus runoff considered for planning	14.54
Proposed Artificial Recharge Structures	
PT	51
CD	145
Volume of Water expected to be recharged @ 75% efficiency (MCM)	10.91
GWR available to bring stage of development upto 70% through dvelopment (MCM)	15.52
Total Resources available (MCM)	26.43
Proposed RTRWH	
Households to be covered	63040
Total RWH potential	1.63
Rainwater harvested / recharged @ 80% runoff co-efficient	1.30
Estimated Expenditure (Rs. in Cr.)	94.56
RTRWH Economically not viable & Not Recommended. Total estimated Cost of RTRWH would be-94.56 Cr. For Harvesting 1.30 MCM of Rain Water.	
Total volume of water expected to be available	26.43 MCM
Total Estimated Expenditure for AR	120 corers

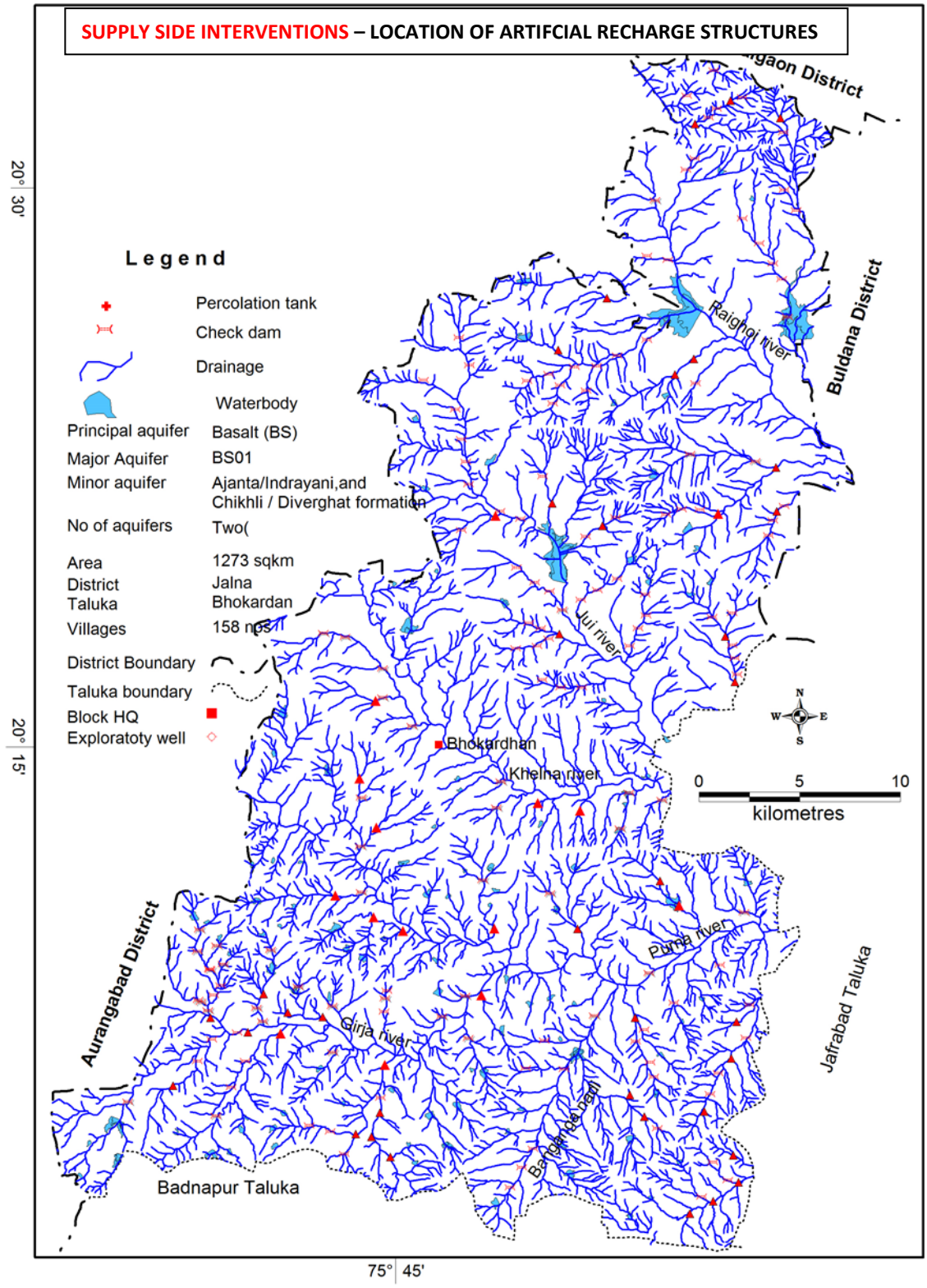


Fig. 5.1 Location of Artificial Recharge structures

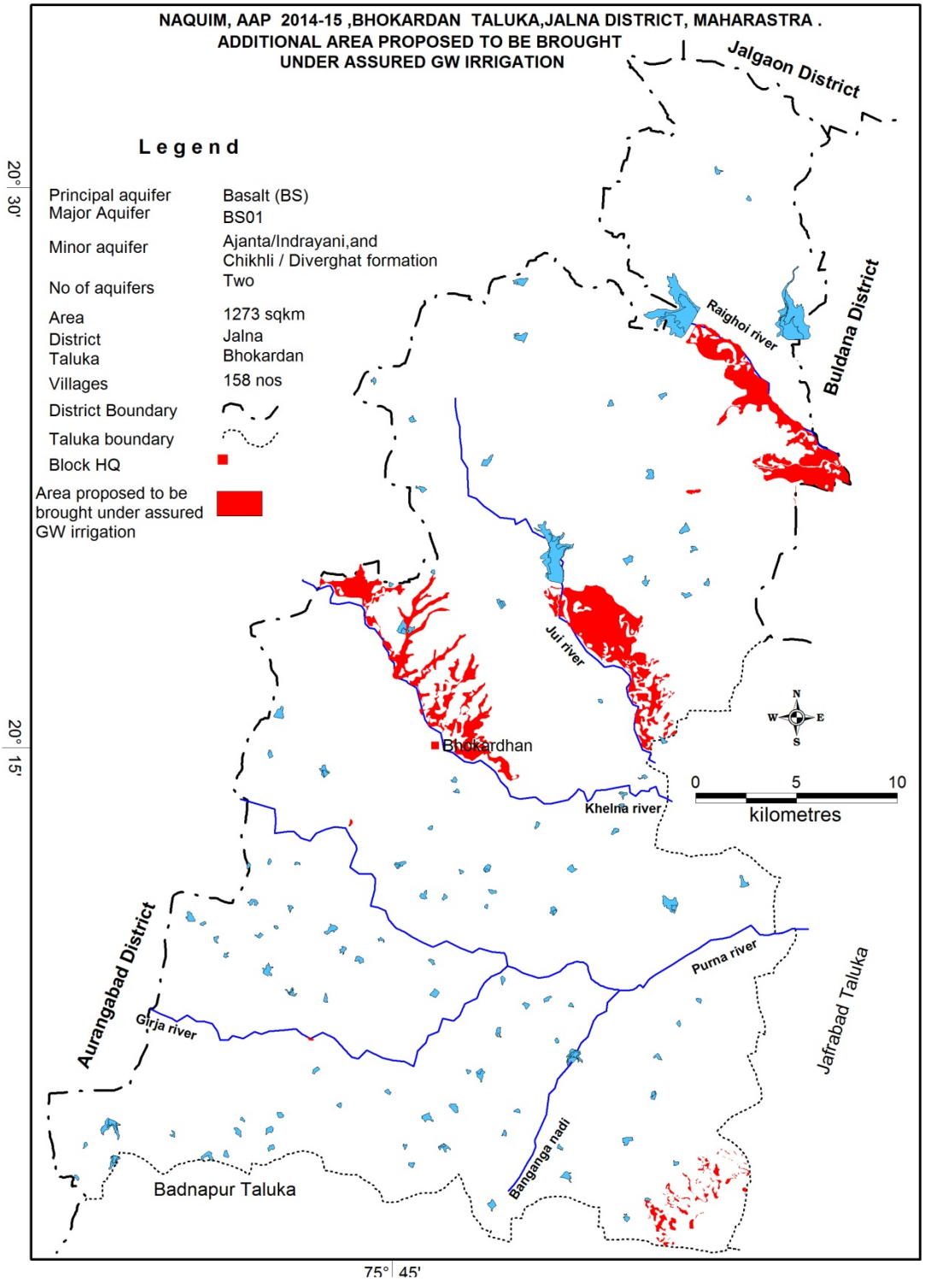


Fig 5.2 Location of Proposed additional area of 40.67 sq.km under assured GW irrgation in Bhokardan Taluka.

5.2 Resource Enhancement by Demand Side Interventions	
Change in Cropping Pattern	None
Micro irrigation techniques	None

5.3 Probable Benefits

Additional GW resources available after implementing above measures.	**26.43 MCM**
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	40.47

5.4 Regulatory Measures

Regulatory Measures	Regulation of wells below 80 m

6 SUM UP NAD RECOMMENDATIONS

The highly diversified occurrence and considerable variations in the availability and utilization of groundwater makes its management a challenging task. Scientific development and management strategy for groundwater has become imperative to avert the looming water crisis. In this context, various issues such as, prioritization of areas for development of groundwater resources vis-a-vis its availability, augmentation of groundwater through rainwater harvesting and artificial recharge, pricing and sectoral allocation of resources and participation of the stakeholders must be considered. In view of the above, the present study area a systematic, economically sound and politically feasible framework for groundwater management is required.

A thorough study was carried out based on data gap analysis, data generated in-house, data acquired from State Govt. departments and GIS maps prepared for various themes. All the available data was brought on GIS platform and an integrated approach was adopted for preparation of aquifer maps and aquifer management plans of Bhokardan taluka.

The study area is spanning over 1273 sq.km. Geologically the area is occupied by Basalt . The stage of ground water development is 61.76%. The area has witnessed ground water depletion and water scarcity in Lean period (Tanker fed). As per rainfall analysis, the area comes under drought prone affected. The declining water level trend of more than 0.20 m/yr has been observed in 493.10 sq.km. during post-monsoon. The area receives less rainfall and are completely dependent on ground water irrigation. The increasing allurement towards cash crops and decreasing availability of water have compelled the farmers to shift from traditional irrigation methods to micro irrigation techniques like drip irrigation. At present the area under double crop is 193 sq. km. and irrigated through ground water.

Ground water management plan has been prepared with the objective to arrest the declining trend and to reduce the water scarcity period by applying supply side interventions. The supply side interventions are proposed to construct 51 Percolation tank and 145 check dam with a cost estimate of 120 cr. This will generate additional 10.91 MCM water resources. Presently the taluka is having stage of development is 61.76%. The ground water resources available to bring stage of development upto 70% after development is 15.52 MCM. The total resource available is 26.43 MCM. This will bring an area of 40.67 sq.km. under assured ground water irrigation.

Thus the focus of proposed management plan was to use ground water very effectively with supply and demand side interventions. The perusal of above ground water management plan lays stress on adopting micro-irrigation techniques and artificial recharge measures.

However, considering the low storage potential of hard rock aquifer in the area this ground water development should also be coupled with ground water augmentation plan, so that there is no stress on ground water regime of the area.

Root top Rain water harvesting is not recommended, as the volume of water harvested would be 1.30 MCM with an estimate cost of Rs. 94.56 corers. As , it is not economically viable and hence not recommended.

No demand side interventions are proposed.

Tangible and Non Tangible Benefits

The timely and proper implementation of the above suggested management plan will have many tangible and non-tangible benefits for Bhokardan taluka. Some of the major benefits are listed below.

The proposed construction of the artificial recharge structures viz., 51 percolation tanks and 145 check dams at the estimated cost of Rs. 120 crores to augment the ground water resources to the tune of 10.91 MCM and the ground water resources available to bring stage of development upto 70% after development is 15.52 MCM. The total resource available is 26.43 MCM. This will bring an area of 40.67 sq.km. under assured ground water irrigation considering an average crop water requirement of 0.65 m.

The implementation of above water conservation, artificial recharge and RTRWH measures will have a positive impact on drinking water sources of the area. It will ensure that the wells don't go dry during summer/lean/stress period in the areas of implementation and sufficient ground water availability is there in the wells even during the summer season. Thus the drinking and domestic water sources will be strengthened. These measures will also be able to arrest the decline in water levels of Aquifer-I and raise the water levels in Aquifer-II.

The probable benefits of the proposed management plan after implementing above recharge measures will be help in arrest the declining trend and will reduce the water scarcity period in Bhokardantaluka. Further ground water resources of 26.43 MCM will be available for utilisation.

These interventions also need to be supported by regulation of deeper aquifer and hence it is recommended to regulate/ban deeper tubewells/borewellsof more than 80 m depth in this taluka, so that the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought.

No demand side interventions are proposed.

IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory groundwater management.