2330/NQM/2021

केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

जल शक्ति मंत्रालय

भारत सरकार

CENTRAL GROUND WATER BOARD

Department of Water Resources, RD & GR

Ministry of Jal Shakti

Government of India

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

PARBHANI DISTRICT, MAHARASHTRA

(AAP 2019-20)

मध्य क्षेत्र, नागपुर,

Central Region, Nagpur

मार्च 2021/March 2021

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN PARBHANI DISTRICT, MAHARASHTRA

(AAP 2019-20)

CONTRIBUTORS

Principal Author		
Sh. Ashwin Kumar Atey	:	Assistant Hydrogeologist
Supervision & Guidance		
Dr. P. K. Jain Dr. Umesh Balpande	: :	Regional Director Senior Hydrogeologist/ Scientist-D
Hydrogeology, GIS maps and Management Plan		
Sh. Ashwin Kumar Atey	:	Assistant Hydrogeologist
Map preparation		
Sh. Ashwin Kumar Atey	:	Assistant Hydrogeologist
Sh. L.S Nawghare		Draftsman

PARBHANI DISTRICT AT A GLANCE

1. GENERAL INFORMATION			
	Geographical Area	:	6311.15 sq. km.
	Administrative Divisions (2011)	:	Taluka-9; Parbhani, Jintur, Gangakhed, Pathri, Purna, Palam, Selu, Sonpeth and Manwat
	Villages	:	830
	Population (2011)	:	1836086
	Average Annual Rainfall (2009-2019)	:	687.1 mm
	Actual Rainfall 2019	:	816.4 mm
2. GEOMORPHOLOGY			
	Major Physiographic unit	:	Part of Western Ghat, Ajanta Hill Ranges
	Major Drainage	:	Godavari, Purna, Karpara, Dudhana river
3. LAND USE (2016-17) (source: mahasdb.maharashtra.gov.in/district Report)			
	Forest Area	:	101.80 sq. km.
	Net Area Sown	:	7752.04 sq. km.
	Cultivable Area	:	5642.67 sq. km.
4.	**SOIL TYPE**	:	Black cotton soil
5. PRINCIPAL CROPS (2017-18)			
	Cotton	:	1767.62 sq. km.
	Cereals	:	1552.86 sq. km.
	Pulses	:	2007.85 sq. km.
	Jowar	:	1124.13 sq. km.
	Wheat	:	372.96 sq. km.
IRRIGATION BY DIFFERENT SOURCES (2017-018) –Nos.			
	Irrigation wells	:	46986
	Minor Irrigation (Local)	:	40
	Minor Irrigation (ZP)		307
	Medium Irrigation		6
	Major Irrigation	:	1
7. GROUND WATER MONITORING WELLS (2019)			
	Dugwells	:	38
	Piezometers	:	02
8. GEOLOGY			
	Recent	:	Alluvium
	Upper Cretaceous-Lower Eocene	:	Basalt (Deccan Trap)
9. HYDROGEOLOGY			
	Water Bearing Formation	:	Basalt (Deccan Traps) weathered, vesicular fractured, jointed. Under phreatic and confined conditions.
	Pre-monsoon Depth to Water Level (May-2019)	:	3.20 mbgl (Runj T Purna)-35.0 mbgl (Dharmapur)
	Post-monsoon Depth to Water Level (Nov.-2019)	:	0.2 mbgl (Tadlimla)- 11.5 mbgl (Shinde Takli)

	Pre-monsoon Water Level Trend (2010-2019)	:	Rise: 0.00030 m/yr (Pendu Bk) – 1.519 m/yr (Dharmapuri)
			Fall: 0.0151 m/yr (Mahatpuri) – 2.14 m/yr (Shinde Takli)
	Post-monsoon Water Level Trend (2010-2019)	:	Rise: 0.0148 m/yr (Jintur) – 2.374m/yr (Dharmapur)
			Fall: 0.0042 m/yr (Tadkalas)-3.073m/yr (Hadgaon_Pz)
10. GROUND WATER EXPLORATION (As on March 2019)			
	Wells Drilled	:	46 wells (30 EW + 11 OW + 5 PZ)
	Depth Range (mbgl)	:	37.10 to 204.75
	Weathered thickness(mbgl)	:	5.00-19.00
	SWL	:	0.84 magl-188.70 mbgl
	Discharge(m^3/day)		Traces to 2339.71
11. GROUND WATER QUALITY			
	The quality of ground water is generally alkaline and suitable for drinking and irrigation purpose except Fluoride and Nitrate affected Villages.		
	Type of Water	:	Ca-Cl and Ca-HCO_3
12. DYNAMIC GROUND WATER RESOURCES (ham)- (2017)			
	Total Ground Water Annual Recharge	:	84024.26 Ham
	Annual Extractable Ground Water Recharge	:	79714.1 ham
	Total Extraction (Irrigation + Domestic+ Industrial)	:	37745.96 Ham
	Net ground Water Avalability for future use	:	34333.14 Ham
	Stage of Ground Water Extraction	:	47.35 %
	Overall Category		Safe
13. MAJOR GROUND WATER PROBLEMS AND ISSUES			
	Although a modest area in Parbhani district is under canal command of various irrigation projects and the area is showing declining trend of ground water levels due to exploitation of ground water for irrigation and other purposes at a faster rate. There is much scope for conjunctive use in such areas. The conjunctive use of water is recommended in this area. Ground water quality is adversely affected at many places due to high concentration of some parameters specially nitrate and floride. Adequate sanitary protection to the wells may be provided to control the nitrate contamination. About 50% area of the district is having low yield potential (<1 lps).		
14. AQUIFER MANAGEMENT PLAN			
	Supply side Management		Proposed AR structures: 234 Percolation Tanks and 668 Check Dams.

			The expected recharge every year from these structures is 50.09 MCM.
	Demand side Management		A total of 73.08 sq km area of sugarcane crop is proposed to cover under drip irrigation. 41.66 MCM of ground water can be saved.
	Development plan		Proposed 15435 Dugwells and 2573 Borewells in phased manner.

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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN PARBHANI DISTRICT, MAHARASHTRA

1. INTRODUCTION

National Aquifer Mapping (NAQUIM) has been taken up in XII five year plan by CGWB to carry out detailed hydrogeological investigation on toposheet scale of 1:50,000. The NAQUIM has been prioritized to study Over-exploited, Critical and Semi-Critical blocks as well as the other stress areas recommended by the State Govt. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers.

The vagaries of rainfall, inherent heterogeneity & unsustainable nature of hard rock aquifers, over exploitation of once ample alluvial aquifers, lack of regulation mechanism has a negative effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from “traditional groundwater development concept” to “modern groundwater management concept”.

Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. The proposed management plans will provide the “Road Map” for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus, the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation. The aquifer maps and management plans will be shared with the Administration of Parbhani district, Maharashtra for its effective implementation.

The activities under NAQUIM are aimed at:

- Identifying the aquifer geometry,
- Aquifer characteristics and their yield potential
- Quality of water occurring at various depths,
- Aquifer wise assessment of ground water resources
- Preparation of aquifer maps and
- Formulate ground water management plan

1.1 About the study area

Parbhani district was known as “Prabhavati” in ancient times. It is located towards east of Maharashtra and it is one of the eight districts of Marathwada division. From 1596 to 1724, major part of the present territory of the district was divided between Pathri and Washim sarkars of Berar Subah of the Mughal empire. In 1724, after the battle of Sakharkheda, it went under the Nizam's rule. Following the re-organization of the states in 1956, Parbhani along with the other districts of Marathwada became part of Bombay State. On 1 May 1960 when Maharashtra state was formed, it became a part of it. The district headquarters is located at Parbhani town.

Parbhani district is divided into 9 talukas. These are Parbhani Gangakhed, Sonpeth, Pathri, Manwat, Palam, Seloo, Jintur and Purna. Parbhani district is located in the east partof Marathwada region of Maharashtra State. The district is bounded on the north by Hingoli and Buldhana districts. On the east by Nanded and Hingoli, on the South by Latur and on the West by Beed and Jalna districts.

The district as a whole belongs to the Godavari peninsular drainage, but the area of the district mainly belongs to two river systems, one in the north and north-east: the Penganga, Marathwada Purna and other immediate tributaries of the Godavari flowing in this district.

Parbhani district has been taken up under NAQUIM study during the year 2019-20. The total area of the district is about 6,214 sq. km. The district is categorized as safe as per Ground Water Resources Estimation as on March 2017. The Administrative and Index map of the study area is presented in **Figure 1.1 & Figure 1.2.** Central Ground Water Board has taken up several studies in the district since 1982 to 2005 including Systematic Hydrogeological Survey, Reappraisal Hydrogeological Studies, etc. The data generated have been shared with the Central and State agencies as well as with the stake holders in the form of reports, maps etc.

Figure 1.1: Location map of Parbhani District

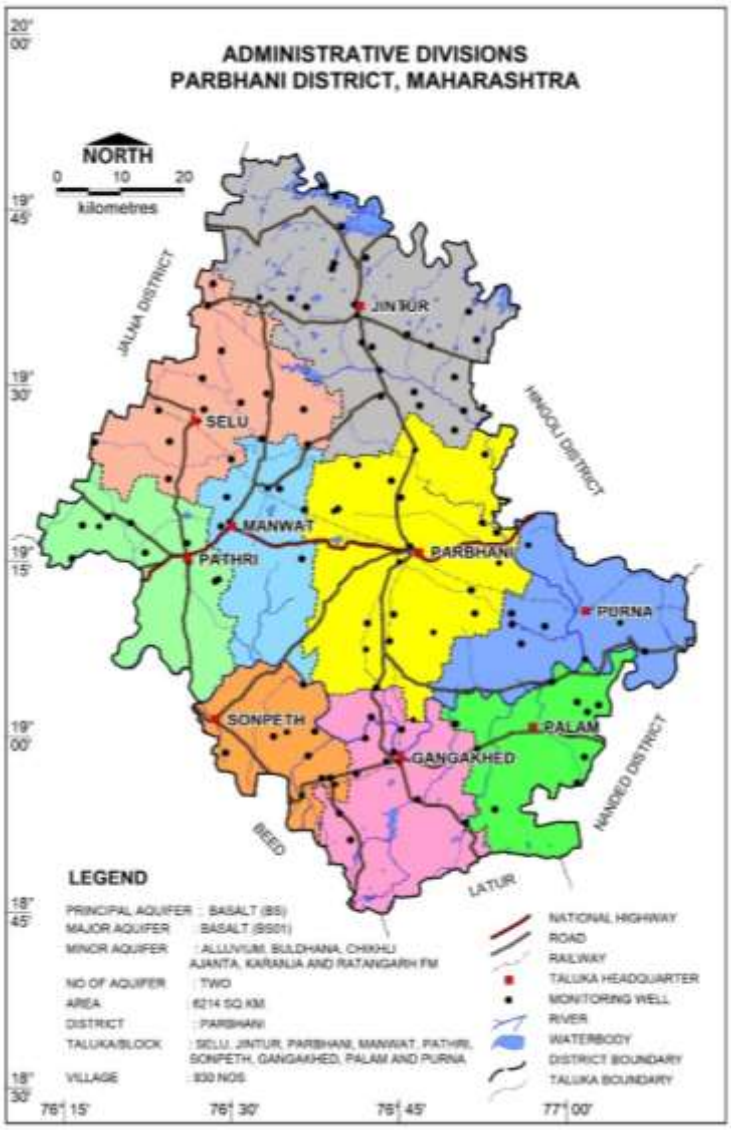


Figure 1.2: Administrative map of Parbhani District

1.2 Geomorphology, Drainage Landuse and Soil Types

As a part of the Deccan Plateau, the land of the district has a general elevation of about 457.50 metres above the sea level, its highest and lowest levels being 579.73 metres in the Jintur range, about 12.87 km. north of Charthana. and 366.0 metres above sea level on the Godavari bank near the point where the river crosses over the district boundary. Pathri, Partur (except its northern part), Gangakhed and Parbhani tahsils are plain topographically. So also, are the tahsils lying to the south. But Jintur, Hingoli, Kalamnuri and the northern and eastern parts of Partur and Basmath tahsils are all hilly and mountainous in nature. Figure 1.3 shows the geomorphology of the district.

The prevailing tone of the landscape in Parbhani is that of plateau forms having eroded scarps and detached remnants. In places, the plateau ranges succeed one another to attain higher elevations. Where the plateau is wide it assumes the appearance of an undulating remnant plain, with its scarp face overlooking broad river

basins. These scarp lands present a much-eroded appearance and so intense is the erosive action of streams that their deeply entrenched valley courses are flanked by broken and bare scrublands as in the region north and east of Kalamnuri.

The Jintur range is the more prominent portion in the heights of the district. It is a remnant plateau with a general trend from west north-west to south south-east and forms a part of the Ajantha ranges emanating from the Sahyadris. The crest line consists of flat tops at an average elevation of 533.75 metres above sea level but here and there rounded peaks record heights up to 549 metres and 579.50 metres above sea level. In its several parts, flat tops, as in Sawarkheda and Lohra Khurd, are agriculturally useful, but other areas, especially the marginal belts overlooking the scarp sides, are bare. Thus, the landscape of Parbhani district has two contrasting features: the undulating agricultural plains and the residual plateau features with deeply eroded sides covered with scrub and occasional stony wastes. The scarp-lands lying to the north of the Purna area are counterparts of the Jintur hills, but they are more continuous and have an undulating plateau extension towards the north.

The district as a whole belongs to the Godavari peninsular drainage, but the area of the district mainly belongs to two river systems, one in the north and north-east: the Penganga, Marathwada Purna and other immediate tributaries of the Godavari flowing in this district. The drainage map of the district is shown in figure 1.4.

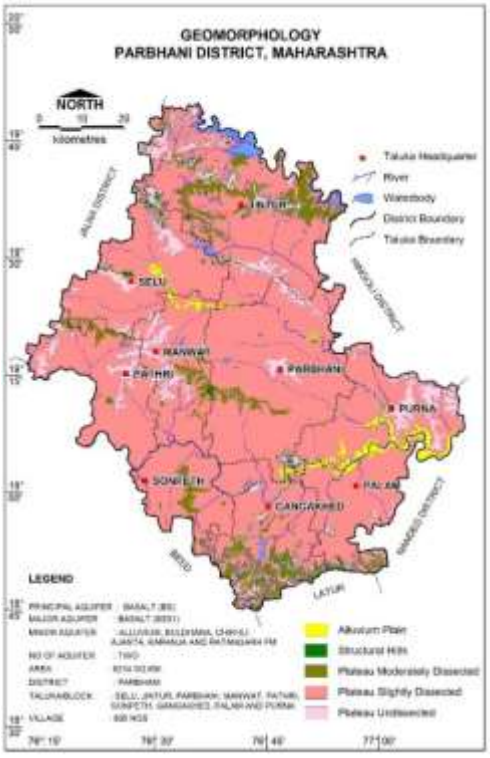


Figure 1.3: Geomorphology

Figure 1.4: Drainage

Due to rolling and undulating topography soil of varying thickness has developed. The soil varies from clayey to clayey loamy in valleys and sandy loamy on hills and slopes. The types of Soils are seen in the district are:

- Light and medium soil is seen in the northern ghat wherein the soil horizon is shallow. The soil is also seen in southern part of the Gangakhed taluka.
- Heavy black soil exists in the central part of the district viz in parts of Pathri and Parbhani talukas. The soil horizon is thick. This soil is called Regur which is rich in various plant nutrients. The soil horizon is very thick in valley portions.

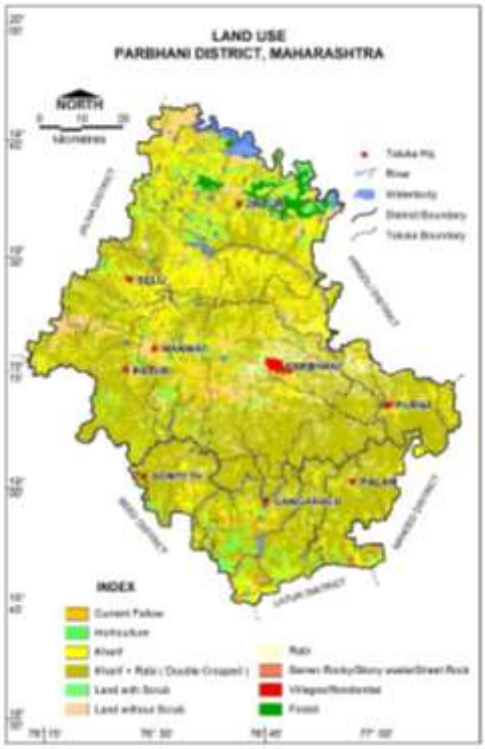


Figure 1.5: Land Use

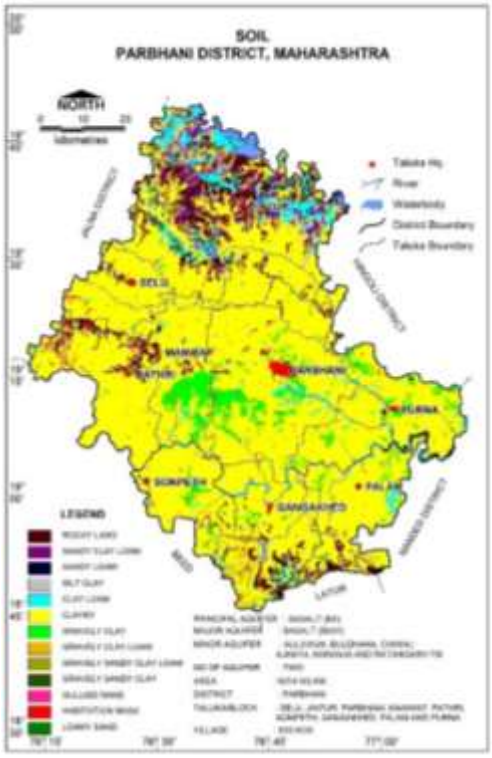


Figure 1.6: Soil

1.3 Climate and Rainfall

The climate of the district is generally dry except during the south-west monsoon season. The year may be divided into four seasons. The cold season from December to February, followed by the hot season from March to May, the south-west monsoon season from June to September and the post-monsoon season from October to November. Isohyet map of Parbhani district shown in Figure 1.7.

Rainfall is not uniform in all the blocks of the district. The district normal rainfall for the year is 830.3 mm. The decadal average rainfall for the district ranges from 417.8 mm (2015) to 1168.9 mm (2005). The rainfall trend analysed shows a falling trend @ 18.62 mm/year. The short-term rainfall analysis data of Parbhani district indicates a normal rainfall in 66.67% and excess rainfall in 4.76 % of total year with moderate drought conditions in 28.57 %.

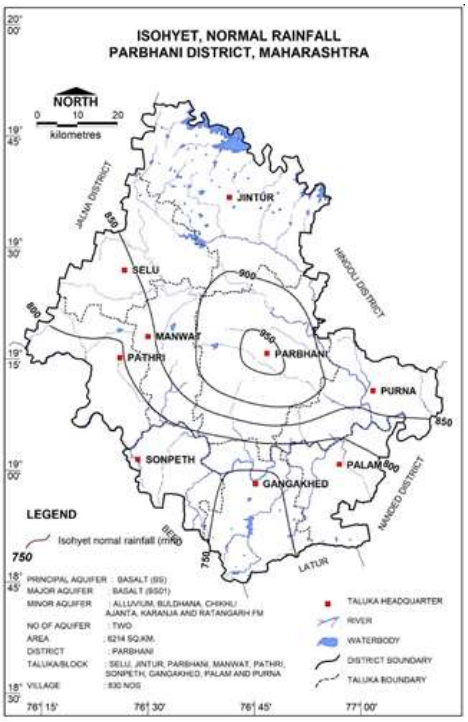


Figure 1.7: Isohyetal map of Parbhani District

Average rainfall for the district and yearly departures from Normal for the period 1999-2019 are presented in **Table 1.1** and depicted in **Figure 1.8.** The long-term rainfall analysis (1999-2019) is presented in **Table 1.2.**

Table 1.1: Long term (1999-2019) Rainfall Data and Departures

YEAR	AVERAGE Rainfall (mm)	NORMAL Rainfall (mm)	DEPARTURE (%)	CATEGORY
1999	1021.9	830.3	23.0759966	NORMAL
2000	953.5	830.3	14.8380104	NORMAL
2001	1031.7	830.3	24.2562929	NORMAL
2002	789.6	830.3	-4.90184271	NORMAL
2003	876.1	830.3	5.51607853	NORMAL
2004	566.5	830.3	-31.7716488	MODERATE
2005	1168.9	830.3	40.7804408	EXCESS
2006	896.6	830.3	7.98506564	NORMAL
2007	791.8	830.3	-4.63687824	NORMAL
2008	608.6	830.3	-26.7011923	MODERATE
2009	693.2	830.3	-16.5121041	NORMAL
2010	1013.3	830.3	22.0402264	NORMAL
2011	667.5	830.3	-19.6073708	NORMAL
2012	637.2	830.3	-23.2566542	NORMAL
2013	968	830.3	16.5843671	NORMAL
2014	448.3	830.3	-46.0074672	MODERATE
2015	417.8	830.3	-49.6808383	MODERATE
2016	836.4	830.3	0.73467421	NORMAL
2017	550.9	830.3	-33.6504878	MODERATE

YEAR	AVERAGE Rainfall (mm)	NORMAL Rainfall (mm)	DEPARTURE (%)	CATEGORY
2018	509	830.3	-38.6968566	MODERATE
2019	816.4	830.3	-1.6740937	NORMAL

(Source-website of Maharashtra Government: mahaagri.gov.in)

Table 1.2: Analysis of Long term (1999-2019) Rainfall Data

Period	1999 to 2019		
No. of years	21		
Normal rainfall	830.3	Mean:	774.4
Standard deviation	212.43 mm	Median:	791.8
Coefficient of variation	27.4 %	Mode:	NA
Slope	- 18.62mm/year	No of years:21	
Intercept	979.31		
Equation of trend line	y = -18.624x + 979.31		

CATEGORY	NUMBER OF YEARS	% OF TOTAL YEARS
DEPARTURES		
POSITIVE	9	42.86
NEGATIVE	12	57.14
DROUGHTS		
MODERATE	6	28.57
SEVERE	0	0.00
ACUTE	0	0.00
NORMAL & EXCESS R/F		
NORMAL	14	66.67
EXCESS	1	4.76

Rainfall departure: EXCESS: > +25; NORMAL: +25 TO -25; MODERATE: -25 TO -50; SEVERE: -50 TO -75; ACUTE: <-75

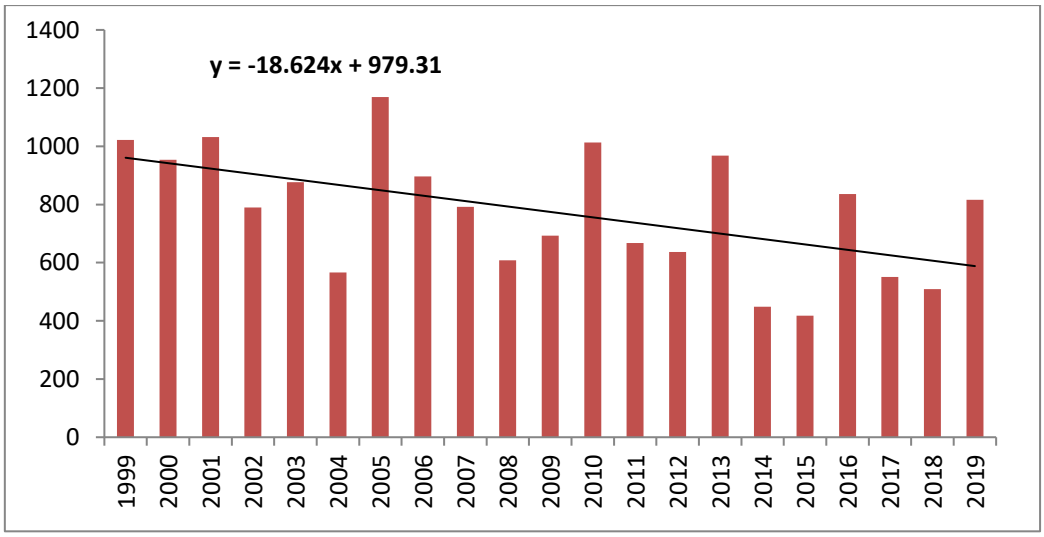


Figure 1.8: Long term annual rainfall (1999-2019)

1.4 Geology

Geologically, the area is occupied by Recent River Alluvium and Basaltic lava flows known as Deccan Traps belonging to Cretaceous to Eocene (68-62 m.y.), with patches of inter-trappean beds. The generalized geological sequence occurring in the area is given in **Table 1.3** and the geological map is shown in **Figure 1.9.**

Table 1.3: Generalized Geological sequence Parbhani district

Age	**Formation**	**Lithology**
Recent-Quaternary	Alluvium	Sand, silt and Gravel
Eocene-Upper Cretaceous	Deccan trap Volcanic lava flows with inter-trappean beds.	Basalt

Alluvium:

Alluvium is extremely limited in the district and is present along the Godavari River, the Purna River, the Dudhna River, the Galati River, the Dhond River and Karpara rivers. They are more than 10 meters in width and yield appreciable quantities of ground water. However, they are broader and of mappable size at places along the banks of rivers and 1 to 2 kms broad south of Chikhalthana and western boundary of the district towards Beed.

Deccan Trap Basalt:

Deccan trap basalts of Upper Cretaceous- Eocene period occupy almost 100% area of the district. The Basaltic lava flow comprises of two types of flows viz., “Pahoehoe” flows and “aa” flows. “Pahoehoe” flows are compound flows with several unit of varied thickness from a meter to several meters thick. Each unit shows a basal section massive Basalt followed by vesicular Basalt in the upper unit. The vesicles are spherical and filled with zeolites, cherts, or quartz. The “Pahoehoe” flow is generally altered and shows grey, purple and red colours. Upper surface of “Pahoehoe” flow is reddish and shows curved or twisted rope like structures.

The other type of flow, which is at basal section, has a thin layer of clinker block of vesicular trap cemented in glass, zeolite or pulverised rock. Mainly the flow comprises of dark grey massive Basalt, flow breccia, consisting of sub-rounded zeolites and pulverised rock at the top. Top surface of “aa” flows shows elongated or twisted vesicles filled with zeolite, quartz or chert. In “aa” flows massive Basalt is hard, resistant and shows spheroidal weathering while the brecciated Basalt weathers deeply.

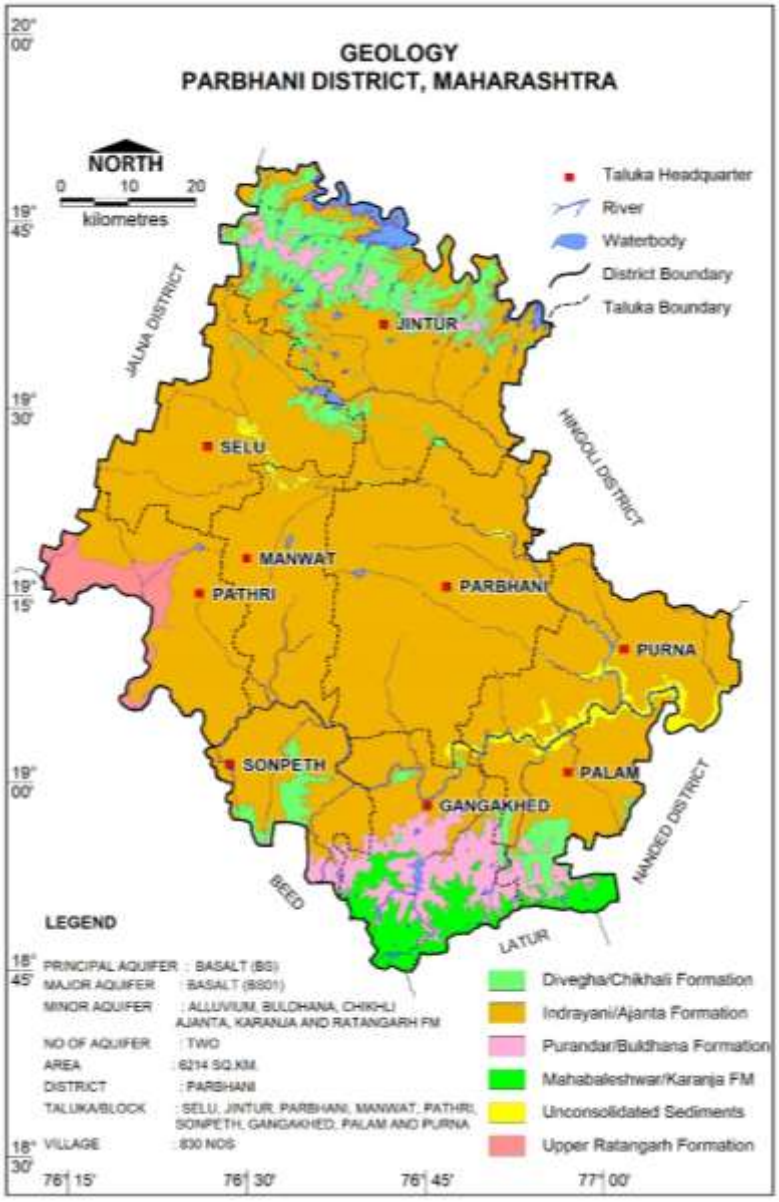


Figure 1.9: Geological Map with basaltic flow

2. HYDROGEOLOGY

Basalt forms the main aquifers in the district. Based on the existing data and the data generated it is observed that there is two aquifer Systems in Basalt prevailing in the district.

2.1 Major Aquifer System

Deccan Traps occurs as Basaltic lava flows, which are normally horizontally disposed over a wide stretch and give rise to tableland type of topography, on weathering also known as plateau. These flows occur in layered sequence ranging in thickness from few meters to 50 m. Flows are represented by massive portion at bottom and vesicular portion at top and are separated from each other by marker bed known as bole bed.

Ground water in Deccan Trap Basalt occurs under phreatic and semi-confined conditions. The weathered and fractured trap occurring in topographic lows form the main aquifer in the district. The vesicular portion of different lava flow varies in thickness from 8 to 10 m and forms the potential zones.

Deccan Trap Basalt of Upper Cretaceous to Lower Eocene age are the major rock formation in the district covering entire district. Although, Alluvium occurs along the major river in the district, but it does not form potential aquifer except locally. A map depicting hydrogeological features is presented in **Figure 2.1.**

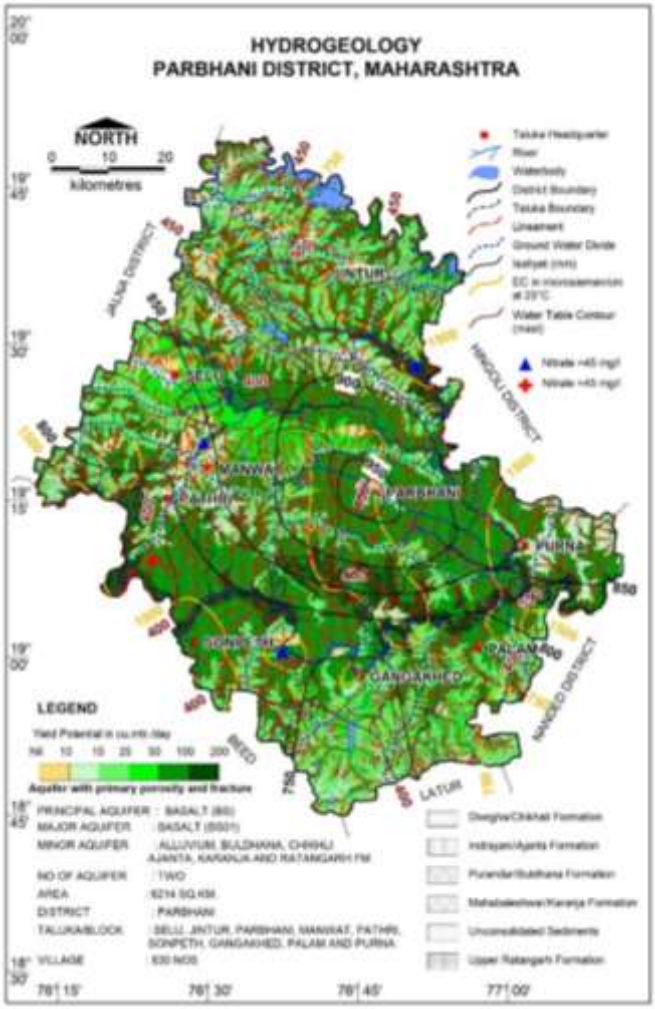


Figure 2.1: Hydrogeology

Deccan basalts are hydrogeologically in-homogeneous rocks. The weathered and jointed/ fractured parts of the rock constitute the zone of ground water storage and flow. The existence of multiple aquifers is characteristic of basalt and is indicative of wide variation in the joint/fracture pattern and intensity. The yield of wells is function of the permeability and transmissivity of aquifer and it depends upon the degree of weathering, intensity of joints/ fractures and topographic setting of the aquifer. Due to wide variation in secondary openings, the potential areas for ground water are generally localized. In general Ground water occurs under phreatic/unconfined to semi-confined conditions in basalts. Shallow Aquifer is generally tapped by the dug wells of 8 to 40 m depth, water levels range from 0.2 to 35 m bgl and yield varies from 10 to 100 m^3/day. The deeper Aquifer is being tapped by borewells with depth 40 m bgl and the water level from 0.84 magl to 188.70 m bgl yield varies Traces to 2338.56 m3/day.

Based on Ground Water Exploration, aquifer wise characteristics are given in **Table 2.1.** Maps depicting aquifer wise depth of occurrence and fractured/granular zone's thickness and yield potential are shown in **Figures 2.2 and 2.3,** respectively.

Table 2.1: Aquifer Characteristic of Parbhani district

Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer	Aquifer-I	Aquifer-II
Formation	Weathered/Fractured Basalt	Jointed / Fractured Basalt
Depth of Occurrence (mbgl)	9 to 40	40 to 180
SWL (mbgl)	0.2 to 35	0.84 magl to 188.70 mbgl
Weathered / Fractured rocks thickness (m)	5 to 40	5.00 to 19.00
Fractures encountered (mbgl)	Upto 40	Upto 180
Yield	10 to 100 m^3/day	Traces to 2338.56 m^3/day
Sustainability	1 to 3 hrs	0.5 to 3 hrs
Transmissivity (m^2/day)	30 - 40 m^2/day	0.14 to 201.45 m^2/day
Specific Yield/ Storativity (Sy/S)	0.02	*0.000245 - 0.0000145
Suitability for drinking/ irrigation	Suitable for both (except high EC, Nitrate and floride affected villages) drinking & agriculture	

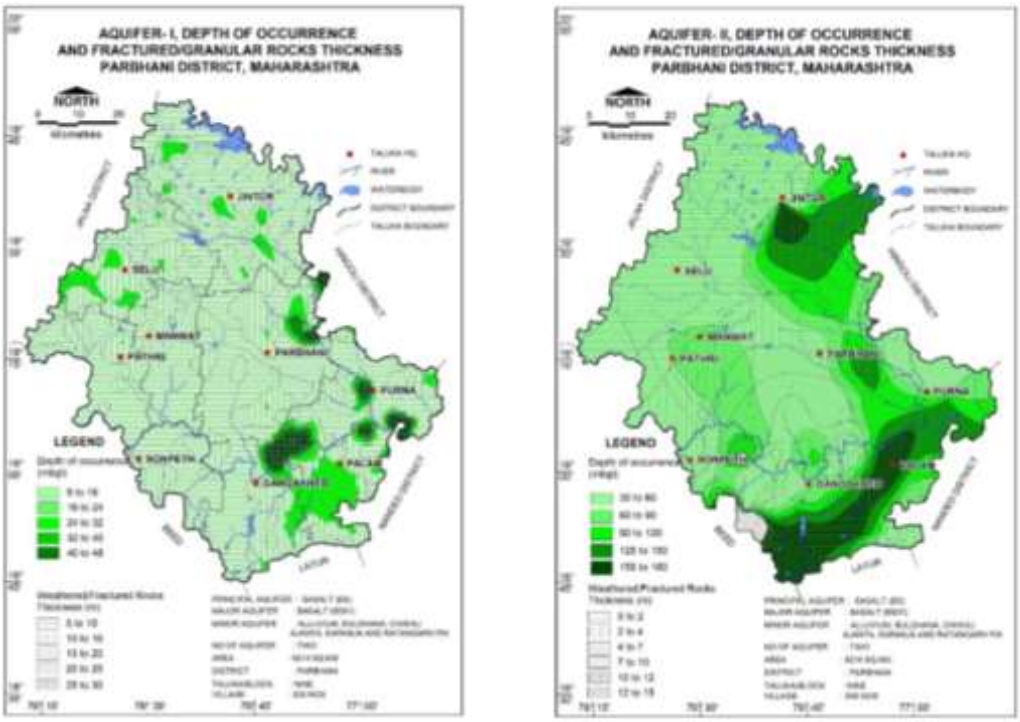


Figure 2.2: Aquifer wise depth of occurrence and fractured rock thickness

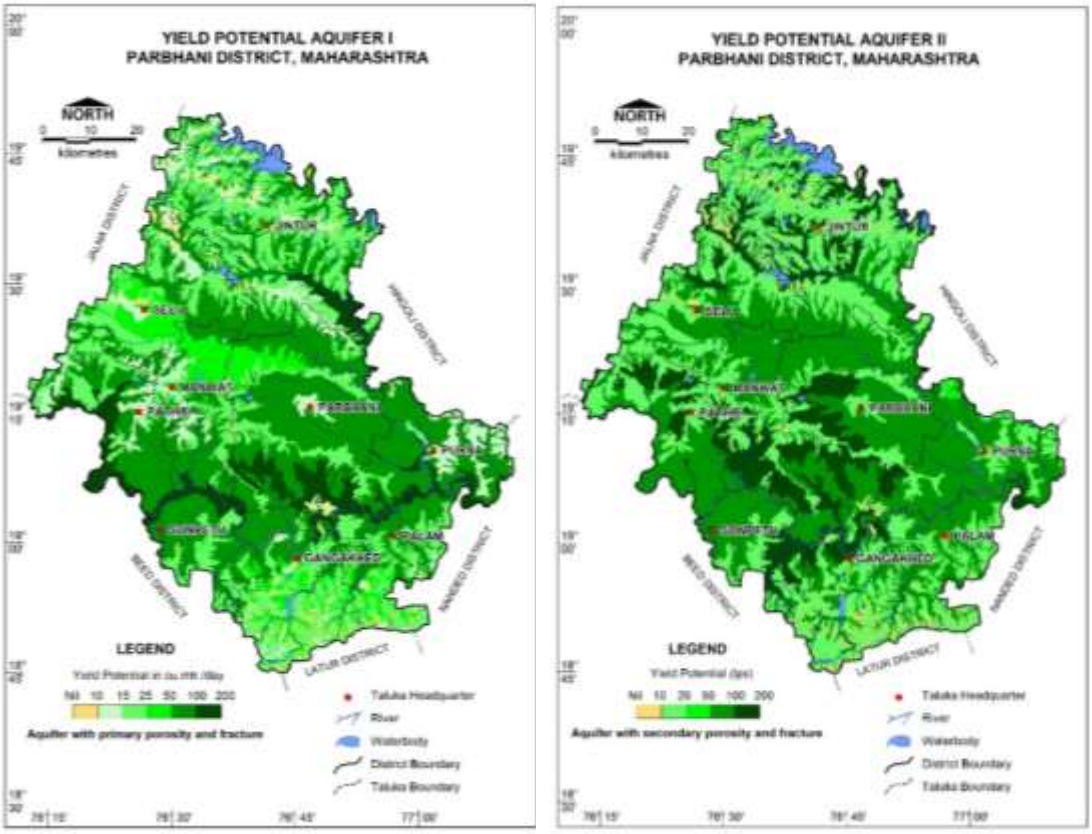


Figure 2.3: Aquifer wise yield Potential

2.2 Aquifer Parameters

Aquifer parameters have been obtained from ground water exploratory drillings carried out in the basalt covered areas of the district. The transmissivity of basaltic aquifers in the district is generally ranges between 30 - 40 m^2/day. Dug wells are the most common ground water extraction structures in the area. The yield of dug wells during the post monsoon season varies between 10 to 100 m^3/ day. The specific capacity of well gives an idea about the productivity of the well and is controlled by diameter and depth. The pumping tests conducted on 12 exploratory wells in the areas indicate the transmissivity range from 0.14 to 201.45 m^2/day.

2.3 3-D and 2-D Aquifer Disposition

Based on the existing data, aquifer disposition in 3D Fence diagram, 3D Bar diagram and few hydrogeological sections have been prepared along section lines shown in **Figure 2.4, 2.5, and 2.6 (a to d)** to understand the subsurface disposition of aquifer system.

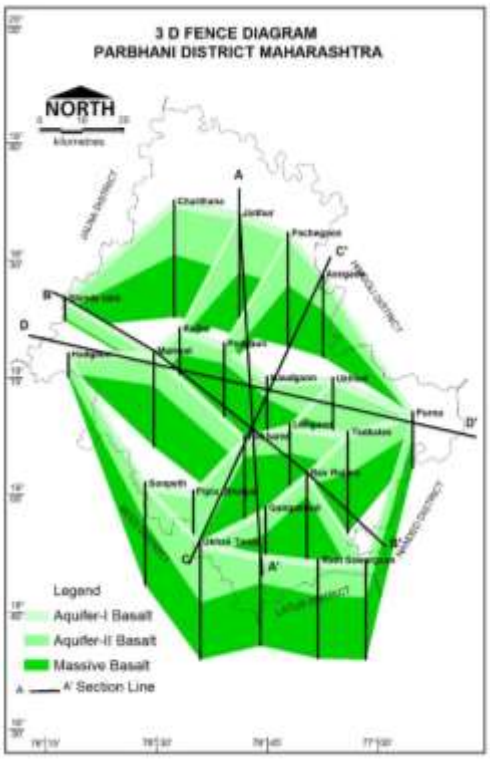


Figure 2.4: 3D Fence Diagram

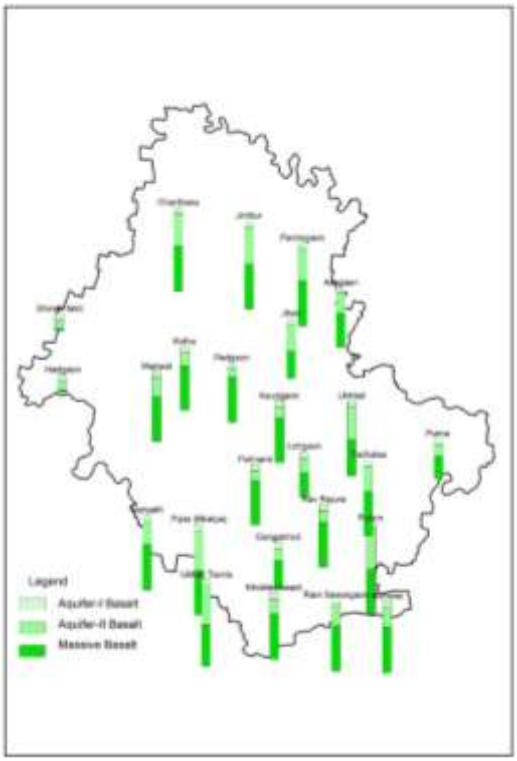


Figure 2.5: 3D Bar Diagram

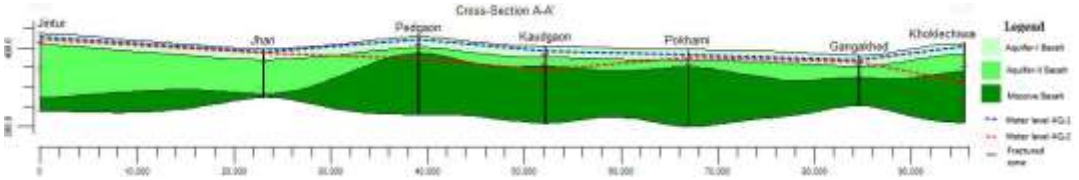


Figure 2.6 (a): Lithological section along A – A'

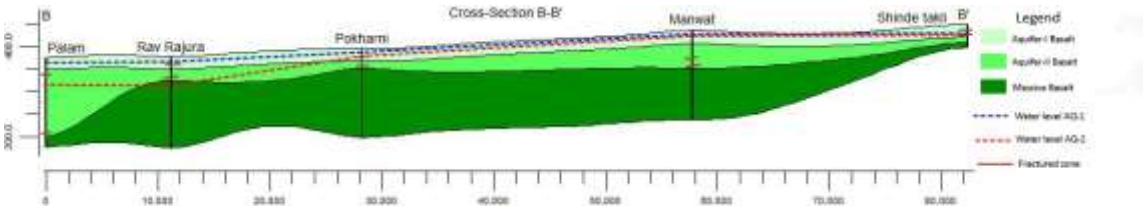


Figure 2.6 (b): Lithological section along B – B'

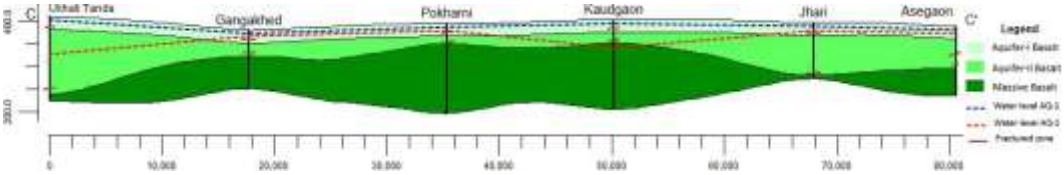


Figure 2.6 (c): Lithological section along C – C'

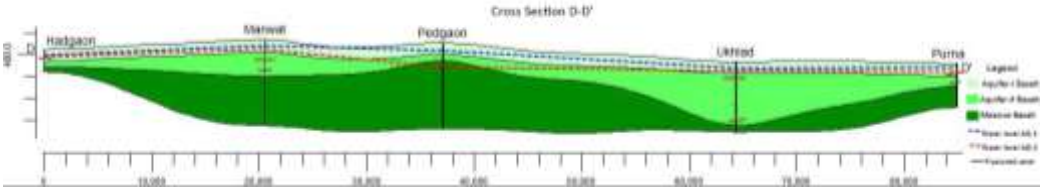


Figure 2.6 (d): Lithological section along D – D'

3. WATER LEVEL SCENARIO

3.1 Depth to water level (Aquifer-I /Shallow Aquifer)

Central Ground Water Board periodically monitors 40 Ground Water Monitoring Wells (GWMWs) including 38 dugwells and 2 piezometers. Groundwater Surveys and Development Agency periodically monitored 74 dugwells four times a year i.e., in January, May (Pre-monsoon), August and November (Post-monsoon) in Parbhani district. Water level of monitoring wells is given in **Annexure-II & III**. Long-term water level trends (2010-2019) are given in **Annexure-VI**.

3.1.1 Depth to Water Level – Pre-monsoon (May-2019)

The depth to water levels in aquifer-I (Shallow aquifer) Parbhani district during May 2019 ranges between 3.2 mbgl (Runj, Purna block) and 35.00 mbgl (Dharampur, Parbhani block). The depth to water levels between 5 to 10 and 10 to 20 mbgl are observed in entire district covering all the blocks. The Deeper water levels i.e., more than 20 mbgl are observed as isolated patches, in almost all the blocks. Small patch of waters between 2 to 5 mbgl is observed in eastern part of district. The pre-monsoon depth to water level map is depicted in **Figure 3.1.**

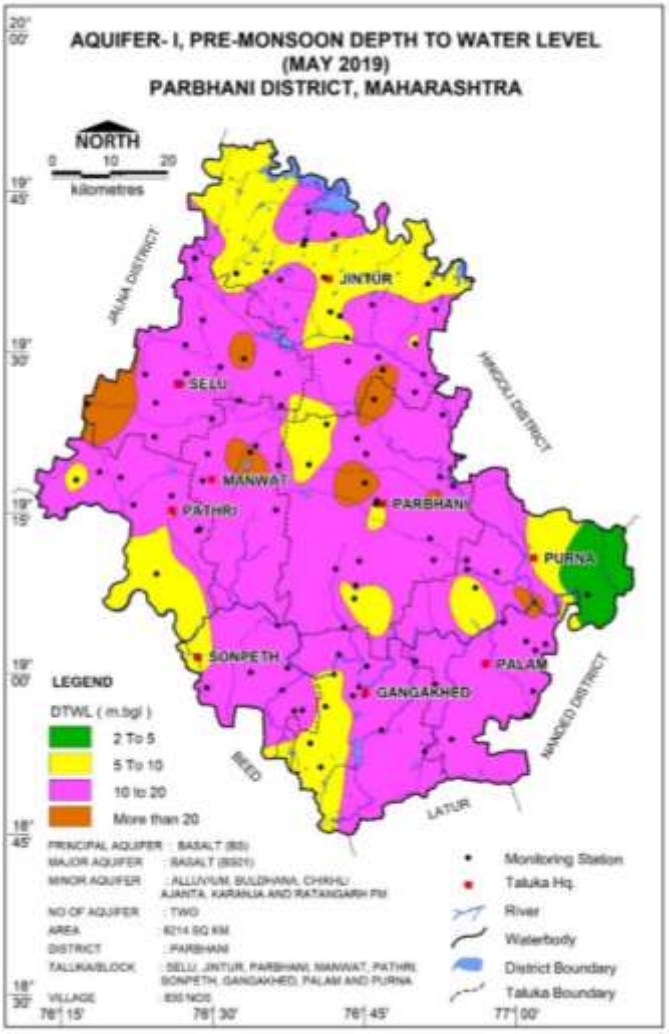


Figure 3.1: DTWL Aquifer-I Shallow aquifer (May 2019)

3.1.2 Depth to Water Level – Post monsoon (Nov-2019)

The depth to water levels in Parbhani district during Nov. 2019 ranges between near ground level / 0.9 mbgl (Tadlimbla, Parbhani block) and 21.70 mbgl (Shinde Takli, Selu Block). Shallow water levels within 5 m bgl observed in middle and eastern and south eastern part of district and moderate water level 5 to 10 mbgl are observed in North and North-West parts and in patches in South-East and South-West parts of the district. Deeper water levels 10 to 20 m bgl are observed as small, isolated patch in Parbhani, Selu and Pathri blocks. Spatial variation in post-monsoon depth to water levels is shown in Figure 3.2.

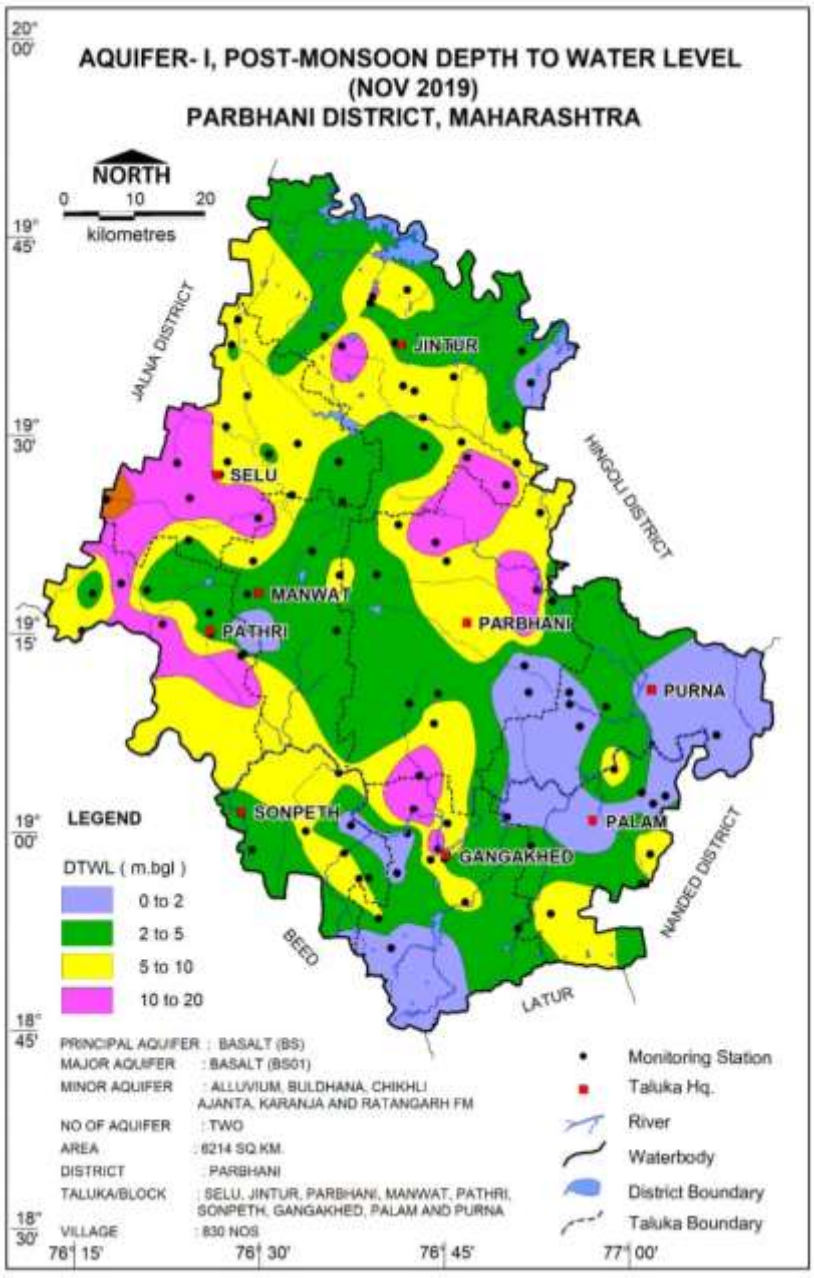


Figure 3.2: DTWL Aquifer-I Shallow aquifer (November 2019)

3.2 Depth to water level (Aquifer-II / Deeper Aquifer)

In Aquifer-II, the post-monsoon depth to water levels in Parbhani District ranges between 1.30 (Devinagar Tanda, Sonpeth block) and 60.00 mbgl (Kaudgaon and Pedgaon Parbhani block). Depth to water level less than 10 m bgl has been observed in southern and western central part of the district covering parts of Palam, Gangakhed, Parbhani, Pathri, Manwat, Selu. Major part of the district shows deeper water levels ranging between 10 and 20 mbgl observed in eastern northern part. The deepest water level of more than 20 mbgl upto 50 mbgl are observed in isolated patches in Parbhani and Manwat blocks. The post-monsoon depth to water level for Aquifer –II is given in **Figure 3.3.** The salient features of Ground water Exploration in Parbhani district, including the depth to water level in deeper aquifer is given in **Annexure-I.**

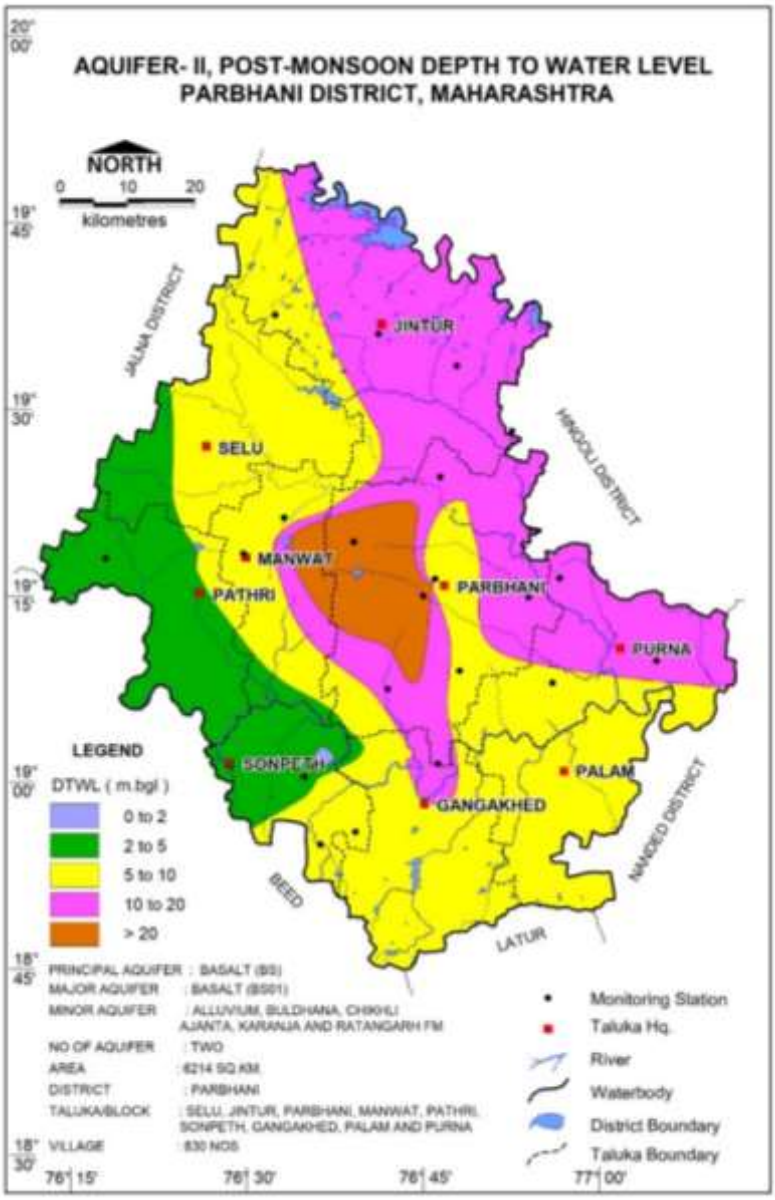


Figure 3.3: DTWL Aquifer-II deeper aquifer (Postmonsoon)

3.3 Water Level Trend (2010-2019)

During pre-monsoon, rise in water level trend has been recorded at 48 stations and ranges from 0.0118 (Parbhani, Parbhani block) to 1.519 m/year (Dharmapuri, Parbhani block) while falling trend was observed in 73 stations varying from 2.14 (Shinde Takli, Selu block) to 0.0151 m/year (Mahatpuri, Gangakhed block). During pre-monsoon, declining water level trend has been observed in area covering almost all blocks. Rise in water level trend has been observed in area covering small parts of Pathri, Parbhani, Jintur and Purna blocks of the district **(Figure 3.4)**. The long-term trend (2010-2019) of ground water monitoring wells is given in **Annexure-VI.**

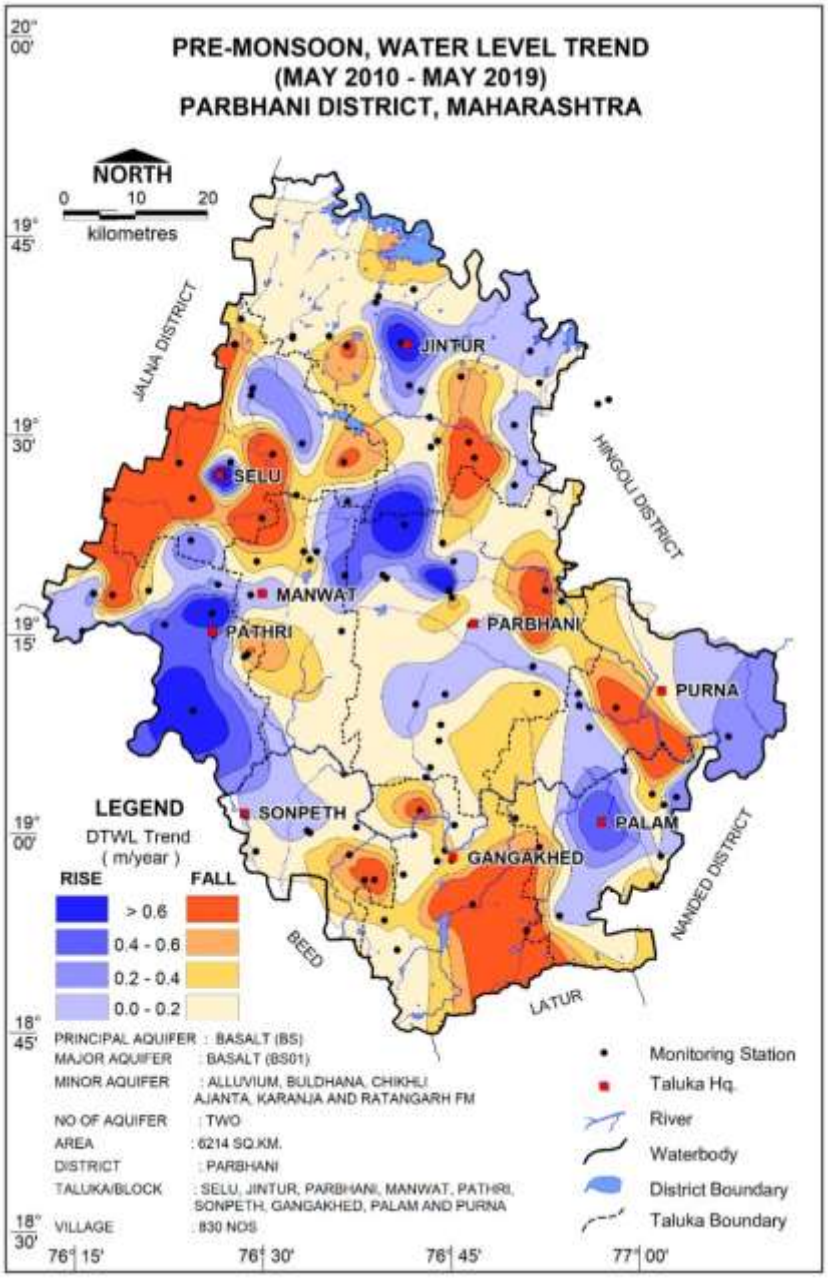


Figure 3.4: Pre-monsoon decadal trend (Shallow aquifer) (2010-19)

During post-monsoon, rise in water level trend has been recorded at 29 stations and it ranges between 0.0148 m/year (Jintur, Jintur block) to 2.374 (Dharmapur, Parbhani block) while falling trend was observed in 91 stations varying from 3.0733 (Hadgaon Pz, block) to 0.00424 m/year (Tadkalas, Purna block). Rising water level trend has been observed in covering major parts of Pathri, Jintur, Parbhani, Gangakhed and Palam blocks of the district while small areas of Selu and Manwat blocks. Fall in water level trend has been observed in the Western and Eastern parts of the district covering major pats of Selu, Purna, Parbhani and Sonpeth, also small portion of the Gangakhed, Manwat, Palam, Pathri and Jintur blocks **(Figure 3.5).**

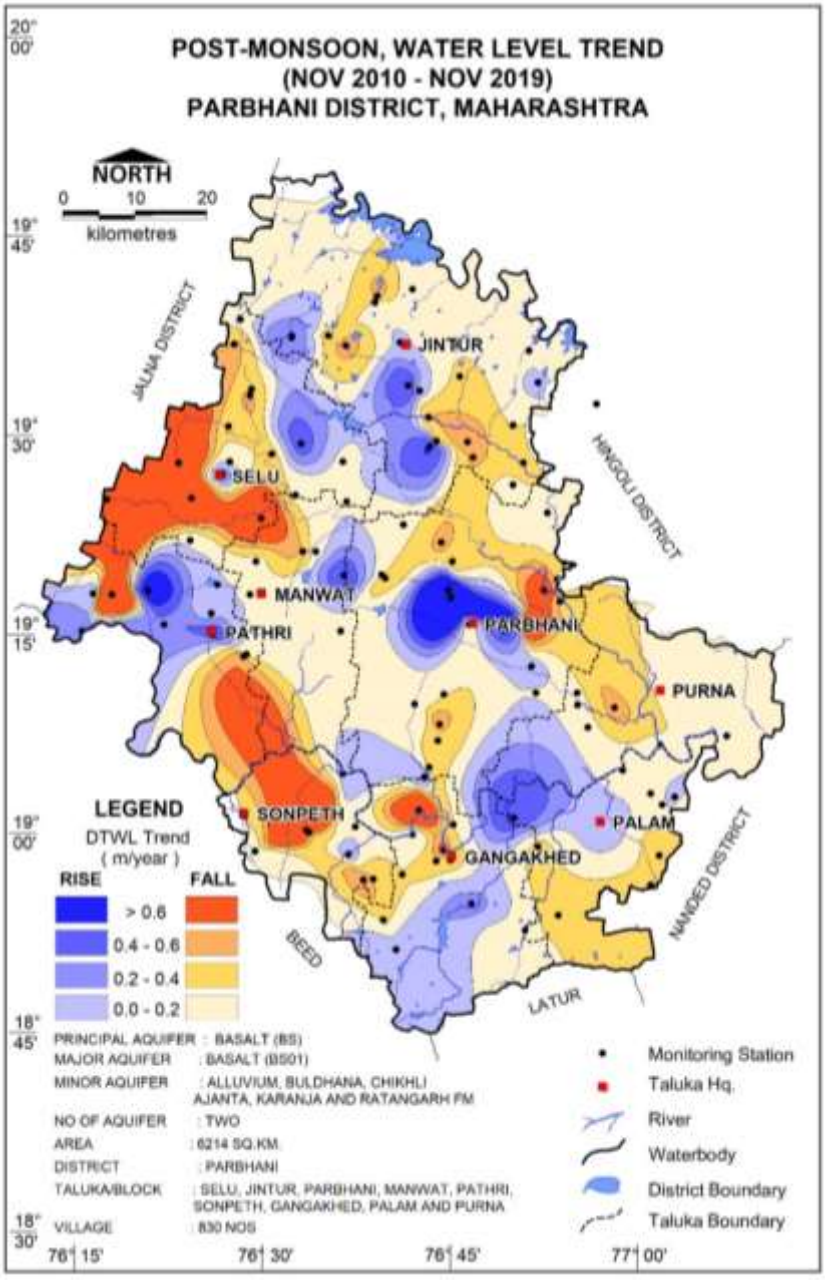


Figure 3.5: Post-monsoon decadal trend (Shallow aquifer) (2010-19)

3.4 Hydrograph Analysis

The variation in short term and long-term water level trends may be due to variation in natural recharge due to rainfall and withdrawal of groundwater for various agricultural activities, domestic requirements, and industrial needs. The analysis of hydrographs shows that the annual rising limbs in hydrographs indicate the natural recharge of groundwater regime due to monsoon rainfall, as the monsoon rainfall is the sole source of natural recharge to the ground water regime (**Figure 3.6 a to 3.6 g**). However, continuous increase in the groundwater draft is indicated by the recessionary limb.

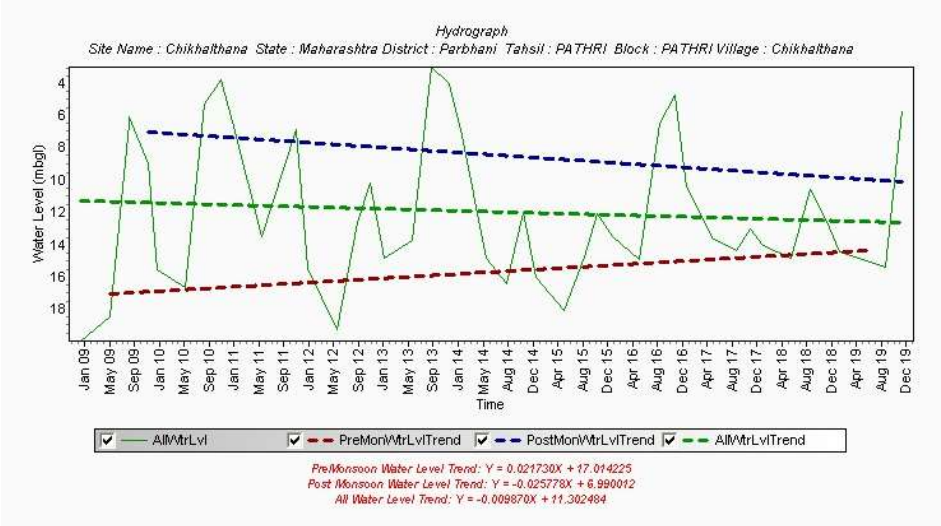


Figure 3.6 a: Hydrograph (2009-19), Chikhalthana, Pathri Block, Parbhani District

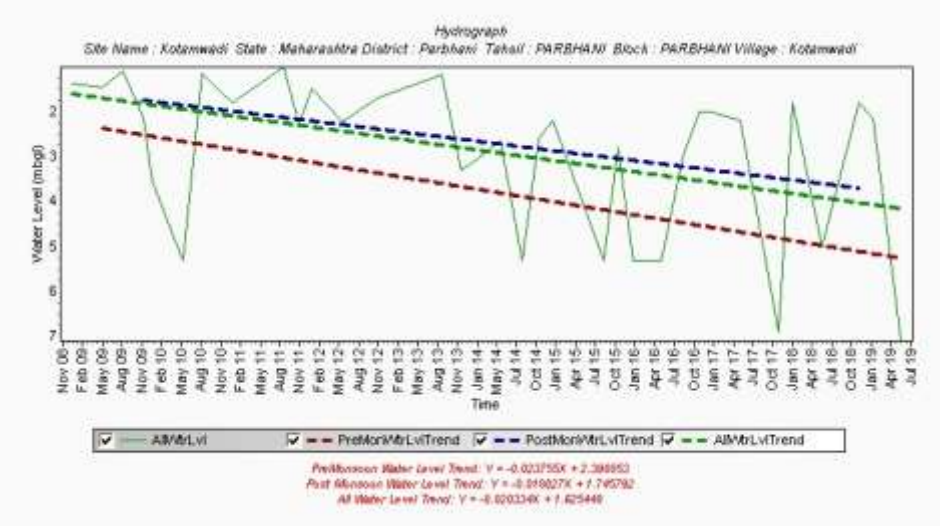


Figure 3.7 b: Hydrograph (2009-19), Kotamwadi, Parbhani Block, Parbhani District

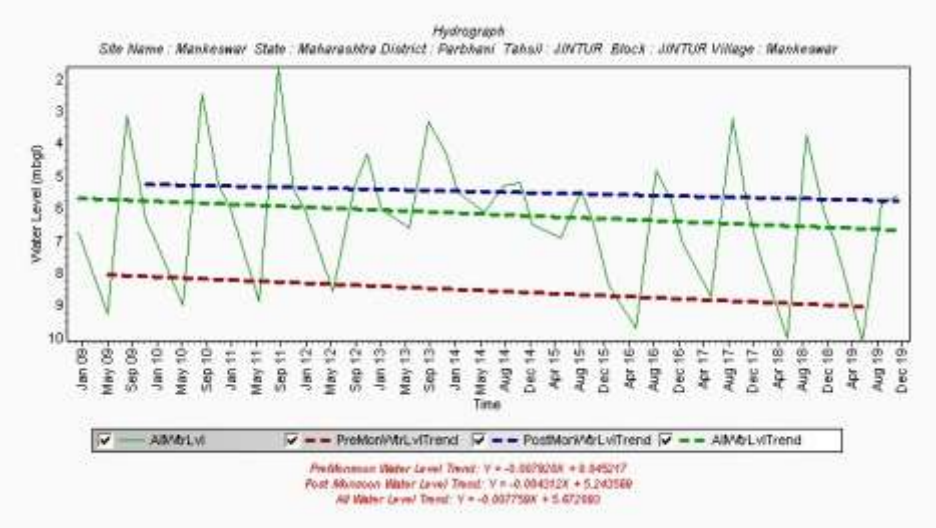


Figure 3.7 c: Hydrograph (2009-19), Mankeswar, Parbhani Block, Parbhani District

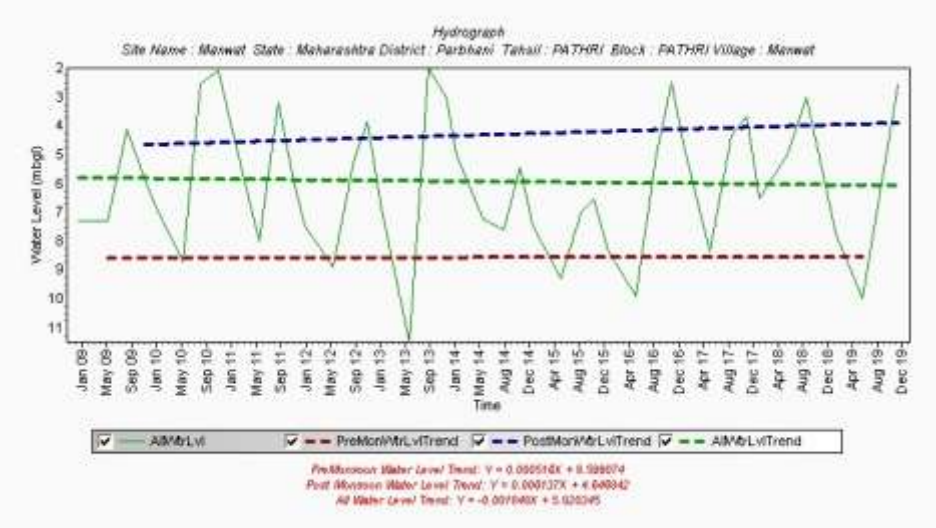


Figure 3.7 d: Hydrograph (2009-19), Manwat, Pathri Block, Parbhani District

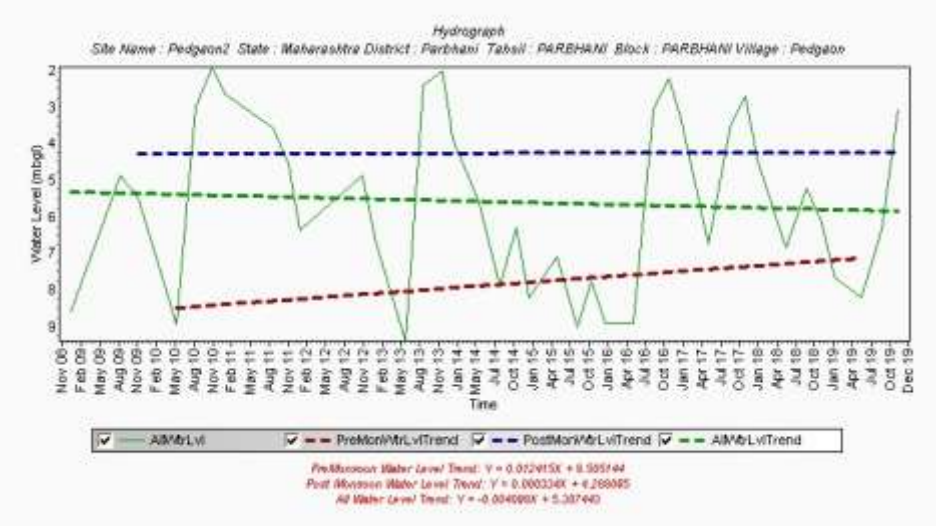


Figure 3.7 e: Hydrograph (2009-19), Padgaon, Parbhani Block, Parbhani District

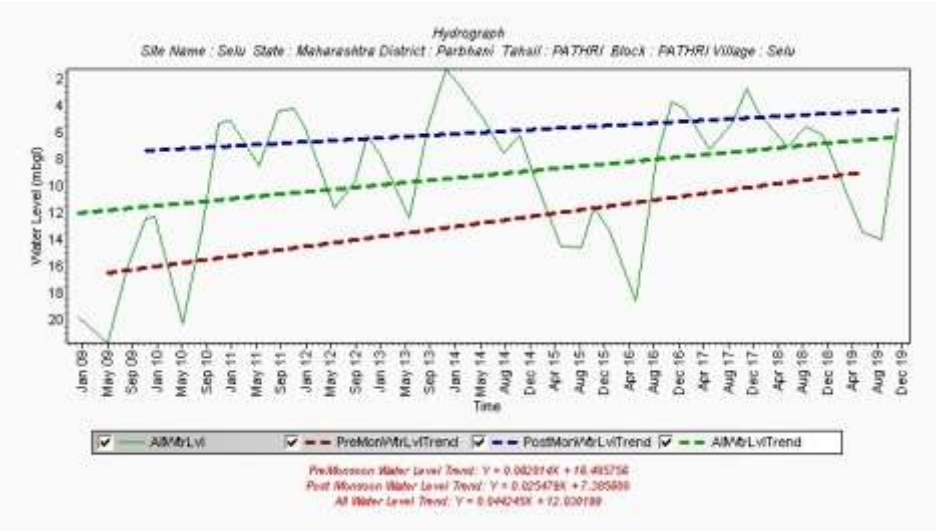


Figure 3.7 f: Hydrograph (2009-19), Selu, Pathri Block, Parbhani District

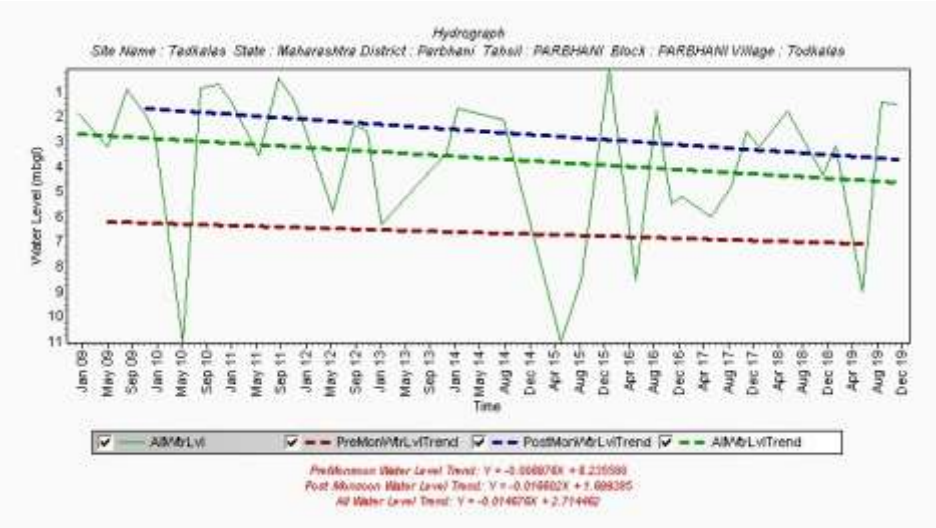


Figure 3.7 g: Hydrograph (2009-19), Tadkalas, Parbhani Block, Parbhani District

4. GROUND WATER QUALITY

Water sampling is being done every year from GWM wells during pre-monsoon period (May). The data gap analysis has been carried out to find out the adequacy of information on water quality. To decipher the ground water quality scenario, 77 samples from Aquifer-I / shallow aquifer and 40 from Aquifer-II / deeper aquifers have been utilised including monitoring wells/exploratory wells, tubewells/borewells of CGWB and GSDA; data from earlier studies. The aquifer wise ranges of different chemical constituents present in ground water are given in **Table 4.1**. The details of chemical analysis are given in **Annexure IV and V**.

Table 4.1: Aquifer wise ranges of chemical constituents in Parbhani district

Constituents	Aquifer-I / Shallow aquifer			Aquifer-II / Deeper aquifer		
	Min	Max	Avg.	Min	Max	Avg.
pH	6.8	8.4	7.6	6.6	8.5	7.72
EC	391	2690	1138	600	2340	1241
TDS	207	1750	710	315	1440	750
TH	133	1750	673	45	625	271
Ca	14	236	92	14	140	49
Mg	4.0	104	50.8	1	113	33.6
Na	22	92	54.71	36	368	168
K	0.65	6.54	1.88	0.5	28	9.9
CO3	0	0	0	0.0	15.0	2.1
HCO3	167	607	377	67	427	232.6
Cl	14	282	100.9	25	277	150
SO4	15	203	60.84	24	700	181
NO3	2	88	31.26	1	309	47
F	0.14	2.14	0.58	0	7	1.34

4.1 Electrical Conductivity (EC)

4.1.1 Distribution of Electrical Conductivity in Aquifer-I / Shallow Aquifer:

The concentration of EC in shallow aquifer varies between 391 (Amberwadi, Jintur block) and 2690µS/cm (Asegaon, Jintur block). Out of 77 samples collected from dug wells, 2 samples are having EC in range of 2250 to 3000 µS/cm observed in Manwat block covering 4.13 sq.km. EC in the range 250-750 µS/cm covering small part of Pathri, Selu Jintur, Gangakhed, Sonpeth and Palam block covering 664.33 sq.km. The ground water is potable. EC in the range 750-2250 µS/cm covering 5660 sq.km area in covering almost all blocks of the district. The distribution of Electrical Conductivity in Aquifer-I / shallow aquifers is shown in **Figure 4.1.**

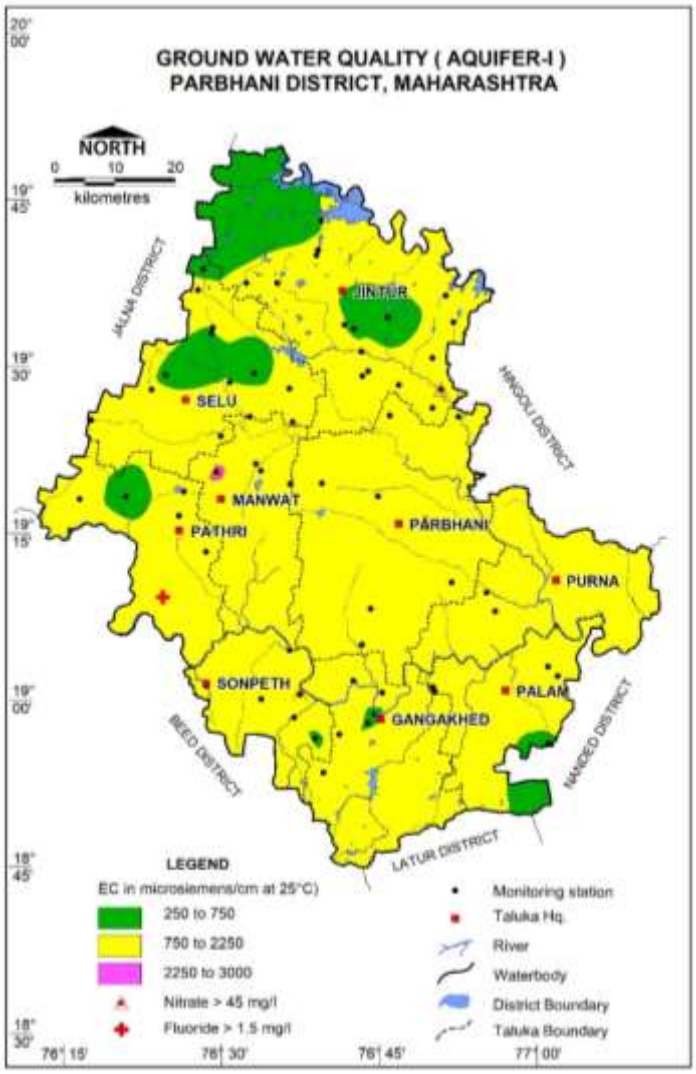


Figure 4.1: Ground water quality, Aquifer-I / Shallow aquifer

4.1.2 Distribution of Electrical Conductivity in Aquifer-II / Deeper Aquifer:

The concentration of EC in deep aquifer varies between 600 (Ukhali Tanaa, Sonpeth block) and 2340 µS/cm (Hadgaon, Pathri block). Out of 40 samples collected from tube wells/bore wells, 2 samples are having EC in range of 2000 to 3000µS/cm observed in 19.91 sq km area in pathri block. EC in the range 250-750 µS/cm covering 204 sq km area in small parts of Gangakhed and Purna blocks. The ground water is potable. EC in the range 750-2250 µS/cm covering 6073 sq.km area in covering almost all blocks of the district. The distribution of electrical conductivity in Aquifer–II / Deeper aquifers is shown in **Figure 4.2.**

4.2 Nitrate

Nitrogen in the form of dissolved nitrate nutrient for vegetation, and the element is essential to all life. The major contribution in ground water is from sewage, waste disposal, nitrate fertilizer and decaying of organic matter. As per BIS (2012) the desirable limit is 45 mg/l. In aquifer – I / shallow aquifer, nitrate concentration varies between 2 to 88 mg/l. Out of 77 samples 03 water samples show the nitrate

concentrations exceeding the desirable limit of 45 mg/l (**Figure 4.1)**. The high concentration of Nitrate may be due to domestic waste and sewage. In aquifer – II / deeper aquifer, nitrate concentration varies between 0.2 to 309 mg/l. Out of 40 samples analysed 11 water samples show nitrate concentration exceeding the desirable limit of 45 mg/l (**Figure 4.2)**. The deeper aquifer affected by nitrate contamination may be due to percolation of nitrate contaminants from the ground surface as there are no other reasons for nitrate contamination in deeper aquifers.

4.3 Fluoride

In Aquifer-I / shallow aquifer, concentration of fluoride ranges from 0.14 to 2.14 mg/l. Out of 77 samples were analysed, only two samples show fluoride concentration more than 1.5 mg/l. The highest concentration of fluoride is found in Loni village, Patri block (2.14 mg/l). In aquifer – II / deeper Aquifer, concentration of fluoride ranges from 0.12 to 7.0 mg/l. Out of 40 samples analysed, nine samples show fluoride concentration more than 1.5 mg/l. The highest concentration of fluoride is found in Banwas village, Palam block (7.0 mg/l), it may be due to the lithological reason only.

4.4 Suitability of ground water for drinking purpose

In Aquifer-I / shallow aquifer, Ca, Mg, NO_3, &TH is found beyond the maximum permissible limit while most of the parameters as within MPL (**Table 4.2**). About 2.6 % of samples have fluoride concentration above the MPL. The water from such area is not fit for drinking purpose if directly consumed without treatment. For rest of the area ground water quality is good and fit for drinking purpose except few locations.

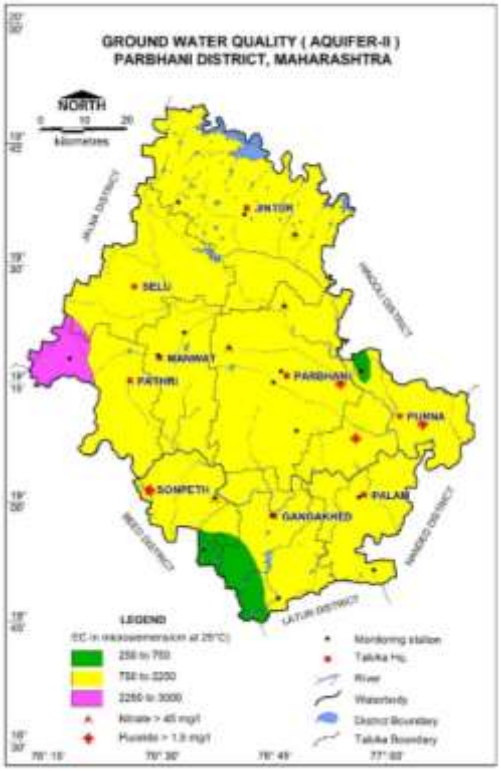


Figure 4.2: Ground water quality, Aquifer-II/Deeper aquifer

Table 4.2: Concentration of Chemical constituents in Aquifer-I/shallow Aquifer

Parameter	Drinking water Standards (IS-10500-2012)		Total no of ground water samples	Aquifer-I/Shallow aquifer					
				Samples (<DL)		Samples (DL-MPL)		Samples (>MPL)	
	DL	MPL		No	%	No	%	No	%
pH	6.5-8.5	-	77	0	0.00	77	100.00	0	0.00
TDS	500	2000	77	21	27.27	56	72.73	0	0.00
TH	300	600	77	10	12.99	24	31.17	43	55.84
Ca (mg/L)	75	200	77	29	37.66	45	58.44	3	3.90
Mg (mg/L)	30	100	77	16	20.78	58	75.32	3	3.90
Cl (mg/L)	250	1000	77	75	97.40	2	2.60	0	0.00
SO_4 (mg/L)	200	400	77	76	98.70	1	1.30	0	0.00
NO_3 (mg/L)	45	No relaxation	77	74	96.10	-	-	3	3.90
F (mg/L)	1	1.5	77	71	92.21	4	5.19	2	2.60

(Here, DL- Desirable Limit, MPL- Maximum Permissible Limit)

Likewise, in Aquifer-II / deeper aquifer, Ca, Mg, NO_3, &TH is found beyond the maximum permissible limit while most of the parameters as within MPL. About 22.5 % of samples have fluoride concentration above the MPL. The water from such area is not fit for drinking purpose if directly consumed without treatment (**Table 4.3**). For rest of the area ground water quality is good and fit for drinking purpose except few locations.

Table 4.3: Concentration of Chemical constituents in aquifer-II Deeper Aquifer

Parameter	Drinking water Standards (IS-10500-2012)		Total no of ground water samples	Aquifer-II/Deeper aquifer					
				Samples (<DL)		Samples (DL-MPL)		Samples (>MPL)	
	DL	MPL		No	%	No	%	No	%
pH	6.5-8.5	-	40	0	0	40	100	0	0
TDS	500	2000	40	13	32.5	27	67.5	0	0
TH	300	600	40	24	60	15	37.5	1	2.5
Ca (mg/L)	75	200	22	19	86.36	3	13.64	0	0
Mg (mg/L)	30	100	22	12	54.55	9	40.90	1	4.55
Cl (mg/L)	250	1000	22	20	90.91	2	9.09	0	0
SO_4 (mg/L)	200	400	22	18	81.82	2	9.09	2	9.09
NO_3 (mg/L)	45	No relaxation	40	31	77.5	-		9	22.5
F (mg/L)	1	1.5	40	28	70	3	7.5	9	22.5

(Here, DL- Desirable Limit, MPL- Maximum Permissible Limit)

4.5 Suitability of ground water for irrigation

The quality of Irrigation water affects the productivity, yield and quality of the crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. The Electrical Conductivity (EC), Sodium Absorption

Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which asses the water quality and its suitability for irrigation.

Electrical Conductivity (EC)

The amount of dissolved ions in the water is represented by the electrical conductivity. As discussed in 4.1 with reference to Figure 4.2 & 4.3, the classification of water for irrigation based on the EC values is given in Table 4.4 and discussed as follows: -

Low Salinity Water (EC: 100-250 µS/cm): This water can be used for irrigation with most crops on most soils with little likelihood that salinity will develop.

Medium Salinity Water (EC: 250 – 750 µS/cm): This water can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

High Salinity Water (EC: 750 – 2250 µS/cm): This water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very High Salinity Water (EC: >2250 µS/cm): This water is not suitable for irrigation under ordinary condition. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

In aquifer-I/shallow aquifer as well as in aquifer-II/deeper aquifer, maximum numbers of samples fall under the category of medium to high salinity type of water. While the areas with very high salinity prevails (>2250 µS/cm), very high salt tolerant crops and with proper soil and crop management practices are recommended (**Figure 4.1 & 4.2**).

Table 4.4: Classification of Ground water for Irrigation based on EC values

S. No	Water Quality Type	EC in µS/cm	Aquifer-I / shallow aquifer		Aquifer-II / Deeper Aquifer	
			No. of Samples	% of samples	No. of samples	% of samples
1	Low Salinity Water	< 250	0	0.00	0	0
2	Medium Salinity Water	>250-750	16	20.78	5	12.50
3	High Salinity Water	>750-2250	59	76.62	33	82.50
4	Very High Salinity Water	> 2250	2	02.60	2	05.00
Total			77	100	40	100

4.6 Sodium Absorption Ratio (SAR)

Excess of sodium in water render it unsuitable for irrigation on soil containing exchangeable Calcium and Magnesium ions. Soil containing exchangeable Calcium and Magnesium takes up sodium of irrigation water in exchange for Calcium and Magnesium, the ratio reflects the Sodium hazard. The SAR indicates the relative

activity of the Sodium ions in exchange reactions with the soil. The main problem with high sodium concentration is its effect on soil permeability, hardening of soil & water irrigation system. Sodium also contributes directly to the total salinity of the water and may be toxic to sensitive crops such as fruit trees. The higher value of SAR indicates soil structure damage.

In Aquifer-I /shallow aquifer, 77 % of samples fall in 'Good' category and 23% samples fall in 'Good to Permissible' category. While 45.45 % sample from aquifer-II/deeper aquifer falls in bad category, 13.13 % samples fall in good and doubtful category each. whereas 27.27% sample fall in good to permissible category. The classification of ground water samples based on SAR values for its suitability for irrigation purpose is shown in **Table 4.5**.

Table 4.5: Classification of Ground water for Irrigation based on SAR values

Characteristics	Total Number of GW samples	SAR value							
		< 10		10-18		18-26		> 26	
		Good		Good to Permissible		Doubtful		Bad (Unsuitable)	
		No	%	No	%	No	%	No	%
Aquifer-I/ Shallow Aquifer	22	17	77	5	23	0	-	-	-
Aquifer-II/ Deeper Aquifer	22	3	13.64	6	27.27	3	13.64	10	45.45

4.7 Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate (RSC) is considered to be superior to SAR as a measure of sodacity particularly at low salinity levels. Calcium reacts with bi-carbonate and precipitate as $CaCO_3$. Magnesium salt is more soluble and so there are fewer tendencies for it to precipitate. When calcium and magnesium are lost from the water, the proportion of sodium is increased resulting in the increase in sodium hazard. This hazard is evaluated in terms of RSC. The classification of ground water samples based on RSC values for its suitability for irrigation purpose is shown in **Table 4.6**.

In Aquifer-I/shallow aquifer, it is observed that only 4.5% samples show RSC values within 'Bad' category and 'doubtful' category each. while 91 % fall in 'good' category indicating that the ground water of the area is suitable for irrigation. In aquifer-II/deeper aquifer, about 91% samples show RSC less than 1.25 meq/L indicating ground water of the area is suitable for irrigation while about 1 % samples fall in 'doubtful to Unsuitable' category and 1% samples fall in 'bad' category indicating that the ground water of the area is bad and not suitable for irrigation.

Table 4.6: Classification of Ground water for Irrigation based on RSC values

Characteristics	Total No of GW samples	RSC values (meq/L)					
		< 1.25		1.25-2.50		> 2.50	
		Good		Doubtful		Bad (Unsuitable)	
		No	%	No	%	No	%
Aquifer-I / Shallow Aquifer	22	20	91	1	4.5	1	4.5
Aquifer-II / Deeper Aquifer	22	20	90.90	1	4.55	1	4.55

5. GROUND WATER RESOURCES

5.1 Ground Water Resources – Aquifer-I

Central Ground Water Board and Groundwater Surveys and Development Agency (GSDA) have jointly estimated the ground water resources of Parbhani district based on GEC-2015 methodology. Block wise ground water resources are given in **Table 5.1**, and graphical representations of the resources on the map are shown in **Figure5.1**.

Ground Water Resources estimation was carried out for 6214 sq. km. area out of which 2531.38 sq. km. is under command and 3682.62 sq. km. is non-command. As per the estimation, the net annual ground water availability comes to be 840.24 MCM. The Current Annual Ground water extraction is estimated at 377.45 MCM with irrigation sector being the major consumer having an extraction of 357.61 MCM. The domestic & industrial water requirements are worked at 19.84 MCM. The net ground water availability for future use is estimated at 343.33 MCM. The Stage of ground water development varies from 39.74 % (Jintur) to 57.62% (Sonpeth). The overall stage of ground water development for the district is 47.35 % (SAFE Category). Block wise assessments indicate that all the blocks in the district fall under “Safe” category.

Table 5.1 Ground water resources, Aquifer-I (Shallow aquifer)

(Values in ham)

Assessment Unit Name	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Recharge (Ham)	Current Annual Ground Water Extraction (Ham)				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
				Irrigation Use	Industrial Use	Domestic Use	Total Extraction				
Gangakhed	8466.25	432.28	8033.97	3102.85	0.00	311.90	3414.75	1325.52	3355.56	42.50	Safe
Jintur	17968.47	898.42	17070.05	6528.41	0.00	254.53	6782.94	875.77	9373.75	39.74	Safe
Manwat	6129.33	306.47	5822.87	2794.21	0.00	128.00	2922.20	681.01	2147.03	50.18	Safe
Palam	6006.87	300.34	5706.53	2922.57	0.00	138.74	3061.31	531.31	2794.65	53.65	Safe
Parbhani	14080.13	747.78	13332.35	6058.22	0.00	384.10	6442.32	2718.71	4520.15	48.32	Safe
Pathari	7430.52	371.53	7058.99	3768.32	0.00	194.90	3963.22	924.34	2446.58	56.14	Safe
Purna	12125.18	606.26	11518.92	4871.61	0.00	248.06	5119.67	1086.49	5514.31	44.45	Safe
Selu	8214.90	410.74	7804.15	3913.00	0.00	187.00	4100.00	870.18	3219.17	52.54	Safe
Sonpepth	3602.60	236.32	3366.28	1802.49	0.00	137.05	1939.54	605.96	961.96	57.62	Safe
Total	84024.26	4310.15	79714.11	35761.68	0.00	1984.28	37745.96	9619.29	34333.14	47.35	Safe

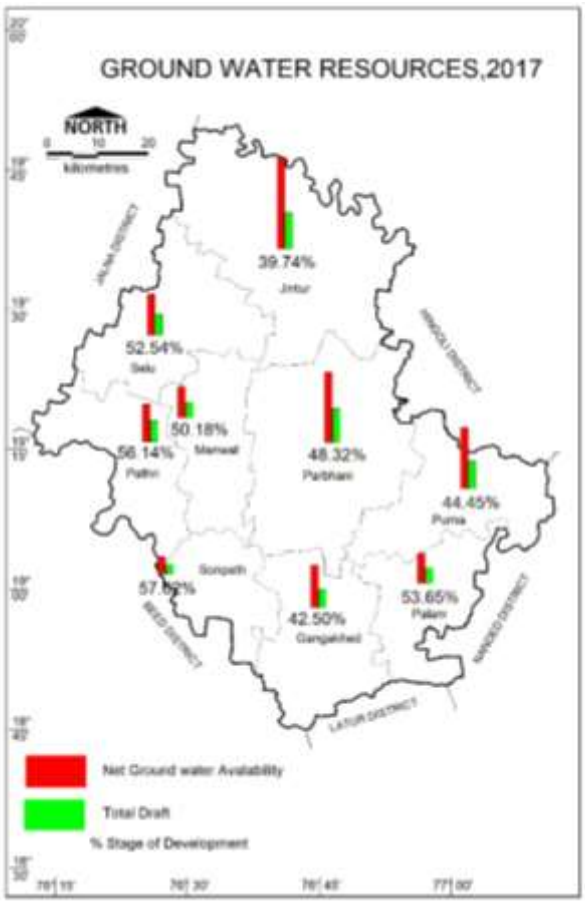


Figure 5.1: Ground Water Resource-2017, Parbhani District

5.2 Ground Water Resources – Aquifer-II

The ground water resource of Aquifer-II was also assessed to have the correct quantification of resources so that proper management strategy can be framed. Block wise summarized Ground Water Resources of Aquifer-II is given in **Table 5.2**.

Table 5.2: Ground Water Resources of Aquifer-II (Deeper aquifer)

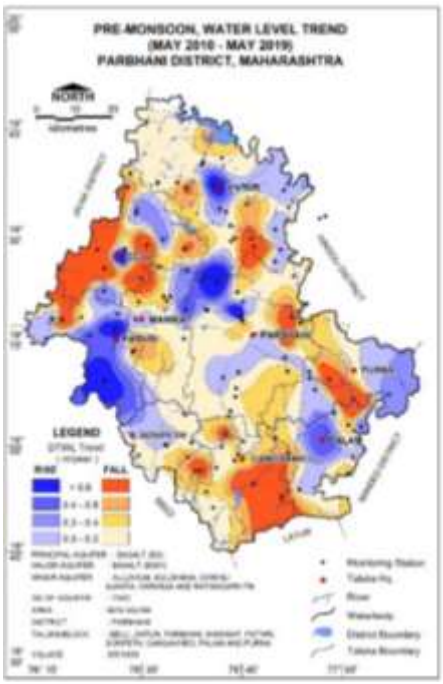
SN	Taluka	Mean thickness (m)	Area in sq km	PZ (confining layer)	Sy	S	Resource above confining layer (MCM)	Resource in confining aquifer (MCM)	Total Aquifer (MCM)
1	Jintur	1	844.77	60	0.002	0.0000145	0.73495	1.68954	2.42449
2	Jintur	3	415.1	40	0.002	0.0000145	0.240758	2.4906	2.731358
3	Selu	1	667.4	40	0.002	0.0000145	0.387092	1.3348	1.721892
4	Selu	3	32.35	40	0.002	0.0000145	0.018763	0.1941	0.212863
5	Pathri	1	328	30	0.002	0.0000145	0.14268	0.656	0.79868
6	Pathri	3	228.4	30	0.002	0.0000145	0.099354	1.3704	1.469754
7	Sonpeth	3	103.59	40	0.002	0.0000145	0.060082	0.62154	0.681622
8	Sonpeth	5.5	136.05	70	0.002	0.0000145	0.138091	1.49655	1.634641
9	Sonpeth	8.5	74.75	40	0.002	0.0000145	0.043355	1.27075	1.314105
10	Sonpeth	11	36.55	40	0.002	0.0000145	0.021199	0.8041	0.825299

SN	Taluka	Mean thickness (m)	Area in sq km	PZ (confining layer)	Sy	S	Resource above confining layer (MCM)	Resource in confining aquifer (MCM)	Total Aquifer (MCM)
11	Sonpeth	13.5	33.53	60	0.002	0.0000145	0.029171	0.90531	0.934481
12	Gangakhed	1	137.07	20	0.002	0.0000145	0.03975	0.27414	0.31389
13	Gangakhed	3	148.55	30	0.002	0.0000145	0.064619	0.8913	0.955919
14	Gangakhed	5.5	218.21	30	0.002	0.0000145	0.094921	2.40031	2.495231
15	Gangakhed	8.5	121.57	25	0.002	0.0000145	0.044069	2.06669	2.110759
16	Gangakhed	11	17.48	20	0.002	0.0000145	0.005069	0.38456	0.389629
17	Gangakhed	13.5	11.95	30	0.002	0.0000145	0.005198	0.32265	0.327848
18	Palam	1	41.93	40	0.002	0.0000145	0.024319	0.08386	0.108179
19	Palam	3	191.35	30	0.002	0.0000145	0.083237	1.1481	1.231337
20	Palam	5.5	222.06	65	0.002	0.0000145	0.209292	2.44266	2.651952
21	Palam	8.5	37.09	30	0.002	0.0000145	0.016134	0.63053	0.646664
23	Purna	3	20.97	30	0.002	0.0000145	0.009122	0.12582	0.134942
24	Purna	5.5	318.96	60	0.002	0.0000145	0.277495	3.50856	3.786055
25	Purna	8.5	297.02	35	0.002	0.0000145	0.150738	5.04934	5.200078
26	Parbhani	1	173.34	40	0.002	0.0000145	0.100537	0.34668	0.447217
27	Parbhani	3	363.25	55	0.002	0.0000145	0.289692	2.1795	2.469192
28	Parbhani	5.5	350.53	17	0.002	0.0000145	0.086406	3.85583	3.942236
29	Parbhani	8.5	256.08	38	0.002	0.0000145	0.1411	4.35336	4.49446
30	Manwat	1	171.28	40	0.002	0.0000145	0.099342	0.34256	0.441902
31	Manwat	3	184.54	30	0.002	0.0000145	0.080275	1.10724	1.187515
32	Manwat	5.5	111.87	30	0.002	0.0000145	0.048663	1.23057	1.279233
33	Manwat	8.5	32.82	30	0.002	0.0000145	0.014277	0.55794	0.572217
								Total	**49.93564**

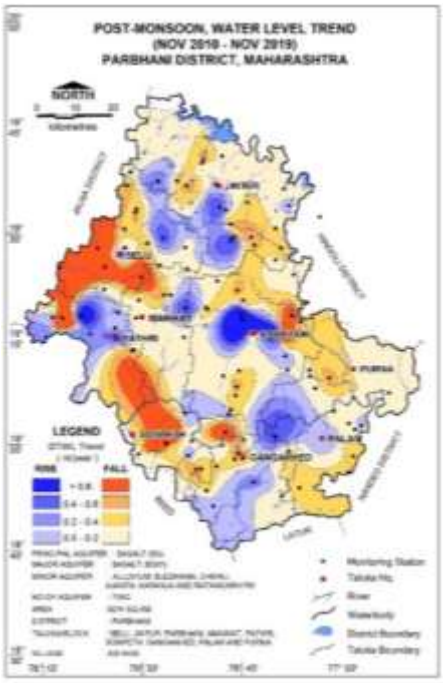
6. GROUND WATER RELATED ISSUES

6.1 Declining Water Levels

The ground water exploitation has resulted in decline of water levels over the period of time. In pre-monsoon season, declining water level trend has been observed in about 4270.75 sq. km area covering major part of Selu, Gangakhed blocks and parts of Parbhani, Purna, Jintur and Sonpeth blocks. In post-monsoon season, decline has been observed in about 4558 sq.km area covering major parts of Sonpeth, Parbhani and Selu blocks and parts in Jintur, Purna and Gangakhed blocks.



Pre-monsoon Fall in 4270.75 Sq km area



Post-monsoon Fall 4558.69 Sq km area

6.2 Rainfall and Droughts

Based on the short-term rainfall analysis from 1999 to 2019 it is observed that severe drought was observed in one year while three years moderate drought were faced in the Parbhani district. It is observed that all the blocks have experienced declining rainfall trend ranging from 4.33 to 31.04 mm/year. Severe droughts have been observed in jintur, Selu, Pathri, Parbhani, Sonpeth, Gangakhed and Palam blocks. All the blocks experienced Moderate droughts. Thus, Parbhani district is facing frequent droughts since long which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.

7. GROUND WATER MANAGEMENT PLAN

The aquifer management plan has been proposed to manage the ground water resources and to arrest further decline in water levels. The management plan comprises two components namely supply-side management and demand side management. The supply side management is proposed based on surplus surface water availability and the unsaturated thickness of aquifer whereas the demand side management is proposed by use of micro irrigation techniques and change in cropping pattern.

7.1 Supply Side Management

The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also, it is necessary to understand the unsaturated aquifer volume available for recharge. The unsaturated volume of aquifer was computed based on the area feasible for recharge, unsaturated depth below 3 mbgl and the specific yield of the aquifer. The **Table 7.1** gives the block wise volume available for the recharge.

Table 7.1: Area feasible and volume available for Artificial Recharge

Block	Geographical Area (sq. km.)	Area feasible for recharge (Sq. km.)	Unsaturated Volume (MCM)
Selu	727.03	173.10	865.50
Jintur	1270.04	32.61	104.03
Parbhani	1135.32	421.01	2250.06
Manwat	468.17	273.26	397.59
Pathri	579.63	333.55	1181.13
Sonpeth	354.79	384.56	2139.11
Gangakhed	518.36	471.59	1414.78
Palam	508.4	400.66	1342.02
Purna	651.82	492.07	1820.66
Total	6213.56	2982.41	11514.88

The total unsaturated volume available for artificial recharge is 11514.88 MCM and it ranges from 104.03 MCM in Jintur block to 2250.06 MCM in Parbhani block.

The surplus runoff for artificial recharge is 66.79 MCM. Using this surplus, 234 percolation tanks and 668 check dams can be constructed at suitable sites in the district **(Table 7.2**). The number of feasible artificial recharge structures was calculated by considering 0.20 MCM per percolation tanks and 0.03 MCM per check dam. This intervention should lead to recharge of about 50.09 MCM/year at 75% efficiency. The tentative locations of these structures are given in **Figure 7.**1 and details also given in **Annexure VII and VIII**.

The rainwater harvesting in urban areas can be adopted in 50% of the household with 50 sq. km roof area. A total of 3.39 MCM potential can be generated. However, it is economically not viable & hence, not recommended.

Table 7.2: Proposed Artificial Recharge Structures

Block	Volume of unsaturated granular zone (MCM)	Recharge Potential (MCM)	Surface water requirement @ 75% efficiency (MCM)	Availability of Surplus surface runoff (MCM)	No. of PT (100 TCM * 2 Fillings = 200 TCM)	N0. of CD (10 TCM * 3 Fillings = 300 TCM)	Volume of Water expected to be conserved/ recharged @ 75% efficiency (MCM)
Gangakhed	1414.78	28.29	37.72	10.56	37	106	7.92
Jintur	104.10	2.08	2.77	0.73	3	7	0.55
Manwat	397.59	7.95	10.60	6.12	21	61	4.59
Palam	1342.02	26.84	35.78	8.97	31	90	6.73
Parbhani	2250.06	45.00	60.00	9.43	33	94	7.07
Pathri	1181.13	23.62	31.49	7.47	26	75	5.60
Purna	1820.66	36.41	48.55	11.02	39	110	8.27
Selu	865.50	17.31	23.08	3.88	14	39	2.91
Sonpeth	2139.11	42.78	57.04	8.61	30	86	6.46
TOTAL	**11514.95**	**230.28**	**307.03**	**66.79**	**234**	**668**	**50.09**

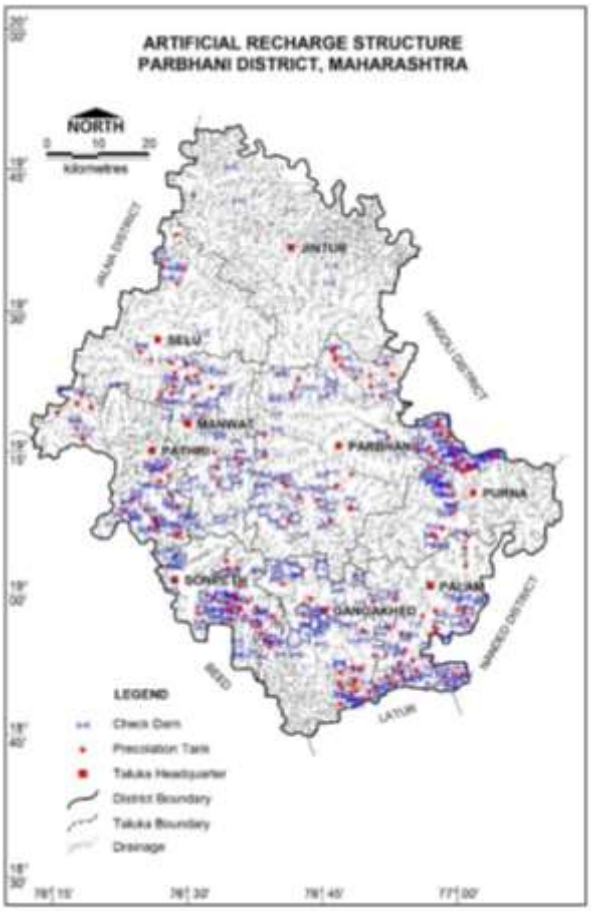


Figure 7.1: Location of Proposed Artificial Recharge structures

7.2 Demand Side Management

The Demand Side Management is proposed in areas where the stage of ground water development is relatively high and adopting micro-irrigation techniques for water intensive crops or change in cropping pattern or both are required to save water. The micro-irrigation techniques are proposed to be adopted in 73.08 sq.km area by adopting drip irrigation for sugarcane. This would lead to saving of a total of 41.66 MCM as given **Table 7.3. Figure 7.2** depicts the proposed demand side interventions in the area. No change in cropping patterns is proposed in any of the blocks.

Table 7.3: Demand side interventions proposed.

Block	Sugarcane Area proposed to be covered under drip (sq.km)	Sugarcane Volume of Water expected to be saved with drip irrigation @.57m (MCM)	Total Volume of water Saved (MCM)
Jintur	10.68	6.09	6.09
Selu	6.7	3.82	3.82
Pathri	0	0.00	0.00
Manwat	15.89	9.06	9.06
Parbhani	20	11.40	11.40
Purna	8.21	4.68	4.68
Sonpeth	0	0.00	0.00
Gangakhed	11.6	6.61	6.61
Palam	0	0.00	0.00
TOTAL	**73.08**	**41.66**	**41.66**

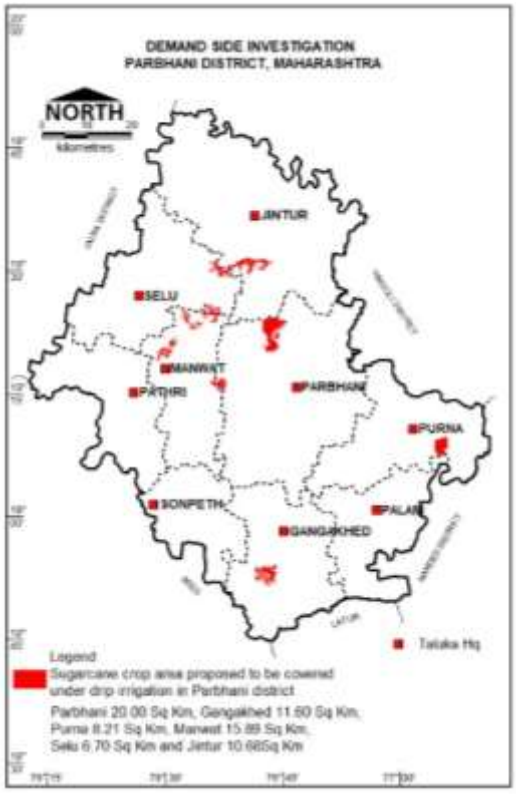


Figure 7.2: Proposed Demand side intervention, Parbhani district

7.3 Expected Benefits

The impact of groundwater management plans on the groundwater system in the district after its implementation is evaluated and the outcome shows significant improvement in groundwater scenario in all blocks as given in the **Table 7.4**.

Table 7.4: Expected benefits after management options

Block	Total GW resource available after supply side intervention (MCM)	Total GW Draft after Demand side intervention (MCM)	Stage of GWD after supply side and demand side interventions (%)	GWR available/ required to bring the Stage of GWD to 70% (MCM)	Additional Area (sq.km.) proposed to be brought under assured GW irrigation (sq.km)
Gangakhed	88.26	27.54	31.20	34.24	52.68
Jintur	171.25	61.74	36.05	58.13	89.43
Manwat	62.81	20.16	52.01	23.80	36.62
Palam	63.8	30.61	47.98	14.05	21.62
Parbhani	140.39	53.02	33.77	45.25	69.62
Pathri	76.19	39.63	52.01	13.70	21.08
Purna	123.46	46.52	37.68	39.90	61.39
Selu	80.95	37.18	45.93	19.48	29.98
Sonpeth	40.12	19.40	48.35	8.68	13.36
TOTAL	**847.22**	**335.80**	**39.64**	**257.26**	**395.78**

As seen in the **Table 7.4,** about 257.25 MCM ground water would be available for development after supply side and demand side interventions. With this about 399.66 sq. km additional area can be irrigated as shown In **Figure 7.4**.

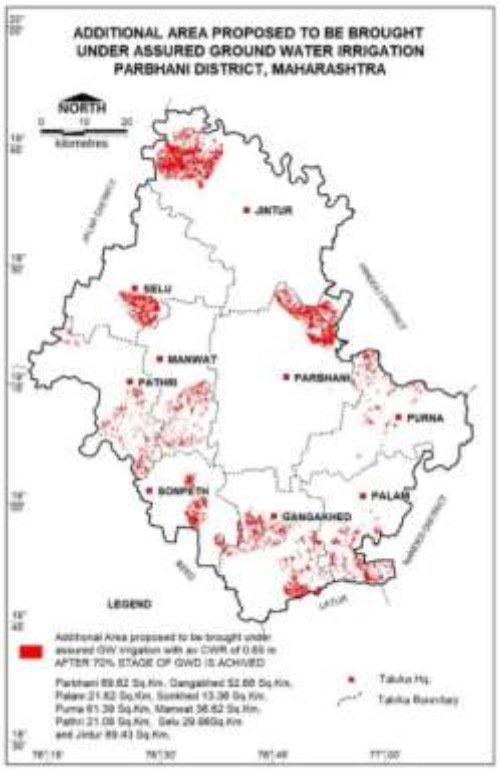


Figure 7.3: Additional area Proposed to be bought under Assured GW irrigation

7.4 Development Plan

The ground water development plan is proposed with a view to developing the additional ground water resources available after supply side interventions to bring the stage of ground water development up to 70%. The additional area proposed above can be irrigated by constructing 15435 Dug wells and 2573 Borewells as given in **Table 7.5.**

Table 7.5: Block wise additional area under assured GW Irrigation.

Block	GW Resources Available for Development to Bring Stage of GWD up to 70% from present SOD	Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	Proposed no. of BW* (@ 1.0 ham for 10% of GWR Available)
Jintur	58.13	3488	581
Selu	19.48	1169	195
Pathri	13.70	822	137
Manwat	23.80	1428	238
Parbhani	45.25	2715	453
Purna	39.90	2394	399
Sonpeth	8.68	521	87
Gangakhed	34.24	2055	342
Palam	14.05	843	141
TOTAL	**257.26**	**15435**	**2573**

8. SUM UP

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 block wise aquifer maps and aquifer management plans of Parbhani district.

Parbhani district covers an area of 6213.56 Sq.km. Geologically, the area is occupied by Basalt and local river Alluvium. The Stage of ground water development varies from 39.74 % (Jintur) to 57.62 % (Sonpeth). The overall stage of ground water development for the district is 47.35 % (SAFE Category). The area has witnessed declining water level, irregular rainfall and frequent droughts, and low yield potential aquifers are the major issues in the district. Declining water level trend has been observed in 4270.75 sq km during pre-monsoon while it is 4558.69 sq km during post monsoon.

The management plan has been proposed to manage the ground water resources and to arrest further decline in water levels. The management plan comprises two components namely supply-side management and demand side management.

The surplus runoff for artificial recharge is 66.79 MCM. Using this surplus, 234 percolation tanks and 668 check dams can be constructed at suitable sites in the district. This intervention should lead to recharge of about 50.09 MCM/year.

The rainwater harvesting in urban areas can be adopted but it is economically not viable & hence, not recommended.

As a part of **Demand Side Management**, the micro-irrigation techniques are proposed to be adopted in 73.08 sq.km area under Sugarcane cultivation this would lead to saving of 41.66 MCM/year of ground water.

The **ground water development plan** has been proposed in view of the developing additional ground water resources available after supply side and demand side interventions to bring the stage of ground water development up to 70%. Additional ground water available would be of about 257.25 MCM. This can be used to bring additional 399.66 sq.km area under assured irrigation through construction of additional 15435 dugwells and 2573 borewells.

These interventions also need to be supported by regulation for deeper aquifer and hence it is recommended to regulate/ban deeper tubewells/borewells of more than 60 m depth in these blocks, so that the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought. IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory ground water management.

9. AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

I. JINTUR BLOCK

II. SELU BLOCK

III. PATHRI BLOCK

IV. MANWAT BLOCK

V. PARBHANI BLOCK

VI. PURNA BLOCK

VII. SONPETH BLOCK

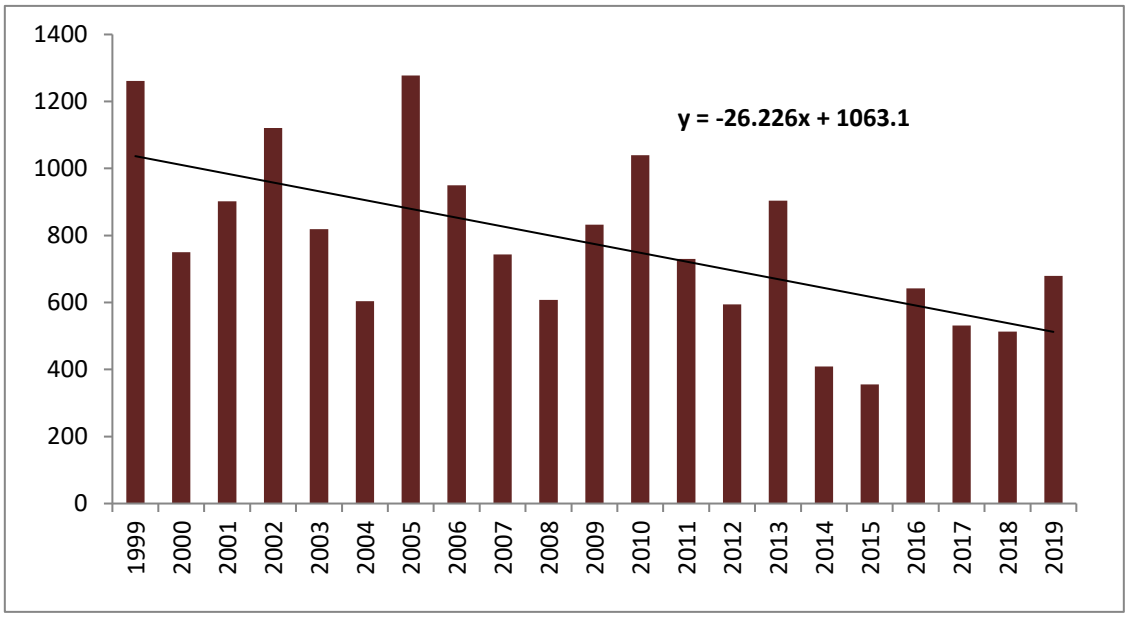
VIII. GANGAKHED BLOCK

IX. PALAM BLOCK

9.1 JINTUR BLOCK, PARBHANI DISTRICT, MAHARASHTRA

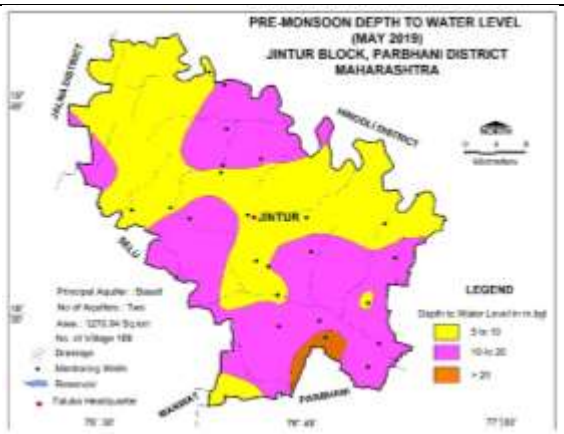
1. SALIENT FEATURES	
1.1 Introduction	
Block Name	Jintur
Geographical Area (Sq. Km.)	1270.04
Hilly Area (Sq. Km)	Nil
Population (2011)	282756
Climate	Sub-tropical
1.2 Rainfall Analysis	
Normal Rainfall	867.5 mm
Annual Rainfall (2019)	679 mm
Decadal Average Annual Rainfall (2010-19)	639.8 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -26.22 mm/year. Probability of Normal/Excess Rainfall- 47.62% / 14.29%. Probability of Drought (Moderate/Severe/Acute)-: 28.57% Moderate, 9.52%Severe & Acute –nil.

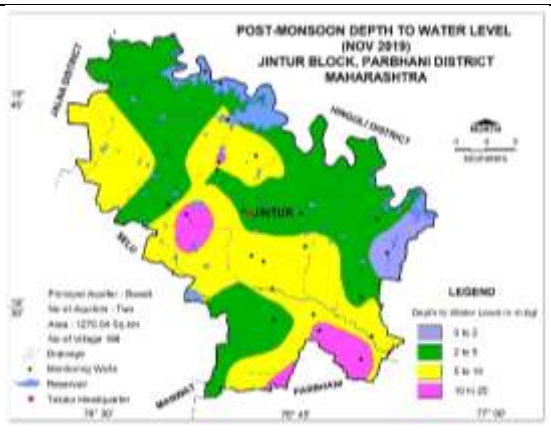
Rainfall Trend Analysis (1999 To 2019)



1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	Covered with Plateau slightly dissected 0-1 m weathering; central portion covered with Plateau moderately dissected
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene
Soil	Shallow (10 to 25 cm) consisting mostly of Gravelly clay to Sandy clay loam and Deep to very deep BCS consisting mostly of clay and loam, 50-100 cm and at some places >100 cm thick.
1.4. Hydrology & Drainage	
Drainage	Purna river in the North of the block and its tributaries with sub-dendritic to dendritic drainage

Hydrology		Medium projects	1
		Minor Irrigation Projects (Local)	14
		Minor Irrigation Projects (ZP Level)	16
			PT-41, KT-16, UGB-124
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		99.05 Sq. Km.	
Cultivable Area		943.46 Sq. Km.	
Net Sown Area		1023.81 Sq. Km.	
Double Cropped Area		324.12 Sq. km	
Area under Irrigation	Surface Water	97.54 Sq. Km.	
	Ground Water	48.32 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	234.50
		Cereals	200.07
		Pulses	310.60
		Sugarcane	0.067
		Citreous fruit	0.119
		Others	0.055
1.6. Water Level Behaviour			
1.6.1 Aquifer-I (Shallow Aquifer)			
Pre-Monsoon (May-2019) DTWL 5 mbgl to 20 mbgl is observed in entire block except in southern part of the block where water level more than 20 mbgl is observed. Remaining area is covered the DTWL is 5 mbgl to 20 mbgl.		**Post-Monsoon (November-2019)** DTWL less than 2 mbgl is observed in isolated patches in north eastern and south eastern part of the block. Water level in the range of 2 to 5 mbgl is observed in the north, south eastern and south western block. except in some patches in North-western, south-western part of block. Water level in the range of 5 to 10 mbgl is observed in the central part, north western, and southern part except isolated patches of where water level ranges between 5 to 10 mbgl.	

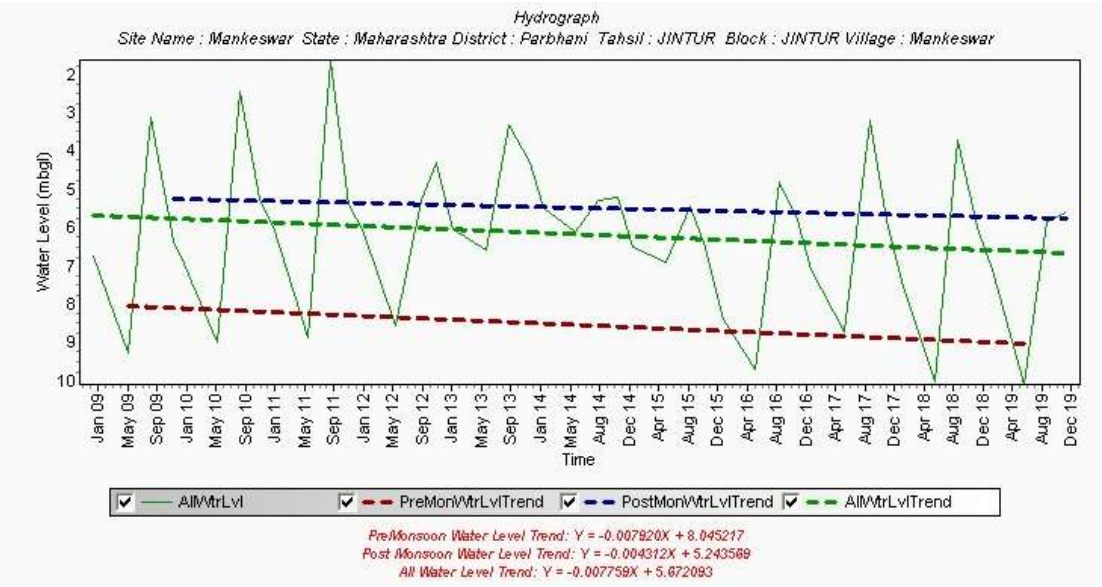




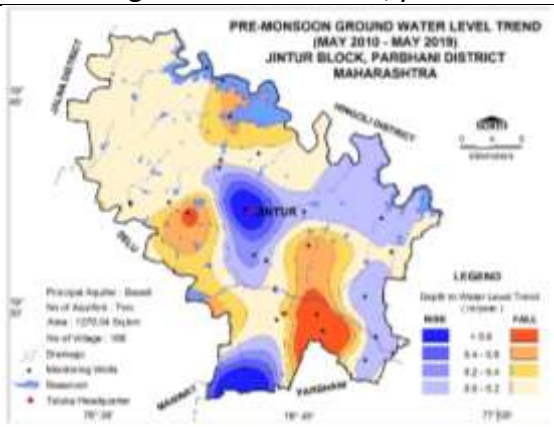
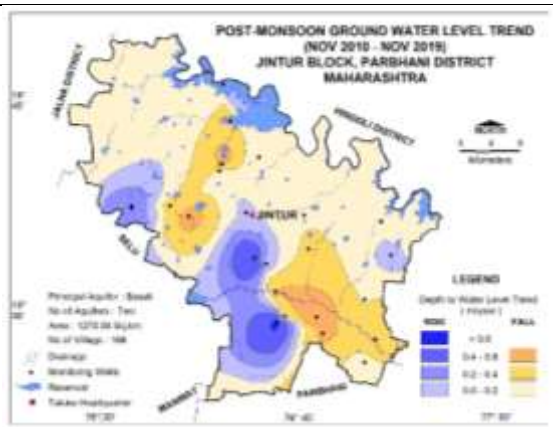
1.6.2 Water Level Behaviour – Aquifer-II (Deeper Aquifer)

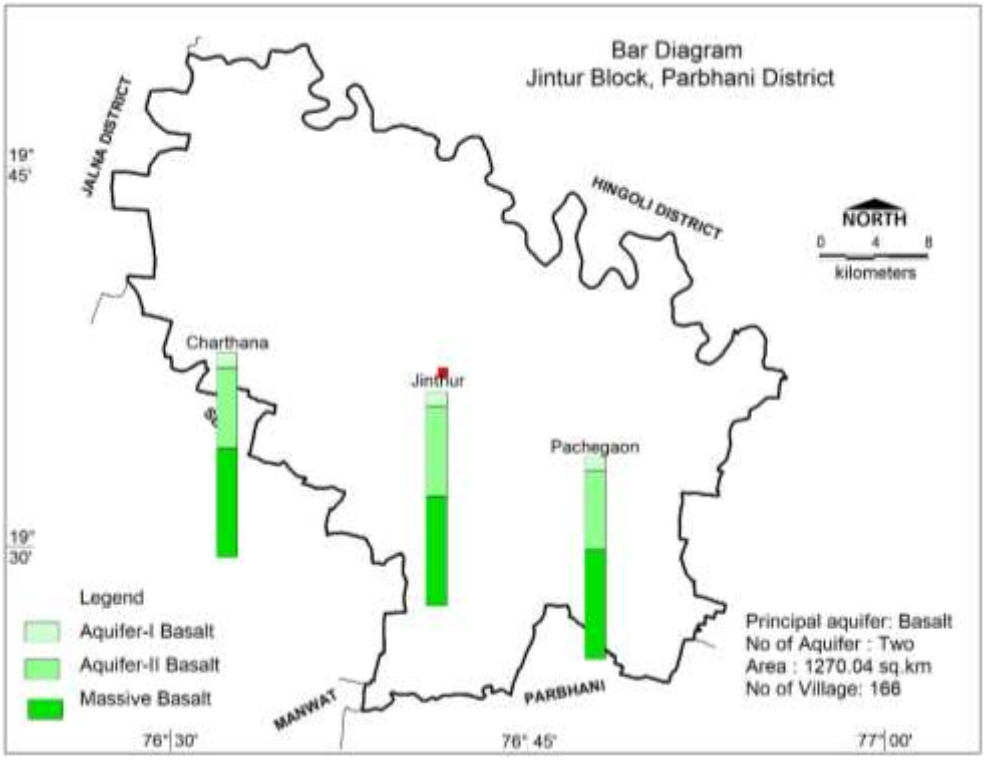
DTWL 10-20 mbgl is observed in major part of the block. Northern and western and south western part shows the water level ranging between 5 to 10 mbgl.

1.7. Hydrographs

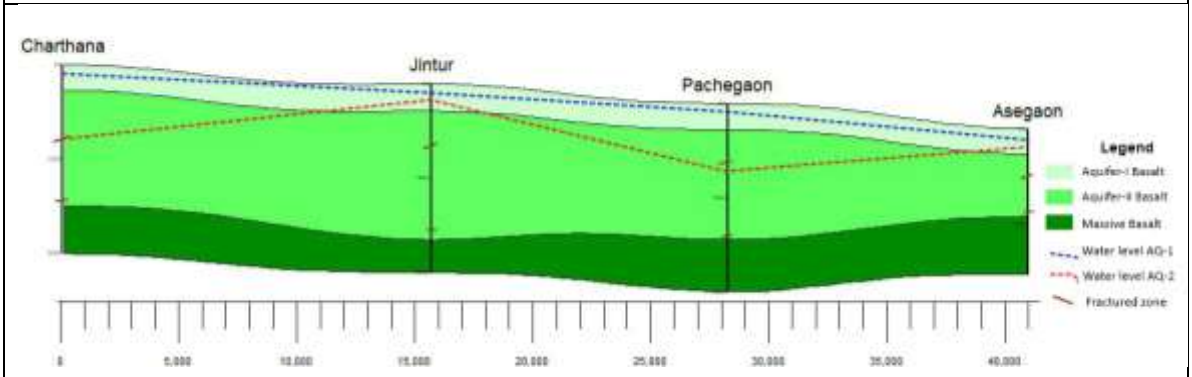


Hydrograph shows Pre-monsoon declining water level trend @ 0.0950 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.0517 m/year

<table>
<tr><td colspan="2">1.8. Water Level Trend (2009-18)</td></tr>
<tr><td>1.8.1 Pre-Monsoon trend
Falling 0.02 (Adgaon bazar) to 1.2(Karwali) m/year
Rising 0.024 (Panchegaon-1) to 0.80 (Jintur) m/year</td><td>1.8.2 Post-Monsoon trend
Rising 0.014(Jintur) to 0.91 (Charthana-1) m/year; Falling 0.062 (Kehal) to 0.55 (Zari) m/year</td></tr>
<tr><td>Major part of the block shows falling water level trend up to 0.6 m/year (894.35 sq km). Rising trend upto 0.6 m/year has been observed in north-eastern part of the block as well as in north-east and south-eastern part of the block in patches (365.27 sq km). The central part and south- western part show rising trend 0.2 to 0.6 m/year.</td><td>Major part of the block shows falling trend up to 0.6 m/year (994.52 sq.km) while rising trend of 0.2 to 0.6 m/year has been observed in south-western and western part of the block (282.45 sq. km) Central and south eastern part of block show falling trend of 0.0 to 0.4 m/year</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Declining Water Level trend in postmonsoon is observed 994.52 sq. km. area of the block.
❖ Frequent droughts (28.57% Moderate droughts) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
<tr><td colspan="2">3.2. Lithological Disposition</td></tr>
</table>



3.3. Cross Sections



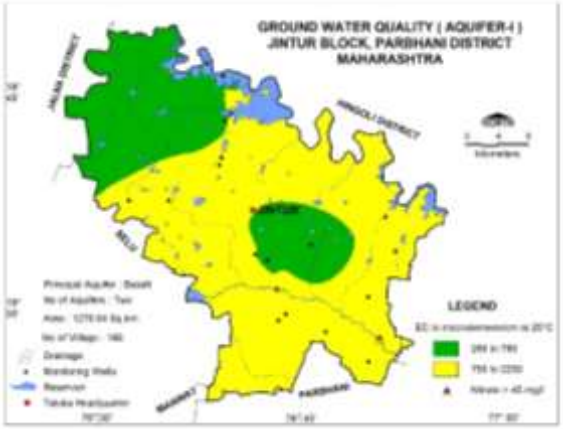
3.4. Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (m bgl)	1.00 – 21.60	3 -70
Depth of Occurrence (mbgl)	9-24	30 - 180
weathered/fractured rocks thickness (m)	5- 30	0.00 to 15.00
Yield	10 – 100 m^3/day	0-2.5 lps
Specific yield/ Storativity (S)	0.02	$2.45x10^{-4}$ to $1.45x10^{-5}$
Transmissivity (T)	30-40 m^2/day	0.38 – 2.94 m^2/day

*Value taken from Mantha block, Jalna District

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)



EC ranging from 750 to 2250 µS/cm has been observed in major part of block covering about 867.2 sq. km area of the block except North part and some part of central part of block covering about 392.8 sq. km area and Ground water is suitable for all purpose. Asegaon village is also affected by Nitrate contaminations.

4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)

Entire area of block covering EC ranging from 750 to 2250 µS/cm has been observed having area 1270.04 sq. km. Ground water is suitable for all purpose. However, Pachegaon village is affected by Nitrate contaminations.

5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

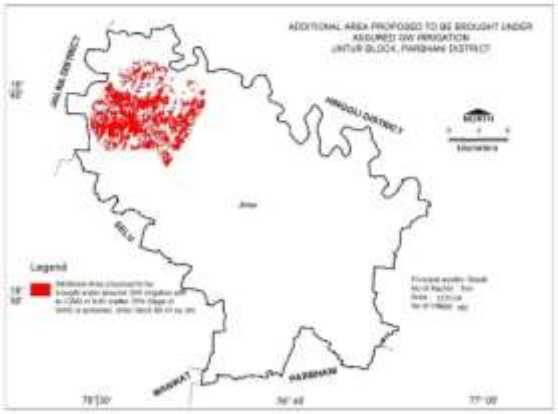
Ground Water Recharge Worthy Area (Sq. Km.)	1270.04
Total Annual Ground Water (MCM) Recharge	179.68
Total Natural Discharges (MCM)	8.98
Annual Extractable Ground Water Recharge (MCM)	170.70
Current Annual Ground Water Extraction for irrigation use (MCM)	65.28
Current Annual Ground Water Extraction for domestic and industrial use (MCM)	2.55
Total Extraction (MCM)	67.83
Annual GW Allocation for Domestic Use as on 2025 (MCM)	8.76
Net Ground Water Availability for future use (MCM)	93.74
Stage of Ground Water Extraction (%)	39.74
Categorization	**Safe**

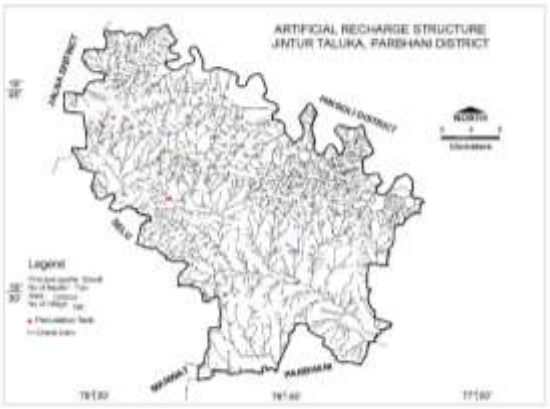
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)

Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
844.77	1	0.002	0.0000145	60	2.42449
415.1	3	0.002	0.0000145	40	2.731358
				Total	**5.155848**

6.0. GROUND WATER MANAGEMENT		
6.1. Supply Side Management		
SUPPLY (MCM)		
Available Resource (MCM)		170.7
Gross Annual Draft (MCM)		67.83
Agricultural Demand –GW		65.28
Agricultural Demand –SW		63.401
Domestic Demand – GW		2.55
Domestic Demand – SW		0.64
Total Demand		**131.8685**
Area of Block (Sq. Km.)		1270.04
Area suitable for Artificial recharge (Sq. Km)		
Type of		Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		32.61
Volume of Unsaturated Zone (MCM)		104.10
Average Specific Yield		0.02
Availability of Surplus surface runoff (MCM)		0.7305
Surplus runoff considered for planning (MCM) @75%		0.55
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)
Number of Structures	3	7
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	0.38	0.17
RTRWH Structures – Urban Areas		
Households to be covered (50% with 50 m^2area)		3861
Rainwater harvested / recharged @ 80% runoff co-efficient		0.253
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area proposed for drip irrigation (sq. km.)		10.68
Volume of Water expected to be saved (MCM). Surface Flooding req-2.45 m. Drip Req. - 1.88, WUE- 0.57 m		6.08
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
Water Saving by Change in Cropping Pattern		Nil
6.3. Expected Benefits		
Net Ground Water Availability (MCM)		170.7
Additional GW resources available after Supply side interventions (MCM)		0.55
Ground Water Availability after Supply side intervention (MCM)		171.25
Existing Ground Water Draft for All Uses (MCM)		67.83
GW draft after Demand Side Interventions (MCM)		61.74

Present stage of Ground Water Development (%)	39.74
Expected Stage of Ground Water Development after interventions (%)	36.05
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	58.13
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	3488
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	581
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of GWD is achieved	89.43
Regulatory Measures	60m borewells/tube wells

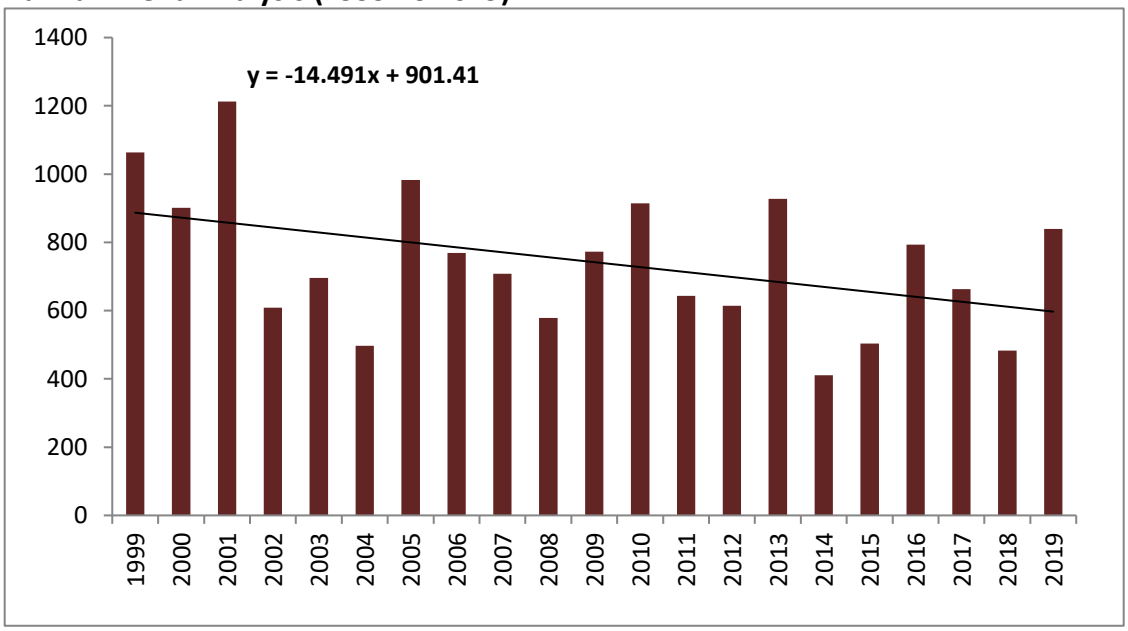




9.2 SELU BLOCK, PARBHANI DISTRICT, MAHARASHTRA

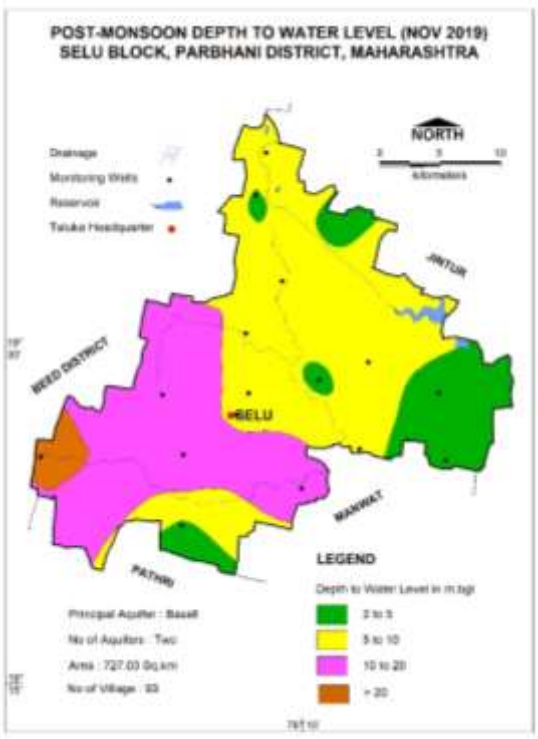
1. SALIENT FEATURES	
1.1 Introduction	
Block Name	Selu
Geographical Area (Sq. Km.)	727.03
Hilly Area (Sq. Km)	Nil
Population (2011)	169174
Climate	Sub-tropical
1.2 Rainfall Analysis	
Normal Rainfall	845.6 mm
Annual Rainfall (2019)	839.7 mm
Decadal Average Annual Rainfall (2010-19)	679.26 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -14.49 mm/year. Probability of Normal/Excess Rainfall- 57.14% / 9.52%. Probability of Drought (Moderate/Severe/Acute)-: 28.57% Moderate, 4.76%Severe & Acute –nil.

Rainfall Trend Analysis (1999 To 2019)



1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Undissected (PLU), 0-1m weathering with Alluvial Plain - Older - Moderate (AYM) at North eastern side
Geology	Deccan Traps (Basalt) Age: Upper Cretaceous to Lower Eocene
Soil	Shallow (10 to 25 cm), BCS consisting mostly of Gravelly clay loam, 10-25 cm thick and some palces deep having thickness (50 to 100 cm) consisting mostly of Silty clay.
1.4. Hydrology & Drainage	
Drainage	Tributaries of Purna river i.e Dudhana river central part of the block with sub-dendritic to dendritic drainage

Hydrology		Major projects	01
		Medium projects	0
		Minor Irrigation Projects (Local)	0
		Minor Irrigation Projects (ZP Level)	1
			PT-10, KT-4, UGB-34
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		759.63 Sq. Km.	
Net Sown Area		966.16 Sq. Km.	
Double Cropped Area		391.83 Sq. Km.	
Area under Irrigation	Surface Water	127.93 Sq. Km.	
	Ground Water	22.46 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	296.43
		Cereals	206.40
		Pulses	308.00
		Sugarcane	10.68
		Citreous fruit	0.065
		Others	0.015
1.6. Water Level Behaviour			
1.6.1 Aquifer-I (Shallow Aquifer)			
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major parts of the block while water level in the range of 5 to 10 mbgl is observed in small patch at Noerthern and south eastern portion of block. Deeper DTWL >20 mbgl is observed in south western portion and small patch at eastern portion of block.		**Post-Monsoon (November-2019)** DTWL 2 to 5 mbgl are observed as isolated patches in north-east, south-east, southern parts of the block. DTWL 5 to 10 mbgl is observed in entire block except western part of the block where DTWL ranging 10 to 20 mbgl. Isolated patch of DTWL >20 mbgl observed at western portion of block.	

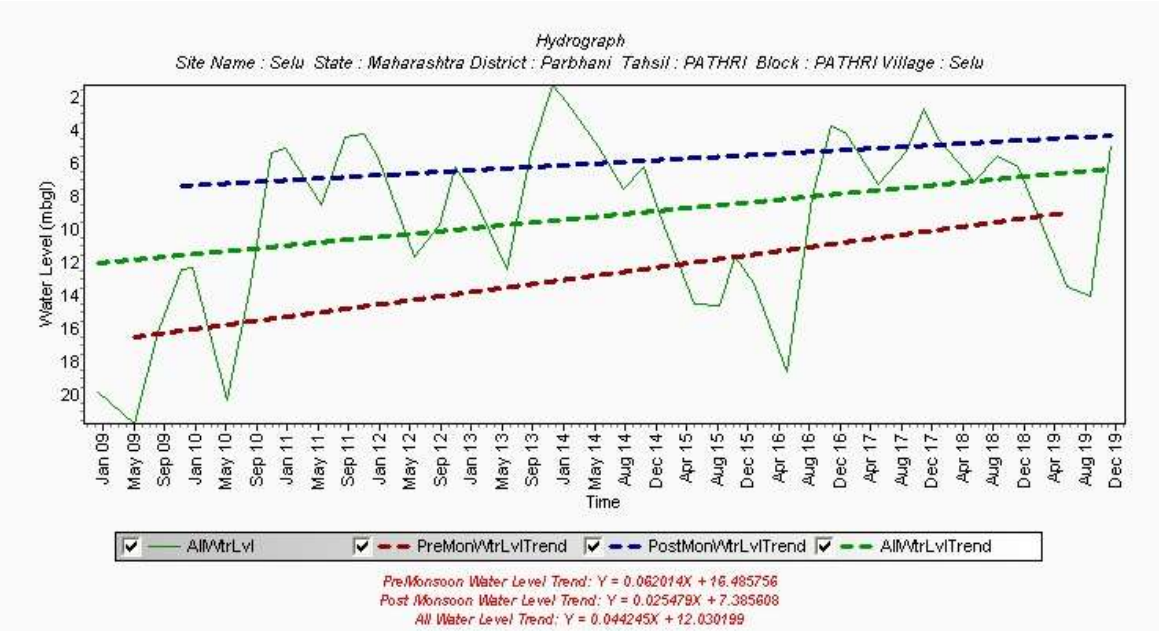


1.6.2 Water Level Behaviour– Aquifer-II (Deeper Aquifer)

Post-Monsoon

DTWL 5 to 10 mbgl is observed in major part in Northern, Eastern and Southern part of block. DTWL 2-5 mbgl is observed in western part of the block.

Hydrographs



Hydrograph shows Pre-monsoon rising water level trend @ 0.744 m/year.	Hydrograph shows Post- monsoon rising water level trend @ 0.305 m/year
1.8. Water Level Trend (2010-19)	
1.8.1 Pre-Monsoon trend Rising @0.14 m/year (Pimpri Kh) to 1.07 m/year (Selu); Falling 0.2(Borkini) to 2.4 (Shinde Takli) m/year.	**1.8.2 Post-Monsoon trend** Rising 0.33 (Selu) to 0.48 (Walur) m/year; Falling 0.01 (Gava T) to 1.82 (Shinde Takli) m/year
Major part of the block shows falling water level trend up to 0.6 m/year (534.62 sq km) except rising trend 0.2-0.6 mbgl (165.16 sq km) in northwest part of the block and 0.0-0.4 in patch in the eastern part of the block. Falling trend>0.6 m/year has been observed in western and southern part of the block.	Eastern part of the block shows rising trend upto 0.6 m/year (172.19 sq km) while falling trend 0.2 to 0.6 m/year (453.53 sq km) has been observed in central part of the block. Falling trend>0.6 m/year has been observed in western part of the block.

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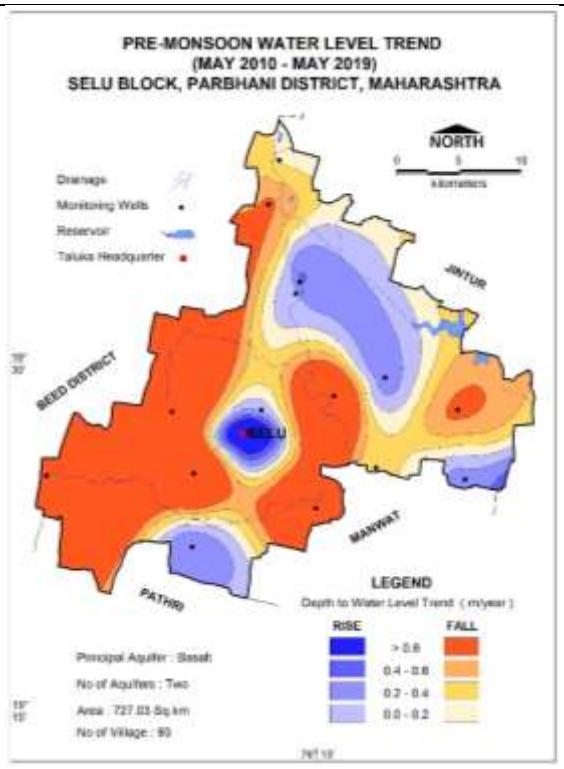
<td> 
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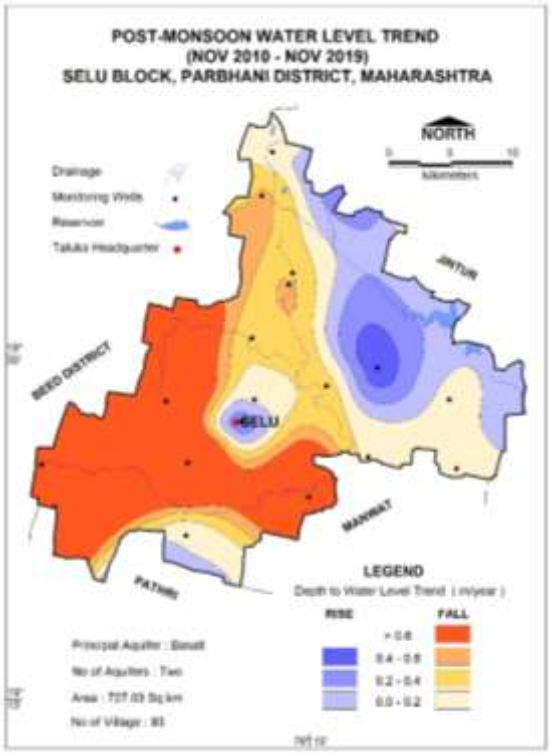
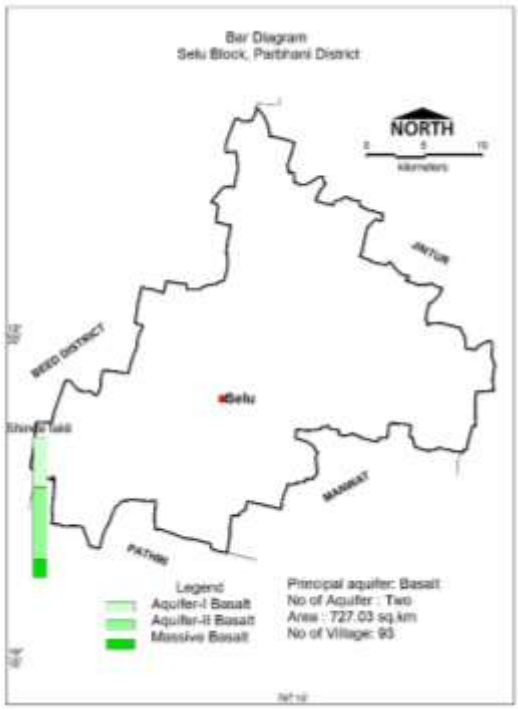
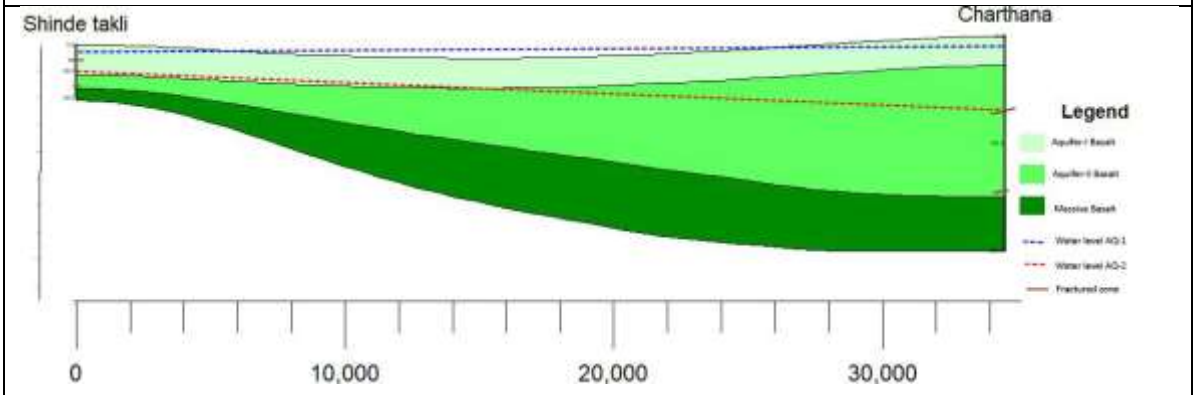
<td> 
</td>
</tr>
<tr>
<td colspan="2">2. Ground Water Issues</td>
</tr>
<tr>
<td colspan="2">❖ Block shows declining water level trend up to 0.6 m/year.
❖ Frequent droughts (28.57% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td>
</tr>
<tr>
<td colspan="2">3. AQUIFER DISPOSITION</td>
</tr>
<tr>
<td>3.1. Number of Aquifers</td>
<td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td>
</tr>
</table>

3.2. Lithological Disposition



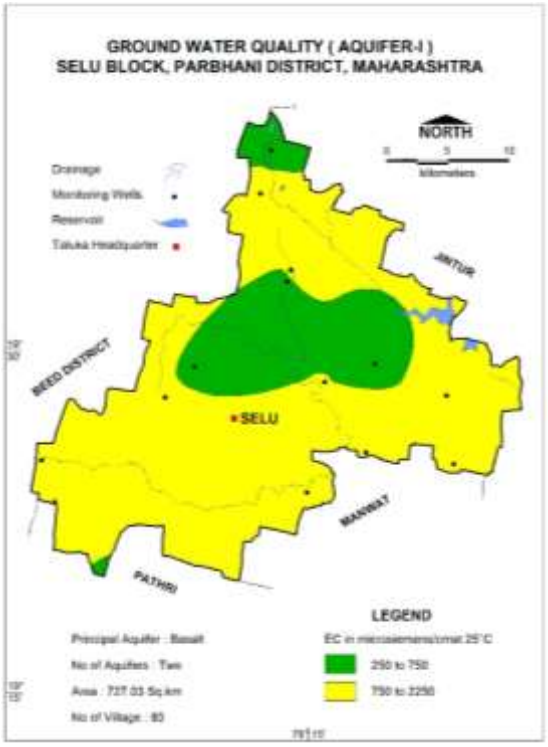
3.3. Cross Sections



3.4. Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (m bgl)	2.5 – 29.1	3 -70
Depth of Occurrence (mbgl)	3 – 24	30 - 150
weathered/fractured rocks thickness (m)	5 – 15	0.00 – 15.00
Yield	10 to 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*2.45x10^{-4} to 1.45x10^{-5}
Transmissivity (T)	30-40 m^2/day	0.38 – 2.94 m^2/day

*Value taken from Partur block, Jalna District

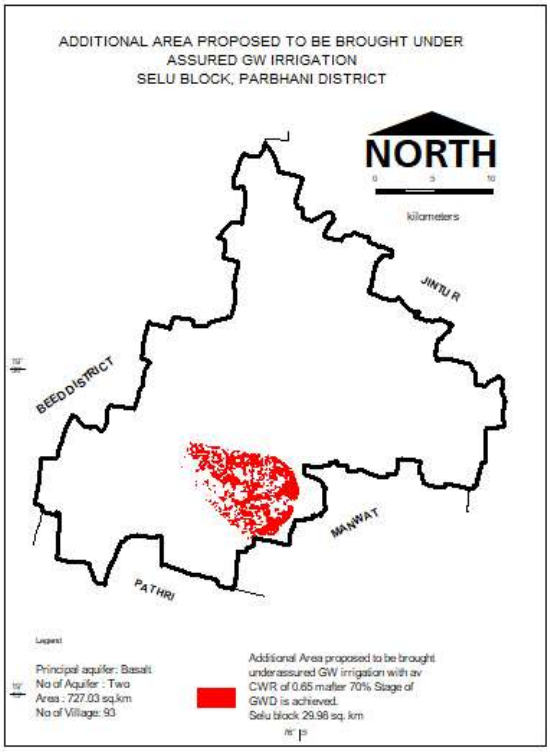
4. GROUND WATER QUALITY	
4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)	**4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)**
	
EC ranging from 750 to 2250 µS/cm has been observed in major part of block covering about 543.6 sq km area of the block & ground water is suitable for all purpose. Whereas EC ranging from 250 to 750 has been observed in patches at central, north, south having area 155.9 sq. km.	EC ranging from 750 to 2250 µS/cm has been observed in major part of block covering about 689.9 sq.km area of the block & ground water is suitable for all purpose. Whereas, EC ranging from 250 to 750 has been observed small patch at south having area 9.82 sq. km.

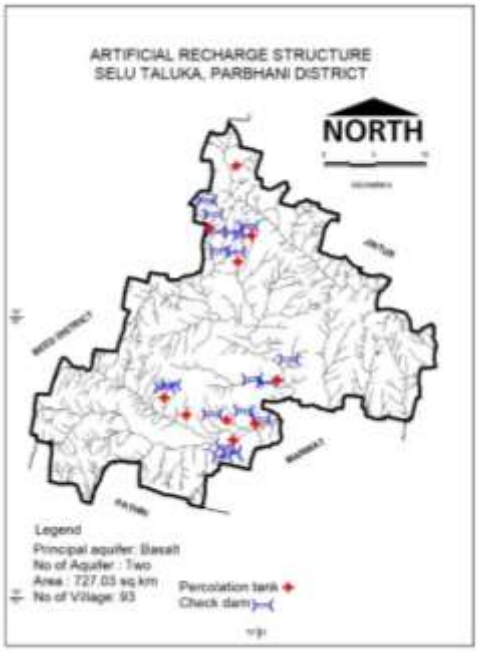
5. GROUND WATER RESOURCE	
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	727.03
Total Annual Ground Water (MCM) Recharge	82.14
Total Natural Discharges (MCM)	4.11
Annual Extractable Ground Water Recharge (MCM)	78.04
Current Annual Ground Water Extraction for irrigation use (MCM)	39.13
Current Annual Ground Water Extraction for domestic and industrial use (MCM)	1.87
Total Extraction (MCM)	41
Annual GW Allocation for Domestic Use as on 2025 (MCM)	8.70
Net Ground Water Availability for future use (MCM)	32.19
Stage of Ground Water Extraction (%)	52.54
Categorization	**Safe**
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)	

Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
667.4	1	0.002	0.0000145	40	1.721892
32.35	3	0.002	0.0000145	40	0.212863
				Total	**1.934755**

6.0. GROUND WATER RESOURCE ENHANCEMENT		
6.1. Supply Side Management		
SUPPLY (MCM)		
Available Resource (MCM)		78.04
Gross Annual Draft (MCM)		41.00
Agricultural Demand –GW		39.13
Agricultural Demand –SW		83.15
Domestic Demand – GW		1.87
Domestic Demand – SW		0.47
Total Demand		124.62
Area of Block (Sq. Km.)		727.03
Area suitable for Artificial recharge (Sq. Km)		173.10
Type of Aquifer		Hard Rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		173.10
Volume of Unsaturated Zone (MCM)		865.50
Average Specific Yield		0.02
Availability of Surplus surface runoff (MCM)		3.8774
Surplus runoff considered for planning (MCM) @75%		2.91
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)
Number of Structures	14	39
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.03	0.87
RTRWH Structures – Urban Areas		
Households to be covered (50% with 50 m^2 area)		4380
Rainwater harvested / recharged @ 80% runoff co-efficient		0.295
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area proposed for drip irrigation (sq. km.)		6.70
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. – 1.88, WUE- 0.57 m		3.81
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
Water Saving by Change in Cropping Pattern		Nil
6.3. Expected Benefits		

Net Ground Water Availability (MCM)	78.04
Additional GW resources available after Supply side interventions (MCM)	2.91
Ground Water Availability after Supply side intervention (MCM)	80.95
Existing Ground Water Draft for All Uses (MCM)	41.00
GW draft after Demand Side Interventions (MCM)	37.18
Present stage of Ground Water Development (%)	52.53
Expected Stage of Ground Water Development after interventions (%)	45.93
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	19.48
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	1169
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	195
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of gwd is achieved	29.98
Regulatory Measures	**60m borewells/tube wells**

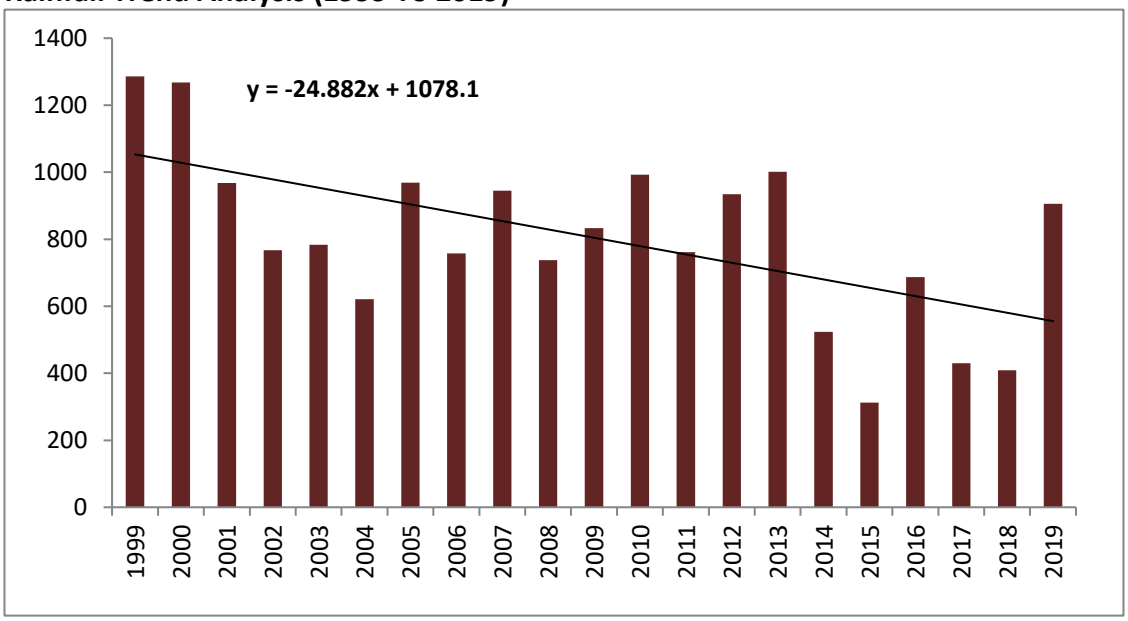



ARTIFICIAL RECHARGE STRUCTURE
SELU TALUKA, PARBHANI DISTRICT
NORTH
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 727.03 sq.km
No of Village: 93
Percolation tank
Check dam

9.3 PATHRI BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES	
1.1 Introduction	
Block Name	PATHRI
Geographical Area (Sq. Km.)	579.63
Hilly Area (Sq. Km)	Nil
Population (2011)	139046
Climate	Monsoon Sub-tropical
1.2 Rainfall Analysis	
Normal Rainfall	797.4 mm
Annual Rainfall (2019)	905.8 mm
Decadal Average Annual Rainfall (2010-19)	695.79 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend 24.88 mm/year. Probability of Rainfall: 66.67% Normal Rainfall; 14.29 % Excess Rainfall Probability of Drought: 14.29% Moderate Drought, 4.76% Severe drought

Rainfall Trend Analysis (1999 To 2019)

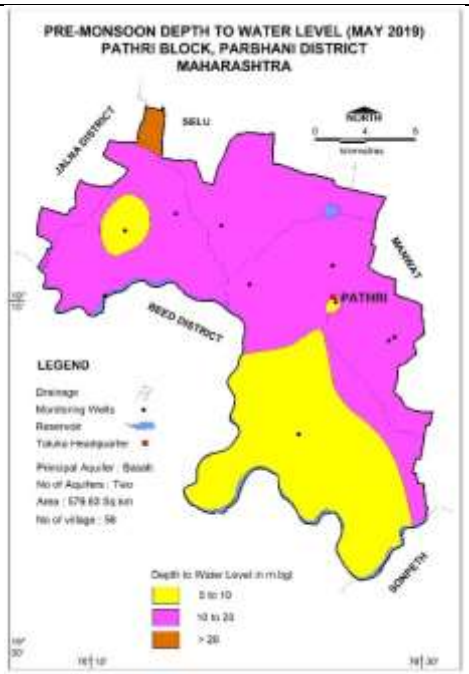


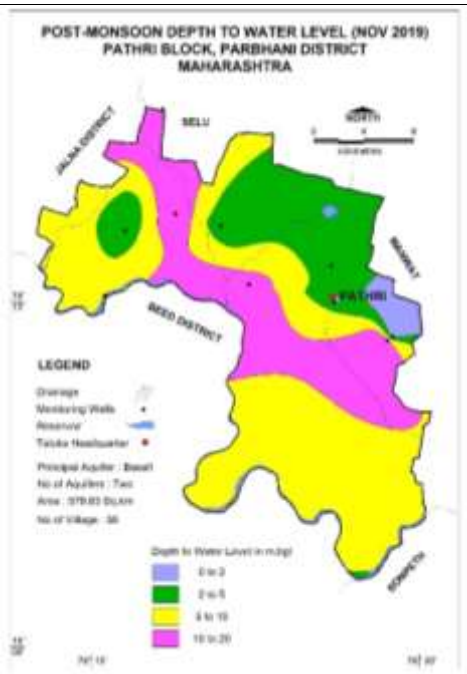
1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Undissected (PLU), 0-1m weathering.
Geology	Deccan Traps (Basalt) Age: Upper Cretaceous to Lower Eocene
Soil	Shallow (10 to 25 cm), BCS consisting mostly of Gravelly clay loam to Clay loam, 10-25 cm thick and Very deep having thickness more than 100 cm, BCS consisting mostly of clayey.
1.4. Hydrology & Drainage	
Drainage	Godavari river in the South of the block and its tributaries with sub-dendritic to dendritic drainage

Hydrology	Major project	Nil
	Medium project	02
	Minor Irrigation Projects (Local)	03
	Minor Irrigation Projects (ZP Level)	0
		PT-0, KT-0, UGB-1

1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		568.32 Sq. Km.	
Net Sown Area		758.98 Sq. Km.	
Double Cropped Area		258.53. Km.	
Area under Irrigation	Surface Water	107.19 Sq. Km.	
	Ground Water	36.13 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	235.40
		Cereals	133.60
		Pulses	137.00
		Sugarcane	99.00
		Citreous fruit	0.36
		Others	0.30

1.6. Water Level Behaviour	
1.6.1 Aquifer-I (Shallow Aquifer)	
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in entire block except DTWL 5 to 10 mbgl at South eastern portion and small patch at north western of block.	**Post-Monsoon (November-2019)** Water level in the range of 0 to 2 mbgl is observed in small isolated patch in eastern part of the block. DTWL 2 to 5 mbgl is observed in north eastern and small patch at north western of the block. DTWL 5 to 10 mbgl is observed in south and North eastern portion of block. Water level in the range of 10 to 20 mbgl is observed running patch in north-west and south east part of the block.

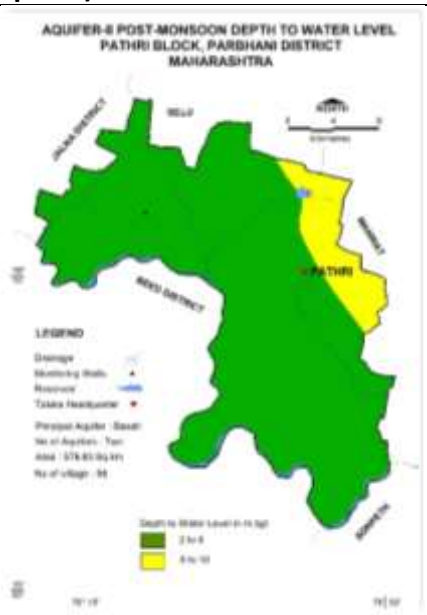




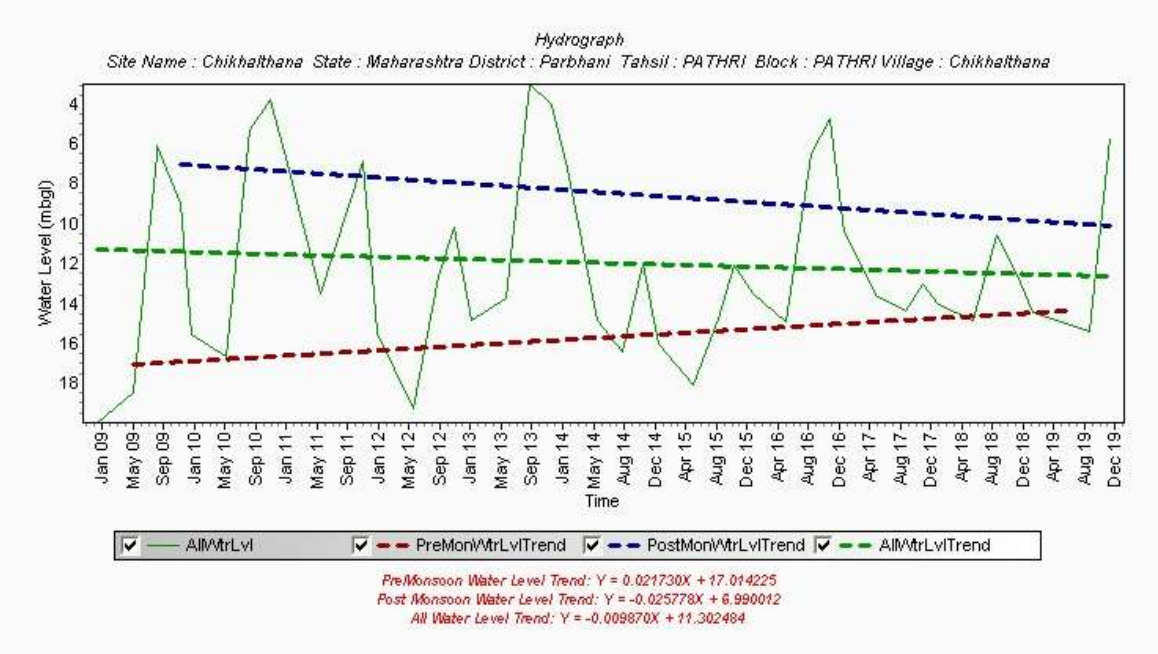
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon

DTWL 2-5 mbgl is observed in major part of block i.e. northern, western and southern part of block. Small patch of DTWL 5-10 mbgl in eastern part of block.



1.7. Hydrographs



Hydrograph shows Pre-monsoon rising water level trend @ 0.260 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.308 m/year
1.8. Water Level Trend (2010-19)	
Pre-Monsoon trend Rising 0.06 m/year (Zari) to 1.23 m/year (Pathri); Falling 0.14 m/year (Kansur) to 1.30 m/year (Hadgaon)	**Post-Monsoon trend** Rising 0.02 (Zari) to 0.81 (Wadi Pati) m/year; Falling 0.02 (Renapur) to 3.07 (Hadgaon) m/year
Major area shows Rising water level trend up to 0.4 m/year (416.91 sq km). Rising trend >0.6 m/year has been observed in western part of block. Falling water level trend 0.4 to > 0.6 m/year has been observed in northern part of block	North eastern and western part of the block shows rising trend 0.2 to > 0.6 m/year (255.62sq km) and small patch shows rising trend > 0.6 m/year while falling trend 0.00 to > 0.6 m/year (300.04 sq km) has been observed in north and southern part of the block.

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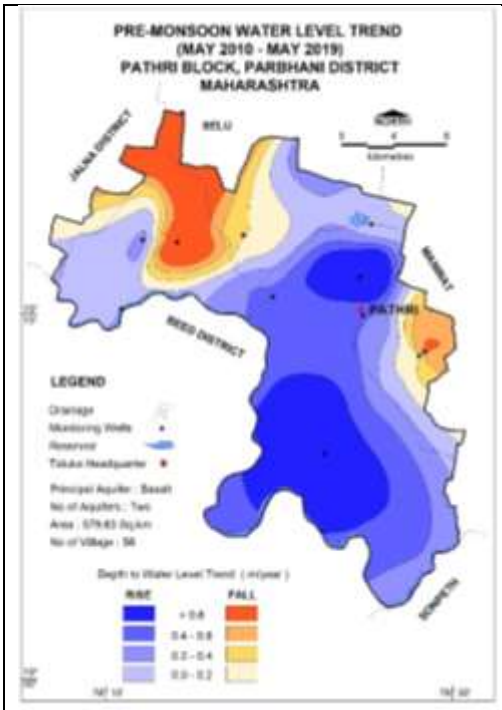
<td> 
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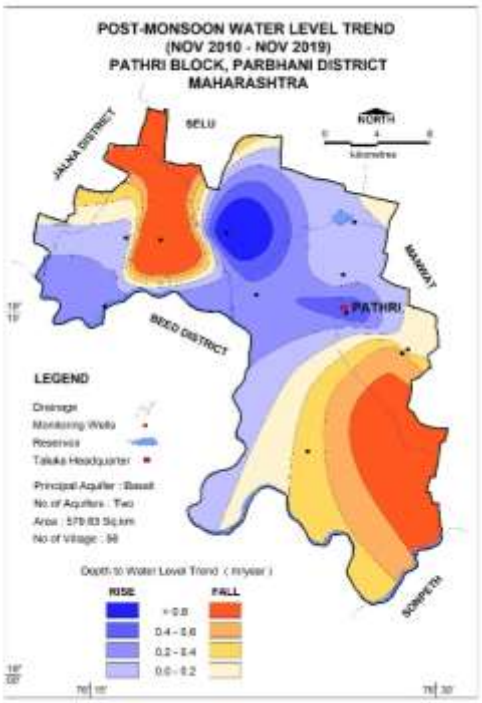
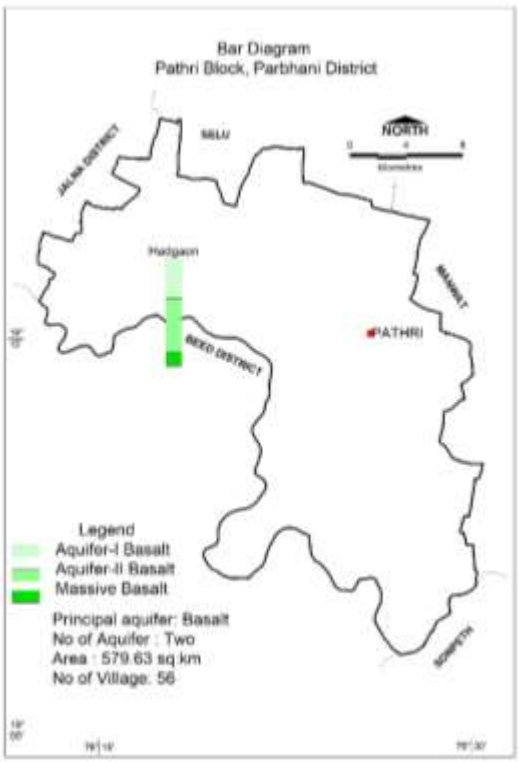
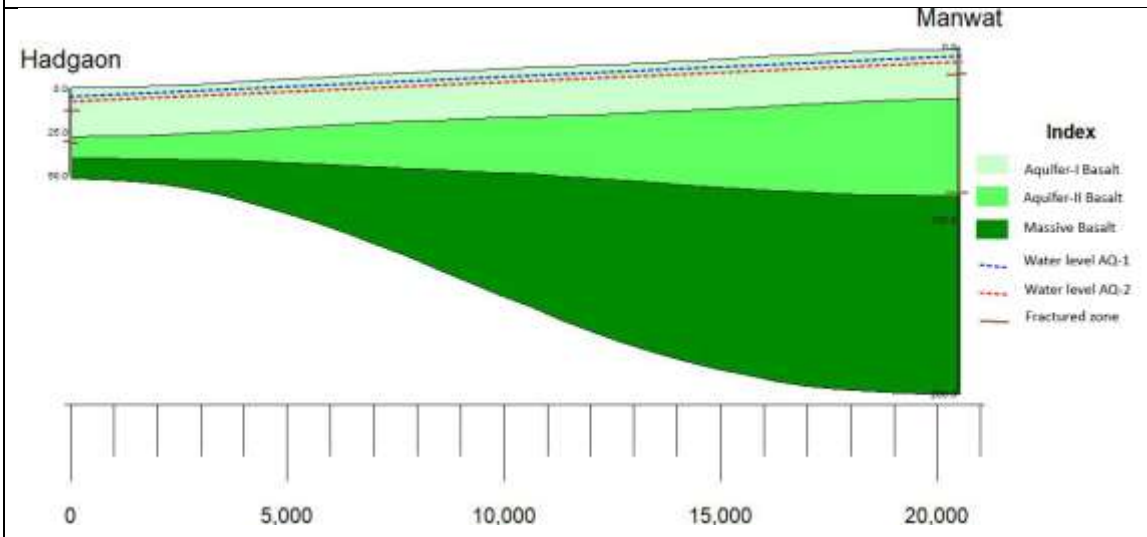
<td> 
</td>
</tr>
<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Frequent droughts (14.29% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
<tr><td colspan="2">3.2. Lithological Disposition</td></tr>
</table>



3.3. Cross Section

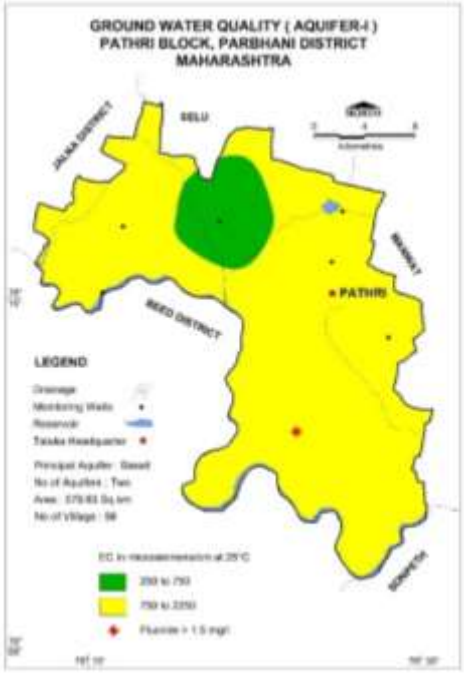
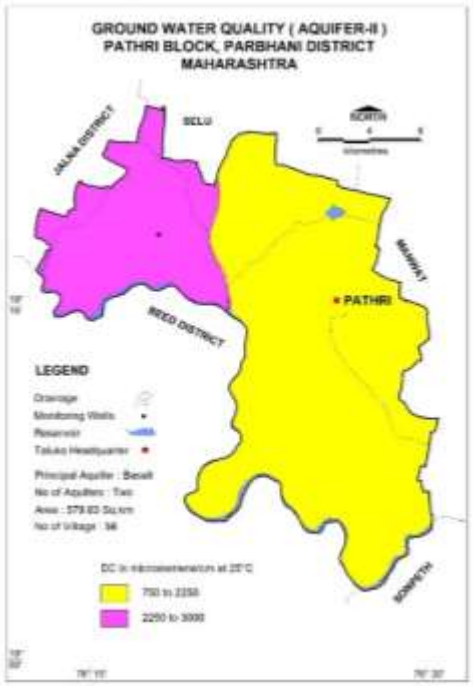


3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (m bgl)	1.00 – 17.00	3 -70
Depth of Occurrence (mbgl)	3 - 24	30 - 90

weathered/fractured rocks thickness (m)	5 - 15	0.00 – 15.00
Yield	10 – 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*2.45x10^{-4} to 1.45x10^{-5}
Transmissivity (T)	30 - 40 m^2/day	0.38 – 2.94 m^2/day
		*value taken from Partur block, Jalna District

4. GROUND WATER QUALITY

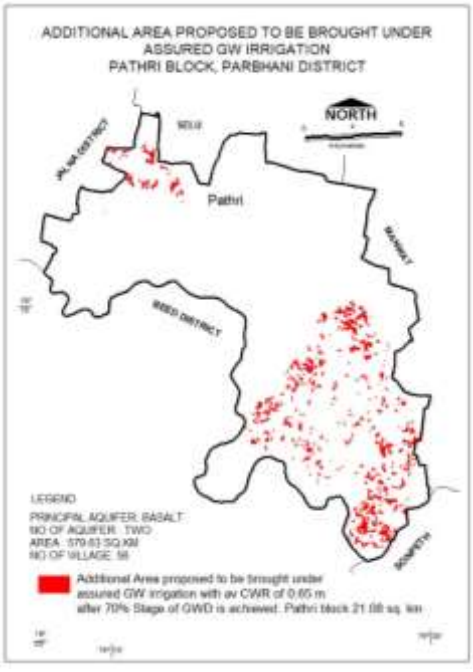
4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)	**4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)**
	
EC ranging from 750 to 2250 µS/cm has been observed in major part of block covering about 504.7 sq.km area of the block & ground water is suitable for all purpose. Patches of EC ranging 250-750 µS/cm are observed in north part of the block covering about 51.67 sq.km area. Few villages are also affected by Nitrate and Fluoride contamination.	EC ranging from 750 to 2250 µS/cm has been observed in entire part of block covering about 413.9 sq. km area of the block except northern part of block having EC ranging from 2250 to 3000 µS/cm. Ground water is suitable for all purpose.

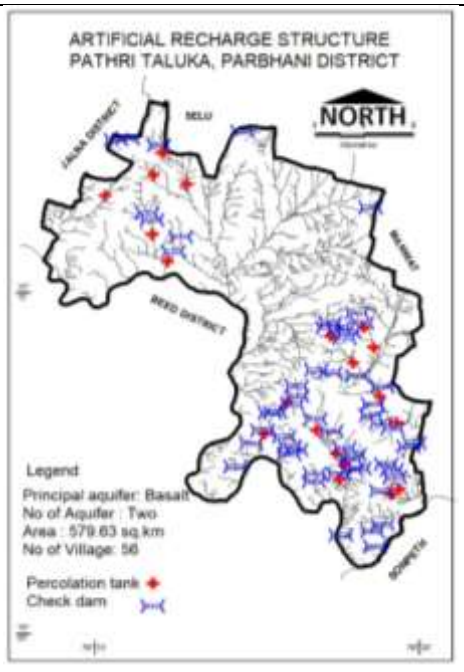
5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	579.63
Total Annual Ground Water (MCM) Recharge	74.30
Total Natural Discharges (MCM)	3.72
Annual Extractable Ground Water Recharge (MCM)	70.59
Current Annual Ground Water Extraction for irrigation use (MCM)	37.68
Current Annual Ground Water Extraction for domestic and industrial use (MCM)	1.95

Total Extraction (MCM)					39.63
Annual GW Allocation for Domestic Use as on 2025 (MCM)					9.24
Net Ground Water Availability for future use (MCM)					24.47
Stage of Ground Water Extraction (%)					56.14
Categorization					**Safe**
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
328.0	1	0.002	0.0000145	30	0.79868
228.4	3	0.002	0.0000145	30	1.469754
				Total	**2.268434**
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					70.59
Gross Annual Draft (MCM)					39.63
Agricultural Demand –GW					37.68
Agricultural Demand –SW					69.67
Domestic Demand – GW					1.95
Domestic Demand – SW					0.49
Total Demand					**109.79**
Area of Block (Sq. Km.)					579.63
Area suitable for Artificial recharge (Sq. Km)					333.55
Type of Aquifer					Hard Rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					333.55
Volume of Unsaturated Zone (MCM)					1181.13
Average Specific Yield					0.02
Recharge Potential (MCM)					23.6226
Surface water requirement @ 75% efficiency (MCM)					31.4968
Proposed Structures		Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)		Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	
Number of Structures		26		75	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		3.92		1.68	
RTRWH Structures – Urban Areas					
Households to be covered (50% with 50 m^2area)					3330
Rainwater harvested / recharged @ 80% runoff co-efficient					0.229
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					
Sugarcane crop area proposed for drip irrigation (sq. km.)					0

Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m	0
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
6.3. Expected Benefits	
Net Ground Water Availability (MCM)	70.59
Additional GW resources available after Supply side interventions (MCM)	5.60
Ground Water Availability after Supply side intervention (MCM)	76.19
Existing Ground Water Draft for All Uses (MCM)	39.63
GW draft after Demand Side Interventions (MCM)	39.63
Present stage of Ground Water Development (%)	56.14
Expected Stage of Ground Water Development after interventions (%)	52.01
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	13.70
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	822
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	137
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of GWD is achieved	21.08
Regulatory Measures	60m borewells/tube wells

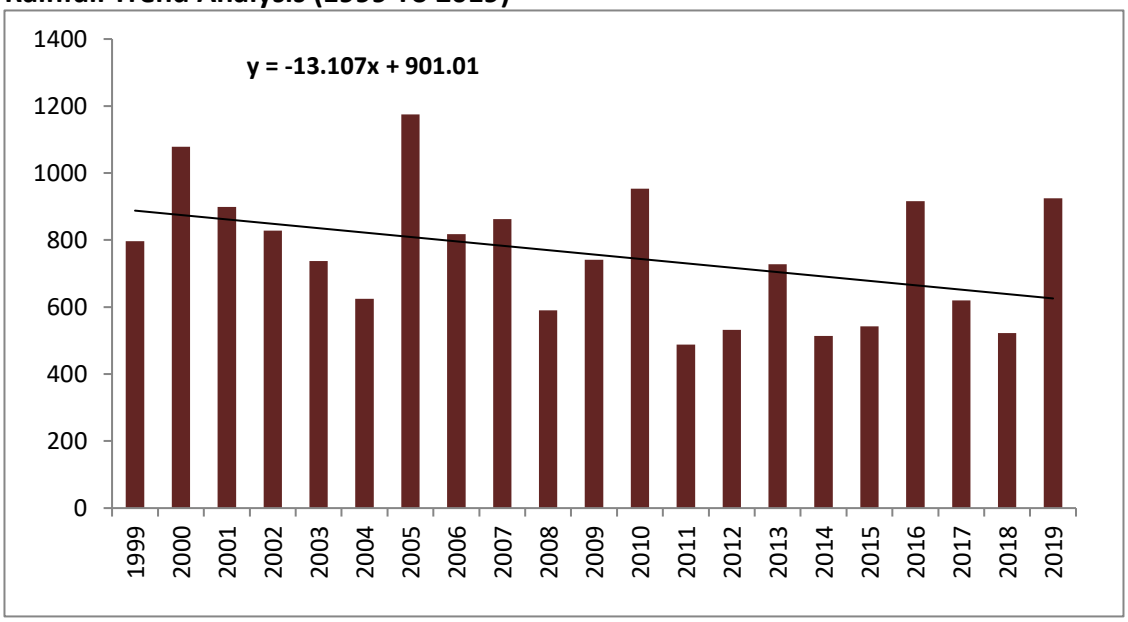




9.4 MANWAT BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name		Manwat
Geographical Area (Sq. Km.)		468.17
Hilly Area (Sq. Km)		Nil
Population (2011)		116817
Climate		Sub-tropical
1.2 Rainfall Analysis		
Normal Rainfall		845.6 mm
Annual Rainfall (2019)		924.7 mm
Decadal Average Annual Rainfall (2010-19)		674.18 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -13.107 mm/year. Probability of Rainfall: 52.38% Normal Rainfall; 9.52 % Excess Rainfall Probability of Drought: 38.10% Moderate Drought	

Rainfall Trend Analysis (1999 To 2019)



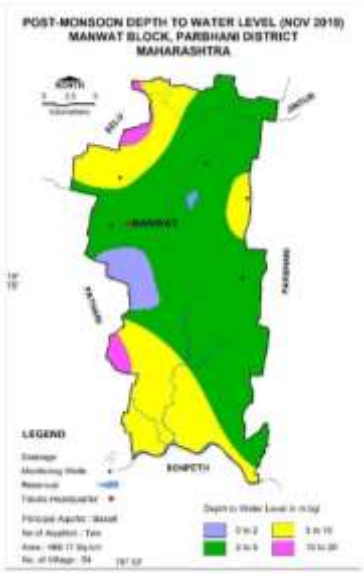
1.3. Geomorphology & Geology		
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Undissected (PLU), 0-1m weathering with Alluvial Plain - Older - Moderate (AYM) at North side	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Very shallow (0 to 10 cm) to Shallow (10 to 25 cm), BCS consisting mostly of Clayey to Gravelly clay	
1.4. Hydrology & Drainage		
Drainage	Dudhana river in the North of the block and Godavari river in the South of the block with sub-dendritic to dendritic drainage	
Hydrology	Major and Medium project	Nil

	Minor Irrigation Projects (Local)	1
	Minor Irrigation Projects (ZP Level)	0
		PT-1, KT-6, UGB-40

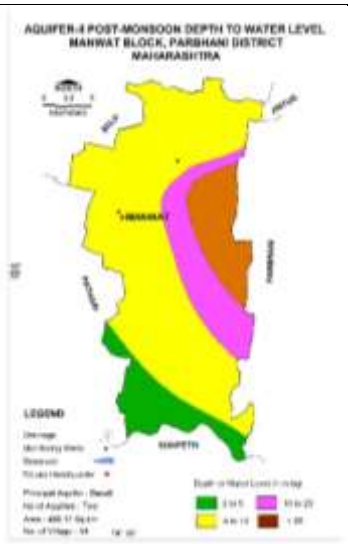
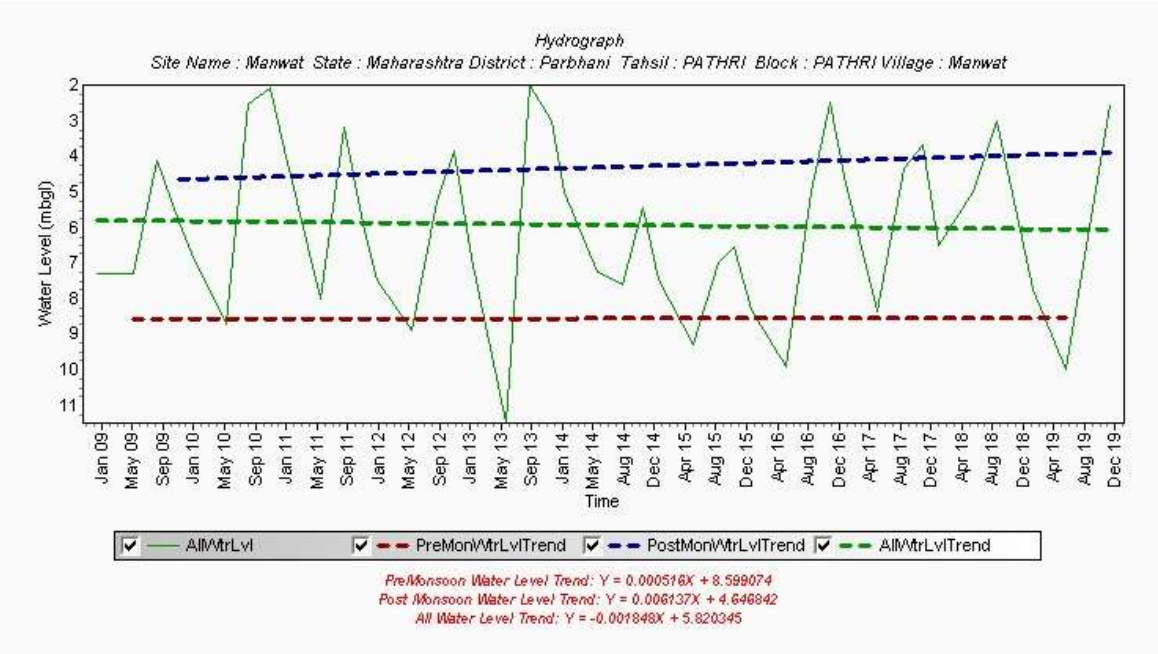
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		406.18 Sq. Km.	
Net Sown Area		584.76 Sq. Km.	
Double Cropped Area		227.24	
Area under Irrigation	Surface Water	80.55 sq km	
	Ground Water	23.38 sq km	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	205.36
		Cereals	87.33
		Pulses	121.37
		Sugarcane	15.89
		Citreous fruit	4.04
		Others	0.21

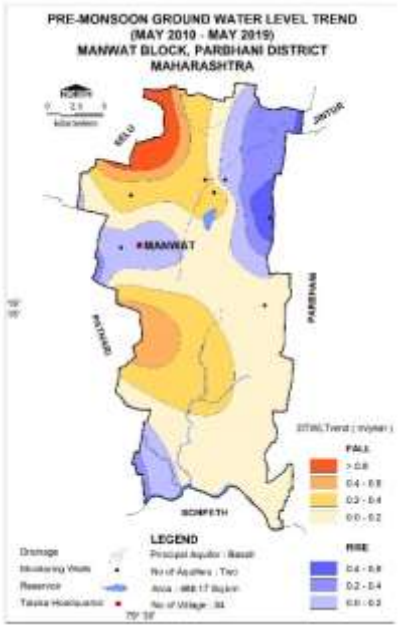
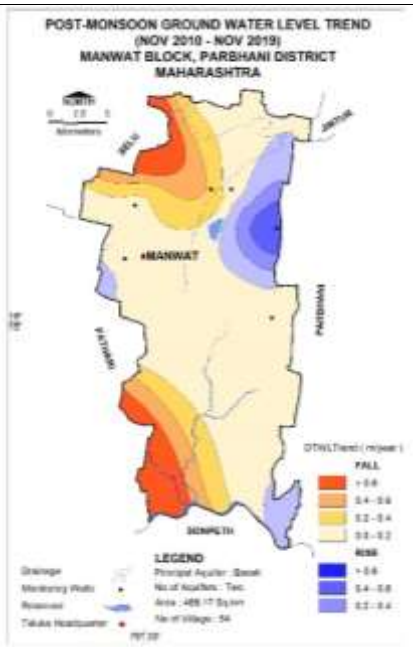
1.6. Water Level Behaviour

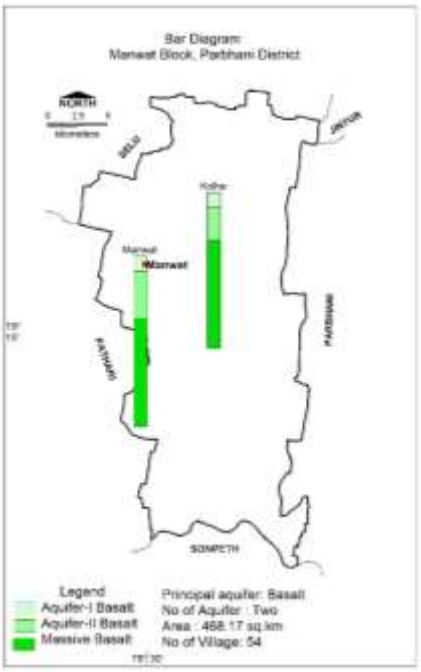
1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
DTWL 10 to 20 mbgl is observed in major area except isolated patch at centre having DTWL more than 20 mbgl. Small patch of DTWL 5 to 10 mbgl at North eastern part of block.	DTWL 2 to 5 mbgl is observed in major part. DTWL of 5 to 10 mbgl is observed as patches in western, Northern eastern, eastern, south eastern part of the block. Small patch of DTWL 10 to 20 mbgl is observed in north and south western part.
	

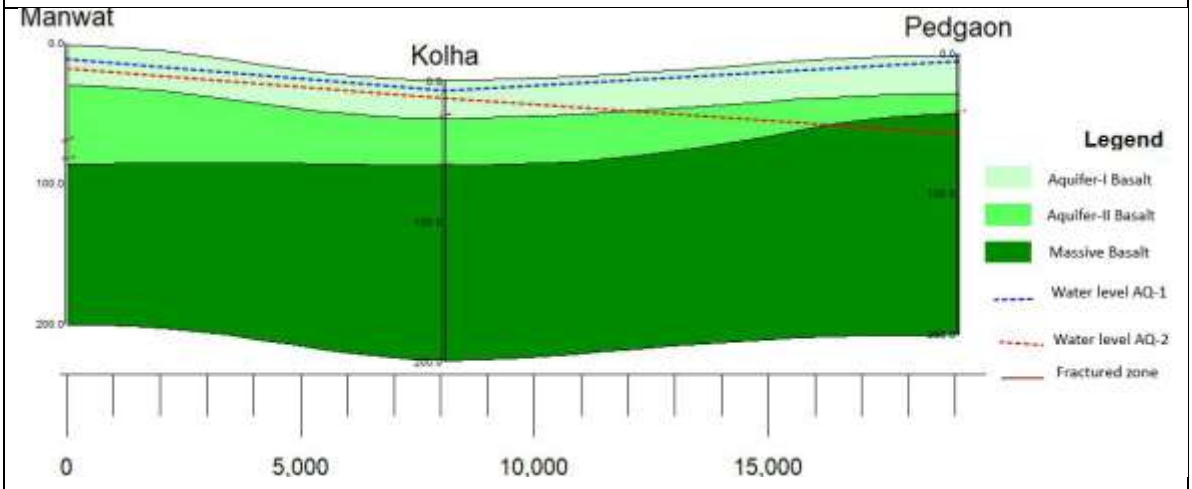
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon DTWL 5-10 mbgl is observed in major part of block i.e Northern, western part of the block. DTWL 2-5 mbgl is observed in South, south-west part of the block whereas DTWL 10-20 mbgl is observed in central eastern part of the block and DTWL > 20 mbgl observed on eastern part in small patch.	
Hydrographs 	
Hydrograph shows Pre-monsoon rising water level trend @ 0.006 m/year	Hydrograph shows Post- monsoon rising water level trend @ 0.074 m/year
1.8. Water Level Trend (2010-19)	
Pre-Monsoon trend Rising 0.09 m/year (Narlad) to 0.55 m/year (Tarborgaon) Falling 0.09 m/year (Palodi) to 0.33 m/year (Kola).	**Post-Monsoon trend** Rising 0.58 m/year (Tarborgaon); Falling 0.007 m/year (Manwat) to 0.39 m/year (Kolha).
Major area shows falling water level trend up to 0.6 m/year (384.44 sq km) in southern, Southwest, Northern, central part, North-west and eastern part of the block. Rising trend upto 0.6 m/year has	Major part of the block shows falling trend up to 0.6 m/year (435.36 sq km) while rising trend upto 0.6 m/year (65.23 sq km) has been observed in north east and south eastern part in small patches.

been observed in, north-eastern, small patch of south west in 116.14 sqkm area.	
	
2. Ground Water Issues	
❖ Block shows declining water level trend more than 0.6 m/year ❖ 38.10% Moderate Drought which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation. ❖ Less ground water potential basaltic aquifer.	
3. AQUIFER DISPOSITION	
3.1. Number of Aquifers	Basalt –Aquifer-I (Phreatic / Shallow aquifer) Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
3.1 Lithological Disposition	



3.3. Cross Sections

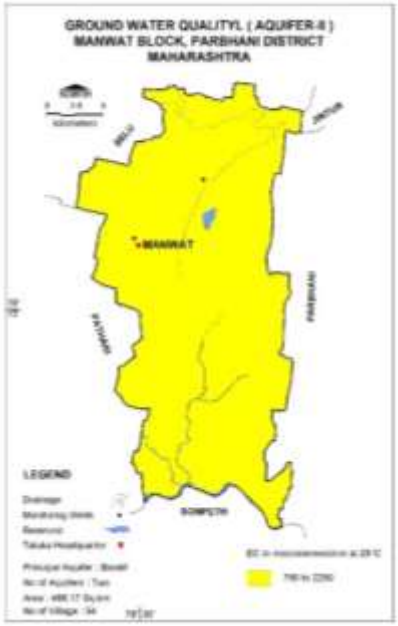


3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	2.4 – 29.59	5 - 70
Depth of Occurrence (mbgl)	3 - 30	30 - 120
weathered/fractured rocks thickness (m)	5 – 30	0.00 – 15.00
Yield	10 to 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*1.45x10^{-5}
Transmissivity (T)	30 - 40 m^2/day	0.14 – 0.55 m^2/day

*values taken from Partur block, Jalna District

4. GROUND WATER QUALITY

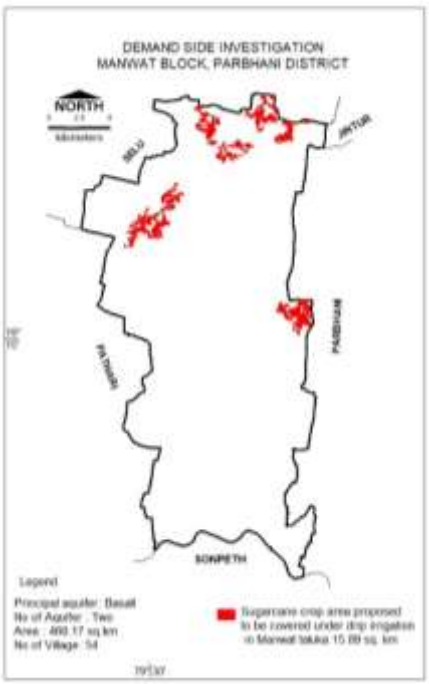
4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)	**4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)**
 EC ranging 750 to 2250 µS/cm has been observed in major part of the block while small patch of EC ranging 2250 to 3000 µS/cm is observed in north western part of block.	 EC ranging from 750 to 2250 µS/cm has been observed in entire part of the block. (468.17 sq.km).

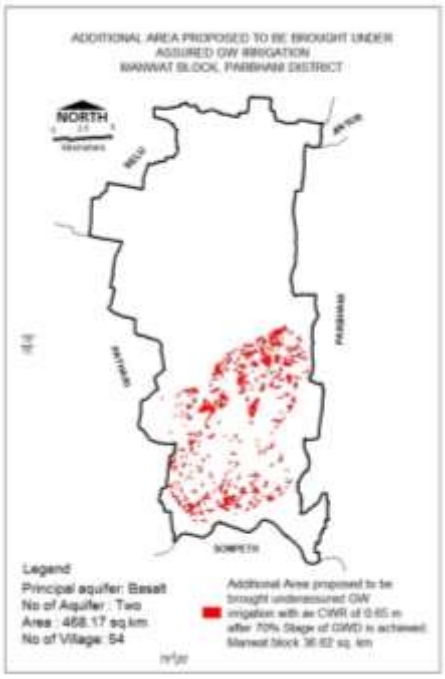
5. GROUND WATER RESOURCE					
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)					
Ground Water Recharge Worthy Area (Sq. Km.)					468.17
Total Annual Ground Water (MCM) Recharge					61.29
Total Natural Discharges (MCM)					3.06
Annual Extractable Ground Water Recharge (MCM)					58.22
Current Annual Ground Water Extraction for irrigation use (MCM)					27.94
Current Annual Ground Water Extraction for domestic and industrial use (MCM)					1.28
Total Extraction (MCM)					29.22
Annual GW Allocation for Domestic Use as on 2025 (MCM)					6.81
Net Ground Water Availability for future use (MCM)					21.47
Stage of Ground Water Extraction (%)					50.19
Categorization					**Safe**
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
171.28	1	0.002	0.0000145	40	0.441902
184.54	3	0.002	0.0000145	30	1.187515
111.87	5.5	0.002	0.0000145	30	1.279233

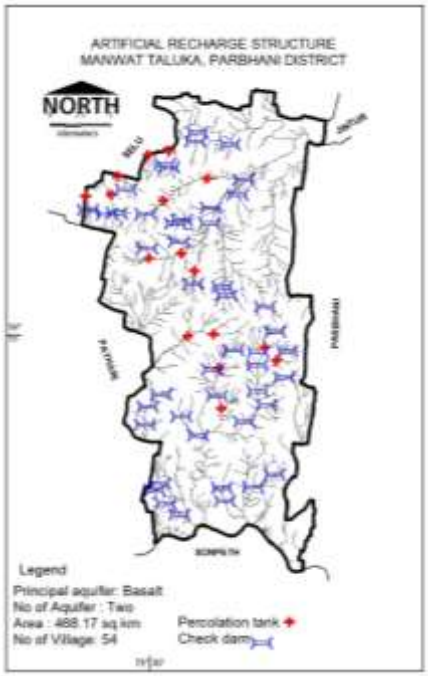
32.82	8.5	0.002	0.0000145	30	0.572217
				Total	3.480867

6.0. GROUND WATER RESOURCE ENHANCEMENT		
6.1. Supply Side Management		
Supply (MCM)		
Available Resource (MCM)		58.22
Gross Annual Draft (MCM)		29.22
Agricultural Demand –GW		27.94
Agricultural Demand –SW		52.36
Domestic Demand – GW		1.28
Domestic Demand – SW		0.32
Total Demand		**81.90**
Area of Block (Sq. Km.)		468.17
Area suitable for Artificial recharge (Sq. Km)		273.26
Type of Aquifer		Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		273.26
Volume of Unsaturated Zone (MCM)		397.59
Average Specific Yield		0.02
Recharge Potential (MCM)		7.95
Surface water requirement @ 75% efficiency (MCM)		10.60
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)
Number of Structures	21	61
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	3.21	1.38
RTRWH Structures – Urban Areas		
Households to be covered (50% with 50 m^2area)		3006
Rainwater harvested / recharged @ 80% runoff co-efficient		0.197
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area proposed for drip irrigation (sq. km.)		15.89
Volume of Water expected to be saved (MCM). Surface Flooding req-2.45 m. Drip Req. - 1.88, WUE- 0.57 m		9.05
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
Water Saving by Change in Cropping Pattern		Nil
6.3 Expected Benefits		
Net Ground Water Availability (MCM)		58.22
Additional GW resources available after Supply side interventions (MCM)		4.59
Ground Water Availability after Supply side intervention (MCM)		62.81

Existing Ground Water Draft for All Uses (MCM)	29.22
GW draft after Demand Side Interventions (MCM)	20.16
Present stage of Ground Water Development (%)	50.19
Expected Stage of Ground Water Development after interventions (%)	32.10
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4 Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	23.80
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	1428
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	238
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 70% stage of gwd is achieved	36.62
Regulatory Measures	60m borewells/tube wells



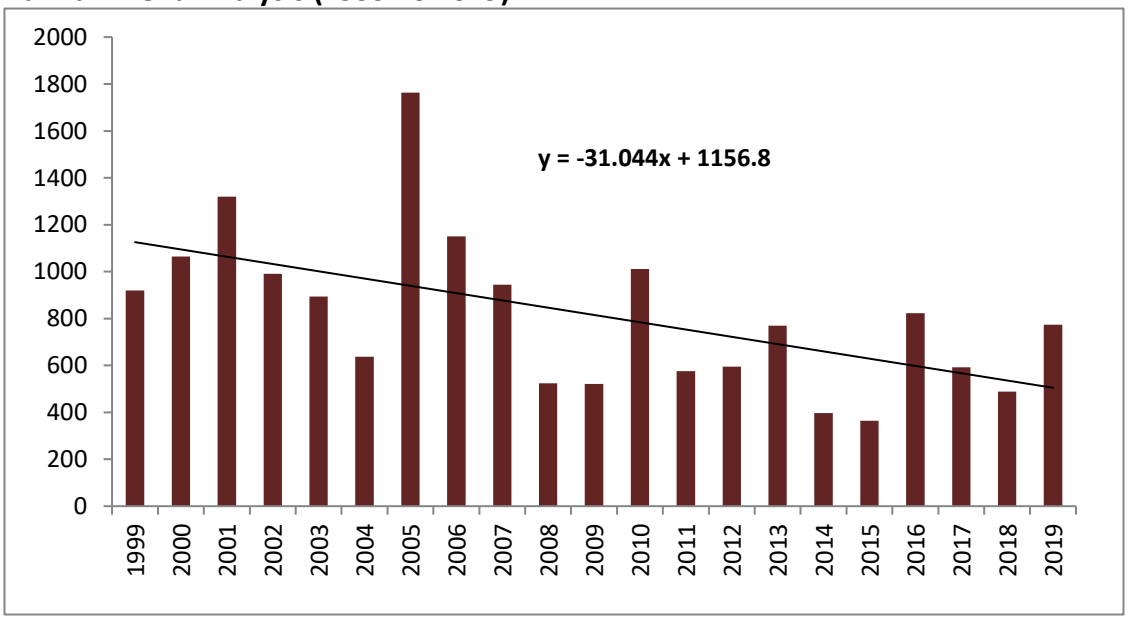



ARTIFICIAL RECHARGE STRUCTURE
MANWAT TALUKA, PARBHANI DISTRICT
NORTH
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 468.17 sq.km
No of Village: 54
Percolation tank
Check dam

9.5 PARBHANI BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name		Parbhani
Geographical Area (Sq. Km.)		1135.32
Hilly Area (Sq. Km)		5.21
Population (2011)		537810
Climate		Sub-tropical
1.2 Rainfall Analysis		
Normal Rainfall		957.6 mm
Annual Rainfall (2019)		773.4 mm
Decadal Average Annual Rainfall (2010-19)		639.18 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -31.04 mm/year. Probability of Rainfall: 47.62 % Normal Rainfall; 9.52 % Excess Rainfall Probability of Drought: 33.33 % Moderate Drought; 9.52 % Severe Drought	

Rainfall Trend Analysis (1999 To 2019)

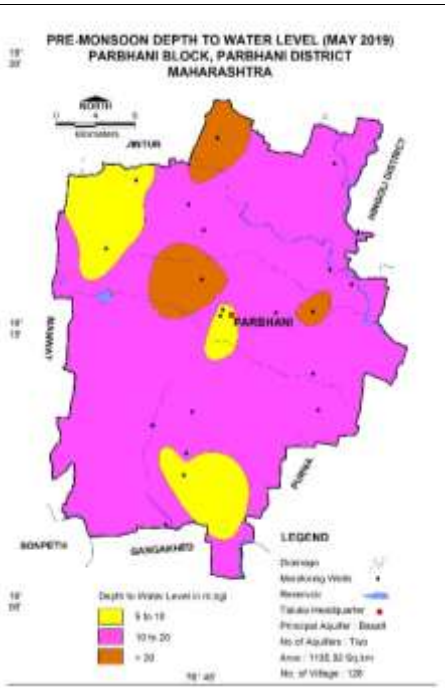


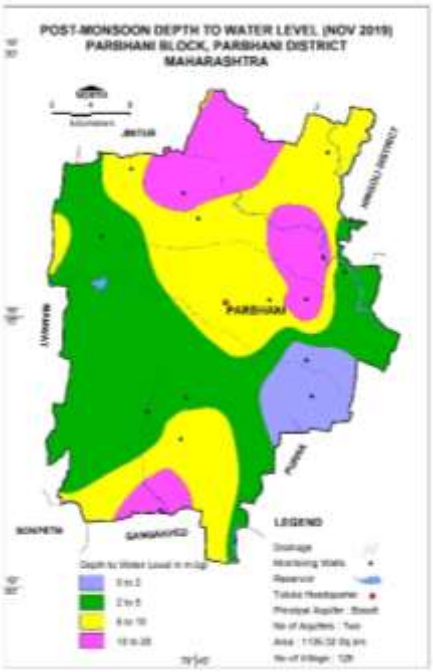
1.3. Geomorphology & Geology		
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Moderately Dissected (PLM) with patches of Alluvial Plain - Older - Moderate (AYM)	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Shallow BCS consisting mostly of clay, 10-25 cm thick.	
1.4. Hydrology & Drainage		
Drainage	Dudhana river in the North of the block and Godavari river in the South of the block with sub-Parallel to Parallel drainage	
Hydrology	Major and Medium project	Nil

	Minor Irrigation Projects (Local)	2
	Minor Irrigation Projects (ZP Level)	68
		PT-15, KT-8, UGB-45

1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		32.08 Sq. Km.	
Cultivable Area		1165.99 Sq. Km.	
Net Sown Area		1689.17 Sq. Km.	
Double Cropped Area		684.63 Sq. Km.	
Area under Irrigation	Surface Water	236.92 Sq. Km.	
	Ground Water	94.87 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	344.17
		Cereals	310.25
		Pulses	472.45
		Sugarcane	88.00
		Citreous fruit	1.27
		Others	0.46

1.6 Water Level Behaviour	
1.6.1 Aquifer-I (Shallow Aquifer)	
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major part while DTWL 5 to 10 mbgl is observed in small patches at northern, central, and eastern part. DTWL 2 to 5 mbgl observed in small patches in north-west, central and southern part of block.	**Post-Monsoon (November-2019)** DTWL 2 to 5 mbgl is observed in major part. DTWL of 5 to 10 mbgl is observed in north central and south part of the block. DTWL ranging between 10 to 20 mbgl is observed in patches at north, east and south part of block. While DTWL 0 to 2 mbgl in isolated patch in south-east part of the block.

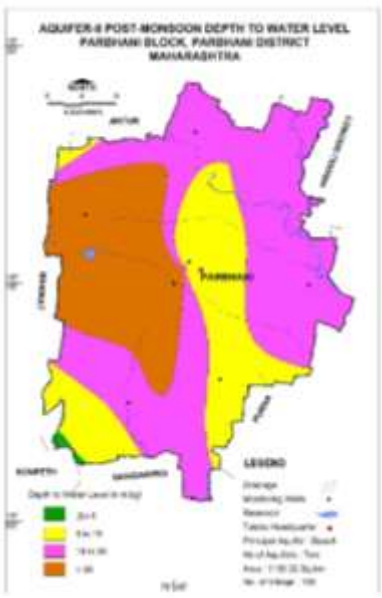




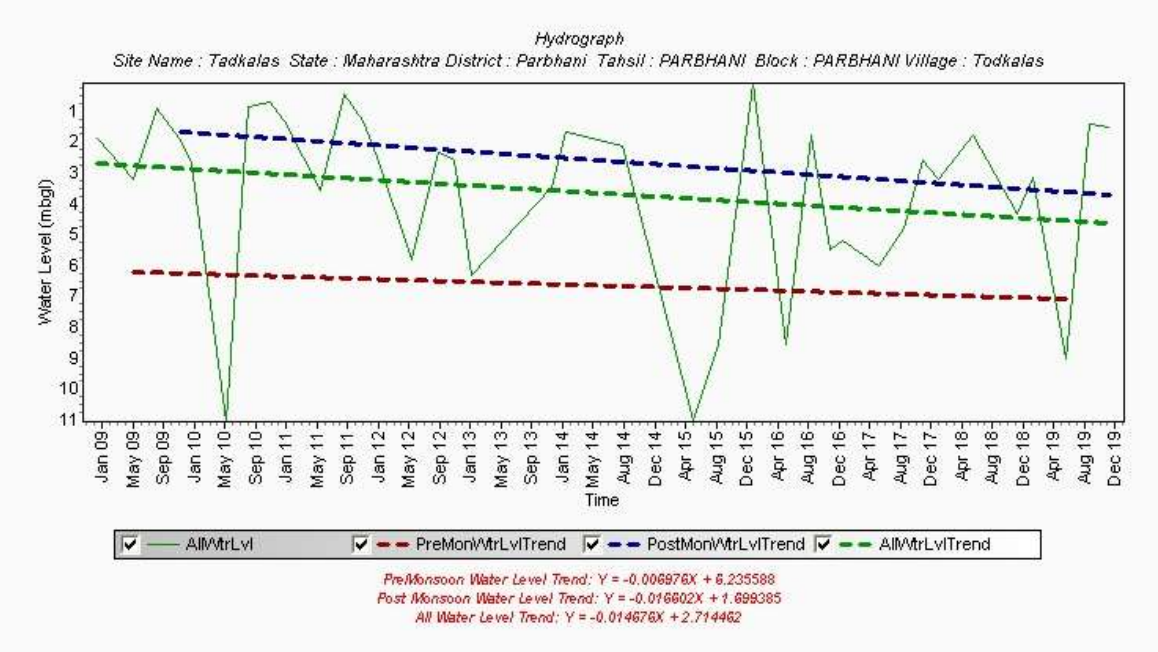
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon

DTWL 10-20 mbgl is observed in eastern, northern and southern part of the block. DTWL 5-10 mbgl is observed in central and south western part of block. Small patch of 2-5 mbgl observed in south eastern part of block. DTWL > 20 mbgl is observed in western part of block.



1.7. Hydrograph



Hydrograph shows Pre-monsoon falling water level trend @ 0.083 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.199 m/year
1.8. Water Level Trend (2010-19)	
1.8.1 Pre-Monsoon trend Rising 0.01m/year (Parbhani) to 1.52 m/year (Dharmapuri), Falling 0.02 m/year (Pedgaon) to 1.75 m/year (Asola)	**1.8.2 Post-Monsoon trend** Rising 0.09 m/year (Pingali) to 2.37 m/year (Dharmapur); Falling 0.007 m/year (Tadlimla) to 1.3 m/year (Asola)
Major area shows falling trend upto 0.6 m/year (824.97 sq km) with falling trend > than 0.6 m/year at north and eastern part in small patches. Rising trend upto 0.4 observed in north western and central part of block (318.24 sq.km) with small patches having rising trend >0.6 m/year	Major area shows falling trend of 0.0 to 0.6 m/year (786.60) with small patch having falling trend >0.6 m/year at eastern part of block. while rising trend upto 0.6 is observed in rest part in central and south-west, south east part of the block (356.62 sq.km) with patch at central having water level trend rising >0.6 m/year

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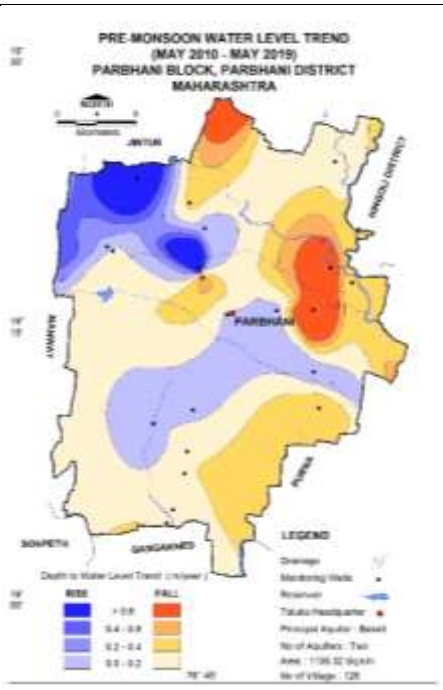
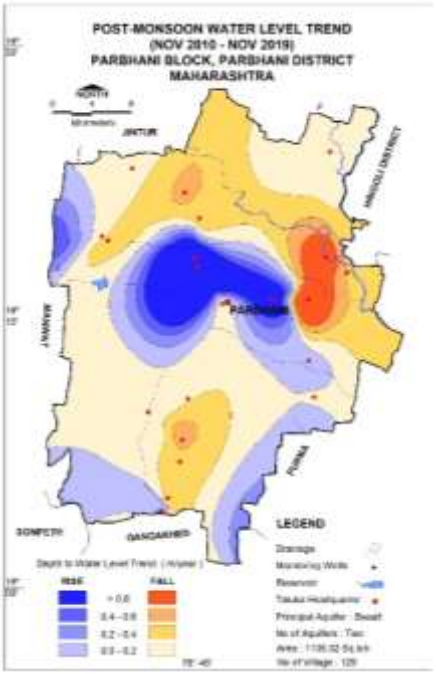
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Block shows declining water level trend is 0.2 to 0.6 m/year
❖ Frequent droughts (33.33 % Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
<tr><td colspan="2">3.2. Lithological Disposition</td></tr>
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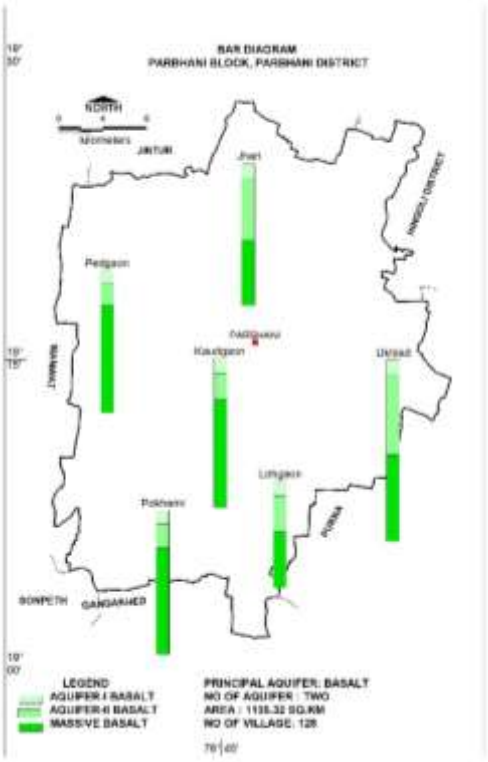
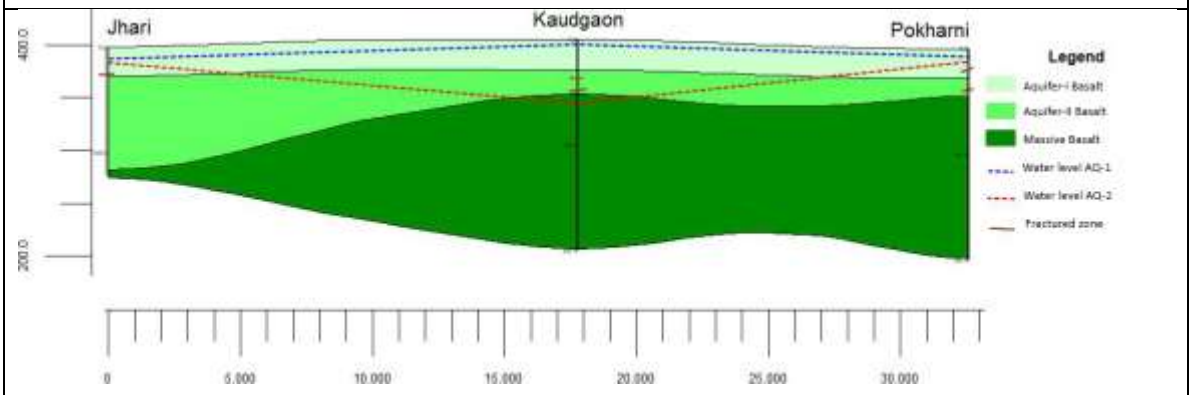


3.3. Cross Sections



3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.2 – 28.00	1.26 - 70
Depth of Occurrence (mbgl)	3 - 30	30 - 150
weathered/fractured rocks thickness (m)	5– 30	0 - 10
Yield	10 – 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*1.45 x 10^{-5}

Transmissivity (T)	30 - 40 m^2/day	0.32 – 201.45 m2/day
		*value taken from Partur block, Jalna district

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)	**4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)**
	
EC ranging 750-2250 µS/cm has been observed in major part (1135.32sq.km). Few villages are also affected by fluoride contamination.	EC ranging 750-2250 µS/cm has been observed in major part (1135.32sq.km). Few villages are also affected by fluoride and nitrate contamination

5. GROUND WATER RESOURCE

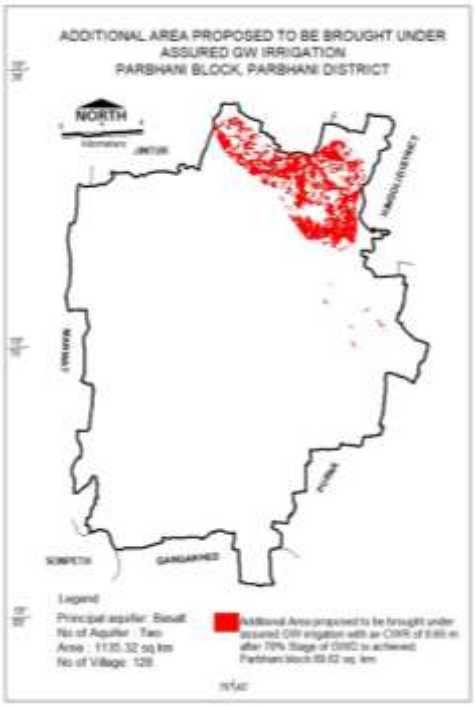
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

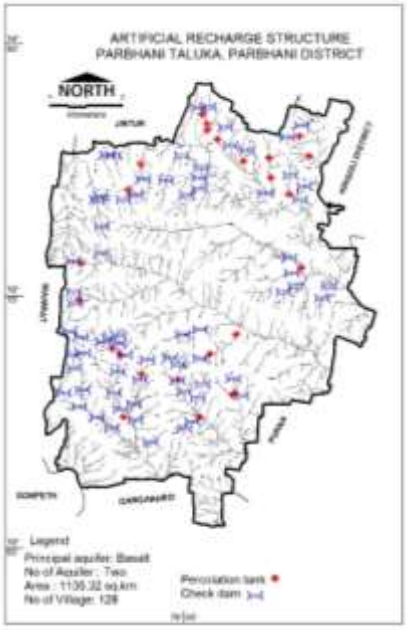
Ground Water Recharge Worthy Area (Sq. Km.)	1135.32
Total Annual Ground Water (MCM) Recharge	140.80
Total Natural Discharges (MCM)	7.48
Annual Extractable Ground Water Recharge (MCM)	133.32
Current Annual Ground Water Extraction for irrigation use (MCM)	60.58
Current Annual Ground Water Extraction for domestic and industrial use (MCM)	3.84
Total Extraction (MCM)	64.42
Annual GW Allocation for Domestic Use as on 2025 (MCM)	27.19
Net Ground Water Availability for future use (MCM)	45.20
Stage of Ground Water Extraction (%)	48.32
Categorization	**Safe**

5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
173.34	1	0.002	0.0000145	40	0.447217
363.25	3	0.002	0.0000145	55	2.469192
350.53	5.5	0.002	0.0000145	17	3.942236
256.08	8.5	0.002	0.0000145	38	4.49446
				Total	**11.3531**

6.0. GROUND WATER RESOURCE ENHANCEMENT		
6.1. Supply Side Management		
Supply (MCM)		
Available Resource (MCM)		133.32
Gross Annual Draft (MCM)		64.42
Agricultural Demand –GW		60.58
Agricultural Demand –SW		154.00
Domestic Demand – GW		3.84
Domestic Demand – SW		0.96
Total Demand		**219.38**
Area of Block (Sq. Km.)		1135.32
Area suitable for Artificial recharge (Sq. Km)		421.01
Type of Aquifer		Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		421.01
Volume of Unsaturated Zone (MCM)		2250.06
Average Specific Yield		0.02
Availability of Surplus surface runoff (MCM)		9.43
Surplus runoff considered for planning (MCM) @75%		7.07
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)
Number of Structures	33	94
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.95	2.12
RTRWH Structures – Urban Areas		
Households to be covered (50% with 50 m^2area)		28283
Rainwater harvested / recharged @ 80% runoff co-efficient		1.736
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area proposed for drip irrigation (sq. km.)		20.00
Volume of Water expected to be saved (MCM). Surface Flooding req-2.45 m. Drip Req. - 1.88, WUE- 0.57 m		11.40
Proposed Cropping Pattern change		

Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
6.4. Expected Benefits	
Net Ground Water Availability (MCM)	133.32
Additional GW resources available after Supply side interventions (MCM)	7.07
Ground Water Availability after Supply side intervention (MCM)	140.39
Existing Ground Water Draft for All Uses (MCM)	64.42
GW draft after Demand Side Interventions (MCM)	53.02
Present stage of Ground Water Development (%)	48.32
Expected Stage of Ground Water Development after interventions (%)	37.77
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	45.25
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	2715
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	453
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of GWD is achieved	69.62
Regulatory Measures	60m borewells/tube wells

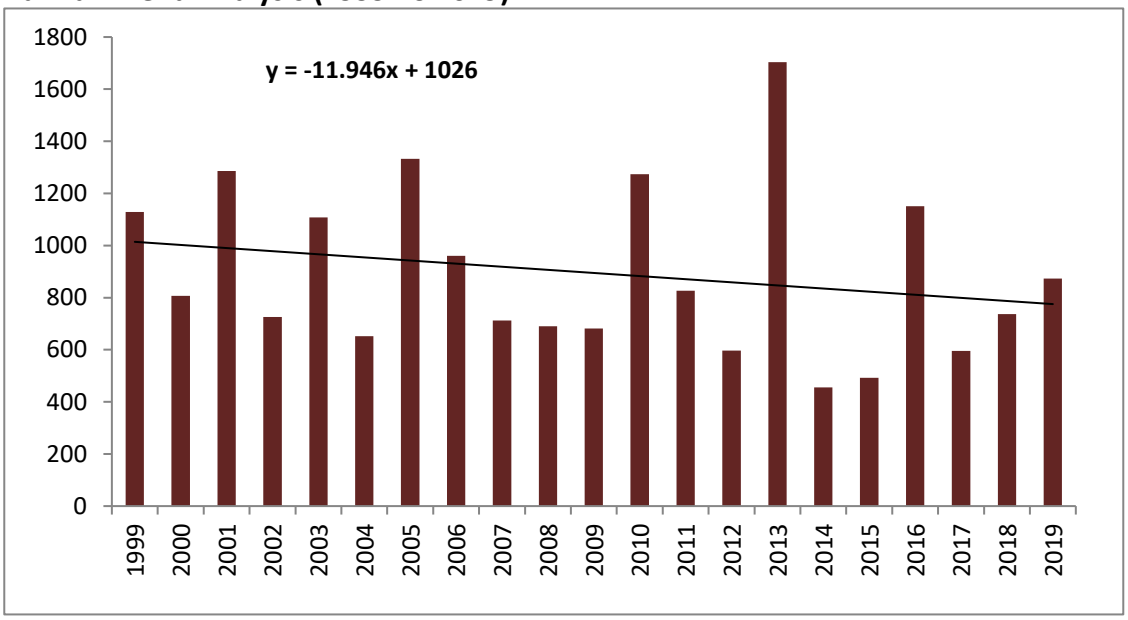



ARTIFICIAL RECHARGE STRUCTURE
PARBHANI TALUKA, PARBHANI DISTRICT
NORTH
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 1135.32 sq.km
No of Village: 128
Percolation tank
Check dam

9.6 PURNA BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name		Purna
Geographical Area (Sq. Km.)		651.82
Hilly Area (Sq. Km)		Nil
Population (2011)		182652
Climate		Sub-tropical
1.2 Rainfall Analysis		
Normal Rainfall		861.3 mm
Annual Rainfall (2019)		873.5 mm
Decadal Average Annual Rainfall (2010-19)		870.37 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend: -11.946 mm/year. Probability of Rainfall: 42.86 % Normal Rainfall; 33.33 % Excess Rainfall Probability of Drought: 23.81% Moderate Drought	

Rainfall Trend Analysis (1999 To 2019)



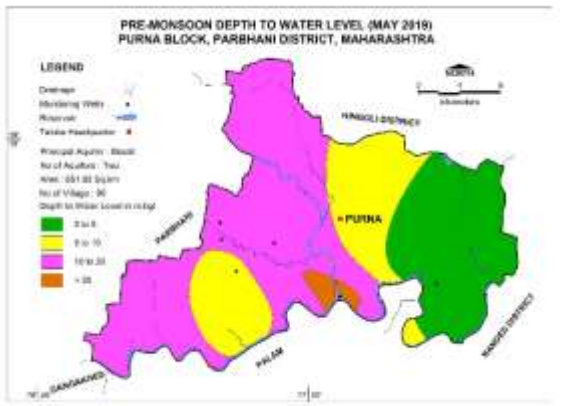
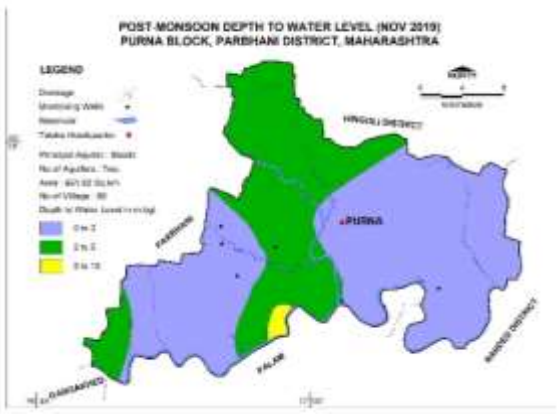
1.3. Geomorphology, Soil & Geology		
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Undissected (PLU), 0-1m weathering with Alluvial Plain - Older - Moderate (AYM) at southern part.	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Major area shows Very deep (> 100 cm) BCS consisting mostly of clay	
1.4. Hydrology & Drainage		
Drainage	Godavari river in the South of the block and Dudhana river in the wester part of block with sub-dendritic to dendritic drainage	
Hydrology	Major and Medium project	Nil

	Minor Irrigation Projects (Local)	3
	Minor Irrigation Projects (ZP Level)	46
		PT-1, KT-5, UGB-41

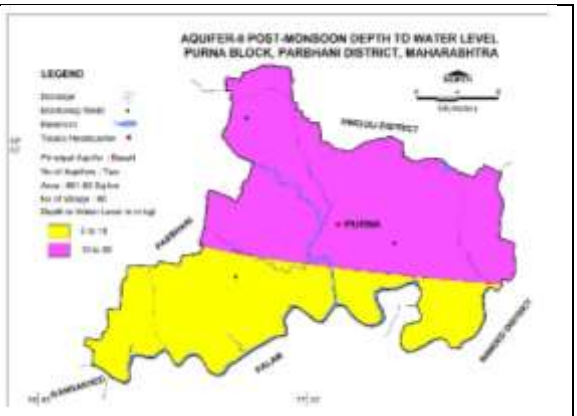
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		610.24 Sq. Km.	
Net Sown Area		820.84 Sq. Km.	
Double Cropped Area		340.24 Sq. Km.	
Area under Irrigation	Surface Water	119.43 Sq. Km.	
	Ground Water	77.94 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	92.50
		Cereals	115.75
		Pulses	166.76
		Sugarcane	71.14
		Citreous fruit	0.13
		Others	0.07

1.6. Water Level Behaviour

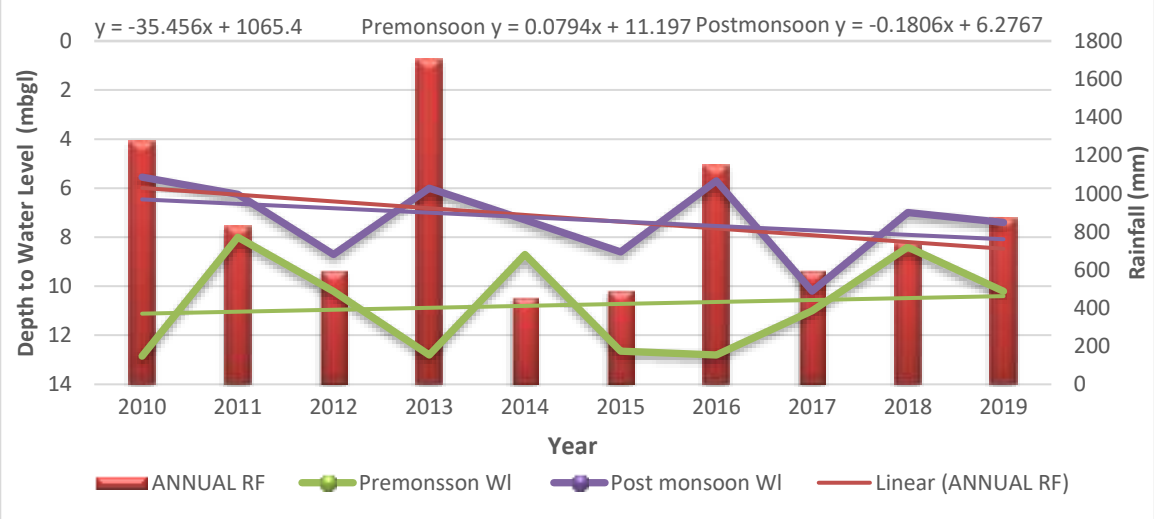
1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
Major area is showing DTWL 10 to 20 m bgl in western, North- western and central part of block. Whereas, in eastern part of block observed DTWL 2 to 5 m bgl. Central part and patch of south western showing DTWL 5-10mbgl. Small patch of DTWL >20 mbgl is seen at southern part of block.	DTWL 0-2 mbgl is observed in major part at eastern as well as western part block. DTWL of 2-5 mbgl is observed in central and northern part of block. Small patch of DTWL 5-10 mbgl is seen at southern part.
	

1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon DTWL 10-20 mbgl is observed in half Northern part of block. DTWL 5-10 mbgl is observed in southern part of block.	

1.7. Hydrographs



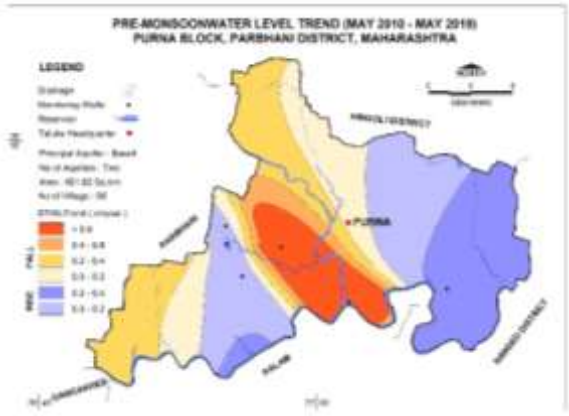
Village: Pharkanda, Purna Taluka, Parbhani district

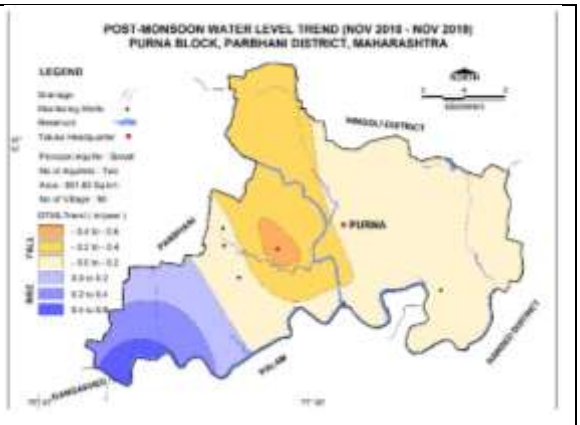
(Source GSDA, Maharashtra)

Hydrograph shows Pre-monsoon rising water level trend @ 0.079 m/year.	Hydrograph shows Post- monsoon falling water level trend @ 0.18 m/year.

1.8. Water level Trend (2010-19)

Pre-Monsoon trend Rising 0.027m/year (Balsa Bk) to 0.23 m/year (Runj T Purna); Falling 0.86 m/year (Ekrukha) to 1.56 m/year (Katneshwar).	**Post-Monsoon trend** Rising 0.01 m/year (Tondgaon) to 1.58 m/year (Parbhani); Falling 0.01 m/year (Kekatumra) to 0.77 m/year (Falegaon).
Falling trend upto 0.6 m/year shows at north, western and central portion covering 347.78 sq. km area with falling trend > 0.6 m/year at south portion of block. Rising water level trend ranging from 0.0 to 0.4 m/year is observed (289.09 sq.km).	Major area shows falling water level trend up to >0.6 m/year (527.12 sq. km) whereas, in eastern part of the block rising water level trend ranging from 0.0 to 0.6 m/year is observed (109.82 sq.km).





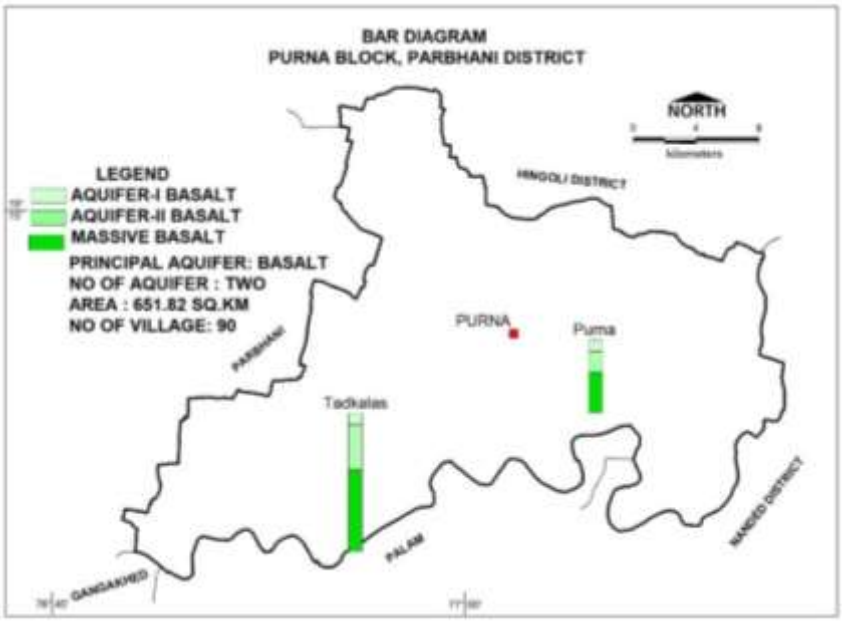
2. Ground Water Issues

- ❖ Block shows declining water level trend ranging from 0.2 to 0.6 m/year during pre-monsoon as well as in post-monsoon.
- ❖ Frequent droughts (23.81 % Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
- ❖ Less ground water potential basaltic aquifer.

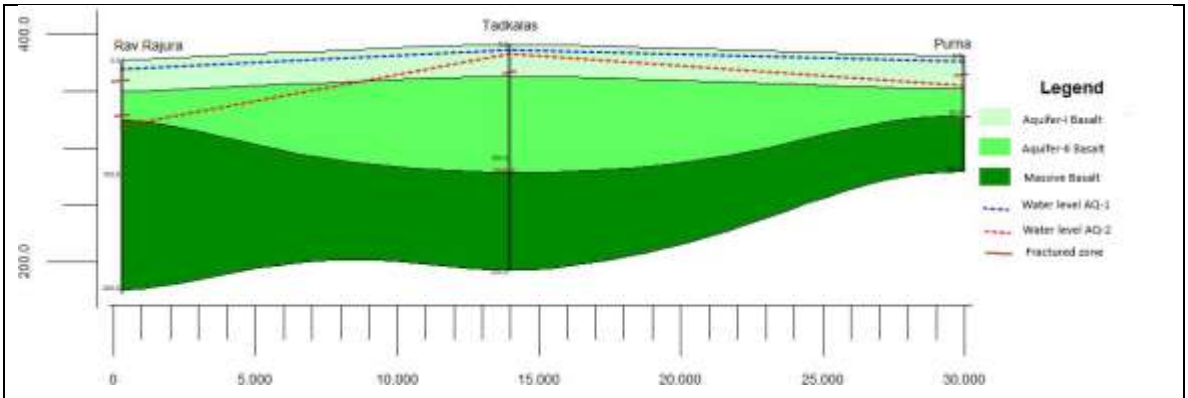
3. AQUIFER DISPOSITION

3.1. Number of Aquifers	Basalt –Aquifer-I (Phreatic / Shallow aquifer) Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)

3.2. Bar Diagram



3.3. Cross Section



3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.8 – 22.3	0.84 magl to 70 mbgl
Depth of Occurrence (mbgl)	9 - 30	30 - 180
weathered/fractured rocks thickness (m)	5 – 30	0.00 - 10
Yield	10 – 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.20	*1.45 x 10^{-5}
Transmissivity (T)	30 - 40 m^2/day	0.54 – 4.37 m2/day

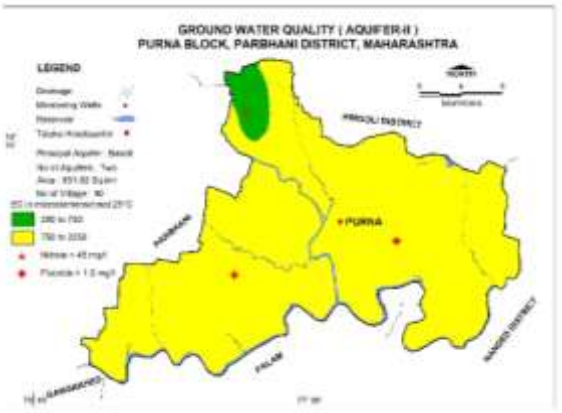
*values taken from Ahmadpur block, Latur District

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)

EC ranging upto 750-2250 µS/cm has been observed in major part (651.82 sq km) The ground water is suitable for all purpose.

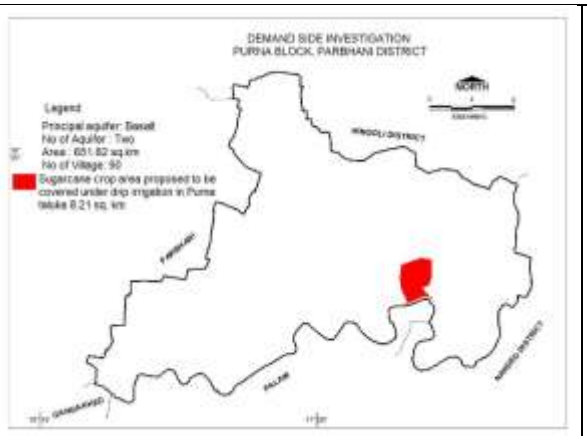
4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)

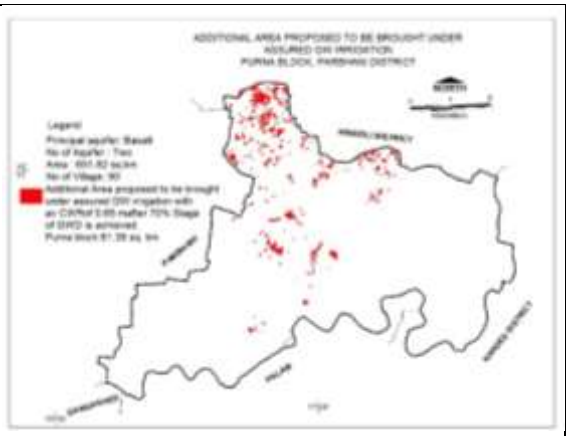


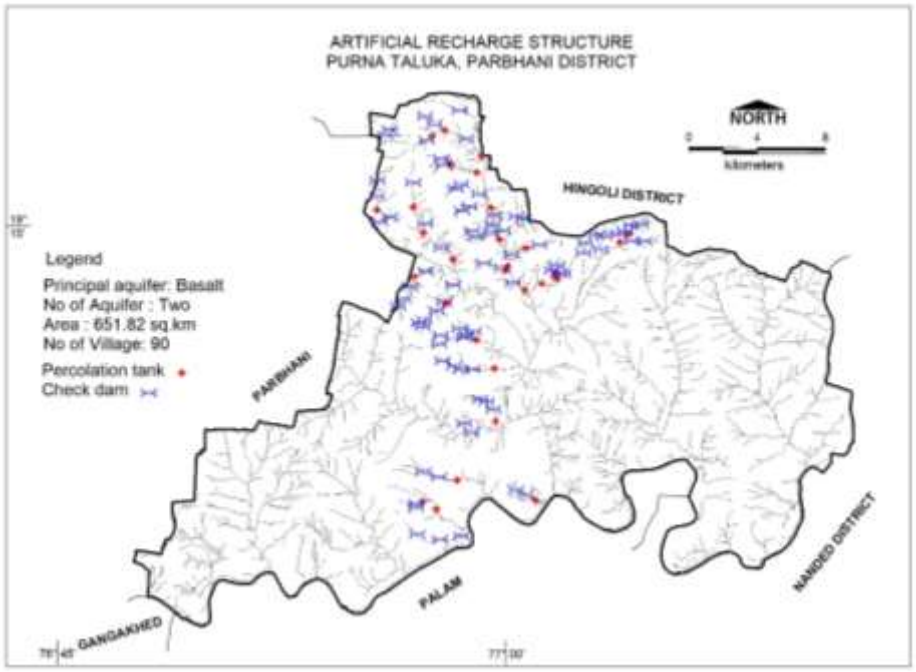
EC ranging 750-2250 µS/cm has been observed in major part (615.64 sq km) except EC ranging 250 -750µS/cm in 21.30 sq. km area in small patch at north part of the block. The ground water is suitable for all purpose. Few villages are affected by nitrate contamination.

5. GROUND WATER RESOURCE & EXTRACTION					
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)					
Ground Water Recharge Worthy Area (Sq. Km.)					651.82
Total Annual Ground Water (MCM) Recharge					121.25
Total Natural Discharges (MCM)					6.06
Annual Extractable Ground Water Recharge (MCM)					115.19
Current Annual Ground Water Extraction for irrigation use (MCM)					48.72
Current Annual Ground Water Extraction for domestic and industrial use (MCM)					2.48
Total Extraction (MCM)					51.20
Annual GW Allocation for Domestic Use as on 2025 (MCM)					10.86
Net Ground Water Availability for future use (MCM)					55.14
Stage of Ground Water Extraction (%)					44.45
Categorization					**Safe**
5.1 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
20.97	3	0.002	0.0000145	30	0.134942
318.96	5.5	0.002	0.0000145	60	3.786055
297.02	8.5	0.002	0.0000145	35	5.200078
				Total	**9.121075**
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					115.19
Gross Annual Draft (MCM)					51.2
Agricultural Demand –GW					48.72
Agricultural Demand –SW					77.63
Domestic Demand – GW					2.48
Domestic Demand – SW					0.62
Total Demand					129.45
Area of Block (Sq. Km.)					651.82
Area suitable for Artificial recharge (Sq. Km)					492.07
Type of Aquifer					Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					492.07
Volume of Unsaturated Zone (MCM)					1820.66
Average Specific Yield					0.02
Availability of Surplus surface runoff (MCM)					11.0224
Surplus runoff considered for planning (MCM) @75%					8.27

Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)
Number of Structures	39	110
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	5.79	2.48
RTRWH Structures – Urban Areas		
Households to be covered (50% with 50 m^2area)		3332
Rainwater harvested / recharged @ 80% runoff co-efficient		0.283
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane area proposed for drip irrigation (sq. km.)		8.21
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. – 1.88, WUE- 0.57 m		4.68
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
Water Saving by Change in Cropping Pattern		Nil
6.3. Expected Benefits		
Net Ground Water Availability (MCM)		115.19
Additional GW resources available after Supply side interventions (MCM)		8.27
Ground Water Availability after Supply side intervention (MCM)		123.46
Existing Ground Water Draft for All Uses (MCM)		51.2
GW draft after Demand Side Interventions (MCM)		46.52
Present stage of Ground Water Development (%)		44.45
Expected Stage of Ground Water Development after interventions (%)		37.68
Other Interventions Proposed, if any		
Alternate Water Sources Available		Nil
6.4. Development Plan		
Volume of water available for GWD after stage of GWD brought to 70% (MCM)		39.90
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)		2394
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)		399
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of gwd is achieved		61.39
Regulatory Measures	60m borewells/tube wells	


DEMAND SIDE INVESTIGATION
PURNA BLOCK, PARBHANI DISTRICT
NORTH
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 651.82 sq.km
No of Village: 90
Sugarcane crop area proposed to be covered under drip irrigation in Purna taluka 8.21 sq. km
HINGOLI DISTRICT
PARBHANI
PALAM
NANDED DISTRICT
GANGAKHED

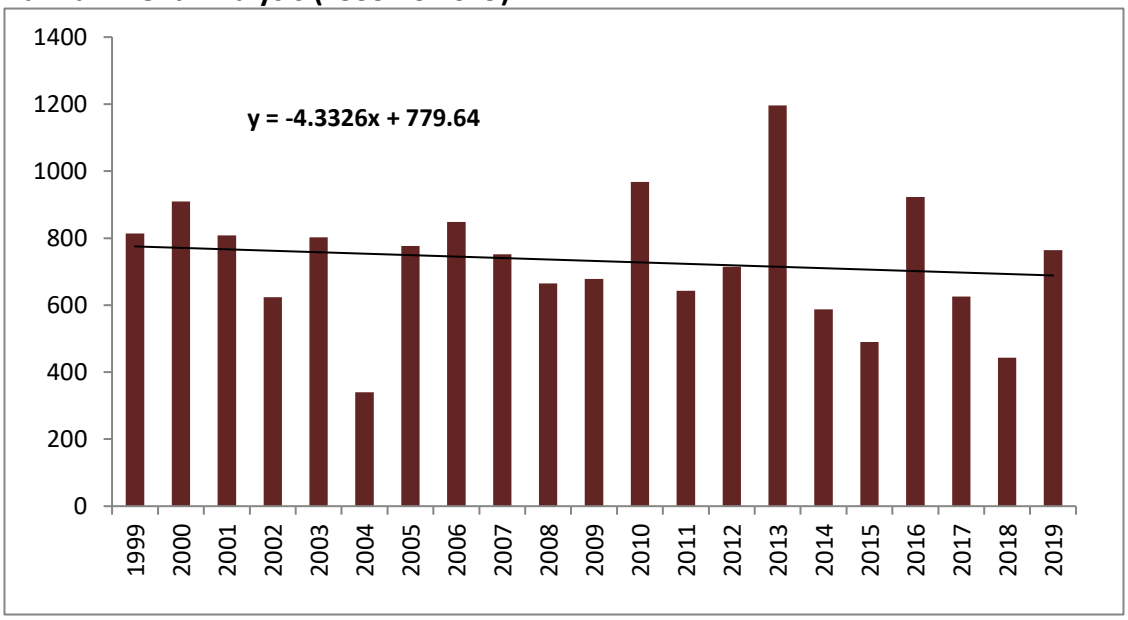

NORTH
HINGOLI DISTRICT
PARBHANI
PALAM


ARTIFICIAL RECHARGE STRUCTURE
PURNA TALUKA, PARBHANI DISTRICT
NORTH
kilometers
HINGOLI DISTRICT
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 651.82 sq.km
No of Village: 90
Percolation tank
Check dam
PARBHANI
PALAM
NANDED DISTRICT
GANGAKHED

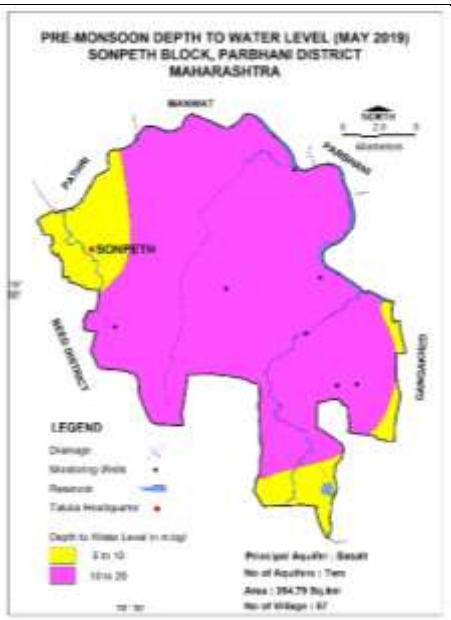
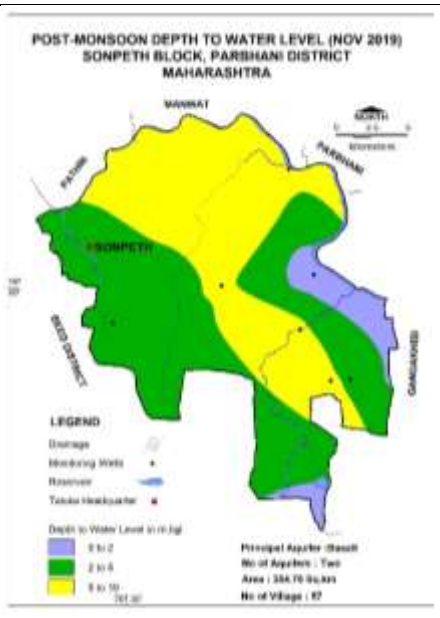
9.7 SONPETH BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name		Sonpeth
Geographical Area (Sq. Km.)		354.79
Hilly Area (Sq. Km)		Nil
Population (2011)		89582
Climate		Sub-tropical
1.2 Rainfall Analysis		
Normal Rainfall		777.8 mm
Annual Rainfall (2019)		764.2 mm
Decadal Average Annual Rainfall (2010-19)		735.43 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -4.3326 mm/year. Probability of Rainfall: 80.95 % Normal Rainfall; 4.76 % Excess Rainfall Probability of Drought: 9.52 % Moderate Drought; 4.76 % Severe Drought	

Rainfall Trend Analysis (1999 To 2019)



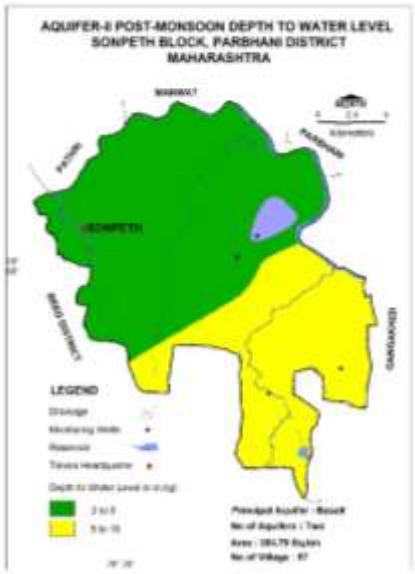
1.3. Geomorphology & Geology		
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Moderately Dissected (PLM)	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Major area shows Very deep (> 100 cm) BCS consisting mostly of clay	
1.4. Hydrology & Drainage		
Drainage	Dudhana river in the North of the block with sub-dendritic to dendritic drainage.	
Hydrology	Major and Medium project	Nil

	Minor Irrigation Projects (Local)		1
	Minor Irrigation Projects (ZP Level)		37
			PT-8, KT-3, UGB-26
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		369.66 Sq. Km.	
Net Sown Area		537.28 Sq. Km.	
Double Cropped Area		228.30 Sq. Km.	
Area under Irrigation	Surface Water	62.31 Sq. Km.	
	Ground Water	34.04 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	170.40
		Cereals	95.29
		Pulses	117.53
		Sugarcane	8.21
		Citreous fruit	0.48
		Others	0.23
1.6 Water Level Behaviour			
1.6.1 Aquifer-I (Shallow Aquifer)			
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major part while DTWL 5 to 10 mbgl is observed in north-western and southern part and small patches in south east and eastern part near border.		**Post-Monsoon (November-2019)** DTWL 5 to 10 mbgl is observed in north and south eastern part. DTWL of 2 to 5 mbgl is observed in western and central eastern part of the block. While DTWL 0 to 2 mbgl in small patches in eastern and southern part near border.	
			

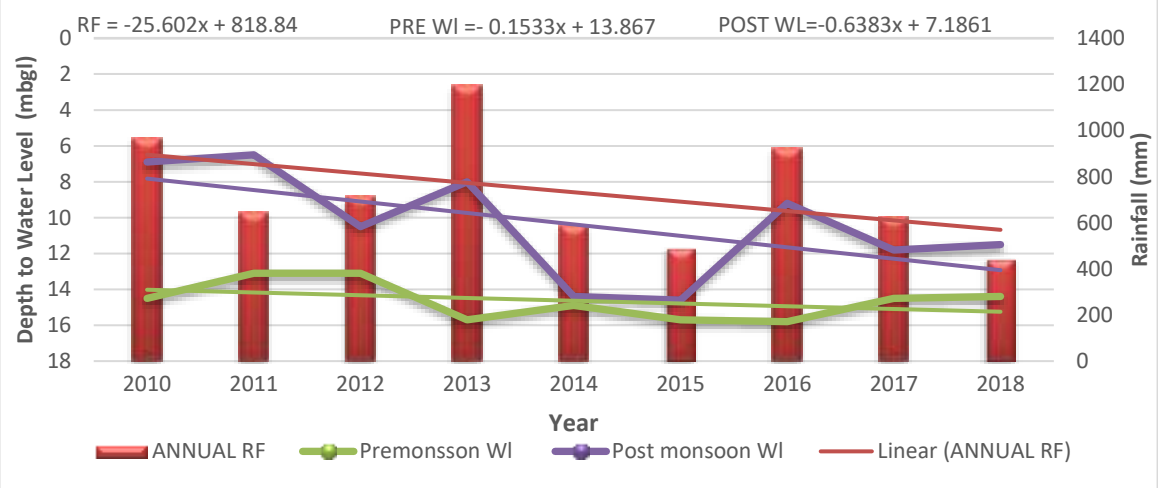
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon

DTWL 2-5 mbgl is observed in half portion at northern part. DTWL 5-10 mbgl is observed in central and southern part of the block.



1.7. Hydrograph



Village: Shirsi BK, Taluka Sonpeth, Parbhani District

(Source GSDA, Maharashtra)

Hydrograph shows Pre-monsoon falling water level trend @ 0.153 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.64 m/year

1.8. Water Level Trend (2009-18)

1.8.1 Pre-Monsoon trend Rising 0.17m/year (Narwadi), Falling 0.03 m/year (Khadka) to 1.01 m/year (Wadgaon)	**1.8.2 Post-Monsoon trend** Rising 0.05 m/year (Shirsi Bk) to 0.10 m/year (Avalgaon); Falling 0.07 m/year (Khadka) to 1.5 m/year (Narwadi)
Major area shows falling trend upto 0.6 m/year (277.90 sq km) area with falling trend > 0.6 m/year at south eastern portion of block. Rising trend upto 0.4 observed in north west of block (106.56 sq.km).	Major area shows falling trend upto > 0.6 m/year (358.01 sq.km) while rising trend upto 0.4 is observed in small patches at eastern, sothern and central part of the block (26.46 sq.km).

<table>
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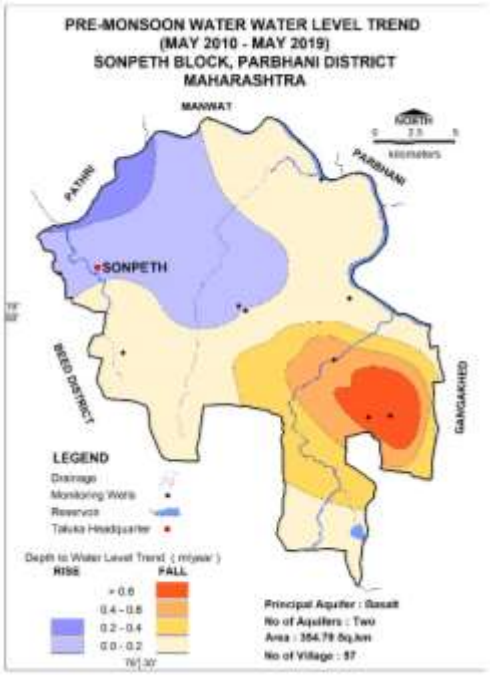
<td> 
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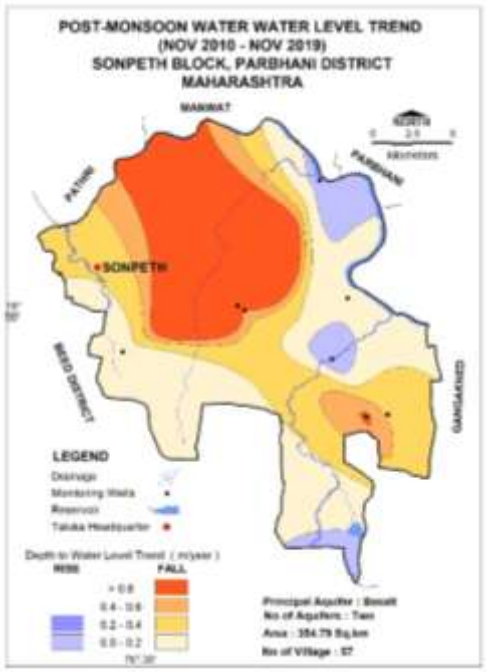
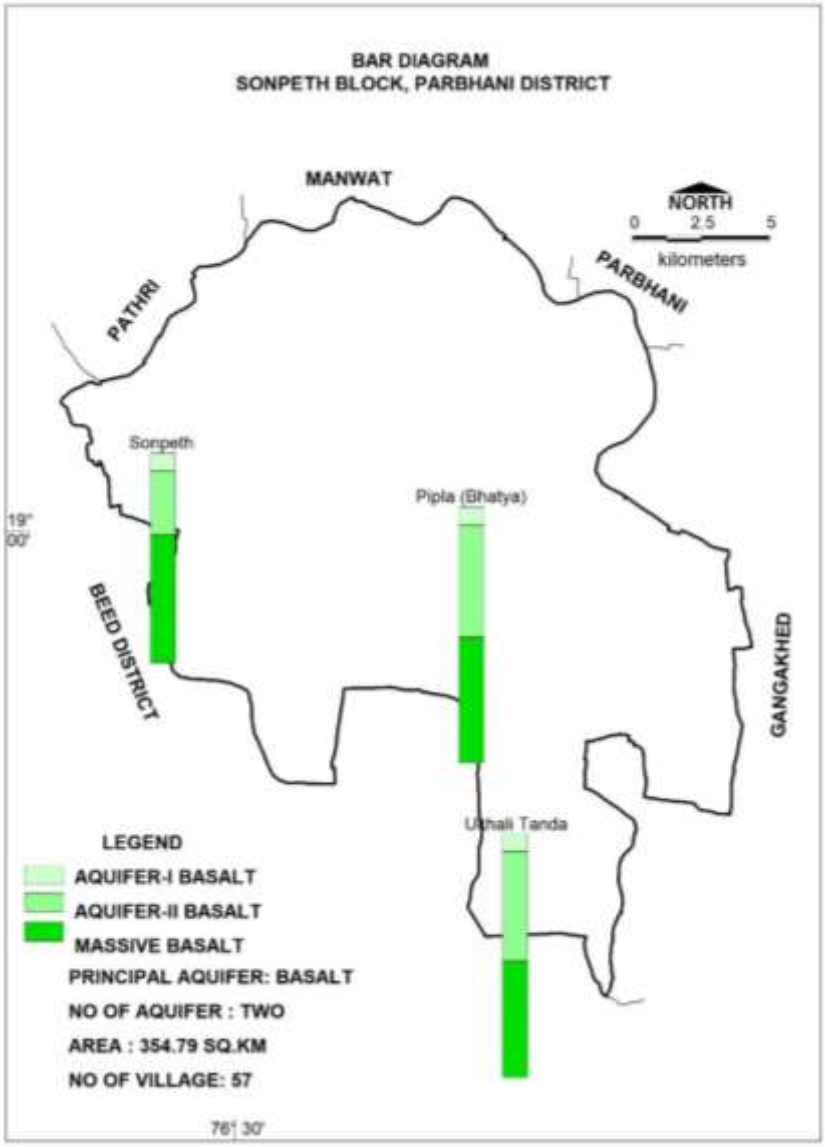
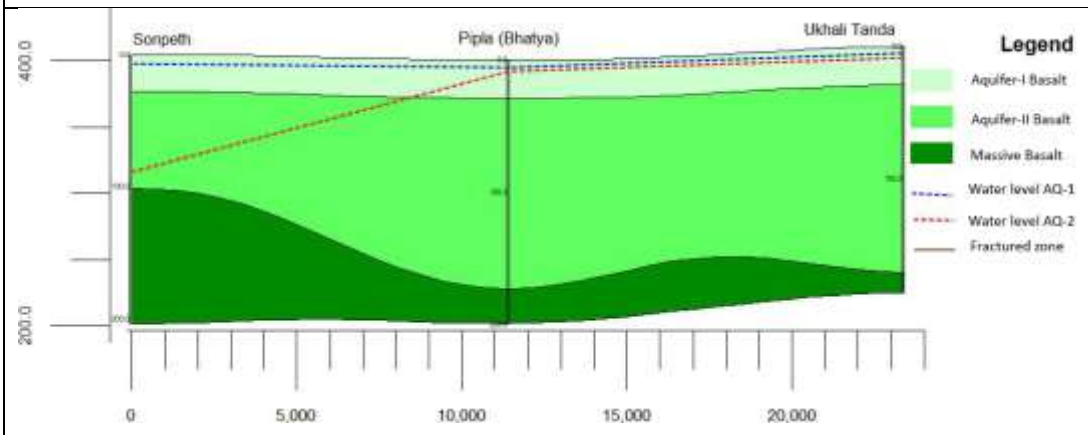
<td> 
</td>
</tr>
<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Block shows declining water level trend 0.2 to >0.6 m/year
❖ Frequent droughts (9.52% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
<tr><td colspan="2">3.2. Lithological Disposition</td></tr>
</table>



3.3. Cross Section



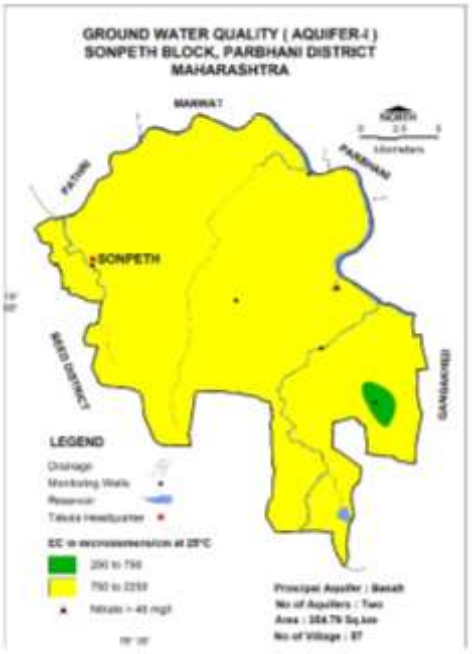
3.4. Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)

Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.9 - 19.2	1.30 – 150.10
Depth of Occurrence (mbgl)	3 - 16	30 - 180
weathered/fractured rocks thickness (m)	5 - 15	0.00 – 15.00
Yield	10 – 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	$1.45x10^{-5}$
Transmissivity (T)	30 - 40 m^2/day	0.14 – 0.55 m^2/day
		*value taken from Partur block, Jalna District

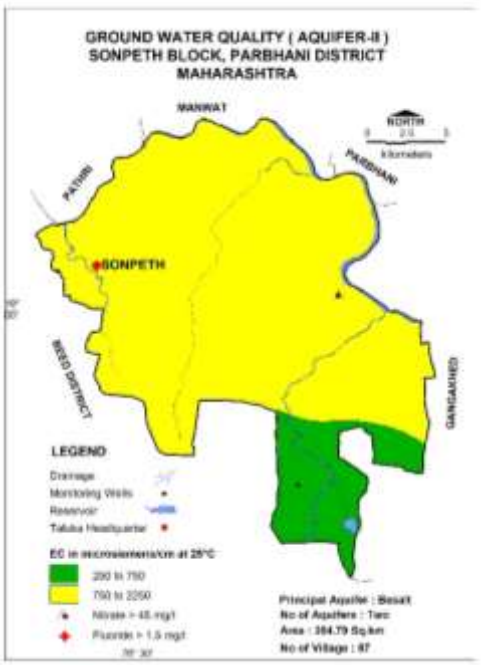
4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)



EC ranging 750-2250 µS/cm has been observed in major part (380.46 sq.km) & EC ranging 250 to 750 µS/cm (4.00 sq km) in small patch in south east. The ground water is suitable for all purpose. Few villages are also affected by nitrate & fluoride contamination.

4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)



EC ranging 750 - 2250 µS/cm has been observed in major part (336.22 sq. km) except EC ranging 250 -750 µS/cm (48.23 sq. km) in patches in southern part. The ground water is suitable for all purpose. Few villages are also affected by nitrate & fluoride contamination.

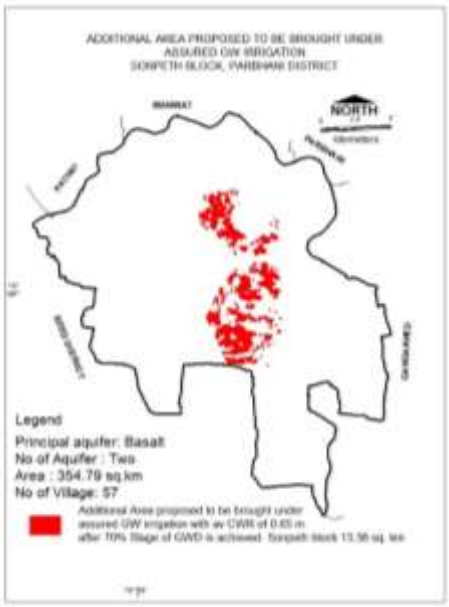
5. GROUND WATER RESOURCE

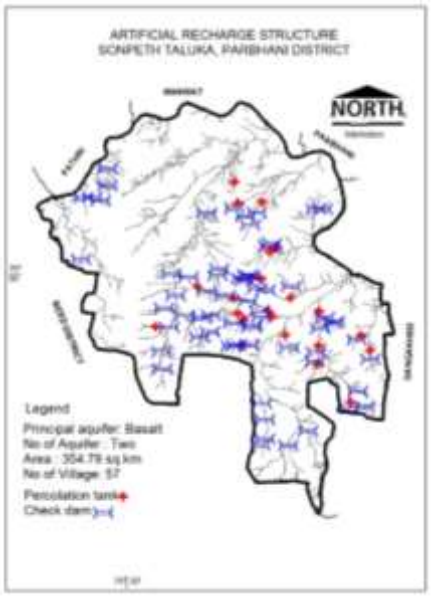
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

Ground Water Recharge Worthy Area (Sq. Km.)	354.79
Total Annual Ground Water (MCM) Recharge	36.03
Total Natural Discharges (MCM)	2.36
Annual Extractable Ground Water Recharge (MCM)	33.66

Current Annual Ground Water Extraction for irrigation use (MCM)					18.02
Current Annual Ground Water Extraction for domestic and industrial use (MCM)					1.37
Total Extraction (MCM)					19.40
Annual GW Allocation for Domestic Use as on 2025 (MCM)					6.06
Net Ground Water Availability for future use (MCM)					9.62
Stage of Ground Water Extraction (%)					57.62
Categorization					**Safe**
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
103.59	3	0.002	0.0000145	40	0.681622
136.05	5.5	0.002	0.0000145	70	1.634641
74.75	8.5	0.002	0.0000145	40	1.314105
36.55	11	0.002	0.0000145	40	0.825299
33.53	13.5	0.002	0.0000145	60	0.934481
				Total	**5.390148**
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					33.66
Gross Annual Draft (MCM)					19.4
Agricultural Demand –GW					18.03
Agricultural Demand –SW					40.50
Domestic Demand – GW					1.37
Domestic Demand – SW					0.34
Total Demand					**60.24**
Area of Block (Sq. Km.)					354.79
Area suitable for Artificial recharge (Sq. Km)					354.79
Type of Aquifer					Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					354.79
Volume of Unsaturated Zone (MCM)					2139.11
Average Specific Yield					0.02
Availability of Surplus surface runoff (MCM)					8.6141
Surplus runoff considered for planning (MCM) @75%					6.46
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)		Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)		
Number of Structures	30		86		
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.52		1.94		
RTRWH Structures – Urban Areas					

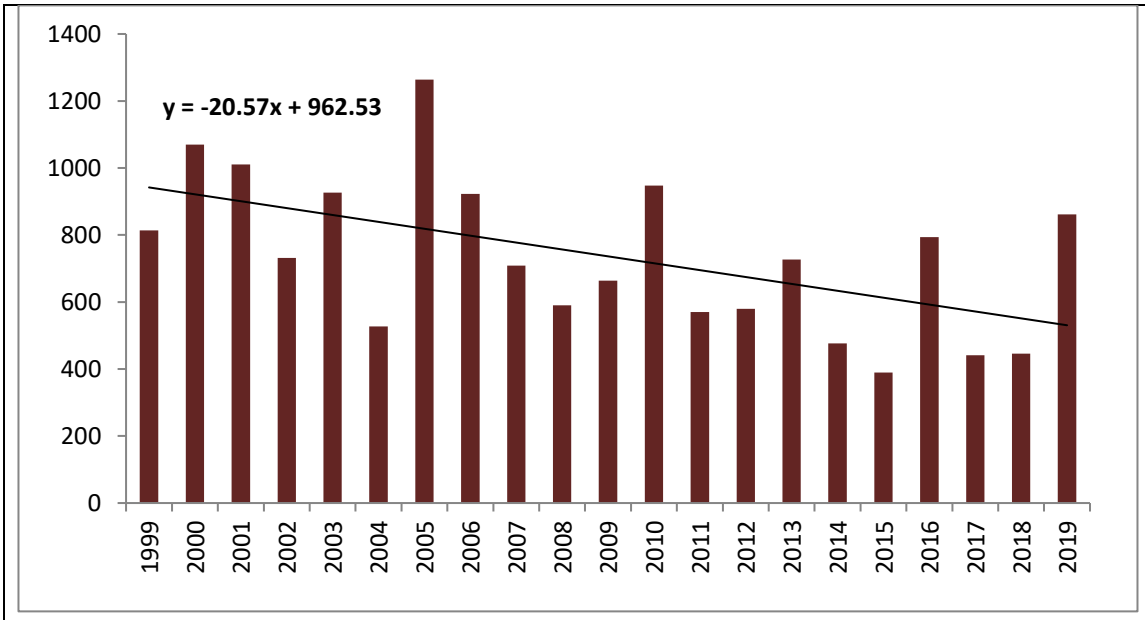
Households to be covered (50% with 50 m^2area)	1516
Rainwater harvested / recharged @ 80% runoff co-efficient	0.110
However, it is economically not viable & hence, not recommended.	
6.2. Demand Side Management	
Micro irrigation techniques	
Sugarcane area proposed for drip irrigation (sq. km.)	0
Volume of Water expected to be saved (MCM). Surface Flooding req-2.45 m. Drip Req. - 1.88, WUE- 0.57 m	0
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
6.4. Expected Benefits	
Net Ground Water Availability (MCM)	33.66
Additional GW resources available after Supply side interventions (MCM)	6.46
Ground Water Availability after Supply side intervention (MCM)	40.12
Existing Ground Water Draft for All Uses (MCM)	19.4
GW draft after Demand Side Interventions (MCM)	19.4
Present stage of Ground Water Development (%)	57.62
Expected Stage of Ground Water Development after interventions (%)	48.35
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	8.68
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	521
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	87
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 70% stage of GWD is achieved	13.36
Regulatory Measures	60m borewells/tube wells





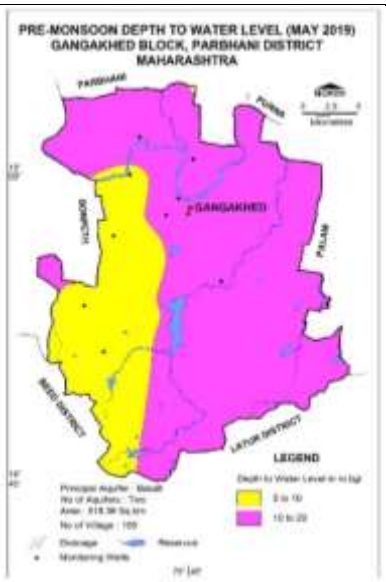
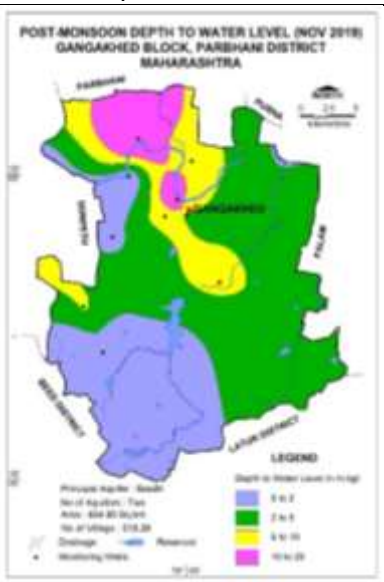
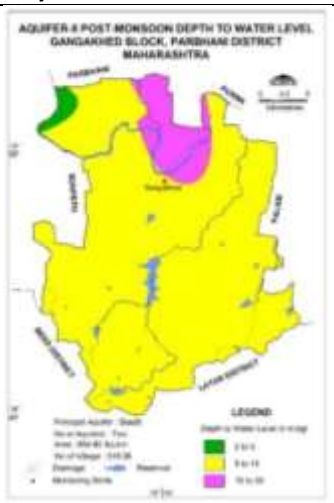
9.8 GANGAKHED BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name		Gangakhed
Geographical Area (Sq. Km.)		518.36
Hilly Area (Sq. Km)		Nil
Population (2011)		202867
Climate		Sub-tropical
1.2 Rainfall Analysis		
Normal Rainfall		742.7 mm
Annual Rainfall (2019)		861.3 mm
Decadal Average Annual Rainfall (2010-19)		623.25 mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -30.14 mm/year. Probability of Rainfall: 57.14 % Normal Rainfall; 19.05 % Excess Rainfall Probability of Drought: 23.81 % Moderate Drought	
Rainfall Trend Analysis (1999 To 2019)		

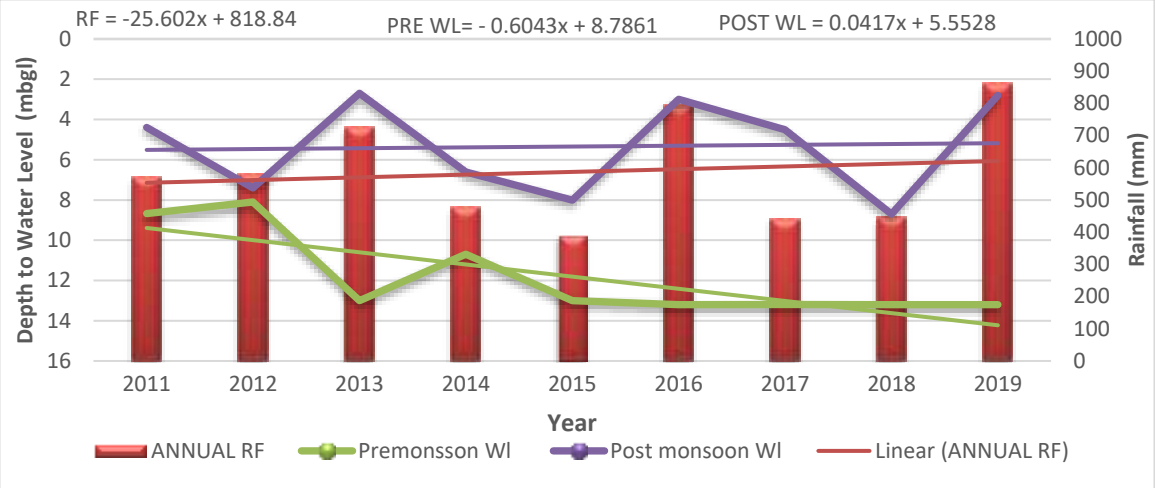


1.3. Geomorphology & Geology		
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Moderately Dissected (PLM) with small patch of Alluvial Plain - Older - Moderate (AYM)	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Major area shows Very deep (> 100 cm) BCS consisting mostly of clay	
1.4. Hydrology & Drainage		
Drainage	Dudhana river in the North of the block with sub-dendritic to dendritic drainage.	
Hydrology	Major project	Nil
	Medium project	2
	Minor Irrigation Projects (Local)	13
	Minor Irrigation Projects (ZP Level)	110
		PT-43, KT-8, UGB-58

1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		Nil	
Cultivable Area		558.39 Sq. Km.	
Net Sown Area		978.81 Sq. Km.	
Double Cropped Area		553.16 Sq. Km	
Area under Irrigation	Surface Water	164.10 Sq. Km.	
	Ground Water	24.50 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	168.90
		Cereals	271.21
		Pulses	219.59
		Sugarcane	38.25

	Citreous fruit	0.065
	Others	0.035
1.6 Water Level Behaviour		
1.6.1 Aquifer-I (Shallow Aquifer)		
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major part while DTWL 5 to 10 mbgl is observed in western part.		**Post-Monsoon (November-2019)** DTWL 2 to 5 mbgl is observed in major part. DTWL of 5 to 10 mbgl is observed in north and central part also in small patch at western part of the block. While DTWL 0 to 2 mbgl is observed in southern part and patch near border at western part. DTWL 10-20 mbgl is observed in northern and in patch at central part of block.
		
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)		
Post-Monsoon DTWL 5 to 10 mbgl is observed in major part. DTWL 10.20 mbgl is observed in northern part of the block. DTWL 2 to 5 mbgl is observed in north western part near border.		

1.7. Hydrograph



Village: Kerwadi, Gangakhed Taluka, Parbhani District

(Source GSDA, Maharashtra)

Hydrograph shows Pre-monsoon falling water level trend @ 0.604 m/year	Hydrograph shows Post- monsoon rising water level trend @ 0.0417 m/year
1.8. Water Level Trend (2010-19)	
1.8.1 Pre-Monsoon trend Falling 0.02 m/year (Mahatpuri) to 1.10 m/year (Rani Sawargaon)	**1.8.2 Post-Monsoon trend** Rising 0.12 m/year (Dongar pimpla) to 0.25 m/year (Isath); Falling 0.02 m/year (Mahatpuri) to 1.44 m/year (Khali)
All area of block shows falling trend upto 0.6 m/year (654.45 sq km) area with south eastern part shows falling trend > 0.6 m/year	Rising trend of upto 0.6 m/year (310.93 sq.km) at north eastern, central and south western part while falling trend upto 0.6 is observed in rest part in north, south-east, east part of block. (343.52 sq.km).

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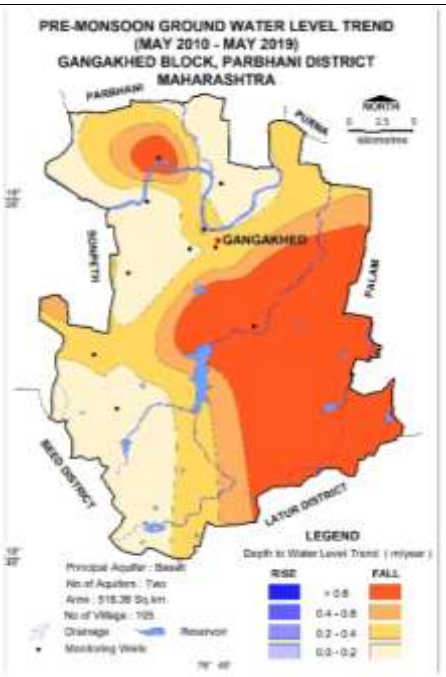
<td> 
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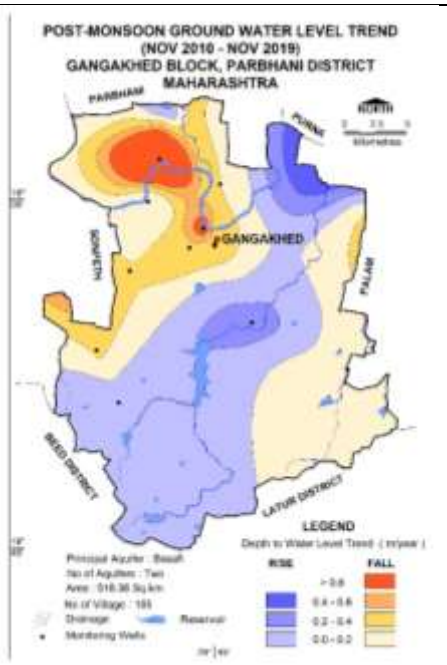
<td> 
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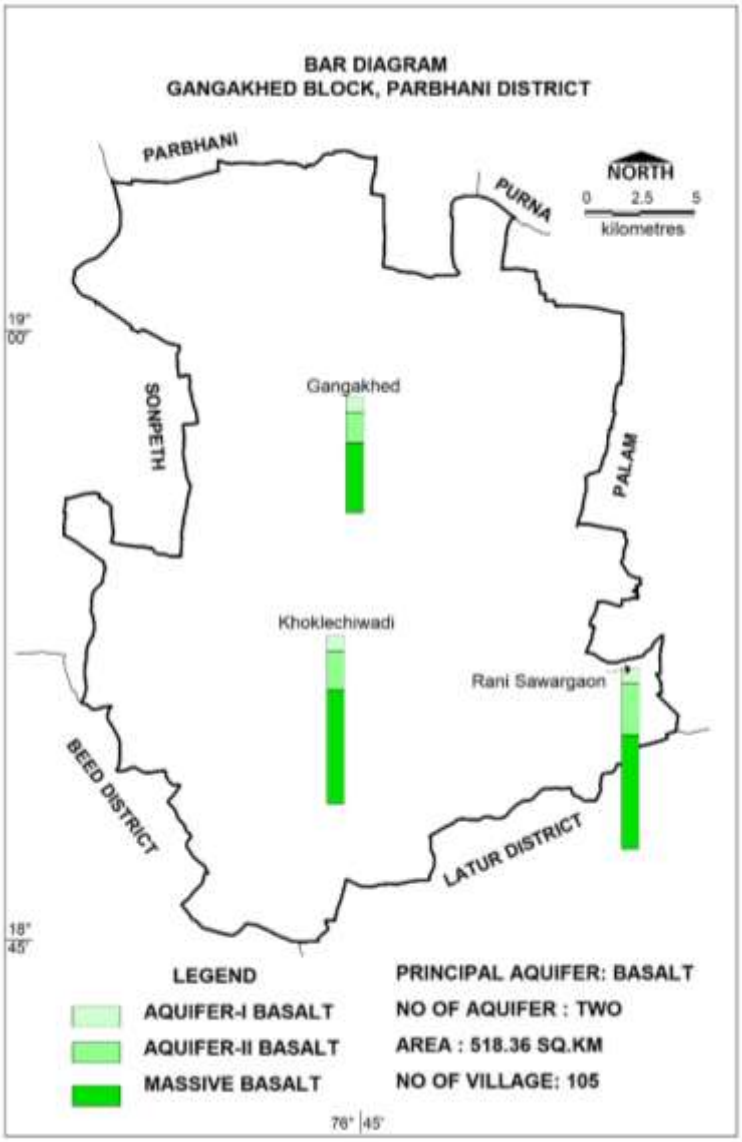
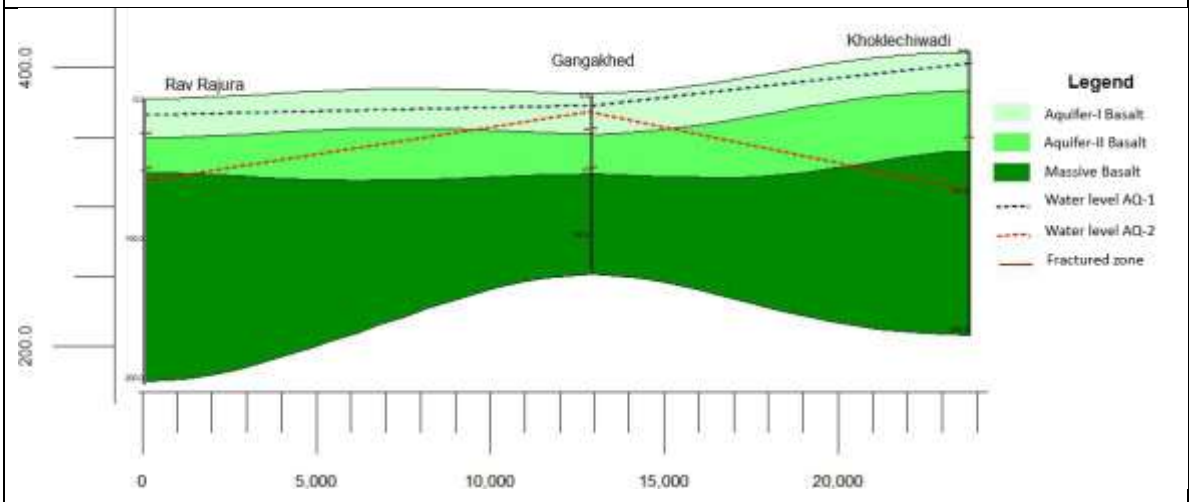
<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Block shows declining water level trend 0.2 to > 0.6 m/year
❖ Frequent droughts (23.81% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
<tr><td colspan="2">3.2. Lithological Disposition</td></tr>
</table>



3.3. Cross Section



3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.2 – 19.5	5.28 - 188.70
Depth of Occurrence (mbgl)	3 - 30	30 - 180
weathered/fractured rocks thickness (m)	5 – 30	0.00 – 15.00
Yield	10 – 100 m^3/day	0.00 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*1.45x10^{-5}
Transmissivity (T)	30 - 40 m^2/day	0.14 – 0.55 m2/day
		*value taken from Ahamdpur block, Latur District

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)

EC ranging 750-2250 µS/cm has been observed in major part (646.40 sq.km) & EC ranging 250 to 750 µS/cm (8.45 sq km) in small patches in central part. The ground water is suitable for all purpose.

4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)

EC ranging 750 - 2250 µS/cm has been observed in major part (521.15sq. km) & EC ranging 250 -750 µS/cm in) in south-western part of block (133.70 sq.km). The ground water is suitable for all purpose. Few villages are also affected by nitrate contamination.

5. GROUND WATER RESOURCE

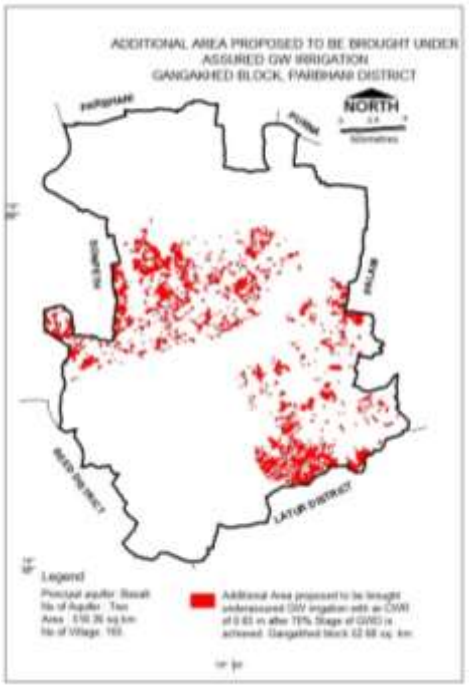
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

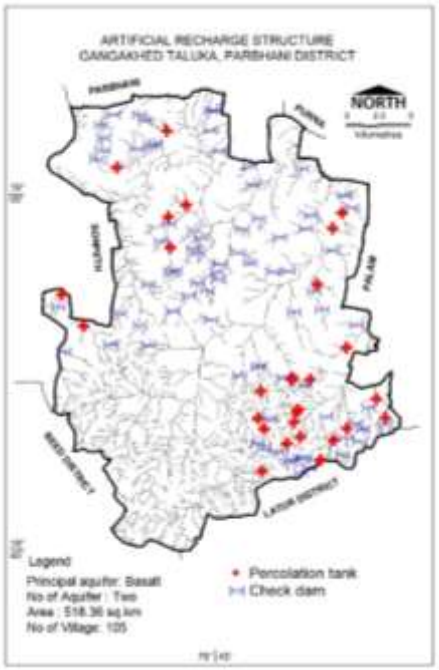
Ground Water Recharge Worthy Area (Sq. Km.)	518.36
Total Annual Ground Water (MCM) Recharge	84.66
Total Natural Discharges (MCM)	4.32
Annual Extractable Ground Water Recharge (MCM)	80.34

Current Annual Ground Water Extraction for irrigation use (MCM)					31.03
Current Annual Ground Water Extraction for domestic and industrial use (MCM)					3.12
Total Extraction (MCM)					34.15
Annual GW Allocation for Domestic Use as on 2025 (MCM)					13.26
Net Ground Water Availability for future use (MCM)					33.56
Stage of Ground Water Extraction (%)					42.50
Categorization					**Safe**
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
137.07	1	0.002	0.0000145	20	0.31389
148.55	3	0.002	0.0000145	30	0.955919
218.21	5.5	0.002	0.0000145	30	2.495231
121.57	8.5	0.002	0.0000145	25	2.110759
17.48	11	0.002	0.0000145	20	0.389629
11.95	13.5	0.002	0.0000145	30	0.327848
				Total	**6.593277**
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					80.34
Gross Annual Draft (MCM)					34.15
Agricultural Demand –GW					31.03
Agricultural Demand –SW					106.67
Domestic Demand – GW					3.12
Domestic Demand – SW					0.78
Total Demand					**141.60**
Area of Block (Sq. Km.)					518.36
Area suitable for Artificial recharge (Sq. Km)					471.59
Type of Aquifer					Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					471.59
Volume of Unsaturated Zone (MCM)					1414.78
Average Specific Yield					0.02
Availability of Surplus surface runoff (MCM)					10.5636
Surplus runoff considered for planning (MCM) @75%					7.92
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)			
Number of Structures	37	106			

Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	5.55	2.37
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m^2area)		4658
Rainwater harvested / recharged @ 80% runoff co-efficient		0.28134
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area proposed for drip irrigation (sq. km.)		11.60
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m		6.61
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
Water Saving by Change in Cropping Pattern		Nil
6.4. Expected Benefits		
Net Ground Water Availability (MCM)		80.34
Additional GW resources available after Supply side interventions (MCM)		7.92
Ground Water Availability after Supply side intervention (MCM)		88.26
Existing Ground Water Draft for All Uses (MCM)		34.15
GW draft after Demand Side Interventions (MCM)		27.54
Present stage of Ground Water Development (%)		42.50
Expected Stage of Ground Water Development after interventions (%)		31.20
Other Interventions Proposed, if any		
Alternate Water Sources Available		Nil
6.4. Development Plan		
Volume of water available for GWD after stage of GWD brought to 70% (MCM)		34.24
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)		2055
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)		342
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m till 70% stage of GWD is achieved		52.68
Regulatory Measures	60m borewells/tube wells	


DEMAND SIDE INVESTIGATION
GANGAKHED BLOCK, PARBHANI DISTRICT
NORTH
PARBHANI
PURNA
HINGOLI
PALAM
BEED DISTRICT
LATUR DISTRICT
Legend

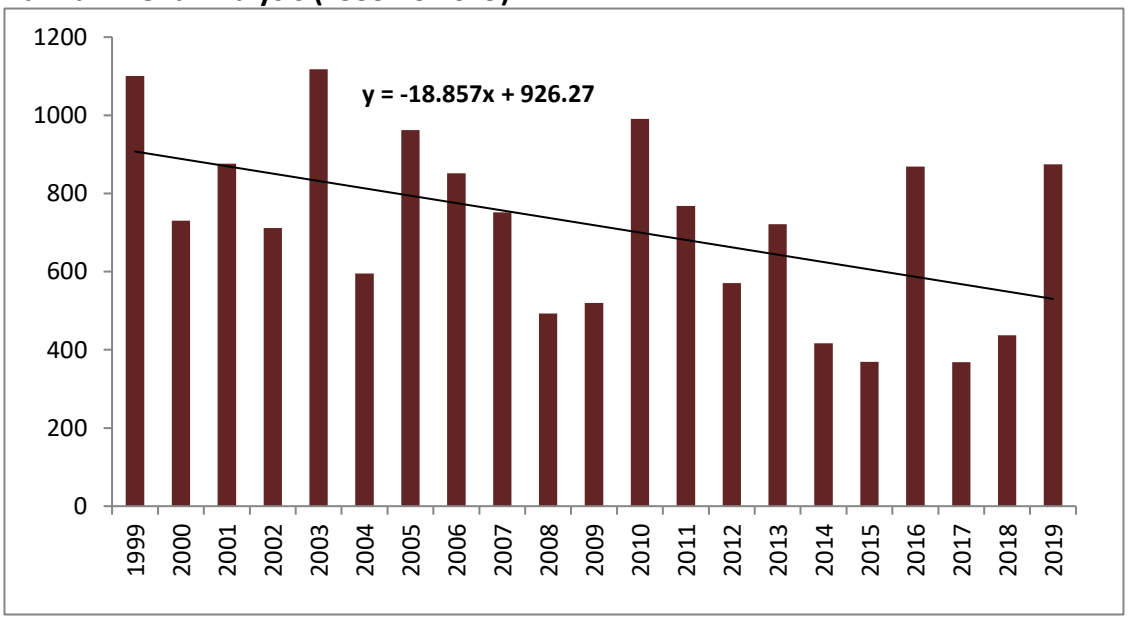

ADDITIONAL AREA PROPOSED TO BE BROUGHT UNDER
ASSURED GW IRRIGATION
GANGAKHED BLOCK, PARBHANI DISTRICT
NORTH
PARBHANI
PURNA
HINGOLI
PALAM
BEED DISTRICT
LATUR DISTRICT
Legend


ARTIFICIAL RECHARGE STRUCTURE
GANGAKHED TALUKA, PARBHANI DISTRICT
NORTH
PARBHANI
PURNA
HINGOLI
PALAM
BEED DISTRICT
LATUR DISTRICT
Legend
Principal aquifer: Basalt
No of Aquifer : Two
Area : 516.36 sq.km
No of Village: 105
Percolation tank
Check dam

9.9 PALAM BLOCK, PARBHANI DISTRICT, MAHARASHTRA

1. SALIENT FEATURES	
1.1 Introduction	
Block Name	Palam
Geographical Area (Sq. Km.)	508.84
Hilly Area (Sq. Km)	Nil
Population (2011)	115382
Climate	Sub-tropical
1.2 Rainfall Analysis	
Normal Rainfall	777.8 mm
Annual Rainfall (2019)	874.7 mm
Decadal Average Annual Rainfall (2010-19)	638.57mm
Long Term Rainfall Analysis (1999-2019)	Falling trend -18.857 mm/year. Probability of Rainfall: 52.38 % Normal Rainfall; 14.29 % Excess Rainfall Probability of Drought: 23.81 % Moderate Drought; 9.52 % Severe Drought

Rainfall Trend Analysis (1999 To 2019)

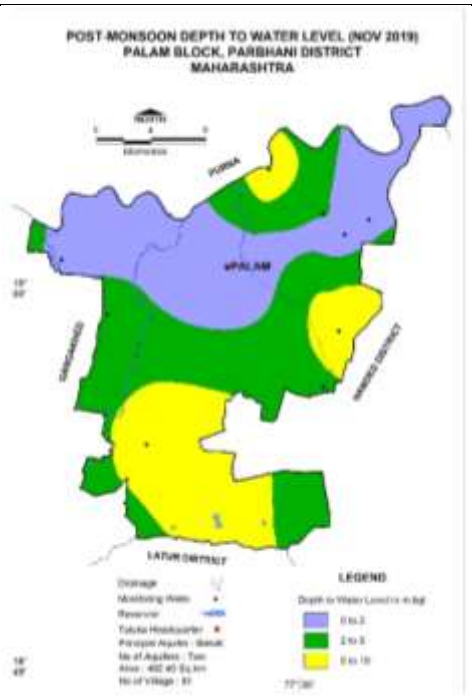


1.3. Geomorphology & Geology	
Geomorphic Unit	Plateau Slightly Dissected (PLS), 0-1m weathering to Plateau Moderately Dissected (PLM) with Alluvial Plain - Older - Moderate (AYM) at North side
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene
Soil	Major area shows Very deep (> 100 cm) BCS consisting mostly of clay
1.4. Hydrology & Drainage	
Drainage	Dudhana river in the North of the block with sub-dendritic to dendritic drainage.

Hydrology	Major project	Nil
	Medium project	1
	Minor Irrigation Projects (Local)	3
	Minor Irrigation Projects (ZP Level)	29
		PT-7, KT-4, UGB-17

1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Forest Area		2.42 Sq. Km.	
Cultivable Area		260.80 Sq. Km.	
Net Sown Area		392.23 Sq. Km.	
Double Cropped Area		220.91 Sq. Km.	
Area under Irrigation	Surface Water	79.01 Sq. Km.	
	Ground Water	23.30 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)** *(Reference year 2016-17)*
		Cotton	19.96
		Cereals	132.96
		Pulses	154.55
		Sugarcane	11.60
		Citreous fruit	0.00
		Others	0.08

1.6 Water Level Behaviour	
1.6.1 Aquifer-I (Shallow Aquifer)	
Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major part while DTWL 5 to 10 mbgl is observed in north eastern part in small patch near border. DTWL 2 to 5 mbgl observed i in north eastern part in small patch near border. Small patch having DTWL >20 mbgl is observed at northern part	**Post-Monsoon (November-2019)** DTWL 2 to 5 mbgl is observed in central, northern and western part. DTWL of 5 to 10 mbgl is observed in southern part and small patch at easten and northern part of the block. While DTWL 0 to 2 mbgl in isolated patch in east- west part and also northern part of the block.

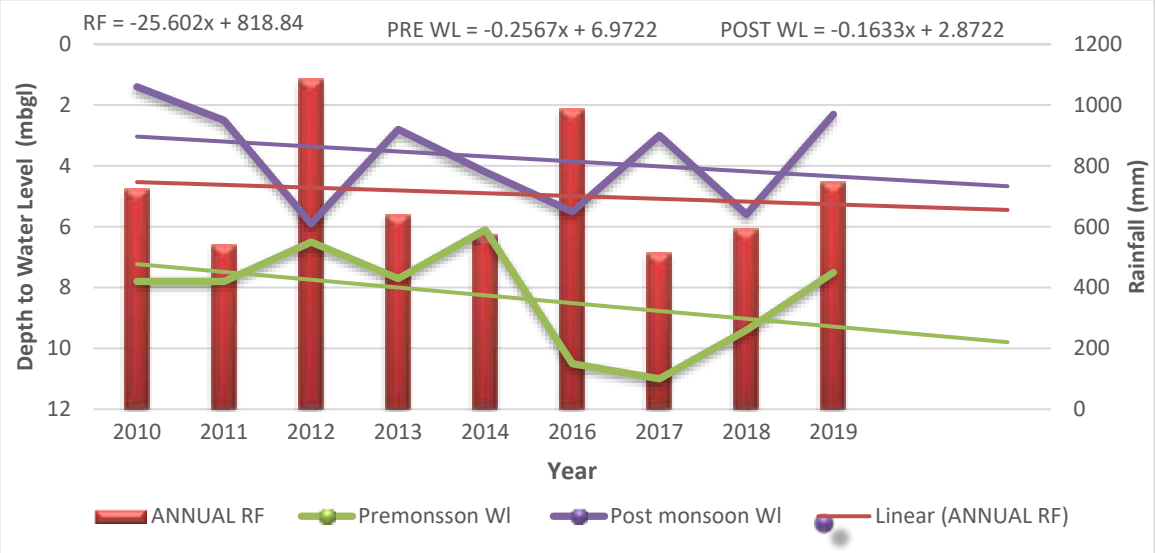


1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Post-Monsoon

DTWL 5 -10 mbgl is observed in total part of the block

1.7. Hydrograph



Village: Kerwadi, Palam Taluka, Parbhani District

(Source GSDA, Maharashtra)

Hydrograph shows Pre-monsoon falling water level trend @ 0.257 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.163 m/year
1.8. Water Level Trend (2010-19)	
1.8.1 Pre-Monsoon trend Rising 0.0003 m/year (Pendu Bk) to 0.56 m/year (Palam), Falling 0.06 m/year (Sheikh Rajura) to 0.71 m/year (Chudawa)	**1.8.2 Post-Monsoon trend** Rising 0.03 m/year (Parwa) to 0.54 m/year (Anjanawadi); Falling 0.02 m/year (Kharab Dhanora) to 0.32 m/year (Pendu Bk)
Falling trend upto 0.6 m/year (285.99 sq km) area in western and southern borders with falling trend > 0.6 m/year in small patches at north and eastern part of block and rising trend upto 0.4 observed in central part and in east near borders (206.07 sq.km).	Major area shows falling trend of upto 0.4 m/year (368.22 sq.km) while rising trend upto 0.6 is observed in rest part in north-east and small patch at east of the block (124.22 sq.km).

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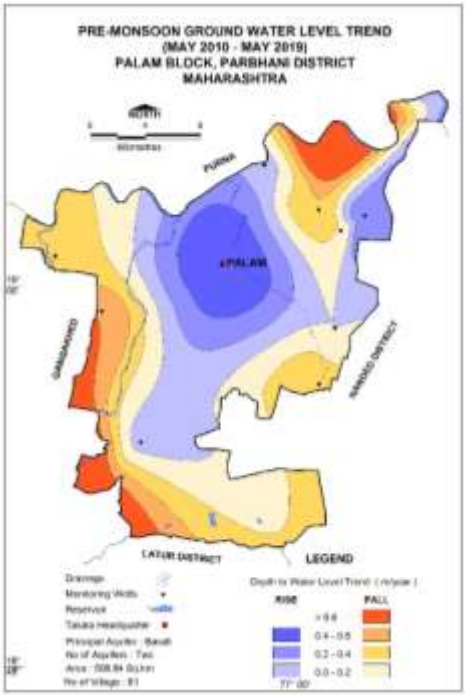
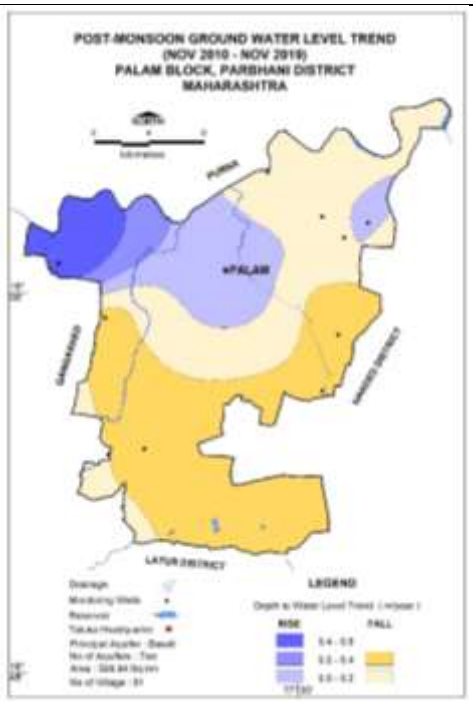
<tr><td> 
</td><td> 
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<tr><td colspan="2">2. Ground Water Issues</td></tr>
<tr><td colspan="2">❖ Block shows declining water level trend up to > 0.6 m/year
❖ Frequent droughts (23.81% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
❖ Less ground water potential basaltic aquifer.</td></tr>
<tr><td colspan="2">3. AQUIFER DISPOSITION</td></tr>
<tr><td>3.1. Number of Aquifers</td><td>Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</td></tr>
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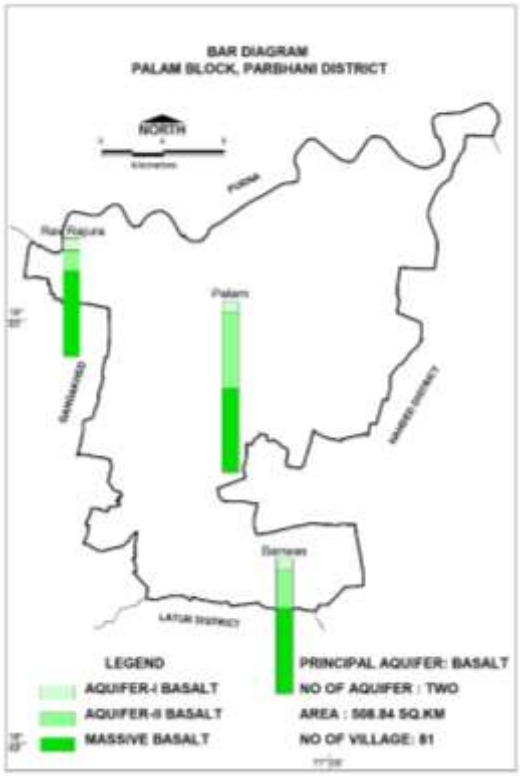
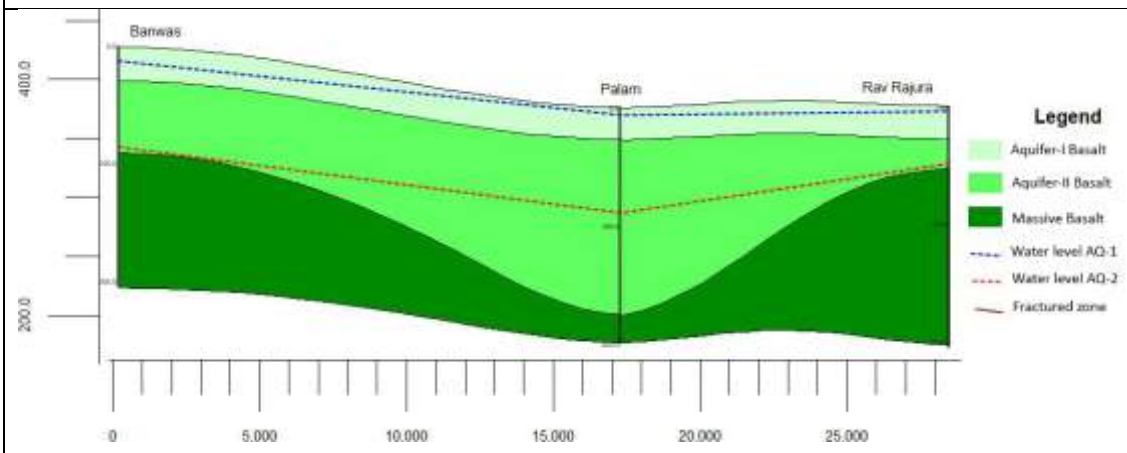


3.3. Cross Section



3.4. Aquifer Characteristics

Major Aquifers	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt –Aquifer-I (Phreatic / Shallow aquifer)	Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.7 to 16.9	5 to157.5
Depth of Occurrence (mbgl)	9 to 40	30 to 180
weathered/fractured rocks thickness (m)	5 to 30	1 to 10
Yield	10 – 100 m^3/day	0 to 2.5 lps
Specific yield/ Storativity (S)	0.02	*1.45 x 10^{-5}

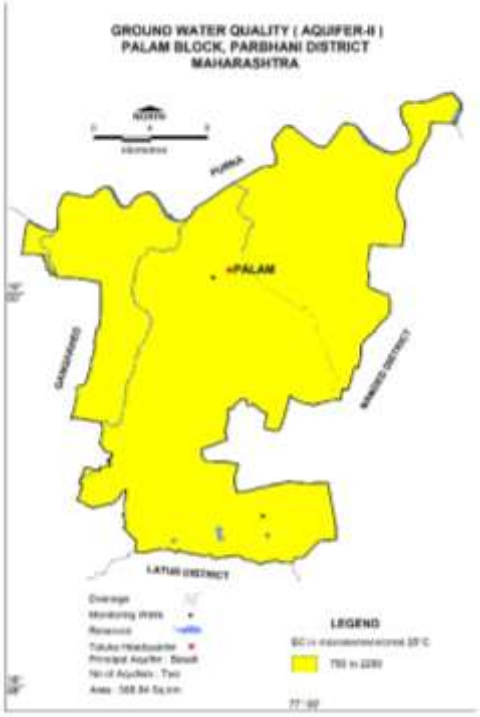
Transmissivity (T)	30 - 40 m^2/day	0.14 – 0.55 m^2/day
		*values taken from Ahamdpur block, Latur District

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)

EC ranging 750-2250 µS/cm has been observed in major part (441.13 sq.km) & EC ranging 250 to 750 µS/cm (51.31 sq km) in patches in south-east part of block. The ground water is suitable for all purpose. Few villages are also affected by nitrate & fluoride contamination.

4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)



Entire part of block EC ranging 750 - 2250 µS/cm has been observed (508.84 sq. km). The ground water is suitable for all purpose. Few villages are also affected by nitrate & fluoride contamination.

5. GROUND WATER RESOURCE

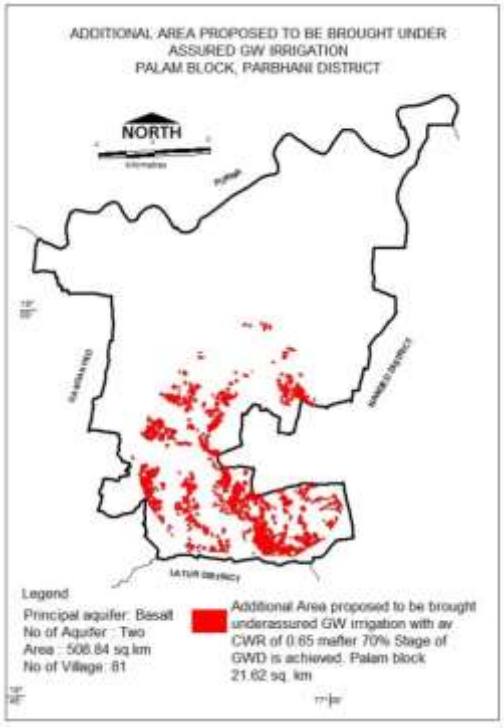
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

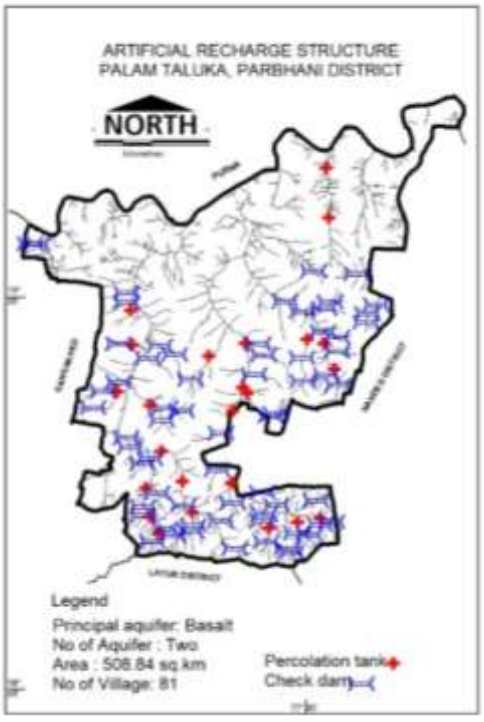
Ground Water Recharge Worthy Area (Sq. Km.)	508.84
Total Annual Ground Water (MCM) Recharge	60.07
Total Natural Discharges (MCM)	3.00
Annual Extractable Ground Water Recharge (MCM)	57.07
Current Annual Ground Water Extraction for irrigation use (MCM)	29.22
Current Annual Ground Water Extraction for domestic and industrial use (MCM)	1.39
Total Extraction (MCM)	30.61
Annual GW Allocation for Domestic Use as on 2025 (MCM)	5.31
Net Ground Water Availability for future use (MCM)	27.95
Stage of Ground Water Extraction (%)	53.65
Categorization	**Safe**

5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
41.93	1	0.002	0.0000145	40	0.108179
191.35	3	0.002	0.0000145	30	1.231337
222.06	5.5	0.002	0.0000145	65	2.651952
37.09	8.5	0.002	0.0000145	30	0.646664
				Total	**4.638132**

6.0. GROUND WATER RESOURCE ENHANCEMENT			
6.1. Supply Side Management			
SUPPLY (MCM)			
Available Resource (MCM)			57.07
Gross Annual Draft (MCM)			30.61
Agricultural Demand –GW			29.22
Agricultural Demand –SW			51.36
Domestic Demand – GW			1.39
Domestic Demand – SW			0.35
Total Demand			**82.31**
Area of Block (Sq. Km.)			508.84
Area suitable for Artificial recharge (Sq. Km)			400.66
Type of Aquifer			Hard rock
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)			508.84
Volume of Unsaturated Zone (MCM)			1342.02
Average Specific Yield			0.02
Availability of Surplus surface runoff (MCM)			8.9748
Surplus runoff considered for planning (MCM) @75%			6.73
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	
Number of Structures	31	90	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.71	2.02	
RTRWH Structures – Urban Areas			
Households to be covered (50% with 50 m2area)			0
Total RWH potential (MCM)			0
Rainwater harvested / recharged @ 80% runoff co-efficient			0
However, it is economically not viable & hence, not recommended.			
6.2. Demand Side Management			
Micro irrigation techniques			
Sugarcane crop area proposed for drip irrigation (sq. km.)			0

Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m	0.57
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
6.4. Expected Benefits	
Net Ground Water Availability (MCM)	57.07
Additional GW resources available after Supply side interventions (MCM)	6.73
Ground Water Availability after Supply side intervention (MCM)	63.8
Existing Ground Water Draft for All Uses (MCM)	30.61
GW draft after Demand Side Interventions (MCM)	30.61
Present stage of Ground Water Development (%)	53.65
Expected Stage of Ground Water Development after interventions (%)	47.98
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	14.05
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	843
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	141
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 70% stage of GWD is achieved	21.62
Regulatory Measures	60m borewells/tube wells





10. ANNEXURES

ANNEXURES

Annexure-I: Salient Features of Ground Water Exploration, Parbhani District

S. no.	Village	Type of Well	Taluka	Year	Lat_Dec	Long_Dec	Altitude (m a MSL)	Depth drilled (mbgl)	Depth of casing (mbgl)	Aquifer zones encountered (mbgl)	Aquifer	SWL (mbgl)	Discharge (lps)	DD (m)
1.	Asegaon	EW	Jintur	2011-12	19.4705	76.8761	389.4	153	5.6	57,90-92	FB	15.06	3	37.33
2.	Asegaon	OW	Jintur	2011-12	19.4705	76.8761	389.4	100	5.6	24-25,93-95	FB	14.76	0.73	40.8
3.	Rani Sawargaon	EW	Gangakhed	2004-05	18.8611	76.8667	427.9	204.75	5.64	29 -	J MB	188.7	-	-
4.	Pimpaldari	EW	Gangakhed	2004-05	18.7994	76.7611	450.5	204.75	5.62	29 - ,154 -156	J MB	23	1.37	-
5.	Khoklechiwadi	EW	Gangakhed	2004-05	18.8744	76.7389	412	204.75	5.64	66 -	J AB	100	-	-
6.	Gangakhed	EW	Gangakhed	2004-05	18.9722	76.7472	380.3	126	6.45	6 -7 ,26 -31 ,54 -56 ,34 -36	F V & MB	5.28	27.08	-
7.	Charthana	EW	Jintur	2012-13	19.6261	76.5400	458	200	5.6		MB	>60	traces	
8.	Pachegaon	EW	Jintur	2012-13	19.5580	76.7975	416.7	200	5.6	60.50, 143.80	VFB	>60	1.37	
9.	Jinthur	EW	Jintur	2012-13	19.6005	76.6863	437.8	200	5.6	17 -18, 78-79, 91-92, 166-167	VFB	3.52	4.43	49.48
10.	Jinthur	OW	Jintur	2012-13	19.6077	76.6863	440.8	117.4	5.6	18-19	FB		0.38	
11.	Manwat	EW	Manwat	2011-12	19.3066	76.4950	437	200	5.6	68.00,84.00	FB	5.75	0.21	46.32
12.	Kolha	EW	Manwat	2011-12	19.3544	76.5530	409.8	200	5.6	29.00	FB	7.1	1.38	50.52
13.	Rav Rajura	EW	Palam	2004-05	19.0472	76.8403	376.8	204.75	5.6	6.85 - ,18.2 -	J AB	55.15	-	-
14.	Banwas	EW	Palam	2004-05	18.8583	76.9722	428.4	204.75	5.64	25.5 -29	J AB	157.5	-	-
15.	Palam	EW	Palam	2004-05	19.0097	76.9388	375.3	200.2	5.4	5.4 -7 ,31 -34 ,179 -180 ,88 -90	F V & MB	49.7	-	-
16.	Pokharni	EW	Parbhani	2010-11	19.1250	76.7000	396	200	5.6	9.6-12.70, 40.10-43.2	FVWB	10.5	<0.14	
17.	Muli	EW	Parbhani	2010-11	19.0250	76.7708	381	200	5.6	21.8-24.9, 92.0-95.00,	FVB	10.23	0.38	42.11
18.	Ukhlad	EW	Parbhani	2011-12	19.2483	76.8994	384.3	162.1	6.1	49.30-52.30, 159.10-162.10	FB	8.07	7.76	46.51
19.	Ukhlad	OW	Parbhani	2011-12	19.2483	76.8994	384.3	200	5.6	122.50-125.50	FB	>50	Traces	
20.	Lohgaon	EW	Parbhani	2011-12	19.1494	76.8013	398.3	104.2	10	12.70-18.80, 37.10-43.20, 67.60-79.80	FB	3.32	12.18	16.7
21.	Lohgaon	OW-I	Parbhani	2011-12	19.1494	76.8013	398.3	191	6.1	9.60-12.70, 15.70-18.80	FMB	1.26	4.43	54.31
22.	Lohgaon	OW-II	Parbhani	2011-12	19.1494	76.8013	398.3	153	6.1	9.60-12.70, 21.80-24.90	FVB	1.52	17.9	48
23.	Kaudgaon	EW	Parbhani	2011-12	19.2500	76.7500	405	200	21.5	24.90-31.00	VB	>50	0.023	
24.	Pedgaon	EW	Parbhani	2011-12	19.3222	76.6519	429.7	200	11.5	37.10-40.10	MB	>50	0.023	
25.	Jhari	EW	Parbhani	2011-12	19.4091	76.7738	397.7	122.5	5.6	117.00-118.50	Basalt	11.45	0.73	45.6
26.	Parbhani	PZ-I	Parbhani	2011-12	19.2727	76.7666	430	100	5.6	57.00	Basalt	5.11	0.215	
27.	Parbhani	PZ-II	Parbhani	2011-12	19.2727	76.7666	430	37.1	5.6	24.00	Basalt	5.19	0.031	
28.	Hadgaon	PZ	Pathri	1995-96	19.3000	76.3000	413	50	10	10.8 -11	Basalt	3.8	-	-
29.	Purna	PZ	Purna	2010-11	19.1750	77.0791	381	100	5.6	18.8-21.8, 46.2-49.3, 49.3-52.3	BV	22	1.37	30.74
30.	Purna	PZ	Purna	2010-11	19.1750	77.0791	381	37.1	4	12.70-15.70, 31.00-34.00	FB	20.55	0.14	47.28
31.	Gaur	EW	Purna	2010-11	19.1627	77.0808	378	123	5.6	31.00-37.00, 119.50-122.50	FB	0.84mag l	4.43	47.28
32.	Gaur	OW	Purna	2010-11	19.1627	77.0808	378	122	5.6	119.00-122.00	FB	0.49	9.84	45.66

S. no.	Village	Type of Well	Taluka	Year	Lat_Dec	Long_Dec	Altitude (m a MSL)	Depth drilled (mbgl)	Depth of casing (mbgl)	Aquifer zones encountered (mbgl)	Aquifer	SWL (mbgl)	Discharge (lps)	DD (m)
33.	Gaur	OW	Purna	2010-11	19.1627	77.0808	378	122	5.6	119.00-122.00	FB	0.16	9.84	46.3
34.	Tadkalas	EW	Purna	2011-12	19.1333	76.9333	391	200	4	27.90-31.00, 52.30-55.40, 110.30-113.30	FVB	2.71	0.38	61.3
35.	Katneswar	EW	Purna	2011-12	19.2736	76.9436	395.1	200	5.6	9.60-12.70, 31.00-34.00	FB	30.23	1.73	31.65
36.	Khadka	EW	Sonpeth	2004-05	19.0083	76.6214	389.7	204.75	5.64	15 - ,16 -	J AB	150.1	-	-
37.	Sonpeth	EW	Sonpeth	2004-05	19.025	76.475	405	204.75	5.64	9.1 - ,11 -13	J MB	87.1	-	-
38.	Ukhali Tanda	EW	Sonpeth	2004-05	18.9	76.5972	411.3	186.55	5.64	9.1 - ,18.2 -20 ,173 -180 ,41 -47	J F MB & J AB	3.5	7.76	-
39.	Ukkadgaon	EW	Sonpeth	2010-11	18.9166	76.6041	400	200	6.1	12.7-15.7	FVB	2.45	0.14	47.44
40.	Wadgaon	EW	Sonpeth	2010-11	18.9333	76.6541	405	200	6.1	24.0-29	FVB	4.21	2.16	49.43
41.	Devinagar Tanda	EW	Sonpeth	2010-11	19.0208	76.5958	392	200	3.5	6.6-9.6, 40.10-43.20, 76.7-82.8, 153-156, 159.1-165.2, 177.4-186.5	FVB	1.68	5.15	50.02
42.	Devinagar Tanda	OW	Sonpeth	2010-11	19.0208	76.595833	392	200	3.5	6.6-9.6, 12.7-15.7, 174.3-177.4	FB	1.3	1.37	52.84
43.	Devinagar Tanda	OW	Sonpeth	2010-11	19.0208	76.5958	392	200	3.5	3.5-6.6, 15.70-18.8, 37.1-40.1	FVB	2.24	3.77	50.54
44.	Pipla (Bhatya)	OW	Sonpeth	2010-11	19.0072	76.5819	400.9	200	5.6	9.6-12.7, 46.2-49.3, 177.4-180.4	FVB	4.9	0.14	53.47
45.	Pipla (Bhatya)	EW	Sonpeth	2010-11	19.0072	76.5819	400.9	200	5.6	6.6-9.6, 24.9-27.9	FVB	4.54	0.78	52.1
46.	Pipla (Bhatya)	OW	Sonpeth	2010-11	19.0072	76.5819	400.9	200	5.6	18.8-21.8	FVB	6.9	Traces	

Annexure-II: Details of GSDA wells in Parbhani District

Sl. no.	District	Taluka	Site name	Latitude	Longitude	D.T.W. (Pre - 2018) (m bgl)	D.T.W. (Post - 2018) (m bgl)	RL
1	Parbhani	Gangakhed	Dongar pimpla	18.8542	76.6778	9.3	0.3	445.3
2	Parbhani	Gangakhed	Dhangar moha	18.8917	76.6611	8	5.2	436
3	Parbhani	Gangakhed	Ban pimpla	18.9486	76.6861	6.8	1.5	392.4
4	Parbhani	Gangakhed	Gangakhed	18.9667	76.75	12.7	4.9	392
5	Parbhani	Gangakhed	Dharkheda	18.9792	76.7417	19.5	17.4	376
6	Parbhani	Gangakhed	Mahatpuri	18.9986	76.7	8	1	392
7	Parbhani	Gangakhed	Muli	19.0111	76.7542	10.9	7.2	386
8	Parbhani	Gangakhed	Khali	19.0292	76.7083	19.5	17.3	381
9	Parbhani	Selu	Kawada	19.425	76.5444	10	5.5	406
10	Parbhani	Jintur	Dudhgaon	19.4375	76.8333	15.4	11.4	402
11	Parbhani	Jintur	Asegaon	19.4653	76.8472	15.7	9.5	391
12	Parbhani	Jintur	Karwali	19.4722	76.7806	21.6	10.5	405.6
13	Parbhani	Jintur	Zari	19.4917	76.7728	16.5	9.2	400.7
14	Parbhani	Jintur	Wassa	19.5128	76.8333	9.7	4.3	414.7
15	Parbhani	Jintur	Nagapur	19.5228	76.7208	8.9	6.3	404.7
16	Parbhani	Jintur	Adgaon bazar	19.5661	76.8667	11.5	1	425
17	Parbhani	Jintur	Bhogaon	19.5736	76.7625	14.2	6.3	425.7
18	Parbhani	Jintur	Mohkheda	19.6061	76.8544	7.2	2.6	430.2
19	Parbhani	Jintur	Pimprala-I	19.6125	76.6111	16.1	12.3	441.7
20	Parbhani	Jintur	Jintur	19.6139	76.7569	6.2	3	490.4
21	Parbhani	Jintur	Jogwada	19.625	76.5875	7.7	4	450
22	Parbhani	Jintur	Kehal	19.6667	76.65	7	4.1	519
23	Parbhani	Jintur	Bhosi	19.675	76.6528	12	10.7	496.3
24	Parbhani	Jintur	Bamni bk	19.7703	76.6547	14.6	3.1	461
25	Parbhani	Jintur	Kolpa	19.785	76.635	8.5	2.1	461
26	Parbhani	Manwat	Palodi	19.2542	76.6042	11.9	4.2	453
27	Parbhani	Manwat	Manoli	19.3417	76.4917	10.6	5.6	436
28	Parbhani	Manwat	Narlad	19.3542	76.5708	10.2	2.4	408
29	Parbhani	Palam	Isad	18.8972	76.8936	10.1	6.1	396
30	Parbhani	Palam	Kerwadi	18.9353	77.0167	11	4.6	406.7
31	Parbhani	Palam	Pendu Bk	18.9722	77.0278	10.65	6.6	425.6
32	Parbhani	Palam	Palam	19.0139	76.95	10.4	0.7	384.7

Sl. no.	District	Taluka	Site name	Latitude	Longitude	D.T.W. (Pre - 2018) (m bgl)	D.T.W. (Post - 2018) (m bgl)	RL
33	Parbhani	Palam	Kharab Dhanora	19.0361	77.0319	12	0.8	394.2
34	Parbhani	Palam	Parwa	19.0458	77.0486	11.6	0.8	388.7
35	Parbhani	Palam	Sheikh Rajura	19.05	77.0167	9	2.3	379
36	Parbhani	Palam	Chudawa	19.05	77.0167	16.9	1.8	379
37	Parbhani	Parbhani	Tad pangri	19.1369	76.7358	11.7	8.3	409
38	Parbhani	Parbhani	Borwand bk	19.1625	76.7028	10.6	2	409
39	Parbhani	Parbhani	Tadlimla	19.1767	76.8636	11.5	0.2	397.7
40	Parbhani	Parbhani	Pingali	19.21	76.8583	10.7	0.3	399
41	Parbhani	Parbhani	Asola	19.2667	76.8583	21.7	15.8	384
42	Parbhani	Parbhani	Nandgaon bk	19.2917	76.8958	18	2.9	377
43	Parbhani	Parbhani	Murumba	19.3056	76.875	18.4	12.6	368.7
44	Parbhani	Parbhani	Takli kumbharna	19.3417	76.7528	11.2	8.6	404
45	Parbhani	Parbhani	Nandapur	19.3653	76.7383	17.1	13.8	405
46	Parbhani	Parbhani	Takli Bobale	19.4028	76.8792	12.5	6.4	387
47	Parbhani	Pathri	Kansur	19.2222	76.475	17	12.1	410
48	Parbhani	Pathri	Renapur-I	19.225	76.4792	11.2	1	409
49	Parbhani	Pathri	Pathri	19.25	76.4344	9.9	1.9	433
50	Parbhani	Pathri	Banegaon	19.2542	76.2597	15.1	9.6	394.7
51	Parbhani	Pathri	Niwali	19.2625	76.3694	13.6	11.2	403.3
52	Parbhani	Pathri	Pathargavhan bk	19.3014	76.275	7.3	2.1	423.3
53	Parbhani	Palam	Pharkanda	19.0792	76.9792	10.2	6.5	375
54	Parbhani	Purna	Katneshwar	19.1111	77.0292	22.3	2	365.7
55	Parbhani	Purna	Runj T Purna	19.1222	77.1181	3.2	1.6	376.8
56	Parbhani	Purna	Tadkalas	19.1333	76.9333	8.5	0.8	391
57	Parbhani	Purna	Ekrukha	19.1583	76.9686	18.5	2.1	383.7
58	Parbhani	Purna	Sirkalas	19.1611	76.9194	10.9	0.8	378.9
59	Parbhani	Purna	Balsa Bk	19.1764	76.9186	12.6	1.4	385
60	Parbhani	Selu	Dhengli Pimpalgaon	19.3958	76.4986	17.8	12.9	405.7
61	Parbhani	Selu	Gava T	19.4167	76.6125	10.2	2.5	399
62	Parbhani	Selu	Shinde Takli	19.4194	76.2931	29.1	21.7	451.4
63	Parbhani	Selu	Mahalsapur I	19.4208	76.4056	17.8	16.5	418
64	Parbhani	Selu	Selu	19.4506	76.4472	14	9.2	425.7
65	Parbhani	Selu	Rewalgaon	19.4653	76.3889	18.2	16.1	439.1
66	Parbhani	Selu	Pimpri Kh	19.4667	76.4569	10.8	6.6	424

Sl. no.	District	Taluka	Site name	Latitude	Longitude	D.T.W. (Pre - 2018) (m bgl)	D.T.W. (Post - 2018) (m bgl)	RL
67	Parbhani	Selu	Gulkhand	19.4667	76.6069	10.4	4.6	420.7
68	Parbhani	Selu	Brahmangaon	19.4764	76.5125	17.4	4.9	408.7
69	Parbhani	Selu	Borkini	19.6458	76.4708	11.2	7.5	461
70	Parbhani	Sonpeth	Nila I	18.9417	76.6347	18.1	7.6	389.3
71	Parbhani	Sonpeth	Dighol Islampur	18.9778	76.4903	10.2	3.8	409.8
72	Parbhani	Sonpeth	Narwadi	19.0014	76.5625	10.4	5.1	403.7
73	Parbhani	Sonpeth	Khadka	19.0083	76.6236	11.2	0.9	385.7
74	Parbhani	Sonpeth	Shirsi Bk	19.075	76.6069	15.3	5.3	386

Annexure-III: Details of ground water monitoring wells in Parbhani district

S.No.	DISTRICT	Block Name	SITE_NAME	Latitude	Longitude	SITE_TYPE	Geology	Aquifer Type	DTWL May-2019 (mbgl)	DTWL Nov. 2019 (mbgl)
1	Parbhani	Gangakhed	Gangakhed-3	18.9656	76.7311	DW	DTB	Unconfined	11.5	3.9
2	Parbhani	Parbhani	Daithana	19.0711	76.7158	DW	DTB	Unconfined	14.7	12.7
3	Parbhani	Palam	Anjanawadi-1	19.0194	76.8347	DW	DTB	Unconfined	11.5	1.8
4	Parbhani	Palam	Kerwadi	18.9833	76.8667	DW	DTB	Unconfined	13.2	2.8
5	Parbhani	Parbhani	Singanapur	19.175	76.7417	DW	DTB	Unconfined	12.45	4.15
6	Parbhani	Purna	Tadkalas	19.1333	76.9333	DW	DTB	Unconfined	9	1.55
7	Parbhani	Selu	Selu	19.3681	76.4042	DW	DTB	Unconfined	13.5	4.85
8	Parbhani	Parbhani	Pedgaon2	19.325	76.6583	DW	DTB	Unconfined	8.2	4.8
9	Parbhani	Pathri	Wadi Pati	19.305	76.3478	DW	DTB	Unconfined	13.4	2.2
10	Parbhani	Selu	Devgaon	19.6142	76.4625	DW	DTB	Unconfined	15.4	4.9
11	Parbhani	Jintur	Pangri	19.5625	76.6942	DW	DTB	Unconfined	7.45	5.15
12	Parbhani	Jintur	Panchegaon-1	19.5558	76.7094	DW	DTB	Unconfined	10	6.7
13	Parbhani	Selu	Chikhalthana	19.55	76.4833	DW	DTB	Unconfined	15	5.7
14	Parbhani	Selu	Moregaon	19.5111	76.455	DW	DTB	Unconfined	13.5	7.5
15	Parbhani	Jintur	Amberwadi	19.7181	76.6572	DW	DTB	Unconfined	16.59	5.6
16	Parbhani	Jintur	Mankeswar	19.6833	76.7	DW	DTB	Unconfined	10.09	5.6
17	Parbhani	Jintur	Jintur	19.6167	76.6833	DW	DTB	Unconfined	9.4	4.8

Annexure-IV: Chemical analysis of ground water samples, Aquifer- I / Shallow aquifers

SN	Block	Village	Lat	Log	pH	EC	TDS	TH	Ca	Mg	Cl	SO4	NO3	F	Remark
1	Pathri	Walur-1	19.48972	76.55139	7.8	675	358	260	63	24	41	15	40	0.41	CGWB
2	Parbhani	Bori	19.48556	76.7225	7.8	830	439	321	80	29	21	33	42	0.52	CGWB
3	Pathri	Chikhalthana	19.55	76.48333	7.4	679	360	240	41	33	14	15	33	0.77	CGWB
4	Parbhani	Todkalas	19.13333	76.93333	7.5	742	394	168	61	4	56	36	3	0.69	CGWB
5	Parbhani	Pedgaon2	19.325	76.65833	7.6	1503	796	556	51	102	113	32	42	0.51	CGWB
6	Jintur	Panchegaon-1	19.55583	76.70944	7.6	448	237	194	43	21	19	37	39	0.65	CGWB
7	Gangakhed	Anjanawadi-1	19.01944	76.83472	7.4	1674	887	638	137	70	130	53	43	0.58	CGWB
8	Sonpeth	Wadgaon	18.9425	76.6475	7.7	636	337	301	96	15	53	32	35	0.38	CGWB
9	Pathri	Pathri-1	19.27639	76.43222	7.6	1369	725	515	137	41	108	66	41	0.44	CGWB
10	Pathri	Devgaon	19.61417	76.4625	7.7	1098	582	444	80	58	53	37	43	0.75	CGWB
11	Parbhani	Avalgaon	18.97389	76.61444	7.8	1224	648	505	63	83	150	29	4	0.76	CGWB
12	Gangakhed	Gangakhed-3	18.96556	76.73111	7.8	728	386	275	94	10	34	45	22	0.91	CGWB
13	Pathri	Kola	19.34389	76.56167	7.9	901	477	326	51	47	34	34	42	1.18	CGWB
14	Pathri	Wadi Pati	19.305	76.34778	7.8	530	281	214	45	24	43	42	6	0.47	CGWB
15	Parbhani	Karegaon	19.26611	76.8225	7.9	1093	539	403	31	78	58	26	35	1.58	CGWB
16	Parbhani	Bangri	19.5625	76.69417	7.9	763	404	265	33	44	38	47	7	0.81	CGWB
17	Pathri	Loni	19.15472	76.40667	7.9	1117	592	403	20	84	105	69	3	2.14	CGWB
18	Pathri	Tarborgaon	19.32389	76.60833	8	820	434	286	55	35	36	27	42	0.88	CGWB
19	Parbhani	Jhari-1	19.42639	76.76583	7.9	1021	571	321	35	56	16	20	40	1.12	CGWB
20	Jintur	Amberwadi	19.71806	76.65722	7.7	391	207	133	31	13	24	20	2	0.81	CGWB
21	Purna	SIRKALAS	19.16111	76.91944	7.9	1068	694	694	96	35.96	82	19.64	22.1	0.98	GSDA
22	Purna	KATNESHWAR	19.11111	77.02917	7.86	1800	1170	1170	120	92.34	194	90.85	32.54	0.42	GSDA
23	Purna	TADKALAS	19.13333	76.93333	7.15	1485	965	965	148	40.82	191	82.94	42.4	0.45	GSDA
24	Parbhani	DHARMAPURI	19.30556	76.74722	7.24	1869	1215	1215	116	90.88	217	85.12	41.1	0.18	GSDA
25	Parbhani	TADPANGRI	19.13694	76.73583	7.34	1868	1214	1214	100	53.46	198	87.9	41.72	0.37	GSDA
26	Parbhani	DAITHANA	19.08333	76.72222	7.68	1077	700	700	100	39.85	100	59.69	21.5	0.56	GSDA
27	Parbhani	TADLIMLA	19.17667	76.86361	7.36	1312	853	853	90	48.11	124	74.54	29.78	0.35	GSDA
28	Parbhani	PINGALI BAZAR	19.425	76.875	7.26	1726	1122	1122	130	80.67	235	87	39.74	0.34	GSDA
29	Sonpeth	SONPETH	19.02167	76.47472	7.94	1842	1197	1197	80	58.8	130	68	25.85	1	GSDA
30	Parbhani	NANDAPUR	19.425	76.875	7.15	1254	815	815	96	64.63	82	60	16.22	0.19	GSDA
31	Jintur	WASSA	19.51278	76.83333	7.8	1146	745	745	104	51	98	88	27	0.7	GSDA
32	Jintur	ASEGAON	19.46528	76.84722	7.23	1172	762	762	100	35.96	122	68.21	31.43	0.21	GSDA
33	Jintur	KAWADA	19.425	76.54444	7.6	1092	710	710	60	62	219	55	35	0.7	GSDA
34	Jintur	BHOSI	19.675	76.65278	7.2	1622	1054	1054	142	83	164	81	41	0.6	GSDA
35	Jintur	JOGWADA	19.625	76.5875	7.4	878	570	570	48	68	71	19	33	0.5	GSDA
36	Jintur	KEHAL	19.66667	76.65	7.4	783	509	509	36	55	50	67	21	0.4	GSDA
37	Jintur	KARAVALI	19.47222	76.78056	7.8	1176	765	765	86	51	153	94	35	0.7	GSDA
38	Jintur	ASEGAON	19.46528	76.84722	7.4	1248	811	811	84	64	162	98	39	0.5	GSDA
39	Jintur	ASEGAON	19.46528	76.84722	7.5	2690	1750	1750	226	104	282	203	88	1	GSDA
40	Jintur	MOHAKHED	19.60611	76.85444	7.3	1058	687	687	66	64	75	66	25	0.6	GSDA

SN	Block	Village	Lat	Log	pH	EC	TDS	TH	Ca	Mg	Cl	SO4	NO3	F	Remark
41	Jintur	NAGAPUR	19.52278	76.72083	8.1	1010	656	656	46	77	65	58	24	0.8	GSDA
42	Jintur	DUDHAGAON	19.4375	76.83333	6.8	1434	932	932	146	83	79	61	37	0.7	GSDA
43	Jintur	ADGAON BAZAR	19.56611	76.86667	7.3	1355	880	880	92	78	80	74	39	0.8	GSDA
44	Jintur	CHARTHANA	19.625	76.53889	7.4	940	611	611	52	61	49	43	36	0.7	GSDA
45	Jintur	AMBARWADI	19.72694	76.66417	7	1273	827	827	106	67	112	79	38	0.4	GSDA
46	Jintur	KOLPA	19.785	76.635	7.1	537	349	349	54	23	20	31	16	0.5	GSDA
47	Jintur	BHOGAON DEVI	19.57361	76.7625	7.1	420	272	272	14	25	24	21	12	0.7	GSDA
48	Jintur	BORI	19.49278	76.73194	7	1458	949	949	96	79	184	107	42	0.5	GSDA
49	Jintur	BAMANI BK.	19.77028	76.65472	7.5	622	404	404	36	49	41	23	16	0.4	GSDA
50	Palam	SHAIKHRAJUR	19.05	77.01667	7.56	1623	1055	1055	142	67.06	103	65.11	38.51	0.15	GSDA
51	Gangakhed	BANPIMPLA	18.94861	76.68611	7.02	1096	731	731	108	31.59	80	35.19	33.17	0.51	GSDA
52	Gangakhed	MULI	19.01111	76.75417	7.5	979	627	627	104	35.478	91	68.62	22.3	0.25	GSDA
53	Gangakhed	DHARKHED	18.97917	76.74167	7.8	707	452	452	168	10.692	81	20.4	40.54	0.74	GSDA
54	Gangakhed	KHALI	19.02917	76.70833	7.9	907	580	580	168	5.346	78	50.54	35.8	0.35	GSDA
55	Gangakhed	DHANGARMOHA	18.89167	76.66111	7	1099	702	702	142	34.02	52	22.97	20.38	0.26	GSDA
56	Palam	KHRAB DHANORA	19.03611	77.03194	7.1	1160	750	750	108	15.552	146	70.8	30.4	0.55	GSDA
57	Sonpeth	KHADKA	19.00833	76.62361	7	1978	1285	1285	236	102.06	268	120.48	70.61	0.48	GSDA
58	Palam	ROKDEWADI	19.0125	76.8375	7.3	1090	697	697	68	42.768	142	97.95	20.44	0.85	GSDA
59	Sonpeth	SHIRSHI	19.075	76.60694	7.9	821.5385	534	534	50	27.702	104	99.72	15.45	0.84	GSDA
60	Palam	KERWADI	18.93528	77.01667	7.2	730	467	467	102	34.992	194	67.46	30.67	0.59	GSDA
61	Sonpeth	NARWADI	19.00139	76.5625	7.4	1236	791	791	92	17.496	101	40.82	40.82	0.9	GSDA
62	Pathri	RENAPUR	19.22222	76.475	7.5	1048	682	682	96	47	72	68.01	25.14	0.34	GSDA
63	Pathri	PATHARGAVHAN BK.	19.30139	76.275	7.2	1133	737	737	104	50	94	82.35	31.92	0.34	GSDA
64	Pathri	KANSUR	19.22222	76.475	8	750	486	486	72	35	82	61.14	21.12	0.24	GSDA
65	Pathri	BANEGAON	19.25417	76.25972	7.78	1870	1216	1216	180	75.81	169	72.84	39.51	0.14	GSDA
66	Manwat	MANOLI	19.34167	76.49167	7.68	2335	1518	1518	220	99.14	192	90.42	84.19	0.31	GSDA
67	Manwat	KOLHA	19.35417	76.55417	8	1053	685	685	88	48	74	70.85	26.01	0.31	GSDA
68	Pathri	ZARI	19.3125	76.44028	7.9	1200	780	780	104	35	86	81.62	26.14	0.31	GSDA
69	Selu	BORKINI	19.64583	76.47083	8.4	514	334	334	48	25	36	50.14	12.27	0.3	GSDA
70	Selu	GULKHAND	19.46667	76.60694	8.4	877	566	566	84	38	84	77.13	31.58	0.29	GSDA
71	Selu	PIMPRALA	19.4875	76.41167	8.4	584	379	379	52	30	36	36.12	20.12	0.25	GSDA
72	Selu	RAVALGAON	19.46528	76.38889	8.4	936	607	607	88	92	96	51.63	25.34	0.29	GSDA
73	Selu	D. PIMPALGAON	19.39583	76.49861	8	1449	942	942	128	65	168	87.14	35.12	0.34	GSDA
74	Selu	SHINDE TAKLI	19.41944	76.29306	8.2	1470	950	950	136	64	102	72.15	25.43	0.26	GSDA
75	Selu	BRAMHANGAON P. F.	19.47639	76.5125	8.1	755	490	490	60	36	44	38.76	17.46	0.44	GSDA
76	Selu	CHIKALTHANA KH	19.55833	76.48611	8.4	863	561	561	80	39	72	49.81	22.68	0.52	GSDA
77	Selu	GAVHA	19.41667	76.6125	8.4	1152	749	749	100	52	86	71.55	24.13	0.36	GSDA

Annexure-V: Chemical analysis of ground water samples, Aquifer- II / Deeper aquifers

SN	Block	Village	Lat	Log	PH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F	Fe
1	Aundha	Asegaon	19.471	76.876	7.6	1090	NA	100	26	8.5	195.0	12.0	0.0	195.0	191	73	24	0.38	0.0
2	Jintur	Charthana	19.626	76.54	7	1000	NA	110	40	2.4	185.0	10.0	0.0	67.0	213	125	35	0.48	0.0
3	Aundha	Asegaon	19.471	76.876	7.2	1150	NA	110	30	8.5	215.0	16.0	0.0	232.0	209	73	40	0.42	0.0
4	Parbhani	Jhari	19.409	76.774	7.3	780	NA	125	14	21.9	124.0	10.0	0.0	415.0	25	24	45	0.35	0.0
5	Jintur	Pachegaon	19.558	76.798	6.6	1630	NA	155	34	17.0	265.0	28.0	0.0	171.0	273	181	62	0.72	0.0
6	Gangakhed	Gangakhed	18.972	76.747	8.2	920	563	160	40	15.0	136.0	4.6	0.0	165.0	110	110	64	0.74	0.0
7	Gangakhed	Gangakhed	18.972	76.747	8.2	920	563	160	40	15.0	136.0	4.6	0.0	165.0	110	110	64	0.74	0.0
8	Sonpeth	Sonpeth	19.025	76.475	7.9	1580	986	175	64	4.0	279.0	5.0	0.0	201.0	277	133	120	3.76	0.0
9	Palam	Palam	19.01	76.939	7.6	1480	913	180	62	6.0	254.0	6.0	0.0	183.0	234	246	10	3.54	0.0
10	Purna	Gaur	19.163	77.081	8.1	1810	NA	180	NA	NA	NA	NA	NA	NA	NA	NA	3	1.97	0.0
11	Purna	Gaur	19.163	77.081	8.1	1800	NA	180	NA	NA	NA	NA	NA	NA	NA	NA	3	2.02	0.0
12	Parbhani	Kaudgaon	19.25	76.75	7.8	2010	NA	190	NA	NA	NA	NA	NA	NA	NA	NA	14	1.46	0.0
13	Purna	Gaur	19.163	77.081	7.9	1840	NA	190	NA	NA	NA	NA	NA	NA	NA	NA	1	1.99	0.0
14	Purna	Gaur	19.163	77.081	7.7	1870	NA	210	NA	NA	NA	NA	NA	NA	NA	NA	1	1.95	0.0
15	Sonpeth	Ukhali Tanaa	18.9	76.597	8	600	315	215	32	33.0	36.0	0.5	0.0	201.0	39	42	31	0.88	0.0
16	Sonpeth	Ukhali Tanaa	18.9	76.597	8	600	315	215	32	33.0	36.0	0.5	0.0	201.0	39	42	31	0.88	0.0
17	Jintur	Jinthur	19.601	76.686	7.5	1120	NA	215	44	25.5	150.0	17.0	0.0	195.0	167	144	38	0.63	0.0
18	Purna	Katneshwar	19.274	76.944	7.5	730	NA	220	NA	NA	NA	NA	NA	NA	NA	NA	0	BDL	0.0
19	Gangakhed	Pimpaldari	18.799	76.761	8.1	770	407	225	30	36.0	74.0	1.1	0.0	275.0	53	46	29	0.52	0.0
20	Gangakhed	Pimpaldari	18.799	76.761	8.1	770	407	225	30	36.0	74.0	1.1	0.0	275.0	53	46	29	0.52	0.0
21	Purna	Tadkalas	19.133	76.933	7.7	730	NA	260	NA	NA	NA	NA	NA	NA	NA	NA	5	1.48	0.0
22	Parbhani	Lohgaon	19.149	76.801	8	930	NA	260	NA	NA	NA	NA	NA	NA	NA	NA	22	BDL	0.0
23	Parbhani	Pedgaon	19.322	76.652	8.3	1120	NA	280	NA	NA	NA	NA	NA	NA	NA	NA	309	0.13	0.0
24	Parbhani	Lohgaon	19.149	76.801	6.7	940	NA	300	NA	NA	NA	NA	NA	NA	NA	NA	22	1.30	0.0
25	Purna	Tadkalas	19.133	76.933	7.7	910	NA	320	NA	NA	NA	NA	NA	NA	NA	NA	4	1.51	0.0
26	Parbhani	Lohgaon	19.149	76.801	7.9	1050	NA	330	NA	NA	NA	NA	NA	NA	NA	NA	25	BDL	0.0
27	Parbhani	Parbhavi	19.273	76.767	7.6	1130	NA	350	52	53.5	85.0	20.0	0.0	171.0	199	108	30	0.56	0.0
28	Pathri	Hadgaon	19.3	76.3	8.5	2340	1440	370	30	72.0	368.0	2.0	15.0	366.0	74	700	13	NA	0.0
29	Pathri	Hadgaon	19.3	76.3	8.5	2340	1440	370	30	72.0	368.0	2.0	15.0	366.0	74	700	13	0.00	0.0
30	Parbhani	Lohgaon	19.149	76.801	8.1	900	NA	380	NA	NA	NA	NA	NA	NA	NA	NA	23	BDL	0.0
31	Purna	Katneshwar	19.274	76.944	7.8	670	NA	390	NA	NA	NA	NA	NA	NA	NA	NA	91	BDL	0.0
32	Parbhani	Lohgaon	19.149	76.801	7.9	1110	NA	390	NA	NA	NA	NA	NA	NA	NA	NA	28	0.18	0.0
33	Manwat	Mauwat	19.307	76.495	7	1160	NA	400	88	43.8	77.0	17.0	0.0	299.0	160	55	2	0.12	0.0
34	Parbhani	Ukhlad	19.248	76.899	7.5	1340	NA	400	NA	NA	NA	NA	NA	NA	NA	NA	128	2.11	0.0
35	Parbhani	Parbhavi	19.273	76.767	7.2	1300	NA	400	82	47.4	100.0	28.0	0.0	183.0	206	129	13	0.55	0.0
36	Parbhani	Lohgaon	19.149	76.801	6.9	910	NA	420	NA	NA	NA	NA	NA	NA	NA	NA	22	0.40	0.0
37	Parbhani	Ukhlad	19.248	76.899	8.1	1560	NA	430	NA	NA	NA	NA	NA	NA	NA	NA	146	0.70	0.0
38	Sonpeth	Khadka	19.008	76.621	7.6	1330	785	460	140	27.0	92.0	4.0	0.0	268.0	174	118	95	0.82	0.0
39	Manwat	Kohla	19.354	76.553	7.4	1960	NA	625	64	113.1	165.0	15.0	0.0	427.0	181	337	41	0.32	0.0
40	Palam	Banwas	18.858	76.972	8.4	1010	614	45	16	1.0	209.0	4.0	6.0	67.0	248	80	9	7.00	0.0

Annexure-VI: Long term trend (2010-2019) of Ground water monitoring wells

S. No.	District	Taluka	Village	Latitude	Longitude	Pre trend (m /year)	Post trend (m /year)	Source
1	Parbhani	Palam	Anjanawadi-1	19.0194	76.8347	-0.268648	0.542262	CGWB
2	Parbhani	Sonpeth	Avalgaon	18.9739	76.6144	-0.544643	0.101786	CGWB
3	Parbhani	Jintur	Bori	19.4856	76.7225	-0.0714286	0.617857	CGWB
4	Parbhani	Jintur	Charthana-1	19.6222	76.5392	-0.333929	0.91	CGWB
5	Parbhani	Selu	Chikhalthana	19.55	76.4833	0.165758	-0.44679	CGWB
6	Parbhani	Parbhani	Daithana	19.0711	76.7158	-0.144286	0.281429	CGWB
7	Parbhani	Selu	Devgaon	19.6142	76.4625	-0.625	-0.42143	CGWB
8	Parbhani	Parbhani	Dharmapur	19.2964	76.7508	-0.48	2.37429	CGWB
9	Parbhani	Gangakhed	Gangakhed-1	18.9681	76.75	-0.500943	-0.18	CGWB
10	Parbhani	Gangakhed	Gangakhed-3	18.9656	76.7311	-0.173881	-0.3597	CGWB
11	Parbhani	Gangakhed	Gojegaon	19.5394	76.9444	-0.241939	-0.15333	CGWB
12	Parbhani	Pathri	Hadgaon_Pz	19.3	76.3	-1.3	-3.07335	CGWB
13	Parbhani	Pathri	Hadgaon-1	19.3	76.3	-0.551311	-0.62	CGWB
14	Parbhani	Gangakhed	Isath	18.9117	76.7781	-1.03929	0.251429	CGWB
15	Parbhani	Jintur	Jintur	19.6167	76.6833	0.801892	0.014849	CGWB
16	Parbhani	Parbhani	Karegaon	19.2661	76.8225	0.0264286	0.937888	CGWB
17	Parbhani	Parbhani	Kausdi_Pz	19.3875	76.6875	1.05279	-0.1268	CGWB
18	Parbhani	Palam	Kerwadi	18.9833	76.8667	-0.583879	-0.24152	CGWB
19	Parbhani	Parbhani	Kotamwadi	19.1167	76.7333	-0.197577	-0.24833	CGWB
20	Parbhani	Jintur	Mankeswar	19.6833	76.7	-0.174424	-0.12515	CGWB
21	Parbhani	Manwat	Manwat	19.3	76.4833	0.0912121	-0.00697	CGWB
22	Parbhani	Sonpeth	Narwadi_Pz	19.0042	76.5583	0.170753	-3.60113	CGWB
23	Parbhani	Jintur	Panchegaon-1	19.5558	76.7094	0.0244048	0.084524	CGWB
24	Parbhani	Jintur	Pangri	19.5625	76.6942	0.264286	0.582143	CGWB
25	Parbhani	Pathri	Pathri-1	19.2764	76.4322	1.2325	0.102174	CGWB

S. No.	District	Taluka	Village	Latitude	Longitude	Pre trend (m /year)	Post trend (m /year)	Source
26	Parbhani	Parbhani	Pedgaon2	19.325	76.6583	0.14958	-0.07788	CGWB
27	Parbhani	Gangakhed	Rani Sawargaon-1	18.8783	76.8494	-1.09821	-0.12453	CGWB
28	Parbhani	Selu	Selu	19.3681	76.4042	0.393515	-0.02891	CGWB
29	Parbhani	Parbhani	Singanapur	19.175	76.7417	0.0457917	-0.18939	CGWB
30	Parbhani	Purna	Tadkalas	19.1333	76.9333	0.135346	-0.21433	CGWB
31	Parbhani	Manwat	Tarborgaon	19.3239	76.6083	0.55	0.575	CGWB
32	Parbhani	Sonpeth	Wadgaon	18.9425	76.6475	-1.01786	-0.3875	CGWB
33	Parbhani	Pathri	Wadi Pati	19.305	76.3478	-0.208929	0.805357	CGWB
34	Parbhani	Selu	Walur-1	19.4897	76.5514	0.289714	0.486071	CGWB
35	Parbhani	Gangakhed	Dongar pimpla	18.8542	76.6778	-0.0857576	0.124545	GSDA
36	Parbhani	Gangakhed	Dhangar moha	18.8917	76.6611	-0.271515	-0.23152	GSDA
37	Parbhani	Palam	Isad	18.8972	76.8936	0.0672973	-0.28167	GSDA
38	Parbhani	Palam	Kerwadi	18.9353	77.0167	-0.336364	-0.25076	GSDA
39	Parbhani	Sonpeth	Nila I	18.9417	76.6347	-0.644242	-0.61606	GSDA
40	Parbhani	Gangakhed	Ban pimpla	18.9486	76.6861	-0.0533333	-0.20742	GSDA
41	Parbhani	Gangakhed	Gangakhed	18.9667	76.75	-0.219697	-0.40515	GSDA
42	Parbhani	Palam	Pendu Bk	18.9722	77.0278	0.00030303	-0.31985	GSDA
43	Parbhani	Sonpeth	Dighol Islampur	18.9778	76.4903	-0.129583	-0.11212	GSDA
44	Parbhani	Gangakhed	Dharkheda	18.9792	76.7417	-0.427879	-0.68727	GSDA
45	Parbhani	Gangakhed	Mahatpuri	18.9986	76.7	-0.0151515	-0.01667	GSDA
46	Parbhani	Sonpeth	Narwadi	19.0014	76.5625	-0.039697	-0.44939	GSDA
47	Parbhani	Sonpeth	Khadka	19.0083	76.6236	-0.0381818	-0.04606	GSDA
48	Parbhani	Gangakhed	Muli	19.0111	76.7542	-0.0872727	-0.2	GSDA
49	Parbhani	Palam	Palam	19.0139	76.95	0.559394	0.093939	GSDA
50	Parbhani	Gangakhed	Khali	19.0292	76.7083	-0.796364	-1.44	GSDA
51	Parbhani	Palam	Kharab Dhanora	19.0361	77.0319	-0.186667	-0.02424	GSDA

S. No.	District	Taluka	Village	Latitude	Longitude	Pre trend (m /year)	Post trend (m /year)	Source
52	Parbhani	Palam	Parwa	19.0458	77.0486	0.367273	0.032121	GSDA
53	Parbhani	Palam	Sheikh Rajura	19.05	77.0167	-0.0606061	-0.08091	GSDA
54	Parbhani	Palam	Chudawa	19.05	77.0167	-0.715758	-0.08833	GSDA
55	Parbhani	Sonpeth	Shirsi Bk	19.075	76.6069	-0.147879	0.046364	GSDA
56	Parbhani	Palam	Pharkanda	19.0792	76.9792	0.0793939	-0.10712	GSDA
57	Parbhani	Parbhani	Daithana	19.0833	76.7222	-0.121818	-0.36788	GSDA
58	Parbhani	Purna	Katneshwar	19.1111	77.0292	-1.55878	-0.14758	GSDA
59	Parbhani	Purna	Runj T Purna	19.1222	77.1181	0.234242	-0.0603	GSDA
60	Parbhani	Purna	Tadkalas	19.1333	76.9333	0.134545	-0.00424	GSDA
61	Parbhani	Parbhani	Tad pangri	19.1369	76.7358	-0.181515	-0.52515	GSDA
62	Parbhani	Purna	Ekrukha	19.1583	76.9686	-0.858485	-0.42849	GSDA
63	Parbhani	Purna	Sirkalas	19.1611	76.9194	0.211515	-0.07152	GSDA
64	Parbhani	Parbhani	Borwand bk	19.1625	76.7028	0.0672727	-0.08303	GSDA
65	Parbhani	Purna	Balsa Bk	19.1764	76.9186	0.0266216	-0.15046	GSDA
66	Parbhani	Parbhani	Tadlimla	19.1767	76.8636	-0.382727	-0.00652	GSDA
67	Parbhani	Parbhani	Pingali	19.21	76.8583	0.101818	0.091061	GSDA
68	Parbhani	Pathri	Kansur	19.2222	76.475	-0.14	-0.49227	GSDA
69	Parbhani	Pathri	Renapur-I	19.225	76.4792	-0.613939	-0.02848	GSDA
70	Parbhani	Pathri	Pathri	19.25	76.4344	0.406061	0.536364	GSDA
71	Parbhani	Pathri	Banegaon	19.2542	76.2597	0.124848	0.319394	GSDA
72	Parbhani	Manwat	Palodi	19.2542	76.6042	-0.0939394	-0.13697	GSDA
73	Parbhani	Pathri	Niwali	19.2625	76.3694	0.434545	0.354545	GSDA
74	Parbhani	Parbhani	Parbhani	19.2625	76.775	0.0118182	-0.09591	GSDA
75	Parbhani	Parbhani	Asola	19.2667	76.8583	-1.74545	-1.3	GSDA
76	Parbhani	Parbhani	Nandgaon bk	19.2917	76.8958	-0.241212	-0.39273	GSDA
77	Parbhani	Pathri	Pathargavhan bk	19.3014	76.275	0.227273	0.085354	GSDA

S. No.	District	Taluka	Village	Latitude	Longitude	Pre trend (m /year)	Post trend (m /year)	Source
78	Parbhani	Manwat	Manwat	19.3028	76.4989	0.106061	-0.07015	GSDA
79	Parbhani	Parbhani	Dharmapuri	19.3056	76.7472	1.5197	1.43924	GSDA
80	Parbhani	Parbhani	Murumba	19.3056	76.875	-0.843636	-0.88636	GSDA
81	Parbhani	Pathri	Zari	19.3125	76.4403	0.0606061	0.015152	GSDA
82	Parbhani	Parbhani	Pedgaon	19.3208	76.6639	-0.0215152	-0.29879	GSDA
83	Parbhani	Manwat	Manoli	19.3417	76.4917	-0.284848	-0.14803	GSDA
84	Parbhani	Parbhani	Takli kumbharna	19.3417	76.7528	0.0821212	-0.31591	GSDA
85	Parbhani	Manwat	Kolha	19.3542	76.5542	-0.266667	-0.38652	GSDA
86	Parbhani	Manwat	Narlad	19.3542	76.5708	0.0866667	-0.08364	GSDA
87	Parbhani	Parbhani	Nandapur	19.3653	76.7383	-0.243636	-0.43152	GSDA
88	Parbhani	Selu	Dhengli Pimpalgaon	19.3958	76.4986	-1.22667	-1.12348	GSDA
89	Parbhani	Parbhani	Takli Bobale	19.4028	76.8792	-0.118514	-0.02727	GSDA
90	Parbhani	Selu	Gava T	19.4167	76.6125	0.270541	-0.00939	GSDA
91	Parbhani	Selu	Shinde Takli	19.4194	76.2931	-2.14	-1.81848	GSDA
92	Parbhani	Selu	Mahalsapur I	19.4208	76.4056	-1.56788	-1.71182	GSDA
93	Parbhani	Selu	Kawada	19.425	76.5444	-0.272727	-0.17333	GSDA
94	Parbhani	Jintur	Dudhgaon	19.4375	76.8333	0.0418182	-0.12273	GSDA
95	Parbhani	Selu	Selu	19.4506	76.4472	1.07	0.334286	GSDA
96	Parbhani	Selu	Rewalgaon	19.4653	76.3889	-1.14727	-1.08636	GSDA
97	Parbhani	Jintur	Asegaon	19.4653	76.8472	0.0445455	-0.37606	GSDA
98	Parbhani	Selu	Pimpri Kh	19.4667	76.4569	0.148485	-0.03545	GSDA
99	Parbhani	Selu	Gulkhand	19.4667	76.6069	-0.63973	-0.04121	GSDA
100	Parbhani	Jintur	Karwali	19.4722	76.7806	-1.20788	-0.41667	GSDA
101	Parbhani	Selu	Brahmangaon	19.4764	76.5125	-1.18091	-0.24924	GSDA
102	Parbhani	Jintur	Zari	19.4917	76.7728	-0.775152	-0.55606	GSDA
103	Parbhani	Jintur	Bori	19.4928	76.7319	-0.362424	-0.22424	GSDA

S. No.	District	Taluka	Village	Latitude	Longitude	Pre trend (m /year)	Post trend (m /year)	Source
104	Parbhani	Jintur	Wassa	19.5128	76.8333	0.134545	-0.1953	GSDA
105	Parbhani	Jintur	Nagapur	19.5228	76.7208	-0.0748485	-0.39455	GSDA
106	Parbhani	Selu	Chikalthana Bk	19.5583	76.4861	0.415455	-0.30606	GSDA
107	Parbhani	Jintur	Adgaon bazar	19.5661	76.8667	-0.0248485	0.059091	GSDA
108	Parbhani	Jintur	Bhogaon	19.5736	76.7625	-0.485152	-0.22758	GSDA
109	Parbhani	Jintur	Mohkheda	19.6061	76.8544	0.113636	-0.0753	GSDA
110	Parbhani	Jintur	Pimprala-I	19.6125	76.6111	-0.646757	-0.44455	GSDA
111	Parbhani	Jintur	Jintur	19.6139	76.7569	0.0642424	-0.17546	GSDA
112	Parbhani	Jintur	Charthana	19.625	76.5389	0.0278788	-0.10303	GSDA
113	Parbhani	Jintur	Jogwada	19.625	76.5875	-0.0909091	-0.28515	GSDA
114	Parbhani	Selu	Borkini	19.6458	76.4708	-0.196061	-0.05773	GSDA
115	Parbhani	Jintur	Kehal	19.6667	76.65	0.134545	-0.06273	GSDA
116	Parbhani	Jintur	Bhosi	19.675	76.6528	-0.106667	-0.46182	GSDA
117	Parbhani	Jintur	Ambarwadi	19.7269	76.6642	-0.494848	-0.30076	GSDA
118	Parbhani	Jintur	Bamni bk	19.7703	76.6547	-0.533333	0.076212	GSDA
119	Parbhani	Jintur	Kolpa	19.785	76.635	-0.146364	-0.08273	GSDA

Annexure VII: Location of proposed Percolation tanks in Parbhani District

S.NO.	Village	Block
1	Waghi (Dhanora)	Jintur
2	Bhambri	Jintur
3	Bhambri	Jintur
4	Karanji	Selu
5	Zodgaon	Selu
6	Ambegaon Diger	Selu
7	Kundi	Selu
8	Mhalasapur	Selu
9	Zodgaon	Selu
10	Salegaon	Selu
11	Jawala Jivaji	Selu
12	Borkini	Selu
12	Chikhalthana Kh	Selu
13	Karanji	Selu
14	Zodgaon	Selu
15	Gopegaon	Pathri
16	Gopegaon	Pathri
17	Kasapuri	Pathri
18	Warkheda	Pathri
19	Kinhola Kh	Pathri
20	Hadgaon Bk	Pathri
21	Babultar	Pathri
22	Takalgavhan	Pathri
23	Babultar	Pathri
24	Babultar	Pathri
25	Loni Bk	Pathri
26	Kansur	Pathri
27	Kansur	Pathri
28	Limba	Pathri
29	Vita Bk	Pathri
30	Mudgal	Pathri
31	Limba	Pathri
32	Limba	Pathri
33	Waghala	Pathri
34	Waghala	Pathri
35	Gopegaon	Pathri
36	Gopegaon	Pathri
37	Warkheda	Pathri
38	Kinhola Kh	Pathri
39	Hadgaon Bk	Pathri
40	Babultar	Pathri

S.NO.	Village	Block
41	Takalgavhan	Pathri
42	Babultar	Pathri
43	Babultar	Pathri
44	Manwath (M Cl)	Manwat
45	Manwath (M Cl)	Manwat
46	Manwat Road	Manwat
47	Manoli	Manwat
48	Karanji	Manwat
49	Karanji	Manwat
50	Manoli	Manwat
51	Manoli	Manwat
52	Manwath (M Cl)	Manwat
53	Ukkalgaon	Manwat
54	Itali	Manwat
55	Kinhola Bk	Manwat
56	Kinhola Bk	Manwat
57	Rame Takli	Manwat
58	Lohara	Manwat
59	Mandewadgaon	Manwat
60	Manwath (M Cl)	Manwat
61	Manwath (M Cl)	Manwat
62	Ukkalgaon	Manwat
63	Itali	Manwat
64	Kinhola Bk	Manwat
65	Manwath (M Cl)	Parbhani
66	Ukkalgaon	Parbhani
67	Itali	Parbhani
68	Kinhola Bk	Parbhani
69	Kinhola Bk	Parbhani
70	Manwath (M Cl)	Parbhani
71	Ukkalgaon	Parbhani
72	Itali	Parbhani
73	Kinhola Bk	Parbhani
74	Kinhola Bk	Parbhani
75	Manwath (M Cl)	Parbhani
76	Ukkalgaon	Parbhani
77	Itali	Parbhani
78	Kinhola Bk	Parbhani
79	Kinhola Bk	Parbhani
80	Manwath (M Cl)	Parbhani
81	Ukkalgaon	Parbhani

S.NO.	Village	Block
82	Itali	Parbhani
83	Kinhola Bk	Parbhani
84	Kinhola Bk	Parbhani
85	Manwath (M Cl)	Parbhani
86	Ukkalgaon	Parbhani
87	Itali	Parbhani
88	Kinhola Bk	Parbhani
89	Kinhola Bk	Parbhani
90	Manwath (M Cl)	Parbhani
91	Manwath (M Cl)	Parbhani
92	Ukkalgaon	Parbhani
93	Itali	Parbhani
94	Ukkalgaon	Parbhani
95	Itali	Parbhani
96	Kinhola Bk	Parbhani
97	Ukkalgaon	Parbhani
98	Katneshwar	Purna
99	Katneshwar	Purna
98	Katneshwar	Purna
99	Aherwadi	Purna
100	Aherwadi	Purna
101	Pimpari deshmukh	Purna
102	Pimpari deshmukh	Purna
103	Babhali	Purna
104	Nawaki	Purna
105	Kaudgaon tarf purna	Purna
106	Surwadi	Purna
107	Surwadi	Purna
108	Purna (M Cl)	Purna
109	Purna (M Cl)	Purna
110	Mamdapur	Purna
111	Khujada	Purna
112	Ekrukha tarf gangakhed	Purna
113	Nila	Purna
114	Dhanora Kale	Purna
115	Dhanora Kale	Purna
116	Banegaon	Purna
117	Mahagaon	Purna
118	Ganpur	Purna
119	Suhagan	Purna
120	Suhagan	Purna
121	Ganpur	Purna
122	Purna (M Cl)	Purna

S.NO.	Village	Block
123	Kanhegaon	Purna
124	Kanhegaon	Purna
125	Katneshwar	Purna
126	Katneshwar	Purna
127	Katneshwar	Purna
128	Aherwadi	Purna
129	Aherwadi	Purna
130	Dhanora Kale	Purna
131	Dhanora Kale	Purna
132	Banegaon	Purna
133	Mahagaon	Purna
134	Ganpur	Purna
135	Suhagan	Purna
136	Ganpur	Purna
137	Shelgaon Maratha	Sonpeth
138	Shelgaon Maratha	Sonpeth
139	Saikheda	Sonpeth
140	Saikheda	Sonpeth
141	Saikheda	Sonpeth
142	Chukar Pimpri	Sonpeth
143	Chukar Pimpri	Sonpeth
144	Kothala	Sonpeth
145	Naikota	Sonpeth
146	Naikota	Sonpeth
147	Naikota	Sonpeth
148	Kothala	Sonpeth
149	Awalgaon	Sonpeth
150	Awalgaon	Sonpeth
151	Wadi Naikata	Sonpeth
152	Nila	Sonpeth
153	Naikota	Sonpeth
154	Dhamoni	Sonpeth
155	Naikota	Sonpeth
156	Wadgaon	Sonpeth
157	Wadgaon	Sonpeth
158	Karam	Sonpeth
159	Harangul	Sonpeth
160	Shelgaon Maratha	Sonpeth
161	Awalgaon	Sonpeth
162	Awalgaon	Sonpeth
163	Wadi Naikata	Sonpeth
164	Nila	Sonpeth
165	Naikota	Sonpeth

S.NO.	Village	Block
166	Dhamoni	Sonpeth
162	Dampuri	Gangakhed
163	Dampuri	Gangakhed
164	Dampuri	Gangakhed
165	Pimpaldari	Gangakhed
166	Supa (khal	Gangakhed
167	Supa (khal	Gangakhed
168	Belwadi	Gangakhed
169	Ghantagra	Gangakhed
170	Ghantagra	Gangakhed
171	Supa (khal	Gangakhed
172	Gunjegaon	Gangakhed
173	Gaulwadi	Gangakhed
174	Sadgirwadi	Gangakhed
175	Landakwadi	Gangakhed
176	Umbarwadi	Gangakhed
177	Limbewadi	Gangakhed
178	Limbewadi	Gangakhed
179	Bothi	Gangakhed
180	Ilegaon	Gangakhed
181	Gopa	Gangakhed
182	Gopa	Gangakhed
183	Gaundgaon	Gangakhed
184	Khali	Gangakhed
185	GANGAKHED	Gangakhed
186	Gangakhed	Gangakhed
187	Gangakhed	Gangakhed
188	Shendga	Gangakhed
189	Dhangar Mo	Gangakhed
190	Dampuri	Gangakhed
191	Supa (khal	Gangakhed
192	Belwadi	Gangakhed
193	Ghantagra	Gangakhed
194	Ghantagra	Gangakhed
195	Supa (khal	Gangakhed
196	Gunjegaon	Gangakhed
197	Gaulwadi	Gangakhed

S.NO.	Village	Block
198	Sadgirwadi	Gangakhed
199	Sadgirwadi	Gangakhed
200	Landakwadi	Gangakhed
201	Umbarwadi	Gangakhed
202	Limbewadi	Gangakhed
203	Limbewadi	Gangakhed
204	Banwas	Palam
205	Mozamabad	Palam
206	Girdharwadi	Palam
207	Tandulwadi	Palam
208	Landakwadi	Palam
209	Pokharni Devi	Palam
210	Warkhed	Palam
211	Selu	Palam
212	Sheikh Rajura	Palam
213	Digras	Palam
214	Peth Pimpalgaon	Palam
215	Chatori	Palam
216	Navhalgaon	Palam
217	Ajamabad	Palam
218	Teljapur	Palam
219	Chorwad	Palam
220	Martandwadi	Palam
221	Girdharwadi	Palam
222	Umra	Palam
223	Khoras	Palam
224	Umra	Palam
225	Chatori	Palam
226	Pendu Bk.	Palam
227	Selu	Palam
228	Banwas	Palam
229	Warkhed	Palam
230	Selu	Palam
231	Sheikh Rajura	Palam
232	Digras	Palam
233	Peth Pimpalgaon	Palam
234	Chatori	Palam

Note: Construction of AR structures may be taken up at these sites after field checks/verification only

Annexure VIII: Location of proposed Check dams in Parbhani District

S.NO.	Village	Block
1	Mankeshwar	Jintur
2	Bhogaon	Jintur
3	Reedaj	Jintur
4	Kurhadi	Jintur
5	Korwadi	Jintur
6	Mankeshwar	Jintur
7	Bhogaon	Jintur
8	Khairi	Selu
9	Nagthana	Selu
10	Jawala Jivaji	Selu
11	Chikhalthana Bk	Selu
12	Ambegaon Diger	Selu
13	Nipani Takali	Selu
14	Mhalasapur	Selu
15	Mhalasapur	Selu
16	Dhanegaon	Selu
17	Dhengli Pimpalgaon	Selu
18	Walangwadi	Selu
19	Dhengli Pimpalgaon	Selu
20	Zodgaon	Selu
21	Zodgaon	Selu
22	Zodgaon	Selu
23	Chikhalthana Bk	Selu
24	Chikhalthana Bk	Selu
25	Chikhalthana Bk	Selu
26	Kumbhari (Pargane Charthana)	Selu
27	Khairi	Selu
28	Nagthana	Selu
29	Jawala Jivaji	Selu
30	Chikhalthana Bk	Selu
31	Ambegaon Diger	Selu
32	Nipani Takali	Selu
33	Dhanegaon	Selu
34	Dhengli Pimpalgaon	Selu
35	Walangwadi	Selu
36	Chikhalthana Bk	Selu
37	Chikhalthana Bk	Selu
38	Jawala Jivaji	Selu
39	Chikhalthana Bk	Selu
40	Ambegaon Diger	Selu
41	Nipani Takali	Selu
42	Dhanegaon	Selu
43	Khairi	Selu
44	Nagthana	Selu
45	Jawala Jivaji	Selu
46	Chikhalthana Bk	Selu
47	Limba	Pathri
48	Limba	Pathri
49	Limba Tanda	Pathri
50	Mudgal	Pathri

S.NO.	Village	Block
51	Mudgal	Pathri
52	Loni Bk	Pathri
53	Loni Bk	Pathri
54	Loni Bk	Pathri
55	Chate Pimpalgaon	Pathri
56	Kansur	Pathri
57	Waghala	Pathri
58	Babultar	Pathri
59	Babultar	Pathri
60	Babultar	Pathri
61	Babhulgaon	Pathri
62	Loni Bk	Pathri
63	Waghala	Pathri
64	Waghala	Pathri
65	Waghala	Pathri
66	Babultar	Pathri
67	Babultar	Pathri
68	Babultar	Pathri
69	Babultar	Pathri
70	Loni Bk	Pathri
71	Babhulgaon	Pathri
72	Waghala	Pathri
73	Waghala	Pathri
74	Waghala	Pathri
75	Limba	Pathri
76	Limba	Pathri
77	Limba	Pathri
78	Limba	Pathri
79	Tarugavhan	Pathri
80	Tarugavhan	Pathri
81	Vita Bk	Pathri
82	Vita Bk	Pathri
83	Vita Bk	Pathri
84	Anandnagar (vitatanda)	Pathri
85	Umara	Pathri
86	Umara	Pathri
87	Kansur	Pathri
88	Kansur	Pathri
89	Babhulgaon	Pathri
90	Babhulgaon	Pathri
91	Sarola Bk	Pathri
92	Pathargavhan Bk	Pathri
93	Pathargavhan Bk	Pathri
94	Dongargaon	Pathri
95	Dongargaon	Pathri
96	Dongargaon	Pathri
97	Renakhali	Pathri
98	Zari	Pathri
99	Gopegaon	Pathri
100	Gopegaon	Pathri

S.NO.	Village	Block
101	Daku Pimpri	Pathri
102	Kansur	Pathri
103	Umara	Pathri
104	Kansur	Pathri
105	Kansur	Pathri
106	Babhulgaon	Pathri
107	Babhulgaon	Pathri
108	Umara	Pathri
109	Kansur	Pathri
110	Gopegaon	Pathri
111	Daku Pimpri	Pathri
112	Kansur	Pathri
113	Gopegaon	Pathri
114	Daku Pimpri	Pathri
115	Babultar	Pathri
116	Babhulgaon	Pathri
117	Loni Bk	Pathri
118	Waghala	Pathri
119	Babultar	Pathri
120	Loni Bk	Pathri
121	Loni Bk	Pathri
122	Mandewadgaon	Manwat
123	Manwath (M Cl)	Manwat
124	Pimpla	Manwat
125	Bondarwadi	Manwat
126	Bondarwadi	Manwat
127	Nagar Jawala	Manwat
128	Manwath (M Cl)	Manwat
129	Manwath (M Cl)	Manwat
130	Lohara	Manwat
131	Lohara	Manwat
132	Kinhola Bk	Manwat
133	Kinhola Bk	Manwat
134	Rame Takli	Manwat
135	Rame Takli	Manwat
136	Kekar Jawala	Manwat
137	Kekar Jawala	Manwat
138	Chate Pimpalgaon	Manwat
139	Mangrul Bk	Manwat
140	Pohandul	Manwat
141	Mangrul Bk	Manwat
142	Rame Takli	Manwat
143	Wazur Bk	Manwat
144	Pohandul	Manwat
145	Rampuri Bk	Manwat
146	Kumbhari (Ganga Kinara)	Manwat
147	Kumbhari (Ganga Kinara)	Manwat
148	Mudgal	Manwat
149	Wazur Kh	Manwat
150	Wadi Pimpalgaon	Manwat
151	Rampuri Bk	Manwat
152	Rampuri Bk	Manwat
153	Karanji	Manwat

S.NO.	Village	Block
154	Karanji	Manwat
155	Manoli	Manwat
156	Manoli	Manwat
157	Manwath (M Cl)	Manwat
158	Manwath	Manwat
159	Irlad	Manwat
160	Irlad	Manwat
161	Irlad	Manwat
162	Kolha	Manwat
163	Rudhi	Manwat
164	Kolha	Manwat
165	Rudhi	Manwat
166	Manoli	Manwat
167	Manwath	Manwat
168	Wazur Kh	Manwat
169	Mandewadgaon	Manwat
170	Manwath	Manwat
171	Pimpla	Manwat
172	Bondarwadi	Manwat
173	Kinhola Bk	Manwat
174	Rame Takli	Manwat
175	Mandewadgaon	Manwat
176	Manwath	Manwat
177	Pimpla	Manwat
178	Bondarwadi	Manwat
179	Rudhi	Manwat
180	Manoli	Manwat
181	Wazur Kh	Manwat
182	Mandewadgaon	Manwat
183	Pedgaon	Parbhani
184	Pedgaon	Parbhani
186	Panhera	Parbhani
187	Ismailpur tarf parbhani	Parbhani
188	Shahapur	Parbhani
189	Takli kumbhakarna	Parbhani
190	Zari	Parbhani
191	Zari	Parbhani
192	Zari	Parbhani
193	Pimpla	Parbhani
194	Pimpla	Parbhani
195	Takli Bobade	Parbhani
196	Mangangaon	Parbhani
197	Matakarala	Parbhani
198	Sadegaon	Parbhani
183	Takli kumbhakarna	Parbhani
184	Takli kumbhakarna	Parbhani
185	Mohapuri	Parbhani
186	Mandakhali	Parbhani
187	Jangamwadi	Parbhani
188	Bhosa	Parbhani
189	Bhosa	Parbhani
190	Bhosa	Parbhani
191	Anandwadi	Parbhani

S.NO.	Village	Block
192	Pimpalgaon Thombare	Parbhani
193	Pimpalgaon Thombare	Parbhani
194	Surpimpari	Parbhani
195	Tamaswadi	Parbhani
196	Wadgaon tarf bharaswad	Parbhani
197	Indewadi	Parbhani
198	Wadgaon tarf bharaswad	Parbhani
199	Kuotamwadi	Parbhani
200	Indewadi	Parbhani
201	Indewadi	Parbhani
202	Singnapur	Parbhani
203	Pokharni	Parbhani
204	Tadpangari	Parbhani
205	Ambe takli	Parbhani
206	Tadpangari	Parbhani
207	Dampuri	Parbhani
208	Daithana	Parbhani
209	Porwad	Parbhani
210	Daithana	Parbhani
211	Rampuri Bk	Parbhani
212	Hatkarwadi	Parbhani
213	Pegargavhan	Parbhani
214	Bramhapuri tarf pathri	Parbhani
215	Bramhapuri tarf pathri	Parbhani
216	Singnapur	Parbhani
217	Singnapur	Parbhani
218	Borwand bk.	Parbhani
219	Pimpalgaon Thombare	Parbhani
220	Mangrul Bk	Parbhani
221	Anandwadi	Parbhani
222	Borwand bk.	Parbhani
223	Singnapur	Parbhani
224	Jawala	Parbhani
225	Sonula	Parbhani
226	Hasnapur	Parbhani
227	Singnapur	Parbhani
228	Takli kumbhakarna	Parbhani
229	Takli kumbhakarna	Parbhani
230	Samsapur	Parbhani
231	Durdi	Parbhani
232	Ismailpur tarf parbhani	Parbhani
233	Asola	Parbhani
234	Asola	Parbhani
235	Pingali	Parbhani
236	Pingali	Parbhani
237	Tattu jawala	Parbhani
238	Babhali	Parbhani
239	Dampuri	Parbhani
240	Daithana	Parbhani
241	Porwad	Parbhani
242	Daithana	Parbhani
243	Rampuri Bk	Parbhani
244	Hatkarwadi	Parbhani

S.NO.	Village	Block
245	Pegargavhan	Parbhani
246	Bramhapuri tarf pathri	Parbhani
247	Bramhapuri tarf pathri	Parbhani
248	Sadegaon	Parbhani
249	Takli kumbhakarna	Parbhani
250	Takli kumbhakarna	Parbhani
251	Mohapuri	Parbhani
252	Mandakhali	Parbhani
253	Jangamwadi	Parbhani
254	Bhosa	Parbhani
255	Bhosa	Parbhani
256	Bhosa	Parbhani
257	Anandwadi	Parbhani
258	Pedgaon	Parbhani
259	Panhera	Parbhani
260	Ismailpur tarf parbhani	Parbhani
261	Shahapur	Parbhani
262	Takli kumbhakarna	Parbhani
263	Zari	Parbhani
264	Wadgaon tarf bharaswad	Parbhani
265	Kuotamwadi	Parbhani
266	Indewadi	Parbhani
267	Indewadi	Parbhani
268	Singnapur	Parbhani
269	Pokharni	Parbhani
270	Takli Bobade	Parbhani
271	Mangangaon	Parbhani
272	Matakarala	Parbhani
273	Sadegaon	Parbhani
274	Takli kumbhakarna	Parbhani
275	Takli kumbhakarna	Parbhani
276	Mohapuri	Parbhani
277	Harangul	Sonpeth
278	Ukhali Bk.	Sonpeth
279	Ukhali Bk.	Sonpeth
280	Ukkadgaon Makta	Sonpeth
281	Wadi Naikata	Sonpeth
282	Wadi Naikata	Sonpeth
283	Karam	Sonpeth
284	Nila	Sonpeth
285	Wadgaon	Sonpeth
286	Saikheda	Sonpeth
287	Naikota	Sonpeth
288	Kothala	Sonpeth
289	Naikota	Sonpeth
290	Chukar Pimpri	Sonpeth
291	Chukar Pimpri	Sonpeth
292	Kothala	Sonpeth
293	Shelgaon Maratha	Sonpeth
294	Saikheda	Sonpeth
295	Saikheda	Sonpeth
296	Kanhegaon	Sonpeth
297	Saikheda	Sonpeth

S.NO.	Village	Block
298	Awalgaon	Sonpeth
299	Wandan	Sonpeth
300	Wandan	Sonpeth
301	Wandan	Sonpeth
302	Wadgaon	Sonpeth
303	Harangul	Sonpeth
304	Harangul	Sonpeth
305	Karam	Sonpeth
306	Wandan	Sonpeth
307	Kanhegaon	Sonpeth
308	Saikheda	Sonpeth
309	Wadi Naikata	Sonpeth
310	Naikota	Sonpeth
311	Naikota	Sonpeth
312	Bhisegaon	Sonpeth
313	Kothala	Sonpeth
314	Wanisangam	Sonpeth
315	Wanisangam	Sonpeth
316	Wanisangam	Sonpeth
317	Bondargaon	Sonpeth
318	Bondargaon	Sonpeth
319	Wadi Naikata	Sonpeth
320	Bondargaon	Sonpeth
321	Bondargaon	Sonpeth
322	Dhamoni	Sonpeth
323	Dhamoni	Sonpeth
324	Dhamoni	Sonpeth
325	Dighol Islampur	Sonpeth
326	Kothala	Sonpeth
327	Bondargaon	Sonpeth
328	Ukhali Bk.	Sonpeth
329	Ukhali Bk.	Sonpeth
330	Ukhali Bk.	Sonpeth
331	Dighol Islampur	Sonpeth
332	Kothala	Sonpeth
333	Shelgaon Maratha	Sonpeth
334	Sonpeth (M Cl)	Sonpeth
335	Dudhgaon	Sonpeth
336	Wanisangam	Sonpeth
337	Kothala	Sonpeth
338	Chukar Pimpri	Sonpeth
339	Chukar Pimpri	Sonpeth
340	Chukar Pimpri	Sonpeth
341	Wadi Naikata	Sonpeth
342	Wadgaon	Sonpeth
343	Saikheda	Sonpeth
344	Naikota	Sonpeth
345	Kothala	Sonpeth
346	Naikota	Sonpeth
347	Chukar Pimpri	Sonpeth
348	Chukar Pimpri	Sonpeth
349	Kothala	Sonpeth
350	Shelgaon Maratha	Sonpeth

S.NO.	Village	Block
351	Harangul	Sonpeth
352	Ukhali Bk.	Sonpeth
353	Ukhali Bk.	Sonpeth
354	Ukkadgaon Makta	Sonpeth
355	Wadi Naikata	Sonpeth
356	Wadi Naikata	Sonpeth
357	Ukhali Bk.	Sonpeth
358	Dighol Islampur	Sonpeth
359	Kothala	Sonpeth
360	Shelgaon Maratha	Sonpeth
361	Sonpeth	Sonpeth
362	Kothala	Sonpeth
363	Ukhali Bk.	Gangakhed
364	Mankadevi	Gangakhed
365	Dhangar Mo	Gangakhed
366	Khadgaon	Gangakhed
367	Pokharni W	Gangakhed
368	Akoli	Gangakhed
369	Suralwadi	Gangakhed
370	Margalwadi	Gangakhed
371	Margalwadi	Gangakhed
372	Gangakhed	Gangakhed
373	Gangakhed	Gangakhed
374	Gangakhed	Gangakhed
375	Margalwadi	Gangakhed
376	Kasarwadi	Gangakhed
377	Shankarwad	Gangakhed
378	Gangakhed	Gangakhed
379	Gangakhed	Gangakhed
380	Gangakhed	Gangakhed
381	Gaundgaon	Gangakhed
382	Chinchtakl	Gangakhed
383	Chinchtakl	Gangakhed
384	Rumna Jawl	Gangakhed
385	Sayala Sun	Gangakhed
386	Sunegaon S	Gangakhed
381	Dharkhed	Gangakhed
382	Gopa	Gangakhed
344	Mardasgaon	Gangakhed
345	Khandali	Gangakhed
346	Bothi	Gangakhed
347	Umbarwadi	Gangakhed
348	Umbarwadi	Gangakhed
349	Umbarwadi	Gangakhed
350	Dampuri	Gangakhed
351	Kundgirwad	Gangakhed
352	Supa (khal	Gangakhed
353	Gaulwadi	Gangakhed
354	Pangri	Gangakhed
355	Dampuri	Gangakhed
356	Makhani	Gangakhed
357	Pokharni W	Gangakhed
358	Pokharni W	Gangakhed

S.NO.	Village	Block
359	Bhendewadi	Gangakhed
360	Kasarwadi	Gangakhed
361	Gangakhed	Gangakhed
362	Gangakhed	Gangakhed
363	Malewadi	Gangakhed
364	Mairal Saw	Gangakhed
365	Mairal Saw	Gangakhed
366	Dharasur	Gangakhed
367	Khali	Gangakhed
368	Dusalgaon	Gangakhed
369	Dharasur	Gangakhed
370	Gangakhed	Gangakhed
371	Gangakhed	Gangakhed
372	Waghalgaon	Gangakhed
373	Waghalgaon	Gangakhed
374	Pimpri Zol	Gangakhed
375	Muli	Gangakhed
376	Dharasur	Gangakhed
377	Dharasur	Gangakhed
378	Narlad	Gangakhed
379	Tokwadi	Gangakhed
380	Dampuri	Gangakhed
381	Umbarwadi	Gangakhed
382	Ranisawarg	Gangakhed
383	Dampuri	Gangakhed
384	Kundgirwad	Gangakhed
385	Pandhargao	Gangakhed
386	Wagdara	Gangakhed
387	Khandali	Gangakhed
388	Ghantagra	Gangakhed
389	Dampuri	Gangakhed
390	Dampuri	Gangakhed
391	Dampuri	Gangakhed
392	Sadgirwadi	Gangakhed
393	Limbewadi	Gangakhed
394	Wagdara	Gangakhed
395	Ilegaon	Gangakhed
396	Gangakhed	Gangakhed
397	Chinchtakl	Gangakhed
398	Rumna Jawl	Gangakhed
399	Sayala Sun	Gangakhed
400	Sunegaon S	Gangakhed
401	Dharkhed	Gangakhed
402	Gopa	Gangakhed
403	Mardasgaon	Gangakhed
404	Khandali	Gangakhed
405	Bothi	Gangakhed
406	Umbarwadi	Gangakhed
407	Umbarwadi	Gangakhed
408	Umbarwadi	Gangakhed
409	Dhangar Mo	Gangakhed
410	Khadgaon	Gangakhed
411	Pokharni W	Gangakhed

S.NO.	Village	Block
412	Akoli	Gangakhed
413	Suralwadi	Gangakhed
414	Margalwadi	Gangakhed
415	Khandali	Gangakhed
416	Ghantagra	Gangakhed
417	Dampuri	Gangakhed
418	Dampuri	Gangakhed
419	Dampuri	Gangakhed
420	Sadgirwadi	Gangakhed
421	Limbewadi	Gangakhed
422	Wagdara	Gangakhed
423	Ilegaon	Gangakhed
424	Gangakhed	Gangakhed
425	Chinchtakl	Gangakhed
426	Rumna Jawl	Gangakhed
427	Sayala Sun	Gangakhed
428	Sunegaon S	Gangakhed
429	Umbarwadi	Gangakhed
430	Umbarwadi	Gangakhed
431	Dampuri	Gangakhed
432	Kundgirwad	Gangakhed
433	Supa (khal	Gangakhed
434	Gaulwadi	Gangakhed
435	Pangri	Gangakhed
436	Gaundgaon	Gangakhed
437	Chinchtakl	Gangakhed
438	Chinchtakl	Gangakhed
439	Rumna Jawl	Gangakhed
440	Sayala Sun	Gangakhed
441	Sunegaon S	Gangakhed
442	Dharkhed	Gangakhed
443	Gopa	Gangakhed
444	Mardasgaon	Gangakhed
445	Khandali	Gangakhed
446	Bothi	Gangakhed
447	Umbarwadi	Gangakhed
448	Umbarwadi	Gangakhed
449	Umbarwadi	Gangakhed
450	Dampuri	Gangakhed
451	Kundgirwad	Gangakhed
452	Supa (khal	Gangakhed
453	Pandhargao	Gangakhed
454	Wagdara	Gangakhed
455	Khandali	Gangakhed
456	Ghantagra	Gangakhed
457	Dampuri	Gangakhed
458	Dampuri	Gangakhed
459	Dampuri	Gangakhed
460	Tokwadi	Gangakhed
461	Dampuri	Gangakhed
462	Umbarwadi	Gangakhed
463	Ranisawarg	Gangakhed
464	Dampuri	Gangakhed

S.NO.	Village	Block
465	Kundgirwad	Gangakhed
466	Ghantagra	Gangakhed
467	Dampuri	Gangakhed
468	Dampuri	Gangakhed
469	Khadi	Palam
470	Bandarwadi	Palam
471	Bandarwadi	Palam
472	Anandwadi	Palam
473	Anandwadi	Palam
474	Martandwadi	Palam
475	Pokharni Devi	Palam
476	Landakwadi	Palam
477	Dongargaon (palam)	Palam
478	Dongargaon (palam)	Palam
479	Banwas	Palam
480	Mozamabad	Palam
481	Fattunaik Tanda	Palam
482	Girdharwadi	Palam
483	Girdharwadi	Palam
484	Girdharwadi	Palam
485	Girdharwadi	Palam
486	Banwas	Palam
487	Banwas	Palam
488	Banwas	Palam
489	Banwas	Palam
490	Tandulwadi	Palam
491	Ukkadgaon Jagir	Palam
492	Khadi	Palam
493	Mutkhed	Palam
494	Sipegaon	Palam
495	Pendu Kh.	Palam
496	Pendu Bk.	Palam
497	Pendu Bk.	Palam
498	Peth Shivani	Palam
499	Kolwadi	Palam
500	Peth Shivani	Palam
501	Peth Shivani	Palam
502	Sategaon	Palam
503	Sategaon	Palam
504	Kandalgaon	Palam
505	Masla	Palam
506	Masla	Palam
507	Ajamabad	Palam
508	Selu	Palam
509	Peth Shivani	Palam
510	Peth Pimpalgaon	Palam
511	Kapsi	Palam
511	Navha	Palam
512	Khoras	Palam
513	Sadlapur	Palam
514	Ramapur	Palam
515	Chorwad	Palam
516	Chatori	Palam

S.NO.	Village	Block
517	Umra	Palam
518	Selu	Palam
519	Mahadewadi	Palam
520	Mahadewadi	Palam
521	Banwas	Palam
522	Banwas	Palam
523	Navha	Palam
524	Selu	Palam
525	Sategaon	Palam
526	Sategaon	Palam
527	Peth Pimpalgaon	Palam
528	Navha	Palam
529	Ukkadgaon Jagir	Palam
530	Ukkadgaon Jagir	Palam
531	Pokharni Devi	Palam
532	Konerwadi	Palam
533	Banwas	Palam
534	Banwas	Palam
535	Dongargaon (palam)	Palam
536	Banwas	Palam
537	Mozamabad	Palam
538	Fattunaik Tanda	Palam
539	Girdharwadi	Palam
540	Girdharwadi	Palam
541	Girdharwadi	Palam
542	Pendu Bk.	Palam
543	Peth Shivani	Palam
544	Kolwadi	Palam
545	Peth Shivani	Palam
546	Peth Shivani	Palam
547	Sategaon	Palam
548	Sategaon	Palam
549	Masla	Palam
550	Ajamabad	Palam
551	Selu	Palam
552	Peth Shivani	Palam
553	Peth Pimpalgaon	Palam
554	Anandwadi	Palam
555	Martandwadi	Palam
556	Pokharni Devi	Palam
557	Landakwadi	Palam
558	Selu	Palam
559	Kanhegaon	Purna
560	Purna (M Cl)	Purna
561	Purna (M Cl)	Purna
562	Mategaon	Purna
563	Mategaon	Purna
564	Mategaon	Purna
565	Ganpur	Purna
566	Ganpur	Purna
567	Ganpur	Purna
568	Ganpur	Purna
569	Khambegaon	Purna

S.NO.	Village	Block
570	Khambegaon	Purna
571	Khujada	Purna
572	Khujada	Purna
573	Khambegaon	Purna
574	Khambegaon	Purna
575	Khujada	Purna
576	Sirkalas	Purna
577	Ekrukha tarf gangakhed	Purna
578	Ekrukha tarf gangakhed	Purna
579	Ekrukha tarf gangakhed	Purna
580	Nila	Purna
581	Tadkalas	Purna
582	Ekrukha tarf gangakhed	Purna
583	Tadkalas	Purna
584	Kalgaon	Purna
585	Kalgaon	Purna
586	Pharkanda	Purna
587	Mahagaon	Purna
588	Mahagaon	Purna
589	Pimpari deshmukh	Purna
590	Karjanapur	Purna
591	Kaudgaon tarf purna	Purna
592	Kaudgaon tarf purna	Purna
593	Yerndeshwar	Purna
594	Pimpalgaon balapur	Purna
595	Pimpalgaon balapur	Purna
596	Surwadi	Purna
597	Purna (M Cl)	Purna
598	Mategaon	Purna
599	Suhagan	Purna
600	Suhagan	Purna
601	Dhanora Kale	Purna
602	Dhanora Kale	Purna
603	Dhanora Kale	Purna
604	Dhanora Kale	Purna
605	Banegaon	Purna
606	Mahatpuri	Purna
607	Mahatpuri	Purna
608	Ganpur	Purna
609	Kaudgaon tarf purna	Purna
610	Pimpari deshmukh	Purna
611	Nawaki	Purna
612	Karjanapur	Purna
613	Yerndeshwar	Purna
614	Nandgaon kh.	Purna
615	Pimpalgaon balapur	Purna
616	Khujada	Purna
617	Pimpari deshmukh	Purna
618	Yerndeshwar	Purna
619	Ganpur	Purna

S.NO.	Village	Block
620	Ganpur	Purna
621	Khambegaon	Purna
622	Khambegaon	Purna
623	Pimpalgaon balapur	Purna
624	Surwadi	Purna
625	Purna (M Cl)	Purna
626	Mategaon	Purna
627	Suhagan	Purna
628	Suhagan	Purna
629	Dhanora Kale	Purna
630	Mahatpuri	Purna
631	Mahatpuri	Purna
632	Ganpur	Purna
633	Kaudgaon tarf purna	Purna
634	Pimpari deshmukh	Purna
635	Nawaki	Purna
636	Karjanapur	Purna
637	Kanhegaon	Purna
638	Purna (M Cl)	Purna
639	Suhagan	Purna
640	Dhanora Kale	Purna
641	Dhanora Kale	Purna
642	Ekrukha tarf gangakhed	Purna
643	Nila	Purna
644	Tadkalas	Purna
645	Mategaon	Purna
646	Mategaon	Purna
647	Ganpur	Purna
648	Ganpur	Purna
649	Kalgaon	Purna
650	Pharkanda	Purna
651	Mahagaon	Purna
652	Pimpari deshmukh	Purna
653	Nawaki	Purna
654	Karjanapur	Purna
655	Pharkanda	Purna
656	Mahagaon	Purna
657	Mahagaon	Purna
658	Pimpari deshmukh	Purna
659	Karjanapur	Purna
660	Kaudgaon tarf purna	Purna
661	Kaudgaon tarf purna	Purna
662	Yerndeshwar	Purna
663	Pimpalgaon balapur	Purna
664	Pimpalgaon balapur	Purna
665	Surwadi	Purna
666	Khujada	Purna
667	Pimpari deshmukh	Purna
668	Mategaon	Purna

Note: Construction of AR structures may be taken up at these sites after field checks/verification only