



केन्द्रीय भूमि जल बोर्ड

जल शक्ती मंत्रालय

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

भारत सरकार

CENTRAL GROUND WATER BOARD

Ministry of Jalshakti,
Division of Water Resources,
River Development & Ganga Rejuvenation
Government of India

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN NAGPUR DISTRICT, MAHARASHTRA

(AAP 2019-20)

मध्य क्षेत्र, नागपुर, Central Region, Nagpur

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**AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN
NAGPUR DISTRICT, MAHARASHTRA
(AAP 2019-20)
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NAGPUR DISTRICT AT A GLANCE

1. GENERAL INFORMATION		
Geographical Area	:	9892 sq.km
Administrative Divisions (2011)	:	14; Ramtek, Umred, Kalmeshwar, Katol, Kamthi, Kuhi, Narkhed, Nagpur, Nagpur (Rural), Parseoni, Bhiwapur, Mauda, Saoner, Hingna.
Villages	:	1859
Population (2011)	:	46,53,570
Average Annual Rainfall	:	1138.84 mm
Normal Rainfall	:	1139.4 mm
Actual Rainfall (2019)	:	1129.1 mm
2. GEOMORPHOLOGY		
Major Physiographic unit	:	Three; Northern hilly area, Western hilly area and Kanhan & Wena river valley area
Major Drainage	:	Two; Wardha and Wainganga
3. LAND USE (2018) (source: mahades.maharashtra.gov.in/district Report)		
Forest Area	:	2564.19 sq. km.
Net Area Sown	:	3964.69 sq. km.
Cultivable Area	:	6332.12sq. km.
4. SOIL TYPE	:	Loamy-clayey soils.
5. PRINCIPAL CROPS (2016-17)		
Cereals	:	187015 ha
Pulses	:	92405 ha
Cotton	:	142789 ha
Oil seeds	:	202096 ha
Sugarcane	:	1214 ha
6. IRRIGATION BY DIFFERENT SOURCES (2017-18)		
Nos. / Potential Created (ha)		
Irrigation wells	:	65218/68275.9 ha
Minor Irrigation	:	14106/65774 ha
Medium Irrigation	:	16/65786 ha
Major Irrigation	:	3/218205 ha
Net Irrigated Area	:	150293 ha
7. GROUND WATER MONITORING WELLS (2019)		
Dugwells	:	82
Piezometers	:	15
8. GEOLOGY		
Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Deccan Trap Basalt
Cretaceous	:	Lameta
Permo-carboniferous	:	Gondwana
Archeans	:	Sausars and Granitic gneiss

9. HYDROGEOLOGY		
	Water Bearing Formation	: Basalt- weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions. Alluvium-Sand and Gravel under phreatic and semi-confined to confined conditions.
	Pre-monsoon Depth to Water Level (May-2019)	: 1.5 mbgl (Sawali, Kuhi)- 32.4 mbgl (Parsodi wakil, Kalmeshwar)
	Post-monsoon Depth to Water Level (Nov.-2019)	: 0.1 mbgl (kadoli, kamtee)- 20.2 mbgl (Parsodi wakil, Kalmeshwar)
	Pre-monsoon Water Level Trend (2010-2019)	: Rise: 0.18 m/yr (Wadi naka-2.35 m/yr (Chichbhuwan)
		Fall: 0.002 m/yr (Amgaon) – 4.94 m/yr (Jalalkheda)
	Post-monsoon Water Level Trend (2010-2019)	: Rise: 0.006 m/yr (Ramdaspath) – 2.69 m/yr (Kondhali)
		Fall: 0.006 m/yr (Amgaon)-14.79 m/yr (Paradsinga)
10. GROUND WATER EXPLORATION (Upto 2019)		
	Wells Drilled	: EW-137 OW-57, Pz-38
	Depth Range	: 30.00 to 307.00 m bgl
	Discharge	: 0.14 – 14.00 lps
	Storativity	: 3.1×10^{-3} to 6.6×10^{-6}
	Transmissivity	: 8.10 to 1638.73 m ² /day (Basalt)
11. GROUND WATER QUALITY		
	Good and suitable for drinking and irrigation purpose, however localized nitrate/ fluoride contamination is observed.	
12. DYNAMIC GROUND WATER RESOURCES (ham) - (2017)		
	Net Annual Ground Water Availability	: 89604.53
	Total Extraction (Irrigation + Domestic+ Industrial)	: 45961.83
	Projected Demand (Domestic + Industrial)	: 10660.92
	Stage of Ground Water Development	: 51.29
	Overall Category	: Safe
13. MAJOR GROUND WATER PROBLEMS AND ISSUES		
	Ground water quality is adversely affected by nitrate / fluoride contamination. Declining water level trend both pre-monsoon and post-monsoon	
14.	Aquifer Management Plan	

	Supply side management	:	Proposed AR structures Percolation tanks: 354 Check dams: 1010 Expected Augmentation: 75.78 MCM/year
	Demand side management	:	Area Proposed for drip irrigation for Sugarcane: 2.02 sq km. Area Proposed for drip irrigation for Cotton: 28.75 sq km. Expected Saving: 9.88 MCM /year
	Expected Benefits	:	Stage of groundwater development gets reduced from 51.3 % to 46.28%. Balance Groundwater resource available: 230.53 MCM.
	Development Plan	:	Proposed no. of Dugwells: 13832 Proposed no. of Borewells:2305 These can provide assured irrigation to about 472.99 sq km.

**AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS
NAGPUR DISTRICT, MAHARASHTRA
(AAP 2019-20)
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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS NAGPUR DISTRICT, MAHARASHTRA

1. INTRODUCTION

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. To defeat the aftermath of this effect on groundwater, 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.

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 of ground water management through community participation. The aquifer maps and management plans will be shared with the Administration of Nagpur 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

Nagpur district is one of the eleven districts of Vidarbha Region and is located in the eastern region of Vidharbha of Maharashtra State. Nagpur Districts is located on 20°35' & 21° 44'N longitude & 78° 15' & 79° 40' E latitude. As per Survey of India toposheets Nagpur lies in 55/O, 55/K, 55/L & 55/P degree sheets. Towards the northern border of District, the Chindawara & Shiwani Districts of Madhya- Pradesh state is located, Bhandara District is towards eastern border, & towards southern border is Wardha District of Maharashtra. While towards south east border is

Chandrapur District of Maharashtra & towards north-west border is Amravati District of Maharashtra.

In 1853, after the death of Raghoji III, the princely state of Nagpur was annexed by the British and the territory occupied by the present district became part of the then Nagpur Province. In 1861, it was merged with the Central Provinces. In 1903 it became part of the Central Provinces and Berar. In 1950 Nagpur district was created as became part of the newly formed Madhya Pradesh state and Nagpur became its capital. In 1956, after a reorganisation of Indian states, Nagpur district was incorporated into Bombay state. On 1 May 1960, it became a district of Maharashtra state. It is the part of Nagpur Division. The district headquarters is located at Nagpur town. "Zero Mile" located in Nagpur, from here the distances throughout India are measured. All the Major highways & railways pass via Nagpur. This district is divided into 14 talukas - Ramtek, Umred, Kalmeshwar, Katol, Kamthi, Kuhi, Narkhed, Nagpur, Nagpur (Rural), Parseoni, Bhiwapur, Mauda, Saoner, Hingna. The Index and Administrative map of the district is presented in **Figure 1.1 and 1.2** respectively.

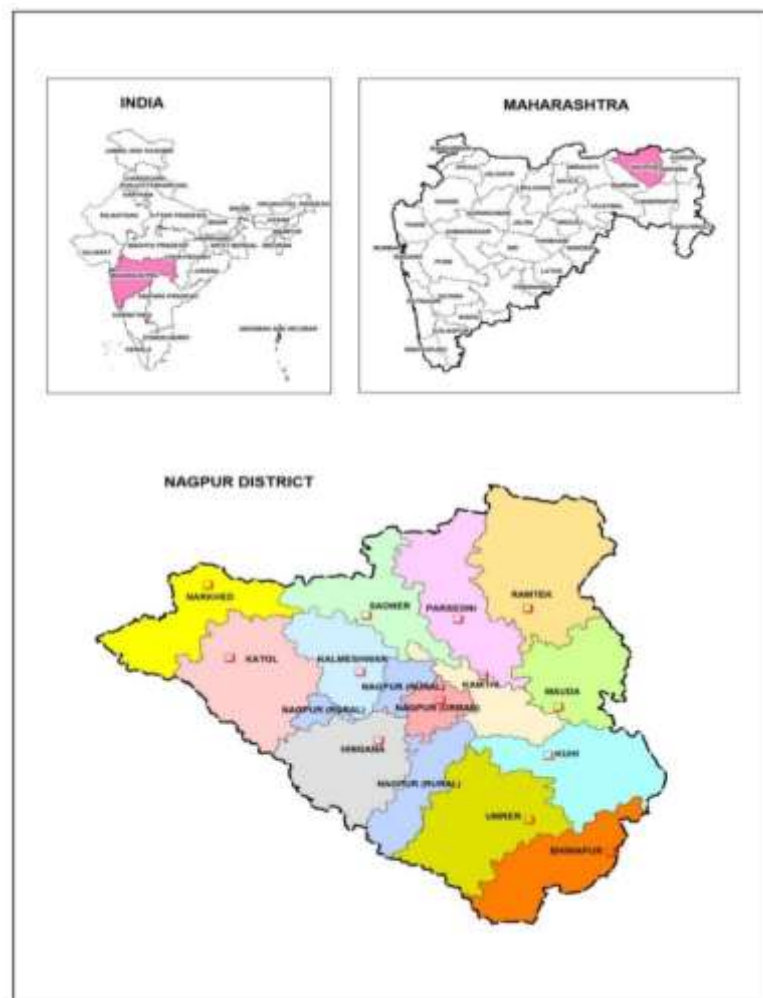


Figure 1.1. Index map of Nagpur District

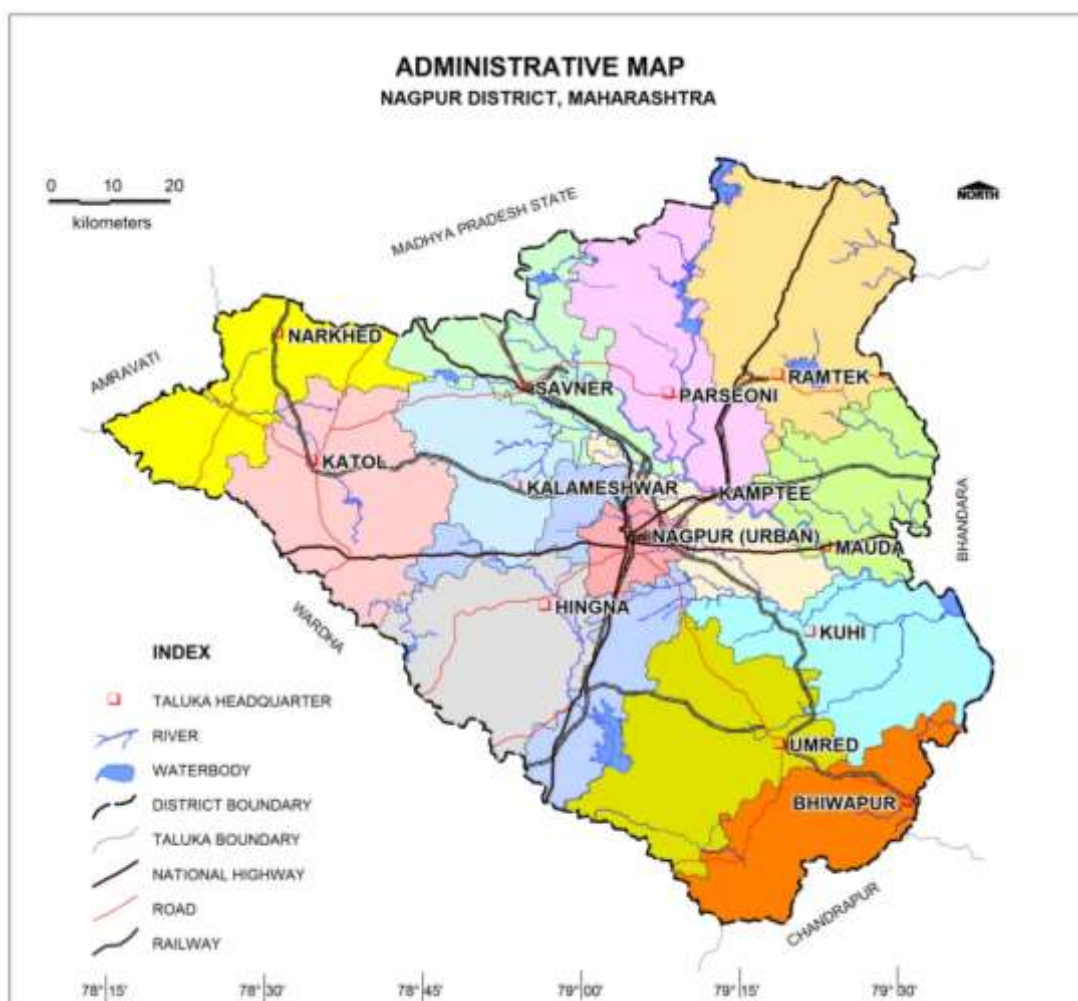


Figure 1.2. Administrative map of Nagpur District

The district forms part of Godavari basin. Wainganga River is the main river flowing through the district.

Nagpur district has been taken up under NAQUIM study during the year 2019-20. The total area of the district is about 9892 sq.km. The district is categorized as safe as per Ground Water Resources Estimation as on March 2017. Central Ground Water Board has taken up several studies in the district since 1970 to 2019 including Systematic Hydrogeological Survey, Reappraisal Hydrogeological Studies, Pollution Studies, Pilot Project of Aquifer Mapping, NAQUIM studies etc. The data generated have been shared with the Central, State agencies as well as with the stake holders in the form of reports, maps etc. Salient Features of Ground Water Exploration are given in **Annexure-I** and details of KOW established during AAP 2019-20 under NAQUIM are given in **Annexure-II**.

To assess the ground water regime, 94 existing ground water monitoring stations of CGWB being monitored 4 times in a year were used. Ground water exploration data was used to decipher sub-surface lithological disposition and hydrogeological setup of shallow aquifer (Aquifer-I) and deep aquifer (Aquifer). The details of monitoring wells are given in **Annexure-III**.

1.2 Geomorphology, Drainage and Soil Types

The Satpuda mountain ranges constitute the northern & north western part of Nagpur district. They show plateaus & hillocks landforms. Towards the east & north- east side of the district, few Satpuda mountain ranges are seen. The district forms part of Deccan Plateau having flat topped and terraced features. Eastward and north-eastwards the landscape changes due to the change in the underlying rocks. The rocks of Gondwana series present a low rolling topography with a poor soil cover and vegetation. On the north the upland ranges are the extension of Satpuras which gradually narrows down towards west. South of these upland range stretches the Ambegad hills, the western extremity of which is the Nagpur district. The Ramtek temple is on the spur of this range. The Girad hill range extends along the southeast and separates the valley of the Kar from that of Jamb up to Kondhali. Another main hill range runs northwards through Katol taluka from Kondhali to Kelod separating the Wardha and Wainganga valleys. The central part of the district is plain terrain. District has the highest altitude of 652m above mean sea level, in the northern side and the lowest altitude of 274m above mean sea level near the Kanhan River of the district.

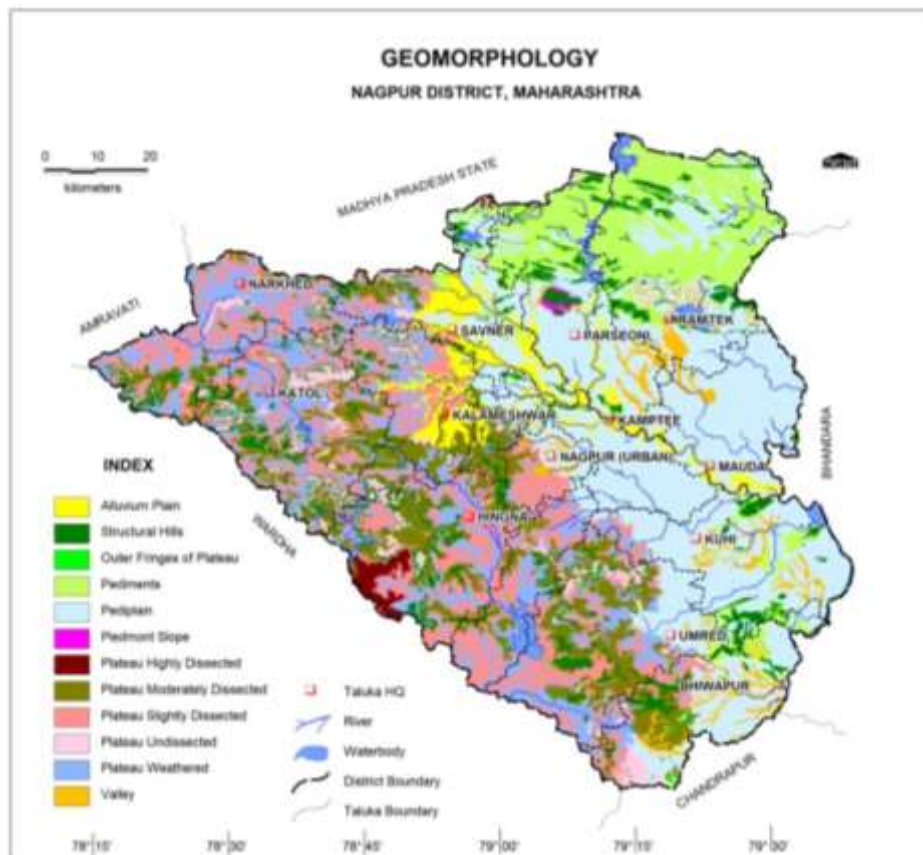


Figure 1.3: Geomorphology

Nagpur District is drained by the Wainganga and Wardha Rivers, the northern, north-eastern & south-eastern part of the district is occupied by Wainganga river basin. The Wainganga basin has its river sub basin like Kanhan, Pench, Kolar, Bawanthadi, Sur, Aam & Maru. All these rivers flow from north, north-

CGWB, CR, Nagpur

east towards south, south-east. The Chandrabhaga & Nag River flow from west towards east & meet the Kolar Sub Rivers. The Kanhan, Pench, Kolar, Bawanthadi Chandrabhaga & Nag Rivers are perennial.

The North –west, west & south-west part of the district are occupied by the Wardha river basin, with Jam, Kad, Vena, Nand & Bor sub river basins. The Wardha River, the Bor & the Vena rivers are perennial.

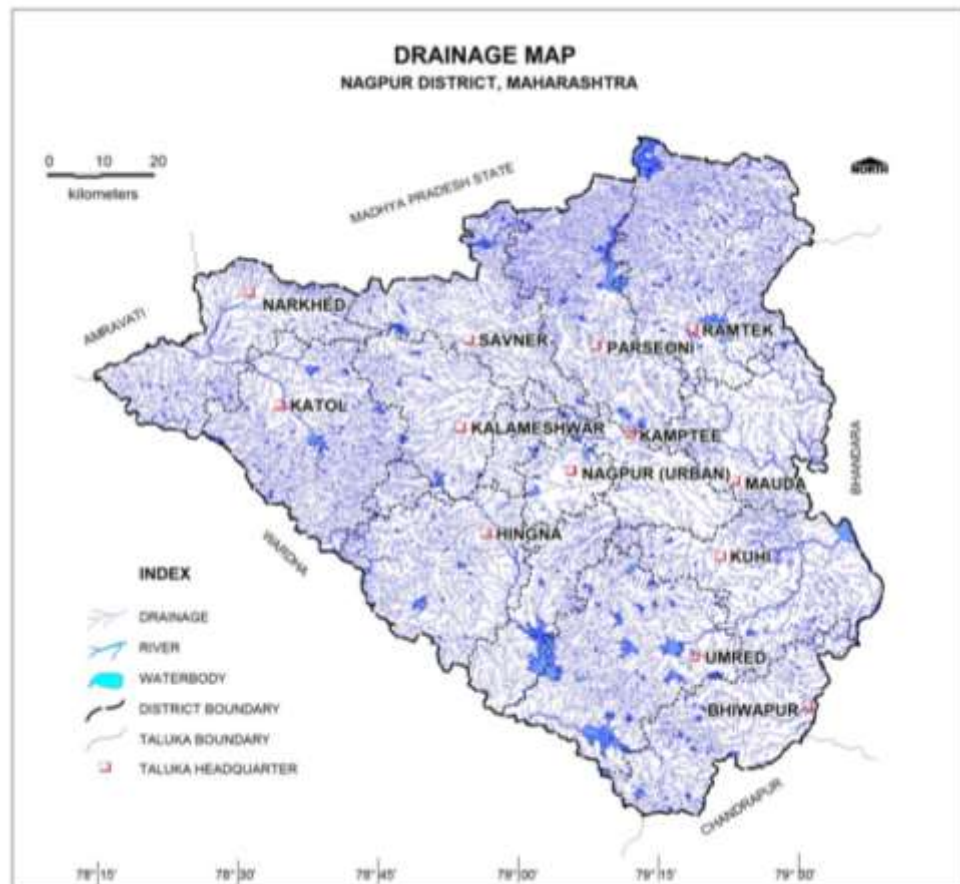


Figure 1.4: Drainage

There are six types of soils found in Nagpur district. The details are as follows:

- 1) **Kali soils:** These are black cotton soils which are fine grained clayey in texture and varies in depth from 1 to 6 m or more and retain moisture. They are found around Kalmeshwar, Saoner and Nagpur.
- 2) **Morand soils:** These are predominant in the district. They are black cotton soils with higher percentage of lime than the Kali soils. They are black, grey or light to dark brown in colour, clayey in texture and have a depth of about 1 to 3 m.
- 3) **Khardi soils:** They are shallow soils mixed with sand and found mainly in hills. These are grey in colour, clay loam in texture.
- 4) **Bardi soils:** They are red gravel covered with boulders found on summits and slopes of trap hills and are less fertile in nature.

- 5) **Kachchar soils:** They are mainly found in the banks of Kanhan River and are alluvial soils, loamy in nature and vary in depth from 1 to 3 m.
- 6) **Wardi soils:** They are red soils with a large amount of sand. They are shallower and clayey loam in nature. They are mainly found in the paddy tracts in the eastern part of the district.

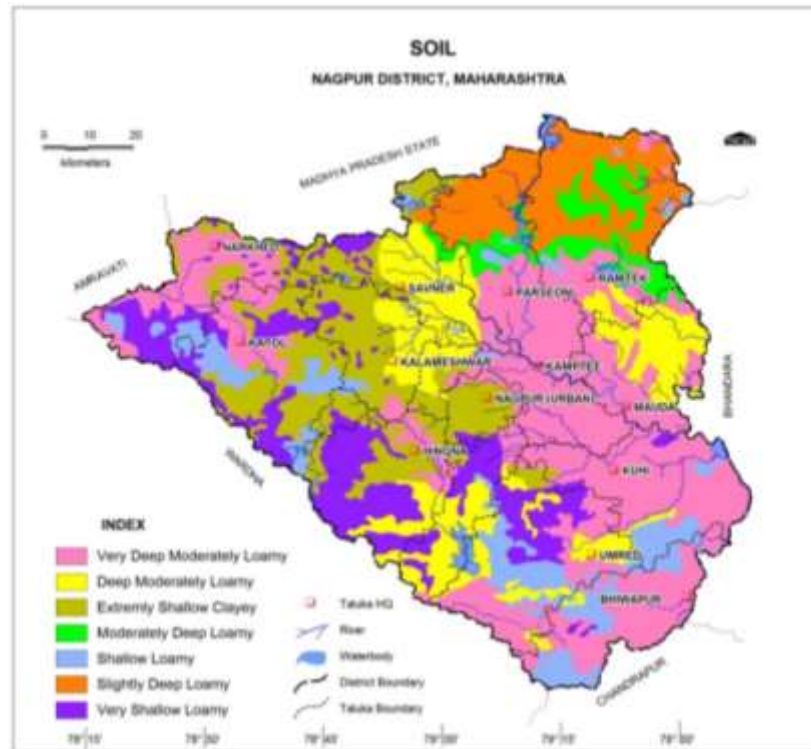


Figure 1.5: Soils

Figure 1.6 shows the Land Use details in the district. It is observed that the major parts of the district are covered by agricultural land with net sown area of 3964.69 Sq.km (40.08 %). Forest covers area of 2564.19 Sq.km (25.92 %) and double cropped area covers 2290 Sq.km (23.15 %). The built-up area is reflected wherever settlements have come up.

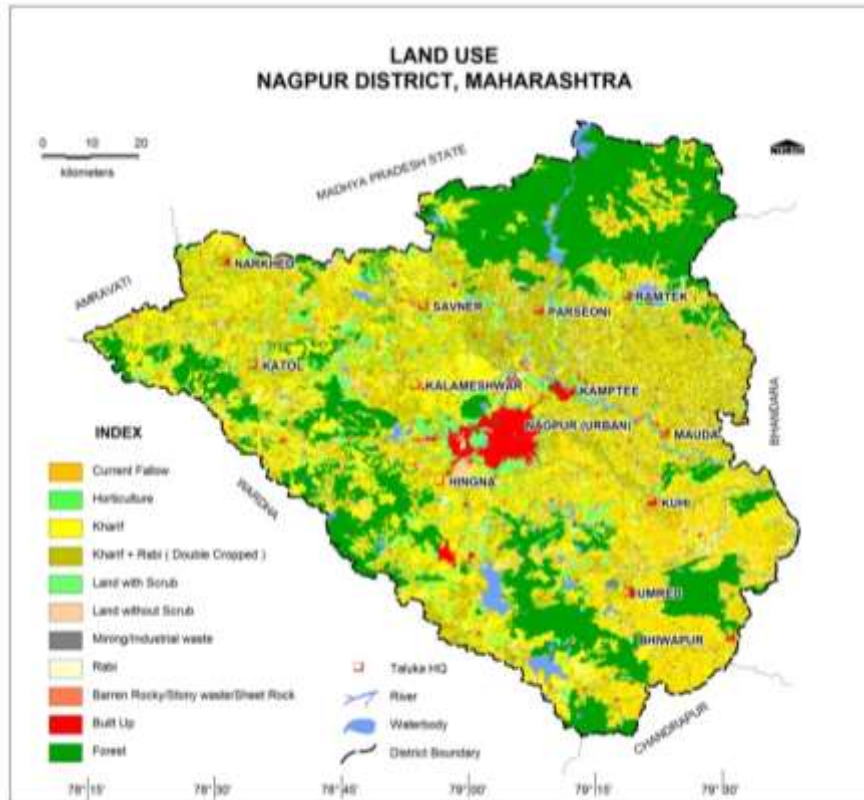


Figure 1.6: Land Use

1.3 Climate and Rainfall

Nagpur District has a semi-arid climate, winter lasts from October to February, the December & January are severely cold. The average day temperature is about 27°C while that of night is about 11°C & sometimes it can drop down even by 5°C. From the month of March temperature starts increasing. May is the hottest Month, with average temperature of about 40°C rising even up to 47°C. Nagpur District mainly experiences rainfall from south-west monsoon. It rains from June to September. The western parts of the District receive on an average rainfall of 800-900 mm and other parts of District receive 1000- 1200mm annual rainfall. The long-term rainfall analysis (1998-2019) is presented in **Table 1.1**. The special distribution of the rainfall is given in **figure 1.7** and **figure 1.8** show the variation of data with time. The minimum rainfall occurred in 2004 (699.2 mm) and maximum rainfall in 2001 (1455.8mm). The rainfall trend analysis shows a falling trend @ 18.44 mm/year.

The rainfall analysis shows that the departure of annual rainfall from the normal rainfall, expressed in terms of percentage, varied from -38 to +27 percent. The departure percent analysed denotes the rainfall variation pattern with respect to normal rainfall during the period. The area experienced 1 time (5%) excess rainfall, 17 times (77%) normal rainfall and 4 times (18%) moderate drought conditions as given in **Table 1.1**. The coefficient of variation of the annual rainfall from the mean rainfall has been observed to be 21.1 %.

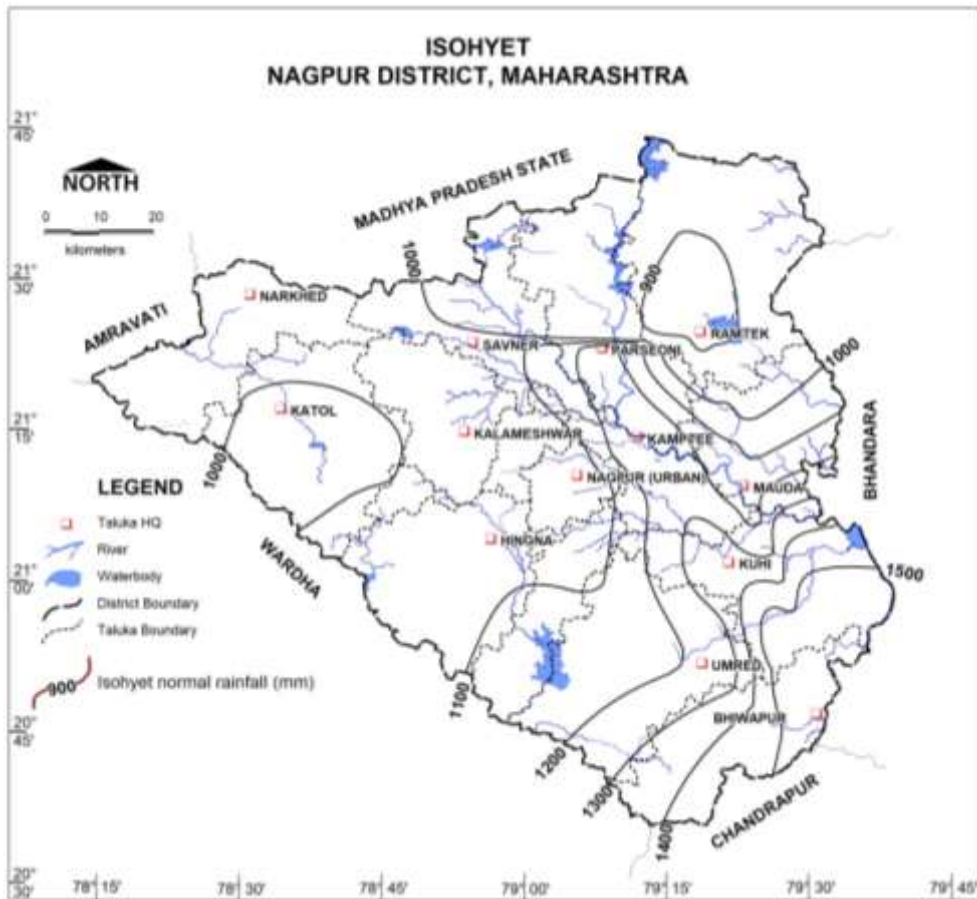


Figure 1.7: Isohyet map of Nagpur District

Table 1.1: Long term (1998-2019) Rainfall Analysis, Nagpur district, Maharashtra

YEAR	AVERAGE	NORMAL	DEPARTURE	CATEGORY
1998	1385	1139.4	21.55520449	Normal
1999	1385	1139.4	21.55520449	Normal
2000	1384.5	1139.4	21.51132175	Normal
2001	1455.8	1139.4	27.76900123	Excess
2002	870.1	1139.4	-23.63524662	Normal
2003	1075.8	1139.4	-5.581885203	Normal
2004	699.2	1139.4	-38.63436897	Moderate
2005	1333.5	1139.4	17.03528173	Normal
2006	1002.3	1139.4	-12.03264876	Normal
2007	1150.2	1139.4	0.947867299	Normal
2008	849.6	1139.4	-25.43443918	Normal
2009	947.8	1139.4	-16.815868	Normal
2010	1263	1139.4	10.84781464	Normal
2011	943.5	1139.4	-17.19325961	Normal
2012	1030.5	1139.4	-9.557661927	Normal
2013	1030.5	1139.4	-9.557661927	Normal
2014	797.3	1139.4	-30.02457434	Moderate
2015	1100.9	1139.4	-3.378971388	Normal

YEAR	AVERAGE	NORMAL	DEPARTURE	CATEGORY
2016	823.6	1139.4	-27.71634193	Moderate
2017	821.5	1139.4	-27.90064946	Moderate
2018	902.6	1139.4	-20.78286818	Normal
2019	1129.1	1139.4	-0.903984553	Normal
PERIOD	:	1998 to 2019		
No. of years	:	22	MEAN :1062.8	
Normal Rainfall	:	1139.4	MEDIAN : 1030.5	
Standard Deviation	:	223.83 mm	MODE :1385	
COEFFICIENT OF VARIATION		21.1 %		
SLOPE		-18.438 mm/yr		
INTERCEPT		1274.8		
EQUATION OF TREND LINE		$y = -18.438x + 1274.8$		
CATEGORY		NUMBER OF YEARS	%OF TOTAL YEARS	
DEPARTURES				
POSITIVE		7	32	
NEGATIVE		15	68	
DROUGHTS				
MODERATE		4	18	
SEVERE		0	0	
ACUTE		0	0	
NORMAL & EXCESS R/F				
NORMAL		17	77	
EXCESS		1	5	

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

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

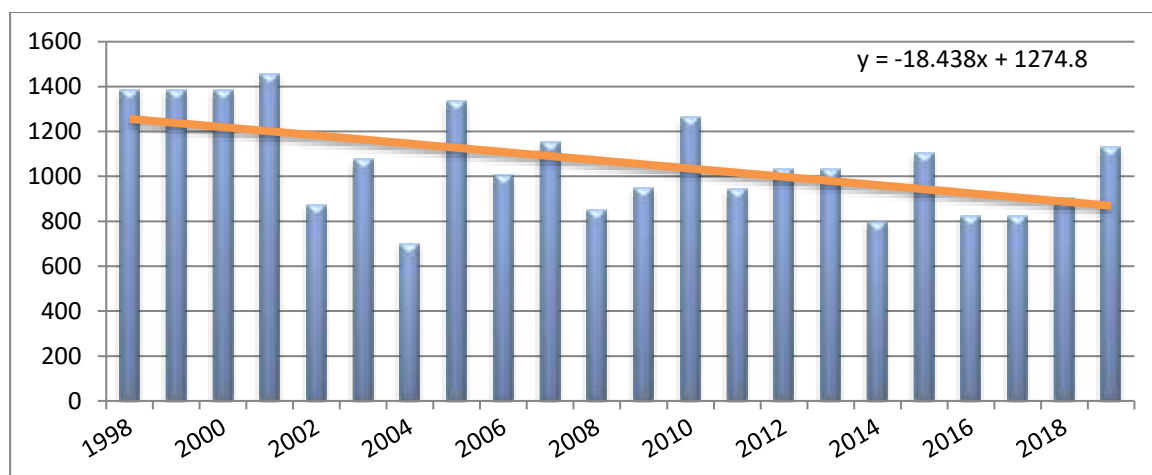


Figure 1.8: Long term annual rainfall (1998-2019)

1.4 Geology

Nagpur District has varied Geology. The District has all the rock types like igneous, sedimentary, and metamorphic. The geological map is shown in **Figure 1.9**. The Geological formation of the Nagpur Districts is as follows:

S.	Age	Formation	Lithology	Name of Talukas included
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CGWB, CR, Nagpur

No.				
1	Recent to subrecent	Alluvial	Sand, Silt & Caly	Saoner, Kamptee, Parseoni, Mouda, Kuhi, Narkhed
2	Upper cretaceous to lower Eocene	Deccan trap (Basalt)	Basaltic lava flows with associated intertrappean sediments	Nagpur, Hingana, Kalmeshwar, Katol, Kuhi, Narkhed, & Saoner
3	Upper carboniferous to lower cretaceous	Lameta	Calcareous Sandstone, Sandy Limestone with intercalations of chert and clay	Nagpur, Hingana, Saoner, Kalmeshwar, Umred, Kuhi & Bhiwapur
4	Lower Permian to upper Permian	Gondwana	Kamthi, Barakar and Talchir stages. (Sandstone, grit, clay, carboniferous shales and basal conglomerates	Nagpur, Saoner, Kalmeshwar, Parsioni, Kamptee, Narkhed, Umred, Bhiwapur
5	Archean	Saucer and Sakoli formations	Streaky Granite Gniess and metasediments of Sausar and Sakoli formations	Nagpur, Saoner, Ramtek, Parseoni, Kamptee, Mouda, Umred, Kuhi, Bhiwapur

Archean Formations:

The Archeans comprise two lithological units, the older unit comprising of various Gneisses, granulites and Schists resulting from metamorphism of ancient sediments and younger group of Gneisses.

Tirodi Gneissic Complex of Archaean to paleo Proterozoic age comprising Migmatite, ortho gneiss, and Granite occupies the eastern and north eastern part. An Outcrop of granulite is marked at 14 km NE of Mauda.

Amgaon Gneissic complex of Archaean to paleo Proterozoic age occupies the South Eastern part and comprises granitic gneisses, Migmatite gneiss, calc- silicates, quartzite, Ultramafics and Amphibolites. Sakoli Group of Meso Proterozoic age occupies the southern part and comprises mica schist, phyllite, and carbonaceous phyllite, metabasalt with associated tuff, metarhyolite and felsic volcanics with associated tuff.

Sausar and Sakoli Group of Meso Proterozoic age occupies the northern part and comprises quartz-muscovite schist, feldspar-muscovite schist and intercalated quartzite (Sitasawangi Formation); calc-gneiss and manganiferous marble with pockets of manganese ore (Lohangi Formation); muscovite biotite schist with manganese ore (Mansar Formation); quartzite and quartzite muscovite schist

(Chorbaoli Formation); muscovite –biotite schist and quartzite-biotite granite (Junewani Formation) and crystalline Limestone and dolomite (Bichua Formation) which are repeatedly tight folded. Sausar group is a store house of Manganese ore deposits. Sakoli group is considered to be continuation of Saucer group.

Gondwana Group

Rocks comprising of Talchir, barakar and kamthi stages of Gondwana formation are of fluviatile and lacustrine origin. These sediments were deposited in troughs and synclines, consolidated and lifted and now preserved in troughs produced by faults. The Kelod kamptee line which marks the north-east boundary of Kamthi beds with Archeans is a boundary fault.

Talchir Formation:

Basal beds of Gondwana group comprising green shales and sandstones with minor intercalations of clay and a basal conglomerate and rest unconformable over the Archean rocks. These are exposed at Kodadonagri (north of Patansaongi) and 9 km north of Nagpur near Suradevi hills.

Barakars:

Following Talchirs Barakar consists of white and grey sandstones and grits, fire clays and carbonaceous shales with workable coal seams.

Kamthis:

These are predominantly composed of soft and coarse-grained sandstones with some micaceous sandstones and homogenous and compact shales. These rocks occupy an area which is bounded by Kelod- Kamtee line towards north-east along which Kamtees have been faulted. Southwards they stretch upto Bokhara 6km north of Nagpur. At Silewara about 8 km north west of Kamtee a low range of hills composed of Kamthis and extending upto Bokhara forms the type area. Two inliers of Kamth rocks are seen in deccan trap basalt area to the west of Nagpur. One of these lies to the north east of Bazargaon and another north west of Nagpur at Gonkheri.

Lametas:

Lametas also known as infratrapeans are fresh water deposits and rest horizontally over the older Gondwana and Archean rocks. Lametas have limited extent and rarely attains a thickness of more than 15-20 m. They comprises of calcareous sandstones, to sandy limestones, with intercalations of chert and clay. They occur at foothills of Kelod and sitabuldi (Nagpur) hills. A large spread of Lametas is seen immediately west of Umrer.

Deccan Trap:

Basalt is the main formation of the District which occupies an area of about 4300 sq.km, i.e., about 50% of the total area of the District. The area covering Katol, Narkhed, Hingna & umred talukas and some part of Nagpur, Saoner, Kalmeshwar, Bhiwapur & Kuhu taluka. The thickness of the layer is generally 15 to 30 mts. Within the two layers intertrapean clay deposits are found known as red bole beds. Individual flow is generally massive at bottom and Vesicular or amygdaloidal at top. Secondary fillings of vesicles comprise calcite, zeolite and quartz.

Alluvium:

Alluvium deposits of recent age deposited by the tributaries of Kanhan and Wainganaga rivers. The Alluvium is composed of sand, gravel, clay and kankar and its thickness seldom exceeds 30m. They overlie the older formations such as Archaeans, Gondwana and Basalt and have thickness more than 25 m.

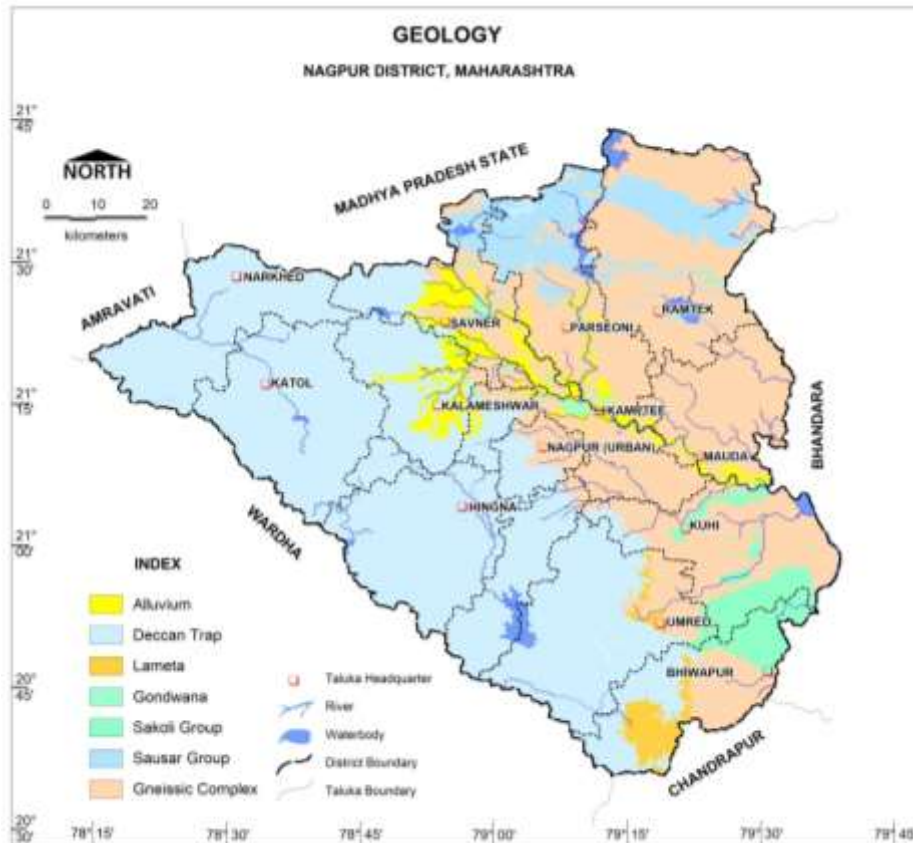


Figure 1.9: Geological Map, Nagpur district

2. HYDROGEOLOGY

The important water bearing formations of Nagpur district are discussed below. A map depicting the hydrogeological features is shown in Figure-2.1.

Consolidated Formations

Archaean and the Deccan trap basalts are the two consolidated formations, which form the hard rock aquifers occurring in the district.

a) Archaean- The crystalline rocks comprising of gneiss, schist, pegmatite and quartzite are the main formations occurring in north-eastern and south eastern parts of the district. In these rocks, weathered parts, in general, observed down to a depth of 25 mbgl, forms the important shallow aquifers being exploited through dug wells. In crystalline rocks, besides weathered parts of the rock, the occurrence and movement of ground water is controlled mainly by joints and fractures. The yields are generally controlled by the density, intensity and interconnection of joints/fractures in the rock formations.

b) Deccan Traps- Basalt is the main rock formation of the district and occupies an area of about 4300 sq. km. Deccan basalts are hydrogeologically inhomogeneous rocks. The weathered and jointed /fractured parts of the rock constitute the zone of ground water flow. Each individual lava flow consists of lower massive part becoming vesicular/amygdaloidal towards top, range in their individual thickness from a few centimetres to tens of meters. The groundwater occupies under phreatic conditions in the exposed lava flows and in semi confined to confine in the subsurface flows. Groundwater is present in pore spaces in the vesicular units of each flow and in the jointed and fractured portions of massive basalt. However secondary porosity and permeability developed due to weathering, fracturing & joints play a very important role in the storage and movements of ground water. This has given rise to good aquifer in Deccan trap.

Semi-Consolidated Formations

Two types of semi consolidated formations i.e. Lameta and Gondwanas occur in the district. They along with the unconsolidated Alluvial formation form the soft rock aquifers occurring in the district.

a) Lameta beds- Lameta beds, found to the north of the district in a small patch are compact, clayey and poor in permeability. Hence it is not a good water bearing formation.

b) Gondwana Sediments- Gondwana formation, occupying a total area of about 470 sq.km, occurs in the northern part of the Nagpur city extending from Kamptee to Saoner, and an isolated patch also occurs near north of Satnaori. Among the Gondwanas, the Barakars and Kamthis generally consist of medium to coarse-grained friable sandstone. These constitute the important water bearing formations in the district. Barakars are usually associated with coal seams of economic importance. The depth of this aquifer is about 45 to 50 m bgl.

Unconsolidated Alluvial Formations

Alluvium consisting of sand, silt, clay and kankar forms the potential water bearing formations and occurs in southern part of the district from Butibori to Bela. The alluvium of recent to sub-recent age and are found to have been deposited along the Kanhan and Pench Rivers and their tributaries. These formations are highly productive aquifers and sustain long duration pumping with very less drawdown and fast recuperation. Ground water occurs in water table and semi-confined conditions in the alluvial formation.

Deccan basalts are hydro geologically 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.

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 **Figure 2.2 and 2.3** respectively.

Table 2.1: Aquifer Characteristic of Nagpur district

Major Aquifers	Basalt (Deccan Traps)		Gondwana (Sandstone)		Granite Gneiss/Biotite gneiss	
	Aquifer-I	Aquifer-II	Aquifer-I	Aquifer-II	Aquifer-I	Aquifer-II
Formation	Weathered/Fractured Basalt	Jointed / Fractured Basalt	Weathered Sandstone	TCG	Weathered	Jointed/Fractured
Depth of occurrence	05 - 32	32-186	12-28	26-194	11 - 25	25-172
Granular/ Weathered /Fractured rocks thickness (m)	0.2-11	1-36.36	Upto 28	2-54	0.3-7	1-40.35
SWL (mbgl)	1-20	1.2-29.03	5-11	2.32-22	0.1-19.4	1-24.15
Yield	10 to 100 m ³ /day	50 to 150 m ³ /day	20-80 m ³ /day	1.37 to 17.90 (lps)	10-33 m ³ /day	18-33 m ³ /day
Transmissivity (m ² /day)	30 to 131.80	25 to 210	15.00 to 70.50 m ² /day	9.32	130.00 to 279.13	198.35 to 336.5
Specific Yield/ Storativity (Sy/S)	0.02	1.2 x10 ⁻⁴ to 3.57x10 ⁻⁴	0.015 to 0.020	9.8 x 10 ⁻³ to 1.14 x 10 ⁻⁴	--	2.37 x 10 ⁻⁴ to 8 x 10 ⁻⁵
Suitability for drinking/ irrigation	Suitable for both (except high EC, Fluoride and Nitrate affected villages) drinking & agriculture.					

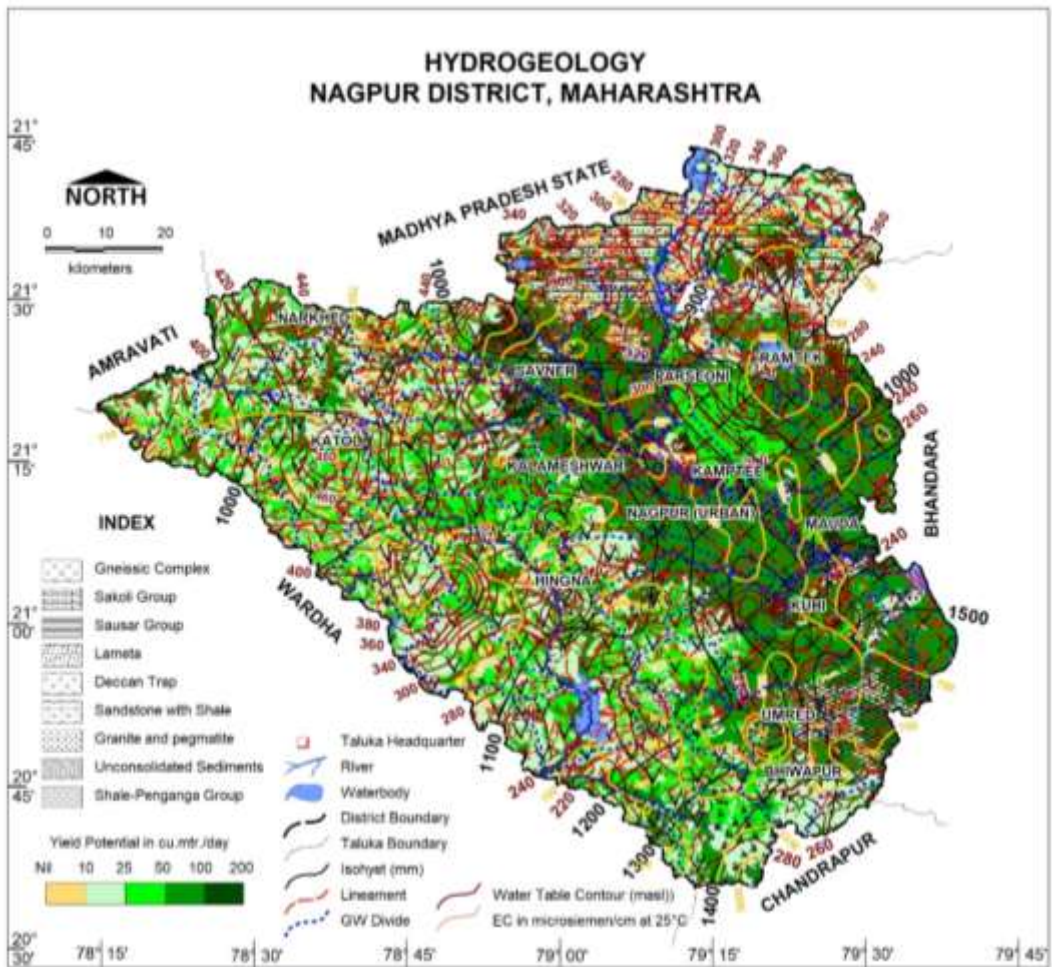


Figure 2.1: Hydrogeology

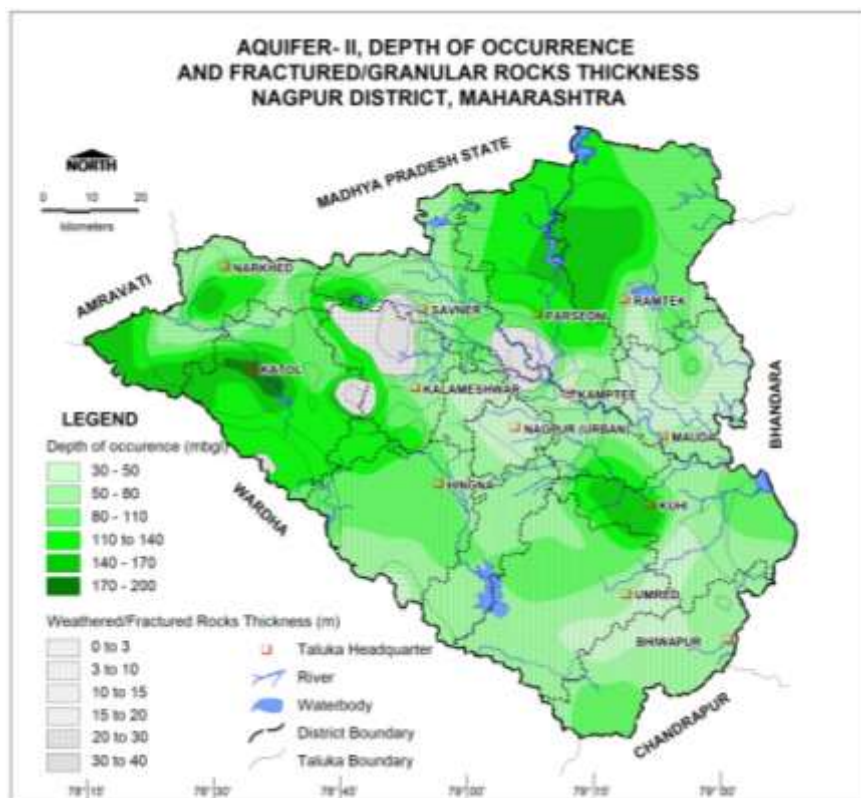
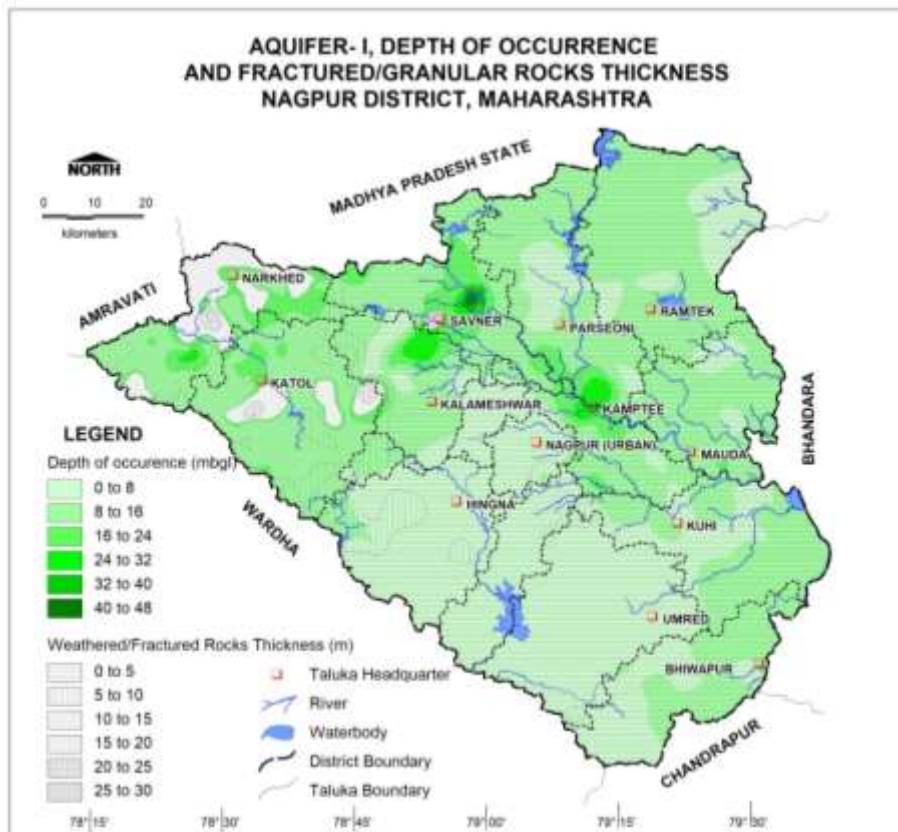


Figure 2.2: Aquifer wise Depth of occurrence and fractured rock thickness

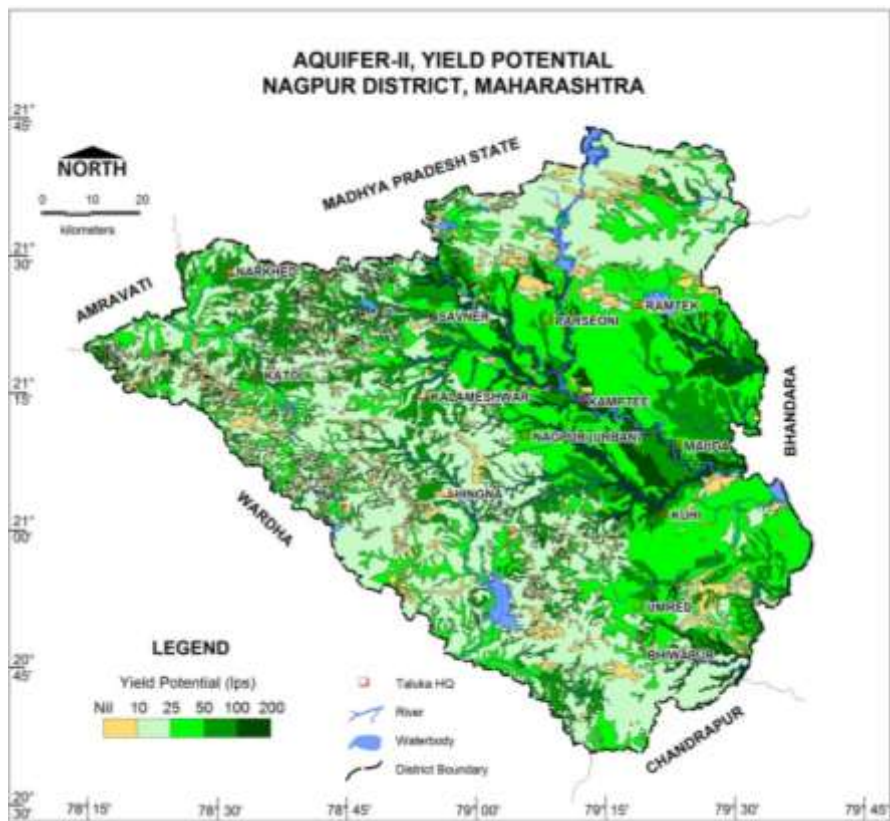
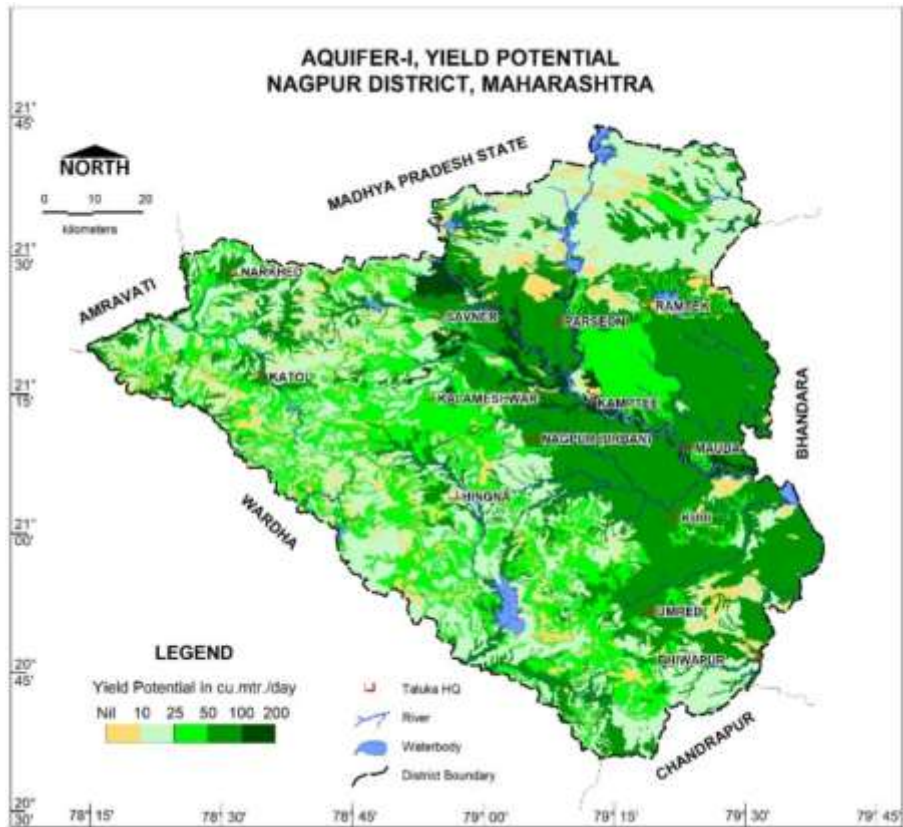


Figure 2.3: Aquifer wise yield Potential

2.1 Aquifer Parameters

Aquifer parameters are available from historic data of ground water exploration carried out in the district as well as from the pumping tests. Pumping tests conducted on wells in the district show that transmissivity of shallow aquifer in basalts ranges from 52.57 to 701.22 m²/day, specific capacity of wells ranges from 157.14 to 1250 lpm/m. Specific capacity of wells and transmissivity in alluvium ranges from 130 to 2050 lpm/m and 120 to 210 m³ / day respectively. On an average, specific yield of basalt aquifers comes to be only 2%.

2.1.1 Specific Yield Tests

To estimate the aquifer parameters of shallow aquifer (Aquifer-I) in the area, 2 pumping tests on open dug wells have been conducted during the year 2019-20. The data has been analysed by Kumarswamy method. The salient features of pumping tests are given in **Table 2.2**. The discharge of the wells ranged 350 lpm for pumping duration of 60 minutes.

The drawdown observed at the end of the pumping ranged from 0.28 to 2.1 m and the residual drawdown for the 1st minute was observed to be ranging from 0.08 to 0.47 m. The aquifer parameter values estimated by Kumarswamy method are observed to be well within the general range of values for weathered and jointed basalt i.e., the transmissivity value was observed from 52.57 to 1349.99 m²/day, whereas the specific yield 0.010 to 0.019, whereas specific capacity values ranged from 157.14 to 1250 lpm/m.

Table 2.2: Salient features of pumping tests – shallow aquifer (dug well) using Kumarswamy method.

S. No	Village	Diameter (m)	Depth (mbgl)	SWL (mbgl)	Q (lpm)	Pt (min)	DD (m)	RDD (m)	C (lpm/m)	T m ² /day	Sy
1	Titur	8	15	4.3	350	60	0.28	0.08	1250	52.57	0.010
2	Mangli	7	13	8.03	350	60	0.91	0.47	384.62	324.33	0.019
3	Wadamba	10.2	18	4.5	450	100	1.9	0.09	236.84	1349.99	0.018
4	Tekadi	9.6	15.5	3.1	330	100	2.1	0.42	157.14	701.22	0.019

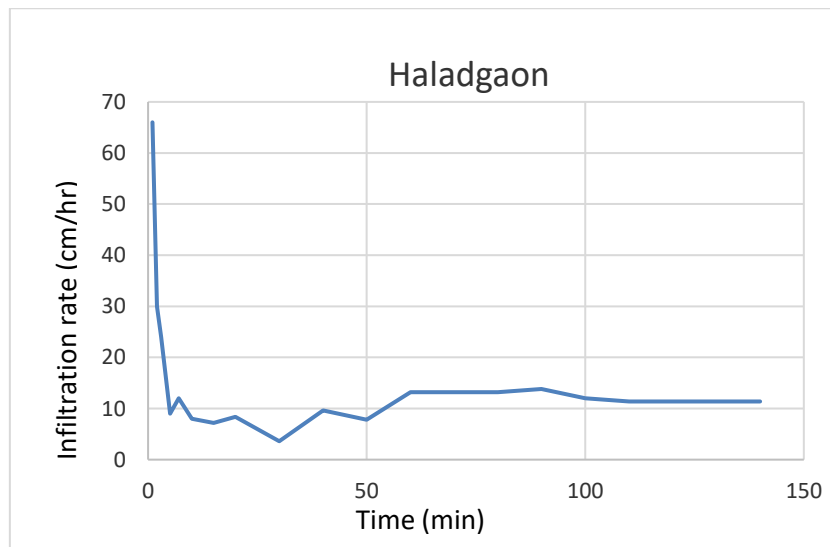
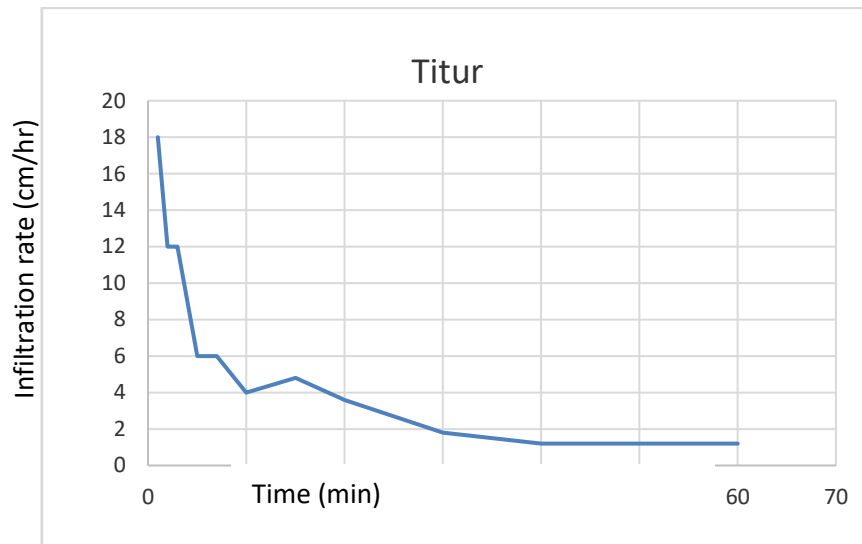
Here, SWL – Static Water Level, Q – Discharge, Pt - Pumping duration, D/D – Drawdown, RDD - Residual drawdown, C - Specific Capacity, T – Transmissivity, Sy - Specific Yield

2.2 Soil Infiltration Tests

Soil infiltration tests were carried out to estimate the actual rate of infiltration of various soil cover and their impact on recharge to ground water. Total 4 infiltration tests have been conducted at Titur, Haladgaon, Wadamba and Kodamendi in various soil types. The data has been analysed and the salient features of the infiltration tests are presented in **Table 2.3**, whereas the data is presented in **Annexure-IV** and the plots of soil infiltration tests are presented in **Figure 2.4**. The duration of the test ranged from 60 to 140 minutes, the depth of water infiltrated varied from 2.90 cm to 28.90 cm and the final infiltration rate in the area ranged from 1.2 cm/hr at Titur to 11.4 cm/hr at Haladgaon.

Table 2.3: Salient Features of Infiltration Tests

S. No.	Village	Date	Duration (min)	Water Level (cm agl)	Final Infiltrated Water Depth (cm)	Final Infiltration Rate (cm/hr)
1	Titur	12.01.2020	60	12	2.90	1.2
2	Haladgaon	13.02.2020	140	14	26.4	11.4
3	Wadamba	01.10.2019	140	15	28.90	4.8
4	Kodamendi	21.02.2020	140	14	25.50	5.4



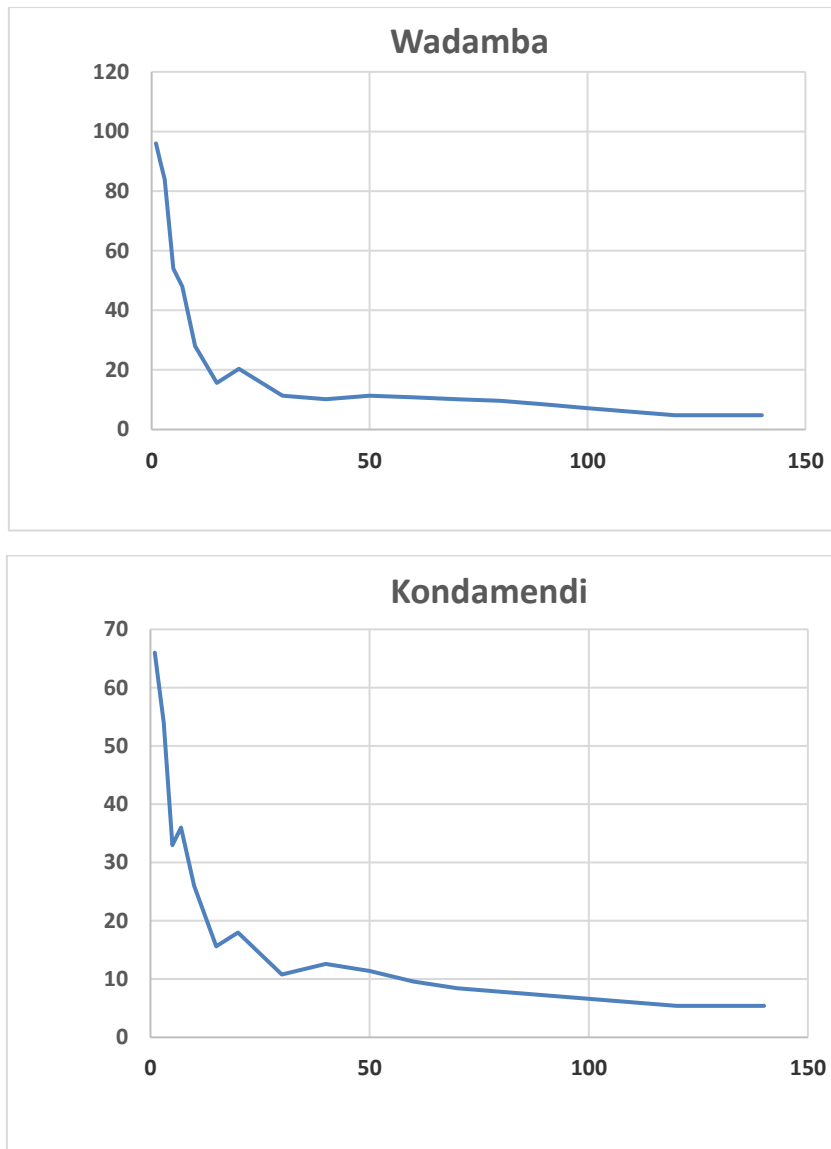


Figure 2.4: Soil Infiltration test

2.3 2-D Aquifer Disposition

Based on the existing data, aquifer disposition in, Fence diagram, Bar diagram and few hydrogeological sections have been prepared along section lines shown in **Figure 2.5, 2.6, 2.7 and 2.8 (a to d)** to understand the subsurface disposition of aquifer system.

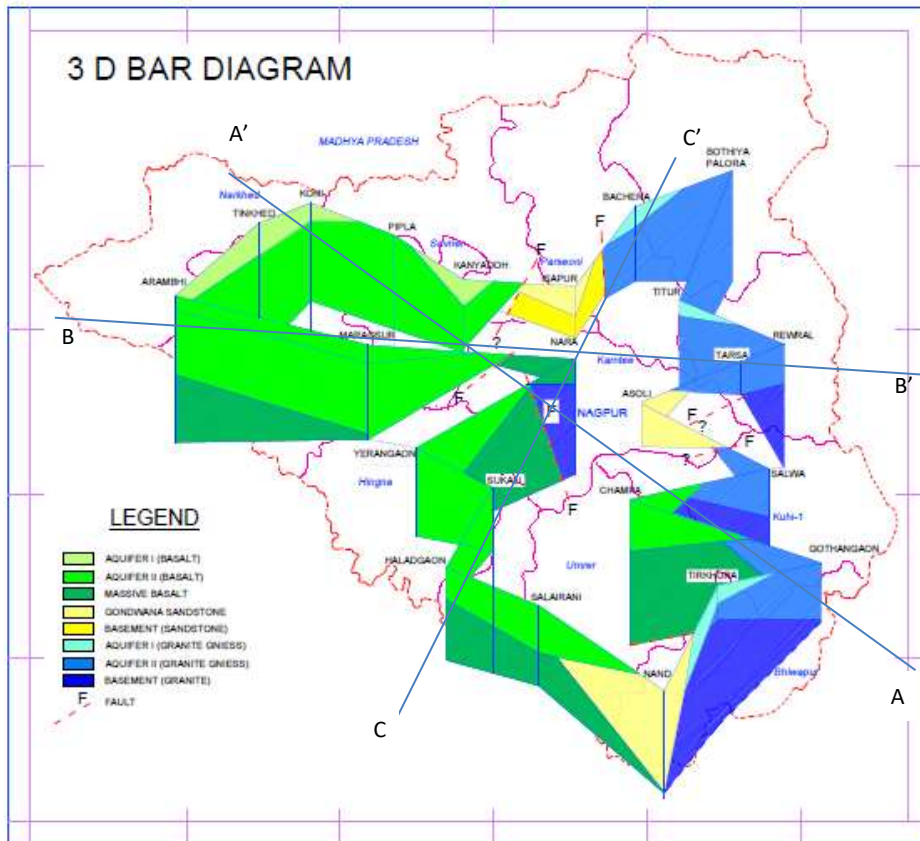


Figure 2.5: 3D Fence Diagram

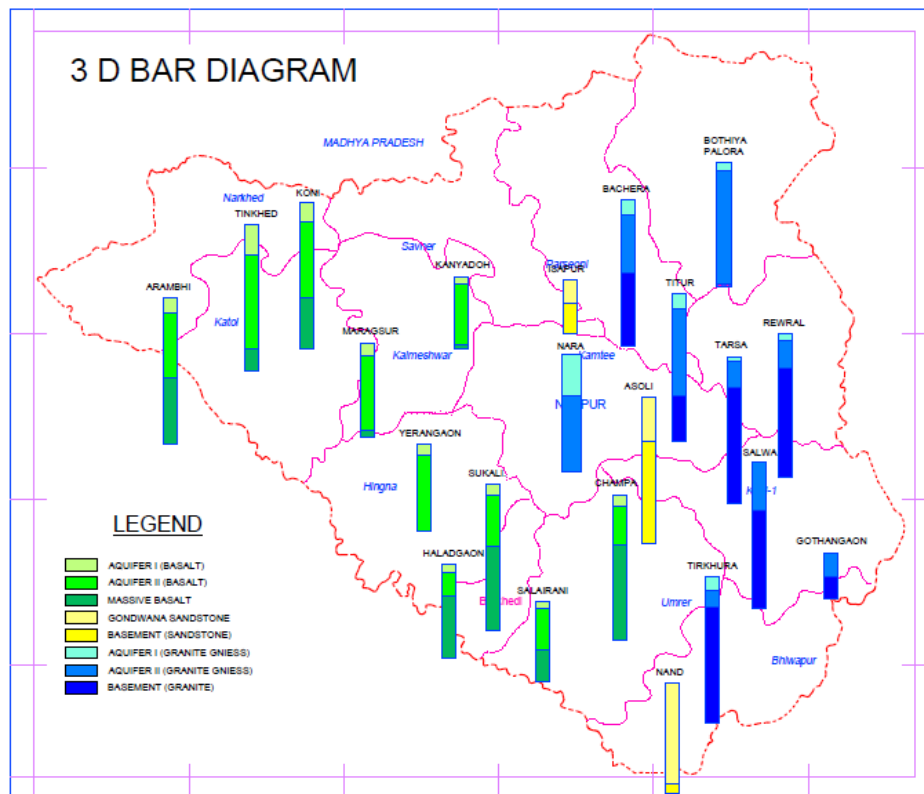


Figure 2.6: Bar Diagram

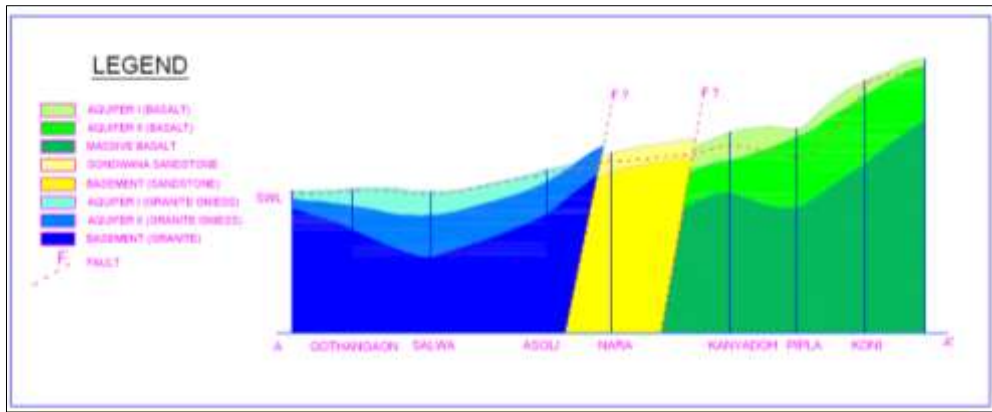


Figure 2.7(a): Lithological section along A – A’

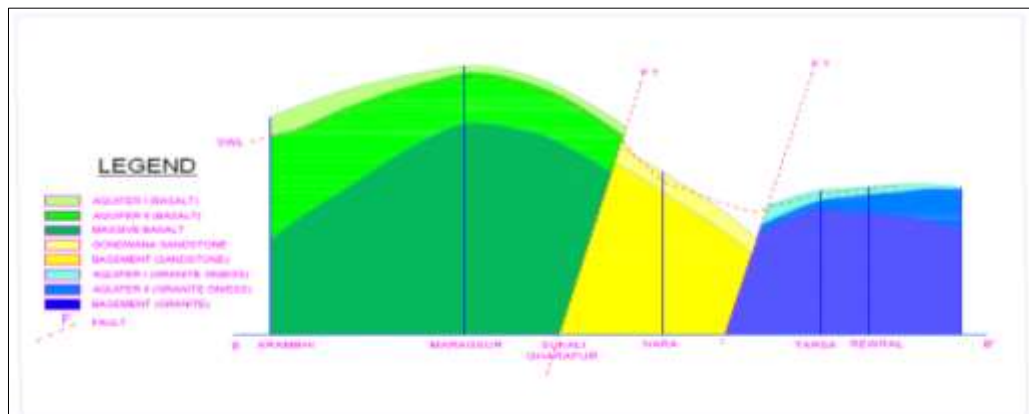


Figure 2.7(b): Lithological section along B – B’

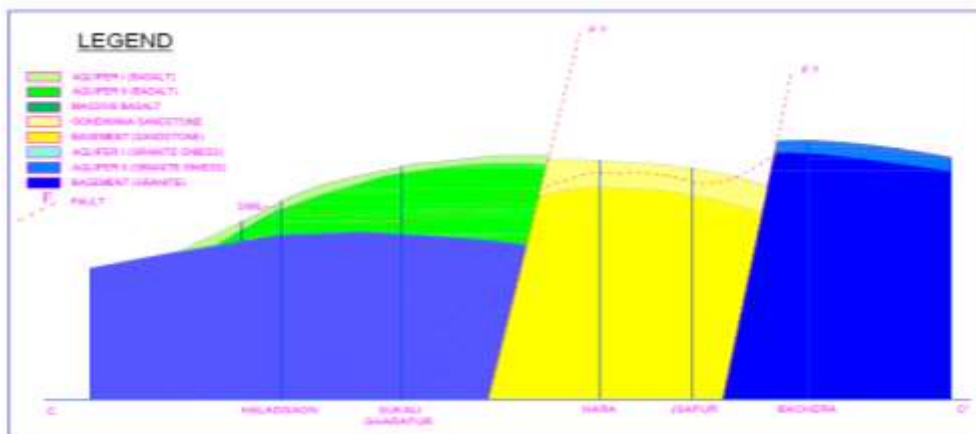


Figure 2.7(c): Lithological section along C – C’

3. WATER LEVEL SCENARIO

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

Central Ground Water Board periodically monitors 98 Ground Water Monitoring Wells (GMMWs) including 82 dugwells and 16 piezometers in the Nagpur district, four times a year i.e., in January, May (Pre-monsoon), August and November (Post-monsoon). Apart from this under NAQUIM study, 174 KOW were also established and monitored during the year 2019. These data have been used for preparation of depth to water level maps of the district. Pre-monsoon and post-monsoon water levels along with long-term water level trends (2010-2019) are given in **Annexure-VII**.

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

The depth to water levels in aquifer-I (Shallow aquifer) Nagpur district during May 2019 ranges between 1.5 mbgl (sawali, Kuhi block) and 32.4 mbgl (Parsodi Wakil, Kalmeshwar block). The depths to water levels between 5 to 10 mbgl are observed in major part of district. The water levels between 2 to 5 mbgl are observed in isolated patches in central part of the district as well as in Umred, Bhiwapur, Kuhi, Hingna, Ramtek and Mauda blocks. The water levels from 10 to 20 mbgl are observed as patches in Saoner, Katol, Narkhed, Kalmeshwar, Parseoni, Hingna, Mauda kuhi and Bhiwapur blocks. The deeper water levels i.e., from 20 to 40 mbgl and > 40 mbgl are observed in isolated patches in North West part of the district where major part of the patch fall in Kalmeshwar block and remaining in Katol block. The pre-monsoon depth to water level map is depicted in **Figure 3.1**.

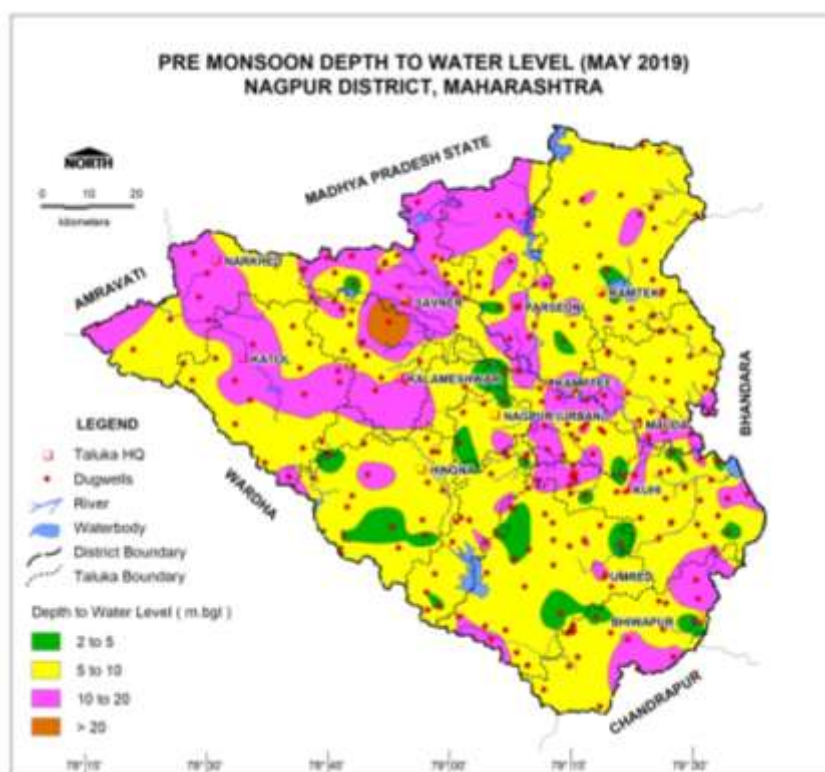


Figure 3.1: DTWL Aquifer-I Shallow aquifer (May 2019)

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

The depth to water levels in Nagpur district during Nov. 2019 ranges between near ground level / 0.1 mbgl at Kadoli, Kamptee and 20.2 mbgl (Parsodi wakil, kalmeshwar block). Shallow water levels within 5 m bgl are observed in major part of the district and moderate water level 5 to 10 mbgl are observed in North-West and few central parts and in patches in East and South-East parts of the district. Deeper water levels 10 to 20 m bgl are observed as small isolated patch in Narkhed, Kamtee Savner Maud, Nagpur rural and Katol blocks. Spatial variation in post-monsoon depth to water levels is shown in **Figure 3.2**.

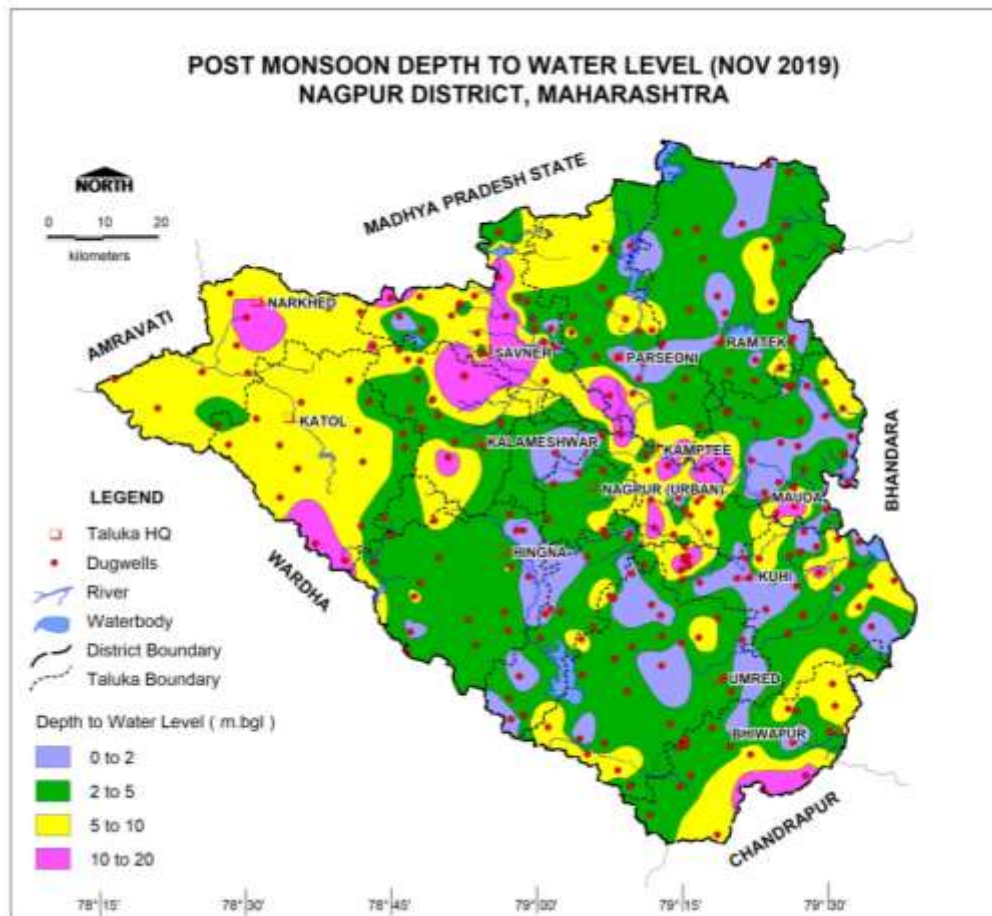


Figure 3.2: DTWL Aquifer-I Shallow aquifer (November 2019)

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

3.2.1 Pre-monsoon Depth to Water Level (May-2019)

In Aquifer-II (Deeper Aquifer), the pre-monsoon depth to water levels, in Nagpur District during May 2019, range from 11.4 (Sonoli, Katol block) to 30 mbgl (Makardhokda Pz, Umred block). The depth to water level more than 20 mbgl is observed only in some parts of Hingna, Katol and Kalmeshwar blocks. The major parts of the district show depth to water level between 0 and 5 mbgl. The water level between 5 and 20 mbgl are observed in major parts of Nagpur, Hingna, kalmeshwar, katol, Narkhed, Saoner, Umred, and Bhiwapur blocks. The pre-monsoon depth to water level for Aquifer -II is given in **Figure 3.3**.

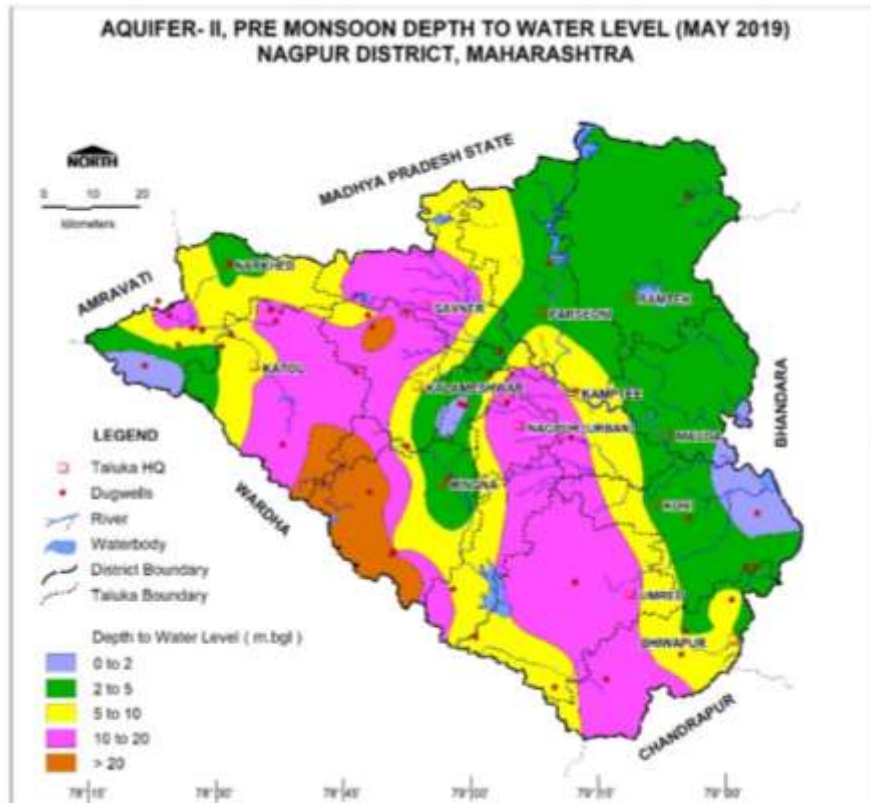


Figure 3.3: DTWL Aquifer-II deeper aquifer (May 2019)

3.2.2 Post-monsoon Depth to Water Level (Nov.-2019)

In Aquifer-II, the post-monsoon depth to water levels in Nagpur District during Nov. 2019 range between 1.00 (Rewral, Mauda block) and 29.6 mbgl (K. Pipla, Kalmeshwar block). Depth to water level less than 2 m bgl has been observed in eastern part of the district covering parts of Mauda, Bhiwapur, Kuhii and Ramtek blocks. A major part of the district shows deeper water levels ranging between 2 and 5 mbgl. The deeper water level between 10 to 20 and more than 20 mbgl are observed in Hingna, katol, narkhed, saoner and Parseoni blocks. The post-monsoon depth to water level for Aquifer –II is given in **Figure 3.4**.

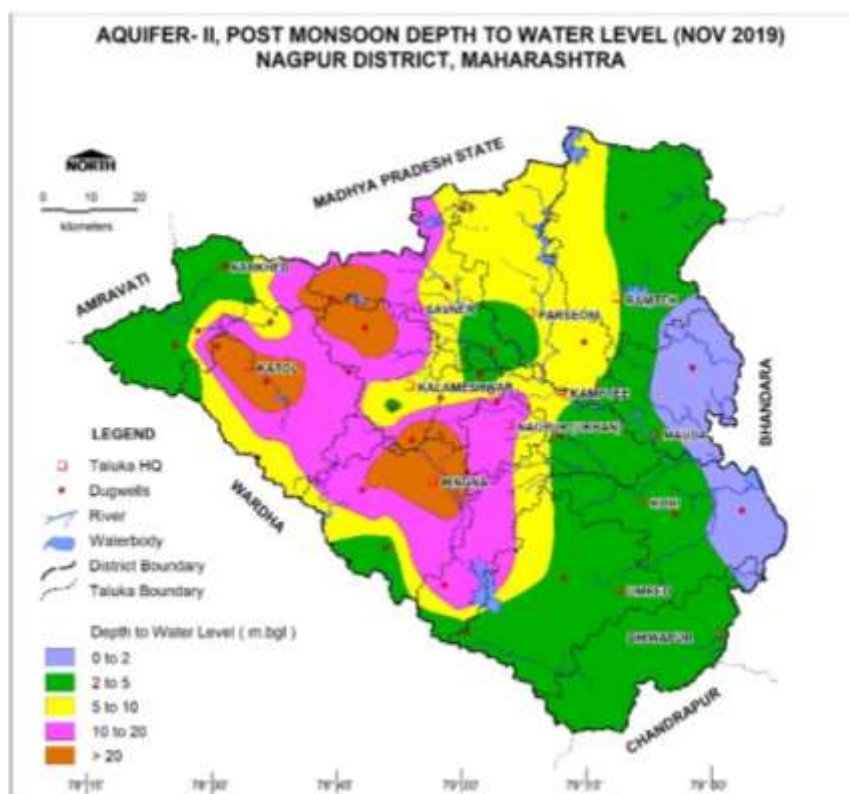


Figure 3.4: DTWL Aquifer-II deeper aquifer (Nov. 2019)

3.3 Water Level Trend (2010-2019)

During pre-monsoon, rise in water level trend has been recorded at 7 stations ranging from 0.184 (Wadi Naka, Nagpur Urban block) to 2.35 m/year (Chichbhuvan, Nagpur Urban block) while falling trend was observed in 65 stations varying from 4.95 (Jalalkheda, Narkhed block) to 0.002 m/year (Amgaon, Hingna 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 Hingna, Nagpur, Parseoni, Ramtek and Narkhed blocks of the district (Figure 3.5).

During post-monsoon, rise in water level trend has been recorded at 24 stations ranging between 0.0058 m/year (Ramdaspath, Nagpur block) to 2.7 (Kondhali, Katol block) while falling trend was observed in 52 stations varying from 14.8 (Paradsinga, Katol block) to 0.0056 m/year (Amgaon, Hingna block). Rising water level trend has been observed in covering parts of Katol, Narkhed, Umred, Ramtek and Nagpur blocks of the district. Fall in water level trend has been observed in major parts of the district covering major parts of Kuhi, Bhiwapur, Mauda, Nagpur Rural and parts of Umred, Katol, Narkhed, Ramtek and Parseoni, also small portion of the Saoner block (Figure 3.6).

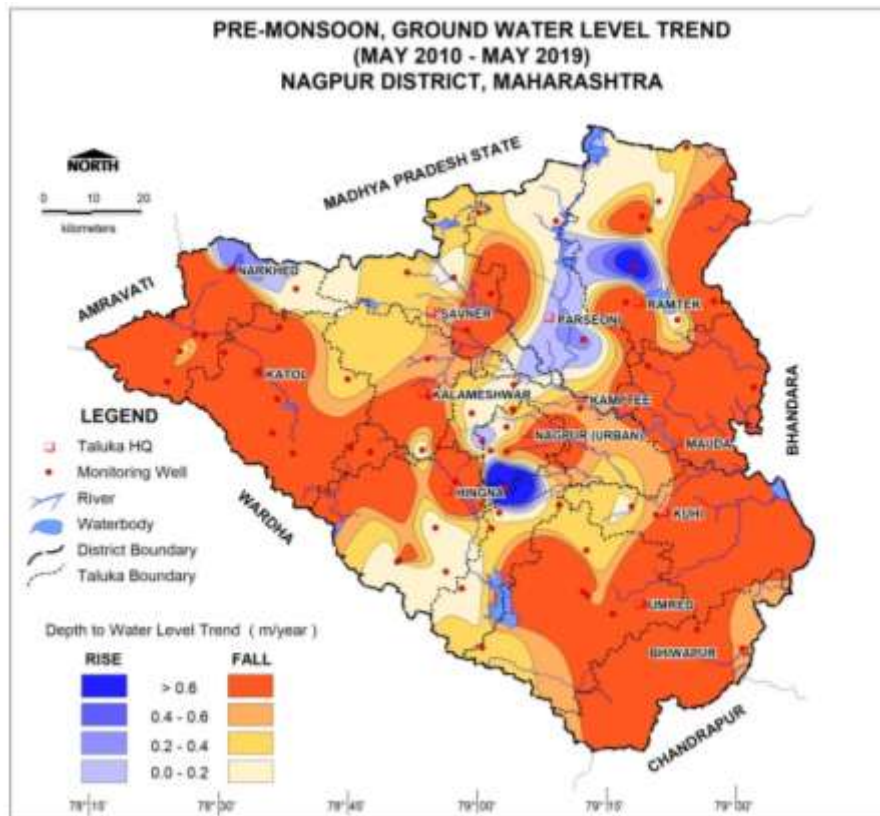


Figure 3.5: Pre-monsoon decadal trend (Shallow aquifer) (2010-2019)

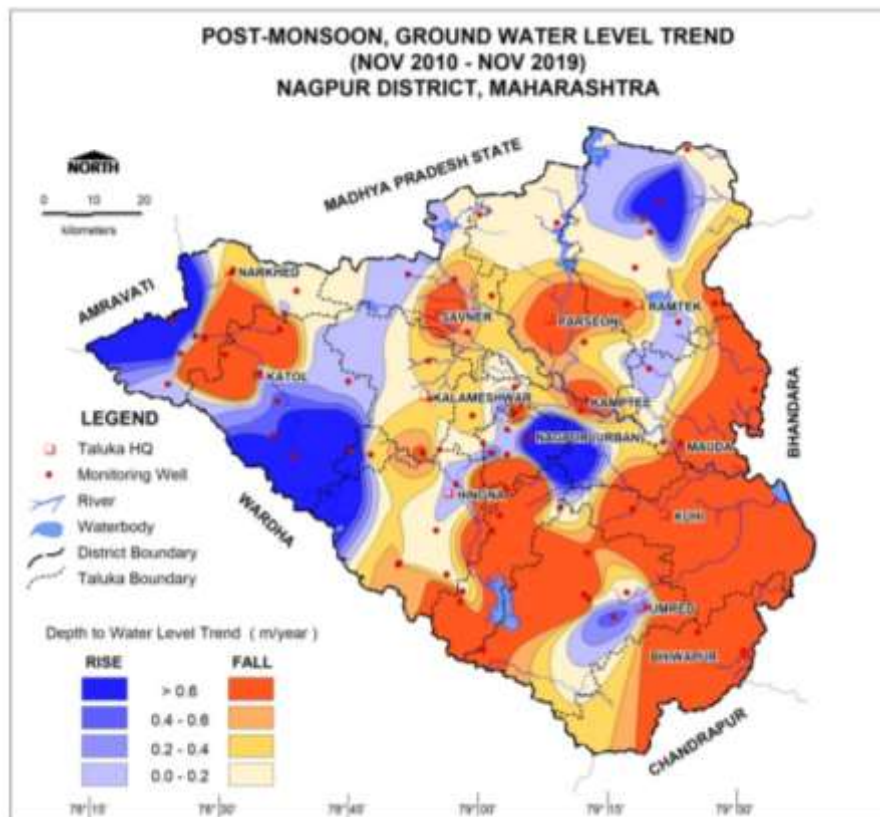


Figure 3.6: Post-monsoon decadal trend (Shallow aquifer) (2010-2019)

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 show that the continuous increase in the groundwater draft is indicated by the recessionary limb.

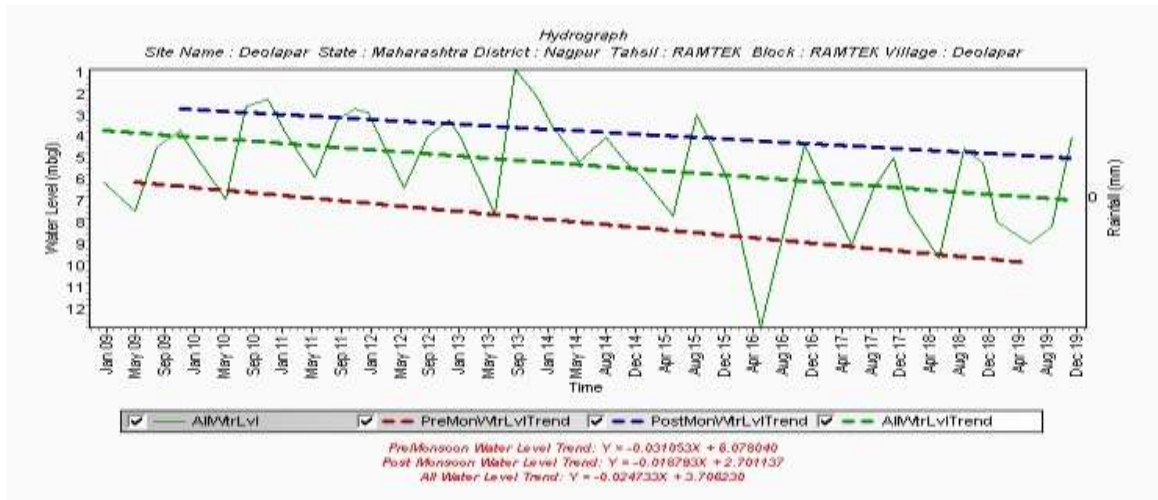


Figure 3.7 a: Hydrograph (2010-19), Deolapar, Ramtek Block, Nagpur District

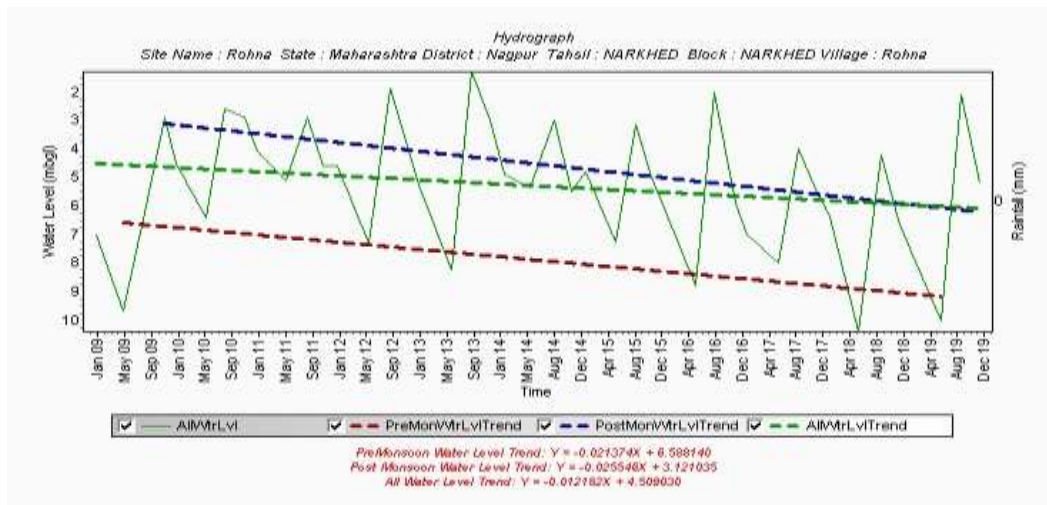


Figure 3.7 b: Hydrograph (2010-19), Rohna, Narkhed Block, Nagpur District

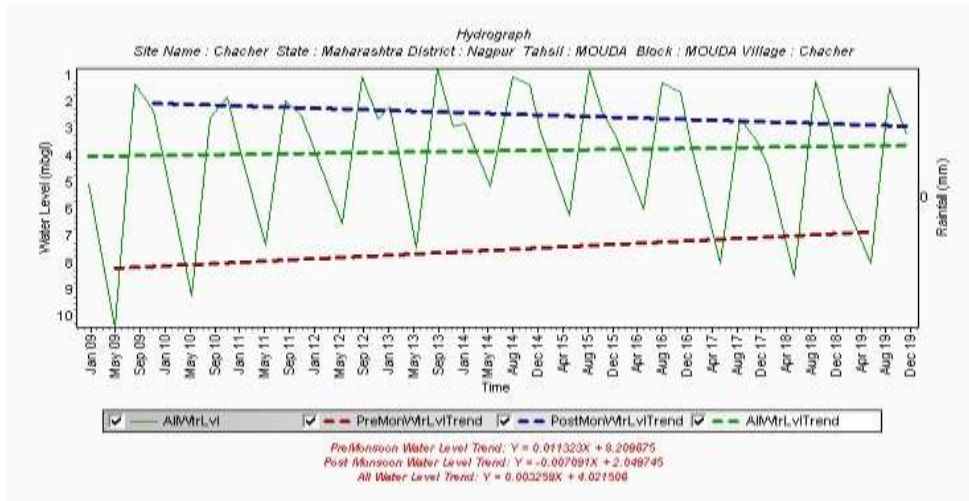


Figure 3.7 c: Hydrograph (2010-19), Chacher, Mouda Block, Nagpur District

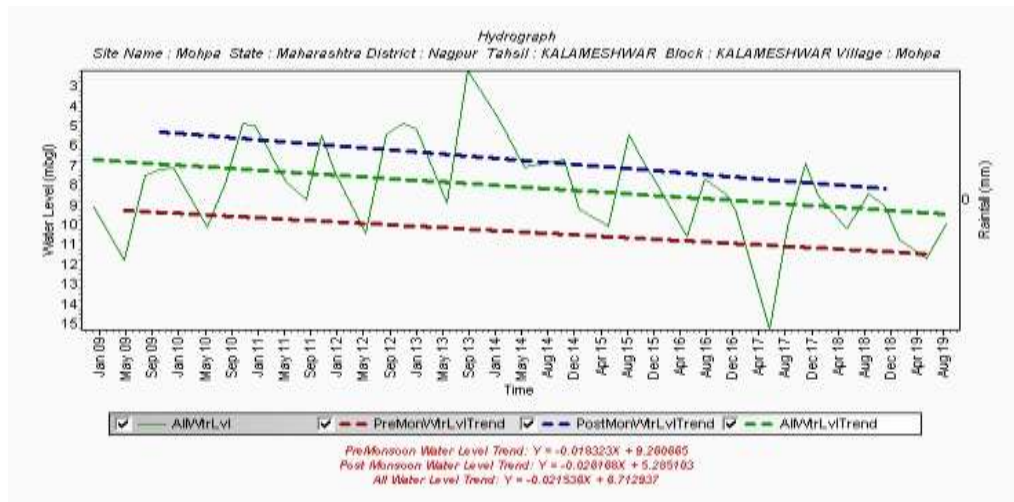


Figure 3.7 d: Hydrograph (2010-19), Mohpa, Kalmeshwar Block, Nagpur District

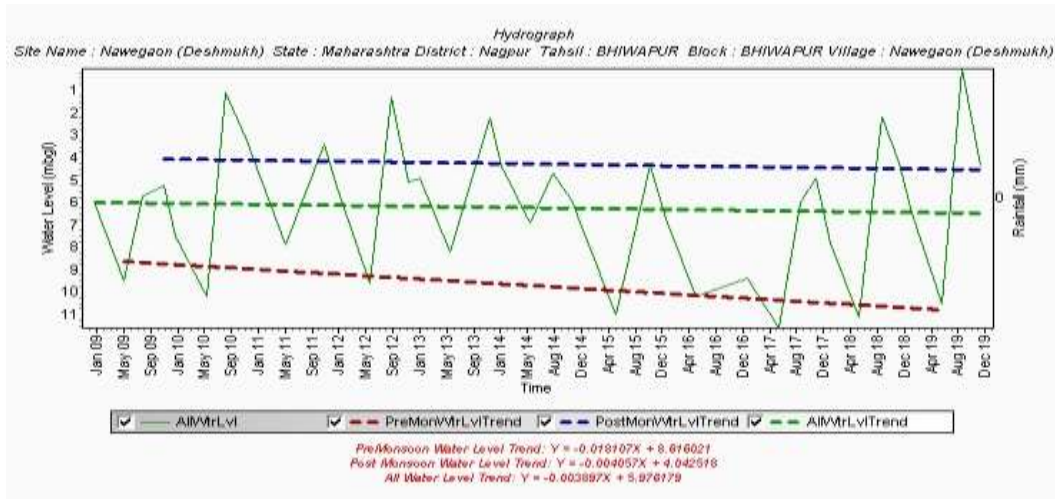


Figure 3.7 e: Hydrograph (2010-19), Navegaon Deshmukh, Bhiwapur Block, Nagpur District

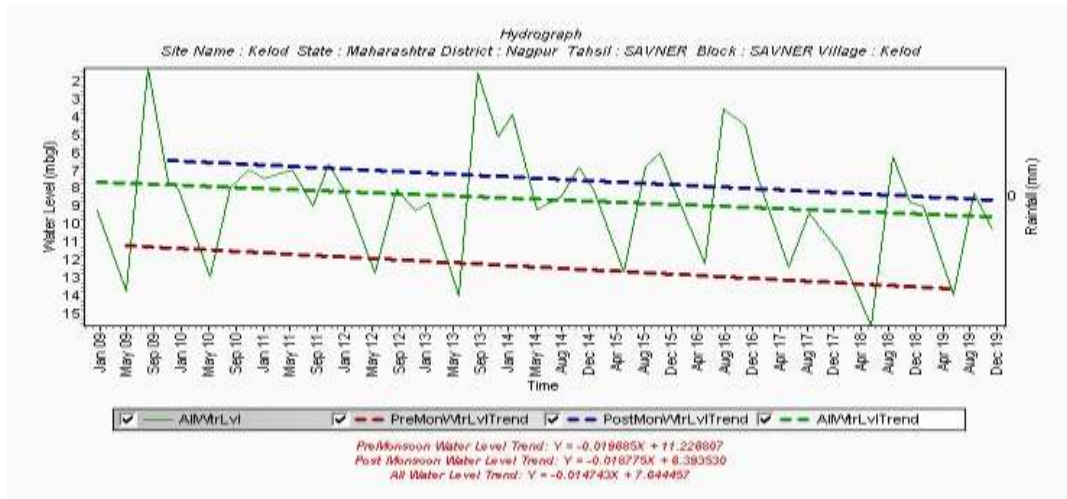


Figure 3.7 f: Hydrograph (2010-19), Kelod, Saoner Block, Nagpur District

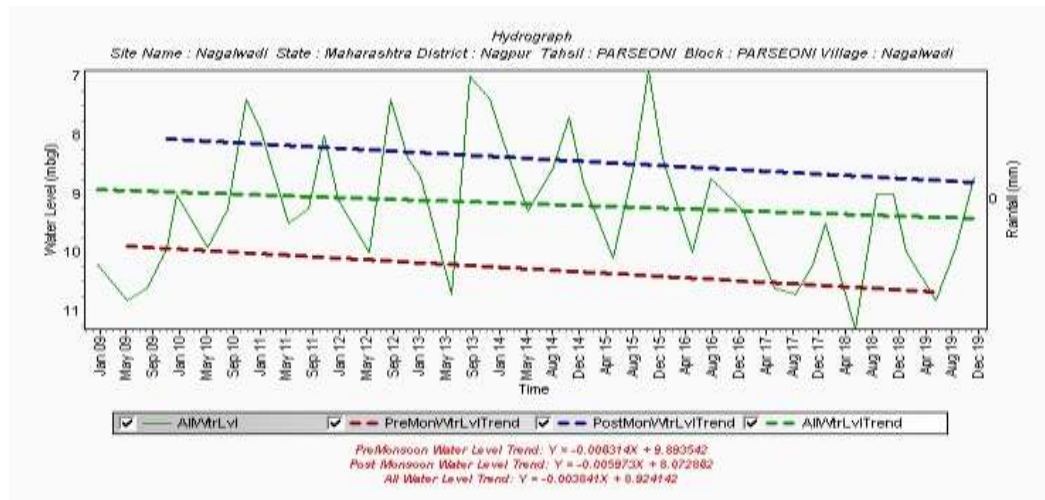


Figure 3.7 g: Hydrograph (2010-19), Nagalwadi, Parseoni Block, Nagpur District

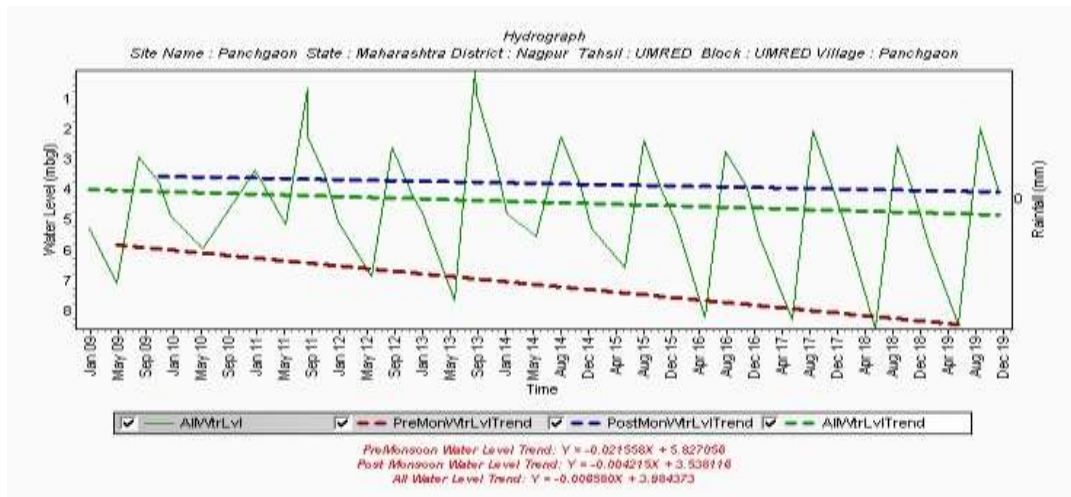


Figure 3.7 h: Hydrograph (2010-19), Pachgaon, Umred Block, Nagpur District

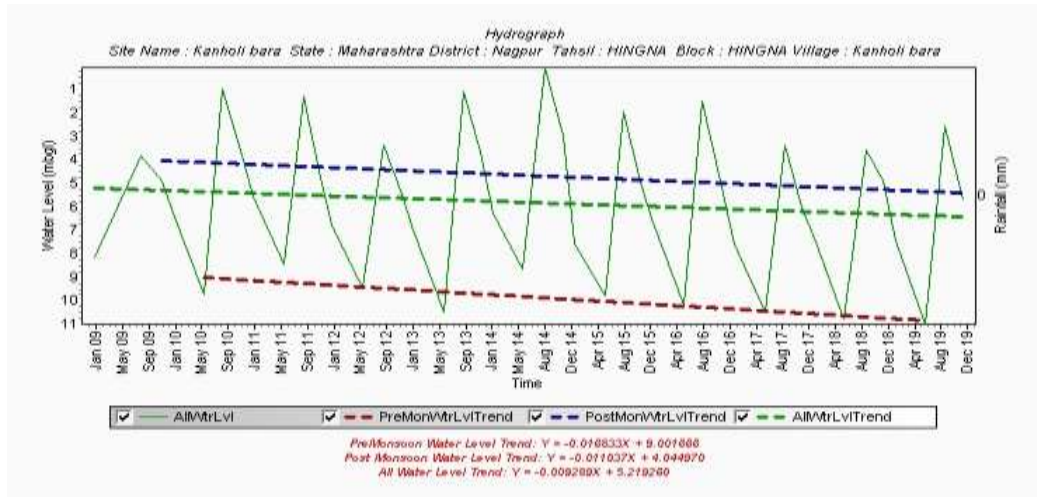


Figure 3.7 i: Hydrograph (2010-19), Kanolibara, Hingna Block, Nagpur District

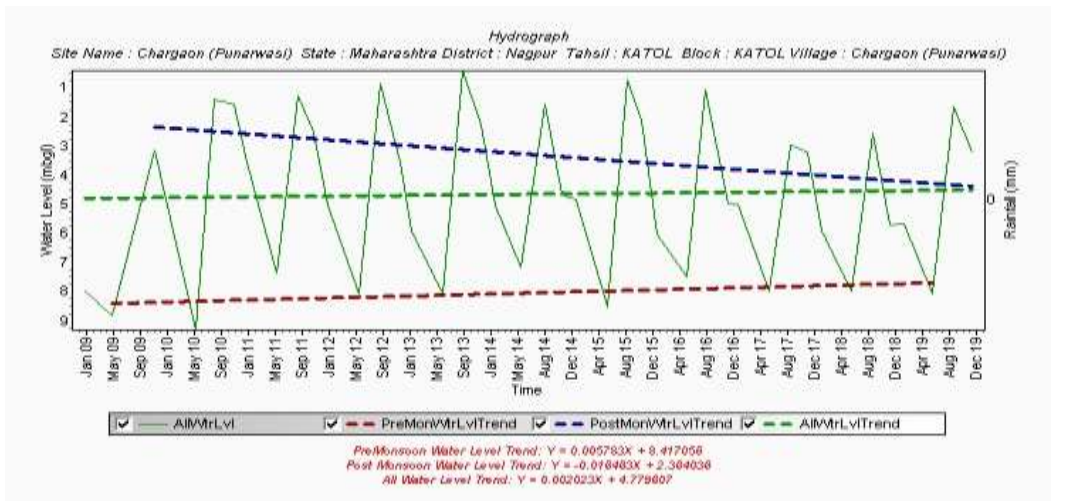


Figure 3.7 j: Hydrograph (2010-19), Chargaon, Katol Block, Nagpur District

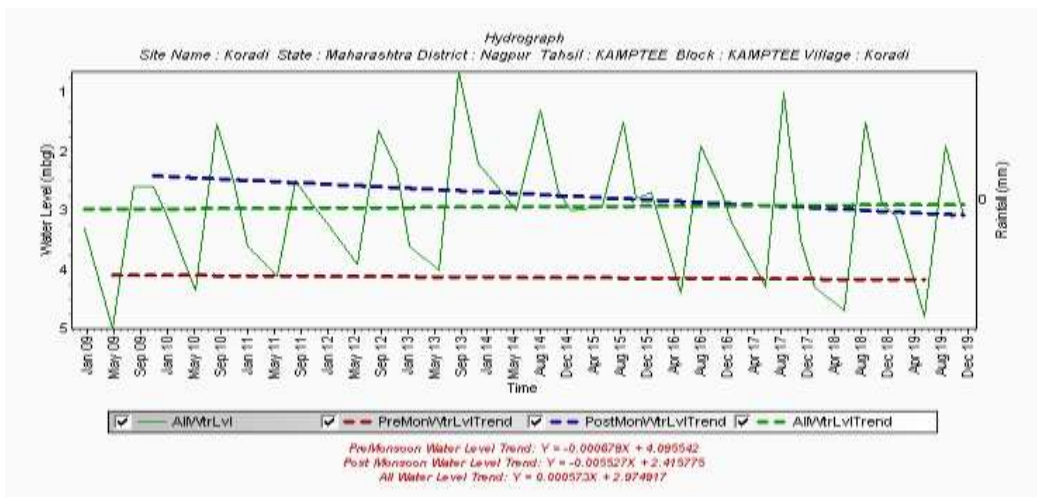


Figure 3.7 k: Hydrograph (2010-19), Koradi, Kamptee Block, Nagpur District

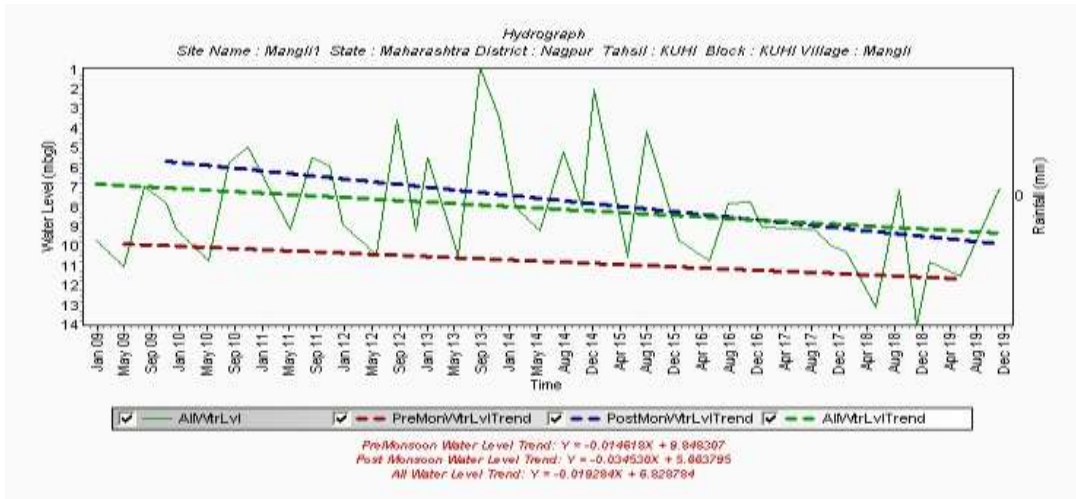


Figure 3.7 I: Hydrograph (2010-19), Mangli, Kuhi Block, Nagpur District

4. GROUND WATER QUALITY

Ground 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, 263 samples from aquifer-I / shallow aquifer and 84 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 V and VI**.

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

Constituents	Aquifer-I / Shallow aquifer			Aquifer-II / Deeper aquifer		
	Min	Max	Avg.	Min	Max	Avg.
pH	7.1	8.2	7.6	6.8	8.7	7.8
EC	215	4920	1067.51	179	3020	981.14
TDS	140	3213	622	55	1963	551.93
TH	64.7	976.1	305.2	60	960	274.44
Ca	18.4	305.4	74.62	10	246	47.32
Mg	2	163	37.27	1.2	127.6	37
Na	2.24	1035	74.65	2	338.1	64.44
K	0.06	114.2	9.8	0.11	47.47	5.3
HCO ₃	39	927.81	313.97	36.61	793.26	203.98
Cl	11.2	14.50	106.61	21.27	694.82	130.6
SO ₄	2	374	47.97	7	460.29	100.2
NO ₃	1	93	26.47	0.75	286	32.92
F	0.11	2.49	0.71	0.03	4.4	0.75

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 215 (Tembhurdoh, Saoner block) and 4920 $\mu\text{S}/\text{cm}$ (Belgaon, Umred block). Out of 263 samples collected from dug wells, 2 samples are having EC in range of more than 3000 $\mu\text{S}/\text{cm}$ observed in 22.05 sq km area. EC in the range 2250-3000 $\mu\text{S}/\text{cm}$ is observed in few patches in Southern and South-east part of the district covering 1500 sq km area in major parts of Umred, Bhiwapur and Mauda blocks. The ground water is potable. EC in the range of 750-2250 $\mu\text{S}/\text{cm}$ is observed in major part of the district covering 3635 sq.km area of the district. The distribution of electrical conductivity in aquifer – I / shallow aquifers is shown in Figure 4.1.

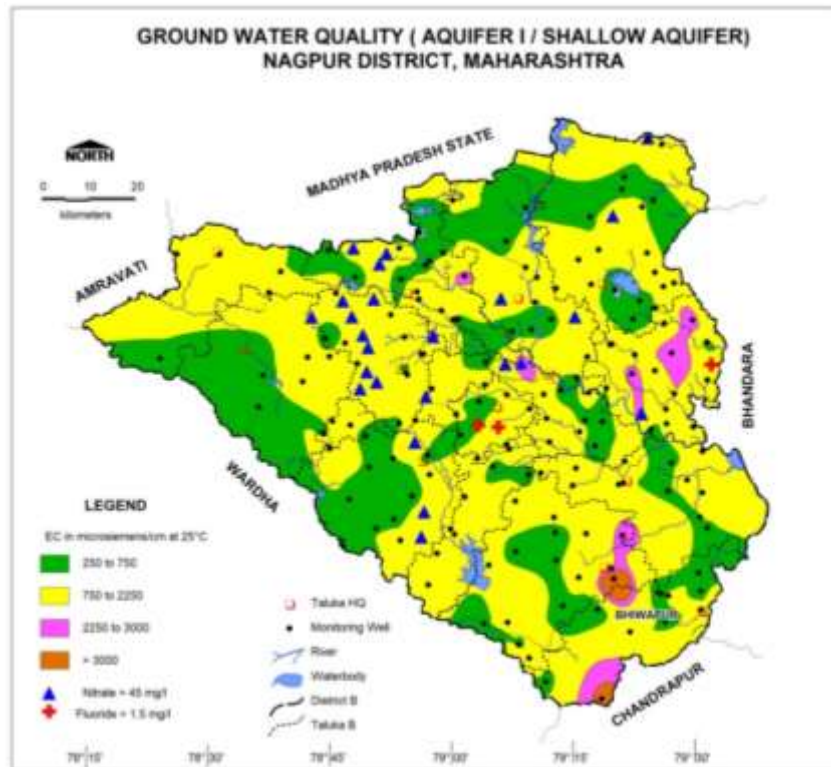


Figure 4.1: Ground water quality, Aquifer-I / Shallow aquifer

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

The concentration of EC in deep aquifer varies between 179 $\mu\text{S}/\text{cm}$ (Amgaon, Ramtek block) and 3020 $\mu\text{S}/\text{cm}$ (Besur, Bhiwapur block). Out of 84 samples collected from tube wells/bore wells, 7 samples are having EC in range of 2000 to 3000 $\mu\text{S}/\text{cm}$ observed in Hingna and Katol blocks. EC in the range 250-750 $\mu\text{S}/\text{cm}$ area in northern parts of Nagpur district major part in Saoner, ramtek and Parseoni blocks. The ground water is potable. EC in the range 750-2250 $\mu\text{S}/\text{cm}$ covering major area of the district. The distribution of electrical conductivity in aquifer – I / shallow aquifers is shown in **Figure 4.1**.

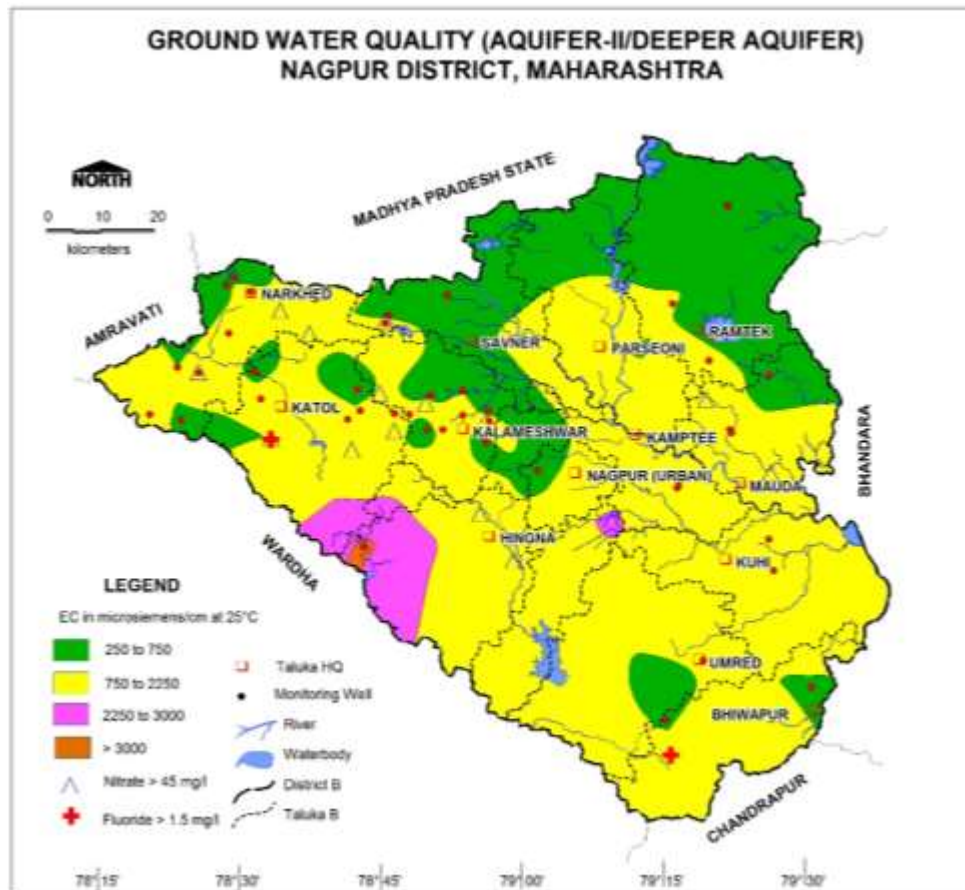


Figure 4.2: Ground water quality, Aquifer-II/Deeper aquifer

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 1 to 93 mg/l. Out of 263 samples 35 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 the urban and rural parts of district.

In aquifer – II / deeper aquifer, nitrate concentration varies between 0.75 to 286 mg/l. Out of 84 samples analysed, 17 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 0.11 to 2.49 mg/l. Out of 263 samples were analysed, 6 samples show fluoride concentration more than 1.5 mg/l. The highest concentration of 2.49 mg/l fluoride is found in Ramdaspath, Nagpur city and Khat, Mauda Block. In aquifer – II / deeper Aquifer, concentration of fluoride ranges from 0.03 to 4.4 mg/l. Out of 84 samples analysed, 4 samples show fluoride concentration

more than 1.5 mg/l. The highest concentration of fluoride is found in Sukali gharapure village, Hingna block (4.4 mg/l).

4.4 Suitability of Ground Water for Drinking Purposes

In aquifer-I / shallow aquifer Ca, Mg, NO₃, and TH is found beyond the maximum permissible limit while most of the parameters are within MPL (Table 4.2). About 1.5 % of samples have fluoride concentration above the MPL. The water from such area is not fit for drinking purpose if directly consumed without treatment. For rest of the area ground water quality is good and fit for drinking purpose except few locations.

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					
	DL	MPL		Samples (<DL)		Samples (DL-MPL)		Samples (>MPL)	
				No	%	No	%	No	%
pH	6.5-8.5	-	263	263	100	0		0	
TDS	500	2000	263	121		121		1	
TH	300	600	263	160		85		18	
Ca (mg/L)	75	200	263	163		95		5	
Mg (mg/L)	30	100	263	116		145		2	
Cl (mg/L)	250	1000	263	243		19		1	
SO ₄ (mg/L)	200	400	263	258		5		0	
NO ₃ (mg/L)	45	No relaxation	263	228				35	
F (mg/L)	1	1.5	263	131	49.80	26	10.64	6	1.5

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

Likewise, in aquifer-II / deeper aquifer, TH, Ca, Mg & SO₄ found more than maximum permissible limit (MPL) and about 3 % 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 Deeper Aquifer

Parameter	Drinking water Standards (IS-10500-2012)		Total no of ground water samples	Aquifer-II/Deeper aquifer					
	DL	MPL		Samples (<DL)		Samples (DL-MPL)		Samples (>MPL)	
				No	%	No	%	No	%
pH	6.5-8.5	-	84	83		1			
TDS	500	2000	69	37		35			
TH	300	600	84	56		26		2	
Ca (mg/L)	75	200	69	60		9		1	
Mg (mg/L)	30	100	69	33		32		5	
Cl (mg/L)	250	1000	84	73		11			
SO ₄ (mg/L)	200	400	79	68		10		1	
NO ₃ (mg/L)	45	No relaxation	84	66		18			
F (mg/L)	1	1.5	84	67		11		4	

(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 assess 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 $\mu\text{S/cm}$): 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 $\mu\text{S/cm}$): 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 $\mu\text{S/cm}$): 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 $\mu\text{S/cm}$): 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 $\mu\text{S/cm}$), 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 $\mu\text{S/cm}$	Aquifer-I / shallow aquifer		Aquifer-II / Deeper Aquifer	
			No. of Samples	% of samples	No. of samples	% of samples
1	Low Salinity Water	< 250	2	0.8	3	4
2	Medium Salinity Water	>250-750	89	33.83	32	38
3	High Salinity Water	>750-2250	158	60.07	44	52
4	Very High Salinity Water	> 2250	14	5.3	5	6
Total			263	100	84	100

4.6 Sodium Absorption Ratio (SAR)

Excess of sodium in water renders 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. I

In both the aquifer-I and aquifer- II, 99 % of samples fall in 'Good' category and 1% fall in **Good to Permissible category** whereas no sample fall in bad 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	263	261	99	2	1	-	-	-	-
Aquifer-II/ Deeper Aquifer	84	83	99	1	1	-	-	-	-

4.7 Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate (RSC) is considered to be superior to SAR as a measure of sodicity particularly at low salinity levels. Calcium reacts with bicarbonate and precipitate as CaCO₃. 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 2.28% samples show RSC values within 'Bad' category while only 93.92 % fall in 'good' category indicating that the ground water of the area is suitable for irrigation. In aquifer-II/deeper aquifer, about 93 % samples show RSC less than 1.25 meq/L indicating ground water of the area is suitable for irrigation while about 6 % 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	263	247	93.92	10	3.80	6	2.28
Aquifer-II / Deeper Aquifer	84	78	93	5	6	1	1

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 Nagpur 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 **Figure 5.1**.

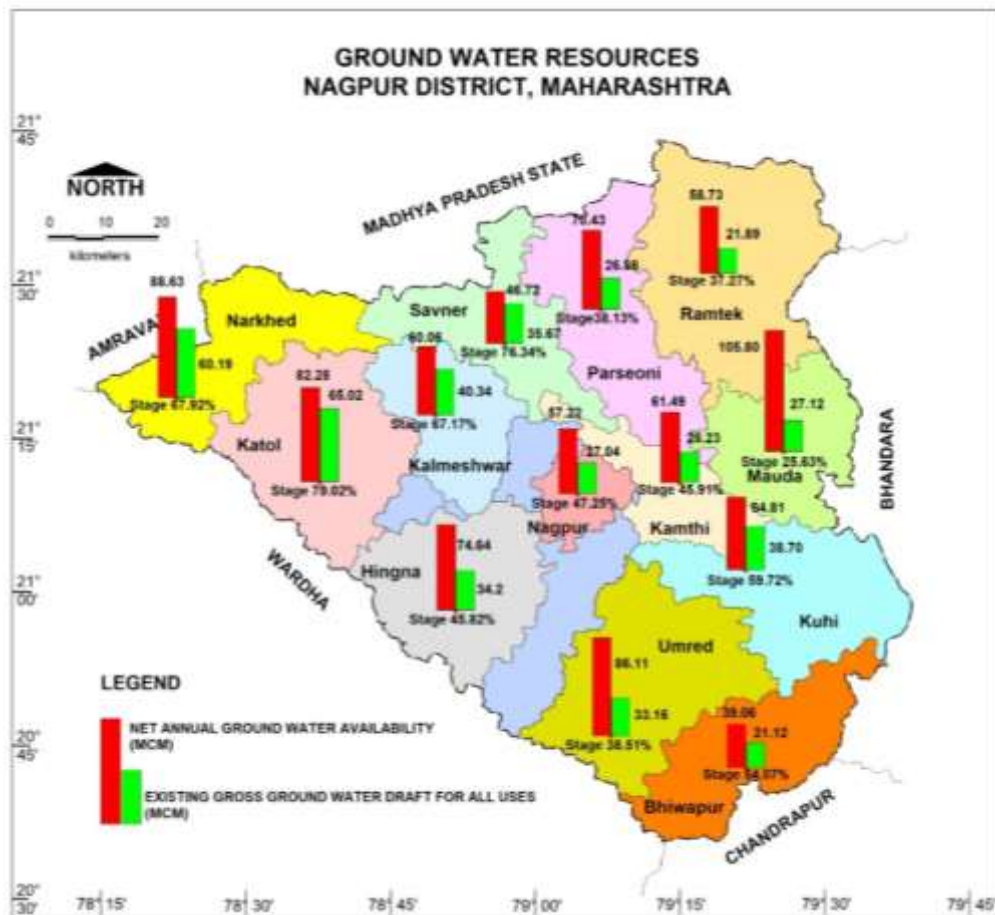


Figure 5.1. Groundwater resources (2017), Nagpur district, Maharashtra

Ground Water Resources estimation was carried out for 9802.01 sq. km. area out of which 2269.24 sq. km. is under command and 5721.18 sq. km. is non-command. As per the estimation, the Annual Extractable Ground Water Recharge comes to be 896.05 MCM. The Annual Ground Water Extraction is estimated at 459.62 MCM with irrigation sector being the major consumer having a draft of 356.43 MCM. The domestic water requirements are worked at 103.19 MCM. Net Ground Water Availability for future use is estimated at 433.01 MCM. The Stage of ground water development varies from 25.64 % (Mauda) to 79.02 % (Katol). The overall stage of ground water development for the district is 51.29 % (SAFE Category). Block wise assessments indicates that two blocks i.e, Katol and Saoner fall under “Semi-Critical” category whereas the other blocks of the district fall under “Safe” category.

Table 5.1: Ground water resources, Aquifer-I (Shallow aquifer), Nagpur district (2017)

Assessment Unit Name	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges	Annual Extractable Ground Water Recharge (Ham)	Current Annual Ground Water Extraction (Ham)				Annual GW Allocation for for Domestic Use as on 2025	Net Ground Water Availability for future use)	Stage of Ground Water Extraction	Categorization (OE/Critical/ Semi critical/ Safe)
				Irrigation Use	Industrial Use	Domestic Use	Total Extraction				
	Ha.m	Ha.m 1	Ha.m	Ha.m	Ha.m	Ha.m	Ha.m	Ha.m	Ha.m	%	
Bhiwapur	4207.57	301.04	3906.53	1691.51	0.00	421.00	2112.51	421.00	1780.54	54.08	Safe
Hingana	7857.47	392.87	7464.60	2562.84	0.00	858.13	3420.98	911.00	4010.18	45.83	Safe
Kalameshwar	6407.01	400.73	6006.28	3572.68	0.00	462.25	4034.93	507.87	1989.64	67.18	Safe
Kamtee	6485.25	335.76	6149.50	2112.36	0.00	711.21	2823.56	711.21	3233.67	45.92	Safe
Katol	8720.94	492.57	8228.37	5519.58	0.00	982.86	6502.44	982.86	1647.54	79.02	Semi Critical
Kuhi	6822.44	341.12	6481.32	3193.41	0.00	677.39	3870.81	752.66	2613.10	59.72	Safe
Mouda	11137.86	556.89	10580.96	1672.06	0.00	1040.70	2712.76	1061.81	7847.08	25.64	Safe
Nagpur	6045.56	322.94	5722.62	1954.01	0.00	750.14	2704.14	834.31	3041.98	47.25	Safe
Narkhed	9382.03	518.78	8863.24	5047.30	0.00	972.68	6019.98	972.68	2831.76	67.92	Safe
Parshioni	7432.54	388.83	7043.71	1875.46	0.00	810.99	2686.45	827.85	4291.66	38.14	Safe
Ramtek	6186.23	312.57	5873.66	1276.16	0.00	913.27	2189.43	931.68	3714.58	37.28	Safe
Saoner	5004.76	332.06	4672.70	2913.22	0.00	654.01	3567.23	681.68	1097.31	76.34	Semi Critical
Umred	9079.97	468.93	8611.04	2252.29	0.00	1064.33	3316.62	1064.33	5201.68	38.52	Safe

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**.

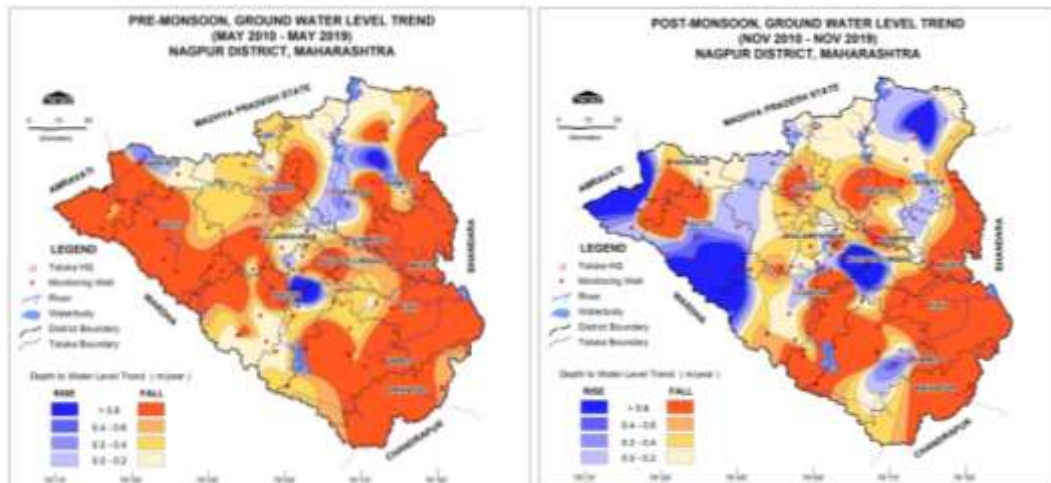
Table 5.2: Ground Water Resources of Aquifer-II (Deeper aquifer)

Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Bhiwapur	3.15	557.65	61.17	0.015	0.00008	0.140528
Hingna	3.16	634.14	53.64	0.015	0.00035	0.700725
Kalmeshwar	8.52	471.12	48.47	0.015	0.000055	0.220767
Kamptee	4.60	536.04	6.235	0.015	0.00035	0.863024
Kuhi	4.15	749.97	47.18	0.015	0.00008	0.248990
Mauda	4.80	753.58	34.75	0.015	0.00089	0.863024
Nagpur	4.03	535.25	32.5	0.015	0.00035	0.248990
Parseoni	3.60	536.51	12.03	0.015	0.00089	3.219294
Ramtek	7.00	632.71	157.6	0.015	0.00089	0.755595
Savner	13.44	562.37	49.97	0.015	0.000482	1.718978
Umred	3.19	824.92	76.07	0.015	0.00035	3.941783
Katol	30.03	552.93	37.66	0.015	0.000114	3.642400
Narkhed	31.23	643.23	31.71	0.015	0.006434	0.921023

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 9321 sq km area covering major part of district. In post-monsoon season, decline has been observed in about 7228.7 sq.km area covering major parts of Kuhi, Bhiwapur, Umred, Mauda, Hingna, Nagpur Rural, Kalmeshwar blocks and parts in Katol, Narkhed, Saoner, Ramtek blocks.



Pre-monsoon Fall in 9321 Sq km area Post-monsoon Fall 7228.7 Sq km area.

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 5 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)
Umred	979.1	93.00	37.65
HIngna	785.64	526.73	1594.42
Bhiwapur	701.97	251.39	206.70
Kuhi	829.48	782.90	3754.03
Nagpur (R)	886.4	178.66	558.47
Mauda	612.87	263.58	571.09
Saoner	618.59	336.45	841.12
Ramtek	1142.9	62.40	77.95
Kamtee	423.82	197.10	330.15
Kalmeshwar	543.45	466.43	2023.67
Katol	841.82	780.39	1935.41
Narkhed	768.25	297.52	1084.65
Parseoni	786.94	400.27	2042.39
Total	9921.23	4636.82	15057.70

The total unsaturated volume available for artificial recharge is **15057.70** MCM and it ranges from 37.65 MCM in Umred block to 3754.03 MCM in Kuhi block. The available surplus runoff can be utilized for artificial recharge through construction of percolation tanks, Check dams and Recharge shafts at suitable sites. After taking into consideration all the factors, 101.04 MCM of surplus water can be utilised for recharge, which is given in **Table 7.2**. This surplus water can be utilized for constructing **354** percolation tanks and 1010 check dams at suitable sites.

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 about 75.78 MCM/year. The tentative locations

CGWB, CR, Nagpur

of these structures are given in **Figure 7.1** and details also given in **Annexure VIII and IX**.

The rainwater harvesting in urban areas can be adopted in 25% of the household with 50 sq. km roof area. A total of 1.4631 MCM potential can be generated by taking 80% runoff coefficient. However, it is economically not viable & hence, not recommended.

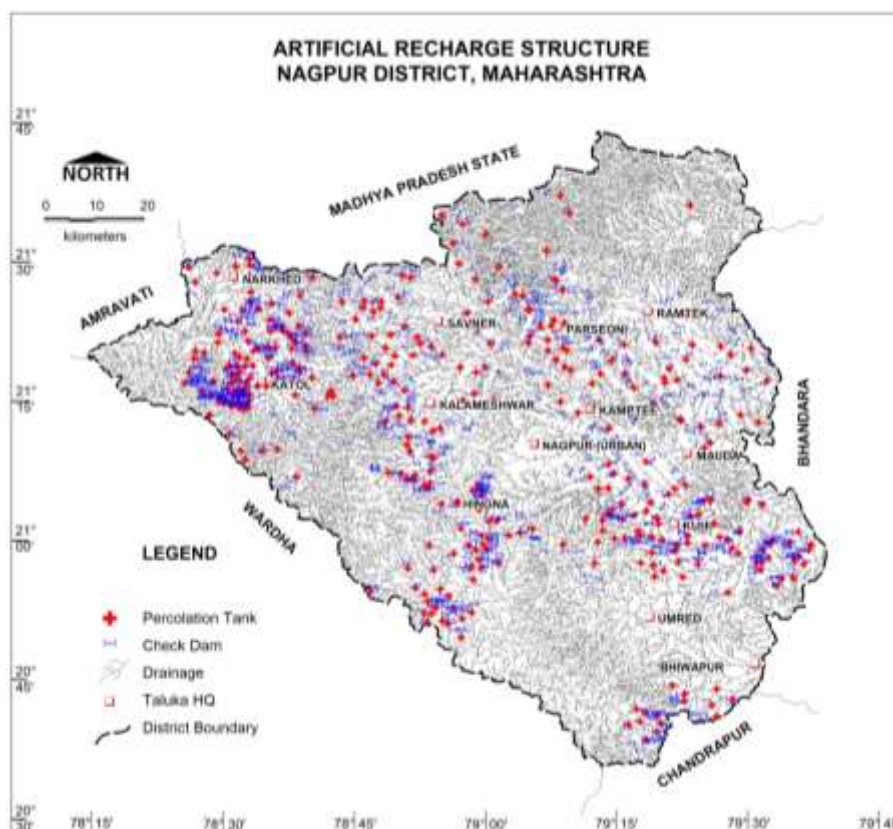


Figure 7.1: Location of Proposed Artificial Recharge structures

Table 7.2: Proposed Artificial Recharge Structures

Block	Surplus water available Considered for AR (MCM)	Proposed number of structures		Total Volume of Water expected to be recharged@ 75 % efficiency (MCM)		Total recharged @ 75 % efficiency (MCM)
		PT	CD	PT	CD	
Umred	0.75	3	8	0.40	0.17	0.56
Hingna	11.80	41	118	6.19	2.65	8.85
Bhiwapur	4.13	14	41	2.17	0.93	3.10
Kuhl	17.54	61	175	9.21	3.95	13.15
Nagpur	4.00	14	40	2.10	0.90	3.00
Mauda	5.90	21	59	3.10	1.33	4.43
Saoner	7.54	26	75	3.96	1.70	5.65

Block	Surplus water available Considered for AR (MCM)	Proposed number of structures		Total Volume of Water expected to be recharged@ 75 % efficiency (MCM)		Total recharged @ 75 % efficiency (MCM)
		PT	CD	PT	CD	
Ramtek	1.40	5	14	0.73	0.31	1.05
Kamtee	4.42	15	44	2.32	0.99	3.31
Kalmeshwar	10.45	37	104	5.49	2.35	7.84
Katol	17.48	61	175	9.18	3.93	13.11
Narkhed	6.66	23	67	9.18	3.93	5.00
Parseoni	8.97	31	90	4.71	2.02	6.72
Total	101.04	354	1010	58.72	25.17	75.78

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 30.77 Sq. Km area in the district. In Saoner Block 2.02 sq.km sugarcane area and in Katol Block 28.75 sq.km of Cotton area is proposed. This intervention would lead to saving of about 9.88 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	Crop Type	Area proposed for micro irrigation. (Sq. Km.)	Volume of Water saved (MCM)
Saoner	Sugarcane	2.02	1.14
Katol	Cotton	28.75	8.74
Total		30.77	9.88

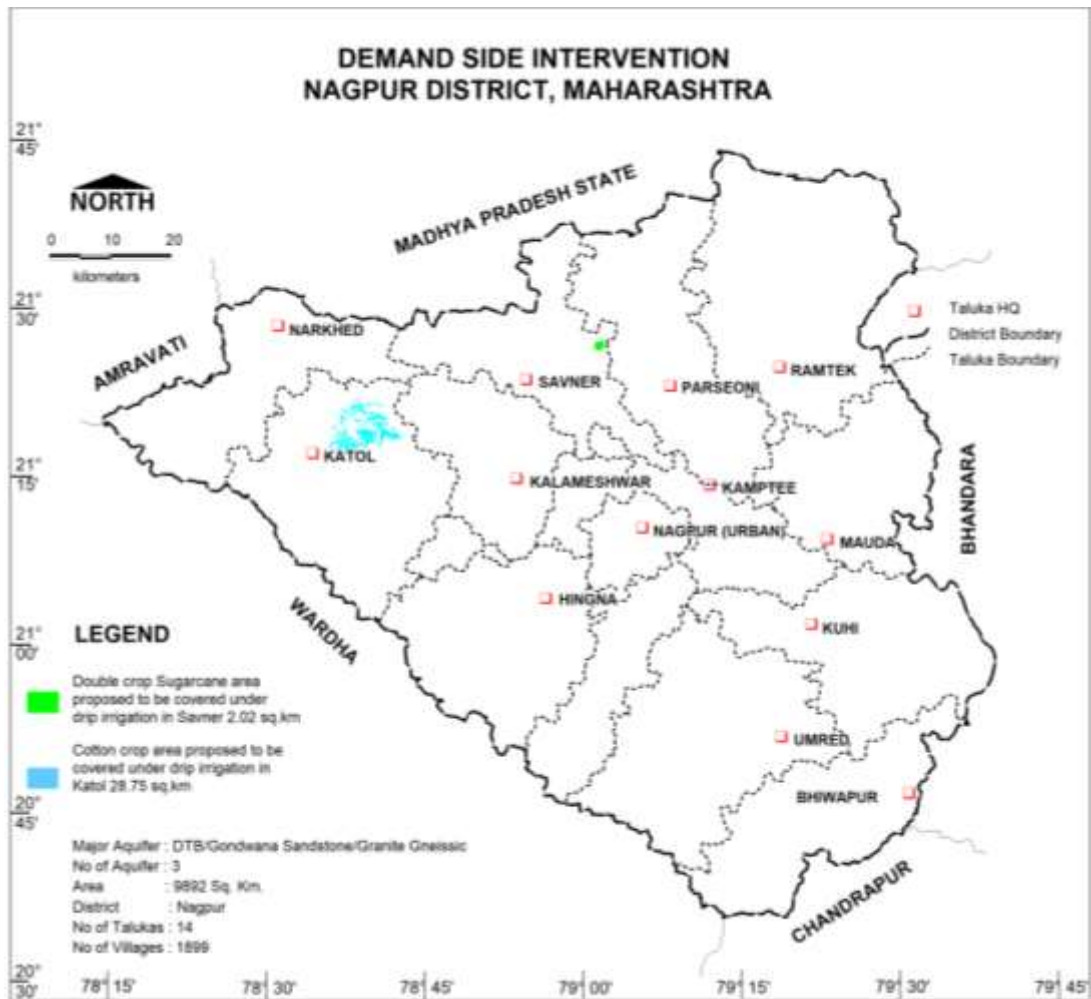


Figure 7.2: Proposed Demand side intervention, Nagpur district

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 implementation of management options

Block	Current Net Ground water availability (MCM)	Current Total ground water draft (MCM)	Current Stage of GW Development %	Water Recharge d by Supply side intervention (MCM)	Water saving by demand side interventions. (MCM)	Ground water resources after supply side management (MCM) (2+5)	Ground water Draft after demand side management (MCM) (3-6)	Expected stage of Development. % [(8/7) * 100]
1	2	3	4	5	6	7	8	9
Umred	86.11	33.17	38.52	0.56		86.67	33.17	38.27
Hingna	74.65	34.21	45.83	8.85		83.5	34.21	40.97
Bhiwapur	39.07	21.13	54.08	3.1		42.17	21.13	50.1

Kuhi	64.81	38.71	59.72	13.15		77.96	38.71	49.65
Nagpur	57.23	27.04	47.25	3		60.23	27.04	44.89
Mauda	105.8	27.13	25.64	4.43		110.23	27.13	24.61
Saoner	46.72	35.67	76.34	5.65	1.14	52.37	36.81	65.93
Ramtek	58.74	21.89	37.28	1.05		59.79	21.89	36.61
Kamtee	61.5	28.24	45.92	3.31		64.81	28.24	43.57
Kalmeshwar	60.06	40.35	67.18	7.84		67.9	40.35	59.43
Katol	82.28	65.02	79.02	13.11	8.74	95.39	73.76	59
Narkhed	88.63	60.2	67.92	5		93.63	60.2	64.3
Parseoni	70.44	26.86	38.14	6.72		77.16	26.86	34.82
Total	896.03	459.62	51.3	75.78	9.88	971.81	469.74	46.28

7.4 Development Plan

The ground water development plan is proposed in the view of developing the additional ground water resources available after supply side interventions to bring the stage of ground water development up to 70 %. about 230.53 MCM of ground water generated can bring 472.99 sq km additional area under assured ground water irrigation with average crop water requirement of 0.65 m by constructing 13832 Dug wells and 2305 Borewells. The area feasible for ground development is shown in **Figure 7.3** while block wise details are given in **Table 7.5**.

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

Block	Balance GWR available for GW Development after STAGE OF GWD is brought to 70% (MCM)	Proposed No. of DW @1.5 ham for 90% of GWR Available)	Proposed No. of BW @1.5 ham for 10% of GWR Available)	Additional Area (sq.km.) proposed to be brought under assured GW (sq. Km)
Umred	27.51	1650	275	43.19
HIngna	24.24	1454	242	50.9
Bhiwapur	8.39	503	84	17.68
Kuhi	15.86	952	159	44.64
Nagpur	15.12	907	151	27.88
Mauda	50.03	3002	500	83.78
Saoner	2.13	128	21	13.73
Ramtek	19.96	1198	200	32.32
Kamtee	17.13	1028	171	31.44
Kalmeshwar	7.18	431	72	23.1
Katol	10.49	630	105	36.31
Narkhed	5.34	320	53	15.9
Parseoni	27.15	1629	271	52.11
Total	230.53	13832	2305	472.99

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 Nagpur district.

Nagpur district covering an area of 9802 Sq.km, out of this 1811.59 sq km (18.48 %) is hilly area. Geologically, the area is occupied by Archeans, Gondwana, Lameta, Deccan Trap Basalt, and local river Alluvium. The Stage of ground water development varies from 25.64 % (Mauda) to 79.02 % (Katol). The overall stage of ground water development for the district is 51.30 % (SAFE Category). The area has witnessed declining water level which is the major issue in the district. Declining water level trend has been observed in 9321 sq km during pre-monsoon while it is 7228.7 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.

As a part of **Supply Side Management**, a total 354 Percolation tanks and 1010 Check dams are proposed, which will augment ground water resources to the tune of **75.78 MCM** (58.72 MCM by Percolation tanks and 25.17 MCM by Check dams).

As a part of **Demand Side Management**, the micro-irrigation techniques are proposed to be adopted in 30.77 Sq. Km area in entire district by saving a total of 9.88 MCM.

The **ground water development plan** has been proposed in view of the developing additional ground water resources available after supply side interventions to bring the stage of ground water development up to 70%. About 230.53 MCM volume of ground water generated can bring 472.99 sq km additional area under assured ground water irrigation with average crop water requirement of 0.65 m by constructing 13832 Dug wells and 2305 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 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. BLOCK WISE AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

1. UMRED BLOCK
2. HINGNA BLOCK
3. BHIWAPUR BLOCK
4. KUHI BLOCK
5. NAGPUR BLOCK
6. KATOL BLOCK
7. NARKHED BLOCK
8. KALMESHWAR
9. KAMTEE
10. MAUDA
11. PARSEONI
12. RAMTEK

9.1 UMRED BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES																																											
1.1 Introduction																																											
Block Name	Umred																																										
Geographical Area (Sq. Km.)	989.45																																										
Hilly Area (Sq. Km)	164.53																																										
Population (2011)	53971																																										
Climate																																											
1.2 Rainfall Analysis																																											
Normal Rainfall	1179.7 mm																																										
Annual Rainfall (2019)	1209 mm																																										
Decadal Average Annual Rainfall (2010-19)	1016.94 mm																																										
Long Term Rainfall Analysis (2000-2019)	Rising trend 8.7 mm/year. Probability of Normal/Excess Rainfall- 40% / 20%. Probability of Drought (Moderate/Severe/Acute)-: 30% Moderate / Severe-nil & Acute -10.																																										
<div style="text-align: center;"> <h3>Rainfall Trend Analysis (2000 - 2019)</h3> <p>$y = 8.7109x + 917.66$</p> <table border="1"> <caption>Annual Rainfall Data (2000-2019)</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2000</td><td>34.2</td></tr> <tr><td>2001</td><td>208.2</td></tr> <tr><td>2002</td><td>846.2</td></tr> <tr><td>2003</td><td>747.1</td></tr> <tr><td>2004</td><td>1856.3</td></tr> <tr><td>2005</td><td>1856.3</td></tr> <tr><td>2006</td><td>1014.2</td></tr> <tr><td>2007</td><td>1464</td></tr> <tr><td>2008</td><td>1060.4</td></tr> <tr><td>2009</td><td>926.2</td></tr> <tr><td>2010</td><td>1552.2</td></tr> <tr><td>2011</td><td>887.1</td></tr> <tr><td>2012</td><td>1122</td></tr> <tr><td>2013</td><td>1530.8</td></tr> <tr><td>2014</td><td>695.2</td></tr> <tr><td>2015</td><td>960.2</td></tr> <tr><td>2016</td><td>686.8</td></tr> <tr><td>2017</td><td>684.2</td></tr> <tr><td>2018</td><td>841.9</td></tr> <tr><td>2019</td><td>1209</td></tr> </tbody> </table> </div>		Year	Rainfall (mm)	2000	34.2	2001	208.2	2002	846.2	2003	747.1	2004	1856.3	2005	1856.3	2006	1014.2	2007	1464	2008	1060.4	2009	926.2	2010	1552.2	2011	887.1	2012	1122	2013	1530.8	2014	695.2	2015	960.2	2016	686.8	2017	684.2	2018	841.9	2019	1209
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2016	686.8																																										
2017	684.2																																										
2018	841.9																																										
2019	1209																																										
1.3. Geomorphology, Soil & Geology																																											
Geomorphic Unit	Plateau, weathered (shallow) slightly o moderately dissected																																										
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene Gneissic complex: Archean																																										
Soil	Shallow to very deep BCS consisting mostly of clay and loam																																										
1.4. Hydrology & Drainage																																											
Drainage	Godavari river basin.																																										
Hydrology	Major and Medium projects	1																																									
	Minor Irrigation Projects (Local)	28																																									
	Minor Irrigation Projects (ZP Level)	13																																									
		PT-2, KT-118, UGB-367																																									
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern																																											
Forest Area	298.73 Sq. Km.																																										
Cultivable Area	555.45 Sq. Km.																																										

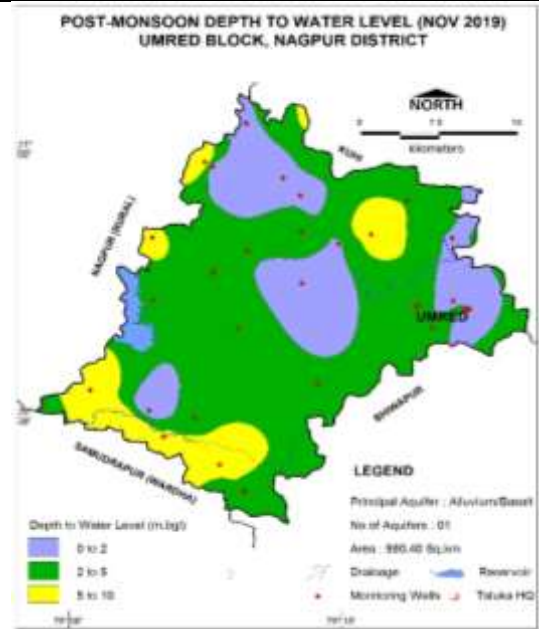
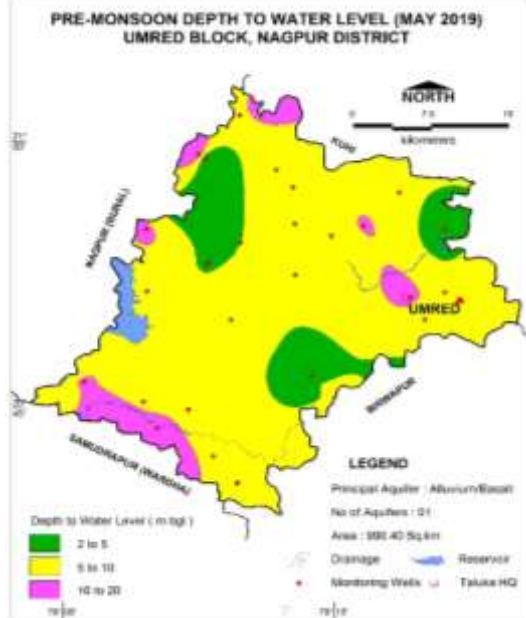
Net Sown Area		462.31 Sq. Km.
Double Cropped Area		138.37 Sq. km
Area under Irrigation	Surface Water	69.05 Sq. Km.
	Ground Water	66.05 Sq. Km.
Principal Crops	Crop Type	Area (Sq. Km.) (Reference year 2014-15)
	Cotton	146.13
	Cereals	76.04
	Pulses	78.86
	Oil Seeds	226.92
Horticultural Crops	Citric fruit	1.82
	Sugarcane	1.06
	Vegitable	13.92

1.6. Water Level Behaviour

1.6.1 Aquifer-I (Shallow Aquifer)

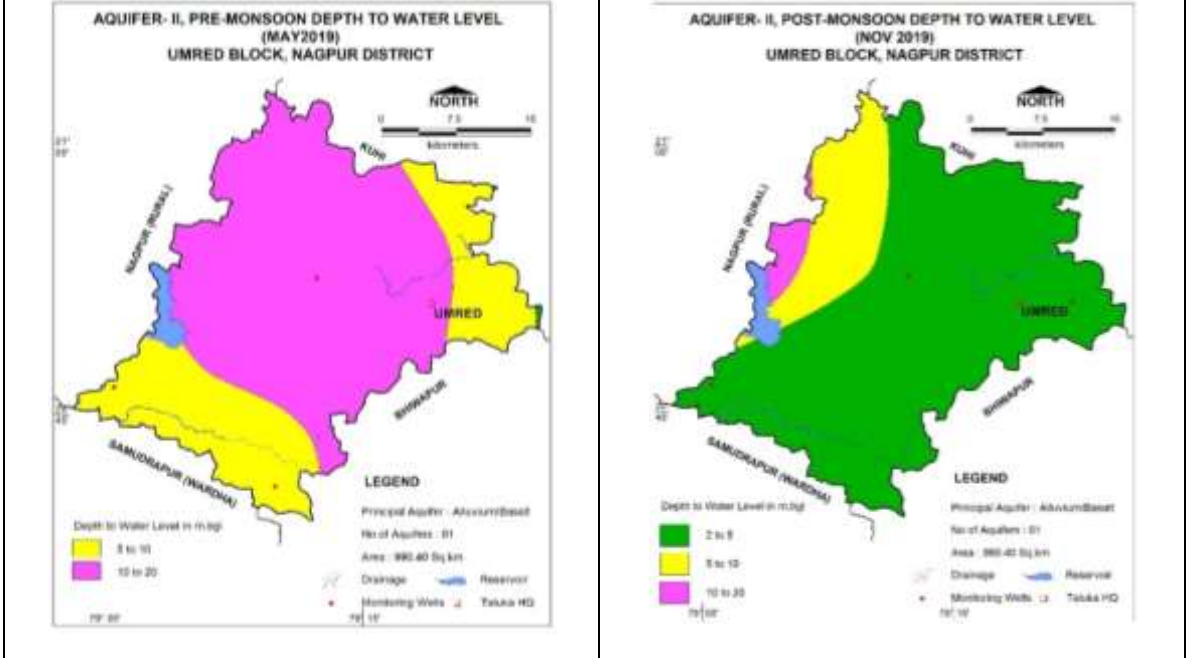
Pre-Monsoon (May-2019)
DTWL 05 to 10 mbgl is observed in entire block except in few isolated small patches of the block where water level in the range of 2 to 5 mbgl is observed. Water level in the range of 10 to 20 mbgl is observed in north and south west regions in small patches.

Post-Monsoon (November-2019)
DTWL less than 2 mbgl is observed in isolated patches in north, central and eastern part of the block. Water level in the range of 2 to 5 mbgl is observed in the entire block except in some patches in North-western, south-western and in one isolated patch in north-eastern part of the block where water level ranges between 5 to 10 mbgl.

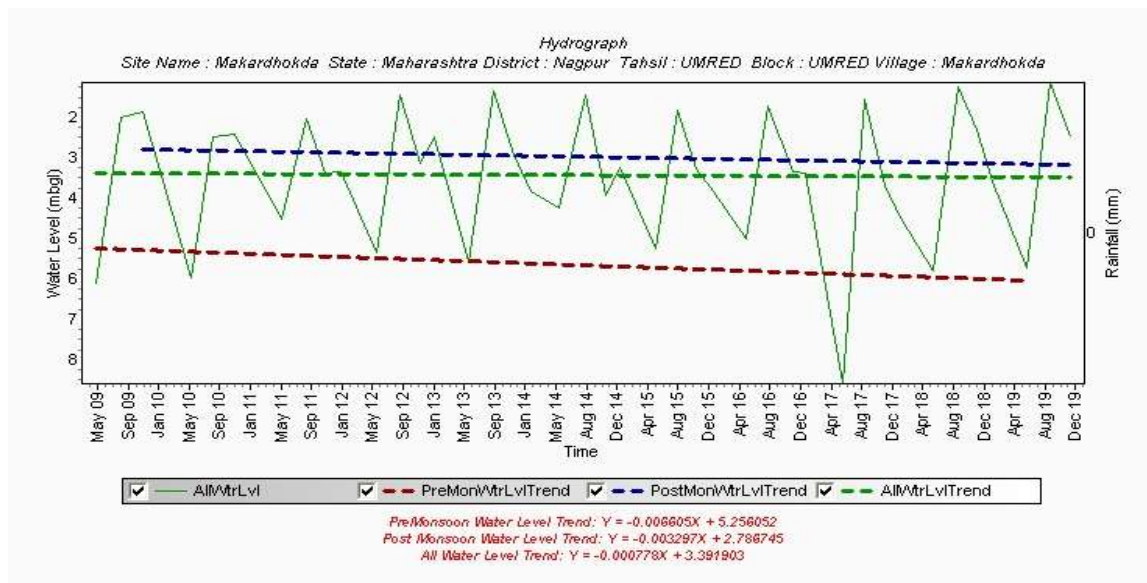


1.6.2 Water Level Behaviour – Aquifer-II (Deeper Aquifer)

<p>Pre-Monsoon (May-2019) DTWL 10-20 mbgl is observed in major part of the block. DTWL 5-10 mbgl is observed in eastern and south-western parts of the block.</p>	<p>Post-Monsoon (November-2019) DTWL 2-5 mbgl is observed in major part of the block. North-western part shows the water level 5-10 mbgl engulfing one patch of DTWL 10-20 mbgl is observed.</p>
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1.7. Hydrograph



Hydrograph shows Pre-monsoon falling water level trend @0.007 m/year

Hydrograph shows Post-monsoon falling water level trend @ 0.003 m/year

1.8. Water Level Trend (2000-2019)

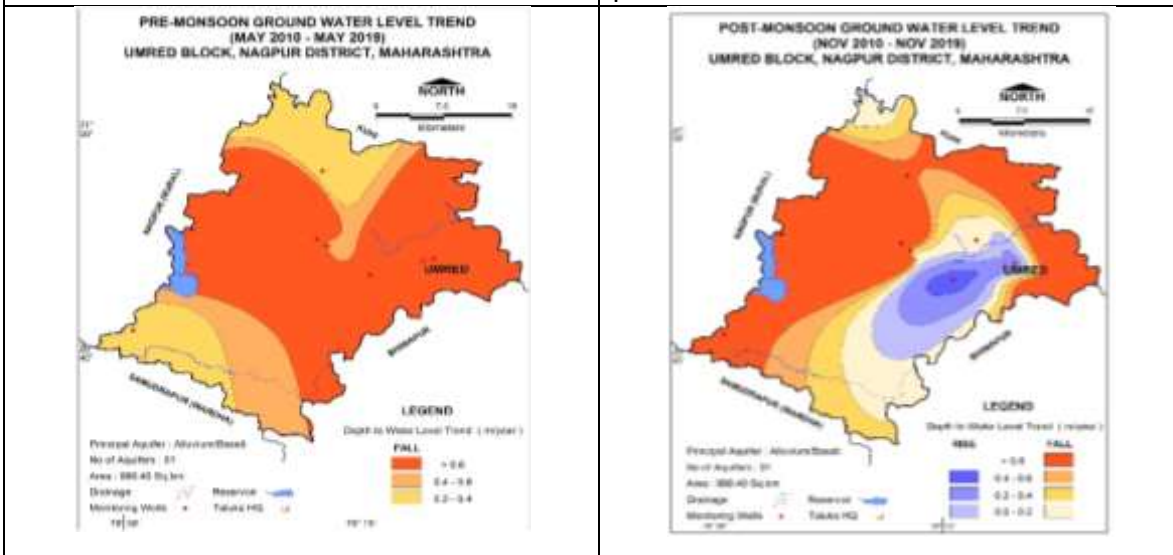
1.8.1 Pre-Monsoon trend

Falling 0.2 (Bela) to 1.8 (Shivani) m/year

1.8.2 Post-Monsoon trend

Rising 0.3 (Umred) to 0.5 (Pipaldol) m/year; Falling 0.02 (Pachgaon) to 3.9 (Makardhokla) m/year

<p>Major part of the block shows falling water level trend up >0.6 m/year. Falling trend less than 0.6 m/year has been observed in North and south western part of the block in patches.</p>	<p>Major part of the block shows falling trend >0.6 m/year. Rising trend of 0.2 to 0.6 m/year has been observed in south-eastern part of the block, Falling trend less than 0.6 m/year has been observed in north and south part of the block in a patch.</p>
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2. Ground Water Issues

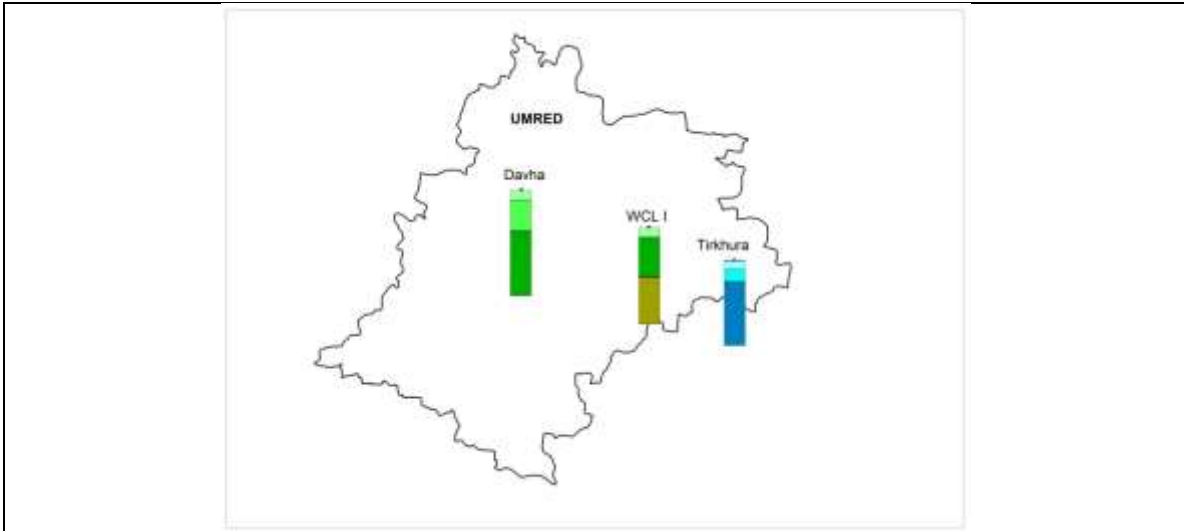
Declining Water Level trend is observed in 302 sq. km. area of the block. Frequent droughts (30% Moderate droughts) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.

3. AQUIFER DISPOSITION

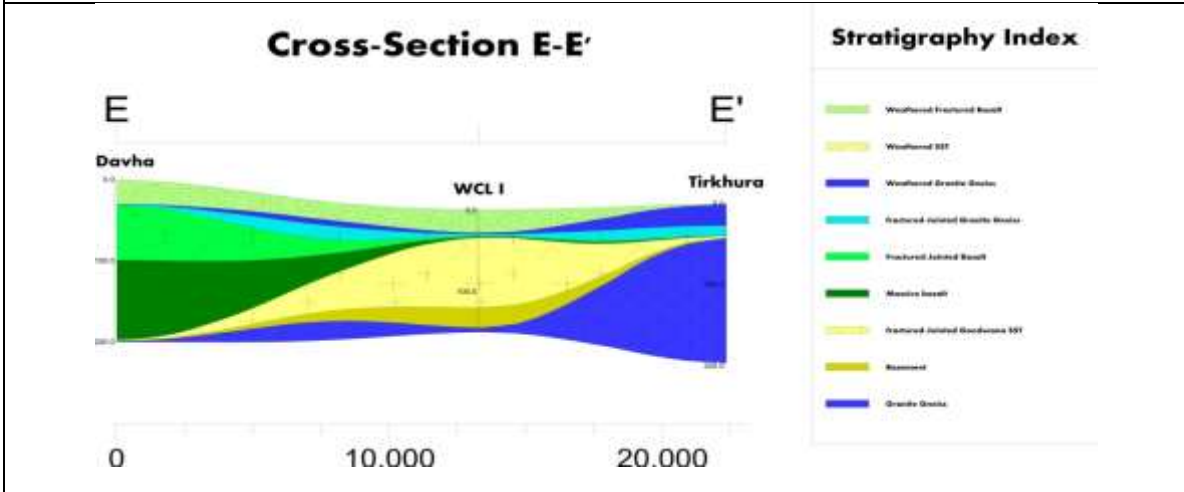
3.1. Number of Aquifers

- Aquifer-I
1. Basalt (Phreatic / Shallow aquifer)
 2. Granite Gneiss (Phreatic / Shallow aquifer)
- Aquifer-II –
1. Basalt (Semi-confined / confined / Deeper aquifer);
 2. Granite Gneiss (Semi-confined / confined / Deeper aquifer)

3.2. Lithological Disposition



3.3. Cross Sections



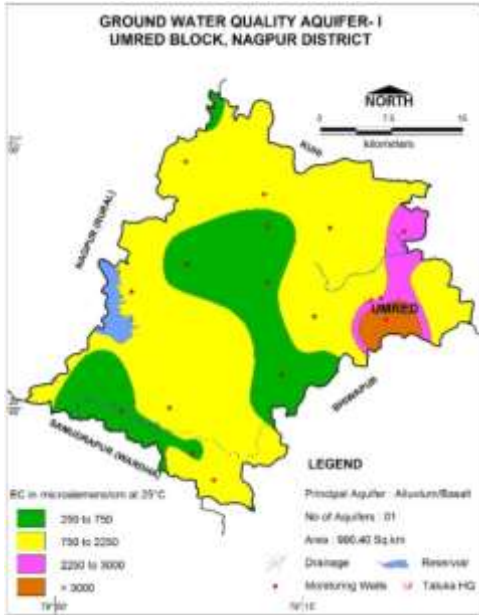
3.4. Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)		Gondwana Sandstone	Granite Gneiss
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt – Aquifer-I (Phreatic / Shallow aquifer)	Basalt – Aquifer-II (Semi-confined / confined / Deeper aquifer)	Sandstone Aquifer-II (Semi-confined / confined / Deeper aquifer)	Granite Gneiss Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (m bgl)	0.5-9.6	4.4-5.7	16-38.15	Upto 3.6
Depth of Occurrence (mbgl)	2-8	71.6-99.1	144-124	40-74.45
weathered/fractured rocks thickness (m)	1-6	3-3.1	2-8	2.5-11
Yield	10 – 100 m ³ /day	10-100 lpm	--	-
Specific yield/ Storativity (S)	0.019 to 0.028	0.000245 - 0.0000145	0.015	-
Transmissivity (T)	30-40	25-210	--	-

	m ² /day	m ² /day		
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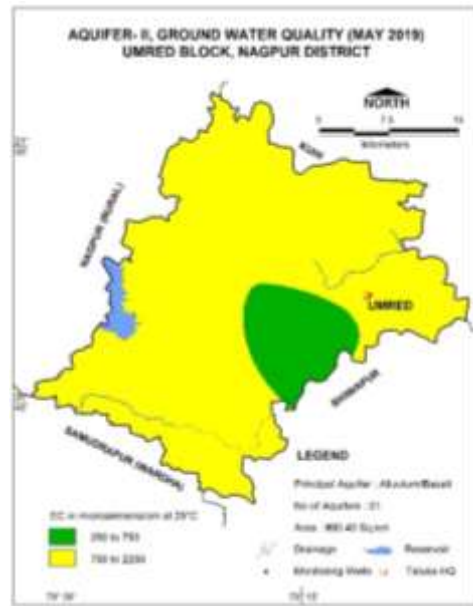
4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)



EC ranging from 750 to 2250 $\mu\text{S}/\text{cm}$ has been observed in major part of block covering about 515.8 sq. km area of the block whereas EC ranging from 250 to 750 $\mu\text{S}/\text{cm}$ observed in central, southeast and south-west parts of the block in patches (339.1 sq.km) EC ranging greater than 2250 $\mu\text{S}/\text{cm}$ has been observed in eastern part in an isolated patch.

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



EC ranging from 750 to 2250 $\mu\text{S}/\text{cm}$ has been observed in major parts of the block covering about 490.8 sq. km area of the block engulfing EC ranging from 250 to 750 $\mu\text{S}/\text{cm}$ observed in south-eastern part of the block in patch (363.7 sq.km). Ground water is suitable for all purpose.

5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Phreatic Aquifer

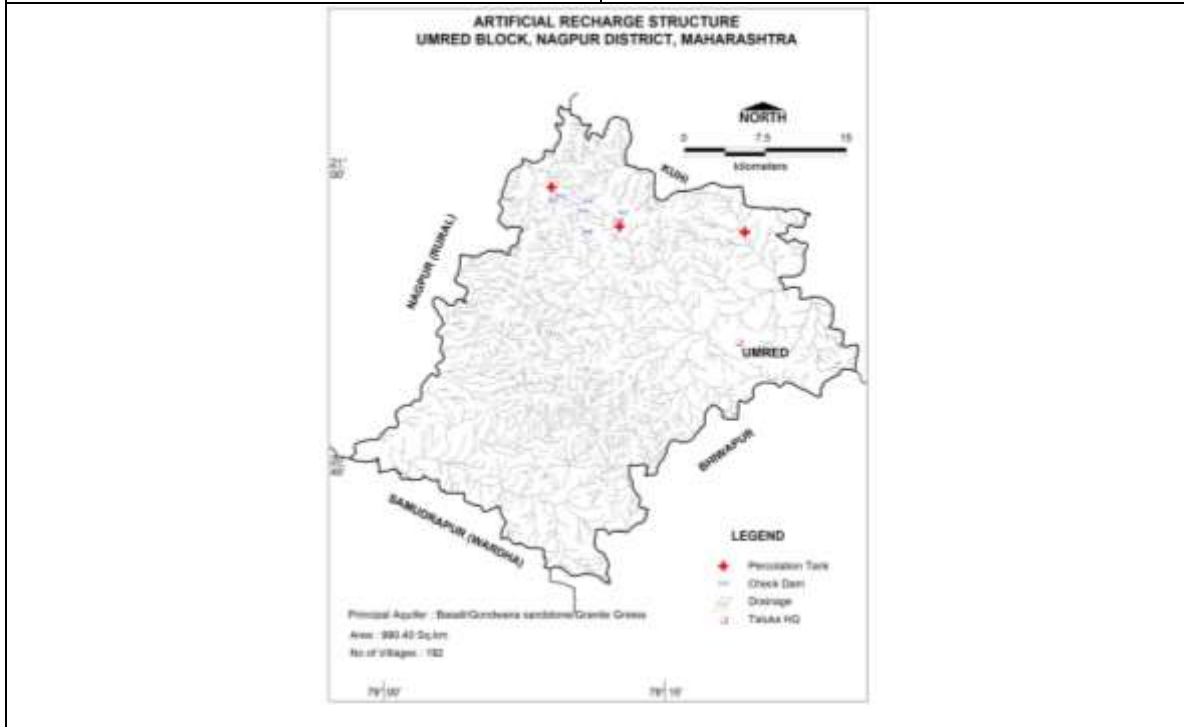
Ground Water Recharge Worthy Area (Sq. Km.)	93
Total Annual Ground Water Recharge (MCM)	90.79
Natural Discharge (MCM)	4.68
Annual Extractable Ground Water Recharge (MCM)	86.11
Current Annual Ground Water Extraction for irrigation (MCM)	22.52
Current Annual Ground Water Extraction for domestic water supply (MCM)	10.64
Current Annual Ground Water Extraction for All uses (MCM)	33.17
Annual GW Allocation for for Domestic Use as on 2025 (MCM)	10.65
Net Ground Water Availability for future use (MCM)	52.01
Stage of Ground Water Development (%)	38.52
Category	SAFE

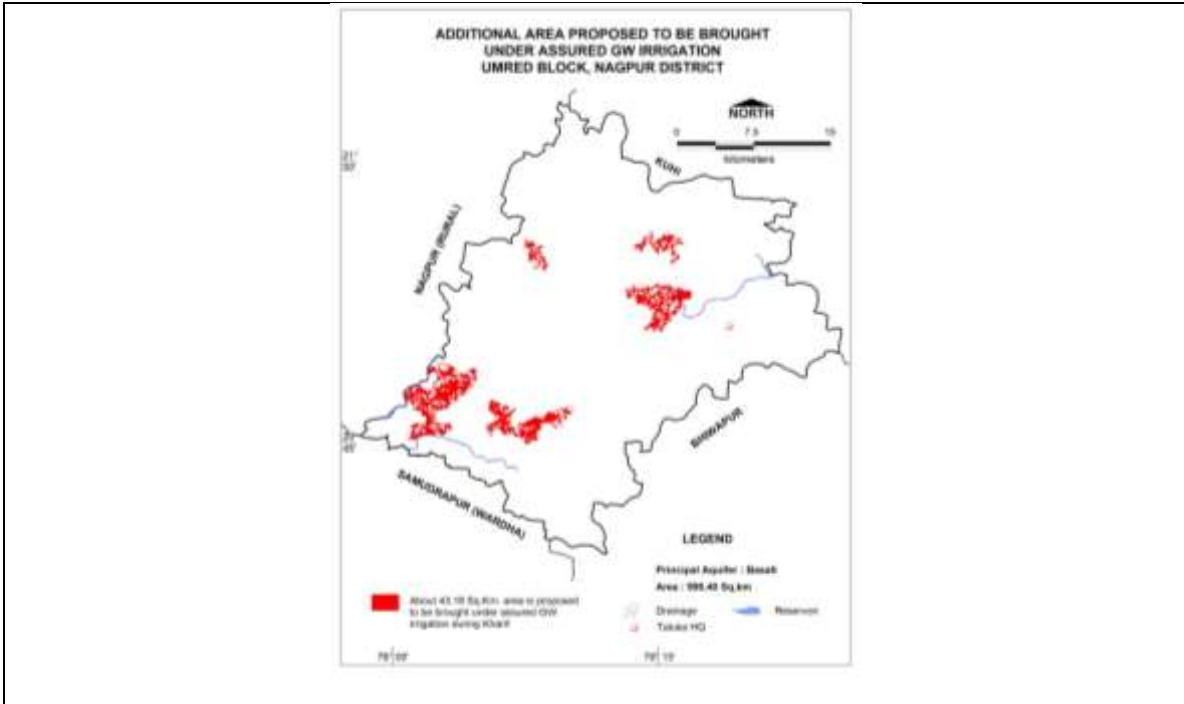
5.2 Aquifer-II (Semi-confined/Confined Deeper Aquifer)

Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining)	Total Resource
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				layer)	(MCM)
824.92	3.19	0.015	0.00035	76.1	3.94
6.0. GROUND WATER MANAGEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					86.11
Gross Annual Draft (MCM)					33.17
Agricultural Demand –GW					22.52
Agricultural Demand –SW					44.88
Domestic Demand – GW					10.64
Domestic Demand – SW					2.66
Total Demand					80.71
Area of Block (Sq. Km.)					990.40
Area suitable for Artificial recharge (Sq. Km)					93
Type of Aquifer					
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					93
Volume of Unsaturated Zone (MCM)					37.65
Average Specific Yield					0.015
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)					0.56
Surplus water Available (MCM)					0.75
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		8	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		0.4		0.17	
RTRWH Structures – Urban Areas					
Households to be covered (25% with 50 m ² area)					12277
Total RWH potential (MCM)					0.6064838
Rainwater harvested / recharged @ 80% runoff co-efficient					1.1718
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					Nil
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)					86.11
Additional GW resources available after Supply side interventions (MCM)					0.56
Ground Water Availability after Supply side intervention (MCM)					86.68
Existing Ground Water Draft for All Uses (MCM)					33.17

GW draft after Demand Side Interventions (MCM)	33.17
Present stage of Ground Water Development (%)	38.52
Expected Stage of Ground Water Development after interventions (%)	38.26
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)	27.51
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	1650
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	275
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	43.19
Regulatory Measures	60m borewells/tube wells





9.2 HINGNA BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES																																											
1.1 Introduction																																											
Block Name	Hingna																																										
Geographical Area (Sq. Km.)	802.45																																										
Hilly Area (Sq. Km)	168.31																																										
Population (2011)	121151																																										
Climate	Monsoon Tropical																																										
1.2 Rainfall Analysis																																											
Normal Rainfall	1171.5mm																																										
Annual Rainfall (2019)	1010.6 mm																																										
Decadal Average Annual Rainfall (2010-2019)	885.32 mm																																										
Long Term Rainfall Analysis (2000-2019)	Insignificantly falling trend -10.58 mm/year. Probability of Rainfall: 35% Normal rainfall and 5% Excess rainfall Probability of Drought-: 55% Moderate AND 5% SEVERE Drought																																										
<p style="text-align: center;">Rainfall Trend Analysis (2000 - 2019)</p> <table border="1"> <caption>Rainfall Trend Analysis (2000 - 2019) Data</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2000</td><td>1870.7</td></tr> <tr><td>2001</td><td>1188.6</td></tr> <tr><td>2002</td><td>479.2</td></tr> <tr><td>2003</td><td>583.3</td></tr> <tr><td>2004</td><td>920.4</td></tr> <tr><td>2005</td><td>920.4</td></tr> <tr><td>2006</td><td>814.9</td></tr> <tr><td>2007</td><td>806</td></tr> <tr><td>2008</td><td>683.1</td></tr> <tr><td>2009</td><td>724.7</td></tr> <tr><td>2010</td><td>942.2</td></tr> <tr><td>2011</td><td>814.8</td></tr> <tr><td>2012</td><td>838.7</td></tr> <tr><td>2013</td><td>1235.7</td></tr> <tr><td>2014</td><td>778.6</td></tr> <tr><td>2015</td><td>956.2</td></tr> <tr><td>2016</td><td>681.6</td></tr> <tr><td>2017</td><td>779.5</td></tr> <tr><td>2018</td><td>815.3</td></tr> <tr><td>2019</td><td>1010.6</td></tr> </tbody> </table>		Year	Rainfall (mm)	2000	1870.7	2001	1188.6	2002	479.2	2003	583.3	2004	920.4	2005	920.4	2006	814.9	2007	806	2008	683.1	2009	724.7	2010	942.2	2011	814.8	2012	838.7	2013	1235.7	2014	778.6	2015	956.2	2016	681.6	2017	779.5	2018	815.3	2019	1010.6
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2016	681.6																																										
2017	779.5																																										
2018	815.3																																										
2019	1010.6																																										
1.3. Geomorphology, Soil & Geology																																											
Geomorphic Unit	Plateau (Slightly to Highly d Dissected) with weathered thickness ranging from 0 to 5 m.																																										
Geology	Deccan Traps (Basalt) Age: Upper Cretaceous to Lower Eocene																																										
Soil	Fine loamy to clayey soil.																																										
1.4. Hydrology & Drainage																																											
Drainage	Godavari river basin.																																										
Hydrology	Major projects	0																																									
	Medium projects	1																																									
	Minor Irrigation Projects (Local)	11																																									
	Minor Irrigation Projects (ZP Level)	7																																									
		PT-8, KT-148, UGB-155																																									
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern																																											

Forest Area		105.23 Sq. Km.
Cultivable Area		471.30 Sq. Km.
Net Sown Area		321.65 Sq. Km.
Double Cropped Area		34.99 Sq. Km.
Area under Irrigation	Surface Water	7.34 sq. km.
	Ground Water	3123ha
Principal Crops	Crop Type	Area (Sq. Km.)(Reference year 2014-15)
	Cotton	188.12
	Cereals	28.91
	Pulses	0
	Oil Seeds	89.04
Horticultural Crops	Sugarcane	0.37
	Citrous fruit	5.25
	Vegetables	8.58

1.6. Water Level Behaviour

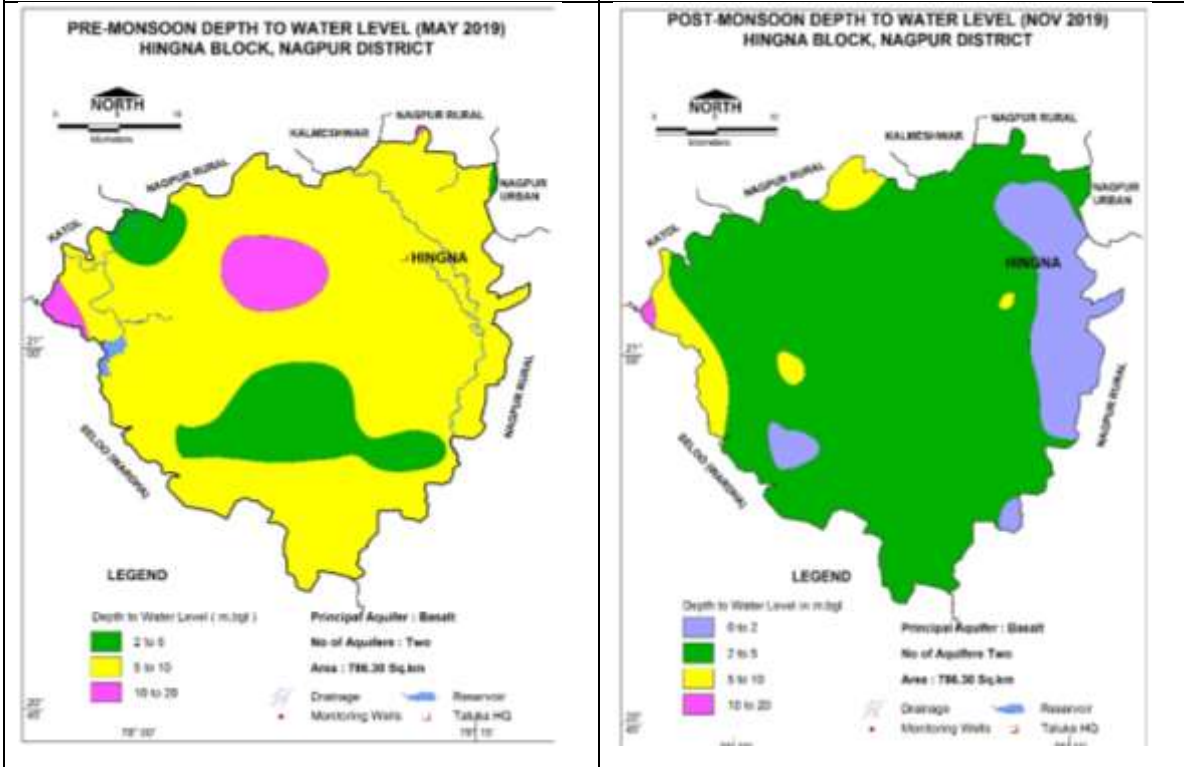
1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)

DTWL 5 to 10 mbgl is observed in major parts of the block while water level in the range of 2 to 5 mbgl is observed in northern, northwestern parts. Deeper DTWL 10 to 20 mbgl is observed as in a long horizontal patch in southern part and north western part.

Post-Monsoon (November-2019)

DTWL 2 to 5 mbgl is observed in entire block except western and small area in north-west and north part of the block where DTWL ranging 5 to 10. DTWL less than 2 mbgl are observed as patches in north-east and south-east-west parts of the block.



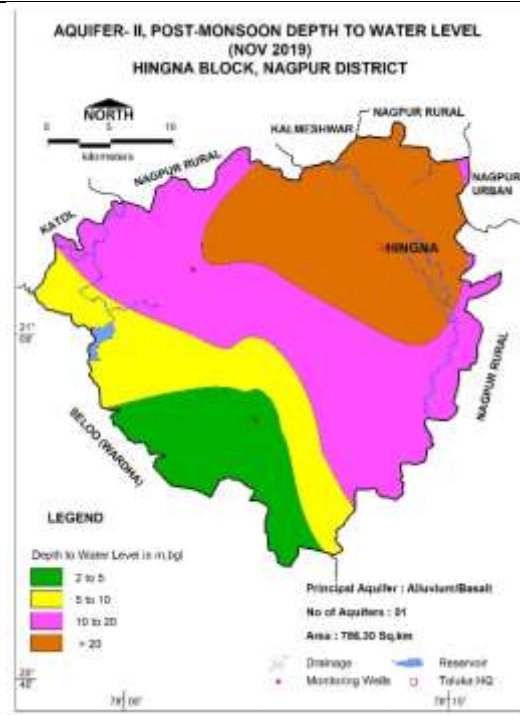
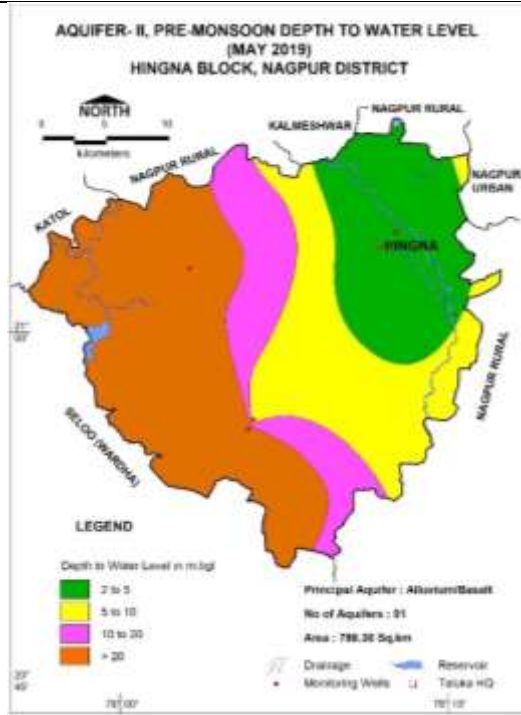
1.6.2 Water Level Behaviour– Aquifer-II (Deeper Aquifer)

Pre-Monsoon (May-2019)

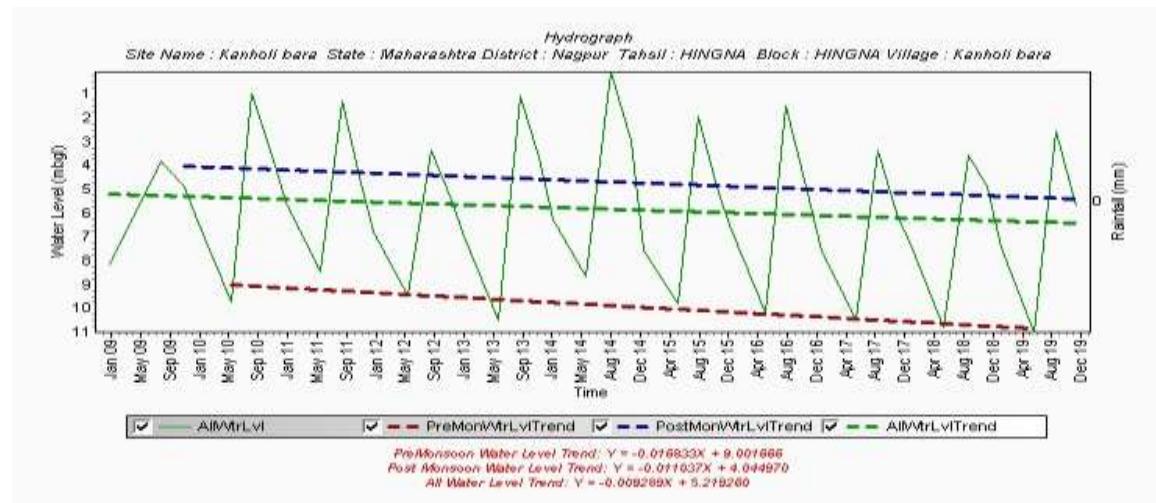
DTWL >20 mbgl is observed in major part engulfing small patch of 5-10 and 10-20 mbgl. Northeastern area has DTWL 2-5 mbgl.

Post-Monsoon (November-2019)

DTWL 2-5 mbgl is observed in major part of block. DTWL 0-2 mbgl is observed in north-eastern part as well as in an isolated patch in south west part of the block. Deeper DTWL 10-20 is observed in central, north-western part in small patch of the block.



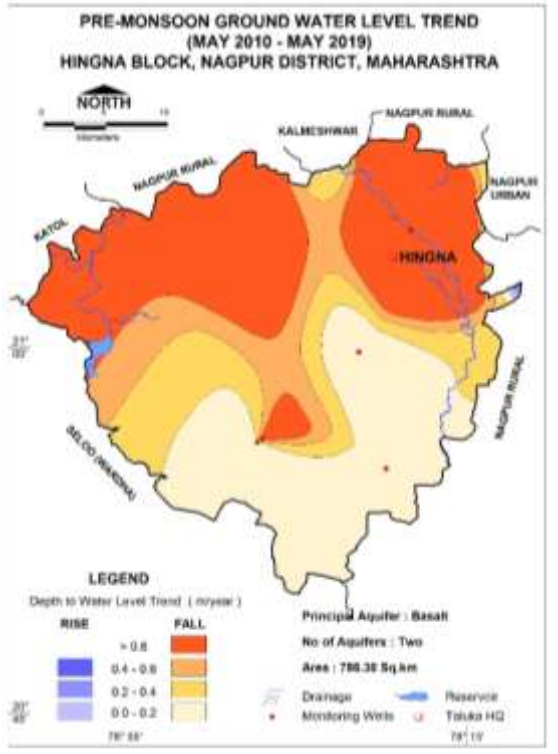
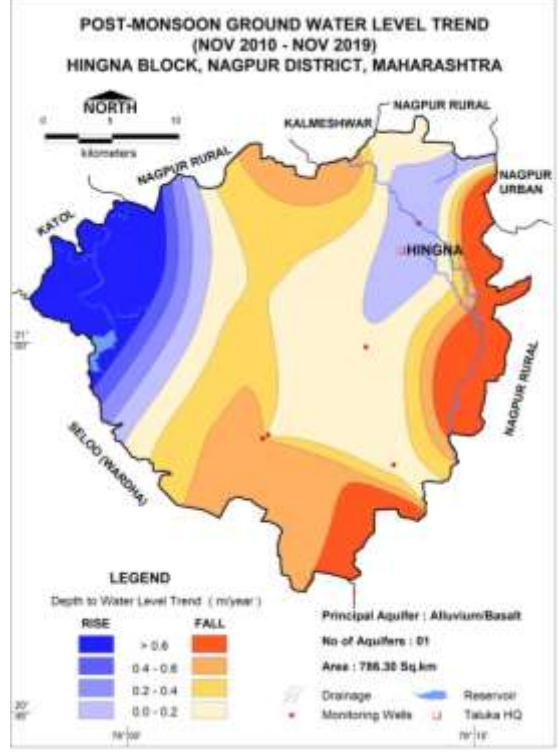
Hydrographs

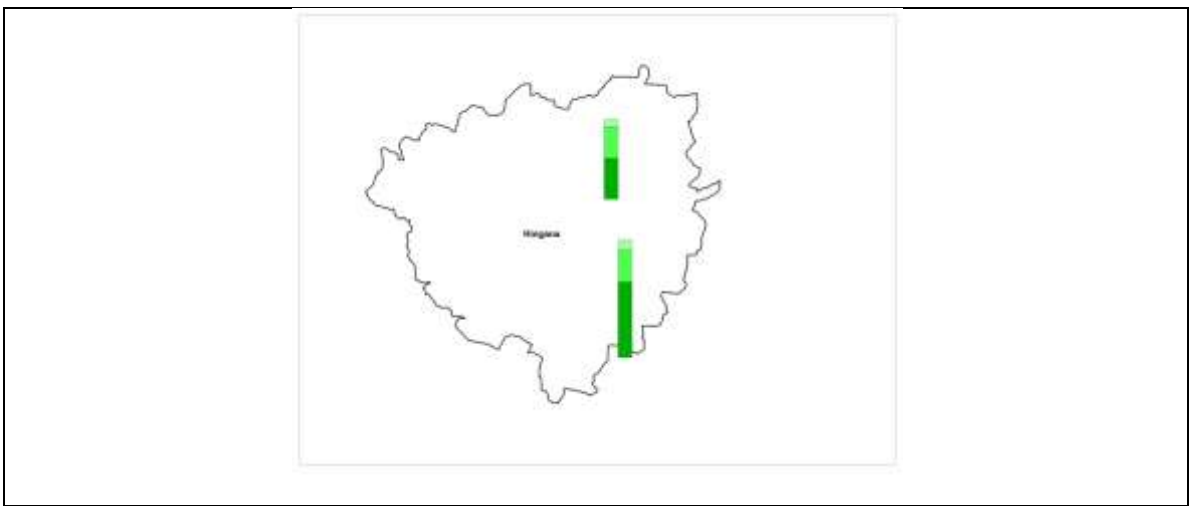


Hydrograph shows Pre-monsoon falling water level trend @ 0.02 m/year.

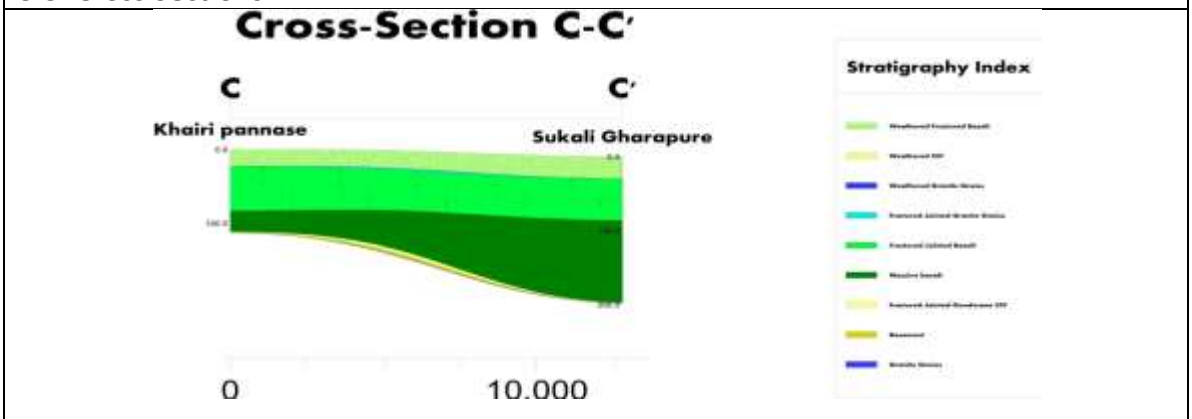
Hydrograph shows Post- monsoon rising water level trend @ 0.01 m/year

1.8. Water Level Trend (2010-2019)

<p>1.8.1 Pre-Monsoon trend Falling 0.002 (Amgaon) to 3.9 (Makardhokda) m/year.</p>	<p>1.8.2 Post-Monsoon trend Rising @0.12 m/year (Hingna Raipur); Falling 0.006 (Amgaon) to 1.3 (Gumgaon) m/year.</p>
 <p>Block shows falling water level trend up to 0.6 m/year trend upto 0.2 mbgl in southern part of the block and 0.2-0.6 in long patches in the south-western, central and south-east part of the block. Falling trend >0.6 m/year has been observed in Central and north-west and north east part of the block.</p>	 <p>Major part of the block shows falling water level trend up to 0.6 m/year. In the southern part one patch of falling water level trend > 0.6 m/year is observed. Northern and north-west part of the block shows rising trend 0.2 to 0.6 m/year. A small isolated patch of rising trend is found in the north-eastern part of the block.</p>
<p>2. Ground Water Issues</p>	
<ul style="list-style-type: none"> i. Block shows declining water level trend up to 0.6 m/year. ii. Frequent droughts (55% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation. iii. Less ground water potential basaltic aquifer. 	
<p>3. AQUIFER DISPOSITION</p>	
<p>3.1. Number of Aquifers</p>	<p>Basalt –Aquifer-I (Phreatic / Shallow aquifer) Basalt –Aquifer-II (Semi-confined / confined / Deeper aquifer)</p>
<p>3.2. Lithological Disposition</p>	



3.3. Cross Sections

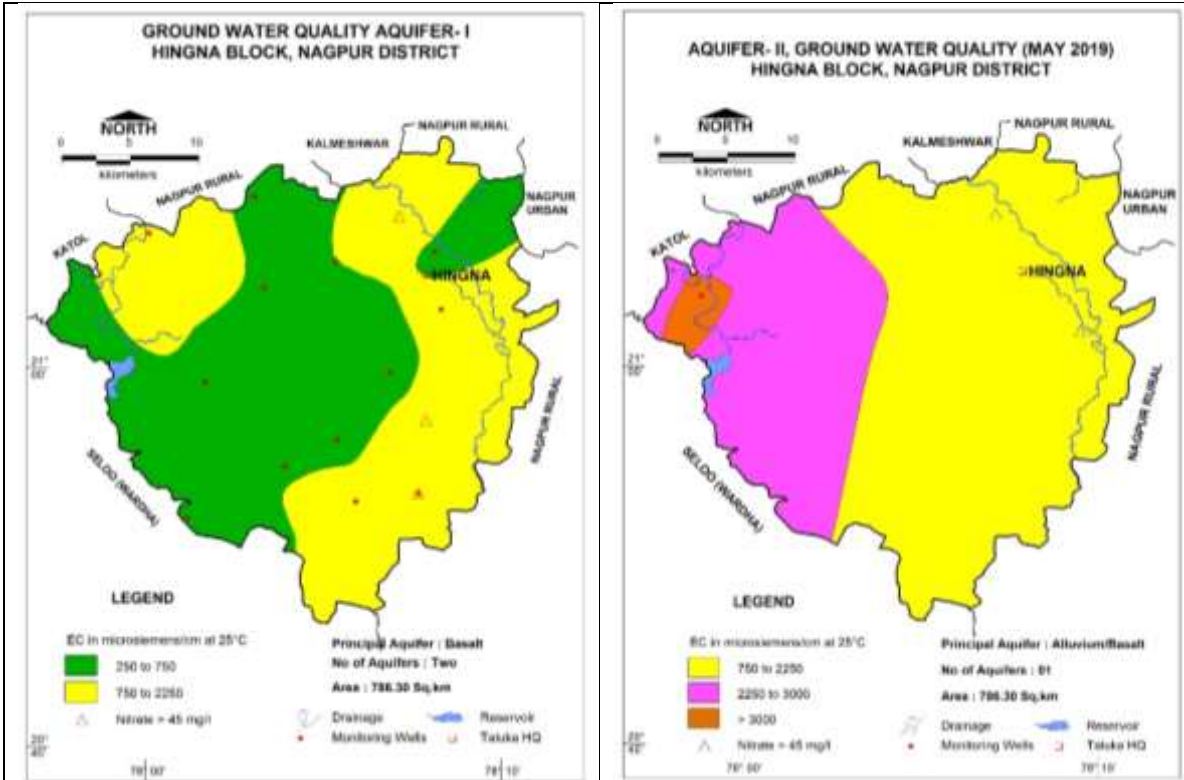


3.4. Aquifer Characteristics

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)	0.6-5.8	3-27.65
Depth of Occurrence (mbgl)	2-8	44.2-86.3
weathered/fractured rocks thickness (m)	1.2-7	2.1-6
Yield	10 – 100 m ³ /day	10-100 lpm
Specific yield/ Storativity (S)	0.02	0.0000145 -0.00005
Transmissivity (T)	20-70 m ² /day	30 – 150 m ² /day

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 $\mu\text{S}/\text{cm}$ has been observed in major part of block & ground water is suitable for all purpose. Ground water with EC ranges from 250 to 750 $\mu\text{S}/\text{cm}$ is observed in an isolated patch in south western part while $\text{EC} < 750$ is observed in 176.7 sq.km area in southern, southwestern part of the block.

EC ranging from 750 to 2250 $\mu\text{S}/\text{cm}$ has been observed in major part of block & ground water is suitable for all purpose. Whereas EC ranging from 2250 to 3000 has been observed in southern, south-western and north western part of the block. Few villages are affected by Nitrate contamination.

5. GROUND WATER RESOURCE

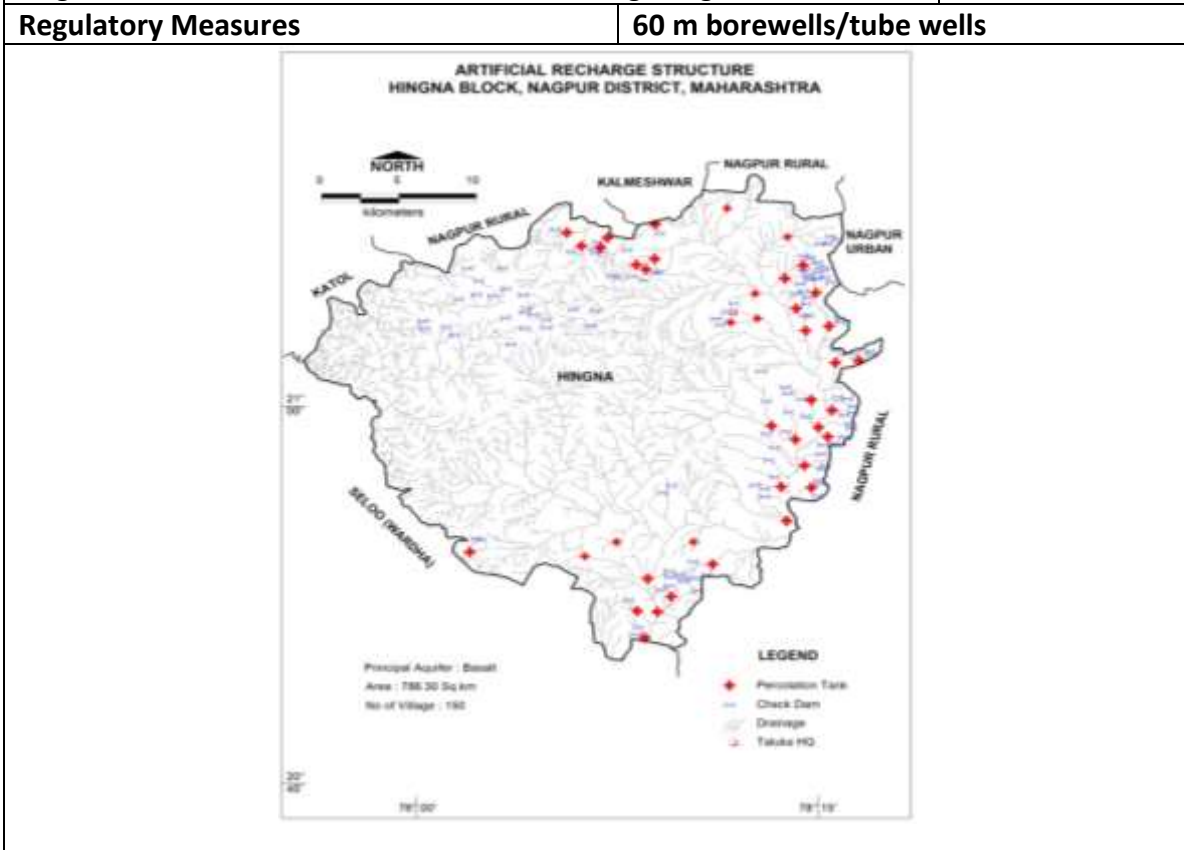
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

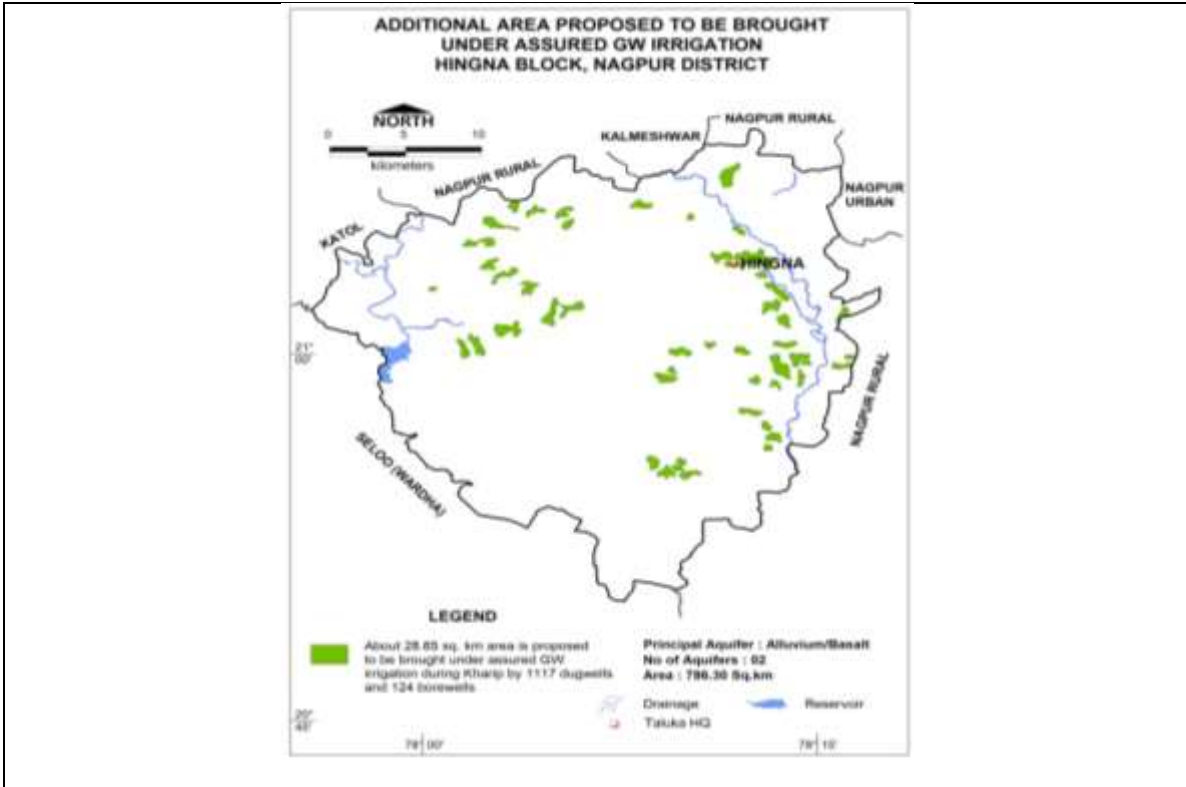
Ground Water Recharge Worthy Area (Sq. Km.)	634.14
Total Annual Ground Water Recharge (MCM)	78.57
Natural Discharge (MCM)	3.93
Annual Extractable Ground Water Recharge (MCM)	74.646
Current Annual Ground Water Extraction for irrigation (MCM)	25.63
Current Annual Ground Water Extraction for domestic water supply (MCM)	8.58
Current Annual Ground Water Extraction for All uses (MCM)	34.2098
Annual GW Allocation for for Domestic Use as on 2025 (MCM)	9.11
Net Ground Water Availability for future use (MCM)	40.10
Stage of Ground Water Development (%)	45.83
Category	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)
634.14	3.16	0.015	0.00035	53.64	0.7
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					74.646
Gross Annual Draft (MCM)					34.2098
Agricultural Demand –GW					25.63
Agricultural Demand –SW					4.77
Domestic Demand – GW					8.58
Domestic Demand – SW					2.15
Total Demand					41.13
Area of Block (Sq. Km.)					786.3
Area suitable for Artificial recharge (Sq. Km)					634.14
Type of Aquifer					
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					526.73
Volume of Unsaturated Zone (MCM)					1594.42
Average Specific Yield					0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)					31.89
Surplus water Available (MCM)					11.80
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		41		118	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		6.19		2.65	
RTRWH Structures – Urban Areas					
Households to be covered (25% with 50 m ² area)					30325
Total RWH potential (MCM)					1.29791
Rainwater harvested / recharged @ 80% runoff co-efficient					
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					
Sugarcane crop area, proposed to be covered under Drip (sq.km.)					Nil
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.36 m. Drip Req. - 0.24, WUE- 0.12 m					
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)					74.646

Additional GW resources available after Supply side interventions (MCM)	8.85
Ground Water Availability after Supply side intervention (MCM)	83.50
Existing Ground Water Draft for All Uses (MCM)	34.21
GW draft after Demand Side Interventions (MCM)	34.21
Present stage of Ground Water Development (%)	45.83
Expected Stage of Ground Water Development after interventions (%)	40.97
Alternate Water Sources Available	Nil
6.4. Development Plan	
Volume of water available for GWD after stage of GWD brought to 70% (MCM)	24.24
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	1454
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	242
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	50.90





9.3 BHIWAPUR BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES																																												
1.1 Introduction																																												
Block Name	Bhiwapur																																											
Geographical Area (Sq. Km.)	701.97																																											
Hilly Area (Sq. Km)	111.65																																											
Population (2011)																																												
Climate	Monsoon Tropical																																											
1.2 Rainfall Analysis																																												
Normal Rainfall	1309.5 mm																																											
Annual Rainfall (2019)	1602.3 mm																																											
Decadal Average Annual Rainfall (2010-2019)	1226.85 mm																																											
Long Term Rainfall Analysis (2000 to 2019)	Rising trend 32 mm/year. Probability of Rainfall: 50% Normal Rainfall; 10 % Excess Rainfall Probability of Drought: 30 % Moderate Drought; 10% Acute Drought																																											
Rainfall Trend Analysis (2000 to 2019)																																												
<table border="1"> <caption>Rainfall Trend Analysis (2000 - 2019)</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2000</td><td>7.4</td></tr> <tr><td>2001</td><td>251.1</td></tr> <tr><td>2002</td><td>923.3</td></tr> <tr><td>2003</td><td>740.4</td></tr> <tr><td>2004</td><td>1431.2</td></tr> <tr><td>2005</td><td>1431.2</td></tr> <tr><td>2006</td><td>1045.6</td></tr> <tr><td>2007</td><td>1341.8</td></tr> <tr><td>2008</td><td>853.2</td></tr> <tr><td>2009</td><td>993.7</td></tr> <tr><td>2010</td><td>1690.1</td></tr> <tr><td>2011</td><td>1088.4</td></tr> <tr><td>2012</td><td>1275.3</td></tr> <tr><td>2013</td><td>1788.2</td></tr> <tr><td>2014</td><td>744</td></tr> <tr><td>2015</td><td>1320.7</td></tr> <tr><td>2016</td><td>855.4</td></tr> <tr><td>2017</td><td>906.3</td></tr> <tr><td>2018</td><td>997.8</td></tr> <tr><td>2019</td><td>1602.3</td></tr> </tbody> </table>			Year	Rainfall (mm)	2000	7.4	2001	251.1	2002	923.3	2003	740.4	2004	1431.2	2005	1431.2	2006	1045.6	2007	1341.8	2008	853.2	2009	993.7	2010	1690.1	2011	1088.4	2012	1275.3	2013	1788.2	2014	744	2015	1320.7	2016	855.4	2017	906.3	2018	997.8	2019	1602.3
Year	Rainfall (mm)																																											
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2019	1602.3																																											
1.3. Geomorphology, Soil & Geology																																												
Geomorphic Unit	Pediplain to moderately dissected plateau.																																											
Geology	Deccan Traps (Basalt) Age: Upper Cretaceous to Lower Eocene; TCG Age: Permo-carboniferous; Granite Gneiss Age : Archeans																																											
Soil	Fine to coarse loamy soil.																																											
1.4. Hydrology & Drainage																																												
Drainage	Wainganga river and its tributaries.																																											
Hydrology	Major and Medium project	Nil																																										
	Minor Irrigation Projects (Local)	30																																										
	Minor Irrigation Projects (ZP Level)	8																																										
	PT-6, KT-129, UGB-132																																											
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern																																												
Forest Area	105.72 Sq. Km.																																											
Cultivable Area	471.25 Sq. Km.																																											
Net Sown Area	371.44 Sq. Km.																																											

Double Cropped Area		139.69 sq. Km.
Area under Irrigation	Surface Water	18.91 Sq. Km.
	Ground Water	64.57 Sq. Km.
Principal Crops	Crop Type	Area (Sq. Km.) (Reference year 2014-15)
	Cotton	125.08
	Cereals	85.30
	Pulses	0.5
	Oil Seeds	176.48
	Sugarcane	1.22
	Citrous fruit	1.35
	Others	12.21

1.6. Water Level Behaviour

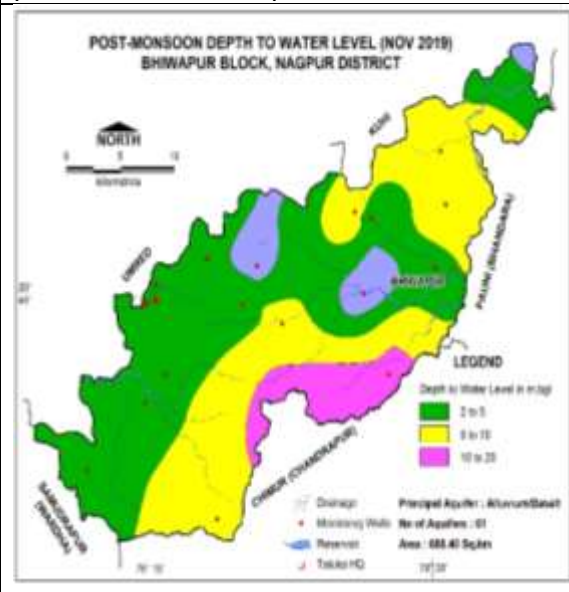
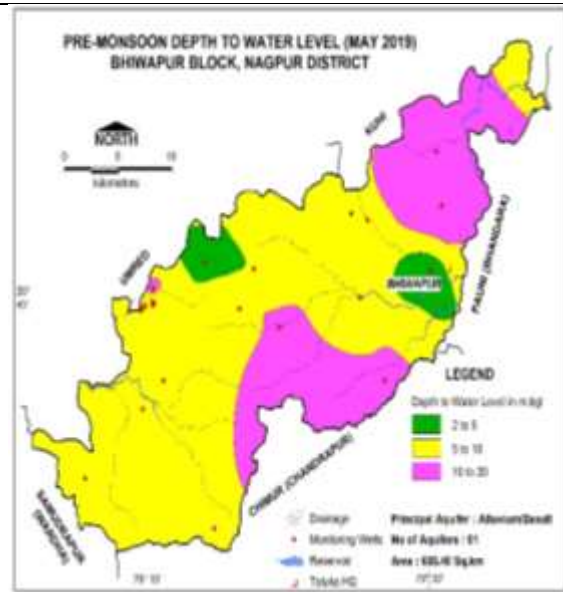
1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)

DTWL 5 to 10 mbgl is observed in entire block engulfing DTWL patches of 10 to 20 mbgl. Shallow DTWL 2-5 mbgl is observed as isolated patch in eastern-western part of the block.

Post-Monsoon (November-2019)

Water level in the range of 5 to 10mbgl is observed in southern part and in patch in north-eastern part of the block. DTWL 2 to 5 mbgl is observed in major part of the block. Water level in the range of 10 to 20 mbgl is observed only as small isolated patch in south-east part of the block.



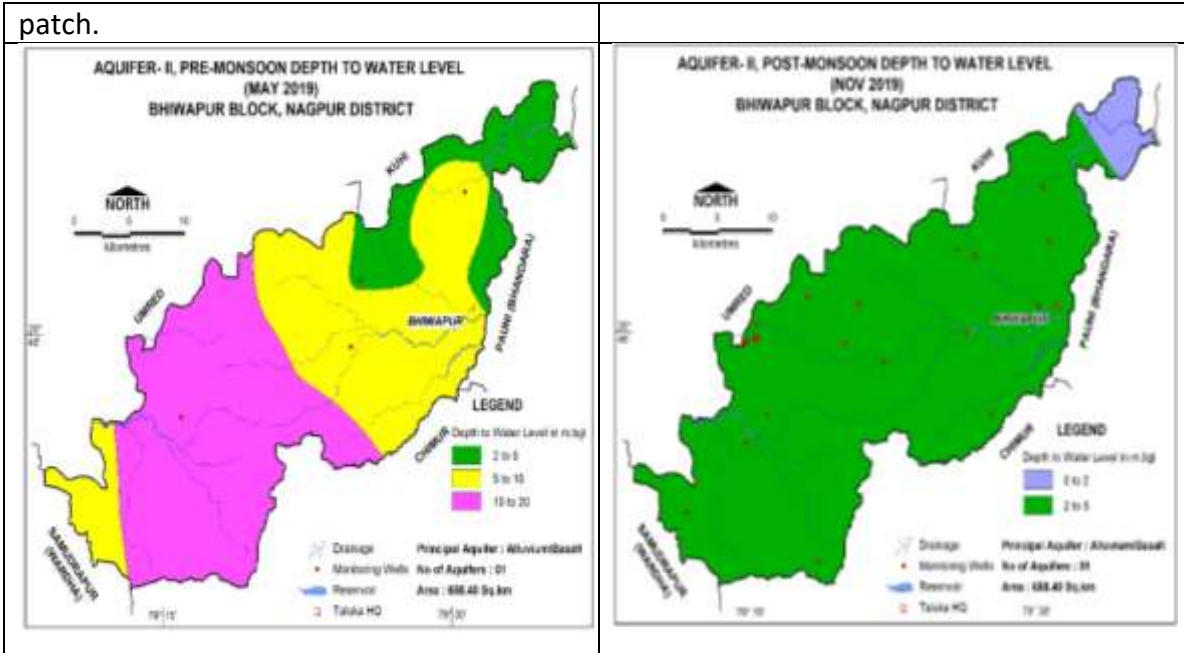
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Pre-Monsoon (May-2019)

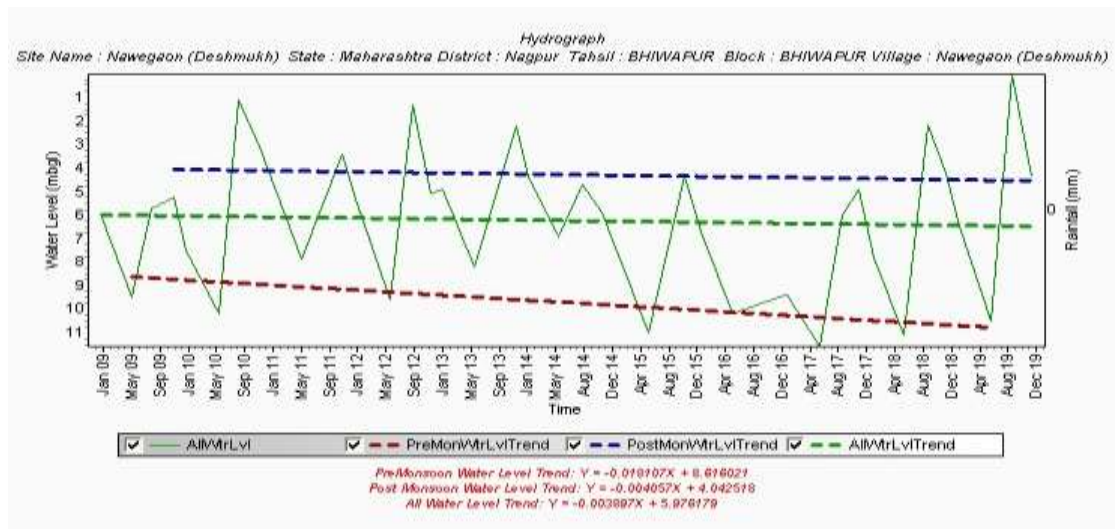
DTWL 10-20 mbgl is observed in south-south west part of the block. DTWL 5-10 mbgl is observed in the central and north-eastern parts of the block. DTWL 2-5 mbgl is observed in the northern part in small

Post-Monsoon (November-2019)

DTWL 2-5 mbgl is observed in major part except small patch of DTWL 0 - 2 mbgl in north east parts of the block.



1.7. Hydrographs



Hydrograph shows Pre-monsoon falling water level trend @ 0.02 m/year

Hydrograph shows Post-monsoon falling water level trend @ 0.004 m/year

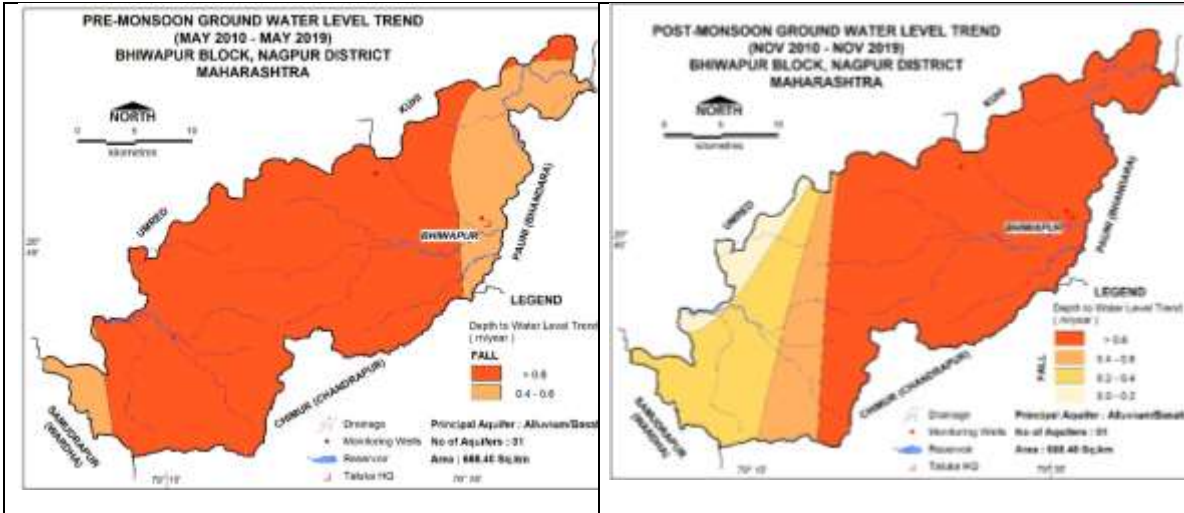
1.8. Water Level Trend (2000-2019)

Pre-Monsoon trend
 Falling 0.5 m/year (Bhiwapur)

Post-Monsoon trend
 Falling 0.7 (Bhiwapur) to 2.9 (Navegaon) m/year

Major area shows falling water level trend > 0.6 m/year.

Major part of the block shows falling trend > 0.6 m/year, falling trend < 0.6 m/year has been observed in south-western part of the block.



2. Ground Water Issues

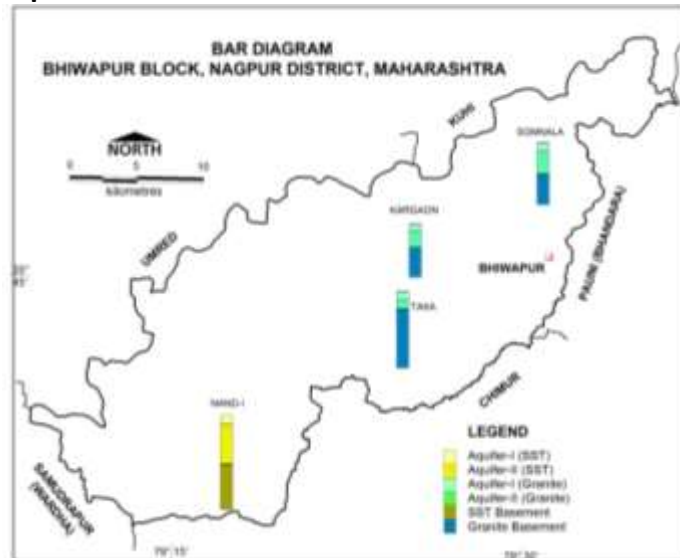
- i. Block shows declining water level trend > 0.6 m/year.
- ii. Frequent droughts (30% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
- iii. Less ground water potential basaltic aquifer.

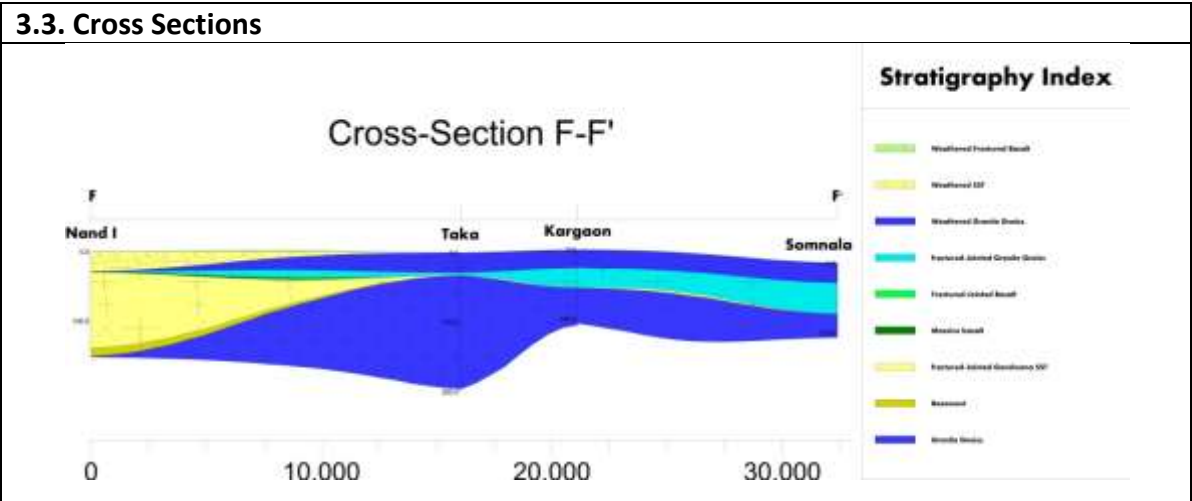
3. AQUIFER DISPOSITION

3.1. Number of Aquifers

Aquifer-I - 1. Basalt (Phreatic / Shallow aquifer)
 2. Granite Gneiss (Phreatic / Shallow aquifer)
 Basalt Aquifer-II – 1. Basalt (Semi-confined / confined / Deeper aquifer) 2. TCG; 3. Granite Gneiss (Semi-confined / confined / Deeper aquifer)

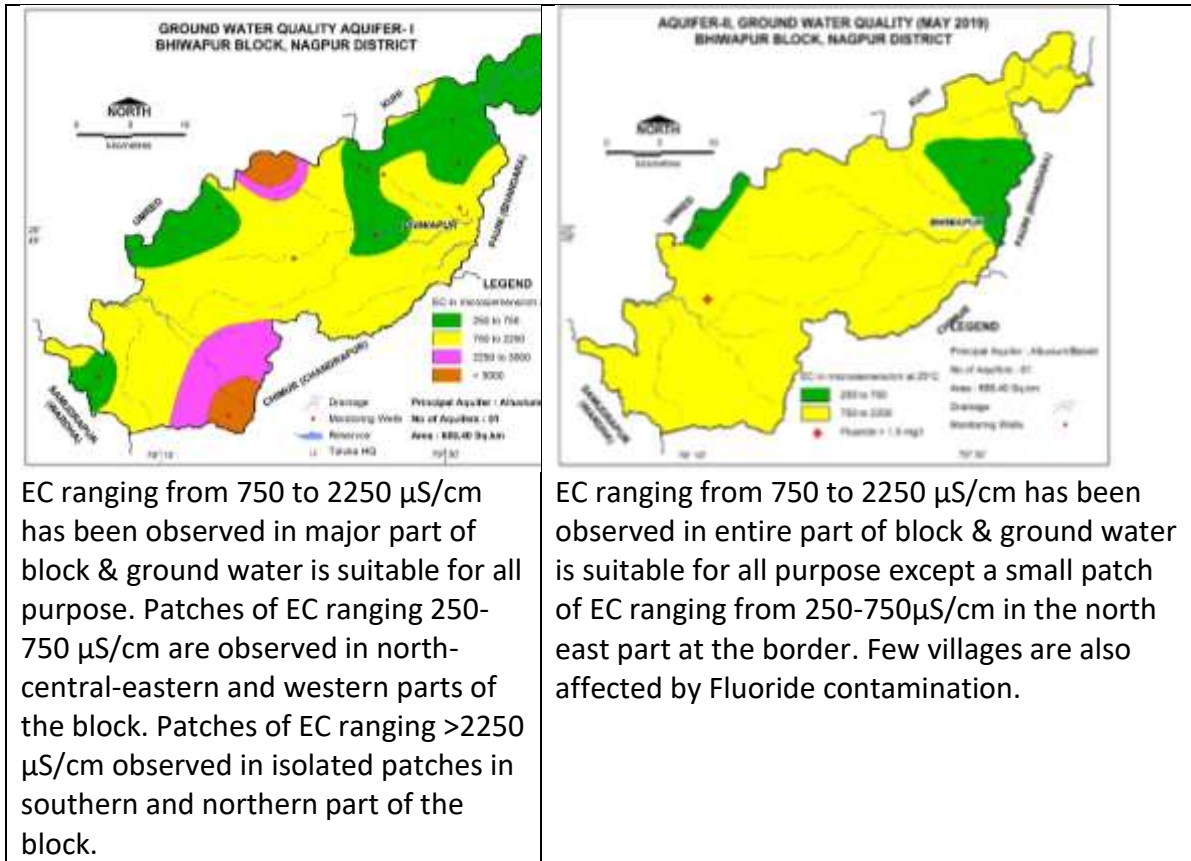
3.2. Lithological Disposition





3.4. Aquifer Characteristics

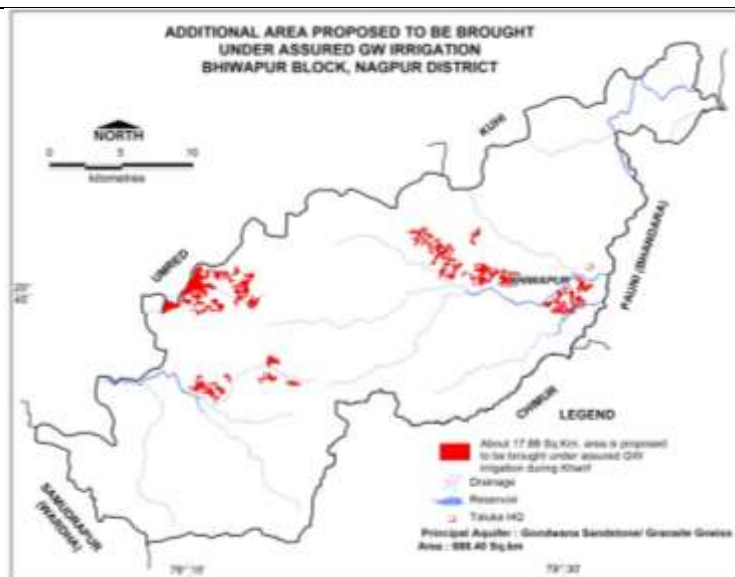
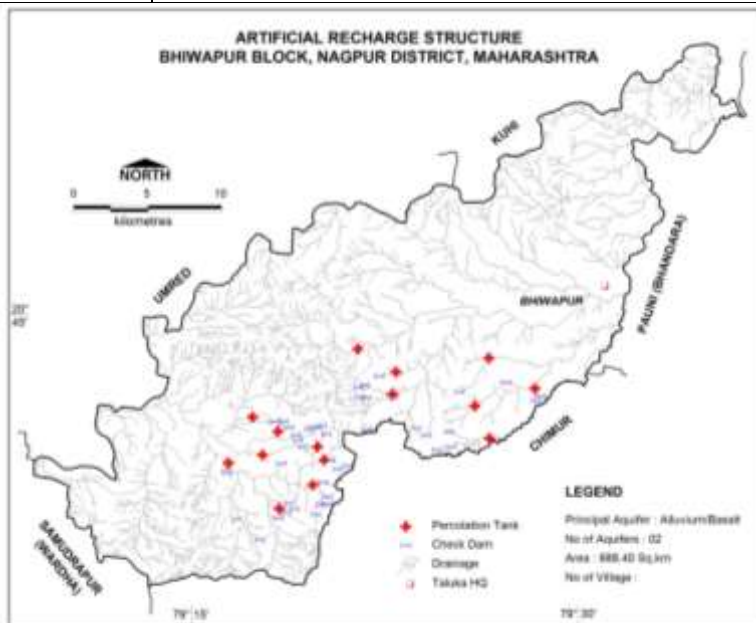
Major Aquifers	Basalt (Deccan Traps)		TCG	Granite Gneiss	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Basalt – Aquifer-I (Phreatic / Shallow aquifer)	Basalt – Aquifer-II (Semi-confined / Deeper aquifer)	TCG-aquifer II (Semi-confined / confined / Deeper aquifer)	Granite Gneiss Aquifer-I (Phreatic / Shallow aquifer)	Granite Gneiss Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (m bgl)					
Depth of Occurrence (mbgl)	5.2-10	Upto 38.1	34-140	6-14	40-74.45
weathered/fractured rocks thickness (m)	0.3-1.5	Upto 3.1	4-6	0.2-2	2.-11
Yield	10 – 100 m ³ /day	10-100 lpm	16.00-17.90 m ³ /day	10-33 m ³ /day	18-33 m ³ /day
Specific yield/ Storativity (S)	0.02	0.000245 - 0.0000145	9.32	130.00 to 279.13	198.35 to 336.5
Transmissivity (T)	0.41 - 80 m ² /day	5 - 30 m ² /day	9.8 x 10 ⁻³ to 1.14 x 10 ⁻⁴	-	2.37 x 10 ⁻⁴ to 8 x 10 ⁻⁵
4. GROUND WATER QUALITY					
4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)			4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)		



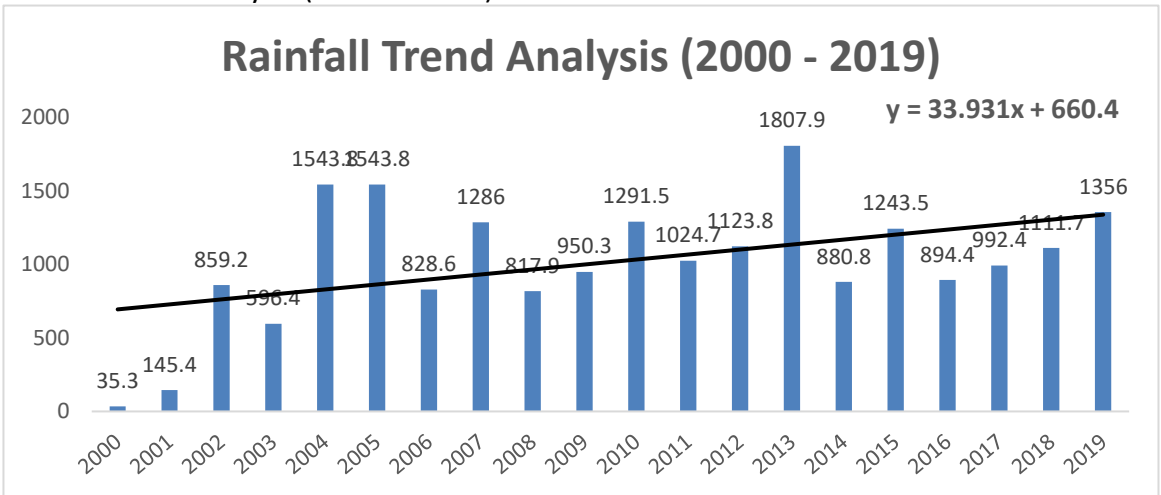
5. GROUND WATER RESOURCE					
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)					
Ground Water Recharge Worthy Area (Sq. Km.)					55765
Total Annual Ground Water Recharge (MCM)					42.07
Natural Discharge (MCM)					3.01
Annual Extractable Ground Water Recharge (MCM)					39.07
Current Annual Ground Water Extraction for irrigation (MCM)					16.91
Current Annual Ground Water Extraction for domestic water supply (MCM)					4.21
Current Annual Ground Water Extraction (MCM)					21.13
Annual GW Allocation for for Domestic Use as on 2025 (MCM)					4.21
Net Ground Water Availability for future use (MCM)					17.80
Stage of Ground Water Development (%)					54.08
Category					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)
557.65	3.15	0.015	0.00008	61.16	0.14
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					

Available Resource (MCM)		39.07
Gross Annual Draft (MCM)		21.1251
Agricultural Demand –GW		16.92
Agricultural Demand –SW		12.2915
Domestic Demand – GW		4.21
Domestic Demand – SW		1.0525
Total Demand		34.47
Area of Block (Sq. Km.)		669.30
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		251.39
Volume of Unsaturated Zone (MCM)		206.7
Average Specific Yield		0.015
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)		3.10
Surplus water Available (MCM)		4.134
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	41
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.17	0.93
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m ² area)		Nil
Total RWH potential (MCM)		
Rainwater harvested / recharged @ 80% runoff co-efficient		
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Sugarcane crop area, proposed to be covered under Drip (sq.km.)		Nil
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m		
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)		39.07
Additional GW resources available after Supply side interventions (MCM)		3.10
Ground Water Availability after Supply side intervention (MCM)		42.32
Existing Ground Water Draft for All Uses (MCM)		21.13
GW draft after Demand Side Interventions (MCM)		21.13
Present stage of Ground Water Development (%)		54.08%

Expected Stage of Ground Water Development after interventions (%)	50.10
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)	8.39
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	503
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	84
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	17.68
Regulatory Measures	60m borewells/tube wells



9.4 KUHI BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name	Kuhi	
Geographical Area (Sq. Km.)	825.19	
Hilly Area (Sq. Km)	75.22	
Population (2011)	123977	
Climate	Monsoon Tropical	
1.2 Rainfall Analysis		
Normal Rainfall	1309.5 mm	
Annual Rainfall (2019)	1602.3 mm	
Decadal Average Annual Rainfall (2010-2019)	1172.67 mm	
Long Term Rainfall Analysis (2000-2019)	Significantly rising trend 33.931 mm/year. Probability of Rainfall: 50% Normal Rainfall; 5 % Excess Rainfall Probability of Drought: 30% Moderate Drought; 5% Severe Drought & 10% Acute drought	
Rainfall Trend Analysis (2000 to 2019)		
		
1.3. Geomorphology & Geology		
Geomorphic Unit	Shallow Pediplain area with weathered thickness ranging from 0 to 2 m.	
Geology	Granite Gneiss: Age- a\Archeans	
Soil	Fine loamy soil.	
1.4. Hydrology & Drainage		
Drainage	Arunavati river, tributary of Painganga river, Godavari river basin with sub-dendritic to dendritic drainage.	
Hydrology	Major project	1
	Medium project	1
	Minor Irrigation Projects (Local)	6
	Minor Irrigation Projects (ZP Level)	2
		PT-16, KT-159, UGB-110
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Forest Area	96.79 Sq. Km.	

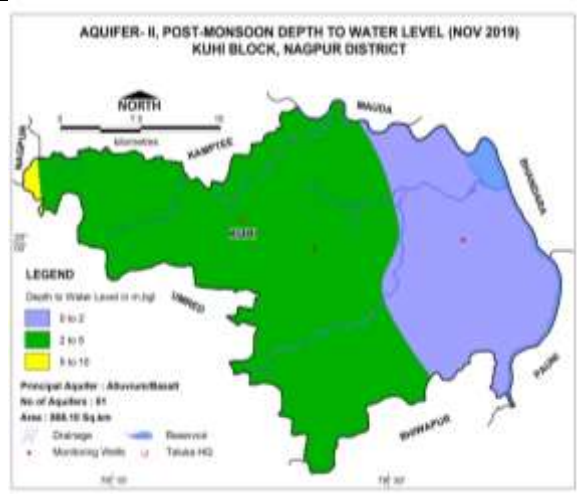
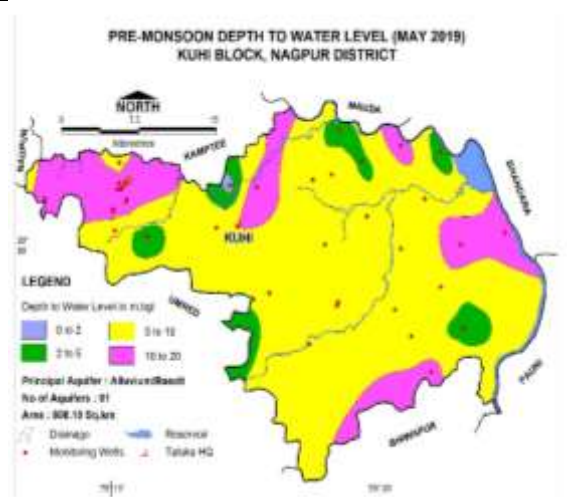
Cultivable Area		587.50 Sq. Km.
Net Sown Area		483.73 Sq. Km.
Double Cropped Area		93.34 Sq. Km.
Area under Irrigation	Surface Water	0.40 sq km
	Ground Water	100 ha
Area under Drip & Sprinkler Irrigation		
Principal Crops	Crop Type	Area (Sq. Km.) (Reference year 2014-15)
	Cotton	27.24
	Cereals	177.06
	Pulses	93.04
	Oil Seeds	283.37
	Sugarcane	0.78
	Citrous fruit	0.94
	Vegetables	8.94

1.6. Water Level Behaviour

1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)
DTWL 5 to 10 mbgl is observed in major area engulfing DTWL 2 to 5 mbgl. DTWL 10 to 20 mbgl is observed in north-eastern and western part in patches.

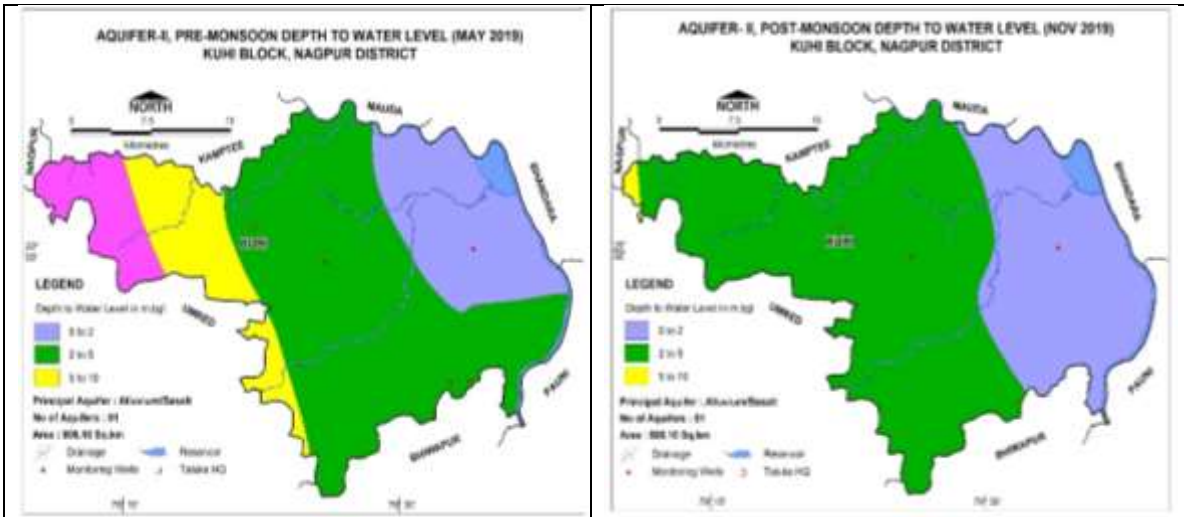
Post-Monsoon (November-2019)
DTWL 2 to 5 mbgl is observed in half of the area engulfing small patch of DTWL 5 to 10 mbgl. DTWL 0 to 2 mbgl is observed in north-eastern and eastern part.



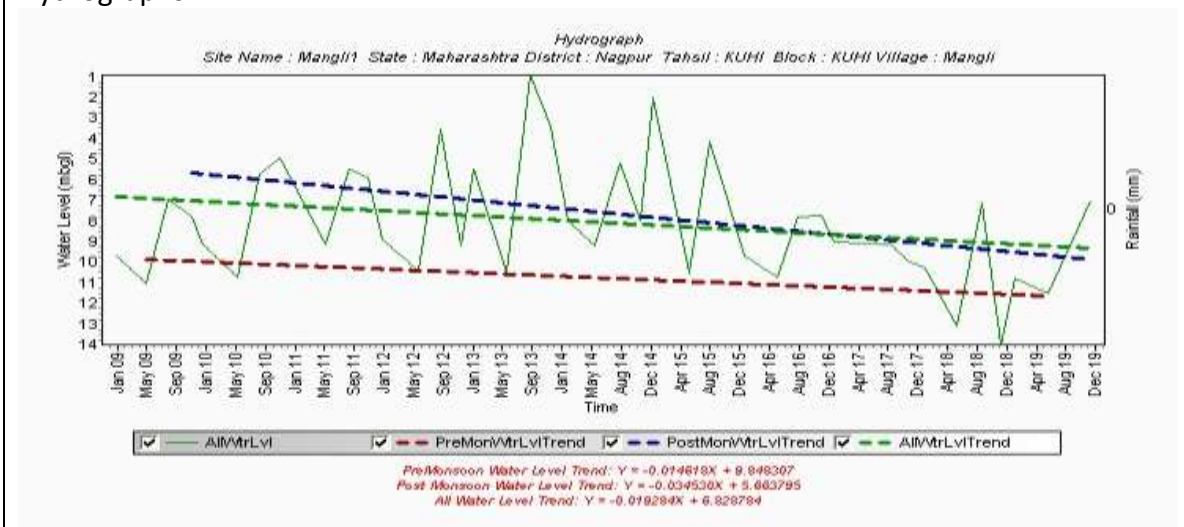
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Pre-Monsoon (May-2019)
DTWL 2-5 mbgl is observed in major part. DTWL 0-2 mbgl is observed in eastern and DTWL 5-10 western part of the block engulfing deeper DTWL i.e., 10 to 20 mbgl.

Post-Monsoon (November-2019)
DTWL 2-5 mbgl is observed in major part of the block. DTWL 0-2 mbgl is observed in eastern part of the block whereas small patch of DTWL 5-10 mbgl is observed in western parts of the block.



Hydrographs



Hydrograph shows Pre-monsoon falling water level trend @ 0.015 m/year

Hydrograph shows Post- monsoon falling water level trend @ 0.04 m/year

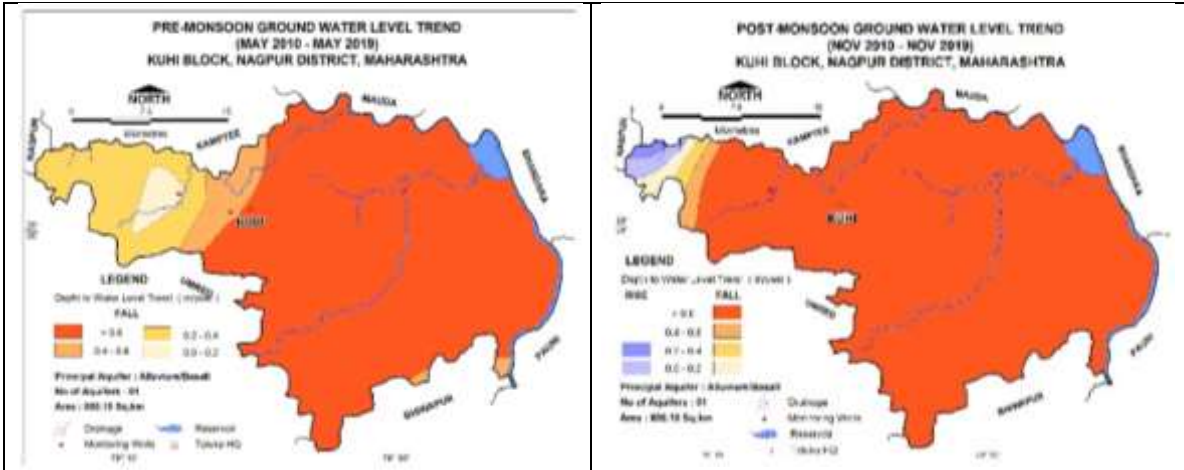
1.8. Water Level Trend (2010-2019)

Pre-Monsoon trend
 Falling 0.02 m/year (Khubala) to 0.4 m/year (Makardhokda).

Post-Monsoon trend
 Falling 1.2 m/year (Mangli)

Major area shows falling water level trend > 0.6 m/year trend less than 0.6 m/year western part of the block.

Major part of the block shows falling trend up to 0.6 m/year while rising trend upto 0.4 m/year has been observed in West, part in small patch.



2. Ground Water Issues

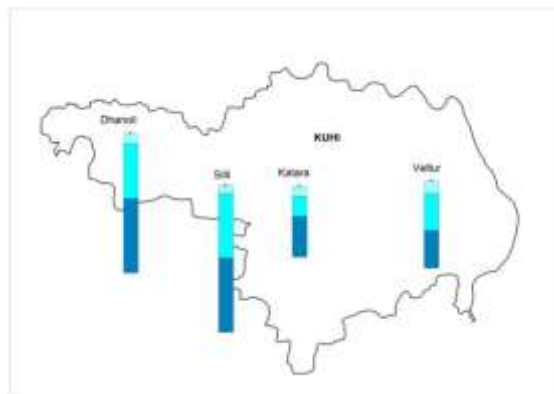
Block shows declining water level trend >0.6 m/year frequent droughts (30 % Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation. Less ground water potential basaltic aquifer.

3. AQUIFER DISPOSITION

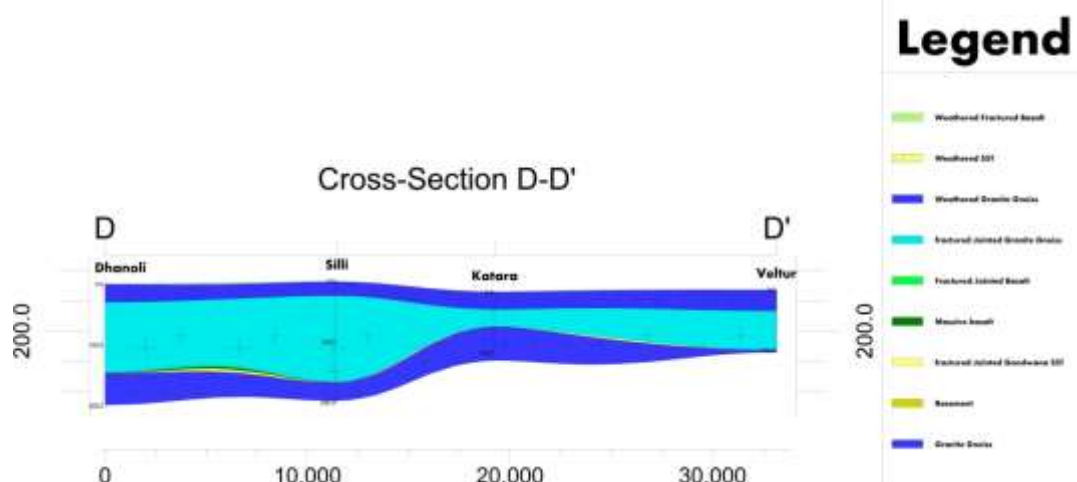
3.1. Number of Aquifers

Aquifer-I Granite Gneiss (Phreatic / Shallow aquifer)
 Aquifer-II Granite Gneiss (Semi-confined / confined / Deeper aquifer)

3.1 Lithological Disposition



3.2 Cross Section

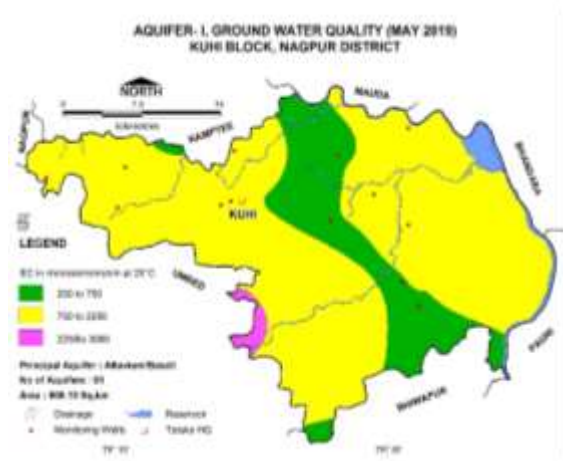


3.4. Aquifer Characteristics

Major Aquifers	Granite Gneiss	
Type of Aquifer (Phreatic/Semi-confined/Confined)	Granite Gneiss Aquifer-I (Phreatic / Shallow aquifer)	Granite Gneiss Aquifer-II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.3-19.4	1.3-3.4
Depth of Occurrence (mbgl)	6-24	25-172.3
weathered/fractured rocks thickness (m)	0.2-2	3-28
Yield	10-33 m ³ /day	18-33 m ³ /day
Specific yield/ Storativity (S)	2.37 x 10 ⁻⁴ to 8 x 10 ⁻⁵	2.37 x 10 ⁻⁴ to 8 x 10 ⁻⁵
Transmissivity (T) m ² /day	130.00 to 279.13	198.35 to 336.5

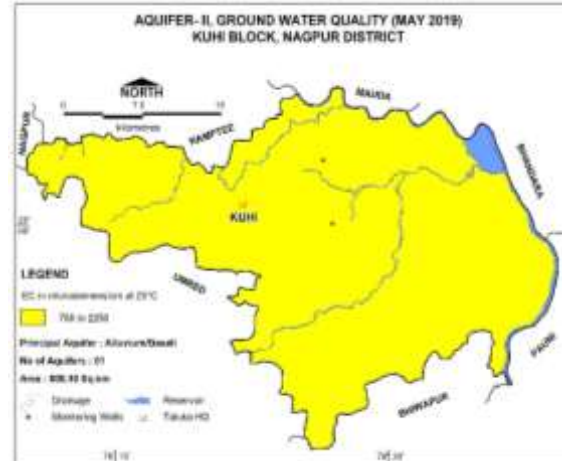
4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)



EC ranging 750 to 2250 $\mu\text{S}/\text{cm}$ has been observed in major part of the block while EC ranging 250 to 750 $\mu\text{S}/\text{cm}$ is observed in central part in long narrow patch of the block (336.2 sq.km). The ground water is suitable for all purpose.

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



EC ranging from 750 to 2250 $\mu\text{S}/\text{cm}$ has been observed in entire part. The ground water is suitable for all purpose.

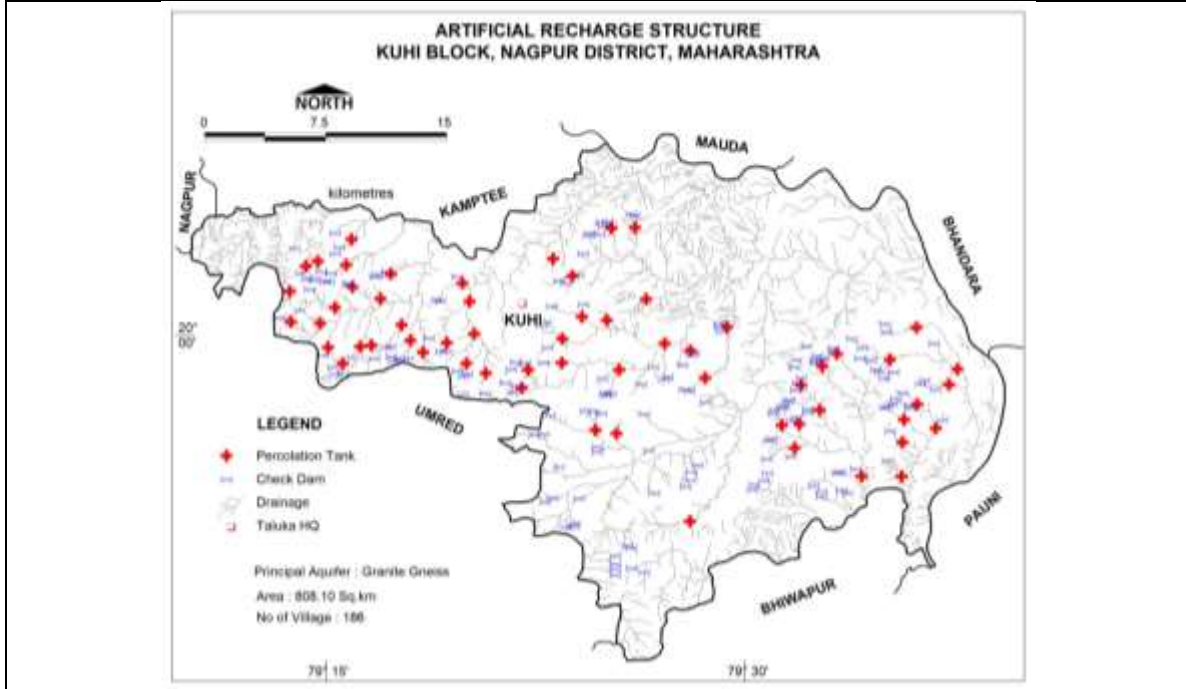
5. GROUND WATER RESOURCE

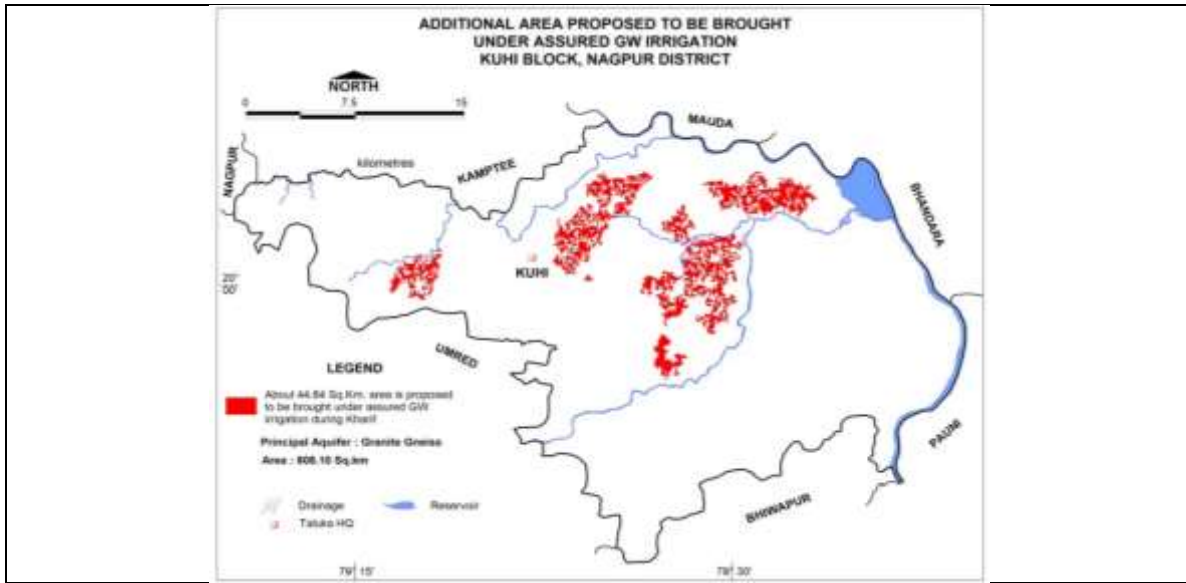
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

Ground Water Recharge Worthy Area (Sq. Km.)	74997
Total Annual Ground Water Recharge (MCM)	68.22
Natural Discharge (MCM)	3.41
Annual Extractable Ground Water Recharge (MCM)	64.81
Current Annual Ground Water Extraction for irrigation (MCM)	31.93
Current Annual Ground Water Extraction for domestic water supply (MCM)	6.77
Current Annual Ground Water Extraction for All uses (MCM)	38.71
Annual GW Allocation for for Domestic Use as on 2025 (MCM)	7.52
Net Ground Water Availability for future use (MCM)	26.13
Stage of Ground Water Development (%)	59.72

Category					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)
749.97	4.15	0.015	0.00008	47.18	0.25
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					64.81
Gross Annual Draft (MCM)					38.71
Agricultural Demand –GW					31.94
Agricultural Demand –SW					0.26
Domestic Demand – GW					6.77
Domestic Demand – SW					1.6925
Total Demand					40.6625
Area of Block (Sq. Km.)					82519
Type of Aquifer					
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					782.9
Volume of Unsaturated Zone (MCM)					3754.03
Average Specific Yield					
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)					
Surplus water Available (MCM)					17.53696
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		61		175	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		9.21		3.95	
RTRWH Structures – Urban Areas					Nil
Households to be covered (25% with 50 m ² area)					
Total RWH potential (MCM)					
Rainwater harvested / recharged @ 80% runoff co-efficient					
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					
Cotton crop area proposed to be covered under Drip (sq.km.)					Nil
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m					
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)	64.81
Additional GW resources available after Supply side interventions (MCM)	13.15
Ground Water Availability after Supply side intervention (MCM)	77.96
Existing Ground Water Draft for All Uses (MCM)	38.71
GW draft after Demand Side Interventions (MCM)	38.71
Present stage of Ground Water Development (%)	59.72
Expected Stage of Ground Water Development after interventions (%)	49.65
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)	15.86
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	952
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	159
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	44.64
Regulatory Measures	60m borewells/tube wells





9.5 NAGPUR BLOCK, NAGPURDISTRICT, MAHARASHTRA

1. SALIENT FEATURES																																											
1.1 Introduction																																											
Block Name	Nagpur																																										
Geographical Area (Sq. Km.)	640.74																																										
Hilly Area (Sq. Km)	105.49																																										
Population (2011)	2559442																																										
Climate	Monsoon Tropical																																										
1.2 Rainfall Analysis																																											
Normal Rainfall	1186.7 mm																																										
Annual Rainfall (201)	1013.7 mm																																										
Decadal Average Annual Rainfall (2010-19)	1040.53 mm																																										
Long Term Rainfall Analysis (2000-2019)	Falling trend -11.46 mm/year. Probability of Rainfall : 75 % Normal Rainfall; 5 % Excess Rainfall Probability of Drought: 20 % Moderate Drought																																										
Rainfall Trend Analysis (2000 to 2019)																																											
<table border="1"> <caption>Rainfall Trend Analysis (2000 - 2019)</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2000</td><td>1237</td></tr> <tr><td>2001</td><td>1339.3</td></tr> <tr><td>2002</td><td>966.7</td></tr> <tr><td>2003</td><td>689</td></tr> <tr><td>2004</td><td>1274.7</td></tr> <tr><td>2005</td><td>1274.7</td></tr> <tr><td>2006</td><td>1205.5</td></tr> <tr><td>2007</td><td>966.3</td></tr> <tr><td>2008</td><td>953</td></tr> <tr><td>2009</td><td>2947.4</td></tr> <tr><td>2010</td><td>1494.7</td></tr> <tr><td>2011</td><td>913.8</td></tr> <tr><td>2012</td><td>1197.9</td></tr> <tr><td>2013</td><td>1389.9</td></tr> <tr><td>2014</td><td>768.7</td></tr> <tr><td>2015</td><td>1071.4</td></tr> <tr><td>2016</td><td>684.6</td></tr> <tr><td>2017</td><td>856.3</td></tr> <tr><td>2018</td><td>937.9</td></tr> <tr><td>2019</td><td>1090.1</td></tr> </tbody> </table>		Year	Rainfall (mm)	2000	1237	2001	1339.3	2002	966.7	2003	689	2004	1274.7	2005	1274.7	2006	1205.5	2007	966.3	2008	953	2009	2947.4	2010	1494.7	2011	913.8	2012	1197.9	2013	1389.9	2014	768.7	2015	1071.4	2016	684.6	2017	856.3	2018	937.9	2019	1090.1
Year	Rainfall (mm)																																										
2000	1237																																										
2001	1339.3																																										
2002	966.7																																										
2003	689																																										
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2008	953																																										
2009	2947.4																																										
2010	1494.7																																										
2011	913.8																																										
2012	1197.9																																										
2013	1389.9																																										
2014	768.7																																										
2015	1071.4																																										
2016	684.6																																										
2017	856.3																																										
2018	937.9																																										
2019	1090.1																																										
1.3. Geomorphology & Geology																																											
Geomorphic Unit	Plateau (slightly dissected to moderately dissected) with weathered thickness ranging from 0 to 2 m.																																										
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene / granite Gneiss Age: Archeans																																										
Soil	Shallow to moderate deep clayey to loamy soil.																																										
1.4. Hydrology & Drainage																																											
Drainage	Godavari river basin with sub-dendritic to dendritic drainage.																																										
Hydrology	Major project	0																																									
	Medium project	1																																									
	Minor Irrigation Projects (Local)	12																																									
	Minor Irrigation Projects (ZP Level)	2																																									
		PT-0, KT-60, UGB-70																																									
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern																																											
Forest Area	49.31 Sq. Km.																																										
Cultivable Area	444.20 Sq. Km.																																										
Net Sown Area	220.67 Sq. Km.																																										

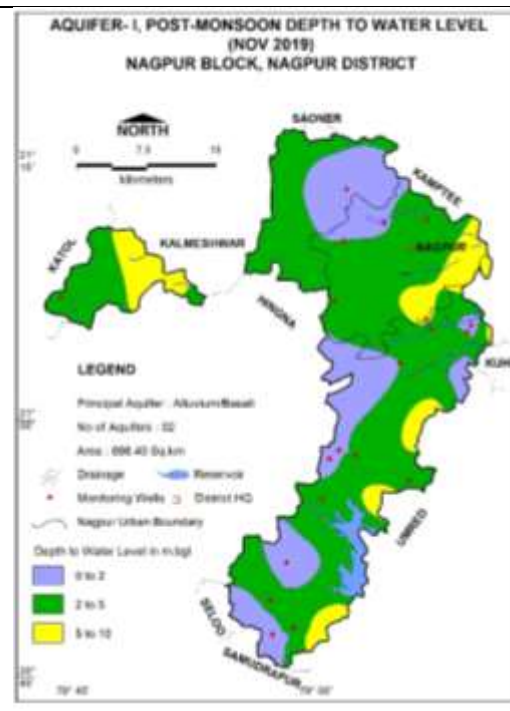
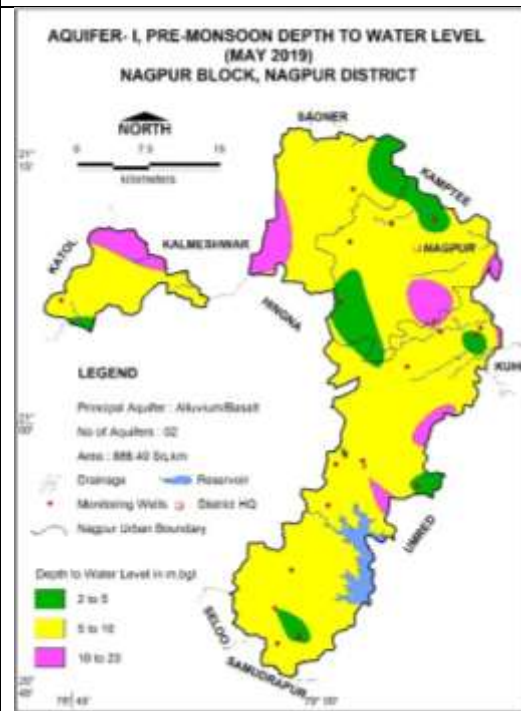
Double Cropped Area		19.47 Sq. Km.
Area under Irrigation	Surface Water	0.7 Sq. Km.
	Ground Water	19.07 Sq. Km.
Area under Drip & Sprinkler Irrigation		ha
Principal Crops	Crop Type	Area (Sq. Km.) <i>(Reference year 2014-15)</i>
	Cotton	85.50
	Cereals	18.29
	Pulses	0.01
	Oil Seeds	92.96
Horticultural Crops	Sugarcane	0.43
	Citrous fruit	4.85
	vegetables	8.40

1.6 Water Level Behaviour

1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)
DTWL 5 to 10 mbgl is observed in major part engulfing DTWL 10 to 20 mbgl is observed in Central, eastern, north-western part. DTWL 2 to 5 mbgl observed in small patches in north-east and central parts.

Post-Monsoon (November-2019)
DTWL 2 to 5 mbgl is observed in major part. DTWL of 0 to 2 mbgl is observed as isolated patches in north and south part of the block. While DTWL 5 to 10 mbgl in isolated patch in north-west part and also in south east and western part of the block.

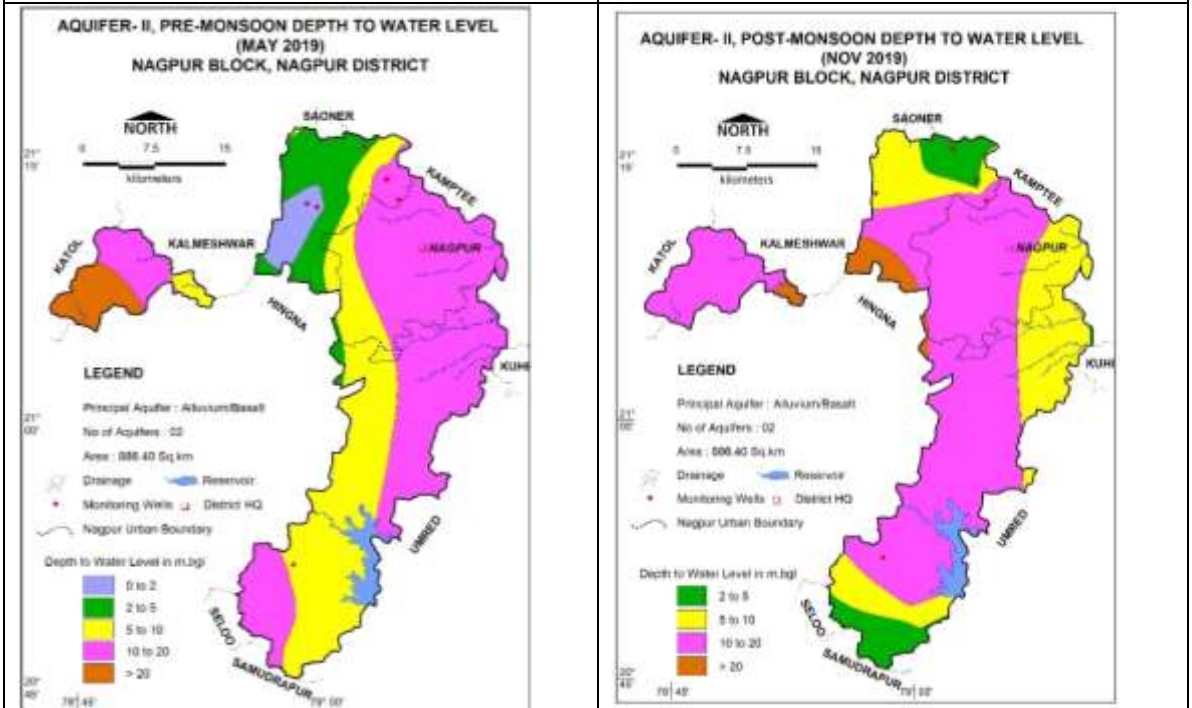


1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

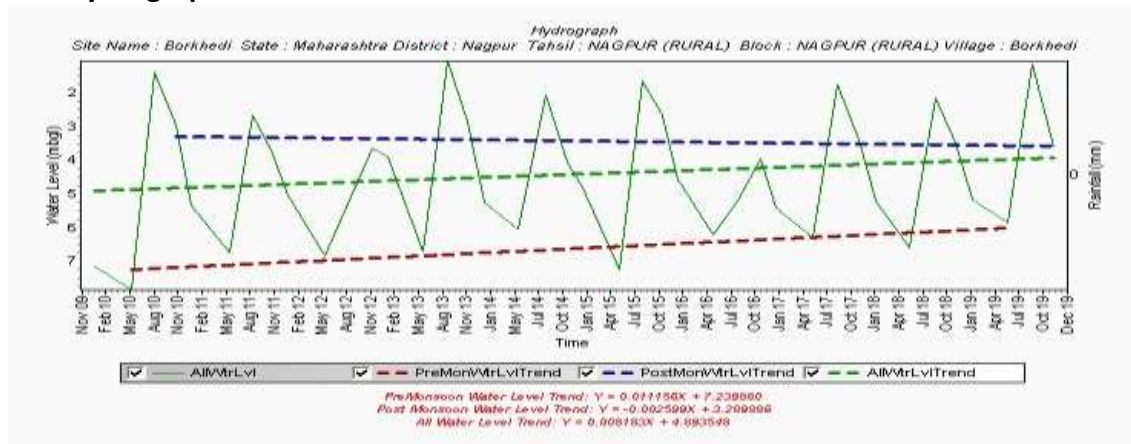
Pre-Monsoon (May-2019)
DTWL 10 to 20 mbgl is observed in major

Post-Monsoon (November-2019)
DTWL 10-20 mbgl is observed in major

part. DTWL >20 mbgl is observed in western part whereas DTWL 5 to 10 mbgl is observed in central part in long patch and DTWL of 2-5 northern part of the block.	part. DTWL 5-10 mbgl is observed in north-south-eastern part of the block. DTWL 2 to 5 mbgl is observed in south and north part near border.
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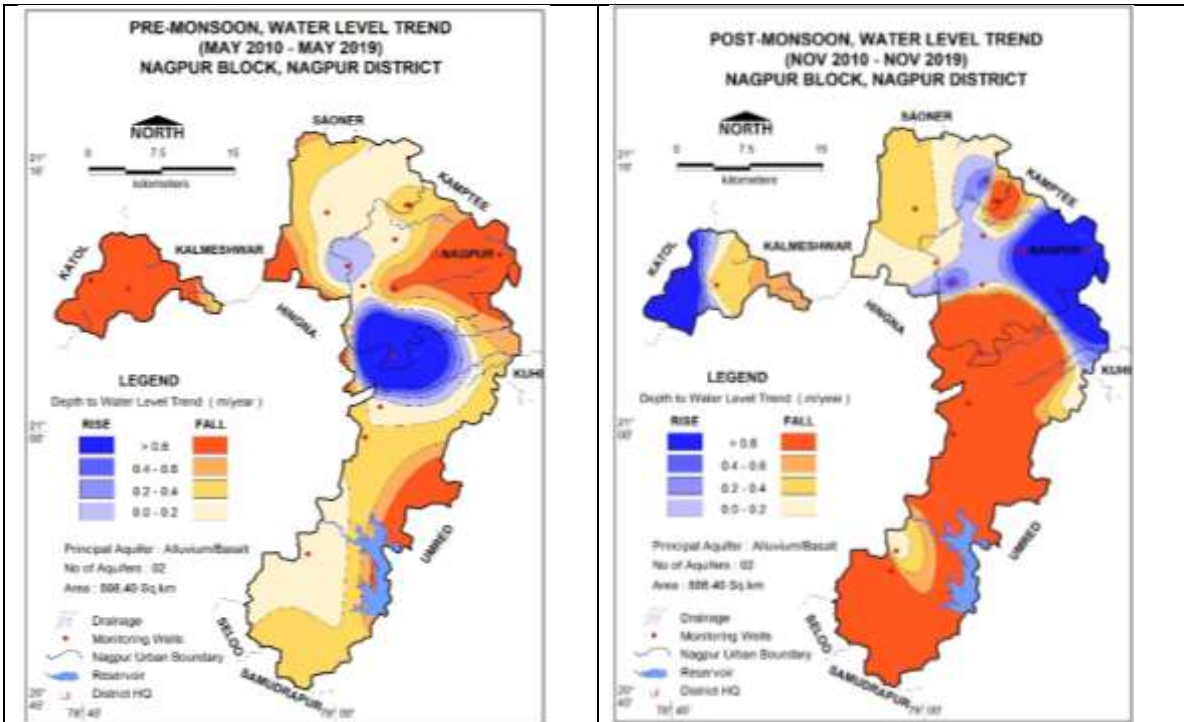
1.7. Hydrograph



Hydrograph shows Pre-monsoon rising water level trend @ 0.1 m/year	Hydrograph shows Post- monsoon falling water level trend @ 0.003 m/year
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1.8. Water Level Trend (2010-2019)

<p>1.8.1 Pre-Monsoon trend Rising 2.35 m/year (Chichbhuwan), Falling 0.03 m/year (Borkhedi) to 2.4 m/year (Nandora).</p>	<p>1.8.2 Post-Monsoon trend Rising 0.006 m/year (Ramdaspath) to 2.4 m/year (Punapur); Falling 0.09 m/year (Borkhedi) to 9.1 m/year (Chichbhuwan).</p>
Major area shows falling trend upto 0.6 m/year except few patches of rising trend upto 0.6 observed in central part.	Major area shows falling trend of > 0.6 m/year while rising trend upto 0.6 is observed in rest part in north-east and north-west part of the block .



2. Ground Water Issues

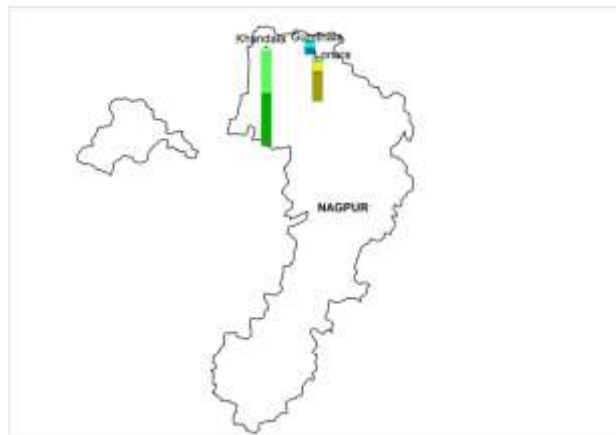
Block shows declining water level trend up to 0.6 m/year
 Frequent droughts (25% Moderate) which is ultimately responsible for less ground water recharge and non-availability of surface & ground water for irrigation.
 Less ground water potential basaltic aquifer.

3. AQUIFER DISPOSITION

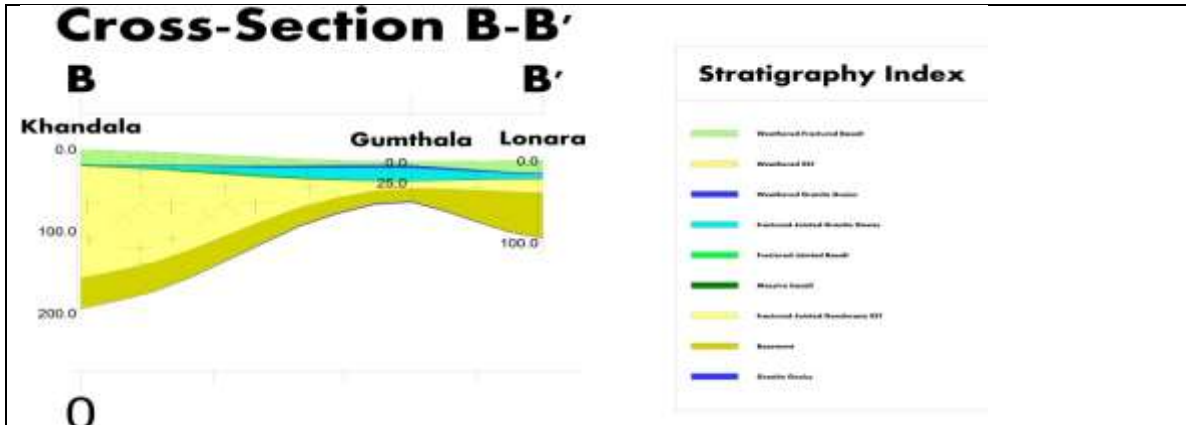
3.1. Number of Aquifers

Aquifer-I Basalt; Granite Gneiss(Phreatic / Shallow aquifer)
 Aquifer-II; basalt ; granite Gneiss(Semi-confined / confined / Deeper aquifer)

3.2. Lithological Disposition



3.3. Cross Sections - Section CC'

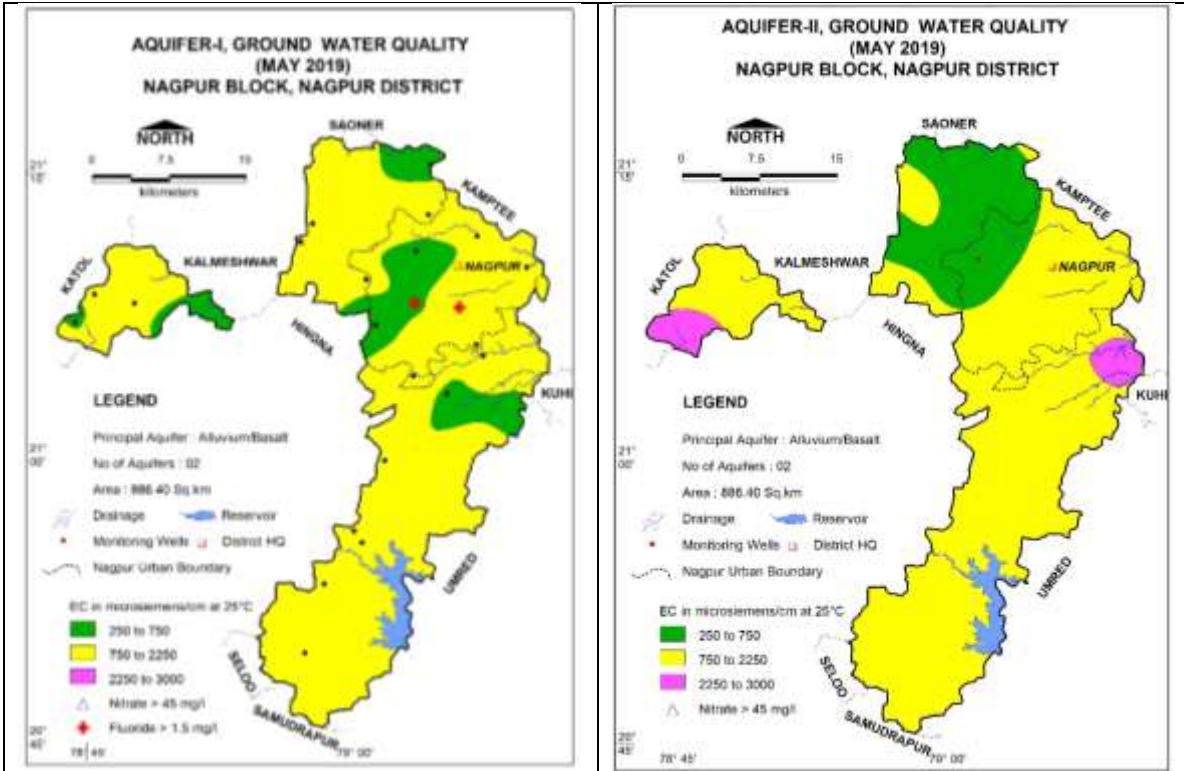


3.4. Aquifer Characteristics

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)	TCG-aquifer II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	0.4-6.8	1.9-26.9	0.8-29.6
Depth of Occurrence (mbgl)	2-8	32-120	Upto 120
weathered/fractured rocks thickness (m)	1-7.5	3-12.2	9.5-11
Yield	10 – 100 m ³ /day	0.2 - 0.75 lps	-
Specific yield/ Storativity (S)	0.018 – 0.20	0.0000145	-
Transmissivity (T)	20 - 50 m ² /day	20 - 60 m ² /day	-

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 $\mu\text{S}/\text{cm}$ has been observed in major part & EC ranging 250 to 750 $\mu\text{S}/\text{cm}$ in patches in north-west, north-east and central parts of the block. The ground water is suitable for all purpose. Few villages are also affected by fluoride contamination. However, the water from such area is not fit for drinking purpose without treatment.

EC ranging 750 - 2250 $\mu\text{S}/\text{cm}$ has been observed in major part except EC ranging 250 -750 $\mu\text{S}/\text{cm}$ in) in patch in north part near border. The ground water is suitable for all purpose. Two isolated patches of EC ranging 2250-3000 $\mu\text{S}/\text{cm}$ is observed in eastern and western parts of the block. Ground water is suitable for irrigation purpose with proper salinity control measures. However, the water from such area is not fit for drinking purpose without treatment.

5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

Ground Water Recharge Worthy Area (Sq. Km.)	535.25
Total Annual Ground Water Recharge (MCM)	60.46
Natural Discharge (MCM)	3.23
Annual Extractable Ground Water Recharge (MCM)	57.23
Current Annual Ground Water Extraction for irrigation (MCM)	19.54
Current Annual Ground Water Extraction for domestic water supply (MCM)	7.50
Current Annual Ground Water Extraction for All uses (MCM)	27.04
Annual GW Allocation for for Domestic Use as on 2025 (MCM)	8.34
Net Ground Water Availability for future use (MCM)	30.41
Stage of Ground Water Development (%)	47.25
Category	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)
535.25	4.03	0.015	0.00035	32.5	0.25
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					57.23
Gross Annual Draft (MCM)					27.05
Agricultural Demand –GW					19.54
Agricultural Demand –SW					0.46
Domestic Demand – GW					7.5
Domestic Demand – SW					1.875
Total Demand					29.37
Area of Block (Sq. Km.)					886.4
Type of Aquifer					
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					178.66
Volume of Unsaturated Zone (MCM)					558.47
Average Specific Yield					
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)					
Surplus water Available (MCM)					4.001984
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		40	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		2.10		0.9	
RTRWH Structures – Urban Areas					564149
Households to be covered (25% with 50 m ² area)					29.54762
Total RWH potential (MCM)					282074.5
Rainwater harvested / recharged @ 80% runoff co-efficient					
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					
Sugarcane crop area proposed to be covered under Drip (sq.km.)					Nil
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m					
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					

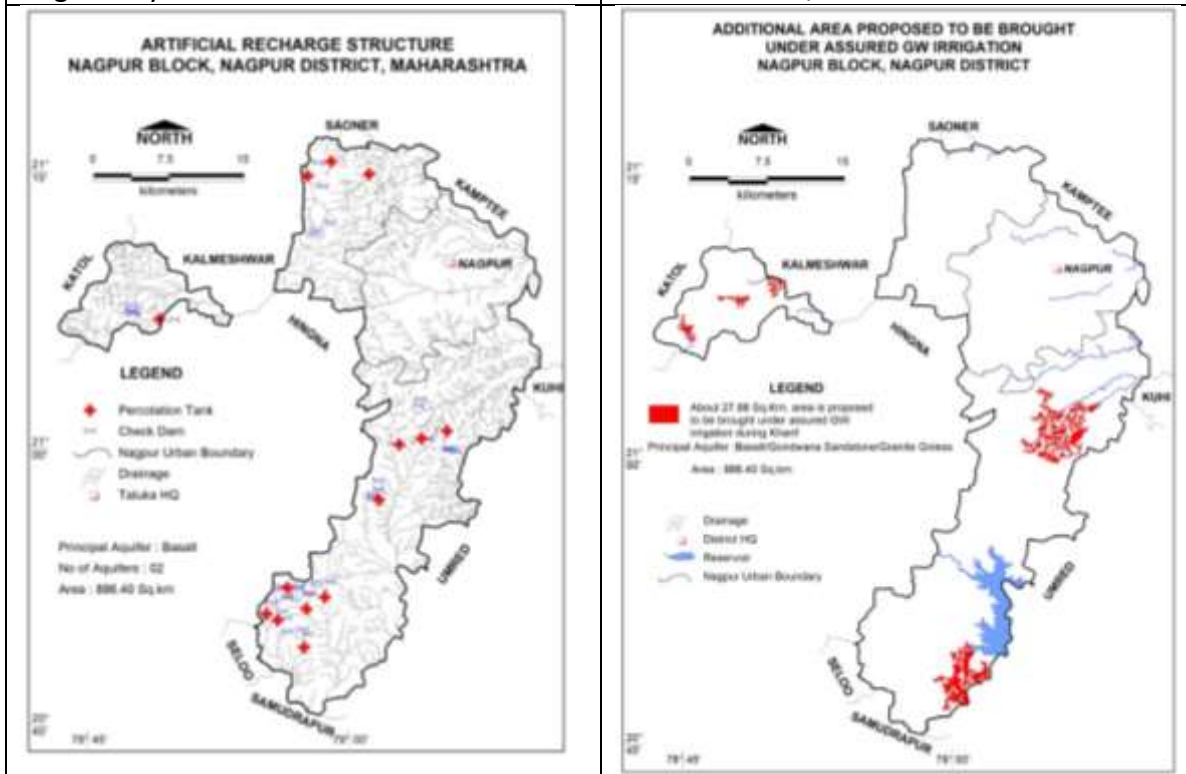
Net Ground Water Availability (MCM)	57.23
Additional GW resources available after Supply side interventions (MCM)	3.00
Ground Water Availability after Supply side intervention (MCM)	60.23
Existing Ground Water Draft for All Uses (MCM)	27.04
GW draft after Demand Side Interventions (MCM)	27.04
Present stage of Ground Water Development (%)	47.25
Expected Stage of Ground Water Development after interventions (%)	44.89
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)	15.12
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	907
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	151
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	27.88

Regulatory Measures

60m borewells/tube wells



9.6 KATOL BLOCK, NAGPUR DISTRICT, MAHARASHTRA

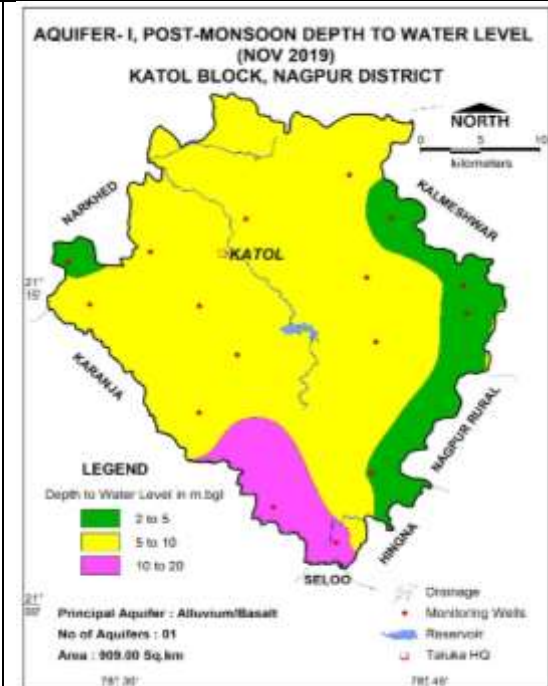
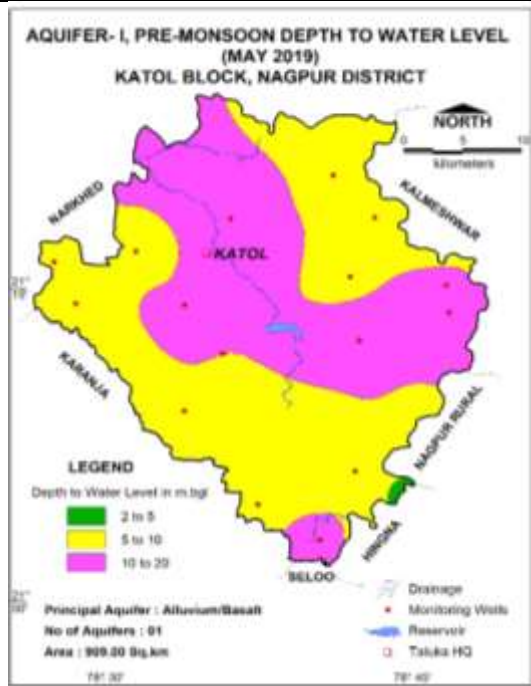
1. SALIENT FEATURES																																											
1.1 Introduction																																											
Block Name	Katol																																										
Geographical Area (Sq. Km.)	734.63																																										
Hilly Area (Sq. Km)	181.70																																										
Population (2011)	43267																																										
Climate	Monsoon Tropical																																										
1.2 Rainfall Analysis																																											
Normal Rainfall	973 mm																																										
Annual Rainfall (2019)	990.6 mm																																										
Decadal Average Annual Rainfall (2010-2019)	873.97 mm																																										
Long Term Rainfall Analysis (2000-2019)	Rising trend 20.60 mm/year. Probability of Rainfall: 65 % Normal Rainfall; 5 % Excess Rainfall Probability of Drought: 20 % Moderate and 10% Acute Drought																																										
Rainfall Trend Analysis (2000 to 2019)																																											
<table border="1"> <caption>Rainfall Trend Analysis (2000 - 2019)</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2000</td><td>67.7</td></tr> <tr><td>2001</td><td>0</td></tr> <tr><td>2002</td><td>649.6</td></tr> <tr><td>2003</td><td>555.1</td></tr> <tr><td>2004</td><td>1092.3</td></tr> <tr><td>2005</td><td>1092.3</td></tr> <tr><td>2006</td><td>937.4</td></tr> <tr><td>2007</td><td>1271.8</td></tr> <tr><td>2008</td><td>773.2</td></tr> <tr><td>2009</td><td>888.4</td></tr> <tr><td>2010</td><td>1027.9</td></tr> <tr><td>2011</td><td>801.8</td></tr> <tr><td>2012</td><td>1050.1</td></tr> <tr><td>2013</td><td>1065.2</td></tr> <tr><td>2014</td><td>647.5</td></tr> <tr><td>2015</td><td>1035.2</td></tr> <tr><td>2016</td><td>773</td></tr> <tr><td>2017</td><td>766.7</td></tr> <tr><td>2018</td><td>581.7</td></tr> <tr><td>2019</td><td>990.6</td></tr> </tbody> </table>		Year	Rainfall (mm)	2000	67.7	2001	0	2002	649.6	2003	555.1	2004	1092.3	2005	1092.3	2006	937.4	2007	1271.8	2008	773.2	2009	888.4	2010	1027.9	2011	801.8	2012	1050.1	2013	1065.2	2014	647.5	2015	1035.2	2016	773	2017	766.7	2018	581.7	2019	990.6
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2018	581.7																																										
2019	990.6																																										
1.3. Geomorphology & Geology																																											
Geomorphic Unit	Plateau (slightly dissected to moderately dissected and weathered plateau) with weathered thickness ranging from 0 to 5 m.																																										
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene																																										
Soil	Moderately deep BCS consisting mostly of clay, 25-100 cm thick.																																										
1.4. Hydrology & Drainage																																											
Drainage	Wardha river and its tributaries and Wainanga river and its tributaries, Godavari river basin with sub-dendritic to dendritic drainage.																																										
Hydrology	Major project	0																																									
	Medium project	1																																									
	Minor Irrigation Projects (Local)	41																																									
	Minor Irrigation Projects (ZP Level)	6																																									
		PT-34, KT-316, UGB-370																																									
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern																																											
Forest Area	132.63 Sq. Km.																																										

Cultivable Area		609.34 Sq. Km.
Net Sown Area		486.65 Sq. Km.
Double Cropped Area		158.41 Sq. Km.
Area under Irrigation	Surface Water	0 Sq. Km.
	Ground Water	70.47 Sq. Km.
Principal Crops	Crop Type	Area (Sq. Km.) (Reference year 2014-15)
	Cotton	57.50
	Cereals	38.05
	Pulses	81.12
Horticultural Crops	Sugarcane	0.06
	Citrous fruit	60.45
	vegetables	8.68

1.6 Water Level Behaviour

1.6.1 Aquifer-I (Shallow Aquifer)

<p>Pre-Monsoon (May-2019) DTWL 5 to 10 mbgl is observed in major part while DTWL 10 to 20 mbgl is observed in Central, eastern, north, north-western and southern part. DTWL 2 to 5 mbgl observed in small patch in south-east part near border.</p>	<p>Post-Monsoon (November-2019) DTWL 5 to 10 mbgl is observed in major part. DTWL of 2 to 5 mbgl is observed as long patch in south-west and east part also in west part of the block in a small patch. While DTWL 10 to 20 mbgl in isolated patch in southern part and part of the block.</p>
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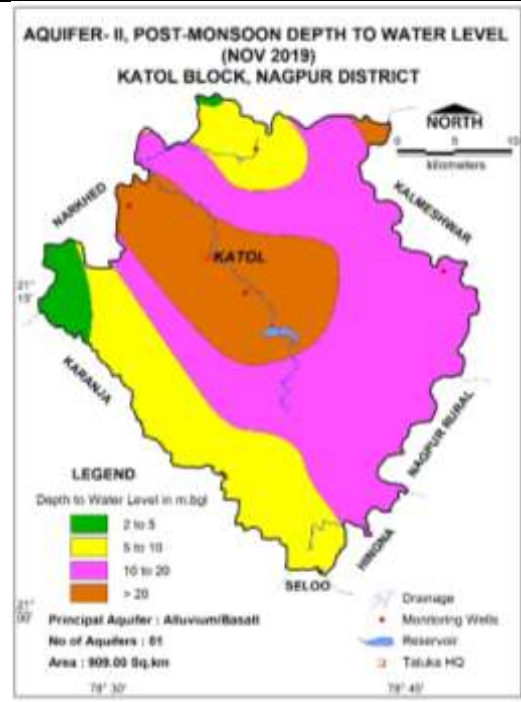
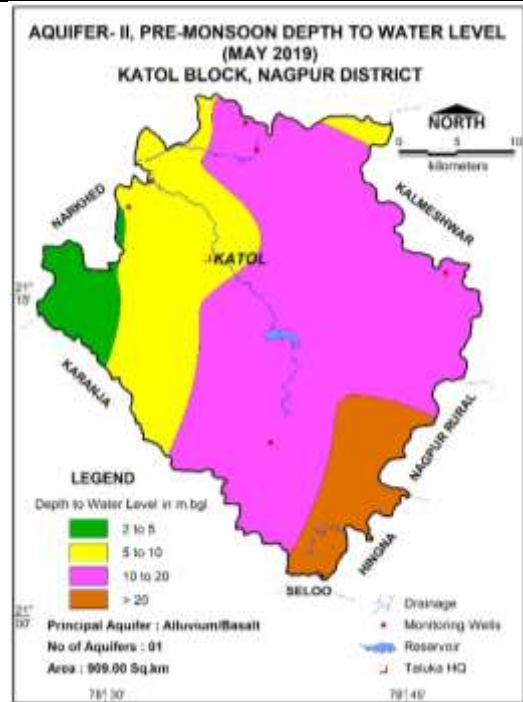


1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

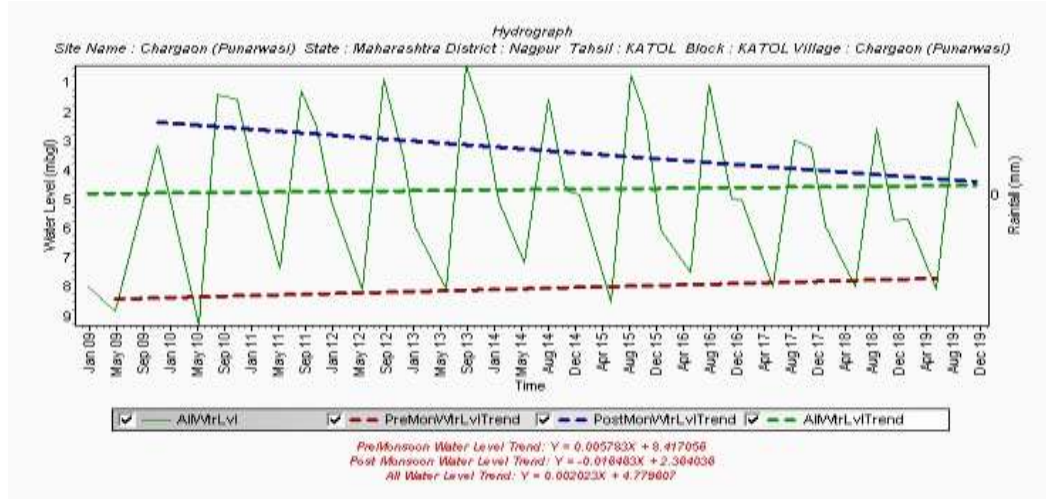
<p>Pre-Monsoon (May-2019) DTWL 10 to 20 mbgl is observed in major</p>	<p>Post-Monsoon (November-2019) DTWL 10 to 20 mbgl is observed in major</p>
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part. DTWL >20 mbgl is observed in south east part whereas DTWL 5 to 10 mbgl is observed in western part engulfing a patch of DTWL of 2 to 5 m bgl.

part engulfing patch of DTWL >20 mbgl is observed in central and north-western part of the block. DTWL 5 to 10 mbgl is observed in south west part engulfing a small solated patch of DTWL of 2 to 5 m bgl near border.



1.7. Hydrograph



Hydrograph shows Pre-monsoon rising water level trend @ 0.006 m/year

Hydrograph shows Post- monsoon falling water level trend @ 0.02 m/year

1.8. Water Level Trend (2010-2019)

1.8.1 Pre-Monsoon trend

Falling 0.002 m/year (Amgaon) to 4.95 m/year (jalalkheda)

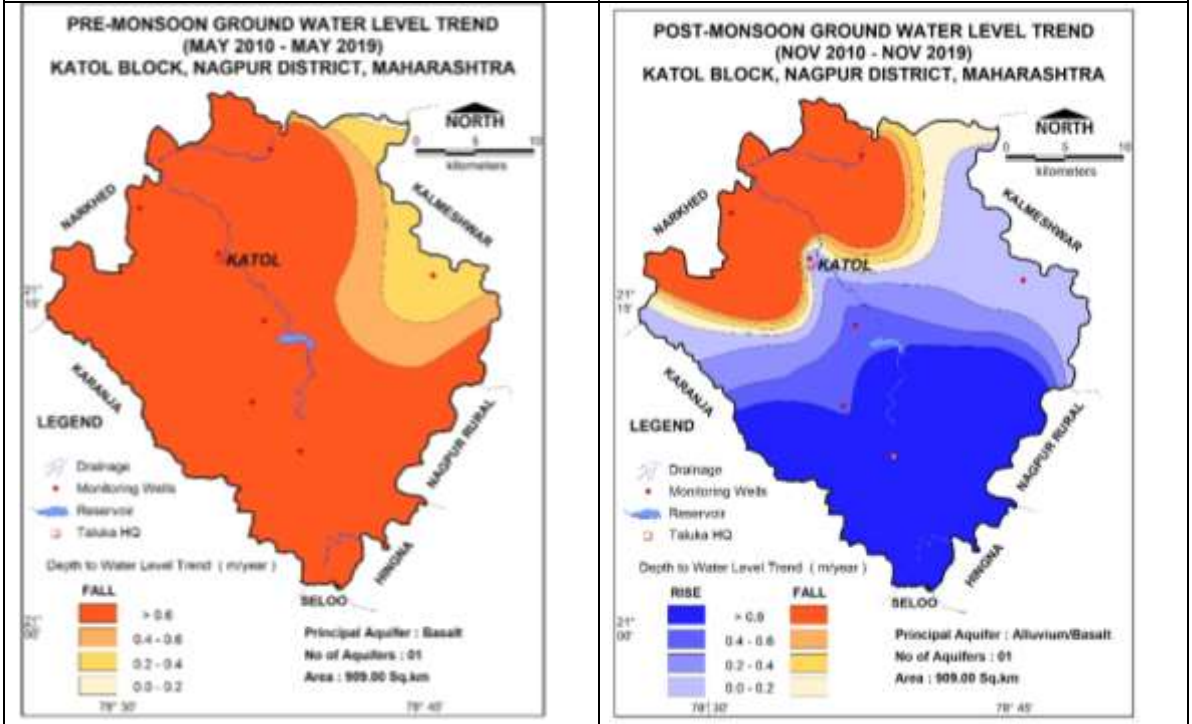
1.8.2 Post-Monsoon trend

Rising 0.1 m/year (Chargaon) to 2.6 m/year (kondhali); Falling 1.8 m/year (sonoli) to 14 m/year (Paradsinga)

Major area shows falling trend > 0.6

Major area shows rising trend of > 0.6

m/year area except patches of falling trend 0.4 to 0.6 observed in north east near borders. m/year) while falling trend upto 0.6 is observed in rest part in north- west part of the block .



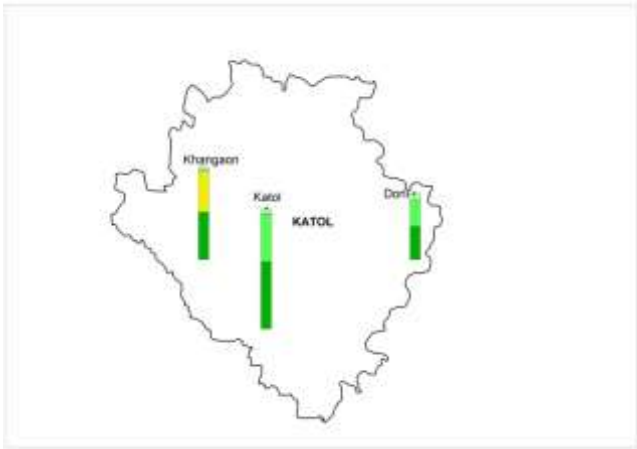
2. Ground Water Issues

Block shows declining water level trend up to 0.6 m/year
 Frequent droughts (20% 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.

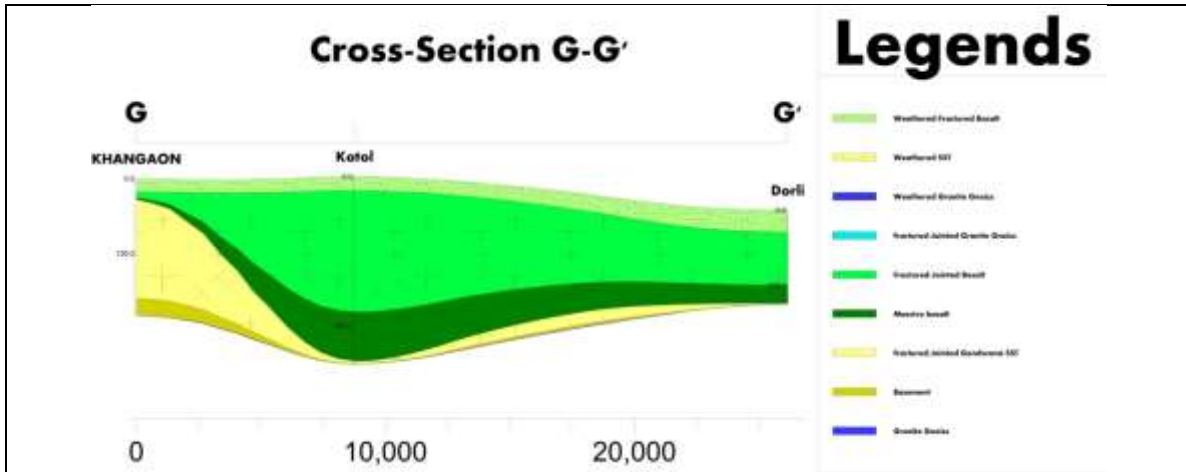
3. AQUIFER DISPOSITION

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

3.2. Lithological Disposition



3.3. Cross Sections

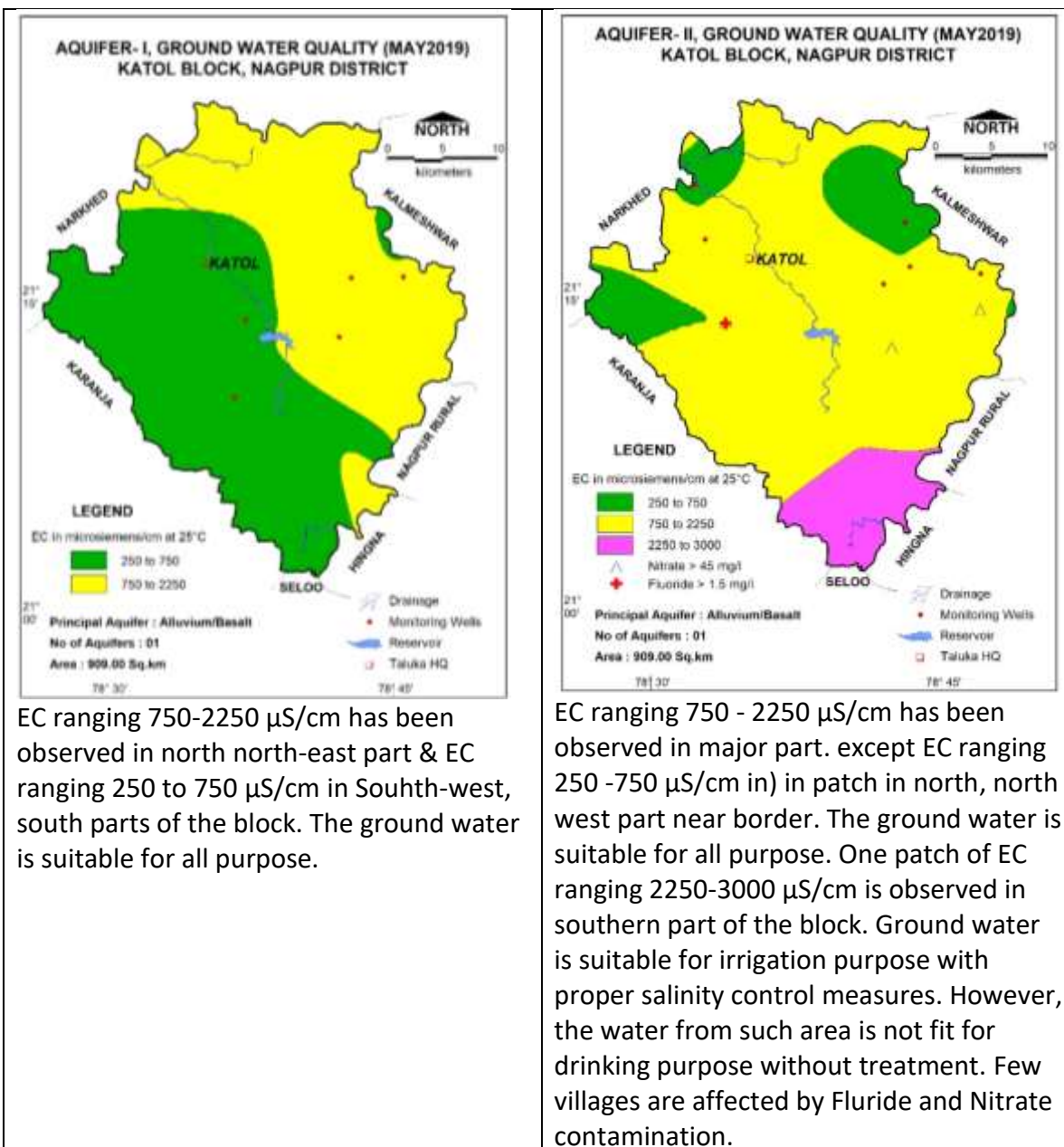


3.4. Aquifer Characteristics

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)	TCG-aquifer II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	2.8-13.5	5-28.3	0.8-29.6
Depth of Occurrence (mbgl)	13.7-34	70-198.8	26-194.5
weathered/fractured rocks thickness (m)	1-25	0.5-36.36	2-41.67
Yield	10 – 100 m ³ /day	0.2 - 0.75 lps	-
Specific yield/ Storativity (S)	0.018 – 0.20	4.69-2.99×10 ⁻⁴	-
Transmissivity (T)	20 - 50 m ² /day	20 - 60 m ² /day	-

4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)	4.2 Semi-confined/Confined Aquifer (Aquifer II/ Deeper aquifer)
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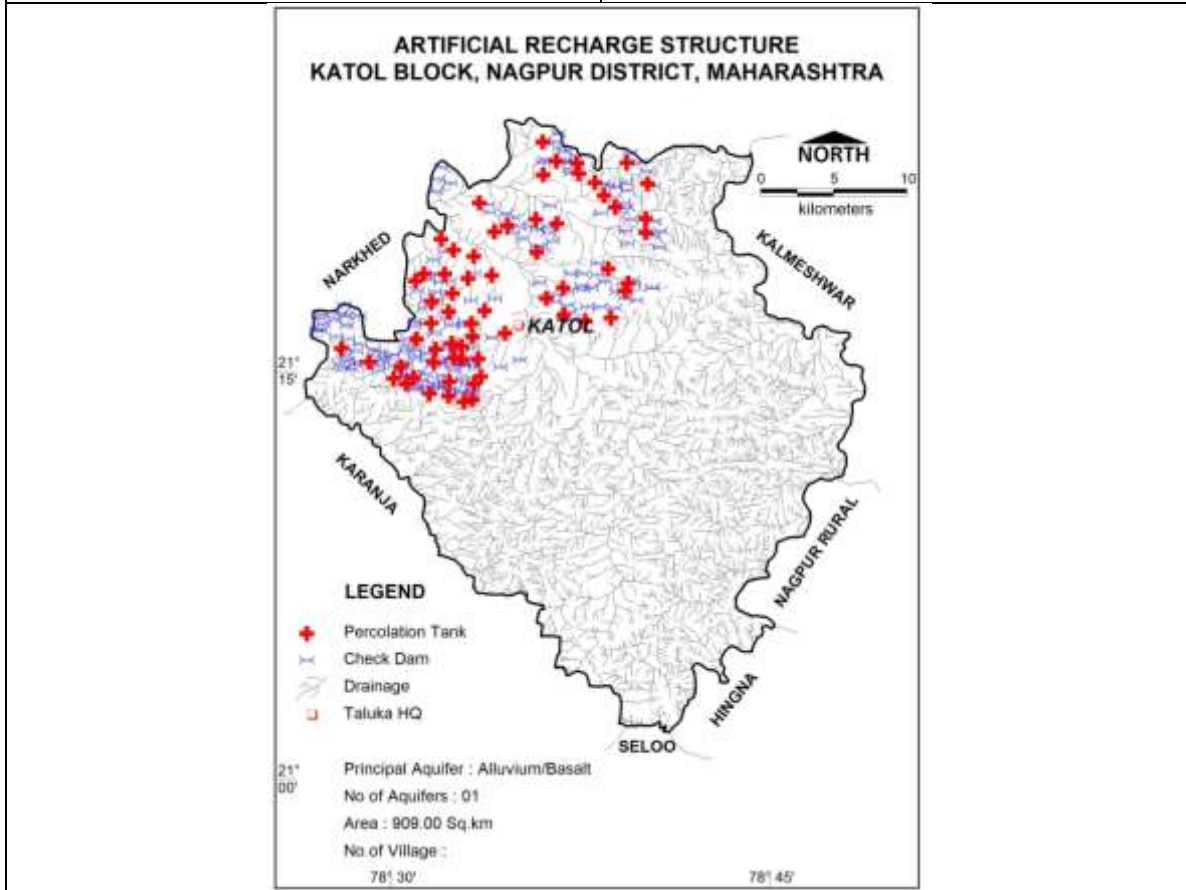
5. GROUND WATER RESOURCE

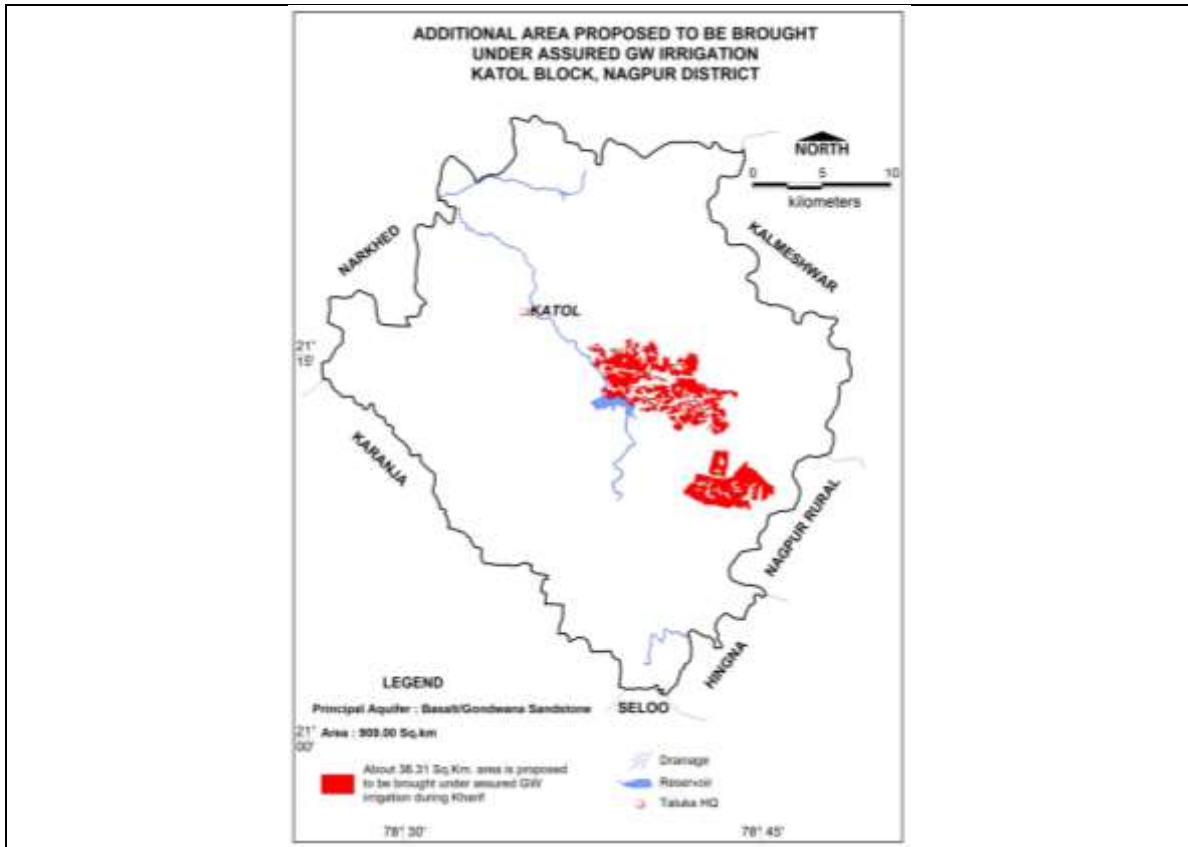
5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

Ground Water Recharge Worthy Area (Sq. Km.)	55293
Total Annual Ground Water Recharge (MCM)	87.2
Natural Discharge (MCM)	4.92
Annual Extractable Ground Water Recharge (MCM)	82.28
Current Annual Ground Water Extraction for irrigation (MCM)	55.19
Current Annual Ground Water Extraction for domestic water supply (MCM)	9.82
Current Annual Ground Water Extraction for All uses(MCM)	65.02
Annual GW Allocation for Domestic Use as on 2025 (MCM)	9.82
Net Ground Water Availability for future use (MCM)	16.47
Stage of Ground Water Development (%)	79.02
Category	Semi-critical

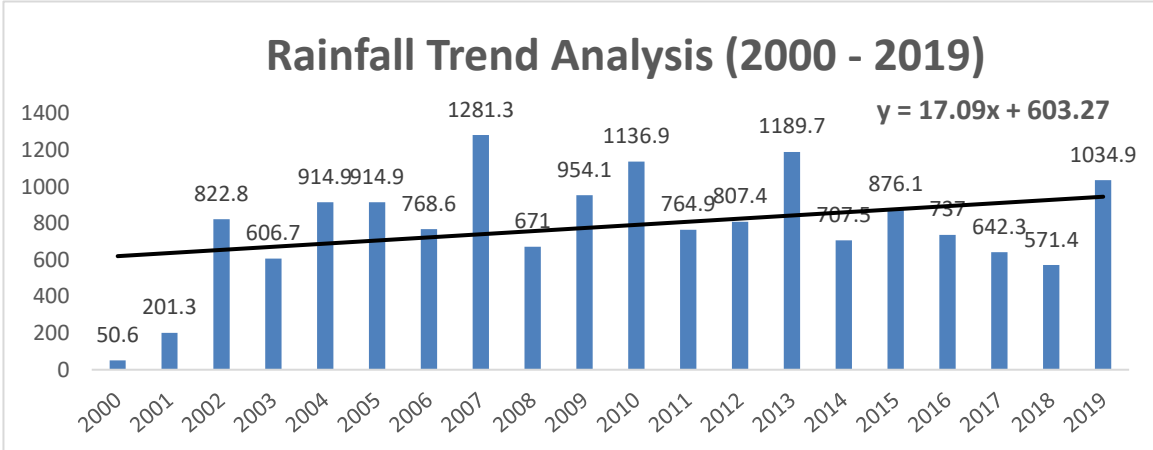
5.2 Aquifer-II (Semi-confined/Confined Deeper Basaltic Aquifer)					
Total Area (Sq. Km.)	Mean aquifer thickness (m)	SY	S	Piezometric Head (m above confining layer)	Total Resource (MCM)
552.93	30.03	0.015	0.000114	37.66	3.64
6.0. GROUND WATER RESOURCE ENHANCEMENT					
6.1. Supply Side Management					
SUPPLY (MCM)					
Available Resource (MCM)					82.28
Gross Annual Draft (MCM)					65.02
Agricultural Demand –GW					55.19
Agricultural Demand –SW					0
Domestic Demand – GW					9.83
Domestic Demand – SW					2.46
Total Demand					67.48
Area of Block (Sq. Km.)					734.63
Type of Aquifer					
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)					780.39
Volume of Unsaturated Zone (MCM)					1935.41
Average Specific Yield					0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)					38.71
Surplus water Available (MCM)					17.48
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		61		175	
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		9.18		3.93	
RTRWH Structures – Urban Areas					
Households to be covered (25% with 50 m ² area)					9866
Total RWH potential (MCM)					0.4262112
Rainwater harvested / recharged @ 80% runoff co-efficient					4933
However, it is economically not viable & hence, not recommended.					
6.2. Demand Side Management					
Micro irrigation techniques					
Micro Irrigation Techniques proposed in 50% Cotton cropped area of 57.5 sq.km.					28.75
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m					8.74
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)	82.28
Additional GW resources available after Supply side interventions (MCM)	13.11
Ground Water Availability after Supply side intervention (MCM)	95.39
Existing Ground Water Draft for All Uses (MCM)	65.02
GW draft after Demand Side Interventions (MCM)	56.28
Present stage of Ground Water Development (%)	79.02
Expected Stage of Ground Water Development after interventions (%)	59
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)	10.49
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	630
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	105
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	36.31
Regulatory Measures	60m borewells/tube wells





9.7 NARKHED BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name	Narkhed	
Geographical Area (Sq. Km.)	79820	
Hilly Area (Sq. Km)		
Population (2011)	29904	
Climate	Monsoon Tropical	
1.2 Rainfall Analysis		
Normal Rainfall	1029.3 mm	
Annual Rainfall (2019)	1034.9 mm	
Decadal Average Annual Rainfall (2000-2019)	782.72 mm	
Long Term Rainfall Analysis (2000-2019)	Rising trend 17.09 mm/year. Probability of Rainfall: 55 % Normal Rainfall; Probability of Drought: 35 % Moderate and 10% Acute Drought	
Rainfall Trend Analysis (2000 to 2019)		
		
1.3. Geomorphology & Geology		
Geomorphic Unit	Plateau (slightly dissected to moderately dissected and weathered plateau) with weathered thickness ranging from 0 to 1 m.	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Shallow to deep loamy soil.	
1.4. Hydrology & Drainage		
Drainage	Wardha river, Kar and Kolar rivers and tributaries; Godavari river basin with sub-dendritic to dendritic drainage.	
Hydrology	Major project	0
	Medium project	0
	Minor Irrigation Projects (Local)	20
	Minor Irrigation Projects (ZP Level)	2
		PT-30, KT-129, UGB-272
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Forest Area	69.62 Sq. Km.	
Cultivable Area	157.80 Sq. Km.	
Net Sown Area	44.59 Sq. Km.	

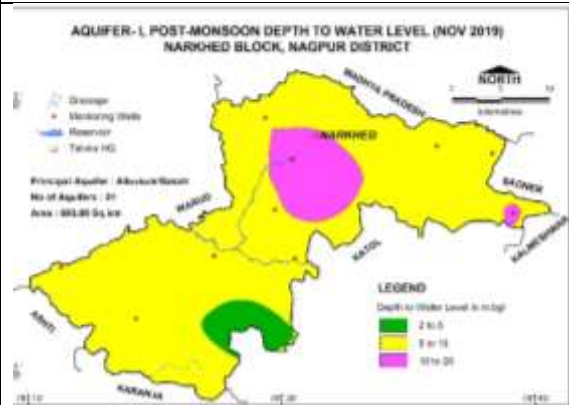
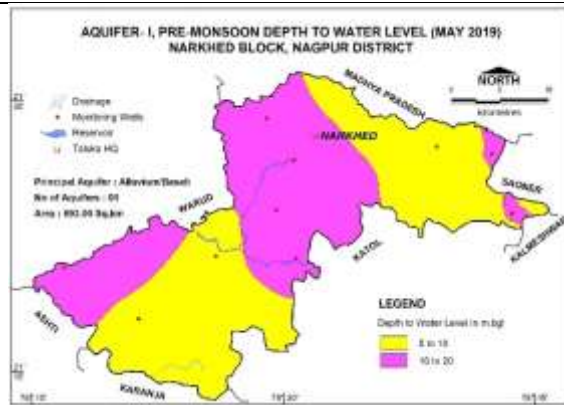
Double Cropped Area		143.32 Sq. Km.
Area under Irrigation	Surface Water	0 Sq. Km.
	Ground Water	94.51 Sq. Km.
Principal Crops	Crop Type	Area (Sq. Km.) (Reference year 2014-15)
	Cotton	162.50
	Cereals	71.75
	Pulses	114.27
	Oil Seeds	370.85
Horticultural Crops	Sugarcane	0.02
	Citrous fruit	62.39
	Others	3.57

1.6 Water Level Behaviour

1.6.1 Aquifer-I (Shallow Aquifer)

Pre-Monsoon (May-2019)
DTWL 5 to 10 mbgl is observed in southern and eastern part while DTWL 10 to 20 mbgl is observed in Central, western part.

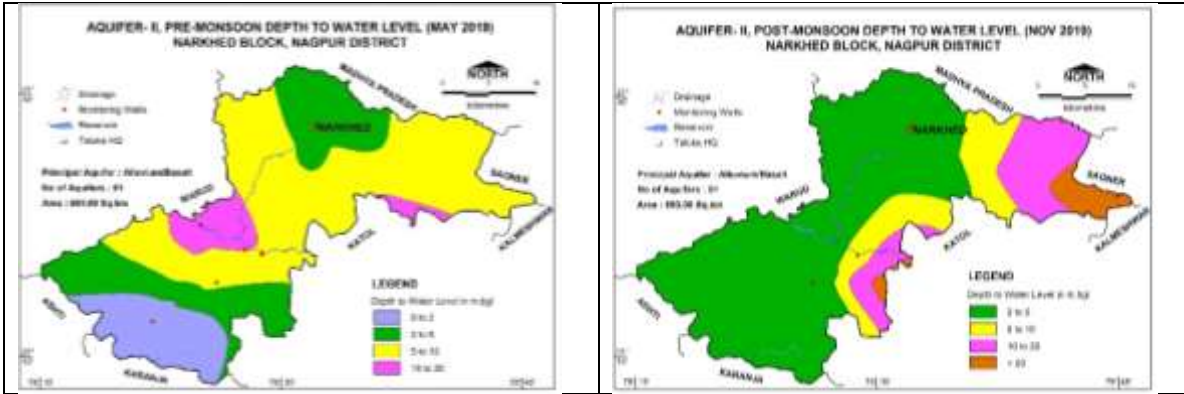
Post-Monsoon (November-2019)
DTWL 5 to 10 mbgl is observed in major part. DTWL of 2 to 5 mbgl is observed in a patch in south part part of the block in a small patch. While DTWL 10 to 20 mbgl in isolated patch in central part and part of the block.



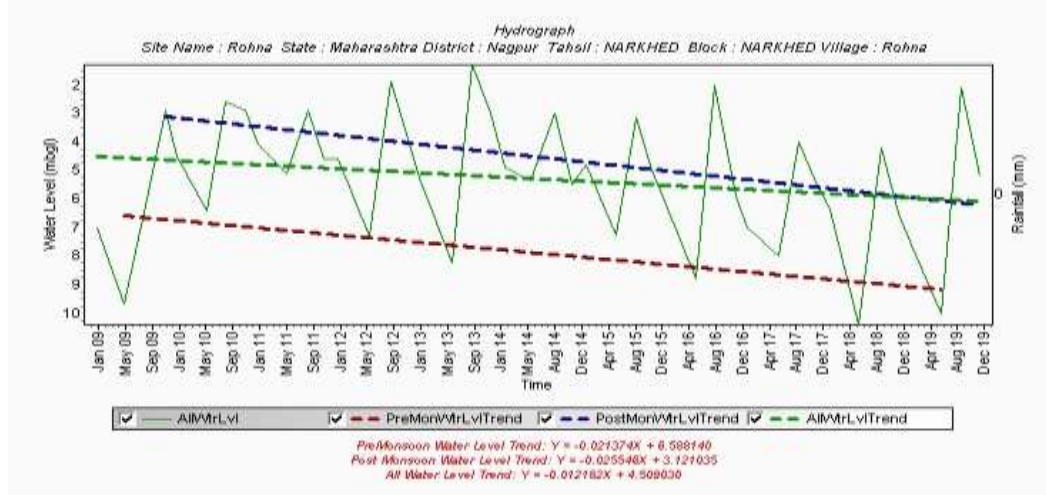
1.6.2 Water Level Behaviour - Aquifer-II (Deeper Aquifer)

Pre-Monsoon (May-2019)
DTWL 5 to 10 mbgl is observed in major part. DTWL >20 mbgl is observed in south east part whereas DTWL 2 to 5 mbgl is observed in south-east part engulfing a patch of DTWL of 0 to 2 m bgl.

Post-Monsoon (November-2019)
DTWL 2 to 5 mbgl is observed in major part of the block. DTWL 2 to 10 mbgl is observed in south east and east part engulfing a small isolated patch of DTWL of DTWL >20 mbgl near border.



1.7. Hydrograph



Hydrograph shows Pre-monsoon falling water level trend @ 0.02 m/year

Hydrograph shows Post-monsoon falling water level trend @ 0.03 m/year

1.8. Water Level Trend (2010-2019)

1.8.1 Pre-Monsoon trend

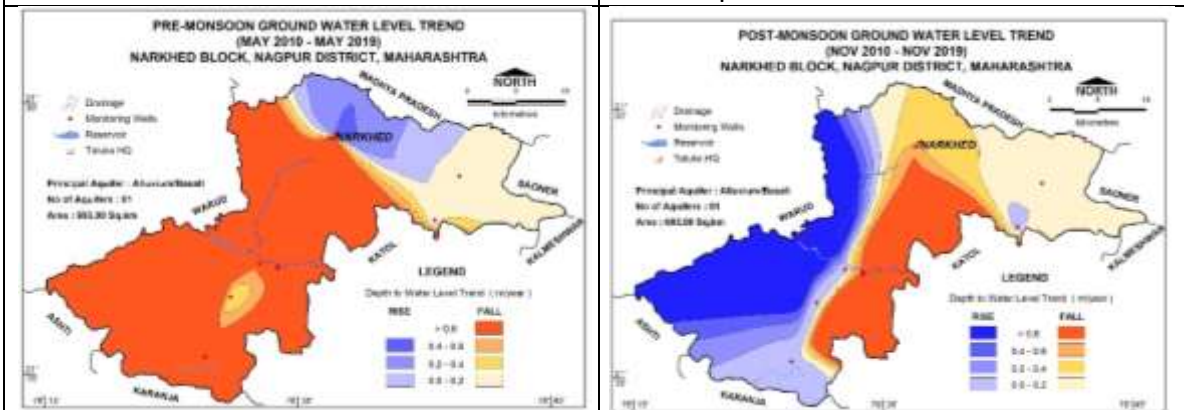
Rising 0.2 m/year (Sawargaon), Falling 0.1 m/year (Rohna) to 0.6 m/year (Jamgaon bk.)

1.8.2 Post-Monsoon trend

Rising 0.09 m/year (Lohara) to 1.8 m/year (Jalalkheda); Falling 0.01 m/year (Rohna) to 0.6 m/year (Narkhed)

Major area shows falling trend > 0.6 m/year area except few patches of rising trend upto 0.6 observed in north near borders.

Major area shows rising trend of > 0.6 m/year while falling trend > 0.6 is observed in part in north-east and south-east and eastern part of the block.



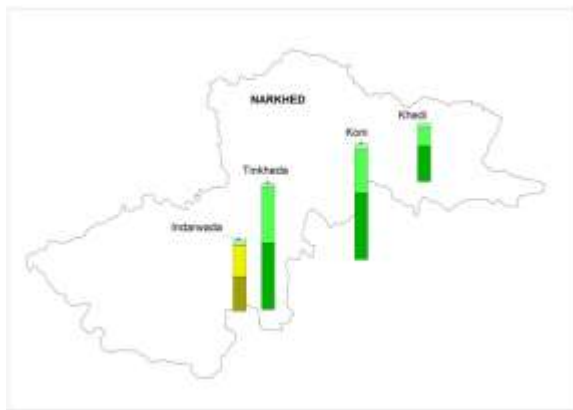
2. Ground Water Issues

Block shows declining water level trend more than 0.6 m/year
 Frequent droughts (35% 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.

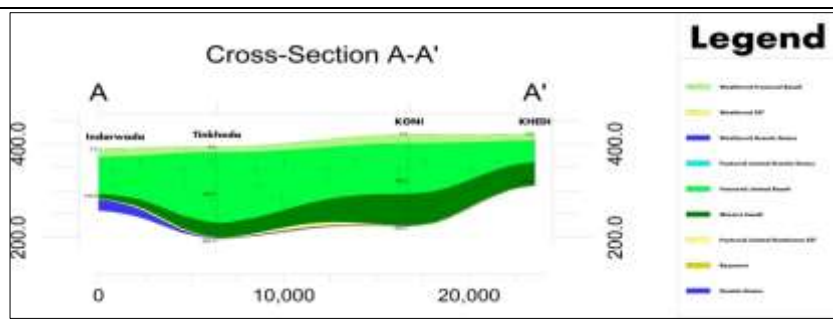
3. AQUIFER DISPOSITION

3.1. Number of Aquifers	Aquifer-I Basalt (Phreatic / Shallow aquifer) Aquifer-II Basalt; TCG (Semi-confined / confined / Deeper aquifer)
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3.2. Lithological Disposition



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)	TCG-aquifer II (Semi-confined / confined / Deeper aquifer)
Static Water Level (mbgl)	3-17	2-33.37	1.9-29
Depth of Occurrence (mbgl)	15-40	19-171	26-194.5
weathered/fractured rocks thickness (m)	3-27	0.5-20	2-54
Yield	35-110 m ³ /day	1->2 lps	Moderate to high
Specific yield/ Storativity (S)	0.018 – 0.20	5.6×10 ⁻⁴	-
Transmissivity (T)	3.5-45 m ² /day	10-300 m ² /day	-

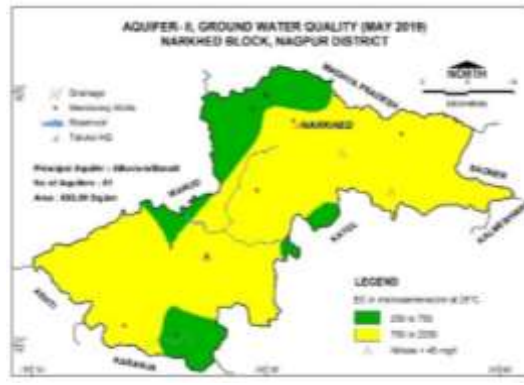
4. GROUND WATER QUALITY

4.1 Phreatic Aquifer (Aquifer-I/ Shallow aquifer)



EC ranging 750-2250 $\mu\text{S}/\text{cm}$ has been observed in major part & EC ranging 250 to 750 $\mu\text{S}/\text{cm}$ in patches in south and east parts of the block. The ground water is suitable for all purpose.

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



EC ranging 750 - 2250 $\mu\text{S}/\text{cm}$ has been observed in major part except EC ranging 250 -750 $\mu\text{S}/\text{cm}$ in) in patch in north-west and south part near border. The ground water is suitable for all purpose. Few villages are also affected by nitrate contamination. However, the water from such area is not fit for drinking purpose without treatment.

5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

Ground Water Recharge Worthy Area (Sq. Km.)	643.23
Total Annual Ground Water Recharge (MCM)	93.82
Natural Discharge (MCM)	5.2
Annual Extractable Ground Water Recharge (MCM)	88.63
Current Annual Ground Water Extraction for irrigation (MCM)	50.47
Current Annual Ground Water Extraction for domestic water supply (MCM)	9.73
Current Annual Ground Water Extraction for All uses (MCM)	60.2
Annual GW Allocation for Domestic Use as on 2025 (MCM)	9.73
Net Ground Water Availability for future use (MCM)	28.32
Stage of Ground Water Development (%)	67.92
Category	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)
643.23	31.23	0.015	0.006434	31.71	0.9210

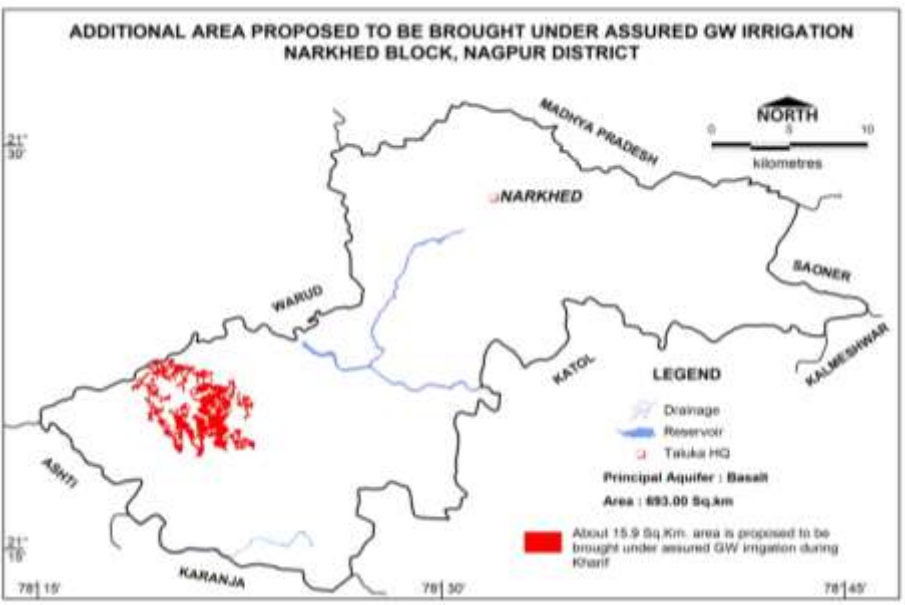
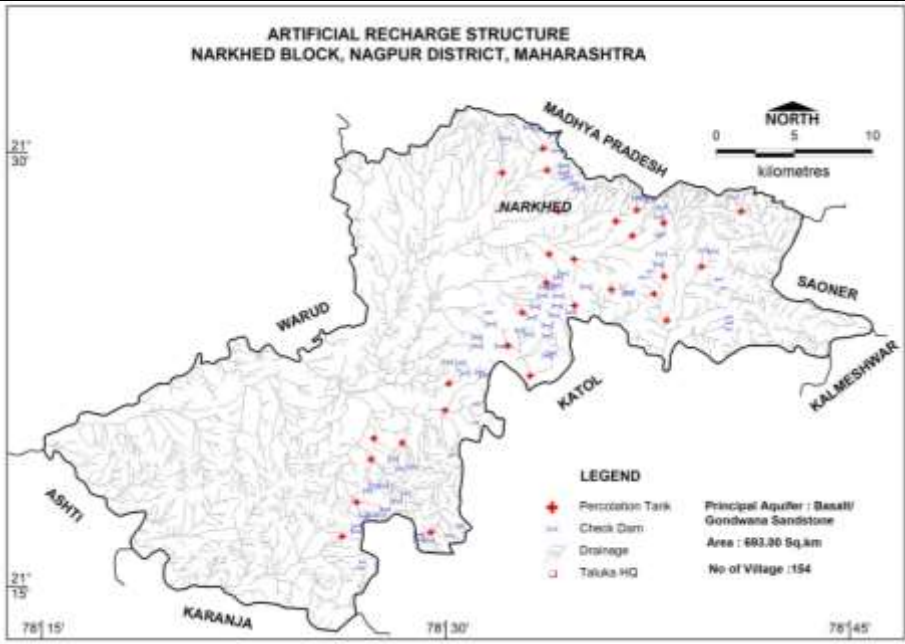
6.0. GROUND WATER RESOURCE ENHANCEMENT

6.1. Supply Side Management

SUPPLY (MCM)	
Available Resource (MCM)	88.63
Gross Annual Draft (MCM)	60.2
Agricultural Demand –GW	50.47

Agricultural Demand –SW		0
Domestic Demand – GW		9.7
Domestic Demand – SW		2.4
Total Demand		62.63
Area of Block (Sq. Km.)		79820
Area suitable for Artificial recharge (Sq. Km)		
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		297.52
Volume of Unsaturated Zone (MCM)		1084.65
Average Specific Yield		0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)		21.69
Surplus water Available (MCM)		6.66
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	23	67
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	3.50	1.50
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m ² area)		6760
Total RWH potential (MCM)		0.293384
Rainwater harvested / recharged @ 80% runoff co-efficient		3380
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Micro Irrigation Techniques proposed in Cotton cropped area @ WUE 0.511 m		Nil
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.815 m. Drip Req. -0.511, WUE- 0.304 m		
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)		88.63
Additional GW resources available after Supply side interventions (MCM)		5.00
Ground Water Availability after Supply side intervention (MCM)		93.63
Existing Ground Water Draft for All Uses (MCM)		60.20
GW draft after Demand Side Interventions (MCM)		60.20
Present stage of Ground Water Development (%)		67.92
Expected Stage of Ground Water Development after interventions (%)		64.30
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)	5.34
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	320
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	53
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	15.90
Regulatory Measures	60m borewells/tube wells



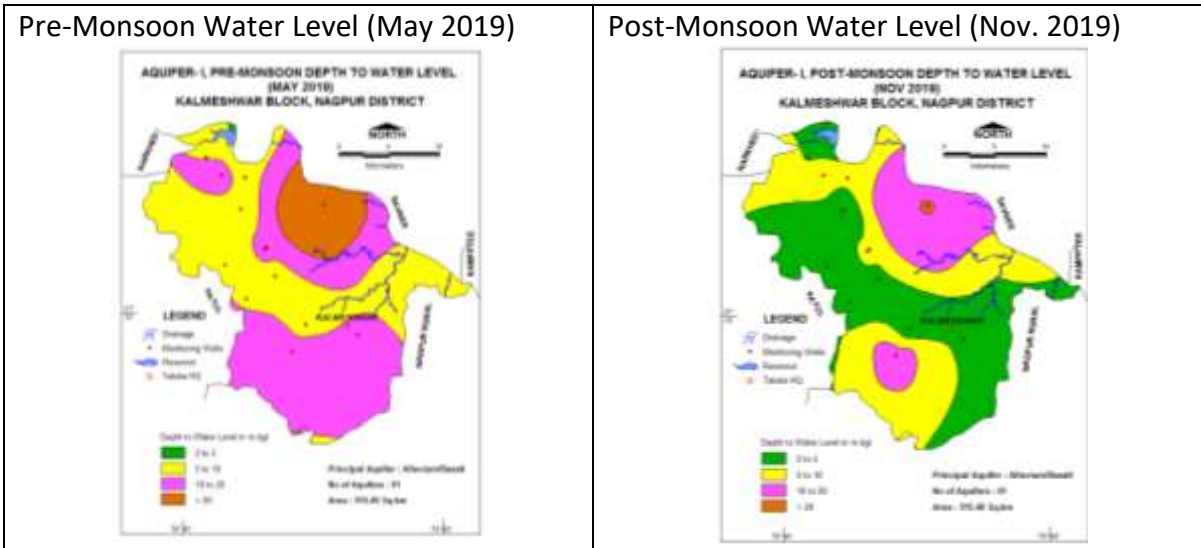
9.8 KALMESHWAR BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name	KALMESHWAR	
Geographical Area (Sq. km.)	518.13Sq. km.	
Hilly Area (Sq. km.)	47.01 Sq. km.	
Poor Ground Quality Area (Sq. km.)	Nil	
Population (2011)	1,22,363	
Climate	Sub-Tropical	
1.2 Rainfall Analysis		
Normal Rainfall	985.40 mm	
Annual Rainfall (2019)	1007.0mm	
Decadal Average Annual Rainfall (2010-19)	958.10 mm	
Long Term Rainfall Analysis (1999-2019)	Rising Trend 0.6762 mm/year Probability of Normal and Excess Rainfall 57.14% & 23.81% Probability of Droughts -: 14.29% Moderate and 4.76% Acute	
Rainfall Trend Analysis (1999 to 2019) <div style="text-align: center;"> </div>		
EQUATION OF TREND LINE $y = -0.6762x + 918.63$		
1.3. Geomorphology, Soil & Geology		
Major Geomorphologic Unit	Weathered, Slightly, Moderately and highly dissected Plateau; alluvium plain;	
Soil	Extremely Shallow Clayey, Deep moderate loamy, Very Shallow Loamy, Very deep Moderately Loamy	
Geology	Unconsolidated Sediments, Deccan Traps (Basalt) Age: Late Cretaceous to Eocene Gondwana Super group (Permian to Carboniferous)	
1.4. Hydrology & Drainage		
Drainage	Nil	
Hydrology (Reference DSA Year: June 2016-17)	Major project	Nil
	Medium project	Completed: 02 medium irrigation projects generating a gross irrigation Potential of

		2698 ha out of 5687 ha area.
	Small project	Completed: 18 small irrigation projects generating a gross irrigation Potential of 2403 ha out of 3494 ha area.
	Irrigation Project (100-250 Ha)/others	Completed: 01 irrigation projects; generating a gross irrigation Potential of 133 ha. 6 PT, 119 Kolhapur Bandhara, 92 surface storage bandhara, 6538 irrigation well, 99 diesel pump, 6736 electric pump

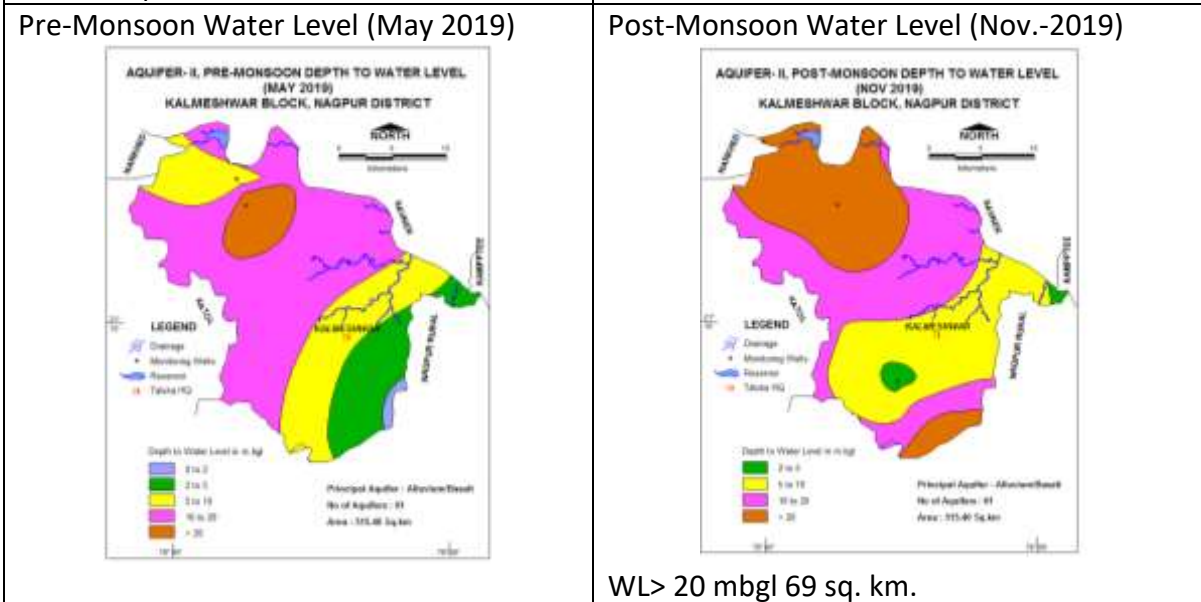
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Geographical Area	518.13Sq. km.	
Forest Area	54.35 Sq. km.	
Cultivable Area	385.41 Sq. km.	
Net Sown Area	443.95 Sq. km.	
Double Cropped Area	52.67 Sq. km.	
Area under Irrigation	Surface Water	1.67 Sq. km.
	Ground Water	78.80 Sq. km.
Principal Crops <i>(Reference year 2019)</i>	Crop Type	Area (Sq. km.)
	Cereals	43.55
	Pulses	50.39
	Soyabean	127.20
	Sugarcane	12.01
	Cotton	184.42
Horticultural Crops	Orange	41.41
	Other fruits	0.15
	Banana	0
	Vegetables	49.24

1.6. Water Level Behavior	
1.6.1. Aquifer-I/Shallow Aquifer	
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
Water level between 2-5 mbgl has been observed as a very tiny isolated patch in northern part of the block; Water level between 5 to 10 mbgl has been observed in central, western and eastern part as a continuous patch of the block whereas water levels between 10-20 mbgl have been observed in southern, western and central part of the block. Water levels > 20 mbgl is observed in entire northern part.	Water level between 2-5 mbgl has been observed in central, western and eastern part as a continuous patch of the block; Water level between 5 to 10 mbgl have been observed in southern, western and central part of the block. Whereas water levels between 10-20 mbgl is observed in entire northern part. Water levels > 20 mbgl as a very tiny isolated patch in northern part of the block.

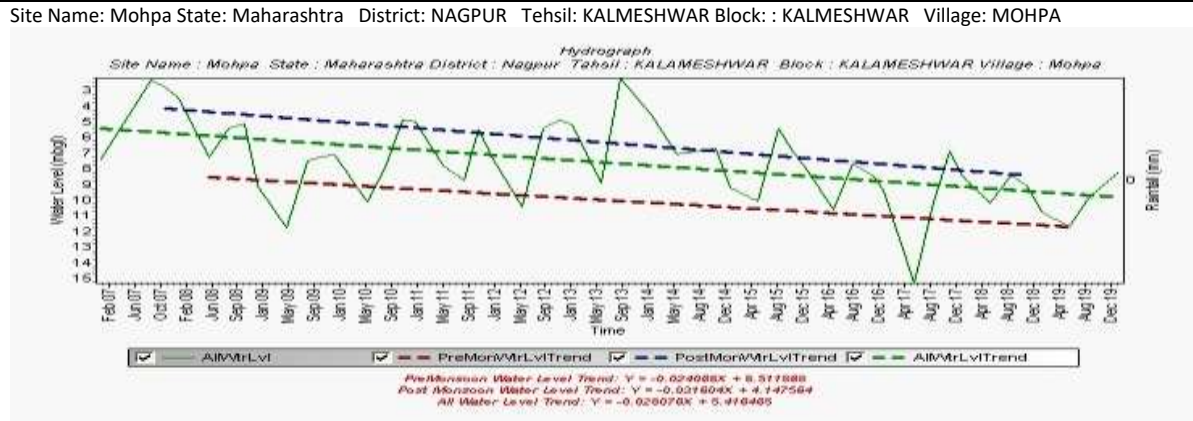


1.6.2. Aquifer-II/Deeper Aquifer

<p>Pre-Monsoon (May-2019)</p> <p>Water levels between 0 to 2 mbgl are observed as tiny isolated patch in south-eastern fringe of the block; Water levels between 2 to 5 mbgl are observed as continuous patch in south-eastern part of the block; Water levels between 5 to 10 mbgl are observed as continuous patch from east to southern part of the block and also in western part; Water levels between 10 to 20 mbgl are observed as continuous patch along central, northern, western parts of the block; Water levels > 20 mbgl is seen as a isolated patch in northern part of the block.</p>	<p>Post-Monsoon (November-2019)</p> <p>Water levels between 2 to 5 mbgl are observed as tiny isolated patch in south-eastern part and eastern fringe of the block; Water levels between 5 to 10 mbgl are observed as continuous patch from east to southern part of the block; Water levels between 10 to 20 mbgl are observed as continuous patch along central, northern, southern and western parts of the block; Water levels > 20 mbgl is seen as a continuous patch in north-western part of the block.</p>
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1.7. Hydrograph



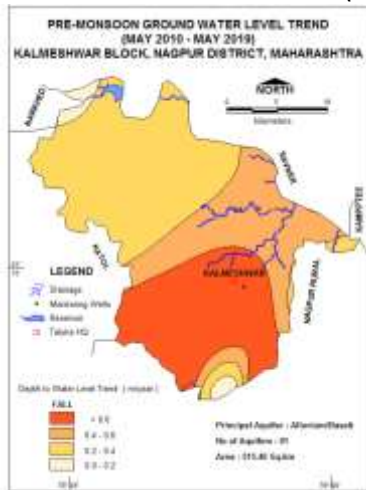
Hydrograph shows Pre-monsoon falling water level trend @ 0.29 m/year and Post monsoon falling water level trend @ 0.379 m/year

1.8. Water Level Trend (2010-19)

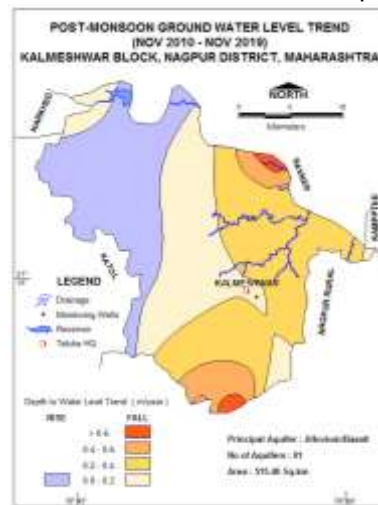
Decline in water level trend up to 0.2 m/year has been observed as a very tiny isolated patch along southern fringe of the block; whereas decline in water level trend between 0.2 to 0.4 m/year has been observed in entire north, west part and as tiny isolated patches in eastern and southern fringes; whereas decline in water level trend between 0.4 to 0.6 m/year has been observed in entire eastern and central parts of the block; whereas decline in water level trend > 0.6 m/year has been observed in entire southern part of the block.

Rising trend between 0.2 to 0.4 m/year has been observed in entire northern and central and western part of the block; Decline in water level trend up to 0.2 m/year has been observed as a very tiny isolated patch along western fringe of the block and as a continuous patch from north to south; whereas decline in water level trend between 0.2 to 0.4 m/year has been observed in entire east and south part; whereas decline in water level trend between 0.4 to 0.6 m/year has been observed as tiny isolated patches along northern and southern fringes of the block; whereas decline trend in water level > 0.6 m/year has been observed as tiny isolated patches along northern and southern fringes of the block;

Pre-Monsoon Water Level Trend (2010-19)



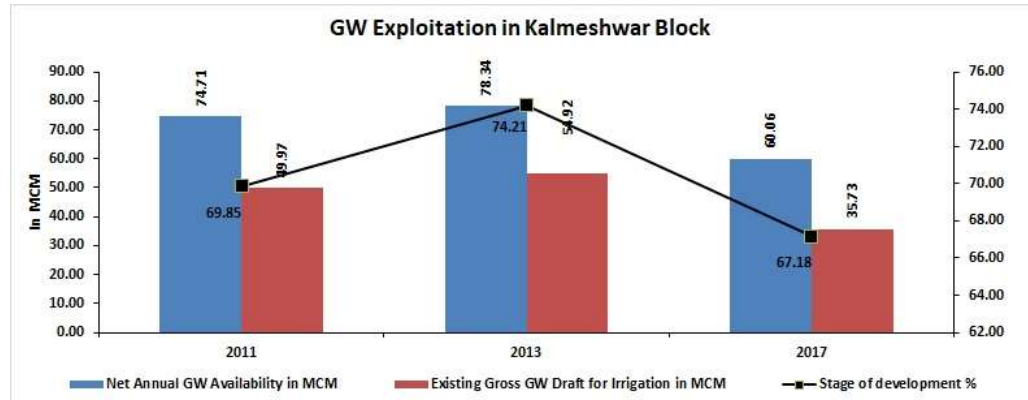
Post-Monsoon Water Level Trend (2010-19)



2. Ground Water Issues

Exploitation of Ground Water: -

The stage of ground water development has increased during 2011 to 2013 from 69.85% to 74.21% and afterwards decreased during 2013 to 2017 from 74.21% to 67.18% in Kalmeshwar block of Nagpur District. Further, the net ground water availability increased during 2011 to 2013 from 74.71 MCM to 78.34 MCM again decreased from 78.34 MCM to 60.06 MCM during 2013 to 2017. Whereas the draft for irrigation first increased during 2011 to 2013 from 49.97 MCM to 54.92 MCM and again decreased from 54.92 MCM to 35.73 MCM during 2013 to 2017.



Declining water level Trend: -

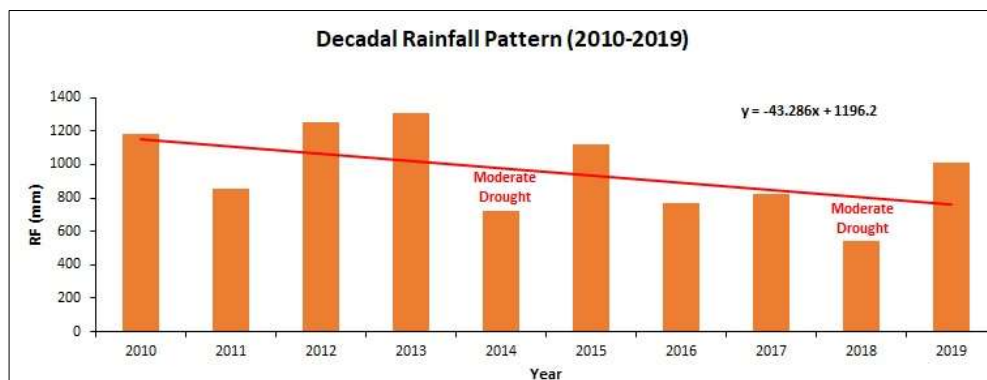
Pre monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 527 sq. km. covering about 97% area of the block.

Post monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 244 sq. km. covering about 45 % area of the block.

Low rainfall and Droughts:

The long-term rainfall analysis for the period 1999-2019 indicates that normal rainfall of Kalmeshwar block is 958.40 mm, and also indicates a rising rainfall trend @ 0.6762 mm/year with 14.29% probability of moderate drought & 4.76 % probability of acute drought.

Based on the short-term rainfall data from 2010-2019 for the block, the analysis indicates that average rainfall is 958.10 mm. The rainfall from last ten years shows that the area continuously experienced low and declining rainfall with frequent moderate droughts.



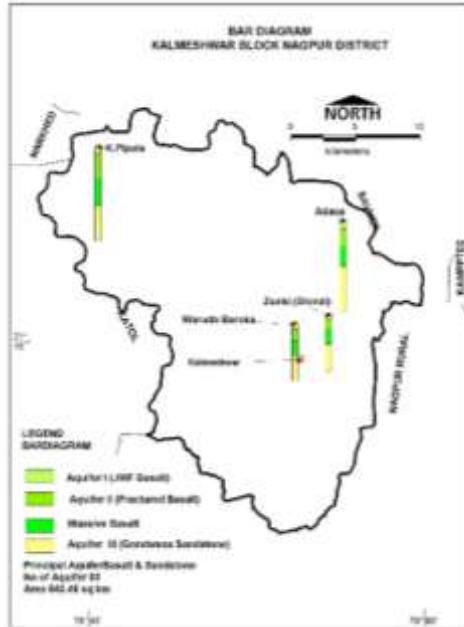
Low yielding Aquifer resulting poor sustainability:

Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 60% area of the block has low yield potential (< 50 m³/day) and can sustain pumping only for 1-1.5 hrs.

3. AQUIFER DISPOSITION

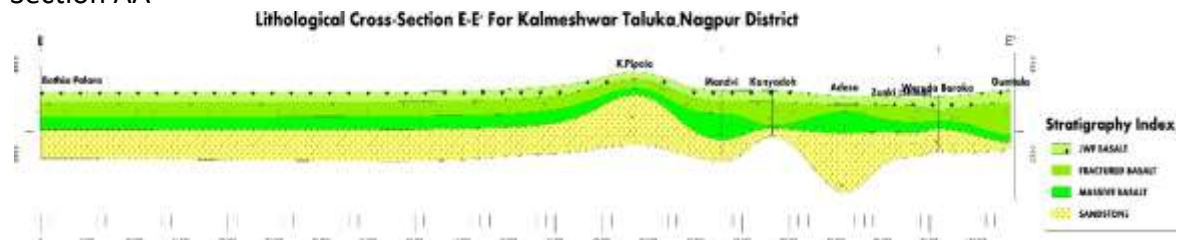
3.1. Number of Aquifers Basalt –Aquifer-I, Aquifer-II; Sandstone Aquifer-II

3.2. Lithological disposition



3.3. Cross Section

Section AA'



3.4. Basic Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)		Sandstone
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/c onfined)	Aquifer-II (Semiconfined/confined)
Depth to bottom of Aquifer (mbgl)	4 to 32	34 to 158.50	26-194
Weathered/Fractured zones encountered (mbgl)	up to 32	up to 158.50	2-54
Weathered/Fractured rocks thickness (m)	0.5 to 2	6 to 16	2-54
SWL (mbgl)	5.30 to 11.90	7.30 to 28.50	2.32-22
Specific yield/Storativity (S)	0.020 to 0.070	5.8x10 ⁻⁴ to 9.8x10 ⁻³	9.8 x 10 ⁻³ to 1.14 x 10 ⁻⁴
Transmissivity (T)	15.00 to 70.50	9.32 to	9.32 m ² /day

	m ² /day	250m ² /day	
Yield	20-80 m ³ /day	10 to 200 m ³ /day	20-80
Sustainability	2 to 4 hrs	1 to 5 hrs	2-5 hrs

4. GROUND WATER QUALITY

4.1 Aquifer-I/ Shallow Aquifer

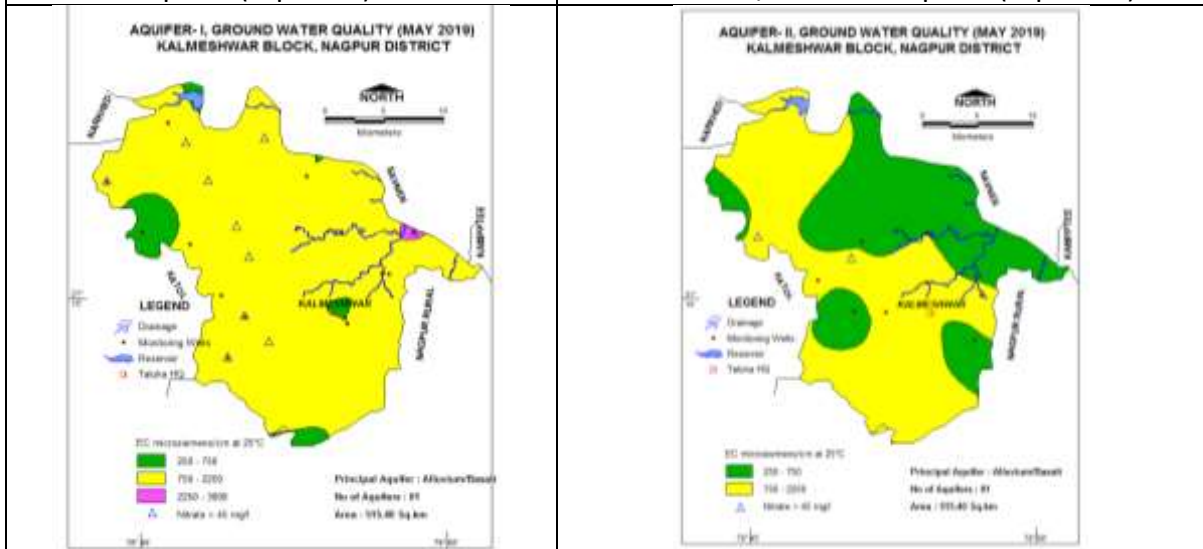
EC values between 750-2250 μS/cm are observed in almost entire parts of the block and EC values between 250-750 μS/cm are observed in north, west, south and central part as very tiny isolated patches of the block; whereas EC values >2250 μS/cm are observed as very tiny isolated patch in eastern fringe of the block. Ground water is suitable for all purposes except some villages having Nitrate values more than 45 mg/L.

4.2 Aquifer II/Deeper Aquifer

EC between 250-750μS/cm is observed in entire eastern part of the block and as isolated patches along west, south, south-east extremities of the block and EC values between 750 to 2250 μS/cm is observed in almost entire block except entire eastern part of the block and some isolated patches along west, south, south-east extremities of the block. Ground water is suitable for all purposes except some villages having Nitrate values more than 45 mg/L.

Phreatic Aquifer (Aquifer-I)

Semi confined/Confined Aquifer (Aquifer II)



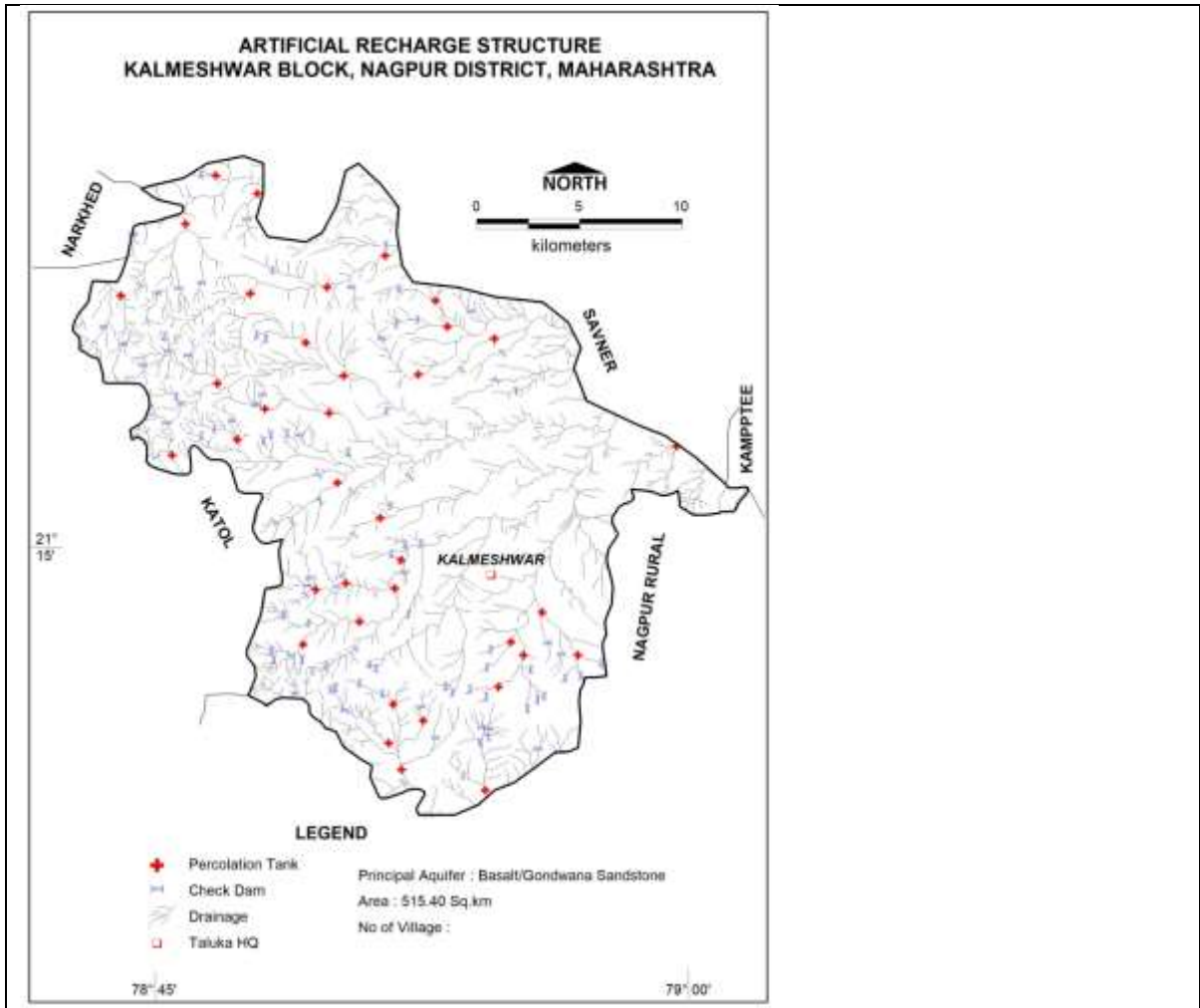
5. GROUND WATER RESOURCE

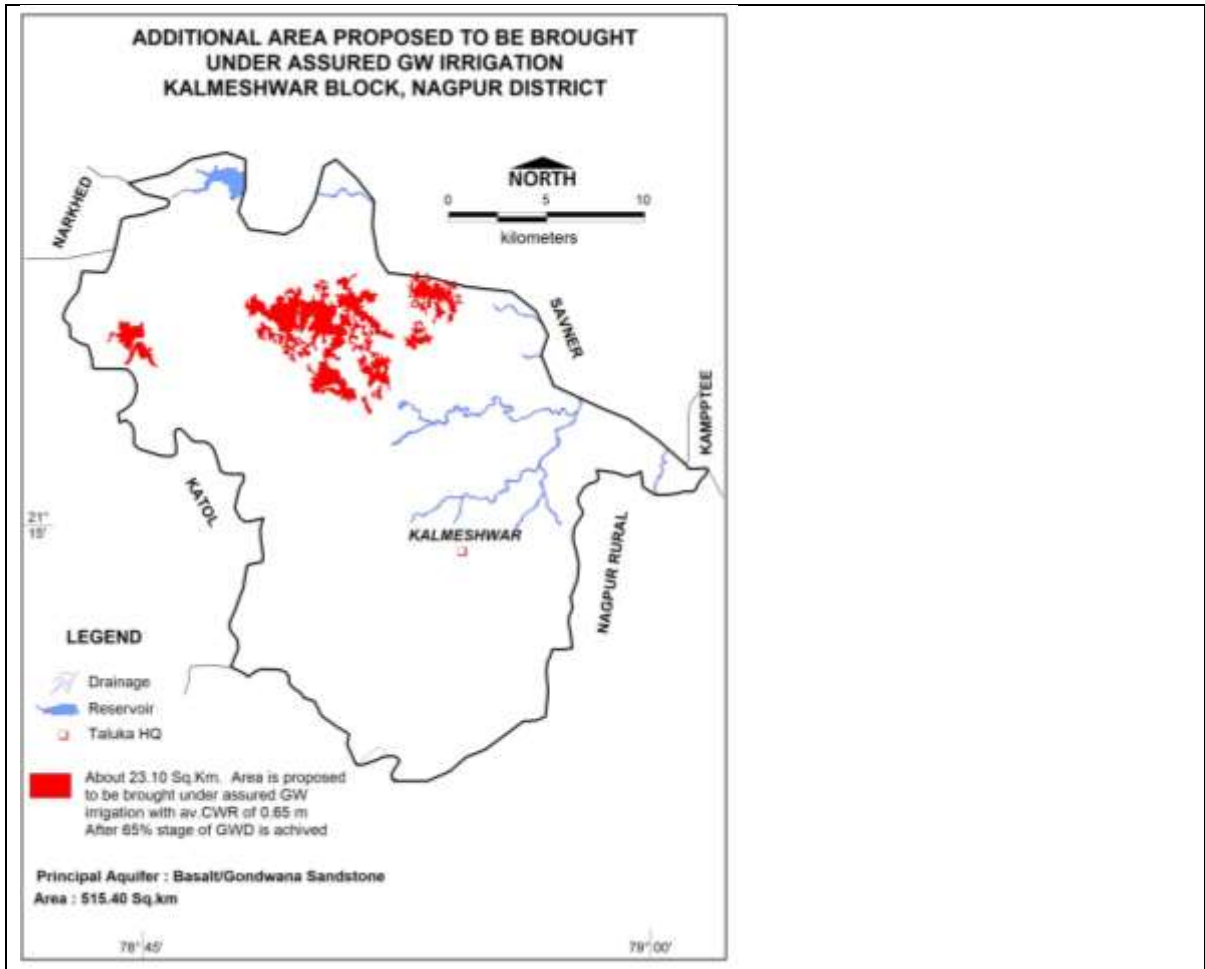
5.1 Aquifer-I/ Shallow Aquifer

Ground Water Recharge Worthy Area (Sq. km.)	471.12
Total Annual Ground Water Recharge (MCM)	64.07
Natural Discharge (MCM)	4.00
Annual Extractable Ground Water Recharge (MCM)	60.06
Current Annual Ground Water Extraction for irrigation (MCM)	35.72
Current Annual Ground Water Extraction for domestic water supply (MCM)	4.62
Current Annual Ground Water Extraction for All uses (MCM)	40.34
Provision for domestic and industrial requirement supply to 2025(MCM)	5.07

Net Ground Water Availability for future use (MCM)							19.89
Stage of Ground Water Development (%)							67.18
Category							SAFE
5.2 Aquifer-II/Deeper Aquifer							
Semi confined/Confined Aquifer (Basalt)							
District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Kalmeshwar	8.52	471.12	48.47	0.015	0.000055	0.220767
6.0. GROUND WATER MANAGEMENT							
6.1. Supply Side Management							
SUPPLY (MCM)							
Available Resource (MCM)							60.06
Gross Annual Draft (MCM)							40.35
Agricultural Demand –GW							35.7275
Agricultural Demand –SW							1.0855
Domestic Demand – GW							4.6225
Domestic Demand – SW							1.155625
Total Demand							42.591125
Area of Block (Sq. Km.)							543.45
Area suitable for Artificial recharge (Sq. Km)							522.75
Type of Aquifer							
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)							466.43
Volume of Unsaturated Zone (MCM)							2023.67
Average Specific Yield							0.020
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)							40.4734
Surface water requirement @ 75% efficiency (MCM)							53.96453333
Surplus water Available (MCM)							10.448032
Surplus runoff considered for planning (MCM) @ 75%/100%							7.836024
Proposed Structures				Percolation (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)		Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	
Number of Structures				37		104	
Volume of Water expected to be conserved / recharged @ 75 % efficiency (MCM)				5.49		2.35	
RTRWH Structures – Urban Areas							
Households to be covered (25% with 50 m2 area)							8623
Total RWH potential (MCM)							0.4035564
Rainwater harvested / recharged to DW or BW of 50% household							4311.5
However, it is economically not viable & hence, not recommended.							

6.2. Demand Side Management	
Micro irrigation techniques	Nil
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)	60.06
Additional GW resources available after Supply side interventions (MCM)	7.84
Ground Water Availability after Supply side intervention(MCM)	67.89
Existing Ground Water Draft for All Uses (MCM)	40.35
GW draft after Demand Side Interventions (MCM)	40.35
Present stage of Ground Water Development (%)	67.18
Expected Stage of Ground Water Development after interventions (%)	59.43
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
GW available for Development Plan to bring SOD to 70%	7.18
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	431
Proposed no. of BW (@ 1 ham for 10% of GWR Available)	72
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	23.10
Regulatory Measures	60 m


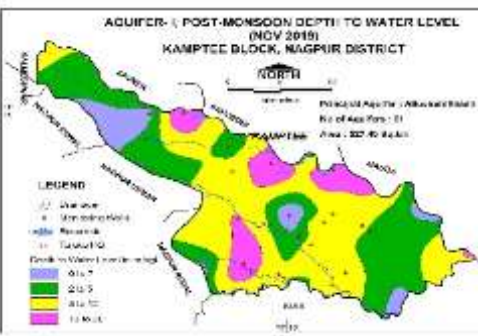

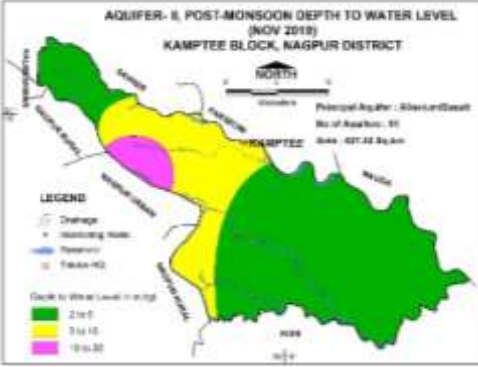


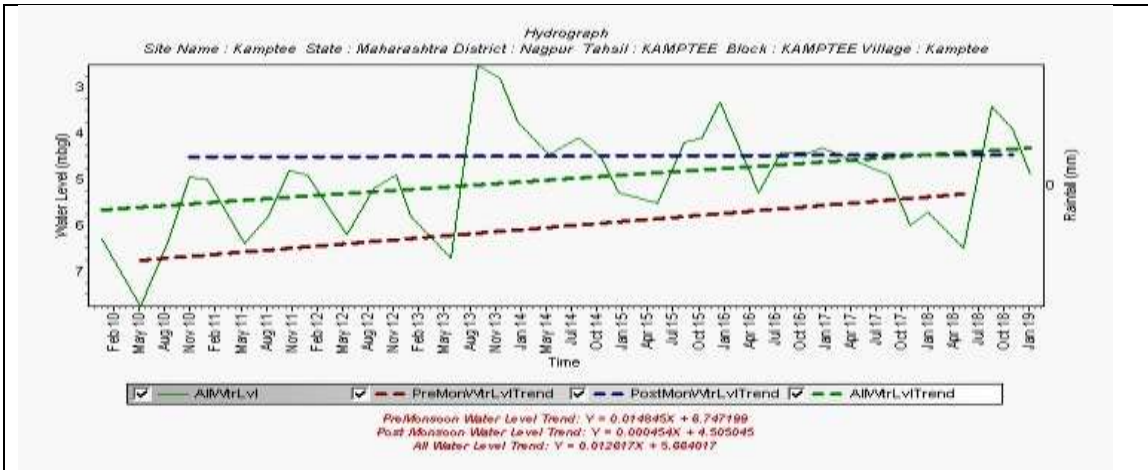


9.9 KAMPTEE BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES																																														
1.1 Introduction																																														
Block Name	KAMPTEE																																													
Geographical Area (Sq. km.)	585.24Sq. km.																																													
Hilly Area (Sq. km.)	49.20 Sq. km.																																													
Poor Ground Quality Area (Sq. km.)	Nil																																													
Population (2011)	2,38,870																																													
Climate	Sub-Tropical																																													
1.2 Rainfall Analysis																																														
Normal Rainfall	1171.50 mm																																													
Annual Rainfall (2019)	1269.80mm																																													
Decadal Average Annual Rainfall (2010-19)	987.86 mm																																													
Long Term Rainfall Analysis (1999-2019)	Declining Trend 7.115 mm/year Probability of Normal and Excess Rainfall 66.67 % & 4.76% Probability of Droughts -: 28.57% Moderate																																													
Rainfall Trend Analysis (1999 to 2019)																																														
<p>Bar chart showing annual rainfall (mm) from 1999 to 2019. The trend line equation is $y = -7.115x + 1119$.</p> <table border="1"> <caption>Annual Rainfall Data (1999-2019)</caption> <thead> <tr> <th>Year</th> <th>Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>1999</td><td>1180</td></tr> <tr><td>2000</td><td>1020</td></tr> <tr><td>2001</td><td>1120</td></tr> <tr><td>2002</td><td>1020</td></tr> <tr><td>2003</td><td>1200</td></tr> <tr><td>2004</td><td>700</td></tr> <tr><td>2005</td><td>1450</td></tr> <tr><td>2006</td><td>1180</td></tr> <tr><td>2007</td><td>1200</td></tr> <tr><td>2008</td><td>780</td></tr> <tr><td>2009</td><td>1020</td></tr> <tr><td>2010</td><td>1100</td></tr> <tr><td>2011</td><td>850</td></tr> <tr><td>2012</td><td>800</td></tr> <tr><td>2013</td><td>1380</td></tr> <tr><td>2014</td><td>700</td></tr> <tr><td>2015</td><td>950</td></tr> <tr><td>2016</td><td>750</td></tr> <tr><td>2017</td><td>920</td></tr> <tr><td>2018</td><td>1080</td></tr> <tr><td>2019</td><td>1269.80</td></tr> </tbody> </table>			Year	Rainfall (mm)	1999	1180	2000	1020	2001	1120	2002	1020	2003	1200	2004	700	2005	1450	2006	1180	2007	1200	2008	780	2009	1020	2010	1100	2011	850	2012	800	2013	1380	2014	700	2015	950	2016	750	2017	920	2018	1080	2019	1269.80
Year	Rainfall (mm)																																													
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EQUATION OF TREND LINE $y = -7.115x + 1119$																																														
1.3. Geomorphology, Soil & Geology																																														
Major Geomorphoc Unit	Alluvium plain; Pediplain																																													
Soil	Very deep Moderately Loamy to Shallow Loamy soil																																													
Geology	Unconsolidated Sediments, Gondwana Super group (Permian to Carboniferous)																																													
1.4. Hydrology & Drainage																																														
Drainage	Kanhani river and its tributaries																																													
Hydrology (Reference DSA Year: June 2016-17)	Major project	Nil																																												
	Medium project	Nil																																												
	Small project	Completed: 2 small irrigation projects.																																												
	Irrigation Project (100-250)	Completed: 54 Kolhapur Bandhara, 104 surface storage																																												

	Ha)/others	bandhara, 2781 irrigation well.
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Geographical Area	585.24Sq. km.	
Forest Area	42.38 Sq. km.	
Cultivable Area	348.91 Sq. km.	
Net Sown Area	347.40 Sq. km.	
Double Cropped Area	111.84 Sq. km.	
Area under Irrigation	Surface Water	43.57 Sq. km.
	Ground Water	57.30 Sq. km.
Principal Crops <i>(Reference year 2019)</i>	Crop Type	Area (Sq. km.)
	Cereals	127.50
	Pulses	48.38
	Soyabean	119.54
	Cotton	13.51
Horticultural Crops	Orange	2.02
	Other fruits	0.09
	Banana	0.02
	Vegetables	71.02
1.6. Water Level Behaviour		
1.6.1. Aquifer-I/Shallow Aquifer		
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)	
Water level between 2-5 mbgl has been observed in north-western and south-eastern parts of the block covering an area of 88sq km; Water level between 5 to 10 mbgl has been observed in major parts of the block covering an area of 321 sq km; whereas Water level between 10 to 20 mbgl has been observed in central to northern parts of the block covering an area of 176 sq km	Water level between 0-2 mbgl has been observed as isolated patches covering an area of 59 sq km; Water level between 2-5 mbgl has been observed in north-western and south-eastern parts of the block covering an area of 117 sq km; Water level between 5 to 10 mbgl has been observed in major parts of the block covering an area of 351 sq km; whereas Water level between 10 to 20 mbgl has been observed in central to northern parts of the block covering an area of 49 sq km	

<p>Pre-Monsoon Water Level (May 2019)</p>  <p>WL>10 mbgl 176 sq. km.</p>	<p>Post-Monsoon Water Level (Nov. 2019)</p>  <p>WL>10 mbgl 49 sq. km.</p>
<p>1.6.2. Aquifer-II/Deeper Aquifer</p>	
<p>Pre-Monsoon (May-2019)</p> <p>Water level between 2-5 mbgl has been observed in north-western and south-eastern parts of the block covering an area of 53 sq km; Water level between 5 to 10 mbgl has been observed in major parts of the block covering an area of 238 sq km; whereas Water level between 10 to 20 mbgl has been observed in central to northern parts of the block covering an area of 240 sq km</p>	<p>Post-Monsoon (November-2019)</p> <p>Water level between 2-5 mbgl has been observed in major parts of the block covering an area of 316 sq km; Water level between 5 to 10 mbgl has been observed in central parts of the block covering an area of 156 sq km; whereas Water level between 10 to 20 mbgl has been observed in central to northern parts of the block covering an area of 52 sq km.</p>
<p>Pre-Monsoon Water Level (May 2019)</p>  <p>WL> 10 mbgl 240 sq. km.</p>	<p>Post-Monsoon Water Level (Nov.-2019)</p>  <p>WL> 10 mbgl 52 sq. km.</p>
<p>1.7. Hydrograph Site Name: Kamptee State: Maharashtra District: NAGPUR Tehsil: KAMPTEE Block: : KAMPTEE Village: Kamptee</p>	



Hydrograph shows Pre-monsoon rising water level trend @ 0.17814 m/year and Post monsoon falling water level trend @ 0.005448 m/year

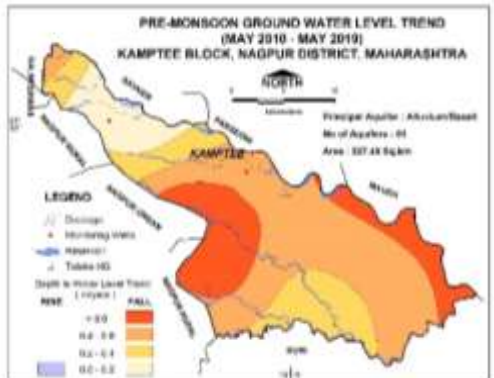
1.8. Water Level Trend (2010-19)

Pre-Monsoon trend | Post-Monsoon trend

Rising water level trend up to 0.20 m/year has been observed along north-western fringe of the block; whereas decline in water level trend up to 0.2 m/year has been observed in north-western parts of the block; Declining trend between 0.20-0.40m/year is observed in north-western, central and southern parts of the block; Declining trend between 0.40-0.60 m/year is seen as majority along central, south-eastern and eastern parts of the block; whereas more than 0.6 m/year has been observed in southern and eastern part of the block covering about 104 sq. km. area.

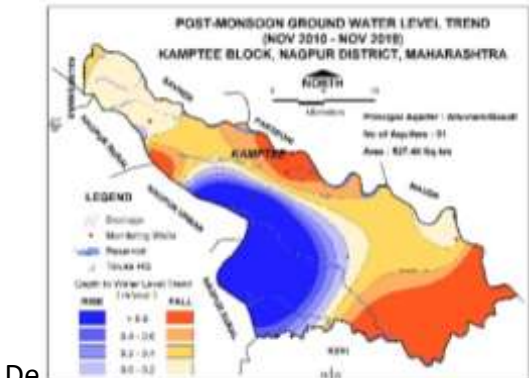
Rising water level trend from 0-0.60 m/year has been observed along the entire central and southern part of the block covering an area of 210 sq km; whereas north-western fringe of the block; Decline more than 0.2 m/year has been observed in major part of the block covering 490 sq km area; whereas more than 0.6 m/year has been observed in southern and eastern part of the block covering about 131 sq. km. area.

Pre-Monsoon Water Level Trend (2010-19)



Declining trend @ >0.6 m/year 104 sq. km.

Post-Monsoon Water Level Trend (2010-19)

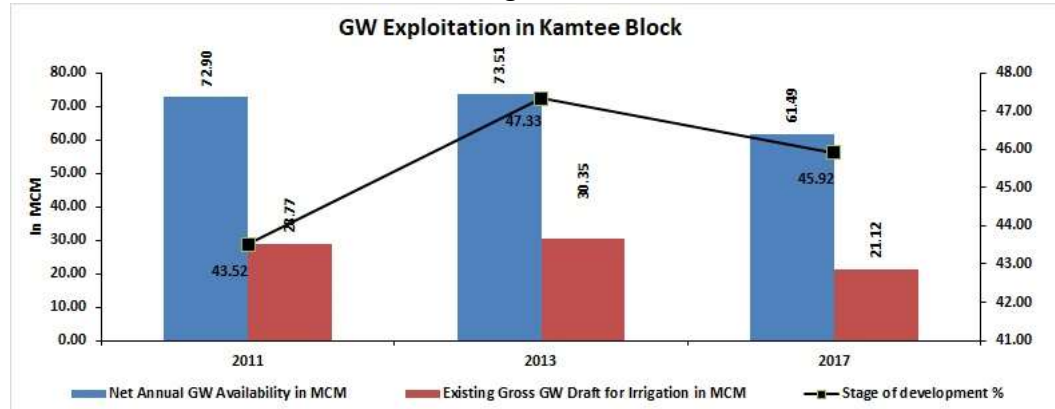


Declining trend @ >0.6 m/year 131 sq. km.

2. Ground Water Issues

Exploitation of Ground Water: -

The stage of ground water development has increased during 2011 to 2013 from 43.52% to 47.33% and afterwards decreased during 2013 to 2017 from 47.33% to 45.92% in Kamptee block of Nagpur District. Further, the net ground water availability increased during 2011 to 2013 from 72.90 MCM to 73.51 MCM again decreased from 73.51 MCM to 61.49 MCM during 2013 to 2017. Whereas the draft for irrigation first increased during 2011 to 2013 from 28.77 MCM to 30.35 MCM and again decreased from 30.35 MCM to 21.12 MCM during 2013 to 2017.



Declining water level Trend : -

Pre monsoon (2010-19): decline in water level trend more than 0.6 m/year is observed in about 104 sq. km. covering about 20% area of the block.

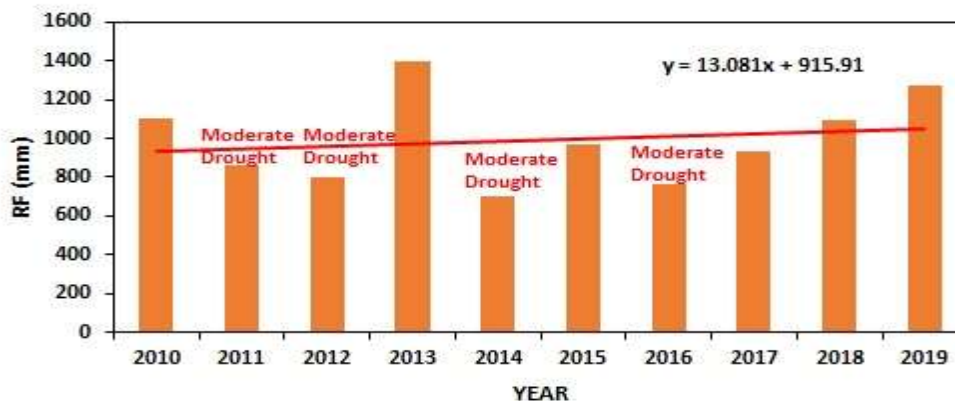
Post monsoon (2010-19): decline in water level trend more than 0.6 m/year is observed in about 131 sq. km. covering about 25 % area of the block.

Low rainfall and Droughts:

The long-term rainfall analysis for the period 1999-2019 indicates that normal rainfall of Kamptee block is 1171.50 mm, and also indicates a falling rainfall trend @ 7.115 mm/year with 28.57% probability of moderate drought.

Based on the short-term rainfall data from 2010-2019 for the block, the analysis indicates that average rainfall is 987.86 mm. The rainfall from last ten years shows that the area continuously experienced rise in rainfall with frequent moderate droughts.

Decadal Rainfall Pattern (2010-2019)



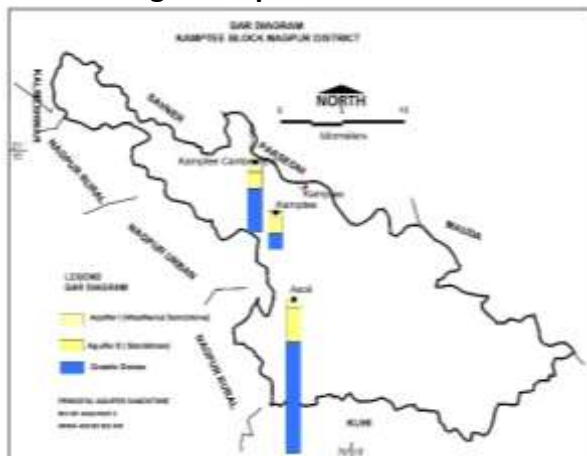
Low yielding Aquifer resulting poor sustainability:

Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 50% area of the block has low yield potential (< 100 m³/day) and can sustain pumping only for 1-1.5 hrs.

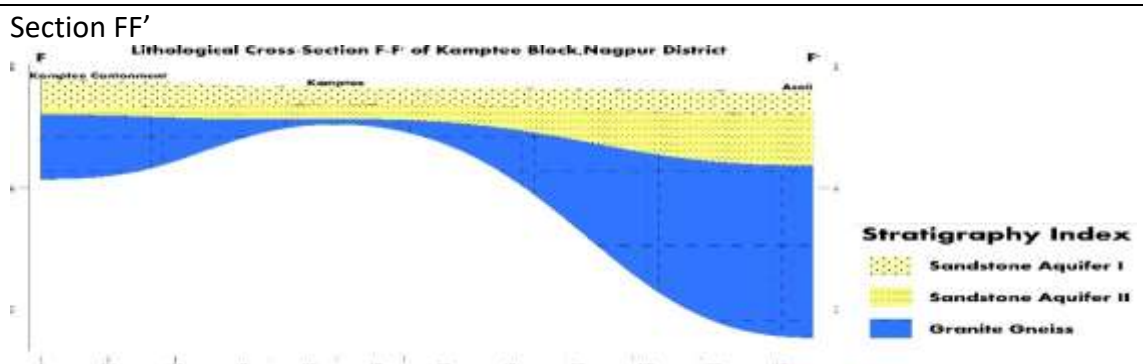
3. AQUIFER DISPOSITION

3.1. Number of Aquifers Sandstone –Aquifer-I, Aquifer-II

3.2. Lithological disposition



3.3. Cross Section



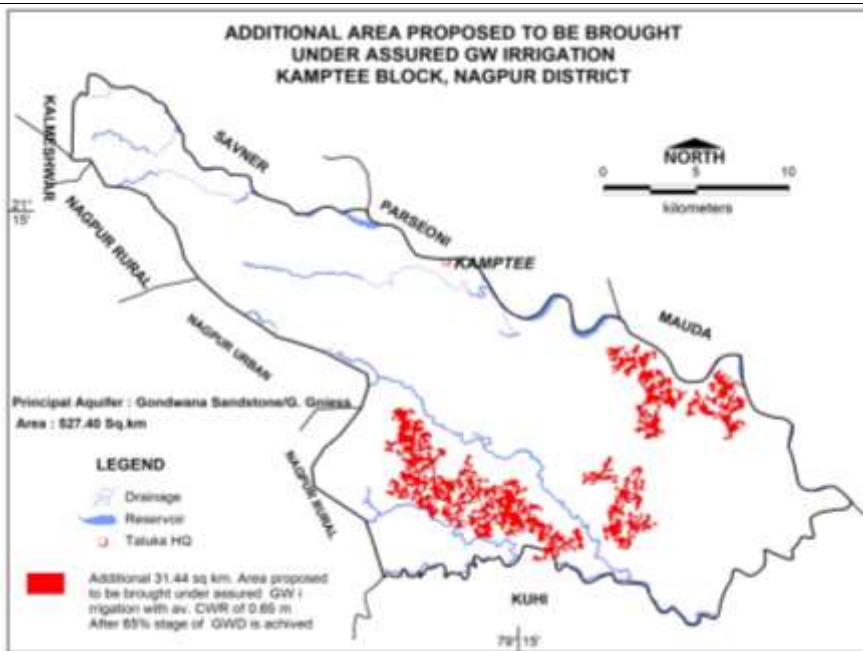
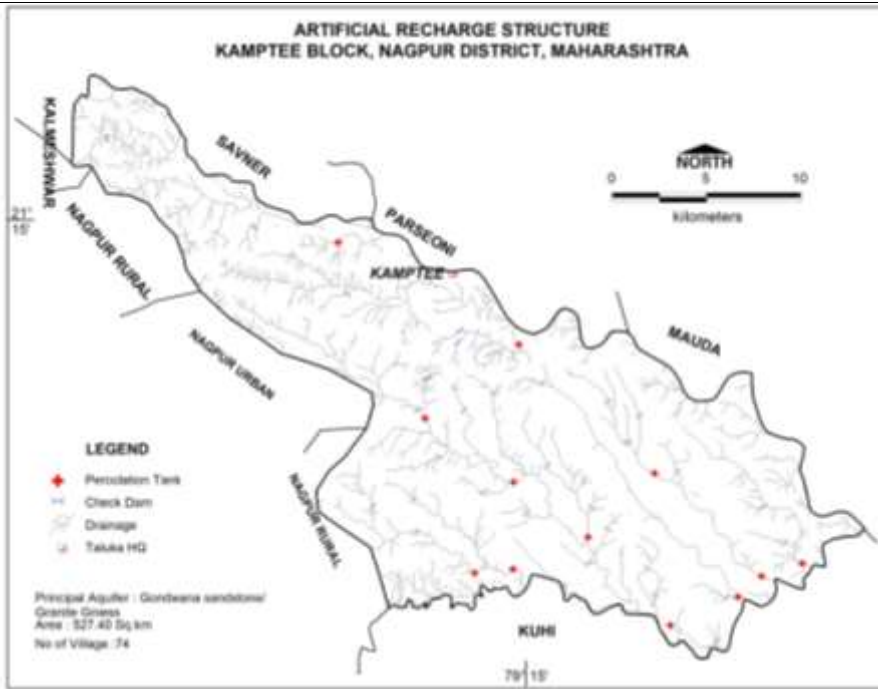
3.4. Basic Aquifer Characteristics		
Major Aquifers	Sandstone Gondwana	
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/con fined)
Depth to bottom of Aquifer (mbgl)	12 to 28	28.50 to 60.50
Weathered/Fractured zones encountered (mbgl)	up to 28	up to 60.50
Weathered/Fractured rocks thickness (m)	5 to 11	1 to 10
SWL (mbgl)	3.50 to 18.7	8 to 21.8
Specific yield/Storativity (S)	0.015 to 0.020	5.8x10 ⁻⁴ to 9.8x10 ⁻³
Transmissivity (T)	15.00 to 70.50 m ² /day	9.32 to 250m ² /day
Yield	20-80 m ³ /day	10 to 200 m ³ /day
Sustainability	2 to 4 hrs	1 to 5 hrs

4. GROUND WATER QUALITY

4.1 Aquifer-I/ Shallow Aquifer							
EC values up to 750 $\mu\text{S}/\text{cm}$ is observed in north-western and southern-eastern parts of the block and EC values between 750 to 2250 $\mu\text{S}/\text{cm}$ are observed in major part of the block, whereas EC value between 2250-3000 $\mu\text{S}/\text{cm}$ is observed as isolated patch in northern fringe of the block. Ground water is suitable for all purposes except some villages having Nitrate more than 45 mg/L.							
4.2 Aquifer II/Deeper Aquifer							
EC values up to 750 $\mu\text{S}/\text{cm}$ is observed in north-western part of the block and EC value between 750 to 2250 $\mu\text{S}/\text{cm}$ is observed in majority of the block; whereas EC value between 2250-3000 $\mu\text{S}/\text{cm}$ is observed as isolated patch in southern fringe of the block. Ground water is suitable for all purposes.							
Phreatic Aquifer (Aquifer-I)				Semi confined/Confined Aquifer (Aquifer II)			
5. GROUND WATER RESOURCE							
5.1 Aquifer-I/ Shallow Aquifer							
Ground Water Recharge Worthy Area (Sq. km.)						536.04	
Total Annual Ground Water Recharge (MCM)						64.84	
Natural Discharge (MCM)						3.35	
Annual Extractable Ground Water Recharge (MCM)						61.49	
Current Annual Ground Water Extraction for irrigation (MCM)						21.12	
Current Annual Ground Water Extraction for domestic water supply (MCM)						7.11	
Current Annual Ground Water Extraction for All uses (MCM)						28.23	
Annual GW Allocation for for Domestic Use as on 2025 (MCM)						7.11	
Net Ground Water Availability for future use (MCM)						32.33	
Stage of Ground Water Development (%)						45.92	
Category						SAFE	
5.2 Aquifer-II/Deeper Aquifer							
Semi confined/Confined Aquifer (Basalt)							
District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Kamptee	4.6	536.04	6.235	0.015	0.00035	0.863024
6.0. GROUND WATER MANAGEMENT							
6.1. Supply Side Management							

SUPPLY (MCM)		
Available Resource (MCM)	61.5	
Gross Annual Draft (MCM)	28.24	
Agricultural Demand –GW	21.1279	
Agricultural Demand –SW	28.3205	
Domestic Demand – GW	7.1121	
Domestic Demand – SW	1.778025	
Total Demand	58.338525	
Area of Block (Sq. Km.)	423.82	
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)	197.1	
Volume of Unsaturated Zone (MCM)	330.15	
Average Specific Yield	0.015	
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)	4.95225	
Surface water requirement @ 75% efficiency (MCM)	6.603	
Surplus water Available (MCM)	4.42	
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	15	44
Volume of Water expected to be conserved / recharged @ 75 % efficiency (MCM)	2.32	0.99
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m2 area)	28547	
Total RWH potential (MCM)	1.3759654	
Rainwater harvested / recharged to DW or BW of 50% household	14273.5	
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques	Nil	
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)	61.50	
Additional GW resources available after Supply side interventions (MCM)	3.31	
Ground Water Availability after Supply side intervention (MCM)	64.81	
Existing Ground Water Draft for All Uses (MCM)	28.24	
GW draft after Demand Side Interventions (MCM)	28.24	
Present stage of Ground Water Development (%)	45.92	
Expected Stage of Ground Water Development after interventions (%)	43.57	

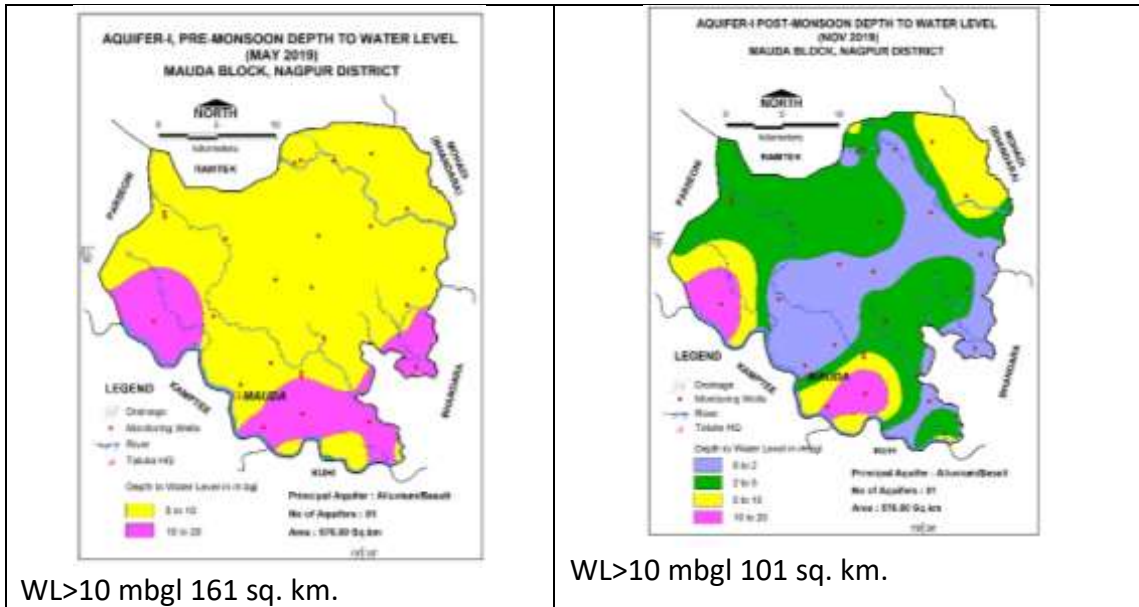
Other Interventions Proposed if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
GW available for Development Plan to bring SOD to 70%	17.13
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	1028
Proposed no. of BW (@ 1 ham for 10% of GWR Available)	171
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m AFTER 65 % STAGE OF GWD IS ACHIEVED	31.44
Regulatory Measures	60 m
Proposed locations for AR structures	



9.10 MAUDA BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name	MAUDA	
Geographical Area (Sq. km.)	800.91Sq. km.	
Hilly Area (Sq. km.)	47.33 Sq. km.	
Population (2011)	1,39,776	
Climate	Sub-Tropical	
1.2 Rainfall Analysis		
Normal Rainfall	1248.50 mm	
Annual Rainfall (2019)	1148.50mm	
Decadal Average Annual Rainfall (2010-19)	1156.90 mm	
Long Term Rainfall Analysis (1999-2019)	Rising Trend 9.873 mm/year Probability of Normal and Excess Rainfall 52.38 % & 9.52 % Probability of Droughts -: 33.33% Moderate and 4.76% Acute	
<p>Rainfall Trend Analysis (1999 to 2019)</p> <p>EQUATION OF TREND LINE $y = 9.873x + 971.04$</p>		
1.3. Geomorphology, Soil & Geology		
Major Geomorphic Unit	Pediplain	
Soil	Very Deep Moderately Loamy to Deep Moderately Loamy to Moderately Loamy soil	
Geology	Tirodi Gneissic Complex (Dharwar Super Group-Archaeans)	
1.4. Hydrology & Drainage		
Drainage	Kanhan river and its tributaries	
Hydrology (Reference DSA Year: June 2016-17)	Major project	Nil
	Medium project	Nil
	Small project	Completed: 3 small irrigation projects generating a gross irrigation Potential of 197 ha out of 323 ha area.
	Irrigation Project	Completed: 56 Kolhapur Bandhara,

	(100-250 Ha)/others	186 surface storage bandhara, 2322 irrigation well.
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Geographical Area	800.91Sq. km.	
Forest Area	61.28 Sq. km.	
Cultivable Area	440.06 Sq. km.	
Net Sown Area	102.37 Sq. km.	
Double Cropped Area	389.84 Sq. km.	
Area under Irrigation	Surface Water	463.29 Sq. km.
	Ground Water	110.87 Sq. km.
Principal Crops <i>(Reference year 2019)</i>	Crop Type	Area (Sq. km.)
	Cereals	637.46
	Pulses	83.08
	Soyabean	83.86
	Cotton	5.70
Horticultural Crops	Orange	0.43
	Other fruits	0.15
	Banana	0.20
	Vegetables	25.01
1.6. Water Level Behaviour		
1.6.1. Aquifer-I/Shallow Aquifer		
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)	
Water level between 5-10 mbgl has been observed in major parts of the block covering an area of 641 sq km; whereas water levels more than 10 mbgl have been observed in eastern and southern part of the block covering about 161 sq. km. area.	Water level between 0-2 mbgl has been observed in entire central part, eastern part covering an area of 210 sq km; whereas Water level between 2-5 mbgl has been observed in north-western, eastern, northern parts of the block covering an area of 390 sq km; water levels between 5 to 10 mbgl have been observed in north-east, north-west and south eastern fringes of the block covering an area of 119 sq km; whereas water levels more than 10 mbgl have been observed as isolated patches in south eastern parts of the block covering about 101 sq. km. area.	
Pre-Monsoon Water Level (May 2019)	Post-Monsoon Water Level (Nov. 2019)	

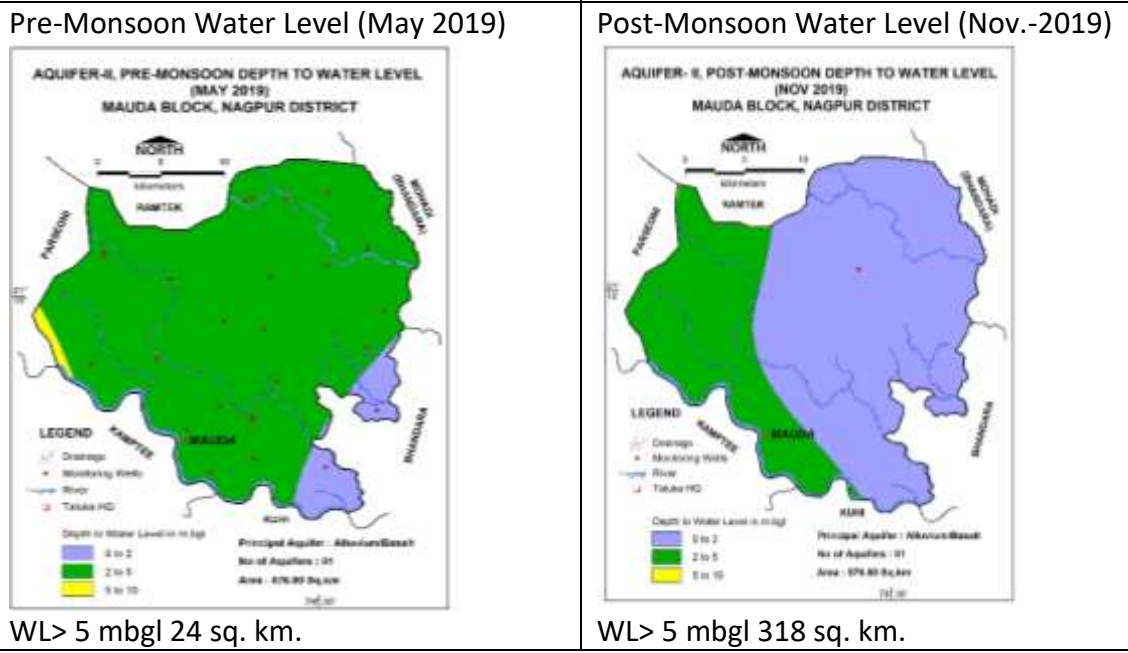


WL>10 mbgl 161 sq. km.

WL>10 mbgl 101 sq. km.

1.6.2. Aquifer-II/Deeper Aquifer

Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
<p>Water levels between 0 to 2 mbgl are observed in south-eastern part of the block covering an area of 82 sq km; water levels between 2 to 5 mbgl are observed in major parts of the block covering about 696 sq. km. area of the block; whereas deeper water level between 5 to 10 mbgl are seen as thin isolated patch along south-western fringe of the block covering an area of 24 sq km.</p>	<p>Water levels between 0 to 2 mbgl are observed in south-eastern, eastern and northern part of the block covering an area of 482 sq km; water levels between 2 to 5 mbgl are observed in north-western western and southern parts of the block covering about 318 sq. km. area of the block;</p>

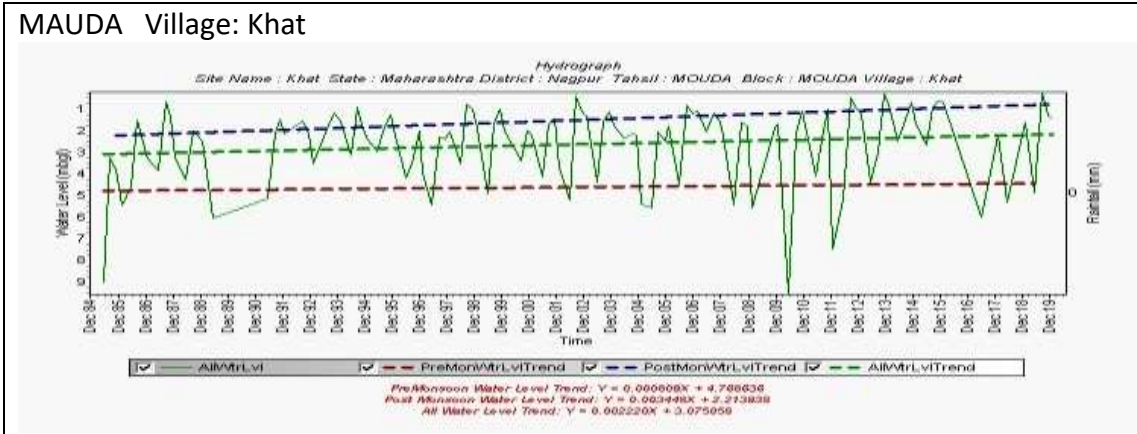


WL> 5 mbgl 24 sq. km.

WL> 5 mbgl 318 sq. km.

1.7. Hydrograph

Site Name: Khat State: Maharashtra District: NAGPUR Tehsil: MAUDA Block: :

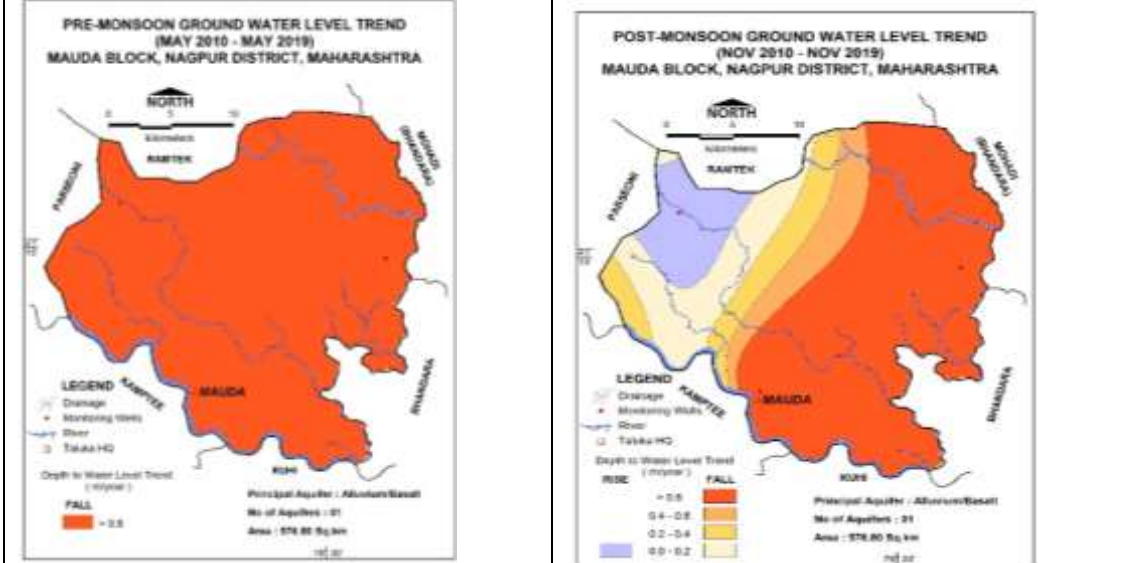


Hydrograph shows Pre-monsoon rising water level trend @ 0.009708 m/year and Post monsoon rising water level trend @ 0.02664 m/year

1.8. Water Level Trend (2010-19)

Pre-Monsoon trend	Post-Monsoon trend
Decline in water level trend up to 0.6 m/year has been observed in entire block covering about 800 sq. km. area.	Rising trend between 0.0-0.20 m/year has been observed along north-west part of the block; whereas decking trend between 0.4-0.6 m/year and 0.20-0.40 m/year has been observed in central part of the block. The Declining water level trend between 0-0.20 m/year has been observed along western part of the block. Decline more than 0.6 m/year has been observed in major part of the block covering 440 sq km area.

Pre-Monsoon Water Level Trend (2010-19) Post-Monsoon Water Level Trend (2010-19)

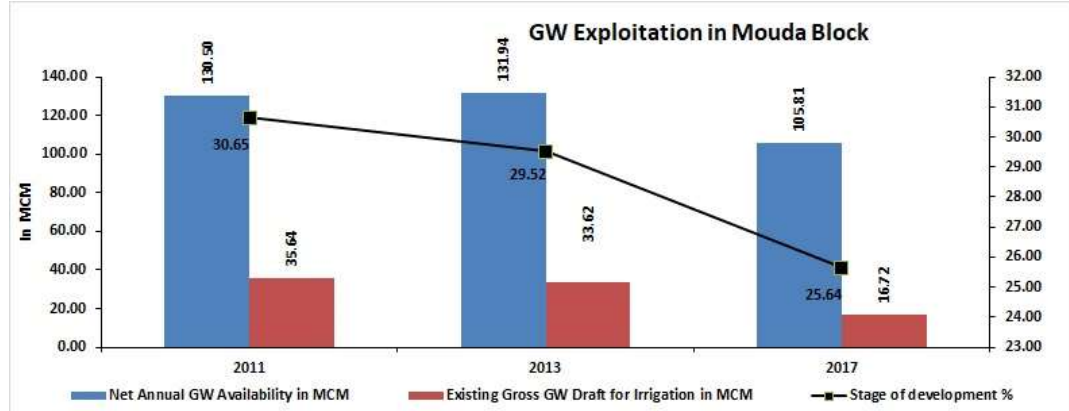


Declining trend @>0.6 m/year 800 sq. km. Declining trend @>0.6 m/year 440 sq. km.

2. Ground Water Issues

Exploitation of Ground Water: -

The stage of ground water development has decreased during 2011 to 2013 from 30.65% to 29.52% and afterwards further decreased during 2013 to 2017 from 29.52% to 25.64% in Mouda block of Nagpur District. Further, the net ground water availability increased during 2011 to 2013 from 130.50 MCM to 131.94 MCM again decreased from 131.94 MCM to 105.81 MCM during 2013 to 2017. Whereas the draft for irrigation decreased during 2011 to 2013 from 35.64 MCM to 33.62 MCM and again decreased from 33.62 MCM to 16.72 MCM during 2013 to 2017.



Declining water level Trend:

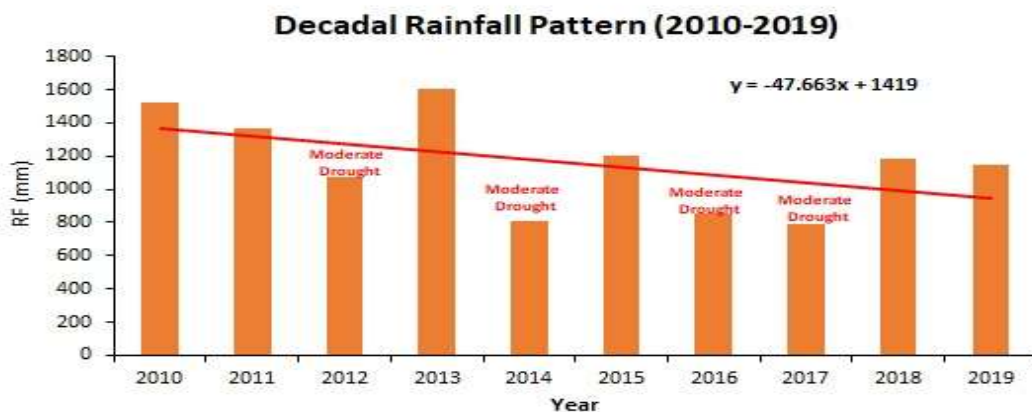
Pre monsoon (2010-19): decline in water level trend more than 0.6 m/year is observed in about 800 sq. km. covering about 100% area of the block.

Post monsoon (2010-19): decline in water level trend more than 0.6 m/year is observed in about 440 sq. km. covering about 55 % area of the block.

Low rainfall and Droughts:

The long-term rainfall analysis for the period 1998-2019 indicates that normal rainfall of Mouda block is 718.5 mm, and also indicates a falling rainfall trend @ 11.33 mm/year with 15% probability of moderate drought.

Based on the short-term rainfall data from 2009-2019 for the block, the analysis indicates that average rainfall is 677.18 mm. The rainfall from last ten years shows that the area continuously experienced low and declining rainfall with frequent moderate droughts.



Low yielding Aquifer resulting poor sustainability:

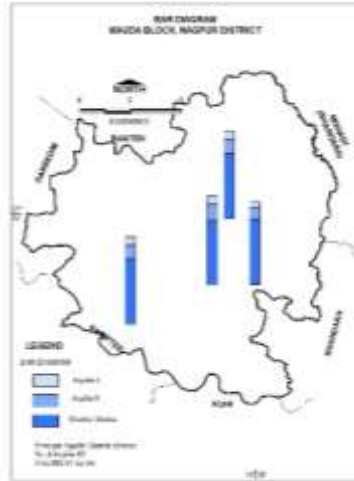
Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 80% area of

the block has low yield potential (< 200 m³/day) and can sustain pumping only for 2-2.5 hrs.

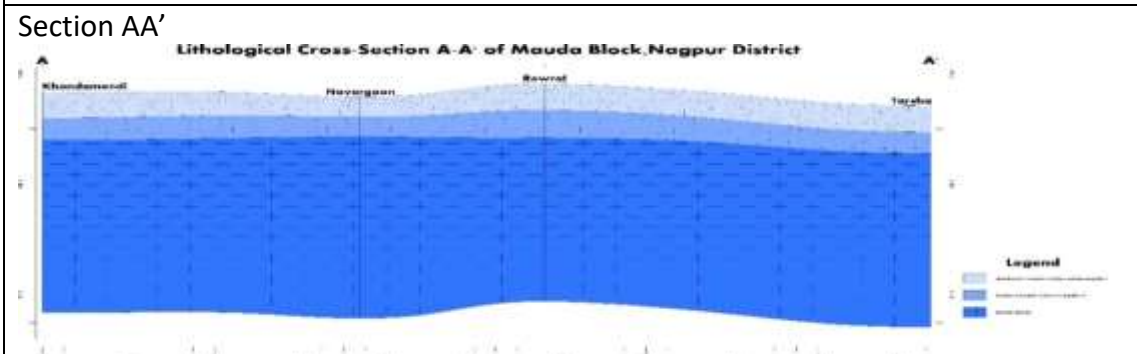
3. AQUIFER DISPOSITION

3.1. Number of Aquifers | W/Fr Granite Gneisses –Aquifer-I, Aquifer-II

3.2. Lithological disposition



3.3. Cross Section



3.4. Basic Aquifer Characteristics

Major Aquifers	Granite Gneisses (Archaen)	
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of Aquifer (mbgl)	6 to 17	36 to 147.65
Weathered/Fractured zones encountered (mbgl)	up to 17	up to 147.65
Weathered/Fractured rocks thickness (m)	1 to 2	1 to 6
SWL (mbgl)	4.88 to 12.20	3.80 to 6.20
Specific yield/Storativity (S)	0.015 to 0.020	1.40 x10 ⁻⁴ to 1.18 x10 ⁻⁴
Transmissivity (T)	15.00 to 70.50 m ² /day	20.19 to 85.49 m ² /day
Yield	5-120 m ³ /day	up to to 2.5 lps
Sustainability	2 to 4 hrs	1 to 5 hrs

4. GROUND WATER QUALITY

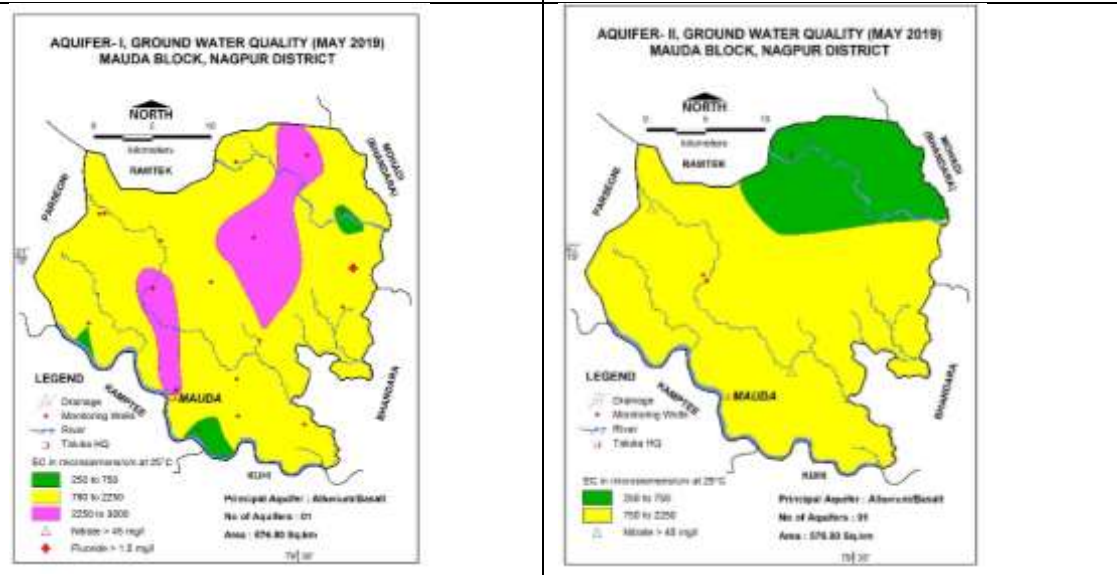
4.1 Aquifer-I/ Shallow Aquifer

EC values up to 750 $\mu\text{S}/\text{cm}$ is observed as isolated patches in southern parts of the block and EC values between 750 to 2250 $\mu\text{S}/\text{cm}$ are observed in major part of the block, whereas EC values between 2250 to 3000 $\mu\text{S}/\text{cm}$ are observed as thin patches in northern and central parts of the block. Ground water is suitable for all purposes except some villages having Fluoride more than 1 mg/L.

4.2 Aquifer II/Deeper Aquifer

EC up to 750 $\mu\text{S}/\text{cm}$ is observed in eastern part of the block and EC value between 750 to 2250 $\mu\text{S}/\text{cm}$ is observed in entire block. Ground water is suitable for all purposes.

Phreatic Aquifer (Aquifer-I)	Semi confined/Confined Aquifer (Aquifer II)
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5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Aquifer

Ground Water Recharge Worthy Area (Sq. km.)	753.58
Total Annual Ground Water Recharge (MCM)	111.37
Natural Discharge (MCM)	5.56
Net Annual Ground Water Availability (MCM)	105.80
Current Annual Ground Water Extraction for irrigation (MCM)	16.72
Current Annual Ground Water Extraction for domestic water supply (MCM)	10.40
Current Annual Ground Water Extraction for All uses (MCM)	27.12
Annual GW Allocation for for Domestic Use as on 2025 (MCM)	10.61
Net Ground Water Availability for future use (MCM)	78.47
Stage of Ground Water Development (%)	25.64
Category	SAFE

5.2 Aquifer-II/Deeper Aquifer

Semi confined/Confined Aquifer (Basalt)

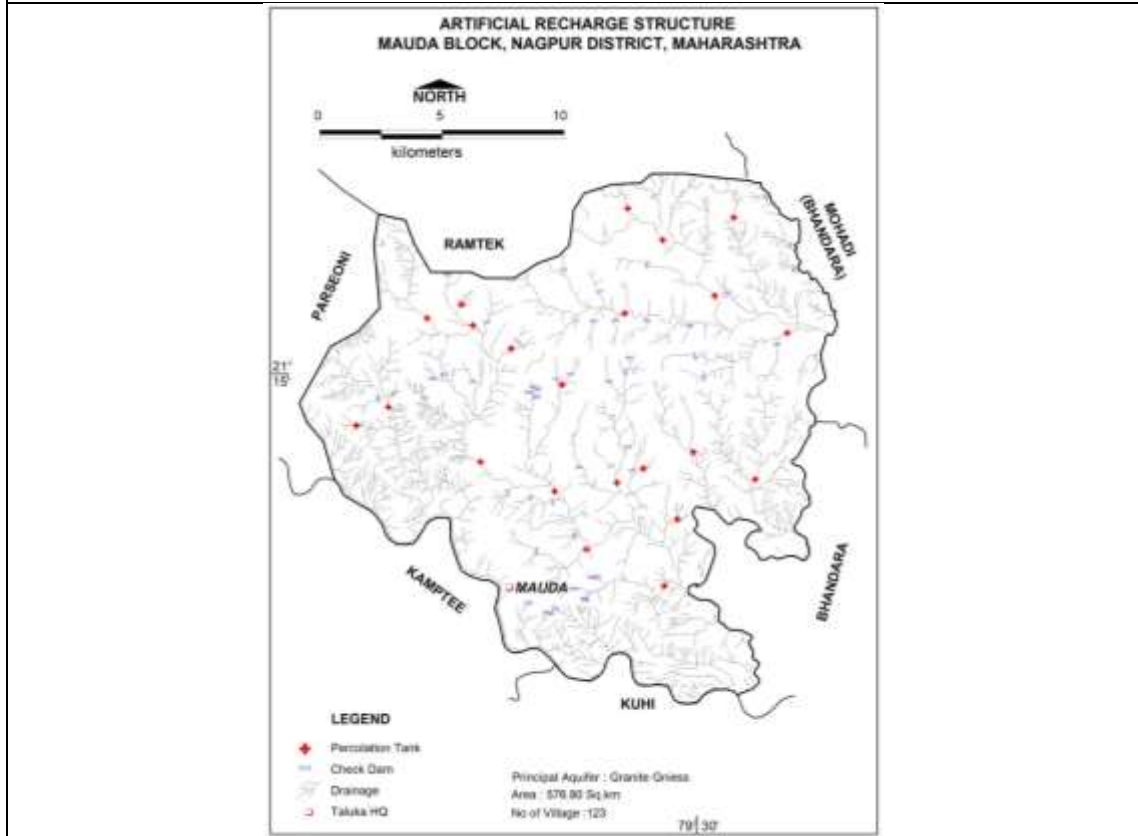
District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Mauda	4.8	753.58	34.75	0.015	0.00089	0.863024

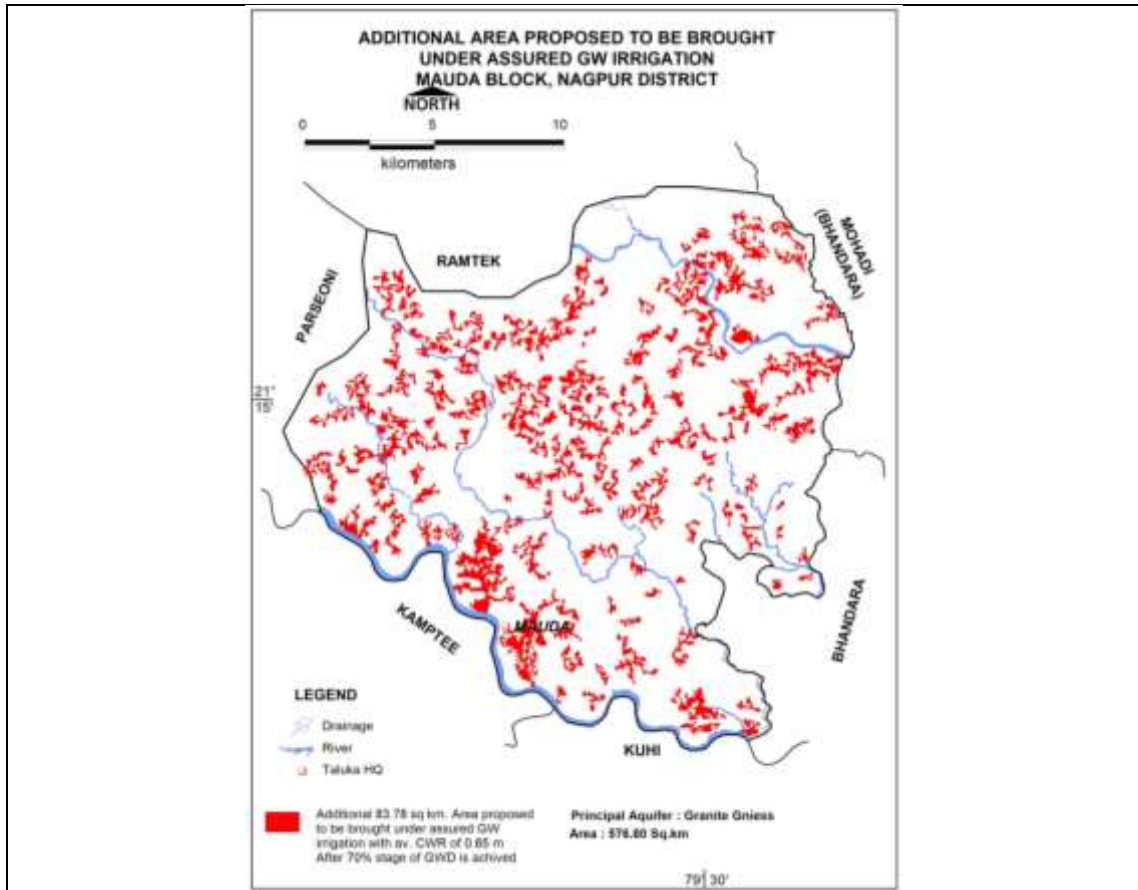
6.0. GROUND WATER MANAGEMENT

6.1. Supply Side Management

SUPPLY (MCM)		
Available Resource (MCM)	105.80	
Gross Annual Draft (MCM)	27.13	
Agricultural Demand –GW	16.72	
Agricultural Demand –SW	301.1385	
Domestic Demand – GW	10.41	
Domestic Demand – SW	2.6025	
Total Demand	330.871	
Area of Block (Sq. Km.)	612.87	
Area suitable for Artificial recharge (Sq. Km)	263.58	
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)	263.58	
Volume of Unsaturated Zone (MCM)	571.09	
Average Specific Yield	0.015	
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)	8.56635	
Surface water requirement @ 75% efficiency (MCM)	11.42	
Surplus water Available (MCM)	5.90	
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	59
Volume of Water expected to be conserved / recharged @ 75 % efficiency (MCM)	3.10	1.33
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m2 area)	3476	
Total RWH potential (MCM)	0.20336338	
Rainwater harvested / recharged to DW or BW of 50% household	1738	
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques	Nil	
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)	105.80	
Additional GW resources available after Supply side interventions (MCM)	4.43	
Ground Water Availability after Supply side intervention (MCM)	110.23	
Existing Ground Water Draft for All Uses (MCM)	27.13	
GW draft after Demand Side Interventions (MCM)		

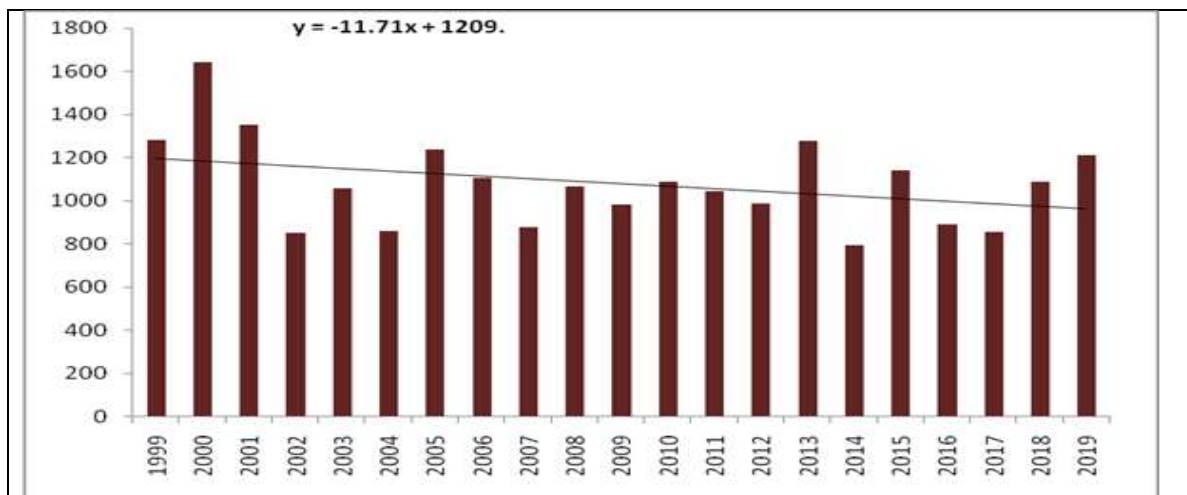
Present stage of Ground Water Development (%)	25.64
Expected Stage of Ground Water Development after interventions (%)	
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
GW available for Development Plan to bring SOD to 70%	50.03
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	3002
Proposed no. of BW (@ 1 ham for 10% of GWR Available)	500
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m AFTER 65 % STAGE OF GWD IS ACHIEVED	83.78
Regulatory Measures	Regulation of wells below 60 m
Proposed locations for AR structures	





9.11 PARSEONI BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES	
1.1 Introduction	
Block Name	PARSEONI
Geographical Area (Sq. km.)	865.38 Sq. km.
Hilly Area (Sq. km.)	328.87 Sq. km.
Poor Ground Quality Area (Sq. km.)	Nil
Population (2011)	1,43,019
Climate	Sub-Tropical
1.2 Rainfall Analysis	
Normal Rainfall	1040.20 mm
Annual Rainfall (2019)	1213.70mm
Decadal Average Annual Rainfall (2010-19)	1037.88 mm
Long Term Rainfall Analysis (1999-2019)	Declining Trend 11.71 mm/year Probability of Normal and Excess Rainfall 90.48% & 9.52% Probability of Droughts -: Nil
Rainfall Trend Analysis (1999 to 2019)	



EQUATION OF TREND LINE $y = -11.71x + 1209$

1.3. Geomorphology, Soil & Geology

Major Geomorphic Unit	Pediplain, structural Hills, Pediments
Soil	Very Deep Moderately Loamy to Moderately Deep Loamy to Moderately Loamy to slightly Deep Loamy soil
Geology	Granite Gneisses, Schist meta sediments of Saucer group belonging to Dharwar Super Group and Archaen Age

1.4. Hydrology & Drainage

Drainage	Pench, Kanhan river and its tributaries	
Hydrology <i>(Reference DSA Year: June 2016-17)</i>	Major project	Completed: 01 Major irrigation project generating a gross irrigation Potential of 90.70 ha out of 188.15 ha area.
	Medium project	Completed: 01 medium irrigation projects.
	Small project	Completed: 7 small irrigation projects generating a gross irrigation Potential of 8.71 ha out of 48.32 ha area.
	Irrigation Project (100-250 Ha)/others	Completed: 1 PT, 54 Kolhapur Bandhara, 136 surface storage bandhara, 2960 irrigation well.

1.5. Land Use, Agriculture, Irrigation & Cropping Pattern

Geographical Area		865.38 Sq. km.
Forest Area		78.69 Sq. km.
Cultivable Area		407.77 Sq. km.
Net Sown Area		126.48 Sq. km.
Double Cropped Area		85.33 Sq. km.
Area under Irrigation	Surface Water	75.58 Sq. km.
	Ground Water	31.78 Sq. km.
Principal Crops	Crop Type	Area (Sq. km.)

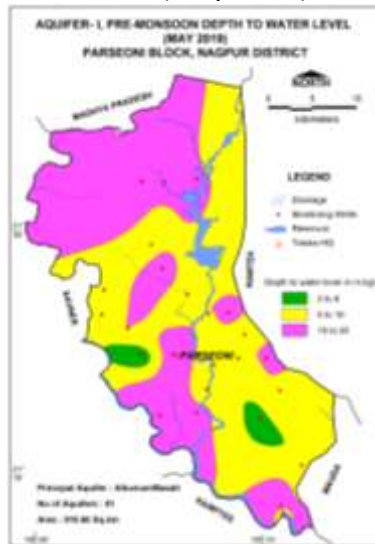
(Reference year 2019)	Cereals	128.06
	Pulses	19.09
	Soyabean	55.15
	Cotton	128.80
Horticultural Crops	Orange/Lemon	3.01
	Other fruits	0.17
	Banana	0.03
	Vegetables	12.20

1.6. Water Level Behaviour

1.6.1. Aquifer-I/Shallow Aquifer

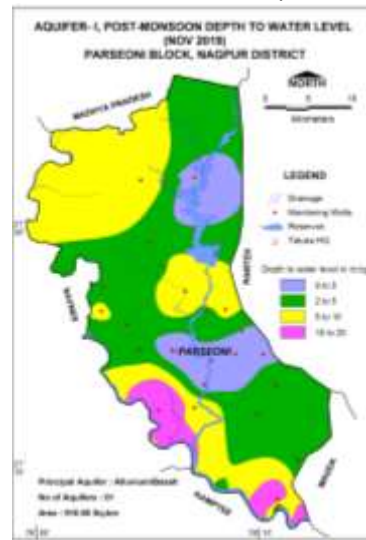
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
Water level less than 5 mbgl has been observed in isolated patch in southern and western part of the block covering an area of 43 sq km; Water level between 5 to 10 mbgl has been observed in major parts of the block covering an area of 410 sq km; whereas water levels more than 10 mbgl have been observed in northern and southern part of the block covering about 398 sq. km. area.	Water levels less than 2 mbgl have been observed in central and northern parts of the block covering an area of 130 sq km; Water level between 2-5 mbgl has been observed in major parts of the block covering an area of 519 sq km; water levels between 5 to 10 mbgl have been observed in north, south, central part of the block covering an area of 259 sq km; whereas water levels more than 10 mbgl have been observed as isolated patches in southern parts of the block covering about 83 sq. km. area.

Pre-Monsoon Water Level (May 2019)



WL>10 mbgl 398 sq. km.

Post-Monsoon Water Level (Nov. 2019)

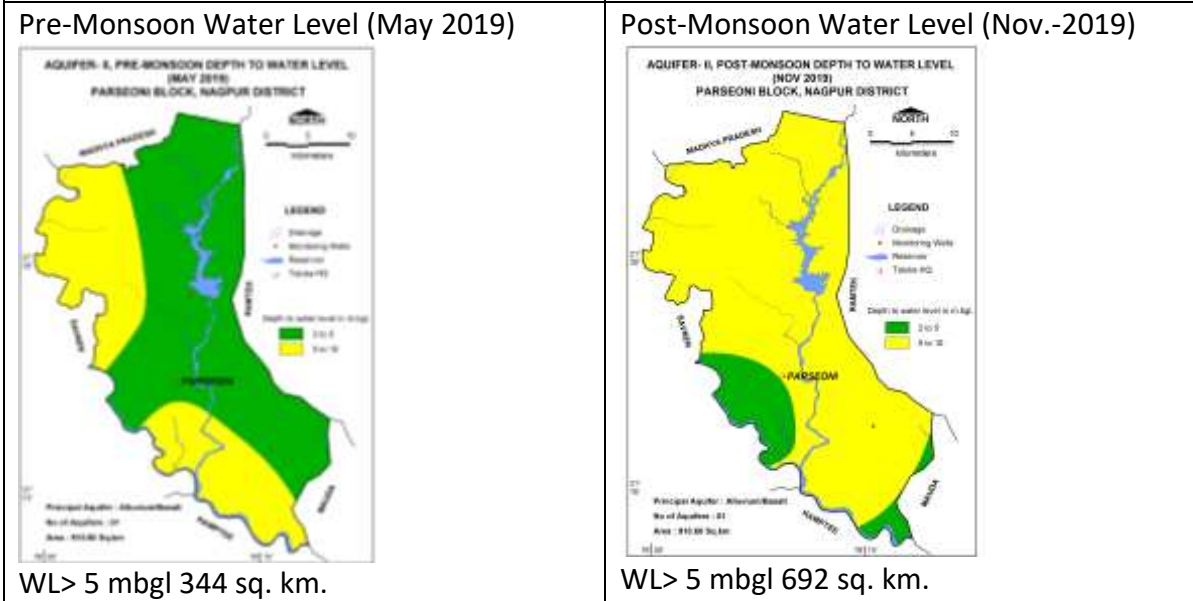


WL>10 mbgl 83 sq. km.

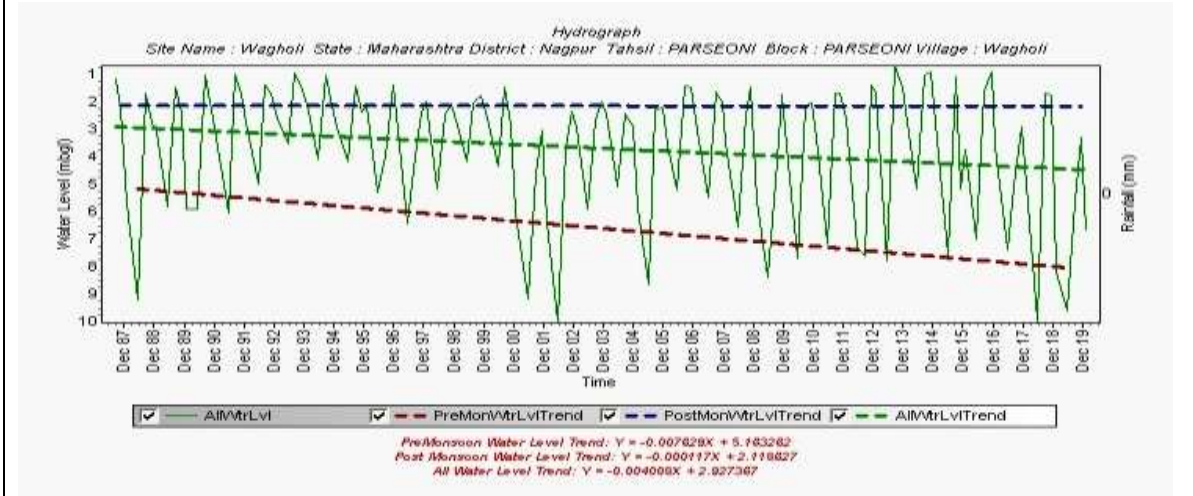
1.6.2. Aquifer-II/Deeper Aquifer

Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
Water levels between 2 to 5 mbgl are observed in entire north, east, central and southern parts of the block covering an area of 519 sq km; water levels more than	Water levels between 2 to 5 mbgl are observed in southern parts of the block covering an area of 173 sq km; water levels more than 5 mbgl have been

5 mbgl have been observed in north-west and southern half of the block covering about 344 sq. km. area of the block.	observed in entire block covering about 692 sq. km. area of the block.
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1.7. Hydrograph
 Site Name: Wagholi State: Maharashtra District: NAGPUR Tehsil: PARSEONI Block: : PARSEONI Village: Wagholi

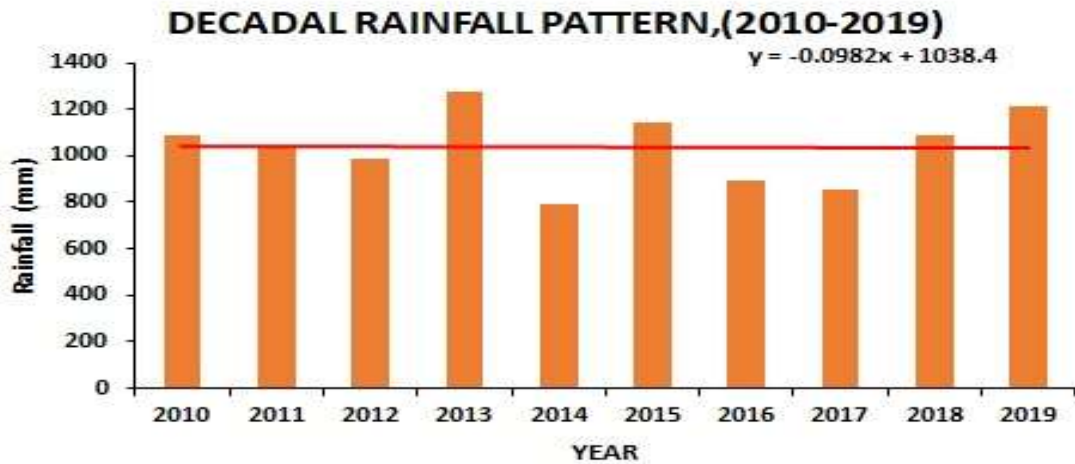


Hydrograph shows Pre-monsoon falling water level trend @ 0.091548 m/year and Post monsoon falling water level trend @ 0.001404 m/year

1.8. Water Level Trend (2010-19)	
Pre-Monsoon trend	Post-Monsoon trend
Rise in water level trend up to 0.40 m/year has been observed in entire central parts of the block; Decline in water level up to 0.2 m/year has been observed in eastern and north western parts of the block while rise in water level up to 0.2 m/year has been observed in northern parts of the block. Declining trend > 0.6 m/year has been	Rise in water level trend has been observed in southern part of the block; Declining water level trend up to 0.2 m/year has been observed in northern and southern part of the block; Decline more than 0.2 m/year has been observed in major part of the block covering 778 sq km area.

The long-term rainfall analysis for the period 1999-2019 indicates that normal rainfall of Parseoni block is 1040.20 mm, and also indicates a falling rainfall trend @ 11.71 mm/year with 0% probability of moderate drought.

Based on the short-term rainfall data from 2010-2019 for the block, the analysis indicates that average rainfall is 1037.88 mm. The rainfall from last ten years shows that the area continuously experienced normal rainfall with no droughts.



Low yielding Aquifer resulting poor sustainability:

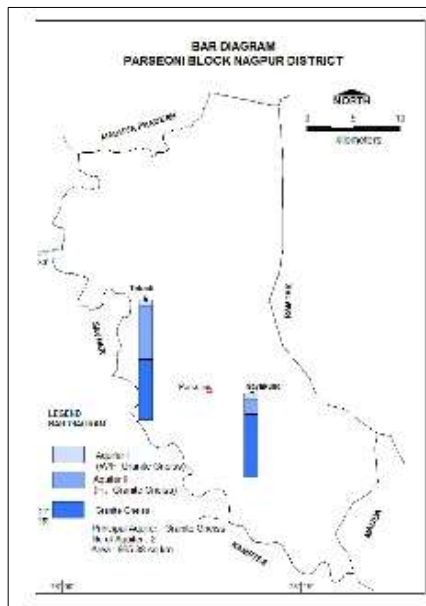
Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 51% area of the block has low yield potential (< 100m³/day) and can sustain pumping only for 1-1.5 hrs.

3. AQUIFER DISPOSITION

3.1. Number of Aquifers

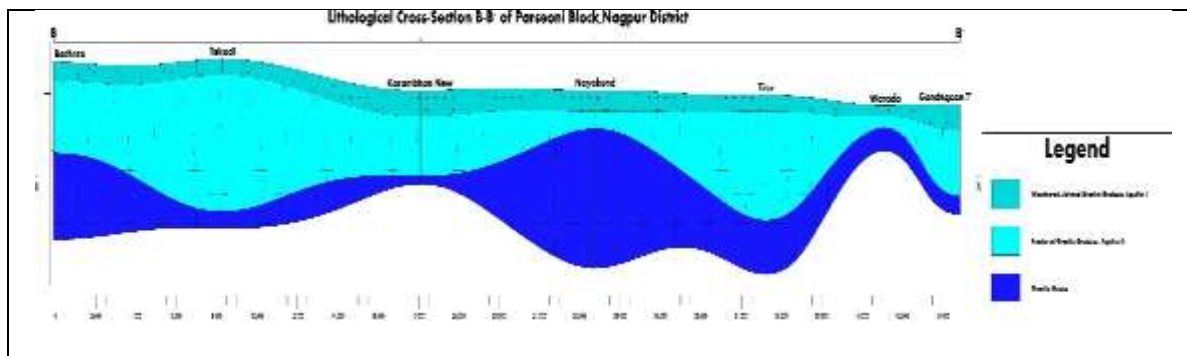
W/Fr Granite Gneisses –Aquifer-I, Aquifer-II

3.2. Lithological disposition



3.3. Cross Section

Section BB'



3.4. Basic Aquifer Characteristics

Major Aquifers	Granite Gneisses (Tirodi Gneissic Complex)	
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of Aquifer (mbgl)	6 to 28	26 to 171
Weathered/Fractured zones encountered (mbgl)	up to 28	up to 171
Weathered/Fractured rocks thickness (m)	1 to 10	1 to 18
SWL (mbgl)	7.70 to 15.85	6 to 48.50
Specific yield/Storativity (S)	0.020 to 0.030	3.35×10^{-4} to 3.65×10^{-5}
Transmissivity (T)	15.00 to 70.50 m ² /day	15.00 to 110.00 m ² /day
Yield	5-120 m ³ /day	up to to 4.43 lps
Sustainability	2 to 4 hrs	1 to 5 hrs

4. GROUND WATER QUALITY

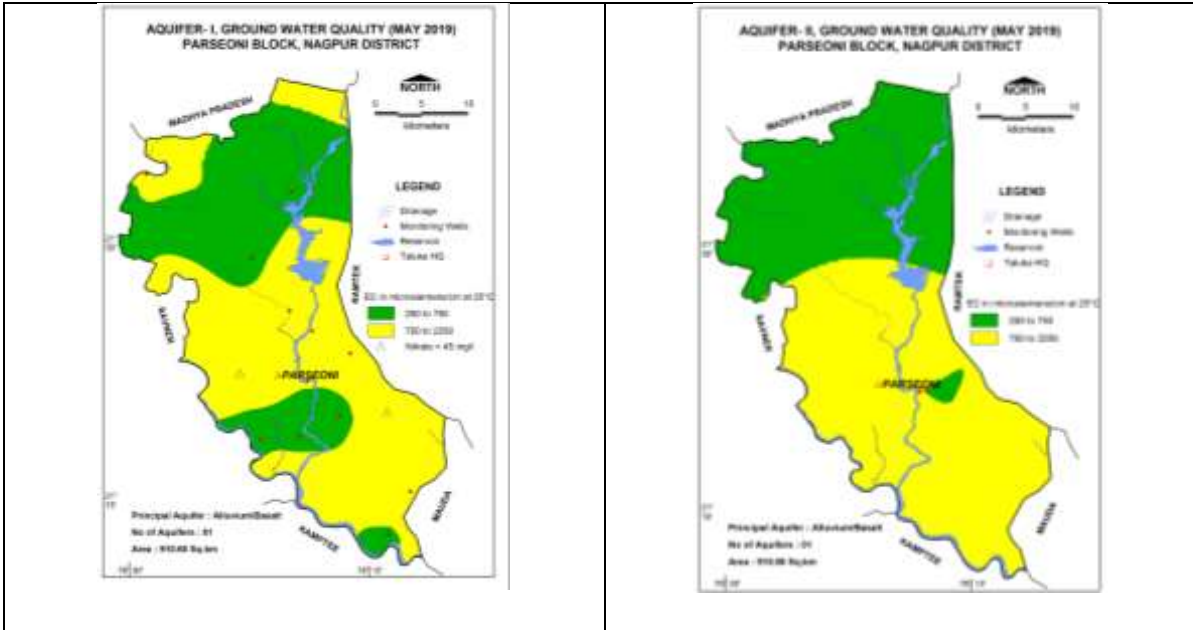
4.1 Aquifer-I/ Shallow Aquifer

EC values up to 750 μ S/cm are observed in northern and southern parts of the block and EC values between 750 to 2250 μ S/cm are observed in major part of the block. Ground water is suitable for all purposes except some village having Nitrate more than 45 mg/L.

4.2 Aquifer II/Deeper Aquifer

EC up to 750 μ S/cm is observed in northern part of the block and EC value between 750 to 2250 μ S/cm is observed in entire block. Ground water is suitable for all purposes.

Phreatic Aquifer (Aquifer-I)	Semi confined/Confined Aquifer (Aquifer II)
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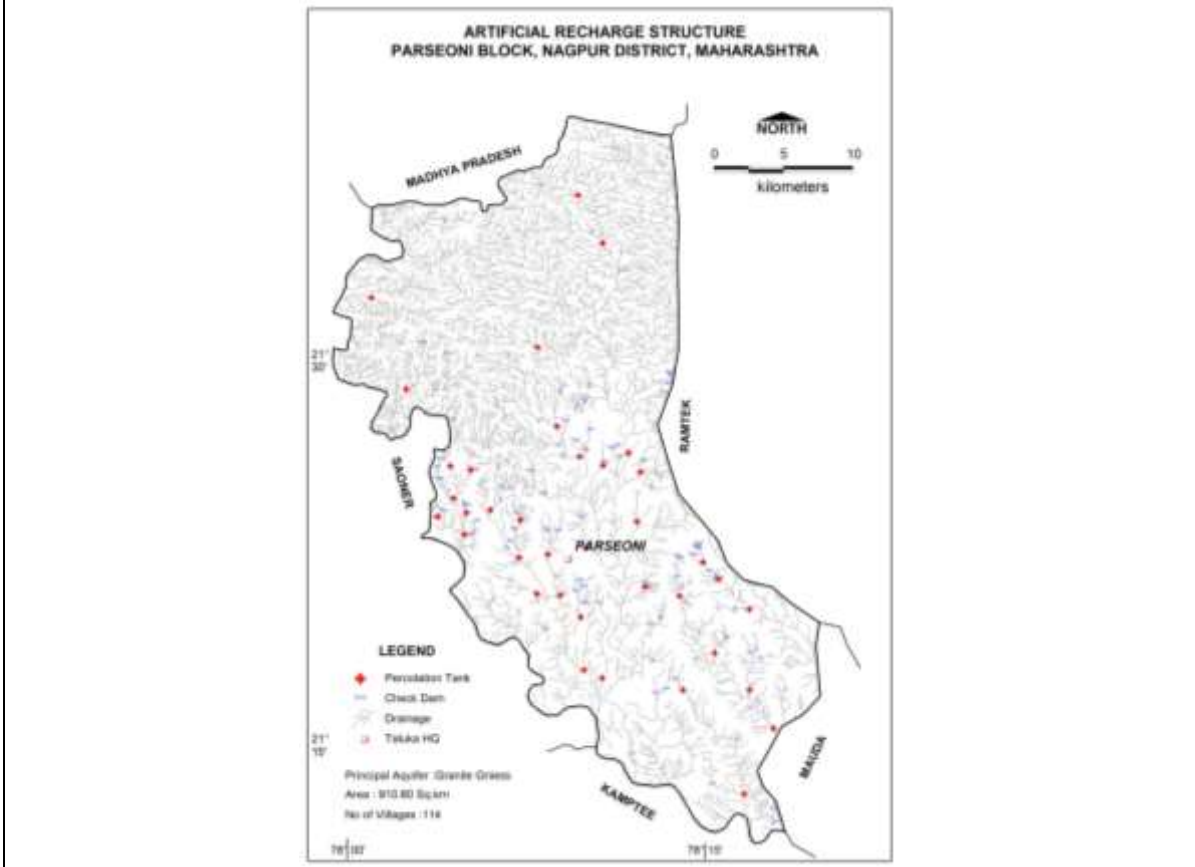


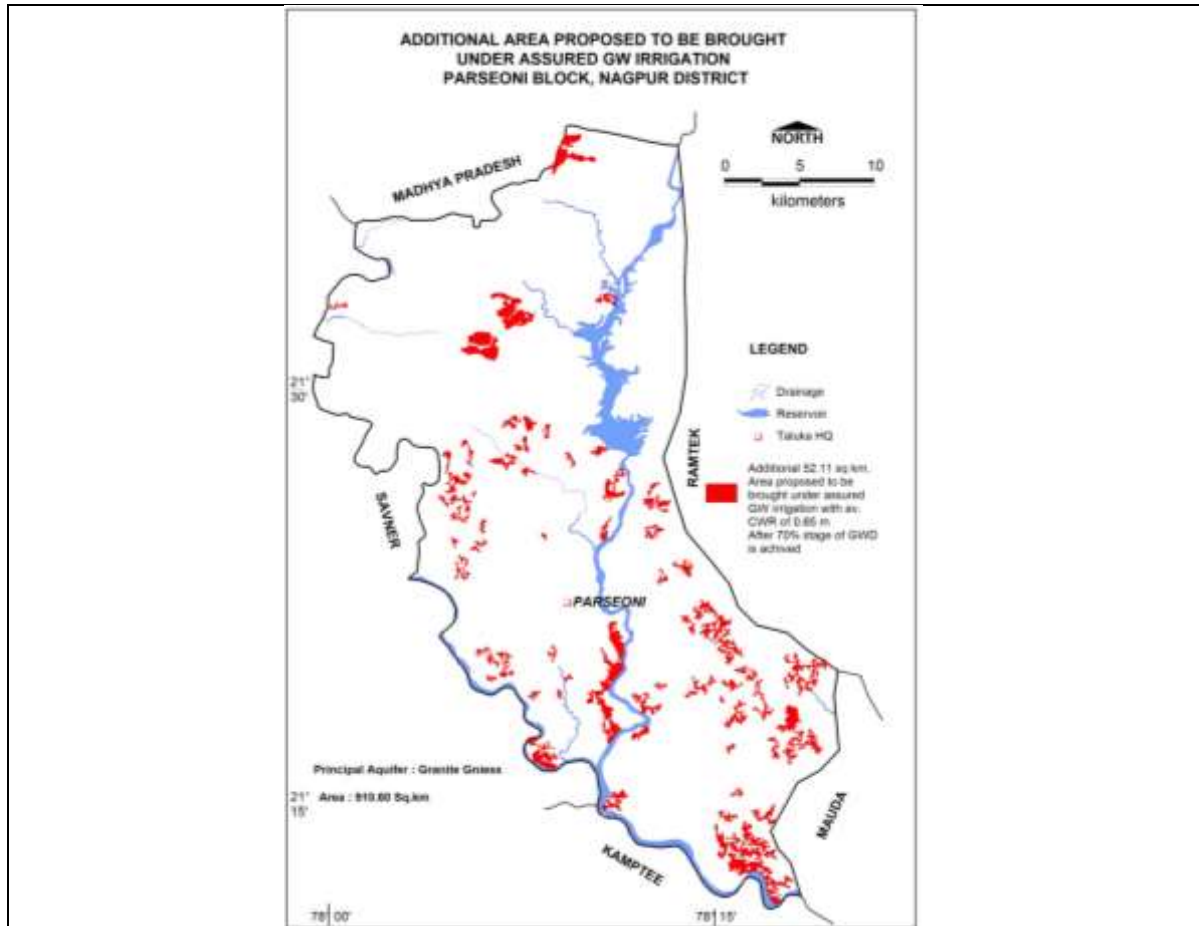
5. GROUND WATER RESOURCE							
5.1 Aquifer-I/ Shallow Aquifer							
Ground Water Recharge Worthy Area (Sq. km.)							536.51
Total Annual Ground Water Recharge (MCM)							74.36
Natural Discharge (MCM)							3.88
Net Annual Ground Water Availability (MCM)							70.43
Current Annual Ground Water Extraction for irrigation (MCM)							18.75
Current Annual Ground Water Extraction for domestic water supply (MCM)							8.10
Current Annual Ground Water Extraction for All uses (MCM)							26.86
Provision for domestic and industrial requirement supply to 2025(MCM)							8.27
Net Ground Water Availability for future use (MCM)							42.91
Stage of Ground Water Development (%)							38.14
Category							SAFE
5.2 Aquifer-II/Deeper Aquifer							
Semi confined/Confined Aquifer (Basalt)							
District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Parseoni	3.6	536.51	12.03	0.015	0.00089	3.219294
6.0. GROUND WATER MANAGEMENT							
6.1. Supply Side Management							
SUPPLY (MCM)							
Available Resource (MCM)							70.4371
Gross Annual Draft (MCM)							26.8645
Agricultural Demand –GW							18.7546
Agricultural Demand –SW							49.127
Domestic Demand – GW							8.1099
Domestic Demand – SW							2.027475

Total Demand		78.018975
Area of Block (Sq. Km.)		786.94
Area suitable for Artificial recharge (Sq. Km)		410.42
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		400.27
Volume of Unsaturated Zone (MCM)		2042.39
Average Specific Yield		0.020
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)		40.85
Surface water requirement @ 75% efficiency (MCM)		54.46
Surplus water Available (MCM)		8.97
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 (25% with 50 m2 area)		9391
Total RWH potential (MCM)		0.47659325
Rainwater harvested / recharged to DW or BW of 50% household		4695.5
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		Nil
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)		70.4371
Additional GW resources available after Supply side interventions (MCM)		6.72
Ground Water Availability after Supply side intervention(MCM)		77.16
Existing Ground Water Draft for All Uses (MCM)		26.86
GW draft after Demand Side Interventions (MCM)		26.86
Present stage of Ground Water Development (%)		38.14
Expected Stage of Ground Water Development after interventions (%)		34.82
Other Interventions Proposed, if any		
Alternate Water Sources Available		Nil
6.4. Development Plan		
GW available for Development Plan to bring SOD to 65%		27.15
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)		1629
Proposed no. of BW (@ 1 ham for 10% of GWR Available)		271

Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m AFTER 65 % STAGE OF GWD IS ACHIEVED	52.11
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Regulatory Measures	60 m
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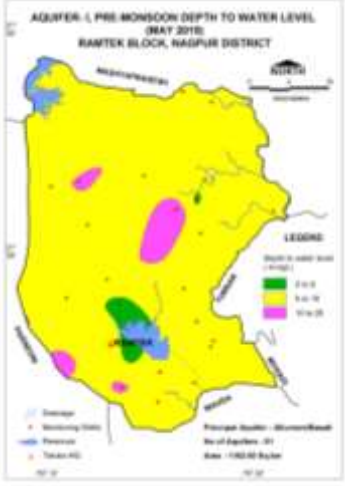
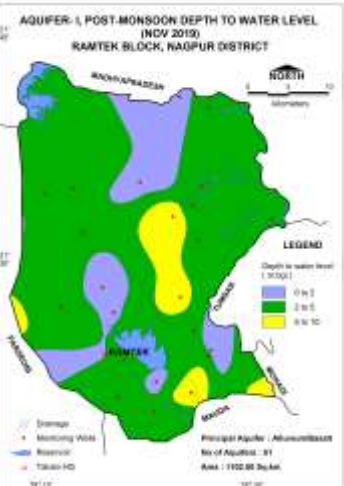




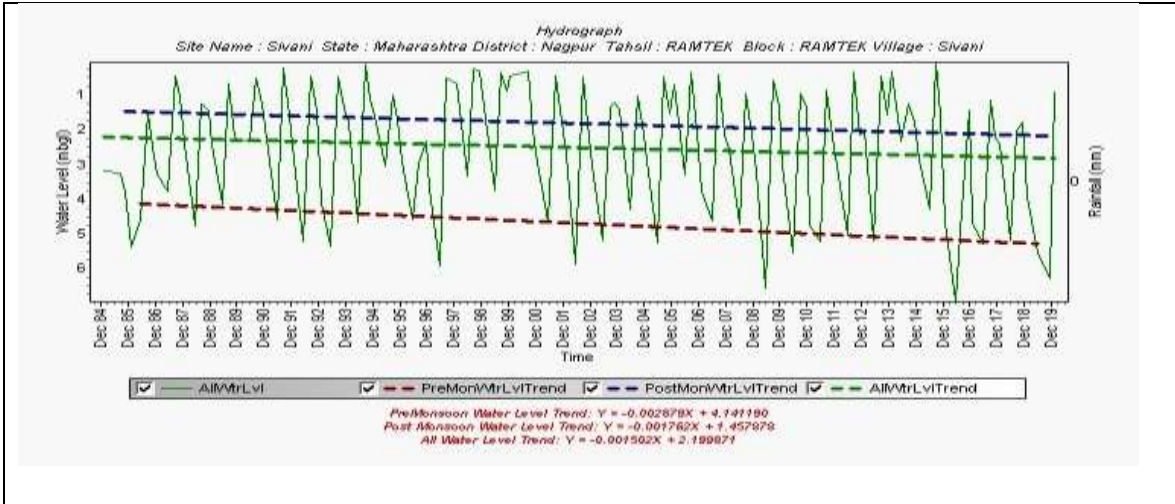


9.12 RAMTEK BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Block Name	RAMTEK	
Geographical Area (Sq. km.)	896.96 Sq. km.	
Hilly Area (Sq. km.)	264.25 Sq. km.	
Poor Ground Quality Area (Sq. km.)	Nil	
Population (2011)	1,58,643	
Climate	Sub-Tropical	
1.2 Rainfall Analysis		
Normal Rainfall	1164.20 mm	
Annual Rainfall (2019)	893.10mm	
Decadal Average Annual Rainfall (2010-19)	981.26 mm	
Long Term Rainfall Analysis (1999-2019)	Declining Trend 15.48 mm/year Probability of Normal and Excess Rainfall 61.90% & 9.52% Probability of Droughts -: 28.57% Moderate	
Rainfall Trend Analysis (1999 to 2019)		
<p>The chart displays annual rainfall data from 1999 to 2019. The y-axis ranges from 0 to 1800 mm in increments of 200. The x-axis lists years from 1999 to 2019. A downward-sloping trend line is drawn through the data points, with the equation $y = -15.48x + 1227$. The rainfall values for each year are approximately: 1999: 1050, 2000: 1500, 2001: 1400, 2002: 1100, 2003: 800, 2004: 700, 2005: 1400, 2006: 1100, 2007: 1350, 2008: 850, 2009: 900, 2010: 1150, 2011: 850, 2012: 750, 2013: 1450, 2014: 750, 2015: 950, 2016: 1000, 2017: 850, 2018: 1050, 2019: 850.</p>		
EQUATION OF TREND LINE $y = -15.480x + 1227$		
1.3. Geomorphology, Soil & Geology		
Major Geomorphic Unit	Pediplain, structural Hills, Pediments	
Soil	Very Deep Moderately Loamy to Moderately Deep Loamy to Moderately Loamy to slightly Deep Loamy soil	
Geology	Granite Gneisses, Schist meta sediments of Saucer group belonging to Dharwar Super Group and Archaen Age	
1.4. Hydrology & Drainage		
Drainage	Pench river and its tributaries	
Hydrology (Reference DSA Year: June 2016-17)	Major project	Nil
	Medium project	Completed: 1 medium irrigation projects generating a gross irrigation Potential of 1437 ha out of 5000 ha

		area.	
	Small project	Completed: 75 small irrigation projects generating a gross irrigation Potential of 1691 ha out of 5253 ha area.	
	Irrigation Project (100-250 Ha)/others	Completed: 02 Lift irrigation projects; 10 PT, 190 Kolhapur Bandhara, 325 surface storage bandhara, 1662 irrigation well.	
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern			
Geographical Area		896.96 Sq. km.	
Forest Area		114.29 Sq. km.	
Cultivable Area		292.26 Sq. km.	
Net Sown Area		375.29 Sq. km.	
Double Cropped Area		70.80 Sq. km.	
Area under Irrigation	Surface Water	139.66 Sq. km.	
	Ground Water	29.67 Sq. km.	
Principal Crops <i>(Reference year 2019)</i>		Crop Type	Area (Sq. km.)
		Cereals	187.69
		Pulses	42.95
		Soyabean	42.60
		Cotton	24.72
Horticultural Crops		Orange	6.59
		Other fruits	0.29
		Banana	0
		Vegetables	14.57
1.6. Water Level Behaviour			
1.6.1. Aquifer-I/Shallow Aquifer			
Pre-Monsoon (May-2019)		Post-Monsoon (November-2019)	
Water level less than 5 mbgl has been observed in isolated patch in central part of the block; Water level between 5 to 10 mbgl has been observed in entire part of the block whereas water levels more than 10 mbgl have been observed as isolated patches in central and southern part of the block covering about 79 sq. km. area.		Water levels less than 2 mbgl have been observed in central, southern, northern and eastern parts of the block; Water levels between 2-5 mbgl have been observed in major parts of the block; water levels between 5 to 10 mbgl have been observed in central and southern part of the block covering about 99 sq. km. area.	

<p>Pre-Monsoon Water Level (May 2019)</p>  <p>WL>10 mbgl 79 sq. km.</p>	<p>Post-Monsoon Water Level (Nov. 2019)</p>  <p>WL>5 mbgl 99 sq. km.</p>
<p>1.6.2. Aquifer-II/Deeper Aquifer</p>	
<p>Pre-Monsoon (May-2019)</p> <p>Water levels between 2 to 5 mbgl are observed in entire block covering an area of 897 sq km.</p>	<p>Post-Monsoon (November-2019)</p> <p>Water levels less than 2 mbgl have been observed in southern parts of the block; Water levels between 2-5 mbgl have been observed in major parts of the block; water levels between 5 to 10 mbgl have been observed in north-west to central to south-east part covering about 269 sq. km. area.</p>
<p>Pre-Monsoon Water Level (May 2019)</p>  <p>WL> 2 mbgl 897 sq. km.</p>	<p>Post-Monsoon Water Level (Nov.2019)</p>  <p>WL> 5 mbgl 269 sq. km.</p>
<p>1.7. Hydrograph Site Name: Sivani State: Maharashtra District: NAGPUR Tehsil: RAMTEK Block: : RAMTEK Village: Sivani</p>	



Hydrograph shows Pre-monsoon falling water level trend @ 0.034548 m/year and Post monsoon falling water level trend @ 0.018024 m/year

1.8. Water Level Trend (2010-19)

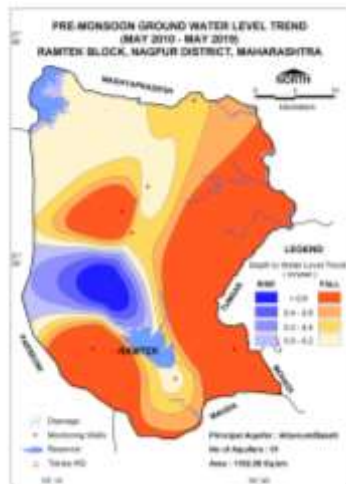
Pre-Monsoon trend

Decline in water level up to 0.2 m/year has been observed in western and north western parts of the block while rise in water level from 0-0.6 m/year has been observed in western in parts of the block; whereas Declining trend more than 0.2 m/year has been observed in major part of the block covering about 627 sq. km. area.

Post-Monsoon trend

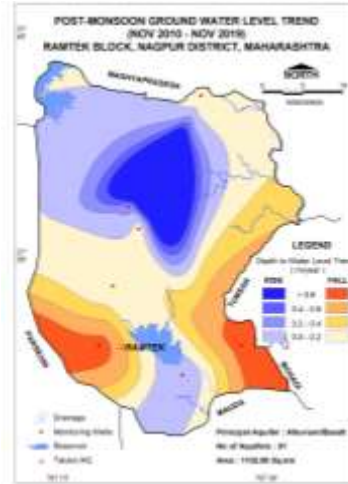
Declining water level trend up to 0.2 m/year has been observed in west central part to east central part of the block while rise in water level up to 0-0.60 m/year has been observed in north-west, western part of block. Decline more than 0.2 m/year has been observed in south-east, south-west part of the block covering 268 sq km area.

Pre-Monsoon Water Level Trend (2010-19)



Declining trend @ >0.2 m/year 627 sq. km.

Post-Monsoon Water Level Trend (2010-19)



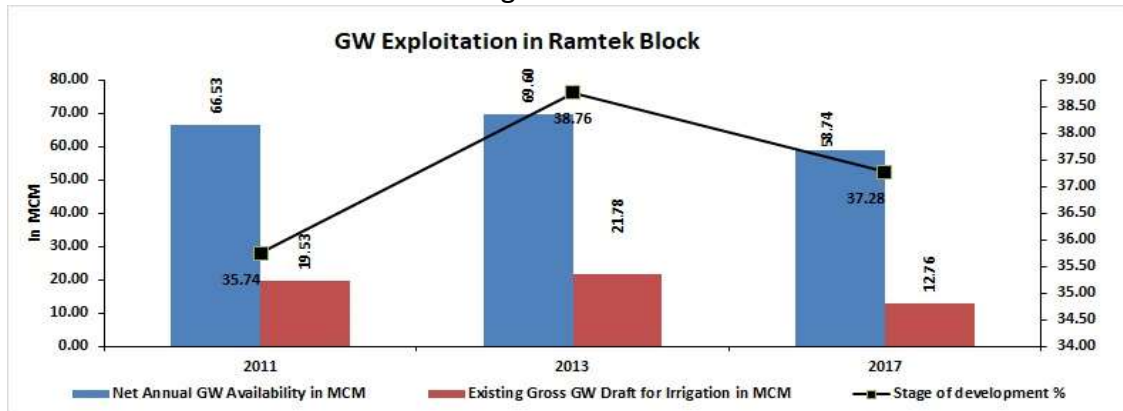
Declining trend @ >0.2 m/year 268 sq. km.

2. Ground Water Issues

Exploitation of Ground Water :-

The stage of ground water development has increased during 2011 to 2013 from 35.74% to 38.76% and afterwards further decreased during 2013 to 2017 from 38.76% to 37.28% in Ramtek block of Nagpur District. Further, the net ground water availability

increased during 2011 to 2013 from 66.53 MCM to 69.60 MCM again decreased from 69.60 MCM to 58.74 MCM during 2013 to 2017. Whereas the draft for irrigation increased during 2011 to 2013 from 19.53 MCM to 21.78 MCM and again decreased from 21.78 MCM to 12.76 MCM during 2013 to 2017.



Declining water level Trend:

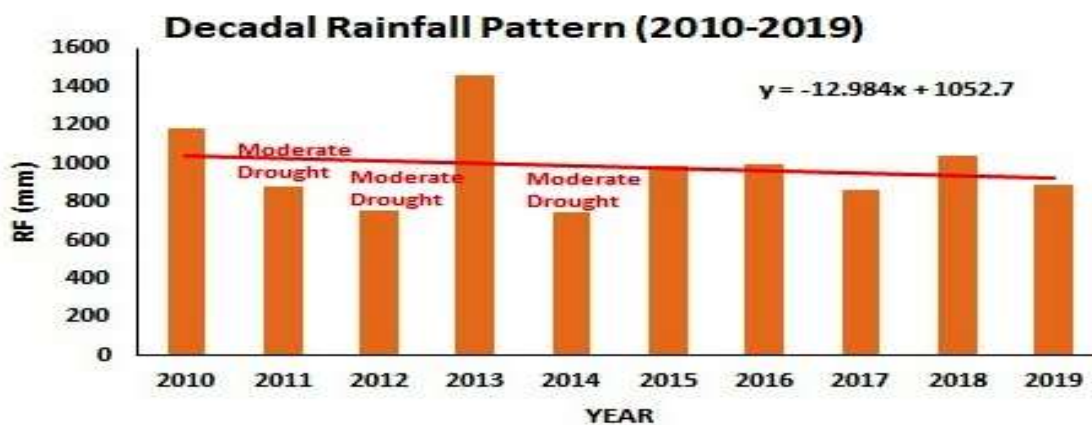
Pre monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 627 sq. km. covering about 69% area of the block.

Post monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 268 sq. km. covering about 30 % area of the block.

Low rainfall and Droughts:

The long-term rainfall analysis for the period 1999-2019 indicates that normal rainfall of Ramtek block is 1164.20 mm, and also indicates a declining rainfall trend @ 15.48 mm/year with 28.57% probability of moderate drought.

Based on the short-term rainfall data from 2009-2019 for the block, the analysis indicates that average rainfall is 981.26 mm. The rainfall from last ten years shows a declining rainfall trend @ 12.984 mm/year showing that the area is continuously experiencing low and declining rainfall with frequent moderate droughts.



Low yielding Aquifer resulting poor sustainability:

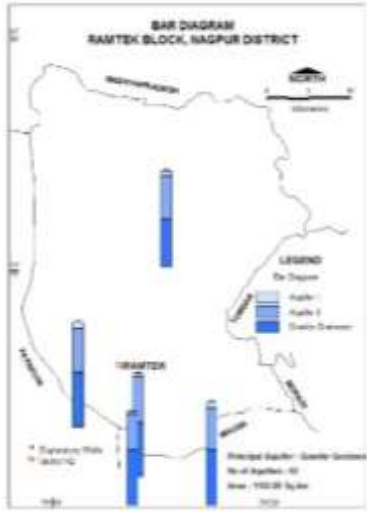
Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 55% area of the block has low yield potential (< 100m³/day) and can sustain pumping only for 1-1.5 hrs.

3. AQUIFER DISPOSITION

3.1. Number of Aquifers	W/Fr Granite Gneisses –Aquifer-I, Aquifer-
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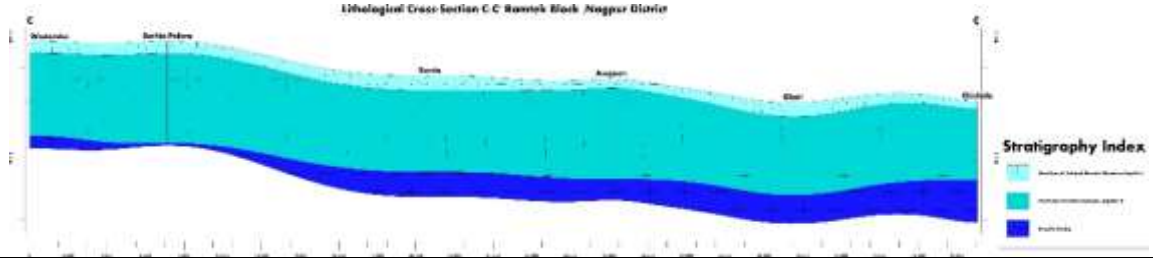
II

3.2. Lithological disposition



3.3. Cross Section

Section CC'



3.4. Basic Aquifer Characteristics

Major Aquifers	Granite Gneisses (Tirodi Gneissic Complex)	
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of Aquifer (mbgl)	4.90 to 15.00	36 to 168
Weathered/Fractured zones encountered (mbgl)	up to 15.00	up to 168
Weathered/Fractured rocks thickness (m)	0.90 to 2.00	1 to 7
SWL (mbgl)	4.65 to 10.05	3.90 to 12.0
Specific yield/Storativity (S)	0.015 to 0.020	1.80×10^{-4} to 2.60×10^{-5}
Transmissivity (T)	12.00 to 80.50 m ² /day	12.00 to 100.00 m ² /day
Yield	5-120 m ³ /day	0.38 to 7.76 lps
Sustainability	2 to 4 hrs	1 to 5 hrs

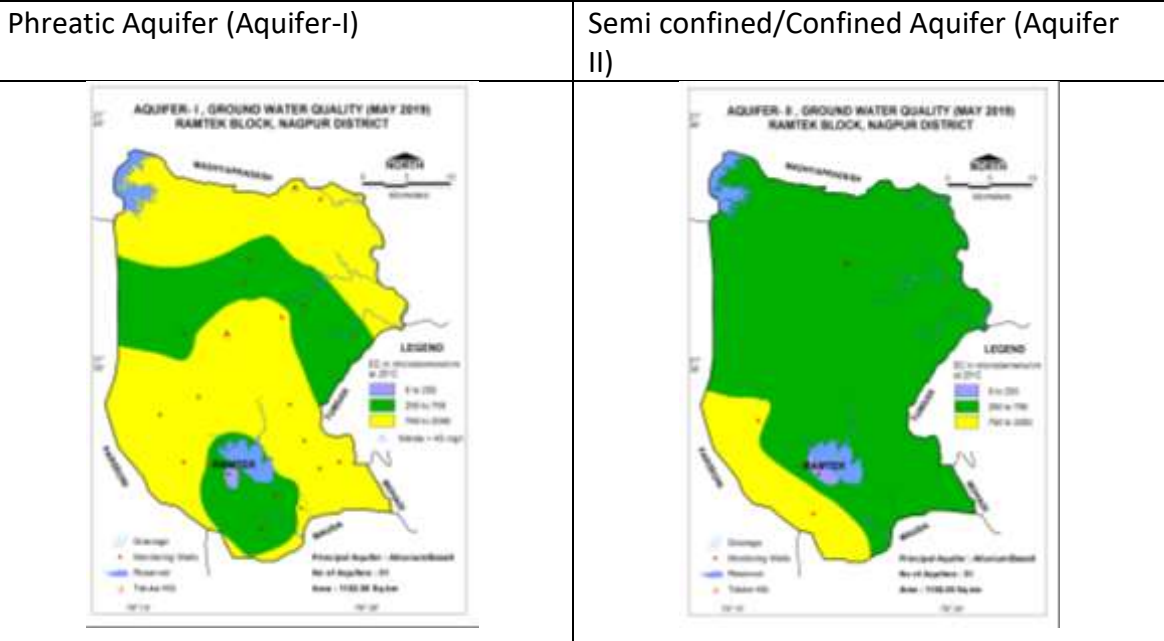
4. GROUND WATER QUALITY

4.1 Aquifer-I/ Shallow Aquifer

EC values up to 250 $\mu\text{S}/\text{cm}$ are observed as isolated patch in central parts of the block. EC values between 250-750 $\mu\text{S}/\text{cm}$ are observed in central and southern parts of the block and EC values between 750 to 2250 $\mu\text{S}/\text{cm}$ are observed in major part of the block. Ground water is suitable for all purposes.

4.2 Aquifer II/Deeper Aquifer

EC values up to 250 $\mu\text{S}/\text{cm}$ are observed as isolated patch in central parts of the block. EC values between 250-750 $\mu\text{S}/\text{cm}$ are observed in major parts of the block and EC values between 750 to 2250 $\mu\text{S}/\text{cm}$ are observed in south-west part of the block. Ground water is suitable for all purposes.



5. GROUND WATER RESOURCE

5.1 Aquifer-I/ Shallow Aquifer

Ground Water Recharge Worthy Area (Sq. km.)	632.71
Total Annual Ground Water Recharge (MCM)	61.86
Natural Discharge (MCM)	3.12
Annual Extractable Ground Water Recharge (MCM)	58.73
Current Annual Ground Water Extraction for irrigation (MCM)	12.76
Current Annual Ground Water Extraction domestic water supply (MCM)	9.13
Current Annual Ground Water Extraction for All uses (MCM)	21.89
Provision for domestic and industrial requirement supply to 2025(MCM)	9.31
Net Ground Water Availability for future use (MCM)	37.14
Stage of Ground Water Development (%)	37.28
Category	SAFE

5.2 Aquifer-II/Deeper Aquifer

Semi confined/Confined Aquifer (Basalt)

District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Ramtek	7	632.71	157.6	0.015	0.00089	0.755595

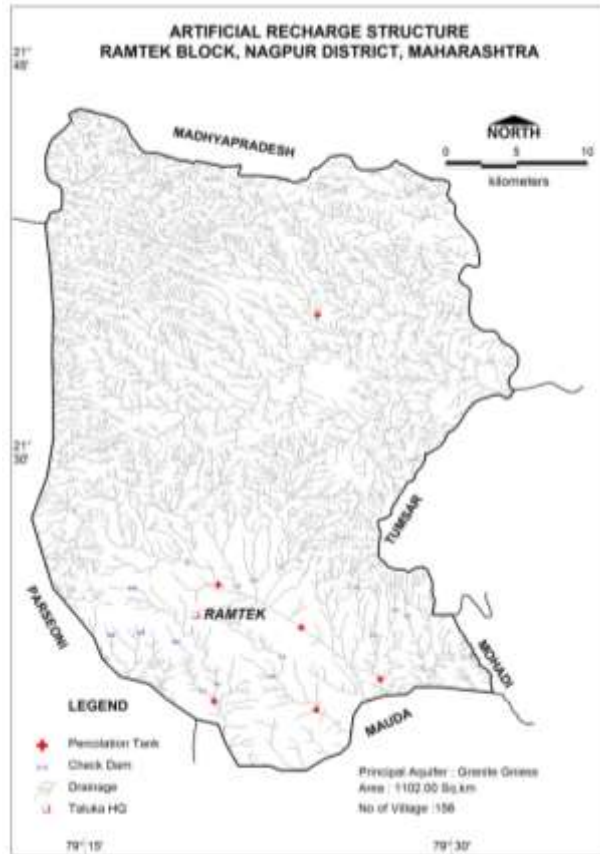
6.0. GROUND WATER MANAGEMENT

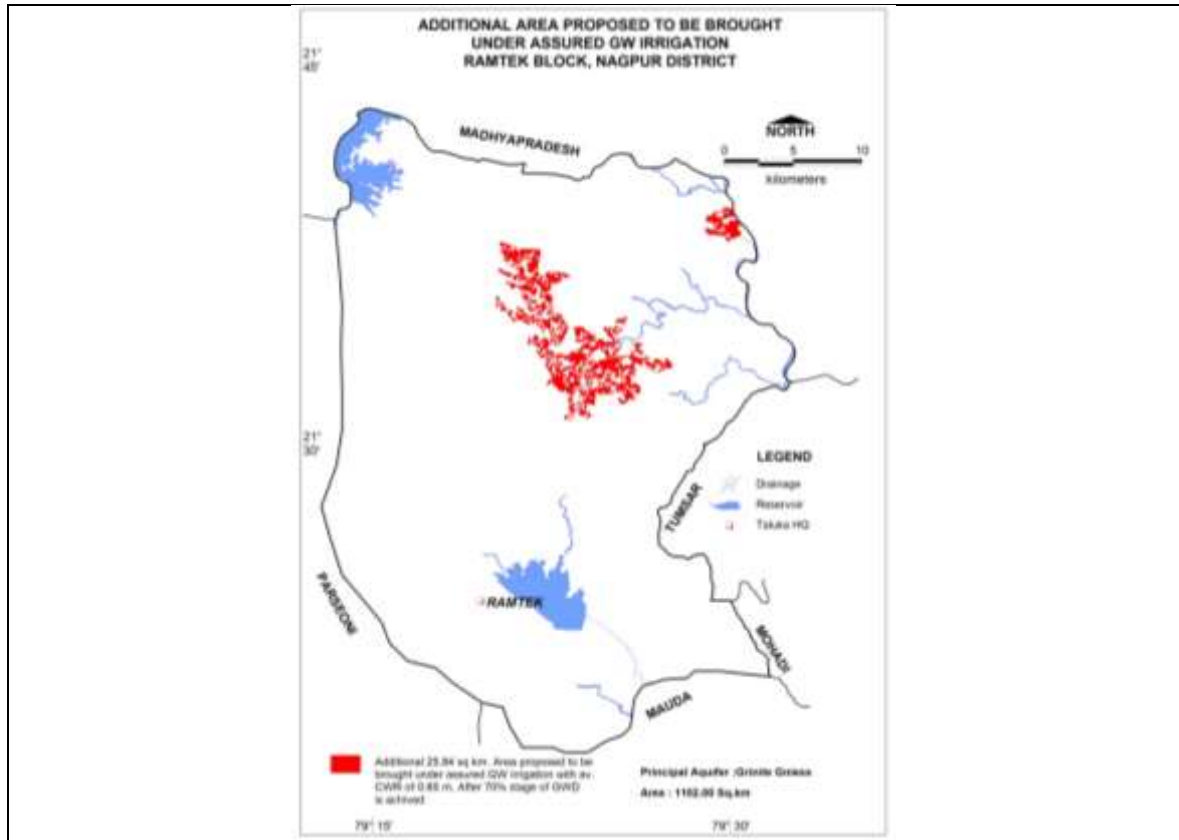
6.1. Supply Side Management

SUPPLY (MCM)	
Available Resource (MCM)	58.74
Gross Annual Draft (MCM)	21.89

Agricultural Demand –GW		12.757
Agricultural Demand –SW		90.779
Domestic Demand – GW		9.133
Domestic Demand – SW		2.28325
Total Demand		114.95225
Area of Block (Sq. Km.)		1142.9
Area suitable for Artificial recharge (Sq. Km)		62.4
Type of Aquifer		
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)		62.4
Volume of Unsaturated Zone (MCM)		77.95
Average Specific Yield		0.015
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)		1.16925
Surface water requirement @ 75% efficiency (MCM)		1.559
Surplus water Available (MCM)		1.39776
Surplus runoff considered for planning (MCM) @ 75%/100%		1.04832
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	5	14
Volume of Water expected to be conserved / recharged @ 75 % efficiency (MCM)	0.73	0.31
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m2 area)		6081
Total RWH potential (MCM)		0.29888115
Rainwater harvested / recharged to DW or BW of 50% household		3040.5
However, it is economically not viable & hence, not recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		Nil
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)		58.74
Additional GW resources available after Supply side interventions (MCM)		1.05
Ground Water Availability after Supply side intervention(MCM)		59.79
Existing Ground Water Draft for All Uses (MCM)		21.89
GW draft after Demand Side Interventions (MCM)		21.89
Present stage of Ground Water Development (%)		37.28
Expected Stage of Ground Water Development after interventions (%)		36.61
Other Interventions Proposed, if any		
Alternate Water Sources Available		Nil

6.4. Development Plan	
GW available for Development Plan to bring SOD to 65%	19.96
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	1198
Proposed no. of BW (@ 1 ham for 10% of GWR Available)	200
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	32.32
Regulatory Measures	60 m





9.13 SAVNER BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES	
1.1 Introduction	
Block Name	SAVNER
Geographical Area (Sq. km.)	675.43Sq. km.
Hilly Area (Sq. km.)	113.06Sq. km.
Poor Ground Quality Area (Sq. km.)	Nil
Population (2011)	2,29,450
Climate	Sub-Tropical
1.2 Rainfall Analysis	
Normal Rainfall	1012.70 mm
Annual Rainfall (2019)	816.40mm
Decadal Average Annual Rainfall (2010-19)	962.90 mm
Long Term Rainfall Analysis (1999-2019)	Rising Trend 4.349 mm/year Probability of Normal and Excess Rainfall 76.19% & 9.52% Probability of Droughts -: 4.76% Moderate and 9.52% Acute
<p>Rainfall Trend Analysis (1999 to 2019)</p> <p>EQUATION OF TREND LINE $y = 4.349x + 912.70$</p>	
1.3. Geomorphology, Soil & Geology	
Major Geomorphic Unit	Weathered, Slightly, Moderately and highly dissected Plateau; alluvium plain; Pediplain, structural Hills, Pediments
Soil	Deep moderate loamy to Moderately Deep Loamy to Moderately Loamy to slightly Deep Loamy to very shallow loamy to extremely shallow clayey soil
Geology	Unconsolidated Sediments, Deccan Traps (Basalt) Age: Late Cretaceous to Eocene Gondwana Super group (Permian to Carboniferous) Granite Gneisses, Schist meta sediments of Saucer group

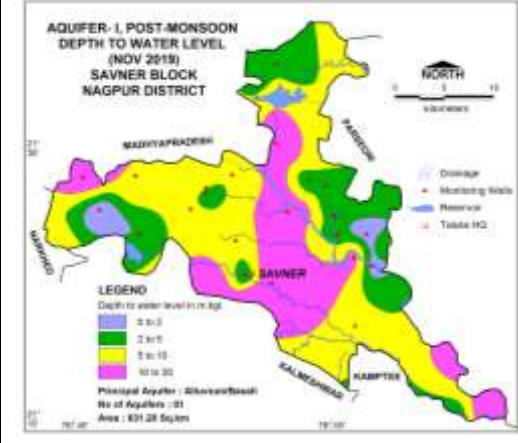
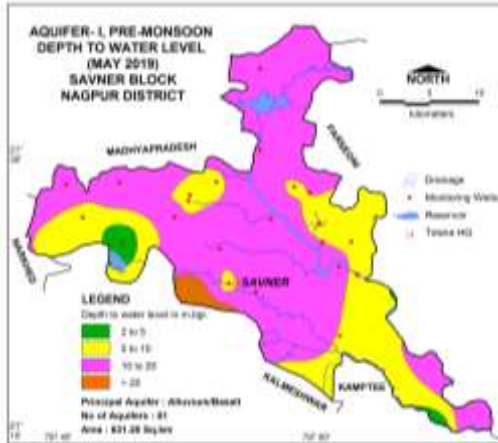
	belonging to Dharwar Super Group and Archaen Age	
1.4. Hydrology & Drainage		
Drainage	Kanhari river and its tributaries	
Hydrology <i>(Reference DSA Year: June 2016-17)</i>	Major project	Nil
	Medium project	Completed: 05 medium irrigation projects generating a gross irrigation Potential of 100069 ha out of 22401 ha area.
	Small project	Completed: 15 small irrigation projects generating a gross irrigation Potential of 813 ha out of 3478 ha area.
	Irrigation Project (100-250 Ha)/others	Completed: 2 PT, 92 Kolhapur Bandhara, 132 surface storage bandhara, 2 Lift Irrigation scheme, 5549 irrigation well.
1.5. Land Use, Agriculture, Irrigation & Cropping Pattern		
Geographical Area	675.43Sq. km.	
Forest Area	54.35 Sq. km.	
Cultivable Area	461.39 Sq. km.	
Net Sown Area	501.41 Sq. km.	
Double Cropped Area	51.65 Sq. km.	
Area under Irrigation	Surface Water	0.00 Sq. km.
	Ground Water	28.04 Sq. km.
Principal Crops <i>(Reference year 2019)</i>	Crop Type	Area (Sq. km.)
	Cereals	28.04
	Pulses	89.47
	Soyabean	20.82
	Cotton	278.67
Horticultural Crops	Orange	17.24
	Other fruits	0.28
	Banana	0.02
	Vegetables	31.16
1.6. Water Level Behaviour		
1.6.1. Aquifer-I/Shallow Aquifer		
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)	
Water level between 2-5 mbgl has been observed in isolated patch in western part of the block; Water level between 5 to 10 mbgl has been observed in east, south central and west part of the block whereas water levels between 10-20 mbgl	Water level between 0-2 mbgl has been observed in isolated patch in western and eastern part of the block; Water level between 2-5 mbgl has been observed in eastern, western and northern part of the block; Water level between 5 to 10 mbgl	

have been observed in major part of the block covering about 506 sq. km. area. Water level > 20 mbgl is observed in isolated patch in south-western part of the block covering an area of 34 sq km.

has been observed in east, south, north central and west part of the block whereas water levels more than 10 mbgl have been observed as in northern, southern and central parts of the block covering about 168 sq. km. area.

Pre-Monsoon Water Level (May 2019)

Post-Monsoon Water Level (Nov. 2019)



WL>20 mbgl 34 sq. km.

WL>10 mbgl 168 sq. km.

1.6.2. Aquifer-II/Deeper Aquifer

Pre-Monsoon (May-2019)

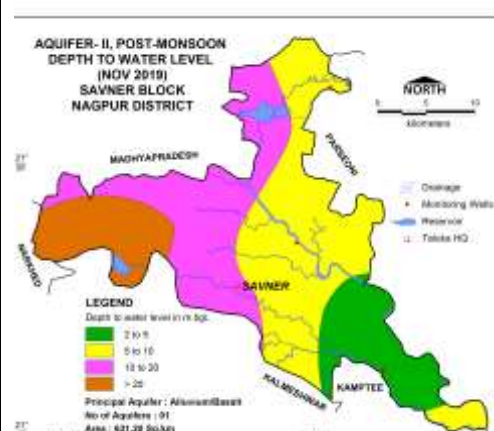
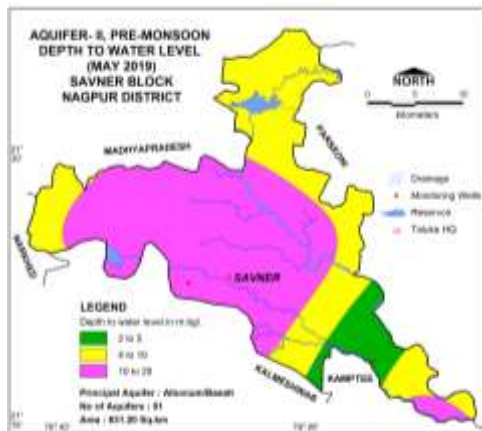
Post-Monsoon (November-2019)

Water levels between 2 to 5 mbgl are observed in southern half of the block; water levels between 5 to 10 mbgl are observed in south, east, north west part of the block; whereas more than 10 mbgl have been observed in major half of the block covering about 405 sq. km. area of the block.

Water levels between 2 to 5 mbgl are observed in southern half of the block; water levels between 5 to 10 mbgl are observed in south, east, north part of the block; Water levels between 10 to 20 mbgl have been observed in central, north part of the block whereas more than 20 mbgl has been observed as isolated patch in north western part of the block and cover 122 sq. km. area.

Pre-Monsoon Water Level (May 2019)

Post-Monsoon Water Level (Nov.-2019)

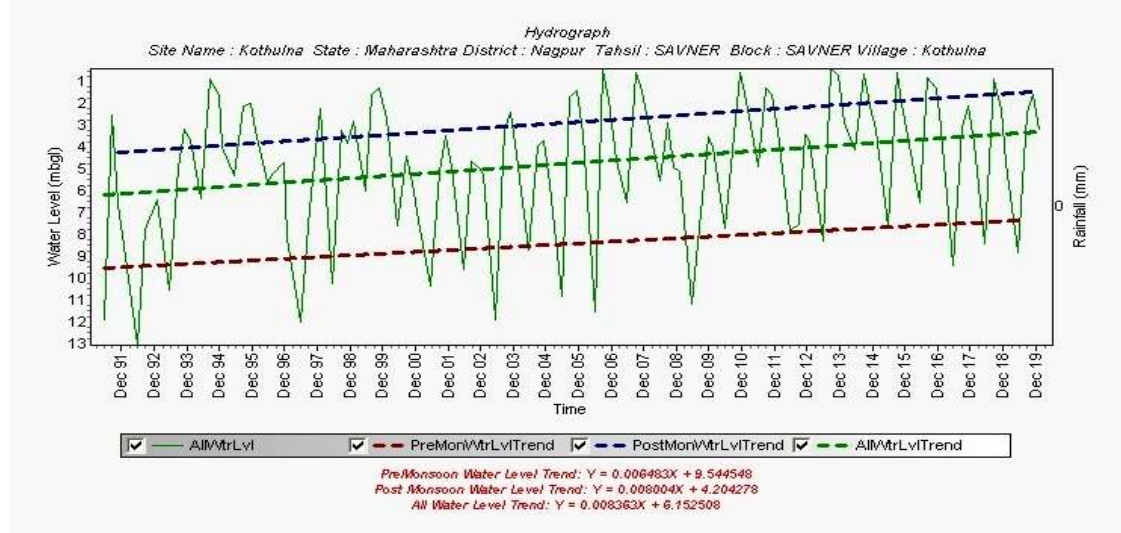


WL> 10 mbgl 405 sq. km.

WL> 20 mbgl 122 sq. km.

1.7. Hydrograph

Site Name: Kothulna State: Maharashtra District: NAGPUR Tehsil: SAVNER Block: : SAVNER Village: Kothulna



Hydrograph shows Pre-monsoon rising water level trend @ 0.077796 m/year and Post monsoon rising water level trend @ 0.096048 m/year

1.8. Water Level Trend (2010-19)

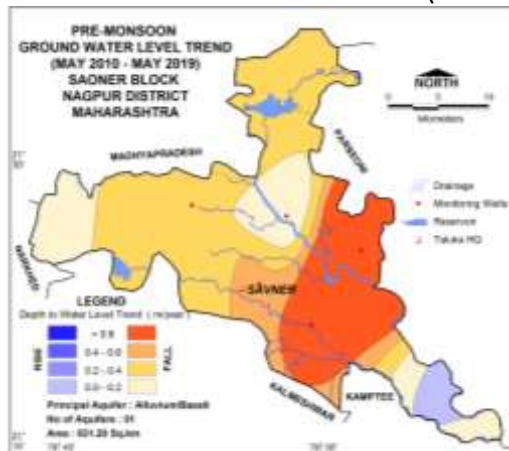
Pre-Monsoon trend
 Rising 0.0216 to 0.19 m/year
 Falling 0.12 to 1.65 m/year

Post-Monsoon trend
 Rising 0.073 to 0.622 m/year
 Falling 0.071 to 1.770 m/year

Decline in water level up to 0.2 m/year has been observed in central, southern and north western parts of the block while rise in water level up to 0.2 m/year has been observed in isolated patches in southern parts of the block. Declining trend more than 0.2 m/year has been observed in major part of the block covering about 473 sq. km. area.

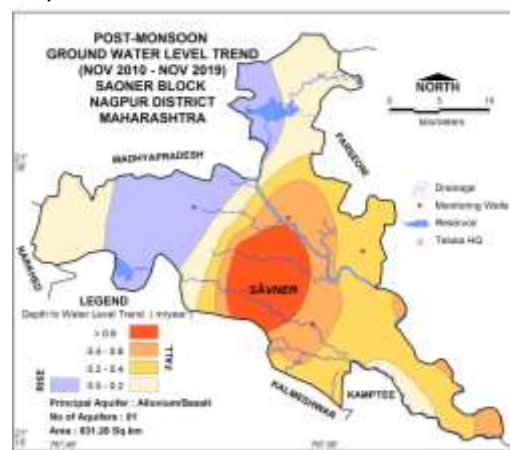
Declining water level trend up to 0.2 m/year has been observed in east central, north west part of the block while rise in water level up to 0.2 m/year has been observed in northern part of block. Decline more than 0.2 m/year has been observed in major part of the block except northern part covering 405 sq km area.

Pre-Monsoon Water Level Trend (2010-19)



Declining trend @ >0.2 m/year 473 sq. km.

Post-Monsoon Water Level Trend (2010-19)



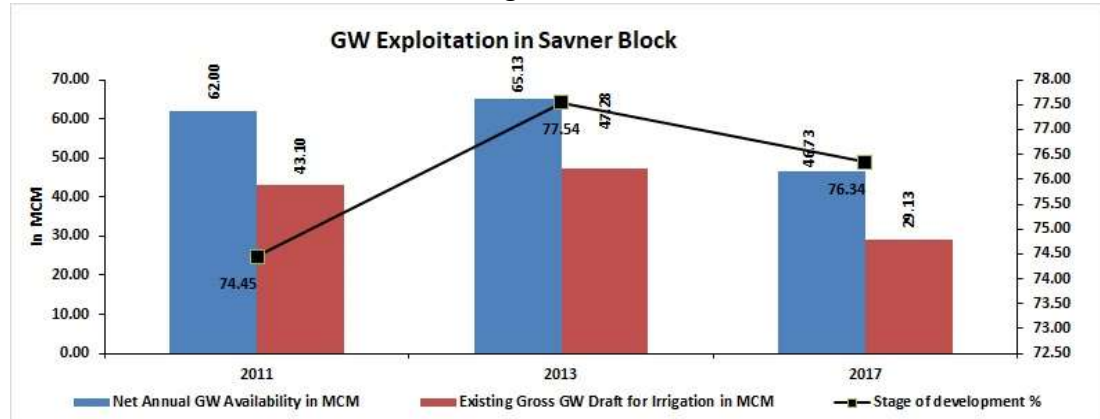
Declining trend @ >0.2 m/year 405 sq.

km.

2. Ground Water Issues

Exploitation of Ground Water: -

The stage of ground water development has increased during 2011 to 2013 from 74.45% to 77.54% and afterwards further decreased during 2013 to 2017 from 77.54% to 76.34% in Savner block of Nagpur District. Further, the net ground water availability increased during 2011 to 2013 from 62.00 MCM to 65.13 MCM again decreased from 65.13 MCM to 46.73 MCM during 2013 to 2017. Whereas the draft for irrigation increased during 2011 to 2013 from 43.10 MCM to 47.28 MCM and again decreased from 47.28 MCM to 29.13 MCM during 2013 to 2017.



Declining water level Trend : -

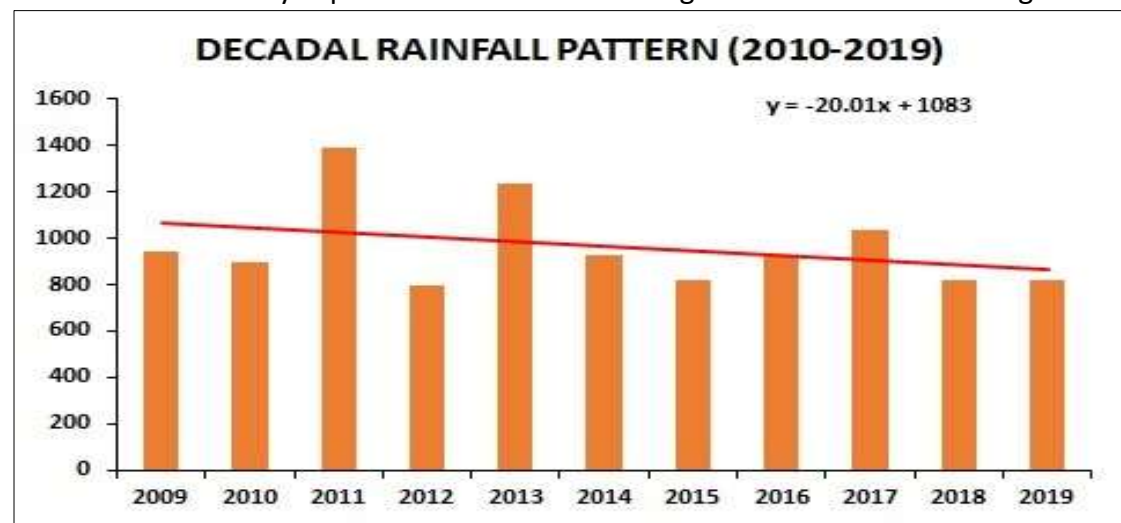
Pre monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 473 sq. km. covering about 69% area of the block.

Post monsoon (2010-19): decline in water level trend more than 0.2 m/year is observed in about 405 sq. km. covering about 60 % area of the block.

Low rainfall and Droughts:

The long-term rainfall analysis for the period 1999-2019 indicates that normal rainfall of Savner block is 1012.70 mm, and also indicates a rising rainfall trend @ 4.349 mm/year with 4.76% probability of moderate drought.

Based on the short-term rainfall data from 2010-2019 for the block, the analysis indicates that average rainfall is 962.90 mm. The rainfall from last ten years shows that the area continuously experienced low and declining rainfall but with no droughts.

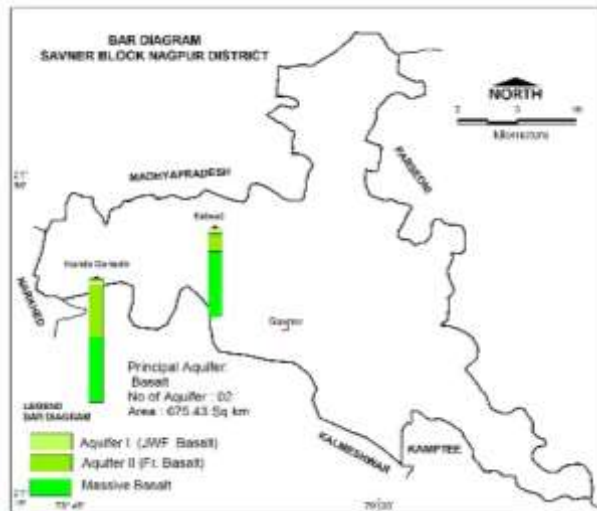


Low yielding Aquifer resulting poor sustainability:
 Limited extent of porous and pervious zone, because of predominance of secondary porosity that has evolved from prevailing erratic joint pattern and also the absence of primary porosity, results in poor sustainability of the aquifers. About 55% area of the block has low yield potential (< 100m³/day) and can sustain pumping only for 1-1.5 hrs.

3. AQUIFER DISPOSITION

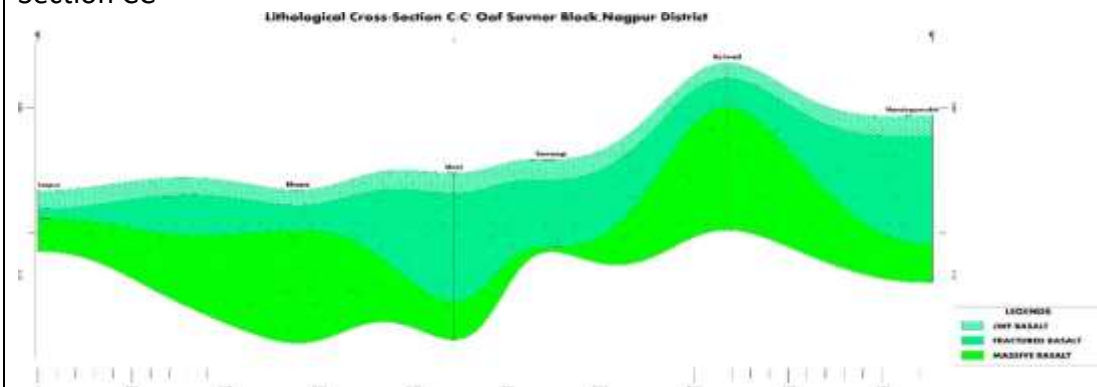
3.1. Number of Aquifers | W/Fr Granite Gneisses –Aquifer-I, Aquifer-II

3.2. Lithological disposition



3.3. Cross Section

Section CC'



3.4. Basic Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semi confined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of Aquifer (mbgl)	10 to 21	33 to 194.50
Weathered/Fractured zones encountered (mbgl)	up to 21	up to 194.50
Weathered/Fractured rocks thickness (m)	0.5 to 2.0	3 to 21
SWL (mbgl)	4.80 to 13.95	2.32 to 17.42
Specific yield/Storativity (S)	0.02 to 0.030	3.35 x10 ⁻⁴ to 3.65 x10 ⁻⁵
Transmissivity (T)	15.00 to 70.50 m ² /day	15.00 to 110.00 m ² /day

Yield	10 to 120 m ³ /day	up to to 2.50 lps
Sustainability	2 to 4 hrs	1 to 5 hrs

4. GROUND WATER QUALITY

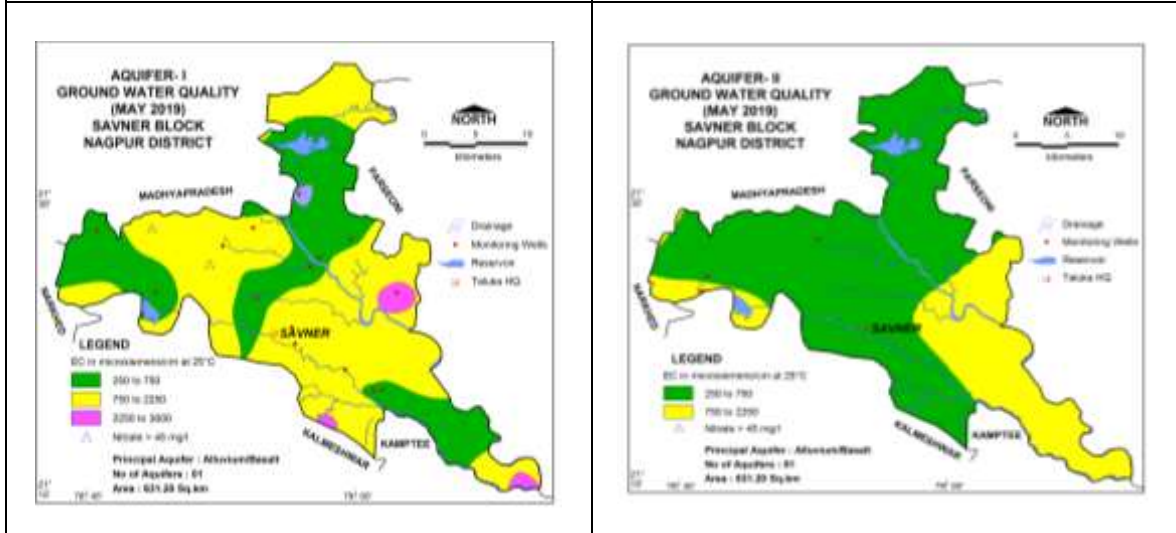
4.1 Aquifer-I/ Shallow Aquifer

EC values between 250-750 µS/cm are observed in central, western, southern and northern parts of the block and EC values between 750 to 2250 µS/cm are observed in major part of the block. EC values between 2250-3000 µS/cm are observed as isolated patch in eastern parts of the block. Ground water is suitable for all purposes except some village having Nitrate more than 45 mg/L.

4.2 Aquifer II/Deeper Aquifer

EC values between 250-750 µS/cm are observed in major parts of the block and EC values between 750 to 2250 µS/cm are observed in south-east part of the block. Ground water is suitable for all purposes.

Phreatic Aquifer (Aquifer-I)	Semi confined/Confined Aquifer (Aquifer II)
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5. GROUND WATER RESOURCE

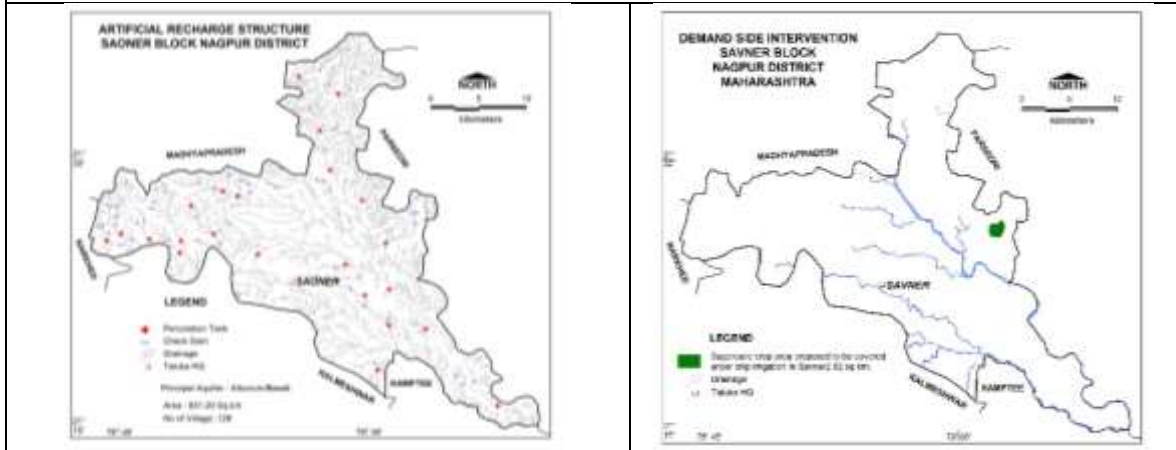
5.1 Aquifer-I/ Shallow Aquifer

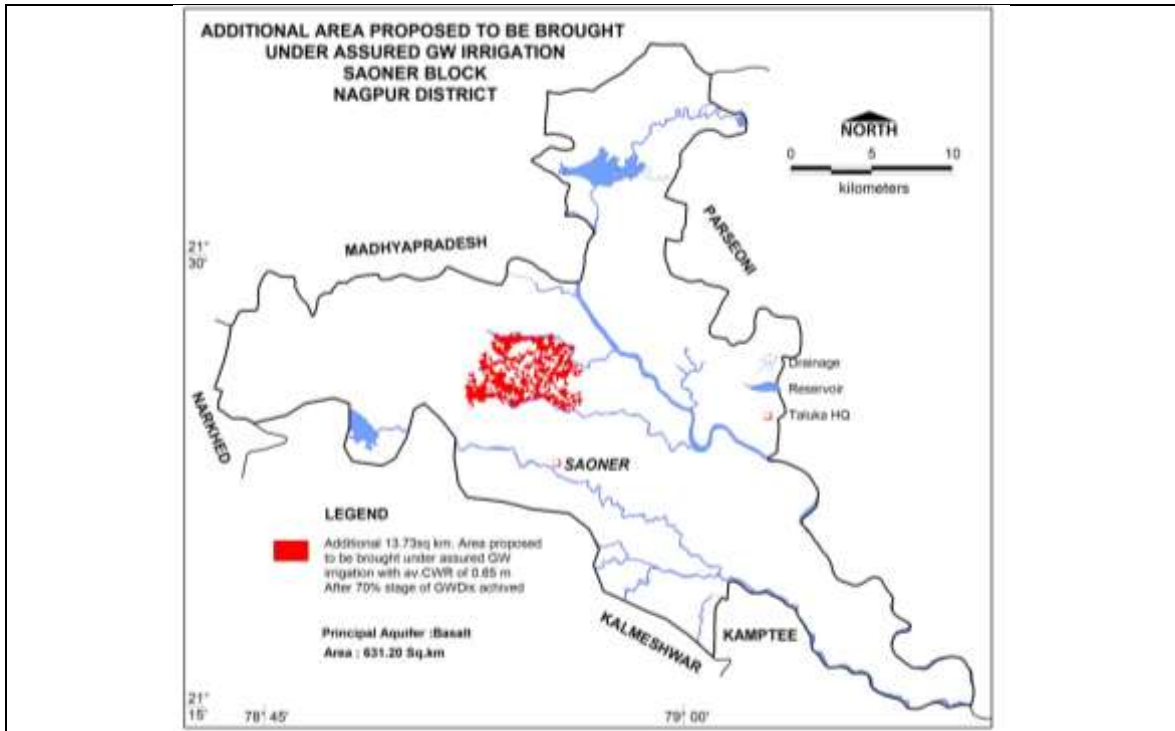
Ground Water Recharge Worthy Area (Sq. km.)	562.37
Total Annual Ground Water Recharge (MCM)	50.04
Natural Discharge (MCM)	3.32
Net Annual Ground Water Availability (MCM)	46.72
Existing Gross Ground Water Draft for irrigation (MCM)	29.13
Existing Gross Ground Water Draft for domestic and industrial water supply (MCM)	6.54
Existing Gross Ground Water Draft for All uses (MCM)	35.67
Provision for domestic and industrial requirement supply to 2025(MCM)	6.81
Net Ground Water Availability for future irrigation development (MCM)	10.97
Stage of Ground Water Development (%)	76.34
Category	Semi-Critical

5.2 Aquifer-II/Deeper Aquifer

Semi confined/Confined Aquifer (Basalt)							
District	Taluka	Mean thickness (m)	Area	Average Piezometric head (m)	Sy	S	Resource (MCM)
Nagpur	Savner	13.4375	562.37	49.9675	0.015	0.000482	1.718978
6.0. GROUND WATER MANAGEMENT							
6.1. Supply Side Management							
SUPPLY (MCM)							
Available Resource (MCM)						46.72	
Gross Annual Draft (MCM)						35.67	
Agricultural Demand –GW						29.1299	
Agricultural Demand –SW						0	
Domestic Demand – GW						6.5401	
Domestic Demand – SW						1.635025	
Total Demand						37.305025	
Area of Block (Sq. Km.)						618.59	
Area suitable for Artificial recharge (Sq. Km)						497.69	
Type of Aquifer							
Area feasible for Artificial Recharge (WL >3mbgl) (Sq. Km.)						336.45	
Volume of Unsaturated Zone (MCM)						841.12	
Average Specific Yield						0.020	
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)/Recharge Potential (MCM)						16.8224	
Surface water requirement @ 75% efficiency (MCM)						22.42986667	
Surplus water Available (MCM)						7.53648	
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)				3.96		1.70	
RTRWH Structures – Urban Areas							
Households to be covered (25% with 50 m2 area)						22052	
Total RWH potential (MCM)						1.097087	
Rainwater harvested / recharged to DW or BW of 50% household						11026	
However, it is economically not viable & hence, not recommended.							
6.2. Demand Side Management							
Micro irrigation techniques							
Sugarcane crop of about 2.02 sqkm area is ground water irrigated, 100 % ground water irrigated (2.02 sqkm) proposed to be covered under Drip (sq.km.)						2	
Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m						1.14	

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)	46.72
Additional GW resources available after Supply side interventions (MCM)	5.65
Ground Water Availability after Supply side intervention (MCM)	52.37
Existing Ground Water Draft for All Uses (MCM)	35.67
GW draft after Demand Side Interventions (MCM)	34.53
Present stage of Ground Water Development (%)	76.34
Expected Stage of Ground Water Development after interventions (%)	65.93
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
6.4. Development Plan	
GW available for Development Plan to bring SOD to 70%	2.13
Proposed no. of DW (@ 1.5 ham for 90% of GWR Available)	128
Proposed no. of BW (@ 1 ham for 10% of GWR Available)	21
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	13.73
Regulatory Measures	60 m
Proposed locations for AR structures	





P

ANCHAYAT LEVEL AQUIFER MANAGEMENT PLAN

- I. Sukali**
- II. Mandwa**
- III. Salai Godhni**
- IV. Dhanoli**

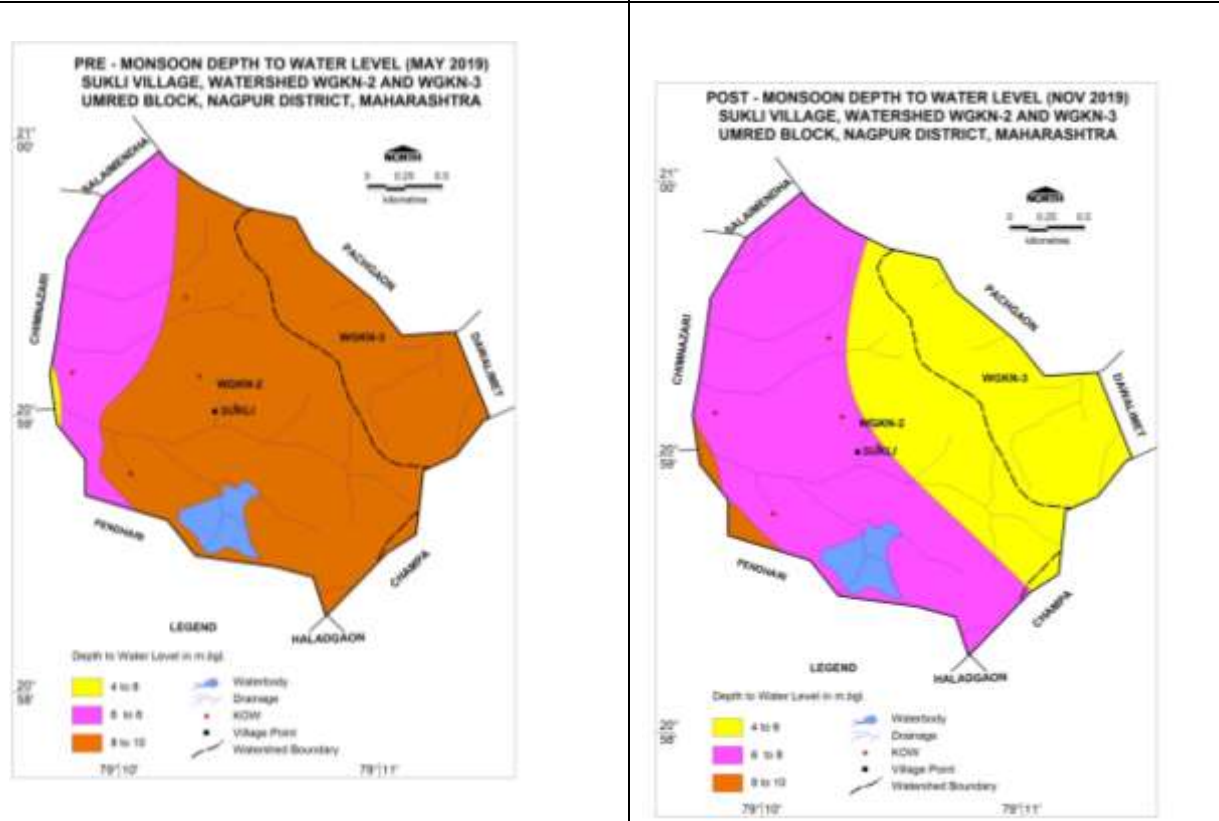
10. PANCHAYAT LEVEL AQUIFER MANAGEMENT PLAN

10.1 WATERSHEDS WGKN-2 and WGKN-3, SUKALI, UMRED BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Village Name	Sukali	
Geographical Area (Sq. Km.)	5.9659 sq km	
Hilly Area (Sq. Km)	Nil	
Population (Predicted -2019)	54	
Climate	Monsoon Tropical	
Normal Rainfall (mm) (nearest rain gauge station-Umred)	1179.7 mm	
Annual Rainfall (mm) 2009-18 (nearest rain gauge station-Umred)	1209 mm	
1.2. Geomorphology, Soil & Geology		
Geomorphic Unit	Plateau (slightly to moderately dissected).	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	BCS – Clayey to loamy.	
1.3. Hydrology & Drainage		
Watershed	WGKN -2; WGKN - 3	
Drainage	Godavari basin, Wainganga River with sub-dendritic drainage pattern.	
Irrigation Project (Major/Medium/Minor etc.)	Nil	
WC structures (PT / KT / CD / FP etc.)	01-CD, 1- Village Pond	
1.4. Land Use, Agriculture, Irrigation & Cropping Pattern		
Specifics	Area (Sq. Km.)	
Forest Area	1.76	
Cultivable Area	1.556	
Net Sown Area	1.556	
Double Cropped Area	1.1	
Irrigation Dug wells	Nil	
Irrigation Bore wells	Nil	
Area under Drip & Sprinkler Irrigation	Nil	
Area under Irrigation	Surface Water	Nil
	Ground Water	144.60 ha
Principal Crops (Reference year 2019-20)	Cotton	75.40 ha
	Soyabean	50.20 ha
	Pulses	18.70 ha
	Wheat	18.20 ha
	Gram	12.10 ha
	Vegetables	5 ha
1.5. Water Level Behaviour: Aquifer-I (Shallow Aquifer)		
Pre-Monsoon (May-2019) Based on pre-monsoon data from Key Observation wells in and around the village it	Post-Monsoon (November-2019) Based on post-monsoon data from Key Observation wells in and around the village	

is observed that in the north, north-east, east and central part, the DTWL ranges between 8-10 mbgl whereas in the north-west and south-west DTWL ranges between less than 8 mbgl.

it is observed that north east and eastern part of the village shows DTWL in the range of 4-6 mbgl. In the north-western, south and south western part a long patch of DTWL ranging upto 10 mbgl is observed.



2. Ground Water Issues

Non-availability of surface and Groundwater for irrigation.
Less ground water potential of aquifer.

3. AQUIFER DISPOSITION

3.1. Number of Aquifers	Basalt –Aquifer-I (Phreatic / Shallow aquifer)
3.2. Aquifer Characteristics	
Major Aquifers	Basalt (Deccan Traps)
Type of Aquifer	Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Static Water Level (mbgl)	3.6
Depth of Occurrence (mbgl)	10.00
weathered/fractured rocks thickness (m)	0-8
Specific yield (Sy)	0.02

4. GROUND WATER QUALITY: Phreatic Aquifer (Aquifer-I/ Shallow aquifer)

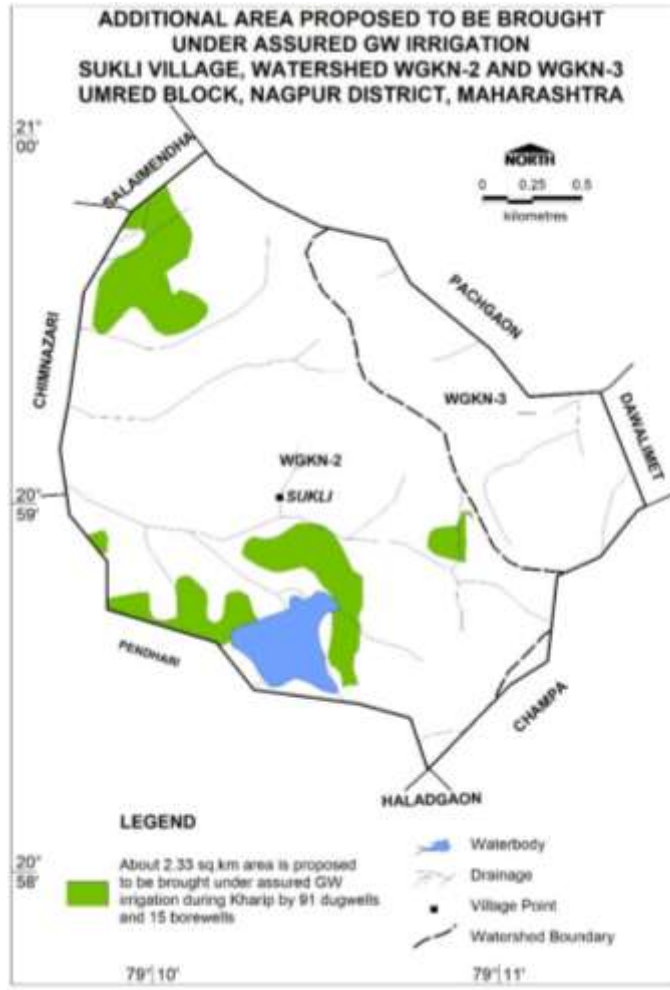
Except Sulphate, which is above MPL, rests of the parameters are within MPL. The quality of ground water is good and fit for drinking after proper treatment, domestic and irrigation purpose.

PH	EC	TDS	TH	Ca	Mg	Na	K	CO ₃	HCO ₃	Cl	SO ₄	NO ₃	F
8.2	1698	1104	335	46	53	237	4	0	140	323	259	20	12.2

5. GROUND WATER RESOURCES- Aquifer-I/ Shallow Phreatic Aquifer (Basalt)		
5.1 Water budgeting		
A. Water availability		
Area (ha)	596.59	
Rainfall (m)	1.209	
Water precipitated, ham, (Area X RF)	721.28	
90 % of precipitations (ham)	1.088	
AR recharge by artificial recharge structure (mcm)	0.0012	
Runoff (2.5%) (RF-AR) (ham)	16.23	
Evaporation (35%) (ham)	227.20	
Water retained in ground Tank, Nala etc. (5%) (ham)	32.46	
Recharge to phreatic aquifer (10%) (ham)	64.92	
Enhance soil moisture, utilised by root system (ham)	194.75	
Total Water availability (MCM)	2.92	
B. Requirement		
Domestic @60 lpcd X total person (54) (MCM)	0.0012	
Animal @40 lpad X total animal (210) (MCM)	0.0031	
Irrigation water applied (MCM)	0.31	
Non agriculture use (MCM)	0.06	
Total Requirement (MCM)	0.38	
C. GW available for Planning (MCM)	2.54	
Stage of GW Development (%)	13.06	
6.0. GROUND WATER RESOURCE MANAGEMENT		
6.1. Supply Side Management		
SUPPLY (MCM)		
Available Resource (MCM)	2.92	
Agricultural Supply –GW	0.31	
Agricultural Supply -SW	0.00	
Domestic Supply - GW	0.0042	
Domestic Supply - SW	0.00	
Non agriculture use (MCM)	0.06	
Total GW availability (MCM)	2.54	
Gross Annual Draft (MCM)	0.38	
Area of Block (Sq. Km.)	5.9659	
Area suitable for Artificial recharge (Sq. Km)	5.97	
Type of Aquifer	Hard rock	
Area feasible for Artificial Recharge (WL >5mbgl) (Sq. Km.)	5.368	
Volume of Unsaturated Zone (MCM)	0.000013	
Average Specific Yield	0.02	
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)	0.00000027	
Surplus water Available (MCM)	16.23	
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)

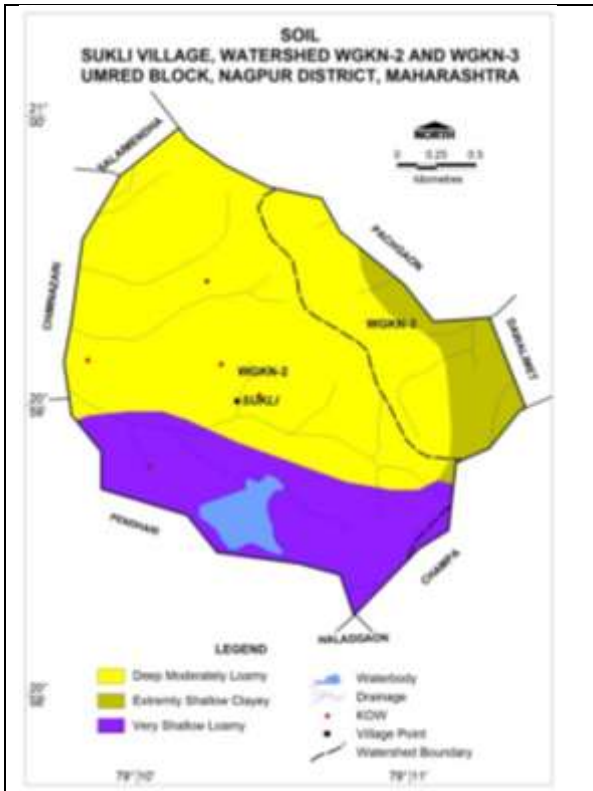
	TCM)	
Number of Structures	Not Proposed	Not Proposed
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)		
Specific Recommendations As per State Govt. Resolution, segment wise nala/stream (on 2 nd and 3 rd order streams /nala's) desilting, deepening and widening upto 3 m depth or upto weathered rock considering the local hydrogeological condition without disturbing the ecology/aquifer/environmental flow of nala/stream.		Not Proposed
Considering average nala deepening of 1 m depth, additional storage		--
Considering average nala deepening of 1 m depth, additional recharge @ 75%		--
RTRWH Structures		
Households to be covered (25% with 50 m ² area)		227
Total RWH potential (MCM)		0.0000499
Rainwater harvested / recharged @ 80% runoff co-efficient		0.0000400
However, RTRWH is economically not viable & not Recommended.		
6.2. Demand Side Management		
Micro irrigation techniques		
Area is proposed to be covered under Drip		Not Proposed
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)		Not proposed
6.3. Expected Benefits		
Net Ground Water Availability (MCM)		2.92
Additional GW resources available after Supply side interventions (MCM)		0.00
Ground Water Availability after Supply side intervention (MCM)		2.92
Existing Ground Water Draft for All Uses (MCM)		0.38
GW draft after Demand Side Interventions (MCM)		0.00
Present stage of Ground Water Development (%)		13.06
Expected Stage of Ground Water Development after interventions (%)		13.06
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 65% (MCM)		1.52
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)		91
Proposed Number of BW (@ 1.0 ham for 10% of GWR Available)		15
Area (ha) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 65% stage of GWD is achieved		233.44
Regulatory Measures	60m borewells/tube wells	

Panchayat Management Plan

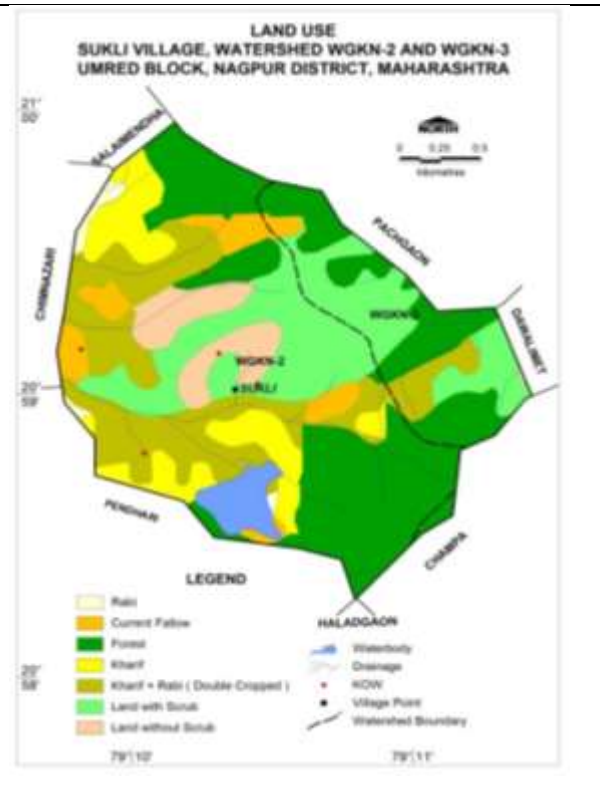


Soil map

Landuse map

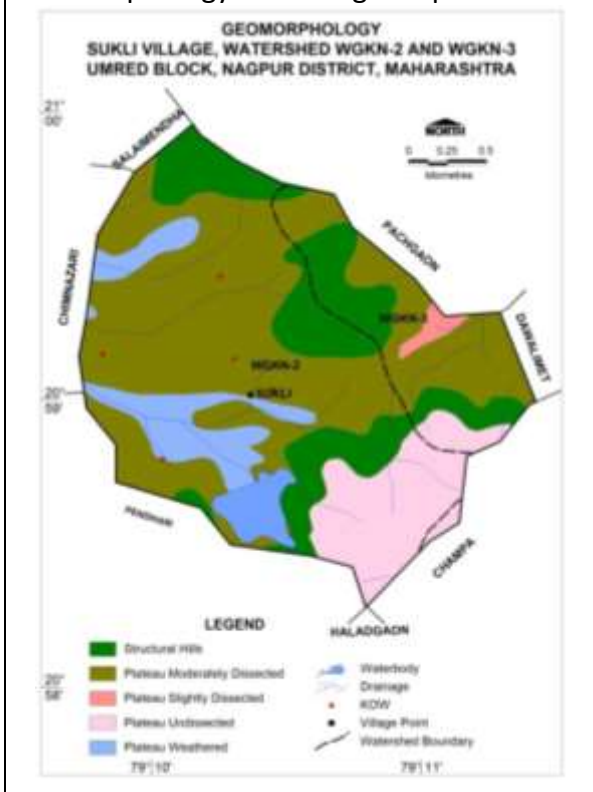


In the village major area is covered by deep loamy soil covering 6.889 sq.km area whereas in some parts such as in south side shallow loamy soil is observed.



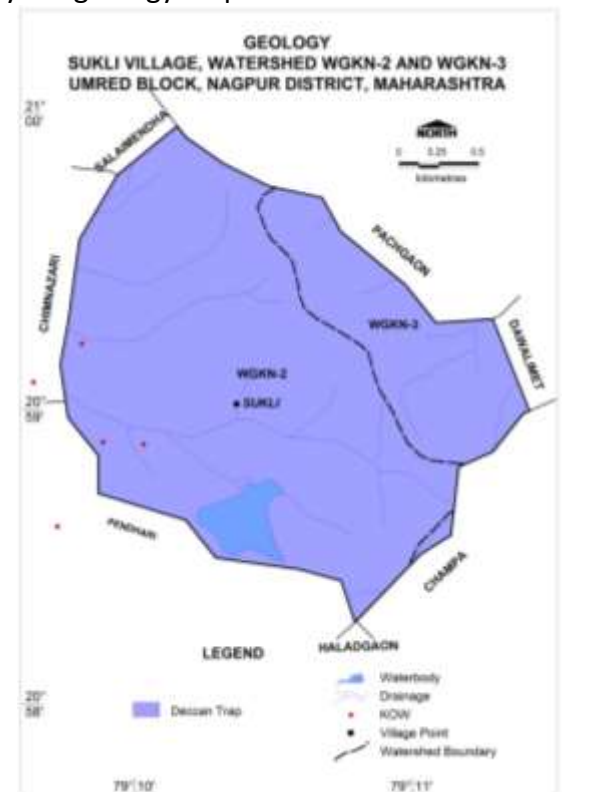
In the village major cultivable land is under double cropping pattern covering 3.619 sq.km. whereas 2.026 sq.km area is under kharif.

Geomorphology & Drainage map



Major part of the village shows moderately

Hydro-geology map



Entire village is covered by Deccan trap Basalt

<p>dissected plateau. In the south-east part of the village undissected plateau is observed, while few structural hillocks are found in the village in north, central and south-east parts.</p>	<p>except in the small part in north-west and north, north-east part of the village is covered by residual Laterite capping.</p>
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Panchayat Level Aquifer Management Plan

Village – Sukali, Umred Block, Nagpur District

Aquifer (Prominent Lithology)	Current Scenario	Geology	Geomorphology	Ground water quality	Recommendations for Aquifer Development					Aquifer Management Plan
					Type/number	Zones/Depth to be tapped	HP of pump to be lowered	Pumping Hours	Yield (Cu. m / Day)	
Aquifer I (Basalt- Weathered and fractures)	144.60 ha cultivable land, 1 CD, 1 village farm, 17- DW, SOD-13.06 %	Deccan Trap Basalt	Plateau (Moderately dissected to un dissected)	Quality of ground water is good and fit for drinking, domestic and irrigation purpose; All parameters are within MPL except sulphate contamination.	Dug well / 91	Depth Range of Zones : 6 – 15 m	3 to 5	1 to 4	< 10 – 200 m ³ /day Or 0.7 ham/year	<ol style="list-style-type: none"> About 255.91 ha area is proposed to be brought under assured GW irrigation during Rabi. The DW should be used for irrigation purpose. Desilting of existing water conservation and artificial recharge structures.
Aquifer II (Basalt- Jointed & Fractures)	-	-	--	Not assessed	Bore well / 15	Depth : 60 m	3 to 5	3 to 8	0.14-2.16 lps	<ol style="list-style-type: none"> The BW should be used for drinking purpose. BW should not be drilled down below the red bole and depth not more than 60 m

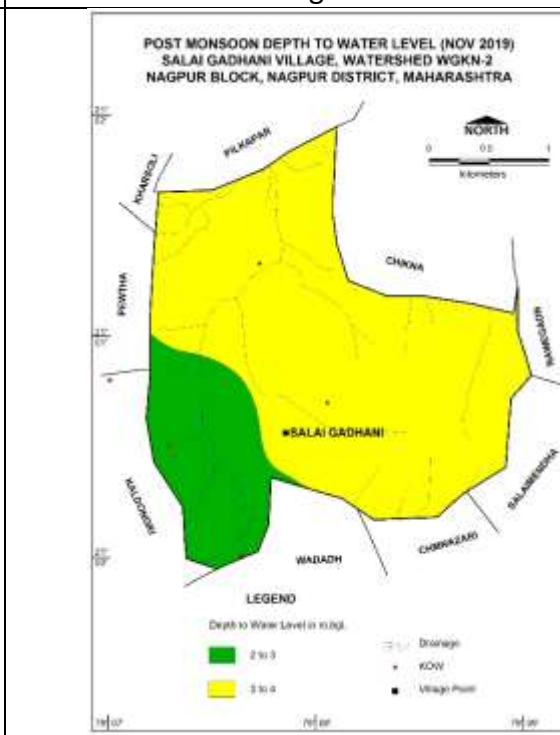
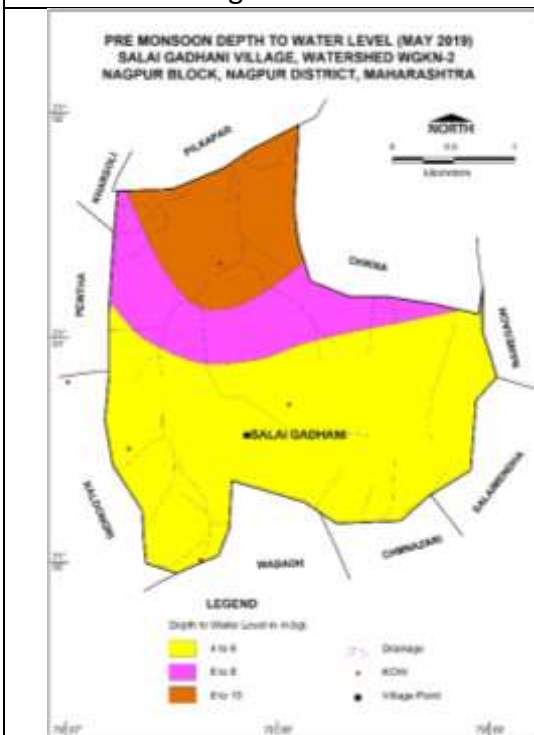
Note: DW (d) = Dug well Domestic; DW (i) = Dug Well Irrigation; BW(d) = Bore Well Domestic; BW(i) = Bore Well Irrigation

10.2 WATERSHEDS WGKN-2, VILLAGE SALAI GODHANI, NAGPUR (RURAL) BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Village Name	Salai Godhni	
Geographical Area (Sq. Km.)	7.26	
Hilly Area (Sq. Km.)	Nil	
Population (Current year -2019)	871	
Climate	Monsoon Sub-Tropical	
Normal Rainfall (mm) (nearest rain gauge station- Nagpur)	1.2	
Annual Rainfall (mm) 2019 (nearest rain gauge station- Nagpur)	1.1	
1.2. Geomorphology, Soil & Geology		
Geomorphic Unit	Plateau (slightly dissected to Weathered, moderately dissected).	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Very shallow loamy to deep moderately loamy soil.	
1.3. Hydrology & Drainage		
Watershed	WGKN-2	
Drainage	Godavari basin with dendritic to sub-dendritic drainage pattern.	
Irrigation Project (Major/Medium/Minor etc.)	Nil	
WC structures (PT / KT / CD / FP etc.)	01-Village farm	
1.4. Land Use, Agriculture, Irrigation & Cropping Pattern		
Specifics	Area	
Forest Area	Nil	
Cultivable Area	210 ha	
Net Sown Area	210 ha	
Double Cropped Area	Nil	
Irrigation Dug wells	39	
Irrigation Bore wells	10	
Area under Drip & Sprinkler Irrigation	Nil	
Area under Irrigation	Surface Water	Nil
	Ground Water	210 ha
Principal Crops (Reference year 2019)	Soyabean	80 ha
	Wheat	30 ha
	Gram	25 ha
	Pulses	15 ha
	Jawari	5 ha
	Cotton	75 ha
	Other	31 ha
1.5. Water Level Behaviour: Aquifer-I (Shallow Aquifer)		
In the village, 08 KOW were established to decipher the water level scenario.		
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)	

In the village major shows the DTWL ranges between 4-6 mbgl whereas in the northern part DTWL ranges between more than 6 mbgl.

Major area of the village shows DTWL in the range of 3-4 mbgl DTWL. While a small, isolated patch of the DTWL 2-3 mbgl is observed in the south-west of the village.



2. GROUND WATER ISSUES

- Declining water level.
- Non-availability of surface water for irrigation.
- Less ground water potential basaltic aquifer.
- Water stress situation during lean period (March to June).

3. AQUIFER DISPOSITION

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

3.2. Aquifer Characteristics

Major Aquifers	Basalt (Deccan Traps)
Type of Aquifer	Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Static Water Level (mbgl)	3-8.7
Depth of Occurrence (mbgl)	3-6
weathered thickness (m)	1.5-3
Specific yield (Sy)	0.02 (norms)

GROUND WATER QUALITY: Phreatic Aquifer (Aquifer-I/ Shallow aquifer)
 All the parameters are within the desirable/Permissible limits of BIS Drinking Water Standards IS- 10500-2012. Hence the ground water is *suitable* for drinking purposes & also can be used for agricultural purposes& other domestic use purposes.

PH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
7.56	564	367	155	52	6	58	2	0	214	25	48	25	0.67

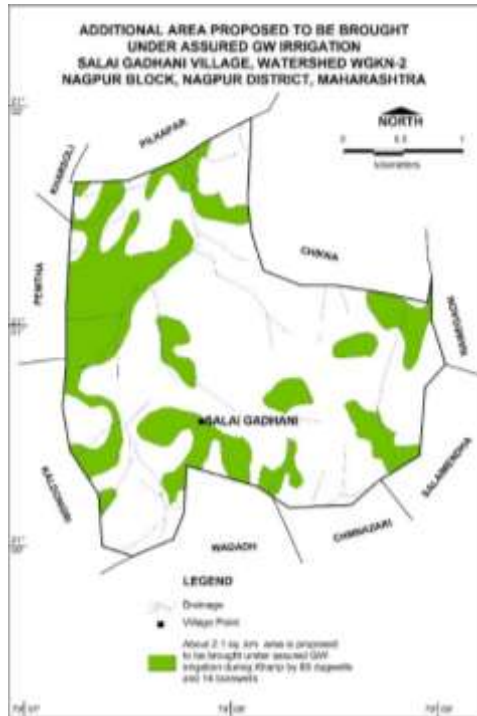
5. GROUND WATER RESOURCES- Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

5. 1 Water budgeting

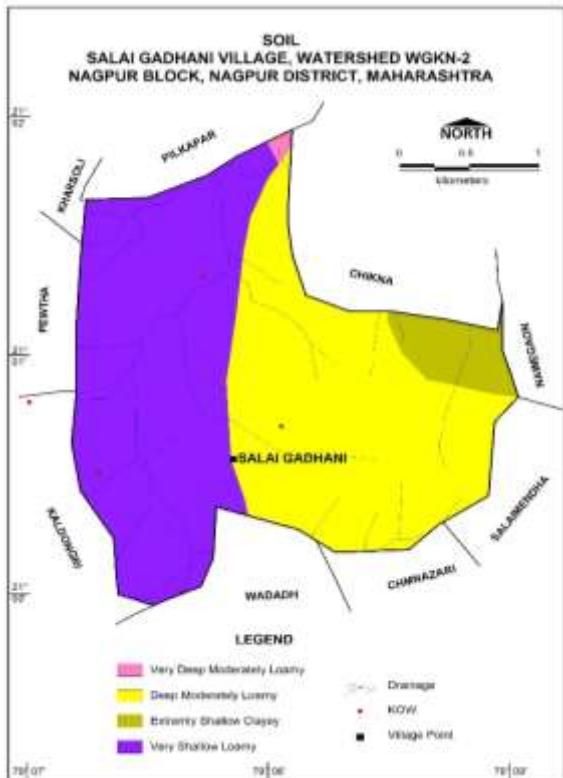
A. Water availability	
Area (ha)	726.07
Rainfall (m)	1.1
Water precipitated, ham, (Area X RF)	798.68
90 % of precipitations (ham)	718.81
AR recharge by artificial recharge structure	nil
Runoff (2.5%)(RF-AR) (ham)	17.9702
Evaporation (35%) (ham)	251.5833
Water retain in ground Tank, Nala etc. (5%) (ham)	35.9405
Recharge to phreatic aquifer (10%) (ham)	71.8809
Enhance soil moisture, utilised by root system (ham)	215.6428
Total Water availability (MCM)	3.2346
B. Requirement	
Domestic @60 lpcd X total person (MCM)	0.0190749
Animal @40 lpad X total animal (MCM)	0.0139868
Irrigation water applied (MCM)	0.43
Non agriculture use (MCM)	0.14
Total Requirement (MCM)	0.61
C. GW available for Planning (MCM)	2.63
Stage of GW Development (%)	18.74
GROUND WATER RESOURCE MANAGEMENT	
6.1. Supply Side Management	
SUPPLY (MCM)	
Available Resource (MCM)	3.23
Agricultural Supply –GW	0.43
Agricultural Supply -SW	0.00
Domestic Supply - GW	0.03
Domestic Supply - SW	0.00
Non agriculture use (MCM)	0.14
Total GW availability (MCM)	2.63
Gross Annual Draft (MCM)	0.61
Area of village (Sq. Km.)	7.2607
Area suitable for Artificial recharge (sq km)	7.26
Type of Aquifer	Hard rock
Area feasible for Artificial Recharge (WL >5mbgl) (Sq. Km.)	4.119
Volume of Unsaturated Zone (MCM)	0.000010297500
Average Specific Yield	0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)	0.000000205950
Surplus runoff considered for planning (MCM) @ 100%	17.97
Proposed AR Structures (Check Dam, Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	Not proposed
Proposed AR Structures Gabion	Not proposed
Proposed AR Structures Other	Not proposed
Volume of Water expected to be conserved / recharged @ 75%	

efficiency (MCM)	
Specific Recommendations - As per State Govt. Resolution, segment wise nala/stream desilting, deepening, and widening upto 3 m depth or upto weathered rock considering the local hydrogeological condition without disturbing the ecology/aquifer/environmental flow of nala/stream.	Not proposed
Considering average nala deepening of 1 m depth, additional storage	
Considering average nala deepening of 1 m depth, additional recharge @ 75%	
RTRWH Structures	
Households to be covered (Pakka House only)	378
Total RWH potential (MCM) (25% with 50 m ² area)	0.0000499
Rainwater harvested / recharged @ 80% runoff co-efficient (MCM)	0.0000400
<i>However, RTRWH is economically not viable & not Recommended</i>	
6.2. Demand Side Management	
Micro irrigation techniques	
Area is proposed to be covered under Drip	Not proposed
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.36 m. Drip Req. - 0.24, WUE- 0.12 m	--
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	
6.3. Expected Benefits	
Net Ground Water Availability (MCM)	3.23
Additional GW resources available after Supply side interventions (MCM)	0.00
Ground Water Availability after Supply side intervention (MCM)	3.23
Existing Ground Water Draft for All Uses (MCM)	0.61
GW draft after Demand Side Interventions (MCM)	0.00
Present stage of Ground Water Development (%)	18.74
Expected Stage of Ground Water Development after interventions (%)	18.74
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 65% (MCM)	1.39
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	83
Proposed Number of BW (@ 1.0 ham for 10% of GWR Available)	14
Area (ha) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 65% stage of GWD is achieved	214.02

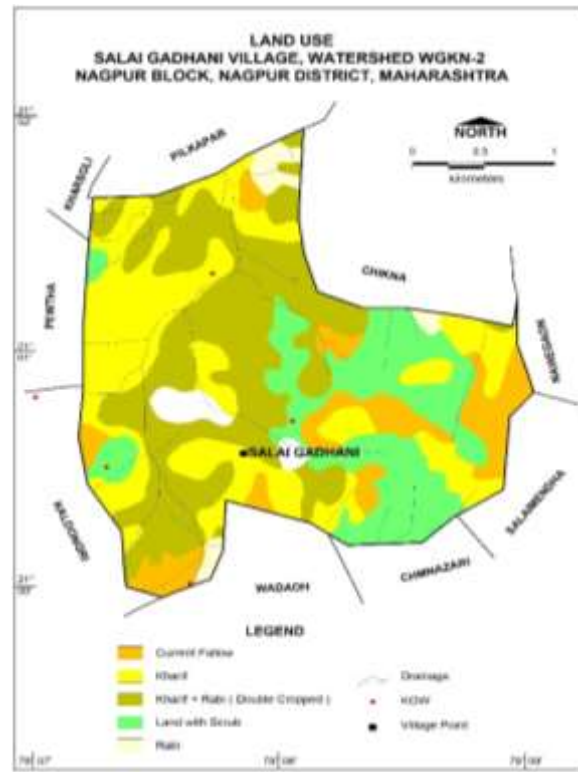
Panchayat Management Plan



Soil map



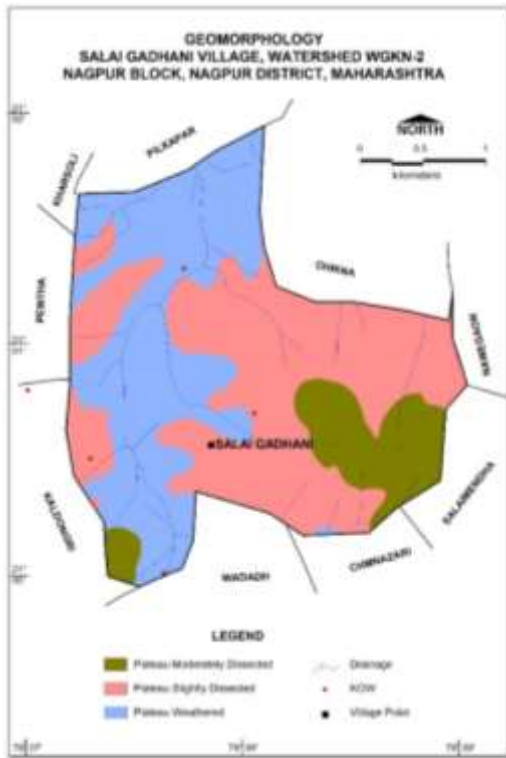
Landuse map



In the village half of the area is covered by very shallow loamy soil such as in north-west and West, south west. Similarly, in north-east and east, deep moderately loamy soil is observed.

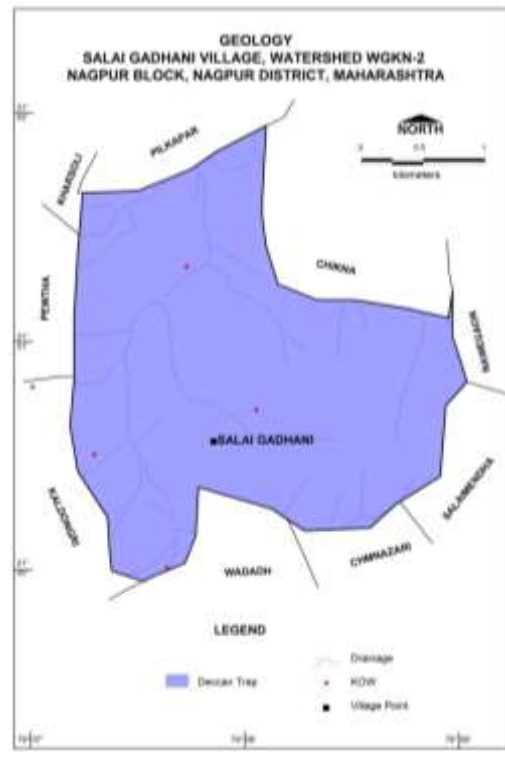
In the village major cultivable land is under Kharif cropping pattern.

Geomorphology & Drainage map



Major part of the village shows plateau weathered to slightly dissected. In the south-east part of the village moderately dissected plateau is observed.

Hydro-geology map



Entire village is covered by Deccan trap Basalt.

Panchayat Level Aquifer Management Plan

Village – Salai Godhni, Nagpur (Rural) Taluka, Nagpur District

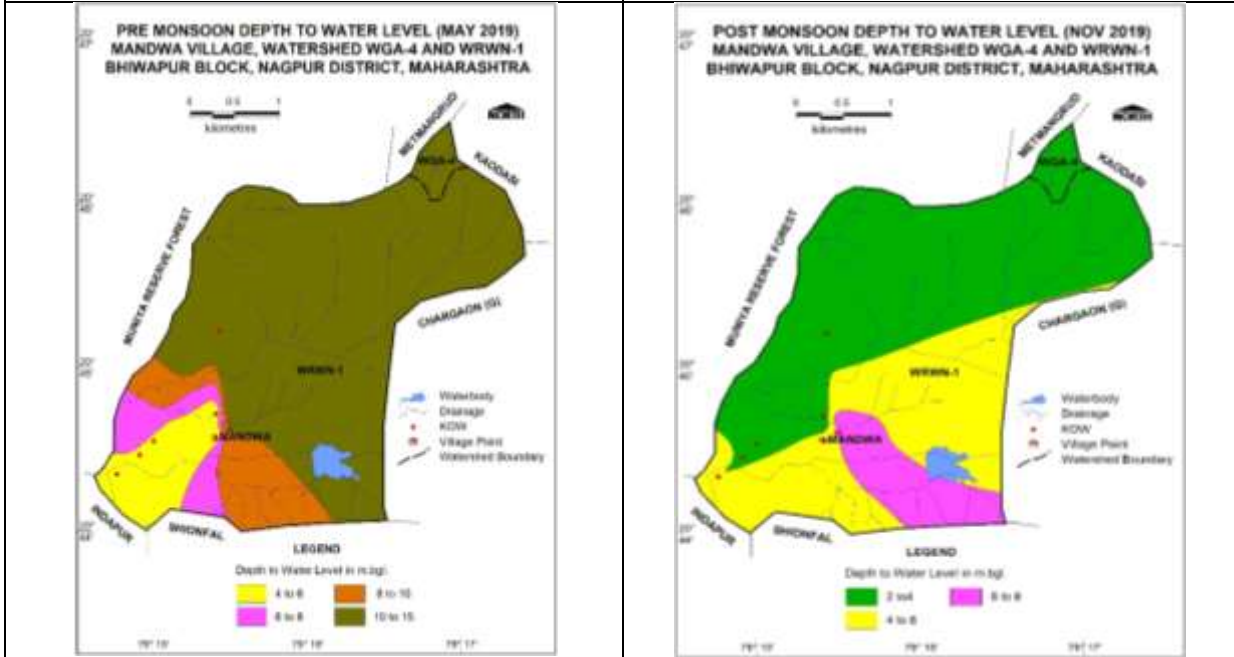
Aquifer (Prominent Lithology)	Current Scenario	Geology	Geomorphology	GW quality	Recommendations for Aquifer Development					Aquifer Management Plan
					Type	Zones/Depth to be tapped	HP of pump to be lowered	Pumping Hours	Yield (Cu. m / Day)	
Aquifer I (Basalt-Weathered and fractures)	210 ha cultivable land by GW, 1 village farm, 40 DW, 13 BW, SOD-18.74%	DT Basalt	Plateau (slightly dissected to Weathered, moderately dissected).	Quality of ground water is good and fit for drinking, domestic and irrigation purpose; All parameters are within MPL.	Dug well 83	Depth Range of Zones : 6 – 15 m	3 to 5	1 to 4	< 10 – 200 m ³ /day Or 0.7 ham/year	<ol style="list-style-type: none"> About 255.07 ha area is proposed to be brought under assured GW irrigation during Rabi. Desilting of existing water conservation and artificial recharge structures. The DW should be used for irrigation purpose.
Aquifer II (Basalt-Jointed & Fractures)	13 BW	As above	--	Not assessed	Bore well 14	Depth : 60 m	3 to 5	1 to 3	0.14-2.16 lps	<ol style="list-style-type: none"> The BW should be used for drinking purpose. The BW should not be drilled down below the red bole.

Note: DW(d)= Dug well Domestic; DW (i)= Dug Well Irrigation; BW(d)= Bore Well Domestic; BW(i)= Bore Well Irrigation

10.3 WATERSHEDS WGA- 4 and WRWN-1, VILLAGE MANDWA, BHIWAPUR BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Village Name	Mandwa	
Geographical Area (Sq. Km.)	11.49	
Hilly Area (Sq. Km.)		
Population (Current year -2019)	1974	
Climate	Monsoon Sub-Tropical	
Normal Rainfall(mm)(nearest rain gauge station-Bhiwapur)	1.3	
Annual Rainfall (mm) 2009-18(nearest rain gauge station-Bhiwapur)	1.6	
1.2. Geomorphology, Soil & Geology		
Geomorphic Unit	Plateau moderately to slightly dissected.	
Geology	Deccan Traps (Basalt) Age: Late Cretaceous to Eocene	
Soil	Shallow to deep loamy soil.	
1.3. Hydrology & Drainage		
Watershed	WGA -4 and WRWN -1	
Drainage	Wainganga river and its tributaries. Godavari basin with dendritic to sub-dendritic drainage pattern.	
Irrigation Project (Major/Medium/Minor etc.)	Nil	
WC structures (PT/KT/CD/FP etc.)	10-CD, 02-PT	
1.4. Land Use, Agriculture, Irrigation & Cropping Pattern		
Specifics	Area (sq km)	
Forest Area	5.3	
Cultivable Area	4.65	
Net Sown Area	4.65	
Double Cropped Area	Nil	
Irrigation Dug wells (no.)	110	
Irrigation Bore wells(no.)	-	
Area under Drip & Sprinkler Irrigation	-	
Area under Irrigation	Surface Water	Nil
	Ground Water	464.78 ha
Principal Crops (Reference year 2018)	Soyabean	100 ha
	Maize	4 ha
	Cotton	300 ha
	Soyabean	100 ha
	Gram	30 ha
	Wheat	40 ha
	Vegetables	91 ha
1.5. Water Level Behaviour: Aquifer-I (Shallow Aquifer)		
In the village, 07 KOW were established to decipher the water level scenario.		

<p>Pre-Monsoon (May-2019) Most of the area of the village DTWL ranges 10-15 mbgl whereas In the south western part of the village DTWL ranges less than 10 mbgl.</p>	<p>Post-Monsoon (November-2019) Major area of the village shows DTWL in the range of 2-4 mbgl. A patch of DTWL ranging 6-8 mbgl is observed in southern part. Rest of the area shows DTWL 4-6 mbgl.</p>
--	---



2. Ground Water Issues

Declining water level.
 Non availability of surface water for irrigation.
 Less ground water potential basaltic aquifer.
 Water stress situation during lean period (March to June).

3. AQUIFER DISPOSITION

3.1. Number of Aquifers	Basalt –Aquifer-I (Phreatic / Shallow aquifer)
3.2. Aquifer Characteristics	
Major Aquifers	Basalt (Deccan Traps)
Type of Aquifer	Basalt –Aquifer-I (Phreatic / Shallow aquifer)
Static Water Level (m bgl)	3-6
Depth of Occurrence (m bgl)	6-11
weathered thickness (m)	1.5-2
Specific yield (Sy)	0.02

4. GROUND WATER QUALITY: Phreatic Aquifer (Aquifer-I/ Shallow aquifer)
 All the parameters are within the desirable/Permissible limits of BIS Drinking Water Standards IS- 10500-2012. Hence the ground water is suitable for drinking purposes & also can be used for agricultural purposes & other domestic use.

PH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
7.47	392	255	145	26	19	23	2	0	73	71	29	3	0.43

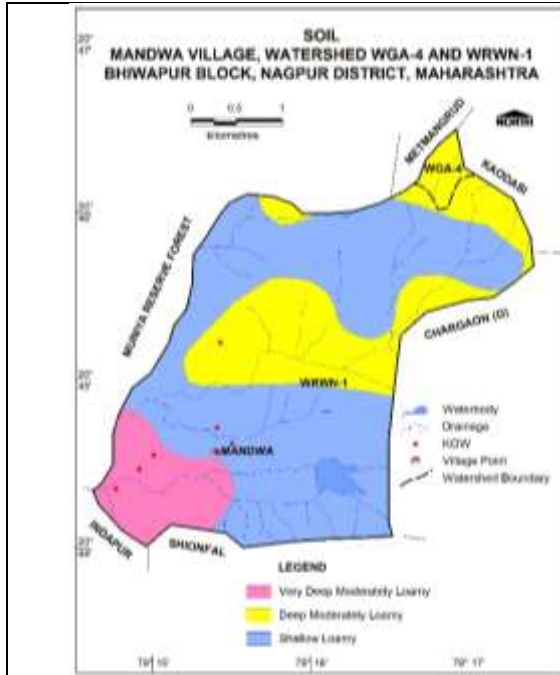
5. GROUND WATER RESOURCES- Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

5. 1 Water budgeting	
A. Water availability	
Area (ha)	1148.93

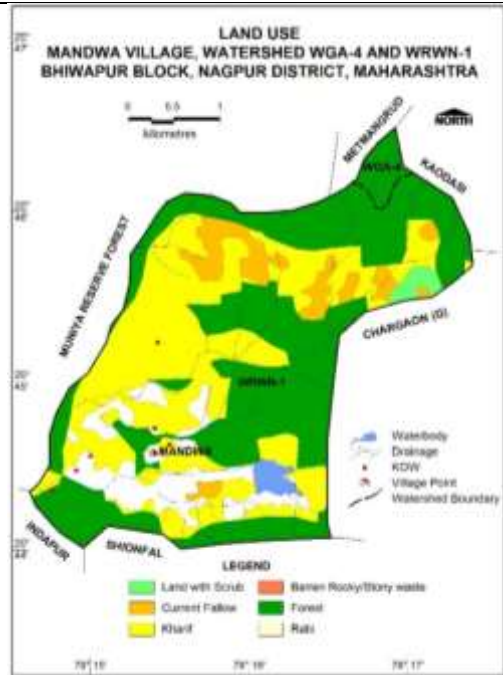
Rainfall (m)	1.23
Water precipitated, ham, (Area X RF)	1409.74
90 % of precipitations (ham)	1268.76
AR recharge by artificial recharge structure	0.8120
Runoff (2.5%) (RF-AR) (ham)	31.6988
Evaporation (35%) (ham)	444.0672
Water retained in ground Tank, Nala etc. (5%) (ham)	63.4382
Recharge to phreatic aquifer (10%) (ham)	126.8763
Enhance soil moisture, utilised by root system (ham)	380.6290
Total Water availability (MCM)	5.7176
B. Requirement	
Domestic @60 lpcd X total person (MCM)	0.0432306
Animal @40 lpad X total animal (MCM)	0.0292000
Irrigation water applied (MCM)	1.48
Non agriculture use (MCM)	0.13
Total Requirement (MCM)	1.68
C. GW available for Planning (MCM)	4.04
Stage of GW Development (%)	29.40
6.0. GROUND WATER RESOURCE MANAGEMENT	
6.1. Supply Side Management	
SUPPLY (MCM)	
Available Resource (MCM)	5.72
Agricultural Supply –GW	1.42
Agricultural Supply -SW	0.00
Domestic Supply - GW	0.07
Domestic Supply - SW	0.00
Non agriculture use (MCM)	0.13
Total GW availability (MCM)	4.10
Gross Annual Draft (MCM)	1.68
Area of village (Sq. Km.)	11.4893
Area suitable for Artificial recharge (sq km)	11.49
Type of Aquifer	Hard rock
Area feasible for Artificial Recharge (WL >5mbgl) (Sq. Km.)	4.119
Volume of Unsaturated Zone (MCM)	0.000010297500
Average Specific Yield	0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)	0.000000205950
Surplus runoff considered for planning (MCM) @ 100%	31.70
Proposed AR Structures (Check Dam Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM))	Not proposed
Proposed AR Structures Gabion	Not proposed
Proposed AR Structures Other	Not proposed
Volume of Water expected to be conserved /	Not proposed

recharged @ 75% efficiency (MCM)	
Specific Recommendations - As per State Govt. Resolution, segment wise nala/stream desilting, deepening and widening upto 3 m depth or upto weathered rock considering the local hydrogeological condition without disturbing the ecology/aquifer/environmental flow of nala/stream.	0.00
Considering average nala deepening of 1 m depth, additional storage	0.00
Considering average nala deepening of 1 m depth, additional recharge @ 75%	0.00
RTRWH Structures	
Households to be covered (Pakka House only)	
Total RWH potential (MCM) (25% with 50 m2 area)	
Rainwater harvested / recharged @ 80% runoff co-efficient (MCM)	
<i>However, RTRWH is economically not viable & not Recommended</i>	
6.2. Demand Side Management	
Micro irrigation techniques	
Area is proposed to be covered under Drip	Not proposed
Volume of Water expected to be saved (MCM). Surface Flooding req- 1.4 m. Drip Req. - 0.95, WUE- 0.45 m	
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	
6.3. Expected Benefits	
Net Ground Water Availability (MCM)	5.72
Additional GW resources available after Supply side interventions (MCM)	0.00
Ground Water Availability after above intervention (MCM)	5.72
Existing Ground Water Draft for All Uses (MCM)	1.68
GW draft after Demand Side Interventions (MCM)	0.00
Present stage of Ground Water Development (%)	29.40
Expected Stage of Ground Water Development after interventions (%)	29.40

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)	2.04
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	122
Proposed Number of BW (@ 1.0 ham for 10% of GWR Available)	20
Area (ha) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 65% stage of GWD is achieved	313.15
Regulatory Measures	60m borewells/tube wells
Panchayat Management Plan	
Soil map	Landuse map

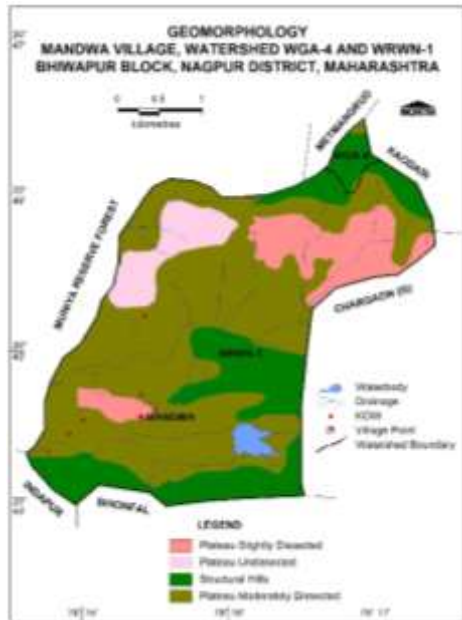


In the village major area is covered by shallow loamy soil whereas in some parts such as in south-West moderately loamy soil is observed. Similarly, small patches in North and central and east part deep loamy soil are observed.



In the village major cultivable land is under Kharif cropping pattern. Some area is under Rabi crops.

Geomorphology & Drainage map



Major part of the village shows plateau moderately dissected. the village while plateau slightly dissected is observed in north-eastern part of the village, some patches slightly dissected south-west side of the village.

Hydro-geology map



Entire village is covered by Deccan trap Basalt.

Panchayat Level Aquifer Management Plan

Village – Mandwa, Bhiwapur Taluka, Nagpur District

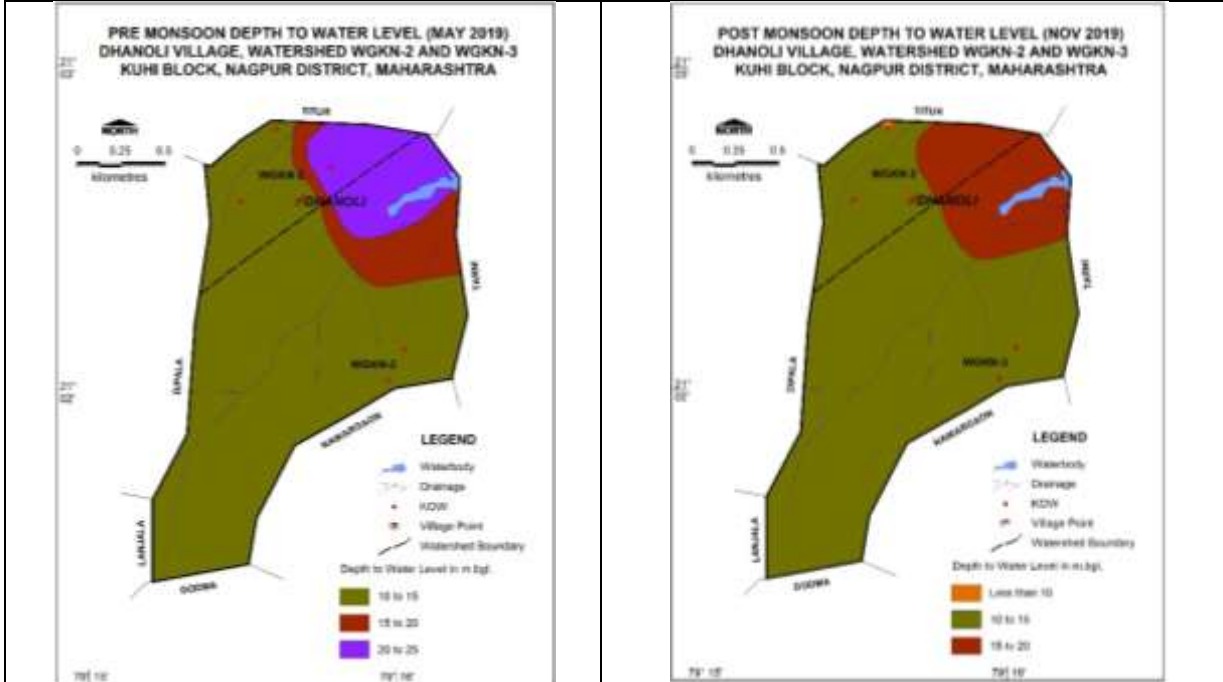
Aquifer (Prominent Lithology)	Current Scenario	Geology / Basalt flow	Geomorphology	GW quality	Recommendations for Aquifer Development					Aquifer Management Plan
					Type	Zones/Depth to be tapped	HP of pump to be lowered	Pumping Hours	Yield (Cu. m / Day)	
Aquifer I (Basalt- Weathered and fractures)	464.78 ha cultivable land, 30- CD, 02-PT, 40 LBS, 123 DW;	DT Basalt (Sahyadri Group), Aa /pahoehoe /simple basaltic lava flows (Buldana / Purandargarh Formation)	Plateau moderately dissected to slightly dissected	Quality of ground water is good and fit for drinking, domestic and irrigation purpose; All parameters are within MPL.	Dug wells- 122	Depth Range of Zones: 6 – 15 m	3 to 5	1 to 4	< 10 – 200 m ³ /day Or 0.7 ham/year	<ol style="list-style-type: none"> About 313.15 ha area is proposed to be brought under assured GW irrigation during Rabi. Desilting of existing water conservation and artificial recharge structures. The DW should be used for irrigation purpose.
Aquifer II (Basalt- Jointed & Fractures)	-	As above	--		Bore wells- 20	Depth: 60 m	3 to 5	1 to 3	0.14-2.16 lps	<ol style="list-style-type: none"> The BW should be used for drinking purpose.

Note: DW(d)= Dug well Domestic; DW (i)= Dug Well Irrigation; BW(d)= Bore Well Domestic; BW(i)= Bore Well Irrigation

10.4 WATERSHEDS WGKN-2 AND WGKN-3, VILLAGE DHANOLI, KUHI BLOCK, NAGPUR DISTRICT, MAHARASHTRA

1. SALIENT FEATURES		
1.1 Introduction		
Village Name	Dhanoli	
Geographical Area (Sq. Km.)		
Hilly Area (Sq. Km.)		
Population (Current year -2019)		
Climate	Monsoon Sub-Tropical	
Normal Rainfall (mm) (nearest rain gauge station-Kuhi)	1309.5	
Average Annual Rainfall (mm) 2019 (nearest rain gauge station-Kuhi)	1356	
1.2. Geomorphology, Soil & Geology		
Geomorphic Unit	Pediplain area.	
Geology	Granite Gneiss Age: Archeans	
Soil	Very deep moderately loamy soil.	
1.3. Hydrology & Drainage		
Watershed	WGKN-2 , WGKN-3	
Drainage	Godavari basin; Dendritic to sub-dendritic drainage pattern.	
Irrigation Project (Major/Medium/Minor etc.)	Nil	
WC structures (PT / KT / CD / FP etc.) *CFP-Community Farm pond	Nil	
1.4. Land Use, Agriculture, Irrigation & Cropping Pattern (Data collected field /Irrigation Dept)		
Specifics	Area Sq km	
Forest Area	Nil	
Cultivable Area	2.64	
Net Sown Area	2.64	
Double Cropped Area	0.2	
Irrigation Dug wells	Nil	
Irrigation Bore wells	Nil	
Area under Drip & Sprinkler Irrigation	Nil	
Area under Irrigation	Surface Water	Nil
	Ground Water	263.99 ha
Principal Crops (Reference year 2019)	Soyabean	23.50 ha
	Cotton	176.39 ha
	Wheat	26.20 ha
	Gram	11.20 ha
	Sugarcane	4 ha
1.5. Water Level Behaviour: Aquifer-I (Shallow Aquifer)		
In the village, 9 KOW were established to decipher the water level scenario.		
Pre-Monsoon (May-2019) In the entire area the DTWL ranges	Post-Monsoon (November-2019) Major area of the village shows DTWL in the	

between 10-15 mbgl whereas in the north-north-east, DTWL ranges between 15-20 mbgl engulfing 20-25 mbgl. range of 10-15 mbgl except in the north-east small area with DTWL ranging 15-20 mbgl is observed.



2. GROUND WATER ISSUES

Declining water level.
 Non-availability of surface water for irrigation.
 Less ground water potential basaltic aquifer.
 Water stress situation during lean period (March to June)

3. AQUIFER DISPOSITION

3.1. Number of Aquifers	Granite Gniess–Aquifer-II (Deeper aquifer)
3.2. Aquifer Characteristics	
Major Aquifers	Basalt (Deccan Traps)
Type of Aquifer	Granite Gniess–Aquifer-II (Deeper aquifer)
Static Water Level (mbgl)	12-19.2
Depth of Occurrence (mbgl)	11-13
weathered thickness (m)	0.5-2

4. GROUND WATER QUALITY: Phreatic Aquifer (Aquifer-I/ Shallow aquifer)

PH	EC	TDS	TH	Ca	Mg	Na	K	CO ₃	HCO ₃	Cl	SO ₄	NO ₃	F
7.8	2512	1633	585	24	128	338	16	0	61	695	288	14	3.2

After ground water analysis it is observed that, the groundwater is affected by high salinity, sulphates and fluoride. Hence, the ground water is not suitable for drinking purposes.

5. GROUND WATER RESOURCES- Aquifer-I/ Shallow Phreatic Aquifer (Basalt)

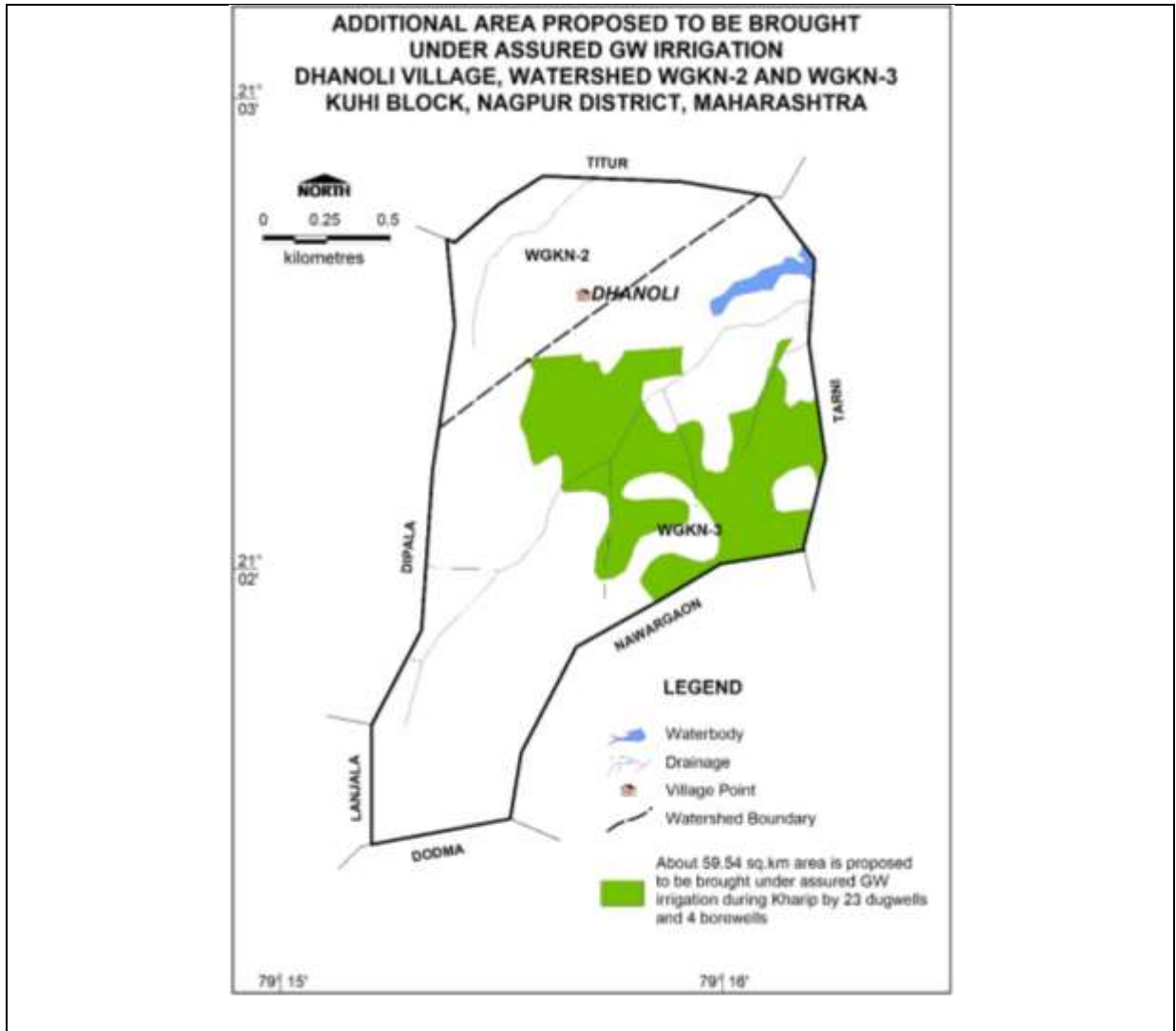
5. 1 Water budgeting


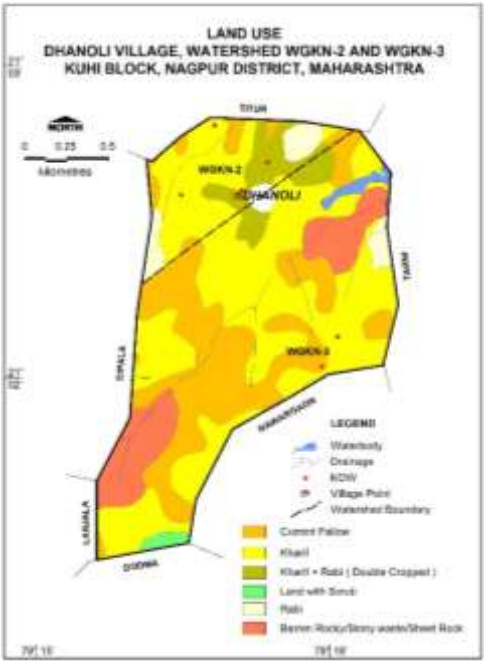
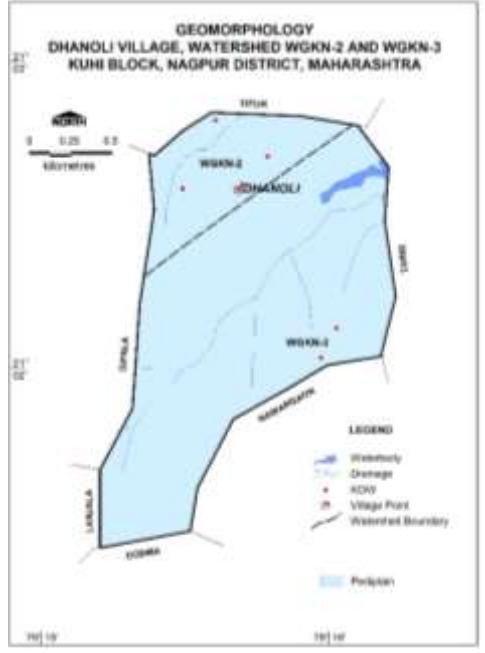

A. Water availability

Area (ha)	269.99
Rainfall (m)	1.36
Water precipitated, ham, (Area X RF)	366.11
90 % of precipitations (ham)	329.50

AR recharge by artificial recharge structure	0.0000
Runoff (2.5%) (RF-AR) (ham)	8.2374
Evaporation (35%) (ham)	115.3235
Water retained in ground Tank, Nala etc. (5%) (ham)	16.4748
Recharge to phreatic aquifer (10%) (ham)	32.9496
Enhance soil moisture, utilised by root system (ham)	98.8487
Total Water availability (MCM)	1.4827
B. Requirement	0.0067671
Domestic @60 lpcd X total person(3000) (MCM)	0.0014600
Animal @40 lpad X total animal (1111) (MCM)	0.54
Irrigation water applied (MCM)	0.03
Non agriculture use (MCM)	0.58
Total Requirement (MCM)	0.91
C. GW available for Planning (MCM)	38.90
Stage of GW Development (%)	
6.0. GROUND WATER RESOURCE MANAGEMENT	
6.1. Supply Side Management	
SUPPLY (MCM)	
Available Resource (MCM)	1.48
Agricultural Supply –GW	0.52
Agricultural Supply -SW	0.00
Domestic Supply - GW	0.01
Domestic Supply - SW	0.00
Non agriculture use (MCM)	0.03
Total GW availability (MCM)	0.92
Gross Annual Draft (MCM)	0.58
Area of village (Sq. Km.)	2.6999
Area suitable for Artificial recharge (sq km)	2.70
Type of Aquifer	Hard rock
Area feasible for Artificial Recharge (WL >5mbgl) (Sq. Km.)	2.6999
Volume of Unsaturated Zone (MCM)	0.000006749750
Average Specific Yield	0.02
Volume of Sub Surface Storage Space available for Artificial Recharge (MCM)	0.000000134995
Surplus runoff considered for planning (MCM) @ 100%	8.24
Proposed AR Structures (Check Dam, Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM))	Not proposed
Proposed AR Structures Gabion	Not proposed
Proposed AR Structures Other	Not proposed
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	Not proposed
Specific Recommendations - As per State Govt. Resolution, segment wise nala/stream desilting, deepening and widening upto 3 m depth or upto weathered rock considering the local hydrogeological condition without disturbing	0.00

the ecology/aquifer/environmental flow of nala/stream.	
Considering average nala deepening of 1 m depth, additional storage	0.00
Considering average nala deepening of 1 m depth, additional recharge @ 75%	0.00
RTRWH Structures	
Households to be covered (Pakka House only)	42
Total RWH potential (MCM)	0.0000499
Rainwater harvested / recharged @ 80% runoff co-efficient	0.0000400
<i>However, RTRWH is economically not viable & not Recommended</i>	
6.2. Demand Side Management	
Micro irrigation techniques	
Area is proposed to be covered under Drip	Not proposed
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.36 m. Drip Req. - 0.24, WUE- 0.12 m	-
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	
6.3. Expected Benefits	
Net Ground Water Availability (MCM)	1.48
Additional GW resources available after Supply side interventions (MCM)	0.00
Ground Water Availability after Supply side intervention(MCM)	1.48
Existing Ground Water Draft for All Uses (MCM)	0.58
GW draft after Demand Side Interventions (MCM)	0.00
Present stage of Ground Water Development (%)	38.90
Expected Stage of Ground Water Development after interventions (%)	38.90
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 65% (MCM)	0.39
Proposed Number of DW (@ 1.5 ham for 90% of GWR Available)	23
Proposed Number of BW (@ 1.5 ham for 10% of GWR Available)	4
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m after 65% stage of gwd is achieved	59.54
Regulatory Measures	60m borewells/tube wells
Panchayat Management Plan	



<p style="text-align: center;">Soil map</p> 	<p style="text-align: center;">Landuse map</p> 
<p>In the village entire area is covered by very deep moderately loamy soil .</p>	<p>In the village major cultivable land is under Kharif cropping pattern rest of the area is under Rabi crop and double cropped.</p>
<p style="text-align: center;">Geomorphology & Drainage map</p> 	<p style="text-align: center;">Hydro-geology map</p> 
<p>Entire area of the village falls under pediplain area.</p>	<p>Entire village is covered by Granite Gneiss.</p>

Panchayat Level Aquifer Management Plan

Village – Dhanoli, Kuhi Taluka, Nagpur District

Aquifer (Prominent Lithology)	Current Scenario	Geology / Basalt flow	Geomorphology	Ground water quality	Recommendations for Aquifer Development					Aquifer Management Plan
					Type/number	Zones/Depth to be tapped	HP of pump to be lowered	Pumping Hours	Yield (Cu. m / Day)	
Aquifer I (Granite GneissWeathered and fractures)	263.99 ha cultivable land by GW, DW 20 DW SOD – 38.9 %	Granite Gniess	Entire area of the village falls under pediplain area.	The groundwater is affected by high salinity, sulphates and fluoride. Hence, the ground water is not suitable for drinking purposes.	Dug well / 23	Depth Range of Zones 6 – 15 m	3 to 5	1 to 4	< 10 – 200 m ³ /day Or 0.7 ham/year	i. About 59.54 ha area is proposed to be brought under assured GW irrigation during Rabi. ii. The DW should be used for irrigation purpose. iii. Desilting of existing water conservation and artificial recharge structures.
Aquifer II (Granite gneiss- Jointed & Fractures)	2 BW	As above	--	Not assessed	Bore well / 4	Depth 60 m	3 to 5	3 to 8	0.14-2.16 lps	1. The BW should be used for drinking purpose. 2. BW should not be drilled more than 60 m

Note: DW(d)= Dug well Domestic; DW (i)= Dug Well Irrigation; BW(d)= Bore Well Domestic; BW(i)= Bore Well Irrigation

11. ANNEXURES

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

S.No.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
1	Kalameshwar	K.Pipala	78.7486	21.4042	382.3	1989-90	EW	Basalt/Sandstone	162	60.6	100 -114, 116 -132	29.06	14.4
2	Kalameshwar	K.Pipala	78.7486	21.4042	382.3	1989-90	OW	Sandstone	164.6	-	97 -113, 116 -119	22.12	4.43
3	Katol	Katol	78.6167	21.25	421	1989-90	EW		254	10	12.2 -18.3, 183 -186	28.3	1.05
4	Karanja	Khairi	78.5972	21.1083	492	1991-92	EW	F Basalt	115.9	6.33	21 -24, 27.4 -33.4, 76 -79, 52 -55, 101 -104, 113 -115.9	7.45	38.5
5	Kalameshwar	Zunki (Shindi)	78.9292	21.2667	324	2003-04	EW	Basalt/Sandstone	132	127.5	7 -15, 34 -54	-	1.37
6	Savner	Saoner	78.9167	21.3875	326.1	1999-00	PZ		43	30	25 -30	11.9	0.78
7	Kalameshwar	Adasa	78.9403	21.3319	329.5	1994-95	OW	Sandstone	218.57	2	28 -34	-	5.15
8	Kalameshwar	Adasa	78.9403	21.3319	329.5	1994-95	OW	Sandstone	151	50.5	62.25 -65.25, 72 -75	-	4.43
9	Katol	Dorli	78.7833	21.2667	375.9	1989-90	EW	F Basalt	125	2	36.6 -39.6, 88.4 -100.6	14.22	1.37
10	Katol	Dorli	78.7833	21.2667	375.9	1989-90	OW	F Basalt	153.5	1.5	30.5 -33.5, 115.5 -125	13.88	13.96
11	Kalameshwar	Kanyadoh	78.8667	21.3333	342.1	1989-90	EW		100.65	43.1	42.5 -46, 48 -54, 61 -64, 59.6 -60, 71 -93, 80.5 -81.5, 93.94 -94, 96 -98	19.48	1.37
12	Savner	Khapa	78.9833	21.425	301.3	1989-90	EW		183	35.5	35 -48	6.27	3.77
13	Kalameshwar	Mandvi	78.8167	21.35	388	1989-90	EW		159.5	4.45	85.05 -85.4, 90 -107, 128 -138.5, 108 -116, 154 -158.5	25	3.16
14	Kalameshwar	Mandvi	78.8167	21.35	388	1989-90	OW		115.9	6.5	85.05 -88, 95 -106.5	28.5	1.36
15	Savner	Sawangi	78.8833	21.3792	338	1989-90	EW		109.8	44.6	44 -61, 82 -104	17.42	5.15
16	Kalameshwar	Waruda Baroka	78.9042	21.2611	328.6	1991-92	EW	Sandstone / Granite	122	32.5	32 -40, 51 -54	13.5	1.37
17	Nagpur (Rural)	Satnaori Tola	78.8083	21.1411	358.7	1998-99	PZ	Kamthis	76.59	45	16 -24, 42 -43.5	-	2.64

S.No.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
18	Nagpur (Rural)	Yerla	78.9883	21.2361	341	2002-03	EW	J MB & Granite Gneiss	159.45	5.15	29.75 -, 46.55 -49.65	24.15	2.64
19	Nagpur (Rural)	Gondkheri	78.9083	21.1375	317.9	1989-90	EW	Basalt/Sandstone	134.2	8.1	97 -103, 115 -120	26.9	13.05
20	Kalameshwar	Gumtala	78.8708	21.1986	362.7	1989-90	EW		134.2	10.25	79.3 -85.4, 97.6 -100.6	4.55	0.78
21	Hingna	Yerangaoan	78.8067	21.045	429.1	1990-91	OW		118.9	2.5	94.50-97.30;115.80-118.9	22.82	3.77
22	Hingna	Yerangaoan	78.8067	21.045	429.1	1990-91	EW		107.7	2.5	42.70-45.70; 103.70-107.70	24.85	19.57
23	Hingna	Yerangaoan	78.8067	21.045	429.1	1990-91	OW		134.2	2.5	91.50-94.50; 113.00-114.00	25.19	9.8
24	Hingna	Yerangaoan	78.8067	21.045	429.1	1990-91	OW		85.4	2.6	57.90-61.0082.30-85.40	14.68	21.33
25	Nagpur (Rural)	Yerla	78.9667	21.2167	338	1989-90	EW	F Basalt	79.3	3.2	33.5 -39.6, 51.8 -57.9	7.7	14
26	Nagpur (Rural)	Yerla	78.9667	21.2167	338	1989-90	OW	F Basalt	100	3	30.5 -36.6, 39.6 -42.7	8.07	9.84
27	Narkhed	Arambhi	78.3486	21.2694	415.6	2012-13	OW	FMB	155	5.6	40-43 & 153-156	31.72	0.78
28	Narkhed	Arambhi	78.3486	21.2694	415.6	2012-13	EW	Deccan Trap Basalt	200	5.6	24-27 & 105-108	33.37	3.17
29	Narkhed	Belona	78.4864	21.4833	405.5	2012-13	EW	FVB	200	5.6	9-12 & 28-31	6.55	2.16
30	Narkhed	Indarwada	78.4622	21.3519	389	2012-13	EW	FMB	128.6	5.6	16-19	20	0.14
31	Narkhed	Jamgaon (Bk)	78.4333	21.3208	398	2011-12	Pz	FMB	40		3.00-6.00 and 24.00-27.00	4.25	Traces
32	Narkhed	Jamgaon Bk.	78.4478	21.3278	393.7	2012-13	EW	FB	31	5.6	24-27	1.9	1.05
33	Narkhed	Lohari Sawanga	78.4044	21.26	399.7	2012-13	EW	FMB	200	5.6	168.10-171.40	>80	0.78
34	Narkhed	Tinkheda	78.4903	21.4033	393.3	2012-13	EW	FMB	200	5.6	9-12, 37-40, 140-143 & 165-168		2.16
35	Warud	Mohogaoan	78.3944	21.4025	375	1993-94	EW	Sandstone	300.76	62.5	68-271	-	-

S.N o.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
		(Bhadade)											
36	Savner	Pota	79.1028	21.2778	293.9	2002-03	EW	Sandstone	135.15	130	80 -86, 100 -128	5.94	8.85
37	Parseoni	Gondega on	79.1925	21.2672	292	2002-03	EW	Sandstone	130.73	129	17.5 -23.5, 31 -33	19.3	3.77
38	Parseoni	Gondega on	79.2056	21.2675	288.4	2002-03	EW	Sandstone	32.5	32	20 -23, 27 -30	16.95	4.43
39	Parseoni	Gondega on I	79.1981	21.2519	288	1998-99	PZ		124.24	105.5	49.5 -51.5, 64 -67, 96 -98, 74 -76, 102 -103.5	-	0.78
40	Parseoni	Gondega on II	79.1981	21.2519	288	1998-99	PZ	Barakar Sandstone	39	36	16 -16.5, 31 -34	-	-
41	Parseoni	Juni Kamthi	79.1828	21.2522	286.5	2002-03	EW	Sandstone	75	33	16 -21, 25 -30	17.12	1.05
42	Parseoni	Tekadi	79.2278	21.2583	282.6	2002-03	EW	J F Granite Gneiss	31.75	29.3	22.55 -28	6.69	3.17
43	Parseoni	Tekadi	79.2278	21.2583	282.6	2002-03	EW	J F Granite Gneiss	50	-	23 -26, 29 -32	6.77	-
44	Parseoni	Wagholi	79.2417	21.2986	302.3	2002-03	EW	J F Granite Gneiss	50	20.8	14 -20, 35 -42	8.03	1.37
45	Parseoni	Warada	79.2167	21.2806	286.7	2002-03	EW	J F Granite Gneiss	50	-	15 -18, 23 -26, 45 -47, 34 -39	6.3	0.56
46	Parseoni	Warada	79.2167	21.2806	286.7	2002-03	EW	J F Granite Gneiss	50	-	6 -12, 20 -24	13	-
47	Parseoni	Yeshamba	79.2486	21.2917	300.3	2002-03	EW	J F Granite Gneiss	50	15.5	24 -, 42 -45	12.75	-
48	Savner	Bhanega on	79.1389	21.2675	288.6	2004-05	EW	Sandstone	200.34	196	98 -116, 121 -126, 138 -143, 131.5 -133.5, 152 -164, 170 -173, 179 -185, 191.5 -194.5	12.95	6.21
49	Savner	Bhanega on	79.1389	21.2675	288.6	2004-05	OW	Sandstone	201.64	196	104 -110, 122 -125, 182 -185, 155 -161, 191 -194	-	-
50	Savner	Patansawangi	79.0247	21.3211	295.1	2004-05	EW	Sandstone	100.15	90	47 -50, 56 -71	6.98	3.25

S.No.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
51	Savner	Patansawangi	79.0247	21.3211	295.1	2004-05	OW	Sandstone	196.38	170	109 -115, 125 -128, 144 150, 136 -139, 164 -168	-	-
52	Savner	Patansawangi	79.0247	21.3211	295.1	2004-05	OW	Sandstone	90.15	90	47 -50, 58 -70	6	1.5
53	Parseoni	Bachera	79.1667	21.4639	335.8	1994-95	EW	F Gneiss	199.65	13.4	19 -21, 90 -, 160.05 -163.05, 99.05 -102.05	4.05	0.56
54	Nagpur (Rural)	Brahmanwada	79.0083	21.2556	324.2	2006-07	EW	SEMICON	103.7	38	15-36		
55	Savner	Isapur	79.075	21.3342	300.9	2005-06	Pz		72.5	35	12.00-33.00		4.25
56	Parseoni	Karambhan New	79.1125	21.3736	303.6	1994-95	EW	F Granite	104.95	29.5	40.85 -61.8, 95.75 -104.55	-	-
57	Savner	Silewara (B1OW3)	79.1167	21.2917	285	1980-81	OW	Sandstone	117.5	65	5.5 -21.32, 28.35 -54.2	15.95	-
58	Savner	Silewara (B1M)	79.1167	21.2917	285	1980-81	OW	Sandstone	123	58	32.92 -50.6, 54.86 -88.09	17.56	8
59	Savner	Silewara (B1OW1)	79.1167	21.2917	285	1980-81	OW	Sandstone	133	75	20.23 -26.56, 34.14 -38.4, 47.24 -68.58, 41.45 -42.67, 72.85 -109.73, 114.6 - 131.98	16.94	-
60	Savner	Silewara (B1OW2)	79.1167	21.2917	285	1980-81	OW	Sandstone	157	70	32 -35.97, 52.73 -57.91, 67.06 -89.3, 61.26 -62.79, 93.27 -134.42, 137.16 - 155.45	16.04	-
61	Savner	Silewara (B1OW4)	79.1167	21.2917	285	1980-81	OW	Sandstone	119.1	68	11.05 -34.36, 47.72 -58, 64.93 -118.9, 64.93 -118.9	18.54	-
62	Savner	Silewara (B2MW)	79.1167	21.2917	285		OW	Sandstone	148.21	117	5.25 -7.35, 10.5 -44.75, 112.1 -132.27, 47.75 - 109.76, 135.27 -176.21	19.55	2.5
63	Savner	Silewara (B2OW)	79.1167	21.2917	285		OW	Sandstone	152.55	125	7.9 -11.05, 14.05 -29.05, 53.05 -113.05, 32.05 -53.05, 119.05 -152.05	19.06	-

S.N o.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
64	Savner	Silewara (BHE I)	79.1167	21.2917	285		OW	Sandstone	307	-	21.85 -31, 34.14 -39.62, 62.79 -64.01, 53.34 -60.05, 68.88 -90.22, 93.88 -137.16, 139.6 -162.76, 165.11 -187.15, 188.87 -199.34, 220.37 -250.55, 275.84 -286.27, 287.73 -296.57	-	-
65	Savner	Silewara (BHE II)	79.1167	21.2917	285		OW	Sandstone	303	-	30.78 -35.66, 40 -64, 114 -132.89, 69.49 -110.94, 138.38 -157.28, 160.63 -170.99, 187.45 -224.33, 232.87 -238.44	-	-
66	Savner	Silewara (BHE III)	79.1167	21.2917	285		OW	Sandstone	302	-	21.64 -24.08, 32.94 -49.68, 67.06 -85.66, 52.73 -64.31, 90.53 -110.03, 115.52 -135.03, 137.16 -140.22, 167.34 -235, 243.84 -255.12, 256.34 -260.43, 273.13 -142.93	-	-
67	Savner	Silewara (WTM)	79.1167	21.2917	285	1980-81	EW	Sandstone	67.11	38	19.21 -21.95, 35.66 -56.08	15.4	6
68	Savner	Silewara (WTOW 2)	79.1167	21.2917	285	1980-81	OW	Sandstone	50.2	34	7.01 -49.38	16.81	-
69	Savner	Silewara (WTOW)	79.1167	21.2917	285	1980-81	OW	Sandstone	53.32	37	14.8 -52.73	15.81	-
70	Kamptee	Kamptee	79.1917	21.2042	283	2004-05	EW	Alluvium & Granite Gneiss	30.44	28	11 -14, 18 -26	8.89	7.85
71	Kamptee	Kamptee	79.1917	21.2042	283	2004-05	OW	Alluvium & Granite Gneiss	29.93	26	12 -14, 18 -24	8.88	1.5
72	Kamptee	Kamptee Cantonm	79.1756	21.2408	288.9	2002-03	EW	Sandstone	81.43	30	18 -22.5, 24.5 -28.5	16.45	3.17

S.N o.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
		ent											
73	Nagpur (Urban)	Nara	79.0806	21.2083	304.3	1999-00	PZ		162.36	30	21.5 -32	10.05	-
74	Parseoni	Inder Colliery	79.2067	21.2494	281.9	2002-03	EW	Sandstone	91.48	89	56 -74, 80 -86	-	1.73
75	Parseoni	Kandri	79.2403	21.2386	286.8	2002-03	EW	Sandstone	95	78	15 -18, 25 -32, 71 -77, 44 -48	19.1	0.8
76	Parseoni	Kandri (WCL)	79.2392	21.2489	281	2001-02	EW	Sandstone	100	73.5	13.5 -19.5, 66 -72	9.32	-
77	Parseoni	Kandri (WCL)	79.2392	21.2489	281	2001-02	EW	Sandstone	150	105	21 -30, 28 -102	14.42	1.37
78	Parseoni	Kanhan	79.2417	21.2283	285	2002-03	EW	Sandstone	70	28	20 -26	19.6	-
79	Parseoni	Pipri	79.2203	21.2375	279.4	2002-03	EW	Sandstone	50	43	15 -18, 24 -30	10.35	4.43
80	Parseoni	WCL MAGAZI NE	79.2122	21.2367	282	2001-02	EW	Sandstone	82.75	54	18 -14, 34 -37	14.4	7.76
81	Parseoni	WCL MAGAZI NE	79.2122	21.2367	282	2001-02	OW	Sandstone	42	37	21 -24, 31 -34	14.47	2.16
82	Parseoni	WCL MAGAZI NE	79.2122	21.2367	282	2001-02	OW	Sandstone	56.5	50	18 -24, 29 -32	16.5	7.76
83	Kamptee	Asoli	79.2056	21.1414	279.5	1994-95	EW	Sandstone	202.45	37.75	15.45 -18.45, 45 -47, 66 -72, 52 -60.8	4.53	1.37
84	Nagpur (Rural)	Bokhara	79.0694	21.2278	319	2005-06	Pz		107		57.00-67.00		
85	Nagpur (Rural)	Lonara	79.0578	21.2389	310.8	2005-06	Pz		113.65	41	36-39.00		0.2
86	Ramtek	Bothia Palora	79.3403	21.5528	393.9	1994-95	EW	F Gneiss	172.05	7.8	161-168	4.7	4.43
87	Ramtek	Bothia Palora	79.3403	21.5528	393.9	1994-95	OW	F Gneiss	146	11.5	161-168	5.05	-

S.N o.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
88	Mauda	Rewral	79.4736	21.2667	284.4	1994-95	EW	F Gneiss	187.25	27	34.75 -37.85, 46.5 -53.05, 83.55 -89.65, 71.35 -74.45, 142.55 -147.65	1	1.37
89	Parseoni	Titur	79.2569	21.3181	298.3	1994-95	EW	F Gneiss	201.55	12.25	15 -18, 137.45 -140.45	6.26	2.16
90	Umred	WCL I	79.2917	20.8769	277	1998-99	PZ	Barakars	148.45	124	114 -116, 120 -122	-	-
91	Umred	WCL II	79.2917	20.8769	277	1998-99	PZ	Barakars	67.52	39	35.5 -37.5	-	0.78
92	Bhiwapur	Kargaon	79.425	20.7833	271.1	1995-96	EW		100.2	35.5	22 -26, 54 -56	-	-
93	Bhiwapur	Kargaon	79.425	20.7811	271.3	1995-96	OW		74.75	-	28 -34, 38 -40	4.92	0.78
94	Kuhi	Katara	79.4361	20.9917	263.7	1994-95	EW		109.5	20	20.5 -29, 35 -36, 62 -64, 51 -53	3.42	6.81
95	Kuhi	Katara	79.4356	20.9894	267.4	1994-95	OW		200	25	25 -28, 42 -46	3.22	5.84
96	Umred	Tirkhura	79.3731	20.8478	285.7	1994-95	EW	F Gneiss	200	23.5	24 -26.5, 34.5 -38	3.64	1.37
97	Bhiwapur	Nand I	79.2897	20.6556	268	1998-99	PZ	Barakars	151.95	142	136 -140	-	1.37
98	Bhiwapur	Nand II	79.2897	20.6556	268	1998-99	PZ	Kamthis	36.5	35	28 -34	-	-
99	Kuhi	Gothang aon	79.5478	20.8981	246.3	1995-96	EW		81.55	7.5	5 -15, 22 -30, 63 -66, 44 -48, 72 -75	3.12	-
100	Kuhi	Gothang aon	79.5644	20.8981	237.2	1995-96	OW	Granite	62.25	11	19 -22, 29 -31	3.4	10.98
101	Bhiwapur	Somnala	79.5167	20.8375	251.1	1995-96	EW	F Gneiss	106	16.85	59.15 -60.25, 71.35 -74.45	5.3	0.78
102	Kuhi	Veltur	79.57	20.9967	267.9	1994-95	EW		36.5	15	10 -15, 20 -25	1.3	25.04
103	Kuhi	Veltur	79.57	20.9967	267.9	1994-95	OW		101.75	6	19 -19.55, 28.5 -35, 90 -94, 42 -45, 97.75 -99.75	1.33	6.81
104	Hingna	Khairi pannase	78.93305556	21.0977222		2019-20	EW	F Basalt	111.3		19.80-22.80 ; 80.80-83.80		
105	Kuhi	Dhanoli	79.26452778	21.04183333		2019-20	EW	Schist/Gneiss	200		144.80-147.90		
106	Kuhi	Pachkhedi	79.39418	20.912223		2019-20	EW	F Granite	190.6		38.10-41.10		
107	Bhiwapur	Mandaw	79.2587222	20.75152		2019-20	EW	F Basalt	50.3		35.00-38.10		

S.No.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
		a	2	778									
108	Nagpur (R)	Salai Godhni	79.13095833	21.01483056		2019-20	EW	F Basalt	68.6		28.90-32.00; 50.30-53.30		
109	Nagpur (R)	Salairani	79.03639	20.78306		2019-20	EW	F Basalt	111.3		59.40-62.50		
110	Kuhi	Salwa	79.44444	21.04972		2019-20	EW	Gneiss	200		28.90-32.00;59.40-62.50		
111	Umred	Manori	70.11462	20.70829		2019-20	EW	F Basalt	105.2		96.00- 99.10		
112	Umred	Champa	79.19889	20.97615		2019-20	EW	F Basalt	200		68.60-71.60		
113	Hingna	Sukali Gharapur e	78.947275	20.98292222		2019-20	EW	F Basalt	200		80.80-86.30		
114	Kuhi	Silli	79.36117	20.99233		2019-20	EW	F Granite	200		19.80-22.80;120.40-123.50;169.20-172.30		
115	Umred	Davha	79.1691	20.91022		2019-20	EW	F Basalt			96.00-99.10		
116	Hingna	Haladgaon	78.8743	20.8461		2019-20	EW	F Basalt			31-32;41.10-44.20		
117	Hingna	Haladgaon	78.8743	20.8461		2019-20	OW-1	F Basalt/Am ygdaloidal			31-32;41.10-44.20		
118	Nagpur	Mangli	78.92569	20.82875		2019-20	EW	F Basalt			32.35; 68.60-71.60		
119	Katol	Dorli	78.7833	21.2667		2015-16	EW	F Basalt	125	2	36.6 -39.6, 88.4 -100.6		
120	Katol	Dorli	78.7833	21.2667		2015-16	OW	F Basalt	153.5	1.5	30.5 -33.5, 115.5 -125		
121	Katol	Katol	78.6167	21.25		2015-16	EW	F Basalt	254	10	12.2 -18.3, 183 -186		
122	Katol	Khairi	78.5972	21.1083		2015-16	EW	F Basalt	115.9	6.33	21 -24, 27.4 -33.4, 76 -79, 52 -55, 101 -104, 113 -115.9		
123	Katol	Katol	78.6167	21.25	421	2015-16	EW	F Basalt	254	10	12.2 -18.3, 183 -186		
124	Narkhed	Arambhi	78.3486	21.2694	415.6	2015-16	EW	F Basalt	200	5.6	40-43 & 153-156		
125	Narkhed	Belona	78.4864	21.4833	405.5		EW	F Basalt	200	5.6	9-12 & 28-31		
126	Narkhed	Indarwada	78.4622	21.3519	389		EW	F Basalt	128.6	5.6	16-19		

S.No.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
127	Narkhed	Jamgaon Bk.	78.4478	21.3278	393.7		EW	F Basalt	31	5.6	24-27		
128	Narkhed	Lohari Sawanga	78.4044	21.26	399.7		EW	F Basalt	200	5.6	165-168		
129	Narkhed	Tinkheda	78.4903	21.4033	393.3		EW	F Basalt	200	5.6	9-12, 37-40, 140-143 & 165-168		
130	Katol	Maragsur	78.7071111	21.20731	512	2015-16	EW	F Basalt	126.5	20	114.30-117.40		
131	Katol	Ladgaon	78.5646944	21.22706	538	2015-16	EW	F Basalt	200	20	28.90-32; 114.30-117.40		
132	Katol	Ladgaon	78.5646944	21.22706	538	2015-16	OW	F Basalt	200	20	28.90-32;114.30-117.40		
133	Katol	KHANGA ON	78.5466944	21.29417	418	2015-16	EW	F Basalt	181.5	20	16-17		
134	Katol	KHANGA ON	78.5468056	21.29417	418	2015-16	OW	F Basalt	181.5	20	157 (Basalt-Gondwana contact)		
135	Katol	SAWARGAON	78.6342222	21.40108	420	2015-16	EW	F Basalt	200	20	10.3-13.70		
136	Narkhed	KONI	78.5824722	21.43964	421	2015-16	EW	F Basalt	200	25	16.70-19.80, 126.50-129.60		
137	Narkhed	KHEDI	78.6445556	21.45894	421	2015-16	EW	F Basalt	105.2	25	53.30-56.40		
138	Narkhed	MANIKWADA	78.4998889	21.49717	417		EW	F Basalt	200	25	19.80, 41.10, 108.2		
139	Katol	SONKHAMBA	78.72252778	21.27225	411		EW	F Basalt	197.75	11.2	11.10 - 11.20, 22.60 - 23.00, 76.45 - 79.10		
140	Katol	RAULGAON	78.78313889	21.23755556	394		EW	F Basalt	200	59.37	150.34 - 162.45, 174.55 - 198.80		
141	Narkhed	PIPLA	78.73333333	21.4	348		EW	F Basalt	162	100	100-114, 116-132		
142	Narkhed	MOHGON BHADADE	78.72222222	21.39166667	400		EW	F Basalt	300	68	68-72, 89-97, 107-113, 118-123, 143-147, 148-154, 165-172, 176-178, 184-204, 218-225, 232-238, 244-257, 266-271		
143	Ramtek	Amgaon	79.34833333	21.38888889		2019-20	EW	FGN	200	11.5	45-46		
144	Ramtek	Wadamba	79.38055556	21.60527778		2019-20	EW	FGN	172	18.5	34-36		

S.N o.	Taluka	Village	Longitude	Latitude	Altitude (m)	Year	Type	Aquifer	Drilling depth	Casing	Aquifer Zones	Drilling SWL	Discharge
145	Ramtek	Wadamba	79.38055556	21.60527778		2019-20	OW	FGN	177	18.5	36-37;155-156		
146	Ramtek	Borda	79.27972222	21.44416667		2019-20	EW	FGN	160	24.5	33-34;115-117;157-159		
147	Ramtek	Borda	79.27972222	21.44416667		2019-20	OW	FGN	200	24	40-44;89.70-92;120-123;144-147		
148	Ramtek	Chichala	79.34166667	21.34833333		2019-20	EW	FGN	200	12.5	35-37		
149	Mauda	Tarsha	79.38111111	21.22805556		2019-20	EW	FGN	44	24	34.80-37.90		
150	Mauda	Tarsha	79.38111111	21.22805556		2019-20	OW	FGN	200	36	42-43		
151	Parseoni	Nayakund	79.19611111	21.36944444		2019-20	EW	FGN	200	24	dry		
152	Savner	Nandagomukh	78.77111111	21.4225		2019-20	EW	FMB	200	24	150.70-153.80		
153	Savner	Kelwad	78.8675	21.4625		2019-20	EW	FMB	200	18	50-53		
154	Parseoni	Tekadi	79.16333333	21.46305556		2019-20	EW	FGN	190.4	18	22-25;132-133;156-159		
155	Parseoni	Tekadi	79.16333333	21.45861111		2019-20	OW	FGN	190.4	18	26-27;135-136;169-171		
156	Mauda	Rewral	79.45861111	21.26388889		2019-20	EW	FGN	196.5	24	48-49		
157	Mauda	Navergaon	79.49944444	21.25888889		2019-20	EW	FGN	200	18	35-36		
158	Mauda	Khondamendi	79.47472222	21.32138889		2019-20	EW	FGN	200	18	35-37;40-44;		
159	Mauda	Khondamendi	79.47472222	21.32138889		2019-20	OW	FGN	166	24	41-43		
160	Ramtek	Ghoti	79.43305556	21.35861111		2019-20	EW	FGN	200	23.5	38.00-41.00;151.00-153.00		
161	Ramtek	Ghoti	79.43305556	21.35861111		2019-20	OW	FGN	200	23.5	41-44		

Annexure-II: Details of KOWs in Nagpur district

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
1	Nagpur	Hudkeshwar Bk.	8.30	7.92	4.5	3.42	1170	2080	7.6	3
2	Umred	Wadegaon	12.40	11.80	3.4	8.40	898	664	8.2	3.3
3	Nagpur (R)	Salai Godhni	10.50	2.80	2	0.80	1172	965	5.6	4.2
4	Nagpur (R)	Banawadi	7.00	5.35	2	3.35	724	780	4.2	4
5	Umred	Matkazari	4.70	2.60	1.4	1.20	288	1205	8.6	3
6	Umred	Jamgarh	7.00	5.00	4	1.00	658	1254	5.9	2
7	Umred	Junapani	9.00	4.50		4.50	444		6	4
8	Umred	Chargaon	8.50	7.00	2.7	4.30	653	990	5.5	8
9	Nagpur (R)	Chimnazari	11.00	5.00	2.8	2.20	865	1145	3.9	3
10	Nagpur (U)	Saubhagyanagar	12.20	10.40		10.40	956		8.6	5
11	Nagpur	Jaitala	4.75	4.00		4.00	266		6.4	6
12	Hingna	Panjari	9.00	8.40	5.05	3.35	574	935	4.3	2
13	Hingna	Nagalwadi	10.00	Dry	2.2	#VALUE!		731	6.2	8
14	Nagpur (U)	Pioli Nadi	7.30	4.65	3.7	0.95	861	1056	5.2	2
15	Hingna	Salai Dabha	10.00	9.30	3.5	5.80	1204	838	5	4
16	Hingna	Lakhmpur	7.80	3.20	2.9	0.30	545	1085	6.2	7
17	Hingna	Khairi kh.	8.00	5.40	3.3	2.10	965	1505	6	3
18	Hingna	Chauki	6.00	5.60	4.2	1.40	670	998	7.1	1.9
19	Hingna	Deoli	5.00	4.85	1.3	3.55	1026	1116	5.3	5
20	Hingna	Navegaon	12.00	7.00		7.00	554		4.6	7
21	Hingna	Kavdas	8.50	7.30	4.1	3.20	1214	945	6.3	3
22	Hingna	Ambazari	12.50	11.60	3.7	7.90	826		4.3	2.9
23	Umred	Paradgaon	12.20	5.10	4	1.10	460	576	4.6	8

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
24	Umred	Virali	11.30	10.20	6.8	3.40	1054	1204	5.5	7
25	Umred	Barva	11.00	Dry	4.8	#VALUE!		2308	5.6	4
26	Umred	Bramhni	12.50	3.40	1.9	1.50	2574	2133	7.7	6
27	Umred	Tirkhura	9.50	Dry	4.3	#VALUE!	862	2445	8	6
28	Umred	Belgaon	9.20	6.40	2.6	3.80	7540	1568	6.9	4
29	Umred	Dighori	10.00	3.90	2.2	1.70	740	980	6.5	5
30	Umred	Devli	10.00	7.00	3.2	3.80	645	648	4.1	7
31	Nagpur (R)	Shiwa	8.7	7.85	2.1	5.75	647	850	8.5	6
32	Hingna	Digdoh	5	3.55	3.2	0.35	1270	1028	7.2	4
33	Hingna	Turagondi	17	7.7	5.3	2.40	633	605	6	6
34	Umred	Belpeth/ Shedeshwar	8	7.9	3	4.90	1661	1790	4.5	3
35	Umred	Kinhala	13	8.5	9.6	-1.10	274	618	6.3	4
36	Umred	Sirsi	8.5	8.4	2.4	6.00	745	1516	5.6	5
37	Nagpur (R)	Kharda	8	Dry	6.8	#VALUE!			5.9	4
38	Nagpur (R)	Bori	8	6.55	3.5	3.05	2055	1834	4.6	6
39	Nagpur	Pitesur	9	Dry	1.1	#VALUE!		719	5.8	6
40	Nagpur	Gowari	9	7.25		7.25	1025		9.6	8
41	Umred	Walad	12.55	11.65	7.3	4.35	1183	1453	4.8	4
42	Umred	Davha	5.5	5	2.2	2.80	558	605	7.6	3
43	Umred	Marasghat	12.2	10.55	6	4.55	685	685	5.7	3
44	Umred	Wakeshwar	11	10		10.00	608		4.5	9
45	Hingna	Tembhari	5.5	4.2	2.6	1.60	1092	1564	3.6	4
46	Bhiwapur	Kaodasi	5.4	4.2	2.3	1.90	593	596	5.2	0.8

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
47	Bhiwapur	Mandawa	9	5.35	3.15	2.20	826	786	7	0.6
48	Bhiwapur	Besur	10	5.7	4.5	1.20	2374	2204	7	0.5
49	Bhiwapur	Chikhalapur	10	0	2.9	0.00		1682	8	0.3
50	Bhiwapur	Zamkoli	6.8	5.4	3.3	2.10	683	558	4.5	1
51	Bhiwapur	Kholdoda	9	7.9	7.7	0.20	3265	2390	6	1.5
52	Bhiwapur	Taka	17	14.6	13.1	1.50	815	730	14	0.5
53	Bhiwapur	Botezari	13	7.8	3.87	3.93	741	458	9	1
54	Bhiwapur	Gardapar	9	5.05	1.45	3.60	634	544	5	1
55	Bhiwapur	Malewada	13	11.2	6.3	4.90	1590	1627	7	0.5
56	Bhiwapur	Zibodi	11.3	11.3	11.3	0.00			10	1.2
57	Bhiwapur	Seloti	15	6.7	0.9	5.80	594	331	8.5	1
58	Bhiwapur	Mokhana	13	3.4	3	0.40	829	279	7.5	0.4
59	Bhiwapur	Adyal	18	16.05	9.75	6.30	654	626	16	0.6
60	Bhiwapur	Somnala	11.7	#VALUE!	6.7	#VALUE!		1673	10	0.5
61	Kuhi	Murabhi	9	5.6	1.5	4.10	1259	1768	7	0.6
62	Kuhi	Virkhedi	16	8.2	4.1	4.10	2785	1652	10	0.4
63	Kuhi	Mandhal	12	6	1.8	4.20	2218	2050	8	0.8
64	Kuhi	Taroli	12	8.8	6.45	2.35	673	649	9	2
65	Kuhi	Gothangaon	9	7.4	3.6	3.80	730	624	8.5	0.2
66	Bhiwapur	Jiwanapur	13	10	3.8	6.20	791	684	12	0.7
67	Bhiwapur	Tutanbori	13.8	9.7	6.4	3.30	684	575	11	0.2
68	Bhiwapur	Gondbori	13	8.1	2.4	5.70	1067	922	9	1
69	Kuhi	Adam	15	6.1	1.6	4.50	690	645	7	0.7
70	Kuhi	Channa	13	5.4	1.6	3.80	1488	1570	7.5	0.5

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
71	Kuhi	Mendha Kh	15	9.3	2.5	6.80	1265	755	11	0.2
72	Kuhi	Ruyad	14	8.5	5	3.50	1609	961	10	0.8
73	Kuhi	Pauni	12.3	0	11.3	0.00		658	6	1.7
74	Kuhi	Sarawa	11	5.9	2.4	3.50	978	1258	10	0.3
75	Kuhi	Bhiwakund	12	9.8	2.4	7.40	621	965	12	1.5
76	Kuhi	Rajola	15	11.4	8.9	2.50	1655	1430	6	2
77	Kuhi	Sawarkhanda	9	4.6	0.5	4.10	378	385	6	0.5
78	Kuhi	Kuhi	11	8	1.8	6.20	1080	958	9	2
79	Kuhi	Dhanoli	29	25.3	19.4	5.90	997	979	24	2
80	Kuhi	Dodama	12	6.1	4.2	1.90	1930	1782	7	2
81	Kuhi	Sasegaon	11	4.4	1	3.40	1914	1858	7	2
82	Kuhi	Ambadi	10	5.3	2.5	2.80	990	755	7	2
83	Kuhi	Sawali	11	1.5	0.8	0.70	2058	785	6	1.2
84	Bhiwapur	Mandawa-1	14	11.2	3	8.20	820	727	11	2
85	Bhiwapur	Mandawa-2	10	5.6	3.5	2.10	780	651	6	2
86	Bhiwapur	Mandawa-3	10	5.7	3.3	2.40	813	618	6	1.5
87	Bhiwapur	Mandawa-4	9	5.9	4.1	1.80	490	632	7	2
88	Bhiwapur	Mandawa-5	10	5	4.35	0.65	1260	548	7	2
89	Bhiwapur	Mandawa-6	12	10.5	6.4	4.10	653	799	7	2
90	Kuhi	Dhanoli-2	13.3	12.7	12.4	0.30	640	512	11	0.5
91	Kuhi	Dhanoli-3	16	14.4	13.8	0.60	950	899	13	2
92	Kuhi	Dhanoli-4	19	12.3	12	0.30	833	859	12	1
93	Kuhi	Dhanoli-5	14	11.9	11.2	0.70	811	762	13	0.9
94	Kuhi	Dhanoli-6	14	11.8	9.5	2.30	800	899	12	1

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
95	Kuhi	Dhanoli-7	24.4	21.5	18.8	2.70	1524	1154	13	1
96	Kuhi	Dhanoli-8	19.5	19.5	19.2	0.30	1056	964	12	2
97	Kuhi	Dhanoli-9	12	7.3	7.3	0.00	1145	923	12	2
98	Ramtek	Karwahi	9.8	9.8	3.15	6.65	1500	1741	9	1
99	Ramtek	Pathrai	15.6	5.15	3.1	2.05	577	1062	15	1
100	Ramtek	Kamthi	9	3.8	2.3	1.5	446	512	8.5	1
101	Ramtek	Lakhapur	5.1	4.8	2.1	2.7	322	499	4.9	1
102	Ramtek	Murda	10	9.1	5.9	3.2	1285	1591	9	1
103	Ramtek	Gugaldoh/ Ghogra	10.5	5	3.4	1.6	1408	1287	9	1
104	Kamthi	Asoli Sakwa	12.5	11.85	10.1	1.75	1140	1359	12	1
105	Kamthi	Gumthala	16.2	11	8.2	2.8	717	796	15	1
106	Kamthi	Palsad	11.9	8.8	7.15	1.65	1050	1189	9.5	1
107	Kamthi	Chikli	15	11.7	6.4	5.3	686	2356	14.5	1
108	Kamthi	Badoda/ Wadoda	8.7	8.1	7.5	0.6	276	320	7	2
109	Mauda	Vanjara	12.5	10.7	10.2	0.5	613	670	11.5	2
110	Mauda	Chirvha	17.4	16.5	15.4	1.1	1038	815	17	2
111	Mauda	Marodi	15.6	12.2	10.8	1.4	805	2732	15	1
112	Mauda	Dhanala	7.55	5.2	3.1	2.1	1950	1590	7	2
113	Mauda	Govri	12.6	10.45	1.7	8.75	1321	1780	12	1
114	Mauda	Panjra	9.4	7.1	3.45	3.65	1511	652	9	1
115	Mauda	Sirsoli	9.2	7.9	7.35	0.55	803	1947	8.5	2
116	Mauda	Bori Ghiwari	10.1	9.05	5.7	3.35	2346	692	8	1
117	Mauda	Aroli	6.2	5.45	4.15	1.3	862	692	6	2

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
118	Mauda	Kumbhapur	16.7	14.8	13	1.8	717	774	16	1
119	Mauda	Bhendala	9.2	5.7	1.7	4	1438	1310	9	1
120	Mauda	Hingna	10	6.6	3.25	3.35	1613	2778	9	2
121	Mauda	Chacher	12.7	5.6	3.7	1.9	2456	2850	12	1
122	Mauda	Rewral	9.5	7.8	3.65	4.15	860	1168	9	1
123	Kamthi	Waregaon	22.2	15.8	13.3	2.5	2268	2230	22	0.2
124	Kamthi	Suradevi	9.8	2.1	1.7	0.4	1578	1727	9	0.8
125	Kamthi	Ghorpada	10.7	9.2	6.5	2.7	1635	1814	9	1.7
126	Kamthi	Gada	20.3	17.8	14.4	3.4	264	712	20	0.3
127	Kamthi	Ungaon	17.7	14.8	13.6	1.2	926	1371	15	1.5
128	Parseoni	Khandala	15.4	13.6	12.6	1	771	715	13	2
129	Kalmeshwar	Kalmeshwar	14	13.2	4.2	9	1655	1748	13.5	0.5
130	Kalmeshwar	Uparvani	14.8	14.4	11.4	3	1185	1278	12	2
131	Kalmeshwar	Wathoda	8.5	7.75	4.5	3.25	1465	82.7	6	2
132	Kalmeshwar	Mohpa	19.2	15.45	8.1	7.35	1164	1209	17	2
133	Kalmeshwar	Khairi	7.2	5.9	2.8	3.1	947	1230	4	2
134	Kalmeshwar	Mandvi	7	6.2	2.8	3.4	899	1193	5.5	2
135	Kalmeshwar	Tishti	12.2	11.9	6.9	5	963	1332	11	1.2

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
	r									
136	Kalmeshwar	Parsodi Wakil	35.2	32.4	20.2	12.2	786	814	32	2
137	Kalmeshwar	Tel-Kamthi	8.3	4.7	2.2	2.5	1046	1373	5	2
138	Kalmeshwar	Dadhera	10.5	9.8	4.8	5	884	850	9	1.5
139	Saoner	Khursipar	20.2	16.52	14.5	2.02	559	658	18	2
140	Saoner	Jatamkhor	17.2	13.8	8.6	5.2	1135	1117	15	2
141	Saoner	Umri	13	3	2.1	0.9	492	788	10	2
142	Saoner	Rampuri	14	11.9	7.4	4.5	1181	1343	13.5	0.5
143	Saoner	Kelwad	13	8.7	5.45	3.25	1181	1315	11	2
144	Parseoni	Satak	11	9.2	3.95	5.25	1238	1295	10	1
145	Ramtek	Amgaon	14.9	3.4	4.2	-0.8	239	165	14	0.9
146	Parsioni	Tamaswadi	23	18.8	15.3	3.5	671	694	22	1
147	Parsioni	Guramde	13	11.4	8.6	2.8	688	700	12	1
148	Parsioni	Kharambad	10	3.4	3.6	-0.2	1561	1598	7	2
149	Parsioni	Sakarla	11	8.5	6.5	2	1505	1099	9	2
150	Parsioni	Salai	9	7.5	2.1	5.4	430	192	8	1
151	Parsioni	Khubala	17	10.1	4.65	5.45	821	1134	16	1
152	Saoner	Tembhurdoh	22	19.4	16.4	3	622	449	21	1
153	Saoner	Tekadi	14	16.8	4.4	12.4	1142	1242	13	1
154	Saoner	Waki	14	9.8	6.85	2.95	910	4645	13	1
155	Saoner	Gujarwadi	20	16.9	13.9	3	1134	1161	19	1

S. No.	Taluka	Site name	Depth (m)	D.T.W. (Pre - 2019) (m bgl)	D.T.W. (Post - 2019) (m bgl)	Fluctuation	EC (Pre – Monsoon - 2019) (micromhos)	EC (Post – Monsoon 2019) (micromhos)	Depth to Fractures (mbgl)	Thickness of fracture zone
156	Saoner	Khurajgaon	18	14.2	7.8	6.4	728	503	17	1
157	Saoner	Nanda Kuurd Nandapur	21	17.5	14.1	3.4	775	1091	20	1
158	Saoner	Kawatha	13	9.3	5.3	4	1324	1391	12	1
159	Saoner	Ramdongri	17	13.6	10.7	2.9	821	925	16	1
160	Parseoni	SuwarDhara	10	6.3	2.65	3.65	611	626	7	2
161	Parseoni	Bitoli	10	6.5	8.6	-2.1	1397	581	7	2
162	Parseoni	Mahul	14	9.2	4.2	5	1489	1405	10	2
163	Parseoni	Khandala Ghatate	17	14	9.1	4.9	794	697	16	1
164	Parseoni	Kherdi	8	5.2	2.57	2.63	1026	1210	6	2
165	Parseoni	Keradi	9	4.4	2.85	1.55	2020	173	8	1
166	Ramtek	Chinchala	12	10.1	4.1	6	1821	2264	11	1
167	Ramtek	Kachurwadi	11	8.2	2.8	5.4	513	1430	9	2
168	Mohda	KhaperKhedi	12	8.8	7.2	1.6	985	1377	11	1
169	Ramtek	Patgavri	10	6.1	1.9	4.2	1072	911	7	2
170	Borda	Ramtek	9	5.7	3.85	1.85	1312	1769	8	1
171	Warghat	Ramtek	12	11.4	7.5	3.9	1171	1105	11	1
172	Karwahi	Ramtek	12	9.1	4.42	4.68	1246	1225	9	2
173	Dongri	Ramtek	8	4	1.75	2.25	1485	1398	7	1
174	Parsodi	Mauda	18	14.6	13	1.6	884	1339	17	1

Annexure-III: Details of GW monitoring wells in Nagpur district

S. No.	District	Site Name	Aquifer	Lat	Long	DTW_May 2019	DTWL_Nov.19
1	Nagpur	Amgaon	Unconfined	20.99444	78.925	6.4	2.7
2	Nagpur	Ashti	Unconfined	21.20194	78.96833	11.15	4.5
3	Nagpur	Bela_Pz	Unconfined	20.775	79.0125	7.6	3.2
4	Nagpur	Bhasali Takli	Unconfined	21.35333	78.99056	12.9	15
5	Nagpur	Bhiwapur	Unconfined	20.76639	79.51639	9.7	6.4
6	Nagpur	Bokhara_Pz	Semi/Confined	21.22778	79.06944	5.85	2.1
7	Nagpur	Borkhedi	Unconfined	20.88333	78.975		3.6
8	Nagpur	Borkhedi_Pz	Unconfined	20.86444	78.96972	8.04	
9	Nagpur	Chacher	Unconfined	21.28333	79.34167	8.05	3.2
10	Nagpur	Chargaon (Punarwasi)	Unconfined	21.26667	78.75833	5.05	3.2
11	Nagpur	Chorbaoli	Unconfined	21.46667	79.31667	8.95	3.9
12	Nagpur	Deolapar	Unconfined	21.58333	79.36667	13.2	4
13	Nagpur	Dhapewada	Unconfined	21.30278	78.91389	8.7	12.8
14	Nagpur	Dongargaon Gumgaon	Unconfined	20.98778	79.03111	1.8	5.2
15	Nagpur	Fetri_Pz	Unconfined	21.2025	78.99806	7.7	
16	Nagpur	Gahuhivra	Unconfined	21.25278	79.24389	11.9	3.8
17	Nagpur	Ghumthala	Unconfined	21.135	79.3025	8.1	9.7
18	Nagpur	Gonkhedi	Unconfined	21.13639	78.90083		3.9
19	Nagpur	Gumthala_Pz	Unconfined	21.25917	79.04722	10	3
20	Nagpur	Hingna (Dhangarpura)	Unconfined	21.07389	78.95778		4.6
21	Nagpur	Jamgaon Bk_Pz	Unconfined	21.32083	78.43333	5.3	2.5
22	Nagpur	Kalmeshwar	Unconfined	21.23333	78.91667	11	2.2
23	Nagpur	Kamptee	Unconfined	21.20833	79.20833	7.9	6.95
24	Nagpur	Kanholi bara	Unconfined	20.93333	78.85	10	5.7

S. No.	District	Site Name	Aquifer	Lat	Long	DTW_May 2019	DTWL_Nov.19
25	Nagpur	Kanholibara_Pz	Unconfined	20.93583	78.85389	13.95	4
26	Nagpur	Katol	Unconfined	21.28333	78.58333	9.85	5.1
27	Nagpur	Kelod	Unconfined	21.45972	78.87639	10.9	10.35
28	Nagpur	Khairgaon	Unconfined	21.18583	78.95667	7.2	3.5
29	Nagpur	Khapri	Unconfined	21.23528	78.835	4.88	5.8
30	Nagpur	Kharpada	Unconfined	21.53083	79.3475	4.8	4
31	Nagpur	Khat	Unconfined	21.24167	79.54583	11.25	1.3
32	Nagpur	Khubala	Unconfined	21.45	78.96667	4.8	3.6
33	Nagpur	Kohli	Unconfined	21.25222	78.81611	8.8	7.2
34	Nagpur	Koradi	Unconfined	21.25278	79.08	8.8	3.1
35	Nagpur	Kothulna	Unconfined	21.41944	79.03833	5.3	1.6
36	Nagpur	Kuhi-1	Unconfined	21.015	79.36028	9.5	6.8
37	Nagpur	Linga	Unconfined	21.20278	78.82139	5.7	3.5
38	Nagpur	Lohara	Unconfined	21.26583	78.40833	5.74	1.85
39	Nagpur	Lohgad	Unconfined	21.34222	78.72306	30	3.5
40	Nagpur	Makardhokda	Unconfined	20.86667	79.21944	9.6	2.5
41	Nagpur	Makardhokda_Pz	Unconfined	20.87417	79.20944	10.05	4.4
42	Nagpur	Malapur	Unconfined	21.43222	78.65944	11.5	12.5
43	Nagpur	Manegaon Tek	Unconfined	21.68056	79.42222	10.32	6.3
44	Nagpur	Mangli1	Unconfined	21.02833	79.305	19	7
45	Nagpur	Metpanjara	Unconfined	21.26583	78.71278	10.85	5.7
46	Nagpur	Mohad	Unconfined	21.46861	78.44583	11.7	10
47	Nagpur	Mohgaon Zelpi	Unconfined	21.06833	78.8875	8.25	6.6
48	Nagpur	Mohpa	Unconfined	21.14167	78.7625	10.8	
49	Nagpur	Mouda-1	Unconfined	21.14722	79.40028	10.55	10.4
50	Nagpur	Nagalwadi	Unconfined	21.56667	79.01667	7.4	8.7
51	Nagpur	Nagpur_Chinchbawan	Unconfined	21.06611	79.06111	7.5	7.1

S. No.	District	Site Name	Aquifer	Lat	Long	DTW_May 2019	DTWL_Nov.19
52	Nagpur	Nagpur_Hanuman nagar	Unconfined	21.12639	79.10556	4.3	1.9
53	Nagpur	Nagpur_Koradi naka	Unconfined	21.20861	79.07722	7	2.3
54	Nagpur	Nagpur_Police line takli	Unconfined	21.17639	79.06528		2.2
55	Nagpur	Nagpur_Punapur	Unconfined	21.16083	79.16917	4	0.4
56	Nagpur	Nagpur_Ramdaspath	Unconfined	21.13056	79.06389	6	3.6
57	Nagpur	Nagpur_Wadi naka	Unconfined	21.15222	79.01778	10.4	0.4
58	Nagpur	Nandora	Unconfined	21.17056	78.61111	4.4	3
59	Nagpur	Nara_Pz	Semi/Confined	21.20833	79.08056	10.5	12.8
60	Nagpur	Narkhed	Unconfined	21.46667	78.53333	15.35	6
61	Nagpur	Narkhed_Pz	Unconfined	21.47083	78.53694	13	3
62	Nagpur	Nawegaon (Deshmukh)	Unconfined	20.80278	79.42861	8.45	4.4
63	Nagpur	Nayakund	Unconfined	21.36667	79.18333		10.8
64	Nagpur	Pallora	Unconfined	21.55556	79.33472	8.6	12
65	Nagpur	Panchgaon	Unconfined	21.03333	79.1	12	4.1
66	Nagpur	Paradsinga_Pz	Unconfined	21.31806	78.51944	5.4	25.2
67	Nagpur	Parseoni	Unconfined	21.55	79.16667	8.9	5
68	Nagpur	Patansaongi-2	Unconfined	21.33528	79.01667	10.3	8.7
69	Nagpur	Pipaldol	Unconfined	20.83306	79.26556	7.79	2
70	Nagpur	Pipla Wadi	Unconfined	21.40444	78.84417	11.2	6
71	Nagpur	Ramgiri	Unconfined	21.30194	78.75139	8.1	2.5
72	Nagpur	Ramtek	Unconfined	21.4	79.3	10	4.3
73	Nagpur	Ridhora	Unconfined	21.23222	78.62056	12.1	13
74	Nagpur	Ringnabodi-1	Unconfined	21.12833	78.71694	10.5	5.2
75	Nagpur	Rohna	Unconfined	21.34917	78.48	10.2	5.2
76	Nagpur	Rohna_Pz	Unconfined	21.34722	78.48	8.45	7.2
77	Nagpur	Rui_Gavsi Manapur	Unconfined	21.02	79.04861	14.1	7.7
78	Nagpur	Saoner-1	Unconfined	21.38972	78.94056	10.8	8.7

S. No.	District	Site Name	Aquifer	Lat	Long	DTW_May 2019	DTWL_Nov.19
79	Nagpur	Satgaon	Unconfined	20.92972	79.00361	10.53	4.1
80	Nagpur	Sathnaori	Unconfined	21.13333	78.8	6.25	11
81	Nagpur	Sawargaon	Unconfined	21.39167	78.635	4.65	5.6
82	Nagpur	Sillori	Unconfined	21.30222	78.97306	5.55	8.8
83	Nagpur	Singori	Unconfined	20.74528	79.06972	18.9	3
84	Nagpur	Sirpur Toli	Unconfined	21.36667	79.4	10.4	4.2
85	Nagpur	Sivani	Unconfined	21.4	79.47083	12.2	6.3
86	Nagpur	Sonoli_Pz	Unconfined	21.3625	78.62583	19.2	5.6
87	Nagpur	Takalghat	Unconfined	20.91444	78.94389	1.1	7.4
88	Nagpur	Tarsha	Unconfined	21.22583	79.38111	4.85	3.6
89	Nagpur	Tondakhairi	Unconfined	21.26917	78.9525	9.6	16.2
90	Nagpur	Umrer	Unconfined	20.85	79.33333	8	1
91	Nagpur	Uti	Unconfined	20.95	79.21667	10.6	2
92	Nagpur	Wagholi	Unconfined	21.33333	79.21667	12	3.3
93	Nagpur	Wardhamna	Unconfined	21.14167	78.93333		1.4
94	Nagpur	Wasboli	Unconfined	21.21889	78.70222	14.5	2.3

Annexure IV: Soil Infiltration Test

Date	12-01-2019
Unique ID no.	
Village	Titur
Taluka	Kuhi
District	Nagpur
Coordinates	21.075734, 79.26151
Elevation/RL (mamsl)	278
Initial water level	12
Geology	Granitic gneiss
Soil Type	Clayey Moderately Deep
Final Infiltration Rate	1.2
Total Precipitation	2.90 cm

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
1.00	1	12.30	0.30	18
1.00	2	12.20	0.20	12
1.00	3	12.20	0.20	12

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
2.00	5	12.20	0.20	6
2.00	7	12.20	0.20	6
3.00	10	12.20	0.20	4
5.00	15	12.40	0.40	4.8
5.00	20	12.30	0.30	3.6
10.00	30	12.30	0.30	1.8
10.00	40	12.20	0.20	1.2
10.00	50	12.20	0.20	1.2
10.00	60	12.20	0.20	1.2

Soil Infiltration Test_II

Date	13.02.2020
Unique ID no.	
Village	Haladgaon
Taluka	Ngapur
District	Nagpur
Coordinates	20.842977, 78.866043

Elevation/RL (mamsl)	260
Initial water level	14
Geology	Deccan trap
Soil Type	Black cotton soil
Final Infiltration Rate	11.4
Total Precipitation	26.40 cm

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
1.00	1	15.10	1.10	66
1.00	2	14.50	0.50	30
1.00	3	14.40	0.40	24
2.00	5	14.30	0.30	9
2.00	7	14.40	0.40	12
3.00	10	14.40	0.40	8
5.00	15	14.60	0.60	7.2
5.00	20	14.70	0.70	8.4
10.00	30	14.60	0.60	3.6
10.00	40	15.60	1.60	9.6
10.00	50	15.30	1.30	7.8

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
10.00	60	16.20	2.20	13.2
10.00	70	16.20	2.20	13.2
10.00	80	16.20	2.20	13.2
10.00	90	16.30	2.30	13.8
10.00	100	16.00	2.00	12
10.00	110	15.90	1.90	11.4
10.00	120	15.90	1.90	11.4
10.00	130	15.90	1.90	11.4
10.00	140	15.90	1.90	11.4

Soil Infiltration Test _III

Date	21.02.2020
Unique ID no.	
Village	Kondamendi
Taluka	Mauda
District	Nagpur
Coordinates	21°19'17", 79°28'26"
Elevation/RL (mamsl)	352

Initial water level	14
Geology	Granite Gneisses
Soil Type	Moderately Deep loamy soil
Final Infiltration Rate	5.4
Total Precipitation (cm)	25.50

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
1.00	1	15.10	1.10	66
1.00	2	15.00	1.00	60
1.00	3	14.90	0.90	54
2.00	5	15.10	1.10	33
2.00	7	15.20	1.20	36
3.00	10	15.30	1.30	26
5.00	15	15.30	1.30	15.6
5.00	20	15.50	1.50	18
10.00	30	15.80	1.80	10.8
10.00	40	16.10	2.10	12.6
10.00	50	15.90	1.90	11.4

10.00	60	15.60	1.60	9.6
10.00	70	15.40	1.40	8.4
10.00	80	15.30	1.30	7.8
10.00	90	15.20	1.20	7.2
10.00	100	15.10	1.10	6.6
10.00	110	15.00	1.00	6
10.00	120	14.90	0.90	5.4
10.00	130	14.90	0.90	5.4
10.00	140	14.90	0.90	5.4

Soil Infiltration Test _IV

Date	01.10.2019
Unique ID no.	
Village	Wadamba
Taluka	Ramtek
District	Nagpur
Coordinates	21°36'19.00", 79°22'50.00"

Elevation/RL (mamsl)	507
Initial water level	15
Geology	Granite Gneisses
Soil Type	Moderately Deep loamy soil
Final Infiltration Rate	4.8
Total Precipitation (cm)	28.90

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
1.00	1	16.60	1.60	96
1.00	2	16.50	1.50	90
1.00	3	16.40	1.40	84
2.00	5	16.80	1.80	54
2.00	7	16.60	1.60	48
3.00	10	16.40	1.40	28
5.00	15	16.30	1.30	15.6
5.00	20	16.70	1.70	20.4
10.00	30	16.90	1.90	11.4

Duration (min)	Cum Time (min)	Water level Depth (cm)	Infiltrated water depth (cm)	Infiltration rate (cm/hr)
10.00	40	16.70	1.70	10.2
10.00	50	16.90	1.90	11.4
10.00	60	16.80	1.80	10.8
10.00	70	16.70	1.70	10.2
10.00	80	16.60	1.60	9.6
10.00	90	16.40	1.40	8.4
10.00	100	16.20	1.20	7.2
10.00	110	16.00	1.00	6
10.00	120	15.80	0.80	4.8
10.00	130	15.80	0.80	4.8
10.00	140	15.80	0.80	4.8

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

S. No	Taluka	Site name	lat	Long	PH	EC	TDS	TH	Ca	Mg	Na	K	HCO ₃	Cl	SO ₄	NO ₃	F	SAR	RSC
1	Nagpur	Hudkeshwar Bk.	21.0831	79.1269	8	1160	757	245	92.0	3.6	152	4.7	170	199	20	40		4.22	-2.11
2	Umred	Wadegaon	21.0367	79.1908	7.9	968	632	345	90.0	29.2	62	2.0	160	128	23	47		1.45	-4.28
3	Nagpur (R)	Banawadi	21.0500	79.0928	7.7	670	438	300	90.0	18.2	16	2.0	149	50	22	29		0.40	-3.56
4	Umred	Matkazari	20.9822	79.1378	7.6	965	630	275	90.0	12.2	92	19.6	273	57	24	31		2.41	-1.03
5	Umred	Jamgarh	20.8844	79.1378	8.1	670	438	260	84.0	12.2	23	2.0	152	50	23	28		0.62	-2.70
6	Umred	Chargaon	20.8589	79.0814	7.8	902	589	370	108.0	24.3	37	7.8	135	160	24	42		0.83	-5.19
7	Nagpur (R)	Chimnazari	20.8225	78.9561	7.6	995	650	400	96.0	38.9	44	0.4	202	113	8	43		0.95	-4.69
8	Nagpur (U)	Saubhagyanagar	21.0931	79.1208	7.9	1050	686	360	122.0	13.4	71	7.8	142	195	6	81		1.63	-4.88
9	Nagpur	Jaitala	21.1119	79.0264	8.1	315	206	110	40.0	2.4	21	3.9	64	21	23	23		0.86	-1.15
10	Hingna	Panjari	21.0358	78.9617	8.1	916	598	240	82.0	8.5	92	7.8	199	110	6	31		2.58	-1.55
11	Nagpur (U)	Pioli Nadi	21.1889	79.1228	8	815	532	350	88.0	31.6	35	3.9	131	117	48	25		0.80	-4.85
12	Hingna	Salai Dabha	20.9625	78.9500	7.7	1045	682	285	100.0	8.5	104	3.9	174	156	11	48		2.67	-2.85
13	Hingna	Lakhmpur	20.9505	78.8874	7.8	606	396	250	74.0	15.8	23	2.0	163	21	24	19		0.63	-2.33
14	Hingna	Khairi kh.	20.9094	78.9000	7.6	972	635	235	80.0	8.5	115	3.9	163	113	53	37		3.26	-2.03
15	Hingna	Chauki	20.8998	78.7814	7.8	608	397	230	76.0	9.7	35	2.0	149	25	34	25		0.99	-2.16
16	Hingna	Navegaon	20.9896	78.7948	7.9	550	359	200	72.0	4.9	35	3.9	142	25	34	19		1.06	-1.68
17	Hingna	Ambazari	21.0517	78.8374	8	709	463	290	100.0	9.7	28	3.9	177	35	48	25		0.70	-2.89
18	Umred	Paradgaon	20.9203	79.2192	7.9	460	300	200	62.0	10.9	14	2.0	71	64	38	12		0.42	-2.84
19	Umred	Virali	20.9172	79.2828	8.1	954	623	380	118.0	20.7	46	3.9	89	181	72	37		1.03	-6.15
20	Umred	Bramhni	20.9128	79.3575	7.9	2433	1589	625	98.0	92.4	276	11.7	43	638	211	37		4.80	-11.80
21	Umred	Belgaon	20.8290	79.3378	8.1	4920	3213	225	64.0	15.8	1035	15.6	124	1450	240	12		30.00	-2.470
22	Umred	Dighori	20.7783	79.2319	8.1	660	431	240	58.0	23.1	41	3.9	53	149	22	17		1.16	-3.93
23	Nagpur (R)	Shiwa	21.1172	78.7439	8.2	648	423	270	86.0	13.4	23	3.9	142	46	24	37		0.61	-3.08
24	Hingna	Digdoh	21.0886	78.7567	7.9	1343	877	530	180.0	19.4	64	7.8	238	199	23	37		1.22	-6.71
25	Hingna	Turagondi	21.1122	78.8314	8	658	430	205	64.0	10.9	53	3.9	82	78	58	25		1.61	-2.76

26	Umred	Belpeth/Shedeshwar	20.7477	79.1181	8.1	1600	1045	640	120.0	82.6	78	7.8	284	206	82	37		1.34	-8.15
27	Umred	Kinhala	20.7040	79.1405	7.9	581	379	200	64.0	9.7	41	2.0	43	103	48	37		1.27	-3.30
28	Umred	Sirsi	20.6783	79.1619	7.9	1435	937	605	142.0	60.8	46	7.8	39	397	58	37		0.81	-11.46
29	Nagpur (R)	Bori	20.9194	79.0111	8	2040	1332	710	222.0	37.7	143	7.8	121	425	230	37		2.33	-12.22
30	Nagpur	Gowari	21.2697	78.9478	7.9	1085	709	340	122.0	8.5	92	3.9	46	248	72	37		2.17	-6.04
31	UMRED	Umrer	20.8500	79.3333	7.9	2212	1171	637.5	139.0	69.3	181.8	10.22	862.4	130.3	182	2	0.92	3.14	1.49
32	PARSEONI	Ramtek	21.4000	79.3000	7.7	1407	746	387.6	87.9	40.1	102.23	10	469.9	117.9	51	44	0.95	2.27	0.01
33	NARKHED	Narkhed	21.4667	78.5333	7.4	1417	750	351.9	73.6	40.1	109	1.99	487.7	85.6	43	44	0.55	2.54	1.02
34	HINGNA	Gumgaon	20.9917	79.0333	7.9	758	402	285.6	83.8	18.2	38	8.79	398.5	11.2	12	9	0.73	0.98	0.84
35	RAMTEK	Deolapar	21.5833	79.3667	7.7	613	325	204	47.0	20.7	41	5.67	345.0	13.6	11	0	1.36	1.25	1.60
36	UMRED	Panchgaon	21.0333	79.1667	8	584	310	229.5	63.4	17.0	17	1	249.8	13.6	41	28	1.21	0.49	-0.47
37	Kalmeshwar	Wardhamna	21.1417	78.9333	7.6	1587	841	459	83.8	59.5	61	6.13	475.8	170.0	23	4	0.51	1.24	-1.29
38	KALAMESHWAR	Kalmeshwar	21.2333	78.9167	7.7	685	363	260.1	40.9	37.7	25	4.66	178.4	80.6	35	3	0.46	0.68	-2.22
39	RAMTEK	Chorbaoli	21.4667	79.3167	8	1134	566	255	51.1	30.4	133	2.13	487.7	73.2	20	0	0.84	3.64	2.94
40	PARSEONI	Parseoni	21.5500	79.1667	7.5	696	369	214.2	42.9	25.5	33	33.16	309.3	26.1	19	11	0.12	0.98	0.82
41	PARSEONI	Nagalwadi	21.5667	79.0167	7.7	781	414	229.5	47.0	26.7	51	7.07	327.1	28.5	18	15	0.65	1.47	0.81
42	RAMTEK	Sivani	21.4000	79.4708	7.9	790	418	234.6	42.9	30.4	69	1.41	374.7	33.5	23	14	1.23	1.97	1.50
43	Umrer	Uti	20.9500	79.2167	7.8	967	512	311.1	61.3	37.7	51	3.25	410.4	38.5	35	34	0.77	1.26	0.56
44	MOUDA	Chacher	21.2833	79.3417	7.7	792	420	234.6	53.1	24.3	65	1.81	315.2	45.9	64	4	1.31	1.85	0.51

45	RAMTEK	Manegaon Tek	21.6806	79.4222	7.6	1459	773	433.5	83.8	53.5	42	5.56	463.9	95.5	7	46	0.83	0.88	-0.99
46	SAVNER	Kelod	21.4597	78.8764	7.7	1236	655	311.1	65.4	35.2	128	4.52	428.2	75.7	55	42	1.34	3.17	0.85
47	HINGNA	Sathnaori	21.1333	78.8000	7.8	1015	539	244.8	65.4	19.4	60	43.87	345.0	50.9	41	42	0.63	1.67	0.78
48	PARSEONI	Nayakund	21.3667	79.1833	7.8	773	409	239.7	45.0	30.4	50	6.06	309.3	36.0	22	33	0.92	1.41	0.32
49	SAVNER	Khubala	21.4500	78.9667	7.6	728	386	234.6	42.9	30.4	41	14.06	321.2	23.6	21	21	0.91	1.17	0.62
50	PARSEONI	Wagholi	21.3333	79.2167	7.7	666	353	214.2	40.9	26.7	52	4.6	315.2	23.6	14	15	0.96	1.55	0.92
51	RAMTEK	Sirpur Toli	21.3667	79.4000	7.3	502	266	198.9	34.7	26.7	23	4.07	226.0	16.1	21	24	0.28	0.71	-0.23
52	MOUDA	Khat	21.2417	79.5458	7.9	861	456	249.9	47.0	31.6	56	2.04	368.7	48.4	32	7	2.22	1.55	1.09
53	NAGPUR (RURAL)	Borkhedi	20.8833	78.9750	7.6	826	438	239.7	49.1	27.9	54	3.93	386.6	26.1	18	9	0.55	1.52	1.58
54	KATOL	Chargaon (Punarwasi)	21.2667	78.7583	7.7	858	454	285.6	45.0	41.3	56	1.22	356.9	31.0	28	39	0.54	1.45	0.20
55	NAGPUR (RURAL)	Nagpur_Ramdaspeth	21.1306	79.0639	7.9	693	367	198.9	42.9	21.9	55	1.39	303.3	40.9	16	4	2.49	1.70	1.03
56	Narkhed	Lohara	21.2658	78.4083	7.3	647	342	229.5	65.4	15.8	43	1.6	291.4	36.0	33	8	0.22	1.24	0.21
57	BHIWAPUR	Nawegaon (Deshmukh)	20.8028	79.4286	7.7	564	299	163.2	38.8	15.8	41	7.56	291.4	16.1	21	1	1.12	1.40	1.54
58	SAVNER	Kothulna	21.4194	79.0383	7.7	2329	1233	647.7	110.4	88.7	125	6.73	713.7	232.0	71	45	1.26	2.15	-1.12
59	Hingana	Kanholi bara	20.9333	78.8500	7.5	688	365	234.6	63.4	18.2	33	4.04	309.3	43.4	22	4	0.41	0.94	0.40
60	UMRED	Makardhokda	20.8667	79.2194	7.9	727	384	295.8	59.3	35.2	28	0.66	327.1	28.5	30	10	0.64	0.71	-0.50
61	HINGNA	Amgaon	20.9944	78.9250	7.4	564	299	188.7	42.9	19.4	26	1.14	243.8	31.0	22	1	0.38	0.83	0.25
62	NARKHED	Sawargaon	21.3917	78.6350	7.5	824	436	285.6	47.0	40.1	24	3	321.2	48.4	21	13	0.34	0.62	-0.39
63	Nagpur (Rural)	Mohpa	21.1417	78.7625	7.8	877	465	290.7	49.1	40.1	48	1.94	345.0	36.0	28	30	1.25	1.23	-0.10

64	KALAMESH WAR	Dhapewada	21.3028	78.9139	7.5	136 2	722	504. 9	106.3	57.1	78	1.0 4	463. 9	122. 8	41	44	0.4 4	1.52	-2.41
65	KAMPTEE	Koradi	21.2528	79.0800	7.5	476	252	147. 9	38.8	12.2	40	4.7 8	166. 5	45.9	24	7	0.6 3	1.43	-0.21
66	NAGPUR (RURAL)	Nagpur_Hanuma n nagar	21.1264	79.1056	7.5	103 9	549	362. 1	40.9	62.0	53	2.1 8	428. 2	58.3	37	6	1.6 7	1.22	-0.12
67	SAVNER	Saoner-1	21.3897	78.9406	7.9	130 4	691	418. 2	63.4	62.0	62	0.7 3	487. 7	73.2	38	44	0.5 1	1.33	-0.27
68	KATOL	Nandora	21.1706	78.6111	7.8	397	210	137. 7	26.6	17.0	28	2.6 6	148. 7	13.6	64	4	0.4 5	1.04	-0.29
69	HINGNA	Takalghat	20.9144	78.9439	7.6	220 9	1170	627. 3	126.7	74.1	109	88. 05	927. 8	155. 1	59	47	0.5 8	1.90	2.77
70	SAVNER	Bhasali Takli	21.3533	78.9906	7.8	150 7	798	387. 6	85.9	41.3	162	3.3 8	606. 6	103. 0	52	46	0.3 1	3.59	2.25
71	UMRED	Pipaldol	20.8331	79.2656	8	915	484	321. 3	47.0	48.6	43	6.3 4	350. 9	68.2	66	5	0.2 9	1.05	-0.60
72	Bhiwapur	Bhiwapur	20.7664	79.5164	7.6	944	500	260. 1	59.3	26.7	79	8.3 9	315. 2	98.0	76	15	1.0 2	2.14	0.00
73	RAMTEK	Kharpada	21.5308	79.3475	7.5	134 5	760	367. 2	83.8	37.7	53	9.1 8	315. 2	95.5	82	46	0.2 5	1.21	-2.12
74	NARKHED	Malapur	21.4322	78.6594	7.7	767	406	270. 3	42.9	38.9	29	1.3 6	71.4	145. 2	40	42	0.4 9	0.77	-4.18
75	NAGPUR (RURAL)	Gonkhedi	21.1364	78.9008	7.7	724	384	214. 2	42.9	25.5	55	1.5 8	315. 2	28.5	50	12	1.0 5	1.64	0.92
76	KATOL	Ridhora	21.2322	78.6206	7.6	638	338	198. 9	40.9	23.1	33	2.1 5	285. 5	21.1	20	17	0.5 4	1.02	0.74
77	NAGPUR (RURAL)	Nagpur_Wadi naka	21.1522	79.0178	7.6	912	483	316. 2	47.0	47.4	53	2.1 4	309. 3	68.2	56	22	0.3 3	1.30	-1.18
78	NAGPUR (RURAL)	Nagpur_Chinchb hawan	21.0661	79.0611	7.5	154 2	818	351. 9	83.8	34.0	158	11. 11	493. 6	120. 4	87	44	0.6 9	3.67	1.10
79	NAGPUR (RURAL)	Nagpur_Punapur	21.1608	79.1692	7.5	990	524	275. 4	63.4	27.9	82	11. 41	208. 2	140. 2	78	2	0.1 9	2.16	-2.06
80	Nagpur (Rural)	Nagpur_Koradi naka	21.2086	79.0772	7.8	159 1	844	346. 8	85.9	31.6	165	9.8 3	493. 6	189. 8	14	8	0.5 4	3.86	1.20
81	NAGPUR (RURAL)	Nagpur_Police line takli	21.1764	79.0653	7.6	454	240	204	38.8	25.5	17	0.8 4	107. 1	21.1	130	2	0.8 1	0.52	-2.29
82	KUHI	Kuhi-1	21.0150	79.3603	7.9	780	413	163. 2	18.4	27.9	62	2.2 3	321. 2	18.6	19	14	0.7	2.12	2.05

83	MOUDA	Tarsha	21.2258	79.3811	7.5	2490	1318	821.1	177.8	89.9	143	58.65	731.5	219.6	178	36	0.51	2.18	-4.30
84	HINGNA	Mohgaon Zelpi	21.0683	78.8875	7.5	749	397	219.3	47.0	24.3	32	0.91	249.8	23.6	35	41	0.68	0.94	-0.26
85	SAVNER	Patansaongi-2	21.3353	79.0167	8	560	297	209.1	65.4	10.9	34	1.59	309.3	13.6	8	14	0.45	1.02	0.90
86	KALAMESH WAR	Lohgad	21.3422	78.7231	7.5	908	480	321.3	47.0	48.6	36	2.99	291.4	45.9	42	47	0.27	0.88	-1.57
87	UMRED	Singori	20.7453	79.0697	7.7	557	295	209.1	42.9	24.3	43	1.09	243.8	23.6	29	27	0.44	1.30	-0.15
88	Kalmeshwar	Tondakhairi	21.2692	78.9525	7.7	825	436	300.9	47.0	43.7	39	15.51	380.6	36.0	19	37	0.74	0.98	0.29
89	Katol	Metpanjara	21.2658	78.7128	7.7	1391	737	469.2	124.7	37.7	39	6.32	368.7	112.9	87	30	0.48	0.78	-3.29
90	Kalmeshwar	Sillori	21.3022	78.9731	7.7	2343	1241	877.2	249.4	60.8	106	114.2	921.9	187.4	126	46	0.24	1.56	-2.36
91	Kalmeshwar	Khapri	21.2353	78.8350	7.8	953	505	367.2	45.0	60.8	26	1.1	368.7	48.4	36	45	0.75	0.59	-1.20
92	Kalmeshwar	Linga	21.2028	78.8214	7.7	1476	782	418.2	47.0	71.7	63	63.78	529.3	85.6	75	46	0.54	1.35	0.43
93	Kalmeshwar	Kohli	21.2522	78.8161	7.7	908	482	367.2	65.4	48.6	29	1.64	380.6	40.9	42	41	1.03	0.66	-1.03
94	Katol	Wasboli	21.2189	78.7022	7.7	1141	569	326.4	42.9	52.3	40	12.84	386.6	53.4	41	44	0.62	0.97	-0.11
95	Kalmeshwar	Ramgiri	21.3019	78.7514	7.2	522	276	163.2	45.0	12.2	45	1.79	273.6	16.1	14	9	0.6	1.54	1.24
96	Nagpur (Rural)	Khairgaon	21.1858	78.9567	7.3	1333	706	453.9	92.0	53.5	33	1.8	428.2	78.2	66	47	0.25	0.68	-1.98
97	Nagpur (Rural)	Satgaon	20.9297	79.0036	7.7	1012	536	214.2	42.9	25.5	72	0.77	243.8	83.1	62	25	1.02	2.15	-0.25
98	KALAMESH WAR	Ashti	21.2019	78.9683	7.8	782	414	300.9	65.4	32.8	37	1.23	374.7	18.6	26	41	0.76	0.93	0.17
99	NARKHED	Mohad	21.4686	78.4458	7.7	2076	1100	622.2	139.0	65.6	130	3.06	463.9	294.1	68	16	0.26	2.27	-4.74
100	MOUDA	Mouda-1	21.1472	79.4003	7.6	2288	1212	275.4	40.9	41.3	286	10.67	624.5	204.7	154	46	0.5	7.54	4.79
101	HINGNA	Hingna (Dhangarpura)	21.0739	78.9578	7.6	664	352	249.9	24.5	45.0	33	1.55	321.2	21.1	23	23	0.32	0.91	0.34

102	Ramtek	Karwahi	21.6689	79.4500	8	1703	1107	438.2	145.7	71.1	170.87	2.51	385.5	215.9	99	31		2.90	-6.82
103	Ramtek	Pathrai	21.5306	79.3000	7.8	638	415	239	73.9	40.1	38.4	2	263.5	25.7	50	10		0.89	-2.68
104	Ramtek	Kamthi	21.6067	79.3722	7.8	474	308	229.1	77.8	36.8	19.96	2.01	253.8	12.9	12	16		0.47	-2.76
105	Ramtek	Lakhapur	21.5603	79.4311	7.6	335	218	109.6	31.9	18.9	33.46	1.6	107.4	28.3	35	8		1.16	-1.39
106	Ramtek	Murda	21.4589	79.4164	7.4	1251	813	448.2	129.7	77.4	65.01	0.65	170.8	267.3	11	31		1.11	-10.05
107	Ramtek	Gugaldoh/ Ghogra	21.4217	79.4322	7.6	1590	1034	517.9	167.7	85.1	85.22	0.96	322.1	210.8	109	31		1.34	-10.11
108	Kamthi	Asoli Sakwa	21.1414	79.2042	7.9	1290	839	219.1	77.8	34.3	165.19	0.28	361.1	138.8	33	10		3.92	-0.79
109	Kamthi	Gumthala	21.1375	79.2836	7.7	687	447	288.8	93.8	47.4	34.05	0.85	185.4	79.7	53	31		0.71	-5.55
110	Kamthi	Palsad	21.1147	79.2717	7.6	908	590	303.8	101.8	49.1	61.81	2.07	161	79.7	139	39		1.26	-6.49
111	Kamthi	Chikli	21.0867	79.3031	8	553	359	164.3	49.9	27.8	61.71	1.83	190.3	43.7	36	16		1.74	-1.66
112	Kamthi	Badoda/ Wadoda	21.1339	79.3192	7.8	473	307	204.2	61.9	34.6	14.34	11.5	195.2	18	32	11		0.36	-2.74
113	Mauda	Vanjara	21.1172	79.4189	7.8	619	402	254	79.8	42.3	36.3	1.82	253.8	18	49	29		0.82	-3.31
114	Mauda	Chirvha	21.1278	79.4511	8	900	585	234.1	81.8	37.0	102.06	4.16	292.8	79.7	43	15		2.35	-2.33
115	Mauda	Marodi	21.1564	79.4500	7.9	777	505	219.1	65.9	37.2	38.43	2.87	302.6	43.7	15	18		0.94	-1.40
116	Mauda	Dhanala	21.1858	79.4686	7.6	2240	1456	976.1	305.4	163.0	51.2	0.84	117.1	601.4	145	41		0.59	-26.76
117	Mauda	Govri	21.1214	79.5056	7.9	1885	1225	562.7	167.7	96.0	135.69	30.03	551.4	246.7	76	37		2.07	-7.25
118	Mauda	Panjra	21.2114	79.5369	8.2	1770	1151	368.5	123.8	59.5	235	1.67	395.3	231.3	127	28		4.34	-4.61
119	Mauda	Sirsoli	21.2853	79.5369	8.1	685	445	293.8	85.8	50.5	41.17	3.09	253.8	77.1	31	20		0.87	-4.29

120	Mauda	Bori Ghiwari	21.3281	79.5078	7.9	2894	1881	358.6	123.8	57.1	320.48	1.9	385.5	390.7	72	32		5.97	-4.57
121	Mauda	Aroli	21.3228	79.4494	8.2	919	597	408.4	125.7	68.7	12.38	0.06	219.6	79.7	81	12		0.22	-8.34
122	Mauda	Kumbhapur	21.1989	79.3283	8.1	751	488	403.4	139.7	64.1	2.24	0.06	322.1	20.6	52	19		0.04	-6.98
123	Mauda	Bhendala	21.2308	79.4289	7.9	1674	1088	338.6	105.8	56.6	138.9	0.62	331.8	208.2	53	31		2.71	-4.51
124	Mauda	Hingna	21.2622	79.3878	7.9	1691	1099	408.4	141.7	64.8	138.25	0.59	409.9	182.5	56	30		2.41	-5.70
125	Mauda	Chacher	21.2831	79.3372	8.2	1970	1281	343.6	117.8	54.9	35.19	0.41	175.7	105.4	59	30		0.67	-7.53
126	Mauda	Rewral	21.2647	79.4639	7.8	2952	1919	308.8	103.8	49.8	175	10	444.1	336.7	21	41		3.53	-2.01
127	Kamthi	Waregaon	21.2475	79.1539	7.6	2506	1629	811.7	279.4	129.3	39	24.02	234.2	439.5	77	88		0.48	-20.77
128	Kamthi	Suradevi	21.2469	79.1211	7.6	1569	1020	209.2	63.9	35.3	165	22	229.4	218.5	70	51		4.11	-2.34
129	Kamthi	Ghorpada	21.1886	79.1992	7.6	1985	1290	418.3	143.7	66.7	37.9	20.6	122	277.6	62	8		0.65	-10.67
130	Kamthi	Gada	21.1964	79.2344	7.5	585	380	144.4	47.9	23.5	32.6	18.49	224.5	30.8	19	15		0.96	-0.65
131	Kamthi	Ungaon	21.1903	79.2922	7.7	889	578	308.8	101.8	50.3	37.6	19.34	297.7	69.4	24	29		0.76	-4.35
132	Parseoni	Khandala	21.2192	79.2672	7.7	724	471	119.5	35.9	20.3	68	21	283	43.7	22	17		2.25	1.17
133	Kalmeshwar	Kalmeshwar	21.2297	78.9183	7.6	1898	1234	308.8	91.8	52.7	175	20	214.7	411.2	48	16		3.60	-5.41
134	Kalmeshwar	Uparvani	21.2150	78.8553	7.9	1174	763	239	79.8	38.7	85.33	20.16	361.1	100.2	29	59		1.96	-1.25
135	Kalmeshwar	Wathoda	21.2825	78.8389	7.4	1234	802	263.9	93.8	41.3	61	34.07	209.8	156.8	45	50		1.32	-4.65
136	Kalmeshwar	Mohpa	21.3064	78.8283	7.6	1109	721	318.7	107.8	51.3	35.16	20.45	239.1	125.9	32	62		0.70	-5.69
137	Kalmeshwar	Khairi	21.2925	78.7908	7.5	847	551	244	73.9	41.4	30.51	5.88	136.6	97.7	29	43		0.70	-4.86

138	Kalmeshwar	Mandvi	21.3425	78.8058	7.8	962	625	139.4	47.9	22.2	60.5	36.6	39	92.5	84	46		1.81	-3.58
139	Kalmeshwar	Tishti	21.3731	78.7875	7.4	1026	667	259	87.8	41.6	35.3	20.9	175.7	107.9	35	78		0.78	-4.93
140	Kalmeshwar	Parsodi Wakil	21.3464	78.8856	7.7	756	491	149.4	43.9	25.6	52.9	20.46	268.4	28.3	16	32		1.57	0.10
141	Kalmeshwar	Tel-Kamthi	21.3761	78.8517	7.7	1059	688	219.1	67.9	36.8	60.8	30.07	219.6	128.5	35	53		1.48	-2.82
142	Kalmeshwar	Dadhera	21.3889	78.7728	7.9	929	604	159.4	49.9	26.6	68.16	21.9	195.2	74.5	55	19		1.94	-1.48
143	Saoner	Khursipar	21.4731	78.7589	7.8	590	384	169.3	49.9	29.0	60.7	20.38	185.4	79.7	21	23		1.69	-1.84
144	Saoner	Jatamkhor	21.4747	78.8103	7.4	970	631	179.3	55.9	30.0	34	20.7	161	46.3	42	75		0.91	-2.62
145	Saoner	Umri	21.4203	78.8136	7.6	543	353	129.5	41.9	21.3	30.16	20.1	209.8	25.7	23	17		0.95	-0.41
146	Saoner	Rampuri	21.4436	78.8642	7.5	1240	806	313.7	119.8	47.1	53.8	22.3	219.6	169.6	41	68		1.05	-6.27
147	Saoner	Kelwad	21.4633	78.8792	8	1329	864	273.9	91.8	44.2	122	20.44	409.9	110.5	108	51		2.62	-1.51
148	Parseoni	Satak	21.3367	79.2661	7.4	1243	808	363.5	133.7	55.8	36.8	30.2	156.2	161.9	52	72		0.67	-8.72
149	Ramtek	Amgaon	21.3881	79.3489	7.5	229	149	64.7	20.0	10.9	12.3	3.4	53.7	28.3	12	10		0.55	-1.02
150	Parsioni	Tamaswadi	21.3111	79.1350	7.5	551	358	154.4	53.9	24.4	28.77	1.43	248.9	22.1	2	4		0.82	-0.62
151	Parsioni	Guramde	21.3136	79.1750	7.1	476	309	114.5	33.9	19.6	54.33	2.76	248.9	12.9	36	9		1.84	0.77
152	Parsioni	Kharanbad	21.3739	79.1139	7.6	1360	884	263.9	91.8	41.8	116.49	49.81	327	195.3	7	59		2.53	-2.67
153	Parsioni	Khubala	21.4656	78.9956	7.8	690	449	164.3	59.9	25.4	33.32	23.99	214.7	38.6	35	9		0.91	-1.57
154	Saoner	Tembhurdoh	21.5047	78.9472	7.8	215	140	144.4	47.9	23.5	69.32	2.62	307.4	22.1	22	29		2.05	0.71
155	Saoner	Waki	21.3358	79.0250	7.8	693	450	179.3	63.9	28.0	64.06	0.93	278.2	46.3	61	41		1.68	-0.94
156	Saoner	Gujarwadi	21.3756	78.9436	7.8	934	607	263.9	93.8	41.3	81.74	0.59	458.7	64.3	17	39		1.77	-0.57

157	Saoner	Khurajgaon	21.4147	78.9081	7.9	605	393	164.3	59.9	25.4	72.38	10.25	219.6	59.1	30	33		1.97	-1.49
158	Saoner	Nanda Kuurd Nandapur	21.4414	78.9583	7.9	613	398	164.3	59.9	25.4	84.64	1.18	361.1	22.1	23	6		2.31	0.83
159	Saoner	Kawatha	21.4753	78.9047	7.8	1114	724	298.8	111.8	45.4	76.29	6.16	390.4	84.8	4	39		1.54	-2.93
160	Parseoni	SuwarDhara	21.4856	79.1256	7.7	437	284	144.4	53.9	22.0	30.76	2.86	131.8	22.1	61	14		0.89	-2.34
161	Parseoni	Bitoli	21.4347	79.1650	7.7	2181	1418	438.2	139.7	72.5	298.3	0.81	444.1	308.4	149	12		5.10	-5.67
162	Parseoni	Mahul	21.4150	79.1883	7.4	1089	708	249	99.8	36.3	50.69	15.01	268.4	120.8	2	9		1.10	-3.58
163	Parseoni	Khandala Ghatate	21.2189	79.2672	7.9	612	398	129.5	37.9	22.2	74.22	2.55	307.4	15.4	16	3		2.37	1.32
164	Parseoni	Kherdi	21.2600	79.2900	8.2	1844	1199	378.5	119.8	62.9	103.8	26.51	336.7	311	2	1		1.91	-5.65
165	Ramtek	Kachurwadi	21.3317	79.3853	7.8	401	261	119.5	35.9	20.3	22.27	1.4	156.2	22.1	7	20		0.74	-0.90
166	Mohda	KhaperKhedi	21.3531	79.4292	7.7	770	501	129.5	39.9	21.8	10.5	0.65	53.7	82.2	4	38		0.33	-2.91
167	Ramtek	Patgavri	21.3936	79.2278	8.1	1031	670	219.1	73.9	35.3	101	15.4	419.7	72	54	12		2.42	0.28
168	Borda	Ramtek	21.4483	79.2742	8	1213	788	253.5	89.8	39.8	111.84	56.62	380.6	156.8	55	31		2.47	-1.53
169	Warghat	Ramtek	21.5481	79.4075	7.6	970	631	164.3	59.9	25.4	82.74	4.64	205	77.1	25	5		2.26	-1.72
170	Karwahi	Ramtek	21.3936	79.4492	7.8	984	640	234.1	81.8	37.0	55.3	3.74	248.9	79.7	15	22		1.27	-3.05
171	Parsodi	Mauda	21.0958	79.2092	7.6	1766	1148	373	135.7	57.7	113.2	7.23	224.5	254.4	23	17		2.05	-7.85
172	Bhiwapur	Kaodasi	20.7698	79.3038	8	504		200	32.0	29.0	25	3	195	35	33	19	0.8	0.77	-0.79
173	Bhiwapur	Zamkoli	20.6314	79.1953	8	622		265	60.0	28.0	21	2	226	64	10	37	0.6	0.56	-1.60
174	Bhiwapur	Kholdoda	20.5974	79.3098	8	3142		295	56.0	38.0	610	20	427	638	374	8	0.8	15.41	1.07
175	Bhiwapur	Malewada	20.7262	79.3695	8	1560		325	82.0	29.0	202	16	336	266	96	37	1.1	4.88	-0.98

176	Bhiwapur	Seloti	20.7450	79.4421	8	600		225	60.0	18.0	32	8	293	28	14	16	0.6	0.93	0.32
177	Bhiwapur	Adhyal	20.8030	79.5158	8	583		210	40.0	27.0	37	3	220	32	62	4	0.8	1.11	-0.62
178	Bhiwapur	Somnala	20.8383	79.5119	8	738		260	70.0	21.0	48	4	232	78	38	36	0.4	1.29	-1.42
179	Kuhi	Gothangaon	20.9252	79.5316	8	675		245	60.0	23.0	41	4	311	39	14	17	1.1	1.14	0.21
180	Kuhi	Jiwanapur	20.9462	79.5167	8.2	728		240	40.0	34.0	58	3	348	50	10	4	0.5	1.63	0.91
181	Kuhi	Tutanbori	20.7992	79.4353	8.1	322		200	66.0	9.0	51	4	311	21	24	7	0.4	1.56	1.06
182	Bhiwapur	Gondbori	20.7949	79.4498	8.2	850		320	80.0	29.0	48	4	183	177	19	11	0.3	1.17	-3.39
183	Kuhi	Adam	20.9977	79.4521	8.2	646		290	60.0	34.0	14	4	244	67	24	2	0.3	0.36	-1.80
184	Kuhi	Channa	20.9933	79.5230	8	1410		355	136.0	4.0	145	6	336	220	58	40	0.8	3.34	-1.62
185	Kuhi	Pauni	21.0189	79.4919	8	1680		385	40.0	69.0	207	8	336	365	43	8	0.4	4.59	-2.17
186	Kuhi	Bhiwkund	21.0519	79.4594	8.2	630		265	60.0	28.0	23	2	244	53	24	23	0.8	0.61	-1.30
187	Kuhi	Rajola	21.0733	79.5244	8.1	1450		410	46.0	72.0	147	2	391	248	29	40	0.4	3.15	-1.82
188	Kuhi	Kuhi	21.0119	79.3509	8.1	950		290	100.0	10.0	94	20	226	199	34	24	0.8	2.40	-2.12
189	Kuhi	Dhanoli	21.0446	79.2636	7.9	947		310	36.0	53.0	74	8	415	53	38	30	0.9	1.83	0.64
190	Kuhi	Dodama	21.0112	79.2560	8	1906		500	62.0	84.0	207	16	336	440	43	37	0.8	4.02	-4.50
191	Kuhi	Ambadi	21.0569	79.3643	8.1	928		270	46.0	38.0	85	8	281	135	14	37	0.5	2.24	-0.82
192	UMRED	Umrer	20.8500	79.3333	7.9	2212	1171	637.5	139.0	69.3	181.8	10.22	862.4	130.3	182	2	0.92	3.14	1.49
193	PARSEONI	Ramtek	21.4000	79.3000	7.7	1407	746	387.6	87.9	40.1	102.23	10	469.9	117.9	51	44	0.95	2.27	0.01
194	NARKHED	Narkhed	21.4667	78.5333	7.4	1417	750	351.9	73.6	40.1	109	1.99	487.7	85.6	43	44	0.55	2.54	1.02

195	HINGNA	Gumgaon	20.9917	79.0333	7.9	758	402	285.6	83.8	18.2	38	8.79	398.5	11.2	12	9	0.73	0.98	0.84
196	RAMTEK	Deolapar	21.5833	79.3667	7.7	613	325	204	47.0	20.7	41	5.67	345.0	13.6	11	0	1.36	1.25	1.60
197	UMRED	Panchgaon	21.0333	79.1667	8	584	310	229.5	63.4	17.0	17	1	249.8	13.6	41	28	1.21	0.49	-0.47
198	Kalmeshwar	Wardhamna	21.1417	78.9333	7.6	1587	841	459	83.8	59.5	61	6.13	475.8	170.0	23	4	0.51	1.24	-1.29
199	KALAMESHWAR	Kalmeshwar	21.2333	78.9167	7.7	685	363	260.1	40.9	37.7	25	4.66	178.4	80.6	35	3	0.46	0.68	-2.22
200	RAMTEK	Chorbaoli	21.4667	79.3167	8	1134	566	255	51.1	30.4	133	2.13	487.7	73.2	20	0	0.84	3.64	2.94
201	PARSEONI	Parseoni	21.5500	79.1667	7.5	696	369	214.2	42.9	25.5	33	33.16	309.3	26.1	19	11	0.12	0.98	0.82
202	PARSEONI	Nagalwadi	21.5667	79.0167	7.7	781	414	229.5	47.0	26.7	51	7.07	327.1	28.5	18	15	0.65	1.47	0.81
203	RAMTEK	Sivani	21.4000	79.4708	7.9	790	418	234.6	42.9	30.4	69	1.41	374.7	33.5	23	14	1.23	1.97	1.50
204	Umrer	Uti	20.9500	79.2167	7.8	967	512	311.1	61.3	37.7	51	3.25	410.4	38.5	35	34	0.77	1.26	0.56
205	MOUDA	Chacher	21.2833	79.3417	7.7	792	420	234.6	53.1	24.3	65	1.81	315.2	45.9	64	4	1.31	1.85	0.51
206	RAMTEK	Manegaon Tek	21.6806	79.4222	7.6	1459	773	433.5	83.8	53.5	42	5.56	463.9	95.5	7	46	0.83	0.88	-0.99
207	SAVNER	Kelod	21.4597	78.8764	7.7	1236	655	311.1	65.4	35.2	128	4.52	428.2	75.7	55	42	1.34	3.17	0.85
208	HINGNA	Sathnaori	21.1333	78.8000	7.8	1015	539	244.8	65.4	19.4	60	43.87	345.0	50.9	41	42	0.63	1.67	0.78
209	PARSEONI	Nayakund	21.3667	79.1833	7.8	773	409	239.7	45.0	30.4	50	6.06	309.3	36.0	22	33	0.92	1.41	0.32
210	SAVNER	Khubala	21.4500	78.9667	7.6	728	386	234.6	42.9	30.4	41	14.06	321.2	23.6	21	21	0.91	1.17	0.62
211	PARSEONI	Wagholi	21.3333	79.2167	7.7	666	353	214.2	40.9	26.7	52	4.6	315.2	23.6	14	15	0.96	1.55	0.92
212	RAMTEK	Sirpur Toli	21.3667	79.4000	7.3	502	266	198.9	34.7	26.7	23	4.07	226.0	16.1	21	24	0.28	0.71	-0.23
213	MOUDA	Khat	21.2417	79.5458	7.9	861	456	249.9	47.0	31.6	56	2.04	368.7	48.4	32	7	2.22	1.55	1.09

214	NAGPUR (RURAL)	Borkhedi	20.8833	78.9750	7.6	826	438	239.7	49.1	27.9	54	3.93	386.6	26.1	18	9	0.55	1.52	1.58
215	KATOL	Chargaon (Punarwasi)	21.2667	78.7583	7.7	858	454	285.6	45.0	41.3	56	1.22	356.9	31.0	28	39	0.54	1.45	0.20
216	NAGPUR (RURAL)	Nagpur_Ramdaspeth	21.1306	79.0639	7.9	693	367	198.9	42.9	21.9	55	1.39	303.3	40.9	16	4	2.49	1.70	1.03
217	Narkhed	Lohara	21.2658	78.4083	7.3	647	342	229.5	65.4	15.8	43	1.6	291.4	36.0	33	8	0.22	1.24	0.21
218	BHIWAPUR	Nawegaon (Deshmukh)	20.8028	79.4286	7.7	564	299	163.2	38.8	15.8	41	7.56	291.4	16.1	21	1	1.12	1.40	1.54
219	SAVNER	Kothulna	21.4194	79.0383	7.7	2329	1233	647.7	110.4	88.7	125	6.73	713.7	232.0	71	45	1.26	2.15	-1.12
220	Hingana	Kanholi bara	20.9333	78.8500	7.5	688	365	234.6	63.4	18.2	33	4.04	309.3	43.4	22	4	0.41	0.94	0.40
221	UMRED	Makardhokda	20.8667	79.2194	7.9	727	384	295.8	59.3	35.2	28	0.66	327.1	28.5	30	10	0.64	0.71	-0.50
222	HINGNA	Amgaon	20.9944	78.9250	7.4	564	299	188.7	42.9	19.4	26	1.14	243.8	31.0	22	1	0.38	0.83	0.25
223	NARKHED	Sawargaon	21.3917	78.6350	7.5	824	436	285.6	47.0	40.1	24	3	321.2	48.4	21	13	0.34	0.62	-0.39
224	Nagpur (Rural)	Mohpa	21.1417	78.7625	7.8	877	465	290.7	49.1	40.1	48	1.94	345.0	36.0	28	30	1.25	1.23	-0.10
225	KALAMESHWAR	Dhapewada	21.3028	78.9139	7.5	1362	722	504.9	106.3	57.1	78	1.04	463.9	122.8	41	44	0.44	1.52	-2.41
226	KAMPTEE	Koradi	21.2528	79.0800	7.5	476	252	147.9	38.8	12.2	40	4.78	166.5	45.9	24	7	0.63	1.43	-0.21
227	NAGPUR (RURAL)	Nagpur_Hanuman nagar	21.1264	79.1056	7.5	1039	549	362.1	40.9	62.0	53	2.18	428.2	58.3	37	6	1.67	1.22	-0.12
228	SAVNER	Saoner-1	21.3897	78.9406	7.9	1304	691	418.2	63.4	62.0	62	0.73	487.7	73.2	38	44	0.51	1.33	-0.27
229	KATOL	Nandora	21.1706	78.6111	7.8	397	210	137.7	26.6	17.0	28	2.66	148.7	13.6	64	4	0.45	1.04	-0.29
230	HINGNA	Takalghat	20.9144	78.9439	7.6	2209	1170	627.3	126.7	74.1	109	88.05	927.8	155.1	59	47	0.58	1.90	2.77
231	SAVNER	Bhasali Takli	21.3533	78.9906	7.8	1507	798	387.6	85.9	41.3	162	3.38	606.6	103.0	52	46	0.31	3.59	2.25
232	UMRED	Pipaldol	20.8331	79.2656	8	915	484	321.3	47.0	48.6	43	6.34	350.9	68.2	66	5	0.29	1.05	-0.60

233	Bhiwapur	Bhiwapur	20.7664	79.5164	7.6	944	500	260.1	59.3	26.7	79	8.39	315.2	98.0	76	15	1.02	2.14	0.00
234	RAMTEK	Kharpada	21.5308	79.3475	7.5	1345	760	367.2	83.8	37.7	53	9.18	315.2	95.5	82	46	0.25	1.21	-2.12
235	NARKHED	Malapur	21.4322	78.6594	7.7	767	406	270.3	42.9	38.9	29	1.36	71.4	145.2	40	42	0.49	0.77	-4.18
236	NAGPUR (RURAL)	Gonkhedi	21.1364	78.9008	7.7	724	384	214.2	42.9	25.5	55	1.58	315.2	28.5	50	12	1.05	1.64	0.92
237	KATOL	Ridhora	21.2322	78.6206	7.6	638	338	198.9	40.9	23.1	33	2.15	285.5	21.1	20	17	0.54	1.02	0.74
238	NAGPUR (RURAL)	Nagpur_Wadinaka	21.1522	79.0178	7.6	912	483	316.2	47.0	47.4	53	2.14	309.3	68.2	56	22	0.33	1.30	-1.18
239	NAGPUR (RURAL)	Nagpur_Chinchbhawan	21.0661	79.0611	7.5	1542	818	351.9	83.8	34.0	158	11.11	493.6	120.4	87	44	0.69	3.67	1.10
240	NAGPUR (RURAL)	Nagpur_Punapur	21.1608	79.1692	7.5	990	524	275.4	63.4	27.9	82	11.41	208.2	140.2	78	2	0.19	2.16	-2.06
241	Nagpur (Rural)	Nagpur_Koradinaka	21.2086	79.0772	7.8	1591	844	346.8	85.9	31.6	165	9.83	493.6	189.8	14	8	0.54	3.86	1.20
242	NAGPUR (RURAL)	Nagpur_Police line takli	21.1764	79.0653	7.6	454	240	204	38.8	25.5	17	0.84	107.1	21.1	130	2	0.81	0.52	-2.29
243	KUHI	Kuhi-1	21.0150	79.3603	7.9	780	413	163.2	18.4	27.9	62	2.23	321.2	18.6	19	14	0.7	2.12	2.05
244	MOUDA	Tarsha	21.2258	79.3811	7.5	2490	1318	821.1	177.8	89.9	143	58.65	731.5	219.6	178	36	0.51	2.18	-4.30
245	HINGNA	Mohgaon Zelpi	21.0683	78.8875	7.5	749	397	219.3	47.0	24.3	32	0.91	249.8	23.6	35	41	0.68	0.94	-0.26
246	SAVNER	Patansaongi-2	21.3353	79.0167	8	560	297	209.1	65.4	10.9	34	1.59	309.3	13.6	8	14	0.45	1.02	0.90
247	KALAMESH WAR	Lohgad	21.3422	78.7231	7.5	908	480	321.3	47.0	48.6	36	2.99	291.4	45.9	42	47	0.27	0.88	-1.57
248	UMRED	Singori	20.7453	79.0697	7.7	557	295	209.1	42.9	24.3	43	1.09	243.8	23.6	29	27	0.44	1.30	-0.15
249	Kalmeshwar	Tondakhairi	21.2692	78.9525	7.7	825	436	300.9	47.0	43.7	39	15.51	380.6	36.0	19	37	0.74	0.98	0.29
250	Katol	Metpanjara	21.2658	78.7128	7.7	1391	737	469.2	124.7	37.7	39	6.32	368.7	112.9	87	30	0.48	0.78	-3.29
251	Kalmeshwar	Sillori	21.3022	78.9731	7.7	2343	1241	877.2	249.4	60.8	106	11.42	921.9	187.4	126	46	0.24	1.56	-2.36

25 2	Kalmeshwar	Khapri	21.2353	78.8350	7.8	953	505	367. 2	45.0	60.8	26	1.1	368. 7	48.4	36	45	0.7 5	0.59	-1.20
25 3	Kalmeshwar	Linga	21.2028	78.8214	7.7	147 6	782	418. 2	47.0	71.7	63	63. 78	529. 3	85.6	75	46	0.5 4	1.35	0.43
25 4	Kalmeshwar	Kohli	21.2522	78.8161	7.7	908	482	367. 2	65.4	48.6	29	1.6 4	380. 6	40.9	42	41	1.0 3	0.66	-1.03
25 5	Katol	Wasboli	21.2189	78.7022	7.7	114 1	569	326. 4	42.9	52.3	40	12. 84	386. 6	53.4	41	44	0.6 2	0.97	-0.11
25 6	Kalmeshwar	Ramgiri	21.3019	78.7514	7.2	522	276	163. 2	45.0	12.2	45	1.7 9	273. 6	16.1	14	9	0.6	1.54	1.24
25 7	Nagpur (Rural)	Khairgaon	21.1858	78.9567	7.3	133 3	706	453. 9	92.0	53.5	33	1.8	428. 2	78.2	66	47	0.2 5	0.68	-1.98
25 8	Nagpur (Rural)	Satgaon	20.9297	79.0036	7.7	101 2	536	214. 2	42.9	25.5	72	0.7 7	243. 8	83.1	62	25	1.0 2	2.15	-0.25
25 9	KALAMESH WAR	Ashti	21.2019	78.9683	7.8	782	414	300. 9	65.4	32.8	37	1.2 3	374. 7	18.6	26	41	0.7 6	0.93	0.17
26 0	NARKHED	Mohad	21.4686	78.4458	7.7	207 6	1100	622. 2	139.0	65.6	130	3.0 6	463. 9	294. 1	68	16	0.2 6	2.27	-4.74
26 1	MOUDA	Mouda-1	21.1472	79.4003	7.6	228 8	1212	275. 4	40.9	41.3	286	10. 67	624. 5	204. 7	154	46	0.5	7.54	4.79
26 2	HINGNA	Hingna (Dhangarpura)	21.0739	78.9578	7.6	664	352	249. 9	24.5	45.0	33	1.5 5	321. 2	21.1	23	23	0.3 2	0.91	0.34
26 3	Kuhi	khairi Pannase (dw)	78.9331	21.0977	7.8	130 9	850.8 5	205	54.1	17.0	9	0.2	305. 1	212. 7	360.22 5	93	0.1 1	0.27	0.90

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

s. no.	TAHSIL_ NAME	Site Name	LONGITU DE	LATITUD E	pH	EC	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	mg (mg/l)	Na(m g/l)	K(m g/l)	HCO3(mg/l)	Cl(m g/l)	SO4(m g/l)	NO3 (mg/l)	F (mg/ l)	SAR	RSC
1	Ramtek	Amgaon	79.3483	21.3889	6.8	203	132.0	90	20	9.7	4.6	3.9	42.7	35.5	19.2	3.1	0.21	0.21	-1.10
2	Ramtek	Amgaon PYT	79.3483	21.3889	7	179	116.4	70	20	4.9	8.7	2.0	36.6	24.8	8.2	1.24	0.15	0.45	-0.80
3	Ramtek	Wadamba EW Drilling	79.3803	21.6053	7.4	458	297.7	160	40	14.6	29.9	2.0	164.8	46.1	76.8	24.8	0.65	1.03	-0.50
4	Ramtek	Wadamba EW PYT	79.3803	21.6053	7.3	214	139.1	90	24	7.3	6.9	2.0	42.7	31.9	9.6	9.92	0.77	0.32	-1.10
5	Ramtek	WadambaO W Drilling	79.3803	21.6053	7.4	465	302.3	150	40	12.2	34.5	3.9	73.2	70.9	24.0	6.82	0.7	1.22	-1.80
6	Ramtek	Wadamba OW PYT	79.3803	21.6053	7.3	581	377.7	160	20	26.7	57.5	3.9	195.3	49.6	43.2	18.6	0.72	1.98	0.00
7	Ramtek	Borda EW PYT 1	79.2797	21.4439	7.9	801	520.7	275	20	54.7	50.6	3.9	372.2	21.3	43.2	16.74	1.3	1.33	0.60
8	Ramtek	Borda EWPYT 2	79.2797	21.4439	8.2	810	526.5	250	10	54.7	69.0	4.7	244.1	53.2	225.6	24.8	1.37	1.90	-1.00
9	Ramtek	Borda EW Drilling	79.2797	21.4439	7.9	807	524.6	275	40	42.5	59.8	5.1	109.8	24.8	307.2	24.8	1.4	1.57	-3.70
10	Ramtek	Borda OW PYT	79.2797	21.4439	8.2	638	414.7	240	30	40.1	34.5	3.1	256.3	39.0	192.0	4.96	1	0.97	-0.60
11	Ramtek	Chichala EW Drilling	79.3428	21.3483	8.1	1719	1117.4	575	22	126.4	135.7	4.7	793.3	269.4	19.2	31	0.38	2.46	1.50
12	Ramtek	WadambaDugwell 1	79.3811	21.6050	7.6	812	527.8	310	96	17.0	41.4	3.9	305.1	81.5	14.4	31	1	1.02	-1.20
13	Ramtek	Wadamba Dugwell 2	79.3814	21.6039	7.7	792	514.8	340	66	42.5	25.3	2.0	311.2	70.9	19.2	31	0.9	0.60	-1.70
14	Mauda	Tarsha Dugwell 1	79.3814	21.2286	7.6	1751	1138.2	475	114	46.2	202.4	7.8	286.8	407.7	86.4	24.8	0.52	4.04	-4.80
15	Mauda	Tarsha Dugwell 2	79.3786	21.2331	7.7	1217	791.1	275	98	7.3	149.5	3.9	274.6	124.1	163.2	43.4	0.98	3.92	-1.00
16	Mauda	Tarsha HandPump	79.3811	21.2281	7.6	2542	1652.3	900	168	116.7	172.5	9.0	335.6	655.8	48.0	42.16	0.45	2.50	-12.50
17	Parseoni	Nayakund Dugwell 1	79.1947	21.3653	7.8	1232	800.8	465	100	52.3	66.7	5.1	335.6	159.5	76.8	43.4	0.67	1.34	-3.80
18	Parseoni	Nayakund Dugwell 2	79.2011	21.3667	7.9	690	448.5	210	30	32.8	59.8	3.9	274.6	35.5	57.6	13.02	0.7	1.79	0.30

s. no.	TAHSIL_NAME	Site Name	LONGITUDE	LATITUDE	pH	EC	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	mg (mg/l)	Na(mg/l)	K(mg/l)	HCO3(mg/l)	Cl(mg/l)	SO4(mg/l)	NO3 (mg/l)	F (mg/l)	SAR	RSC
19	Parseoni	Nayakund HandPump	79.1961	21.3694	7.4	752	488.8	300	70	30.4	29.9	7.8	305.1	49.6	28.8	31	0.8	0.75	-1.00
20	Kamptee	GumthalaDugwell 1	79.2836	21.1375	7.6	753	489.5	250	30	42.5	52.9	7.8	280.7	70.9	14.4	38.44	0.42	1.45	-0.40
21	Kamptee	GumthalaDugwell 2	79.2856	21.1406	7.6	949	616.9	290	66	30.4	80.5	3.9	439.3	35.5	33.6	31	0.44	2.06	1.40
22	Savner	NandagomukhDugwell 1	78.7753	21.4306	7.8	365	237.3	125	20	18.2	25.3	2.0	122.0	35.5	14.4	24.8	0.33	0.98	-0.50
23	Savner	NandagomukhDugwell 2	78.7700	21.4211	7.3	1320	858.0	500	20	109.4	71.3	3.9	335.6	212.7	43.2	49.6	0.27	1.39	-4.50
24	Savner	NandagomukhHandPump	78.7694	21.4175	7.6	1151	748.2	450	24	94.8	46.0	4.7	305.1	184.3	25.0	24.8	0.4	0.94	-4.00
25	Bhiwapur	Mandawa	79.2587	20.7515	8.1	458	297.7	120	38.076	6.1	2.0	0.9	189.2	35.5	190.1	23	0.29	0.08	0.70
26	Hingna	khairi Pannase	78.9331	21.0977	7.5	1162	755.3	230	56.112	21.9	6.9	0.2	146.4	262.3	460.3	83	0.14	0.20	-2.20
27	Kuhi	Salwa	79.4444	21.0497	7.7	765	497.3	105	28.056	8.5	5.0	0.6	366.1	28.4	110.1	11	1.3	0.21	3.90
28	KUHI	ADAM	79.4521	20.9977	7.3	1935	1258.0	264						224.0	148.0	9	0.89	#DIV /0!	0.00
29	BHIWAPUR	ADYAL (PU)	79.5158	20.8030	7.9	723	470.0	188						30.0	32.0	2	0.84	#DIV /0!	0.00
30	MOUDA	AROLI	79.4494	21.3228	7.16	512	333.0	200						52.0	9.0	12	0.52	#DIV /0!	0.00
31	MOUDA	AROLI	79.0367	21.1694	7.28	586	381.0	236						54.0	56.0	3	0.62	#DIV /0!	0.00
32	BHIWAPUR	BESUR	79.2660	20.6936	8.4	1678	1091.0	244						216.0	92.0	9	2	#DIV /0!	0.00
33	BHIWAPUR	BESUR	78.7250	21.0458	8.3	3020	1963.0	402						350.0	300.0	15	1	#DIV /0!	0.00
34	MOUDA	CHACHER	79.3372	21.2831	7.52	2160	1404.0	359						308.0	198.0	114	0.65	#DIV /0!	0.00
35	MOUDA	CHACHER	79.1675	21.0861	8.19	2265	1472.0	460						264.0	120.0	286	1.46	#DIV /0!	0.00
36	HINGNA	KANHOLIBA	78.8686	21.2394	8.4	115	753.0	238						82.0	46.0	6	0.03	#DIV /0!	0.00

s. no.	TAHSIL_NAME	Site Name	LONGITUDE	LATITUDE	pH	EC	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	mg (mg/l)	Na(mg/l)	K(mg/l)	HCO3(mg/l)	Cl(mg/l)	SO4(mg/l)	NO3 (mg/l)	F (mg/l)	SAR	RSC
		RA			9	8												/0!	
37	SAONER	KELWAD	78.8792	21.4633	7.42	678	441.0	313						54.0	18.0	16	0.91	#DIV /0!	0.00
38	SAONER	KELWAD	79.3250	20.8500	7.48	803	522.0	338						54.0	22.0	31	1.03	#DIV /0!	0.00
39	NAGPUR RURAL	WATHODA	78.8389	21.2825	8.48	1258	818.0	372						112.0	35.0	49	0.43	#DIV /0!	0.00
40	KUHI	WELTUR	79.4500	21.1597	7.9	1243	808.0	124						128.0	92.0	65	0.69	#DIV /0!	0.00
41	BHIWAPUR	ZAMKOLI	78.9917	21.0194	8.7	1469	955.0	324						220.0	126.0	170	0.85	#DIV /0!	0.00
42	NAGPUR RURAL	BAHADURA	79.1675	21.0861	8.16	2353	1530.0	676						254.0	75.0	102	0.66	#DIV /0!	0.00
43	Katol	Ladgaon Ow-I	78.5644	21.2269	7.8	885	575.0	410	86	47.0	41.0	3.3	244.0	89.0	104.0	51	0.24	0.88	-4.17
44	Katol	Maragsur-EW	78.7071	21.2073	7.9	772	502.0	220	38	30.0	63.0	47.5	79.0	121.0	173.0	48	0.2	1.85	-3.07
45	Katol	Ladgaon Ew-I	78.5644	21.2269	7.5	621	404.0	90	26	6.0	109.0	1.7	207.0	71.0	62.0	33	1.87	5.00	1.60
46	Katol	Khangaon Z-I Ow	78.5467	21.2942	7.6	523	340.0	220	62	16.0	44.0	8.4	275.0	43.0	45.0	24	0.66	1.29	0.09
47	Katol	Metpanjra-EW	78.7000	21.2583	7.9	979	636.0	100	34	4.0	188.0	0.9	43.0	216.0	203.0	16	0.39	8.11	-1.32
48	Katol	Narkhed PZ	78.5381	21.3381	7.8	697	439.1	255	32.064	42.5	7.6	0.4	158.6	46.1	78.0	12	1.04	0.21	-2.50
49	Katol	Khangaon Ew	78.5467	21.2942	7.1	1183	769.0	235	86	5.0	192.0	5.5	165.0	163.0	323.0	11	0.94	5.44	-2.01
50	Katol	Dorli-OW	78.7833	21.2667	8.3	1160	725.0	70	26	1.2	235.0	2.0	128.0	170.0	225.0	1.4		12.22	0.70
51	Narkhed	Lohari Sawanga-PYT	78.4044	21.2600	8.1	700	NA	60	12	7.3	NA	NA	213.5	99.3	NA	BDL	1	0.00	2.30
52	Narkhed	Sawargaon Ew	78.6342	21.4008	7.5	829	539.0	335	96	23.0	71.0	2.2	207.0	89.0	192.0	51	0.17	1.69	-3.30
53	Narkhed	Koni Ew	78.5822	21.4394	7.9	772	502.0	220	38	30.0	63.0	47.5	79.0	121.0	173.0	48	0.2	1.85	-3.07

s. no.	TAHSIL_NAME	Site Name	LONGITUDE	LATITUDE	pH	EC	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	mg (mg/l)	Na(mg/l)	K(mg/l)	HCO3(mg/l)	Cl(mg/l)	SO4(mg/l)	NO3 (mg/l)	F (mg/l)	SAR	RSC
54	Narkhed	Manikwada Z-III Ew	78.4997	21.4969	8	450	293.0	155	48	9.0	46.0	2.1	183.0	32.0	51.0	48	0.2	1.60	-0.14
55	Narkhed	Manikwada Z-II Ew	78.4997	21.4969	7.8	400	260.0	150	52	5.0	37.0	1.2	153.0	32.0	43.0	47	0.17	1.31	-0.50
56	Narkhed	Jamgaon Kh.-EW	78.4367	21.3381	7.3	980	NA	365	68	47.4	NA	NA	274.5	67.4	NA	46.32	0.55	0.00	-2.80
57	Narkhed	Manikwada Ew PYT	78.4997	21.4969	8	402	261.0	180	40	19.0	25.0	1.0	201.0	25.0	24.0	45	0.24	0.81	-0.27
58	Narkhed	Narkhed-OW	78.5292	21.4722	7.9	1426	898.4	470	64.128	75.3	17.1	0.1	225.7	212.7	42.0	44	0.33	0.34	-5.71
59	Narkhed	Manikwada Z-I Ew	78.4997	21.4969	8	350	228.0	130	32	12.0	36.0	1.7	92.0	32.0	42.0	38	0.21	1.38	-1.08
60	Narkhed	Arambhi-EW	78.3486	21.2694	7.5	700	NA	75	20	6.1	110.0	25.0	103.7	127.7	55.0	32	0.45	5.52	0.20
61	Narkhed	Arambhi	78.3486	21.2694	8.1	670	NA	90	14	13.4	NA	NA	244.0	81.5	NA	24.3	1	0.00	2.20
62	Narkhed	Jamgaon Kh.-EW PYT	78.4367	21.3381	8.7	1160	NA	160	38	15.8	NA	NA	170.8	109.9	NA	20.6	0.55	0.00	0.80
63	Narkhed	Arambhi	78.3486	21.2694	7.8	640	NA	75	10	12.2	NA	NA	237.9	81.5	NA	20	0.99	0.00	2.40
64	Narkhed	Khedi Ew	78.6444	21.4589	7.9	979	636.0	100	34	4.0	188.0	0.9	43.0	216.0	203.0	16	0.39	8.11	-1.32
65	Narkhed	Arambhi-EW	78.3486	21.2694	6.85	1830	NA	545	106.212	68.1	150.2	32.0	274.5	205.6	374.4	7.8	0.13	2.80	-6.41
66	Narkhed	Tinkheda-EW PYT	78.4903	21.4033	7.24	961	NA	215	46.092	24.3	116.7	2.4	201.3	124.1	122.4	2.55	0.3	3.46	-1.00
67	Narkhed	Belona-EW PYT	78.4864	21.4833	7.32	630	NA	140	38.076	10.9	88.9	0.7	286.7	42.5	36.0	0.75	0.93	3.26	1.90
68	Narkhed	Wadvihra-EW	78.3986	21.3472	7.5	750	0.0	135	24	9.0	0.0	0.0	140.0	136.0	0.0	0		0.00	0.35
69	Katol	Sonkhamb	78.7225	21.2723	8.3	857	105.0	400	26	81.0	16.0	0.2	128.0	160.0	147.0	11	1.4	0.35	-5.77
70	Katol	Ramgiri	78.7575	21.3001	8.2	798	105.0	325	48	50.0	6.0	0.2	128.0	89.0	95.0	65	0.5	0.14	-4.42
71	Katol	Malegaon	78.7183	21.3078	8	519	140.0	235	42	32.0	5.0	0.3	171.0	46.0	21.0	42	0.46	0.14	-1.93
72	Kalmeshwar	Kohli	78.8094	21.2653	8.1	852	55.0	375	16	81.0	16.0	0.2	67.0	106.0	189.0	44	1.4	0.36	-6.37
73	Kalmeshwar	Dahegaon	78.9456	21.2163	8.3	540	110.0	235	30	39.0	8.0	0.4	134.0	67.0	33.0	28	0.68	0.23	-2.21

s. no.	TAHSIL_NAME	Site Name	LONGITUDE	LATITUDE	pH	EC	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	mg (mg/l)	Na(mg/l)	K(mg/l)	HCO3(mg/l)	Cl(mg/l)	SO4(mg/l)	NO3 (mg/l)	F (mg/l)	SAR	RSC
74	Kalmeshwar	Khapri	78.8408	21.2397	8.5	492	185.0	225	12	47.0	9.0	0.3	226.0	25.0	7.0	21	1.31	0.26	-0.36
75	Kalmeshwar	Mohgaon	78.8475	21.2965	8.4	563	170.0	275	50	36.0	3.0	0.3	207.0	57.0	26.0	21	0.36	0.08	-1.77
76	Savner	Dhapewada	78.9050	21.3033	8.1	747	205.0	330	58	45.0	6.0	0.3	250.0	78.0	41.0	32	0.53	0.14	-2.50
77	Mauda	Gowri	78.9497	21.2686	8.3	470	95.0	210	26	35.0	5.0	0.7	116.0	85.0	13.0	1	0.36	0.15	-1.98
78	Kalmeshwar	Khairi lakhmaji	78.9517	21.2528	7.2	2211	110.0	960	246	84.0	10.0	17.9	134.0	557.0	187.0	31	0.9	0.14	-17.02
79	Katol	Raulgaon	78.7831	21.2376	8.2	904	120.0	395	22	83.0	17.0	0.2	146.0	110.0	139.0	46	1.23	0.37	-5.54
80	Kalmeshwar	Waroda	78.9047	21.2636	8	1421	250.0	250	60	120.3	9.8	0.2	305.0	202.0	100.2	39.1	0.41	0.17	-7.90
81	NAGPUR RURAL	Salai Godhani	79.1203	21.0093	7.56	564		155	52	6.1	57.5	2.0	213.6	24.8	48.0	25.42	0.67	2.01	0.40
82	Kuhi	Dhanoli	79.2645	21.0418	7.8	2512		585	24	127.6	338.1	15.6	61.0	694.8	288.0	14.26	2.2	6.08	-10.70
83	Hingna	Sukali Gharapure	78.9473	20.9829	8.2	1698		335	46	53.5	236.9	3.9	140.3	322.6	259.2	19.84	4.4	5.63	-4.40
84	Bhiwapur	Mandwa	79.2587	20.7515	7.47	392		145	26	19.4	23.0	2.0	73.2	70.9	28.8	3.1	0.43	0.83	-1.70

Annexure-VII: Water Level of Ground water monitoring wells (2019) with long term trend (2010-2019)

S.No.	District	Site name	Site id	Lat	Long	DTWL_May 2019 (m bgl)	Pre-trend (m /year)	DTWL_Nov.19 (m bgl)	Post-trend (m /year)
1	Nagpur	Amgaon	W205940078553001	20.99444	78.925	6.4	-0.002	2.7	-0.00564
2	Nagpur	Bela_Pz	W204630079004501	20.775	79.0125	7.6	-0.24677	3.2	-0.69044
3	Nagpur	Bhasali Takli	W212112078592601	21.35333	78.99056	12.9	-0.78714	15	-0.44319
4	Nagpur	Bhiwapur	W204559079305901	20.76639	79.51639	9.7	-0.56891	6.4	-0.67144
5	Nagpur	Bokhara_Pz	W211340079041002	21.22778	79.06944	5.85		2.1	0.477883
6	Nagpur	Borkhedi	W205300078583001	20.88333	78.975		-0.025	3.6	-0.08705
7	Nagpur	Borkhedi_Pz	W205152078581101	20.86444	78.96972	8.04			-1.02897
8	Nagpur	Chacher	W211700079203001	21.28333	79.34167	8.05	-0.78452	3.2	0.101203
9	Nagpur	Chargaon (Punarwasi)	W211600078453001	21.26667	78.75833	5.05	-0.31066	3.2	0.104029
10	Nagpur	Chorbaoli	W212800079190001	21.46667	79.31667	8.95	0.906192	3.9	-0.06602
11	Nagpur	Deolapar	W213500079220001	21.58333	79.36667	13.2	-0.02907	4	2.535773
12	Nagpur	Dhapewada	W211810078545001	21.30278	78.91389	8.7	-0.42924	12.8	-0.25912
13	Nagpur	Fetri_Pz	W211209078595301	21.2025	78.99806	7.7	-0.13529		-0.29411
14	Nagpur	Gonkhedi	W210811078540301	21.13639	78.90083		-0.05015	3.9	-0.63235
15	Nagpur	Gumgaon	W205930079020001	20.99167	79.03333		-0.23449		-1.25452
16	Nagpur	Hingna(Raipur)_Pz	W210439078575101	21.0775	78.96417		-2.25589	4.6	0.12178
17	Nagpur	Inderwada_Pz	W212107078274401	21.35194	78.46222		-0.62022		0.071632
18	Nagpur	Jalalkheda_Pz	W212301078250901	21.38361	78.41917		-4.94745		1.89802
19	Nagpur	Jamgaon Bk_Pz	W211915078260001	21.32083	78.43333	5.3	-0.30992	2.5	0.04406
20	Nagpur	Kalmeshwar	W211400078550001	21.23333	78.91667	11	-0.79902	2.2	-0.19591
21	Nagpur	Kamptee	W211230079123001	21.20833	79.20833	7.9	-0.52308	6.95	-0.68743
22	Nagpur	Kanholi bara	W205600078510001	20.93333	78.85	10	-0.12076	5.7	-0.48929
23	Nagpur	Kanholibara_Pz	W205609078511401	20.93583	78.85389	13.95	-0.79163	4	-0.07937
24	Nagpur	Katol	W211700078350001	21.28333	78.58333	9.85	-1.3991	5.1	0.121706
25	Nagpur	Kelod	W212735078523501	21.45972	78.87639	10.9	-0.27849	10.35	0.092891
26	Nagpur	Kharpada	W213151079205101	21.53083	79.3475	4.8	-0.34504	4	-0.05339
27	Nagpur	Khat	W211430079324501	21.24167	79.54583	11.25	-0.82062	1.3	-0.758
28	Nagpur	Khubala	W212700078580001	21.45	78.96667	4.8	-0.02148	3.6	-0.57668
29	Nagpur	Kondhali	W210800078390001	21.13333	78.65	8.8	-1.38704	7.2	2.689655
30	Nagpur	Koradi	W211510079044801	21.25278	79.08	8.8	-0.02561	3.1	-0.08191
31	Nagpur	Kothulna	W212510079021801	21.41944	79.03833	5.3	-1.36949	1.6	-0.31288
33	Nagpur	Makardhokda	W211557078243001	21.26583	78.40833	9.6	-0.80574	2.5	0.092835
34	Nagpur	Makardhokda_Pz	W205200079131001	20.86667	79.21944	10.05	-0.38797	4.4	-0.21928
35	Nagpur	Malapur	W205227079123401	20.87417	79.20944	11.5	-3.86675	12.5	-3.93917
36	Nagpur	Manegaon Tek	W212556078393401	21.43222	78.65944	10.32	-0.05548	6.3	-0.19401

S.No.	District	Site name	Site id	Lat	Long	DTWL_May 2019 (m bgl)	Pre-trend (m /year)	DTWL_Nov.19 (m bgl)	Post-trend (m /year)
37	Nagpur	Mangli1	W214050079252001	21.68056	79.42222	19	-0.35309	7	-0.09692
38	Nagpur	Mauda_Pz	W210142079181801	21.02833	79.305		-0.18286		-1.20906
39	Nagpur	Mohpa	W210900079220002	21.15	79.36667	10.8			-0.18163
40	Nagpur	Mouda-1	W210830078454501	21.14167	78.7625	10.55	-0.85077	10.4	1.701493
41	Nagpur	Nagalwadi	W210850079240101	21.14722	79.40028	7.4		8.7	-0.88299
42	Nagpur	Nagpur VNIT_Pz	W213400079010001	21.56667	79.01667		-0.26727		-0.02276
43	Nagpur	Nagpur_Chinchbawan	W210800079020001	21.13333	79.03333	7.5	-0.09965	7.1	0.463174
44	Nagpur	Nagpur_Koradi naka	W210358079034001	21.06611	79.06111	7	2.35	2.3	-9.12855
45	Nagpur	Nagpur_Police line takli	W211231079043801	21.20861	79.07722		-0.87979	2.2	-0.90019
46	Nagpur	Nagpur_Punapur	W211035079035501	21.17639	79.06528	4	-0.07331	0.4	0.038742
47	Nagpur	Nagpur_Ramdaspath	W210939079100901	21.16083	79.16917	6	-0.84957	3.6	2.404691
48	Nagpur	Nagpur_Wadi naka	W210750079035001	21.13056	79.06389	10.4	-0.63449	0.4	0.005769
49	Nagpur	Nandora	W210908079010401	21.15222	79.01778	4.4	0.183585	3	-0.17251
50	Nagpur	Nara_Pz	W211014078364001	21.17056	78.61111	10.5	-2.42023	12.8	0.453333
51	Nagpur	Narkhed	W211230079045001	21.20833	79.08056	15.35	0.289243	6	-1.2606
52	Nagpur	Narkhed_Pz	W212800078320001	21.46667	78.53333	13	-1.35666	3	-0.59557
53	Nagpur	Nawegaon (Deshmukh)	W212815078321301	21.47083	78.53694	8.45	0.445542	4.4	-0.21379
54	Nagpur	Nayakund	W204810079254301	20.80278	79.42861		-0.84163	10.8	-2.92633
55	Nagpur	Pallora	W212200079110001	21.36667	79.18333	8.6	0.219476	12	-0.98807
56	Nagpur	Panchgaon	W213320079200501	21.55556	79.33472	12	-1.4454	4.1	0.266968
57	Nagpur	Paradsinga_Pz	W210200079100001	21.03333	79.16667	5.4	-0.29919	25.2	-0.01458
58	Nagpur	Parseoni	W211905078311001	21.31806	78.51944	8.9	-1.09739	5	-14.7851
59	Nagpur	Pipaldol	W213300079100001	21.55	79.16667	7.79	-0.00763	2	-0.02697
60	Nagpur	Ramtek	W204959079155601	20.83306	79.26556	10	-0.85802	4.3	0.462318
61	Nagpur	Ridhora	W212400079180001	21.4	79.3	12.1	-1.62976	13	-0.65252
62	Nagpur	Rohna	W211356078371401	21.23222	78.62056	10.2	-0.84031	5.2	0.447029
63	Nagpur	Rohna_Pz	W212057078284801	21.34917	78.48	8.45	-0.47214	7.2	-0.13285
64	Nagpur	Rui_Gavsi Manapur	W212050078284801	21.34722	78.48	14.1	-1.16249	7.7	-1.2304
65	Nagpur	Saoner-1	W210112079025501	21.02	79.04861	10.8	-0.11241	8.7	-0.58764
66	Nagpur	Sathnaori	W212323078562601	21.38972	78.94056	6.25	-0.46363	11	-1.17467
67	Nagpur	Sawargaon	W210800078480001	21.13333	78.8	4.65	-2.00545	5.6	-0.33383
68	Nagpur	Sirpur Toli	W212330078380601	21.39167	78.635	10.4	-0.01214	4.2	0.105399
69	Nagpur	Sivani	W212200079240001	21.36667	79.4	12.2	-0.12329	6.3	0.116961
70	Nagpur	Sonoli_Pz	W212400079281501	21.4	79.47083	19.2	-1.78802	5.6	-0.64639
71	Nagpur	Takalghat	W212145078373301	21.3625	78.62583	1.1	-1.85325	7.4	-1.82538
72	Nagpur	Umrer	W205452078563801	20.91444	78.94389	8	-0.10368	1	-0.14911

S.No.	District	Site name	Site id	Lat	Long	DTWL_May 2019 (m bgl)	Pre-trend (m /year)	DTWL_Nov.19 (m bgl)	Post-trend (m /year)
73	Nagpur	Uti	W205237079173001	20.87694	79.29167	10.6		2	-0.11882
74	Nagpur	Wagholi	W205700079130001	20.95	79.21667	12	-0.20502	3.3	-0.63584
75	Nagpur	Wardhamna	W212000079130001	21.33333	79.21667		0.229631	1.4	-0.35151

Annexure VIII: Location of Percolation Tanks

S. No.	Village	Block
1	Indora	MAUDA
2	Khaparkheda (Ga	MAUDA
3	Chacher	MAUDA
4	Barshi	MAUDA
5	Babadeo	MAUDA
6	Ajangaon	MAUDA
7	Korad	MAUDA
8	Ashti	MAUDA
9	Dhanla	MAUDA
10	Mohadi	MAUDA
11	Sawagi	MAUDA
12	Tanda	MAUDA
13	Dahegaon	MAUDA
14	Gangner	MAUDA
15	Wagbodi	MAUDA
16	Berdipar	MAUDA
17	Amgaon	RAMTEK
18	Nagardhan	RAMTEK
19	Masala	RAMTEK
20	Khirsadi(Rithi)	RAMTEK
21	Nanda Gomukh	SAVNER
22	Salai	SAVNER
23	Umari (Bharatpu	SAVNER
24	Umari (Bharatpu	SAVNER

S. No.	Village	Block
25	Pandhari (J)	SAVNER
26	Kelwad	SAVNER
27	Malegaon	SAVNER
28	Wakodi	SAVNER
29	Takali	SAVNER
30	Kodegaon	SAVNER
31	Khairi (Panjabr	SAVNER
32	Badegaon	SAVNER
33	Itangoti	SAVNER
34	Kesori	KAMPTEE
35	Bhugaon	KAMPTEE
36	Mahalgaon	KAMPTEE
37	Temsana	KAMPTEE
38	Palsad	KAMPTEE
39	Parsodi	KAMPTEE
40	Pawangaon	KAMPTEE
41	Raibasa	SAVNER
42	Sironji	SAVNER
43	Sindewani Kh.	SAVNER
44	Khubala	SAVNER
45	Bichwa	SAVNER
46	Yeltur	SAVNER
47	Mangsa	SAVNER
48	Joga	SAVNER

S. No.	Village	Block
49	Jalalkheda	SAVNER
50	Ajani	SAVNER
51	Umari	SAVNER
52	Bhendala	SAVNER
53	Chorkhairi	SAVNER
54	Jakhegaon	KAMPTEE
55	Ajani	KAMPTEE
56	Gumthala	KAMPTEE
57	Suradevi	KAMPTEE
58	Zharap	KAMPTEE
59	Khapari (uma)	KALAMESHWAR
60	Khapari (uma)	KALAMESHWAR
61	Khapari (kothe)	KALAMESHWAR
62	Sonegaon	KALAMESHWAR
63	Susundri	KALAMESHWAR
64	Kanyadhol	KALAMESHWAR
65	Panuabali	KALAMESHWAR
66	Khumari	KALAMESHWAR
67	Pipla (kewalram)	NARKHED
68	Telkamthi	KALAMESHWAR
69	Khairi (Harji)	KALAMESHWAR
70	Budhla	KALAMESHWAR
71	Telkamthi	KALAMESHWAR
72	Pohigond Khairi	KALAMESHWAR
73	Mandvi	KALAMESHWAR
74	Parsodi wakil	KALAMESHWAR

S. No.	Village	Block
75	Ramgiri	KALAMESHWAR
76	Sonoli	KALAMESHWAR
77	Belori bk.	KALAMESHWAR
78	Tishti bk.	KALAMESHWAR
79	Tishti kh.	KALAMESHWAR
80	Wathoda	KALAMESHWAR
81	Tidangi	KALAMESHWAR
82	Khursapar	KALAMESHWAR
83	Bori (Rani)	PARSEONI
84	Panjara (Ri)	PARSEONI
85	Naikund	PARSEONI
86	Nandgaon	PARSEONI
87	Yesamba	PARSEONI
88	Karanbhad	PARSEONI
89	Karanbhad	PARSEONI
90	Karanbhad	PARSEONI
91	Digalwadi	PARSEONI
92	Tamaswadi	PARSEONI
93	Hingana (Ba)	PARSEONI
94	Parshivni	PARSEONI
95	Sakarla	PARSEONI
96	Palasavali	PARSEONI
97	Makardhokada	PARSEONI
98	Salai (Mokasa)	PARSEONI
99	Salai (Mokasa)	PARSEONI
100	Satak	PARSEONI

S. No.	Village	Block
101	Ukhali	BHIWAPUR
102	Zilbodi	BHIWAPUR
103	Polgaon	BHIWAPUR
104	Bhagwanpur	BHIWAPUR
105	Sukali	BHIWAPUR
106	Wani	BHIWAPUR
107	Khapari	BHIWAPUR
108	Ukhali	BHIWAPUR
109	Pandharwani	BHIWAPUR
110	Dhamangaon	BHIWAPUR
111	Besur	BHIWAPUR
112	Nand	BHIWAPUR
113	Mankapur	BHIWAPUR
114	Yedsambha	BHIWAPUR
115	Shivmadka	HINGNA
116	Gumgaon	HINGNA
117	Sukali	HINGNA
118	Wagdara	HINGNA
119	Sumthana	HINGNA
120	Dahegaon	NAGPUR (RURAL)
121	Isasani	HINGNA
122	Wagdara	HINGNA
123	Salaidabha	HINGNA
124	Sirul	HINGNA
125	Wadgaon	HINGNA
126	Dhanoli	HINGNA

S. No.	Village	Block
127	Khapri (Moreshw	HINGNA
128	Bhansuli	HINGNA
129	Ghodeghat	HINGNA
130	Sawangi	HINGNA
131	Wadgaon	HINGNA
132	Menkhat	HINGNA
133	Dhanoli	HINGNA
134	Kinhi	HINGNA
135	Ghodeghat	HINGNA
136	Sawangi	HINGNA
137	Chauki	HINGNA
138	Nildoh	HINGNA
139	Gondkhairi	KALAMESHWAR
140	Chandrapur	NAGPUR (RURAL)
141	Neri	HINGNA
142	Turagondi	HINGNA
143	Nildoh	HINGNA
144	Mangrul	HINGNA
145	Neri	HINGNA
146	Khokarla	KUHI
147	Sonpuri	KUHI
148	Khokarla	KUHI
149	Gonha	KUHI
150	Weltur	KUHI
151	Ambhora kh.	KUHI
152	Pandhargota	KUHI

S. No.	Village	Block
153	Jiwanapur	KUHI
154	Gonha	KUHI
155	Weltur	KUHI
156	Khairlanji	KUHI
157	Khairlanji	KUHI
158	Sonpuri	KUHI
159	Madnapur	KUHI
160	Khenda	KUHI
161	Khenda	KUHI
162	Hudpa	KUHI
163	Pachkhedi (gand	KUHI
164	Majri	KUHI
165	Chikna tukum	KUHI
166	Lohara	KUHI
167	Satara	KUHI
168	Pilkapar	KUHI
169	Chanoda	KUHI
170	Kuhi	KUHI
171	Silli	KUHI
172	Umarpeth	KUHI
173	Rajola	KUHI
174	Bodkhipeth	KUHI
175	Bhandarbodi	KUHI
176	Chapegadi	KUHI
177	Chanoda	KUHI
178	Pandegaon	KUHI

S. No.	Village	Block
179	Rajola	KUHI
180	Navegaon	KUHI
181	Salwa	KUHI
182	Lanjala	KUHI
183	Kuchadi	KUHI
184	Dhanoli	KUHI
185	Kuchadi	KUHI
186	Mangli	KUHI
187	Dodma	KUHI
188	Malni	KUHI
189	Titur	KUHI
190	Dodma	KUHI
191	Mangli	KUHI
192	Khalasana	KUHI
193	Mohadi	KUHI
194	Chitapur	KUHI
195	Warada	NAGPUR (RURAL)
196	Gawasi Manapur	NAGPUR (RURAL)
197	Bothali	NAGPUR (RURAL)
198	Dhawalpeth	NAGPUR (RURAL)
199	Tarsi	NAGPUR (RURAL)
200	Nawegaon	NAGPUR (RURAL)
201	Chimanzari	NAGPUR (RURAL)
202	Khairi (Lakhmaj	KALAMESHWAR
203	Walani	NAGPUR (RURAL)
204	Brahmanwada	NAGPUR (RURAL)

S. No.	Village	Block
205	Padri khapa	NAGPUR (RURAL)
206	Jangeshwar	NAGPUR (RURAL)
207	Dudha	NAGPUR (RURAL)
208	Isapur (navegao	KUHI
209	Champa	UMRED
210	Salaimendha	UMRED
211	Sonoli	KATOL
212	Sonoli	KATOL
213	Dorli (Bhandwal	KATOL
214	Rajni	KATOL
215	Khamli	KATOL
216	Mohkhedi	KATOL
217	Yenwa	KATOL
218	Bori	KATOL
219	Khamli	KATOL
220	Nanda	KATOL
221	Tapani	KATOL
222	Tapani	KATOL
223	Bori	KATOL
224	Mukani	KATOL
225	Yenwa	KATOL
226	Harankhuri	KATOL
227	Chichala	KATOL
228	Isapur (Kh)	KATOL
229	Isapur (Kh)	KATOL
230	Dongargaon	KATOL

S. No.	Village	Block
231	Dongargaon	KATOL
232	Dongargaon	KATOL
233	Pathar	KATOL
234	Bordoh	KATOL
235	Isapur (Kh)	KATOL
236	Wadvihara	KATOL
237	Digras (Bk)	KATOL
238	Lamdham	KATOL
239	Digras (Bk)	KATOL
240	Wadvihara	KATOL
241	Kalambha	KATOL
242	Kalambha	KATOL
243	Ambada	NARKHED
244	Paradsinga	KATOL
245	Paradsinga	KATOL
246	Paradsinga	KATOL
247	Masli	KATOL
248	Junewani	KATOL
249	Khandala (Kh)	KATOL
250	Ambada (sonak)	KATOL
251	Khadki	KATOL
252	Junewani	KATOL
253	Ambada (sonak)	KATOL
254	Khandala (Kh)	KATOL
255	Jatamkohala	KATOL
256	Paradsinga	KATOL

S. No.	Village	Block
257	Fetri	KATOL
258	Khaprikene	NARKHED
259	Junewani	KATOL
260	Paradsinga	KATOL
261	Junewani	KATOL
262	Junewani	KATOL
263	Fetri	KATOL
264	Khadki	KATOL
265	Pandhardhakani	KATOL
266	Chaurepathar	KATOL
267	Mohgaon (Jangli	KATOL
268	Chaurepathar	KATOL
269	Khedi Gowargond	NARKHED
270	Mohadi (Dalvi)	NARKHED
271	Bamhani	NARKHED
272	Pimpalgaon (wak	NARKHED
273	Toyapar	NARKHED
274	Ambola	NARKHED
275	Sawargaon	NARKHED
276	Mogra	NARKHED
277	Ambada (Deshmuk	NARKHED
278	Umari	NARKHED
279	Sawargaon	NARKHED
280	Chorkhairi	NARKHED
281	Nawegaon	NARKHED
282	Wadgaon (Umari)	NARKHED

S. No.	Village	Block
283	Khaprikene	NARKHED
284	Tinkheda	NARKHED
285	Wiwara	NARKHED
286	Indarwada	NARKHED
287	Khapa	NARKHED
288	Jamgaon Bk	NARKHED
289	Kinhi	HINGNA
290	Mangli	HINGNA
291	Sukali (Gharapur	HINGNA
292	Pipri	HINGNA
293	Khairi kh	HINGNA
294	Panjari	HINGNA
295	Mandawa	HINGNA
296	Dongargaon	HINGNA
297	Bhansoli	HINGNA
298	waranga	HINGNA
299	Dhokarda	HINGNA
300	Chauki	HINGNA
301	Singardip	HINGNA
302	Majri	KUHI
303	Rajola	KUHI
304	Dighori bk.	KAMPTEE
305	Gothangaon	KUHI
306	Sonarwahi	KUHI
307	Salai	UMRED
308	Musalgaon	KUHI

S. No.	Village	Block
309	Banor	KUHI
310	Yekardi	KAMPTEE
311	Sagundhara	KUHI
312	Akoli	KUHI
313	Khobna	KUHI
314	Chirwha	MAUDA
315	Lapaka	MAUDA
316	Nerla	MAUDA
317	Khodegaon	RAMTEK
318	Chacher	MAUDA
319	Ghat Rohana	PARSEONI
320	Babadeo	MAUDA
321	Khedi	KAMPTEE
322	Chitapur	KUHI
323	Sahajapur	KALAMESHWAR
324	Selu	KALAMESHWAR
325	Susundri	KALAMESHWAR
326	Lonara	KALAMESHWAR
327	Sawangi	KALAMESHWAR
328	Uparwani	KALAMESHWAR
329	Khangaon	KALAMESHWAR
330	Dhapewada bk.	KALAMESHWAR

S. No.	Village	Block
331	Khursapar	KALAMESHWAR
332	Kalmeshwar	KALAMESHWAR
333	Kalmeshwar	KALAMESHWAR
334	Yelkapar	KALAMESHWAR
335	Dhawalapur	KATOL
336	Dhurkheda	KATOL
337	Khursapur	KATOL
338	Chandanpardi	KATOL
339	Murti	KATOL
340	Sakarla	PARSEONI
341	Parsodi	PARSEONI
342	Itagaon	PARSEONI
343	Itagaon	PARSEONI
344	Dahegaon (joshi)	PARSEONI
345	Dahegaon (joshi)	PARSEONI
346	Bhage Mahari	PARSEONI
347	Karanbhad	PARSEONI
348	Karanbhad	PARSEONI
349	Pardi	PARSEONI
350	Makardhokada	PARSEONI
351	Makardhokada	PARSEONI

Annexure IX: Location of Check Dams

Sr. No.	Village	Block	Type of Structure
1	Ajangaon	MAUDA	Check Dam
2	Ajangaon	MAUDA	Check Dam
3	Ajangaon	MAUDA	Check Dam
4	Aroli	MAUDA	Check Dam
5	Aroli	MAUDA	Check Dam
6	Ashti	MAUDA	Check Dam
7	Babadeo	MAUDA	Check Dam
8	Chokhala	RAMTEK	Check Dam
9	Barshi	MAUDA	Check Dam
10	Batnor	MAUDA	Check Dam
11	Chacher	MAUDA	Check Dam
12	Chacher	MAUDA	Check Dam
13	Charbha	MAUDA	Check Dam
14	Dhani	MAUDA	Check Dam
15	Dhani	MAUDA	Check Dam
16	Dhani	MAUDA	Check Dam
17	Dhanoli	MAUDA	Check Dam
18	Gangner	MAUDA	Check Dam
19	Isapur	MAUDA	Check Dam
20	Kargaon(rithi)	MAUDA	Check Dam
21	Khandala	MAUDA	Check Dam
22	Khandala	MAUDA	Check Dam
23	Kirnapur	RAMTEK	Check Dam
24	Khaparkheda	MAUDA	Check Dam

Sr. No.	Village	Block	Type of Structure
25	Khaparkheda	MAUDA	Check Dam
26	Khaparkheda	MAUDA	Check Dam
27	Khaparkheda	MAUDA	Check Dam
28	Khaparkheda (Ga	MAUDA	Check Dam
29	Khaparkheda (Ga	MAUDA	Check Dam
30	Khaparkheda (Ki	MAUDA	Check Dam
31	Khaparkheda (Ki	MAUDA	Check Dam
32	Kharda	MAUDA	Check Dam
33	Khat	MAUDA	Check Dam
34	Khidki	MAUDA	Check Dam
35	Kodamendhi	MAUDA	Check Dam
36	Korad	MAUDA	Check Dam
37	Mangli(Teli)	MAUDA	Check Dam
38	Mangli(Teli)	MAUDA	Check Dam
39	Mathani	MAUDA	Check Dam
40	Morgaon	MAUDA	Check Dam
41	Mouda	MAUDA	Check Dam
42	Nandgaon	MAUDA	Check Dam
43	Nawargaon	MAUDA	Check Dam
44	Nerla	MAUDA	Check Dam
45	Astikala	KALAMESHWAR	Check Dam
46	Astikala	KALAMESHWAR	Check Dam
47	Astikala	KALAMESHWAR	Check Dam
48	Mohgaon	NARKHED	Check Dam

Sr. No.	Village	Block	Type of Structure
	(Bhadad		
49	Belori bk.	KALAMESHWAR	Check Dam
50	Bordoh	KALAMESHWAR	Check Dam
51	Budhla	KALAMESHWAR	Check Dam
52	Budhla	KALAMESHWAR	Check Dam
53	Budhla	KALAMESHWAR	Check Dam
54	Budhla	KALAMESHWAR	Check Dam
55	Dahegaon	KALAMESHWAR	Check Dam
56	Dhapewada bk.	KALAMESHWAR	Check Dam
57	Dhapewada bk.	KALAMESHWAR	Check Dam
58	Dorli gangaji	KALAMESHWAR	Check Dam
59	Dudhabardi	KALAMESHWAR	Check Dam
60	Gondkhairi	KALAMESHWAR	Check Dam
61	Gondkhairi	KALAMESHWAR	Check Dam
62	Gondkhairi	KALAMESHWAR	Check Dam
63	Gondkhairi	KALAMESHWAR	Check Dam
64	Gowari	KALAMESHWAR	Check Dam
65	Gumthala	KALAMESHWAR	Check Dam
66	Gumthala	KALAMESHWAR	Check Dam
67	Jirola	KALAMESHWAR	Check Dam
68	Kalambi	KALAMESHWAR	Check Dam
69	Kalambi	KALAMESHWAR	Check Dam
70	Kalambi	KALAMESHWAR	Check Dam
71	Kanyadhool	KALAMESHWAR	Check Dam
72	Karli	KALAMESHWAR	Check Dam

Sr. No.	Village	Block	Type of Structure
73	Karli	KALAMESHWAR	Check Dam
74	Ketapar	KALAMESHWAR	Check Dam
75	Ketapar	KALAMESHWAR	Check Dam
76	Ketapar	KALAMESHWAR	Check Dam
77	Khairi (Desh)	KALAMESHWAR	Check Dam
78	Khairi (Harji)	KALAMESHWAR	Check Dam
79	Khairi (Harji)	KALAMESHWAR	Check Dam
80	Khairi (Harji)	KALAMESHWAR	Check Dam
81	Khapari (kothe)	KALAMESHWAR	Check Dam
82	Khapari (uma)	KALAMESHWAR	Check Dam
83	Khursapar	KALAMESHWAR	Check Dam
84	Khursapar	KALAMESHWAR	Check Dam
85	Khursapar	KALAMESHWAR	Check Dam
86	Kohali	KALAMESHWAR	Check Dam
87	Kohali	KALAMESHWAR	Check Dam
88	Kohali	KALAMESHWAR	Check Dam
89	Kohali	KALAMESHWAR	Check Dam
90	Linga	KALAMESHWAR	Check Dam
91	Linga	KALAMESHWAR	Check Dam
92	Linga	KALAMESHWAR	Check Dam
93	Linga	KALAMESHWAR	Check Dam
94	Raulgaon	KATOL	Check Dam
95	Linga	KALAMESHWAR	Check Dam
96	Linga	KALAMESHWAR	Check Dam
97	Lohagad	KALAMESHWAR	Check Dam

Sr. No.	Village	Block	Type of Structure
98	Lohagad	KALAMESHWAR	Check Dam
99	Lonara	KALAMESHWAR	Check Dam
100	Nanda	KALAMESHWAR	Check Dam
101	Nimboli	KALAMESHWAR	Check Dam
102	Parsodi wakil	KALAMESHWAR	Check Dam
103	Parsodi wakil	KALAMESHWAR	Check Dam
104	Parsodi wakil	KALAMESHWAR	Check Dam
105	Pipla	KALAMESHWAR	Check Dam
106	Pohigond Khairi	KALAMESHWAR	Check Dam
107	Pohigond Khairi	KALAMESHWAR	Check Dam
108	Pohigond Khairi	KALAMESHWAR	Check Dam
109	Pohigond Khairi	KALAMESHWAR	Check Dam
110	Ramgiri	KALAMESHWAR	Check Dam
111	Ramgiri	KALAMESHWAR	Check Dam
112	Ramgiri	KALAMESHWAR	Check Dam
113	Ramgiri	KALAMESHWAR	Check Dam
114	Ramgiri	KALAMESHWAR	Check Dam
115	Rohana	KALAMESHWAR	Check Dam
116	Sawali kh.	KALAMESHWAR	Check Dam
117	Selu	KALAMESHWAR	Check Dam
118	Selu	KALAMESHWAR	Check Dam
119	Sonegaon	KALAMESHWAR	Check Dam
120	Sonoli	KALAMESHWAR	Check Dam
121	Sonoli	KALAMESHWAR	Check Dam
122	Susundri	KALAMESHWAR	Check Dam

Sr. No.	Village	Block	Type of Structure
123	Telgaon	KALAMESHWAR	Check Dam
124	Chakorda (rithi	RAMTEK	Check Dam
125	Nagardhan	RAMTEK	Check Dam
126	Sirpur	RAMTEK	Check Dam
127	Nawargaon	RAMTEK	Check Dam
128	Kelapur (R)	RAMTEK	Check Dam
129	Musewadi	RAMTEK	Check Dam
130	Amgaon	RAMTEK	Check Dam
131	Bhondewada	RAMTEK	Check Dam
132	Guguldoh	RAMTEK	Check Dam
133	Bhandar Bodi	RAMTEK	Check Dam
134	Bhandar Bodi	RAMTEK	Check Dam
135	Bhandar Bodi	RAMTEK	Check Dam
136	Agra	SAVNER	Check Dam
137	Agra	SAVNER	Check Dam
138	Ajani	SAVNER	Check Dam
139	Badegaon	SAVNER	Check Dam
140	Bhendala	SAVNER	Check Dam
141	Bichawa	SAVNER	Check Dam
142	Bid jatamkhora	SAVNER	Check Dam
143	Chhatrapur	SAVNER	Check Dam
144	Chorkhairi	SAVNER	Check Dam
145	Gadami	SAVNER	Check Dam
146	Hetikheda	SAVNER	Check Dam
147	Hingna	SAVNER	Check Dam

Sr. No.	Village	Block	Type of Structure
148	Itangoti	SAVNER	Check Dam
149	Jaitgad	SAVNER	Check Dam
150	Jaitgad	SAVNER	Check Dam
151	Jaitgad	SAVNER	Check Dam
152	Jaitgad	SAVNER	Check Dam
153	Jaitpur	SAVNER	Check Dam
154	Jakhewada	SAVNER	Check Dam
155	Jakhewada	SAVNER	Check Dam
156	Jalalkheda	SAVNER	Check Dam
157	Jatamkhora	SAVNER	Check Dam
158	Joga	SAVNER	Check Dam
159	Joga	SAVNER	Check Dam
160	Joga	SAVNER	Check Dam
161	Khapa (Narsala)	SAVNER	Check Dam
162	Khurajgaon	SAVNER	Check Dam
163	Khursapar	SAVNER	Check Dam
164	Kodadongri	SAVNER	Check Dam
165	Kodegaon	SAVNER	Check Dam
166	Kormeta	SAVNER	Check Dam
167	Kothulana	SAVNER	Check Dam
168	Kusumbi	SAVNER	Check Dam
169	Maharkund	SAVNER	Check Dam
170	Malegaon	SAVNER	Check Dam
171	Malegaon	SAVNER	Check Dam
172	Telkamthi	KALAMESHWAR	Check Dam

Sr. No.	Village	Block	Type of Structure
173	Manegaon	SAVNER	Check Dam
174	Nanda Gomukh	SAVNER	Check Dam
175	Nanda Gomukh	SAVNER	Check Dam
176	Patansavangi	SAVNER	Check Dam
177	Pendhari	SAVNER	Check Dam
178	Pipla (da-B)	SAVNER	Check Dam
179	Raibasa	SAVNER	Check Dam
180	Ranala	SAVNER	Check Dam
181	Ranala	SAVNER	Check Dam
182	Salai	SAVNER	Check Dam
183	Sawali	SAVNER	Check Dam
184	Sawangi	SAVNER	Check Dam
185	Tekadi	SAVNER	Check Dam
186	Telang Khedi	PARSEONI	Check Dam
187	Tembhurdoh	SAVNER	Check Dam
188	Telang Khedi	PARSEONI	Check Dam
189	Satak	PARSEONI	Check Dam
190	Naikund	PARSEONI	Check Dam
191	Satak	PARSEONI	Check Dam
192	Satak	PARSEONI	Check Dam
193	Khandala (Du)	PARSEONI	Check Dam
194	Juni Kamptee	PARSEONI	Check Dam
195	Panjara (Ri)	PARSEONI	Check Dam
196	Amadi	PARSEONI	Check Dam
197	Digalwadi	PARSEONI	Check Dam

Sr. No.	Village	Block	Type of Structure
198	Parsodi	PARSEONI	Check Dam
199	Nimbha	PARSEONI	Check Dam
200	Nimbha	PARSEONI	Check Dam
201	Nimbha	PARSEONI	Check Dam
202	Bhage Mahari	PARSEONI	Check Dam
203	Itagaon	PARSEONI	Check Dam
204	Karanbhad	PARSEONI	Check Dam
205	Pendhari	PARSEONI	Check Dam
206	Kusumdhara	PARSEONI	Check Dam
207	Kusumdhara	PARSEONI	Check Dam
208	Salai (Mokasa)	PARSEONI	Check Dam
209	Kanhadevi	PARSEONI	Check Dam
210	Kusumdhara	PARSEONI	Check Dam
211	Kondasawari	PARSEONI	Check Dam
212	Kondasawari	PARSEONI	Check Dam
213	Palasavali	PARSEONI	Check Dam
214	Mogra	PARSEONI	Check Dam
215	Tigai	SAVNER	Check Dam
216	Kanhadevi	PARSEONI	Check Dam
217	Sakarla	PARSEONI	Check Dam
218	Bhage Mahari	PARSEONI	Check Dam
219	Nimkheda	PARSEONI	Check Dam
220	Telang Khedi	PARSEONI	Check Dam
221	Naikund	PARSEONI	Check Dam
222	Khandala (Du)	PARSEONI	Check Dam

Sr. No.	Village	Block	Type of Structure
223	Mahedi	PARSEONI	Check Dam
224	Naikund	PARSEONI	Check Dam
225	Parshivni	PARSEONI	Check Dam
226	Parshivni	PARSEONI	Check Dam
227	Naikund	PARSEONI	Check Dam
228	Mahedi	PARSEONI	Check Dam
229	Tekadi	PARSEONI	Check Dam
230	Pali	PARSEONI	Check Dam
231	Umari	PARSEONI	Check Dam
232	Makardhokada	PARSEONI	Check Dam
233	Suwardhara	PARSEONI	Check Dam
234	Khandala (Gha	PARSEONI	Check Dam
235	Khandala (Gha	PARSEONI	Check Dam
236	Bhulewadi	PARSEONI	Check Dam
237	Neur Wada	PARSEONI	Check Dam
238	Umari jambhalp	SAVNER	Check Dam
239	Mahadula	PARSEONI	Check Dam
240	Aoleghat	PARSEONI	Check Dam
241	Umari (Bharatpu	SAVNER	Check Dam
242	Adaka	KAMPTEE	Check Dam
243	Ajani	KAMPTEE	Check Dam
244	Asalwada	KAMPTEE	Check Dam
245	Avandhi	KAMPTEE	Check Dam
246	Avandhi	KAMPTEE	Check Dam
247	Babulkheda	KAMPTEE	Check Dam

Sr. No.	Village	Block	Type of Structure
248	Bhowari	KAMPTEE	Check Dam
249	Bhugaon	KAMPTEE	Check Dam
250	Bhugaon	KAMPTEE	Check Dam
251	Bidgaon.	KAMPTEE	Check Dam
252	Chikhali	KAMPTEE	Check Dam
253	Dighori bk.	KAMPTEE	Check Dam
254	Dighori bk.	KAMPTEE	Check Dam
255	Rewaral	MAUDA	Check Dam
256	Gada	KAMPTEE	Check Dam
257	Ghorpad	KAMPTEE	Check Dam
258	Gumthala	KAMPTEE	Check Dam
259	Kadoli.	KAMPTEE	Check Dam
260	Kapsi bk	KAMPTEE	Check Dam
261	Kawtha	KAMPTEE	Check Dam
262	Kem	KAMPTEE	Check Dam
263	Lhigaon	KAMPTEE	Check Dam
264	Mahalgaon	KAMPTEE	Check Dam
265	Nerala	KAMPTEE	Check Dam
266	Neri	KAMPTEE	Check Dam
267	Neri	KAMPTEE	Check Dam
268	Palsad	KAMPTEE	Check Dam
269	Pawangaon	KAMPTEE	Check Dam
270	Ranala	KAMPTEE	Check Dam
271	Zilbodi	BHIWAPUR	Check Dam
272	Dhaparla	BHIWAPUR	Check Dam

Sr. No.	Village	Block	Type of Structure
273	Zilbodi	BHIWAPUR	Check Dam
274	Bhagwanpur	BHIWAPUR	Check Dam
275	Taka	BHIWAPUR	Check Dam
276	Taka	BHIWAPUR	Check Dam
277	Taka	BHIWAPUR	Check Dam
278	Bordkhurd	BHIWAPUR	Check Dam
279	Sukali	BHIWAPUR	Check Dam
280	Alesur	BHIWAPUR	Check Dam
281	Khapari	BHIWAPUR	Check Dam
282	Alesur	BHIWAPUR	Check Dam
283	Kharkada	BHIWAPUR	Check Dam
284	Alesur	BHIWAPUR	Check Dam
285	Polgaon	BHIWAPUR	Check Dam
286	Polgaon	BHIWAPUR	Check Dam
287	Polgaon	BHIWAPUR	Check Dam
288	Khapari	BHIWAPUR	Check Dam
289	Taka	BHIWAPUR	Check Dam
290	Taka	BHIWAPUR	Check Dam
291	Sukali	BHIWAPUR	Check Dam
292	Chorvihara	BHIWAPUR	Check Dam
293	Salebhatti	BHIWAPUR	Check Dam
294	Dhamangaon	BHIWAPUR	Check Dam
295	Nand	BHIWAPUR	Check Dam
296	Chorvihara	BHIWAPUR	Check Dam
297	Chorvihara	BHIWAPUR	Check Dam

Sr. No.	Village	Block	Type of Structure
298	Salebhatti	BHIWAPUR	Check Dam
299	Polgaon	BHIWAPUR	Check Dam
300	Polgaon	BHIWAPUR	Check Dam
301	Polgaon	BHIWAPUR	Check Dam
302	Polgaon	BHIWAPUR	Check Dam
303	Pirawa	BHIWAPUR	Check Dam
304	Pirawa	BHIWAPUR	Check Dam
305	Khapari	BHIWAPUR	Check Dam
306	Bhagwanpur	BHIWAPUR	Check Dam
307	Wani	BHIWAPUR	Check Dam
308	Lonara	BHIWAPUR	Check Dam
309	Mankapur	BHIWAPUR	Check Dam
310	Pirawa	BHIWAPUR	Check Dam
311	Bhagwanpur	BHIWAPUR	Check Dam
312	Asola	HINGNA	Check Dam
313	Bhansuli	HINGNA	Check Dam
314	Bhansuli	HINGNA	Check Dam
315	Bothali	HINGNA	Check Dam
316	Chauki	HINGNA	Check Dam
317	Datala	HINGNA	Check Dam
318	Telhara	NAGPUR (RURAL)	Check Dam
319	Dahegaon	NAGPUR (RURAL)	Check Dam
320	Datala	HINGNA	Check Dam

Sr. No.	Village	Block	Type of Structure
321	Dhanoli	HINGNA	Check Dam
322	Dongargaon	HINGNA	Check Dam
323	Ghodeghat	HINGNA	Check Dam
324	Girola	HINGNA	Check Dam
325	Godhani	HINGNA	Check Dam
326	Gumgaon	HINGNA	Check Dam
327	Isasani	HINGNA	Check Dam
328	Isasani	HINGNA	Check Dam
329	Junapani	HINGNA	Check Dam
330	Junapani	HINGNA	Check Dam
331	Junapani	HINGNA	Check Dam
332	Junapani	HINGNA	Check Dam
333	Kanholi	HINGNA	Check Dam
334	Kanholi	HINGNA	Check Dam
335	Kanholi (Rithi)	HINGNA	Check Dam
336	Kanholi (Rithi)	HINGNA	Check Dam
337	Kanholi (Rithi)	HINGNA	Check Dam
338	Kanholi (Rithi)	HINGNA	Check Dam
339	Kanholibara	HINGNA	Check Dam
340	Khairi kh	HINGNA	Check Dam
341	Khairi kh	HINGNA	Check Dam
342	Jamtha	NAGPUR (RURAL)	Check Dam
343	Jamtha	NAGPUR (RURAL)	Check Dam

Sr. No.	Village	Block	Type of Structure
344	Khairi kh	HINGNA	Check Dam
345	Khairi kh	HINGNA	Check Dam
346	Khapri (Moreshw	HINGNA	Check Dam
347	Khapri (Moreshw	HINGNA	Check Dam
348	Kinhi	HINGNA	Check Dam
349	Kinhi	HINGNA	Check Dam
350	Kinhi	HINGNA	Check Dam
351	Kinhi	HINGNA	Check Dam
352	Kinhi	HINGNA	Check Dam
353	Kirmati	HINGNA	Check Dam
354	Kirmati	HINGNA	Check Dam
355	Kohala	HINGNA	Check Dam
356	Kohala	HINGNA	Check Dam
357	Kohala	HINGNA	Check Dam
358	Kohala	HINGNA	Check Dam
359	Kotewada	HINGNA	Check Dam
360	Kotewada	HINGNA	Check Dam
361	Ladgaon	HINGNA	Check Dam
362	Ladgaon	HINGNA	Check Dam
363	Ladgaon	HINGNA	Check Dam
364	Mandavghorad	HINGNA	Check Dam
365	Mandavghorad	HINGNA	Check Dam
366	Mangli	HINGNA	Check Dam
367	Menkhat	HINGNA	Check Dam
368	Metaumari	HINGNA	Check Dam

Sr. No.	Village	Block	Type of Structure
369	Metaumari	HINGNA	Check Dam
370	Metaumari	HINGNA	Check Dam
371	Murzari	HINGNA	Check Dam
372	Vyahad	NAGPUR (RURAL)	Check Dam
373	Neri	HINGNA	Check Dam
374	Neri	HINGNA	Check Dam
375	Neri	HINGNA	Check Dam
376	Neri	HINGNA	Check Dam
377	Neri	HINGNA	Check Dam
378	Neri	HINGNA	Check Dam
379	Nildoh	HINGNA	Check Dam
380	Nildoh	HINGNA	Check Dam
381	Nildoh	HINGNA	Check Dam
382	Telkamthi	KALAMESHWAR	Check Dam
383	Mohgaon bk.	NAGPUR (RURAL)	Check Dam
384	Panjari	HINGNA	Check Dam
385	Gonha	KUHI	Check Dam
386	Mendhe kh.	KUHI	Check Dam
387	Chikhali	KUHI	Check Dam
388	Chikhali	KUHI	Check Dam
389	Sonarwahi	KUHI	Check Dam
390	Weltur	KUHI	Check Dam
391	Weltur	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
392	Weltur	KUHI	Check Dam
393	Weltur	KUHI	Check Dam
394	Weltur	KUHI	Check Dam
395	Pratappur	KUHI	Check Dam
396	Adegaon	KUHI	Check Dam
397	Adegaon	KUHI	Check Dam
398	Weltur	KUHI	Check Dam
399	Weltur	KUHI	Check Dam
400	Fegad	KUHI	Check Dam
401	Dhanla	KUHI	Check Dam
402	Dhanla	KUHI	Check Dam
403	Dhanla	KUHI	Check Dam
404	Dhanla	KUHI	Check Dam
405	Dhanla	KUHI	Check Dam
406	Dhanla	KUHI	Check Dam
407	Dhanla	KUHI	Check Dam
408	Pratappur	KUHI	Check Dam
409	Sonpuri	KUHI	Check Dam
410	Pratappur	KUHI	Check Dam
411	Sonpuri	KUHI	Check Dam
412	Rajoli	KUHI	Check Dam
413	Kesori	KUHI	Check Dam
414	Kesori	KUHI	Check Dam
415	Pachkhedi (gand	KUHI	Check Dam
416	Pachkhedi (gand	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
417	Khairlanji	KUHI	Check Dam
418	Madnapur	KUHI	Check Dam
419	Khairlanji	KUHI	Check Dam
420	Parsodi (raja)	KUHI	Check Dam
421	Pandhargota	KUHI	Check Dam
422	Pandhargota	KUHI	Check Dam
423	Pachkhedi (gand	KUHI	Check Dam
424	Fegad	KUHI	Check Dam
425	Pandhargota	KUHI	Check Dam
426	Rajoli	KUHI	Check Dam
427	Sonpuri	KUHI	Check Dam
428	Pratappur	KUHI	Check Dam
429	Channa	KUHI	Check Dam
430	Sonpuri	KUHI	Check Dam
431	Sonpuri	KUHI	Check Dam
432	Kesori	KUHI	Check Dam
433	Kesori	KUHI	Check Dam
434	Kesori	KUHI	Check Dam
435	Kesori	KUHI	Check Dam
436	Khairlanji	KUHI	Check Dam
437	Weltur	KUHI	Check Dam
438	Khenda	KUHI	Check Dam
439	Khenda	KUHI	Check Dam
440	Takli	KUHI	Check Dam
441	Adam	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
442	Khenda	KUHI	Check Dam
443	Khenda	KUHI	Check Dam
444	Navegaon (devi)	KUHI	Check Dam
445	Navegaon (devi)	KUHI	Check Dam
446	Adam	KUHI	Check Dam
447	Adam	KUHI	Check Dam
448	Katara	KUHI	Check Dam
449	Adam	KUHI	Check Dam
450	Bamhani	KUHI	Check Dam
451	Mohgaon	KUHI	Check Dam
452	Bodkhipeth	KUHI	Check Dam
453	Navegaon	KUHI	Check Dam
454	Navegaon	KUHI	Check Dam
455	Khobna	KUHI	Check Dam
456	Bhowardeo	KUHI	Check Dam
457	Umarpeth	KUHI	Check Dam
458	Umarpeth	KUHI	Check Dam
459	Umarpeth	KUHI	Check Dam
460	Umarpeth	KUHI	Check Dam
461	Umarpeth	KUHI	Check Dam
462	Umarpeth	KUHI	Check Dam
463	Mohgaon	KUHI	Check Dam
464	Katara	KUHI	Check Dam
465	Chipdi	KUHI	Check Dam
466	Chipdi	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
467	Kuhi	KUHI	Check Dam
468	Kuhi	KUHI	Check Dam
469	Kuhi	KUHI	Check Dam
470	Kuhi	KUHI	Check Dam
471	Chipdi	KUHI	Check Dam
472	Kuhi	KUHI	Check Dam
473	Kuhi	KUHI	Check Dam
474	Satara	KUHI	Check Dam
475	Satara	KUHI	Check Dam
476	Satara	KUHI	Check Dam
477	Sonegaon	KUHI	Check Dam
478	Heti	KUHI	Check Dam
479	Kuhi	KUHI	Check Dam
480	Kuhi	KUHI	Check Dam
481	Silli	KUHI	Check Dam
482	Parsodi	KUHI	Check Dam
483	Powari	KUHI	Check Dam
484	Kuhi	KUHI	Check Dam
485	Silli	KUHI	Check Dam
486	Malni	KUHI	Check Dam
487	Malni	KUHI	Check Dam
488	Bhamewada	KUHI	Check Dam
489	Heti	KUHI	Check Dam
490	Sagundhara	KUHI	Check Dam
491	Titur	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
492	Selu	KAMPTEE	Check Dam
493	Bhamewada	KUHI	Check Dam
494	Titur	KUHI	Check Dam
495	Titur	KUHI	Check Dam
496	Chitapur	KUHI	Check Dam
497	Titur	KUHI	Check Dam
498	Titur	KUHI	Check Dam
499	Titur	KUHI	Check Dam
500	Bhamewada	KUHI	Check Dam
501	Mangli	KUHI	Check Dam
502	Dodma	KUHI	Check Dam
503	Nawargaon	KUHI	Check Dam
504	Nawargaon	KUHI	Check Dam
505	Sasegaon	KUHI	Check Dam
506	Sasegaon	KUHI	Check Dam
507	Sasegaon	KUHI	Check Dam
508	Sasegaon	KUHI	Check Dam
509	Sasegaon	KUHI	Check Dam
510	Mohadi	KUHI	Check Dam
511	Titur	KUHI	Check Dam
512	Kuchadi	KUHI	Check Dam
513	Kuchadi	KUHI	Check Dam
514	Kuchadi	KUHI	Check Dam
515	Mohadi	KUHI	Check Dam
516	Kuchadi	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
517	Dipala	KUHI	Check Dam
518	Bothali	NAGPUR (RURAL)	Check Dam
519	Pewatha	NAGPUR (RURAL)	Check Dam
520	Khapari	NAGPUR (RURAL)	Check Dam
521	Pewatha	NAGPUR (RURAL)	Check Dam
522	Pewatha	NAGPUR (RURAL)	Check Dam
523	Pewatha	NAGPUR (RURAL)	Check Dam
524	Rui	NAGPUR (RURAL)	Check Dam
525	Rui	NAGPUR (RURAL)	Check Dam
526	Jamtha	NAGPUR (RURAL)	Check Dam
527	Dongargaon	NAGPUR (RURAL)	Check Dam
528	Dongargaon	NAGPUR (RURAL)	Check Dam
529	Panjari	HINGNA	Check Dam
530	Panjari	HINGNA	Check Dam

Sr. No.	Village	Block	Type of Structure
531	Panjari	HINGNA	Check Dam
532	Pipardhara	HINGNA	Check Dam
533	Pipardhara	HINGNA	Check Dam
534	Pohi	HINGNA	Check Dam
535	Dhawalpeth	NAGPUR (RURAL)	Check Dam
536	Dhawalpeth	NAGPUR (RURAL)	Check Dam
537	Dhawalpeth	NAGPUR (RURAL)	Check Dam
538	Salaidabha	HINGNA	Check Dam
539	Salaidabha	HINGNA	Check Dam
540	Rui khairi	NAGPUR (RURAL)	Check Dam
541	Murarpur	NAGPUR (RURAL)	Check Dam
542	Bamhani	NAGPUR (RURAL)	Check Dam
543	Bamhani	NAGPUR (RURAL)	Check Dam
544	Dudha	NAGPUR (RURAL)	Check Dam
545	Dhawalpeth	NAGPUR (RURAL)	Check Dam
546	Dudha	NAGPUR	Check Dam

Sr. No.	Village	Block	Type of Structure
		(RURAL)	
547	Pardi	NAGPUR (RURAL)	Check Dam
548	Telkamthi	KALAMESHWAR	Check Dam
549	Yerla	NAGPUR (RURAL)	Check Dam
550	Yerla	NAGPUR (RURAL)	Check Dam
551	Telkamthi	KALAMESHWAR	Check Dam
552	Pachanvari	NAGPUR (RURAL)	Check Dam
553	Mohgaon bk.	NAGPUR (RURAL)	Check Dam
554	Pachanvari	NAGPUR (RURAL)	Check Dam
555	Pachanvari	NAGPUR (RURAL)	Check Dam
556	Pachanvari	NAGPUR (RURAL)	Check Dam
557	Mangli	UMRED	Check Dam
558	Chimanazari	UMRED	Check Dam
559	Ukadwadi	UMRED	Check Dam
560	Isapur (navegao	KUHI	Check Dam
561	Bothali	NAGPUR (RURAL)	Check Dam

Sr. No.	Village	Block	Type of Structure
562	Dhawalpeth	NAGPUR (RURAL)	Check Dam
563	Mohgaon bk.	NAGPUR (RURAL)	Check Dam
564	Kaldongri	NAGPUR (RURAL)	Check Dam
565	Champa	UMRED	Check Dam
566	Haladgaon	UMRED	Check Dam
567	Pachgaon	UMRED	Check Dam
568	Gollarkhapa	KATOL	Check Dam
569	Gollarkhapa	KATOL	Check Dam
570	Gollarkhapa	KATOL	Check Dam
571	Gollarkhapa	KATOL	Check Dam
572	Tapani	KATOL	Check Dam
573	Tapani	KATOL	Check Dam
574	Malapur	NARKHED	Check Dam
575	Jatamzari	KATOL	Check Dam
576	Gangaldoh	KATOL	Check Dam
577	Isapur (Kh)	KATOL	Check Dam
578	Isapur (Kh)	KATOL	Check Dam
579	Gangaldoh	KATOL	Check Dam
580	Bordoh	KATOL	Check Dam
581	Isapur (Kh)	KATOL	Check Dam
582	Gangaldoh	KATOL	Check Dam
583	Mendki	KATOL	Check Dam

Sr. No.	Village	Block	Type of Structure
584	Gollarkhapa	KATOL	Check Dam
585	Zilpa	KATOL	Check Dam
586	Sonoli	KATOL	Check Dam
587	Zilpa	KATOL	Check Dam
588	Zilpa	KATOL	Check Dam
589	Bori	KATOL	Check Dam
590	Zilpa	KATOL	Check Dam
591	Khairi (Navghar	KATOL	Check Dam
592	Isapur(Bk)	KATOL	Check Dam
593	Gonhi	KATOL	Check Dam
594	Isapur(Bk)	KATOL	Check Dam
595	Gonhi	KATOL	Check Dam
596	Bhajipani	KATOL	Check Dam
597	Gonhi	KATOL	Check Dam
598	Isapur (Kh)	KATOL	Check Dam
599	Bordoh	KATOL	Check Dam
600	Bhajipani	KATOL	Check Dam
601	Dongargaon	KATOL	Check Dam
602	Dongargaon	KATOL	Check Dam
603	Dongargaon	KATOL	Check Dam
604	Rajni	KATOL	Check Dam
605	Rajni	KATOL	Check Dam
606	Sawargaon	NARKHED	Check Dam
607	Rajni	KATOL	Check Dam
608	Sawargaon	NARKHED	Check Dam

Sr. No.	Village	Block	Type of Structure
609	Khamli	KATOL	Check Dam
610	Khamli	KATOL	Check Dam
611	Khamli	KATOL	Check Dam
612	Sonoli	KATOL	Check Dam
613	Gollarkhapa	KATOL	Check Dam
614	Rajni	KATOL	Check Dam
615	Mukani	KATOL	Check Dam
616	Rajni	KATOL	Check Dam
617	Malapur	NARKHED	Check Dam
618	Gonhi	KATOL	Check Dam
619	Yenwa	KATOL	Check Dam
620	Yenwa	KATOL	Check Dam
621	Yenwa	KATOL	Check Dam
622	Yenwa	KATOL	Check Dam
623	Mohkhedi	KATOL	Check Dam
624	Kalambha	KATOL	Check Dam
625	Kalambha	KATOL	Check Dam
626	Mohkhedi	KATOL	Check Dam
627	Kalambha	KATOL	Check Dam
628	Kalambha	KATOL	Check Dam
629	Karla	KATOL	Check Dam
630	Yenwa	KATOL	Check Dam
631	Yenwa	KATOL	Check Dam
632	Mohkhedi	KATOL	Check Dam
633	Yerla (Dhote)	KATOL	Check Dam

Sr. No.	Village	Block	Type of Structure
634	Gondidigras	KATOL	Check Dam
635	Digras (Bk)	KATOL	Check Dam
636	Khandala (Kh)	KATOL	Check Dam
637	Ambada (sonak)	KATOL	Check Dam
638	Ambada (sonak)	KATOL	Check Dam
639	Khandala (Kh)	KATOL	Check Dam
640	Khandala (Kh)	KATOL	Check Dam
641	Khandala (Kh)	KATOL	Check Dam
642	Khandala (Kh)	KATOL	Check Dam
643	Ambada (sonak)	KATOL	Check Dam
644	Dongargaon	KATOL	Check Dam
645	Ambada	NARKHED	Check Dam
646	Panwadi	KATOL	Check Dam
647	Dongargaon	KATOL	Check Dam
648	Dongargaon	KATOL	Check Dam
649	Kolambi	KATOL	Check Dam
650	Junewani	KATOL	Check Dam
651	Kolambi	KATOL	Check Dam
652	Fetri	KATOL	Check Dam
653	Khangaon	KATOL	Check Dam
654	Kolambi	KATOL	Check Dam
655	Dhiwarwadi	KATOL	Check Dam
656	Jatamkohala	KATOL	Check Dam
657	Junewani	KATOL	Check Dam
658	Junewani	KATOL	Check Dam

Sr. No.	Village	Block	Type of Structure
659	Junewani	KATOL	Check Dam
660	Junewani	KATOL	Check Dam
661	Junewani	KATOL	Check Dam
662	Junewani	KATOL	Check Dam
663	Ambada (sonak)	KATOL	Check Dam
664	Jatamkohala	KATOL	Check Dam
665	Junewani	KATOL	Check Dam
666	Jatamkohala	KATOL	Check Dam
667	Jatamkohala	KATOL	Check Dam
668	Jatamkohala	KATOL	Check Dam
669	Jatamkohala	KATOL	Check Dam
670	Jatamkohala	KATOL	Check Dam
671	Jatamkohala	KATOL	Check Dam
672	Jatamkohala	KATOL	Check Dam
673	Khandala (Kh)	KATOL	Check Dam
674	Paradsinga	KATOL	Check Dam
675	Paradsinga	KATOL	Check Dam
676	Paradsinga	KATOL	Check Dam
677	Paradsinga	KATOL	Check Dam
678	Paradsinga	KATOL	Check Dam
679	Paradsinga	KATOL	Check Dam
680	Wadvihara	KATOL	Check Dam
681	Paradsinga	KATOL	Check Dam
682	Paradsinga	KATOL	Check Dam
683	Bhidhnur	NARKHED	Check Dam

Sr. No.	Village	Block	Type of Structure
684	Bhidhnur	NARKHED	Check Dam
685	Masli	KATOL	Check Dam
686	Bhidhnur	NARKHED	Check Dam
687	Wadvihara	KATOL	Check Dam
688	Khaprikene	NARKHED	Check Dam
689	Khaprikene	NARKHED	Check Dam
690	Junewani	KATOL	Check Dam
691	Khaprikene	NARKHED	Check Dam
692	Junewani	KATOL	Check Dam
693	Khaprikene	NARKHED	Check Dam
694	Junewani	KATOL	Check Dam
695	Khaprikene	NARKHED	Check Dam
696	Khadki	KATOL	Check Dam
697	Chaurepathar	KATOL	Check Dam
698	Chaurepathar	KATOL	Check Dam
699	Junewani	KATOL	Check Dam
700	Chaurepathar	KATOL	Check Dam
701	Khadki	KATOL	Check Dam
702	Chaurepathar	KATOL	Check Dam
703	Khadki	KATOL	Check Dam
704	Junewani	KATOL	Check Dam
705	Khadki	KATOL	Check Dam
706	Chaurepathar	KATOL	Check Dam
707	Chaurepathar	KATOL	Check Dam
708	Khadki	KATOL	Check Dam

Sr. No.	Village	Block	Type of Structure
709	Khadki	KATOL	Check Dam
710	Chaurepathar	KATOL	Check Dam
711	Pandhardhakani	KATOL	Check Dam
712	Chaurepathar	KATOL	Check Dam
713	Chaurepathar	KATOL	Check Dam
714	Pandhardhakani	KATOL	Check Dam
715	Pandhardhakani	KATOL	Check Dam
716	Pandhardhakani	KATOL	Check Dam
717	Pandhardhakani	KATOL	Check Dam
718	Pandhardhakani	KATOL	Check Dam
719	Pandhardhakani	KATOL	Check Dam
720	Pandhardhakani	KATOL	Check Dam
721	Pandhardhakani	KATOL	Check Dam
722	Junewani	NARKHED	Check Dam
723	Pandhardhakani	KATOL	Check Dam
724	Junewani	NARKHED	Check Dam
725	Junewani	NARKHED	Check Dam
726	Kakaddara	NARKHED	Check Dam
727	Kakaddara	NARKHED	Check Dam
728	Kakaddara	NARKHED	Check Dam
729	Kakaddara	NARKHED	Check Dam
730	Pandhardhakani	KATOL	Check Dam
731	Kakaddara	NARKHED	Check Dam
732	Khaprikene	NARKHED	Check Dam
733	Junewani	NARKHED	Check Dam

Sr. No.	Village	Block	Type of Structure
734	Ambada (Deshmuk	NARKHED	Check Dam
735	Pithori	NARKHED	Check Dam
736	Chorkhairi	NARKHED	Check Dam
737	Khedi Gowargond	NARKHED	Check Dam
738	Khedi Gowargond	NARKHED	Check Dam
739	Khedi Gowargond	NARKHED	Check Dam
740	Umari	NARKHED	Check Dam
741	Mhasora	NARKHED	Check Dam
742	Mhasora	NARKHED	Check Dam
743	Umari	NARKHED	Check Dam
744	Khandala[Bk]	NARKHED	Check Dam
745	Ambola	NARKHED	Check Dam
746	Toyapar	NARKHED	Check Dam
747	Mogra	NARKHED	Check Dam
748	Mogra	NARKHED	Check Dam
749	Toyapar	NARKHED	Check Dam
750	Toyapar	NARKHED	Check Dam
751	Wadgaon (Umari)	NARKHED	Check Dam
752	Mohadi (Dhotra)	NARKHED	Check Dam
753	Mohadi (Dhotra)	NARKHED	Check Dam
754	Ambola	NARKHED	Check Dam
755	Ambola	NARKHED	Check Dam
756	Khandala[Bk]	NARKHED	Check Dam
757	Khandala[Bk]	NARKHED	Check Dam

Sr. No.	Village	Block	Type of Structure
758	Khandala[Bk]	NARKHED	Check Dam
759	Singarkheda	NARKHED	Check Dam
760	Khandala[Bk]	NARKHED	Check Dam
761	Mhasora	NARKHED	Check Dam
762	Mhasora	NARKHED	Check Dam
763	Koni	NARKHED	Check Dam
764	Mohadi (Dalvi)	NARKHED	Check Dam
765	Mohadi (Dalvi)	NARKHED	Check Dam
766	Nawegaon	NARKHED	Check Dam
767	Mohadi (Dalvi)	NARKHED	Check Dam
768	Palasgaon	NARKHED	Check Dam
769	Palasgaon	NARKHED	Check Dam
770	Bamhani	NARKHED	Check Dam
771	Bamhani	NARKHED	Check Dam
772	Bamhani	NARKHED	Check Dam
773	Nawegaon	NARKHED	Check Dam
774	Wadgaon (Umari)	NARKHED	Check Dam
775	Wadgaon (Umari)	NARKHED	Check Dam
776	Tinkheda	NARKHED	Check Dam
777	Pandhardhakani	KATOL	Check Dam
778	Pandhardhakani	KATOL	Check Dam
779	Pandhardhakani	KATOL	Check Dam
780	Salaidabha	HINGNA	Check Dam
781	Sawangi	HINGNA	Check Dam
782	Singardip	HINGNA	Check Dam

Sr. No.	Village	Block	Type of Structure
783	Singardip	HINGNA	Check Dam
784	Sinka	HINGNA	Check Dam
785	Sirul	HINGNA	Check Dam
786	Sirul	HINGNA	Check Dam
787	Sirul	HINGNA	Check Dam
788	Sumthana	HINGNA	Check Dam
789	Sumthana	HINGNA	Check Dam
790	Wagdara	HINGNA	Check Dam
791	Wagdara	HINGNA	Check Dam
792	Wagdara	HINGNA	Check Dam
793	Wagdara	HINGNA	Check Dam
794	Wagdara	HINGNA	Check Dam
795	Wagdara	HINGNA	Check Dam
796	Wagdara	HINGNA	Check Dam
797	Wagdara	HINGNA	Check Dam
798	Wagdara	HINGNA	Check Dam
799	Wagdara	HINGNA	Check Dam
800	Wagdara	HINGNA	Check Dam
801	Wagdara	HINGNA	Check Dam
802	Wagdara	HINGNA	Check Dam
803	Wanadongri	HINGNA	Check Dam
804	Waranga	HINGNA	Check Dam
805	Wayfal	HINGNA	Check Dam
806	Wadgaon	HINGNA	Check Dam
807	Wadgaon	HINGNA	Check Dam

Sr. No.	Village	Block	Type of Structure
808	Wadgaon	HINGNA	Check Dam
809	Wadgaon	HINGNA	Check Dam
810	Dhanoli	HINGNA	Check Dam
811	Dhanoli	HINGNA	Check Dam
812	Dhanoli	HINGNA	Check Dam
813	Dhanoli	HINGNA	Check Dam
814	Nildoh	HINGNA	Check Dam
815	Nildoh	HINGNA	Check Dam
816	Nildoh	HINGNA	Check Dam
817	Nildoh	HINGNA	Check Dam
818	Nildoh	HINGNA	Check Dam
819	Nildoh	HINGNA	Check Dam
820	Nildoh	HINGNA	Check Dam
821	Nildoh	HINGNA	Check Dam
822	Wanadongri	HINGNA	Check Dam
823	Wanadongri	HINGNA	Check Dam
824	Surabardi	NAGPUR (RURAL)	Check Dam
825	Kuhi	KUHI	Check Dam
826	Kuhi	KUHI	Check Dam
827	Ambadi	KUHI	Check Dam
828	Shirpur	KAMPTEE	Check Dam
829	Tarodi bk.	KAMPTEE	Check Dam
830	Tarodi bk.	KAMPTEE	Check Dam
831	Parsodi	UMRED	Check Dam

Sr. No.	Village	Block	Type of Structure
832	Paradgaon	UMRED	Check Dam
833	Kanheri kh.	KUHI	Check Dam
834	Kanheri kh.	KUHI	Check Dam
835	Akoli	KUHI	Check Dam
836	Chanoda	KUHI	Check Dam
837	Sawli	KUHI	Check Dam
838	Mandhal	KUHI	Check Dam
839	Wag	KUHI	Check Dam
840	Chikhali	KUHI	Check Dam
841	Fegad	KUHI	Check Dam
842	Dahegaon	KUHI	Check Dam
843	Parsodi (raja)	KUHI	Check Dam
844	Navegaon (devi)	KUHI	Check Dam
845	Karhandla	KUHI	Check Dam
846	Awarmara	KUHI	Check Dam
847	Navegaon	KUHI	Check Dam
848	Rajola	KUHI	Check Dam
849	Rajola	KUHI	Check Dam
850	Rajola	KUHI	Check Dam
851	Siroli	KUHI	Check Dam
852	Murbi	KUHI	Check Dam
853	Chipdi	KUHI	Check Dam
854	Titur	KUHI	Check Dam
855	Dodma	KUHI	Check Dam
856	Dodma	KUHI	Check Dam

Sr. No.	Village	Block	Type of Structure
857	Mendha	KUHI	Check Dam
858	Powari	KUHI	Check Dam
859	Bhojapur	KUHI	Check Dam
860	Kuhi	KUHI	Check Dam
861	Kuhi	KUHI	Check Dam
862	Malchi	KUHI	Check Dam
863	Pachkhedi	KUHI	Check Dam
864	Chikna tukum	KUHI	Check Dam
865	Virkhandi	KUHI	Check Dam
866	Chikna tukum	KUHI	Check Dam
867	Pohara	KUHI	Check Dam
868	Channa	KUHI	Check Dam
869	Channa	KUHI	Check Dam
870	Borada	KUHI	Check Dam
871	Weltur	KUHI	Check Dam
872	Sonegaon	MAUDA	Check Dam
873	Tanda	MAUDA	Check Dam
874	Tarsa	MAUDA	Check Dam
875	Tondli Rithi	MAUDA	Check Dam
876	Tuman	MAUDA	Check Dam
877	Wagholi (Rithi	MAUDA	Check Dam
878	Waygaon	MAUDA	Check Dam
879	Wirshi	MAUDA	Check Dam
880	Wirshi	MAUDA	Check Dam
881	Wirshi	MAUDA	Check Dam

Sr. No.	Village	Block	Type of Structure
882	Zullar	MAUDA	Check Dam
883	Waygaon	MAUDA	Check Dam
884	Waygaon	MAUDA	Check Dam
885	Tondli Rithi	MAUDA	Check Dam
886	Umari	KAMPTEE	Check Dam
887	Undgaon	KAMPTEE	Check Dam
888	Wadoda	KAMPTEE	Check Dam
889	Tondli Rithi	MAUDA	Check Dam
890	Tondli Rithi	MAUDA	Check Dam
891	Yekardi	KAMPTEE	Check Dam
892	Yekardi	KAMPTEE	Check Dam
893	Pawangaon	KAMPTEE	Check Dam
894	Umari	KAMPTEE	Check Dam
895	Yekardi	KAMPTEE	Check Dam
896	Tarodi bk.	KAMPTEE	Check Dam
897	Mahalgaon	KAMPTEE	Check Dam
898	Asalwada	KAMPTEE	Check Dam
899	Avandhi	KAMPTEE	Check Dam
900	Telkamthi	KALAMESHWAR	Check Dam
901	Tidangi	KALAMESHWAR	Check Dam
902	Tishti bk.	KALAMESHWAR	Check Dam
903	Tishti bk.	KALAMESHWAR	Check Dam
904	Tishti bk.	KALAMESHWAR	Check Dam
905	Tishti bk.	KALAMESHWAR	Check Dam
906	Tishti kh.	KALAMESHWAR	Check Dam

Sr. No.	Village	Block	Type of Structure
907	Tishti kh.	KALAMESHWAR	Check Dam
908	Ubagi	KALAMESHWAR	Check Dam
909	Ubagi	KALAMESHWAR	Check Dam
910	Ubagi	KALAMESHWAR	Check Dam
911	Ubali	KALAMESHWAR	Check Dam
912	Ubali	KALAMESHWAR	Check Dam
913	Ubali	KALAMESHWAR	Check Dam
914	Wathoda	KALAMESHWAR	Check Dam
915	Umari (Bharatpu	SAVNER	Check Dam
916	Malegaon	SAVNER	Check Dam
917	Malegaon	SAVNER	Check Dam
918	Malegaon	SAVNER	Check Dam
919	Maharkund	SAVNER	Check Dam
920	Maharkund	SAVNER	Check Dam
921	Maharkund	SAVNER	Check Dam
922	Raibasa	SAVNER	Check Dam
923	Kothulana	SAVNER	Check Dam
924	Kothulana	SAVNER	Check Dam
925	Kothulana	SAVNER	Check Dam
926	Bid jatamkhora	SAVNER	Check Dam
927	Bid jatamkhora	SAVNER	Check Dam
928	Hetikheda	SAVNER	Check Dam
929	Hetikheda	SAVNER	Check Dam
930	Hetikheda	SAVNER	Check Dam
931	Jalalkheda	SAVNER	Check Dam

Sr. No.	Village	Block	Type of Structure
932	Jalalkheda	SAVNER	Check Dam
933	Jalalkheda	SAVNER	Check Dam
934	Chorkhairi	SAVNER	Check Dam
935	Chorkhairi	SAVNER	Check Dam
936	Chorkhairi	SAVNER	Check Dam
937	Zilpi	KALAMESHWAR	Check Dam
938	Zilpi	KALAMESHWAR	Check Dam
939	Zilpi	KALAMESHWAR	Check Dam
940	Zilpi	KALAMESHWAR	Check Dam
941	Murti	KATOL	Check Dam
942	Pandhardhakani	KATOL	Check Dam
943	Sonkhamb	KATOL	Check Dam
944	Metpanjara	KATOL	Check Dam
945	Dhawalapur	KATOL	Check Dam
946	Gangaldoh	KATOL	Check Dam
947	Gangaldoh	KATOL	Check Dam
948	Panjra (Kate)	KATOL	Check Dam
949	Jatlapur	KATOL	Check Dam
950	Jatlapur	KATOL	Check Dam
951	Masod	KATOL	Check Dam
952	Masod	KATOL	Check Dam
953	Masod	KATOL	Check Dam
954	Chicholi	KATOL	Check Dam
955	Junapani	KATOL	Check Dam
956	Bihalgondi	KATOL	Check Dam

Sr. No.	Village	Block	Type of Structure
957	Mendhepathar	KATOL	Check Dam
958	Hatla	KATOL	Check Dam
959	Mendhepathar	KATOL	Check Dam
960	Mendhepathar	KATOL	Check Dam
961	Sonmoh	KATOL	Check Dam
962	Dorli (Bk)	KATOL	Check Dam
963	Sawandri	KALAMESHWAR	Check Dam
964	Pohigond Khairi	KALAMESHWAR	Check Dam
965	Mohpa	KALAMESHWAR	Check Dam
966	Deoli	KALAMESHWAR	Check Dam
967	Chargaon	KATOL	Check Dam
968	Dorli (Bk)	KATOL	Check Dam
969	Khutamba	KATOL	Check Dam
970	Tarabodi	KATOL	Check Dam
971	Khapari (Kh)	KATOL	Check Dam
972	Gujarkhedi	KATOL	Check Dam
973	Ghukashi	PARSEONI	Check Dam
974	Bachhera	PARSEONI	Check Dam
975	Salai	PARSEONI	Check Dam
976	Gundhari (pande	PARSEONI	Check Dam
977	Chichbhuwan	PARSEONI	Check Dam
978	Salai	PARSEONI	Check Dam
979	Dundakhairi	PARSEONI	Check Dam
980	Nandgaon	PARSEONI	Check Dam
981	Nandgaon	PARSEONI	Check Dam

Sr. No.	Village	Block	Type of Structure
982	Bakhari	PARSEONI	Check Dam
983	Nandgaon	PARSEONI	Check Dam
984	Dumari Kh.	PARSEONI	Check Dam
985	Bakhari	PARSEONI	Check Dam
986	Chargaon	PARSEONI	Check Dam
987	Dahegaon (joshi	PARSEONI	Check Dam
988	Dahegaon (joshi	PARSEONI	Check Dam
989	Dahegaon (joshi	PARSEONI	Check Dam
990	Dahegaon (joshi	PARSEONI	Check Dam
991	Sawali	PARSEONI	Check Dam
992	Tamaswadi	PARSEONI	Check Dam
993	Itagaon	PARSEONI	Check Dam
994	Dahegaon (joshi	PARSEONI	Check Dam
995	Dahegaon (joshi	PARSEONI	Check Dam
996	Bhage Mahari	PARSEONI	Check Dam
997	Naikund	PARSEONI	Check Dam
998	Tamaswadi	PARSEONI	Check Dam
999	Kanhadevi	PARSEONI	Check Dam
1000	Sakarla	PARSEONI	Check Dam
1001	Bhage Mahari	PARSEONI	Check Dam
1002	Nimkheda	PARSEONI	Check Dam
1003	Telang Khedi	PARSEONI	Check Dam
1004	Bhage Mahari	PARSEONI	Check Dam
1005	Mahuli	PARSEONI	Check Dam
1006	Panjara (Ri)	PARSEONI	Check Dam

Sr. No.	Village	Block	Type of Structure
1007	Amadi	PARSEONI	Check Dam
1008	Digalwadi	PARSEONI	Check Dam

Sr. No.	Village	Block	Type of Structure
1009	Bhage Mahari	PARSEONI	Check Dam
1010	Mahuli	PARSEONI	Check Dam