2337/NQM/2021

केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

जलशक्ति मंत्रालय

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

NANDED DISTRICT MAHARASHTRA

(AAP 2019-2020)

मध्यक्षेत्र, नागपुर / **Central Region, Nagpur**

अगस्त **2021 /August 2021**

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NANDED DISTRICT AT A GLANCE

1. GENERAL INFORMATION	
Geographical Area (Sq. Km.)	10542
Administrative Divisions (2011)	16 Blocks Ardhapur, Bhokar, Biloli, Degloor, Dharmabad, Hadgaon, Himataytnagar, Kandhar, Kinwat, Loha, Mahur, Mudkhed, Mukhed, Naigaon, Nanded, Umari
Towns / Villages (Census 2011)	17 /1603
Population (Census 2011)	3361292
Annual Rainfall (2019)	1027.1 mm
Normal Rainfall	827.25 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend: 4.178 mm/year. Probability of Normal/Excess Rainfall-64% & 23%. Probability of Drought (Moderate/Severe / Acute)-: 14% Moderate.
2. GEOMORPHOLOGY, SOIL & DRAINAGE	
Major Physiographic Unit	
Major Drainage	River Godavari and its tributaries, River Manar and its tributaries, River Landi and its tributaries
3. LAND USE (2017-18) (Source: DSA 2018)	
Forest Area	1052.5 Sq. Km.
Cultivable Area	9449Sq. Km.
Net Sown Area	7561 Sq. Km.
Area Sown more than Once	1898 Sq. Km.
5.PRINCIPAL CROPS (2018)	
Cotton	2697.79
Pulses	285.94
Cereals	88.92
Oil Seeds	3242.22
Sugarcane	362.95
Others	38.34
6. HORTICULTURAL CROPS	
Sugarcane	362.95
Others	38.34
7. GROUND WATER ABSTRACTION STRUCTURES (Reference Year: 2006-07)	
Dug Wells	38253
Bore Wells/Tube Wells	15531
8. GROUND WATER MONITORING WELLS (As on 31/03/2019)	
Dug Wells	59
Piezometers	02
9. GEOLOGY	Recent Riverbed Alluvium, Basaltic lava flows of Deccan traps belonging to Late Cretaceous to Early Eocene, Intertrappeans of Precambrian age and Peninsular granite-gneiss comples of Archean age.

10. HYDROGEOLOGY	
Water Bearing Formation	Alluvium-Sand and Gravel (Under Phreatic condition)
	Deccan Traps: Under phreatic to semi-confined/confined
	Granite: Under phreatic to semi-confined/confined
	Gneiss: Under phreatic to semi-confined/confined
Depth to water Level in Shallow Aquifer	
Premonsoon Depth to water level (May 2019)	1.55 to 31.7mbgl
Post monsoon Depth to water Level (Nov.2019)	0.01 to 13.8 mbgl
Depth to water Level in Deeper Aquifer	
Premonsoon Depth to water level (May 2019)	2.07 to 30.35 mbgl
Post monsoon Depth to water Level (Nov.2019)	1.48 to 39.2 mbgl
11. GROUND WATER EXPLORATION (As on 31/03/2019)	
Wells Drilled	EW-37, OW-26, PZ-03
Depth Range	54 to 208.00 m bgl
Discharge	Traces to 9.54 lps
Transmissivity	6.15 to 83.53 m^2/day
Storativity	2.2×10^{-4} to 1×10^{-2}
12.GROUND WATER QUALITY	
Ground Water is suitable for Drinking and Irrigation Purposes except in area where EC> 2250 µS/cm and areas of Fluoride and Nitrate Contamination	
Type of water	Medium to High Saline water
13. GROUND WATER RESOURCES AVAILABILITY (2017)	
Net Annual Ground Water Availability (MCM)	1139.75
Existing Gross Ground Water Draft for All uses (MCM)	382.03
Annual GW Allocation for Domestic Use as on 2025	93.45
Stage of Ground Water Development %	35.44 %
Category	SAFE
Over Exploited Blocks	None
Semi-Critical Blocks	None
Notified Blocks	None
14. GROUND WATER ISSUES	
LOW DEVELOPMENT: The stage of ground water development varies from 20.20 % in Ardhapur block to 60.50% in Dharmabad block. Thus, there is a low stage of ground water developmentnet in the district. DECLINING WATER LEVEL TREND: The declining trend of water level has been observed in the major parts of the district during both premonsoon and post	

monsoon. During Premonsoon, a falling trend @ 0.0 to 2.38 m/year is observed in about 6699.24 Sq Km area and a falling trend @ 0.0 to 0.84 m/year is observed in about 5106.56 Sq Km area LOW YIELDING AQUIFERS: The yield of the aquifer in major parts of the block ranges from 1 to 2 lps as given in Figure 6.3. This is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers. FLOURIDE CONTAMINAION: The Fluoride contamination in unconfined aquifers is observed in 3 sites in Kinwat, Himayatnagr and Biloli blocks and Nitrate contamination is observed in 3 sites of Himayatnagar block. In Semiconfined/confined aquifers, the presence of Flouride was obtained in 7 sites in Mahur, Mukhed, Kandhar, Mudkhed and Himayatnagar blocks and the nitrate contamination was obtained in 11 sites in Naigaon, Hadgaon, Mudkhed, Himayatnagar, Degloor, Biloli, Ardhapur blocks.	
15. AQUIFER MANAGEMENT PLAN	
SUPPLY SIDE MANAGEMENT	Proposed AR structures-1181 Percolation Tank-307 Check Dam-874 Leading to Additional 65.69 MCM
DEMAND SIDE MANAGEMENT	Area proposed for Drip irrigation: Sugarcane Area:8.11 sq km Ground water saving:6.63 MCM
EXPECTED BENEFITS	711 Sq Km additional area proposed for irrigation through 27714 Dugwells and 4620Borewells

AQUIFER MAPPING AND MANAGEMENT PLAN NANDED DISTRICT, MAHARASHTRA

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AQUIFER MAPPING AND MANAGEMENT PLAN OF NANDED DISTRICT, MAHARASHTRA

1. INTRODUCTION

In XII five-year Plan, National Aquifer Mapping (NAQUIM) had been taken up by CGWB to carry out detailed hydrogeological investigation on topo-sheet 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.

The vagaries of rainfall, inherent heterogeneity & unsustainable nature of hard rock aquifers, over exploitation of once copious alluvial aquifers, lack of regulation mechanism has a detrimental effect on ground water scenario of the Country in last decade or so. 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.

Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The proposed management plans will provide the **"Road Map"** for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus, the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation. The aquifer maps and management plans will be shared with the Administration of Amravati 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 Area

Nanded District is one of the eight districts of Marathwada region of Maharashtra State. It is situated in the eastern part of the Marathwada region of Maharashtra State and surrounded on the north by Yavatmal Ditsrict of Vidarbha Region, on the west by Parbhani, Nanded and Osmanabad districts, on the South by Bidar District of Karnataka and on the east by Nizamabad and Adilabad districts of Andhra Pradesh and lies between north latitudes 18°16' and 19°55' and east longitudes 76°56' and 78°19'. The total area of the district is 10542 Sq. km. of which only 10178 Sq Km area is mappable and falls in Survey of India degree sheets 56/B, 56/C and 56/F. For administrative purposes, the district is divided into three sub-divisions and 16 blocks. Nanded subdivision includes Bhokar, Mudkhed, Nanded Ardhapur, Kandhar, Loha and Umri tehsils; Deglur subdivision includes Deglur, Biloli, Nigaon (Khairgaon), Mukhed and Dharmabad tehsils; Kinwat subdivision includes Kinwat, Mahur, Hadgaon and Himayatnagar tehsils (**Figure 1.1).** The

talukas are further divided into 17 towns and 1603 villages. The index map of the district is given in F**igure 1.2.**

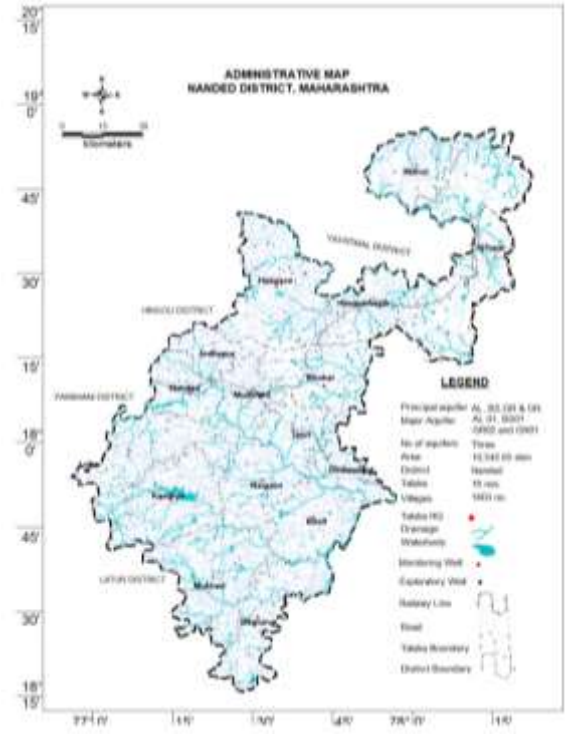


Figure 1.1: Administrative Map

Figure 1.2: Index Map

Based on the tehsil and district-wise statistics of population as per 2011 census, it has been estimated that the total population of the district is 3,361,292 out of which 73 % is rural population and 27 % is rural population with 1,73,0075 males and 1,189,234 females. The average density of population in the district is 319 persons per sq. Km.

The National Aquifer Mapping & Management Programme (NAQUIM) has been taken up in all the blocks of the district in a single phase of XIII five Year Plan in AAP 2019-20.

1.2 Geomorphology, Drainage, Soil Types, Land Use

1.2.1 Geomorphology

The district is situated on plateau's having plain terrain with undulations. The main trend of the hills is from North-west to South-east in parallel ranges with offshoots generally running in a perpendicular direction. The Satmala Range enters the district after Penganga valley just after Mahur and rise in three distinct terraces of elevation; above 350 to 570 magl; 570 to 600 magl and more than 600 magl.

To the south of the Satmala ranges, the Nirmala Hills ranges run parallel to them and to the east of Penganga they are linked to the former by offshoot hills which are aligned more or less to the course of the river which in turn forms the district boundary. Generally, the hills occurring in the North and South side of the Godavari River are of lower elevation and are known as Wakhad in Bhokar and Hadgaon Tehsils and as Balaghat in Kandhar and Mukhed tehsils. Savargaon plateau hill ranges form the water divide between the Penganaga and Godavari rivers and runs continuously for 13 kms before they split into three main ranges extending

eastwars, south-east wards and southwards. The geomorphological map of Nanded district is depicted in **Figure 1.3.**

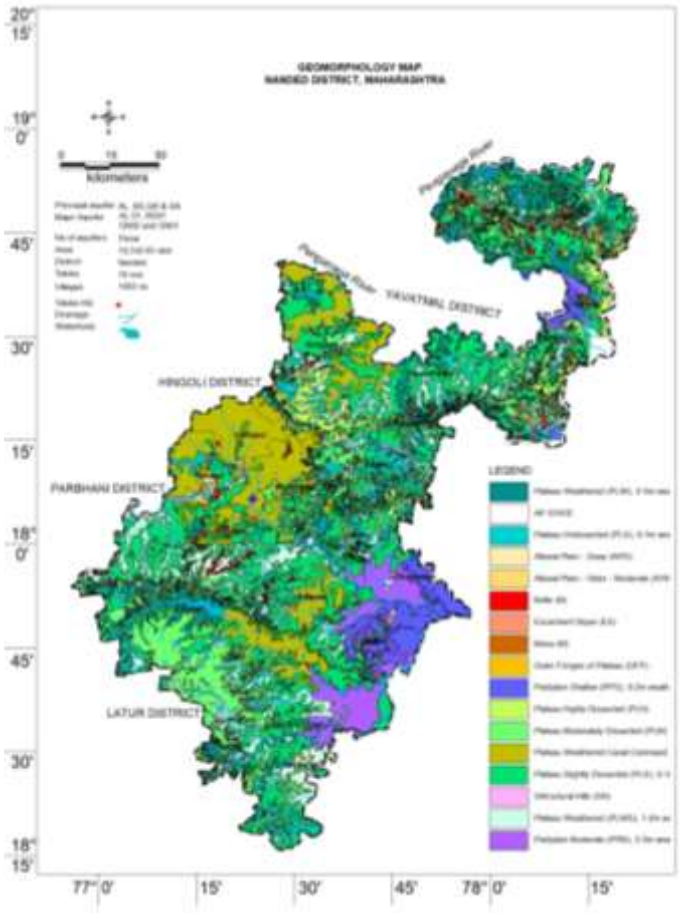


Figure 1.3: Geomorphology of Nanded District

1.2.2 Drainage

The principal rivers of the district are Penganaga, Godavari, Manjra and Mannar. The river Godavari runs for about 140 Kms through the district flows in northwest- southeast direction and confluences with Manjra. The Godavari River in the district has three tributaries namely Asna, Sita and Siddha.

The Manjra is the most important tributary of the Godavari and forms the district boundary on the southeast for about 40 Kms upto its confluence with the Godavari. The Manjra has two tributaries viz: the Mannar and the Lendi. The Mannar rising near Dharmapur in Beed District enters Nanded in a southwesterly direction at 3 kms south of Malegaon village.

The Lendi with its tributary Tiru drains southernmost parts of the district towards the Manjra and forms part of the district boundary after Hanuman Hipperga.

The Penganga River forms the northern boundary of the district with its long sinous course. The river flows from west to east with a big “S” shaped curve. The Penganga River has two tributaries viz; the Kayathu and the Tamsa nala. The drainage map of Nanded District is depicted in Figure 1.4.

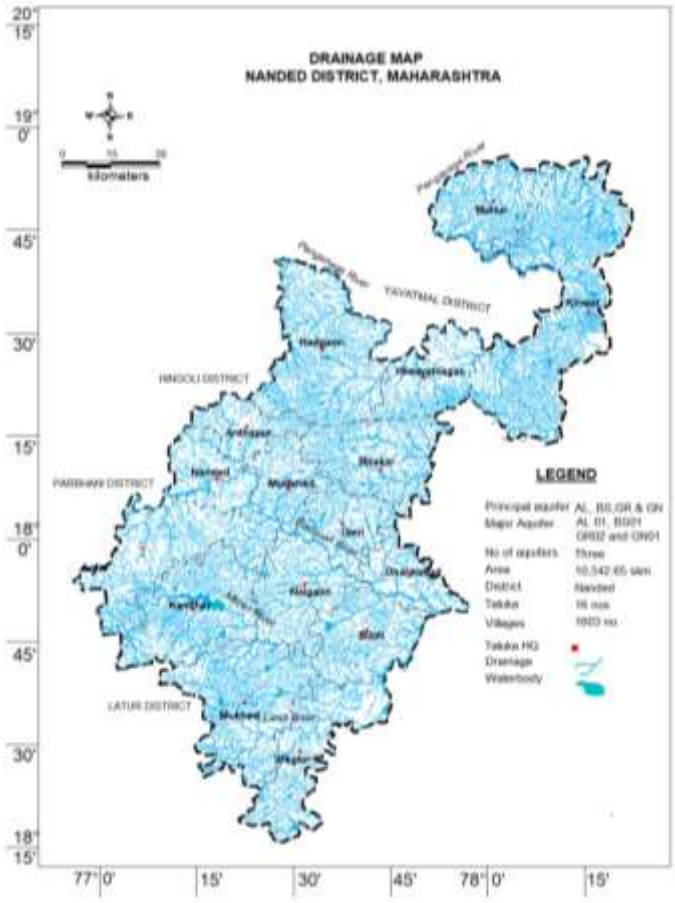


Figure 1.4: Drainage, Nanded District

1.2.3 Soil Types

The soils are black and fertile. The best black soils, which are deep and clayey are found as narrow strips of land in the riverbanks of Godavari, Penganga and their tributaries. Soils are of light grey, brown to grey-brown in colour and appear on the surface with clayey and blockey structure. In Kandhar and watrn parts of Mukhed tehsils the soils though black are thin and stoney, as a result only kharif crop is gown. The soils occurring in Deglur and Biloli tehsils are the best soils in the district and are more fertile in nature. Hence in addition to Kharif crops, Rabi crops can also be grown.

The district can be divided into 4 different soil types based on the characteristics of soil as shown in Figure 1.5 and the basic physico-chemical property of the profile is:

- Coarse Shallow Soils: Occurs along hillslopes and elevated plains and are brown to grey in colour. They are less fertile with thickness ranging from between 0 to 15 cm. They comprise gravels, pieces of basaltic quartz, and calcareous nodules.
- Medium Black Soils: Occurs in undulating plains and depressions. It is dark brown in colour and contains clay, coarse grains of basalt quartz etc. The thickness varies from 15 to 20 cm.
- Deep Black Soils: Occurs along low plains, depressions and valley regions. These are dark, plastic, sticky and clayey in nature and are rich in plant matter

and are very fertile. They are also known as black cotton soils. The thickness varies from 50 to 200cm.

- Loamy Soils: These occur mainly in NE of Biloli town and SE of Deglur town where the parent rock is granite and consists of sand, silt and clay in roughly equal proportions. Lateritic soils occur around Mukhedtown.

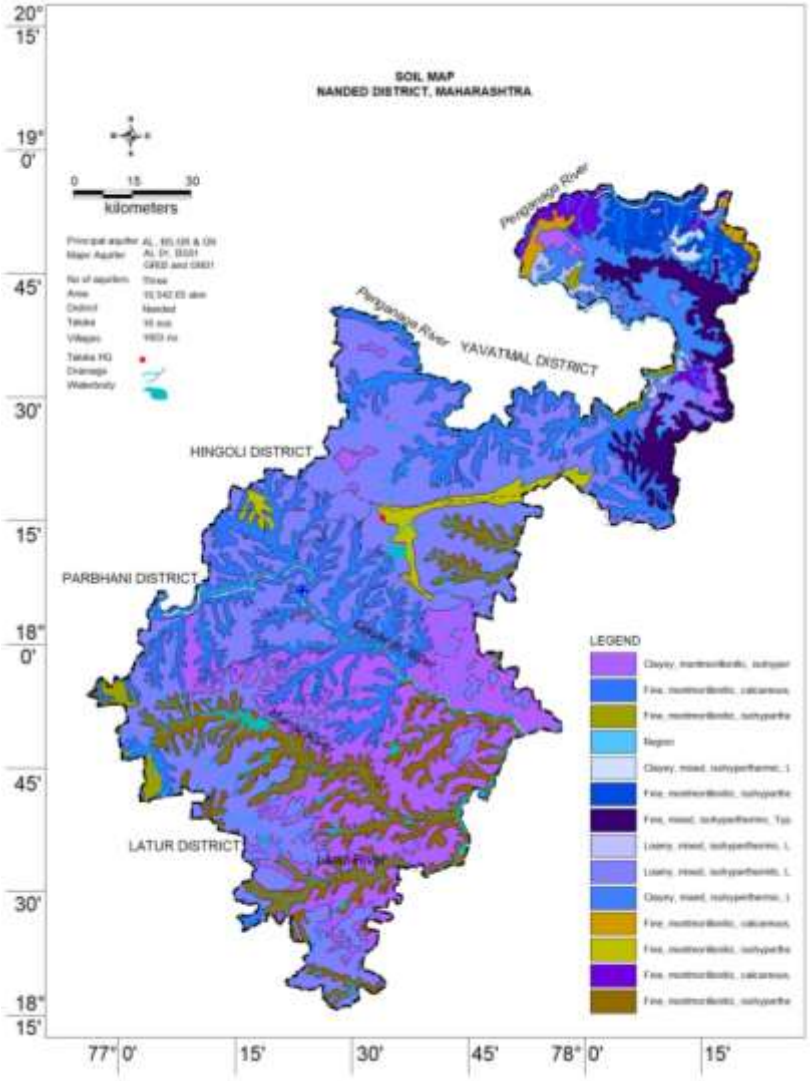


Figure 1.5: Soil Map, Nanded District

1.2.4 Land Use

The total area of the district can be classified into cultivated and uncultivated land. In 2017-18, the total geographical area of the district was 10542 Sq Km. Out of this, the area under current fallow, other fallow and net sown area was grouped as cultivable area. It amounts to 79 percent of the total area of which 18% of cultivable area is sown more than twice. The area under forests, uncultivable land and land under non-agricultural use are grouped under area not available for cultivation. The proportion of the gross cropped area in the district is more than the cultivable area. The land use details of the district are given in Table 1.1 & Figure 1.6

Table 1.1: Land Use Details (Reference Year: 2017-18)

District	Total Geographical Area	Forest	Uncultivated Area		Cultivated Area				
			Fallow land	Land under Non-agricultural use	Current Fallow	Other fallow	Net sown area	Area sown more than once	Gross cropped area
Nanded	10542	1052.5	134.78	293.46	444	331	7561	1898	9449

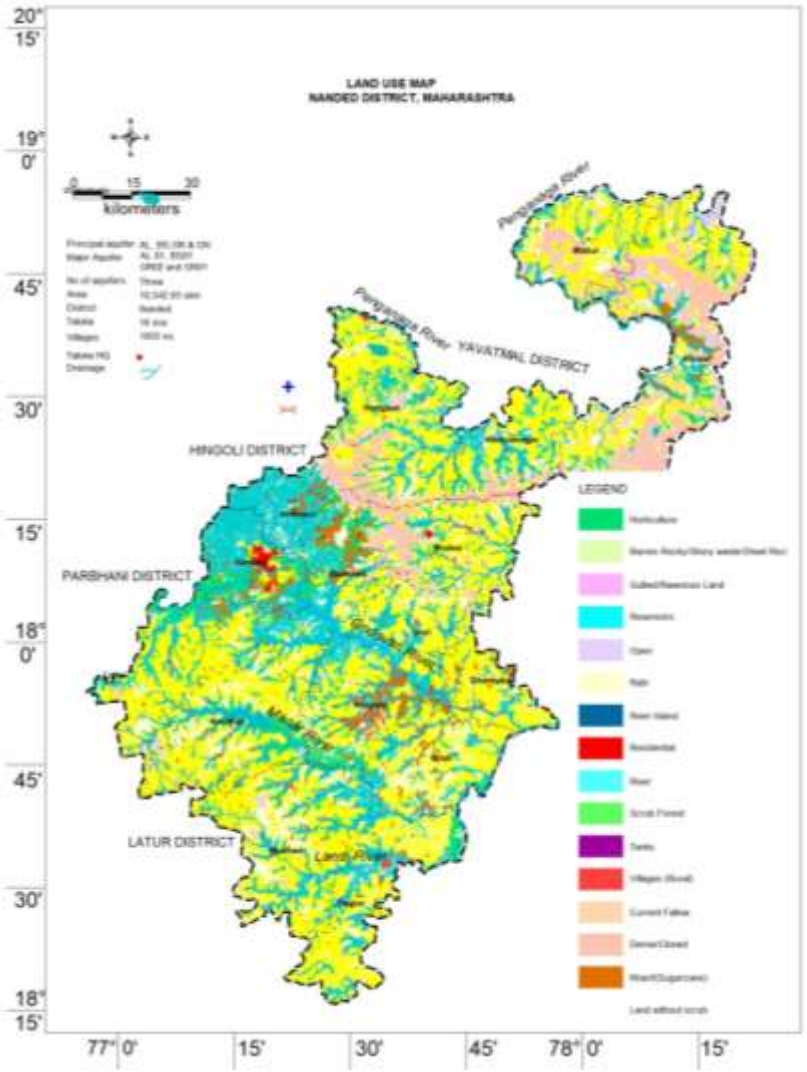


Figure 1.6: Land Use, Nanded District

1.2.5 Cropping Pattern

The early monsoon crops are called kharif (June-October) and late monsoon crops are called rabi (November to March). The major Kharif crops are cotton, jowar, groundnut and the Rabbi crops are wheat, jowar, gram, kardi and groundnut. In addition to this sugarcane and banana are also grown in some parts of the district. The district is mainly dependent on ground water for irrigation than surface water and the map showing gross irrigated area by ground water and surface water is depicted in **Figure 1.7.**

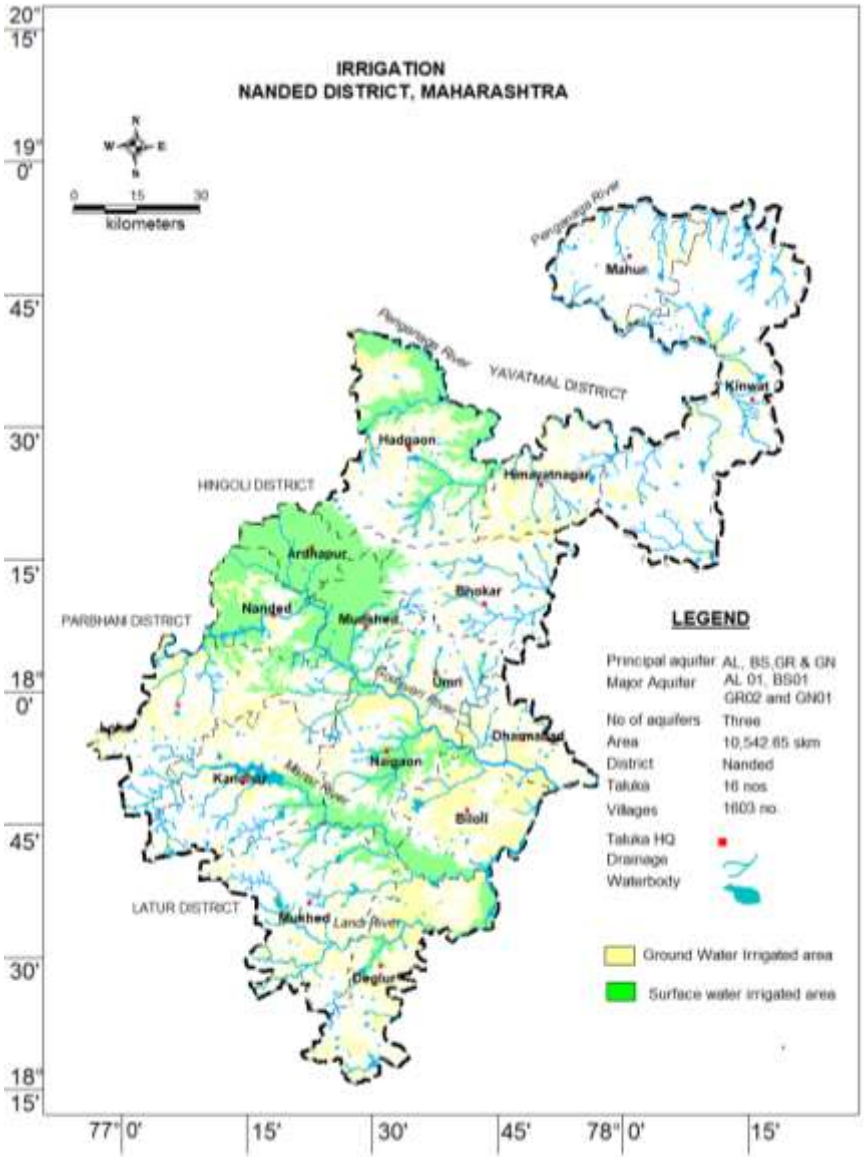


Figure 1.7: Irrigation, Nanded District

1.3 Climate & Rainfall

The district has sub-tropical to tropical wet and dry climate characterized by a very hot summer and very cold winter. The mean minimum temperature during winter is 13 °C and the mean maximum temperature during summer is 42°C. The district receives south-west monsoon from middle of June to end of September.

Nanded District falls under the assured rainfall zone of Maharashtra receiving 700 to 900 mm of rainfall. The current average annual rainfall of the district is 1027 mm whereby the normal rainfall is 827.25 mm. The decadal annual rainfall (2010 to 2019) of the Nanded district ranges from 599 mm to 1125.8 mm with 50% normal rainfall, 20% moderate rainfall and 30% excess rainfall and falling trend @ 0.92 mm/year **(Figure 1.8 & Table 1.2)**.

The aerial distribution of annual rainfall has been studied by preparing an isohyet map of the district for 22-year period **(Figure 1.10)**. The monthly and annual averages were computed for those stations covering the full period of record and corresponding averages were computed for stations of shorter duration. The

isohyet maps indicate that there is a gradual decline in rainfall from eastern part of the district to western. The long-term rainfall analysis (1998 to 2019) indicates a falling trend @ -4.178 mm/year and standard deviation of 229.71 mm with 45 % of years showing positive departures and 55 % showing negative departures resulting in moderate droughts in 14 % of the years and normal (64%) to excess rainfall (23 %) **(Figure 1.9 & Table 1.3).**

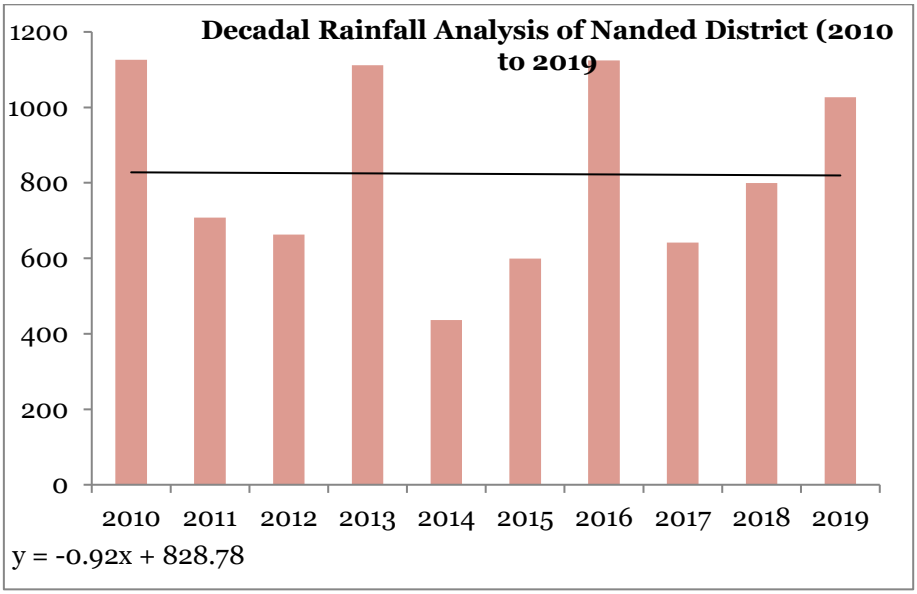


Figure 1.8: Decadal Annual Rainfall Analysis (2010-19) of Nanded District.

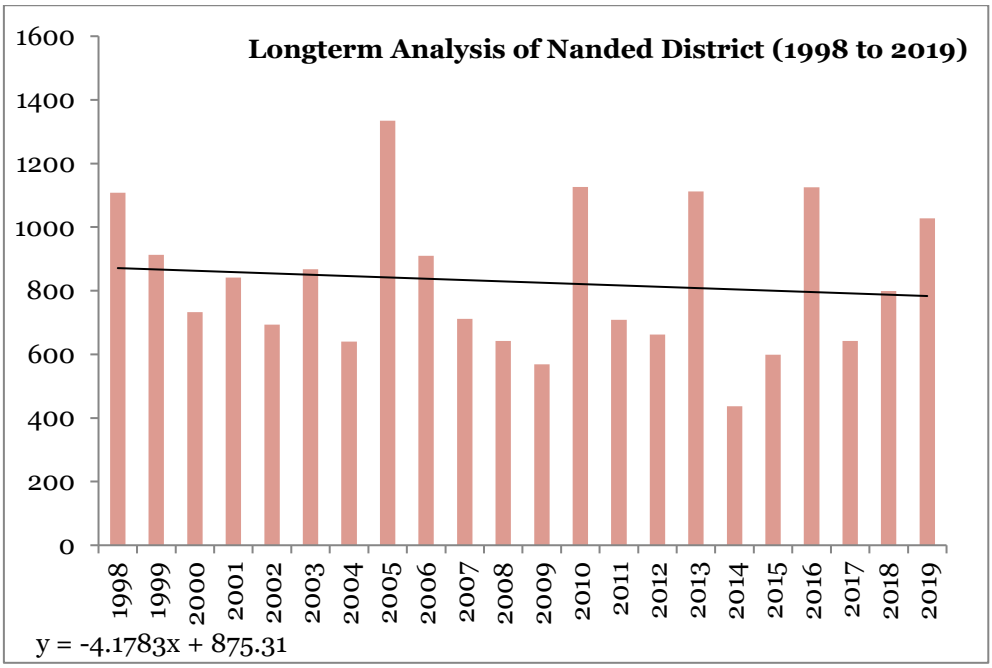


Figure 1.9: Long term Rainfall Analysis (1998-19) of Nanded District.

Table 1.2: Annual rainfall data (2010-2019) (in mm)

Sl No.	Taluka	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Decadal Avg.
1	Ardhapur	1281	657	651	1070.3	391.2	498.3	1141.8	670.3	897.9	1045	830.41
2	Bhokar	1288	440	685	1316.5	473.5	668.2	1310.7	694	989.1	1041	890.58
3	Biloli	743	603	674	905.8	309	487.6	1129.3	617.8	607.9	945.9	702.33
4	Degloor	781	692	643.4	850	300.9	417.6	907.2	460.2	406.3	1030	648.81
5	Dharmabad	989	773	597	926.7	382.9	394.2	957.8	557.7	710.7	1055	734.41
6	Hadgaon	1154	674	685	1247.6	443	655.7	1114.6	643.3	943.5	931.3	849.2
7	Himayatnagar	1315	720	829	1384.2	479.1	773.4	954.5	536.8	984.7	773.8	875.05
8	Kandhar	1213	817	527	855.5	344.8	546	1067.2	614.3	856.8	1231	807.23
9	Kinwat	1335	835	1004	1367.9	635.1	780.7	1115.4	612.6	866.3	961.8	951.38
10	Loha	1031	674	389	871.4	450.9	538.9	1337.6	610	782.5	1193	787.81
11	Mahur	1149	923	886	1589.8	618.8	864.9	1319.6	543.7	1085.3	971	995.11
12	Mudkhed	1374	672	667	1062.6	373.9	654.8	961.2	840.7	1004.5	1231	884.18
13	Mukhed	879	737	745	1073.8	427.6	555.1	1142.7	657.2	557.7	1034	780.9
14	Naigaon	1271	581	506	1299.4	443.7	652.9	1242.1	860.7	899.6	992.1	874.85
15	Nanded	1271	581	506	1299.4	443.7	652.9	1242.1	860.7	899.6	992.1	874.85
16	Umari	1214	846	594	1070.8	482.6	511	984	655.6	820.6	1086	826.42
17	Grand Total	1143	701.5	661.7	1136.9	437.54	603.2	1120.4	652.22	832.06	1032	832.09

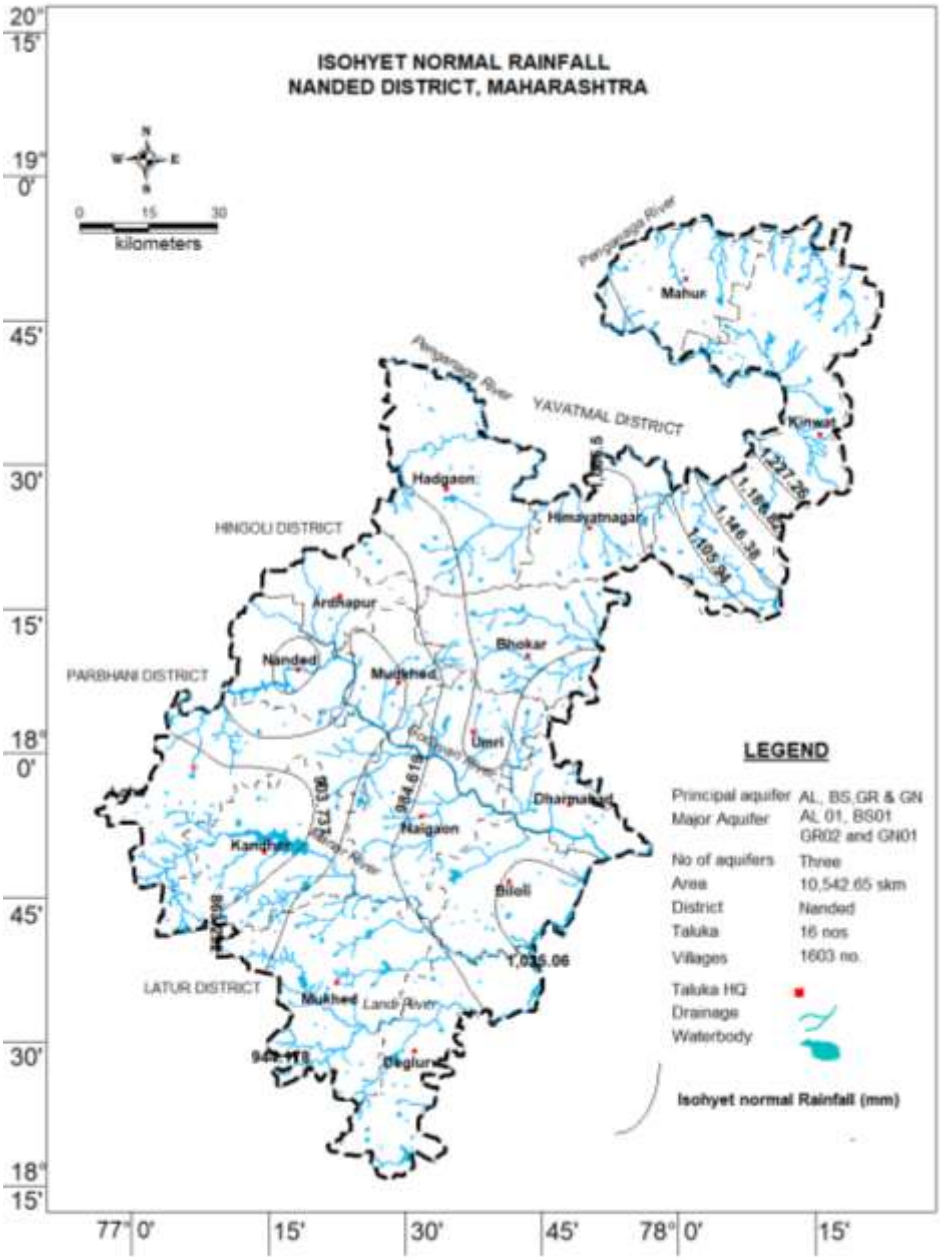


Figure 1.10: Isohyetal Map of the district

Table 1.3: Long Term Rainfall Analysis (1998 to 2019) of Nanded District

PERIOD = 1998 to 2019				No. of years = 22
YEAR	ANNUAL	NORMAL	DEPARTURE	Normal Rainfall = 827.25mm
1998	1107.9	827.25	33.92566	Standard Deviation = 229.7 mm
1999	912.5	827.25	10.30523	COEFFICIENT OF VARIATION = 27.8 %
2000	732.5	827.25	-11.4536	MEAN=827.3
2001	840.9	827.25	1.650045	MEDIAN=766
2002	693.6	827.25	-16.1559	SLOPE= -4.178 mm/Year
2003	867.5	827.25	4.865518	INTERCEPT= 875.31 mm
2004	640.6	827.25	-22.5627	EQUATION OF TREND LINE= y = -4.178x + 875.31

2005	1334.6	827.25	61.32971	CATEGORY	NUMBER OF YEARS	%OF TOTAL YEARS
2006	910.1	827.25	10.01511	DEPARTURES		
2007	711.6	827.25	-13.9801	POSITIVE	9	45
2008	641.7	827.25	-22.4297	NEGATIVE	11	55
2009	569	827.25	-31.2179	DROUGHTS		
2010	1125.8	827.25	36.08945	MODERATE	3	15
2011	708.1	827.25	-14.4031	SEVERE	0	0
2012	662.7	827.25	-19.8912	ACUTE	0	0
2013	1111.9	827.25	34.40919	NORMAL & EXCESS R/F		
2014	436.5	827.25	-47.2348	NORMAL	14	70
2015	599	827.25	-27.5914	EXCESS	3	15
2016	1124.8	827.25	35.96857	*NB: RAINFALL: EXCESS: > +25; NORMAL: +25 TO -24 DEOUGHT: MODERATE: -25 TO -49; SEVERE: -50 TO -75; ACUTE: < -76*		
2017	641.8	827.25	-22.4176			
2018	799.5	827.25	-3.35449			
2019	1027.1	827.25	24.15836			

1.4 Geology

The basic geologic succession of the rocks occurring in Nanded District is as follows:

Table 1.4: Geological succession of Nanded district

Geological Period	Stratigraphic Units	Rock Units
Recent to Sub-recent (Holocene)	Alluvium	Caly, silt, sand, gravel
Eocene to upper Cretaceous	Deccan Traps	Basalt: Hard, Massive, Vesicular and Amygdaloidal with inter-trappeans
Pre-Cambrians (Inter-trappeans)	Vindhyans	Sandstone and Limestone
Archean	Archean Complex	Peninsular granite-gneiss complex, intrusive pink and grey granites, dolerites and quartz veins. Banded Hematite-Quartzites of Dharwar system.

Archaeans: Numerous small bands of banded Hematite-Quartzite and Epidiorites enclosed in the granites represent the rocks of Dharwar system. They are resistant to weathering and form small hillocks rising from 15 to 30 m above the ground level. Extensive out crops of granite are found in the south- eastern parts of the district along the border of Andhra Pradesh. Smaller outcrops are noticed in the north- east side near Kinwat. The gneisses are found as lenses within the granite. Amphibolite and Dolerite dykes, Pegmatite and Quartz vein of small dimension are seen in the granitic area of the district. There are two types of granites, the grey and the pink, with association of Pegmatite. The colour of the granite depends upon the

colour of the feldspar in it. With the increase or decrease of the pink or grey feldspar the granite also shows various gradations in colour. These granites vary in texture from fine to medium grained and even porphyritic.

Pre- Cambrians: - Limestones of Vindhyan Super-group are exposed in the nala near Pardi village in Kinwat tahsils. Out crops are few and scattered. At places about 20 Km West of Kinwat beds of thin nodular limestone and grey sandstone occur below the Deccan Traps.

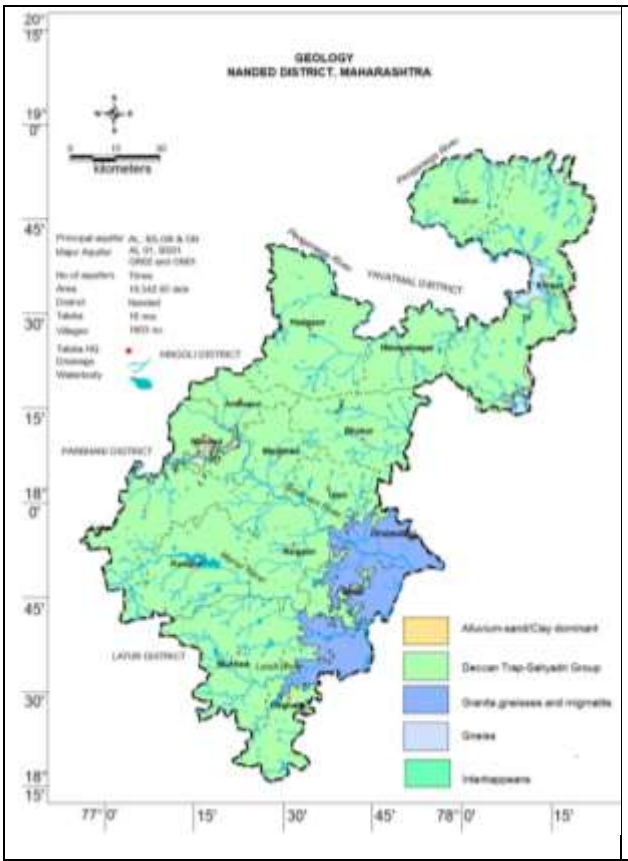


Figure 1.11: Geology of Nanded District

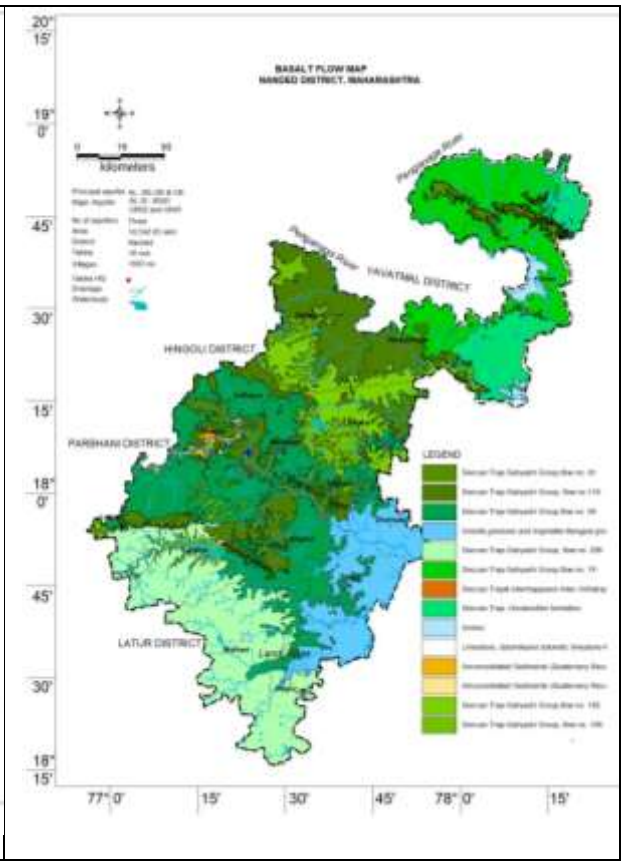


Figure 1.52: Basaltic flow of Nanded District

Eocene to Upper Cretaceous: - Deccan traps occupy more than two-thirds of the district and overlay the granites. The traps are quite massive, fine-grained bluish grey to brown in colour. Only Labradorite feldspar is visible to the naked eye. Its contact with granite in the south -west varies in elevations of 350-m amsl near Betamogra to 396-m amsl near Sagruli. Both “aa” and “Pahoehoe” types of basalts are seen. The Pahoehoe type, which is dominant, is characterised by predominant vesicular basalt with very thin massive portions. The vesicles are highly irregular. The pipe amygdales and the ropy structure mark the basal portions of these flows. The amygdales are filled with chlorite, Calcite, Zeolites, and devitrified glass. The” aa” flow is characterised by lower thick massive basalt showing columnar jointing and spheroidal weathering and upper vesicular portions showing brecciation. In one section near Kinwat, out of seventeen basalt flows twelve are pahoehoe and others are” aa” type. The average thickness of each flow is 20 m. During the quiescence period of flow eruptions, terrestrial lakes came into existence. In these were

deposited sandstones and cherty limestone beds, which have fossils of gastropods, lamellibranchs and leaf impressions. These beds are known as Intertrappean beds. Such sedimentary beds of 1 to 1.5 mt. in thickness are seen between different basaltic flows near Kinwat, Matul, Ravangaon, Pimpaldhau, and Jhari. Some of the samples picked contained 80 to 92 % $CaCo_3$. The clay beds are either interbedded in limestones, shales and cherts or occur as lenses in the trap without them. The clays are indurated and often pass into Flagstone or into compact cherty limestone. The clay beds vary in thickness and laterally form small lenses to extensive beds. They show sharp contact with the overlying traps. These clays are green, dirty grey, red and variegated in colours; they are non-plastic, gritty & greasy and calcareous to siliceous in nature.

Recent to Sub-Recent: - The transported recent deposits are confined to the valleys formed by rivers and their major tributaries viz.; Godavari, Penganga, Manjara, Asna, Lendi, Mannar, Siddha etc. The depth of alluvium ranges between 12 to 30 mts. It consists of round to sub-rounded gravels of basalts, chert, chalcedony, silt, sand and Kankar. The residual deposits depend upon the nature of the parent rock, climatic conditions, and configuration of the country rock from which it is derived. There are two main types of Soil, the black cotton soil or 'regur' and sandy loams. The sandy alluvium is locally referred as "Yesgi –Sagroli" alluvium which is highly productive for construction of shallow tube wells. However, Godavari alluvium which is mostly clayey is not productive for ground water potential.

2. HYDROGEOLOGY

2.1 Major Aquifer System

Aquifer System in the study area is governed by underlying geological formations, recharge conditions and level of ground water exploitation. Based on the existing data and the data collected from State Ground Water Department (GSDA), the hydrogeological map of the district is depicted **Figure 2.1.**

Occurrence of Water

Ground water exists in coarse granular strata occurring below water table in alluvium and in fractures, joints, sheared and weathered zones in granites, gneisses and massive basalts. In vesicular basalt it occurs in vesicles in addition to fractures, joints and weathered zones. The Ground Water in the district occurs under unconfined, semi-confined and confined conditions.

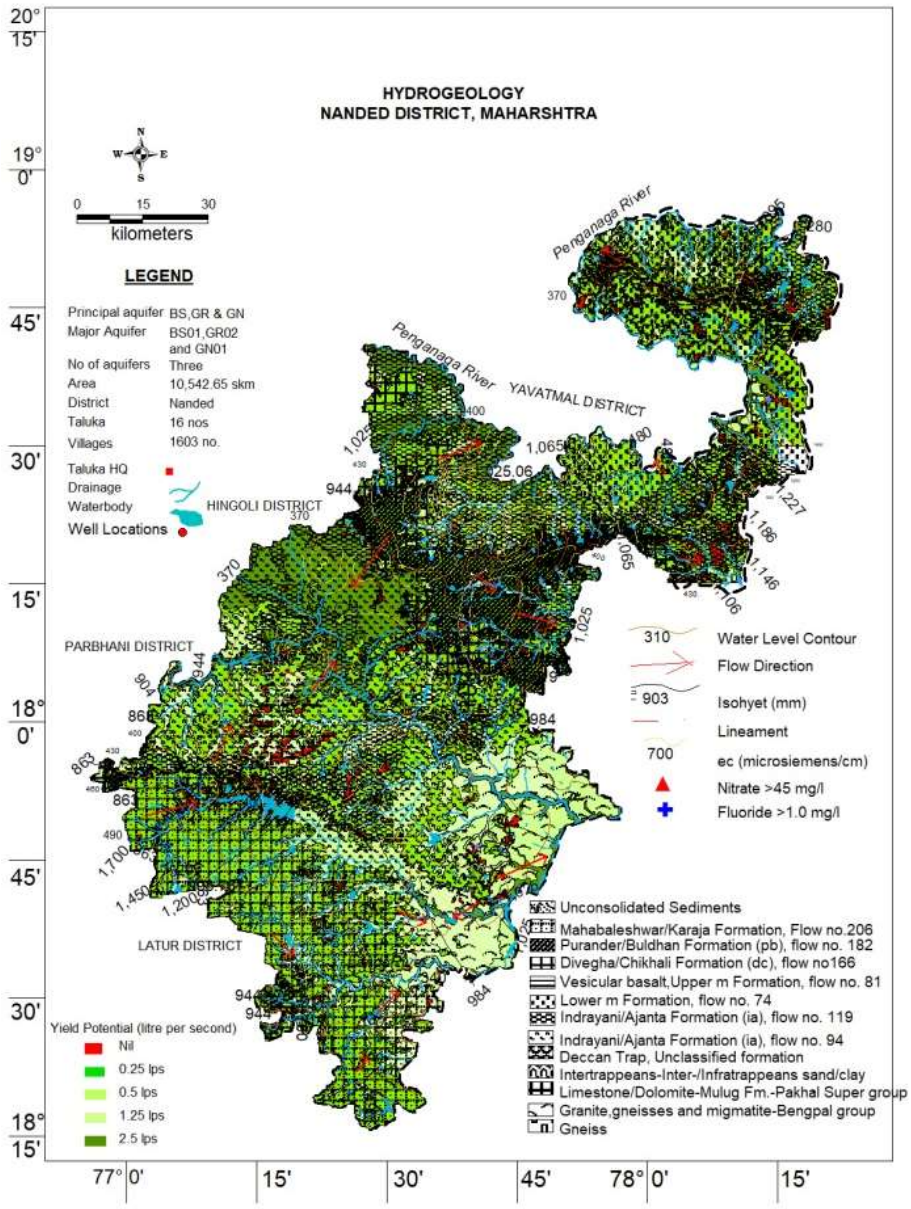


Figure 2.1: Hydrogeology of Nanded

2.2Aquifer Parameters

The major aquifer systems of Nanded district are: River Alluvium (Aquifer I), Basalt (Aquifer I & II), Gneiss (Aquifer I), Granite (Aquifer-I & II). The basic characteristic of the major aquifer of the district is given **Table 2.1** and is depicted in **Figures 2.3 to 2.6**.

Table 2.1: Basic Aquifer Characteristics of the major aquifers of the district.

Major Aquifers	**Alluvium**		**Basalt (Deccan Traps)**		**Gneiss**		**Granite**	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semi-confined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to Bottom of Aquifer (mbgl)	10-35	Nil	8-35	28-188	10-14	Nil	8-16	28-108
Weathered/ Fractured rocks thickness (m)	8-26	Nil	5-26	2-24	8-10	Nil	7-13	2-15
Yield Potential	100-200 cu.m/ day	Nil	0 to 100 cu.m/day	0 to 2.5 lps	10-50 cu.m/ day	Nil	0 to 100 cu.m/ day	0.25 to 2.5 lps
Specific Yield (Sy)/ Storativity (S)	0.02	Nil	0.02	0.00029-0.01	0.02	Nil	0.02	0.00022-0.00074
Transmissivity (T) (m^2 /day)	-	-	-	5.83 to 326.26	-	-	-	44-518.48

2.33D and 2D Aquifer Disposition

Based on the existing data and data generated, 3 D aquifer disposition **(Figure 2.2)** and several Hydrogeological cross sections has been prepared along the section lines as shown in **Figure 2.7 t**o understand the sub surface disposition of aquifer system. **Figure 2.8** depicts the 3D Bar Diagram and the cross sections A-A' TO D-D' is shown in **Figure 2.9 to 2.12.**

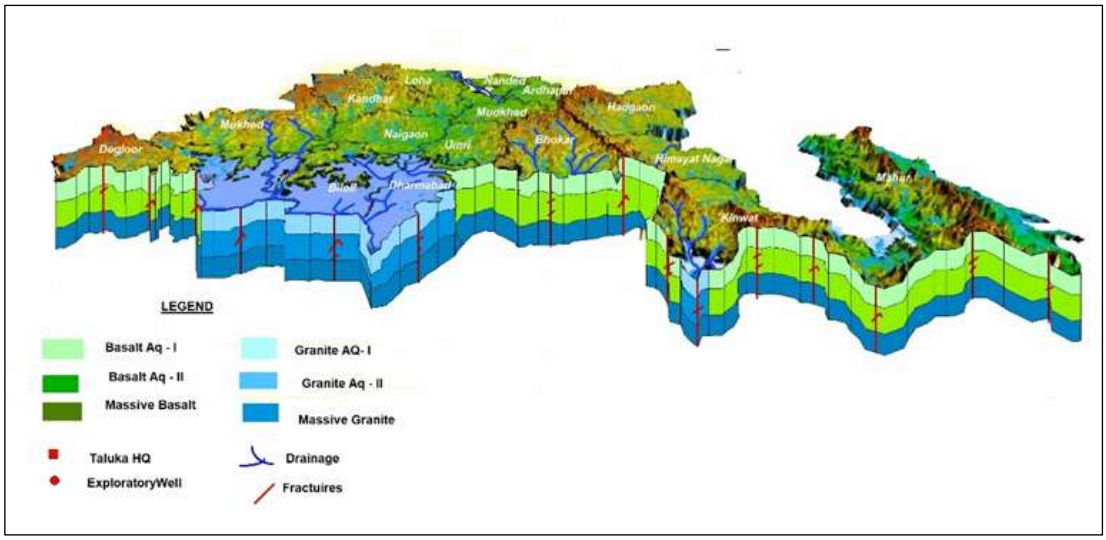


Figure 2 2: 3D Diagram Aquifer Disposition

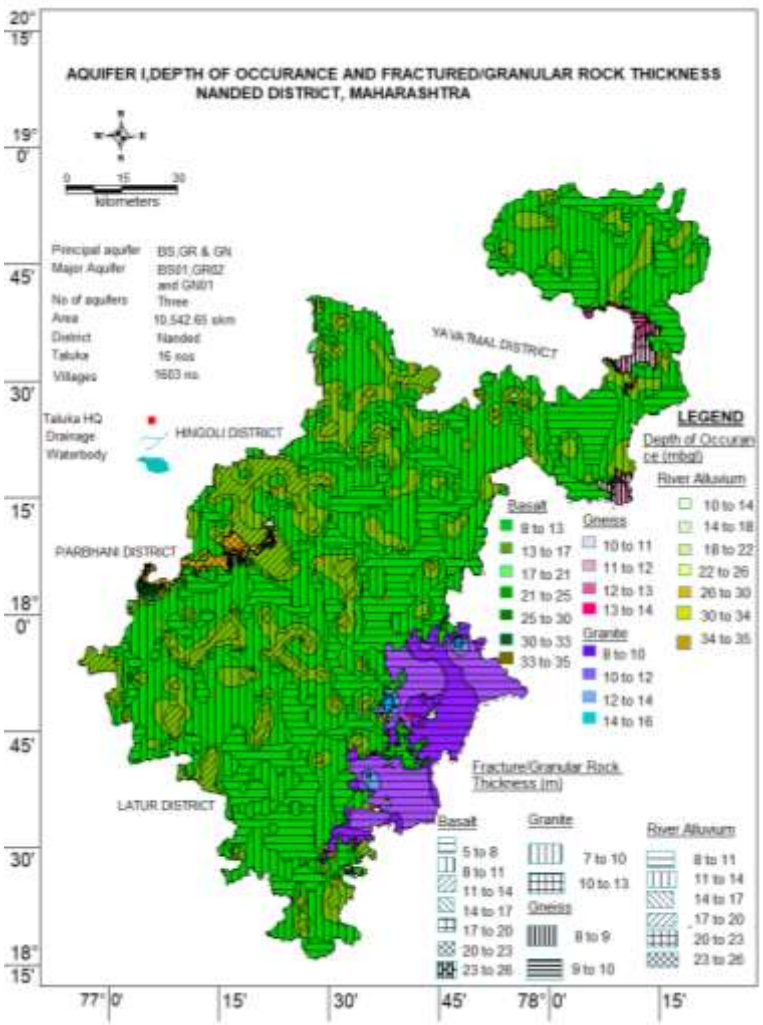


Figure 2.3: Aquifer-I, Depth of Occurrence and thickness

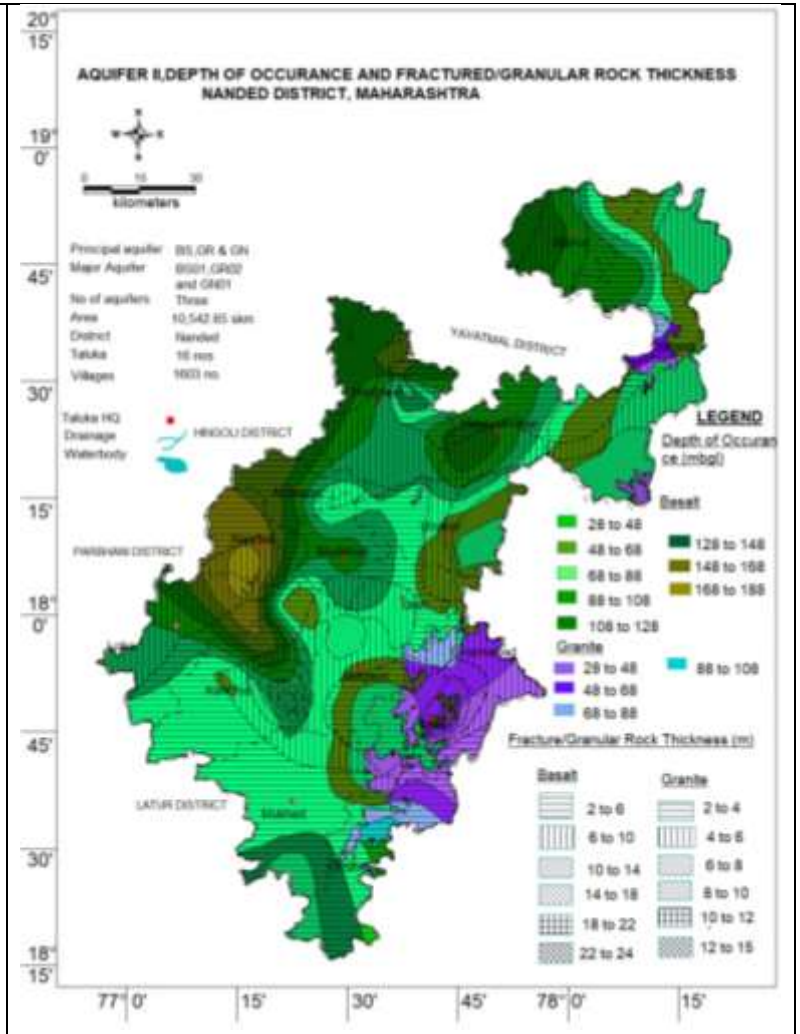


Figure 2.4: Aquifer-II, Depth of Occurrence and thickness

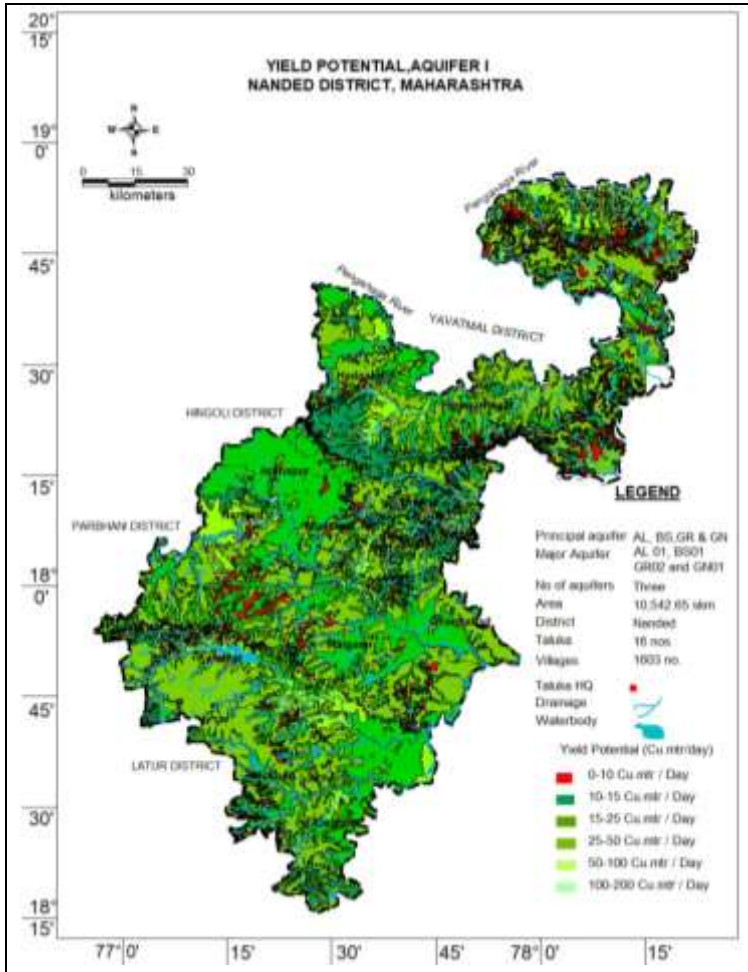


Figure 2.5: Aquifer-I, Yield Potential

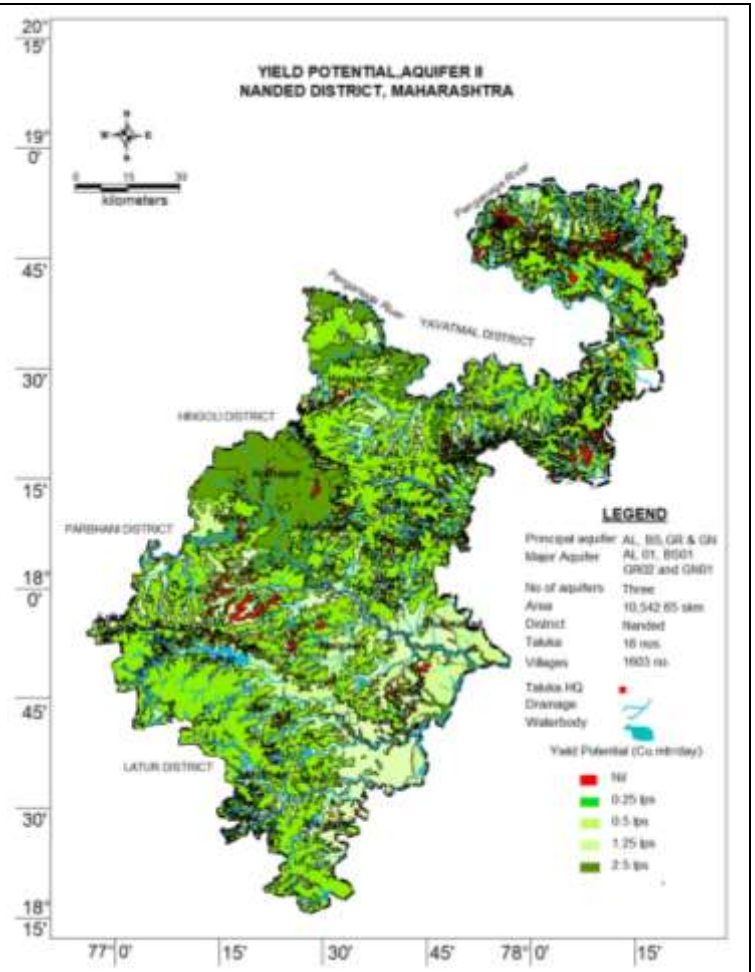


Figure 2.6: Aquifer-II, Yield Potential

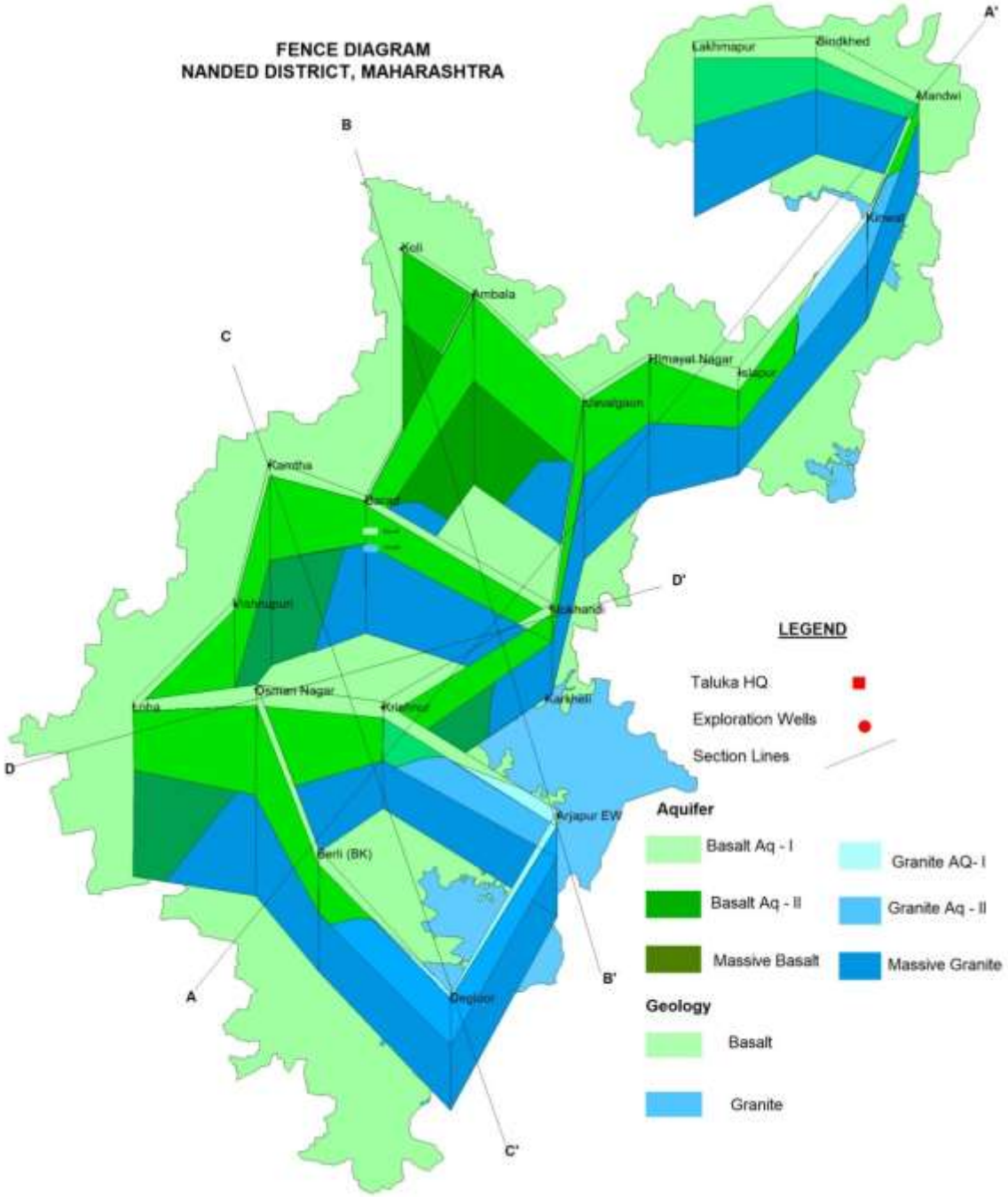


Figure 2.7: 3D Fence Diagram

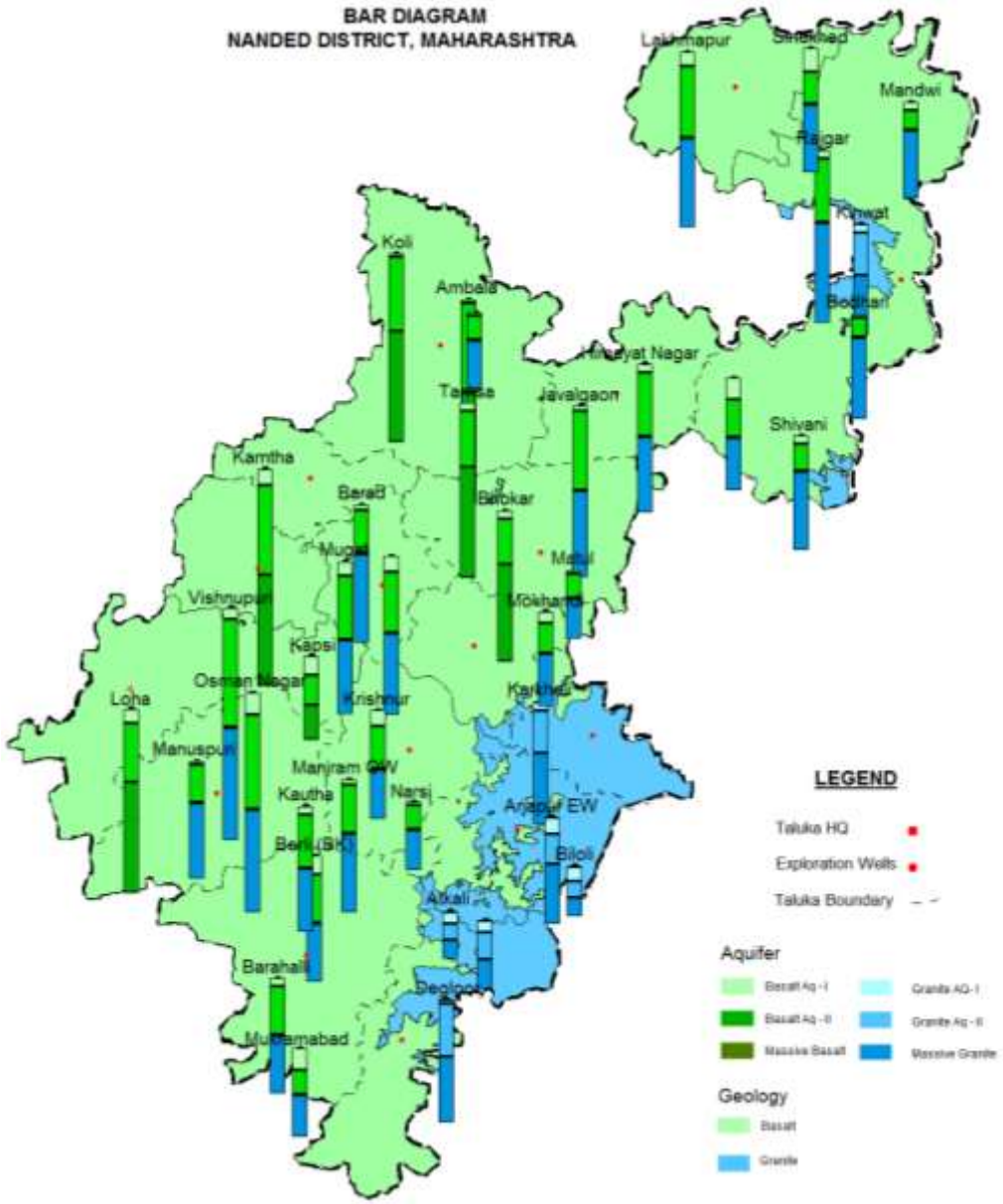


Figure 2.8: 3D Bar Diagram

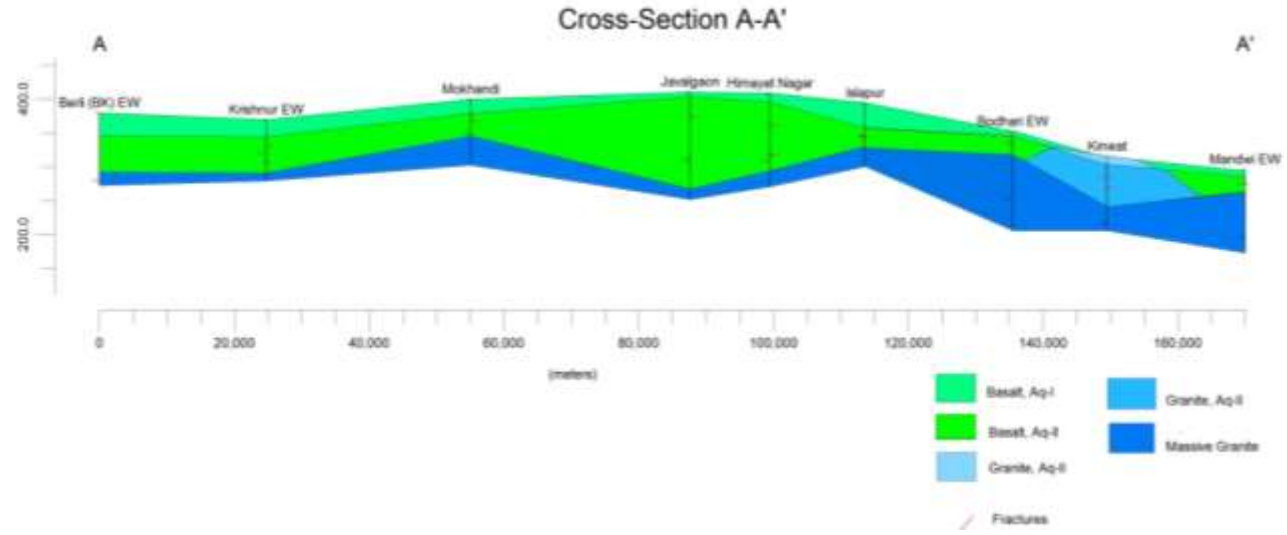


Figure 2.9 : Hydro-geological Cross Section A-A'

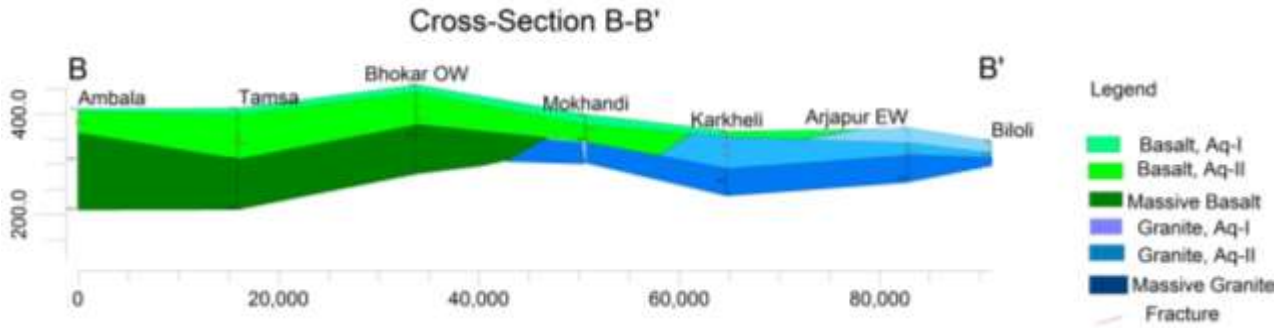


Figure 2.10 : Hydro-geological Cross Section B-B'

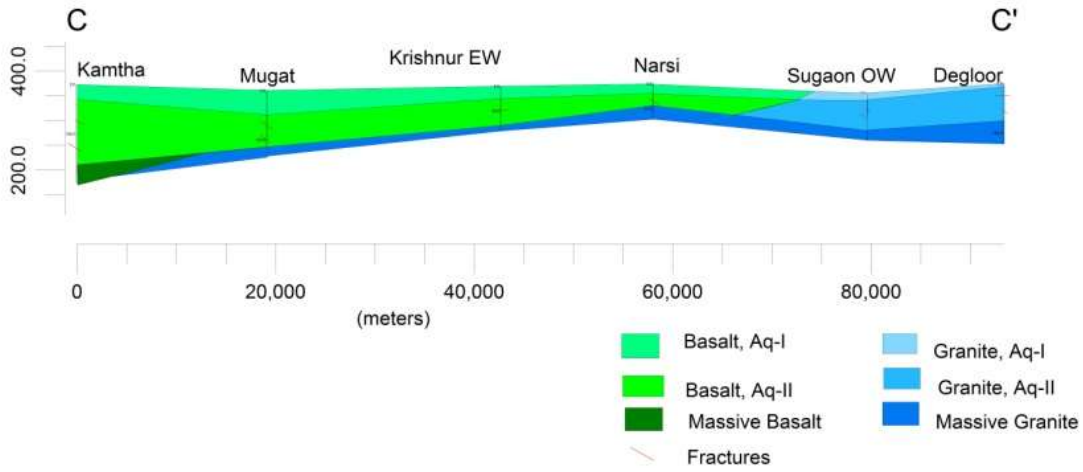


Figure 2.11 : Hydro-geological Cross Section C-C'

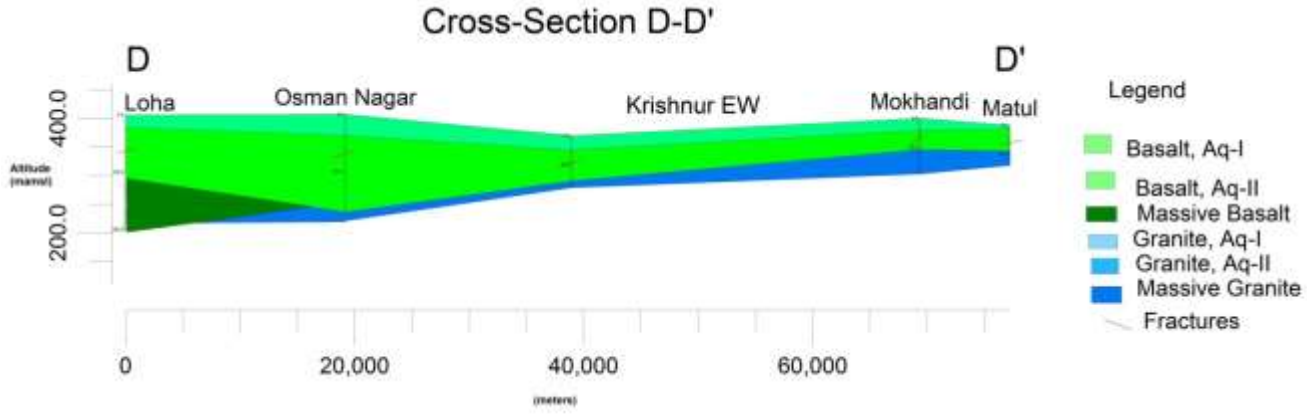


Figure 2.12 : Hydro-geological Cross Section D-D'

3. Water Level Scenario

Central Ground Water Board periodically monitors 59 Dugwells and 02 Borewells as Ground Water Monitoring Wells (GWMW) in the district, four times a year i.e., in January, May (Premonsoon), August and November (Postmonsoon). In addition, Ground Water Monitoring well data from Ground Water Survey and Development Agency (GSDA) was utilized in the preparation of Water level maps in the NAQUIM undertaken areas.

3.1 Depth to Water Level (Phreatic Aquifer/Aquifer I)

The Pre-monsoon depth to water level of unconfined aquifer **(Figure 3.1)** ranges from 1.55 mbgl (Umri-Gortha, Umari taluka) to 31.7 mbgl (Nanded, Nanded taluka) as given in **Annexure-III**. The major parts of the district covering 5969 Sq Km area has water level in the range of 5 mbgl to 10 mbgl. The depth to water level less than 5 mbgl is obserbed in only 352.8 Sq Km area in isolated patches in Loha, Kandhar, Dharmabad, Umari, Himayatnagar, Hadgaon, Ardhapur, Kinwat and Mukhed blocks. The deepest water level of more than 20 mbgl is observed in small patches in Nanded and Mudkhed blocks in 48 Sq Km areas. The deeper depth to water level may be due to exploitation of ground water for irrigation during Rabi season.

The post-monsoon depth to water level of unconfined aquifer **(Figure 3.2)** ranges from 0.01 mbgl (Kuncheli, Biloli block) to 13.8 mbgl (Taroda, Nanded block) as shown in **Annexure-III**. The depth to water level between 2 mbgl and 5 mbgl is observed in major parts of the district covering 6477 Sq Km area. The shallow depth to water level less than 2 mbgl is observed in 544.7 Sq Km area in isolated patches in all the blocks. The depth to water level of more than 5 mbgl is observed in 3226 Sq Km area is observed in small parts in all the blocks.

3.1.1 Depth to Water Level (Semiconfined/Confined Aquifer-Aquifer II)

The Pre-monsoon depth to water level of semiconfined/confined aquifer **(Figure 3.3)** ranges from 2.07 mbgl (Shivani, Kinwat block) to 30.35 mbgl (islapur, Kinwat block) as given in **Annexure II**. The depth to water level between 2 mbgl and 5 mbgl is observed in 190.52 sq km area in part of Kinwat block. The major parts of the district covering 4970 Sq Km area has depth to water level between 5 mbgl and 10mbgl.The depth to water level between 10 mbgl and 20 mbgl is observed in 3330 Sq Km area in parts of Mukhed, Delur, Dharmabad, Umri, Bhokar, Himayatnagar,

Hadgaon and Kinwat blocks. The deeper depths to water level between 20 mbgl and 30 mbgl is observed in 1138 Sq Km area in parts of Mukhed, Deglur, Himayatnagar and Kinwat blocks whereas depths to water level more than 30 mbgl is observed 650 Sq Km area in Mahur and Kinwat blocks.

The post-monsoon depth to water level in Semiconfined/Confined aquifers **(Figure 3.4)** ranges from1.48 mbgl (Koli, Hadgaon block) to 39.2 mbgl (Talegaon, Bhokar block) **(Annexure II)**. The depth to water level between 0 mbgl and 5 mbgl is observed in 428 Sq Km area in major parts of the district. The depths to water level between 5 mbgl and 10 mbgl are observed in 3682 Sq Km area in parts of Ardhapur, Hadgaon, Mudkhed, Bhokar, Umri, Dharmabad, Mahur, Kinwat, Biloli, Degloor, Naigaon, Kandhar and Loha blocks. The deeper depths to water level between 10 mbgl and 20 mbgl is observed in small parts in all the blocks except Dharmabad block. The deeper depths to water level between 20 mbgl and 30 mbgl are observed in 1611 sq km area in Kandhar, Mukhed, Naigaon, Himayatnagar Kinwat, Mahur and Hadgaon blocks whereas the depths between 30 mbgl and 40 mbgl is observed in Kandhar, Mukhed, Hadgaon and Kinwat blocks.

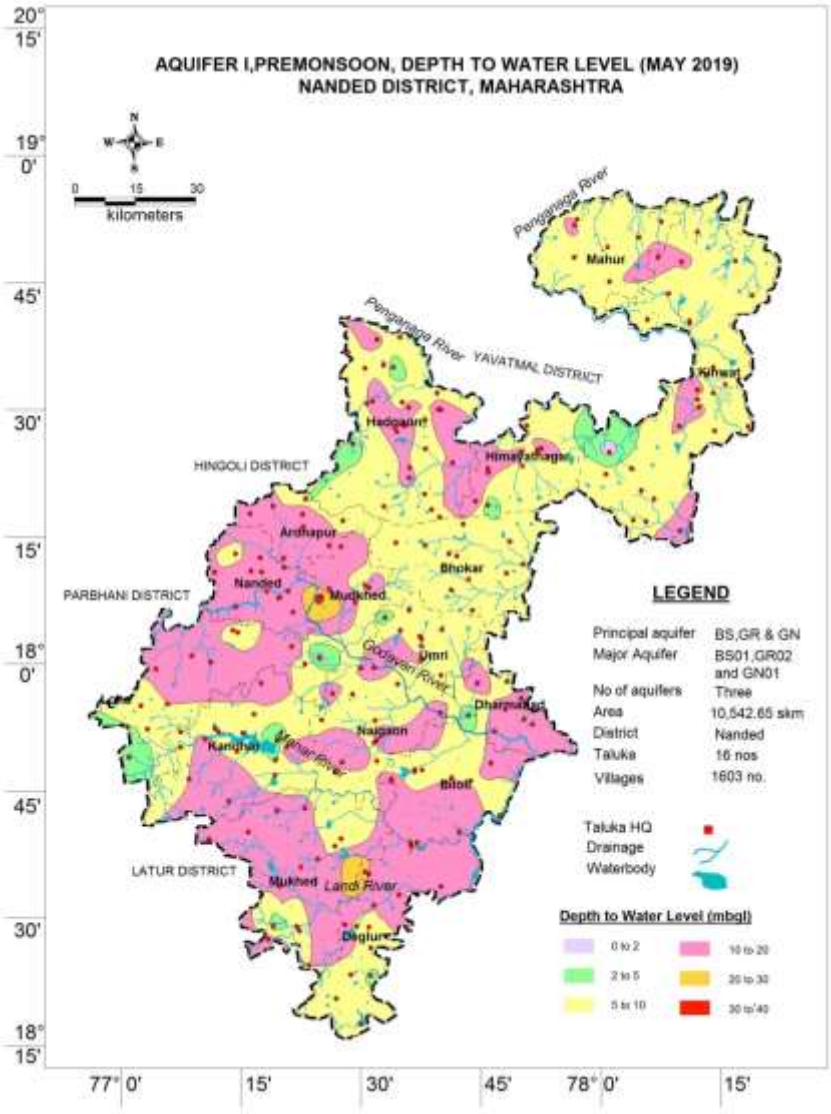


Figure 3.1 : Aquifer I, Pre-monsoon DTWL (May 2019)

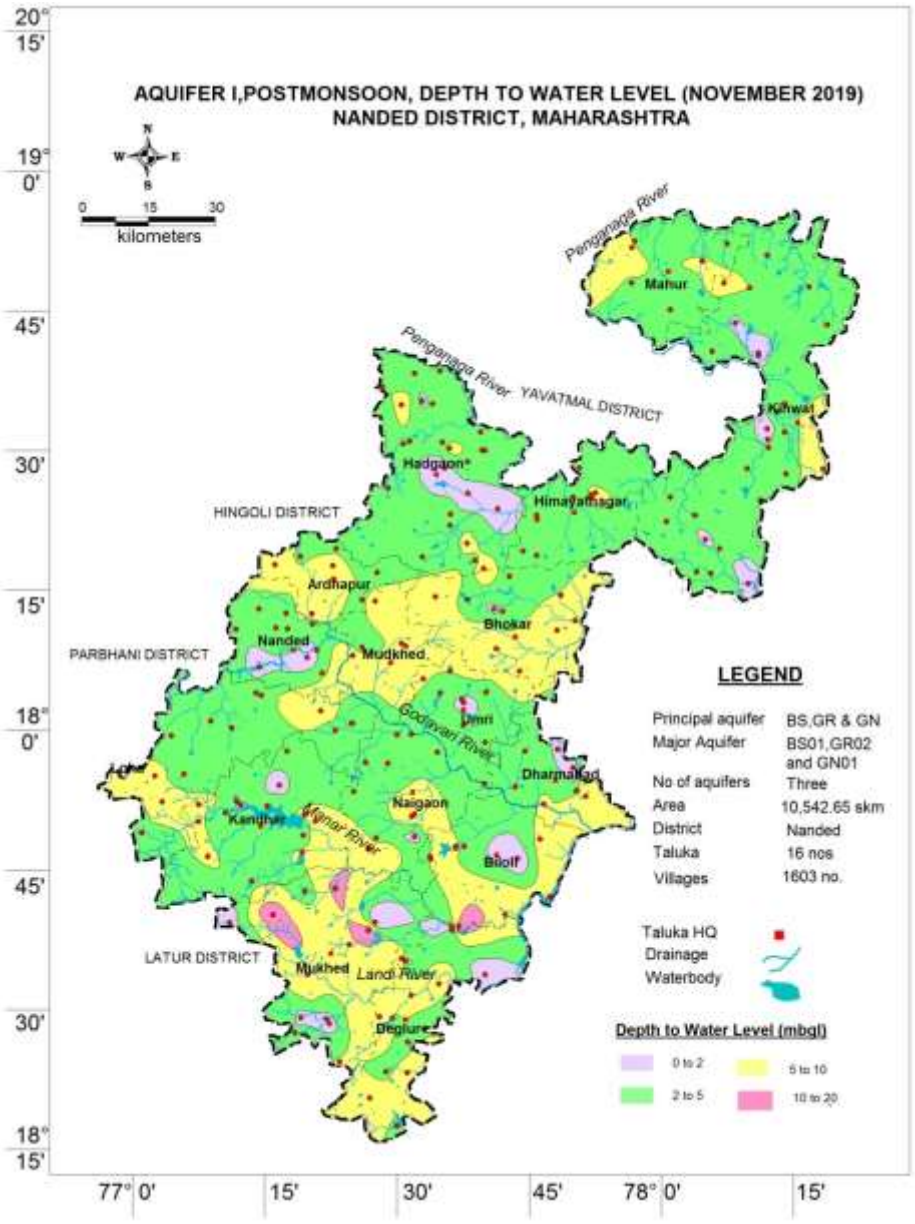


Figure 3.2 : Aquifer I, Post-monsoon DTWL (Nov. 2019)

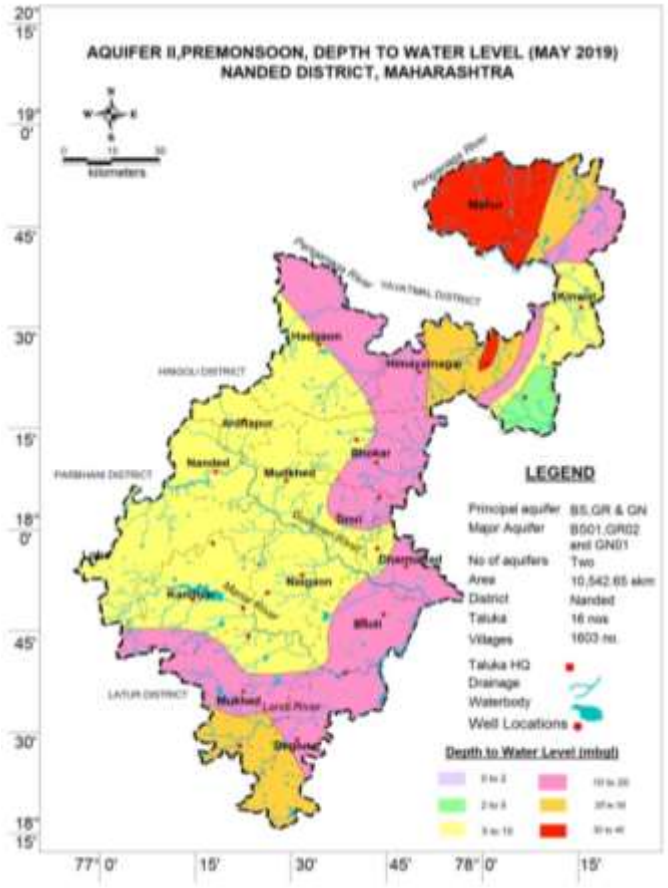


Figure 3.3: Aquifer II: Pre-monsoon Depth to Water Level (May 2019)

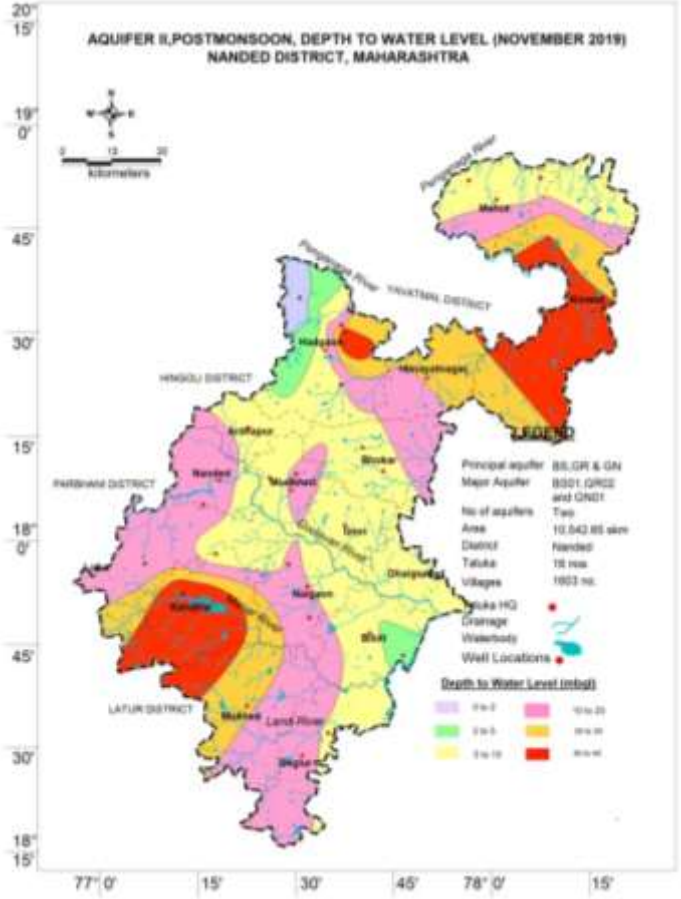


Figure 3.4: Aquifer II: Post-monsoon Depth to Water Level (Nov. 2019)

3.2 Water Level Trend (2010-19)

The Premonsoon decadal water level trend (2010-19) indicates a falling trend @ 0 to 2.38 m/year covering 6699.24 Sq Km areas **(Annexure VI)**. The rising trend is observed in only about 3593 Sq Km area @ 0.0 to 0.57 m/year. The falling trend @ 0.0 m/year to 0.2 m/year is observed in 2368 SqKm areas in small parts in all the blocks of the district; the fall @ 0.2 to 0.4 m/year is observed in 1467.23 sq km area in all blocks in small proportion. The falling trend @ 0.4 to 0.6 m/yr is observed in all blocks except Loha and Kandhar blocks covering 1637.39 Sq Km area **(Figure 3.5**). In Biloli, Nanded, Mudkhed, Mahur, Hadgaon and Himayatnagar blocks, falling trend more than 0.6 m/year is observed covering 1226.6 Sq Km. The rising trend @ 0 to 0.2 m/year is observed in 2188.3 sq km area in all blocks of the district except in Mahur block. The rise in trend @ 0.2 to 0.4 m/year is observed in 951.82 sq km area in Mukhed, Kandhar, Degloor, Biloli, Naigaon, Hadgaon, Bhokar and Kinwat blocks. The rise @ 0.4 to 0.6 m/year is observed in 452.9 sq km area in Deglur, Mukhed and Kinwat blocks of the district.

The Postmonsoon decadal water level trend (2010-19) indicates a falling trend @ 0.0 to 0.8 m/year covering 5106.8 Sq Km areas **(Annexure VI)**. The rising trend is observed in about 5175 Sq Km area @ 0.0 to >0.6 m/year. The falling trend @ 0.0 m/year to 0.2 m/year is observed in 2649.6 Sq Km area mostly in all the blocks of the district. The fall @ 0.2 to 0.4 m/year is observed in 1709.14 Sq Km area and fall @ 0.4 to 0.6 m/year covering 534.05 sq km area are observed as isolated patches in Mukhed, Dharmabad, Nanded, Ardhapur, Bhokar, Hadgaon, Himayatnagar, Mahur and Kinwat blocks. The fall between 0.6 m/year and 0.8 m/year is observed in only 213.8 Sq km area in Nanded, Ardhapur, Mahur, Kinwat, Hadgaon and Himayatnagar blocks of the district. The riding trend @0 to 0.2 m/year is observed in 1568.5 sq km area in small patches in all the blocks whereas trend @ 0.2 to 0.4 m/year is observed in 1311.83 sq km area in Deglur, Mukhed, Loha, Naigaon, Kandhar, Umri, Himayatnagar, Kinwat and Mahur blocks. The rise in trend @ 0.4 to 0.6 m/year is observed in 851.85 sq km area in Deglur, Mukhed, Loha, Naigaon, Kandhar, Umri, Himayatnagar, Kinwat and Mahur blocks. The rise more than 0.6 m/year is observed in 1443.15 sq km area in Deglur, Biloli, Kandhar, Naigaon, Loha,Bhokar and Himyatnagar blocks. **(Figure 3.6).**

3.3 Hydrographs

The hydrographs (time series) of selected locations indicating water level over the years (2010 to 2019) is depicted in **Figure 3.7 (a) to 3.7 (j)**. The hydrograph indicates a rise in water level trend in most parts of the block.

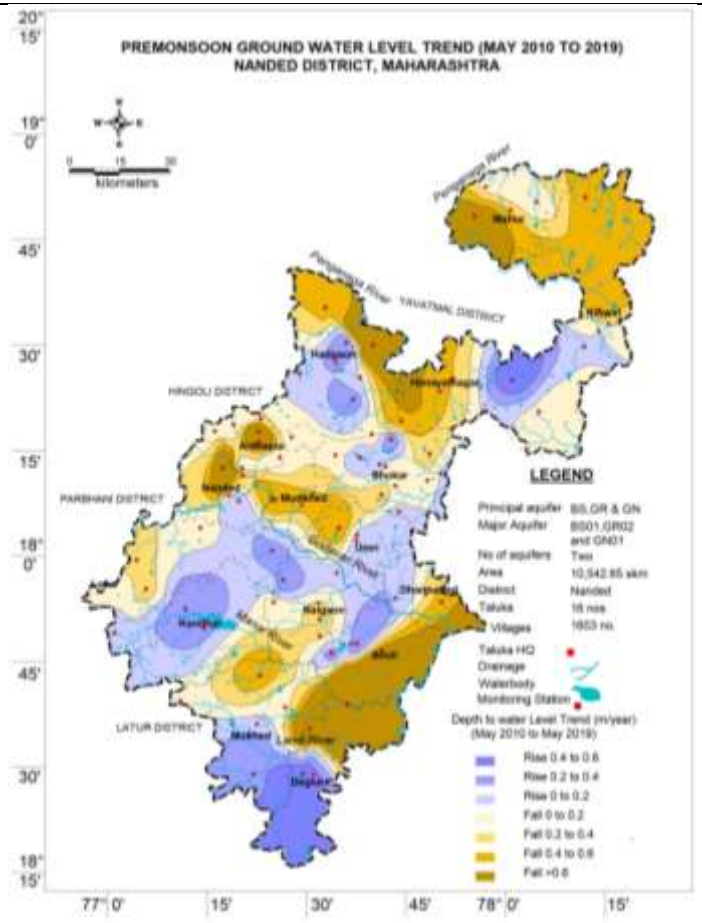


Figure 3.4: Premonsoon Water Level Trend (2010-2019)

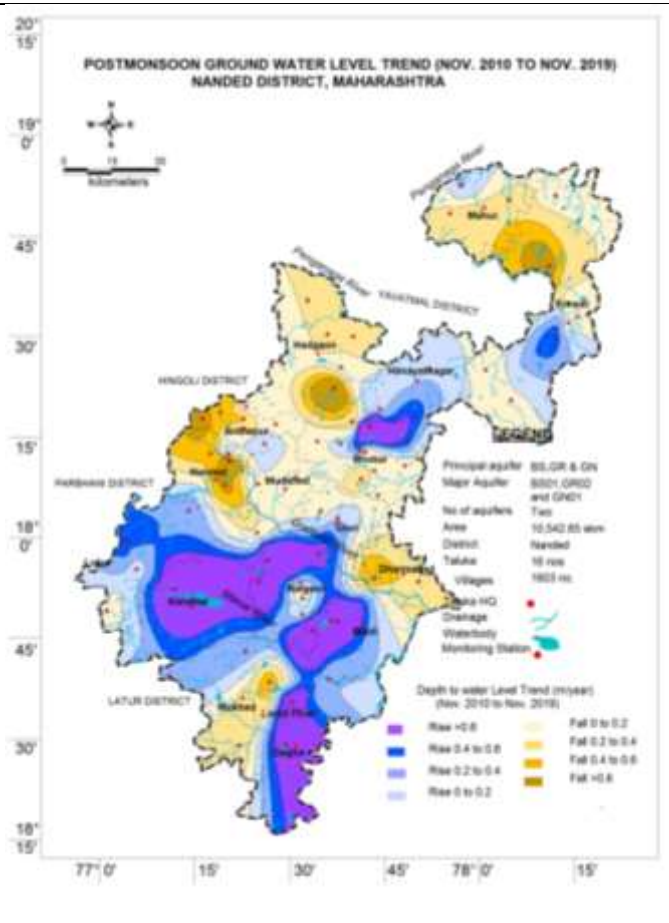
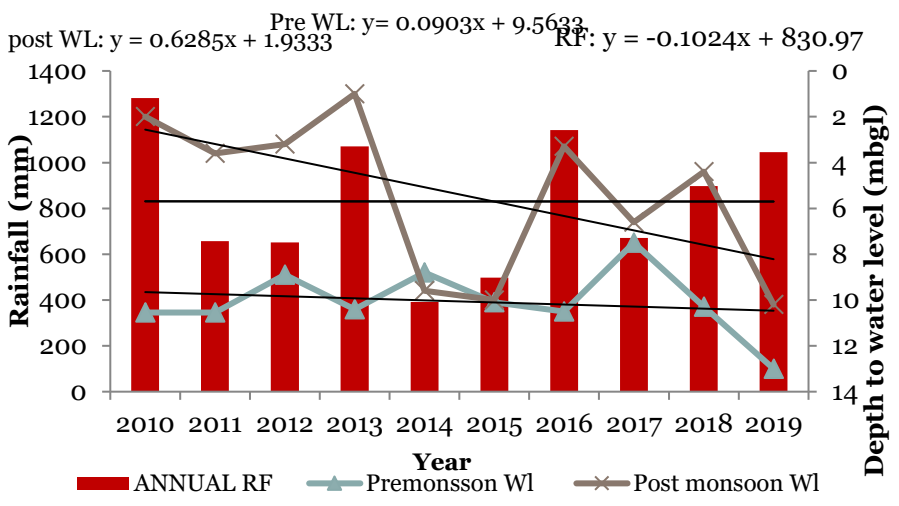
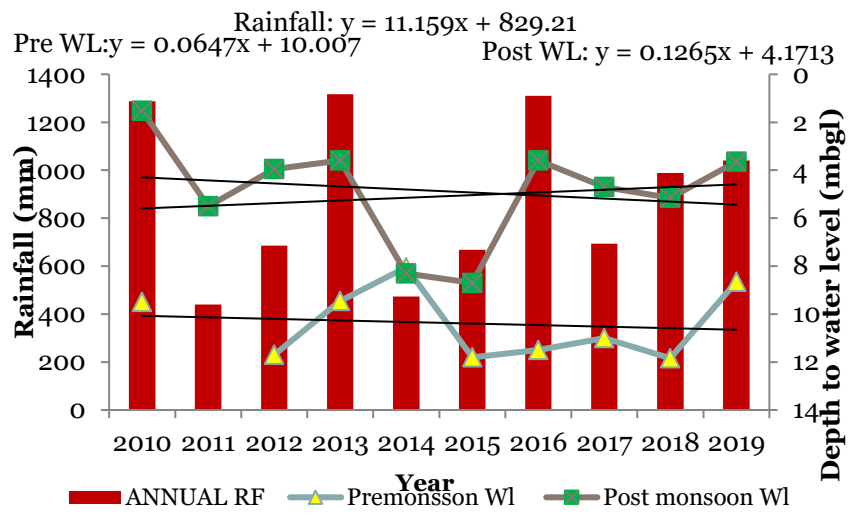


Figure 3.6: Postmonsoon Water Level Trend (2010-2019)



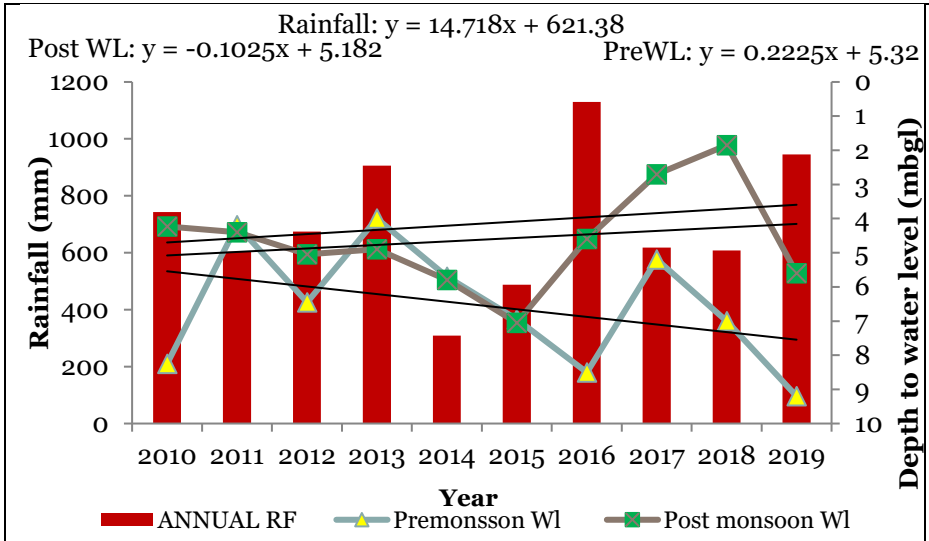
A rising trend during premonsoon@ 1.08 m/year and a falling trend during postmonsoon @7.53 m/year respectively.

Figure 3.5: Hydrograph of Malegaon, Ardhapur Block, Nanded District



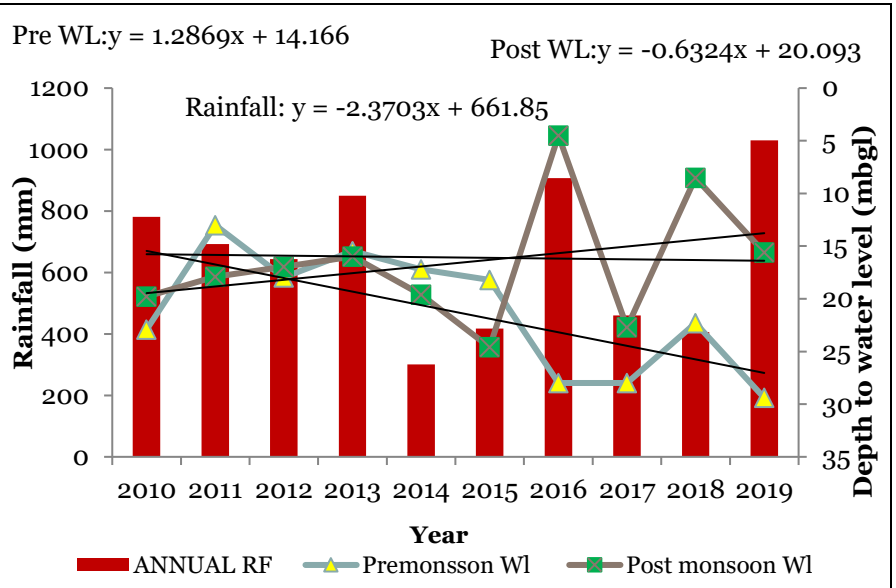
A rising trend during both pre-monsoon and postmonsoon @ 0.0647 m/year and 0.1265 m/year respectively

Figure 3.6: Hydrograph of Nagapur, Bhokar block, Nanded District



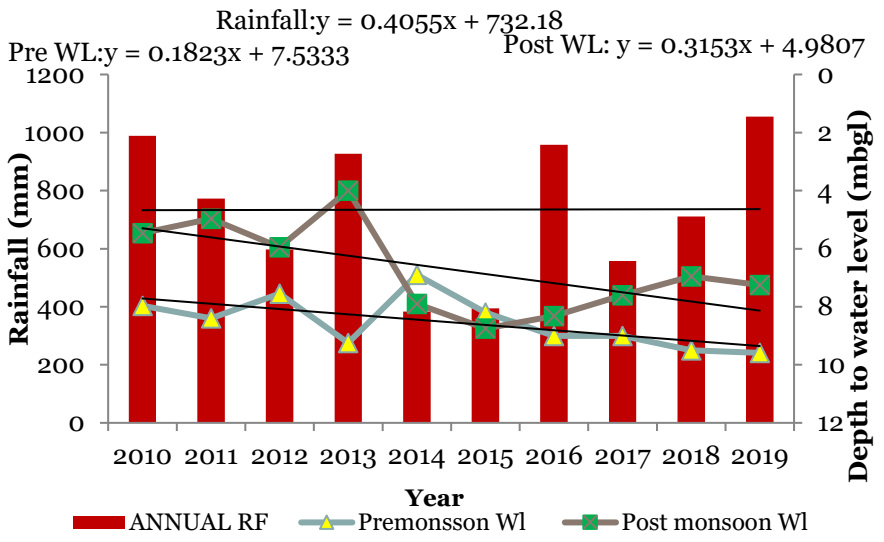
A rising trend @ 0.2225 m/year during premonsoon and a fallling trend @ 0.1025 m/year during postmonsoon.

Figure 3.7: Hydrograph of Nagapur, Biloli Block, Nanded District



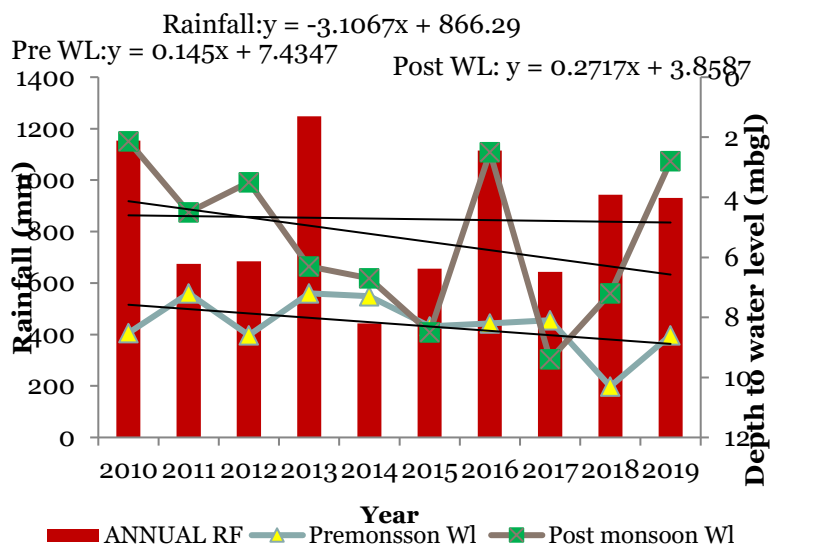
A rising trend during premonsoon @ 1.28 m/year and falling trend during postmonsoon @ 0.632 m/year

Figure 3.8: Hydrograph of Atkali_PZ, Degloor Block, Nanded District



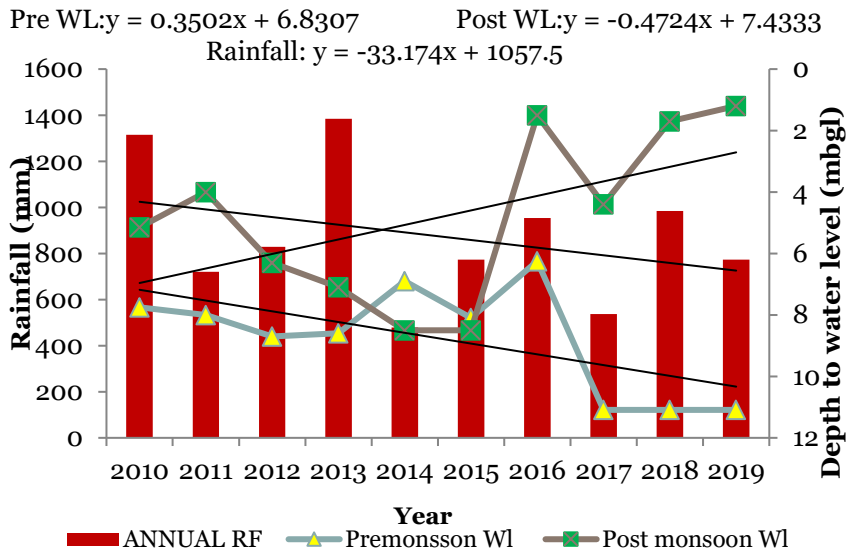
A rising trend during both premonsoon and postmonsoon @ 0.182 m/year and 0.315 m/year respectively.

Figure 3.9: Hydrograph of Dharmabad, Dharmabad block, Nanded District



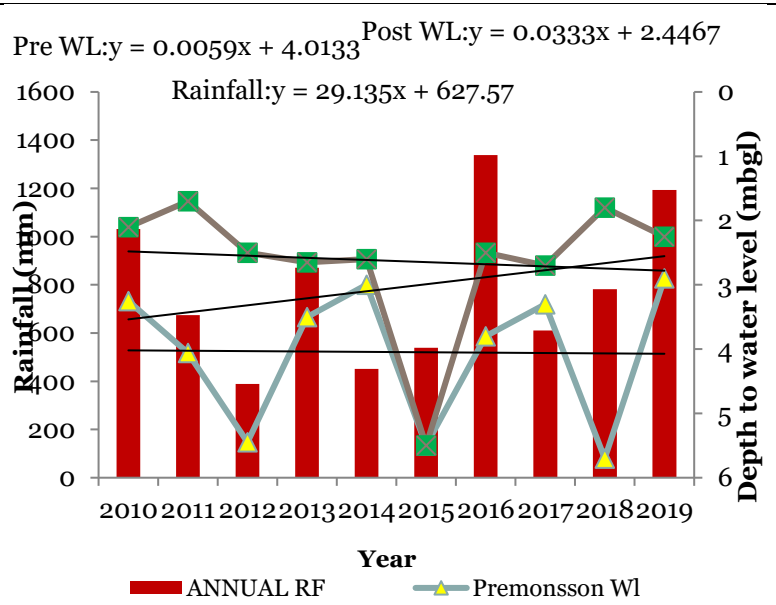
A rising trend during both premonsoon and postmonsoon @ 0.145 m/year and 0.271 m/year respectively.

Figure 3.10: Hydrograph of Dhawari Buzurg, Hadgaon Block, Nanded District



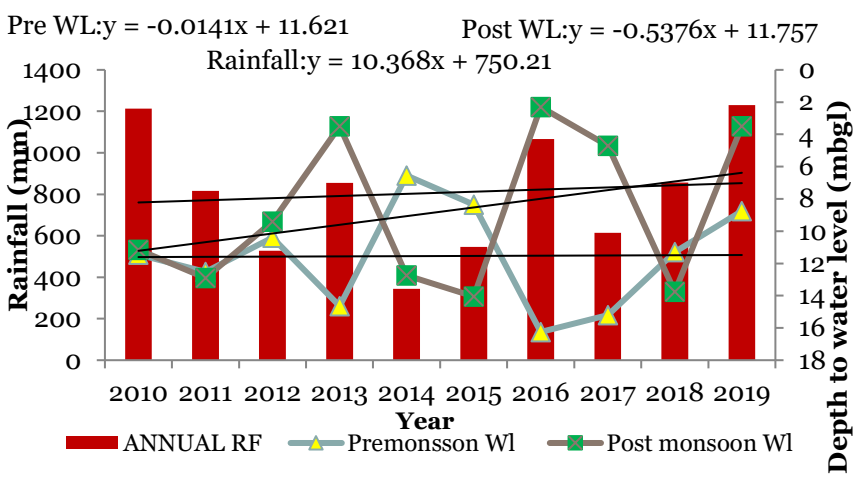
A rising trend during premonsoon @ 0.350 m/year and a falling trend during postmonsoon @ 0.472 m/year respectively.

Figure 3.11: Hydrograph of HIMAYATNAGAR, Himayatnagar block, Nanded District



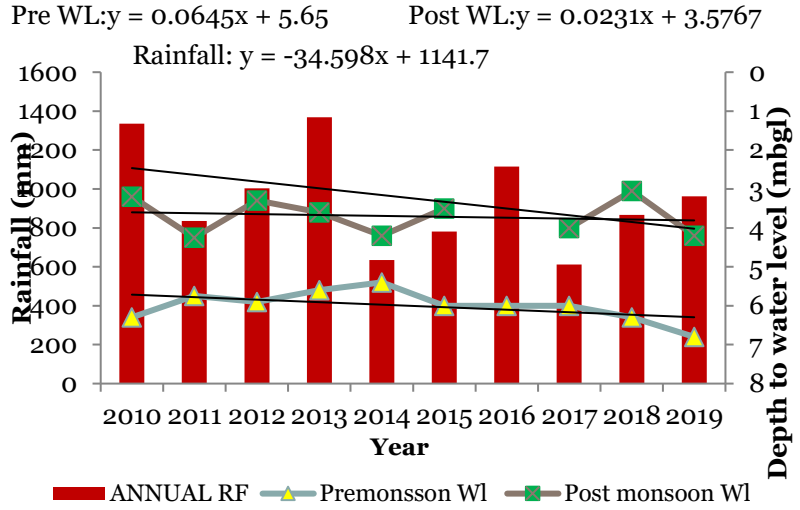
A rising trend during both premonsoon and postmonsoon @ 0.0059m/year and 0.0333 m/year respectively.

Figure 3.12: Hydrograph of Malegaon, Loha Block, Nanded District



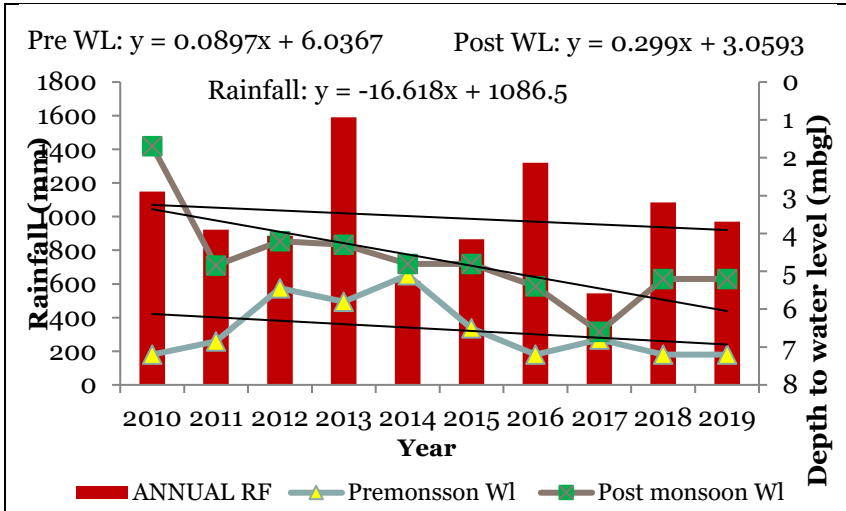
A falling trend during both premonsoon and postmonsoon @ 0.0141m/year and 0.537 m/year respectively.

Figure 3.13: Hydrograph of Janapuri, Kandhar Block, Nanded District



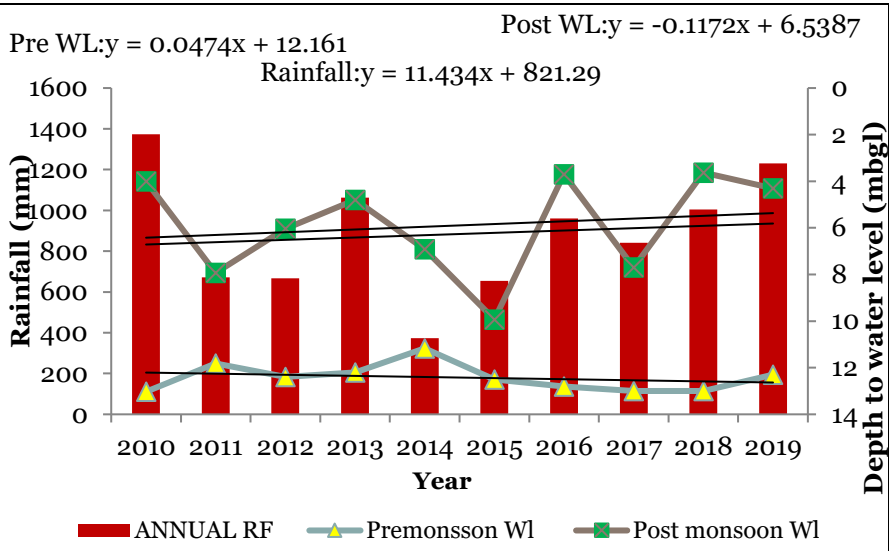
A rising trend during both premonsoon and postmonsoon @ 0.064 m/year and 0.023 m/year respectively.

Figure 3.14: Hydrograph of Jhalakwadi, Kinwat block, Nanded District



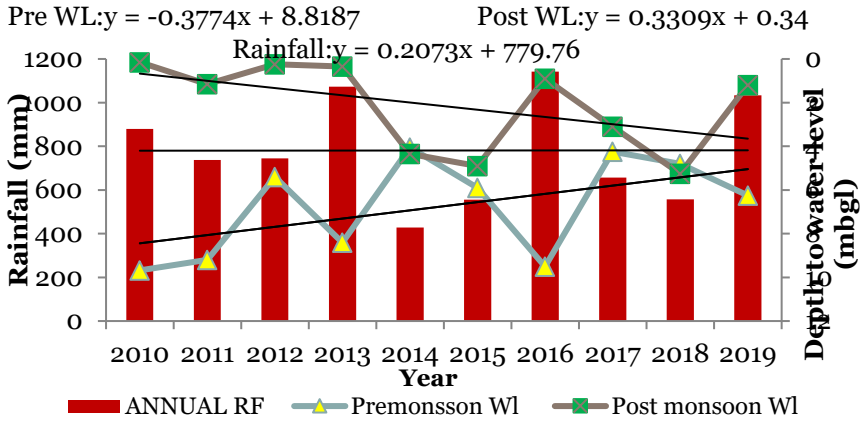
A rising trend during both premonsoon and postmonsoon @ 0.0897m/year and 0.299 m/year respectively.

Figure 3.17: Hydrograph of Anjankhed, Mahur block, Nanded District



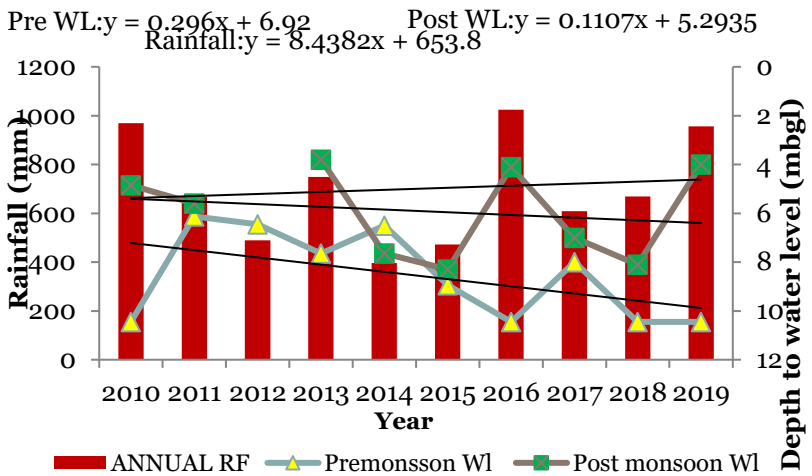
A rising trend during premonsoon @ 0.047 m/year and a falling trend postmonsoon @ 0.117 m/year respectively.

Figure 3.18: Hydrograph of Barad, Mudkhed Block, Nanded District



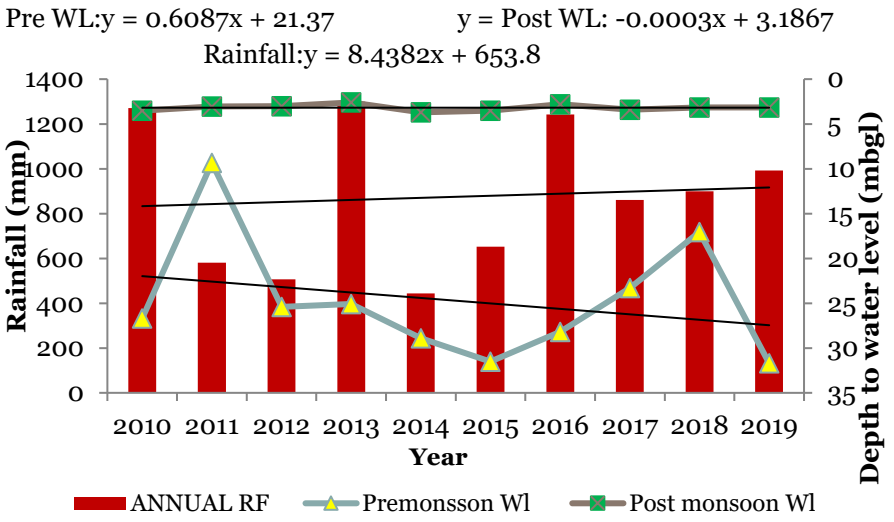
A falling trend during premonsoon @ 0.377 m/year and a rising trend during postmonsoon @ 0.331 m/year.

Figure 3.19: Hydrograph of Mukhed, Mukhed Block, Nanded District



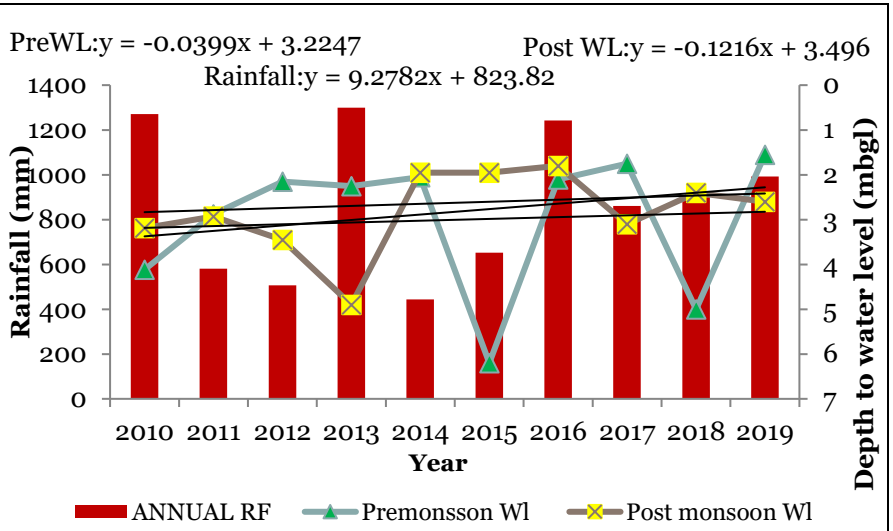
A rising trend during both premonsoon and postmonsoon @ 0.296 m/year and 0.1107 m/year respectively.

Figure 3.20: Hydrograph of Naigaon, Naigaon block, Nanded District



A falling trend during premonsoon @ 0.608 m/year and a rising trend @ 0.0003 m/year during postmonsoon.

Figure 3.21: Hydrograph of Sikarghat, Nanded block, Nanded District



A falling trend during both premonsoon and postmonsoon @ 0.0339 m/year and 0.121 m/year respectively.

Figure 3.22: Hydrograph of Umri Gortha, Umari Block, Nanded Block

4. GROUND WATER QUALITY

The concentrations of various gases and ions dissolved in water from the atmosphere, soil strata and minerals and rocks with which it comes are the characteristics of water. This ultimately decides the quality of ground water. The concentration of CO_3^{2-}, HCO_3^-, OH^- and H^+ ions and dissolved CO_2 gases in water decide the acidic or basic nature of water while the salts of ions like Ca^{2+} and Mg^{2+} in water makes it soft or hard. Water with high Na^+ and Cl^- concentration can make the water saline. Nitrate ions percolated from anthropogenic sources can become predominant major anion in ground water. The excess fluoride concentration in ground water from fluoride bearing minerals may be related to the concentration of Ca^{2+}, Na^+ and HCO_3^- ions present in ground water.

4.1 Electrical Conductivity

The ground water quality of unconfined aquifer inmajor parts of the district covering 9059 SqKm area has EC between 750 µS/cm and 2250 µS/cm **(Figure 4.1)** of brackish nature**.** This may be due to higher rate of evapotranspiration or higher residence time of ground water bringing more ions to ground water through water rock interaction. The Isolated patches in the district covering 234 Sq Km area has EC values ranging from 2250 to 5000 µS/cm. High concentration of nitrate (> 45 mg/l) is observed in 3 sites across the district. About 3 sites show fluoride contamination (>1.5 mg/l). Under natural geochemical condition, the nitrate rarely becomes a major ion in the ground water. The domestic waste, wastewater and sewage in the urban and rural parts of the district may help NO_3 to percolate in ground water. The presence of Fluoride in water may be due to geogenic source or by excess use of pesticides in agriculture. The **Annexure IV** depicts the results of chemical analysis of ground water samples collected from unconfined aquifer during premonsoon, May 2018.

The ground water quality of semi-confined/confined aquifer inmajor parts of the district covering 7456 SqKm area has EC between 750 µS/cm and 2250 µS/cm (**Figure 4.2)**. About 2451 sq km has fresh water with EC<750 µS/cm. The ground water quality varies from fresh to brackish. The Isolated patches in the district covering 29 Sq Km area has EC values more than 2250 µS/cm. High values of Nitrate>45 mg/l is found observed in 21 sites. The presence of Fluoride is also observed in 8 sites. **Annexure V** depicts the results of chemical analysis of ground water samples collected from confined/semiconfined aquifers.

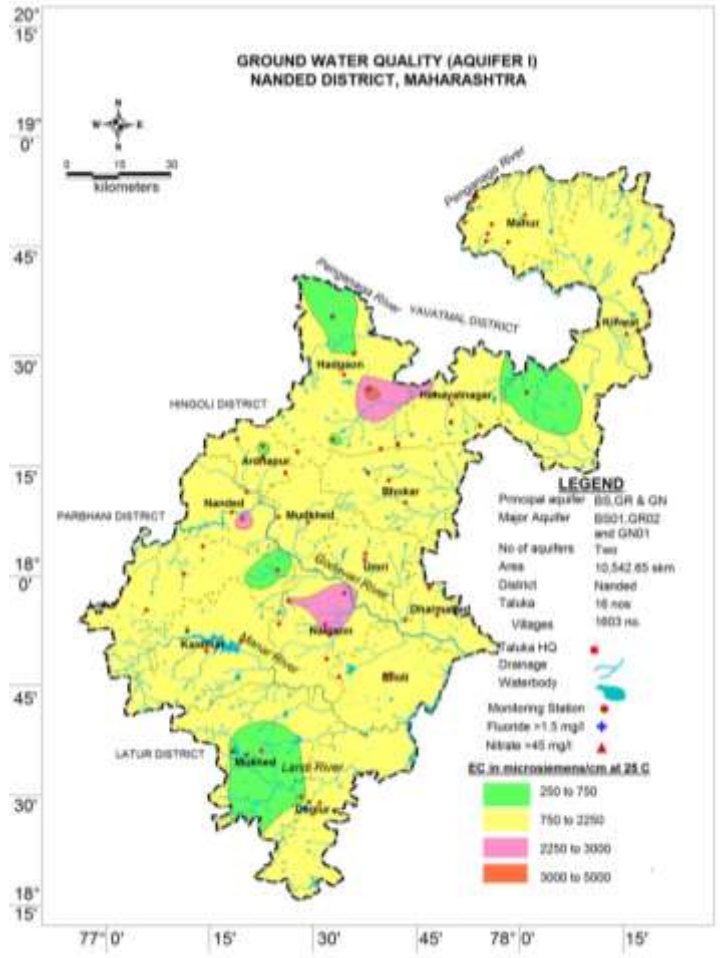


Figure 4.1: Aquifer I, Ground Water Quality

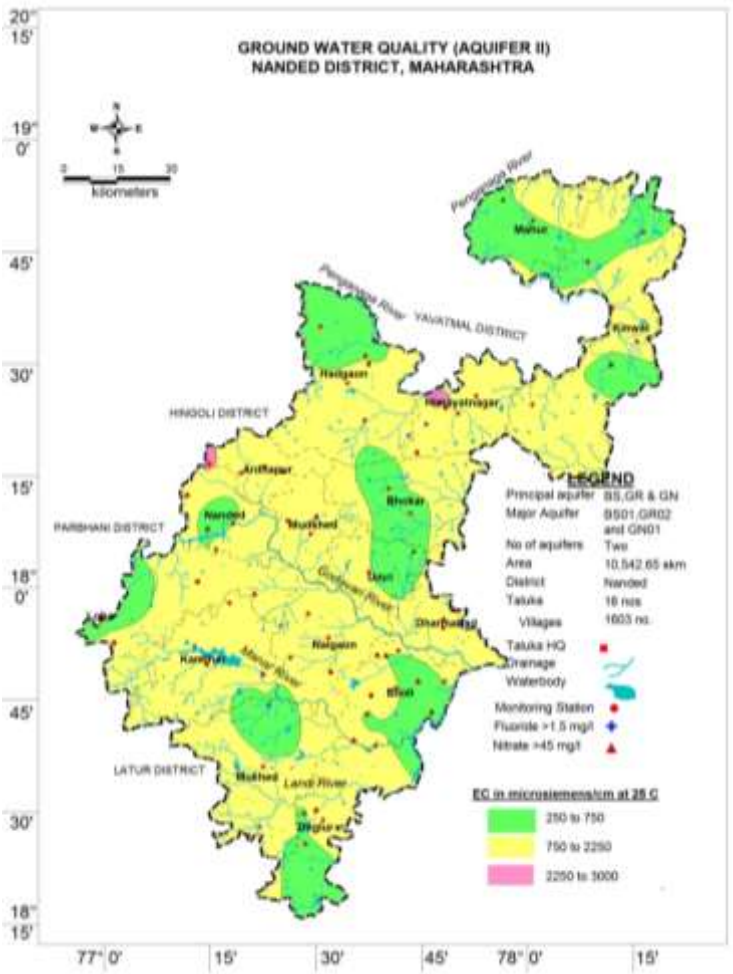


Figure 4.2: Aquifer II, Ground Water Quality

4.2Suitability Of Ground Water for Drinking Purposes

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human beings. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2012) were used to decide the suitability of ground water for drinking purpose. The overall classification of ground water samples falling below desirable limit (<DL), in the range of desirable and maximum permissible limit (DL-MPL) and above maximum permissible limit (MPL) for drinking water purpose is shown in **Table 4.1** and the graphical representation is shown in **Figure 4.3.**

Table 4.1: Classification of Ground Water Samples as per BIS Drinking Water Standards

Parameter	Drinking water Standards (IS-10500-12)		Total Samples	Samples < DL		Samples between DL and MPL		Samples > MPL	
	DL	MPL		Total Samples	%	Total Samples	%	Total Samples	%
pH	6.5-8.5	-	47	0	0	47	100.0	0	0.0
TDS	500	2000	47	16	34.0	31	66.0	0	0.0
TH	300	600	47	19	40.4	23	48.9	5	10.6
Ca (mg/L)	75	200	47	25	53.2	22	46.8	0	0.0
Mg (mg/L)	30	100	47	5	10.6	24	51.1	18	38.3
Cl (mg/L)	250	1000	47	42	89.4	5	10.6	0	0.0
SO4(mg/L)	200	400	47	47	100.0	0	0.0	0	0.0
NO_3(mg/L)	45	No relax	47	44	93.6	0	0.0	3	6.4
F (mg/L)	1	1.5	47	41	87.2	3	6.4	3	6.4

DL-Desirable Limit, MPL-Maximum Permissible Limit.

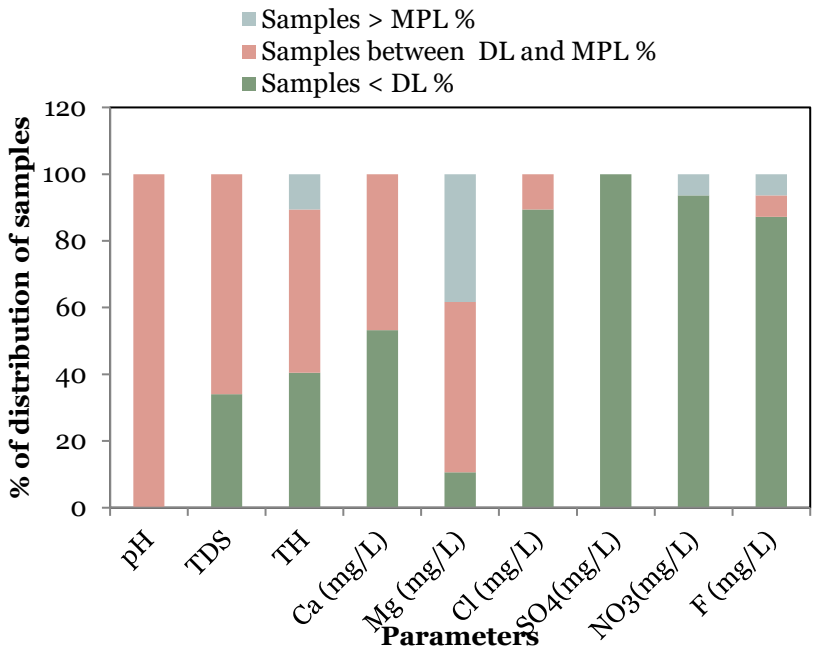


Figure 4.2: Percentage Distribution of Ground Water Samples as per BIS Drinking Water Standards

4.3Suitability Of Ground Water for Irrigation Purposes

The ground water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated 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 influence the water quality and its suitability for irrigation. The quality of GW based on EC is discussed in **Table 4.2**

CLASSIFICATION BASED ON EC

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

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

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

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

Table 4.2: Classification of Ground Water Samples based on EC

S.No.	Water Quality Type	EC in µS/cm	No. of samples	% of samples
1	Low Salinity Water	< 250	0	0
2	Medium Salinity Water	250-750	10	21
3	High Salinity Water	750-2250	33	70
4	Very High Salinity Water	> 2250	4	9
		Total	**138**	**100**

Thus, it can be inferred that most parts of the district have medium to high saline water. Thus, salt tolerant crops shall be promoted to be grown in brackish water areas and saline areas along with management of Salinity in ground water.

5. GROUND WATER RESOURCES

Central Ground Water Board and Groundwater Surveys and Development Agency (GSDA), Govt. of Maharashtra, have jointly estimated the ground water resources of Nanded district based on GEC-97 methodology. The same is presented in **Table 5.1** whereas the graphical representations of the resources are shown in **Figure 5.1**.

5.1 Ground Water Resources-Aquifer I

Ground water resource assessment for unconfined aquifers was carried out during GEC 2017-18 for 10542 sq. km. area of which 1244.99 sq. km. area is under command and 8932.71 sq. km. is under non-command area. The stage of ground water development varies from 20.20 % (Ardhapur) to 60.50 % (Dharmabad). The overall stage of ground water development for the district is 35.44 %. All the 16 blocks of the district, falls under “Safe” category.

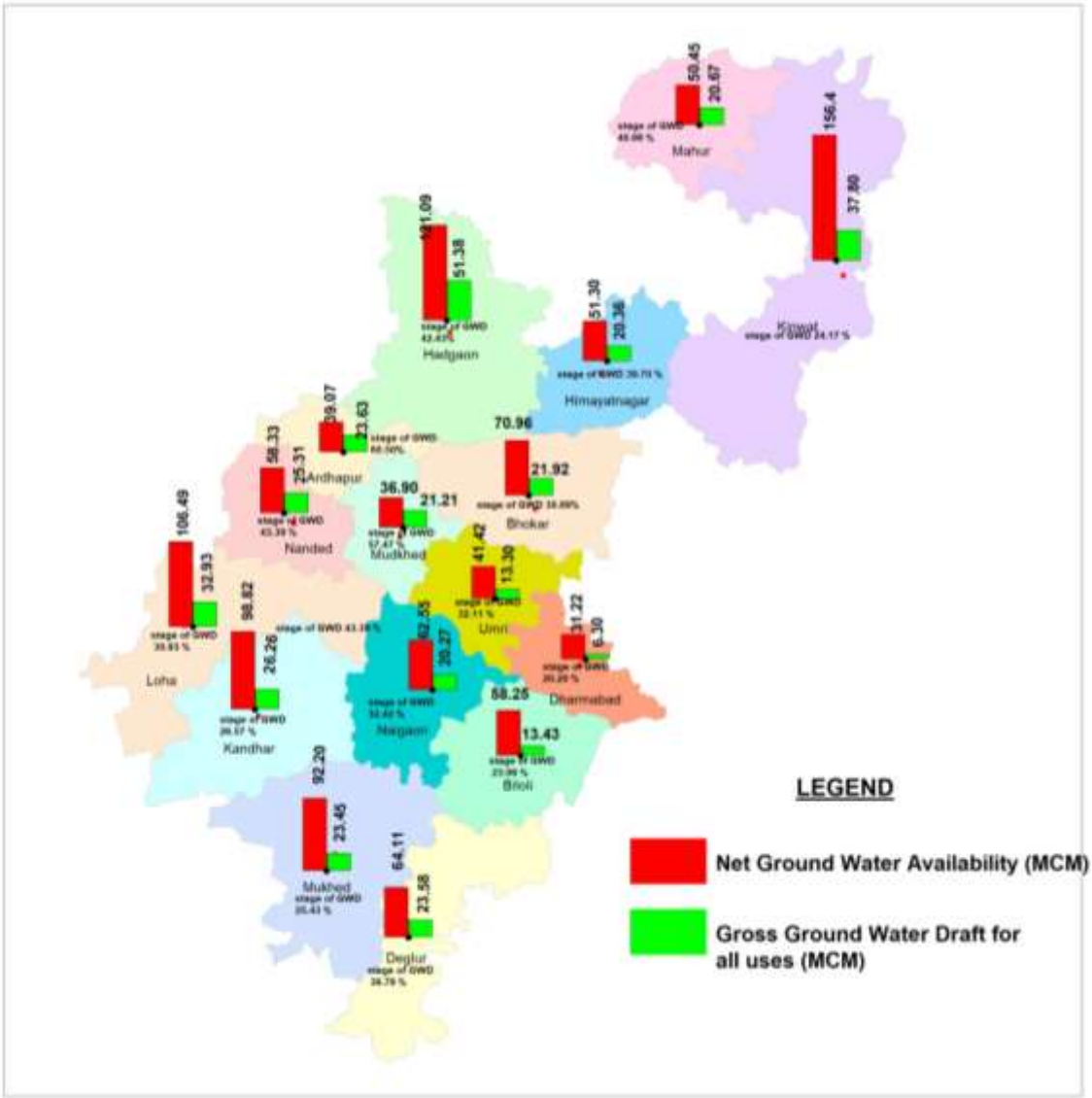


Figure 5.1: Block wise Net GW Availability and Draft for all Purposes

Table 5.1: Ground Water Resources, 2017 (Unit in MCM)

Administrative Unit	Net Annual GW Availability	Existing Gross GW Draft for irrigation	Existing Gross GW Draft for domestic and industrial water supply	Existing Gross GW Draft for All uses	Annual GW Allocation for Domestic Use as on 2025	Net GW Availability for future irrigation development	Stage of GW Development %	Category
Ardhapur	39.07	22.94	0.70	23.64	1.87	14.73	60.50	Safe
Bhokar	70.97	20.90	1.02	21.92	3.00	47.10	30.89	Safe
Biloli	58.26	11.26	2.17	13.43	5.36	43.64	23.06	Safe
Degloor	64.11	18.45	5.13	23.58	14.28	31.40	36.79	Safe
Dharmabad	31.22	5.52	0.79	6.31	2.23	23.46	20.20	Safe
Hadgaon	121.09	48.50	2.89	51.38	8.26	64.60	42.43	Safe
Himataytnahar	51.31	19.52	0.85	20.37	3.12	28.70	39.70	Safe
Kandhar	98.82	24.26	2.00	26.26	5.83	69.13	26.57	Safe
Kinwat	156.41	34.88	2.93	37.81	8.98	112.58	24.17	Safe
Loha	106.49	30.93	2.01	32.94	5.87	69.74	30.93	Safe
Mahur	50.45	19.68	1.00	20.68	2.60	28.15	40.98	Safe
Mudkhed	36.91	20.63	0.58	21.21	1.77	14.48	57.47	Safe
Mukhed	92.20	20.46	2.99	23.45	9.69	61.97	25.43	Safe
Naigaon	62.55	18.71	1.56	20.28	3.66	38.45	32.42	Safe
Nanded	58.33	20.63	4.68	25.31	13.36	23.06	43.39	Safe
Umari	41.43	11.91	1.39	13.30	3.42	25.99	32.11	Safe
Total	**1139.63**	**349.17**	**32.70**	**381.87**	**93.28**	**697.18**		

5.2 Ground Water Resources-Aquifer II

Ground water resources for Semi confined/confined aquifers of Nanded District for all the blocks of the district was calculated as per the data available from exploration and is given in Table 5.2.

Table 5.2: Ground Water Resources of Semiconfined/Confined Aquifer

S No	Taluka	Area (Sq Km)	Mean thickness (m)	Peizometer (macl)	S	Sy	Resources above the confining layer (MCM)	Resources within the confining layer (MCM)
1	Ardhapur	298.15	4.000	4.0	0.00035	0.002	2.39	0.42
2	Bhokar	682.04	10.000	10.0	0.00074	0.002	13.64	5.05
3	Biloli	599.03	5.500	5.5	0.00035	0.002	6.59	1.15
4	Degloor	684.2	4.000	4.0	0.00065	0.002	5.47	1.78
5	Dharmabad	336.47	6.000	6.0	0.00022	0.002	4.04	0.44
6	Hadgaon	1036.92	10.000	10.0	0.00035	0.002	20.74	3.63
7	Himayatnagar	517.8	6.000	6.0	0.00035	0.002	6.21	1.09
8	Kandhar	815.02	13.600	14.0	0.00076	0.002	22.82	8.67

S No	Taluka	Area (Sq Km)	Mean thickness (m)	Peizometer (macl)	S	Sy	Resources above the confining layer (MCM)	Resources within the confining layer (MCM)
9	Kinwat	1515.85	7.410	7.4	0.00029	0.002	22.46	3.26
10	Loha	865.4	6.000	6.0	0.00035	0.002	10.38	1.82
11	Mahur	517.41	8.000	8.0	0.0013	0.002	8.28	5.38
12	Mudkhed	338	6.000	6.0	0.0006	0.002	4.06	1.22
13	Mukhed	941.47	6.000	6.0	0.00086	0.002	11.30	4.86
14	Naigaon	580.08	8.000	8.0	0.00249	0.002	9.28	11.56
15	Nanded	406.8	6.000	6.0	0.0026	0.002	4.88	6.35
16	Umari	408.01	8.500	8.5	0.0024	0.002	6.94	8.32
	Total	**10542.65**	**115.01**	**115.41**	**0.01**	0.002	**159.48**	**64.98**

6. GROUND WATER RELATED ISSUES

6.1 Low Development

The stage of ground water development varies from 20.20 % in Ardhapur block to 60.50% in Dharmabad block. Thus, there is a low stage of ground water development in the district.

6.2 Declining Water Level Trend

The declining trend of water level has been observed in the major parts of the district during both premonsoon and post monsoon. During Premonsoon, a falling trend @ 0.0 to 2.38 m/year is observed in about 6699.24 Sq Km area and a falling trend @ 0.0 to 0.84 m/year is observed in about 5106.56 Sq Km area **(Figure 6.1 & 6.2).**

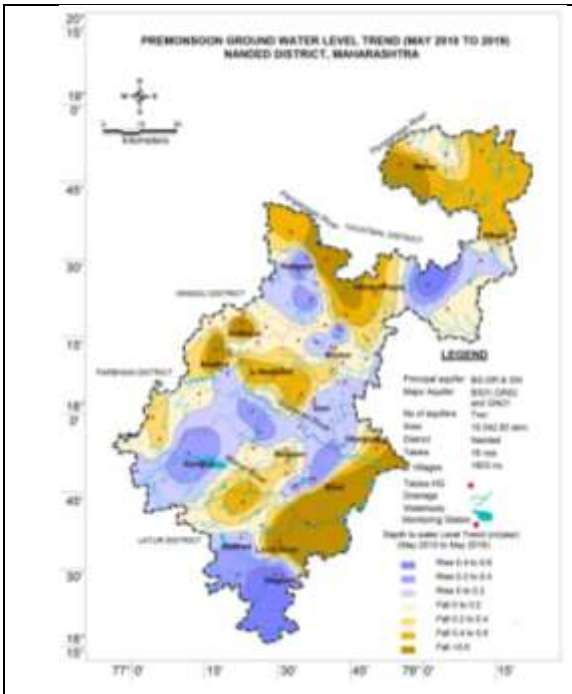


Figure 6.1: Pre-monsoon WL Trend

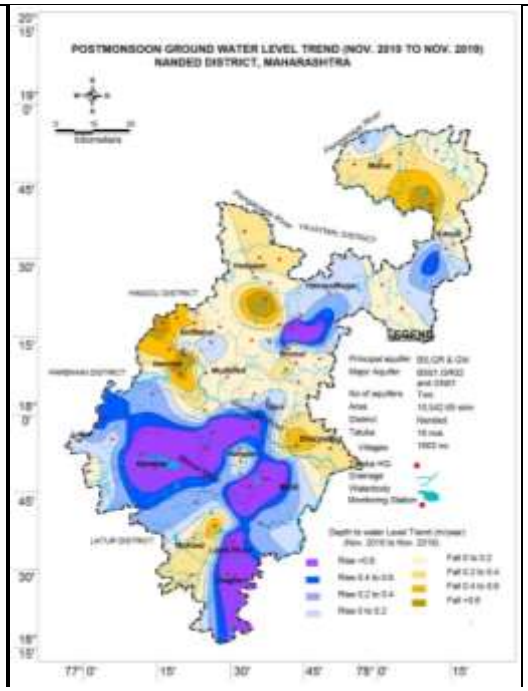


Figure 6.2: Post-monsoon WL Trend

6.3 FLUORIDE CONTAMINATION

The Fluoride contamination in unconfined aquifers is observed in 3 sites in Kinwat, Himayatnagr and Biloli blocks and Nitrate contamination is observed in 3 sites of Himayatnagar block. In Semiconfined/confined aquifers, the presence of Flouride was obtained in 7 sites in Mahur, Mukhed, Kandhar, Mudkhed and Himayatnagar blocks and the nitrate contamination was obtained in 11 sites in Naigaon, Hadgaon, Mudkhed, Himayatnagar, Degloor, Biloli, Ardhapur blocks.

The ground water in these sites is neither suitable for drinking nor for irrigation purposes. **Figure 6.6 &6.**7 depicts the Nitrate and Fluoride affected sites of phreatic and semiconfined/confined aquifers.

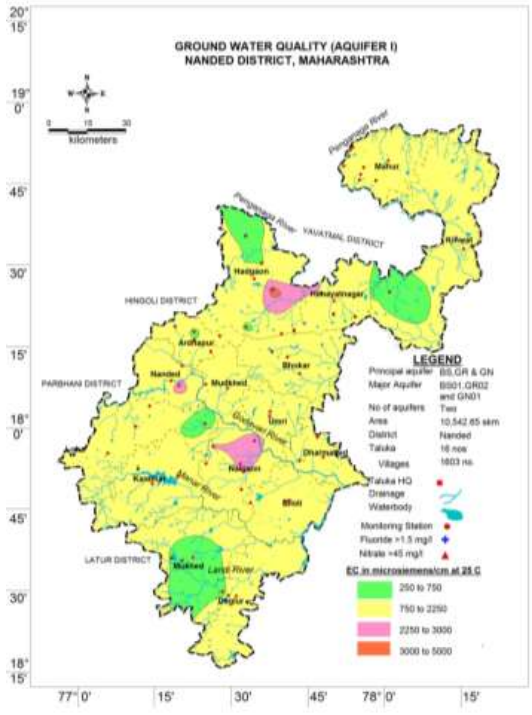


Figure 6.3: GW Quality of Unconfined Aquifer

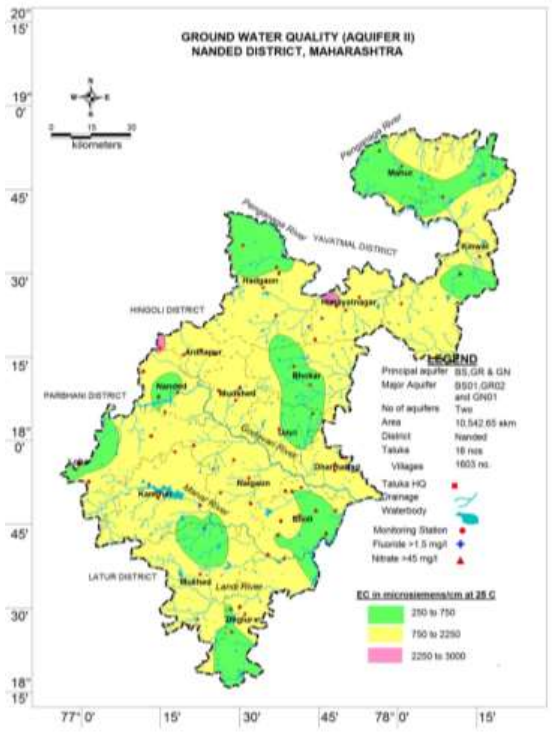


Figure 6.4: GW Quality of Semiconfined/ Confined Aquifers

6.4 LOW YIELDING AQUIFERS

The yield of the aquifer in major parts of the block ranges from 1 to 2 lps as given in **Figure 6.5**. This is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

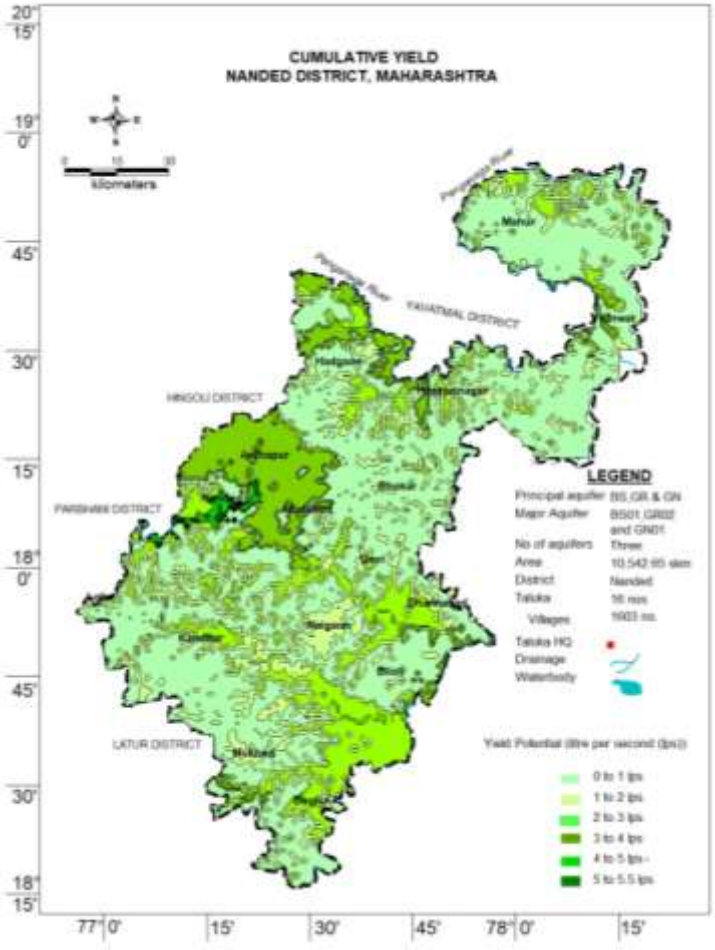


Figure 6.5: Cumulative Yield Potential

7. GROUND WATER RESOURCE MANAGEMENT

The management plan has been proposed to manage the ground water resources and to arrest further decline in water levels. The management plan comprises two components namely supply-side management and demand side management. The management Plan proposed in all blocks of Nanded District is discussed below.

7.1 Supply Side Management

The supply side management of ground water resources is proposed based on availability of surplus surface water within river sub basins and micro watersheds and their artificial recharge in unconfined aquifers. The feasibility of the area for recharge, specific yield of the aquifer, the unsaturated volume of the aquifer, the aquifer thickness as well as the unsaturated depth below 5 mbgl is also taken into consideration during AR.

A total of 307 Percolation Tanks and 874 Check dams to be constructed in 5674.34 Sq Km feasible area of Nanded district to arrest the decline in water levels. The **Table 7.1** gives the blockwise volume of water available for recharge& the proposed number of structures. The area recommended for the construction of proposed structures is shown in **Figure 7.1 &** location of proposed percolation tanks is mentioned in **Annexure VII.**

Table 7.1: Proposed AR Structures and area feasible for recharge

Block	Geographical Area (sq. km.)	Area feasible for recharge (sq. km.)	Unsaturated Volume (MCM)	Number of Structures	
				PT	CD
Ardhapur	298.15	105.95	211.908	6	18
Bhokar	682.04	480.93	961.86	28	81
Biloli	599.03	524.47	1048.944	31	88
Deglur	684.2	606.79	1213.588	36	102
Dharmabad	336.47	308.76	617.522	18	52
Hadgaon	1036.92	286.10	572.194	17	48
Himayatnagar	517.8	498.96	16.92	0	1
Kandhar	815.02	587.02	1174.03	35	99
Kinwat	1515.85	184.70	369.4	11	31
Loha	865.4	190.32	380.636	11	32
Mahur	517.41	114.76	229.514	7	19
Mudkhed	338	326.73	653.462	19	55
Mukhed	941.47	504.70	1009.39	30	85
Naigaon	580.08	323.27	646.546	19	54
Nanded	406.8	232.49	464.98	14	39
Umri	408.01	418.39	836.786	25	70
Total	**10542.65**	**5694.34**	**10407.68**	**307**	**874**

The volume of subsurface storage space available for AR storage is 208.15 MCM while the surplus availability is 116.35 MCM. The cumulative volume of water expected to be recharged by the Percolation Dams and Check Dams is 65.69 MCM as given in **Table 7.2.**

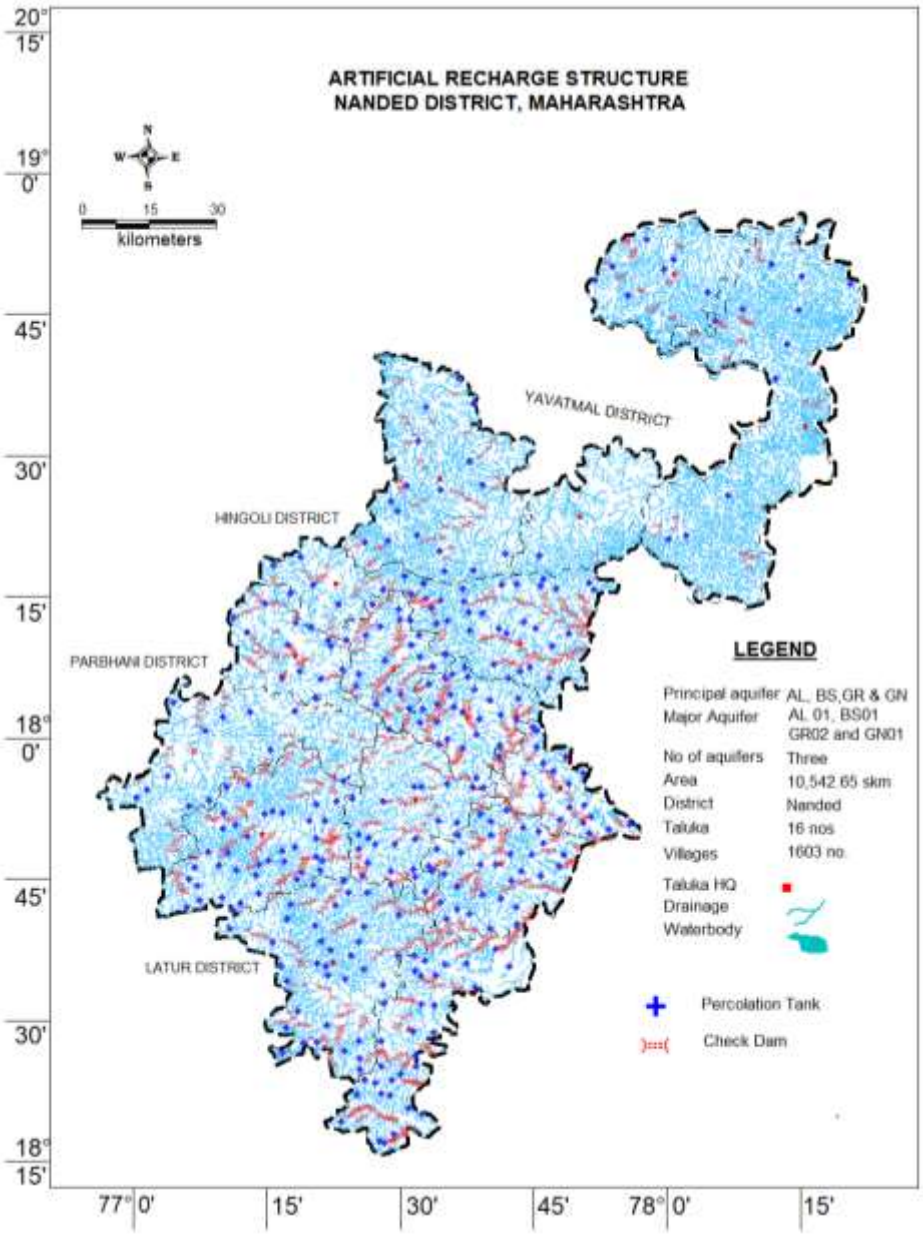


Figure 7.1: Proposed Artificial Recharge Structures

The rainwater harvesting in urban areas can be adopted in 25% of the household with 50 sq. km roof area. A total of 4.09 MCM potential can be generated by taking 80% runoff coefficient. However, it is not recommended as it is economically not viable.

Table 7.2: Volume of water expected to be recharged by Artificial Recharge structures

Block	Volume of Sub-surface storage space available for AR (MCM)	Surplus Water Availabl e (MCM)	Volume of Water expected to be conserved/rec harged @ 75% efficiency (MCM) by Percolation Tank	Volume of Water expected to be conserved/ recharged @ 75% efficiency (MCM) by Check Dam	Total Volume of Water expected to be conserved/re charged @ 75% efficiency (MCM)
Ardhapur	4.24	2.37	0.9	0.41	1.31
Bhokar	19.24	10.75	4.2	1.82	6.02
Biloli	20.98	11.73	4.65	1.98	6.63
Deglur	24.27	13.57	5.4	2.29	7.69
Dharmabad	12.35	6.90	2.7	1.17	3.87
Hadgaon	11.44	6.40	2.55	1.08	3.63
Himayatnagar	0.34	0.19	0	0.0225	0.0225
Kandhar	23.48	13.12	5.25	2.23	7.48
Kinwat	7.39	4.13	1.65	0.69	2.34
Loha	7.61	4.26	1.65	0.72	2.37
Mahur	4.59	2.57	1.05	0.43	1.48
Mudkhed	13.07	7.30	2.85	1.23	4.08
Mukhed	20.19	11.28	4.50	1.91	6.41
Naigaon	12.93	7.23	2.85	1.21	4.06
Nanded	9.30	5.20	2.10	0.88	2.98
Umri	16.74	9.35	3.75	1.57	5.32
Total	**208.15**	**116.35**	**46.05**	**19.64**	**65.69**

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. As the stage of ground water development is less than 60% in all the blocks of the district, no demand side interventions have been proposed in most of the blocks. However, demand side interventions are proposed in ground water irrigated sugarcane areas of Ardhapur and Mudkhed blocks. A total of 8.11 Sq Km area is proposed to be bought under drip irrigation thereby saving 6.63 MCM of ground water (Table 7.3 & Figure 7.2). The location of proposed check dams is mentioned in Annexure VIII.

Table 7.3: Volume of water expected to be recharged by Demand Side Intervention

Block	Ground water irrigated sugarcane crop area proposed to be brought under drip) Sq Km)	Volume of water expected to be saved (MCM)
Ardhapur	2.8	1.6
Bhokar	Nil	Nil
Biloli	Nil	Nil
Deglur	Nil	Nil
Dharmabad	Nil	Nil
Hadgaon	Nil	Nil
Himayatnagar	Nil	Nil
Kandhar	Nil	Nil
Kinwat	Nil	Nil
Loha	Nil	Nil
Mahur	Nil	Nil
Mudkhed	5.31	5.03
Mukhed	Nil	Nil
Naigaon	Nil	Nil
Nanded	Nil	Nil
Umri	Nil	Nil
Total	**8.11**	**6.63**

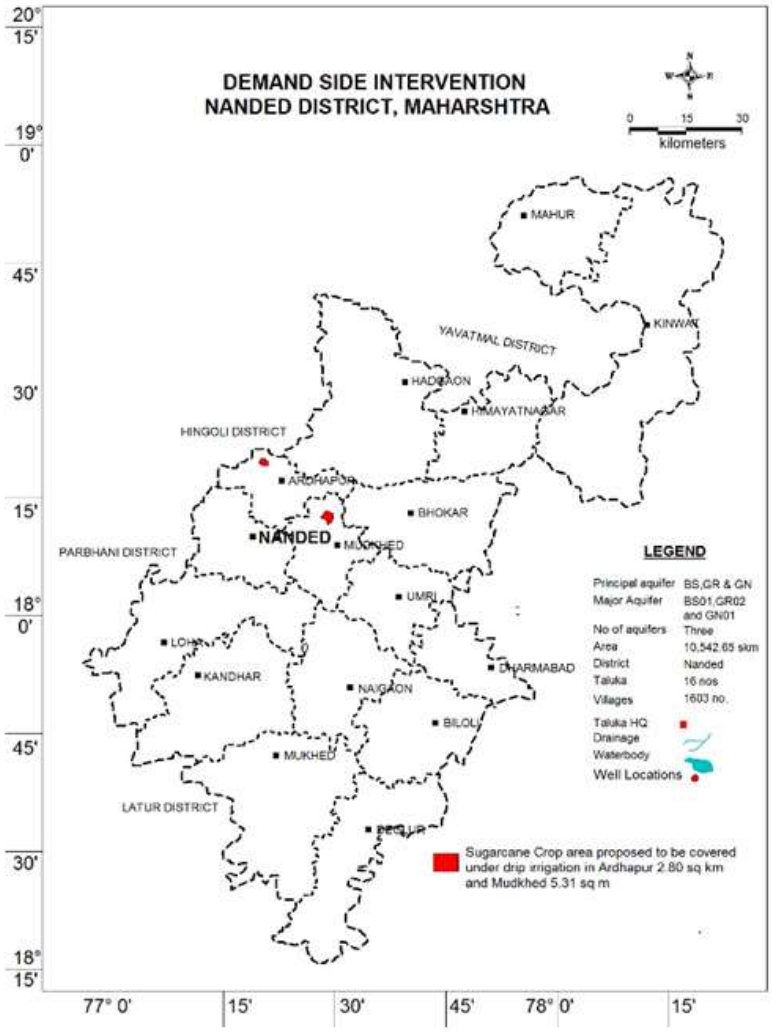


Figure 7.2: Proposed Demand Side Interventions

7.3 Expected Benefits

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

Table 7.4: Expected benefits after management options

Block	Net Ground Water Availability (MCM)	Additional GW resources available after implementing above measures (MCM)	Ground Water Availability after Supply side Intervention (MCM)	Existing Ground Water Draft for All Purposes (MCM)	Saving of Ground Water through demand side intervention (MCM)	GW draft after Demand side interventions (MCM)	Present stage of Ground Water Development (%)	Stage of Ground Water Development after interventions (%)
Ardhapur	39.07	1.31	40.38	23.64	1.6	22.04	60.50	54.5
Bhokar	70.97	6.02	76.99	21.92	0.00	21.92	30.89	28.5
Biloli	58.26	6.63	64.89	13.43	0.00	13.43	23.06	20.7

Block	Net Ground Water Availability (MCM)	Additional GW resources available after implementing above measures (MCM)	Ground Water Availability after Supply side Intervention (MCM)	Existing Ground Water Draft for All Purposes (MCM)	Saving of Ground Water through demand side intervention (MCM)	GW draft after Demand side interventions (MCM)	Present stage of Ground Water Development (%)	Stage of Ground Water Development after interventions (%)
Deglur	64.11	7.69	71.80	23.58	0.00	23.58	36.79	32.8
Dharmabad	31.22	3.87	35.09	6.31	0.00	6.31	20.20	18.0
Hadgaon	121.09	3.63	124.72	51.38	0.00	51.38	42.43	41.2
Himayatnagar	51.31	0.02	51.33	20.37	0.00	20.37	39.70	39.7
Kandhar	98.82	7.48	106.30	26.26	0.00	26.26	26.57	24.7
Kinwat	156.41	2.34	158.75	37.81	0.00	37.81	24.17	23.8
Loha	106.49	2.37	108.86	32.94	0.00	32.94	30.93	30.3
Mahur	50.45	1.48	51.93	20.68	0.00	20.68	40.98	39.8
Mudkhed	36.91	4.08	40.99	21.21	5.03	16.21	57.47	39.54
Mukhed	92.20	6.41	98.61	23.45	0.00	23.45	25.43	23.8
Naigaon	62.55	4.06	66.61	20.28	0.00	20.28	32.42	30.4
Nanded	58.33	2.98	61.31	25.31	0.00	25.31	43.39	41.3
Umri	41.43	5.32	46.75	13.30	0.00	13.30	32.11	28.5
Total	**1139.63**	65.69	1205	**381.87**	**6.63**	**375.27**	**35.44**	32.34

7.4 Development Plan

The ground water development plan has been proposed in the view of developing the addition ground water resources available after supply side interventions to bring the stage of ground water up to 70%. The 461.87 MCM of volume of ground water generated can bring 711 sq km additional area under assured ground water irrigation with average crop water requirement of 0.65 m by constructing 27,714 Dug wells and 4620 Borewells (**Table:7.5). Figure7.3** depicts the additional area proposed for ground water irrigation after 70% GW development.

Table 7.5: Block wise additional area under Assured GW Irrigation

Block	Additional Volume of Water Available for GWD 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 irrigation with average CRW of 0.65 m
Ardhapur	4.63	278	46	7.00
Bhokar	31.97	1918	320	49.00
Biloli	31.98	1919	320	49.00
Deglur	26.68	1601	267	41.00
Dharmabad	18.26	1096	183	28.00
Hadgaon	35.92	2155	359	55.00
Himayatnagar	15.56	934	156	24.00
Kandhar	48.15	2889	481	74.00
Kinwat	73.32	4399	733	113.00
Loha	43.27	2596	433	67.00
Mahur	15.68	941	157	24.00
Mudkhed	7.48	449	75	12.00
Mukhed	45.58	2735	456	70.00
Naigaon	26.36	1582	264	41.00
Nanded	17.60	1056	176	27.00
Umri	19.43	1166	194	30.00
Total	461.87	27714.00	4620.00	711.00

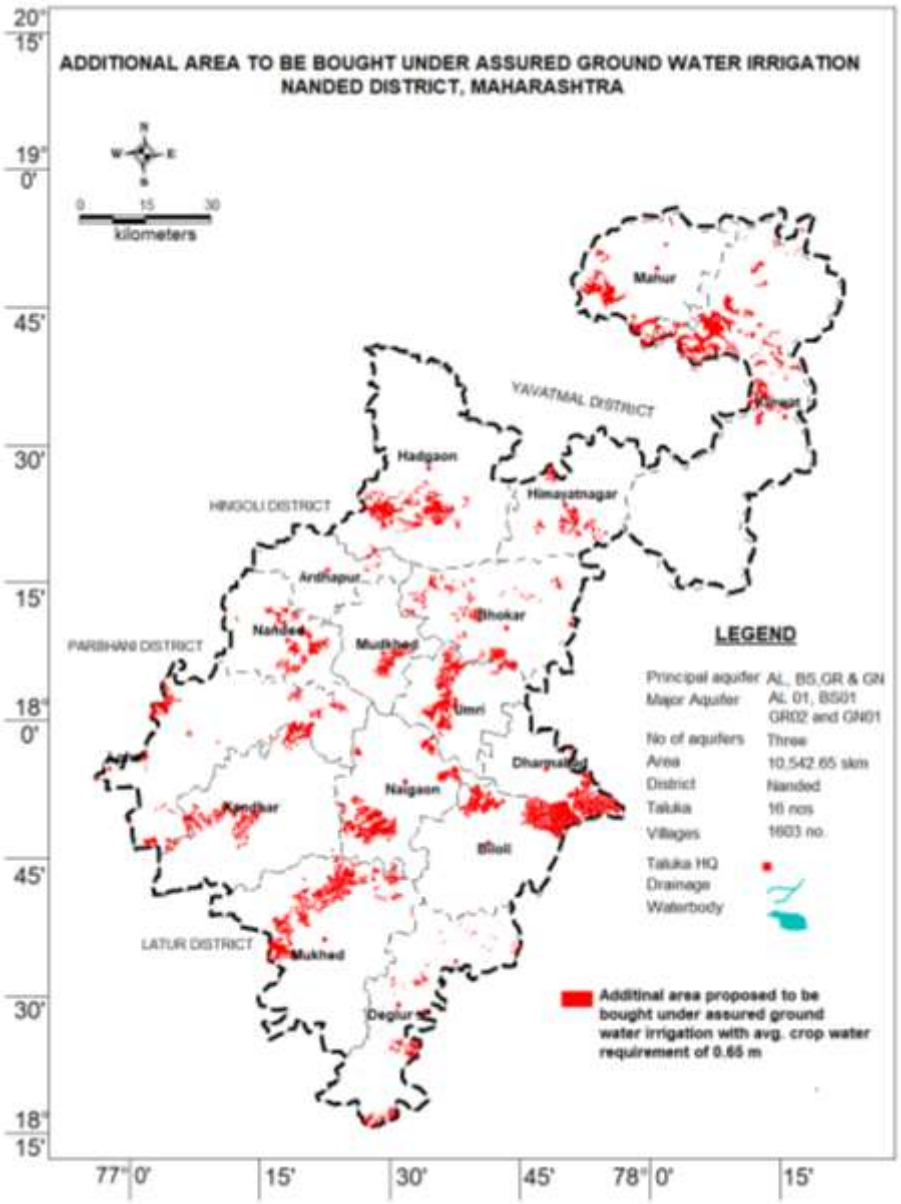


Figure 7.3: Additional Area proposed for GW irrigation

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 Amravati district.

Nanded district covering an area of 7156.91 Sq Km has 521.43 sq km of which only 6635.48Sq Km area is mappable. Geologically, Basaltic lava flows of Deccan traps belonging to Late Cretaceous to Paleogene (68-62 million years in age) occupy the entire area of the district with a few inter-trappean beds. The stage of ground water development is 74.59 %. The area has witnessed Declining water level trend, Overexploitation, declining rainfall trend, fluoride and nitrate contamination and low yield potential aquifers, being the major issues in the district. Declining water level trend @ 0.0 to 0.7138 m/year is observed in about 5796 Sq Km areaduring pre-monsoon. During post monsoon. declining water level trend@ 0.0 to 0.79 m/year is observed in about 5637 Sq Km.

The management plan has been proposed for all theblocks of Nanded district 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 307 Percolation tanks and 874 Check dams are proposed, which will augment ground water resources to the tune of 65.69 MCM (46.05MCM by Percolation tanks and 19.64 MCM by Check dams).

In Nanded District, a total 65.69 MCM ground water resources will be augmented after adopting artificial recharge

- As the stage of ground water development is less than 60% in all the blocks of the district, have been proposed in most of the blocks. However, demand side interventions are proposed in ground water irrigated sugarcane areas of Ardhapur and Mudkhed blocks. A total of 8.11 Sq Km area is proposed to be bought under drip irrigation thereby saving 6.63 MCM of ground water
- The ground water development plan has been proposed in the view of developing the addition ground water resources available after supply side interventions to bring the stage of ground water up to 70%. The 461.87 MCM volume of ground water generated can bring 711 sq km additional area under assured ground water irrigation with average crop water requirement of 0.65 m by constructing 27714 Dug wells and 4620 Borewells.
- These interventions also need to be supported by regulation of deeper aquifer and hence it is recommended to regulate/ban deeper tube wells/borewells of more than 60 m depth in these blocks, so that the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought. IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory ground water management.

BLOCKWISE AQUIFER MAP AND MANAGEMENT PLAN

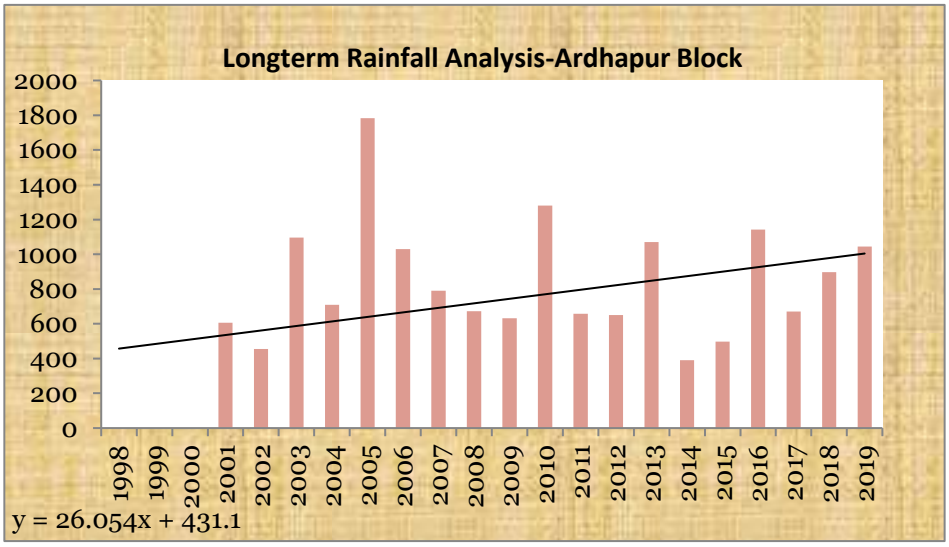
- ARDHAPUR BLOCK
- BHOKAR BLOCK
- BILOLI BLOCK
- DEGLUR BLOCK
- DHARMABAD BLOCK
- HADGAON BLOCK
- HIMAYATNAGAR BLOCK
- KANDHAR BLOCK
- KINWAT BLOCK
- LOHA BLOCK
- MAHUR BLOCK
- MUDKHED BLOCK
- MUKHED BLOCK
- NAIGAON KHURD BLOCK
- NANDED BLOCK
- UMARI BLOCK

9. AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

9.1 ARDHAPUR BLOCK, NANDED DISTRICT

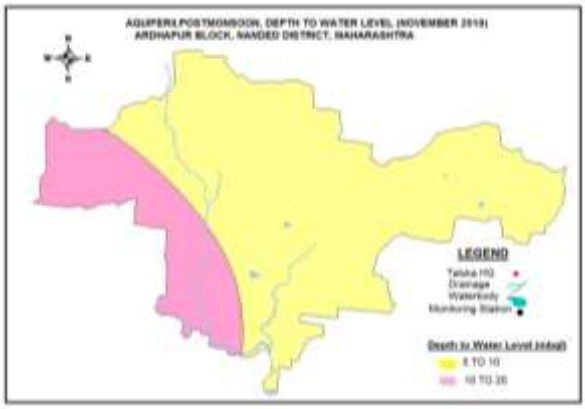
1. SALIENT INFORMATION	
1.1. Introduction	
Block Name	Ardhapur
Geographical Area (Sq. Km.)	298.15 Sq. Km.
Hilly Area (Sq. Km)	16.39 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	109,332
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	828.5 mm
Annual Rainfall (2019)	1045.3 mm
Decadal Average Annual Rainfall (2010-19)	830.41 mm
Long Term Rainfall Analysis (1998-2019)	Rising Trend: 26.05 mm/year. Probability of Normal/Excess Rainfall-47% & 37%. Probability of Drought (Moderate/Severe / Acute)-: 16% Moderate Frequency of occurance of Drought:1 in 6 years

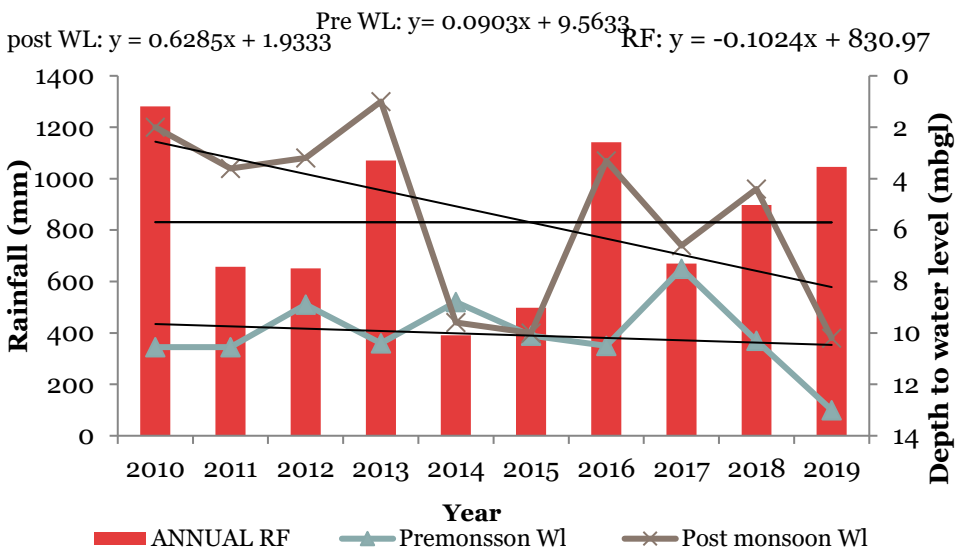
RAINFALL TREND ANALYSIS (1951 to 2019)



1.3. Geomorphology, Soil &Geology	
Geomorphic Unit	➢ Plateau Weathered-Canal Command ➢ Plateau slightly dissected, 0 to 1 m weathering
Soil	➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Shallow, moderately well drained clayey soils on gently sloping summits/spurs with moderate erosion. ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion;

	moderate salinity and slight sodicity			
Geology	Recent River Alluvium &Deccan Traps (Basalt) ofLate Cretaceous to Early Eocene Age			
1.4. Hydrology & Drainage				
Drainage	Penganga River and its tributaries form the main drainage system of the block.			
Hydrology	Major & Medium Irrigation Projects (>250 Ha) *(Reference Year: 2012-13)*	Nil		
	Minor Irrigation Projects (0 to 250 Ha) *(Reference Year: 2017-18)*	No. of projects completed till March 2017	24	
		No. of projects operating till end	24	
		Command area of the operating project (Sq. Km.)	5	
		Net irrigated area under Operating project (Sq. Km.)	4.28	
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN				
Geographical Area	298.15 Sq. Km.			
Forest Area	15.26 Sq. Km.			
Cultivable Area	320.82 Sq. Km.			
Net Sown Area	238.63 Km.			
Double Cropped Area	88.73 Sq. Km.			
Area under Irrigation *(Reference Year: 2016-17)*	Surface Water	120.80 Sq. Km.		
	Ground Water	78.46 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**		
	Pulses	99.2		
	Cotton	48.60		
	Cereals	12.91		
	Oil Seeds	143.54		
Horticultural Crops	Sugarcane	28.01		
	Others	20.05		
1.6.WATER LEVEL BEHAVIOUR				
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)				
Pre-Monsoon (May-2019)		**Post-Monsoon (November-2019)**		
➢ Water Level of 10 to 20 mbgl is observed in 85.6 Sq Km area in north-eastern part of the block. ➢ About 212 Sq Km area of the remaining parts of the block have depth to water level in the range of 20 to 30 mbgl.		➢ Shallow water Level of 5 to 10 mbgl is observed in 45.16 Sq Km area in eastern, parts of the block. ➢ About 248.77 Sq Km area of the remaining parts of the block have depth to water level in the range of 10 to 20 mbgl		
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)				

Pre-Monsoon Water Level (May 2019)	Post-Monsoon Water Level (Nov.2019)
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
➢ The whole block of 298 sq km has depth to water level in the range of 10 to 20 mbgl.	➢ The depth to water level between 10 mbgl and 20 mbgl is observed in 230Sq Km area in major parts of the block. ➢ The depth to water level between 20 mbgl and 30 mbgl is observed in about 63 Sq Km area along western parts of the block
1.7. Hydrograph	



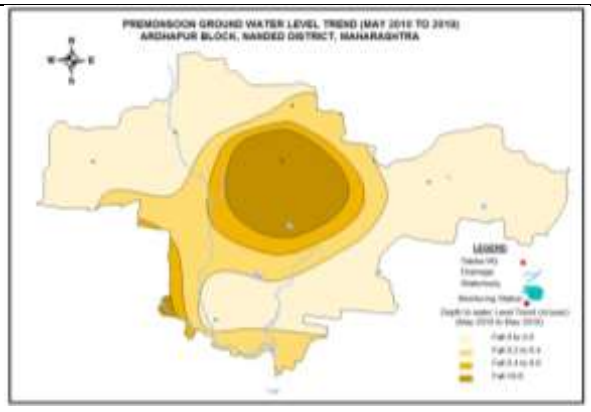
The hydrograph of CGWB Monitoring site at Malegaon for the period 2010 to 2019 shows:

- A rising trend during premonsoon@ 1.08 m/year and a falling trend during postmonsoon @7.53 m/year respectively.
- The depth to water level during premonsoon ranges from 7.5 mbgl to 13 mbgl due to overdraft of ground water in dry season.
- The depth to water level during postmonsoon ranges from 1 mbgl to 10.2 mbgl during postmonsoon

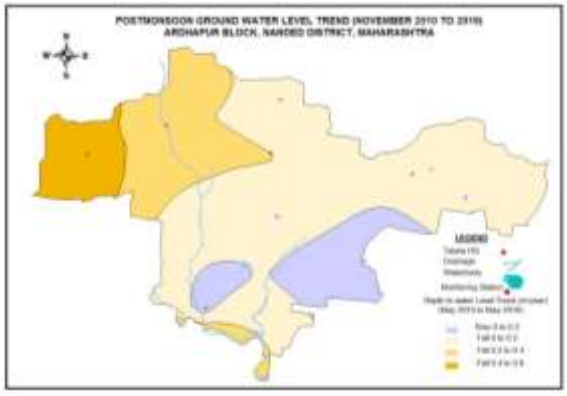
1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-19)		**Post-Monsoon Trend (November2010-19)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
Nil	0.0 to 0.2 m/year in 165 Sq Km area; 0.2 to 0.4 m/year in 65.09 Sq Km area; 0.4 to 0.6 m/year in 24.44 Sq Km area and > 0.6 m/year in 36 Sq Km area.	0 to 0.2 m/year in 36 Sq Km area	0 to 0.2 m/year in 173.2 Sq Km area; 0.2 to 0.4 m/year in 58.11 Sq Km area and 0.4 to 0.6 m/year in 24.91 Sq Km area

Pre-Monsoon WL Trend (May 2010-2019)



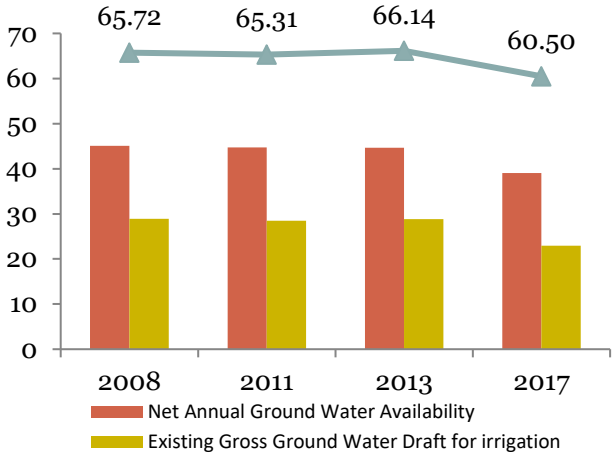
Post-Monsoon WL Trend (Nov.2007-2016)



2. GROUND WATER ISSUES

1) Variation in Stage of Ground Water Development:

The stage of groundwater Development varies from 65.72 to 60.50 alongwith the decrease in Net ground water availability from 45 MCM to 39 MCM.



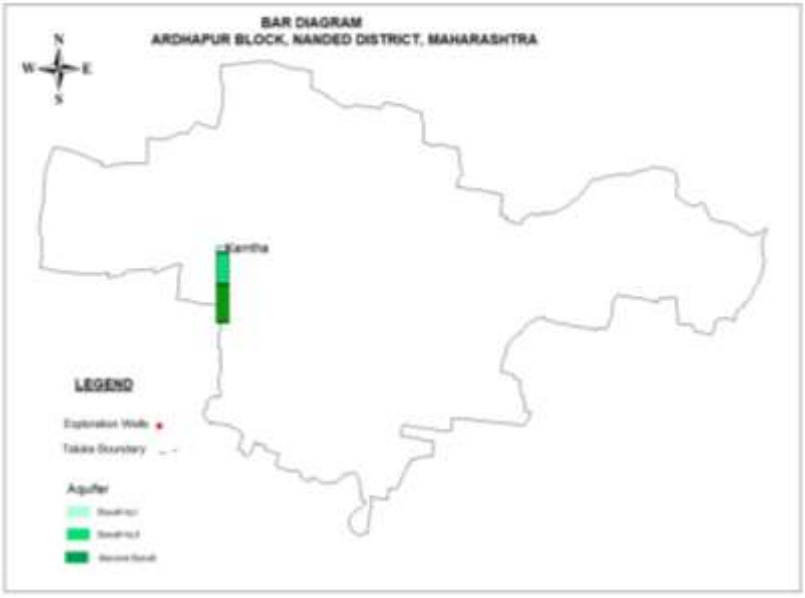
2) **Declining Water Level Trend: -**

The decline in water level trend (2010-19) upto 0.6 m/year is observed in 290.53 sq km area of the block during premonsoon and 256.2 sq km area during postmonsoon.

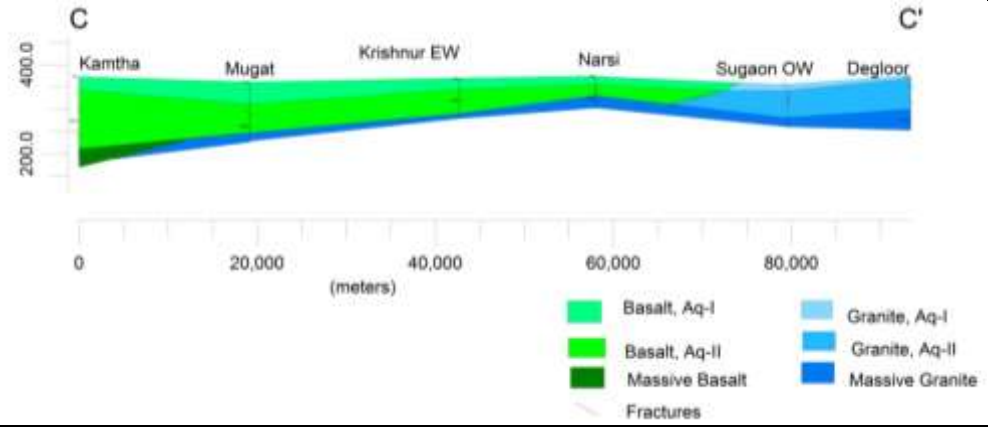
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two: Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined /confined)
Depth to bottom of aquifer (mbgl)	10 to 16	88 to 148
Weathered/ Fractured rocks thickness (m)	8 to 14	2 to 6
Yield Potential	15 to 100 m3/day	0.2 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00035
Transmissivity (T)		126 to 156.46 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

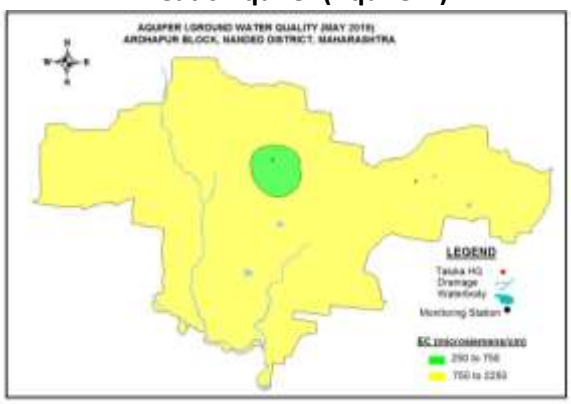
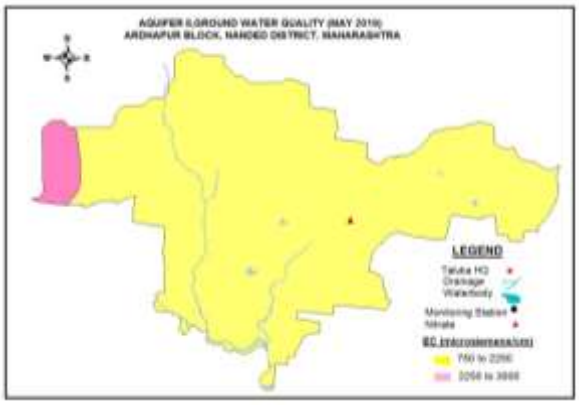
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes. ➢ About 8.00 Sq Km area of the block has EC well within the potable range of 250 to 750 microsiemens/cm whereas 285.67 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In major parts of the block covering 285.6 Sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The SAR valuesofall the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes. ➢ RSC value is less than 20% indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes.

4.1 Aquifer II/Deeper Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected village (1 site)	➢ In major parts of the block covering 282 Sq Km area, EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance

➢ About 282 Sq Km area of the block has EC EC between 750 and 2250 microsiemens/cm and 10.78 sq km area has EC >2250 microsiemens/cm . ➢ Nitrate contamination with nitrate more than 45 mg/l is observed in Loni Bk village	should be selected.

3.2.CHEMICAL QUALITY MAP

Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II &III)**
	

5. GROUND WATER RESOURCE & EXTRACTION

Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	281.76
Total Annual Ground Water Recharge (MCM)	41.12
Natural Discharge (MCM)	2.05
Net Annual Ground Water Availability (MCM)	39.07
Existing Gross Ground Water Draft for irrigation (MCM)	22.96
Existing Gross Ground Water Draft for domestic and industrial water supply (MCM)	0.70
Existing Gross Ground Water Draft for All uses (MCM)	23.63
Net Ground Water Availability for future irrigation development (MCM)	14.72
Provision for domestic and industrial requirement supply to 2025(MCM)	1.86
Stage of Ground Water Development %	60.50
Category	**SAFE**

Aquifer-II

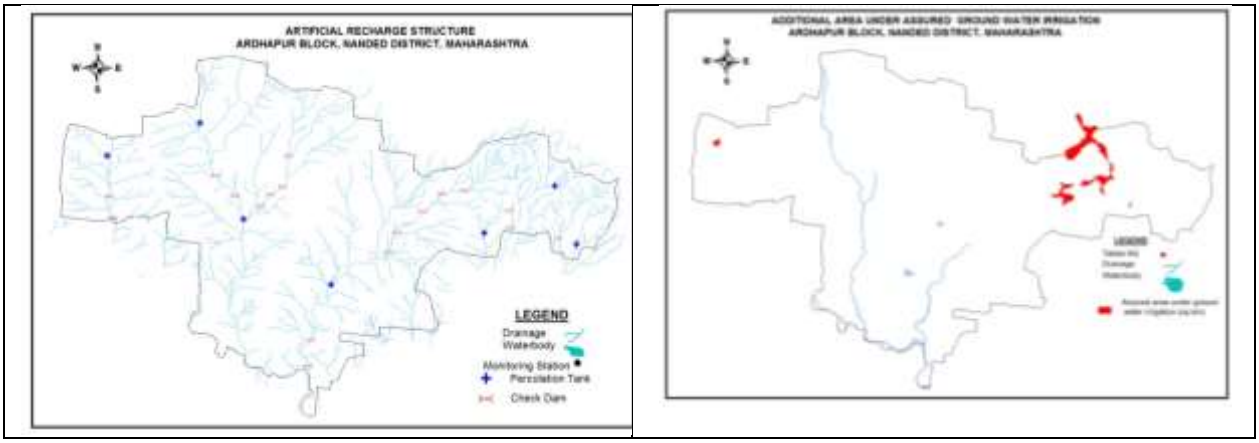
Semiconfined/Confined Aquifer (Basalt)

Resources above the confining layer				**Resources within the confining layer**			
Total Area (Sq. Km.)	**Peizometer (macl)**	S	Resources above confining	Total Area (Sq. Km.)	Mean aquifer thickness	Sy	Resources within the confining

			layer 9MCM)		(m)		layer (MCM)
298.15	92.6	0.00035	9.66	298.15	4.000	0.002	2.39

5.0. GROUND WATER RESOURCE ENHANCEMENT			
Available Resource (MCM)	39.07		
Gross Annual Draft (MCM)	23.63		
5.1. SUPPLY SIDE MANAGEMENT			
SUPPLY (MCM)			
Agricultural Supply -GW	22.93		
Agricultural Supply -SW	120.80		
Domestic Supply - GW	0.70		
Domestic Supply - SW	0.14		
Total Supply	**144.57**		
Area of Block (Sq. Km.)	298.15		
Area suitable for Artificial recharge (Sq. Km)	281.76		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge (WL >5mbgl) (Sq. Km.)	105.95	-	
Volume of Unsaturated Zone (MCM)	211.908	-	
Average Specific Yield	0.02	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	4.23	-	
Surplus water Available (MCM)	2.373	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	6	18	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	0.9	0.405	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	4950		
Total RWH potential (MCM)	0.205		

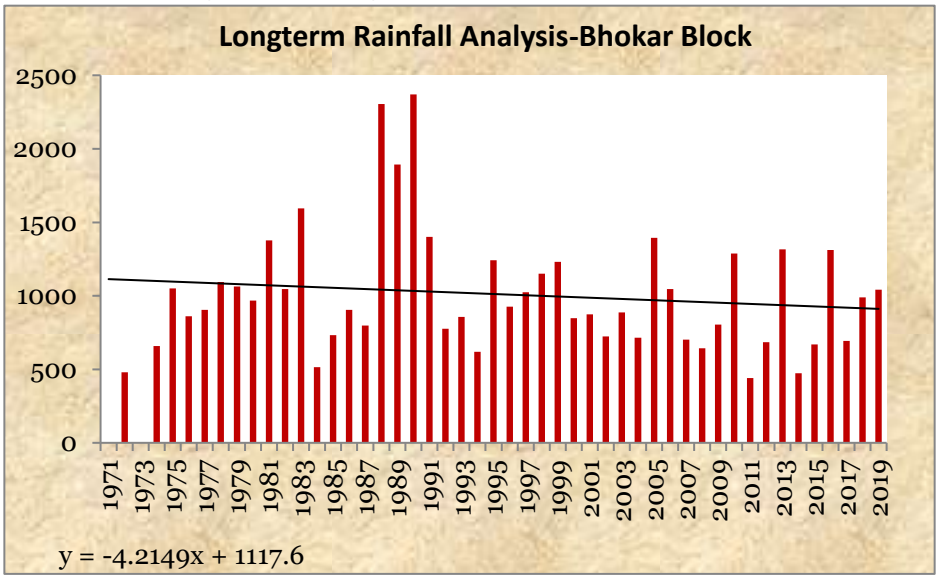
Rainwater harvested / recharged @ 80% runoff co-efficient	0.164 (**Economically not viable & Not Recommended)**
5.2. DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	2.8
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	1.6
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	39.07
Additional GW resources available after Supply side interventions (MCM)	1.305
Ground Water Availability after Supply side intervention	40.375
Existing Ground Water Draft for All Purposes (MCM)	23.63
Saving of Ground Water through demand side intervention (MCM)	1.6
GW draft after Demand Side Interventions (MCM)	22.03
Present stage of Ground Water Development (%)	60.5
Expected Stage of Ground Water Development after interventions (%)	54.57 **(SAFE)**
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 60.5% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available for GWD to 60% (MCM)	4.6325
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	278
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	46
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	7
Proposed Artificial Recharge Structure	**Additional Area proposed to be brought under Assured Ground Water Irrigation**


ARTIFICIAL RECHARGE STRUCTURE
ARDHAPUR BLOCK, NANDED DISTRICT, MAHARASHTRA
LEGEND
Drainage
Waterbody
Monitoring Station
Percolation Tank
Check Dam

9.2BHOKAR BLOCK, NANDED DISTRICT

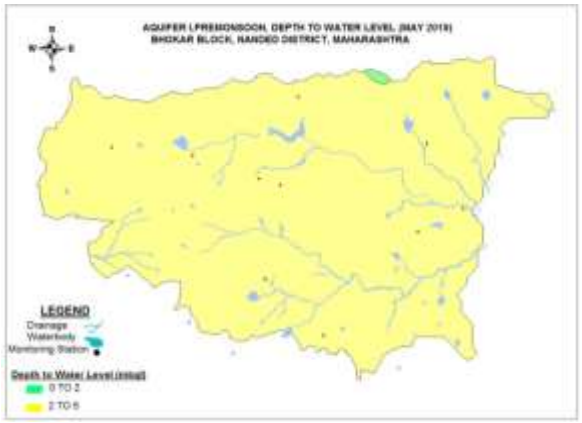
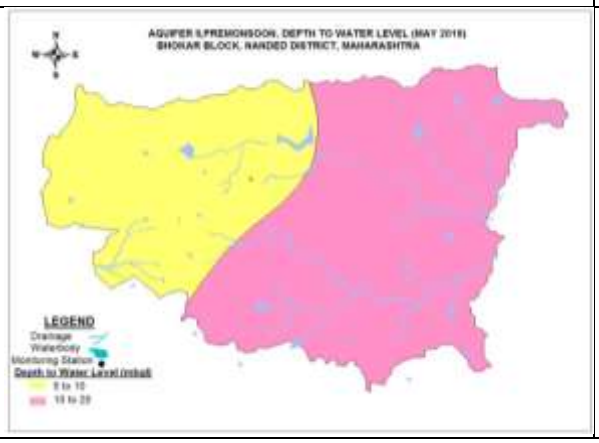
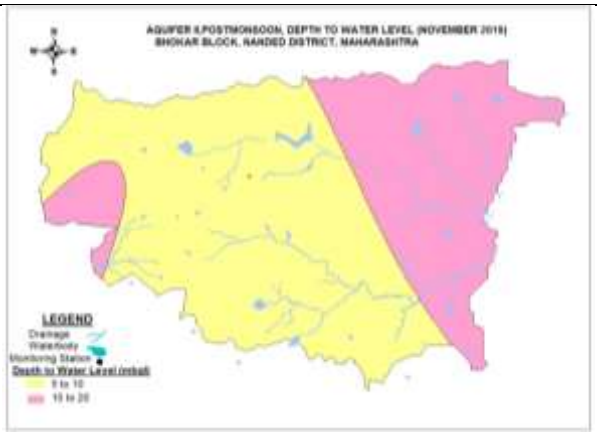
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Bhokar
Geographical Area (Sq. Km.)	682.04 Sq. Km.
Hilly Area (Sq. Km)	51.78
Poor Quality Area (Sq. Km.)	-
Population (2011)	1,05,414
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	1008.1 mm
Annual Rainfall (2019)	1040.8 mm
Decadal Average Annual Rainfall (2010-19)	890.58 mm
Long Term Rainfall Analysis (1971-2019)	Falling Trend: -4.215 mm/year. Probability of Normal/Excess Rainfall-50% &21%. Probability of Drought (Moderate/Severe / Acute)-: 23% Moderate & 6% Severe. Frequency of Drought: 1 in 3 years

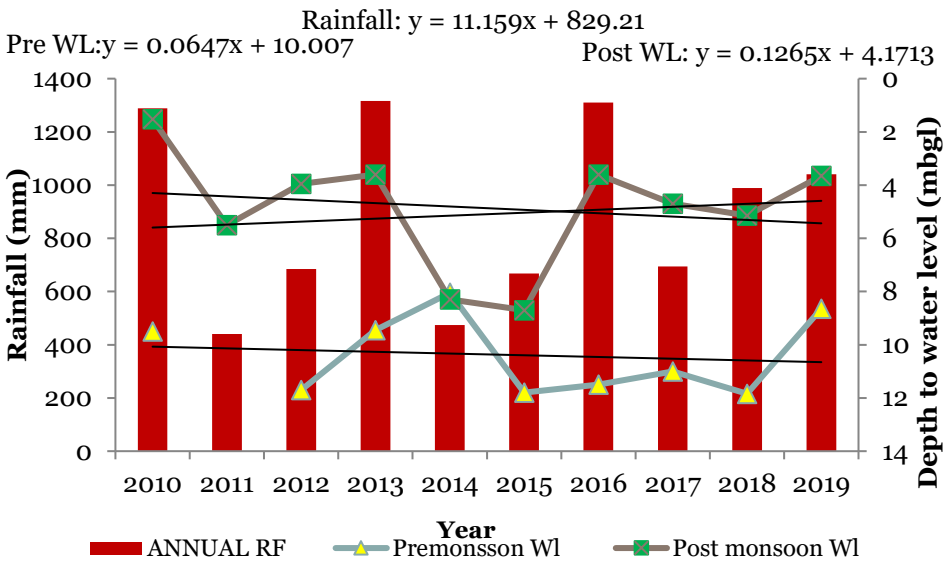
RAINFALL TREND ANALYSIS (1998 to 2017)



1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Escarment Slope (ES) ➢ Plateau Highly Dissected (PLH) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering
Soil	➢ Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands with moderate erosion; ➢ Very shallow, somewhat excessively drained, loamy

	soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity ➢ Moderately deep, moderately well drained, fine, moderately calcareous soils on gently'sloping summits/spurs with moderate erosion		
Geology	Deccan Trap-Sahyadri Group & Intertrappeans		
1.4. Hydrology & Drainage			
Drainage	NIL		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha) *(Reference Year: 2012-13)*	01 Medium project Net irrigated area under the project:3.59 sq km	
	Minor Irrigation Projects (0 to 250 Ha) *(Reference Year: 2017-18)*	No. of projects completed till March 2017	40
		No. of projects operating till end	39
		Command area of the operating project (Sq. Km.)	50.99
		Net irrigated area under Operating project (Sq. Km.)	22.78
1.5. LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	682.04 Sq. Km.		
Forest Area	120.04 Sq. Km.		
Cultivable Area	472.5 Sq. Km.		
Net Sown Area	460.63 Sq. Km.		
Double Cropped Area	80.54 Sq. Km.		
Area under Irrigation – Surface Water	2.73 Sq. Km		
Area under Irrigation – Ground Water	10.63 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Cereals	65.57	
	Pulses	93.62	
	cotton	262.70	
	Oil Seeds	105.73	
Horticultural Crops	Sugarcane	7.47	
	Others	7.26	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**		

➢ Shallow water Level between 5 mbgl and 10 mbgl is observed in very small isolated patch in 1.34 sq km area ➢ All the remaining area of 648.27 sq km area has depth to water level between 10 mbgl and 20 mbgl.	➢ Shallow water Level less than 5 mbgl is observed in 3.67 Sq Km area in a very small isolated patch ➢ In about 114.4 Sq Km area, depth to water level between 5 mbgl and 10 mbgl is observed ➢ About 531.98 Sq Km area occupying the major parts of the block has depth to water level between 10 mbgl and 20 mbgl.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
➢ The depth to water Level between 5 mbgl and 10 mbgl is observed only in 242.4 Sq Km area in the western part of the block. ➢ In about 407.9 Sq Km area, the depth to water level in the range of 10 mbgl and 20 mbgl is observed.	➢ The depth to water Level between 5 mbgl and 10 mbgl is observed only in 412.4 Sq Km area in the central, southern and eastern parts of the block. ➢ In about 239.17 Sq Km area, the depth to water level in the range of 10 mbgl and 20 mbgl is observed.
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (November 2019)**
	
1.7. Hydrograph	

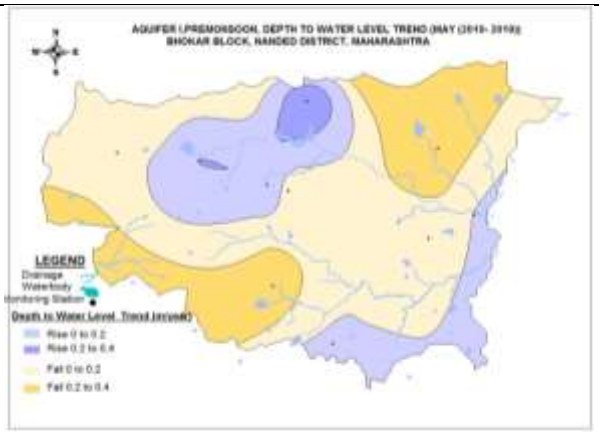


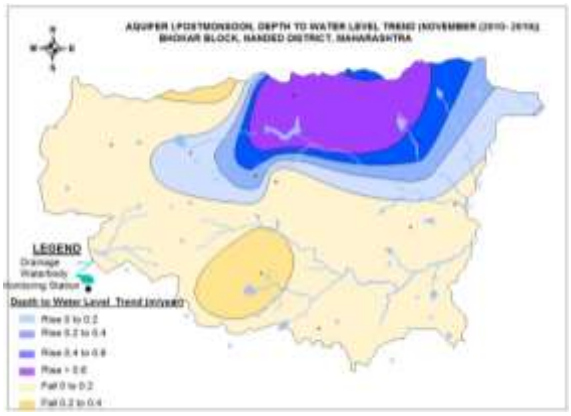
The hydrograph of CGWB Monitoring site at Nagapur for the period 2010 to 2019 shows:

- A rising trend during both pre-monsoon and postmonsoon @ 0.0647 m/year and 0.1265 m/year respectively
- The depth to water level during premonsoon ranges from 8.05 mbgl to 11.84 mbgl with deeper depths to water level during 2012, 2015 and 2018 respectively @ 11.7 mbgl, 11.8 mbgl and 11.84 mbgl
- The depth to water level during postmonsoon ranges from 1.52 mbgl to 8.7 mbgl during postmonsoon due to increase in rainfall trend @ 11.159 mm/year.
- A rising trend @11.19mm/year is also observed during the period 2010 to 2019.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 97.87 Sq Km area and 0.2 to 0.4 m/year in 150.44 Sq Km area.	0.00 to 0.2 m/year in 327 Sq Km area and 0.2 to 0.4 m/year in 154.38 Sq Km area,	0 to 0.2 m/year in 76.42 Sq Km area, @ 0.2 to 0.4 m/year in 40.32 Sq Km area, 0.4 to 0.6 m/year in 38.11 Sq Km area, 0.6 to 0.8 m/year in 35.99 Sq Km area and more than 0.8 m/year in 44.40 Sq Km area.	0 to 0.2 m/year in 415 Sq Km area,
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

1) **Low Development: -**Low Development of 30.89 % of Stage of Ground Water Development is observed in the block

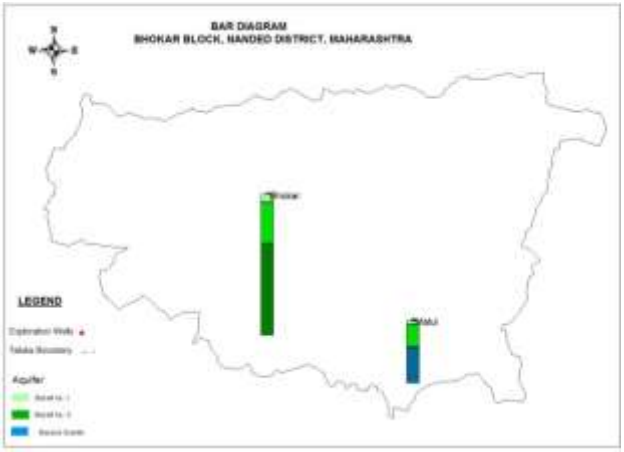
2) **Low Yielding Aquifers**: The yield of the aquifer in major parts of the block is less than 2 lps. This is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

3) **Declining Water Level Trend:-** About 415 Sq Km area show declining water level trend during both the seasons over the decade.

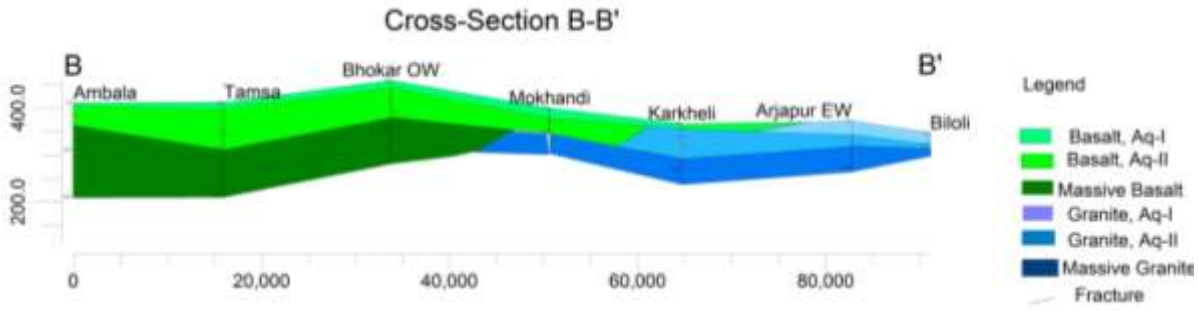
3. AQUIFER DISPOSITION

3.1 Number of Aquifers (Major)	One: Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined /confined)
Depth of Occurrence (mbgl)of bottom of aquifer	10 to 16	30 to 90
Granular/Weathered/ Fractured rocks thickness (m)	8 to 12	2 to 20
Yield Potential	15 to 100 m3/day	0.2 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00074
Transmissivity (T)	-	126 to 156.46 m^2/day

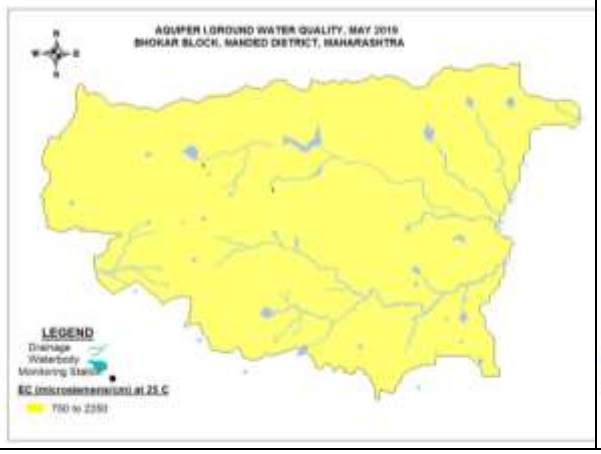
4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ All the block has EC between 750 and 2250 microsiemens/cm	➢ Since the block has EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The SAR values of the analysed samples in the block are well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples except at 1 site (Bhokar), have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ All the analysed samples have % Na between 20 and 40 indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes.

4.1 Aquifer II/ Deeper Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 266.7 Sq Km area of the block has	➢ In 266.7 Sq Km area, plants with moderate salt tolerance can be grown. However, in 383.3 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be

EC well within the potable range of 250 to 750 microsiemens/cmwhereas 383.3 sq Km area has EC between 750 and 2250 microsiemens/cm..	required and plants with good salt tolerance should be selected. ➢ The SAR value of the analysed sample in the block is well within 0 to 10 types and is therefore good for irrigation. ➢ The RSC values of the analysed sample has value < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ The analysed sample have %Na between 20 and 40 indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes.
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I) 	**Semiconfined/Confined Aquifer (Aquifer II &III)** 
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt & Alluvium)	
Ground Water Recharge Worthy Area (Sq. Km.)	281.76
Total Annual Ground Water Recharge (MCM)	74.70
Natural Discharge (MCM)	3.73
Net Annual Ground Water Availability (MCM)	70.96
Existing Gross Ground Water Draft for irrigation (MCM)	20.90
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	1.02
Existing Gross Ground Water Draft for All uses(MCM)	21.92
Net Ground Water Availability for future irrigation development(MCM)	47.09
Provision for domestic and industrial requirement supply to 2025(MCM)	2.99
Stage of Ground Water Development %	30.89
Category	**SAFE**

Aquifer-II							
Semiconfined/Confined Aquifer (Basalt)							
Resources above the confining layer				**Resources within the confining layer**			
Total Area (Sq. Km.)	**Peizometer (macl)**	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	Sy	Resources within the confining layer (MCM)
682.04	37.3	0.00074	9.66	682.04	4.0	0.002	13.64

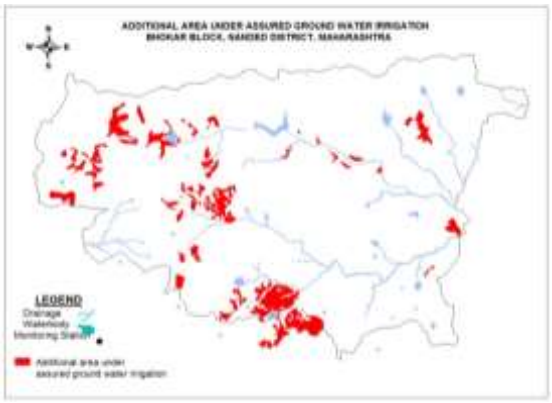
5.0. GROUND WATER RESOURCE ENHANCEMENT			
Available Resource (MCM)	70.96		
Gross Annual Draft (MCM)	21.92		
5.1.SUPPLY SIDE MANAGEMENT			
SUPPLY (MCM)			
Agricultural Supply -GW	20.90		
Agricultural Supply -SW	2.73		
Domestic Supply - GW	1.02		
Domestic Supply - SW	0.20		
Total Supply	**24.85**		
Area of Block (Sq. Km.)	682.04		
Area suitable for Artificial recharge (Sq. Km)	630.26		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	480.93	0	
Volume of Unsaturated Zone (MCM)	961.86	0	
Average Specific Yield	0.020	0.070	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	19.24	0	
Surplus water Available (MCM)	10.77	0	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	28	81	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.2	1.8225	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for	Nil		

harvesting	
Additional volume created by desilting	**Nil**
RTRWH Structures – Urban Areas	
Households to be covered (25% with 50 m^2area)	5328
Total RWH potential (MCM)	0.237
Rainwater harvested / recharged @ 80% runoff co-efficient	0.190 (**Economically not viable & Not Recommended)**
5.2. DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	**Nil**
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	**Nil**
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	70.96
Additional GW resources available after Supply side interventions (MCM)	6.0225
Ground Water Availability after Supply side intervention	76.9825
Existing Ground Water Draft for All Purposes (MCM)	21.92
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	21.92
Present stage of Ground Water Development (%)	30.9
Expected Stage of Ground Water Development after interventions (%)	28.5
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4. RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 54.01% to 70%	
5.5. DEVELOPMENT PLAN	

Volume of water available for GWD to 70% (MCM)	31.96
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1918
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	320
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	49

Proposed Artificial Recharge Structure

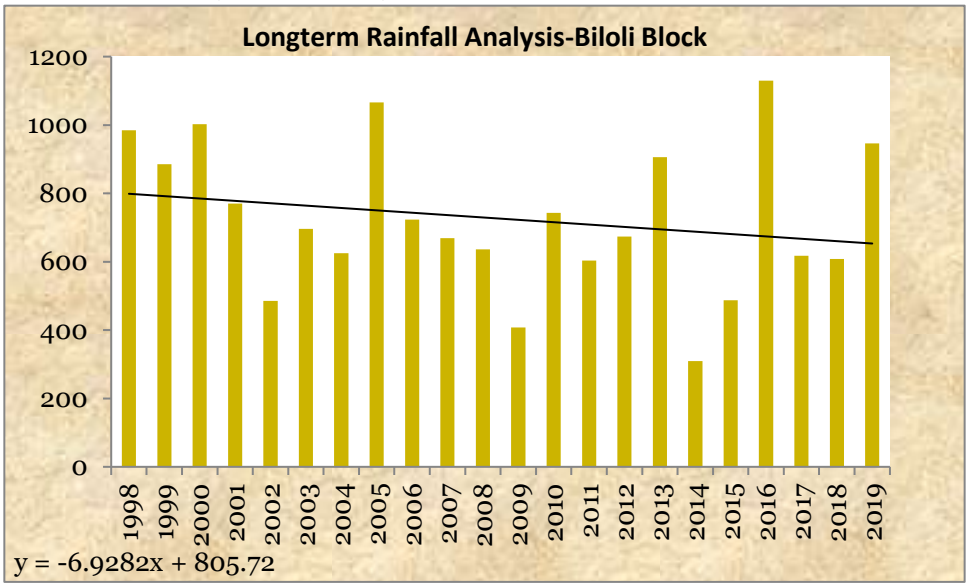
Additional Area proposed to be brought under Assured Ground Water Irrigation



9.3 BILOLI BLOCK, NANDED DISTRICT

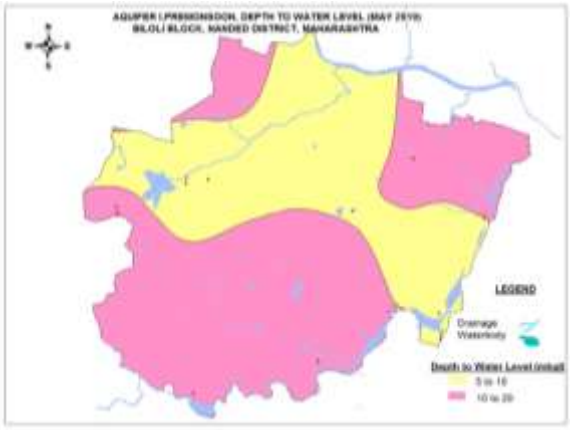
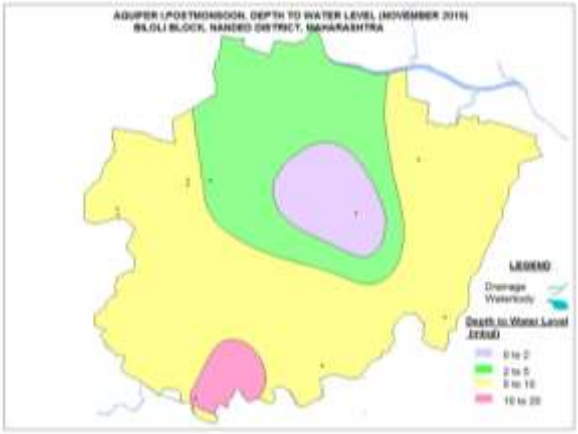
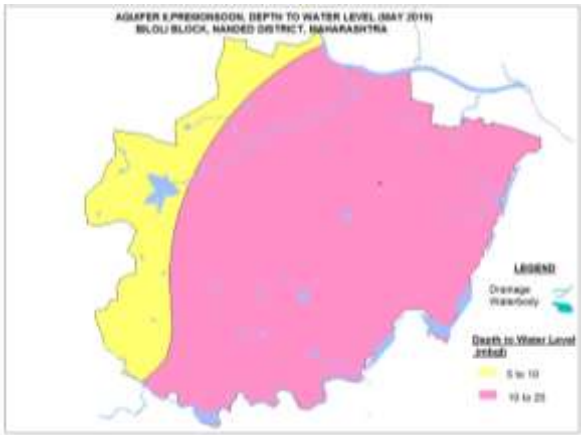
3. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Biloli
Geographical Area (Sq. Km.)	599.03Sq. Km.
Hilly Area (Sq. Km)	18.66 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	140476
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	726.04 mm
Annual Rainfall (2019)	945.9 mm
Decadal Average Annual Rainfall (2010-19)	702.33 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend: -6.92 mm/year. Probability of Normal/Excess Rainfall-54% & 27%. Probability of Drought (Moderate/Severe/Acute)-: 14% Moderate & 5% Severe Frequency of occurrence of drought: 1 in 5 years

RAINFALL TREND ANALYSIS (1998 to 2019)



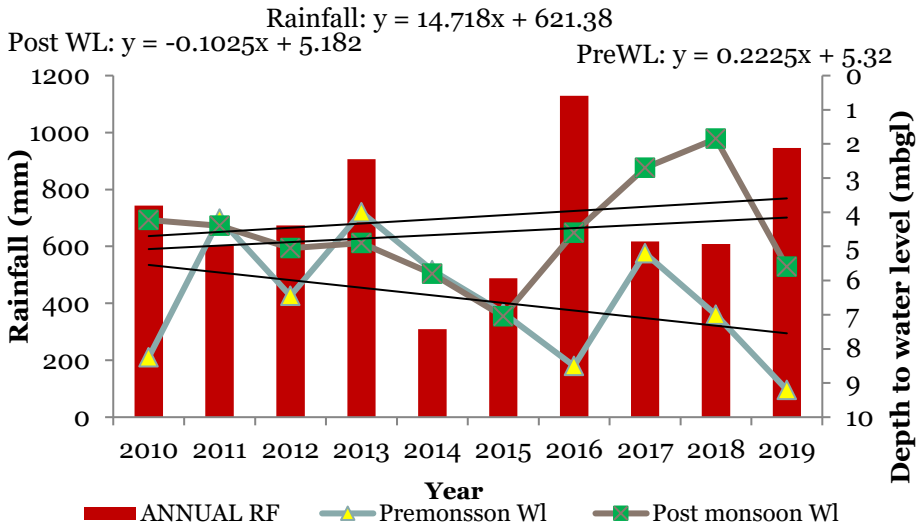
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Pediment (PD) ➢ Butte (B) ➢ Escarment Slope (ES) ➢ Pediplain Moderate (PPM), 2-5m weathering ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering

Soil	➢ Very shallow, somewhat excessively drained, loamy soils on moderately sloping summits/spurs with severe erosion ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene) & Gneiss-Granitoid / Migmatite Complex (Archean age)		
1.4. Hydrology & Drainage			
Drainage	Godavari River and its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha) *(Reference Year: 2012-13)*	Nil	
	Minor Irrigation Projects (0 to 250 Ha) *(Reference Year: 2017-18)*	No. of projects completed till March 2017	61
		No. of projects operating till end	60
		Command area of the operating project (Sq. Km.)	22.88
		Net irrigated area under Operating project (Sq. Km.)	9.64
1.5. LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	599.03Sq. Km.		
Forest Area	20.12 Sq. Km.		
Cultivable Area	579 Sq. Km.		
Net Sown Area	469.89 Sq. Km		
Double Cropped Area	259.38 Sq. Km.		
Area under Irrigation – Surface Water	Nil		
Area under Irrigation – Ground Water	10.46 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Cereals	79.52	
	Pulses	299.64	
	Cotton	75.63	
	Oil Seeds	269.41	
Horticultural Crops	Sugarcane	0.17	
	Others	2.32	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**		

➢ Depth to water Level between 5 mbgl and 10 mbgl is observed in 249.9 Sq Km area in the north-central, northwestern and northeastern parts of the taluka. ➢ About 332 Sq. Km area of the remaining parts of the block has depth to water level in the range of 10 to 20 mbgl.	➢ Shallow water Level less than 2 mbgl is observed in 47.13 Sq Km area in small patch in the block. ➢ In 159.51 Sq Km area of the block covering north-central parts, has depth to water level between 2 mbgl and 5 mbgl. ➢ About, 138.2 Sq Km area along southern, eastern and north-eastern parts has depth to water level between 5 mbgl and 10 mbgl. ➢ Deeper depths to water level between 10 mbgl and 20 mbgl is observed in the south-central part of the district in small patch.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2017)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (November 2019)**
➢ The depth to water level between 5 mbgl and 10 mbgl is observed in 109.3 Sq Km area along the western and north-westernpart of the block	➢ The shallow depth to water level less than 5 mbgl is observed in 94.11 Sq Km area of the block along the eastern boundary of the block.

➢ The deeper depth to water level between 10 mgl and 20 mbgl is observed in about 459.9 Sq Km area in the remaining parts of the block.	➢ The depth to water level between 5 mbgl and 10 mbgl is observed in 372.8 Sq Km area in the major parts of the block. ➢ The depth to water level between 10 mbgl and 20 mbgl is observed in about 100.6 Sq Km area in the western sideof the block.

1.7. Hydrograph

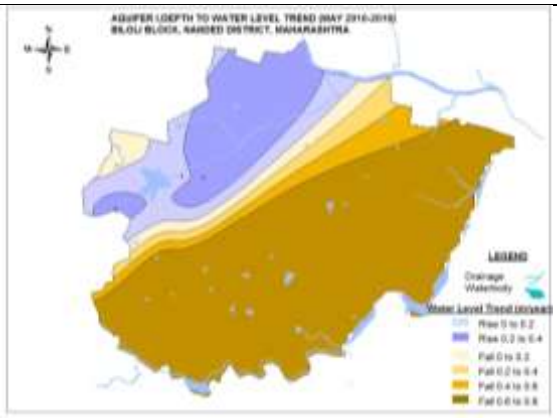


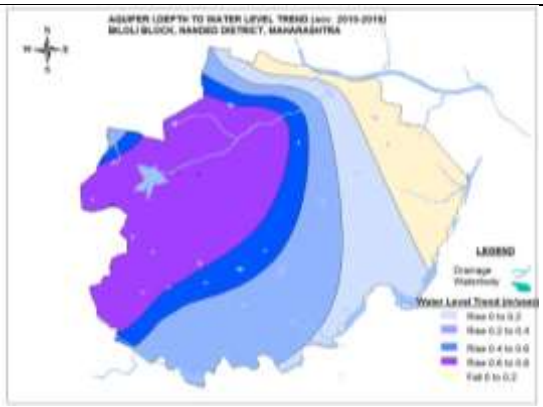
The hydrograph of CGWB Monitoring site at Narsi for the period 2010 to 2019 shows:

- A rising trend @ 0.2225 m/year during premonsoon and a fallling trend @ 0.1025 m/year during postmonsoon.
- The depth to water level during premonsoon ranges from 4.00 mbgl to 9.2 mbgl.
- The depth to water level during postmonsoon ranges from 1.85 mbgl to 7.05 mbgl during postmonsoon due to increase in rainfall trend @ 14.718 mm/year.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0 to 0.2 m/year in 56.42 Sq Km area and @ 0.2 to 0.4 m/year in 79.33 Sq Km area.	0.02 to 0.20 m/year in 30.09 Sq Km area , 0.2 to 0.4 m/year in 25.26 Sq Km area, 0.4 to 0.6 m/year in 31.74 Sq Km area and 0.6 to 0.8 m/year in 338.4 Sq Km area.	0 to 0.2 m/year in 92.74 Sq Km area and 0.2 to 0.4 m/year in 139.3 Sq Km area, 0.4 to 0.6 m/year in 64.19 Sq Km area, 0.6 to 0.8 m/year in 46 Sq Km area and >0.8 m/year in 133.9 Sq Km area	0 to 0.2 m/year in 88.97 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

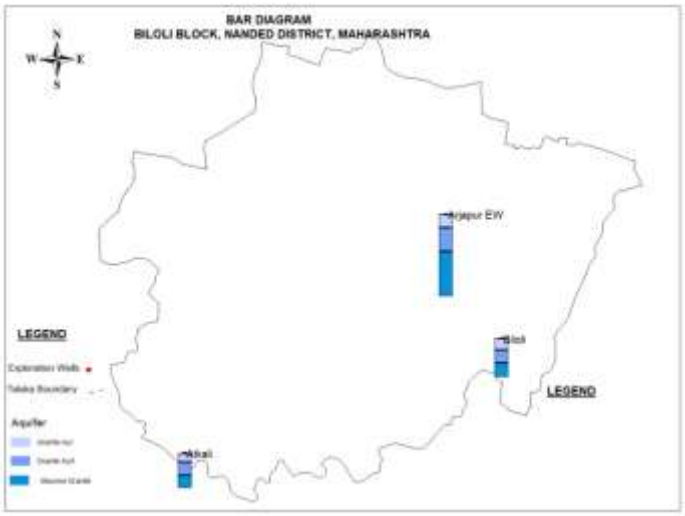
1) **Declining Water Level Trend: -** The decline in water level trendupto more than 0.6 m/year is observed in major section of the block during both the seasons. This is due to the exploitation of shallow aquifers as for the dependency in ground water for irrigation during both Kharif and Rabi season due to lack of availability of surface water.
2) **Low ground water yield Potential of the aquifers:**The ground water yield potentiality of the aquifers ranges from 0 to 1lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

3) **Declining Rainfall Trend and Drought:** The longterm rainfall analysis(1998 to 2019) indicates a declining trend @6.92 mm/year with the probability of occurance of moderate drought in 14% of the years and severe drought in 5% of the years and the frequency of occurance of drought being 1 in 5 years.

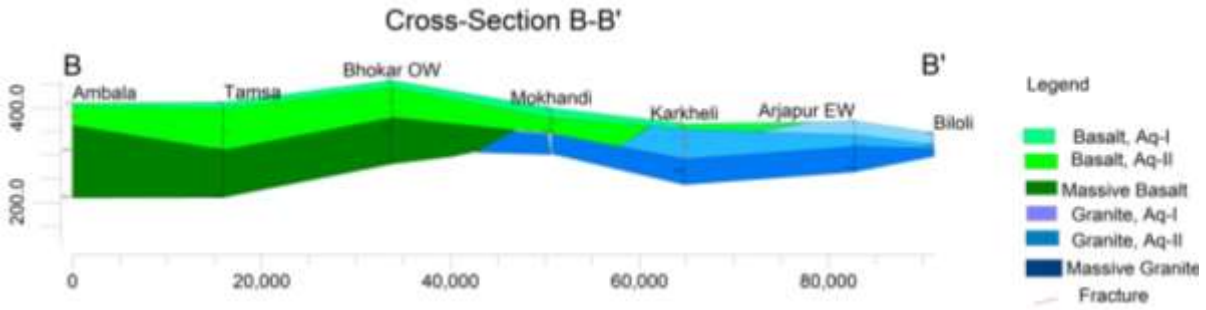
4) **Deteriorated quality of Ground Water:** The presence of Fluoride was observed in Bioili village making it unsuitable for both drinking and irrigation purposes.

3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two: Basalt –Aquifer-I, Aquifer-II Granite-Aquifer-I, Aquifer-II
3.2. LITHOLOGICAL DISPOSITION	



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS

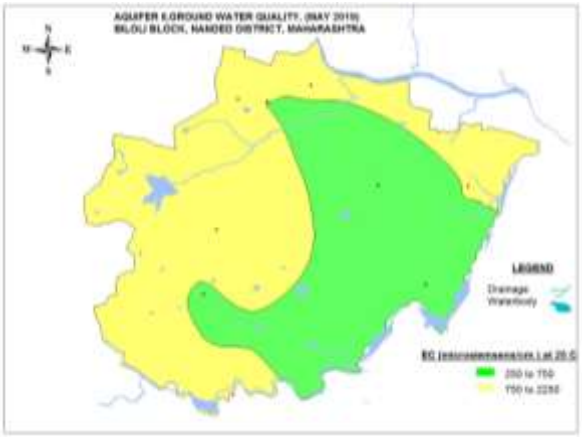
Major Aquifer	Basalt (Deccan Traps)		Granite	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined/confined)
Depth of Occurrence (mbgl)	9 to 17	28 to 68	8 to 16	28 to 88
Granular/Weathered/ Fractured rocks thickness (m)	5 to 14	2 to 10	7 to 13	2 to 12
Yield Potential	0 to 100 m3/day	0 to 0.4 lps	0 to 100 m3/day	0 to 2.5 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00035	0.02	0.00079
Transmissivity (T)	-	126 to 56.46 m^2/day	-	84.08 to 104 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Flouride infested Biloli village. ➢ All the block has EC between 750 and 2250 microsiemens/cm	➢ Since the block has EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The SAR values of the analysed samples

	in the block are well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples except at 1 site (Bhokar), have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ About 33% of analysed samples have % Na less than 20, 67% have %Na between 20 and 40 indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/ Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic purposes except in Nitrate affected villages namely Biloli, Atklai, Arjapur, Pachpimpli, Torna, Dugaon villages. ➢ About 241.8 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm whereas 324.3 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In 241.8 Sq Km area of the block with medium salinity water, the 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. However, in 324.3 Sq Km area where EC >750 micro siemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The SAR value for all the analysed samples in the block are well within 0 to 10 types and are therefore good for irrigation. ➢ Most of the analysed samples have RSC values > 1.25 meq/l indicating that the ground is not good for irrigation. ➢ About 50% have %Na between 40 and 60and 50% have %Na more than 60. Indicating that the ground water is suitable for irrigation purposes except in areas where %Na is more than 60.
3.2.CHEMICAL QUALITY MAP	

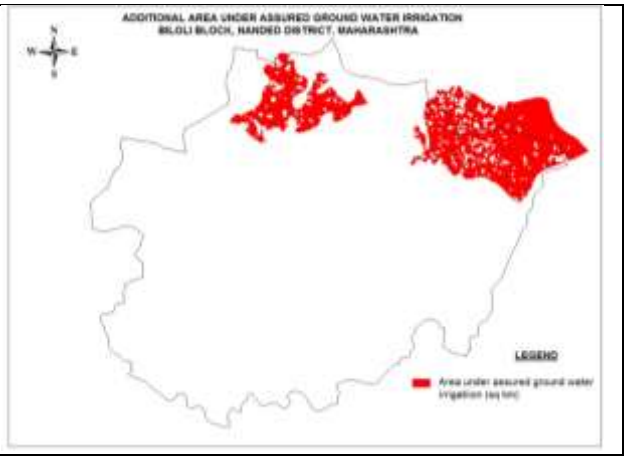
Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II &III)
	

5. GROUND WATER RESOURCE & EXTRACTION							
Aquifer-I/ Phreatic Aquifer (Basalt & Alluvium)							
Ground Water Recharge Worthy Area (Sq. Km.)	580.37						
Total Annual Ground Water Recharge (MCM)	61.32						
Natural Discharge (MCM)	3.06						
Net Annual Ground Water Availability (MCM)	58.25						
Existing Gross Ground Water Draft for irrigation (MCM)	11.26						
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	2.16						
Existing Gross Ground Water Draft for All uses(MCM)	13.43						
Net Ground Water Availability for future irrigation development(MCM)	43.63						
Provision for domestic and industrial requirement supply to 2025(MCM)	5.36						
Stage of Ground Water Development %	23.06						
Category	**SAFE**						
Aquifer-II							
Semiconfined/Confined Aquifer (Basalt)							
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)
599.09	4.6	0.00035	0.96	599.09	8	0.00035	1.677
5.0. GROUND WATER RESOURCE ENHANCEMENT							
Available Resource (MCM)	58.25						
Gross Annual Draft (MCM)	13.43						
5.1.SUPPLY SIDE MANAGEMENT							
SUPPLY (MCM)							
Agricultural Supply -GW	11.26						
Agricultural Supply -SW	0.00						

Domestic Supply - GW	2.16		
Domestic Supply - SW	0.43		
Total Supply	**13.85**		
Area of Block (Sq. Km.)	599.03		
Area suitable for Artificial recharge (Sq. Km)	580.37		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	524.47	-	
Volume of Unsaturated Zone (MCM)	1048.944	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	20.98	-	
Surplus water Available (MCM)	11.75	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	31	88	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.65	1.98	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	7270		
Total RWH potential (MCM)	0.255		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.204 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	**Nil**		

Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop (ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	58.25
Additional GW resources available after Supply side interventions (MCM)	6.63
Ground Water Availability after Supply side intervention	64.88
Existing Ground Water Draft for All Purposes (MCM)	13.43
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	13.43
Present stage of Ground Water Development (%)	23.1
Expected Stage of Ground Water Development after interventions (%)	20.7
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 44.43% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available for GWD to 70% (MCM)	31.986
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1919
Proposed Number of BW(@ 1 ham for 10% of GWR Available)	320
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	49
Proposed Artificial Recharge Structure	**Addditional Area proposed to be brought under assured ground water irrigation**

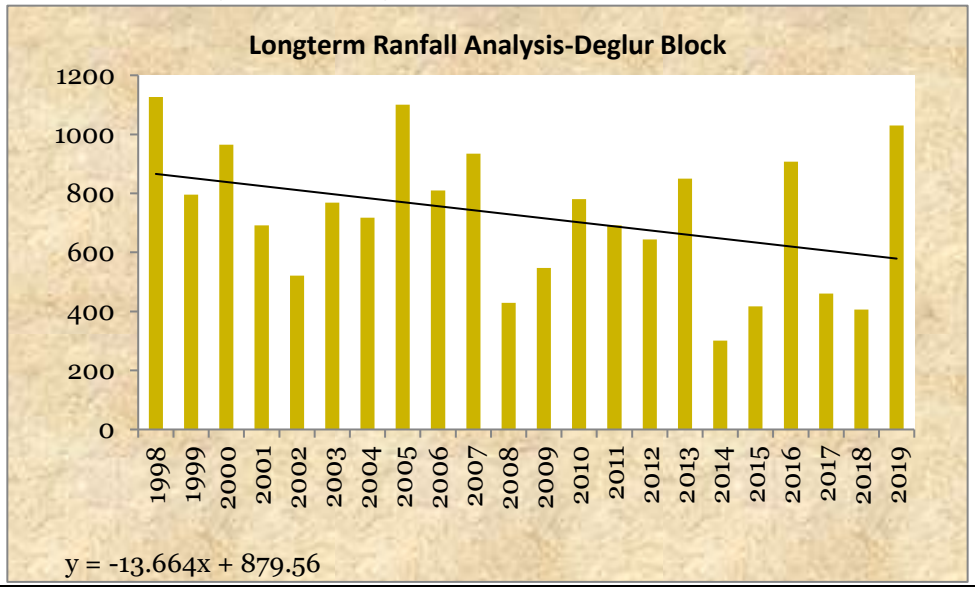

ARTIFICIAL RECHARGE STRUCTURES
BILOLI BLOCK, NANDED DISTRICT, MAHARASHTRA
N
W
E
S
LEGEND
Percolation Tank
Check Dam


ADDITIONAL AREA UNDER ASSURED GROUND WATER IRRIGATION
BILOLI BLOCK, NANDED DISTRICT, MAHARASHTRA
N
W
E
S
LEGEND

9.4DEGLUR BLOCK, NANDED DISTRICT

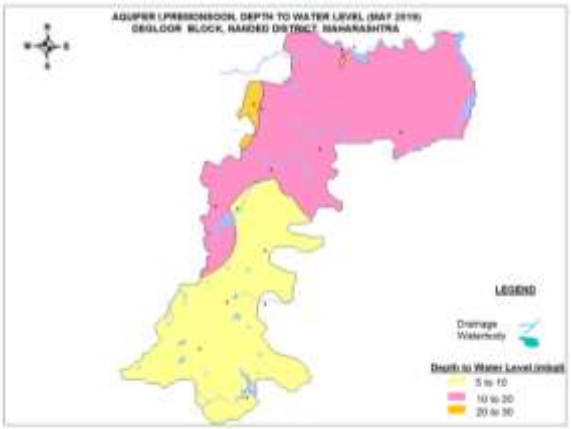
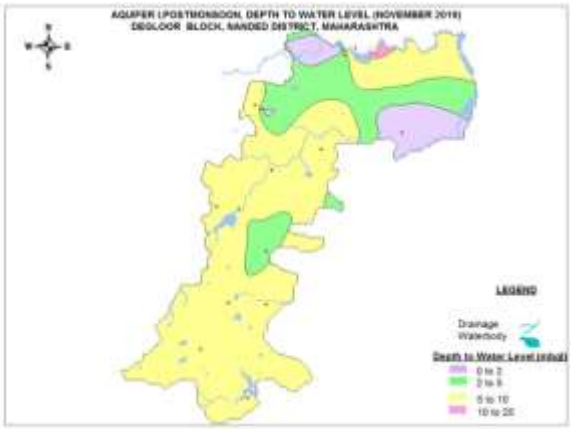
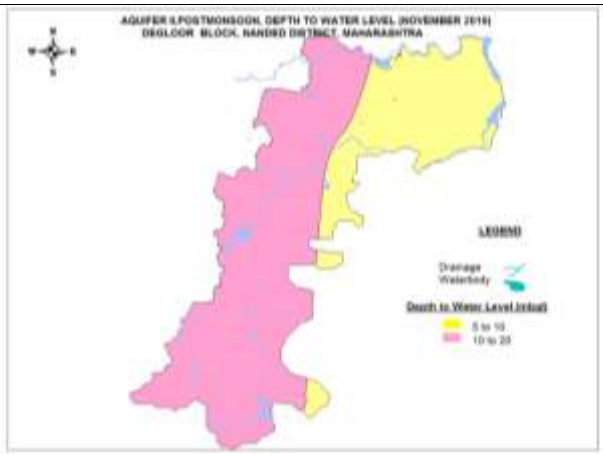
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Deglur
Geographical Area (Sq. Km.)	684.20 Sq. Km.
Hilly Area (Sq. Km)	18.30 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	173369
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	722.42 mm
Annual Rainfall (2019)	1029.5 mm
Decadal Average Annual Rainfall (2010-19)	648.81 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend:-13.66 m/year. Probability of Normal/Excess Rainfall:-45% & 27%. Probability of Drought (Moderate/Severe / Acute):- 23% Moderate & 5% Severe Frequency of occurrence of Drought:- 1 in 4 Years

RAINFALL TREND ANALYSIS (1998 to 2019)



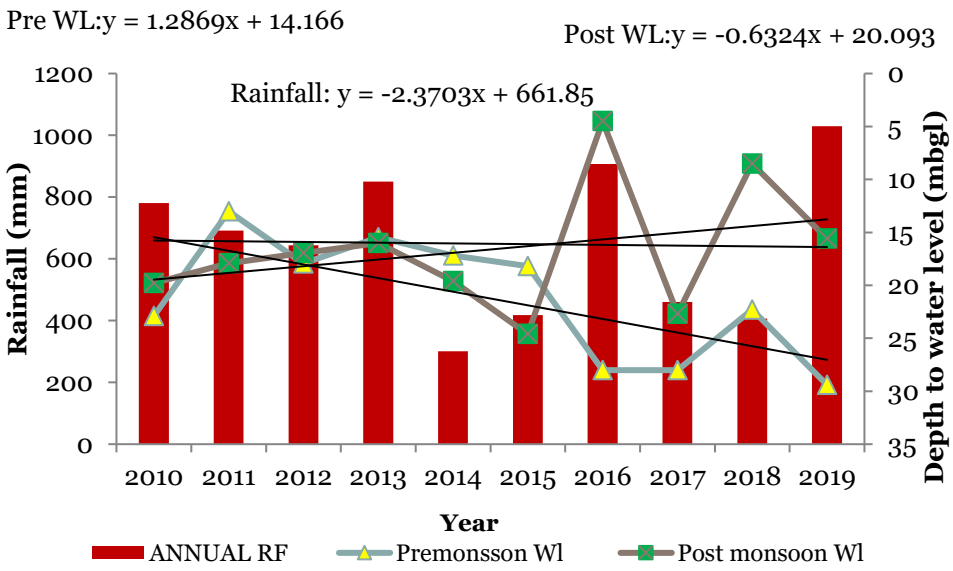
1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	➢ Butte (B) ➢ Pediplain Under Canal Command (PPC) ➢ Pediplain Moderate (PPM), 2-5m weathering ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered-Canal Command (PLC)

Soil		➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping undulating lands with mesas and buttes with moderate erosion ➢ Very shallow, well drained, loamy soils on gently sloping rolling lands with mesas and buttes with moderate erosion and moderate stoniness. ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion		
Geology		Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene) & Gneiss-Granitoid / Migmatite Complex (Archean)		
1.4. Hydrology & Drainage				
Drainage		The Landi river and its tributaries		
Hydrology (as on March 2017)		Major & Medium Irrigation Projects (>250 Ha)	Nil	
		Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	73
			No. of projects operating till end	73
			Command area of the operating project (Sq. Km.)	48.09
			Net irrigated area under Operating project (Sq. Km.)	22.54
1.5. LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN				
Geographical Area		684.20 Sq. Km.		
Forest Area		5.73 Sq. Km.		
Cultivable Area		668.50 Sq. Km.		
Net Sown Area		514.35 Km.		
Double Cropped Area		170.75 Sq. Km.		
Area under Irrigation	Surface Water	0		
	Ground Water	18.89 sq. km.		
Principal Crops		**Crop Type**	**Area (Sq. Km.)**	
		Pulses	289.62	
		Cotton	90.91	
		Cereals	54.63	
		Oil Seeds	196.50	
Horticultural Crops		Sugarcane	0.20	
		Others	5.52	
1.6.WATER LEVEL BEHAVIOUR				
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)				
Pre-Monsoon (May-2019)		**Post-Monsoon (November-2019)**		

❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 293.14 Sq Km area in the southern parts of the block. ❖ Depth to water level between 20 mbgl and 30 mbgl observed in northern parts of the block ❖ Isolated patches of 3.14 Sq Km area show depth to water level more than 30 mbgl in the northeastern part of the block.	❖ Shallow Depth to water level between 2 mbgl and 5 mbgl is observed in 57 Sq Km area in the northeastern and north-western parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 140.79 Sq Km area in the north-central and central parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in the major parts of the block. ❖ Isolated patch of 2.53 Sq Km area show depth to water level more than 20 mbgl
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2017)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ The depth to water level between 10 mbgl and 20 mbgl is observed in 409.6 Sq Km area in the major parts of the block. ❖ The deeper depth to water level between 20 mbgl and 30 mbgl is	❖ The depth to water level between 10 mbgl and 20 mbgl is observed in 208.96 Sq Km area in the north-eastern parts of the block. ❖ The deeper depth to water level between 20 mbgl and 30 mbgl is observed in 441.5

observed in 242 Sq Km area in the southern parts of the block.	Sq Km area in the major parts of the block.

1.7. Hydrograph



The hydrograph of CGWB Monitoring site at Atkali_Pz village for the period 2010 to 2019 shows:

- A rising trend during premonsoon @ 1.28 m/year and falling trend during postmonsoon @ 0.632 m/year
- Thedepth to water level during premonsoon ranges from 13.01 mbgl to 29.4 mbgl
- The depth to water level ranges from 4.5 to 24.6 mbgl during postmonsoon due tofalling rainfall trend @2.37 mm/year.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.00 to 0.2m/year in 18.87 Sq Km area, 0.2 to 0.4 m/year in 31 sq km area and 0.4 to 0.6 sq km area in 283.9 sq km area.	0.0 to 0.2 m/year in 14.16 Sq Km area, 0.2 to 0.4 m/year in 13.37Sq Km area; 0.4 to 0.6 m/year in 10.56 sq Km area and 0.6 to 0.8 sq km area in 276.7 sq km area	0 to 0.2 m/year in 96.46 Sq Km area, 0.2 to 0.4 m/year in 101.5 sq km area, 0.4 to 0.6 m/year In 94.18 sq km area; 0.6 to 0.8 m/year in 129.8 sq km area and >0.8 m/year in 165.2 sq km area	0.0 to 0.2 m/year in 7.21 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	

2. GROUND WATER ISSUES

1. **Low Development:-**Low Development of 36.79 % of Stage of Ground Water Development is observed in the block

2. **Declining Water Level Trend: -**
   The decline in water level trend (2010-19) more than 0.6 m/year is observed in major section of the block during Pre-season. This is due to the exploitation of shallow aquifers as for the

dependency in ground water for irrigation during both Kharif and Rabi season due to lack of availability of surface water.

3. **Low ground water yield Potential of the aquifers:**

The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

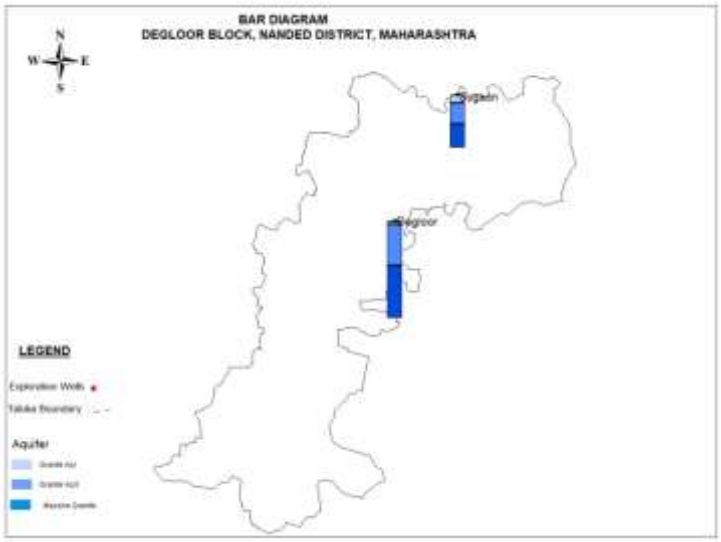
4. **Declining Rainfall Trend and Drought:** The longterm rainfall analysis(1998 to 2019) indicates a declining trend @13.66 mm/year with the probability of occurance of moderate drought in 23% of the years and severe drought in 5% of the years and the frequency of occurance of drought being 1 in 4 years.

5. **Deteriorated quality of Ground Water**: The presence of Nitrate was observed in both the aquifers in some sites making it unsuitable for both drinking and irrigation purposes in those areas.

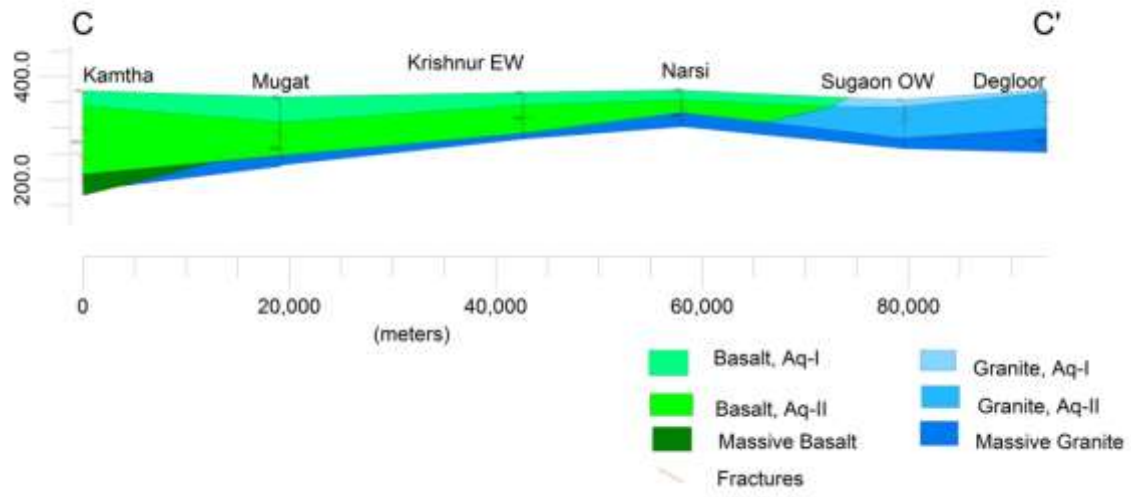
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two: Basalt –Aquifer-I, Aquifer-II Granite-Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



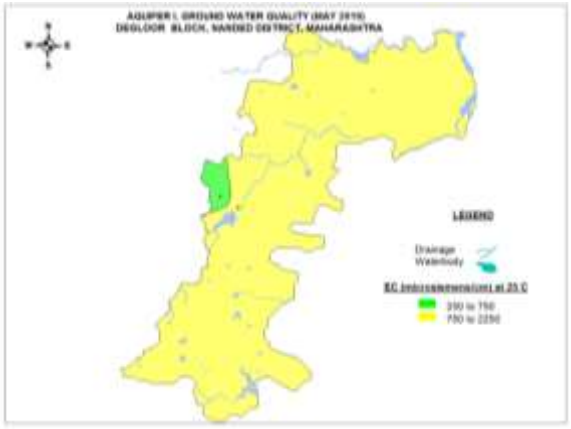
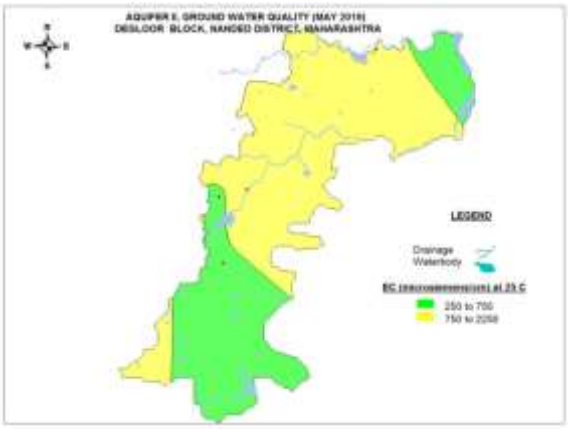
3.4 AQUIFER CHARACTERISTICS

Major Aquifer	Basalt (Deccan Traps)/Granite		Granite	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth tobottom of aquifer (mbgl)	10 to 16	28 to 108	8 to 17	28 to 108
Weathered/ Fractured rocks thickness (m)	7 to 12.8	2 to 6	5 to 14	2 to 6
Yield Potential	15 to 100 m3/day	0 to 1.25 lps	0 to 100 m3/day	0 to 2.5 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00065	0.02	0.011 to 0.19
Transmissivity (T)	-	212-209.5 m^2/day	-	143.25 to 209.5 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected areas. ➢ About 13 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm whereas 636.6 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In 13.8 sq km area of the block, plants with moderate salt tolerance can be grown. However, in 636.6 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l except in ine site (Umri) indicating that the ground water is

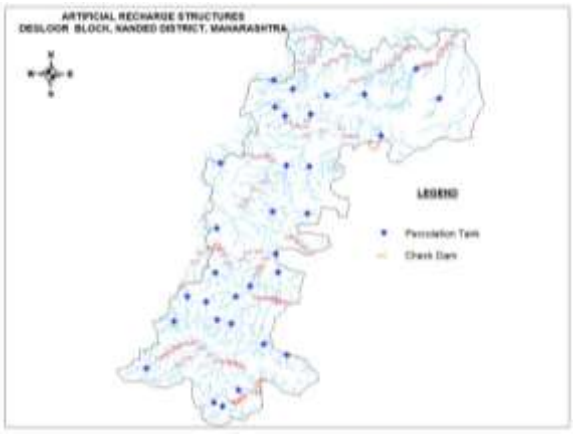
	good for irrigation. ➢ All the analysed samples have %Na between 20 and 40 indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Sangvi village ➢ About 242.45 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm whereas 404.7 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In 242.5 Sq Km area, plants with moderate salt tolerance can be grown. However, in 404.7 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all theanalysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ The analyzed sample has %Na value between 40 and 60 indicating that the ground water is good for irrigation.
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt & Alluvium)	
Ground Water Recharge Worthy Area (Sq. Km.)	665.9
Total Annual Ground Water Recharge (MCM)	67.48
Natural Discharge (MCM)	3.37
Net Annual Ground Water Availability (MCM)	64.11
Existing Gross Ground Water Draft for irrigation (MCM)	18.45
Existing Gross Ground Water Draft for domestic	5.76

and industrial water supply(MCM)							
Existing Gross Ground Water Draft for All uses(MCM)				23.58			
Net Ground Water Availability for future irrigation development(MCM)				31.39			
Provision for domestic and industrial requirement supply to 2025(MCM)				14.27			
Stage of Ground Water Development %				36.79			
Category				**SAFE**			
Aquifer-II							
Semiconfined/Confined Aquifer (Basalt)							
Resources above the confining layer				**Resources within the confining layer**			
Total Area (Sq. Km.)	**Peizometer (macl)**	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	Sy	Resources within the confining layer (MCM)
684.2	45.1	0.00065	20.08	684.2	4.000	0.002	5.47
5.0. GROUND WATER RESOURCE ENHANCEMENT							
Available Resource (MCM)			64.11				
Gross Annual Draft (MCM)			23.58				
5.1.SUPPLY SIDE MANAGEMENT							
SUPPLY (MCM)							
Agricultural Supply -GW			18..45				
Agricultural Supply -SW			0.00				
Domestic Supply - GW			5.12				
Domestic Supply - SW			1.28				
Total Supply			**6.40**				
Area of Block (Sq. Km.)			684.2				
Area suitable for Artificial recharge (Sq. Km)			665.9				
Type of Aquifer			Hard Rock	Soft Rock			
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)			606.79	-			
Volume of Unsaturated Zone (MCM)			1213.588	-			
Average Specific Yield			0.020	-			
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)			24.27	-			
Surplus water Available (MCM)			13.59	-			
Proposed Structures			**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30	**Recharge shaft** (Av. Gross Capacity-60 TCM)		

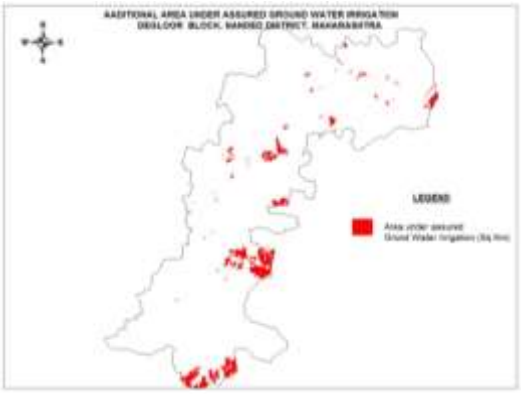
		TCM)	
Number of Structures	36	102	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	5.4	2.295	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	8993		
Total RWH potential (MCM)	0.291		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.233(**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	64.11		
Additional GW resources available after Supply side interventions (MCM)	7.695		
Ground Water Availability after Supply side intervention	71.805		
Existing Ground Water Draft for All Purposes (MCM)	23.58		

Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	23.58
Present stage of Ground Water Development (%)	36.8
Expected Stage of Ground Water Development after interventions (%)	32.8
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended, if additional ground water resources are available after bringing the expected stage of development from 56.45% to 70%.	
5.5.DEVELOPMENT PLAN	
Additional Volume of water available for GWD to 70% (MCM)	26.68
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1601
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	267
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	41

Proposed Artificial Recharge Structure



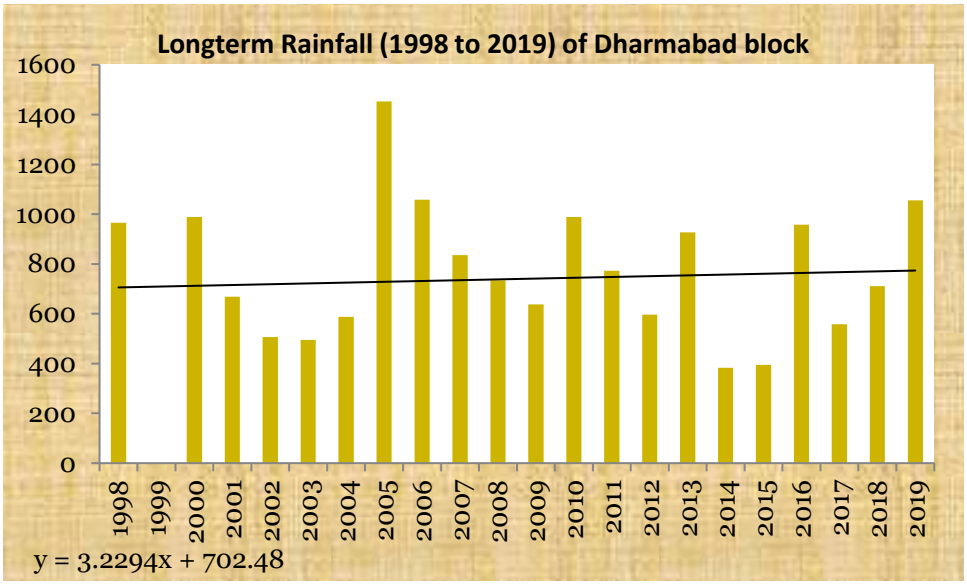
Addditional Area proposed to be brought under assured ground water irrigation



9.5 DHARMABAD BLOCK, NANDED DISTRICT

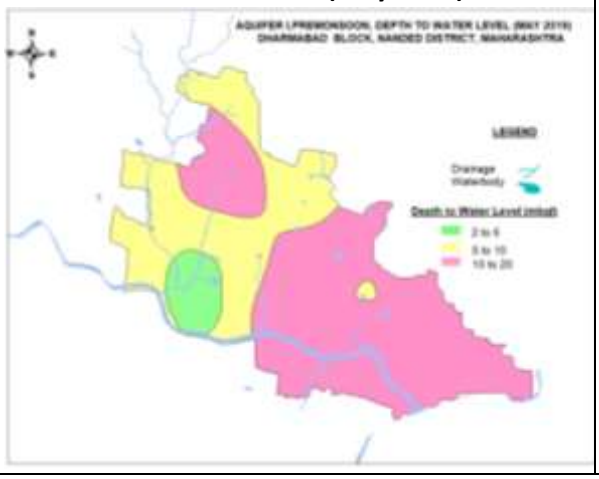
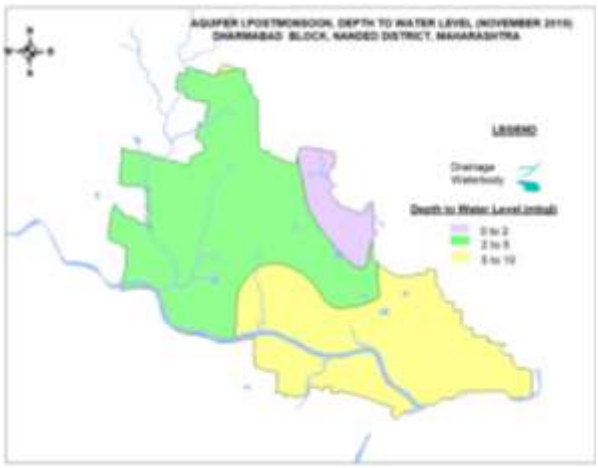
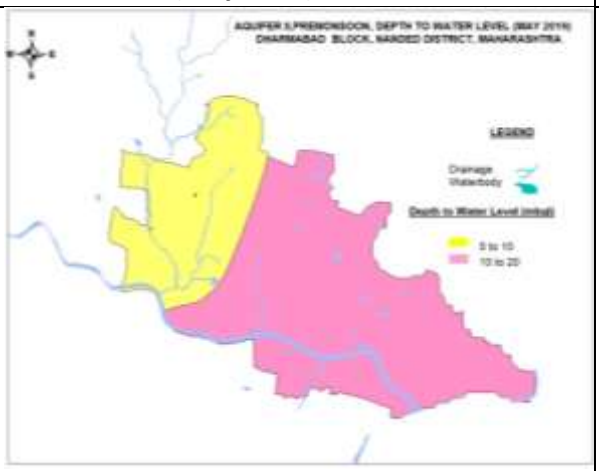
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	DHARMABAD
Geographical Area (Sq. Km.)	336.47 Sq. Km.
Hilly Area (Sq. Km)	1.10 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	12508
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	774.83 mm
Annual Rainfall (2019)	1055.1 mm
Decadal Average Annual Rainfall (2010-19)	734.41 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend:-3.229 m/year. Probability of Normal/Excess Rainfall:- 38% & 38%. Probability of Drought (Moderate/Severe/ Acute):- 24% Moderate Frequency of occurrence of Drought:- 1 in 4 Years

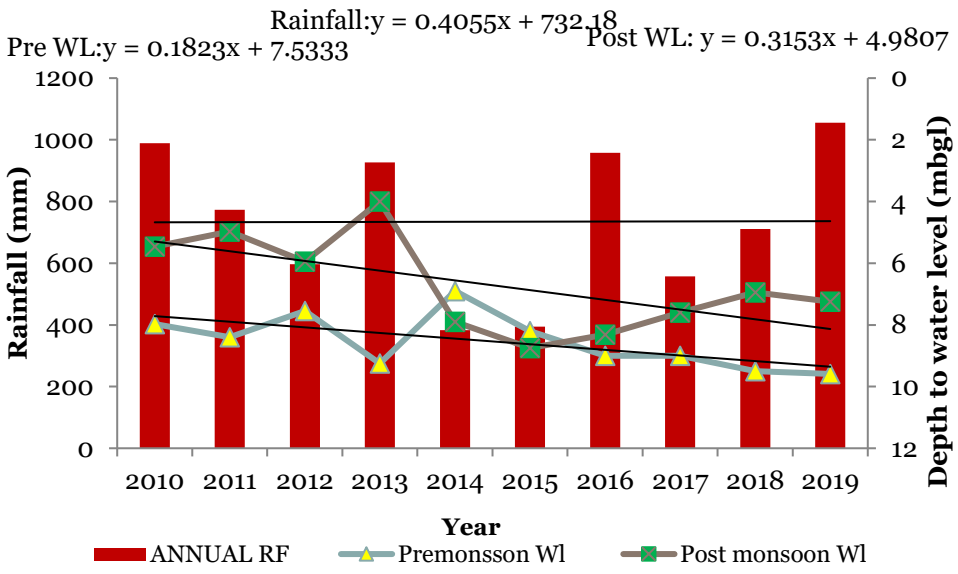
RAINFALL TREND ANALYSIS (1998 to 2019)



1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	➢ Pediment (PD) ➢ Pediplain Moderate (PPM), 2-5m weathering ➢ Pediplain Shallow (PPS), 0-2m weathering ➢ Plateau Slightly Dissected (PLS), 0-1m weathering
Soil	➢ Very shallow, somewhat excessively drained, loamy soils on moderately sloping summits/spurs with severe erosion ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion

	➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene) & Gneiss-Granitoid / Migmatite Complex (Archean)		
1.4.Hydrology & Drainage			
Drainage	Godavari river		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1 Medium project	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	46
		No. of projects operating till end	46
		Command area of the operating project (Sq. Km.)	4.21
		Net irrigated area under Operating project (Sq. Km.)	3.05
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	336.47 Sq. Km.		
Forest Area	35.34 Sq. Km.		
Cultivable Area	332.62 Sq. Km.		
Net Sown Area	254.97. Km.		
Double Cropped Area	175.52 Sq. Km.		
Area under Irrigation	Surface Water	0	
	Ground Water	2.14 sq km	
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	190.22	
	Cotton	113.21	
	Cereals	57.46	
	Oil Seeds	118.73	
Horticultural Crops	Sugarcane	0.33	
	Others	1.62	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			
Pre-Monsoon (May-2019)		**Post-Monsoon (November-2019)**	
❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 9 Sq Km area in the southern parts of the block ❖ The deeper depths to water level between 10 mbgl and 20 mbgl is observed in 103.16 Sq Km area in the western parts. ❖ Th remaining parts of the block covering		❖ The shallow depth to water level below 5 mbgl is observed in 20.25 Sq Km area in an isolated patch in the northern part of the block. ❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 163 Sq Km area in the western and north-western parts of the block. ❖ The deeper depths to water level between	

187.52 sq km area has depths to water level between 20 mbgl and 30 mbgl.	10 mbgl and 20 mbgl is observed in 128.89 Sq Km area in the remaining parts of the block
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ The deeper depth to water level between 10 mbgl and 20 mbgl is observed in 93.37 Sq Km area coveringnorth-western part of the block. ❖ The deeper depths to water level between 20 mbgl and 30 mbgl is observed in 215.6 Sq Km area in the remaining parts of the block	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in the whole of the block
1.7. Hydrograph	



The hydrograph of CGWB Monitoring site at Dharmabad village for the period 2010 to 2019 shows:

- A rising trend during both premonsoon and postmonsoon @ 0.182 m/year and 0.315 m/year respectively.
- The depth to water level during premonsoon ranges from 6.9 mbgl to 9.59 mbgl. The deeper depths to water level indicates overdraft from the well during dry season.
- The depth to water level ranges from 4 mbgl to 8.75 mbgl during postmonsoon
- A rising trend of rainfall @ 0.4 mm/year was observed during the period

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 118.4 Sq Km area & 0.2 to 0.4 m/year in 9.63 Sq Km area.	0.0 to 0.2 m/year in 39.05 Sq Km area, 0.2 to 0.4 m/year in 38.19 Sq Km area; 0.4 to 0.6 m/year in 54.15 Sq Km area and >0.6 m/year in 56.58 sq km area.	Nil	0.0 to 0.2 m/year in 248.8 Sq Km area and 0.2 to 0.4 m/year in 67.27Sq Km area.
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	

2. GROUND WATER ISSUES

1) Declining Water Level Trend: -

The decline in water level trend (2010-19) upto more than 0.6 m/year is observed in major section of the block during both the seasons despite the increase in rainfall @3.2 mm/year. This is due to the exploitation of shallow aquifers as for the dependency in ground water for irrigation during both Kharif and Rabi.

2) **Low ground water yield Potential of the aquifers:**

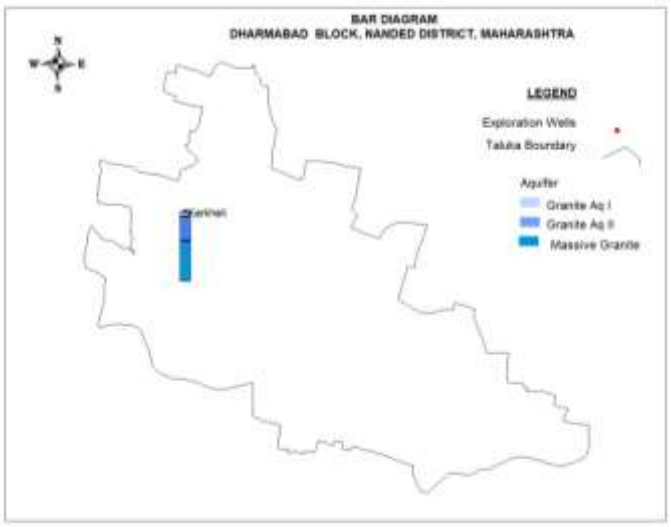
The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability

evolved from secondary porosity and hence poor sustainability of aquifers.

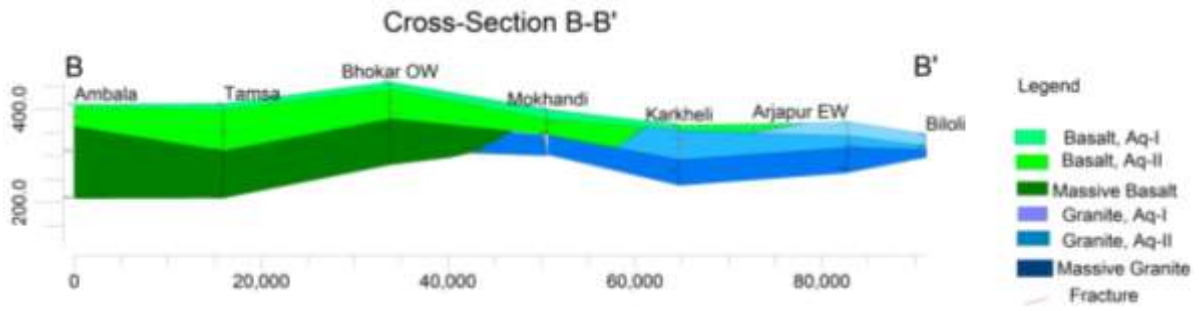
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two 1)Basalt –Aquifer-I, Aquifer-II 2)Granite-Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



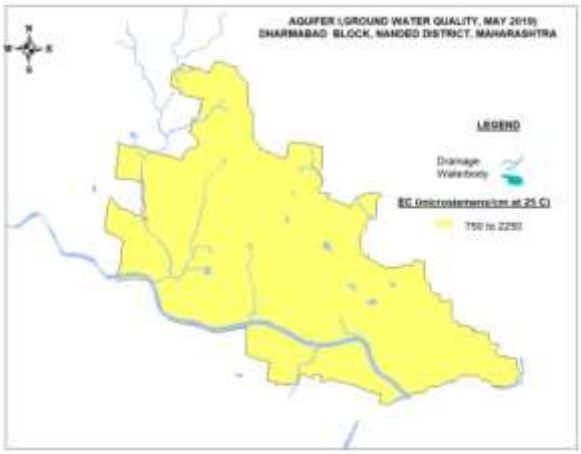
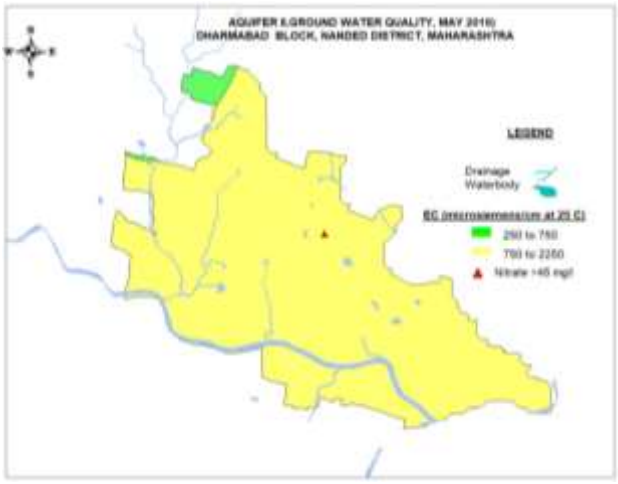
3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS

Major Aquifer	Basalt (Deccan Traps)		Granites	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	10 to 16	48 to 88	8 to 16	28 to 68
Weathered/ Fractured rocks thickness (m)	8 to 12	2 to 6	7 to 13	4 to 8
Yield Potential	0 to 50 m3/day	0 to 0.25 lps	10 to 50 m3/day	0 to 1.25 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00022	0.02	0.00022
Transmissivity (T)	-	85 to 281 m^3/day	-	104.09 to 143.25 m^3/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes The entire block has EC between 750 and 2250 microsiemens/cm.	➢ Since the block has EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate Karkheli village ➢ About 6.3 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm whereas 309 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In major parts of the block covering 6 Sq Km area, plants with moderate salt tolerance can be grown. However, in 309 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The analysed sample in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of the analysed sample haS value > 1.25 meq/l indicating that the ground water is not good for irrigation. ➢ The analysed sample has %Na value more than 60% indicating that the ground water is not good for irrigation in that area
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	

5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	335.57
Total Annual Ground Water Recharge (MCM)	32.86
Natural Discharge (MCM)	1.64
Net Annual Ground Water Availability (MCM)	31.22
Existing Gross Ground Water Draft for irrigation	5.52

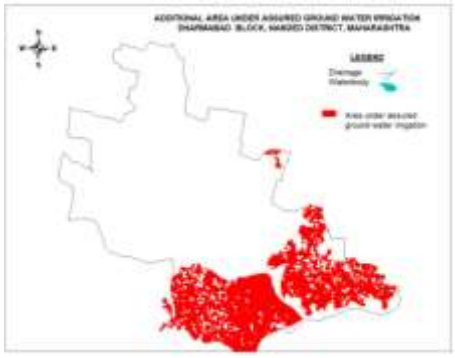
(MCM)							
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)				0.78			
Existing Gross Ground Water Draft for All uses (MCM)				6.30			
Net Ground Water Availability for future irrigation development (MCM)				23.46			
Provision for domestic and industrial requirement supply to 2025(MCM)				2.22			
Stage of Ground Water Development %				20.20			
Category				**SAFE**			
Aquifer-II							
Semiconfined/Confined Aquifer (Basalt)							
Resources above the confining layer				**Resources within the confining layer**			
Total Area (Sq. Km.)	Peizometer head (macl)	S	Resources above confining layer(MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	Sy	Resources within the confining layer (MCM)
336.47	36.8	0.00022	2.72	336.47	6.000	0.002	4.04
5.0. GROUND WATER RESOURCE ENHANCEMENT							
Available Resource (MCM)			31.22				
Gross Annual Draft (MCM)			6.30				
5.1.SUPPLY SIDE MANAGEMENT							
SUPPLY (MCM)							
Agricultural Supply -GW			5.51				
Agricultural Supply -SW			2.19				
Domestic Supply - GW			0.78				
Domestic Supply - SW			0.20				
Total Supply			**8.68**				
Area of Block (Sq. Km.)			336.47				
Area suitable for Artificial recharge (Sq. Km)			335.37				
Type of Aquifer			Hard Rock		Soft Rock		
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)			308.76		-		
Volume of Unsaturated Zone (MCM)			617.522		-		
Average Specific Yield			0.020		-		
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)			12.35044		-		
Surplus water Available (MCM)			12.35044		-		
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	18	52
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.7	1.17
Area of Saline Patch	**Nil**	
Proposed Structures	Nil	
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil	
Volume of water available for harvesting	Nil	
Additional volume created by desilting	**Nil**	
RTRWH Structures – Urban Areas		
Households to be covered (25% with 50 m^2area)	3127	
Total RWH potential (MCM)	0.115	
Rainwater harvested / recharged @ 80% runoff co-efficient	0.092 (**Economically not viable & Not Recommended)**	
5.2. DEMAND SIDE MANAGEMENT		
Micro irrigation techniques		
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil	
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil	
Proposed Cropping Pattern change		
Irrigated area under Water Intensive Crop(ha)	Not proposed	
Water Saving by Change in Cropping Pattern	Nil	
5.3. EXPECTED BENEFITS		
Net Ground Water Availability (MCM)	31.22	
Additional GW resources available after Supply side interventions (MCM)	3.87	
Ground Water Availability after Supply side intervention	35.09	
Existing Ground Water Draft for All Purposes (MCM)	6.30	

Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	6.3
Present stage of Ground Water Development (%)	20.2
Expected Stage of Ground Water Development after interventions (%)	18.0
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 58.25% to 70%.	
5.5.DEVELOPMENT PLAN	
Additional Volume of water available for GWD upto 70% (MCM)	18.26
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1096
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	183
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	28

Proposed Artificial Recharge Structure

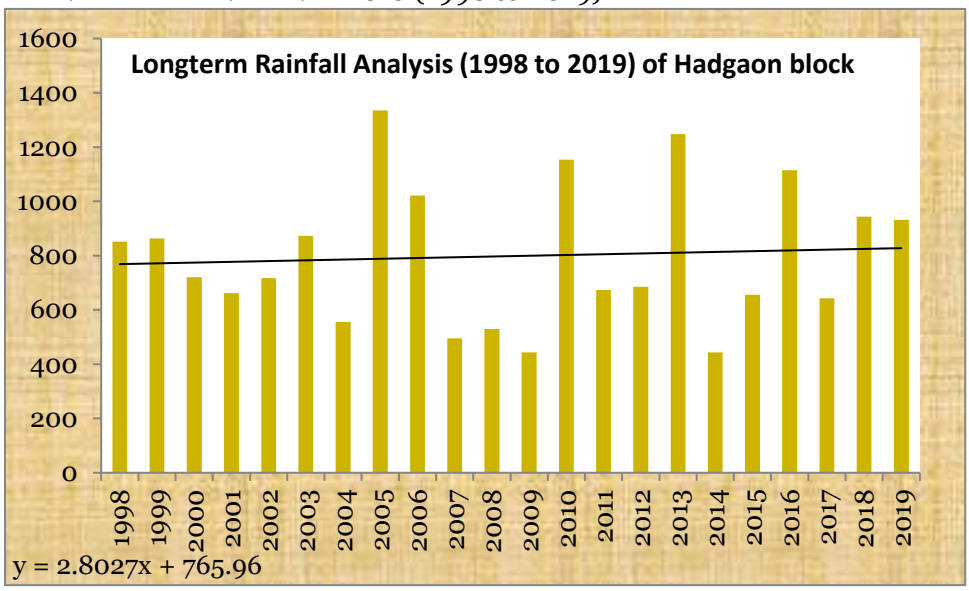
Additional Area proposed to be brought under assured ground water irrigation



9.6HADGAON BLOCK, NANDED DISTRICT

SALIENT INFORMATION	
1.1. Introduction	
Block Name	HADGAON
Geographical Area (Sq. Km.)	1036.92 Sq. Km.
Hilly Area (Sq. Km)	32.81 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	232553
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	798.1 mm
Annual Rainfall (2019)	931.3 mm
Decadal Average Annual Rainfall (2008-17)	849.2 mm
Long Term Rainfall Analysis (1998-2019)	Rising Trend: 2.803 m/year. Probability of Normal/Excess Rainfall: -54% & 23%. Probability of Drought (Moderate/ Severe/ Acute):- 23% Moderate Frequency of occurrence of Drought:- 1 in 4 Years

RAINFALL TREND ANALYSIS (1998 to 2019)

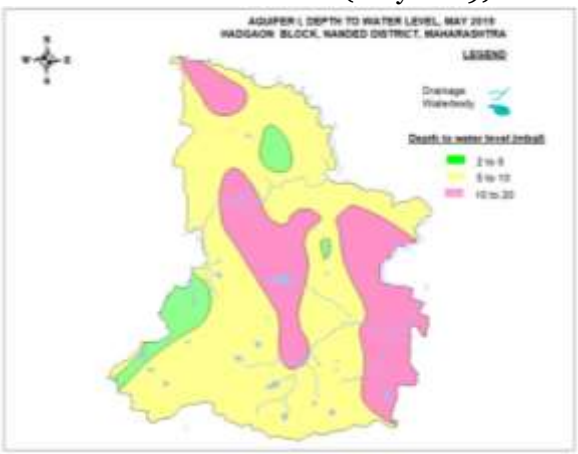
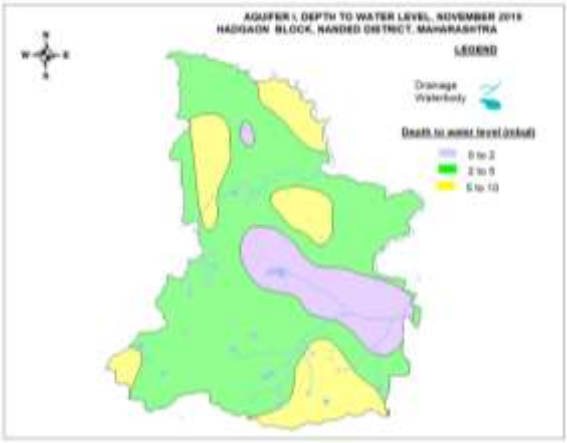


1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	Butte (B) Mesa (M) Plateau Moderately Dissected (PLM) Plateau Slightly Dissected (PLS), 0-1m weathering Plateau Undissected (PLU), 0-1m weathering Plateau Weathered (PLWS), 1-2m weathering Plateau Weathered (PLW), 2-5m weathering Plateau Weathered-Canal Command (PLC)
Soil	Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands with moderate

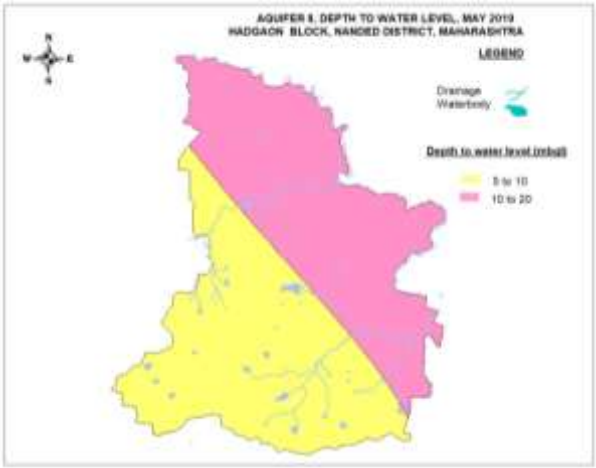
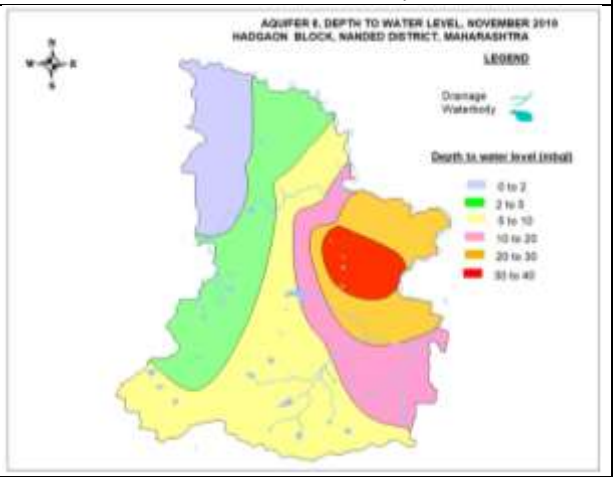
	erosion Very shallow, somewhat excessively drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion Shallow, moderately well drained clayey soils on gently sloping summits/spurs with moderate erosion. Moderately deep, moderately well drained, fine, moderately calcareous soils on gently sloping summits/spurs with moderate erosion Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	Penganga River and its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	Nil	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	60
		No. of projects operating till end	60
		Command area of the operating project (Sq. Km.)	75.29
		Net irrigated area under Operating project (Sq. Km.)	29.69
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	1036.92 Sq. Km.		
Forest Area	27.95 Sq. Km.		
Cultivable Area	812.73 Sq. Km.		
Net Sown Area	752.38. Km.		
Double Cropped Area	135.15 Sq. Km.		
Area under Irrigation – Surface Water	0.04 sq km		
Area under Irrigation – Ground Water	18.44 Sq. Km.		
Principal Crops	Crop Type	Area (Sq. Km.)	
	Pulses	230.30	
	Cotton	346.05	
	Cereals	91.70	
	Oil Seeds	452.72	
Horticultural Crops	Sugarcane	42.91	
	Others	12.55	

1.6.WATER LEVEL BEHAVIOUR

1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

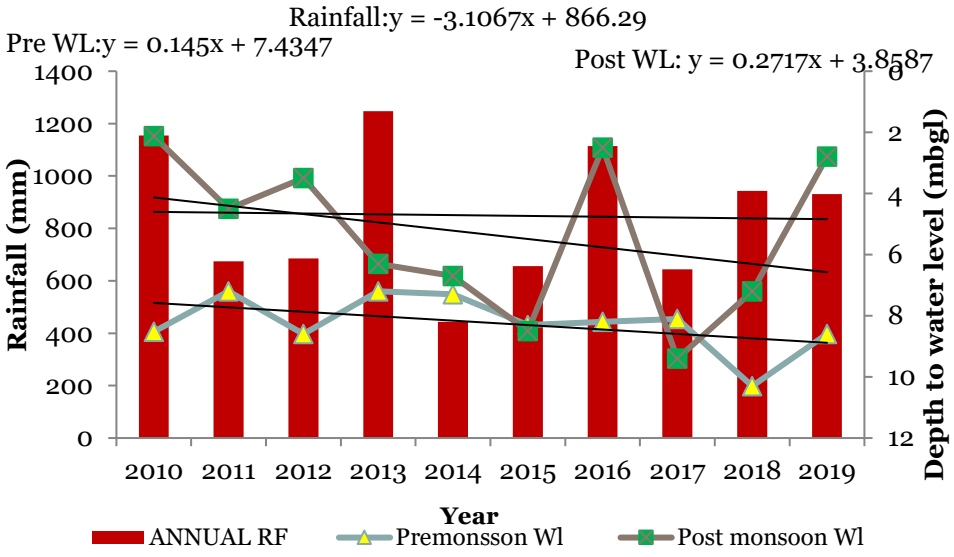
Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
small patches of 57 Sq Km area has depth to water level between 5 mbgl and 10 mbgl Depth to water level between 10 mbgl and 20 mbgl observed in 559.5 Sq Km area in the major parts of the block Depth to water level between 20 mbgl and 30 mbgl observed in 286 Sq Km area in the soothe-eastern and south-central parts of the block.	Very shallow Depth to water level between less 2 mbgl is observed in 144.57 Sq Km area along the southeastern parts of the block.. Depth to water level between 2 mbgl and 5 mbgl is observed in 655.7 Sq Km area in the major parts of the block Depth to water level between 10 mbgl and 20 mbgl is observed in 82.47 sq km area in the small isolated portions distributed in the north and southern parts of the block. The shallow depths to water level may be dueto recharge from rainfall.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	Post-Monsoon Water Level (Nov.2019)
	

1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)

Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
	
Pre-Monsoon Water Level(May 2019)	Post-Monsoon Water Level(November 2019)
Depth to water level between 5 mbgl and 10 mbgl observed in 522 Sq Km area in the western, south-western parts of the block	The shallow depth to water level less than 2 mbgl is observed in 116.7 Sq Km areain the north-western parts of the block.

Depth to water level between 10 mbgl and 20 mbgl observed in 502 Sq Km area in the eastern and north-eastern parts of the block.	The shallow depth to water level between 2 mbgl and 5 mbgl is observed in 215.7 Sq Km area in the north-western parts of the block. Depth to water level between 5 mbgl and 10 mbgl is observed in 357.8 Sq Km area in the central and southern parts of the block. Depth to water level between 10 mbgl and 20 mbgl is observed in 146.2 Sq Km area in the eastern parts of the block. Deeper depths to water level between 20 mbgl and 30 mbgl are observed in 181.48 Sq Km area in the north-eastern parts of the block.

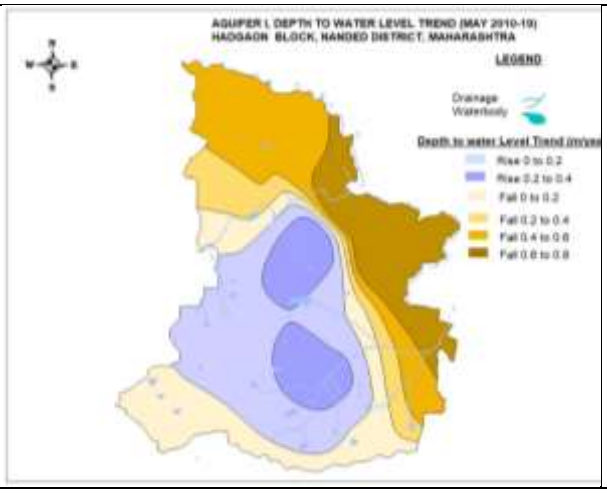
1.7. Hydrograph

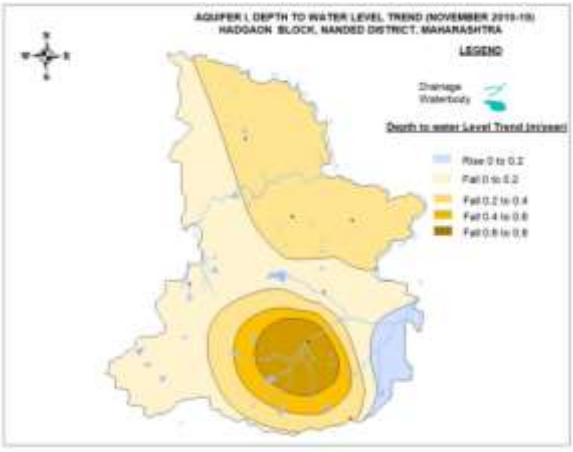


The hydrograph ph of CGWB Monitoring site at Dhawari Buzurg for the period 2010 to 2019 shows:
A rising trend during both premonsoon and postmonsoon @ 0.145 m/year and 0.271 m/year respectively.
The depth to water level during premonsoon ranges from 7.2 mbgl to 10.3 mbgl.
The depth to water level during postmonsoon ranges from 2.13mbgl to 9.4 mbgl with deeper depths to water level of 21.7 mbgl and 21.9 mbgl

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		Post-Monsoon Trend (November 2010-2019)	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0 to 0.2 m/year in 276.8 Sq Km area, 0.2 to 0.4 m/year in 112.83 sq km area.	0.00 to 0.2 m/year in 193.4 Sq Km area, 0.2 to 0.4 m/year in 87.90 Sq Km area, 0.4 to 0.6 m/year in 189.2 sq km area and >0.6 m/year in 152.5 Sq Km area	0 to 0.2 m/year in 42.21Sq Km area	0 to 0.2 m/year in 833.5 Sq Km area; 0.2 to 0.4 m/year in 67.25 Sq Km area and >04 m/year in 69.65 sq km
Pre-Monsoon WL Trend (May 2010-2019)		Post-Monsoon WL Trend (Nov.2010-2019)	





2. GROUND WATER ISSUES

Low development

Low Development: -Low Development of 42.43 % of Stage of Ground Water Development is observed in the block

2) Declining Water Level Trend: -

The decline in water level trend (2010-19) upto 0.6 m/year is observed in major section of the block during both the seasons despite the increase in rainfall @2.8 mm/year. This is due to the exploitation of shallow aquifers as for the dependency in ground water for irrigation during both Kharif and Rabi.

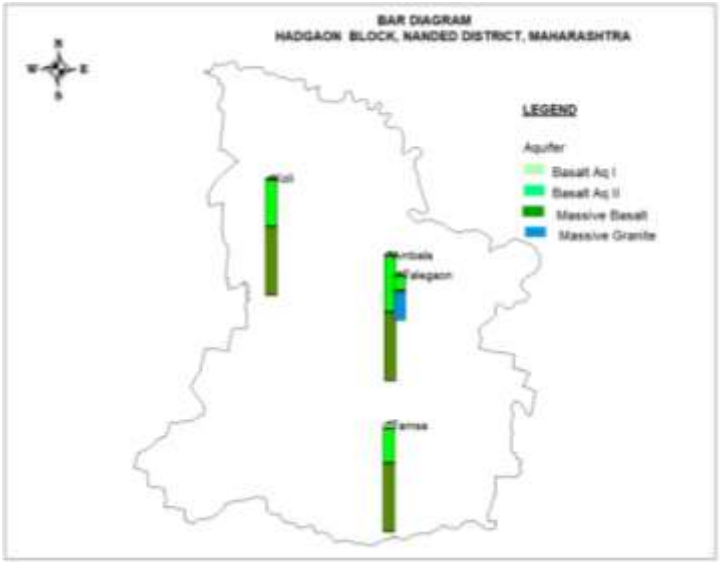
3) Low ground water yield Potential of the aquifers:

The ground water yield potentiality of the aquifers ranges from 0 to 1.5 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

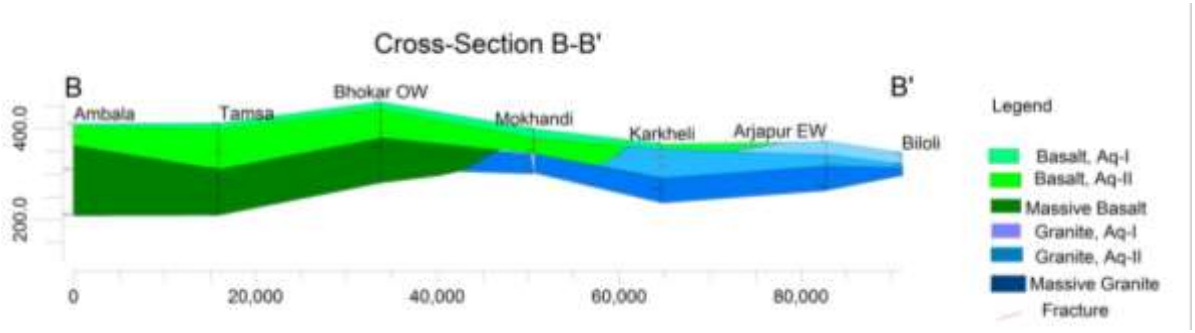
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One: Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS

Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined /confined)
Depth of Occurrence bottom of aquifer (mbgl)	9 to 21	30 to 201
Weathered/ Fractured rocks thickness (m)	8 to 14	2 to 14
Yield Potential	10 to 100 m3/day	0 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00035
Transmissivity (T)		546.11m²/day

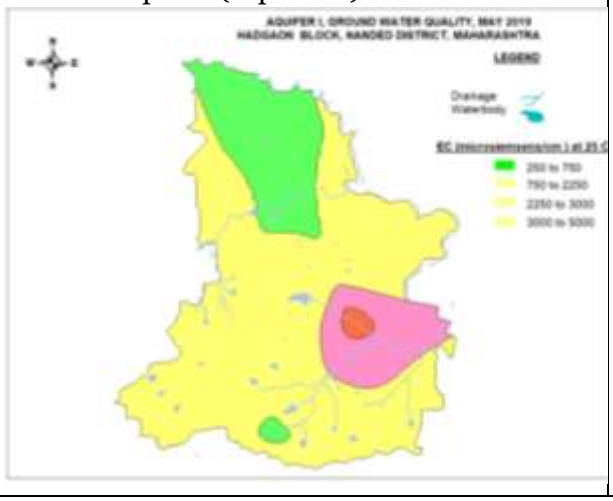
4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	Suitability for Irrigation Purposes
The overall quality of Aquifer is potable and useful for drinking and domestic purposes except in Nitrate affected areas. About 179.09 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 723.9 sq Km area has EC between 750 and 2250 microsiemens/cm ; 105.2 sq km area has EC between 2250 and 3000 microsiemens/cm and 9 sq km area has EC between 3000 and 5000 microsiemens/cm	In 179.09 sq km area of the block covering, plants with moderate salt tolerance can be grown. However, in 723 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. The RSC values of all the analysed samples have values < 1.25 meq/l except in 2 sites (Dhawari , Mathala) indicating that the ground water is good for irrigation. About 50% of the analysed samples have % Na less than 20 and 50 % have %Na between 20 and 40 indicating that the ground water is good for irrigation. Hence, the overall quality of ground water is suitable for irrigation purposes

4.1 Aquifer II/Deeper Aquifer

Suitability for Drinking Purposes	Suitability for Irrigation Purposes
The overall quality of Aquifer is potable and useful for drinking and domestic purposes	In 337.96 Sq Km area, plants with moderate salt tolerance can be grown. However, in 677

except in Nitrate affected Talegaon village About 337.96 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm and 677 sq Km area has EC between 750 and 2250 microsiemens/cm.	sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. The RSC values of the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation and 50% of the samples except in Tamsa and Koli villages. Half of the analysed samples have %Naless than 60% and 50% of the samples has % Na more than 60%.. Hence, the overall quality of ground water is suitable for irrigation purposes except in villages with high RSC values and % Na concentration more than 60%.
3.2. CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt & Alluvium)	
Ground Water Recharge Worthy Area (Sq. Km.)	100.41
Total Annual Ground Water Recharge (MCM)	127.46
Natural Discharge (MCM)	6.37
Net Annual Ground Water Availability (MCM)	121.09
Existing Gross Ground Water Draft for irrigation (MCM)	48.49
Existing Gross Ground Water Draft for domestic and industrial water supply (MCM)	0
Existing Gross Ground Water Draft for All uses (MCM)	2.88

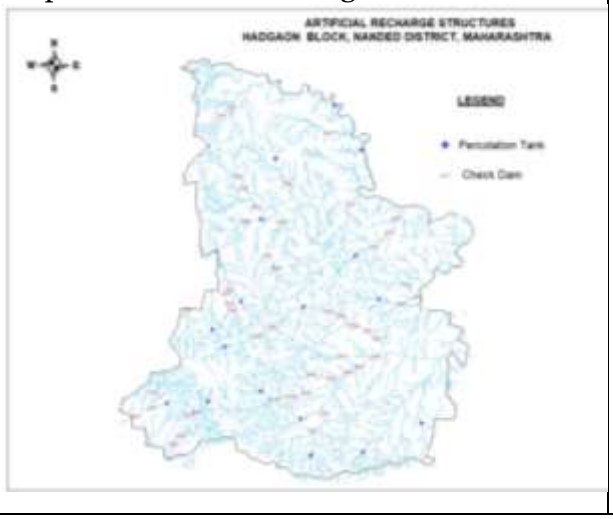
Net Ground Water Availability for future irrigation development (MCM)				6.46			
Provision for domestic and industrial requirement supply to 2025(MCM)				8.25			
Stage of Ground Water Development %				42.43			
Category				SAFE			
Aquifer-II							
Semiconfined/Confined Aquifer (Basalt)							
Resources above the confining layer				Resources within the confining layer			
Total Area (Sq. Km.)	Peizometer head (macl)	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	Sy	Resources within the confining layer (MCM)
1036.92	37.3	0.00035	13.54	1036.92	8.000	0.002	20.74

5.0. GROUND WATER RESOURCE ENHANCEMENT				
Available Resource (MCM)	121.09			
Gross Annual Draft (MCM)	51.38			
5.1.SUPPLY SIDE MANAGEMENT				
SUPPLY (MCM)				
Agricultural Supply -GW	48.49			
Agricultural Supply -SW	0.04			
Domestic Supply - GW	2.88			
Domestic Supply - SW	0.72			
Total Supply	52.13			
Area of Block (Sq. Km.)	1036.92			
Area suitable for Artificial recharge (Sq. Km)	1004.11			
Type of Aquifer	Hard Rock	Soft Rock		
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	286.10	-		
Volume of Unsaturated Zone (MCM)	572.19	-		
Average Specific Yield	0.020	-		
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	11.44	-		
Surplus water Available (MCM)	6.41	-		
Proposed Structures	Percolation Tank (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	Recharge shaft (Av. Gross Capacity-60 TCM)	
Number of Structures	17	48	0	
Volume of Water expected to be	2.55	1.08	0	

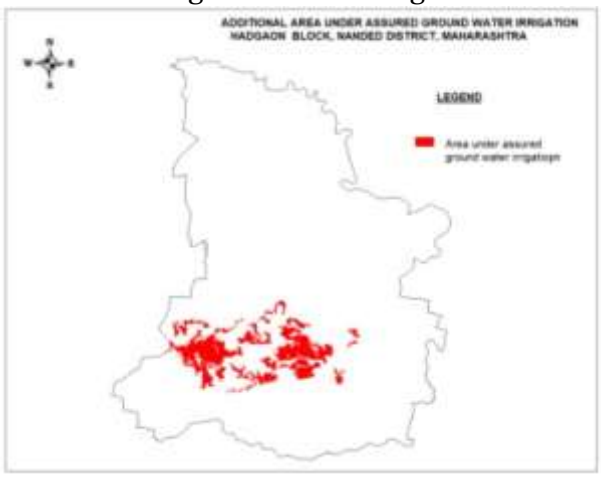
conserved / recharged @ 75% efficiency (MCM)			
Area of Saline Patch	Nil		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	Nil		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	11923		
Total RWH potential (MCM)	0.506		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.405 (Economically not viable & Not Recommended)		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	121.09		
Additional GW resources available after Supply side interventions (MCM)	3.63		
Ground Water Availability after Supply side intervention	124.72		
Existing Ground Water Draft for All Purposes (MCM)	51.38		
Saving of Ground Water through demand side intervention (MCM)	0		
GW draft after Demand Side Interventions (MCM)	51.38		

Present stage of Ground Water Development (%)	42.4
Expected Stage of Ground Water Development after interventions (%)	41.2
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the expected stage of development from 40.90% to 70%.	
5.5.DEVELOPMENT PLAN	
Volume of water available for GWD to 70% (MCM)	35.92
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	2155
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	359
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	55

Proposed Artificial Recharge Structure



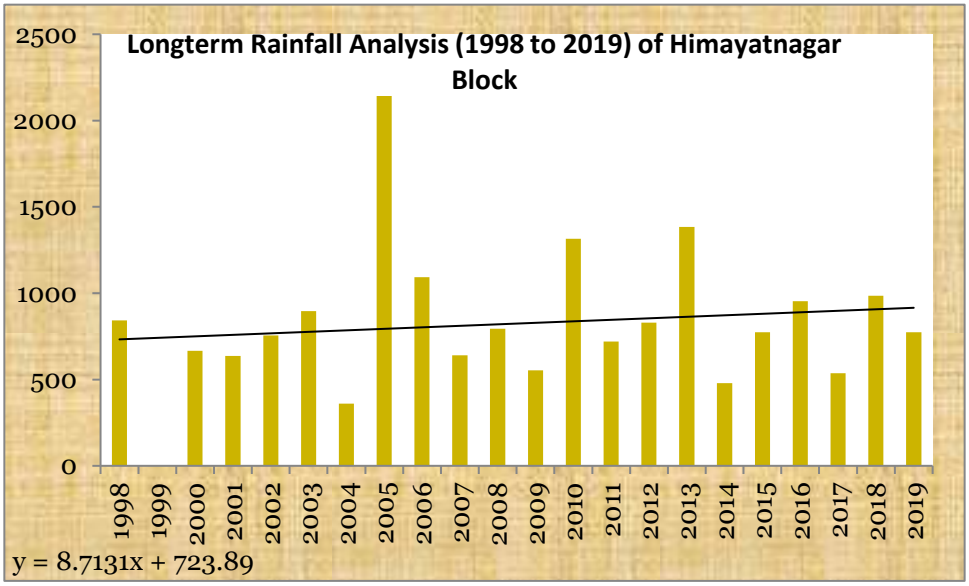
Addditional Area proposed to be brought under assured ground water irrigation



9.7 HIMAYATNAGAR BLOCK, NANDED DISTRICT

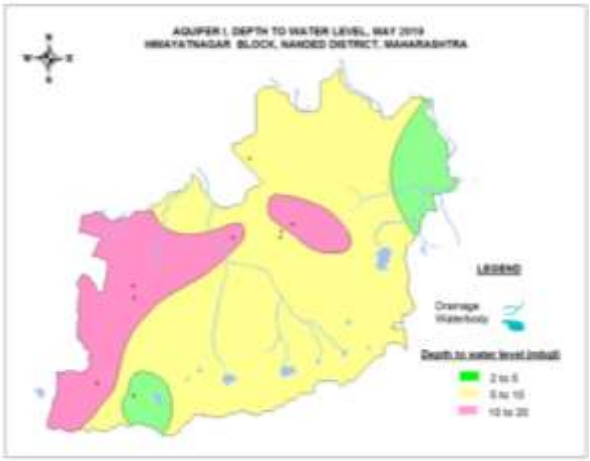
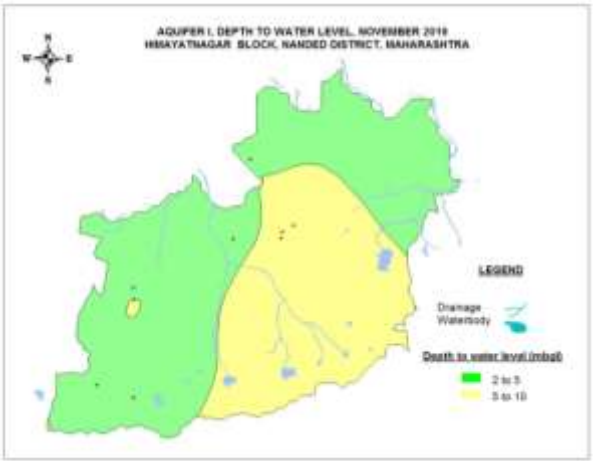
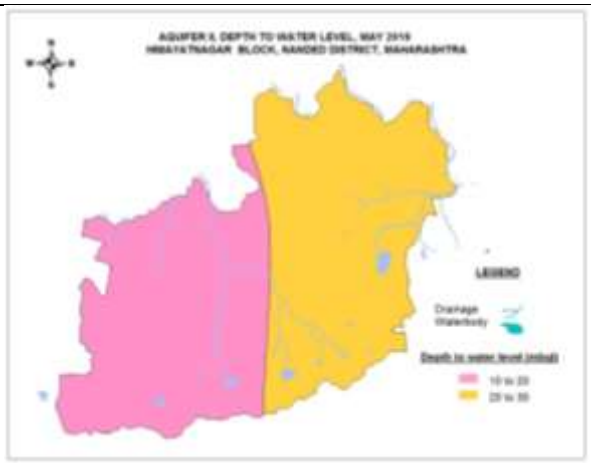
SALIENT INFORMATION	
1.1.Introduction	
Block Name	Himayat Nagar
Geographical Area (Sq. Km.)	517.80 Sq. Km.
Hilly Area (Sq. Km)	18.84 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	109727
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	824 mm
Annual Rainfall (2019)	773.8 mm
Decadal Average Annual Rainfall (2010-19)	870.5 mm
Long Term Rainfall Analysis (1998-2019)	Rising Trend: 8.713 m/year. Probability of Normal/Excess Rainfall: - 62% & 19%. Probability of Drought (Moderate/ Severe/ Acute):- 14% Moderate & 5% Severe Frequency of occurance of Drought:- 1 in 5 Years

RAINFALL TREND ANALYSIS (1998 to 2019)



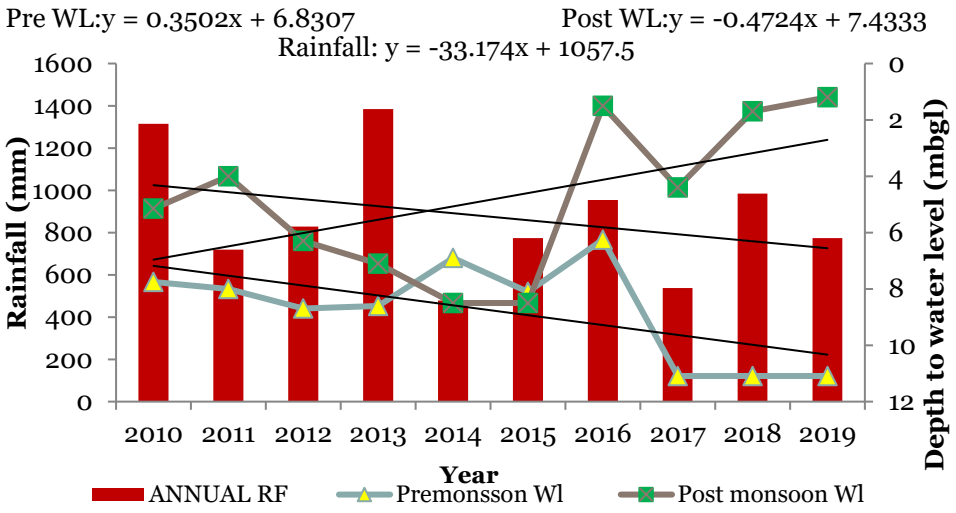
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Butte (B) ➢ Escarment Slope (ES) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering
Soil	➢ Very shallow, well drained, loamy, moderately

	calcareous soils on gently sloping undulating lands with moderate erosion ➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Moderately deep, moderately well drained, fine, moderately calcareous soils on gently'sloping summits/spurs with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	ManarRiverforms the main drainage system of the block.		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	Nil	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	22
		No. of projects operating till end	22
		Command area of the operating project (Sq. Km.)	30.19
		Net irrigated area under Operating project (Sq. Km.)	11.13
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	517.80 Sq. Km.		
Forest Area	28.02 Sq. Km.		
Cultivable Area	436.16 Sq. Km.		
Net Sown Area	395.23. Km.		
Double Cropped Area	74.35 Sq. Km.		
Area under Irrigation – Surface Water	3.75 Sq Km		
Area under Irrigation – Ground Water	64.89 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	85.56	
	Cotton	188.29	
	Cereals	23.94	
	Oil Seeds	118.55	
Horticultural Crops	Sugarcane	14.83	
	Others	3.14	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			

Pre-Monsoon (May-2019)	Post-Monsoon (November-2019)
❖ Depth to water level between 5 mbgl and 10 mbgl observed in 38.58 Sq Km areas in the north-eastern and southern parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 322.7 Sq Km area in the major parts of the block ❖ Depth to water level between 20 mbgl and 30 mbgl observed in 39.35 Sq Km area in the south-western parts of the block	❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 275.6 Sq Km area in the western and north-eastern parts of the block ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 185 Sq Km area in the south-eastern parts of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ The shallow depth to water level between 10 mbgl and 20 mbgl observed in 224.8 Sq Km area in the western part of the block. ❖ Depth to water level between 20 mbgl	❖ The shallow depth to water level between 10 mbgl and 20 mbgl observed in 224.8 Sq Km area in the western part of the block. ❖ Depth to water level between 20 mbgl and 40 mbgl observed in 247./8 Sq Km area in

and 30 mbgl observed in 242.2 Sq Km area in the remaining parts of the block.	the remaining parts of the block.

1.7. Hydrograph

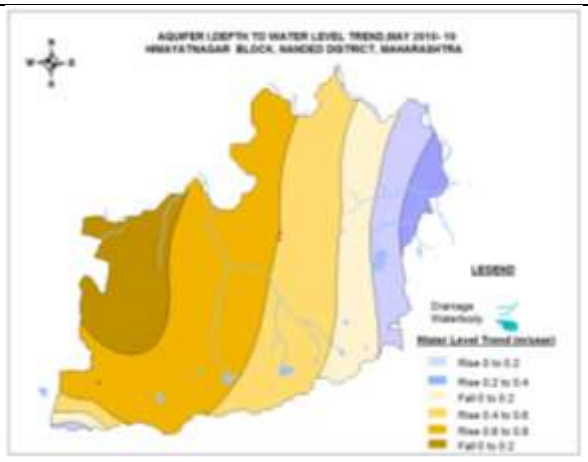
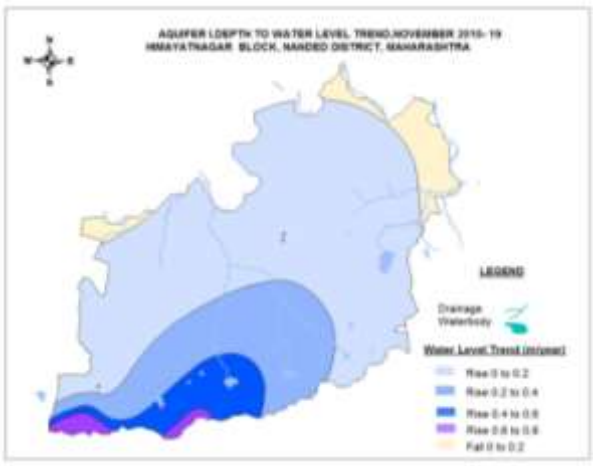


The hydrograph of CGWB Monitoring site at Himayatnagar for the period 2010 to 2019 shows:

- A rising trend during premonsoon @ 0.350 m/year and a falling trend during postmonsoon @ 0.472 m/year respectively.
- The depth to water level during premonsoon ranges from 6.25 mbgl to 11.09 mbgl.
- The depth to water level during postmonsoon ranges from 1.2 mbgl to 8.5 mbgl.
- A falling rainfall trend for the period 2010 to 2019 is observed @ 33.174 mm/year

1.8. Water Level Trend (2010-19)

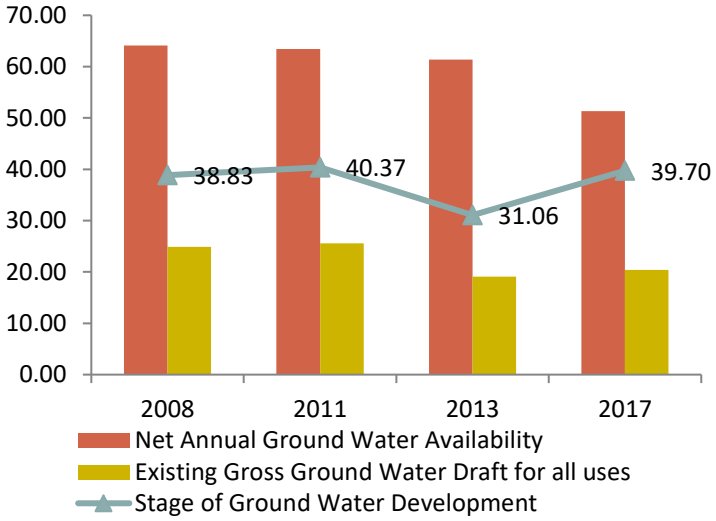
Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.00 to 0.2 m/year in 41 Sq Km area and @ 0.2 to 0.4 m/year in 14.05 Sq Km area.	0 to 0.2 m/year in 58.28 Sq Km area, 0.2 to 0.4 m/year in 120 Sq Km area, 0.4 to 0.6 m/year in 168.4 Sq Km area and >0.6 m/year in 59.17 sq km area.	0 to 0.2 m/year in 296.6 Sq Km area; 0.2 to 0.4 m/year in 92.75 Sq Km area; 0.4 to 0.6 m/year in 34.56 sq km area and >0.6 m/year in 7.5 sq km area	0 to 0.2 m/year in 31.67 Sq Km area.

Pre-Monsoon WL Trend (May 2010-2019)	**Post-Monsoon WL Trend (Nov.2010-2019)**
	

2. GROUND WATER ISSUES

1) Increase in stage of ground water development

The stage of ground water development has increased from 38.83 % (2008) to 39.70% (2017).



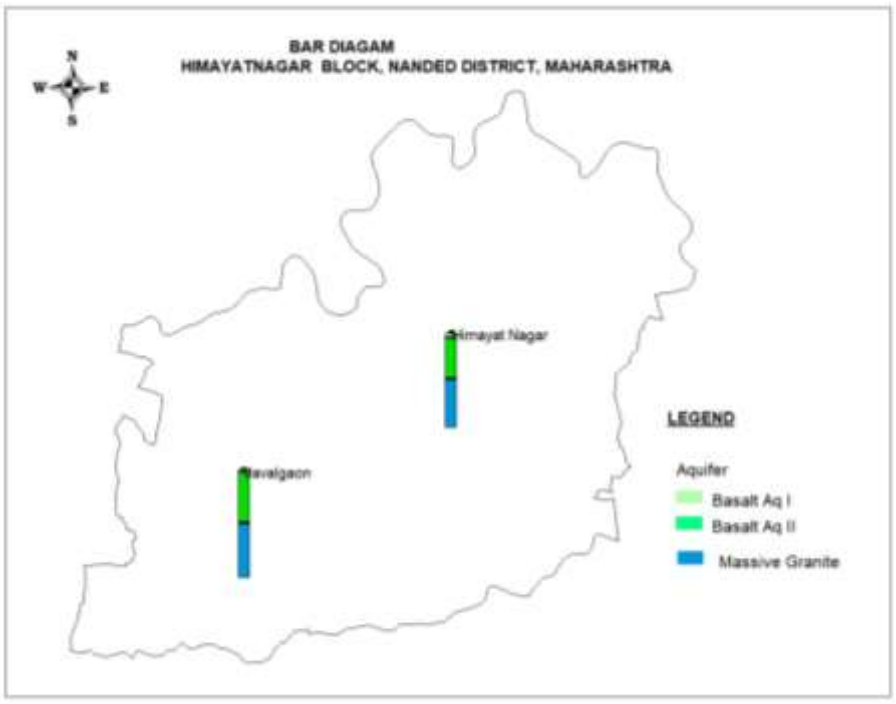
2) **Low ground water yield Potential of the aquifers:**

The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

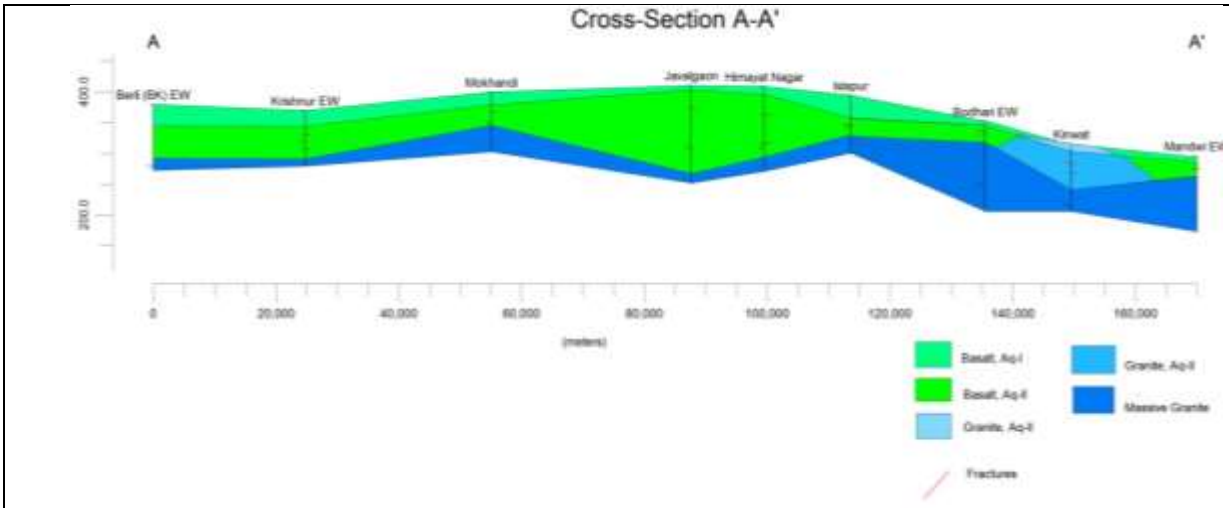
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One:Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



1.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined /confined)
Depth to bottom of aquifer (mbgl)	9 to 18	90 to 180
Weathered/ Fractured rocks thickness (m)	8 to 14.4	5 to 11
Yield Potential	15 to 100 m3/day	0 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00035
Transmissivity (T)	-	74.05 to 156 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

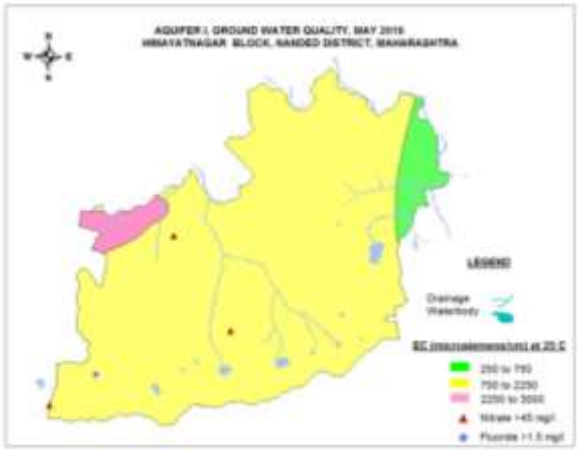
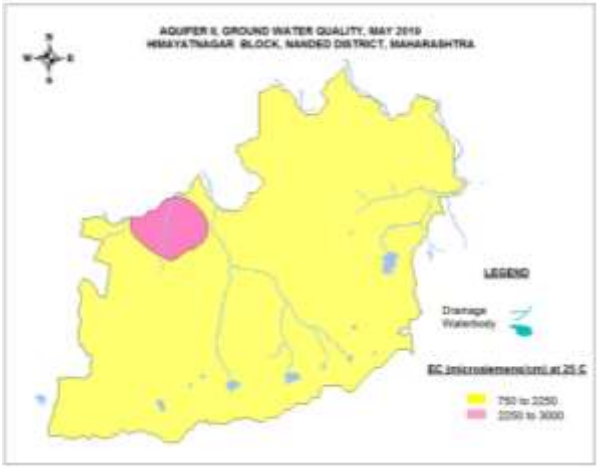
4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected areas (Waghi, Takral BK, Walkewadi) and Flouride infested areas (Wadgaon Kh)) ➢ About 20.68 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm, 431.9 sq Km area has EC between 750 and 2250 microsiemens/cm and 13.81 Sq Km area has EC>2250 microsiemens/cm	➢ In 20 Sq Km area of the block, plants with moderate salt tolerance can be grown. However, in 431.9 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ All analysed samples have % Na between 40 and 60. Hence, the overall quality of ground water is suitable for irrigation purposes except in areas with %Na value more than 60%.

4.1 Aquifer II/Deeper Aquifer

Suitability for Drinking Purposes	Suitability for Irrigation Purposes
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Kiramgan and Daregaon villages and Fluoride infested Parwa village. ➢ About 447.7 Sq Km area of the block has EC between 750 and 2250 microsiemens/cm and 165.85 sq km area has EC more than 2250 microsiemens/cm.	➢ In major parts of the block covering 447 Sq Km area, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected.

3.2.CHEMICAL QUALITY MAP

Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	

5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	498.86
Total Annual Ground Water Recharge (MCM)	54
Natural Discharge (MCM)	2.70
Net Annual Ground Water Availability (MCM)	51.31
Existing Gross Ground Water Draft for irrigation (MCM)	19.51
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	0.85
Existing Gross Ground Water Draft for All uses(MCM)	20.36
Net Ground Water Availability for future irrigation development(MCM)	28.69
Provision for domestic and industrial requirement supply to 2025(MCM)	3.11
Stage of Ground Water Development %	39.7
Category	**SAFE**
Aquifer-II	
Semiconfined/Confined Aquifer (Basalt)	

Resources above the confining layer				Resources within the confining layer				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
517.8	4	0.00035	0.725	517.8	8	0.00035	1.45	2.175

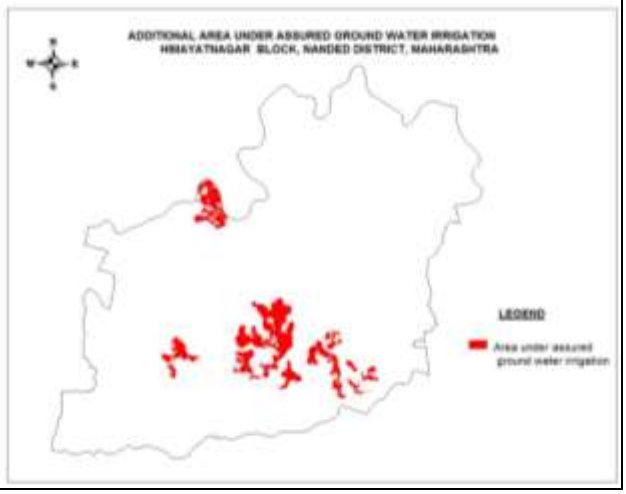
5.0. GROUND WATER RESOURCE ENHANCEMENT			
Available Resource (MCM)	51.31		
Gross Annual Draft (MCM)	20.37		
5.1.SUPPLY SIDE MANAGEMENT			
SUPPLY (MCM)			
Agricultural Supply -GW	19.52		
Agricultural Supply -SW	3.75		
Domestic Supply - GW	0.85		
Domestic Supply - SW	0.21		
Total Supply	**24.33**		
Area of Block (Sq. Km.)	517.8		
Area suitable for Artificial recharge (Sq. Km)	498.96		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	8.46	-	
Volume of Unsaturated Zone (MCM)	16.92	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	0.34	-	
Surplus water Available (MCM)	0.19	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	0	1	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	0	0.0225	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting	Nil		

through farm ponds.	
Volume of water available for harvesting	Nil
Additional volume created by desilting	**Nil**
RTRWH Structures – Urban Areas	
Households to be covered (25% with 50 m^2area)	5667
Total RWH potential (MCM)	0.241
Rainwater harvested / recharged @ 80% runoff co-efficient	0.192 (**Economically not viable & Not Recommended)**
5.2.DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	51.31
Additional GW resources available after Supply side interventions (MCM)	0.0225
Ground Water Availability after Supply side intervention	51.3325
Existing Ground Water Draft for All Purposes (MCM)	20.37
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	20.37
Present stage of Ground Water Development (%)	39.7
Expected Stage of Ground Water Development after interventions (%)	39.7
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	

Nil	
5.5.DEVELOPMENT PLAN	
Additional Volume of water available after stage of GWD is brought to 70% (MCM)	15.56
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	934
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	156
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	24

Proposed Artificial Recharge Structure

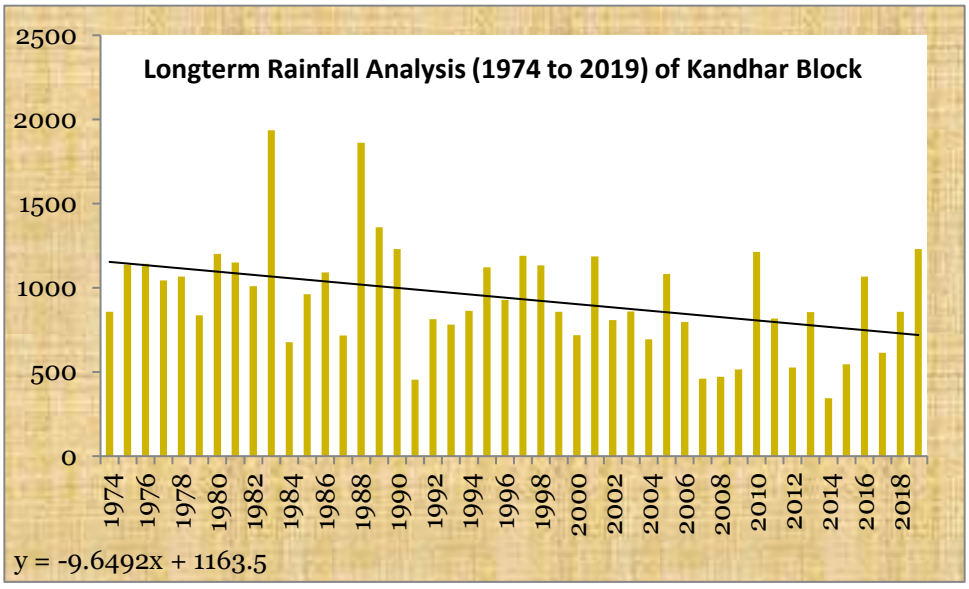
Addditional Area proposed to be brought under assured ground water irrigation



9.8KANDHAR BLOCK, NANDED DISTRICT

SALIENT INFORMATION	
1.1.Introduction	
Block Name	Kandhar
Geographical Area (Sq. Km.)	815.02 Sq. Km.
Hilly Area (Sq. Km)	35.40 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	224027
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	936.7 mm
Annual Rainfall (2019)	1230.7 mm
Decadal Average Annual Rainfall (2010-19)	807.23 mm
Long Term Rainfall Analysis (1974-2019)	Falling Trend: -9.64 m/year. Probability of Normal/Excess Rainfall: - 58% & 20%. Probability of Drought (Moderate/ Severe/ Acute):- 15% Moderate & 7% Severe Frequency of occurance of Drought:- 1 in 5 Years

RAINFALL TREND ANALYSIS (1974 to 2019)



1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	➢ Butte (B) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)
Soil	➢ Very shallow, well drained, loamy soils on gently

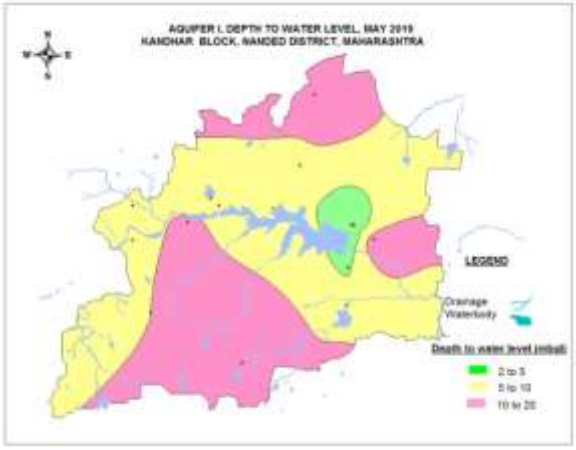
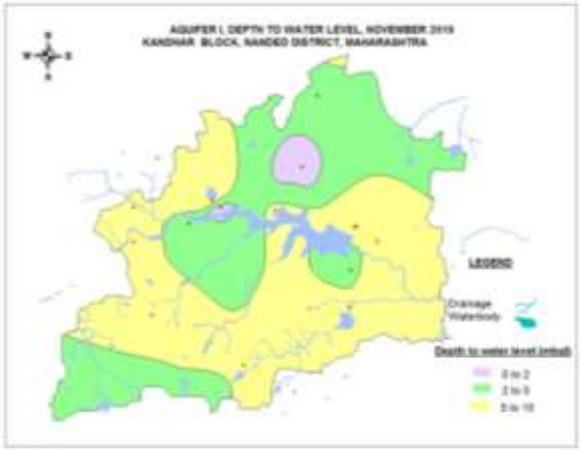
	sloping rolling lands with mesas and buttes with moderate erosion and moderate stoniness ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion ➢ Slightly deep, moderately well drained, fine, moderately calcareous soils on moderately sloping undulating lands with moderate erosion		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4. **Hydrology & Drainage**			
Drainage	Manar River and its tributaries forms the main drainage system of the block.		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1 Major Project and 2 Medium Projects	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	102
		No. of projects operating till end	101
		Command area of the operating project (Sq. Km.)	46.02
		Net irrigated area under Operating project (Sq. Km.)	32.20
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	815.02 Sq. Km.		
Forest Area	63.45 Sq. Km.		
Cultivable Area	708.37 Sq. Km.		
Net Sown Area	701.42 Sq. Km.		
Double Cropped Area	47.50 Sq. Km.		
Area under Irrigation – Surface Water	88.41 Sq. Km.		
Area under Irrigation – Ground Water	29.34 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	92.20	
	Cotton	195.50	
	Cereals	135.69	
	Oil Seeds	219.36	
Horticultural Crops	Sugarcane	3.24	
	Others	2.02	

1.6.WATER LEVEL BEHAVIOUR

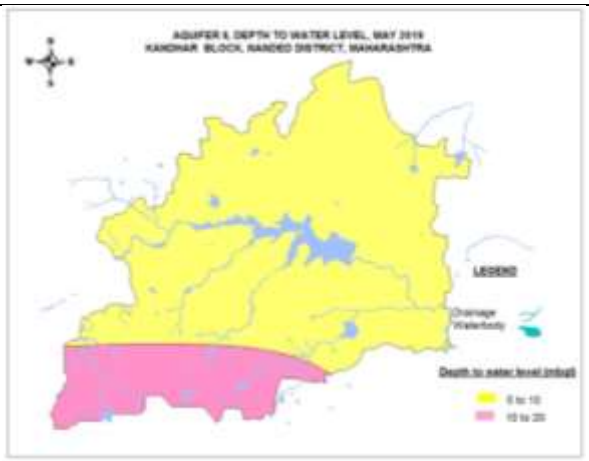
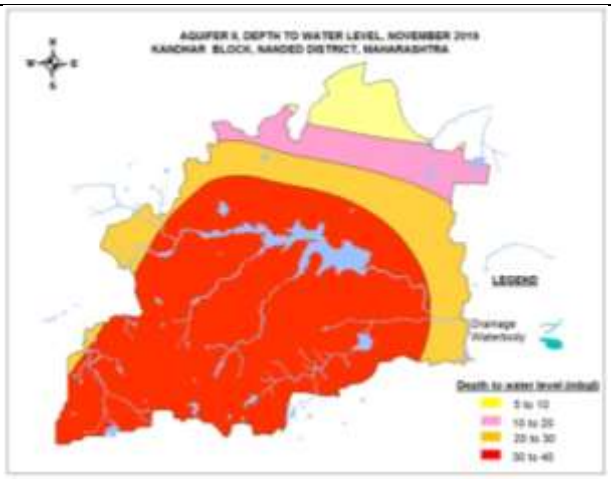
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl observed in 29.78 Sq Km area in a small isolated part of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 448.8 Sq Km area in the major parrts of the block ❖ Depth to water level between 20 mbgl and 30 mbgl is observed in about 325 Sq Km area in the southern, northern and eastern parts of the block	❖ The shallow depth to water level between 2 mbgl and 5 mbgl is observed in 21.93 Sq Km area in small isolated patches in northern parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 322.53 Sq Km area in the northern, central parts of the block and as isolated patch in the southern part. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 459.2 Sq Km area in the remaining parts of the block.

Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

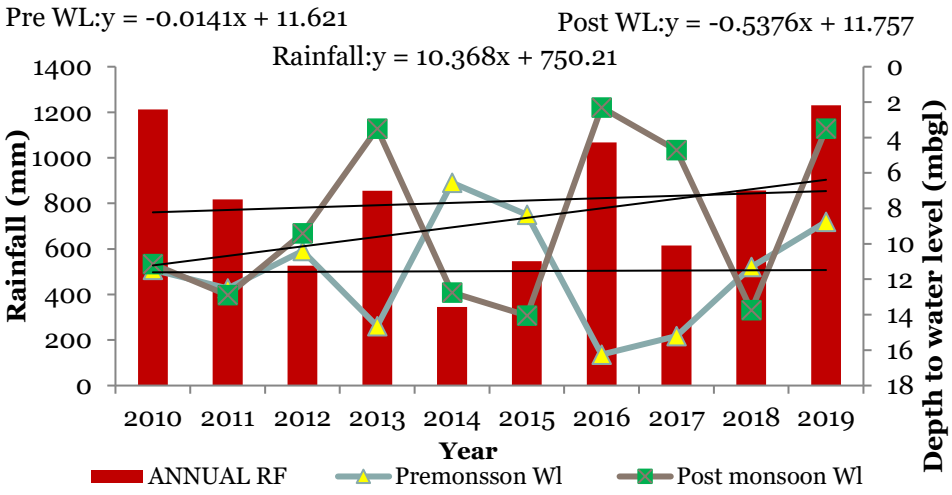
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	

1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)

Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 665.1	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 42.74 sq km

sq km area in the major parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 140.5 Sq Km area in the southern parts of the block.	area in the north-eastern part of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 70.60 Sq Km area in the northern part of the block. ❖ Depth to water level between 20 mbgl and 30 mbgl is observed in 152.5 Sq Km area in the along the central parts of the block as a fringe. ❖ Depth to water level between 30 mbgl and 40 mbgl is observed in 538.9 Sq Km area in the southern and south-central parts of the block.

1.7. Hydrograph

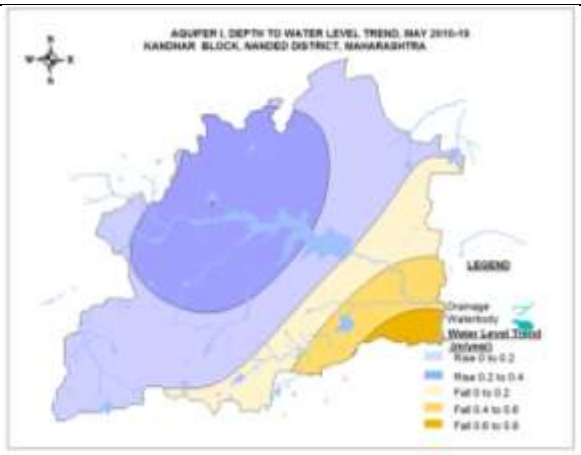
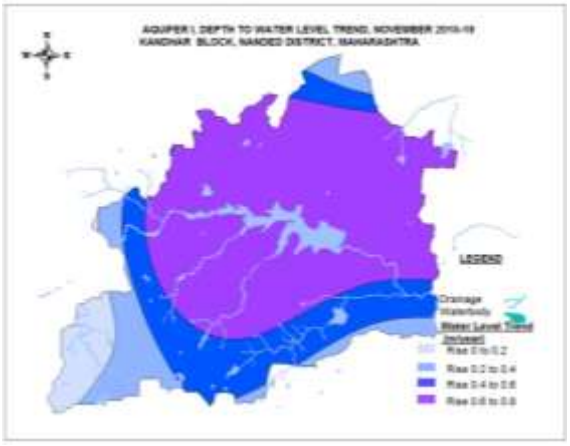


The hydrograph of CGWB Monitoring site at Janapuri for the period 2010 to 2019 shows:

- ❖ A falling trend during both premonsoon and postmonsoon @ 0.0141m/year and 0.537 m/year respectively.
- ❖ The depth to water level during premonsoon ranges from 6.5 mbgl to 16.25 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 2.3 mbgl to 14.05 mbgl.
- ❖ A rising rainfall trend @ 10.36 mm/year for a period of 2010-2019 is observed.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 340.4 Sq Km area and @ 0.2 to 0.4 m/year in 257.6 Sq Km area.	0.0 to 0.2 m/year in 121.1 Sq Km area, 0.2 to 0.4 m/year in 67.04 Sq Km area and 0.4 to 0.6 m/year in 17.87 Sq Km area	0 to 0.2 m/year in 45.17 Sq Km area, 0.2 to 0.4 m/year in 67.94 sq km area; 0.4 to 0.6 m/year in 174.8 sq km area; 0.6 to 0.8 m/year in 188.6 sq km area and >0.8 m/year in 309 sq km area.	Nil

Pre-Monsoon WL Trend (May 2010-2019)	Post-Monsoon WL Trend (Nov.2010-2019)
	

2. GROUND WATER ISSUES

1) **Low Development:** Low development of 26.57% of satge of Ground Water Development is observed in the block.

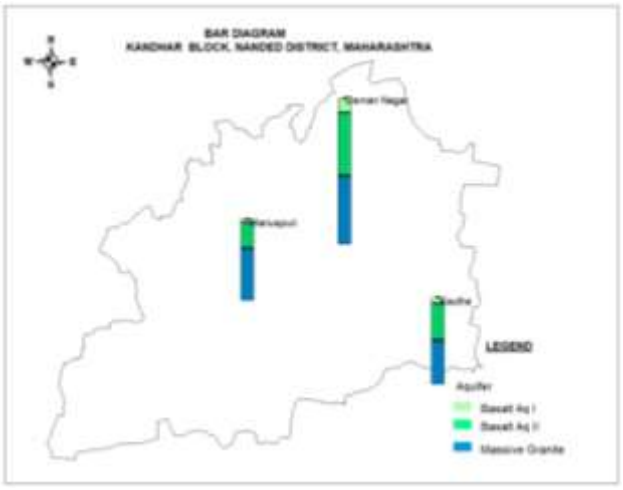
2) **Declining Water Level Trend:** Declining Water Level Trend upto 0.6 m/year is observed in 206 sq km area in the Premonsoon season.

3) **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1.5 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

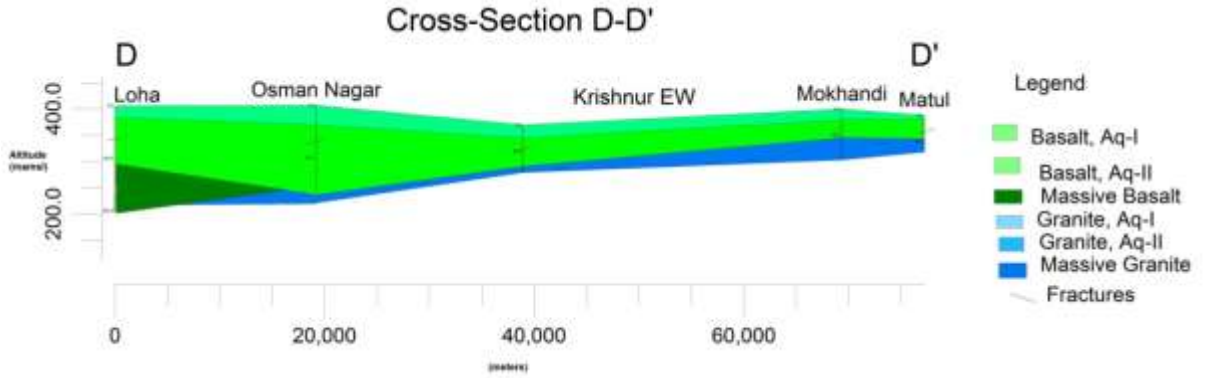
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One: Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined /confined)
Depth to bottom of aquifer (mbgl)	10 to 16	90 to 180
Granular/Weathered/ Fractured rocks thickness (m)	8 to 12.8	2 to 17
Yield Potential	0 to 100 m3/day	0.23 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.00076
Transmissivity (T)	-	4.76 to 14.18 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

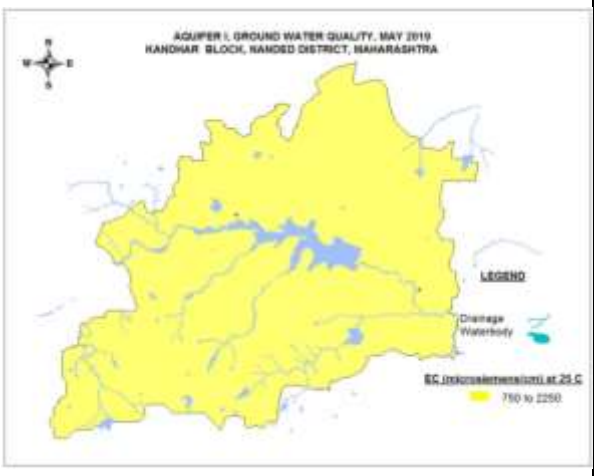
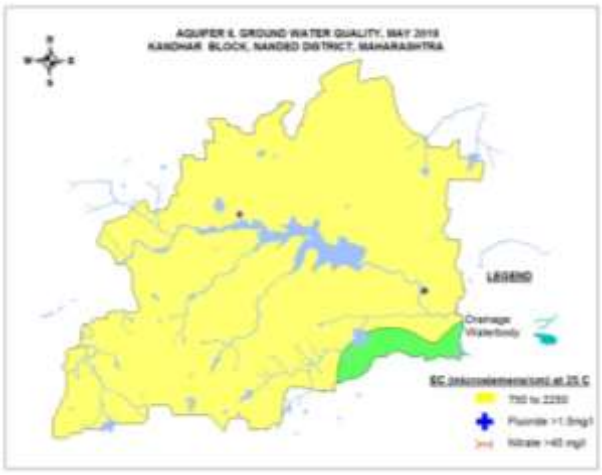
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes. ➢ The entire block has EC well within the potable range of 250 to 750microsiemens/cm	➢ In the entire block, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ About 50 % of the analysed samples have % Na less than 20; 50 % have %Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation purposes except in areas with %Na value more than 60%.

4.1 Aquifer II/Deeper Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable	➢ In major parts of the block covering 774.5

and useful for drinking and domestic puposes except in Nitrate affected Kautha village. ➢ About 28.59 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm, 774.5 sq Km area has EC between 750 and 2250 microsiemens/cm.	Sq Km area, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of most of the analysed samples have values > 1.25 meq/l indicating that the ground water is not good for irrigation. ➢ About 33% of the analysed samples have % Na between 20 and 40 and 64% have %Na more than 60. Hence, the quality of ground water is suitable for irrigation purposes except in areas with high RSC values and %Na value more than 60%.

3.2.CHEMICAL QUALITY MAP

Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	

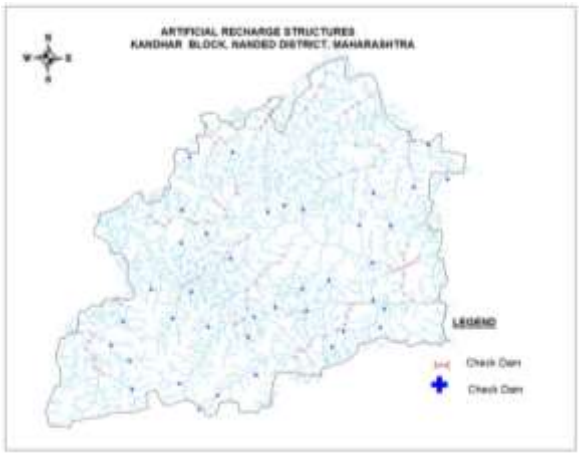
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	779.62
Total Annual Ground Water Recharge (MCM)	104.02
Natural Discharge (MCM)	5.20
Net Annual Ground Water Availability (MCM)	98.82
Existing Gross Ground Water Draft for irrigation (MCM)	24.25
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	2

Existing Gross Ground Water Draft for All uses(MCM)			26.26					
Net Ground Water Availability for future irrigation development(MCM)			69.12					
Provision for domestic and industrial requirement supply to 2025(MCM)			5.82					
Stage of Ground Water Development %			26.57					
Category			**SAFE**					
Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
815.02	5.91	0.00076	3.6	815.02	9.500	0.00076	5.9	9.545
5.0. GROUND WATER RESOURCE ENHANCEMENT								
Available Resource (MCM)			98.82					
Gross Annual Draft (MCM)			26.26					
5.1.SUPPLY SIDE MANAGEMENt								
SUPPLY (MCM)								
Agricultural Supply -GW			24.25					
Agricultural Supply -SW			88.41					
Domestic Supply - GW			2.00					
Domestic Supply - SW			0.50					
Total Supply			**115.16**					
Area of Block (Sq. Km.)			815.02					
Area suitable for Artificial recharge (Sq. Km)			779.62					
Type of Aquifer			Hard Rock	Soft Rock				
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)			587.02	-				
Volume of Unsaturated Zone (MCM)			1174.03	-				
Average Specific Yield			0.020	-				
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)			23.48	-				
Surplus water Available (MCM)			13.14	-				
Proposed Structures			**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings =	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)			**Recharge shaft** (Av. Gross Capacity-60 TCM)	

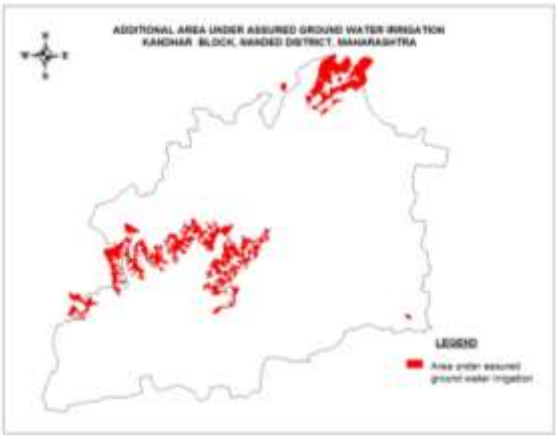
	200 TCM)		
Number of Structures	35	99	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	5.25	2.2275	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	11049		
Total RWH potential (MCM)	0.446		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.357 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	98.82		
Additional GW resources available after Supply side interventions (MCM)	7.4775		
Ground Water Availability after Supply side intervention	106.2975		
Existing Ground Water Draft for All	26.26		

Purposes (MCM)	
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	26.26
Present stage of Ground Water Development (%)	26.6
Expected Stage of Ground Water Development after interventions (%)	24.7
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Nil	
5.5.DEVELOPMENT PLAN	
Additional Volume of water available after stage of GWD is brought to 70% (MCM)	48.15
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	2889
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	481
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	74

Proposed Artificial Recharge Structure



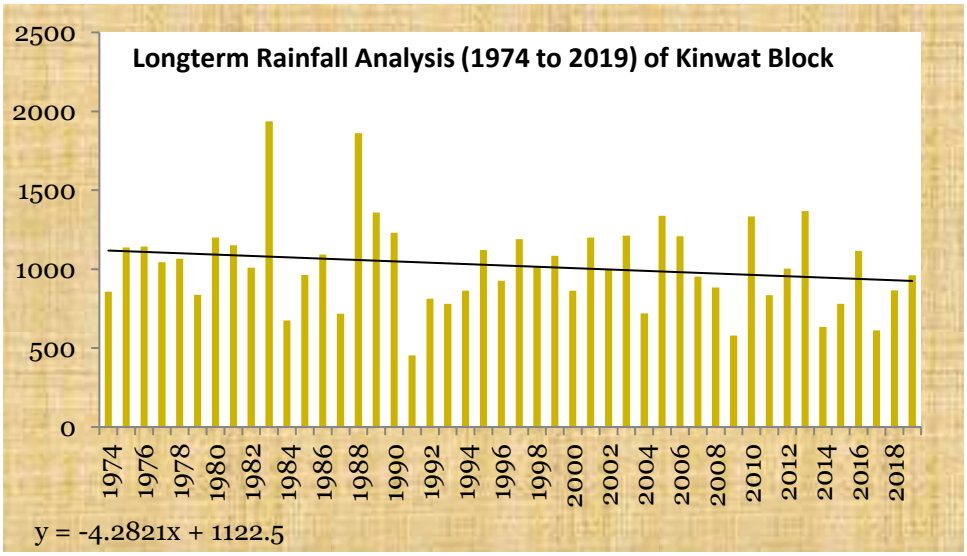
Addditional Area proposed to be brought under assured ground water irrigation



9.9KINWAT BLOCK, NANDED DISTRICT

1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Kinwat
Geographical Area (Sq. Km.)	1515.85 Sq Km
Hilly Area (Sq. Km)	40.23 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	219332
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	1021.8 mm
Annual Rainfall (2019)	961.8 mm
Decadal Average Annual Rainfall (2008-17)	951.38 mm
Long Term Rainfall Analysis (1974-2019)	Falling Trend: -4.282 m/year. Probability of Normal/Excess Rainfall:- 72% & 13%. Probability of Drought (Moderate/ Severe/ Acute):- 13% Moderate & 2% Severe Frequency of occurance of Drought:- 1 in 7 Years

RAINFALL TREND ANALYSIS (1974 to 2019)



1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Butte (B) ➢ Mesa (M) ➢ Pediplain Moderate (PPM), 2-5m weathering ➢ Pediplain Shallow (PPS), 0-2m weathering ➢ Plateau Highly Dissected (PLH) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering

	➢ Plateau Weathered (PLWS), 1-2m weathering		
Soil	➢ Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands with moderate erosion ➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping isolated hillocks and pediments with severe erosion ➢ Shallow, well drained, clayey soils on very gently sloping rolling lands with mesas a'nd buttes and moderate erosion ➢ Very deep, well drained, loamy soils on very gently sloping dissected table lands with moderate erosion ➢ Extremely shallow, well drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Very deep, moderately well drained, clayey soils on very gently sloping lands with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity ➢ Moderately deep, moderately well drained, fine, moderately calcareous soils on gently sloping summits/spurs with moderate erosion		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age) & Gneiss (Archeans)		
1.4.Hydrology & Drainage			
Drainage	Penganga river and its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	3 Medium Projects	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	122
		No. of projects operating till end	122
		Command area of the operating project (Sq. Km.)	90.13
		Net irrigated area under Operating project (Sq. Km.)	30.95
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	1515.85 Sq Km		
Forest Area	554.33 Sq. Km.		
Cultivable Area	701.90 Sq. Km.		
Net Sown Area	699.10 Sq. Km.		

Double Cropped Area		134.23 Sq. Km.	
Area under Irrigation	Surface Water	32.50 Sq. Km.	
	Ground Water	50.00 Sq Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)**
		Pulses	36.9
		Cotton	157.84
		Cereals	17.95
		Oil Seeds	497.65
Horticultural Crops		Sugarcane	40.87
		Others	3.93

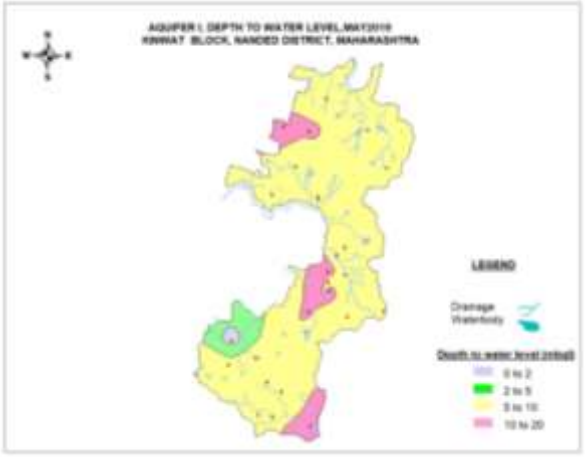
1.6.WATER LEVEL BEHAVIOUR

1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

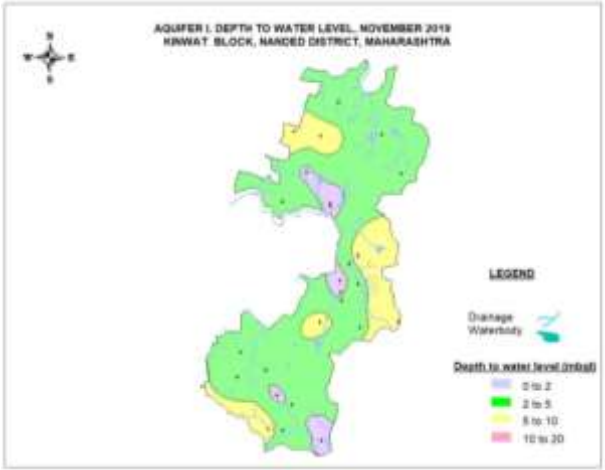
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
❖ Depth to water level between 2 mbgl and 5 mbgl observed in 9 Sq Km area as an isolated patch. ❖ Depth to water level between 5 mbgl and 10 mbgl observed in 68.7 Sq Km area in the south-western part of the block ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 1244 Sq Km area in the major portions of the block ❖ Deeper depth to water level between 20 mbgl and 30 mbgl is observed in 137.34 sq km area in isolated patches in distributed in the block.	❖ The shallow depth to water level less than 2 mbgl is observed only as isolated patches in the block covering only 105 Sq Km area. ❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 1097.6 Sq Km area in major parts of the block ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 269 Sq Km area in patches in the eastern, north-western and south-western partsof the block

Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

Pre-Monsoon Water Level (May 2019)

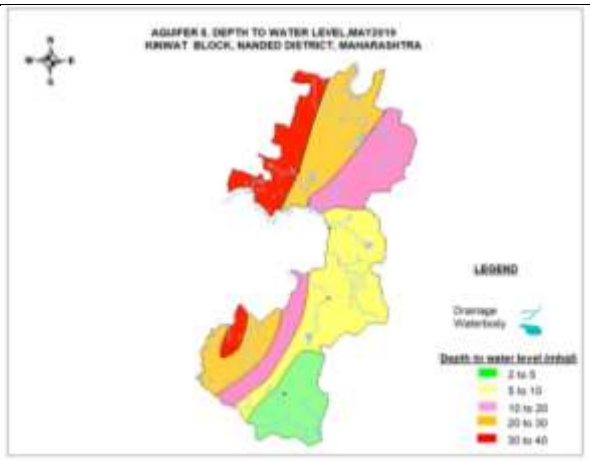
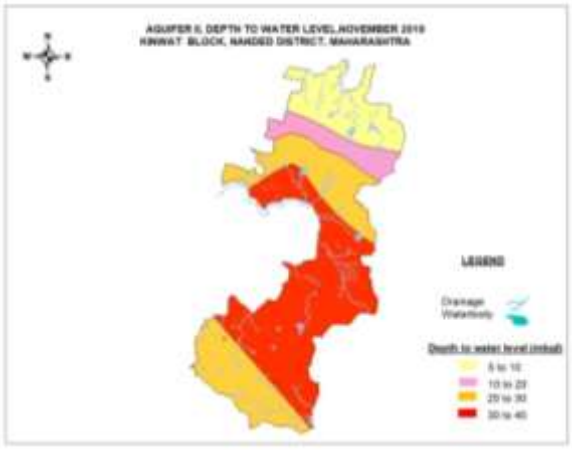


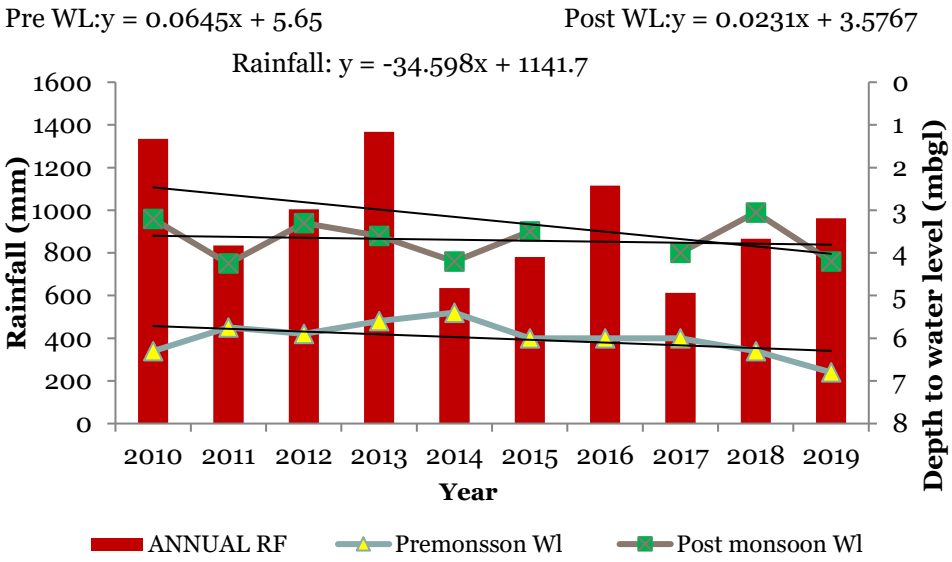
Post-Monsoon Water Level (Nov.2019)



1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)

Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**

	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 2mbgl and 5 mbgl observed in 182.3 Sq Km area in the south-eastern parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 397.4 Sq Km area in the eastern and south-central parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in about 312.7 Sq Km area in the north-eastern and south-western parts of the block. ❖ Depth to water level between 20 mbgl and 30 mbgl is observed in380.2 sq km area in the northern and south-western parts of the block. ❖ Deeper depth to water level more than 30 mbgl is observed in 198.85 sq km area in the north-western tip of the block.	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in only 236.8 Sq Km area in the northern fringe of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 119.9 Sq Km area in the northern part of the block ❖ Depth to water level between 20 mbgl and 30 mbgl is observed in 457.9 Sq Km area in the southern and north-central parts of the block ❖ The deeper deptht to water level of more than 30 mbgl is observed in the central parts of the block
1.7. Hydrograph	

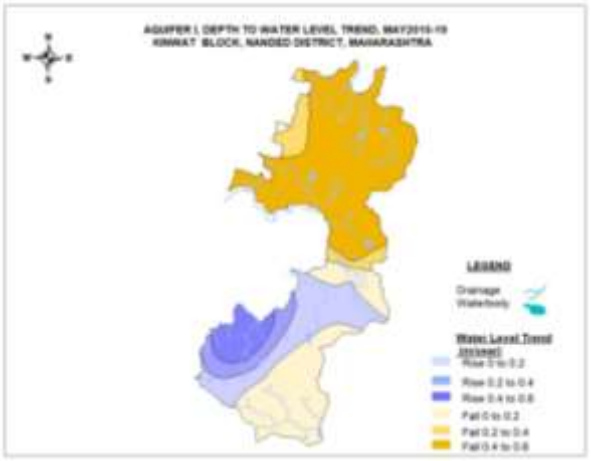
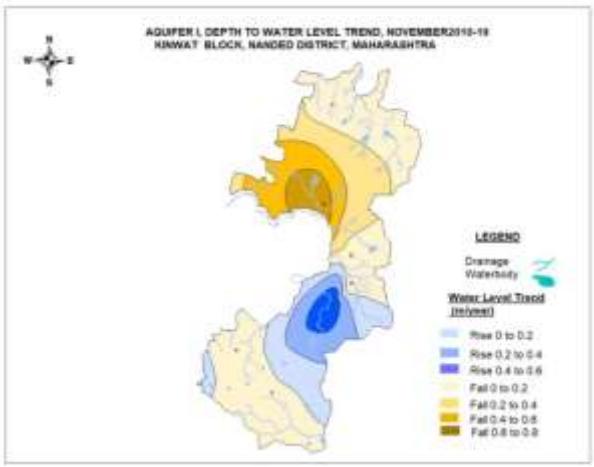


The hydrograph of CGWB Monitoring site at Jhalakwadi for the period 2010 to 2019 shows:

- A rising trend during both premonsoon and postmonsoon @ 0.064 m/year and 0.023 m/year respectively.
- The depth to water level during premonsoon ranges from 5.4 mbgl to 6.8 mbgl.
- The depth to water level during postmonsoon ranges from 3.05 mbgl to 4.25 mbgl.
- A falling rainfall trend @34.59 mm/year is observed for a period of 2010-19

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 225.4 Sq Km area; 0.2 to 0.4 m/year in 75.91 Sq Km area and 0.4 to 0.6 m/year in 87.04 sq km area.	0.0 to 0.2 m/year in 331.39 Sq Km area, 0.2 to 0.4 m/year in 79.65 Sq Km area and 0.4 to 0.6 m/year in 659.5 Sq Km area	0.0 to 0.2 m/yr in 211.79 Sq Km area, 0.2 to 0.4 m/year in 116.3 Sq Km area and 0.4 to 0.6 m/year in 40.77 Sq Km area.	0 to 0.2 m/year in 890.8 Sq Km areas, 0.2 to 0.4 m/year in 141.5 Sq Km area and 0.4 to 0.6 m/year in 63.40 Sq Km area

Pre-Monsoon WL Trend (May 2010-2019)	**Post-Monsoon WL Trend (Nov.2010-2019)**
	

2. GROUND WATER ISSUES

6. **Low Development:-**Low Development of 24.17 % of Stage of Ground Water Development is observed in the block

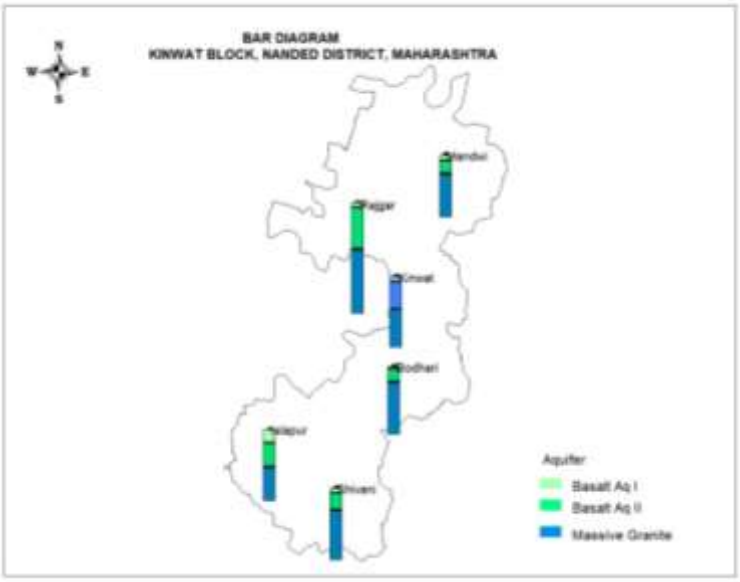
7. **Declining Water Level Trend: -**
   The decline in water level trend (2010-19) upto 0.6 m/year is observed in 1050 sq km area of the block during both the seasons

8. **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1.5 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

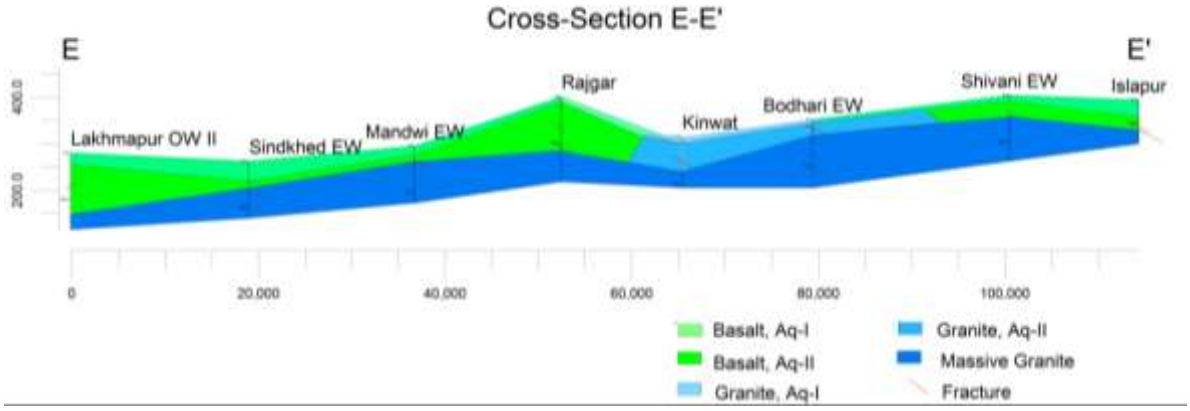
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two: 1)Basalt –Aquifer-I, Aquifer-II 2)Gneiss-Aquifer-I, 3)Granite-Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



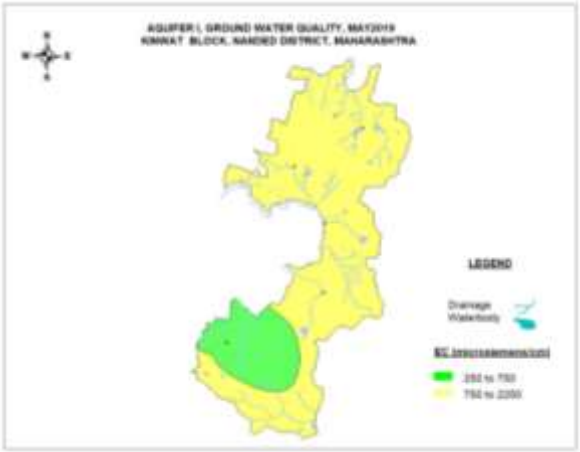
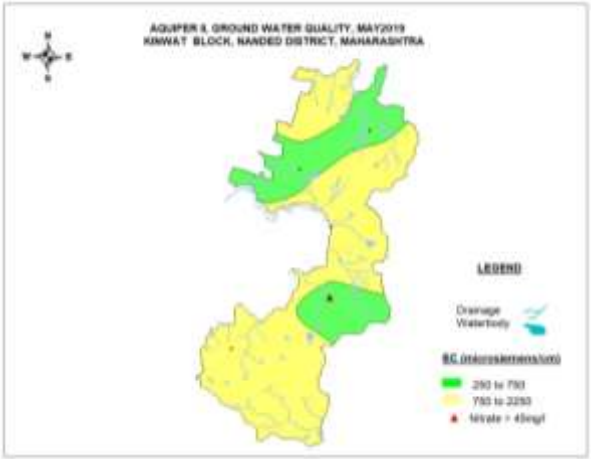
3.4 AQUIFER CHARACTERISTICS

Major Aquifer	Basalt (Deccan Traps)		Gneiss	Granite
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II(Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	9 to 15	28 to 128	10 to 14	28 to 88
Weathered/ Fractured rocks thickness (m)	5 to 11	2 to 14	8 to 10	2 to 15
Yield Potential	0 to 100 m3/day	0 to 0.25 lps	0 to 50 m3/day	0 to 1.25
Specific Yield (Sy)/ Storativity (S)	0.02	0.0013	0.02	0.00029-0.0014
Transmissivity (T)	-	22.08 m2/day	-	44.032 to 593.26 m2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Flouride in fested area (Gokunda village) ➢ About 248 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm and 1219 sq Km area has EC between 750 and 2250 microsiemens/cm.	➢ In 248 Sq Km area of the block, plants with moderate salt tolerance can be grown. However, in 1219 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed except at one site (Islapur village) have values < 1.25 meq/l indicating that the ground water is good for irrigation in almost the major parts of the block.

	➢ All the analysed samples have % Na less than %Na between 20 and 40. Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Bodhari village ➢ About 416.8 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm and 1045.8 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 416 Sq Km area, plants with moderate salt tolerance can be grown. However, in 1045.8 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of 40% of the analysed samples have values > 1.25 meq/l and 60% has RSC < 1.25 meq/l ➢ About 20 % of the analysed samples have % Na less than 20; 40% has % Na between 20 nad 40 and 40% have %Na more than 60. Hence, the overall quality of ground water is suitable for irrigation purposes except in areas with %Na value more than 60.and RSC is more than 1.25 meq/l
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II &III)**
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	1475.62
Total Annual Ground Water Recharge (MCM)	164.63

Natural Discharge (MCM)	8.23
Net Annual Ground Water Availability (MCM)	156.4
Existing Gross Ground Water Draft for irrigation (MCM)	34.87
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	2.92
Existing Gross Ground Water Draft for All uses(MCM)	37.80
Net Ground Water Availability for future irrigation development(MCM)	112.58
Provision for domestic and industrial requirement supply to 2025(MCM)	8.98
Stage of Ground Water Development %	24.17
Category	**SAFE**

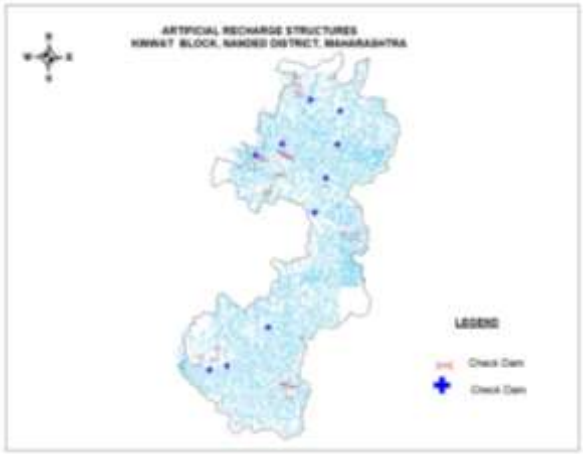
Aquifer-II								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
1515.85	0.27	0.00029	47	1515.85	9.5	0.00029	4.17	4.29

5.0. GROUND WATER RESOURCE ENHANCEMENT		
Available Resource (MCM)	156.40	
Gross Annual Draft (MCM)	37.80	
5.1.SUPPLY SIDE MANAGEMENT		
SUPPLY (MCM)		
Agricultural Supply -GW	34.87	
Agricultural Supply -SW	32.40	
Domestic Supply - GW	2.92	
Domestic Supply - SW	0.73	
Total Supply	**70.92**	
Area of Block (Sq. Km.)	1515.85	
Area suitable for Artificial recharge (Sq. Km)	1475.62	
Type of Aquifer	Hard Rock	Soft Rock
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	184.70	-
Volume of Unsaturated Zone (MCM)	369.4	-
Average Specific Yield	0.020	-
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	7.39	-
Surplus water Available (MCM)	4.14	-

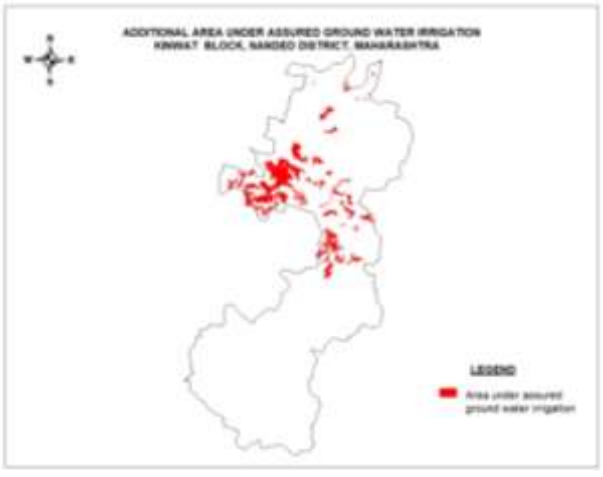
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	11	31	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	1.65	0.6975	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	11588		
Total RWH potential (MCM)	0.551		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.441 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	156.40		
Additional GW resources available after Supply side interventions	2.3475		

(MCM)	
Ground Water Availability after Supply side intervention	158.7475
Existing Ground Water Draft for All Purposes (MCM)	37.80
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	37.8
Present stage of Ground Water Development (%)	24.2
Expected Stage of Ground Water Development after interventions (%)	23.8
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Nil	
5.5.DEVELOPMENT PLAN	
Additional Volume of water available after stage of GWD is brought to 70% (MCM)	73.32
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	4399
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	733
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	113

Proposed Artificial Recharge Structure



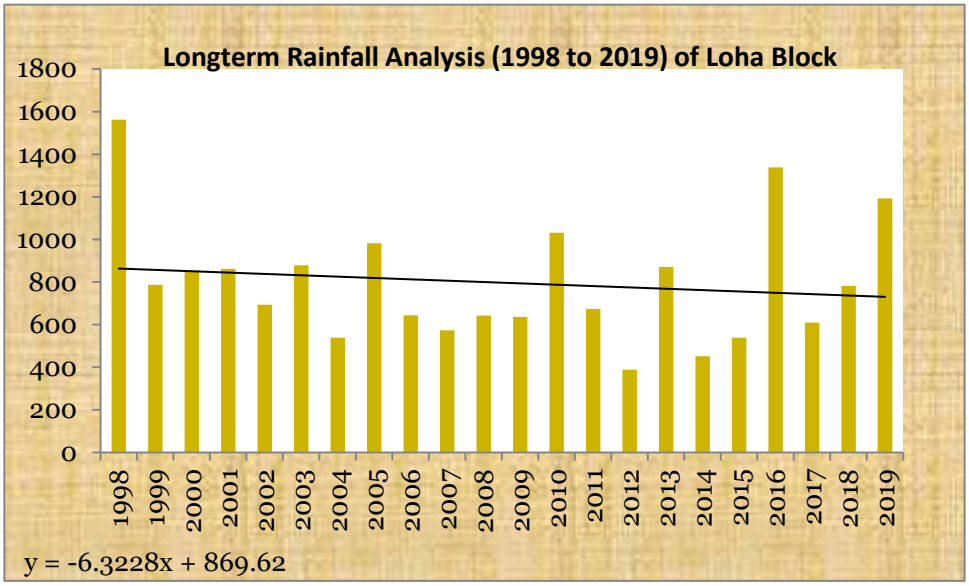
Demand Side Interventions



9.10 LOHA BLOCK, NANDED DISTRICT

1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Loha
Geographical Area (Sq. Km.)	865.4 Sq. Km.
Hilly Area (Sq. Km)	15.85 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	217760
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	796.9 mm
Annual Rainfall (2019)	1192.8 mm
Decadal Average Annual Rainfall (2010-19)	787.8 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend: -6.32 m/year. Probability of Normal/Excess Rainfall: - 59% & 18%. Probability of Drought (Moderate/ Severe/ Acute):- 18% Moderate & 5% Severe Frequency of occurrence of Drought:- 1 in 4 Years

RAINFALL TREND ANALYSIS (1998 to 2017)



1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Alluvial Plain - Deep (APD) ➢ Alluvial Plain - Older - Moderate (AYM) ➢ Butte (B) ➢ Escarment Slope (ES) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering

	➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)		
Soil	➢ Very shallow, somewhat excessively drained, loamy soils on moderately sloping summits/spurs with severe erosion ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands with moderate erosion ➢ Slightly deep, moderately well drained, fine, moderately calcareous soils on moderately sloping undulating lands with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity		
Geology	Recent River Alluvium-sand/Clay dominant & Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	Godavari river & its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1 Medium Projects	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	76
		No. of projects operating till end	74
		Command area of the operating project (Sq. Km.)	45.08
		Net irrigated area under Operating project (Sq. Km.)	21.37
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	865.4 Sq. Km.		
Forest Area	25.04 Sq. Km.		
Cultivable Area	702.50 Sq. Km.		
Net Sown Area	682.80 Sq. Km.		
Double Cropped Area	129.06 Sq. Km.		
Area under Irrigation – Surface Water	34.05 Sq. Km.		
Area under Irrigation – Ground Water	69.70 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	146.91	
	Cotton	152.03	
	Cereals	112.26	

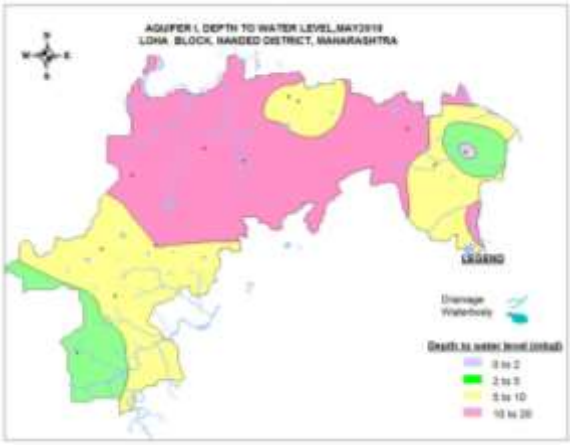
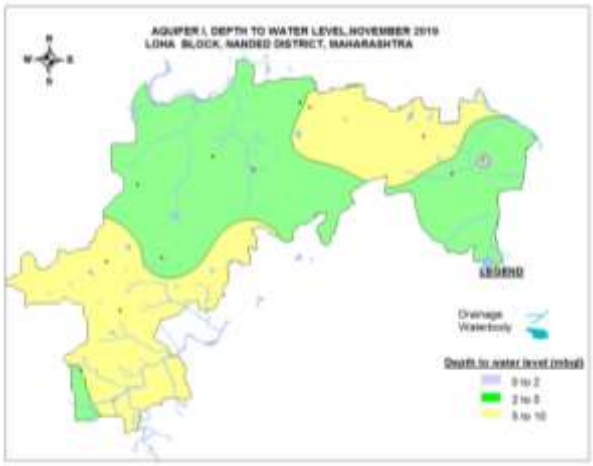
	Oil Seeds	372.45
Horticultural Crops	Sugarcane	8.47
	Others	3.87

1.6.WATER LEVEL BEHAVIOUR

1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

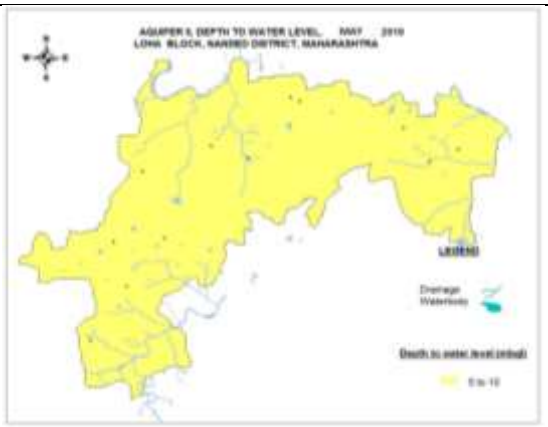
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
❖ Isolated patch of 2.3 sq km area has depth to water level less than 2 mbgl. ❖ Depth to water level between 2 mbgl and 5 mbgl observed in 94.32 Sq Km areas in the north-eastern part of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl observed in 309.5 Sq Km area in the north-eastern, northern and southern parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 426.39 sq km area in the northern and north-eastern parts of the block.	❖ The shallow depth to water level less than 2 mbgl is observed only as isolated patch in 1.21 Sq Km area. ❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 462.3 Sq Km area in the northern parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 368 Sq Km area in the northern and southern parts of the block.

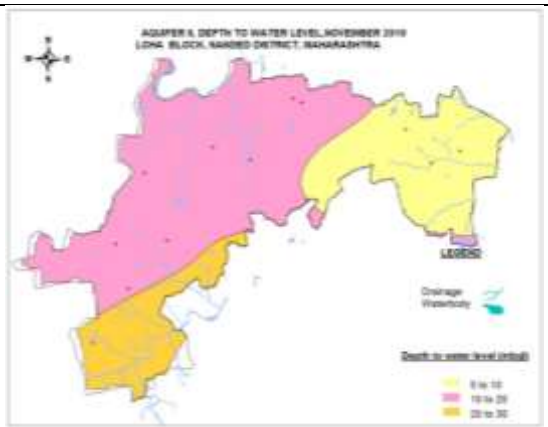
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)

Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	

1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)

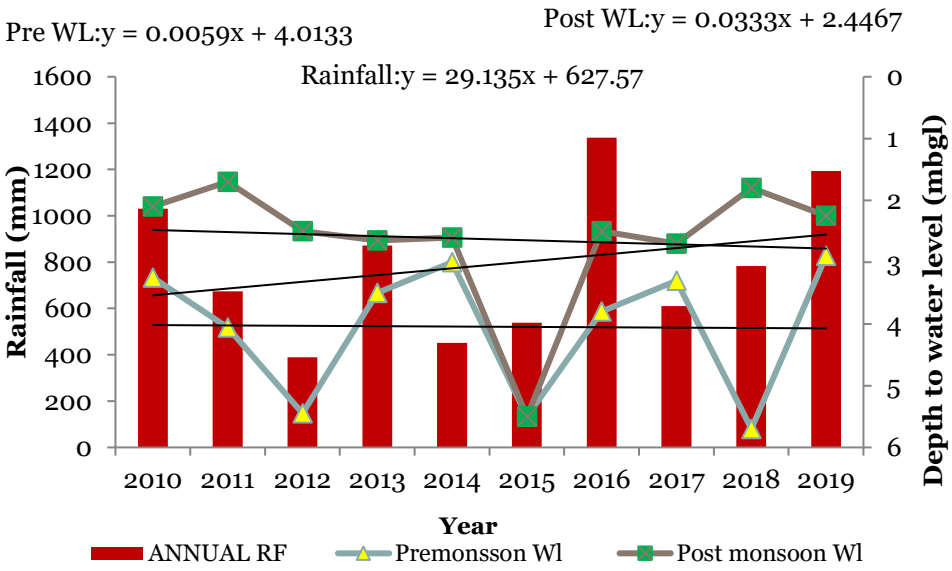
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**





Pre-Monsoon Water Level(May 2019)	Post-Monsoon Water Level(November 2019)
❖ Depth to water level between 5 mbgl and 10 mbgl is observed in the whole of the block.	❖ The depth to water level between 10 mbgl and 20 mbgl is observed in 493.3 Sq Km area in the major parts of the block. ❖ Deeper depth to water level between 20 mbgl and 30 mbgl is observed in 122.6 Sq Km area in the southern parts of the block

1.7. Hydrograph

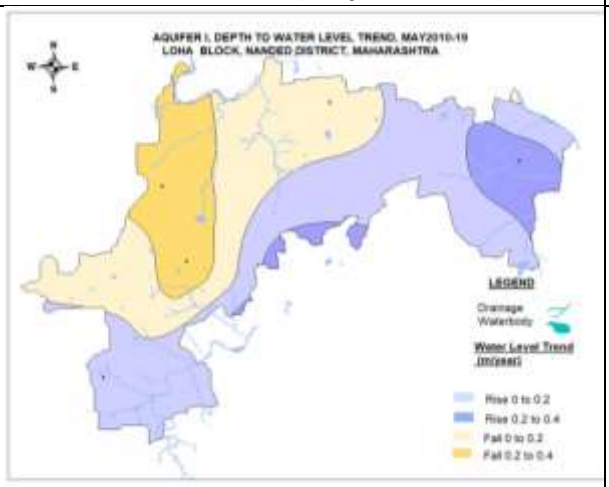
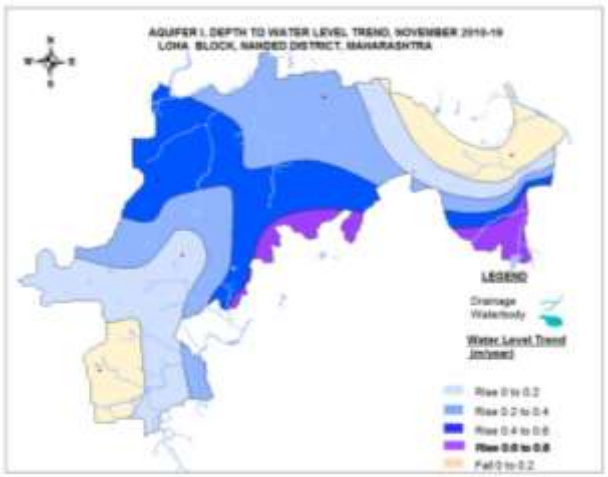


The hydrograph of CGWB Monitoring site at Malegaon for the period 2010 to 2019 shows:

- ❖ A rising trend during both premonsoon and postmonsoon @ 0.0059m/year and 0.0333 m/year respectively.
- ❖ The depth to water level during premonsoon ranges from 2.9 mbgl to 5.7 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 1.7 mbgl to 5.5 mbgl.
- ❖ A rising rainfall trend @ 29.13 mm/year for a period of 2010-2019 is observed.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		Post-Monsoon Trend (November 2010-2019)	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in	0.0 to 0.2 m/year in	0 to 0.2 m/year in 136.4	0 to 0.2 m/year in

347.4 Sq Km area and 0.2 to 0.4 m/year in 77.16 sq km area.	279.1 Sq Km area, 0.2 to 0.4 m/year in 131 Sq Km area	Sq Km area, 0.2 to 0.4 m/year in 246.41 Sq Km area, 0.4 to 0.6 m/year in 200.3 Sq Km area and > 0.6 m/year in 33.01 sq km area	151.03 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	
			

2. GROUND WATER ISSUES

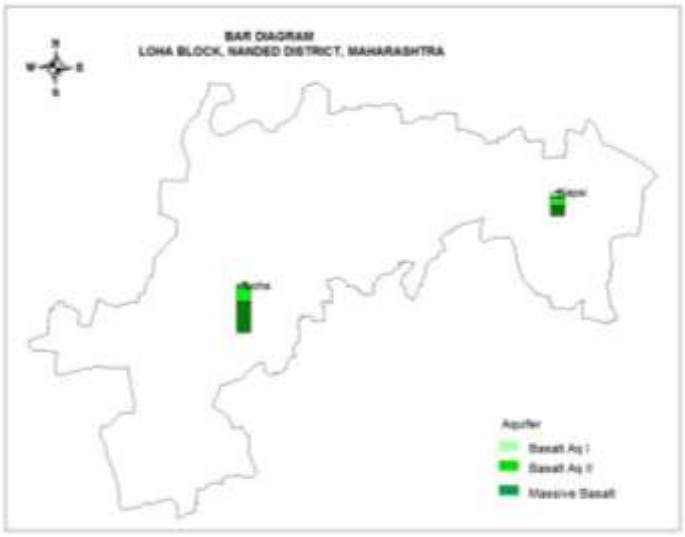
1. **Low Development:-**Low Development of 30.93 % of Stage of Ground Water Development is observed in the block

2. **Declining Water Level Trend: -**
   The decline in water level trend (2010-19) upto 0.4 m/year is observed in 410 sq km area of the block during Pre-monsoon and 151 Sq Km areas during Postmonsoon.

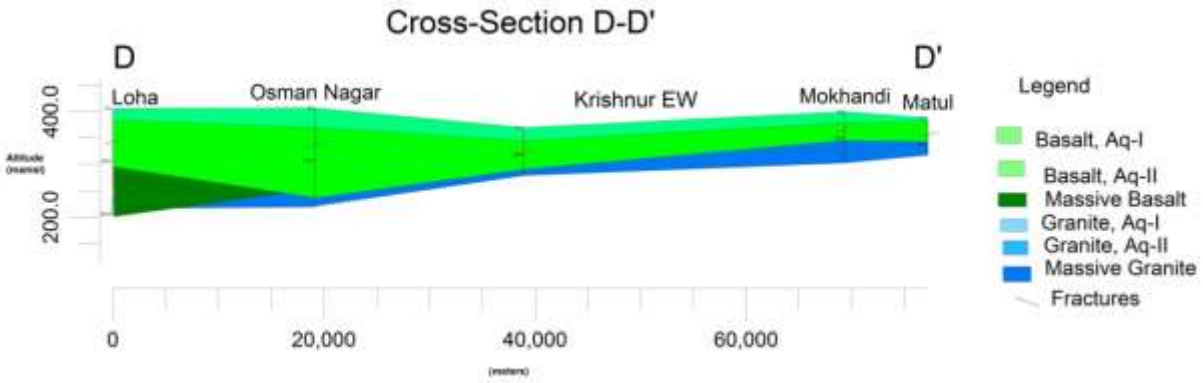
3. **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two 1)Alluvium-Aquifer-I 2)Basalt –Aquifer-I, Aquifer-II
3.2. LITHOLOGICAL DISPOSITION	



3.3. CROSS SECTIONS



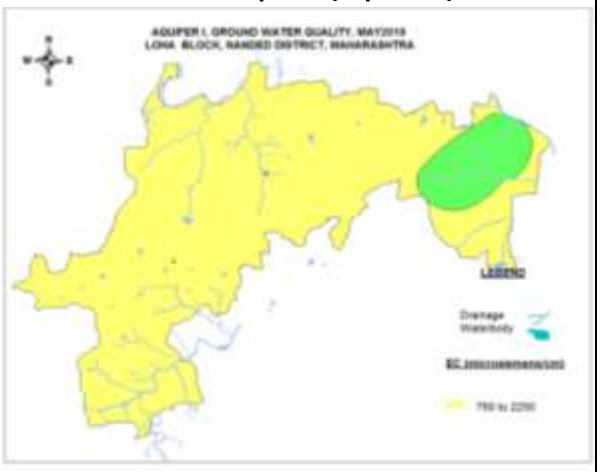
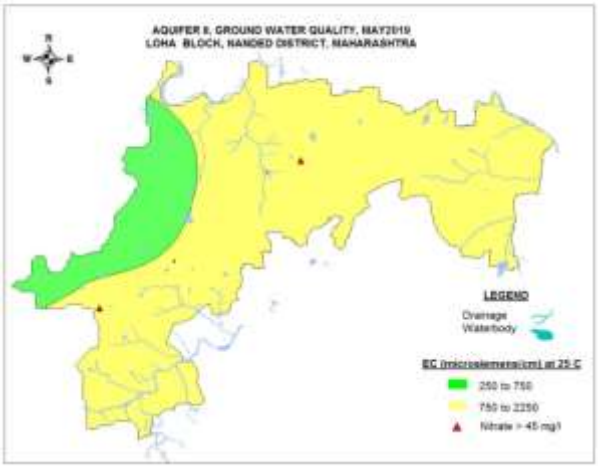
3.4 AQUIFER CHARACTERISTICS

Major Aquifer	**Alluvium**	**Basalt (Deccan Traps)**	
Type of Aquifer (Phreatic/Semiconfined/ Confined)	Aquifer-I (Phreatic)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	34 to 35	10 to 35	120 to 180
Weathered/ Fractured rocks thickness (m)	23 to 26	8 to 25	5 to 8
Yield Potential	100 to 200 m3/day	15 to 100 m3/day	0.23 to 0.65 lps
Specific Yield (Sy)/ Storativity (S)	0.07	0.02	0.00035
Transmissivity (T)	-	-	22.96 to 73.57 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes	➢ In the entire block, where EC > 750 microsiemens/cm, special management for salinity control may be required and

➢ The entire block has EC between 750 and 2250 microsiemens/cm	plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ All the analysed samples have % Na %Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Ghugewadi and Madki villages.. ➢ About 128.5 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 706.8 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 128.5 Sq Km area, plants with moderate salt tolerance can be grown. However, in 706.8 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected.
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	849.55
Total Annual Ground Water Recharge (MCM)	112.09
Natural Discharge (MCM)	5.60
Net Annual Ground Water Availability (MCM)	106.49
Existing Gross Ground Water Draft for irrigation (MCM)	30.92

Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	2.01
Existing Gross Ground Water Draft for All uses(MCM)	32.93
Net Ground Water Availability for future irrigation development(MCM)	69.73
Provision for domestic and industrial requirement supply to 2025(MCM)	5.86
Stage of Ground Water Development %	30.93
Category	**SAFE**

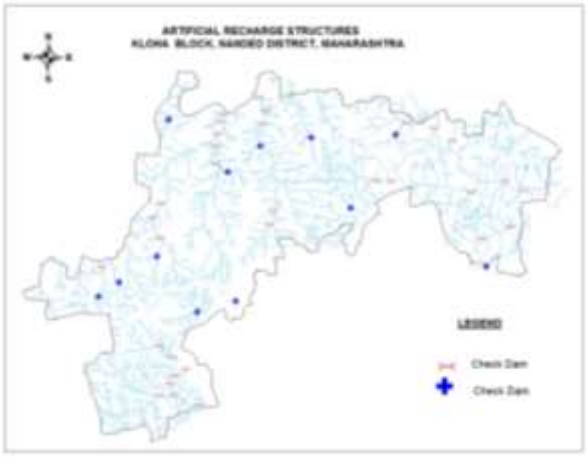
Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
865.4	22	0.00035	2.320	865.4	6.500	0.00035	1.96	4.28

5.0. GROUND WATER RESOURCE ENHANCEMENT		
Available Resource (MCM)	106.49	
Gross Annual Draft (MCM)	32.93	
5.1.SUPPLY SIDE MANAGEMENt		
SUPPLY (MCM)		
Agricultural Supply -GW	30.92	
Agricultural Supply -SW	37.05	
Domestic Supply - GW	2.01	
Domestic Supply - SW	0.50	
Total Supply	**70.48**	
Area of Block (Sq. Km.)	865.4	
Area suitable for Artificial recharge (Sq. Km)	849.55	
Type of Aquifer	Hard Rock	Soft Rock
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	190.32	-
Volume of Unsaturated Zone (MCM)	380.636	-
Average Specific Yield	0.020	-
Volume of Sub surface Storage Space available for Artificial Recharge	7.61	-

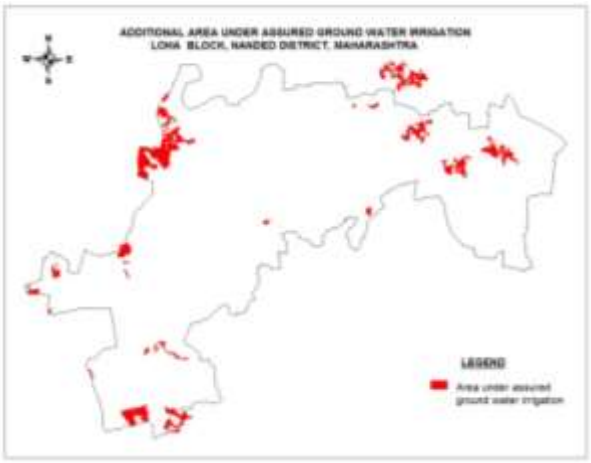
(MCM)			
Surplus water Available (MCM)	4.26	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	11	32	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	1.65	0.72	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	10627		
Total RWH potential (MCM)	0.418		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.335 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	**Nil**		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	**Nil**		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	106.49		
Additional GW resources available after Supply side interventions	2.37		

(MCM)	
Ground Water Availability after Supply side intervention	108.86
Existing Ground Water Draft for All Purposes (MCM)	32.93
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	32.93
Present stage of Ground Water Development (%)	30.9
Expected Stage of Ground Water Development after interventions (%)	30.2
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 59.76% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	43.27
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	2596
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	433
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	67

Proposed Artificial Recharge Structure



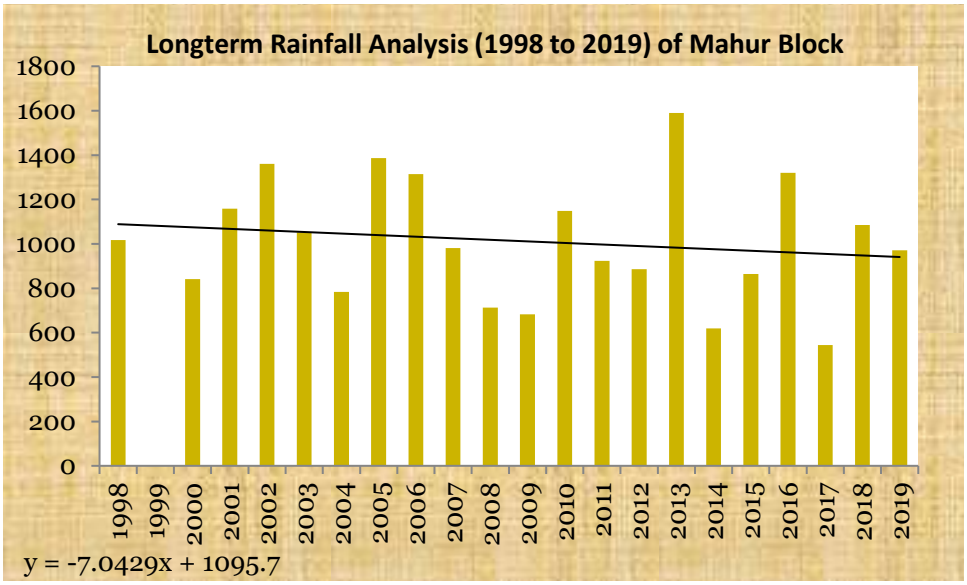
Additional Area proposed to be brought under assured ground water irrigation



9.11 MAHUR BLOCK, NANDED DISTRICT

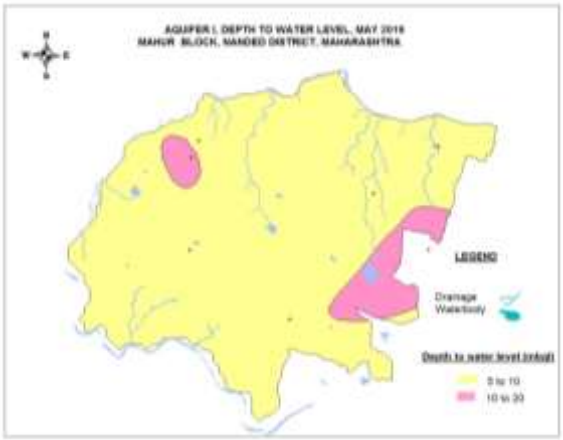
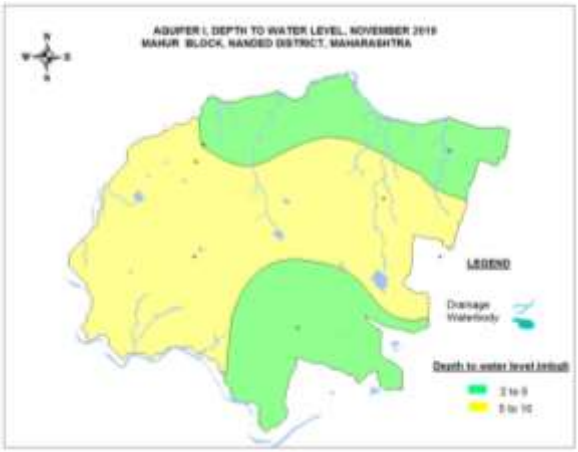
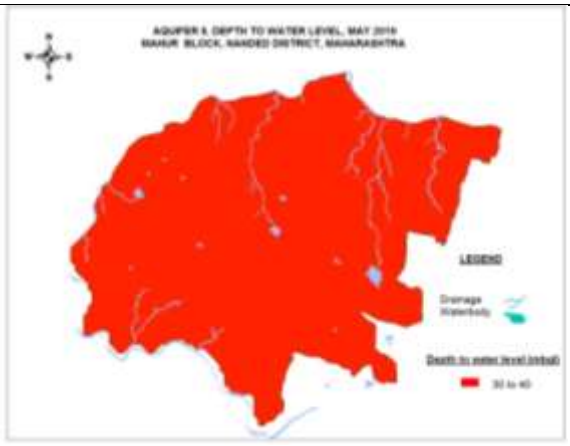
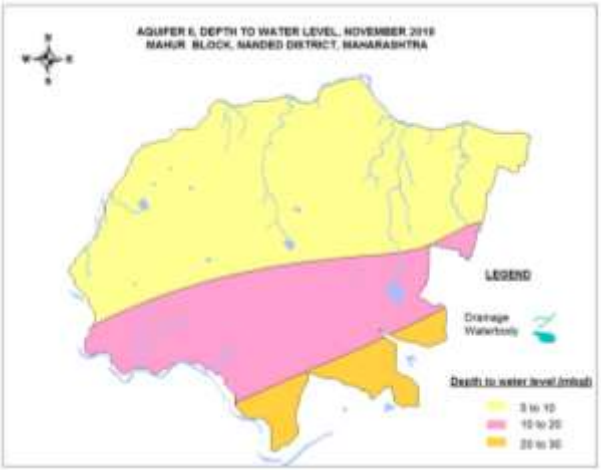
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Mahur
Geographical Area (Sq. Km.)	517.41 Sq. Km.
Hilly Area (Sq. Km)	19.23 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	22127
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	1011.49 mm
Annual Rainfall (2019)	971 mm
Decadal Average Annual Rainfall (2010-19)	995.1 mm
Long Term Rainfall Analysis (1998-2019)	Falling Trend: -7.042 m/year. Probability of Normal/Excess Rainfall: - 57% & 24%. Probability of Drought (Moderate/ Severe/ Acute):- 19% Moderate Frequency of occurance of Drought:- 1 in 5 Years

RAINFALL TREND ANALYSIS (1998 to 2017)



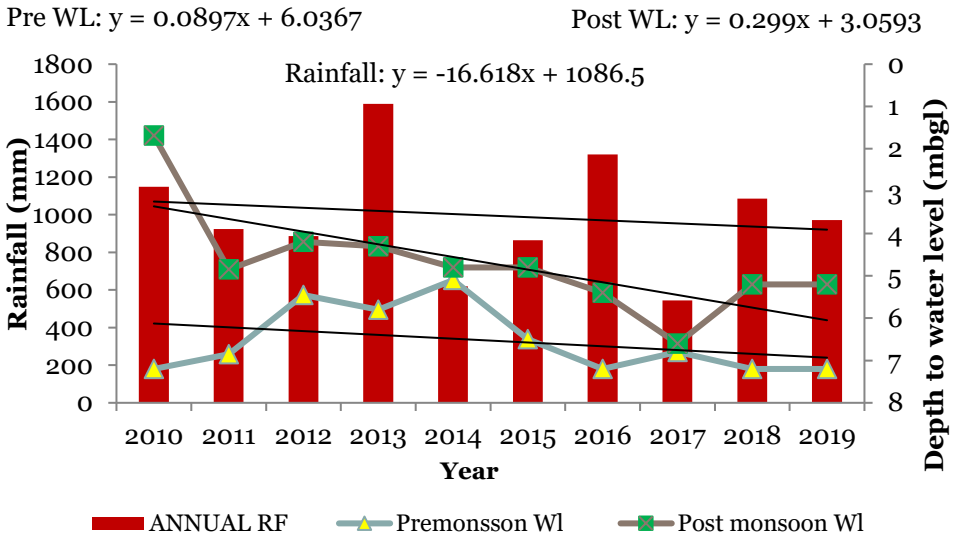
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Butte (B) ➢ Escarment Slope (ES) ➢ Plateau Highly Dissected (PLH) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering

Soil		➢ Extremely shallow, well drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Very shallow, well drained, clayey soils on gently sloping dissected lands with moderate erosion ➢ Very shallow, well drained, clayey soils on gently sloping dissected lands with moderate erosion\ ➢ Shallow, well drained, clayey soils on very gently sloping dissected table lands with moderate erosion ➢ Slightly deep, moderately well drained, clayey soils on very gently sloping lands with moderate erosion ➢ Very deep, moderately well drained, clayey soils on very gently sloping lands with moderate erosion	
Geology		Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)	
1.4.Hydrology & Drainage			
Drainage		Penganga river & its tributaries	
Hydrology(as on March 2017)		Major & Medium Irrigation Projects (>250 Ha)	Nil
		Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017: 23
			No. of projects operating till end: 23
			Command area of the operating project (Sq. Km.): 21.34
			Net irrigated area under Operating project (Sq. Km.): 6.39
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area		517.41 Sq. Km.	
Forest Area		94.38 Sq. Km.	
Cultivable Area		317.68 Sq. Km.	
Net Sown Area		317.68 Sq. Km.	
Double Cropped Area		19.37 Sq. Km.	
Area under Irrigation	Surface Water	0	
	Ground Water	45.70 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)**
		Pulses	54.53
		Cotton	257.42
		Cereals	10.57
		Oil Seeds	95.84
Horticultural Crops		Sugarcane	0.47
		Others	2.96

1.6.WATER LEVEL BEHAVIOUR	
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl observed in 458.4 Sq Km areas in major parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 40.28 Sq Km area in the north-western and eastern parts as patches	❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 193.96 Sq Km area in the northern and southern parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 238 Sq Km area in the northwestern, western and southern parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in only 307.17 Sq Km area in the major parts of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 30 mbgl and 40 mbgl is observed in the whole of the block.	❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 309.5 Sq Km area in the northern part of the block.

	❖ Depth to water level between 10 mbgl and 20 mbgl is observed in about 156.2 Sq Km area aqlong the central part of the block. ❖ Deeper depth to water level more than 20 mbgl is observed in 37.46 sq km area in the southern part of the block as fringes

1.7. Hydrograph

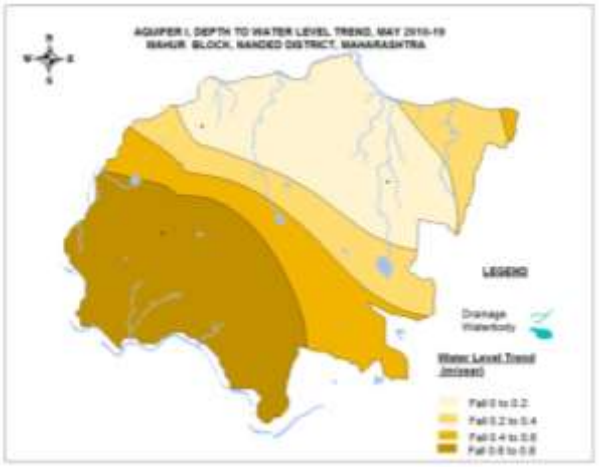


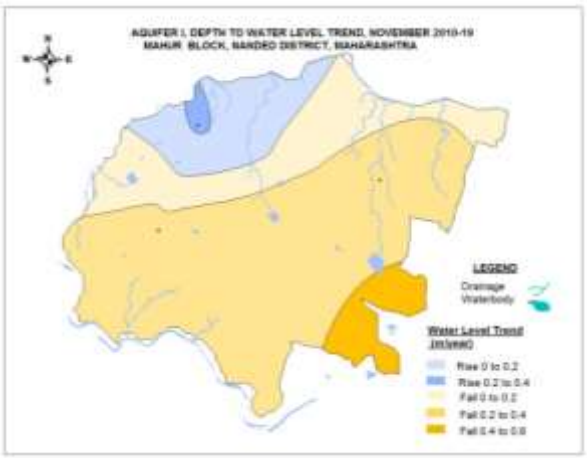
The hydrograph of CGWB Monitoring site at Anjankhed for the period 2010 to 2019 shows:

- ❖ A rising trend during both premonsoon and postmonsoon @ 0.0897m/year and 0.299 m/year respectively.
- ❖ The depth to water level during premonsoon ranges from 5.1 mbgl to 7.2 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 1.69 mbgl to 6.6 mbgl.
- ❖ A falling rainfall trend @ 16.6 mm/year is observed during the period 2010-19.

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
Nil	0.0 to 0.2 m/year in 149.2 Sq Km area, 0.2 to 0.4 m/year in 92.59 Sq Km area, 0.4 to 0.6 m/year in 84.32 sq km area and >0.6 m/year in 175.3 sq km area.	0 to 0.2 m/year in 60.79 Sq Km area and 0.2 to 0.4 m/year in 4.6 Sq Km area	0 to 0.2 m/year in 405.3 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

1. **Low Development:-**Low Development of 40.98 % of Stage of Ground Water Development is observed in the block

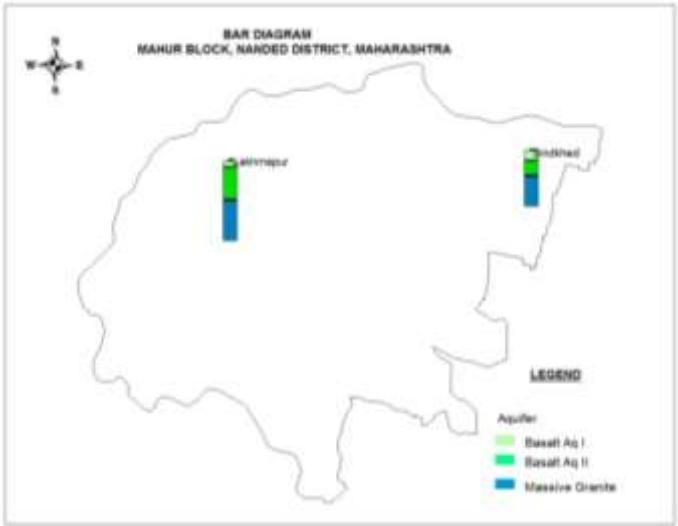
2. **Declining Water Level Trend: -**
   The decline in water level trend (2010-19) upto 0.6 m/year is observed in 501 sq km area of the block during premonsoon and 405 sq km area during postmonsoon.

3. **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

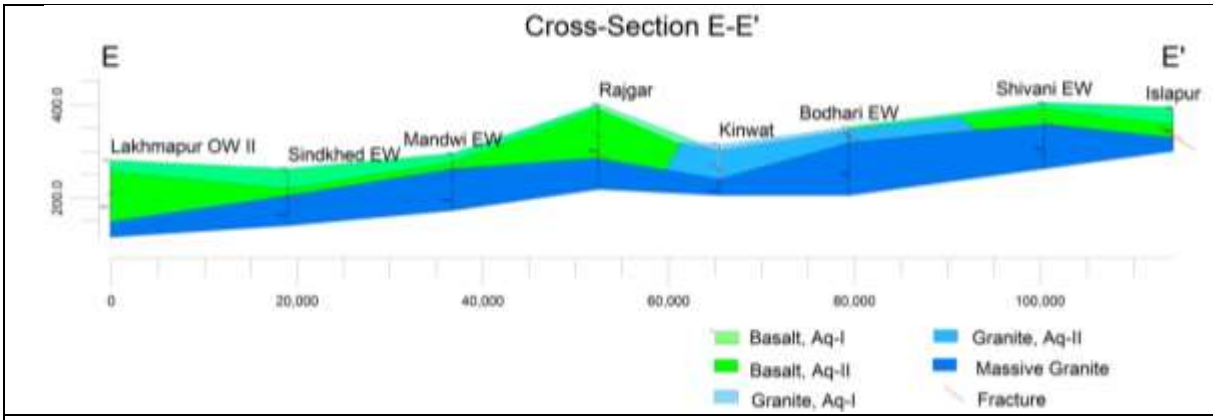
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One:Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	9 to 16	30 to 150
Weathered/ Fractured rocks thickness (m)	6.3 to 12	5 to 11
Yield Potential	0 to 100 m3/day	0 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.0013
Transmissivity (T)	-	19 to 22.08 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

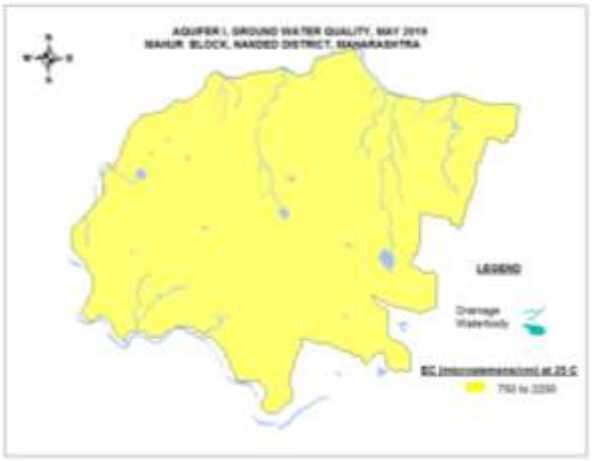
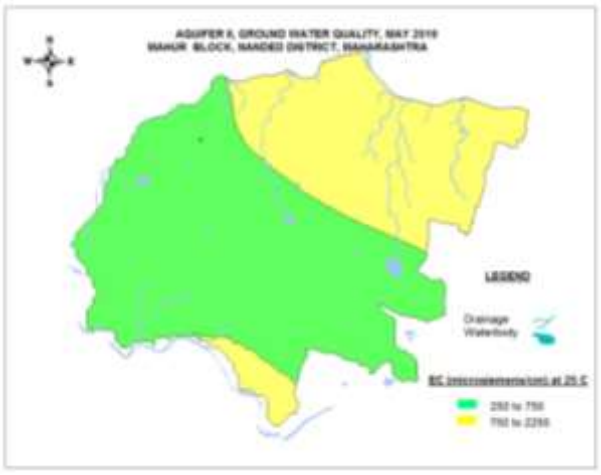
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ The entire block has EC between 750 and 2250 microsiemens/cm	➢ In the entire block, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected.

4.1 Aquifer II/Deeper Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 315.4 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 185 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 315 Sq Km area, plants with moderate salt tolerance can be grown. However, in 185 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good

	for irrigation. Except in Sindkhed villlage ➢ About 50 % of the analysed samples have % Na less than between 40 and 60; 50% have %Na more than 60 Hence, the overall quality of ground water is suitable for irrigation purposes except in areas where %Na is more than 60 and high RSC values.

3.2.CHEMICAL QUALITY MAP

Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	

5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	498.18
Total Annual Ground Water Recharge (MCM)	53.11
Natural Discharge (MCM)	2.65
Net Annual Ground Water Availability (MCM)	50.45
Existing Gross Ground Water Draft for irrigation (MCM)	19.67
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	0.99
Existing Gross Ground Water Draft for All uses(MCM)	20.67
Net Ground Water Availability for future irrigation development(MCM)	28.15
Provision for domestic and industrial requirement supply to 2025(MCM)	2.59
Stage of Ground Water Development %	40.98
Category	**SAFE**
Aquifer-II	
Semiconfined/Confined Aquifer (Basalt)	

Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq.	Mean aquifer thickness	S	Resources above confining	Total Area (Sq. Km.)	Mean aquifer thicknes	S	Resources within the	Total Resources

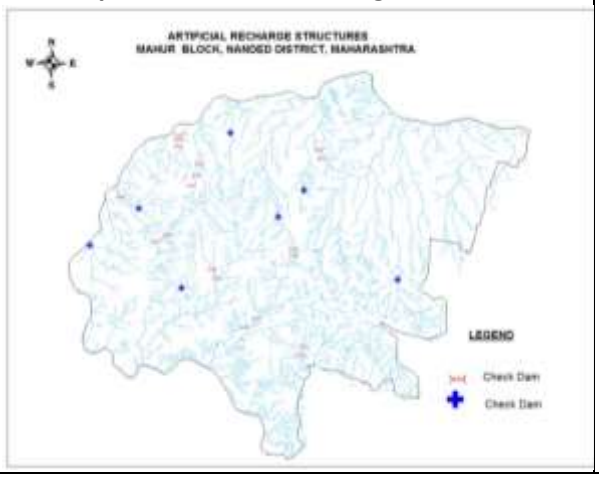
Km.)	(m)		layer (MCM)		s (m)		confining layer (MCM)	(MCM)
517.41	6.63	0.0013	4.460	517.41	8.000	0.001 3	5.38	9.84

5.0. GROUND WATER RESOURCE ENHANCEMENT			
Available Resource (MCM)	50.45		
Gross Annual Draft (MCM)	20.67		
5.1.SUPPLY SIDE MANAGEMENt			
SUPPLY (MCM)			
Agricultural Supply -GW	19.67		
Agricultural Supply -SW	0.00		
Domestic Supply - GW	0.99		
Domestic Supply - SW	0.25		
Total Supply	**20.91**		
Area of Block (Sq. Km.)	517.41		
Area suitable for Artificial recharge (Sq. Km)	498.18		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	114.76	-	
Volume of Unsaturated Zone (MCM)	229.51	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	4.59	-	
Surplus water Available (MCM)	2.57	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	7	19	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	1.05	0.4275	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by	**Nil**		

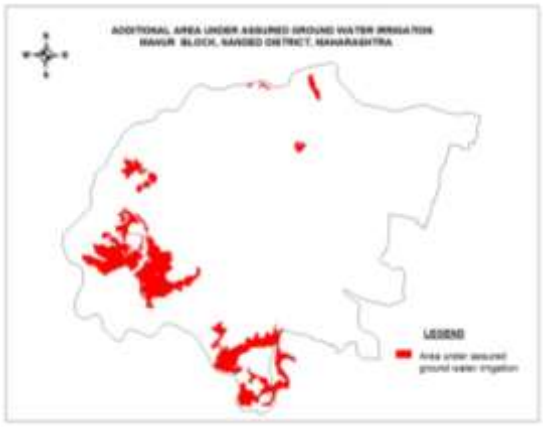
desilting	
RTRWH Structures – Urban Areas	
Households to be covered (25% with 50 m^2area)	5532
Total RWH potential (MCM)	0.275
Rainwater harvested / recharged @ 80% runoff co-efficient	0.220 (**Economically not viable & Not Recommended)**
5.2.DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	50.45
Additional GW resources available after Supply side interventions (MCM)	1.4775
Ground Water Availability after Supply side intervention	51.9275
Existing Ground Water Draft for All Purposes (MCM)	20.67
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	20.67
Present stage of Ground Water Development (%)	41.0
Expected Stage of Ground Water Development after interventions (%)	39.8
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 41% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	15.68

Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	941
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	157
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	24

Proposed Artificial Recharge Structure



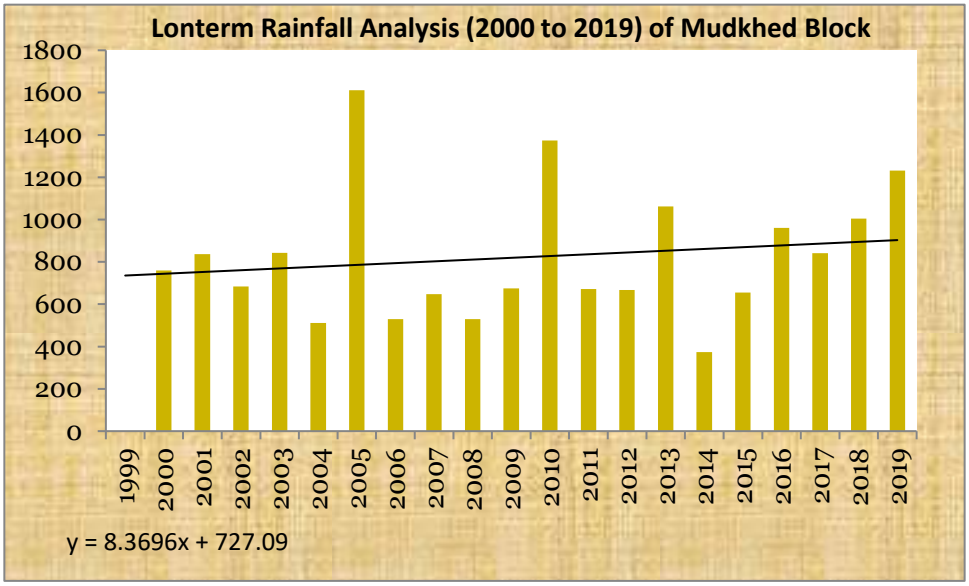
Addditional Area proposed to be brought under assured ground water irrigation



9.12 MUDKHED BLOCK, NANDED DISTRICT

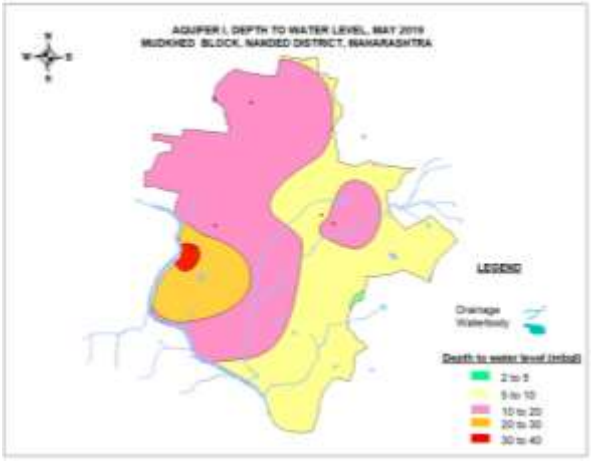
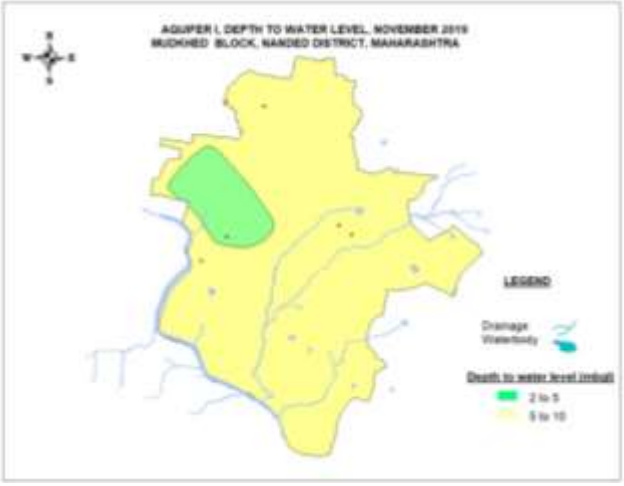
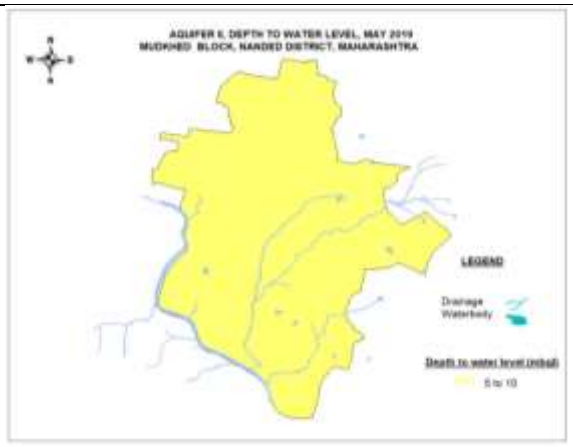
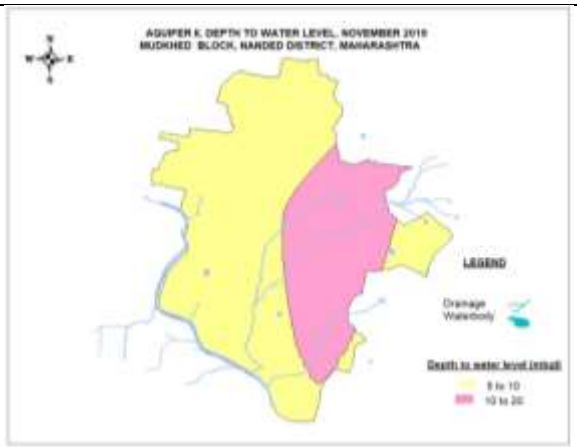
1. SALIENT INFORMATION	
1.1. Introduction	
Block Name	Mudkhed
Geographical Area (Sq. Km.)	338 Sq. Km.
Hilly Area (Sq. Km)	14.06 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	92179
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	823.34 mm
Annual Rainfall (2019)	1231.1 mm
Decadal Average Annual Rainfall (2010-19)	884.18 mm
Long Term Rainfall Analysis (2000-2019)	Rising Trend: 17.921 m/year. Probability of Normal/Excess Rainfall: - 55% & 25%. Probability of Drought (Moderate/ Severe/ Acute):- 15% Moderate & 5% Severe Frequency of occurrence of Drought: - 1 in 5 Years

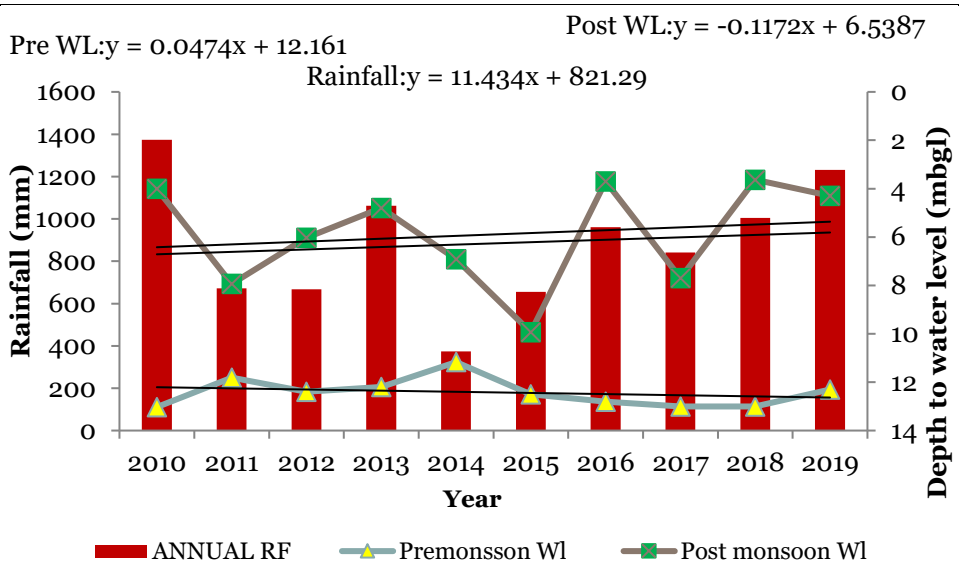
RAINFALL TREND ANALYSIS (2000 to 2017)



1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	➢ Butte (B) ➢ Escarpment Slope (ES) ➢ Mesa (M) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)

<table>
<tr><td colspan="2">Soil</td><td colspan="3">➢ Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands with moderate erosion
➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity</td></tr>
<tr><td colspan="2">Geology</td><td colspan="3">Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)</td></tr>
<tr><td colspan="5">1.4.Hydrology & Drainage</td></tr>
<tr><td colspan="2">Drainage</td><td colspan="3">Godavari River & its tributaries</td></tr>
<tr><td colspan="2" rowspan="5">Hydrology(as on March 2017)</td><td>Major & Medium Irrigation Projects (>250 Ha)</td><td colspan="2">1 Major Project</td></tr>
<tr><td rowspan="4">Minor Irrigation Projects (0 to 250 Ha)</td><td>No. of projects completed till March 2017</td><td>37</td></tr>
<tr><td>No. of projects operating till end</td><td>37</td></tr>
<tr><td>Command area of the operating project (Sq. Km.)</td><td>12..39</td></tr>
<tr><td>Net irrigated area under Operating project (Sq. Km.)</td><td>8.06</td></tr>
<tr><td colspan="5">1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN</td></tr>
<tr><td colspan="2">Geographical Area</td><td colspan="3">338 Sq. Km.</td></tr>
<tr><td colspan="2">Forest Area</td><td colspan="3">9.30 Sq. Km.</td></tr>
<tr><td colspan="2">Cultivable Area</td><td colspan="3">285.56 Sq. Km.</td></tr>
<tr><td colspan="2">Net Sown Area</td><td colspan="3">281.78 Sq. Km.</td></tr>
<tr><td colspan="2">Double Cropped Area</td><td colspan="3">49.41 Sq. Km.</td></tr>
<tr><td rowspan="2">Area under Irrigation</td><td>Surface Water</td><td colspan="3">9.47 Sq. Km.</td></tr>
<tr><td>Ground Water</td><td colspan="3">14.76 Sq. Km.</td></tr>
<tr><td colspan="2" rowspan="5">Principal Crops</td><td>Crop Type</td><td colspan="2">Area (Sq. Km.)</td></tr>
<tr><td>Pulses</td><td colspan="2">63.85</td></tr>
<tr><td>Cotton</td><td colspan="2">35.46</td></tr>
<tr><td>Cereals</td><td colspan="2">51.55</td></tr>
<tr><td>Oil Seeds</td><td colspan="2">113.66</td></tr>
<tr><td colspan="2" rowspan="2">Horticultural Crops</td><td>Sugarcane</td><td colspan="2">53.12</td></tr>
<tr><td>Others</td><td colspan="2">42.88</td></tr>
<tr><td colspan="5">1.6.WATER LEVEL BEHAVIOUR</td></tr>
<tr><td colspan="5">1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)</td></tr>
<tr><td colspan="3">Pre-Monsoon (May-2019)</td><td colspan="2">Post-Monsoon (November-2019)</td></tr>
<tr><td colspan="3">❖ Depth to water level less than 5 mbgl is observed only as very small isolated patch of 0.5 sq km area.
❖ Depth to water level between 5 mbgl</td><td colspan="2">❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 29.8 Sq Km area in the western part of the block as an isolated patch.</td></tr>
</table>

and 10 mbgl observed in 131 Sq Km area in the eastern parts of the block. ❖ Depth to water level between 10 mbgl and 20mbgl is observed in 157.6 sq km area in the western parts of the block. ❖ The deeper depths to water level more than 20 mbgl is observed in 34.5 sq km area in the west-central parts of the block.	❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 310 Sq Km area in the remaining parts of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 5mbgl and 10 mbgl is observed in the whole of the block.	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 238.6 Sq Km area in the major parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 101.9 Sq Km area in the eastern parts of the block.
1.7. Hydrograph	

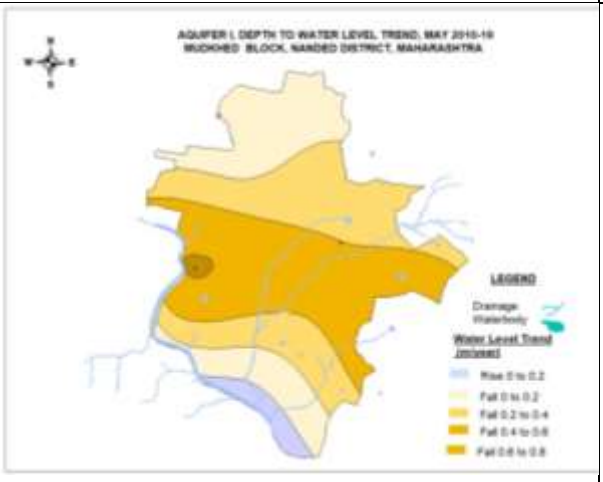
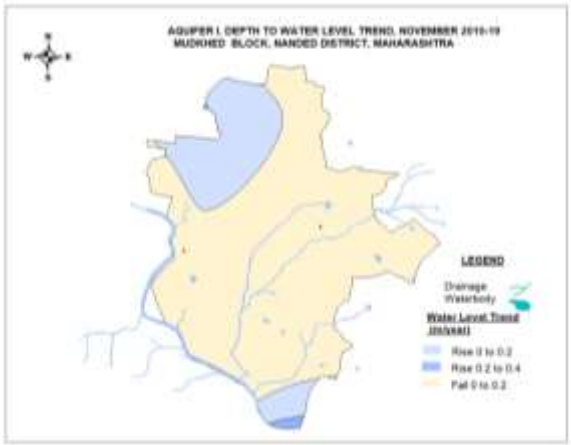


The hydrograph of CGWB Monitoring site at Barad for the period 2010 to 2019 shows:

- A rising trend during premonsoon @ 0.047 m/year and a falling trend postmonsoon @ 0.117 m/year respectively.
- The depth to water level during premonsoon ranges from 11.17 mbgl to 13.03 mbgl.
- The depth to water level during postmonsoon ranges from 3.63 mbgl to 9.93 mbgl.
- A rising rainfall trend @ 11.43mm/year for the period 2010 to 2019.

1.8. Water Level Trend (2010-19)

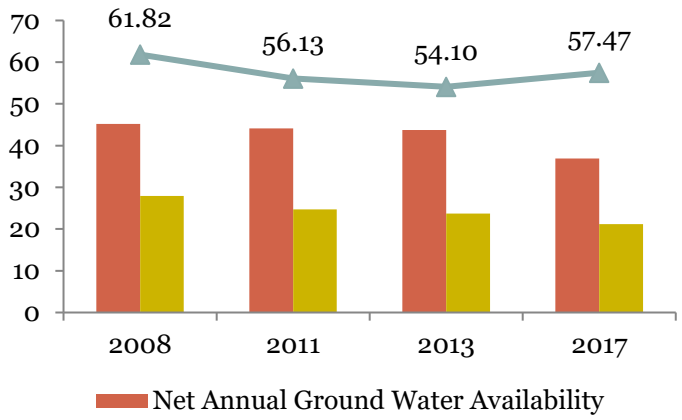
Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 12.8 Sq Km area	0.0 to 0.2 m/year in 86.47 Sq Km area, 0.2 to 0.4 m/year in 115.4 Sq Km area, 0.4 to 0.6 m/year in 123.1 sq km area and >0.6 m/year in 2.72 sq km area.	0 to 0.2 m/year in 52.58 Sq Km area	0 to 0.2 m/year in 277.1 Sq Km area

Pre-Monsoon WL Trend (May 2010-2019)	**Post-Monsoon WL Trend (Nov.2010-2019)**
	

2. GROUND WATER ISSUES

1) Variation in stage of ground water development

The stage of ground water development has varied from 61.82 % (2004) to 57.47% (2017) with the decrease in Net Ground Water Availability from 45 MCM (2004) to 36 MCM (2017).



1) **Declining Water Level Trend: -** The decline in water level trend (2010-19) more than 0.6 m/year is observed in 327 sq km area of the block during premonsoon

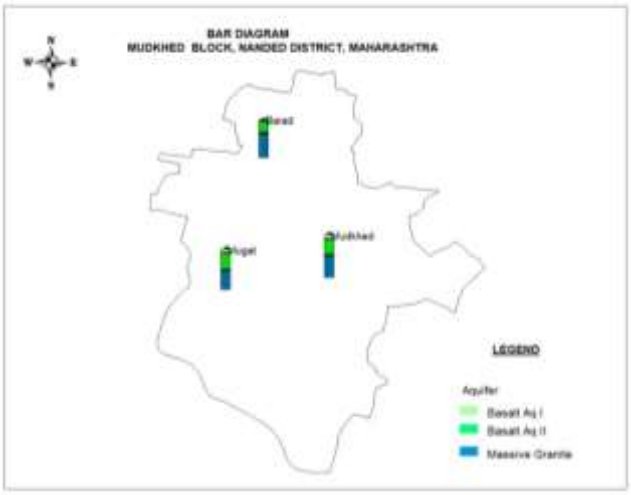
3) **Low ground water yield Potential of the aquifers:**

The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers are obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

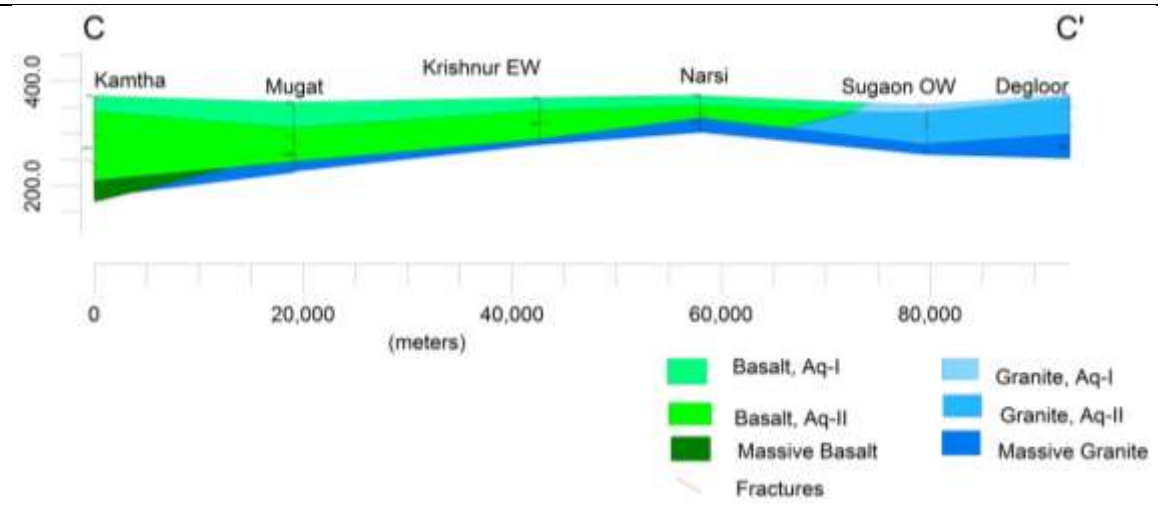
QUIFER DISPOSITION

3.1. Number of Aquifers (Major)	Two: Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS

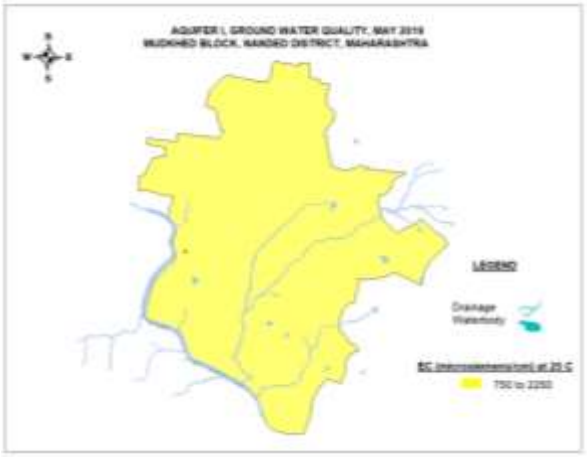
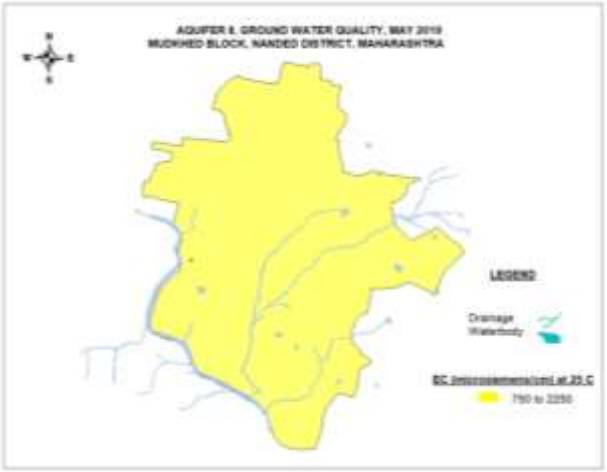


3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	10 to 16	60 to 150
Weathered/ Fractured rocks thickness (m)	8 to 12	2 to 8
Yield Potential	15 to 100 m3/day	0 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.0006
Transmissivity (T)	-	5.83 to 6.78 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION	
4.1 Aquifer I/Shallow Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ The entire block has EC between 750 and 2250 microsiemens/cm	➢ In the entire block, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Mudkhed village. ➢ The entire block has EC well has EC between 750 and 2250 microsiemens/cm	➢ The entire block has EC > 750 icrosiemens/cm, where special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. About 50 % of the analysed samples have %Na

	between 20 and 40; 50% have %Na between 40 and 60

3.2.CHEMICAL QUALITY MAP

Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	

5. GROUND WATER RESOURCE & EXTRACTION

Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	323.94
Total Annual Ground Water Recharge (MCM)	38.85
Natural Discharge (MCM)	1.94
Net Annual Ground Water Availability (MCM)	36.90
Existing Gross Ground Water Draft for irrigation (MCM)	20.62
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	0.58
Existing Gross Ground Water Draft for All uses(MCM)	21.21
Net Ground Water Availability for future irrigation development(MCM)	14.47
Provision for domestic and industrial requirement supply to 2025(MCM)	1.76
Stage of Ground Water Development %	57.47
Category	**SAFE**

Aquifer-II

Semiconfined/Confined Aquifer (Basalt)

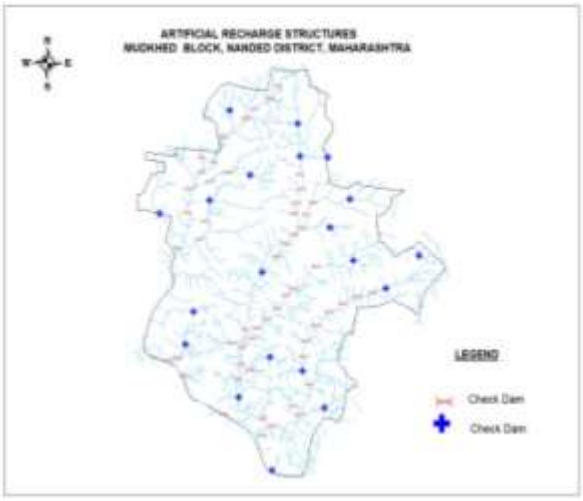
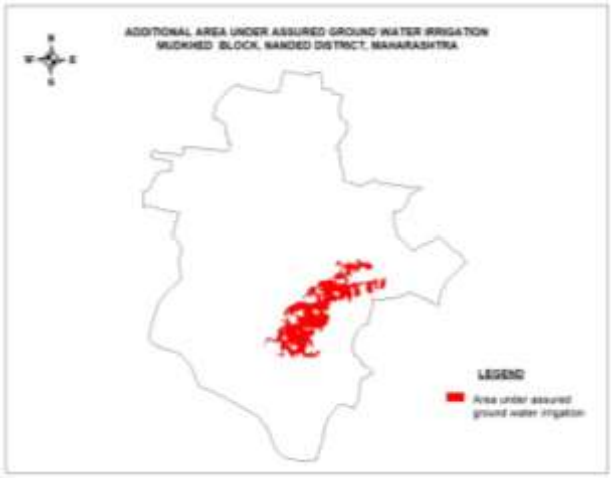
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
338	3.63	0.0006	0.736	338	5	0.0006	1.014	1.75

5.0. GROUND WATER RESOURCE ENHANCEMENT

Available Resource (MCM)	36.90

Gross Annual Draft (MCM)	21.21		
5.1.SUPPLY SIDE MANAGEMENT			
SUPPLY (MCM)			
Agricultural Supply -GW	20.62		
Agricultural Supply -SW	9.47		
Domestic Supply - GW	0.58		
Domestic Supply - SW	0.12		
Total Supply	**30.79**		
Area of Block (Sq. Km.)	338		
Area suitable for Artificial recharge (Sq. Km)	323.94		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	326.73	-	
Volume of Unsaturated Zone (MCM)	653.46	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	13.07	-	
Surplus water Available (MCM)	7.32	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	19	55	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.85	1.2375	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	4277		
Total RWH potential (MCM)	0.189		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.151 (**Economically not viable & Not Recommended)**		

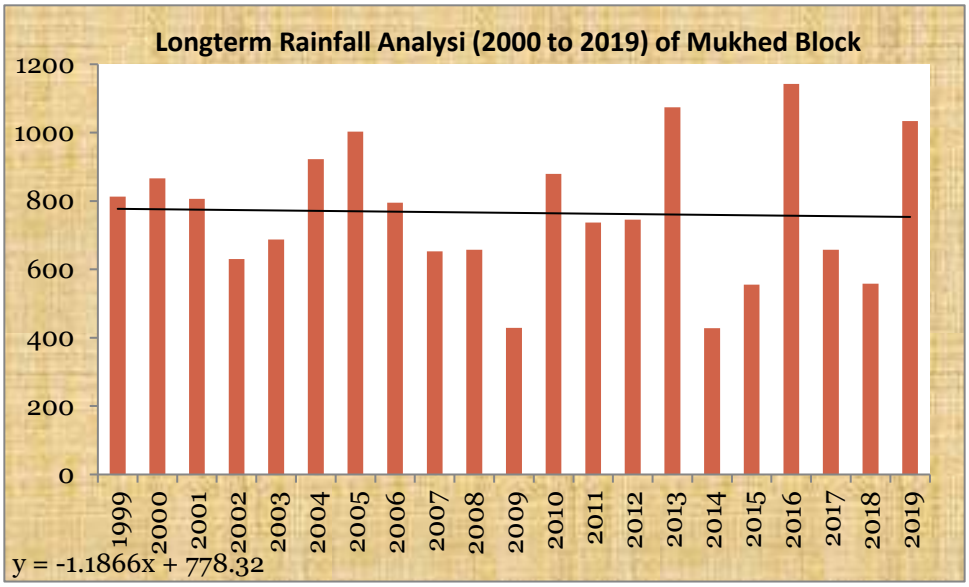
5.2.DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Ground water irrigated Sugarcane cropped area proposed through drip irrigation	**5.3**
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	**5.03**
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	36.90
Additional GW resources available after Supply side interventions (MCM)	4.0875
Ground Water Availability after Supply side intervention	40.9875
Existing Ground Water Draft for All Purposes (MCM)	21.21
Saving of Ground Water through demand side intervention (MCM)	5.03
GW draft after Demand Side Interventions (MCM)	16.18
Present stage of Ground Water Development (%)	57.5
Expected Stage of Ground Water Development after interventions (%)	39.48
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 57.5 % to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	7.48125
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	449
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	75
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	12

Proposed Artificial Recharge Structure	Addditional Area proposed to be brought under assured ground water irrigation
	

9.13 MUKHED BLOCK, NANDED DISTRICT

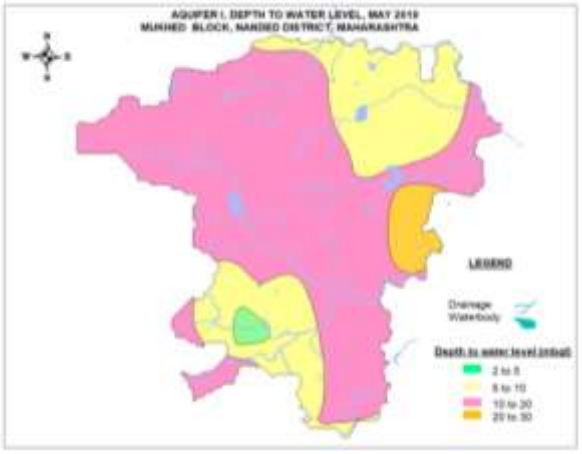
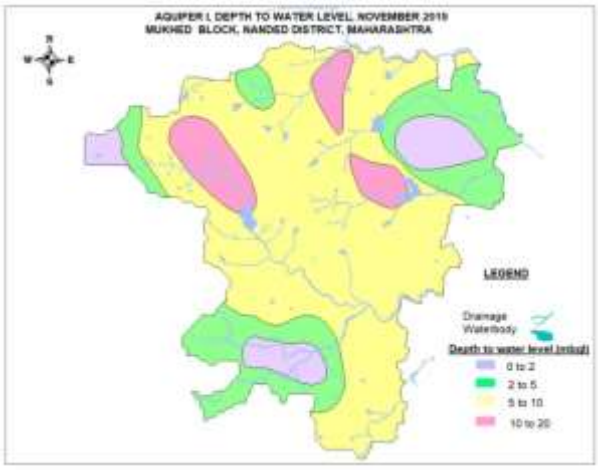
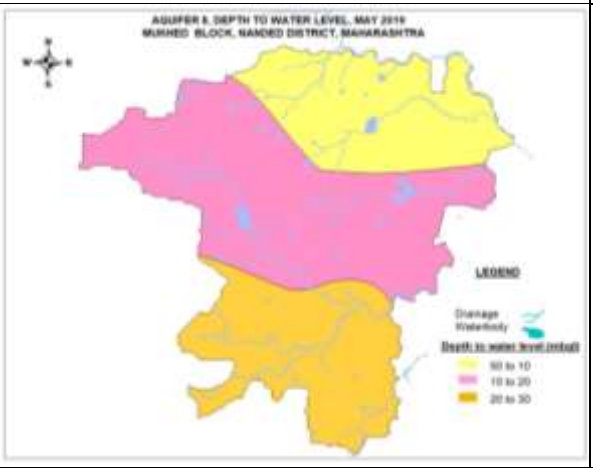
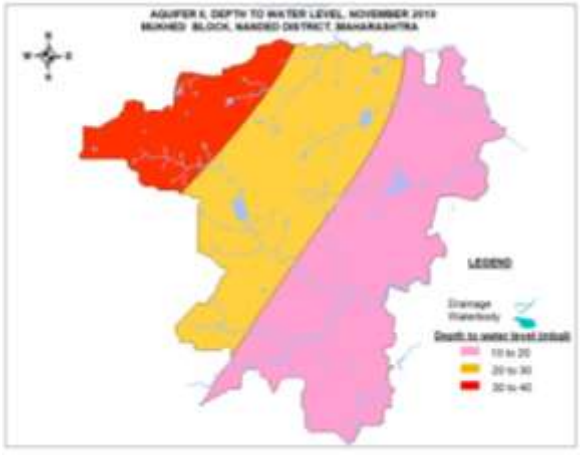
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Mukhed
Geographical Area (Sq. Km.)	941.47Sq. Km.
Hilly Area (Sq. Km)	65.53 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	266235
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	765.27 mm
Annual Rainfall (2019)	1033.9 mm
Decadal Average Annual Rainfall (2010-19)	780.9 mm
Long Term Rainfall Analysis (1999-2019)	Falling Trend: 1.18 m/year. Probability of Normal/Excess Rainfall: - 62% & 19%. Probability of Drought (Moderate/ Severe/ Acute):- 19% Moderate Frequency of occurrence of Drought:- 1 in 5 Years

RAINFALL TREND ANALYSIS (1999 to 2019)



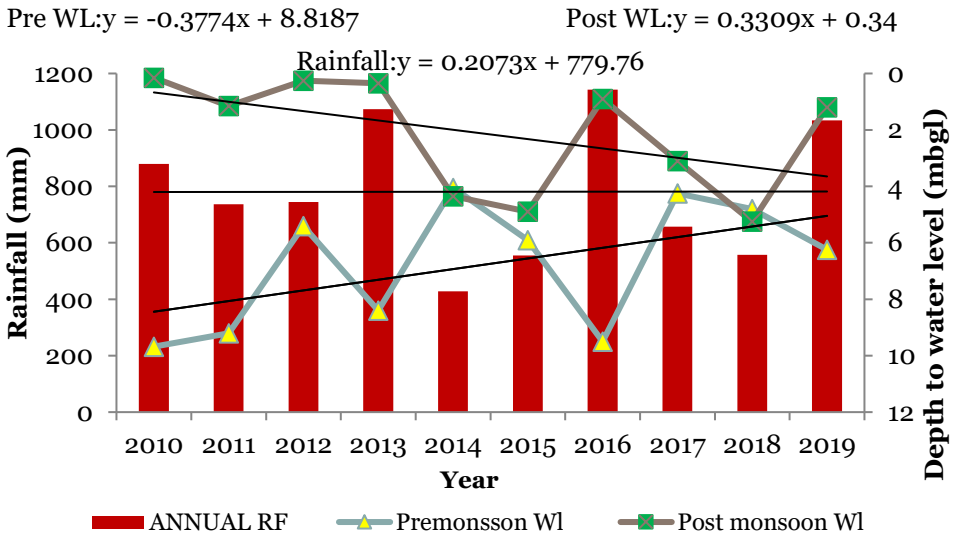
1.3. Geomorphology, Soil & Geology	
Geomorphic Unit	➢ Butte (B) ➢ Escarpment Slope (ES) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLW), 2-5m weathering

	➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)		
Soil	➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping undulating lands with mesas and buttes with moderate erosion ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	Landi river & its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1 Major Project & 1 Medium Project	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	118
		No. of projects operating till end	118
		Command area of the operating project (Sq. Km.)	78.57
		Net irrigated area under Operating project (Sq. Km.)	38.77
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	941.47Sq. Km.		
Forest Area	21.81 Sq. Km.		
Cultivable Area	785.72 Sq. Km.		
Net Sown Area	751.10 Sq. Km.		
Double Cropped Area	168.32 Sq. Km.		
Area under Irrigation – Surface Water	85.00 Sq. Km.		
Area under Irrigation – Ground Water	2.3 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	251.65	
	Cotton	63.13	
	Cereals	192.34	
	Oil Seeds	351.92	
Horticultural Crops	Sugarcane	15.00	
	Others	3.63	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**		

❖ Depth to water level between 5 mbgl and 10 mbgl observed in 9.8 Sq Km areas in a small isolated patch in the southern part of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 612 Sq Km area in the major parts of the block. ❖ Depth to water level between 20 mbgl and 30 mbgl is observed in 36 sq km area in the eastern part of the block.	❖ The shallow depth to water level less than 2 mbgl is observed in 73 sq km area in isolated patches in the block. ❖ Depth to water level between 2 mbgl and 5 mbgl is observed in 188 Sq Km area in north-eastern, north-western and southern parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 580.67 Sq Km area in the major parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 82.61 Sq Km area in isolated patches in the northern part of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 237.8 Sq Km area northeastern part of the block.	❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 438.7 Sq Km area in the eastern part of the block

❖ Depth to water level between 10 mbgl and 20 mbgl is observed in about 438.7 Sq Km area in the eastern, central and western parts of the block. ❖ Depth to water level more than 20 mbgl is observed in 253.7 Sq Km area in the southern parts the block.	❖ Depth to water level between 20 mbgl and 30 mbgl is observed in 347.1 Sq Km area along the central part of the block ❖ The deeper depth to water level of more than 30 mbgl is observed in 137.6 Sq Km area in the north-western boundary of the block.

1.7. Hydrograph

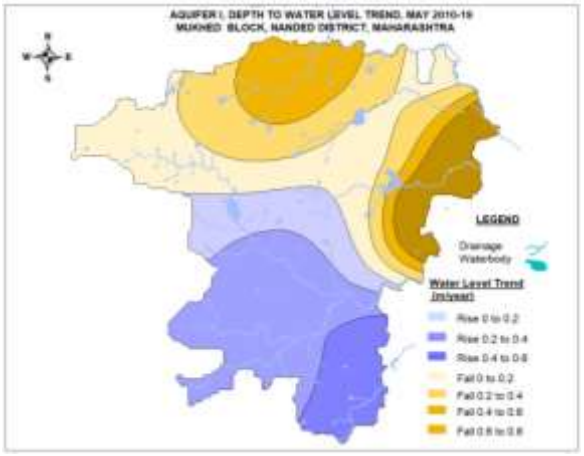


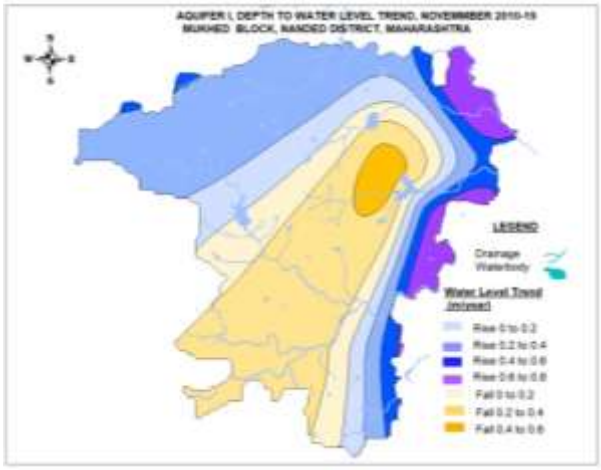
The hydrograph of CGWB Monitoring site at Mukhed for the period 2010 to 2019 shows:

- ❖ A falling trend during premonsoon @ 0.377 m/year and a rising trend during postmonsoon @ 0.331 m/year.
- ❖ The depth to water level during premonsoon ranges from 4.05 mbgl to 9.68 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 0.15 mbgl to 5.25 mbgl.
- ❖ A rising rainfall trend @0.207 mm/year for the period 2010-19

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 93.73 Sq Km area and 0.2 to 0.4 m/year in 208.9 sq km area and 0.4 to 0.6 m/year in 74.45 sq km area.	0.0 to 0.2 m/year in 213.7 Sq Km area, 0.2 to 0.4 m/year in 114.2 Sq Km area, 0.4 to 0.6 m/year in 81.06 sq km area.	0 to 0.2 m/year in 124.4 Sq Km area; 0.2 to 0.4 m/year in 271.6 sq km area and0.4 to 0.6 m/year in 54.99 sq km area. And > 0.6 m/year in 25.86 sq km area.	0 to 0.2 m/year in 398.6 Sq Km area and 0.2 to 0.4 m/year in 23.26 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

1) **Low Development:-**Low Development of 25.43% of Stage of Ground Water Development is observed in the block

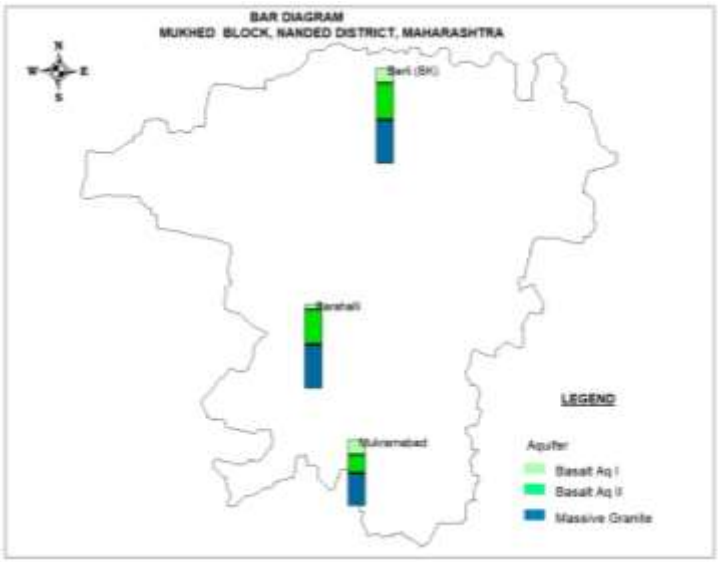
2) **Declining Water Level Trend: -**
The decline in water level trend (2010-19) upto 0.6 m/year is observed in 408 sq km area of the block during premonsoon and upto 0.4 m/year in 421 sq km area during postmonsoon.

3) **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

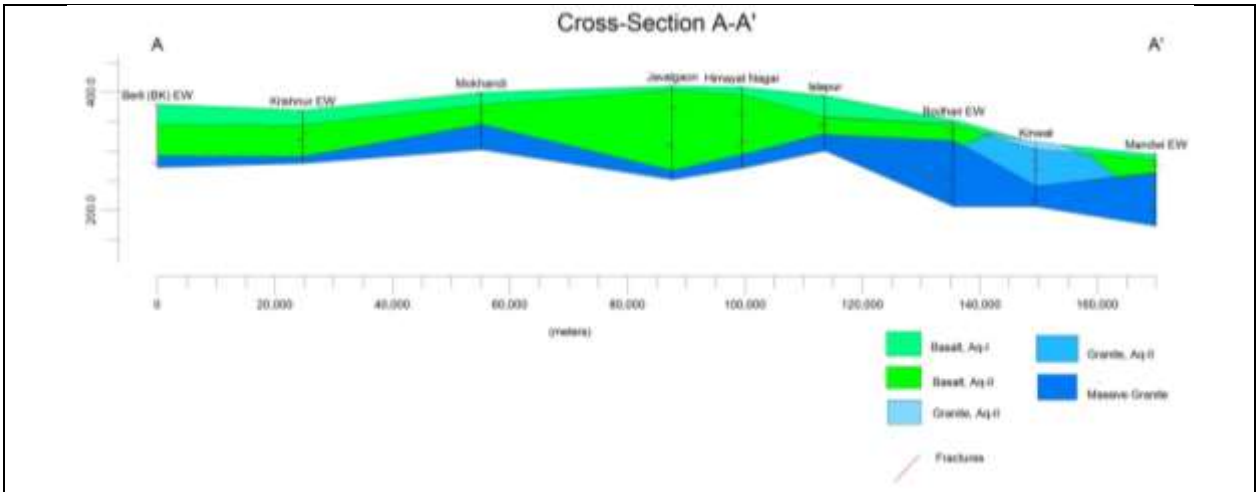
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	1)Basalt –Aquifer-I, Aquifer-II 2)Granite-Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION

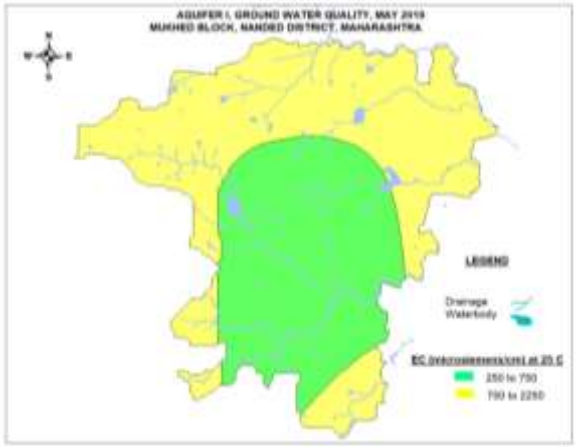
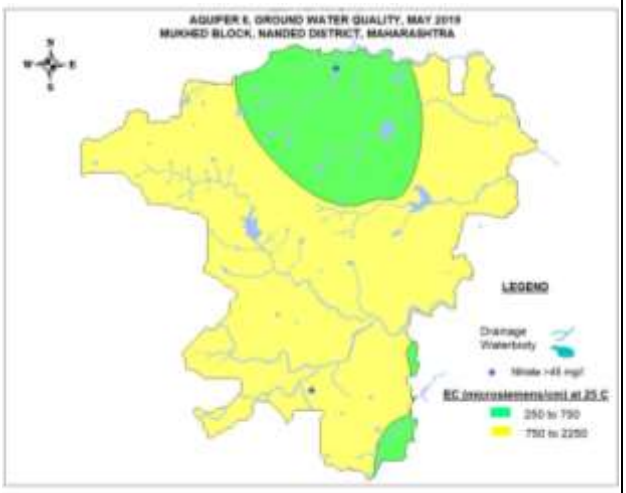


3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	9 to 16	30 to 90
Weathered/ Fractured rocks thickness (m)	5.4 to 12.8	2 to 8
Yield Potential	0 to 100 m3/day	0.23 to 0.4 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.0008
Transmissivity (T)	-	2.62 to 5.35 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION	
4.1 Aquifer I/Shallow Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected areas. ➢ About 402.1 Sq Km area of the block has EC well within the potable range of 250 to 750 microsiemens/cm; 505 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 402 Sq Km area of the block, plants with moderate salt tolerance can be grown. However, in 505 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l except at Balegaon Village indicating that the ground water is good for irrigation. ➢ The analysed samples have %Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation purposes.

4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic purposes ➢ About 213.6 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 712.9 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 213 Sq Km area, plants with moderate salt tolerance can be grown. However, in 712.9 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l except in Berli village indicating that the ground water is good for irrigation. ➢ About 33 % of the analysed samples have % Na between 20 and 40 and 64% of analysed samples has %Na more than 60% Hence, the quality of ground water is not suitable for irrigation purposes with high RSC values and with %Na values more than 60%.
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	875.94
Total Annual Ground Water Recharge (MCM)	97.10
Natural Discharge (MCM)	4.89

Net Annual Ground Water Availability (MCM)	92.20
Existing Gross Ground Water Draft for irrigation (MCM)	20.45
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	3.55
Existing Gross Ground Water Draft for All uses(MCM)	23.45
Net Ground Water Availability for future irrigation development(MCM)	61.97
Provision for domestic and industrial requirement supply to 2025(MCM)	9.69
Stage of Ground Water Development %	25.43
Category	**SAFE**

Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
941.47	4.21	0.0008	3.409	941.47	5	0.0008	4.048	7.45

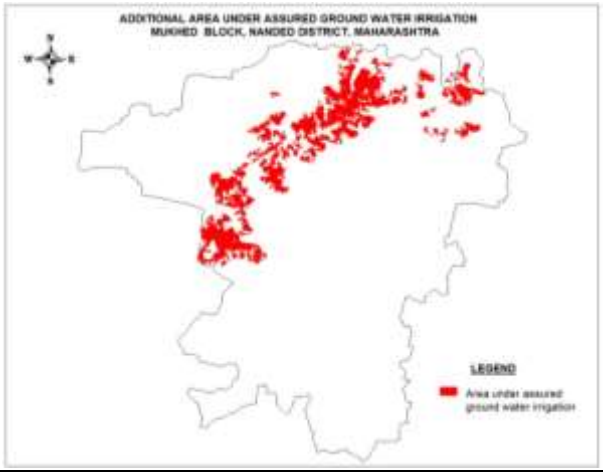
5.0. GROUND WATER RESOURCE ENHANCEMENT		
Available Resource (MCM)	92.20	
Gross Annual Draft (MCM)	23.45	
5.1.SUPPLY SIDE MANAGEMENT		
SUPPLY (MCM)		
Agricultural Supply -GW	20.45	
Agricultural Supply -SW	85.00	
Domestic Supply - GW	2.98	
Domestic Supply - SW	0.60	
Total Supply	**109.03**	
Area of Block (Sq. Km.)	941.47	
Area suitable for Artificial recharge (Sq. Km)	875.94	
Type of Aquifer	Hard Rock	Soft Rock
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	504.70	-
Volume of Unsaturated Zone (MCM)	1009.39	-
Average Specific Yield	0.020	-
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	20.2	-
Surplus water Available (MCM)	11.31	-

Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	30	85	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.5	1.9125	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	13462		
Total RWH potential (MCM)	0.525		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.420 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	92.20		
Additional GW resources available after Supply side interventions (MCM)	6.4125		

Ground Water Availability after Supply side intervention	98.6125
Existing Ground Water Draft for All Purposes (MCM)	23.45
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	23.45
Present stage of Ground Water Development (%)	25.4
Expected Stage of Ground Water Development after interventions (%)	23.8
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 23.8% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	45.57875
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	2735
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	456
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	70

Proposed Artificial Recharge Structure

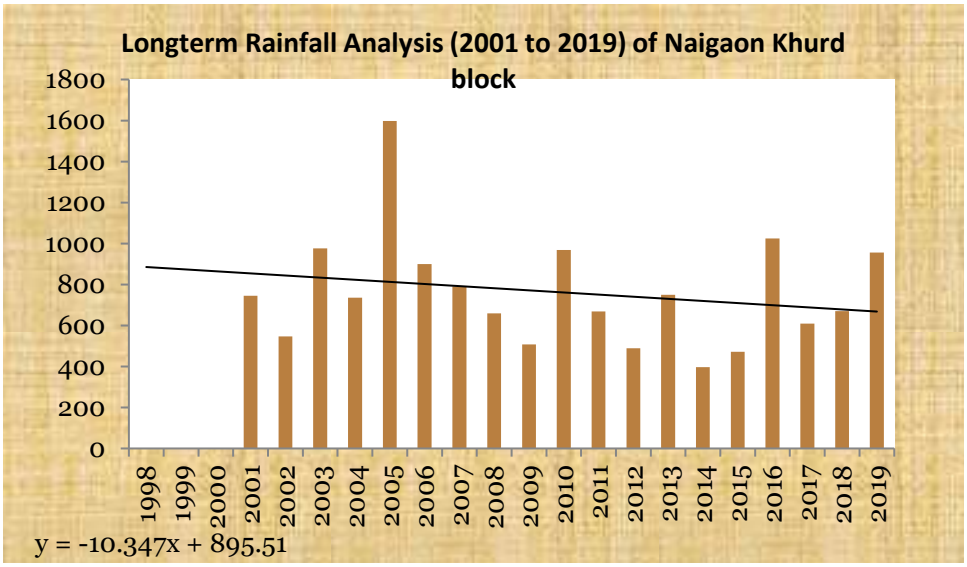
Addditional Area proposed to be brought under assured ground water irrigation



9.14 NAIGAON BLOCK, NANDED DISTRICT

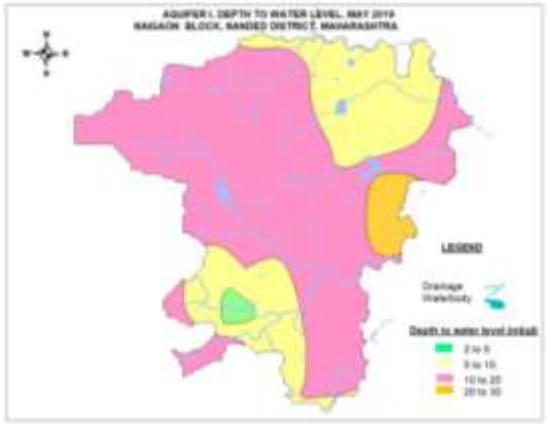
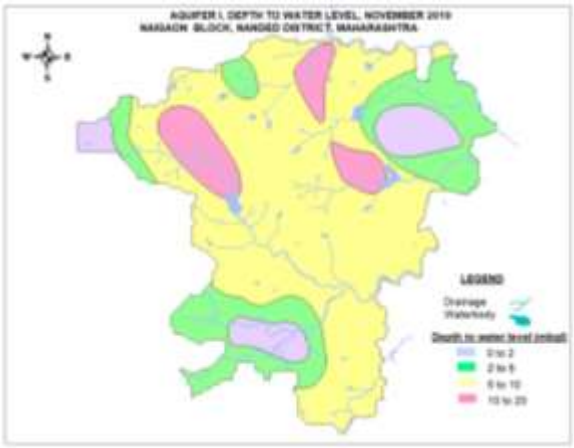
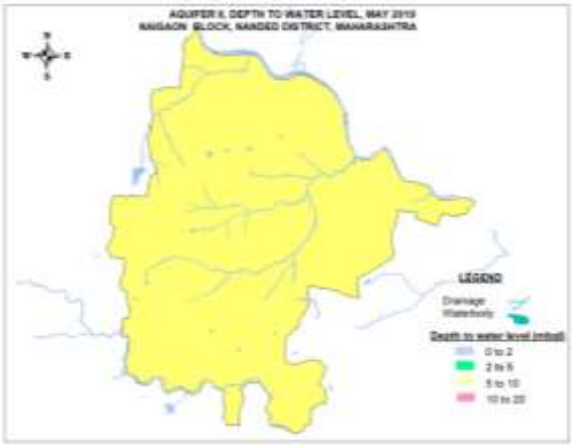
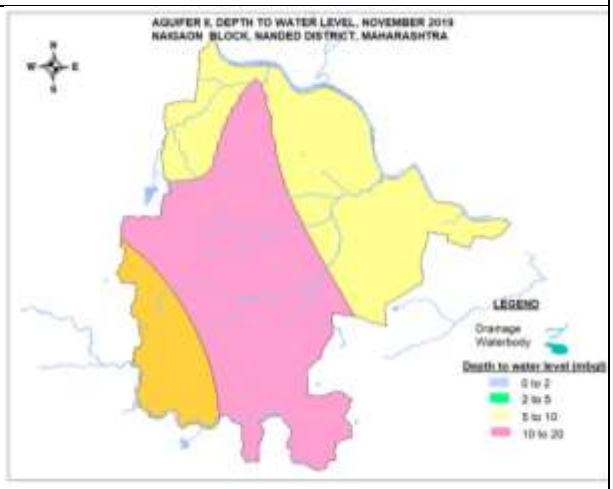
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Naigaon
Geographical Area (Sq. Km.)	580.08 Sq. Km.
Hilly Area (Sq. Km)	14.48 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	182868
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	760.99 mm
Annual Rainfall (2019)	955.7 mm
Decadal Average Annual Rainfall (2010-19)	700.21 mm
Long Term Rainfall Analysis (2001-2019)	Falling Trend: -10.34 m/year. Probability of Normal/Excess Rainfall: - 53% & 31%. Probability of Drought (Moderate/ Severe/ Acute):- 16% Moderate & 10% Severe Frequency of occurance of Drought:- 1 in 6 Years

RAINFALL TREND ANALYSIS (2001 to 2019)



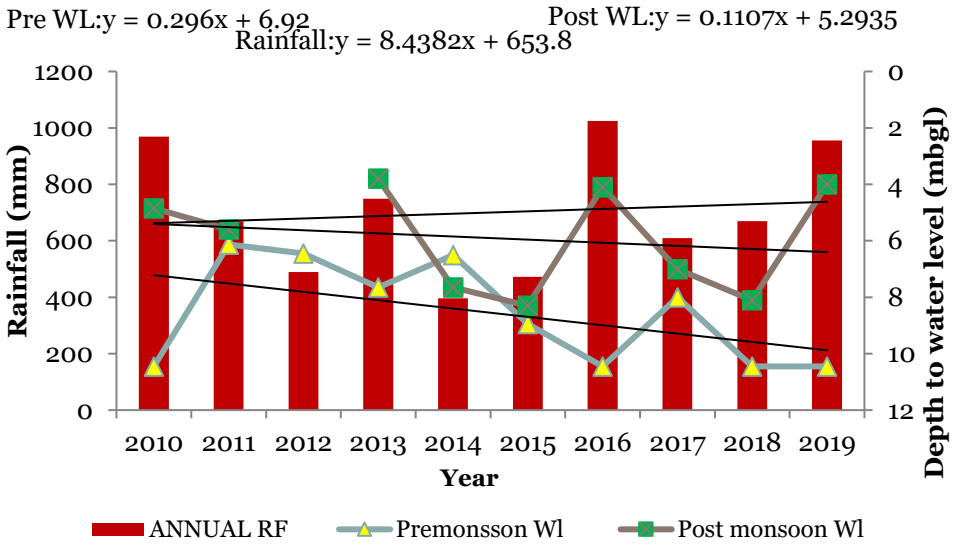
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Butte (B) ➢ Escarment Slope (ES) ➢ Plateau Moderately Dissected (PLM) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)

Soil	➢ Very shallow, somewhat excessively drained, loamy soils on moderately sloping summits/spurs with severe erosion ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity ➢ Deep, moderately well drained, fine soils on gently sloping plains and valleys with moderate erosion ➢ Very shallow, well drained, loamy soils on gently sloping rolling lands with mesas and buttes with moderate erosion and moderate stoniness		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age) & Gneiss-Granitoid / Migmatite Complex (Archean)		
1.4.Hydrology & Drainage			
Drainage	Godavari river & its tributaries		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	Nil	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	51
		No. of projects operating till end	49
		Command area of the operating project (Sq. Km.)	19.43
		Net irrigated area under Operating project (Sq. Km.)	12.53
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	580.08 Sq. Km.		
Forest Area	8.36 Sq. Km.		
Cultivable Area	423.94 Sq. Km.		
Net Sown Area	423.94 Sq. Km.		
Double Cropped Area	132.92 Sq. Km.		
Area under Irrigation – Surface Water	26.95 Sq Km.		
Area under Irrigation – Ground Water	2.50 Sq. Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	99.60	
	Cotton	193.36	
	Cereals	42.03	
	Oil Seeds	215.52	
Horticultural Crops	Sugarcane	1.04	
	Others	2.72	

1.6.WATER LEVEL BEHAVIOUR	
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl observed in 358.75 Sq Km areas in the major parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 197.9 Sq Km area in patches in eastern, western and northern parts of the block.	❖ The shallow depth to water level less than 2 mbgl is obseerved only as isolated patch in the south-eastern part of the block covering only 4.6 Sq Km area. ❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 219.9 Sq Km area in the western and eastern major parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 344.58 Sq Km area in the remaining parts of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl is observed in the whole of the	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 222.2 Sq Km

block	area in the noth-eastern and north-western parts of the block ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 288.6 Sq Km along the central part of the block ❖ Deeper depth to water level between 20 mbgl and 30 mbgl is observed in 67.62 Sq Km area south-western part of the block.

1.7. Hydrograph

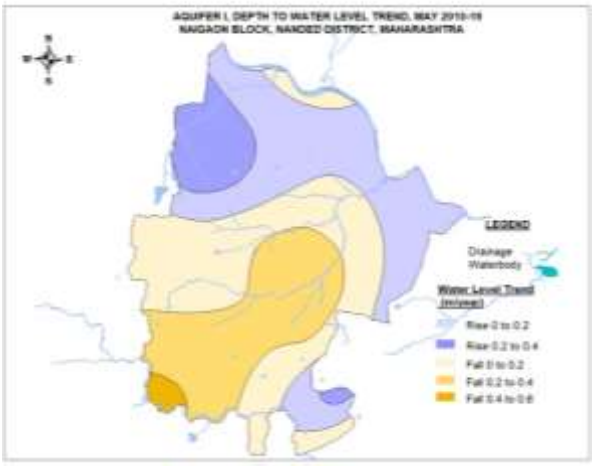


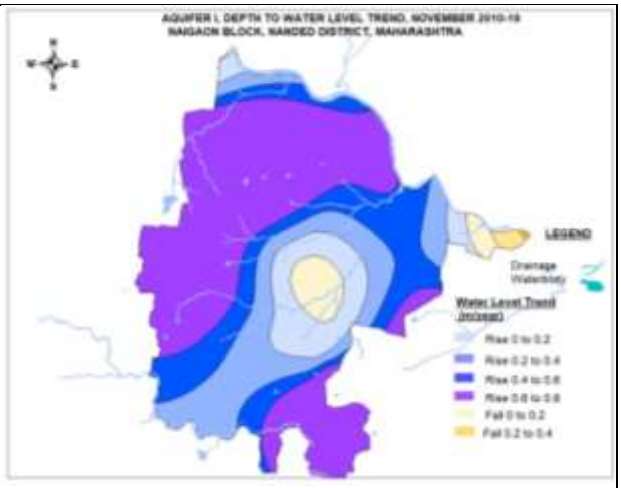
The hydrograph of CGWB Monitoring site at Naigaon for the period 2010 to 2019 shows:

- ❖ A rising trend during both premonsoon and postmonsoon @ 0.296 m/year and 0.1107 m/year respectively.
- ❖ The depth to water level during premonsoon ranges from 6.13 mbgl to 10.45 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 3.8 mbgl to 8.3 mbgl.
- ❖ A rising rainfall trend @ 8.43mm/year is observed for the period 2010 to 2019

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0.0 to 0.2 m/year in 177.8 Sq Km area and 0.2 to 0.4 m/year in 48.38 sq km area	0.0 to 0.2 m/year in 183 Sq Km area, 0.2 to 0.4 m/year in 137 Sq Km area, 0.4 to 0.6 m/year in 7.6 sq km area.	0 to 0.2 m/year in 48.55 Sq Km area; 0.2 to 0.4 m/year in 89.58 sq km area; 0.4 to 0.6 m/year in 112.7 sq km area; 0.6 to 0.8 m/year in79.42 sq km area and >0.8 m/year in 140.6 sq km area.	0 to 0.2 m/year in 17.7 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

1. **Low Development:-**Low Development of 32.42 % of Stage of Ground Water Development is observed in the block

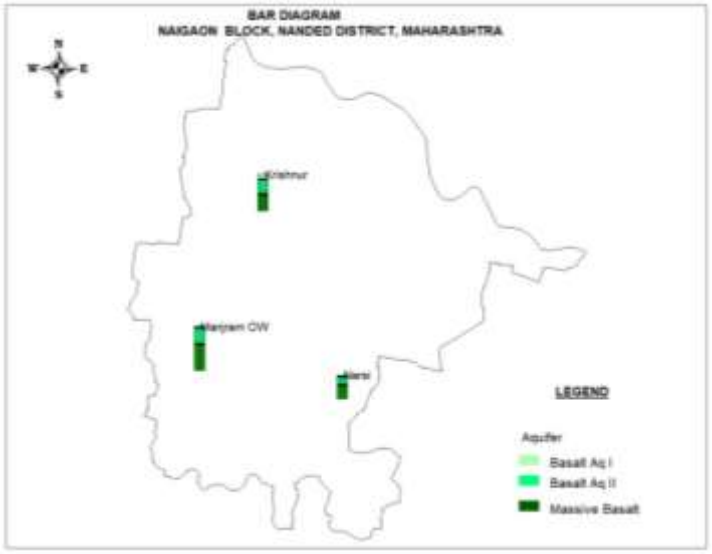
2. **Declining Water Level Trend: -**
   The decline in water level trend (2010-19) upto 0.6 m/year is observed in 327 sq km area of the block during premonsoon.

3. **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

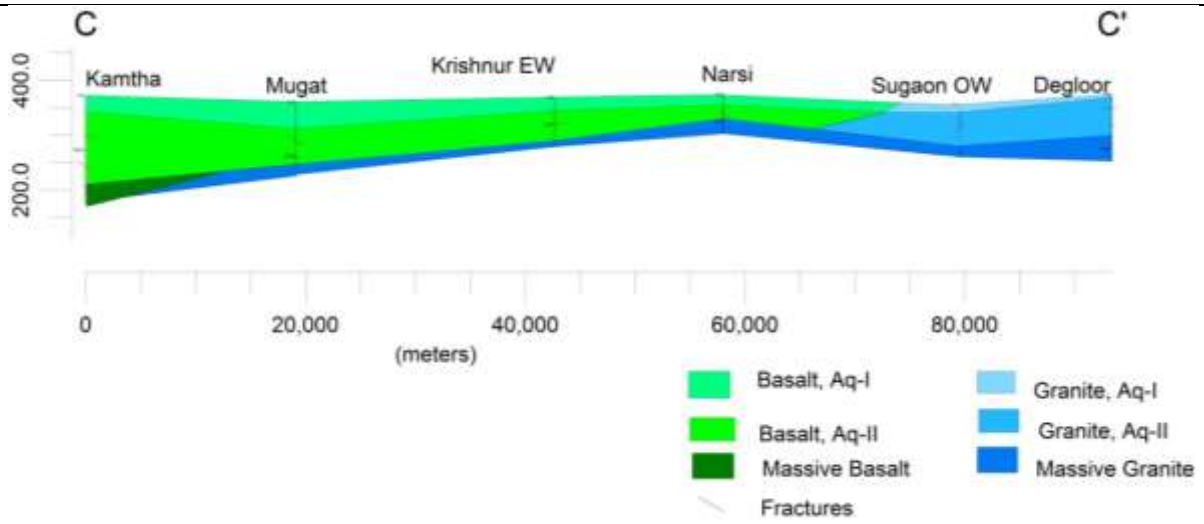
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	1)Basalt –Aquifer-I, Aquifer-II 2)Granite-Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION

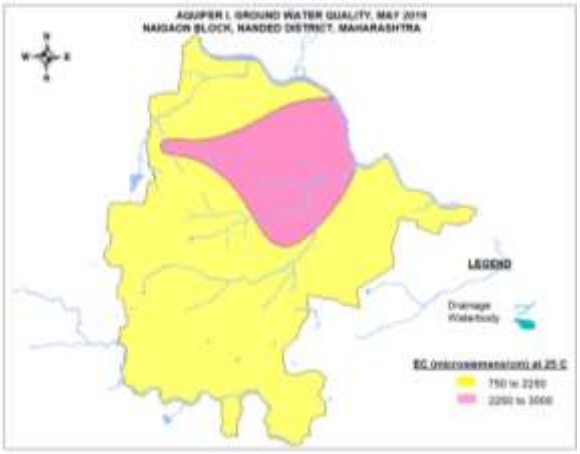
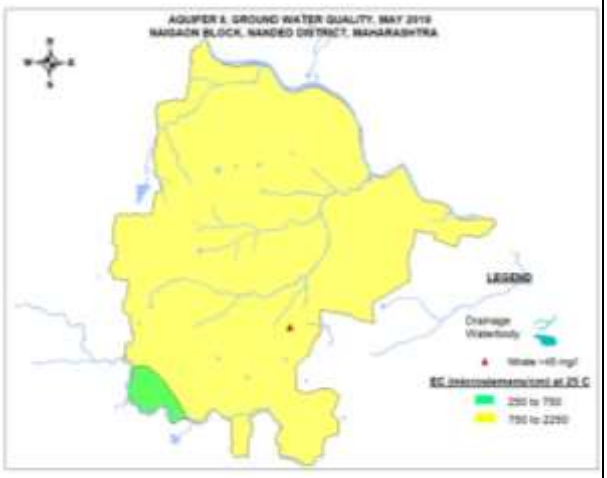


3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS				
Major Aquifer	Basalt (Deccan Traps)		Granite	
Type of Aquifer (Phreatic/Semiconfined/ Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined /confined)
Depth to bottom of aquifer (mbgl)	10 to 16	30 to 90		
Weathered/ Fractured rocks thickness (m)	8 to 12.8	5 to 14		
Yield Potential	0 to 100 m3/day	0 to 0.4 lps		
Specific Yield (Sy)/ Storativity (S)	0.02	0.00249		
Transmissivity (T)	-	64.7 to 326.26 m^2/day		
4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION				
4.1 Aquifer I/Shallow Aquifer				
Suitability for Drinking Purposes		**Suitability for Irrigation Purposes**		

➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 463.9 Sq Km area of the block has EC between 750 and 2250 microsiemens/cm and 114.5 Sq Km area has EC more than 2250 microsiemens/cm	➢ In major parts of the block covering 463.9 Sq Km area, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l except in Somthana village indicating that the ground water is good for irrigation in major parts of the block. ➢ About 50 % of the analysed samples have % Na less than 20 and 50% have %Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Narsi village. ➢ About 12.58 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 565.9 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 12.85 Sq Km area, plants with moderate salt tolerance can be grown. However, in 565.9 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of all the analysed samples have values < 1.25 meq/l indicating that the ground water is good for irrigation. ➢ About 33 % of the analysed samples have % Na less than 20; 33 % have %Na between 40 and 60; 34% have %Na more than 60 Hence, the overall quality of ground water is suitable for irrigation purposes except in areas where %Na is more than 60.
3.2.CHEMICAL QUALITY MAP	

Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	

5. GROUND WATER RESOURCE & EXTRACTION								
Aquifer-I/ Phreatic Aquifer (Basalt)								
Ground Water Recharge Worthy Area (Sq. Km.)	565.60							
Total Annual Ground Water Recharge (MCM)	65.84							
Natural Discharge (MCM)	3.29							
Net Annual Ground Water Availability (MCM)	62.55							
Existing Gross Ground Water Draft for irrigation (MCM)	18.71							
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	1.56							
Existing Gross Ground Water Draft for All uses(MCM)	20.27							
Net Ground Water Availability for future irrigation development(MCM)	38.45							
Provision for domestic and industrial requirement supply to 2025(MCM)	3.65							
Stage of Ground Water Development %	32.42							
Category	**SAFE**							
Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
580.08	4.48	0.00249	6.47	580.08	9.5	0.00249	13.72	20.193

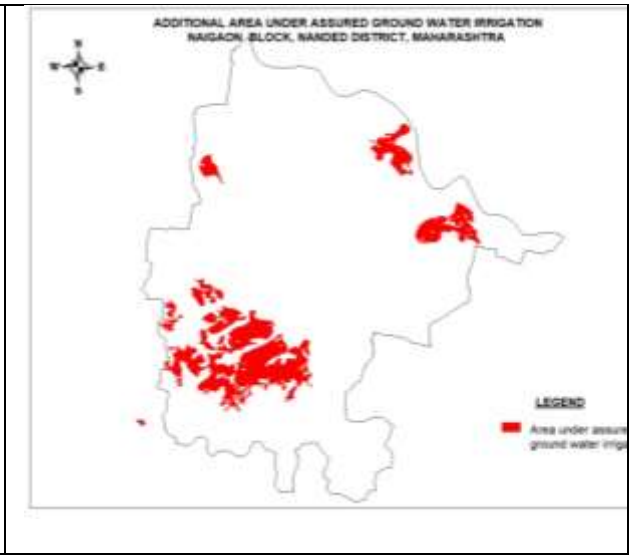
5.0. GROUND WATER RESOURCE ENHANCEMENT	
Available Resource (MCM)	62.55
Gross Annual Draft (MCM)	20.27
5.1.SUPPLY SIDE MANAGEMENt	

SUPPLY (MCM)			
Agricultural Supply -GW	18.71		
Agricultural Supply -SW	26.95		
Domestic Supply - GW	1.56		
Domestic Supply - SW	0.31		
Total Supply	**47.53**		
Area of Block (Sq. Km.)	580.08		
Area suitable for Artificial recharge (Sq. Km)	565.6		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	323.27	-	
Volume of Unsaturated Zone (MCM)	646.546	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	12.93	-	
Surplus water Available (MCM)	7.241	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	19	54	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.85	1.215	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	9742		
Total RWH potential (MCM)	0.341		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.273 (**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			

Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	62.55
Additional GW resources available after Supply side interventions (MCM)	4.065
Ground Water Availability after Supply side intervention	66.615
Existing Ground Water Draft for All Purposes (MCM)	20.27
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	20.27
Present stage of Ground Water Development (%)	32.4
Expected Stage of Ground Water Development after interventions (%)	30.4
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 59.76% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	26.3605
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1582
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	264
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	41

Proposed Artificial Recharge Structure	**Addditional Area proposed to be brought under assured ground water irrigation**

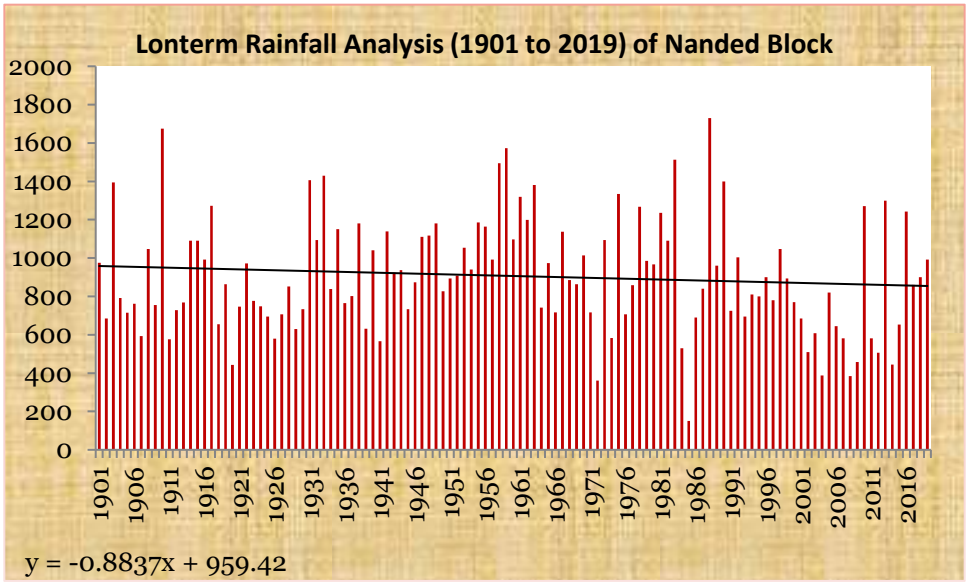

ARTIFICIAL RECHARGE STRUCTURES
NAIGAON BLOCK, NANDED DISTRICT, MAHARASHTRA
LEGEND
Check Dam
Check Dam


ADDITIONAL AREA UNDER ASSURED GROUND WATER IRRIGATION
NAIGAON BLOCK, NANDED DISTRICT, MAHARASHTRA
LEGEND

9.15 NANDED BLOCK, NANDED DISTRICT

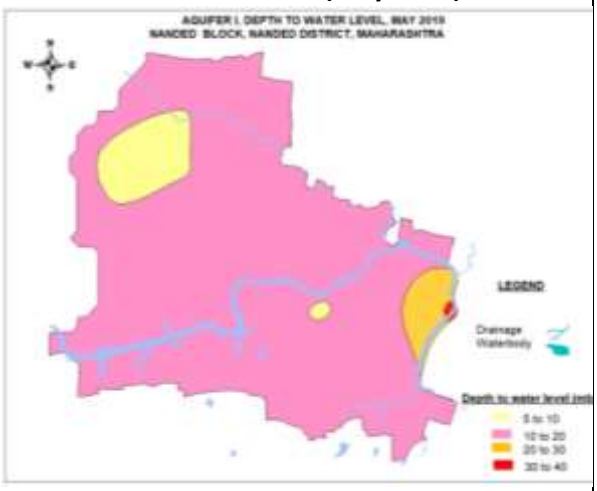
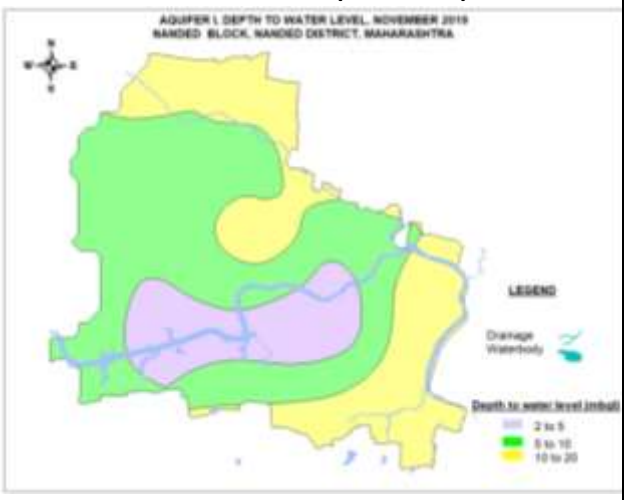
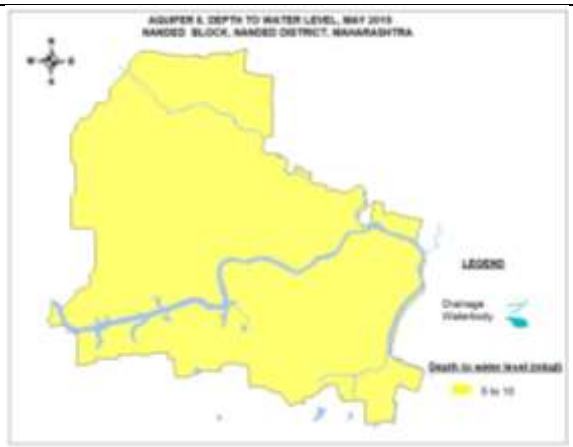
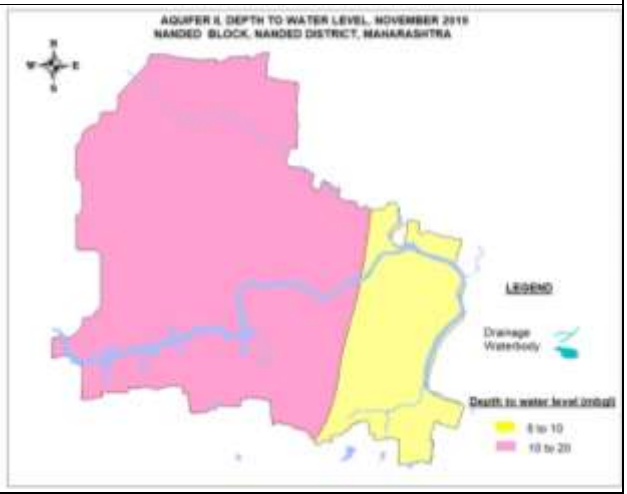
1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Nanded
Geographical Area (Sq. Km.)	406.80 Sq. Km.
Hilly Area (Sq. Km)	0.4 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	168749
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	906.3 mm
Annual Rainfall (2019)	992.1 mm
Decadal Average Annual Rainfall (2010-19)	874.85 mm
Long Term Rainfall Analysis (1901-2019)	Falling Trend: -0.883 m/year. Probability of Normal/Excess Rainfall: - 59% & 22%. Probability of Drought (Moderate/ Severe/ Acute):- 14% Moderate & 4% Severe & 1% Acute Frequency of occurance of Drought:- 1 in 5 Years

RAINFALL TREND ANALYSIS (1901 to 2019)



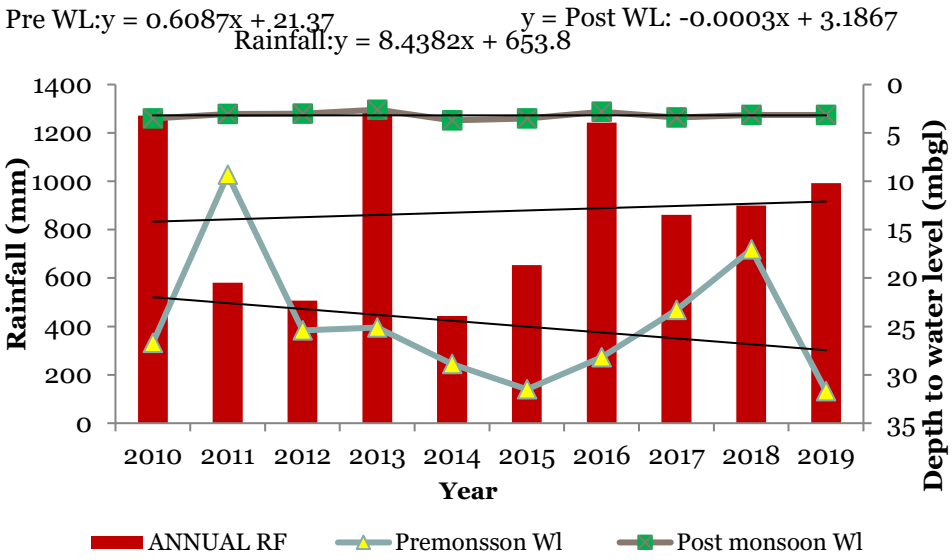
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Alluvial Plain - Deep (APD) ➢ Alluvial Plain - Older - Moderate (AYM) ➢ Butte (B) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered-Canal Command (PLC)
Soil	➢ Very shallow, well drained, loamy, moderately calcareous soils on gently sloping undulating lands

	with moderate erosion ➢ Very shallow, somewhat excessively drained, loamy soils on moderately sloping summits/spurs with severe erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity		
Geology	Recent River Alluvium-sand/Clay dominant & Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	Godavari river & its tributary		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1 Major Project	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	25
		No. of projects operating till end	26
		Command area of the operating project (Sq. Km.)	12.10
		Net irrigated area under Operating project (Sq. Km.)	8.38
1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area	406.80 Sq. Km.		
Forest Area	Nil		
Cultivable Area	354.39 Sq. Km.		
Net Sown Area	314.11 Sq. Km.		
Double Cropped Area	187.61 Sq. Km.		
Area under Irrigation – Surface Water	304.39Sq. Km.		
Area under Irrigation – Ground Water	3.042 SQ Km.		
Principal Crops	**Crop Type**	**Area (Sq. Km.)**	
	Pulses	163.56	
	Cotton	64.48	
	Cereals	96.30	
	Oil Seeds	174.80	
Horticultural Crops	Sugarcane	30.17	
	Others	14.22	
1.6.WATER LEVEL BEHAVIOUR			
1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)			
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**		

❖ Depth to water level between 5 mbgl and 10 mbgl observed in 25.33 Sq Km areas as isolated patches in parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl observed in 350.95 Sq Km area in the major parts of the block. ❖ Depth to water level more than 20 mbgl is observed in 13.48 sq km area in patches in western and eastern parts of the block.	❖ The shallow depth to water level less than 2 mbgl is observed in 63.86 sq km area in the south-central part of the block. ❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 200 Sq Km area in the central parts of the block. ❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 129 Sq Km area in the northwestern and south-western parts of the block.
Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)	
Pre-Monsoon Water Level (May 2019)	**Post-Monsoon Water Level (Nov.2019)**
	
1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)	
Pre-Monsoon (May-2019)	**Post-Monsoon (November-2019)**
	
Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 331 Sq Km area in the central part of the whole of the block	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 83.5 Sq Km area in the eastern part of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in the remaining parts

	of the block.

1.7. Hydrograph

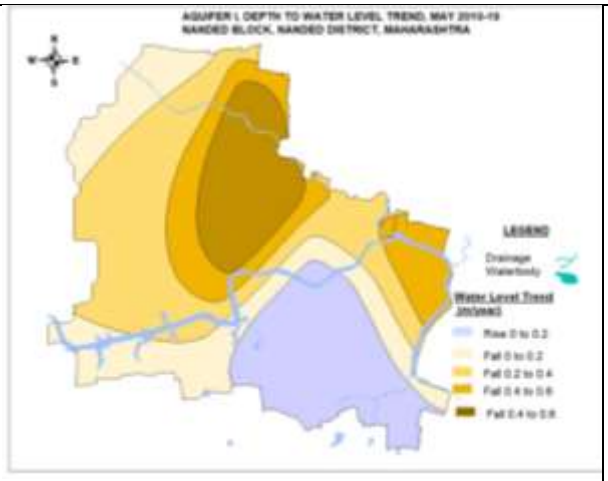


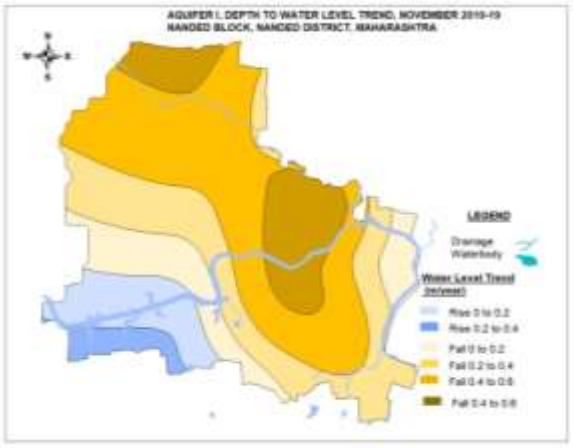
The hydrograph of CGWB Monitoring site at Sikarghat for the period 2010 to 2019 shows:

- A falling trend during premonsoon @ 0.608 m/year and a rising trend @ 0.0003 m/year during postmonsoon.
- The depth to water level during premonsoon ranges from 9.3 mbgl to 31.7 mbgl.
- The depth to water level during postmonsoon ranges from 2.6 mbgl to 3.7 mbgl.
- A rising rainfall trend @ 8.4 mm/year is observed during the period 2010-19

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		**Post-Monsoon Trend (November 2010-2019)**	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0 to 0.2 m/year in 79.60 Sq Km area	0 to 0.2 m/year in 83.79 Sq Km area; 0. to 0.4 m/year in 120.2 sq km area and 0.4 to 0.6 m/year in 38.29 sq km area and >0.6 m/year in 52.50 sq km area	0 to 0.2 m/year in 36.86 Sq Km area and 0.2 to 0.4 m/year in 13.74 sq km area.	0 to 0.2 m/year in 143.2 Sq Km area; 0.2 to 0.4 m/year in 145 sq km area and 0.4 to 0.6 m/year in 54.77 sq km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	





2. GROUND WATER ISSUES

1) **Low Development:-**Low Development of 43.39 % of Stage of Ground Water Development is observed in the block

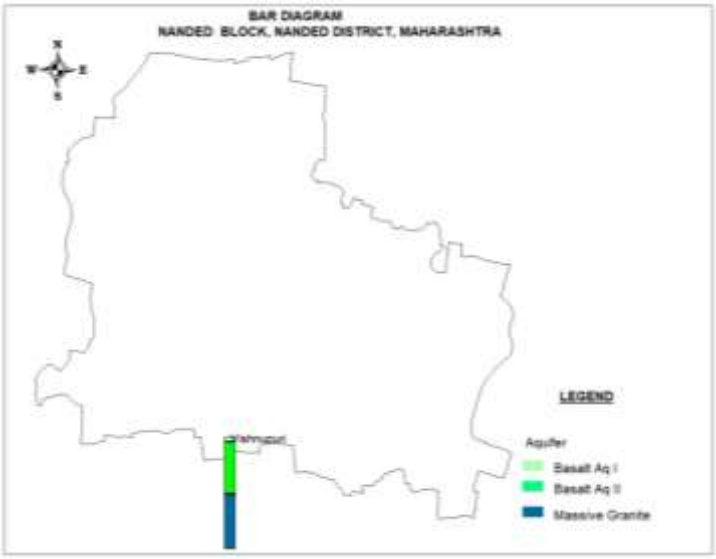
2) **Declining Water Level Trend: -**
The decline in water level trend (2010-19) more than 0.6 m/year is observed in 294 sq km area of the block during premonsoon and upto 0.6m/year in 293 sq km area during postmonsoon.

3) **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

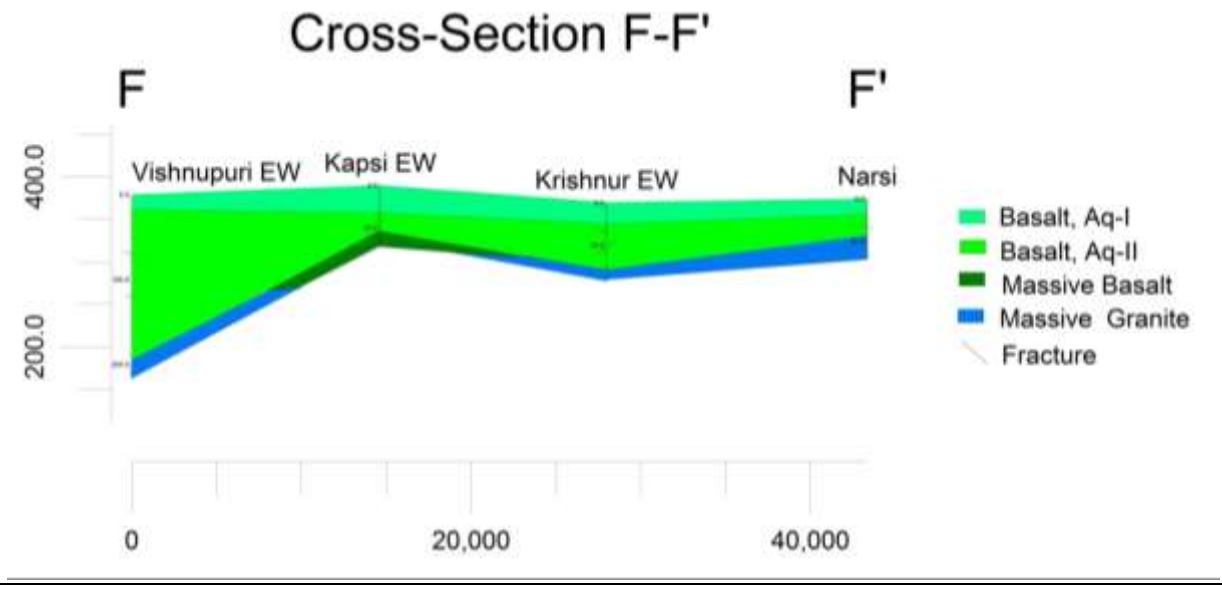
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One:Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION



3.3. CROSS SECTIONS



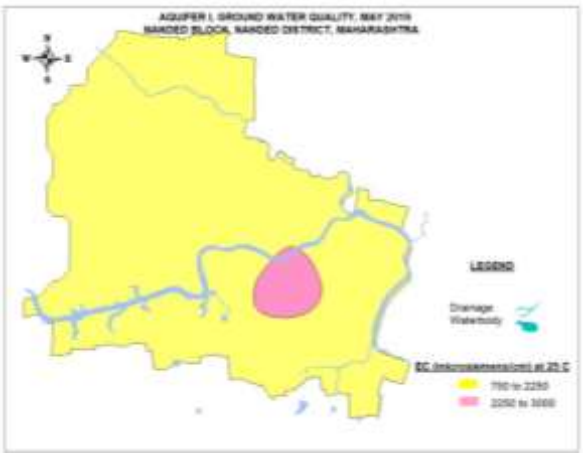
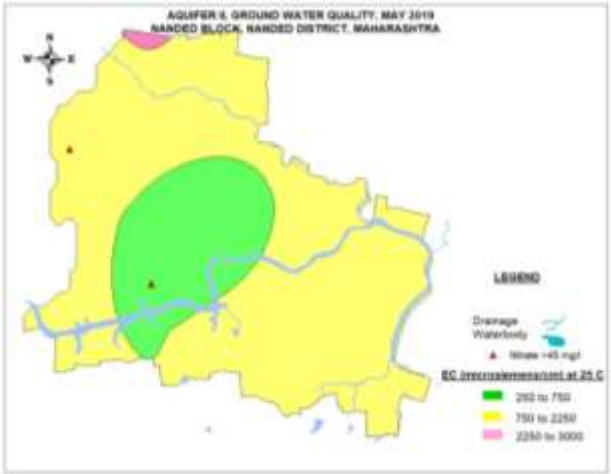
3.4 AQUIFER CHARACTERISTICS

Major Aquifer	Alluvium		Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	10 to 35	Nil	10 to 35	60 to 210
Weathered/ Fractured rocks thickness (m)	8 to 26	Nil	8 to 25	2 to 8
Yield Potential	0 to 200 m3/day	Nil	15 to 100 m3/day	0 to 0.65 lps
Specific Yield (Sy)/ Storativity (S)	0.07	Nil	0.02	0.0026
Transmissivity (T)	-	Nil	-	5.74 m^2/day

4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION

4.1 Aquifer I/Shallow Aquifer

Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 379.6 Sq Km area of the block has EC between 750 and 2250 microsiemens/cm and 15.29 Sq Km area has EC more than 2250 microsiemens/cm	➢ In major parts of the block covering 379.6 Sq Km area, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of 33% of the analysed samples have values < 1.25 meq/l and 64% have values > 1.25 meq/l indicating that the ground water quality for irrigation is not good in major parts of the

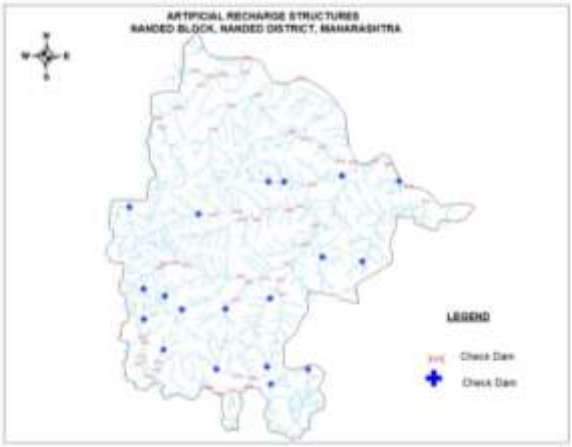
	block. ➢ All the analysed samples have % Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation purposes.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes except in Nitrate affected Talni and Borgaon Telang. ➢ About 82.77 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 307.8 sq Km area has EC between 750 and 2250 microsiemens/cm and 2.19 Sq Km area has EC more than 2250 microsiemens/cm	➢ In 82.7 Sq Km area, plants with moderate salt tolerance can be grown. However, in 307.8 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The analysed sample in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC values of the analysed sample haS value > 1.25 meq/l indicating that the ground water is not good for irrigation. ➢ The %Na value of the analysed sample is between 40 and 60.
3.2.CHEMICAL QUALITY MAP	
Phreatic Aquifer (Aquifer-I)	**Semiconfined/Confined Aquifer (Aquifer II)**
	
5. GROUND WATER RESOURCE & EXTRACTION	
Aquifer-I/ Phreatic Aquifer (Basalt)	
Ground Water Recharge Worthy Area (Sq. Km.)	406.33
Total Annual Ground Water Recharge (MCM)	61.40
Natural Discharge (MCM)	3.07
Net Annual Ground Water Availability (MCM)	58.33
Existing Gross Ground Water Draft for irrigation (MCM)	20.62
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	4.68

Existing Gross Ground Water Draft for All uses(MCM)				25.31				
Net Ground Water Availability for future irrigation development(MCM)				23.06				
Provision for domestic and industrial requirement supply to 2025(MCM)				13.36				
Stage of Ground Water Development %				43.39				
Category				**SAFE**				
Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer 9MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
406.8	1.13	0.0026	1.195	406.8	5	0.0026	5.28	6.48
0. GROUND WATER RESOURCE ENHANCEMENT								
Available Resource (MCM)			58.33					
Gross Annual Draft (MCM)			25.31					
5.1.SUPPLY SIDE MANAGEMENt								
SUPPLY (MCM)								
Agricultural Supply -GW			20.62					
Agricultural Supply -SW			304.39					
Domestic Supply - GW			4.68					
Domestic Supply - SW			0.94					
Total Supply			**330.63**					
Area of Block (Sq. Km.)			406.8					
Area suitable for Artificial recharge (Sq. Km)			406.3					
Type of Aquifer			Hard Rock	Soft Rock				
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)			232.49	-				
Volume of Unsaturated Zone (MCM)			464.98	-				
Average Specific Yield			0.020	-				
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)			9.2996	-				
Surplus water Available (MCM)			5.21	-				
Proposed Structures			**Percolation Tank** (Av. Gross Capacity-100 TCM*2 fillings =	Check Dam (Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)			**Recharge shaft** (Av. Gross Capacity-60 TCM)	

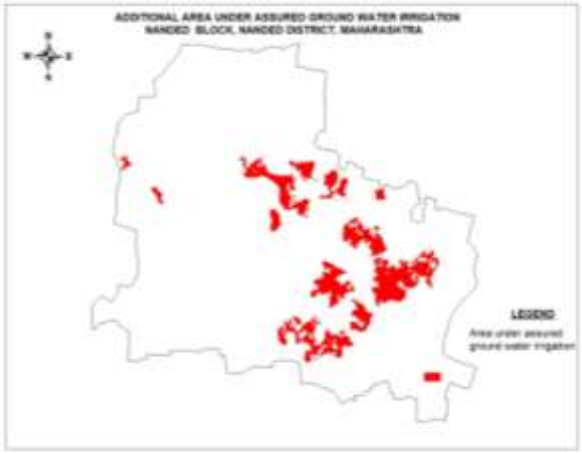
	200 TCM)		
Number of Structures	14	39	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	2.1	0.8775	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	7810		
Total RWH potential (MCM)	0.341		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.273(**Economically not viable & Not Recommended)**		
5.2.DEMAND SIDE MANAGEMENT			
Micro irrigation techniques			
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil		
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil		
Proposed Cropping Pattern change			
Irrigated area under Water Intensive Crop(ha)	Not proposed		
Water Saving by Change in Cropping Pattern	Nil		
5.3.EXPECTED BENEFITS			
Net Ground Water Availability (MCM)	58.33		
Additional GW resources available after Supply side interventions (MCM)	2.9775		
Ground Water Availability after Supply side intervention	61.3075		
Existing Ground Water Draft for All Purposes (MCM)	25.31		

Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	25.31
Present stage of Ground Water Development (%)	43.4
Expected Stage of Ground Water Development after interventions (%)	41.3
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 43.4% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	17.60525
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1056
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	176
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	27

Proposed Artificial Recharge Structure



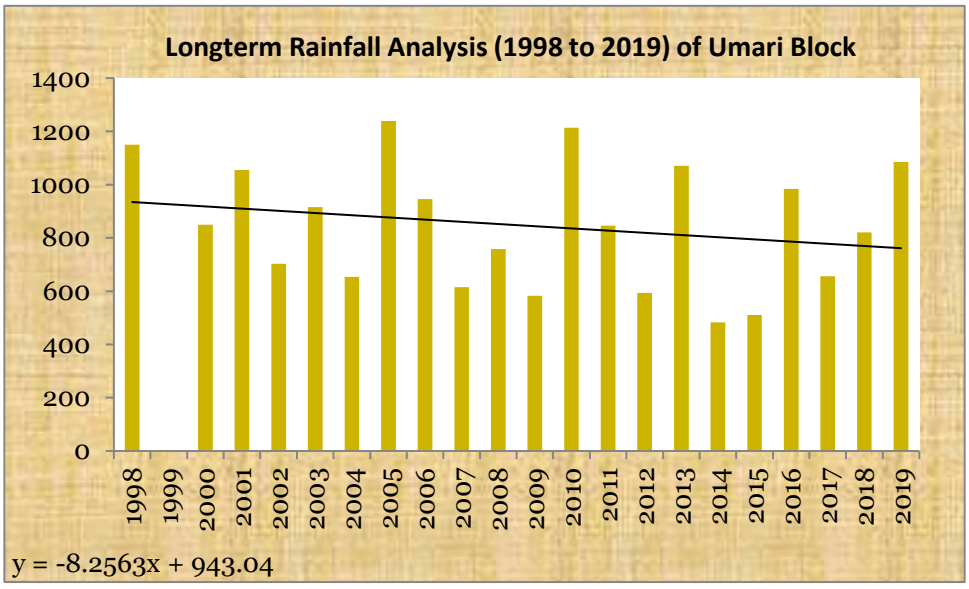
Addditional Area proposed to be brought under assured ground water irrigation



9.16 UMARI BLOCK, NANDED DISTRICT

1. SALIENT INFORMATION	
1.1.Introduction	
Block Name	Umari
Geographical Area (Sq. Km.)	408.01 Sq. Km.
Hilly Area (Sq. Km)	1.81 Sq. Km.
Poor Quality Area (Sq. Km.)	Nil
Population (2011)	85518
Climate	Tropical climate
1.2. Rainfall Analysis	
Normal Rainfall	844.3 mm
Annual Rainfall (2019)	1085.6 mm
Decadal Average Annual Rainfall (2010-19)	826.4 mm
Long Term Rainfall Analys (1998-2019)	Falling Trend: -8.25 m/year. Probability of Normal/Excess Rainfall: - 52% & 29%. Probability of Drought (Moderate/ Severe/ Acute):- 19% Moderate Frequency of occurance of Drought:- 1 in 5 Years

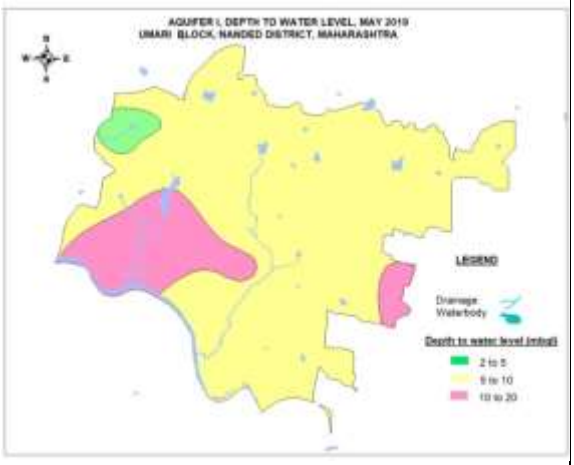
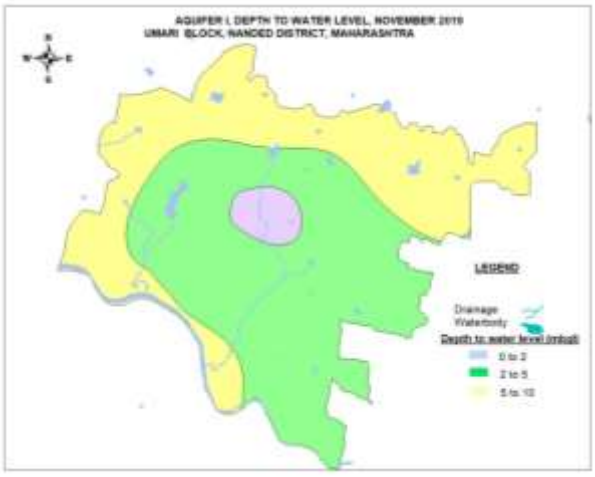
RAINFALL TREND ANALYSIS (1998 to 2019)

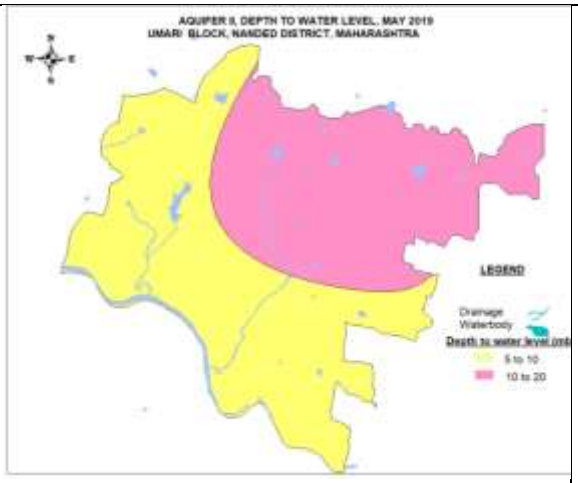


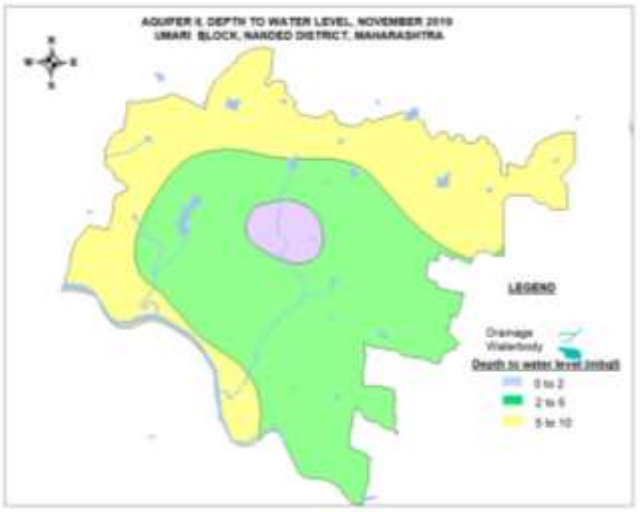
1.3. Geomorphology,Soil&Geology	
Geomorphic Unit	➢ Butte (B) ➢ Plateau Slightly Dissected (PLS), 0-1m weathering ➢ Plateau Undissected (PLU), 0-1m weathering ➢ Plateau Weathered (PLW), 2-5m weathering ➢ Plateau Weathered (PLWS), 1-2m weathering ➢ Plateau Weathered-Canal Command (PLC)
Soil	➢ Very shallow, well drained, loamy, moderately

	calcareous soils on gently sloping undulating lands with moderate erosion ➢ Very shallow, somewhat excessively drained, loamy soils on gently sloping rolling lands with mesas and buttes with severe erosion ➢ Shallow, well drained, clayey soils on gently sloping lands with moderate erosion ➢ Deep, imperfectly drained, fine, calcareous soils on very gently sloping plains and valleys with moderate erosion; moderate salinity and slight sodicity		
Geology	Deccan Trap-Sahyadri Group (Late Cretaceous to Early Eocene Age)		
1.4.Hydrology & Drainage			
Drainage	Godavari river & its tributary		
Hydrology(as on March 2017)	Major & Medium Irrigation Projects (>250 Ha)	1Medium Project	
	Minor Irrigation Projects (0 to 250 Ha)	No. of projects completed till March 2017	20
		No. of projects operating till end	20
		Command area of the operating project (Sq. Km.)	22.12
		Net irrigated area under Operating project (Sq. Km.)	11.27

1.5.LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN			
Geographical Area		408.01 Sq. Km.	
Forest Area		23.37 Sq. Km.	
Cultivable Area		317.94 Sq. Km.	
Net Sown Area		307.54 Sq. Km.	
Double Cropped Area		44.72 Sq. Km.	
Area under Irrigation	Surface Water	18.89 Sq. Km.	
	Ground Water	7.00 Sq. Km.	
Principal Crops		**Crop Type**	**Area (Sq. Km.)**
		Pulses	96.52
		Cotton	113.37
		Cereals	23.70
		Oil Seeds	135.62

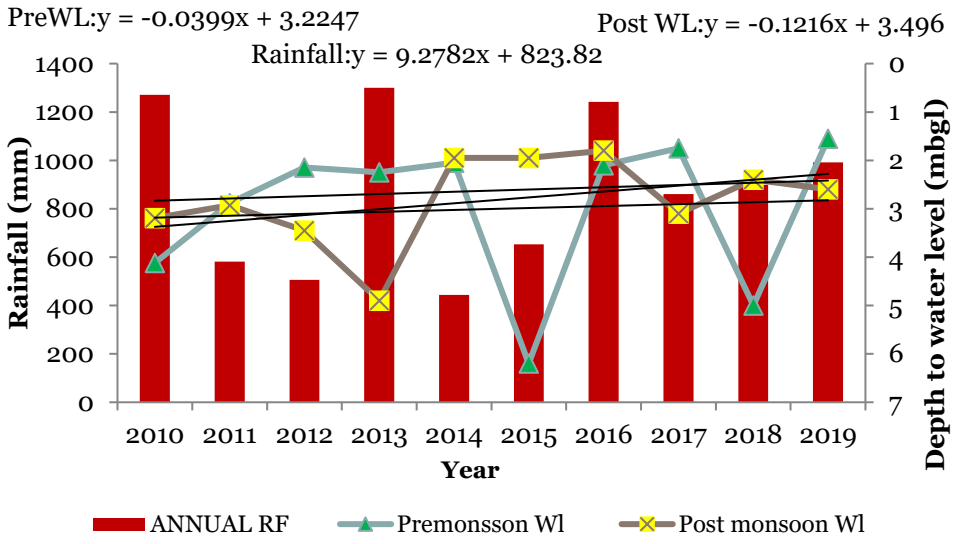
<table>
<tr><td rowspan="2">Horticultural Crops</td><td>Sugarcane</td><td>23.08</td></tr>
<tr><td>Others</td><td>5.27</td></tr>
<tr><td colspan="3">1.6.WATER LEVEL BEHAVIOUR</td></tr>
<tr><td colspan="3">1.6.1. Aquifer-I/Shallow Aquifer (Phreatic Aquifer)</td></tr>
<tr><td>Pre-Monsoon (May-2019)</td><td colspan="2">Post-Monsoon (November-2019)</td></tr>
<tr><td>❖ Depth to water level between 2 mbgl and 5 mbgl observed in 2.96 Sq Km areas in an isolated patch in western part of the block.
❖ Depth to water level between 5 mbgl and 10 mbgl observed in 331 Sq Km area in the major parts of the block.
❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 62.6 sq km area in the eastern and western parts of the block.</td><td colspan="2">❖ The shallow depth to water level less than 2 mbgl is obseerved only as isolated patch in the central part of the block covering only 14 Sq Km area.
❖ The depth to water level between 2 mbgl and 5 mbgl is observed in 228 Sq Km area in the major parts of the block.
❖ Depth to water level between 5 mbgl and 10 mbgl is observed in 171 Sq Km area in the western and northern parts of the block.</td></tr>
<tr><td colspan="3">Water Level Map- Aquifer-I/Shallow Aquifer (Phreatic Aquifer)</td></tr>
<tr><td>Pre-Monsoon Water Level (May 2019)</td><td colspan="2">Post-Monsoon Water Level (Nov.2019)</td></tr>
<tr><td> 
</td><td colspan="2"> 
</td></tr>
<tr><td colspan="3">1.6.2. Aquifer-II/Deeper Aquifer (Semiconfined/Confined Aquifer)</td></tr>
<tr><td>Pre-Monsoon (May-2019)</td><td colspan="2">Post-Monsoon (November-2019)</td></tr>
</table>





Pre-Monsoon Water Level(May 2019)	**Post-Monsoon Water Level(November 2019)**
❖ Depth to water level between 20 mbgl and 30 mbgl is observed in 409.8 Sq Km area covering almost the entire block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed only in a small patch of 4.5 sq km.	❖ The depth to water level between 5 mbgl and 10 mbgl is observed in 231 Sq Km area in the western, south-western parts of the block. ❖ Depth to water level between 10 mbgl and 20 mbgl is observed in 183.9 sq km area in the remaining parts of the block.

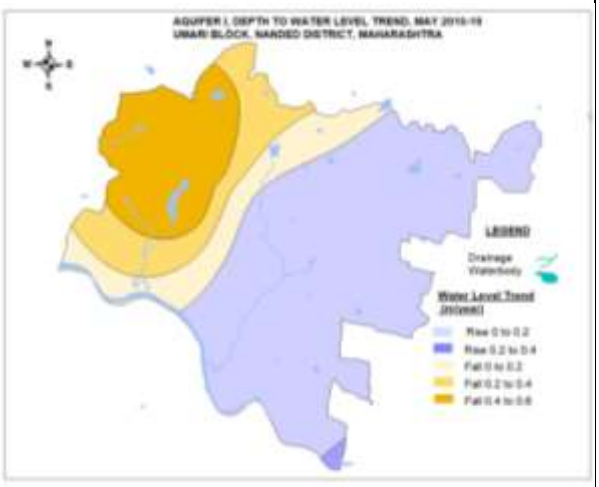
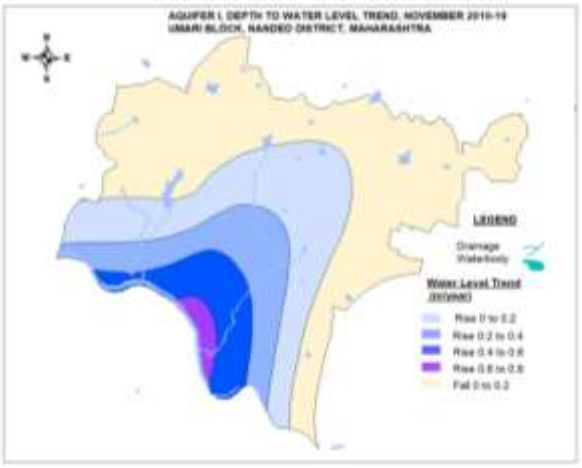
1.7. Hydrograph



The hydrograph of CGWB Monitoring site at Umri-Gortha for the period 2010 to 2019 shows:

- ❖ A falling trend during both premonsoon and postmonsoon @ 0.0339 m/year and 0.121 m/year respectively.
- ❖ The depth to water level during premonsoon ranges from 1.5 mbgl to 6.2 mbgl.
- ❖ The depth to water level during postmonsoon ranges from 1.8 mbgl to 4.9 mbgl.
- ❖ A rising rainfall trend @9.27 mm/year is observed during the period 2010-19

1.8. Water Level Trend (2010-19)

Pre-Monsoon Trend (May 2010-2019)		Post-Monsoon Trend (November 2010-2019)	
Rising Trend @	Falling Trend @	Rising Trend @	Falling Trend @
0 to 0.2 m/year in 243.4 Sq Km area	0 to 0.2 m/year in 49.7 Sq Km area; 0.2 to 0.4 m/year in 47.95 sq km area and 0.4 to 0.6 m/year in 71.33 sq km area	0 to 0.2 m/year in 95.63 Sq Km area ;0.2 to 0.4 m/year in 53.05 sq km area; 0.4 to 0.6 m/year in 36.39 sq km area and >0.6 m/year in 7.306 sq km area	0 to 0.2 m/year in 221.5 Sq Km area
Pre-Monsoon WL Trend (May 2010-2019)		**Post-Monsoon WL Trend (Nov.2010-2019)**	
			

2. GROUND WATER ISSUES

1) **Low Development:-**Low Development of 32.11 % of Stage of Ground Water Development is observed in the block

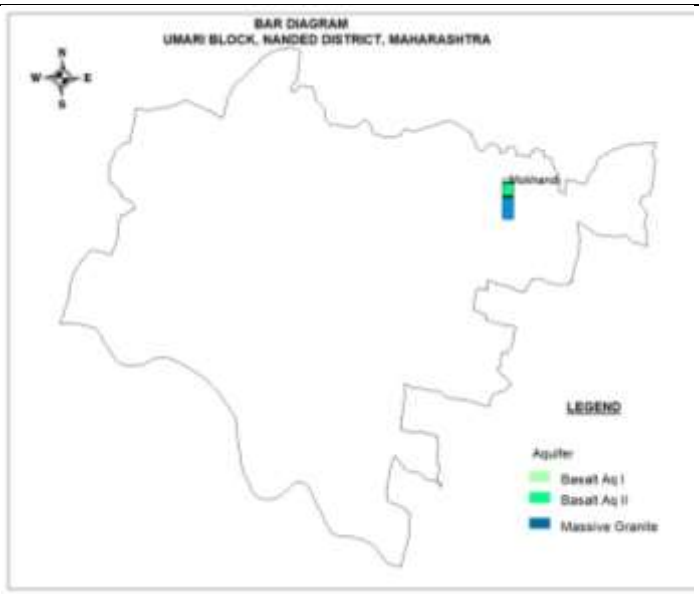
2) **Declining Water Level Trend: -**
The decline in water level trend (2010-19) upto 0.6 m/year is observed in 168 sq km area of the block during premonsoon.

3) **Low ground water yield Potential of the aquifers:** The ground water yield potentiality of the aquifers ranges from 0 to 1 lps in major parts of the block. However, high yielding aquifers re obtained only along the drainages, faults/ fractures or joints. The low potential zone in major parts of the block is due to limited extent of porosity and permeability evolved from secondary porosity and hence poor sustainability of aquifers.

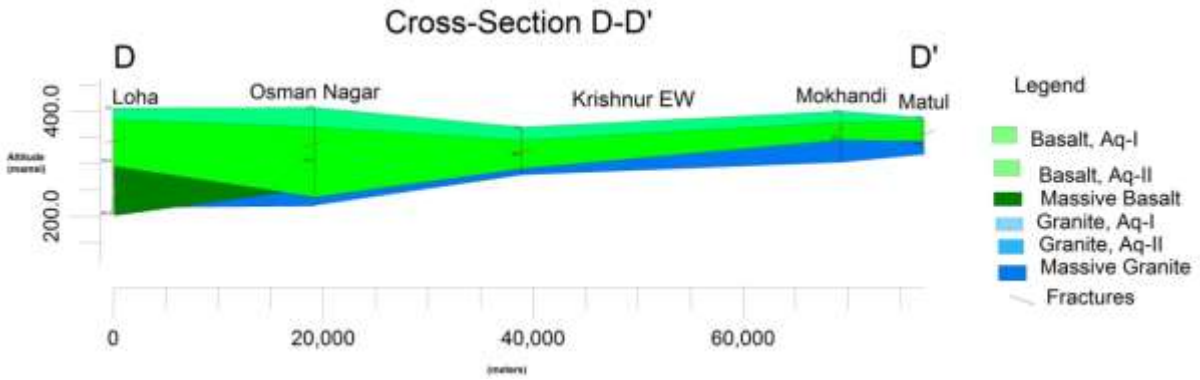
3. AQUIFER DISPOSITION

3.1. Number of Aquifers (Major)	One:Basalt –Aquifer-I, Aquifer-II

3.2. LITHOLOGICAL DISPOSITION

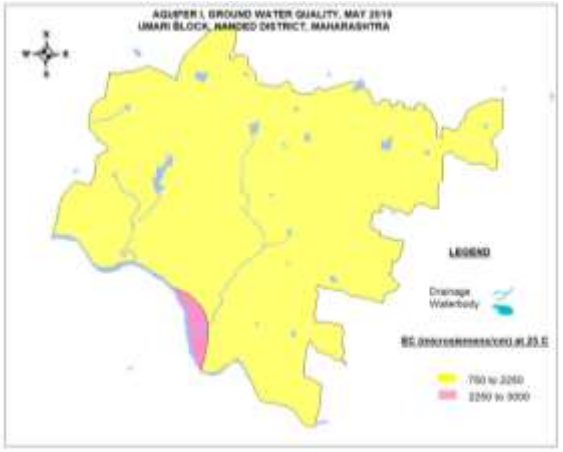
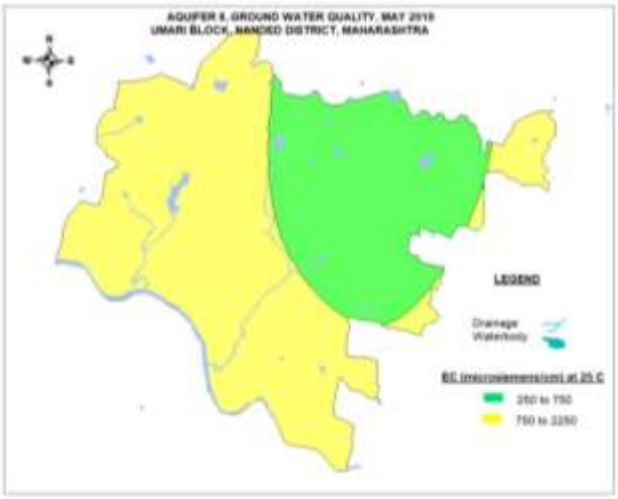


3.3. CROSS SECTIONS



3.4 AQUIFER CHARACTERISTICS		
Major Aquifer	Basalt (Deccan Traps)	
Type of Aquifer (Phreatic/Semiconfined/Confined)	Aquifer-I (Phreatic)	Aquifer-II (Semiconfined/confined)
Depth to bottom of aquifer (mbgl)	10 to 35	60 to 210
Weathered/ Fractured rocks thickness (m)	8 to 25	2 to 8
Yield Potential	15 to 200 m3/day	0 to 0.65 lps
Specific Yield (Sy)/ Storativity (S)	0.02	0.0024
Transmissivity (T)	-	75.87 to 281 m^2/day
4.CHEMICAL QUALITY OF GROUND WATER &CONTAMINATION		
4.1 Aquifer I/Shallow Aquifer		
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**	

➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 408.7 Sq Km area of the block has EC between 750 and 2250 microsiemens/cm and 5.85 Sq Km area has EC more than 2250 microsiemens/cm	➢ In major parts of the block covering 408.7 Sq Km area, where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ All the analysed samples in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The analysed samples have values > 1.25 meq/l indicating that the ground water is not good for irrigation in Umri-Gortha village. ➢ The analysed samples has %Na between 20 and 40 Hence, the overall quality of ground water is suitable for irrigation except in RSC affected and mpre % Na areas.
4.1 Aquifer II/Deeper Aquifer	
Suitability for Drinking Purposes	**Suitability for Irrigation Purposes**
➢ The overall quality of Aquifer is potable and useful for drinking and domestic puposes ➢ About 146.2 Sq Km area of the block has EC well within the potable range of 250 to 750microsiemens/cm; 268.1 sq Km area has EC between 750 and 2250 microsiemens/cm	➢ In 146.2 Sq Km area, plants with moderate salt tolerance can be grown. However, in 268.1 sq Km area where EC > 750 microsiemens/cm, special management for salinity control may be required and plants with good salt tolerance should be selected. ➢ The analysed sample in the block have SAR value well within 0 to 10 types and are therefore good for irrigation. ➢ The RSC value of the analysed sample is > 1.25 meq/l indicating that the ground water is notgood for irrigation. ➢ The analysed samples has %Na between 40 and 60 and hence good for irrigation.
3.2.CHEMICAL QUALITY MAP	

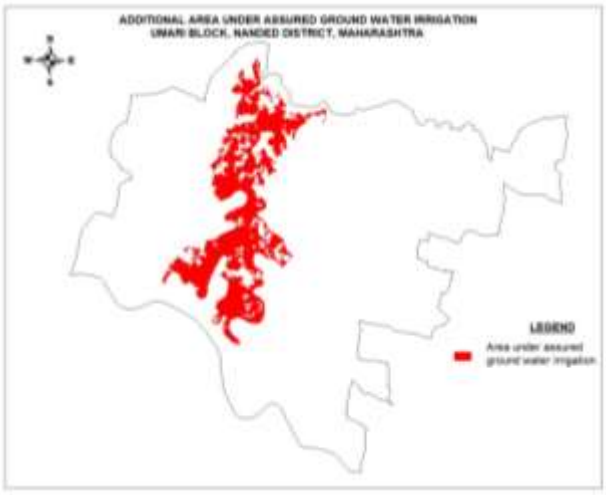
Phreatic Aquifer (Aquifer-I)	Semiconfined/Confined Aquifer (Aquifer II)
	

5. GROUND WATER RESOURCE & EXTRACTION								
Aquifer-I/ Phreatic Aquifer (Basalt)								
Ground Water Recharge Worthy Area (Sq. Km.)	406.20							
Total Annual Ground Water Recharge (MCM)	43.61							
Natural Discharge (MCM)	2.18							
Net Annual Ground Water Availability (MCM)	41.42							
Existing Gross Ground Water Draft for irrigation (MCM)	11.91							
Existing Gross Ground Water Draft for domestic and industrial water supply(MCM)	1.38							
Existing Gross Ground Water Draft for All uses(MCM)	13.30							
Net Ground Water Availability for future irrigation development(MCM)	25.99							
Provision for domestic and industrial requirement supply to 2025(MCM)	3.42							
Stage of Ground Water Development %	32.11							
Category	**SAFE**							
Aquifer-II								
Semiconfined/Confined Aquifer (Basalt)								
Resources above the confining layer				**Resources within the confining layer**				
Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources above confining layer (MCM)	Total Area (Sq. Km.)	Mean aquifer thickness (m)	S	Resources within the confining layer (MCM)	Total Resources (MCM)
408.01	6.5	0.0024	5	408.01	5	0.0024	4.89	11.26
5.0. GROUND WATER RESOURCE ENHANCEMENT								
Available Resource (MCM)	41.43							
Gross Annual Draft (MCM)	13.30							

5.1.SUPPLY SIDE MANAGEMENt			
SUPPLY (MCM)			
Agricultural Supply -GW	11.91		
Agricultural Supply -SW	18.89		
Domestic Supply - GW	1.38		
Domestic Supply - SW	0.28		
Total Supply	**32.46**		
Area of Block (Sq. Km.)	408.01		
Area suitable for Artificial recharge (Sq. Km)	406.2		
Type of Aquifer	Hard Rock	Soft Rock	
Area feasible for Artificial Recharge(WL >5mbgl) (Sq. Km.)	418.39	-	
Volume of Unsaturated Zone (MCM)	836.786	-	
Average Specific Yield	0.020	-	
Volume of Sub surface Storage Space available for Artificial Recharge (MCM)	16.74	-	
Surplus water Available (MCM)	9.372	-	
Proposed Structures	**Percolation Tank** (Av. Gross Capacity -100 TCM*2 fillings = 200 TCM)	Check Dam (Av. Gross Capacity- 10 TCM * 3 fillings = 30 TCM)	**Recharge shaft** (Av. Gross Capacity-60 TCM)
Number of Structures	25	70	0
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	3.75	1.575	0
Area of Saline Patch	**Nil**		
Proposed Structures	Nil		
No of farm pond proposed (size: 30m*30m*3) with 3 filling= 0.0081 mcm capacity, 50% available water may be utilized for harvesting through farm ponds.	Nil		
Volume of water available for harvesting	Nil		
Additional volume created by desilting	**Nil**		
RTRWH Structures – Urban Areas			
Households to be covered (25% with 50 m^2area)	4250		
Total RWH potential (MCM)	0.176		
Rainwater harvested / recharged @ 80% runoff co-efficient	0.140 (**Economically not viable & Not Recommended)**		

5.2.DEMAND SIDE MANAGEMENT	
Micro irrigation techniques	
Remaining ground water irrigated Sugarcane cropped area proposed through drip irrigation	Nil
Volume of Water expected to be saved (MCM). (Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m)	Nil
Proposed Cropping Pattern change	
Irrigated area under Water Intensive Crop(ha)	Not proposed
Water Saving by Change in Cropping Pattern	Nil
5.3.EXPECTED BENEFITS	
Net Ground Water Availability (MCM)	41.43
Additional GW resources available after Supply side interventions (MCM)	5.325
Ground Water Availability after Supply side intervention	46.755
Existing Ground Water Draft for All Purposes (MCM)	13.30
Saving of Ground Water through demand side intervention (MCM)	0
GW draft after Demand Side Interventions (MCM)	13.3
Present stage of Ground Water Development (%)	32.1
Expected Stage of Ground Water Development after interventions (%)	28.4
Other Interventions Proposed, if any	
Alternate Water Sources Available	Nil
5.4.RECOMMENDATION	
Ground water development is recommended to bring the stage of development from 32.1% to 70%	
5.5.DEVELOPMENT PLAN	
Volume of water available to bring the stage of GWD is to 70% (MCM)	19.42
Proposed Number of DW(@ 1.5 ham for 90% of GWR Available)	1166
Proposed Number of BW(@ 1.5 ham for 10% of GWR Available)	194
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	30
Proposed Artificial Recharge Structure	**Addditional Area proposed to be brought under assured ground water irrigation**


ARTIFICIAL RECHARGE STRUCTURES
UMARI BLOCK, NANDED DISTRICT, MAHARASHTRA
LEGEND
Check Dam
Check Dam


ADDITIONAL AREA UNDER ASSURED GROUND WATER IRRIGATION
UMARI BLOCK, NANDED DISTRICT, MAHARASHTRA
LEGEND
Area under assured ground water irrigation

10.ANNEXURES

ANNEXURE 1: SALIENT FEATURES OF GROUND WATER EXPLORATION
ANNEXURE II: DETAILS OF GW EXPLORATION WELLS IN NANDED DISTRICT
ANNEXURE III: DETAILS OF GW MONITORING WELLS IN NANDED DISTRICT
ANNEXURE IV: CHEMICAL ANALYSIS OF GROUND WATER SAMPLES, AQUIFER-1/SHALLOW AQUIFERS
ANNEXURE V: CHEMICAL ANALYSIS OF GROUND WATER SAMPLES, AQUIFER-II/DEEPER AQUIFERS
ANNEXURE VI: WATER LEVEL OF GROUND WATER MONITORING WELLS (2019) WITH LONG TERM TREND (2010-19)
ANNEXURE VII: LOCATION OF PERCOLATION TANK
ANNEXURE VIII: LOCATION OF CHECK DAMS

ANNEXURE I: SALIENT FEATURES OF GROUND WATER EXPLORATION

Sl No	District	Taluka	Wells Drilled	Drilled depth	Zones (mbgl)	Discharge (lps)	SWL (mbgl)
1	Nanded	Ardhapur	EW-1, OW-1	77.4-199.4	34.7-37.8	-	3.4-3.6
2	Nanded	Bhokar	EW-4, OW-3	70-178.15	12.7-66	0.14-19.66	8.5-39.2
3	Nanded	Biloli	EW-3,OW-2, PZ-2	31.65-141.55	9-80	0.14-7.76	4.8-16.9
4	Nanded	Deglur	EW-2,OW-1,PZ-1	30-122	12.5-50	0.07-3.35	3.01-11.05
5	Nanded	Hadgaon	EW-3	202	13-87	0.38-0.78	1.48-10.8
6	Nanded	Himayatnagar	EW-2, OW-1	134-159	6.75-128.75	-	4.4-15.6
7	Nanded	Kandhar	EW-3, OW-5	30-186	8-173.5	0.78-8	6.2-54.75
8	Nanded	Kinwat	EW-6, OW-2	94.75-183.65	8-178	0.38-5.39	2.07-30.35
9	Nanded	Loha	EW-2, OW-3	12.85-201.95	12.15-60.65	0.14-17.99	3.01-14.34
10	Nanded	Mahur	EW-2, OW-3	90-165.45	21.3-150	9.07-10.34	5.6-15.75
11	Nanded	Mudkhed	EW-2, OW-2	52-165.35	6.75-132.35	3.17	9.2-12.2
12	Nanded	Mukhed	EW-3, OW-1	78-107.5	9.25-70.75	3.3	5.1-23
13	Nanded	Naigaon	EW-2, OW-1	71.35-90.5	13-64	1.05	9.4-13.09
14	Nanded	Nanded	EW-2, OW-1	132.4-208	7-123	1.05-3.77	5.85-13.05
Total			**EW-37, OW-26, PZ-3**	**12.85-208**	**6.75-132.35**	**traces-19.66**	**1.48-54.75**

ANNEXURE II: DETAILS OF GW EXPLORATION WELLS IN NANDED DISTRICT

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_ depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Dishargе (lps)
1	Nanded	Biloli	Biloli	77.77416667	18.72333333	347	1995-96	PZ	GRANITE	34	26	26.4 -29	4.8	0.14
2	Nanded	Naigaon	Narsi	77.53527778	18.81333333	374.3	1995-96	EW	FMB/W. GRANITE	71.35	7	13 - 16.45 ,44 -58	13.09	1.05
3	Nanded	Naigaon	Krishnur	77.48166667	18.94222222	369.7	1995-96	EW	Basalt/ Granite	90.5	2	40 -43 ,60 - 64.75	10.63	
4	Nanded	Naigaon	Krisnur	77.48166667	18.94222222	369.7	1995-96	OW	Basalt	80.25	2.75	22 -26 ,40.5 -44 ,60 - 64.25	9.4	
5	Nanded	Biloli	Atkali	77.58944444	18.66	358.7	1995-96	PZ	F.W.GRANITE	31.65	3.25	22.55 - 28.65	6.94	7.76
6	Nanded	Deglur	Hanegaon	77.34	18.44833333	449	1995-96	PZ	Basalt	30	5.9	12.50-17.00	3.01	0.07
7	Nanded	Biloli	Manjaran	77.43916667	18.845	396	1996-97	OW	Basalt	56.15	2.5	17 -20 ,47 -53	5.35	5.29
8	Nanded	Biloli	Manjaran	77.43916667	18.845	396	1996-97	EW	Basalt	141.55	1.6	9-10.35, 23-25.65,77 -80	5.65	
10	Nanded	Biloli	Karkheli	77.725	18.95416667	367	1996-97	EW	W Granite	55	12.6	15-19.5, 57-59	7.05	1.37

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Dishargе (lps)
11	Nanded	Biloli	Arjapur	77.74166667	18.79166667	373	1996-97	EW	W F Granite	109.3	29.6	29.6 -37, 52 -55	15.6	4.09
12	Nanded	Biloli	Arjapur	77.74166667	18.79166667	373	1996-97	OW	W F Granite	104.35	23.5	23.5 -38	16.9	
13	Nanded	Bhokar	Mokhandi	77.73083333	19.08083333	400	1996-97	EW	F W MB	97.25	2	31 -35.5	16.9	19.66
14	Nanded	Bhokar	Mokhandi	77.73083333	19.08083333	400	1996-97	OW	F W MB	121	3.25	23 -23.5, 26 -28	17.8	4.43
15	Nanded	Bhokar	Bhokar	77.67166667	19.2225	459	1996-97	EW	F W Basalt	174	12.6	12.7 - 13.2 , 24.5 - 25.5 , 40 -44	8.8	4.31
16	Nanded	Bhokar	Bhokar	77.67166667	19.2225	459	1996-97	OW	F W Basalt	178.15	12.5	12.7 - 15.5, 25 -28	8.5	
17	Nanded	Hadgaon	Tamsa	77.615	19.37416667	412	1996-97	EW	W VB	202	4.2	13 - 15.45, 83-87	9.25	0.78
18	Nanded	Himayatnagar	Himayat Nagar	77.87833333	19.42833333	409	1996-97	EW	F VB & W Granite	138	6.2	6.75 - 12.85, 126 - 128.75	4.4	
19	Nanded	Himayatnagar	Himayat Nagar	77.87833333	19.42833333	409	1996-97	OW	F VB & W Granite	134	6	125.75 - 128.75	15.6	

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Dishargе (lps)
20	Nanded	Himayatnagar	Javalgaon	77.7833333	19.37	411	1996-97	EW	F VB & W Granite	159.25	7.3			
21	Nanded	Hadgaon	Koli	77.51	19.5833333	432	1996-97	EW	F MB	201.95	4.25	21 -25,	1.48	0.78
22	Nanded	Hadgaon	Ambala	77.6166667	19.5183333	411	1996-97	EW	F MB	201.95	6.5	33 -35, 48 -51	10.8	0.38
23	Nanded	Mudkhed	Barad	77.4583333	19.2305556	371.3	1996-97	EW	F W MB	165.35	4	6.75 - 9.75, 43.35 - 46.35	9.22	
24	Nanded	Mudkhed	Barad	77.4583333	19.2305556	371.3	1996-97	OW	F W MB	55.55	4.2	7 -9.75, 40.25 - 43.35	9.55	
25	Nanded	Nanded	Vishnupuri	77.2638889	19.0861111	379.2	1996-97	OW	F VB & F MB	208	13	7 -9.75, 40.25 - 43.35	13.05	3.77
26	Nanded	Nanded	Vishnupuri	77.2638889	19.0861111	379.2	1996-97	EW	F VB & F MB	201.55	11.5	51.5 - 53.5 ,56.6 -60	14.7	3.515
27	Nanded	Loha	Kapsi	77.3833333	19.0183333	390	1996-97	EW	W F VB & MB	60	16.5	21 -23 ,48-55, 57 - 60.65	6.74	17.99
28	Nanded	Loha	Kapsi	77.3833333	19.0183333	390	1996-97	OW	W VB	12.85	12.15	12.15 - 12.85	3.01	
29	Nanded	Loha	Kapsi	77.383333	19.018333	390	1996	OW	F W MB	58.55	18.7	15.5 -18	6.17	

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Discharge (lps)
				33	33		-97				5			
30	Nanded	Loha	Kapsi	77.38333333	19.01833333	390	1996-97	OW	F W MB	60.65	10	12.5 - 16.5 ,48 -51	6.58	
31	Nanded	Kinwat	Islapur	78.01083333	19.40916667	395	1996-97	EW	F VB & MB & Granite	94.75	1.55	37.25 - 38 ,46 - 49,91.25 -94	30.35	0.6
32	Nanded	Kinwat	Bodhari	78.19722222	19.49861111	352.6	1996-97	EW	F VB & MB & Granite	141.55	4.75	6.75 -9 ,129 - 135	4.78	
33	Nanded	Kinwat	Bodhari	78.19722222	19.49861111	352.6	1996-97	OW	F M Granite	139	7.3	42 -45 ,76 -85 ,123 - 126	8	4.17
34	Nanded	Nanded	Mugat	77.43333333	19.15	361	1996-97	EW	W VB	132.4	4.6	7.4 -9 ,26 - 31,117-123	5.85	1.05
35	Nanded	Bhokar	Matul	77.77361111	19.13888889	388.1	1996-97	EW	F MB & W Granite	70	4	25.5 -40 ,54 -60	12.03	
36	Nanded	Bhokar	Matul	77.77361111	19.13888889	388.1	1996-97	OW	F MB & W Granite	85.8	4.2	37 -40 ,44 -47	17.11	
37	Nanded	Ardhapur	Kamtha	77.31416667	19.28083333	373	1996-97	EW	W F VB	199.4	4	34.7 - 37.8	3.4	

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_ depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Discharge (lps)
38	Nanded	Ardhapur	Kamtha	77.31416667	19.28083333	373	1996-97	OW	W F VB	77.4	4.2	34.7 - 37.8	3.68	
39	Nanded	Kinwat	Kinwat	78.2	19.625	316	1997-98	EW	F W Granite	110.45	13.7	13.7 - 13.7 ,15.4 - 15.4	6.69	0.38
40	Nanded	Kinwat	Shivani	78.11083333	19.3275	405	1997-98	EW	Basalt & Granite	140.25	2.5	13 -16 ,20.25 - 30	5.25	5.395
41	Nanded	Kinwat	Shivani	78.11083333	19.3275	405	1997-98	OW	Basalt & Granite	100	4.75	21 -31 ,46 -53	2.07	
42	Nanded	Kinwat	Mandwi	78.27416667	19.79583333	296	1997-98	EW	Basalt	123	9.7	9.7 -15 ,30.3 - 33.65	6.73	1.37
43	Nanded	Mahur	Sindkhed	78.125	19.87166667	263	1997-98	EW	F Basalt & Granite	122.65	0.6	46.35 - 49 ,58 - 64.65	6.15	9.07
44	Nanded	Mahur	Sindkhed	78.125	19.87166667	263	1997-98	OW	F Basalt & Granite	90	0.65	43.35 - 49.45	5.6	
45	Nanded	Kinwat	Rajgar	78.1425	19.72833333	402	1997-98	EW	F Basalt & Granite	183.65	0.7	8 -12.5 ,176 - 178	30	
46	Nanded	Mahur	Lakhmapur	77.9425	19.86583333	281	1997-98	EW	Basalt & Granite	161.25	21.3	21.3 -25 ,35 -37 ,146.5 -	15.75	10.34

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_ depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Dishargе (lps)
												150 ,95 -97		
47	Nanded	Mahur	Lakhmapur	77.9425	19.86583333	281	1997-98	OW	F VB & MB & Fr Granite	86.05	24.3	24.3 -26 ,36.5 -40	7.9	
48	Nanded	Mahur	Lakhmapur	77.9425	19.86583333	281	1997-98	OW	F VB & Massive Basalt & Fr Granite	165.45	21.3	21.5 -25 ,42 -45	6.89	
49	Nanded	Loha	Loha	77.115	18.94416667	406	1997-98	EW	F W MB	201.95	14	16 -22	14.34	0.14
50	Nanded	Kandhar	Osman Nagar	77.29583333	18.96666667	407	1997-98	EW	F W MB	73.85	4	8 -10 ,49 -50	6.26	
51	Nanded	Kandhar	Osman Nagar	77.29583333	18.96666667	407	1997-98	OW	F W MB	120.15	7	8 -10 ,49.25 -50	6.39	8.017
52	Nanded	Kandhar	Osman Nagar	77.29583333	18.96666667	407	1997-98	OW	F MB & F Granite	186	61.65	119 -120 ,172 -173.5	6.61	
53	Nanded	Mukhed	Berli (BK)	77.38833333	18.7375	380	1997-98	EW	F MB	107.5	2.55	10 -15 ,44.7 -46.7	5.65	3.348
54	Nanded	Mukhed	Berli (BK)	77.38833333	18.7375	380	1997-98	OW	F MB	93.5	3.3	9.25 -15 ,44.5 -46.5	5.1	

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_ depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Dishargе (lps)
55	Nanded	Mukhed	Barahalli	77.3333333	18.5658333	425	1997-98	EW	F MB & W Granite	107.35	10	10 -11 ,48.5 -50	4.7	
56	Nanded	Deglur	Sugaon	77.6416667	18.6475	356	1997-98	EW	F W Granite	54	11.9	18.5 -21	11.05	
57	Nanded	Deglur	Sugaon	77.6416667	18.6475	356	1997-98	OW	F W Granite	96.5	14	17 -25	10.5	3.35
58	Nanded	Mukhed	Mukramabad	77.3666667	18.4666667	423	1998-99	EW	F Basalt	78	6	28.05 - 31.15 ,24.15 - 37.25 ,67.75 - 70.75 ,43.35 - 46.35	23	traces
59	Nanded	Kandhar	Kautha	77.3747222	18.8075	379	1998-99	EW	F Basalt	116.55	11.65	7 -12 ,20 -30		7.76
60	Nanded	Kandhar	Kautha	77.3747222	18.8075	379	1998-99	OW	F Basalt	105.41	11.55	62 -64	9.12	4.43
61	Nanded	Kandhar	Kautha	77.3747222	18.8075	379	1998-99	OW	F Basalt	30	11.5	10 -12 ,20 -30	7.1	0.78
62	Nanded	Kandhar	Manuspuri	77.2133333	18.87	404	1998-99	EW	F VB	139	5.75	8 -10 ,33 -37, 134-139	54.75	7.76
63	Nanded	Kandhar	Manuspuri	77.2133333	18.87	404	1998-99	OW	F VB	139	5.65	6 -7.5 ,67 -	36	7.76

Sl No	District	Taluka	Village	Longitude	Latitude	Altitude (m)	Year of drilling	Type	Aquifer	Drilling_ depth	Casing (mbgl)	Aquifer Zones	Drilling_SWL	Discharge (lps)
												69,137-139.20		
64	Nanded	Bhokar	Talegaon	77.625	19.50138889	437.3	1998-99	EW	F Basalt & Granite	86.05	7	42 -43 ,63 -66	39.2	0.14
65	Nanded	Mudkhed	Mudkhed	77.50166667	19.15888889	367.7	1998-99	EW	F VB & W Granite	150.75	5.6	21 - 22.55 ,83 -86 ,129.35 - 132.35 ,110 - 114.05	12.21	3.17
66	Nanded	Mudkhed	Mudkhed	77.50166667	19.15888889	367.7	1998-99	OW	F VB	52	5.6	21 -22.4 ,34 -37.7	10.05	
67	Nanded	Deglur	Degloor	77.58333333	18.53611111	375	1998-99	EW	F W Granite	122	5.6	48 -50	9.72	traces

ANNEXURE III: DETAILS OF GW MONITORING WELLS IN NANDED DISTRICT

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
1	NHS	Nanded	KANDHAR	Ambe Sangwi	19.0042	77.1875	1.15	Dug Well	13.35	3.6
2	NHS	Nanded	KINWAT	Anjankhed	19.8389	78.0778	0.3	Dug Well	7.2	5.2
3	NHS	Nanded	NANDED	Ardhapur-1	19.2947	77.3783	0	Dug Well	18.2	7.2
4	NHS	Nanded	DEGLUR	Atkali_Pz	18.5917	77.5083	0.5	Bore Well	29.4	
5	NHS	Nanded	DEGLUR	Atkali-1	18.6478	77.6031	1.2	Dug Well	15.3	6.7
6	NHS	Nanded	MUKHED	Balegaon	18.9606	77.5761	0.3	Dug Well	5.5	1.7
7	NHS	Nanded	NANDED	Barad	19.2333	77.4333	0.47	Dug Well	12.3	4.3
8	NHS	Nanded	KANDHAR	Barul	18.8494	77.3253	0.55	Dug Well	2.05	
9	NHS	Nanded	BHOKAR	Bhokar	19.2167	77.6833	0.75	Dug Well	9.65	4.25
10	NHS	Nanded	BILOLI	Biloli-1	18.8992	77.7233	0.6	Dug Well	3	7.3
11	NHS	Nanded	KINWAT	Chikhli Chota	19.5333	78.2333	0.8	Dug Well	8	
12	NHS	Nanded	NANDED	Dhanegaon	19.1300	77.3297	0.4	Dug Well	9.9	1.7
13	NHS	Nanded	NANDED	Dharmabad	18.8917	77.8394	0.7	Dug Well	9.59	
14	NHS	Nanded	HADGAON	Dhawari Buzurg	19.2889	77.6639	0	Dug Well	8.6	2.8
15	NHS	Nanded	HADGAON	Dorli	19.4239	77.6344	0.72	Dug Well	5.4	3.1
16	NHS	Nanded	HADGAON	Gadga	18.8069	77.4606	0.8	Dug Well	17.3	1.2
17	NHS	Nanded	KINWAT	Gokunda (Kinwat)-1	19.5833	78.2333	0.55	Dug Well	8.15	2.6
18	NHS	Nanded	HADGAON	Hadgaon-1	19.5000	77.6667	0.4	Dug Well	22.6	6.1
19	NHS	Nanded	HADGAON	Himayat Nagar	19.4167	77.8667	1.5	Dug Well	11.09	1.2
20	NHS	Nanded	HADGAON	Himayat Nagar-1	19.4208	77.8672	0.2	Dug Well	5.6	
21	NHS	Nanded	KINWAT	Islapur	19.4167	78.0167	0.75	Dug Well	1.75	2.7
22	NHS	Nanded	MUKHED	Jamb Buzurg	18.6561	77.1833	0.4	Dug Well	13.1	4.4
23	NHS	Nanded	KANDHAR	Janapuri-1	19.0667	77.2333	0.55	Dug Well	8.75	3.5

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
24	NHS	Nanded	KINWAT	Jhalakwadi	19.3417	78.0833	0.5	Dug Well	6.8	4.2
25	NHS	Nanded	KINWAT	Kamtala	19.6750	78.1833	0.7	Dug Well	9.1	6.1
26	NHS	Nanded	KANDHAR	Kandar-1	18.8728	77.1961	0.3	Dug Well	8	
27	NHS	Nanded	NANDED	Kapsi Gumta	19.0125	77.4144	1.1	Dug Well	1.7	2.6
28	NHS	Nanded	DEGLUR	Karadkher-1	18.4850	77.4908	0.3	Dug Well	5.5	1.45
29	NHS	Nanded	NANDED	Khambegaon	18.9906	77.0731	1.2	Dug Well	11.4	3.3
30	NHS	Nanded	MUKHED	Kolambi	18.8900	77.4178	0	Dug Well	9	1.8
31	NHS	Nanded	BILOLI	Kuncheli	18.7694	77.5631	0	Dug Well	10.1	0.01
32	NHS	Nanded	NANDED	Lahan	19.2819	77.4625	0.8	Dug Well	8.2	4.7
33	NHS	Nanded	KINWAT	Lakmapur	19.8750	77.9500	0.65	Dug Well	7.5	1.95
34	NHS	Nanded	KANDHAR	Malegaon (I)	18.8167	77.0167	1.1	Dug Well	2.9	
35	NHS	Nanded	NANDED	Malegaon (II)	19.3111	77.3167	0.9	Dug Well	10.6	4.5
36	NHS	Nanded	HADGAON	Manwadi phata	19.5047	77.5997	0.75	Dug Well	12.55	2
37	NHS	Nanded	HADGAON	Mathala	19.5881	77.5469	0	Dug Well	7.6	
38	NHS	Nanded	NANDED	Mudkhed2	19.1500	77.5167	1	Dug Well	11.5	3.5
39	NHS	Nanded	MUKHED	Mukher-1	18.7167	77.3833	0	Dug Well	10.4	1.3
40	NHS	Nanded	MUKHED	Mukrambad (Kharka)	18.4833	77.3667	0.75	Dug Well	6.25	1.2
41	NHS	Nanded	BHOKAR	Nagapur	19.2125	77.6992	1.15	Dug Well	8.65	3.65
42	NHS	Nanded	BILOLI	Naigaon	18.8500	77.5333	0.75	Dug Well	10.45	4
43	NHS	Nanded	NANDED	Nanded	19.1906	77.3394	0.65	Dug Well	10.05	4.6
44	NHS	Nanded	BILOLI	Narsi	18.8097	77.5333	0.6	Dug Well	9.2	5.6
45	NHS	Nanded	BHOKAR	Narwat	19.2333	77.6333	0.48	Dug Well	8.15	1.75
46	NHS	Nanded	MUKHED	Pala	18.6417	77.4458	0.7	Dug Well	8	8
47	NHS	Nanded	BILOLI	Panchpipli	18.7919	77.6267	1	Dug Well	9.5	10.5

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
48	NHS	Nanded	NANDED	Police Wadi	18.9219	77.0967	0.45	Dug Well	10	1.7
49	NHS	Nanded	MUKHED	Ramwadi Shivar	18.4853	77.3178	0	Dug Well	3	2.15
50	NHS	Nanded	BHOKAR	Shelgaon	19.0669	77.5814	0.3	Dug Well	9.5	6.7
51	NHS	Nanded	NANDED	Sikarghat (Amdura)	19.1333	77.4167	0.3	Dug Well	31.7	3.15
52	NHS	Nanded	MUKHED	Somthana	18.9428	77.4403	0.4	Dug Well	11.2	1.5
53	NHS	Nanded	BILOLI	Talani	18.7925	77.6117	0.3	Dug Well	9	3.8
54	NHS	Nanded	NANDED	Taroda (Bk)	19.2094	77.2906	0.4	Dug Well	18	13.8
55	NHS	Nanded	DEGLUR	Umri-Gortha	19.0497	77.6264	1.25	Dug Well	1.55	2.6
56	NHS	Nanded	KINWAT	Unkeshwar	19.8500	78.2000	1	Dug Well	9.1	
57	NHS	Nanded	BHOKAR	Wadgaon (kh)	19.3208	77.7383	0.9	Dug Well	15	3.4
58	NHS	Nanded	HADGAON	Wanwadi	19.3097	77.5478	0	Dug Well	7.1	
59	NHS	Nanded	HADGAON	Waranga	19.4333	77.4833	0.5	Dug Well	4.8	1.3
60	GSDA	Nanded	ARDHAPUR	Lahan	19.28194444	77.46250000		Dug Well	8.20	3.20
61	GSDA	Nanded	ARDHAPUR	Malegaon	19.29583333	77.26944444		Dug Well	13.00	7.40
62	GSDA	Nanded	ARDHAPUR	Pardi I	19.32500000	77.38472222		Dug Well	4.80	3.50
63	GSDA	Nanded	ARDHAPUR	Pimpalgaon M	19.20833333	77.33888889		Dug Well	14.00	10.20
64	GSDA	Nanded	BHOKAR	Divshi Kh	19.19583333	77.83666667		Dug Well	8.70	2.90
65	GSDA	Nanded	BHOKAR	Halda	19.14583333	77.68750000		Dug Well	6.80	1.80
66	GSDA	Nanded	BHOKAR	Kini	19.24166667	77.80972222		Dug Well	6.20	2.10
67	GSDA	Nanded	BHOKAR	Loglood	19.17916667	77.80277778		Dug Well	7.30	2.60
68	GSDA	Nanded	BHOKAR	Nanda Bk	19.10555556	77.73194444		Dug Well	6.80	2.30
69	GSDA	Nanded	BHOKAR	Somthana (patti Bhokar)	19.27500000	77.71250000		Dug Well	9.30	2.70
70	GSDA	Nanded	BHOKAR	Wakad	19.23888889	77.57222222		Dug Well	8.80	3.60
71	GSDA	Nanded	BILOLI	Adampur	18.64972222	77.61666667		Dug Well	10.50	8.70

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
72	GSDA	Nanded	BILOLI	Biloli New	18.77083333	77.72777778		Dug Well	9.90	4.70
73	GSDA	Nanded	BILOLI	Hippargathadi New	18.67083333	77.70416667		Dug Well	16.80	9.40
74	GSDA	Nanded	BILOLI	Kinala	18.77361111	77.56250000		Dug Well	10.80	7.60
75	GSDA	Nanded	BILOLI	Kondalwadi	18.80555556	77.77083333		Dug Well	10.50	8.80
76	GSDA	Nanded	BILOLI	Talni	18.78888889	77.61111111		Dug Well	9.20	5.10
77	GSDA	Nanded	BILOLI	Yesgi New	18.70277778	77.78888889		Dug Well	8.60	9.80
78	GSDA	Nanded	DEGLUR	Amdapur	18.48750000	77.46666667		Dug Well	17.50	7.40
79	GSDA	Nanded	DEGLUR	Chakur Ballur	18.52500000	77.52638889		Dug Well	10.20	
80	GSDA	Nanded	DEGLUR	Dawangir	18.38888889	77.47916667		Dug Well	8.40	8.20
81	GSDA	Nanded	DEGLUR	Deglur	18.54583333	77.57916667		Dug Well	14.60	11.50
82	GSDA	Nanded	DEGLUR	Hali	18.38750000	77.51944444		Dug Well	4.70	0.70
83	GSDA	Nanded	DEGLUR	Hanegaon	18.34166667	77.44861111		Dug Well	7.20	8.90
84	GSDA	Nanded	DEGLUR	Narangal b.k	18.56250000	77.66666667		Dug Well	17.20	8.80
85	GSDA	Nanded	DEGLUR	Tadkhel	18.58750000	77.51666667		Dug Well	11.00	5.80
86	GSDA	Nanded	DEGLUR	Wazarga	18.64166667	77.60472222		Dug Well	20.40	7.80
87	GSDA	Nanded	DEGLUR	Zari	18.44166667	77.52000000		Dug Well	7.55	6.80
88	GSDA	Nanded	DHARMABAD	Dharmabad	18.88194444	77.85666667		Dug Well	13.00	9.80
89	GSDA	Nanded	DHARMABAD	Karkheli	18.96250000	77.74194444		Dug Well	11.70	7.60
90	GSDA	Nanded	DHARMABAD	Loha Berli Kh	18.93333333	77.83333333		Dug Well	12.00	4.20
91	GSDA	Nanded	DHARMABAD	Patoda Kh	18.86805556	77.77777778		Dug Well	12.45	7.00

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
92	GSDA	Nanded	DHARMABAD	Yeoti	18.96611111	77.80333333		Dug Well	7.60	7.60
93	GSDA	Nanded	HADGAON	Dhanora(hastara)	19.51527778	77.58527778		Dug Well	8.20	7.40
94	GSDA	Nanded	HADGAON	Dongargaon	19.48055556	77.63333333		Dug Well	4.50	1.10
95	GSDA	Nanded	HADGAON	Gargavhan	19.46944444	77.59027778		Dug Well	13.30	1.80
96	GSDA	Nanded	HADGAON	Ghogari	19.30416667	77.64722222		Dug Well	10.00	2.70
97	GSDA	Nanded	HADGAON	Gojegaon	19.53333333	77.65833333		Dug Well	7.30	3.10
98	GSDA	Nanded	HADGAON	Hadgaon	19.50138889	77.66111111		Dug Well	9.80	8.70
99	GSDA	Nanded	HADGAON	Koli	19.58194444	77.50833333		Dug Well	8.70	3.00
100	GSDA	Nanded	HADGAON	Niwgha	19.58333333	77.56666667		Dug Well	3.80	1.20
101	GSDA	Nanded	HADGAON	Pimparkhed New	19.51277778	77.51194444		Dug Well	9.40	5.25
102	GSDA	Nanded	HADGAON	Sapti	19.64305556	77.58055556		Dug Well	6.70	1.90
103	GSDA	Nanded	HADGAON	Shivpuri	19.33416667	77.63250000		Dug Well	7.60	4.25
104	GSDA	Nanded	HADGAON	Sibdara (j)	19.51666667	77.52361111		Dug Well	13.60	4.40
105	GSDA	Nanded	HADGAON	Talni	19.63888889	77.53333333		Dug Well	10.50	1.45
106	GSDA	Nanded	HADGAON	Tamsa New	19.38638889	77.60138889		Dug Well	10.10	4.70
107	GSDA	Nanded	HADGAON	Umri J	19.36666667	77.60000000		Dug Well	11.00	3.80
108	GSDA	Nanded	HADGAON	Umri p.k	19.61388889	77.47222222		Dug Well	9.60	3.40
109	GSDA	Nanded	HADGAON	Walki Kh.	19.39583333	77.69027778		Dug Well	10.60	7.20
110	GSDA	Nanded	HIMAYATNAGAR	Dabdari T	19.31250000	77.76388889		Dug Well	4.20	2.20
111	GSDA	Nanded	HIMAYATNAGAR	Himayatnager	19.42500000	77.87500000		Dug Well	12.50	4.40
112	GSDA	Nanded	HIMAYATNAGAR	Kamarwadi	19.38500000	77.76388889		Dug Well	10.50	4.90

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
113	GSDA	Nanded	HIMAYATNAGAR	Kandi Bk	19.41666667	77.83333333		Dug Well	10.35	5.60
114	GSDA	Nanded	HIMAYATNAGAR	Khairgaon	19.37722222	77.76444444		Dug Well	11.40	2.40
115	GSDA	Nanded	HIMAYATNAGAR	Palaspur	19.46888889	77.84527778		Dug Well	7.50	2.30
116	GSDA	Nanded	KANDHAR	Babulgaon	18.86666667	77.12500000		Dug Well	8.30	2.40
117	GSDA	Nanded	KANDHAR	Bachoti	18.86388889	77.25416667		Dug Well	7.50	2.70
118	GSDA	Nanded	KANDHAR	Bahadarpura	18.86666667	77.20416667		Dug Well	8.80	3.40
119	GSDA	Nanded	KANDHAR	Bamni p.k	18.90138889	77.27777778		Dug Well	8.70	1.00
120	GSDA	Nanded	KANDHAR	Barul	18.85000000	77.32777778		Dug Well	2.60	2.70
121	GSDA	Nanded	KANDHAR	Digras Kh	18.73055556	77.22500000		Dug Well	13.20	5.30
122	GSDA	Nanded	KANDHAR	Nagalgaon	18.77361111	77.14166667		Dug Well	10.00	2.40
123	GSDA	Nanded	KANDHAR	Osmanagar	18.96250000	77.29166667		Dug Well	13.00	2.70
124	GSDA	Nanded	KANDHAR	Pethwadaj	18.78055556	77.32083333		Dug Well	8.20	4.10
125	GSDA	Nanded	KANDHAR	Rauthkheda	18.83750000	77.34583333		Dug Well	11.00	3.80
126	GSDA	Nanded	KANDHAR	Shekapur	18.85222222	77.17500000		Dug Well	10.50	5.80
127	GSDA	Nanded	KANDHAR	Umraj Patalganga	18.83666667	77.12500000		Dug Well		4.30
128	GSDA	Nanded	KANDHAR	Warwant	18.81250000	77.32222222		Dug Well	4.30	1.20
129	GSDA	Nanded	KINWAT	Apprao peth	19.26250000	78.16388889		Dug Well	11.30	1.20
130	GSDA	Nanded	KINWAT	Bodhadi Bk.	19.52000000	78.20111111		Dug Well	8.20	3.30
131	GSDA	Nanded	KINWAT	Chikhali	19.28333333	78.06666667		Dug Well	7.40	4.30
132	GSDA	Nanded	KINWAT	Gokunda	19.50555556	78.20277778		Dug Well	10.50	5.30
133	GSDA	Nanded	KINWAT	Islapur	19.46750000	78.30611111		Dug Well	7.40	3.30
134	GSDA	Nanded	KINWAT	Kamthala	19.66944444	78.18333333		Dug Well	9.90	5.30

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
135	GSDA	Nanded	KINWAT	Kinwat New	19.53944444	78.20000000		Dug Well	11.20	6.30
136	GSDA	Nanded	KINWAT	Kosmet	19.37361111	78.00972222		Dug Well	6.00	3.10
137	GSDA	Nanded	KINWAT	Kuncholi	19.28055556	78.09305556		Dug Well	7.70	5.30
138	GSDA	Nanded	KINWAT	Malborgaon	19.67777778	78.09583333		Dug Well	6.00	2.30
139	GSDA	Nanded	KINWAT	Mandvi	19.79305556	78.27916667		Dug Well	8.30	1.90
140	GSDA	Nanded	KINWAT	Nandgaon tanda	19.38472222	78.06250000		Dug Well	7.50	1.70
141	GSDA	Nanded	KINWAT	Pradhnsangvi	19.56944444	78.21805556		Dug Well	7.70	4.50
142	GSDA	Nanded	KINWAT	Rajgad tanda	19.72916667	78.14027778		Dug Well	6.70	2.40
143	GSDA	Nanded	KINWAT	Sarkhani	19.80000000	78.11805556		Dug Well	12.40	7.30
144	GSDA	Nanded	KINWAT	Sawari	19.46805556	78.16250000		Dug Well	10.10	3.60
145	GSDA	Nanded	KINWAT	Shivani	19.32500000	78.10972222		Dug Well	6.10	1.10
146	GSDA	Nanded	KINWAT	Singarwadi	19.45833333	78.23611111		Dug Well	8.60	3.70
147	GSDA	Nanded	KINWAT	Talaiguda	19.72500000	78.31388889		Dug Well	6.60	2.90
148	GSDA	Nanded	KINWAT	Umri Bazar	19.79166667	78.16666667		Dug Well	10.20	3.80
149	GSDA	Nanded	LOHA	Janapuri	19.06250000	77.24305556		Dug Well	8.60	2.80
150	GSDA	Nanded	LOHA	Kapsi Bk	19.00000000	77.38333333		Dug Well	8.30	2.30
151	GSDA	Nanded	LOHA	Khadak Manjari	19.01666667	77.14722222		Dug Well	12.70	3.60
152	GSDA	Nanded	LOHA	Malkoli Khedkarwadi	18.87222222	77.05555556		Dug Well	6.30	1.80
153	GSDA	Nanded	LOHA	Sawargaon N	18.91805556	77.04166667		Dug Well	6.30	5.90
154	GSDA	Nanded	LOHA	Shambergaon	19.03472222	77.35555556		Dug Well	13.60	4.20
155	GSDA	Nanded	MAHUR	Datta Manjri	19.80000000	77.94333333		Dug Well	5.90	2.10
156	GSDA	Nanded	MAHUR	Lakhmapur I	19.86333333	77.94444444		Dug Well	11.30	3.40
157	GSDA	Nanded	MAHUR	Sindkhed I I	19.87083333	78.12500000		Dug Well	6.90	3.60
158	GSDA	Nanded	MAHUR	Wanola	19.75222222	78.01666667		Dug Well	9.70	5.00

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
159	GSDA	Nanded	MUDKHED	Barad	19.23055556	77.45833333		Dug Well	12.50	4.70
160	GSDA	Nanded	MUDKHED	Mudkhed	19.15555556	77.50833333		Dug Well	8.90	2.50
161	GSDA	Nanded	MUDKHED	Mugat	19.14861111	77.43333333		Dug Well	11.30	2.70
162	GSDA	Nanded	MUKHED	Barhali	18.56250000	77.33055556		Dug Well	11.80	7.70
163	GSDA	Nanded	MUKHED	Dapka Gundopant	18.29166667	77.50000000		Dug Well	8.10	6.00
164	GSDA	Nanded	MUKHED	Halni	18.45833333	77.30694444		Dug Well	10.90	7.90
165	GSDA	Nanded	MUKHED	Khatgaon	18.40694444	77.39166667		Dug Well	10.00	4.80
166	GSDA	Nanded	MUKHED	Kotgyal	18.71250000	77.32500000		Dug Well	12.00	7.20
167	GSDA	Nanded	MUKHED	Mandlapur	18.65694444	77.45833333		Dug Well	5.50	3.20
168	GSDA	Nanded	MUKHED	Mukarmabad	18.47500000	77.37222222		Dug Well	7.10	3.00
169	GSDA	Nanded	MUKHED	Sawargaon Pir	18.66944444	77.26527778		Dug Well	14.60	8.30
170	GSDA	Nanded	MUKHED	Yeoti	18.61666667	77.40972222		Dug Well	11.90	6.80
171	GSDA	Nanded	NAIGAON	Aluwadgaon	18.78750000	77.44861111		Dug Well	7.30	2.70
172	GSDA	Nanded	NAIGAON	Antargaon	18.99305556	77.52638889		Dug Well	14.80	9.40
173	GSDA	Nanded	NAIGAON	Badbada	18.99166667	77.50000000		Dug Well	10.30	4.80
174	GSDA	Nanded	NAIGAON	Krushnoor	18.94111111	77.48277778		Dug Well	7.10	2.70
175	GSDA	Nanded	NAIGAON	Naigaon Bazar	18.84583333	77.52777778		Dug Well	9.30	5.10
176	GSDA	Nanded	NANDED	Limbgaon	19.18055556	77.19583333		Dug Well	10.30	3.30
177	GSDA	Nanded	NANDED	Markand	19.11250000	77.23888889		Dug Well	14.50	1.20
178	GSDA	Nanded	NANDED	Marlak kd	19.21666667	77.23888889		Dug Well	8.60	1.40
179	GSDA	Nanded	NANDED	Taroda New	19.18138889	77.29305556		Dug Well	16.80	12.30
180	GSDA	Nanded	NANDED	Tuppa	19.10194444	77.35833333		Dug Well	13.20	9.30
181	GSDA	Nanded	NANDED	Wadi Bk New	19.18333333	77.27083333		Dug Well	13.90	9.80
182	GSDA	Nanded	NANDED	Wajegaon	19.14305556	77.34861111		Dug Well	10.40	4.70

Sl No	Project type	District	Block	Village	Latitude(DD)	Longitude(DD)	Height of Measuring Point (magl)	Type of Well	Water level (mbgl)	
									Pre-monsoon	Post-monsoon
183	GSDA	Nanded	UMRI	Gortha	19.05416667	77.62222222		Dug Well	10.00	4.70
184	GSDA	Nanded	UMRI	Karla Ii	19.10555556	77.60000000		Dug Well	5.90	2.40
185	GSDA	Nanded	UMRI	Kawalguda Kh	18.90416667	77.66583333		Dug Well	11.10	
186	GSDA	Nanded	UMRI	Nimtok	18.97777778	77.66666667		Dug Well	6.10	2.70
187	GSDA	Nanded	UMRI	Sindhi	19.09166667	77.55000000		Dug Well	4.30	1.30
188	GSDA	Nanded	UMRI	Somthana J	19.06750000	77.66805556		Dug Well	7.60	2.10
189	GSDA	Nanded	UMRI	Talegaon	19.00833333	77.62500000		Dug Well	10.30	4.80

ANNEXURE IV: CHEMICAL ANALYSIS OF GROUND WATER SAMPLES, AQUIFER-1/SHALLOW AQUIFERS

Sl No	DISTRICT_NAME	TAHSIL_NAME	SITE_NAME	Data Source	LATITUDE	LONGITUDE	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
1	Nanded	NANDED	Sikarghat (Amdura)	CGWA	19.13333	77.41667	7.6	1052	557	372	102	28	79	2.18	0	488	96	40	33	0.29
2	Nanded	BHOKAR	Bhokar	CGWA	19.21667	77.68333	7.5	1879	997	541	129	52	97	22.7	0	494	249	57	42	0.13
3	Nanded	BHOKAR	Narwat	CGWA	19.23333	77.63333	7.6	1378	929	444	123	33	49	7.01	0	482	98	35	42	0.12
4	Nanded	Kinwat	Islapur	CGWA	19.41667	78.01667	7.7	480	254	163	47	11	32	5.26	0	226	26	21	3	0.3
5	Nanded	NANDED	Malegaon (II)	CGWA	19.31111	77.31667	7.7	1394	738	490	108	52	50	3.55	0	434	150	47	41	0.39
6	Nanded	HADGAON	Dhawari Buzurg	CGWA	19.28889	77.66389	7.6	1294	686	469	114	44	51	4.66	0	464	110	50	42	0.31
7	Nanded	NANDED	Barad	CGWA	19.23333	77.43333	7.6	1279	677	515	112	56	30	0.51	0	446	128	29	41	0.39
8	Nanded	HADGAON	Dorli	CGWA	19.42389	77.63444	7.7	3065	1625	571	82	87	199	50.17	0	613	334	53	42	0.33
9	Nanded	NANDED	Lahan	CGWA	19.28194	77.4625	7.6	1690	894	515	102	62	62	10.14	0	446	120	45	41	0.13
10	Nanded	BILOLI	Narsi	CGWA	18.80972	77.53333	7.6	2096	1112	627	119	79	92	22.12	0	541	257	36	35	0.21
11	Nanded	KANDHAR	Janapuri-1	CGWA	19.06667	77.23333	7.6	908	480	372	82	40	38	0.71	0	416	63	29	39	0.49
12	Nanded	KINWAT	Gokunda (Kinwat)-1	CGWA	19.58333	78.23333	7.7	1528	810	505	119	50	95	1.14	0	523	130	45	33	1.56
13	Nanded	Himayatnagar	Wadgaon (kh)	CGWA	19.32083	77.73833	7.4	787	417	214	31	33	79	1.39	0	285	101	36	8	4.91
14	Nanded	Hadgaon	Mathala	CGWA	19.58806	77.54694	7.6	741	393	393	72	51	19	2.1	0	345	46	32	38	0.46
15	Nanded	NANDED	Ardhapur-1	CGWA	19.29472	77.37833	7.2	679	360	296	67	30	34	2.43	0	333	41	28	1	0.42
16	Nanded	Umri	Umri-Gortha	CGWA	19.04972	77.62639	7.6	1203	638	316	74	32	80	2.92	0	285	101	60	31	0.54

Sl No	DISTRICT_NAME	TAHSIL_NAME	SITE_NAME	Data Source	LATITUDE	LONGITUDE	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
17	Nanded	BILOLI	Biloli-1	CGWA	18.89917	77.72333	7.8	1171	621	403	51	66	103	1.09	0	565	21	66	11	2.18
18	Nanded	NANDED	Kapsi Gumta	CGWA	19.0125	77.41444	7.4	591	313	230	61	18	45	2.41	0	291	46	41	1	0.92
19	Nanded	NANDED	Nanded	CGWA	19.19056	77.33944	7.4	1455	771	520	86	73	64	1.3	0	375	177	35	42	0.62
20	Nanded	Nanded	Dhanegaon	CGWA	19.13	77.32972	7.4	2458	1307	780	178	80	129	1.98	0	607	309	71	41	0.58
21	Nanded	NANDED	Police Wadi	CGWA	18.92194	77.09667	7.5	1818	962	724	43	147	105	1.71	0	732	153	67	41	0.45
22	Nanded	MUKHED	Balegaon	CGWA	18.96056	77.57611	7.4	2392	1268	979	180	126	112	1.65	0	791	341	50	42	0.98
23	Nanded	Naigaon	Kolambi	CGWA	18.89	77.41778	7.7	973	496	439	53	73	39	0.92	0	547	34	24	42	0.55
24	Nanded	KANDHAR	Kandar-1	CGWA	18.87278	77.19611	7.5	1681	891	627	102	89	92	5.69	0	726	91	18	36	0.39
25	Nanded	HADGAON	Manwari phata	CGWA	19.50472	77.59972	7.7	744	394	250	51	29	33	0.83	0	232	31	75	40	0.74
26	Nanded	Naigaon	Somthana	CGWA	18.94278	77.44028	7.5	2274	1206	525	108	61	119	40.36	0	369	252	71	42	0.39
27	Nanded	Deglur	Karadkher-1	CGWA	18.485	77.49083	7.6	848	449	321	55	44	40	0.72	0	410	38	27	32	1.23
28	Nanded	BILOLI	Kuncheli	CGWA	18.76944	77.56306	7.5	962	510	372	47	61	38	1.33	0	369	66	37	42	0.5
29	Nanded	Loha	Ambe Sangwi	CGWA	19.00417	77.1875	7.4	899	476	321	49	47	81	3.87	0	404	101	28	10	1.05
30	Nanded		Barul	CGWA	18.84944	77.32528	7.6	1217	645	449	78	61	73	3.73	0	470	96	43	28	0.4
31	Nanded		Wanwadi	CGWA	19.30972	77.54778	7.6	708	375	352	55	51	21	0.55	0	393	24	26	37	0.23
32	Nanded	MUKHED	PAISMAL	GSDA	18.5915	77.3399	8.1	600	390	156	16	NA					22	22	12	0.7
33	Nanded	MUKHED	SUGAON (BK)	GSDA	18.5988	77.3053	6.9	737	480	206	24	NA					26	24	11	0.8
34	Nanded	MUKHED	UNDRI (PM)	GSDA	18.5988	77.3053	8.1	753	490	202	24	NA					24	41	15	0.5

Sl No	DISTRICT_NAME	TAHSIL_NAME	SITE_NAME	Data Source	LATITUDE	LONGITUDE	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
35	Nanded	DEGLOOR	DAREGAON	GSDA	18.4966	77.4715	7.4	662	430	180	24	NA					48	28	26	0.3
36	Nanded	HIMAYATNAGAR	WAGHI	GSDA	19.4144	77.7943	7.8	2227	1448	480	22	NA					168	48	166	0.7
37	Nanded	HIMAYATNAGAR	TAKRALA(BK)	GSDA	19.3003	77.7052	8.0	1310	852	240	33	NA					100	63	148	1.0
38	Nanded	HIMAYATNAGAR	WALKEWADI	GSDA	19.3498	77.8343	7.6	1367	859	266	33	NA					102	70	88	0.9
39	Nanded	HIMAYATNAGAR	DARESARSAM	GSDA	19.3414	77.9036	7.8	1446	940	340	34	NA					132	78	29	0.6
40	Nanded	MAHOOR	EWALESHWAR	GSDA	19.7607	77.9181	7.3	794	516	188	59	NA					100	18	45	0.5
41	Nanded	MAHOOR	PAWANALA	GSDA	19.7591	77.9719	8.3	772	502	226	56	NA					106	35	15	0.4
42	Nanded	MAHOOR	TANDALA	GSDA	19.7779	77.9223	7.5	785	510	234	59	NA					94	26	33	0.3
43	Nanded	MAHOOR	DATTAMANJARI	GSDA	19.7994	77.9318	7.3	818	532	216	76	NA					74	43	32	0.4
44	Nanded	MAHOOR	HADSANI	GSDA	19.8045	77.8674	8.0	852	554	230	83	NA					114	53	45	0.3
45	Nanded	MAHOOR	RUI	GSDA	19.8339	77.884	8.0	883	574	242	102	NA					94	54	45	0.4
46	Nanded	MAHOOR	SHEKAPUR	GSDA	19.862	77.8979	7.9	877	570	220	88	NA					62	38	45	0.2
47	Nanded	MAHOOR	KEROLI	GSDA	19.8541	77.8895	8.0	735	478	246	98	NA					70	26	39	0.4
48	Nanded	DHARMABAD	HASNALI	GSDA	18.9712	77.7808														

ANNEXURE V: CHEMICAL ANALYSIS OF GROUND WATER SAMPLES, AQUIFER-II/DEEPER AQUIFERS

Sl. No.	Data Source	District	Taluka	Village	Longitude	Latitude	Drilling depth	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	Fe	F
1	CGWA	Nanded	Biloli	Biloli	77.774167	18.723333	34	8.2	610	315	180	36	22	58	3	0	323	25	0	7	0	0
2	CGWA	Nanded	Naigaon	Narsi	77.535278	18.813333	71.35	8.35	1700	1040	425	136	21	147	10.1	3	281	330	70	95	0	0
3	CGWA	Nanded	Naigaon	Krisnur	77.481667	18.942222	80.25	8.4	1170	680	235	38	34	145	27	9	268	145	125	24	0	0
4	CGWA	Nanded	Biloli	Atkali	77.589444	18.660000	31.65	8.6	1030	628	155	20	26	166	2	27	189	35	25	7	0	0
5	CGWA	Nanded	Mukhed	Hanegaon	77.340000	18.448333	30	8.2	1070	605	425	60	67	51	4	0	275	71	175	38	0	0
6	CGWA	Nanded	Naigaon	Manjaran	77.439167	18.845000	-	7.8	910	500	375	82	41	37	2	0	201	131	75	33	0	0
7	CGWA	Nanded	Biloli	Karkheli	77.825000	18.954167	130	7	1850	875	355	76	40	276	16	0	140	266	60	8.5		
8	CGWA	Nanded	Biloli	Arjapur	77.741667	18.791667	109.3	8.5	460	250	115	38	5	54	13	15	207	18	5	7		
9	CGWA	Nanded	Umri	Mokhandi	77.730833	19.080833	97.25	8.5	540	280	120	18	18	69	2	15	256	21	5			
10	CGWA	Nanded	Bhokar	Bhokar	77.671667	19.222500	174	8.6	520	270	180	56	10	33	5	18	220	25	5	10		0.06
11	CGWA	Nanded	Hadgaon	Tamsa	77.615000	19.374167	202	8.5	810	440	335	70	44	23		6	153	135	50	31		
12	CGWA	Nanded	Himayatnagar	Himayat Nagar	77.878333	19.428333	138															
13	CGWA	Nanded	Hadgaon	Koli	77.510000	19.583333	201.95	8.6	680	375	120	28	101	10		12	244	50	30	21		
14	CGWA	Nand	Hadga	Ambala	77.616667	19.51	201.95	8	488	265	95	24	9	67	0	0	183	56	20	3.		

Sl. No.	Data Source	District	Taluka	Village	Longitude	Latitude	Drilling depth	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	Fe	F
		ed	on			8333														8		
15	CGWA	Nanded	Nanded	Vishnupuri	77.263889	19.086111	208	8.6	1000	600	235	70	15	122	2	12	96	177	120	32		
16	CGWA	Nanded	Kinwat	Islapur	78.010833	19.409167	94.75	8	1070	456	125	26	15	189	3	0	49	308	60	1		
17	CGWA	Nanded	Kinwat	Bodhari	78.197222	19.498611	141.55	8.03	590	330	85	26	5	92	3		183	64	50	_		
18	CGWA	Nanded	Mudkhed	Mugat	77.433333	19.150000	135.5	8.2	950	521	345	90	59	60	2		305	131	32	24		
19	CGWA	Nanded	Kinwat	Kinwat	78.200000	19.625000	110.45	7.55	1680	900	560	92	80	107	14		348	259	103	42		
20	CGWA	Nanded	Kinwat	Mandwi	78.274167	19.795833	123	7.85	680	352	285	68	25	2		250	71	15	18.2			
21	CGWA	Nanded	Mahur	Sindkhed	78.125000	19.871667	90	9.8	1300	905	140	34	13	229	6		30	259	250			1.63
22	CGWA	Nanded	Kinwat	Rajgar	78.142500	19.728333	183.65	7.35	590	325	190	50	16	46	4		189	57	20	38		
23	CGWA	Nanded	Mahur	Lakhmapur	77.942500	19.865833	165.45	7.9	720	385	180	48	15	80	3		366	18	12	22		
24	CGWA	Nanded	Kandhar	Osman Nagar	77.295833	18.966667	73.85	7.35	1640	834	485	96	64	140	2		380	148	170	44.3		0.37
25	CGWA	Nanded	Mukhed	Berli (BK)	77.388333	18.737500	107.5	8.17	530	291	40	10	3.6	85	2		189	71	23	0.14		1.63
26	CGWA	Nanded	Deglur	Sugaon	77.641667	18.647500	54	8.4	800	440	235	42	32	75	6	15	281	50	60	18		
27	CGWA	Nanded	Mukhed	Mukramabad	77.366667	18.466667	78	7	1870	1218	285	110	2.4	294	9		55	234	536	3		2.05
28	CGWA	Nanded	Kandh	Kautha	77.374722	18.807500	116.55	7.22	1460	810	210	36	29	239	2		640	57	118	5.37		23.37

Sl. No.	Data Source	District	Taluka	Village	Longitude	Latitude	Drilling depth	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	Fe	F
			ar																			
29	CGWA	Nanded	Kandhar	Manuspuri	77.213333	18.870000	139	8.04	910	550	55	12	8	184	2		122	170	100	17		6
30	CGWA	Nanded	Hadgaon	Talegaon	77.625000	19.501389	86.05	7.64	1090	670	155	48	21	170	17		281	124	75	77		0.01
31	CGWA	Nanded	Mudkhed	Mudkhed	77.501667	19.158889	150.75	7.5	1280	780	275	68	26	161	12		153	202	175	60		2.5
32	GSDA	NANDED	HIMAYATNAGAR	WAGHI	77.7943	19.4144		7.6	2333	15	540	18	NA						81	120		0.3
33	GSDA	NANDED	HIMAYATNAGAR	PARWA(KH)	77.7605	19.3656		7.1	1569	1020	300	12	NA						68	100		1.6
34	GSDA	NANDED	HIMAYATNAGAR	KIRAMGAON	77.8071	19.4033		8.1	1920	1248	320	30	NA						80	96		0.3
35	GSDA	NANDED	HIMAYATNAGAR	KANDLI(BK)	77.7191	19.3401		8.2	1304	848	260	42	NA						61	1		1.6
36	GSDA	NANDED	HIMAYATNAGAR	DAREGAON	77.7382	19.3026		8.1	1089	708	260	23	NA						70	7		0.4
37	GSDA	NANDED	LOHA	DEVLAT	76.9909	18.9275		7.9	351	228	80	21	NA						1	11		1.1
38	GSDA	NANDED	DEGLOOR	MARKHEL	77.4751	18.4285		7.2	631	410	100	12	NA						80	12		0.3

Sl. No.	Data Source	District	Taluka	Village	Longitude	Latitude	Drilling depth	pH	EC	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	Fe	F
39	GSDA	NANDED	DEGLOOR	SANGVI (K)	77.5007	18.5038		6.9	1354	880	420	51	NA						49	68		0.2
40	GSDA	NANDED	DEGLOOR	DAREGAON	77.4715	18.4966		7.2	646	420	148	21	NA						14	24		0.3
41	GSDA	NANDED	BILOLI	DONGAON (BK)	77.6216	18.7166		7.3	707	460	152	8	NA						68	26		1.0
42	GSDA	NANDED	BILOLI	PACHPIMPALI	77.6302	18.761		7.4	1323	860	264	22	NA						186	73		0.9
43	GSDA	NANDED	BILOLI	TORNA	77.6654	18.8489		7.3	738	480	156	11	NA						31	76		0.1
44	GSDA	NANDED	BILOLI	DUGAON(BK)	77.6449	18.8505		7.8	1369	890	340	42	NA						101	56		0.7
45	GSDA	NANDED	BILOLI	HARNALA	77.8032	18.7908		7.9	754	490	184	21	NA						40	17		0.1
46	GSDA	NANDED	BILOLI	KOLGAON	77.6952	18.8603		8.5	769	900	380	26	NA						18	35		0.6
47	GSDA	NANDED	ARDHAPUR	DEGAON KHU.	0	0		8.4	2362	1535	624	226	NA						138	114		0.5

ANNEXURE VI: WATER LEVEL OF GROUND WATER MONITORING WELLS (2019) WITH LONG TERM TREND (2010-19)

Sl No	Village	SITE ID	Latitude	Longitude	DTWL_May 2019 (mbgl)	Pre_trend(2010-19)	DTWL_Nov 2019 (mbgl)	post_trend(2010-19)
1	Anjankhed	W195020078044002	19.8389	78.0778	7.2	0.088	5.2	0.29
2	Ardhapur-1	W191741077224201	19.2947	77.3783	18.2	1.164	7.2	0.40
3	Atkali_Pz	W183530077303001	18.5917	77.5083	29.4	1.177	0	-0.97
4	Atkali-1	W183852077361101	18.6478	77.6031	15.3	2.386	6.7	-0.22
5	Balegaon	W185738077343401	18.9606	77.5761	5.5	-0.053	1.7	-0.68
6	Barad	W191400077260001	19.2333	77.4333	12.3	0.047	4.3	-0.11
7	Bhokar	W191300077410001	19.2167	77.6833	9.65	-0.189	4.25	-0.35
8	Biloli-1	W185357077432401	18.8992	77.7233	3	-0.189	7.3	0.53
9	Bodhadi Bk-1	W192947078115201	19.4964	78.1978	NA	NA	0	-0.50
10	Chikhli Chota	W193200078140001	19.5333	78.2333	8	0.002	0	0.16
11	Dhanegaon	W190748077194701	19.1300	77.3297	9.9	-0.152	1.7	0.65
12	Dharmabad	W185330077502201	18.8917	77.8394	9.59	0.496	0	0.35
13	Dhawari Buzurg	W191720077395001	19.2889	77.6639	8.6	0.145	2.8	0.27
14	Divshi Kh	GSDA	19.19583333	77.83666667	8.7	-0.003	0	0.03
15	Dorli	W192526077380401	19.4239	77.6344	5.4	0.012	3.1	0.11
16	Gokunda (Kinwat)-1	W193500078140002	19.5833	78.2333	8.15	0.563	2.6	0.13
17	Hadgaon-1	W193000077400002	19.5000	77.6667	22.6	1.176	6.1	0.29
18	Halda	GSDA	19.14583333	77.6875	6.8	0.269	0	0.25
19	Himayat Nagar	W192500077520001	19.4167	77.8667	11.09	0.516	1.2	-0.59
20	Himayat Nagar-1	W192515077520201	19.4208	77.8672	5.6	0.284	0	0.29
21	Islapur	W192500078010001	19.4167	78.0167	1.75	-0.575	2.7	0.07

Sl No	Village	SITE ID	Latitude	Longitude	DTWL_May 2019 (mbgl)	Pre_trend(2010-19)	DTWL_Nov 2019 (mbgl)	post_trend(2010-19)
22	Jamb Buzurg	W183922077110001	18.6561	77.1833	13.1	0.050	4.4	-0.37
23	Janapuri-1	W190400077140002	19.0667	77.2333	8.75	0.066	3.5	-0.31
24	Jhalakwadi	W192030078050001	19.3417	78.0833	6.8	0.065	4.2	0.02
25	Kamtala	W194030078110001	19.6750	78.1833	9.1	0.523	6.1	0.68
26	Kandar-1	W185222077114601	18.8728	77.1961	8	-0.386	0	-0.89
27	Kapsi Gumta	W190045077245201	19.0125	77.4144	1.7	-0.243	2.6	0.17
28	Karadkher-1	W182906077292701	18.4850	77.4908	5.5	-0.519	1.45	-0.86
29	Khambegaon	W185926077042301	18.9906	77.0731	11.4	0.225	3.3	-0.47
30	Kini	GSDA	19.24166667	77.80972222	6.2	0.328	0	-0.52
31	Kolambi	W185324077250401	18.8900	77.4178	9	0.045	1.8	-1.03
32	Kuncheli	W184610077334701	18.7694	77.5631	10.1	-0.267	0.01	-1.92
33	Lahan	W191655077274501	19.2819	77.4625	8.2	0.094	4.7	0.06
34	Lahan	W191655077274501	19.28194444	77.4625	8.2	0.133	4.7	0.07
35	Lakmapur	W195230077570001	19.8750	77.9500	7.5	0.158	1.95	-0.21
36	Loglood	GSDA	19.17916667	77.80277778	7.3	0.119	0	0.08
37	Mahur	W194820077552001	19.8056	77.9222	0	0.778	0	0.24
38	Malegaon	GSDA	19.29583333	77.26944444	13	0.090	0	0.66
39	Malegaon (I)	W184900077010001	18.8167	77.0167	2.9	-0.091	0	0.05
40	Malegaon (II)	W191840077190001	19.3111	77.3167	10.6	0.052	4.5	0.53
41	Manwadi phata	W193017077355901	19.5047	77.5997	12.55	-0.360	NA	NA
42	Mathala	W193517077324901	19.5881	77.5469	7.6	0.477	NA	NA
43	Mudkhed2	W190900077310002	19.1	77.516	11.5	0.401	3.5	0.13

Sl No	Village	SITE ID	Latitude	Longitude	DTWL_May 2019 (mbgl)	Pre_trend(2010-19)	DTWL_Nov 2019 (mbgl)	post_trend(2010-19)
			500	7				
44	Mukher-1	W184300077230002	18.7167	77.3833	10.4	0.510	1.3	-0.28
45	Mukrambad (Kharka)	W182900077220001	18.4833	77.3667	6.25	-0.377	1.2	0.33
46	Nagapur	W191245077415701	19.2125	77.6992	8.65	0.065	3.65	0.13
47	Naigaon	W185100077320001	18.8500	77.5333	10.45	0.296	4	0.11
48	Nanda Bk	GSDA	19.10555556	77.73194444	6.8	-0.035	0	0.07
49	Nanded	W191126077202201	19.1906	77.3394	10.05	0.397	4.6	0.79
50	Narsi	W184835077320001	18.8097	77.5333	9.2	0.223	5.6	-0.10
51	Narwat	W191400077380001	19.2333	77.6333	8.15	-0.201	1.75	-0.05
52	Pala	W183830077264501	18.6417	77.4458	8	0.139	8	0.50
53	Panchpipli	W184731077373601	18.7919	77.6267	9.5	-0.380	10.5	-1.30
54	Pardi I	GSDA	19.325	77.38472222	4.8	0.209	0	0.11
55	Pimpalgaon M	GSDA	19.20833333	77.33888889	14	0.092	0	-0.06
56	Police Wadi	W185519077054801	18.9219	77.0967	10	0.298	1.7	-0.11
57	Shelgaon	W190401077345301	19.0669	77.5814	9.5	0.592	6.7	0.07
58	Sikarghat (Amdura)	W190800077250001	19.1333	77.4167	31.7	0.609	3.15	0.02
59	Somthana	W185634077262501	18.9428	77.4403	11.2	-0.310	1.5	-1.76
60	Somthana (patti Bhokar)	GSDA	19.275	77.7125	9.3	-0.310	0	-1.76
61	Talani	W184733077364201	18.7925	77.6117	9	-0.056	3.8	-0.93
62	Tamsa_Pz	W192215077370001	19.3708	77.6167	0	-0.272	0	0.84
63	Taroda (Bk)	W191234077172601	19.2094	77.2906	18	1.074	13.8	0.51
64	Umri-Gortha	W190259077373501	19.0497	77.6264	1.55	-0.023	2.6	-0.17
65	Unkeshwar	W195100078120001	19.8	78.200	9.1	0.495	0	0.13

Sl No	Village	SITE ID	Latitude	Longitude	DTWL_May 2019 (mbgl)	Pre_trend(2010-19)	DTWL_Nov 2019 (mbgl)	post_trend(2010-19)
			500	0				
66	Wadgaon (kh)	W191915077441801	19.3208	77.7383	15	0.532	3.4	-0.18
67	Wakad	GSDA	19.23888889	77.57222222	8.8	0.126	0	0.05
68	Waranga	W192600077290001	19.4333	77.4833	4.8	-0.112	1.3	0.11

ANNEXURE VII: LOCATION OF PERCOLATION TANK

Sl No	VILLAGE	TALUKA
1	Umri	Kinwat
2	Bhiku Na	Kinwat
3	Kothari	Kinwat
4	Nichpur	Kinwat
5	Ambadi	Kinwat
6	KINWAT	Kinwat
7	Wadoli	Kinwat
8	Jawarla	Kinwat
9	Mulzara	Kinwat
10	Karanji	Kinwat
11	Jaldhara	Kinwat
12	Yavli	Hadgaon
13	Loha	Hadgaon
14	Ghogri	Hadgaon
15	Pimprala	Hadgaon
16	Jambhala	Hadgaon
17	Chabhara	Hadgaon
18	Nimgaon	Hadgaon
19	Manatha	Hadgaon
20	Manatha	Hadgaon
21	Khamgavh	Hadgaon
22	Kedargud	Hadgaon
23	Pimparkh	Hadgaon
24	Laihari	Hadgaon
25	Dongarga	Hadgaon
26	Niwdha	Hadgaon
27	Matala	Hadgaon
28	Peva	Hadgaon
29	Delup Kh	Ardhapur
30	Sangvi K	Ardhapur
31	Barasgao	Ardhapur
32	Pangri T	Nanded
33	Talni	Nanded
34	Sayal	Nanded
35	Chanapur	Ardhapur
36	Patnur	Ardhapur
37	Chanapur	Ardhapur
38	Babulgao	Nanded
39	Tuppa	Nanded
40	WAGHALA	Nanded
41	Malegaon	Ardhapur
42	Chikhali	Nanded

Sl No	VILLAGE	TALUKA
43	NANDED	Nanded
44	Taroda K	Nanded
45	Sangvi B	Nanded
46	Wadi Jan	Nanded
47	Punegaon	Nanded
48	Nandusa	Nanded
49	Degaon B	Nanded
50	Pathrad	Mudkhed
51	Saregaon	Mudkhed
52	Pimpal K	Mudkhed
53	Pimpal K	Mudkhed
54	Pandharw	Mudkhed
55	Dongarga	Mudkhed
56	Daregaon	Mudkhed
57	Pimpalka	Mudkhed
58	Pimpalga	Mudkhed
59	Devapur	Mudkhed
60	Shemboli	Mudkhed
61	Wai	Mudkhed
62	Wadi Niy	Mudkhed
63	Barad	Mudkhed
64	Takli	Mudkhed
65	Malkauth	Mudkhed
66	Mendka	Mudkhed
67	Gargotwa	Bhokar
68	Ijali	Mudkhed
69	Eardada	Mudkhed
70	Dholumri	Umri
71	Palasgao	Umri
72	Karla	Umri
73	Kalgaon	Bhokar
74	Kalgaon	Umri
75	Ishwarna	Umri
76	Hunda (p	Umri
77	Rahati B	Umri
78	Sailgaon	Umri
79	Sailgaon	Umri
80	Jamgaon	Umri
81	Ijjatgao	Umri
82	Ijjatgao	Umri
83	Gortha	Umri
84	PETHUMRI	Umri

Sl No	VILLAGE	TALUKA
85	Talegaon	Umri
86	Bolsa Bk	Umri
87	Somthana	Umri
88	Shirur	Umri
89	Bitnal	Umri
90	Mandala	Umri
91	Miyadadp	Umri
92	Kaudgaon	Umri
93	Waghala	Umri
94	Bolsa	Umri
95	Hassa	Umri
96	Bhoshi	Bhokar
97	Bhoshi	Bhokar
98	Chitgiri	Bhokar
99	Amdariwa	Bhokar
100	Therban	Bhokar
101	Somthana	Bhokar
102	Kini	Bhokar
103	Paki Tan	Bhokar
104	Raikhod	Bhokar
105	Raikhod	Bhokar
106	Amdari	Bhokar
107	Bhokar	Bhokar
108	Narwat	Bhokar
109	Wakad	Bhokar
110	Tatkalwa	Bhokar
111	Pandurna	Bhokar
112	Ritha	Bhokar
113	Pomnala	Bhokar
114	Sonari	Bhokar
115	Maslaga	Bhokar
116	Nekli	Bhokar
117	Nekli	Bhokar
118	Pimpaldh	Bhokar
119	Kandli	Bhokar
120	Baliram	Himayatn
121	Turati	Bhokar
122	Dharjani	Bhokar
123	Nanda Bk	Bhokar
124	Kamangao	Bhokar
125	Rajapur	Dharmaba
126	Rajapur	Dharmaba
127	Junni	Dharmaba

Sl No	VILLAGE	TALUKA
128	Babulgao	Dharmaba
129	Yeoti	Dharmaba
130	Mutnyal(	Dharmaba
131	Patoda B	Dharmaba
132	DHARMABA	Dharmaba
133	DHARMABA	Dharmaba
134	Jaflapur	Dharmaba
135	Sirajkhe	Dharmaba
136	Atkur	Dharmaba
137	Bannali	Dharmaba
138	Belur Bk	Dharmaba
139	Salegaon	Dharmaba
140	Babhali	Dharmaba
141	Aloor	Dharmaba
142	Sirajkhe	Dharmaba
143	Vilegaon	Dharmaba
144	Dugaon	Biloli
145	Iklimore	Biloli
146	Betak Bi	Biloli
147	Atala	Biloli
148	Torna	Biloli
149	Belkoni	Biloli
150	Lohgaon	Biloli
151	Kinala	Biloli
152	Ramtirth	Biloli
153	Nagani	Biloli
154	Daulapur	Biloli
155	BILOLI	Biloli
156	Kerur	Biloli
157	Alandi	Biloli
158	Kamras P	Biloli
159	Kerur	Biloli
160	Hipparga	Biloli
161	Sangroli	Biloli
162	Bamni Bk	Biloli
163	Badur	Biloli
164	Bhosi	Biloli
165	Sawali	Biloli
166	Chirli	Biloli
167	BILOLI	Biloli
168	BILOLI	Biloli
169	Belkoni	Biloli
170	Gaglegao	Biloli

Sl No	VILLAGE	TALUKA
171	KUNDALWA	Biloli
172	Padada T	Biloli
173	KUNDALWA	Biloli
174	Minki	Biloli
175	Hangraga	Naigaon
176	Koklegao	Naigaon
177	Kaudgaon	Naigaon
178	Sategaon	Naigaon
179	Vanjarwa	Naigaon
180	Ghungral	Naigaon
181	Bhukmari	Naigaon
182	Manjram	Naigaon
183	Manjram	Naigaon
184	Kedar Wa	Naigaon
185	Marwali	Naigaon
186	Kandala	Naigaon
187	Naigaon	Naigaon
188	Bendri	Naigaon
189	Manjram	Naigaon
190	Manjram	Naigaon
191	Hiparga	Naigaon
192	Kuncholi	Naigaon
193	Kandala	Naigaon
194	Hippar G	Naigaon
195	Halda	Kandhar
196	Umra	Kandhar
197	Chikhali	Kandhar
198	Katkalmb	Kandhar
199	Barul	Kandhar
200	Bachoti	Kandhar
201	Bachoti	Kandhar
202	Bachoti	Kandhar
203	Navrangp	Kandhar
204	KANDHAR	Kandhar
205	Tolyachi	Kandhar
206	Patalgan	Kandhar
207	Umbaj	Kandhar
208	Kandhare	Kandhar
209	Nagalgao	Kandhar
210	Kurla	Kandhar
211	Wahad	Kandhar
212	Daithana	Kandhar
213	Guttewad	Kandhar

Sl No	VILLAGE	TALUKA
214	Kurla	Kandhar
215	Bolka	Kandhar
216	Nandansh	Kandhar
217	Hadoli B	Kandhar
218	Somthana	Kandhar
219	Digras B	Kandhar
220	Gandhina	Kandhar
221	Harbal P	Kandhar
222	Dewaichi	Kandhar
223	Gaul	Kandhar
224	Bramhwad	Kandhar
225	Kalka	Kandhar
226	Shirsi B	Kandhar
227	Rahati	Kandhar
228	Kallali	Kandhar
229	Kallali	Kandhar
230	Rahati	Kandhar
231	Penur	Loha
232	Sayal.	Loha
233	Bhedegao	Loha
234	Sonkhed	Loha
235	Kiwala	Loha
236	Kalambar	Loha
237	Golegaon	Loha
238	Hadoli J	Loha
239	Haranwad	Loha
240	Sawargao	Loha
241	Maski	Loha
242	Shirsi K	Kandhar
243	Madali	Mukhed
244	Tembhurn	Naigaon
245	Ghubadwa	Kandhar
246	Ravankol	Mukhed
247	Halni	Mukhed
248	Ravi	Mukhed
249	Bennal	Mukhed
250	Savarmal	Mukhed
251	Wandgir	Mukhed
252	Itgyal P	Mukhed
253	Jamb Bk.	Mukhed
254	Kamjalga	Mukhed
255	Sangvi B	Mukhed
256	Admalwad	Mukhed

Sl No	VILLAGE	TALUKA
257	Berli Bk	Mukhed
258	Kharab K	Mukhed
259	Takli(t.	Mukhed
260	Bapshetw	Mukhed
261	Undri P.	Mukhed
262	Paismal	Mukhed
263	Jirga	Mukhed
264	Rathodwa	Mukhed
265	Kamlewad	Mukhed
266	Shikara	Mukhed
267	Pimpalku	Mukhed
268	Saknur	Mukhed
269	Bhatapur	Mukhed
270	Chondi	Mukhed
271	Khapral	Mukhed
272	Ratna Ta	Mukhed
273	Bhagnurw	Mukhed
274	Karna	Mukhed
275	Mukhed K	Mukhed
276	Shelkewa	Mukhed
277	Jambhali	Mukhed
278	Walanki	Mukhed
279	Hatral	Mukhed
280	Dapka Gu	Mukhed
281	Khanapur	Deglur
282	Adlur	Deglur
283	Dhanaj	Mukhed
284	Tadkhel	Deglur
285	Tadkhel	Deglur
286	DEGLUR	Deglur
287	Gavandga	Deglur
288	Manur Bk	Deglur

Sl No	VILLAGE	TALUKA
289	Bembra	Deglur
290	Wazar	Deglur
291	Tumbarpa	Deglur
292	Bhutan H	Deglur
293	Kini	Deglur
294	Kanmarpa	Deglur
295	Bijalwad	Deglur
296	Markhel	Deglur
297	Pujarwad	Deglur
298	Walag	Deglur
299	Devapur	Deglur
300	Achegaon	Deglur
301	Tamlur	Deglur
302	Chainpur	Deglur
303	Khanapur	Deglur
304	Alur	Deglur
305	Malegaon	Deglur
306	Takali J	Deglur
307	Kutub Sh	Deglur
308	Loni	Deglur
309	Loni	Deglur
310	Yedur.	Deglur
311	Thana	Mukhed
312	Hanuman	Deglur
313	Met	Mahur
314	Gundwal	Mahur
315	Murli	Mahur
316	Chorad	Mahur
317	Hadsani	Mahur
318	Dattaman	Mahur
319	Asoli	Mahur

ANNEXURE VIII: LOCATION OF CHECK DAMS

Sl No	Village	Taluka
1	Rui	Mahur
2	Dattamanjari	Mahur
3	Gundwal	Mahur
4	Dattamanjari	Mahur
5	Dattamanjari	Mahur
6	Mahor	Mahur
7	Mahor	Mahur
8	Lakhamapur Tanda	Mahur
9	Ner	Mahur
10	Ner	Mahur
11	Ner	Mahur
12	Pavnala	Mahur
13	Machehhandra Pardi	Mahur
14	Kasarpeth	Mahur
15	Kasarpeth	Mahur
16	Wanola	Mahur
17	Wanola	Mahur
18	Borwadi	Mahur
19	Wai	Mahur
20	Vazra Bk	Kinwat
21	Gauri	Kinwat
22	Gauri	Kinwat
23	Chinchkhed	Kinwat
24	Unakdeo	Kinwat
25	Nichpur	Kinwat
26	Nichpur	Kinwat
27	Nichpur	Kinwat
28	Sindgi (kinwat)	Kinwat
29	Sindgi (kinwat)	Kinwat
30	Warche Maregaon	Kinwat
31	Warche Maregaon	Kinwat
32	Loni	Kinwat
33	Loni	Kinwat
34	Wadoli	Kinwat
35	Wadoli	Kinwat
36	Wadoli	Kinwat
37	Damandhari	Kinwat
38	Hudi (islapur)	Kinwat
39	Kothari	Kinwat
40	Mulzara	Kinwat
41	Bhosi	Kinwat
42	Andhbori (islapur)	Kinwat
43	Shivni (islapur)	Kinwat
44	Shivni (islapur)	Kinwat
45	Dayal Dhanora	Kinwat
46	Shivni (islapur)	Kinwat
47	Nagzari	Kinwat
48	Nagzari	Kinwat
49	Nagzari	Kinwat
50	Pawana	Himayatnagar
51	Umri Kh	Hadgaon
52	Talni	Hadgaon
53	Koli	Hadgaon
54	Marlegaon	Hadgaon
55	Bhanegaon Tanda	Hadgaon
56	Kawana	Hadgaon
57	Baradshewala	Hadgaon
58	Jagapur	Hadgaon
59	Jagapur	Hadgaon
60	Jagapur	Hadgaon
61	Jagapur	Hadgaon
62	Pingli	Hadgaon
63	Umri (daryabai)	Hadgaon
64	Dorli	Hadgaon
65	Shivani	Hadgaon
66	Jambhala	Hadgaon
67	Krushnapur	Hadgaon
68	Ekrala	Hadgaon
69	Digras	Hadgaon
70	Digras	Hadgaon
71	Choramba (nanded)	Hadgaon
72	Nimgaon	Hadgaon
73	Lahan	Ardhapur
74	Lahan	Ardhapur
75	Chabhara	Hadgaon
76	Hardaf	Hadgaon
77	Hardaf	Hadgaon
78	HADGAON	Hadgaon

79	Kothala	Hadgaon
80	Pangri(tamsa)	Hadgaon
81	Tamsa	Hadgaon
82	Tamsa	Hadgaon
83	Wadgaon Bk	Hadgaon
84	Kanjara (kh)	Hadgaon
85	Kanjara (kh)	Hadgaon
86	Choramba Kh.	Hadgaon
87	Deshmukhwadi	Hadgaon
88	Marlegaon	Hadgaon
89	Pimparkheda	Hadgaon
90	Hastara	Hadgaon
91	Shirad	Hadgaon
92	Warwat	Hadgaon
93	Chabhara	Hadgaon
94	Nimgaon	Hadgaon
95	Patnur	Ardhapur
96	Chanapur	Ardhapur
97	Chanapur	Ardhapur
98	Lahan	Ardhapur
99	Loni Kh.	Ardhapur
100	Ardhapur	Ardhapur
101	Ardhapur	Ardhapur
102	Chabhara	Hadgaon
103	Chabhara	Hadgaon
104	Wadi Emshet	Ardhapur
105	Degaon Bk.	Ardhapur
106	Daur	Ardhapur
107	Daur	Ardhapur
108	Ardhapur	Ardhapur
109	Belsar	Ardhapur
110	Barad	Mudkhed
111	Barad	Mudkhed
112	Chinchban	Ardhapur
113	Ganpur	Ardhapur
114	Ganpur	Ardhapur
115	Wadi Bk.	Nanded
116	Sayal	Nanded
117	Waghi	Nanded
118	Waghi	Nanded
119	Sugaon Bk.	Nanded
120	Hassapur	Nanded
121	Pimpalgaon Mishri	Nanded
122	Talni	Nanded
123	Wadwana	Nanded
124	Nila	Nanded
125	Ekdara	Nanded
126	Ekdara	Nanded
127	Alegaon	Nanded
128	Hadidadpur	Nanded
129	Hadidadpur	Nanded
130	Nerli	Nanded
131	Khurgaon	Nanded
132	Kalhal	Nanded
133	NANDED	Nanded
134	NANDED	Nanded
135	NANDED	Nanded
136	WAGHALA	Nanded
137	WAGHALA	Nanded
138	Pimpalgaon Korka	Nanded
139	Tuppa	Nanded
140	Wasri	Nanded
141	WAGHALA	Nanded
142	WAGHALA	Nanded
143	NANDED	Nanded
144	Kakandi Tarf Pasadga	Nanded
145	Pathrad	Nanded
146	Waghi	Nanded
147	Pimpalgaon Korka	Nanded
148	WAGHALA	Nanded
149	WAGHALA	Nanded
150	Kottirth	Nanded
151	Pimpalgaon Korka	Nanded
152	Naleshwar	Nanded
153	Barad	Mudkhed
154	Khairgaon Kh.	Mudkhed
155	Amrapur (dudhawadi)	Mudkhed
156	Dhanaj	Mudkhed
157	Saregaon	Mudkhed
158	Mugat	Mudkhed

159	Mugat	Mudkhed
160	Trikut	Nanded
161	Rajwadi	Mudkhed
162	MUDKHED	Mudkhed
163	Dongaon	Mudkhed
164	Dongaon	Mudkhed
165	Dongaon	Mudkhed
166	Gopalwadi (n.v.)	Mudkhed
167	Pimpalkautha	Mudkhed
168	Bolsa	Umri
169	Manur	Umri
170	Manur	Umri
171	Manur	Umri
172	Malkautha	Mudkhed
173	Chilpimpri	Mudkhed
174	Rajwadi	Mudkhed
175	Pimpalgoan (rohi)	Mudkhed
176	Malkautha	Mudkhed
177	Pimpalgoan (rohi)	Mudkhed
178	Umra	Loha
179	Dhanaj Bk.	Loha
180	Kapshi Bk.	Loha
181	MUDKHED	Mudkhed
182	Chikala	Mudkhed
183	Hajapur	Mudkhed
184	MUDKHED	Mudkhed
185	MUDKHED	Mudkhed
186	Daregaon	Mudkhed
187	Daregaon	Mudkhed
188	Pangargaon	Mudkhed
189	Pimpalgoan (rohi)	Mudkhed
190	Pimpalgoan (rohi)	Mudkhed
191	Kamlaj	Mudkhed
192	Shankhtirth	Mudkhed
193	Devapur	Mudkhed
194	Amrapur (dudhawadi)	Mudkhed
195	Jawala Murhar	Mudkhed
196	Saregaon	Mudkhed
197	MUDKHED	Mudkhed
198	MUDKHED	Mudkhed
199	Pardi (vaijapur)	Mudkhed
200	Pardi (vaijapur)	Mudkhed
201	Pardi (vaijapur)	Mudkhed
202	MUDKHED	Mudkhed
203	Barad	Mudkhed
204	Chanapur	Mudkhed
205	Nageli	Mudkhed
206	Daregaon	Mudkhed
207	Pimpalgoan (rohi)	Mudkhed
208	Ralaj	Bhokar
209	Palaj	Bhokar
210	Palaj	Bhokar
211	Mahalsapur	Bhokar
212	Mahagaon	Bhokar
213	Mahagaon	Bhokar
214	Kini	Bhokar
215	Kini	Bhokar
216	Kini	Bhokar
217	Divshi Bk.	Bhokar
218	Divshi Bk.	Bhokar
219	Divshi Bk.	Bhokar
220	Mahagaon	Bhokar
221	Divshi Kh.	Bhokar
222	Divshi Kh.	Bhokar
223	Divshi Kh.	Bhokar
224	Divshi Kh.	Bhokar
225	Paki	Bhokar
226	Nanda Kh.	Bhokar
227	Nanda Kh.	Bhokar
228	Kolgaon Bk.	Bhokar
229	Divshi Kh.	Bhokar
230	Divshi Kh.	Bhokar
231	Ranapur	Bhokar
232	Ranapur	Bhokar
233	Kolgaon Kh.	Bhokar
234	Kolgaon Bk.	Bhokar
235	Borgaon	Bhokar
236	Borgaon	Bhokar
237	Dhanora	Bhokar
238	Borgaon	Bhokar
239	Borgaon	Bhokar

240	Narwat	Bhokar
241	Pandurna	Bhokar
242	Gargotwadi	Bhokar
243	Dorli	Bhokar
244	Hassapur	Bhokar
245	Hassapur	Bhokar
246	Raikhod	Bhokar
247	Raikhod	Bhokar
248	Sayal	Bhokar
249	Daur	Bhokar
250	Daur	Bhokar
251	Daur	Bhokar
252	Pimpaldhav	Bhokar
253	Moghali	Bhokar
254	Moghali	Bhokar
255	Dharjani	Bhokar
256	Dharjani	Bhokar
257	Dharjani	Bhokar
258	Dharjani	Bhokar
259	Daur	Bhokar
260	Bendri	Bhokar
261	Bendri	Bhokar
262	Matul	Bhokar
263	Pimpaldhav	Bhokar
264	Ballal	Bhokar
265	Ballal	Bhokar
266	Laglud	Bhokar
267	Laglud	Bhokar
268	Matul	Bhokar
269	Matul	Bhokar
270	Rawangaon	Bhokar
271	Rawangaon	Bhokar
272	Laglud	Bhokar
273	Ranapur	Bhokar
274	Bhoshi	Bhokar
275	Bhoshi	Bhokar
276	Bhoshi	Bhokar
277	Bhoshi	Bhokar
278	Bhoshi	Bhokar
279	Bhoshi	Bhokar
280	Bachoti Kamp.(n.v.)	Bhokar

281	Tatkalwadi	Bhokar
282	Tatkalwadi	Bhokar
283	Tatkalwadi	Bhokar
284	Bembar	Bhokar
285	Hassapur	Bhokar
286	Matul	Bhokar
287	Nanda Patti Mhaisa.	Bhokar
288	Rawangaon	Bhokar
289	Rahati Bk..	Umri
290	Yelegaon	Naigaon
291	Bolsa	Umri
292	Ijjatgaon	Umri
293	Balegaon	Umri
294	Balegaon	Umri
295	Balegaon	Umri
296	Balegaon	Umri
297	Baghalwada	Umri
298	Salegaon (d)	Umri
299	Golegaon	Umri
300	Golegaon	Umri
301	Sindhi	Umri
302	Sindhi	Umri
303	Sindhi	Umri
304	Sailgaon	Umri
305	Sailgaon	Umri
306	Sailgaon	Umri
307	Sailgaon	Umri
308	Sailgaon	Umri
309	Sailgaon	Umri
310	Palasgaon	Umri
311	Sailgaon	Umri
312	Kudla	Umri
313	Kudla	Umri
314	Sailgaon	Umri
315	Kudla	Umri
316	Sailgaon	Umri
317	Talegaon	Umri
318	Talegaon	Umri
319	Talegaon	Umri
320	Ijjatgaon	Umri
321	Dhanora Bk	Umri

322	Dhanora Bk	Umri
323	Bolsa Bk	Umri
324	Bolsa Bk	Umri
325	Bolsa Kh	Umri
326	Bolsa Kh	Umri
327	Bolsa Bk	Umri
328	Dhanora Bk	Umri
329	Dhanora Bk	Umri
330	Dhanora Bk	Umri
331	Sawargaon (kala)	Umri
332	Ramkhadak	Umri
333	Ramkhadak	Umri
334	Mandala	Umri
335	Sindhi	Umri
336	Palasgaon	Umri
337	Hunda (patti Ganga)	Umri
338	Bolsa	Umri
339	Gortha	Umri
340	Gortha	Umri
341	Gortha	Umri
342	Gortha	Umri
343	Gortha	Umri
344	Dhanora Bk	Umri
345	Waghala	Umri
346	Mandala	Umri
347	Mandala	Umri
348	Bitnal	Umri
349	Hangirga	Umri
350	Hangirga	Umri
351	Hangirga	Umri
352	Miyadadpur	Umri
353	Balegaon	Umri
354	Balegaon	Umri
355	Atkur	Dharmabad
356	DHARMABAD	Dharmabad
357	DHARMABAD	Dharmabad
358	DHARMABAD	Dharmabad
359	Patoda Bk.	Dharmabad
360	Patoda Bk.	Dharmabad
361	Patoda Bk.	Dharmabad
362	Patoda Bk.	Dharmabad
363	Patoda Kh.	Dharmabad
364	Dhanora Kh.	Dharmabad
365	Cholakha	Dharmabad
366	Belgujari	Dharmabad
367	Belgujari	Dharmabad
368	Atala	Dharmabad
369	Sangam	Biloli
370	Nagani	Biloli
371	Machnur	Biloli
372	Nagani	Biloli
373	Samrala	Dharmabad
374	Samrala	Dharmabad
375	Samrala	Dharmabad
376	Pangri	Dharmabad
377	Pangri	Dharmabad
378	Haregaon	Dharmabad
379	Baghalwada	Dharmabad
380	Dhanora Kh.	Dharmabad
381	Chincholi	Dharmabad
382	Chincholi	Dharmabad
383	Naigaon (d)	Dharmabad
384	Aloor	Dharmabad
385	Sirajkhed	Dharmabad
386	Sirajkhed	Dharmabad
387	Yeoti	Dharmabad
388	Karkheli	Dharmabad
389	Karkheli	Dharmabad
390	Junni	Dharmabad
391	Salegaon (d)	Dharmabad
392	Salegaon (d)	Dharmabad
393	Bolsa Bk	Dharmabad
394	Dhanora Kh.	Dharmabad
395	Dhanora Kh.	Dharmabad
396	Samrala	Dharmabad
397	DHARMABAD	Dharmabad
398	Shelgaon Thadi	Dharmabad
399	Shelgaon Thadi	Biloli
400	Sangam	Dharmabad
401	Chincholi	Dharmabad
402	Sirajkhed	Dharmabad

403	Mutnyal(d)	Dharmabad
404	Mutnyal(d)	Dharmabad
405	Adampur	Biloli
406	Adampur	Biloli
407	Adampur	Biloli
408	Atkali	Biloli
409	Atkali	Biloli
410	Sangroli	Biloli
411	Sangroli	Biloli
412	Daulatpur	Biloli
413	Laghul	Biloli
414	Laghul	Biloli
415	Pokharni Bk.	Biloli
416	Rampur (m)	Biloli
417	Mukhed	Biloli
418	Dongaon Bk.	Biloli
419	Pach Pimpli	Biloli
420	Talni	Biloli
421	Dongaon Bk.	Biloli
422	Lohgaon	Biloli
423	Lohgaon	Biloli
424	Lohgaon	Biloli
425	Lohgaon	Biloli
426	Lohgaon	Biloli
427	Takli Bk.	Biloli
428	Takli Bk.	Biloli
429	Takli Bk.	Biloli
430	Ganjgaon	Biloli
431	Ganjgaon	Biloli
432	Waliyabad	Biloli
433	Waliyabad	Biloli
434	Bavalgaon	Biloli
435	Bavalgaon	Biloli
436	Babhali (a)	Biloli
437	Machnur	Biloli
438	Arli	Biloli
439	Arli	Biloli
440	Arli	Biloli
441	Arli	Biloli
442	Arli	Biloli
443	Sawali	Biloli
444	Hungunda	Biloli
445	Atala	Biloli
446	Atala	Dharmabad
447	Atala	Dharmabad
448	Chondi	Dharmabad
449	Chondi	Biloli
450	Jarikot	Dharmabad
451	Hussa	Biloli
452	Hussa	Biloli
453	Shelgaon Thadi	Biloli
454	Karhal	Biloli
455	KUNDALWADI	Biloli
456	Mamdapur	Biloli
457	KUNDALWADI	Biloli
458	KUNDALWADI	Biloli
459	BILOLI	Biloli
460	BILOLI	Biloli
461	BILOLI	Biloli
462	Kerur	Biloli
463	Atkali	Biloli
464	Alandi	Biloli
465	Alandi	Biloli
466	Dongaon Bk.	Biloli
467	Dongaon Bk.	Biloli
468	Bhopala	Biloli
469	Bhopala	Biloli
470	Bhopala	Biloli
471	Belkoni Kh.	Biloli
472	Belkoni Kh.	Biloli
473	Kumbhargaon	Biloli
474	Kumbhargaon	Biloli
475	Gujri	Biloli
476	Chondi	Biloli
477	Jarikot	Biloli
478	Belkoni Kh.	Biloli
479	Gaglegaon	Biloli
480	Gaglegaon	Biloli
481	Machnur	Biloli
482	Rudrapur	Biloli
483	Dongaon Bk.	Biloli
484	Anjani	Biloli

485	Pach Pimpli	Biloli
486	Sawali	Biloli
487	Belkoni Kh.	Biloli
488	Kangathi	Biloli
489	Hussa	Biloli
490	Dornali	Mukhed
491	Mukramabad	Mukhed
492	Mukramabad	Mukhed
493	Mukramabad	Mukhed
494	Paratpur	Mukhed
495	Bamni	Mukhed
496	Ravi	Mukhed
497	Ravi	Mukhed
498	Degaon	Mukhed
499	Degaon	Mukhed
500	Degaon	Mukhed
501	Gonegaon	Mukhed
502	Gonegaon	Mukhed
503	Gojegaon	Mukhed
504	Walag	Deglur
505	Andegaon	Mukhed
506	Sawali	Mukhed
507	Bhatapur P.mu.	Mukhed
508	Bhatapur P.mu.	Mukhed
509	Dornali	Mukhed
510	Hatral	Mukhed
511	Dapka Gundopant	Mukhed
512	Dapka Gundopant	Mukhed
513	Krushnawadi (n.v.)	Mukhed
514	Bapshetwadi	Mukhed
515	Motarga	Mukhed
516	Motarga	Mukhed
517	Motarga	Mukhed
518	Dhanaj	Mukhed
519	Dhanaj	Mukhed
520	Jamkhed	Mukhed
521	Pala	Mukhed
522	Pala	Mukhed
523	Pala	Mukhed
524	Bhagnurwadi	Mukhed
525	Tandli	Mukhed
526	Tandli	Mukhed
527	Umardari	Mukhed
528	Umardari	Mukhed
529	Honwadaj	Mukhed
530	Sugaon	Mukhed
531	Sugaon	Mukhed
532	Sugaon	Mukhed
533	Kundral	Mukhed
534	Mangyal	Mukhed
535	Mangyal	Mukhed
536	Mangyal	Mukhed
537	Takli Bk.	Mukhed
538	Shelgaon Gauri	Mukhed
539	Bawalgaon	Mukhed
540	Bawalgaon	Mukhed
541	Bawalgaon	Mukhed
542	Nandgaon P.k.	Mukhed
543	Nandgaon P.k.	Mukhed
544	Nandgaon P.k.	Mukhed
545	Nandgaon P.k.	Mukhed
546	Salagara Kh.	Mukhed
547	Salagara Kh.	Mukhed
548	Berli Bk.	Mukhed
549	Khairka	Mukhed
550	Khairka	Mukhed
551	Bavanwadi (n.v.)	Mukhed
552	Mukhed Khede	Mukhed
553	MUKHED	Mukhed
554	Kotgyal	Mukhed
555	Kotgyal	Mukhed
556	Kotgyal	Mukhed
557	Rui	Mukhed
558	Wartala	Mukhed
559	Wartala	Mukhed
560	Kamjalga	Mukhed
561	Dapka Raja	Mukhed
562	Dapka Raja	Mukhed
563	Hipparga	Mukhed
564	Chandola	Mukhed
565	Bhendegaon Kh.	Mukhed
566	Kabnur	Mukhed

567	Hippalnari	Mukhed
568	Barhali	Mukhed
569	Kalambar	Mukhed
570	Kalambar	Mukhed
571	Dapka Gundopant	Mukhed
572	Hatral	Mukhed
573	Nagral	Mukhed
574	Chinchgaon	Mukhed
575	Hipparga Thadi	Deglur
576	Shevala	Deglur
577	Shevala	Deglur
578	Nandur	Deglur
579	Khatgaon	Deglur
580	Kotekallur	Deglur
581	Limba	Deglur
582	Tupshelgaon	Deglur
583	Wazarga	Deglur
584	Atkali	Deglur
585	Lakhkha	Deglur
586	Manshakarga	Deglur
587	Sugaon	Deglur
588	Eklara	Deglur
589	Eklara	Deglur
590	Hanuman Hipparga	Deglur
591	Sundgi Kh.	Deglur
592	Degaon Kh	Deglur
593	Munjalga	Deglur
594	Takli Bagam	Deglur
595	Degaon Bk.	Deglur
596	Kavalgaon	Deglur
597	Sangvi Karadkhed	Deglur
598	Karadkhed	Deglur
599	Karadkhed	Deglur
600	Somar	Deglur
601	Khutmapur	Deglur
602	Kamajiwadi	Deglur
603	Hanegaon	Deglur
604	Hanegaon	Deglur
605	Kudali	Deglur
606	Hanegaon	Deglur
607	Kshirsamudra	Deglur
608	Kshirsamudra	Deglur
609	Kshirsamudra	Deglur
610	Kshirsamudra	Deglur
611	Kini	Deglur
612	Yergi	Deglur
613	Devapur	Deglur
614	Devapur	Deglur
615	Devapur	Deglur
616	Bembra	Deglur
617	Bembra	Deglur
618	Ramtapur	Deglur
619	Yedur.	Deglur
620	Yedur.	Deglur
621	Yedur.	Deglur
622	Yedur.	Deglur
623	Yedur.	Deglur
624	Yedur.	Deglur
625	Yedur.	Deglur
626	Bembra	Deglur
627	Bembra	Deglur
628	Somar	Deglur
629	Somar	Deglur
630	Wazar	Deglur
631	Shilwani	Deglur
632	Shilwani	Deglur
633	Shilwani	Deglur
634	Shilwani	Deglur
635	Shilwani	Deglur
636	Hanegaon	Deglur
637	Kini	Deglur
638	Kshirsamudra	Deglur
639	Kshirsamudra	Deglur
640	Dhosni	Deglur
641	Bhayegaon	Deglur
642	Kavalgadda	Deglur
643	Kavalgadda	Deglur
644	Lingapur	Deglur
645	Rampur Thadi	Deglur
646	Shevala	Deglur
647	Shevala	Deglur
648	Shevala	Deglur

649	Kotekallur	Deglur
650	Kotekallur	Deglur
651	Kesrali	Deglur
652	Kesrali	Deglur
653	Atkali	Deglur
654	Sugaon	Deglur
655	Mavali	Deglur
656	Alandi	Deglur
657	Sugaon	Deglur
658	Borgaon Thadi	Deglur
659	Mavali	Deglur
660	Malegoan	Deglur
661	Khanapur	Deglur
662	Tadkhel	Deglur
663	Tadkhel	Deglur
664	Alur	Deglur
665	Nandur	Deglur
666	Devapur	Deglur
667	Pendpalli	Deglur
668	Takali Jahagir	Deglur
669	Takali Jahagir	Deglur
670	Takali Jahagir	Deglur
671	Zari	Deglur
672	Zari	Deglur
673	Markhel	Deglur
674	Walag	Deglur
675	Markhel	Deglur
676	Markhel	Deglur
677	Markhel	Deglur
678	Bennal	Deglur
679	Markhel	Deglur
680	Badbade	Naigaon
681	Badbade	Naigaon
682	Vazirgaon	Naigaon
683	Vazirgaon	Naigaon
684	Vazirgaon	Naigaon
685	Vazirgaon	Naigaon
686	Kahala Bk.	Naigaon
687	Badbade	Naigaon
688	Badbade	Naigaon
689	Patoda (t.b.)	Naigaon
690	Kuntoor	Naigaon
691	Ghungrala	Naigaon
692	Degaon	Naigaon
693	Talbid	Naigaon
694	Kuntoor	Naigaon
695	Koklegaon	Naigaon
696	Degaon	Naigaon
697	Naigaon (b)	Naigaon
698	Naigaonwadi	Naigaon
699	Lalondi	Naigaon
700	Kuntoor	Naigaon
701	Atala	Dharmabad
702	Singnapur	Naigaon
703	Hassa	Umri
704	Kaudgaon	Naigaon
705	Bijegaon	Naigaon
706	Tembhurni	Naigaon
707	Tembhurni	Naigaon
708	Tembhurni	Naigaon
709	Kedar Wadgaon	Naigaon
710	Manjram	Naigaon
711	Godamgaon	Naigaon
712	Kolambi	Naigaon
713	Manjram	Naigaon
714	Talbid	Naigaon
715	Ransugaon	Naigaon
716	Sategaon	Naigaon
717	Sategaon	Naigaon
718	Balegaon	Naigaon
719	Rui Bk	Naigaon
720	Manur Tarf Ba	Naigaon
721	Kahala Bk.	Naigaon
722	Takli Bk.	Naigaon
723	Naigaon (b)	Naigaon
724	Naigaon (b)	Naigaon
725	Bendri	Naigaon
726	Kandala	Naigaon
727	Marwali	Naigaon
728	Marwali	Mukhed
729	Mugaon	Naigaon
730	Mugaon	Naigaon

731	Mugaon	Naigaon
732	Tembhurni	Naigaon
733	Nawandi	Naigaon
734	Kedar Wadgaon	Naigaon
735	Kautha	Kandhar
736	Shirur	Kandhar
737	Kautha	Kandhar
738	Jakapur	Kandhar
739	Rahati	Kandhar
740	Rahati	Kandhar
741	Kautha	Kandhar
742	Telur	Kandhar
743	Telur	Kandhar
744	Pethwadaj	Kandhar
745	Pethwadaj	Kandhar
746	Pethwadaj	Kandhar
747	Pethwadaj	Kandhar
748	Pethwadaj	Kandhar
749	Pethwadaj	Kandhar
750	Abulaga	Kandhar
751	Abulaga	Kandhar
752	Abulaga	Kandhar
753	Gaul	Kandhar
754	Gaul	Kandhar
755	Gaul	Kandhar
756	Gaul	Kandhar
757	Gaul	Kandhar
758	Harbal P.k.	Kandhar
759	Ghagardarwadi	Kandhar
760	Phulwal	Kandhar
761	Phulwal	Kandhar
762	Phulwal	Kandhar
763	Panshewadi	Kandhar
764	Panshewadi	Kandhar
765	Panshewadi	Kandhar
766	Panshewadi	Kandhar
767	Nagalgaon	Kandhar
768	Nagalgaon	Kandhar
769	Mohija	Kandhar
770	Mathandoh	Kandhar
771	Mathandoh	Kandhar
772	Wahad	Kandhar
773	Wahad	Kandhar
774	Hatkayal	Kandhar
775	Hatkayal	Kandhar
776	Hatkayal	Kandhar
777	Ramanaik Tanda	Kandhar
778	Ramanaik Tanda	Kandhar
779	Ghodaj	Kandhar
780	Ghodaj	Kandhar
781	Umbaj	Kandhar
782	Umbaj	Kandhar
783	Shekapur	Kandhar
784	Bijewadi (n.v.)	Kandhar
785	Mangal Sangvi	Kandhar
786	Sawleshwar	Kandhar
787	Chikhali	Kandhar
788	Dahikalamba	Kandhar
789	Datala	Kandhar
790	Dahikalamba	Kandhar
791	Shiradhon	Kandhar
792	Shiradhon	Kandhar
793	Shiradhon	Kandhar
794	Shiradhon	Kandhar
795	Osmannagar	Kandhar
796	Osmannagar	Kandhar
797	Osmannagar	Kandhar
798	Osmannagar	Kandhar
799	Pangra	Kandhar
800	Sanguchiwadi	Kandhar
801	Sanguchiwadi	Kandhar
802	Sanguchiwadi	Loha
803	Panbhoshi	Kandhar
804	Panbhoshi	Kandhar
805	Naugharwadi	Kandhar
806	Panbhoshi	Kandhar
807	Wanjarwadi	Kandhar
808	Bahadarpura	Kandhar
809	KANDHAR	Kandhar
810	Bijewadi (n.v.)	Kandhar
811	Bijewadi (n.v.)	Kandhar
812	Gulabwadi	Kandhar

813	Gulabwadi	Kandhar
814	Mangal Sangvi	Kandhar
815	Telur	Kandhar
816	Kautha	Kandhar
817	Kautha	Kandhar
818	Katkalmba	Kandhar
819	Rautkheda	Kandhar
820	Kautha	Kandhar
821	Kautha	Kandhar
822	Rautkheda	Kandhar
823	Ladka	Kandhar
824	Ladka	Kandhar
825	Dinda	Kandhar
826	Binda	Kandhar
827	Kallali	Kandhar
828	Kallali	Kandhar
829	Rui	Kandhar
830	Rui	Kandhar
831	Rui	Kandhar
832	Rui	Kandhar
833	Rui	Kandhar
834	Jawala	Loha
835	Jawala	Loha
836	Bet Sangvi	Loha
837	Penur	Loha
838	Penur	Loha
839	Penur	Loha
840	Dongargaon	Loha
841	Hanmantwadi (n.v.)	Loha
842	Dagad Sangvi	Loha
843	Dagad Sangvi	Loha
844	Dagad Sangvi	Loha
845	Shivani Jamga	Loha
846	Shivani Jamga	Loha
847	Waka	Loha
848	Kumbhargaon	Loha
849	Kiwala	Loha
850	Takalgaon	Loha
851	Walki Bk.	Loha
852	Malkautha	Mudkhed
853	Telki	Loha
854	Londhe Sangvi	Loha
855	Wagdarwadi	Loha
856	Chondi	Loha
857	Raywadi	Loha
858	Pimpalgaon Dhage	Loha
859	Kabegaon	Loha
860	Dhanora (makta)	Loha
861	Deulgaon	Loha
862	Murambi	Loha
863	Malkajam Tanda (n.v.	Kinwat
864	Kolgaon	Hadgaon
865	Hardaf	Hadgaon
866	HADGAON	Hadgaon
867	Chendkapur	Hadgaon
868	Hajapur	Mudkhed
869	Hajapur	Mudkhed
870	Kolha	Mudkhed
871	Kolha	Mudkhed
872	Chikala	Mudkhed
873	Kuntoor	Naigaon
874	Shekapur	Kandhar