केंद्रीय भूमि जल बोर्ड

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भारत सरकार

Central Ground Water Board

Department of Water Resources, River Development and Ganga Rejuvenation,

Ministry of Jal Shakti

Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

MAHESANA DISTRICT, GUJARAT

पश्चिमी मध्य क्षेत्र, अहमदाबाद

West Central Region, Ahmedabad

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Contents

List of Tables

List of Figures

List of Annexures

GROUND WATER MANAGEMENT PLAN OF

MAHESANA DISTRICT

I. Introduction

Aquifer mapping addresses the issues related with development of groundwater resources in terms of quantity and quality of ground water in the aquifer systems of an area. In order to address the issues arising from development of the aquifer system, information on the vertical and lateral extent of the aquifers, characteristics of aquifers and recharge and discharge mechanisms of the aquifer system is much required.
The aquifer mapping study has been initiated since 2012 and has contributed to 1) collection of data, 2) descriptions of the geologic and hydrogeological characteristics of the aquifer system 3) conceptualization of the aquifer and finally, 4) to prepare aquifer management plan for effective management of the groundwater resources. In this Report Aquifer Mapping and Management plan of Mahesana District is discussed. The Mahesana district forms a part of the Cambay Basin which hosts the most productive aquifers in north Gujarat area. The aquifer of North Gujarat is regionally extensive and characterized by alternate layers of sand, clay, silt, gravels etc.

1. Objectives

The aquifer mapping implemented is primarily based on the existing data that are collected, compiled, analyzed and interpreted from available sources. In order to represent the heterogeneity of ground water system, the complexity of aquifer system on map is simplified based on the availability of data for generation of information to be depicted in Aquifer maps broadly representative of the area. The data gap analysis carried out helped in to propose/generate additional data from new data-collection activities such as exploratory drilling, geophysical investigations, water level measurements and groundwater quality analysis. By integrating and analyzing the existing data and the data generated, regional hydrogeological maps, thematic maps, water quality maps, cross-sections, 2-D and 3 –D aquifer dispositions and maps of the potentiometric head were generated. Theses maps were utilized for defining the aquifer geometry and assessment of ground water resources and planning possible interventions for improvement in groundwater scenario.

2. Scope of the Study

Scope of the study is limited to the extent defining the geometry of aquifer system in space i.e lateral and vertical disposition of aquifer system, based on existing available data. Defining characteristics of aquifer system wherever available and its significance in development and management of ground water resources in terms of quantity and quality of groundwater of the area depicting ground water regime in Two and Three dimension form for understanding & quantification of ground water resources in space, demand and supply of ground water and its use in the area. Identification of issues related with development and use of ground water to meet the competing water demand and its depiction for addressing the issue. Groundwater management strategies for addressing the issues by introducing management interventions (on demand and supply side) into the system.
Finally it is the user, whose participatory approach and perspective of ground water development, use and management based on available Aquifer information system as a stakeholder is envisaged.

3. Approach and Methodology

Methodology involves creation of database for each of the principal aquifer. Delineation of aquifer, Aquifer Geometry and their characteristics, integration of Hydrogeological, geophysical, geological, hydrochemical data on GIS platform, identification of issues, manifestation of issues and formulation of strategies to address the issues by possible interventions at local and regional level.

The activities of the Aquifer Mapping can be grouped as follows

i. Data Compilation & Data Gap Analysis:

One of the important aspect of the aquifer mapping programme was the synthesis of the large volume of data already collected during specific studies carried out by Central Ground Water Board and various Government organizations with a new data set generated that broadly describe an aquifer system. The data were collected from the available sources, analysed, examined, synthesized and interpreted. Predominantly non-computerized data was converted into computer based GIS data sets and on the basis of available data, data gaps were identified.

ii. Data Generation:

There is a strong need for generating additional data to fill the data gaps to achieve the task of aquifer mapping. This was achieved by multiple activities such as exploratory drilling, geophysical techniques, hydro-geochemical analysis, remote sensing, and hydrogeological surveys to delineate multi aquifer system.

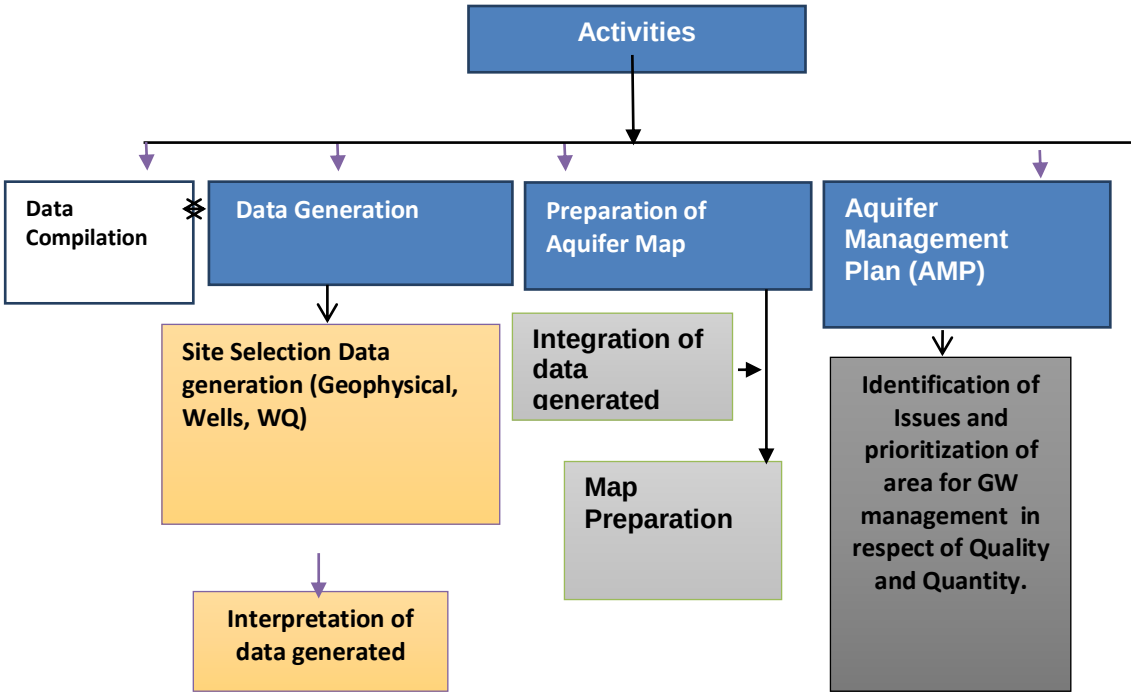
iii. Aquifer Map Preparation:

On the basis of integration of data generated from various studies aquifers have been delineated and characterized in terms of quality and potential. Various maps have been prepared bringing out details of Aquifers, these are termed as Aquifer maps providing spatial variation (lateral & vertical) in reference to aquifer extremities (i.e. quality & quantity).

iv. Aquifer Management Plan Formulation:

A suitable strategy for sustainable development of the aquifer in the area has been formulated.All the above activities under the ground National Aquifer Mapping programme is depicted/elaborated in presented in Chart-1.

Chart – 1: Activities under National Aquifer Mapping Programme



Activities:-

Step 1 :-No activity needed

Step 2 :- Data generation

Step 3 :- Aquifer map preparation

Step 4 :- Preparation of management plan

4. Overview of the Area

Mahesana is one of the agriculturally, socially and economically advanced districts, situated in the northern part of Gujarat State. Regionally, it forms part of North Gujarat Region and is bounded towards north and west by Banaskantha & Patan, towards south by Ahmedabad & Gandhinagar and towards east by Sabarkantha districts. The Mahesana district lies between North Latitudes 23°02' & 24°06’ and 71°55' & 72°53' East Longitudes and falls in the SOI degree sheet nos. 46A & 45D. It is part of north Gujarat alluvium Plain. The district is administratively divided into 9 talukas (Becharaji, Kadi, Kheralu, Mahesana, Satlasana, Unjha, Vadnagar, Vijapur and Visnagar) covering 604 villages that include 10 abandoned villages (Figure-1). Salient features of the district is summarised in Table-1

Groundwater occurs under phreatic and confined conditions and is developed extensively in alluvium through dug wells, dug cum bore wells and tube wells for irrigation and domestic purpose. The Miocene and Cretaceous sediments also form good aquifer and developed in the north, i.e. in parts of Vijapur, Visnagar and Kheralu talukas. The open wells tapping shallow aquifer are few as water table is deep particularly in most part of Mahesana district. In such areas, ground water development is through DCB and TW. Ground water development from phreatic aquifer is low to moderate due to limited saturated aquifer thickness and at place due to low yield &/or salinity. The hard rock aquifer in the north-east yields moderate to low quantity of water and is developed through dug wells and shallow bores in valley areas.

Out of the Nine blocks of Mahesana district Eight are under overexploited category except Vadnagar talukas is categorized under Critical category. Stage of ground water development of the District is 121.55%.

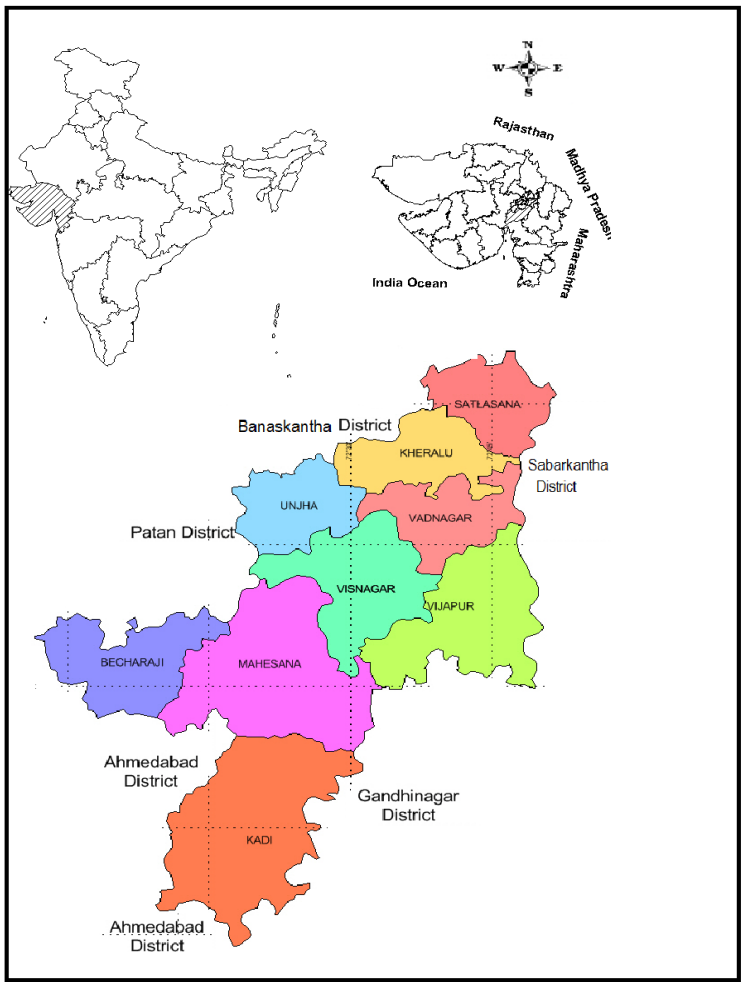
Table –1 Salient Features of Mahesana district, Gujarat

Geographical Area	4,371 sq. km
No of Blocks/ Talukas	9, OE-8, Critical -1
Population (2011 Census)	20,27,727
Average Annual Rainfall	827 mm
Range of Average Temperature	21-31 °C
Major Drainage System	Sabarmati, Rupen & Khari
Major/ Medium Irrigation Scheme	Dharoi
Major Geological Formation	Soft Rock: Alluvium Hard Rock: Granite, Meta Sediments
Utilizable Ground Water Resources (2013)	950.73 MCM/Yr
Net Ground Water Draft	1,155.57 MCM/Yr
Stage of Ground Water Development	121.55 %
Fresh Instorage ground water resources	21,014 MCM AQ-(I+II+III) (2,651+7,736+10,615)
Artificial Recharge and Water conservation structures under different schemes by various department in Gujarat	Check Dams – 2,090 Bori bands – 1,929 Khet Talav – 6,196
Repair ,Renovation and Restoration of Water	Deepening of tanks – 1,280

bodies under different schemes	
No of Tanks under the water resources department	734
Minor irrigation structures (5^{th} MI Census,2013-14)	Deep Tubewells: 761 Shallow Tubewells: 3283 Medium Tubewells:14500 Dug wells:4786 Tanks: 116 Water conservation structures: 481
Blocks Showing Intensive Ground Water Development	**Over exploited** Bechraji Kadi Kheralu Mahesana Satlasana Unjha Vijapur Visnagar **Critical** Vadnagar

The main economic activity in the district is agriculture and animal husbandry. Unjha is the major market for agricultural produce such as cumin, Isabgol and other spices. The major crops are Bajri, Jawar, Wheat, Castor, Cotton, Cumin, Isabgol etc. The district has crude oil and natural gas as its main mineral resources. Agriculture and Animal Husbandry is the main source of livelihood for the rural people of the district.

Figure – 1 Administrative Divisions, Mahesana District



Average annual growth rate of agriculture increased from 3.6% in 1960s to 9.5% in 2010. Understanding the cropping patterns and trends in resource utilization in Gujarat over 1960 to 2000, has invariably drawn attention to erratic and uneven development performance. This is attributed to the inadequate and uneven distribution of rainfall during monsoon often with water scarcity manifested during irrigation development. During the period 2000-2014/15 area /Acreage under major food grains like wheat, most of the cash crops and horticulture crops increased whereas area/acreage under coarse cereals, pulses, oil seeds was declined. This was mainly due to increase in rainfall, irrigation facility and introduction of BT cotton variety.

Mahesana district has followed modern agriculture practices since 1980s and percentage of Gross cropped area irrigated increased from 19.3% in 1960s to 40.1% in 1980s and about > 60% in 2000 and has continued. ***There has been paragon shift in groundwater utilization in the district over the years and is witnessed by change in cropping pattern.*** *Among the different regions North Gujarat reported the highest level of crop diversification followed by middle Gujarat, South Gujarat and Saurashtra – Kachchh. (Ref:Working paper 235)*

5. Data availability

The Geological, Geophysical, Hydrogeological and Hydrochemical data generated during Ground water exploration, Systematic Hydrogeologial studies, Reappraisal Hydrogeological studies, Groundwater Management studies, Micro level hydrogeological studies and special studies by the Central Ground Water Board since its inception has by central and state government and other institutions have been collected and considered. In preparation of Aquifer Map and Ground water management plan. The data available on on soil, Drainage, Geomorphology, Land use and Land cover compiled and integrated to generate respective thematic maps and summarized below in Table - 2.

Table –2 Data availability and utilized for preparation of Aquifer map and management Plan

Sl. No	Themes	Data available/considered			
	Aquifer /Aquifer Group	I Up to 120m		II Between 120 to 200m	III >200m
1	Groundwater level data Long term :	DW	PZ	PZ	PZ
	CGWB	14	7	8	4
	GWRDC +	29	15	13	6
	Total	43	22	21	10
2	Groundwater quality Data				
	CGWB	14			
	GWRDC+	58		11	8
	Total	62		11	8
3	Ground water Exploration Data Aquifer Parameters/ Pumping Test	CGWB -35 GWRDC –137			
4	Borehole Lithology data upto 300 m (SR)/200m (HR)	CGWB -16 GWRDC - 09			
5	Geophysical Data Resistivity Log	Electrical Log - 20 VES - 112			

6	Land use and Land Cover	Information available GIS data set with limited attributes
7	Geomorphology	
8	Drainage	
9	Soil	
10	Irrigation/ Minor Irrigation Data	Available from State Water Resources Data centre
11	Water conservation Structures	Statistical Data available from State Water Resources Department
12	Soil Conservation structures	Statistical Data available from State Government departments
13	Cropping Pattern Data	Zilla Panchayat
15	Hydrological Data	Available from State Water Resources Data centre
14	Rainfall Data	

Source – Government of Gujarat.

6. Data adequacy, data gap analysis and data generation

Data adequacy and data gap analysis carried out on grid basis indicated that though large no of Ground water abstraction structures exists aquifer wise information is available for a few locations in the district.

Table 3 - Data collection and Generation in Mahesana District																		
Sl. No.	Block	Area (sqkm.)	AQSYS	Wells/ TS	Data Required			Data Available and Generated (Till March,2015)			Data to be Generated Inhouse (2015-16)			Balance Data Requirement			Geology
					No of Wells	No of VES	Water Samples	No of Wells	No of VES	Water Samples	No of Wells	No of VES	Water Samples	No of Wells	No of VES	Water Samples	
1	Becharaji	434	3	10	2	3	16		3					2	0	16	SR
2	Kadi	831	3	10	6	10	56		4			4		6	2	56	SR
3	Kheralu	338	2	8	3	7	39		3	27	3	2		3	2	12	HR
4	Mahesana	834	3	10	5	9	51	3	7	51	2	1		2	1	0	SR
5	Satlasana	308	2	8	3	7	36		2	29	3	2		3	3	7	HR
6	Unjha	318	3	10	2	4	21		4	21		0		2	0	0	SR
7	Vadnagar	307	2	8	3	6	36		3	24		2		3	1	12	SR
8	Vijapur	552	2	8	1	2	14		2	14		0		1	0	0	SR
9	Visnagar	485	3	10	4	7	38	3	5	38	1	2		1	0	0	SR
	Total	4407			30	55	307	6	33	204	9	13		24	9	103	

Since all the management plan is based on Aquifer group/system it is observed that for large number of point locations some part of the information available was useful but that does not suffices these points for considering that point as a data point and hence considered data gap for other parameters. It is felt that if closely spaced data/information is available aquifer wise outcome of the Aquifer Map based on such information will be more realistic and serve the purpose for planning local level development and management activities also. Otherwise it largely depends on the nature and extent of the aquifer system in the study area that will qualify the term of adequacy at that point.

For the present study following generalization is made to maintain uniform approach throughout North Gujarat region for data adequacy and to some extent this exercise was carried out Toposheet wise and later on information was regrouped District/Taluk wise for reworking the data adequacy and data gap analysis in District/Taluk. Summary of the Data requirement and existing generated is summarized in Table-3 and 4

Table–4 Data adequacy and data gap analysis and data generation in Mahesana district

S No		Data Requirement	Data available	Additional Data Required	Data generated	Remarks
Water Level	I II III	57 32 32	65 21 10	- 11 22		
Water Quality	I II III	307	42 10 08	247	153	
Geophysical VES		112	33	79	79	
Exploration		EW- 40 OW-24	35	29	8	

7. Rainfall-spatial, temporal and secular distribution

Mahesana district falls under North Gujarat Agro-climatic Zone-IV, which is further sub-divided into 4 Agro-ecological situations. The district has semi-arid climate with three distinguished seasons i.e. Kharif (June to September), Rabi (October to January) and Summer (February to May). Extreme temperatures erratic rainfall and high evaporation are the characteristics of this type of climate. Over 90% of the annual rainfall occurs during South west monsoon between Jun-September. July and August are the wettest months receiving more than 70% of annual rainfall. Out of the total 31 average rainy days, 29 rainy days occur during June to September. Average annual rainfall of the district is 625mm. During 2014-15 it varies from 533 in Kheralu Taluka to 1263 mm in Unjha Taluka. There is a progressive decrease in average annual rainfall towards west. Climatological data (1951-1980) of nearest

IMD station at Deesa is given in the table-4 and depicted in figure-3. The temperature varies from 6.30 ºC to 43.80 ºC.The December and January are the coldest months while April and May are the hottest months of the year.

Taluka wise no of rainy days for the year 2014-15 is given in table -6 and Taluka wise annual rainfall for the year 2003 to 2015 is given in table – 7.

Figure – 3 Climatology Data of Deesa IMD station (1950-1980)

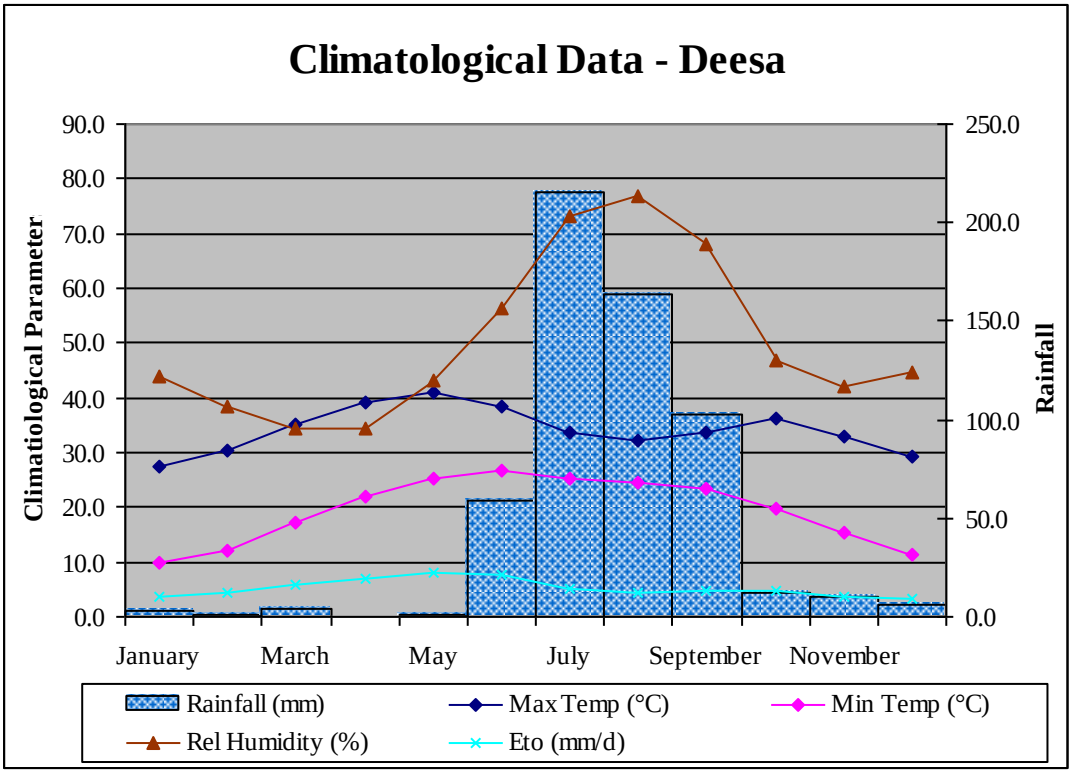


Table – 5 Climatological Data of Deesa IMD station (1950-1980)

Month	Maximum Temp. (°C)	Minimum Temp. (°C)	Humidity (%)	Wind Speed (kmpd)	Sunshine (Hours)	Evapotranspiration (mm/Day)	Rainfall (mm)
January	27.3	9.8	44	129.4	8.9	3.5	2.7
February	30.2	12.0	38.5	127.7	9.5	4.3	0.9
March	35.1	17.1	34.5	136.3	10.1	5.7	4.3
April	39.0	21.9	34.5	134.6	10.8	6.8	0.1
May	41.0	25.3	43.0	184.6	11.4	8.2	1.4
June	38.5	26.7	56.5	246.7	8.7	7.5	59.2
July	33.6	25.4	73.0	201.8	5.3	5.0	215.7
August	32.2	24.5	77.0	162.2	5.4	4.4	163.2
September	33.7	23.5	68.0	122.5	7.9	4.8	102.2
October	36.1	19.7	47.0	100.1	9.6	4.7	12.6
November	33.0	15.2	42.0	103.5	9.3	3.8	10.2

December	29.3	11.2	44.5	115.6	8.9	3.3	6.3
Total							578.8
Average	34.1	19.4	50.2	147.1	8.8	5.2	

Table – 6 Taluka wise Rainfall and Climate (Arid to semi arid)																				
No.	Taluka Name	Year	January - May		June		July		August		September		October		November - December		Annual Total			
			Rainy Days	RainFall m.m.	Rainy Days	Rainfall m.m	Rainy days	Rainfall m.m.	Rainy days	Rainfall m.m.	Rainy days	Rainfall m.m.	Rainy days	Rainfall m.m.	Rainy Days	Rainfall m.m.	Rainy days	Rainfall m.m.	Normal Rainfall	% against normal Rainfall
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Bechraji	2014-15			4	13	8	117	8	50	6	454					26	634	625	101
2	Kadi	2014-15			1	4	8	583	6	90	9	275					24	952	625	152
3	Jotana	2014-15					10	442	11	110	10	333					31	885	625	142
4	Kheralu	2014-15					8	175	5	78	7	280					20	533	625	85
5	Mahesana	2014-15			1	16	11	390	10	60	10	278					32	744	625	119
6	Satlasana	2014-15					10	341	9	79	8	377	1	2			28	799	625	128
7	Unjha	2014-15			1	22	11	425	12	243	9	573					33	1263	625	202
8	Vadnagar	2014-15					10	132	15	152	10	351					35	635	625	101
9	Vijapur	2014-15					10	292	12	153	8	355					30	800	625	128
10	Visnagar	2014-15					9	165	10	112	10	239					29	516	625	83

Climate - Maximum & Minimum Temperature (Degree Centigrade)																
	Location		January	Feb	March	April	May	Jun	July	Aug	September	October	November	December	Annual	
	Centre-Jagudan	Max	25.1	29.7	34.3	39.8	35.9	41.9	40.8	35.5	33.3	33.6	33	27.7		
		Min	9.25	12.1	16.1	20.7	25.3	26.6	28.3	26	25.7	24.4	20.30	11.8		

Kharif- June-September; Rabi – Oct-Jan; Summer- Feb-May

Table –7 Talukawise Annual Rainfall (mm)											
Sr. No.	Year	Name of Taluka									
		Becharaji	Kadi	Kheralu	Mahesana	Satalasana	Unjha	Vadnagar	Vijapur	Visnagar	Average
1	2003	719	985	868	720	614	556	696	1440	797	**822**
2	2004	475	845	604	636	456	514	353	567	629	**564**
3	2005	848	1817	1183	1240	824	925	939	1214	1133	**1125**
4	2006	993	1595	1510	1282	1591	1300	1574	1230	1711	**1421**
5	2007	1165	1456	971	1155	957	1091	922	1236	1118	**1119**
6	2008	925	957	531	560	471	452	439	662	577	**619**
7	2009	328	623	282	697	393	369	370	582	481	**458**
8	2010	1115	1532	557	805	700	669	529	665	721	**810**
9	2011	911	692	516	943	761	613	622	888	1155	**789**
10	2012	211	454	323	451	654	429	385	688	251	**427**
11	2013	586	1308	700	1086	857	1222	587	897	540	**900**
12	2014	634	952	533	744	799	1263	635	800	516	**764**
13	2015	667	727	446	875	710	952	390	767	397	**658**
14	2016	448	453	357	535	598	623	430	514	261	**471**
Average		**757**	**1028**	**670**	**838**	**742**	**784**	**634**	**868**	**735**	**784**

Source: Government of Gujarat

The annual normal rainfall of Mahesana district is 784 mm, during the last four years deviation in annual rainfall from normal as recorded during 2013 is (900 mm) +116 mm, 2014 (764 mm) -20 mm, 2015 (658 mm) -126 mm and in 2016 (471 mm) -313 mm. The area fall under Agro-climatic Zone IV - (Semi-arid and Sub-tropical) and season wise cropping pattern is given below.

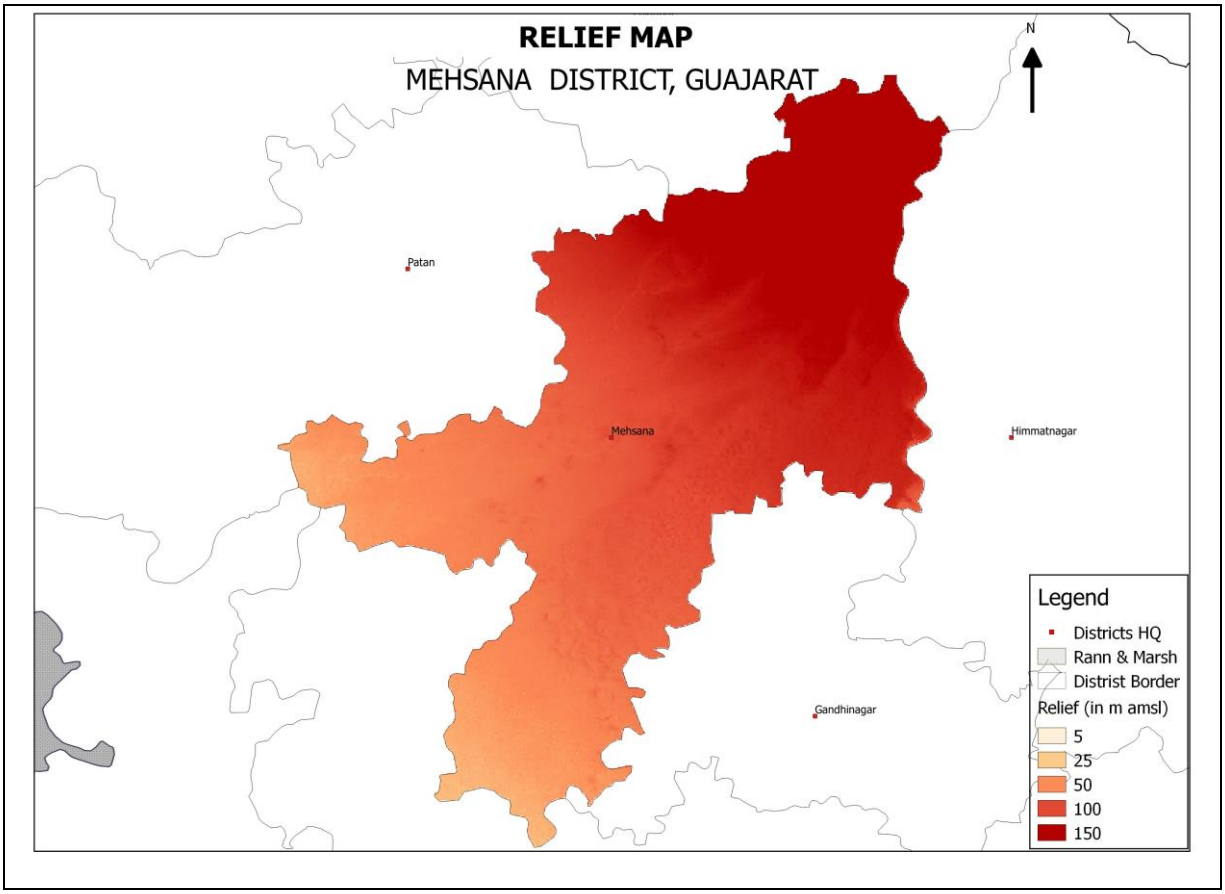
Season wise cropping pattern: Castor, bajra, cotton, tomato, moong are the main kharif crops and wheat, mustard and cumin are the main rabi crops grown in the district. The district has gross cropped area of 5076.25 Sqkm (2015-16) and net sown area of (3407.31 Skkm.) constitute about 77.59% of the total geographical area (4391.53 Sqkm) and the net irrigated area (2878.56 Sqkm) formed 84.48% of the net sown area. (NABARD)

Though the major occupation of the district is farming, there is heavy dependence on rainfall for cultivation. Canal-based irrigation facilities is available in a few blocks like parts of Becharaji, Visnagar , Vadnagar, Kadi and Kheralu. The Tube/bore-wells along with dugwells are the major groundwater abstraction structures for agriculture. Agriculture in the district is going through a major change with farmers progressively switching over to cash-crops and fodder cultivation replacing food crops, including cereals and pulses. The thrust is more on cultivation of hybrid cotton, castor, mustard, tobacco, potato etc.

8. Physiographic setup Digital Elevation Model –

The district has a diverse landscape with surface elevations varying from less than 40 m to more than 500 m above mean sea level. Physiographically, major part of the district forms part of the north Gujarat alluvial plain. Alluvial plain is monotonously flat with gradual slope toward south-west, and exhibits mildly undulating dune landscape. Towards north-east, particularly northern part of Kheralu taluka, the topography is hilly and undulating. Aravalli and Taranga Hills are located in the northern part of the district.
Most part of the district is drained by Rivers Rupen and Khari. Both these rivers are ephemeral in nature and flow only during good monsoon years. The river Sabarmati forms the eastern boundary of the district with very limited catchment area in the district. Major part of the area is devoid of drainage network and does not fall in any catchment.

Figure 4 – Digital Elevation model of Mahesana District



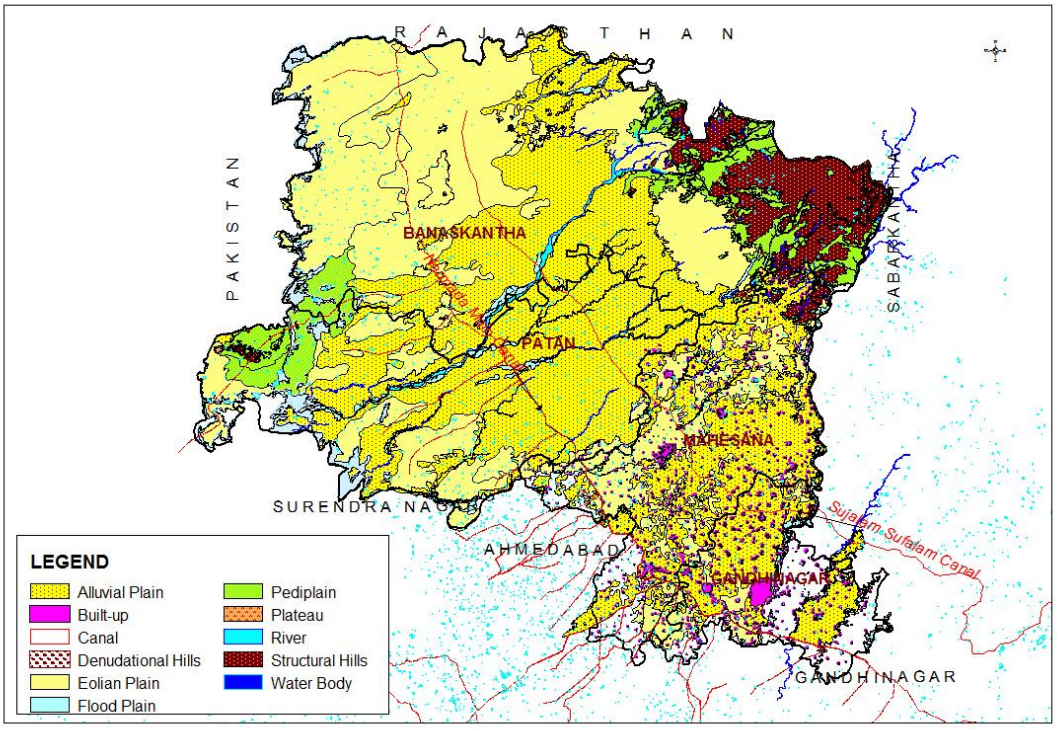
9. Geomorphology

Geomorphologically the area is divided into three major zones

- Alluvial plain: A vast sandy tract characterised by gently sloping, slightly rolling undulatory topography owing to presence of sand dunes. It is the most prominent unit that covers the major part of the district.

- Dissected hilly terrain: The north eastern part of Satlasana taluka which is made up of Delhi metasediments and post Delhi intrusives is characterised by high hills and linear ridges with narrow intermontain valleys.
- Piedmont plain with inselbergs: A belt of about 20-30 km width fringing the hilly terrain in the north eastern part of the district is characterised by moderate relief (2m/km) and is comprised of shallow alluvium with boulder/gravel beds and occasional inliers of older rocks.

Figure – 5 Geomorphology of North Gujarat area



10. Landuse

Landuse data for the year 2013-14 is given in Table

Table-8 Taluka wise Landuse pattern in Mahesana District												
Taluka		**1**	**Bechraji**	**Kadi**	**Kheralu**	**Mahesana**	**Satlasana**	**Unjha**	**Vadnagar**	**Vijapur**	**Visnagar**	**Total**
Geographical area (Sq. km.)		2	399.82	830.98	334.24	832.64	308.33	317.7	312.23	572.15	484.67	4401
Area according to village papers		3	413.81	830.9	334.38	832.65	308.49	316.68	311.32	563.34	479.96	4391.53
Area under Forest		4	0	0	0	0	63	0	0	8.75	0	71.75
Land not available for cultivation	Land put to non agricultural uses	5	33.18	59	31.32	61.98	11.67	29	25.96	26.98	36.14	315.23
	Barren & uncultivable land	6	3.91	3.71	3.08	0.7	17.36	5.05	4.3	12.23	2.09	52.43
	Total (5+6)	7	37.09	62.71	34.4	62.68	29.03	34.05	30.26	39.21	38.23	367.66
Other cultivable land excluding fallow	Permanent pastures & other grazing lands	8	27.19	50.01	23.1	48.45	26.93	15.47	14.72	33.86	28.86	268.59

	Land under miscellaneous tree crops & groves not included in net area sown	9	0	0	0	0	0	0	0	0	0	0
	Cultivable Land	10	349.53	718.18	276.88	721.7	189.53	267.16	266.34	481.52	41.2	3312.04
	Total (8+9+10)	11	376.72	768.19	299.98	770.15	216.46	282.63	281.06	515.38	70.06	3580.63
Fallow land	Fallow land other than current fallow	12	0	1.03	0	0	0.49	0	0	0	0	1.52
	Current fallow	13	7.71	10.76	4.02	5.4	18.66	3.56	14.47	72.51	3.46	140.55
	Total (12+13)	14	7.71	11.79	4.02	5.4	19.15	3.56	14.47	72.51	3.46	142.07
Net area sown		15	337.25	699.31	268.72	715.01	150.4	260.6	249.98	405.07	407.08	3493.42
Area sown more than once		16	79.83	197.93	110.99	150.86	58.5	65.22	59.71	113.79	138.03	974.86
Total cropped area (15+16)		17	417.08	897.24	379.71	865.87	208.9	325.82	309.69	518.86	545.11	4468.28

It is observed that out of a total geographical area of 4391.53 sqkm, 71.75 sqkm area is under forest which is 1.63 % of the total geographical area. Out of net sown area of 3493.42 sqkm , 974.86 sqkm area is sown more than once thus the total cropped area is 4468.28 sqkm giving a cropping intensity of 127.9%.

11. Soil

In major part the district soils are sandy in nature. Most soils have good aeration, porosity and permeability. The soils of the district possess neutral soil pH (6.5 to 7.5). Organic carbon and nitrogen content of the soil is low, phosphorus content of the soil is medium and high in potassium. In general the soils are poor to medium in water retention capacity and overall, the soil fertility indices are poor from the point of view of agriculture. Soils of the district fall in five broad categories as below.

a) Saline and alkali soils: These are typically deep, grey calcareous sandy clay loams of low permeability.
b) Calcareous sandy loams: These are generally Deep, light grey or brown sandy loams of moderate to good permeability and drainage.
c) Calcareous sandy soils: These are mostly pale yellow and brown sands & loamy sands of good depth and high permeability.
d) Non calcic brown soils: These are characterised by pale brown to brown deep loamy sands and sandy loams of adequate to good permeability.
e) Non calcic red brown soils: These are of mixed colluvial and alluvial derivations from rocks of the Aravali system. Mostly deep loamy sands to sandy loams with adequate to good hydraulic conductivity.

The hydraulic conductivity of the soils ranges from as low as 0 for saline and alkali soils in the western part to more than 7cm/hr for calcareous sandy soils in the north and west. Areal distribution is given below in table

S.No.	Soil	Taluka	% Area
1	Black and sandy soil	Kadi	15
2	Sandy loam rocky and sandy	Kheralu, Vadnagar, Satlasana, and Unjha	59
3	Sandy Loam, sandy	Visnagar, Bijapur and Mahesana	7
4	Black and Saline salty soil	Becharaji	19

12. Hydrology

The district is deficient in surface water resources. There are no perennial rivers as such and the water resources mainly depend on the surface run-off and river flows during monsoon period. Mahesana district falls in the Regional basin of rivers draining into little rain of Kachchh. Basin wise surface water available for planning aquifer recharge is given below table-…. And same is depicted in Map.

Table –9 Available, Committed and surplus Surface water (MCM)

Sr. No.	Regional Basin	Basin	Available	Total committed	Surplus*
	Rivers Draining into the Little Rann of Kachchh	Banas	295	672	0
1		Saraswati	400	100	300
2		Rupen	163	25	138
3		Other area	150	7	143
			1008	804	581

Note: In the basins where total committed is more than available, the surplus is considered as zero.

Proportions as given in Arid Zone Report

As per the Table –9, out of 1,008 mcm of total available surface water resource 743 mcm surface water resource of existing Major, Medium & Minor Irrigation Projects & 61 mcm surface water resource stored in existing recharge structures, has been considered as committed resource. Thus, total committed surface water resource works out to 804 mcm, and surplus surface water resource (run off) of 581 mcm is available for Managed Aquifer Recharge (MAR) for Rivers Draining into Rann of Kachchh basins.

Gross capacity of the Dharoi reservoir is 813 MCM and effective storage of 745 MCM. It has Culturable command area and ultimate irrigation potential of 610.85 Sqkm.

Sources of water supply include Major & medium irrigation canals, Minor irrigation tanks, Diversion channels, Rain Water Harvesting structures and Groundwater extraction structures such as Tubewells. There are five line irrigation departments namely Dharoi Nahar, Panchayat Irrigation Department, Sujlam Suflam, SSNNL & GWRDC which are engaged in supply

& distribution of water mainly for irrigation, domestic and also for industrial purposes.

Nagar Palika, Gram Panchayats and Drinking Water Departments are responsible for supplying drinking water. However, to some extent domestic and industrial water requirement is also met from private sources.

The other sources include dug wells, bore wells, farm ponds, village lakes and water tanks. There are around 6826 bore wells/tube wells which cover 1,78,100 ha area, 1307 micro irrigation units cover 25,000 ha and thus meet 85% need of water.

An estimation of dynamic ground water resources and future requirement of district is assessed by Central Ground Water Board and GWRDC, the talukawise details are as under:

Water supply for drinking, industrial and irrigation purposes in the district is from three main sources as below

Source

1. Gujarat Water Supply and Sewerage Board (GWSSB),
2. Narmada canal Based water supply scheme
3. Dharoi Regional Water supply Scheme (Sabarmati).

4. Medium irrigation schemes on river Sabarmati near Village Dharoi in Satlasana Taluk.

Flood Control
Hydropower Generation
Water supply to municipalities
Thermal Power stations
Irrigation through left and right bank canals.

13. Drainage

Major part of the area in the district is devoid of drainage network and does not fall under any catchment. Part of the district is drained by Rivers Rupen and Khari. Both these rivers are ephemeral in nature and flow only during good monsoon years and meet at the small desert of Kachchh. The river Sabarmati forms the eastern boundary of the district with very limited catchment area in the district. It has broad and deep channel and its banks rise to heights of 20-25 meters with bad land features indicating active erosion. In the district as a whole the drainage density is low, except in hard rock areas. This suggests higher soil permeability and in turn high infiltration of rain water in the subsurface. (Figure-5)

14. Agriculture

Mahesana is primarily an agricultural district with about 4468.28 sqkm area under cultivation and majority of its working population is engaged in agriculture and agro related activities. Major food crops of the district are Wheat, Rice, Cotton, Castor oil Seeds, jowar (kharif), groundnut (kharif), bajra, tur, gram, til etc Vegetable crops - Brinjal, Potatoes, Tomatoes, Okra, among orchard crops - Mango, Citrus, Sapota and Spices Fennel seed, Psyllium and Cumin etc are cultivated in the district. Rabi crops are grown with the help of irrigation and occasional fare weather showers. The irrigation water demand is mainly met through ground water. The crop calendar for the main crops is given in table.

Table-10 Crop calendar in the district

Sl.No	Name of Crop	Time of sowing	Time of harvesting
1	Rice (kharif)	July - August	October to November
2	Jowar (kharif)	June - July	Dec – Jan
3	Groundnut (kharif)	May – June	October
4	Cotton	June – July	April
5	Wheat	November – December	March – April
6	Bajra	June – July	October
7	Tur	June – July	October-November
8	Gram	October	March-April
9	Castor	July-August	March-April
10	Til	June-July	October-November

Source: Directorate of agriculture, Gandhinagar

Season wise cropping pattern:

Castor, *bajra*, cotton, tomato, moong are the main kharif crops and wheat, mustard and cumin are the main rabi crops grown in the district.

The district, has gross cropped area of 507625 ha (2015-16) and net sown area (340731ha.) constituted about 77.59% of the total geographical area (439153 ha) and the net irrigated area (287856 ha) formed 84.48% of the net sown area.

Though the major occupation of the majority populace is farming, there is heavy dependence on rainfall for cultivation, next to canal-based irrigation facilities available in a few blocks like parts of Becharaji, Kadi and Kheralu and the bore-wells. Agriculture in the district is going through a major change with farmers progressively switching over to cash-crops and fodder cultivation

replacing food crops, including cereals and pulses. The thrust is more on cultivation of hybrid cotton, castor, mustard, tobacco, potato etc.

15. Irrigation - Minor irrigation structures:

The irrigation water demand is met through ground water abstraction structures i.e. dug wells, tube wells and also by surface flow schemes. The source wise area irrigated by Minor Irrigation schemes is given in table. North-central part of the district is covered by irrigation canals of Dharoi project that provide irrigation in about 300 sq. km command area. However, canal irrigation is provided only during normal or excess rainfall years depending on the availability of sufficient storage in the reservoir.
Ground water is the main source of irrigation in the district, about 93% of the area is irrigated by groundwater. The irrigation potential created through groundwater is 2140.71 Sqkm. There are more than 10250 tube wells and more than 6650 dug wells exclusively for irrigation. *(ONGC Mahesana Report)*
A total of 331.26 Sqkm. area is being irrigated by the minor irrigation schemes in the district both by ground water and surface water schemes.

Table-11 Taluka wise existing and extended Irrigation command area

Name of Project	District	Talukas benefited	Original planned area		Extended area		Total	
			Villages benefited	Planned irrigation area	Villages benefited	Planned irrigation area	Villages benefited	Planned irrigation area
Dhori Reservoir Project (Dharoi Right bank Irrigation area	Mahesana	Mahesana	07	2670	17	3983	24	6653
		Visnagar	29	12683	28	3044	57	15727
		Unjha	15	7358	19	3388	34	10746
		Total	51	22711	64	10415	115	33126

As per the Fourth Minor irrigation census (Base year 2006-07), there are 3908 Dug wells, 217 Shallow Tubewells and 15464 Deep Tubewells total 19589 Ground water structures. There are 325 surface flow schemes and 2 surface lift schemes in the district. More recent information for the year 2014-15 is given below in table.

Table-12 Watershed of North Gujarat covering Mahesana District

No	Water Shed Code	WATERSHED	AREA (sq. km)	DISTRICTS COVERED
1	5F1A6	RB Sabarmati	72	Ahmedabad, Mahesana
2	5F1A7	RB Sabarmati	62	Mahesana
3	5F1B2	RB Sabarmati	73	Banaskantha, Mahesana
4	5H2C4		58	Kutch, Mahesana
5	5H3A1	Mostly Ephemeral	465	Mahesana, Ahmedabad, Surendranagar
6	5H3B2		146	Mahesana, Surendranagar
7	5H3B3	Pushpavati	97	Mahesana
8	5H3B4	Rupen-Khari	125	Mahesana
9	5H3B5	L.Saraswati	80	Mahesana
10	5H3B6	L.Saraswati	55	Mahesana
11	5H3B7	Arjuni	92	Banaskantha, Mahesana
12	5H3B8	Amardasi	45	Banaskantha, Mahesana
13	5H3C1	L.Banas	140	Banaskantha, Mahesana
14	5H3C2	Khara Chekaria	125	Banaskantha, Mahesana
		Total area	1,635	

Table -13 Source wise Irrigation (Area In Sq. Km.)													
No.	Taluka Name	Year	Gross Irrigated Area	Gross Cropped Area	% Of Gross Irrigated Area Against Gross Cropped area	Govt. Canal (length in km)	Private /Panchayat Canal (length in km)	Pond	Dug Well	Other	Area irrigated More than once	Gross Irrigated Area	Net Irrigated Area
1	**2**	**3**	**4**		**5**	***6***	***7***	**8**	**9**	**10**	**11**	**12**	**13**
1	Bechraji	2013-14	268.18	399.53	67	20	0	0	40.8	255.9	29.3	326.20	296.90
2	Kadi	2013-14	546.12	718.14	76	50	0	0.6	108.05	454.8	77.5	641.45	563.95
3	Kheralu	2013-14	175.5	276.88	63	50	0	0.1	91.66	139.49	58.4	290.15	231.75
4	Mahesana	2013-14	546.93	721.7	76	51	0	0	31.0	472.8	158.05	662.36	504.31
5	Satlasana	2013-14	161.5	189.53	85	63	0	0.8	0.25	164.89	4.5	171.07	166.57
6	Unjha	2013-14	222.48	267.16	83	41	0	0	26.62	290.11	14.5	331.64	317.14
7	Vadnagar	2013-14	241.57	266.34	91	30	0	0	5.40	244.1	7.3	257.10	249.80
8	Vijapur	2013-14	323.73	481.52	67	24	0	0	48.25	420.99	155.6	625.08	469.48
9	Visnagar	2013-14	392.52	412.87	95	50	0	0	35.1	413.68	58	507.28	449.28
	Total		**2878.53**	**3733.67**		***379***	0	**15**	**387.13**	**2856.76**	**563.15**	3812.33	3249.18
Gross Irrigated and Rainfed area under Agriculture Crops: Out of total gross cropped area under Agriculture, Mahesana Taluka has a share of 19.3 per cent, followed by Kadi (19.23%) and Vijapur (12.89%). Mahesana Taluka has the largest rainfed area of the district, i.e. ~~38,933~~ ha.													

Table -14 Mode /Source of Irrigation																	
Sl. No.	Taluka Name	Year	Length Of Canal (km)		Dug Well		Only Irrigation Dug well				Dug Well Not In Use	Water Bodies Other Than Ponds	Dug wells For Domestic Use Only	Pond		Oil Engine	Electric Motor
							Govt.		Private					Irrigation More Than 50 Ha	Irrigation Less Than 50 Ha		
			Govt.	Private	Govt.	Private	Lined	Unlined	*Lined*	Unlined							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Becharaji	2013-14	20	0	24	575	0	0	144	98	178	0	15	0	0	267	252
2	Kadi	2013-14	50	0	80	815	0	0	1806	0	1715	1	35	0	6	595	1241
3	Kheralu	2013-14	50	0	23	865	0	0	2899	76	705	0	30	0	1	298	1210
4	Mahesana	2013-14	51	0	30	1965	0	0	61	0	52	0	12	0	0	126	1710
5	Satlasana	2013-14	63	0	1	775	0	0	1398	584	610	0	10	0	8	312	1734
6	Unjha	2013-14	41	0	21	690	0	0	1920	22	242	0	5	0	0	942	1568
7	Vadnagar	2013-14	30	0	26	715	0	0	1192	205	310	0	5	0	0	562	881
8	Vijapur	2013-14	24	0	94	1040	0	0	1006	0	910	0	8	0	0	27	1212
9	Visnagar	2013-14	50	0	70	1116	0	0	112	4	95	0	10	0	0	486	1221
	Total	2013-14	379	0	369	8556	0	0	10538	989	4817	1	130	0	15	3615	11029

Perusal of the above tables indicated area wise, crop wise irrigation status. It is found that **o**ut of gross cropped area of 5,45,781 ha (exclusive of horticulture crops) in the district, 3,73,985 ha (or 68.52%) is irrigated while 1,71,796 ha (31.48%) is rainfed. Kharif crops have a share of 3,04,946 ha (or 55.87%), Rabi crops have a share of 1,87,480 ha (or 34.35%) and Summer crops have a share of 53,355 ha (or 9.78%). Castor and Cotton are the Major crops cultivated in kharif season with an area share of 34.13 per cent and 31.87 per cent respectively. In rabi season, 60.39 per cent area, i.e. 73,843 ha was covered under wheat and 23.74 per cent area (29,036 ha.) was covered under Rapeseed & Mustard. Bajra is the major crop cultivated in summer season with area share of 92 per cent respectively.

16. Cropping patterns

Majority of the households (over 90%) in the Mahesana district are engaged in primary activities of Agriculture. Only 10% of the households are indulged in other activities like small scale domestic business, private and government sector jobs, labour etc. Except from Agriculture as major occupation, locals are also engaged in Husbandry (Livestock) activities as their sub occupation. Livestock's are farmed for their dairy products. There is wide variation in the cultivation of the crops. Almost 25 different crops are grown by the farmers in a year for different purposes. Major crops are Wheat, Bajari, Castor, Cotton, Gram, Gawar, Jawar, Maize, Moong, Rayado, Tobacco, Tal and Variali. These crops are grown in bulk. There are some other crops as well which are cultivated but in small amount and in rotation. These crops are Barley, Kothamir ,Methi, Math, Marcha, Potato, Onion, Water Melon, Flower, Rajka, Rajagra, Satho, Chikuvi etc. In this study only 13 major crops with highest yearly yield are studied because the difference in yield quantity is very wide.

Seasonal Crops

From the Agricultural point of view there are three crop seasons in study area. Three of the seasons have different crops from each other because the time of the cultivation is in the different season of the year. These crop seasons are

Summer (Jayad)
First season of the year starts with summer (Jayad) including crops Bajari, Jawar, Maize, Moong and Tal. This season have bit small variation in crops.

Monsoon (kharif)
Second season of the year is Monsoon (Kharif) with heavy rainfall. Major crops of this season are Arenda, Cotton, Gawar, Jawar, Maize, Water melon, Kakdi,Lady Finger etc.

Winter (Rabi).
Monsoon season is followed by winter (Rabi) season with crops Wheat, Channa, Rayado, Barley, Tobacco and Varyali. Apart from these, crops like Methi, Rajgra, and Math are also grown in winter. This season have more variations than summers.

All the crops of different seasons have different span of time form cultivation to harvesting. Some of them stand in the fields for long time and some take a small span of time but there time of cultivation remains the same according to the temperature required to the sprout of seeds.

A huge change in the cultivation practices takes place when canal was constructed in the area. It gave locals a permanent source of water supply so that they can cultivate large amount of crops without any fear of draught, low rainfall and inconsistent rainfall throughout the year. Some of the crops show increase in the yield due to the permanent irrigational facilities.

Summary of the main crops and their production in the district is given in Table - below

Table – 15 Area under major Crops and its production in Mahesana District

S No.	Crop	Area (sq.km.)	% Against Gross Crop Area	Production (metric Tonne)	Production kg/Hectare
1	Grain & Pulses	1849.7	49.11		
	Paddy Unirrigated	68.1	1.8	2208	3243
	Wheat irrigated	692.23	18.38	19929	2879
	Kharif Juwar	669.46	17.77	3501	523
	Bajri Kharif	48.83	1.29	438	897
	Corn	3.6		35.6	1393
	Total Grain	1500.6	39.89	26112	8935
	Tuvar	0.39			
	Gram	1.79			
	Mung	23.59	0.62	141.54	600
	Udad	23.8	0.62	166.6	700
	Chola/Math	10.89		65.34	600
	Other	286.65	7.61		
	Total Pulse	347.11	9.21	373.48	1900
2	Oil crops				
	Ground Nut	76.82	2.03	1613	2100
	Castor	776.67	20.62	13583	1749
	Mustard	194.53	5.16	2408	1238
	Til	29.29	0.77	102.51	350
	Total Oil crop	1077.3	28.6	17707	5437
3	Other Non Food Crops				
	Cotton	542.98	14.41	66.79	1230
	Tobacco	129.72	3.44	1282	988
4	Condiments & Spices	86.75	2.3	388	447
5	Vegetables	79.65	2.11	19462	24435
	Total Non Food Crops 3 to 5	839.1	22.28	211199	27100
	Total All Crops 1 To 5	3766.1	100%	65390	34437

Source: Govt. of Gujarat

Table -16 Cropwise Gross Irrigated Area (Sq. Km.)										
Taluka Name	Becharaji	Kadi	Kheralu	Mahesana	Satlasana	Unjha	Vadnagar	Vijapur	Visnagar	Total
Year	2014-15	2014-15	2014-15	2014-15	2014-15	2014-15	2014-15	2014-15	2014-15	
Wheat	46.65	116.15	65.84	111.32	63.48	46.45	95.2	65.3	81.84	692.23
Juwar	15.5	32.45	2.59	58	5.47	0.2	44.45	15.42	19.5	216.89
Bajri	9.99	0	12.25	17.69	0	5.80	1.20	0	1.90	48.83
Barley	0.20	0	9.15	0.58	3	2.53	0.62	0	1.36	17.44
Corn	0	0	4.90	0	2.90	0	0	0	1.60	9.4
Total Grain	72.34	148.6	118.04	187.59	74.85	54.98	141.47	80.72	106.2	984.79
Gram	0.9	0.05	0.05		0.25		0.42		0.12	17.9
Total Pulses	0.9	0.05	0.05		0.25		0.42		0.12	17.9
Total Grain & Pulses	73.24	148.65	118.09	187.59	75.1	54.98	141.89	80.72	106.32	986.58
Potato	0	0.400	0.84	2.57	3.00	0.19	0.20	58.13	0.18	65.51
Total Food Crops	73.24	149.05	118.93	190.16	78.10	55.17	142.09	138.85	106.5	1052.09
Cotton & Hemp	48.17	71.85	38.69	96.12	18.75	43.35	44.15	91.00	90.90	542.98
Ground Nut	0	0.10	1.18	0	66.14	0	0	9.40	0	76.82
Castor	97.07	165.36	64.8	149.09	36.15	46.95	74.5	48.5	94.25	776.67
Tobbaco	2.31	1.78	1.08	11.64	1.25	6.65	14.00	71.37	19.64	129.72
Grass/Alfalfa	16.55	60.6	42.67	57.73	14.50	16.32	11.52	20.64	45.08	285.61
Total Nonfood Crops	164.1	299.69	148.42	314.58	136.79	113.27	144.17	240.91	249.87	1811.8
Total Crops	**237.34**	**448.74**	**267.35**	**504.74**	**214.89**	**168.44**	**286.26**	**379.76**	**356.37**	**2863.89**

17. Prevailing water conservation/recharge practices and other relevant Information

State is experiencing water shortage since last 3 decade owing to increase in water demand in agriculture sector. This has created lot of awareness and state is in practice of implementing various water conservation techniques including construction of large number of Artificial Recharge and Water conservation structures under different schemes by various departments. Efforts made and work undertaken/completed is given in Table-

Table – 17 Water conservation structure completed in Mahesana District as on 31.03.2014

Organization and Structures		Nos.
W.R.D. check dam		1234
Rural Dev. Deptt.	Check dam	256
	Bori bandh	1901
	Khet Talavadi	4317
Tribal Deptt.	Check dam	0
	Bori bandh	0
Forest & Environment Deptt.	Check dam	26
	Bori bandh	28
Agriculture Deptt.	Check dam	574
	Bori bandh	0
	Khet + sim Talavadi	1879
Water Supply check dam		0
Total	Check dam	2090
	Bori bandh	1929
	Khet Talavadi	6196

Table-18 Deepening of Tanks under different schemes in Mahesana District

Water resources Department	903
Gujarat Pattern (By Water Res. Dept.)	0

Land Dev. Cor.	94
Land Dev. Cor. (By Grant of Water Res. Dept.)	0
Land Dev. Cor. (By the Grant of GHDC)	0
Rural Development	32
Registered Sahakari Mandli	222
Forest Deptt.	29
Panchayat Dept.	0
Municipal Finance Board	0
Industries Dept.	0
Total	1280

Number of Tanks under water resources department – 734

Water conservation structures under Minor Irrigation – 192

Large number of structures constructed in the District has resulted in arresting of declining ground water level even in the increasing ground water development scenario to some extent. A precise detail of the structures constructed is readily not available with the concerned departments. *Details available of Water conservation structures/Recharge structures/Soil conservation structures is given in Annexure-(DWDU, Panchayat Irrigation Department, GWRDC, WASMO etc)*

II. Data Collection and Generation

Central Ground Water Board and GWRDC are the only two agencies in the State that carry out Systematic hydrogeological and hydrochemical data generation and analysis. Data Collected and generated by CGWB and GWRDC are compiled for the following

Data generated prior to implementation of NAQUIM i.e. up to March 2012 were compiled and data requirement as per prevailing hydrogeological conditions were worked out. Need for generation of additional/balance data requirement was assessed and accordingly data generation was taken up in the district. During the process additional data generated by GWRDC and CGWB is also incorporated in the preparation of Aquifer Map and Ground water management Plan. Item wise summary of the Hydrogeological, Hydrochemical, Geophysical, and Exploratory drilling data is given in the respective tables including data generated under NAQUIM i.e from April 2012 onwards.

Table –19 Data Collection and generation for preparation of Aquifer map and management Plan

Sl. No	Themes	Data available/considered				
	Hydrogeological data	I 120m		II 200m	III >200m	
1	Groundwater level data Long term :	DW	PZ	PZ	PZ	
	CGWB	14	7	8	4	
	GWRDC +	29	15	13	6	
	Total	43	22	21	10	
2	Hydrochemical Data					
	CGWB	14				
	GWRDC+	58		11	8	

	Total	62	11	8	
3	Geophysical Data Resistivity Log	Geophysical Log - VES -			
4	Ground water Exploration Data Aquifer Parameters/ Pumping Test	CGWB -35 GWRDC –137			Partial Data availabl e
4	Borehole Lithology data upto 300 m (SR)/200m (HR)	CGWB -16 GWRDC - 09			

The historical data on ground water regime as well as ground water exploration carried out by CGWB and State government agencies is collected and compiled and used for initial analysis so as to identify the aquifer wise spatial data gaps. Hydrogeological data of CGWB exploratory wells, CGWB/State govt. Piezometers, Production wells for water supply and Irrigation tubewells have been compiled and analysed. These data contain partial information on lithology, Depth, Zones tapped, Inferred zones from E-logs, Water level, discharge, chemical quality etc. from the wells of depth varying between 60m to 600m. Data gap analysis was carries out SOI toposheet wise.

Hydrogeological Data (water level, pumping tests, soil infiltration studies, slug test etc. is given in annexure – 1, Hydrochemical data (water quality sampling, number of samples and analysis etc. is given in annexure-2, Geophysical data (location, number, analytical techniques etc. is given in annexure-3 and Ground water exploratory drilling data of CGWB and GWRDC is given in annexure-4 (number, location, depths, zone tapped etc.)

Table – 2 0 Summary of Ground water exploration data (Aquifer properties)

Sl.	XLONG	YLAT	VILLAGE	YEAR_CONS	STATE	DISTRICT	TALUKA	DEPTH_DR (m)	DEPTH_CONS (m)	Zfrom (m)	Zto (m)	AquiferThickness (m)	PT_Disch (lpm)	Specific Capacity (lpm/m)	Transmissivity (m²/day)	Permeability	Storage Coeff
No. 1	72.200	23.183	Wadhrod	1958-1962	Gujarat	Mahesana	Kadi	30	26	4	26	8	210	25	32	4.	
2	72.466	23.733	Vala	1958-1962	Gujarat	Mahesana	Visnagar	30	28	7	28	1	249	40	113	1	
3	72.716	23.533	Pilwa	1971-1974	Gujarat	Mahesana	Vijapur	613.	284.	22	27	4	19	2.	7	1.	0.00008
4	72.491	23.666	Saola (Sawala)	1971-1974	Gujarat	Mahesana	Visnagar	524	240.	20	23	2	225	21.	78	34.	0.000211
5	72.500	23.666	Saol	1971-1974	Gujarat	Mahesana	Visnagar	20	20	16	18	2	66	8.	63	1	
6	72.133	23.516	Charasan	1971-1974	Gujarat	Mahesana	Becharaji	21	20	17	20	3	63	2.	9	2.	
7	72.133	23.516	Charasan PW-1 PH-1	1971-1974	Gujarat	Mahesana	Mahesana	601	515	494	512	52	517	2.2	59	1.1	

In Mahesana district detailed well inventory of about 124 wells is carried out and about 153 numbers of water samples were collected for detailed chemical analysis. Ground water level is monitored with the help of 89 observation wells (excluding dry piezometer wells) including Shallow and deep piezometers of CGWB and State Government agencies in the area.

Apart from the CGWB data information about the saline fresh water interface available from the Exploratory drilling data of re-drilling programme of GWRDC is also considered. Summary of data is given in Annexure and saline fresh water interface is depicted in Fig/Plate- 8.

Any method that allows measurement or qualitative observation of the similarities and differences in a particular aquifer characteristic in a vertical or horizontal direction allows assessment of weather an aquifer is homogeneous or heterogeneous. In preparation of aquifer maps validated Lithological logs, water level and water quality data of CGWB and GWRDC wells were analysed and aquifer groups are characterised accordingly. Aquifer heterogeneity is characterised by lateral and vertical variation in lithology and its aerial extent in the area.

Table -21 Data collection and Generation in Mahesana District																					
Sl. No.	Taluka	Area (sqkm)	AQ SYS	Wells/TS	Data Required				Data Available and Generated (Till March,2015)				Data Generation inhouse (2015-16)				Balance Data Requirement				Geology
					No of Wells	No of VES	Water Sample	Sampling for Isotope analysis	No of Wells	No of VES	Water Sample	Sampling for Isotope analysis	No of Wells	No of VES	Water Sample	Sampling for Isotope analysis	No of Wells	No of VES	Water Sample	Sampling for Isotope analysis	
1	Becharaji	434	3	10	2	3	16			3							2	0	16		SR
2	Kadi	831	3	10	6	10	56			4				4			6	2	56		SR
3	Kheralu	338	2	8	3	7	39			3	27		3	2			3	2	12		HR
4	Mahesana	834	3	10	5	9	51		3	7	51		2	1			2	1	0		SR
5	Satlasana	308	2	8	3	7	36			2	29		3	2			3	3	7		HR
6	Unjha	318	3	10	2	4	21			4	21			0			2	0	0		SR
7	Vadnagar	307	2	8	3	6	36			3	24			2			3	1	12		SR
8	Vijapur	552	2	8	1	2	14			2	14			0			1	0	0		SR
9	Visnagar	485	3	10	4	7	38		3	5	38		1	2			1	0	0		SR
	Total	4407			30	55	307		6	33	204		9	13			24	9	103		

III. Data Interpretation, Integration and Aquifer Mapping

Results and interpretation of all studies mentioned leading to preparation of aquifer maps- 2 D and 3D diagrams. Here we discuss the Regional Aquifer system – Cambay basin Central trough in Mahesana district.

Geologically the area is underlain by formations ranging in age from Precambrian to recent. Major part of the area is characterized by the thick quaternary and tertiary sediments deposited in the Cambay basin. The alluvium at surface represents the windblown or aeolian deposits. The river alluvium is observed only along the rivers. Generalised geological succession of the north Gujarat is given in table 22.

Table: 22 Generalized geological succession of the area

Era	Period/Epoch	Series/Formation	Description
Quaternary	Recent to Pleistocene	Alluvium	Fluvial sediment, piedmont, flood plain & valley filled deposit, eolian sand
	Miocene	Alluvium	Marine & non marine sediment
----------Unconformity----------			
Mesozoic	Cretaceous	Himmatnagar sandstone	Sand stones, clay, conglomerate etc.
	----------Unconformity----------		
Proterozoic	Pre Cambrian	Post Delhi intrusive	Erinpura granite Epidiorite, Hornblende schist, gabbro etc.
	----------Unconformity----------		
		Delhi super group	Limestone, calc schist, calc gneiss, phyllite, biotite schist, quartzite.
	----------Unconformity----------		
	Archaean	Aravalli super group	Quarzite, Schist, Phyllite (not exposed in the area)

The alluvium formations have intergranular porosity, and contain water primarily under unconfined conditions. The hydraulic conductivity of the aquifers is variable, depending on the sorting of aquifer materials and the amount of silt and clay present, but generally it is high in case of granular formations. Aquifer thickness ranges from a few meters or few tens of meters in the blanket sands along the hard rock hill ranges in the north and north east to hundreds of meters in the basin-fill aquifers of the Central part of the area i.e. North Gujarat.

In unconsolidated sand and gravel aquifers groundwater flows along relatively short flow paths typical of local flow systems; however, in basin-fill aquifers

have intermediate flow systems, and the thick basin fill of Cambay basin aquifer system has a regional flow system. Likewise, the thick sands of the the Banas/Sabarmati/Sarasvati River Valley alluvial aquifer of the central part may also have regional flow systems.

Widespread, blanket-like deposits of sand and gravel form aquifers in lowland areas along part of the lower reaches of the River. These aquifers mostly consist of alluvial deposits. They commonly contain water under unconfined conditions, and most groundwater flow in them travels short to intermediate distances from recharge to discharge areas.

Basin-fill or valley-fill aquifer materials were deposited in depressions formed by faulting or erosion or both. Fine-grained deposits of silt and clay form local confining units in these aquifers, and thick sequences of the unconsolidated deposits become more compact and less permeable with depth. Most basins are bounded by low-permeability rocks, but some in the Northern fringe of the unconsolidated area may also be hydraulically connected to adjacent Hard-rock aquifers.(Kheralu and Satlasana Talukas)

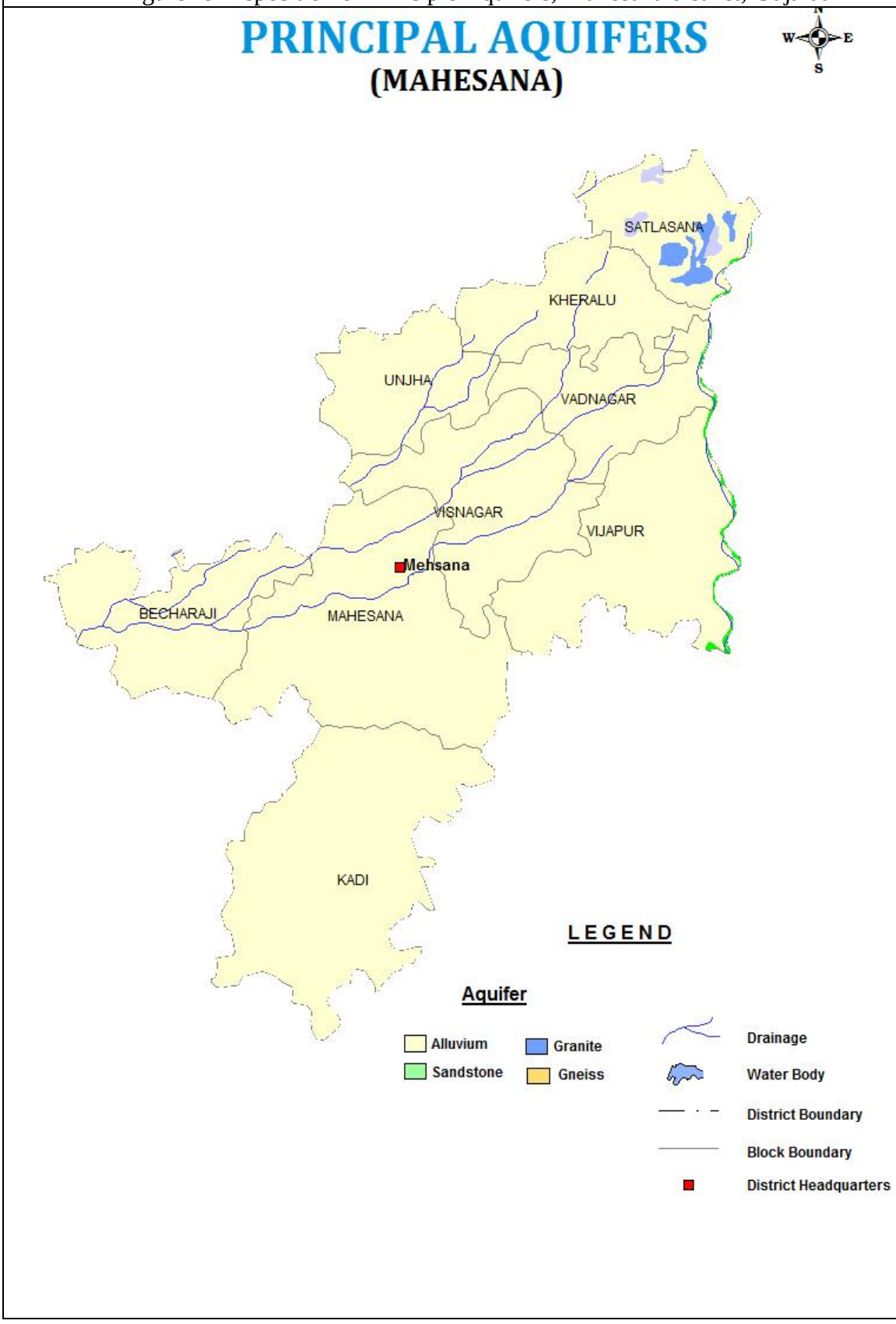
Major part of the area is underlain by alluvium, which is mainly consists of fine to coarse-grained sand, gravel, silt, and clay. The thickness of alluvium gradually increases from piedmont zone in the northeast towards west and southwest. Thickness of alluvium is more towards central part.

Most of the dug wells tapping phreatic aquifer occurring mostly along the Sujalam Sufalam canal which have gone dry over a period of time is observed rejuvenating now at places. In other areas phreatic aquifer at places is sparsely saturated. Ground water occurs in the lower unit of the alluvial formations (deeper aquifer) comprising of few hundred meters of alternate sandy and clayey horizon in semi-confined to confined conditions. The piedmont plain in east and northeast part forms the principal recharge zone for deeper aquifers.

1. Hydrogeology

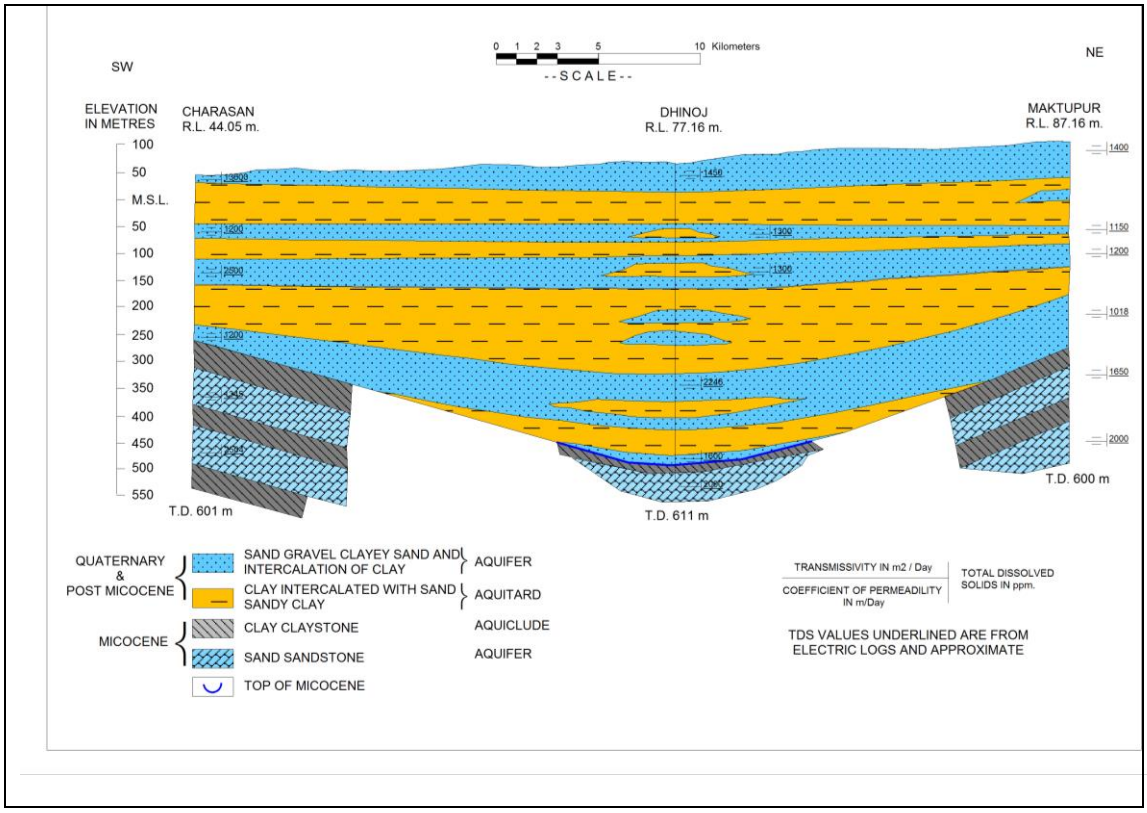
Hydrogeological framework in the district is mainly controlled by the geological setup, distribution of rainfall in time and space, the primary and secondary porosity of geologic formation for recharge and movement of water through them. Ground water occurs both under phreatic, semi confined and confined conditions. However the development is restricted depending on the aquifer geometry and yield characteristics of individual aquifer. The thick alluvial deposit (post Miocene) forms the most prolific aquifer system. The hard rock exposed in the northeast part form aquifer with low yield prospects. Thickness of alluvium is less in the north and gradually increases towards south and south-west. Within the explored depth of 600m, the alluvium is underlain by Miocene sediments (Tertiary) and Himatnagar sandstone (Mesozoic). Pre-Cambrian bedrock is encountered at shallow depth in the north.

Figure- 6 Disposition of Principle Aquifers, Mahesana district, Gujarat



The geological framework with some areas affected by salinity presents a diverse hydrogeological scenario in the district. Pre-Cambrian hard rock, post-Miocene alluvium and Mesozoic sedimentary formations form multiple aquifer system in the district. Within alluvial plains, two major aquifers have been identified up to the maximum explored depth of about 600m below surface. *On the basis of hydrogeological survey and exploratory drilling carried out earlier and findings of UNDP project, which was also extended to western and southern part of the Mahesana district.* Description of various aquifers in Mahesana district, based on studies carried out by CGWB/UNDP (1976) in the North Gujarat is given in Table 22. A Generalised hydrogeological cross section is presented in figure- 7

Figure-7 Hydrogeological Cross section in the centre part of Basin
(Charasan – Dhinoj- Maktupur)



Multilayered aquifer system – Very large storage – Variable flow
Regional extension – Lateral continuity

Table 23: Generalised Hydrogeology of North Gujarat area

Stratigraphy	Formation group	Depth to top of aquifer (m)	Thickness range (m bgl)	Range of transmissivity (m^2/day)	Remarks
Recent to post Miocene	Aquifer A	5-71	35-125	30-1000	Variable water quality
	Aquitard I	79-162	13-88		-
	Aquifer B	78-162	10-80	47-3400	Generally good water quality.
	Aquitard II		13-80		-
	Aquifer C	154-274	13-62	94 (Data available for only one well	Generally good water quality.
	Aquitard III		19-172		-
	Aquifer D	229-402	11-105	1.3 – 6.9	Variable water quality
	Aquitard IV		11-76		-
	Aquifer E	300-542	15-57	Data not available	Developed in central part. Water quality good
Miocene	Aquiclude V		13-148		-
	Aquifer F	200-574	7-68	59-70 |(Tested |Cumulat-|ively) |with	Variable water quality
	Aquiclude VI		34-49	|Aquifer | G	-
	Aquifer G	264-513	9-124	|	Water generally saline
Paleocene to Cretaceous	Basalt				
Cretaceous	Aquifer H	214-547	98-145	86 (Data available for one well.	Variable water quality.

1.1. Aquifer Mapping In North Gujarat Area

Aquifer mapping is takenup in North Gujarat Area under the National Aquifer Mapping Programme (NAQUIM) in Phase –I. Observation and a gist of studies are discussed below.

1.2. Aquifer Disposition

Perusal of the data indicated that the upper unit is mainly phreatic, but at places becomes semi-confined to confined and has been designated as

aquifer "A". The lower unit comprises a few hundred meters of alternating arenaceous (sandy) and argillaceous beds and forms the confined aquifer system. It is sub-divided into aquifer B, C, D and E contained in post Miocene deposits and aquifer F and G in Miocene sediments. The sediments belonging to Mesozoic period include marine as wells as non-marine sedimentary formation. Himatnagar sandstone (Cretaceous) forms local aquifer in north-eastern part and has been designated as aquifer 'H'. Areas with salinity in the southern and southwestern part present a diverse hydrogeological scenario in the north Gujarat. Aquifer 'B' is the shallowest confined aquifer and extends over a large part of the district. It comprises medium to coarse grained sand, gravel with thin intercalation of clay with sand. It is 10m to 60m thick, being thickest in the central part and thinning out in the west and south. The aquifer occurs between a depth of 70 to 180m below land surface. The quality of ground water in general is fresh and most of the tube wells in the district tap this aquifer and thus this is the most exploited one. Aquifer 'C' is the second confined aquifer and occurs between 110 and 215m below land surface. Its thickness varies from 15m to 50m. It consists of medium to coarse-grained sand with minor gravel and clayey sands. Thick clay beds separate this aquifer from the overlying and underlying aquifers. The quality of ground water in this aquifer is good in major part of the district and this aquifer is also exploited heavily for domestic and irrigation purpose. The aquifers occurring below 210 to 290m from land surface have been designated as 'D' and 'E' within post Miocene sediments and 'F' 'G' in Miocene sediments. These aquifers generally have variable quality of ground water and are usually less exploited. Himmatnagar sandstone forms an aquifer in a limited area around Mahi in Vadgam taluka between 230 to 320m bgl resting directly over granite. Lateral extent of major Aquifer systems spread over the area in this region is grouped into four categories and depicted in Figure-7+ as per development/availability of individual aquifer system at depth and is summarized below in Table 24.

Table-24 Lateral extent of identified aquifers and Zoning based on occurrence of aquifers upto explored depth in the area

Generalized occurrence of Aquifers system		Area
Zone-I	Aquifer A & A+B	All along Sujalam Sufalam Canal near the vicinity of canal, Lakroda, Delwad, Mansa, Pilwai etc
Zone-II	Aquifer A+B	All along Sujalam Sufalam Canal,
Zone-III	Aquifer A+B+C	Khoraj Dabhi, Charada, Mahesana

Zone-IV	Aquifer A+B+C+ D (post Miocene Alluvium)	Mahesana, Gandhinagar & Patan
	Aquifer E F G Miocene	Mahesana & Patan
H–Himmatnagar SST		*Mahesana & Sabarkantha*
Unconfined Aquifer - 'A'- down to depth of 100-125m and Confined/Semi confined Aquifers - 'B, C, D, & E- down to a depth between 100-125 to 600 m.		

Aquifer group summary Three aquifer group generalized with base of aquifer separated by Aquitard comprising of Clay interbedded with thin sand layers in the depth range of

Table- 25 Summary of Aquifer Groups in Mahesana District

Aquifer Group	Base of Aquifer (m)	Generalized Thickness	Yield lpm	Quality/ EC (µS/cm)	Water Level/ Piezometric head (mbgl)	Aquifer Type
Aquifer-Group I (A)	90-120	30-85	150 to 300	720-15850	2.75-109.6	Phreatic
Aquifer-Group II (B+C)	180-210	15-90	600 to 1200	1000-4570	32-180	Semi Confined/ Confined
Aquifer-Group III (B+C+D)	(300+)	20-80	600 to 1200	1040-3110	66.64-174.40	Confined

The area has multi layer aquifer system. The aquifers are of pheretic/semi-confined/confined in nature. First Aquifer group is well developed in North & North Eastern part of the district. Second aquifer group is developed in West and West Central part of the district and Third Aquifer Group is developed in Central,Western and Southern part of the district. It is observed that aquifer separation minimal in North and Northeastern part of the area and maximum separation in south and south western part indicating partial control by Major Aravali's in the north and North east and Rann in the west. Depth to ground water level during premonsoon in Phreatic aquifer system is depicted in Figures 9 and variation in water table during premonsoon period is given in figures 10 & 11. In some areas ground water is saline at shallow depth and is followed by fresh/better quality of ground water at deeper depth below these zones. In the southern and south eastern part of the area most of the operating tubewells are constructed tapping quaternary alluvium i.e. zones above the blue clay (Tertiary). Tubewells tapping Aquifer zones below Blue clay are yielding relatively poor quality of groundwater and are with comparatively of higher temperature.

The hard rock granite and gneiss and metasediments in the north-eastern part of area covering part of Satlasana and Kharalu Taluka and Sandstones in the small area at the periphery of Vadnagar and Visnagar Taluks form aquifer with low yield prospects upto 42 m3/hr. Depth to water level ranges from 2.75 to 70 meters below ground level(mbgl) in in Phreatic and 32 – 180 mbgl in first confined aquifer and 66 to 174 mbgl in second confined aquifer and are depicted in Figure .15-17.

Three dimensional aquifer geometry of the Mahesana district is depicted in the form of panel diagram in Figure-. 17 & 18 The perusal of the panel diagrams indicates that the clay content increases from eastern part to western part and the multilayered aquifer system is well developed in the central and southern part of the district. In the northeastern part of the district granular zones are predominant with lack of aquifer differentiation due to absence of clay layers.

1.3. Ground water Level Decline

Aquifer wise historical ground water level data for more than last two decade are available for a few locations in North Gujarat. Study of the data indicated decline in water level/piezometric head in both phreatic, semi confined as well as in confined aquifers over the years. In phreatic aquifer, it is observed at Madhasana OW II of Kheralu taluka of Mahesana district, water level was 19.49m bgl in 1996, 24.79 mbgl in 2007 and now it is dry. At Hariz Pz of Hariz taluka of Patan district, water level was 4.78 mbgl in 1996 and gone down to 23.05 mbgl in 2014. Similarly, at Matarwadi Pz III, depth to water level 21.52 mbgl was recorded in 1996, 71.28m bgl in 2001 and later the well was dry. The dugwell at Varahi, measured 3.67 mbgl in 1996 and 6.20 mbgl in 2014.

For semi confined aquifer, at Hariz Pz-II, water level measured 63.45 mbgl in 1996 was declined to 97.41m bgl in 2008. Similarly Hariz Pz-I also recorded the declining water level of 69.51mbgl in 1996 to 97.57mbgl in 2008.

For the confined aquifer, at Bhutia Vasna Pz-II of Patan district, water level measured 19.43 mbgl in 1996 was declined to 33.95m bgl in 2005. At Chanasma Pz-II, in 1996 water level measured was 94.25 mbgl was declined to 139.77m bgl in 2008. In Deesa taluka of Banaskantha district, at Jherda Pz, 57.2 mbgl water level measured in 1999 was declined to 168.5mbgl in 2015. At Balodhar Pz-I, 79.2 mbgl of water level measured in 2006 was declined to 145.2m bgl 2015. Declines in the water level are summarised in the table 25

Table: 26 Generalized decline in Pre-monsoon water level/piezometric head (in meter) (1996-2015)

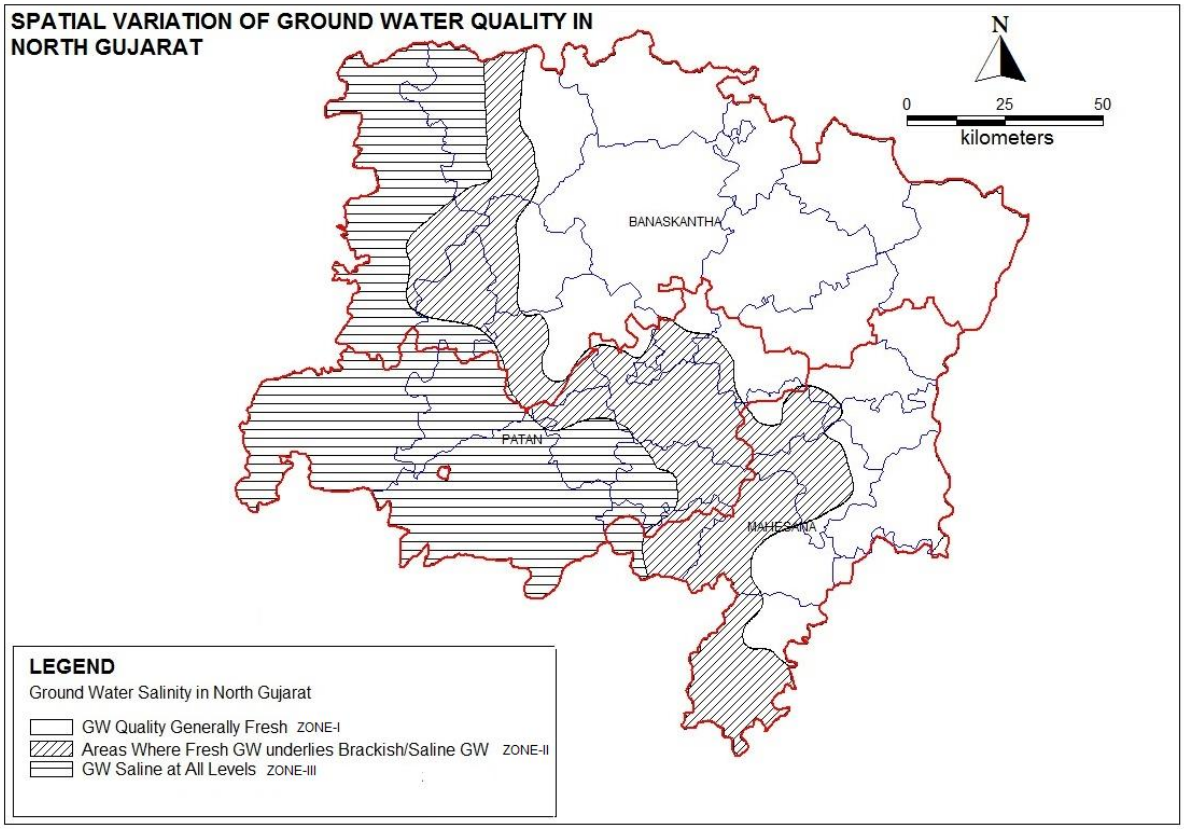
District	Phreatic Aquifer (in m)	Semi Confined Aquifer (in m)	Confined Aquifer (in m)

Mahesana	5 to 7	12 to 23	18 to 50
Patan	2.5 to 49	25 to 36	13 to 45
Banaskantha	9 to 18	21 to 28	15 to 111

1.4. Variation in ground water Quality

Ground water quality of phreatic and confined aquifer system is depicted in figures – 12 & 13. It is observed that Ground water quality is highly variable.

Figure-8 Spatial Variation of Groundwater quality in North Gujarat



The variation in ground water quality in the district is observed in space as well as with depth. The ground water quality of phreatic aquifer is saline in four out of seven talukas; these talukas are located in the western part close to Rann. In these talukas availability of fresh ground water is limited in a few pockets which are under the influence of nearby water bodies.

Considering the spatial variation of ground water quality in North Gujarat Fig-8, The north eastern and eastern part of the Mahesana district generally has fresh ground water at all levels and is classified as Zone I. The central and western part of the district is underlain by brackish to saline ground water in shallow aquifer which in turn is underlain by fresh/better quality of ground water in deeper aquifer is demarcated as zone II. The depth of freshwater in this zone varies from 50 mbgl to 230 mbgl. Very limited western part of the district at the periphery of Patan district has saline ground water at all levels demarcated as Zone III. In this zone fresh water available in few pockets which are under influence of nearby water body. This is probably due to its distance from the recharge area causing increased salinity due to in travel time and more residual time in these aquifers dissolving salts en route.

Figure – 9 Depth to Water Level in unconfined Aquifer
2015 (Pre monsoon)

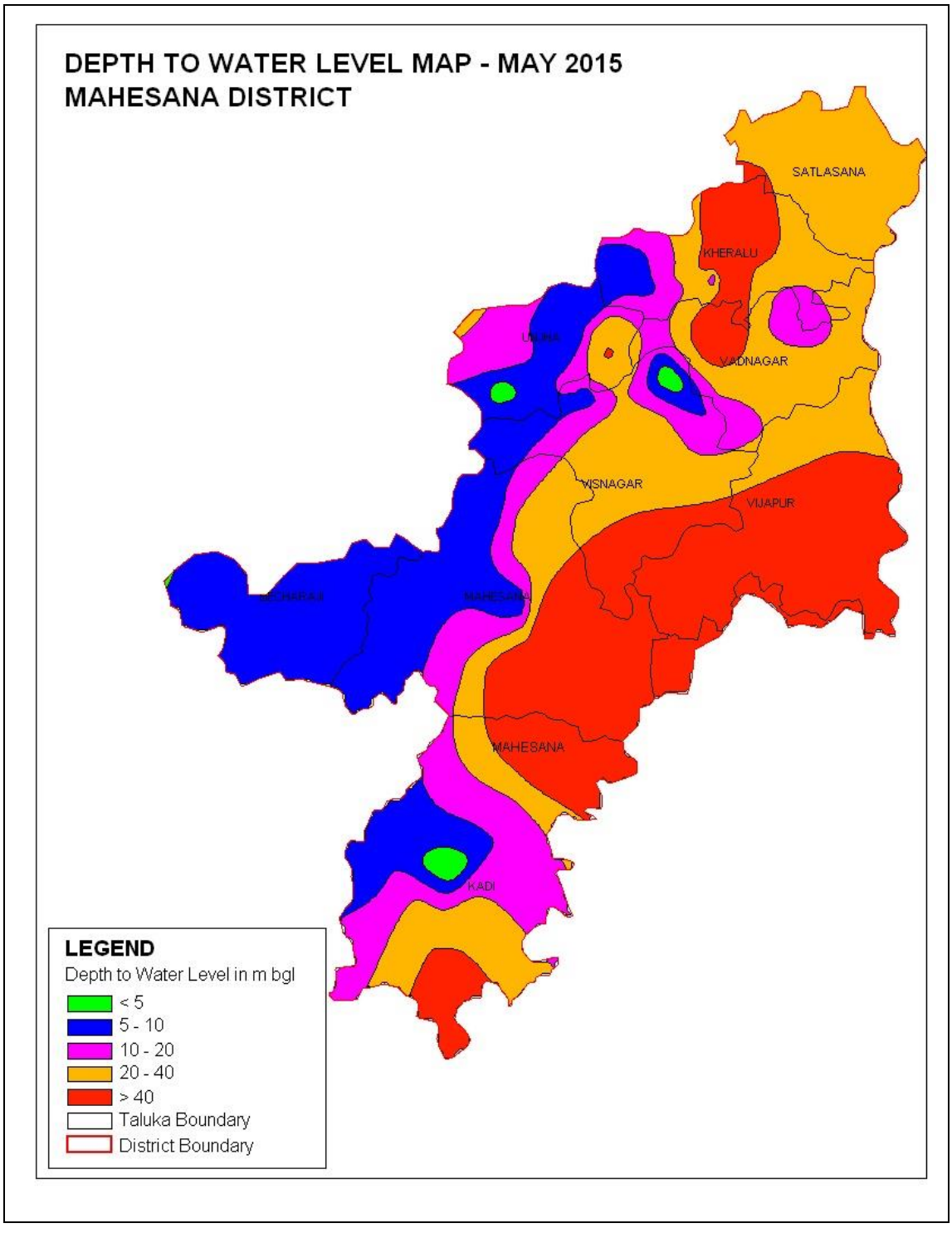


Figure- 10 Water Table elevation in unconfined Aquifer
2015 (Pre monsoon)

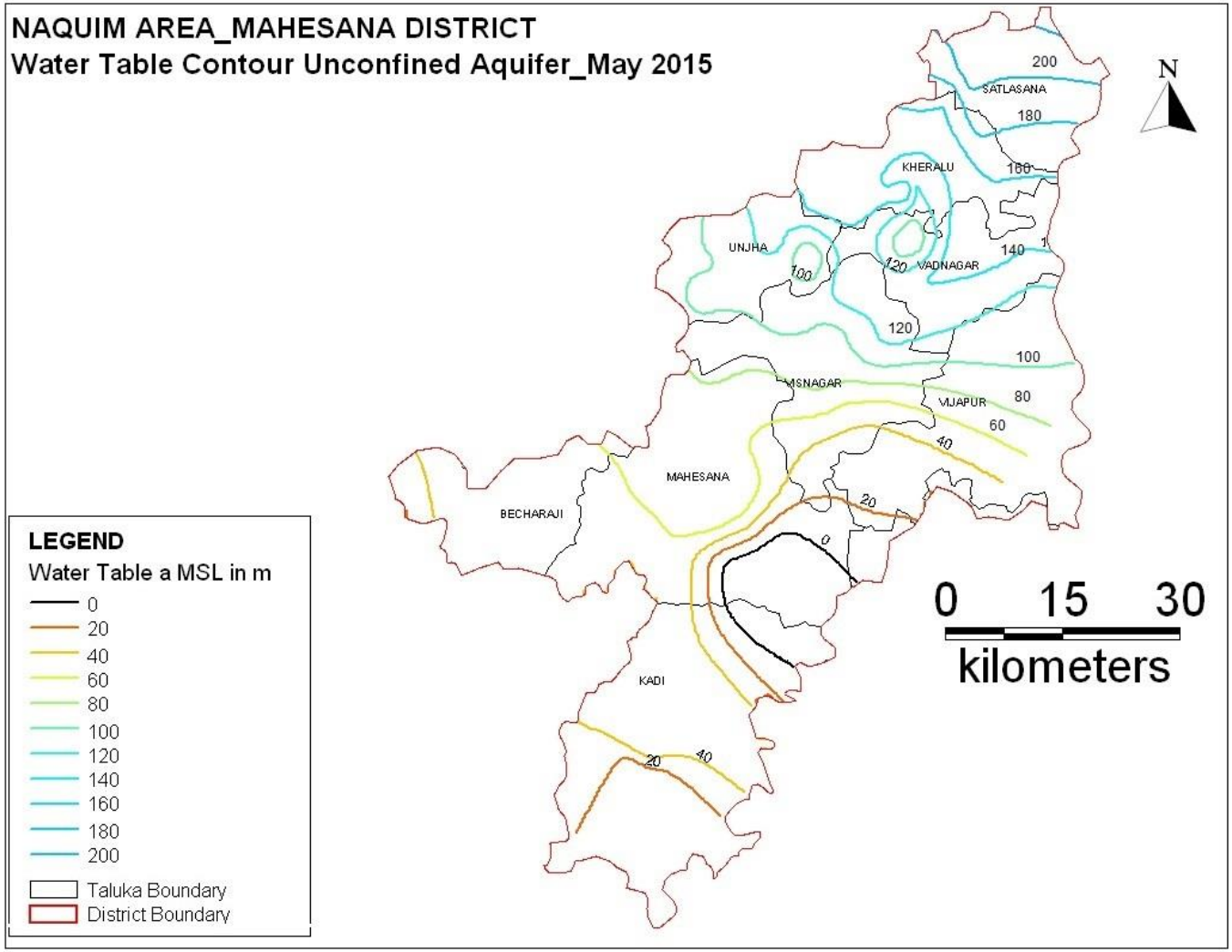


Figure- 11 Water Table elevation in confined Aquifer
2015(Pre monsoon)

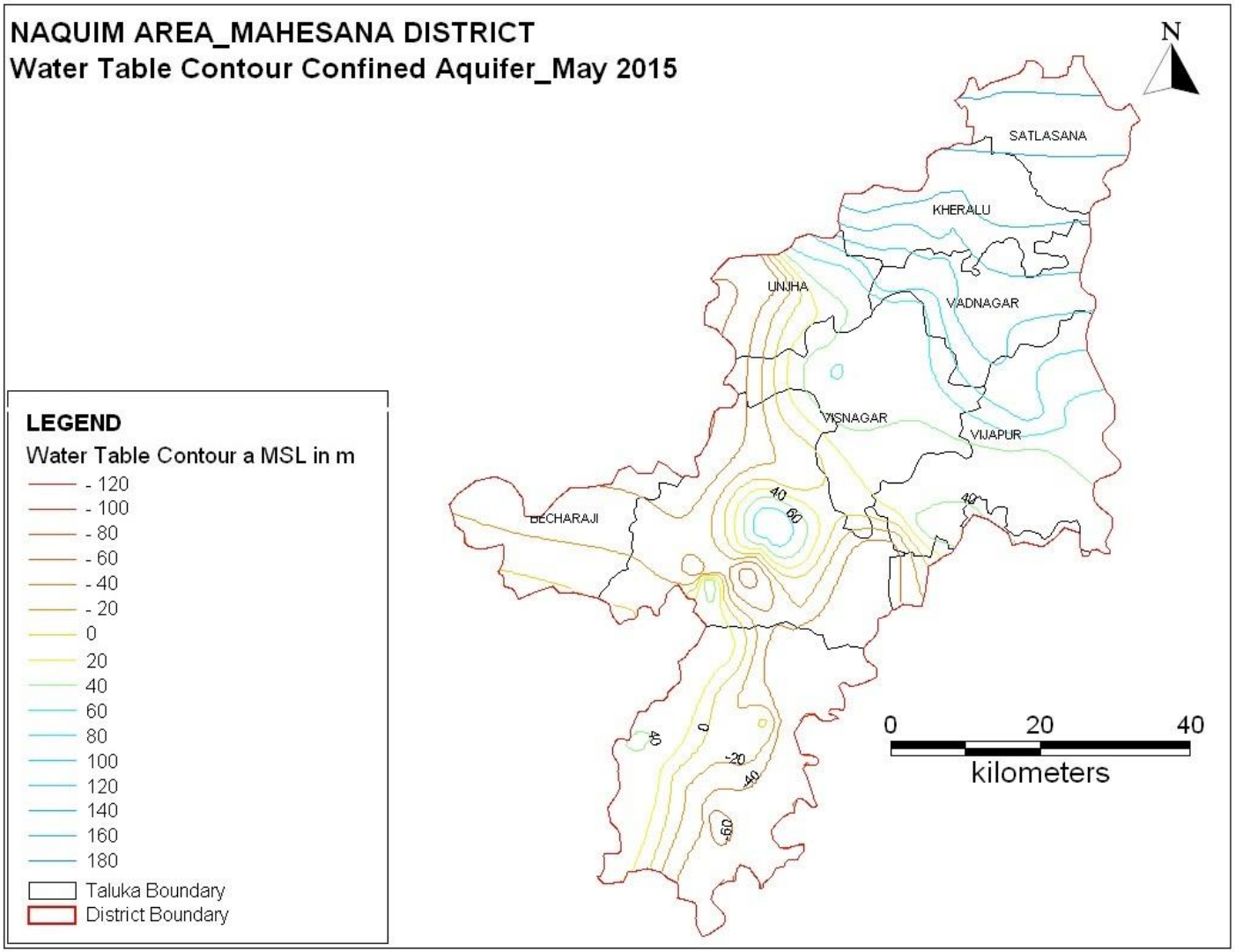


Figure-12 Ground Water Quality in Unconfined Aquifer

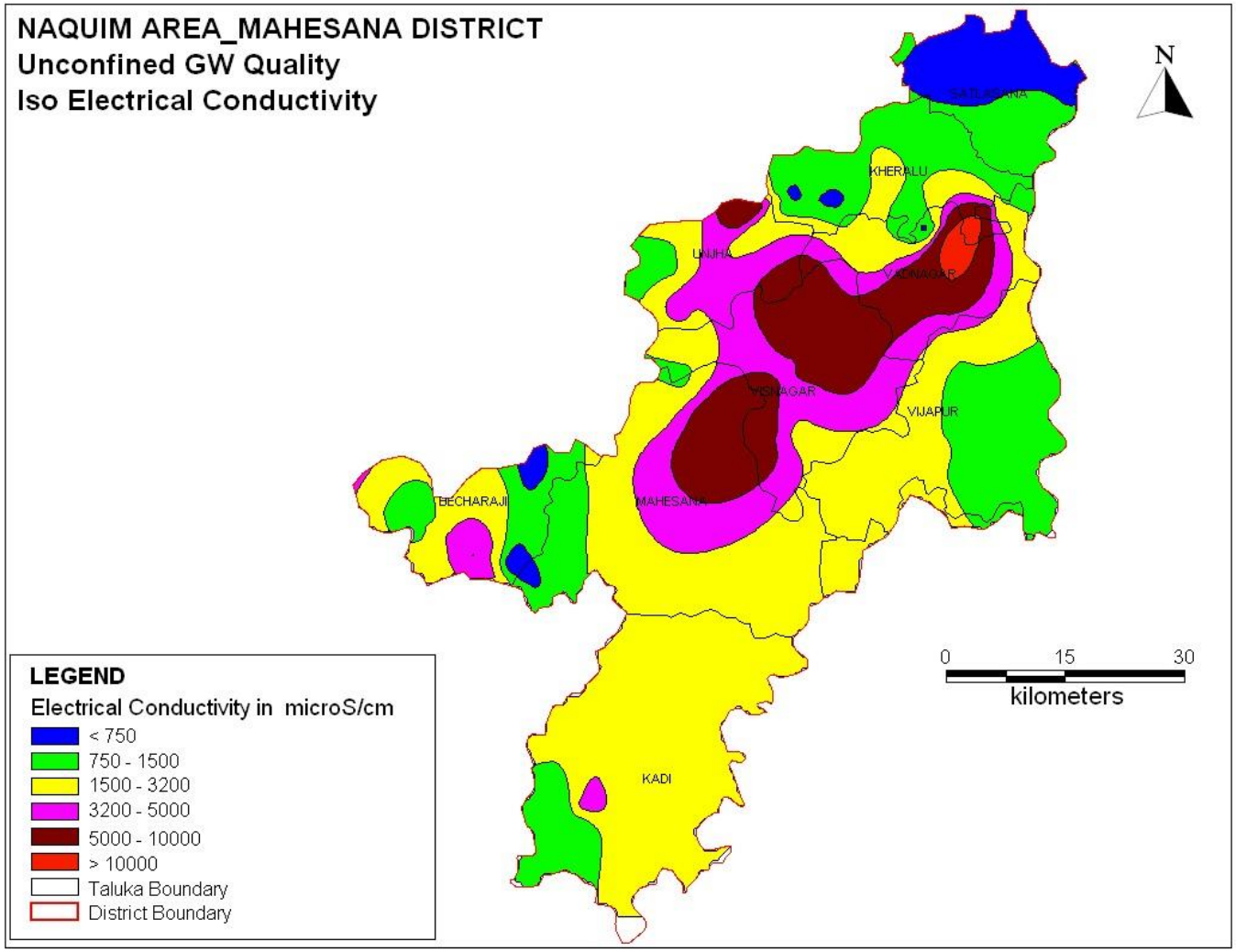


Figure- 13 Ground Water Quality in confined Aquifer

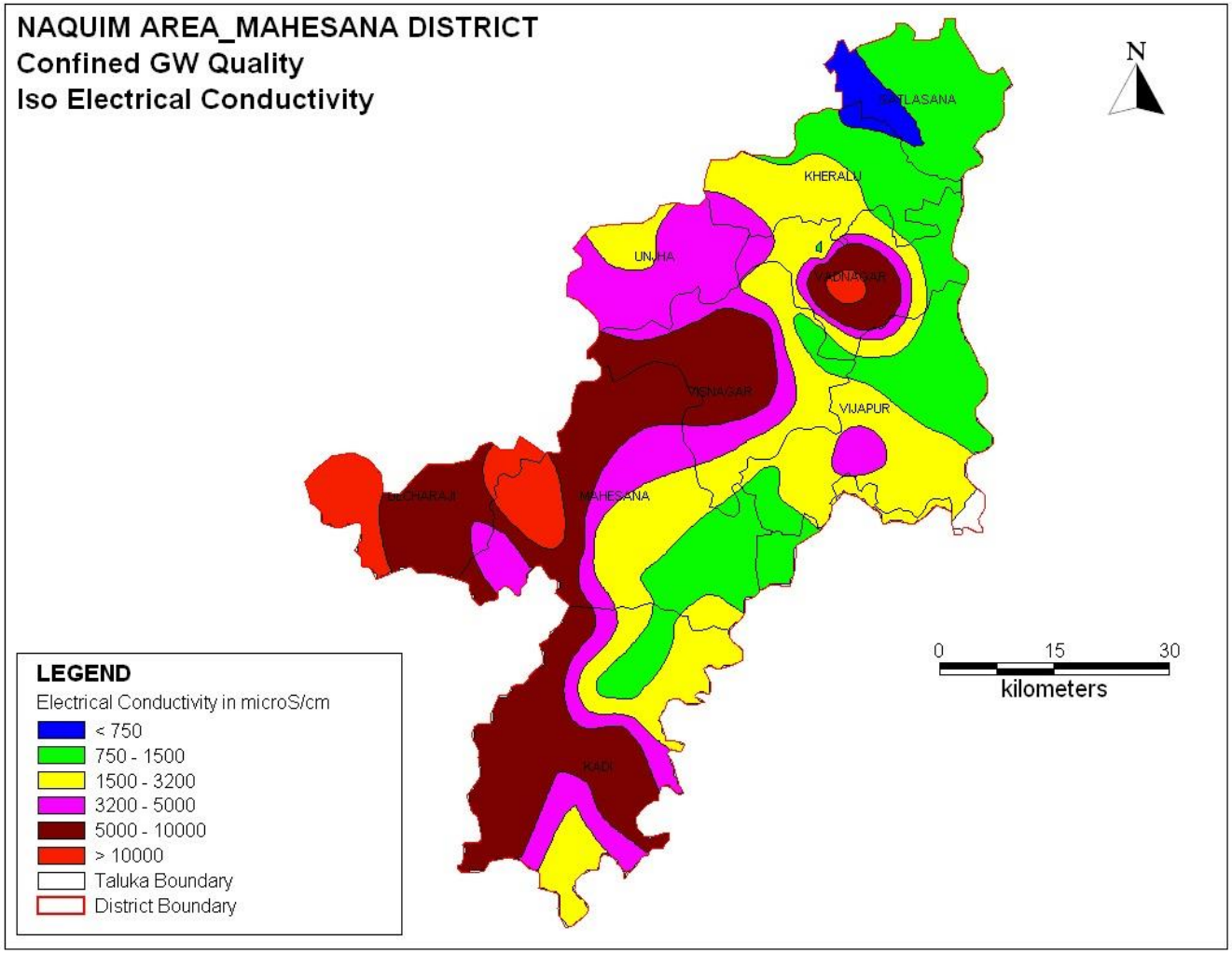


Figure – 14 Typical Hydrogeological cross section of Mahesana Alluvium Aquifer
(Ref: K.R. Ruston & P.N. Phadtare

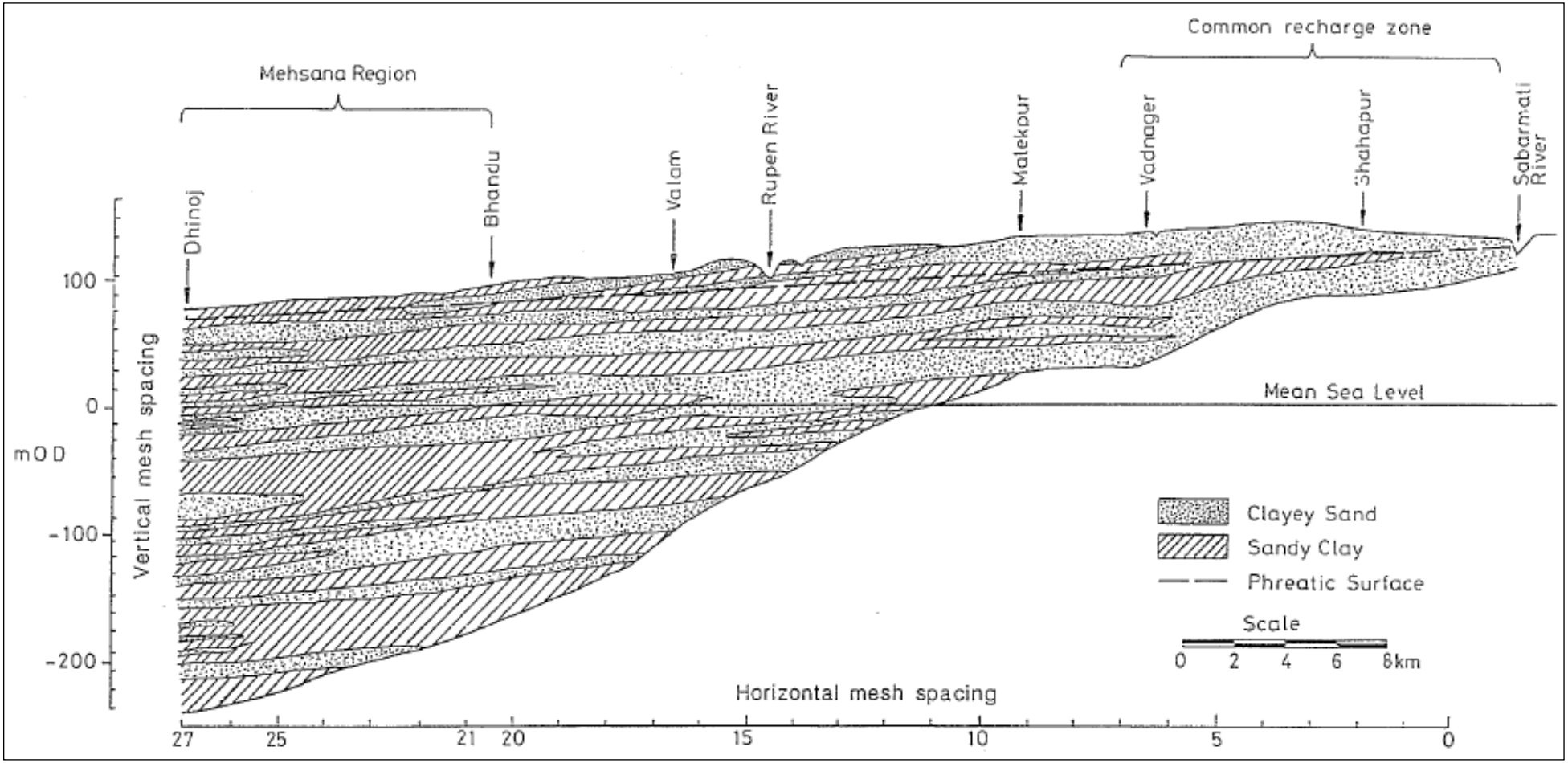


Figure – 15 Hydrogeological cross section along (Sariayad-Kamboi-Jangral-Bhatsan-Rasna) (Northern Part of Mahesana-Patan District)

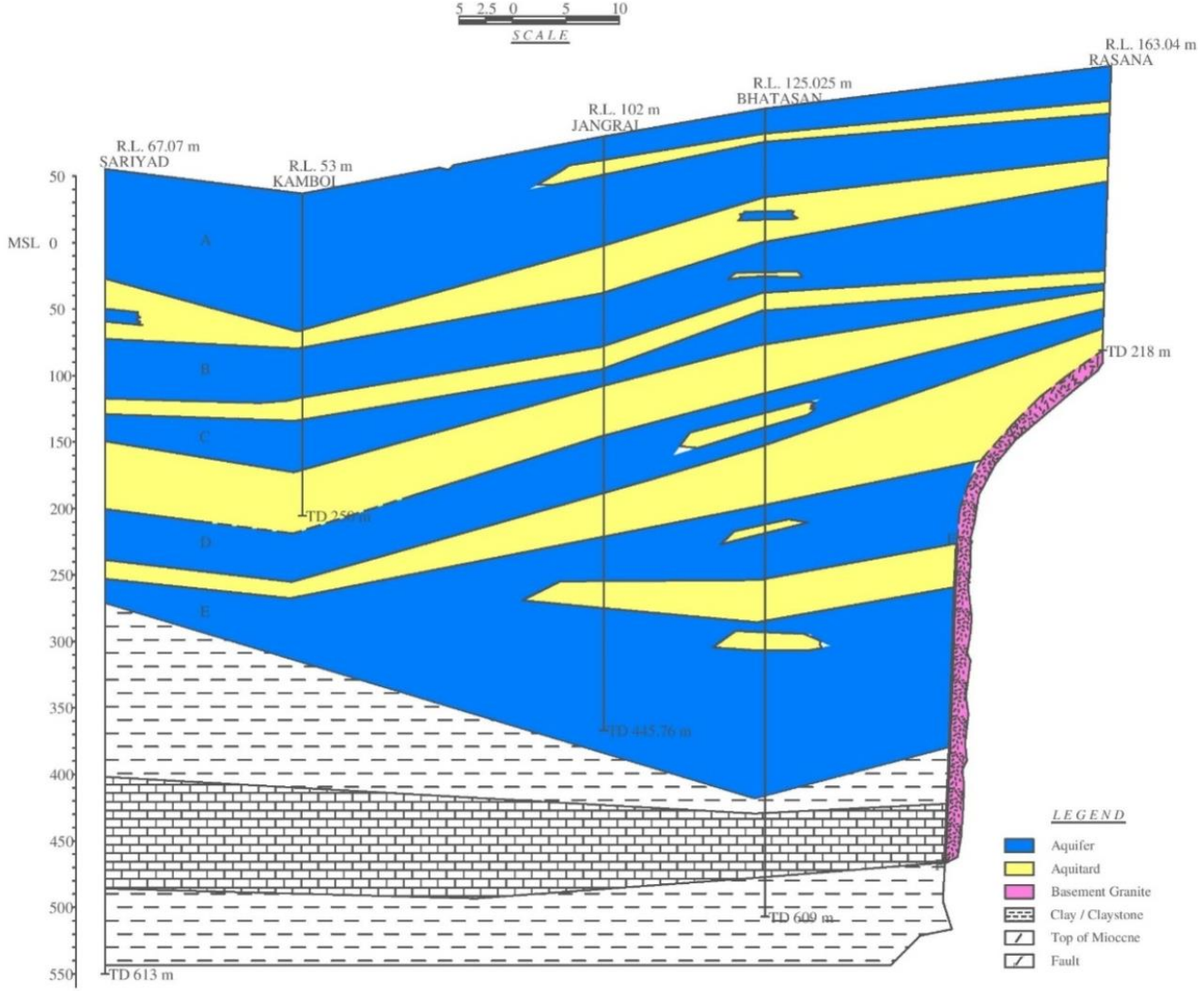
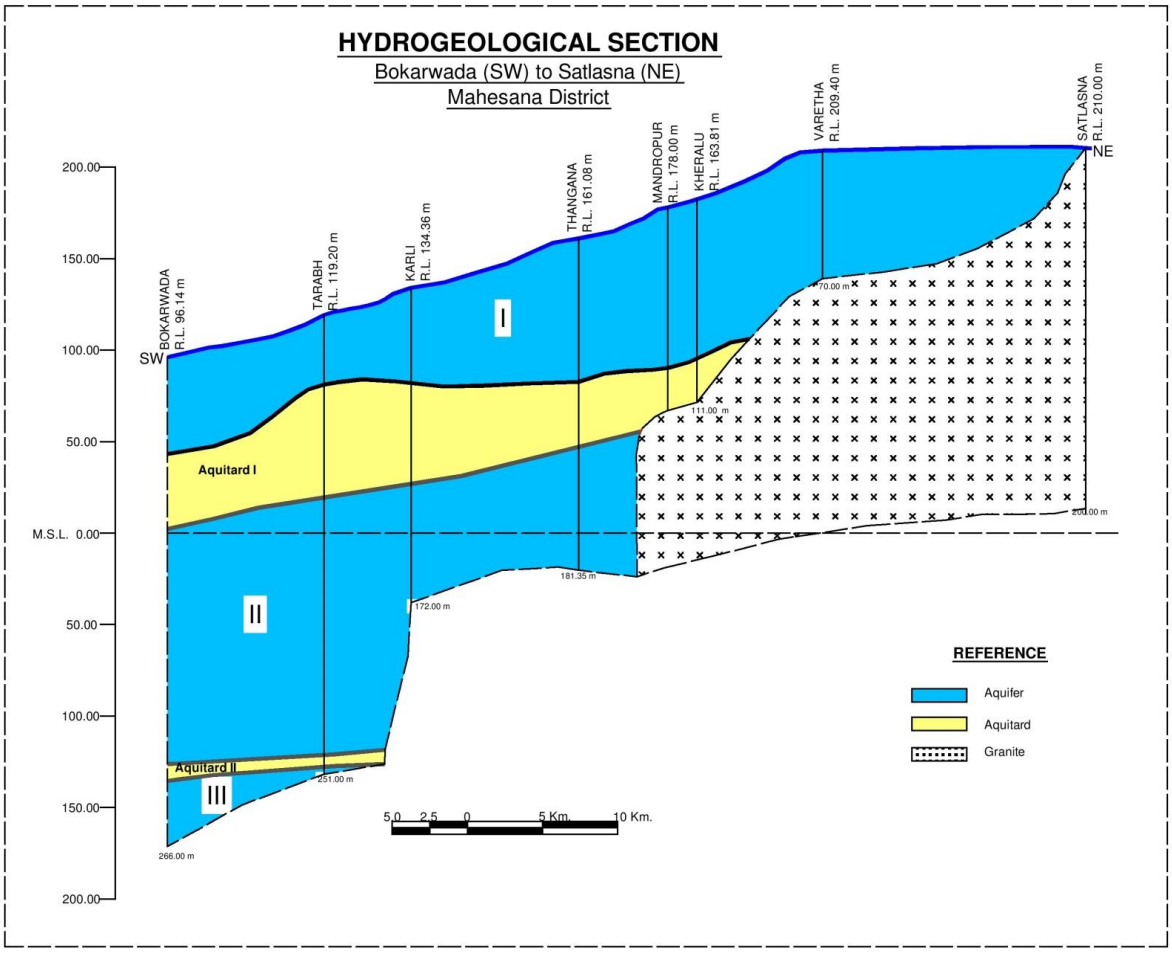


Figure – 16 Hydrogeological cross section along Bokarwada – Satlasana Mahesana District



Multi layer granular aquifers with alternate sand and Clay and mixed aquifer material. Granular Horizons form potential aquifer (Aquifer group II & III). Water quality variable- generally saline in western and south western part (Aquifer group III)

Figure – 17 Hydrogeological Panel Diagram along fringe area of alluvium and Hard rock Aquifer system Kheralu Taluka, Mahesana district

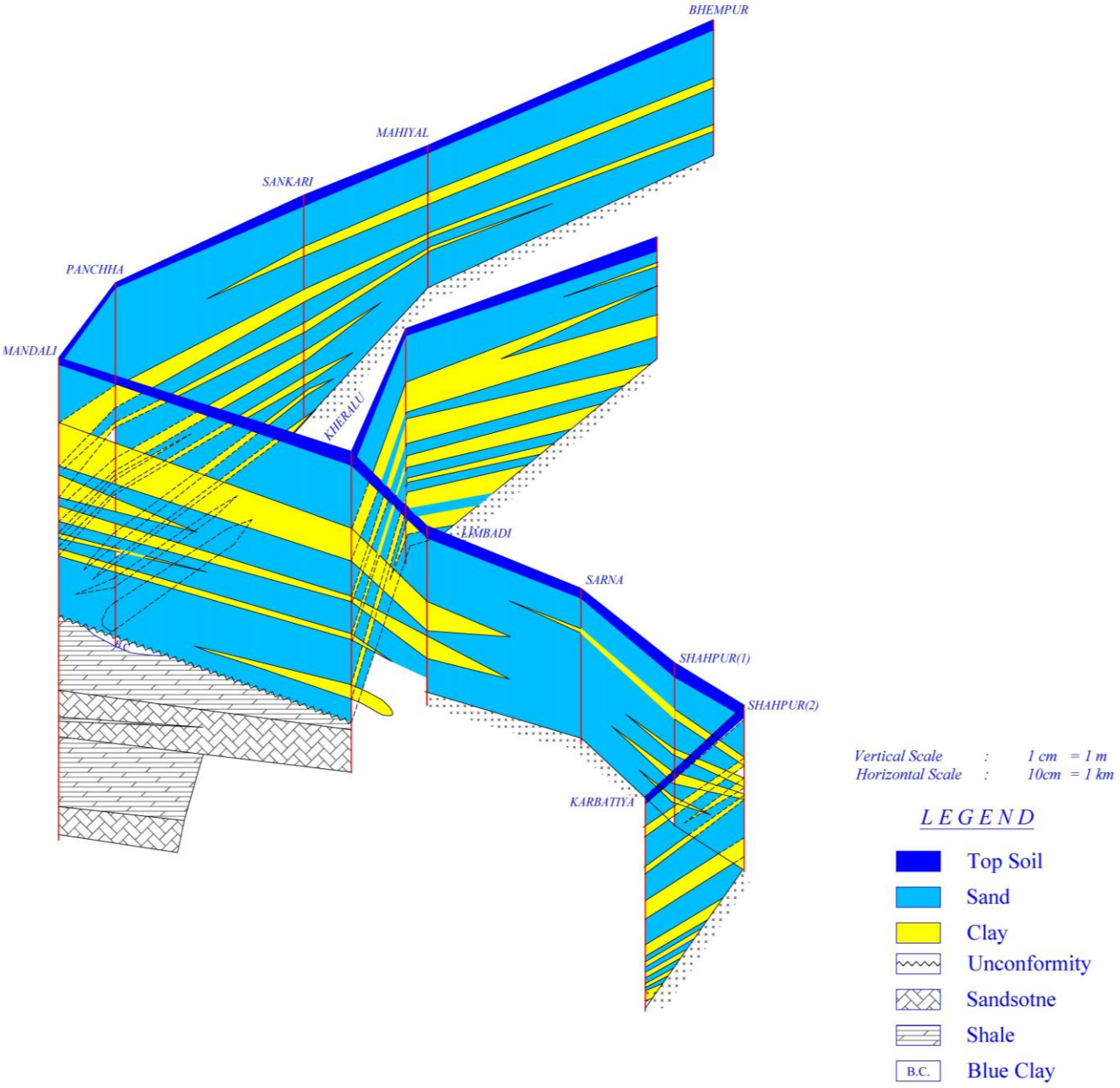


Figure – 18 Hydrogeological Panel Diagram around Sujalam Sufalam Canal
Including Mahesana district

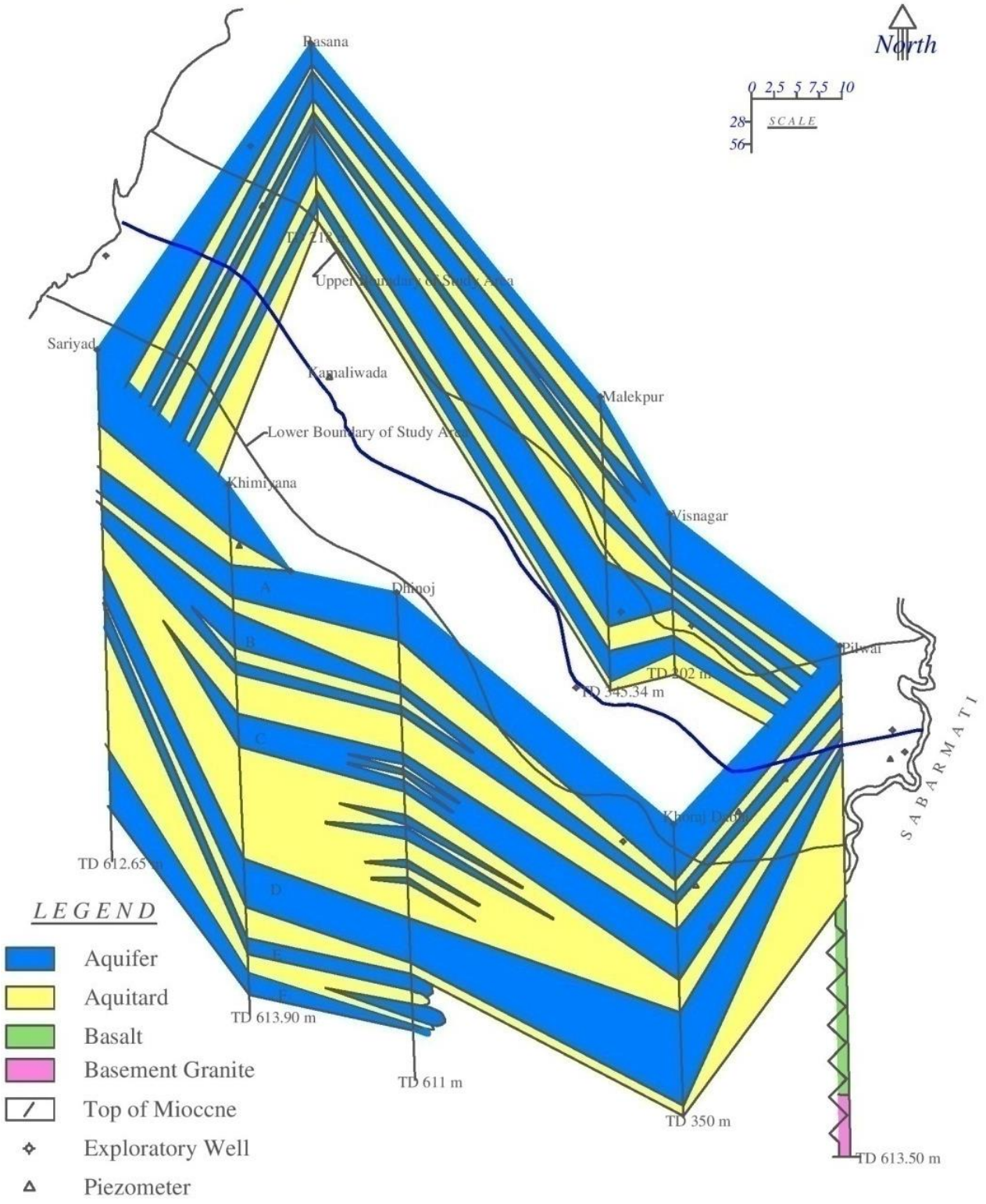


Figure – 19 Hydrogeological cross section along Bhimpur(Kharalu Taluk) to Bamosana (Visnagar Taluka) of Mahesana-

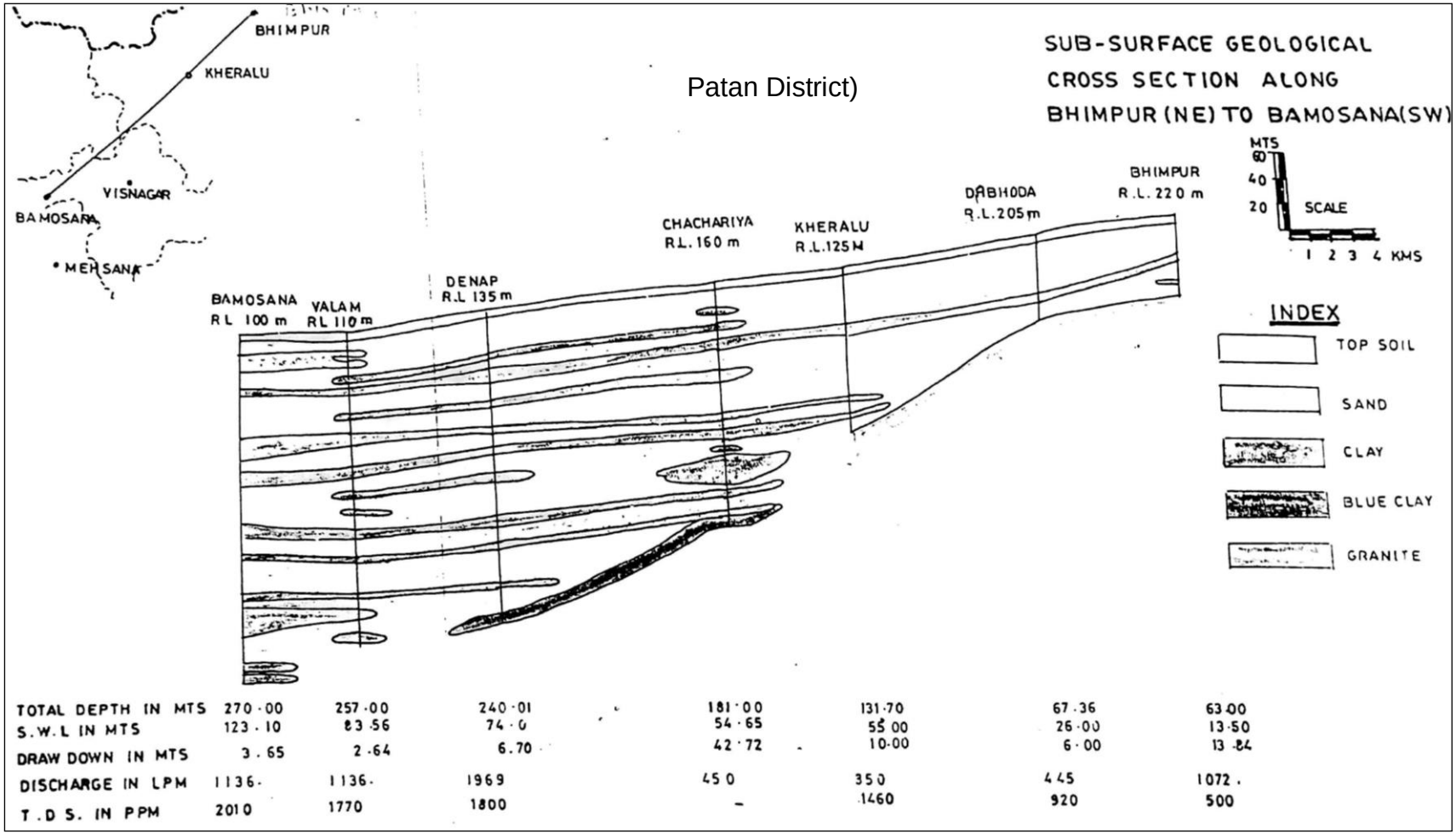
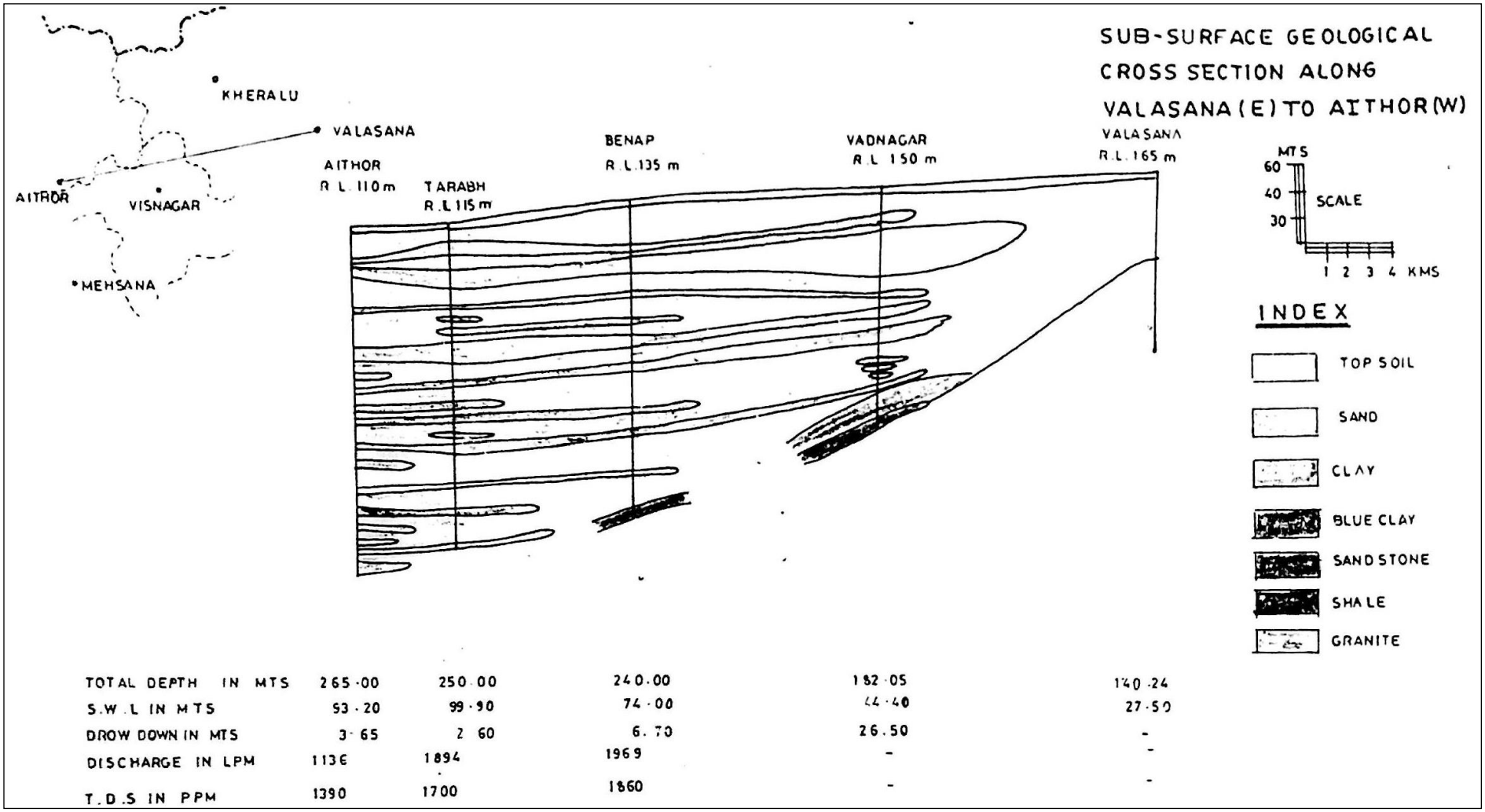
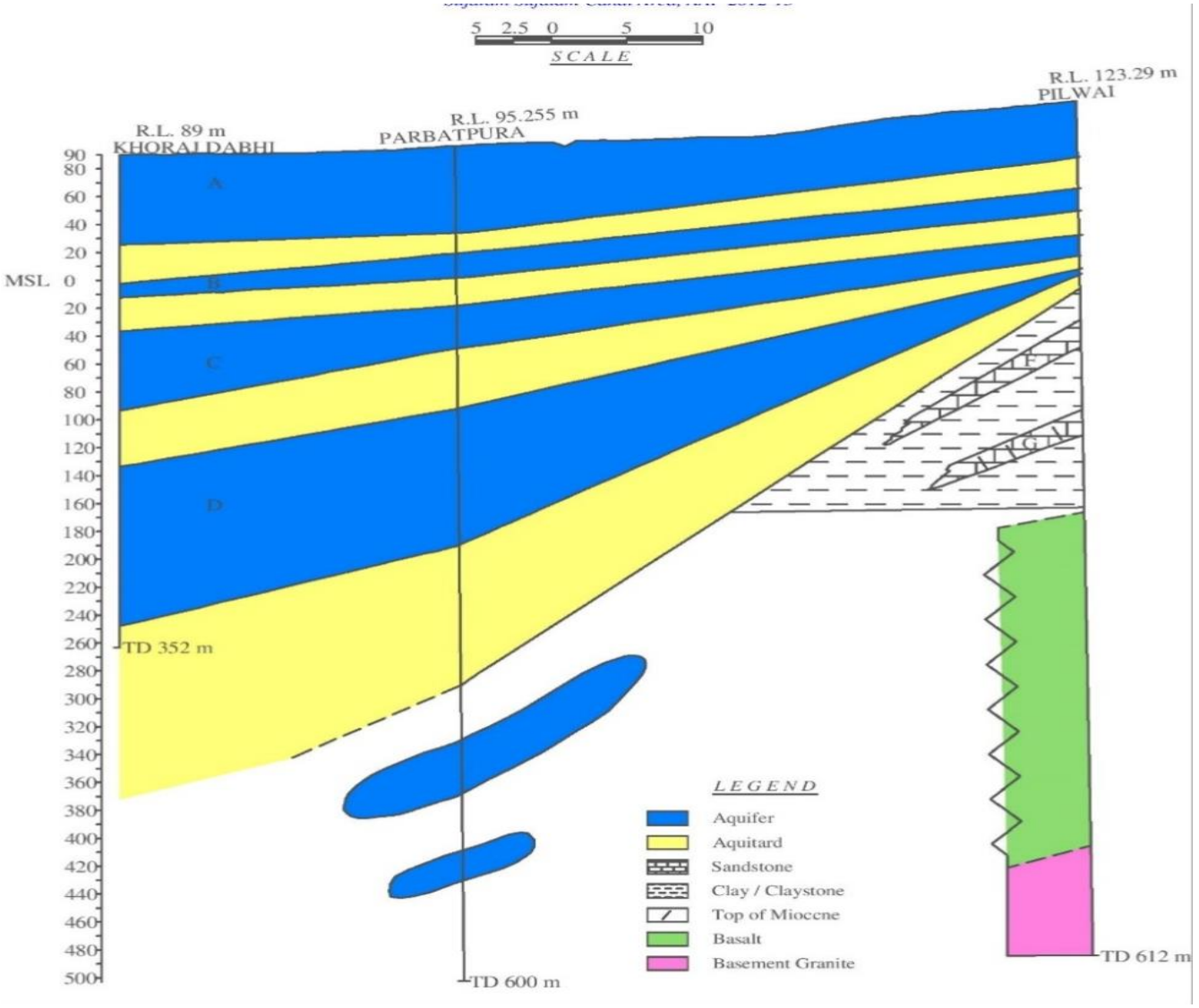


Figure – 20 Hydrogeological cross section along Valasana(Kharalu Taluk) to Arthor (Unjha Taluka) of Mahesana-Patan District)



TOTAL DEPTH IN MTS	265·00	250·00	240.00	182·05	140·24
S.W.L IN MTS	53·20	99·90	74·00	44·40	27·50
DROW DOWN IN MTS	3·65	2 60	6. 70	26.50	-
DISCHARGE IN LPM	1136	1894	1969	-	-
T.D.S IN PPM	1390	1700	1860	-	-

Figure – 21 Hydrogeological cross section along (Khoraj Dabhi-Parbatpura-Pilwai) southernmost part of Mahesana District indicating multi layer granular aquifers with alternate sand and Clay.



IV. GROUND WATER RESOURCE ESTIMATION

Dynamic Ground Water Resources

The groundwater resources for the district have been computed by the Government of Gujarat in association with the CGWB based broadly on the guidelines and recommendations of GEC-97. The unit of assessment of ground water resources has been the administrative unit (Taluks). Out of the 9 talukas for which resources is computed 8 talukas are in over exploited category and one is in critical stage of ground water development Draft and Stage of groundwater development of replenishable resource (Table-26).

In storage Ground Water resources

In storage round water resources computed for the district considering taluka/block as a unit and conceptual depiction of multilayer aquifer system in parts of Becharji and Mahesana Taluks (Mahesana district) for the computation of in-storage ground water resources up to 300 m depth is given below Figure-22 and computed resources are given in Table-27.

Table –27 Ground Water Resources of Mahesana District (Fresh)

S No.	Taluka	Total Geographical Area (SqKm)	AQI (MCM)	AQII (MCM)	AQIII (MCM)	In-Storage Ground Water (MCM)	Annual Replenishable Ground water (MCM)	Total Availability of Ground Water Resources (MCM)
1	Becharaji	433.9	167	189	126	482	21.94	504
2	Kadi	830.97	593	1,280	2,561	4,434	175.06	4,609
3	Kheralu	337.57	389	820	0	1,209	81.46	1,290
4	Mahesana	834.44	457	1,333	2,665	4,455	209.54	4,665
5	Satlasana	307.71	49	466	0	515	54.74	570
6	Unjha	317.7	342	559	890	1,791	64.5	1,856
7	Vadnagar	307.21	20	614	922	1556	103.13	1,659
8	Vijapur	552.36	983	1,105	1,768	3,855	121.77	3,977
9	Visnagar	484.7	337	1,309	1,745	3,391	118.59	3,510
	Mahesana Total	4,406.56	3,337	7,675	10,677	21,688	950.73	22,639

Table – 28 Ground Water Resources of Mahesana District (Saline/Brackish)					
S No.	Taluk	Total Geographical Area (Sqkm)	In-Storage Ground Water (MCM)	Annual Replenishable Ground water (MCM)	Total Availability of Ground Water Resources (MCM)
1	Becharaji	433.9	793	66.7	859.7
2	Kadi	830.97	108	0	108
3	Kheralu	337.57	0	0	0
4	Mahesana	834.44	85	7.89	92.89
5	Satlasana	307.71	0	0	0
6	Unjha	317.7	0	0	0
7	Vadnagar	307.21	0	0	0
8	Vijapur	552.36	0	0	0
9	Visnagar	484.7	0	0	0
	Mahesana Total	4406.56	986	74.59	1060.59

The summarized in storage ground water resources and the dynamic ground water resources is given in Table-29

Table- 29 Availability of Ground water resources in Mahesana District.
(Fresh and Saline)

S No.	Taluka	Total Geographical Area (SqKm)	In-Storage Ground Water (MCM)		Annual Replenishable Ground water (MCM)		Total Availability of Ground Water Resources (MCM)	
			F	S	F	S	F	S
1	Becharaji	433.9	315.315	793.152	21.94	66.7	337.255	859.852
2	Kadi	830.97	3840.858	107.73	175.06	0	4015.918	107.73
3	Kheralu	337.57	1215.252	0	81.46	0	1296.712	0
4	Mahesana	834.44	3997.62	84.726	209.54	7.89	4207.16	92.616
5	Satlasana	307.71	578.62	0	54.74	0	633.36	0
6	Unjha	317.7	1779.12	0	64.5	0	1843.62	0
7	Vadnagar	307.21	1536.05	0	103.13	0	1639.18	0
8	Vijapur	552.36	3866.52	0	121.77	0	3988.29	0
9	Visnagar	484.7	3053.61	0	118.59	0	3172.2	0

	Mahesana Total	4406.56	20182.97	985.608	950.73	74.59	21133.7	1060.198

Refinement in computation of ground water resources is also considered based on the improved aquifer geometry and more precise ground water regime and quality maps by increasing the density of information from the data integration of CGWB and GWRDC for the purpose. Conceptual depiction of in storage aquifer system in Mahesana district is depicted in Figures 22

Figure-22 Conceptual depiction of in storage aquifer system

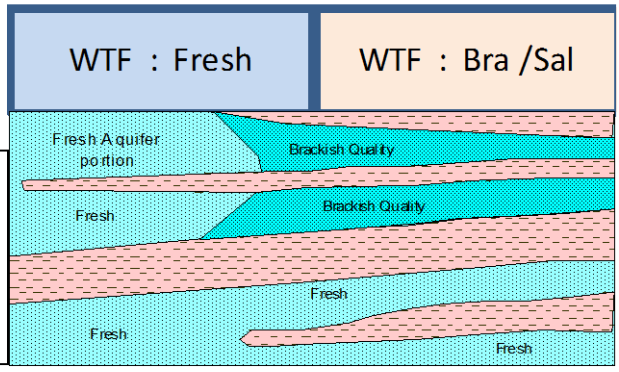
Becharaji Taluka : Multilayer Alluvium

WTF zone : Both Fresh & Saline Area

In Storage Quality	Fresh	Brackish / Saline
Thicjness Granulazone in confined Aquifer	30	20
In Storage Resources	(Fa x 30 x sy) + (Sa x 20 x sy)	Sa x (20) x (sy)

confined aquifer with total 50 m thick granular zone

Conceptual depiction of in storage aquifer system



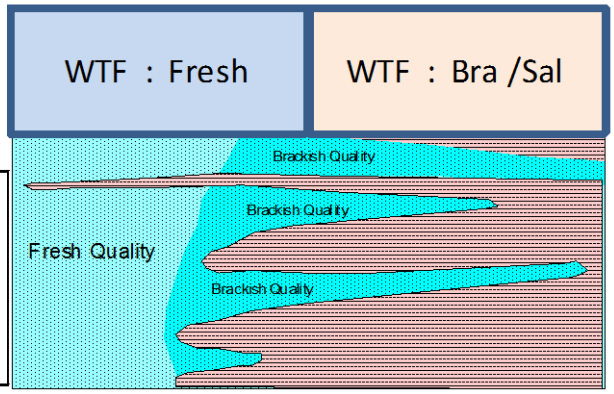
Mahesana Taluka : Multilayer Alluvium

WTF zone : Both Fresh & Saline Area

In Storage Quality	Fresh	Brackish / Saline
Thicjness Granulazone in confined Aquifer	60	10
In Storage Resources	Fa x (60) x (sy)	Sa x (10) x (sy)

confined aquifer with total 60 m thick granular zone

Conceptual depiction of in storage aquifer system



V. Ground Water Related Issues

1. Identification of issues

Traditional agricultural /irrigation practices, flood irrigation practices, increase in water demand, irrigation practices based on power supply. Farmers irrigate the crops when power supply is available rather than waiting for the wilting to start. Following are the issues identified for aquifer management in the area:

Arid/Semi arid area
High rate of Evapotranspiration
Non availability of surface water resources
Over exploitation of ground water
Decline in ground water levels
De saturation of Phreatic aquifers
Deeper Piezometric head of Confined Aquifer-III
Decline in Piezometric heads of semi confined/confined aquifer
Increase in well depth as water levels become deeper
Increase in depth of prime mover/pump setting
Decline in well yields
Large scale ground water development over the years : Level of ground water development 2004 –151.17%, 2009-147.96%, 2011 – 116.08%, 2013 – 121.55%
Water Logging /Shallow Water Level in Commnad area

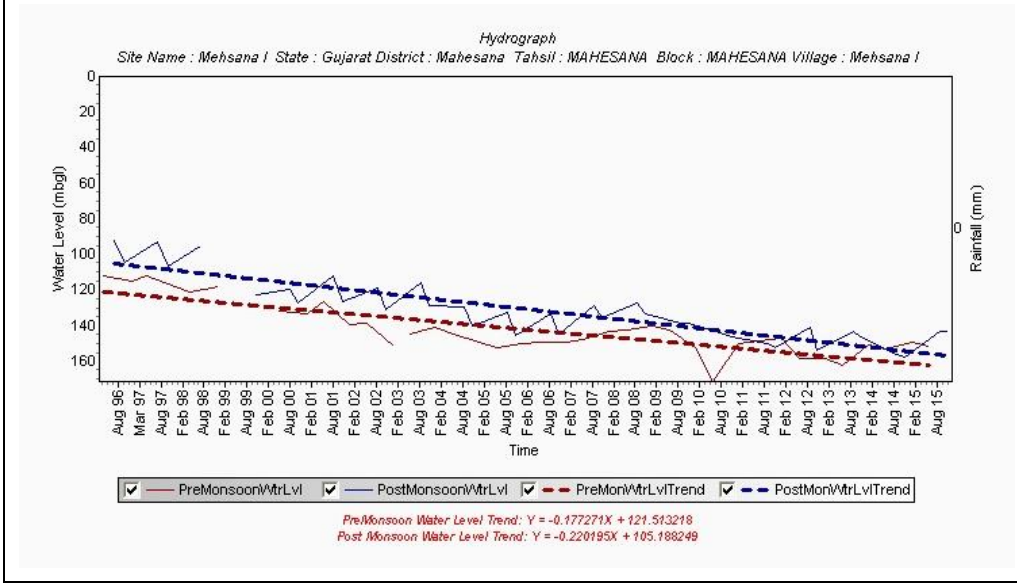
2. Geographical distribution and quantification with respect to ground water resources and ground water quality/contamination

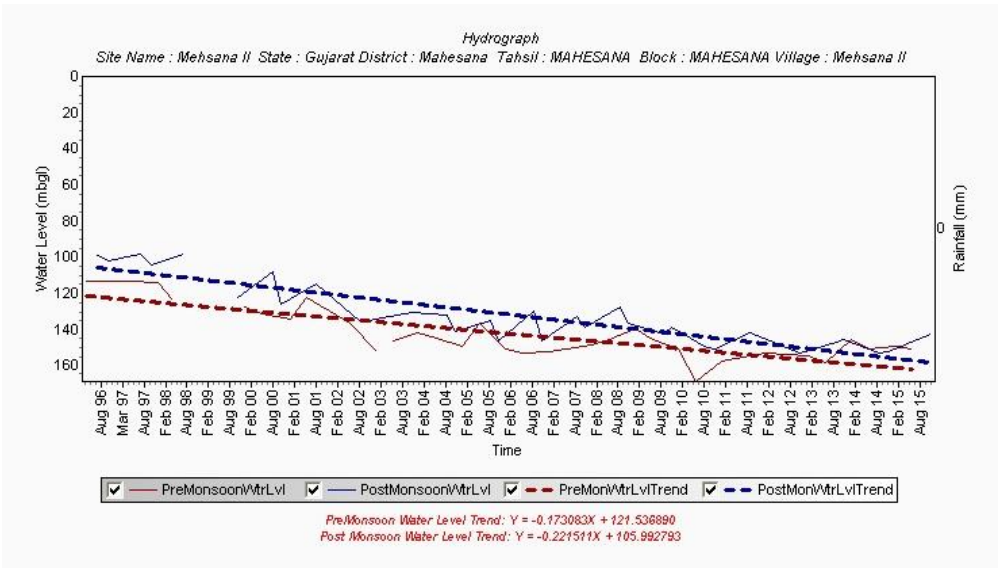
The groundwater conditions in the study area are unique in the sense that on one side water logging conditions prevail due to recharge from the supply of water from canal and rainfall in the existing shallow aquifers, while in other neighbouring areas, the water levels are very deep. The perched water table conditions due to the presence of clay horizon at very shallow depths, and occurrence of hard rock sysem the ground water management becomes even more important in this area. In the Dharoi Command (RBC) area particularly in some part of Kheralu, Vadnagar, Visnagar and Unjha talukas, water logging conditions prevail. Recharge from the supply of water from canal in shallow aquifers and occurrence of clay at shallow depth acting as aquiclude/aquitard is considered as one of the causes for water logging condition.

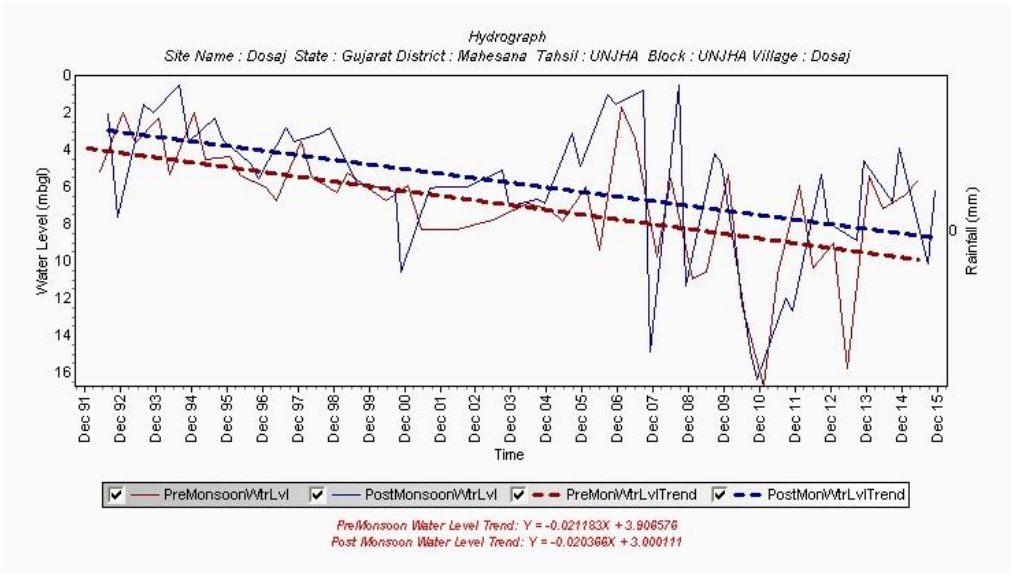
For water logging in command area where clay horizon is at shallow depth, feasibility of recharge the water from water logged area to the lower aquifer can also be considered on site specific location basis however uttermost precaution has to be taken to protect the quality of ground water system when direct recharge to ground water system is considered.
Over exploitation of ground water, Lateral and Vertical change in Ground water yield and quality, high demand of water for existing irrigation practices are some of the major ground water related issues in the area.

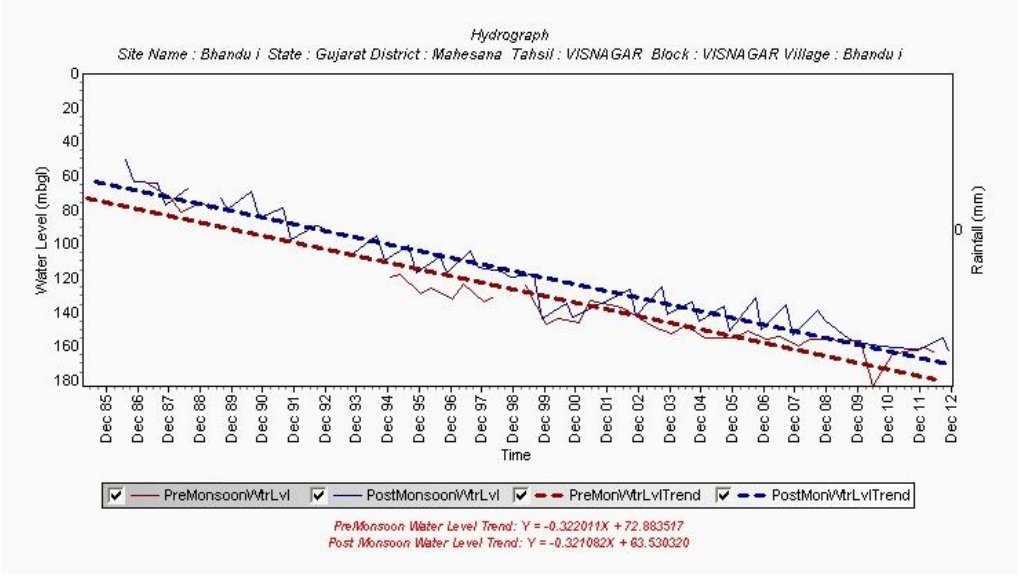
Out of the total area of district about 80 % area is having deeper water level and 50 % area is experiencing steadier decline in ground water level over the years as depicted in Hydrographs given below.

Figure –23 Typical hydrographs showing decline in ground water levels/piezometric head




Hydrograph
Site Name : Mehsana II State : Gujarat District : Mahesana Tahsil : MAHESANA Block : MAHESANA Village : Mehsana II
Water Level (mbgl)
Rainfall (mm)
Time
PreMonsoonWtrLvl
PostMonsoonWtrLvl
PreMonWtrLvlTrend
PostMonWtrLvlTrend
PreMonsoon Water Level Trend: Y = -0.173083X + 121.536890
Post Monsoon Water Level Trend: Y = -0.221511X + 105.992793


Hydrograph
Site Name : Dosaj State : Gujarat District : Mahesana Tahsil : UNJHA Block : UNJHA Village : Dosaj
Water Level (mbgl)
Rainfall (mm)
Time
PreMonsoonWtrLvl
PostMonsoonWtrLvl
PreMonWtrLvlTrend
PostMonWtrLvlTrend
PreMonsoon Water Level Trend: Y = -0.021183X + 3.906576
Post Monsoon Water Level Trend: Y = -0.020366X + 3.000111


Hydrograph
Site Name : Bhandu i State : Gujarat District : Mahesana Tahsil : VISNAGAR Block : VISNAGAR Village : Bhandu i
Water Level (mbgl)
Rainfall (mm)
Time
PreMonsoonWtrLvl
PostMonsoonWtrLvl
PreMonWtrLvlTrend
PostMonWtrLvlTrend
PreMonsoon Water Level Trend: Y = -0.322011X + 72.883517
Post Monsoon Water Level Trend: Y = -0.321082X + 63.530320

3. Reasons for Ground water related issues

Prevailing agricultural /Irrigation practices, increase in ground water demand, geogenic reason for variation in ground water quality and schedule of power supply are some of the major reasons for ground water related issues in these area.

4. Future demand (for 2025 and 2030) scenario and stress aspects of the aquifer

Area is under high stressed as the economy of the area is based on Agriculture and every individual intend to cash in for market driven cash crop irrespective of availability of water for irrigation. Economy of the area is mainly based on agro & food processing, paper and pulp and cotton based industries textiles and mineral based industries (ceramics).

5. Participatory ground water management issues

As on date participatory ground water management issues are not much significant as farmers themselves forms cooperative societies of water user groups driven by the economic need of the region and capital requirement for construction of irrigation facility using ground water. However defaults and disputes among user groups cannot be ruled out. Lessons learnt from the existing practice of cooperative societies for sharing of irrigation water kept in mind while implementing management plan with participatory approach.

6. Interventions to enhance Ground water resources in North Gujarat

Out of the total geographical area of Gujarat State 1,96,024 sq. km, North Gujarat region incorporates about 20 % of the State. The area has high dependency on rainfall for drinking, industrial and irrigation water requirement. Under the UNDP assisted programme during 1971-74 in order to investigate and evaluate ground water potential and quality, identified aquifers were classified. Overexploitation of groundwater was identified as a major issue. A pilot project was taken up in North Gujarat and recharge techniques were developed and demonstrated (1984-85). During 1991 a Master Plan on Artificial Recharge was prepared and for North Gujarat it was observed that sufficient surplus water resource is not available. Subsequently a Task force was constituted by Government of Gujarat for assessment of aquifer wise potentiality for subsurface storage and non committed runoff availability on river basin approach for increasing ground water recharge. Increase in average annual rainfall from 860mm to 1200 mm.

Following interventions are in place in Gujarat to address the issues related with water resources

About 2,35,000 Ha area is brought/covered under Drip irrigation schemes (by GGRC and GWRDC)
Construction of Sujalam Suflam Canal
Six bulk water supply pipelines have been commissioned for transferring surplus water water of Narmada to North Gujarat Region.
On an average, 25,000 MCFT (7075 MCM) water is being transferred per year
About 35,000 Ha command area of Narmada canal is developed
By interlinking of various river, water is transferred to other river basins
4000 Nos Construction of Check dams, 300 nos deepening of Ponds and reservoirs
Interconnectivity of Natural drains and ponds/Tanks (80 Nos)

In order to address the issue of water stressed area of North Gujarat and Kachchh Region it was decided to divert surplus water from Narmada Canal by Government of Gujarat. A scheme was prepared and implemented by diverting excess runoff by supplying water from Mahi and Narmada to the Sujalam Sufalam Canal Scheme in North Gujarat and by diverting flow of Narmada during flood for recharge through canal, filling of village tanks/ponds

The ground water availability and quality of water is the issue of serious concern (such as high level of salinity). In order to address the issues and

possible measures Aquifer Map and Aquifer Management Plan is taken up in Mahesana distict for the area of 4407 Sq.Km. covering 9 blocks (OE-8 and Critical-1).

Figure –24 Schematic depiction of Sujalam Sufalam Spreading canal Scheme

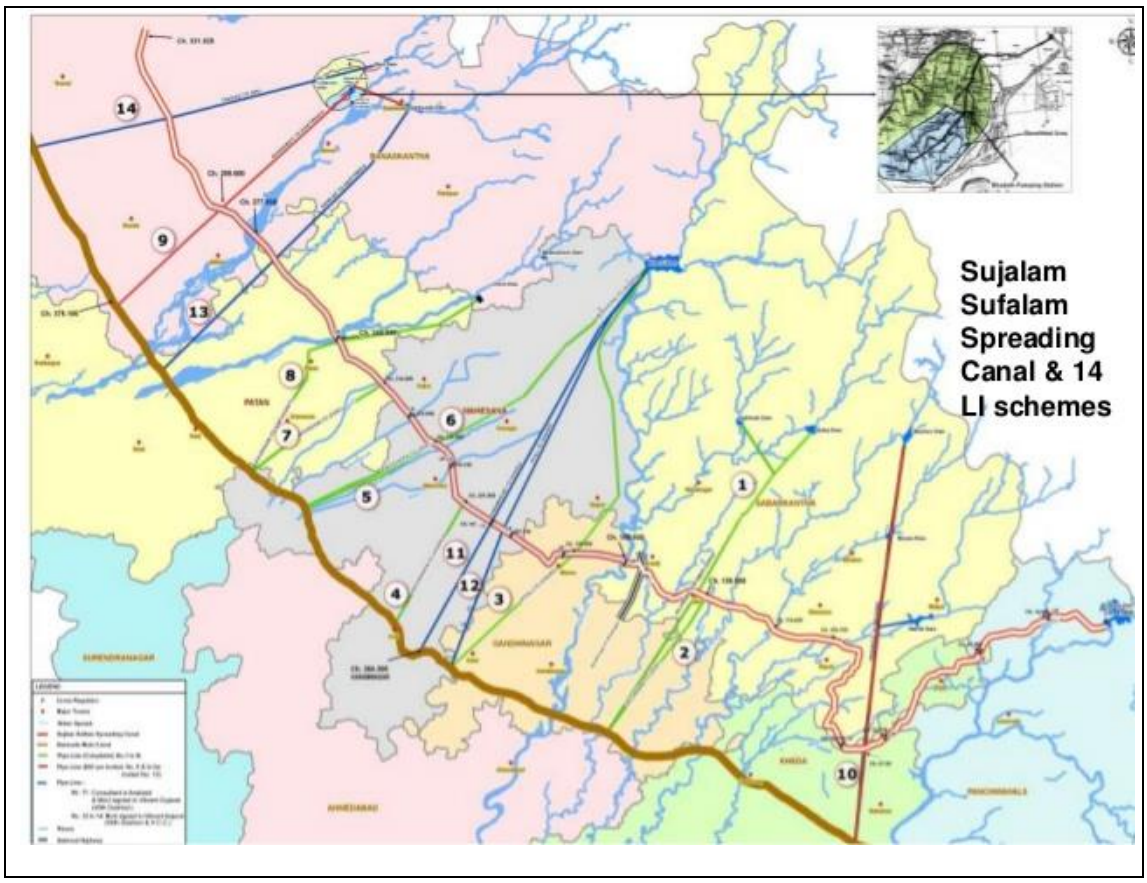
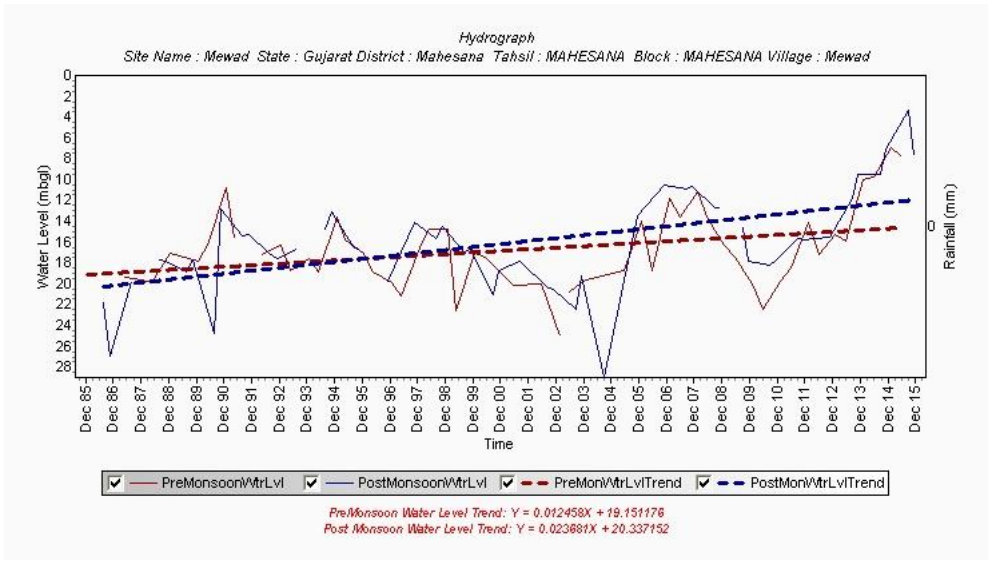
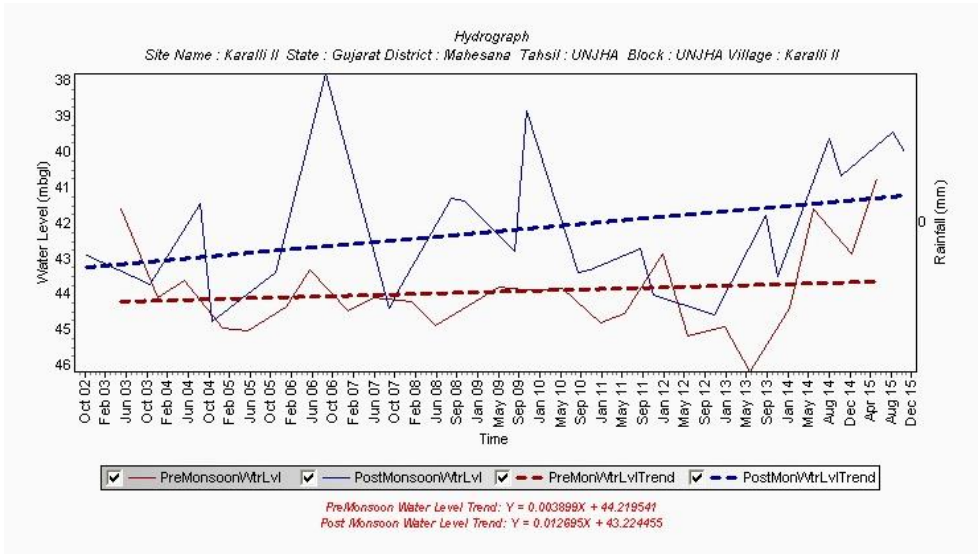
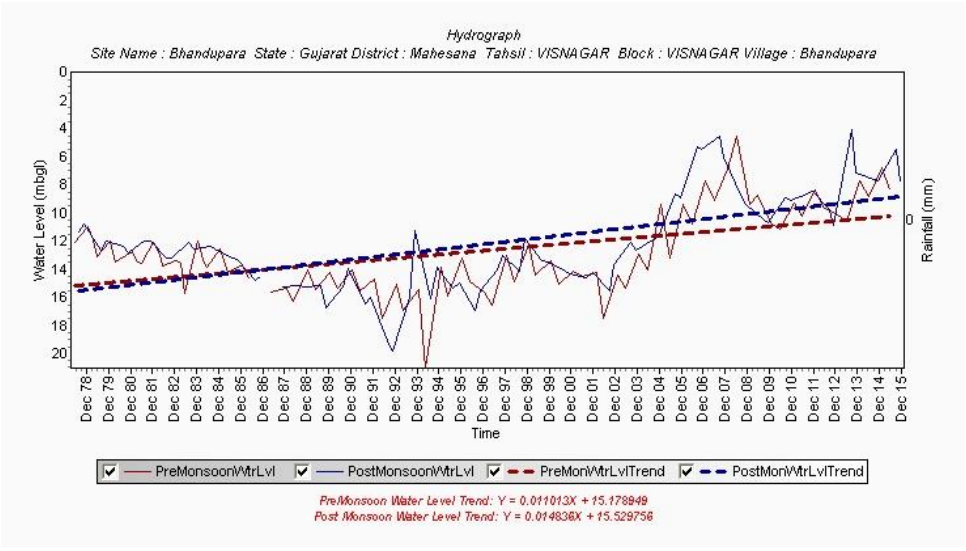
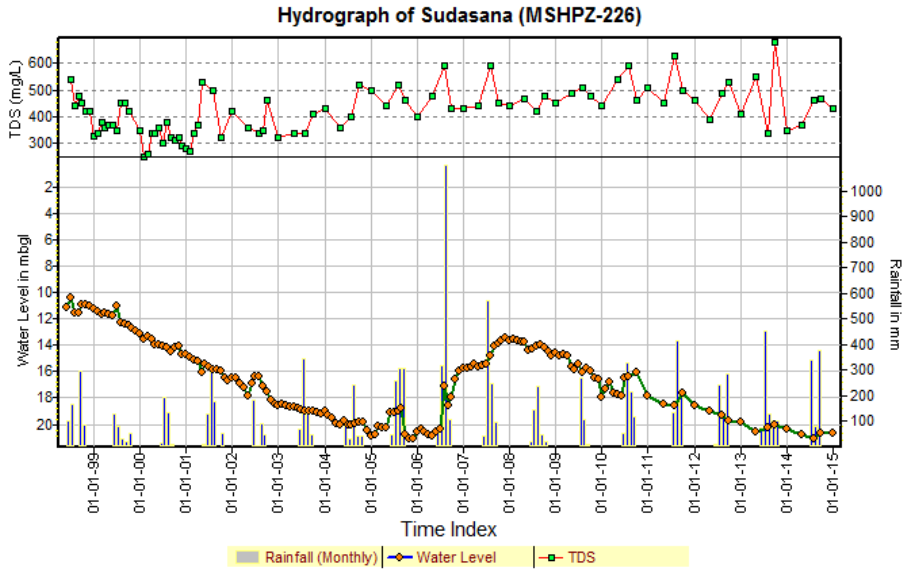


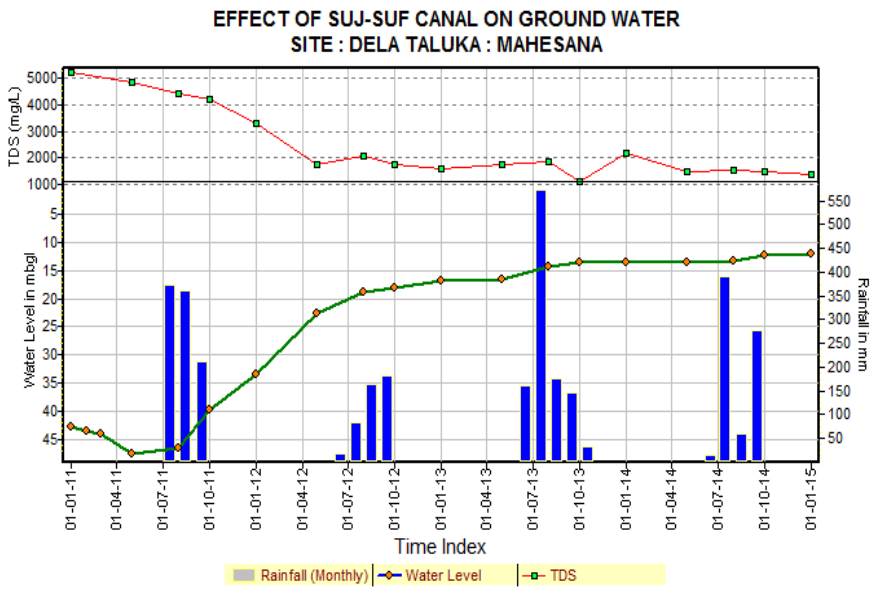
Figure – 25 Typical hydrographs showing change in ground water levels/piezometric head placed on the district Map of Mahesana in Sujalam Sufalam area

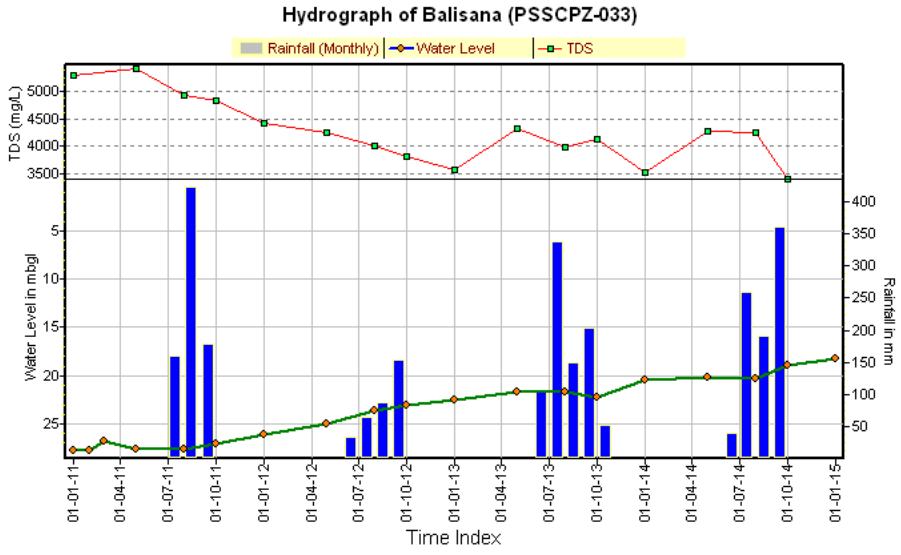





Hydrograph
Site Name : Bhandupara State : Gujarat District : Mahesana Tahsil : VISNAGAR Block : VISNAGAR Village : Bhandupara
Water Level (mbgl)
Rainfall (mm)
Time
PreMonsoonWtrLvl
PostMonsoonWtrLvl
PreMonWtrLvlTrend
PostMonWtrLvlTrend
PreMonsoon Water Level Trend: Y = 0.011013X + 15.178949
Post Monsoon Water Level Trend: Y = 0.014838X + 15.529756


Hydrograph of Sudasana (MSHPZ-226)
TDS (mg/L)
Water Level in mbgl
Rainfall in mm
Time Index
Rainfall (Monthly)
Water Level
TDS


EFFECT OF SUJ-SUF CANAL ON GROUND WATER
SITE : DELA TALUKA : MAHESANA
TDS (mg/L)
Water Level in mbgl
Rainfall in mm
Time Index
Rainfall (Monthly)
Water Level
TDS


Hydrograph of Balisana (PSSCPZ-033)
Rainfall (Monthly)
Water Level
TDS
TDS (mg/L)
Water Level in mbgl
Rainfall in mm
Time Index

VI. Management Strategies and Management Plan

Management strategies for the available groundwater resources considering Aquifer as a unit is considered for sustainable management of resources and grouped under the following heads…

1. Aquifer Management

The taskforce identified basins with subsurface space in dewatered vadose zone, computed the volume of space available, estimated volume of water needed to arrest annual ground water depletion and to stabilize ground water levels at 8 mbgl. They have also computed the average annual runoff available in different basins. However, the recommendation were made for the basins where there was surplus water available but pleaded non-availability of average annual non-committed surplus runoff for Managed Aquifer Recharge (MAR) where it was badly needed such as in north Gujarat region.

Artificial Recharge by diverting surplus run-off during monsoon into ponds, percolation tanks, Spreading basins, abandoned dug wells etc is implemented. Aquifer wise Plan for sustainable management of the ground water resource including proposed modeling outputs is also to be considered in a phased manner. It is envisaged that effective utilization of available water resources and moderate use of water will result in higher and better productivity from the existing agriculture land.

2. Interlinking from surplus to water deficit area

Inter Basin Transfer of water from Narmada Main Canal to en-route rivers by diverting flow of the water of Narmada available during flood through Narmada main canal to eleven rivers of Gujarat viz. Heran, Orsang, Karad, Mahi, Saidak, Mohar, Watrak, Sabarmati, Khari, Rupen and Banas. The filling of about 700 Nos. of small/large village Tanks/Ponds by water of Narmada. This is considered one of the most rewarding scheme of Government of Gujarat for the lager population of water scared North Gujarat districts.

3. Recharge through Sujalam-Sufalam Spreading Channel

Taking into consideration the non availability of surplus water in the North Gujarat Region, Government of Gujarat launched ambitious inter basin water transfer projects of Sujalam Sufalam Recharge canal for this region in order to augment ground water through recharge canal and also to supplement irrigation. Thus, augmentation of ground water resource was the prime

objective of the Sujalam Sufalam Yojna, the scheme also benefits villages that are facing scarcity of irrigation and drinking water by utilizing surplus water and flood water available in other basins. Salient features of the various schemes planned and being implemented is summarized below -

Overflowing flood water from Kadana dam is diverted by gravity to the scarcity hit areas of Panchmahals, Gandhinagar, Sabarkantha, Mahesana , Patan and parts of Banaskantha districts (North Gujarat region).
Sujlam-Suflam Spreading Channel – 332 Km. From Kadana dam to Sabarmati river – 158 km. From Sabarmati to Banas river: 174 km. This recharge canal is helping in recharging 21 rivers which includes Khari, Watrak, Meshwo, Mazam, Rupen, Pushpavati, Saraswati and Banas River extending benefit to 7 Districts, 14 Talukas and about 508 villages. It was estimated that about 70,000 Ha. area to be benefitted by this project. It is envisaged that through Sujalam Sufalam spreading canal Yojana about 700 million cubic meter of flood water will be diverted to water scarce areas from time to time that otherwise used to flow in to the ocean (NWR, WS & K, and Govt. of Gujarat).
Sujalam Sufalam Spreading Canal passing through district (length 34 km) is an unlined canal originating from Kadana Dam having total length of 337 km crossing 21 rivers and with series of check dams and provision of Inter basin transfer of about 735.64 MCM of flood water is diverted to water deficit areas of North Gujarat from time to time which is otherwise use to flow to the ocean. (Bottom Width -12m, Top width- 27.5m, Depth 4.25m, Free board 0.95m and Slope 1: 1.5, Unlined throughout).

Table – 30 Availability of Water for recharge in Sujalam Sufalam Spreading Canal

Mahesana District

	Taluka	Length of Canal (km)	Water released (735.46 MCM) / Available (MCM)	Recharge MCM
1	Becharji			
2	Kadi			
3	Kheralu			
4	Mahesana	17	69.87	20.96
5	Satlasana			

6	Vadnagar			
7	Visnagar	15	61.65	18.49
8	Vijapur			
9	Unjha	2	8.22	2.47
Total Mahesana District			139.73	41.92

It is estimated that about 1.231 MCM water will recharge to the ground water system per km length of unlined canal when run in full capacity i.e. when water released is 735.46 MCM. It is estimated that additional availability of about 41.92 MCM water in Mahesana district is achieved through recharge from spreading canal. This has proved beneficial with accrued benefits to the larger population of area. (Figure 25)

4. Recharge through Canal Linking Ponds (Mahesana)

Government of Gujarat implemented schemes on integrated surface and ground water irrigation approach coupled with recharge to ground water system by diverting surplus run-off during monsoon into ponds, percolation tanks, Check dams, spreading channels/basins, abandoned dugwells etc. by interlinking either through pipeline or channels from Saradar Sarover Narmada Main canal, Sujalam Sufalam Spreading Canal or through Dharoi-Sabarmati Canal. A Talukawise detail of number of tanks linked/filled with existing capacity is given below in Table - 31

Table –31 Tanks Filled –Linking Ponds, Mahesana District

	Taluka	**SS Narmda Main Canal** No of Tanks/ Capacity (MCM)	Rech arge MCM	S.S.S. Canal & Drain **net work** No of Tanks/ Capacity (MCM)	Recha rge MCM	Dharoi Sabarmat i No of Tanks/ Capacity (MCM)	Recha rge MCM	Total Linke d Struct ures	Total Recha rge From Linke d Tanks MCM
1	Becharji	22/11.33	3.40				0.00		3.40
2	Kadi	5/4.84	1.45				0.00		1.45
3	Kheralu	10/3.24	0.97			13/8.41	2.52	23	3.49
4	Mahesana	14/10.62	3.19			2/1.42	0.42	16	3.61
5	Satlasana		0.00				0.00		0.0
6	Vadnagar	1/0.59	0.18			42/25.87	7.76	43	7.94
7	Visnagar	7/0.76	0.23			21/30.68	9.20	28	9.43
8	Vijapur		0.00			8/4.10	1.23	8	1.23
9	Unjha		0.00	2/0.80	0.23	18/9.65	2.90	20	3.13
Total Mahesana District		**59/ 31.38**	**9.41**	**2/.80**	**0.23**	**104/ 80.12**	**24.04**	**165/**	**33.68**

Perusal of the table indicate that about 165 number of linked structures of about 31.38 MCM capacity are filled once or more whenever surplus water is available. This practice of filling of these structures has also lead to additional

availability of about 33.68 MCM in Mahesana district through recharge to ground water system. Practice of filling of linked pond to be continued with accrued benefits to the larger population of the area by bringing additional tanks and pond and other similar structures in this area as per feasibility of site and availability of water.*(Details no of structures linked/filled 204)*

5. Augmentation of the ground water resource through artificial recharge and water conservation measures

During the course of surveys and aquifer Mapping utilizing the existing data it is observed that large amount of subsurface storage space is available in the system to accommodate the surplus monsoon runoff viz a viz additional water if made available to the system from any other distance sources, It is estimated that unsaturated zone - about 2539 MCM space is available in the district to accommodate the recharge water in unconfined system. Talukawise detail is given in table-32 & 33, and area feasible and most suitable for Artificial Recharge is given in the map. However feasibility of each of the recharge structures in these areas and locally identified areas in the rest of the area can only be firmed up after detail hydrogeological investigation specific to site and structure feasible.

It is observed that unsaturated zone available in the system can be used for augmenting the ground water recharge in the area provided sufficient quantity of surplus water is available for recharge. In the areas where surplus source water is not available, recharge to the ground water system using water diverted from water surplus area to water deficit area is also considered and implemented. Successful implementation of such projects in the past hold the key for successful completion of additional such recharge project in the area at technically feasible sites.

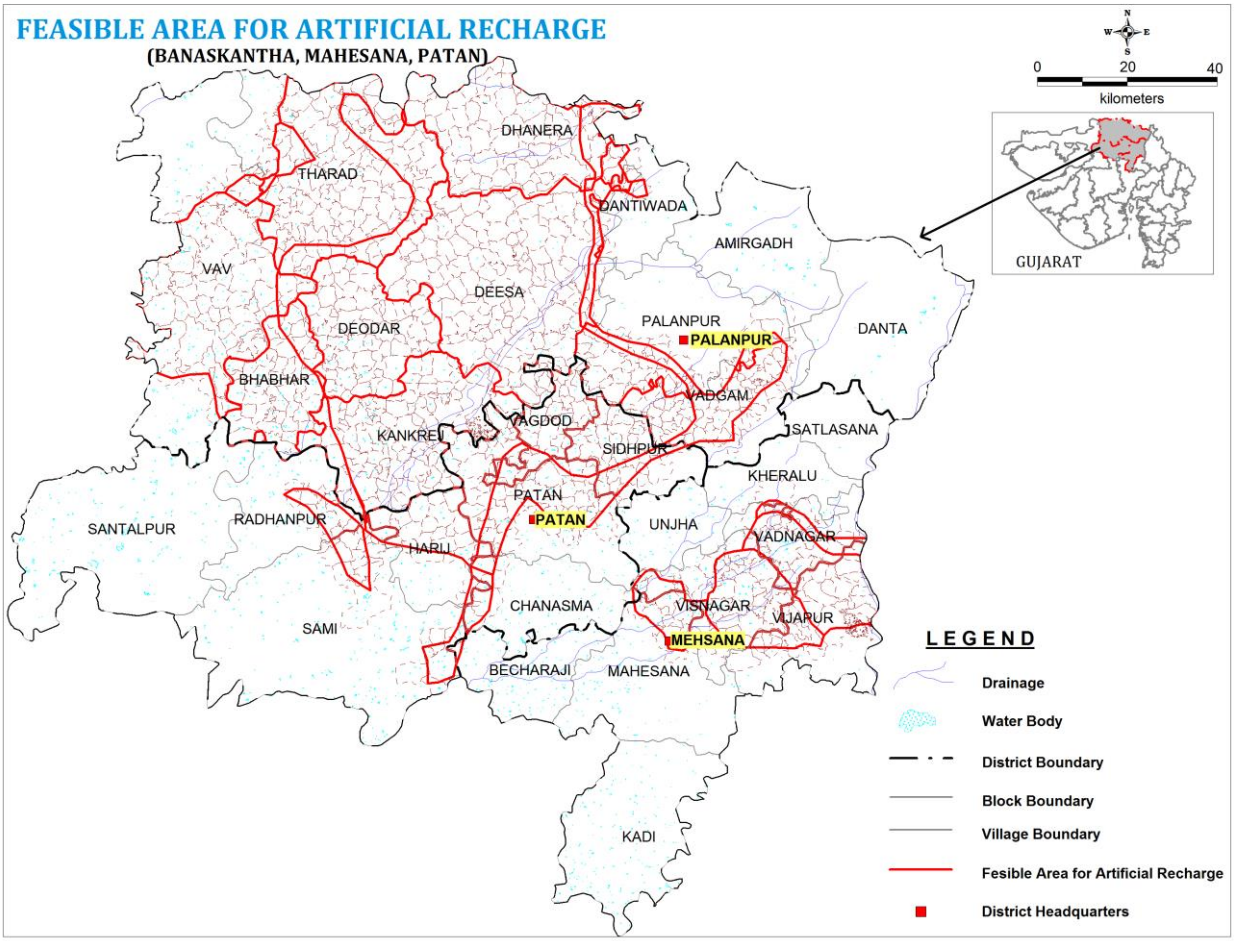
Table – 32 Availability of unsaturated zone for recharge to the ground water system

S.No	Taluka	Area of Taluka (Sq.km.)	Volume of sub surface storage space (50% of unsaturated thickness) available for artificial recharge (MCM)	Volume of water required for recharge (MCM)	Volume of surplus /distant source (3% of monsoon rainfall) available for recharge (MCM)	Volume of water to be harnessed (MCM)
1	Becharaji	**434**	**23**	**25**	4.56	4.11
2	Kadi	**831**	**542**	**602**	25.27	22.74
3	Kheralu	**338**	**347**	**385**	7.70	6.93
4	Mahesana	**834**	**483**	**536**	21.16	19.05
5	Satalasana	**308**	**225**	**250**	5.81	5.23

6	Vadnagar	**307**	**99**	**109**	4.86	4.37
7	Visnagar	**485**	**130**	**145**	7.84	7.06
8	Vijapur	**552**	**545**	**605**	13.84	12.45
9	Unjha	**318**	**145**	**161**	6.12	5.51
	Total	**4,407**	**2,539**	**2,818**	**97.00**	**87.45**

It is estimated that about 2,818 MCM water is required to recharge this unsaturated space. Although surplus monsoon runoff is not available in the area if we could manage to divert about 3% of monsoon rainfall i.e. about 97 MCM/year for recharge to ground water system. Area prioritized and considered in the first instance for implementing artificial recharge after reassessing site specific hydrogeological and hydrological environment in the local area at the time of implementation is given below in figure 26 (Mahesana district) and 27 (North Gujarat)

Figure –27 Area prioritized and considered feasible for Artificial Recharge in North Gujarat area (Mahesana-Patan-Banaskantha Districts).



Augmentation of Ground water Recharge of 87.5 MCM through Rain water Harvesting and Artificial Recharge by construction of 287 Percolation Tanks, 475 Farm ponds, and 212 Recharge shafts/Point recharge structures. Considering the average cost of construction of a recharge structures these structures can be constructed at favorable locations at the cost of 10.77 Crore.

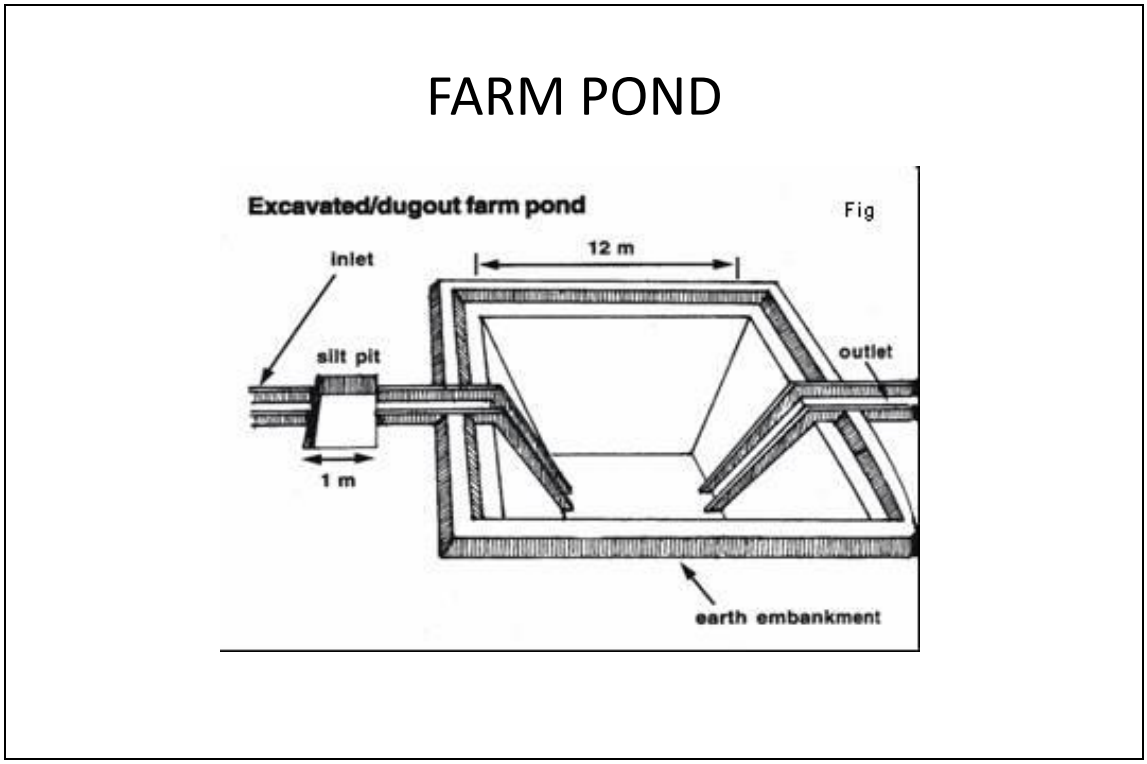
Table-33 Volume of water planned and no of structures proposed for Artificial recharge to ground water in Mahesana District

S. No.	Taluka	Volume of water planned for recharge/conservation through			Cost (₹)			
		Percolation Tank/ (Unit storage 0.2 MCM)	through Farm Pond/ (Unit storage 0.05 MCM	through Recharge shaft/ (Unit storage 0.03 MCM	Percolation Tank (Unit cost Rs 0.4 cr)	Farm Pond (Unit cost Rs 0.1 cr)	Recharge shaft (Unit cost Rs 0.05 cr)	Total
1	Becharaji	3.28/ 16	0.37/ 7	0.45/ 15	6.57	0.74	0.75	8.06
2	Kadi	21.15/ 106	1.21/ 24	0.39/ 13	42.31	2.41	0.64	45.36
3	Kheralu	2.77/ 14	3.54/ 71	0.62/ 21	5.55	7.07	1.04	13.66
4	Mahesana	14.86/ 74	3.52/ 70	0.67/ 22	29.71	7.05	1.11	37.87
5	Satalasana	0.26/ 1	2.88/ 58	2.09/ 70	0.52	5.76	3.49	9.77
6	Vadnagar	3.28/ 16	0.66/ 13	0.44/ 15	6.56	1.31	0.73	8.60
7	Visnagar	5.65/ 28	0.73/ 15	0.68/ 23	11.29	1.45	1.14	13.89
8	Vijapur	2.24/ 11	9.94/ 199	0.27/ 9	4.48	19.88	0.46	24.82
9	Unjha	3.86/ 19	0.91/ 18	0.74/ 25	7.71	1.82	1.24	10.77
	Total Mahesana District	**57.35/ 287**	**23.74/ 475**	**6.36/ 212**	**115**	**47**	**11**	**173**

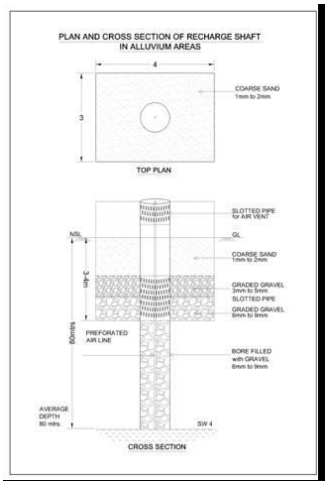
This proposal is generalized based on major criteria however other structures may also be feasible i.e Recharge through Shallow tubewell/Dugwells in combination with Pit/Shaft and farm pond as per prevailing site specific

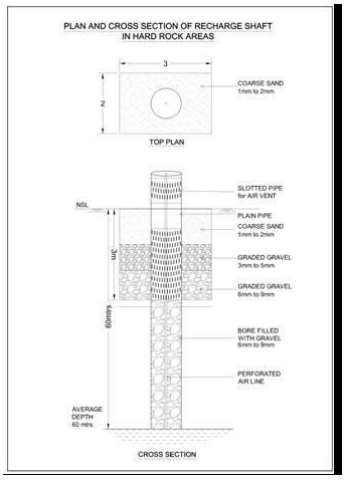
condition for eventual recovery during lean period for sustainability of Crops. In the field Artificial recharge scheme is implemented coupled with observation well/piezometer for monitoring the impact of Artificial recharge to the ground water system. Separate budget proposal should be considered on actual basis as per site condition for monitoring and surveillance of the recharge structures on long term basis.

Figure – 28 Schematic designs of recharge structures



RECHARGE SHAFT





6. Demand side management through irrigation efficiency/ Ground water use efficiency

Farmers of Mahesana have realized the importance of high value agriculture and cash crops and are proactive for suitable crop diversification and absorption of micro irrigation technologies. Thus, to enable and to support the transformation of agriculture, the development of land is a must to avoid crop stress on moisture, nutrition, etc.

Demand side management by Micro Irrigation System i.e. Sprinkler and drip irrigation (in practice in about 28% of area irrigated by ground water), By adding about 15% of the balance area every year in a phased manner, water saving of about 36 MCM in Mahesana can be achieved. It is necessary to bring more and more area of the group of farmers under public tube well/community irrigation by installation of drip/sprinkler irrigation techniques.

Table-34 Volume of water which can be saved by adopting Micro irrigation practices in Mahesana District

Taluka	Irrigation Draft (mcm) 2013	Gross Irrigated Area by GW (Ha)	Area already Covered under MIS (Ha) GGRC	Irrigation Potential created (Ha.)	Area Proposed under MIS* (Ha)	Irrigation Draft for MIS (mcm) Water Saving)
Becharaji	23.66	7940	972	4731	4878	7.32
Kadi	238.67	29376	2183	47734	19035	28.55
Kheralu	101.21	18083	4929	20242	9208	13.81
Mahesana	256.28	37848	1987	51256	25103	37.65
Satalasana	52.41	11240	5337	10482	4132	6.20
Unjha	62.61	12246	835	12522	7988	11.98
Vadnagar	91.61	12360	680	18321	8176	12.26
Vijapur	152.28	29268	2234	30456	18924	28.39

Visnagar	127.09	24650	1643	25418	16105	24.16
Mahesana	**1105.81**	**183011**	**20800**	**221162**	**113547**	**170.32**
**Irrigation Draft for MIS=(Area Proposed under MIS*Δ GW Requirement*0.3)/100*						
70% of the remaining GIA proposed for Micro Irrigation						

At present, the most suitable water-saving technologies available are Drip Irrigation and Sprinkler Irrigation. All the agencies concerned, including banks, are required to put in their best efforts to promote the activity. Even though subsidy is available for Drip irrigation system, spread of the same is on lower side in the district. The lower spread of Drip irrigation system can be attributed to the fact that irrigation wells are shared by the farmers with different land holdings on partnership basis and partners do not agree to share irrigation well for Drip irrigation.

7. Improvement in Ground water development Scenario

Data generation and integration made in Ground Water for the preparation of Ground Water management Plan with information compiled and analyzed aquifer group wise is the first of in its kind and never done before at this scale for the area as a whole. Ground Water Management Plan thus prepared involving Local bodies, resource persons from Central and State Government Organizational and NGOs, Socioeconomic experts etc. after discussion in corridors of power will take it a long way in redefining the planning activities by the people for the people based on scientific information for the development of Ground water resources in the area for the benefit to the larger population of the area.

It is considered that an integrated water resources management with equitable distribution of available Water. Redistribution of pumping pattern, shift in more water efficient cropping pattern as per locally available water to be adopted. Institutional finance and appropriate technology should be freely made available to any individual or cooperative group of farmers that undertake resource augmentation and management measures. Cooperative irrigation scheme as already existing in the area should be encouraged/ rationalized at PRI level. Effective Water management by Stakeholders, Community participation, Socio economic sensitization, NGO's (Sustainability) Conjunctive use of surface and ground water is proposed. Resultant /Expected Change in scenario of groundwater resources through integrated approach/interventions are given below in Table 35.

Table-35 Resultant /Expected Change in Scenario of Groundwater Resources through integrated approach/interventions in Mahesana District

Sr. No.	Taluka	Stage of ground water development 2013	Stage of Ground Water Development (%) after Implementaion of Proposed MIS	Sujalam Sufalam Canal Induced Recharge (mcm)	Additional Recharge from Filling of Tanks (mcm)	Balance Volume of surplus local/ distant source available for recharge (mcm)	Net Annual Ground Water Availability after Additional recharge from SS Canal,Filling of Tanks & surplus run off available for recharge (mcm)	Stage of Ground Water Development (%) after MIS & Recharge	Category after MIS & Recharge
			Demand side	Supply Side					
1	Becharaji	137.1	**122.81**		3.4	11.9	37.24	**66.75**	Semi-critical
2	Kadi	138.05	**131.06**		1.45		176.51	**125.36**	Over Exploited
3	Kheralu	130.43	**123.16**		3.49	9.62	94.57	**101.92**	Over Exploited
4	Mahesana	125.07	**117.37**	22.99	3.61	23.09	259.23	**90.72**	Critical
5	Satalasana	108.48	**103.62**				54.74	**100.39**	Over Exploited
6	Unjha	103.93	**95.96**	2.71	2.96	8.78	78.95	**74.06**	Semi-critical
7	Vadnagar	95.96	**90.86**		7.94	9.27	120.34	**74.95**	Semi-critical
8	Vijapur	127.39	**117.4**		1.23	16.23	139.23	**96.86**	Over Exploited
9	Visnagar	113.83	**105.1**	20.29	9.43	14.16	162.47	**72.47**	Semi-critical
District Total		121.55	**113.87**	**45.99**	**33.51**	**93.05**	1123.28	**92.04**	Semi-critical

It is observed that by taking Demand side intervention in a phased manner, ground water development in the district can be brought at about 114%. After implementation of all the water conservation measures in the form of Sujalam Sufalam project in total and artificial recharge interventions over the period of time in long run, stage of ground water development can be managed within 100% and to some extent relief can be provided to the overexploited area of the district that can be brought under safe category.

Present change in ground water development scenario of the Area in Mahesana district in table 36 indicate the trends in the stress aspect against future demand and accordingly development and management proposals can be considered for meeting demand during 2025 and 2030.

Table-36 Change in Ground water development scenario over the years in Mahesana District

S No	Taluka	Stage of Development As on March 2004	Stage of Development As on March 2009	Stage of Development As on March 2011	Stage of Development As on March 2013	Category As on March 2013
1	Bacharaji	151.26	134.15	136.87	137.1	OE
2	Kadi	137.95	155.02	119.11	138.05	OE
3	Kheralu	92.79	124.72	117.31	130.43	OE
4	Mahesana	143.56	183.54	126.91	125.07	OE
5	Satlasana	158.37	148.46	103.95	108.48	OE
6	Unjha	114.83	118.92	102.41	103.93	OE
7	Vadnagar	183.14	96.87	92.17	95.96	Critical
8	Vijapur	173.37	163.94	120.79	127.39	OE
9	Visnagar	121.43	140.72	114.34	113.83	OE
District Total		**151.17**	**147.96**	**116.08**	**121.55**	OE

VII. Summary of Management Plan

Change in Ground Water Scenario after Proposed interventioons(additional area under MIS and Recharge in Mahesana District)

Taluka	Net Annual Ground Water Availability (mcm) 2013	Irrigation Draft (mcm) 2013	Domestic And Industrial uses Draft 2013	Total Draft (mcm) 2013	Gross Irrigated Area by GW (Ha)	Area already Covered under MIS (Ha) GGRC	Area Proposed under MIS* (Ha)	Δ GW Requirement	Irrigation Draft for MIS (mcm)	Irrigation Draft After MIS (mcm)	Total Draft after MIS (mcm)	Stage of Ground Water Development (%) (GWRE 2013)	Category (GWRE 2013)	Stage of Ground Water Development (%) after MIS	Additional Recharge from SS canal (mcm)	Additional Recharge from Filling of Tanks (mcm)	Balance Volume of surplus local/ distant source available for recharge (MCM)	Additional water required to convert taluka into safe category (MCM)	Net Annual Ground Water Availability after Additional recharge from SS Canal,Filling of Tanks & surplus run off available for recharge (mcm)	Stage of Ground Water Development (%) after MIS,Recharge and additional water put	Projected Category (after All Interventions)
Becharaji	21.94	23.66	6.43	30.09	7940	972	4878	0.5	7.32	16.34	22.77	137.10	OE	103.76		3.4	11.9		37.24	61.13	Safe
Kadi	175.06	238.67	3.00	241.67	29376	2183	19035	0.5	28.55	210.12	213.12	138.05	OE	121.74		1.45		**130**	306.51	69.53	Safe
Kheralu	81.46	101.21	5.04	106.25	18083	4929	9208	0.5	13.81	87.40	92.44	130.43	OE	113.47		3.49	9.62	**40**	134.57	68.69	Safe
Mahesana	209.54	256.28	5.80	262.08	37848	1987	25103	0.5	37.65	218.63	224.43	125.07	OE	107.10	22.99	3.61	23.09	**65**	324.23	69.22	Safe
Satalasana	54.74	52.41	6.97	59.38	11240	5337	4132	0.5	6.20	46.21	53.18	108.48	OE	97.15				**25**	79.74	66.69	Safe
Unjha	64.50	62.61	4.42	67.03	12246	835	7988	0.5	11.98	50.63	55.05	103.93	OE	85.35	2.71	2.96	8.78		78.95	69.73	Safe
Vadnagar	103.13	91.61	7.35	98.96	12360	680	8176	0.5	12.26	79.34	86.69	95.96	Critical	84.06		7.94	9.27	**10**	130.34	66.51	Safe
Vijapur	121.77	152.28	2.85	155.13	29268	2234	18924	0.5	28.39	123.89	126.74	127.39	OE	104.08		1.23	16.23	**50**	189.23	66.98	Safe
Visnagar	118.59	127.09	7.90	134.99	24650	1643	16105	0.5	24.16	102.93	110.83	113.83	OE	93.46	20.29	9.43	14.16		162.47	68.22	Safe
Mahesana	**950.73**	**1105.81**	**49.76**	**1155.6**	**183011**	**20800**	**1E+05**		**170.32**	**935.49**	**985.25**	**121.55**	OE	**89.10**	**45.99**	**33.51**	93.05	**320**	**1443.28**	**68.26**	Safe
*Irrigation Draft for MIS=(Area Proposed under MIS*Δ GW Requirement*0.3)/100																					
70% of the remaining GIA proposed for Micro Irrigation																					

Looking at the Management Plan including demand side and supply side interventions the best we can achieve is to bring the district under Critical Category with stage of ground water development 92.04%. Kadi, Kheralu and Satalasana Talukas will still be under Over Exploited Category with SGWD of 125.36,101.92 and 100.39% respectively.

As per the directions and deliberations at CHQ, Management plan should be prepared in such a manner to convert the district into Safe Category. As we can see above all possible interventions are exhausted. In such scenario quantum of additional water has been calculated in respect of individual talukas to turn them into safe category. It is estimated that additional 320 mcm water is required to convert the district into safe category. Taluka wise breakup is provided as below.

Taluka	Net Annual Ground Water Availability (mcm) 2013	Stage of Ground Water Development (%) (GWRE 2013)	Category (GWRE 2013)	Stage of Ground Water Development (%) after MIS	Category after MIS	Net Annual Ground Water Availability after Additional recharge from SS Canal,Filling of Tanks & surplus run off available for recharge (mcm)	Stage of Ground Water Development (%) after MIS & Recharge	Category after MIS & Recharge	Additional water required to convert taluka into safe category (MCM)	Net Annual Ground Water Availability after Additional recharge from SS Canal,Filling of Tanks & surplus run off available for recharge (mcm)	Stage of Ground Water Development (%) after MIS,Recharge and additional water put	Projected Category (after All Interventions)
Becharaji	21.94	**137.10**	OE		OE	37.24	61.13	Semi-critical		37.24	61.13	Safe
Kadi	175.06	**138.05**	OE	**121.74**	OE	176.51	120.74	Over Exploited	**130**	306.51	69.53	Safe
Kheralu	81.46	**130.43**	OE	**113.47**	OE	94.57	97.74	Over Exploited	**40**	134.57	68.69	Safe
Mahesana	209.54	**125.07**	OE	**107.10**	OE	259.23	86.57	Critical	**65**	324.23	69.22	Safe
Satalasana	54.74	**108.48**	OE	**97.15**	Critical	54.74	97.15	Over Exploited	**25**	79.74	66.69	Safe
Unjha	64.50	**103.93**	OE	**85.35**	Semi-critical	78.95	69.73	Semi-critical		78.95	69.73	Safe
Vadnagar	103.13	**95.96**	Critical	**84.06**	Semi-critical	120.34	72.04	Semi-critical	**10**	130.34	66.51	Safe
Vijapur	121.77	**127.39**	OE	**104.08**	OE	139.23	91.03	Over Exploited	**50**	189.23	66.98	Safe
Visnagar	118.59	**113.83**	OE	**93.46**	Critical	162.47	68.22	Semi-critical		162.47	68.22	Safe
Mahesana	**950.73**	**121.55**	OE	**89.10**	Semi-critical	**1123.28**	**87.71**	Semi-critical	**320**	**1443.28**	**68.26**	Safe

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And several other unpublished reports of CGWB**.**

Annexure 01: Water Level and Water Table Data of Unconfined Aquifer, Mahesana District

Sl. No.	X_long	Y_lat	SITE_NAME	SITE_SUB_TYPE	DISTRICT	TALUKA	AQUIFER_TYPE	AQUIFER GROUP	Year	RL	WL (mbgl) May_2015	**May_WT_15**
1	72.30	23.25	Vidaj	Dug Cum Bore Well	Mahesana	KADI	Unconfined	I	2015	56.60	3.12	53.48
2	72.38	23.29	Budasan	Dug Well	Mahesana	KADI	Unconfined	I	2015	62.00	11.87	50.13
3	72.18	23.51	Asjol	Dug Well	Mahesana	BECHARAJI	Unconfined	I	2015	55.90	5.95	49.95
4	72.11	23.55	Dharpura	Dug Well	Mahesana	BECHARAJI	Unconfined	I	2015	51.00	6.97	44.03
5	72.29	23.58	Maguna	Dug Well	Mahesana	MAHESANA	Unconfined	I	2015	72.60	7.91	64.69
6	72.34	23.63	Panchot	Dug Well	Mahesana	MAHESANA	Unconfined	I	2015	82.10	6.05	76.05
7	72.38	23.73	Bhandupara	Dug Well	Mahesana	VISNAGAR	Unconfined	I	2015	101.00	8.4	92.60
8	72.46	23.76	Tarabh	Dug Well	Mahesana	VISNAGAR	Unconfined	I	2015	122.10	7.65	114.45
9	72.36	23.77	Unawa	Dug Well	Mahesana	UNJHA	Unconfined	I	2015	110.00	4.05	105.95
10	72.35	23.80	Sihi	Dug Well	Mahesana	UNJHA	Unconfined	I	2015	111.00	13.46	97.54
11	72.45	23.84	Dosaj	Dug Well	Mahesana	UNJHA	Unconfined	I	2015	131.00	5.63	125.37
12	72.72	23.85	Unad1	Dug Well	Mahesana	KHERALU	Unconfined	I	2015	170.00	10.62	159.38
13	72.61	23.89	Kheralu1	Dug Well	Mahesana	KHERALU	Unconfined	I	2015	174.00	13.97	160.03
14	72.52	23.89	Rampura1	Dug Well	Mahesana	KHERALU	Unconfined	I	2015	160.00	8.23	151.77
15	72.76	23.85	Madhasana	Piezometer	Mahesana	Vadnagar	Unconfined	I	2015	170.30	21.2	149.10
16	72.69	24.03	Sudasana	Piezometer	Mahesana	Satlasana	Unconfined	I	2015	226.50	21	205.50
17	72.79	23.75	Ransipur	Piezometer	Mahesana	Vijapur	Unconfined	I	2015	145.30	33.9	111.40
18	72.52	23.71	Kansa-I	Piezometer	Mahesana	VISNAGAR	Unconfined	I	2015	128.00	32.5	95.50
19	72.45	23.77	Tarabh-I	Piezometer	Mahesana	VISNAGAR	Unconfined	I	2015	124.50	10.9	113.60
20	72.60	23.74	Gunja	Piezometer	Mahesana	VISNAGAR	Unconfined	I	2015	139.10	10.1	129.00
21	72.56	23.78	Umta-I	Piezometer	Mahesana	VISNAGAR	Unconfined	I	2015	142.00	3.1	138.90
22	72.64	23.79	Vadnagar-I	Piezometer	Mahesana	Vadnagar	Unconfined	I	2015	176.10	2.75	173.35
23	72.28	23.21	Daran_Pz-II	Tube Well	Mahesana	KADI	Unconfined	I	2015	49.30	45.11	4.19
24	72.22	23.27	Visatpura	Piezometer	Mahesana	KADI	Unconfined	I	2015	48.00	7.8	40.20

25	72.66	23.98	Davol	Piezometer	Mahesana	Kheralu	Unconfined	I	2015	216.60	56.6	160.00
26	72.62	23.89	Kheralu	Piezometer	Mahesana	Kheralu	Unconfined	I	2015	172.50	52.7	119.80
27	72.61	23.90	Kheralu (deep)	Tube Well	Mahesana	KHERALU	Unconfined	I	2015	176.10	48.06	128.04
28	72.42	23.43	Jornang	Piezometer	Mahesana	MAHESANA	Unconfined	I	2015	89.70	109.6	-19.90
29	72.30	23.47	Jotana Pziii	Tube Well	Mahesana	MAHESANA	Unconfined	I	2015	72.40	14.6	57.80
30	72.21	23.49	Martoli-I	Piezometer	Mahesana	MAHESANA	Unconfined	I	2015	60.80	6.8	54.00
31	72.40	23.60	Mehsana v	Tube Well	Mahesana	MAHESANA	Unconfined	I	2015	90.00	28.32	61.68
32	72.38	23.53	Mewad	Tube Well	Mahesana	MAHESANA	Unconfined	I	2015	84.90	7.85	77.05
33	72.49	23.80	Karalli II	Tube Well	Mahesana	UNJHA	Unconfined	I	2015	132.30	40.76	91.54
34	72.55	23.56	Dabhla	Piezometer	Mahesana	Vijapur	Unconfined	I	2015	113.40	89.1	24.30
35	72.04	23.57	Adiwada	Piezometer	Mahesana	Becharaji	Unconfined	I	2013	41.70	9.8	31.90
36	72.11	23.55	Delvada	Piezometer	Mahesana	Becharaji	Unconfined	I	2013	49.30	6.4	42.90
37	72.35	23.24	Borisana	Piezometer	Mahesana	KADI	Unconfined	I	2013	54.30	34.9	19.40
38	72.45	23.37	Dangarva	Piezometer	Mahesana	KADI	Unconfined	I	2013	83.40	79.5	3.90
39	72.31	23.39	Suraj	Piezometer	Mahesana	KADI	Unconfined	I	2013	65.70	40.8	24.90
40	72.66	23.98	Davol	Piezometer	Mahesana	Kheralu	Unconfined	I	2013	216.60	55.1	161.50
41	72.25	23.52	Balol	Piezometer	Mahesana	MAHESANA	Unconfined	I	2013	67.40	74.1	-6.70
42	72.80	23.95	Hadol	Piezometer	Mahesana	Satlasana	Unconfined	I	2013	172.00	25.7	146.30
43	72.47	23.82	Ranchhodpura	Piezometer	Mahesana	Unjha	Unconfined	I	2013	133.50	69.9	63.60
44	72.61	23.82	Kesimpa	Piezometer	Mahesana	Vadnagar	Unconfined	I	2013	145.90	11.8	134.10
45	72.76	23.85	Madhasana	Piezometer	Mahesana	Vadnagar	Unconfined	I	2013	170.30	23.2	147.10
46	72.64	23.79	Vadnagar-I	Piezometer	Mahesana	Vadnagar	Unconfined	I	2013	176.10	4.5	171.60
47	72.74	23.56	Vijapur	Piezometer	Mahesana	Vijapur	Unconfined	I	2013	126.40	42.6	83.76

Annexure 02: Water Quality Data of Unconfined Aquifer, Mahesana District

District	Taluka	Village	AQUIFER_TYPE	AQUIFER GROUP	Year	EC (µS/cm)
Mahesana	Becharaji	Dethali	Unconfined	I	2013	5010
Mahesana	Becharaji	Gambhu	Unconfined	I	2013	600
Mahesana	Becharaji	Rantej	Unconfined	I	2013	520
Mahesana	Becharaji	Shankhalpur	Unconfined	I	2013	1020
Mahesana	Kadi	Bavlu	Unconfined	I	2013	1810
Mahesana	Kadi	Khavad	Unconfined	I	2013	3900
Mahesana	Kadi	Vekara	Unconfined	I	2013	1000
Mahesana	Kheralu	Chada	Unconfined	I	2013	1010
Mahesana	Kheralu	Mandali	Unconfined	I	2013	600
Mahesana	Kheralu	Nani Hirwani	Unconfined	I	2013	610
Mahesana	Mahesana	Dela	Unconfined	I	2013	9560
Mahesana	Mahesana	Gorad	Unconfined	I	2013	1410
Mahesana	Satlasana	Dharoi	Unconfined	I	2013	500
Mahesana	Satlasana	Khodamali	Unconfined	I	2013	950
Mahesana	Satlasana	Kothasana	Unconfined	I	2013	460
Mahesana	Satlasana	Umeracha	Unconfined	I	2013	700
Mahesana	Unjha	Bhunav	Unconfined	I	2013	7300
Mahesana	Unjha	Unjha	Unconfined	I	2013	3360
Mahesana	Vadnagar	Sipor	Unconfined	I	2013	710
Mahesana	Vadnagar	Sundhiya	Unconfined	I	2013	1810
Mahesana	Vadnagar	Vadnagar	Unconfined	I	2013	6200
Mahesana	Vijapur	Hirpura	Unconfined	I	2013	910
Mahesana	Vijapur	Jantral	Unconfined	I	2013	1300
Mahesana	Vijapur	Kukarvada	Unconfined	I	2013	1600
Mahesana	Vijapur	Pamol	Unconfined	I	2013	1540
Mahesana	Visnagar	Bhandu	Unconfined	I	2013	1250
Mahesana	Visnagar	Denap	Unconfined	I	2013	6200
Mahesana	Visnagar	Kharavada	Unconfined	I	2013	2800
Mahesana	Visnagar	Pudgam	Unconfined	I	2013	5010
Mahesana	Visnagar	Visnagar	Unconfined	I	2013	5600
Mahesana	Mahesana	Asjol	Unconfined	I	2013	884
Mahesana	Mahesana	Bhandupara	Unconfined	I	2013	2774
Mahesana	Mahesana	Dharpura	Unconfined	I	2013	2470
Mahesana	Mahesana	Dosaj	Unconfined	I	2013	2614
Mahesana	Visnagar	Jagapura	Unconfined	I	2013	2010
Mahesana	Kheralu	Kheralu1	Unconfined	I	2013	1637
Mahesana	Mahesana	Panchot	Unconfined	I	2013	2855
Mahesana	Kheralu	Rampura1	Unconfined	I	2013	1232
Mahesana	Unjha	Sihi	Unconfined	I	2013	1246
Mahesana	Kheralu	Unad1	Unconfined	I	2013	14440
Mahesana	Unjha	Unawa	Unconfined	I	2013	3549
Mahesana	Kadi	Vidaj	Unconfined	I	2013	1923

Mahesana	Becharaji	Adiwada	Unconfined	I	2013	12140
Mahesana	Becharaji	Delvada	Unconfined	I	2013	8220
Mahesana	Kadi	Borisana	Unconfined	I	2013	7360
Mahesana	Kadi	Dangarva	Unconfined	I	2013	1850
Mahesana	Kadi	Suraj	Unconfined	I	2013	5840
Mahesana	Kheralu	Davol	Unconfined	I	2013	720
Mahesana	Kheralu	Kheralu	Unconfined	I	2013	2200
Mahesana	Mahesana	Balol	Unconfined	I	2013	15050
Mahesana	Satlasana	Hadol	Unconfined	I	2013	760
Mahesana	Satlasana	Sudasana	Unconfined	I	2013	750
Mahesana	Unjha	Ranchhodpura	Unconfined	I	2013	4380
Mahesana	Vadnagar	Kesimpa	Unconfined	I	2013	3080
Mahesana	Vadnagar	Madhasana	Unconfined	I	2013	760
Mahesana	Vadnagar	Vadnagar-I	Unconfined	I	2013	15850
Mahesana	Vijapur	Ransipur	Unconfined	I	2013	810
Mahesana	Vijapur	Vijapur	Unconfined	I	2013	1820
Mahesana	Visnagar	Gunja	Unconfined	I	2013	1020
Mahesana	Visnagar	Kansa-I	Unconfined	I	2013	12550
Mahesana	Visnagar	Tarabh-I	Unconfined	I	2013	5120
Mahesana	Visnagar	Umta-I	Unconfined	I	2013	2600

Annexure 03: Piezometric Headl of Confined Aquifer in Mahesana District (May-2015)

Sl. No.	SITE_NAME	X_long	Y_lat	SITE_SUB_TYPE	TALUKA	AQUIFER_TYPE	AQUIFER GROUP	WL (mbgl) May_2015	Water Table
1	Daran_Pz-I	72.2797	23.2064	Tube Well	Kadi	Confined	III	101.0	-51.7
2	Indrad	72.4081	23.3006	Piezometer	Kadi	Confined	III	131.4	-56.1
3	Kundal	72.3481	23.3206	Piezometer	Kadi	Confined	III	97.0	-22.4
4	Laxmanpura-I	72.3081	23.1806	Piezometer	Kadi	Confined	III	105.7	-58.4
5	Laxmanpura-II	72.3081	23.1806	Piezometer	Kadi	Confined	III	117.7	-70.4
6	Suraj	72.3067	23.3897	Tube Well	Kadi	Confined	III	32.0	36.0
7	Thol Pz-III	72.3761	23.1306	Tube Well	Kadi	Confined	III	109.5	-52.4
8	Jaska(Sy_8")Pz_I	72.5347	23.8236	Tube Well	Kheralu	Confined	III	56.9	88.6
9	Jotana Pzi	72.2878	23.4739	Tube Well	Mahesana	Confined	III	117.2	-43.4
10	Martoli-II	72.2078	23.4892	Piezometer	Mahesana	Confined	III	113.4	-52.6
11	Martoli-III	72.2078	23.4892	Piezometer	Mahesana	Confined	III	120.9	-60.1
12	Mehsana III	72.3986	23.5975	Tube Well	Mahesana	Confined	III	101.6	-11.6
13	Maktupur-I	72.3658	23.8300	Piezometer	Unjha	Confined	III	180.0	-60.9
14	Maktupur-II	72.3658	23.8300	Piezometer	Unjha	Confined	III	176.6	-57.5
15	Falu	72.8025	23.6383	Piezometer	Vijapur	Confined	III	89.2	48.6
16	Jantral	72.7153	23.6803	Piezometer	Vijapur	Confined	III	44.9	90.7
17	Motipura_Pz_I	72.6042	23.5339	Tube Well	Vijapur	Confined	III	51.6	59.4
18	Pamol	72.6789	23.5847	Piezometer	Vijapur	Confined	III	101.5	21.4
19	Modhera II	72.4667	23.7167	Tube Well	Visnagar	Confined	III	56.2	60.7
20	Tarabh-II	72.4489	23.7681	Piezometer	Visnagar	Confined	III	101.5	23.0
21	Umta-II	72.5561	23.7808	Piezometer	Visnagar	Confined	III	97.7	44.3
22	Khanderaopura	72.3081	23.1106	Piezometer	Kadi	Confined	III	95.60	-54.20
23	Laxmanpura-III	72.3081	23.1806	Piezometer	Kadi	Confined	III	108.90	-61.60

24	Nandasan	72.4081	23.3806	Piezometer	Kadi	Confined	III	138.90	-54.40
25	Thol Pz-I	72.3761	23.2972	Piezometer	Kadi	Confined	III	66.64	1.96
26	Ambasan	72.3511	23.4736	Piezometer	Mahesana	Confined	III	143.70	-66.20
27	Mehsana I	72.3986	23.5975	Piezometer	Mahesana	Confined	III	151.60	-61.60
28	Mehsana II	72.3986	23.5975	Piezometer	Mahesana	Confined	III	150.71	-60.71
29	Meu	72.5278	23.4925	Piezometer	Mahesana	Confined	III	161.94	-56.64
30	Karalli (i)	72.4861	23.8042	Piezometer	Unjha	Confined	III	140.00	-7.70
31	Maktupur-III	72.3658	23.8300	Piezometer	Unjha	Confined	III	174.40	-55.30

Annexure 04: Water Level Data of Semi Confined Aquifer in Mahesana District (May-2015)

Sl. No.	SITE_NAME	X_long	Y_lat	SITE_SUB_TYPE	DISTRICT	TALUKA	AQUIFER_TYPE	AQUIFER GROUP	WL (mbgl) May_2015	Water Table
1	Daran_Pz-I	72.2797	23.2064	Tube Well	Mahesana	Kadi	Semi-Confined	II	101.0	-51.7
2	Indrad	72.4081	23.3006	Piezometer	Mahesana	Kadi	Semi-Confined	II	131.4	-56.1
3	Kundal	72.3481	23.3206	Piezometer	Mahesana	Kadi	Semi-Confined	II	97.0	-22.4
4	Laxmanpura-I	72.3081	23.1806	Piezometer	Mahesana	Kadi	Semi-Confined	II	105.7	-58.4
5	Laxmanpura-II	72.3081	23.1806	Piezometer	Mahesana	Kadi	Semi-Confined	II	117.7	-70.4
6	Suraj	72.3067	23.3897	Tube Well	Mahesana	Kadi	Semi-Confined	II	32.0	36.0
7	Thol Pz-III	72.3761	23.1306	Tube Well	Mahesana	Kadi	Semi-Confined	II	109.5	-52.4
8	Jaska(Sy_8")Pz_I	72.5347	23.8236	Tube Well	Mahesana	Kheralu	Semi-Confined	II	56.9	88.6
9	Jotana Pzi	72.2878	23.4739	Tube Well	Mahesana	Mahesana	Semi-Confined	II	117.2	-43.4
10	Martoli-II	72.2078	23.4892	Piezometer	Mahesana	Mahesana	Semi-Confined	II	113.4	-52.6
11	Martoli-III	72.2078	23.4892	Piezometer	Mahesana	Mahesana	Semi-Confined	II	120.9	-60.1
12	Mehsana III	72.3986	23.5975	Tube Well	Mahesana	Mahesana	Semi-Confined	II	101.6	-11.6
13	Maktupur-I	72.3658	23.8300	Piezometer	Mahesana	Unjha	Semi-Confined	II	180.0	-60.9
14	Maktupur-II	72.3658	23.8300	Piezometer	Mahesana	Unjha	Semi-Confined	II	176.6	-57.5
15	Falu	72.8025	23.6383	Piezometer	Mahesana	Vijapur	Semi-Confined	II	89.2	48.6
16	Jantral	72.7153	23.6803	Piezometer	Mahesana	Vijapur	Semi-Confined	II	44.9	90.7
17	Motipura_Pz_I	72.6042	23.5339	Tube Well	Mahesana	Vijapur	Semi-Confined	II	51.6	59.4
18	Pamol	72.6789	23.5847	Piezometer	Mahesana	Vijapur	Semi-Confined	II	101.5	21.4
19	Modhera II	72.4667	23.7167	Tube Well	Mahesana	Visnagar	Semi-Confined	II	56.2	60.7
20	Tarabh-II	72.4489	23.7681	Piezometer	Mahesana	Visnagar	Semi-Confined	II	101.5	23.0
21	Umta-II	72.5561	23.7808	Piezometer	Mahesana	Visnagar	Semi-Confined	II	97.7	44.3

Annexure 05: EC of Deep Aquifer in Mahesana District

Sl. No.	District	Taluka	Village	year	Depth of Sampling	EC	Aquifer_Type
1	Mahesana	Kadi	Khanderaopura	2013	99	2090	III
2	Mahesana	Kadi	Laxmanpura-III	2013	108	3110	III
3	Mahesana	Kadi	Nandasan	2013	129	1040	III
4	Mahesana	Mahesana	Ambasan	2013	146	2040	III
5	Mahesana	Mahesana	Meu	2013	144	1150	III
6	Mahesana	Unjha	Maktupur-II	2013	18	2310	III
7	Mahesana	Unjha	Maktupur-III	2013	180	2950	III

Annexure 06: Chemical Quality Data of Wells Inventoried in Mahesana District

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
1	TW	Wasai	Vijapur	8.20	952	638	0	293	121	41	24	0.15	240	20	19	130	157	2.8	6.0
2	TW	Kamalpur	Visnagar	8.12	1238	829	0	329	170	41	69	0.01	270	16	32	170	206	3.4	6.9
3	TW	Dabhla	Vijapur	8.10	932	624	0	268	107	46	51	0.20	220	20	29	170	135	3.1	4.5
4	TW	Devipura	Vijapur	8.10	1230	824	0	244	170	47	102	0.10	200	28	44	250	155	3.5	4.3
5	TW	Lachadi	Visnagar	8.08	985	660	0	342	114	42	16	0.10	280	16	27	150	158	3.2	5.6
6	TW	Lachadi 1	Visnagar	8.12	1205	807	0	354	142	43	68	0.02	290	8	41	190	188	3.7	5.9
7	TW	Maninagar	Visnagar	8.12	1385	928	0	366	213	36	47	0.28	300	16	24	140	250	3.1	9.2
8	TW	Kharwada	Visnagar	8.15	1575	1055	0	403	227	37	97	0.15	330	12	32	160	288	3.1	9.9
9	TW	Ganpatpura	Visnagar	8.13	1336	895	0	281	199	40	109	0.20	230	24	27	170	226	3.6	7.5
10	TW	Manekpura	Vijapur	8.14	1130	757	0	305	85	44	137	0.10	250	16	27	150	184	3.2	6.5
11	TW	Wasai 2	Vijapur	8.09	1244	833	0	268	227	46	33	0.20	220	20	29	170	205	2.5	6.8
12	TW	Padhriya	Mahesana	8.20	1217	815	0	305	170	44	61	0.10	250	16	29	160	199	2.9	6.8
13	TW	Dabhala 2	Vijapur	7.80	1256	842	0	244	163	85	110	0.40	200	60	32	280	155	3.6	4.0
14	TW	Dhamanwa	Visnagar	8.00	1245	834	0	305	149	48	100	0.15	250	32	24	180	196	3.3	6.4
15	DW	Dhandhusan 1	Mahesana	8.10	2236	1498	0	647	291	39	117	2.88	530	28	29	190	422	1.0	13.3
16	TW	Dhandhusan 2	Mahesana	8.10	1155	774	0	354	142	44	30	0.30	290	32	17	150	189	3.2	6.7
17	TW	Meu	Mahesana	8.00	1458	977	0	268	227	46	136	0.15	220	36	22	180	250	3.4	8.1
18	TW	Laxmipura	Mahesana	8.00	1204	807	0	244	192	48	70	0.20	200	40	29	230	164	4.8	4.7

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
19	TW	Anandpura 2	Mahesana	7.90	1800	1206	0	280	312	70	137	0.53	230	40	49	300	265	2.5	6.7
20	TW	Gojhariya 1	Mahesana	8.20	1050	704	0	317	135	36	29	0.20	260	32	12	130	176	3.6	6.7
21	TW	Gojhariya 2	Mahesana	8.20	850	570	0	293	107	26	15	0.42	240	12	22	120	143	3.0	5.7
22	DW	Gojhariya 3	Mahesana	8.00	1317	882	0	415	170	44	22	0.37	340	76	29	310	153	4.3	3.8
23	TW	Gojhariya 4	Mahesana	8.10	1260	844	0	281	192	33	58	0.37	230	28	27	180	190	3.6	6.2
24	TW	Unava	Unjha	7.90	2606	1746	0	354	511	32	208	1.33	290	40	39	260	463	3.8	12.5
25	DW	Unava 2	Unjha	8.20	4353	2917	0	427	980	8	317	0.93	350	16	44	220	860	20.6	25.2
26	DW	Sunok	Unjha	8.20	3425	2294.75	0	732	696	14	89	1.94	600	40	136	660	480	1.8	8.1
27	TW	Sunok 2	Unjha	8.20	2423	1623.41	0	500	412	33	123	2.60	410	56	10	180	451	2.5	14.6
28	DW	Aithor	Unjha	7.80	6066	4064.22	0	439	1434	21	561	1.08	360	48	107	1600	650	1.3	7.1
29	TW	Aithor 2	Unjha	7.90	2974	1992.58	0	488	568	110	107	2.66	400	40	34	240	542	16.9	15.2
30	DW	Tarabh	Unjha	8.20	3293	2206.31	0	817	611	7	120	2.70	670	28	92	450	441	199.0	9.0
31	DW	Mahakali Mata	Unjha	8.20	1205	807.35	0	293	206	27	57	0.85	240	72	29	300	146	7.9	3.7
32	DW	Unjha	Unjha	8.10	3142	2105.14	0	537	497	235	190	1.05	440	36	122	590	437	96.3	7.8
33	TW	Unjha 2	Unjha	8.20	1311	878.37	0	366	227	23	57	2.70	300	24	15	120	271	1.6	10.8
34	TW	Dhanpura (Ghantu)	Vijapur	7.10	2438	1633	0	146	624	80	119	0.65	120	176	133	990	97	1.1	1.3

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
35	TW	Bhimpur	Vijapur	7.40	1815	1216	0	268	411	115	19	0.80	220	104	90	630	134	1.1	2.3
36	TW	Wajapura Shakapura	Vijapur	7.22	2700	1809	0	183	659	115	146	0.63	150	100	162	920	192	1.1	2.8
37	TW	Kotadi	Vijapur	7.76	2061	1381	0	220	440	12	165	0.80	180	60	47	340	300	9.1	7.1
38	TW	Tintodan	Vijapur	7.60	1546	1036	0	183	319	62	117	0.25	150	56	39	300	220	4.1	5.5
39	TW	Sokada	Vijapur	7.30	900	603	0	183	135	50	72	0.15	150	32	29	200	119	3.9	3.7
40	TW	Wadasan	Vijapur	7.50	846	567	0	268	128	32	21	0.30	220	24	24	160	134	4.3	4.6
41	TW	Devda	Vijapur	7.58	895	600	0	305	85	49	65	0.20	250	56	26	240	110	3.8	3.1
42	TW	Mahadevpur Dabhla	Vijapur	7.16	957	641	0	244	149	48	33	0.10	200	52	19	210	127	4.2	3.8
43	TW	Didiyasan	Mahesana	8.00	2900	1943	0	220	674	43	246	0.33	180	60	65	420	467	5.3	9.9
44	TW	Panchot	Mahesana	8.10	1768	1185	0	244	312	6	186	0.85	200	40	29	220	288	6.0	8.4
45	TW	Chhatiarda	Mahesana	8.24	1511	1012	0	439	248	2	28	1.50	360	20	22	140	280	3.7	10.3
46	DW	Butta Paldi	Mahesana	8.20	490	328	0	244	28	3	16	0.20	200	32	19	160	46	12.4	1.6
47	DW	Moti Dau	Mahesana	8.28	2871	1924	0	342	681	48	115	0.42	280	40	55	330	498	4.5	11.9
48	TW	Tareti	Mahesana	7.93	2187	1465	0	256	461	7	220	0.58	210	64	46	350	347	5.3	8.1
49	DW	Poladar	Mahesana	7.93	2745	1839	0	256	581	33	276	0.55	210	32	50	290	490	6.8	12.5
50	DW	Bhandu	Visnagar	8.20	2300	1541	0	317	532	41	45	0.37	260	56	84	490	281	48.4	5.5
51	DW	Jetalvasana	unjha	8.29	2390	1601	0	488	404	50	124	1.14	400	20	36	200	437	47.4	13.4
52	DW	Amarpura	Mahesana	8.90	17110	11464	60	415	5070	6	910	1.20	440	240	792	3900	2180	19.0	15.2
53	DW	Nawapura	unjha	8.20	448	300	0	220	50	3	14	0.40	180	48	12	170	46	3.7	1.5

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
54	DW	Pali	unjha	8.20	1245	834	0	586	85	6	12	3.68	480	20	24	150	220	10.3	7.8
55	DW	Kanthravi	Unjha	8.24	3977	2665	0	659	780	105	200	0.74	540	60	96	550	470	320.0	8.7
56	DW	Kharsada	Mahesana	8.26	498	334	0	281	14	2	20	0.00	230	56	12	190	38	20.8	1.2
57	DW	Virata	Mahesana	8.19	744	498	0	244	85	25	19	0.37	200	36	29	210	70	45.9	2.1
58	DW	Gorad	Mahesana	9.00	1764	1182	48	317	255	65	115	0.93	340	36	46	280	221	100.0	5.7
59	TW	Nagalpur	Mahesana	7.62	2151	1441	0	281	454	44	139	0.30	230	48	51	330	336	9.1	8.0
60	TW	Lakhwad	Mahesana	8.10	1871	1254	0	390	369	44	37	0.30	320	36	27	200	332	5.9	10.2
61	TW	Meghaaliyasna	Visnagar	8.02	1624	1088	0	488	241	45	15	0.25	400	20	22	140	302	4.5	11.1
62	TW	Gunjala	Visnagar	7.56	1585	1062	0	354	277	37	49	0.26	290	28	19	150	284	4.2	10.1
63	TW	Ubalpur	Visnagar	7.95	1453	974	0	342	262	47	43	0.25	280	40	27	210	243	4.5	7.3
64	TW	Thumthal	Visnagar	8.00	2050	1374	0	403	425	50	23	0.14	330	36	32	220	360	4.4	10.6
65	TW	Dharusan	Visnagar	8.15	1060	710	0	293	177	41	18	0.18	240	32	17	150	182	3.7	6.5
66	TW	Mulsan	Visnagar	7.90	1429	957	0	268	284	55	33	0.05	220	60	36	300	186	3.8	4.7
67	TW	Sangampur	Mahesana	8.17	926	620	0	244	142	41	26	0.14	200	40	12	150	144	3.2	5.1
68	TW	Kherwa	Mahesana	8.20	1368	917	0	244	269	50	60	0.25	200	48	46	310	174	3.5	4.3
69	TW	Kadwasan	Mahesana	8.16	1992	1335	0	207	567	25	27	0.25	170	60	70	440	271	3.2	5.6
70	TW	Rampura	Mahesana	8.28	1798	1205	0	207	312	31	234	0.05	170	48	34	260	287	4.2	7.7

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
71	TW	Dela	Mahesana	8.26	2371	1589	0	317	397	49	337	0.09	260	80	291	400	376	4.5	8.2
72	TW	Uchrpi	Mahesana	8.28	3028	2029	0	317	830	10	23	0.25	260	48	61	370	510	37.0	11.5
73	DW	Chitroda	Visnagar	8.25	1928	1292	0	403	227	42	251	0.00	330	104	17	330	285	4.2	6.8
74	TW	Becharpur	Visnagar	8.50	1942	1301	48	305	362	22	114	0.18	330	36	22	180	370	4.6	12.0
75	TW	KansaraKui	Visnagar	8.60	1960	1313	78	317	340	6	57	0.25	390	20	22	310	290	4.0	7.2
76	DW	Ghada	Mahesana	8.20	1810	1213	0	647	213	5	78	2.00	530	60	73	450	190	66.0	3.9
77	DW	Piludra	Mahesana	8.27	3240	2171	0	525	695	33	126	0.12	430	60	75	460	516	3.8	10.5
78	TW	Tavadia	Mahesana	8.28	2166	1451	0	439	425	50	92	0.35	360	80	24	300	370	4.0	9.3
79	TW	Vadu	Visnagar	8.06	3020	2023	0	525	617	1	120	0.43	430	28	46	260	528	46.0	14.2
80	DW	Bamosana	Visnagar	8.50	1600	1072	60	98	369	40	91	0.02	180	48	51	330	232	14.2	5.6
81	DW	Randala	Visnagar	8.70	2300	1541	78	366	397	26	88	0.35	430	20	32	180	428	3.6	13.9
82	DW	Ganeshpura	Visnagar	8.50	2334	1564	96	366	376	60	100	0.67	460	20	27	160	456	20.0	15.7
83	DW	Pudgam	Visnagar	8.62	2254	1510	78	183	383	50	258	1.10	280	28	48	270	400	3.6	10.6
84	TW	Iyasera	Visnagar	8.28	2710	1816	0	464	532	35	140	0.50	380	60	24	250	415	150.0	11.4
85	DW	Valam	Visnagar	8.26	2980	1997	0	622	518	65	110	0.18	510	36	22	180	556	74.0	18.0
86	TW	Khandosan	Visnagar	8.29	2215	1484	0	488	425	31	39	0.95	400	60	120	210	398	4.1	11.9
87	TW	Laxmipura	Visnagar	8.28	2760	1849	0	476	603	31	66	1.70	390	100	24	350	460	4.0	10.7

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
88	TW	Rupal	Mahesana	8.16	2096	1404	0	183	510	39	98	1.50	150	36	41	260	348	4.8	9.4
89	TW	Hebuwa	Mahesana	8.10	1230	824	0	281	256	18	55	0.30	230	32	27	190	220	2.6	6.9
90	DW	Punasan-A	Mahesana	8.10	2045	1370	0	476	398	24	105	0.75	390	92	71	520	262	5.4	5.0
91	TW	Punasan-B	Mahesana	8.10	1567	1050	0	232	355	21	93	0.50	190	52	36	280	245	3.7	6.4
92	TW	Jagudhan	Mahesana	8.10	820	549	0	281	142	17	6	0.35	230	52	17	200	117	2.2	3.6
93	TW	Kochwa	Mahesana	8.20	992	665	0	305	163	27	43	0.55	250	28	24	170	175	1.8	5.8
94	TW	Mewad	Mahesana	8.00	1594	1068	0	183	369	8	171	0.53	150	92	22	320	250	4.3	6.1
95	TW	Boriavi	Mahesana	8.20	1653	1108	0	183	398	23	147	0.45	150	40	39	270	286	3.7	7.6
96	TW	Sukhpurda	Mahesana	8.20	1668	1118	0	329	376	38	23	0.20	270	24	19	190	309	3.3	9.7
97	TW	Sobhasan	Mahesana	8.20	1629	1091	0	293	405	39	58	0.40	240	24	39	220	318	3.2	9.3
98	TW	Palawasana	Mahesana	8.20	1593	1067	0	256	362	15	99	0.28	210	28	39	230	282	3.4	8.1
99	TW	Hanumant	Mahesana	8.10	1374	921	0	268	298	9	124	0.45	220	40	36	250	245	3.0	6.7
100	TW	Linch	Mahesana	8.10	975	653	0	281	163	46	15	0.55	230	24	22	150	169	1.9	6.0
101	TW	Baliyasan	Mahesana	8.20	985	660	0	281	156	60	52	0.45	230	44	15	170	178	2.6	5.9
102	TW	Jornang	Mahesana	8.00	1557	1043	0	451	249	85	61	0.65	370	32	39	240	285	2.6	8.0
103	TW	Navi Shedhavi	Mahesana	8.20	1570	1052	0	464	199	49	103	0.45	380	20	36	200	282	2.1	8.7
104	TW	Hadvi	Mahesana	8.10	2130	1427	0	390	499	75	88	0.55	320	36	61	340	389	3.1	9.2

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
105	TW	Wadasma	Mahesana	8.20	1290	864	0	329	256	48	15	0.55	270	16	34	180	235	2.2	7.6
106	TW	Langhnaj	Mahesana	8.20	1395	935	0	573	121	35	27	0.40	470	16	22	130	262	2.7	10.0
107	TW	Badal Pura	Mahesana	7.90	2295	1538	0	232	618	65	68	0.40	190	60	63	410	362	3.2	7.8
108	TW	Akhaj	Mahesana	8.00	1220	817	0	305	249	56	29	0.40	250	40	27	210	217	2.9	6.5
109	TW	Chaluwa	Mahesana	8.00	1060	710	0	329	199	29	44	0.50	270	32	34	220	186	2.7	5.5
110	TW	Bhakdiya	Mahesana	8.20	1266	848	0	293	256	35	26	0.40	240	24	36	210	208	2.5	6.2
111	TW	Ditasan	Mahesana	8.00	1495	1002	0	220	348	4	125	0.50	180	92	27	340	217	4.3	5.1
112	TW	Dholasan	Mahesana	8.20	1270	851	0	281	277	39	14	0.35	230	24	17	130	250	3.2	9.5
113	DW	Ambaliyasan	Mahesana	8.10	290	194	0	183	28	9	33	0.20	150	36	27	200	15	3.8	0.5
114	TW	Sunderpur	Vijapur	8.1	1108	742.36	0	390	71	90	**29**	0.55	320	52	56	360	76	2.4	1.7
115	TW	Ganeshpura	Vijapur	7.7	2028	1358.76	0	354	468	26	**34**	1.80	290	72	54	400	285	3.8	6.2
116	DW	Khari	Satlasna	8.0	444	297	0	220	36	29	**24**	2.10	912	40	17	170	53	3.5	1.8
117	TW	Vasai	Satlasna	7.9	631	423	0	146	92	55	**9**	0.50	818	64	17	230	35	3.3	1.0
118	TW	Chelana	Satlasna	8.1	452	303	0	195	43	50	**3**	0.60	813	60	10	190	35	0.8	1.1
119	TW	Dulana 1	Satlasna	8.1	923	618	0	134	135	190	**20**	0.00	654	92	19	320	72	1.6	1.7
120	DW	Dulana 2	Satlasna	8.0	1028	689	0	183	149	205	**15**	0.00	619	108	24	370	80	2.1	1.8
121	TW	Jaspur	Satlasna	8.1	605	405	0	195	71	95	**9**	0.00	1088	68	15	230	54	0.7	1.5

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
122	DW	Ranpur 1	Satlasna	8.0	625	419	0	232	78	29	**7**	0.01	1369	40	24	200	61	2.5	1.9
123	TW	Ranpur 2	Satlasna	8.1	585	392	0	195	78	37	**11**	0.06	858	40	19	180	61	0.5	2.0
124	TW	Takhatpura	Satlasna	8.2	691	463	0	207	71	58	**40**	0.75	765	32	15	140	102	0.9	3.7
125	TW	Talegadh	Satlasna	8.2	550	369	0	171	57	100	**4**	0.07	647	48	24	220	40	1.6	1.2
126	TW	Mahamadpura	Satlasna	8.1	487	326.29	0	171	43	62	**10**	0.50	1783	40	17	170	43	0.9	1.4
127	TW	Umari	Satlasna	8.2	420	281.4	0	220	36	24	**12**	1.50	1753	48	12	170	45	2.0	1.5
128	DW	Bhalu moti	Satlasna	8.2	831	556.77	0	366	64	26	**28**	1.35	2198	76	34	330	53	7.1	1.3
129	DCB	Semor 1	Satlasna	8.2	1056	707.52	0	159	156	220	**13**	1.30	2031	80	32	330	100	9.6	2.4
130	TW	Semor 2	Satlasna	8.2	625	418.75	0	195	64	105	**7**	1.40	852	48	22	210	63	1.8	1.9
131	DW	Bhalu nani	Satlasna	8.2	533	357.11	0	183	64	55	**7**	1.30	1122	48	17	190	49	2.4	1.5
132	DCB	Vasda	Satlasna	8.2	454	304.18	0	159	43	55	**6**	0.95	901	48	15	180	30	1.5	1.0
133	TW	Sardarpura Chikana 1	Satlasna	8.0	615	412.05	0	171	64	90	**20**	0.60	1108	60	22	240	40	1.3	1.1
134	TW	Sardarpura Chikana 2	Satlasna	8.1	647	433.49	0	146	78	110	**12**	0.55	909	60	27	260	34	0.9	0.9
135	TW	Sudasana	Satlasna	7.9	713	477.71	0	281	64	70	**18**	4.20	1023	56	17	210	91	2.2	2.7
136	TW	Nava Sudasana	Satlasna	8.0	458	306.86	0	232	36	15	**16**	3.00	1398	40	17	170	50	1.1	1.7
137	TW	Oida	Satlasna	7.8	798	534.66	0	256	92	80	**8**	2.70	1909	24	17	130	134	0.7	5.1
13	TW	Umrecha 1	Satlasna	8.2	594	397.98	0	220	50	55	**10**	1.40	886	36	15	150	46	41.7	1.6

S. N.	Type	Location	Taluka	pH	EC (µS/cm)	TDS (mg/L)	CO3 (mg/L)	HCO3(mg/L)	Cl(mg/L)	NO3 (mg/L)	SO4 (mg/L)	F (mg/L)	Alk'y (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	Na (mg/L)	K (mg/L)	SAR
8																			
139	DW	Umrecha 2	Satlasna	8.0	354	237.18	0	171	36	4	**1**	2.88	920	32	15	140	29	3.3	1.1
140	TW	Bhalusana	Satlasna	7.9	867	580.89	0	207	99	105	**29**	1.38	1157	76	22	280	69	2.3	1.8
141	DW	Bhatwas	Satlasna	8.1	707	473.69	0	329	56	45	**18**	0.55	1594	88	19	300	49	15.1	1.2
142	TW	Rinchhada	Satlasna	8.0	710	475.7	0	244	71	50	**26**	1.15	965	40	17	170	93	0.9	3.1
143	TW	Ankaliyara	Satlasna	7.9	1082	724.94	0	342	128	115	**59**	0.30	1505	28	17	140	220	1.1	8.1
153	DW	Khari	Satlasna	8.0	444	297	0	220	36	29	**24**	2.10	912	40	17	170	53	3.5	1.8

Annexure 07: Wells Inventoried for Aquifer Mapping in Mahesana District

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
1	Dediasan	TW	Panchayat	Mahesana	Govt. Supply TW near old Library, infront of Govt. Primary School	46A/6	2B1	23.59	72.35	300	0.2		165 (Reported)	
2	Panchot	TW	Goswami Narendar Puri Kashi Puri	Mahesana	In Owner's field on RHS of the road from Panchot to Dediasan, about 1km from village Panchot	46A/6	2B2	23.62	72.34	420	0.3		135 (Reported)	
3	Chhatiarda	TW	Kantila Dwarkadas Patel	Mahesana	Infront of Motipura Locality in land of the Owner	46A/6	2B3	23.65	72.33	360	0.25		120 (Reported)	
4	Butta Paldi	DW	Panchayat	Mahesana	Near Telephone Exchange on the road side	46A/6	1B1	23.67	72.36	16.7	3.2	1	9.26	
5	Moti Dau	DW	Panchayat	Mahesana	Near Water Supply overhead tank	46A/6	1B2	23.68	72.40	24.8	6.3	1	23.7	
6	Tareti	TW	Panchayat	Mahesana	Near Water Supply overhead tank	46A/6	2B4	23.65	72.68	330	0.2		135 (Reported)	
7	Poladar	DW	Panchayat	Mahesana	Near Somnath Mahadev temple and Overhead tank	46A/6	2B5	23.64	72.36	16.17	3.6	1.5	10.1	
8	Bhandu	DW	Panchayat	Visnagar	Panchayat well for water supply near railway track	46A/6	1B3	23.70	72.39	16.43	4.8	2	11.73	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
9	Jetal Vasana	DW	Panchayat	Visnagar	Near the water supply panchayat tubewell	46A/6	1B4	23.73	72.41	27.5	4.2	1	2.28	
10	Amarpura	DW	Panchayat	Visnagar	Near the agricultural field of Pratapji Gopaji Rajput	46A/6	1B5	23.72	72.36	16.2	3.2	0.75	12.84	
11	Nawapura	DW	Panchayat	Unjha	Panchayat well , near the village entrance and Prathmik School	46A/6	1B6	23.73	72.34	22.1	3.9	1	6.16	
12	Pali	DW	Panchayat	Unjha	Near Govt. Primary School on Dabri Tri Junction	46A/6	1A3	23.75	72.32	17.5	3.1	0.75	8.25	
13	Kanthravi	DW	Panchayat	Unjha	In the centre of the village (Navan Kua) near old girls school	46A/6	1A2	23.73	72.31	18.24	6.2	1	9.9	
14	Kharsda	DW	Panchayat	Mahesana	Behind Govt. high school and near Panchayat office and Ramji Temple	46A/6	1B7	23.71	72.34	17.8	3.4	1	12.4	
15	Virata	DW	Panchayat	Mahesana	Near village Bus Stand	46A/6	1A6	23.70	72.30	30.13	3.5	2	20.6	
16	Gorad	DW	Panchayat	Mahesana	Near Overhead tank	46A/6	1A7	23.69	72.32	36	4.1	1	17	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
17	Nagalpur	TW	Panchayat	Mahesana	Near Over Head tank and village Panchayat Office	46A/6	2B6	23.58	72.36	360	0.2		150 (Reported)	
18	Lakhwad	TW	Panchayat	Mahesana	Outside the village in Govt. land near water supply overhead tank, about 1 km away from the village	46A/6	2C1	23.59	72.42	255	0.2		120 (Reported)	
19	Megha Aliyasana	TW	Panchayat	Visnagar	Behind Govt. Primary School	46A/6	2C2	23.60	72.46	300	0.2		125 (Reported)	
20	Gunjala	TW	Panchayat	Visnagar	Near Water Supply overhead tank and Varahi Mata Temple	46A/6	3C1	23.57	72.47	240	0.2		150 (Reported)	
21	Udalpur	TW	Panchayat	Visnagar	Road side of Mahesana Himatnagar highway near overhead tank and Govt. dispensary	46A/6	3C3	23.56	72.48	278	0.2		165 (Reported)	
22	Thumthal	TW	Panchayat	Visnagar	Near Overhead tank and Rohitwas locality (Harijan Basti)	46A/6	2C3	23.58	72.49	210	0.2		150 (Reported)	
23	Dharvasan	TW	Panchayat	Visnagar	Near Panchayat Office	46A/6	3C3	23.54	72.49	225	0.2		150 (Reported)	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
24	Mulsan	TW	Lalaji Chavda	Visnagar	In the Owner's land on road side	46A/6	3C4	23.52	72.48	138	0.2		120 (Reported)	
25	Mulsan Pz	Pz	GWRDC	Visnagar		46A/6	3C9	23.52	72.48		0.15	0.5	56.7	
26	Sanganpur	TW	Panchayat	Mahesana	Near overhead tank, in front of Dugdha Utpadak Sahkari Mandali	46A/6	3C5	23.51	72.45	240	0.2		90 (Reported)	
27	Kherwa	TW	Patel Pahladbhai Keshav Lal	Mahesana	Near the Road Junction (Sanganpur Chowkdi)	46A/6	3C6	22.54	72.44	270	0.25		180 (Reported)	
28	Kadwasan	TW	Rasikbhai G Patel	Mahesana		46A/6	3C7	23.56	72.48	250	0.3		144 (Reported)	
29	Rampura	TW	Panchayat	Mahesana	Near the village gate, overhead tank & Khodiyar Mata Temple	46A/6	3C8	23.57	72.42	300	0.2		160 (Reported)	
30	Dela	TW	Panchayat	Mahesana	Outside the village near overhead tank	46A/6	2C4	23.62	72.43	270	0.2		165 (Reported)	
31	Uchrpi	TW	Choudhary Mahadevbhai Bhava bhai	Mahesana	In the owner's field outside the village	46A/6	2C5	23.61	72.43	210	0.3		60 (Reported)	
32	Chitroda	DW	Panchayat	Visnagar	Near Rama Peer temple, infront of house of Shankarbhai	46A/6	2C6	23.62	72.46	104	3.2	0.5	6.8	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
					Jethabhai Choudhary on Basana Road									
33	Becharpur	TW	Panchayat	Visnagar	Near overhead tank , infront of Govt. Middle school	46A/6	2C7	23.63	72.48	225	0.2		162 (Reported)	
34	Kansara Kui	TW	Panchayat	Visnagar	Near overhead tank, Kali Mata Temple and Nursing college	46A/6	2C8	23.65	72.48	300	0.2		150 (Reported)	
35	Ghada	DW	Panchayat	Mahesana	Near Overhead tank	46A/6	2C9	23.66	72.45	20.5	4.8		15.1	
36	Piludra	DW	Panchayat	Mahesana	Near Nilkanth Mahadev Temple and Chidia ghar	46A/6	2C10	23.66	72.44	11.8	4.6	0.5	5	
37	Tavadiya	TW	Panchayat	Mahesana	Near Overhead tank and Panchayat Office	46A/6	2B6	23.63	72.41	300	0.2		150 (Reported)	
38	Vadu	TW	Panchayat	Visnagar	Outside the village	46A/6	1C1	23.70	72.43	225	0.2		105 (Reported)	
39	Bamosana	DW	Panchayat	Visnagar	Village Panchayat well near overhead tank, pond and Milk Dairy	46A/6	1C2	23.68	72.42	11.6	3.5	0.5	6.48	
40	Randala	DW	Panchayat	Visnagar	Infront of Govt. Primary School	46A/6	1C3	23.67	72.46	11.8	3.2	1.5	7.8	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
41	Ganeshpura	DW	Panchayat	Visnagar	Near overhead tank	46A/6	1C4	23.67	72.49	17.3	3.4	1	5.08	
42	Ganeshpura 2	TW	Panchayat	Visnagar	Near overhead tank	46A/6	1C4	23.67	72.48	250	0.2		135 (Reported)	
43	Pudgam	DW	Panchayat	Visnagar	Near overhead tank	46A/6	1C5	23.69	72.48	40	4	1.5	11.27	
44	Pudgam 2	TW	Panchayat	Visnagar	Near overhead tank	46A/6	1C5	23.70	72.47	213	0.25		150 (Reported)	
45	Iyasara	TW	Panchayat	Visnagar	Near Hanumanwas Temple and Arogya kendra	46A/6	1C6	23.72	72.49	210	0.25		135 (Reported)	
46	Valam	DW	Panchayat	Visnagar	Public Well near Public Library and Mahesana District Central Co-Operative Bank	46A/6	1C7	23.72	72.46	12.5	3.1		3.16	
47	Khandosan	TW	Kachara bhai Revabhai Choudhary	Visnagar	Near the Panchayat well and Overhead tank, near Gangwo Kuo	46A/6	1C8	23.74	72.47	75	0.2		18	
48	Laxmipura	TW	Panchayat	Unjha	Near overhead tank, Ambaji Temple	46A/6	1C9	23.74	72.43	300	0.2		105 (Reported)	
49	Rupal (Kukas)	TW	Panchayat	Mahesana	Near Panchayat office and overhead tank	46A/6	3B1	23.68	72.35	280	0.2		150 (Reported)	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
50	Hebuwa	TW	Panchayat	Mahesana	On the roadside near overhead tank	46A/6	3B2	23.55	72.41	273	0.2		150 (Reported)	
51	Punasan	DW	Panchayat	Mahesana	Behind Brahmani Mata Temple	46A/6	3B3	23.54	72.41	36.2	4	1.5	20.66	
52	Jagudan	TW	Panchayat	Mahesana	Near Bus Stand and overhead tank	46A/6	3B4	23.52	72.41	210	0.2		160 (Reported)	
53	Kochwa	TW	Panchayat	Mahesana	Near Panchayat office and Primary School	46A/6	3C9	23.51	72.42	220	0.2		175 (Reported)	
54	Mewad	TW	Panchayat	Mahesana	Near Panchayat office and overhead tank	46A/6	3B5	23.53	72.39	225	0.2		175 (Reported)	
55	Boriavi	TW	Panchayat	Mahesana	Infront of Ambaji temple and overhead tank	46A/6	3B6	23.53	72.36	315	0.25		150 (Reported)	
56	Sukhpurda	TW	Sardarji Cheheraji	Mahesana	In owner's house and farm on roadside	46A/6	3B7	23.54	72.38	210	0.2		150 (Reported)	
57	Sobhasan	TW	Panchayat	Mahesana	Near Primary school, Panchayat office and overhead tank	46A/6	3B8	23.54	72.41	225	0.2		150 (Reported)	
58	Palawasana	TW	Panchayat	Mahesana	Near Primary School	46A/6	3B9	23.57	72.37	270	0.25		150 (Reported)	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
59	Henduwa Hanumant	TW	Panchayat	Mahesana	Near overhead tank and Primary School	46A/6	3B10	23.57	72.36	270	0.2		150 (Reported)	
60	Linch	TW	Panchayat	Mahesana	Vata Locality in the village, near overhead tank	46A/7	1B1	23.50	72.37	270	0.2		135 (Reported)	
61	Baliyasan	TW	Panchayat	Mahesana	Near overhead tank and milk Dairy	46A/7	1B2	23.45	72.39	255	0.2		135 (Reported)	
62	Jornang	TW	Panchayat	Mahesana	Near overhead tank and Shmashan Ghat	46A/7	1C1	23.44	72.44	220	0.2		150 (Reported)	
63	Navi Shedhavi	TW	Panchayat	Mahesana	Near overhead tank and Chehar Mata temple	46A/7	1C2	23.42	72.44	240	0.2		135 (Reported)	
64	Hadvi	TW	Panchayat	Mahesana	Infront of primary school and Varahi Mata temple	46A/7	2C1	23.40	72.47	216	0.2		150 (Reported)	
65	Wadasma	TW	Panchayat	Mahesana	Near Bustand and infront of primary school	46A/7	2C2	23.41	72.49	300	0.2		175 (Reported)	
66	Langhnaj	TW	Panchayat	Mahesana	Near overhead tank and the Union High School, infront of Jilla Panchayat Rest house on Meu Road	46A/7	1C3	23.45	72.50	270	0.2		165 (Reported)	
67	Badalpura	TW	Panchayat	Mahesana	Near Chehar Mataji Temple	46A/7	1C4	23.48	72.51	210	0.2		135 (Reported)	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
68	Akhaj	TW	Panchayat	Mahesana	Near overhead tank and Santokba Arogya Kendra	46A/7	1C5	23.48	72.46	270	0.2		165 (Reported)	
69	Chaluwa	TW	Panchayat	Mahesana	Near Primary school and Overhead tank	46A/7	1C6	23.47	72.44	255	0.2		135 (Reported)	
70	Bhakdiya	TW	Panchayat	Mahesana	Near Overhead tank and Panchayat Office	46A/7	1C7	23.49	72.43	216	0.2		150 (Reported)	
71	Ditasan	TW	Panchayat	Mahesana	Near Overhead tank and Panchayat Office	46A/7	1B3	23.50	72.41	235	0.2		150 (Reported)	
72	Dholasan	TW	Panchayat	Mahesana	On the roadside to the village from highway in Bhagoliya locality near Chamunda Mata temple	46A/7	1B4	23.41	72.34	270	0.2		150 (Reported)	
73	Ambliyasan	DW	Panchayat	Mahesana	Near Overhead tank (Water Supply Tank) in front of Varahi mata Temple	46A/7	1B5	23.45	72.43	18.4	3.3	0.4	17.5	
74	Wasai	TW	Bhogilal Patel	Vijapur	About 200m East of Railway Track, About 500m South of Wasai Dabhla Railway Station in Owner's Farm	46A/10	3A1	23.53	72.58	317	0.3		110 (Reported)	900

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
75	Kamalpur	TW	Amritpuri Becharpuri Goswami	Visnagar	About 500m East of Kamalpur Village, South of Mahesana Vijapur Highway	46A/10	3A2	23.56	72.52	219.5	0.3		122 (Reported)	1200
76	Dabhla	TW	Panchayat	Vijapur	20m North of Mahesana Vijapur Highway, South East of Dabhla village near Transformer and Overhead Tank	46A/10	3A3	23.56	72.55	183	0.25		76 (Reported)	1000
77	Devipura (Dabhla)	TW	Panchayat	Vijapur	South East of Village near Overhead Tank, North of Devipura-Mahadevpura Road	46A/10	3A4	23.56	72.56	259	0.2		137 (Reported)	1100
78	Lachhadi	TW	Chamanlal Naranlal Patel (Ghaghret)	Visnagar	East of Dabhla-Lachhadi Road, About 400m South of Old Canal Bridge	46A/10	2A1	23.58	72.55	213	0.3		122 (Reported)	1100
79	Lachhadi 1	TW	Panchayat	Visnagar	In the Centre of the village near overhead tank	46A/10	2A2	23.61	72.55	268	0.2		140 (Reported)	1100
80	Maninagar	TW	Choudhari Mongibhai Bhemjibhai	Visnagar	South of Maninagar-Kharwada Road, South of	46A/10	2A3	23.61	72.53	229	0.25		131 (Reported)	1400

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
					Village in Owner's farm									
81	Kharwada	TW	Choudhari Ajitbhai Rawabhai	Visnagar	South of Kharwada Pond in Owner's Farm (Surdeep farm)	46A/10	2A4	23.60	72.52	248.5	0.3		146 (Reported)	1100
82	Ganpatpura	TW	Panchayat	Visnagar	North of Village near Overhead Tank and Dairy	46A/10	2A5	23.58	72.52	244	0.2		161.5 (Reported)	1200
83	Manekpura	TW	Patel Bechardas Ishwardas	Vijapur	About 1.4 km South of Rampura Village, West of Manekpura-Rampura Road, about 500m North of Manekpura Village in Owner's farm	46A/10	2A6	23.58	72.54	244	0.25		137 (Reported)	1000
84	Wasai2	TW	Madhurbhai Keshavlal Patel	Vijapur	About 1.5 km East of Padhariya Village North of Wasai-Padhariya Road	46A/10	3A6	23.53	72.54	213	0.3		122 (Reported)	400
85	Padhariya	TW	Panchayat	Mahesana	North East of Village near Over head Tank, East of Padhariya Kamalpur Road	46A/10	3A7	23.53	72.53	213	0.25		146 (Reported)	1100

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
86	Dabhla 2	TW	Harijee Bhagajee	Vijapur	About 1.5 km SSW of Dabhla Village, West of Padhariya-Dabhla Kacha Track in Owner's Farm	46A/10	3A8	23.55	72.54	198	0.25		131 (Reported)	1000
87	Dhamanwa	TW	Panchayat	Visnagar	South of Village on Old Dune	46A/10	3A9	23.53	72.53	213	0.25		152.4 (Reported)	1100
88	Padhariya	Pz	GWRDC	Mahesana	About 1 km SE of Padhariya village, North of padhariya to Dhandhusan Road	46A/10	3A10	23.52	72.53	60	0.15	1	13.46	1100
89	Dhandhusan	DW	Ramaji Hamerji Thakore Dabhi	Mahesana	About 400m West of Bridge on Sujalam Sufalam Canal inside Right Bank	46A/10	3A11	23.52	72.54	6.4	4	0.4	3.3	
90	Dhandhusan 2	TW	Panchayat	Mahesana	North of Village on Old Dune near Overhead Tank and Prathmik Shala	46A/10	3A12	23.51	72.54	274	0.2		164.6 (Reported)	1000
91	Meu	TW	Panchayat	Mahesana	About 750m NE of Village on Kacha track to Padhariya fro Meu	46A/10	3A13	23.51	72.52	213	0.25		122 (Reported)	1200
92	Laxmipura	TW	Narsibhai Ishwarbhai patel	Mahesana	East of Village, South of approach road from Highway	46A/11	1A1	23.50	72.53	216.4	0.3		167.6	1100

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
					to Laxmipura									
93	Anandpura 2	TW	Panchayat	Mahesana	West of the village near over head tank	46A/11	1A3	23.49	72.53	168	0.2		79 (Reported)	1400
94	Gojhariya1	TW	Amritbhai Lalludas Patel	Mahesana	North of Mahesana Gojariya Highway, Just before the Railway Crossing	46A/11	1A4	23.49	72.56	366	0.3		146 (Reported)	1000
95	Gojhariya2	TW	Rasikbhai Dahyabhai Patel	Mahesana	Besides Sujalam Sufalam Canal on Kacha track from Gojhariya to Railway line Hanuman dada Temple in owner's farm	46A/11	1A5	23.49	72.56	305	0.25		168 (Reported)	900
96	Gojhariya 3	DW	Public	Mahesana	About 200m North of Gojhariya Charada Road, West of Sujalam Sufalam Canal	46A/11	1A6	23.48	72.57	16.4	2.5	0.15	13.8	1000
97	Gojhariya 4	TW	Himatbhai Shankarbhai Patel	Mahesana	About 200m North of Gojhariya Charada Road, West of Sujalam Sufalam Canal	46A/11	1A7	23.48	72.57	305	0.3		146 (Reported)	1200

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
98	Saldi	TW	Panchayat	Mahesana	In the Centre of the village near overhead tank	46A/11	1A8	23.43	72.53	242	0.2		161.50 (Reported)	1600
99	Charadu	TW	Panchayat	Mahesana	NW of village near Charadu-Langhnaj-Meu Road Junction	46A/11	1A9	23.46	72.53	265	0.3		161.5 (Reported)	1000
100	Langhnaj	TW	Hareshbhai Harshadbhai	Mahesana	About 200m North of Langhnaj-Charadu Road, about 1km East of Langhnaj village in Owner's Farm	46A/11	1A10	23.45	72.51	274	0.3		137 (Reported)	1600
101	Unawa	TW	Kantibhai Manilal	Unjha	About 1.5 km NW of Unawa village, South of Unawa - Dabhi Road in Owner's Farm	46A/5	3A1	23.78	72.35	329	0.3		161 (Reported)	1700
102	Unawa 2	DW	Hargovindbhai	Unjha	About 500m SW of Unaw-Dabhi Road, about 200m South of Small pond in owner's Farm	46A/5	1C2	23.77	72.35	13.4	2.75	0.15	11.04	2600
103	Sunok	DW	Girishbhai Kantijee Brahmbhatt	Unjha	About 500m West of Sunok village, about 50m North of Sunok - Sidhpur Road in owner's farm	46A/5	1C3	23.80	72.31	27.65	2.75	0.2	24	1600

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
104	Sunok 2	TW	Panchayat	Unjha	North of village near north eastern embankment of pond and overhead tank	46A/5	1C4	23.80	72.32	305	0.2		152 (Reported)	1500
105	Aithor	DW	Padumal maharaj	Unjha	About 1.5 km West of village, 300m South of Unawa-Aithor Road in Owner's Farm	46A/5	3B2	23.76	72.39	18.15	3.4	0.5	10.75	3700
106	Aithor 2	TW	Panchayat	Unjha	North of Village South of Pond Near Sump	46A/5	3B4	23.77	72.40	366	0.25		133 (Reported)	2100
107	Tarabh	DW	Public	Visnagar	West of Village, South of Unjha-Visnagar Road in Nathpura area	46A/5	3C1	23.75	72.45	20.9	2.7	0.25	17.27	2500
108	Tarabh Pz1	Pz	GWRDC	Visnagar	Infront of Tarbh prathmikshala, Behind Walinath Temple,Just near the village entrance	46A/5	3C2	23.75	72.45	40	0.15	1	13.5	3000
109	Tarabh Pz 2	Pz	GWRDC	Visnagar	Infront of Tarbh prathmikshala, Behind Walinath Temple,Just near the village entrance	46A/5	3C3	23.75	72.45	120	0.15	1	105.9	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
110	Mahakali Temple (Unjha)	DW	Mayapuri Maharaj	Unjha	In the premises of Mahakali Temple on Wanagala-Unjha Road	46A/5	3C4	23.79	72.42	16.9	1.75	0.5	14.8	900
111	Unjha	DW	Umiya Mata Trust	Unjha	South of Unjha, North of Road connectio to Highway near Aithor Chowkdi in the compound of Umiya Mata Trust	46A/5	3B5	23.80	72.39	16.6	3.25	0.9	4.8	2900
112	Unjha 2	TW	Panchayat	Unjha	In the premises of Rambagh Prathmikshala near over head tank, NW of Unjha near IshwarPark Society	46A/5	3B6	23.81	72.39	366	0.3		137.16 (Reported)	1300
113	Maktupur Pz1	Pz	GWRDC	Unjha	West of Mahesana-Palanpur Highway, Outside the boundary of High school just before village entrance	46A/5	3B7	23.83	72.37	205.72	0.15	1	>150	

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
114	Maktupur Pz2	Pz	GWRDC	Unjha	West of Mahesana-Palanpur Highway, Outside the boundary of High school just before village entrance	46A/5	3B8	23.83	72.37	246	0.15	1	>150	
115	Dhanpura(Ghantu)	TW	Mani Lal Ghagan Das	Vijapur	200 m from mian road In the field of Mani Lal Ghagan Das on Mahudi - Dhanpura Road about 1.5 km before the village.	46 A/14	3A1			122	0.25			2100
116	Bhimpur	TW	Panchayat	Vijapur	Water supply well near Prathmic Shala and OHT	46 A/14	3A2			122	0.2			1820
117	Wajapura Shakapura	TW	Panchayat	Vijapur	Old Water Supply well in Chauk near OHT and Village Water supply well by the side of Park	46 A/14	3A3			122	0.25	0.65	60.25 (Reported)	2400
118	Kotadi	TW	Panchayat	Vijapur	Old ab well /Water Supply well by the side of road near Primary School	46 A/10	3C1			244		0.75	63.25 (Reported)	1940

Sr No.	Village	Well Type	Owner	Taluka	Location	Toposheet	Quad	Ylat	Xlong	Depth (m)	Dia (m)	MP (m AGL)	WL mbmp	EC (µS/cm)
119	Tintodan	TW	Patel Mani Lal Gopal Bhai	Vijapur	In the field of Patel Manilal Gopal Bhai by the side of Road Tintodan - Harnohoda	46 A/10	3B4			213	0.25			
120	Kukarwada	DW	Pramod Bhai Heera Bhai Maharaj	Visnagar	Well is near the market yard in Pvt Land of Pramod Bhai Heera Bhai maharaj	46 A/10	3B6A	23.55	72.62	24.4		0.6	13.3	?
121	Sokada	TW	Panchayat	Vijapur	Water supply well in the Centre of Village near Panchayat Office	46 A/10	3B7			253			141 (Reported)	1110
122	Wadasan	TW	Panchayat	Vijapur	Water Supply well in front of Panchayat office	46 A/10	2B1			212			137 (Reported)	980
123	Deveda	TW	Panchayat	Vijapur	Water supply well in the Centre of Village near OHT	46 A/10	3B8			213	0.2		142 (Reported)	950
124	Mahadevpur Dabhla	TW	Suresh Bhai Rama Bhai	Vijapur	Pvt well behind Mahakali mandir, South of Mahdevpura - Anandpura Road in the field of Suresh Bhai Rama Bhai of Mahadevpur (Dabhla)	46 A/10	3B9			213			145 (Reported)	1070

Annexure 08: VES Location in Mahesana District

S.No.	Site Name	Taluka	District	Latitude	Longitude
1	Khadalpur	Kheralu	Mahesana	23:53:50.79	72:38:58.45
2	Shahpura	Satlasana	Mahesana	23:58:23.02	70:43:21.00
3	Kheralu-Mahekubpura	Kheralu	Mahesana	23:53:18.74	72:36:14.79
4	Gunja	Visnagar	Mahesana	23:44:50.56	72:35:21.76
5	Visnagar	Visnagar	Mahesana	23:41:7.28	72:32:6.27
6	Vihar	Vijapur	Mahesana	23:32:32:07	72:39:3:22
7	Pilwai	Vijapur	Mahesana	23:28:12:90	72:39::2:00
8	Pilwai	Vijapur	Mahesana	23:32:16:90	72:43:6:00
9	Vijapur(Maheshwer society)	Vijapur	Mahesana	23:34:23:27	72:43:59:74
10	Motipura	Vijapur	Mahesana	23:34:21:15	72:43:6:80
11	Gawada	Vijapur	Mahesana	23:35:33:52	72:41:46:24
12	Kulawada	Vijapur	Mahesana	23:34:49:88	72:40:46:71
13	Malosana	Vijapur	Mahesana	23:35:51:54	72:41:5:27
14	Karsanpura	Vijapur	Mahesana	23:35:51:54	72:41:5:27
15	Karsanpura	Vijapur	Mahesana	23:37:20:26	72:41:42:20
16	ladol	Vijapur	Mahesana	23:36:14:77	72:42:24:17
17	ladol	Vijapur	Mahesana	23:35:16:51	72:43:4:72
18	Kharod	Vijapur	Mahesana	23:38:50:68	72:40:53:22
19	Kharod(Kharod-Jantral Road)	Vijapur	Mahesana	23:40:30:79	72:41:13:99
20	Jantral	Vijapur	Mahesana	23:42:00:70	72:41:55:64
21	Malav	Vijapur	Mahesana	23:43:17:47	72:41:10:15
22	Abasana	Vijapur	Mahesana	23:42:54:95	72:40:13:31
23	Kamalpur	Vijapur	Mahesana	23:41:29:14	72:43:43:75
24	Sardarpur	Vijapur	Mahesana	23:41:27:11	72:45:51;54
25	Gudasana	Vijapur	Mahesana	23:43:30:99	72:43:38:82
26	Philodpura	Vijapur	Mahesana	23:43:50:91	72:44:20:00
27	Pamol	Vijapur	Mahesana	23:36:20:21	72:40:50:09
28	Gerita	Vijapur	Mahesana	23:34:49:80	72:39:00:17
29	Vadnagar	Vadnagar	Mahesana	23:46:22:06	72:37:16:50
30	Sipor	Vadnagar	Mahesana	23:51:12:23	72:40:90:01
31	Unold	Vadnagar	Mahesana	23:50:35:62	72:43:49:70
32	Valasana	Vadnagar	Mahesana	23:50:43:58	72:46:58:41
33	Undhani	Vadnagar	Mahesana	23:48:38:73	72:42:58:12
34	Undhani	Vadnagar	Mahesana	23:51:57:80	72:46:42:52
35	Subasana	Vadnagar	Mahesana	23:47:31:67	72:46:10:35
36	Techwa	Vijapur	Mahesana	23:45:27:21	72:46:53:99
37	Rangipur	Vijapur	Mahesana	23:44:23:14	72:47:14:83
38	Kot	Vijapur	Mahesana	23:43:60:25	72:47:30:10
39	Sardarpura	Vijapur	Mahesana	23:41:19:19	72:46:90:46
40	Hirapura	Vijapur	Mahesana	23:36:49:35	72:58:33:72
41	Aaglod	Vijapur	Mahesana	23:37:48:99	72:48:33:04

42	Jaipur	Vijapur	Mahesana	26:55:70:96	75:56:36:70
43	Hasanpur	Vijapur	Mahesana	23:39:30:86	72:47:43:15
44	Madhi	Vijapur	Mahesana	23:41:23:92	72:47:80:59
45	Pedhamali	Vijapur	Mahesana	23:40:13:54	72:49:31:13
46	Pudheda	Vijapur	Mahesana	23:41:70:95	72:45:29:17
47	Valasana(Near River)	Vijapur	Mahesana	23:45:54:87	72:47:39:50
48	Ganeshpura	Vadnagar	Mahesana	23:53:19:95	72:47:48:15
49	Dedusan	Kheralu	Mahesana	23:54:70:74	72:47:45:52
50	Khevrasan	Satlasana	Mahesana	23:55:11:59	72:47:38:22
51	Dharavania	Satlasana	Mahesana	23:55:41:61	72:47:16:75
52	Adole	Satlasana	Mahesana	23:54:14:10	72:46:45:83
53	Malapura	Satlasana	Mahesana	23:56:20:62	72:47:53:08
54	Kanedia(Tri-Junction)	Satlasana	Mahesana	23:55:33:42:	72:46:20:75
55	Rangpur	Satlasana	Mahesana	23:53:32:70	72:43:59:24
56	Chada	Kheralu	Mahesana	23:53:46:54	72:45:51:48
57	Amarpura	Kheralu	Mahesana	23:52:22:86	71:36:48:30
58	Aspa	Vadnagar	Mahesana	23:51:34:24	72:45:49:73
59	Madhasana	Kheralu	Mahesana	23:50:12:57	72:45:27:21
60	Karsanpura	Vadnagar	Mahesana	23:50:52:46	72:41:24:96
61	Shahpura	Satlasana	Mahesana	23:58:23.02	70:43:21.00
62	Kelisana	Kheralu	Mahesana	23:56:5.53	72:40:15.90
63	Vihar	Vijapur	Mahesana	23:32:32:07	72:39:3:22
64	Pilwai	Vijapur	Mahesana	23:28:12:90	72:39::2:00
65	Pilwai	Vijapur	Mahesana	23:32:16:90	72:43:6:00
66	Vijapur(Maheshwer society)	Vijapur	Mahesana	23:34:23:27	72:43:59:74
67	Motipura	Vijapur	Mahesana	23:34:21:15	72:43:6:80
68	Gawada	Vijapur	Mahesana	23:35:33:52	72:41:46:24
69	Kulawada	Vijapur	Mahesana	23:34:49:88	72:40:46:71
70	Malosana	Vijapur	Mahesana	23:35:51:54	72:41:5:27
71	ladol	Vijapur	Mahesana	23:36:14:77	72:42:24:17
72	ladol	Vijapur	Mahesana	23:35:16:51	72:43:4:72
73	Kharod	Vijapur	Mahesana	23:38:50:68	72:40:53:22
74	Kharod(Kharod-Jantral Road)	Vijapur	Mahesana	23:40:30:79	72:41:13:99
75	Vidnagar	Vadnagar	Mahesana	23:46:22:06	72:37:16:50
76	Becharaji-1	Becharaji	Mahesana		
77	Becharaji-2	Becharaji	Mahesana		
78	Dasada-25km Stone1	Becharaji	Mahesana		
79	Dasada-25km Stone2	Becharaji	Mahesana		
80	Chandarda	Kadi	Mahesana		
81	Dhanot	Kadi	Mahesana	23 16 51.4	72 25 11.57
82	Jamiyatpura	Kadi	Mahesana		

83	Kundal	Kadi	Mahesana	23:19:11:65	72:20:46:68
84	Kheralu	Kheralu	Mahesana	23:53:17:97	72:36:22:51
85	Lunva	Kheralu	Mahesana	23:53:23:43	72:29:47:18
86	Samoja	Kheralu	Mahesana	23:52:16:51	72:39:37:07
87	Bhandu	Mahesana	Mahesana	23:42:58:41	72:22:49:35
88	Heduva-Rajgar	Mahesana	Mahesana	23:33:36:03	72:21:07:27
89	Mandali	Mahesana	Mahesana	23:25:59:51	72:23:39:65
90	Mareda	Mahesana	Mahesana		
91	Motidau	Mahesana	Mahesana	23:40:30:07	72:23:05:26
92	Panchot	Mahesana	Mahesana	23:34:07:69	72:20:20:24
93	Bhimpur	Satlasana	Mahesana	23:59:23:34	72:44:35:20
94	Samarapur	Satlasana	Mahesana	24:03:06:78	72:46:37:67
95	Bharat Nagar	Unjha	Mahesana	23:48:32:74	72:22:43:38
96	Brahmanwada	Unjha	Mahesana	23:52:19:63	72:22:05:97
97	Maktupur-1	Unjha	Mahesana	23:50:11:36	72:22:07:09
98	Maktupur-2	Unjha	Mahesana	23:49:50:08	72:22:06:22
99	Unava	Unjha	Mahesana	23:45:33:82	72:22:01:68
100	Khatasana	Vadnagar	Mahesana	23;51:17:85	72:40:34:17
101	Valasana-1	Vadnagar	Mahesana	23:50:1:81	72:47:1:26
102	Valasana-2	Vadnagar	Mahesana	23:50:08:33	72:45:36:13
103	Vijapur-1	Vijapur	Mahesana	23:36:46:91	72:55:06:30
104	Vijapur-2	Vijapur	Mahesana	23:33:52:19	72:33:52:19
105	Visnagar	Visnagar	Mahesana	24:10:54:09	72:25:13:47
106	Wasai1	Visnagar	Mahesana	23°32'18"	72°34'06"
107	Wasai2	Visnagar	Mahesana	23°32'24"	72°34'07"
108	Dhamanwa1	Visnagar	Mahesana	23°32'01"	72°30'48"
109	Dhamanwa2	Visnagar	Mahesana	23°32'02"	72°30'39"
110	Brahmanwada	Unjha	Mahesana	23°39'38"	72°06'07"
111	Mandlop	Unjha	Mahesana	23°40'58"	72°06'22"
112	Mervada	Mahesana	Mahesana	23°38'48"	72°12'52"

Annexure 09: Details of Inhouse Exploration Under NAQUIM in Mahesana District

Sl. No.	*Well Name*	*AAP*	*District*	*Taluka*	*Latitude*	*Longitude*	*Toposheet No.*	*Geology*	*Depth Drilled (m)*	*Depth Constructed (m)*	*Zone Tapped/Fracture encountered (m)*	*PYT Discharge (lps)*	*PYT SWL (mbgl)*	*PYT RDD (m)*	*Transmissivity (m^2/day)*	*EC (µS/cm)*
1	*Magroda EW*	*2013-2014*	*Mahesana*	*Visnagar*	*23.60944*	*72.50083*	*46A/10*	*Alluvium*	*202.2*	*201*	*126-138, 144-153, 162-168, 171-183, 190-196*	*0.7*	*137.25*	*8.75 (120 min.)*		
2	*Magroda OW*	*2013-2014*	*Mahesana*	*Visnagar*	*23.60944*	*72.50083*	*46 A/10*	*Alluvium*	*202.12*	*201*	*126-138, 144-153, 162-168, 171-183, 190-196*	*1.25*	*122.95*	*15.8 (4th min.)*		
3	*Kherwa EW*	*2013-2014*	*Mahesana*	*Mahesana*	*23.54667*	*72.44472*	*46 A/06*	*Alluvium*	*200.3*	*197*	*89-98, 115-127, 135-150, 160-178, 186-192*	*0.53*	*115*	*5.05 (4th min)*		
4	*Kherwa OW*	*2013-2014*	*Mahesana*	*Mahesana*	*23.54667*	*72.44472*	*46 A/06*	*Alluvium*	*200.2*	*197*	*89-98, 115-127, 135-150, 160-178, 186-192*	*2.87*	*81.15*	*1 (5 th min)*		
5	*Satlasana EW II*	2015-2016	*Mahesana*	*Satlasana*	*24.03278*	*72.79722*	*45 D/16*	*Granite/Fracture Granite*	*200*	*200*	*20.12, 50.02-52.02*	*0.05*	*13.97*	*129.21 (7th min)*	*0.01*	*900*
6	*Satlasana EW I*	2015-2016	*Mahesana*	*Satlasana*	*24.03278*	*72.79722*	*45 D/16*	*Granite/Fracture Granite*	*104.92*	*104.92*	*16.42, 19.52-21.52, 46.92-50.02*	*1.05*	*15.39*	*50.59 (2nd min)*	*0.22*	*900*

7	*Bhalu Moti EW 1*	2015-2016	*Mahesana*	*Satlasana*	*24.04417*	*72.7125*	*45 D/12*	*Granite*	*300*	*300*	*28.00-29.50,65.00-69.00*	*0.6*	*11.9*	*156.65 (7th min)*	*0.08*	*1500*
8	*Bhalu Moti EW II*	2015-2016	*Mahesana*	*Satlasana*	*24.04417*	*72.7125*	*45 D/12*	*Weathered Granite*	*81*	*81*	*19.60-29.50,65.00-69.00*	*3.49*	*12.82*	*27.99 (2nd min)*	*15.81*	*300*
9	*Bhalu Moti OW II*	2015-2016	*Mahesana*	*Satlasana*	*24.04417*	*72.7125*	*45 D/12*	*Weathered Granite*	*81.2*	*81.2*	*19.60-29.50,65.00-69.00*	*1.05*	*13.11*	*26.62(1st minute)*	*0.69*	*300*
10	*Hadol EW*	2015-2016	*Mahesana*	*Satlasana*	*23.95694*	*72.80167*	*46A/13*	*Granite*	*300*	*300*	*13.45, 224.50-227.60*	*0.8*	*15.1*	*134.10(7th minute)*	*0.08*	*600*
11	Dharampur EW I	2016-2017	*Mahesana*	Kadi	23.2177	72.2134	*46A/04*	*Alluvium*	*200*	*134*	*70-76, 79-81, 95-98, 112-115, 125-131*	*4.07*	*51.07*	*0.25 (1st minute)*	*294.11*	*1400*
12	Dharampur OW I	2016-2017	*Mahesana*	Kadi	23.2177	72.2134	*46A/04*	*Alluvium*	*134*	*134*	*70-76, 79-81, 95-98, 112-115, 125-131*	*4.7*	*50.48*	*0.48 (1st minute)*	*303.82*	*1400*
13	Dharampur EW II	2016-2017	*Mahesana*	Kadi	23.2177	72.2134	*46A/04*	*Alluvium*	*50*	*48*	*28-31, 35-44*					
14	Manipur EW I	2017-2018	*Mahesana*	Kadi	23.2159	72.3146	*46A/08*	*Alluvium*	*200*	*200*	*117-120, 140-146, 153-165, 172-181, 187-196*	*11.5*	*109.01*	*1.33 (4th minute)*	*307.43*	*1000*
15	Manipur OW I	2017-2018	*Mahesana*	Kadi	23.2159	72.3146	*46A/08*	*Alluvium*	*200*	*200*	*117-120, 140-146, 153-165, 172-181, 187-196*					
16	Manipur OW II	2017-2018	*Mahesana*	Kadi	23.2159	72.3146		*Alluvium*	*90*	*87*	*65-68, 75-84*					

17	Kherwa EW I (Deep)	2017-2018	*Mahesana*	*Mahesana*	23.5465	72.4446	*46 A/06*	*Alluvium*	*300*	*300*	*186-189, 198-204, 224-230, 269-275, 293-296*	*10*	*131.6*	*2.5 (3.5 th minute)*	*137.27*	*1400*
18	Kherwa OW I (Deep)	2017-2018	*Mahesana*	*Mahesana*	23.5465	72.4446	*46 A/06*	*Alluvium*	*300*	*300*	*186-189, 198-204, 224-230, 269-275, 293-296*					
19	Magroda EW (Deep)	2017-2018	*Mahesana*	Visnagar	23.6132	72.4901	*46A/10*	*Alluvium*	*300.5*	*294*	*232-235, 242-248, 251-263, 270-276, 284-290*	*10.92*	*165.66*	*0.78 (7th minute)*	*220.62*	*1700*

Annexure 10: Proposed locations for Desilting of Ponds and construction of Recharge Shaft

Sl. No.	District	Taluka	Village	Latitude	Longitude	Area_Pond (sq.m.) Source: BISAG	Perimeter (m) Source: BISAG	Proposed cost for one meter desilting (@111 Rs./cu.m.)	Proposed Recharge shaft @Rs. 5 lac for avg. depth of 60m
1	Mahesana	Becharaji	Adivada	23.5823	72.0470	6320	321	701543	Yes
2	Mahesana	Becharaji	Adivada	23.5740	72.0475	7105	388	788674	Yes
3	Mahesana	Becharaji	Ajabpura	23.6088	72.1177	3887	247	431474	No
4	Mahesana	Becharaji	Akba	23.4752	72.1388	4596	250	510188	No
5	Mahesana	Becharaji	Akba	23.4730	72.1274	5417	292	601294	Yes
6	Mahesana	Becharaji	Akba	23.4725	72.1385	4172	246	463103	No
7	Mahesana	Becharaji	Akba	23.4669	72.1360	5486	287	608902	No
8	Mahesana	Becharaji	Ambala	23.6133	72.0004	7446	359	826463	No
9	Mahesana	Becharaji	Asjol	23.5177	72.1796	10173	390	1129233	Yes
10	Mahesana	Becharaji	Bariyaf	23.4688	72.1138	10377	373	1151887	Yes
11	Mahesana	Becharaji	Bariyaf	23.4672	72.1117	8041	430	892558	Yes
12	Mahesana	Becharaji	Chadasna	23.5177	72.1049	3647	244	404774	Yes
13	Mahesana	Becharaji	Chandroda	23.5865	71.9822	10016	419	1111726	Yes
14	Mahesana	Becharaji	Dedana	23.4693	72.0917	9713	400	1078177	Yes
15	Mahesana	Becharaji	Delpura Khant	23.5580	72.0992	9290	493	1031162	Yes
16	Mahesana	Becharaji	Delpura Khant	23.5570	72.0955	6095	335	676538	No
17	Mahesana	Becharaji	Delpura Khant	23.5545	72.0788	4287	247	475839	No
18	Mahesana	Becharaji	Delvada Khant	23.5293	72.1277	5315	269	589968	Yes
19	Mahesana	Becharaji	Dethli	23.4935	72.1257	3802	232	421972	No
20	Mahesana	Becharaji	Dethli	23.4920	72.0991	6298	327	699044	Yes
21	Mahesana	Becharaji	Devgadh	23.5100	72.0926	3000	214	333015	No
22	Mahesana	Becharaji	Dharpura-Khant	23.5381	72.1065	4665	296	517824	No
23	Mahesana	Becharaji	Dharpura-Khant	23.5303	72.1112	6288	302	697991	Yes

24	Mahesana	Becharaji	Dharpura-Khant	23.5254	72.1012	3473	219	385472	No
25	Mahesana	Becharaji	Dharpura-Khant	23.5207	72.1104	6349	333	704783	Yes
26	Mahesana	Becharaji	Edala	23.5609	72.0635	4955	266	550048	No
27	Mahesana	Becharaji	Edala	23.5460	72.0779	6285	308	697674	Yes
28	Mahesana	Becharaji	Edala	23.5424	72.0600	4170	238	462882	No
29	Mahesana	Becharaji	Ganeshpura	23.5329	72.0675	6737	303	747805	Yes
30	Mahesana	Becharaji	Jetpur	23.5811	72.2132	6783	302	752876	No
31	Mahesana	Becharaji	Kakasna	23.6444	72.2547	11901	566	1321007	Yes
32	Mahesana	Becharaji	Kalri	23.5138	72.0670	5466	292	606727	No
33	Mahesana	Becharaji	Kalri	23.5079	72.0777	6041	299	670537	Yes
34	Mahesana	Becharaji	Kalri	23.5075	72.0631	3361	217	373058	No
35	Mahesana	Becharaji	Kalri	23.5000	72.0656	11746	516	1303773	Yes
36	Mahesana	Becharaji	Kanoda	23.6320	72.2582	4046	243	449143	No
37	Mahesana	Becharaji	Karansagar	23.5541	72.1924	10135	382	1124951	Yes
38	Mahesana	Becharaji	Karansagar	23.5419	72.1833	4276	241	474689	No
39	Mahesana	Becharaji	Karansagar	23.5396	72.1851	5739	321	637016	No
40	Mahesana	Becharaji	Khambhel	23.6149	72.0555	7871	336	873707	Yes
41	Mahesana	Becharaji	Khambhel	23.5931	72.0355	3197	220	354823	No
42	Mahesana	Becharaji	Modhera	23.5875	72.1160	5535	276	614362	No
43	Mahesana	Becharaji	Modhera	23.5682	72.1677	8516	346	945313	Yes
44	Mahesana	Becharaji	Motap	23.6140	72.2710	3991	276	443008	No
45	Mahesana	Becharaji	Motap	23.5939	72.2869	9631	423	1069037	Yes
46	Mahesana	Becharaji	Pratapgadh	23.4998	72.0851	8539	347	947881	Yes
47	Mahesana	Becharaji	Ranchhodpura	23.5649	72.1789	5617	296	623468	Yes
48	Mahesana	Becharaji	Ranchhodpura	23.5635	72.1748	4799	291	532669	No
49	Mahesana	Becharaji	Rantej	23.4992	72.1524	6418	317	712448	Yes
50	Mahesana	Becharaji	Rantej	23.4897	72.1638	6963	318	772883	Yes
51	Mahesana	Becharaji	Rantej	23.4889	72.1424	4984	270	553193	Yes
52	Mahesana	Becharaji	Rantej	23.4794	72.1623	5583	332	619724	No

53	Mahesana	Becharaji	Rantej	23.4750	72.1576	5463	287	606401	No
54	Mahesana	Becharaji	Ruppura Karanpura	23.4941	72.1817	11891	427	1319888	Yes
55	Mahesana	Becharaji	Sankhalpur	23.5239	72.0176	9790	442	1086706	Yes
56	Mahesana	Becharaji	Sujanpura	23.5606	72.1398	5039	274	559306	No
57	Mahesana	Becharaji	Suraj	23.5531	71.9818	5121	280	568427	No
58	Mahesana	Becharaji	Venpura	23.5740	72.0252	7689	407	853486	Yes
59	Mahesana	Becharaji	Vijapurda	23.5963	72.1643	10481	394	1163349	Yes
60	Mahesana	Jotana	Alampur	23.4000	72.3523	10356	412	1149541	Yes
61	Mahesana	Jotana	Balsasan	23.4162	72.2791	6531	327	724887	Yes
62	Mahesana	Jotana	Balsasan	23.4155	72.2576	6756	305	749868	Yes
63	Mahesana	Jotana	Dhandhalpur	23.3713	72.2697	3643	222	404394	Yes
64	Mahesana	Jotana	Jakasna	23.4371	72.3149	3472	245	385356	Yes
65	Mahesana	Jotana	Jotana	23.4687	72.2954	9787	390	1086401	Yes
66	Mahesana	Jotana	Kasalpura	23.4816	72.2931	11435	424	1269298	Yes
67	Mahesana	Jotana	Kasalpura	23.4761	72.2828	10129	452	1124306	Yes
68	Mahesana	Jotana	Katosan	23.4670	72.2196	10611	414	1177867	Yes
69	Mahesana	Jotana	Manknaj	23.5226	72.3159	8241	341	914742	Yes
70	Mahesana	Jotana	Manknaj	23.5184	72.3281	4752	258	527472	Yes
71	Mahesana	Jotana	Manknaj	23.5165	72.3122	4546	260	504592	Yes
72	Mahesana	Jotana	Manknaj	23.5107	72.3086	9528	383	1057586	Yes
73	Mahesana	Jotana	Manknaj	23.5072	72.2982	7664	318	850698	Yes
74	Mahesana	Jotana	Martoli	23.4897	72.2072	9303	425	1032638	Yes
75	Mahesana	Jotana	Mudarda	23.4224	72.3269	3256	210	361393	Yes
76	Mahesana	Jotana	Mudarda	23.4222	72.3340	5909	284	655945	Yes
77	Mahesana	Jotana	Rampura (Katosan)	23.4654	72.1750	6797	322	754521	Yes
78	Mahesana	Jotana	Rampura (Katosan)	23.4539	72.1663	4465	245	495599	Yes
79	Mahesana	Jotana	Ranipura	23.4588	72.3168	3198	221	355027	Yes
80	Mahesana	Jotana	Virsoda	23.4300	72.2026	3052	202	338805	Yes
81	Mahesana	Jotana	Virsoda	23.4250	72.1923	10250	440	1137728	Yes

82	Mahesana	Kadi	Achrasan	23.2517	72.4015	10128	440	1124215	Yes
83	Mahesana	Kadi	Agol	23.1260	72.2783	6173	295	685229	Yes
84	Mahesana	Kadi	Ambliyara	23.1734	72.3636	4600	264	510636	No
85	Mahesana	Kadi	Ankhol	23.2739	72.4091	3580	224	397326	No
86	Mahesana	Kadi	Budasan	23.2854	72.3768	9323	362	1034806	Yes
87	Mahesana	Kadi	Charol	23.2875	72.2168	5646	286	626722	No
88	Mahesana	Kadi	Dangarva	23.3746	72.4372	5628	277	624664	Yes
89	Mahesana	Kadi	Daran	23.2065	72.2780	9756	475	1082911	Yes
90	Mahesana	Kadi	Daran Morva	23.2174	72.3023	9797	391	1087479	Yes
91	Mahesana	Kadi	Della	23.1272	72.2318	11674	468	1295855	Yes
92	Mahesana	Kadi	Deusana	23.3453	72.2827	6841	309	759328	Yes
93	Mahesana	Kadi	Deusana	23.3390	72.2892	5179	284	574818	No
94	Mahesana	Kadi	Fattehpura	23.1545	72.2133	7487	363	831103	Yes
95	Mahesana	Kadi	Fattehpura	23.1497	72.2092	11404	439	1265811	Yes
96	Mahesana	Kadi	Galodra	23.2660	72.1809	5818	307	645841	No
97	Mahesana	Kadi	Ghughla	23.2325	72.2436	4477	247	496961	No
98	Mahesana	Kadi	Ghumasan	23.3497	72.4539	10508	386	1166430	Yes
99	Mahesana	Kadi	Haripura	23.3058	72.2189	5817	327	645720	No
100	Mahesana	Kadi	Irana	23.3047	72.3919	6593	301	731851	Yes
101	Mahesana	Kadi	Ishvarpura	23.1433	72.2126	3451	218	383078	No
102	Mahesana	Kadi	Jamiyatpura	23.1537	72.2307	6693	299	742912	Yes
103	Mahesana	Kadi	Jesangpura	23.1448	72.2217	4720	254	523866	Yes
104	Mahesana	Kadi	Jesangpura	23.1420	72.2393	9610	437	1066683	Yes
105	Mahesana	Kadi	Jhaloda	23.1573	72.3440	10902	399	1210173	Yes
106	Mahesana	Kadi	Jhaloda	23.1433	72.3487	11756	491	1304944	Yes
107	Mahesana	Kadi	Kaiyal	23.4024	72.4297	11880	544	1318699	Yes
108	Mahesana	Kadi	Kalyanpura	23.1195	72.2059	10094	398	1120444	Yes
109	Mahesana	Kadi	Kanjari	23.1117	72.3216	6023	296	668579	No
110	Mahesana	Kadi	Karannagar	23.2715	72.3694	8558	396	949974	Yes

111	Mahesana	Kadi	Karannagar	23.2535	72.3920	5926	282	657783	No
112	Mahesana	Kadi	Karsanpura	23.2044	72.3309	8816	404	978533	Yes
113	Mahesana	Kadi	Kasva	23.2716	72.2906	9627	365	1068649	Yes
114	Mahesana	Kadi	Khanderavpura	23.1048	72.3109	6585	340	730955	Yes
115	Mahesana	Kadi	Khavad	23.1986	72.2329	5482	280	608517	No
116	Mahesana	Kadi	Khavad	23.1974	72.2194	6955	335	772007	Yes
117	Mahesana	Kadi	Khavad	23.1972	72.2396	3810	226	422954	No
118	Mahesana	Kadi	Khavad	23.1910	72.2354	4639	264	514934	No
119	Mahesana	Kadi	Kolad	23.1751	72.2831	4972	276	551843	No
120	Mahesana	Kadi	Kolad	23.1736	72.2860	10571	425	1173358	Yes
121	Mahesana	Kadi	Korda	23.2443	72.1912	4400	277	488345	No
122	Mahesana	Kadi	Kundal	23.3055	72.3470	10666	416	1183952	Yes
123	Mahesana	Kadi	Kundal	23.3055	72.3705	3958	253	439293	No
124	Mahesana	Kadi	Lakshmanpura	23.1793	72.3447	8180	362	907968	Yes
125	Mahesana	Kadi	Lakshmanpura	23.1743	72.3545	8244	382	915087	Yes
126	Mahesana	Kadi	Lakshmanpura	23.1728	72.3513	5180	263	575009	No
127	Mahesana	Kadi	Lhor	23.1857	72.3368	9541	390	1059028	Yes
128	Mahesana	Kadi	Mokasan	23.3648	72.3235	4855	306	538930	No
129	Mahesana	Kadi	Nadan	23.1052	72.2751	3980	247	441742	No
130	Mahesana	Kadi	Nadoliya	23.1633	72.2450	9930	370	1102179	Yes
131	Mahesana	Kadi	Panthoda	23.1085	72.2565	6623	303	735123	Yes
132	Mahesana	Kadi	Rajpur	23.3233	72.4032	6819	300	756925	No
133	Mahesana	Kadi	Sedardi	23.2261	72.2614	8457	345	938777	Yes
134	Mahesana	Kadi	Sendrana	23.2543	72.2420	7665	351	850867	Yes
135	Mahesana	Kadi	Thol	23.1415	72.4190	10686	385	1186158	Yes
136	Mahesana	Kadi	Thol	23.1298	72.3504	9886	378	1097386	Yes
137	Mahesana	Kadi	Thol	23.1249	72.3513	9759	379	1083263	No
138	Mahesana	Kadi	Vadavi	23.1762	72.3770	10867	384	1206223	Yes
139	Mahesana	Kadi	Vaghroda	23.2103	72.1957	5168	268	573671	Yes

140	Mahesana	Kadi	Vaghroda	23.2039	72.1875	6189	306	686973	No
141	Mahesana	Kadi	Vaghroda	23.1856	72.2026	7325	363	813032	Yes
142	Mahesana	Kadi	Valavdi	23.1345	72.1975	8828	343	979927	Yes
143	Mahesana	Kadi	Vamaj	23.2478	72.3940	3857	227	428179	No
144	Mahesana	Kadi	Vamaj	23.2185	72.4141	8842	395	981422	Yes
145	Mahesana	Kadi	Vansol	23.2382	72.4281	6132	331	680663	No
146	Mahesana	Kadi	Varkhadia	23.1595	72.1956	11236	461	1247145	Yes
147	Mahesana	Kadi	Varkhadia	23.1523	72.2044	3569	221	396186	Yes
148	Mahesana	Kadi	Varkhadia	23.1510	72.1948	5185	273	575518	No
149	Mahesana	Kadi	Vekra	23.1808	72.2056	9514	367	1056108	No
150	Mahesana	Kadi	Vidaj	23.2439	72.2997	9106	402	1010750	Yes
151	Mahesana	Kadi	Vidaj	23.2278	72.2906	6533	311	725145	Yes
152	Mahesana	Kadi	Vinayakpura	23.1583	72.2487	10619	465	1178732	Yes
153	Mahesana	Kadi	Yashvantpura	23.0618	72.3177	9138	459	1014271	No
154	Mahesana	Kheralu	Balad	23.9084	72.5769	5161	265	572836	Yes
155	Mahesana	Kheralu	Chachariya	23.8552	72.5418	7071	319	784920	Yes
156	Mahesana	Kheralu	Chada	23.9011	72.7666	4156	254	461319	Yes
157	Mahesana	Kheralu	Fattepura(Khe)	23.9314	72.5869	7317	344	812176	Yes
158	Mahesana	Kheralu	Machhava	23.8684	72.5157	7228	331	802268	Yes
159	Mahesana	Kheralu	Mandropur	23.9224	72.5947	9004	383	999400	Yes
160	Mahesana	Kheralu	Moti Hirvani	23.8687	72.5432	7644	359	848478	Yes
161	Mahesana	Kheralu	Moti Hirvani	23.8665	72.5377	6107	297	677909	Yes
162	Mahesana	Kheralu	Sangathala	23.9023	72.7225	3356	213	372519	Yes
163	Mahesana	Kheralu	Shahpur (Santokpura)	23.9240	72.5719	3624	249	402310	Yes
164	Mahesana	Mahesana	Akhaj	23.4876	72.4769	8342	330	925986	Yes
165	Mahesana	Mahesana	Akhaj	23.4816	72.4631	7857	335	872111	No
166	Mahesana	Mahesana	Aloda	23.6288	72.3216	6675	316	740917	Yes
167	Mahesana	Mahesana	Ambaliyasan (CT)	23.4466	72.4024	6284	303	697493	No

168	Mahesana	Mahesana	Balol	23.5254	72.2369	6661	313	739347	No
169	Mahesana	Mahesana	Balol	23.5239	72.2535	7693	380	853935	No
170	Mahesana	Mahesana	Balol	23.5222	72.2610	5341	414	592866	No
171	Mahesana	Mahesana	Balol	23.5037	72.2733	4878	344	541489	No
172	Mahesana	Mahesana	Balol	23.5032	72.2817	10006	476	1110707	Yes
173	Mahesana	Mahesana	Bodla	23.6114	72.2919	5850	298	649302	Yes
174	Mahesana	Mahesana	Chitrodipura	23.6312	72.4316	11546	428	1281618	Yes
175	Mahesana	Mahesana	Davada	23.7020	72.3393	9270	392	1028941	Yes
176	Mahesana	Mahesana	Dediyasan	23.5997	72.3449	10320	376	1145546	Yes
177	Mahesana	Mahesana	Deloli	23.5704	72.2586	11169	448	1239780	Yes
178	Mahesana	Mahesana	Deloli	23.5697	72.2448	11091	415	1231096	Yes
179	Mahesana	Mahesana	Deloli	23.5653	72.2548	10865	480	1206041	No
180	Mahesana	Mahesana	Divanpura-Alias-Apap	23.4443	72.3516	3180	229	352932	Yes
181	Mahesana	Mahesana	Gamanpura	23.5508	72.2622	7966	350	884252	No
182	Mahesana	Mahesana	Gamanpura	23.5459	72.2693	7510	358	833652	No
183	Mahesana	Mahesana	Gamanpura	23.5403	72.2674	4919	281	546021	No
184	Mahesana	Mahesana	Ghadha	23.6599	72.4513	5317	306	590146	No
185	Mahesana	Mahesana	Ghadha	23.6544	72.4530	11925	455	1323697	Yes
186	Mahesana	Mahesana	Gorad	23.6973	72.3338	3314	210	367905	No
187	Mahesana	Mahesana	Hardesan	23.6215	72.3092	8474	341	940604	No
188	Mahesana	Mahesana	Heduva Hanumat	23.5745	72.3836	3335	213	370184	No
189	Mahesana	Mahesana	Heduva Hanumat	23.5687	72.3831	4905	260	544461	No
190	Mahesana	Mahesana	Hinglajpura	23.5904	72.2792	9675	382	1073924	Yes
191	Mahesana	Mahesana	Jamnapur	23.4244	72.4673	8021	344	890322	Yes
192	Mahesana	Mahesana	Jamnapur	23.4231	72.4626	5546	351	615585	No
193	Mahesana	Mahesana	Kherva	23.5470	72.4405	4294	261	476633	No
194	Mahesana	Mahesana	Kukas	23.5770	72.4059	4909	289	544918	No
195	Mahesana	Mahesana	Laxmipura	23.5259	72.2951	5560	300	617126	No
196	Mahesana	Mahesana	Linch	23.4733	72.3912	11766	551	1306011	Yes

197	Mahesana	Mahesana	Maguna	23.5771	72.2827	8770	359	973458	Yes
198	Mahesana	Mahesana	Mahesana (M)	23.5884	72.3893	4090	271	454015	No
199	Mahesana	Mahesana	Mevad	23.5329	72.3900	3860	230	428422	No
200	Mahesana	Mahesana	Mitha	23.5345	72.2831	3434	245	381168	No
201	Mahesana	Mahesana	Motidau	23.6879	72.3961	8808	368	977719	Yes
202	Mahesana	Mahesana	Motidau	23.6809	72.3930	4237	245	470362	No
203	Mahesana	Mahesana	Nadasa	23.5378	72.2220	5807	284	644532	No
204	Mahesana	Mahesana	Nugar	23.6040	72.3067	5357	363	594656	Yes
205	Mahesana	Mahesana	Padhariya	23.5275	72.5247	4391	264	487398	Yes
206	Mahesana	Mahesana	Palaj	23.5444	72.2400	10063	412	1117045	Yes
207	Mahesana	Mahesana	Palodar	23.6400	72.3623	10625	449	1179405	Yes
208	Mahesana	Mahesana	Palodar	23.6356	72.3763	5961	319	661680	No
209	Mahesana	Mahesana	Palwasana	23.5660	72.3626	3688	242	409370	No
210	Mahesana	Mahesana	Piludara	23.6604	72.4376	5313	304	589696	No
211	Mahesana	Mahesana	Punasan	23.5442	72.4091	9259	391	1027781	Yes
212	Mahesana	Mahesana	Rupal	23.6841	72.3432	8429	369	935588	Yes
213	Mahesana	Mahesana	Sobhasan	23.5542	72.3929	9330	356	1035576	Yes
214	Mahesana	Mahesana	Taleti	23.6342	72.3960	9216	363	1023030	Yes
215	Mahesana	Mahesana	Tavadiya	23.6317	72.4139	5743	276	637492	No
216	Mahesana	Mahesana	Ucharpi	23.6051	72.4312	7598	323	843386	Yes
217	Mahesana	Mahesana	Vadosan	23.5549	72.3508	5555	280	616559	No
218	Mahesana	Mahesana	Vadosan	23.5368	72.3400	9794	386	1087169	Yes
219	Mahesana	Satlasana	Vaghva-Mandva	24.0394	72.8462	9759	593	1083219	Yes
220	Mahesana	Unjha	Aithor	23.7669	72.4060	10089	491	1119839	Yes
221	Mahesana	Unjha	Aithor	23.7433	72.4114	6718	326	745707	Yes
222	Mahesana	Unjha	Aithor	23.7379	72.4333	4646	276	515732	No
223	Mahesana	Unjha	Brahmanvada	23.8645	72.3608	7470	432	829181	Yes
224	Mahesana	Unjha	Dabhi	23.7840	72.3123	7530	329	835839	Yes
225	Mahesana	Unjha	Dasaj	23.8434	72.4471	7390	351	820254	Yes

226	Mahesana	Unjha	Dasaj	23.8380	72.4413	5493	282	609727	Yes
227	Mahesana	Unjha	Dasaj	23.8316	72.4194	8675	358	962941	Yes
228	Mahesana	Unjha	Kahoda	23.8906	72.4402	11673	473	1295695	Yes
229	Mahesana	Unjha	Kanthravi	23.7269	72.3029	4605	274	511179	Yes
230	Mahesana	Unjha	Kanthravi	23.7248	72.2931	8618	454	956562	Yes
231	Mahesana	Unjha	Karli	23.7863	72.5131	11524	417	1279122	Yes
232	Mahesana	Unjha	Karli	23.7832	72.4975	6227	309	691215	Yes
233	Mahesana	Unjha	Khatasana	23.8784	72.4651	5221	279	579541	Yes
234	Mahesana	Unjha	Maktupur	23.8307	72.3662	11286	408	1252734	Yes
235	Mahesana	Unjha	Ranchhodpura	23.8229	72.4612	7596	322	843182	Yes
236	Mahesana	Unjha	Sunak	23.8064	72.3275	5932	281	658405	Yes
237	Mahesana	Unjha	Tundav	23.8260	72.3291	9102	375	1010331	Yes
238	Mahesana	Unjha	Unava	23.7535	72.3432	10949	394	1215298	Yes
239	Mahesana	Unjha	Unjha (M)	23.8139	72.4099	6383	297	708556	Yes
240	Mahesana	Unjha	Unjha (M)	23.8085	72.3718	5712	276	634037	Yes
241	Mahesana	Unjha	Unjha (M)	23.8046	72.4159	11135	413	1235990	Yes
242	Mahesana	Unjha	Unjha (M)	23.7831	72.4068	5844	294	648676	Yes
243	Mahesana	Unjha	Unjha (M)	23.7751	72.3904	5974	280	663154	Yes
244	Mahesana	Unjha	Upera	23.8305	72.5053	4929	279	547082	Yes
245	Mahesana	Unjha	Visol	23.8675	72.3339	8762	367	972554	Yes
246	Mahesana	Vadnagar	Bajpura	23.8068	72.5800	9350	402	1037825	Yes
247	Mahesana	Vadnagar	Chhabaliya	23.7283	72.6519	5559	283	617081	No
248	Mahesana	Vadnagar	Dabu	23.8668	72.7433	4940	273	548328	No
249	Mahesana	Vadnagar	Kamalpur	23.7815	72.6015	7836	358	869799	Yes
250	Mahesana	Vadnagar	Kesimpa	23.8214	72.6180	6952	308	771669	Yes
251	Mahesana	Vadnagar	Malekpur	23.7714	72.5915	4166	249	462460	No
252	Mahesana	Vadnagar	Malekpur	23.7673	72.5954	11016	409	1222758	Yes
253	Mahesana	Vadnagar	Rajpur (Vad)	23.7884	72.7011	4986	289	553412	No
254	Mahesana	Vadnagar	Shobhasan	23.7987	72.7433	4587	275	509123	Yes

255	Mahesana	Vadnagar	Sultanpur	23.8069	72.6880	4593	301	509841	No
256	Mahesana	Vadnagar	Sundhiya	23.8460	72.5883	3457	230	383712	No
257	Mahesana	Vadnagar	Sundhiya	23.8428	72.5962	6022	305	668485	Yes
258	Mahesana	Vadnagar	Sundhiya	23.8344	72.5753	11195	428	1242673	Yes
259	Mahesana	Vadnagar	Sundhiya	23.8323	72.5630	6091	383	676100	No
260	Mahesana	Vadnagar	Unad	23.8486	72.7245	10259	390	1138703	Yes
261	Mahesana	Vadnagar	Unad	23.8437	72.7178	11717	401	1300634	Yes
262	Mahesana	Vadnagar	Unad	23.8356	72.7355	4910	271	544999	No
263	Mahesana	Vadnagar	Vadnagar (M)	23.8093	72.6098	6334	294	703048	Yes
264	Mahesana	Vadnagar	Vadnagar (M)	23.7914	72.6313	4568	296	507053	No
265	Mahesana	Vadnagar	Vadnagar (M)	23.7896	72.6508	3642	225	404248	No
266	Mahesana	Vadnagar	Vadnagar (M)	23.7846	72.6298	3458	216	383846	No
267	Mahesana	Vadnagar	Vadnagar (M)	23.7832	72.6558	3744	230	415569	No
268	Mahesana	Vadnagar	Vadnagar (M)	23.7829	72.6490	4956	300	550133	No
269	Mahesana	Vadnagar	Vadnagar (M)	23.7729	72.6404	9642	436	1070260	Yes
270	Mahesana	Vadnagar	Vadnagar (M)	23.7711	72.6372	4060	240	450678	No
271	Mahesana	Vadnagar	Vadnagar (M)	23.7706	72.6573	3187	273	353717	No
272	Mahesana	Vadnagar	Vadnagar (M)	23.7657	72.6464	7640	332	848086	Yes
273	Mahesana	Vadnagar	Vadnagar (M)	23.7631	72.6140	11480	465	1274329	Yes
274	Mahesana	Vadnagar	Vadnagar (M)	23.7584	72.6350	6803	300	755086	Yes
275	Mahesana	Vadnagar	Vadnagar (M)	23.7534	72.6184	8846	400	981936	Yes
276	Mahesana	Vadnagar	Vadnagar (M)	23.7519	72.6440	7267	355	806648	Yes
277	Mahesana	Vijapur	Abharampura	23.6302	72.6802	4055	261	450081	Yes
278	Mahesana	Vijapur	Ashnapur (G)	23.5910	72.6371	7230	312	802485	Yes
279	Mahesana	Vijapur	Asoda	23.5855	72.5938	11837	436	1313864	Yes
280	Mahesana	Vijapur	Dabhala	23.5555	72.5258	5541	329	615105	No
281	Mahesana	Vijapur	Ghantudhanpura	23.5465	72.7915	10445	388	1159441	Yes
282	Mahesana	Vijapur	Kharod	23.6603	72.6859	8439	367	936728	Yes
283	Mahesana	Vijapur	Kolavda	23.5731	72.6724	8957	371	994247	Yes

284	Mahesana	Vijapur	Motipura	23.5267	72.6039	3500	235	388500	No
285	Mahesana	Vijapur	Pedhamali	23.6740	72.8060	7553	345	838403	Yes
286	Mahesana	Vijapur	Pilvai	23.5379	72.7109	9105	355	1010701	Yes
287	Mahesana	Vijapur	Titodan	23.5258	72.6092	7688	349	853416	Yes
288	Mahesana	Vijapur	Vijapur (M)	23.5654	72.7386	7514	340	834056	Yes
289	Mahesana	Visnagar	Basana	23.6281	72.4585	10174	396	1129344	Yes
290	Mahesana	Visnagar	Bhandu	23.7241	72.3785	6388	298	709106	Yes
291	Mahesana	Visnagar	Bhandu	23.7218	72.4033	3572	225	396475	No
292	Mahesana	Visnagar	Bhandu	23.6994	72.4031	3835	237	425715	No
293	Mahesana	Visnagar	Bhandu	23.6952	72.3533	10411	400	1155669	Yes
294	Mahesana	Visnagar	Bokarvada	23.7213	72.3533	10200	439	1132240	Yes
295	Mahesana	Visnagar	Chitrodipura	23.6079	72.4601	7646	414	848754	Yes
296	Mahesana	Visnagar	Dadhiyal	23.6130	72.5411	4995	289	554451	No
297	Mahesana	Visnagar	Dadhiyal	23.6109	72.5146	7148	325	793432	Yes
298	Mahesana	Visnagar	Denap	23.7723	72.5146	11417	404	1267254	Yes
299	Mahesana	Visnagar	Gunja	23.7416	72.5847	3488	219	387191	No
300	Mahesana	Visnagar	Gunja	23.7401	72.5954	10498	433	1165304	Yes
301	Mahesana	Visnagar	Gunja	23.7271	72.5883	8126	429	901971	Yes
302	Mahesana	Visnagar	Gunjala	23.5715	72.4656	6928	351	768968	No
303	Mahesana	Visnagar	Jetalvasana	23.7278	72.4051	7170	327	795823	No
304	Mahesana	Visnagar	Jetalvasana	23.7273	72.4088	7782	352	863822	Yes
305	Mahesana	Visnagar	Kada	23.6441	72.5482	5500	276	610521	No
306	Mahesana	Visnagar	Kada	23.6362	72.5471	4689	250	520474	No
307	Mahesana	Visnagar	Kada	23.6173	72.5671	5230	270	580534	No
308	Mahesana	Visnagar	Kajialiyasana	23.7533	72.5122	7595	363	843022	Yes
309	Mahesana	Visnagar	Kajialiyasana	23.7506	72.5062	11880	405	1318710	Yes
310	Mahesana	Visnagar	Kamana	23.6395	72.5399	5526	299	613338	Yes
311	Mahesana	Visnagar	Kansa	23.7050	72.5111	3194	208	354479	No
312	Mahesana	Visnagar	Kansa	23.7040	72.5141	4621	274	512901	No

313	Mahesana	Visnagar	Khadalpur	23.7572	72.5331	5712	295	634086	Yes
314	Mahesana	Visnagar	Khadalpur	23.7529	72.5377	5338	295	592548	Yes
315	Mahesana	Visnagar	Khadalpur	23.7495	72.5447	4049	261	449418	No
316	Mahesana	Visnagar	Khandosan	23.7469	72.4936	7660	345	850239	Yes
317	Mahesana	Visnagar	Khandosan	23.7403	72.4607	4276	263	474617	No
318	Mahesana	Visnagar	Kharvada	23.6040	72.5169	3584	230	397835	No
319	Mahesana	Visnagar	Kiyadar	23.7511	72.5859	4379	250	486099	No
320	Mahesana	Visnagar	Paldi	23.7371	72.5614	4172	237	463067	No
321	Mahesana	Visnagar	Rampura	23.7279	72.4996	4518	263	501518	No
322	Mahesana	Visnagar	Ravalapura	23.6559	72.5005	4866	264	540095	No
323	Mahesana	Visnagar	Savala	23.6668	72.4809	7887	364	875486	Yes
324	Mahesana	Visnagar	Tarabh	23.7494	72.4575	3100	206	344115	No
325	Mahesana	Visnagar	Udalpur	23.5576	72.4869	8664	399	961716	Yes
326	Mahesana	Visnagar	Umta	23.8082	72.5489	11645	461	1292645	Yes
327	Mahesana	Visnagar	Umta	23.7841	72.5238	3749	243	416181	No
328	Mahesana	Visnagar	Umta	23.7829	72.5528	10249	382	1137637	Yes
329	Mahesana	Visnagar	Umta	23.7764	72.5687	3852	242	427623	No
330	Mahesana	Visnagar	Vadu	23.7071	72.4178	7083	347	786214	Yes
331	Mahesana	Visnagar	Valam	23.7331	72.4510	4769	335	529331	No
332	Mahesana	Visnagar	Valam	23.7173	72.4521	6664	315	739728	Yes
333	Mahesana	Visnagar	Valam	23.7141	72.4540	5385	290	597784	No
334	Mahesana	Visnagar	Valam	23.7131	72.4582	6540	394	725988	Yes
335	Mahesana	Visnagar	Valam	23.7044	72.4626	3134	237	347909	No
336	Mahesana	Visnagar	Valam	23.6992	72.4389	4988	263	553631	Yes
337	Mahesana	Visnagar	Visnagar (M)	23.6762	72.5472	11124	436	1234734	Yes
							Total Cost (Rs.)	**261335046**	**106000000**