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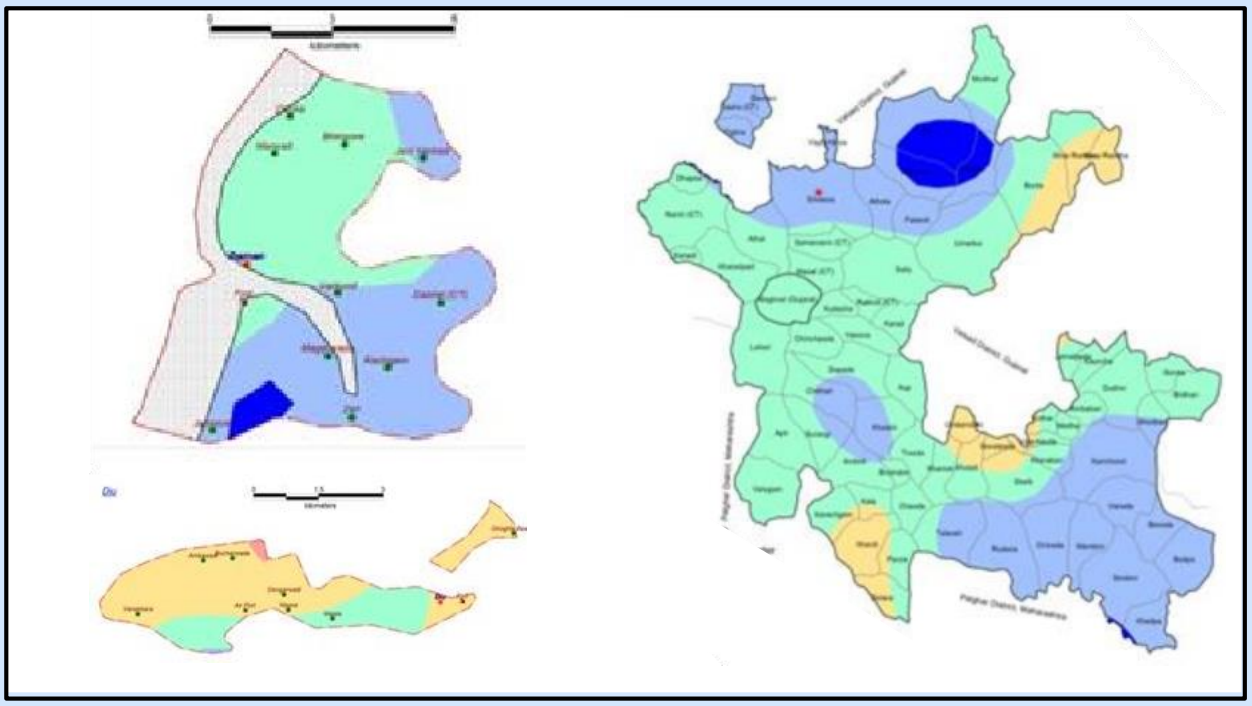
CENTRAL GROUND WATER BOARD
भारत सरकार/GOVERNMENT OF INDIA
जल शक्ति मंत्रालय/MINISTRY OF JAL SHAKTI
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA REJUVENEATION

वार्षिक भूजल पुस्तिका 2023-24
GROUNDWATER YEAR BOOK:2023-24

Union Territory of Daman & Diu and Dadra & Nagar Haveli
केंद्र शासित प्रदेश दमन और दीव और दादरा एवं नगर हवेली



REGIONAL OFFICE DATA CENTRE
Central Ground Water Board
West Central Region
Ahmedabad
2024

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Forward

Central Ground Water Board, West Central Region, has been issuing Ground Water Year Book annually for Gujarat state, by compiling the hydrogeological and groundwater level data collected from the Groundwater Monitoring Wells established by the Board in Union Territory of Daman & Diu and Dadra and Nagar Haveli.

Monitoring of groundwater level furnish valuable information on the groundwater regime characteristics of the different hydrogeological units moreover, analysis of these valuable data collected from existing observation wells during May, August, November and January in each ground water year (June to May) indicate the pattern of ground water movement, changes in recharge-discharge relationship, behaviour of water level and quantitative changes of groundwater regime in time and space. It also helps in identifying and delineating areas prone to decline of water table and piezometric surface due to large scale withdrawal of groundwater for industrial, agricultural and urban water supply requirement.

Further water logging prone areas can also be identified with historical water level data analysis. This year book contains the data and analysis of groundwater regime monitoring for the year 2023-24. The scientific officers of the regional office have systematically collected field data from the Groundwater Monitoring Network Wells four times during the viz., May, August, and November and January and the analysis of same has been presented in this report along with changes in different seasons and long-term changes in water level. The behaviour of groundwater levels as analysed from the existing Ground Water Monitoring Wells data is discussed in details in this report along with the thematic maps depicting the groundwater scenario for different periods of measurements. The depth to water level, water level fluctuations, and water table maps have been prepared and presented in this report along with detailed discussion on each map. I hope the report would be extremely useful to various agencies engaged in groundwater development and management for fruitful planning in time and space.

Date: 14/10/2024
Place: Ahmedabad

Regional Director
CGWB, WCR Ahmedabad

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GROUNDWATER YEAR BOOK of UNION TERRITORY of DAMAN & DIU AND DADRA & NAGAR HAVELI (2023-24)

EXECUTIVESUMMARY

- Central Ground Water Board, WCR has set up a network of 43 Groundwater Monitoring Wells including 5 piezometers. Initially the monitoring commenced with the establishment of 2 observation wells spread uniformly over the entire state, in the year 1969 and since then number of stations were added regularly so as to get proper hydrological information of different hydrogeological and geo-morphological units.

- The average decadal rainfall varies from about 995.7 mm in Diu to about 2195.8mm in Daman and 2650 mm in Dadra & Nagar Haveli.

- Groundwater levels are being monitored four times in a year. 69% of the wells have depth to water levels in the range of 2 to 10 mbgl (meter below ground level) during pre-monsoon 2023 and 55.6% of wells have depth to water levels in the range of 2 to 5 mbgl (meter below ground level) during pre-monsoon 2023.

- The long term groundwater scenario in comparison to pre-monsoon 2023 indicates that 87% well shows fall where as in post monsoon rising trend is observed in 57% of wells.

- Pointed attention of the administrators and policy makers is drawn towards adoption of artificial recharge, public awareness and other appropriate measures for ensuring adequate groundwater availability and sustainability.

GROUNDWATER YEAR BOOK of UNION TERRITORYOFDAMAN&DIU AND DADRA & NAGAR HAVELI (2023-24)

1. INTRODUCTION

The West Central Region of Central Ground Water Board has jurisdiction over the Union Territory of Daman & Diu and Dadra and Nagar Haveli (UT 0f DDD). Daman & Diu covering an area of 112 sq km. Diu is an Island just south of Saurashtra coast and Daman is situated west of Vapi in the south and Dadra Nagar Haveli covering an area 491 sq km. (Fig01)

Daman is a small porton the Arabian Sea. Daman is situated between north latitudes 20°22' & 20°29'58" and east longitudes 72°49'42" & 72°54'43"and falls in Survey of India toposheet No. 46 D/15. It covers an area of 72 sq. km. Its length measures 11 km from extreme north to south and the width measures 8 km. from east to west. The UT is bounded on the north, east and south by Valsad district of Gujarat state and west by Arabian Sea.

Diu district of UT of DDD is situated in southern part of Saurashtra region of Gujarat State, in western India. The Diu district is situated between north latitudes 20°44'39" & 20°42'00" and east longitudes 70°52'26" & 71°00'24" and falls in Survey of India toposheet No. 41 L/14. Its east west extent is nearly 19.2 km and north south width is varying from 1 to 2.5 km. Out of the total area of 43.8 Sq Km, 26.84 Sq. Km is rural area and 17.76 Sq.km is urban area.

The Union Territory of Dadra and Nagar Haveli is situated on the western coast of India between states of Gujarat and Maharashtra. It lies between north latitudes 20° 02' and 20° 22' and east longitudes 72° 54' and 73° 14' and falls in Survey of India Toposheet no. 46 D/15, 16, 46H/3 and H/4. The Territory is surrounded on the west, north and east by Valsad district of Gujarat State and in the south and southeast by Thane and Nashik districts of Maharashtra State.

The total population of UT of Daman and Diu&Dadra and Nagar Haveliis 243,247 of which 150,301 are males and 92,946 are females (2011 Census) and for Dadra and Nagar Haveli is 343,709 of which 193,760 are males and 149,949 are females (2011 Census).

2. PHYSIOGRAPHY AND DRAINAGE

The diverse physiographic, climatic, topographic and geologic conditions have given rise to diversified ground water situations in different parts of the UT. Occurrence and movement of groundwater is controlled by rock formations of varied composition and structure and range in age from Mesozoic to Recent. Similarly, the landform varies from the hilly tract to the uplands of Daman, the alluvial plains and miliolitic limestones in the low lying coastal tract. The topography and rainfall virtually control the runoff and groundwater recharge.

The river Daman Ganga passing through the middle of Daman divided it in to two parts namely Moti Daman and Nani Daman. The altitude is 12 m amsl. The Kolak river flows along the northern boundary and the Kalunadi forms the southern boundary. These three rivers flowing almost parallel to each other enter Daman from south east and follow almost westerly course. There are 22 villages, 10 village panchayats, one municipal council and one town under the Daman district.

The mean minimum temperature is 12ºC and the mean maximum temperature is 37ºC. Due to proximity of the sea the humidity is generally high being 100% in the monsoon period and around 24% during summer. The winds are generally moderate except during late summer and monsoon period when they are very strong. The maximum wind speed is 30 km/hr.

The major part of Diu district has a distinct geomorphic identity as an island, is surrounded by the Arabian Sea while small portion, known as Gogala area, in northeast, is attached with mainland of Gujarat State. The Diu Island faces open sea in south and in north it is separated from mainland Gujarat by an east-west extending marshy low land and tidal waters of the Arabian Sea, known as Sesalkhada Channel.

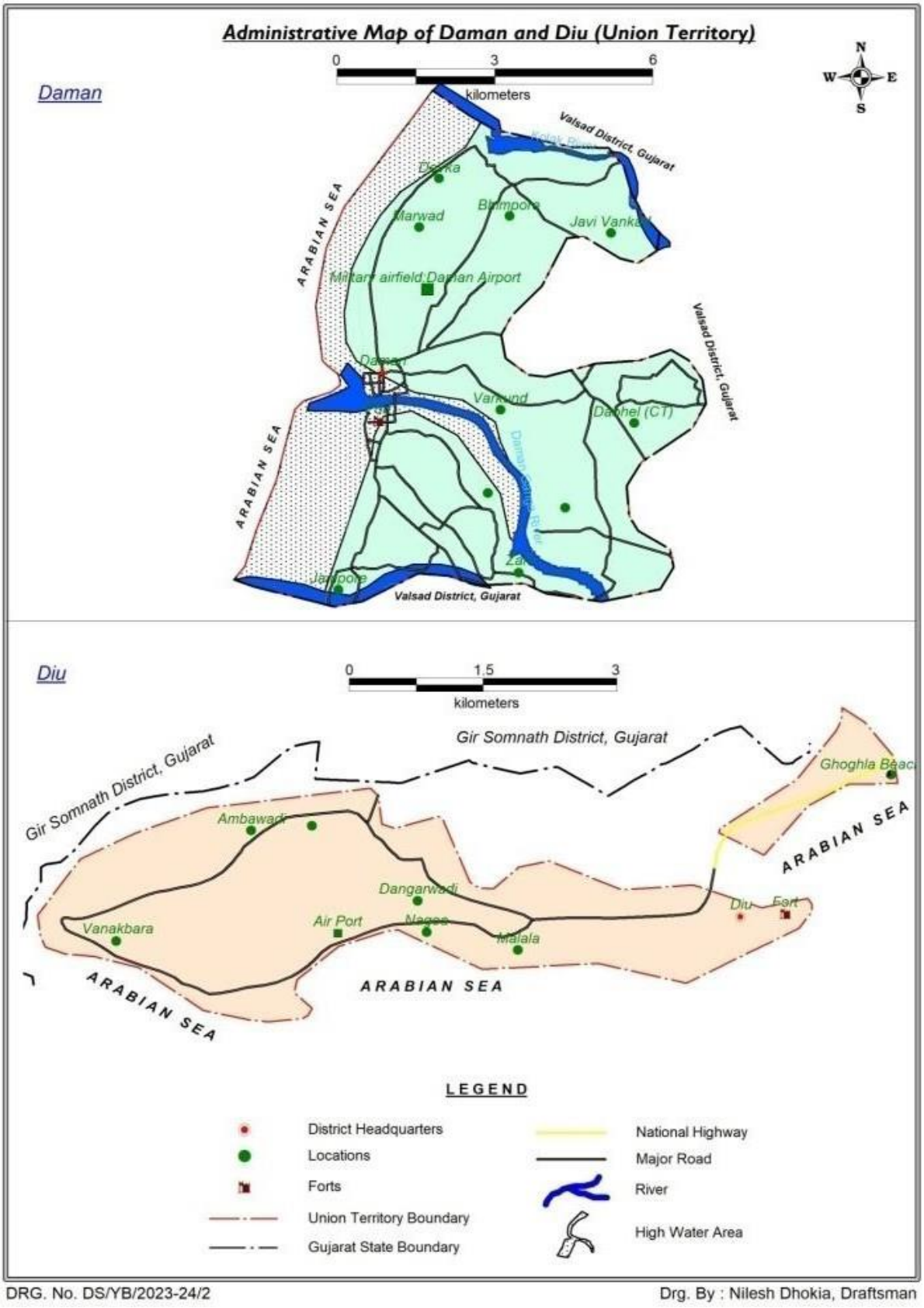

Figure 1: Map showing administrative divisions of UT of Daman and Diu

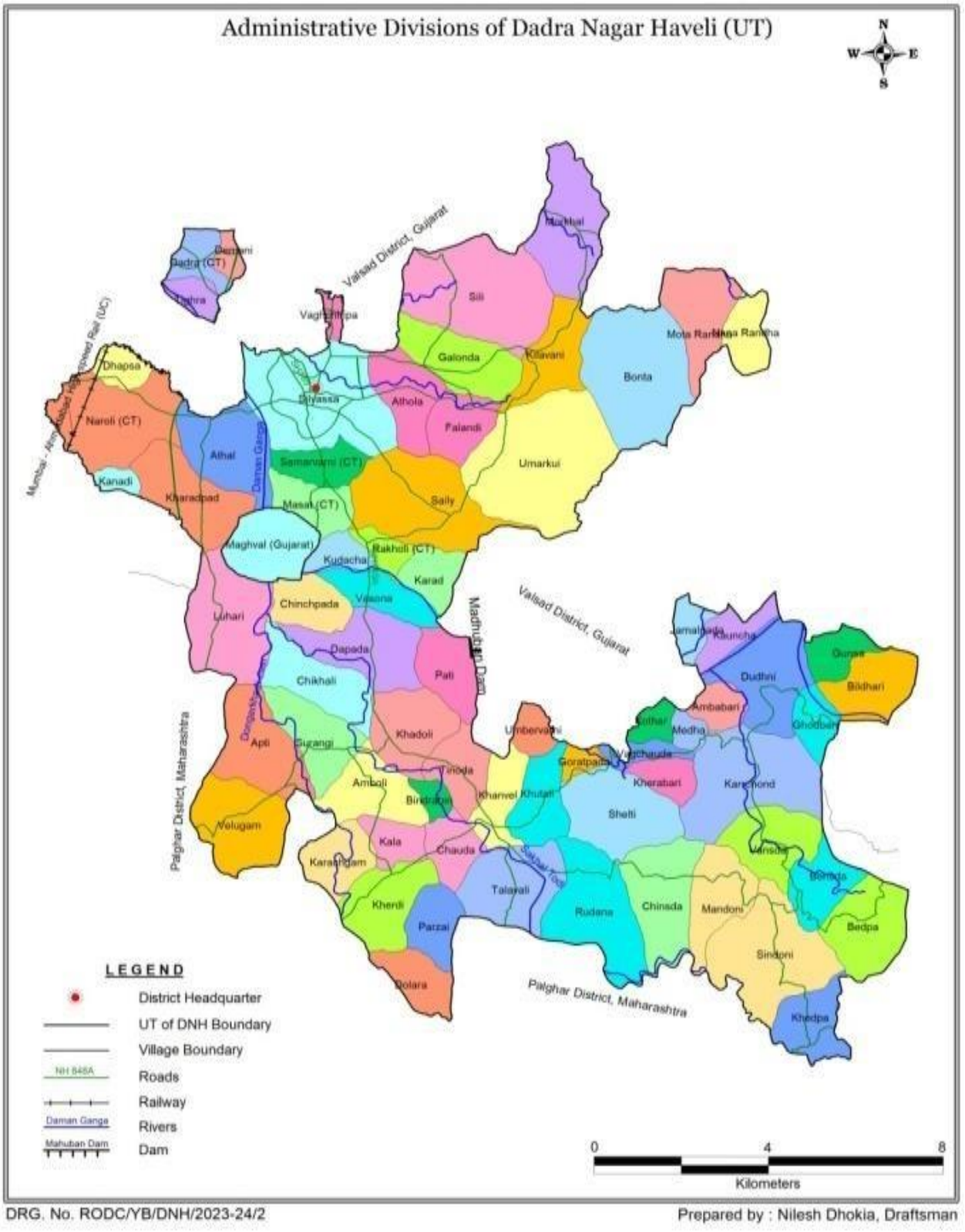

Figure 2 Map showing administrative divisions of UT of Dadra and Nagar Haveli

Topography of the Island is highly variable rolling nature but within range highest 30 m in central part to near sea level in northern part. Towards south east cost it is high cliff of 8 to 10 m facing open sea front except smooth beach of Nagua and Vanakwar. Large tract in between mainland Gujarat and Diu Island is covered by marshy and saline mud flats which are inundated by the diurnal tides daily.

Hydrogeological point of view, the UT of Diu has very limited natural water resources; as such its main area is an island surrounded by saline waterfronts on all sides, with no freshwater resources in form of rivers or streams except annual average rainfall of 750 mm during four months of south west monsoon cycle of Indian Subcontinent. It has excellent aquifer in form of typical Miliolitic Limestone but it has limited thickness of 20 to 40 m as cap rocks, followed by poor aquifer of Gaj formations at depth. This natural constraint of limited ground water resources has become more acute by steadily increasing groundwater draft for ever increasing population and also due to rapid urbanisation and related activities in last two decades. In past, (during 1990-1998) at many places of the Diu Island and Gogala area deterioration of ground water quality has been reported due to sea water ingress in aquifer of the region and incidence of upconing of saline groundwater. Taking note of all such adverse effects of the development, in October 1998 the Central Ground Water Authority (CGWA) has notified whole of the Union Territory of Diu as a 'Critical Area' and imposed prohibition and restriction on the construction, installation of any structures for extraction of groundwater resources to avoid its further depletion. It also authorized the Collector and Administrator of UT of Diu to take action as deem fit for prohibition and restriction on the construction, installation of any ground water abstraction structures in the notified area. It also directed to get registered all persons / agencies having ground water abstraction structures in existence and banned to undertake any scheme / project of groundwater development & management in the notified areas without permission of the Authority.

The UT of DNH has hilly terrain especially towards the North-East and East where it is surrounded by ranges of Sahyadri Mountains (Western Ghats). The terrain is intersected by the River Daman Ganga and its three tributaries. The river rises in the Ghat 64 km.'s from the western coast and discharges itself in the Arabian Sea at the port of Daman. A realies in the middle of the undulating watershed of the Daman Ganga River, which flows through Nagar Haveli and later forms the short southern border of Dadra. The towns of Dadra and Silvassa lie on the north bank of the river. The Western Ghats range rises to the in their later part with temperatures reaching as high as 39° in the month of May. The monsoon starts in the month of June and extends until September. The rainfall is brought by South West monsoon winds. Winters are between maritime temperate and semi- tropical with temperatures ranging from 14° to 30°. The average wind speed recorded is 7.4 km/h. The annual rainfall data for the period 2013 to 2023 is presented in Table-1.2.

Table 1: District-wise average annual rainfall in UT

S.No.	District	Rainfall2023	Average Rainfall in mm(2013to2023)	Departure %(Year2023)
1	UT of Daman	2,195.80	3193	**-0.31**
2	UT of Diu	995.7	622.6	**0.60**
3	Dadra and Nagar Haveli	2650.5	1925.9	**0.38**

Two distinct hydro-geological units are identified in UT viz., hard rocks and soft rocks. The distributions of monitoring wells in different hydro-geological units are given in Table 2.

Table 2: Distribution of ground Water Monitoring Wells In Different Hydrogeological units, Union Territory of Daman And Diu And Dadra and Nagar Haveli

S.No	DISTRICT	HardRock		SoftRock		Total		
		DW	PZ	DW	PZ	DW	PZ	Total
1	Daman	14	2	0	0	14	2	16
2	Diu	0	0	6	2	6	2	8
3	Dadra and Nagar Haveli	18	1	0	0	18	1	19
	U.T.Total	**32**	**3**	**6**	**2**	**38**	**5**	**43**

River basins have been identified by the All India Soil Survey & Land Use Departments listed below:

Table 3: Distribution of Ground Water Monitoring Wells in Different Hydrogeological Units, Union Territory of Daman And Diu And Dadra and Nagar Haveli

DISTRICT_NAME	BASIN_NAME	SUB_BASIN_NAME	Total
DAMAN	SharavatitoTapti	Savitri To Tapti	**15**
		Sharavati To Savitri	**1**
	SharavatitoTaptiTotal		**16**
DAMAN Total			**19**
DIU	Southern Kathiawar	Draining Into Gulf of Khambat	**8**
	Southern Kathiawar Total		**8**
DIU Total			**8**
Dadra and Nagar Haveli	Daman ganga basin	Draining Into Arabian Sea	**19**
Dadra and Nagar Haveli			**19**
Grand Total			**43**

Table 4: District wise distribution of groundwater monitoring wells monitored during 2023-24

Sl. No.	District	Monitored During May- 2023			Monitored During August- 2023			Monitored During November - 2023			Monitored During January - 2024		
		Dw	**Pz**	**Total**	**Dw**	**Pz**	**Total**	**Dw**	**Pz**	**Total**	**Dw**	**Pz**	Total
1	U.T.Of Daman	7	0	7	13	1	14	12	1	13	14	1	**15**
2	U.T. of Diu	3	2	5	4	1	5	4	2	6	3	1	**4**
3	Dadra and Nagar Haveli	13	0	13	17	1	18	17	1	18	18	1	**19**
Ut Total		**23**	**2**	**25**	**34**	**3**	**37**	**33**	**4**	**37**	**35**	**3**	**38**

The sub-basins and the distribution of groundwater monitoring wells in thes e river basins are given in Table 3. Map showing Hydrograph stations monitored during the year and their distribution in different basin and the district.
Central Ground Water Board, as a part of its national programs, has established a network of observation wells in the U.T. of Daman and Diu for periodic monitoring of groundwater levels and to study its quality variation in time and space. 12 groundwater monitoring wells including 4 piezometers (Pz) are presently being monitored in the U.T. of Daman and Diu. The distributions of monitoring wells in different districts are given in Table 3.

3. HYDROGEOLOGY

3.1 UT of Daman

Basalt is the main basement rock which occurs at variable depths in most parts of Moti Daman and also exposed at surface in the north west part of Daman namely in Marwad, Devka, Kadiya. Basaltic ridges having elevation of about 111m amsl are exposed in and around Kunta and Wankad villages. Basalt sheet rocks are exposed in river beds of Daman Ganga, Kaluand kolak rivers bordering UT of Daman. Alluvial deposits are found overlying the basalts, all along Moti Daman area and also in Dabhel and Kachigam areas having depth of 12 to 40m bgl. Alluvium deposits are river terrace type along the banks of river Daman Ganga.

The basalt occurs in the form of flows comprising massive and compact basalt in the bottom and gradually passes into vesicular basalt at the top. The basalts vary in colour from dark green to pink and show different sets of joints. All the joint systems are restricted to the individual flow seldom cutting across other flows. The surface weathering is characterised by spheroidal weathering.

Ground Water Occurs in Both The Basaltic And Alluvial Formations. In Moti Daman Area and Warkund, Dabhel and Kachigam Areas of Nani Daman, Alluvium Forms the Unconfined Aquifer System. However, In Nani DamanArea This Aquifer Has Become Desaturated and Do Not Sustain Irrigation/Domestic Requirement.

In alluvial formation ground water occurs in unconfined condition, water level ranging from 4m bgl to 8m bgl. The basaltic rock is encountered at variable depth of 20m bgl to 40m bgl underlying the alluvial formation. Ground water occurring in this aquifer gets recharged from rainfall infiltration and it is also assumed that the river Daman Ganga and other perennial rivers like Kalu and Kolak contribute to a large extent during monsoon period. The movement of ground water is controlled by the topographic features. The yield of the wells in both the basaltic and the alluvial formations are moderate, varying from 30 m3 to 300m3/day.

3.2 UT of Diu

Diu district is underlain by Miliolitic limestone of Upper Pleistocene age, which are sandy in nature and consist of varying proportions of calcium carbonate, shell fragments and other detrital materials. They have an N-S to NNW-SSE trend and usually dip gently towards east. This limestone possesses both primary as well as secondary porosity and is cavernous, friable in nature and forms good aquifers. Near the surface (1 – 2 m) the limestone is hard and compact due to calcification of the limestone, as calcium carbonate solutions has given rise to hard and compact curst. The solution activity has resulted in formation of caverns/cavities. The karstic activity is more predominant in the zone of water table fluctuation and in the lower parts, near the contact with underlying Gaj Formations. The Miliolitic limestone is underlain by Gaj Formation of Miocene period, having a thickness of more than 200m. The Gaj formation comprises upper yellowish white clays underlain by interbedded marls, calcareous sandstone, grit, impure (earthy) limestone and clays. (Phadtare, 1988). Pale gray or yellow are the predominant colours of the Gaj sediments. The base of Gaj Formation rests over the Deccan Trap Basalt. The west central part of Diu Island is covered by sand dunes of 10 to 20 m height, overlying milliolite rock.
The generalized geological succession in the area is as follows:

Table 5: Table Showing Geological Succession In The Area

Age	Formation	Lithology	Max. thickness/Remarks
Recent to Pleistocene	*Coastal Alluvium & Miliolite limestone*	*Sand,clays,Miliolite-limestone*	*40-50m*
Miocene(Tertiary)	*Gaj beds*	*Clay, Marl, calc.sandstone,limestone etc.*	*+200m Notexposed*
Upper Cretaceous to Eocene	*Deccan Trap*	*Basaltic lava*	*Not exposed*

Map showing hydrogeology and major geomorphic features is presented in figure1below.

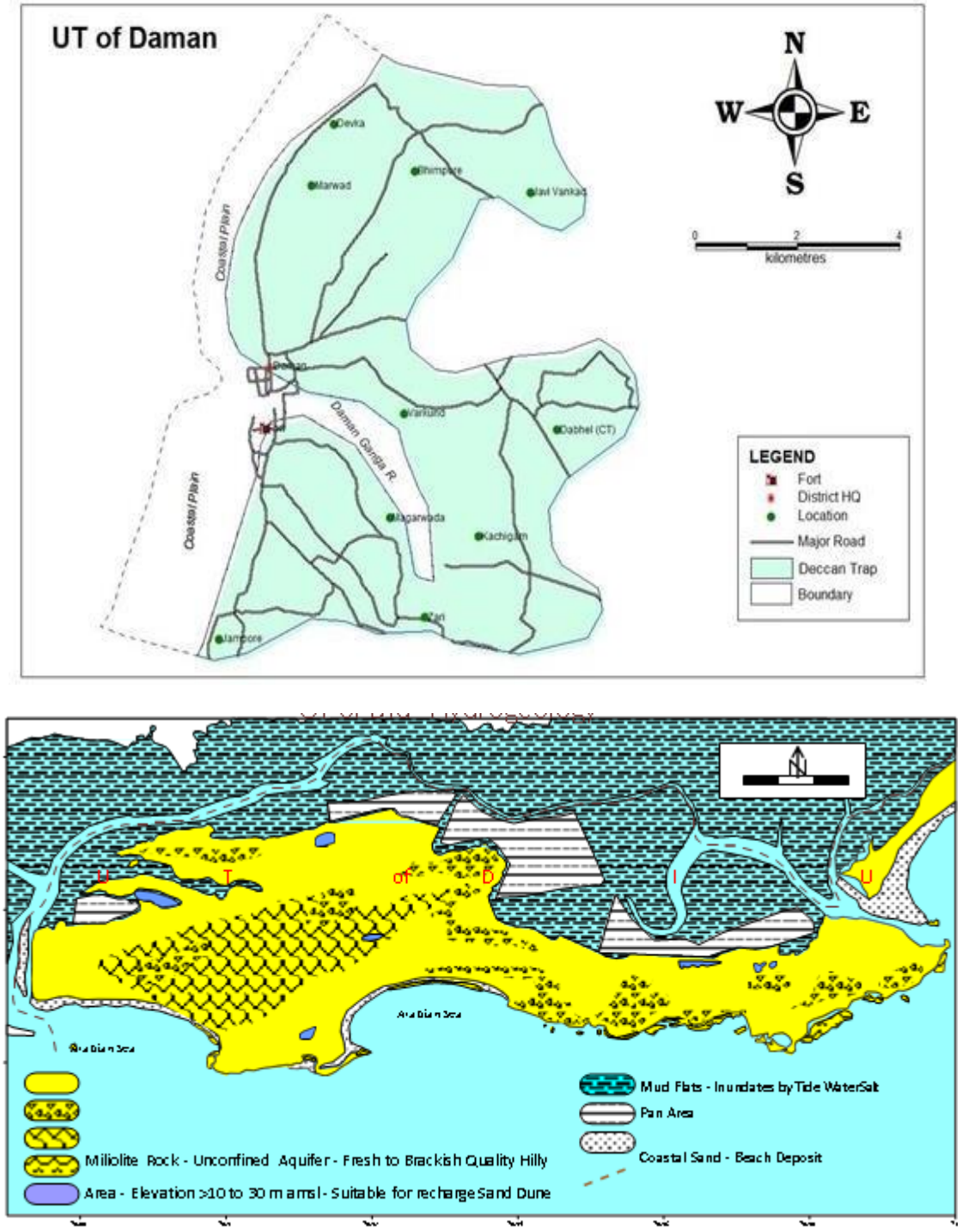

Figure 3: Geology Map UT of Daman And Diu

3.3 UT of Dadra and Nagar Haveli

The area exposes a thick succession of basaltic lava flows of cretaceous to Eocene age. The flows have been intruded by a number of basic and intermediate dykes. A major Trachyte-Rhyolite acidic complex in the western part of the area is quite conspicuous. The flows are intruded by dykes of dolerite and basalt. The intrusions have north-south trends and are quite closely spaced. The area is occupied by 16 basaltic flows within 390m thick lava pile between elevation of 40 m and 435 m amsl. Nine out of 16 basaltic lava flows are of 'aa' type and seven are compound pa-hoe-hoe in nature.

The major water bearing formation in the UT of Dadra and Nagar Haveli is Deccan Trap Basalt. The basaltic lava flows are massive and fine grained with negligible primary porosity and transmissivity. The area occurs in the vicinity of western coast, which have witnessed many tectonic disturbances. These have caused development of joints and fractures in the basaltic strata. Also weathered zones of about 10-20 m thickness have developed in plains and depressions. Thus the weathered, jointed and fractured zones of vesicular and massive units of a flow constitute the main water bearing horizons. However, these zones are not continuous and uniformly developed laterally or vertically and this factor plays an important role in the success and failure of wells in the area.

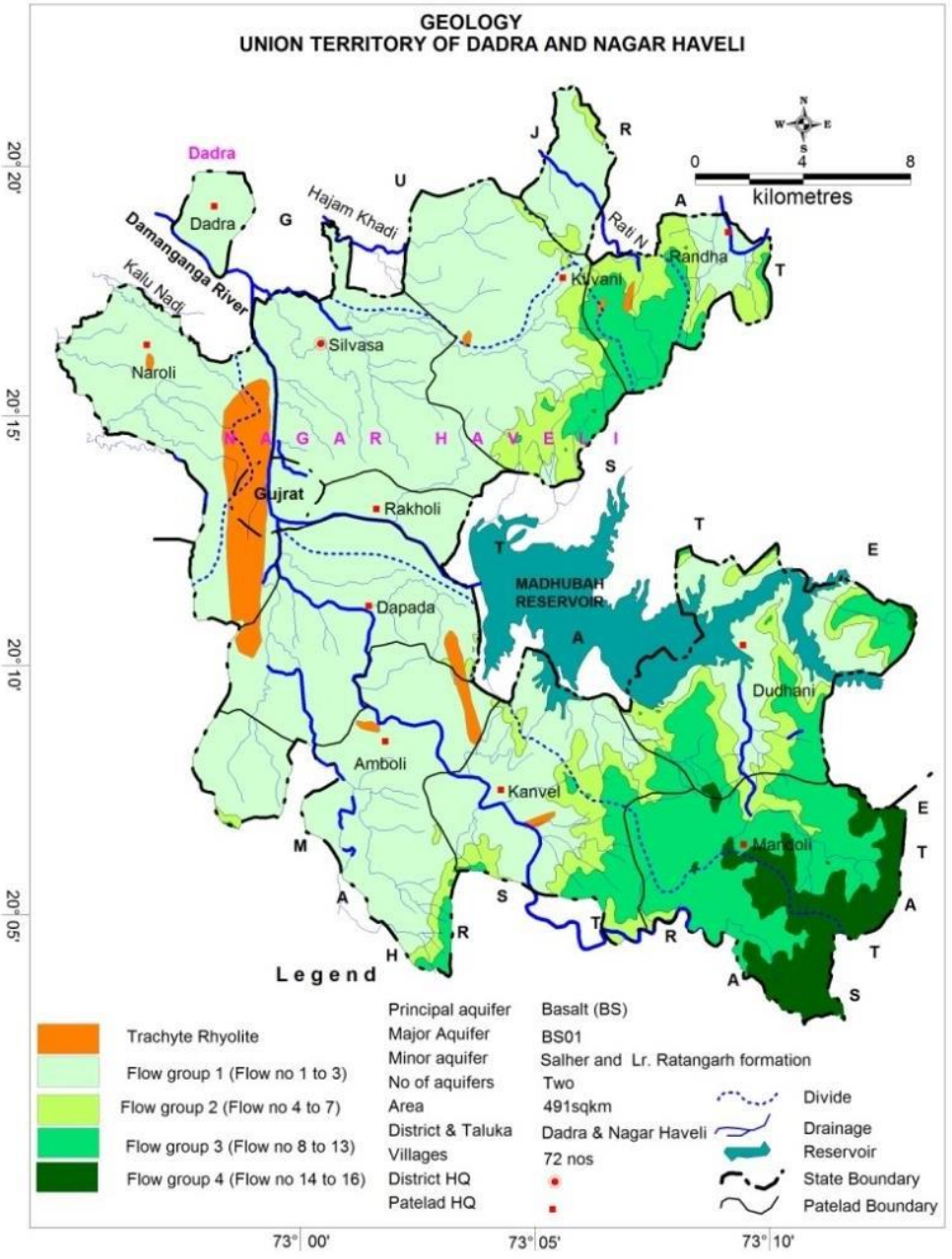

Figure 4: Geology Map UT of Dadra and Nagar Haveli

4. GROUND WATER SCENARIO

Systematic and regular monitoring of groundwater levels brings out the changes taking place in the groundwater regime. The maps so generated are of immense help for regional groundwater flow modelling which serves as a groundwater management tool to provide the necessary advance information to the user agencies to prepare contingency plans in case of unfavorable groundwater recharge situation. The data also has immense utility in deciding the legal issues arising out of conflicting interests of groundwater users.

Ground Water Levels

The monitoring of ground water levels has been carried out at groundwater monitoring wells four times in a year simultaneously throughout the State during the following periods.

1. May - 20th to 30th (water level of pre-monsoon period).
2. August - 20th to 30th (peak monsoon water level).
3. November - 1st to 10th (water levels of post-monsoon period).
4. January - 1st to 10th (the recession stage of water level).

Water level data of the ground water monitoring wells collected during the year 2023– 2023 has been utilized to prepare various maps showing depth to water level and fluctuation of water level.
Depth to water level maps are useful in dealing with problems of water logging and artificial recharge, where the relative position of water level with reference to the ground surface is of critical importance. Water level fluctuation maps (rise or fall) are indispensable for estimation of change in storage in the aquifer.

The water level data of these open wells and piezometers are presented in the Annexure II.

The data is analyzed for each set of measurement, and report prepared which include following maps to understand the groundwater regime in the state.

- Depth to water level
- Seasonal fluctuation - water level fluctuation in comparison to pre- monsoon.
- Annul fluctuation- water level fluctuation in comparison to same month in the previous year.
- Decadal fluctuation - water level fluctuation in the month of measurement with reference to the decadal average for the same month.

4.1 Depth to Water Level (Unconfined Aquifer)

An analysis was done to understand the water level behaviors of the ground water monitoring wells in the different categories of the water levels during every monitoring period and the same is depicted in Fig. 6.

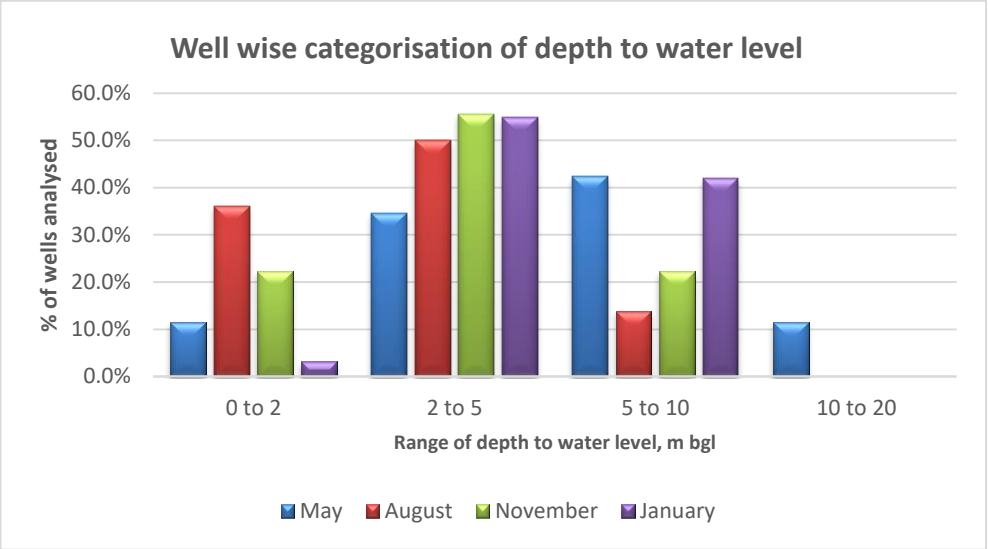

Figure 5: Graph Showing Distribution of Depth to Water Level in UT of Daman and Diu &Dadra and Nagar Haveli

4.1.1 Depth to Water Level (May 2023)

In the pursuance of Fig no. 6 reveals that 92.3% of of the total well analysed (table- 6) of the state falls in the water levels ranges 0 – 20 m bgl. Water levels below of 5 mbgl are observed in 11.5% of stations of the UT of Daman and Diu & Dadra and Nagar Haveli. Details of depth to water level in different range, are presented in table – 6.

In Daman all of the total well analysed (table- 6) of the state falls in the water levels ranges 0 – 10 m bgl. The depth to water level is in the range of 3.3 m bgl at Devka to 9.21 m bgl at Daman;

In Diu all of the well analysed falls within the water level range of 2-10 m bgl. Water level ranges from 3.81 m bgl observed at Vanakbarh to 7.33 m bgl at Pothia Bapa in Diu;

In Dadra and Nagar Haveli, the well analysed falls within the water level range of 0-20 m bgl and out of which alone 46.2% represent the water level range of 0-5 m bgl. The deepest water level of 12.6 m bgl at Dudhani whereas shallowest water level of 0.71 m bgl at Chinsda.

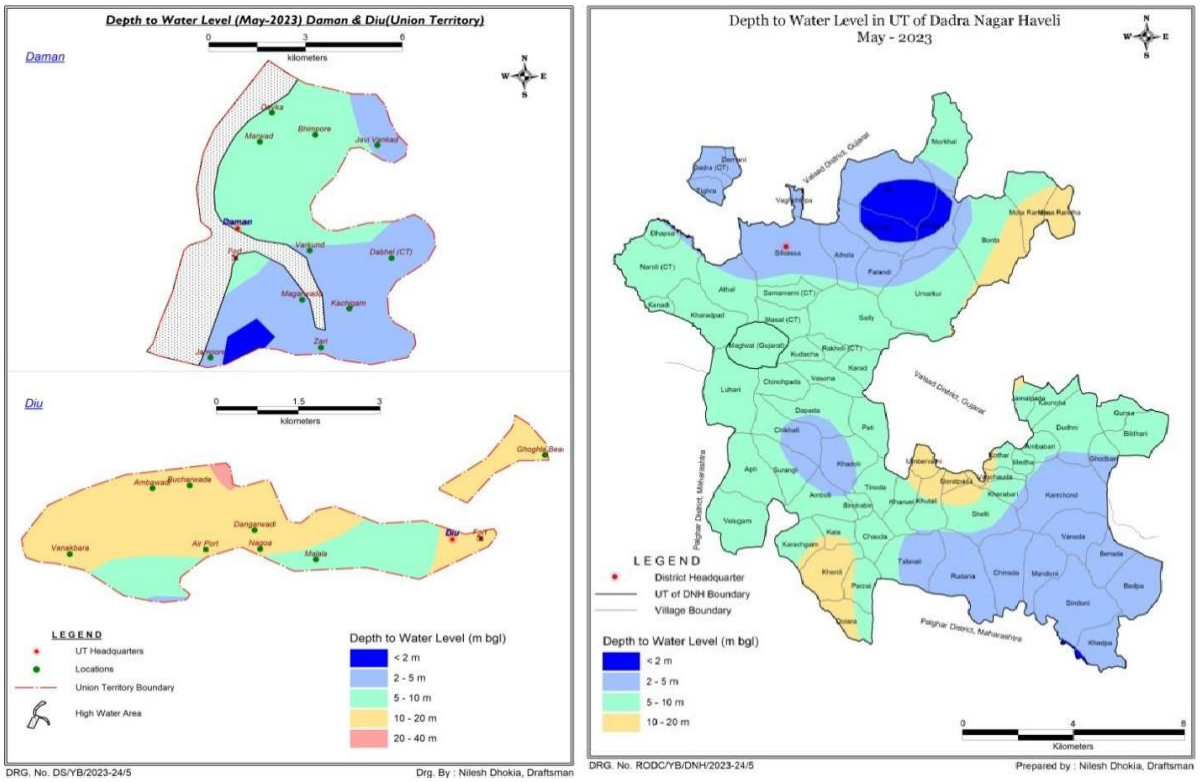

Figure 6: Map showing Depth to Water Level of Union Territory of Daman and Diu (right) and Dadra and Nagar Haveli (left) during May 2023

Table 6: Well Wise Categorization of Depth to Water Level - May 2023

Sr. No.	District Name	No of well analyzed	DTWL, mbgl		No. of wells in different depth range					
			Min	Max	0 to 2	2 to 5	5 to 10	10 to 20	20 to 40	> 40
1	Daman	8	3.3	9.21	1	3	3	1	0	**0**
					12.5%	37.5%	37.5%	12.5%	0.0%	**0.0%**
2	Diu	5	3.81	7.33	0	2	3	0	0	**0**
					0.0%	40.0%	60.0%	0.0%	0.0%	**0.0%**
3	Dadra and Nagar Haveli	13	2.7	12.6	2	4	5	2	0	**0**
					15.4%	30.8%	38.5%	15.4%	0.0%	**0.0%**
	UT of Daman and Diu & Dadra and Nagar Haveli	**26**	**3.30**	**9.21**	3	9	11	3	0	**0**
					11.5%	34.6%	42.3%	11.5%	0.0%	0.0%

4.1.2 Depth to Water Level (August 2023)

During August 2023 (Fig-07) the depth to water level of unconfined aquifer range from 0.65 to 12.5 m bgl. Details of depth to water level in different range, from 0-2 m, 2 to 5 m, 5 to 10 m, 10 to 20m, 20 to 40 m and more than 40 mbgl are presented in table – 7. The perusal of the depth to water level reveals that 86.1% of the monitoring stations falls in the ranges of 0 to 5 mbgl whereas 5 to 10 mbgl water level are observed in 13.9% of the well in UT of Daman and Diu & Dadra and Nagar Haveli.

In Daman all of the well analysed (table- 6) of the state falls in the water levels ranges 0 – 5 m bgl. The depth to water level is in the ranges from 1.3 m bgl at Devka to 3.4 m bgl at Amrutlaywa;

In Diu about 60% of the total well analysed falls within the water level range of 0-2 m bgl and water level of 5-10 mbgl found in 40% of the total well analysed. Water level ranges from 1.4 m bgl observed at Jalawadi to 6.69 m bgl at Pothia Bapa in Diu.

In Dadra and Nagar Haveli, about 84.6% of the total well analysed falls within the water level range of 0-10 m bgl and out of which alone 46.2% represent the water level range of 0-5 m bgl. The deepest water level of 7.4 m bgl at Dapada whereas shallowest water level of 0.65 m bgl at Kilvani Sharyapada

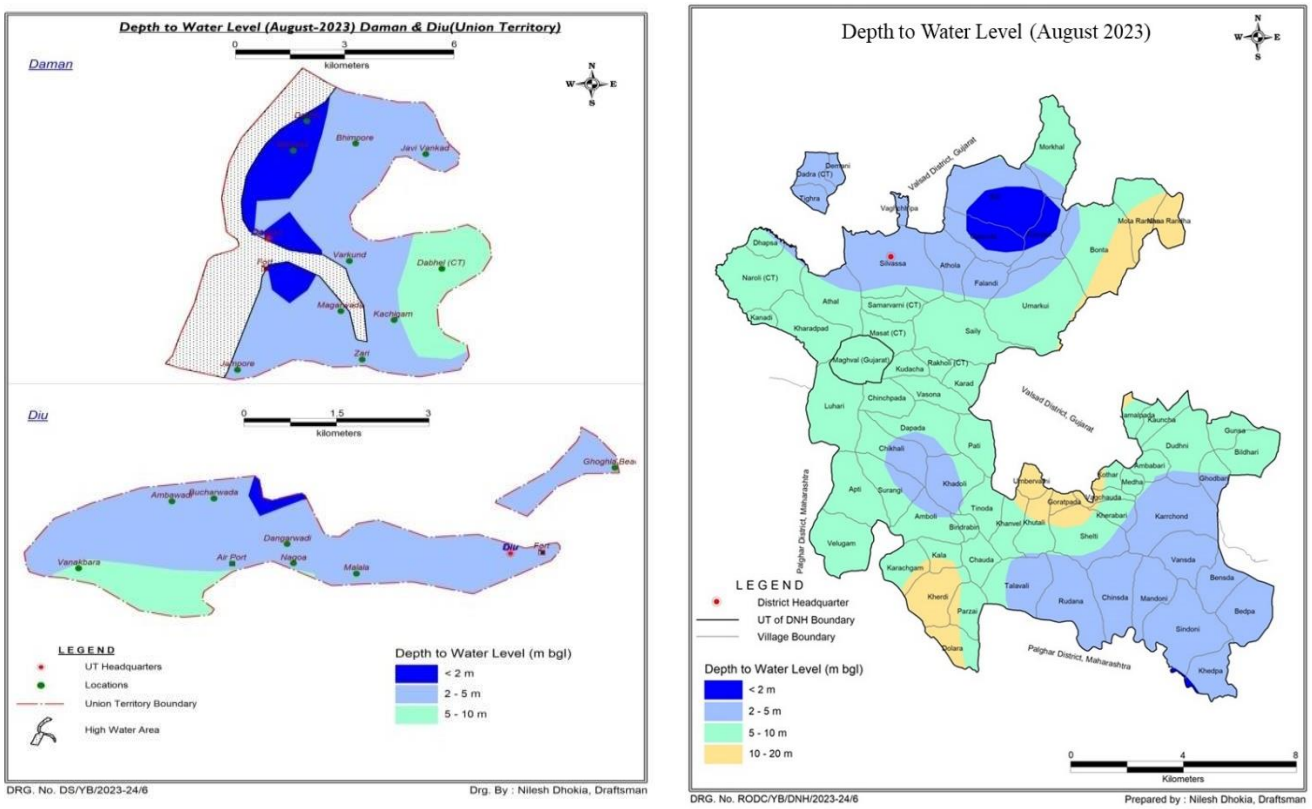

Figure 7: Map showing Depth To Water Level of Union Territory of Daman And Diu (right) and Dadra and Nagar Haveli (left) during, August2023

Table 7: Well Wise Categorisation of Depth To Water Level - August 2023

Sr. No.	District Name	No of well analysed	DTWL, mbgl		No. of wells in different depth range					
			Min	Max	0 to 2	2 to 5	5 to 10	10 to 20	20 to 40	> 40
1	Daman	14	1.3	3.4	7	7	0	0	0	0
					50.0%	50.0%	0.0%	0.0%	0.0%	0.0%
2	Diu	5	1.4	6.69	1	2	2	0	0	0
					20.0%	40.0%	40.0%	0.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	17	0.65	7.4	5	9	3	0	0	0
					29.4%	52.9%	17.6%	0.0%	0.0%	0.0%
	UT of Daman and Diu & Dadra and Nagar Haveli	**36**	**0.65**	**7.40**	13	18	5	0	0	0
					36.1 %	**50.0 %**	**13.9 %**	**0.0%**	**0.0%**	**0.0 %**

4.1.3 Depth to Water Level (November 2023)

The depth to water level of unconfined aquifer ranges from 1.15m bgl to 9.37 m bgl during November 2023 (Fig 8 and table no 8). Details of depth to water level in different range, from 0-2 m, 2 to 5 m, 5 to 10 m, 10 to 20m, 20 to 40 m and more than 40 mbgl are presented in table – 8. The perusal of the depth to water level reveals that 77.8% of the monitoring stations falls in the ranges of 0 to 5 mbgl whereas 5 to 10 mbgl water level are observed in 22.2% of the well in UT of Daman and Diu & Dadra and Nagar Haveli.

In Daman all of the well analysed (table- 6) of the state falls in the water levels ranges 0 – 10 m bgl out of which major wells lie in range of 2-5 mbgl (53.8). The depth to water level is in the ranges from 1.15 m bgl at Ambawadi to 6.13 m bgl at Nani Vankad;

In Diu about 33% of the total well analysed falls within the water level range of 2-5 m bgl and water level of 5-10 mbgl found in 67% of the total well analysed. Water level ranges from 2.75 m bgl observed at Jalawadi to 6.6 m bgl at Pothia Bapa in Diu.

In Dadra and Nagar Haveli, about 82.4% of the total well analysed falls within the water level range of 0-5 m bgl and 17.6% represent the water level range of 5-10 m bgl. The deepest water level of 9.37 m bgl at Dudhani whereas shallowest water level of 1.53 m bgl at Mandoni.

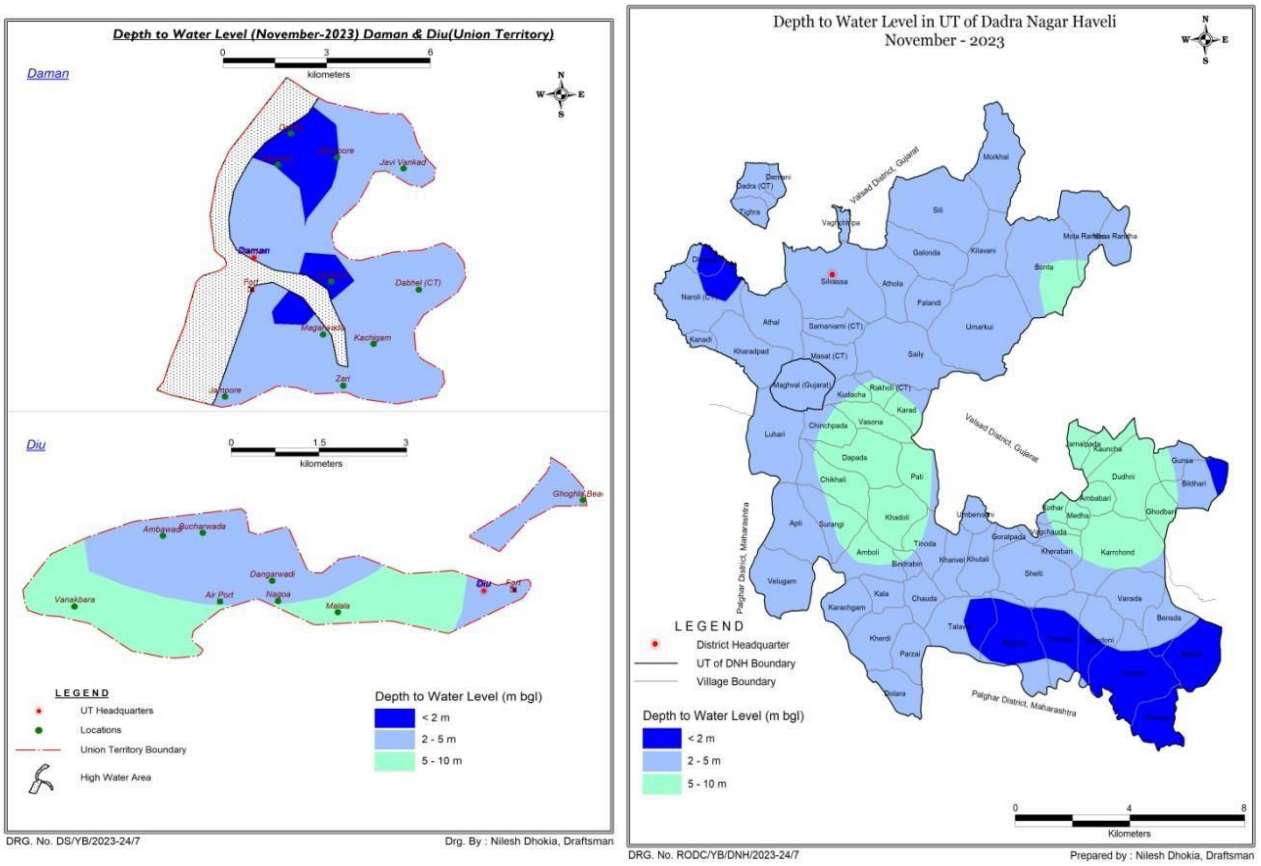

Figure 8: Map showing Depth to Water Level of Union Territory of Daman and Diu (right) and Dadra and Nagar Haveli (left) during November2023

Table 8: Well Wise Categorisation of Depth to Water Level - November 2023

Sr. No.	District Name	No of well analysed	DTWL, mbgl		No. of wells in different depth range					
			Min	Max	0 to 2	2 to 5	5 to 10	10 to 20	20 to 40	> 40
1	Daman	13	1.15	6.13	5	7	1	0	0	0
					38.5%	53.8%	7.7%	0.0%	0.0%	0.0%
2	Diu	6	2.75	6.6	0	2	4	0	0	0
					0.0%	33.3%	66.7%	0.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	17	1.53	9.37	3	11	3	0	0	0
					17.6%	64.7%	17.6%	0.0%	0.0%	0.0%
	UT of Daman and Diu &Dadra and Nagar Haveli	**36**	**1.15**	**9.37**	8	20	8	0	0	0
					22.2 %	**55.6 %**	**22.2 %**	**0.0%**	**0.0%**	**0.0 %**

4.1.4 Depth to Water Level (January 2024)

The depth to water level of unconfined aquifer ranges from 1.98 m bgl to 9.78 m bgl during November 2023 (Fig 9 and table no 9). Details of depth to water level in different range, from 0-2 m, 2 to 5 m, 5 to 10 m, 10 to 20m, 20 to 40 m and more than 40 mbgl are presented in table –9. The perusal of the water level reveals that 58.1% of the total well analysed has water level less than 5m bgl, in UT of Daman and Diu & Dadra and Nagar Haveli. Water levels of 5 to 10m bgl are observed in 41.9% of the well.

In Daman all of the well analysed (table- 6) of the state falls in the water levels ranges 2 – 10 m bgl out of which major wells lie in range of 2-5 mbgl (60%). The depth to water level is in the ranges is within the range of 3.08 m bgl (Bhathaiya) to 8.3 m bgl (Dabhel) in Daman

In Diu about all of the total well analysed falls within the water level range of 2-10 m bgl of the total well analysed. Water level ranges from 3.74 m bgl at (Vanakbarh) to 6.5 m bgl at Pothiabapa.

In Dadra and Nagar Haveli, about 82.4% of the total well analysed falls within the water level range of 0-5 m bgl and 17.6% represent the water level range of 5-10 m bgl. The deepest water level of 9.75 m bgl at Dapada whereas shallowest water level of 1.45 m bgl at Moolpada, UT of DNH

Table 9: Well Wise Categorisation of Depth to Water Level - January 2024

Sr. No.	District	No of well analysed	DTWL, mbgl		No. of wells in different depth range					
			Min	Max	0 to 2	2 to 5	5 to 10	10 to 20	20 to 40	> 40
1	Daman	10	3.08	8.3	0	6	8	0	0	0
					0.0%	42.9%	57.1%	0.0%	0.0%	0.0%
2	Diu	4	3.74	6.5	0	2	2	0	0	0
					0.0%	50.0%	50.0%	0.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	18	1.45	9.75	1	11	6	0	0	0
					5.6%	61.1%	33.3%	0.0%	0.0%	0.0%
	UT of Daman and Diu &Dadra and Nagar Haveli	**31**	**1.98**	**9.78**	1	17	13	0	0	0
					3.2%	**54.8%**	**41.9%**	**0.0%**	**0.0%**	**0.0%**

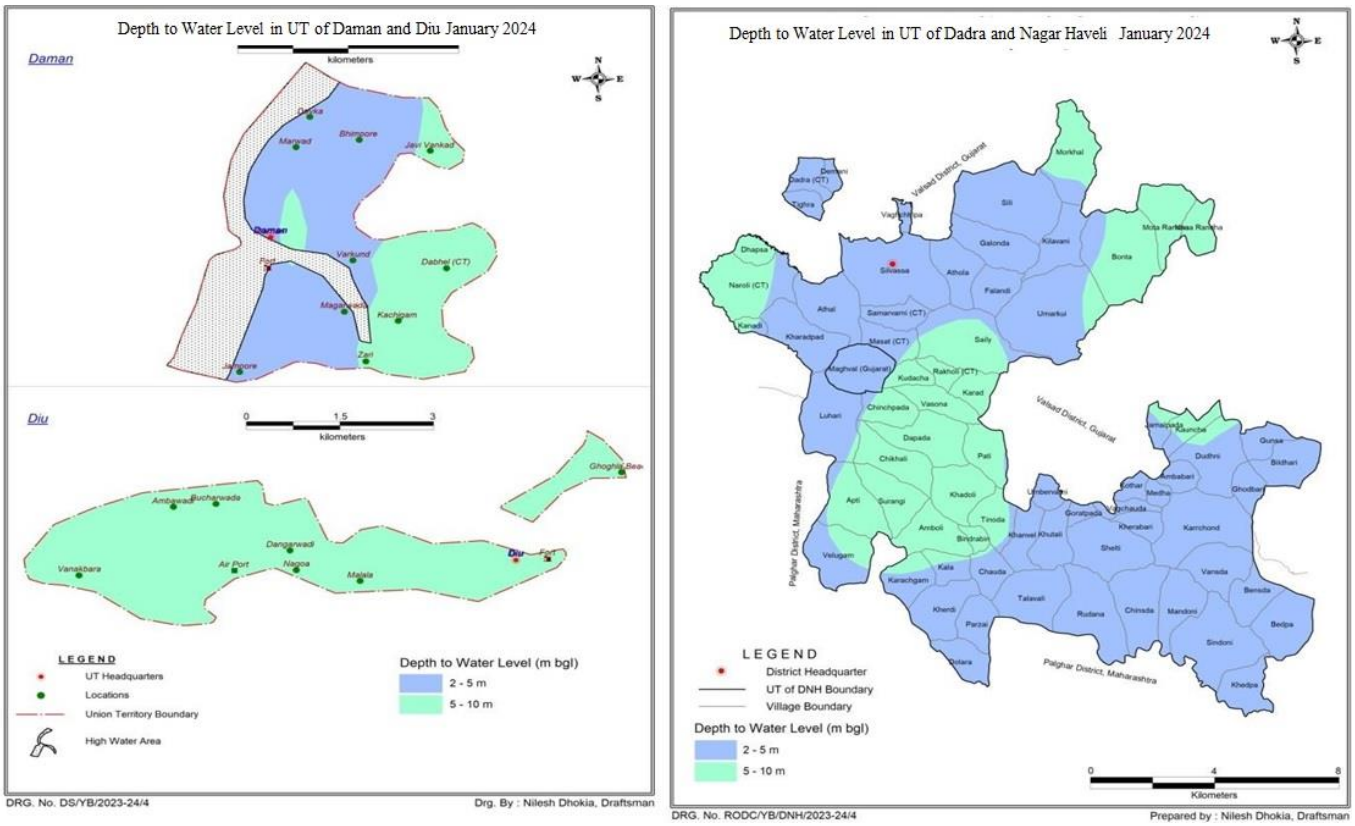

Figure 9: Map showing Depth to Water Level of Union Territory of Daman and Diu (right) and Dadra and Nagar Haveli (left) during January 2024

4.2 Seasonal Water Level Fluctuation

To study the effect of monsoon on the groundwater regime and subsequent utilization of groundwater for various needs like agriculture, irrigation, Domestic etc., changes in depth to water levels with respect to May data are studied. The change in groundwater in the region over different periods is presented and a summary of each observation is discussed below.

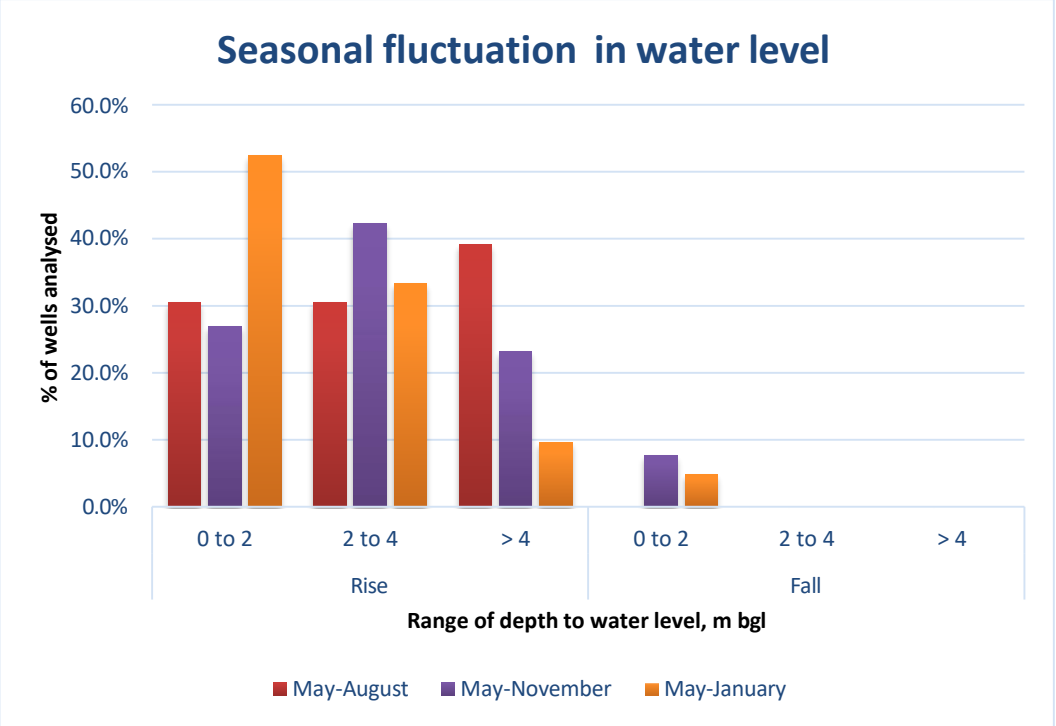

Figure 10: Distribution of seasonal Fluctuation of water level

4.2.1 May 2023 to August 2023

A perusal of Table 10 reveals that all of the total wells in UT of Daman and Diu & Dadra and Nagar Haveli shows a rise in water level. Rise in water level are observed in the range of 0 to 2 m in 30.4 % of wells, 2 to 4 m in 30.4% of well and more than 4m in 39.1% of wells monitored in the Union Territory of Daman and Diu and Dadra and Nagar Haveli. The maximum rise of 9.21 m is recorded at Daman in Daman whereas the maximum rise of 7.33 m is recorded at Pothiabapa in Diu and 10.95 m is recorded at Kilvani Sharyapada in Dadra and Nagar Haveli.

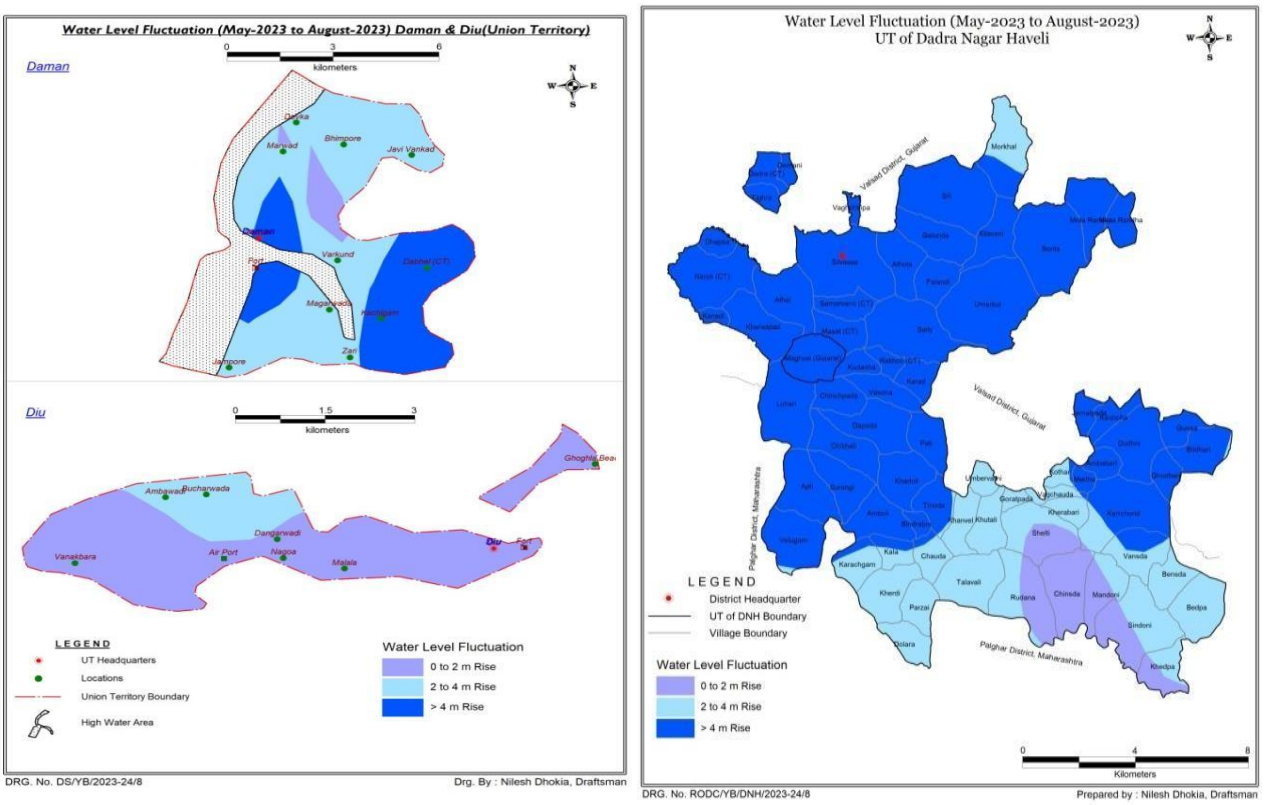

Figure 11: Map Showing Seasonal Fluctuation of Union Territory of Daman And Diu And Dadra and Nagar Haveli Water level May 2023 To August 2023

Table 10: Categorisation of Changes in Water Level Between May 2023 To August 2023

Sr. No.	District Name	No of Well Analysed			Fluctuation Range, M				No. of Wells In Different Depth Range					
					Rise		Fall		Rise			Fall		
		Total	Rise	Fall	Min	Max	Min	Max	0 To 2	2 To 4	> 4	0 To 2	2 To 4	> 4
1	Daman	7	7	0	1.03	7.91	0	0	2	2	3	0	0	0
									28.6%	28.6%	42.9%	0.0%	0.0%	0.0%
2	Diu	4	4	0	0.02	2.66	0	0	3	1	0	0	0	0
									75.0%	25.0%	0.0%	0.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	12	12	0	0.45	10.3	0	0	2	4	6	0	0	0
									16.67%	33.33%	50.00%	0.0%	0.0%	0.0%
	UT of DDD	**23**	**23**	**0**	**0.02**	**7.9**	**0.00**	**0**	**7**	**7**	**9**	**0**	**0**	**0**
									30.4%	**30.4%**	**39.1%**	**0.0%**	**0.0%**	**0.0%**

4.2.2 May 2023 to November 2023

The seasonal water level fluctuation shows rise in 96% of the total wells monitored in the UT of Daman and Diu & Dadra and Nagar Haveli area during the Pre and Post Monsoon of 2023 (Fig-12). Fall in water level is observed in 8% of well analyzed.

In the UT, the maximum rise of 9.78m is recorded at Morwad in Daman whereas the maximum rise of 1.05m is observed at Pothiabapa in Diu and the maximum rise of 7.78 m is recorded at Luhari Dungaripada in Dadra and Nagar Haveli. (Table 11).

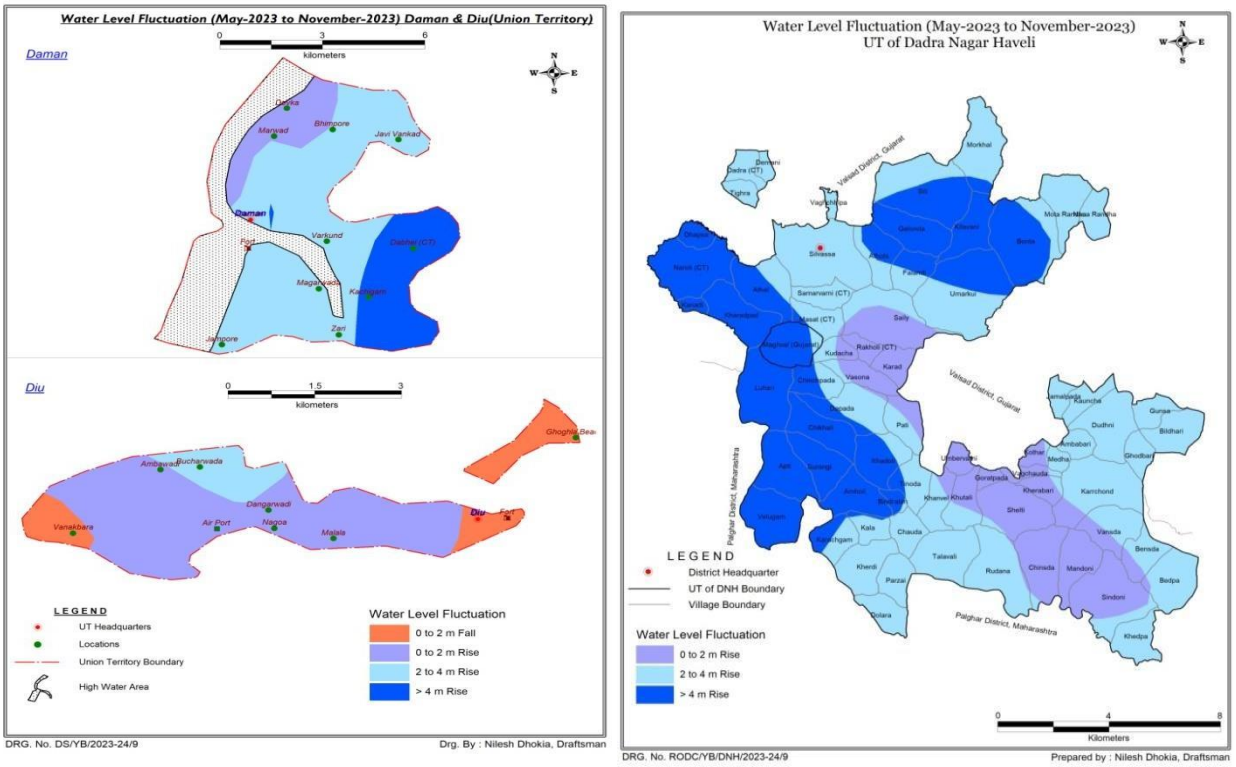

Figure 12: Map Showing Seasonal Fluctuation of water level of Union Territory of Daman and Diu and Dadra and Nagar Haveli May 2023 To November 2023

Table 11: Categorization of Changes in Water Level Between May 2023 To November 2023

Sr. No.	District Name	No of well analyzed			Fluctuation range, m				No. of wells in different depth range					
					Rise		Fall		Rise			Fall		
		Total	Rise	Fall	Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	DAMAN	8	0	8	1.32	6.91	0	0	2	3	3	1	0	0
									25.0%	37.5%	37.5%	12.5 %	0.0%	0.0%
2	DIU	4	1	3	0.47	2.13	0.44	0.44	2	1	0	1	0	0
									50.0%	25.0%	0.0%	25.0 %	0.0%	0.0%
3	Dadra and Nagar Haveli	13	0	13	0.38	7.78	0	0	3	7	3	0	0	0
									23.1%	53.8%	23.1%	0.0 %	0.0%	0.0%
	UT of DDD	**25**	**1**	**24**	**0.04**	**7.78**	**0.44**	**0.44**	**7**	**11**	**6**	**2**	**0**	**0**
									28.0%	**44.0%**	**24.0%**	**8 %**	**0 %**	**0 %**

4.2.3 May 2023 to January 2024

A perusal of Table 11 reveals that about 95% of the total well in the UT of Daman and Diu &Dadra and Nagar Haveli area have recorded rise in water level between May 2023 and January 2024. Fall in water level is observed in 4.8% of well analysed.

In UT of Daman, rise in water level ranges from 0 to 2.12 m bgl whereas fall in water level ranges from 0.81 to 0.81m bgl. In UT of Diu, rise in water level is 0.07 to 0.83 m bgl. In UT of Dadra and Nagar Haveli, rise in water level is 0.2 to 7.73 m bgl.

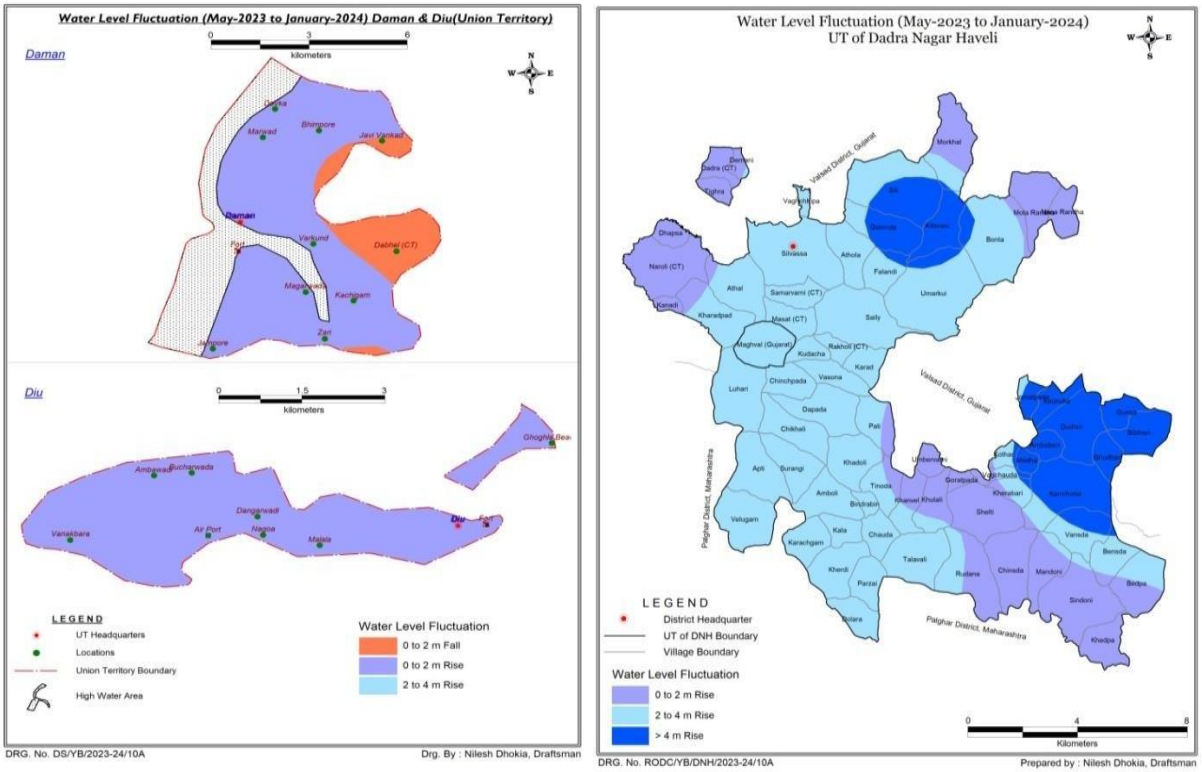

Figure 13: Map Showing Seasonal Fluctuation of water level May 2023 To January 2024

Table 12: Categorisation of Changes in Water Level Between May 2023 To January 2024

Sr. No	District Name	No of well analysed			Fluctuation range, m				No. of wells in different depth range					
					Rise		Fall		Rise			Fall		
.		Total	Rise	Fall	Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	Daman	7	6	1	0	2.12	0.81	0.81	5	1	0	1	0	0
									71.4%	14.3%	0.0%	14.3 %	0.0%	0.0%
2	Diu	2	2	0	0.07	0.83	0	0	2	0	0	0	0	0
									100.0 %	0.0%	0.0%	0.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	12	12	0	0.2	7.73	0	0	4	6	2	0	0	0
									33.3%	50.0%	16.7%	0.0%	0.0%	0.0%
	UT of DDD	**21**	**20**	**1**	**0.00**	**20.5**	**0.81**	**0.81**	**11**	**7**	**2**	**1**	**0**	**0**
									52.4%	**33.3%**	**9.5%**	**4.8%**	**0.0%**	**0.0 %**

4.3 Annual Water Level Fluctuation

Annual Fluctuation in the water levels of the ground water monitoring wells during different monitoring periods were analyzed graphically and depicted in Fig. 14 and discussed below

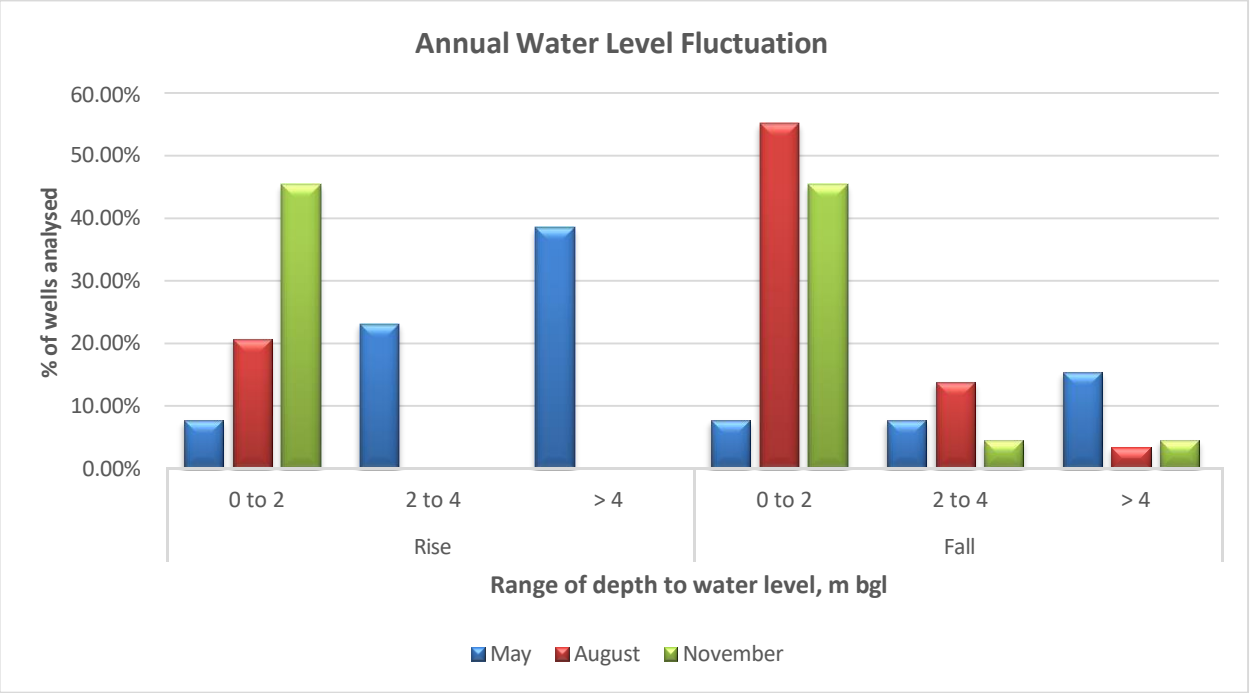

Figure 14: Graph Showing Distribution of Annual Water Level Fluctuation during May, August, November 2023 and January 2024 of UT of Daman and Diu &Dadra and Nagar Haveli

4.3.1 May 2022 to May 2023

A perusal of Table 13 reveals that 61.3% of total monitoring well in the UT of Daman and Diu & Dadra and Nagar Havel shows a rise in water level fall observed in 38.7%. Rise in water level within range of 0 – 2 m is observed in about 51.6% of well. Fall in the range of 0 – 4 m experienced by by 25.8% of well of the UT.
In the UT of Daman, half of total well analysed shows rise in water level and 30% represents in the range of 0 to 2 m of total well in the region. Fall of water level observed in 40% of well analysed in the range of 0 to 2 m.
In the UT of Diu, 40% well analysed shows rise in water level in the range of 0 to 2 m and 60% of total wells analysed show fall in the region. rise of water level is from 0.45 in Chakarteeth and 0.23 m Pothia Bapa
In the UT of Dadra and Nagar Haveli, 75% of total well analysed shows rise in water level and 25% represents fall mainly in the range of 0 to 2 m of total well in the region. Rise of water level ranges from 0.1 to 6.15 m and fall is from 0.68 to 4.45 m.

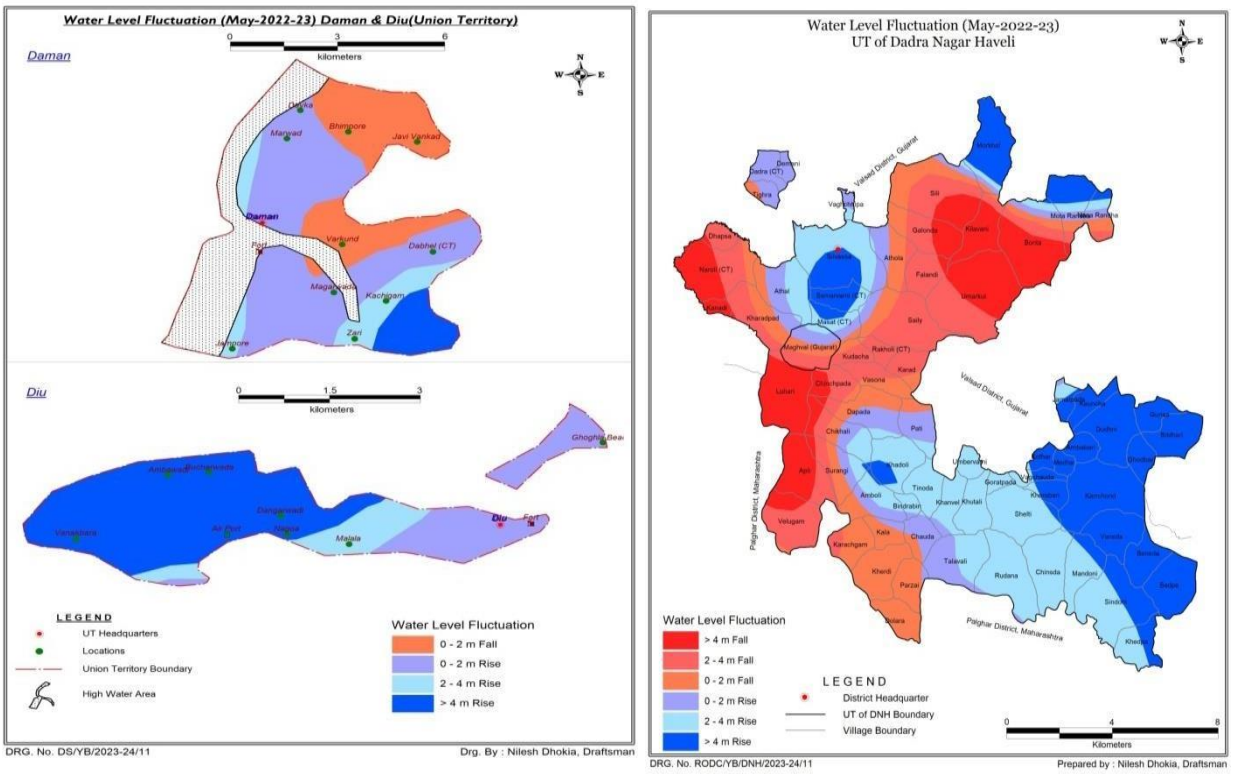

Figure 15: Map Showing Annual Fluctuation of water level May 2022 To May 2023

Table 13: Categorisation of Changes In Water Level Between May 2022 To May 2023

		No of well analysed			Fluctuation range, m				No. of wells in different depth range					
No.	District Name	Total	Rise	Fall	Rise		Fall		Rise			Fall		
					Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	DAMAN	10	4	5	0.2	8.7	0.39	3.3	3	1	1	4	1	0
									30.0 %	10.0 %	10.0 %	40.0 %	10.0 %	0.0%
2	DIU	5	4	0	0.2	0.78	0.17	6.2	2	0	0	2	0	1
									40.0 %	0.0%	0.0%	40.0 %	0.0%	20.0 %
3	**Dadra And Nagar Haveli**	16	9	4	0	6.18	0	4.45	11	0	1	2	1	1
									68.8 %	0.0%	6.3%	12.5 %	6.3%	6.3%
	UT of DDD	31	17	9	0	8.7	0	6.2	16	1	2	8	2	2
									51.6 %	3.2%	6.5%	25.8 %	6.5%	6.5%

4.3.2 August 2022 to August 2023

A perusal of Table 14 reveals that 20.7% of total monitoring well in the UT of Daman and Diu & Dadra and Nagar Havel shows a rise in water level fall observed in 79.3%. Rise in water level within range of 0 – 2 m is observed in about 20.7% of well. Fall in the range of 0 – 2 m experienced by by 62.1% of well of the UT.
In the UT, rise in water level range from 0.35 to 0.9 m bgl in Daman. Fall in water level range from 0.35 to 0.46m bgl in Daman whereas 0.55 to 2.05 m bgl in Diu.

A perusal of Table 15 reveals that 45.5% of total monitoring wells analysed shows a rise and 54.5 % fall in water level of the UT of Daman and Diu & Dadra and Nagar Haveli.
In the UT of Daman, 75% of total well analysed shows rise in water level and 32.5% represents in the range of 0 to 2 m of total well in the region. Fall of water level observed in the range of 2 to 4 m rise of water level is from 0.25 to 0.9m
In the UT of Diu, all well analysed shows rise in water level in the range of 0 to 2 m of total well in the region. rise of water level is from 0.45 in Chakarteeth and 0.23 m Pothia Bapa
In the UT of Dadra and Nagar Haveli, 37.5% of total well analysed shows rise in water level and 62.5% represents fall mainly in the range of 0 to 2 m of total well in the region. Rise of water level ranges from 0.11 to 0.15 m and fall is from 0.45 to 5.97 m

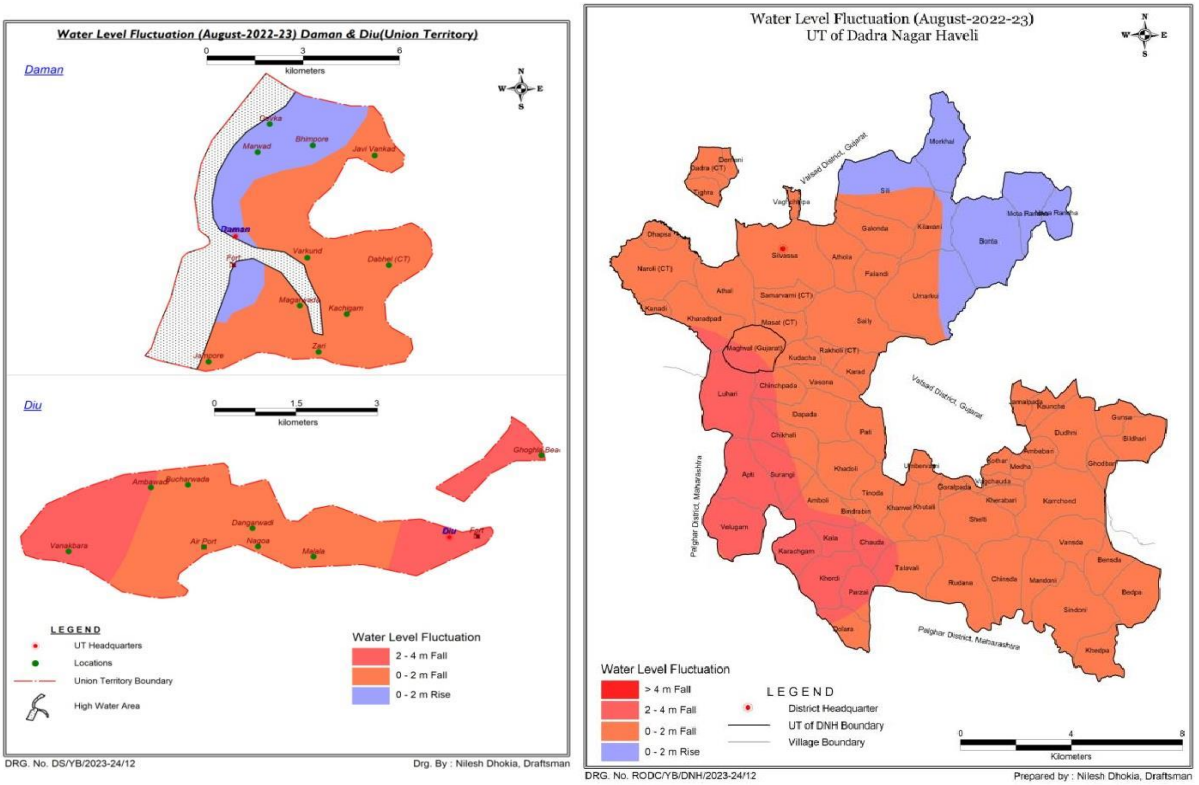

Figure 16: Map Showing Annual Fluctuation of water level August 2022 To August 2023

Table 14: Categorisation of Changes in Water Level Between August 2022 To August 2023

Sr. No.	District Name	No of well analysed			Fluctuation range, m				No. of wells in different depth range					
		Total	Rise	Fall	Rise		Fall		Rise			Fall		
					Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	DAMAN	9	5	4	0.55	0.9	0.35	2.05	5	0	0	3	1	0
									55.6%	0.0%	0.0%	33.3%	11.1%	0.0%
2	DIU	4	0	4	0.39	0	0	4.19	0	0	0	2	1	1
									0.0%	0.0%	0.0%	50.0%	25.0%	25.0%
3	Dadra and Nagar Haveli	16	1	15	0.1	0.4	0.4	3.85	1	0	0	13	2	0
									25.0%	0.0%	0.0%	325.0%	50.0%	0.0%
	UT of DDD	**29**	**6**	**23**	**0.00**	**19.49**	**0.00**	**19**	**6**	**0**	**0**	**18**	**4**	**1**
									20.7%	**0.0%**	**0.0%**	**62.1%**	**13.8%**	**3.4%**

4.3.3 November 2022 to November 2023

A perusal of Table 15 reveals that 45.5% of total monitoring wells analyzed shows a rise and 54.5 % fall in water level of the UT of Daman and Diu & Dadra and Nagar Haveli.

In the UT of Daman, 75% of total well analysed shows rise in water level and 32.5% represents in the range of 0 to 2 m of total well in the region. Fall of water level observed in the range of 2 to 4 m rise of water level is from 0.25 to 0.9m

In the UT of Diu, all well analysed shows rise in water level in the range of 0 to 2 m of total well in the region. rise of water level is from 0.45 in Chakarteeth and 0.23 m Pothia Bapa

In the UT of Dadra and Nagar Haveli, 37.5% of total well analysed shows rise in water level and 62.5% represents fall mainly in the range of 0 to 2 m of total well in the region. Rise of water level ranges from 0.11 to 0.15 m and fall is from 0.45 to 5.97 m

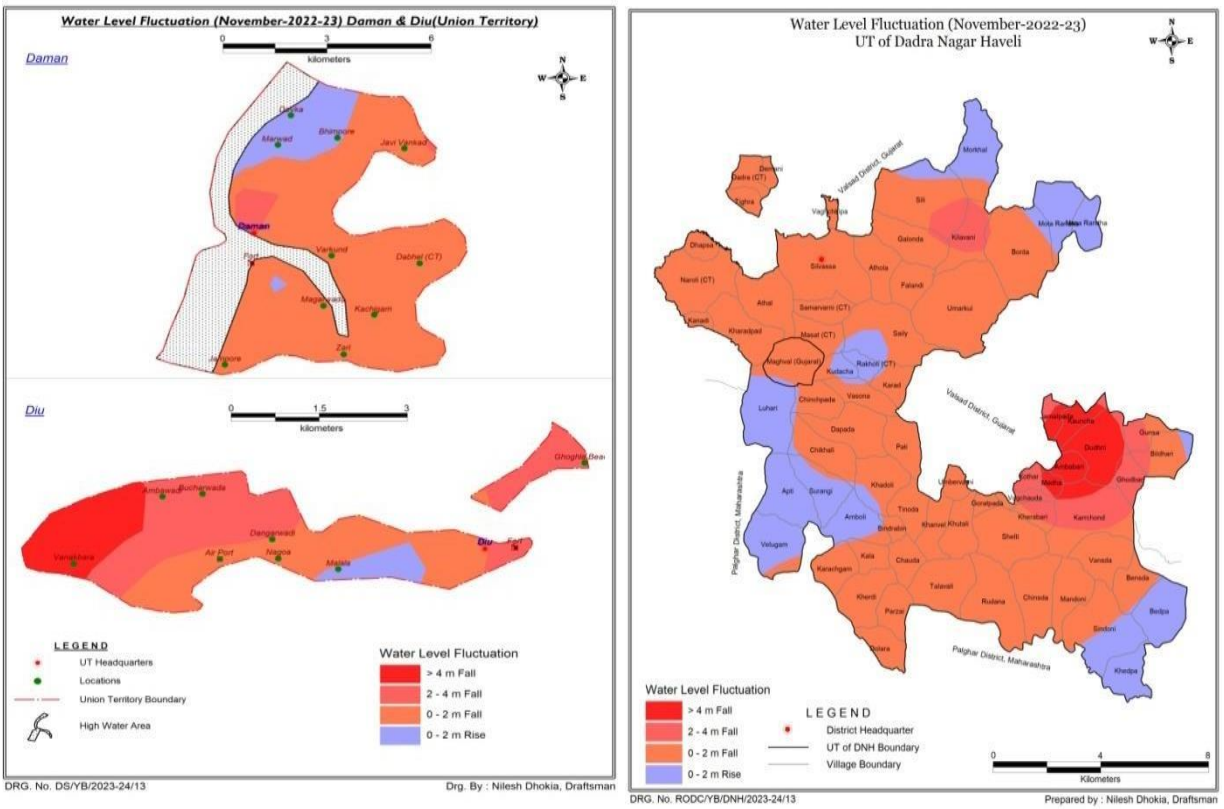

Figure 17: Map Showing Annual Fluctuation of water level November 2022 To November 2023

Table 15: Categorisation of Changes In Water Level Between November 2022 To November 2023

Sr.	District	No of well analysed			Fluctuation range, m				No. of wells in different depth range					
		Total	Rise	Fall	Rise		Fall		Rise			Fall		
					Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	DAMAN	4	3	1	0.02	0.9	0.25	1.81	3	0	0	1	0	0
									75.0%	0.0%	0.0%	25.0%	0.0%	0.0%
2	DIU	2	1	1	0.23	0.45	0.45	0.23	1	0	0	1	0	0
									50.0%	0.0%	0.0%	50.0%	0.0%	0.0%
3	Dadra and Nagar Haveli	16	6	10	0.37	0.77	0.11	5.97	6	0	0	8	1	1
									37.5%	0.0%	0.0%	50.0%	6.3%	6.3%
	UT of DDD	**22**	**10**	**12**	**0.01**	**14.46**	**0.00**	**86.22**	**10**	**0**	**0**	**10**	**1**	**1**
									45.5%	**0.0%**	**0.0%**	**45.5%**	**4.5%**	**4.5%**

4.3.4 January 2023 to January 2024

A perusal of Table 16 reveals that 29.7% of total monitoring wells analysed shows a rise and 70.2 % fall in water level of the UT of Daman and Diu & Dadra and Nagar Haveli.

In the UT of Daman, 23% of total well analysed shows rise in water level and 76.9% represents in the range of 0 to 2 m of total well in the region. Rise of water level observed in the range of 0.25 to .9 m and fall of water level observed in the range of of water level is from .0.02 (Bhathaiya) to 1.8 m (Devka).

In the UT of Diu, 28.6 well analysed shows rise and 71.4 % show fall in water level in the range of 0 to 2 m of total well in the region. rise of water level is from 0.45 in Chakarteeth and 0.23 m Pothia Bapa

In the UT of Dadra and Nagar Haveli, 35.3% of total well analysed shows rise in water level and 64.7% represents fall mainly in the range of 0 to 2 m of total well in the region. Rise of water level ranges from 0.11 (Mandoni) to 0.15 m (Surangi) and fall is from 0.45 (Rudana) to 5.97 m (Dudhani).

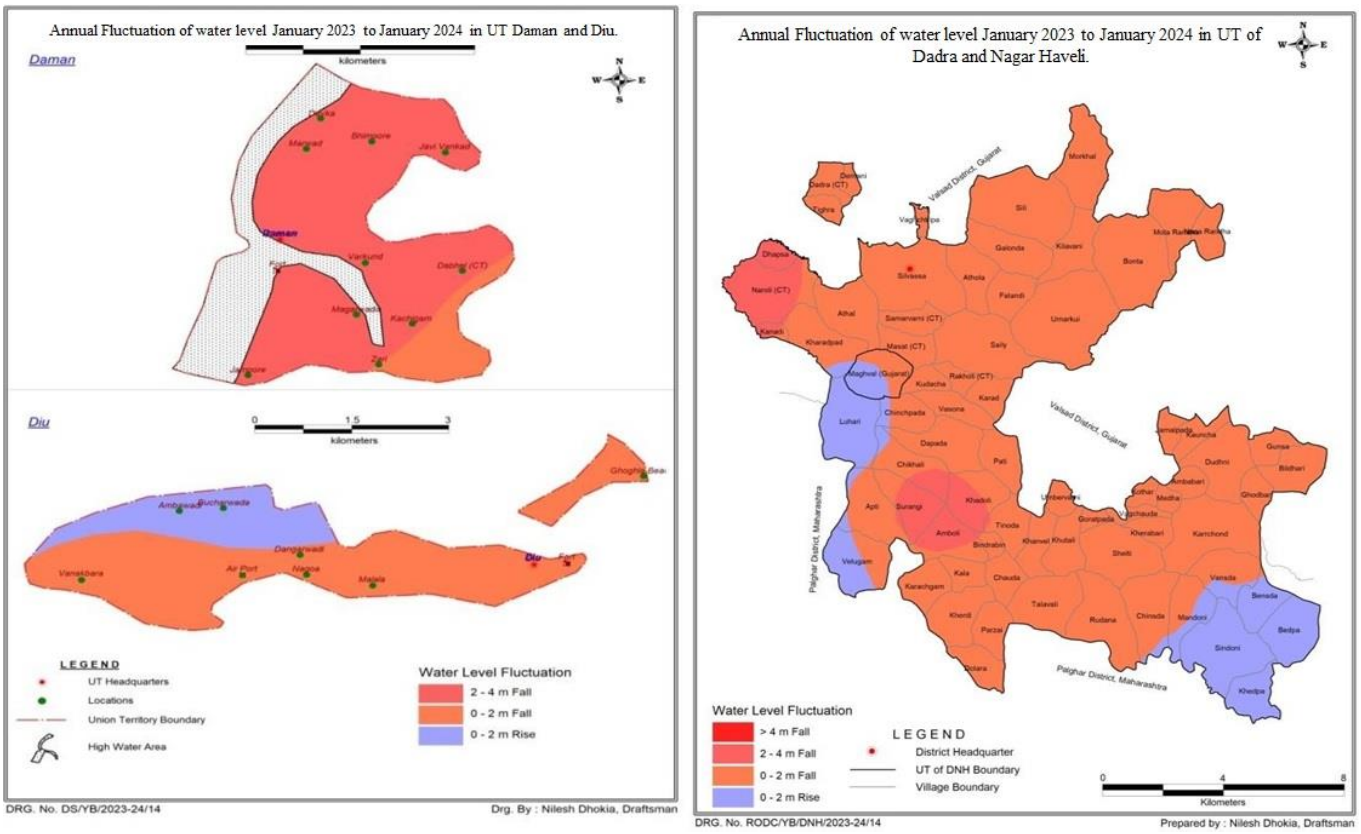

Figure 18: Map Showing Annual Fluctuation of water level January 2023 to January2024

Table 16: Categorisation of Changes in Water Level Between January 2023 to January 2024

Sr.	District	No of well analyzed			Fluctuation range, m				No. of wells in different depth range					
		Total	Rise	Fall	Rise		Fall		Rise			Fall		
					Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4
1	DAMAN	13	3	10	0.02	0.9	0.25	1.81	3	0	0	8	2	0
									23.1%	0.0%	0.0%	61.5%	15.4%	0.0%
2	DIU	7	2	5	0.23	0.45	0.45	0.23	1	0	1	1	1	3
									14.3%	0.0%	14.3%	14.3%	14.3%	42.9%
3	Dadra and Nagar Haveli	17	6	11	0.37	0.77	0.11	5.97	6	0	0	9	1	1
									35.3%	0.0%	0.0%	52.9%	5.9%	5.9%
	UT of DDD	**37**	**11**	**26**	**0.02**	**0.9**	**0.11**	**5.97**	**10**	**0**	**1**	**18**	**4**	**4**
									27.0%	**0.0%**	**2.7%**	**48.6%**	**10.8%**	**10.8%**

5. Long Term Ground Water Scenario

Long-term behavior of water levels was studied by analyzing the data for decadal average water levels and fluctuation of present year water level with respect to decadal average water levels. Maps showing variation in water level scenario over the decade 2013-22 for May, August, November and 2014-23 for January have been prepared to evaluate the long term changes in the groundwater regime.

5. Decadal Variations

Long-term behavior of water levels was studied by analysing fluctuation of present year water level with respect to decadal average water levels. Variation in water level scenario over the decade 2013-2022 for May, August, November and 2014-24 for January have been prepared to evaluate the long term changes in the groundwater regime.

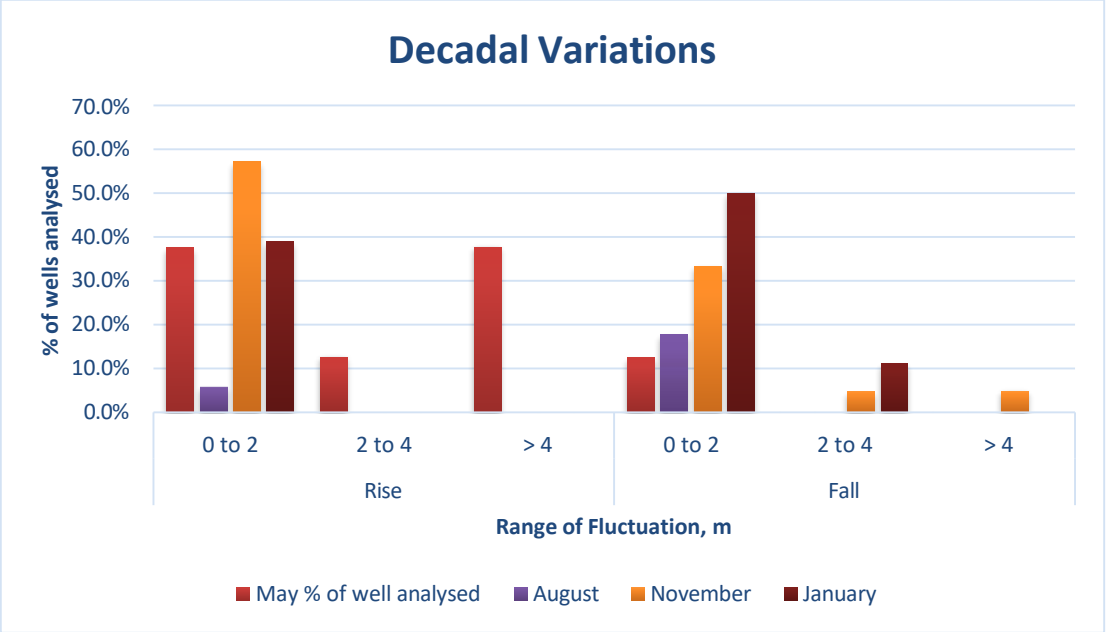

Figure 19: Graph Showing Distribution of Decadal Water Level Fluctuation during May, August, November and January of UT of Daman and Diu &Dadra and Nagar Haveli

5.1.1 Decadal Fluctuation of May (2013-22) to May 2023

A comparison of the water level of the May 2023 with the average water level of the May for last one decade (2013 - 2022) reveals that there is a fall of 12.5% of the wells monitored. Rise and fall is mostly in the range of 0 to 2m. Fall of 0-2 m is observed in 12.5 % of well. The maximum rise of 0.9 m is recorded Chakarteeth Diu whereas the maximum rise of 9.8 m is recorded in Morwad, Daman and 14.6 m in Umarkui (Hathpada), Dadra and Nagar Haveli.

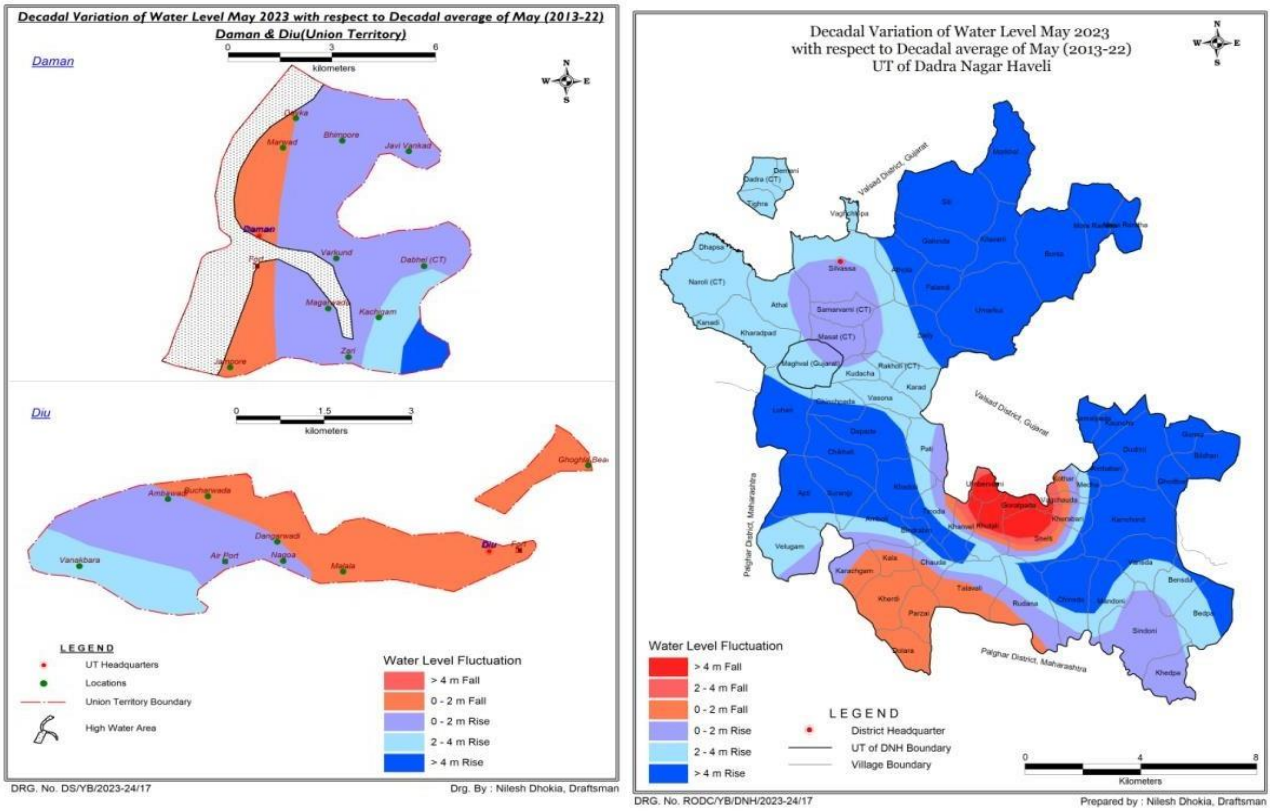

Figure 20: Map Showing Decadal Fluctuation of May (2013-22) To May 2023 in Union Territory of Daman & Diu, and Dadra & Nagar Haveli

Table 17: Well Wise Categorization of Changes In Water Level During May 2023 With Respect To Decadal Average of May (2013-22)

Sr. No.	District Name	No of well analysed	Fluctuation range, m		Fluctuation range, m		No. of wells in different depth range						Total No. of wells	
			Rise		Fall		Rise			Fall				
			Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4	Rise	Fall
1	Daman	7	0.42	9.83	0	0.00	2	0	5	0	0	0	7	0
							28.6 %	0.0 %	71.4 %	0.0%	0.0%	0.0 %		
2	Diu	1	0.92	0.92	0	0.00	1	0	0	0	0	0	1	0
							100.0 %	0.0 %	0.0 %	0.0%	0.0%	0.0 %		
3	Dadra and Nagar Haveli	8	0.46	14.66	0.09	0.51	3	2	1	2	0	0	6	2
							37.5 %	25.0%	12.5 %	25.0 %	0.0%	0.0 %		
	UT of DDD	**16**	**0.42**	14.66	0	0.51	**6**	**2**	**6**	**2**	**0**	**0**	**14**	**2**
							37.5 %	**12.5%**	**37.5 %**	**12.5 %**	**0.0%**	**0.0 %**		

5.1.2 Decadal Fluctuation of August (2013-22) to August2023

A comparison of the water level of the August 2023 with the average water level of the August for last one decade (2013-22) Table 17 reveals that there is a rise in (56% of well analysed) and fall in 70.6% of well analysed. Rise and fall is mostly in the range of 0 to 2 m. The maximum rise of 0.68 m is recorded in Ambawadi, Daman, 0.14 in Diu, whereas the maximum decline of 2.07 m is recorded in Rudana, Dadra and Nagar Haveli.

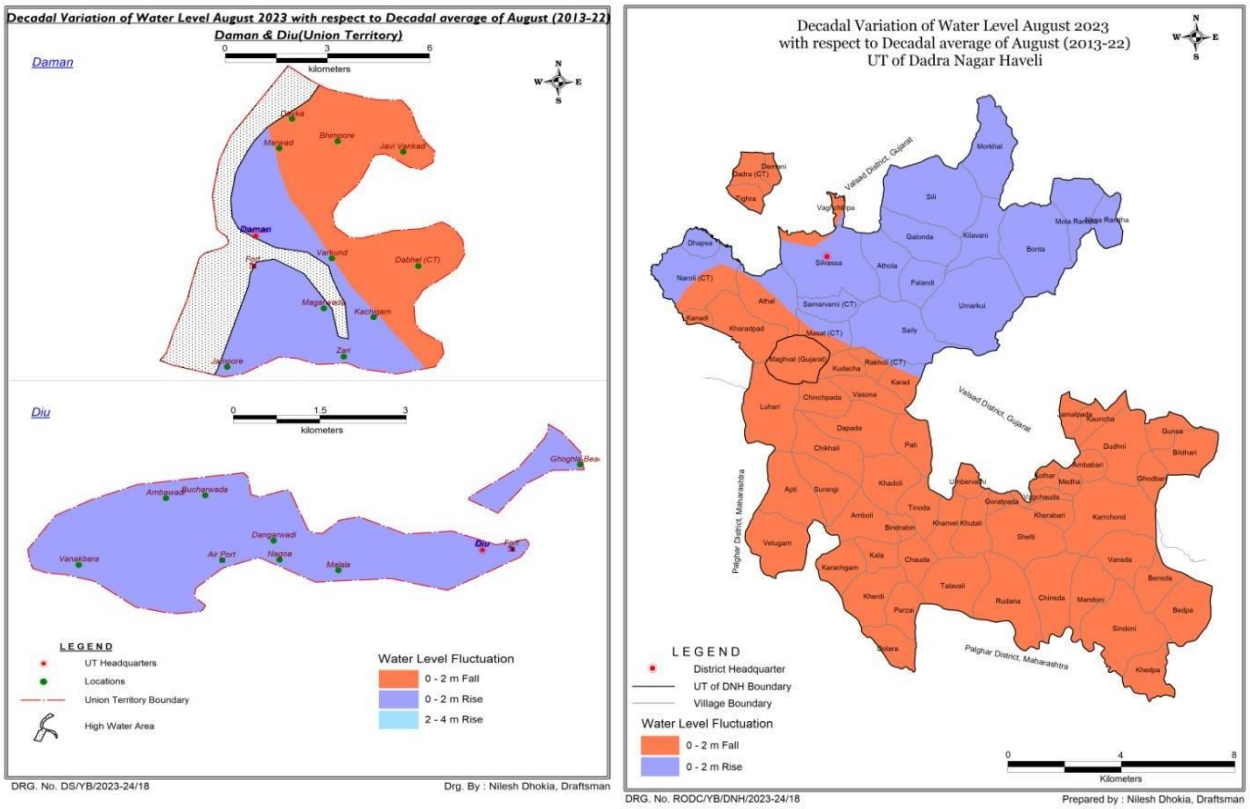

Figure 21: Map Showing Decadal Fluctuation of August(2013-22) To August2023 in Union Territory of Daman & Diu, and Dadra & Nagar Haveli

Table 18: Well Wise Categorization of Changes In Water Level During August 2023 With Respect To Decadal Average of August (2013-22)

Sr. No.	District Name	No of well analysed	Fluctuation range, m		Fluctuation range, m		No. of wells in different depth range						Total No. of wells	
			Rise		Fall		Rise			Fall				
			Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4	Rise	Fall
1	Daman	4	0.68	0.68	0.37	1.55	1	0	0	3	0	0	1	3
							25.0%	0.0%	0.0%	75.0%	0.0%	0.0%		
2	Diu	1	0.14	0.14	0.00	0.00	1	0	0	0	0	0	1	0
							100%	0.0%	0.0%	0.0%	0.0%	0.0%		
3	Dadra and Nagar Haveli	13	0.06	0.38	0.02	2.07	3	0	0	9	1	0	3	10
							23.1%	0.0%	0.0%	69.2%	7.7%	0.0%		
	UT of DDD	**18**	**0.68**	**0.68**	**0.37**	**1.55**	**1.00**	**0.00**	**0.00**	**3.00**	**0.00**	**0.00**	**4**	**13**
							5.9%	**0.0 %**	**0.0 %**	**17.6 %**	**0.0 %**	**0.0 %**		

5.1.3 Decadal Fluctuation of November (2013-22) to November 2023

A comparison of the water level of the November 2023 with the average water level of the November for last one decade (2013-22) Table 18 reveals that there is a rise in (57% of well analysed) and fall in 42.9% of well analysed. In Union Territory of Daman & Diu, and Dadra & Nagar Haveli both rise and fall is observed. In Daman the maximum rise 1.9 m at Ambawadi and fall 0.67 m are observed at Dalwada. In Diu the maximum rise .037 m is observed at Chakarteeth. In Dadra & Nagar Haveli 1.43 m rise at Naroli is recorded.

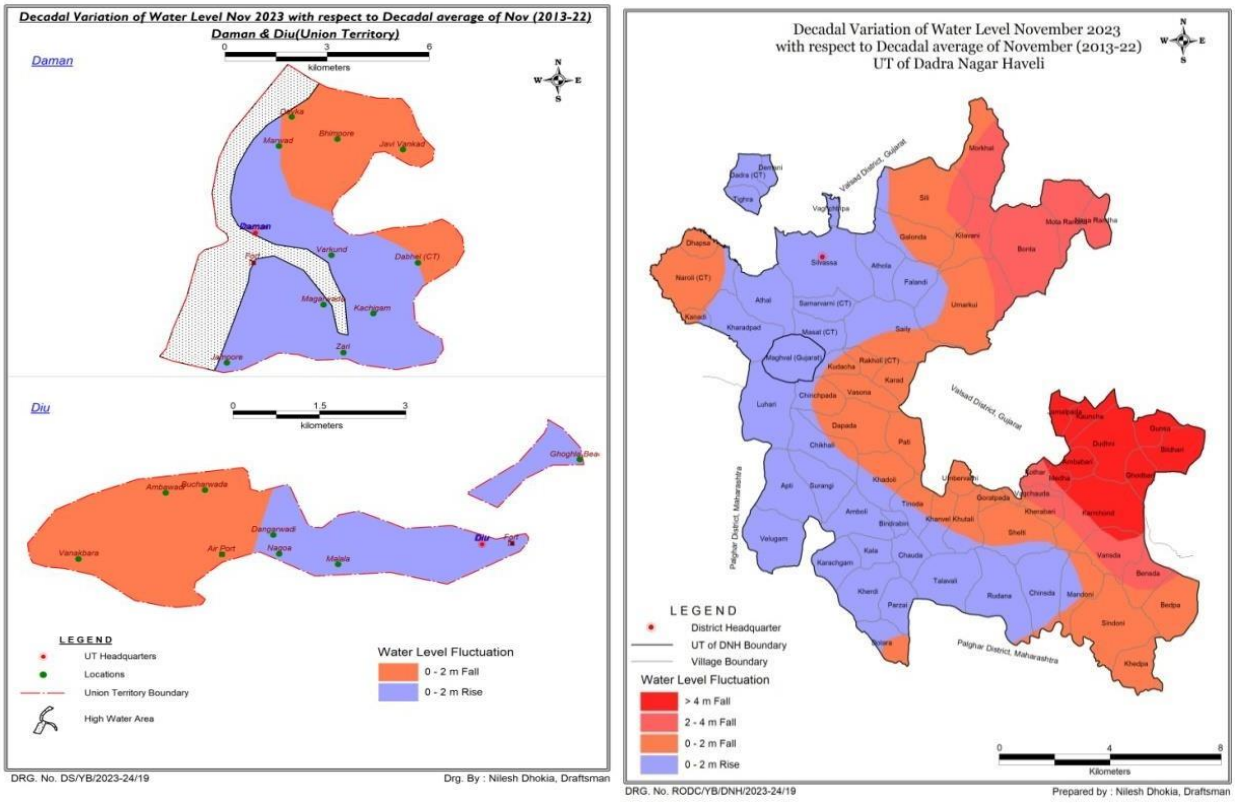

Figure 22: Map Showing Decadal Fluctuation of November (2013-22) To November 2023 in Union Territory of Daman & Diu, and Dadra & Nagar Haveli

Table 19: Well Wise Categorisation of Changes in Water Level During November 2023 With Respect To Decadal Average of November (2013-22)

Sr. No.	District Name	No of well analyzed	Fluctuation range, m		Fluctuation range, m		No. of wells in different depth range						Total No. of wells	
			Rise		Fall		Rise			Fall				
			Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4	Rise	Fall
1	Daman	6	0.26	1.9	0.03	0.66	3	0	0	3	0	0	3	3
							50%	0.0%	0.0%	50.0%	0.0%	0.0%		
2	Diu	1	0.37	0.37	0	0	1	0	0	0	0	0	1	0
							100%	0.0%	0.0%	0.0%	0.0%	0.0%		
3	Dadra and Nagar Haveli	14	0.09	1.43	0.11	5.6	8	0	0	4	1	1	8	6
							57%	0.0%	0.0%	28.6%	7.1%	7.1%		
	UT of DDD	**21**	**0.27**	**1.90**	**0.00**	**0.67**	**12**	**0**	**0**	**7**	**1**	**1**	**12**	**9**
							57%	**0%**	**0%**	**33%**	**4.8%**	**4.8%**		

5.1.4 Decadal Fluctuation of January (2014-2023) to January 2024

A comparison of the water level of the January 2024 with the average water level of the January for last one decade (2014-2023) Table 19 reveals that there is a fall in water level in the UT (68% of total well analysed). Rise and fall is mostly in the range of 0 to 2m. In Union Territory of Daman & Diu, and Dadra & Nagar Haveli both rise and fall is observed. In Daman the maximum rise 0.7 m at Morwad and fall 2.43 m are observed at Dabhel. In Diu the maximum rise0.28 m is observed at Jalawadi. In Dadra & Nagar Haveli 0.83 m rise at Dudhani and fall 2.37 m are observed at Kilvani Sharyapada.is recorded.

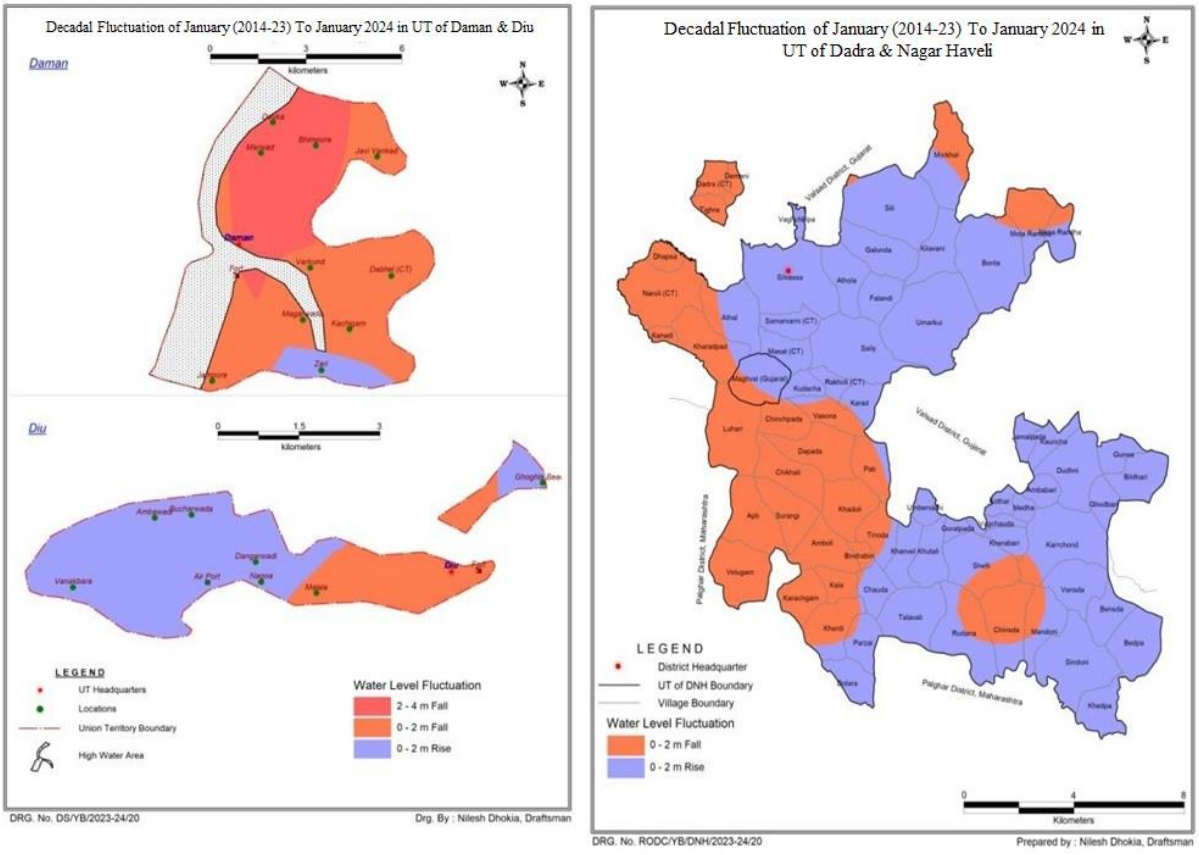

Figure 23: Map Showing Decadal Fluctuation of January (2014 to 2023) To January 2024 in Union Territory of Daman & Diu, and Dadra & Nagar Haveli

Table 20: Categorization of Changes in Water Level During January 2024 With Respect to Decadal Average of January (2014 To 2023)

Sr. No.	District Name	well analysed	Fluctuation n range, m		Fluctuatio n range, m		No. of wells in different depth range						Total No. of wells	
			Rise		Fall		Rise			Fall				
			Min	Max	Min	Max	0 to 2	2 to 4	> 4	0 to 2	2 to 4	> 4	Rise	Fall
1	Daman	4	0.40	0.71	0.89	2.43	2	0	0	1	1	0	2	2
							50.0%	0.0%	0.0%	25.0%	25.0%	0.0%		
2	Diu	1	0.28	0.28	0.00	0.00	1	0	0	0	0	0	1	0
							100.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
3	Dadra and Nagar Haveli	13	0.28	0.83	0.07	2.37	4	0	0	8	1	0	4	9
							30.8%	0.0%	0.0%	61.5%	7.7%	0.0%		
	UT of DDD	18	0.28	0.71	0.00	2.43	7	0	0	9	2	0	7	11
							38.9%	0%	0%	50%	11%	0%		

6. Water Table Scenario in May 2023

The water table map for pre-monsoon period (Fig. 10) reveals that the water table in different parts of the UT ranges between 0.79m to 14.05m amsl (Annexure II). The water table mostly follows the topography of the area.

Water table in UT of Daman vary from 3.14m to 14.05m amsl. Ground water flow direction is west and northwest direction in UT of Daman.

In UT of Diu, water table elevations vary from 0.79m to 5.85m a msl flowing in a south and southeast direction.

In UT of Dadra & Nagar Haveli, water table elevations vary from 0.79m to 5.85m a msl flowing in a west and northwest direction.

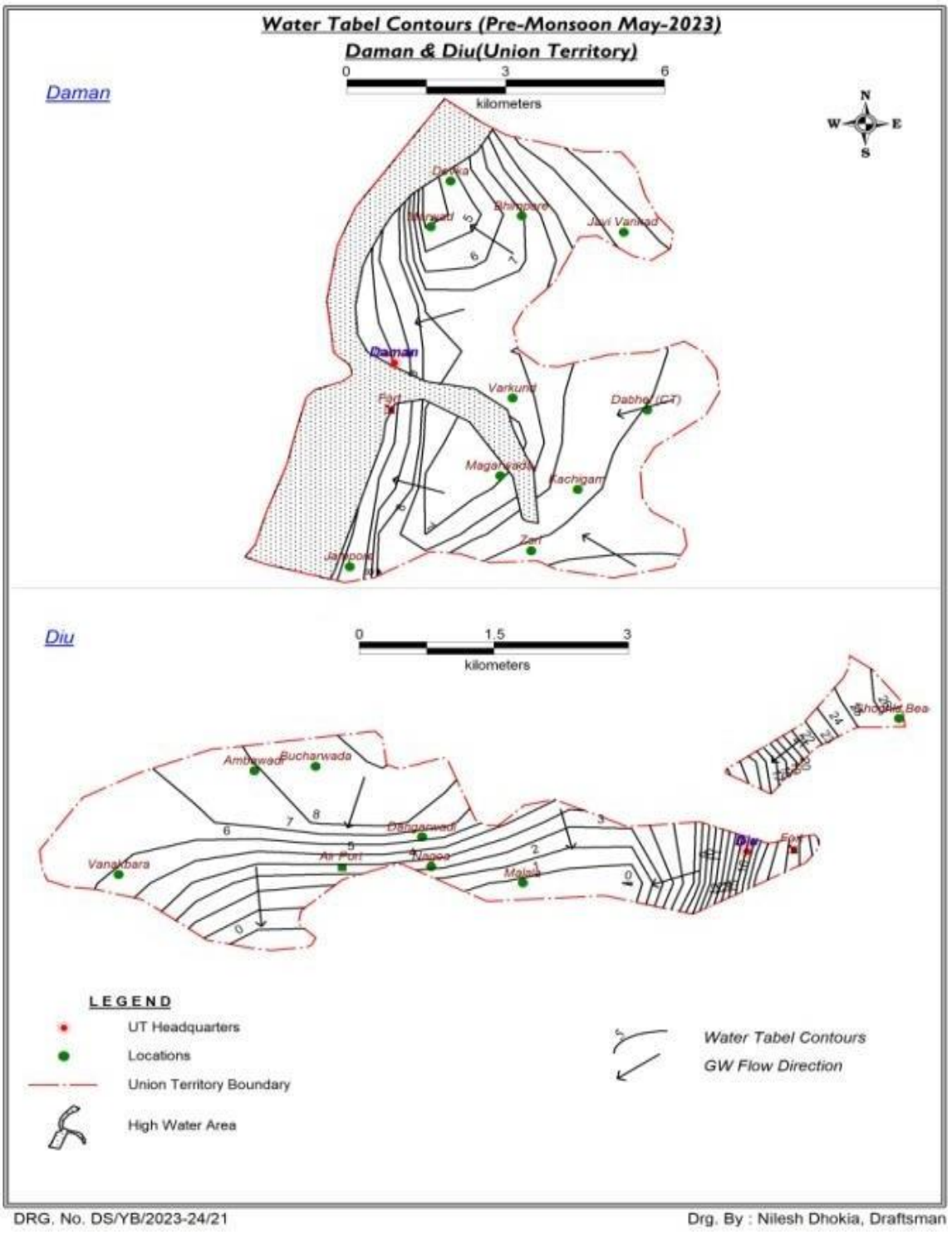

Figure 24: Water Table Map For Pre-Monsoon of Daman & Diu

Figure 25: Water Table Map For Pre-Monsoon of Dadra & Nagar Haveli

Annexures

Annexure I: Water Levels of The National Hydrograph Stations In UT of Daman And Diu & Dadra and Nagar Haveli (2023-24)

District Name	Site Name	Latitude	Longitude	Well Site Type	May-23	Aug-23	Nov-23	Jan- 24
Dadra and Nagar Haveli	Chinsda	20.1114920	73.1250140	Dug Well	2.7	2.25	2.32	2.5
Dadra and Nagar Haveli	Dapada	20.1875000	73.0236110	Dug Well		7.4	8.33	9.75
Dadra and Nagar Haveli	Dudhani	20.1747630	73.1568720	Dug Well	12.6	6.65	9.37	4.87
Dadra and Nagar Haveli	KhediGhodamba	20.1129680	73.0363520	Dug Well	7.3	3.85	3.87	4.4
Dadra and Nagar Haveli	KherdiKathepada	20.1131810	73.0320640	Dug Well		2.45	2.3	2.6
Dadra and Nagar Haveli	KilvaniSharyapada	20.3002780	73.0905560	Dug Well	10.95	0.65	4.43	5.9
Dadra and Nagar Haveli	Luhari_Dungaripada	20.1896850	72.9672300	Dug Well	10.8	5.6	3.02	7.1
Dadra and Nagar Haveli	Mandoni	20.1111450	73.1367570	Dug Well	3.7	1.78	1.53	3.36
Dadra and Nagar Haveli	Mandoni_OW	20.1110800	73.1468800	Bore Well		25.4	33.14	36.08
Dadra and Nagar Haveli	Moolpada (Rep)	20.1146300	73.0945600	Dug Well		2.7		1.45
Dadra and Nagar Haveli	Morkhal (Chowki Falia)	20.3260980	73.1018750	Dug Well	5.8	2.5	3.28	4.47
Dadra and Nagar Haveli	Naroli-1	20.2761100	72.9408300	Dug Well			1.88	3.93
Dadra and Nagar Haveli	Rakhali	20.2222220	73.0277780	Dug Well		2.78		
Dadra and Nagar Haveli	Rakhali (Rep)	20.2246300	73.0237000	Dug Well				7.35
Dadra and Nagar Haveli	Rakhali-1	20.2254220	73.0275090	Dug Well	6.08		4.97	
Dadra and Nagar Haveli	Rudana	20.1132640	73.0859340	Dug Well	5.2	2.8	1.85	2.45
Dadra and Nagar Haveli	Samarvarni	20.2511750	73.0092780	Dug Well	7	2.55	3.43	4.15
Dadra and Nagar Haveli	Shelti	20.1503990	73.1009190	Dug Well	3.8	1.6	3.18	3.1
Dadra and Nagar Haveli	Surangi	20.1545110	73.0252230	Dug Well	11.6	4.9	6.15	8.67
Dadra and Nagar Haveli	Umarkui (Hathpada)	20.2638889	73.0736110	Dug Well		0.73	2.93	5.28
Dadra and Nagar Haveli	Waghchipa	20.3097320	73.0091970	Dug Well	5.6	1.05	2.3	3.27
Daman	Ambawadi	20.4055425	72.8365031	Dug Well		1.9	1.15	
Daman	Ambawadi (Rep)	20.4058900	72.8315900	Dug Well				5.1
Daman	Amrutlaywa	20.4260000	72.8540000	Dug Well	4.43	3.4	1.79	3.53
Daman	Bhathaiya	20.3885390	72.8314260	Dug Well		2.95	1.65	3.08

District Name	Site Name	Latitude	Longitude	Well Site Type	May-23	Aug-23	Nov-23	Jan- 24
Daman	Bhimpork.falia	20.4583333	72.8666667	Dug Well		3.3		
Daman	Bhimpore k. falia (Rep)	20.4566100	72.8602500	Dug Well				7.95
Daman	Dabhel	20.4111111	72.8861111	Dug Well	7.49	2.95	3.19	8.3
Daman	Dalwada	23.2063889	72.2797222	Dug Well		2.1	2.97	5.9
Daman	Daman	20.4240700	72.8503600	Bore Well	9.21	1.3	2.19	
Daman	Daman DW	20.3669400	72.1002800	Dug Well			2.4	5.95
Daman	Devka	20.4530000	72.8380000	Dug Well	3.3	1.3	1.75	3.17
Daman	Jampore(Rep)	20.3706000	72.8272600	Dug Well				3.93
Daman	Jempore	20.3777800	72.8269400	Dug Well		1.4		
Daman	Khariwad daman	20.4250000	72.8458333	Dug Well		1.6		
Daman	Morwad	20.4400000	72.8300000	Dug Well		1.6	3.95	5.02
Daman	Nani Vankad	20.4260000	72.8320000	Dug Well	7.45	2.4	6.13	7.45
Daman	Pariyari	20.3770000	72.8320000	Dug Well	6.14	3	2.86	5.21
Daman	Singha Faliya	20.3930000	72.8500000	Dug Well	4.86	1.5	2.35	4.23
Daman	Warkund	20.4080000	72.8600000	Dug Well	5.68		1.6	3.56
Diu	Chakarteeth_Pz	20.7083333	70.9688889	Tube Well	6.22		5.75	
Diu	Jalawadi	20.7216700	70.9330600	Dug Well		1.4		4.33
Diu	Moti Vachhwadi	20.7167000	70.8850000	Dug Well			5.18	5.86
Diu	Pothia Bapa	20.7016667	70.9119444	Tube Well	7.33	6.69	6.6	6.5
Diu	Vanakbarh	20.7100000	70.8750000	Dug Well	3.81	3.52	4.25	3.74
Diu	Wadiwadi	20.7125350	70.8832290	Dug Well	6.42	6.4	6.1	
Diu	Zolawadi	20.7241960	70.9306040	Dug Well	4.88	2.22	2.75	

Annexure II: Groundwater Table of Union Territory of daman & Diu and Dadra & Nagar Haveli During May 2023

S. N.	DISTRICT NAME	SITE NAME	LATITUDE	LONGITUDE	WATER LEVEL May 2023 (metre bgl)	Elevation, m	WT May, m MSL
1	Dadra and Nagar Haveli	Chinsda	20.111492	73.125014	2.70	207.00	204.30
2	Dadra and Nagar Haveli	Dudhani	20.174763	73.156872	12.60	85.00	72.40
3	Dadra and Nagar Haveli	KhediGhodamba	20.112968	73.036352	7.30	86.00	78.70
4	Dadra and Nagar Haveli	KilvaniSharyapada	20.300278	73.090556	10.95	113.00	102.05
5	Dadra and Nagar Haveli	Luhari_Dungaripada	20.189685	72.967230	10.80	54	43.20
6	Dadra and Nagar Haveli	Mandoni	20.111145	73.136757	3.70	213.00	209.30
7	Dadra and Nagar Haveli	Morkhal (Chowki Falia)	20.326098	73.101875	5.80	79.00	73.20
8	Dadra and Nagar Haveli	Rakhali-1	20.225422	73.027509	6.08	58.00	51.92
9	Dadra and Nagar Haveli	Rudana	20.113264	73.085934	5.20	97.00	91.80
10	Dadra and Nagar Haveli	Samarvarni	20.251175	73.009278	7.00	45.00	38.00
11	Dadra and Nagar Haveli	Shelti	20.150399	73.100919	3.80	101.00	97.20
12	Dadra and Nagar Haveli	Surangi	20.154511	73.025223	11.60	65.00	53.40
13	Dadra and Nagar Haveli	Waghchipa	20.309732	73.009197	5.60	33.00	27.40
14	Daman	Amrutlaywa	20.426000	72.854000	4.43	12.40	7.97
15	Daman	Dabhel	20.411111	72.886111	7.49	197.00	189.51
16	Daman	Daman	20.42407	72.85036	9.21	17.00	7.79
17	Daman	Devka	20.453000	72.838000	3.30	6.60	3.30
18	Daman	Nani Vankad	20.426000	72.832000	7.45	16.60	9.15
19	Daman	Pariyari	20.377000	72.832000	6.14	13.00	6.86
20	Daman	Singha Faliya	20.393000	72.850000	4.86	14.20	9.34
21	Daman	Warkund	20.408000	72.860000	5.68	8.80	3.12
22	Diu	Chakarteeth_Pz	20.708333	70.968889	6.22	6.00	-0.22
23	Diu	Pothia Bapa	20.701667	70.911944	7.33	6.50	-0.83
24	Diu	Vanakbarh	20.710000	70.875000	3.81	9.00	5.19
25	Diu	Wadiwadi	20.713000	70.883000	6.42	14.20	7.78
26	Diu	Zolawadi	20.724196	70.930604	4.88	13.90	9.02

Annexure III: Mean Decadal Water Levels of the National Hydrograph Stations in UT of Daman & Diu and Dadra and Nagar Haveli 2014-2023

S.no.	District Name	SITE NAME	LATITUDE	LONGITUDE	PRE_MONSOON	POST_MONSOON
1	Dadra and Nagar Haveli	Chinsda	20.1115	73.1250	5.04	2.07
2	Dadra and Nagar Haveli	KhediGhodamba	20.1130	73.0364	8.56	3.76
3	Dadra and Nagar Haveli	Rudana	20.1133	73.0859	8.75	2.21
4	Dadra and Nagar Haveli	Surangi	20.1545	73.0252	11.15	6.34
5	Dadra and Nagar Haveli	Shelti	20.1504	73.1009	4.58	2.43
6	Dadra and Nagar Haveli	Dudhani	20.1748	73.1569	13.92	4.32
7	Dadra and Nagar Haveli	Samarvarni	20.2512	73.0093	7.43	4.00
8	Dadra and Nagar Haveli	Umarkui (Hathpada)	20.2639	73.0736	15.79	2.89
9	Daman	Ambawadi	20.4055	72.8365	4.63	2.82
10	Daman	Warkund	20.4080	72.8600	6.06	1.95
11	Daman	Daman	20.4241	72.8504	9.68	1.97
12	Daman	Dalwada	23.2064	72.2797	9.04	2.43
13	Daman	Jempore	20.3778	72.8269	5.06	
14	Daman	Morwad	20.4400	72.8300	9.96	4.30
15	Daman	Khariwad daman	20.4250	72.8458	5.05	
16	Diu	Chakarteeth_Pz	20.7083	70.9689	7.15	6.07