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Delineation of the Groundwater Potential Zone in Kantli River Basin, Jhunjhunu District, Rajasthan: A Geospatial Approach

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Abstract

Remote sensing and GIS are advanced techniques and tools that have been used for various researches including groundwater geology. The Landsat and the IRS satellite datasets have been utilized to extract information on the hydrogeomorphic and groundwater related features of a semi-arid Precambrian hard rock terrain in the Kantli River Basin of Jhunjhunu District, Rajasthan, India. It is the upper part of the Shekhawati River. The study area is covering about 2313.2013 km^2 in the Jhunjhunu District, Rajasthan. In the present study, the groundwater potential zone is identified by the GIS overlay techniques using the spatial analyst tool in ArcGIS 10.2. The developed methodology is demonstrated in the Kantli River Basin of Rajasthan, western India. Originally, nine thematic layers, viz. topographic elevation, land slope, geomorphology, geology, soil, pre and post-monsoon groundwater depths, annual net recharge, annual rainfall and proximity to surface water bodies were considered in this study. Therefore, five groundwater potential zones were identified and distinguished in the study area, viz. 'very good', 'good', 'moderate', 'poor' and 'very poor' based on groundwater potential index values, which will enable the local bodies for the future planning and management of the groundwater resource. Severe groundwater contamination has been found occasionally in the study area. Every year during the summer, the region is facing a lot of problems with portable groundwater. As the study area is semi-desert, the influences of salinity have been increasing day by day in the groundwater.

Keywords: Groundwater, Remote Sensing, Kantli River, Satellite Images, GIS, Potential zone

Introduction

Groundwater is a precious natural resource, which provides life support to all natural beings (Agarwal *et al.*, 2013). It is gradually declining due to rampant and unscientific use by the growing population. Over the past few decades, groundwater is being enormously exploited for drinking water in both urban and rural areas (Das *et al.*, 2010, 2012, 2013, 2015; Nandi and Prabhavathy, 2017). The planning and development of any administrative area can be feasible through groundwater management (Anuradha *et. al.*, 2010). Remote Sensing and GIS technology can facilitate to explore the groundwater sources in urban areas, especially for drinking water (Krishnamurthy *et al.*, 2000; Khan *et al.*, 2006). Remote sensing, GIS and field data play the most significant role in the detection and mapping of groundwater. Groundwater crisis in arid and semi-arid regions is a regular seasonal event. Over the past few decades, the international scientific community has shown a key interest in the extensive application of remote sensing and GIS techniques in the delineation of groundwater potential zones (Singh and Prakash, 2003; Sikdar *et al.*, 2004; Kusky and Gad, 2006; Dinesh Kumar *et al.*, 2007; Jasrotia *et al.*, 2007; Sreedhar *et al.*, 2009; Chowdhury *et al.*, 2009; Chowdhury *et al.*, 2010; Jha *et al.*, 2010; Mohammed-Aslam and Balasubramanian, 2010; Agarwal *et al.*, 2013; Abdalla, 2012; Adhikary *et al.,* 2021; Patra *et al.*, 2021; Mahanta *et al.*, 2020). The present investigation is an attempt to explore the possibility and prospect of groundwater in the Kantli River Basin. Various hydrogeological parameters have been applied to identify the groundwater potential zones. The occurrence and movement of groundwater depend on several factors, namely, the depth of porous sediments, the presence of diverse morphology, surface hydrology, climate, physiography, geology, soil, and lineaments (Sreedhar *et al.*, 2009; Abdalla, 2012; Patel *et al.*, 2014; Goswami and Pati, 2008; Das *et al.*, 2016, 2020; Hota and Goswami, 2018). The main objective of the present study is to evaluate the groundwater controlling features and identify the potential zones through geospatial techniques.

Study Area

The Kantli River Basin is situated in the north-eastern parts of Rajasthan. It extends from 27° 38' 32" N to 28° 22' 14" N latitudes and 75° 21' 09" E to 76° 02' 31" E longitudes. It covers an area of 2313.2013 Km^2 in the central part of the Jhunjhunu District (Fig. 1).

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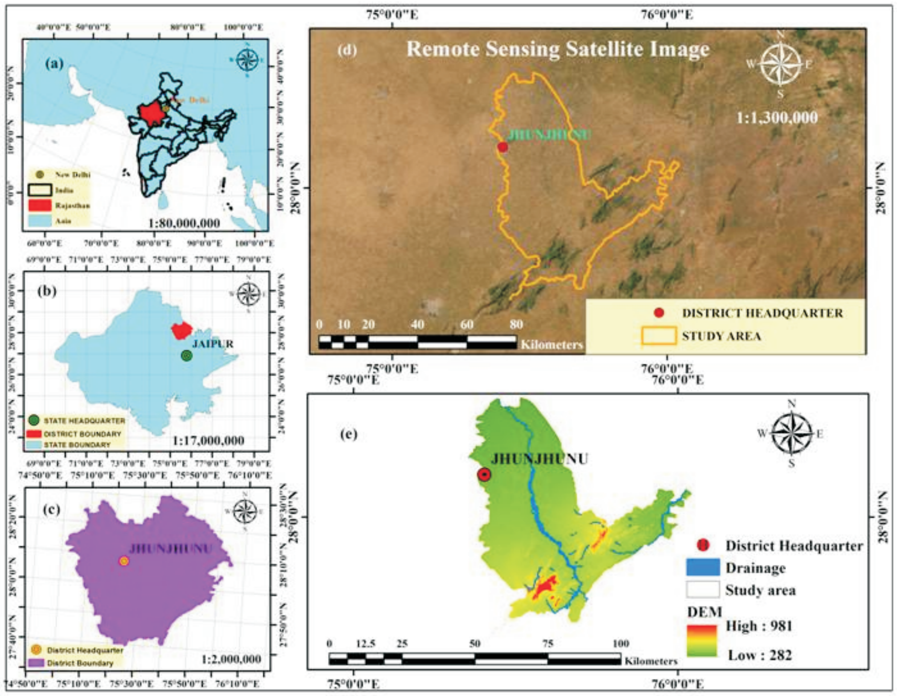

Fig.1. Study area of the upper Shekhawati River basin, (a) India, (b) Rajasthan, (c) Jhunjhunu, (d) Remote sensing images of the study area, (e) DEM topography of the Study area

The eastern parts of the Kantli River Basin are the part of Aravalli Mountain chain.

Geology of the Study Area

Geologically the north-northwestern part of the study area is covered by rocks of the Quaternary period and the south-eastern region is occupied by igneous rocks of the Precambrian period. The distribution of various litho-groups and their spatial extension is depicted in Table 1. The study area is occupied by the Quaternary group of rocks (89.59%), extrusive Malani Plutonic Group (0.40%) and mafic volcanic rocks of Delhi Supergroup (Alwar and Ajabgarh groups) (10.01%) (Sinha Roy, 1984; Sarkar and Dasgupta, 1980; Roy and Jakhar, 2002; Dasgupta, 1968; Pandey *et al.,* 2010). The various geological data are derived not only from SAC and world geology USGS but also from Landsat ETM+ satellite imagery which played a significant role in map preparation. The geological map of the study area is presented in Figure 2.

Hydrogeology of the Study Area

In the study area, the unconfined aquifer consists of two water-bearing formations, namely the Quaternary alluvial and the Precambrian hard rock formation. The shallow alluvial aquifer is filled with sand, silt and clay, and is observed below a depth of 50 meters in the phreatic region. Most shallow unconfined conditions are observed within the depth of 10 meters below the ground level (Pujari *et al.*, 2012; Cahill and Jakobsen, 2013; Gautam and Biswas, 2016). The direction of groundwater flow is decreasing from east to west. A remarkable variation in the water table has been observed in the pre-monsoon and post-monsoon periods. Most of the open wells dry out during the summer season. The hydrogeological data of the study area is given in Table 2. The confined aquifer is located in between 10-20 (m) thicknesses that occupied an area of 775.88 km^2 within the study area. An unconfined aquifer is found in between 0-20 (m) thicknesses that covered an area of 1923.15 km^2 in the investigated area. The top bedrock depth is of 80-100 m-bgl depths covering an area of about 1091.93 km^2 of the entire study area. The hydrogeological map of the study area is presented in Figure 3. The unconfined aquifer is available at very shallow depths (10-20 m) to

Table 1: Detail of distribution of Geology

Geological history	Geological group	Area (%)	Areas sq.km
Undivided Precambrian	Malani Plutonic	0.4	9.25
	Delhi Group	10	231.32
Quaternary	Alluvium and windblow Sand	89.6	2072.63

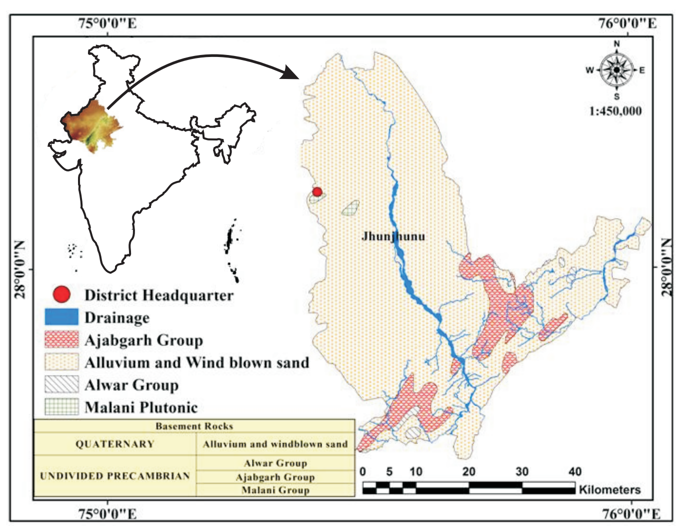

Fig. 2. Geological map of the study area

the northwest of the study area. At the lowest depths, the confined aquifer is found in the north portion of the study area and the deepest depth of the bedrock is found in the north and west parts of the study area. To know the hydrology of the study area the field data has been taken into consideration during analysis.

Methodology

In the present investigation, various parameters have been used to identify the suitable areas for groundwater prospective zones; *viz.* (1) Geology, (2) Geomorphology, (3) Soil, (4) Land Use and Land Cover, (5) Drainage, (6) Slope and (7) Lineament. The drainage and channel layers are generated from the survey of India toposheet in 1:50000 scale. The output layers have been updated with Landsat-4, Landsat-5, Landsat-7 and Landsat-8 satellite imagery. The vector files have been created to digitize and analyze the raster image (Strahler, 1964). The order of every stream is very systematically and sequentially observed in the study area. The digital elevation model (DEM) has been developed and used for elevation studies and comparative analysis of drainage patterns. The digitization and density mapping of all these layers have been prepared for the vector data analysis. It has been done by weighted overlay analysis with the help of ArcGIS software. This map has been scientifically used for the interpretation of groundwater occurrence in the study area and to identify the additional recharge structure. Field observation has been undertaken to validate the map (Chatterjee *et al.*, 2022; Ganapuram *et al.,* 2009). The borehole data is taken directly from the field with the help of the instrument and its validation accuracy is used to identify the groundwater potential zone. A base map of the study area is prepared with the help of Landsat series of TM, MSS, and ETM+, etc. The ERDAS Imagine 2014, Intergraph software was used for digital image processing. SRTM data (Shuttle Radar Topography Mission) of the study area were obtained and processed to construct a continuous DEM. The methodology adopted in the study area to locate the groundwater potential zone is depicted in Figure 4.

Table 2: Hydrogeological condition of the study area

Aquifer				Depth of Bed Rock	
Confined		Unconfined			
Thickness (m)	Area (sq.km)	Thickness (m)	Area (sq.km)	m-bgl	Area (sq.km)
<10	433.27	<5	1149.15	20-40	105.86
10-20	775.88	5-10	274.80	40-60	401.62
20-30	304.01	10-20	489.20	60-80	307.30
30-40	83.42	20-30	137.36	80-100	1091.93
40-50	18.47	30-40	53.07	100-120	118.99
50-60	7.69	40-50	17.24		
60-70	1.49	50-60	3.97		
	60-70	0.93			

Results and Discussion

Topographical and geological maps have been used to delineate the groundwater potential zones in the study area. The groundwater level in the study area depends on the following important factors:

(1) Slope Variation : which controls the runoff of the rainwater, as a gentle slope increases the rate of infiltration of the surface water whereas a steep slope enhances the surface runoff;

(2) Stream Network : which affects runoff and groundwater recharge;

(3) Lineament : as it is significantly enhancing the permeability and porosity of the rocks and affects the vertical percolation of water to recharge the local aquifers;

(4) Lithology : which determines the penetration capacity of soils and opens the rock layers that manage the runoff and storage of groundwater;

(5) Topography : Each of the topographic layers is divided

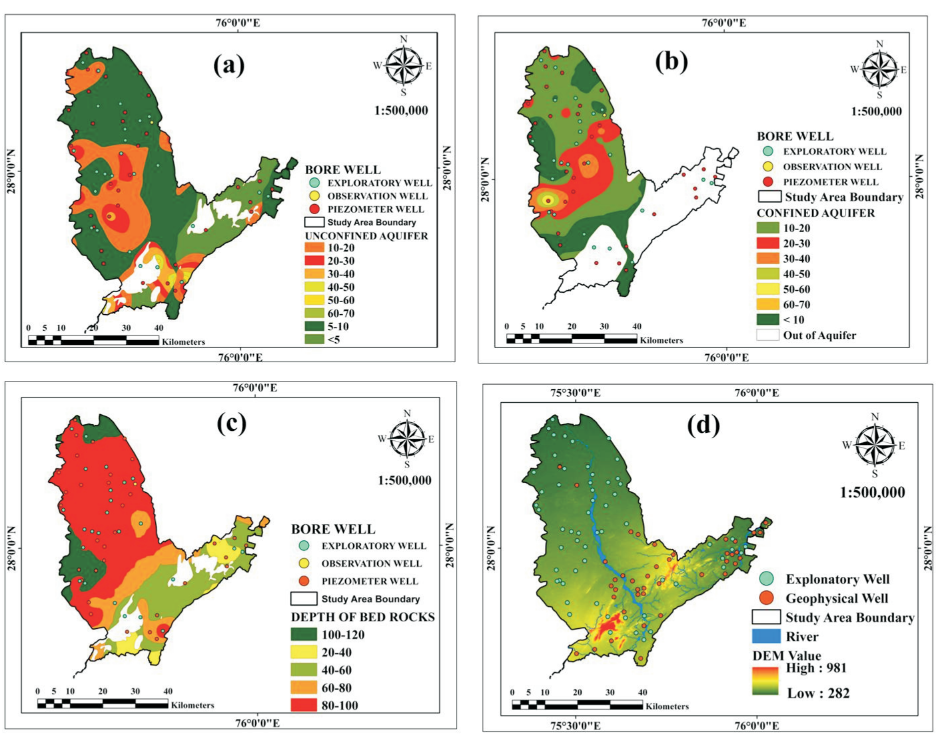

Fig. 3. Hydrogeological map of the study area, (a) unconfined aquifer, (b) confined aquifer, (c) depth of bedrock and (d) well with DEM

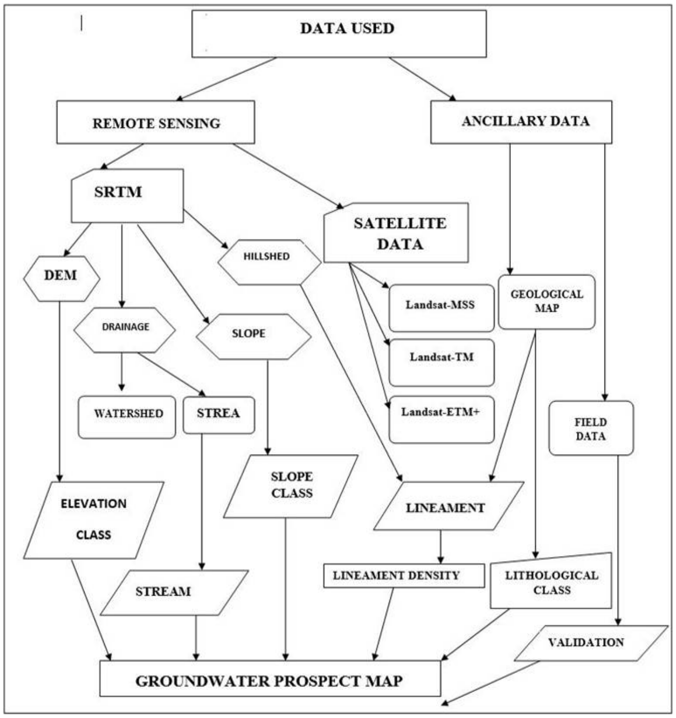

Fig. 4. Flow chart of the steps to prepare groundwater prospect map

into different classes that are controlled by hydrogeological properties. The weighted overlay-analysis is done based on the relative importance of the potential of the groundwater level. The weighted overlay-analysis is performed by GIS for the preparation of the final groundwater potential map (Patra *et al.*, 2021; Chatterjee *et al.*, 2022).

Topography Elevation

A topographical map of the study area has been created from SRTM DEM data. DEM map is depicted in figure 5 (a) to get an accurate idea of the surface elevation of the study area. The surface topography determines the direction of runoff over the surface. As per the DEM data, the lowest and highest elevation of the study area is 282 and 982 meters MSL respectively. Multiple irregular slopes are noticed in the study area. The slope of the northern part is relatively low and the amount of slope in the southern part is fairly high. In the figure 5 (b) the topographical maps are mainly classified into three numerical categories according to the characteristics of the slope. The topographic features have explained the surface hydrology as well as the groundwater hydrological capabilities. The topographic elevation details are illustrated in Table 3.

Slope

Critical analysis of slopes reveals the sources of groundwater infiltration and recharge and in turn enables to delineate groundwater potential zones (Dawoud *et al.*, 2005; Vittala *et al.*, 2005; Solomon and Quiel, 2006, Bagyaraj *et al.*, 2013). A close contour indicates a steeper slope whereas a widely spaced contour specifies a gentle slope. A slope layer has been used to locate the groundwater potential zones (Sreedhar *et al.*, 2009). The groundwater percolation is higher in the gentle and flat areas. In the case of steep slopes, the runoff of rainwater is high, and infiltration is low. The slope amount and numerical values of the slope are presented in figures 5 c-d. The major part of the region (around 73-90%) is covered by a steep slope. Slope details of the area are depicted in Table 3.

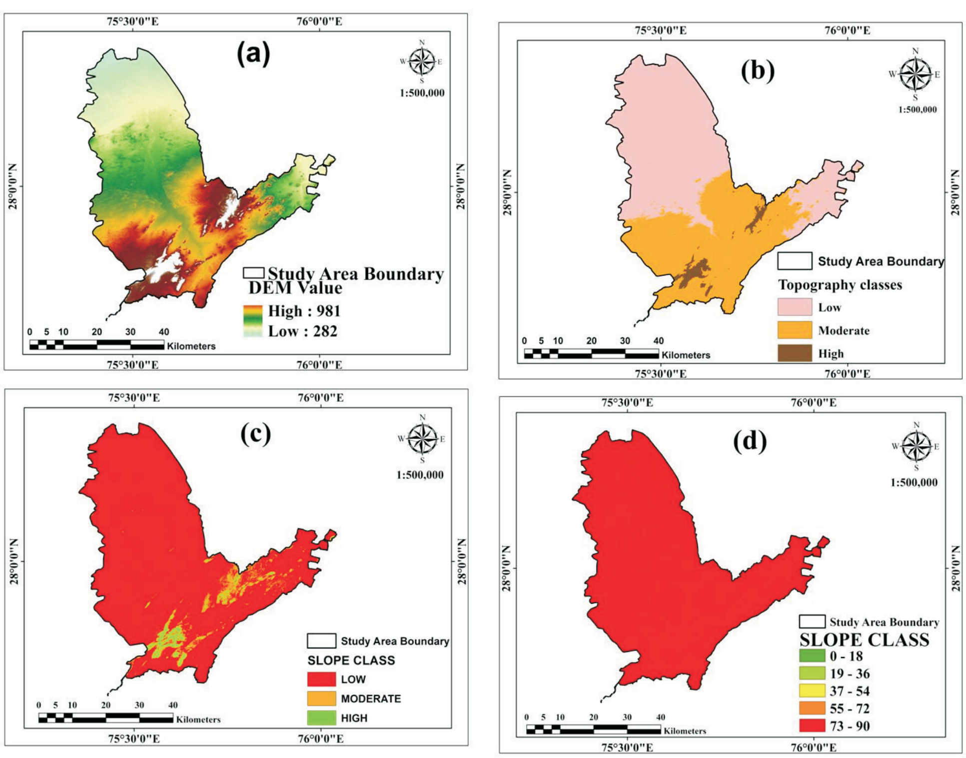

Fig. 5. (a) Digital Elevation Model of the study area, (b) DEM Topography of the study area, (c) Map depicting different slope classes, (d) Map showing slope zoning (numerical value)

Table 3: Details of various hydrological parameters

Parameter	Classes	Groundwater Prospect	Weight	Rank
Topography (Elevation M.)	282-359	Very High	10	5
	259-422	High		4
	422-517	Moderate		3
	517-687	Low		2
	687-981	Very Low		1
Slope	15%< Plain Region	Very Good	10	1
	15%-25% Undulating Region	Good		2
	25%-40% Pediment Region	Moderate		3
	40%-55% Plateau Region	Poor		4
	55%-90% Hilly Region	Very Poor		5
Drainage Density (km/km^2)	0.0-0.6	Very Good	20	1
	0.6-1.8	Good		2
	1.8-3.2	Moderate		3
	3.2-5.2	Low		4
	5.2-9.12	Very Low		5
LULC	Crop Land	Very Good	10	5
	Lake Pond, reservoir, Tanks, river, Stream, Drainage	Good		4
	Forest	Moderate		3
	Core urban, Gullied, Hamlets Household, Peri Urban, Scrub land	Poor		2
	Barren Rocky	Very Poor		1
Geomorphology	Pediment	Very Good	10	5
	Structural/ Linear denudation, Interdunal Depression.	Good		4
	Waterbody, River, Pond, Reservoir, Plain area.	Moderate		3
	Intermontane Valley, fill valley.	Poor		2
	Obstacle Dune	Very Poor		1
Geology	Alwar groups	Very Good	20	5
	Ajabgarh groups	Very Good		5
	Malani Plutonic	Good		4
	Alluvium and windblown Sand	Moderate		3
Soil	Clay loam	Very Good	10	5
	Fine Sand	Moderate		3
	Loam	Moderate		2
	Sandy Loam	Poor		2
Lineament Density (km/km^2)	0.0-0.32	Very Good	10	1
	0.33-0.64	Good		2
	0.65-0.95	Moderate		3
	0.96-1.27	Poor		4
	1.28-1.59	Very Poor		5

Geomorphology

In the study area, twelve geomorphic units have been identified with the help of remote sensing and Landsat ETM+ satellite imagery. The plain area is about 1463.98 km^2 (63.35%) of the investigated terrain. All the geomorphic units are shown in Table 4. Since the study area is part of the semi-desert region, the predominance of sandy plain lands has been observed. The geomorphic categories and geomorphic numerical values are depicted in figure 6 a-b. Groundwater scarcity is noticed in the sandy plains. The geomorphic units like plains, valleys, pediments, and structural hills yield moderate groundwater.

Geology

The occurrence and movement of groundwater depend on the porosity and permeability of the rocks that are closely associated with geology (Sreedhar *et al.*, 2009). The Quaternary and Precambrian deposits are found in the study area. The geology and numerical value of the litho units are depicted in figure 6c-d. There are many pediments and structural areas between the Ajabgarh group and its adjoining areas. Groundwater has existed in fractured and weathered Precambrian rocks in the study area.

Soil

The role of soil is important in groundwater research. Low permeability and limited water infiltration are observed in fine-grained soils. Four major soil units were observed in the study area: Clay loam soils (92.53 km^2, 4.0%), Fine sand soils (1201.29 km^2, 51.9%), Loamy soils (25.52 km^2, 1.1%), and Sandy loam soils (994.20 km^2, 43 %). Soil map of the study area and map showing soil classes are depicted in Figures 7 a-b. Soil data from the study area is presented in Table 5. Soil data reveals that there is inadequate water

Table 4: Geomorphic units and their areal extension in the study area

Geomorphology Category Description	Area sq.km	Area (%)
Alluvial Plain	538.73	23.34
Buried Pediment	305.37	13.21
Aeolian Plain	65.55	2.8
Flood Plain	21.28	0.9
Interdunal Depression	149.82	6.52
Intermontane Valley	28.89	1.2
Obstacle Dune	53.51	2.3
Pediment	30.43	1.3
River/Pond/Reservoir	45.48	2
Sandy Plain	860.70	37.21
Structural/Linear/Denudational	197.91	8.55
Valley Fill	15.52	0.67
Total Area	2313.20	100

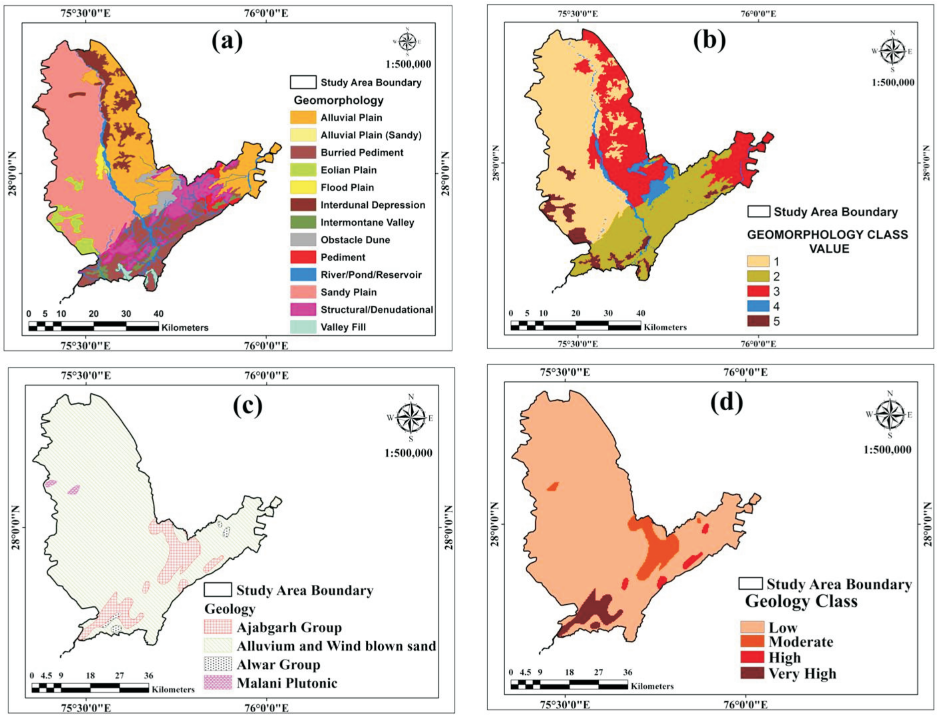

Fig. 6. (a) Map showing different geomorphological types, (b) Map showing various geomorphological classes, (c) Geological map of the study area, (d) Map depicting geological classes

holding capacity and a shortage of groundwater storage as a larger part of the study area is covered by sandy soils.

LULC

Land use land cover mapping has an immense role in delineating the groundwater potential zone as hydrogeological processes are particularly controlled by land use and land cover. Generally, forest areas have high infiltration and runoff is very low. Table 6 demonstrates that the forest land is around 253.04 km^2 (10.93 %) where there is more infiltration; cropland spreads around 1610.31 km^2 (69.61%), where infiltration is moderate. Similarly, scrub land spreads over an area of 255.12 km^2 (11.02%), where infiltration is moderate to low (Fig. 7 c-d).

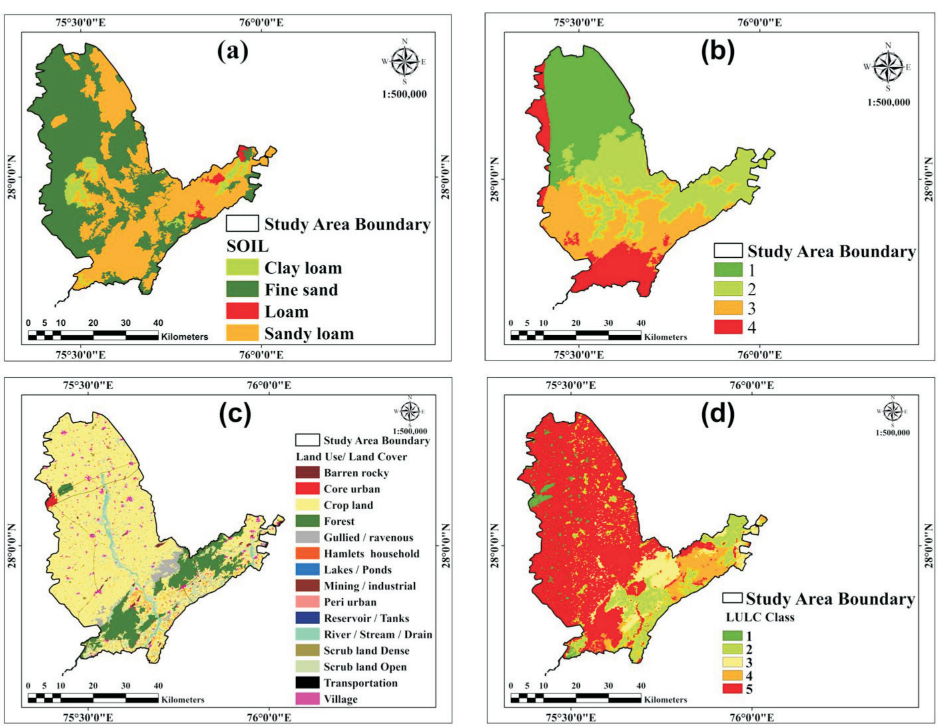

Fig. 7. (a) Soil map of the study area, (b) Map showing soil classes, (c) LULC map of the study area, (d) Map showing LULC classes

Table 5: Distribution of Soil in the study area

SOIL Category Description	Area sq.km	Area (%)
Clay loam	92.53	4.0
Fine sand	1201.29	51.9
Loam	25.52	1.1
Sandy loam	994.20	43.0
Grand Total	2313.20	100.0

Pre and Post Monsoon Groundwater Depth

The groundwater level in the Indian subcontinent is controlled by monsoon rainfall. The variation of groundwater depth is observed between the pre-monsoon and post-monsoon periods. Groundwater recharge is good after post-monsoon periods. The aquifer became rich in the later stage of monsoon rainfall. The pre-monsoon and post-monsoon groundwater depth and the numerical value of the groundwater level are depicted in figure 8 a-d.

Rainfall

Rainfall directly recharges the groundwater. The isohyet line of maximum rainfall was detected in the north-eastern and south-western parts of the study area. The rainfall distribution and rainfall numerical values of the study area are presented in figure 9 a-b. The amount of annual rainfall in various weather monitoring stations located in the study area is presented in Table 7. The maximum amount of rainfall is in the Khetri block of Jhunjhunu district, Rajasthan.

Drainage

Drainage plays an important role in groundwater storage and movement. The drainage density scientifically reveals the groundwater potential and recharge condition of the terrain (Prasad *et al.*, 2008). The drainage pattern is depicted in figure 9c. The drainage density of the study area is presented in figure 9d. The maximum drainage density is located in the north-eastern region of the study area.

Table 6: Land use /Land cover distribution of the study area

LULC Category Description	Area sq.km	Area (%)
Barren rocky	10.43	0.45
Core urban	8.00	0.35
Crop land	1610.31	69.61
Forest	253.04	10.93
Gullied / ravenous	51.31	2.21
Hamlets and dispersed household	29.50	1.27
Lakes / Ponds	0.20	0.008
Mining / industrial	7.10	0.306
Peri urban	0.40	0.017
Reservoir / Tanks	0.08	0.003
River / Stream / Drain	24.40	1.054
Scrub land Dense	8.30	0.358
Scrub land Open	255.12	11.028
Transportation	2.21	0.095
Village	52.80	2.28
Grand Total	2313.20	100

Lineament

Lineament analysis reveals a close relationship between groundwater infiltration and fractured rocks. Groundwater occurrence and movement are governed by the fracture, joints, and lineament in the hard rock region. The source of lineament data is SRTM images. This layer provides important information about the fractured rocks, which control the movement and storage of

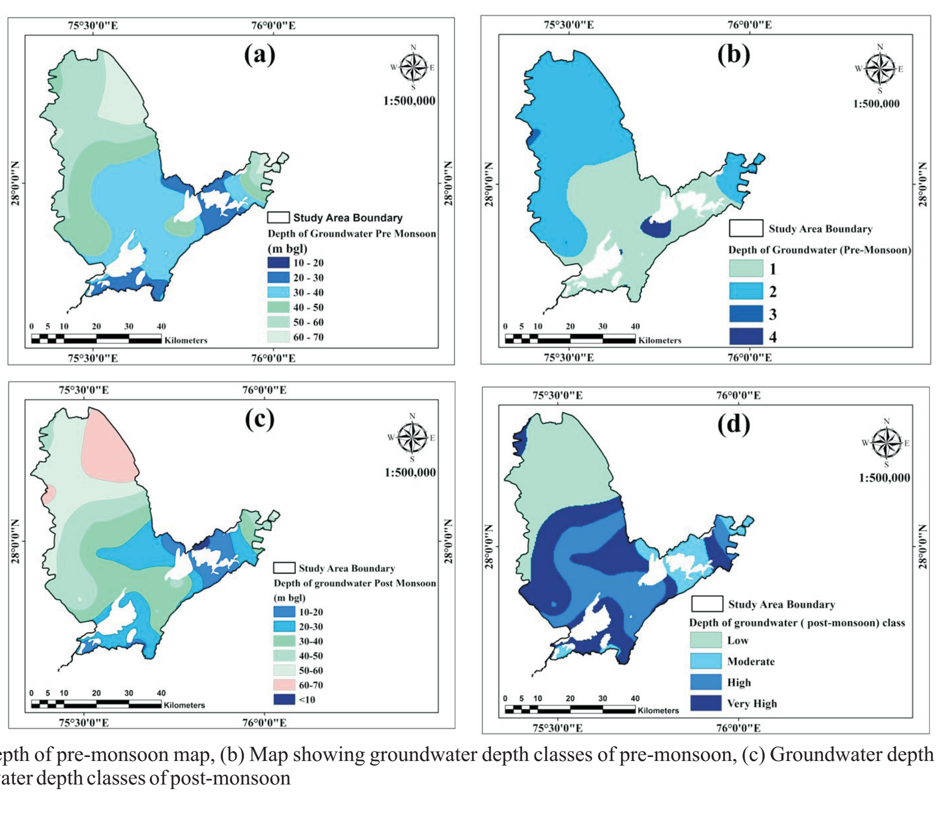

Fig. 8. (a) Groundwater depth of pre-monsoon map, (b) Map showing groundwater depth classes of pre-monsoon, (c) Groundwater depth of the post-monsoon map, (d) Map showing groundwater depth classes of post-monsoon

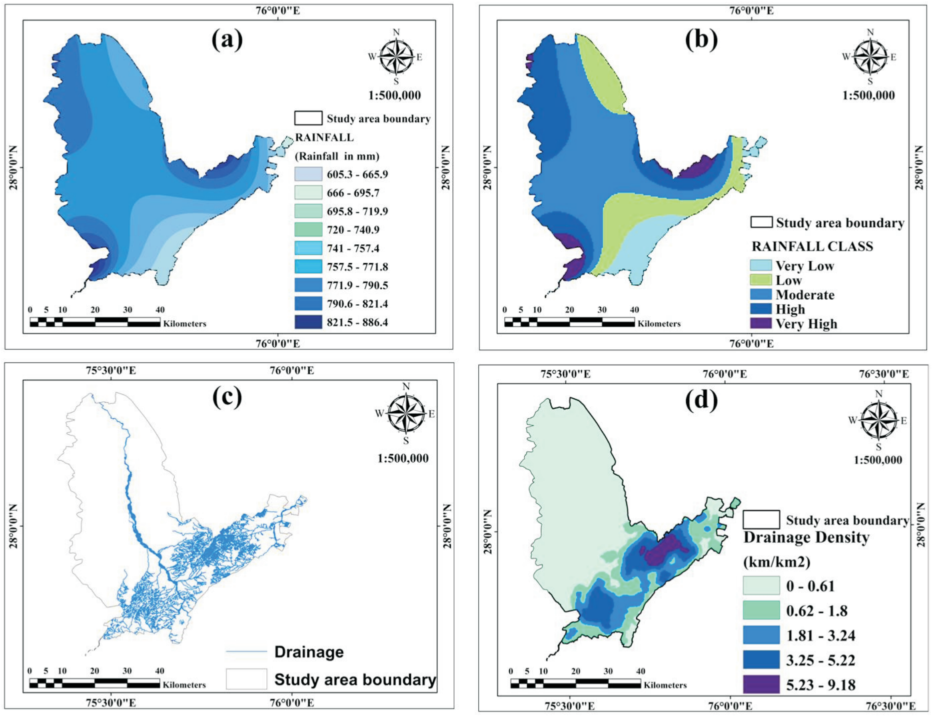

Fig. 9. (a) Rainfall distribution map, (b) Rainfall classes map, (c) Drainage map of the study area, (d) Drainage Density map of the study area

groundwater (Sreedhar *et al.*, 2009). Table 3 shows the lineament density of the study area, which is divided into five categories. The high lineament density region is the potential location for groundwater infiltration. Figure 10 a-b shows the location of the lineament area and the numerical value of lineament density.

Stream Network

The morphometric analysis depends on the stream network. SRTM topographic data are mainly used for stream networks and for delineating watershed regions. Researchers have used stream networks to identify groundwater potential zones (Abdalla, 2012; Sreedhar *et al.*, 2009; Adhikary *et al.*, 2021). Stream network is mainly influenced by lithology, rock masses and lineament. The stream of a region refers to the main rivers, tributaries, and distributaries; and stream network refers to a watershed that flows in the direction of the river. Stream ordering has been done using the Strahler method. It is mainly divided into five numerical groups (Table 3) depending on the capability of runoff and infiltration. Figure 10 c-d shows the stream ordering and stream network density of the study area.

Groundwater Potential Zone

The groundwater potential zone has been obtained with the help of a thematic map of the overlay method of the spatial analysis tool of ArcGIS 10.2 software. Each map was created by a common UTM projection and WGS84 datum. The thematic map has been changed into a raster format. Groundwater potential zones are based on the drainage density, slope, land use/land cover, geomorphology, geology, lineament density, and topography data of the study area (Sikdar *et al.,* 2004; Abdalla, 2012). The output prospective map describes the potential groundwater zone. The Groundwater potential zone map of Kantli River Basin (upper part of the Skekhawati River Basin) is divided into five sections namely: very poor (1051.35 km^2, 45.45%), poor (544.76 km^2, 23.55%), moderate (460.33 km^2, 19.90%), high (175.34 km^2, 7.58%), very high (81.43 km^2, 3.52%) (Table 8). The largest area under the study belongs to the very poor groundwater potential zones, which cover 1051.35 km^2 (45.45%). The groundwater potential map of the study area is depicted in figure 11.

Results Validation with Borehole Data

Two types of aquifers are commonly noticed in the region;

Table 7: Rainfall distribution and rainfall survey station

District	Rainfall Station (Near the study area)	Rainfall (mm)
Jhunjhunu (Rajasthan)	Alsisar	854.7
Jhunjhunu (Rajasthan)	Buhana	650.5
Jhunjhunu (Rajasthan)	Chirawa	734
Jhunjhunu (Rajasthan)	Jhunjhunu	778.9
Jhunjhunu (Rajasthan)	Khetri	913.7
Jhunjhunu (Rajasthan)	Nawalgarh	740.7
Jhunjhunu (Rajasthan)	Surajgarh	617.5
Jhunjhunu (Rajasthan)	Udaipurwati	888
Churu (Rajasthan)	Rajgarh	700.3
Sikar (Rajasthan)	Khandela	414.25
Sikar (Rajasthan)	Neem Ka Thana	620.25
Mahendragarh (Haryana)	Narnaul	570

Table 8: Various groundwater potential zones

Sl.No.	Value	Potential Zone	Area (km^2)	Area (%)
1	0-1	Very Poor	1051.35	45.45
2	1-2	Poor	544.76	23.55
3	2-4	Moderate	460.33	19.90
4	4-6	High	175.34	7.58
5	6-12	Very High	81.43	3.52

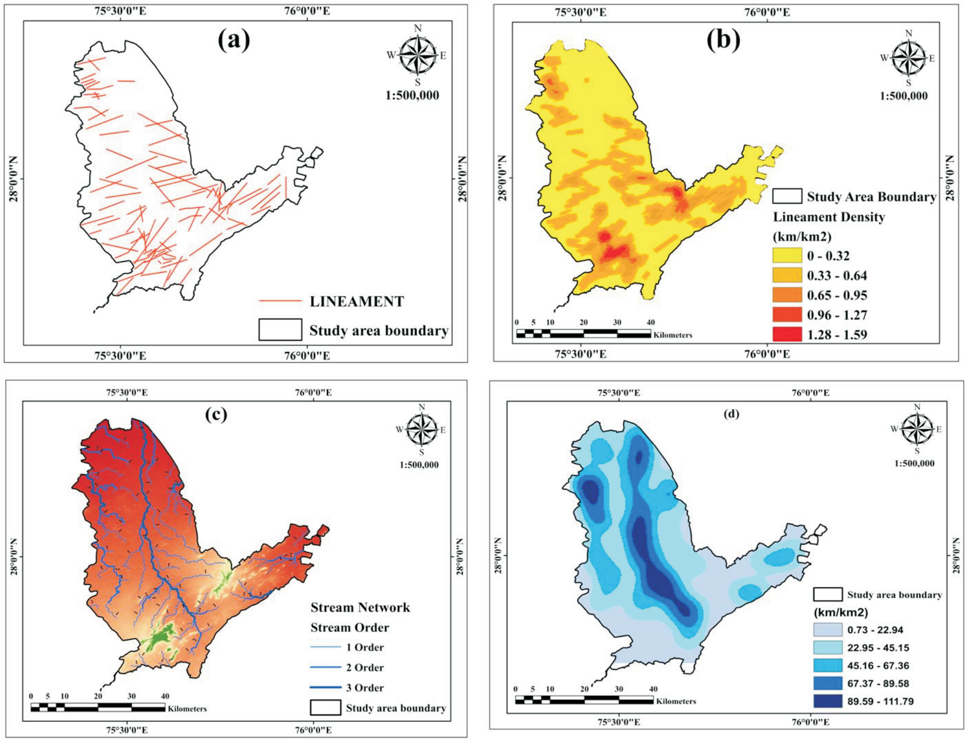

Fig. 10. (a) Lineament map of the study area, (b) Lineament Density map of the study area, (c) Stream ordering map of the study area, (d) Stream Network density map of the study area

confined and unconfined. The result obtained from the boreholes data is that the depth of the shallow unconfined aquifer is located at 8-70 m depth of the study area (27.1%). The confined aquifer is found in a large area, the depth of this well is above 70 meters (72.9%). The groundwater scarcity is found in most of the study area, which is derived from borewell data and pumping test data. Table 9 shows the boreholes (Geophysical Well, Exploratory Well, Observation Well, and Piezometer Well) types and depth of groundwater.

Conclusions

The present study reveals the delineation of potential groundwater zones in the Kantali Basin of Jhunjhunu District (Upper Shekhawati Basin). The various informative thematic map layers have been compiled to identify potential zones of groundwater (very poor, poor, moderate, high, very high). It is observed that only 11% of the total study area constitutes a very good to good groundwater potential zone. Sandy soil, low lineament density, medium to low rainfall, insignificant forest density, moderate to steeply slope have reduced the infiltration and increased the runoff, which has resulted in low and unhealthy groundwater prospective zone in the Kantali Basin. Steps may be taken to construct good numbers of check dam and water harvesting structures at the Government level. Moreover, extensive plantation programmes may also be undertaken in these areas by local bodies and NGOs. Hopefully, subsequently increased groundwater recharge will enhance the groundwater prospects and potentials of the area.

Table 9: Various borehole data of the study area

Types of Boreholes	Several Well no	Number of Borehole	Percentage of Well (%)	Depth (m)	Aquifer
Geophysical Well	15				
Exploratory Well	01	29	27.1	8-70 M	Unconfined
Observation Well	00				Shallow
Piezometer Well	13				
Geophysical Well	33				
Exploratory Well	24	78	72.9	70 M	Confined
Observation Well	01			Above	Deep
Piezometer Well	20				

Authors' Contributions

TC: Study, Conception and Design, Analysis and

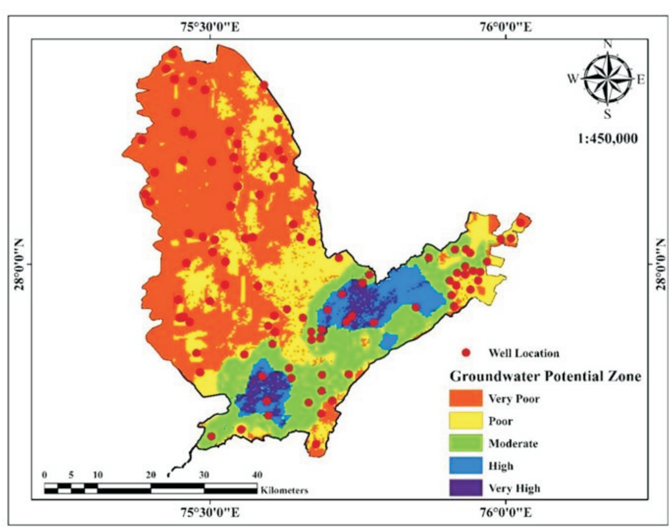

Fig. 11. Groundwater potential zone map of the study area

Interpretation of Results, Data Collection, Reviewing and Editing. **DB:** Study, Conception and Design, Analysis and Interpretation of Results, Draft Manuscript Preparation. **PKP:** Analysis and Interpretation of Results. **SG:** Draft Manuscript Preparation, Data Collection, Reviewing and Editing.

Conflict of Interest

The authors do not have any conflict of interest.

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