Report No.-14

JSA-CTR

Scientific Action Plan for Mewat

सिंचाई एवं जल संसाधन विभाग
हरियाणा

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1 Introduction

1.1 History

Mewat is a historical region of Haryana and Rajasthan states in north western India. The loose boundaries of Mewat generally include Hathin tehsil and Nuh district of Haryana, Alwar (Tijara, Kishangarh, Bas, Ramgarh, Laxmangarh, Kathumar tehsils and Aravalli hills tract), Mahwa, Rajasthan and Mandawar, Rajasthan in Dausa district and Bharatpur districts (Pahari, Nagar, Deeg, Nadbai, Bhusawar, Weir and Kaman tehsils) of Rajasthan, and Chhata Tehsil of Mathura district in Uttar Pradesh. The main centre areas of Mewat are Firozpur Jhirka, Nuh, Ramgarh, Paharisikri and Punahana. Mewat region lies in between Delhi-Jaipur-Agra. In simple words Mewat region consists of Nuh district, eastern part of Alwar district and western part of Bharatpur district. Mandawar, Rajasthan and Mahwa, Rajasthan is in Dausa district but there are many Meo villages near Mahwa, Mandawar, Garhi sawairam, Pinan. The region roughly corresponds to the ancient kingdom of Matsya, founded in the 5th century BCE. Mewati dialect, a slight variant of the Haryanvi and Rajasthani dialects of Hindi, is spoken in rural areas of the region. Mewati Gharana is a distinctive style of Indian classical music.
Meos are inhabitants of Mewat, a region that consists of Mewat district in Haryana and some parts of adjoining Alwar district and Bharatpur district of Rajasthan and Western Uttar Pradesh, where the Meos have lived for a millennium. According to one theory, they were Meenas who converted to Islam between the 12th and 17th centuries so A Meo is Meena with Islam, until as late as Aurangzeb's rule but they have maintained their age-old distinctive cultural identity until today. According to S. L. Sharma and R. N. Srivastava, the Mughals had little effect of strengthening their Islamic identity, but it reinforced their resistance to Mughal rule.

District Nuh was created session Division in August 2013. District Mewat was formed vide Haryana Government Revenue Department Notification No.S.O.30/P.A.17/1887/S.5/2005 dated 4.4.2005, with headquarter at Nuh. Mewat ‘the land of Meos’ comprises 5 blocks i.e., Nuh, Taoru, Nagina, Punhana and Ferozepur Jhirka in old District Gurgaon in Haryana State. A new District known as Mewat (Nuh) came into existence comprising aforesaid 5 blocks. The region is spread over 1507 sq.km inhabited by 10.89 lacs people in 443 villages and 5 small towns. This region is one of the most backward regions of Haryana. In the year 1980, Government of Haryana with a commitment to deliver social and economic justice to the backward and under-privileged sections of society constituted Mewat Development Board (MDB) under the Chairmanship of Chief Minister, Haryana, Ministers and Secretaries of important departments viz. Finance, Irrigation & Power, Industries, Agriculture, Animal Husbandry, Cooperation & Development and all the M.Ps & MLAs of Mewat region, besides D.Cs of Gurgaon and Faridabad and also few other eminent persons of the region as official and non-official members. Mewat Development Agency (executing Agency of MDB) implemented various developmental activities in Mewat area in the fields of Health, Education, Agriculture, Irrigation,

Animal Husbandry, Rural Water Supply Community Development, Housing, Industrial Development etc. This District comprises of 4 subdivisions, 5 tehsils, one sub tehsil and 5 blocks.

1.2 Location

Mewat district lies between 27° 39’ to 28° 20’ North latitude and 76° 51’ to 77° 20’ East longitudes. The area is largely occupied by alluvial plains, traversed by elongated ridges of Delhi quartzites. The ground water in the district area is saline, and salinity increases with depth. The district is socioeconomically backward. Agriculture, the base economic activity of the people is deprived of irrigation. There is no river and area are drained by artificial drains namely Nuh, Ujina & Kotla drains. They carry rain water into Yamuna River. Gurgaon canal carries water to the area which is distributed through Nuh, Firozpur Jhirka, Uttawar, Mandkola, Hathin and Chhyansa distributaries. The Location Map of Mewat district is shown in **Figure 1.**

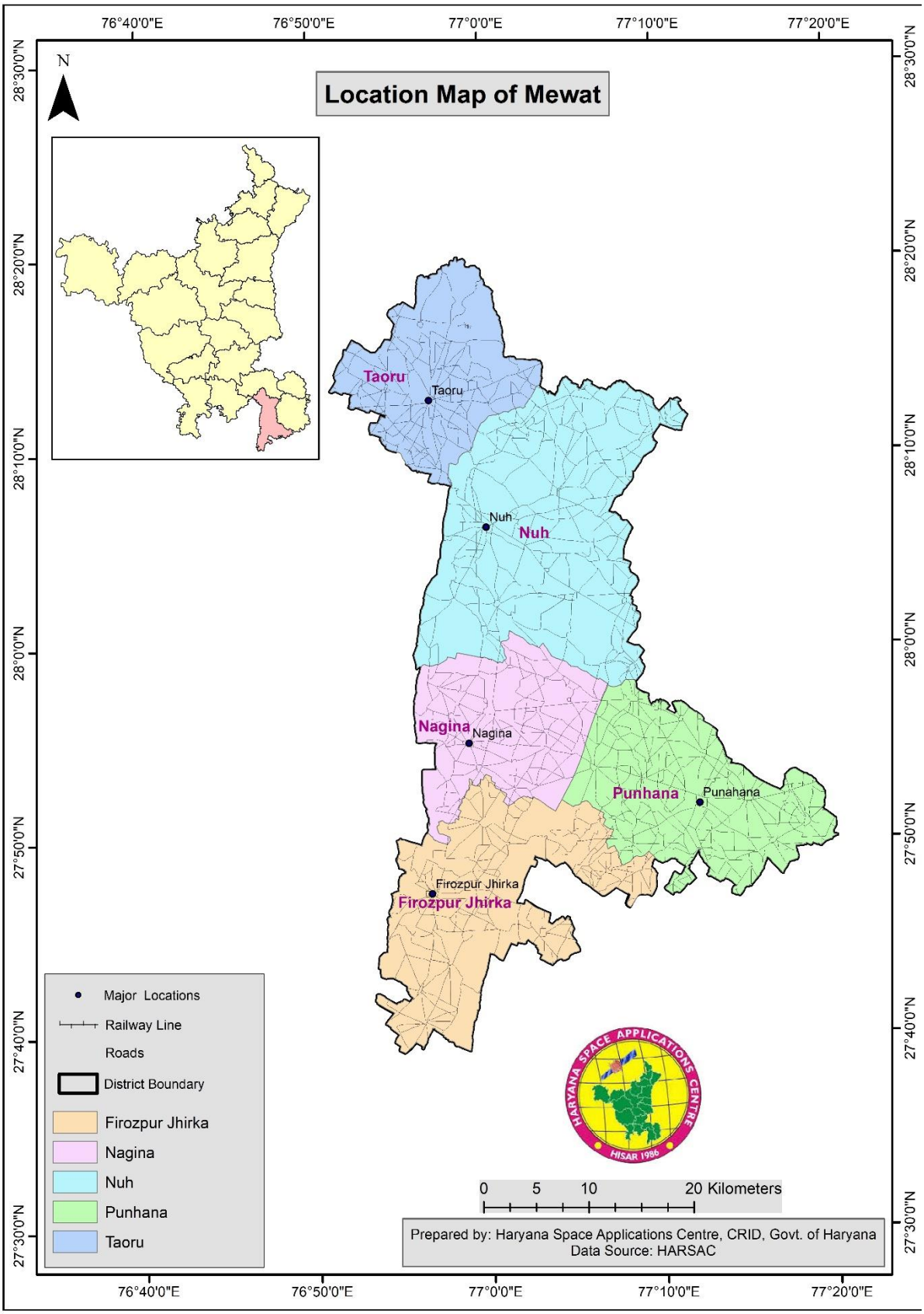


Figure 1 Location Map of Mewat District

1.3 Administrative Setup

Nuh district is one of the 22 districts in the Indian state of Haryana. There are four sub-divisions in this district: Nuh, Ferozepur Jhirka, Punahana, and Taoru. It has an area of 1,860 square kilometres (720 sq. mi) and had a population of 1.09 million in 2011. It is bounded by Gurugram District to the north, Palwal District of Haryana to the east and Alwar District of Rajasthan to the south and west. Its boundaries also touch Bharatpur District of Rajasthan and Mathura District of Uttar Pradesh near Bichhor Village and Nai Village of Punhana Tehsil. It is predominantly populated by farmers of ethnicity The detailed administrative setup is shown in **Table 1**.

Table 1 Major Administrative Jurisdictional Setup of Mewat District.

Country	India
State	Haryana
Division	Faridabad
Headquarters	Nuh
Tehsils	1. Nuh, 2. Ferozepur Jhirka, 3. Punahana, 4. Taoru, 5. Nagina
Area	1,860 km2 (720 sq. mi)
Population (2011)	1,089,263
Total	
Density	590/km2 (1,500/sq. mi)
Lok Sabha constituencies	Gurgaon (Lok Sabha constituency)
Literacy	
Vidhan Sabha constituencies	1. Nuh, 2. Ferozepur Jhirka, 3. Punahana
Website	https://en.wikipedia.org/wiki/Bhiwani_district
Location of Bhiwani	
Coordinates	27° 39', 28° 20' North latitude and 76° 51' and 77° 20' East longitudes.

Source: https://en.wikipedia.org/wiki/Mewat_district

Local Institutions: -

Total Villages	443
Village Level	Panchayat
Block Level	Panchayat Samiti
District Level	Zila Parishad

Source: https://Mewat.gov.in/about-district/administrative-setup/

1.4 Climate

The climate of the district can be classified as tropical steppe, semi-arid and hot which is mainly characterized by the extreme dryness of the Air except during monsoon months, intensely hot summers and cold winters. During three months of south west monsoon from July to September, the moist air of oceanic origin penetrates into the district and causes high humidity, cloudiness and monsoon rainfall.

The period from October to December constitutes post monsoon season. The cold weather season prevails from January to the beginning of March and followed by the hot weather or summer season which prevail up to the last week of June.

1.4.1 Temperature

Mewat falls under the sub-Tropical, Semi-arid climatic zone with extremely hot temperature in summer; Dryness of air is standard feature in Nuh except during the monsoon season. May & June are the hottest months of the year with the temperature ranging from 300 c to 480c, January, on the other hand is the coldest month with temperature ranging between 2 0 c to 280 C. Strong dusty winds are conspicuous during summer.

1.4.2 Rainfall

The annual rainfall varies considerably from year to year. The maximum rainfall is experienced during the monsoon season, which reaches its peak in the month of July. The principal precipitation occurs during monsoon period from June to September when about 80% of the rainfall is received. The average rainfall varies from 336 mm to 440 mm in the district mm spread over 31 days. Humidity is considerably low during the greater part of the year. The Nuh experience high humidity only during the monsoon period. The period of minimum humidity (less than 20%) is between April and May. The south west monsoon sets in the last week of June and withdraws towards the end of September and contributes about 75% of the annual rainfall. July and August are the wettest months. 25% of the annual rainfall occurs during the non-monsoon months in the wake of thunder storms and western disturbances

Normal Annual Rainfall: 594 mm
Normal monsoon Rainfall: 445 mm
Temperature Mean Maximum: 40°C (May & June)
Mean Minimum: 5.1°C(January)
Normal Rainy days: 31
The rainfall map of Mewat district is shown in **Figure 2**.

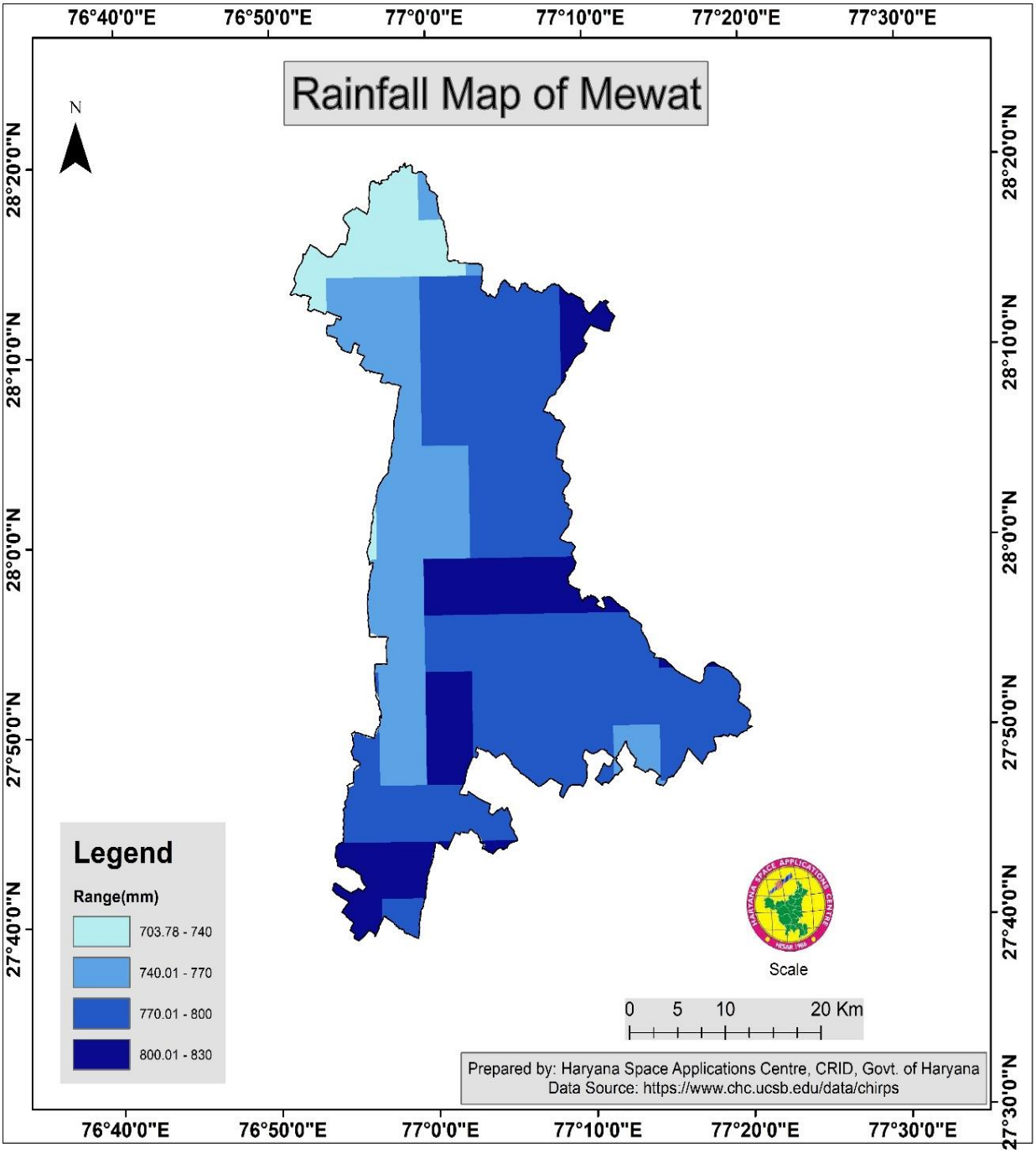


Figure 2 Rainfall Map of Mewat District

1.5 Elevation and Topography

The average elevation of Mewat area above the surrounding alluvial plain is 500 feet (**Figure3**). The summit of the plateau consists of a barren expanse covered with masses of coarse sandstone, almost entirely unrelieved by verdure. The whole range may be regarded as the boundary between the elevated Rajputana desert and the low-lying valley of the Jumna, rather than as a separate hill system. The Aravalli Hills falling Mewat area popularly known as Kala Pahar has a special significance in Mewat.

The district area has undulating topography and is more or less bowl shaped. The sporadic ridges and hillocks make a semi- circle to the west, south and east of Punhana (27° 51’45”to 77° 12’30”). The area does not have a general slope and rather shows distinct altitude differences in certain domains. The general slope in the area is NW-SE in the western part, NE-SW in north-eastern part. The central part is more or less flat. Seasonal streams from the hills west of Nuh drain flow towards southeast and fill up the natural depressions in central part of the district. Some topographic depressions in the area give rise to natural lakes.

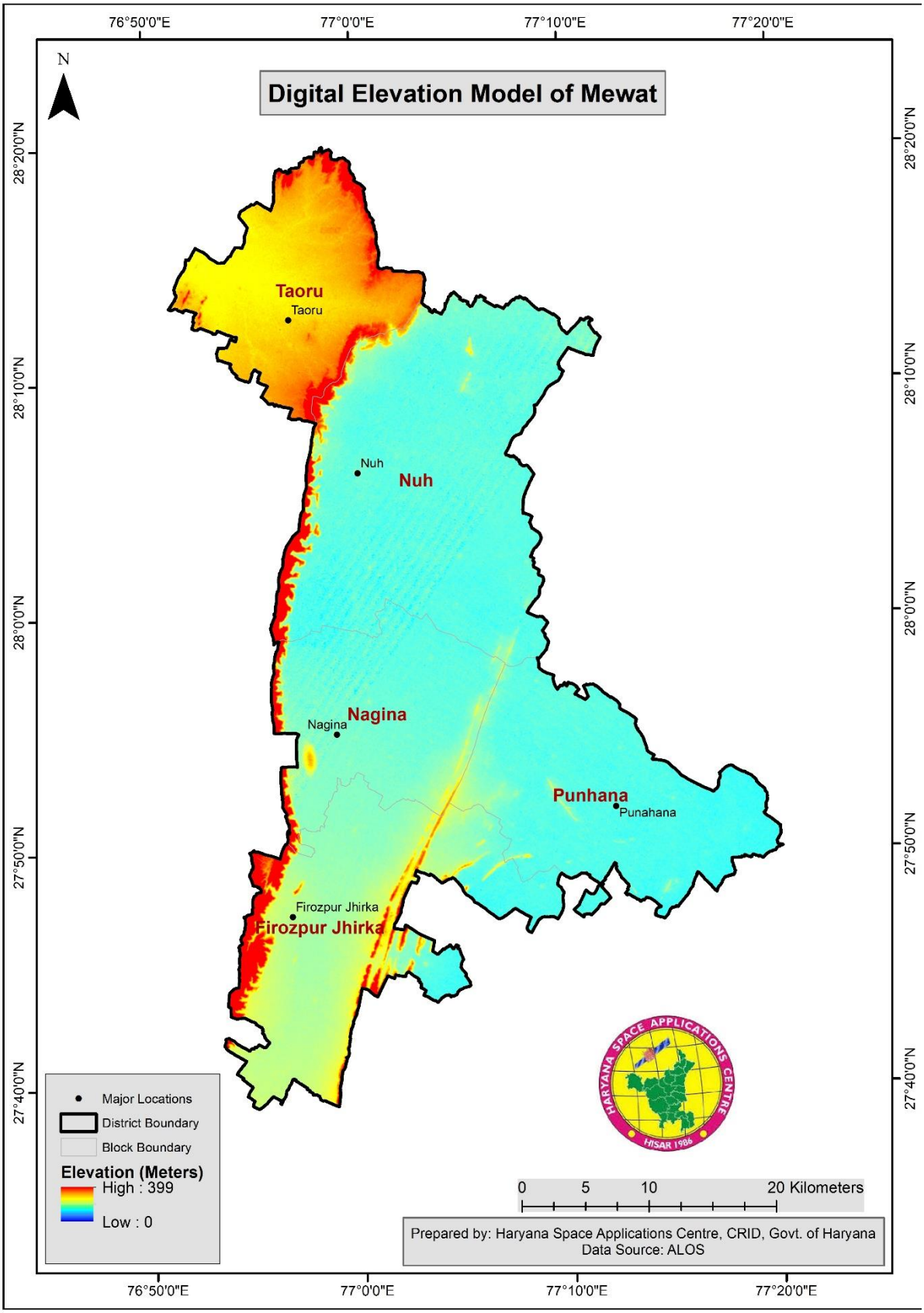


Figure 3 Digital Elevation Model of Mewat District

The slope map is presented below in **Figure 4** where it ranges from flat to more than 35 degrees, indicating an area of gentle slope to minor steeps. Further Slope map of district is prepared to understand flow of water, thorough depth study is separately being conducted with the help of Contour maps (**Figure5**).

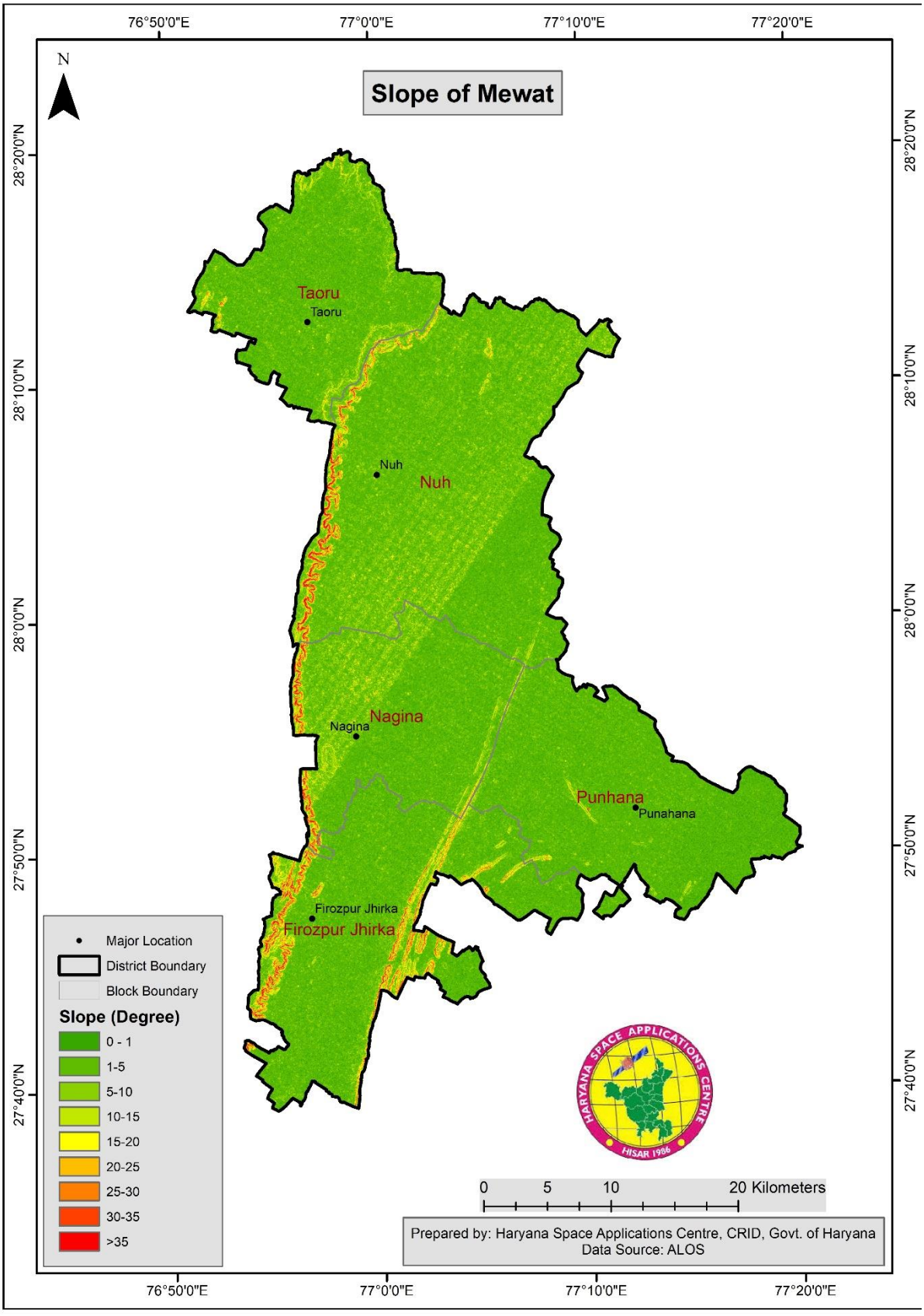


Figure 4 Slope Map of Mewat District

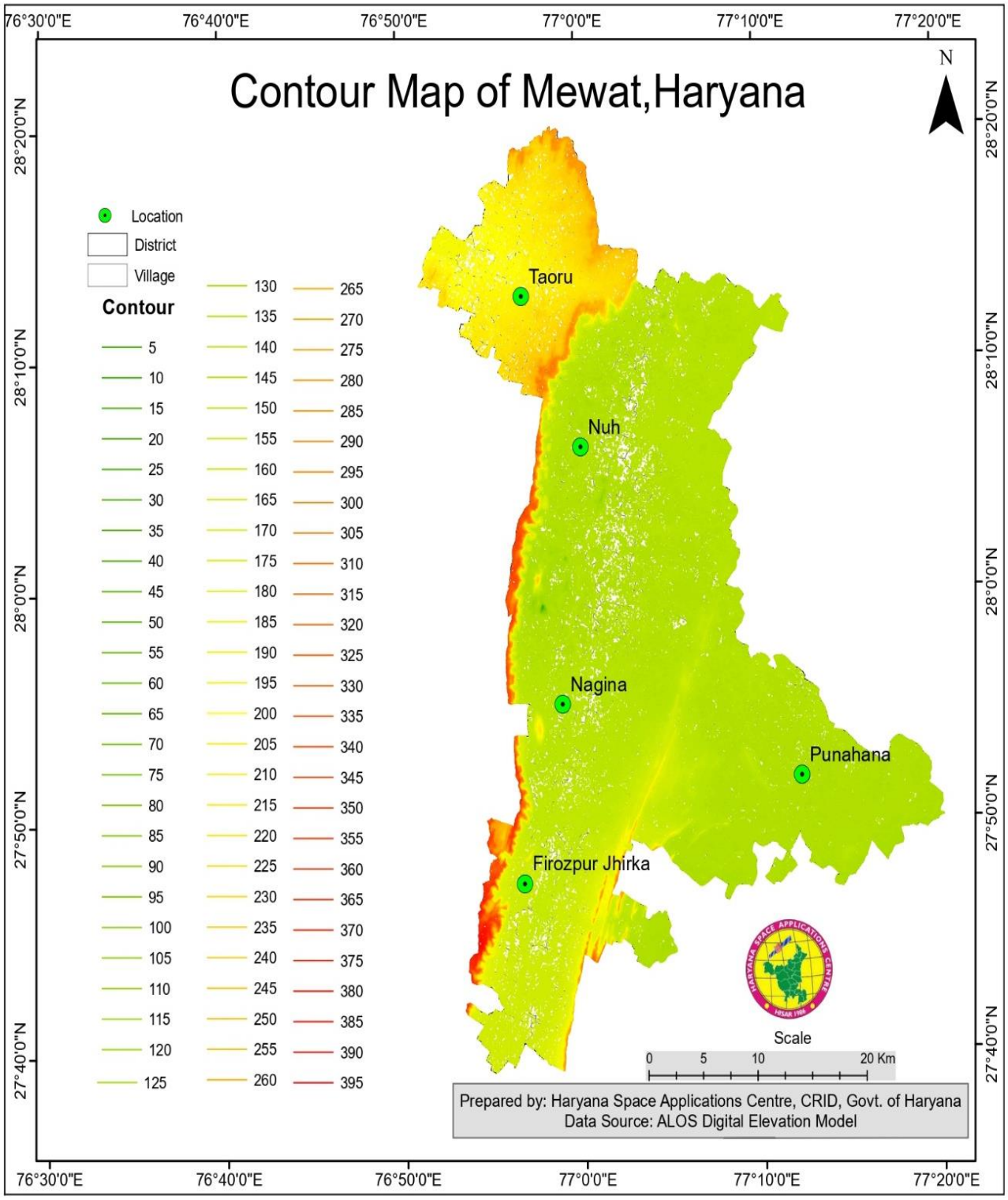


Figure 5 Contour Map of Mewat District

1.5.1 Geology and Lithology

The district area is mainly underlain by alluvium of Quaternary age which forms the principal ground water reservoir. Some amount of ground water also occurs in fractures, joints and crevices of hard rocks found as strike ridge in the district. The ground water in the upper zone, is known to exist down to 70 m depth, and hold water under phreatic condition. The aquifers that occur at deeper levels are confined to semi-confined. Central Ground Water Board has carried out exploratory drilling in Mewat district with the depth ranging between 39and 291 m. The data of the exploratory boreholes reveal that in the deeper zones, alluvial formation comprises sand, clay and kankar in varying proportions. These sediments rests upon the basement of rocks of Delhi System. Alluvium thickness varies from almost insignificant near to hill ranges to above 291meters in the area. The exploratory drilling in the area has revealed that at Alduka (28°07':77°07') in the central part the bed rock was encountered below a depth of 291 m bgl. At Gharrot in the east the depth bed rock was 222m while at Bahin in southeast, the bed rock was reported at a depth of 147.5m while in Thekraka, at a place around central part, the depth to bed rock was mere 45m. indicating highly undulating bed rock in entire Mewat area. In the northwest at Didhara (28°12'30":76°50') , the bed rock was encountered below 182m. In the southeast, at Hathangaon (27°43'40":77°15'50"), the bed rock was encountered at 84m depth. At Raoli (27°48':76°56') in the south, the bed rock was encountered below a depth of 88m in the form of alternate bands of slates and quartzites. Hence, it is concluded that thickness of alluvium is within 300 m in the central and eastern parts while in the remaining parts of Mewat it varies at few places around Santhabari, Raoli, Pingawan being within 90m bgl in general. The ground water exploration data shows that the alluvial sediments consist of fine to medium sand, clay and kankar. Clay and sand beds are mostly mixed up with kankar. In Nuh block sand layers are few and the whole lithology is made up of clay and kankar. In Punhana block, sand ratio predominates at 30 m depth zone. Otherwise, clay ratio predominates at all other depth ranges throughout the district. A lithological map of Mewat is presented in **Figure 6.**

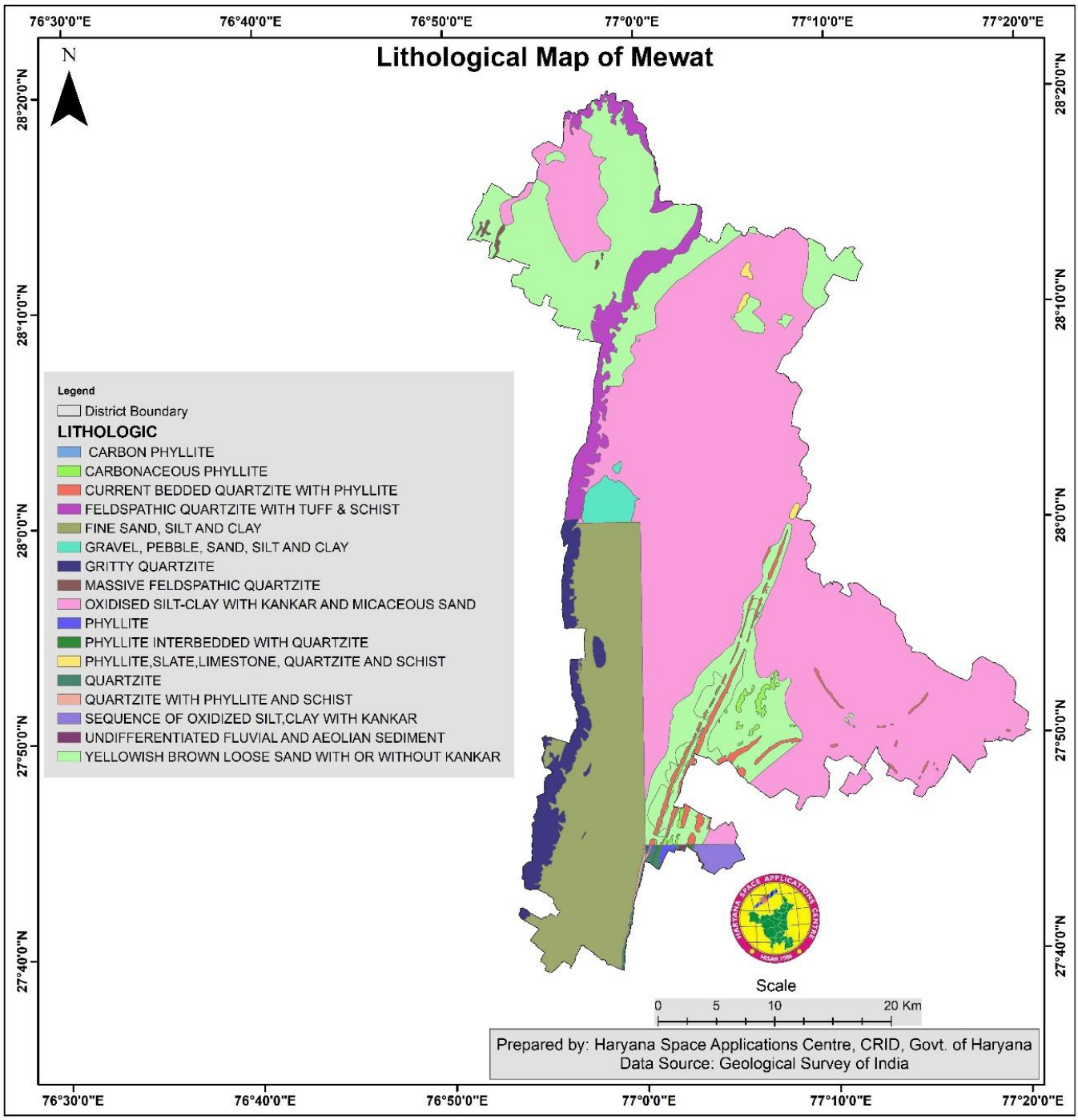


Figure 6 Lithological Map of Mewat District

1.5.2 Soil Profile

Soils of the Mewat district are mostly salt affected. The soils are medium textured loamy sand and falls in low to medium category with 0.2 %to 0.75 % organic content (**Figure7**). . The average conductivity of the soil is not more than (0.80 u mhos/cm) and the average pH of the soil is between 6.5 to 8.7. Soils of the district are suitable for cultivation of variety of crops. The general profile of soil health of Haryana state is shown in **Figure 8**.

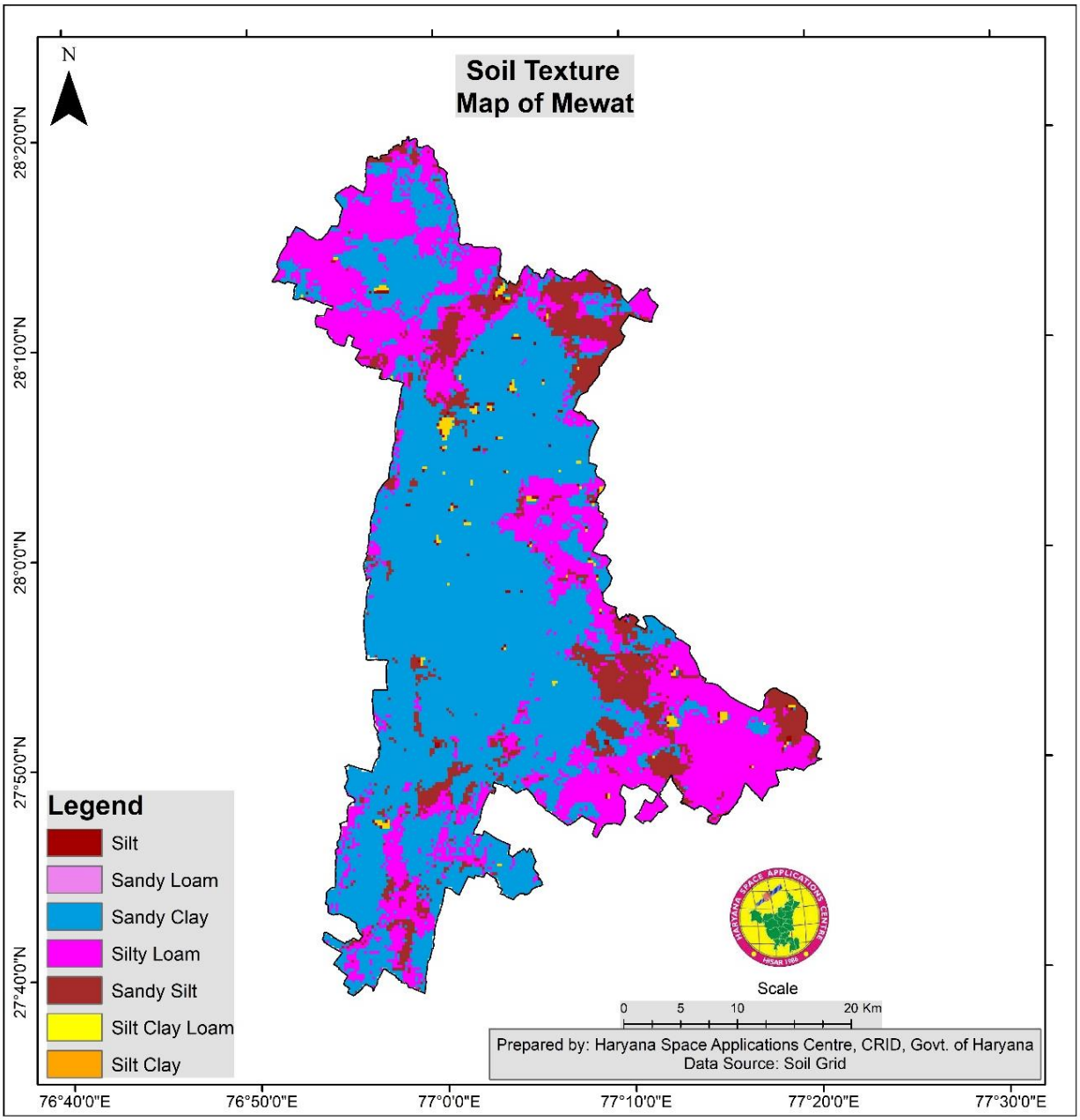


Figure 7 Soil texture map of Mewat District

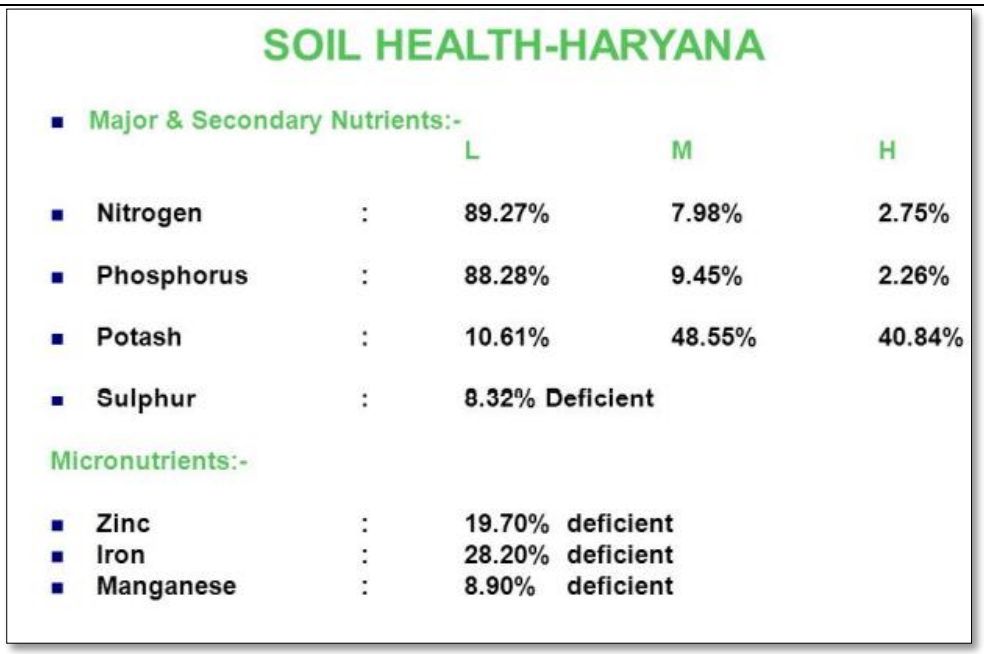


Figure 8 General Soil health profile of Haryana

1.6 Land use

Table 1 Land use and Land cover in Mewat district

Geographical Area	**149782**
Cultivable Area	**115647**
Irrigated Area	**76085**
Forest Area	**19514.86**
Land under non-agricultural use	**41671**
Permanent Pastures	**260**
Current fallow areas	**7536**
Net sown area	**Kharif- 57780/ Rabi - 105509**

Gross cropped area	**163289**
Cropping intensity (%)	**151**

Table1 above shows the area in acres occupied by different sectors under **cultivable area, irrigated area, forest area, land under non-agricultural use, permanent pastures and current fallow pastures.**

From **Figure 9** it can be easily interpreted that the agricultural area is widely spread in the district, with few scattered settlements and forest cover in the south western edges of the map and in the northern portion. The grey region represents the waste land.

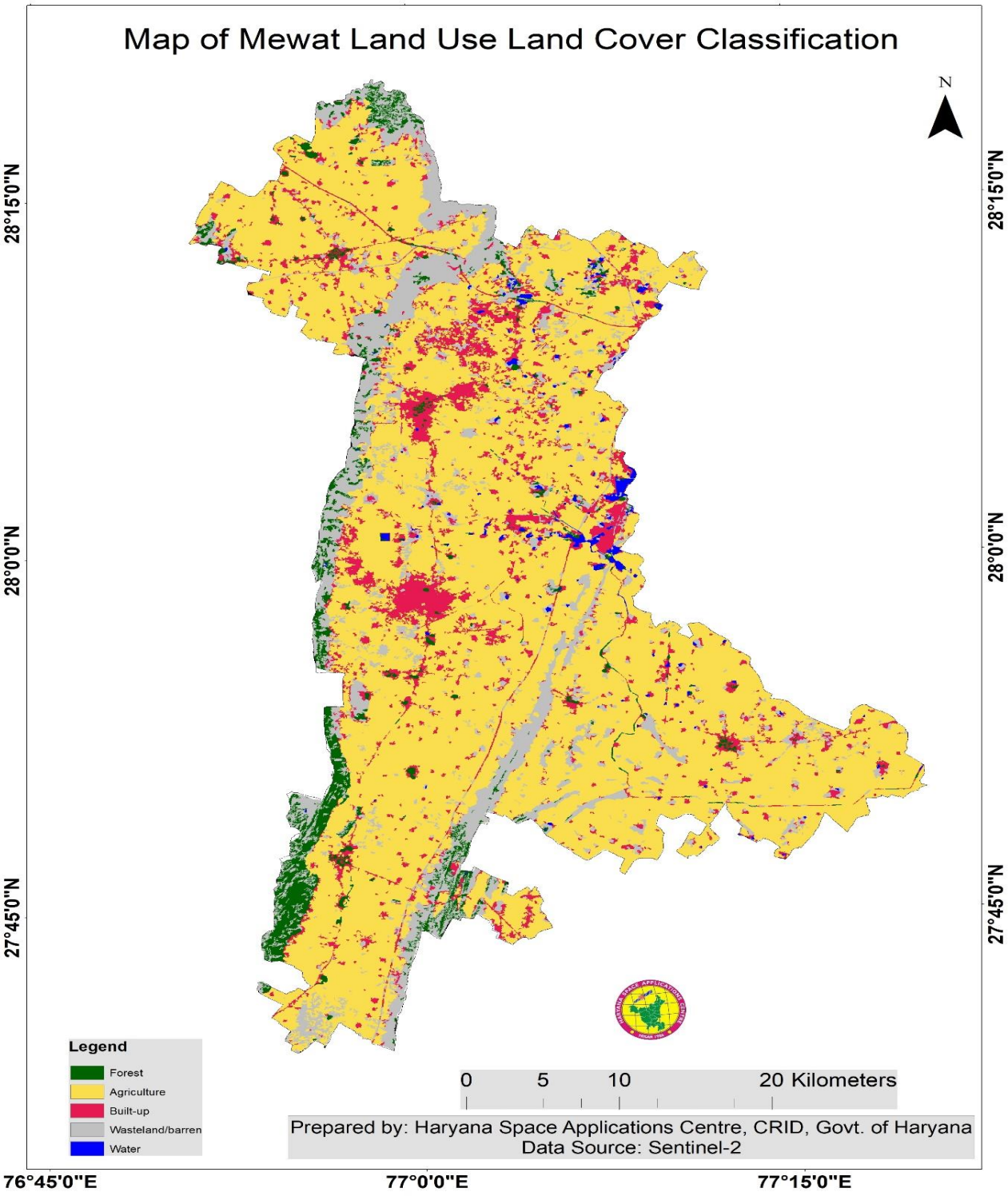


Figure 9 Land use and Landcover of Mewat District

2. District Water Profile

2.1 Source of Water

Mewat fulfil its water requirement by natural and manmade modes like canal, Ponds, treatment plants, extraction of groundwater by tube wells, water harvesting structures, rainfall water harvested from rooftop and many more.

2.1.1 Canals

Gurgaon canal carries water to the area which is distributed through Nuh, Firozpur Jhirka, Uttawar, Mandkola, Hathin and Chhyansa distributaries.

2.1.2 Ponds

A **pond** is a body of still water, either natural or man-made, that is usually smaller than a lake. They may arise naturally in floodplains as part of a river system, or they may be somewhat isolated depressions (examples include vernal pools and prairie potholes). Usually, they contain shallow water with marsh and aquatic plants and animals. A wide variety of man-made bodies of water are classified as ponds. Some ponds are created specifically for habitat restoration, including water treatment. Others, like water gardens, water features and koi ponds are designed for aesthetic ornamentation as landscape or architectural features. **Table 1** shows Mewat block wise no. of ponds. The map of total ponds/waterbodies that include ponds, canals are shown in **Figure 10** and **Figure 11** shows Monsoonal water-logged area of Mewat**.**

Table 1Mewat block wise no. of ponds

Block	Number of ponds
1. Tauro	113
2. Nuh	666
3. Nagina	162
4. Punhana	233
5. Firozpur Jhirka	94

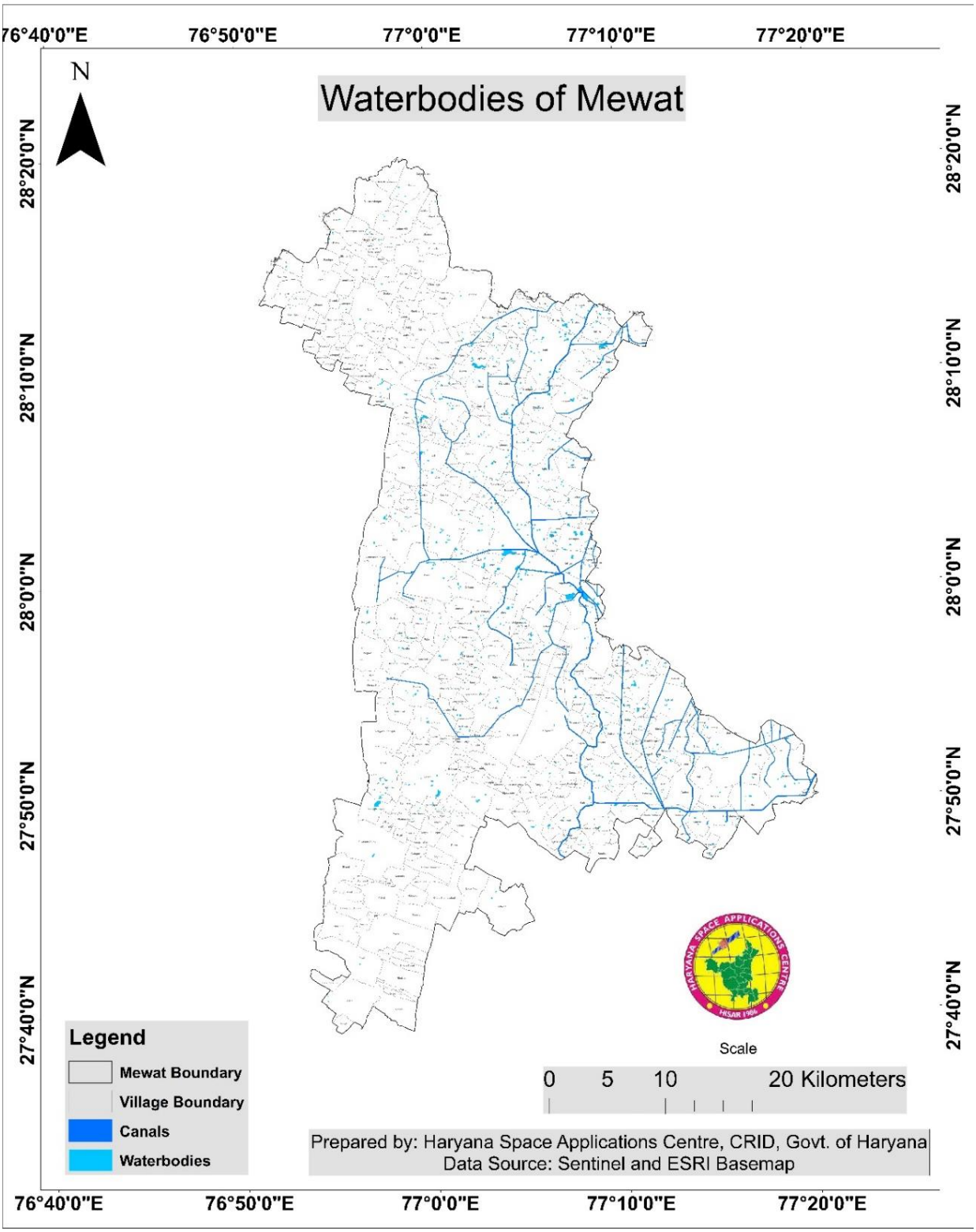


Figure 10 Water bodies of Mewat District

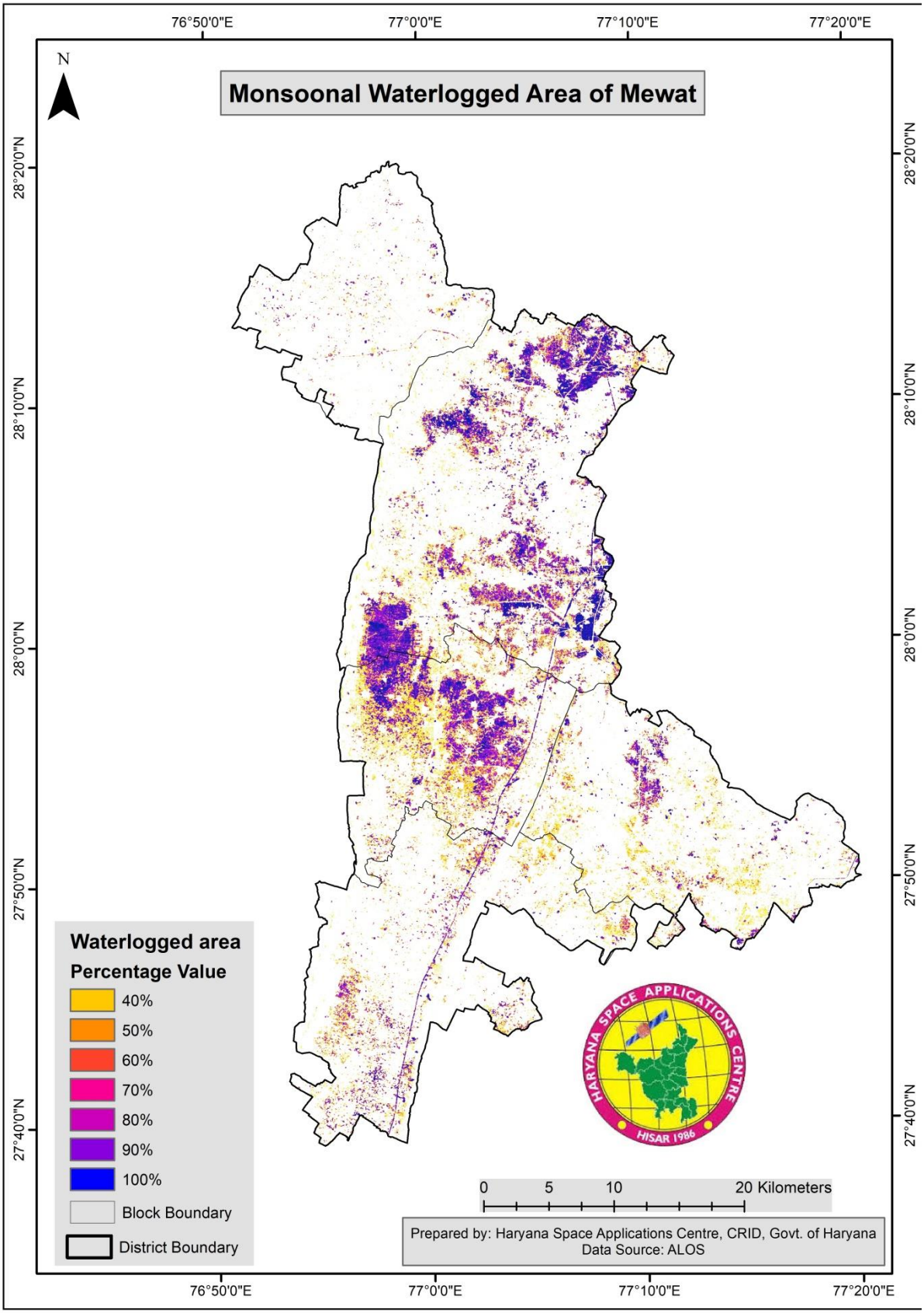


Figure 11Monsoonal water-logged area of Mewat

2.1.3 Drain

Natural drainage means a drainage consisting of native soils such as a natural swale or topographic depression, which gathers or conveys run-off to a permanent or intermittent watercourse or water body. During rain or irrigation, the fields become wet. The water infiltrates into the soil and is stored in its pores. When all the pores are filled with water, the soil is said to be saturated and no more water can be absorbed; when rain or irrigation continues, pools may form on the soil surface. Surface drainage is the removal of excess water from the surface of the land. Shallow ditches, also called open drains, normally accomplish this. The shallow ditches discharge into larger and deeper collector drains. In order to facilitate the flow of excess water toward the drains DEM is very important. The drainage map of Mewat District is shown in **Figure 12.** The statistics of length of drainages under each order are shown in **Table 2**.

Table 2 Drainage order and total length of the drains in Mewat District

Sr. No.	Order of Drainage	Total Length(meters)
1	Order1	5583
2	Order2	2826
3	Order3	1447
4	Order4	823
5	Order5	505
6	Order6	267
7	Order7	24

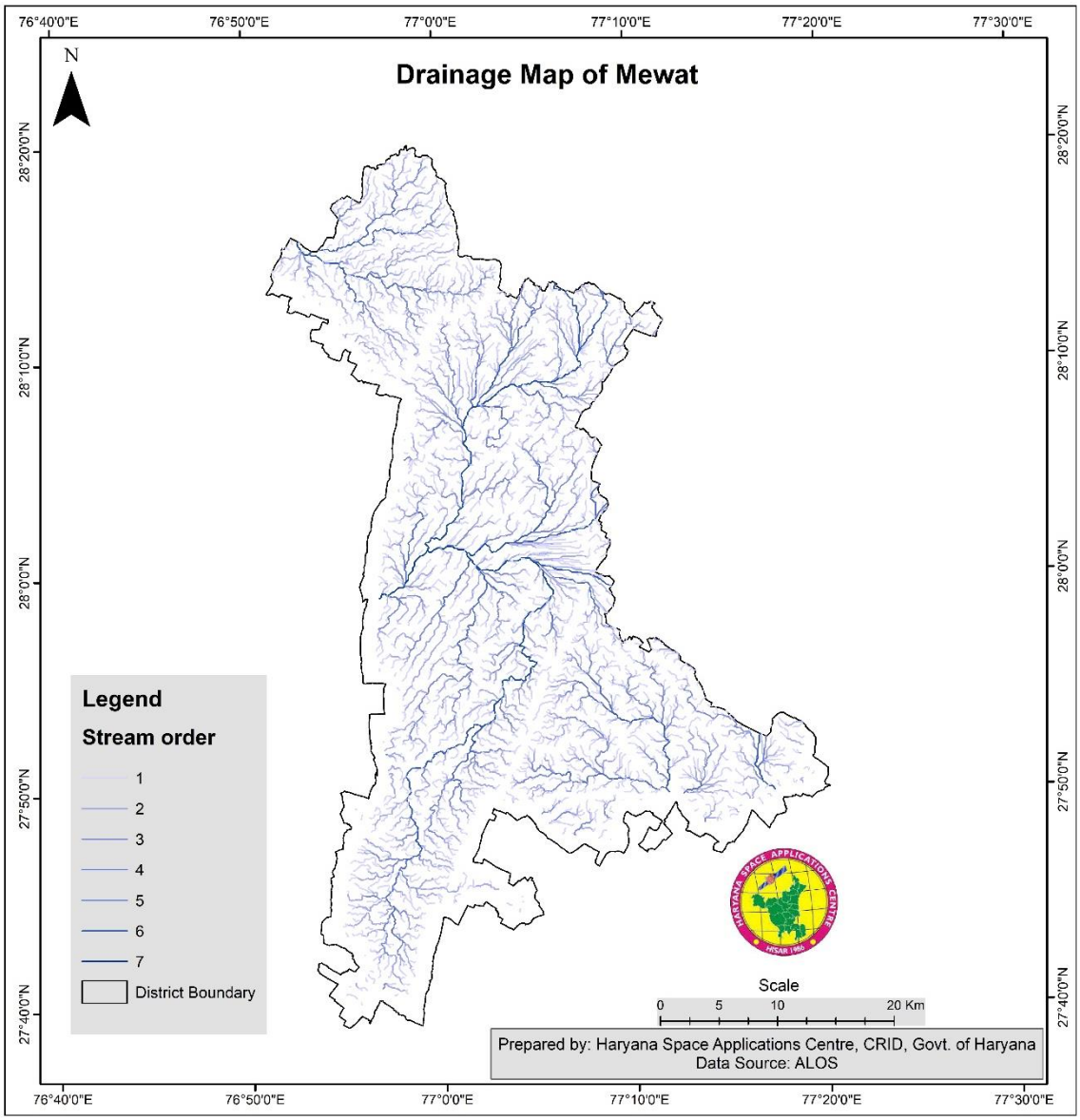


Figure 12 Drainage Map of Mewat

2.3Water Harvesting System

Water harvesting technologies cover all methods of conserving water through increasing water use efficiency, enhancing capacity to retain runoff water, and eliminating water pollution. Water use efficiency largely depends on availability and adoption of water saving devices and willingness of the consumers to reduce their total water consumption volumes. Furthermore, existing rules and regulations such as pricing mechanisms, reduce the total volume used, while economic incentives largely affect the choice and adoption of technology for water conservation technologies. A rainwater harvesting system comprises components of various

stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge

2.3.1 Roof Top Harvesting

There are a number of different ways to harvest rain water. But the one most essential thing that is common in all of the available water conservation techniques is to utilize natural rainwater to supplement the daily life's water consumption. People in the city are becoming all the more conscious day by day in implementing the best possible water conservation techniques. The major benefits of harvesting natural rainfall that the water can be harvested on a small-scale basis, such as on a bungalow or in housing societies, and it can also be done on a large-scale basis, such as at industrial level.

Many commercial premises have incorporated rainwater harvesting system in their building. And slowly, a lot of housing societies are also incorporating this technique. Harvesting rainwater involves the installation of a very simple technology that can be used by both commercial as well as residential places to make a tiny difference for a good cause.

In general, there are three main types of rainwater harvesting systems, which include direct pump, indirect pump and indirect gravity. Mentioned below (**Table 3**) is some of the most popular rain water harvesting techniques:

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks. The Main Objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dry land, hilly, urban and coastal areas. **Table 4** and **Table 5** shows the activities performed by JSA.

Table 3 Water harvesting system in Mewat district

S.NO.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam		5	
2	Pond / Tank		36	
3	Trench	6	0	
4	Rooftop Water Harvesting Structure (Public)	403	0	

5	Rooftop Water Harvesting Structure (Private)	12		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)		0	
7	Other Water Conservation Structures (Bench Terracing, Canal)		28	
	Total		**69**	**1174**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	463	50	
	Total	**463**	**50**	**1065**
Reuse and Recharge Structures				
1	Soak Pit	79	0	
2	Stabilization Pond	3	0	
3	Other Reuse / Recharge Structure	131	13	
	Total	**213**	**13**	**53**
Watershed Development				
1	Gully Plug	8	0	
2	Percolation Tank		0	
3	Staggered Trenches	3	0	
4	Other Watershed Construction Activities	269	193	
	Total		**193**	**2962**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	182181	0	
2	Intensive Afforestation- Plantation		5	
	Total		**5**	**81**
Awareness Programs by KVK				
1	Farmer’s training programs by KVKs on Water Use Efficiency and Appropriate Crops			
2	Distribution of one packet of vegetable seeds and saplings of five nutritious plants to farmers			
3	Awareness Programs/ Kisan Mela on the theme Valuing Water			
	Total			
Waste Water Treatment				
1	Use of Treated Waste Water	67421		
	Total	**67421**		

Table 4 Activities under JSA

1	**Water Conservation and rainwater harvesting (in Nos.)**				
Sr. No.	**Activity**	**Target (in Nos)**	**Achievements (in Nos)**	**Expenditure (in lacs)**	
				Estimated Cost	**Expenditure incurred till date**
A	Roof top water harvesting on public building (In Nos.)	30	30	36	29.50
B	Roof top water harvesting on private building (In Nos.)				
C	Soak pits in rural areas (In Nos)				
D	Soak Pits in urban areas (In Nos)				

Table 5 Activities under JSA (Part 2)

1	**Water Conservation and rainwater harvesting (in Nos.)**				
Sr.No.	**Activity**	**Target (in Nos) 30-11-2021**	**Achievements (in Nos) 30-06-2021**	**Expenditure (in lacs)**	
				Estimated Cost	**Expenditure incurred till date**
A	Roof top water harvesting on public building (In Nos.)	05	3	24	5.61
B	Roof top water harvesting on private building (In Nos.)				
C	Soak pits in rural areas (In Nos)				
D	Soak Pits in urban areas (In Nos)				
2	**Renovation of traditional and other water bodies/tanks (in Nos)**				
Sr.No.	**Activity**	**Target (in Nos) 30-06-2021**	**Achievements (in Nos) 30-11-2021**	**Expenditure (in lacs)**	
				Estimated Cost	**Expenditure incurred till date**
A	Rural	06	10	30	25.87
B	Urban				

4	Watershed Development (in Nos.)				
Sr.No.	Activity	Target (in Nos)	Achievements (in Nos)	Expenditure (in lacs)	
				Estimated Cost	Expenditure incurred till date
A	Check dams and Trenches	5		10 Lakh	

Table 6 District IEC activities

Sr No.	District Name	Date Of Record	Intervention Name	Number Of Activity Planned	Expenditure To Be Incurred	Number Of Activity Executed	Expenditure Incurred	Spent Over Above Expenditure
1	Nuh	24/07/2021	State and District Twitter Account to post daily under #jalshaktiabhiyan	10	0	100	0	0
2	Nuh	24/07/2021	Marathon for afforestation and water conservation	5	50000	1	13773	0
3	Nuh	24/07/2021	Taru yatras (Sapling yatras by people)	50	0	10000	0	0
4	Nuh	24/07/2021	Special Projects such as human chain, crop diversification, micro irrigation etc.	100	0	1450	0	0
5	Nuh	24/07/2021	Nukkad Nataks ICDS	5	0	0	0	0
6	Nuh	24/07/2021	Newspaper Advertisements	20	0	22	0	0
7	Nuh	24/07/2021	Wall Paintings	30	0	30	80000	0
8	Nuh	24/07/2021	Brand Ambassador and youth Icon	4	0	1	0	0
9	Nuh	24/07/2021	Fortnightly success story dissemination through print and social media	10	0	15	0	0
10	Nuh	24/07/2021	Celebration of GP/Block/District with	650	475000	337	0	0

			most water conservation activities					
11	Nuh	24/07/2021	Paudhagiri (tree plantation by children of 6-12 years)	100	0	1000	0	0
12	Nuh	24/07/2021	Radio Jingles	2	0	5	0	0
13	Nuh	24/07/2021	Radio Interviews with scientist/agriculturist	20	0	20	0	0
14	Nuh	24/07/2021	Prabhat pheris	317	0	317	0	0

2.3.2 Water Harvesting System Rooftop

The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be a terrace, courtyard, or paved or unpaved open ground. The terrace may be a flat RCC/stone roof or sloping roof. Therefore, the catchment is the area, which actually contributes rainwater to the harvesting system. Rainwater from the rooftop should be carried through down to take water pipes or drains to the storage/harvesting system. Water pipes should be UV resistant (ISI HDPE/PVC pipes) of the required capacity. The total no of activities achieved in Mewat District for rain water harvesting is shown in **Table 7** at rural and urban area. The map of water conservation activity in Mewat at rural and urban level is shown in **Figure 13**.

Table 7 Water Harvesting Activities in Rural and Urban Area

In Rural Area		
Sr. No	**Block Name**	**Total No of Activity (no.)**
2	Nagina	155
3	Nuh	332
5	Taoru	237
In Urban Area		
1	Nuh	52

1	**Water Conservation and rainwater harvesting (in Nos.)**				
Sr.No.	**Activity**	**Target (in Nos)**	**Achievements (in Nos)**	**Expenditure (in lacs)**	
				Estimated Cost	**Expenditure incurred till date**
A	Roof top water harvesting on public building (In Nos.)	2	0	16	0
2	**De-slitting /Removal of obstructions in Channel**				
Sr.No.	**Activity**	**Target (in Nos)**	**Achievements (in Nos)**	**Expenditure (in lacs)**	
				Estimated Cost	**Expenditure incurred till date**
A	Rural	10	10	23.83	23.83
B	Urban				

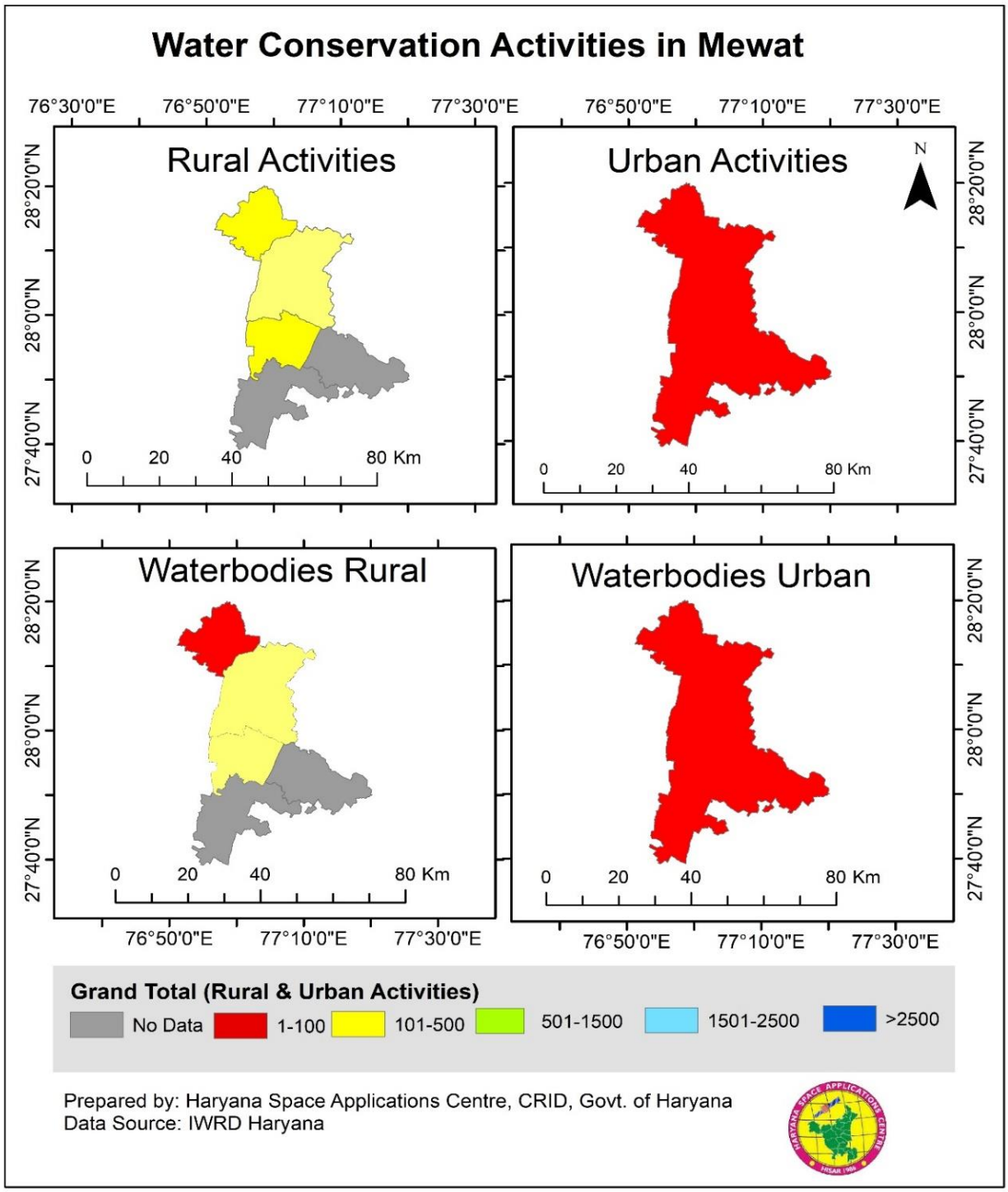


Figure 13 Water Conservation Activities in Mewat

2.3.3 Sewerage Treatment Plant

Sewage from every residential colony, hotel, or corporate office collected in the sewage collection system. The purpose of a sewage treatment plants (STPs) is to thoroughly treat wastewater. The sewerage treatment plant map is shown in **Figure 14**.

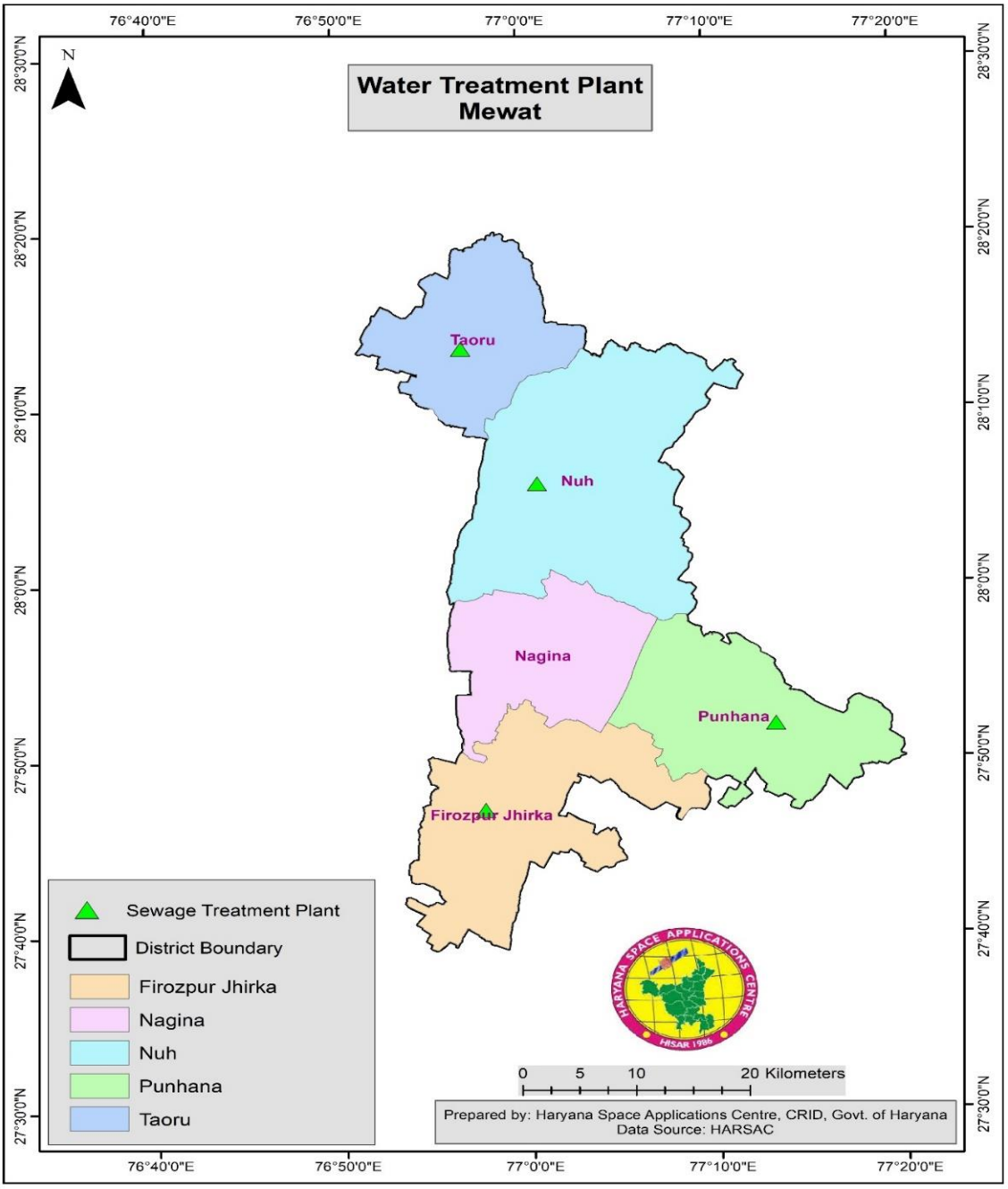


Figure 14 Water Treatment Plants in Mewat District

3 Irrigation Profile

Irrigation is the agricultural process of applying controlled amounts of water to land to assist in the production of crops as well as to grow landscape plants and lawns, where it may be known as watering. Agriculture that does not use irrigation but instead relies only on direct rainfall is referred to as rain-fed. Irrigation helps to grow agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of less than average rainfall. Irrigation also has other uses in crop production, including frost protection, suppressing weed growth in grain fields and preventing soil consolidation.

4 Water availability

4.1 Surface Water Availability

Mewat has a dual problem of saline groundwater and erratic government water supply. **There is no perennial surface water**, and 78 percent of the district has saline groundwater. Salinity is very high, so there is no use of this resource

4.2 Ground Water Availability

The blockwise ground water potentials have been estimated based on methodology recommended by Ground Water Estimation Committee (1997) as on 31st March 2009. The net annual ground water availability in Mewat district is 21623 Ham out of this1830 Ham has been kept reserved for domestic and industrial purposes up to next 25 years. The present net ground water draft in the district is 14453 Ham. The average level of ground water development in the district is 67% and falls in critical category. Therefore, care is required for further development of ground water. In Tauru block (126 %) and Ferozepur Jhirka block (64%) which fall in overexploited category, no further development of ground water should be taken up. Since a large area has shallow ground water levels within 5.0m, there is substantial potential recharge in the district. Figure 15 shows the ground water depth in Mewat district.

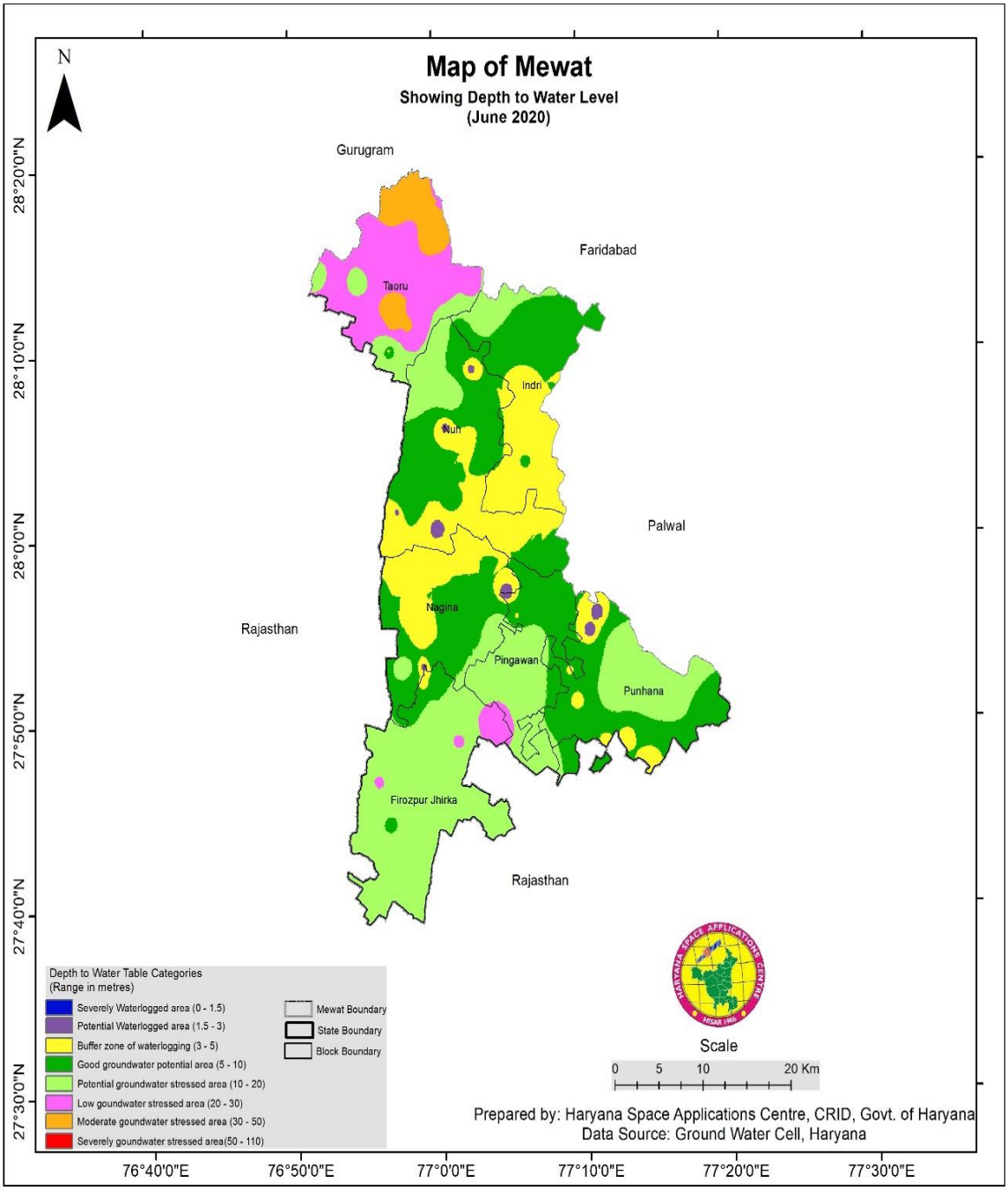


Figure 15 Ground water Availability Map of Mewat District

4.2.1 Ground water resource

The district area is mainly underlain by alluvium of Quaternary age which forms the principal ground water reservoir. Some amount of ground water also occurs in fractures, joints and crevices of hard rocks found as strike ridge in the district. The ground water in the upper zone, is known to exist down to 70 m depth, and hold water under phreatic condition. The aquifers that occur at deeper levels are confined to semi-confined. Central Ground Water Board has carried out exploratory drilling in Mewat district with the depth ranging between 39and 291 m. The data of the exploratory boreholes reveal that in the deeper zones, alluvial formation comprises sand, clay and kankar in varying proportions. These sediments rests upon the basement of rocks of Delhi System. Alluvium thickness varies from almost insignificant near to hill ranges to above 291meters in the area. The exploratory drilling in the area has revealed that at Alduka (28°07':77°07') in the central part the bed rock was encountered below a depth of 291 m bgl. At Gharrot in the east the depth bed rock was 222m while at Bahin in southeast, the bed rock was reported at a depth of 147.5m while in Thekraka, at a place around central part, the depth to bed rock was mere 45m. indicating highly undulating bed rock in entire Mewat area. In the northwest at Didhara (28°12'30":76°50'), the bed rock was encountered below 182m. In the southeast, at Hathangaon (27°43'40":77°15'50"), the bed rock was encountered at 84m depth. At Raoli (27°48':76°56') in the south, the bed rock was encountered below a depth of 88m in the form of alternate bands of slates and quartzites. Hence, it is concluded that thickness of alluvium is within 300 m in the central and eastern parts while in the remaining parts of Mewat it varies at few places around Santhabari, Raoli, Pingawan being within 90m bgl in general.

Table 8 Drinking water Condition in Mewat District

Assessment Unit/Block	Net Ground Water Availability y Ham	Existing Gross Ground Water Draft for irrigation Ham	Existing Gross Ground Water Draft for all uses Ham	Allocation for domestic and industrial requirement supply up to next 25 years Ham	Net Ground Water Availability for future irrigation development Ham	Stage of ground water Development in %	Category of Block
Ferozpur Jhirka	4727	2741	3011	450	1536	64	Over Exploited
Nagina	4185	1813	2025	354	2018	48	safe
Nuh	4526	1701	2011	507	2318	44	safe
Punhana	5420	3724	3910	323	1373	72	Critical
Tauru	2765	3301	3496	195	-731	126	Over Exploited
Total	21623	13280	14453	1830	6513	67	

4.2.2 Ground Water Quality

Chemical quality data of shallow aquifers reveals that ground water is alkaline in nature & is moderate to highly saline with EC values generally ranging from 1890µS/cm to 9370µS/cm. A significant number of samples have conductivity values more than 3000 µS/cm. Concentration of vital chemical constituents such fluoride and nitrate in about 65% of the water samples are within permissible limits assigned by BIS 1991. Among trace metals, lead and iron are found to be present in high concentrations. On comparing the observed concentrations with the concentration limits set by BIS, it is found that groundwater, in general, is not suitable for drinking use due to high levels of salinity, nitrate, iron and lead. Plot of USSL diagram used for the classification of irrigation waters indicates that ground water falls under C3S1, C3S2, C4S1, C4S2 and C4S4 classes. More than 75% ground water, when used for customary irrigation, is likely to cause salinity hazards and thus should be used on well-drained soils for semi salt to salt tolerant crops such as wheat, gram and rice etc. Presence of chemical constituents more than the permissible limits in the district is given below:

Constituent	**No. of wells**	**Location with conc.**
EC > 3000 µS/cm (n=11)	6	Max. 9370µS/cm at Sikarwa
Fluoride >1.5 mg/l (n=11)	1	Luhinge Kalan, 3.99mg/l
Arsenic > 0.01mg/l (n=8)	nil	--
Iron>1.0mg/l (n=12)	3	Max 1.95 mg/l at Akaira

Type of water: Mostly Na-Cl, Mixed cation-Cl type

4.2.3 Status of Ground Water Development

Most of the villages and towns in Mewat district is having piped water supply. The water supply is mainly based on canal water and tube wells located at the base of the ridges and hillocks in the district and maintained by Public Health Dept. The water supply is erratic in Nuh, Nagina, Punhana, Firozpur Jhirka blocks the ground water quality is brackish to saline. The ground water is found to be fresh along the hill ranges. The district is mainly irrigated by shallow tube wells. In Nuh and Nagina blocks the density of minor irrigation units is 4 per sq.km. In some parts of these blocks there is fresh water but it is confined up to 20 metres depth only. The dug wells and tube wells (cavity and filter type) in these areas to meet the irrigational requirements are constructed down to a depth of 10 to 20 metres and their discharge ranges from 150 to 750 lpm. Hathin and Punhana blocks have some area under canal irrigation. **Figure 16** depicts the ground water quality.

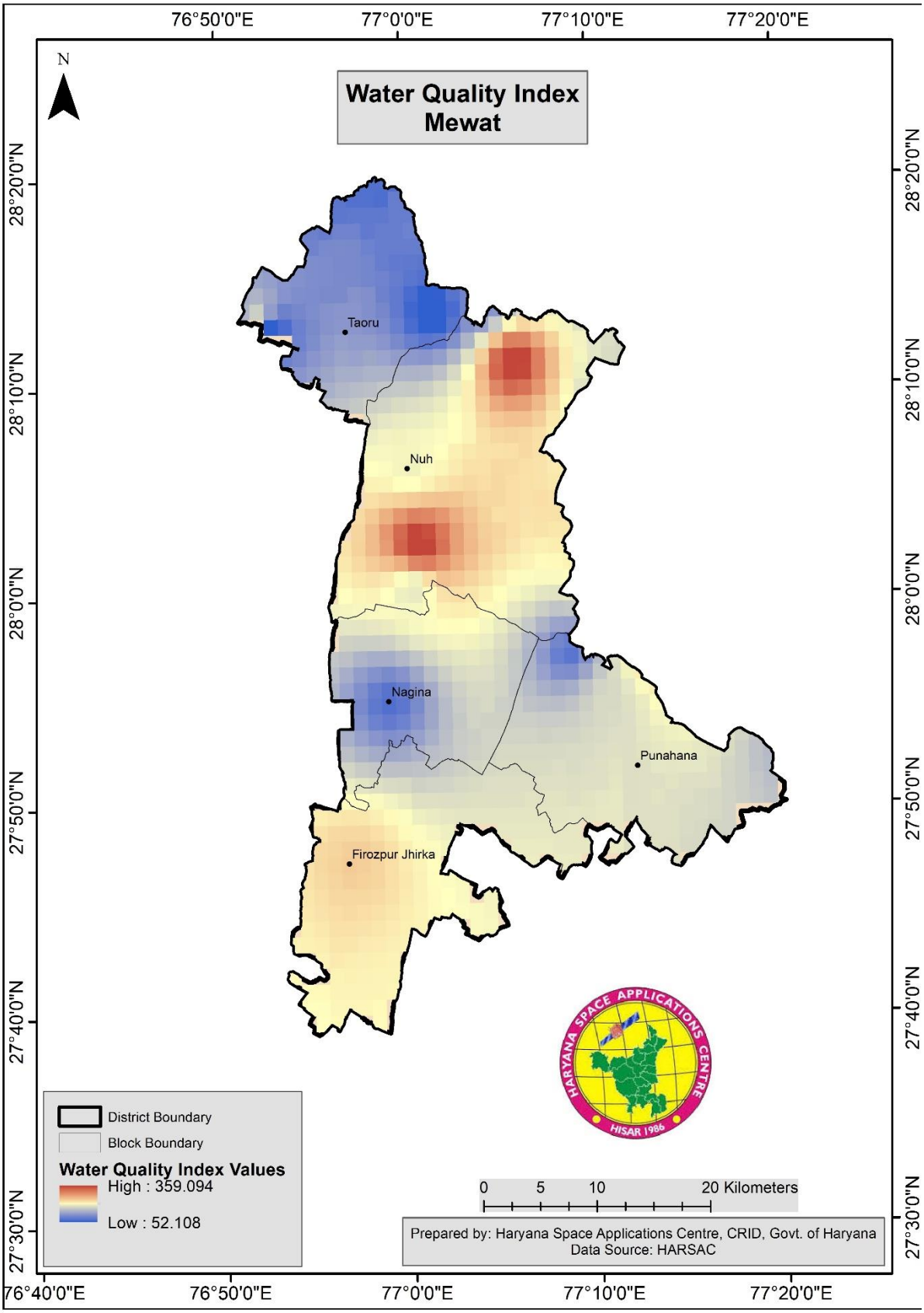


Figure 16 Water quality index of Panipat District

5 Aquifer System

An aquifer is a body of saturated rock through which water can easily move. Aquifers must be both permeable and porous and include such rock types as sandstone, conglomerate, fractured limestone and unconsolidated sand and gravel. Fractured volcanic rocks such as columnar basalts also make good aquifers. The rubble zones between volcanic flows are generally both porous and permeable and make excellent aquifers. In order for a well to be productive, it must be drilled into an aquifer. Rocks such as granite and schist are generally poor aquifers because they have a very low porosity. However, if these rocks are highly fractured, they make good aquifers. A well is a hole drilled into the ground to penetrate an aquifer. Normally such water must be pumped to the surface. If water is pumped from a well faster than it is replenished, the water table is lowered and the well may go dry. When water is pumped from a well, the water table is generally lowered into a cone of depression at the well.

6 Water Requirement/ Demand

6.1 Water Supply and Gap

6.2 Water Budget

7 Strategies for Water Conservation

- Excessive surface runoff should be drained out of the area.
- Shallow borewells be installed so that the withdrawal of ground water at least equals the annual recharge. This will control the rise of water table and reduce the scope of evaporation.
- Plantation of eucalyptus trees should be encouraged where water table is less than 5 m deep. This will serve a dual purpose, first by lowering the water table through rapid transpiration and secondly by providing economic support to local farmers.
- Regulated irrigation by fresh water through canals may be arranged. Use of saline ground water for the irrigation should be discontinued, if not discontinued, it will enhance the salinity and render the marginal soil as wasteland.
- Possibility of Prawn culture using saline ground water could be explored. If feasible, it will uplift economic status of people.
- Salt tolerant crops like barley, wheat, cotton, and sunflower, water melon, tomato, olive, grapes etc. may be grown in the area.
- About 140.29sq.km. area is underlain by hard rock of Delhi System, may be taken up for artificial recharge through bunding and Gabion structures across the seasonal streams flowing to the area.
- Local populace to be educated regarding consequences of mining of ground water and need for its economic use.

Advantages of water conservation-

Water conservation is the reduction of water usage, wastage or loss which in turn benefits the needs of living beings. It involves the reduction in the usage of water as well as recycling the waste water for various purposes such as manufacturing, irrigation and cleaning. Water is the most important factor which every living being is in need of. Water conservation can be done at home by using low-flush toilets and low flow taps. Rain water harvesting is another method for conserving water.

The benefits of are:

saving money,

- environment and energy
- protecting the drinking water resources
- reduce or minimize the pollution and health problems
- reduce the need for new waste water treatment facilities
- save the aquatic environment
- save the energy which is required for heat, treat and pumping the water
- Conserving water can also be helpful during emergency cases such as drought, water contamination or mechanical failures.

7.1 Artificial Recharge

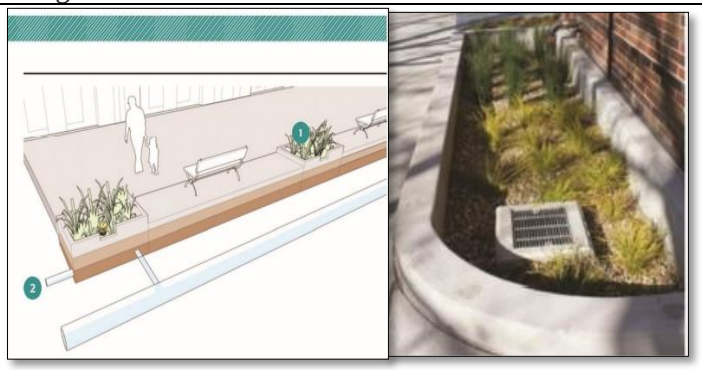
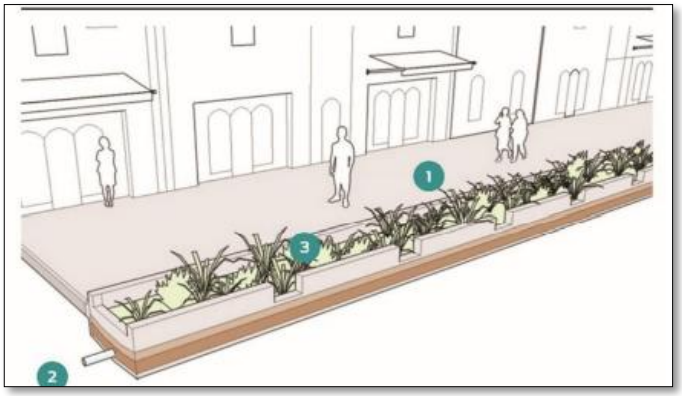
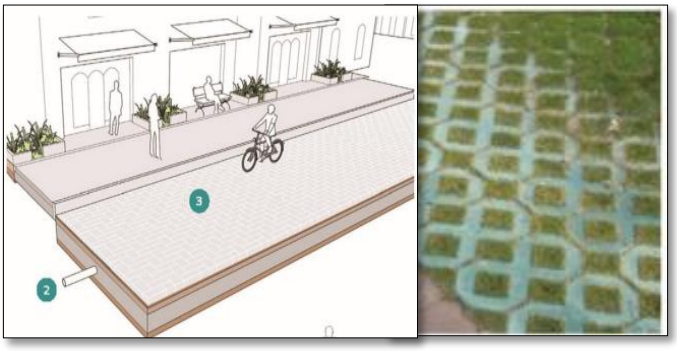
There are few isolated pockets located in the eastern part of the district where water levels are declining very fast. Fresh ground water at deeper level is being exploited by deep tube wells. Limited possibilities of artificial recharge exist in these areas during monsoon season, where excess runoff from upland areas can be utilized. Some of drains which were constructed to drain out excess water can be utilized for artificial recharge by constructing suitable recharge structures, such as injection wells, recharge shafts etc.

Possibility of Artificial Recharge There is few isolated pockets located in the eastern part of the district where water levels are declining very fast. Fresh ground water at deeper level is being exploited by deep tube wells. Limited possibilities of artificial recharge exist in these areas during monsoon season, where excess runoff from upland areas can be utilized. Some of drains which were constructed to drain out excess water can be utilized for artificial recharge by constructing suitable recharge structures, such as injection wells, recharge shafts etc.

7.2 Water Sensitive Urban Design

As more and more portions of the district become urbanized, it is crucial to integrate water sensitive urban design into planning of the major upcoming clusters of towns and cities that are in the satellite of the main city of Mewat. Water Sensitive Urban Design (WSUD) is a familiar concept for engineers and architects practicing and designing in the face of overwhelming environmental changes brought in by climate change. A major part of WSUD also allows us as a society to grow more resilient towards more intensive changes in rainfall patterns, as they grow more intensive, however much scarce in terms of frequency. The methods of water table recharge strategies in urban area are shown in **Table no 16**.

Table 9 the methods of water table recharge strategies in urban area

Sr. No.	Method	Image
1	Flow Through Planters	
2	Pervious Strips	
3	Pervious Pavement	

4	Storm water Tree	

7.3 Plantation

A major portion of WSUD that is popular within the Government Departments is plantation of various species of plants, both in public and private spaces, to encourage community participation and increase green cover. While increasing the aesthetic value of a location, plants are heavily influential to change microclimates and in fact playing a factor to rainfall patterns. Along with benefits of carbon sequestration, they contribute to increasing the local biodiversity of the region by attracting several types of fauna as well. Currently a multi-departmental approach is being undertaken both within and outside of government with the engagement of several active citizen stakeholders and non-governmental organizations. Geo-tagging of these plantations and survival monitoring would be undertaken actively by engagement of the mentioned stakeholders. The wasteland that could be used for plantation for conservation of water in Mewat district is shown in **Figure 17** and **Table 10** shows the proposed no of plantation targets in Mewat District.

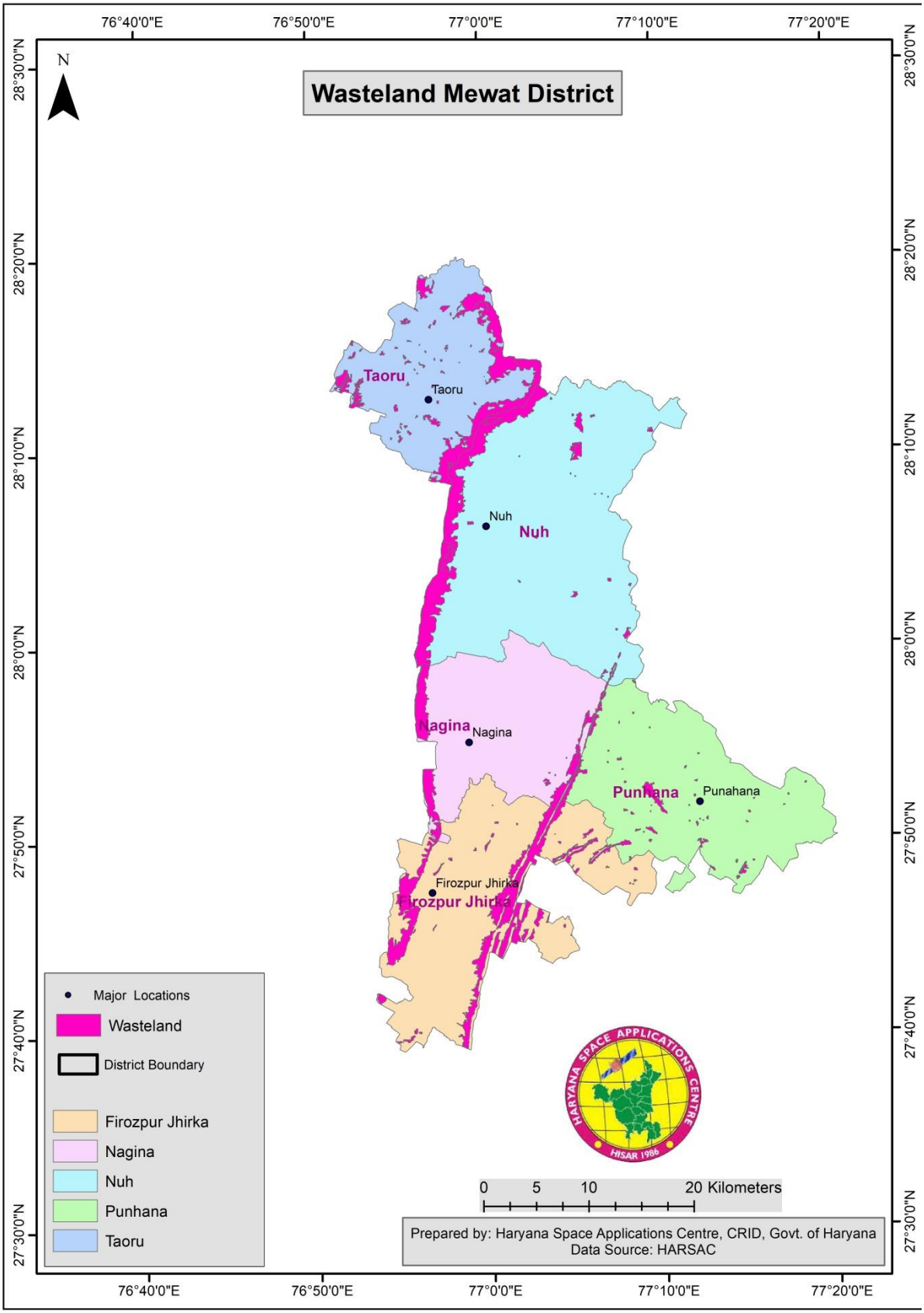


Figure 17 Wasteland Map of Mewat district

Table 10 Plantation area shown below in the table

Block name	Wasteland area	Plantation at 5 feet spacing
Firozpur jhirka	10972.9372	95596228.9
Nagina	4211.347274	36689257.45
Nuh	10376.39168	90399124.31
Punhana	1619.635846	14110267.49
Taoru	9332.813522	81307471.4

7.4 Surface water management

7.4.1 Pond restoration and rejuvenation

7.4.2 Decentralize Treatment Plant

It is recognized that in the absence of 100% sewerage network connectivity just managing the grey water component would be an incomplete solution. In the rapidly urbanizing cities of developing countries, decentralized wastewater treatment systems are an attractive solution for addressing the problems of water pollution and scarcity.

Decentralized wastewater treatment consists of a variety of approaches for collection, treatment, and dispersal/reuse of wastewater for individual dwellings, industrial or institutional facilities, clusters of homes or businesses, and entire communities. An evaluation of site-specific conditions is performed to determine the appropriate type of treatment system for each location. These systems are a part of permanent infrastructure and can be managed as stand-alone facilities or be integrated with centralized sewage treatment systems. They provide a range of treatment options from simple, passive treatment with soil dispersal, commonly referred to as septic or onsite systems, to more complex and mechanized

approaches such as advanced treatment units that collect and treat waste from multiple buildings and discharge to either surface waters or the soil.

Decentralized wastewater treatment systems could be a feasible alternative for areas which are not connected to sewer networks as well as ones which are newly developed, so that the construction of their infrastructure is inadequate, not ready or would be executed in the future. Therefore, for local communities in the peripheries of urban development that exists outside the city centre and rural areas where open drainage systems still exist.

However, planning for sewage infrastructure and pipelines are a long-term investment, with the advent of exponential population increase also has been a challenge. Instead, decentralized wastewater management approach can be considered as a sustainable and cost-effective alternative as it treats discharges or reuses the effluent in the relative vicinity of its source of generation. Therefore, decentralization of wastewater treatment facilities is a feasible solution that may allow for localized treatment which may eventually be reused for secondary purposes.

7.4 Information Education and Communication

Through open exchange of information, education and communication established between the community and the implementing agency, ownership of the projects and interventions is reinstated; from inception to implementation and beyond. Selected committee members that form groups such as self-help groups, youth groups are in fact chosen to carry out regular capacity building of the community at large, with special attention paid to children, women and those belonging most vulnerable groups are carried out. Knowledge exchange and capacity building are at the core of IEC activities. The following image shows the various stakeholders involved in IEC Activities. The following image shows the various stakeholders involved in IEC Activities (**Figure 18**) and **Table 11** shows the numerous activities and interventions that can be carried out for IEC.

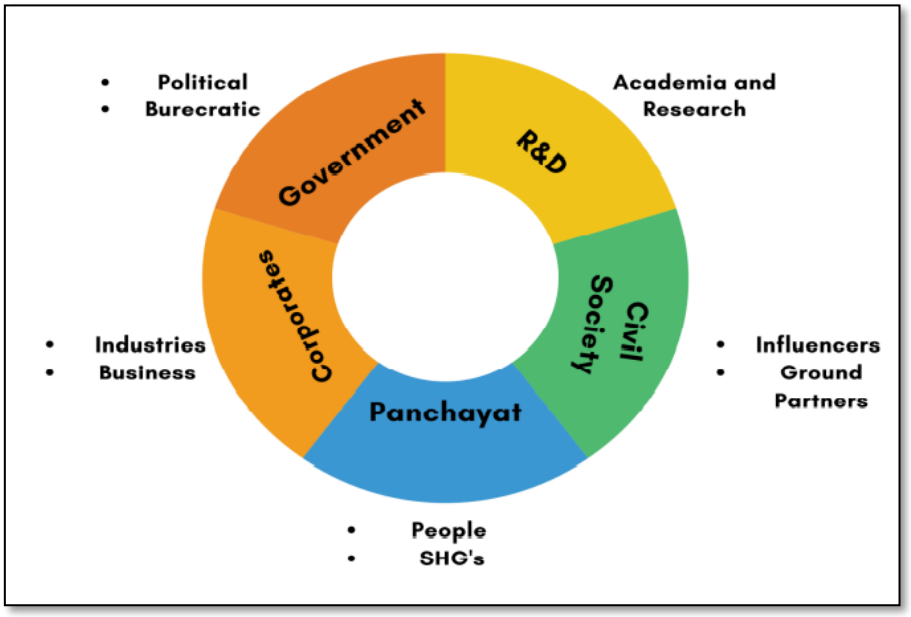


Figure 18The above figure shows the various stakeholders of IEC Activities

Table 11 The numerous activities and interventions that can be carried out for IEC

. S. No.	IEC	Intervention / Topic	Target Group	Objective	Collaterals	Outcome/ Result
1	Webinars	- Role of RWA, Schools and Citizen in Rain water harvesting - How to Harness and Harvest Rain	- RWA(through MCG) - Schools (3rd party) - Corporates(3rd Party)	- To Engage Local People in Rain water Harvesting - To make them aware of the facts and rules of RWH	Letter from which dept. Letter to Mayor and Commissioner for inviting for webinar	- Knowledge about Rain water harvesting - Respective roles and duties towards RWH
2	Capacity Building Sessions	- Technical Training sessions - Awareness Training Sessions - Workshops	- MCG Workers - MCM Workers	- Training of ground worker of MCG - Implementation Work	Presentation Retrofitting Checking list Repair and Cleaning List	1. The workers will clean and repair the RWH post training - Training on Real time Problems - Generate Employment Opportunities
3	Competitions in RWA's (Same type of Settlements)	- Water Man agent and Conservation	- RWA	-To save water - To bring the best practices through RWA	- Competition brief with parameters	- To recognise and reward the best RWA - Lead by by Example
4	Formation of Clubs	-how do we know about good vendor? - how do we identify places for RWH - How do we build RWH?	RWA	To make water representative from every RWA	Check list of water auditing for the water representative	1. do the meetings with respective water representative from every RWA. -Team building for the Society
5	Guidelines	- Guidelines for All the drops of the Society	- RWA - govt institutions - Schools - Corporates	Information Flow	- guidelines and poster	- Information and Awareness on Water

		regarding Rain water harvesting and its maintenance	- Rural Public buildings			conservation and Rules
6	Information Boards	- Water awareness (Ponds, RWH, Plantation)	- Schools - Public Institutes Open Spaces Roads -	- To change the perspective of people	Location, Capacity, Design OF RWH, information board	Awareness , mobilise citizens - Information about the RWH in Their vicinity
7	Rain Centre	- Any Problems related to water	- All the Citizens	To Resolve the issue related to RWH	FAQ (Technical)	Acts as Point of Contact for all the queries in Water Management
8	Social Media	- All the updates of the Events and posts	- All the Citizens	- Digital marketing - Awareness	FAQ TYPES Best Practices Video clips of Officers and celebrities	Awareness , mobilise citizens
9	Recognitions/Awards	- Rain water Harvesting - Best Practises - Best RWA in Water management	- RWA - In Panchayats - NGO - Schools - Corporates - Active Citizens	to recognice best practices	-Parameters list for best practices	To encourage more practices and people - Increase interest and motivation for the end users
10	Video Clips and Interviews	- Individual water Conservation steps - Best Water Management Practices	- RWA - In Panchayats - NGO - Schools - Corporates - Celebs	Digital marketing - Awareness - virtual presence	- letters for the celebs, script.	To recognise people, encourage more
11	Working Models	- Rain water Harvesting Models - GuruJal Pond Sites	- Schools	To aquire more prototypes for District Administration	- Proper Guidelines	Showcasing Children work in Administration

12	Plantation Drives	- Awareness on Plantation drives	- Urban (RWA, MCG, MC) - Rural (Pond Sites) - Schools -NGO's	-To increase the green Cover To increase the water holding Capacity	- Plant List Nursery Database - Distribution Chain Management Posters	Better environment for Future Generations
13	Collaborations	- For IEC	- NYK - District Youth Affairs and Sports -Kalagram -NGO's -Durga Shakthi -Civil Defence -Lion Club	To involve stakeholders to facilitate sessions	- Letter of Collaboration -Google form	- No Overlapping of the work or activities - More effectiveness in Catch the rain Campaign

8 Proposed Activity

8.1 Rainwater harvesting

Roof top rain water harvesting system: A technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water aquifers by adopting artificial recharge techniques or meet the household needs through storage in tanks. These works have to be compulsorily taken up for public/community buildings namely Panchayat Bhawans, schools, Anaganwadis, Public Health Centres and Community halls (if available). Also, households should be convinced to take up roof-top rainwater harvesting structures for their houses.

- Check dams: small engineering structures constructed across a stream/ water course with cement to store water.
- Trenches: Constructed depressions of about 6 feet length, 2 feet width and 1 foot deep (sizes may vary across states) to impound the expected runoff.

There are some factors that affect the rainfall water harvesting which needs to be focused for the development of suitable sites of water harvesting. These factors include rainfall, slope, soil texture, drainage, topography and land use / land cover and integration of these factors using weighted overlay analysis that results in suitable sites for rainwater harvesting. These sites are then classified into various suitability levels, namely, not suitable, less, medium, good and very good. The most suitable sites for

rainfall water harvesting are shown in map (**Figure 19**). The block wise area proposed for rainwater harvesting under most suitable sites is shown in **Table 12.**

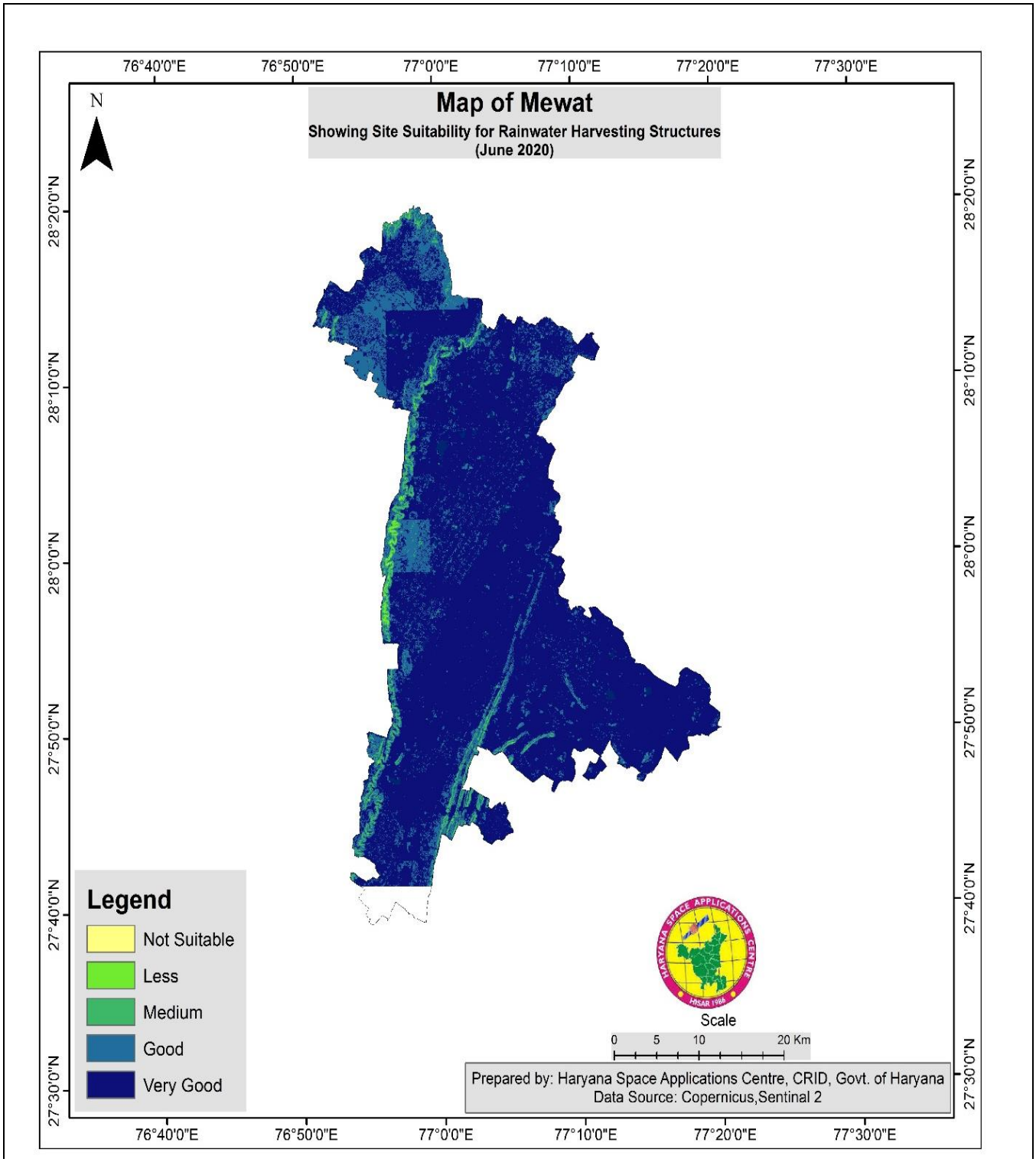


Figure 19Proposed Site Suitable Map based on Drainage

Table 12 Block wise proposed suitable sites based on multi-criteria

block name	Area (Very Good suitability area in Sq. meter)
Firozpur jhirka	252994596.6
Nagina	191174439
Nuh	377728954.1
Punhana	264393218.9
Taoru	127753247

8.2 Proposed Suitable Site based on Multicriteria

In this section some water harvesting structures are proposed with the suitable sites. These structures are calculated based on different criteria. These criteria are Natural drainage and water occurrence datasets that should exclude the settlement and water bodies on the same place. Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. Following are the outcomes that show the type of structure on the streams. **Figure 20** shows the proposed suitable site based on multi criteria. Block wise proposed suitable sites based on multi-criteria is shown in **Table 13**.

Following are the harvesting structures proposed based on criteria mentioned as above.

1. 2 Mini percolation Tanks
2. 4 Percolation Tanks
3. 1Pakka check Dams
4. 0 Annicut
5. 2 Micro Irrigation tanks

Table 13Block wise proposed suitable sites based on multi-criteria

Sl. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Taoru	4	5	4	2	0
2	Nuh	1	3	1	0	0
3	Nagina	0	1	1	0	0
4	Firozpur Jhirka	1	0	0	0	0
5	Punhana	0	0	0	0	0

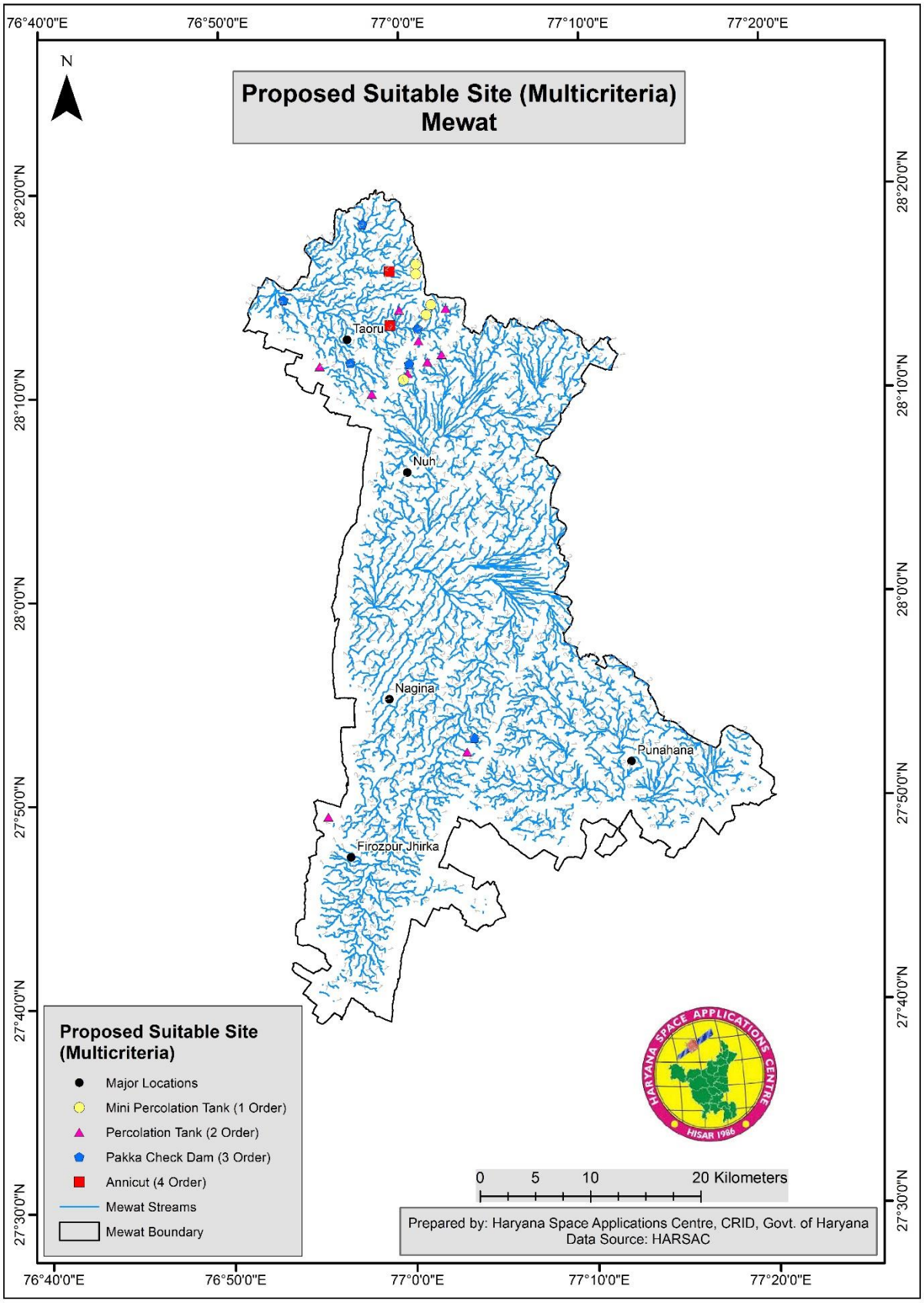


Figure 20 Proposed suitable sites based on multicriteria in Gurugram District

8.3 Proposed Suitable Site based on Drainage

The drainages that are created from satellite imagery can be used as base for the water harvesting structure. Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. So, based on the order of streams we can propose the suitable sites for water harvesting structures. A general idea says that Mini percolation Tanks on Ist order Stream, percolation Tanks on 2nd Order Stream, pakka check Dams 3rd Order Stream, Annicut on 4th order, Micro Irrigation tanks 5th Order can be built. **Figure 21** shows the proposed suitable sites based on drainage structure in Meat district. Proposed harvesting structures in Mewat based on drainage **Table 11.**

Table 14 Proposed harvesting structures in Mewat based on drainage

Sl. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Taoru	44	42	52	40	19
2	Nuh	74	113	106	53	92
3	Nagina	38	41	59	28	30
4	Firozpur Jhirka	72	52	77	32	24
5	Punhana	61	67	68	22	25

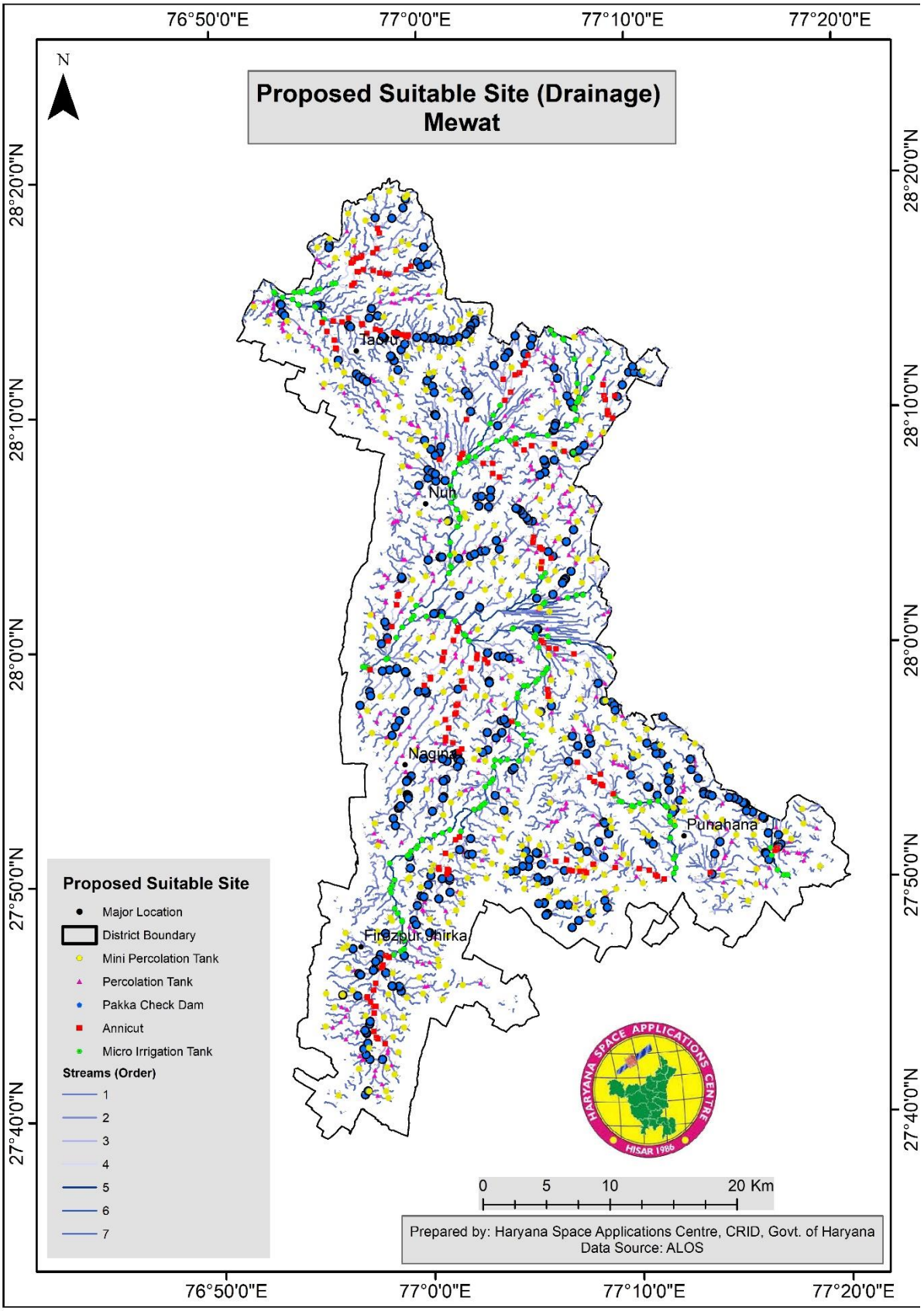


Figure 21Proposed suitable sites based on drainage in Mewat District

9 Conclusion

Water being an ongoing reliable source around the world, it will not be available forever. When top energy consumers include the United States and China, along with environmental factors affecting these two regions, there is no doubt that this valuable resource will be limited on Earth. Water scarcity is no joke and shouldn't be taken lightly for it has great effects on food production, our farm lands, our health, and our economies. Droughts are common factors of this scarcity of water by drying up land and all the life contained in it. The land for crops is shrinking and are in need of more and more water everyday causing limited amounts of fruits and vegetables to be produced according to the research found by Daryanto and Gilis. When there is low food production, there come high demands which affect the economy.

Environmental concerns are not situated in one side of the world. Water is a broad source extending to different countries along with different advanced technologies. Irrigation has become widespread to improve farming and food production as well. Risks are taken into account because there may be cases in which misuse of conservation technology can affect our health and other resources other than water. Menses illustrates this situation well in his research regarding wastewater in the dairy industry. Through extended research, it is found that these happenings don't just occur once and in one place. The solution to prevent these occurrences exists in such initiatives of the government such as the JAL SHAKTI ABHIYAN. This is where collaboration is important among states and regions. To better and preserve our natural resources, actions and attitudes towards sustainability must stay at a high level throughout nation who is willing to work together towards the same goal.

……END……..

“Jal Shakti Abhiyan: Catch The Rain”

- WATER CONSERVATION AND RAIN WATER HARVESTING
- RENOVATION OF TRADITIONAL WATER BODIES
- REUSE AND RECHARGE STRUCTURES
- WATERSHED DEVELOPMENT
- INTENSIVE AFFORESTATION
- ENUMERATION OF WATER BODIES
- TRAINING / AWARENESS PROGRAMS BY KVK

Catch The Rain

Where it falls, When it falls

PIKU