JSA-CTR

Report No. 12

Scientific Action Plan

For

Kurukshetra

Prepared by

Haryana Space Applications Centre (HARSAC),

Citizen Resource Information Department

(CRID)Government of Haryana

2021

जल शक्ति अभियान
संचय जल, बेहतर कल

HARYANA SPACE APPLICATIONS CENTRE
HISAR 1986

सिंचाई एवं जल संसाधन विभाग
हरियाणा

GOVT. OF HARYANA

Contents

List of Figure

List of Table

1 Introduction

1.1 History

Kurukshetra region is an area of great antiquity and remained an important centre of political activity during ancient period. According to Mahabhartata, it came to be called Kurukshetra after the sage King Kuru who is said to have cultivated this land with passionate devotion. Kuru, a simple and pious man was the son of Samvarna and Tapati, the ancestor of the Kauravas and the Pandavas. During 18th century, most of the areas now forming Kurukshetra district were parceled out among various Sikh Chiefs,who formed independent principalities of Thanesar and Ladwa. Both the principalities were gradually lapsed to the British Government. A part of Thanesar (held by Bhag Singh) lapsed in 1832 because of the death of Sardar Jamiat Singh without male heir and the rest of it (held by Bhanga Singh) in 1850 on account of the death of Rani Chand Kaur, widow of Sardar Fateh Singh. Ladwa was lapsed to the British Government in 1845 on account of misconduct of Raja Ajit Singh. The British Government organized these lapsed territories alongwith lapsed principality of Kaithal into Thanesar district in 1849. The district had three Tehsils, namely, Pipli, Thanesar and Kaithal. TheCollector Magistrate was incharge of the district. Thanesar district was broken up in 1862 and the areas were distributed between districts of Karnal and Ambala. Pehowa pargana was included in Karnal district and parganas of Shahabad. Ladwa and a part of Thanesar were included in Ambala and converted into Pipli tehsil. In 1866, Pehowa pargana of Karnal district having 103 villages was transferred to Pipli tehsil of Ambala district. But 14 of these villages in 1876 and remaining 89 villages in 1889 were again transferred from Pipli tehsil to Kaithal tehsil of Karnal district. In 1897, Pipli tehsil was transferred to Karnal district. The headquarters of Pipli tehsil were also shifted to Thanesar in the same year. Haryana Government established Kurukshetra as a separate district on 23rd January, 1973 as the 10th district of the State. The District was reorganized in 1989 and some area of the erstwhile District was transferred to Kaithal & Yamunanager Districts and new Districts Kaithal & Yamunanager were created.

1.2 Location

The district lies between 29°55'0" and 30°15' 15" north latitude and 76°27'0" and 77°17'0" east longitude. Kurukshetra district is located in the North Eastern part of Haryana State (**Figure 1**) at a distance of 160 km from Delhi. The District is bounded on the North by Ambala district, on the east by Yamunanager, on the South by Karnal and on the West by Kaithal and on the northwest by Patiala district of Punjab. The District has an area of 1530 sq. km. as per figures supplied by the Surveyor General of India, constituting 3.46% of the total area of the State (i.e.

44212 sq. km.) . It is the third smallest district of the State in terms of area.

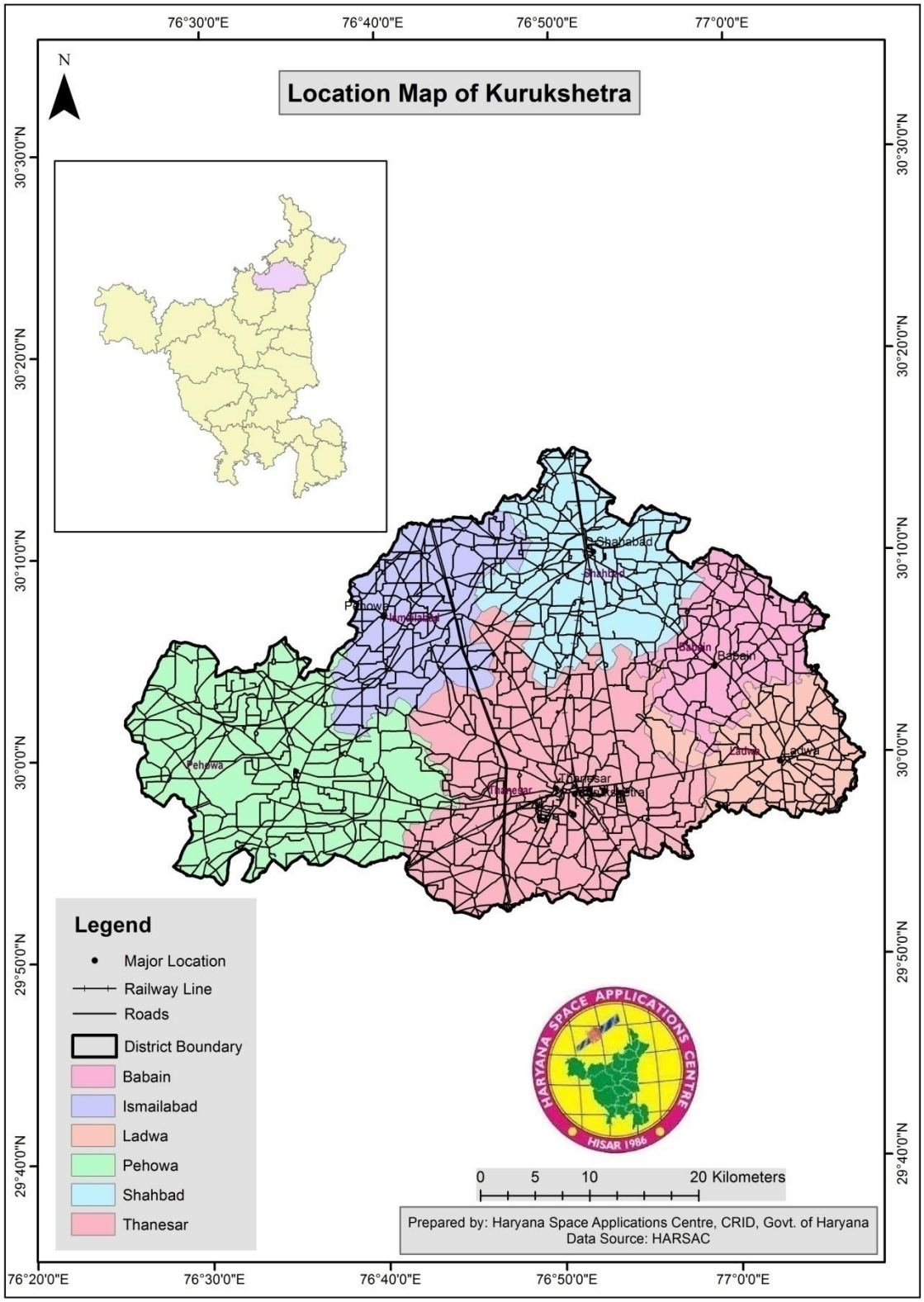


Figure 1 Location Map of Kurukshetra District

1.3 Administrative setup

District Kurukshetra forms a part of Ambala Division. At present Kurukshetra is divided into four revenue Sub-divisions i.e. Thanesar, Pehowa, Shahabad and Ladwa, 4 Tehsils namely Thanesar, Pehowa, Ladwa and Shahabad, 2 Sub Tehsils Babain and Ismailabad. It consists of 5 muncipalities i.e. Municipal Council Thanesar, Municipal Committees Pehowa, Shahabad, Ladwa and Ismailabad, The district further divided into 7 development blocks Thanesar, Pehowa, Shahabad, Ladwa, Babain, Pipli and Ismailabad . Total number of villages and Gram Panchayat are 419 and 393 respectively. Most of the area of the district falls in Kurukshetra Lok Sabha constituency. There are 4 assembly constituencies i.e. Thanesar, Pehowa, Shahabad and Ladwa. Administrative setup of Kurukshetra District is shown in **Table 1**.

Table 1 Major Administrative Jurisdictional Setup of Kurukshetra District.

Country	India
State	Haryana
Division	Kurukshetra
Headquarters	Kurukshetra
Tehsil	1. Thanesar, 2. Pehowa, 3. Shahabad, 4. Ladwa
Area	
Total	1530 Sq. KM
Population (2011)	
Total	9.65 lakh
Density	630
Demographics	
Literacy	Kurukshetra (Lok Sabha constituency)
Vidhan Sabha constituencies	1. Thanesar, 2. Pehowa, 3. Shahabad, 4. Ladwa
Website	https://kurukshetra.gov.in/
Location of Bhiwani	Southern region of Haryana
Co-ordinates	29°55’0” and 30°15’ 15” North latitude and 76°27’0” and 77°17’0” East longitude

Total Area	1530 sq. km
Elevation	711.9 ft above the sea level

Source: https://kurukshetra.gov.in

Sub Divisions (4)	Thanesar, Pehowa, Shahabad, Ladwa
Tehsils (4)	Thanesar, Pehowa, Shahabad, Ladwa
Sub-Tehsils (2)	Babain, Ismailabad
Blocks (7)	Thanesar, Pehowa, Shahabad, Ladwa, Babain, Ismailabad, Pipli
Municipal Corporation (1)	Municipal Corporation Kurukshetra
Municipal Council (1)	Thanesar
Municipal Committees (4)	Pehowa, Shahabad, Ladwa, Ismailabad
Population (Census 2011)	9.65 lakh

Source: https://kurukshetra.gov.in

Total Villages	419
Total Panchayats	393
Village Level	Panchayat (393)
Block Level	Panchyat Samiti (127)
District Level	Zila Parishad (17)

Source: https://kurukshetra.gov.in

1.4 Climate

The climate of the District is of pronounced character i.e. very hot in summer and markedly cold in winter. It is as high as 45° C in summer and as low as 10° C in winter. The year may be divided into four seasons. The Cold season is from mid- November to about mid- March. It is followed by hot season which continues to about the end of June. The period from July to about mid- September is the South west Monsoon season, after which a period of one month constitutes the transition periodfrom Monsoon.

As the cold season starts the temperature begin to decrease rapidly. January is generally the coldest month. From about middle of March temperature begins to rise rapidly. From about April hot westerly winds begin to blow and all the weather progressively becomes hot. May and June are the hottest months. During the south west Monsoon season there is an appreciable drop in day temperature while night temperature continue to be nearly as high as in the summer. In the

mid-September there is an increase in the day temperature but night temperature drops down rapidly with the progress of the season.

1.4.1 Rainfall

The normal annual rainfall of the district is 582 mm which is unevenly distributed over the area. The south west monsoon sets in from last week of June and withdraws in the end of September, contributed about 81% of annual rainfall. July and August are the wettest months. Rest 19% rainfall is receives during non monsoon period in the wake of western disturbances and thunderstorms. In general, rainfall in district increases from southwest to northwest. Rainfall map of Kurukshetra District is shown in **Figure 2.**

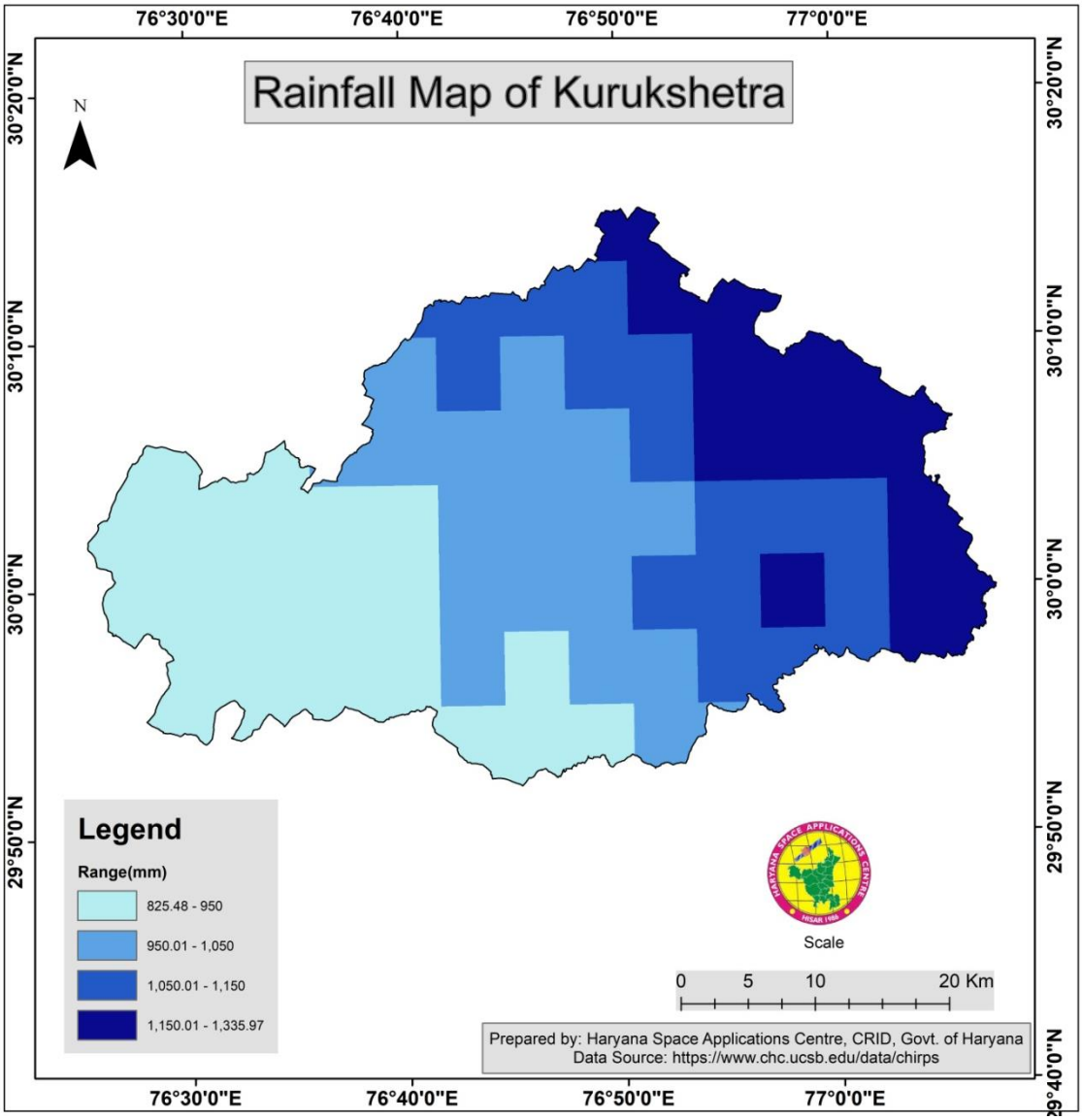


Figure 2 Rainfall Map of Kurukshetra District

1.5 Elevation and Topography

The district is a part of Punjab plain. The Saraswati, which drains into the Ghagghar River, is the main stream flowing in the area. The land is inclined both westward and southward. The average height of the district is about 230 meter above mean sea level (**Figure 3**). Contours are a collection of lines found on maps that show mountains, valleys and landforms. Contours are measured from sea level. If contours are closely spaced, it means that the land is very steep, if the contours are widely spaced, it means the land is more flat. Contours can be used to understand the map and to know where land will be steep or flat (**Figure 4**).

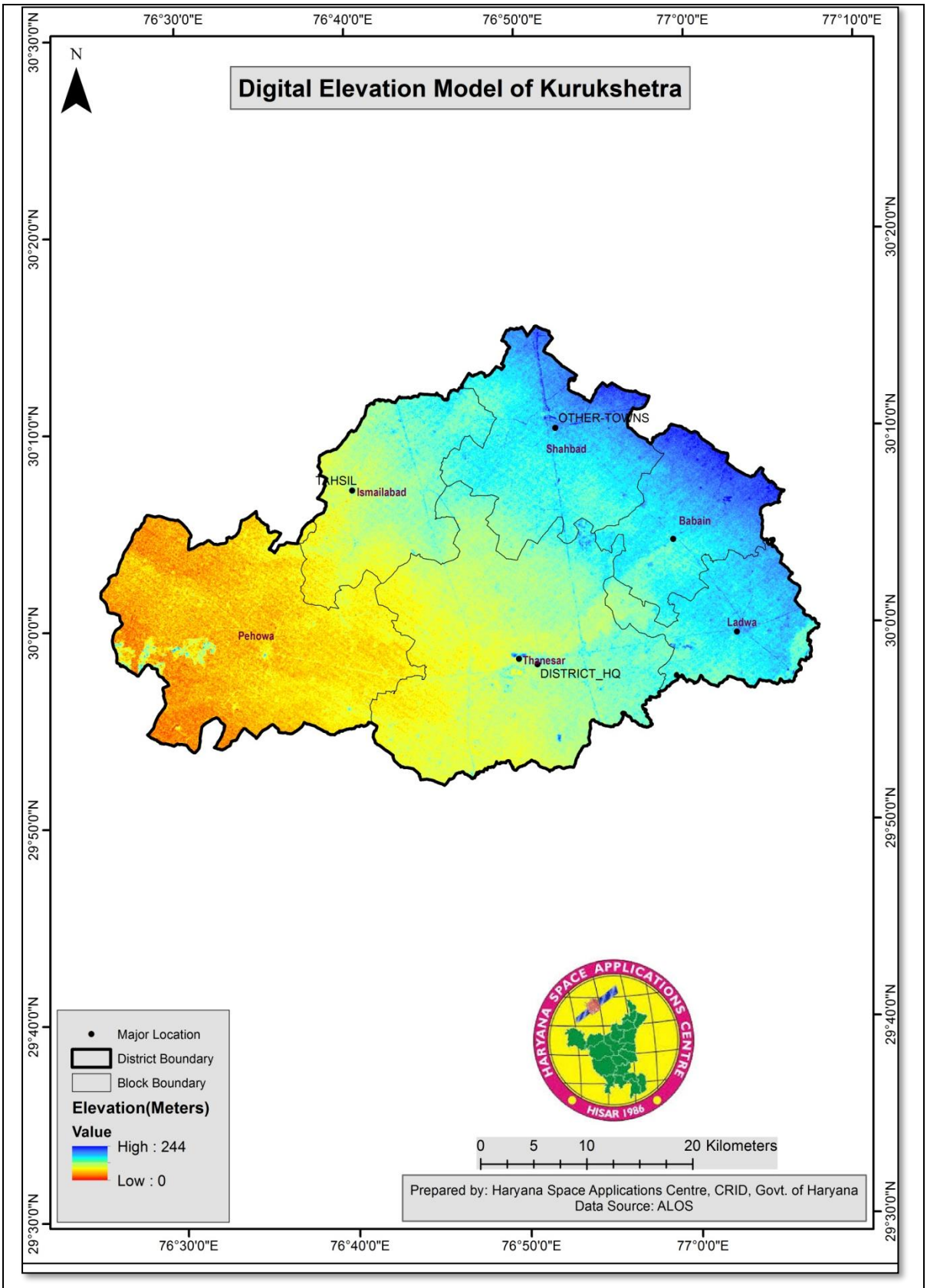


Figure 3 Digital Elevation Model of Kurukshetra District

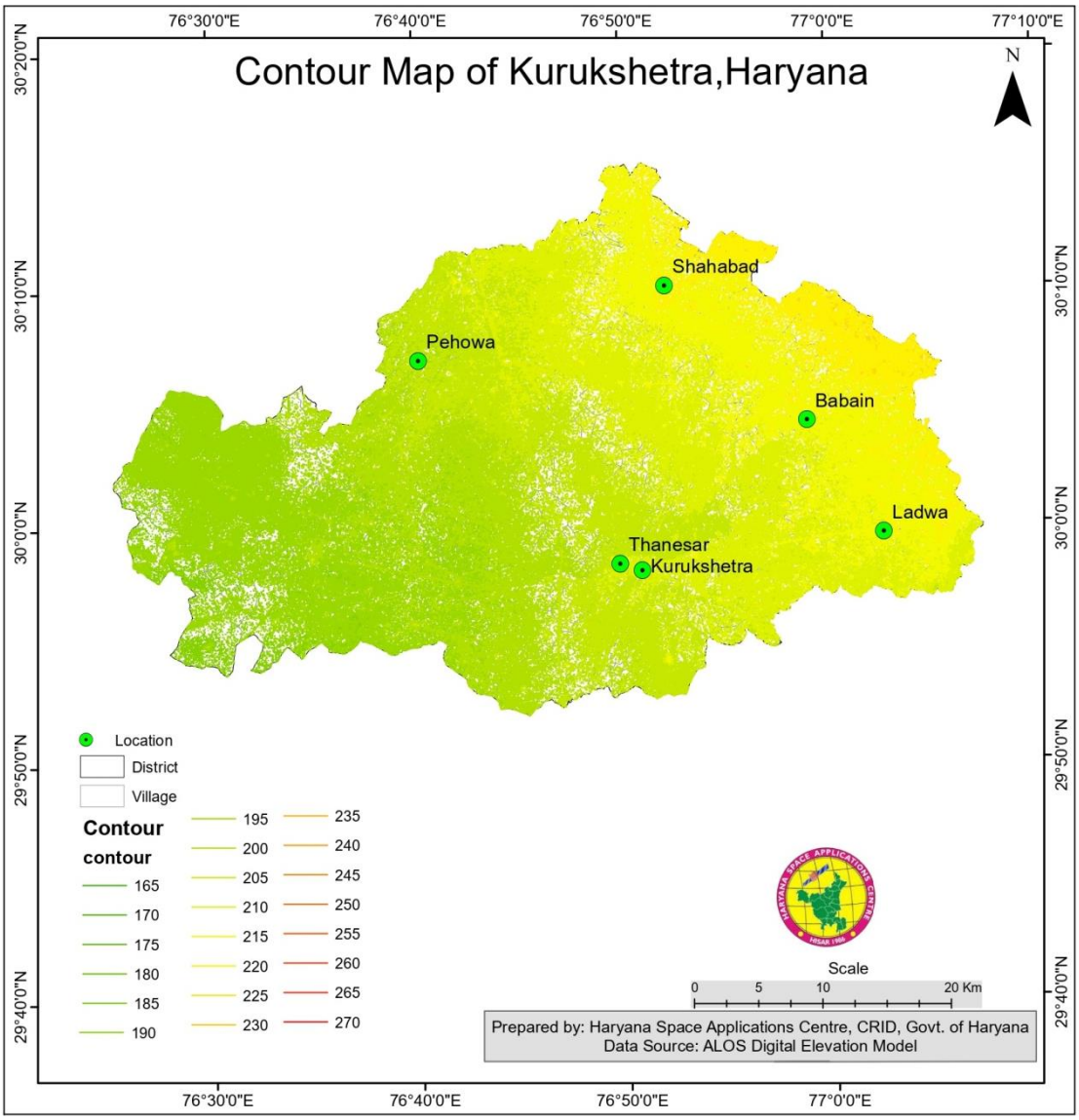


Figure 4 Contour Map of Kurukshetra District

A slope is the rise or fall of the land surface. It is important for the farmer or irrigator to identify the slopes on the land. A slope is easy to recognize in a hilly area. Start climbing from the foot of a hill toward the top, this is called a rising slope. As Kurukshetra district is mostly in plain area so slope varies from 0 to 35 as some part may sloppy. Slope map of Kurukshetra district is shown in map (**Figure 5**).

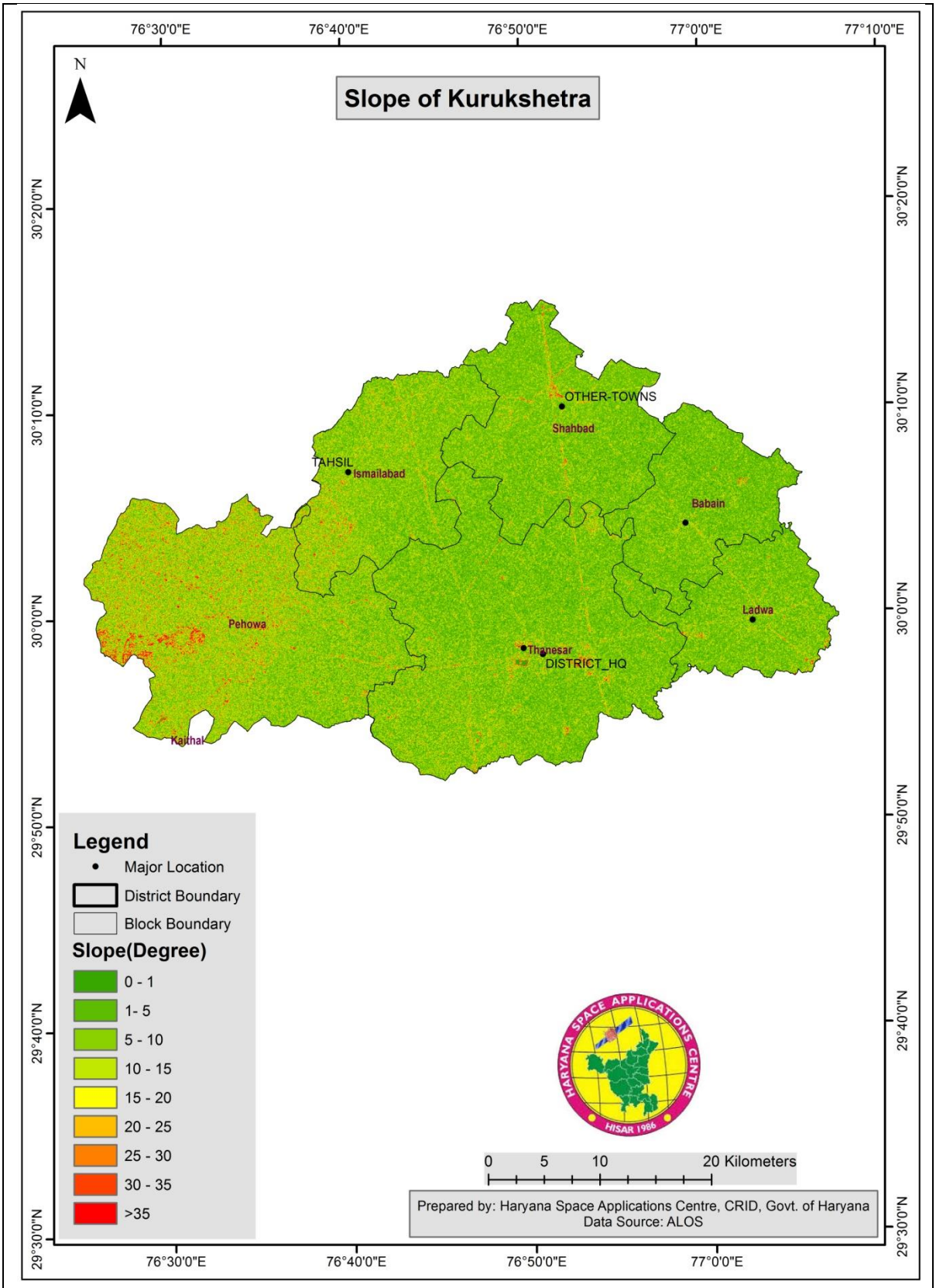


Figure 5 Slope Map of Kurukshetra District

1.5.1 Geology and Lithology

The area is divisible into two physiographic parts, dividing the district into 3 portions. The lithological map of kurukshetra is shown in **Figure 6.**

The Khaddar: It is low laying reverain tract extending up to the broad sandy bed of the river, with light soils and water close to the surface. The khaddar is a flood plain formed by the Yamuna along its course. After rainy season the receding floods deposit a lot of fine silt,which is easy to cultivate and which remains wet for most part of the year. For this reason the soil of this tract seldom suffer from moisture stress. The khaddar is generally about 20 ft lower than upland plain. Within the khaddar tract the altitude gradually decreases to the south, the average fall being 2 ft per mile. The vegetation consists mainly of grass and scrub, with scattered trees here and there.

The Upland plain: This upland plain is not a uniformly level area. It is inclined to the south and southwest. There is a sort of hump in the configuration of the surface covering Thanesar. Within this zone the land is relatively flat. Bangar is irrigated by Tubewells and canals and is a prosperous agricultural area. West of the Bangar is Nardak where water tablehas been deep till recently. It was an open plain covered with grasses and dhak treesuntil a large part of it was reclaimed and brought under plough for agriculture.

The low lying areas (Naili circle - Local term) : It includes areas of Markanda bet and Naili circle. It is low-lying flood plain. Ithas clay loam soil. In dry season this soil is hard and cracked whereas in rainy season it is wet and sticky. Till irrigation was introduced in recent years, the land has been laying waste. Naili circle is a low-lying area along the Saraswati stream. It suffers from poor drainage during rainy months.

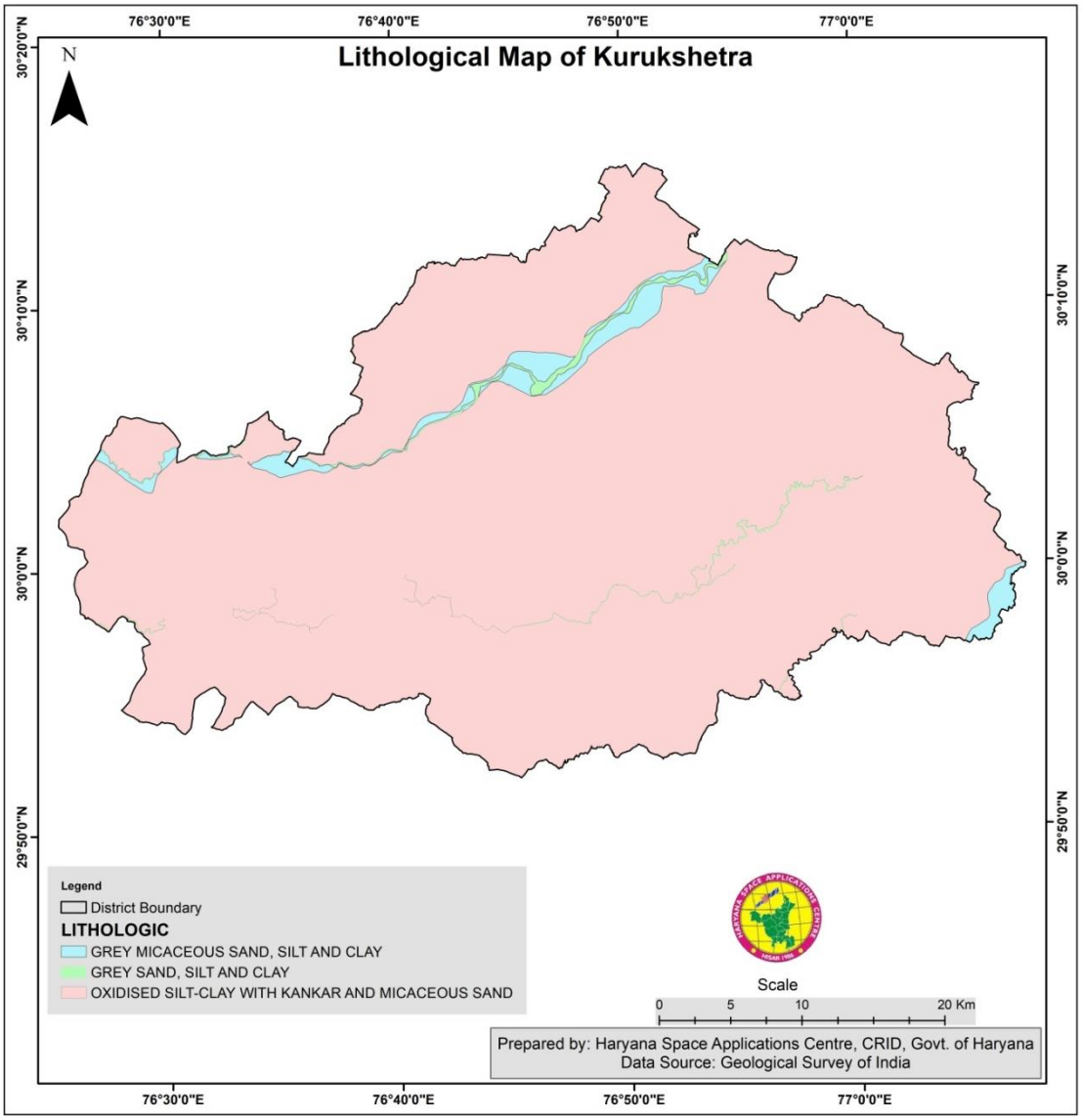


Figure 6 Lithological Map of Kurukshetra District

1.5.2 Soil Profile

The soil is **generally alluvial, loam and clay does** not constitute average texture of the soil. The Kurukshetra soil has an even pale brown colour. The pH value indicates the soil to be mild to strongly alkaline in nature. The soil has low permeability and does not drain well. Moisture content is high. The soil type is loam, sandy loam or clayey loam. There is no salinity and water logging problem in the district and Irrigation water is good for crops Fertility status of the soil of

Kurukshetra in respect of Nitrogen, Phosphorus and Potassium (major nutrients) is described as under. Soil texture map of Kurukshetra district is shown in **Figure 7**.

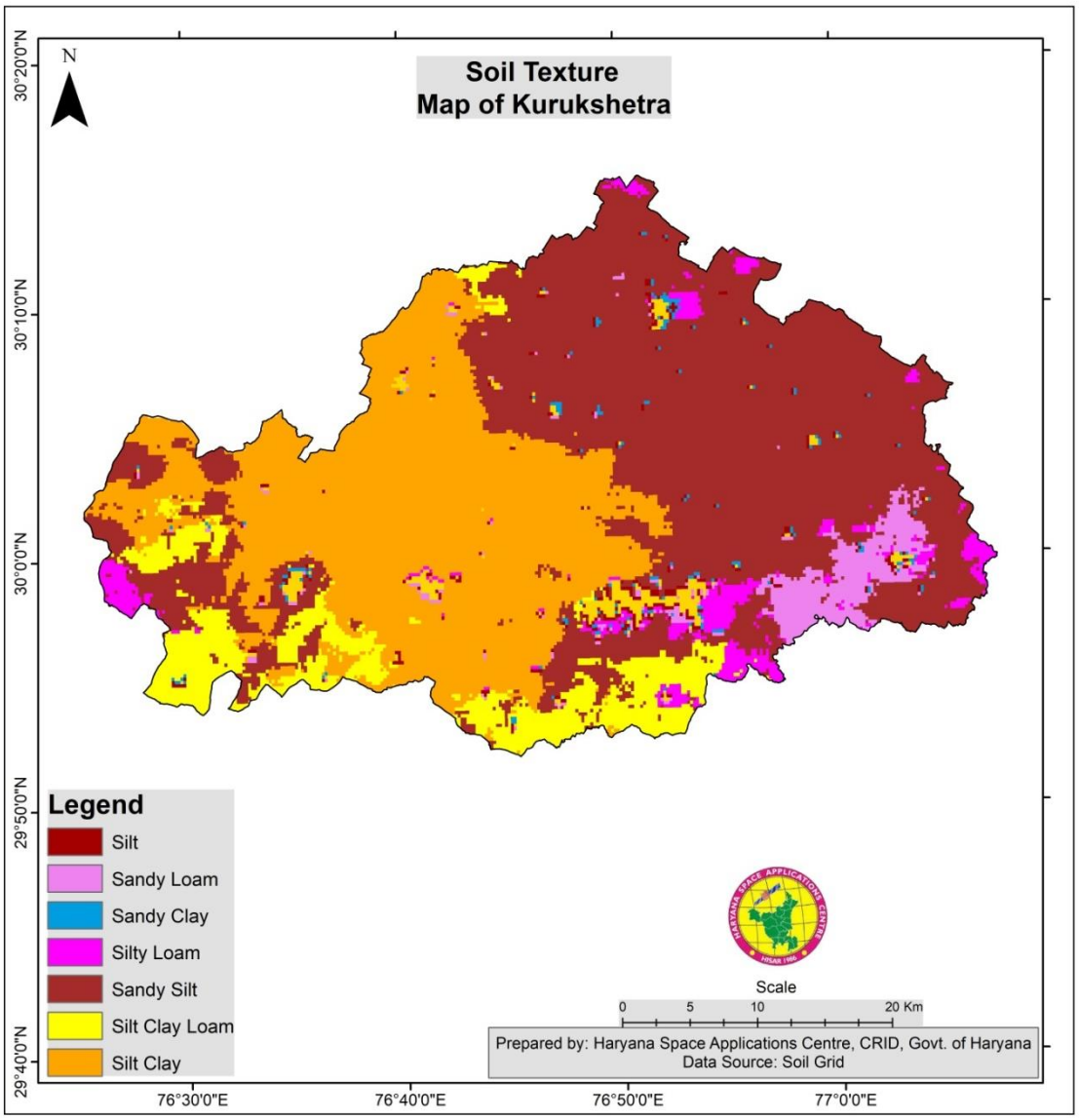


Figure 7 Soil Texture Map of Kurukshetra District

1.6 Landuse

Main land use in the district is for agriculture with 90% of the land being used for agriculture. So land use under agriculture is 137811.40 thousand hactares, under forest is 8810.92 thousand hactares, under built up is 20456.40 thousand hactares, under waste land is 345.16 and under water bodies is 1006.40 thousand hactares. The land use land cover map of Kurukshetra district is shown in **Figure 8**.

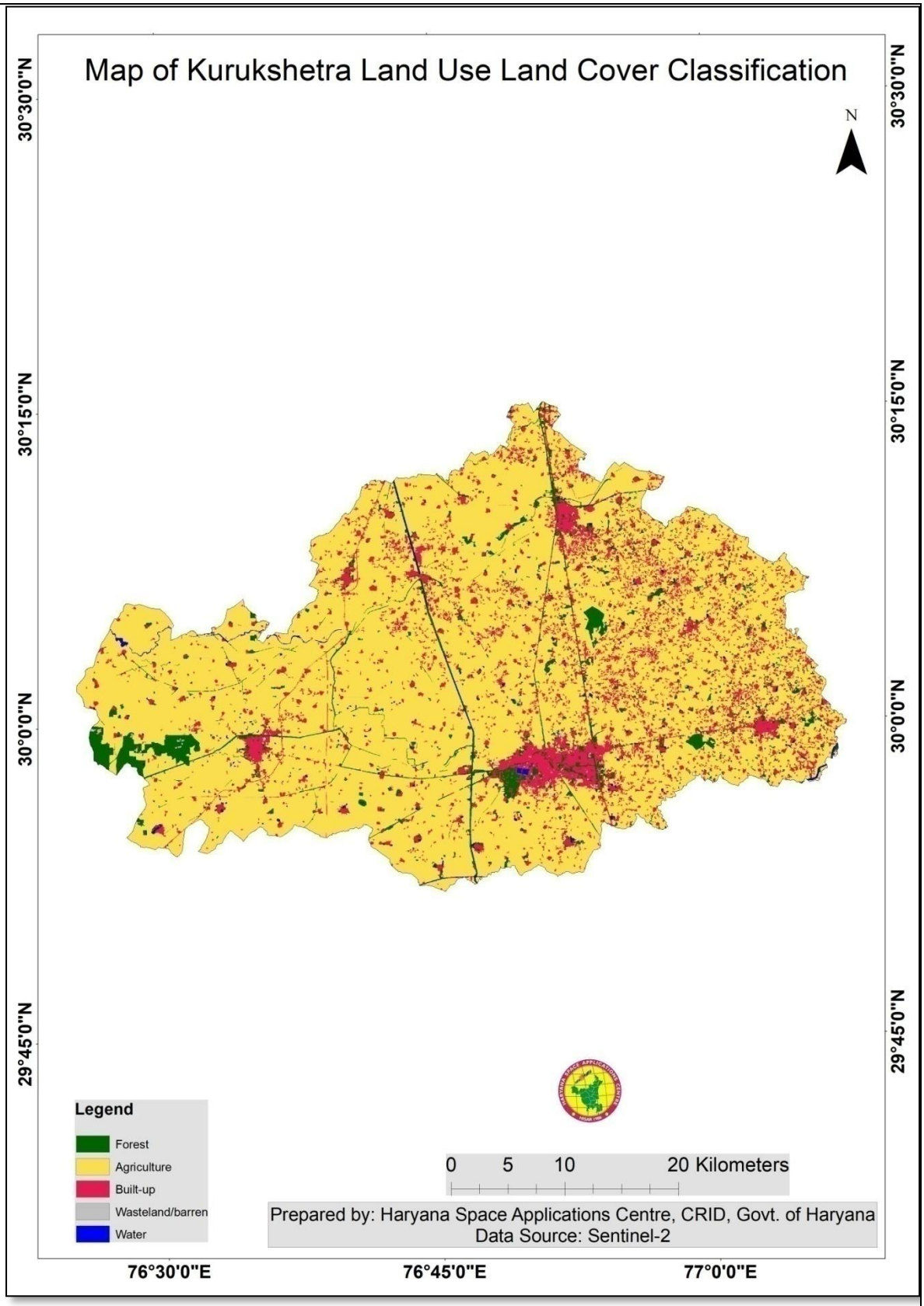


Figure 8 Land use land cover Classification Map of Kurukshetra District

2 District Water Profile

2.1 Source of Water

The area falls in the Upper Yamuna and Ghaggar Basins. The district is occupied by geological formations of Quaternary age comprising of Recent alluvial deposits belong to the vast Indus alluvial plains. Ground water at shallow depth occurs under unconfined and semi confined condition and under confined conditions in deeper aquifers.

2.1.1 Rivers

The Saraswati.- River Saraswati has been referred to as river par excellence and occurs most frequently in the Rigveda. It seems to have been the holy stream of the Vedic age.It is possible that it was as large as the Sutlej in the Vedic age, and actually reached the sea, as the Rigveda describes it as going down to the ocean. On the holy banks of Saraswati were kindled sacred fires, and vedic hymns composed and recited. It played a dominant role in the growth of the culture and civilization in ancient India. The archaeological explorations of the Saraswati-Ghaggar-Hakra bed further prove the Vedic and epic tradition that the Saraswati was once a mighty river with a continuous and perennial flow down to the Arabian Sea. The river seems to have dried up because of serious seismic disturbances towards the close of the Vedic period. The present Saraswati which enters the district from Yamunanagar district is a mere shadow of its former self through most of its course in the district has no defined bed. The Saraswati and its numerous small tributaries drain a large part of the Thanesar tehsil and overspill their waters in the low-lying Naili circle though their floods rarely extend to any distance. It outfalls into Bibipur lake, wherefrom through Saraswati drain, it joins Para, atributary of the Ghaggar.

The Markanda- It is a seasonal stream and originates in the lower Shiwalik hills, it enters the district near Damli in Thanesar tehsil and passes near Shahabad. It has width ranging from 15 to 40 metres. After flowing in the south-westerly direction for about 48 kilometres, it joins Ghaggar. When in spate during the rainy season, it poses a serious threat to villages along its banks and causes considerable damage to standing crops. Chautang and Rakshi are other Seasonal streams which pass through the district.

Lake: Bibipur lake is an important lake of the district. The lake has been created as a result of 12 kilometres long Thanesar Bund designed to protect certain villages from the floods of the Saraswati River. It is filled up during the rainy season. It has a maximum capacity of 12.3 million cubic metres of water. The accumulated water is later released into the Saraswati canal.

2.1.2 Canals

Sutlej Yamuna Link (SYL) Canal as it is popularly known canal in India to connect the Sutlej and Yamuna rivers passes through kurukshetra. Narwana branch is a part of main Bhakra canal and passes from Kurukshetra. This is the life line of Haryana. These canals are main source of fresh water for the district, mainly used in agriculture for irrigation. Due to Himalayan water availability for irrigation this district is rich and major source of production of Basmati Rice. Canals and total water bodies of Kurukshetra district is shown in **Figure 9**.

2.1.3 Ponds

A **pond** is a body of standing water, either natural or man-made, that is usually smaller than a lake (**Figure 9**). 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. Small sized, man-made, perennial and primarily rain-fed ponds occur widely in the rural landscape of Kurukshetra. These wetlands provide suitable habitats and food resources for a wide variety of resident and migratory wetland birds. In Kurukshetra district total 932 ponds/waterbodies found on satellite data. The map of total ponds/waterbodies that include ponds, canals are shown in **Figure 9.**

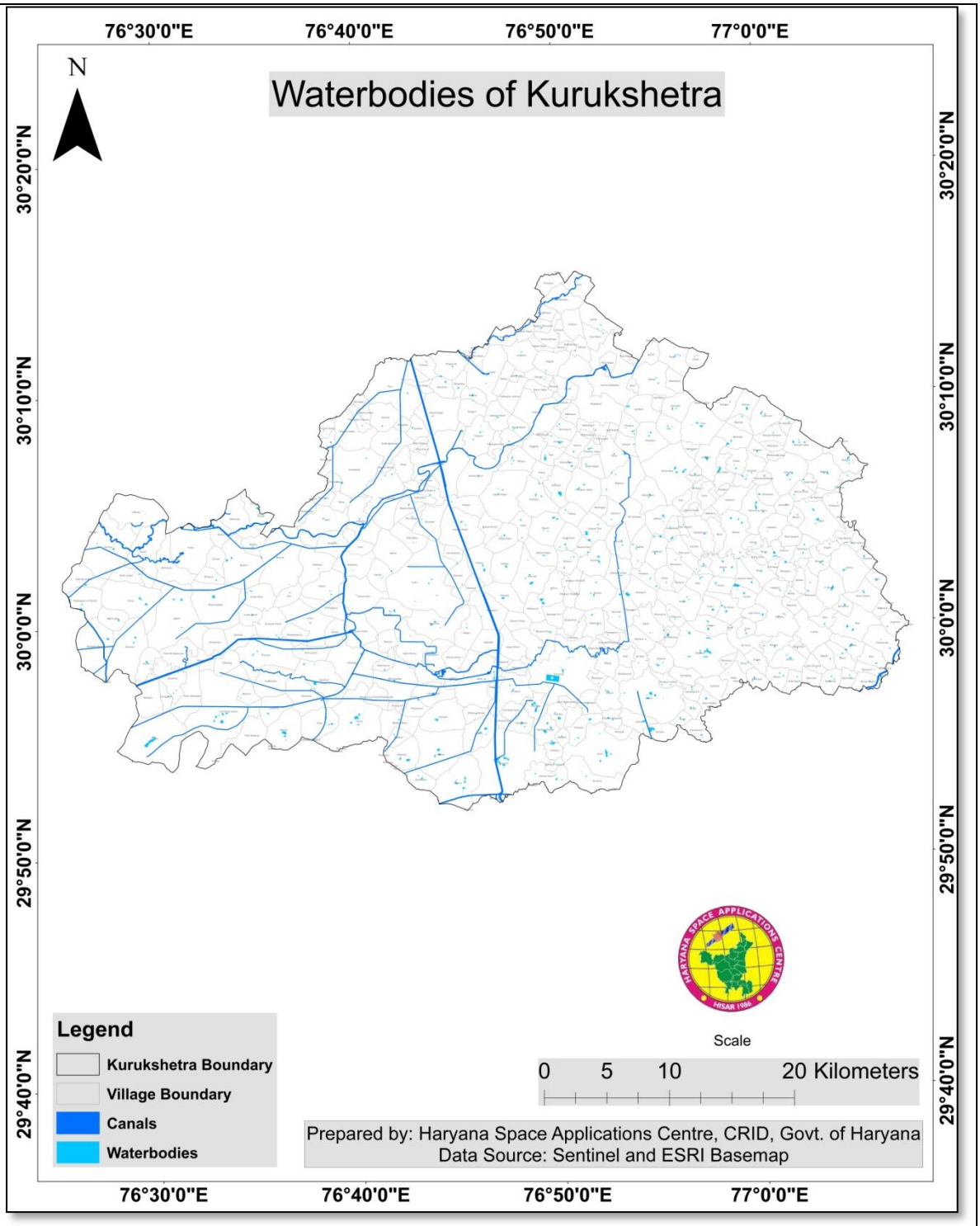


Figure 9 Waterbodies of Kurukshetra District

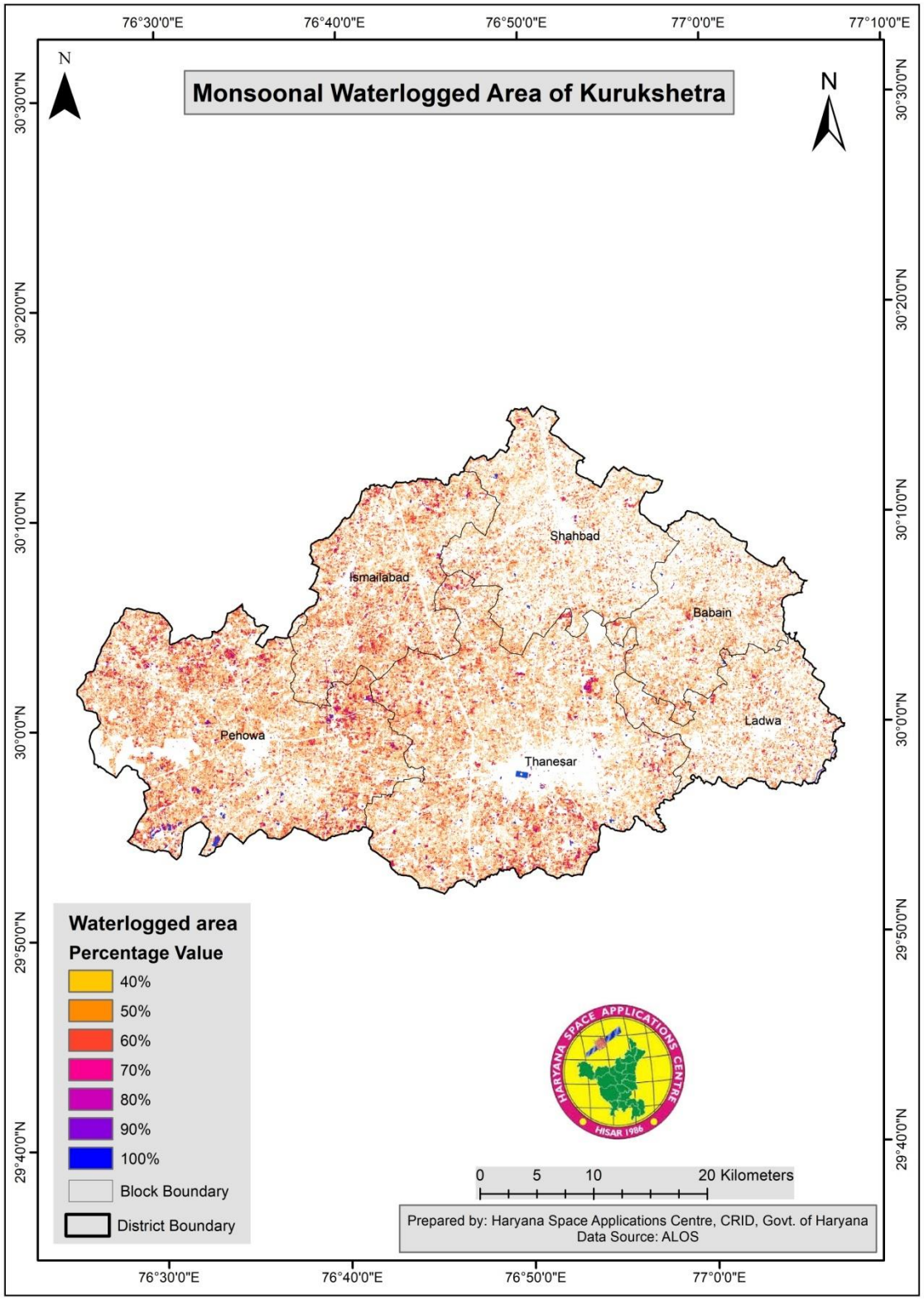


Figure 10 Water Persistence's of Kurukshetra District

2.1.4 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 waterbody. 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 Kurukshetra District is shown in **Figure 11.**The statistics of length of drainages under each order are shown in **Table 4**.

Table 2 Drainage order and total length of the drains in Kurukshetra district

Sr. No.	Order of Drainage	Total Length (in meter)
1	1st Order	1597000
2	2nd Order	885981.1
3	3rd Order	457874.7
4	4th Order	206248.2
5	5th Order	98608
6	6th Order	91601.55
7	7th Order	26894.64

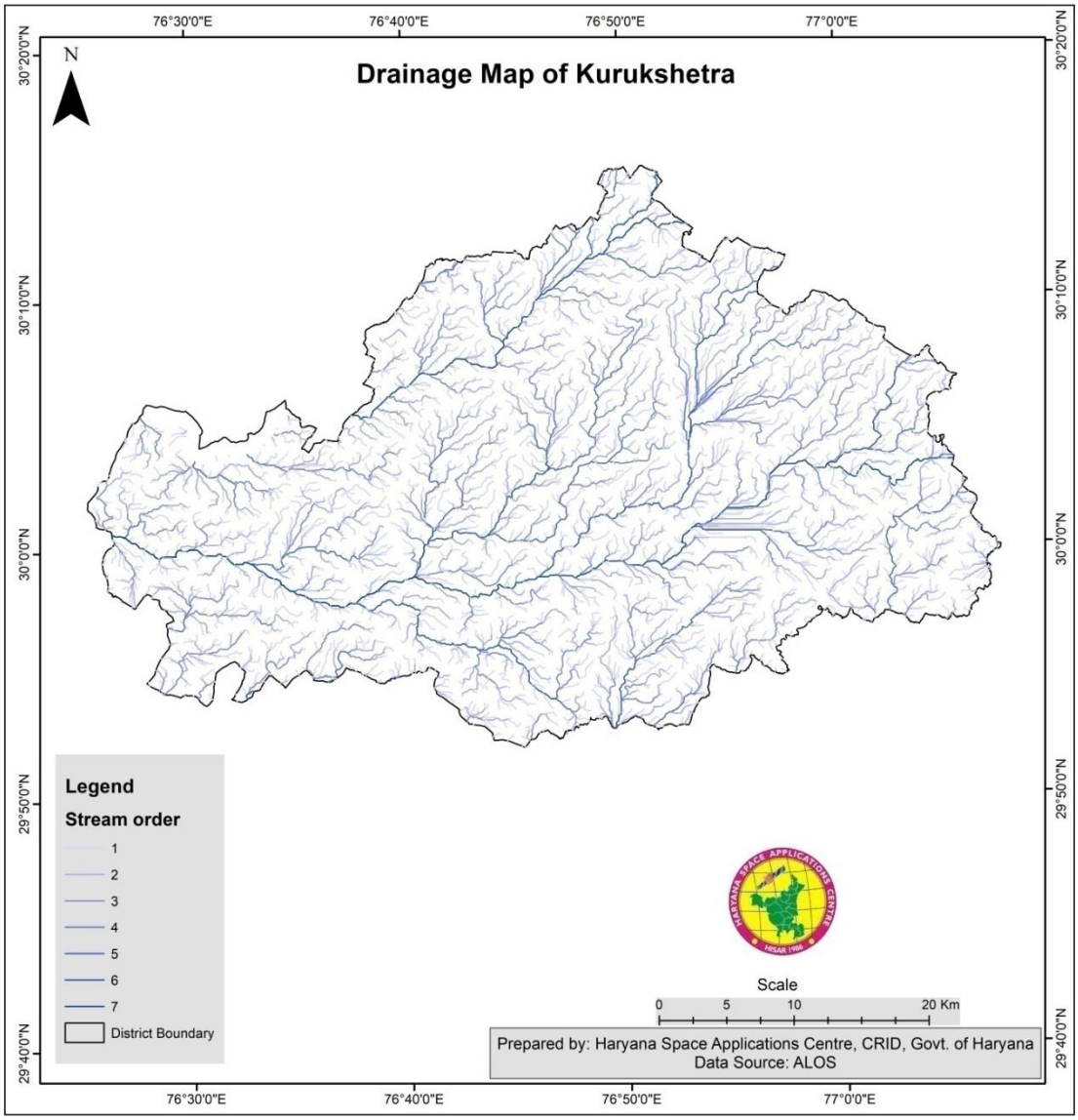


Figure 11 Drainage map of Kurukshetra District

2.2 Water Harvesting System

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge. Water harvesting profile of Kurukshetra district is shown as followed:

2.2.1 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 3 Water Harvesting Structures in Kurukshetra District

S.NO.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam		0	
2	Pond / Tank		3	
3	Trench	3	0	
4	Rooftop Water Harvesting Structure (Public)	675	0	
5	Rooftop Water Harvesting Structure (Private)	54		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for openwell recharge)		0	
7	Other Water Conservation Structures (Bench Terracing, Canal)		3	
Total			**6**	**114**

Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	224	96	
Total		**224**	**96**	**326**
Reuse and Recharge Structures				
1	Soak Pit	2576	119	
2	Stabilization Pond	1	1	
3	Other Reuse / Recharge Structure	809	5	
Total		**3386**	**125**	**6**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank		0	
3	Staggered Trenches	0	0	
4	Other Watershed Construction Activities	33	61	
Total			**61**	**109**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	0	1	
2	Intensive Afforestation- Plantation		13	
Total			**14**	**13**
Awareness Programs by KVK				
1	Farmers training programs by KVKs on Water Use Efficiency and Appropriate Crops	1967		
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	54		
Total		**2021**		
Waste Water Treatment				
1	Use of Treated Waste Water	0		
Total		**0**		

2.2.2 WHS other than roof top

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 Kurukshetra District for rain water harvesting is shown in **Table 4** at rural and urban area. The map of water conservation activity in Kurukshetra at rural and urban level is shown in **Figure 12**.

Table 4 Water Harvesting activities in Rural area and Urban Area

Sr. No	Block Name	Total No of Activity (no.)
1	Babain	261
2	Ismailabad	485
3	Ladwa	271
4	Pehowa	541
5	Shahbad	592
6	Thanesar	770
In Urban Area		
1	Kurukshetra	31

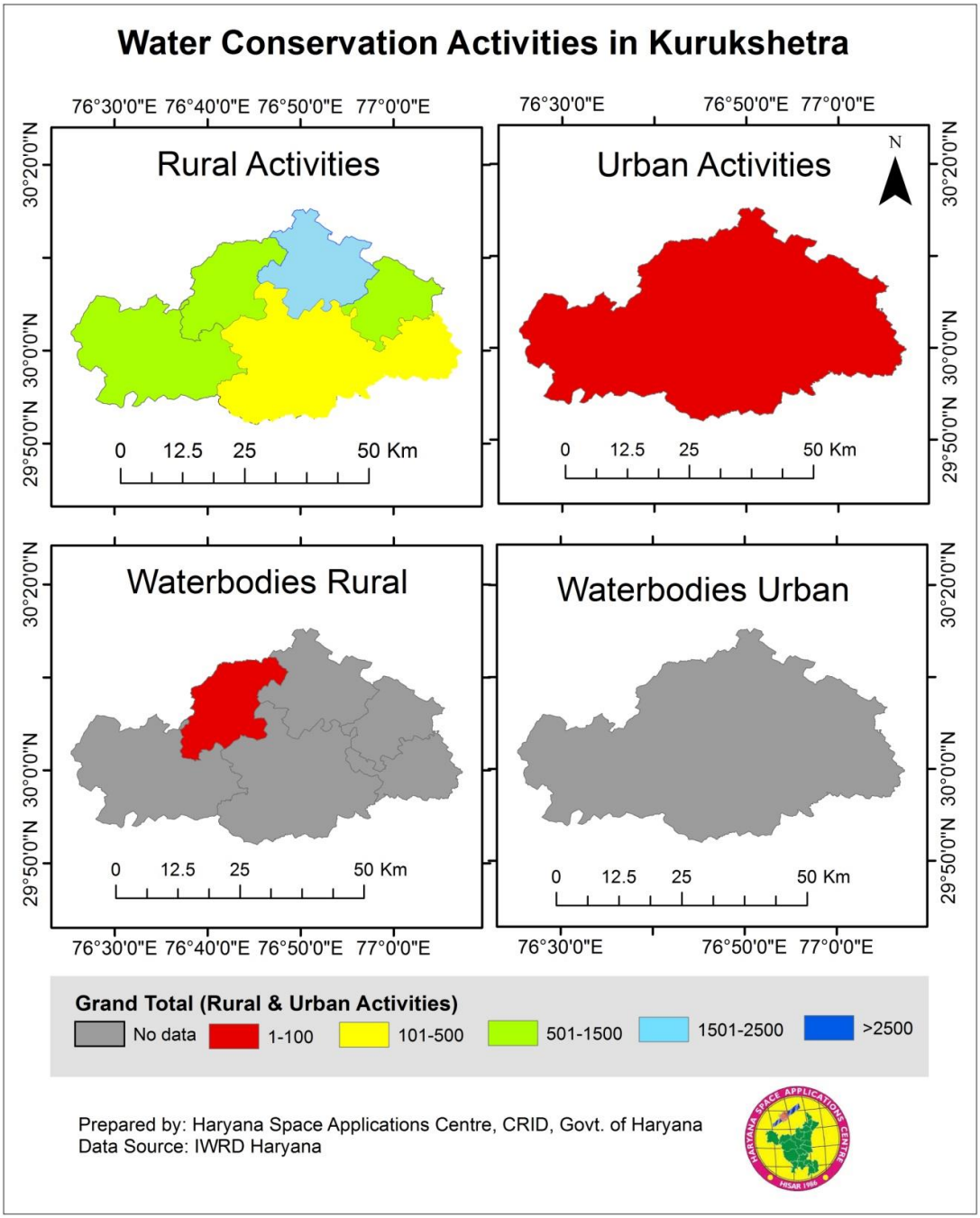


Figure 12 Water Conservation Activities Map of Kurukshetra District

2.2.3 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 No 13**. In Kurukshetra District total of 3

treatment plant are installed having total capacity of aprox 25-30 MLD mainly installed in Pehowa, Ladwa and Sahbad blocks.

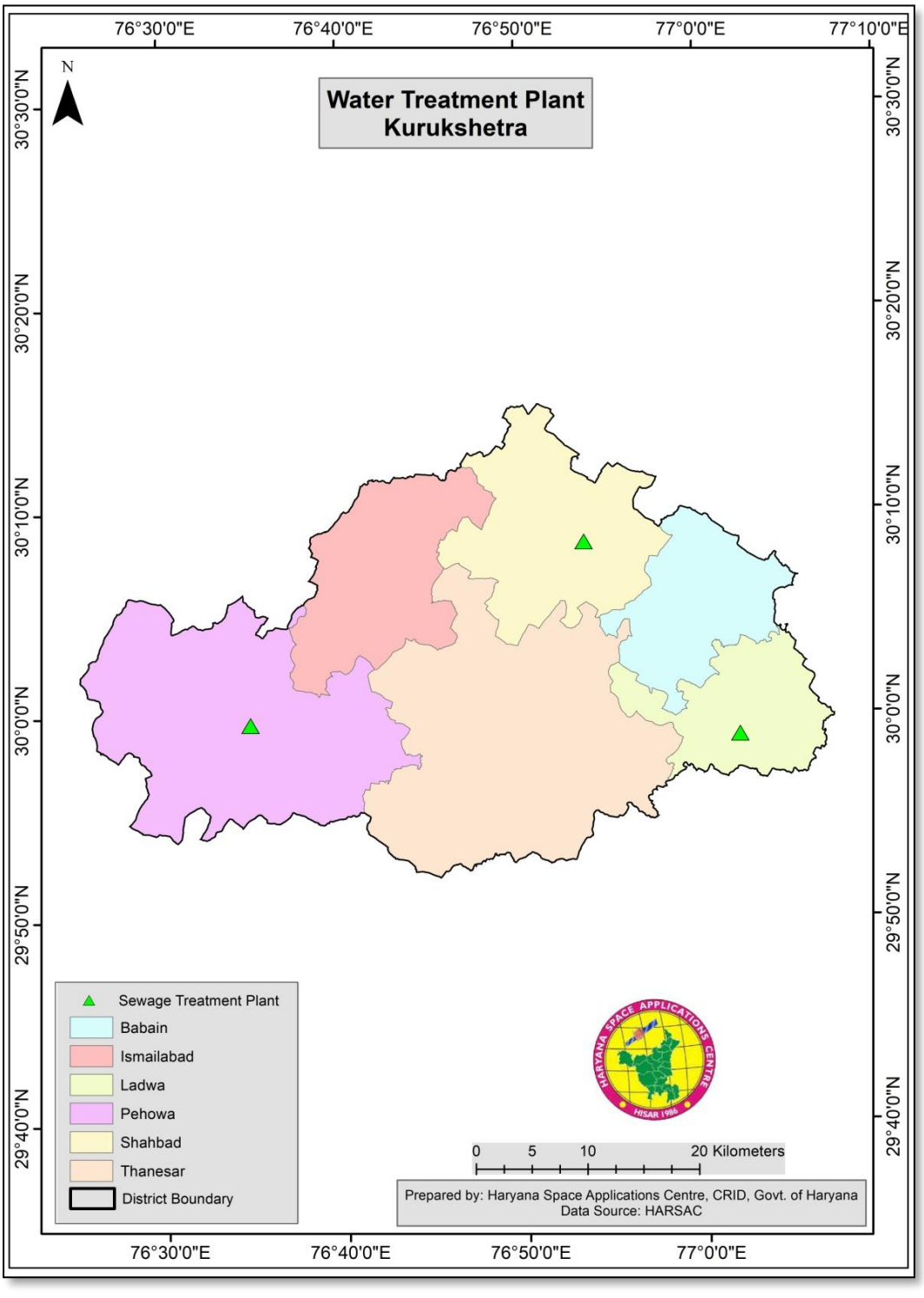


Figure 13 Water Treatment Plant of Kurukshetra District

3 Irrigation Profile

3.1 Area wise, crop wise irrigation status

In Kharif, Rabi and summer season the irrigation of crop is done by tubewells. Other sources like the sprinkler, rain-fed etc are not used by the farmers however the canal water facilities are very nominal in the district. The gross cropped area is 100% irrigated. The whole irrigation is done by tube-wells which are on the cost of ground water. Present status of irrigation sources is given as under (**Table 5**):-

Table 5 Block wise area calculation of corp under irrigation

Crop Type		Kharif (Acre in ha)			Rabi (Acre in ha)			Summer crop (Acre in ha)			Total (Acre in ha)		
		Irrigated	Rain fed	Total	Irrigated	Rain fed	Total	Irrigated	Rain fed	Total	Irrigated	Rain fed	Total
1.	Thanesar	40570	0	40570	37200	0	37200	2540	0	2540	80310	0	80310
2.	Pehowa	40640	0	40640	38775	0	38775	920	0	920	80335	0	80335
3.	Shahabad	31780	0	31780	24470	0	24470	4600	0	4600	60850	0	60850
4.	Ladwa	14600	0	14600	12350	0	12350	820	0	820	27770	0	27770
5.	Babain	11630	0	0	8940	0	0	1200	0	0	21770	0	21770
	Total	139220	0	127590	121735	0	112795	10080	0	8880	271035	0	271035

Source: Deputy Director, Agriculture/

More irrigation methods need to be promoted in the district to save the ground water. Further it is required that Canal Water to be made available for irrigation:-

3.2 Production and Productivity of major crops

The production and productivity of major crops of the district is given in table below. The production of Paddy crop is 709 lakh MT and productivity of Paddy crop is approximately 5869 kg per hectare and average yield of Wheat crop is 5154 kg per hectare and the production of the Wheat is approximately 618 lakh MT.

3.3 Existing Type of Irrigation

The district Kurukshetra has 166872 hectare out of which about 147210 is cultivable area and same is one cultivated area. The land of whole district is leveled and 100% irrigated. The irrigation of whole district crops is covered by tube-wells. In the district about 37418 tube-wells are in working that is why the ground water is depleting drastically. About 6000 hectare area of the district has an

additional facility of canal water, so the irrigation of whole district depend upon ground water and rainfall.

4 Water Availability

4.1 Surface Water Availability

District Kurukshetra comprises a part of the sweet-water belt of Haryana state. The groundwater occurs here in the zone of saturation in the alluvium of the Indo-Genetic Plain. Being main source of alluses including irrigation, the groundwater resource in the district is under immense pressure in the absence of any perennial source of surface water and scanty rains in recent years.

Agriculture is the main occupation of the people in the district and irrigation requirement is fulfilled by extracting groundwater through a large number of tube wells by the farmers in the absence of sufficient canal water availability. But due to all these activities, the balance between the groundwater extraction (Draft) and its replenishment (Recharge) has been affected adversely giving rise to the "Over-Exploitation" of this precious natural resource as can be seen from **Table 6.** The block wise figures of existing groundwater availability as per latest Ground Water Assessment released by the Central Ground Water Board (CGWB), Govt. of India.

Table 6 Surface water availability in Kurukshetra District

Sr. No	Source.	Kharif (BCM/Hect)	Rabi (BCM/Hect)	Summer	Total (BCM/Hect)
1	Surface Irrigation				
(i)	Canal (Major & Medium Irrigation)	$47*10^{-7}$	$28*10^{-7}$		$75*10^{-7}$
(ii)	Minor Irrigation Tanks				
(iii)	Lift Irrigation/Diversion	$12*10^{-7}$	$10*10^{-7}$		$22*10^{-7}$
iv)	Various Water Bodies including Rain Water Harvesting				
(v)	Treated Effluent Received From STP				
	Untreated Effluent				

	Perennial Sources of Water				
2	Ground Water				
(i)	Open Well	-	-	-	-
(ii)	Deep Tube Well	-	-	-	-
(iii)	Medium Tube well	-	-	-	-
iv)	Shallow Tube-wells	0.19126	0.233377	-	-0.42503

Source: Deputy Director, Agriculture/Asstt. Geologist and XEN, Irrigation Department, Kurukshetra

4.2 Ground Water Availability

The Govt. of India has also notified three blocks namely, Shahabad, Pehowa and Ladwa and thus imposed regulations on the groundwater development in these blocks. As a result, no new tube well is allowed in these blocks for any use also for any industrial & infrastructure projects in other blocks too.

It may be concluded that there is further no scope of availability of groundwater in the district for future irrigation requirement. The ground water availability in Kurukshetra district is shown in **Table 7.**

Table 7 Ground water availability in Kurukshetra district

Sr. No.	Name of Assessment Unit	Areal extent (ha)		Average Pre-monsoon Water Level (m bgl)	Depth to bottom of Un confine Aquifer Group I (m bgl)	Total Thickness of formation below Pre-monsoon Water Level (m) (9-8)	Thickness of Granular Zone in un confined Aquifer Group-I below Pre-monsoon WL (m)	Average Specific Yield	In- Storage Ground Water Resources [(4)* (8) * (9)] (ham)
		Total Geographical Area	Fresh Water						
1	2	3	4	5	6	7	8	9	10
1	Babain	16784	16784	34.34	148	113.66	65	0.072	78549
2	Ladwa	16230	16230	32.55	149	116.45	63	0.072	73619
3	Pehowa	50700	50700	31.55	150	118.45	64	0.072	200674
4	Shahabad	37712	37712	33.02	123.5	90.48	42	0.072	84757

5	Thanesar	46827	46827	32.0	160.34	128.34	92	0.072	276506
	Dist. Total (ham)	**168253**	**168253**						**714104**
	Dist. Total (mcm)								**714.1**

Source: Deputy Director, Agriculture/Asstt. Geologist

4.2.1 Ground Water Depth

Depth to water level in the district ranges from 20.64m to 55.90m bgl during the pre- monsoon period (June 2020) and 20.15m to 55.98m bgl during post -monsoon period (Oct.2020) 2020.The depth to water level map indicates that in major parts of the district water level rest more than 30 bgl and spread in Shahbad, Babain ,Pehowa ,Thanesar, Ismailabad, Pipli block and parts of Ladwa block. The shallow water level in depthrange of 20 to 25 m bgl spreads in southern and eastern parts of the district covering Ladwa block. It has been observed that during post monsoon period the area between 20m to 25 m bgl gets reduced and area under more than 30m bgl gets spread indicating stress on ground water to meet out the agriculture demand not only during monsoon season but also in non monsoon period .Long term net change of water level during the period 2010-2020 indicates a general decline (negative change) in the entire district and it range between 1.25m/year to 1.37 m/year. The maximum rate of decline has been observed in piezometer at Ladwa. It is pertinent to mention that the rate of in general has been worked out to be more than 1.0 m/year .Elevation of the water table in the district varies from 198.08m to 241.56m above mean sea level .Average gradient of the water table is of the order of 0.84m /km. Overall flow of ground water is towards South –West direction.

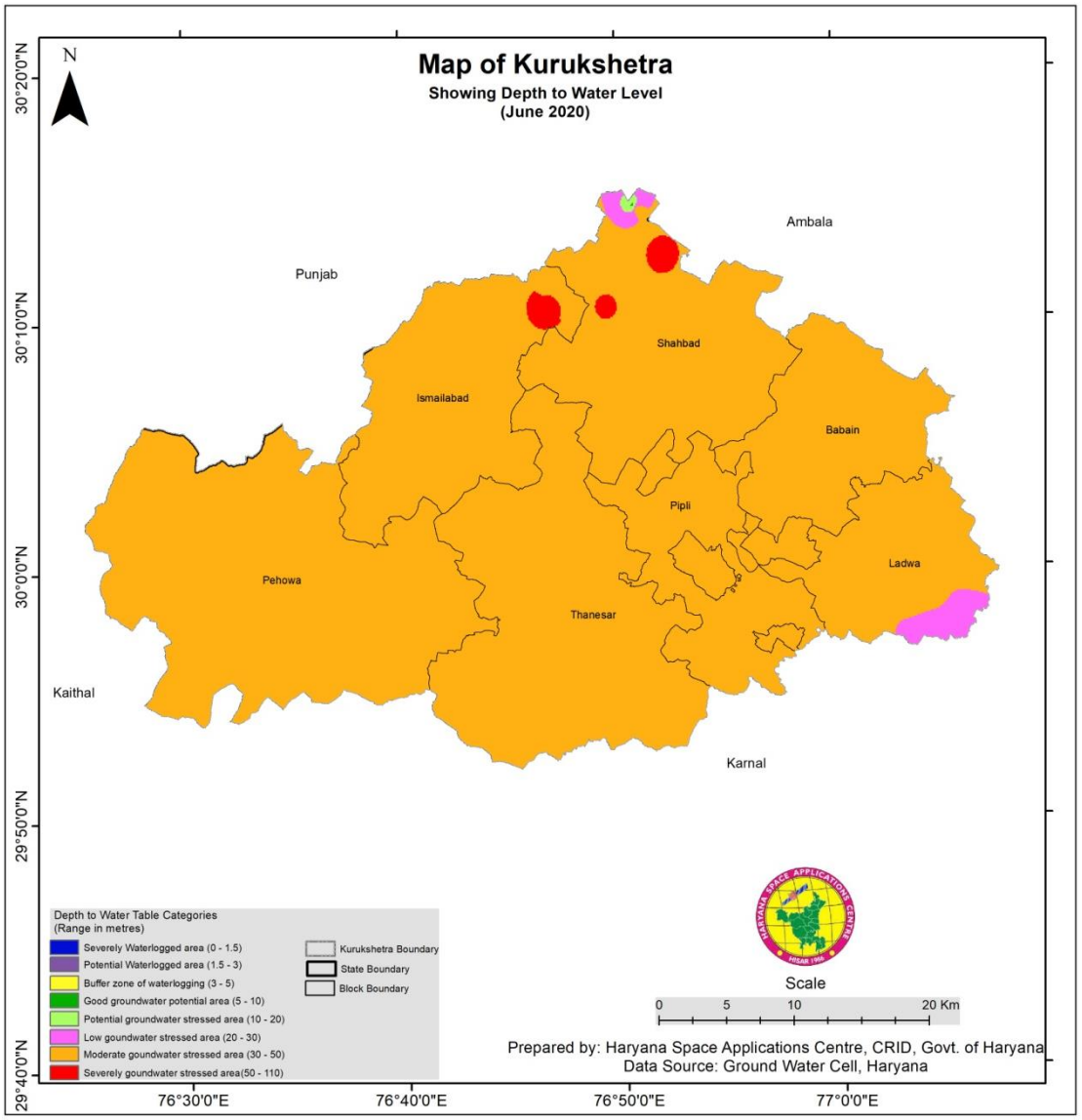


Figure 14 Ground water Depth of Kurukshetra District

The sediments of the district represent a continous saga of deposits of the vast indo gangetic alluvial plain and are composed mainly of clay, clay with kankar, sandy to silty clay, fine to coarse sand and sand with kankar. Fine to coarse sand comprise generally the potential aquifer ,which are tapped by the shallow tube wells in the area .The shallow tubewells yield generally 1893to 5092 lpm for a draw-down of 5.6 to 18.9m . The ground water occur under the water table conditions .The depth to water in district varies from 7.76 to 55.90 m bgl. In general the depth to water table varies between 30 to 50 m depth zone. Water table is on declining trend with an average annual rate of 0.80m since June 1974. The ground water movement is generally from North – East to South –West.

The ground water resource is over exploited and all the seven blocks fall in "dark" category, implying that there is no further scope of its development in the district.

4.2.2 Ground Water Quality

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers. Ground water quality index determines the purity of water. Higher the values on index represent the more turbid water which cannot be used for drinking purpose. In contrast to that lower values on quality index represent the purity of water and are suitable for drinking purpose. According to (http://www.sarasota.wateratlas.usf.edu/library/learn-more/learnmore.aspx?toolsection=lm_wqi) water quality range from 0-45 is good, 45-60 is fair and >60 is very poor quality of water. So, based on that Kurukshetra district's water quality vary from good to poor shown in **Figure15**. Block wise average water quality index value is shown in following T**able 8.**

Table 8 Block wise average water quality index value in Kurukshetra District

Sr. No	Block Name	Average
1	Babain	52.65
2	Ismailabad	71.91
3	Ladwa	52.61
4	Pehowa	67.84
5	Shahbad	57.88
6	Thanesar	61.29

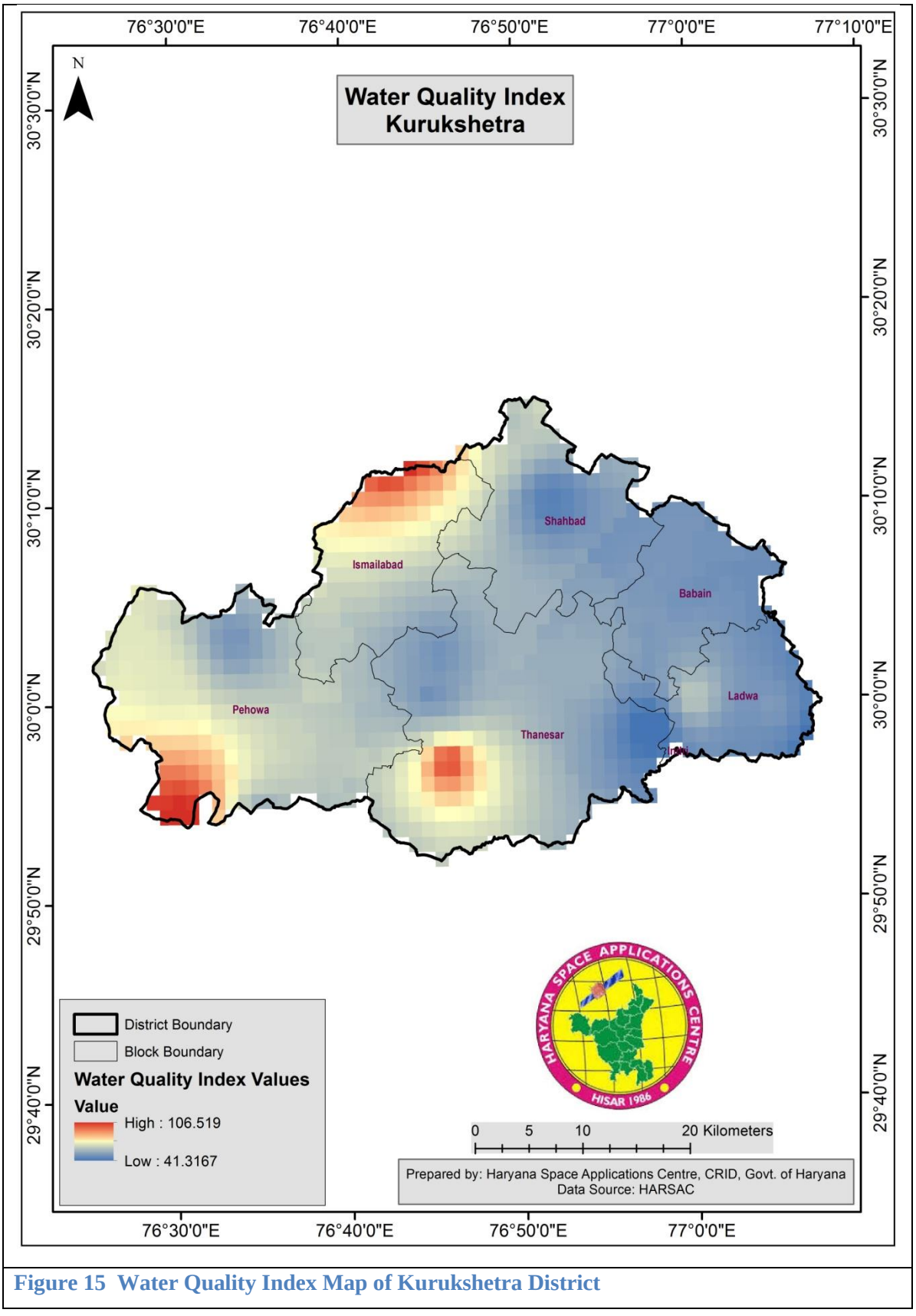


Figure 15 Water Quality Index Map of Kurukshetra District

5 Water Requirement/ Demand

5.1 Domestic water demand

The entire drinking water supply to all rural as well as urban parts of the district is based on ground water only due to the fresh and potable quality of ground water. The tube wells installed by Public Health Department, Haryana for drinking water supply are generally between 80 to 150m deep. The block-wise detail is given as under in **Table 9.**

Table 9 Domestic Water Requirement (MCM)

Block	Population	Existing Population in 2016	Present Water Requirement	Projected Population in 2022	Annual Water Requirement in 2022
Ladwa	88097	96907	0.0053	107478	2.16
Pehowa	159668	175635	0.0097	194795	3.91
Shahabad	154040	169444	0.0093	187929	3.77
Thanesar	221448	243593	0.0134	270167	5.42
Ismailabad	1110093	1221102	0.0672	1354313	27.19
Babain	62177	68395	0.0038	75856	1.52
Total	**1,795523**	**1975075**		**2190538**	

Source: XEN Public Health, Kurukshetra

5.2 Crop Water Demand

As table given below shows that water requirement for irrigation the gross cropped area i.e. 271765 hectare and the water requirement is about 2.53 Billion Cubic Meter (BCM). The block wise demand of district is also given in the table. As agriculture department is emphasizing save the ground water that is why different water saving techniques is being implemented in the district. Direct seeded rice techniques are water saving technique in which paddy is sown like wheat crop and huge quantity of water is saved. Underground pipe line (micro irrigation) is also promoting in the district to save the ground water. Mechanization in agriculture is also promoting to save the ground water. Emphasizing is also given on lazar leveling to save the water and increase the productivity. If field is lazar leveled then less water in required for crops. Summer paddy was banned in the district to save the ground water. So the in 2020 the water consumption in agriculture will be reduced upto 15% i.e. it will be approximately 2.15 BCM (**Table 10**).

Table 10 Blockwise water demand for irrigation of crops

Block	Area sown (ha)	Irrigated acre (ha)	Crop water demand (BCM)	Water requirement in 2020	Water potential required (BCM)	Existing water potential (BCM)	Water potential to be created (BCM)
Thanesar	80140	100%	0.74544	0.63362	-	-	-
Babain	21770	100%	0.19823	0.16849	-	-	-
Ladwa	28670	100%	0.25957	0.22063	-	-	-
Shahabad	60850	100%	0.57054	0.48495	-	-	-
Pehowa	80335	100%	0.75885	0.64502	-	-	-
G.Total	271765	100%	2.53263	2.15271	-	-	-

Source: Deputy Director Agriculture, Kurukshetra

5.3 Crop Water Requirement for Horticulture

Kurukshetra District is major producer of vegetables, Flower crops, Fruits and tree plantation. So water demand is very necessary for these types of crops. Water demand for horticultural crops is shown in **Table 11**.

Table 11 Block wise water demand for irrigation of crops

Block	Crops	Area shown (ha.)	Irrigated area (ha.)	Crop water demand (mm) in 2020	Water potential required (BCM)	Exciting water potential (BCM)	Water potential to be created (BCM)
Ladwa	Vegetable, Flower & Fruits	8107	8107	24 lac Ltr.	40000 ltr. Per ha./ Per month	-	-
Shahbad	Vegetable, Flower & Fruits	4567	4567	24 lac Ltr.	40000 ltr. Per ha./ Per month	-	-
Pehowa	Vegetable, Flower & Fruits	6809	6809	24 lac Ltr.	40000 ltr. Per ha./ Per month	-	-

Thanesar	Vegetable, Flower & Fruits	6471	6471	24 lac Ltr.	40000 ltr. Per ha./ Per month	-	-

Source: District Horticulture Officer, Kurukshetra

5.4 Live Stock Water Demand

The expected demand of water has been calculated by the Animal Husbandry Department. The Projection of demand of water is given as under in **Table 12.**

Table 12 Livestock Water Requirement (MCM)

Livestock Water Requirement (MCM)					
Block	**Total number of livestock**	**Present water demand**	**Water Demand in(2022)**	**Existing Water Potential**	**Water Potential to be created**
Ladwa	25978	2355482	2355482	Public Tubewell	Public Tubewell
Pehowa	66348	5876584	5876584	Public Tubewell	Public Tubewell
Shahabad	41633	3895211	3895211	Public Tubewell	Public Tubewell
Thanesar	57502	5132982	5132982	Public Tubewell	Public Tubewell
Ismailabad	23794	2106924	2106924	Public Tubewell	Public Tubewell
Babain	22376	2090064	2090064	Public Tubewell	Public Tubewell
Pipli	29668	2609050	2609050	Public Tubewell	Public Tubewell
Total	**267299**	**24066297**	**24066297**		

Source: Deputy Director (ICDP), Kurukshetra

5.5 Industrial Water Demand

There is no major industry in the district. Being the agro based economy of the district, there are only rice shellers, cold storages in the district in the name of industry. However, the demand of water in industry cannot be ignored.

5.6 Water Demand for Power Generation

As there is not any thermal or hydro-electrical plant in the district, hence the water demand in power generation is Nil.

5.7 Total water demand of the district for various sectors

The table no. 13 shows the blockwise water quantity required for the current year i.e. 2.53 BCM and it also shows that the water demand upto 2022 will reduce upto 15% i.e. 2.15 BCM. It is pointed out that the water need in 2022 will be 2.15 BCM (Estimated) due to the initiative taken by theAgriculture department (**Table 13**).

.

Table 13 Blockwise Total demand of water in various sector in Kurukshetra District

Sr. No	Block	Components					Total, BCM
		Domestic (BCM)	Crop (BCM)	Livestock (BCM)	Industrial (BCM)	Power generation (BCM)	
1	**Thanesar**	0.01555	0.74544	0.00401	0.00005	0	0.76506
2	**Pehowa**	0.00601	0.75885	0.00333	0.00145	0	0.76963
3	**Shahabad**	0.00583	0.57054	0.00365	0.00013	0	0.58015
4	**Ismailabad**	0.00262			0.00000	0	0.00262
5	**Ladwa**	0.00411	0.25957	0.00168	0.00001	0	0.26536
6	**Babain**	0.00147	0.19823	0.00112	0.000002	0	0.20082
Total		**0.03559**	**2.53263**	**0.01378**	**0.00164**	**0**	**2.58364**

5.8 Water Supply and Gap

Kurukshetra in Haryana has become the 27th Har Ghar Jal district of the country to ensure tap water supply to every rural home under the Jal Jeevan Mission, an initiative of the Jal Shakti Ministry. Around 27 districts, 458 Blocks, 34,994 Panchayats and 65,627 villages have achieved ‘Har Ghar Jal’, which means every family living in these rural areas is getting assured tap water supply in their homes and ‘no one is left behind’.

According to an official statement, Jal Jeevan Mission has been under implementation since August, 2019, in partnership with the state governments with an aim to provide potable water in adequate quantity and of prescribed quality on regular and long-term basis across the country. In addition to this, a '100-Day Campaign' was launched on October 2, 2020, to provide piped water supply to every school, Anganwadi Centre (AWC) and ashramshala and residential schools for children from tribal communities, the Ministry of Jal Shakti said in a statement.

6 Strategies for Water Conservation

The ground water availability in Kurukshetra is limited and presently being over exploited results in decline of ground water levels. The Kurukshetra town is situated in semi-arid area and rain is the main source of recharge to ground water. Due to heavy urbanization and industrialization, most of the storm runoff goes to the sewer or storm drains and reduces the recharge contribution from rainfall. The over exploitation of this vital resource along with the ground water pollution may lead to adverse environmental impact. Thus there is an urgent need for protection of this vital resource by adopting the following measures. The water conservation action plan and blockwise targets under Jal Shakti Abhiyan is shown in **Table 14**.

Table 14 Strategic Action Plan District & Blockwise Targets under Jal Shakti Abhiyan Kurukshetra 2021

Sr.No.	Name of Task	Department	Target
1	Water Conservation and rainwater harvesting	Irrigation & Water Services	3
		Rural Dev& Panchayat	
		Soak Pit (BDPOs)	
		BDPO Thanesar	500
		BDPO Pehowa	500
		BDPO Ladwa	450
		BDPO Pipli	400
		BDPO Ismailabad	400
		BDPO Shahabad	600
		BDPO Babain	400
			3200
		RWHS ZP/XEN PR	17

		RWHS in Anganwari Centres (ICDS/XEN PR)	532
		Agriculture (ASCO)	155
		PWD B&R -1	NIL
		PWD B&R –II	18
		Public Health Department	NIL
		(MCs) Total	116
		MC Thanesar	90
		MC Ladwa	3
		MC Shahabad	7
		MC Pehowa	14
		MC Ismailabad	2
		HSVP (Private Buildings)	21
		DTP (Private Buildings)	16
		Forest Department	
2	Renovation of Traditional and other bodies	ation & Water Services	1
		l Dev & Panchayat NREGA/BDPOs	200
		BDPO Thanesar	35
		BDPO Pehowa	30
		BDPO Ladwa	25
		BDPO Pipli	25
		BDPO Ismailabad	25
		BDPO Shahabad	35
		BDPO Babain	25
		Public health Department	NIL
3	Reuse, borewell recharge structures	Irrigation & Water Services (Water Recharge Shafts)	590
4	Watershed Development	Agriculture DDA	0
		Forest – DFO	0

5	Intensive Afforstration (Number of plants)	Forest Department	1.75 lac
		Development & Panchayats (BDPOs)	2.25 lac
		Total Plantation	4.00 lac
6	Krishi Vigyan Kendera (KVK) Melas	Agriculture Department (DDA/KVK) Kissan Gosthi	1990

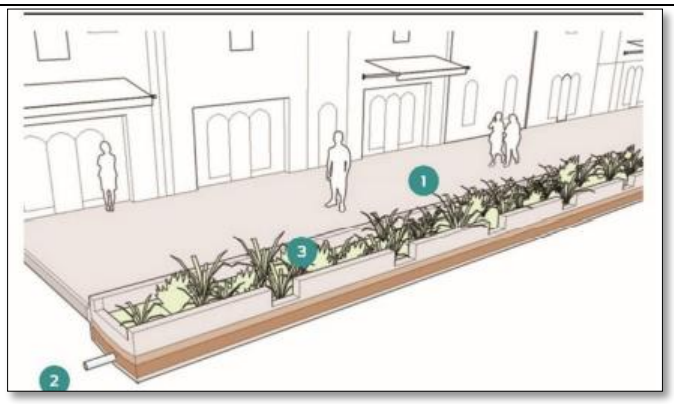
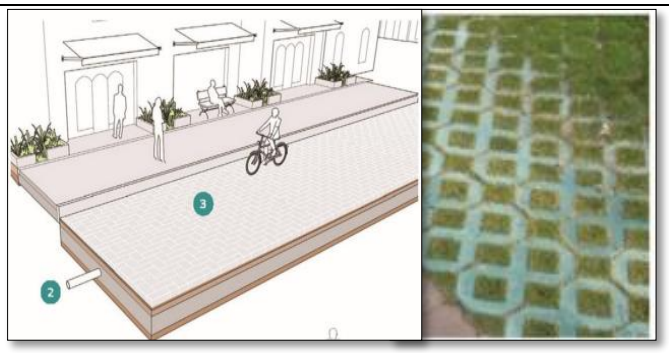
Department and Villagewise Targets/projection is placed at Annexure

6.1 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 Kurukshetra. 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 more scarce in terms of frequency. The methods of water table recharge strategies in urban area is shown in **Table 15.**

Table 15 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	

6.2 Plantation

In district Kurukshetra, department of Horticulture is engaged in vegetable, fruit and flower cultivation activities. This district is growing vegetable in 24660 hectares, fruits in 1184 hectares. And flowers cultivation is done in 109 hectares. Now emphasis is on protected cultivation. Department has given subsidy on 56 numbers of poly/net houses in which horticulture crops vegetable and flowers are given e.g. vegetables: Capsicum, Cucumber and Tomato. In flower, farmers are growing Lilium, Jerbera and Rose cultivation. Moreover, farmers are interested to adopt protected cultivation. Department is giving subsidy on new fruit plantation, marigold cultivation, vegetable hybrid seed, potato planter/ potato digger/ spices (Garlic seed) etc. **Figure 16**

shows the proposed wasteland that can be used for plantation. On the proposed wasteland no of trees would be planted is shown in **table 16.**

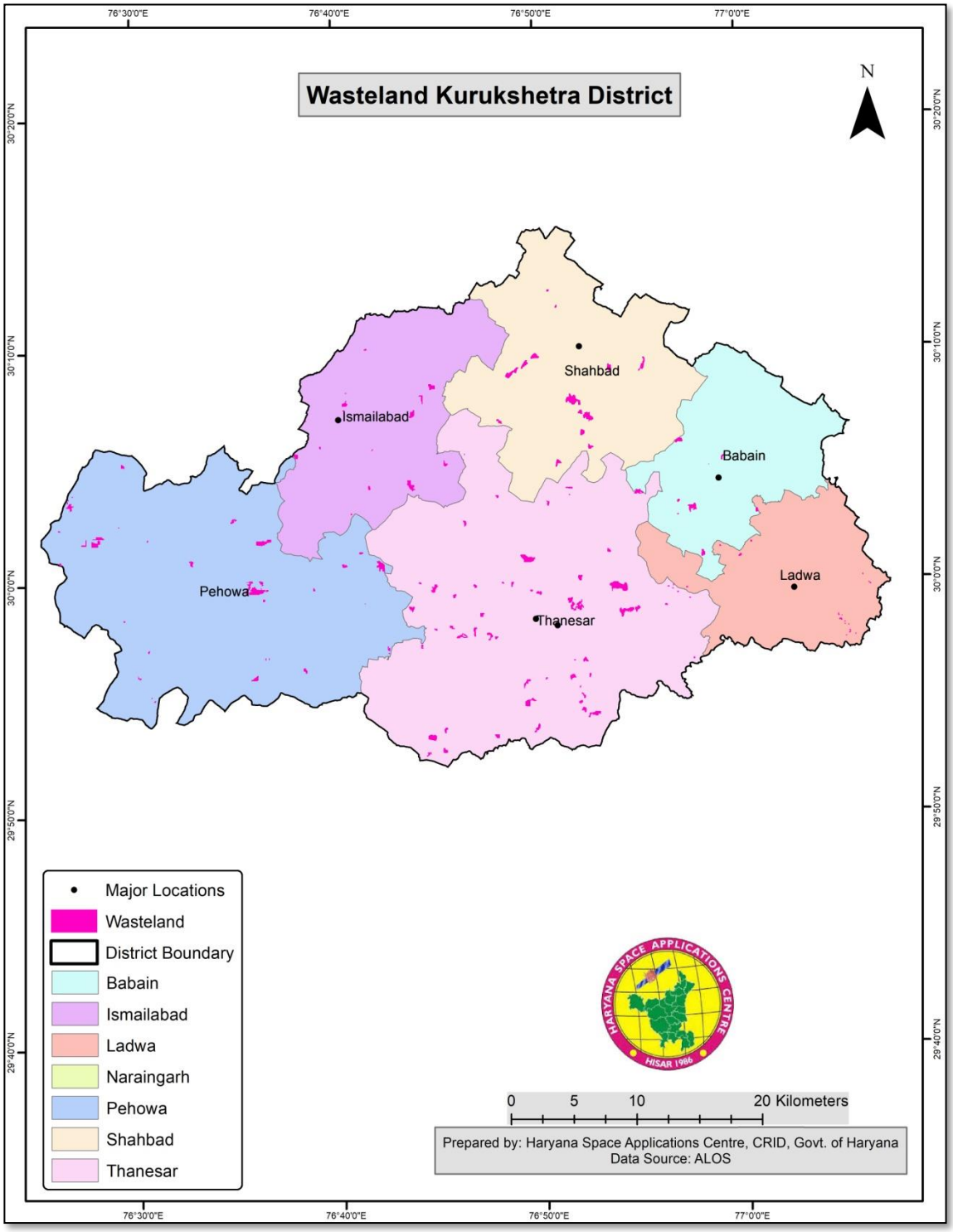


Figure 16 Wasteland in Kurukshetra District

Table 16 The proposed targets for plantation in Kurukshetra Distrcit

Block Name	Wasteland Area	Plantation at 5 feet spacing
Babain	223.7569	1949370
Ismailabad	289.5822	2522840

Ladwa	57.85417	504026
Pehowa	772.1817	6727247
Shahbad	632.8433	5513331
Thanesar	1508.87	13145288
Total	3485.09	30362103

6.3 Surface water management

Pond restoration and rejuvenation

A 100-acre pond site at village Thana in Kurukshetra district was declared as Haryana's first community reserve site in 2017.

- The biodiversity-rich site is a natural habitat of endangered turtle species and attracts migratory birds.
- The village's sewage water however continues to flow in to pond untreated. Much of other restoration work planned initially like strengthening of mounds and proper fencing around the area is still awaited.

In July 2017, the Haryana government had declared a 100-acre pond site at village Thana in its Kurukshetra district as the state's first community reserve site, to conserve its rich biodiversity. Four years on, there is much left to be done at the ailing pond – though there is hope as the authorities too are keen in protecting the pond that the village reveres.

"Despite its rich biodiversity and noble step by Haryana government to declare it community reserve four years ago, the place has not been restored the way it was planned initially," Ved Parkash, a local villager and husband of Thana village's outgoing sarpanch Sharda Devi, told Mongabay-India. He said the entire village's sewage water is drained into the pond. The wildlife department hired a contractor to set up a five-pond system that is a natural way to clean dirty sewerage water inside the pond. But it ceased to work soon after and the department did not take any cognisance of the matter.

6.4 Decentralize Treatment Plant

It is recognized that in the absence of 100% sewerage network connectivity just managing the gray 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 center and rural areas where open drainage systems still exits. Over the past three decades, the city limits of Kurukshetra city have been continuously growing as evidenced by the satellite images of increasing urban infrastructure.

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 are a feasible solution that may allow for localized treatment which may eventually be reused for secondary purposes. Like other systems, decentralised systems must be properly designed, maintained, and operated to provide optimum benefits.

6.5 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

(**Table 17**)

Table 17 I.E.C. Activities Plan Under Jal Shakti Abhiyan-2021

IEC Activities	Target	Department concerned
District Twitter Account to post daily under jal shakti abhiyan	1	DIO/DIPRO
Radio Jingles	2	DIPRO
Radio Interviews with scientist/agriculturist	3	KVK/DDA
Nukkad Nataks	15	DIPRO
Newspaper Advertisements/Press Notes	10	DIPRO
Films/Documentaries	1	DIPRO
Taru yatras (Sapling yatras by people)	20	Forest/Education Drepartment
Special Projects such as human chain, crop diversification, micro irrigation etc	20	Agriculture / Irrigation Department
Wall Paintings	393	One in each Gram Panchayat
Brand Ambassador and youth Icon	5	Sports Department
Fortnightly success story dissemination throw print and social media	10	All Departments
Celebration of GP/Block/District with most water conservation activities	1990	DDA/KVK
Marathon for afforestation and water conservation	1	District Administration/ Sports/ NYK
Prabhat pheris	300	NYK/ICDS
Paudhagiri (tree plantation by children of 6-12 years)	5	Forest / Education Department

7 Proposed Activity

7.1 Rainwater harvesting

Rain water harvesting primarily consists of the collection and storage of rainwater for subsequent use as source of water. The harvested water can be used for both potable and non-potable applications. There are many examples of rainwater harvesting systems which provide water for domestic, commercial, institutional and industrial purposes as well as agriculture, livestock, groundwater recharge, flood control, process water and as an emergency supply for firefighting. There are different criteria and techniques to select suitable sites for harvesting rainwater. In recent years, the analytical hierarchy process (AHP) and multi-influencing factors (MIF) are most widely used model for identification of rainwater harvesting sites. The AHP technique determines the weights of thematic layers and their rank to process identify the zones of rainwater harvesting sites. MIF analysis is an effective tool for water management because it is comparatively simple and reliable.

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 17**). The block wise area proposed for rainwater harvesting under most suitable sites is shown in **Table 18.** For the process of calculating suitable site a fixed weightage is needed to be applies on the above mentioned crieteria (**Table 19).**

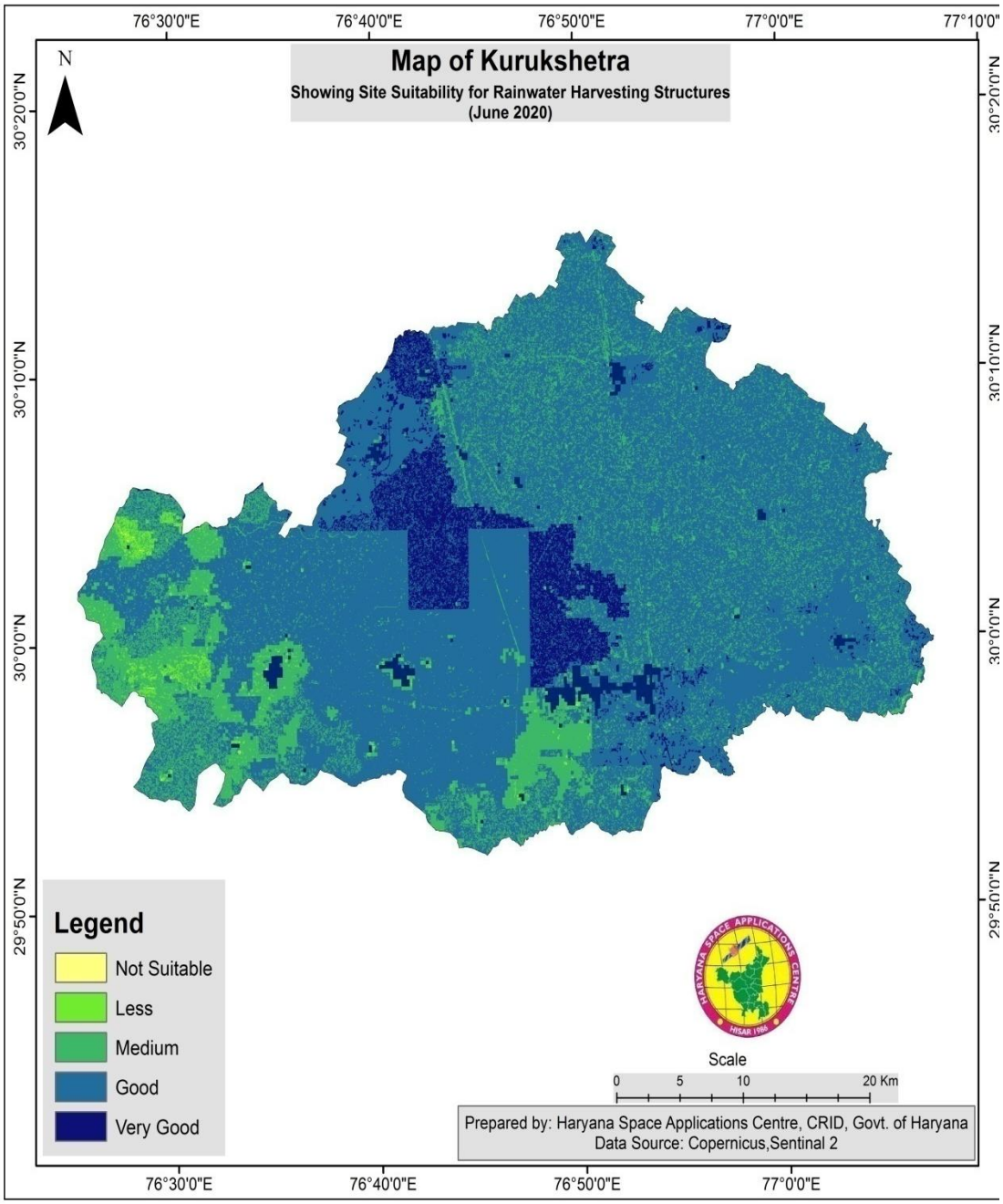


Figure 17 Site Suitability based on Rainwater Harvesting Structures

Table 18 Blockwise area under very good suitable site proposed for rain water harvesting

Block Name	Area (Very Good suitability area in Sq meter)
Babain	132182946.8
Ismailabad	192507964.6
Ladwa	129671922.6
Pehowa	262812658.8
Shahbad	195958456.7
Thanesar	398688315

Table 19 Assigned Weight for Criteria Parameters

Parameters	Weightage
Rainfall	35
Slope	25
Drainge Density	5
Soil Texture	20
Lulc	15

7.2 Proposed Suitable Site based on Multi-criteria

In this section some water harvesting structurs are proposed with the suitable sites. These structures are calculated based on different criterias. 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 18** shows the proposed suitable site based on multi criteria. Block wise proposed suitable sites based on multi-criteria is shown in **Table 20**.

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

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

Table 20 Block 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	Babain	1				1
2	Ismailabad					
3	Ladwa					
4	Pehowa	1		1		
5	Shahbad				2	
6	Thanesar	3	1	1		1

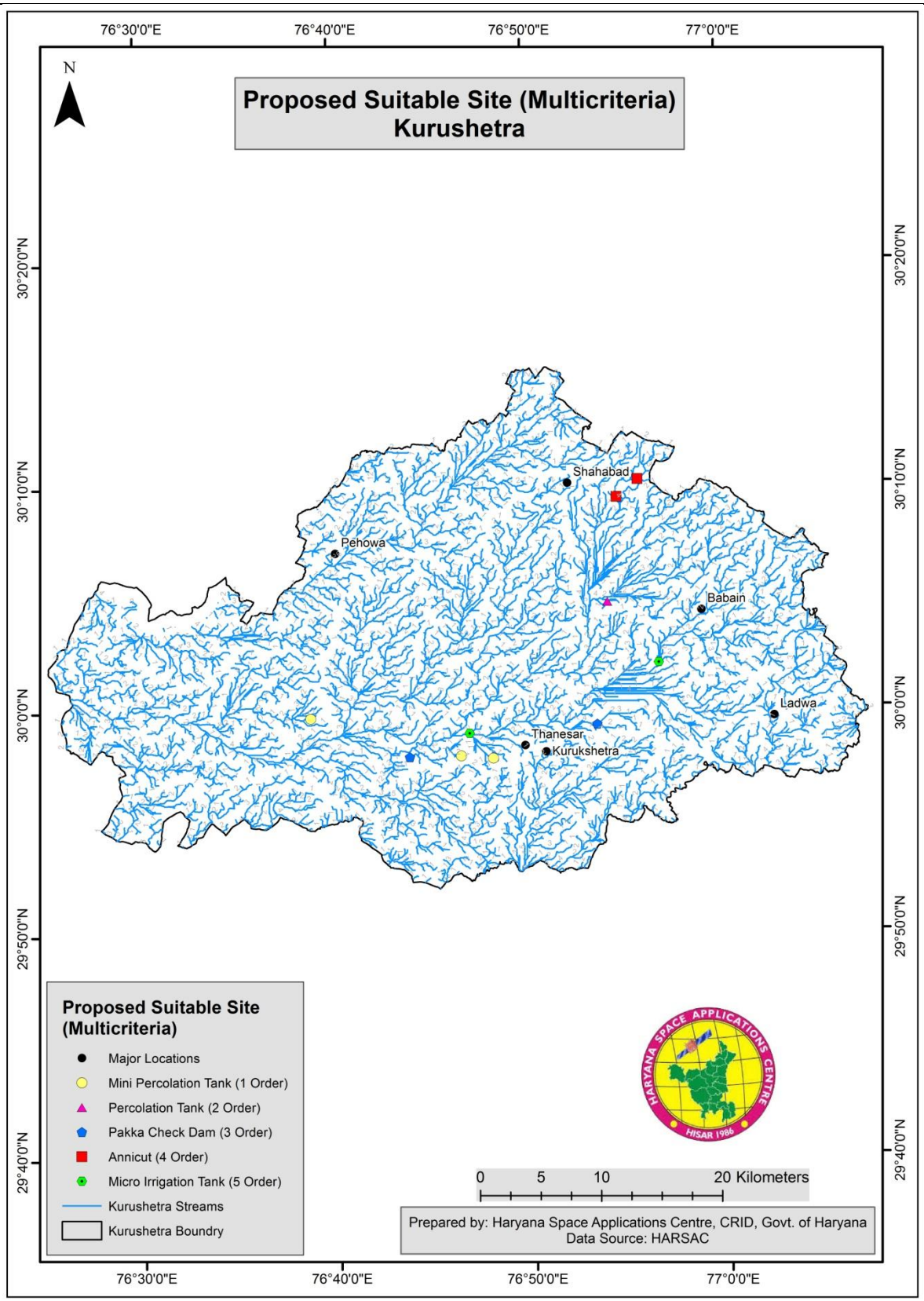


Figure 18 Suitable Site Proposed Based on Multicriteria

7.3 Proposed Suitable Site based on Drainage

The drainages that are created from satellite imagery can be used as base for the water harvesting structure **(Figure 19).**

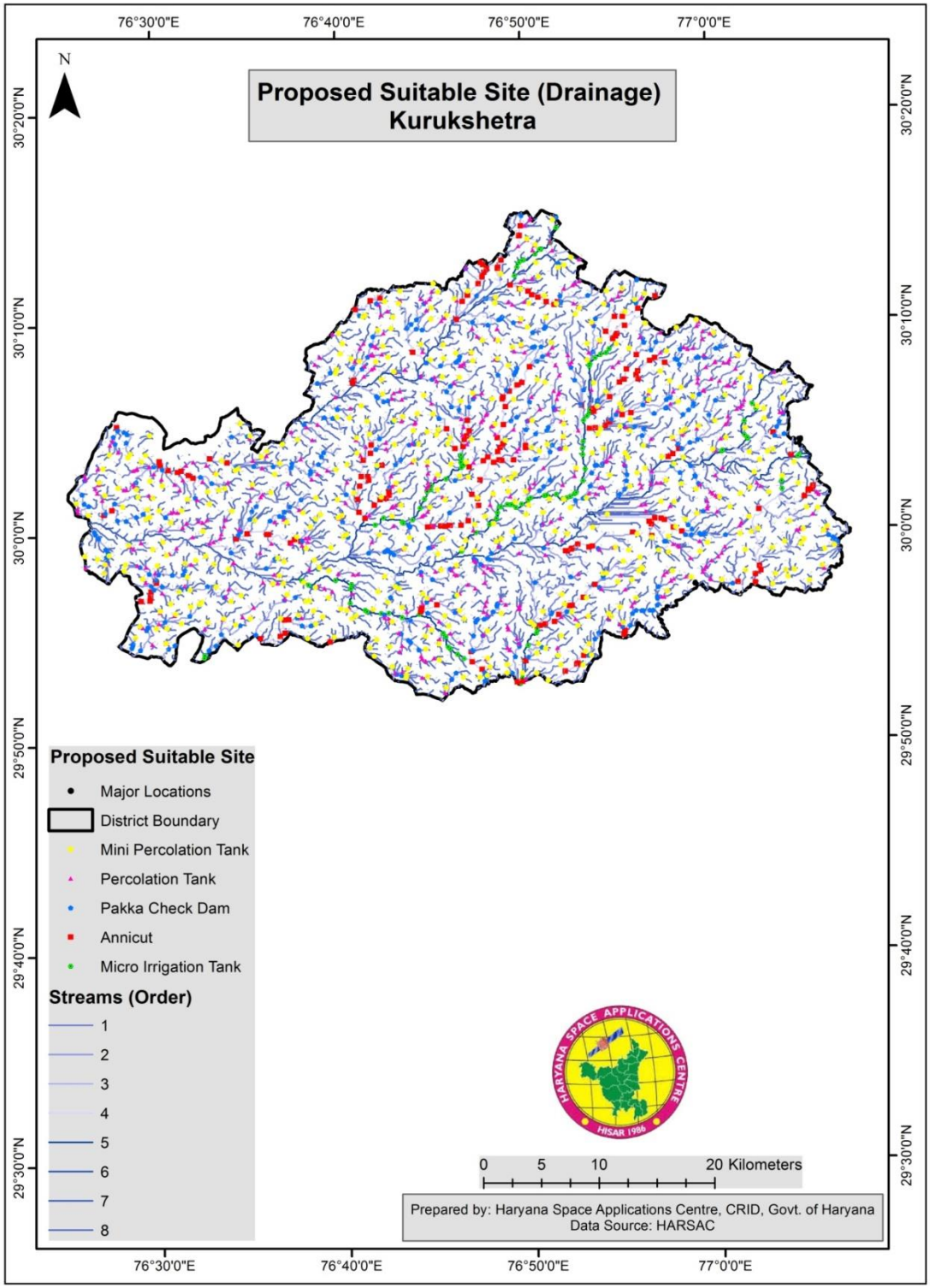


Figure 19 Proposed Site Suitable Map based on Drainage

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 sitesfor 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 build. **Figure 20** shows the proposed suitable sites based on drainage structure in Kurukshetra district. Proposed harvesting structures in Kurukshetra based on drainage are shown in **Table 21.**

Table 21 Proposed harvesting structures in Kuruksherta based on drainage

Sr No	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Babain	44	63	45	4	8
2	Ismailabad	55	60	47	17	0
3	Ladwa	42	30	18	21	4
4	Pehowa	136	127	104	37	10
5	Shahbad	61	74	60	60	21
6	Thanesar	147	155	107	67	59

8 Conclusion

Due to rapid urbanization, the Kurukshetra has seen problems related to water resources. There is water scarcity in lean season and waterlogging in monsoon season. Water logging over roads due to insufficient/unmanaged drains is the major problem. Current scientific report includes required information for the water harvesting where it is excess especially during monsoon/rainy season. The current water infrastructure information related to ponds/waterbodies, canals, natural drains, and drains based on slope is helpful in taking decisions on the construction of new structures for water harvesting. Block-wise estimates are given in the report while village level information is available at https://onemapggm.gmda.gov.in/portal/apps/webappviewer/index.html?id=dba1be50c558408cb6b06c27d337bdb4.