Report No.-10

JSA-CTR

Scientific Action Plan for Kaithal

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1. Introduction

1.1 History

The history of Kaithal word is also found in Ancient History. All Historians believe that name of Kaithal is derived from Kapisthala. Kapisthala means the place of Monkeys. A great number of Monkeys were found here. According to Purana the hero of 'WanarSena' lord Hanuman was also born in Kaithal. The great 'Tilla of Anjani' is also situated here which is named after his mother Anjani. The local people assassinated Razia Begum, the daughter of Iltutmish along with her husband on Nov. 13, 1240. The Tomb of Rajia Begam is still found here. Sikh Guru Har Ray honored the then King Bhai Desu Singh as the symbol of Bhagat after then the administrator of Kaithal were called as Bhai and till 1843 B.C. Bhai Udey Singh ruled over Kaithal and proved as the last King. Bhai Udey Singh died on 14 March 1843. People of Kaithal took active part in 'freedom struggle' in 1857.The famous Chinese Pilgrim Hunstang and Fiahan visited Kaithal along with Kurukshetra. The Splendor of Kaithal was on its top during the reign of Harsha. In Ancient Times the Gujjars, Chandela, Khilji's, Tug Lakas, Bloch's and Ajgans ruled over India. The people have a significant struggling role during the reign of Pathanas and Mughals. The famous Mughal intruder Changej Khan came to India but many Mughals resided in India instead of going back. During the time many Sayaids made their houses in Kaithal and soon became the center of Muslim scholars and counselors. The Tomb of Rajia Sultana is still found in Kaithal. But due to the ignorance of people it has come to ruins. The Sultan of Khillaji Dynasty, Badshah Ullaudin ruled over Kaithal before coming to Sultan of Delhi. In 1938 Nadir Shah ruled over Kaithal after the battle of Panipat since 1756 to 1761 as the king of Afghan. Still there is a village Patti Afghan situated on Gulha-Cheeka Road. The Sikh rulers known as Bhai ruled over Kaithal from 1763 B.C. to 1843 B.C. Bhai Gubrhaks Singh founded his empire. His successor Bhai Desa Singh founded this empire by snatching it from the clutches of Afghans. His son Bhai Lal Singh surrendered before British and accepted their supremacy. His eldest son Partap Singh became the ruler after his death in 1818 B.C. In 1818 his brother Bhai Udey Singh took over the throne. He ruled till 1843 without failure. The monuments of buildings built by him are still found here and the letter by written by Himin Pharsi are still safe in museum in Patiala. The splendor of Kaithal was on the top during his reign. Famous poet Bhai Santokh singh was the poet in his court. His famous work included Nanak Prakash, Atam Puran, and Guru Partap Suraj. He wrote at least one lac Salokas during his lifetime which still exists. He also translated Balmiki Ramayana and created Great Kirti (Guru Partap Suraj).

1.2 Location

Kaithal district is somewhat compact shaped having geographical area of 2,317.00 sq. kms. (Containing 104.30 sq. kms of urban area and 2212.70 sq. kms of rural area) which makes 5.24 percent of the State area. It lies between 29°30’00” North to 30°11’19” North and 76°09’20” East to 76°41’19” East. It makes north western boundary with Punjab State. To its southwest lies Jind district, bounded by Karnal district in its south east and Kurukshetra district lies on its north-east side. The Location Map of Kaithal district is shown in **Figure 1**.

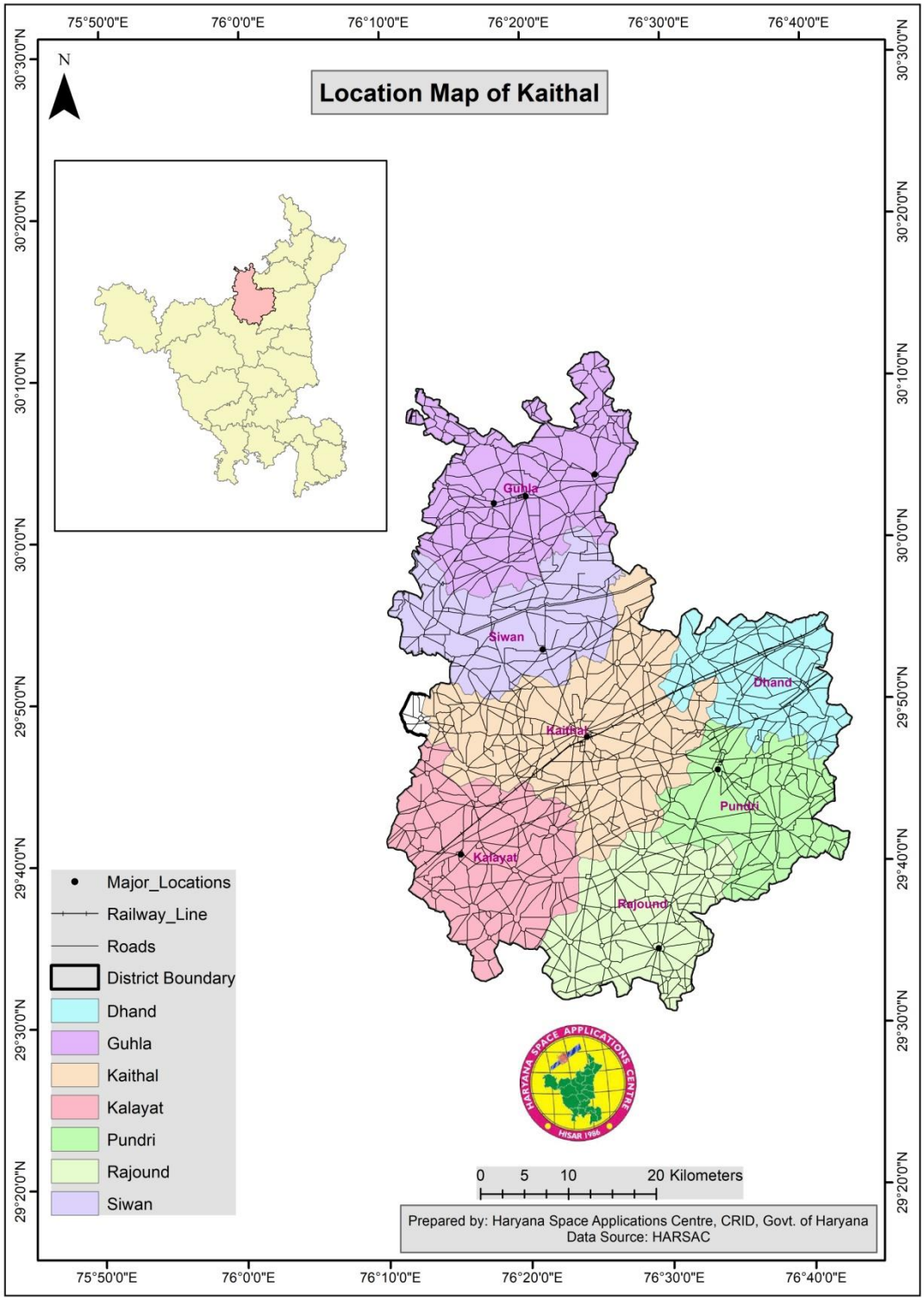


Figure 1 -Location Map of Kaithal District.

1.3 Administrative Setup

The administrative setup of the District of Kaithal has been described in the following table, with specific sectoral development such as water, animal husbandry, agriculture, roadways is operated under specific departments. The detailed administrative setup is shown in **Table 1.**

Table 1- Major Administrative Jurisdictional Setup of Kaithal District.

Country	India
State	Haryana
Division	Kaithal
Headquarters	Kaithal
Tehsil	1.Kaithal, 2. Guhla, 3. Pundri 4. Kalayat
Area	
Total	2,317 km²
Population (2011)	
Total	10,74,304
Density	463
Demographics	
Literacy	70.60%
VidhanSabha constituencies	1.Guhla (15) 2. Kalayat (16) 3. Kaithal (17) 4. Pundri (18)
Website	https://kaithal.gov.in/
Location of Gurugram	Northern most region of Haryana
Coordinates	29°30’00” North to 30°11’19” North 76°09’20” East to 76°41’19” East
Elevation	250 m above the sea level
Sub Divisions (3)	Kaithal, Guhla, Kalayat
Tehsils (4)	1.Kaithal, 2. Guhla, 3. Pundri 4. Kalayat
Sub-Tehsils (3)	Rajound, Dhand and Siwan
Blocks (4)	1.Kaithal, 2. Guhla, 3. Pundri 4. Kalayat
Municipal Corporation (1)	Municipal Corporation, Kaithal.
Municipal Council (1)	Municipal council Kaithal
Municipal Committees (4)	Cheeka, Kalayat, Pundri, Rajound
Population (Census 2011)	10,74,304
Total Villages	278
Total Panchayats	278
Village Level	Panchayat (278)
Block Level	PanchyatSamiti
District Level	ZilaParishad (1)

Source: https://kaithal.gov.in/about-district

1.3 Climate

1.3.1 Temperature

Four seasons are observed in a year. Mid-March to end of June is summer season, followed by monsoonal rainy season from July to mid-September, after which a transition period of two months follows. Then comes the cold season from mid-November to mid-March. Records of Meteorological Observatory at Karnal are representative of the climatic conditions in the district in general. With the start of cold season

temperatures begin to C and°decrease rapidly. January is the coldest month with the highest temperature of 23.6 C. Cold waves affect the region when minimum temperatures°lowest temperature of 3.4 sometimes drop down to below freezing point. With the onset of summer season temperatures begin to rise rapidly. May and June are the hottest months with mean daily maximum C. Hot westerly winds locally known as looh begin to blow from°temperatures reaching 38.6 C.°the month of April. In May and June sometimes, maximum temperatures may go above 43.

1.3.2 Rainfall

Rainfall records (2005-2009) reveal that average annual rainfall in the district is 502.3 mms. and about 71 per cent of the normal annual rainfall in the district is received during June to September, September being the rainiest month. Rainfall generally increases from south west to north-east. In general, winds are low for most part of the year but they gain strength during the monsoon season in July and August. Cloudiness is also heavy during this season. Rest of the year skies are clear or lightly cloudy. Easterly or South-easterly winds blow during summer monsoon season but for the rest of year winds are westerly or north-westerly. Air is dry for most part of the year but humidity is very high during monsoon season. Dust storms mostly occur during April to June. The satellite derived average annual rainfall map (showing average annual rainfall from 2010 to 2020) of Kaithal district is shown in **Figure 2**. The rainfall range is 715.81 mm to 958.74 mm.

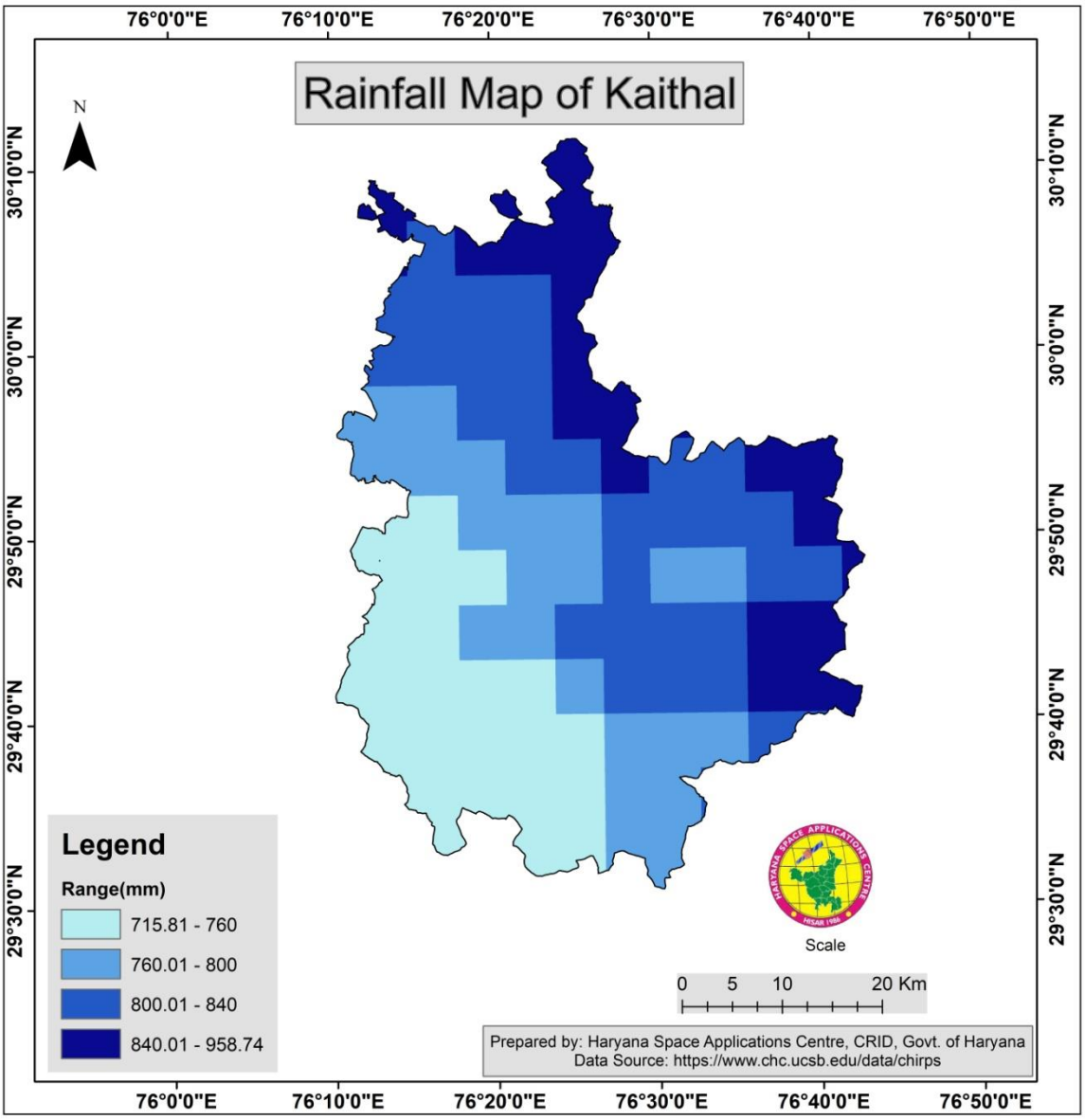


Figure 2- Rainfall Map of Kaithal District

1.4 Elevation and Topography

Generally, the slope of the district is from north east to south west, the direction in which most of the rivers/nadis of the area flow down **(Figure 3).** It is gently sloping plain area however, we can divide the region into three physiographic divisions on the basis of minor variations: Ghaggar Flood Plain, Bet Kaithal and Kaithal Plain. Ghaggar Flood Plain covers northern and northwestern parts of Guhlatahsil. The flood plain is gently sloping towards southwest in which direction the Ghaggar river flows. The soils are river borne sand soft loam and silty clay. The region is fertile and suitable for producing variety of crops. Bet Kaithal lies to the south of Ghaggar Flood Plain extending over southern part of the

Guhlatahsil. It is drained by Saraswati River. Loam and coarse: loam type of soils is found in the region. Kaithal Plain extends over lower half of the district covering whole of Kaithal tahsil. It is a Bhangar area. It contains carbonate of lime at very deep layers, usually in the form of nodules called kankar. The soil is granular and has a low water holding capacity. Slope ranges of the district from flat to >35 degree **(Figure 4).** Contours of 5 meters interval showed similar topography as in digital elevation model **(Figure 5).**

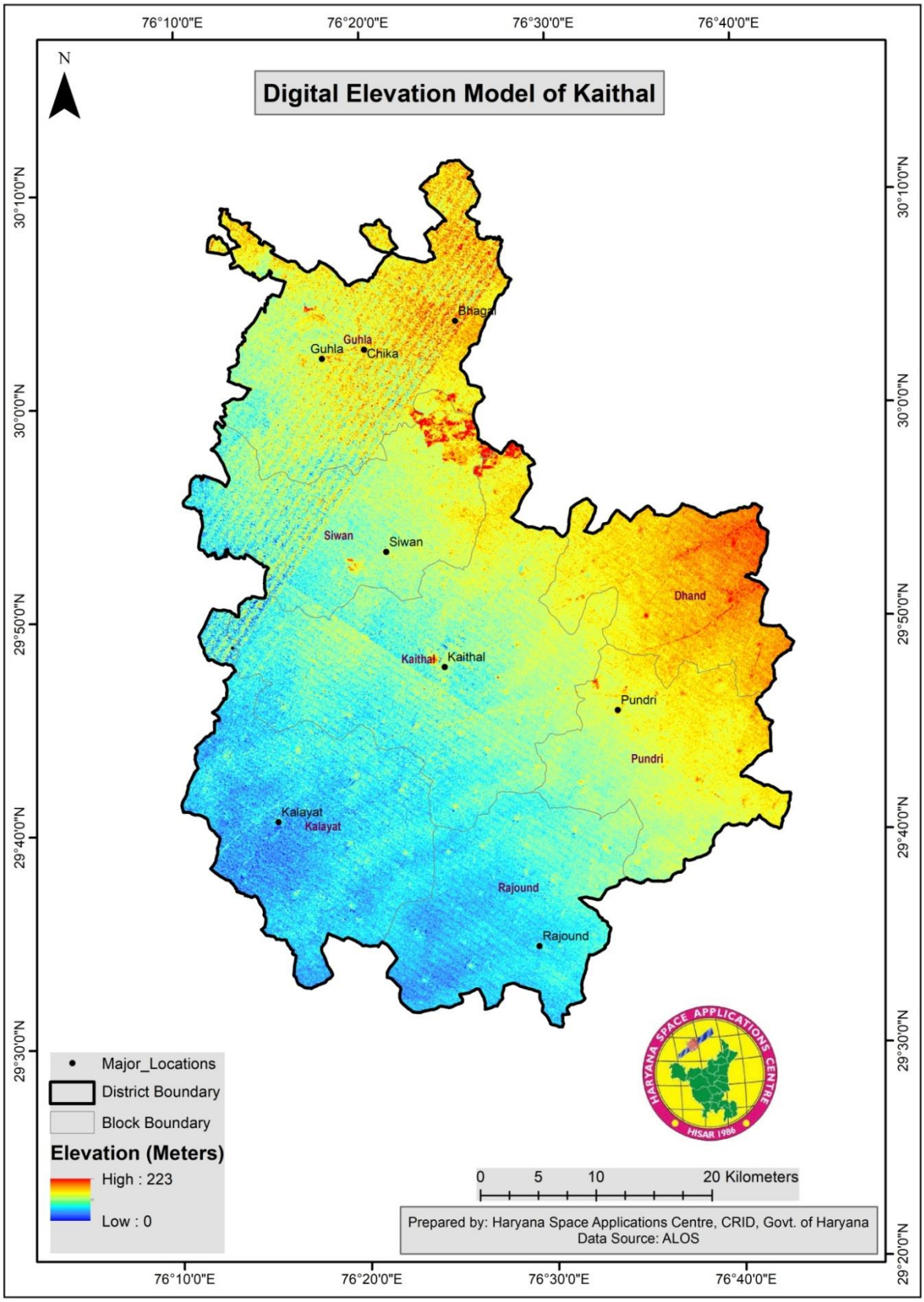


Figure 3 Digital Elevation Model of Kaithal District

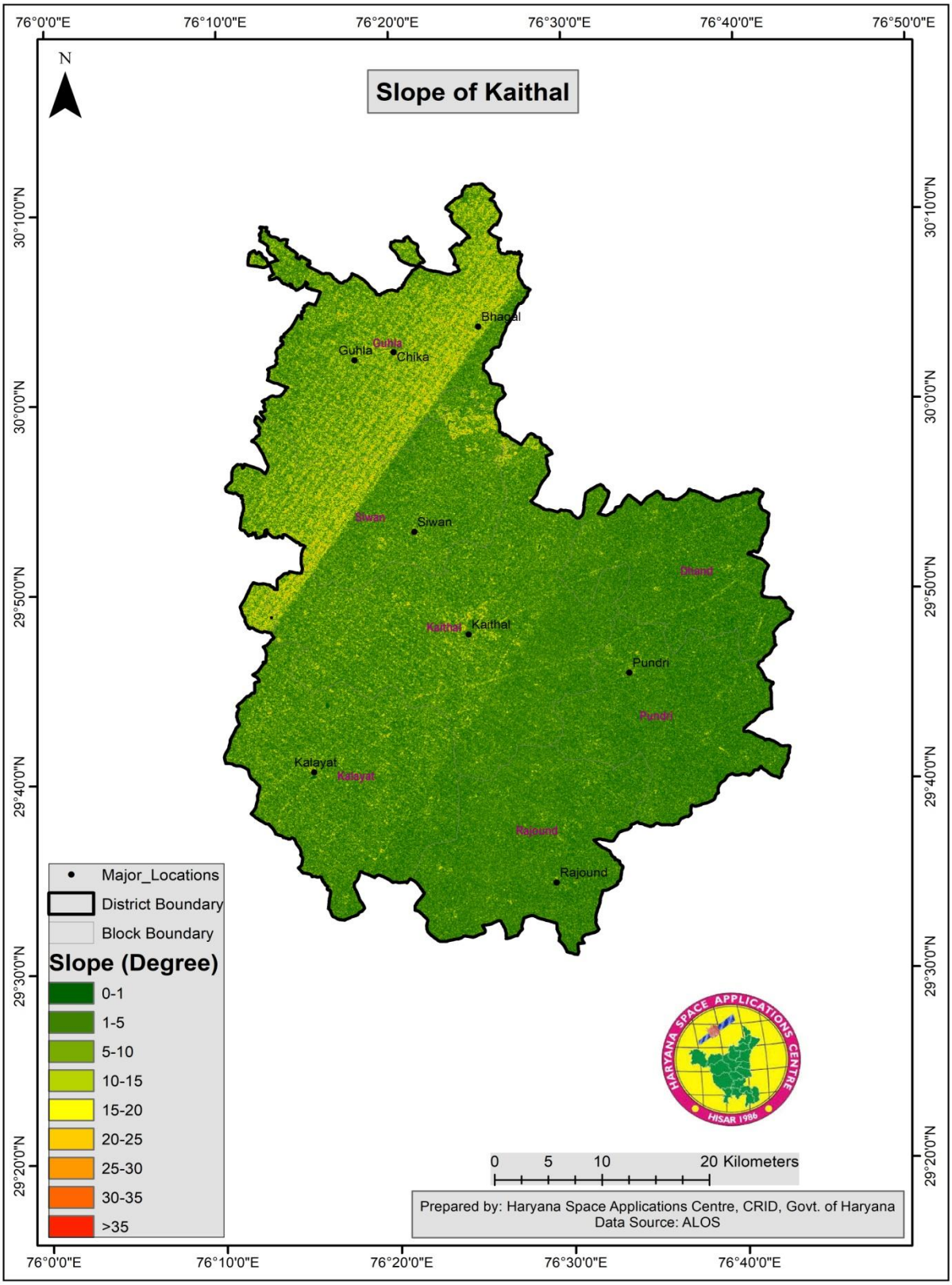


Figure 4 Slope Map of Kaithal District

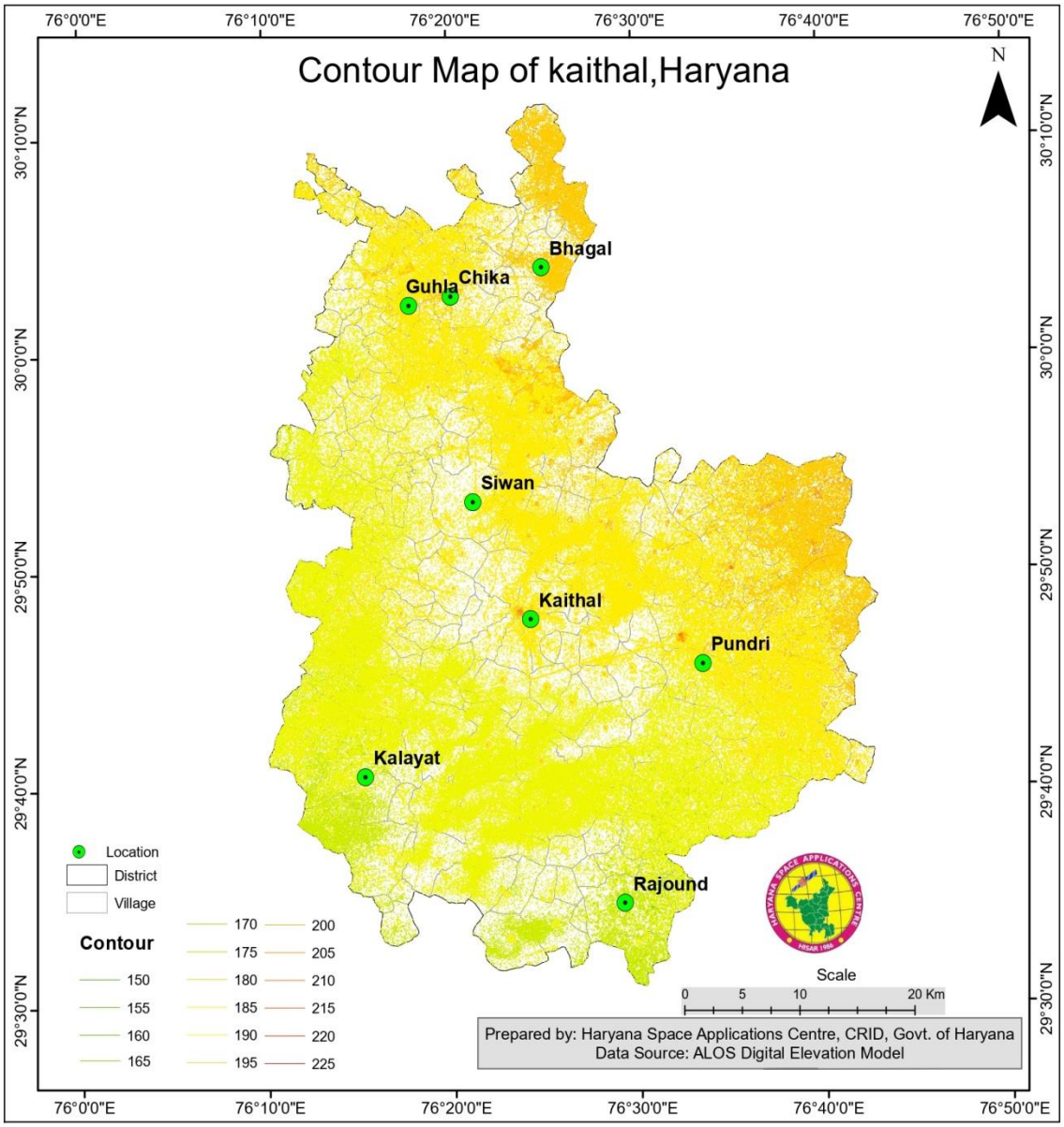


Figure 5- Contour Map of Kaithal District

1.5 Geology and Lithology

The geological formations met within the district comprised unconsolidated alluvial deposits of Quaternary age. The alluvial deposits comprise of sand, silt, clay associated with kankar. Fine to medium grained sand horizon forms the potential aquifer in the area. The Lithology Map of Kaithal district is shown in **(Figure 6).**

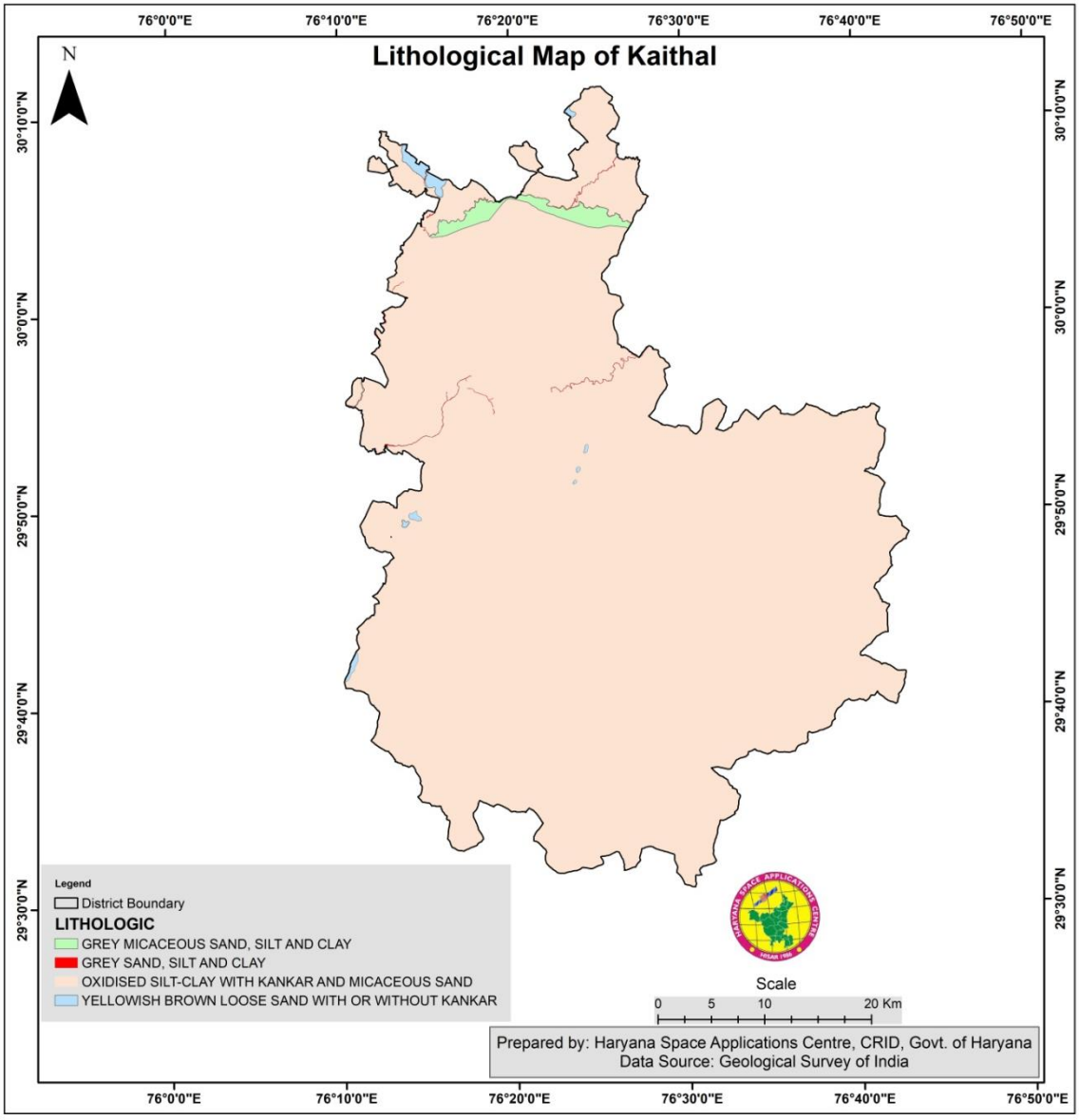


Figure 6- Lithological Map of Kaithal District

1.6 Soil Profile

The district has two types of soils viz Sierozem and Desert soils. The sierozem soils are found in major parts of the district and desert soils are comparatively found in smaller part of the district especially in northern partof the district. Sierozem Soils are found in the areas where the normal annual rainfall varies from 300 to 500 mm. These soils vary from sandy loam to loamy sands in texture and are marginally

fertile. The soil map of Kaithal district is shown in **(Figure 7).** and Table 2 shows Block wise Soil Classification.

Table 2- Block wise Soil Classification

Block	Soil Type	Land Slope				
	Major Soil Classes	**Area(ha)**	**0-3%(ha)**	**3-8%(ha)**	**8-25%(ha)**	**>25%(ha)**
Kaithal	Loam	62280	61198	1082		
Kalayat	Loam	33284	30842	2442		
Cheeka*	Loam	57086	5139	48693	3254	
Pundri*	Loam	48120	46210	1910		
Rajound	Loam	24771	23117	1654		
		225541	**166506**	**55781**	**3254**	

Source: Agriculture Soil Conservation Office, Year2016-17
(*includes both Guhla and Siwan and include Pundri & Dhand)

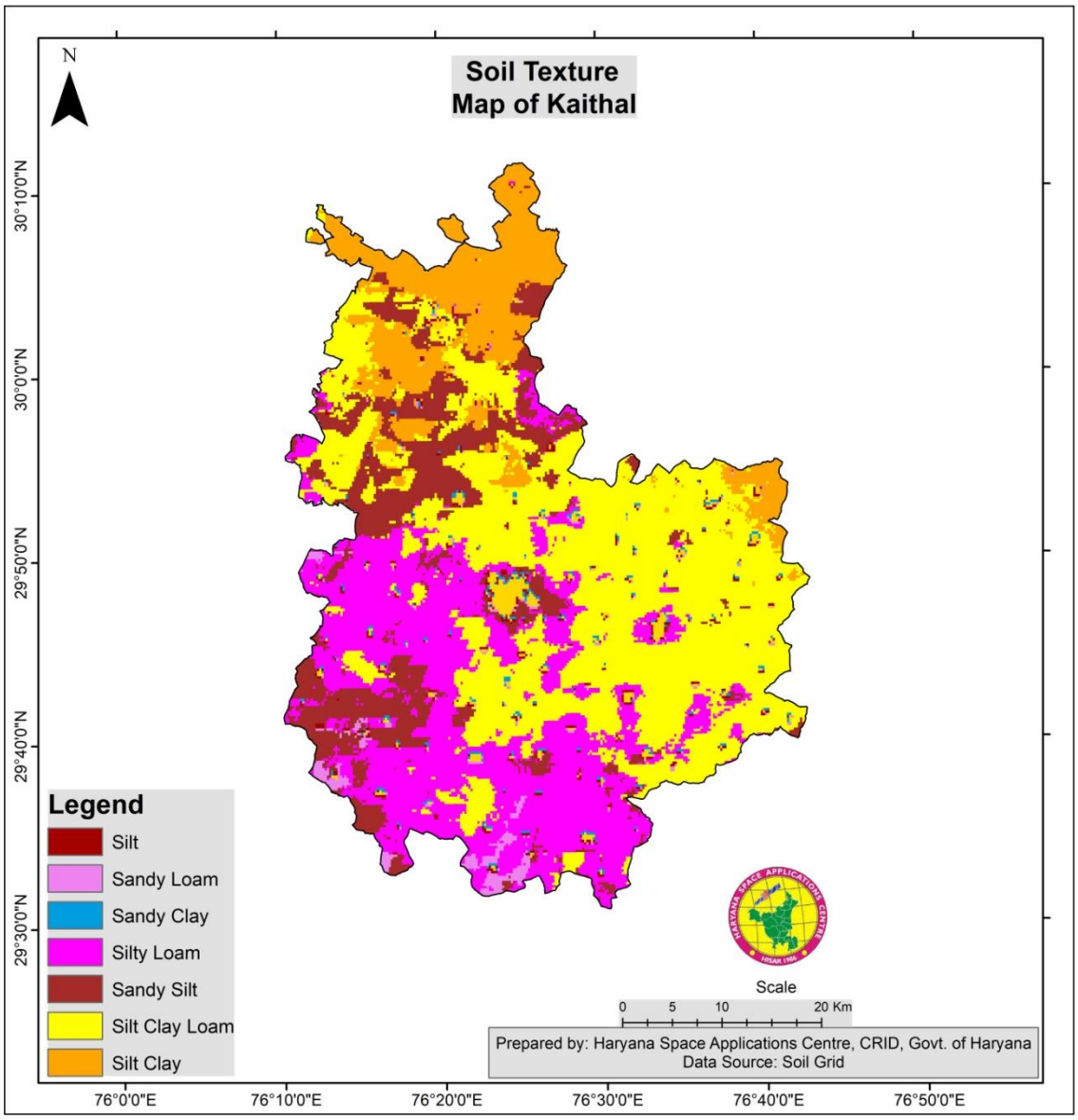


Figure 7 -Soil texture map of Kaithal District

1.7 Landuse

Main land use in the district is for agriculture with 84% of the land being used for agriculture. Land put to various uses in the district is given in the table land use pattern of Karnal district, Haryana. The land use land cover map of Kaithal District is shown in **Figure 8**. The table 3 depicts the land use/ land cover area of Kaithal district in the year 2017.

Table 3 -Types of land use

Sr.No.	Type of Land use	Area (thousand hectares)
1.	Total area	246
2.	Forest	1
3.	Land put to non-agricultural use	23
4.	Barren and unculturable land	13
5.	Permanent pastures and other grazing lands	8
6.	Land under misc. tree crops and grooves not included in net area sown	1
7.	Current fallows	10
8.	Net area sown	190
9.	Culturable area	209
10.	Area sown more than once	190
11.	Total cropped area	380

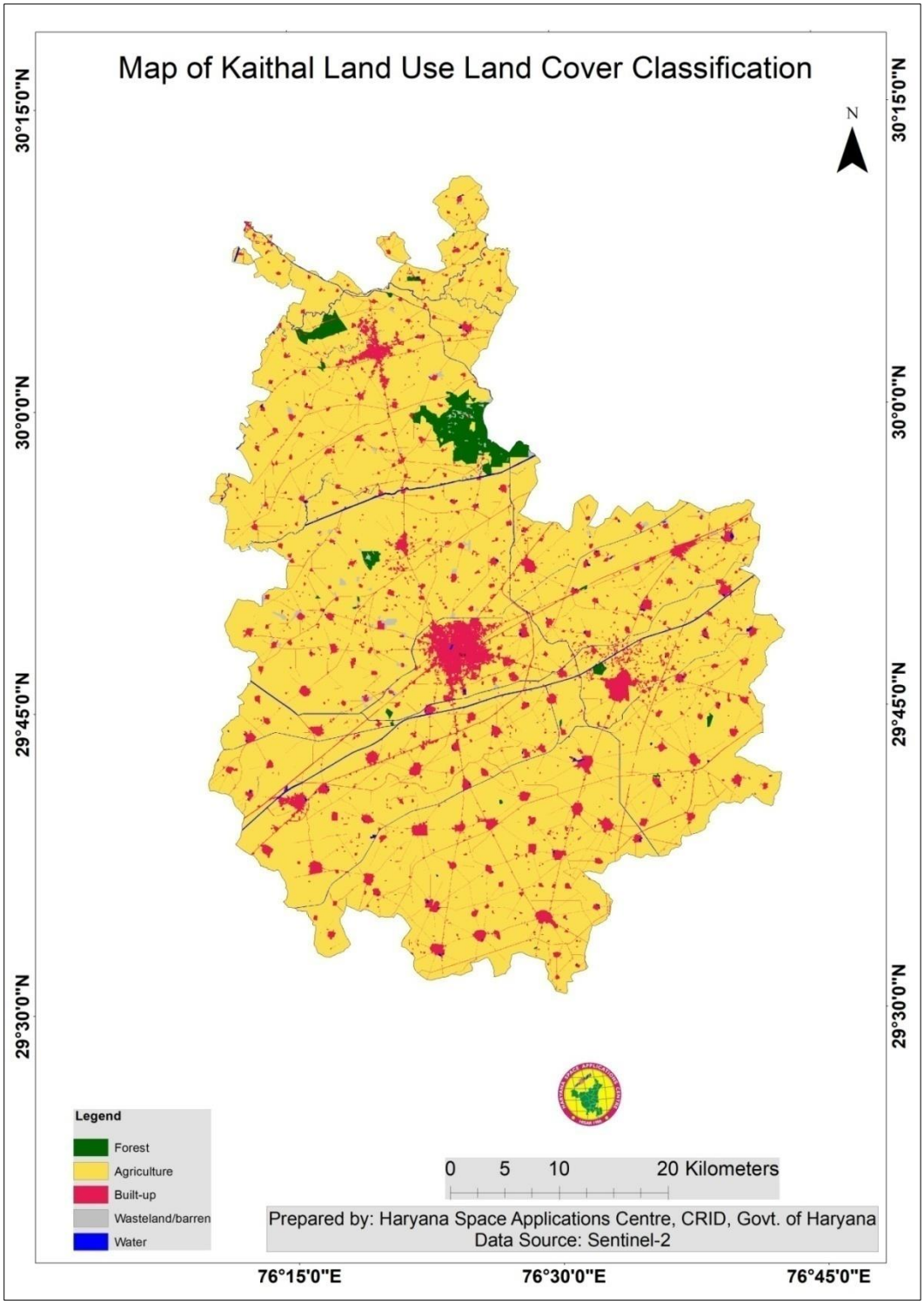


Figure 8-Landuse and Landcover of Kaithal District

2. District Water Profile

2.1 Source of Water

Kaithal fulfill its water requirement by natural and manmade modes like canal, Ponds, treatment plants, extraction of groundwater by tubewells, water harvesting structures, rainfall water harvested from rooftop and many more.

2.1.1 Canals

Canal irrigation in the district is mainly done through Saraswati distributary which takes off from Bibipur Lake, Western Yamuna canal (Sirsa Branch) and the Habri Sub Branch. Western Yamuna canal (Sirsa Branch) traverses the middle of Kaithal tahsil in north east south west direction. In Kaithal tahsil where water table is very deep, canals are the only means of irrigation. The Ghaggar, the Saraswati and their distributaries cause floods in Guhlatahsil of the district and water stagnates for months together preventing most of the rabi sowings.

2.1.2 Ponds

A **pond** is a body of standing 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. In Kaithal district total 1483 ponds/waterbodies found on satellite data. The map of total ponds/waterbodies that include ponds, canals are shown in **Figure 9A** and **Figure 9 B** shows the monsoon waterlogged area of the district.

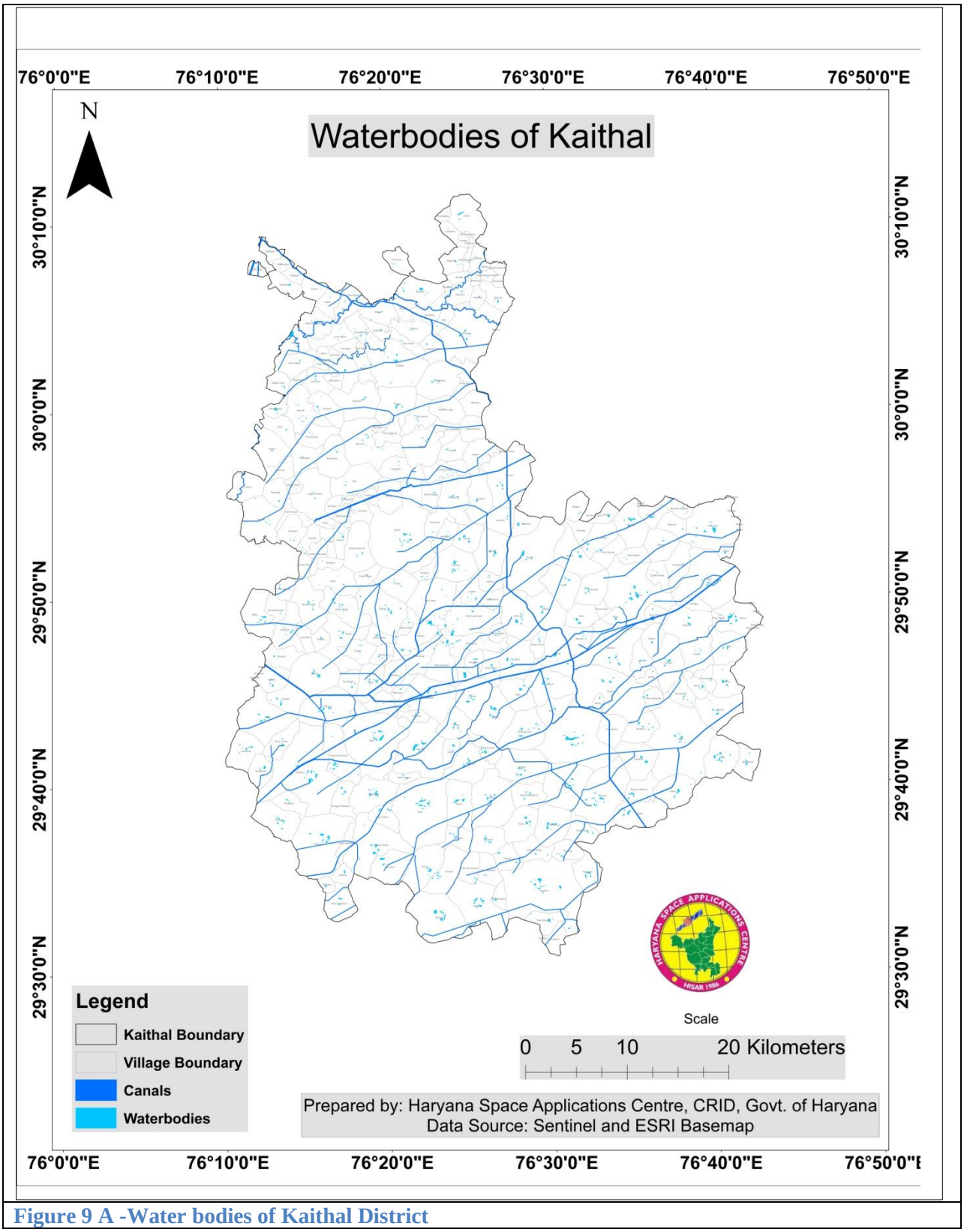


Figure 9 A -Water bodies of Kaithal District

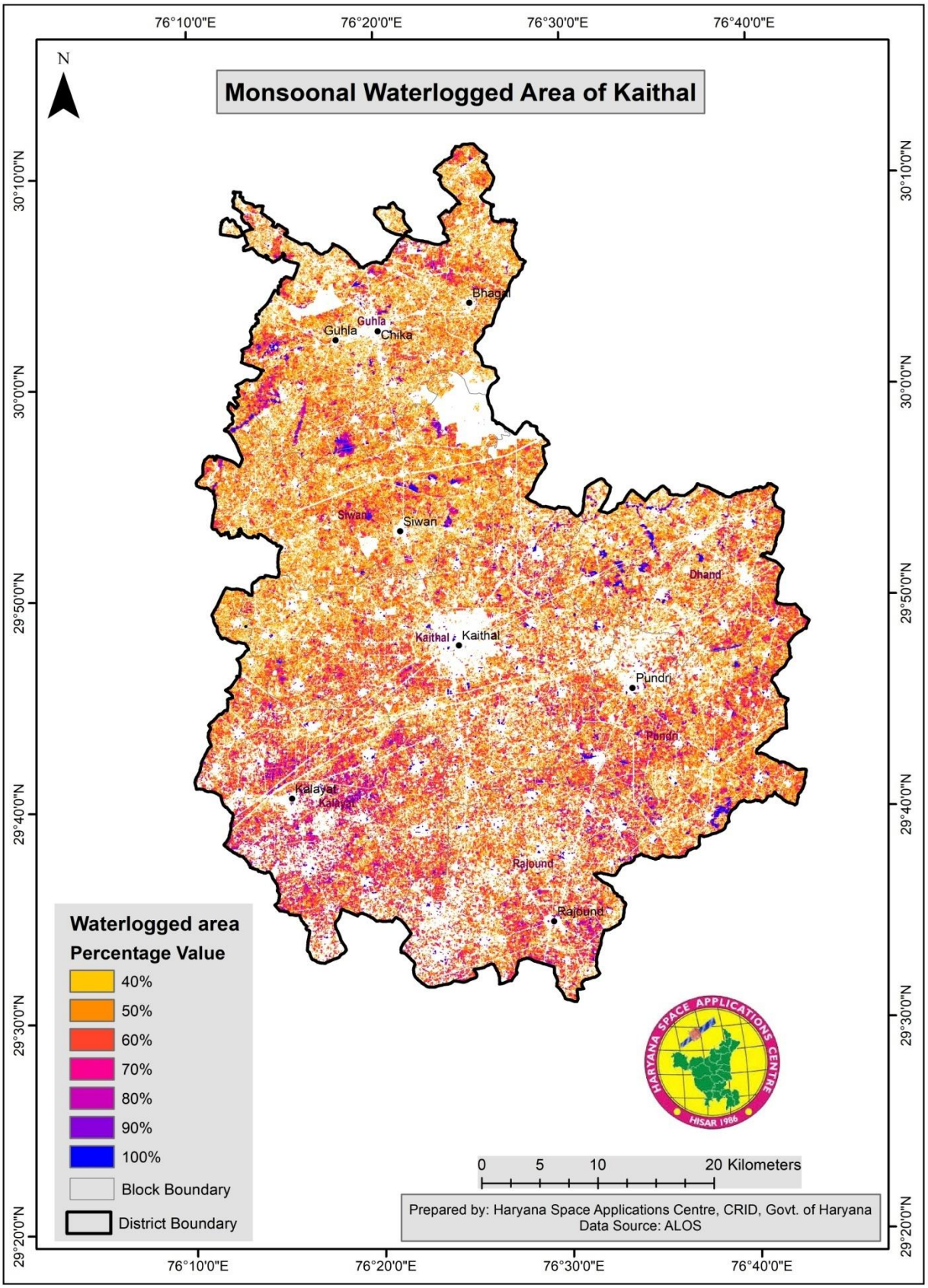

Monsoonal Waterlogged Area of Kaithal
N
76°10'0"E
76°20'0"E
76°30'0"E
76°40'0"E
30°10'0"N
30°0'0"N
29°50'0"N
29°40'0"N
29°30'0"N
29°20'0"N
Bhagal
Guhla
Chika
Siwan
Dhand
Kaithal
Pundri
Kalayat
Rajound
Waterlogged area
Percentage Value
40%
50%
60%
70%
80%
90%
100%
Block Boundary
District Boundary
HARYANA SPACE APPLICATIONS CENTRE
HISAR 1986
0 5 10 20 Kilometers
Prepared by: Haryana Space Applications Centre, CRID, Govt. of Haryana
Data Source: ALOS

Figure 9 B- monsoon waterlogged area of the district

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 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 Kaithal District is shown in **Figure 10.** The statistics of length of drainages under each order are shown in **Table 4.**

Table 4 -Drainage order and total length of the drains in Kaithal district

Stream Order	Total Length (in meter)
1st order	2010894.75299
2nd order	1097821.40223
3rd order	585437.929925
4th order	277936.207942
5th order	205972.908149
6th order	36104.610462

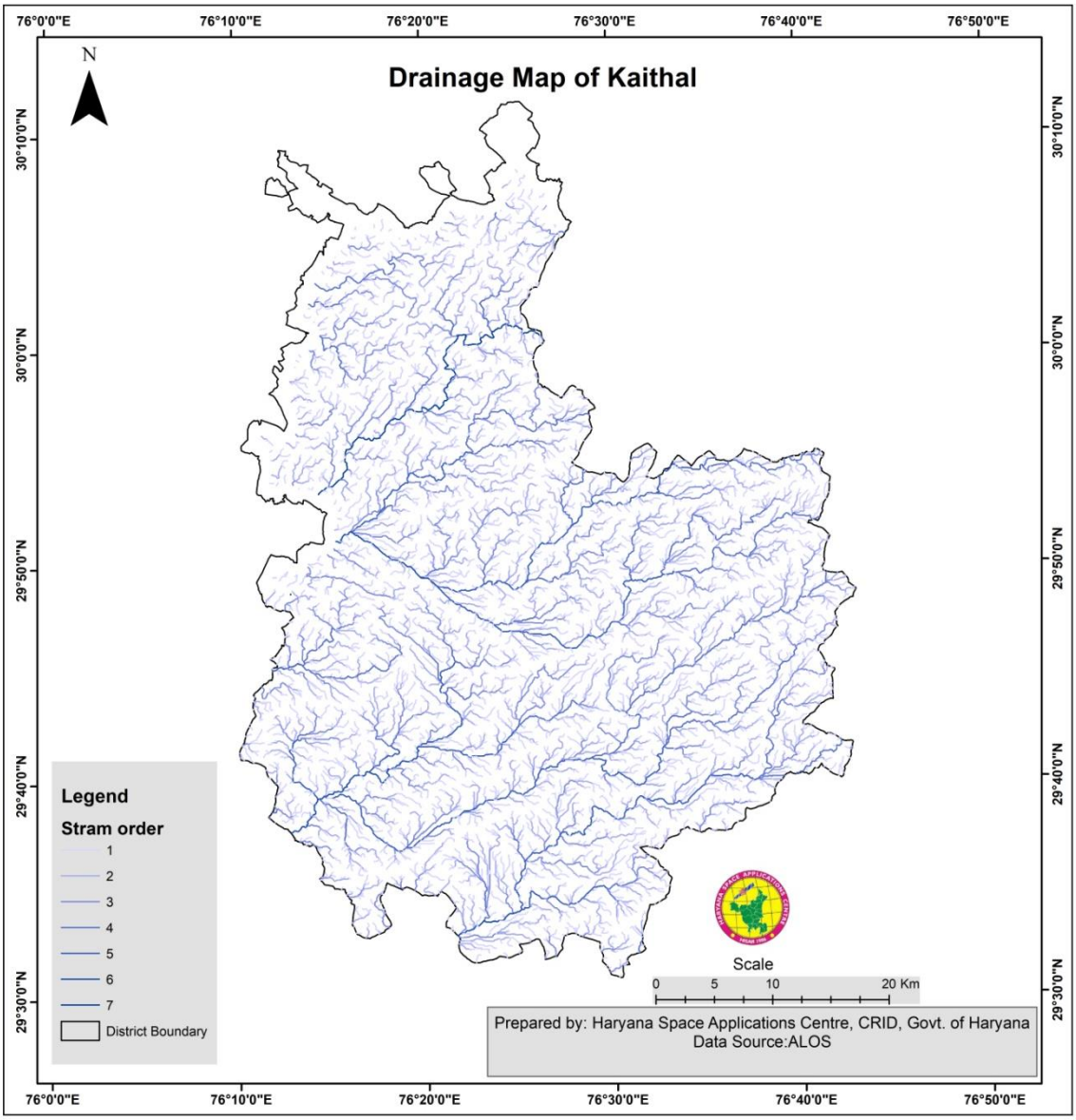


Figure 10- Drainage Map of Kaithal District

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 Dashboard of Kaithal 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 5**) 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 dryland, hilly, urban and coastal areas.

Table 5 -Water Harvesting System in Kaithal 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		0	
3	Trench	59	1	
4	Rooftop Water Harvesting Structure (Public)	12	0	
5	Rooftop Water Harvesting Structure (Private)	0		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)		0	

7	Other Water Conservation Structures (Bench Terracing, Canal)		0	
Total			**1**	**28**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	376	25	
Total		**376**	**25**	**224**
Reuse and Recharge Structures				
1	Soak Pit	1807	0	
2	Stabilization Pond	0	0	
3	Other Reuse / Recharge Structure	172	0	
Total		**1979**	**0**	**1**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank		0	
3	Staggered Trenches	0	0	
4	Other Watershed Construction Activities	76	9	
Total			**9**	**308**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	212025	0	
2	Intensive Afforestation- Plantation		0	
Total			**0**	**37**
Awareness Programs by KVK				
1	Farmer's training programs by KVKs on Water Use Efficiency and Appropriate Crops	28		
2	Distribution of one packet of vegetable seeds and saplings of five nutritious plants to farmers			
3	Awareness Programs/ KisanMela on the theme Valuing Water	1165		
Total		**1193**		
Waste Water Treatment				
1	Use of Treated Waste Water	0		
Total		**0**		

2.2.1 Water Harvesting System- 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 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 Kaithal District for rain water harvesting is shown in **Table 6** at rural and urban area. The map of water conservation activity in Kaithal at rural and urban level is shown in **Figure 10**.

Table 6- Water Harvesting activities in Rural area and Urban Area

In Rural Area		
Sr. No	**Block Name**	**Total No of Activity (no.)**
1	Guhla	**534**
2	Kaithal	**518**
3	Kalayat	**293**
4	Pundri	**234**
5	Rajound	**204**
6	Siwan	**378**
In Urban Area		
1	Kaithal	**29**

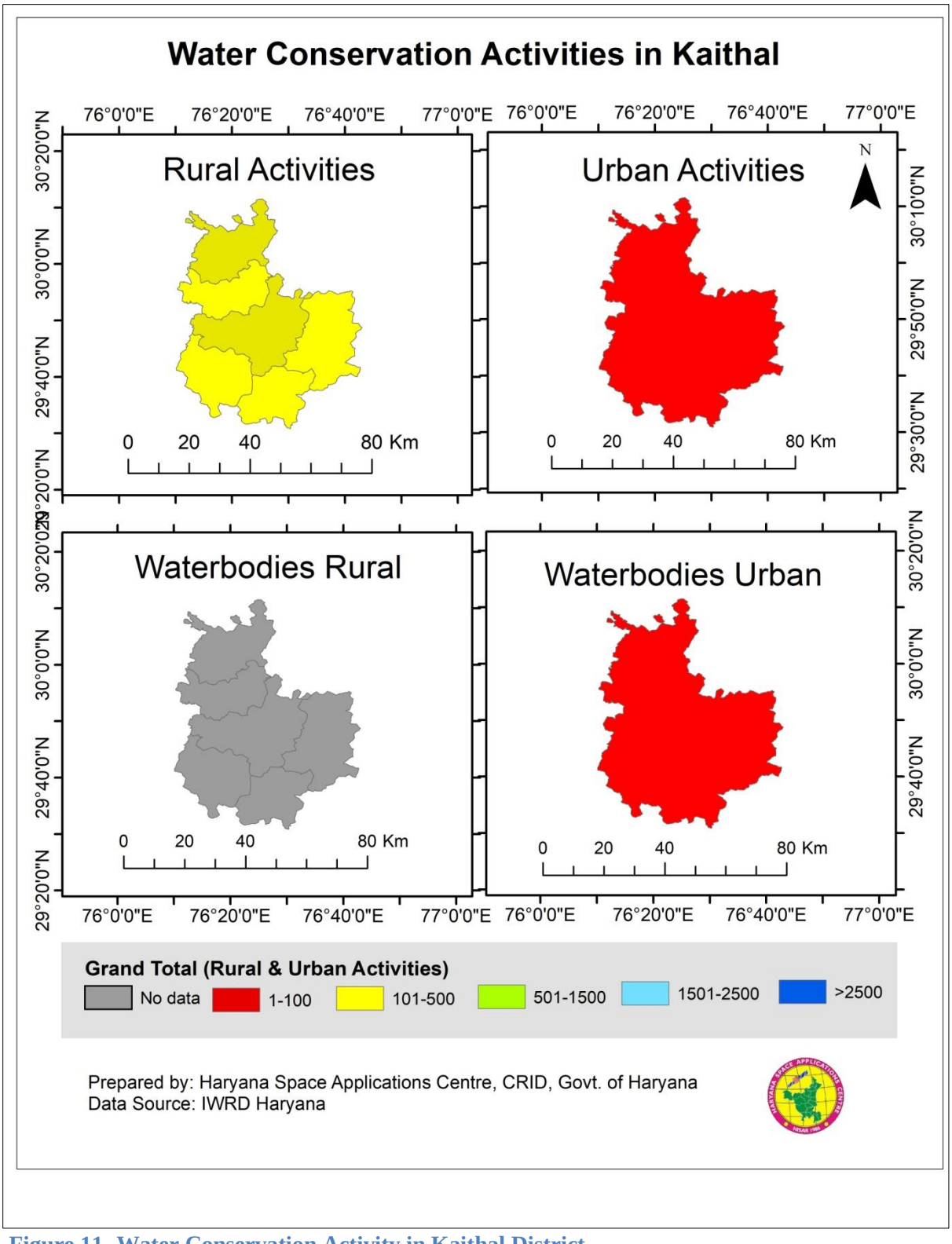


Figure 11- Water Conservation Activity in Kaithal District

2.2.3 Sewerage Treatment Plant

Sewage treatment is the process of removing contaminants from wastewater and household sewage water. Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally". Estimated sewage generation for the State of Haryana is 1816 MLD and total treatment capacity (including proposed) is 1880 MLD (153 STPs). Kaithal have 7 sewage treatment plans. There name is Cheeka-10 MLD, Kaithal (Jind Road)-10 MLD, Kaithal (Manas Road)-10 MLD, Kaithal (Manas Road)-10 MLD-Ph-II, Kaithal (Manas Road)-10 MLD-Ph-II, Kalayat-5 MLD, Pundri-3.50 MLD. The sewerage treatment plant map is shown in **Figure 12**.

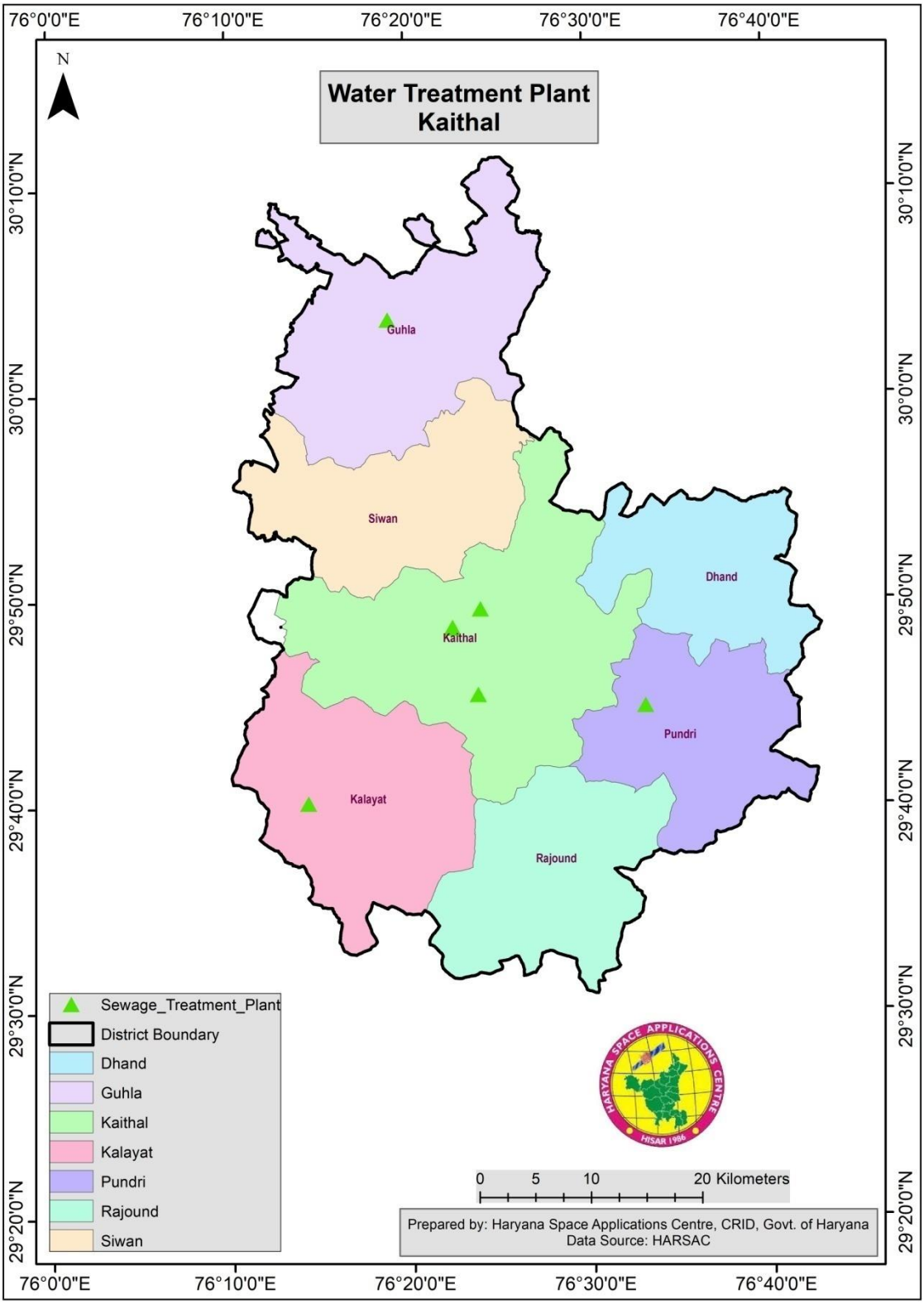


Figure 12- Water Treatment Plant Map of Kaithal District

3 Irrigation Profile

Irrigation in the district is done both through tubewells and government canals. Average annual rainfall in the district (2005-2009) is 502.3 mm, which is very meagre and unreliable. 16 This situation cent per cent necessitates the need for irrigation 99.5 percent of the sown area was irrigated area in the district during 2009-10, out of which 97,000 hectares was irrigated through government canal and 104,000 hectares was irrigated through tube wells. It is among the districts where irrigation intensity is very high (188.6). During 2010-11 there were 60,772 tubewells out of which 19,890 were diesel operated and 40,882 were electric operated. (Source: Statistical Abstract Haryana 2010-11).

4. Water Availability

4.1 Surface Water Availability

water supply to rural as well as urban area of the district is both tubewell and canal based and maintained by State Public Health Department and Sewerage Department along with Municipal Council of Karnal. Western part of the district the ground water is saline to marginally saline. Therefore, the canal water constitutes the major source of water supply to the villages and towns especially western part of the district. Whereas most of water works in northern part of the district are tubewell based. At some places water works are using canal water in conjunction with tubewell water, wherever either water is not available or quality of water is fit for drinking purpose. Water supply in the district is maintained by public health department. **Table 7** depicts the status of water availability.

Table 7 -Status of Water Availability

Status of water availability

Sl.	Source		Kharif		Rabi		Total
I.	**Surface Irrigation**						
(i)	Canal, Major & Medium Irrigation	32536	219.87	30910	29.75	63446	249.62
(ii)	Minor Irrigation Tank (FIS)						
(iii)	Lift Irrigation/ Diversion						
(iv)	Various Water Bodies including RWH						
(v)	Treated Effluent received from STP						35.59
(vi)	Un treated Effluent						
(vii)	Perennial sources of water						
II.	**Ground Water**						
(i)	Open well						
(ii)	Deep Tubewell						
(iii)	Medium Tubewell						
(iv)	Shallow Tubewell	NA	178.47	NA	218.13	NA	396.6

4.2 Ground Water Availability

Block-wise ground water resource potential of the district has been assessed as per GEC-97 as on 31st March 2009. The ground water development in all the blocks has exceeded the available recharge, thus all the blocks have been categorized as over exploited. Stage of ground water development, ranges from 161% (block-Kalayat) to 255% (block-Kaithal). Net annual replenishes able ground water availability in the district have been assessed as 507.83 MCM. The total ground water draft for all uses in the district is 1077.46 MCM, thus leaving shot-fall (over draft) of 569.63 MCM. Stage of ground water development in the Kaithal district has been assessed to be 212%. **Table 7** shows the block wise ground water resources of Kaithal District. The following map **Figure 13** depicts the ground water depth in Kaithal district.

Table 8 -Block wise Ground Water Resources of Kaithal District.

Block wise Ground water Resources of Kaithal District as on 31.03.2009 (in Ham)

Assessment Unit/ District	Net Annual Ground Water Availability (ham)	Existing Gross Ground Water Draft for irrigation (ham)	Existing Gross Ground Water Draft for domestic and industrial water supply (ham)	Existing Gross Ground Water Draft for All uses (ham)	Provision for domestic, and industrial requirement supply to 2025 (ham)	Net Ground Water Availability for future irrigation development (ham)	Stage of Ground Water Development (%)	Categorization
Gulha	10465	18762	1771	20533	1771	-10068	196	Over exploited
Kaithal	14173	33733	2461	36194	2461	-22021	255	Over exploited
Kalayat	7120	11303	150	11453	150	-4333	161	Over exploited
Pundri	11569	25445	1755	27200	1755	-15631	235	Over exploited
Rajound	7456	12261	105	12366	105	-4910	166	Over exploited
Total	**50783**	**101504**	**6242**	**107746**	**6242**	**-56963**	**212**	

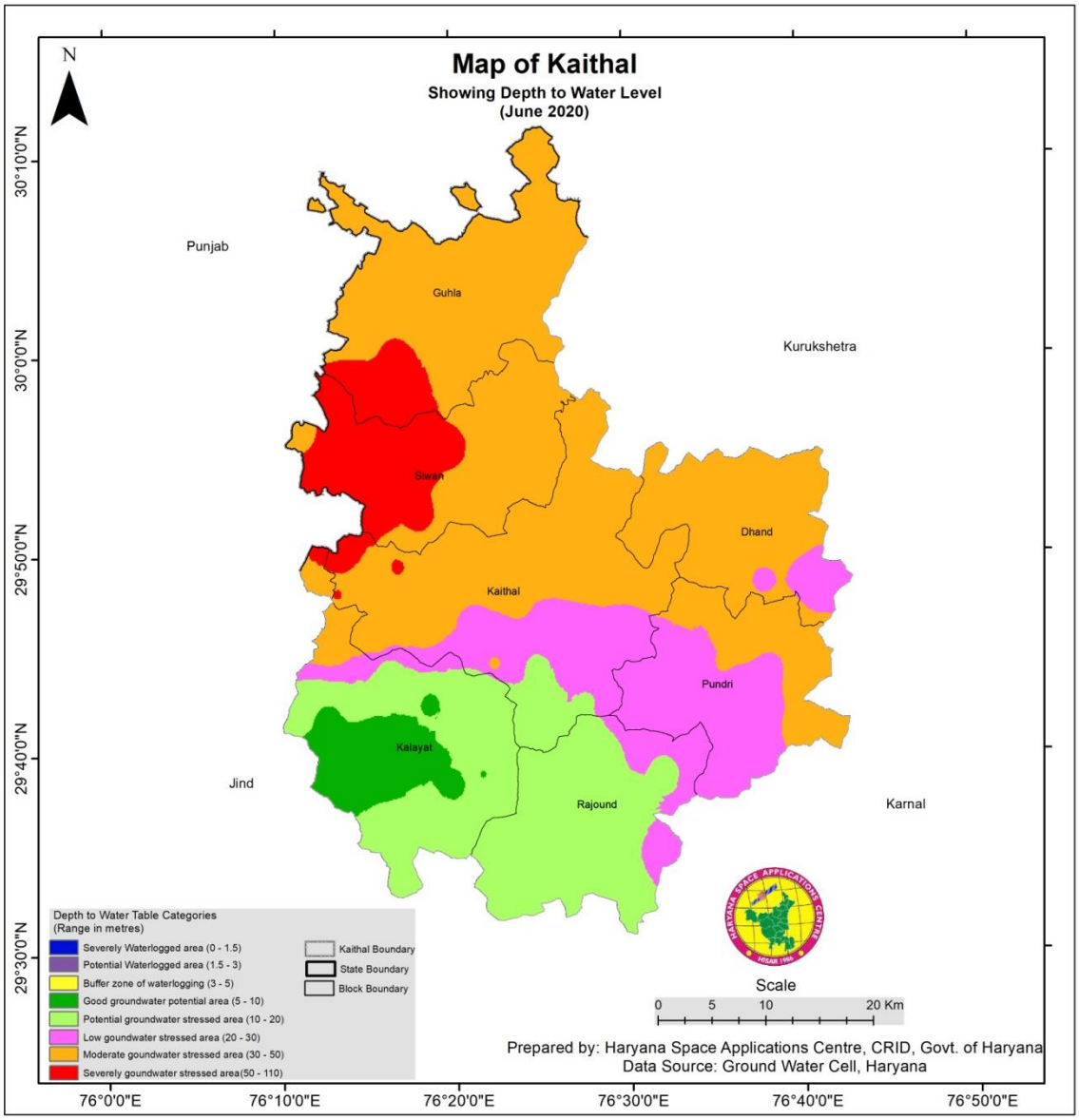


Figure 13- Ground water Availability Map of Kaithal District

4.3 Ground Water Quality

Chemical data of ground water from shallow aquifer indicates that ground water is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are generally less than 3000 µS/cm at 25°C, except at Kalayat and Mataur whether these values are 3310 µS/cm and 5990 µS/cm respectively. Generally, it is suitable for drinking purposes as chemical parameters are well within the permissible limits for safe drinking water set by Bureau of Indian standard (BIS) except at Kalayat and Mataur due to high salinity and nitrate and at Mundri and Rajound due to high fluoride. The fluoride

concentration is found to be higher than the permissible limit at Rajound (1.85 mg/l), Mundri (1.89 mg/l) and Mataur (2.55 mg/l). Among Cations, sodium dominates in more than 73% wells where as among Anions, no single anion dominates and ground water is of mixed anion type in most wells. Plot of USSL diagram used for classification o f irrigation water indicates that ground water falls under C3S1, C3S2, C4S2 a n d C4S3 classes. As 73% ground water sample falls under C3S1 and C3S2 classes and thus are suitable for customary irrigation without any fear of salinity or sodium hazards. The remaining water, nevertheless, can be used on well drained soils on which semi-salt tolerant crops such as wheat, gram and rice etc are grown without any fear of sodium hazards. water quality ranges from 0-45 is good, 45-60 is fair and >60 is very poor quality of water. So, based on that Kaithal district's water quality varies from good to poor (**Figure 14**) for the whole district. Whereas block wise water quality index value is shown in **Table 9**.

Table 9- Block wise average water quality index value in Kaithal District

Block Name	**Average Water Quality Index Value**
Dhand	64.27
Guhla	68.24
Kaithal	102.02
Kalayat	199.06
Pundri	74.10
Rajound	128.06
Siwan	74.45

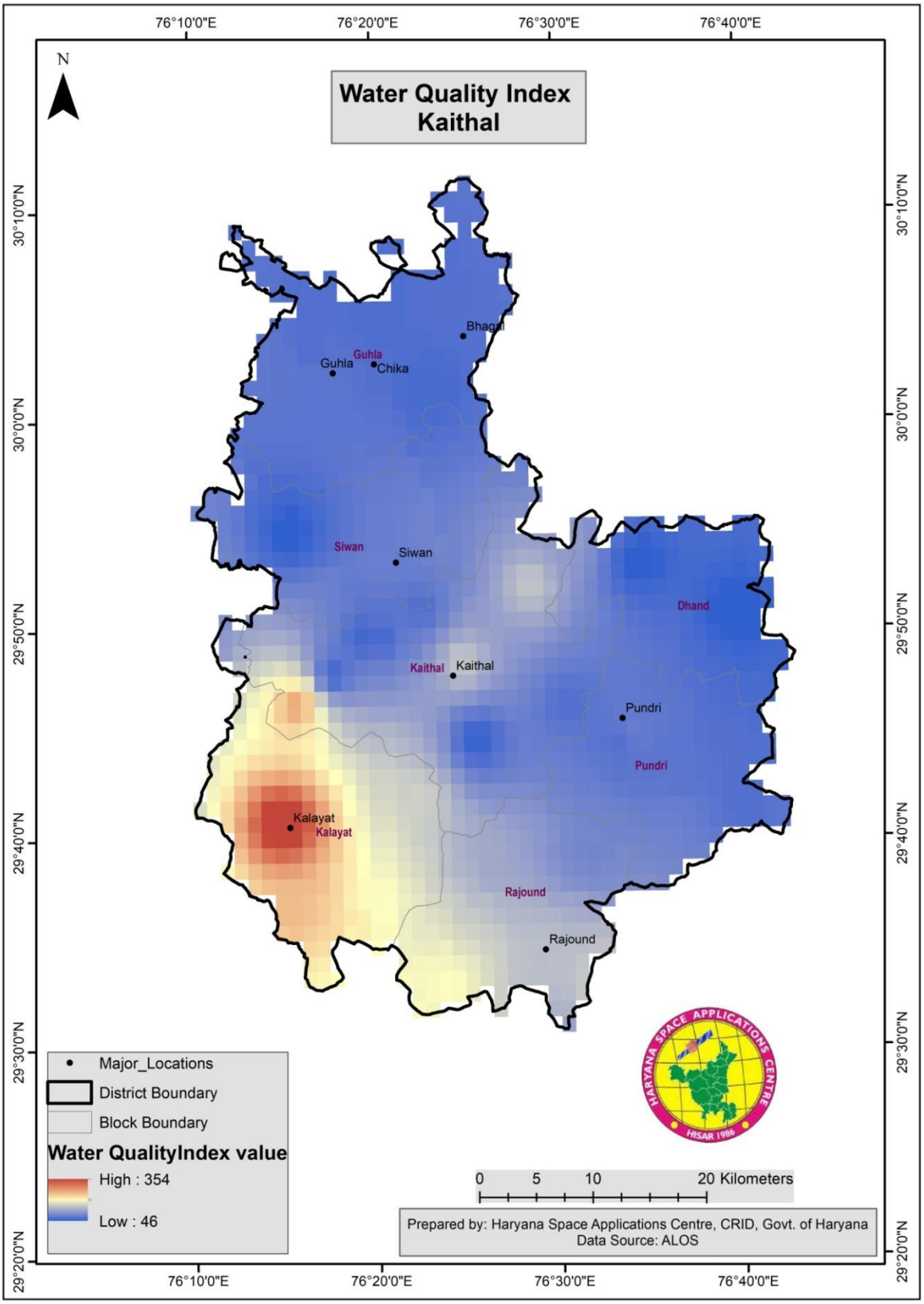


Figure 14- Water quality index of Kaithal District

5. Aquifer System

The area has both unconfined and confined aquifers. In general, the unconfined aquifers occur down to 60 m depth below ground level in the district and abstracted through hand pumps and shallow tubewells. The alluvium forms the principal ground water reservoir and the principal aquifer material comprises fine to medium sand and sand mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well-connected granular zones that have a pinching and swelling disposition and are quite extensive in nature. The ground water in confined condition is abstracted through medium and deep tubewells. In alluvium potential aquifer zone exists down to explored depth of 600 m. In the district, thickness of alluvial formation increases towards Southwest. Perusal of the data of the exploratory tubewell constructed in Ghaggar Basin indicate that tubewells tapping water bearing zone with in 100 to 200 m depth yield 1500 lpm to 3000 lpm for draw down of 5 to 17 m. The quality of water has not been found fresh in shallow as well as deep aquifer in some parts of the district. Shallow aquifer zones contain fresh water in northern and eastern parts of the district covering Gulha, Kaithal, Pundari, Kalayat and Rajaound. Marginal to saline ground water occur in shallow zones in part of Kalayat and Rajaound blocks. In general, deeper zone in Kalayat and Rajaound block contains brackish to saline ground water. A large number of shallow tubewells exists in all parts of the district having fresh water, however their number is significantly large in blocks of Gulha, Pundari, Kaithal, Kalayat followed by Rajaound. Depth of these shallow tubewells ranges from 20 to 50 m and yield varies between 500 lpm to 1200 lpm for moderate drawdown. Deeper tubewells tap water bearing zones down to 120 m depth and yields 1500 to 3000 lpm for 4 to 7 m of draw down. In some parts of district i.e., surrounding Padla in Kaithal block a tubewell tapping unconfined aquifer group in the depth range 26 to 91 m yields a discharge of 1500 lpm for drawdown of 7.0m Central Ground Water Board has drilled 07 exploratory wells, 01 Slim Holes and 06 piezometers to delineate and determine the potential aquifer zones, evaluation of aquifer characteristics etc. Besides, 09 piezometers have been constructed through outsourcing by M/s WAPCOS Ltd. The drilling has been done to a maximum depth of about 610 m and revealed the presence of 6 to 22 prominent permeable granular zones. Aquifer parameters as determined from exploratory activity of the Central Ground Water Board reveals that in the central part of the district transmissivity value 686 m 2 /day, Lateral hydraulic conductivity of 11.45 m/day and specific yield value 2.35 10 -2 have been observed. In the north central part of the district covering part of Gulha block transmissivity value 1400 m 2 /day, Lateral hydraulic conductivity of 25 m/day and in the northern extreme part of the district transmissivity value 400 m 2 /day, Lateral hydraulic conductivity of 22.2 m/day and specific yield value 18.00 10-2 have been reported. 5.2 Water level behavior Depth to water level in the district ranges from 3.92 to 35.39 m bgl during pre-monsoon period and 1.67 mbgl to 36.68 mbgl.

6. Water Requirement/ Demand

The district mainly drained by the river Ghaggar and Markanda. The Ghaggar and Markanda rivers are important and seasonal rivers in the district and flows through the northern part of the district covering Guhla block in westerly direction and enters Patiala district of Punjab. River Ghaggar sometimes gets flooded during monsoon and cause extensive damage to crops and property. Besides Sirsa branch which is part of western Yamuna canal system, is the most important canal passing through the Pundri, Kaithal and Kalayat blocks area. Depletion in ground water resources is the major concern of the district.

As per the information furnished by Irrigation Department, Public Health & Engineering Department (PHE) and Central Ground Water Board Report, 2013, the total annual water availability of the district was 682. 673MCM. As per Central Ground Water Board report 2013, the status of ground water is Over-exploited in all the blocks of the district. None of the blocks of district fall under safe category.

6.1 Demand for water sources and the gap:

The present & projected water demand from various sectors such as domestic, livestock, agriculture, industrial and power in the district is assessed. The total present water demand from various sectors is 2466.03 MCM, while future water demand (2022) is 2470.61 MCM. To meet this demand, total of 174.843MCM of surface water and 507.83 MCM of ground water are available in the district. Therefore, the present water gap is to the tune of 1305.21MCM, and projected water gap (2022) is to the tune of 1306.99 MCM. To bridge this gap, strategic action plan has been prepared by various departments. The following **Table 10** shows the blockwise status of water availability.

Table 10- Block wise status of water availability

Block	Sources			
	Canals	**STP**	**GroundWater**	**Total**
Guhla	8.424	3.65	104.65	**116.724**
Kaithal[1]	46.684	10.95	141.73	**199.364**
Kalayat	53.883	1.825	71.2	**126.908**
Pundri[2]	20.961	1.2775	115.69	**137.9285**
Rajound	27.188	0	74.56	**101.748**
Total	**157.14**	**17.703**	**507.83**	**682.673**

Surce: Irrigation Department, CGWBReport, 2013, PHE Department

6.2 Water Budget

Table 11- Block wise water budget for Kaithal.

Block	Existing water availability			Water Demand	
	Surface	Ground	Total Supply	Present	Project
Kaithal	0	632025	632025	632025	-
Guhla	0	477000	477000	477000	-
Pundri	0	155025	155025	155025	-
Kalayat	0	143100	143100	143100	
Siwan	0	477000	477000	477000	-
Rajound	0	5473575	5473575	5473575	-
Dhand	0	1097100	1097100	1097100	-

7 Strategies for Water Conservation

The ground water availability in Kaithal is limited and presently being over exploited results in decline of ground water levels. The Kaithal 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.

1. In order to arrest the declining trend of water levels in the district, the rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir.

2. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited block

3. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.

4. The water level monitoring network needs to be increased in the block.

5. The contribution of surface water to irrigation in the district is very less. Measures should be made to increase the canal water supply for irrigation and also for drinking purposes.

6. Local populaces to be educate regarding consequences of mining of ground water and need for its effective and economic use.

7. Roof top rain water harvesting for factories institutional buildings, housing complexes and other big buildings has been made mandatory to augment the ground water recharge and may be included in building laws. The law should be strictly implemented.

8. Water harvesting and artificial recharge structures should be constructed in ridge area, which is one of the major recharge zones for Kaithal. The run off should be diverted to abandoned mining pits. Small check dams can be constructed in hilly areas to recharge/ utilize surplus run off.

9. The industrial effluents causing ground water pollution should be treated before discharge so as to curb ground water pollution.

10. Strict regulatory measures are required for ground water pump age, particularly for industrial use. Water meter should be fitted on every tubewell and be allowed to withdraw fixed quantity of ground water.

7.1 Artificial Recharge

There are 292 tanks /ponds in the Kaithal district which act both as water conservation and recharge structures. There is need to revive the tradition water bodies of the villages. The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. Central Ground Water Board has not taken up any recharging scheme in the district. As per assessment of the Central Ground Water Board for preparation of Master Plan on Artificial Recharge, a large part of district is suitable for Artificial Recharge. But, the northern half of the district covering p a r t s of Gulha, Kaithal and Pundari Blocks have been found most suitable and feasible for artificial recharge on the basis of annual decline in water level and annual mean water level for last ten years. Most suitable structure for artificial recharge is recharge trench with or without injection wells and recharge shaft of variable size to accommodate available run-off or surplus available water for recharge. As per ‘Master Plan on Artificial recharge 2013’ an area of 2317sq.km has been identified for artificial recharge in the district which has a subsurface storage potential of 3550 MCM. A volume of 4722 MCM of water would be required to attain this recharge. A total of 5696 Nos of recharge structure have been proposed. Besides this roof top rain water harvesting should also be taken up in the district. The block-wise details on tanks/ponds and recharge through them is given in table below:

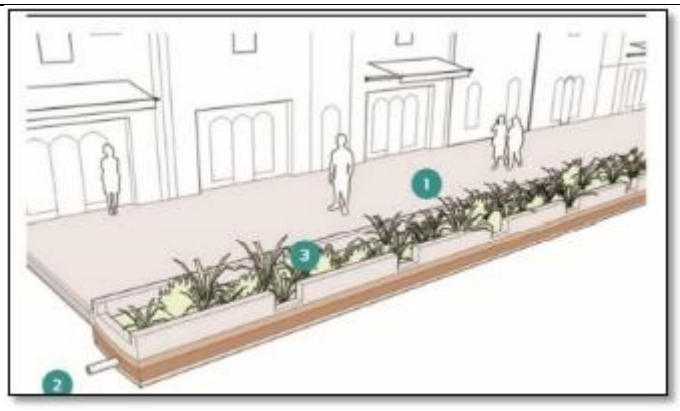
Table 12- The block-wise details on tanks/ponds and recharge

Block	No of Tank/ Pond	Average water spread area(ha)		No of days water available		Recharge (Ham)	
		monsoon	non-monsoon	monsoon	non-monsoon	monsoon	non-monsoon
Gulha	54	27.54	12	120	200	4.758912	3.456
Kithal	81	102.15	35	120	200	17.65152	10.08
Kalayat	42	106.25	38	120	200	18.36	10.944
Pundri	69	199.65	73	120	200	34.49952	21.024
Rajaund	46	73.3	23	120	200	12.66624	6.624

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 Kaithal. 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 13**.

Table 13- Methods of water table recharge strategies in urban area.

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

3	Pervious Pavement	 
4	Stormwater Tree	

7.3 Plantation (wasteland map)

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 within Kaithal 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 Kaithal district is shown in **Figure 15** and **Table 14** shows the proposed no of plantation targets in Kaithal District.

Table 14-The proposed targets for plantation in Kaithal District

Block Name	Wasteland Area (feet)	Plantation at 5 feet spacing
Dhand	6941557	1388311
Guhla	27474668	5494934
Kaithal	26323533	5264707
Kalayat	11770554	2354111
Pundri	4941561	988312.3
Rajound	6652609	1330522
Siwan	14210029	2842006

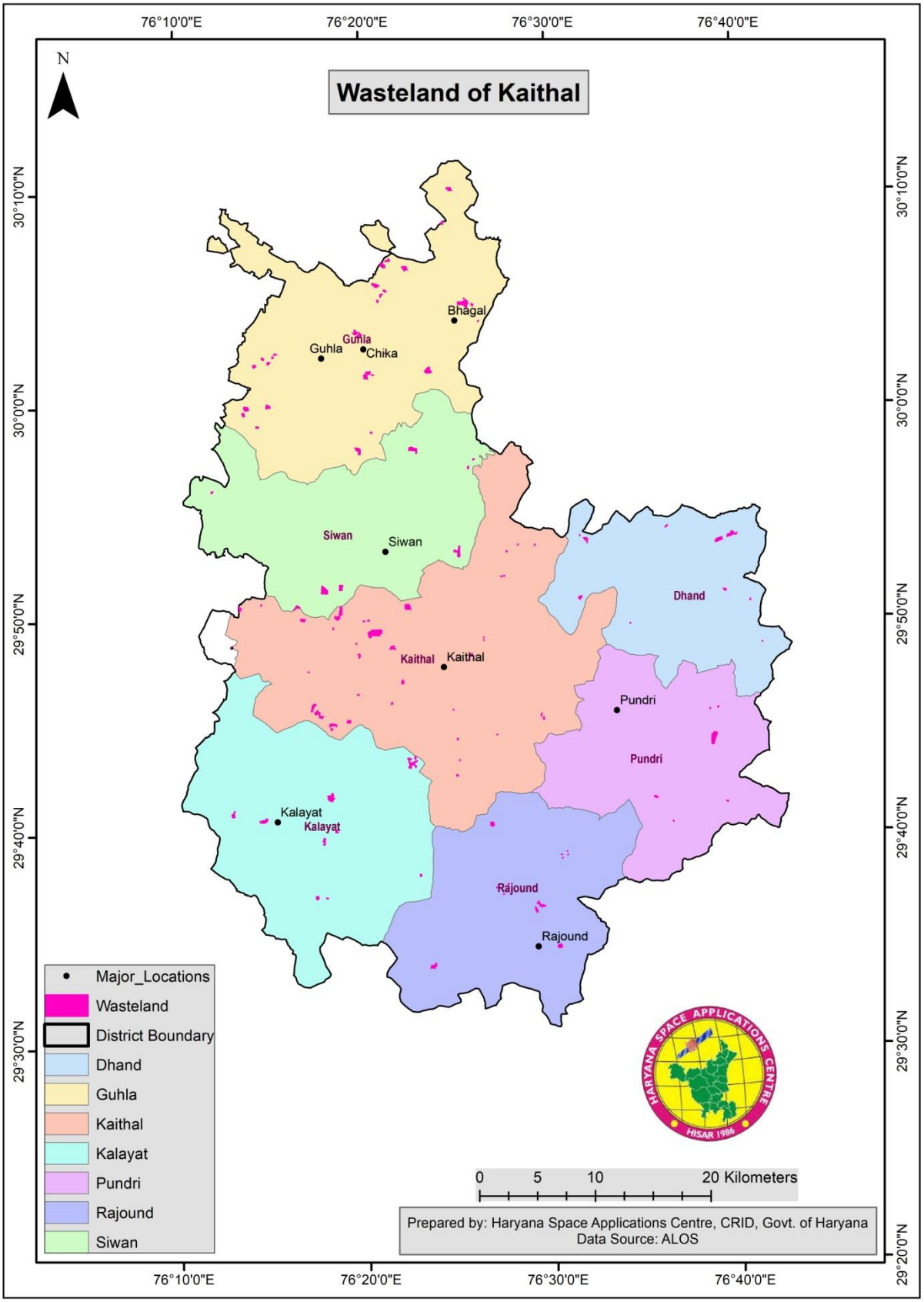


Figure 15- Wasteland Map of Kaithal District

7.4 Surface water management

7.4.1 Pond restoration and rejuvenation

As earlier mentioned, in Chapter II, the number of surface water bodies such as ponds and lakes are continuously disappearing from the landscape. However, their preservation, restoration and rejuvenation would be essential to not only survival of biodiversity, but also to maintain microclimates, and ultimately essential to preserve human civilization.

Research also shows that that storage of water within a single pond structure contributed to a range of 26,000 to 62,000 m3 to groundwater recharge over a year, that was equivalent to 1.3 to 3.6% of the total water recharge volumes in the study carried out in Ramganga Basin, India, which would serve to irrigate lands of 8 to 18 hectares of land cropped in the rabi season. As such ponds demonstratively serve as an essential structure for water security. Although it serves to only hold a relatively small volume of water, the stored water becomes vital for food security and economic stability within a small community.

Ponds are also essential structures that provide water security in areas where groundwater has grown extremely saline and cannot be used for irrigation purposes. Irrigation channels have been built in such areas during the Green Revolution in these areas in order to meet irrigation demands in this region. However, in order to supply to the increasing demands of high yield production, a lot of pressure has been put on the agriculture industry, as a result of which freshwater demand has increased. The original channels are therefore not sufficient to meet the current water demands. Without accesses to enough water, structures such as ponds become of essential service to allow for agriculture to be sustained in areas of water scarcity.

These traditional water bodies are what saved drought hit villages from the brink of extinction and starvation in the great spell of droughts that the nation faced in the 1970’s. Examples led by pioneers such as Anna Hazare and P R Mishra who revolutionized and reinstated the importance of having water storage and wise utilization for increasing crop yield have served as models for reviving these traditional lifelines within the rural eco-system, while setting important benchmarks for its urban counterparts. Culturally, due to its life-sustaining properties, ponds have also been the centers or natural hubs for monthly or annual fairs to be held, and have been biodiversity hotspots that encourage the link between human and wildlife.

In order for pond restoration and rejuvenation to be done in a scientific and methodical manner, following a 11-step procedure that is accommodative of each individual pond site requirements are given below

1. Pond Identification and Pond profiling

2. Project Feasibility Assessment

3. Administrative Approvals (Demarcation, GIS mapping, and Panchayat Resolution)

4. Detailed Project Report

5. Financial Approval

6. Community Mobilization

7. Cleaning and Levelling

8. Civil Work, Micro-STP Installation and Waste Management

9. Landscaping and Beautification

10. Sustainability Plan (O & M)

11. Monitoring and Evaluation

While the above methodology has been described in a step wise fashion, the cycle of pond rejuvenation and restoration functions on a feedback system and therefore inputs from each step can integrated into steps preceding and after as well.

7.4.2 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 exist. Over the past three decades, the city limits of Kaithal 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 is a feasible solution that may allow for localized treatment which may eventually be reused for secondary purposes. Like other systems, decentralized systems must be properly designed, maintained, and operated to provide optimum benefits.

The following table (**Table 15**) shows a list of generic conditions that are most often found in Kaithal according to the type of treatment considerations and other main constraints such as land availability and population, given that finances are a constant.

Table 15 Indicators and factors to decide the type of decentralised treatment required

Type of Effluent Received	Land Availability	Number of people	Type of Treatment Required
Grey and Black Water Effluent	Yes	<5000 people	Natural Based Technology
Grey + Black Water Effluent	Yes	>5000 people	Hybrid Technology
Grey and Black Water Effluent	No	>5000 people	Mechanized
Black Water	Yes	<5000 people	Hybrid
Black Water	No	>5000 people	Mechanized FSTP for a cluster

7.4.3 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.

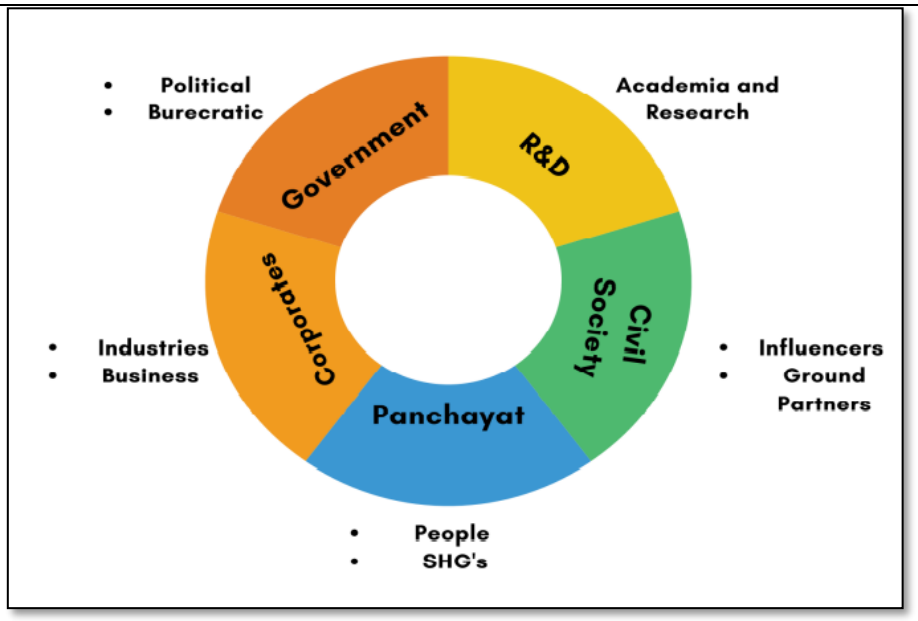


Figure 16- Various stakeholders of IEC Activities

Table 16-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

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 17.** For the process of calculating suitable site a fixed weightage is needed to be applies on the above-mentioned criteria (**Table 18).**

Table 17- Block wise area under very good suitable site proposed for rain water harvesting

Block Name	Area (Very Good suitability area in Sq meter)
Dhand	149786568
Guhla	127359276
Kaithal	205399934
Kalayat	46781615
Pundri	171119362
Rajound	130157943
Siwan	74862466

Table 18 -Assigned Weight for Criteria Parameters

Parameters	Weightage
Rainfall	35
Slope	25
Drainage Density	5
Soil Texture	20
LULC	15

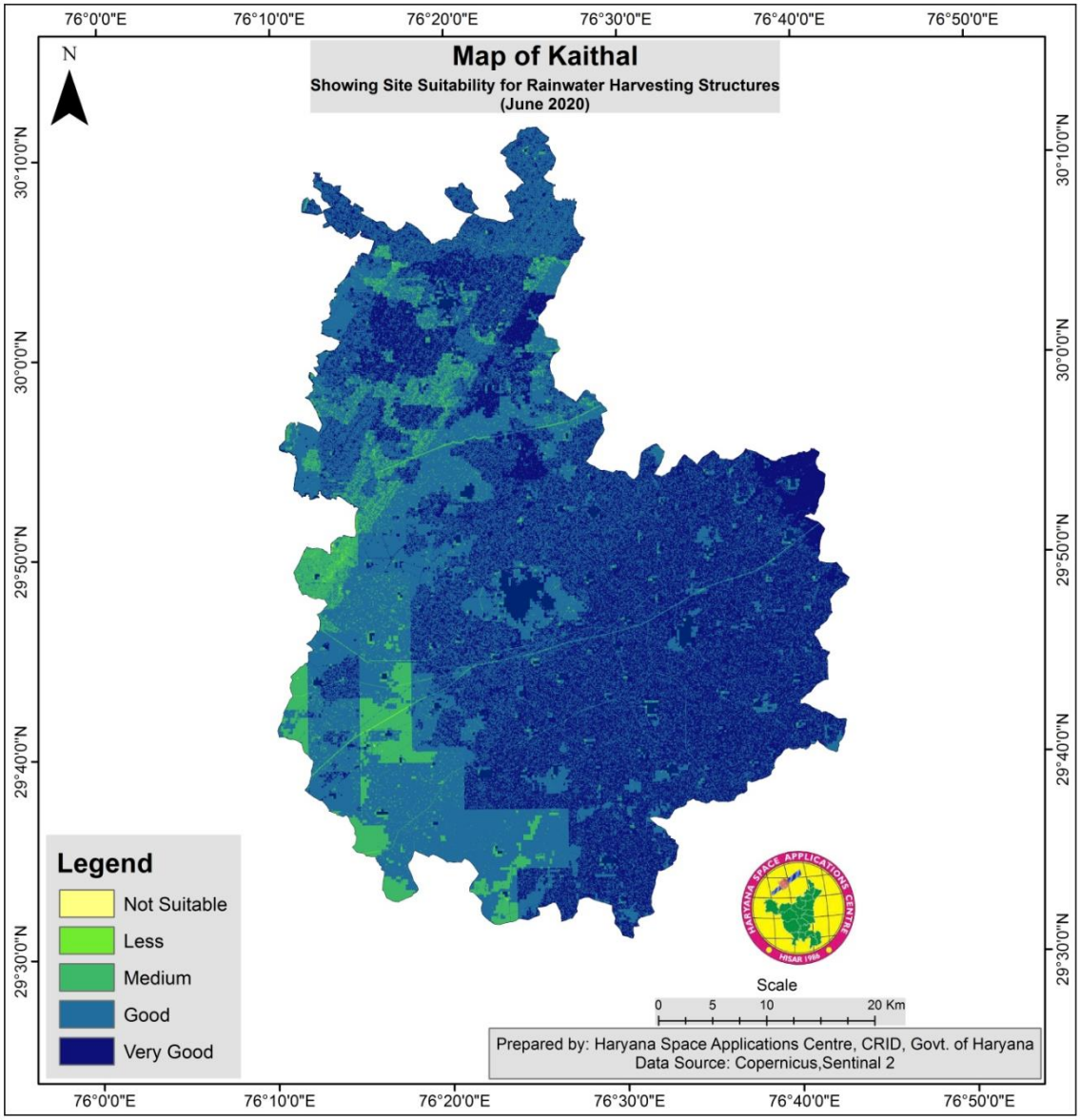


Figure 17 -Site Suitability Map for Rainfall Harvesting Structure in the Year 2020

8.2 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 18**). 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 18 shows the proposed suitable sites based on drainage structure in Kaithal district. Proposed harvesting structures in Kaithal based on drainage is presented in table 19.

Table 19 -Proposed harvesting structures in Kaithal based on drainage

Sl. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Dhand	161	146	47	69	17
2	Guhla	163	158	87	37	0
3	Kaithal	315	275	129	57	65
4	Kalayat	203	203	103	25	75
5	Pundri	171	141	81	61	12
6	Rajound	195	172	67	23	64
7	Siwan	161	151	85	27	24

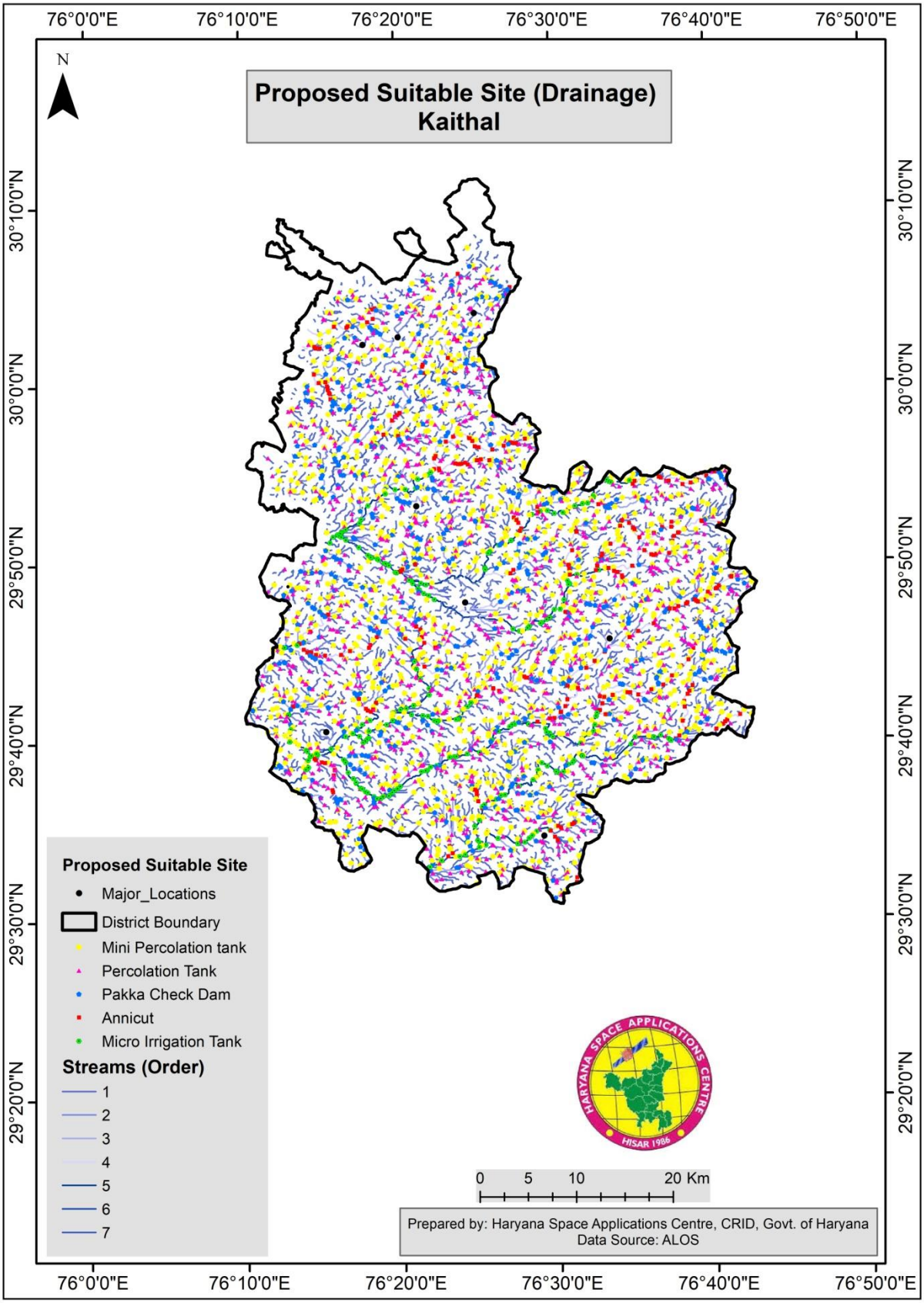


Figure 18- Proposed suitable sites based on drainage in Kaithal District

9 Conclusion

Due to rapid urbanization, the Kaithal 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://kaithal.gov.in/about-district.

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