Report No.-08

JSA-CTR

Scientific Action Plan for Jhajjar

Prepared By-

Haryana Space Applications Centre (HARSAC),

Citizen Resource Information Department (CRID)

Government of Haryana

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1. Introduction

1.1 History

The land of Jhajjar shows signs of early inhabitation. Various historical buildings can be seen here. During 1191 AD when there was a war between Gori and King Prithvi Raj, the area of Jhajjar was not inhabited and was a forest with no one living there. In the eastern part was a town by the name Malokan where the Jats lived and was amongst the worst affected areas due to the war. Most of the people living there relocated to different places after the war. Chajju Jat who was a resident of the village made an appeal so that rehabilitation of the village could be done. However, the appeal was rejected by Emperor Gori. He ordered that the village should be rehabilitated somewhere else. Hence, the jats of Malokan came to live in the city of Jhajjar. After it got established, the city of Jhajjar had to go through a lot of political unrest in the hands of many rulers i.e., Mughal rulers, Muslim rulers and the Britishers too. While many people say that the city derived its name from the founder i.e., Chajju which was changed later to Jhajjar, many others are also of the opinion that it was derived from the natural fountain by the name Jharnagar. It was a part of Rohtak district until July 15th 1997, when it was separated from it.

1.2 Location

Jhajjar district of Haryana lies between 28o 22': 28o 49' North latitudes, and 76o 18': 76o 59' East longitudes. The district lies in the south east of Haryana state. The district is having a geographical area of 1834 sq.km, which is 3.77 % of total area of the state. The total population of the district is 956,907, (514,303 Males and 442,604 Females) as per the Census 2011. Rural population is 74.60% of the total population. Population density is 522 person per sq. km. Administratively, the district is controlled by Rohtak division. It is divided into three tehsils namely Jhajjar and Bahadurgarh & Beri, and sub-divided into five development blocks namely Jhajjar, Beri, Bahadurgarh, Matenhail and Salhawas. The district headquarter is situated in Jhajjar town at a distance of about 65 km from Delhi. On its north lies the Rohtak Subdivision of Rohtak District and in the South lies the Subdivision Rewari of Rewari District. In the East lies Tikri border of Delhi and in the West lies Jhajjar Sub Division of Bhiwani District. In the eastern part of district, the area is considerably even. Some area is uneven and also suffers from inundation and water logging during Monsoon season. The overall topography of the area is marked by alluvial plain and at some places by undulating dunes. The average plain elevation of the district is about 222 meters above mean sea level. There is a gentle slope from North South. The Location Map of Jhajjar district is shown in **Figure 1**.

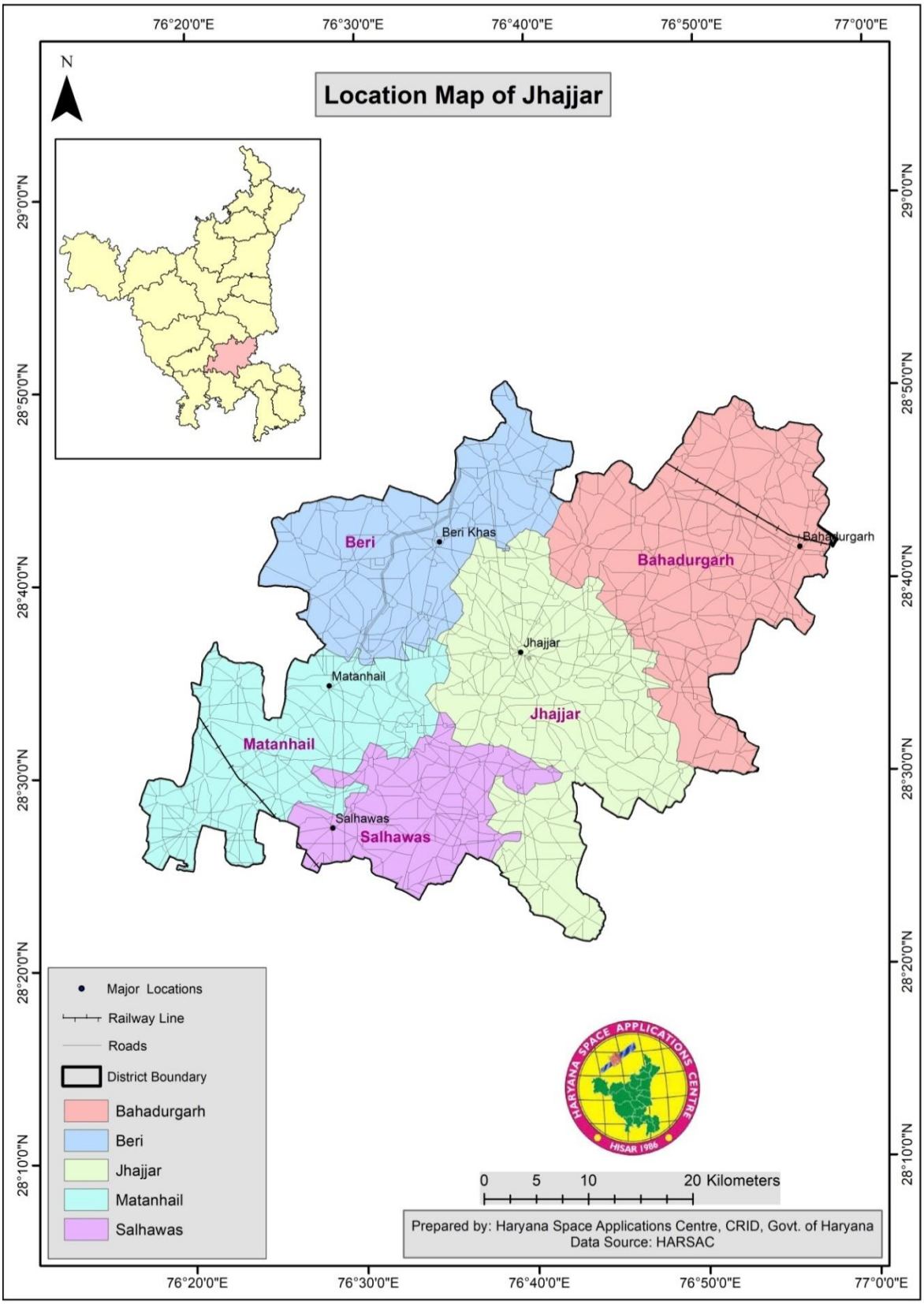

Figure 1 Location Map of Jhajjar District

1.3 Administrative Setup

The administrative setup of the District of Jhajjar 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 Jhajjar District.

Country	India
State	Haryana
Division	
Headquarters	Jhajjar
Total Population (2011)	958,405
Density	520/km2 (1,400/sq. mi)
Vidhan Sabha constituencies	4
Lok Sabha constituencies	Rohtak (shared with Rohtak and Rewari districts)
Website	https://jhajjar.nic.in/
Coordinates	28°35” N latitude and 76°15” E longitude
Total Area	1,834 km2 (708 sq. mi)
Elevation	220M

Sub Divisions (4)	Badli, Bahadurgarh, Beri, Jhajjar
Tehsils (5)	Badli, Bahadurgarh, Beri, Jhajjar, Matanhail
Sub-Tehsils (1)	Salhawas
Blocks (6)	Badli, Bahadurgarh, Beri, Jhajjar, Matanhail, Salhawas
Municipal Council (1)	Bahadurgarh
Municipal Committees (2)	Beri, Jhajjar
Population (Census 2011)	958,405

Local Institutions: -

Total Village	264
Village Level	Panchyat
Block Level	Panchyat Samiti
District Level	Zila Parishad
Total Village	264

Source: https://jhajjar.nic.in/administrative-setup/

1.4 Climate

1.4.1 Temperature

The climate of the district can be classified as tropical steppe, semi-arid and hot which is mainly characterized by the extreme dryness of the air except during monsoon months, intensely hot summers and cold winters. During three months of south west monsoon from last week of June to September, the moist air of oceanic origin penetrates into the district and causes high humidity, cloudiness and monsoon rainfall. The period from October to December constitutes post monsoon season. The cold weather season prevails from January to the beginning of March and followed by the hot weather or summer season which prevails up to the last week of June.

1.4.2 Rainfall

The normal annual rainfall in Jhajjar district is about 532 mm and rainy days spread over 23 days. The south west monsoon sets in the last week of June and withdraws towards the end of September and contributes about 85% of the annual rainfall. July and August are the wettest months. 15% of the annual rainfall occurs during the non-monsoon months in the wake of thunder storms and western disturbances. The maximum temperature reaches up to 45o C while in winter season minimum temperate fall up to 4o C in the month of January. Sandy dust cyclones are common in summer season. The rainfall map of Jhajjar district is shown in **Figure 2.**

Table 2 Rainfall Data of Jhajjar

Normal Annual Rainfall	532 mm
Normal monsoon Rainfall	379.3 mm
Temperature	
Mean Maximum	45 °C (May & June)
Mean Minimum	4 ° C(January)
Normal Rainy days	23

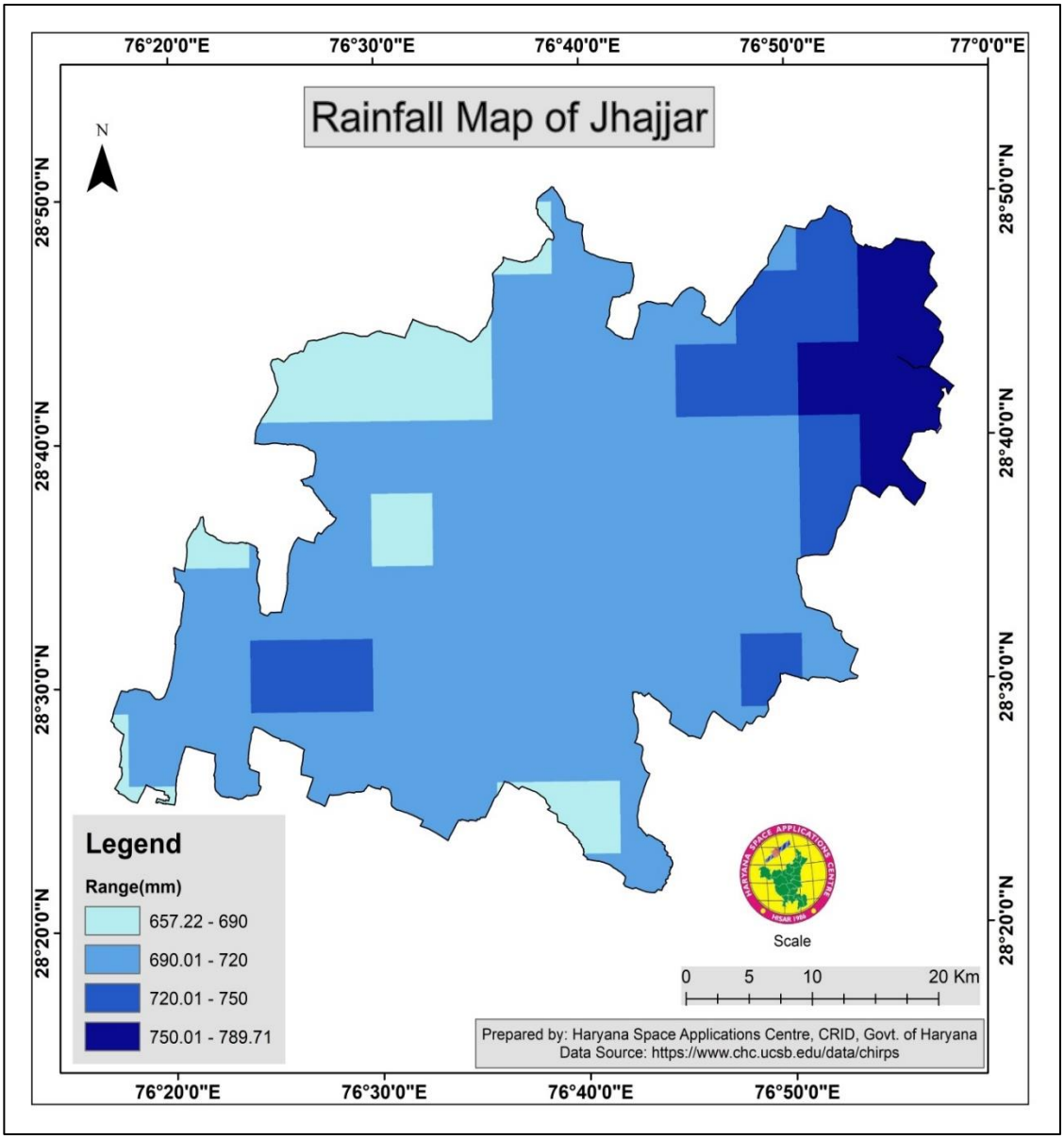

Figure 2 Rainfall Map of Jhajjar District

1.5 Elevation and Topography

The overall topography of the district is marked by alluvial plain and at some places by undulating dunes. The average plain elevation of the district is about 222 meters above mean sea level (**Figure 3**). There is a gentle slope from North South (**Figure 4**). The Hydraulic gradient of ground water is very gentle. Ground water movement in the North Western part is from SE to NW in the South Western part is from SW to NE The district falls within. the classified arid and semi-arid zones. Further Slope map of district is prepared to understand flow of water, though in-depth study is separately being conducted with the help of Contour maps (**Figure5**).

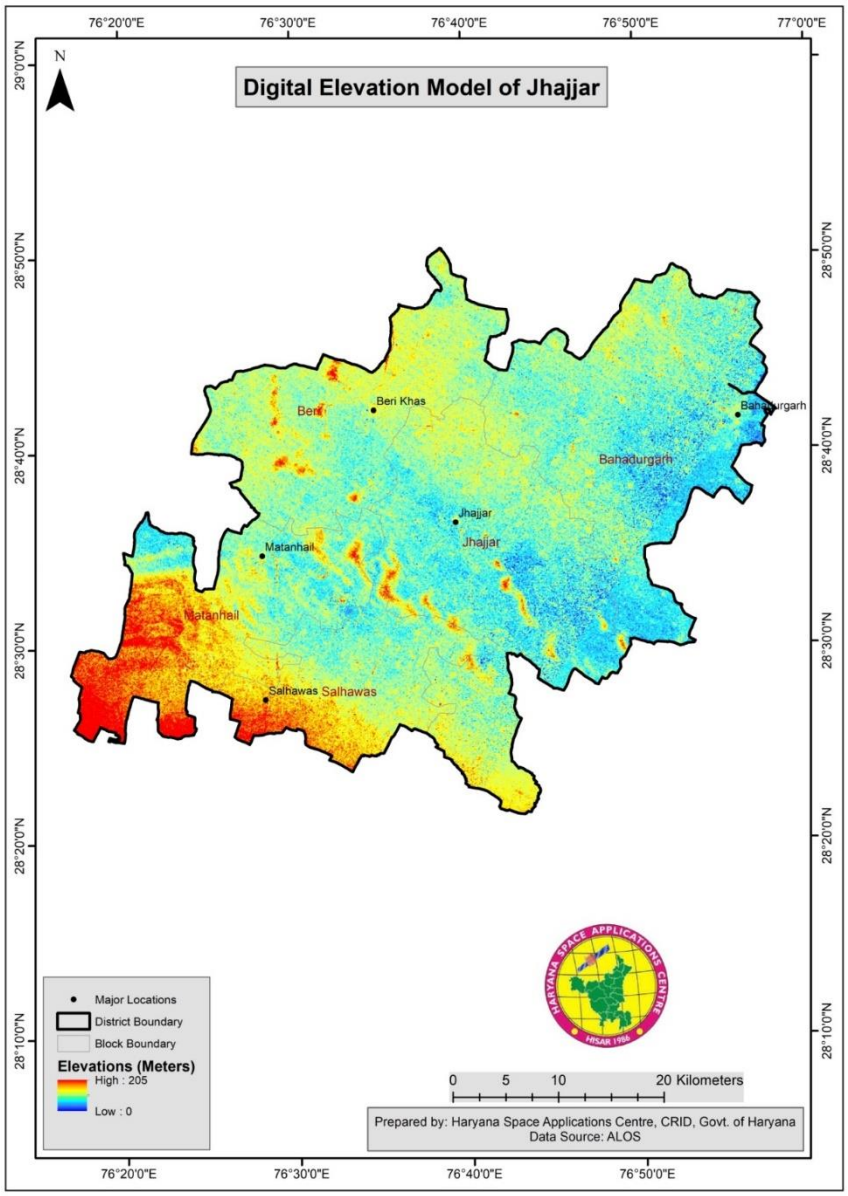

Figure 3 Digital Elevation Model of Jhajjar District

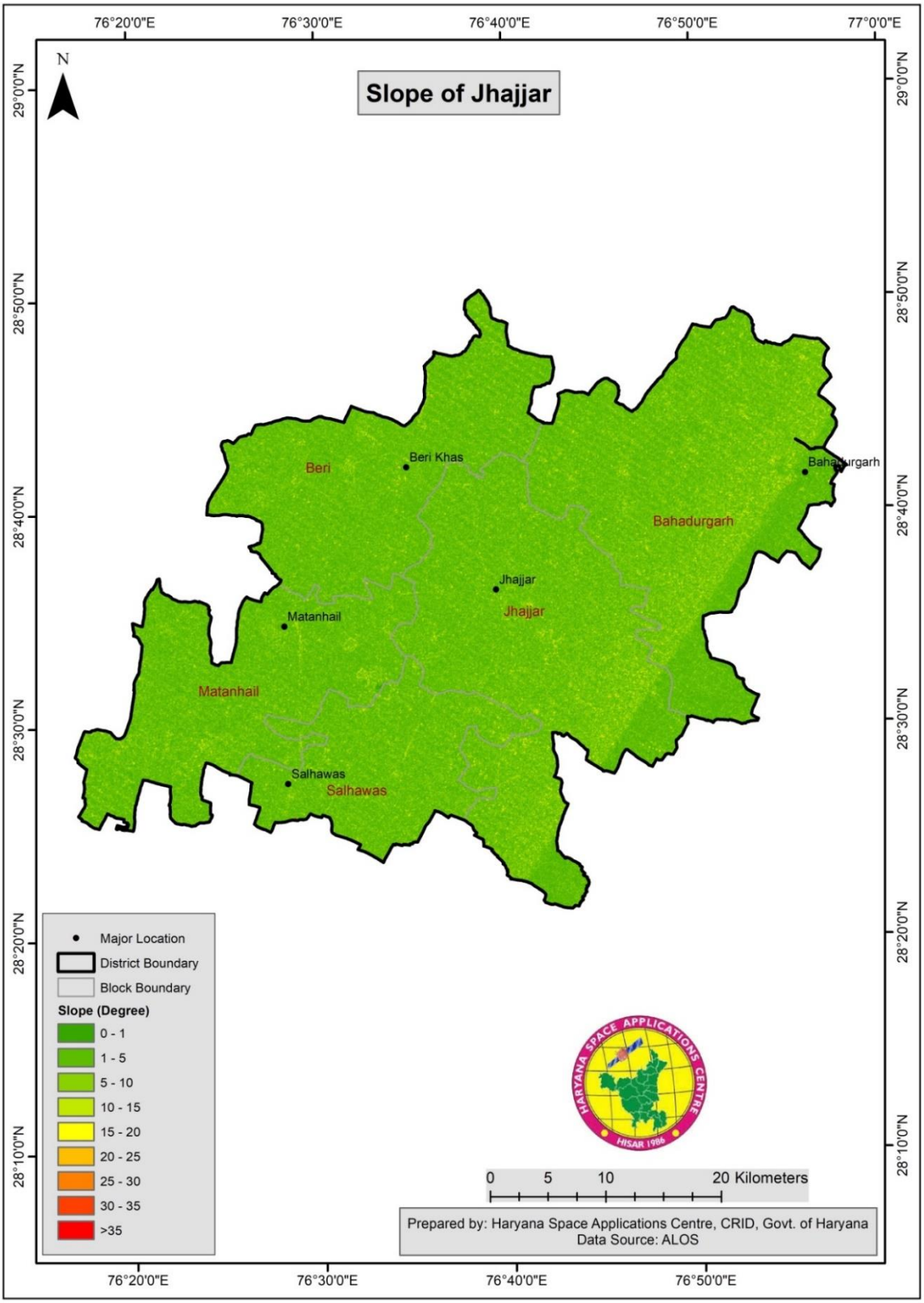

Figure 4 Slope Map of Jhajjar District

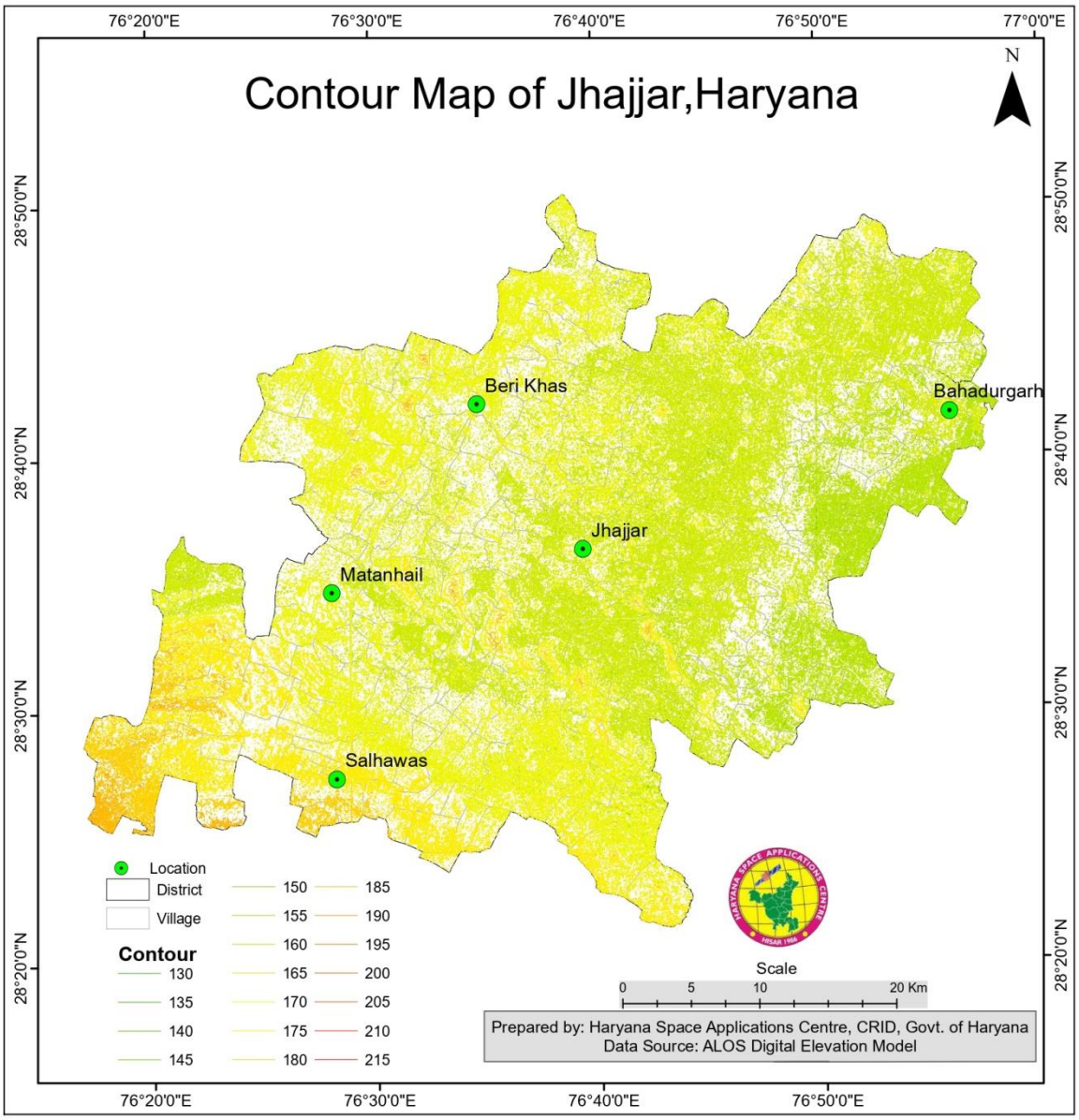

Figure 5 Contour Map of Jhajjar District

1.5.1 Geology and Lithology

The area forms a part of Indo- Gangetic alluvial plain ranging from Pleistocene to recent in age Aeolian deposits of Sub- recent age cap the plains. The sediments comprise of clay, sand and Kankar mixed in different proportions. No exposure of hard rock farming the basement is seen in the area. Physiographically, the district area is dotted with sand dunes and very small isolated hill in south western part and rest is alluvial plain. Alluvial plains are by and large flat. And elevation in the district ranges from 212 to 222m above MSL Howser, the elevation ranges up to 276m above MSL at places in the SW part of the district. The general slope is north east to south west, and is of the order of 0.48m/ km. from north to south and increases towards south west. In absence of natural drainage, the area is drained by main drain No.8 of the district. The canal system of the district, if required, is also utilized to drain rain water during rainy season. The Lithology map of the district is shown in **Figure 6.**

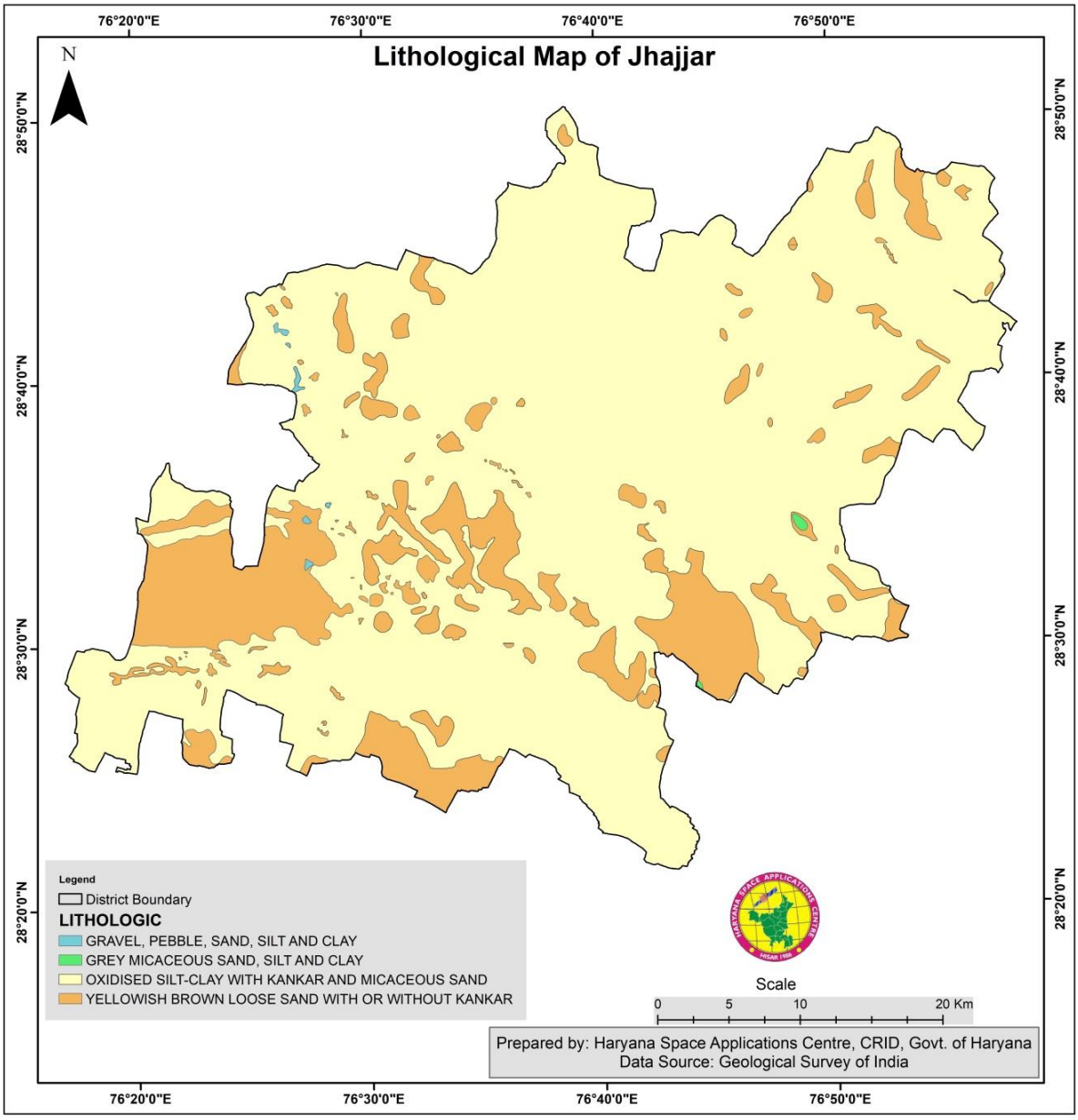

Figure 6 Lithological Map of Jhajjar District

1.5.2 Soil Profile

The area forms a part of Indo- Gangetic alluvial plain ranging from Pleistocene to recent in age Aeolian deposits of Sub- recent age cap the plains. The sediments comprise of clay, sand and Kankar mixed in different proportions (**Figure 8**). No exposure of hard rock farming the basement is seen in the area. Physiographically, the district area is dotted with sand dunes and very small isolated hill in south western part and rest is alluvial plain. Alluvial plains are by and large flat. And elevation in the district ranges from 212 to 222m above MSL. However, the elevation ranges up to 276m above MSL at places in the SW part of the district. The general slope is north east to south west, and is of the order of 0.48m/ km. from north to south and increases towards south west. In absence of natural drainage, the area is drained by main drain No.8 of the district. The canal system of the district, if required, is also utilized to drain rain water during rainy season. The soils of the district are fine to medium textured. It comprises sand to sandy loam in north eastern part covering Bahadurgarh, and Jhajjar blocks. The soil contains massive beds of pale reddish brown coloured clay in the southern eastern parts of the area. The nitrogen contents are low in the soils of the area. Potassium and phosphorous is medium in Salhawas block whereas high potassium, medium phosphorus occurs in the soils of the district. The soils of the district are classified as arid brown (Solonized) and sierozem. The general profile of soil health of Haryana state is shown in **Figure 7**.

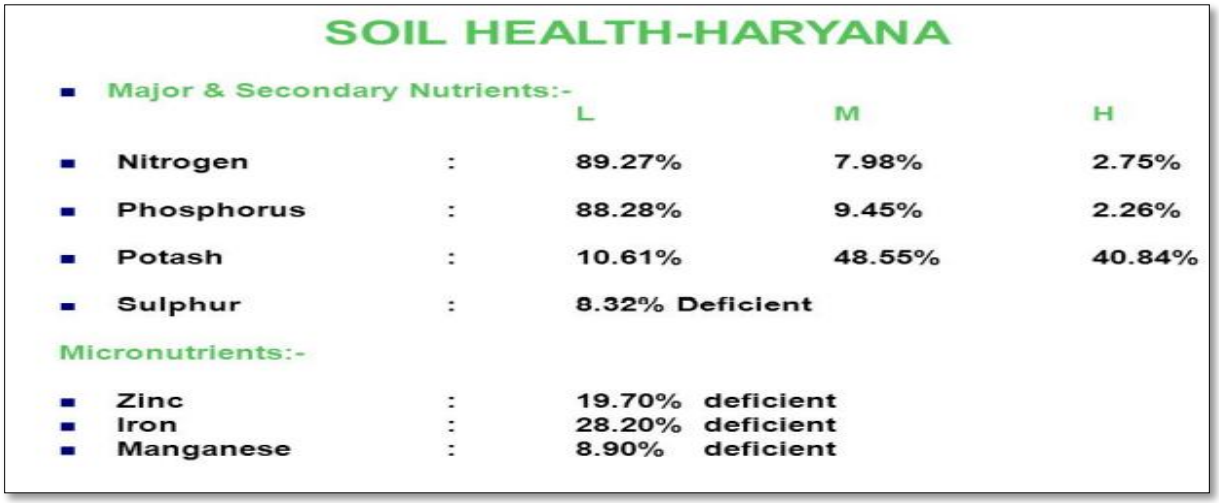

Figure 7 General soil health profile of Haryana

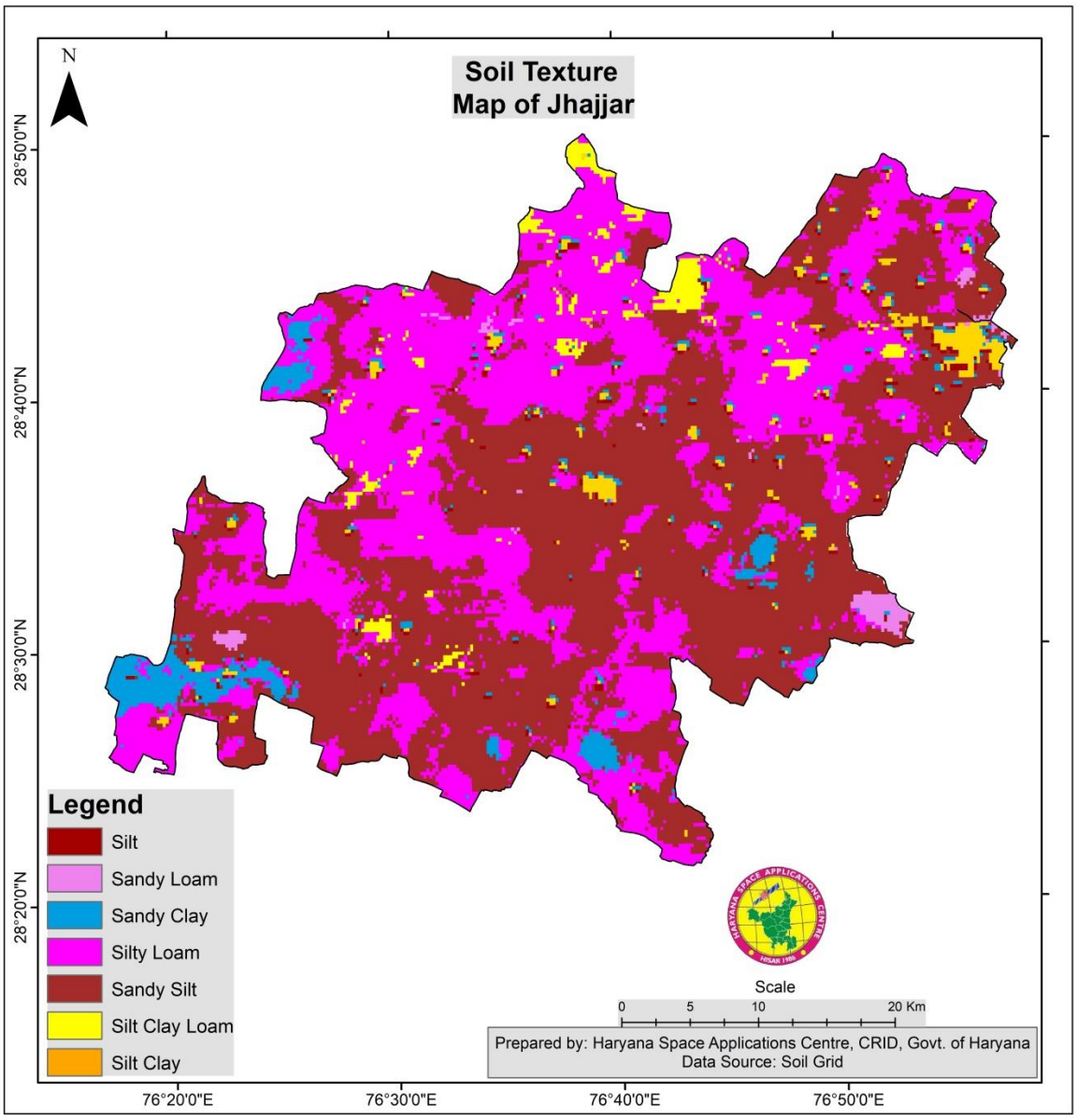

Figure 8 Soil texture map of Jhajjar District

1.6 Landuse

Much of the region falls under the steppe type of vegetation. However, it being an agricultural dominant district, dense cover of natural vegetation is almost absent in the district. In the sandy tracts plants like Dhalphulio, Jawasa, Ratanjot, Meini, Farid buti, Khip, Harmal, Malha/Jhad/Beri etc. are found. Many of them are of great medicinal value. Farash is the most characteristic tree of the drier parts. This tree grows readily from the cuttings and needs limited amount of water. Shisham is grown near villages. Along roadsides and near canal banks are found planted tress namely Lasura, Shahtoot, Jumela, Dhak, Amaltas, Siris, Neem, Kikar, Reru etc. Kachnar, Bama, Sohanjna, Kaim, Symbal etc. are also found occasionally. Chhittar Thohar or Nagphani, the common prickly cactus, can be seen in wastelands and along hedges. The land use land cover map of Jhajjar District is shown in **Figure 9**.

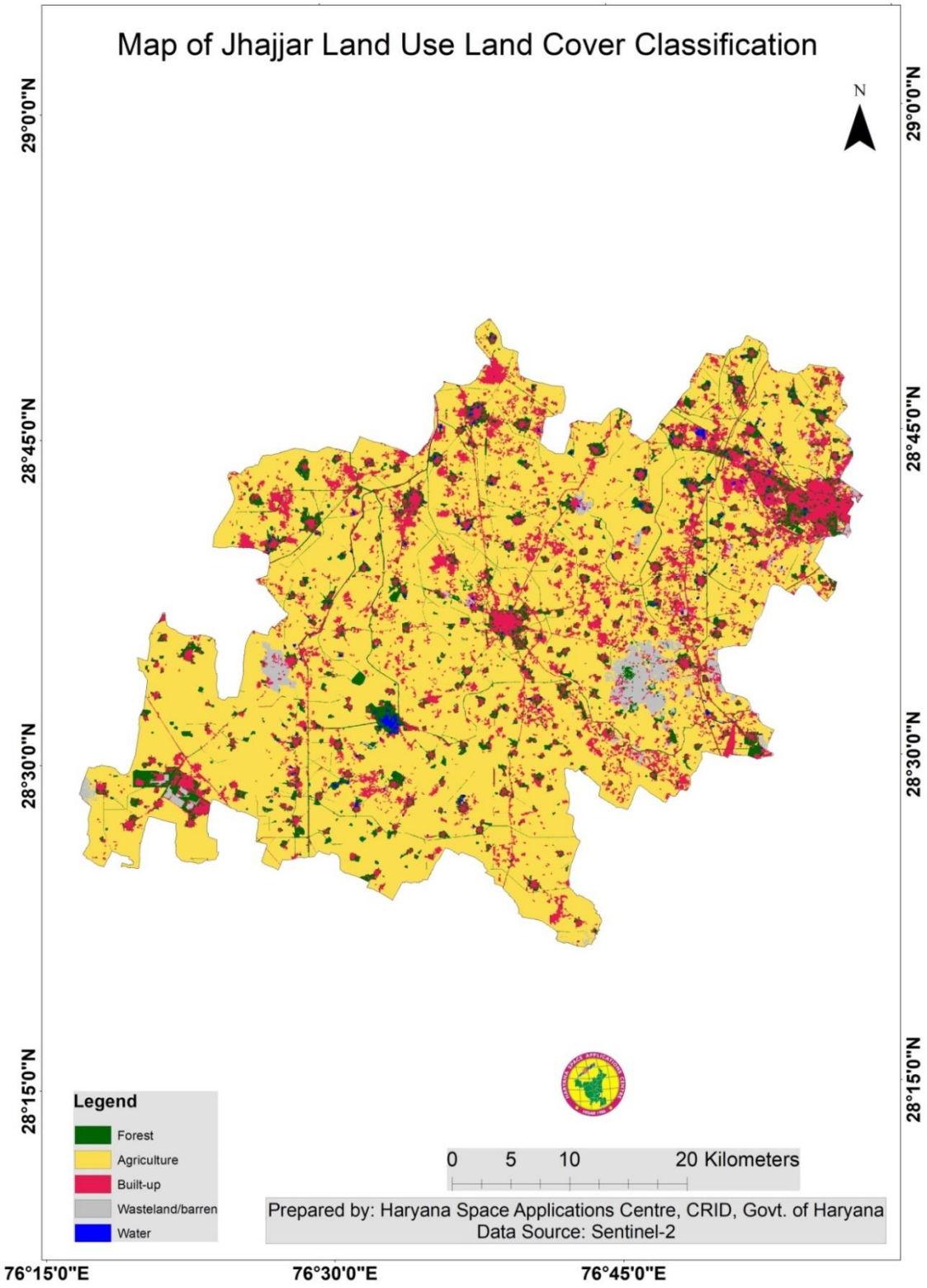

Figure 9 Landuse and Landcover of Jhajjar District

2. District Water Profile

2.1 Source of Water

Jhajjar 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

The district area falls in Yamuna sub-basin of Ganga basin, and is mainly drained by the artificial drain NO.8 flows from north to south. Jawahar Lal Nehru feeder and Bhalaut sub-Branch are main canals of the district.

The major source of irrigation in the district is canal based and bore wells. About 73928 ha of area is under canal irrigation while 58000 ha is under bore wells and constitutes about 56.04% and 43.96%, respectively. The total number of pump sets in the district was found to be 37573

(Source: Agriculture Contingency plan, Jhajjar) The total water availability in the district as canal is 91 MCM. The water availability under kharif season is 50 MCM while under rabi season it is 41 MCM.

Table 3 Water Availability During Rabi and Kharif Season

Blocks	Kharif (Area in Ha)	Volume of Water in MCM	Rabi (Area in Ha)	Volume of Water in MCM	Summer (Area in Ha)	Total (Area in Ha)	Volume of Water in MCM
Jhajjar	2556	2	4717	3	0	7273	5
Beri	4784	3	4286	3	0	9070	6
Salhawas	3723	3	3686	3	0	7409	5
Matanhail	1300	1	1218	1	0	2518	2
Bahadurgarh	5101	41	6183	31	6183	17967	73
Total	17464	50	20090	41	6183	44237	91

Note: The above data is inclusive of block badly and machhroli which have been created recently whose separate data is not available.

Source: CADA, Jhajjar

Among the blocks above shown, the maximum water availability through canal irrigation lies in Bahadurgarh followed by Beri, Salahwas and Jhajjar blocks which are also the major center of agricultural production in the district.

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.

In Jhajjar district total 2705 ponds found with the help of satellite data on village level. **Table 4** shows Jhajjar block wise no. of ponds. The map of total ponds/waterbodies that include ponds, canals are shown in **Figure 10** and **Figure 11** show Monsoonal water-logged area of Jhajjar**.**

Table 4 Jhajjar Block Wise Number of Ponds

Block	Waterbodies
Bahadurgarh	717
Beri	462
Jhajjar	530
Matanhail	452
Salhawas	544

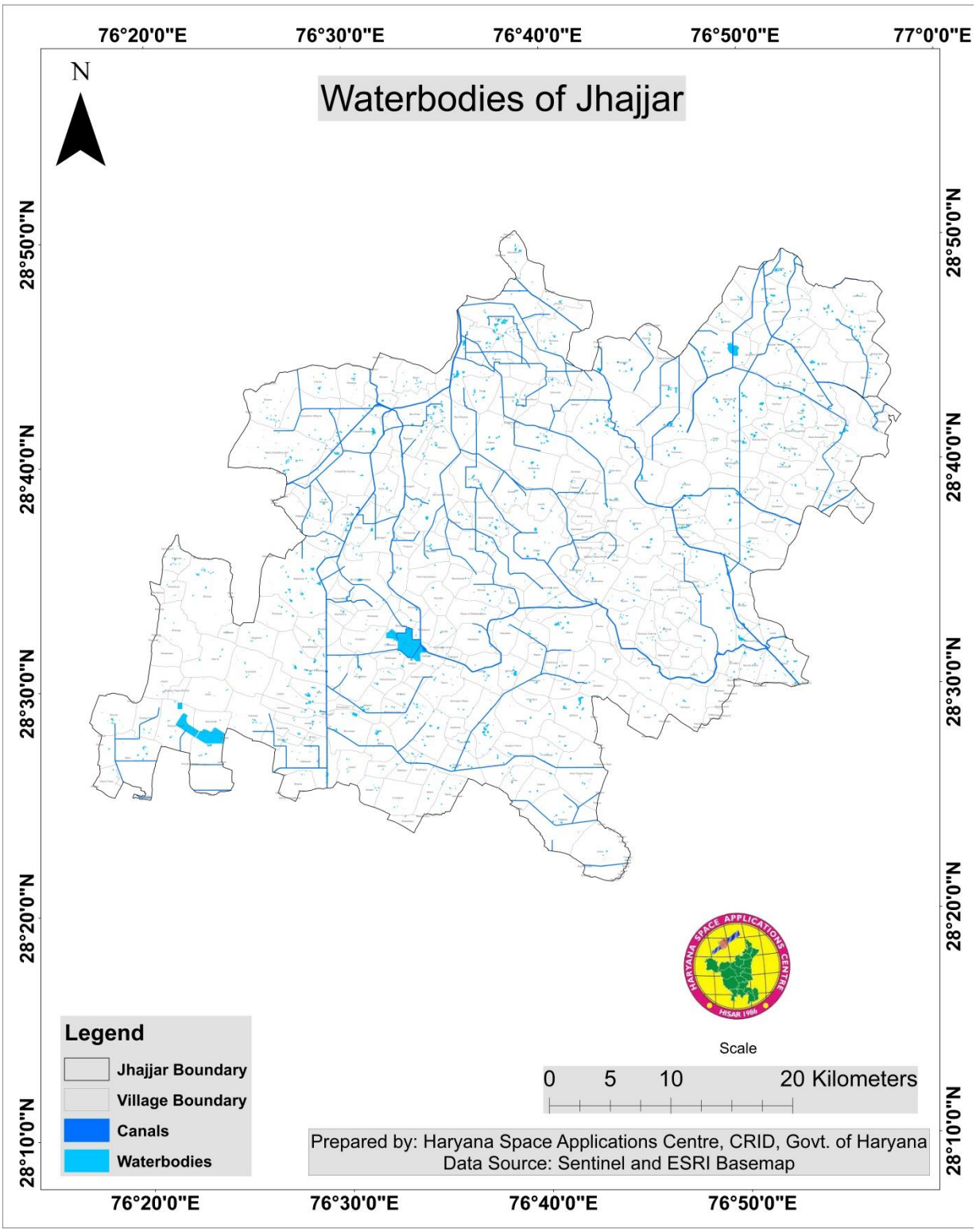

Figure 10 Water bodies of Jhajjar District

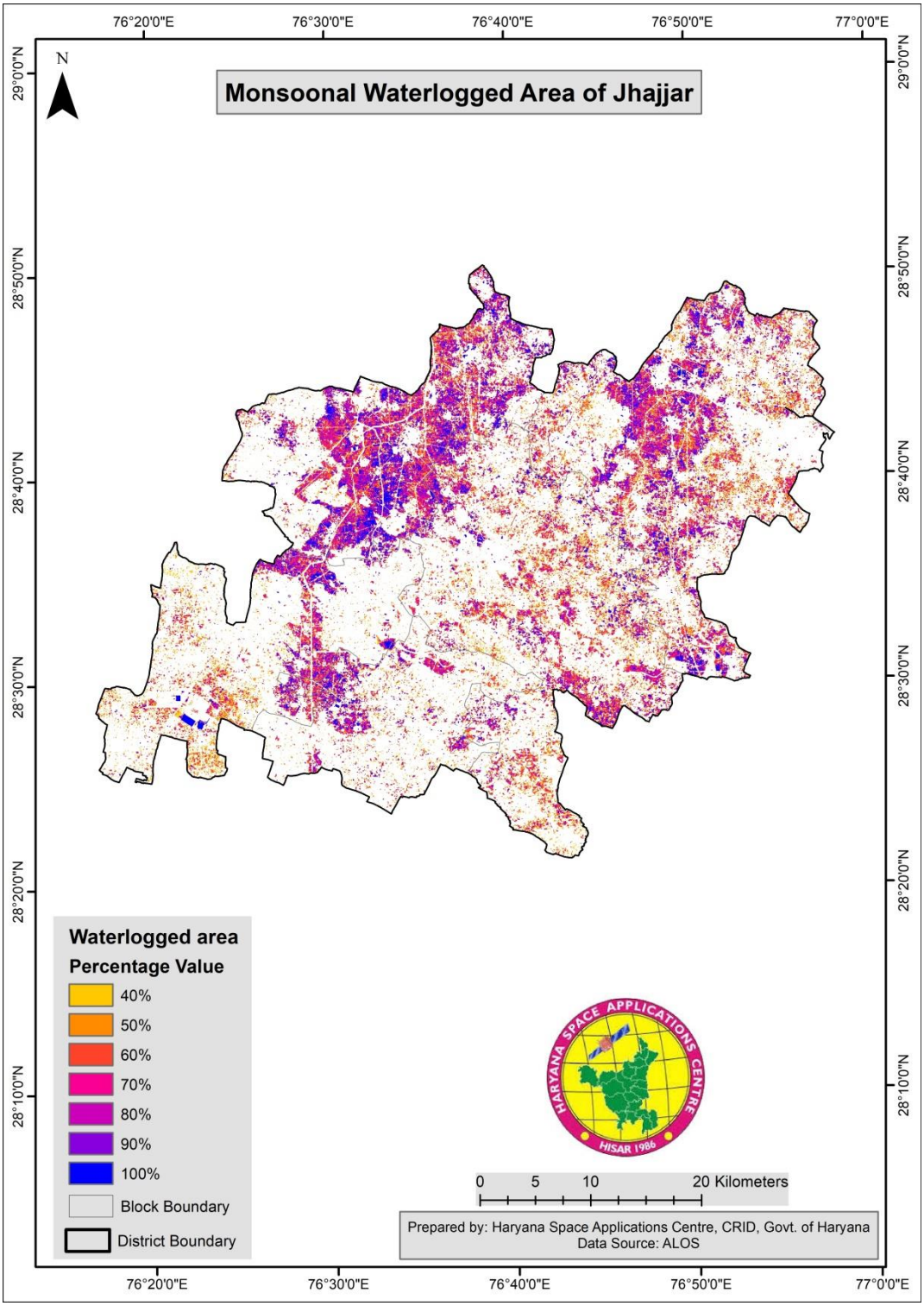

Figure 11 Monsoonal water-logged area of Jhajjar

2.2 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 Jhajjar District is shown in **Figure 12.** The statistics of length of drainages under each order are shown in **Table 5**.

Table 5 Stream Order Length

Stream Order	Length in meters
1st order	1814826.04
2nd order	967559
3rd order	490818
4th order	303526.67
5th order	92487.81
6th order	81546.05
7th order	81084.01
8th order	35592.73

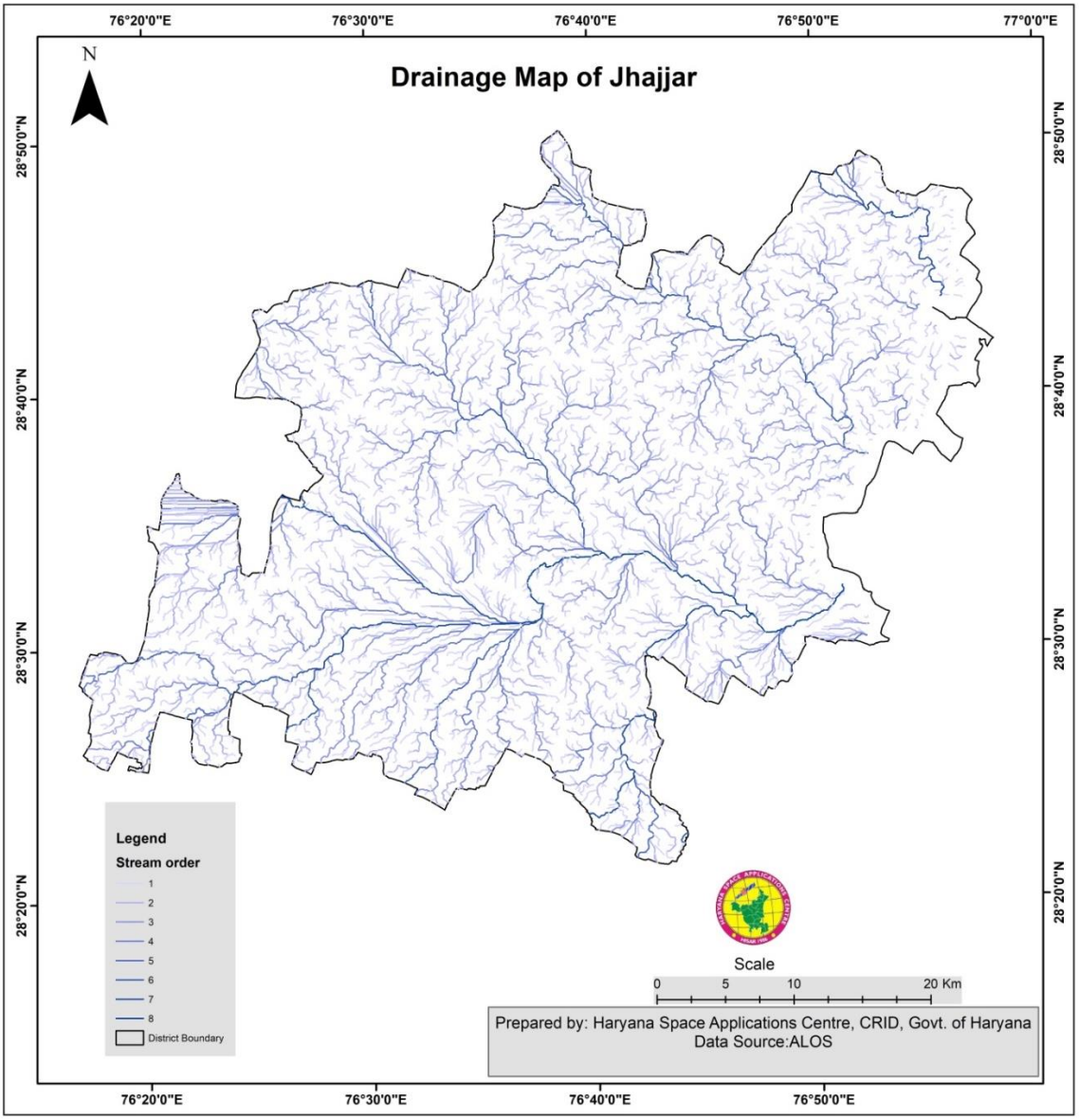

Figure 12 Water bodies of Jhajjar District

2.3 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 Jhajjar district is shown as followed:

2.3.1 Roof Top Harvesting

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

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

In general, there are three main types of rainwater harvesting systems, which include direct pump, indirect pump and indirect gravity. Mentioned below (**Table 6**) 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 6 Water Harvesting System in Jhajjar District

Sr.NO.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam	1	0	
2	Pond / Tank	121	0	
3	Trench	27	0	
4	Rooftop Water Harvesting Structure (Public)	247	0	
5	Rooftop Water Harvesting Structure (Private)	150		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)	483	0	
7	Other Water Conservation Structures (Bench Terracing, Canal)	38	0	
	Total	**1067**	**0**	**0**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	133	9	
	Total	**133**	**9**	**103**
Reuse and Recharge Structures				
1	Soak Pit	649	0	
2	Stabilization Pond	0	0	
3	Other Reuse / Recharge Structure	8	0	
	Total	**657**	**0**	**1**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank	3	0	

3	Staggered Trenches	26	0	
4	Other Watershed Construction Activities	20	10	
Total		**49**	**10**	**106**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	#####	1	
2	Intensive Afforestation- Plantation		7	
Total			**8**	**10**
Awareness Programs by KVK				
1	Farmer's training programs by KVKs on Water Use Efficiency and Appropriate Crops	3		
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	490		
Total		**493**		
Waste Water Treatment				
1	Use of Treated Waste Water	0		
Total		**0**		

2.3.2 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 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 Jhajjar District for rain water harvesting is shown in **Table 7** at rural and urban area. The map of water conservation activity in Jhajjar at rural and urban level is shown in **Figure 13**.

Table 7 Water Harvesting System in Jhajjar District

In Rural Area		
Sr. No.	**Block Name**	**Total No of Activity (no.)**
1	Bahadurgarh	396
2	Beri	184
3	Jhajjar	242
4	Matanhail	0
5	Salhawas	107
In Urban Area		
1	Jhajjar	35

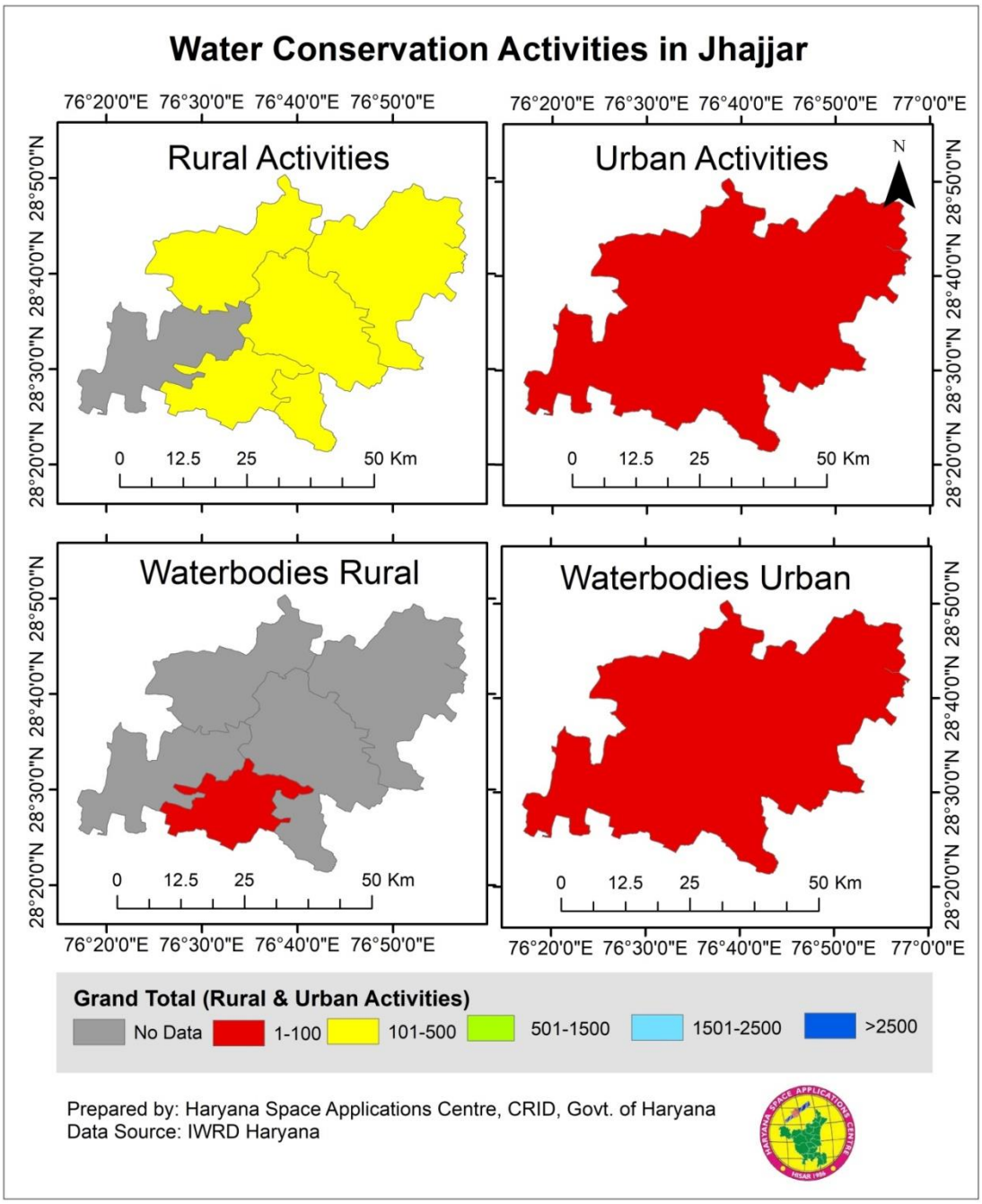

Figure 13 Water Conservation Activity in Jhajjar District

2.3.3 Sewerage Treatment Plant

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

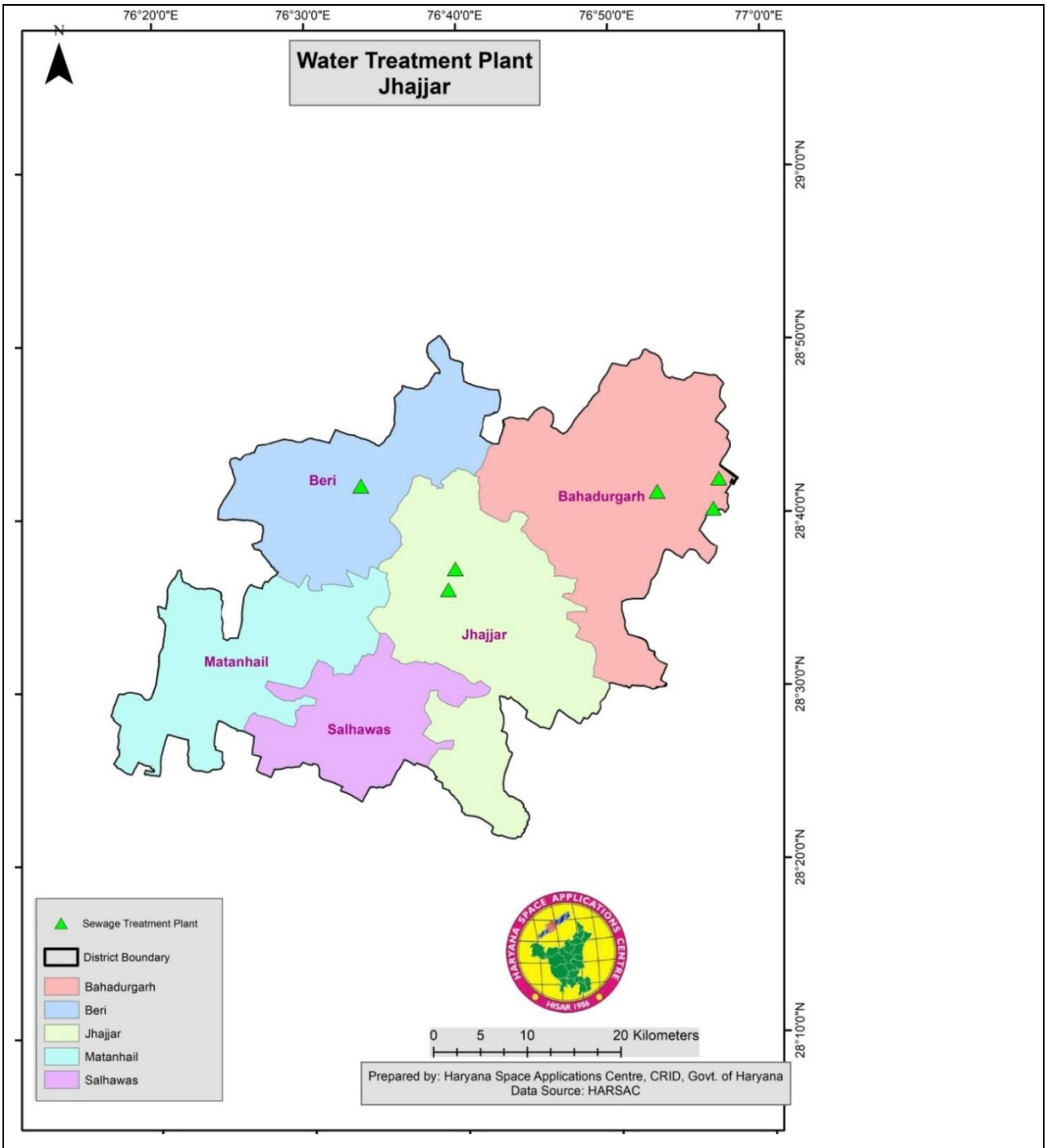

Figure 14 Water Treatment Plant of Jhajjar District

3. Irrigation Profile

The total area under cultivation in the district under different crops is 200387 Ha Out of the total gross cropped area in the district, 90280 ha is under Kharif while rest 110107 ha under rabi crops. The major reason behind large area under rabi crops is due to the fact that the region is mostly under wheat and oilseed cultivation. The total irrigated area under Kharif is 85% of the total Kharif area while the rest is under rainfed cultivation.

Table 8 Irrigation Data of Jhajjar District

Block	Kharif (area in Ha)			Rabi (Area in Ha)			Grand Total (Ha)
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	
Jhajjar	11855	2653	14508	29160	4900	34060	48568
Beri	20187	2655	22842	23137	1900	25037	47879
Salhawas	9986	3048	13034	15881	900	16781	29815
Matanhail	16890	2658	19548	25733	1500	27233	46781
Bahadurgarh	17446	2902	20348	2696	4300	6996	27344
Total	76364	13916	90280	96607	13500	110107	200387

Note: The Above Data is inclusive of Block Badli and Machhroli which have been created recently whose separate data is not available.

Source: DDA, Jhajjar

The total area under irrigation in the district is 86.32% and the rest comes under rainfed area which is 13.68%. The total area under horticultural crops in the district is 11282 ha which includes area under vegetables which is 9859 ha and area under fruits which is 1423 Ha The whole area under horticultural crops is under irrigation. Jhajjar block has the maximum area under fruits and vegetables and it constitutes about 32.25% of the total area under horticultural crops in the district followed by Bahadurgarh with 29.60%.

4. Water Availability

4.1 Surface Water Availability

The district area falls in Yamuna sub-basin of Ganga basin, and is mainly drained by the artificial drain NO.8 flows from north to south. Jawahar Lal Nehru feeder and Bhalaut sub-Branch are main canals of the district.

The major source of irrigation in the district is canal based and bore wells. About 73928. ha of area is under canal irrigation while 58000 ha is under bore wells and constitutes about 56.04% and 43.96%, respectively. The total number of pump sets in the district was found to be 37573

(Source: Agriculture Contingency plan, Jhajjar)

The total water availability in the district as canal is 91 MCM. The water availability under kharif season is 50 MCM while under rabi season it is 41 MCM. The block wise surface water availability in the district is given below:

Table 9 Water Availability in the District

Block	Kharif (area in Ha)			Rabi (Area in Ha)			Grand Total (Ha)
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Bahadurgarh	17446	2902	20348	2696	4300	6996	27344
Total	76364	13916	90280	96607	13500	110107	200387

Note: The Above Data is inclusive of Block Badli and Machhroli which have been created recently whose separate data is not available.

Among the blocks shown above, the maximum water availability through canal irrigation lies in Bahadurgarh followed by Beri, Salahwas and Jhajjar blocks which are also the major center of agricultural production in the district.

4.2 Ground Water Availability

The ground water in the area occurs in the alluvium of Quaternary age. The permeable granular zones comprising fine to medium sand and occasionally coarse-grained sand and gravel. Their lateral as well as vertical extent is limited. The study of borehole data generated by the CGWB indicates that clay group of formations dominate over the sand group in the district. The lithological correlation clearly indicates the presence of clay layer at the top of the surface. In general, source of ground water in the area is rainfall, sub-surface inflow, seepage from canal and return seepage from irrigation. The natural discharge includes sub-surface out flow and evapotranspiration. The artificial discharge includes utilization of groundwater for irrigation, domestic and industrial purposes. Granular zones that occur are inter bedded with clays in alluvial formations, form the principal ground water reservoir. The upper surface of zone of saturation is

represented by water levels in dug wells. Groundwater in the area occurs under water table and semi-confined or confined conditions. The basement also encountered at a depth of 315.50 m. near Jhajjar.

The block wise ground water resource potential in the district has been assessed as per GEC-97 as on 31.03.2011. The stage of ground water development ranges between 77% (block-Beri) to 113% (block-Jhajjar). The total replenishable ground water resource in the district is 427.18 MCM, while the existing ground water draft is 409.43 MCM. Ground water availability for future irrigation development is 17.37 MCM. The stage of ground water development in the district is 96%. The following map (**Figure 15**) depicts the ground water depth in Jhajjar district.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF JHAJJAR DISTRICT, HARYANA AS ON 31ST MARCH, 2011 in ha m

Table 10 Ground Water Availability of Jhajjar

Block Name	**Net Annual Ground Water Availability (Ha m)**	**Existing Gross Ground Water Draft for irrigation (Ha m)**	**Existing Gross Ground Water Draft for all uses (Ha m)**	**Allocation domestic industrial up to next 25 years (Ha m)**	**Net Ground Water Availability for future irrigation development (Ha m)**	**Stage of Ground Water Development (%)**	**Category of Block**
Bahadurgarh	12231	12016	12070	74	141	99	CRITICAL
Beri	8261	6376	6394	25	1860	77	SEMI-CRITICAL
Jhajjar	10635	11995	12046	51	-1411	113	OVER EXPLOITED
Matanhail	6272	4840	4873	44	1388	78	SEMI-CRITICAL
Salhawas	5319	5524	5560	36	-241	105	OVER EXPLOITED
TOTAL	42718	40751	40943	230	1737	96	

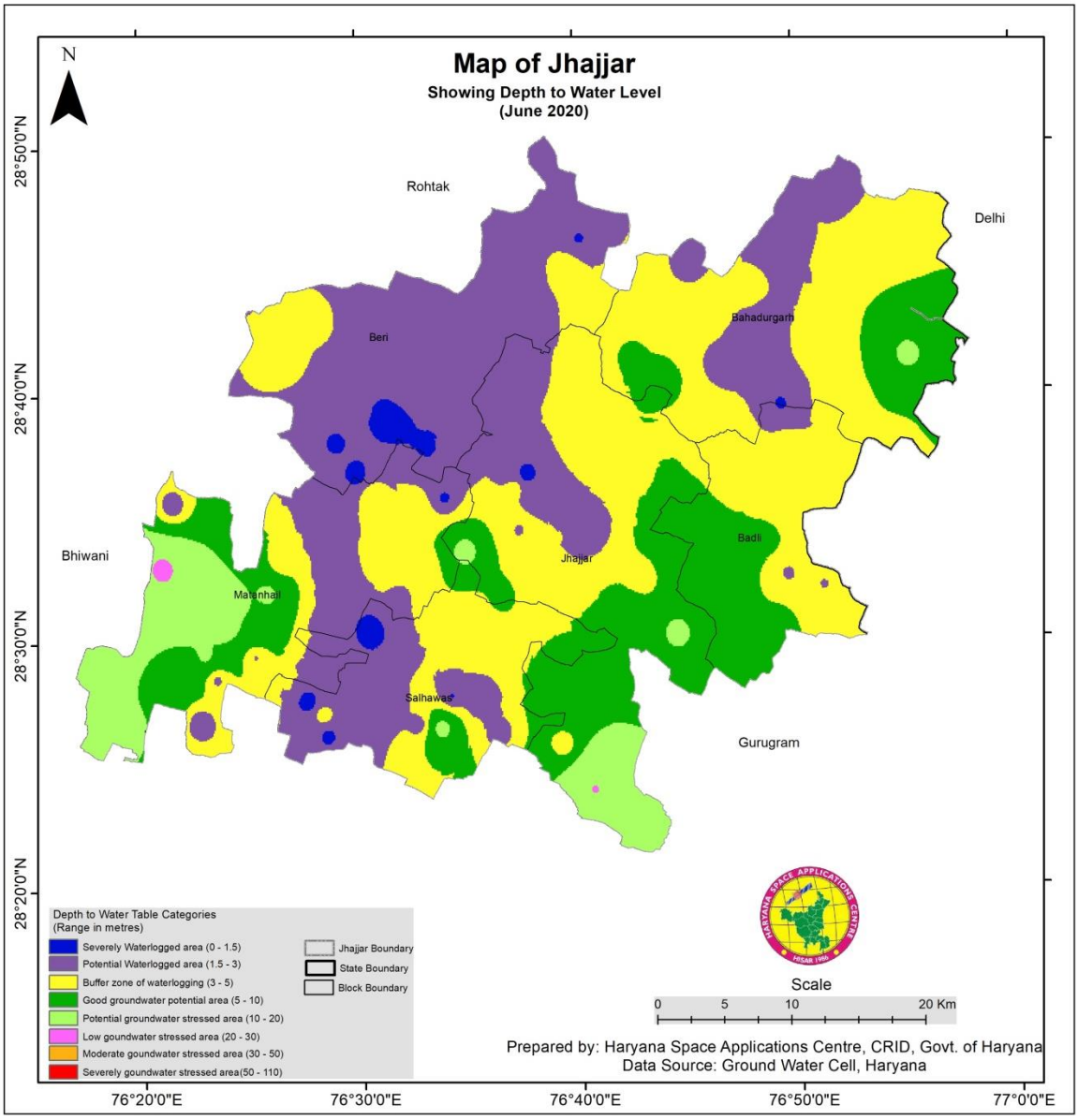


Figure 15 Ground water Availability Map of Jhajjar District

4.3 Ground Water Quality

The ground water of the district is alkaline in nature. The pH values range from7.44 to 8.60 indicating that the ground water is neutral to alkaline (weak base type in nature). The development of highly productive agricultural practices, industries and changing life style of people have been taken place which has indicate the quality of surface and groundwater and which has become more dominant to deterioration. The impassive behavior of pH and electrical conductivity (EC) confirms that there is not a remarkable change in the water quality in the district area. In parts of the district below a relatively thin layer of fresh ground water in dug well zone, the quality deteriorates with depth and as such areas may not always be suitable for installation of shallow tube wells. The over estimation of suitable areas on the basis of chemical analysis of shallow ground water leads to over estimation of the resources. It is therefore essential to recommend in the method that suitability of ground water should be determined on the basis of the samples from normal depth of shallow tube wells rather than open wells. This also indicates that there is not a remarkable change in the salt concentration in the soil. The soil texture has also remained unchanged.

Suitability of groundwater for drinking purposes:

The ground water in the district is alkaline in nature. The pH values range from7.44 to 8.60 indicating that the ground water is neutral to alkaline (weak base type in nature). The electrical conductivity is a measure of total dissolved solids present in water and it ranges from 621 (Sankal) to 15500 micro/mhos at 250 C was observed in Dighal. The nitrate values within the permissible limit are a few places such as Kaulasi, Dubahdhan, Mudsa, Bigoa, Chhuchakwas, Wazirpur, Chhara, Dulhera and Salhawas. Highest value of nitrate was recorded at Dighal (1755 mg/l). The fluoride (F) values range from 0.12 mg/ l to 2.89 mg/l but in general it is within the permissible limit except at Mundsa, Subana, Guhana and chamanpura in the district. Highest value of fluoride was observed at Chhuchakwas (2.89 mg/l). Ground water occurring in the shallow aquifer is by and large saline, but where the EC, NO3, and F value are within the permissible limits set by the BIS: 10500: 1991, it is suitable in the district for drinking purposes, however potable water at places along canals and surface water bodies like ponds, where salinity has decreased, is collected for drinking purposes.

Suitability of groundwater for Irrigation purposes:

The suitability of ground water for irrigation as per the available chemical data (2010) reveals that the ground water is for irrigation except in Mudsa, Chuchakkwas, and Hasanipur. The suitability of ground water for irrigation purposes is generally ascertained by considering salinity, SAR and RSC values. As per USSL diagram ground water fall under C, S, C2S1, C3S1, C S2, C4S1, C4S2, C2S3, and C4S4. The

deep ground water is saline, salinity increases with depth and that water is not fit for irrigation. In a very small patch in the extreme southwest of Jhajjar approximately 50 to 60m thickness of granular zones (with in 80m depth) bearing fresh water has been identified.

So, based on that Jhajjar district's water quality varies from good to poor (**Figure 16**) for the whole district. Whereas block wise water quality index value is shown in **Table 11**.

Table 11 Block wise average water quality index value in Jhajjar District

Sr.No.	Block Name	Average Water Quality Index Value
1	Bahadurgarh	200.7035
2	Beri	282.2871
3	Jhajjar	236.8865
4	Matanhail	209.5733
5	Salhawas	194.2691

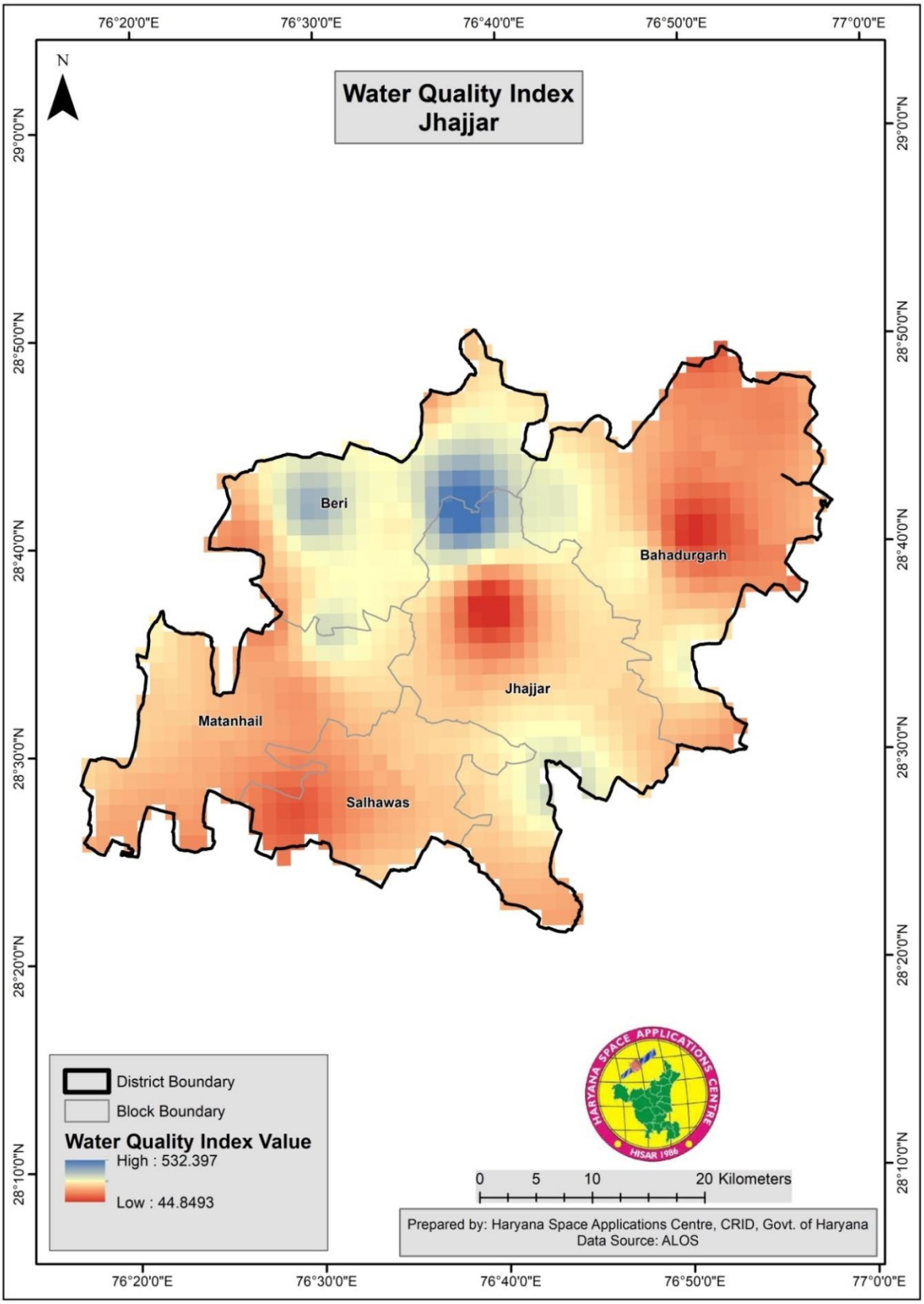


Figure 16 Water quality index of Jhajjar District

5. Aquifer System

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

6. Water Requirement/ Demand

The earlier Chapters deals with the general profile, water profile and water availability of Jhajjar district. The present chapter deals with the current (2021) and projected (2022) demand of water for various sectors. The demand for water has been assessed on the basis of data obtained from different departments.

6.1 Water Supply and Gap

6.1.1 Domestic Water demand

Data of Census 2011 and 2001 has been considered to arrive at the growth rate of population of the district. As per Census 2011, the district has shown an annual growth rate of 8,90%. Current population (in 2021) has been calculated by assuming a growth of 8.90% over a period of ten years (from 2011-2021). Projected population has been calculated in similar way by assuming a growth of 0.89% per annum over the period of eleven years (from 2011-2022).

It has been assumed that per capita daily water requirement of people residing in urban areas of the district is 150 L. per day and for population in rural areas, the daily per capita daily water requirement is 70 L per day and using the same norms domestic water supply demand has been worked out and given in

table 4.1 below. The earlier) chapters dealt with the general profile, water profile and water availability of Jhajjar district. The present chapter deals with the current (2021) and projected (2022) demand of water for various sectors. The demand for water has been assessed on the basis of data obtained from different departments.

Table 12 Domestic water demand of the district

Blocks	2011	2021	Gross Water demand in MCM (2021)	Projected Population 2022 (2022)	Gross Water demand in MCM (2022)
Jhajjar	222918	242758	7.78	245739	7.88
Beri	139838	152284	4.62	154154	4.68
Salhawas	80061	87186	2.23	88257	2.25
Matanhail	117011	127425	3.26	128990	3.30
Bahadurgarh	396751	432062	16.47	437368	16.67
Total	956579	1041715	34.36	1054509	34.78

Note: The above data is inclusive of block badly and machhroli which have been created recently whose separate data is not available.

As per 2011 census, the total population of the district was 9,56,579 which is projected to be 1041715 in the current year 2021. The projected population has been compounded from the current year of 2021 and it is expected to be 10.54.509 by the end of 2022. The current domestic water demand in the district is 34-36 MCM and it is projected to increase to 34.78 MCM by the end of 2022 due increased urbanization and more demand of fresh water by the population. Among blocks, Bahadurgarh has the highest projected water demand under domestic sector which is 47.93% of the total projected water demand in the district followed by Jhajjar with 22.67% of the total projected water demand in the district. The present water demand also showed an upward trend in Bahadurgarh and Jhajjar blocks due to high growth of industrialization and major center of population growth in the district.

6.1.2 Crop Water Requirement

As discussed in Chapter 2, cereals are cultivated on major part of the gross cropped area in the district. Hence, the crop water requirement for major cereals viz. Wheat, Maize, Paddy, as assumed by State Agricultural University has been taken.

Table 13 Crop water demand in District

Blocks	Area sown (Ha)	Irrigated area (Ha)	Crop water demand in MCM	Water Potential Required in MCM	Existing Water Potential MCM	Water Potential to be created MCM
Jhajjar	48568	41015	216.68	216.68	189.03	27.65
Beri	47879	43324	230.75	230.75	214.23	16.32
Salhawas	29815	25867	134.19	134.19	120.01	14.18
Matanhail	46781	42623	209.59	209.59	194.59	15.01
Bahadurgarh	27344	20142	119.40	119.40	92.98	26.42
Total	200387	172971	910.62	910.62	810.83	99.79

Note: The above data is inclusive of block badly and machhroli which have been created recently whose separate data is not available.

Water potential required has been derived from water required by crops cultivated under rainfed conditions. While the existing water potential represents the water requirement of crops cultivated in irrigated areas. The existing water potential available in the district is 810.83 MCM and the projected water demand for crop irrigation is 910.62 MCM.

It can be concluded from the table that a total water potential of 99.79 MCM is to be created in the district to fulfil the requirement of crops and to develop the area under rainfed cultivation.

6.1.3 Livestock Water Demand

The requirement of water by livestock in the district has been derived from two livestock census (2012 & 2019), as discussed in second chapter. The table below represents the animal wise water requirement as well as total water. requirement of the district for livestock.

Table 14 Livestock water Demand

Blocks	Livestock Population in 2019	Present Water Demand in MCM	Water demand in 2022 in MCM	Water Potential to be created in MCM
Jhajjar	89042	0.87	0.89	0.02
Beri	213576	3.55	5.26	1.71
Salhawas	23073	0.23	0.25	0.02
Matanhail	205259	2.13	2.15	0.02
Bahadurgarh	56540	0.96	1.03	0.07
Badli	32943	0.58	0.62	0.04
Machhrauli	55619	0.38	0.41	0.03
Total	676052	8.70	10.61	1.91

The total population of the livestock as per the livestock census 2019 is 676052 which is expected to be 716287 in the current year of 2019. The livestock population has been projected for the year 2022 based on the growth rate estimated by comparing the livestock census of the district in 2012 and 2019 and it will be 736405.

The total present water demand of the livestock has been estimated to be 8.70 MCM which is projected to increase to 10.61 MCM by the end of year 2022. The assumption for the water requirement of livestock has been provided below:

1 Poultry: 200 ml to 500 ml/day

2. Pigs: 6 gallons or 25 Liters/day (70-80 kg growing pigs)

3 Cows: 40 liters per day

4 Buffaloes: 60 liters per day 5 Goats: 6 liters per day

6 Sheep: 4-5 liters per day

6.1.4 Industrial Water Demand

On the Industrial front, Jhajjar district is now witnessing Industrial growth at faster pace by providing good infrastructure to the industries. At present 1510 small scale industrial unit are working besides it.37 large and medium units also exist in the district. Tremendous growth in Exports of Pharmaceuticals, Lathers Footwear, Hallow Glass Wares, Electronic Microwave Components used in Aircraft. Missiles & Radars, Ultra Marine Blue, Ceramic Glazed Tiles, Sanitary Wares, Brake Lining. There are around 250-300 units which are working as ancillaries in the districts of Jhajjar. The details of which can be obtained from the large-scale industries given at 3-4. The growth trend of the same is 10-15%.

Table 15 Industrial Water Demand

Blocks	**No. of Industries**	**Present Water Demand in (MCM)**	**Water demand in 2022 (MCM)**	**Existing Water Potential (MCM)**	**Water Potential to be created (MCM)**
Jhajjar	1849	0.51	0.53	0.51	0.02
Beri		0.25	0.26	0.25	0.01
Salhawas		0.36	0.37	0.36	0.01
Matanhail		0.44	0.46	0.44	0.02
Bahadurgarh		0.74	0.77	0.74	0.03
Total	1849	2.30	2.39	2.30	0.09

Note: The above data is inclusive of block badly and machhroli which have been created recently whose separate data is not available.

Source: MSME, GOI Report

As per the MSME report of Gol, the total registered unit in Jhajjar district was found to be 1849. The water demand calculation has been arrived from the existing water demand for industrial uses as per the central ground water board report for the Jhajjar district and it is 2.30 MCM. The growth in the water demand for the projected year of 2022 has been estimated from the fact that the industrial growth in Haryana for the year 2015-16 has been 4%, taking the growth rate as the base, the water demand also has been projected for 2022.

As per the report of DIC, Bahadurgarh, there are five industrial area in Jhajjar listed as below:

1. Government Industrial Area, Bahadurgarh (48 units of production)
2. MIE Estate-1, MIE Estate-11 (1500 units of production)
3. HSIIDC Sector 16 (146 units of production)
4. HSIIDC Sector 17 (130 units of production)
5. HSIIDC Sector 4B (3 units of production)

6.1.5 Water Demand for Power Generation

The district has been provided with two mega power projects which has been installed and are currently operational. It includes:

1 Indira Gandhi Super Thermal Power Project, Jhajjar (3 Units with 500 MW each)

2. Mahatma Gandhi Super Thermal Power Project. Jhajjar (2 Units with 660 MW each)

Both the power projects have been installed and operational since 2012. The power sector in the district is thermal based and uses coal for power generation. The total power requirement has been estimated to be 1410 MW for the district considering the Haryana share in the power project being 50% as per the HPGCL., Haryana.

Table 16 Waler demand for power in the district

Block	Power requirement (MW)	Water demand (MCM)	Water Demand in 2022 (MCM)	Existing water potential (MCM)	Water potential to be created (MCM)
Jhajjar	1410	8.03	8.36	8.03	0.33
Beri					
Salhawas					
Matanhail					
Bahadurgarh					
Total	1410	8.03	8.36	8.03	0.33

Note: The Above Data is inclusive of Block Badli and Machhroli which have been created recently whose separate data is not available.

Source: HPGCL

The block wise water demand for the power is not available. The total water demand for the power sector has been estimated to be 8.03 MCM. Taking the economic growth of Haryana, as 4% for the year 2015-16, the growth trend of power has also been estimated as industry and domestic sectors are the major power consumption sector in Haryana.

Assumptions taken for the water demand estimation has been given below:

1. Total Installed capacity of 2020 MW from both power projects and taking Haryana share of 50% which is 1410 MW
2. 1 MW 2190 MWh
3. Generating 1 MWh electricity requires 2600 liter or 687 gallon of water through coal based.

6.1.6 Water Demand for Various Sector

In Jhajjar, water is required for domestic use, crop irrigation, and livestock drinking purpose, industrial use, and power generation. Total present animal water demand for district Jhajjar is 962.62 MCM. Maximum water is required for irrigation 94,77%, followed by domestic use 3-43%, livestock 0.72%, Power 0.84% and industry 0.24%.

Table 17 Sector wise present water demand in the district.

Block	Domestic (MCM)	Crop (MCM)	Livestock (MCM)	Industries (MCM)	Power (MCM)	Total (MCM)
Jhajjar	7.47	216.68	0.87	0.51	8.03	233.57
Beri	4.43	230.75	3.55	0.25	0.00	238.98
Salhawas	2.14	134.19	0.23	0.36	0.00	136.92
Matanhail	3.13	209.59	2.13	0.44	0.00	215.29
Bahadurgarh	15.81	110.40	1.92	0.74	0.00	137.81
Total	32.98	910.62	8.70	2.30	8.03	962.62

Note: The Above Data is inclusive of Block Badli and Machhroli which have been created recently whose separate data is not available.

Among the blocks, Beri and Jhajjar has the highest present water demand due to high growth of agricultural sector in these two Blocks and constitutes about 24.77% and 24-33% respectively.

Table 18 Sector wise projected water demand in the district

Block	Domestic (MCM)	Crop (MCM)	Livestock (MCM)	Industries (MCM)	Power (MCM)	Total (MCM)
Jhajjar	7.88	216.68	0.89	0.53	8.36	234.34
Beri	4.68	230.75	5.26	0.26	0.00	240.95
Salhawas	2.25	134.19	0.25	0.37	0.00	137.05
Matanhail	3.30	209.59	2.15	0.46	0.00	215.50
Bahadurgarh	16.67	110.40	2.06	0.77	0.00	138.90
Total	34.78	910.62	10.61	2.39	8.36	966.76

Note: The Above Data is inclusive of Block Badli and Machhroli which have been created recently whose separate data is not available.

The projected water demand in the district is 966.76 MCM with maximum percentage of water demand is from irrigation or agriculture sector. Beri has the maximum water demand followed by Jhajjar which constitutes about 24.71% and 24.32%, respectively.

The sector wise analysis of projected water demand in the district shows the highest demand in the irrigation or agriculture sector followed by domestic sector and constitutes about 94-45% and 3.61%, respectively.

6.2 Water Budget

Water refers to an exercise in balancing water availability and water demand. Water availability is through surface water received from canals and groundwater. Dynamic groundwater availability depends on both natural resources such as amount of rain recharge from surface water resources. Annual water available in the district is 517.57 MCM against annual demand 962.62 MCM, which will further increase in coming years, Projected water demand during 2022 is expected to be 966.76 MCM showing a water gap of 449.19 MCM and it is 4.14 MCM more than the present water gap in the district:

Table 19 Water Budget of the District

Block	Existing water availability (MCM)		Total (MCM)	Water Demand (MCM)		Water Gap (MCM)
	Surface water (MCM)	Ground Water (MCM)		Industries (MCM)	Power (MCM)	
Jhajjar	5.06	106.35	111.41	233.57	234.34	122.93
Beri	6.31	82.61	88.92	238.98	240.95	152.03
Salhawas	1.75	53.19	54.94	136.92	137.07	82.13
Matanhail	5.15	62.72	67.87	215.29	215.50	147.63
Bahadurgarh	72.11	122.31	194.42	137.81	138.90	55.52
Total	90.39	427.18	517.57	962.62	966.76	449.19

Water Gap has been estimated after deducting total supply of water at present from total projected demand for the year 2022. The block Bahadurgarh has the surplus of water due to its high-water table than any other blocks in the district.

Presently there is shortage of 443.26 MCM of water, which will further increase to 446.56 MCM by the year 2022. Since district Jhajjar is not blessed with good perennial river systems, so any increase in water demand requires careful planning for future water resource development. More emphasis is needed to develop technologies for t reducing water losses in reservoirs, conservation of rainwater and development of such crop varieties that require less water. So, it is high time for the planners/users/water resources managers to think in term of expected water demand due to global warming and its likely effect on water resources of Rajasthan. The availability of water has direct bearing on the type of crops to be grown and will determine the economy of the state.

7. Strategies for Water Conservation

Under this campaign, targeted activities shall be undertaken under 5 areas of intervention namely. (i) Water conservation and rainwater harvesting. (ii) Renovation of traditional water bodies/tanks, (l) Reuse, borewell recharge structures, (iv) Watershed development, and (v) Intensive afforestation

In addition, the following interventions will be carried out:

- Development of an integrated Block and district water conservation plans which will incorporate the district irrigation plans
- Promoting efficient water use for irrigation by shifting to micro irrigation systems for water intensive crops through intensive use of IEC: and motivating farmers to move to better choice of crops (More Crop per Drop) through initiatives like Krishi Vigyan Kendra (KVK) Melas

- Engagement of national level scientists and IFTs to be mobilized

Targeted communication shall be designed to promote and achieve accelerated progress of the 5 identified interventions Special focus will be given to mobilize farmers and communities and encourage them to participate in the campaign. These areas of intervention broadly fall under the mandate of Ministry of Jal Shakti, Ministry of Rural Development. Ministry of Agriculture, Cooperation and Farmers Welfare, Ministry of Environment. Forests and Climate Change, and Ministry of Housing and Urban Affairs and will be the concerned Ministries for implementing the campaign. The Department of Drinking Water and Sanitation, Ministry of Jal Shakti is the nodal department for the campaign.

7.1 Artificial Recharge

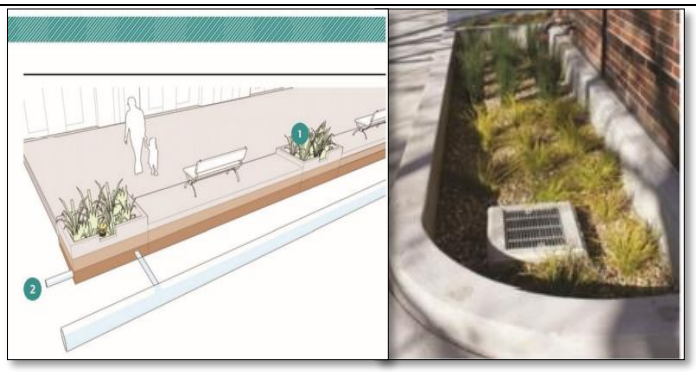
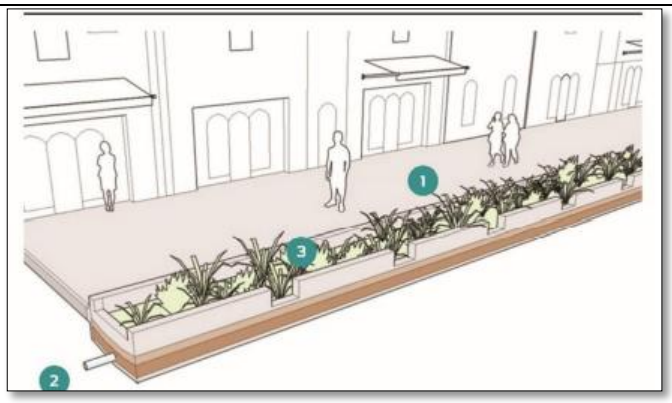
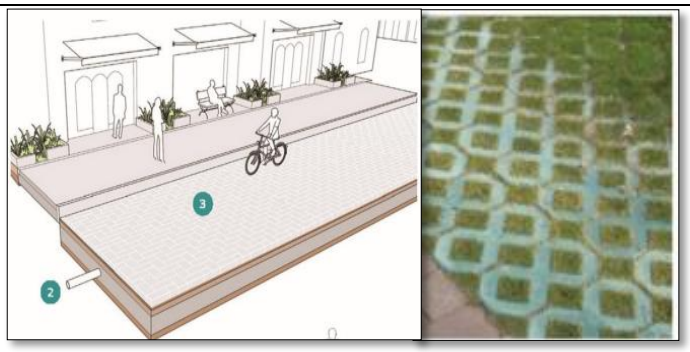
Water scarcity is a concern across parts of the country. Water availability per capita is reducing progressively due to increase in population. The average annual per capita water availability in the years 2001 and 2011 was assessed as 1820 cubic meters and 1545 cubic meters respectively which may reduce further to 1341 and 1140 in the years 2025 and 2050 respectively. Ground water levels have fallen in many parts of the country, which becomes acute in the summer months. Increasing water demand and over dependence on ground water for agriculture and other uses coupled with inter-alia lack of (i) conscious water conservation and (ii) rain water harvesting have decreased the availability of water. There is an urgent need to focus on water conservation measures including rainwater harvesting to augment water resources.

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 Jhajjar. 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 scarcer in terms of frequency. The methods of water table recharge strategies in urban area are shown in **Table no 20**

.

Table 20 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	**Stormwater Tree**	

7.3 Plantation

A major portion of WSUD that is popular within the Government Departments is plantation of various species of plants, both in public and private spaces, to encourage community participation and increase green cover. While increasing the aesthetic value of a location, plants are heavily influential to change microclimates and in fact playing a factor to rainfall patterns. Along with benefits of carbon sequestration, they contribute to increasing the local biodiversity of the region by attracting several types of fauna as well. Currently a multi-departmental approach is being undertaken both within and outside of government with the engagement of several active citizen stakeholders and non-governmental organizations. Geo-tagging of these plantations and survival monitoring would be undertaken actively by engagement of the mentioned stakeholders. The wasteland that could be used for plantation for conservation of water in Jhajjar district is shown in **Figure 17** and **Table21** shows the proposed number of plantation targets in Jhajjar District.

Table 21 The Plantation targets have been provided in the table below.

Block	Wasteland Area (acres)	Plantation at 5 feet spacing
Jhajjar	2569.054735	22381605
Beri	673.965784	5871589.9
Bahadurgarh	963.060463	8390182.8
Matanhail	2477.521164	21584164
Salhawas	1047.840684	9128788
Total	7731.44283	67356330

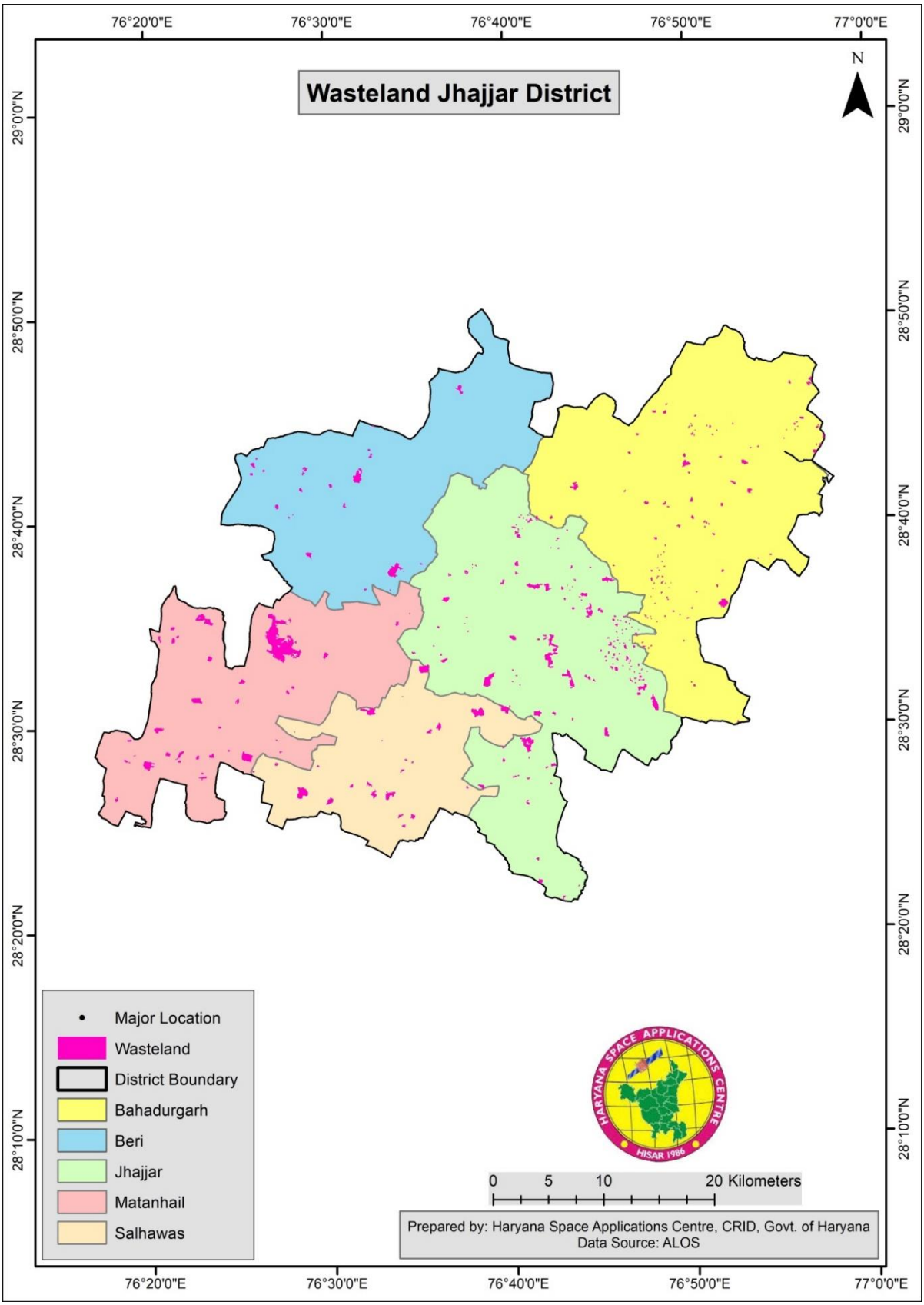


Figure 17 Wasteland Map of Jhajjar district

7.4 Surface water management

7.4.1 Pond restoration and rejuvenation

Water conservation for reliable and equitable irrigation is one of the most powerful interventions, to double he farmer's income and rural prosperity. As per the 5th Minor Irrigation Census of Ministry of Jal Shakti (Department of Water Resources River Development and Ganga Rejuvenation), there are $.92 lakh water bodies providing surface flow irrigation. The surface flow schemes typically consist of tanks, check-dams, structures and can serve as water conservation cum ground water recharge scheme. In addition to these, there are varied traditional water harvesting techniques that reflect the geographical peculiarities and cultural uniqueness of the regions. Many of these water bodies have gone into disuse because of the surge in ground water-based irrigation systems. inadequate maintenance. encroachments. illegal diversion of land for construction purpose etc.

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.

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, decentralised systems must be properly designed, maintained, and operated to provide optimum benefits

7.5 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. The following image shows the various stakeholders involved in IEC Activities (**Figure 18**) and **Table 22** shows the numerous activities and interventions that can be carried out for IEC.

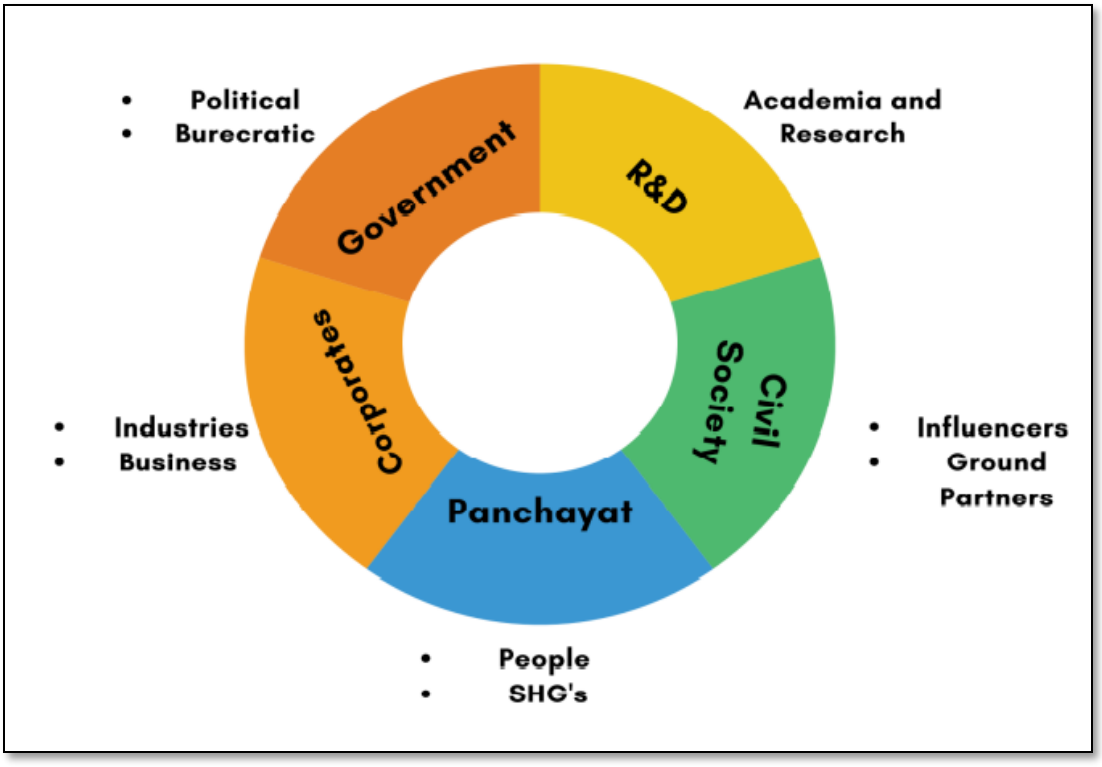


Figure 18 The above figure shows the various stakeholders of IEC Activities

Table 22 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 19**). The block wise area proposed for rainwater harvesting under most suitable sites is shown in **Table 23.** For the process of calculating suitable site a fixed weightage is needed to be applies on the above-mentioned criteria (**Table 24).**

Table 23 Block wise area under very good suitable site proposed for rain water harvesting

Block Name	**Area (Very Good suitability area in Sq. meter)**
Jhajjar	124621053
Beri	223858684
Bahadurgarh	242194505
Matanhail	118155106
Salhawas	50955225

Table 24 Assigned Weight for Criteria Parameters

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

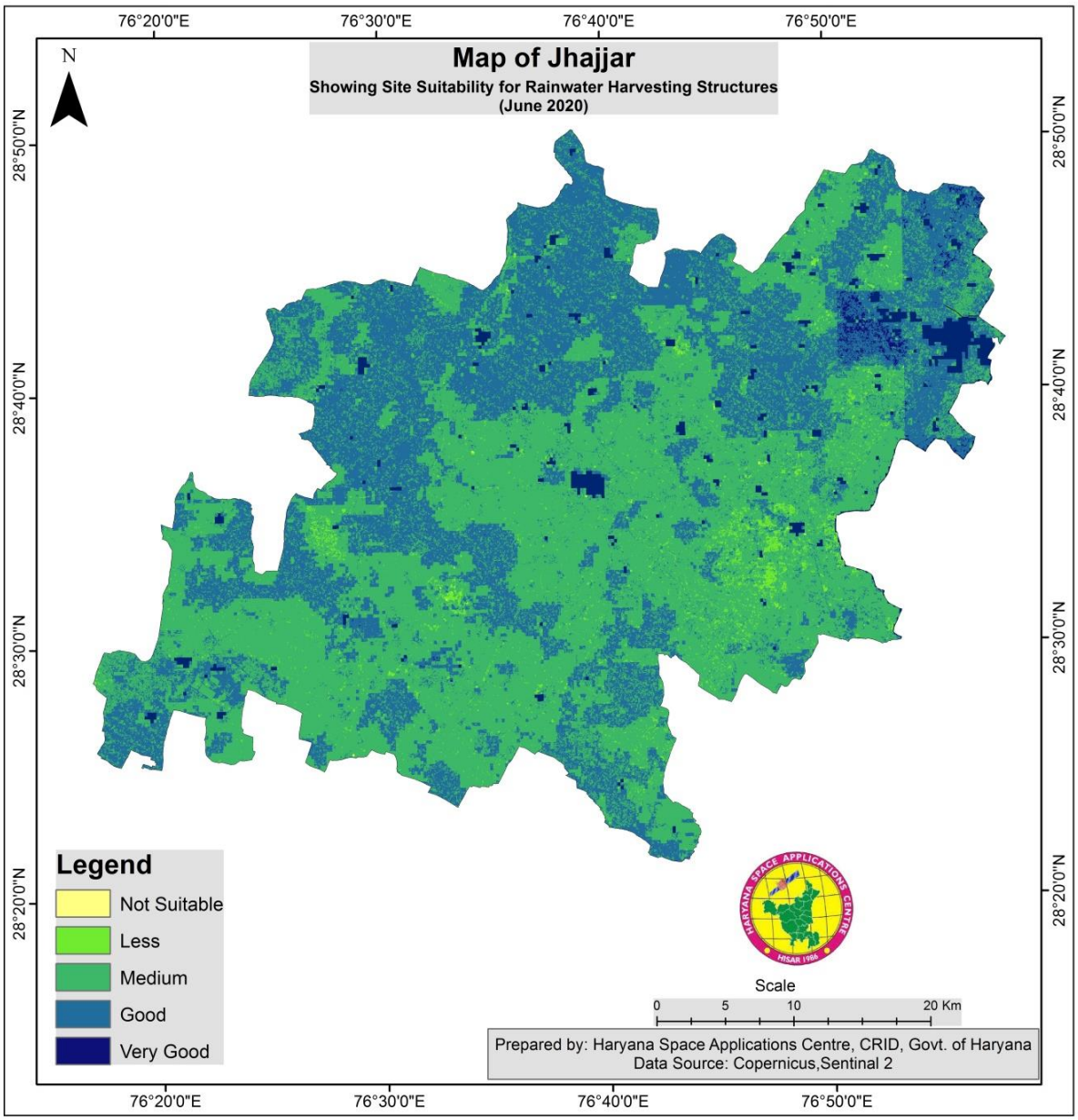


Figure 19 Rainwater Harvesting Structures of Jhajjar

8.2 Proposed Suitable Site based on multi-criteria

In this section some water harvesting structures are proposed with the suitable sites. These structures are calculated based on different criteria. These criteria are Natural drainage and water occurrence datasets that should exclude the settlement and water bodies on the same place. Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. Following are the outcomes that show the type of structure on the streams. **Figure 20** shows the proposed suitable site based on multi criteria. Block wise proposed suitable sites based on multi-criteria is shown in **Table 25**.

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

1. 2 Percolation Tanks

Table 25 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	Jhajjar	0	1	0	0	0
2	Beri	0	0	0	0	0
3	Bahadurgarh	0	1	0	0	0
4	Matanhail	0	0	0	0	0
5	Salhawas	0	0	0	0	0

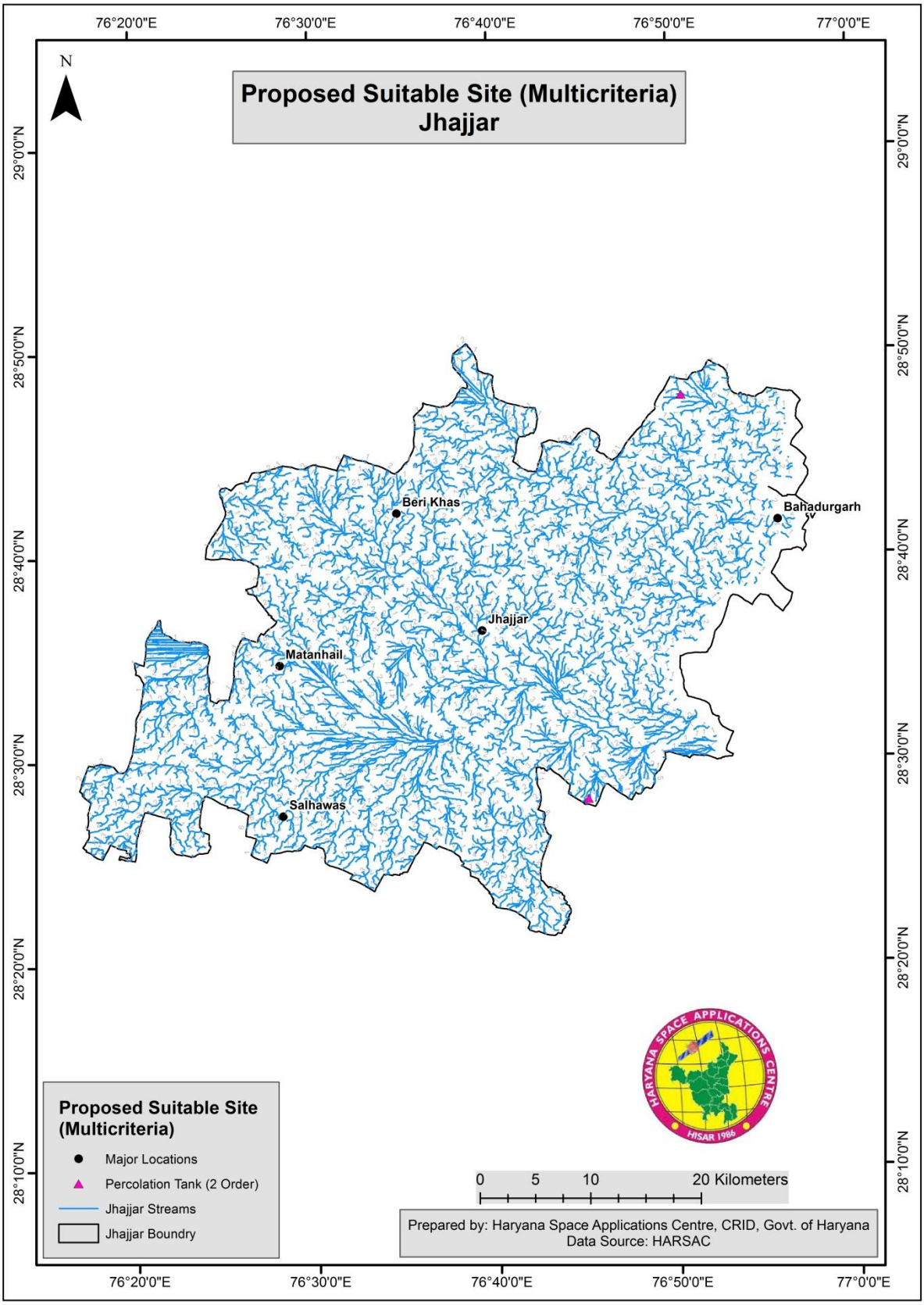


Figure 20 Proposed Suitable Site based on Multicriteria of Jhajjar

8.3 Proposed Suitable Site based on Drainage

The drainages that are created from satellite imagery can be used as base for the water harvesting structure**.** Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. So, based on the order of streams we can propose the suitable sites for water harvesting structures. A general idea says that Mini percolation Tanks on Ist order Stream, percolation Tanks on 2nd Order Stream, pakka check Dams 3rd Order Stream, Annicut on 4th order, Micro Irrigation tanks 5th Order can be built. **Figure 21**shows the proposed suitable sites based on drainage structure in Jhajjar district. Proposed harvesting structures in Jhajjar based on drainage **Table 26.**

Table 26 Proposed harvesting structures in Jhajjar based on drainage

Sr. No.	**Block Name**	**Mini percolation Tank**	**Percolation Tank**	**Pakka Check Dam**	**Annicut**	**Micro Irrigation Tank**
1	Jhajjar	62	41	88	77	101
2	Beri	71	46	87	59	37
3	Bahadurgarh	64	34	86	65	109
4	Matanhail	31	19	60	29	59
5	Salhawas	21	14	39	30	50
	Total	249	154	360	260	356

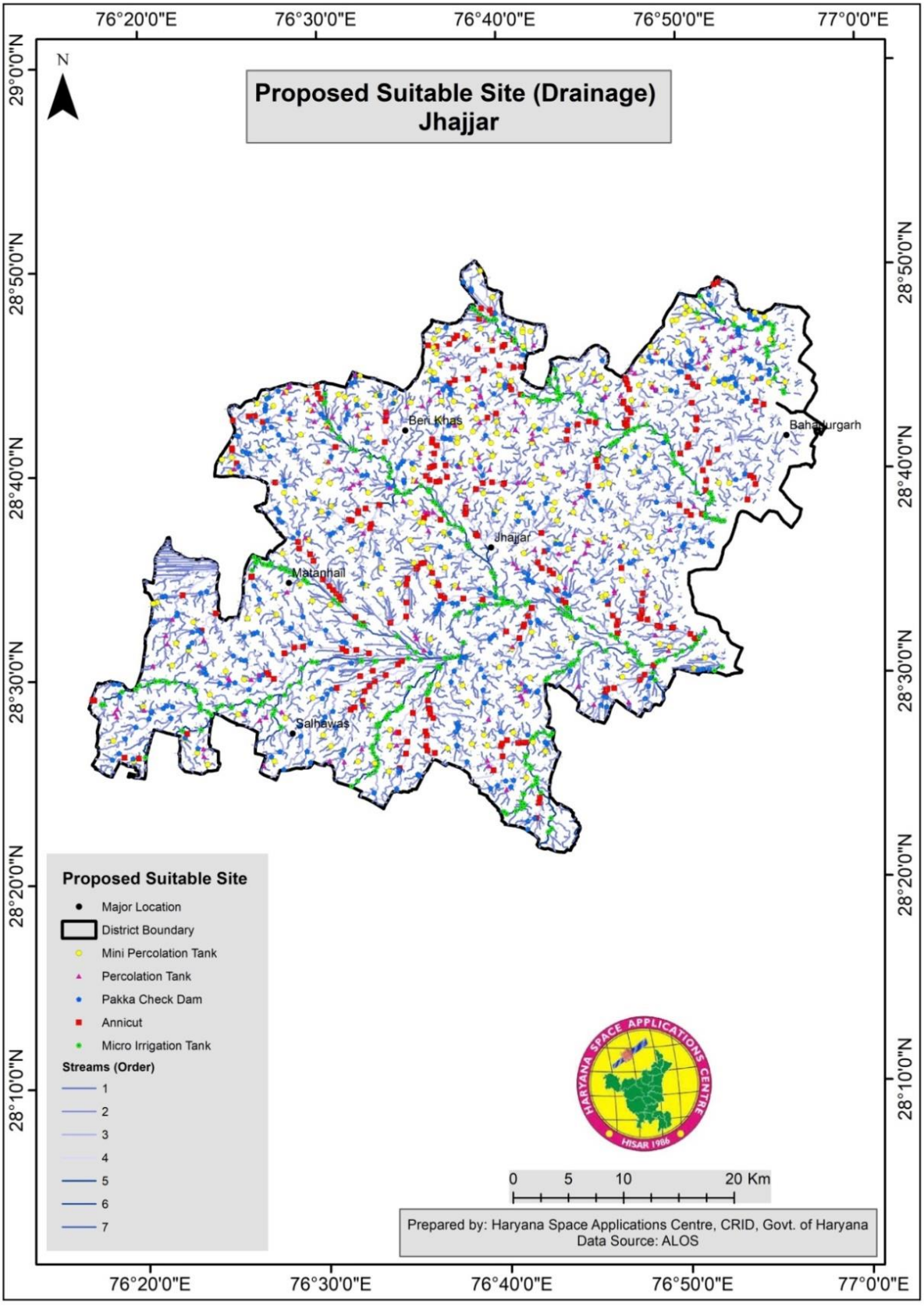


Figure 21 Proposed Suitable Site (Drainage) Jhajjar

9 Conclusion

Water problems will not go away by themselves. On the contrary, they will worsen unless we. as a global community, respond and use water responsibly, So, before it is too late, let us all, as individuals, families, committees, companies & institutions, pledge towards using water wisely. Intelligence is not in lavishness but in conservation. so that our future generations can continue to enjoy the blissful feeling and touch of water.

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