Report No.-15

JSA-CTR

Scientific Action Plan for Palwal

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1. Introduction

1.1. History

The City Palwal got its name from a demon 'Palawasur' who ruled this place during the reign of Pandavas. Palwasur was killed by Balaram, elder brother of Lord Shri Krishna. In his memory, every year a festival named "Baldev Chhat Ka Mela" is organised in Palwal. There is also a temple dedicated to Balaram near Municipal Office chowk. Railway Station of Palwal is the place from where Mahatma Gandhi ji were arrested first time. A historical building "Gandhi Ashram" was made in the memory of Mahatma Gandhi.

During the British period, Palwal was a part of the Punjab Province and a part of Gurgaon district. Many persons from Palwal participated in the 1857 revolt against the British forces. Hayat Ali and Khairat Ali were martyred along with 17 people from Palwal only. Hayat Ali after arrest from his house was taken to Delhi and hanged. All male members of his family were ordered to be hanged. Large number of arrest warrants were issued. Interestingly, Tahsildar Palwal impersonate as Bangle seller like a political decoy, went to the house of Hayat Ali, and saved Nazeer Ali (the grandson of Hayat Ali), who was merely 2 years old, inside a basket fully covered by bangles. He then left the child in the jungles of Nageena near Palwal. Ladies from the family of Hayat Ali, followed him, took the child from jungles and with cautious ultimately reached Tijara. Amongst the 17 people who were hanged in Palwal included the son-in-law of Hayat Ali, whose name was Iradat Ali bin Rustam Ali. When British forces chased the other family members from Pinangwan. The brother of Iradat Ali from Pinangwan, namely Karamat Ali could able to survive his life and ran away to Tijara. He latterly changed his name to 'Zamin Ali'.

On 15 August 1979, Gurgaon district was further divided to form a new Faridabad district, and Palwal became a part of it. Finally, Palwal became the 21st district of Haryana on 15 August, 2008.

1.2. Location

Palwal is the 21st district of Haryana State in northern India. Palwal city is the headquarters of this district. The city is situated at a distance of 60 km from Delhi on the Delhi-Mathura highway (NH-2). The latitude of the town is 28° 40′ N and longitude is 76° 59′ E. It has an average elevation of 195 metres (639 ft). The area of town is 22.10 km sq.

Palwal district of Haryana lies between 27^{o} 50': 28^{o} 15'40" north latitudes and 77^{o} 05': 77^{o}33' east longitudes. Total geographical area of the district is 1364.55 sq.km. Administratively, Palwal is the district Headquarter of the district. It is divided into 5 development blocks namely Palwal, Hathin, Prithla Hodal and Hassanpur. The district area is bounded on western side Mewet district, Eastern side by U.P. state and northern side by Faridabad district and falls in survey of India toposheets no. 53H/3, H/4, H/7,

H/8, H/9, H/12, and 54E/5 and E/9.There are two main canals Agra canal and Gurgaon canal which passes through western and central part of the district respectively from north to south. In the northern part of the district Budia nala is flowing from east to west and discharges its rainy water in river Yamuna. The Gaunchi main drain passes through north south direction of the district running in between Agra canal and Gurgaon canal. CGWB has carried out ground water exploration besides other hydro geological and geophysical studies in the district. The Location Map of Palwal district is shown in **Figure 1**.

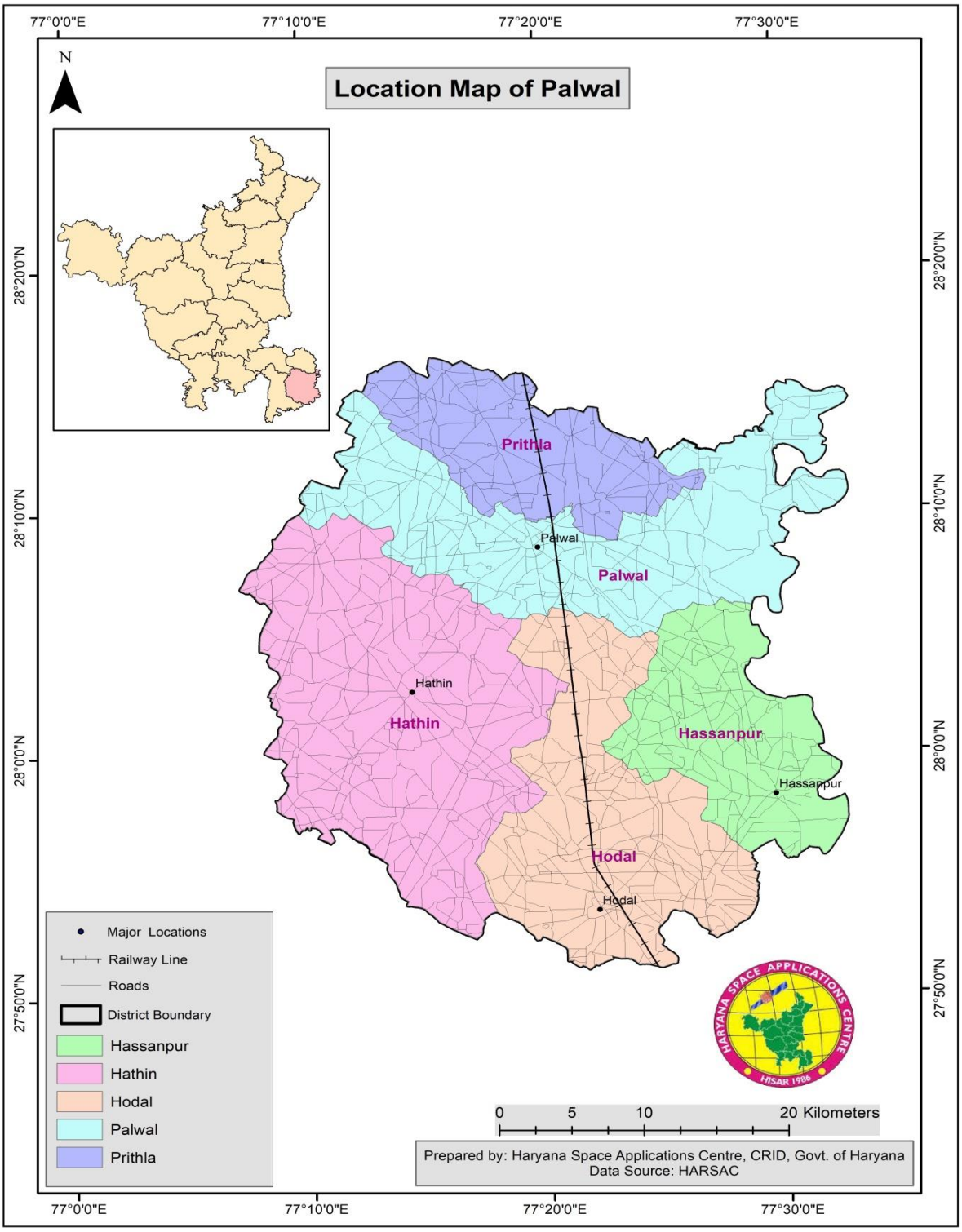


Figure 1 Location Map of Palwal District

1.3. Administrative setup

The administrative setup of the District of Palwal 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 Palwal District.

Country	India
State	Haryana
Division	Faridabad
Headquarters	Palwal
Tehsil	Palwal, Hodal, Hathin
Total Area	1,359 km2 (525 sq. mi)
Total Population (2011)	1,042,708
Density	770/km2 (2,000/sq. mi)
Urban	236,544
Demographics	
Literacy	70.32%
Sex Ratio	879
Website	http://palwal.gov.in/

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

Local Institutions: -

Total Villages	282
Village Level	Panchayat
Block Level	Panchayat Samiti
District Level	Zila Parishad

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

1.4. Climate

1.4.1. Temperature

The climate of Palwal district can be classified as tropical steppe, semiarid and hot which is mainly characterized by the extreme dryness of the Air except during monsoon months. During three months of south west monsoon from last week of June to September, the moist air of oceanic penetrate 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 Palwal district is about 542 mm spread over 27 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 rainfall map of Palwal district is shown in **Figure 2**.

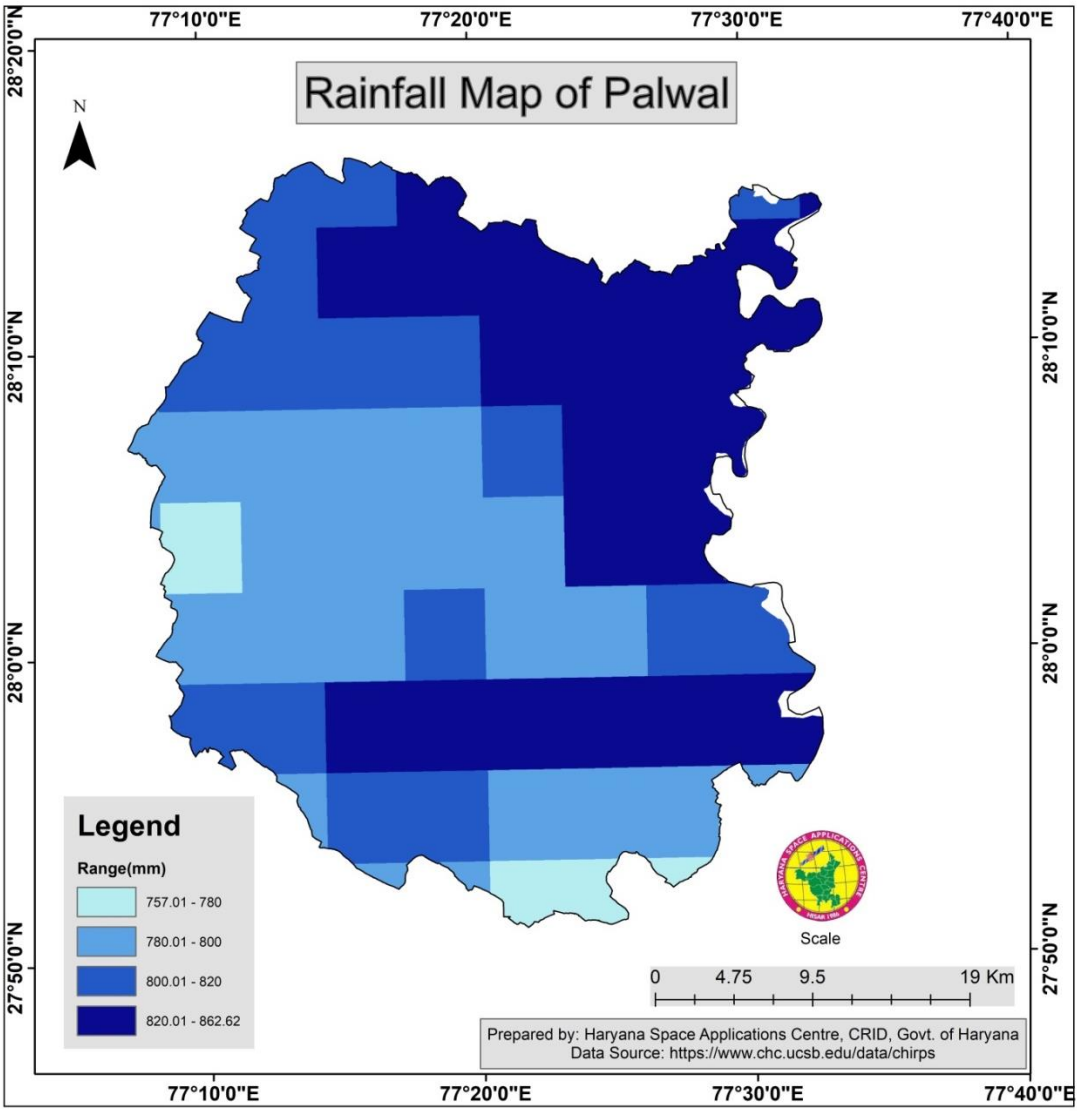


Figure 2 Rainfall Map of Palwal District

1.5. Elevation and Topography

Palwal is located at 28.15°N 77.33°E, between the eastern bank of Yamuna River and the western flank of Aravalli Mountain range. It has an average elevation of 195 meters (639 ft). (**Figure 3**)

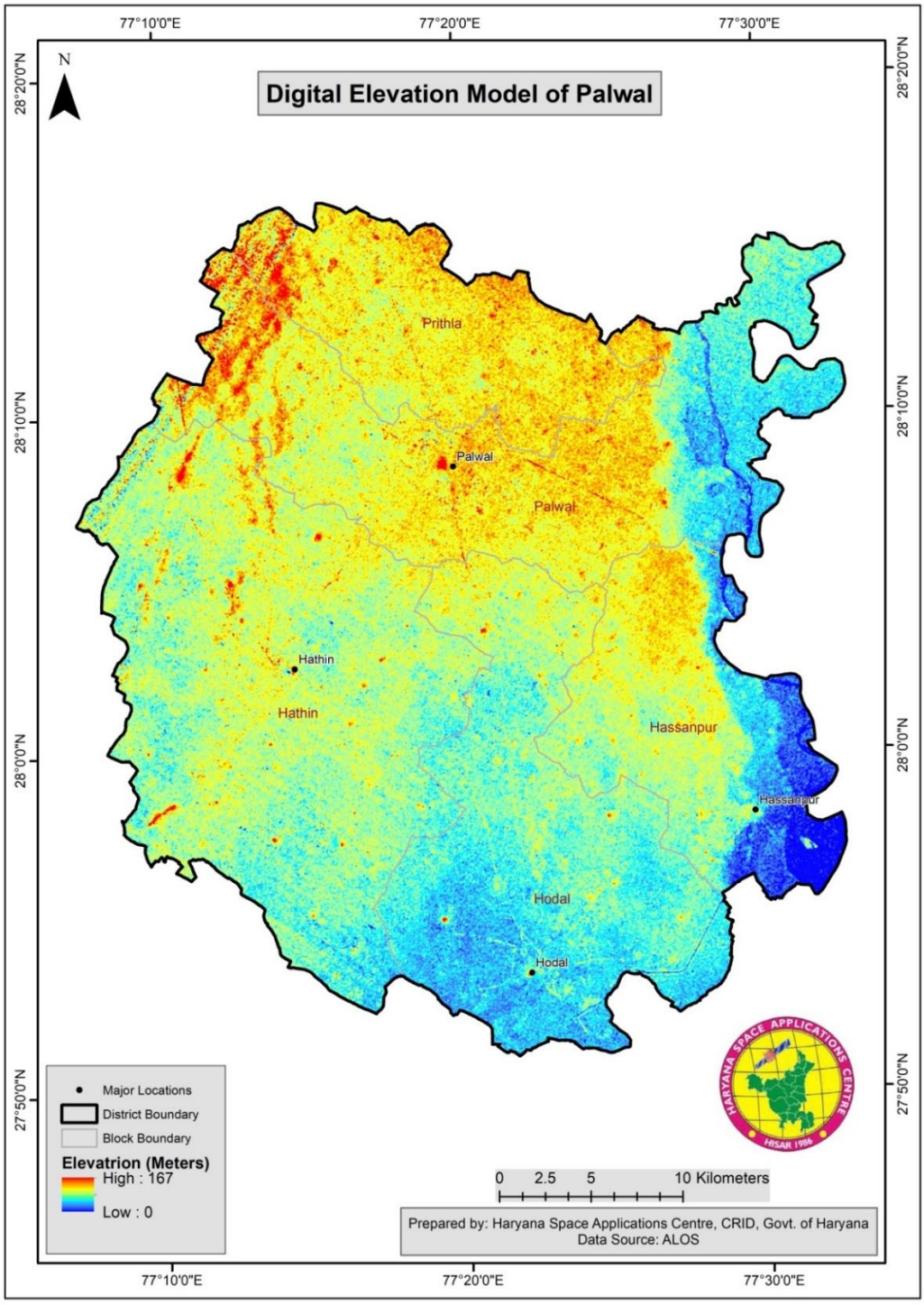


Figure 3 Digital Elevation Model of Palwal District

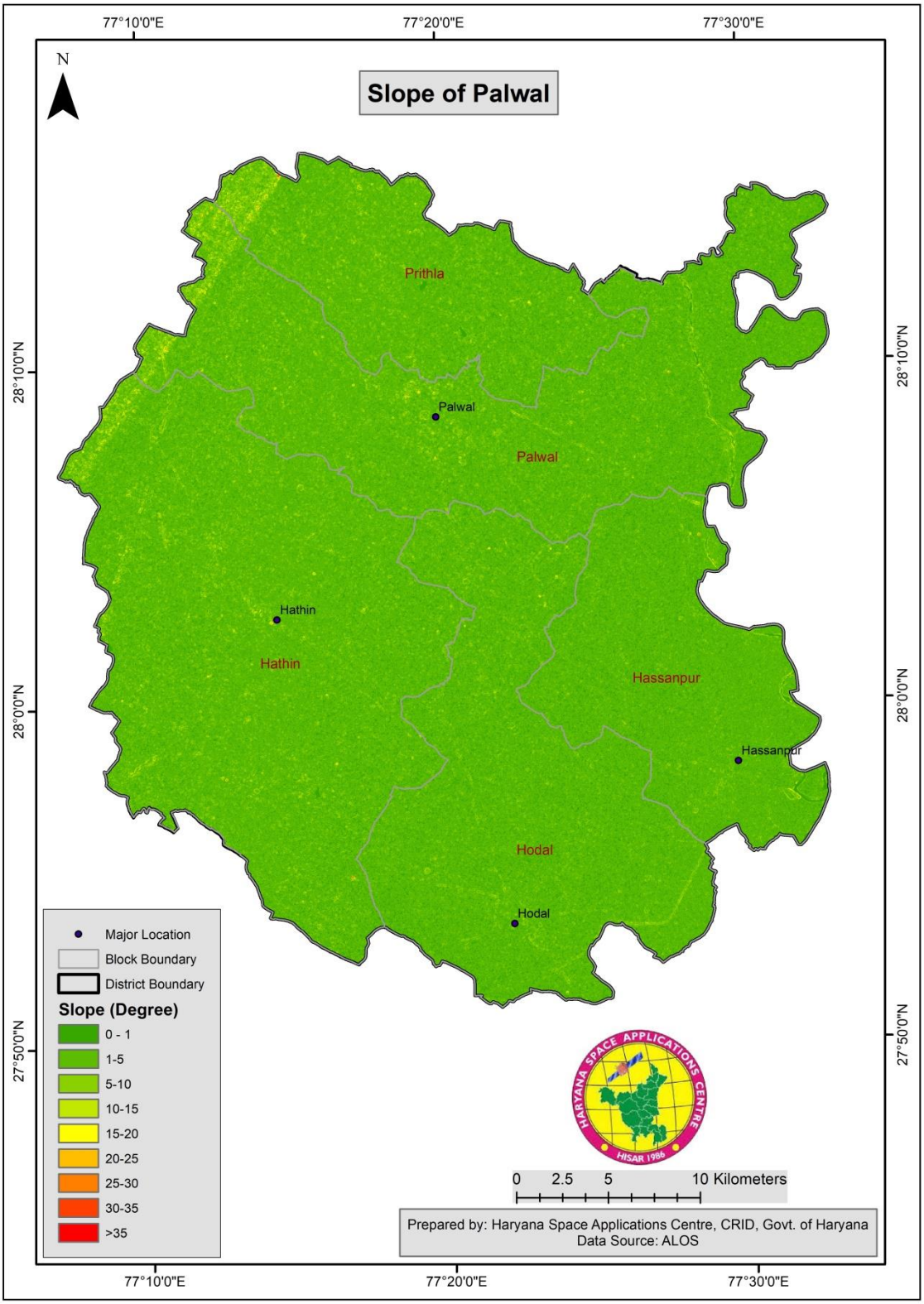


Figure 4 Slope Map of Palwal District

Slope ranges from flat to >35 degree (**Figure 4**). 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**).

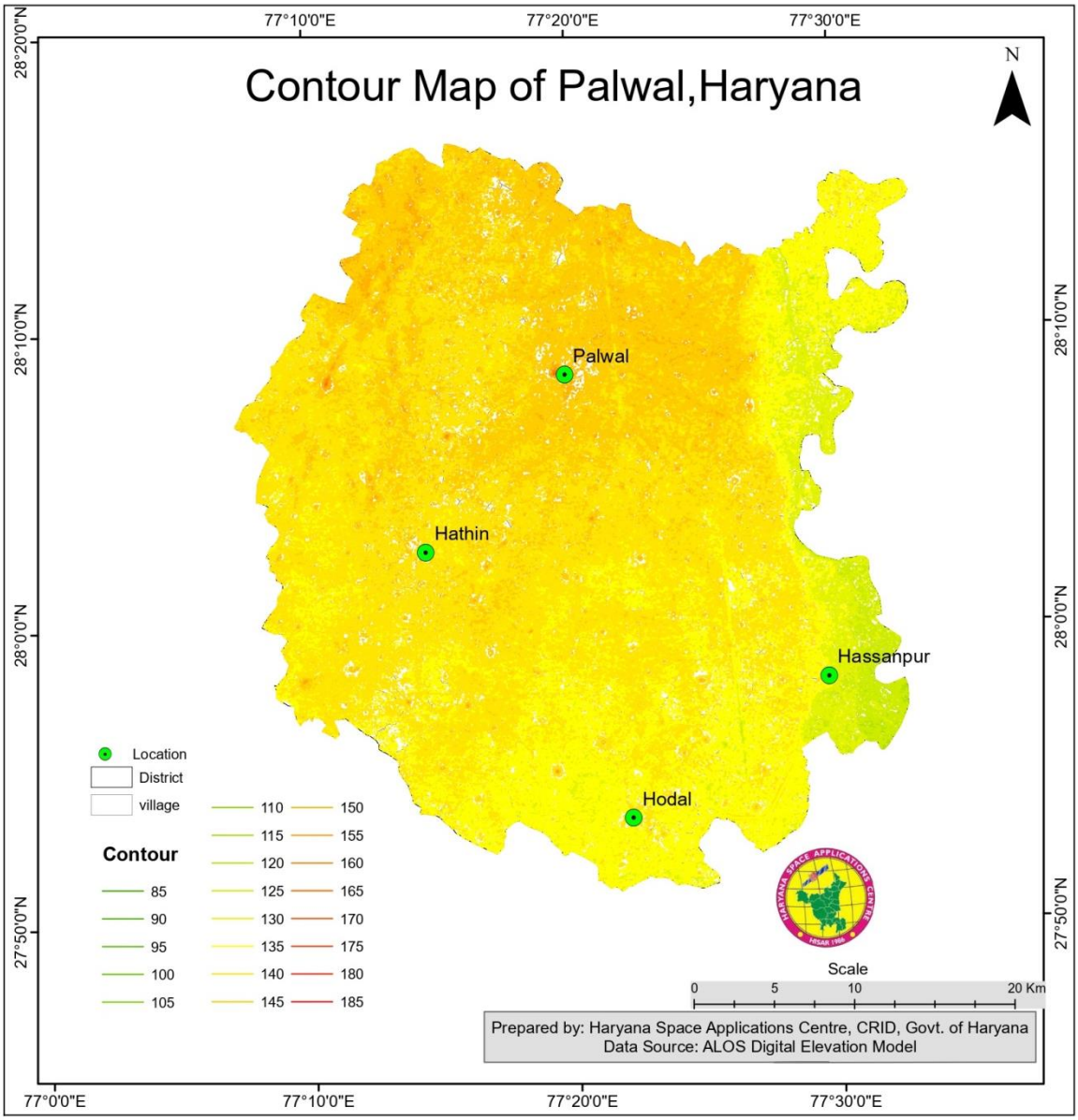


Figure 5 Contour Map of Palwal District

1.5.1. Geology and Lithology

Lithology describes the geochemical, mineralogical, and physical properties of rocks. It plays a key role in many processes at the Earth surface, especially the fluxes of matter to soils, ecosystems, rivers, and oceans. The Lithological map of Palwal is shown in **Figure 6.**

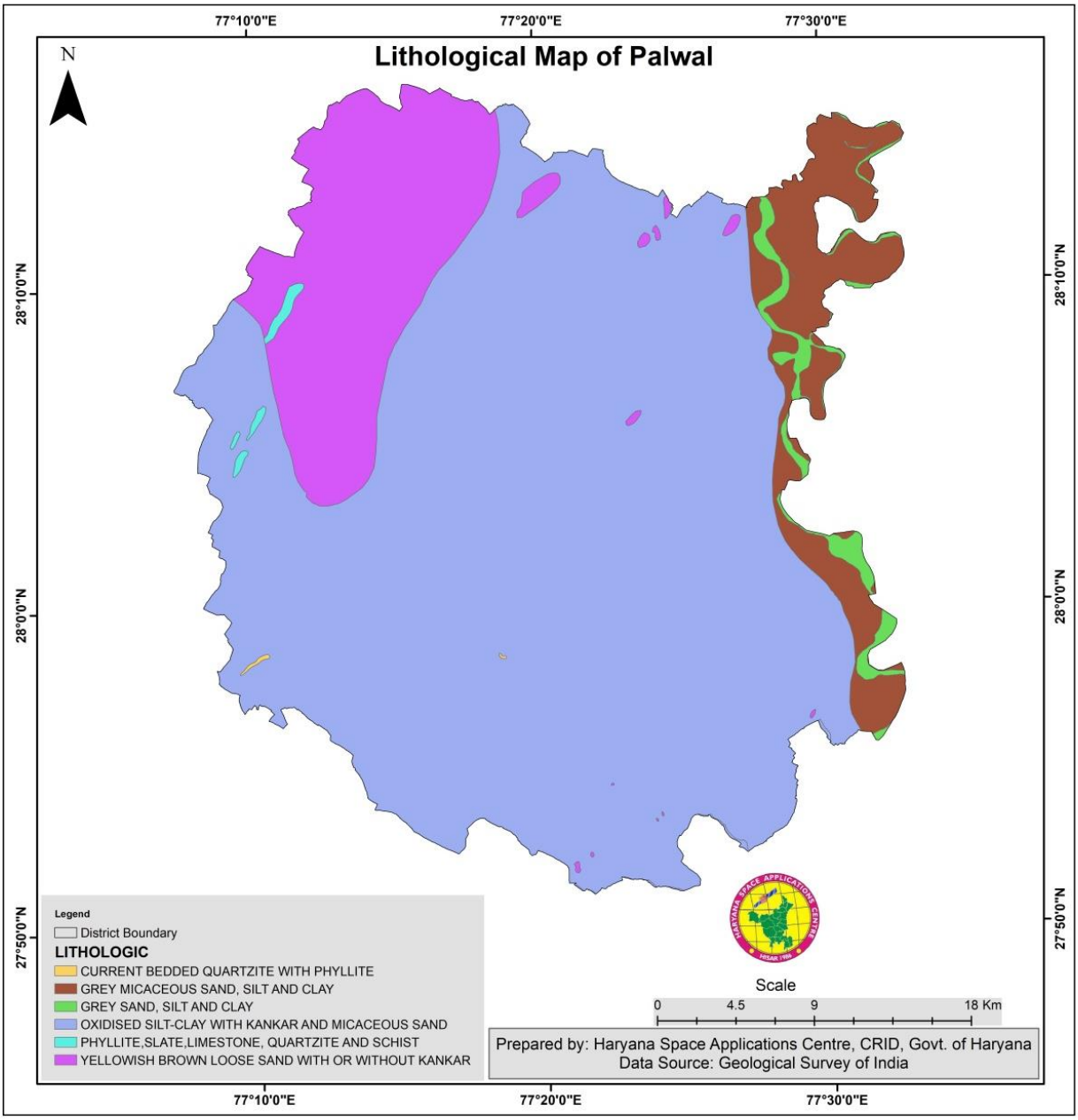


Figure 6 Lithological Map of Palwal District

1.5.2. Soil Profile

Soils of Palwal district are classified as tropical and brown soils, existing in major parts of the district. In Hathin block the organic content of soils ranging from 0.41 to 0.75 percent which is of medium category. In rest of the area organic contents is 0.2 to 0.4 percent and falls in Low category. The average conductivity of the soil is not more than 0.80 µmhos /cm and the average pH of the soil is between 6.5 and 8.7. The area comprises almost flat plains traversed by one ridge running N-S to NNE-SSW direction, divides the alluvium into two parts. The major river is Yamuna which is a perennial river. **Figure 7** shows the soil Texture map of Palwal District And the general profile of soil health of Haryana state is shown in **Figure 8**.

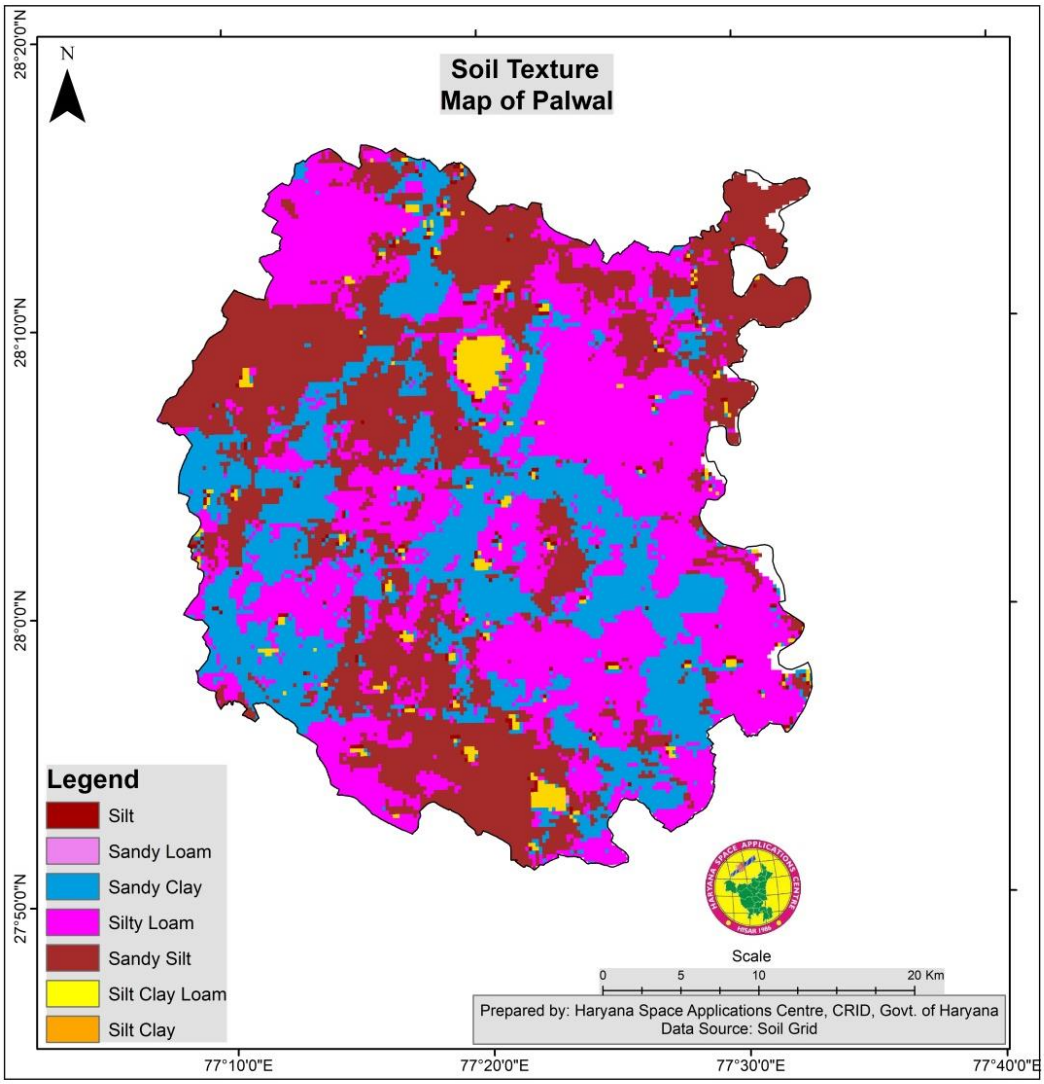


Figure 7 Soil Texture Map of Palwal District

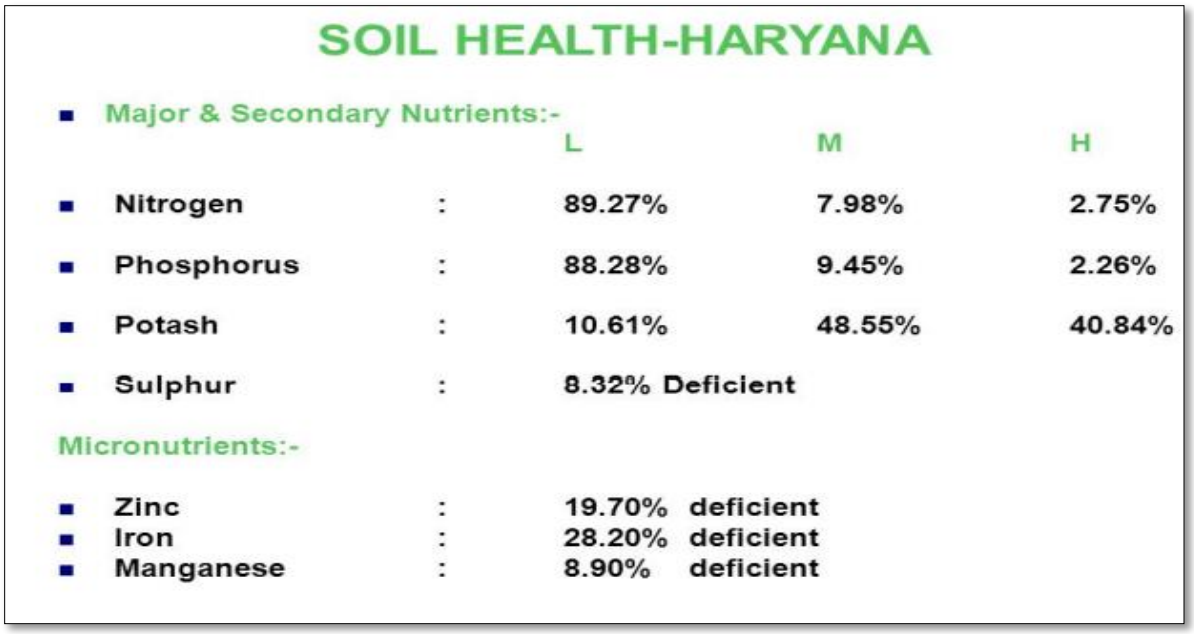


Figure 8 General soil health profile of Haryana

1.6. Land use

Land cover refers to the surface cover on the ground, whether vegetation, urban infrastructure, water, bare soil or other. Land use refers to the purpose the land serves, for example, recreation, wildlife habitat, or agriculture. The Land Use and Land Cover Map of Palwal District is shown in Figure 9.

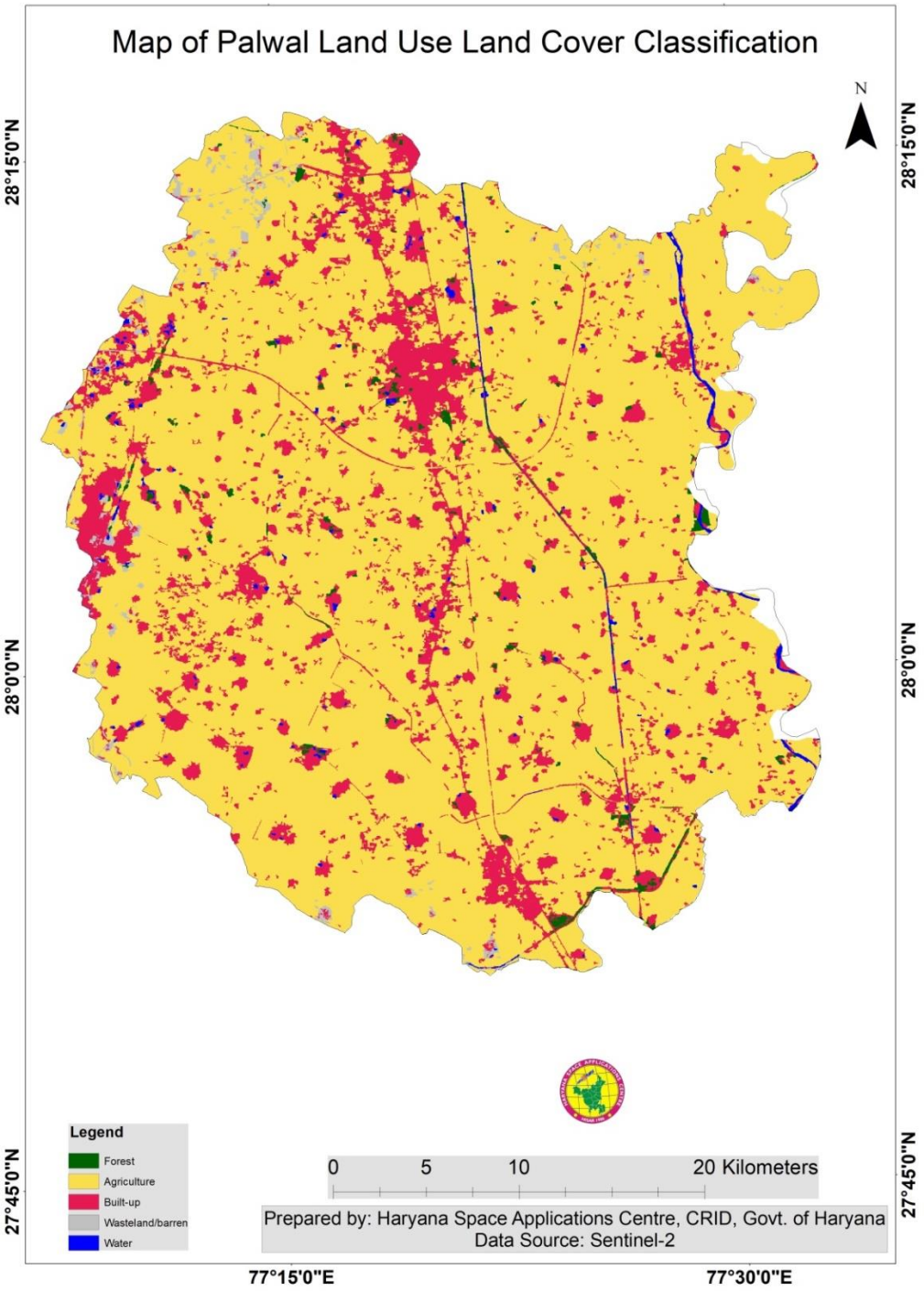


Figure 9 Land Use and Land Cover Map of Palwal District

2. District Water Profile

2.1. Source of Water

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

2.1.1. Canals

A canal is an artificial channel that is constructed to carry water to the fields to perform irrigation. The water is taken either from the river, tank or reservoirs. The canals can be constructed either by means of concrete, stone, brick or any sort of flexible membrane which solves the durability issues like seepage and erosion. Agra Canal takes out of the Yamuna at Okhla in New Delhi. The Canal passes down straight through Ballabgarh Bhangar area into Palwal Plain area and thence into U.P. and provides irrigation for the areas of the district. Gurgaon Canal project is inter-basin transfer of waters and a flow-cum-lift project. For some distance, it runs parallel to Agra Canal on its western side and then takes a southwest turn to enter Gurgaon 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 Palwal district total 878 ponds found with the help of satellite data on village level. Table 2 shows Palwal 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 Palwal.

Table 2 Palwal block wise no. of ponds

Sr. No.	Blocks	No. of Ponds
1	Prithla	161
2	Palwal	174
3	Hathin	429
4	Hodal	189
5	Hasanpur	93

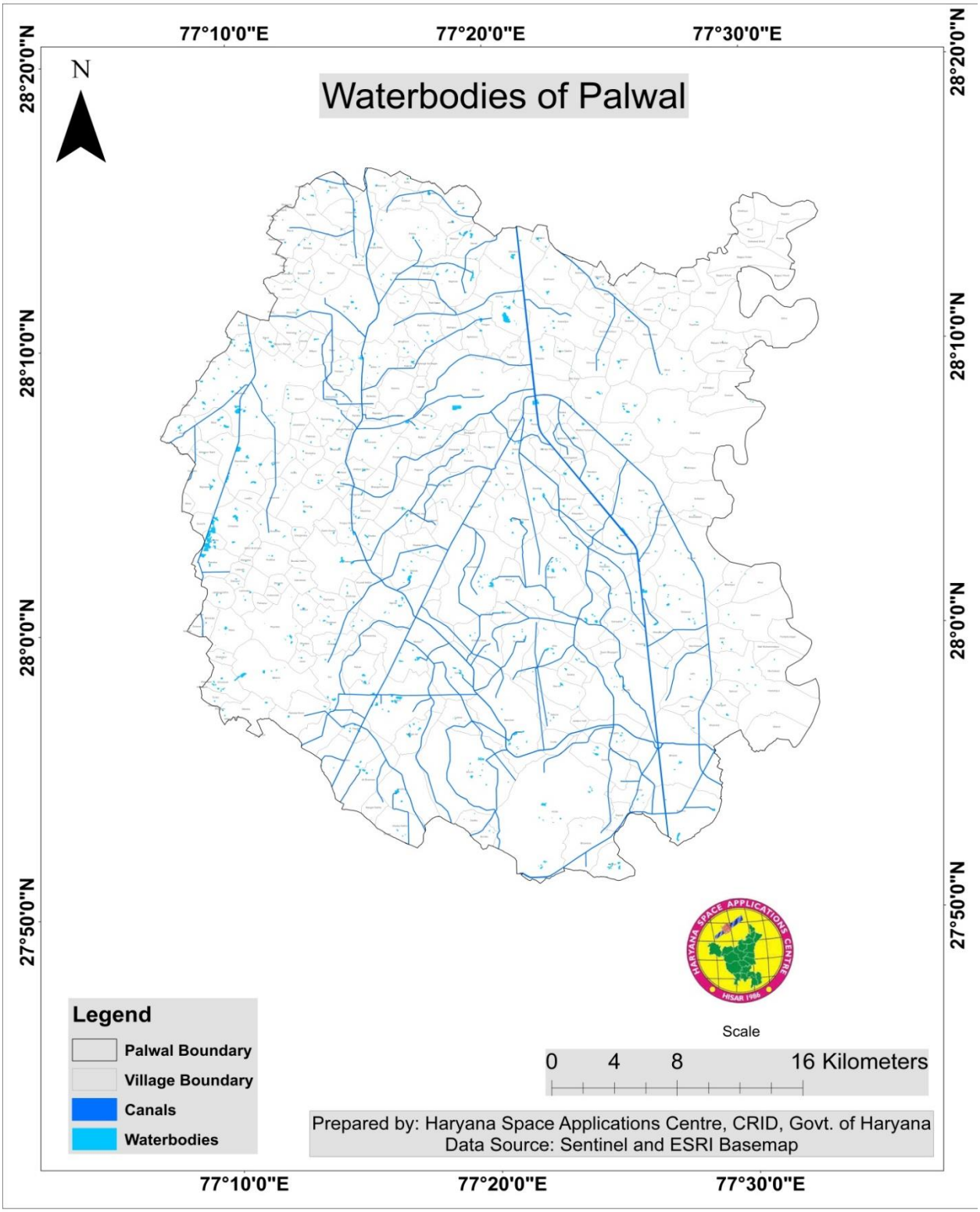


Figure 10 Waterbodies of Palwal District

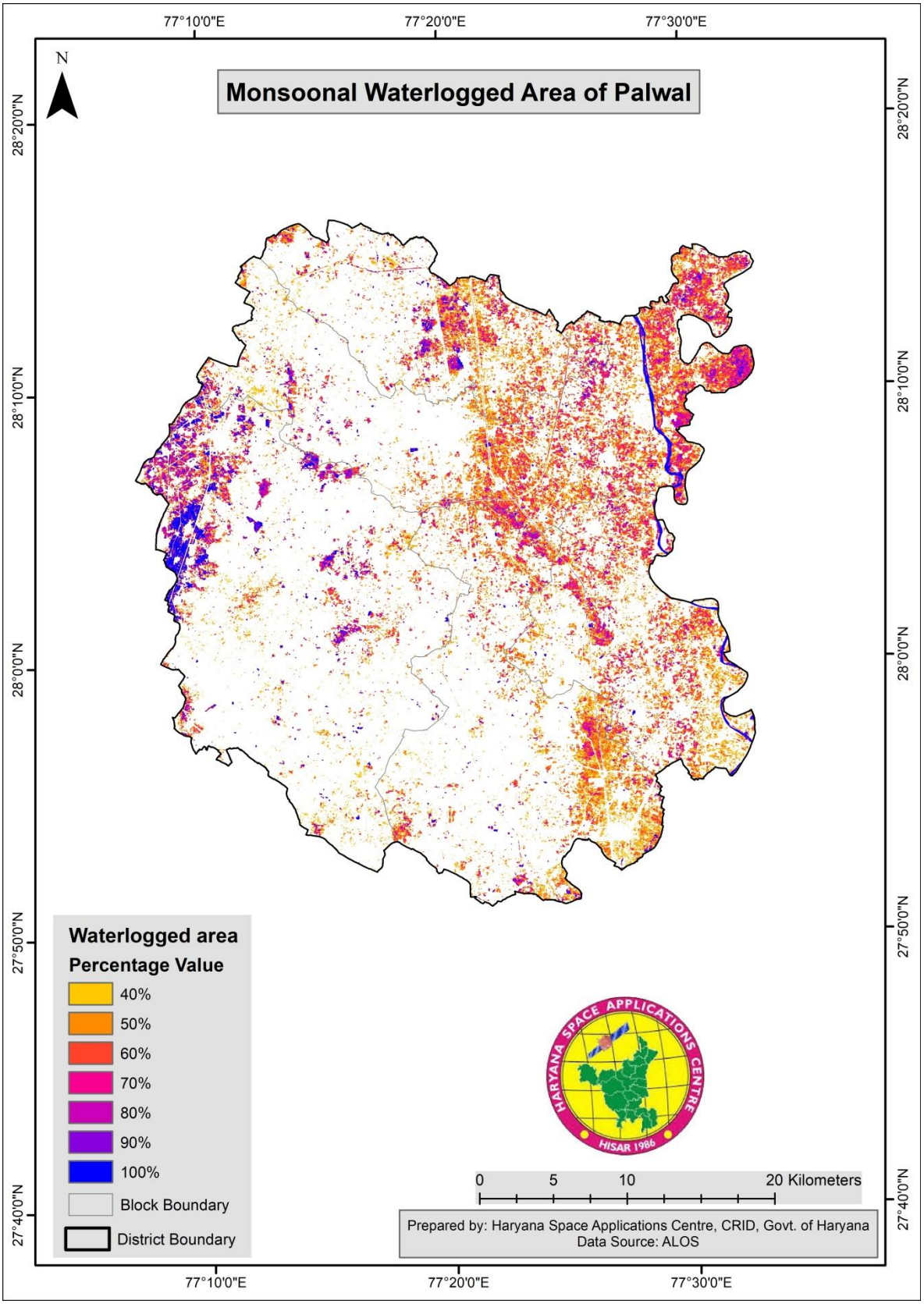


Figure 11 Monsoonal water logged area of Palwal

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 water body. During rain or irrigation, the fields become wet. The water infiltrates into the soil and is stored in its pores. When all the pores are filled with water, the soil is said to be saturated and no more water can be absorbed; when rain or irrigation continues, pools may form on the soil surface. Surface drainage is the removal of excess water from the surface of the land. Shallow ditches, also called open drains, normally accomplish this. The shallow ditches discharge into larger and deeper collector drains. In order to facilitate the flow of excess water toward the drains DEM is very important. The drainage map of Palwal District is shown in **Figure 12.**The statistics of length of drainages under each order are shown in **Table 3**.

Table 3 Drainage order and total length of the drains in Palwal District

S.No.	Stream Order	Length in meters
1	1st order	6294
2	2nd order	3398
3	3rd order	1803
4	4th order	701
5	5th order	381
6	6th order	237

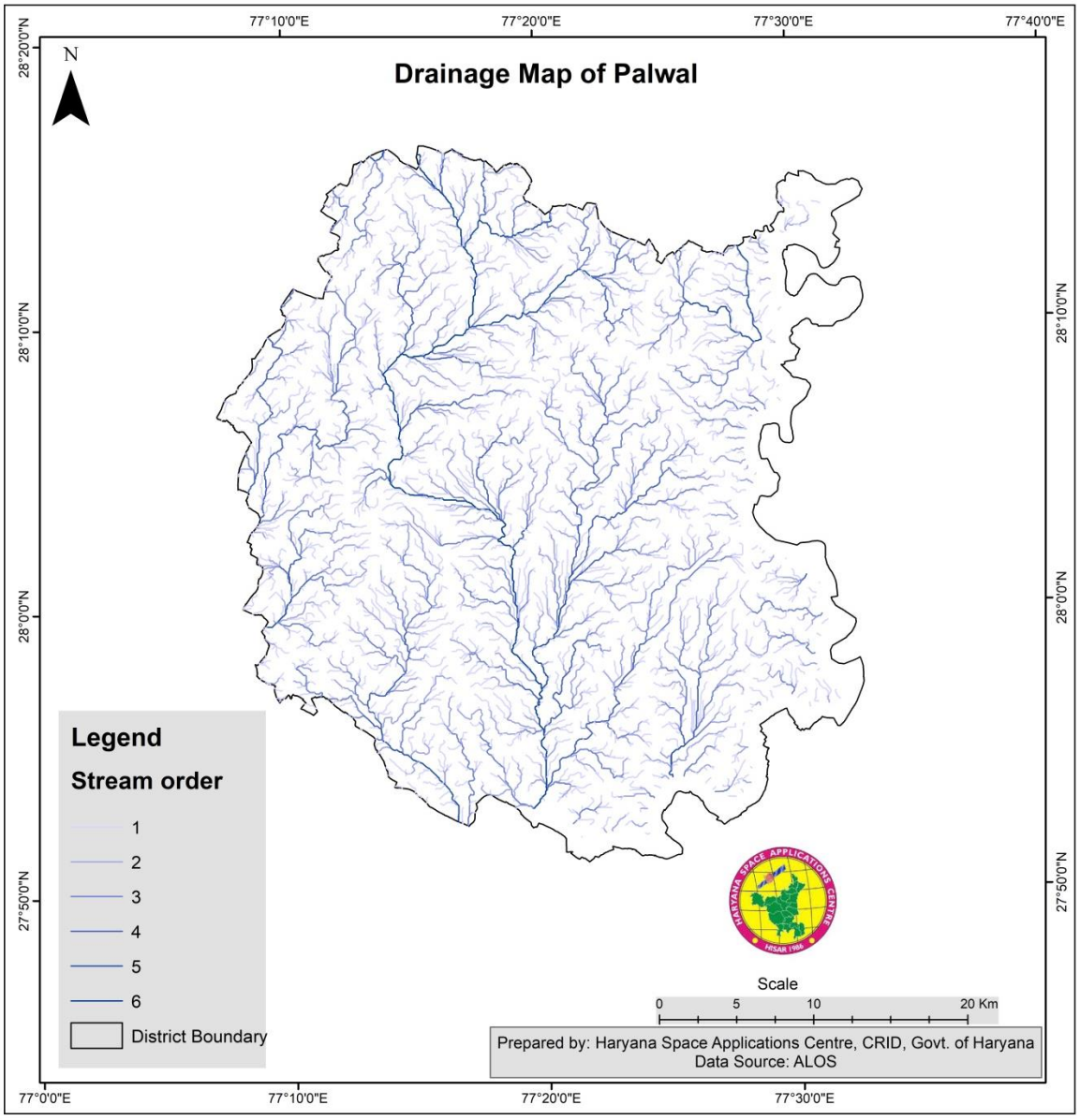


Figure 12 Drainage Map of Palwal District

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 Palwal 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 4**) is some of the most popular rain water harvesting techniques:

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

Table 4 Water Harvesting System in Palwal District

S.NO.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam		1	
2	Pond / Tank		1	
3	Trench	0	9	
4	Rooftop Water Harvesting Structure (Public)	358	0	
5	Rooftop Water Harvesting Structure (Private)	16		

6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)		0	
7	Other Water Conservation Structures (Bench Terracing, Canal)		1	
	Total		**12**	**48**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	52	17	
	Total	**52**	**17**	**308**
Reuse and Recharge Structures				
1	Soak Pit	500	7	
2	Stabilization Pond	0	0	
3	Other Reuse / Recharge Structure	3	2	
	Total	**503**	**9**	**54**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank		0	
3	Staggered Trenches	0	7	
4	Other Watershed Construction Activities	90	52	
	Total		**59**	**632**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	128095	0	
2	Intensive Afforestation- Plantation		4	
	Total		**4**	**83**
Awareness Programs by KVK				
1	Farmers training programs by KVKs on Water Use Efficiency and Appropriate Crops			
2	Distribution of one packet of vegetable seeds and saplings of five nutritious plants to farmers			
3	Awareness Programs/ Kisan Mela on the theme Valuing Water			
	Total			
Waste Water Treatment				
1	Use of Treated Waste Water	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 Palwal District for rain water harvesting is shown in **Table 5** at rural and urban area. The map of water conservation activity in Palwal at rural and urban level is shown in **Figure 13**.

Table 5 Water Harvesting activities in Rural area and Urban Area

In Rural Area		
Sr. No	**Block Name**	**Total No of Activity (no.)**
1	Hassanpur	652
2	Hathin	29
3	Hodal	45
4	Palwal	62
5	Prithla	45
In Urban Area		
1	Palwal	33

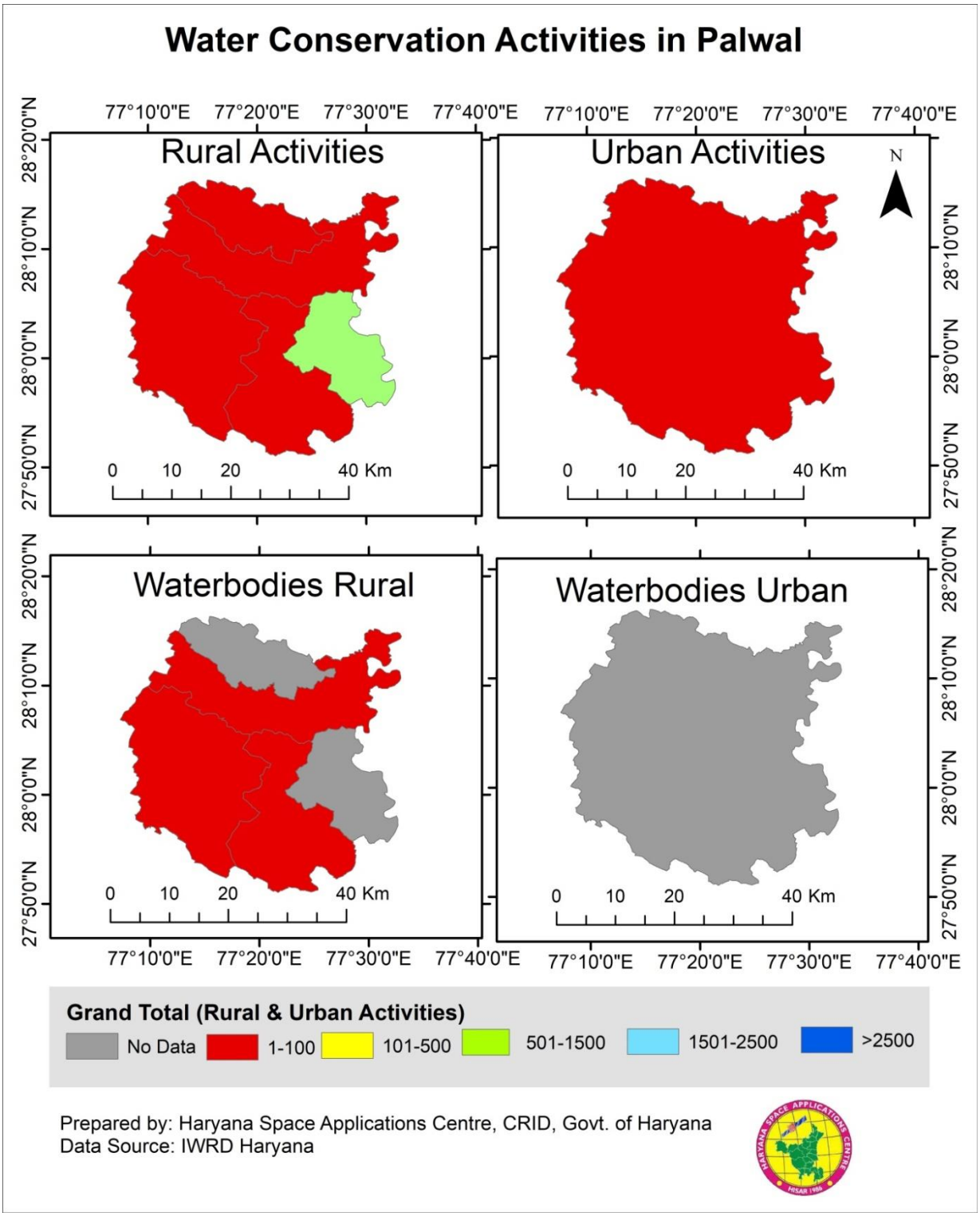


Figure 13 Water Conservation Activities in Palwal

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**. In Palwal District a total of 4 treatment plant.

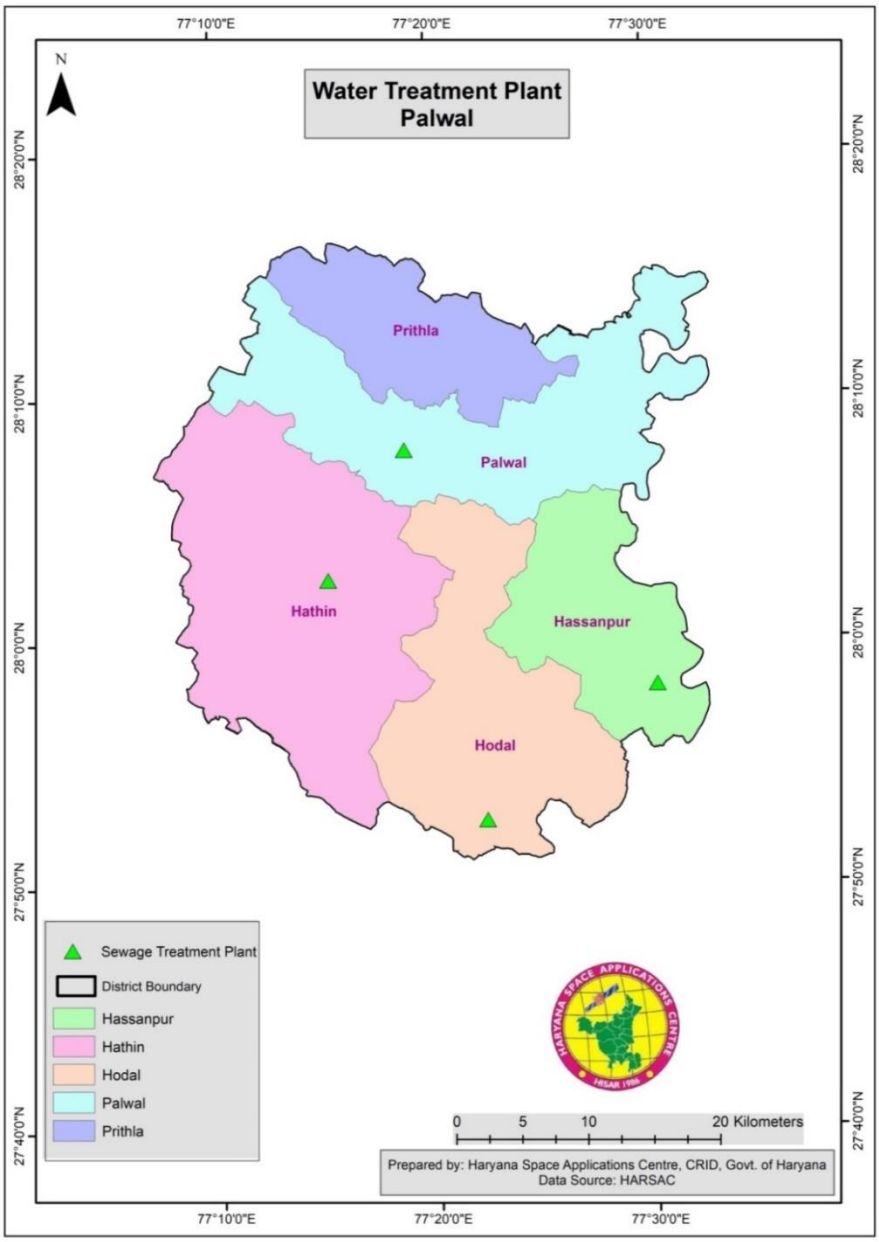


Figure 14 Water Treatment Plant Map of Palwal District

3 Irrigation Profile

Irrigation is the agricultural process of applying controlled amounts of water to land to assist in the production of crops as well as to grow landscape plants and lawns, where it may be known as watering. Agriculture that does not use irrigation but instead relies only on direct rainfall is referred to as rain-fed.

Irrigation helps to grow agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of less than average rainfall. Irrigation also has other uses in crop production, including frost protection, suppressing weed growth in grain fields and preventing soil consolidation.

4 Water Availability

4.1 Surface Water Availability

Surface water is water located on top of the Earth's surface, and may also be referred to as blue water. In common usage, it is usually used specifically for terrestrial waterbodies, the vast majority of which is produced by precipitation and runoff from nearby higher areas.

4.2 Ground Water Availability

Groundwater is the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The following map (Figure 15) depicts the ground water depth in Palwal district.

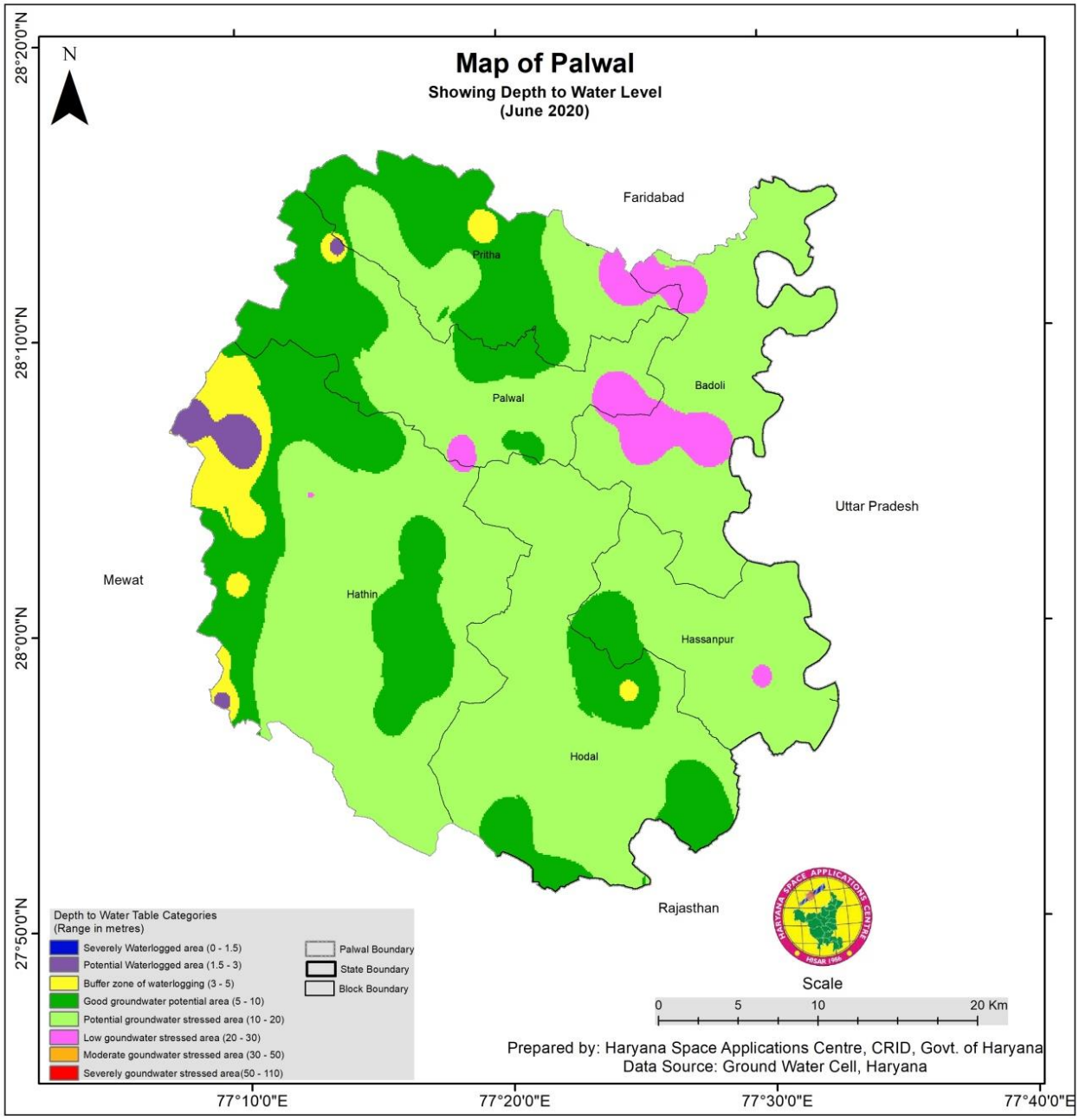


Figure 15 Ground Water Availability Map of Palwal District

4.2.1 Ground Water Quality

The shallow ground water of the district is alkaline in nature (pH 7.75 to 8.62) and is moderately to highly saline (EC 693 to 3600 mS/cm). Among anions, bicarbonate predominates at some places, whereas at other places either none of the anion dominates or chloride is dominant. Among cat ions, by and large, sodium is the dominant cat ion. At some places mixed cationic character has been observed. Comparing the concentration values of major ions with the recommended desirable and permissible concentration limits for drinking waters (Bureau of Indian Standards) It is found that more than half (75%) of the ground waters are not suitable for drinking purposes mainly due to fluoride content that exceeds the maximum permissible limit of 1.5mg/1. Salinity (EC), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the parameters for ascertaining the suitability of ground water for irrigational uses. These parameters range from 693 to 3590 micromhos/cm at 250 C, 2.19 to 15.79 and -14.52 to 13.97 milli equivalents respectively. Plot of USSL diagram used for the classification of irrigation waters indicated that ground water samples fall under class C2S1, C3S1, C3C2, C4S2, C4S2, C4S3 and C4S4. These waters are not suitable for customary irrigation as they may cause salinity and sodium hazards. It would be better if such waters are used for semi-salt tolerant to salt tolerant to salt tolerant crops along with appropriate amount of gypsum on well drained soils. The Palwal 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 6**.

Table 6 Block wise average water quality index value in Palwal District

Sr. No.	Block Name	Average Water Quality Index Value
1	Hassanpur	127.8525
2	Hathin	213.6175
3	Hodal	158.2259
4	Palwal	129.2703
5	Prithla	137.2496

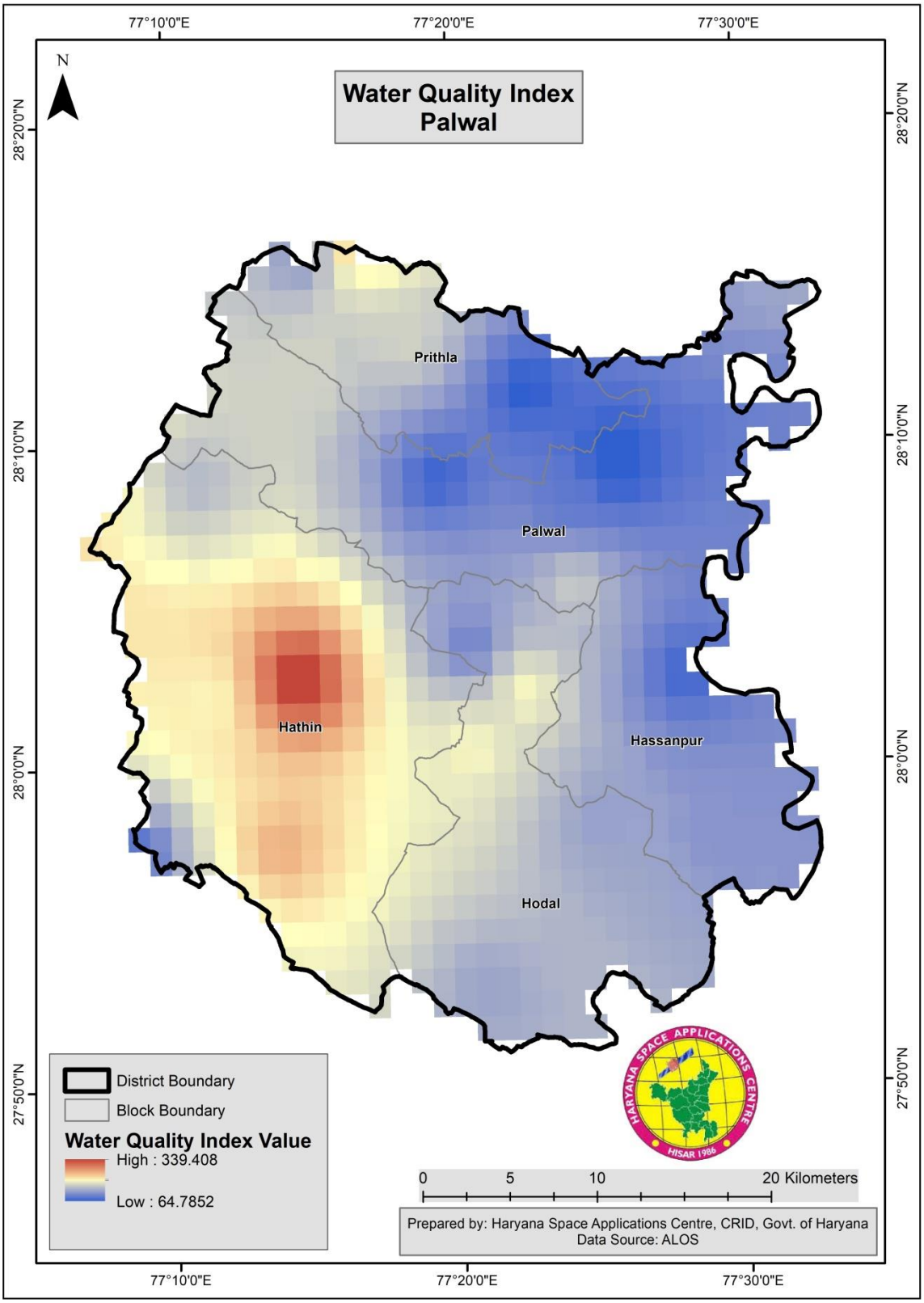


Figure 16 Water Quality Index of Palwal District

5 Aquifer System

The district is occupied by Indo-Gangetic alluvial plain of Quaternary age, and falls in Yamuna sub -basin of Ganga basin. The Central Ground Water Board has drilled 21 exploratory boreholes to delineate and determine potential aquifer zones, evaluation of aquifer characteristics. Out of 21 exploratory boreholes 13 boreholes were abandoned due to poor quality of ground water. The permeable granular zones comprising fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and as well as vertical extent is limited. The borehole data reveals that clay group of formations dominate over the sand group in the district area. Ground water occurs in alluvium and the underlying weathered/fractured quartzites. Alluvium comprises sands silt, Kankar and gravel. Which form the principal ground water bearing horizon. In Quartzite formation, occupying the north- western part of the district, ground water occurs in weathered and jointed fractured horizons. Weathering and fracturing have resulted in formation of semi-consolidated sand beds (BADARPUR SANDS) which form potential aquifer zones. This quartzite formation has not been explored for ground water occurrence. In alluvium, granular zones are evenly distributed in entire thickness which is negligible near the quartzite outcrops to over 350 m in the eastern parts near Yamuna River. The discharge of the wells ranges from 750 lpm to 900 lpm at a drawdown of5.5 to 7.00m. The transmissivity 'T' value ranges between 55 to 200 m 2 /day were determined. Shallow tube wells for irrigation use are generally constructed up to a depth of 40 m. The discharge of these shallow Tubewell range 360 -600 liters per minutes.

6 Water Requirement/ Demand

6.1 Water Supply and Gap

6.2 Water Budget

The earlier Chapters deal with the general profile, water profile and water availability of Palwal district. The present chapter deals with the current (2021) and projected (2026) demand of water for various sectors. The demand for water has been assessed on the basis of data obtained from different departments.

1. Domestic water demand

It has been assumed that per capita daily water requirement of people residing in urban areas of the district is 135 liters and for population in rural areas, the daily per capita daily water requirement is 55

liters. Using the same norms, block-wise Population has been worked out and is given in table 7 and 8 below

Table 7 Population as per 2011 census

Population	1,042,708
Male Population	554,497
Female Population	488,211

Table 8 Estimated population in 2021

Estimated population of Palwal in 2021	1,188,687
Estimated population of males in 2021	632,127
Estimated population of males in 2021 556,560	556,560

2. Crop water requirement

Crop water requirement for the district have been calculated based upon the cropping pattern followed in district. Cropping pattern under irrigated and rainfed system is different in the district. Under irrigated conditions, in almost all the blocks vegetable based cropping system is followed. However, under irrigated system, paddy-wheat, maize-wheat based cropping systems are also being followed. Cereal crops occupy major portion in all the blocks and in district as a whole. Among grain crops, maize, wheat and paddy are the most commonly cultivated crops. Area under different crops is discussed below. Taking into account, the water requirement (Table 9), requirement of water for different crops have been worked out. Existing water potential available (being utilized) has been assumed as the water used in irrigated land.

Table 9 Crop Water Requirement in Million Cubic Meter

Crop	Area under cultivation in '000 hectare (2015- 16)	Area under cultivation in '000 hectare (2019- 20)	% Increase per year	Estimated Area under cultivation in '000 hectare (2021-	Depth of Water Required	Total Water Requirement (in 2021-22) in MCM	Total Water Requirement (in 2025-26) in MCM

				2022)			
Rice	73	77.7	1.2	78.6	.12m	923.4	988.8
Wheat	90.8	90.5	0	90.8	.04m	363.2	363.2
Sugarcane	21.5	24.8	13.3	25.46	0.12	29.76	34.62
Potatoes	0.9	0.9	0	0.9	0.45	4.05	4.05
Bajra	0.1	0,1	0	0.1	0.5	0.5	0.5
Pulses	0.1	0,1	0	0.1	0.4	0.5	0.5
Total						1330.41	1391.67

7 Strategies for Water Conservation

- In order to arrest the declining trends of water levels in the block, 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.

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

- The construction of roof top rainwater harvesting structures should be made mandatory in building byelaws, which will help in checking the falling water level trend in the Palwal town.

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

- The conjunctive use of poor-quality groundwater and canal water by mixing in different ratio.

- Cyclic use of canal water and poor-quality groundwater.

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

- Local populace to be educated regarding consequences of mining of ground water and need for effective and economic use.

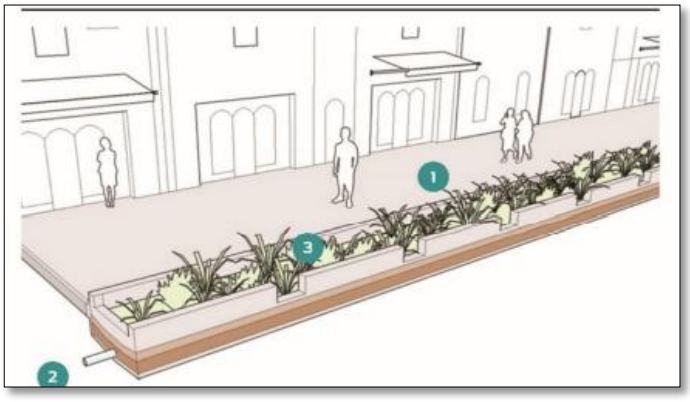
7.1 Artificial Recharge

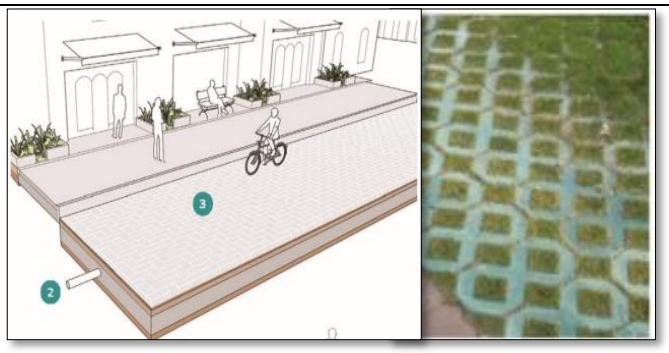
Artificial recharge is the practice of increasing the amount of water that enters an aquifer through human-controlled means. For example, groundwater can be artificially recharged by redirecting water across the land surface through canals, infiltration basins, or ponds; adding irrigation furrows or sprinkler systems; or simply injecting water directly into the subsurface through injection wells.

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 Palwal. 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 11**.

Table 10 The methods of water table recharge strategies in urban area

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

3	Pervious Pavement	
4	Storm water Tree	

7.3 Plantation

A major portion of WSUD that is popular within the Government Departments is plantation of various species of plants, both in public and private spaces, to encourage community participation and increase green cover. While increasing the aesthetic value of a location, plants are heavily influential to change microclimates and in fact playing a factor to rainfall patterns. Along with benefits of carbon sequestration, they contribute to increasing the local biodiversity of the region by attracting several types of fauna as well. Currently a multi-departmental approach is being undertaken both within and outside of government with the engagement of several active citizen stakeholders and non-governmental organizations. Geo-tagging of these plantations and survival monitoring would be undertaken actively by engagement of the mentioned stakeholders. The wasteland that could be used for plantation for conservation of water in Palwal district is shown in **Figure 17** and **Table 11** shows the proposed no of plantation targets in Palwal District.

Table 11 The Plantation targets have been provided in the table below

Block	Wasteland Area (acres)	Plantation at 5 feet spacing
Palwal	960.784247	8370352.4
Prithla	2762.80078	24069520
Hodal	949.987021	8276286.9
Hathin	2504.583745	21819934
Hassanpur	1171.541141	10206466
Total	8349.696934	72742560

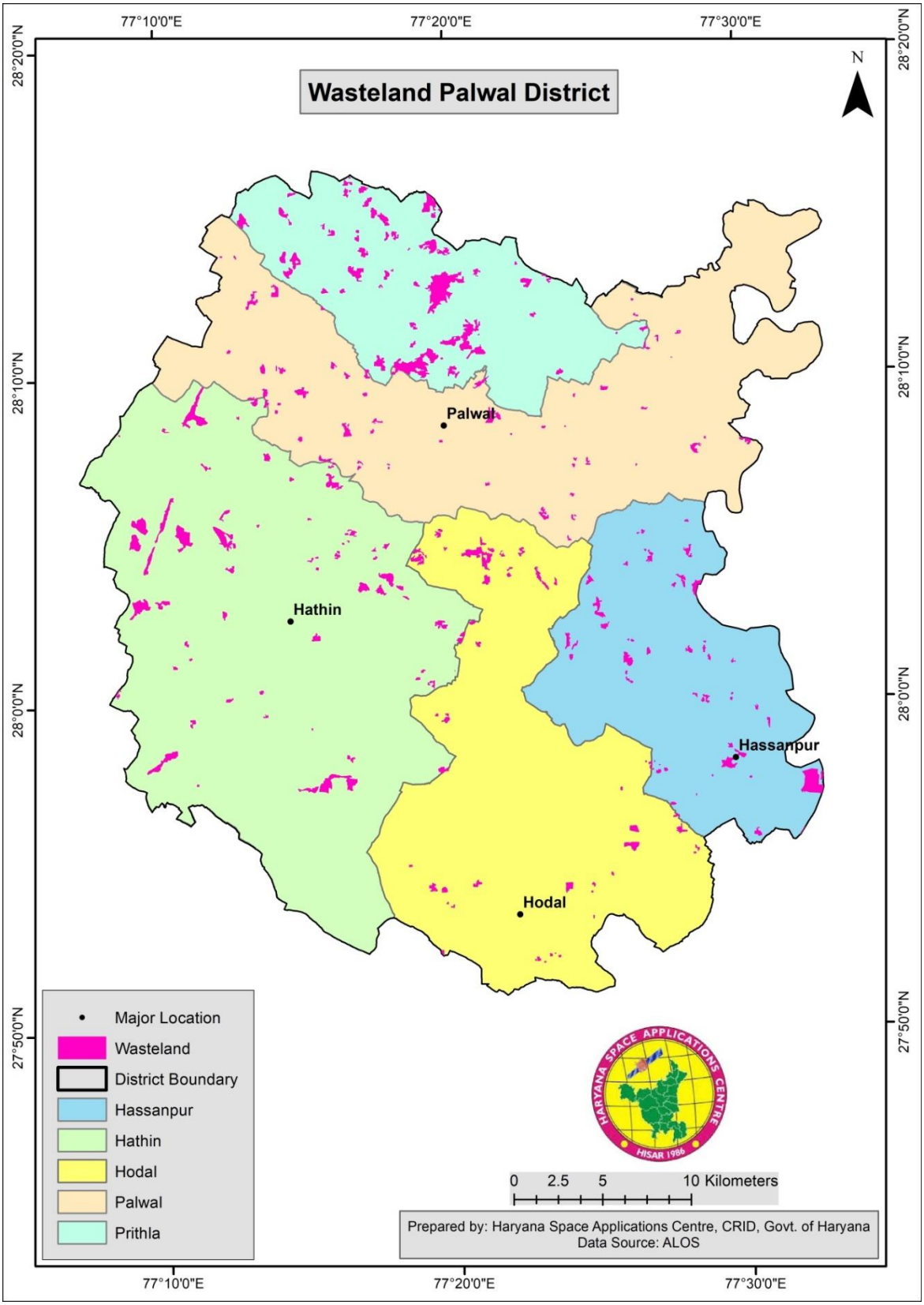


Figure 17 Wasteland Map of Palwal district

7.4 Surface water management

7.4.1 Pond restoration and rejuvenation

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.

Therefore, ponds form a fundamental part of the hydrological cycle in the environment and has allowed a rich cultural, agricultural and societal practices to flourish in India Since ponds can be formed in a much

broader range of environments and landscapes, they demonstrate a wide range of physiochemical activities that allows a wide range of flora and fauna to flourish. However, the ground reality suggests that there are a lot of unmapped points of discharge of wastewater that pollute the local water bodies. These localized incidents of pollution of water bodies contribute to the loss of biodiversity and pose a threat to water security. In the recent years, it has been realized that wastewater may be an essential commodity and tool that may be used to close the demand supply gap and augment freshwater supply.

In order for pond restoration and rejuvenation to be done in a scientific and methodical manner, following 11 step procedures that is accommodative of each individual pond site requirements is 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 Leveling

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 proceeding and after as well.

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 13** shows the numerous activities and interventions that can be carried out for IEC.

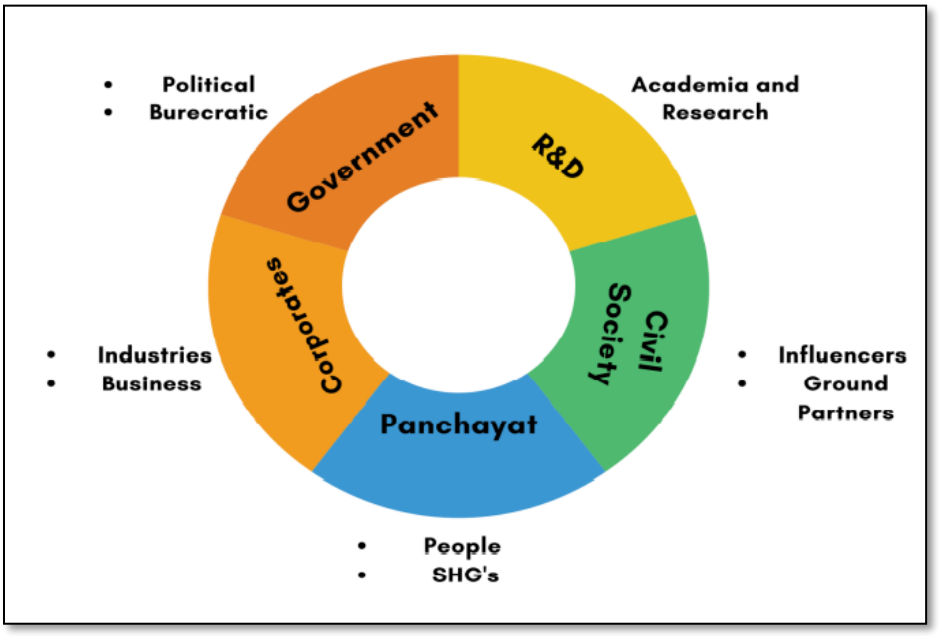


Figure 18 The above figure shows the various stakeholders of IEC Activities

Table 12 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

8.1Rainwater harvesting

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

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

There are some factors that affect the rainfall water harvesting which needs to be focused for the development of suitable sites of water harvesting. These factors include rainfall, slope, soil texture, drainage, topography and land use / land cover and integration of these factors using weighted overlay analysis that results in suitable sites for rainwater harvesting. These sites are then classified into various suitability levels, namely, not suitable, less, medium, good and very good. The most suitable sites for rainfall water harvesting are shown in map (**Figure 19**). The block wise area proposed for rainwater harvesting under most suitable sites is shown in **Table 14.** For the process of calculating suitable site a fixed weightage is needed to be applies on the above-mentioned criteria (**Table 15).**

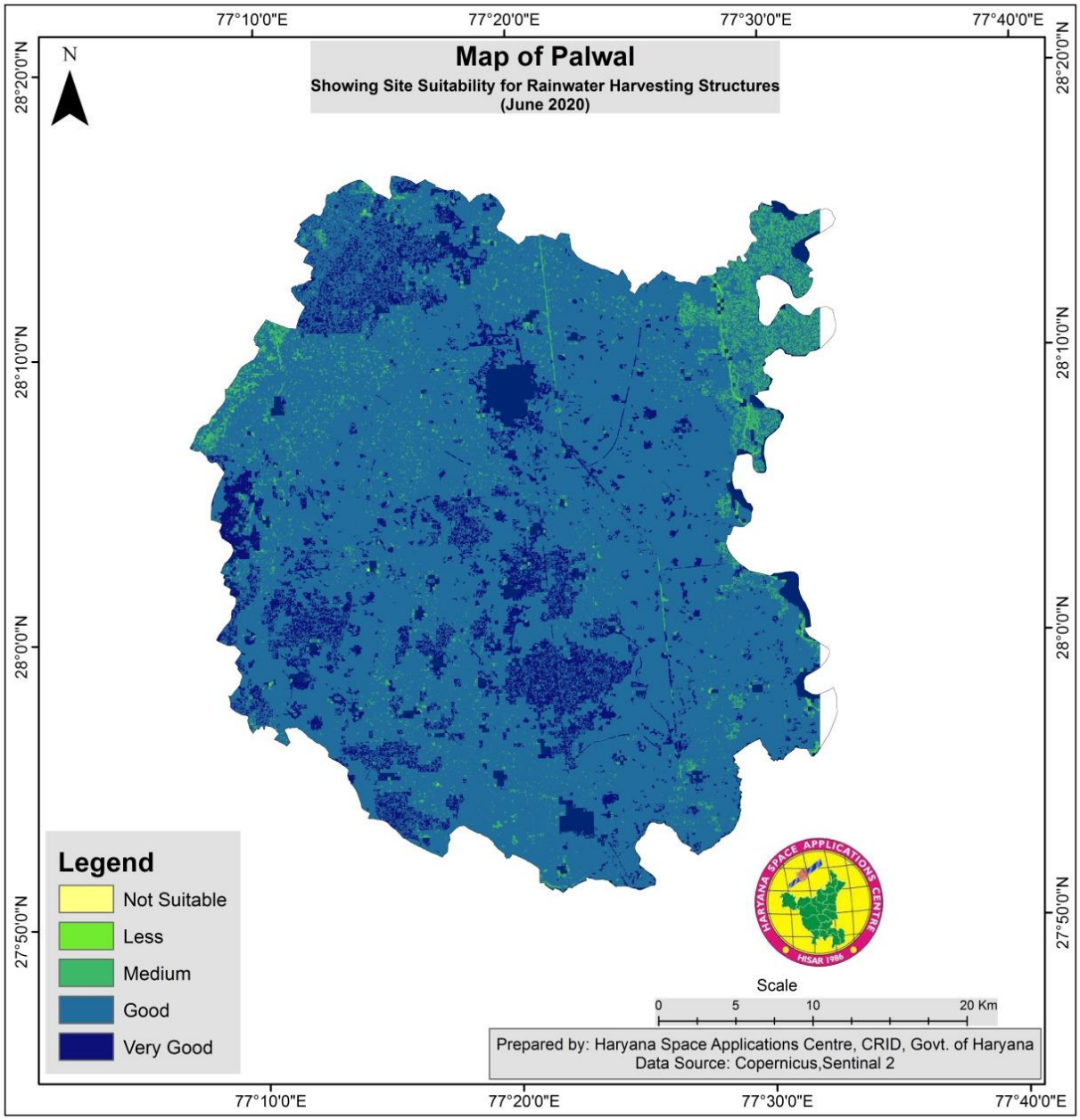


Figure 19 Proposed Site Suitable Map based on Drainage

Table 13 Block wise area under very good suitable site proposed for rain water harvesting

Block Name	Area (Very Good suitability area in Sq meter)
Palwal	184539463
Prithla	399507304
Hodal	279661533
Hathin	264818780
Hassanpur	161778272

Table 14 Assigned Weight for Criteria Parameters

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

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. 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 Palwal district. Proposed harvesting structures in Palwal based on drainage **Table 23.**

Table 15 Proposed harvesting structures in Palwal based on drainage

Sl. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Palwal	80	84	110	27	25
2	Prithla	49	52	51	23	52
3	Hodal	62	67	108	75	38
4	Hathin	118	108	151	91	62
5	Hassanpur	45	40	62	3	0

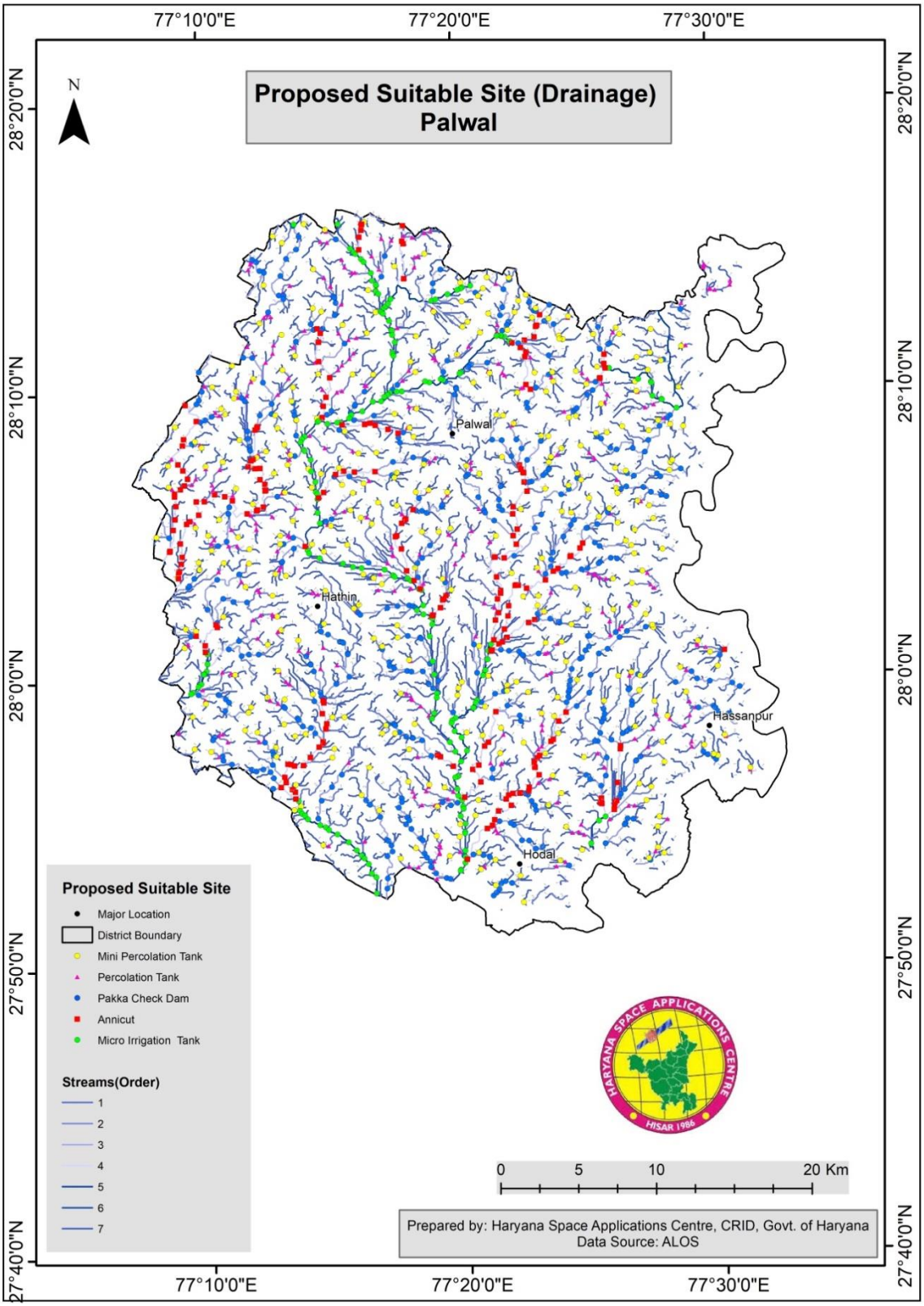


Figure 20 Proposed suitable sites based on drainage in Palwal District

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