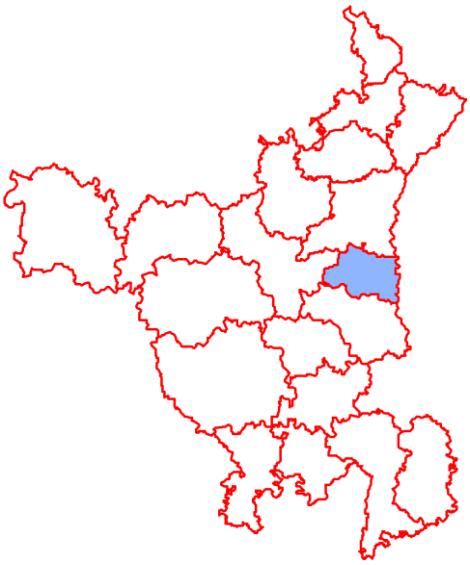
GROUND WATER INFORMATION BOOKLET
PANIPAT DISTRICT, HARYANA



CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH

2013

Contributors

Dr. Shailendra Singh

Assistant Hydrogeologist

Prepared under supervision of

A.K.Bhatia

Regional Director

GROUND WATER INFORMATION BOOKLET

PANIPAT DISTRICT, HARYANA

C O N T E N T S

PANIPAT DISTRICT AT A GLANCE

Sl.NO	ITEM	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.	1268
	ii. Administrative Divisions	
	Number of Tehsils	3- Panipat, Samalkha & Israna
	Number of Blocks	05 Panipat, Bapoli, Samalkha, Madlauda & Israna
	Number of Villages	186
	Number of Towns	12
	iii. Population (As per 2011 Census)	12,02,811
	iv. Normal Annual Rainfall (mm)	680
2.	GEOMORPHOLOGY	
	Major physiographic Units	Vast upland and alluvial bed of River Yamuna
	Major Drainage	Yamuna River
3.	LAND USE (Sq.km.)	
	a. Forest Area:	30
	b. Net area sown:	960
	c. Cultivable area:	1040
	d. Area sown more than once	950
	e. Total cropped area	1910
4.	MAJOR SOIL TYPES	Tropical arid brown
5.	AREA UNDER PRINCIPAL CROPS (Sq.km.)	Rice- 769 Wheat-866 Sugarcane-58
6.	IRRIGATION BY DIFFERENT SOURCES	(Areas sq km and Number Of Structures)
	Dugwells	-
	Tubewells/Borewells	680/83855
	Tanks/ponds	-
	Canals	280
	Other sources	-
	Net Irrigated area	960
	Gross irrigated area	1900
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB	
	No. of dug wells	5
	No of Piezometers	8
8.	PREDOMINANT GEOLOGICAL	Alluvium
9.	HYDROGEOLOGY	

	Major Water bearing formation Pre-monsoon depth to water level Post-monsoon depth to water level Long term water level trend in 10 yrs	Sand,Gravel 2.27 – 26.20 m bgl 0.96 – 28.40 m bgl Fall – 0.52 – 1.10 m/yr Rise – 0.001 – 0.09 m/yr
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW PZ SH	 08 35 01
	Depth range(m)	103 - 460
	Discharge(liters per minutes)	605 - 3258
	Storativity (S)	$2.4x10^{-2}$ – $7.2x10^{-4}$
	Transmissivity (m^2/day)	350 - 1990
	No of PZs constructed through outsourcing by M/s WAPCOS Ltd.	04
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than the permissible limit (eg. EC, F, As etc)	EC- 5000 (µS/cm at 25^oC) F -18 mg/l As- 0.0104 (mg/l) Fe- (1.23 mg/l)
	Type of water	$MgHCO_3$ and $NaHCO_3$
12	DYNAMIC GROUND WATER RESOURCES (2009)	
	Net annual ground water availability	308.65 MCM
	Annual Ground Water Draft	514.56 MCM
	Net Ground Water availability for future irrigation development	205.91 MCM
	Stage of Ground Water Development	167%
13	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	1
	Date	23-3-2001
	Place	Bal Bhawan, Panipat
	No of participants	400
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING BY CGWB	Demonstrative recharge project implemented at two sites.
15.	GROUND WATER CONTROL AND	
	Number of OE Blocks.	5
	Number of Critical Blocks	-
	Number of blocks notified	1 (Samalkha)
16	.MAJOR GROUND WATER PROBLEMS AND ISSUES.	Over-exploitation, declining water levels, water logging, Water quality problems

GROUND WATER INFORMATION BOOKLET

PANIPAT DISTRICT, HARYANA

1.0 INTRODUCTION

Panipat district, lying in the east central part of Haryana State and is located between 29^{o} 09' 15": 29^{o} 27' 25" north latitudes and 76^{o} 38' 30" : 77^{o} 09' 15" east longitudes. The total geographical area of the district is 1268 sq.km. Administratively, the district is controlled by Rohtak division. The district is sub-divided into five development blocks namely Panipat, Bapoli, Samalkha, Madlauda and Israna.

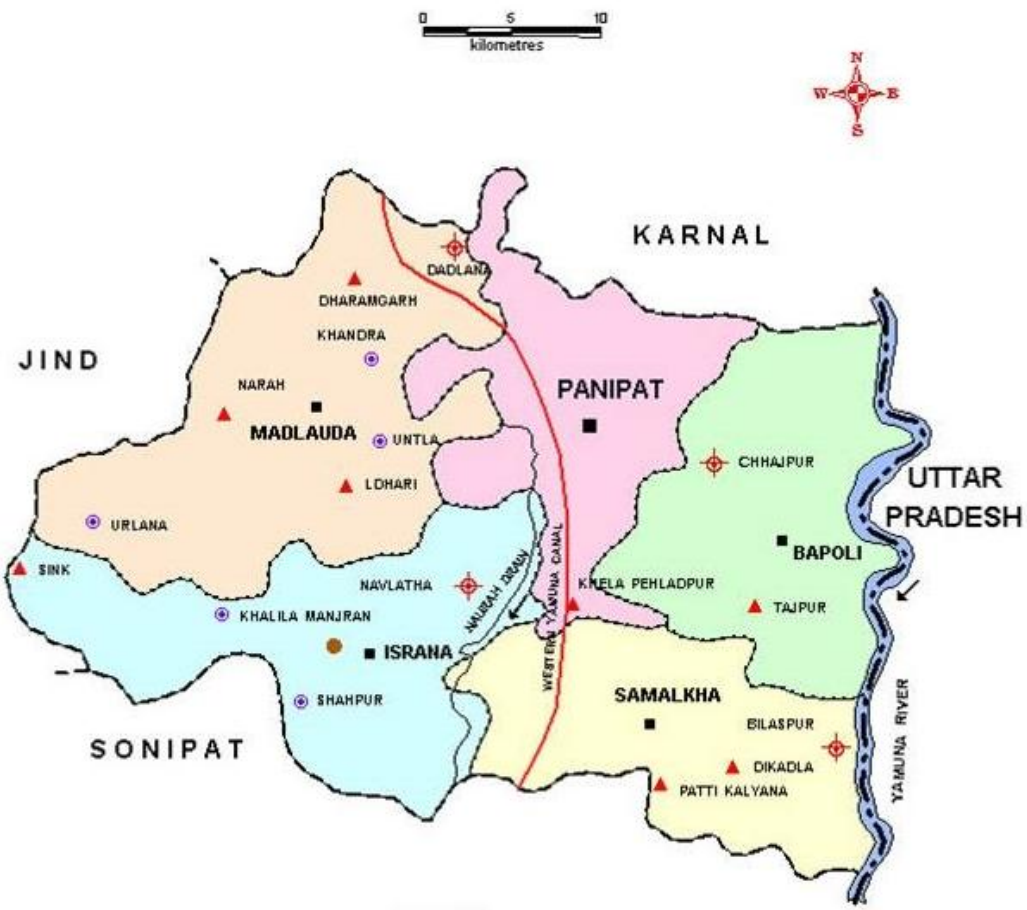
The district headquarter is at Panipat. It has twelve towns, out of which Panipat falls in Class-I, Samalkha in Class-III, Asankhurd in Class V and others falls in Class-VI groups, classified by various population ranges. Towns are well connected by roads. The total population of district was 12,02,811 as per 2011 Census. The district has observed a decennial growth (2001-2011) rate of 24.33 %. The rural and urban population is 6,49,868 and 5,52,945 respectively with an average density of 949 person/sq km against the state average of 573 persons per sq.km. Out of total population, 6,46,324 are males and 5,56,487 are females. The male & female ratio of the district as a whole was 861. In Panipat district rural population is settled in 186 villages and the rest of population is concentrated in 12 towns.

The ground water related issues namely Over-exploitation, declining water levels, water logging conditions and water quality problems are some of the major concern of the district.

2.0 HYDROMETEOROLOGY

The climate of the district can be classified as sub tropical and semi arid. The area receives normal annual rainfall is about 680 mm which is spread over 31 rainy days. 77% of rainfall occurs during south-west monsoon. The normal annual rainfall of district based on average of 5 years (2006-2010) has been computed as 591 mm.

INDEX MAP
PANIPAT DISTRICT, HARYANA



INDEX

- GROUND WATER MONITORING STATION
- PIEZOMETER
- SLIM HOLE
- EXPLORATORY WELL
- STATE BOUNDARY
- DISTRICT BOUNDARY
- BLOCK BOUNDARY
- DISTRICT HEAD QUARTER
- BLOCK HEAD QUARTER

3.0 GEOMORPHOLOGY AND SOILS

The district forms a part of Indo gangetic plain and lies in Yamuna Sub basin of main Ganga basin. Physiographically, the district is characterised by two distinct features i.e. vast upland plain and Yamuna flood plain. The width of the flood plain varies according to the amount of shift experienced by the river. It is narrow in the Northern part and widens downstream. The district is mainly drained by the river Yamuna and its tributaries. The river Yamuna is major perennial river which flows all along the eastern margin of the district from northern to southern direction. The district is also drained by the artificial drain named as 'Naurah Drain' which originate in southern eastern part of Madlauda block and flows through south western part of Panipat and all along eastern boundary of Israna block in southerly direction. The district has two types of soils viz-tropical arid brown and arid brown soils (solemnized). The arid brown soils are found in major parts of the district whereas tropical arid brown soils are found in north eastern part of the district especially in parts of Bapoli and Panipat blocks.

4.0 IRRIGATION AND AGRICULTURE

IRRIGATION: The Western Yamuna Canal (WJC) is the major source of canal irrigation. The WJC passes through the central part of the district covering part of Madlauda. Panipat and Samalkha blocks. Out of 96,000 ha net irrigated area, 28,000 ha is irrigated by canal and 68,000 ha is irrigated by ground water. About 70.83% of the irrigation is based on ground water resources. The gross irrigated area has been worked out as 1,90,000 ha, which is 3.49% to the State total. Percentage of Gross Area Irrigated to Total Cropped Area has been worked out as 99.5% with the irrigation intensity of 197.9.

AGRICULTURE: Net area sown in the district is 96,000 ha which constitutes about 76% of the total area. Area sown more than once is 95,000 ha bringing the total cropped area to 1,91,000 ha. Paddy constitutes main kharif crop whereas the wheat is the main Rabi crop. The details of area under cultivation, production and average yield of important crops of the district during the year 2011-12 is given in table below:

.Crops	Area under cultivation (ha)	Production (Tonnes)	Average yield (Kgs/ha)
Rice	76,900	1,74,000	2,255
Bajra	500	2000	1792
Wheat	86,600	3,99,000	4,584
Sugarcane	2000	15000	7689

5.0 GROUND WATER SCENARIO

5.1 Hydrogeology

The district is occupied by geological formations of Quaternary age comprising of Recent alluvial deposits belonging to the vast Gangetic alluvial plains. The Central Ground Water Board has drilled 08 exploratory boreholes in the depth range of 103 to 460 m and 35 piezometers in the depth range of 33 to 348 m and 01 Slim Hole to delineate and determine potential aquifer zones, evaluation of aquifer characteristics, behavior of water levels etc. Besides, also constructed 04 PZs through outsourcing by M/s WAPCOS Ltd.

The ground water exploration undertaken by CGWB has revealed the existence of 8 – 23 granular zones down to a maximum depth of 460 m. These zones mainly comprise of various grades of sand and gravel. The first granular zone forms the water table aquifer and occurs down to 50 - 150 m below ground level. The second aquifer occurs between 130 and 250 m depth, the third one exists between 286 and 366 m depth. Total thickness of the alluvium is not precisely known. However, the bedrock has not been encountered up to 460 m depth at village Dadlana (deepest exploratory borehole) in the district. The discharges range from 605 to 3258 lpm for 6 - 20 m of draw down. The transmissivity of the aquifers lies between 350 and 1990 m^2 / day.

5.2 Water level behaviour

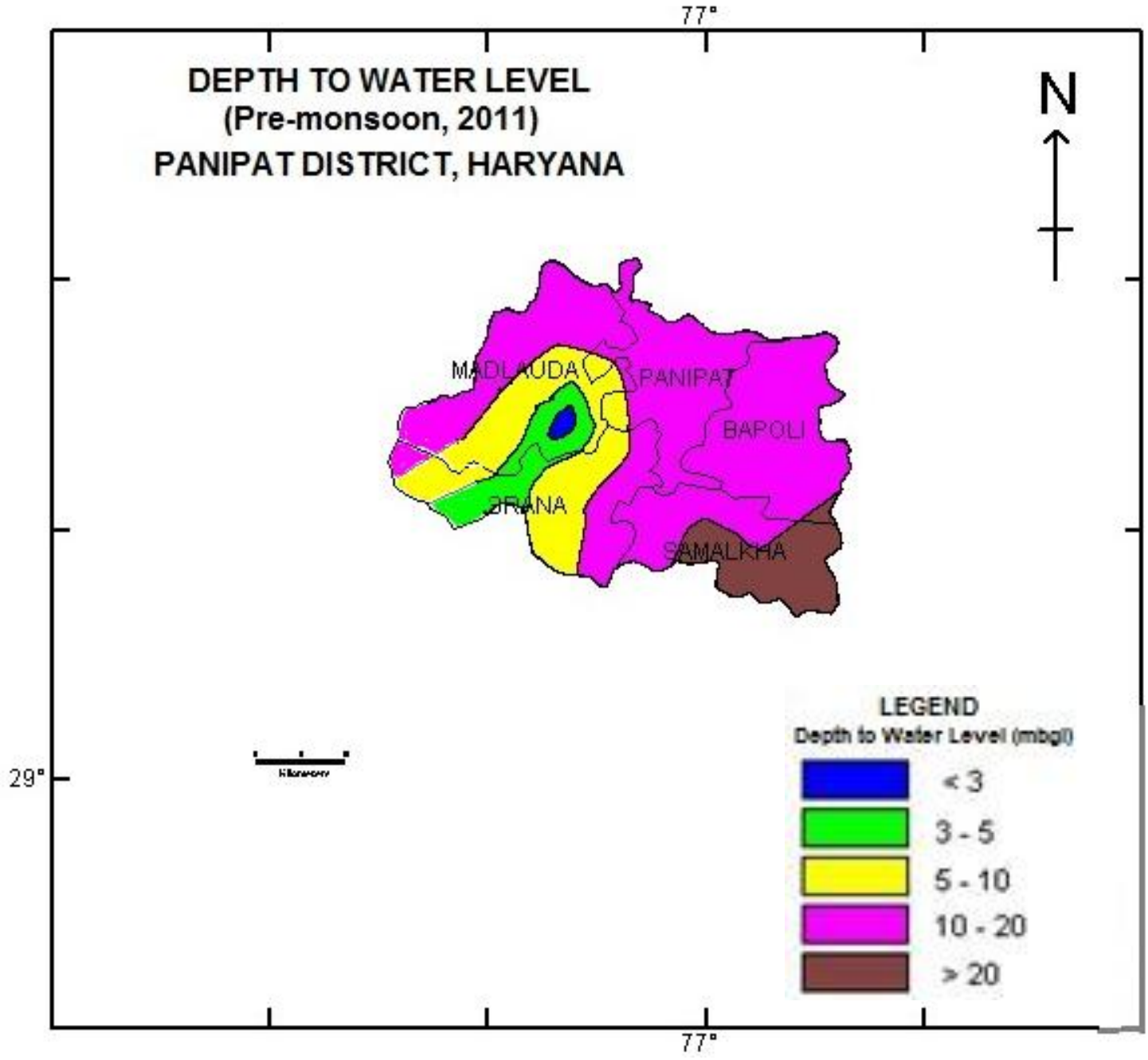
Depth to water level in the district ranges from 2.27 to 26.20 m bgl during pre-monsoon period and 0.96 mbgl to 28.40 mbgl during post-monsoon period 2011. In major part of the district water level ranges between 10 m to 20 m bgl and spreads in part of Samalkha, Bapoli, Panipat, Madlauda and Israna blocks.

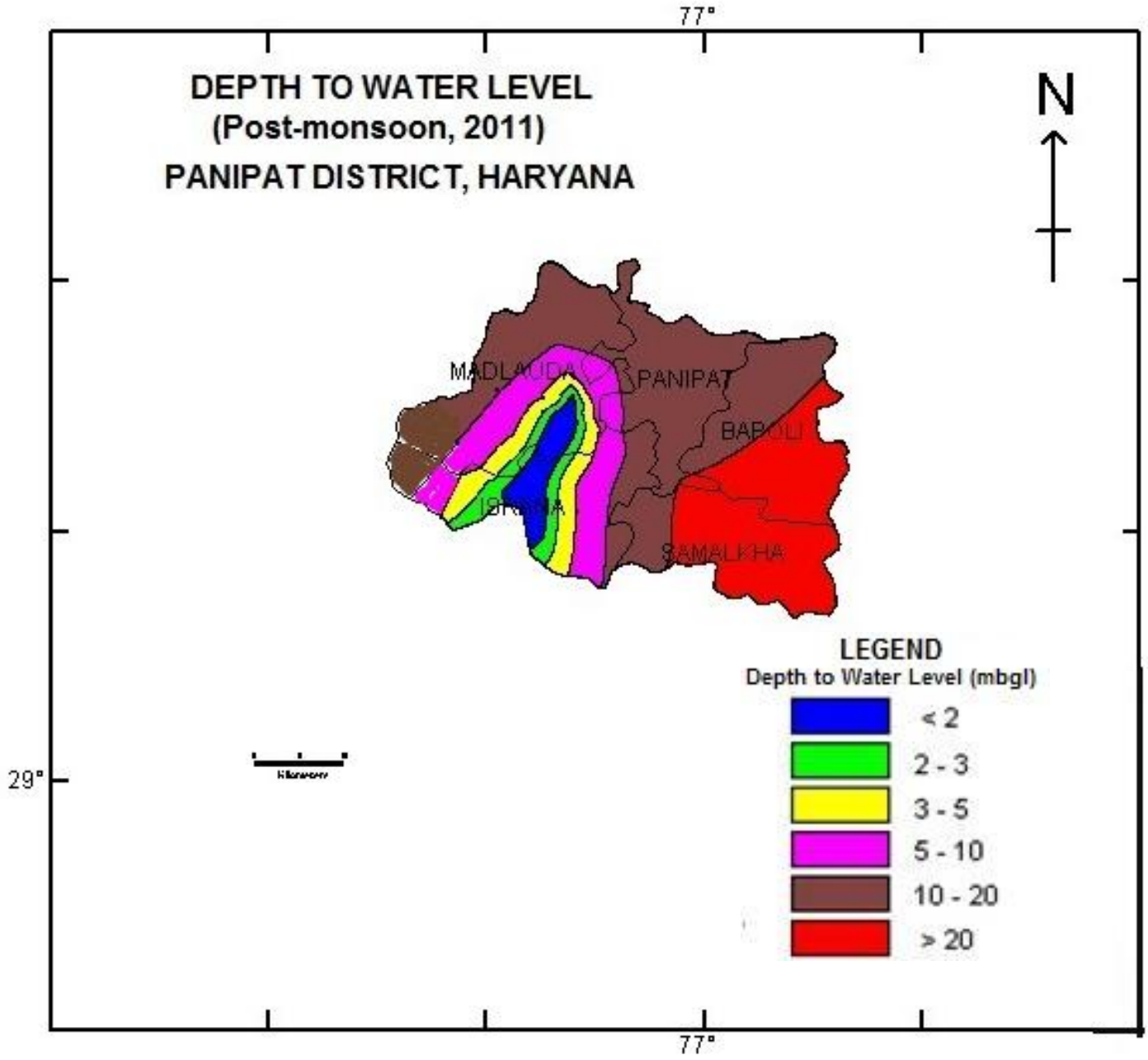
The ground water levels more than 20m bgl has been recorded in part of Samalkha and Bapoli Blocks. The shallow water level in the depth range of 3 m to 5 m bgl spreads in part of Madlauda and Israna Blocks. The water logging conditions exists in South Eastern part of Madlauda block. During post monsoon period the area under water table of depth range more than 20 m bgl gets spreads covering parts of samalkha and Bapoli Pundri Blocks. Besides, the water logging condition is also gets spreads in parts of Madlauda and Israna blocks.

Long-term net change of water levels during the period 2000-2011 reflected by ground water hydrograph indicates declining water level trend which may be due to over-exploitation of ground water. The rate of decline varies from 0.52 m/yr to 1.10 m/yr. The maximum rate of decline has been observed in piezometer at Patti Kalyana. However, at few monitoring stations spreads in parts of Madlauda and Israna blocks rising trend in ground water levels varies from 0.001 m/yr to 0.09 m/yr have also observed. The overall flow of ground water is towards south-west direction.

5.3 Ground Water Resources

Block-wise ground water resource potential of the district has been assessed as per GEC-97 as on 31st March 2009. The ground water development in all the blocks has exceeded the available recharge, thus all the blocks have been categorized as over exploited. Stage of ground water development, ranges from 127% (block-Madlauda) to 210% (block-Samalkha). Net annual replenishable ground water availability in the district have been assessed as 308.65 MCM. The total ground water draft for all uses in the district is 514.56 MCM, thus leaving shot-fall (over draft) of 205.91 M C M . Stage of ground water development in the Panipat district has been assessed to be 167%.


77°
DEPTH TO WATER LEVEL
(Pre-monsoon, 2011)
PANIPAT DISTRICT, HARYANA
N
MADLAUDA
PANIPAT
BAPOLI
SAMALKHA
LEGEND
Depth to Water Level (mbgl)
< 3
3 - 5
5 - 10
10 - 20
> 20
29°
77°

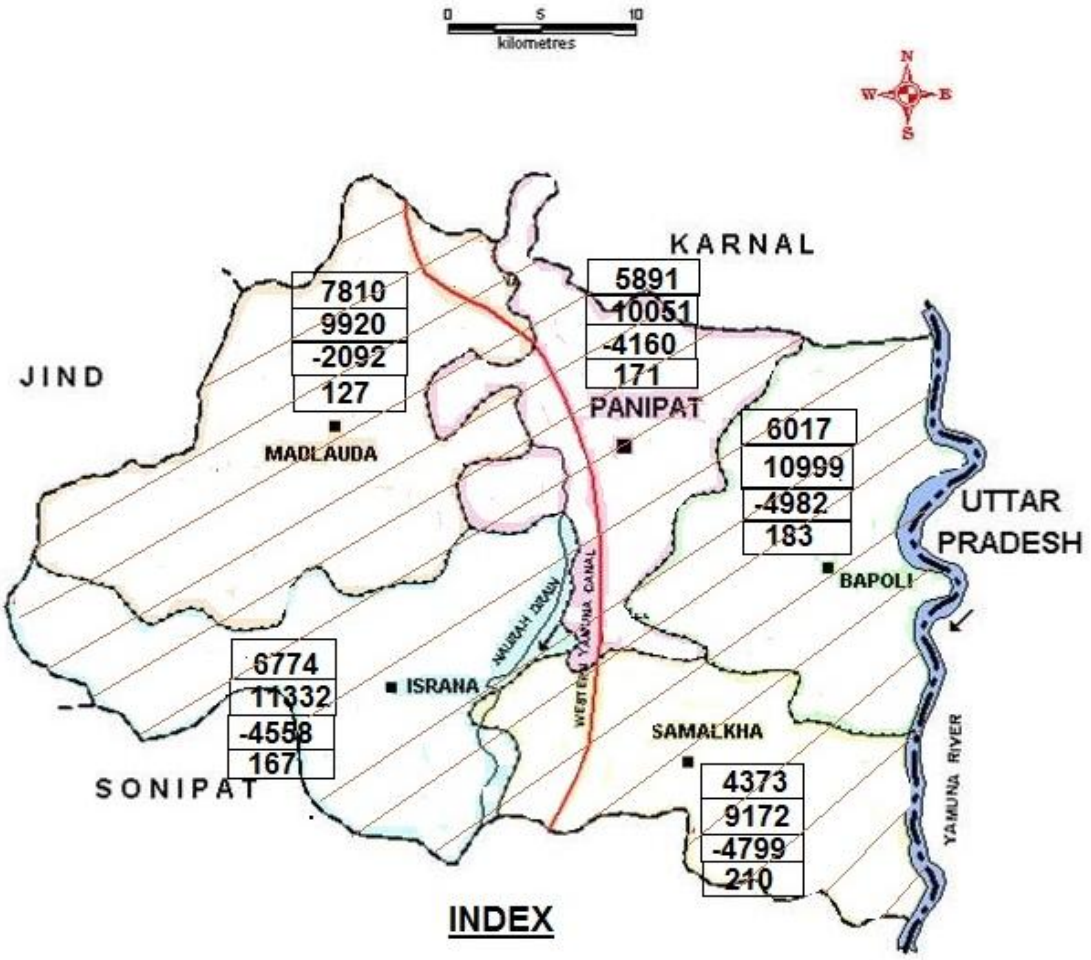

77°
DEPTH TO WATER LEVEL
(Post-monsoon, 2011)
PANIPAT DISTRICT, HARYANA
N
PANIPAT
SAMALKHA
LEGEND
Depth to Water Level (mbgl)
< 2
2 - 3
3 - 5
5 - 10
10 - 20
> 20
29°
77°

Block wise Ground water Resources of Panipat District as on 31.03.2009

Block	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation domestic industrial upto next 25 years (Ham)	Net Ground Water Availability for future irrigation development (Ham)	Stage Ground Water Development (%)	Category of Block
Panipat	5891	9723	10051	328	-4160	171	Over Exploited
Samalkha	4373	9098	9172	74	-4799	210	Over Exploited
Madlauda	7810	9874	9902	28	-2092	127	Over Exploited
Israna	6774	11314	11332	18	-4558	167	Over Exploited
Bapoli	6017	10952	10999	47	-4982	183	Over Exploited
TOTAL	**30865**	**50961**	**51456**	**495**	**-20591**	**167**	**Over Exploited**

GROUND WATER DEVELOPMENT POTENTIALS AND CATEGORISATION OF BLOCKS

PANIPAT DISTRICT, HARYANA



INDEX

4373	Net Ground Water Availability (ham)
11332	Existing Ground Water Draft For All Uses (ham)
-4799	Net Ground Water Availability For Future Irrigation Development (ham)
210	Stage Of Ground Water Development (%)
	Over Exploited Block

5.4 Ground Water Quality

Chemical data of ground water from shallow aquifer indicates that ground water is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are generally less than 3000 µS/cm at 25^{o}C, except at Khalila Majra, Untila, Seenk, Lohari, Dakadla and Puthar where these values are 4690 µS/cm, 3510 µS/cm, 4120 µS/cm, 4100 µS/cm, 3620 µS/cm and 5000 µS/cm respectively. Generally it is suitable for drinking purposes as chemical parameters are well within the permissible limits for safe drinking water set by Bureau of Indian standard (BIS) except at Khalila Majra, Untila, Seenk, Lohari, Goli, Puthar and Dadlana due to high salinity and fluoride. The fluoride concentration is found to be higher than the permissible limit at Khalila Majra (1.64 mg/l), Lohari (7.16 mg/l),, Goli (5.88 mg/l), and Dadlana (18 mg/l). The high concentration of fluoride is found in parts of Madlauda and Israna blocks. High concentration of heavy metals like Iron and Arsenic is also found at one location. Based on the USSL diagram for classification of irrigation waters ground water is suitable for irrigation. However, for drinking some constituents are high and fluoride problem is prevalent in sporadic manner in Madlauda and Israna Blocks.

Type of water: Mg & Na-HCO3 type.

Ground water quality in Panipat City

The study on Ground Water quality and pollution aspects have been carried out in the industrial town of Panipat City. The studies indicate that ground water in the city is polluted by nitrate and fluoride in some parts and is also polluted by heavy metals like Mn, Pb, Fe at many places..Heavy metals like Cd, Ni, Zn, Cu, Co, Sr are also found in low concentrations. Heavy metals are found even at deeper levels also. Ground Water is hard in a large area. Ground Water in some parts of the city is unsuitable for drinking purpose. Deeper ground water is by and large is potable.

5.5 Status of Ground Water Development

Net area sown in the district is 96,000 ha, which is 100% of the total cultivable area of the district. Area sown more than once is 95,000 ha bringing the total cropped area to 1,91,000 ha. The entire net area sown is irrigated through tubewells and canals. Shallow tubewells are the most important ground water development structures in the district and have shown a tremendous growth in

the past years. There are 83,855 tubewells in the district which irrigates an area of 68,000 ha. Most of the these tubewells are cavity type. Filter type tubewells are found in the eastern part of the district especially along the river Yamuna. The average depth of tubewells in the district is 60m, varying between 12 to 80m tapping aquifer between 10 to 80m. The discharge varies from 8 to 14 lps. Canals of the area are irrigating approximately 28,000 ha. Tubewells support 70.83% irrigation in the district. There are 29 deep Direct Irrigation Tube wells of the State exist only in two blocks viz. Panipat and Samalkha. The block-wise detail of MIUs and draft is given below:

Sl. No	Block	Shallow T/W with	Ground Water Draft (Ham)		
			Monsoon	Non-Monsoon	Annual
1	Bapoli	6051	4921	6024	10952
2	Israna	5816	2268	5519	7788
3	Madlauda	7595	1975	7899	9874
4	Panipat	5372	3889	5834	9723
5	Samalkha	5021	2726	6362	9088

The entire drinking water supply to all rural as well as urban parts of the district is based on ground water. There are about 161 tubewells for drinking water supply in the district being maintained by Public Health & Engineering Department (PHED) and drilled down to the depth of 75 - 100 m. These tubewells in general tap the first unconfined/semi-confined aquifer groups. At few places where water quality of ground water is saline or poor, the water supply is based on canal water. The block-wise details of numbers of tubewells and draft are given below:

Sl. No	Block	T/W (PHED)	Annual Ground Water Draft (Ham)
1	Bapoli	20	36
2	Israna	5	9
3	Madlauda	10	18
4	Panipat	95	172
5	Samalkha	31	56

There are about 113 shallow tubewells in the industrial sector in the district, which are mainly concentrated in Panipat block.

5.6 Geophysical Studies

Surface resistivity surveys have been carried out in two blocks Madlauda and Israna of the district. These studies indicate that ground water is saline in major areas of these two blocks but the depth of occurrence of salinity is variable. The central part of these two blocks has saline ground water at all levels. This area is surrounded by shallow ground water salinity where ground water is saline below a depth of 10 – 20 m. These are followed by areas of fresh water upto 20 – 50 m. Fresh water occurs upto depths of 50 – 80 m in a patch around Madlauda extending northwards upto the north eastern boundary of the district. Deep ground water below 100 m is saline throughout these two blocks.

6.0 GROUND WATER MANAGEMENT

6.1 Ground water Development

The stage of ground water development for the district as a whole is 167% and all the five blocks have shown high development of ground water resources and making the blocks overexploited. It indicates that the ground water is under stress and ground water level is declining. Based on the ground water exploration carried out in the district a well assembly of 305 / 203 mm with about 80 m of housing length and 1.19 mm slot size and shrouded with 1.6 – 8 mm gravel would be suitable in the district. Shallow tube wells can have a single diameter pipe assembly of 203 mm screening the granular zones. Since the whole area of the district is alluvium and neither basement nor any cobble, pebble bed has been encountered, hence appropriate method of drilling in the area would be direct or reverse rotary. There is a need to take up the measures to enhance water use efficiency by adopting practices of water conservation techniques. Besides, there is need to arrest the depleting ground water resources by implementing the projects of rain water harvesting and artificial recharge to ground water.

6.2 Water Conservation and Artificial Recharge

There are 344 tanks and ponds in the district which act as both water conservation and recharge structures. There is need to revive the tradition water bodies of the villages. The block-wise details on tanks/ponds and recharge through them is given in table below:

Block	No of Tank/ Pond	Average water spread area(ha)		No of days water Available		Recharge (Ham)	
		Monsoon	non-monsoon	monsoon	non-monsoo	monsoon	non-monsoon
Bapoli	43	36	36	108	132	5.59872	6.84288
Israna	79	190	190	148	182	40.4928	49.7952
Madlauda	80	136	136	121	149	23.69664	29.18016
Panipat	81	81	81	108	132	12.59712	15.39648
Samalkha	61	69	69	148	182	14.70528	18.08352

Whole of the district is suitable for artificial recharge to ground water. Excess rain water in agricultural field, surplus canal water and rooftop rain water can be injected to ground water system. The CGWB has taken up demonstrative artificial recharge studies on experimental basis in the district under Central Sector Scheme. A scheme for artificial recharge to ground water through natural depressions has been implemented at two places namely Rajakheri and Kutani. The artificial recharge structures at these sites consist of a combination of trench and injection well. At village Rajakheri two horizontal trenches 50 x 3 x 3 m with 3 injection wells 48 m deep in each trench have been constructed. At village Kutani one horizontal trench 50 x 3 x 3 m with 3 injection wells 19 m deep has been constructed. Water collects in the large natural depressions at these sites which will recharge ground water through these structures.

As per assessment of the Central Ground Water Board for preparation of Master Plan on Artificial Recharge, blocks namely Panipat, Samalkha, Bhapoli and parts of Israna and Madlauda blocks are found to be feasible for Artificial Recharge. The major source of water for recharge is rainfall. The type of recharge structures suitable are recharge shafts, trenches, injection wells, gabion structures in river bed. As per 'Master Plan on Artificial recharge 2013' an area of 1268 sq.km has been identified for artificial recharge in the district which has a subsurface storage potential of 1402 MCM. A volume of 1865 MCM of water would be required to attain this recharge. A total of 1140 Nos of recharge structure have been proposed. Besides this roof top rain water harvesting should also be taken up in the district.

7.0 GROUND WATER RELATED PROBLEMS

The ground water related problems in the district can be identified as depletion of ground water resources, water logging conditions and water quality problems. Water level decline is occurring in a large part of the district covering Panipat, Samalkha and Bhapoli blocks and parts of Israna and Madlauda blocks. The water levels are falling at a rate of 0.52 to 1.10 m/yr. The maximum fall of water level is observed at Patty Kalyana in Samalkha block.

Water logging conditions (where ground water level is less than 2m below ground level) occurs in Madlauda and Israna blocks. In these blocks rising trend in water level has noticed in the range of 0.001 to 0.09 m/yr.

Ground water quality problem occurs in some parts of the district. Medium salinity occurs in parts of Madlauda and Israna blocks. Fluoride problem is also prevalent in sporadic manner in Madlauda and Israna Blocks.

8.0 AWARENESS AND TRAINING ACTIVITY

A mass awareness program with the theme of checking pollution of ground water which is a major problem in the industrial city of Panipat was organized at Bal Bhawan Panipat on 23.03.2001 for conservation, Protection and Regulation of ground water. About 400 people from surrounding villages and officers/officials of State Government department, NGOs etc attended the program. On this occasion, then Hon'ble speaker, Haryana Vidhan Sabha was the Chief Guest. Chairman HPCB presided over the function. General Manager, Indian Oil Corporation and Chief Engineer Irrigation were also guests.

9.0 AREAS NOTIFIED BY CGWA

The Central Ground Water Authority (CGWA) has notified Samalkha Block on 02.12.2006. The block area has been notified with a view to protect the ground water resources and other development activities in consonance with protection & preservation of ground water resources. Accordingly, aquifers upto 150 m depth have been declared as "Protected Aquifers" which can only be used for construction of tube wells for drinking and domestic water supply.

10.0 RECOMMENDATIONS

The following remedial measures are recommended to minimize the declining ground water trend in parts of the Panipat district as safeguard against environmental degradation.

1. The directives of CGWA notification for the notified block Samalkha should be implemented.
2. Artificial recharge to ground water should be taken up in the urban and rural area to avert the further lowering of ground water level since natural recharge to the aquifer system is not adequate to support such heavy ground water withdrawal.
3. Subsurface drainage system may be laid down in Israna and Madlauda blocks to combat water logging.
4. The study of Flood plains of river Yamuna may be taken up for safe ground water exploitation as flood plains have more prolific fresh water aquifers due to perennial nature of river Yamuna. .
5. Geophysical study is required for the delineation of fresh water zones in Israna and Madlauda blocks.
6. Revival of water bodies like pond in the village could be recommended under scheme of drinking water mission for the sustainability of shallow tube wells and crops of the area.
7. Water use efficiency should be enhanced by practicing modern methods of irrigation like Laser levelling, zero tillage, mulching, Sprinkler irrigation, drip Irrigation etc.
8. Local populace to be educated regarding consequences of mining of ground water and need for its effective/economic use.
9. Local populace should also be educated regarding fluoride problem of the district specifically prevalent in Madlauda and Israna blocks. Safe drinking water should be provided to the populace after ascertaining the concentration of Fluoride for Safe limit.