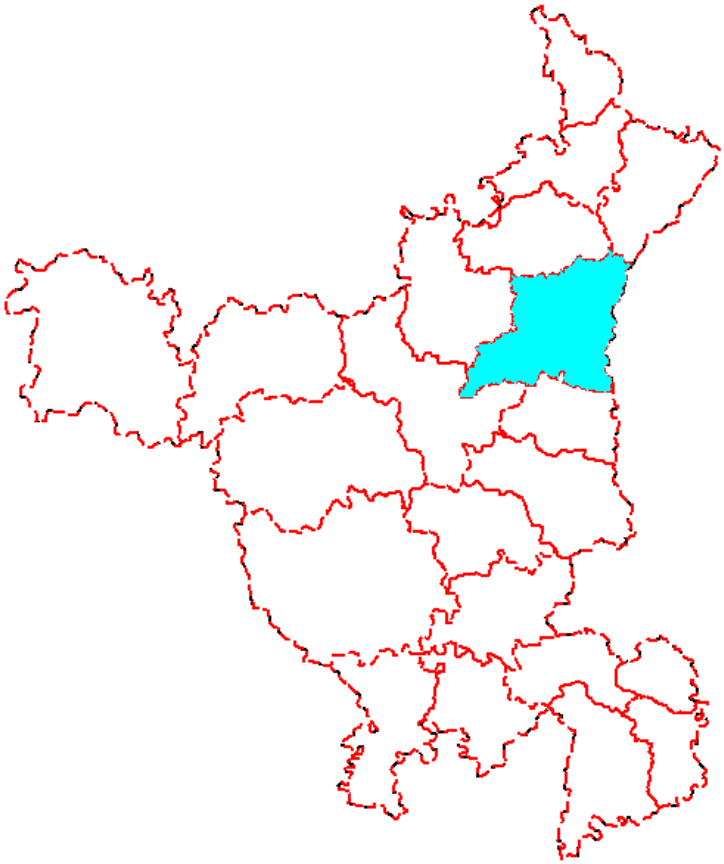
KARNAL DISTRICT, HARYANA



Government of India
Ministry of Water Resources
CENTRAL GROUND WATER BOARD
North Western Region
Chandigarh
2013

Contributors

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Prepared under supervision of

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Regional Director

Our Vision

“Water Security through Ground water Management”

GROUND WATER INFORMATION BOOKLET

KARNAL DISTRICT, HARYANA

C O N T E N T S

KARNAL DISTRICT AT A GLANCE

Sl.No	Contents	Statistics
1.	**GENERAL INFORMATION**	
	i. Geographical Area (Sq.Km)	2520
	Administrative Divisions	As ON 2013
	ii. Sub Divisions	03 (Karnal, Assandh, Indri)
	iii. Number of Tehsils	05 (Karnal, Indri, Assandh, Nilokheri and Gharaunda)
	iv. Number of Blocks	06 (Karnal, Indri, Assandh, Nissing Nilokheri and Gharaunda)
	v. Number of Towns	8
	vi. Number of Villages	434
	vii. Population (As per Census 2011)	17,42,815
	viii. Average Annual Rainfall (mm)	582
2.	**GEOMORPHOLOGY**	
	Major Physiographic Units	Alluvium
	Major Drainage	Yamuna River
3.	**LANDUSE (Sq.Km)**	
	Forest Area	76
	Net area sown	2000
	Cultivable Area	2100
4.	**MAJOR SOIL TYPES**	Clayey Loam, Sandy loam
5.	**AREA UNDER PRINCIPAL CROPS**	399000 ha
	(Wheat- 171000, Rice- 173000, Bajra- 9000 ,Barley – 35000, Sugar cane- 11000 ha)	
6.	**IRRIGATION BY DIFFERENT SOURCES** **(Area and Number of Structures)**	

	Dugwells	--
	Tubewells/ Borewells	1650 sq.km, 41973 nos.
	Tanks/Ponds	
	Canals	350 sq.km
	Other sources	--
	Net Irrigated Area	2000 sq.km
	Gross Irrigated Area	3900 sq.km
7.	**NUMBERS OF GROUNDWATER MONITORING STRUCTURES / WELLS OF CGWB**	
	Number of Dugwells	26
	Number of Piezometers	15
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium
9.	**HYDROGEOLOGY**	
	Major Water Bearing Formation	Sand and gravel
	Pre-monsoon depth to water level	4.18 m to 21.16 m bgl
	Post-monsoon depth to water level	2.68 m to 22.22 m bgl
	Long-term water level trend in 10 yrs in m/yr (2002 – 2011)	Fall : 0.02 to 1.31 m/yr
10.	**GROUNDWATER EXPLORATION BY CGWB**	
	Number of wells drilled	54
	Exploratory Well Observation Well Piezometer Slim Holes	09 -- 44 01
	Depth Range (m)	64 m to 464 m
	Discharge (lpm)	805 to 4542 lpm
	Storativity (S)	1.2 x 10 -2 to 4.5 x 10 -4

	Transmissivity (m^2/day)	525 to 2200 m2/day
11.	**GROUNDWATER QUALITY**	
	Presence of chemical constituents more than the permissible limits	
	EC, in micromhos (> 3000 µ S/cm) (n=23)	nil
	F, in mg/l (> 1.5 mg/l) (n= 23)	nil
	As, in mg/l(> 0.01 mg/l) (n= 36)	(Max at Nalvi Khurd, o.0655 mg/l)
	Fe, in mg/l	(Max at Garhi Khajur, 3.43 mg/l)
	Type of water	Mixed Cation – HCO3
12.	**DYNAMIC GROUNDWATER RESOURCES (MCM)**	As on 31.03.2011
	Annual Replenishable Groundwater Resources	859.05
	Net Annual Groundwater Draft	1201.43
	Projected Demand for Domestic and Industrial uses upto 2025	12.44
	Stage of Groundwater Development	140%
13.	**AWARENESS AND TRAINING ACTIVITY**	2
	Date Place	29.07.2003 & 06.10..2005 Karnal & Gharaunda
	No of participants	250, 300
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Nil
15.	**GROUNDWATER CONTROL AND REGULATION**	
	Number of Over Exploited blocks	6
	Number of Critical blocks	Nil
	Number of Semi Critical blocks	Nil
	Number of blocks notified	1
16.	**MAJOR GROUNDWATER PROBLEMS AND ISSUES**	Depletion of Groundwater resources

GROUND WATER INFORMATION BOOKLET

KARNAL DISTRICT, HARYANA

1.0 INTRODUCTION

Karnal district lies on the western bank of the river Yamuna, which forms its eastern boundary and separates Haryana from Uttar Pradesh and is bounded by North latitudes $29^0$25'05"& $29^0$59'20" and East longitudes $76^0$27'40"& $77^0$13'08", its height above sea level is around 240 meters. It falls in parts of Survey of India Toposheets nos. 53C and 53G covering an area of 2520 sq.km. The district covers 5.69% area of the state. Karnal District is bordered by Kurukshetra District on its north-west, Jind & Kaithal Districts on its west, Panipat District on its south and Uttar Pradesh state on the east. The district is well connected by roads and railways. The SherShah Sri Marg (NH No.1) runs through the entire length of the district. A broad gauge railway line connecting Delhi with Ambala runs almost parallel to the NH No.1. Karnal is the district headquarters. The main townships are Karnal, Indri, Assandh, Nissang, Nilokheri and Gharaunda. Administratively the district comes under Rohtak division and it has five Tehsils, three Sub-Tehsils and Six blocks. The district is one of the most densely populated districts of the state. The total population of the district as per 2011 census is 15,06,323. The district has a population density of 587 per square kilometre (1,550 /sq mi). Its population growth rate over the decade 2001-2011 was 18.22%. Karnal has a sex ratio of 886 females for every 1000 males, and a literacy rate of 76.4%.

The district is a part of the Indus-Ganges plain (Upper Yamuna Basin) and has a well-spread network of western Yamuna canals. Its geographical area has been divided into three agroclimatic regions: Khadar, Bangar and Nardak belt. The river Yamuna which marks the eastern boundary of the Haryana State as well as Karnal district provides the major drainage in the area. Irrigation in the district is done by surface water as well as ground water. 70% of the net irrigated area is covered through ground water.

Karnal district was covered under water balance studies of Upper Jamuna Project by CGWB during 1971-1978. The district was also covered under Reappraisal hydrogeological studies during field season programme of CGWB during 1981-82 , 2004-05.

2.0 RAINFALL & CLIMATE

The climate of the district is characterized by the dryness of the air with an intensely hot summer and a cold winter. The year may be divided in to four seasons. The cold season starts by late November and extends to the middle of March. It is followed by hot season which continues to the end of June when the southwest monsoon arrives over the district. July to September is the southwest monsoon season. The post monsoon season period is from October to December.

The normal annual rainfall of the district is 582mm recorded in 32 rainy days in a year. About 82.39% of the annual rainfall is recorded during the southwest monsoon from July to September. August is the wettest month of the year with an average of 9.0 rainy days and 221.5 mm rainfall. Maximum rainfall of 1404mm and minimum rainfall of 255mm were observed in the years 1998 and 1987 respectively.

3.0 GEOMORPHOLOGY & SOIL TYPES

The area represents almost an alluvial plain without any conspicuous topographical features and forms a part of the vast Indo-Gangetic plain. The elevation of the area above mean sea level ranges from 256 m amsl in the north to 245 m amsl in the south with an average elevation of 240m.amsl.The general slope of the area is southwards. In the north western part of the district the land slopes south west wards. There are many topographical depressions in the area of which the most pronounced is at Daha, south of Karnal.

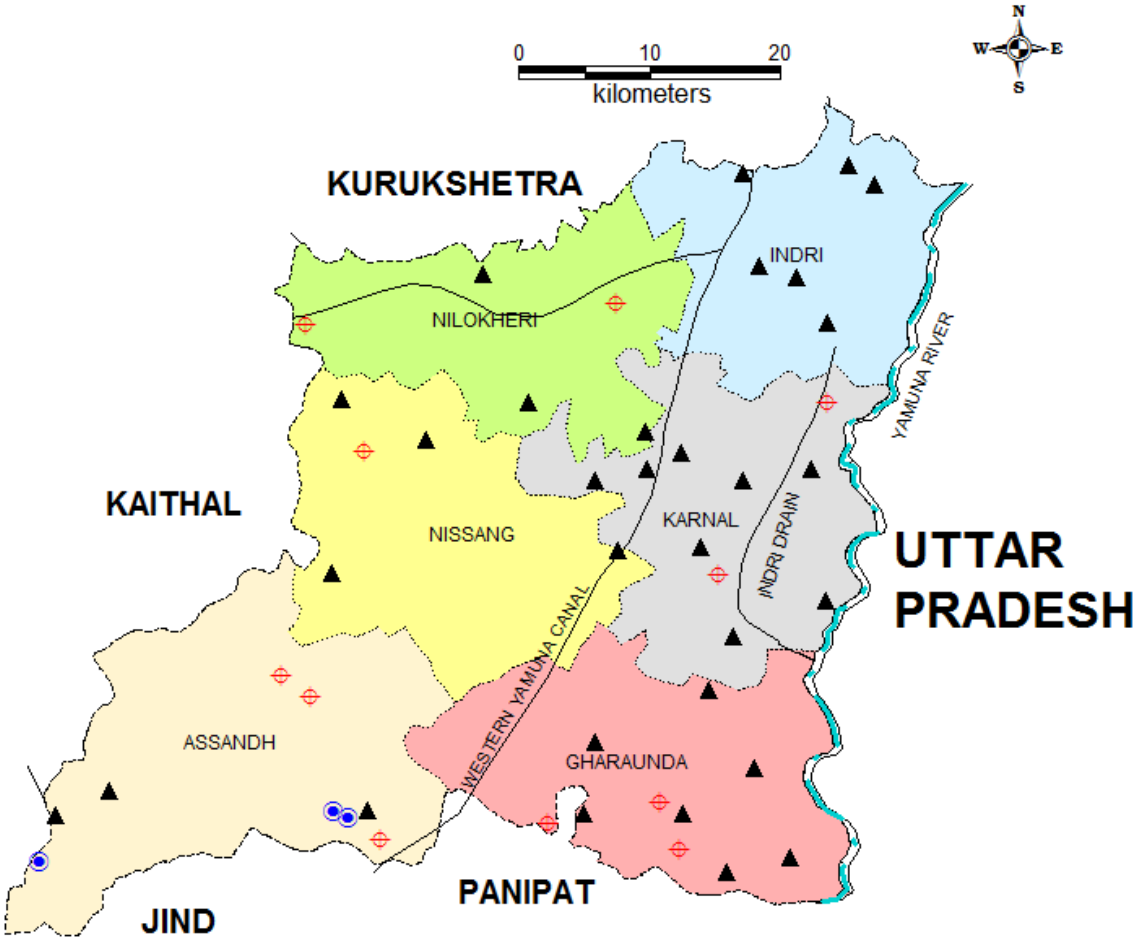
The river Yamuna which marks the eastern boundary of the Haryana State as well as Karnal district provides the major drainage in the area. The river Yamuna emerges from Yamnotri off the Bansur-Punch glacier in Tehri Garhwal district of Uttarakhand at an elevation of 6330 meters. It emerges into the plains from the foothills at Kalesar just north of Tajewala.

The Chantang Nala is the other drainage line and flows from north to southwest in the western part of the district and disappears near Assandh. The soils in Gharaunda and SE half of Karnal blocks are young, stratified with no profile development. They are sandy to fine sandy loams. The soils in SE half of Nilokheri, SW extremity of Karnal block touching Nilokheri, eastern portion of Nissang, Western half of Gharaunda block are heavily textured varying from sandy loam at the surface to clayey loam at about one meter depth.

PLATE: I

INDEX MAP

KARNAL DISTRICT, HARYANA



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- ◉ DUG WELL
- ■ DISTRICT HEAD QUARTER
- — · — STATE BOUNDARY
- ---------- DISTRICT BOUNDARY
- ..... BLOCK BOUNDARY

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY

The area falls in the Upper Yamuna Basin and the principal ground water reservoir in the area is unconsolidated alluvial deposits of Quaternary age. Ground water in near surface zone occurs under water table conditions and occurs under semi confined to confined conditions in deeper aquifers. Rain fall and seepage from the river Yamuna, canal networks and irrigation is the principal source of ground water recharge in the area.

The study of exploratory boreholes drilled in the district during the Upper Yamuna Project of Central Ground Water Board indicated presence of three tier aquifer groups upto 463 m depth below ground level.

Aquifer Group-I: The Aquifer group I is composed of different sand and clay lenses and extends from surface downwards to different depth varying down to 90m to 180m at different places and occurs all over the area. This is composed of relatively coarser sediments. This group of aquifers is underlain by a clayey horizon 10-15m thick which is regionally extensive. The average transmissivity of this group was calculated by the Upper Yamuna Project of CGWB to be of the order of 2200 m^2/day, lateral permeability of the order of 24m/day and average storativity as 0.12.

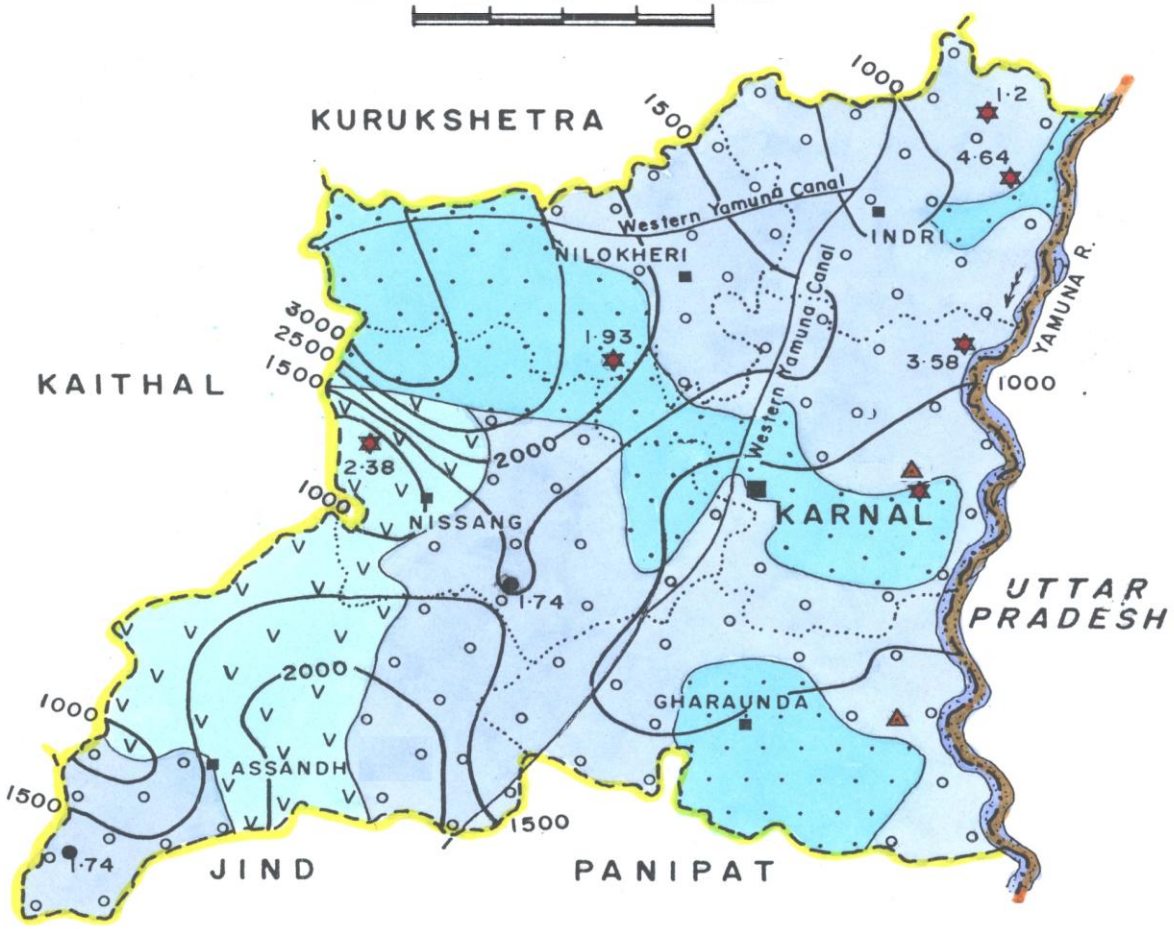
Aquifer Group-II: This group is composed of different sand and clay lenses and lies below aquifer group-I and occurs at varying depths ranging between 115m and 195 m to 215m and 285m. The sediments of this group are less coarse and are mixed with some kankar. This group is underlain by another clayey horizon, which is considerable thick at places and appears to be regionally extensive. The average transmissivity of this group is 700m^2/day, the average lateral permeability is 7.2m/day and the average storativity is $1x10^{-3}$.

Aquifer Group-III: The aquifer group III is composed of thin sand layers alternating with thicker clay layers and occurs at variable depths ranging between 314 m to 405m.bgl. The granular material of this group is generally finer and more so in the southerly direction. This group has an average transmissivity value of 525m^2/day, and average lateral permeability and average storativity values of the order of 7.1m/day and $4.5x10^{-4}$ respectively.

PLATE -II

HYDROGEOLOGY

KARNAL DISTRICT, HARYANA



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	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL(m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 — 300	> 720	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	30 — 100	600 — 720	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS DUG WELLS	REVERSE / DIRECT ROTARY MANUAL	20 — 60	480 — 600	RECHARGE TRENCH AND RECHARGE SHAFT

ELECTRICAL CONDUCTIVITY (MICROMHOS/CM AT 25°C)

2000

IRON > PERMISSIBLE LIMIT (1·0 ppm)

FLUORIDE > PERMISSIBLE LIMIT (1·5 ppm)

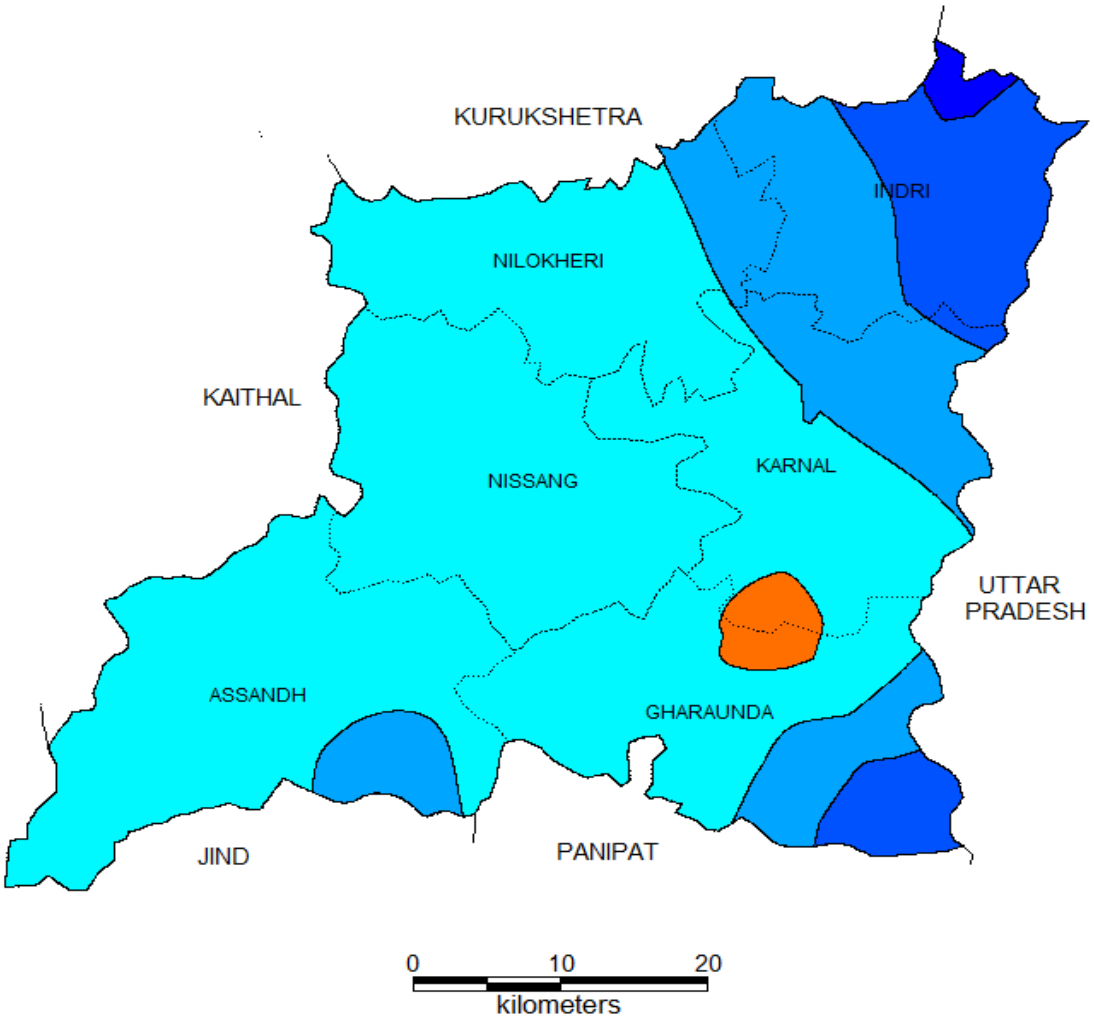
ARSENIC > PERMISSIBLE LIMIT (0·05)

PLATE - III

DEPTH TO WATER LEVEL

(PRE MONSOON, MAY- 2011)

KARNAL DISTRICT, HARYANA



LEGEND

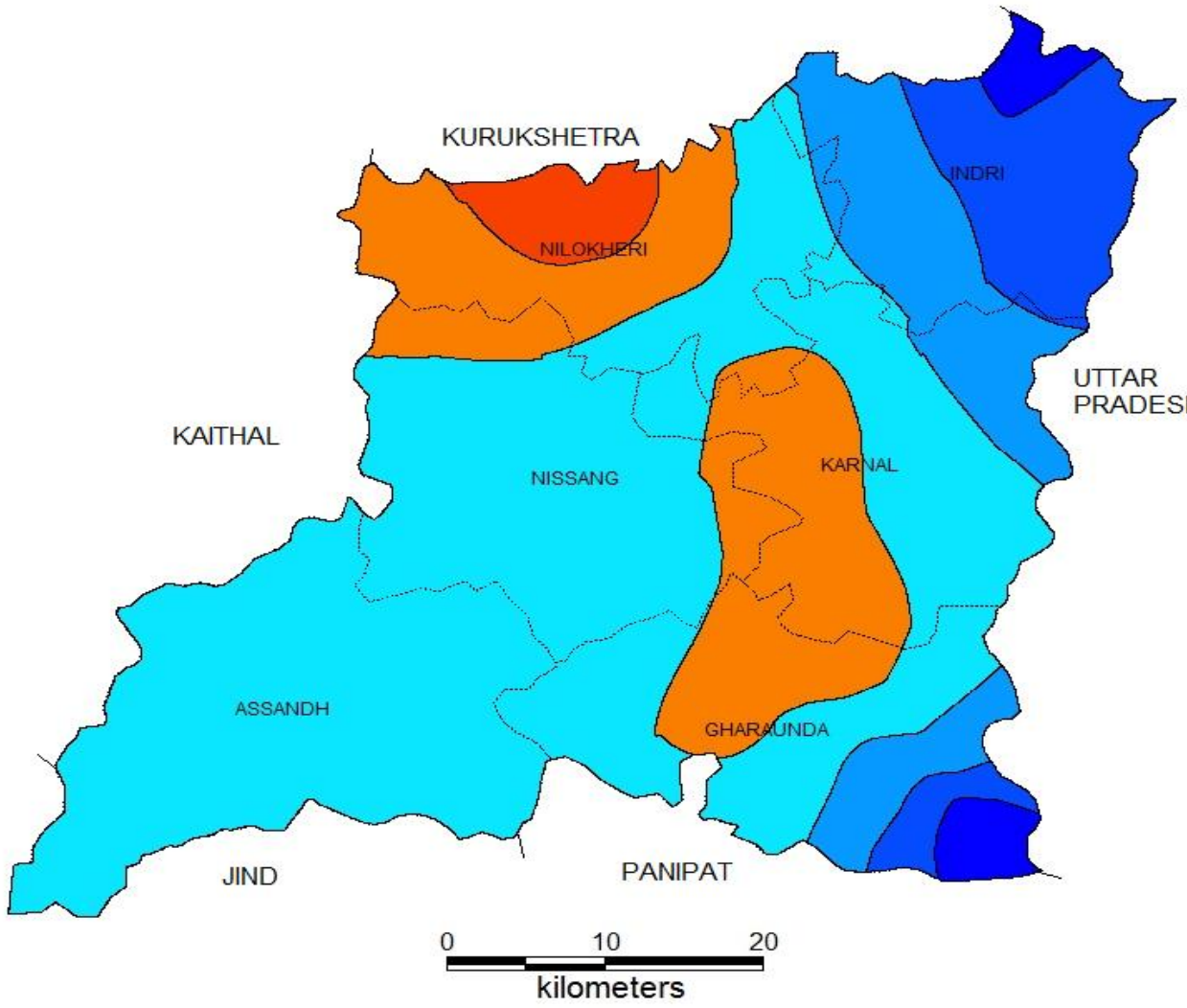
MAP SYMBOL	DTWL Range (m. bgl)
	<5.00
	5.00-10.00
	10.00-15.00
	15.00-20.00
	20.00-25.00

PLATE - IV

DEPTH TO WATER LEVEL

(POST MONSOON, NOVEMBER- 2011)

KARNAL DISTRICT, HARYANA



LEGEND

MAP SYMBOL	DTWL Range (m. bgl)
	<5.00
	5.00-10.00
	10.00-15.00
	15.00-20.00
	20.00-25.00
	> 30.00

At shallow depths the aquifer are under unconfined conditions whereas at deeper levels these are under semi confined or confined conditions. Under exploratory drilling programme Central Ground Water Board has constructed 9 deep tubewells in the district. The depths of these tubewells are in the ranges of 202m to 316m. The discharge of these wells ranges from 825 to 4542 lpm for draw down varying from 4 - 20m. Depth to water level in the district ranges between 4.18 m to 21.16 m bgl in the pre monsoon period.

The depth to water level is deeper in the north-western parts and east central parts and shallow in north eastern parts and central and south-western parts. In the post monsoon period the depth to water level ranges between 2.68 m to 22.22 m bgl. The seasonal fluctuation in water table varies in between –2.09m to 2.73m. During the last 10 years (2002 -2011) the rate of decline of ground water is in the range of 0.02m/yr to 1.31 m/yr.

The water table elevation in the district varies between 254.14m and 213.32m above mean sea level. The elevation is higher in northern part in Indri block and gradually decreases towards south in Assandh and Gharaunda blocks. In general the ground water flow direction is from north-east to south-west. At certain parts there is a change the direction of flow. In western parts of Assandh block the ground water flow is from east to west. The gradient of water table elevation is steeped in northern parts and gentle in southern parts. It varies from 4.27 m/km in the north to 0.47m/km in the south

4.2 GROUND WATER RESOURCES

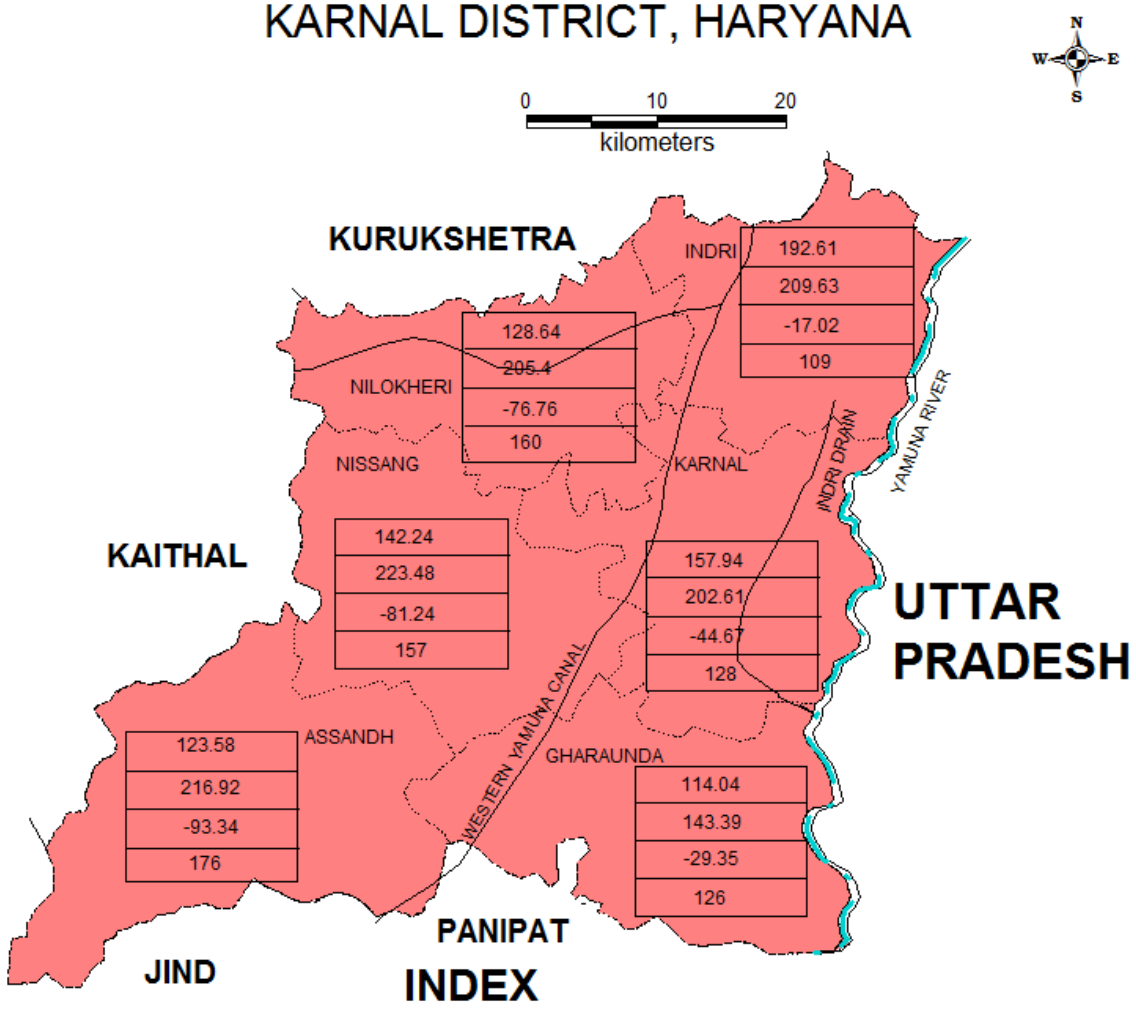
Ground Water Resources estimation of the district was done in 2009 for each individual block. Perusal of the Estimates reveals overall stage of ground water development in the district is of the order of 140%. The present stage of block wise ground water development varies from 109 % (Indri) to 176 % (Assandh).The ground water development in all the blocks of the district has exceeded the available recharge and thus all the blocks have been categorized as over exploited. Net annual ground water availability of the district is 85905 ham and existing gross ground water draft for all users is 120143 ham.

The blockwise ground water resource potential in the district has been assessed as per GEC-97 and are as on 31.3.2011 is as follows:-

PLATE - V

GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS

KARNAL DISTRICT, HARYANA



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OVER EXPLOITED

859.05	NET ANNUAL GROUND WATER AVAILABILITY (MCM/YR.)
1201.43	EXISTING GROUND WATER DRAFT FOR ALL USES (MCM/YR)
-342.38	NET GROUND WATER AVAILABILITY FOR FUTURE IRIGATION DEVELOPMENT (MCM
140	STAGE OF GROUND WATER DEVELOPMENT(%)

STATE BOUNDARY

DISTRICT HEAD QUARTER

DISTRICT BOUNDARY

BLOCK BOUNDARY

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF KARNAL DISTRICT, HARYANAAS ON 31ST MARCH, 2011 in ha m

Block Name	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 up to next 25 years (Ham)	Net Ground Water Availability for future irrigation development (Ham)	Stage of Ground Water Develop-ment (%)	Category of Block
Assandh	12358	21640	21692	52	-9334	176	OVER EXPLOITED
Gharaunda	11404	14138	14339	201	-2935	126	OVER EXPLOITED
Indri	19261	20829	20963	134	-1702	109	OVER EXPLOITED
Karnal	15794	19758	20261	503	-4467	128	OVER EXPLOITED
Nilokheri	12864	20334	20540	206	-7676	160	OVER EXPLOITED
Nissang	14224	22200	22348	148	-8124	157	OVER EXPLOITED
TOTAL	**85905**	**118899**	**120143**	**1244**	**-34238**	**140**	**OVER EXPLOITED**

4.3 GROUND WATER QUALITY

Data of chemical analysis of water samples from shallow aquifers indicates that ground water is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are less than 1000µs/cm, except at Biana and Salwan where the EC values are 1310µs/cm and 1690µs/cm at 25^0C respectively. Generally, it is suitable for drinking purposes as chemical parameters are well within the permissible limits for safe drinking waters set by Bureau of Indian Standards (BIS) except for nitrate at Salwan (83 mg/l), iron and arsenic at few places, where Maximum value of Arsenic is noticed at Nalvi khurd(0.0655 mg/l) and maximum value of Iron is at Garhi Khajur(3.43 mg/l).

Among anions, bicarbonate is the dominant anion in 58% and no individual anion dominates in the remaining water samples. Among cations, either sodium is the dominant cation (46 %) or mixed cationic character prevails.

The suitability of groundwater for irrigational uses is generally ascertained by considering salinity (EC), Sodium Adsorption ratio (SAR) and Residual Sodium Carbonate (RSC). The ground water is fresh to highly saline with low RSC values. The US Salinity Laboratory Classification of irrigation water indicates that ground water falls under C_2S_1, C_3S_1, C_3S_2 and C_3S_3 Classes and therefore suitable for customary irrigation on well – drained soils on which semi – salt tolerant suitable crops such as wheat, gram and rice etc are grown without any fear of sodium hazards.

Type of water:

Nearly all type of waters are available viz. Ca+ Mg – mixed anion, $NaHCO_3$, Mixed cation – bicarbonate type or mixed cation and mixed anion type.

4.4 STATUS OF GROUND WATER DEVELOPMENT

Water for irrigation in the district is based on both ground water and canal surface water. Ground water contributes 95 % of the total need for agriculture. Ground water is being extracted through a large number of shallow tubewells and dug cum bore holes which tap unconfined layer up to the average depth of 60-80m. The table shows the number of extraction structures in each block.

Sl.no	Block	Shallow TW with Pump set	DIT	Ground water Draft (Ham)		
				Monsoon	Non Monsoon	Annual
1	Assandh	11956		9738	11902	21640
2	Gharaunda	9491	15	7832	9572	17404
3	Indri	11532		9393	11480	20873
4	Karnal	11765	4	9610	11745	21355
5	Nilokheri	10633	24	8823	10783	19606
6	Nissang	11066		9013	11016	20029

Entire drinking water supply to all rural as well as urban parts of the district is based on ground water only. This is basically due to the fact that the quality of ground water is fresh and potable all over and the depth to water level is within 10 to 20m in most parts. The tubewells constructed by Public Health Department, Haryana for drinking water supply are generally between 80 to 150m deep. The table shows the block-wise ground water draft for domestic use.

Sl.no	Block	No. of Tube wells	Ground Water Draft (m^3)
1	Assandh	29	520000
2	Gharaunda	111	2010000
3	Indri	74	1340000
4	Karnal	278	4050000
5	Nilokheri	114	2070000
6	Nissang	82	1490000
	TOTAL	688	11480000

4.5 GEOPHYSICAL STUDIES

CGWB has carried out surface geophysical studies in eastern part of the district covering Karnal and indri blocks covering areas of Yamuna flood plains, where show that ground water is fresh at all levels in major part of the flood plain area. The areas where granular zones with fresh water have been inferred at shallow depth are within 35 m.

4.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The stage of ground water development for the district is 140 % and all the six blocks falls in over-exploited category. That means that the ground water is under stress and the ground water level is declining. There is no scope for further ground water development. Only measures should be taken to reduce on the dependence on ground water and to enhance the ground water resources.

5.2 Water Conservation & Artificial Recharge

There are 718 tanks and ponds in Karnal district which act both as water conservation and recharge structures.

Block Name	No. of tanks/ ponds	Average water spread area (ha)		No. of days water is available		Recharge in Ham during	
		Monsoon	Non-Monsoon	Monsoon	Non-Monsoon	Monsoon	Non-Monsoon
Assandh	126	183	183	121	149	14.46	17.67
Gharaunda	95	83	83	95	115	14.66	18.36
Indri	122	93	93	108	132	11.35	13.74
Karnal	131	85	85	120	150	28.96	35.40
Nilokheri	132	149	149	135	165	31.89	39.26
Nissang	112	146	146	135	165	28.38	34.69
TOTAL	**718**	**739**	**739**	**714**	**876**	**129.70**	**159.12**

The higher stage of ground water development in the district and it falls in over exploited category resulting of decline in water levels. There is a need to take measures to arrest the decline of ground water level and artificial recharge to ground water is one of such measures. Whole of the district except the area in the north-east parts in the Indri block 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. Recharging shafts and injection wells are recharging structures suitable for the district.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

In the district, the main issue of concern related to ground water is the depleting ground water resources which are being reflected through the declining ground water level. The stage of ground water development for the district is 140 % that means the net annual withdrawal is more than the net annual recharge. During the last 20 years the ground water level has declined in 80% of the area of the district and the decline is in the range of 1.0m to 13.3m and the rate of decline is in the range of 0.02m/yr to 1.31m/yr. Individually also all the blocks are over exploited . These blocks need macro analysis and there is urgent need for conservation of ground water in the district.

7.0 AWARENESS & TRAINING ACTIVITY

Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB

Central Ground Water Board organized first Mass Awareness Programme at Panchayat Bhawan, Karnal on 29th July 2003 on Conservation, protection and management of Water. Shri R.S.Doon, the Deputy Commissioner of Karnal district was the Chief Guest.Shri A.K.Bhatia, Scientist 'D' , CGWB described the ground water condition in Karnal district. Dr. M.D.Nautiyal, Regional Director, CGWB,NWR highlighted importance of water conservation and described method of ground water management of the district. Sh. G.S.Sehrawat, Deputy Director, Deptt. of Agriculture highlighted the reasons for over exploitation of ground water in the district and described how change in cropping pattern can help to reduce irrigation requirements. Sh.R.S.Doon highlighted the water problems of Karnal district and advised the audience to conserve water and requested the Regional Director, CGWB to implement schemes of rainwater harvesting and artificial recharge to ground water in the district in a big ways to raise the water table of the area. About 250 persons from the field of agriculture, public Health Engineering, Irrigation and Country & Town Planning departments attended the programme. Second Mass Awareness Programme was organized at Gharaunda, district Karnal on 6th October, 2005. The programme was organized in association with Directorate of Agriculture, Haryana on the theme of conservation, protection and regulation of ground water. The main aim to organize the programme is to create awareness among the people for conservation, protection and scientific management of water resources. The Deputy Commissioner, Karnal district was the chief guest. Sh A.K.Bhatia, Scientist 'D' CGWB highlighted specific ground water problems of Karnal district. Dr. S.K.Kamra, Principal Scientist, CSSRI and Hydrologists of Ground Water Cell, Haryana delivered speeches on ground water issues pertaining to the area. About 300 persons attended the function. A painting competition was organized at Sunrise Public School, Gharaunda.

Participation in exhibition, Mela, Fair etc

During Mass Awareness Programme at Karnal an exhibition was installed displaying maps, figures, data and posters on ground water conservations.

Presentation & Lectures delivered in Public forum/Radio/T.V/ Institution of repute/ Grassroots associations/NGO/Academic Institutions etc

Officer of this region have delivered lecturers in training programmes and seminars being organized by Central Soil Salinity Research Institute, Karnal on various topics related to ground water. Participants such as scientists, engineers and academicians from all over the country attended this programmes.

8.0 AREAS NOTIFIED BY CGWA/SGWA

Karnal block has been notified for rejuvenate of ground water extraction by the Central Ground Water Authority.

9.0 RECOMMENDATIONS

1. The stage of ground water development for the district at present is 140 % and all the blocks fall under over-exploited category which leads to constant decline of water level over last 20 years in whole district except around 10% of the area. So no further ground water development is recommended.
2. The contribution of surface water to irrigation in the district is very less. Measures should be made to increase the canal water supply for irrigation.
3. Change in cropping pattern is recommended to reduce the heavy pumping of ground water.
4. Ground water pumping from deep aquifers is recommended to reduce stress on the shallow aquifers.
5. Ground water pumping for supplies should be shifted to the active flood plains all along the river Yamuna.
6. The construction of roof top rainwater harvesting and artificial recharge to ground water should be made mandatory in building by laws.