DYNAMIC GROUND WATER RESOURCES OF HARYANA STATE (AS ON 31st MARCH 2022)

CENTRAL GROUND WATER BOARD
NORTH WESTERN REGION
CHANDIGARH
AND
GROUND WATER CELL
IRRIGATION & WATER RESOURCE DEPARTMENT
HARYANA

January, 2023

DYNAMIC GROUND WATER RESOURCES OF HARYANA STATE (AS ON 31st MARCH 2022)

Prepared by

CENTRAL GROUND WATER BOARD
NORTH WESTERN REGION CHANDIGARH

AND

GROUND WATER CELL
IRRIGATION & WATER RESOURCE DEPARTMENT
HARYANA

January, 2023

CONTRIBUTORS

Ground Water Cell, Irrigation & Water Resource Department, Govt. of Haryana:

1. Sh. Rakesh Kumar, Chief Hydrologist, Ground Water Cell, Panchkula, Haryana.
2. Sh. Pankaj Mahala, Hydrologist, Ground Water Cell, Panchkula, Haryana.
3. Sh. Sudhir Kumar, Technical Officer, Ground Water Cell, Panchkula, Haryana.
4. Sh. Abhinav, Technical Assistant & Sh. Rajiv, Technical Associate, O/o Hydrologist, Ambala,
5. Sh. Ajit Singh, Technical Assistant & Sh. Arvind, Technical Associate. O/o Hydrologist, Gurgaon.
6. Dr. Mahavir Singh, Technical Assistant & Sh. Pardeep, Technical Associate, O/o Hydrologist, Karnal.
7. Sh. Dalbir Singh, Technical Assistant, O/o Hydrologist, Rohtak & Charkhi Dadri.
8. Sh. Ashish, Technical Associate, O/o Hydrologist, Hisar.
9. Sh. Yashpal, Tracer, O/o Assistant Geologist Narnaul.
10. Sh. Mahavir, Technical Associate, O/o Assistant Geologist, Kurukshetra,
11. Sh. Rahul Kumar, Technical Associate, O/o Assistant Geologist, Jind.
12. Sh. Amit Kumar, Technical Associate, O/o Assistant Geologist, Sirsa.
13. Sh. Pramod Kumar, Technical Associate, O/o Assistant Geologist, Bhiwani.

Central Ground Water Board, Ministry of Jal Shakti, Govt. of India:

1. Sh. Aditya Sharma, Scientist 'B' (Hydrometerolgist), CGWB, NWR, Chandigarh
2. Sh. Gyanendra Rai, STA-HG, CGWB, NWR, Chandigarh
3. Sh. Saquib, STA-HG, CGWB, NWR, Chandigarh
4. Sh. Kiran Lale, STA-CHEM, CGWB, NWR, Chandigarh

Under the Supervision & guidance of:

Sh. Vidya Nand Negi, Scientist 'D', CGWB, NWR, Chandigarh

CONTENTS

CONTENTS

Fig. No. FIGURES:

Table No. TABLES:

पंकज अग्रवाल, आई.ए.एस.

आयुक्त और सचिव, हरियाणा सरकार
सिंचाई और जल संसाधन विभाग,
चंडीगढ़।

Pankaj Agarwal, I.A.S.

Commissioner & Secretary, Govt. of Haryana.
Irrigation & Water Resources Department,
Chandigarh.
Email : fciwrd@gmail.com

FOREWORD

Monitoring and assessment of natural resources pave the path to be followed for sustained existence of life on the planet. Due to urbanization, industrialization and heavy exploitation of ground water, the water table in depleting day by day. Water is critical for all form of life; its conservation and preservation are of utmost importance. In order to keep pace with the fast changing scenario i.e. growing population and its demand to cope up with new life style and to ensure National food security, regular monitoring and periodic assessment of water resources is an utmost necessity.

In the hydrological cycle, the sub-surface water and its route, though lately recognized, are most valuable to tide over all types of natural or man-made calamities, especially drought and its assessment.

The ground water resources of Haryana as on march, 2022 have been assessed by Ground Water Cell of Irrigation & Water Resource Department in close association with Central Ground Water Board, Govt. of India, North- Western Region, Chandigarh based on the latest guidelines of Ground Water Estimation Committee, 2015 GEC 2015) through InGres web portal (http://ingres.iith.ac.in/). The report is highly informative and dwells on all important aspects, such as, ground water resources, recharge, draft, balance availability with stage of development in each block, the smallest administrative unit.

I am sure that present report will be of immense use to planners, administrators and agencies involved in the process, who will use this in the most useful manner for the development of State.

PANKAJ AGARWAL, IAS

Room No.336, 3rd Floor,
New Haryana Civil Secretariat, Sector-17, Chandigarh
Tel. No. 0172-2702249

डॉ. सतबीर एस. कादियान
प्रमुख अभियंता

Dr. Satbir S. Kadian, FIE
Engineer-in-Chief

Irrigation & Water Resources Department,
Haryana, Panchkula- 134109
सिंचाई एवं जल संसाधन विभाग,
हरियाणा, पंचकुला- **134109**

Email : eiclcuirr@yahoo.com
ceo-hwra@hry.gov.in

PREFACE

Faced with the challenges of Climate Change and rising demand for freshwater makes it impending necessity to record accurate data and knowledge of existing water reservoirs, whether surface or underground for judicious use and development planning of water resources, Ground Water Resource, although replenishable, is not inexhaustible. The increasing demand on the resource over the years has led to water scarcity in many of the world. During past two decades increase in extraction and over exploitation of this resource has led to sharp decline in the availability of freshwater. Ironically there is a continuous rise in demand, especially in critical and over exploited areas of the country is exacerbating the situation irreversible. Estimates in Haryana, project overall stage of Ground Water Development to be 134.14% (as on 31st March, 2022), ranging from 49.82% in Jhajjar district to 228% in Kurukshetra district.

This report on Ground Water Resources Estimation, as on 31st March 2022, of Haryana has been prepared by the Central Ground Water Board, North Western Region, Chandigarh and Ground Water Cell, I&WRD, Haryana jointly. The report is prepared on guidelines by the Ground Water Resource Estimation Committee (GEC 2015) using InGres web portal (http://ingres.iith.ac.in/) providing details regarding Total Annual Replenishable Ground Water Resources, present draft and scope for future development. The report indicates alarming trends as 88 assessment units i.e. Administrative Blocks out of total 142 Blocks have reached "Over Exploited" category. The report provides valuable inputs for planning of aquifer rejuvenation instead of ground water developmental activities in the State.

I would like to appreciate the efforts of each individual associated with data collection, analysis and preparation of this report by officers and officials of Central Ground Water Board, North Western Region, Chandigarh and Ground Water Cell, I&WRD, Haryana.

I personally feel that this report will be of immense value to the administrators, planners and agencies engaged in the development and regulation of ground water resources.

SATBIR SINGH KADIAN

अनुराग खन्ना
क्षेत्रीय निदेशक
Anurag Khanna
Regional Director

सत्यमेव जयते

भारत सरकार
जल शक्ति मंत्रालय
केन्द्रीय भूमि जल बोर्ड
उत्तर पश्चिमी क्षेत्र चण्डीगढ
Government of India
Ministry of Jal Shakti
Central Ground Water Board
North Western Region, Chandigarh

प्रस्तावना

भूजल की महत्व दिन प्रतिदिन बढ़ती जा रही है। यह लगभग सभी जगह आसानी से उपलब्ध रहता है। भूजल देश की खेती और पेयजल आवश्यकताओं के साथ व्यवसायिक जरूरतों के लिये भी अति आवश्यक है। हरियाणा राज्य मैं भूजल की उपलब्धता सतही जल के अपेक्षाकृत काफी अधिक है। भूजल स्तर में निरंतर गिरावट के कारण भूजल की उपलब्धता, भूजल दोहन एवं भविष्य में भूजल के आंकलन की नियमित रूप से जरूरत महसूस होती रही है।

भारत सरकार के भूजल संसाधन आंकलन (GEC-2015) संबंधी दिशा-निर्देशों एवं InGres web portal (http://ingres.iith.ac.in/) के आधार पर 31 मार्च, 2022 तक भूजल का क्रियाशील आंकलन किया गया और केंद्रीय भूमिजल बोर्ड (CGWB) एवं हरियाणा सरकार के सिंचाई एवंजल संसाधन विभाग के भूजल प्रकोष्ठ के संयुक्त प्रयास से यह रिपोर्ट तैयार की गई है।

इस रिपोर्ट में पुनर्भरण माध्यम से भूजल की वार्षिक उपलब्धता, भूजल के मौजूदा दोहन एवं भविष्य में भूजल की शेष उपलब्धता का ब्लॉक स्तर पर किये गये विस्तृत आंकलन व अध्ययन का पूर्ण वर्णन दिया गया है। यह अध्ययन हरियाणा के 141 ब्लॉक तथा 2 शहरी क्षेत्र (गुडगाँव & फरीदाबाद) में किया गया जो समूचे राज्य में भूजल की उपलब्धता एवं दोहन के आकड़ों को दर्शाता है। हाल ही में किये गये आंकलन के अनुसार हरियाणा राज्य के 88 ब्लॉक अत्यधिक दोहन (Over Exploited) तथा 10 ब्लॉक विकट (Critical) श्रेणी में एवं 9 ब्लॉक अर्द्ध विकट (Semi Critical) श्रेणी में आ गये हैं। अभी हरियाणा राज्य के मात्र 36 ब्लॉक ही सुरक्षित (Safe) श्रेणी में हैं। मैं श्री पंकज अग्रवाल IAS, प्रवर मुख्य सचिव, सिंचाई एवंजल संसाधन विभाग, हरियाणा सरकार एवं अध्यक्ष, भूजल संसाधन आकलन एवं आंकड़ा संशोधन समिति, हरियाणा (Committee for Estimation of Ground Water Resources Potential and Refinement of Figure in State of Haryana) के मार्ग-दर्शन एवं रिपोर्ट की स्वीकृति के लिये मैं आभारी रहूँगा। मैं डॉ. सतबीर सिंह कादियान, इंजीनियर इन चीफ, सिंचाई एवंजल संसाधन विभाग, हरियाणा सरकार के द्वारा दिये गये मार्ग दर्शन एवं रिपोर्ट की संस्तुति के लिये आभार व्यक्त करता हूं।

मैं केंद्रीय भूमिजल बोर्ड के, श्री आदित्य शर्मा, वैज्ञानिक 'बी' (मौसमविद्), श्री ज्ञानेंद्र राय, वरिष्ट तकनिकी सहायक (भूजल), श्री साकिब, वरिष्ट तकनिकी सहायक (भूजल) व श्री किरण लाले, वरिष्ट तकनिकी सहायक (रसायन) एवं भूजल प्रकोष्ठ, सिंचाई एवंजल संसाधन विभाग हरियाणा सरकार के सभी क्षेत्र भुजलविद् द्वारा इस रिपोर्ट के तैयार करने में दिये गये उनके महत्वपूर्ण योगदान के लिये भी उनका आभार व्यक्त करता हूँ।

मैं साथ ही श्री विद्या नंद नेगी, वैज्ञानिक (डी) जिनके पर्यवेक्षण में यह रिपोर्ट तैयार की गई है, का भी आभारी हूँ। मैं श्री राकेश कुमार, मुख्य जल विज्ञानी एवं श्री पंकज महाला, भुजलविद्, भूजल प्रकोष्ठ, सिंचाई एवंजल संसाधन विभाग हरियाणा सरकार का भी आभार व्यक्त करता हूँ जिन्होंने इस रिपोर्ट को तैयार करने में महत्वपूर्ण भुमिका निभाई है।

मैं आशा करता हूँ कि यह रिपोर्ट योजनाकारों, प्रशासकों एवं जल व्यवस्थापन (सूत्रीकरण) से जुड़े समस्त विभाग के लिये निश्चित ही फायदेमंद रहेगी।

अनुराग खन्ना

(अनुराग खन्ना)
क्षेत्रीय निदेशक

भूजल भवन, प्लॉट नं. 3बी, सैक्टर . 27ए, मध्य मार्ग, चण्डीगढ़. 160019
Bhujal Bhawan, Plot No. 3B, Sector - 27A, Madhya Marg, Chandigarh-160019
Tel : 0172-2619500-01, E-mail : rdnwr-cgwb@nic.in

Summary of Ground Water Resources Estimation of Haryana State as on 31st March, 2022

Haryana State is mainly occupied by the alluvial deposits, which cover around 98% of the state while hardrock covers around 2%.Alluvial deposits are of Older and Newer types and consist chiefly of clay, silt and fine to medium sand. Other deposits are piedmont deposits, which are confined to a narrow zone, about 2 to 4 km wide, between Siwalik Hills and alluvial plains. Sand-dunes are found in the districts of Bhiwani, Mahendragarh, Hissar and Sirsa. Coarse sand, gravels and boulders are found to occur in piedmont areas and in the adjacent alluvial tracts. The hard rock formations belong to the formation of Delhi systems of Pre- Cambrian age and occupy the southern part of the state, while Shivalik system of Tertiary age are occupying the northern most part of the state.

Haryana State is mainly occupied by the alluvial deposits, which cover around 98 % of the State while hardrock covers around 2 %. Alluvial deposits are of Older and Newer types and consist chiefly of clay, silt and fine to medium sand. Other deposits are piedmont deposits, which are confined to a narrow zone, about 2 to 4 km wide, between Siwalik Hills and Alluvial Plains. Sand-dunes are found in the districts of Bhiwani, Mahendragarh, Hissar and Sirsa. Coarse sand, gravels and boulders are found to occur in piedmont areas and in the adjacent alluvial tracts. The hard rock formations belong to the formation of Delhi systems of Pre- Cambrian age and occupy the southern part of the state,while Shivalik system of Tertiary age are occupying the northern most part of the state.

Total Annual Ground Water Recharge of the State has been assessed as 9.47 bcm and Annual Extractable Ground Water Resource is 8.61 bcm. The Total Current Annual Ground Water extraction is 12.42 bcm and Stage of Ground Water extraction is 134.14 %.

Out of total 143 assessment units (blocks/Urban), 88 units (61.53 %) have been categorized as ‘Over-exploited’, 10 units (6.99 %) as ‘Critical’, 09 units (6.29 %) as ‘Semi Critical’ and 36 units (25.17 %) as ‘Safe’ categories of assessment units. Similarly out of 40391.06 sq km recharge worthy area of the State, 24772.70 sq km (61.33 %) area are under ‘Over-Exploited’, 2359.29 sq km (5.84 %) under ‘Critical’, 2398.44 sq km (5.94%) under ‘Semi-critical’, 10860.63 sq km (26.89 %) under ‘Safe’ categories of assessment units. Out of total 8606.22 mcm annual extractable ground water resources of the State, 5393.49mcm (62.67 %) are under ‘Over-exploited’, 547.31mcm (6.36 %) under ‘Critical’, 713.03mcm (8.28 %) under ‘Semi-critical’ and 1952.40mcm (22.69 %) are under ‘Safe’ categories of assessment units.

As compared to 2020 assessment, the Total Annual Ground Water Recharge have decreased from 9.53 to 9.48 bcm in 2022, Annual Extractable Resources have decreased from 8.63 to 8.61 bcm and the Annual Ground Water Extraction from 12.59 to 12.42 bcm. The Stage of Ground Water Extraction has decreased from 134.56 % to 134.14 %. The reduction in draft is due to reduction in yield of wells.

In Parts of 13% of the AUs, groundwater is fresh and in districts of Kurukshetra, Yamuna Nagar and Karnal

In Parts of 57 AUs, groundwater is of marginal saline quality covering parts of districts of Bhiwani, CharkiDadri, Faridabad, Fatehabad, Hisar, Jhajjar, Jind, Kaithal, Mahendragarh, Mewat

Palwal, Rewari, Rohtak, Sirsa, Sonipat

In parts of 41 AUs ground water is Flouride contaminated in falling in Bhiwani, Gurugram, Hisar, Jhajjar, Jind, Karnal Mahendragarh, Palwal, Panchkula, Rohtak, Sirsa Sonipat, Faridabad, Fatehabad.

In parts of 38 AUs ground water U concentration is observed in Faridabad, Kaithal, Fatehabad, Panipat, Sonipat, Jhajjar, Bhiwani, Mahendergarh, Mewat, Palwal, Sirsa, Bhiwani, Hisar, Karnal

Total Annual Groundwater Recharge of the State has been assessed as 9.47 bcm and Annual Extractable Ground Water Resource is 8.60 bcm. The Total Current Annual Ground Water extraction is 11.54 bcm and Stage of Ground Water extraction is 134%. Out of total 143 assessed blocks taken for study, 88 have been categorized as 'Over-exploited',10 as 'Critical', 09 as 'Semi Critical' and 36 as 'Safe'. Total Annual Groundwater Recharge has been reduced from 9.52 bcm to 9.47 bcm, annual extractable resources have decreased from 8.62 bcm to 8.60 bcm and the annual ground water extraction reduced from 11.60 bcm to 11.54 bcm. The stage of ground water extraction has decreased from 135% to 134%. Adoption of threshold value at same rate for pre- monsoon and post monsoon seasons and re-organisation of blocks and block boundaries also resulted in slight reduction in rainfall recharge. The decrease in draft is due to identification of irrigation tubewells located in saline areas and same has been reduced and draft from fresh water tubwells is considered in estimation. There is slight increase in number of abstraction structures of drinking and domestic use tubewells for which exact number of tubewells and yield of the tubewells has been provided by PHED, Haryana. In Parts of 13% of the blocks, groundwater is fresh and in districts of Kurukshetra, Yamuna Nagar and Karnal. In Parts of 59 blocks, groundwater is of marginal saline quality covering parts of districts of Bhiwani, CharkiDadri, Faridabad, Fatehabad, Hisar, Jhajjar, Jind, Kaithal, Mahendragarh, Mewat Palwal, Rewari, Rohtak, Sirsa, Sonipat. In parts of 34 blocks ground water is Flouride contaminated falling in Bhiwani, Gurugram, Hisar, Jhajjar, Jind, Karnal Mahendragarh, Palwal, Panchkula, Rohtak, Sirsa Sonipat. Quality tagging has also been made for such blocks. The instorage Ground water resources in poor quality areas have been estimated as 16.15 bcm and additional potential of fresh ground water resources in shallow water level areas is estimated as 1.45 bcm.

CHAPTER-1
INTRODUCTION

1.1 INTRODUCTION

Haryana State is located in Northwest of India and was carved out in 1966 when the present state of Punjab was reorganized. It is one of the smallest states in India with geographical area of 44,212 Sq. Kms. Administratively it is divided into 6 divisions, 72 sub- division, 22 districts, 93 tehsils, 50 sub-tehsils and 142 development blocks. The state is chronically deficit in water resources. Most of the land is either arid or semi arid and drought conditions are common in large tracts of the state particularly in Mahendragarh, Bhiwani, Rewari, Sirsa and Hisar districts. Almost entire southwestern half of the state is a part of desert belt extending to Rajasthan. This area is exposed chronically to drought, crops fail for lack of adequate soil moisture and intense heat accompanied by variation between day and night temperatures.

The present requirement of water for irrigation in the state is much more than the available surface and sub surface resources. The surface water available for utilization in the state is extremely limited. The main perennial rivers of composite Punjab, viz the Satluj, the Beas and Ravi do not pass through the state of Haryana. The share of Haryana in the water in these rivers is being utilized through Bhakra Canal in the western part of the state. The other source of surface water supply is from river Yamuna which is insufficient and is shared by Haryana with UP.
Ground water is the largest available source of fresh water. Natural process replenishes it and if balance could be maintained between utilization and replenishment, a perennial supply can be assured. Unfortunately, only 92% of the area is suitable for the groundwater development through shallow and deep tubewells. In the remaining area either the water is highly saline or thickness of granular zone is inadequate. The state is therefore in need of detailed and thorough groundwater investigation for optimum utilization of the resource.

The state has varied hydrogeological characteristics due to which ground water potentials differ from place to place. Increasing urbanization and growing dependence on ground water for irrigation in the state has called for judicious and planned exploitation of the ground water resources. For proper planning and management of ground water development in a judicious and socio-economically equitable manner, quantification of ground water resources is one of the most important prerequisites. Central Ground Water Board (CGWB) in association with other Central Government as well as State Governments agencies has assessed the ground water resources of the state according to the methodology recommended by the Ground Water Estimation Committee constituted by Government of India time to time. The ground water resources have been estimated as on 2004, 2009,2011, 2013, 2017, 2020 in the past. The present report embodies the quantified ground water resources of Haryana state assessed based on the latest methodology recommended by Government of India (GEC-2015) as on 31st March, 2022.

1.2 BACKGROUND FOR RE-ESTIMATING THE GROUND WATER RESOURCES OF THE STATE.

The first attempt to estimate the ground water resources of the country was made in the year 1979. A committee known as Ground Water Over-exploitation committee was constituted by Agriculture Refinance and Development Corporation (ARDC) of Govt. of India. Based on the methodology and norms recommended by the above Committee, the ground water resources were assessed. Subsequently, the necessity was felt to refine the methodologies and the "Ground water Estimation Committee (GEC)" headed by the Chairman, CGWB came into existence. Based on the detailed surveys and studies by the various offices and projects of CGWB, the Committee recommended the revised methodology in 1984 (GEC-84) for estimation of ground water resources. Again in 1997 the Ground Water Estimation Committee reviewed the previous studies and work done in various states and suggested a modified methodology in 1997 (GEC'97) for computation of ground water resources. Accordingly, ground water estimation was carried out in the 2004 for the assessment period 1998-2002, in the year 2009 for the assessment period 2004-2008, in the year 2011 for the assessment period 2006-2010, the re- estimation as on 31.03.2013 has been carried out for the assessment period 2008-12. Government of India has constituted Ground Water Estimation Committee for revising the methodology GEC-1997. GEC, 2015 has revised GEC-97 and recommended various new approaches for integrated ground water resources estimation including Static ground water resources and ground water resources of saline aquifers. In the estimation done as on 31st March, 2022, the methodology recommended by GEC, 2015 has been adopted and resources have been calculated as per the revised norms recommended by GEC, 2015 for the assessment period 2012-16. Re-estimation of ground water resources as on 31.03.2020 has been carried out for the assessment period 2015-19. The present report embodies the ground water estimation as on 31st March, 2022.

1.3 CONSTITUTION OF STATE-LEVEL COMMITTEE FOR GROUND WATER RESOURCES ESTIMATION.

In an attempt to re-assess the ground water resources of all the blocks of the state based on GEC'2015 methodology by Central Ground Water Board and Irrigation and Water Resources Department, Government of Haryana, a committee for Estimation of Ground Water resources Potential & Refinement of Figures in the State, was constituted by the State Government.

The committee was formed on dated 08.10.2020 vide letter No. Estt. No. 2/72/2020-1IW (Annexure-1) and its constitution is as under:		
1)	Additional Chief Secretary to Govt. Haryana, Irrigation & Water Resorce Deptt.	Chairman
2)	Vice Chancellor, C.C.S. Haryana Agricultural University, Hisar	Member
3)	Director General Agriculture, Haryana	Member
4)	Managing Director, Haryana State Industrial & Infrastructure Development Corporation	Member
5)	Administrator, Command Area Development Authority, Haryana, Panchkula	Member
6)	Director, Rural Development Department, Haryana	Member
7)	Director, Industries and Mines & Geology Department, Haryana	Member
8)	Managing Director, Haryana State Cooperative Agricultural & Rural Development Bank Ltd.	Member
9)	Chairman, Haryana State Pollution Control Board	Member
10)	General Manager, NABARD, Chandigarh	Member
11)	Engineer-in-Chief, Irrigation Department, Haryana	Member
12)	Engineer-in-Chief, Public Health Engineering Department, Haryana	Member
13)	Director, HARSAC	Member
14)	Director, HIRMI, Kurukshetra	Member
15)	Member secretary, Haryana Ponds and Waste Water Management Authority	Member
16)	Cheif Hydrologist, ground Water cell	Member
17)	Regional Director, Central Ground Water Board, Mionistry of Jal Shakti, Govt. of India Chandigarh	Member Secretary

The committee may co-opt any other member (s)/ Special invitee(s) if necessary. The functions of the committee shall be as under: -

I. To estimate annual replenishable ground water resources of the State in accordance with the Ground Water Resource Estimation Methodology.

II. To estimate the status of utilization of annual replenishable ground water resource.

First meeting of the Committee was held on 27.05.2022 under the Chairmanship of Additional Chief Secretary, Irrigation and Water Resources and important issues regarding estimation of ground water resources of Haryana as on 31st March, 2022 were discussed. Various organizations for the data sources for estimation have been identified and nodal officers have been requested to submit the data required as per the data sheets circulated by CGWB. The minutes of Meeting are at Annexure-2

CHAPTER-2
HYDROGEOLOGICAL CONDITIONS OF THE STATE

2.1 DESCRIPTION OF ROCK TYPES WITH AREA COVERAGE

All the three major physiographic units viz. Peninsula, Extra-Peninsula and Indo- Gangetic areas, terminating in the hard rock formations of Delhi systems (Pre-Cambrian age) towards South, Shivalik system (Tertiary age) in the North and in between the alluvial formations (Recent to sub recent age) are observed in the state.

The general geological succession of the various units of the Peninsula and Indo- Gangetic plains traversing the Haryana state are given in table-1

Table 1 General Geological Succession in Haryana state

Age		**Formation**	**Lithology**
Quaternary	Recent	Newer alluvium	Aeolian deposits
			Wind Blown fine sand, silt, sand dunes
			Fluvial deposits, unconsolidated sand, silt, clay, boulder, gravel, kankar etc.
	Pleistocene	Older Alluvium	Fluvial deposits: unconsolidated gravel, sands, silts, clay, and kankar.
Tertiary	Middle Miocene -	Siwalik system	Sandstone, boulders, conglomerate, siltstone,
	Lower Pleistocene		
	Oligocene	Kasauli beds Sirmur series	Sandstone, Claystone, siltstone and purple shales.
	Eocene	Subathu beds,	Limestone, Shales
		Thunda Pathar Series	(Gypseous)
Post Delhi		Intrusive	Erinpura Granites
			Pegmatites quartz, veins and amphibolite
Pre-Cambrian	Delhi and Aravalli System		
i)	Ajabgarh series		Slates, phyllites, mica- schists, quartzites.
ii)	Horn stones & breccia		
iii)	Khushalgarh series		Lime Stone.
iv)	Alwar series		Quarzitic arkose grits conglomerates
			Limestones mica schists
			Contemporaneous volcanic rocks.

In the extra peninsular region (northern part of Panchkula district) Shivalik system (upper tertiary) and Sabathu series (lower tertiary) are exposed. Sabathu comprises of greenish grey and red gypseous shales with thin bands of sand stones and limestone. Shales and limestones are richly fossiliferrous. Shivalik system comprises of mainly graywackes, sandstones, grits, clays, siltstones, conglomerates and pseudo-conglomerates. These are fluviatile deposits and are rich in mammalian fossils.

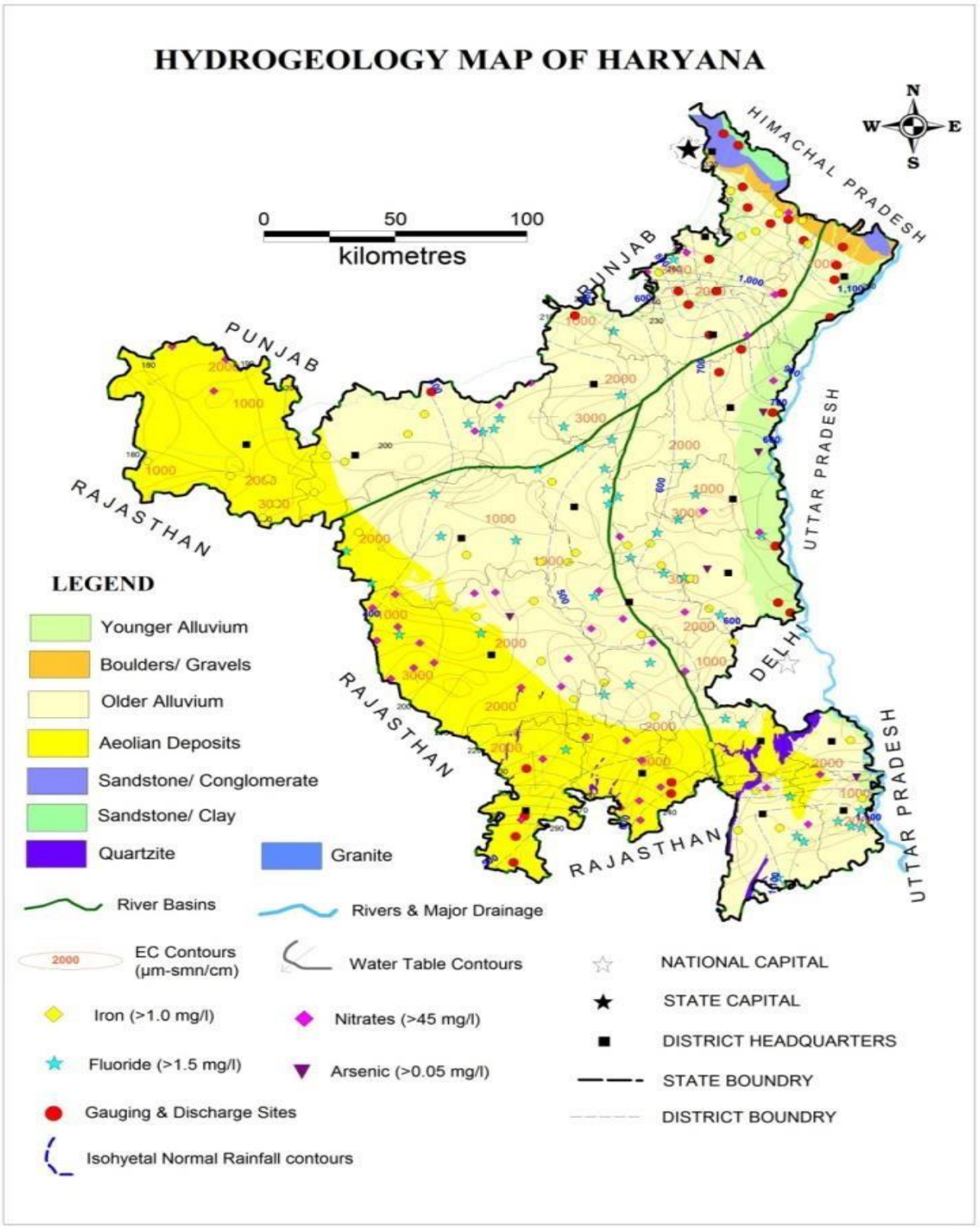


Figure 1 Hydrogeology Map of Haryana

The area in Ambala, Panchkula & Yamunanagar is underlain by the 'Kandı' (equivalent of Bhabar Belt in Uttaranchal), Sirowal (equivalent of Tarai belt in Uttaranchal) and the Alluvium. The Kandi belt which forms the upper higher portions of the composite fan deposits is 2 to 4 kms wide running more or less parallel to the Shivalik foothills. The sediments comprise boulders, pebbles, gravel and sand with clays mixed in varying proportions. Sirowal belt and the adjoining Gangetic plain on the south of the Kandi belt are underlain by silt, fine to medium sand and clays. Gravel and pebbles also occur occasionally.

The area in Gurgaon district is underlain by the rocks of Delhi system and by Quaternary alluvium. The Ajabgarh shales and quartzite form the basement in the western part of the area where the thickness of alluvium is very less.

In Hisar and Bhiwani districts, area is underlain by unconsolidated sediments of Quaternary age. The sediments comprise sand, silt clay and kankar. In Sonepat, Jind, Karnal and Kurukshetra districts the area is underlain by alluvial deposits of Quaternary age. Alluvium comprises clay, silt, and sands of various grades, kankar, gravel and pebbles. The alluvial deposits are generally lenticular in shape.

In Mahendragarh and part of Bhiwani districts, the following geological succession is encountered:

- Recent to Sub-Recent- Alluvium and wind-blown sands etc.
- Post Delhi intrusives-Pegmatites, quartz veins, granites etc.
- Algonkian Delhi system-Ajabgarh Series, Kushalgarh Limestone, Alwar Series.

The alluvium in the area belonging to the Older Alluvium comprises of sand, silt, clay loam and kankar. Newer alluvium is mainly confined to the sides of the river watercourses. The alluvium is the fresh water deposit of the Indo-Gangetic River system. The sub-aerial deposits are represented by the talus material on the hill slopes and wind-blown sands.

Rohtak district is underlain by alluvial deposits of Quaternary age. The alluvium overlies the rocks of Algonkian system outcrops of which are seen outside the district. The alluvium consists of clay, silt and various grades of sand. Winds blown sand occurring as sand dunes are often seen overlying the alluvium in various parts of the district.

The unconsolidated alluvial sediments cover around 98% of the state while hard rocks cover just around 2%. Alluvial deposits are of older and newer types and consist chiefly of clay, silt and fine to medium sand. Other deposits are piedmont deposits, which are confined to a narrow zone, about 2 to 4 kms wide, between Siwalik Hills and alluvial plains. Sand-dunes are found in the districts of Bhiwani, Mahendragarh, Hissar and Sirsa Coarse sand, gravels and boulders are found to occur in piedmont areas and in the adjacent alluvial tracts. These deposits have been developed in the north part of Ambala district.

The thickness of alluvial sediments is more than 600 meter and along Yamunanagar-Karnal stretch it is reported to be more than 3000 meters. However, the thickness of sediments progressively decreases towards Delhi and hard rock areas of Bhiwani, Gurgaon, Faridabad and Mahendragarh districts.

2.2 HYDROMETEOROLOGY- CLIMATE, RAINFALL DISTRIBUTION

2.2.1 CLIMATE

The climate of Haryana state is subtropical, semi-arid to sub-humid, continental and monsoon type. The major part of the state comes under the fertile Indo-Gangetic belt. Most of the year, the climate of Haryana is of a pronounced continental character, very hot in summer and markedly cold in winter. In between are the pleasant months of spring. Haryana is extremely hot in summer at around 45 °C and mild in winter. The hottest months are May and June and the coldest are December and January. The air over the entire state is dry during the greater part of the year. Humidity is high in the monsoon months. April and May are the driest months with relative humidity of about 30% in the morning and less than 20% in the afternoons. Winds are generally light during the post monsoon and winter months. They strengthen during the summer and monsoon months. Except during the monsoon months, winds are predominantly from a westerly or northwesterly direction and tend to be more northerly in the afternoon. Easterly and southeasterly winds are more common in the monsoon months. There are two seasons of rainfall in the state. The average rainfall varies from less than 300 mm in south-western parts to over 1000 mm in the hilly tracks of Shivalik hills (Table-2). The south-west monsoon season, the principal source of ground water sets in last week of June and withdraws towards end of September and contributes about 80% of annual average rainfall. Another period of rainfall is winter rain from December to March is about 20% of total rainfall which is mostly absorbed into the soil. More than 50% of the annual rainfall received in the four rainy months for June to September, only there by leading to large variations on temporal scale. Rainfall is highly variable in time and space. The Normal Rainfall for the State of Haryana is 614 mm, but it has great spatial variations.

Table 2 District wise Actual Annual Rainfall of Haryana State (2012, 2015, 2018, 2021)

S.No.	DISTRICT	Actual Rainfall (mm) 2012	Actual Rainfall (mm) 2015	Actual Rainfall (mm) 2018	Actual Rainfall (mm) 2021	NORMAL Rainfall (mm)
1	AMBALA	861	921	937	689	963
2	BHIWANI	397	328	373	533	428
3	CHARKHI DADRI	450	599	325	535	535
4	FARIDABAD	469	489	437	611	521
5	FATEHABAD	485	220	203	596	376
6	GURUGRAM	397	627	514	988	583
7	HISAR	419	371	294	518	415
8	JHAJJAR	313	521	482	929	442
9	JIND	390	472	479	698	529
10	KAITHAL	477	443	660	693	583
11	KARNAL	477	643	943	708	724
12	KURUKSHETRA	633	495	731	580	696
13	MAHENDRAGARH	468	400	442	715	502
14	MEWAT	497	499	431	697	572
15	PALWAL	496	435	391	572	508
16	PANCHKULA	981	1261	1216	959	1112
17	PANIPAT	432	610	542	697	615
18	REWARI	395	489	554	901	562
19	ROHTAK	316	501	459	860	601
20	SIRSA	396	311	229	388	320
21	SONIPAT	405	584	560	858	629
22	YAMUNA NAGAR	1024	1036	1236	1159	1109

2.2.2 RAINFALL ANALYSIS

The actual annual average rainfall over the state of Haryana is quite uneven. The annual rainfall of 2012, 2015, 2018 & 2021 of Haryana State when analyzed and compared to the normal rainfall, it is observed that out of all districts, maximum rainfall observed at Yamunanagar & Panchkula districts and minimum rainfall recorded at Sirsa & Fatehabad districts (fig.2). Overall, there is a continuously decline trend observed in actual annual rainfall for the state of Haryana (fig.3). During 2012 (-14%), 2014 (-33%), 2015 (-11%), 2016 (-27%), 2017 (-16%), 2018 (-6%), 2019 (-28%), 2020 (-14%) deficient rainfall observed and in 2013 (+6%) and 2021 (+22%) rainfall observed in the state (fig.4&5) and Table 3.

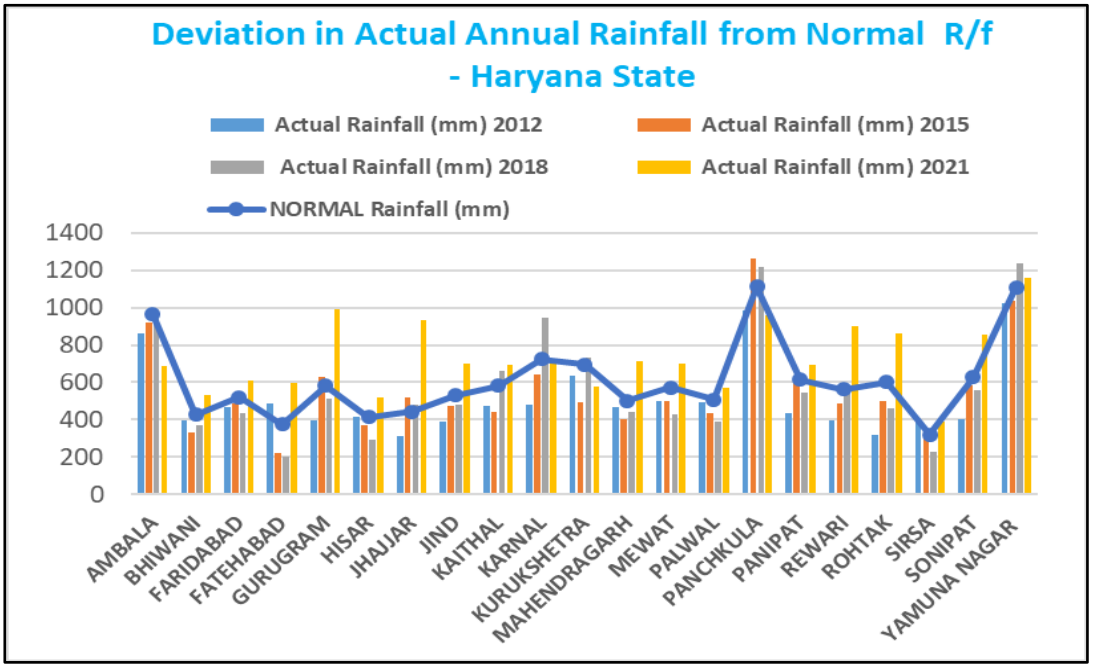


Figure 2 District wise deviation in actual annual rainfall of Haryana State

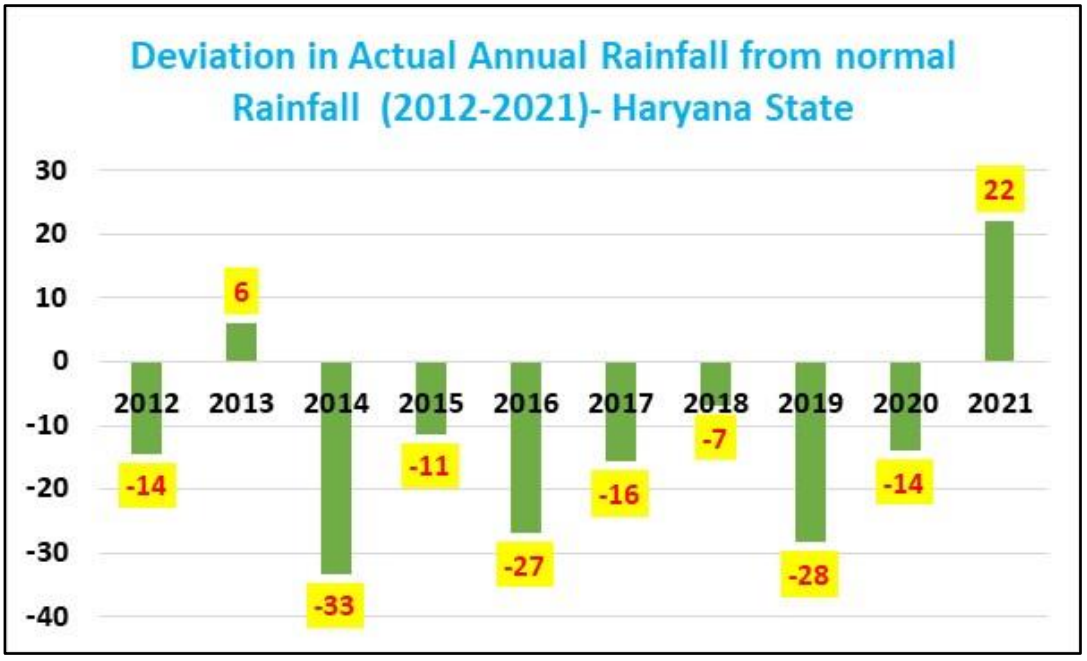


Figure 3 Deviation in actual annual rainfall of Haryana State (2012-2021)

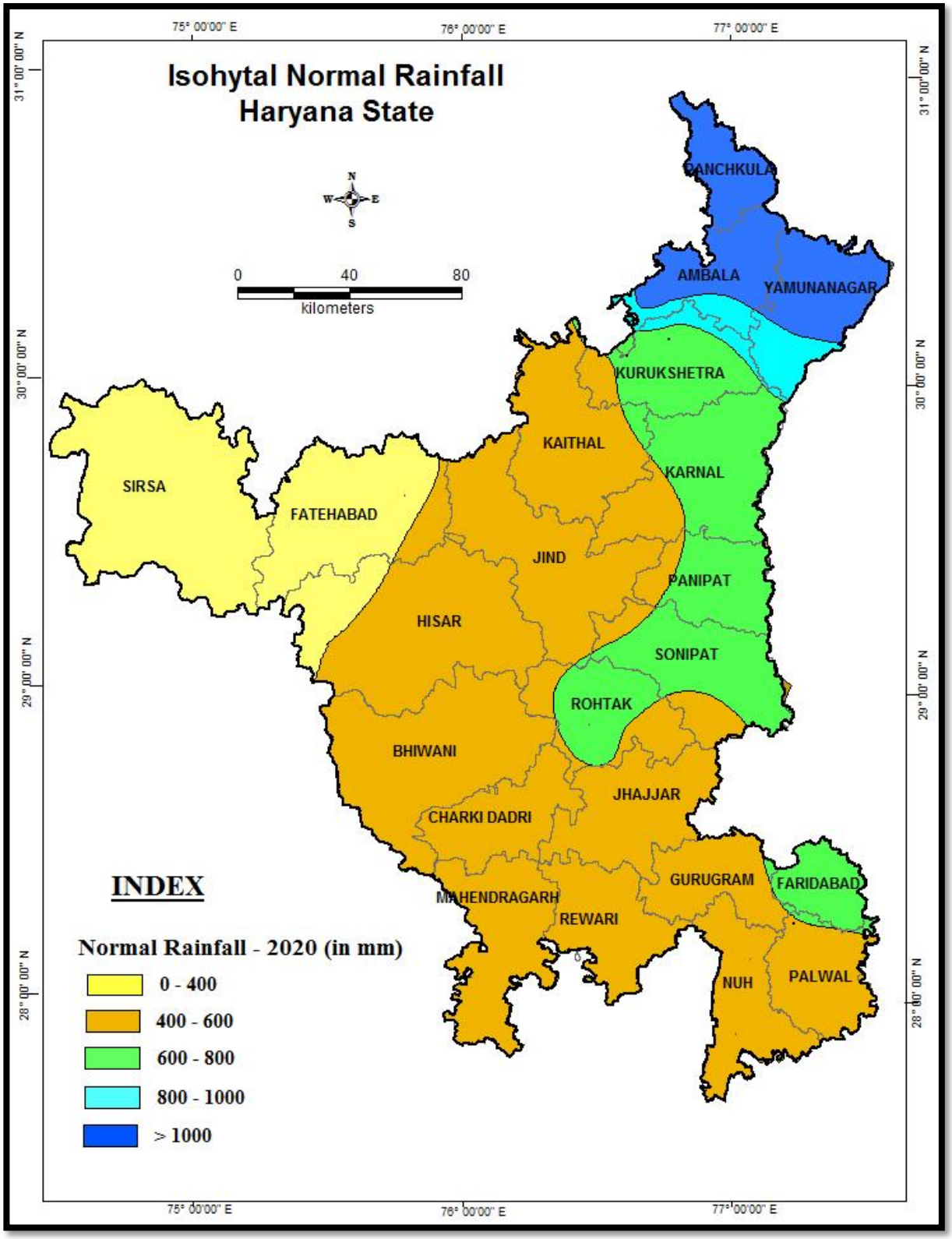


Figure 4 Isohyetal Normal Rainfall of Haryana State

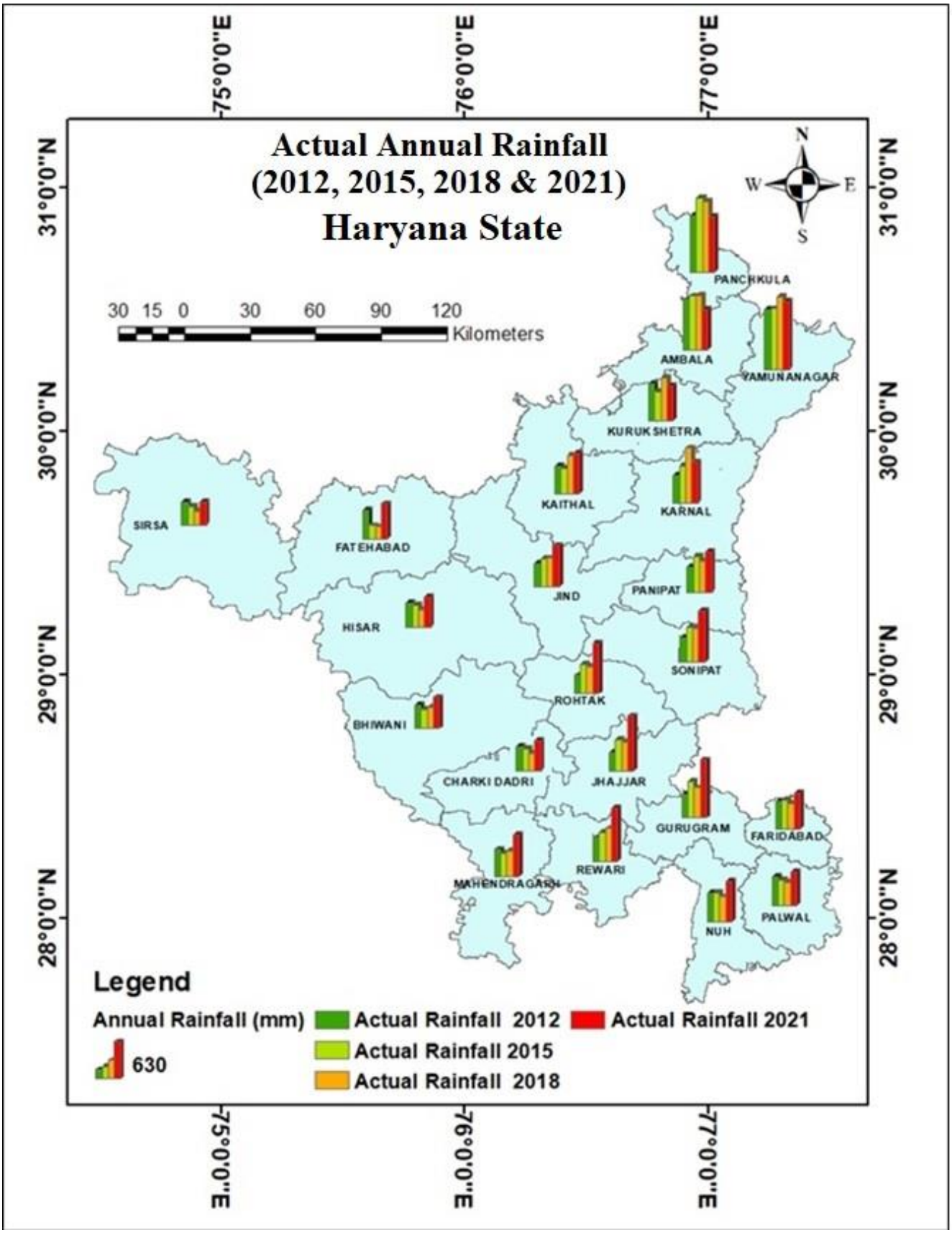


Figure 5 Actual Annual Rainfall of Haryana State (2012, 2015, 2018 & 2021)

Table 3 District-wise and month wise normal rainfall data (in mm)

S.No.	DISTRICT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1	AMBALA	38.9	31.6	25.3	7.7	20.5	105.2	307.8	326	177.6	34.4	8.8	20.9	**1104.7**
2	BHIWANI	14.6	10.4	8.1	5.5	11.2	32.3	128.2	132	56	13.4	4.2	3.6	**419.5**
3	CHARKHIDADRI	18.6	20.4	8.1	22.5	11.2	42.3	138.2	128	97	33.4	8.2	6.6	**534.5**
4	FARIDABAD	16.5	12.3	10.4	10.7	16.1	42.2	201.6	234.7	121.7	18.7	6	6.7	**697.6**
5	FATEHABAD	16.7	11	11.2	6.8	14.9	31.3	104.3	95.9	51.5	12.4	3.6	5	**364.6**
6	GURGAON	10.2	11.7	7	6.4	13.9	38	169	185.2	80.1	12.7	5.5	4.3	**544**
7	HISAR	11	12.2	9.7	7.4	14.5	35.1	118.8	113.8	57.4	13	4.5	4	**401.4**
8	JHAJJAR	12.4	12.5	9.7	7.5	10.6	34.4	159.3	151.2	72.4	11	3.4	4.6	**489**
9	JIND	16.4	18.7	12.4	5.4	14.9	40.7	142.3	147	85.6	15.8	5.1	4.8	**509.1**
10	KAITHAL	17.7	15.2	12.5	5.6	8.5	42.2	128.3	140.1	73.4	14.2	3.9	4.9	**466.5**
11	KARNAL	30.3	21.4	19.4	8.9	13.1	60.3	197.8	224.3	94.6	26.2	5.9	12.2	**714.4**
12	KURUKSHETRA	28.7	19.4	21.5	9.8	10.2	66.3	202.3	203.3	91.1	23.5	5.2	10.1	**691.4**
13	MAHENDRAGARH	11.8	10.9	9.4	5.3	18.9	43.5	154.3	144.4	53.2	14.1	3.5	6.9	**476.2**
14	MEWAT	9.4	9.6	6.3	5.2	9.8	41.3	167.2	194	99.3	20.7	4.1	5.1	**572**
15	PALWAL	9.1	7.9	5.9	4.3	7.7	28.1	160.4	171.8	86.6	20	3.1	3.2	**508.1**
16	PANCHKULA	43.6	37.4	27.8	11.5	27.9	105.6	327	346.6	171.2	18.7	12.2	18.7	**1148.2**
17	PANIPAT	20.6	15.8	12.6	9.5	9.9	55.1	176.2	203.9	86.5	21.8	4.7	7.5	**624.1**
18	REWARI	9.1	8.7	5.2	3	9.9	33.1	150.1	183.5	69.1	13.2	3.5	3.8	**492.2**
19	ROHTAK	19.3	16.8	17.7	9.3	19.8	49.5	194.1	195.8	68.6	13.4	5.8	7.9	**618**
20	SIRSA	11	11.6	10.1	5.5	12.1	23	99.8	81.7	37.6	13.4	4.9	2.8	**313.5**
21	SONEPAT	19.4	15.6	14.4	9.6	16.7	46.2	194.4	208.5	85.2	20.4	5.9	7.9	**644.2**
22	YAMUNANAGAR	42.5	34.9	31.9	15.1	26.4	117.8	304.4	325.4	144.5	36	6.8	21.3	**1107**

2.3 DESCRIPTION OF HYDROGEOLOGICAL UNITS, AQUIFER PARAMETERS.

On the basis of geohydrological conditions as well as groundwater movement and surface drainage pattern, the entire state is divided into the following basins:

1) Yamuna basin
   a) Upper
   b) Lower
2) Ghaggar Basin
   a) Upper
   b) Lower
3) Inland Alluvial Basin
4) Krishnawati Basin
5) Sahibi Basin
6) Landoha Nala Basin
7) Kanti Sub Basin (Loharu Satnali area)

Ground water occurs both under confined and unconfined conditions in the alluvial formation whereas it is mostly under un-confined conditions in Shivalik and piedmont deposits and semi-confined conditions in hard rocks. Broadly, three-aquifer groups down to the depth of 450 mbgl have been deciphered by Central Ground Water Board in the depth range of 40 to 167 mbgl, 65 to 294 mbgl and 197 to 383 mbgl in Ambala-Karnal-Panipat region. The studies carried out by Haryana State Minor Irrigation Tubewells Corporation (now closed) indicate that down to the depth of 120 mbgl in the upper reaches of Yamuna and Ghaggar basins covering Ambala, Karnal and Kurukshetra districts the percentage of sand is more than clay and silt. In these areas a number of clay layers of variable thickness are present, but only 2 to 3 are regionally extensive. The aquifers in these areas contain fresh quality water and derive supplies from Yamuna and Ghaggar Basins. South of district Karnal, sand content decreases and aquifers become thinner and quality of ground water also deteriorates to marginal and saline category. In rest of the districts of the state, below 60 m depth, clay invariably forms the major portion of alluvium. Aquifers in these districts, particularly in the saline areas, are mostly thin and pinch out at short distances, thus restricting the movement of ground water. In the clay predominant region (South of Karnal district) Kankar (nodules of $CaCO_3$ of secondary origin) is mixed with clay and also occasionally present in the sand layers. Kankar layers are distinctly present at different depth ranges in Bhiwani, Faridabad and Sirsa districts. This is considered to be a characteristic of older alluvium and is mostly associated with saline ground water regime. The aquifer parameters for the different aquifer groups are given in table-4.

Table 4 Aquifer Parameters for different Aquifer Groups

Aquifer Group	Depth Range (m bgl)	Transmissivity (m^2/day)	Hydraulic Conductivity (m/day)	Storativity	Yield (m^3/hr)
I	40 to 167	800- 5210	8.75 – 47.10	--	
II	65 to 294	350– 1050	3.95 – 10.70	$5.60 *10^{-4}$ to $1.90*10^{-3}$	--
III	197 to 383	345- 830	3.50 – 10.70	$6.60*10^{-4}$ to $2.40*10^{-4}$	5 – 50

2.4 GROUND WATER LEVELS CONDITIONS

The behaviour of water level in two seasons June 2021and October 2021along with maps (fig. 6 & fig. 7) is given. The maximum and minimum water levels recorded in four seasons is given below Table 5.

Table 5 Range of depth to water levels during the period

Range	June 2021	October 2021
Minimum	0.40 mbgl Rindhana, Sonepat district	0.02mbgl Nidhana, Rohtak district
Maximum	112.80 mbgl Nihalawas, Mahendragarh distt	113.00 mbgl Nihalawas, Mahendragarh distt

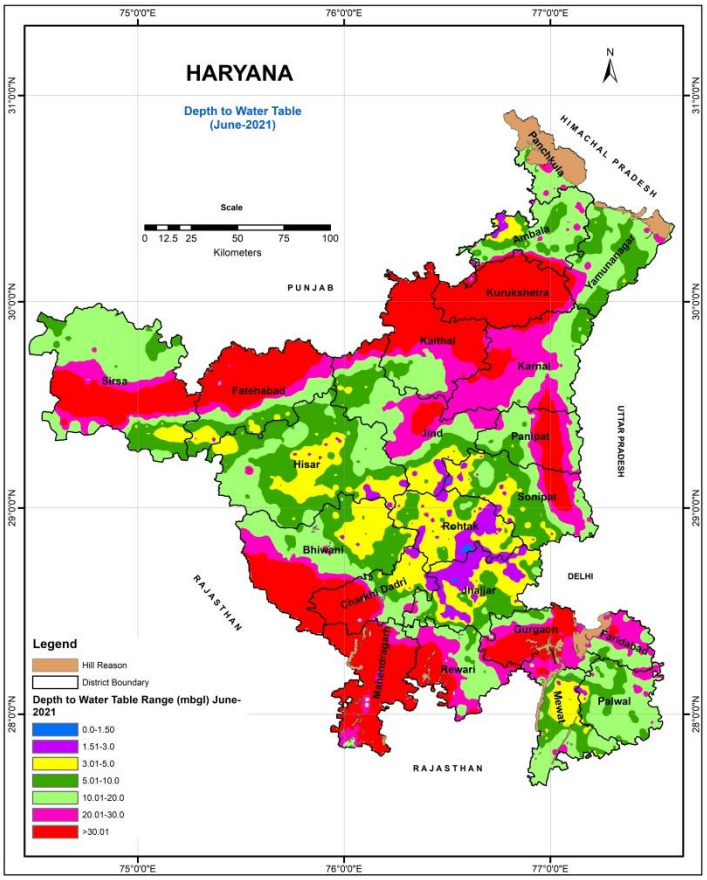


Figure 6 Depth to Water Level Map Haryana State June 2021

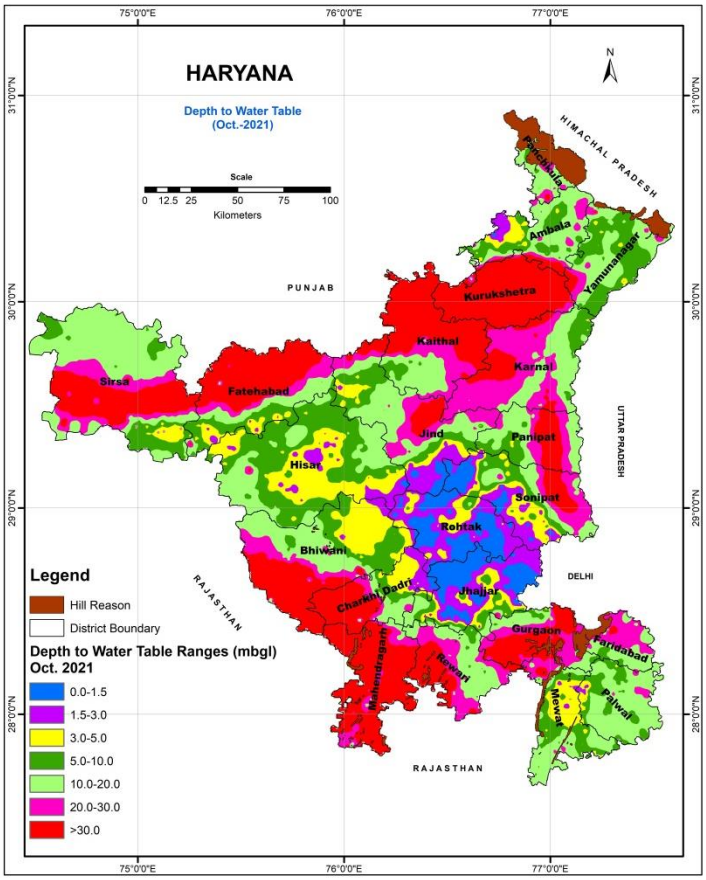


Figure 7 Depth to Water Level Map Haryana State October 2021

2.5 GROUND WATER QUALITY

Character of ground water quality is dependent on geological characteristics and climatic conditions. It is further influenced and generally degraded by human activities. Indiscriminate extraction of groundwater for day to day uses, application of fertilizers in agriculture and unscientific disposal of industrial waste has great impact on ground water quality. The quality of ground water is normally ascertained through concentration values of number of physical, chemical and biological parameters present in it. Concentration of these parameters affects its acceptability and usefulness for domestic, agriculture, industrial and other purposes. It is, therefore, essential to know the chemical composition of ground water to determine its suitability for the intended use. Knowledge of quality of ground water not only helps in finding its suitability for various purposes, but it also helps in taking effective remedial measures for its improvement on scientific lines. In rural as well as in urban area of Haryana State, ground water is a major resource for drinking and other uses. Wherever surface water is inadequate or unavailable, ground water is exploited for drinking and irrigation purposes.

In the backdrop of various uses of ground water, its quality is monitored annually by CGWB, NWR Chandigarh through dedicated ground water monitoring stations (GWMS) of dug wells and/or hand pumps of shallow depth. The water sampling location map is given in fig. 8.

During June 2021, 466 number of ground water samples were collected from these structures spread uniformly over 22 districts of Haryana and no specific treatment such as acidification or filtration was given at the time of sampling. The water samples were analyzed for major cations (Ca, Mg, Na, K) and anions (CO_3, HCO_3, Cl, NO_3, SO_4) in addition to pH, EC, F, SiO_2, PO_4 and TH as $CaCO_3$ in Regional Chemical Laboratory of CGWB, NWR Chandigarh by following 'Standard analytical procedures' as given in American Public Health Agency (APHA) 23rd Edition 2017 and Bureau Indian Standards (BIS).

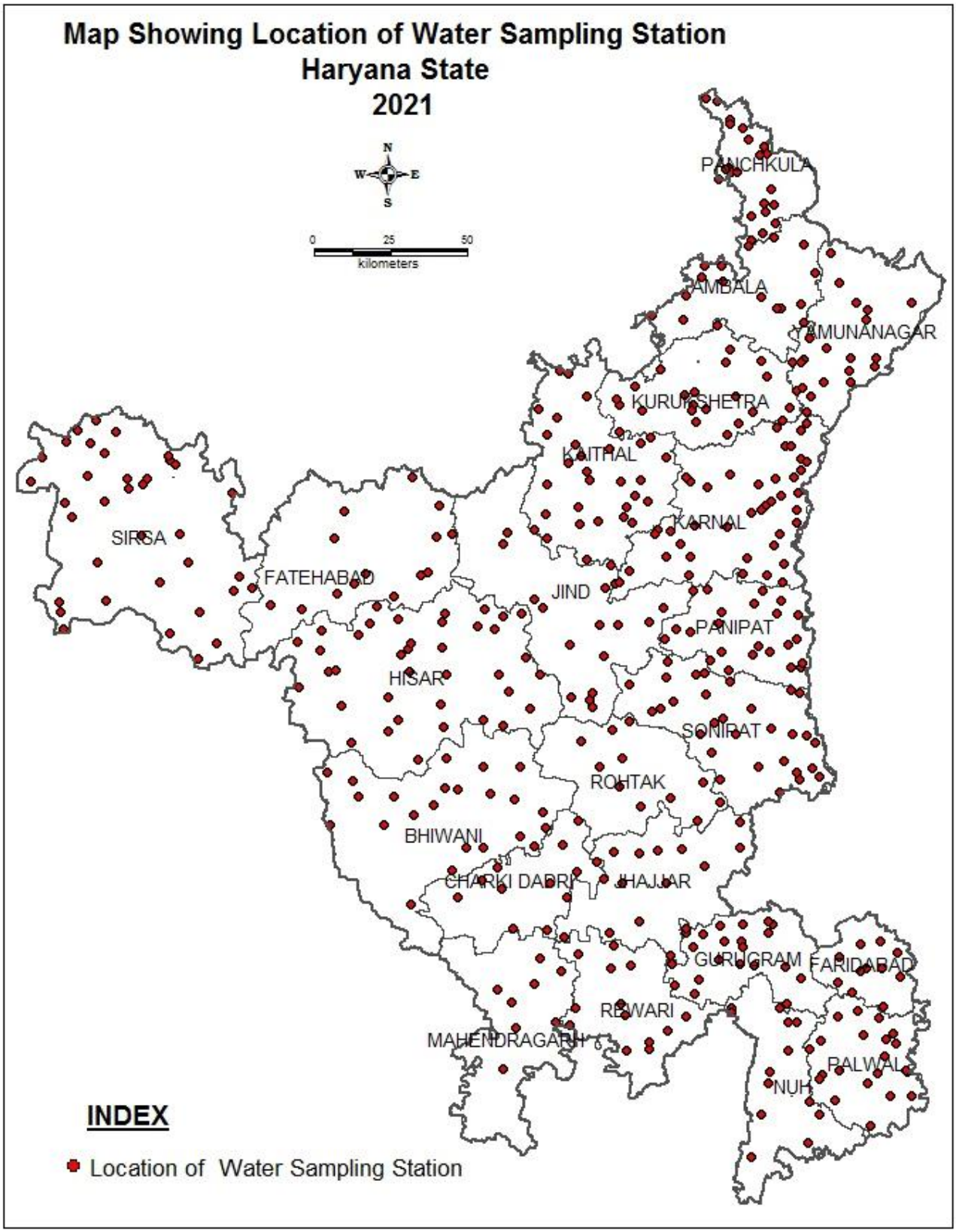


Figure 8 Map Showing the Sampling point of Haryana state

2.5.1 COMPOSITION OF WATERS

Chemical analysis shows that the ground water is moderately alkaline in nature. The pH values range from 7.46 at Nagina in Mewat district to 8.96 at Jhumpa Kalan in Bhiwani district. Salinity of ground water is measured in terms of EC. The ground water is found to have low to very high salt content as the EC of well water ranges from 99 µS/cm at Kami in Sonipat district to 24060 µS/cm at Nagina in Mewat district. Hardness reported in terms of $CaCO_3$ ranges from 33 mg/L at different locations in Sonipat, Karnal and Kaithal districts to 3814 mg/L Nagina in Mewat district. The concentration of calcium ranges between 4 mg/L and 601 mg/L. Magnesium concentration ranges between 2.5 mg/L at Meoka in Gurgaon district and 709 mg/L at Nagina in Mewat district. About 88% samples of ground water contain calcium below 100 mg/L. Calcium is very low in some districts, though it is very essential element for drinking and irrigation purposes. However, magnesium is less than the desirable limit of 30 mg/L in 32% samples and about 45% of samples falls in the range of 31-100 mg/L i.e. desirable limit as per BIS 10500:2012 for drinking water. 23% of samples are having Magnesium concentration above permissible limit of 100 mg/L as per BIS 10500:2012 for drinking water. In about 49% of the total samples, Ca+Mg are the dominant cations having concentration more than 50% of the total cations in the particular sample.

Sodium is the dominant cation in the majority of ground waters except for the samples in the districts of Ambala, Karnal, Kurukshetra, Panchkula, Yamunanagar its concentration varies widely from 4.0 mg/L at different places in Kaithal and Karnal districts to 3678 mg/L at Nagina in the Mewat district. Sodium concentration is less than 100 mg/L in less than half of well (38%) waters under consideration. Potassium is found to be present in low concentration except in some samples where its concentration is even more than 100 mg/L. In 71% of the samples analyzed, the potassium content is less than 10 mg/L. It ranges from less than 1.0 mg/L at various locations to 520 mg/L at Kot in Palwal district. High concentration of potassium (>100mg/L) is found in about 5% samples. Its higher concentration indicates contamination of ground water from various point (industry, sewage) as well as non-point sources (agriculture).

Carbonate is found in a few samples and it varies from 0 mg/L at various locations to 281 mg/L at Kosli in Rewari district. Bicarbonate is the dominant anion and it ranges from 32 mg/L at Guriani in Rewari district to 1063 mg/L at Kosli in Rewari district. The Chloride concentration in ground water varies between 7.0 mg/L at Sabapur in the Yamunanagar district and 5388 mg/L at Luhingi Kalan in Mewat district. The Sulphate (SO_4) content in ground waters was found to be BDL at several places in the State. The highest value of 4430 mg/L of Sulphate has been observed at Nagina in Mewat district. In 65% ground water samples the concentration of sulphate is below 200 mg/L. Nitrate, an indicator of domestic, agricultural and industrial contamination, is found in significant number of samples. Its concentration in groundwater ranges from less 0.20 mg/L at several places to 502 mg/L at Dhansu in Hisar district. The fluoride (F) content in ground water of the State is generally less than 1.0 mg/L (74%). It ranges from less than 0.05 mg/L at several places in the State to 15.2 mg/L at Pataudi in Bhiwani district. Phosphate concentration in sampled ground waters is <0.10 mg/L except for the two samples viz. Halley Mandi in Gurgaon district and Chimnawas in Rewari district, while Silica concentration, measured as SiO_2, ranges between 4.00 to 45 mg/L.

The district-wise concentration range of various chemical components in ground water is depicted in Table 6.

Table 6 Range of Chemical Constituents in Groundwater of Haryana State

S. No.	District	No. of Samples	Conc.	pH	EC in µS/cm	CO_3	HCO_3	Cl	SO_4	NO_3	F	PO_4	Ca	Mg	Na	K	SiO_2	TH as $CaCO_3$	SAR	RSC in meq/L
			Range		at 25^0C	(<---------- mg/L ----------)														
1	Ambala	15	Min	8.18	350	0	134	21	0	0	0.12	0	8.4	20	10	0.8	8	126	0.00	-0.98
			Max	8.79	2805	108	622	305	581	55	0.57	0	59	82	486	11	34	441	11.91	2.47
2	Bhiwani	34	Min	7.63	301	0	98	13	0	0	0.16	0	13	2.7	4.9	0	9	88	0.12	-36.43
			Max	8.96	7715	96	782	1892	1304	181	15.2	0	351	344	1037	185	45	1984	28.42	10.99
3	Faridabad	10	Min	7.93	790	0	63	142	19	0	0.04	0	13	48	73	1.6	10	252	1.84	-22.23
			Max	8.84	5674	124	571	1687	306	148	2.76	0	176	210	714	154	31	1216	14.66	7.17
4	Fatehabad	13	Min	8.05	321	0	84	13	0	0.25	0.22	0	18	11	10	2	11	153	0.33	-38.85
			Max	8.75	6929	96	391	1266	1424	107	3.59	0	334	306	634	40	24	2093	8.81	2.50
5	Gurugram	25	Min	7.76	268	0	79	20	0	0	0.11	0	8.3	2.5	5.7	0.8	9	82	0.21	-57.96
			Max	8.92	8612	156	913	2505	729	31	2.61	0.11	438	471	761	60	31	3031	17.47	14.63
6	Hissar	38	Min	7.57	282	0	56	20	0	0	0.11	0	13	2.7	4.5	1.7	14	99	0.15	-52.90
			Max	8.9	11150	164	727	2737	1573	502	13.9	0	354	666	1589	175	29	3014	14.77	8.43
7	Jhajjar	14	Min	7.76	267	0	139	13	0	0	0.2	0	13	13	9	0.7	6	109	0.32	-29.66
			Max	8.92	4557	151	741	993	631	194	10.7	0	258	232	471	415	17	1578	11.37	3.38
8	Jind	19	Min	7.87	513	0	84	33	0	3.6	0.19	0	8.8	17	34	4	7	109	0.59	-60.60
			Max	8.87	8374	170	950	1077	2631	312	13.9	0	601	421	758	514	15	3100	24.25	19.19
9	Kaithal	29	Min	8.09	230	0	70	13	0	0	0.05	0	4.4	5.3	4	0.8	10	33	0.00	-29.66
			Max	8.91	5502	120	461	1260	968	63	2.81	0	197	320	779	178	34	1622	18.47	7.59
10	Karnal	41	Min	7.91	295	0	70	13	0	0	0.1	0	8.8	2.7	4	0.5	8	33	0.00	-15.86
			Max	8.88	2705	120	629	306	729	60	1.09	0	158	146	281	18	32	942	11.99	5.17
11	Kurukshetra	23	Min	8.11	349	0	98	13	0	0.08	0.19	0	13	5.3	32	0.8	9	66	0.86	-1.40
			Max	8.89	970	68	390	67	108	32	1.12	0	96	48	132	13	21	330	4.88	4.22
12	Mahendragarh	8	Min	8.34	535	31	48	14	0	4.80	0.34	0	8	15	53	0.8	10	82	1.65	-12.49
			Max	8.94	4546	140	508	1347	292	29	4.68	0	99	125	780	11	32	742	15.09	11.35

S. No.	District	No. of Samples	Conc.	pH	EC in µS/cm	CO_3	HCO_3	Cl	SO_4	NO_3	F	PO_4	Ca	Mg	Na	K	SiO_2	TH as $CaCO_3$	SAR	RSC in meq/L
13	Mewat	11	Min	7.46	308	0	63	21	0	3.5	0.05	0	12	19.0	15	1.2	9	120	0.60	-71.02
			Max	8.89	24060	94	539	5388	4430	228	0.91	0	537	709	3678	92	39	3814	26.62	0.20
14	Palwal	23	Min	8.26	915	0	111	71	0	3	0.12	0	8	15	97	2.5	9	130	2.67	-29.08
			Max	8.92	7331	172	713	2084	687	159	3.28	0	72	350	960	520	34	1611	16.93	10.32
15	Panchkula	25	Min	8.06	268	0	48	14	0	0	0.05	0	4	7.3	15	1	10	50	0.62	-1.84
			Max	8.91	1430	109	286	156	109	185	1.14	0	39	61	190	4	24	300	11.07	5.76
16	Panipat	22	Min	7.95	396	0	127	13	0	0	0.21	0	8	10	40	2	5.00	62	1.10	-23.12
			Max	8.90	4367	250	910	1226	508	141	6.41	0	116	255	1050	142	18	1340	50.01	21.58
17	Rewari	13	Min	8.51	818	47	32	57	0	5.1	0.29	0	8.3	10	140	0.4	9	72	4.35	-12.23
			Max	8.94	4161	281	1063	794	846	28	8.16	0.16	91	143	864	4.5	28	742	24.97	22.25
18	Rohtak	11	Min	8.15	891	0	222	35	0	0.7	0.11	0	17	13	68	3.2	0	93	1.66	-47.99
			Max	8.85	10980	82	412	2772	2386	128	5.92	0	70	594	1420	304	32	2619	17.04	6.99
19	Sirsa	37	Min	7.93	272	0	56	13	0	0	0.25	0	8.80	8.0	4.1	0.9	14	88	0.14	-56.46
			Max	8.95	11280	192	838	2292	1974	401	5.02	0	285	586	1264	160	30	3123	25.04	14.24
20	Sonipat	35	Min	7.71	99	0	48	14	0	0	0.04	0	4.4	5.3	7	0.3	4	33	0.24	-24.84
			Max	8.82	6310	109	666	1106	1124	175	2.80	0	158	266	992	197	14	1490	13.67	8.99
21	Yamunanagar	20	Min	8.41	245	16	48	7.09	0	0	0.14	0	8	12.0	7	1.3	9	90	0.28	-2.42
			Max	8.83	1015	62	238	177	239	28	0.76	0	32	54	132	21	19	290	3.87	3.46

2.5.2 DISTRIBUTION OF ELECTRICAL CONDUCTANCE (EC)

The EC value of ground waters in the State varies from 99 to 24060 µS/cm at 25°C. Grouping water samples based on EC values, it is found that 31.55 % of them have EC less than 750 µS/cm, 46.57 % have between 750 and 3000 µS/cm and the remaining 21.89 % of the samples have EC above 3000µS/cm (Table 7). The map showing aerial distribution of EC with intervals corresponding to limits assigned for desirable, permissible and unsuitable classes of waters indicates that desirable class of waters occur throughout the state in patches but in high proportion is in northern and central parts of the State. The ground water occurring in the southern, western and central parts comprising of Sirsa, Fatehabad, Hisar, Jind, Jhajjar, Bhiwani, Mewat, Mahendragarh, Rewari and Faridabad districts is mostly saline and is not suitable for drinking purpose in terms of Electrical Conductance (fig. 9).

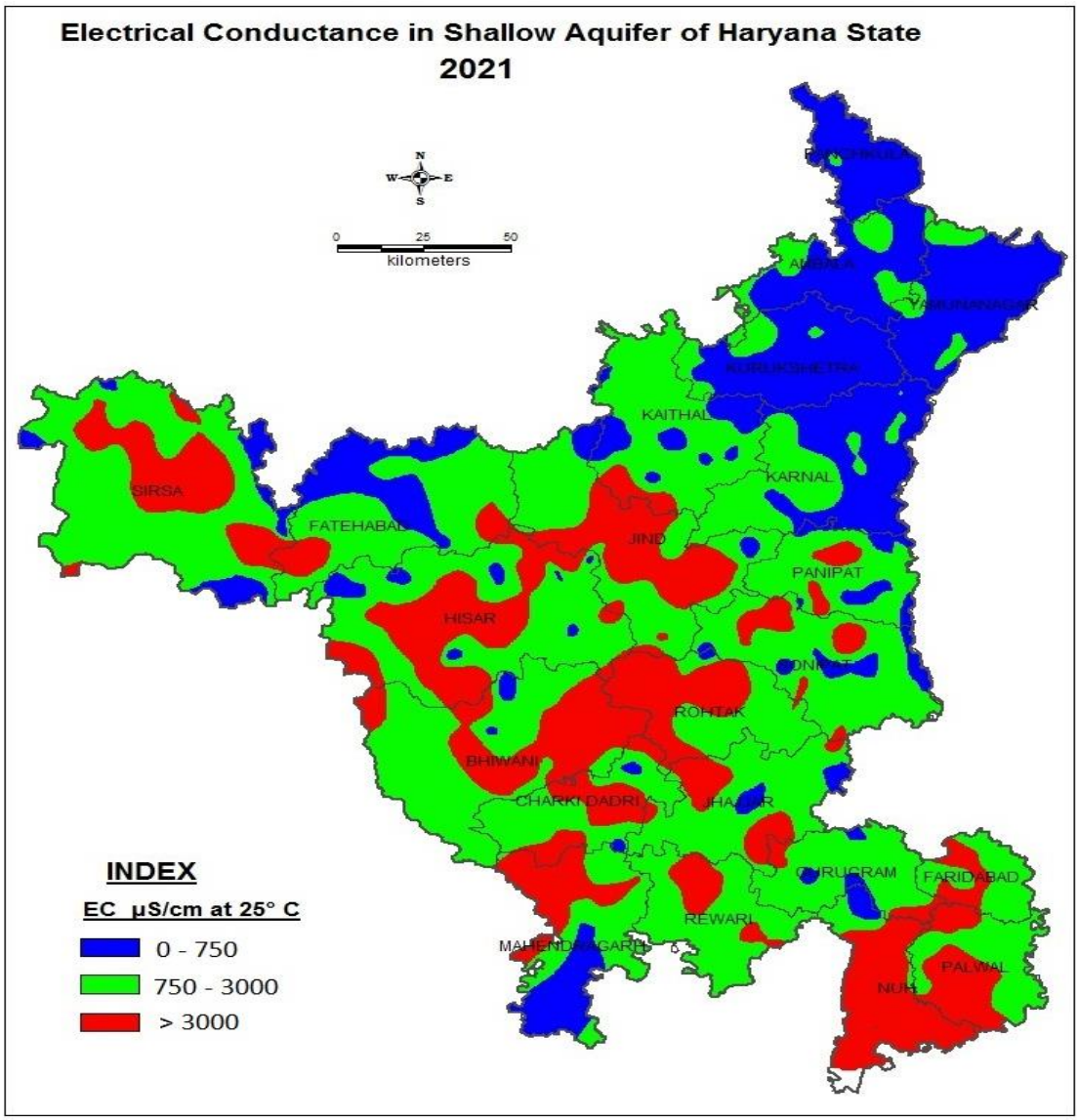


Figure 9 Distribution of Electrical Conductance (EC).

Table 7 District wise distribution of Electrical Conductivity in shallow Ground water of Haryana State

E.C. <750 µS/cm	**E.C. 750-3000 µS/cm**	**E.C.>3000 µS/cm**
Ambala	Ambala	Bhiwani
Bhiwani	Bhiwani	Fatehabad
Fatehabad	Fatehabad	Faridabad
Gurugram	Faridabad	Gurugram
Hisar	Gurugram	Hisar
Jhajjar	Hisar	Jhajjar
Jind	Jhajjar	Jind
Kaithal	Jind	Kaithal
Karnal	Kaithal	Karnal
Kurukshetra	Karnal	Mahendragarh
Mahendragarh	Kurukshetra	Mewat
Mewat	Mahendragarh	Palwal
Panchkula	Mewat	Panipat
Panipat	Palwal	Rewari
Rohtak	Panchkula	Rohtak
Sirsa	Panipat	Sirsa
Sonipat	Rewari	Sonipat
Yamunanagar	Rohtak	
	Sirsa	
	Sonipat	

2.5.3 DISTRIBUTION OF CHLORIDE

Chloride content of ground water normally follows the distribution pattern of EC and it ranges from 7.00 mg/L to 5034 mg/L in the entire State. Chloride concentration above 400 mg/L gives salty taste to water and based on these aesthetic considerations, BIS has recommended a desirable limit of 250 mg/L for chloride in drinking water. This limit can be extended to 1000 mg/L in case of absence of a source with desirable concentration. Grouping of samples in these categories based on chloride content, it is found that Chloride is less than 250 mg/L in 66.75 % of the samples, between 250 and 1000 mg/L in 25.96 % samples and only 7.82 % of the samples are found to have Chloride above 1000 mg/L. Map showing spatial distribution of Cl contents in ground water (Fig 3) indicates that Cl is below 250 mg/L in most of the districts, it is between 250 and 1000 mg/L in Sirsa, Bhiwani, Hisar, Fatehabad, Mahendragarh, Mewat, Palwal and Faridabad districts. Cl is more than 1000 mg/L in isolated places in Sirsa, Hisar, Bhiwani, Mahendragarh, Mewat, Jhajjar and Rohtak district (fig. 10).

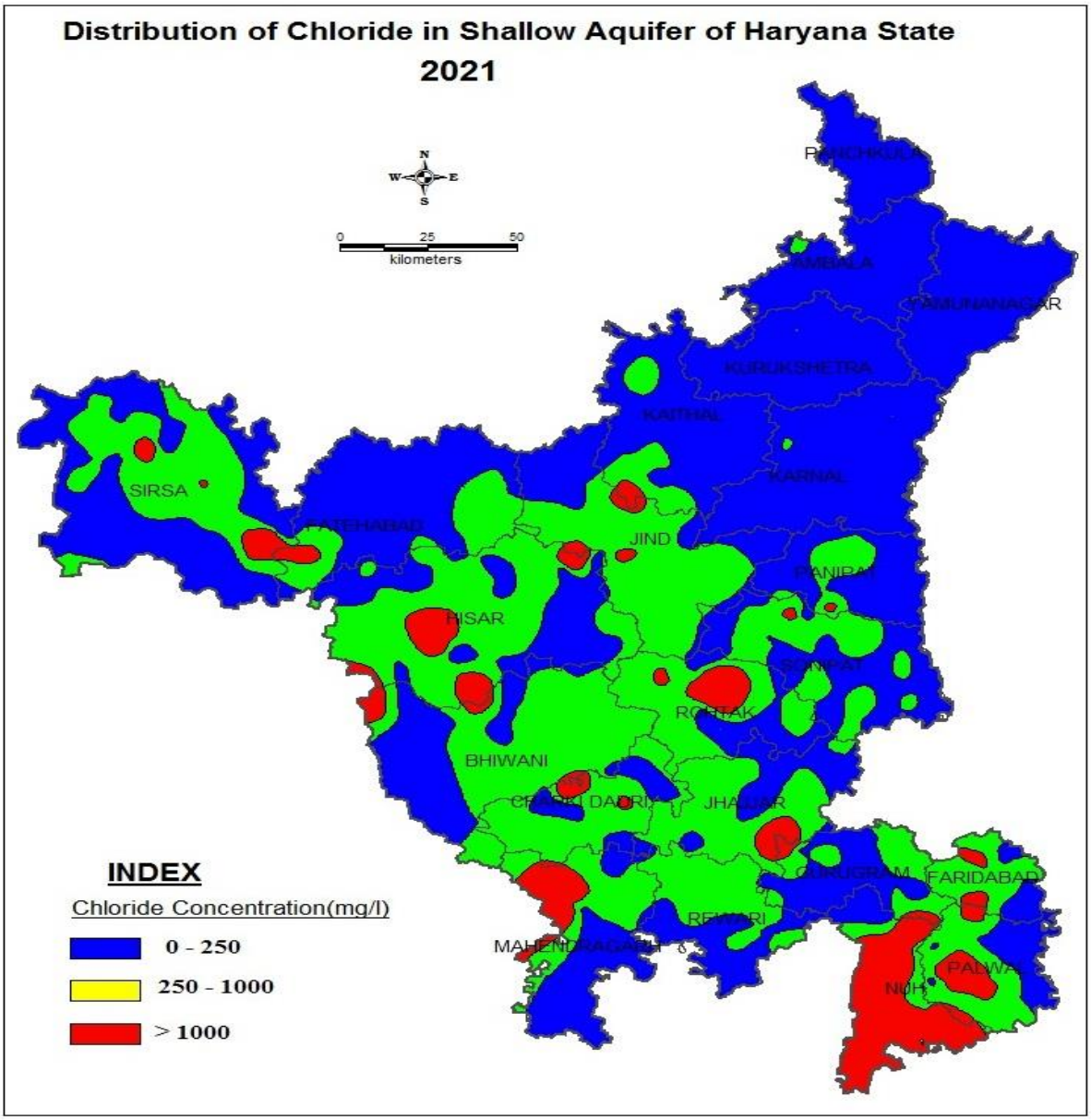


Figure 10 Distribution of Chloride in Haryana (2021).

2.5.4 DISTRIBUTION OF NITRATE

Occurrence of nitrate in ground water above 5.0 mg/L reflects contamination at some stage of its percolation and circulation. The probable sources of nitrate contamination of ground water are through excessive application of fertilizers, bacterial nitrification of organic nitrogen, and seepage from animal and human wastes and atmospheric inputs. In the State, nitrate in ground water samples varies from BDL i.e. less than 0.20 mg/L to 502 mg/L. BIS permits a maximum concentration of 45 mg/L nitrate in drinking water. Considering this limit, it is found that 81.90 % of the samples, spread over the entire State, have nitrate below 45 and 18.10 % have more than 45 mg/L. Spatial distribution of nitrate indicates that ground water with permissible nitrate content generally occurs in the northern, central and some pockets in southern part of the state. A

considerable area of the western and some parts of southern state have nitrate concentration exceeding 45 mg/L (fig. 11) Furthermore, quite a significant number water samples from Hisar, Sirsa, Mewat, Palwal, Rohtak, and Bhiwani found to have nitrate above 45 mg/L

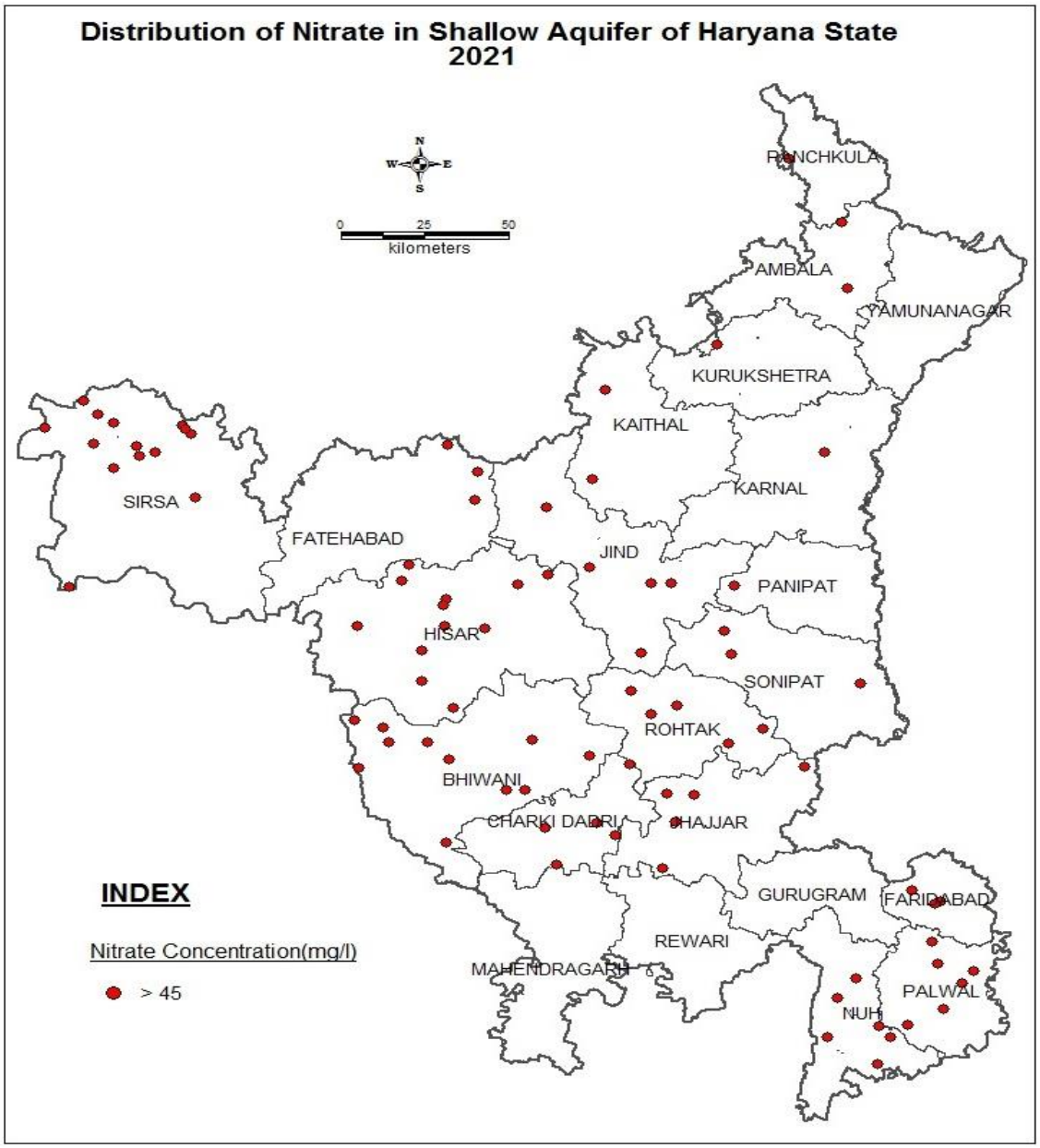


Figure 11 Distribution of Nitrate in Haryana (2021)

Table 8 District wise distribution of Nitrate in shallow Ground water of Haryana State

Nitrate <45mg/L	**Nitrate >45mg/L**	**Nitrate >45mg/L**	**Nitrate >45mg/L**
Ambala	Bhiwani	Palwal	Mahendragarh
Bhiwani	Fatehabad	Panchkula	Mewat
Fatehabad	Faridabad	Panipat	Mewat

Nitrate <45mg/L	Nitrate >45mg/L	Nitrate >45mg/L	Nitrate >45mg/L
Faridabad	Gurugram	Rewari	Palwal
Gurugram	Hisar	Rohtak	Rohtak
Hisar	Jhajjar	Sirsa	Sirsa
Jhajjar	Jind	Sonipat	Sonipat
Jind	Kaithal	Yamunanagar	Kurukshetra
Kaithal	Karnal	Panchkula	Mahendragarh
Karnal	Kurukshetra	Panipat	Rewari

2.5.5 DISTRIBUTION OF FLUORIDE

Fluoride in small amounts in drinking water is beneficial for the dental health while in large amounts it is injurious. The fluoride content in ground water ranges from <0.05 to 15.2 mg/L. BIS recommends that fluoride concentration up to 1.0 mg/L in drinking water is desirable, up to 1.50 mg/L is permitted and above 1.50 mg/L is injurious. Classification of samples based on this recommendation, it is found that 74 % samples have fluoride in desirable range, 7.51 % in the permissible and the remaining 18.45 % have fluoride above 1.50 mg/L. Map showing spatial distribution of fluoride contents in ground water indicates that ground water in most parts of the State has desirable concentration of fluoride. Ground waters with fluoride above 1.50 mg/L are found mainly in Jind, Sirsa, Fatehabad, Hisar, Bhiwani, Panipat, Rewari and Jhajjar districts of the State. It is worth mentioning that high fluoride waters are encountered in areas where high salinity is encountered and extensive agriculture activities are predominant. Extensive use of phosphatic fertilizers, which have fluoride as impurity can be the potential source of the fluoride while geogenic sources also play important role in fluoride concentration in the ground water (fig. 12).

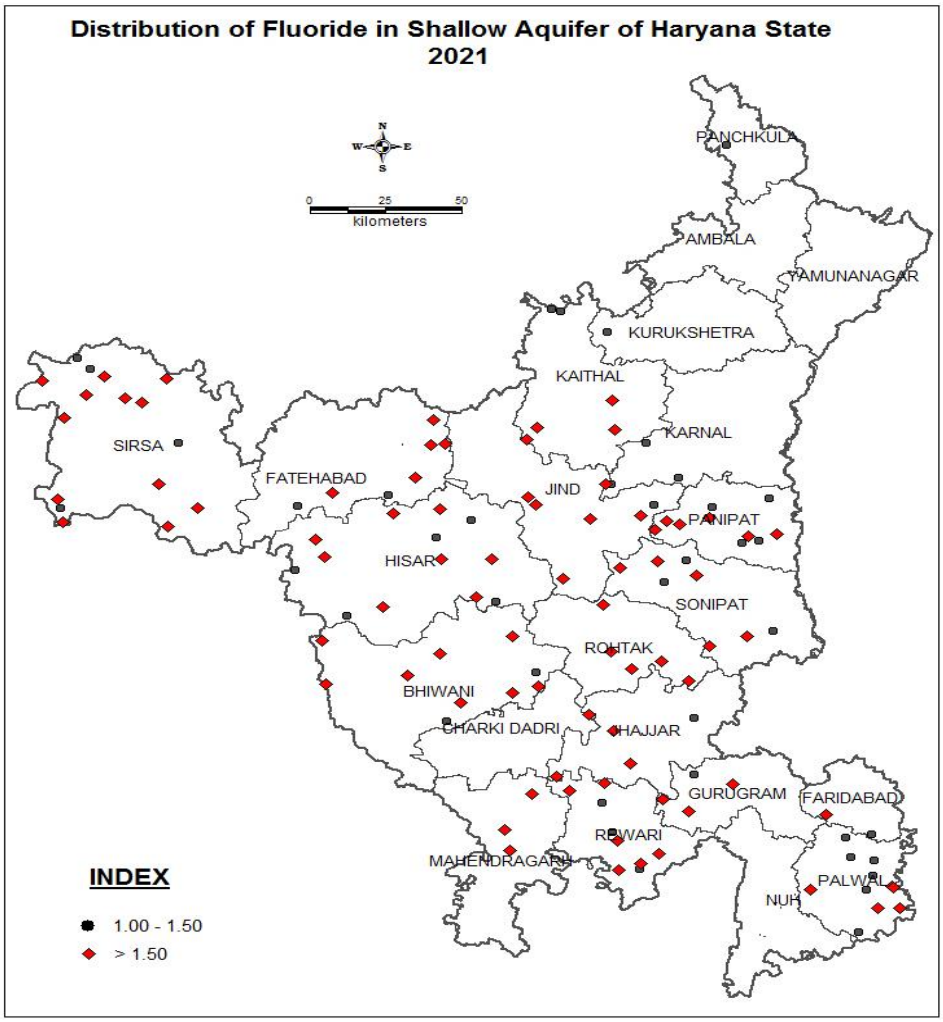


Figure 12 Fluoride Concentration in Ground Water in Haryana State (May 2021).

Table 9 District wise distribution of Fluoride in shallow Ground water of Haryana State

Fluoride <1.00mg/L	**Fluoride 1.01-1.50mg/L**	**Fluoride >1.50mg/L**
Ambala	Bhiwani	Ambala
Bhiwani	Fatehabad	Bhiwani
Fatehabad	Gurugram	Fatehabad
Faridabad	Hisar	Faridabad
Gurugram	Jhajjar	Hisar
Hisar	Jind	Jhajjar
Jhajjar	Kaithal	Jind
Jind	Karnal	Kaithal
Kaithal	Palwal	Karnal
Karnal	Panchkula	Mahendragarh
Kurukshetra	Panipat	Mewat
Mahendragarh	Rewari	Palwal
Mewat	Rohtak	Panipat
Palwal	Sirsa	Rewari
Panchkula	Sonipat	Sirsa
Panipat	Rewari	Rohtak
Sirsa	Sonipat	Yamunanagar

2.5.6 TYPES OF WATERS

Considering the predominance of the cation and anion in the chemical composition of ground water, its type is determined and its relation with its occurrence in an area as well as with its salinity is studied. It is found that no discernible relationship between type of water and its occurrence in any particular area could be established. Nearly all types of waters are available in each district of the State. However, study of salinity of the water clearly indicates that nearly 77% ground waters of the State are fresh i.e. electrical conductivity less than 3000 and predominance of calcium or magnesium or calcium + magnesium cations and bicarbonate as anion. Ground waters having intermediate salinity are mostly mixed cation type - HCO_3 type. At some places HCO_3-type of waters with sodium as dominant cation are also encountered in low to moderately saline ground waters. This can be attributed either to precipitation of $CaCO_3$ due to loss of CO_2 or dissolution of Na-salts from the topsoil layers or to ion exchange reaction during the downward percolation of water. At some isolated locations sulphate is found to be dominant anion. In ground water, where salinity is high; mostly Na is the dominant cation and Cl or Cl + SO_4+NO_3 (Mixed anion) are dominant. Permanent hardness is observed at few locations in Hisar, Jhajjar and Bhiwani districts depicted by dominance of Ca-Cl. Nevertheless, a few exceptions have also been found in these samples and well-defined types of ground waters. District wise variations in quality of ground water viz-aviz suitability for drinking water (BIS standards) are given in Table 10.

2.5.7 SUITABILITY FOR DRINKING

Salinity, chloride, fluoride and nitrate are the important parameters that are normally considered for evaluating the suitability of ground water for drinking uses. Based on recommendations made for these parameters by the BIS, it is found that ground water at quite a few places is not suitable for drinking uses because of either EC/Cl/F/NO_3 or all of them. It is observed that unsuitable quality of ground water occurs in the western parts of central and southwestern regions, while in the northern and north eastern areas ground water is of suitable quality for drinking uses. Table-11 below shows district-wise distribution of ground waters in different classes of suitability based upon EC, Cl, F and NO_3 contents. The bar diagram clearly shows that most of the groundwater occurring in the districts of Ambala, Kaithal, Karnal, Kurukshetra, Panchkula and Yamunanagar occupy almost 75% length of the bar and has almost all the parameters within desirable limit for drinking purposes, thus can be considered as potable (fig. 13). Ground waters from the districts of Bhiwani, Gurugram, Hisar, Jhajjar, Mahendragarh, Palwal, Rohtak and Sirsa have bar length less than 50% indicating low potable rating. Lowest percentage of potable waters found in the districts of Mewat and Rohtak i.e. only 9% of the samples are suitable for drinking out of the all collected samples while all the samples (100%) collected from Kurukshetra and Yamunanagar are suitable for drinking purpose.

Table 10 District wise variations in quality of ground water viz-aviz suitability for drinking water (BIS standards)

S. No	District	No. of Samples	Electrical Conductivity			Chloride			Nitrate		Fluoride		
			<750	750-3000	>3000	<250	250-1000	>1000	<45	>45	<1.00	1.00 - 1.50	>1.50
1	Ambala	15	8	7	0	12	3	0	12	3	12	3	0
2	Bhiwani	34	4	16	14	14	17	3	18	16	24	2	8
3	Faridabad	10	0	6	4	2	6	2	7	3	9	0	1
4	Fatehabad	13	5	7	1	11	1	1	10	3	1	8	4
5	Gurugram	25	4	18	3	16	7	2	25	0	21	1	3
6	Hisar	38	6	15	17	15	20	3	26	12	24	5	9
7	Jhajjar	14	2	7	5	5	9	0	9	5	9	2	3
8	Jind	19	1	12	6	7	10	2	14	5	12	1	6
9	Kaithal	29	8	17	4	23	6	0	27	2	22	3	4
10	Karnal	41	25	16	0	40	1	0	40	1	39	2	0
11	Kurukshetra	23	20	3	0	23	0	0	23	0	23	0	0
12	Mahendragarh	8	2	3	3	4	3	1	8	0	5	0	3
13	Mewat	11	1	0	10	1	1	9	5	6	11	0	0
14	Palwal	23	0	15	8	12	11	0	17	6	11	7	5
15	Panchkula	25	22	3	0	25	0	0	23	2	24	1	0
16	Panipat	22	8	11	3	18	3	1	20	2	12	4	6
17	Rewari	13	0	9	4	8	5	0	13	0	4	2	7
18	Rohtak	11	0	7	4	6	3	2	6	5	6	0	5
19	Sirsa	37	6	21	10	23	10	4	23	14	20	4	13
20	Sonipat	35	9	20	6	22	12	1	32	3	25	5	5
21	Yamunanagar	20	16	4	0	20	0	0	20	0	20	0	0
Grand Total		**466**	**147**	**217**	**102**	**307**	**128**	**31**	**378**	**88**	**334**	**50**	**82**

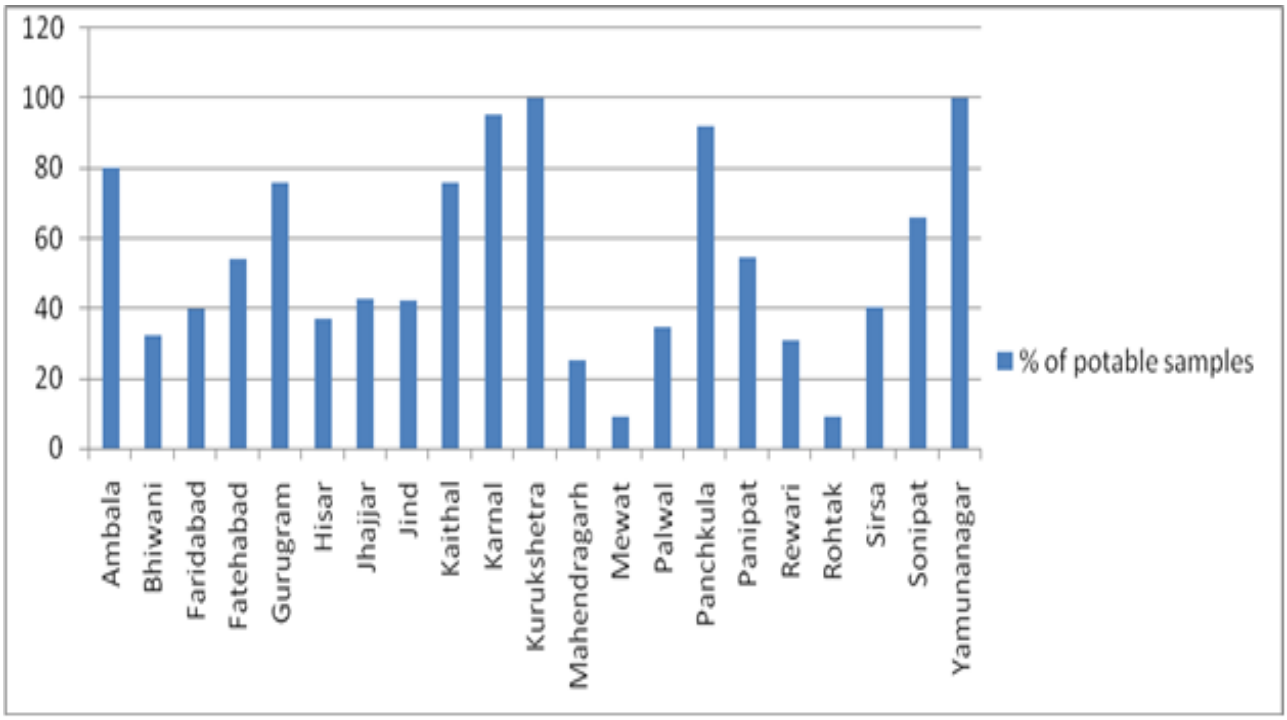


Figure 13 District wise Distribution of Potable Waters in Haryana-2021

Table 11 Percentage wise classification chart for Portable water in Haryana state

Sr. No.	**% Wise classification**	**Name of the districts**	**Remarks**
1.	>80	Karnal, Kurukshetra, Panchkula, Yamunanangar	Samples have been classified on the basis of Salinity (EC, Cl, F, NO_3)
2.	50-80	Ambala Fatehabad, Jind, Kaithal, Mewat, Panipat, Rewari, Sonipat	
3.	<50	Bhiwani, Faridabad, Gurugram, Hisar, Jhajjar, Mahendragarh, Palwal, Rohtak, Sirsa	

2.5.8 SUITABILITY FOR IRRIGATION

The suitability of ground water for irrigation is generally assessed considering salinity expressed as EC, sodium in relation to calcium and magnesium in terms of SAR, sodium in relation to carbonate in terms of RSC. EC and SAR range from 99 to 24060 µS/cm at 25°C and 0.12 to 24.30 respectively. Waters having high values of EC and SAR causes salinity and sodium hazards respectively when used for customary irrigation.

USSL: By plotting the values of EC and SAR in USSL diagram, it is observed that ground water occurring in the northern and central parts of the State falls under C_2S_1 and C_3S_1 classes of irrigation waters. It indicates that most of these waters are suitable for irrigating semi-salt tolerant crops on all soils. Ground water mostly from the southern, western and southwestern parts comprising of Bhiwani, Faridabad, Fatehabad, Hisar, Jhajjar, Mahendragarh, Mewat, Palwal, Rewari, Sirsa districts falls under C_3S_2,C_3S_3, C_3S_4, C_4S_1, C_4S_2, C_4S_3 and C_4S_4 classes of irrigation classification. Such waters when used continuously for irrigation, they are likely to cause salinity hazards and lead to reduction in crop yields. They may also cause sodium hazards and lead to hardening of soils when used for irrigation without the addition of adequate quantity of gypsum. RSC: Alkali hazards of irrigation ground waters are estimated through the computation of Residual Sodium Carbonate (RSC), also known as Eaton's Index. Waters with RSC value <1.25 meq/L are safe for irrigational uses, RSC between 1.25 and 2.5 are marginal and waters with RSC value >2.5 meq/L are unsafe. Based on RSC values of ground waters, it is found that 65.45% of the waters are safe, 13.30% marginal and the remaining 21.24% are unfit for irrigational uses. RSC of ground waters are found to vary from below zero (-18.59) to 19.19 meq/l. The district wise distribution of ground waters in different categories of suitability for irrigational uses based on USSL and RSC considerations is given in Table 12

Table 12 District wise rating for ground water samples of Haryana. Based on Eaton's index and USSL Classification)

S. No.	District	No. of Samples	IRRIGATION SUITABILITY			USSL Classification
			EATON's INDEX (RSC in meq/L)			
			Safe	Marginal	Unsafe	
			<1.25	1.25-2.50	>2.50	
1	Ambala	15	8	7	0	C3S1, C2S1, C2S1, C3S1
2	Bhiwani	34	28	0	6	C4S1, C3S1, C2S1, C3S2, C4S2, C3S3, C3S2, C4S4
3	Faridabad	10	9	0	1	C3S1, C4S1, C4S2
4	Fatehabad	13	10	3	0	C2S1, C3S1, C4S1
5	Gurugram	25	15	1	9	C2S1, C4S1, C3S1, C4S2, C3S3, C3S2
6	Hisar	38	34	0	4	C4S1, C3S1, C2S1, C4S2
7	Jhajjar	14	12	1	1	C4S1, C3S1, C2S1, C3S2
8	Jind	19	14	1	4	C4S2, C4S3, C3S1, C4S1, C2S1, C4S2
9	Kaithal	29	10	3	16	C2S1, C3S1, C2S2, C1S1, C3S2, C4S2, C4S1, C4S2, C3S3
10	Karnal	41	25	8	8	C2S1, C3S1, C3S1, C4S1, C2S2
11	Kurukshetra	23	7	10	6	C2S1, C3S1
12	Mahendragarh	8	5	1	2	C4S1, C3S1, C2S1, C3S2, C4S2
13	Mewat	11	11	0	0	C4S1, C2S1, C4S4, C4S3, C4S2
14	Palwal	23	13	2	8	C4S1, C3S1, C4S2, C3S2
15	Panchkula	25	16	4	5	C2S1, C3S1, C3S2
16	Panipat	22	10	0	12	C3S1, C4S4, C4S1, C2S1, C4S2
17	Rewari	13	2	11	0	C3S2, C4S3, C4S1, C3S1, C4S2, C4S2
18	Rohtak	11	9	1	1	C3S1, C4S1, C4S2
19	Sirsa	37	26	3	8	C2S1, C4S1, C3S1, C4S2, C4S3, C3S2
20	Sonipat	35	29	0	6	C3S1, C4S1, C2S1, C4S2, C1S1
21	Yamunanagar	20	12	6	2	C2S1, C3S1, C1S1
Total		**466**	**305**	**62**	**99**	

Most of ground waters from Ambala, Yamunanagar, Sonipat, Panipat, Karnal, Panchkula are suitable for irrigation for semi-salt tolerant crops on adequately drained soils. The waters from districts of Bhiwani, Sirsa, Hisar, Kaithal, Jhajjar, Palwal, Rohtak, Jind and Gurugram show wide variability in irrigation rating.

2.5.9 SUITABILITY FOR INDUSTRIES

Industries, in general, use water for variety of works depending upon the nature and size of the industry. As such specifications for suitability of water for industries vary widely depending

upon the process in each industry. Therefore, chemical quality of water and its suitability could not be discussed due to diversified nature of industries.

2.5.10 TEMPORAL VARIATION

Abstain of Heavy metals in ground water is also periodically monitored by CGWB and as per studies carried out during 2021, some elements such as Fe, Mn, Zn, Cu, Se, Sn, Mo are essential in trace amounts for growth and development of living organisms as well as plants. Nevertheless, these are hazardous in large amounts. In addition, some metals like Pb, As, Cd, Hg, Cr, Be, Ba, are hazardous even in small amounts. The minimum and maximum Concentration of Heavy Metals has been despite in Table 13:

Table 13 Range of Heavy Metals in Groundwater of Haryana State

District	No.of Sample	Range	Cd	Pb	Mn	Cu	Zn
			PPB		PPM		
Ambala	15	Min	BDL	BDL	BDL	BDL	BDL
		Max	0.48	0.76	0.277	0.019	0.242
Bhiwani	23	Min	0.002	BDL	0.001	BDL	0.002
		Max	0.295	3.601	0.230	0.009	0.92
Faridabad	05	Min	BDL	BDL	0.001	BDL	0.002
		Max	0.72	0.021	0.208	0.395	0.100
Fatehabad	13	Min	0.019	BDL	0.001	0.001	0.005
		Max	0.321	8.853	0.072	0.011	0.302
Gurgaon	25	Min	BDL	BDL	BDL	BDL	0.003
		Max	0.328	3.648	0.218	0.57	0.295
Hissar	38	Min	0.010	BDL	BDL	BDL	0.003
		Max	0.573	5.438	0.252	0.028	0.607
Jhajjar	14	Min	0.033	BDL	0.008	BDL	0.043
		Max	0.123	1.644	0.444	0.001	0.217
Jind	19	Min	0.002	BDL	0.002	BDL	0.007
		Max	0.135	1.234	0.072	0.001	0.105
Kaithal	29	Min	0.014	BDL	0.00	BDL	BDL
		Max	0.501	2.651	0.280	0.003	0.873
Karnal	41	Min	BDL	BDL	BDL	BDL	BDL
		Max	0.075	0.874	0.677	0.011	0.298
Kurukshetra	23	Min	0.010	BDL	0.0	BDL	0.003
		Max	0.131	2.286	0.097	0.052	0.221
Mahendergarh	08	Min	BDL	BDL	BDL	BDL	0.006
		Max	0.068	0.480	0.001	0.003	0.050
Mewat	11	Min	BDL	BDL	0.001	BDL	BDL
		Max	0.266	0.376	0.458	0.006	0.011
Palwal	22	Min	BDL	BDL	0.001	BDL	0.002
		Max	0.373	0.967	0.203	0.009	0.582
Panchkula	24	Min	0.015	BDL	BDL	BDL	BDL
		Max	0.210	4.130	0.128	0.041	0.328
Panipat	22	Min	0.027	0.067	0.002	BDL	0.041
		Max	0.821	1.133	0.256	0.004	0.970

Rewari	13	Min	0.003	BDL	BDL	BDL	0.002
		Max	0.139	0.597	0.038	0.003	1.577
Rohtak	11	Min	0.032	0.107	0.003	BDL	0.014
		Max	0.369	1.941	0.422	0.018	1.175
Sirsa	37	Min	0.009	BDL	BDL	BDL	0.001
		Max	0.276	1.585	0.072	0.006	0.631
Sonipat	34	Min	0.029	0.102	0.002	BDL	0.036
		Max	0.511	2.483	2.070	0.003	1.718
Yamunanagar	21	Min	0.007	BDL	BDL	BDL	BDL
		Max	0.148	3.685	1.024	0.005	0.663

2.5.11 Ground water Quality in respect of Heavy Metals

Cadmium:

The concentrations of cadmium in shallow ground water in Haryana State are almost within the permissible limit. Permissible limit as per BIS Limit 0.003mg/l.

Copper:

The concentrations of copper in shallow ground water in Haryana State are within the permissible limit. Permissible limit as per BIS Limit 1.5mg/l.

Manganese:

Manganese above 0.3mg/l with higher concentration being reported from Ambala, Bhiwani, Jhajjar, Karnal Mewat, Rohtak, Sonipat and Yamunanagar districts. Sporadic cases of highest manganese value have been reported in Bhunderi village (2.070mg/l), of Kathura block Sonipat district.

Lead:

The concentrations of Lead in shallow ground water in Haryana State are almost within the permissible limit. Permissible limit as per BIS Limit 0.01mg/l.

Zinc:

The concentrations of Zinc in shallow ground water in Haryana State are almost within the permissible limit. Permissible limit as per BIS Limit 15.0mg/l.

Arsenic:

Arsenic above 0.3mg/l with higher concentration being reported from Jhajjar, Jhajjar, Panipat, Sonipat and Sirsa districts. Sporadic cases of highest Arsenic value have been reported in Bhunderi village (0.020mg/l), of Kathura block Sonipat district.

Uranium:

Uranium is found above permissible limit (0.03 mg/L) in almost every district of Haryana. Uranium above 0.03 mg/L with higher concentration being reported from Ambala, Bhiwani, Faridabad, Fatehabad, Gurgaon, Hissar, Jhajjar, Jind, Karnal, Kaithal, Kurukshetra, Mahendargarh Mewat, Palwal, Panipat, Rewari, Rohtak, Sirsa, Sonipat and Yamunanagar districts. Sporadic cases of highest uranium value have been reported in Chormar village (0.26mg/l), of Odhan block Sirsa district.

2.5.12 CONCLUSION & RECOMMENDATIONS OF GROUND WATER QUALITY VARIATIONS

On perusal of above carried study, it can be concluded that in Haryana:

- Chemical quality in shallow ground water occurring in northern and northeastern parts is suitable for drinking as well as for irrigation.
- Shallow ground water occurring in central parts has intermediate quality and is permitted for drinking use in case there is no alternative source. However, it is suitable for irrigation on well-drained soil for salt tolerant crops such as wheat, maize, barley etc.
- Quality of shallow ground water occurring in southern and western parts is not suitable for drinking as well as for customary irrigation. The reason for unsuitability for drinking uses is high concentrations of either salinity or nitrate or fluoride. The reason for rejection for irrigation uses are high salinity coupled with high SAR and RSC more than 2.5 meq/l. However, these waters can be used for irrigation in conjunction with surface water.
- Groundwater is the largest available source of fresh water. It gets replenished by natural process and if balance could be maintained between utilization and replenishment, a perennial supply can be assured. Unfortunately, only 92% of the State's area is suitable for groundwaterdevelopment. In the remaining area either the water is unfit for irrigation or thickness of granular zones is inadequate.
- Continued development of the fresh groundwater area located in North Eastern part of the state has resulted in decline of water table. Farmers have to construct deeper wells involving more investment. Another major problem faced by farmers of south and southwestern part of Haryana is the poor quality of groundwater and low discharge from tubewells. This problem is further compounded because of undulating topography and light soils, particularly in the districts of Bhiwani, Rohtak, Mahendragarh, Jhajjar and Hisar. The third problem is in areas where water table is rising and creating water logging problems and salinity hazards.
- Suitable management practices are, therefore, called for groundwater development for augmenting agricultural production on a continual basis. The farmers have taken initiative in this direction by constructing tubewells with submersible pumps. But the water table depletion needs to be contained by curtailment of the groundwater exploitation, conservation practices, rainwater harvesting, change in cropping pattern, suitable land use practices, irrigation management, conjunctive use of surface and groundwater, adoption of efficient method of water application and artificial re-charge practices. The water management in saline area's where water table is rising and creating water logging and salinity problems needs improvement in water use efficiency and surface and sub surface drainages.
- Ground water potential has been worked out as per the guidelines issued by the Govt. of India.

  As on 31st March 2022, 88 assesment units fall under "Over Exploited", 10 assesment units are "Critical", 09 assesment units are "Semi-Critical" and 36 assesment units are of "Safe" category. The detail of assessment units falling under various categories is annexed.
- The over exploited blocks are marked by over development of groundwater resources due to good quality of water and hence higher withdrawal, high growth of tubewells and also high density of tubewells, steep decline in water levels, with no or low critical and water-logged area. The "Critical" blocks area characterized by moderate development of ground water due

to mixed quality of ground water, nominal growth and moderate density of tubewells, decline in water level and critical and water-logged area. In semi-critical and safe blocks there is low development of ground water due to poor quality of ground water and hence lesser withdrawal, less growth of tubewells, less density of tubewells, continuous rise of water level, large critical & water-logged area. In these areas, there is a thin fresh ground water lens over the saline water, which is only being exploited.

CHAPTER- 3
GROUND WATER RESOURCES ESTIMATION METHODOLOGY, 2015

The revised methodology GEC 2015 recommends aquifer wise ground water resource assessment. Ground water resources have two components – Replenishable ground water resources or Dynamic Ground Water Resources and In-storage Resources or Static Resources. GEC 2015 recommends estimation of Replenishable and in-storage ground water resources for both unconfined and confined aquifer. Wherever the aquifer geometry has not been firmly established for the unconfined aquifer, the in-storage ground water resources have to be assessed in the alluvial areas up to the depth of bed rock or 300 m whichever is less. In case of hard rock aquifers, the depth of assessment would be limited to 100 m. In case of confined aquifers, if it is known that ground water extraction is being taken place from this aquifer, the dynamic as well as in-storage resources are to be estimated. If it is firmly established that there is no ground water extraction from this confined aquifer, then only instorage resources of that aquifer has to be estimated

3.1 PERIODICITY OF ASSESSMENT

Keeping in view of the rapid change in Ground Water Extraction, the committee recommends more frequent estimation of Ground Water Resources. The committee observes that the comprehensive assessment of Ground Water Resources is a time intensive exercise. Hence as a tradeoff, it recommends that the resources should be assessed once in every three years. As per the present practice, there is a considerable time lag between assessment and publication of the results. Hence the committee recommends to make all out efforts to reduce the time lag and the results may be reported with in the successive water year.

3.2 GROUND WATER ASSESSMENT UNIT

This methodology recommends aquifer wise ground water resource assessment. An essential requirement for this is to demarcate lateral as well as vertical extent and disposition of different aquifers. A watershed with well-defined hydrological boundaries is an appropriate unit for ground water resource estimation if the principal aquifer is other than alluvium. Ground water resources worked out on watershed as a unit may be apportioned and presented on administrative units (block/ taluka/ mandal/ firka). This would facilitate local administration in planning of ground water management programmes. Areas occupied by unconsolidated sediments (alluvial deposits, aeolian deposits, coastal deposits etc.) usually have flat topography and demarcation of watershed boundaries may not be possible in such areas. Until Aquifer Geometry is established on appropriate scale, the existing practice of using watershed in hard rock areas and blocks/ mandals/ firkas in soft rock areas may be continued.

The ground water resources assessment were carried out based on the guidelines of Ministry of Water Resources, RD & GR which broadly follows the methodology recommended by Ground Water Resources Estimation Committee, 2015. The salient features of the methodology are enumerated in the following paragraphs.

The ground water recharge is estimated season-wise both for monsoon season and non-monsoon season separately. The following recharge and discharge components are assessed in the resource assessment - recharge from rainfall, recharge from canal, return flow from irrigation, recharge from tanks and ponds and recharge from water conservation structures and discharge through ground water draft.

The ground water resources of any assessment unit is the sum of the total ground water availability in the principal aquifer (mostly unconfined aquifer) and the total ground water availability of semi-confined and confined aquifers existing in that assessment unit. The total ground water availability of any aquifer is the sum of Dynamic ground water resources and the In-storage or Static resources of the aquifer.

3.3 GROUND WATER ASSESSMENT OF UNCONFINED AQUIFER SYSTEM

As mentioned earlier, assessment of ground water includes assessment of dynamic and in- storage ground water resources. The development planning should mainly depend on dynamic resource only as it gets replenished every year. Changes in static or in-storage resources reflect impacts of ground water mining. Such resources may not be replenishable annually and may be allowed to be extracted only during exigencies with proper recharge planning in the succeeding excess rainfall years.

Dynamic Ground Water Resources

The methodology for ground water resources estimation is based on the principle of water balance as given below –

Inflow – Outflow = Change in Storage (of an aquifer)

Equation 1 can be further elaborated as -

$$\Delta S = R_{RF}+R_{STR}+R_{C}+R_{SWI}+R_{GWI}+R_{TP}+R_{WCS} \pm VF \pm LF - GE - T - E - B$$

Where,

ΔS – Change in storage R_{RF} – Rainfall recharge

R_{STR}- Recharge from stream channels R_C – Recharge from canals

R_{SWI} – Recharge from surface water irrigation R_{GWI}- Recharge from ground water irrigation

R_{TP}- Recharge from Tanks and Ponds

R_{WCS} – Recharge from water conservation structures VF – Vertical flow across the aquifer system

LF- Lateral flow along the aquifer system (through flow) GE- Ground Water Extraction

T- Transpiration E- Evaporation B-Base flow

It is preferred that all the components of water balance equation should be estimated in an assessment unit. The present status of database available with Government and non-government agencies is not adequate to carry out detailed ground water budgeting in most of the assessment units. Therefore, it is proposed that at present the water budget may be restricted to the major components only taking into consideration certain reasonable assumptions. The estimation is to be carried out using lumped parameter estimation approach keeping in mind that data from many more sources if available may be used for refining the assessment.

Rainfall Recharge

It is recommended that ground water recharge should be estimated on ground water level fluctuation and specific yield approach since this method takes into account the response of ground water levels to ground water input and output components. This, however, requires adequately spaced representative water level measurement for a sufficiently long period. It is proposed that there should be at least three spatially well distributed observation wells in the assessment unit, or one observation well per 100 sq. Km. Water level data should also be available for a minimum period of 5 years (preferably 10years), along with corresponding rainfall data. Regarding frequency of water level data, three water level readings during pre and post monsoon seasons and in the month of January/ May preferably in successive years, are the minimum requirements. It would be ideal to have monthly water level measurements to record the peak rise and maximum fall in the ground water levels. In units or subareas where adequate data on ground water level fluctuations are not available as specified above, ground water recharge may be estimated using rainfall infiltration factor method only. The rainfall recharge during non-monsoon season may be estimated using rainfall infiltration factor method only.

Ground water level fluctuation method

The ground water level fluctuation method is to be used for assessment of rainfall recharge in the monsoon season. The ground water balance equation in non-command areas is given by

$$\Delta S = R_{RF}+R_{STR}+R_{SWI}+R_{GWI}+R_{TP}+R_{WCS} \pm VF \pm LF - GE - T - E - B \qquad 3$$

Where,

ΔS – Change in storage R_{RF} – Rainfall recharge
R_{STR}- Recharge from stream channels

R_{SWI} – Recharge from surface water irrigation (Lift Irrigation) R_{GWI}- Recharge from ground water irrigation
R_{TP}- Recharge from tank and ponds

R_{WCS} – Recharge from water conservation structures VF – Vertical flow across the aquifer system
LF- Lateral flow along the aquifer system (through flow) GE-Ground water Extraction
T- Transpiration E- Evaporation

B-Base flow

Whereas the water balance equation in command area will have another term Recharge due to canals (R_C) and the equation will be as follows:

$$\Delta S = R_{RF}+R_{STR}+R_C+R_{SWI}+R_{GWI}+R_T+R_{WCS}\pm VF \pm LF - GE - T - E - B \quad (4)$$

A couple of important observations in the context of water level measurement must be followed. It is important to bear in mind that while estimating the quantum of ground water extraction, the depth from which ground water is being extracted should be considered, and certain limit should be fixed. First, by estimating recharge by Water Level Fluctuation method, rise in water level (pre to post monsoon Water Level observed in a dug well) is considered and in estimating the draft from dug wells and bore wells (shallow and deep) drop in water level is considered. One should consider only the draft from the same aquifer for which the resource is being estimated.

The change in storage can be estimated using the following equation:

$$\Delta S = \Delta h * A * S_Y \quad (5)$$

Where

ΔS – Change in storage

Δh - rise in water level in the monsoon season A - area for computation of recharge

Sy - Specific Yield

Substituting the expression in equation 5 for storage increase ΔS in terms of water level fluctuation and specific yield, the equations 3 and 4 becomes,

$$R_{RF} = h \times Sy \times A - R_{STR} - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \quad (6)$$

$$R_{RF} = h \times Sy \times A - R_C - R_{STR} - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \quad (7)$$

The recharge calculated from equation 6 in case of non-command sub units and equation 7 in case of command sub units and poor ground water quality sub units gives the rainfall recharge for the particular monsoon season. However, it may be noted that in case base flow/ recharge from stream and through flow have not been estimated, the same may be assumed to be zero.

The rainfall recharge obtained by using equation 6 and equation 7 provides the recharge in any particular monsoon season for the associated monsoon season rainfall. This estimate is to be normalised for the normal monsoon season rainfall as per the procedure indicated below.

Normalization of Rainfall Recharge

Let Ri be the rainfall recharge and ri be the associated rainfall. The subscript i takes values 1 to N where N is number of years data is available which is at least 5. The rainfall recharge, Ri is obtained as per equation 6 and equation 7 depending on the sub unit for which the normalization is being done.

$$R_i = h \times Sy \times A - R_{STR} - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \quad (8)$$

$$R_i = h \times Sy \times A - R_C - R_{STR} - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \quad 9$$

Where

Ri = Rainfall recharge estimated in the monsoon season for the i^{th} particular year

h = Rise in ground water level in the monsoon season for the i^{th} particular year

Sy = Specific yield

A = Area for computation of recharge

GE = Ground water extraction in monsoon season for the i^{th} particular year

B = Base flow the monsoon season for the i^{th} particular year

R_C = Recharge from canals in the monsoon season for i^{th} particular year

R_{STR} = Recharge from stream channels in the monsoon season for i^{th} particular year

R_{SWI} = Recharge from surface water irrigation including lift irrigation in the monsoon Season for the i^{th} particular year

R_{GWI} = Recharge from groundwater irrigation in the monsoon season for the i^{th} particular year

R_{WCS} = Recharge from water conservation structures in the monsoon season for the i^{th} particular year

R_{TP} = Recharge from tanks and ponds in the monsoon season for the i^{th} particular year

LF = Recharge through Lateral flow/ through flow across assessment unit boundary in the monsoon season for the i^{th} particular year

VF – Vertical flow across the aquifer system in the monsoon season for the i^{th} particular year

T- Transpiration in the monsoon season for the i^{th} particular year E- Evaporation in the monsoon season for the i^{th} particular year

After the pairs of data on Ri and ri have been obtained as described above, a normalisation procedure is to be carried out for obtaining the rainfall recharge corresponding to the normal monsoon season rainfall. Let r(normal) be the normal monsoon season rainfall obtained on the basis of recent 30 to 50 years of monsoon season rainfall data. Two methods are possible for the normalisation procedure.

The first method is based on a linear relationship between recharge and rainfall of the form

$$R = ar \quad 10$$

Where,

R = Rainfall recharge during monsoon season r = Monsoon season rainfall

a = a constant

The computational procedure to be followed in the first method is as given below:

$$R_{rf}(normal) = \frac{\sum_{i=1}^{N}\left[R_i \times \frac{r(normal)}{r_i}\right]}{N} \quad 11$$

Where,

$R_{rf\,(normal)}$ - Normalized Rainfall Recharge in the monsoon season. R_i - Rainfall Recharge in the monsoon season for the i^{th} year.
R (normal) - Normal monsoon Season rainfall.
r_i - Rain fall in the monsoon season for the i^{th} year. N - No, of years data is available.

The second method is also based on a linear relation between recharge and rainfall.

However, this linear relationship is of the form,

$$R = ar + b \qquad 12$$

where,

R = Rainfall recharge during monsoon season r = Monsoon season rainfall
a and b = constants.
The two constants "a" and "b" in the above equation are obtained through a linear regression analysis. The computational procedure to be followed in the second method is as given below:

$$a = \frac{NS_4 - S_1 S_2}{NS_3 - S_1^2} \qquad 13$$

$$b = \frac{S_2 - aS_1}{N} \qquad 14$$

$$S_1 = \sum_{i=1}^{N} r_i \qquad S_2 = \sum_{i=1}^{N} R_i \qquad S_3 = \sum_{i=1}^{N} r_i^2 \qquad S_4 = \sum_{i=1}^{N} r_i R_i$$

The rainfall recharge during monsoon season for normal monsoon rainfall condition is computed as below:

$$\mathbf{R_{rf}\ (normal) = a \times r(normal) + b} \qquad \mathbf{15}$$

Rainfall Infiltration Factor method

The rainfall recharge estimation based on Water level fluctuation method reflects actual field conditions since it takes into account the response of ground water level. However, the ground water extraction estimation included in the computation of rainfall recharge using Water Level Fluctuation approach is often subject to uncertainties. Therefore, it is recommended to compare the rainfall recharge obtained from Water Level Fluctuation approach with that estimated using Rainfall Infiltration Factor Method.
Recharge from rainfall is estimated by using the following relationship -

$$\mathbf{Rrf = RFIF * A * (R - a)/1000} \qquad \mathbf{16}$$

Where,

R_{rf} = Rainfall recharge in ham A = Area in Hectares
RFIF = Rainfall Infiltration Factor R = Rainfall in mm
a = Minimum threshold value above which rainfall induces ground water recharge in mmThe relationship between rainfall and ground water recharge is a complex phenomenon depending on several factors like runoff coefficient, moisture balance, hydraulic conductivity and Storativity/ Specific yield of the aquifer etc. In this report, certain assumptions have been adopted for computation of Rainfall recharge factor. These assumptions may be replaced with actual data in case such area specific studies are available. At the same time, it is important to bring in elements of rainfall distribution and variability into sharpening the estimates of precipitation. Average rainfall data from nearby rain gauge stations may be considered for the Ground water assessment unit and the average rainfall may be estimated by the Theisen polygon or isohyet methods. Alternatively other advanced methods may also be used.

The threshold limit of minimum and maximum rainfall event which can induce recharge to the aquifer is to be considered while estimating ground water recharge using rainfall infiltration factor. The minimum threshold limit is in accordance with the relation shown in equation 16 and the maximum threshold limit is based on the premise that after a certain limit, the rate of storm rains is too high to infiltrate the ground and they will only contribute to surface runoff. It is suggested that 10% of Normal annual rainfall be taken as Minimum Rainfall Threshold and 3000 mm as Maximum Rainfall limit. While computing the rainfall recharge, 10% of the normal annual rainfall is to be deducted from the monsoon rainfall and balance rainfall would be considered for computation of rainfall recharge. The same recharge factor may be used for both monsoon and non-monsoon rainfall, with the condition that the recharge due to non-monsoon rainfall may be taken as zero, if the normal rainfall during the non-monsoon season is less than 10% of normal annual rainfall. In using the method based on the specified norms, recharge due to both monsoon and non-monsoon rainfall may be estimated for normal rainfall, based on recent 30 to 50 years of data.

Percent Deviation

After computing the rainfall recharge for normal monsoon season rainfall using the water table fluctuation method and Rainfall Infiltration Factor method these two estimates have to be compared with each other. A term, Percent Deviation (PD) which is the difference between the two expressed as a percentage of the former is computed as

$$PD = \frac{R_{rf}(normal, wtfm) - R_{rf}(normal, rifm)}{R_{rf}(normal, wtfm)} \times 100 \qquad \textbf{17}$$

where,

Rrf (normal, wlfm) = Rainfall recharge for normal monsoon season rainfall estimated by the

water level fluctuation method
Rrf (normal, rifm) = Rainfall recharge for normal monsoon season rainfall estimated by the rainfall infiltration factor method

The rainfall recharge for normal monsoon season rainfall is finally adopted as per the criteria given below:

- If PD is greater than or equal to -20%, and less than or equal to +20%, Rrf (normal) is taken as the value estimated by the water level fluctuation method.
- If PD is less than -20%, Rrf (normal) is taken as equal to 0.8 times the value estimated by the rainfall infiltration factor method.
- If PD is greater than +20%, Rrf (normal) is taken as equal to 1.2 times the value estimated by the rainfall infiltration factor method.

Recharge from other Sources

Recharge from other sources constitute recharges from canals, surface water irrigation, ground water irrigation, tanks and ponds and water conservation structures in command areas where as in non-command areas the recharge due to surface water irrigation, ground water irrigation, tanks and ponds and water conservation structures are possible.

Recharge from Canals: Recharge due to canals is to be estimated based on the following formula:

$$\mathbf{R_C = WA * SF * Days} \qquad \mathbf{18}$$

Where:

R_C= Recharge from Canals WA=Wetted Area
SF= Seepage Factor

Days= Number of Canal Running Days.

Recharge from Surface Water Irrigation: Recharge due to applied surface water irrigation, either by means of canal outlets or by lift irrigation schemes is to be estimated based on the following formula:

$$\mathbf{R_{SWI} = AD*Days*RFF} \qquad \mathbf{19}$$

Where:

R_{SWI} = Recharge due to applied surface water irrigation AD= Average Discharge
Days=Number of days water is discharged to the Fields RFF= Return Flow Factor

Recharge from Ground Water Irrigation: Recharge due to applied ground water irrigation is to be estimated based on the following formula:

$$\mathbf{R_{GWI} = GE_{IRR}*RFF} \qquad \mathbf{20}$$

Where:

R_{GWI} = Recharge due to applied ground water irrigation GE_{IRR}= Ground Water Extraction for Irrigation
RFF= Return Flow Factor

Recharge due to Tanks and Ponds: Recharge due to Tanks and Ponds is to be estimated based on the following formula:

$$R_{TP} = AWSA * RF \quad (21)$$

Where:

R_{TP} = Recharge due to Tanks and Ponds AWSA= Average Water Spread Area RF= Recharge Factor

Recharge due to Water Conservation Structures: Recharge due to Water Conservation Structures is to be estimated based on the following formula:

$$R_{WCS} = GS * RF \quad (22)$$

Where:

R_{WCS} = Recharge due to Water Conservation Structures

GS= Gross Storage = Storage Capacity multiplied by number of fillings.
RF= Recharge Factor

Lateral flow along the aquifer system (Through flow)

In equations 6 and 7, if the area under consideration is a watershed, the lateral flow across boundaries can be considered as zero in case such estimates are not available. If there is inflow and outflow across the boundary, theoretically, the net inflow may be calculated using Darcy law, by delineating the inflow and outflow sections of the boundary. Besides such delineation, the calculation also requires estimate of transmissivity and hydraulic gradient across the inflow and outflow sections. These calculations are most conveniently done in a computer model. It is recommended to initiate regional scale modelling with well-defined flow boundaries. Once the modelling is complete, the lateral through flows (LF) across boundaries for any assessment unit can be obtained from the model. In case Lateral Flow is calculated using computer model, the same should be included in the water balance equation.

Base flow and Stream Recharge

If stream gauge stations are located in the assessment unit, the base flow and recharge from streams can be computed using Stream Hydrograph Separation method, Numerical Modelling and Analytical solutions. If the assessment unit is a watershed, a single stream monitoring station at the mouth of the watershed can provide the required data for the calculation of base flow. Any other information on local-level base flows such as those collected by research centres, educational institutes or NGOs may also be used to improve the estimates on base flows.

Base flow separation methods can be divided into two main types: non-tracer-based and tracer-based separation methods. Non-tracer methods include Stream hydrograph analysis, water balance method and numerical ground water modelling techniques. Digital filters are

available for separating base flow component of the stream hydrograph.
Hydro-chemical tracers and environmental isotope methods also use hydrograph separation techniques based on mass balance approach. Stream recharge can also be estimated using the above techniques.

Base flow assessment and Stream recharge should be carried out in consultation with Central Water Commission in order to avoid any duplicity in the estimation of total water availability in a river basin.

Vertical Flow from Hydraulically Connected Aquifers

This can be estimated provided aquifer geometry and aquifer parameters are known. This can be calculated using the Darcy‟s law if the hydraulic heads in both aquifers and the hydraulic conductivity and thickness of the aquitard separating both the aquifers are known. Ground water flow modelling is an important tool to estimate such flows. As envisaged in this report regional scale modelling studies will help in refining vertical flow estimates.

Evaporation and Transpiration

Evaporation can be estimated for the aquifer in the assessment unit if water levels in the aquifer are within the capillary zone. It is recommended to compute the evaporation through field studies. If field studies are not possible, for areas with water levels within 1.0 mbgl, evaporation can be estimated using the evaporation rates available for other adjoining areas. If depth to water level is more than 1.0m bgl, the evaporation losses from the aquifer should be taken as zero.

Transpiration through vegetation can be estimated if water levels in the aquifer are within the maximum root zone of the local vegetation. It is recommended to compute the transpiration through field studies. Even though it varies from place to place depending on type of soil and vegetation, in the absence of field studies the following estimation can be followed. If water levels are within 3.5m bgl, transpiration can be estimated using the transpiration rates available for other areas. If it is greater than 3.5m bgl, the transpiration should be taken as zero.

For estimating evapotranspiration, field tools like Lysimeters can be used to estimate actual evapotranspiration. Usually, agricultural universities and IMD carry out lysimeter experiments and archive the evapotranspiration data. Remote sensing-based techniques like SEBAL (Surface Energy Balance Algorithm for Land) can be used for estimation of actual evapotranspiration. Assessing offices may apply available lysimeter data or other techniques for estimation of evapotranspiration. In case where such data is not available, evapotranspiration losses can be empirically estimated from PET data provided by IMD.

Recharge during Monsoon Season

The sum of normalized monsoon rainfall recharge and the recharge from other sources and lateral and vertical flows into the sub unit and stream inflows during monsoon season is the total recharge during monsoon season for the sub unit. Similarly, this is to be computed for all the sub units available in the assessment unit.

Recharge during Non-Monsoon Season

The rainfall recharge during non-monsoon season is estimated using Rainfall Infiltration factor Method only when the non-monsoon season rainfall is more than 10% of normal annual

rainfall. The sum of non-monsoon rainfall recharge and the recharge from other sources and lateral and vertical flows into the sub unit and stream inflows during non-monsoon season is the total recharge during non-monsoon season for the sub unit. Similarly, this is to be computed for all the sub units available in the assessment unit.

Total Annual Ground Water Recharge

The sum of the recharge during monsoon and non-monsoon seasons is the total annual ground water recharge for the sub unit. Similarly, this is to be computed for all the sub units available in the assessment unit.

Annual Extractable Ground Water Recharge (EGR)

The Total Annual Ground Water Recharge cannot be utilised for human consumption, since ecological commitments need to be fulfilled, before the extractable resources is defined. The National Water Policy, 2012 stresses that the ecological flow of rivers should be maintained. Therefore, Ground water base flow contribution limited to the ecological flow of the river should be determined which will be deducted from Annual Ground Water Recharge to determine Annual Extractable Ground Water Resources (EGR). The ecological flows of the rivers are to be determined in consultation with Central Water Commission and other concerned river basin agencies.

In case base flow contribution to the ecological flow of rivers is not determined then following assumption is to be followed. In the water level fluctuation method, a significant portion of base flow is already accounted for by taking the post monsoon water level one month after the end of rainfall. The base flow in the remaining non-monsoon period is likely to be small, especially in hard rock areas. In the assessment units, where river stage data are not available and neither the detailed data for quantitative assessment of the natural discharge are available, present practice (GEC 1997) of allocation of unaccountable natural discharges to 5% or 10% of annual recharge may be retained. If the rainfall recharge is assessed using water level fluctuation method this will be 5% of the annual recharge and if it is assessed using rainfall infiltration factor method, it will be 10% of the annual recharge. The balance will account for Annual Extractable Ground Water Resources (EGR).

Estimation of Ground Water Extraction

Groundwater draft or extraction is to be assessed as follows.

$$GE_{ALL} = GE_{IRR} + GE_{DOM} + GE_{IND} \qquad 23$$

Where,

GE_{ALL}=Ground water extraction for all uses GE_{IRR}=Ground water extraction for irrigation GE_{DOM} =Ground water extraction for domestic uses GE_{IND} = Ground water extraction for industrial uses

Ground Water Extraction for Irrigation (GE_{IRR}): The single largest component of the groundwater balance equation in large regions of India is the groundwater extraction and, the precise estimation of ground water extraction is riddled with uncertainties. Therefore, it is recommended that at least two of the three methods for estimation of ground water extraction may be employed in each assessment sub unit.

The methods for estimation of ground water extraction are as follows:

Unit Draft Method: **–** In this method, season-wise unit draft of each type of well in an assessment unit is estimated. The unit draft of different types (eg. Dug well, dug cum bore well, shallow tube well, deep tube well, bore well etc.) is multiplied with the number of wells of that particular type to obtain season-wise ground water extraction by that particular structure. This method is being widely practiced in the country. There are several sources which maintain records on well census. These include Minor Irrigation Census conducted by MoWR, RD, GR, Government of India, and data maintained at the Tehsil level. It is recommended that a single source of well census should be maintained for resources computation at all India level. Minor Irrigation Census of MoWR, RD, GR would be the preferred option.

Crop Water Requirement Method: **–** For each crop, the season-wise net irrigation water requirement is determined. This is then multiplied with the area irrigated by ground water abstraction structures. The database on crop area is obtained from Revenue records in Tehsil office, Agriculture Census and also by using Remote Sensing techniques.

Power Consumption Method: **–** Ground water extraction for unit power consumption (electric) is determined. Extraction per unit power consumption is then multiplied with number of units of power consumed for agricultural pump sets to obtain total ground water extraction for irrigation. Direct metering of ground water draft in select irrigation and domestic wells and in all wells established for industrial purpose may be initiated. Enforcing fitting of water meters and recording draft in all govt. funded wells could also be a feasible option. The unit drafts obtained from these sample surveys can be used to assess ground water extraction. In addition to metering, dedicated field sample surveys (instantaneous discharge measurements) can also be taken up.

Ground Water Extraction for Domestic Use (GE_{DOM}): There are several methods for estimation of extraction for domestic use (GE_{DOM}). Some of the commonly adopted methods are described here.

Unit Draft Method: **–** In this method, unit draft of each type of well is multiplied by the number of wells used for domestic purpose to obtain the domestic ground water draft.

Consumptive Use Method: **–** In this method, population is multiplied with per capita consumption usually expressed in litre per capita per day (lpcd). It can be expressed using following equation.

$$\mathbf{GE_{DOM} = Population \times Consumptive\ Requirement \times Lg} \qquad \mathbf{24}$$

Where,

Lg = Fractional Load on Ground Water for Domestic Water Supply

The Load on Ground water can be obtained from the Information based on Civic water supply agencies in urban areas.

Ground water Extraction for Industrial use (GE_{IND}): The commonly adopted methods for estimating the extraction for industrial use are as below:

Unit Draft Method: - In this method, unit draft of each type of well is multiplied by the number of wells used for industrial purpose to obtain the industrial ground water extraction.

***Consumptive Use Pattern Method:* –** In this method, water consumption of different industrial units are determined. Numbers of Industrial units which are dependent on ground water are multiplied with unit water consumption to obtain ground water draft for industrial use.

$$GE_{IND} = \text{Number of industrial units} \times \text{Unit Water Consumption} \times Lg \qquad 25$$

Where,

Lg = Fractional load on ground water for industrial water supply

The load on Ground water for Industrial water supply can be obtained from water supply agencies in the Industrial belt. Other important sources of data on ground water extraction for industrial uses are - Central Ground Water Authority, State Ground Water Authority, National Green Tribunal and other Environmental Regulatory Authorities.

Ground water extraction obtained from different methods need to be compared and based on field checks, the seemingly best value may be adopted. At times, ground water extraction obtained by different methods may vary widely. In such cases, the value matching the field situation should be considered. The storage depletion during a season where other recharges are negligible can be taken as ground water extraction during that particular period.

Stage of Ground Water Extraction

The stage of ground water extraction is defined by,

$$\text{Stage of Ground Water Extraction} = \frac{\text{Existing gross ground water extraction for all use}}{\text{Annual Extractable Ground water Resources}} \times 100 \qquad 26$$

The existing gross ground water extraction for all uses refers to the total of existing gross ground water extraction for irrigation and all other purposes. The stage of ground water extraction should be obtained separately for command areas, non-command areas and poor ground water quality areas.

Validation of Stage of Ground Water Extraction

The assessment based on the stage of ground water extraction has inherent uncertainties. The estimation of ground water extraction is likely to be associated with considerable uncertainties as it is based on indirect assessment using factors such as electricity consumption, well census and area irrigated from ground water. The denominator in equation 26, namely Annual Extractable Ground Water Resources also has uncertainties due to limitations in the assessment methodology, as well as uncertainties in the data. In view of this, it is desirable to validate the „Stage of Ground Water Extraction" with long term trend of ground water levels.

Long term Water Level trends are to be prepared for a minimum period of 10 years for both pre- monsoon and post-monsoon period. The Water level Trend would be average water level trend as obtained from the different observation wells in the area.

In interpreting the long-term trend of ground water levels, the following points may be kept in view. If the pre and post monsoon water levels show a fairly stable trend, it does not necessarily mean that there is no scope for further ground water development. Such a trend indicates that there is a balance between recharge, extraction and natural discharge in the unit. However, further ground water development may be possible, which may result in a new stable trend at a lower ground water level with associated reduced natural discharge.

If the ground water resource assessment and the trend of long-term water levels contradict each other, this anomalous situation requires a review of the ground water resource computation, as well as the reliability of water level data. The mismatch conditions are enumerated below (Table 14).

Table 14 Stage of Ground Water Development in relation to Water Level Trends

SOGWD	Ground Water level trend	Remarks
≤70%	Decline trend in both pre-monsoon and post- monsoon	Not acceptable and needs reassessment
>100%	No significant decline in both pre-monsoon and post-monsoon long term trend	Not acceptable and needs reassessment

In case, the category does not match with the water level trend given above, a reassessment should be attempted. If the mismatch persists even after reassessment, the sub unit may be categorized based on Stage of Ground Water Extraction of the reassessment. However, the sub unit should be flagged for strengthening of observation well network and parameter estimation.

Categorisation of Assessment Units

As emphasised in the National Water Policy, 2012, a convergence of Quantity and Quality of ground water resources is required while assessing the ground water status in an assessment unit. Therefore, it is recommended to separate estimation of resources where water quality is beyond permissible limits for the parameter salinity.

Categorization of Assessment Units Based on Quantity: The categorization based on status of ground water quantity is defined by Stage of Ground Water extraction as given below:

Table 15 Stage of Ground Water Development

Stage of Ground Water Extraction	Category
≤70%	Safe
> 70%and ≤90%	Semi-Critical
> 90%and ≤100%	Critical
> 100%	Over Exploited

In addition to this Category every assessment sub unit should be tagged with potentiality tag indicating its ground water potentiality viz. Poor Potential (Unit Recharge <0.025m), Moderately Potential (Unit Recharge in between 0.025 and 0.15m) and Highly Potential (Unit Recharge > 0.15m)

Categorization of Assessment Units Based on Quality

To adequately inform management decisions, quality of ground water is also an essential criterion. The Committee deliberated upon the possible ways of categorizing the assessment units based on ground water quality in the assessment units. It was realized that based on the available water quality monitoring mechanism and available database on ground water quality it may not be possible to categorize the assessment units in terms of the extent of quality hazard. As a trade-off, the Committee recommends that each assessment unit, in addition to the Quantity based categorization (safe, semi-critical, critical and over-exploited) should bear a quality hazard identifier. Such quality hazards are to be based on available ground water monitoring data of State Ground Water Departments and/or Central Ground Water Board. If any of the three quality hazards in terms of Arsenic, Fluoride and Salinity are encountered in the assessment sub unit in mappable units, the assessment sub unit may be tagged with the particular Quality hazard.

Allocation of Ground Water Resource for Utilisation

The Annual Extractable Ground Water Resources are to be apportioned between domestic, industrial and irrigation uses. Among these, as per the National Water Policy, requirement for domestic water supply is to be accorded priority. This requirement has to be based on population as projected to the year 2025, per capita requirement of water for domestic use, and relative load on ground water for urban and rural water supply. The estimate of allocation for domestic water requirement may vary for one sub unit to the other in different states. In situations where adequate data is not available to make this estimate, the following empirical relation is recommended.

$$\mathbf{Alloc = 22\ X\ N\ X\ L_g\ mm\ per\ year} \qquad \mathbf{27}$$

Where

Alloc= Allocation for domestic water requirement

N = population density in the unit in thousands per sq. km.

L_g = fractional load on ground water for domestic and industrial water supply (1.0)

In deriving equation 27, it is assumed that the requirement of water for domestic use is 60 lpcd. The equation can be suitably modified in case per capita requirement is different. If by chance, the estimation of projected allocation for future domestic needs is less than the current domestic extraction due to any reason, the allocation must be equal to the present-day extraction. It can never be less than the present-day extraction as it is unrealistic.

Net Annual Ground Water Availability for Future Use

The water available for future use is obtained by deducting the allocation for domestic use and current extraction for Irrigation and Industrial uses from the Annual extractable Ground water recharge. The resulting ground water potential is termed as the net annual ground water availability for future use. The Net annual ground water availability for future use should be calculated separately for non-command areas and command areas. As per the recommendations of the R&D Advisory committee, the ground water available for future use can never be negative. If it becomes negative, the future allocation of Domestic needs can be reduced to current extraction for domestic use. Even then if it is still negative, then the ground water available for future uses will be zero.

Additional Potential Resources under Specific Conditions

Potential Resource Due to Spring Discharge: Spring discharge constitutes an additional source of ground water in hilly areas which emerges at the places where ground water level cuts the surface topography. The spring discharge is equal to the ground water recharge minus the outflow through evaporation and evapotranspiration and vertical and lateral sub- surface flow.

Thus, Spring Discharge is a form of "Annual Extractable Ground Water Recharge". It is a renewable resource, though not to be used for Categorisation. Spring discharge measurement is to be carried out by volumetric measurement of discharge of the springs. Spring discharges multiplied with time in days of each season will give the quantum of spring resources available during that season. The committee recommends that in hilly areas with substantial potential of spring discharges, the discharge measurement should be made at least 4 times a year in parity with the existing water level monitoring schedule.

Potential ground water resource due to springs = Q x No of days

Where

Q = Spring Discharge

No of days= No of days spring yields.

Potential Resource in Waterlogged and Shallow Water Table Areas: The quantum of water available for development is usually restricted to long term average recharge or in other words "Dynamic Resources". But the resource calculated by water level fluctuation approach is likely to lead to under-estimation of recharge in areas with shallow water table, particularly in discharge areas of sub-basin/ watershed/ block/ taluka and waterlogged areas. In such cases rejected recharge may be substantial and water level fluctuations are subdued resulting in under- estimation of recharge component. It is therefore, desirable that the ground water reservoir should be drawn to optimum limit before the onset of monsoon, to provide adequate scope for its recharge during the following monsoon period.

In the area where the ground water level is less than 5m below ground level or in

waterlogged areas, the resources up to 5m below ground level are potential and would be available for development in addition to the annual recharge in the area. It is therefore recommended that in such areas, ground water resources may be estimated up to 5m bgl only assuming that where water level is less than 5m bgl, the same could be depressed by pumping to create space to receive recharge from natural resources. It is further evident that these potential recharges would be available mostly in the shallow water table areas which would have to be demarcated in each sub-basin/ watershed/ block/ taluka/ mandal.

The computation of potential resource to ground water reservoir can be done by adopting the following equation:

Potential ground water resource in shallow water table areas = (5-D) x A x S_Y **29**

Where

D = Depth to water table below ground surface in pre-monsoon period in shallow aquifers.

A = Area of shallow water table zone. S_Y = Specific Yield

The planning of future minor irrigation works in the waterlogged and shallow water table areas as indicated above should be done in such a way that there should be no long-term adverse effects of lowering of water table up to 5m and the water level does not decline much below 5m in such areas. The behaviour of water table in the adjoining area which is not water logged should be taken as a bench mark for development purposes.

This potential recharge to ground water is available only after depression of water level up to 5m bgl. This is not an annual resource and should be recommended for development on a very cautious approach so that it does not adversely affect the ground water potentials in the overall area.

Potential Resource in Flood Prone Areas: Ground water recharge from a flood plain is mainly the function of the following parameters-

- Areal extent of flood plain
- Retention period of flood
- Type of sub-soil strata and silt charge in the river water which gets deposited and controls seepage

Since collection of data on all these factors is time taking and difficult, in the meantime, the potential recharge from flood plain may be estimated on the same norms as for ponds, tanks and lakes. This has to be calculated over the water spread area and only for the retention period using the following formula.

Potential ground water resource in Flood Prone Areas = 1.4 x N x A/1000 **30**

Where

N = No of Days Water is Retained in the Area A = Flood Prone Area

Apportioning of Ground Water Assessment from Watershed to Development Unit:

Where the assessment unit is a watershed, there is a need to convert the ground water assessment in terms of an administrative unit such as block/ taluka/ mandal. This may be done as follows.

A block may comprise of one or more watersheds, in part or full. First, the ground

water assessment in the subareas, command, non-command and poor ground water quality areas of the watershed may be converted into depth unit (mm), by dividing the annual recharge by the respective area. The contribution of this subarea of the watershed to the block is now calculated by multiplying this depth with the area in the block occupied by this sub-area. This procedure must be followed to calculate the contribution from the sub-areas of all watersheds occurring in the block, to work out the total ground water resource of the block.

The total ground water resource of the block should be presented separately for each type of sub-area, namely for command areas, non-command areas and poor ground water quality areas, as in the case of the individual watersheds.

Assessment of In-Storage Ground Water Resources or Static Ground Water Resources

The quantum of ground water available for development is usually restricted to long term average recharge or dynamic resources. Presently there is no fine demarcation to distinguish the dynamic resources from the static resources. While water table hydrograph could be an indicator to distinguish dynamic resources, at times it is difficult when water tables are deep. For sustainable ground water development, it is necessary to restrict it to the dynamic resources. Static or in-storage ground water resources could be considered for development during exigencies that also for drinking water purposes. It is also recommended that no irrigation development schemes based on static or in-storage ground water resources be taken up at this stage.

Assessment of In-storage ground water resources has assumed greater significance in the present context, when an estimation of Storage Depletion needs to be carried out in Over-exploited areas. Recently Remote Sensing techniques have been used in GRACE studies, to estimate the depletion of Ground Water Resources in North West India. Such estimation presents larger scale scenario. More precise estimation of ground water depletion in the over-exploited area based on actual field data can be obtained by estimating the Change in In-storage during successive assessments. Thus In-storage computation is necessary not only for estimation of emergency storage available for utilisation in case of natural extremities (like drought) but also for an assessment of storage depletion in over-exploited areas for sensitising stakeholders about the damage done to the environment.

The computation of the static or in-storage ground water resources may be done after delineating the aquifer thickness and specific yield of the aquifer material. The computations can be done as follows: -

$$SGWR = A * (Z_2 - Z_1) * S_Y \qquad 31$$

Where,

SGWR= Static or in-storage Ground Water Resources

A= Area of the Assessment Unit

Z_2= Bottom of Unconfined Aquifer

Z_1= Pre-monsoon water level

S_Y = Specific Yield in the In storage Zone

Assessment of Total Ground Water Availability in Unconfined Aquifer

The sum of Annual Exploitable Ground Water Recharge and the in-storage ground water resources of an unconfined aquifer is the Total Ground Water Availability of that aquifer.

3.4 GROUND WATER ASSESSMENT OF CONFINED AQUIFER SYSTEM

Assessment of ground water resources of confined aquifers assumes crucial importance, since over-exploitation of these aquifers may lead to far more detrimental consequences than to those of shallow unconfined aquifers. If the piezometric surface of the confined aquifer is lowered below the upper confining layer so that desaturation of the aquifer occurs, the coefficient of storage is no longer related to the elasticity of the aquifer but to its specific yield. In view of the small amounts of water released from storage in the confined aquifers, large scale pumpage from confined aquifers may cause decline in piezometric levels amounting to over a hundred metre and subsidence of land surface posing serious geotectonical problems.
It is recommended to use ground water storage approach to assess the ground water resources of the confined aquifers. The co-efficient of storage or storativity of an aquifer is defined as the volume of water it releases or takes into storage per unit surface area of the aquifer per unit change in head. Hence the quantity of water added to or released from the aquifer (□V) can be calculated as follows

$$\Delta V = S\,\Delta h \qquad 32$$

If the areal extent of the confined aquifer is A then the total quantity of water added to or released from the entire aquifer is

$$Q = A\,\Delta V = SA\Delta h \qquad 33$$

Where

Q = Quantity of water confined aquifer can release (m^3) S = Storativity
A = Areal extent of the confined aquifer (m^2)

Δh= Change in Piezometric head (m)

Most of the storage in confined aquifer is associated with compressibility of the aquifer matrix and compressibility of water. Once the piezometric head reaches below the top confining bed, it behaves like an unconfined aquifer and directly dewaters the aquifer and there is a possibility of damage to the aquifer as well as topography. Hence ground water potential of a confined aquifer is nothing but the water available for use without damaging the aquifer. Hence the resources available under pressure are only considered as the ground water potential. The quantity of water released in confined aquifer due to change in pressure can be computed between piezometric head (h_t) at any given time 't' and the bottom of the top confining layer (h_o) by using the following equation.

$$Q_p = SA\Delta h = SA\,(h_t - h_0) \qquad 34$$

If any development activity is started in the confined aquifer, then there is a need to assess the dynamic as well as in storage resources of the confined aquifer. To assess the ground water resources of the confined aquifer, there is a need to have sufficient number of observation wells tapping exclusively that particular aquifer and proper monitoring of the piezometric heads is also needed.

Dynamic Ground Water Resources of Confined Aquifer

To assess the dynamic ground water resources the following equation can be used with the pre and post monsoon piezometric heads of the particular aquifer.

$$\mathbf{Q_D = SA\Delta h = SA\ (h_{POST} - h_{PRE})} \qquad \mathbf{35}$$

Where

Q_D = Dynamic Ground Water Resource of Confined Aquifer (m^3) S = Storativity

A = Areal extent of the confined aquifer (m^2)

Δh = Change in Piezometric head (m)

h_{post} =Piezometric head during post-monsoon period (m amsl) h_{PRE} = Piezometric head during pre-monsoon period (m amsl)

In storage Ground Water Resources of Confined Aquifer

For assessing the In-storage ground water potential of a confined aquifer, one has to compute the resources between the pre monsoon piezometric head and bottom of the top confining layer. That can be assessed using the following formula:

$$\mathbf{Q_I = SA\Delta h = SA\ (h_{PRE} - h_0)} \qquad \mathbf{36}$$

Where

Q_I =In-storage Ground Water Resource of Confined Aquifer (m^3) S = Storativity

A = Areal extent of the confined aquifer (m^2)

Δh = Change in Piezometric head (m)

h_0 = Bottom level of the top confining layer (m amsl)

h_{PRE} = Piezometric head during pre-monsoon period (m amsl)

If the confined aquifer is not being exploited for any purpose, the dynamic and static resources of the confined aquifer need not be estimated separately. Instead, the in storage of the aquifer can be computed using the following formula.

$$\mathbf{Q_p = SA\Delta h = SA\ (h_{POST} - h_0)} \qquad \mathbf{37}$$

Where

Q_p = In storage Ground Water Resource of the confined aquifer or the Quantity of water under pressure (m^3)

S = Storativity

A = Areal extent of the confined aquifer (m^2)

Δh = Change in Piezometric head (m)

H_{POST} =Piezometric head during post-monsoon period (m amsl) h_0 = Bottom of the Top Confining Layer (m amsl)

The calculated resource includes small amount of dynamic resource of the confined aquifer also, which replenishes every year. But to make it simpler this was also computed as

part of the static or in-storage resource of the confined aquifer.

Assessment of Total Ground Water Availability of Confined Aquifer

If the confined aquifer is being exploited, the Total Ground Water Availability of the confined aquifer is the sum of Dynamic Ground Water Resources and the In-storage ground water resources of that confined aquifer whereas if it is not being exploited, the Total Ground Water Availability of the confined aquifer comprises of only one component i.e., the In-storage of the confined aquifer.

3.5 GROUND WATER ASSESSMENT OF SEMI-CONFINED AQUIFER SYSTEM

The Assessment of Ground Water Resources of a semi-confined aquifer has some more complications. Unless and until, it is well studied that the recharge to this is not computed in the over lying unconfined aquifer or underlying/overlying semi confined aquifers, it should not be assessed separately. If it is assessed separately, there is a possibility of duplication of estimating the same resource by direct computation in one aquifer and as leakage in the other aquifer. As it is advisable to under estimate rather than to overestimate the resources, it is recommended not to assess these resources separately as long as there is no study indicating its non-estimation. If it is found through field studies that the resources are not assessed in any of the aquifers in the area, these resources are to be assessed following the methodology similar to that used in assessing the resources of Confined aquifers.

3.6 TOTAL GROUND WATER AVAILABILITY OF AN AREA

The Total Ground water availability in any area is the Sum of Dynamic Ground Water Resources, the total static/ in-storage ground water resources in the unconfined aquifer and the dynamic and In-storage resources of the Confined aquifers and semi-confined aquifers in the area.

CHAPTER-4
PROCEDURE FOLLOWED IN THE PRESENT ASSESSMENT

The present assessement has been made as per the methodology recommended by GEC, 2015. The norms recommended by the GEC, 2015 were followed. In-GRES software developed by Central Ground Water Board has been used for estimation of ground water resources. As discussed in the first meeting of SLC on 27-05-2022, the estimation has been done considering the following facts:

1. The dynamic ground water resource assessment of 143 assesment units of Haryana State as on 31st March 2022 was carried out as per GEC, 2015 norms. During present estimation, the estimation needs to be carried out for 143 assesment units including two urban areas i.e. Gurgaon and Faridabad in Haryana State which are having population of more than 10 lakh. The organization of data for 143 assesment units need boundary shape files with properly demarcated boundaries of the Blocks. These shape files available with HARSAC, Haryana were shared which form the basis for further data collection and organization.
2. The Rainfall data and Evapo-transpiration data was obtained from IMD and Agriculture Department has shared the data on Rainfall and Evapo-transpiration available with the department.
3. GW Extraction Data which includes Number of irrigations tubewells or crop water requirements and area under various crops was arranged by Agriculture Department.
4. Number of Industrial tubewells and groundwater draft by various industries was shared by Industry Department or HSPCB.
5. Data on Drinking and Domestic Water Requirement was arranged by PHED.
6. Canal Flow data -Length of the canal falling in each block shall be revised and supplied by Irrigation Department. Irrigation Department shall also arrange for the data on Area irrigated by surface water and ground water to estimate the return seepages from the Irrigation.
7. Data on Water Conservation structures like Check dams, percolation ponds or village and urban ponds was arranged by Haryana Ponds and Waste Water Management Authority and Department of Rural Development (SLNA).
8. Data on Aquifer Parameters were utilized based on the recent NAQUIM studies
9. Updated water quality data was arranged by CGWB and GW Cell, Haryana

The norms used in the present assessment for computations of canal seepage, rainfall infiltration factor, specific yield etc have been taken as per GEC-2015 specified norms. As regards to the unit well draft, the figures used in computation are based on the actual field conditions.

CHAPTER-5
COMPUTATION OF GROUND WATER RESOURCES ESTIMATION IN THE STATE

SUMMARY OF GROUNDWATER SCENARIO OF HARYANA STATE:
DYNAMIC GWRE 2022

1.	**Annual Extractable Ground water Resources (Fresh water)**	**8,60,622.17 ham**	**8606.22 MCM**
2.	Existing GW Draft for irrigation	Fresh- 10,29,677 Ham Saline- 87,849 Ham Total- 11,17,526 Ham	10,296 MCM 878 MCM 11,175 MCM
3.	Existing GW Draft for Domestic and Industrial Use	1,24,732 Ham	1247 MCM
4.	Existing GW Draft for all Uses	Fresh- 11,54,409 Ham Saline- 87,849 Ham Total- 12,42,258 Ham	11,544 MCM 878 MCM 12,423 MCM
5.	Net GW Availability for Future Irrigation Development in Safe, semi-critical and critical blocks	1,04,181 Ham	1,042 MCM
6.	**Average Stage of GW Extraction of State**	**134.14 %**	

- The ground water resources estimation for Haryana State has been carried out for 143 Assesment Units (AU).
- In 62% area of Haryana ground water development is more than 100% causing depletion of ground water at an alarming rate (88 Assesment Units of 143 assessed Units are over-exploited).
- In 25% of area falls in Safe Category
- In this estimation (GWRE, 2022) The Assesment Units are categorized into four categories as per recent estimation methodology.
    - Over-exploited: 88
    - Critical: 10
    - Semi-Critical: 09
    - Safe: 36
    - Stage of development for whole State is 134.14%

At present Haryana State has 142 administrative blocks. 141 blocks and 2 urban area (Gurgaon & Faridabad) have been taken into consideration for estimation of ground water resources covering whole Haryaya State.The blocks/AUs are categorized into four categories as per GWRE, 2015 methodology.

- Over-exploited blocks: 88
- Critical blocks: 10
- Semi Critical blocks: 09
- Safeblocks: 36

5.1 SALIENT FEATURES OF DYNAMIC GROUND WATER RESOURCES ASSESSMENT

Assessment period	2021-2022
Type of Assessment Units	Blocks & Urban areas (population > 10 lacs)
Total Number of Blocks in State	142
No. of Assessment Units (Blocks & Urba area) taken for Study	143 (1 Blocks could not be assessed as the block is totally hilly) including 2 urban areas (Gurgaon & Faridabad).
Base Year of Collection of Data	2012-2021
(Water Level trends computed from 2012-2021 data)	
Year of Projection of Data	2022

(Domestic & Industrial Water Use Projection for the year 2027 have been made)

Demarcation of data under command and non command could not be made due to the reason that no assessment unit (block) is either completely canal irrigated or tubewell irrigated. So, the computation has been made entirely on block basis.

No. of Over-Exploited Blocks	88
No. of Critical Blocks	10
No. of Semi-Critical Blocks	09
No. of Safe Blocks	36

Out of total 143 Blocks taken for study 88 Blocks (61.53%) are over-exploited, 10 Blocks (6.99%) are critical, 09 Blocks (6.29%) are semi critical and 36 Blocks (25.17%) are in safe category. While categorizing, long term water level fluctuation of both pre-monsoon and post-monsoon periods has been considered with annual fall of more than 10 cm. per year as significant.

5.2 METHOD ADOPTED FOR COMPUTING RAIN FALL RECHARGE DURINGMONSOON SEASON

The administrative block and Urban areas which are having population of more than 10 lakh has been taken as assessment unit and for computing the block-wise rainfall recharge during monsoon season; Rainfall Infiltration Factor (RIF) Method and Level Fluctuations (WLF) Method has been used.

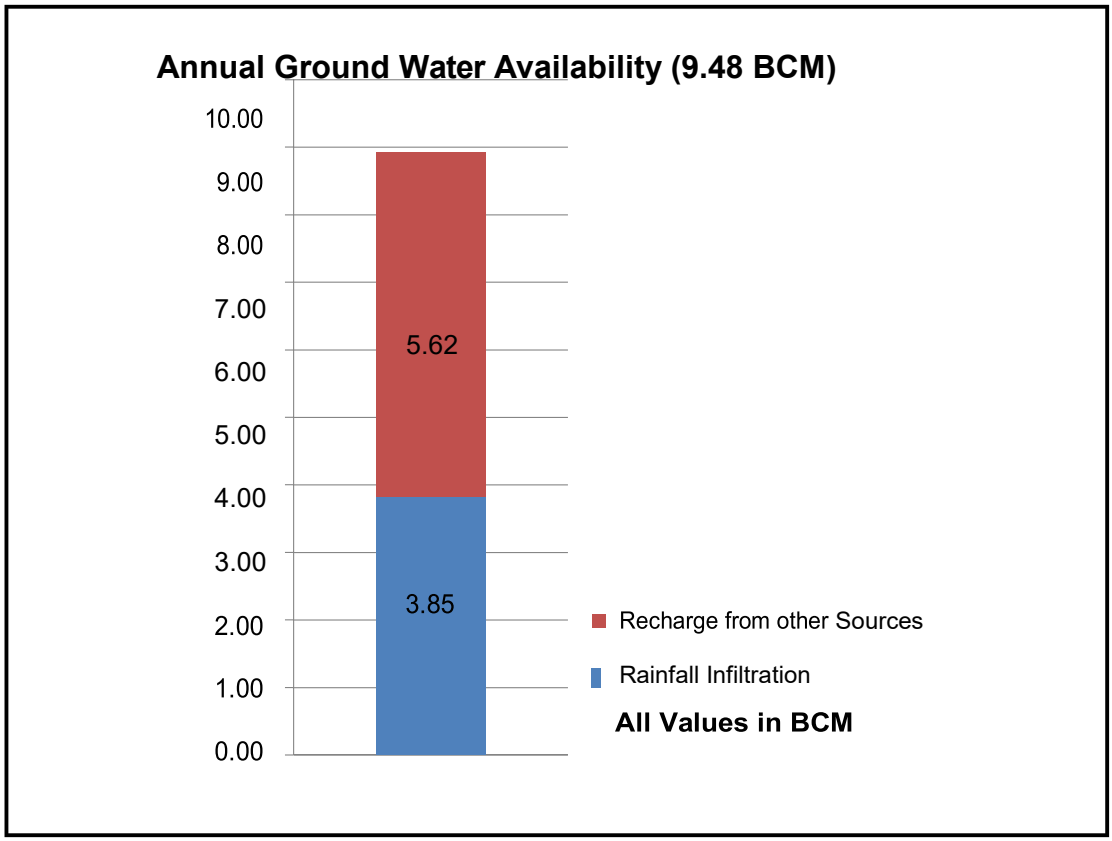
5.3 GROUND WATER RESOURCE ASSESSMENT

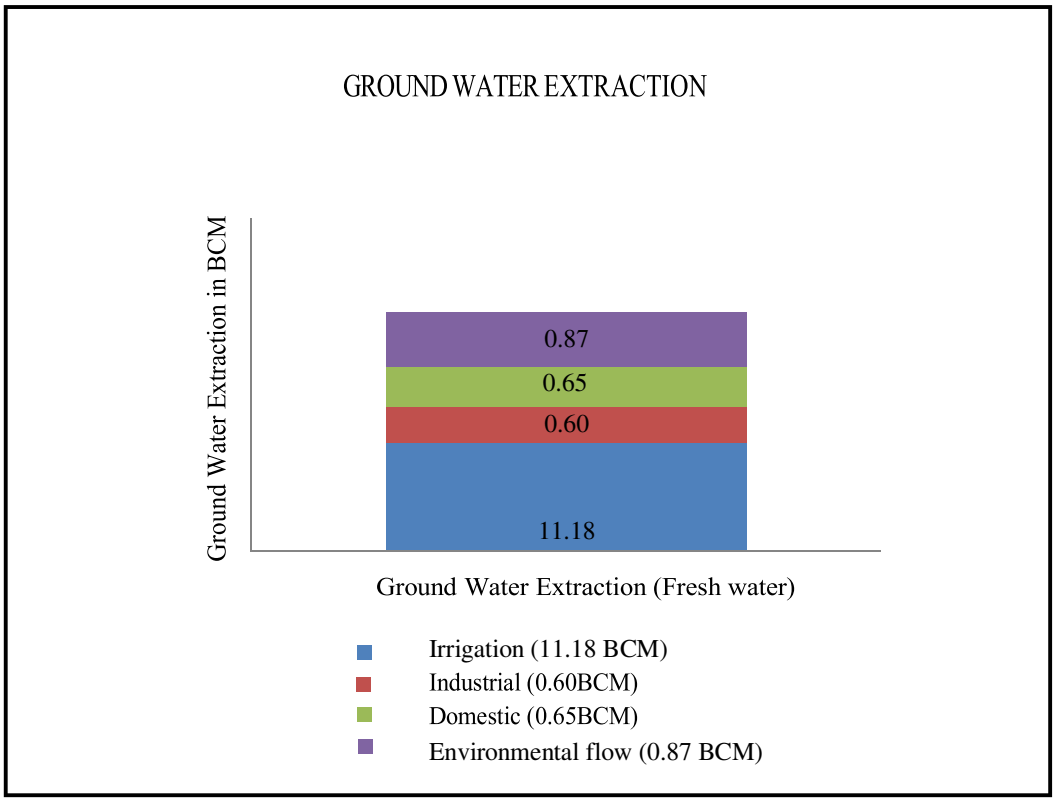
The Ground Water Resource Assessment of Haryana State has been computed as per GEC-2015 Methodology and the abstract of Dynamic Ground Water Assessment is as follows:

Table 16 Dynamic Ground Water Assessment

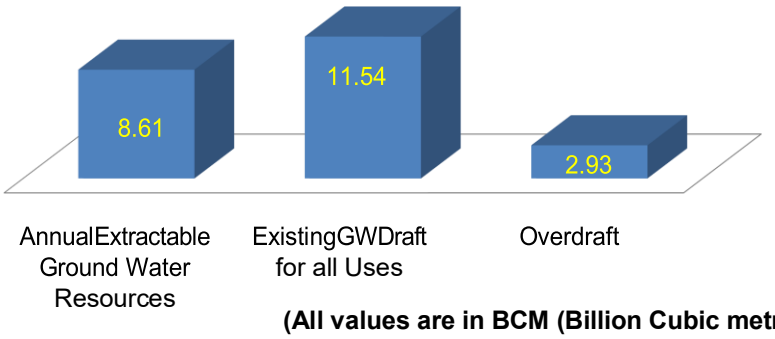
Net Ground Water Availability	**8,60,622.17**	Ham
Existing GW Draft for Irrigation	Fresh- 10,29,677 Saline- 87,849 Total-11,17,526	Ham
Existing GW Draft for Domestic & Industrial Use.	1,17,732	Ham
Existing GW Draft for All Uses	Fresh- 11,54,409 Saline- 87,849 Total- 12,42,258	Ham
Provision for domestic requirement supply to 2025		Ham
Net GW Availability for Future Irrigation Development	1,04,181	Ham
Average Stage of GW Development of State	134%	

The Net Annual Ground Water Availability for the period 2021-2022 (as on March 2022) works out to be 8,60,622.17 Ham (8.60 BCM). The Average Normal Recharge figures for all the districts from rainfall and other resources have been calculated. It has been observed that the Net Ground Water Availability for future irrigation development in the State is 1,04,181 Ham (1.04 BCM). Dynamic Ground Water Resources of Haryana as on March 2022 is given in Annexure XIV.


Annual Ground Water Availability (9.48 BCM)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
5.62
3.85
Recharge from other Sources
Rainfall Infiltration
All Values in BCM


GROUND WATER EXTRACTION
Ground Water Extraction in BCM
0.87
0.65
0.60
11.18
Ground Water Extraction (Fresh water)
Irrigation (11.18 BCM)
Industrial (0.60BCM)
Domestic (0.65BCM)
Environmental flow (0.87 BCM)

DYNAMICGROUNDWATERRESOURCES&Draft OF HARYANA STATE as on 31.3.2022



(All values are in BCM (Billion Cubic metres)

Net GWAvailability for Future Irrigation Development inSafe, Semi-critical, critical blocks is 1.04BCM which can be developed in future for creation of additional irrigation from ground water source.

Comparison of Groundwater status of Haryana since 2009

Category of Assesment Units	2009	2011	2013	2017	2020	2022
Over-Exploited	69 (59%)	71 (61%)	64 (54%)	78 (61%)	85 (60%)	88(62%)
Critical	21 (18%)	15 (13%)	14 (12%)	03 (2%)	12 (09%)	10(7%)
Semi-Critical	9 (8%)	7 (6%)	11(9%)	21 (16%)	14 (10%)	09(6%)
Safe	18 (15%)	23 (20%)	30 (25%)	26 (21%)	30 (21%)	36(25%)
TOTAL	117	116	119	128	141	143

AREA OF ASSESSMENT UNITS UNDER DIFFERENT CATEGORIES IN INDIA (2022)											
HARYANA											
S. No.	Total Recharge Worthy Area of Assessed Units (sq.km)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
		Recharge Worthy Area (in 1000 sq.km)	%	Recharge Worthy Area (in 1000 sq.km)	%	Recharge Worthy Area (in 1000 sq.km)	%	Recharge Worthy Area (in 1000 sq.km)	%	Recharge Worthy Area (in 1000 sq.km)	%
1	40391.06	10860.63	26.89	2398.44	5.94	2359.29	5.84	24772.7	61.33		

GROUNDWATER RESOURCES IN SALINE AREAS & ADDITIONAL

POTENTIAL FRESH WATER
RESOURCES

GEC, 2015 also recommends estimation of saline Ground Water Resources in areas where salinity is more than 3000 ms/cm.
GROUNDWATER RESOURCES IN SALINE AREAS

The In-storage GW Resources in poor quality areas have been calculated as 14562 Ham (0.14BCM)

Additional potential fresh water Resources in water logged and shallow water level area 145198 Ham (1.45BCM)

Table 17 Districtwise Details of Ground water Recharge

S. No	District	Ground Water Recharge				Total Annual Ground Water Recharge	Total Natural Discharge	Annual Extractable Ground Water Recharge (Ham) (12=10-11)
		Monsoon Season		Non-monsoon season				
		Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources			
1	3	6	7	8	9	10	11	12
1	Ambala	25133.77	7742.3	5751.1	6270.6	44897.77	4489.77	40408
2	Bhiwani	16203	12338.16	1917.12	11491.16	41949.44	3729.02	38220.42
3	Charki Dadri	9601.99	5156.68	1581.13	4410.24	20750.04	2075.01	18675.03
4	Faridabad	5390.76	2873.18	1003.9	2992.24	12260.08	1226.01	11034.07
5	Fatehabad	13188.31	29692.82	924.85	22305.74	66111.72	6245.37	59866.35
6	Gurugram	9717.56	5080.19	3206.15	4317.3	22321.2	2232.12	20089.08
7	Hisar	20464.74	15628.16	13132.7	21534.25	70759.85	5926.24	64833.61
8	Jhajjar	9869.56	10265.8	2757.67	10821.82	33714.85	3371.48	30343.37
9	Jind	22887.06	31453.44	5067.85	29141.33	88549.68	8854.98	79694.7
10	Kaithal	16046.93	17246.48	2786.69	12651.71	48731.81	4649.85	44081.96
11	Karnal	24059.02	24848.91	3846.67	28506.02	81260.62	7632.12	73628.5
12	Kurukshetra	15879.5	12502.13	2636.87	10175.99	41194.49	3768.34	37426.15
13	Mahendragarh	7062.54	3884.44	2350.06	7544.18	20841.22	2084.14	18757.08
14	Mewat	7243.84	4445.54	2301.14	4952.04	18942.56	1542.79	17399.77
15	Palwal	9421.83	12710.08	1119.44	15745.08	38996.43	3153.64	35842.79
16	Panchkula	11287.89	1369.6	1650.97	1072.42	15380.88	769.06	14611.82
17	Panipat	9093.39	9589.93	1664.64	12334.42	32682.38	2843.74	29838.64
18	Rewari	10347.05	5592.84	3485.23	9887.71	29312.83	2591.47	26721.36
19	Rohtak	7772.5	9607.65	3476.06	8584.24	29440.45	2944.06	26496.39
20	Sirsa	20237.43	18917.3	1280.52	22551.11	62986.36	5849.34	57137.02
21	Sonipat	23469.35	22437.04	2918.92	20407.09	69232.4	5920.02	63312.38
22	Yamunanagar	20843.31	16024.62	5197.82	15239.66	57305.41	5101.73	52203.68
Total (Ham)		**315221.33**	**279407.29**	**70057.5**	**282936.35**	**947622.47**	**87000.3**	**860622.17**
Total (Bcm)		**3.15**	**2.79**	**0.7**	**2.83**	**9.48**	**0.87**	**8.61**

Table 18: Districtwise Details of Ground water Draft

District	Current Annual Ground Water Extraction				Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)
	Irrigation Use (Ham)	Industrial Use (Ham)	Domestic Use (Ham)	Total Extraction (Ham)			
1	2	3	4	5	6	7	8
Ambala	31289.3	7575	6938.348	45802.65	6938.35	3004.62	113.35
Bhiwani	36509.3	144	2612	39265.3	2612	8730.36	102.73
Charki Dadri	23372.4125	28	1246.792	24647.22	1246.79	4747.61	131.98
Faridabad	12842	4992	4317.6024	22151.6	4350.2	0	200.76
Fatehabad	106108.305	98.2	1859.58	108066.07	1859.58	122.19	180.51
Gurugram	20620.75	17117.17	5080.6642	42818.57	5080.66	0	213.14
Hisar	52871.82	230.22	366.197	53468.24	366.2	18952.4	82.47
Jhajjar	14716.7	86	313.97	15116.67	318.51	15222.16	49.82
Jind	83174.71	462.702	1965.64	85603.05	2486.54	7101.89	107.41
Kaithal	79598.5488	573.77	4809.024	84981.34	4809.02	0	192.78
Karnal	111256.67	7504	8180.991	126941.66	8181	384.43	172.41
Kurukshetra	67780.88	12575.88	5035	85391.76	5035	0	228.16
Mahendragarh	24762.24	31.08	2692	27485.32	2726.74	73.62	146.53
Mewat	12220.03	19.91	1696.35	13936.29	1696.35	4345.4	80.09
Palwal	30876.55	680.6	2201.678	33758.83	2201.68	6874.34	94.19
Panchkula	7459.01	90	1143.18	8692.19	1143.18	5919.63	59.49
Panipat	52897.24	2440	2249.8	57587.04	2249.8	0	192.99
Rewari	31922.61	1452	1969.5276	35344.14	1969.53	265.07	132.27
Rohtak	14166.66	166.06	435.65	14768.37	446.18	11717.49	55.74
Sirsa	84771.76	170.14	2456.13	87398.03	2456.13	2388.91	152.96
Sonipat	62012.69	939.29	2516.632	65468.59	2516.63	11568.55	103.41
Yamunanagar	68446.96	2340	4929.516	75716.48	4929.51	2761.95	145.04
Total (Ham)	**1029677.15**	**59716.02**	**65016.27**	**1154409.41**	**65619.58**	**104180.62**	**134.14**
	10.3	**0.6**	**0.65**	**11.54**	**0.66**	**1.04**	**134.14**

The block- wise ground water development varies from 27% in Baund block of Charkhi Dadri district to maximum of 260% in Thanesar block of Kurukshetra district respectively. The District wise Ground Water Development has been computed and given in. It varies from 49% in Jhajjar district to 228% in Kurukshetra district respectively.

In general, the variation in stage of ground water development has been observed which seems to be mainly due to change in rainfall, construction of water conservation structures and ground water draft.

5.4 CATEGORIZATION OF THE BLOCKS/ASSESMENT UNITS

The list of blocks falling under different categorization is tabulated in table-19

Table 19 CATEGORIZATION OF BLOCKS/ ASSESMENT UNITS

	DISTRICT	SAFE	SEMI-CRITICAL	CRITICAL	OVER EXPLOITED
1	Ambala		1.Ambala-II	1. Ambala-I	1.Barara
			2. Shazadpur		2.Naraingarh
					3.Saha
	TOTAL	00	02	01	03
2	Bhiwani	1. Siwani			1.Behal
		2. Bhiwani			2.Kairu
		3.Bawani Khera			3.Loharu
					4.Tosham
	TOTAL	03	00	00	04
3.	Charki Dadri	1.Baund			1.Badhra
		2.Charki Dadri			2.Jhojhu
	TOTAL	02	00	00	02
4.	Faridabad				1.Ballabgarh
					2.Faridabad 3.Faridabad Urban 4.Taigaon
	TOTAL	00	00	00	04
5.	Fatehabad			1.Bhuna	1. Fatehabad
				2. Bhattu Kalan	2. Jakhal
					3. Ratia
					4. Tohana
					5. Nagpur
	TOTAL	00	00	02	05
6.	Gurugram				1.Farukh nagar
					2.Gurgaon
					3.Pataudi
					4.Sohna
					5. Gurgaon Urban
	TOTAL	00	00	00	05
7.	Hisar	1.Hansi-II	1.Barwala	1.Agroha	1.Narnaud
		2.Uklana			

	DISTRICT	SAFE	SEMI-CRITICAL	CRITICAL	OVER EXPLOITED
		3. Hansi-1			
		4.Hisar-I			
		5.Hisar-II			
		6.Adampur			
	TOTAL	06	01	01	01
8.	Jhajjar	1.Bahadurgarh			
		2.Beri			
		3.Jhajjar			
		4.Salhawas			
		5.Matanhail			
		6.Machhrauli			
		7. Badli			
	TOTAL	07	00	00	00
9.	Jind	1.Julana	1.Pillukhera		1.Alewa
		2.Narwana			2.Jind
					3.Safidon
					4.Uchana
					5.Ujhana
	TOTAL	02	01	00	05
10.	Kaithal				1.Dhand
					2.Gulha
					3.Kaithal
					4.Kalayat
					5.Pundri
					6.Rajound
					7.Siwan
	TOTAL	00	00	00	07
11	Karnal			1.Indri	1.Assandh
					2.Gharaunda (part)
					3.Karnal
					4.Nilokheri
					5.Nissing at Chirao
					6.Kanjpura
					7.Munak
	TOTAL	00	00	01	07
12	Kurukshetra				1.Babain
					2.Ismailabad
					3.Ladwa
					4.Pehowa
					5.Pipli
					6.Shahbad
					7.Thanesar
	TOTAL	00	00	00	07
13	Mahendragarh			1.Nizampur	1.Kanina
				2. Satnali	2.Mahendragarh

	DISTRICT	SAFE	SEMI-CRITICAL	CRITICAL	OVER EXPLOITED
					3. Sihma
					4.Narnaul
					5.NangalChoudhury
					6.Ateli Nangal
	TOTAL	00	00	02	06
14	Mewat	1.Nagina	1. Punahana		1. Taoru
		2.Nuh			2.FerozepurJhirka
		3.Pingwan			
		4.Indri			
	TOTAL	04	01	00	02
15	Palwal	1. Hathin	1. Hodal	1.Hassanpur	1.Badoli
		2.Palwal			2.Prithla
	TOTAL	02	01	01	02
16	Panchkula	1.Barwala		1.Raipur Rani	
		2.Pinjore			
	TOTAL	02	00	01	00
17	Panipat				1.Bapoli
					2.Israna
					3.Madlauda
					4.Panipat
					5.Samalkha
					6.Sanauli Khurd
	TOTAL	00	00	00	06
18	Rewari			1.Dahina	1.Khol at Rewari
					2.Nahar
					3.Rewari
					4.Bawal
					5.Jatusana
					6.Dharuhera
	TOTAL	00	00	01	06
19.	Rohtak	1.Kalanaur			
		2.Lakhan Majra			
		3.Rohtak			
		4.Maham			
		5.Sampla			
	TOTAL	05	00	00	00
20	Sirsa		1.Baragudha		1.Dabwali
					2.Ellenabad
					3.NathusariChopta
					4.Odhan
					5.Rania
					6.Sirsa
	TOTAL	00	01	00	06

	DISTRICT	SAFE	SEMI-CRITICAL	CRITICAL	OVER EXPLOITED
21	Sonipat	1.Kathura			1.Ganaur
		2.Kharkhoda			2.Rai
		3.Gohana			3.Sonipat
					4.Mundlana
					5.Murthal
	TOTAL	03	00	00	05
22	Yamunanagar		1.Khizrabad		1.Sadaura
			2.Chhachhrauli		2.Jagadhri
					3.Mustafabad
					4.Radaur
					5.Bilaspur
	TOTAL	00	02	00	05
TOTAL (in whole State)		**36**	**09**	**10**	**88**

55 GROUND WATER RECHARGE IN POOR GROUND WATER QUALITY ZONE

The ground water recharge in poor ground water quality zones has been worked out and block-wise details are given in Annexure X and the district-wise detail is given in table-20. The table depicts that the ground water recharge in poor ground water quality zones is maximum in Sirsa district with minimum in Karnal district.

Table 20 District-wise details of Total annual ground water recharge in poor ground water quality zone

Sr. No.	Name of District	Total Annual Ground Water Recharge (Ham)
1	AMBALA	0
2	BHIWANI	3830.180002
3	CHARKI DADRI	188.8909
4	FARIDABAD	928.606272
5	FATEHABAD	59.642396
6	GURUGRAM	103.19364
7	HISAR	88.189244
8	JHAJJAR	3531.630692
9	JIND	493.900462
10	KAITHAL	354.722808
11	KARNAL	21.613944
12	KURUKSHETRA	0
13	MAHENDRAGARH	255.838187
14	MEWAT	3204.578608
15	PALWAL	1347.847666
16	PANCHKULA	0
17	PANIPAT	49.46172
18	REWARI	192.61528
19	ROHTAK	1230.75073
20	SIRSA	2892.038606
21	SONIPAT	1911.698426
22	YAMUNANAGAR	0
	TOTAL	**41370.79917**

5.6 ADDITIONAL POTENTIALRECHARGE

Additional potential recharge is computed for waterlogged, shallow water table or flood prone area of the state in Table 21. It could be observed that potential recharge is maximum in Rohtak district. Shallow water level areas having depth to water table less than 5 m bgl in the State are about 3877.18 Km^2, which is in pockets and lying mainly in the central parts of the Haryana State. Block-wise Additional Annual Potential Recharge has been worked out to be 145198.18 Ham for water logged and shallow water table areas of the State. The maximum potential has been observed in Rohtak District.

Table 21 Additional Potential Recharge

S.No.	Name of District	Total Annual Additional Potential Recharge (Ham)
1	AMBALA	4223.48
2	BHIWANI	801.41
3	CHARKHI DADRI	9790.50
4	FARIDABAD	0
5	FATEHABAD	4700.43
6	GURGAON	0
7	HISAR	0
8	JHAJJAR	42854.28
9	JIND	1533.84
10	KAITHAL	0
11	KARNAL	0
12	KURUKSHETRA	0
13	MAHENDRAGARH	0
14	MEWAT	9351.85
15	PALWAL	5885.05
16	PANCHKULA	0
17	PANIPAT	0
18	REWARI	0
19	ROHTAK	47308.38
20	SIRSA	3119.76
21	SONIPAT	15136.80
22	YAMUNA NAGAR	312.38
	Total	**145198.18 HAM**
		1.45 (BCM)

5.7 COMPARISION WITH THE EARLIER GROUND WATER RESOURCES ESTIMATE

The comparative statement of the blocks falling under different categories based on the stage of ground water development in the earlier and present computation are given in the following Table-22.

Table 22 Comparison of Ground WaterResources

Period of Assessment	No. of Blocks falling under			
	Over Exploited	Critical	Semi Critical	Safe
2008-2009 (As on March2009)	68	21	09	18
2010-11 (As on March2011)	71	15	07	23
2012-13 (As on March2013)	64	14	11	30
2016-17 (As on March 2017)	78	03	21	26
2019-20 (As on March 2020)	85	12	14	30
2021-22 (As on March 2022)	88	10	09	36

The stage of ground water extraction has decreased from 135% to 134.14%. Adoption of threshold value at same rate for pre-monsoon and post monsoon seasons and re-organisation of blocks and block boundaries also resulted in slight reduction in rainfall recharge. The decrease in draft is due to identification of irrigation tubewells located in saline areas and same has been reduced and draft from fresh water tubwells is considered in estimation. There is slight increase in number of abstraction structures of drinking and domestic use tubewells for which exact number of tubewells and yield of the tubewells has been provided by PHED, Haryana.

5.8 SPATIAL VARIATION OF GROUND WATER DEVELOPMENT SCENARIO

The Stage of Ground Water Development and Categorization for Future Ground Water Development for each block/Assesment Unit and district as a whole has also been compared for previous 2019-20 (as on 31st March 2020) study and for present 2021-22 (as on 31st March 2022) study are shown in Table- 23**.** It has been observed that 08 AUs have shown change to higher category owing to increased ground water draft for irrigation and other uses. 15 AUs have shown change to lower category due to increased replenishable recharge, reduction in draft of tubewells, rise in water level trends or change in the land use and 118 AUs shows no change in their category.

Table 23 Block/Assesment Unit wise comparison of Stage of Ground Water Development and Category with previousAssessment

S.No	District	Block	SOGWD In 2020	Categorization	District	Block	SOGWD In 2022	Categorization	Remarks
1	Ambala	Ambala-I	97.47	Critical	Ambala	Ambala-I	98.67	Critical	No Change
2	Ambala	Ambala-II	87.86	Semi Critical	Ambala	Ambala-II	76.73	Semi Critical	No Change
3	Ambala	Barara	138.24	Over Exploited	Ambala	Barara	141.07	Over Exploited	No Change
4	Ambala	Naraingarh	157.21	Over Exploited	Ambala	Naraingarh	140.33	Over Exploited	No Change
5	Ambala	Saha	180.40	Over Exploited	Ambala	Saha	147.52	Over Exploited	No Change
6	Ambala	Shahzadpur	98.01	Critical	Ambala	Shahzadpur	75.87	Semi Critical	Improoved
7	Bhiwani	Bawani Khera	74.48	Semi Critical	Bhiwani	Bawani Khera	66.50	Safe	Improoved
8	Bhiwani	Behal	143.81	Over Exploited	Bhiwani	Behal	149.70	Over Exploited	No Change
9	Bhiwani	Bhiwani	90.00	Semi Critical	Bhiwani	Bhiwani	68.51	Safe	Improoved
10	Bhiwani	Kairu	187.41	Over Exploited	Bhiwani	Kairu	155.87	Over Exploited	No Change
11	Bhiwani	Loharu	143.71	Over Exploited	Bhiwani	Loharu	161.94	Over Exploited	No Change
12	Bhiwani	Siwani	48.28	Safe	Bhiwani	Siwani	40.87	Safe	No Change
13	Bhiwani	Tosham	149.15	Over Exploited	Bhiwani	Tosham	159.82	Over Exploited	No Change
14	Charki Dadri	Badhra	244.19	Over Exploited	Charki Dadri	Badhra	234.04	Over Exploited	No Change
15	Charki Dadri	Baund	31.27	Safe	Charki Dadri	Baund	27.09	Safe	No Change
16	Charki Dadri	Charkhi Dadri	64.88	Safe	Charki Dadri	Charkhi Dadri	62.04	Safe	No Change
17	Charki Dadri	Jhojhu	157.65	Over Exploited	Charki Dadri	Jhojhu	152.33	Over Exploited	No Change
18	Faridabad	Ballabgarh	152.67	Over Exploited	Faridabad	Ballabgarh	246.15	Over Exploited	No Change
19	Faridabad	Faridabad	115.69	Over Exploited	Faridabad	Faridabad	146.96	Over Exploited	No Change
20	Faridabad	Faridabad Urban		Not Assessed	Faridabad	Faridabad Urban	339.72	Over Exploited	New
21	Faridabad	Tigaon	120.95	Over Exploited	Faridabad	Tigaon	144.30	Over Exploited	No Change
22	Fatehabad	Bhattu Kalan	112.23	Over Exploited	Fatehabad	Bhattu Kalan	99.44	Over Exploited	No Change
23	Fatehabad	Bhuna	96.89	Ccritical	Fatehabad	Bhuna	98.57	Critical	No Change
24	Fatehabad	Fatehabad	185.11	Over Exploited	Fatehabad	Fatehabad	203.90	Critical	No Change
25	Fatehabad	Jakhal	220.07	Over Exploited	Fatehabad	Jakhal	219.74	Over Exploited	No Change
26	Fatehabad	Nagpur	249.07	Over Exploited	Fatehabad	Nagpur	227.53	Over Exploited	No Change
27	Fatehabad	Ratia	215.51	Over Exploited	Fatehabad	Ratia	248.74	Over Exploited	No Change
28	Fatehabad	Tohana	133.06	Over Exploited	Fatehabad	Tohana	132.29	Over Exploited	No Change

S.No	District	Block	SOGWD In 2020	Categorization	District	Block	SOGWD In 2022	Categorization	Remarks
29	Gurugram	Farrukh Nagar	158.89	Over Exploited	Gurugram	Farrukh Nagar	157.37	Over Exploited	No Change
30	Gurugram	Gurgaon	263.97	Over Exploited	Gurugram	Gurgaon	122.20	Over Exploited	No Change
31	Gurugram	Gurgaon Urban	New	Not Assessed	Gurugram	Gurgaon Urban	326.27	Over Exploited	New
32	Gurugram	Pataudi	172.62	Over Exploited	Gurugram	Pataudi	192.49	Over Exploited	No Change
33	Gurugram	Sohna	172.03	Over Exploited	Gurugram	Sohna	174.96	Over Exploited	No Change
34	Hisar	Adampur	91.82	Critical	Hisar	Adampur	49.49	Safe	Improved
35	Hisar	Agroha	95.30	Critical	Hisar	Agroha	94.08	Critical	No Change
36	Hisar	Barwala	119.64	Over Exploited	Hisar	Barwala	82.31	Semi Critical	Improved
37	Hisar	Bass	64.54	Safe	Hisar	Hansi-II	53.45	Safe	No Change
38	Hisar	Hansi	80.69	Semi Critical	Hisar	Hansi	68.78	Safe	Improved
39	Hisar	Hisar-I	76.21	Semi Critical	Hisar	Hisar-I	64.19	Safe	Improved
40	Hisar	Hisar-II	78.28	Semi Critical	Hisar	Hisar-II	65.87	Safe	Improved
41	Hisar	Narnaund	160.85	Over Exploited	Hisar	Narnaund	215.42	Over Exploited	No Change
42	Hisar	Uklana	20.29	Safe	Hisar	Uklana	29.56	Safe	No Change
43	Jhajjar	Badli	71.09	Semi Critical	Jhajjar	Badli	67.70	Safe	Improved
44	Jhajjar	Bahadurgarh	48.72	Safe	Jhajjar	Bahadurgarh	59.24	Safe	No Change
45	Jhajjar	Beri	33.31	Safe	Jhajjar	Beri	36.62	Safe	No Change
46	Jhajjar	Jhajjar	51.93	Safe	Jhajjar	Jhajjar	65.90	Safe	No Change
47	Jhajjar	Machhrauli	65.55	Safe	Jhajjar	Machhrauli	68.13	Safe	No Change
48	Jhajjar	Matannail	33.87	Safe	Jhajjar	Matannail	30.23	Safe	No Change
49	Jhajjar	Salhawas	45.50	Safe	Jhajjar	Salhawas	46.62	Safe	No Change
50	Jind	Alewa	123.44	Over Exploited	Jind	Alewa	118.45	Over Exploited	No Change
51	Jind	Jind	122.85	Over Exploited	Jind	Jind	125.00	Over Exploited	No Change
52	Jind	Julana	49.76	Safe	Jind	Julana	47.59	Safe	No Change
53	Jind	Narwana	65.90	Safe	Jind	Narwana	53.35	Safe	No Change
54	Jind	Pillukhera	79.48	Semi Critical	Jind	Pillukhera	82.59	Semi Critical	No Change
55	Jind	Safidon	144.78	Over Exploited	Jind	Safidon	138.06	Over Exploited	No Change
56	Jind	Uchana	114.39	Over Exploited	Jind	Uchana	107.05	Over Exploited	No Change
57	Jind	Ujhana	140.18	Over Exploited	Jind	Ujhana	122.94	Over Exploited	No Change
58	Kaithal	Dhand	225.63	Over Exploited	Kaithal	Dhand	204.57	Over Exploited	No Change
59	Kaithal	Guhla	241.79	Over Exploited	Kaithal	Guhla	223.82	Over Exploited	No Change
60	Kaithal	Kaithal	205.10	Over Exploited	Kaithal	Kaithal	170.81	Over Exploited	No Change
61	Kaithal	Kalayat	212.01	Over Exploited	Kaithal	Kalayat	154.06	Over Exploited	No Change

S.No	District	Block	SOGWD In 2020	Categorization	District	Block	SOGWD In 2022	Categorization	Remarks
62	Kaithal	Pundri	170.12	Over Exploited	Kaithal	Pundri	194.57	Over Exploited	No Change
63	Kaithal	Rajound	184.29	Over Exploited	Kaithal	Rajound	186.88	Over Exploited	No Change
64	Kaithal	Siwan	209.10	Over Exploited	Kaithal	Siwan	209.73	Over Exploited	No Change
65	Karnal	Assandh	191.19	Over Exploited	Karnal	Assandh	178.33	Over Exploited	No Change
66	Karnal	Gharaunda (Part)	146.35	Over Exploited	Karnal	Gharaunda (Part)	161.82	Over Exploited	No Change
67	Karnal	Indri	75.44	Semi Critical	Karnal	Indri	96.82	Critical	Deteriorated
68	Karnal	Karnal	159.70	Over Exploited	Karnal	Karnal	169.48	Over Exploited	No Change
69	Karnal	Kunjpura	173.24	Over Exploited	Karnal	Kunjpura	173.89	Over Exploited	No Change
70	Karnal	Munak	236.82	Over Exploited	Karnal	Munak	231.45	Over Exploited	No Change
71	Karnal	Nilokheri	216.58	Over Exploited	Karnal	Nilokheri	211.17	Over Exploited	No Change
72	Karnal	Nissing At Chirao	211.96	Over Exploited	Karnal	Nissing At Chirao	187.38	Over Exploited	No Change
73	Kurukshetra	Babain	284.52	Over Exploited	Kurukshetra	Babain	235.97	Over Exploited	No Change
74	Kurukshetra	Ismailabad	256.01	Over Exploited	Kurukshetra	Ismailabad	236.83	Over Exploited	No Change
75	Kurukshetra	Ladwa	284.62	Over Exploited	Kurukshetra	Ladwa	297.05	Over Exploited	No Change
76	Kurukshetra	Pehowa	184.82	Over Exploited	Kurukshetra	Pehowa	193.14	Over Exploited	No Change
77	Kurukshetra	Pipli	228.61	Over Exploited	Kurukshetra	Pipli	223.64	Over Exploited	No Change
78	Kurukshetra	Shahbad	247.86	Over Exploited	Kurukshetra	Shahbad	196.56	Over Exploited	No Change
79	Kurukshetra	Thanesar	295.83	Over Exploited	Kurukshetra	Thanesar	260.11	Over Exploited	No Change
80	Mahendragarh	Ateli Nangal	91.29	Critical	Mahendragarh	Ateli Nangal	121.07	Over Exploited	Deteriorated
81	Mahendragarh	Kanina	173.75	Over Exploited	Mahendragarh	Kanina	196.56	Over Exploited	No Change
82	Mahendragarh	Mahendragarh	114.18	Over Exploited	Mahendragar	Mahendragarh	127.80	Over Exploited	No Change
83	Mahendragarh	Nangal Chaudhry	61.61	Safe	Mahendragarh	Nangal Chaudhry	153.08	Over Exploited	Deteriorated
84	Mahendragarh	Narnaul	45.23	Safe	Mahendragarh	Narnaul	112.00	Over Exploited	Deteriorated
85	Mahendragarh	Nizmpur	28.67	Safe	Mahendragarh	Nizampur	97.32	Critical	Deteriorated
86	Mahendragarh	Satnali	75.11	Semi Critical	Mahendragarh	Satnali	96.61	Critical	Deteriorated
87	Mahendragarh	Sihma	126.15	Over Exploited	Mahendragarh	Sihma	152.89	Over Exploited	No Change
88	Mewat	Ferozepur Jhirka	90.71	Critical	Mewat	Ferozepur Jhirka	103.63	Over Exploited	Deteriorated
89	Mewat	Indri	70.59	Semi Critical	Mewat	Indri	68.71	Safe	Improved
90	Mewat	Nagina	43.05	Safe	Mewat	Nagina	54.32	Safe	No Change

S.No	District	Block	SOGWD In 2020	Categorization	District	Block	SOGWD In 2022	Categorization	Remarks
91	Mewat	Nuh	36.14	Safe	Mewat	Nuh	33.22	Safe	No Change
92	Mewat	Pingwan	39.27	Safe	Mewat	Pingwan	49.68	Safe	No Change
93	Mewat	Punahana	93.43	Critical	Mewat	Punahana	88.74	Semi Critical	Improved
94	Mewat	Taoru	146.81	Over Exploited	Mewat	Taoru	123.79	Over Exploited	No Change
95	Palwal	Badoli	223.22	Over Exploited	Palwal	Badoli	195.88	Over Exploited	No Change
96	Palwal	Hassanpur	99.92	Critical	Palwal	Hassanpur	95.64	Sritical	No Change
97	Palwal	Hathin	64.59	Safe	Palwal	Hathin	64.83	Safe	No Change
98	Palwal	Hodal	86.12	Semi Critical	Palwal	Hodal	82.89	Semi Critical	No Change
99	Palwal	Palwal	77.47	Semi Critical	Palwal	Palwal	68.03	Safe	Improved
100	Palwal	Prithla	151.59	Over Exploited	Palwal	Prithla	146.50	Over Exploited	No Change
101	Panchkula	Barwala	67.01	Safe	Panchkula	Barwala	53.521	Safe	No Change
102	Panchkula	Morni		NA	Panchkula	Morni	NA	NA	Not Assessed
103	Panchkula	Pinjore	31.49	Safe	Panchkula	Pinjore	37.04	Safe	No Change
104	Panchkula	Raipur Rani	99.00	Critical	Panchkula	Raipur Rani	95.09	Critical	No Change
105	Panipat	Bapoli	220.81	Over Exploited	Panipat	Bapoli	245.55	Over Exploited	No Change
106	Panipat	Israna	140.81	Over Exploited	Panipat	Israna	156.18	Over Exploited	No Change
107	Panipat	Madlauda	137.86	Over Exploited	Panipat	Madlauda	149.74	Over Exploited	No Change
108	Panipat	Panipat	192.85	Over Exploited	Panipat	Panipat	202.37	Over Exploited	No Change
109	Panipat	Samalkha	231.00	Over Exploited	Panipat	Samalkha	226.17	Over Exploited	No Change
110	Panipat	Sanauli Khurd	152.67	Over Exploited	Panipat	Sanauli Khurd	255.16	Over Exploited	No Change
111	Rewari	Bawal	112.83	Over Exploited	Rewari	Bawal	120.86	Over Exploited	No Change
112	Rewari	Dahina	92.18	Critical	Rewari	Dahina	94.93	Critical	No Change
113	Rewari	Dharuhera	141.94	Over Exploited	Rewari	Dharuhera	143.88	Over Exploited	No Change
114	Rewari	Jatusana	166.20	Over Exploited	Rewari	Jatusana	167.73	Over Exploited	No Change
115	Rewari	Khol At Rewari	132.58	Over Exploited	Rewari	Khol At Rewari	141.89	Over Exploited	No Change
116	Rewari	Nahar	173.21	Over Exploited	Rewari	Nahar	164.74	Over Exploited	No Change
117	Rewari	Rewari	106.70	Over Exploited	Rewari	Rewari	119.57	Over Exploited	No Change
118	Rohtak	Kalanaur	27.35	Safe	Rohtak	Kalanaur	31.46	Safe	No Change
119	Rohtak	Lakhan Majra	51.52	Safe	Rohtak	Lakhan Majra	52.56	Safe	No Change
120	Rohtak	Maham	53.62	Safe	Rohtak	Maham	57.46	Safe	No Change
121	Rohtak	Rohtak	54.49	Safe	Rohtak	Rohtak	63.73	Safe	No Change

S.No	District	Block	SOGWD In 2020	Categorization	District	Block	SOGWD In 2022	Categorization	Remarks
122	Rohtak	Sampla	58.28	Safe	Rohtak	Sampla	67.40	Safe	No Change
123	Sirsa	Baragudha	76.31	Semi Critical	Sirsa	Baragudha	78.47	SC	No Change
124	Sirsa	Dabwali	123.20	Over Exploited	Sirsa	Dabwali	138.79	Over Exploited	No Change
125	Sirsa	Ellenabad	244.47	Over Exploited	Sirsa	Ellenabad	226.44	Over Exploited	No Change
126	Sirsa	Nathusari Chopta	106.57	Over Exploited	Sirsa	Nathusari Chopta	119.79	Over Exploited	No Change
127	Sirsa	Odhan	204.85	Over Exploited	Sirsa	Odhan	194.24	Over Exploited	No Change
128	Sirsa	Rania	147.52	Over Exploited	Sirsa	Rania	147.84	Over Exploited	No Change
129	Sirsa	Sirsa	213.50	Over Exploited	Sirsa	Sirsa	210.65	Over Exploited	No Change
130	Sonipat	Ganaur	142.80	Over Exploited	Sonipat	Ganaur	126.06	Over Exploited	No Change
131	Sonipat	Gohana	51.82	Safe	Sonipat	Gohana	52.24	Safe	No Change
132	Sonipat	Kathura	44.35	Safe	Sonipat	Kathura	41.24	Safe	No Change
133	Sonipat	Kharkhoda	60.48	Safe	Sonipat	Kharkhoda	52.87	Safe	No Change
134	Sonipat	Mundlana	120.46	Over Exploited	Sonipat	Mundlana	125.59	Over Exploited	No Change
135	Sonipat	Murthal	203.10	Over Exploited	Sonipat	Murthal	168.73	Over Exploited	No Change
136	Sonipat	Rai	194.93	Over Exploited	Sonipat	Rai	165.10	Over Exploited	No Change
137	Sonipat	Sonipat	127.09	Over Exploited	Sonipat	Sonipat	120.19	Over Exploited	No Change
138	Yamunanagar	Bilaspur	125.89	Over Exploited	Yamunanagar	Bilaspur	120.36	Over Exploited	No Change
139	Yamunanagar	Chhachhrauli	103.16	Over Exploited	Yamunanagar	Chhachhrauli	80.81	Semi Critical	Improved
140	Yamunanagar	Jagadhri	179.85	Over Exploited	Yamunanagar	Jagadhri	157.46	Over Exploited	No Change
141	Yamunanagar	Khizrabad	125.99	Over Exploited	Yamunanagar	Khizrabad	89.45	Semi Critical	Improved
142	Yamunanagar	Mustafabad	178.77	Over Exploited	Yamunanagar	Mustafabad	204.24	Over Exploited	No Change
143	Yamunanagar	Radaur	207.83	Over Exploited	Yamunanagar	Radaur	208.22	Over Exploited	No Change
144	Yamunanagar	Sadaura (Part)	95.39	Ccritical	Yamunanagar	Sadaura (Part)	145.01	Over Exploited	Deteriorated

5.9 Conclusions

The analysis of the figures of the groundwater resources of state indicates that there exists enough scope for development of existing resource in 36 blocks which are considered safe from ground water development point of view. 88 blocks have attained stage of development more than 100% and long-term water level trends during pre and post monsoon period in the block showing declining trend, they are categorized as over exploited (Fig. 14).

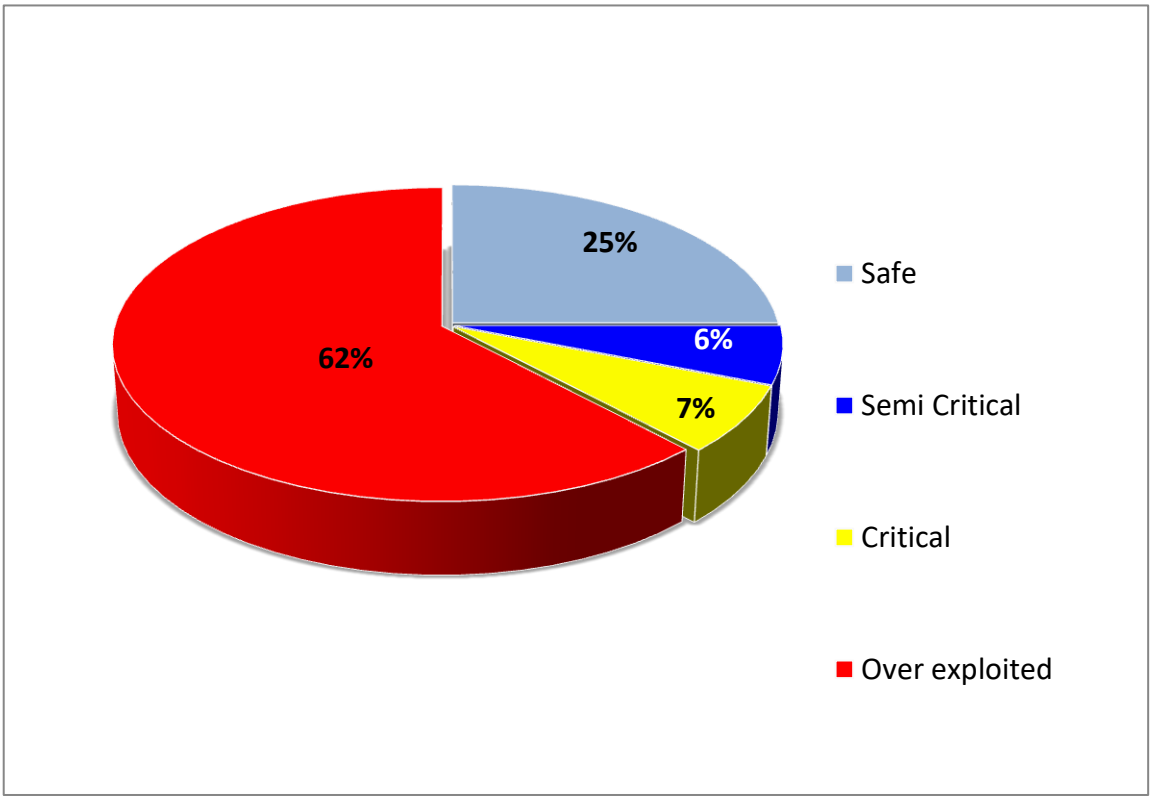


Figure 14 Percentage of Assesment Units under different categories

The analysis of present ground water resource assessment indicates that there is marginal increase in net availability of ground water resources as compared to previous assessment.

The ground water draft has decreased by about 0.58%. The major change in ground water draft is for irrigation & Insdustrial use. The decrease is reflected in decrease in overall Stage of Development from 135% to 134%. The number of Safe blocks/AUs accordingly has increased from 30 to 36 because of decrease in Groundwater Draft.

5.10 Recommendations

The major use of ground water in the state is in agriculture sector. Out of 3.5 million Ha of total area under cultivation, 1.121 m Ha area is under tubewell irrigation. There are approximately 8.40 lakh irrigation tubewells are present in the state. There is urgent need to launch a massive awareness programme to educate the farmers about judicious use of ground water. In order to have an effective & efficient utilization of ground water, incentives can be mooted to the farmers to use water sustainably. Awards may be launched and incentives be

provided for the farmers, Panchayats and industries who have taken excellent measures for conservation of water measures and consuming less water. Governemnt of Haryana has taken the following measures for promotion of ground water conservation in the state:

- ✓ Establishment of **Haryana Water Resources Authority** to take action for Ground Water management.
- ✓ For Ground Water management, the State Government, through its notification dated 07.12.2020 had enacted **"The Haryana Water Resources (Conservation, Regulation and Management) Authority Act, 2020"** for conservation, management and regulation of water resources i.e., Ground Water and surface water within the State.
- ✓ **"The Haryana State Preservation of Sub Soil Water Act, 2009"** has been enacted which prohibits sowing of Paddy before 15th of May and transplanting of Paddy before 15th of June.
- ✓ The Department encourages the farmers to adopt Drip Irrigation System. Subsidy @85% is being provided to all categories of farmers limited to 5 Ha perbeneficiary.
- ✓ The Department encourages the farmers to adopt Sprinkler Irrigation System.Subsidy @85% is being provided to all categories of farmers limited to 5 Ha perbeneficiary.
- ✓ To reduce seepage and evaporation losses, subsidy is being provided to the farmers for laying Underground Pipeline System. Subsidy @50% to the cost of systemlimited to Rs. 25000/- per hectare with maximum of Rs. 60000/- per beneficiary isapplicable.
- ✓ Crop Diversification programmes have been launched in the State, namely **'Mera Pani Meri Virasat'** has been launched in the State during 2020-21, the subsidy benefit of Rs. 7000.00 per acre is provided to the farmers.
- ✓ An area of 96590.14 acre has been covered under **'Mera Pani Meri Virasat'** during 2020.
- ✓ Roof-top Rain-Water Harvesting Structures are constructed in the Govt. buildings such as Schools/ Colleges/ Govt. offices on demonstration basis for artificially recharging the groundwater aquifers.
- ✓ New World Bank funded scheme namely **"Atal Bhujal Yojana (ABHY)"** has been launched in the State for sustainable groundwater management. The scheme has been designed as a pilot with the principal objective of strengthening the institutional framework for participatory ground water management in the 36 Blocks, 1669 GPs of 14 Districts of Haryana.
- ✓ It has been observed that major ground water draft is for paddy cultivation. There is urgent need to promote crops requiring less water by providing incentives to the farmers. Paddy cultivation based on ground water development and irrigation should be banned.
- ✓ Micro-irrigation techniques, such as drip irrigation, & sprinkler irrigation, under ground pipe lines may be adopted for enhancing water use efficiency especially in over exploited blocks. Metering system be introduced to encourage users to avoid excessive use of ground water resources. Farm ponds in the cultivation areas especially in the fields of farmers where farm holding is morethan 2 Ha shall be made mandatory so that the overflow water during rainy season can be stored and can be used during no-rainyperiods.
- ✓ A comprehensive action plan for augmenting ground water by utilizing surplus rainwater runoff

and flood waters may be drawn and implemented in Over-exploited and Critical blocks. Consolidation and expansion of programme for renovation, repair and rejuvenation of water bodies may be taken up in these areas. Haryana ponds and Waste Water Management Authority shall takeup renovation of all the ponds in thestate.

- ✓ Development of flood plain aquifers for irrigation and domestic uses in adjacent areas be taken up to meet the requirement which may help in reducing stress on ground water resources in over-exploited and critical blocks.
- ✓ Groundwater Cell, Irrigation and Water Resources Department shall be strengthened to takeup the assigned tasks in efficientmanner.
- ✓ Conjunctive use of surface and ground water may be promoted for maximizing the gains from IWRM in brackish/saline ground water areas. Possibilities of Ground water development in waterlogged areas may be workedout.
- ✓ Efforts be made to promote use of Sodic waters by applying gypsum and supplementing the tubewell irrigation with canal water. The cropping pattern in water quality problematic areas should be modified and saline resistant crops should be encouraged.
- ✓ Comprehensive assessment of static ground water resources (deeper aquifers) to be taken up to ensure additional water availability to the farmers during stress periods.
- ✓ Ground water management requires multi-disciplinary approach and micro-level studies. There is urgent need for strengthening of state department dealing with ground water and also their capacitybuilding.
- ✓ Strengthening of ground water monitoring network through construction of piezometers and involvement of Panchayati Raj Institution be considered to get the data at micro-level.
- ✓ The quality of ground water is equally important. Excessive use of fertilizers and pesticides should be discouraged to avoid pollution of water and use of bio-fertilizers be propagated.
- ✓ Industries should install ETPs, so that the untreated effluent does not pollute the ground water. Recycling of waste water may be made mandatory for industries.
- ✓ There is urgent need for micro-level data collection, updation, validation and processing related to various parameters and norms used in the report which will help in further refining the estimates.

Wayforward:

- To encourage the farmers to adopt micro irrigation systems such as Drip Irrigation System, Sprinkler Irrigation system, Mini sprinkler Irrigation system.
- To reduce seepage and evaporation losses, encourage the farmers to adopt Underground Pipeline System.
- To aware and encourage farmers to diversify the paddy and other water guzzling crops by adapting Crop Diversification programmes launched in the State for conservation of natural groundwater resource, alternate crops e.g., maize, sunflower, cotton, vegetables, bajra and summer moong etc. are being promoted in place of water guzzlingcrops.
- Enforcement of Treated Waste Water Policy of 2019.
- The initiatives like catch the rain have been be launched to conserve every drop of rain. The project for construction of rainwater harvesting structures has been taken up at large scale and make mandatory for housing societies, infrastructure projects in water stressed areas.
- The construction of Roof-Top Rain-Water Harvesting Structure (RTRWHS) should be made mandatory in all Govt. building including Schools/ Colleges/ Govt. offices for artificially recharging the groundwater aquifers and creating awareness among students and generalpublic.
- To increase the existing canal network in the State.
- To increase supply of canal water during rainy season for recharging Ground Water in water stressedareas.
- Digging of ponds and Ponds rejuvenation.
- All ponds and tanks to be filled with water all times through the surplus water available in canals passing through nearby areas.
- No flood irrigation to be allowed.

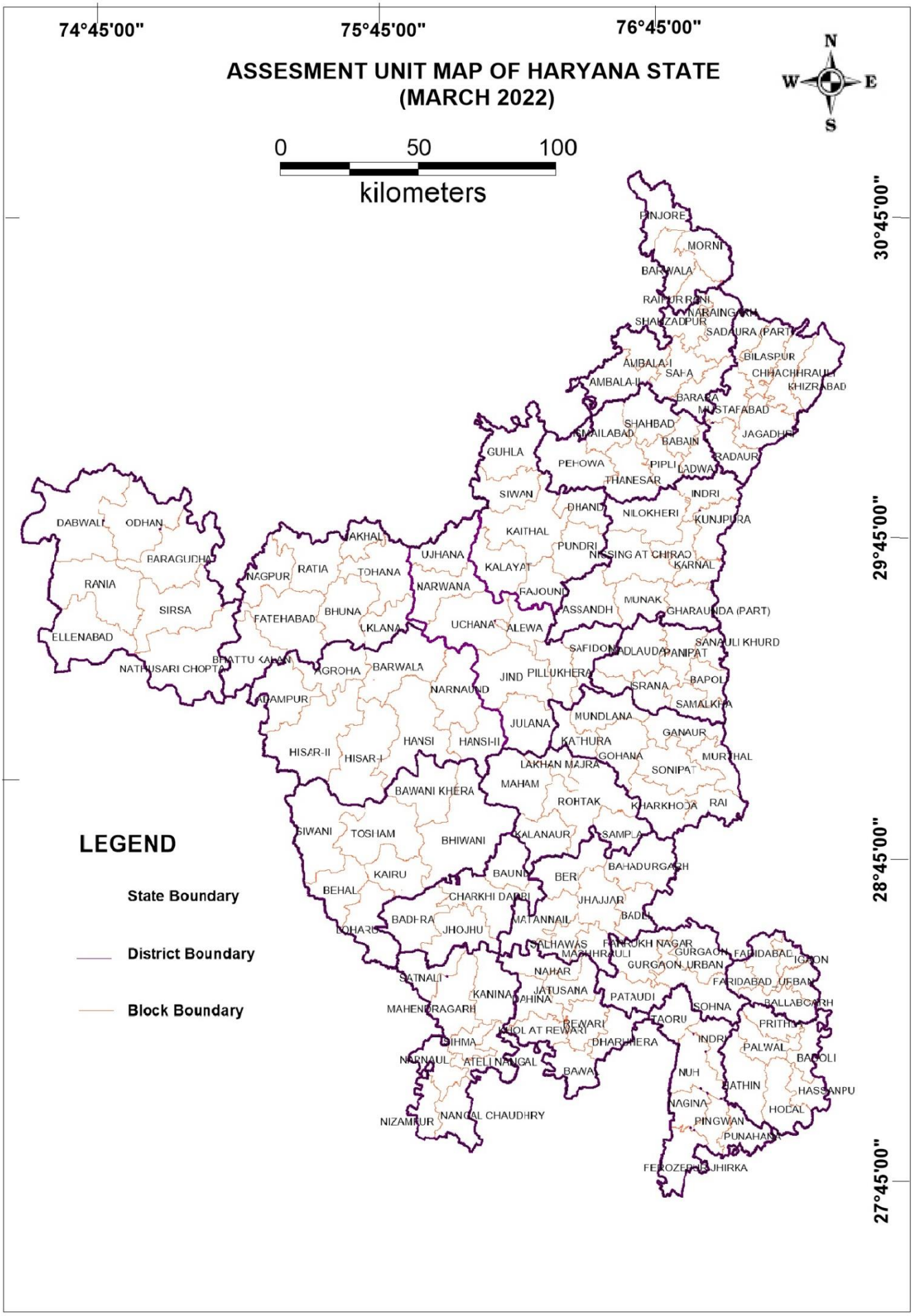


Figure 15 Administrative base map/assessment unit demarcation

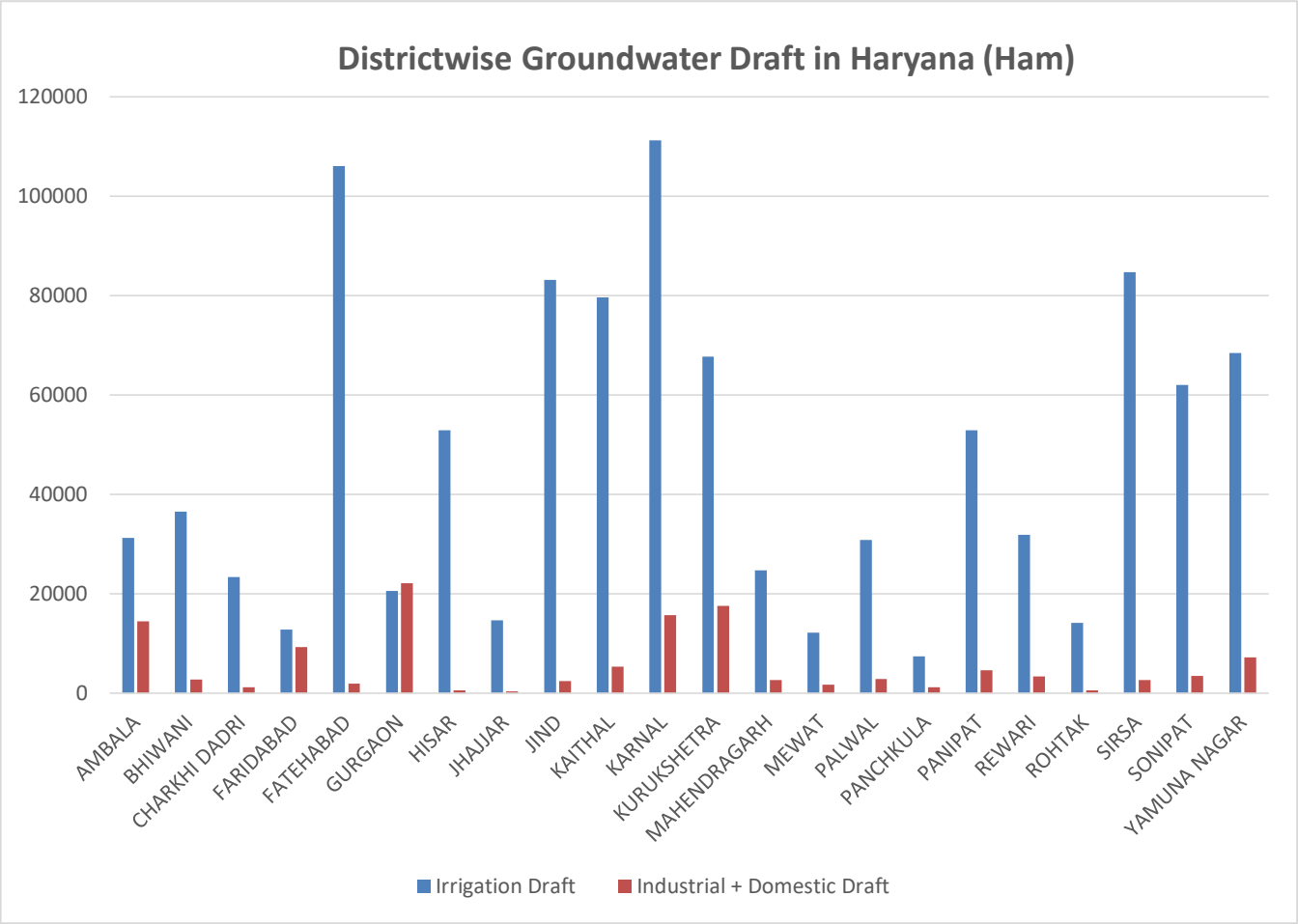


Figure 16 District wise Ground water Draft

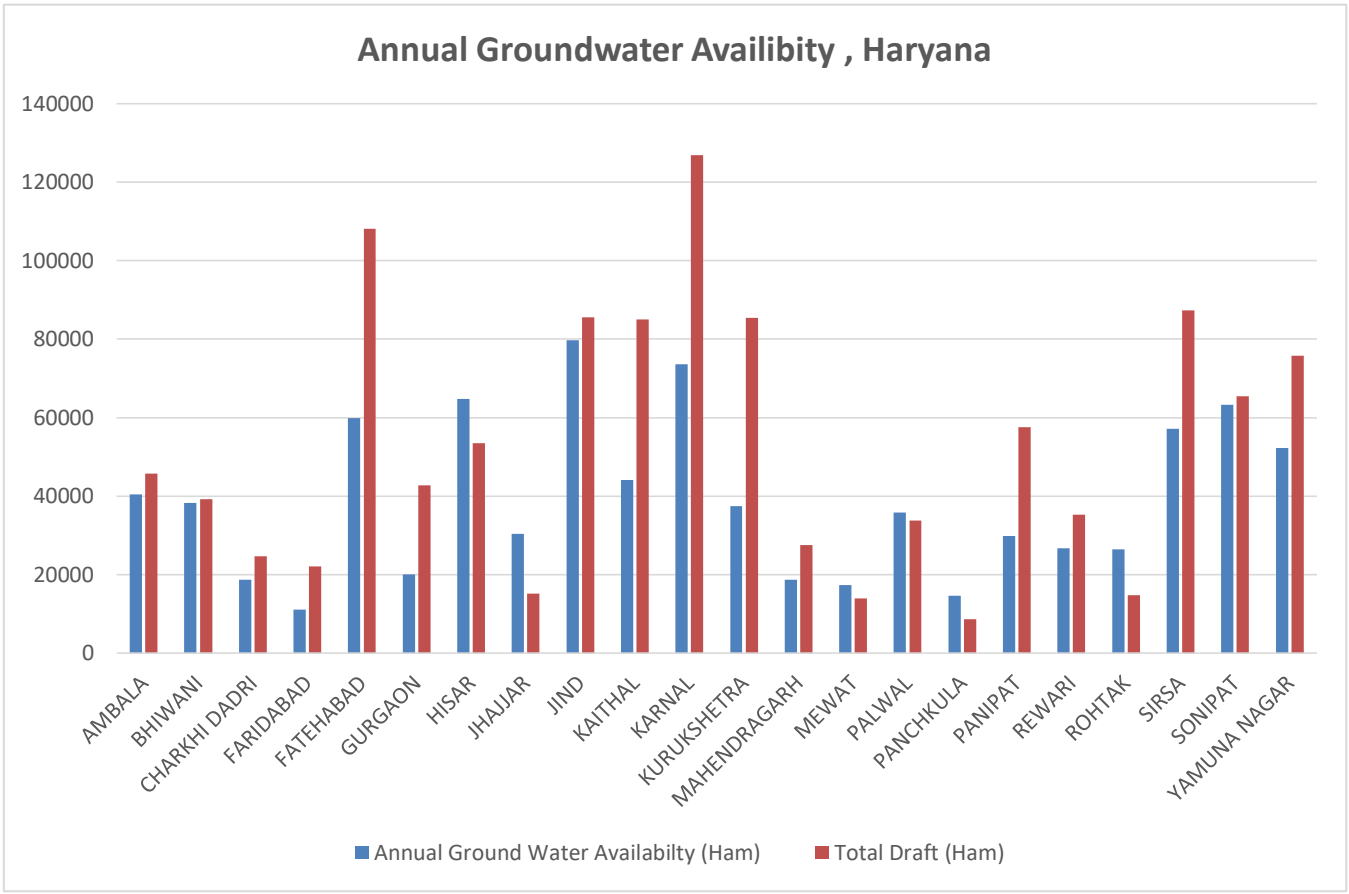


Figure 17 District wise Annual Ground water availability

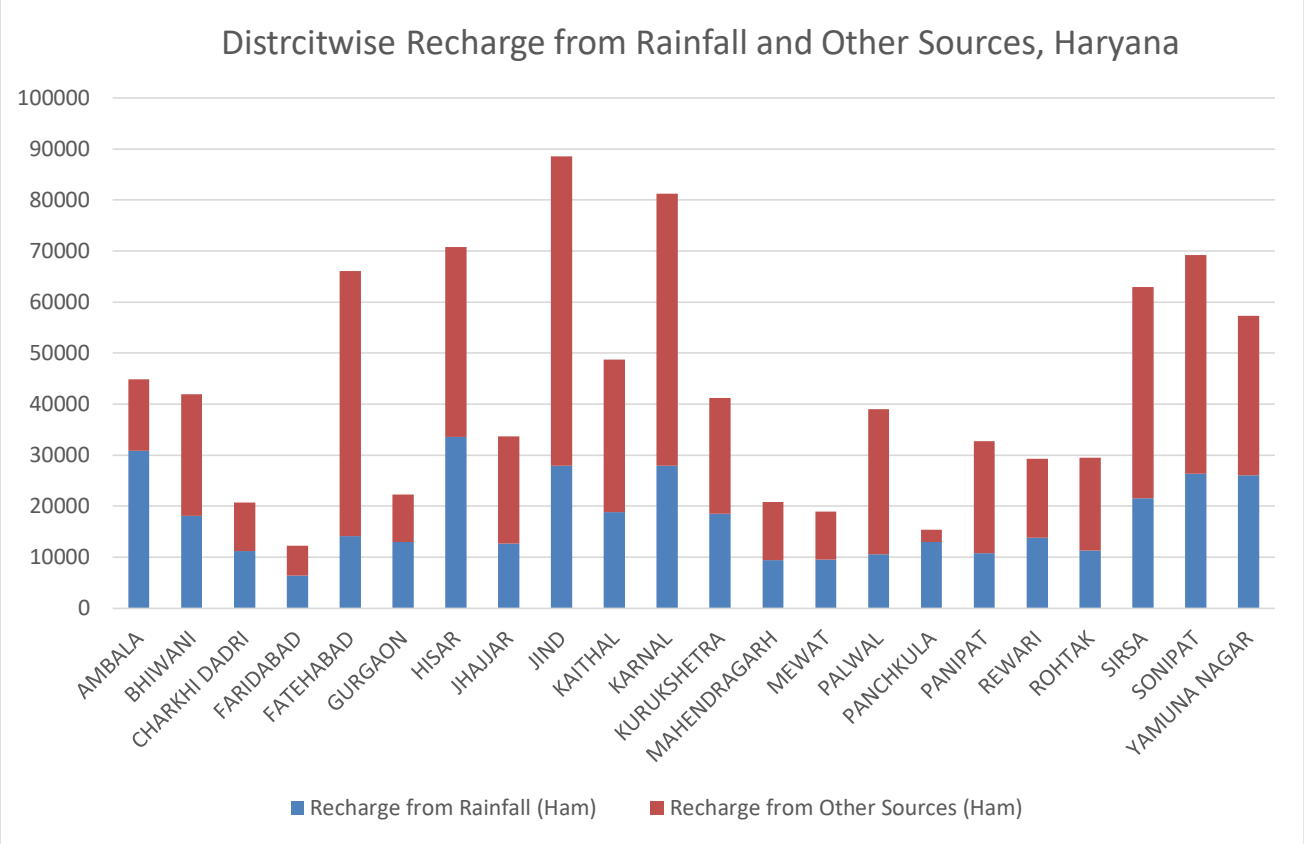


Figure 18 District wise Recharge from Rainfall and other sources

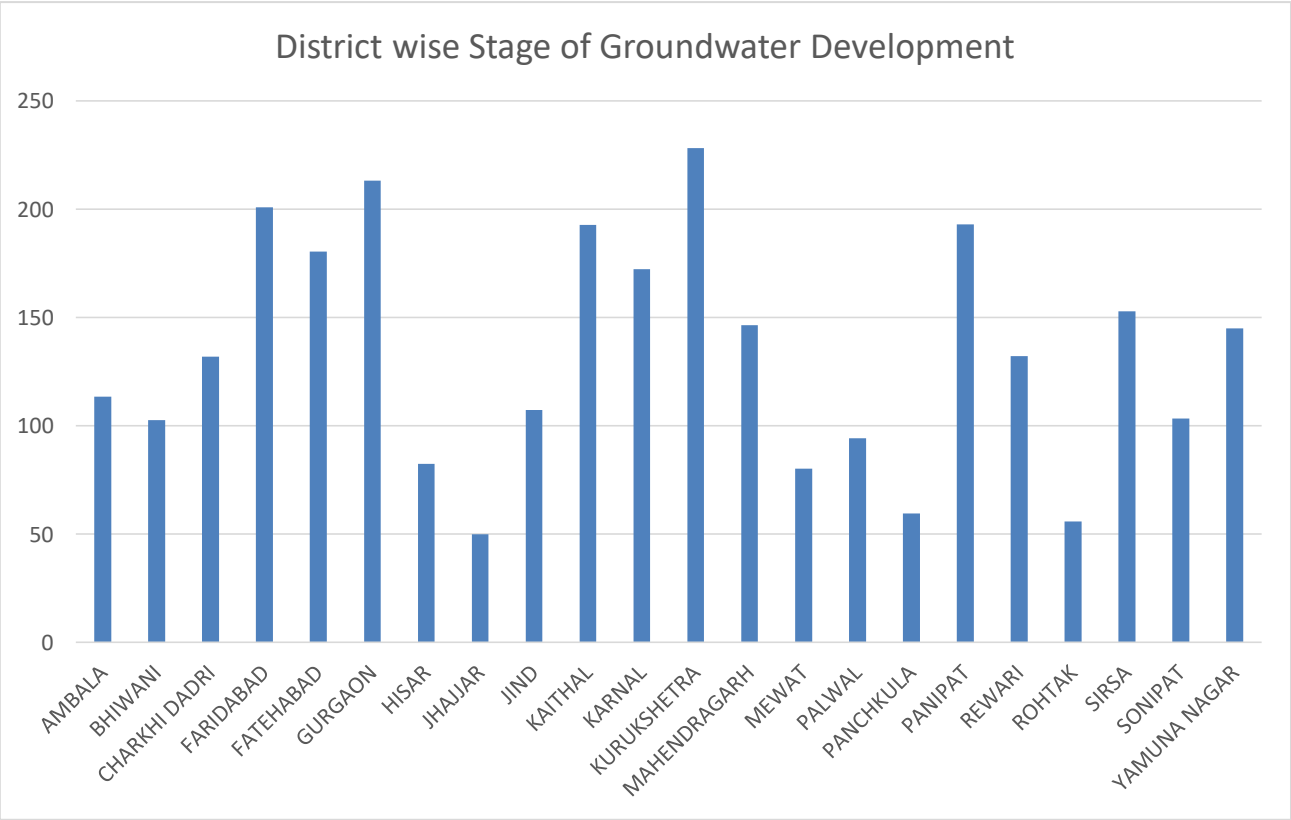


Figure 19 District wise Stage of Groundwater Development

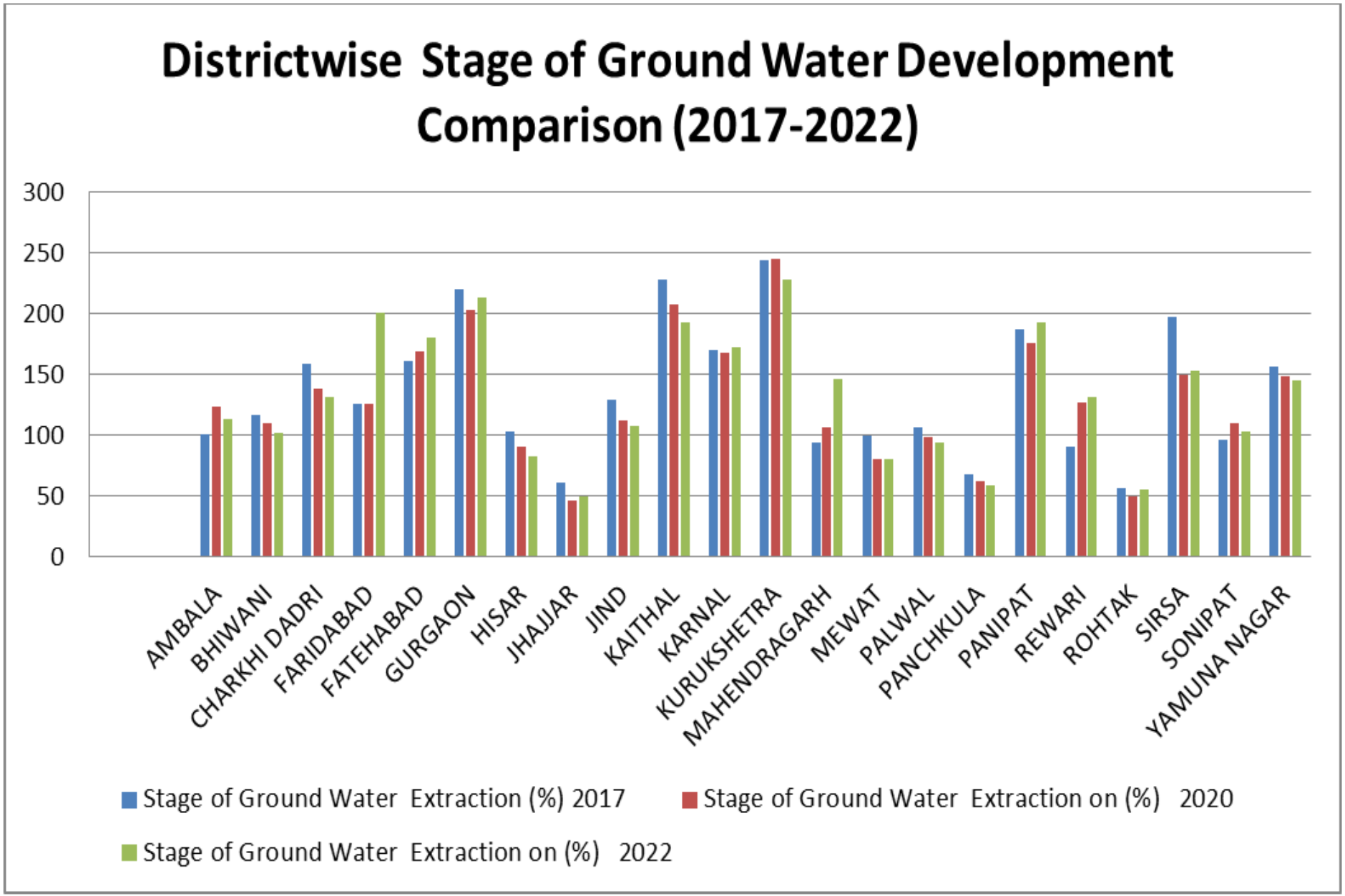


Figure 20 District wise Stage of Groundwater Development Comparison as on 2017 to 2022

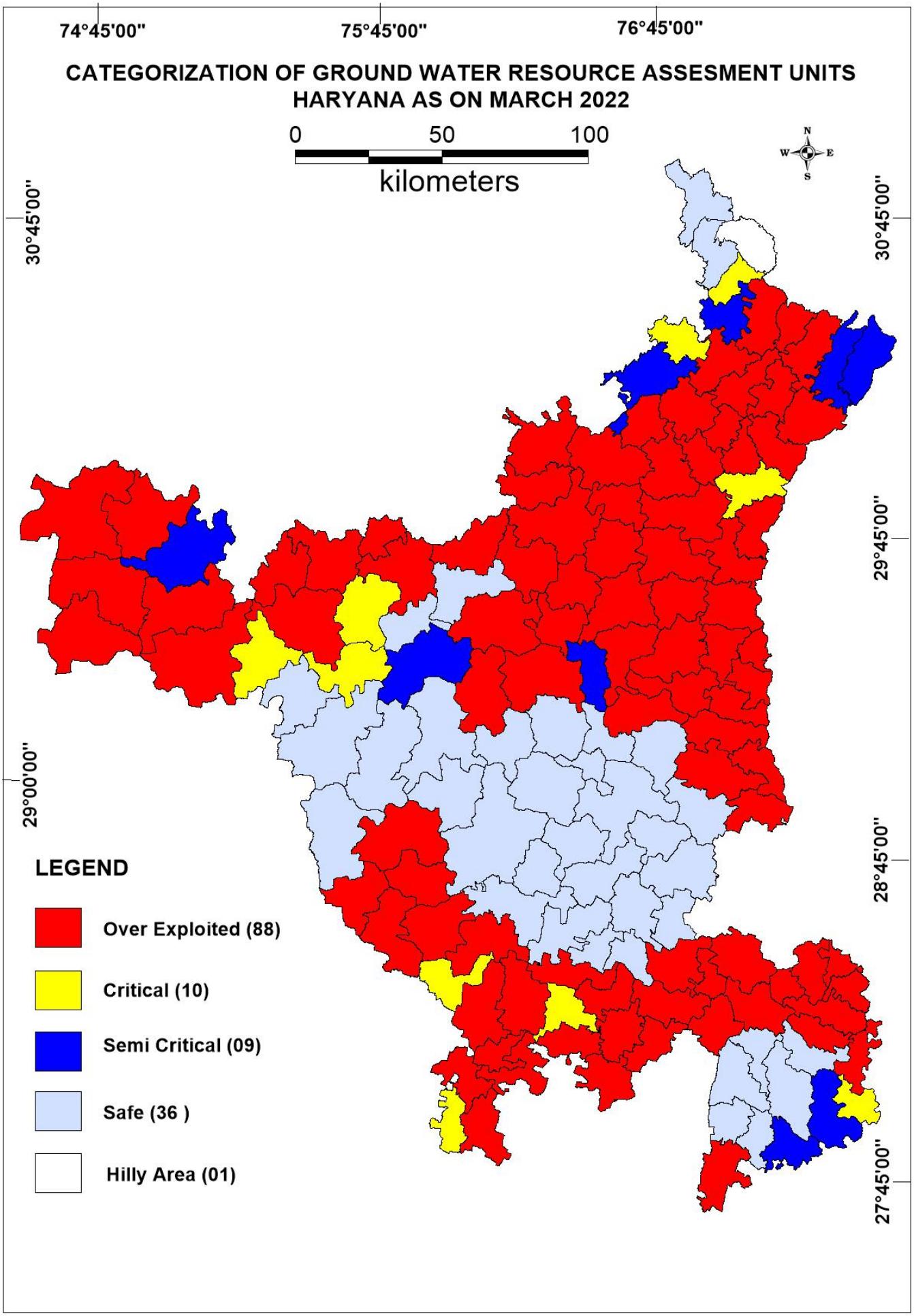


Figure 21 Categorization of Ground Water Resource Assesment Units (As on March 2022)

ANNEXURE I

Constitution of State Level Committee for Ground Water Resource Assessment of Haryana State (as on 31st March 2022)

TIME BOUND MATTER

From

Chief Hydrologist, Ground Water Cell
Irrigation & Water Resources Department,
Krishi Bhawan, Sector-21, Haryana, Panchkula.

To

The Regional Director,
Central Ground Water Board,
Chandigarh.

Memo No. 1578 /GWC Dated: 29/12/2021

Subject: Regarding Ground Water Resources Assessment 2022.

In reference to above mentioned subject and your office email 21.12.2021 it is to informed that the committee for assessment of ground water resource estimation in Haryana is already constituted during 2020 and its tenure is for 3 years, the copy of same is attached. It is also requested to collect rainfall data from IMD.

This is for your kind information and necessary action please.

Encls: As above.

28/12/2021

Hydrologist
for Chief Hydrologist, GWC,
Haryana, Panchkula.

CC:-

- PS to Engineer-in-Chief, LCU & GWC, Irrigation & Water Resources Department, Panchkula for kind information to worthy EIC/LCU.

HARYANA GOVERNMENT
IRRIGATION & WATER RESOURCES DEPARTMENT
ORDER

The Governor of Haryana pleased to constitute the committee for Estimation of Ground Water Resource Potential & Refinement of figures in the State. The composition of the committee will be as under:

1.	Additional Chief Secretary to Govt. Haryana, Irrigation & Water Resource Department	Chairman
2.	Vice Chancellor, C.C.S. Haryana Agricultural University, Hisar	Member
3.	Director General Agriculture, Haryana	Member
4.	Managing Director, Haryana State Industrial & Infrastructure Development Corporation	Member
5.	Administrator, Command Area Development Authority, Haryana, Panchkula	Member
6.	Director, Rural Development Department, Haryana	Member
7.	Director, Industries and Mines & Geology Department, Haryana	Member
8.	Managing Director, Haryana State Cooperative Agricultural & Rural Development Bank Ltd.	Member
9.	Chairman, Haryana State Pollution Control Board	Member
10.	General Manager, NABARD, Chandigarh	Member
11.	Engineer-in-Chief, Irrigation Department, Haryana	Member
12.	Engineer-in-Chief, Public Health Engineering Department, Haryana	Member
13.	Director, HARSAC	Member
14.	Director, HIRMI, Kurukshetra	Member
15.	Member Secretary, Haryana Ponds and Waste Water Management Authority	Member
16.	Chief Hydrologist, Ground Water Cell	Member
17.	Regional Director, Central Ground Water Board, Chandigarh	Member Secretary

The committee may co-opt any other member (s)/ Special invitee(s) if necessary. The functions of the committee shall be as under:-

i) To estimate annual replenishable ground water resources of the State in accordance with the Ground Water Resource Estimation Methodology.
ii) To estimate the status of utilization of annual replenishable ground water resource.

The headquarters of the committee shall be at Chandigarh. Its terms shall be for 03 (three) years. The members shall draw their TA/DA from respective organisation.

Dated Chandigarh, the

Devender Singh, IAS
Additional Chief Secretary to Govt. Haryana,
Irrigation & Water Resource Department.

Endstt. No. 2/72/2020-1IW Dated Chandigarh, the 08th October, 2020

A copy of the above is forwarded to the following for information and necessary action:-

1. Vice Chancellor, C.C.S. Haryana Agricultural University, Hisar.
2. Director General Agriculture, Haryana
3. Managing Director, Haryana State Industrial & Infrastructure Development Corporation
4. Administrator, Command Area Development Authority, Haryana, Panchkula.
5. Director, Rural Development Department, Haryana.
6. Director, Industries and Mines & Geology Department, Haryana.
7. Managing Director, Haryana state Cooperative Agricultural & Rural Development Bank Ltd.
8. Chairman, Haryana State Pollution Control Board.
9. General Manager, NABARD, Chandigarh
10. Engineer- in-Chief, Irrigation &W.R. Department, Haryana
11. Engineer- in-Chief, Public health Engineering Department, Haryana.
12. Director, HARSAC, CCS, HAU Campus, Hisar
13. Director, HIRMI, Kurukshetra
14. Member secretary, Haryana Pond and Waste Water Management Authority
15. Chief Hydrologist, Ground water Cell
16. Regional Director, Central Ground Water Board, Bhujal Bhawan, Sector 27 B, Chandigarh

Superintendent, Irrigation (Works),
for Additional Chief Secretary to Govt. Haryana,
Irrigation and Water Resources Department

CC: A copy of the above is forwarded to PS of W/ACSI&WRD to inform to W/ACSI&WRD please.

Annexure-II

Minutes of meeting of State Level Committee (SLC) for Ground Water Resource Assessment of Haryana State (as on 31st March 2022) held on 27.05.2022 at Haryana Civil Secretariat, Knowledge Centre, 9th floor, Sector-1, Chandigarh

A meeting was held for estimation of Ground Water Resources of Haryana State as on 31st March, 2022 and refinement of figures under the chairmanship of Sh. Devender Singh, IAS, Additional Chief Secretary to Govt. of Haryana, Irrigation and Water Resources Department on 27.05.2022 at 12:30 Hrs. The List of Participants is attached as Annexure-I.

1. At the outset, Shri Dinesh Tewari Scientist-E, Central Ground Water Board (CGWB), NWR, Chandigarh welcomed all the members of SLC and appraised the Chairperson and other members about the purpose of GWRA. He also briefed about the agenda points of the meeting. The agenda points for the meeting in specific were as follows:

a) Salient feature of GWRE-2020
b) Introduction to India-GEC portal.
c) Data requirement and organizations responsible for submission of data.

2. Shri Devender Singh, Additional Chief Secretary to Government of Haryana requested to make presentation. Shri Gyanendra Rai, STA-HG briefly explained the constitution of the committee, mandate of the committee and briefed about the Dynamic Ground Water Resources of Haryana state as on 31st March 2020, through power point presentation.
3. Shri Gyanendra Rai, STA-HG apprised the Committee that Government of India has developed an online portal India GEC portal (http://indiagec.vassarlabs.com/staging) for Ground Water Resource Assessment. Two Trainings for the same have been conducted by CGWB for State Officials. Also, the datasheets, ID & Password for India-GEC portal has already been shared with all the field offices of Ground Water Cell, Govt. of Haryana.
4. It was informed in meeting that the estimation needs to be carried out for 143 blocks as present in Haryana State. The organization of data for 143 Block need boundary shape files with properly demarcated boundaries of the Blocks. In GWRA-2022, separate assessment has to be carried out for Assessment Units which are Urban Areas having population >l0 lakhs. The shape files of such assessment units are also needed. These shape files are available with HARSAC, Haryana and the same may be shared with CGWB.
5. Canal Flow data –Length of the canal falling in each block shall be revised and supplied by Irrigation Department. Irrigation Department shall also arrange for the data on Area irrigated by surface water and ground water to estimate the return seepages from the Irrigation.
6. Data on Water Conservation structures like Check dams, percolation ponds or village and urban ponds shall be arranged by Haryana Ponds and Waste Water Management Authority and Department of Rural Development (SLNA).
7. The date requirement from various State Organizations was discussed in detail and it was assured by Chairperson that the required data will be furnished by them.
8. Number of Industrial tube-wells and groundwater draft by various industries shall be shared by Industry Department/HSPCB/HWRA/Power-Cooperation.
9. It was advised by Chairperson that the category “Safe” shall be replaced by different terminology in area affected with “salinity” as despite being low on fresh water availability, the area is rendered as “safe” which is misleading.
10. Training for IN-GRES shall be organized for HIRMI, for the co-ordination of data for GWRE-2022 and SSAP.

The meeting ended with vote of thanks to the Chair.

****

List of participants of State Level Committee for Ground Water Resource Assessment of Haryana State (as on 31st March 2022) held on 27.05.2022 at Haryana Civil Secretariat, Knowledge Centre, 9th floor, Sector-1, Chandigarh

Sr. No.	Name	Designation & Department	Phone No.
1.	Sh. Satbir Singh Kadian	EIC, Water Resource & Irrigation Department	9216532566
2.	Dr. Jeet Ram Sharma	Director of Research, CCS HAU, Hissar	9416397521
3.	Dr. R.K. Jhorar	Professor & Head CCS HAU, Hissar	9416586022
4.	Sh. J.P. Singh	SEE, HSPCB	9216849307
5.	Sh. Sanjay Rohila	Assistant Director MSME Department	9467751062
6.	Sh. Anil K. Sharma	Additional Secretary HSCARDB	941719181
7.	Sh. Mukesh Gupta	HOD (Engg.) HSIIDC	9996259028
8.	Sh. Pankaj Mahala	Hydrologist, Ground Water Cell	9416444474
9.	Sh. Rakesh Kumar	Chief Hydrologist, Ground Water Cell	9416358828
10.	Sh. Jagbir Malik	Chief Engineer PHED	9466160070
11.	Sh. H.P. Sharma	Tech Advisor HPWWMA	9416683600
12.	Sh. Ravinder Singh	DGM NABARD	9930175648
13.	Sh. Binendu Singh	EIC HIRMI	9811213622
14.	Dinesh Tewari	Scientist 'E' CGWB, NWR, Chandigarh	7986629916
15.	Dr. Kriti Mishra	Scientist 'B' CGWB, NWR, Chandigarh	9415426179
16.	Sh. Gyanendra Rai	STA-HG CGWB, NWR, Chandigarh	9877174756
17.	Sh. Saquib	STA-HG CGWB, NWR, Chandigarh	8081106460

ANNEXURE III

Minutes of the meeting of working group for "Ground Water Resources Estimation of Haryana as March 2022" held on 24.08.2022 at 12.00 Noon in the chamber of Dr. Satbir Singh Kadian, Engineer-in-Chief, Irrigation & Water Resource Department, Govt. of Haryana at Sinchai Bhawan, Panchkula.

A meeting of working group for "Ground Water Resources Estimation of Haryana as March 2022" held on 24.08.2022 at 12.00 Noon under the Chairmanship of Dr. Satbir Singh Kadian, Engineer-in-Chief, Irrigation & Water Resource Department, Govt. of Haryana at Sinchai Bhawan, Panchkula. The field officers and technical officers of concerned district have attended the meeting through virtual mode.

The meeting was attended by the following officers:

i. Sh. Rakesh Kumar, Chief Hydrologist, GWC, Haryana.

ii. Sh. Pankaj Mahaila, Hydrologist, GWC, Haryana.

iii. Sh. Vidya Nand Negi, Scientist 'D', CGWB, Chandigarh.

DELIBERATIONS & DECISIONS

At the very outset, Dr. Satbir Singh Kadian welcomed all the members of **Working Group** for "Ground Water Resources Estimation of Haryana". He also briefed about the agenda points of the meeting. The agenda points for the meeting in specificwere as follows:

1. Sh. Vidya Nand Negi, Scientist 'D' CGWB, Chandigarh briefed about Ground Water Resource Estimation of Haryana as on March 2022 through power point presentation. He has also highlighted the comparison of Stage of ground water development as on March 2022 with 2020.
2. The block wise Stage of ground water development was discussed with the concerned field Hydrologists/Technical officers. Almost all the field Hydrologists/ Technical officers of all the districts were satisfied with the outputs generated through INGRES.
3. The Chairman suggested for changing the nomenclature of 'Blocks' to 'Assessment Units' as it creates confusion after doing the separate assessment for Faridabad urban and Gurgaon Urban. Sh. Vidya Nand Negi agreed to change the names as 'Assessment units' instead of 'Blocks'.

4. The Chairman and Sh. Rakesh Kumar, Chief Hydrologist also suggested showing some of the blocks which have saline problems. Sh. Vidya Nand Negi told that if any block is extracting 100% saline water, we can show that block in 'Saline' category. He agreed that if the field hydrologists provide the number of abstraction structures extracting only saline water as a domestic/industrial/ irrigation draft it will be categorized under 'Saline'.
5. It was also suggested for showing the units of Annual ground water availability, ground water extraction, existing ground water draft etc. in MCM also. It was also suggested to show the list of the blocks where stage of ground water development improved and deteriorated.
6. Dr. Kadian also instructed the concerned field Hydrologists/ Technical officers to revalidate the inputs for the ground water resource estimation of respective blocks and discuss with CGWB if modifications required.

Meeting ended with the vote of thanks.

ANNEXURE IV

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तर पश्चिमी क्षेत्र
भूजल भवन, सेक्टर 27 A, मध्य मार्ग
चंडीगढ़, 160019
दूरभाष : 0172)- 2619500/01/02
ई-मेल : rdnwr-cgwb@nic.in

GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
CENTRAL GROUND WATER BOARD
NORTH-WESTERN REGION
BHUJAL BHAWAN, SECTOR 27 A, MADHYA MARG
CHANDIGARH, 160019
PHONE NO : (0172)- 2619500/01/02
E-MAIL: rdnwr-cgwb@nic.in

No. 4(139)HR/NWR/S&I/2022- 809 Dated: 16.09.2022

To

1. The Vice Chancellor, C.C.S Haryana Agricultural University, Hisar, Haryana
2. The Director General of Agriculture, Haryana, Krishi Bhawan, Sector-21, Panchkula
3. The Managing Director, Haryana State Industrial & Infrastructure Development Corporation, Sector-6, Panchkula
4. The Administrator, Command Area Development Authority, Haryana, Panchkula
5. The Director, Rural Development Department, SCO-183-185, Sector 17, Chandigarh
6. The Director, Industries and Mines & Geology Department, Haryana, 30 Bays Building, Sector-17, Chandigarh
7. The Managing Director, Haryana State Cooperative Agricultural & Rural Development Bank Ltd., Sector-2, Panchkula
8. The Chairman, Haryana State Pollution Control Board, Sector-6, Panchkula
9. The General Manager, NABARD, Sector-34, Chandigarh
10. The Engineer-in-Chief, Irrigation Department, Sinchai Bhawan, Sector-5, Panchkula, Haryana
11. The Engineer-in-Chief, Public Health Engineering Department, Sector-2, Panchkula, Haryana
12. The Director HARSAC, CCS HAU Campus, Hisar.
13. The Director HIRMI, Kurukshetra.
14. The Member Secretary, Haryana Ponds and Waste Water Management Authority, Haryana,
15. The Chief Hydrologist, Ground Water Cell, Haryana.

Sub: Minutes of 2nd meeting of State Level Committee for Approval of Ground Water Resource Estimation of Haryana as on March, 2022-reg.

Sir,

State Level Committee has approved the Ground Water Resource Estimation of Haryana as on March, 2022.

An approved minute of meeting is enclosed herewith.

Yours faithfully,

Akhanna 16/9

(Anurag Khanna)
Regional Director &
Member Secretary

Copy to: The Additional Chief Secretary, Irrigation & Water Resource Department, Govt. of Haryana, Haryana Civil Secretariat, Chandigarh for kind information please.

(Anurag Khanna)
Regional Director &
Member Secretary

Minutes of the 2nd meeting of State Level Committee for Approval of Ground Water Resource Estimation of Haryana as on March, 2022 held on 08.09.2022 at 3.30 PM under the Chairmanship of Commissioner & Secretary to Government, Haryana, Irrigation & Water Resources Department, Haryana in Conference Hall, 6th Floor, Haryana New Civil Secretariat, Sector 17, Chandigarh

A 2nd meeting of State Level Committee for Approval of Ground Water Resource Estimation of Haryana as on March, 2022 was held on 08.09.2022 at 3.30 pm under the Chairmanship of Sh. Pankaj Agarwal (IAS), Commissioner & Secretary to Government, Haryana, Irrigation & Water Resources Department, Haryana in Conference Hall, 6th Floor, Haryana New Civil Secretariat, Sector 17, Chandigarh The list of Members/officers attending the meeting is give in Annexure - I.

At the very outset, Dr. Satbir Singh Kadian, Engineer-in-Chief, Irrigation & Water Resource Department, Govt. of Haryana welcomed all the members ofState Level Committee for "Ground Water Resources Estimation of Haryana". He also briefed about the agenda points of the meeting. The agendas discussed during the above meeting are as given below:

1. Sh. Vidya Nand Negi, Scientist 'D' CGWB, Chandigarh briefed about Ground Water Resource Estimation of Haryana as on March 2022 through power point presentation. He has also highlighted the comparison of Stage of ground water development (SOGWD) as on March 2022 with 2020. The committee has approved the Ground water resource estimation of Haryana as on March 2022 as detailed below:
    - Total Annual Ground Water Recharge of the State has been assessed as 9.47 bcm and Annual Extractable Ground Water Resource is 8.61 bcm.
    - The Total Current Annual Ground Water extraction is 12.42 bcm and Stage of Ground Water extraction is 134.14 %.
    - Out of total 143 assessment units (blocks/Urban), 88 units (61.53 %) have been categorized as 'Over-exploited', 10 units (6.99 %) as 'Critical', 09 units (6.29 %) as 'Semi Critical' and 36 units (25.17 %) as 'Safe' categories of assessment units.
    - Similarly out of 40391.06 sq km recharge worthy area of the State, 24772.70 sq km (61.33 %) area are under 'Over-Exploited', 2359.29 sq km (5.84 %) under 'Critical', 2398.44 sq km (5.94%) under 'Semi-critical', 10860.63 sq km (26.89 %) under 'Safe' categories of assessment units.
2. Sh. B.S. Duggal from Rural Development Department, Panchkula, Haryana had pointed out that there is decrease in total ground water extraction in irrigation use in the State. Dr. Satbir Singh Kadian justified that there is increase in canal irrigation in last two years which lead to the decrease in ground water extraction for irrigation use.

3. Dr. Satbir Singh Kadian told that the categorization done by CGWB is at Block Level, while it has been observed that within a block there are huge variation i.e. some villages may be over exploited and others may be safe but because the Block has been declared as 'OE' thus all villages are treated as 'OE' and this causes lot of public distress as policies are aligned in accordance with the CGWB categorization. This issue can be solved if a 'note' with 'categorization' stating," the categorization is done at Block Level and may vary from village to village as reported by HWRA."

   Sh. Anurag Khanna agreed for incorporating the same in the final report.

4. Dr. R.K. Jhorar, Prof & Head (SWE), CCSHAU, Hisar had pointed out some drastic variation in Stage of Ground Water Development as on 2022 w.r.t. 2020 in Assesment units like Gurgaon in Gurgaon district and Sanauli Khurd in Panipat district. It was replied by CGWB that it was due to the creation of new assesment unit as Gurgaon Urban from Gurgaon block leading to increase in ground water extraction (Domestic) in Gurgaon Urban and decrease in ground water extraction in Gurgaon block. It was also agreed by Sh. Pankaj Agarwal, Chairman of the committee. However in Sanauli Khurd assessment unit, the drastic decrease in SOGWD is because of addition of ground water extraction structures for industrial use in 2022 which was shown zero in 2020 due to non-availability of data. There was increase in ground water extraction (irrigation) also in Sanauli Khurd assessment unit.
5. Sh. Pankaj Agarwal, Chairman of the committee had advised to give the comments on change of SOGWD as on 2022 w.r.t. 2020 in each Assesment units. Sh. Anurag Khanna agreed that the comments will be written in each assesment units for justification in the final report.
6. Sh. Jagbir Malik, Chief Engineer, Public Health Department had pointed out that as per the ground water analysis carried out by Public Health Department no Uranium concentration has been observed. However Central Ground Water Board also carries out ground water quality analysis and detected Uranium concentration which is in above permissible limits in some of the assesment units. Sh. Anurag Khanna& Sh. Dinesh Tiwari, Scientist 'E' requested Sh. Jagbir Malik to have a joint sampling for Uranium analysis. He was also requested to share the sampling locations with results of the Public Health Department& CGWB.

Meeting ended with the vote of thanks.

****

2nd meeting of State Level Committee for Approval of Ground Water Resource Estimation of Haryana as on March, 2022 held on 08.09.2022 at 3.30 pm under the Chairmanship of ACS I&WR, Haryana in Conference Hall, 6th Floor, Haryana New Civil Secretariat, Sector 17, Chandigarh

S.No.	Name & Designation	Department	e-mail ID	Mobile No.	Signature
1	Sanjay Rohilla Addl. Director	MSME Haryana	msmetechhry @gmail.com	9467751012	
2	Dr. R.K. Thorat Prof. & Head (SWCE)	CCS HAU Hisar	hod-swce@ gmail.com	9416586021	
3	Dr. V.S. Arya Director	HARCAC	directorharcac @gmail.com	01662-233622	
4	Mukesh Gupta HOD (Engg)	HSIIDC	mukesh.gupta@ hsiidc.org.in	9996259028	
5	Jagbir Malik CE (PH)	Public Health Deptt	ce.mahr@gmail .com	9466160070	
6	K. Bhardwaj Assistant Secretary	HSCARDBank ACL	hscar.finance @gmail.com	9896176761	
7	Dr. Kuldeep Gautam ADA (SC)	Agriculture	gautamjde@ gmail.com	9416729871	
8	B.S. Duggal	Rural Development PKL	mdeisena.chd-gov.in	9815383221	
9	Gopender Dutt	Rural Dev. Deptt	gopenderdutt1962 @gmail.com	9872722385	
10	B.S. Nara, CE/LCU	I&WR Deptt.		9812012121	
11	Rinender Singh, EIC	I&WRA PD/HIAMI	[illegible] @yahoo.com	9811213622	
12	Mandeep	XEN/ JIA, ABH I&WRD, Haryana	iwrdharyana@ gmail.com	9467207000	
13	Dr. Prabhat	Groundwater expert.	Prabhatsemwal 2008@gmail.com	9760380883	
14	Ashwani, AEE	HSPCB	hspcbwatercell@ gmail.com	9896109409	
15	DR. Subhir S. Kadian	HWRA & I&WRD	Engineer-in-Chief & CEO.	9216532566	
16	ANURAG KHANNA	CGWB	a.khanna-cgwb@gov.in	9557117005	
17	DINESH TEWARI	CGWB	dinesh.tewari-cgwb@gov.in	7986629916	
18	PANKAJ MAHALA	CWC	gwcharyana @gmail.com	9416444474	
19	Rakesh Kumar	GWC	-do-	94163 58828	
20	B.D. Yadav. Sr. Geologist	Mines & Geology Deptt.	[illegible] @gmail.com	9416371535	
21	Vidya Nand Negi Scientist 'D'	CGWB. Chandigarh	negi-cgwb@ [illegible]	9805516739	
22	Gyanendra Rai STA-II	CGWB Chandigarh	gyanendra.cgwb @gov.in	9877174756	

ANNEXURE V

BLOCKWISE AREA DEPTH TO WATER LEVEL (PERIOD JUNE, 2021)

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
1	**AMBALA**									
	Shahzadpur	49791.23	.	0.00	0.00	1098.87	13462.26	32934.35	2295.75	0.00
	Ambala-1	47734.82	-	357.68	10968.92	15847.94	10265.65	8759.09	1474.69	60.85
	Ambala-2	86791.11	-	709.32	6925.08	13084.30	51784.79	13682.03	605.59	0.00
	Barara	56928.18	-	0.00	87.91	747.23	9914.02	29178.30	12253.60	4747.12
	Naraingarh	68519.31	-	0.00	0.00	0.00	3132.88	53680.89	11572.20	133.34
	Saha	63870.78	-	0.00	55.60	395.59	2913.11	34196.83	20187.84	6121.81
	TOTAL	**373635.43**	**0**	**1067.00**	**18037.51**	**31173.93**	**91472.71**	**172431.49**	**48389.67**	**11063.12**
2	**BHIWANI**									
	Siwani	140251.65	-	0	0	0	1980.95	57843.9	48335.32	32091.48
	Bawani Khera	100243.8	-	0	4024.39	52317.02	40975.57	2926.82	0	0
	Bhiwani	211187.63	17.3	0	3526.32	120661.35	80713.63	6269.03	0	0
	Behal	73087.94	-	0	0	0	0	0	1379.02	71708.92
	Loharu	90759.87	4.94	0	0	0	0	0	0	90754.92
	Tosham	128203	2013.9	0	0	7826.35	30187.33	66559.8	20124.89	1490.73
	Kairu	70941.38	-	0	0	0	3887.19	24942.85	16196.66	25914.67
	TOTAL	**814675.27**	**2036.14**	**0**	**7550.71**	**180804.72**	**157744.67**	**158542.4**	**86035.89**	**221960.72**
3	**CHARKHI DADRI**									
	Dadri	106594.08	1227.59		9104.3	43003.61	32928.05	12672.01	5634.14	2024.38
	Jhoju	84019.96	3897.66				1264.15	21112.5	11964.55	45781.1
	Bond	57912.96	-		5998.37	47151.32	4763.27			
	Badhra	90871.47	466.83						317.99	90086.65

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	TOTAL	**339398.47**	**5592.08**	**0**	**15102.67**	**90154.93**	**38955.47**	**33784.51**	**17916.68**	**137892.13**
4	**FARIDABAD**									
	Faridabad	96734.23	18305.54			2352.86084	3921.43473	44704.3559	27450.0431	
	Ballabgarh	53519.88	3234.6			5293.1856	4763.86703	37052.2991	3175.9114	
	Tigaon	33257.27	0			0	0	13302.9081	19954.3621	
	TOTAL	**183511.38**	**21540.14**	**0.00**	**0.00**	**7646.05**	**8685.30**	**95059.56**	**50580.32**	**0.00**
5	**FATEHABAD**									
	Fatehabad	136980.74	-	1369.81	4109.42	8218.84	12328.27	24656.53	17807.5	68490.37
	Tohana	99451.93	-				5967.12	19890.39	24862.98	48731.44
	Jakhal	37785.42	-							37785.42
	Ratia	93376.17	-							93376.17
	Bhattu Kalan	89852.6	-		18869.05	21564.62	34143.99	4492.63	8985.26	1797.05
	Bhuna	95336.96	-		6673.59	3813.48	19067.39	25740.98	12288.8	27752.72
	Nagpur	71187.86	-						3559.39	67628.47
	TOTAL	**623971.68**	**0**	**1369.81**	**29652.06**	**33596.94**	**71506.77**	**74780.53**	**67503.93**	**345561.64**
6	**GURGAON**									
	F. Nagar	70770.87	76.6		0.00	706.94	4948.60	24742.99	26156.88	14138.85
	Pataudi	68072.05	111.18		0.00	0.00	0.00	2588.99	9708.69	55663.18
	Gurugram	84599.15	3182.71		678.47	3392.35	3392.35	3392.35	27138.81	43422.10
	Sohna	87996.05	5992.3		0.00	4823.75	5788.50	14471.25	24118.75	32801.50
	TOTAL	**311438.12**	**9362.79**	**0.00**	**678.47**	**8923.04**	**14129.45**	**45195.58**	**87123.13**	**146025.63**
7	**HISAR**									
	Adampur	90669.85	-		6346.88	31734.45	32641.14	18133.99	1813.39	
	Barwala	125117.52	-		10009.4	58805.23	6255.88	50047.01		
	Hansi	145366.17	-		27619.66	30526.82	72683.08	14536.61		
	Bass	73940.39	-		29576.16	31054.96	13309.27			
	Hisar-1	153929.29	-	1539.29	21550.1	93896.87	33864.44	3078.59		

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Hisar-2	178431.89	-		1784.32	7137.28	85647.31	76725.71	5352.96	1784.31
	Narnaund	101277.37	-			2025.55	45574.82	53677		
	Agroha	81518.54	-			7336.66	57062.98	17118.9		
	Uklana	56770.87	-			2270.83	28385.44	26114.6		
	TOTAL	**1007021.89**	**0**	**1539.29**	**96886.52**	**264788.65**	**375424.36**	**259432.41**	**7166.35**	**1784.31**
8	**JIND**									
	Alewa	58185.82	-	0	0	0	0	5289.62	27890.7239	25005.4773
	Julana	86911.61	-	0	47537.2917	27369.95573	8162.96925	3361.22263	480.17466	0
	Narwana	82273.19	-	0	8181.8645	30000.16984	38182.03446	5909.12436	0	0
	Pillukhera	53250.14	-	0	5166.05872	19074.67844	10729.50659	11524.28485	6358.22612	397.38913
	Safidon	77674.54	-	0.00000	1563.91694	2085.22258	9383.50164	32842.25584	31799.64446	0.00000
	Uchana	125333.15	-	0	0	3190.2983	15039.978	91607.1399	14584.2211	911.5138
	Ujhana	78271.79	-	0	0	943.03363	12730.95408	18389.1559	21218.25681	24990.3915
	Jind	117865.52	-	0	7191.7943	5993.1619	10787.6915	27568.5449	51940.7395	14383.5886
	TOTAL	**679765.76**	**0.00**	**0.00**	**69640.93**	**88656.52**	**105016.64**	**196491.35**	**154271.99**	**65688.36**
9	JHAJJAR									
	Bahadurgarh	95492	-	3551	61557	30384				
	Beri	81029	-	1095	62779	17155				
	Jhajjar	75568	-		25412	47481	2675			
	Matanhail	87017	-	674	43172	16526	7757	18888		
	Sahlawas	37712	-	1840	28514	3679	2453	1226		
	Badli	51589	-	1164	23273	19394	7758			
	Machhroli	41629	-	6493	22151	4583	6493	1909		
	TOTAL	**470036.00**	**0.00**	**14817.00**	**266858.00**	**139202.00**	**27136.00**	**22023.00**	**0.00**	**0.00**
10	K. KSHETRA									
	Thanesar	77837.22	-							77837.22
	Shahabad	68196.35	-							68196.35

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Pehowa	104805.48	-							104805.48
	Ladwa	38733.86	-					1915.59	5796.07	31022.2
	Babain	33101.22	-							33101.22
	Ismailabad	49684.72	-							49684.72
	Pipli	43816.72	-							43816.72
	TOTAL	**416175.57**	**0**	**0**	**0**	**0**	**0**	**1915.59**	**5796.07**	**408463.91**
11	**KAITHAL**									
	KAITHAL									
	Guhla	96766.64	-							96766.64
	Kaithal	126253.65	-					10385.69	18924.25	96943.71
	Dhand	54359.68	-						210.45	54149.23
	Kalayat	80776.54	-				46985.85	33436.39	126.87	227.43
	Rajound	60498.28	-					56247.81	4250.47	
	Siwan	67293.81	-							67293.81
	TOTAL	**561952.62**	**0**	**0**	**0**	**0**	**46985.85**	**100846.34**	**55925.62**	**358194.81**
12	**KARNAL**									
	Karnal	71195.51	-				10517.52	40452	20225.99	
	Indri	60048.53	-			7026.96	26617.26	14905.66	7026.96	4471.69
	Gharaunda	70735.16	-				13194.12	17592.16	24922.23	15026.65
	Nilokheri	98737.23	-					2708.5	90119.27	5909.46
	Assandh	97106.06	-					14565.9	80333.2	2206.96
	Nissing	88594.83	-				788.68	2628.93	51789.85	33387.37
	Kunjpura	57062.29	-			924.08	25181.34	30956.87		
	Munak	66998.42	-				1206.2	34650.57	31141.65	
	TOTAL	**610478.03**	**0.00**	**0.00**	**0.00**	**7951.04**	**77505.12**	**158460.59**	**305559.15**	**61002.13**
13	**M. GARH**									
	Ateli	55137.2	2243.72				611.88	1631.68	1087.79	49562.13

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Kanina	87385.94	-				1896.75	10567.6	13277.24	61644.35
	M.garh	88668.50	2515.53					1085.38	9497.18	75570.41
	N. Chaudhary	61874.60	911.82					1901	8283.19	50778.59
	Narnaul	52145.48	-				407	4345.85	10184.66	37207.97
	Nizampur	41615.62	2735.45				1086	9776.88	11677.94	16339.35
	Sihma	34162.79	-					2036.85	8011.61	24114.33
	Satnali	58598.83	3073.99						407.37	55117.47
	TOTAL	**479588.96**	**11480.51**	**0**	**0**	**0**	**4001.63**	**31345.24**	**62426.98**	**370334.6**
14	**MEWAT**									
	F.P.Zhirka	68308.50	12861.81				4752.57	3168.38	47525.74	
	Nuh	72513.38	7400.79	1370.79	3426.98	42494.53	12337.12	5483.17		
	Nagina	43842.99	3612.67	0.00	2873.59	14367.97	21839.32	1149.44		
	Punhana	51493.37	247.10		3416.42	6832.83	20498.51	20498.51		
	Taoru	54278.58	8305.20					4950.98	23340.33	17682.07
	Pingawan	38417.23	1171.28	0.00	1655.38	6621.50	12415.32	14898.38	1655.38	
	Indri	42377.83	741.31	1110.31	5551.54	16654.61	7217.00	11103.07	0.00	
	TOTAL	**371231.88**	**34340.16**	**2481.10**	**16923.90**	**86971.44**	**79059.83**	**61251.93**	**72521.44**	**17682.07**
15	**PALWAL**									
	Palwal	49313.19	-			1643.77	16437.73	24656.60	6575.09	
	Hassanpur	38202.30	-				6945.87	31256.43		
	Hodel	74265.92	-				29706.37	44559.55		
	Hathin	89006.84	318.76	2771.50	8314.51	4434.40	38801.03	34366.63		
	Pirthala	40482.64	-		1156.65	2891.62	20241.32	11566.47	4626.59	
	Badoli	44681.66	-					20309.84	16247.88	8123.94
	TOTAL	**335952.55**	**318.76**	**2771.50**	**9471.15**	**8969.79**	**112132.32**	**166715.51**	**27449.55**	**8123.94**
16	**PANIPAT**									

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Panipat	52584.72	-				675.61	3040.23	8332.48	40536.4
	Israna	67691.48	-			1990.92	34841.2	12443.29	15429.68	2986.39
	Samalkha	46752.93	-					11121.84	12151.64	23479.45
	Madlauda	89911.78	-			558.46	24572.16	56962.74	7259.96	558.46
	Bapoli	38719.90	-					17499.74	10747.87	10472.29
	Sanoli Khurd	26251.24	-				1182.49	19392.81	5675.94	
	TOTAL	**321912.05**	**0**	**0**	**0**	**2549.38**	**61271.46**	**120460.65**	**59597.57**	**78032.99**
17	**PANCHKULA**									
	Pinjore	72164.48	27750.00	0.00	0.00	0.00	1538.42	42313.32	562.75	0.00
	Barwala	53719.91	-	0.00	263.73	791.19	4395.48	39012.08	8114.62	1142.82
	R.P.Rani	34663.70	8000.00	0.00	0.00	0.00	571.41	21389.13	4703.16	0.00
	Morni	57613.23	57613.23							
	TOTAL	**218161.32**	**93363.23**	**0**	**263.7288**	**791.18628**	**6505.30904**	**102714.53**	**13380.533**	**1142.8247**
18	**ROHTAK**									
	Rohtak	144109.00	-	1326.00	68076.00	49510.00	18124.00	7073.00		
	Meham	110467.00	-	4078.00	69320.00	22242.00	14086.00	741.00		
	Kalanaur	70477.00	-	3233.00	30389.00	29419.00	7436.00			
	Lakhan Majra	31355.00	-	2001.00	22015.00	2335.00	3669.00	1335.00		
	Sampla	56028.00	-		32978.00	23050.00				
	TOTAL	**412436.00**	**0**	**10638.00**	**222778.00**	**126556.00**	**43315.00**	**9149.00**	**0**	**0**
19	**REWARI***									
	Bawal	59316.63	1179.16					11270.57	25160.69	21706.21
	Jatusana	50907.40	-				12085.31	26206.28	12615.85	
	Khol	46726.76	3355.69						3802.00	39569.07
	Rewari	56338.66	-				13307.42	35834.39	5160.00	2036.85
	Nahar	57897.15	-				8554.77	28973.88	20368.5	

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Dahina	51931.5	568.34					4481.00	17109.54	29772.62
	Dharuhera	49733.76						23355.88	22983.13	3394.75
	TOTAL	**372851.86**	**5103.19**	**0**	**0**	**0**	**33947.50**	**130122.00**	**107199.71**	**96479.5**
20	**SONEPAT**									
	Gohana	77947.00	-		25982.00	35320.00	15427.00	1218.00		
	Rai	53566.00	-		4120.00	7290.00	6339.00	25040.00	10777.00	
	Kharkhoda	75996.00	-	1101.00	26066.00	36713.00	12116.00			
	Sonepat	90940.00	-		15549.00	24502.00	29685.00	20261.00	943.00	
	Ganaur	62238.00	-		648.00	7780.00	9725.00	16856.00	14263.00	12966.00
	Kathura	48454.00	-	7098.00	23147.00	17283.00	926.00			
	Mundlana	71875.00	-	9952.00	18798.00	15849.00	27276			
	Murthal	47045.00						16351.00	16925.00	13769.00
	TOTAL	**528061.00**	**0**	**18151.00**	**114310.00**	**144737.00**	**101494.00**	**79726.00**	**42908.00**	**26735.00**
21	**SIRSA***									
	Ellenabad	130438.76	-				29131.32	19565.82	24522.49	57219.13
	Odhan	127456.74	-				7308.52	120148.22		
	Dabwali	197994.94	-				23873.99	172529.35	1591.60	
	N.S.Chopta	187068.53	-		18141.33	33561.03	78352.57	32572.49	14946.68	9494.43
	Baragudha	131915.62	-				22079.00	103393.33	6443.29	
	Sirsa	134565.64	-				2729.53	1559.73	28075.13	102201.25
	Rania	145681.83	-					18930.87	29847.81	96903.15
	TOTAL	**1055122.06**	**0**	**0**	**18141.33**	**33561.03**	**163474.93**	**468699.81**	**105427**	**265817.96**
22	**Y. NAGAR**									
	Jagadhari	74096.64	-	0.00	0.00	1098.87	19065.24	53844.62	87.91	0.00
	Bilaspur	68109.87	2750.00	0.00	0.00	307.68	20862.03	44102.24	87.91	0.00
	Chhachhrauli	64195.33	15500.00	0.00	0.00	307.68	17037.04	31350.61	0.00	0.00

Sr. No.	District	Total Geo. Area (In Acre)	Hilly Area	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	30 & Above
	Sadhaura	36731.71	2500.00	0.00	0.00	1186.78	15510.50	17534.43	0.00	0.00
	Radhaur	60920.31	-	0.00	0.00	581.34	22672.99	14892.99	18057.74	4715.25
	Mustafabad	50766.84	-	0.00	0.00	0.00	11648.02	30415.77	8043.73	659.32
	Khizrabad	69650.17	17500.00	0.00	0.00	0.00	14329.26	34327.68	3493.23	0.00
	TOTAL	**424470.87**	**38250.00**	**0**	**0.00**	**3482.36**	**121125.08**	**226468.34**	**29770.52**	**5374.57**
GRAND TOTAL		**10911848.77**	**221387.00**	**52834.70**	**886294.98**	**1260516.02**	**1740889.40**	**2715616.35**	**1406950.11**	**2627360.21**
%age		**100**	**2**	**0.5**	**8**	**11.5**	**16**	**25**	**13**	**24**

ANNEXURE VI

DISTRICTWISE DEPTH TO WATER TABLE AREA JUNE, 2021 (AREA IN ACRE)

Sr. No.	DISTRICT	TOTAL GEO. AREA IN ACRE	HILLY AREA IN ACRE	DEPTH TO WATER TABLE ZONES IN METRES						
				0-1.5	1.5-3	3-5	5-10	10-20	20-30	>-30
1.	**AMABALA**	373635.43	0	1067.00	18037.51	31173.93	91472.71	172431.49	48389.67	11063.12
2.	**BHIWANI**	814675.27	2036.14	0	7550.71	180804.72	157744.67	158542.4	86035.89	221960.72
3.	**CH. DADRI**	339398.47	5592.08	0	15102.67	90154.93	38955.47	33784.51	17916.68	137892.13
4.	**FARIDABAD**	183511.38	21540.14	0.00	0.00	7646.05	8685.30	95059.56	50580.32	0.00
5.	**FATEHABAD**	623971.68	0	1369.81	29652.06	33596.94	71506.77	74780.53	67503.93	345561.64
6.	**GURGAON**	311438.12	9362.79	0.00	678.47	8923.04	14129.45	45195.58	87123.13	146025.63
7.	**HISAR**	1007021.89	0	1539.29	96886.52	264788.65	375424.36	259432.41	7166.35	1784.31
8.	**JIND**	679765.76	0.00	0.00	69640.93	88656.52	105016.64	196491.35	154271.99	65688.36
9.	**JHAJJAR**	470036.00	0.00	14817.00	266858.00	139202.00	27136.00	22023.00	0.00	0.00
10.	**K. KSHETRA**	416175.57	0	0	0	0	0	1915.59	5796.07	408463.91
11.	**KAITHAL**	561952.62	0	0	0	0	46985.85	100846.34	55925.62	358194.81
12.	**KARNAL**	610478.03	0.00	0.00	0.00	7951.04	77505.12	158460.59	305559.15	61002.13
13.	**M. GARH**	479588.96	11480.51	0	0	0	4001.63	31345.24	62426.98	370334.6
14.	**MEWAT**	371231.88	34340.16	2481.10	16923.90	86971.44	79059.83	61251.93	72521.44	17682.07
15.	**PALWAL**	335952.55	318.76	2771.50	9471.15	8969.79	112132.32	166715.51	27449.55	8123.94
16.	**PANIPAT**	321912.05	0	0	0	2549.38	61271.46	120460.65	59597.57	78032.99
17.	**PANCHKULA**	218161.32	93363.23	0	263.728842	791.1862777	6505.309038	102714.53	13380.5325	1142.82465
18.	**ROHTAK**	412436	0	10638	222778	126556	43315	9149	0	0
19.	**REWARI**	372851.86	5103.19	0	0	0	33947.5	130122	107199.71	96479.5
20.	**SONEPAT**	528061	0	18151	114310	144737	101494	79726	42908	26735
21.	**SIRSA**	1055122.06	0	0	18141.33	33561.03	163474.93	468699.81	105427	265817.96
22.	**Y. NAGAR**	424470.87	38250	0	0.00	3482.36	121125.08	226468.34	29770.52	5374.57
	TOTAL	**10911848.77**	**221387.00**	**52834.70**	**886294.98**	**1260516.02**	**1740889.40**	**2715616.35**	**1406950.11**	**2627360.21**
	%age	**100**	**2**	**0.5**	**8**	**11.5**	**16**	**25**	**13**	**24**

ANNEXURE VII

BLOCK-WISE DEPTH TO WATER TABLE & FLUCTUATIONS IN WATER TABLE SINCE 1974 TO 2021 IN STATE OF HARYANA

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
1	AMBALA	Ambala-1	4.95	5.56	4.74	5.21	6.46	-1.84	-1.23	-2.05	-1.58	-0.33
2		Ambala-11	6.25	6.29	6.34	5.39	7.49	-2.54	-2.50	-2.45	-3.40	-1.30
3		Brara	5.53	6.00	5.93	15.04	15.04	-10.33	-9.86	-9.93	-0.82	-0.82
4		Saha	5.32	5.10	5.88	13.33	14.89	-19.08	-19.30	-18.52	-11.07	-9.51
5		Naraungarh	7.82	7.84	10.71	14.52	18.12	-11.11	-11.09	-8.22	-4.41	-0.81
6		Shahzapur	6.98	6.71	6.88	9.21	11.68	-4.97	-5.24	-5.07	-2.74	-0.27
		AVERAGE	**6.14**	**6.25**	**6.75**	**10.45**	**12.28**	**-8.31**	**-8.20**	**-7.71**	**-4.00**	**-2.17**
1	PANCHKULA	Pinzore	13.14	16.26	15.73	19.08	19.21	-6.40	-3.28	-3.81	-0.46	-0.33
2		Barwala	11.24	12.07	12.63	17.19	17.46	-6.35	-5.52	-4.96	-0.40	-0.13
3		Raipur rani	10.48	10.61	11.61	14.54	16.75	-6.56	-6.43	-5.43	-2.50	-0.29
		AVERAGE	**11.62**	**12.98**	**13.32**	**16.94**	**17.81**	**-6.44**	**-5.08**	**-4.73**	**-1.12**	**-0.25**
1	YAMUNANAGAR	Jagadhari	7.20	7.74	8.55	15.60	14.23	-7.44	-6.90	-6.09	0.96	-0.41
2		MustafAbad	6.91	8.34	7.97	13.02	12.24	-5.40	-3.97	-4.34	0.71	-0.07
3		Radour	6.02	6.23	6.51	20.54	17.37	-11.94	-11.73	-11.45	2.58	-0.59
4		Sadhoura	6.16	6.62	6.99	8.24	9.12	-2.89	-2.43	-2.06	-0.81	0.07
5		Chachhrauli	7.62	7.68	8.40	7.38	7.96	-0.16	-0.10	0.62	-0.40	0.18
6		Bilaspur	5.99	6.55	7.32	8.73	10.23	-5.85	-5.29	-4.52	-3.11	-1.61
7		Khizrabad	11.23	11.24	11.36	12.95	15.04	-3.40	-3.39	-3.27	-1.68	0.41
		AVERAGE	**7.30**	**7.77**	**8.16**	**12.35**	**12.31**	**-5.30**	**-4.83**	**-4.44**	**-0.25**	**-0.29**
1	BHIWANI	Bhiwani	9.83	8.58	7.24	4.98	6.40	3.63	2.38	1.04	-1.22	0.20
2		Bhiwani	16.50	14.35	11.43	6.02	5.52	11.50	9.35	6.43	1.02	0.52

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
		Khera										
3		Tosham	18.36	17.50	15.83	13.53	13.91	4.21	3.35	1.68	-0.62	-0.24
4		Loharu	37.92	40.04	40.23	56.99	66.09	-29.81	-27.69	-27.50	-10.74	-1.64
5		Kairu	18.12	17.92	16.34	18.01	23.54	-5.96	-6.16	-7.74	-6.07	-0.54
6		Siwani	24.23	23.81	22.64	21.77	23.79	0.30	-0.12	-1.29	-2.16	-0.14
7		Bahal	38.27	40.26	42.58	54.90	66.65	-29.77	-27.78	-25.46	-13.14	-1.39
		AVERAGE	**23.32**	**23.21**	**22.33**	**25.17**	**29.41**	**-6.56**	**-6.67**	**-7.55**	**-4.70**	**-0.46**
1	**CH DADRI**	Dadri	8.50	9.72	9.11	8.07	9.52	-1.29	-0.07	-0.68	-1.72	-0.27
2		Badhra	30.64	31.57	36.74	61.03	67.51	-38.26	-37.33	-32.16	-7.87	-1.39
3		Jhojhu	21.95	22.94	23.17	32.66	40.08	-18.92	-17.93	-17.70	-8.21	-0.79
4		Bond	5.17	5.09	5.05	3.06	3.36	1.33	1.25	1.21	-0.78	-0.48
		AVERAGE	**16.57**	**17.33**	**18.52**	**26.21**	**30.12**	**-14.29**	**-13.52**	**-12.33**	**-4.65**	**-0.73**
1	**GURUGRAM**	Gurugram	11.23	13.03	16.07	29.61	35.55	-22.22	-20.42	-17.38	-3.84	2.10
2		f-Nagar	7.07	8.33	11.48	18.53	20.14	-15.90	-14.64	-11.49	-4.44	-2.83
3		Patodi	8.05	10.67	18.37	29.86	39.24	-30.34	-27.72	-20.02	-8.53	0.85
4		Sohna	6.48	8.98	12.59	21.15	25.31	-19.08	-16.58	-12.97	-4.41	-0.25
		AVERAGE	**8.21**	**10.25**	**14.63**	**24.79**	**30.06**	**-21.89**	**-19.84**	**-15.47**	**-5.31**	**-0.03**
1	**FARIDABAD**	Faridabad	8.44	9.46	9.86	15.91	20.92	-15.91	-14.89	-14.49	-8.44	-3.43
2		B.Gard	7.24	8.29	9.91	13.62	17.35	-9.77	-8.72	-7.10	-3.39	0.34
		Tigaon				14.89	21.81				-6.76	0.16
		AVERAGE	**7.84**	**8.88**	**9.89**	**14.81**	**20.03**	**-13.16**	**-12.13**	**-11.12**	**-6.20**	**-0.98**
1	**NUH**	Taoru	10.64	12.08	16.52	22.75	30.39	-20.51	-19.07	-14.63	-8.40	-0.76
2		Nuh	4.94	5.47	5.44	4.84	5.96	-1.08	-0.55	-0.58	-1.18	-0.06
3		Nagina	4.45	5.23	6.22	4.70	5.34	-1.22	-0.44	0.55	-0.97	-0.33
4		F.B Jhirka	5.08	6.04	9.87	13.94	16.71	-11.43	-10.47	-6.64	-2.57	0.20

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
5		Punhana	5.02	4.98	7.95	7.03	9.01	-3.88	-3.92	-0.95	-1.87	0.11
		Indri				6.46	6.05				0.10	-0.31
		Pingwan				9.29	10.15				-1.13	-0.27
		AVERAGE	**6.03**	**6.76**	**9.20**	**9.86**	**11.94**	**-6.12**	**-5.39**	**-2.95**	**-2.29**	**-0.20**
1	**PALWAL**	Palwal	6.38	7.37	8.80	9.32	12.01	-5.67	-4.68	-3.25	-2.73	-0.04
2		Hodal	5.88	6.27	7.69	7.52	11.68	-6.12	-5.73	-4.31	-4.48	-0.32
3		Hassanpur	6.92	8.42	9.04	10.24	13.30	-7.07	-5.57	-4.95	-3.75	-0.69
4		Hathin	5.22	5.32	6.30	7.80	9.30	-4.34	-4.24	-3.26	-1.76	-0.26
5		Pirthla	5.35	6.30	7.27	8.86	11.19	-6.09	-5.14	-4.17	-2.58	-0.25
		Badoli				13.91	17.09				-3.64	-0.46
		AVERAGE	**5.95**	**6.74**	**7.82**	**9.61**	**12.43**	**-6.82**	**-6.03**	**-4.95**	**-3.16**	**-0.34**
1	**HISAR**	Adumpur	13.25	10.71	9.04	8.75	8.45	6.04	3.50	1.83	1.54	1.24
2		Agroha	19.48	17.02	12.16	9.66	9.73	10.83	8.37	3.51	1.01	1.08
3		Bass	8.29	7.28	5.44	3.97	3.75	4.75	3.74	1.90	0.43	0.21
4		Barwala	22.71	19.58	13.17	6.96	6.09	17.16	14.03	7.62	1.41	0.54
5		Hansi	10.57	8.05	6.51	5.98	5.52	5.52	3.00	1.46	0.93	0.47
6		Hisar-1	12.97	11.83	9.80	6.82	6.08	7.46	6.32	4.29	1.31	0.57
7		Hisar-11	15.23	14.87	12.76	11.19	11.52	4.62	4.26	2.15	0.58	0.91
8		Narnaund	11.85	10.77	10.33	9.40	13.05	-0.36	-1.44	-1.88	-2.81	0.84
9		Uklana	15.95	12.07	9.36	6.98	9.14	7.38	3.50	0.79	-1.59	0.57
		AVERAGE	**14.48**	**12.46**	**9.84**	**7.75**	**8.15**	**7.04**	**5.03**	**2.41**	**0.31**	**0.71**
1	**JIND**	Alewa	13.57	13.01	13.58	22.86	31.09	-17.52	-18.08	-17.51	-8.23	0.00
2		Julana	10.98	7.83	6.67	5.55	4.91	7.06	3.91	2.75	1.63	0.99
3		Narwana	11.30	9.83	7.71	5.83	7.35	4.69	3.22	1.10	-0.78	0.74
4		Pillukhera	4.68	3.77	4.06	5.53	7.05	-1.19	-2.10	-1.81	-0.34	1.18
5		Safidon	4.29	5.02	6.96	10.86	16.88	-11.72	-10.99	-9.05	-5.15	0.87

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
6		Uchana	21.98	19.08	15.15	14.04	16.96	5.65	2.75	-1.18	-2.29	0.63
7		Ujhana	11.30	10.28	9.92	17.06	25.27	-12.97	-13.99	-14.35	-7.21	1.00
8		Jind	8.96	8.73	10.97	14.09	20.94	-11.27	-11.50	-9.26	-6.14	0.71
		AVERAGE	**10.88**	**9.69**	**9.38**	**11.98**	**16.31**	**-4.66**	**-5.85**	**-6.16**	**-3.56**	**0.77**
1	**SONIPAT**	Ganaur	6.61	7.63	9.1	14.72	21.59	-13.14	-12.12	-10.65	-5.03	1.84
2		Gohana	3.76	3.77	3.46	5.25	5.41	-0.79	-0.78	-1.09	0.70	0.86
3		Kathura	3.42	3.26	3.23	3.91	4.05	0.20	0.04	0.01	0.69	0.83
4		Kharkhoda	4.81	4.43	5.47	4.87	6.09	0.02	-0.36	0.68	0.08	1.30
5		Mundlana	2.86	3.38	3.07	5.11	6.83	-2.46	-1.94	-2.25	-0.21	1.51
6		Sonipat	6.27	6.31	8.22	6.01	7.61	0.32	0.36	2.27	0.06	1.66
7		Murthal	6.55	8.11	8.52	17.42	27.87	-19.57	-18.01	-17.60	-8.70	1.75
8		Rai	6.43		7.71	11.51	16.43	-7.86		-6.58	-2.78	2.14
		AVERAGE	**5.09**	**5.27**	**6.10**	**8.60**	**11.99**	**-5.41**	**-5.23**	**-4.40**	**-1.90**	**1.49**
1	**KARNAL**	Karnal	7.41	7.29	7.89	15.36	18.09	-9.77	-9.89	-9.29	-1.82	0.91
2		Kunjpura	6.80	7.33	7.33	10.95	12.51	-5.28	-4.75	-4.75	-1.13	0.43
3		Munak	5.32	5.97	4.72	15.98	21.10	-13.99	-13.34	-14.59	-3.33	1.79
4		Indri	7.28	7.54	8.60	12.16	13.74	-5.38	-5.12	-4.06	-0.50	1.08
5		Nilokheri	8.09	8.19	10.26	20.31	26.54	-19.01	-18.91	-16.84	-6.79	-0.56
6		Nissing	7.46	8.24	9.93	20.27	28.37	-19.65	-18.87	-17.18	-6.84	1.26
7		Gharaunda	9.80	9.64	13.34	22.12	23.35	-13.40	-13.56	-9.86	-1.08	0.15
8		Assandh	6.87	7.40	10.62	18.66	26.88	-19.49	-18.96	-15.74	-7.70	0.52
		AVERAGE	**7.38**	**7.70**	**9.09**	**16.98**	**21.32**	**-13.25**	**-12.93**	**-11.54**	**-3.65**	**0.70**
1		Thanesar	11.85	13.86	16.31	28.99	36.89	-24.91	-22.90	-20.45	-7.77	0.13
2		Shahbad	15.27	17.34	19.59	37.16	44.37	-32.09	-30.02	-27.77	-10.20	-2.99
3		Pehowa	9.41	12.20	14.51	28.11	39.54	-29.80	-27.01	-24.70	-11.10	0.33
4		Ladwa	12.95	14.75	17.04	28.94	33.42	-21.69	-19.89	-17.60	-5.70	-1.22

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
5	KURUKSHETRA	Babain	11.68	12.13	13.17	34.86	41.92	-30.15	-29.70	-28.66	-6.97	0.09
6		Isamailabad	12.12	15.52	17.97	35.17	45.37	-32.38	-28.98	-26.53	-9.33	0.87
7		Pipli	17.09	17.61	19.28	34.16	41.17	-25.14	-24.62	-22.95	-8.07	-1.06
		AVERAGE	**12.91**	**14.77**	**16.84**	**32.48**	**40.38**	**-28.02**	**-26.16**	**-24.09**	**-8.45**	**-0.55**
1	KAITHAL	Gulha	8.90	11.39	15.28	29.91	42.87	-35.22	-32.73	-28.84	-14.21	-1.25
2		Kaithal	6.76	8.52	10.94	23.92	35.05	-26.61	-24.85	-22.43	-9.45	1.68
3		Pundari	6.57	8.31	9.62	18.66	30.55	-24.81	-23.07	-21.76	-12.72	-0.83
4		Rajound	6.25	5.59	4.37	10.23	18.02	-11.23	-11.89	-13.11	-7.25	0.54
5		Siwan	9.45	10.60	11.73	37.65	51.16	-41.75	-40.60	-39.47	-13.55	-0.04
6		Dhand	7.71	9.45	12.00	24.38	34.79	-26.91	-25.17	-22.62	-10.24	0.17
7		Kalayat	5.30	5.26	4.96	8.17	11.94	-7.16	-7.20	-7.50	-4.29	-0.52
		AVERAGE	**7.28**	**8.45**	**9.84**	**21.85**	**32.05**	**-24.81**	**-23.64**	**-22.25**	**-10.24**	**-0.04**
1	PANIPAT	Panipat	10.19	10.83	13.02	24.79	35.72	-25.31	-24.67	-22.48	-10.71	0.22
2		Israna	3.86	4.65	5.90	8.99	12.18	-8.00	-7.21	-5.96	-2.87	0.32
3		Samalkha	9.83	10.77	12.78	22.67	28.96	-19.02	-18.08	-16.07	-6.18	0.11
4		Madlauda	4.95	5.16	7.06	10.59	14.51	-8.97	-8.76	-6.86	-3.33	0.59
5		Bopoli	8.72	9.07	9.67	18.67	26.64	-17.91	-17.56	-16.96	-7.96	0.01
6		Sanalikhurd	4.33	6.14	3.19	11.16	15.64	-11.19	-9.38	-12.33	-4.36	0.12
		AVERAGE	**6.98**	**7.77**	**8.60**	**16.15**	**22.28**	**-15.07**	**-14.28**	**-13.44**	**-5.90**	**0.23**
1	ROHTAK	Rohtak	2.91	3.32	3.50	3.81	3.72	-0.76	-0.35	-0.17	0.14	0.05
2		Meham	12.31	8.91	7.12	4.63	5.04	8.17	4.77	2.98	0.49	0.90
3		Kalanaur	5.26	5.35	5.60	2.97	3.57	1.96	2.05	2.30	-0.33	0.27
4		Lakhan Majra	4.96	4.00	5.15	4.45	4.67	0.75	-0.21	0.94	0.24	0.46
5		Sampla	3.74	3.68	4.19	3.93	3.62	0.35	0.29	0.80	0.54	0.23
		AVERAGE	**5.84**	**5.05**	**5.11**	**3.96**	**4.12**	**2.09**	**1.31**	**1.37**	**0.22**	**0.38**

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
1	**JHAJJAR**	Jhajjar	5.42	5.91	6.19	5.96	4.32	0.81	1.30	1.58	1.35	-0.29
2		Bahadurgarh	3.97	4.26	5.15	4.50	4.17	0.30	0.59	1.48	0.83	0.50
3		Beri	5.10	4.66	4.26	2.61	2.49	2.81	2.37	1.97	0.32	0.20
4		Matanhail	6.99	7.17	6.74	5.84	7.92	0.29	0.47	0.04	-0.86	1.22
5		Sahlawas	4.38	4.78	4.90	4.06	4.68	0.50	0.90	1.02	0.18	0.80
6		Badli	3.61	4.60	5.24	5.19	4.68	0.17	1.16	1.80	1.75	1.24
		Machhroli				7.14	7.67				1.58	2.11
1	**REWARI**	Bawal	12.48	13.56	18.04	27.21	31.84	-19.52	-18.44	-13.96	-4.79	-0.16
2		Jatusana	8.72	8.45	11.87	10.62	15.94	-6.84	-7.11	-3.69	-4.94	0.38
3		Khol	17.28	15.58	26.68	46.00	55.50	-38.48	-40.18	-29.08	-9.76	-0.26
4		Rewari	11.95	12.47	14.40	10.10	15.23	-2.98	-2.46	-0.53	-4.83	0.30
5		Nahar	12.07	12.69	12.67	12.64	19.03	-6.71	-6.09	-6.11	-6.14	0.25
		Dahina				46.16	55.74				-9.35	0.23
		Dharuhera				19.48	22.68				-3.22	-0.02
		AVERAGE	**12.50**	**12.55**	**16.73**	**24.60**	**30.85**	**-18.25**	**-18.20**	**-14.02**	**-6.15**	**0.10**
1	**SIRSA**	Ellenabad	7.26	7.52	9.74	21.81	30.24	-22.86	-22.60	-20.38	-8.31	0.12
2		Odhan	18.28	18.61	12.06	11.96	14.35	3.69	4.02	-2.53	-2.63	-0.24
3		Dabwali	19.03	19.53	13.10	11.17	14.06	4.34	4.84	-1.59	-3.52	-0.63
4		N.S Chopta	11.83	12.31	9.22	8.79	10.55	1.38	1.86	-1.23	-1.66	0.10
5		Baragudha	3.72	3.91	3.88	8.92	11.45	-8.03	-7.84	-7.87	-2.83	-0.30
6		Sirsa	9.38	9.74	12.65	37.79	49.99	-40.25	-39.89	-36.98	-11.84	0.36
7		Raina	10.08	10.47	12.50	23.84	34.33	-24.16	-23.77	-21.74	-10.40	0.09
		AVERAGE	**11.37**	**11.73**	**10.45**	**17.75**	**23.57**	**-12.27**	**-11.91**	**-13.19**	**-5.88**	**-0.07**
1		Fatehabad	13.22	13.99	15.83	24.25	32.74	-20.04	-19.27	-17.43	-9.01	-0.52
2		Ratia	8.51	9.43	12.07	29.89	41.95	-37.92	-37.00	-34.36	-16.54	-4.48
3		Tohana	7.97	7.72	11.26	22.82	30.68	-23.34	-23.59	-20.05	-8.49	-0.63

S.NO.	DISTRICT	BLOCK	PERIODIC FLUCTUATIONS									
			Jun-74	Jun-84	Jun-95	Jun-12	Jun-21	Historical Jun 1974-Jun 2021	Historical Jun 1984-Jun 2021	Long Term Jun 1995-Jun 2021	Decadal Jun 2012-Jun 2021	Annual Jun 21-Jun21
4	**FATEHABAD**	Battu kalan	8.61	7.08	5.34	7.32	7.41	1.71	0.18	-1.56	0.42	0.51
5		Jakhal	7.14	9.95	12.04	28.28	41.20	-36.47	-33.66	-31.57	-15.33	-2.41
6		Bhuna	9.12	8.86	8.82	14.92	21.68	-12.56	-12.82	-12.86	-6.76	0.00
		Nagpur				33.76	44.79				-13.09	-2.06
		AVERAGE	**9.10**	**9.51**	**10.89**	**23.03**	**31.49**	**-23.77**	**-23.36**	**-21.97**	**-9.83**	**-1.37**
1	**MAHENEDERGARH**	Ateli	22.49	24.77	28.54	62.71	74.72	-52.32	-50.04	-46.27	-12.10	-0.09
2		Kanina	18.37	17.15	17.63	25.94	31.89	-14.10	-15.32	-14.84	-6.53	-0.58
3		M garh	21.29	22.22	25.54	43.24	50.37	-29.53	-28.60	-25.28	-7.58	-0.45
4		Narnaul	26.54	28.32	34.84	55.73	50.72	-23.68	-21.90	-15.38	5.51	0.50
5		N/Choudhary	16.36	19.47	24.75	41.37	45.68	-29.92	-26.81	-21.53	-4.91	-0.60
6		Shima	21.31	23.56	27.21	40.56	40.23	-18.76	-16.51	-12.86	0.49	0.16
7		Nizampur	20.94	21.81	27.84	28.19	32.61	-11.95	-11.08	-5.05	-4.70	-0.28
8		Satnali	39.56	40.78	43.80	55.74	66.10	-27.48	-26.26	-23.24	-11.30	-0.94
		AVERAGE	**23.36**	**24.76**	**28.77**	**44.19**	**49.04**	**-25.97**	**-24.57**	**-20.56**	**-5.14**	**-0.28**

ANNEXURE VIII

GROUND WATER QUALITY PERIOD JUNE, 2021 (E.C. IN MICRO.MHOS/CM) (AREA IN ACRE)

S.NO.	DISTRICT / BLOCK	TOTAL GEO. AREA	HILLY AREA	FRESH	SUB. MARGINAL	MARGINAL	SALINE
				0-2000	**2000-4000**	**4000-6000**	**>-6000**
1	**AMBALA**						
	Shahzadpur	49791.23	-	49791.23	-	-	-
	Ambala-1	47734.82	-	47734.82	-	-	-
	Ambala-2	86791.11	-	86791.11	-	-	-
	Barara	56928.18	-	56928.18	-	-	-
	Naraingarh	68519.31	-	68519.31	-	-	-
	Saha	63870.78	-	63870.78	-	-	-
	TOTAL	**373635.43**	**0**	**373635.43**	**0**	**0**	**0**
2	**BHIWANI**						
	Siwani	140251.65	-	0	106575.41	24167.66	9508.58
	Bawani Khera	100243.8	-	2195.12	92195.03	5853.65	0
	Bhiwani	211187.63	17.29	4309.95	166503.57	19198.88	21157.94
	Behal	73087.94	-	0	52747.43	19651.01	689.5
	Loharu	90759.87	4.94	2031.96	86352.38	2370.59	0
	Tosham	128203	2013.9	4472.2	110909.09	10807.81	0
	Kairu	70941.38	-	647.87	63490.93	4211.13	2591.47
	TOTAL	**814675.27**	**2036.13**	**13657.1**	**678773.84**	**86260.73**	**33947.49**
3	**CH. DADRI**						
	Dadri	106594.08	1227.59	1611.54	41203.78	48591.23	13959.94
	Jhoju	84019.96	3897.66	11502.93	58666.45	9952.92	
	Bond	57912.96	-		14258.21	39451.42	4203.33
	Badhra	90871.47	466.83	37599.27	52805.37		
	Total	**339398.47**	**5592.08**	**50713.74**	**166933.81**	**97995.57**	**18163.27**
4	**FARIDABAD**						
	Faridabad	96734.23	18305.54	76075.8337	2352.86084		
	Ballabgarh	53519.88	3234.6	37052.2991	13232.964		
	Tigaon	33257.27	0	31261.834	1995.4362		
	TOTAL	**183511.38**	**21540.14**	**144389.97**	**17581.26**	**0**	**0**
5	**FATEHABAD**						
	Fatehabad	136980.74	-	71229.98	60271.54	2739.61	2739.61
	Tohana	99451.93	-	90501.25	8950.68		
	Jakhal	37785.42	-	37785.42			
	Ratia	93376.17	-	89641.12	3735.05		
	Bhattu Kalan	89852.6	-	8086.74	68287.97	10782.31	2695.58
	Bhuna	95336.96	-	36228.06	57202.17	1906.73	
	Nagpur	71187.86	-	68340.35	2847.51		
	TOTAL	**623971.68**	**0**	**401812.92**	**201294.92**	**15428.65**	**5435.19**

S.NO.	DISTRICT / BLOCK	TOTAL GEO. AREA	HILLY AREA	FRESH	SUB. MARGINAL	MARGINAL	SALINE
				0-2000	**2000-4000**	**4000-6000**	**>-6000**
6	**GURUGRAM**						
	F. Nagar	70770.87	76.6	61504.0092	3534.71318	5655.54108	
	Pataudi	68072.05	111.18	64724.6259	3236.2313		
	Gurugram	84599.15	3182.71	71239.3798	6784.70284	3392.35142	
	Sohna	87996.05	5992.29	62708.7548	9647.50074	6753.25052	2894.25022
	TOTAL	**311438.12**	**9362.78**	**260176.77**	**23203.15**	**15801.14**	**2894.25**
7	**HISAR**						
	Adampur	90669.85	-	906.7	83416	4533.5	1813.65
	Barwala	125117.52	-	87582.26	36284.08	1251.18	
	Hansi	145366.17	-	77044.07	61053.8	7268.3	
	Hansi-Bass	73940.39	-	2957.62	66546.35	4436.42	
	Hisar-1	153929.29	-	76964.64	70807.47	6157.18	
	Hisar-2	178431.89	-	119549.39	49960.92	5352.95	3568.63
	Narnaund	101277.37	-	44562.05	55702.55	1012.77	
	Agroha	81518.54	-	32607.41	47280.75	815.2	815.18
	Uklana	56770.87	-	29520.82	27250.05		
	TOTAL	**1007021.89**	**0**	**471694.96**	**498301.97**	**30827.5**	**6197.46**
8	**JIND**						
	Alewa	58185.82	-	9617.4908	42797.836	5770.4944	0
	Julana	86911.61	-	10563.8426	49938.16499	22088.03445	4321.57195
	Narwana	82273.19	-	4090.93223	48182.09121	24545.59341	5454.57631
	Pillukhera	53250.14	-	13511.2305	31791.13068	3576.50219	4371.28046
	Safidon	77674.54	-	34927.4783	29714.42196	8862.19599	4170.44517
	Uchana	125333.15	-	16863.0049	94341.6826	14128.4636	0
	Ujhana	78271.79		47623.1988	17917.63906	11316.40362	1414.55045
	Jind	117865.52	-	60331.1661	47146.2073	9589.0591	799.0882
	TOTAL	**679765.76**	**0.00**	**197528.34**	**361829.17**	**99876.75**	**20531.51**
9	**JHAJJAR**						
	Bahadurgarh	95492	-	12232	71027	11443	790
	Beri	81029	-	7300	51099	10585	12045
	Jhajjar	75568	-	35443	32434	6687	1004
	Matanhail	87017	-	10455	36426	18213	21923
	Sahlawas	37712	-	613	12571	20848	3680
	Badli	51589		9309	15128	16679	10473
	Machhroli	41629		1528	37046	3055	
	TOTAL	**470036**	**0**	**76880**	**255731**	**87510**	**49915**
10	**K. KSHETRA**						
	Thanesar	77837.22	-	77837.22	-	-	-
	Shahabad	68196.35	-	68196.35	-	-	-
	Pehowa	104805.48	-	104805.48	-	-	-
	Ladwa	38733.86	-	38733.86	-	-	-

S.NO.	DISTRICT / BLOCK	TOTAL GEO. AREA	HILLY AREA	FRESH	SUB. MARGINAL	MARGINAL	SALINE
				0-2000	**2000-4000**	**4000-6000**	**>-6000**
	Babain	33101.22	-	33101.22	-	-	-
	Ismailabad	49684.72	-	49684.72	-	-	-
	Pipli	43816.72	-	43816.72	-	-	-
	TOTAL	**416175.57**	**0**	**416175.57**	**0**	**0**	**0**
11	**KAITHAL**						
	Guhla	96766.64	-	96766.64			-
	Kaithal	126253.65	-	115268.05	10985.6		-
	Pundri	76004.02	-	75980.33	23.69		-
	Kalayat	80776.54	-	2104.99	6970.99	71700.56	-
	Rajound	60498.28	-	50157.79	10340.49		-
	Siwan	67293.81	-	67293.81			-
	Dhand	54359.68	-	54359.68			-
	TOTAL	**561952.62**	**0**	**461931.29**	**28320.77**	**71700.56**	**0**
12	**KARNAL**						
	Karnal	71195.51	-	71195.51	-	**-**	**-**
	Indri	60048.53	-	60048.53	-	**-**	**-**
	Gharaunda	70735.16	-	70735.16	-	**-**	**-**
	Nilokheri	98737.23	-	98737.23	-	**-**	**-**
	Assandh	97106.06	-	93574.93	3531.13	**-**	**-**
	Nissing	88594.83	-	88594.83	-	**-**	**-**
	Kunjpura	57062.29	-	57062.29	-	**-**	**-**
	Munak	66998.42	-	66998.42	-	**-**	**-**
	TOTAL	**610478.03**	**0**	**606946.9**	**3531.13**	**0**	**0**
13	**M. GARH**						
	Ateli	55137.2	2243.72	29487.88	23405.6		-
	Kanina	87385.94	-	64994.69	20855.85	1535.4	-
	M.garh	88668.5	2515.53	22007.4	64145.57		-
	N. Chaudhary	61874.6	911.82	44585.18	16377.6		-
	Narnaul	52145.48	-	37687.13	12539.1	1919.25	-
	Nizampur	41615.62	2735.45	38880.17			-
	Sihma	34162.79	-	17913.14	14074.5	2175.15	-
	Satnali	58598.83	3073.99	45160.89	10363.95		-
	TOTAL	**479588.96**	**11480.51**	**300716.48**	**161762.17**	**5629.8**	**0**
14	**NUH**						
	F.P.Zhirka	68308.5	12861.81	31683.8235	19802.3897	3960.47794	
	Nuh	72513.38	7400.79	8910.14317	8224.74754	17134.8907	30842.8033
	Nagina	43842.99	3612.67	14367.971	10344.9391	12643.8145	2873.59421
	Punhana	51493.37	247.1	4782.98487	44413.431	1366.56711	683.283553

S.NO.	DISTRICT / BLOCK	TOTAL GEO. AREA	HILLY AREA	FRESH	SUB. MARGINAL	MARGINAL	SALINE
				0-2000	**2000-4000**	**4000-6000**	**>-6000**
	Taoru	54278.58	8305.2	45973.3845			
	Pingawan	38417.23	1171.28	26486.0111	8276.87847	2483.06354	
	Indri	42377.83	741.31	2775.76809	9437.61152	9992.76514	19430.3766
	TOTAL	**371231.88**	**34340.16**	**134980.09**	**100500.00**	**47581.58**	**53830.06**
15	**PALWAL**						
	Palwal	49313.19	-	28766.0282	18903.39	1643.77304	
	Hassanpur	38202.3	-	24310.5536	13891.7449		
	Hodel	74265.92	-	29706.3669	43074.2319	1485.31834	
	Hathin	89006.84	318.76	11086.0094	58201.5495	15520.4132	3880.1033
	Pirthala	40482.64	-	5783.23403	28916.1702	5783.23403	
	Badoli	44681.66	-	43056.8699	1624.78754		
	TOTAL	**335952.55**	**318.76**	**142709.06**	**164611.87**	**24432.74**	**3880.10**
16	**PANIPAT**						
	Panipat	52584.72	-	52134.32	450.4	-	-
	Israna	67691.48	-	59230.05	8461.43	-	-
	Samalkha	46752.93	-	46752.93			
	Madlauda	89911.78	-	88934.48	977.3	-	-
	Bapoli	38719.9	-	38719.9		-	
	Sanoli Khurd	26251.24	-	26251.24		-	-
	TOTAL	**321912.05**	**0**	**312022.92**	**9889.13**	**0**	**0**
17	**PANCHKULA**						
	Pinjore	72164.48	27750	44414.48	-	-	-
	Barwala	53719.91	-	53719.91	-	-	-
	R.P.Rani	34663.7	8000	26663.7	-	-	-
	Morni	57613.23	57613.23	-	-	-	-
	TOTAL	**218161.32**	**93363.23**	**124798.09**	**0**	**0**	**0**
18	**ROHTAK**						
	Rohtak	144109	-	27849	48184	29617	38459
	Meham	110467	-	15198	70802	24467	
	Kalanaur	70477	-	5173	17134	16164	32006
	Lakhan Majra	31355	-		23016	4670	3669
	Sampla	56028	-	11347	29787	6738	8156
	TOTAL	**412436**	**0**	**59567**	**188923**	**81656**	**82290**

19	**REWARI**						
	Bawal	59316.63	1179.16	12027.3	46110.17		
	Jatusana	50907.4	-	1023.6	48476.39	1407.45	
	Khol	46726.76	3355.69	18111.75	25259.32		
	Rewari	56338.66	-		53395.81	2047.2	895.65
	Nahar	57897.15	-	8572.65	46765.5	2559	
	Dahina	51931.5	568.34	15937.5	35425.66		
	Dharuhera	49733.76		3326.7	45831.29	575.77	
	TOTAL	**372851.86**	**5103.19**	**58999.5**	**301264.14**	**6589.42**	**895.65**
20	**SONIPAT**						
	Gohana	77947	-	33290	25170	17457	2030
	Rai	53566	-	50396	3170		
	Kharkhoda	75996	-	32675	28636	6608	8077
	Sonipat	90940	-	71150	19790		
	Ganaur	62238	-	62238			
	Kathura	48454	-	13888	4629	25924	4013
	Mundlana	71875	-	17692	12901	36490	4792
	Murthal	47045		43603	3442		
	TOTAL	**528061**	**0**	**324932**	**97738**	**86479**	**18912**
21	**SIRSA**						
	Ellenabad	130438.76	-	31035.43	86359.46	8545.98	4497.89
	Odhan	127456.74	-	2430.54	19395.59	8992.94	96637.67
	Dabwali	197994.94	-	12611.98	127778.08	20510.83	37094.05
	N.S.Chopta	187068.53	-	17840.32	117843.37	22937.56	28447.28
	Baragudha	131915.62	-	4015.27	62409.83	18115.05	47375.47
	Sirsa	134565.64	-	7902.71	100320.55	12293.11	14049.27
	Rania	145681.83	-	10468.69	94174.15	14515.4	26523.59
	TOTAL	**1055122.06**	**0**	**86304.94**	**608281.03**	**105910.87**	**254625.22**
22	**Y. NAGAR**						
	Jagadhari	74096.64	-	74096.64	-	-	-
	Bilaspur	68109.87	2750	65359.87	-	-	-
	Chhachhrauli	64195.33	15500	48695.33	-	-	-
	Sadhaura	36731.71	2500	34231.71	-	-	-
	Radhaur	60920.31	-	60920.31	-	-	-
	Mustafabad	50766.84	-	50766.84	-	-	-
	Khizrabad	69650.17	17500	52150.17	-	-	-
	TOTAL	**424470.87**	**38250**	**386220.87**	**0**	**0**	**0**
	Total Area	**10911848.77**	**221386.98**	**5406793.94**	**3868470.36**	**863680.31**	**551517.20**
	%age	**100**	**2**	**50**	**35**	**8**	**5**

ANNEXURE IX

CATEGORIZATION OF ASSESSMENT UNITS, 2022

HARYANA									
S. No	**Name of District**	**S. No**	**Name of Safe Assessment Unit**	**S. No**	**Name of Semi-Critical Assessment Unit**	**S. No**	**Name of Critical Assessment Unit**	**S. No**	**Name of Over-Exploited Assessment Unit**
1	**AMBALA**			1	AMBALA-II	1	AMBALA-I	1	SAHA
				2	SHAHZADPUR			2	BARARA
								3	NARAINGARH
2	**BHIWANI**	1	SIWANI					1	KAIRU
		2	BAWANI KHERA					2	BEHAL
		3	BHIWANI					3	TOSHAM
								4	LOHARU
3	**CHARKHI DADRI**	1	BAUND					1	JHOJHU
		2	CHARKHI DADRI					2	BADHRA
4	**FARIDABAD**							1	BALLABGARH
								2	FARIDABAD
								3	FARIDABAD URBAN
								4	TIGAON
5	**FATEHABAD**					1	BHUNA	1	RATIA
						2	BHATTU KALAN	2	JAKHAL
								3	TOHANA
								4	FATEHABAD
								5	NAGPUR
6	**GURGAON**							1	PATAUDI
								2	FARRUKH NAGAR
								3	SOHNA
								4	GURGAON
								5	GURGAON URBAN
7	**HISAR**	1	HANSI	1	BARWALA	1	AGROHA	1	NARNAUND
		2	UKLANA						
		3	HANSI						
		4	HISAR-I						
		5	HISAR-II						
		6	ADAMPUR						
8	**JHAJJAR**	1	BAHADURGARH						
		2	BERI						
		3	JHAJJAR						
		4	MACHHRAULI						
		5	MATANNAIL						
		6	SALHAWAS						
		7	BADLI						
9	**JIND**	1	JULANA	1	PILLUKHERA			1	SAFIDON

HARYANA									
S. No	**Name of District**	**S. No**	**Name of Safe Assessment Unit**	**S. No**	**Name of Semi-Critical Assessment Unit**	**S. No**	**Name of Critical Assessment Unit**	**S. No**	**Name of Over-Exploited Assessment Unit**
		2	NARWANA					2	UCHANA
								3	ALEWA
								4	JIND
								5	UJHANA
10	**KAITHAL**							1	KALAYAT
								2	PUNDRI
								3	GUHLA
								4	KAITHAL
								5	RAJOUND
								6	SIWAN
								7	DHAND
11	**KARNAL**					1	INDRI	1	KARNAL
								2	MUNAK
								3	GHARAUNDA (PART)
								4	KUNJPURA
								5	NILOKHERI
								6	ASSANDH
								7	NISSING AT CHIRAO
12	**KURUKSHETRA**							1	LADWA
								2	THANESAR
								3	PIPLI
								4	SHAHBAD
								5	PEHOWA
								6	BABAIN
								7	ISMAILABAD
13	**MAHENDRA GARH**					1	NIZAMPUR	1	SIHMA
						2	SATNALI	2	MAHENDRAGARH
								3	KANINA
								4	NARNAUL
								5	ATELI NANGAL
								6	NANGAL CHAUDHARY
14	**MEWAT**	1	NAGINA	1	PUNAHANA			1	TAORU
		2	NUH					2	FEROZEPUR JHIRKA
		3	PINGWAN						
		4	INDRI						
15	**PALWAL**	1	HATHIN	1	HODAL	1	HASSANPUR	1	BADOLI
		2	PALWAL					2	PRITHLA
16	**PANCHKULA**	1	BARWALA			1	RAIPUR RANI		
		2	PINJORE						
17	**PANIPAT**							1	PANIPAT

HARYANA									
S. No	**Name of District**	**S. No**	**Name of Safe Assessment Unit**	**S. No**	**Name of Semi-Critical Assessment Unit**	**S. No**	**Name of Critical Assessment Unit**	**S. No**	**Name of Over-Exploited Assessment Unit**
								2	SANAULI KHURD
								3	ISRANA
								4	BAPOLI
								5	MADLAUDA
								6	SAMALKHA
18	**REWARI**					1	DAHINA	1	KHOL AT REWARI
								2	NAHAR
								3	REWARI
								4	DHARUHERA
								5	JATUSANA
								6	BAWAL
19	**ROHTAK**	1	KALANAUR						
		2	LAKHAN MAJRA						
		3	MAHAM						
		4	ROHTAK						
		5	SAMPLA						
20	**SIRSA**			1	BARAGUDHA			1	SIRSA
								2	DABWALI
								3	ODHAN
								4	NATHUSARI CHOPTA
								5	RANIA
								6	ELLENABAD
21	**SONIPAT**	1	GOHANA					1	MURTHAL
		2	KATHURA					2	SONIPAT
		3	KHARKHODA					3	RAI
								4	MUNDLANA
								5	GANAUR
22	**YAMUNA NAGAR**			1	KHIZRABAD			1	RADAUR
				2	CHHACHHRAULI			2	SADAURA (PART)
								3	MUSTAFABAD
								4	JAGADHRI
								5	BILASPUR

ANNEXURE X

SALINE DYNAMIC GROUND WATER RESOURCES

Saline Dynamic Ground Water Resources							
Sr. No.	**District**	**Assessment Unit Name**	**Poor Ground Water Quality (Ha)**	**Average Annual Rainfall (2015-19) mm)**	**Infiltration Factor**		**Saline Dynamic Ground Water Resources (Ha)**
			Saline		**Value**	**Norms / Field Value**	
1	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	AMBALA	AMBALA-I	0	688.90	22	Norms	0
2	AMBALA	AMBALA-II	0	696.60	22	Norms	0
3	AMBALA	BARARA	0	488.20	22	Norms	0
4	AMBALA	NARAINGARH	0	1480.10	22	Norms	0
5	AMBALA	SAHA	0	488.20	22	Norms	0
6	AMBALA	SHAHZADPUR	0	1470.10	22	Norms	0
	AMBALA						**0**
7	BHIWANI	BAWANI KHERA	10753	221.60	22	Norms	524.23026
8	BHIWANI	BEHAL	4078	310.70	22	Norms	278.74761
9	BHIWANI	BHIWANI	17453	364.10	22	Norms	1398.0202
10	BHIWANI	KAIRU	10196	237.60	22	Norms	532.96531
11	BHIWANI	LOHARU	1515	367.30	22	Norms	122.42109
12	BHIWANI	SIWANI	15191	265.50	22	Norms	887.30631
13	BHIWANI	TOSHAM	2014	195.20	22	Norms	86.489216
	BHIWANI						**3830.18**
14	CHARKI DADRI	BADHRA	0	267.00	22	Norms	0
15	CHARKI DADRI	BAUND	750	307.60	22	Norms	50.754
16	CHARKI DADRI	CHARKHI DADRI	497	302.60	22	Norms	33.086284
17	CHARKI DADRI	JHOJHU	1578	302.60	22	Norms	105.05062
	CHARKI DADRI						**188.8909**
18	FARIDABAD	BALLABGARH	7064	562.60	22	Norms	874.32541
19	FARIDABAD	FARIDABAD	772	319.60	22	Norms	54.280864
	FARIDABAD	FARIDABAD_URBAN		273.10			
20	FARIDABAD	TIGAON	0	573.00	22	Norms	0
	FARIDABAD						**928.60627**
21	FATEHABAD	BHATTU KALAN	158	485.50	22	Norms	16.87598
22	FATEHABAD	BHUNA	504	385.70	22	Norms	42.766416
23	FATEHABAD	FATEHABAD	0	311.40	22	Norms	0
24	FATEHABAD	JAKHAL	0	322.70	22	Norms	0
25	FATEHABAD	NAGPUR	0	448.10	22	Norms	0
26	FATEHABAD	RATIA	0	333.10	22	Norms	0
27	FATEHABAD	TOHANA	0	396.40	22	Norms	0
	FATEHABAD						**59.642396**
28	GURUGRAM	FARRUKH NAGAR	0	387.80	22	Norms	0
29	GURUGRAM	GURGAON	0	321.90	22	Norms	0
30	GURUGRAM	PATAUDI	0	458.50	22	Norms	0
	GURUGRAM	GURUGRAM URBAN		298.80			
31	GURUGRAM	SOHNA	1133	414.00	22	Norms	103.19364
	GURUGRAM						**103.19364**
32	HISAR	ADAMPUR	0	497.80	22	Norms	0
33	HISAR	AGROHA	0	443.70	22	Norms	0
34	HISAR	BARWALA	689	581.80	22	Norms	88.189244

Saline Dynamic Ground Water Resources							
Sr. No.	**District**	**Assessment Unit Name**	**Poor Ground Water Quality (Ha)**	**Average Annual Rainfall (2015-19) mm)**	**Infiltration Factor**		**Saline Dynamic Ground Water Resources (Ha)**
			Saline		**Value**	**Norms / Field Value**	
35	HISAR	HANSI	0	469.00	22	Norms	0
36	HISAR	HANSI-II	0	526.20	22	Norms	0
37	HISAR	HISAR-I	0	474.70	22	Norms	0
38	HISAR	HISAR-II	0	447.75	22	Norms	0
39	HISAR	NARNAUND	0	285.60	22	Norms	0
40	HISAR	UKLANA	0	631.00	22	Norms	0
	HISAR						**88.189244**
41	JHAJJAR	BADLI	0	403.80	22	Norms	0
42	JHAJJAR	BAHADURGARH	9236	451.60	24	Norms	1001.0346
43	JHAJJAR	BERI	5989	396.00	24	Norms	569.19456
44	JHAJJAR	JHAJJAR	7259	328.10	22	Norms	523.96914
45	JHAJJAR	MACHHRAULI	3862	262.70	22	Norms	223.20043
46	JHAJJAR	MATANNAIL	6915	467.50	22	Norms	711.20775
47	JHAJJAR	SALHAWAS	6544	349.40	22	Norms	503.02419
	JHAJJAR						**3531.6307**
48	JIND	ALEWA	0	518.10	22	Norms	0
49	JIND	JIND	0	460.70	22	Norms	0
50	JIND	JULANA	789	475.10	22	Norms	82.467858
51	JIND	NARWANA	1671	450.20	22	Norms	165.50252
52	JIND	PILLUKHERA	1932	235.20	22	Norms	99.969408
53	JIND	SAFIDON	0	494.20	22	Norms	0
54	JIND	UCHANA	2672	248.30	22	Norms	145.96067
55	JIND	UJHANA	0	536.40	22	Norms	0
	JIND						**493.90046**
56	KAITHAL	DHAND	0	527.80	22	Norms	0
57	KAITHAL	GUHLA	0	532.10	22	Norms	0
58	KAITHAL	KAITHAL	0	527.80	22	Norms	0
59	KAITHAL	KALAYAT	720	359.20	22	Norms	56.89728
60	KAITHAL	PUNDRI	0	527.80	22	Norms	0
61	KAITHAL	RAJOUND	3822	354.20	22	Norms	297.82553
62	KAITHAL	SIWAN	0	509.50	22	Norms	0
	KAITHAL						**354.72281**
63	KARNAL	ASSANDH	186	528.20	22	Norms	21.613944
64	KARNAL	GHARAUNDA (PART)	0	486.90	22	Norms	0
65	KARNAL	INDRI	0	667.80	22	Norms	0
66	KARNAL	KARNAL	0	696.70	22	Norms	0
67	KARNAL	KUNJPURA	0	696.70	22	Norms	0
68	KARNAL	MUNAK	0	487.10	22	Norms	0
69	KARNAL	NILOKHERI	0	648.00	22	Norms	0
70	KARNAL	NISSING AT CHIRAO	0	578.50	22	Norms	0
	KARNAL						**21.613944**
71	KURUKSHETRA	BABAIN	0	624.50	22	Norms	0
72	KURUKSHETRA	ISMAILABAD	0	541.00	22	Norms	0
73	KURUKSHETRA	LADWA	0	578.90	22	Norms	0
74	KURUKSHETRA	PEHOWA	0	482.30	22	Norms	0
75	KURUKSHETRA	PIPLI	0	715.90	22	Norms	0

Saline Dynamic Ground Water Resources							
Sr. No.	**District**	**Assessment Unit Name**	**Poor Ground Water Quality (Ha)**	**Average Annual Rainfall (2015-19) mm)**	**Infiltration Factor**		**Saline Dynamic Ground Water Resources (Ha)**
			Saline		**Value**	**Norms / Field Value**	
76	KURUKSHETRA	SHAHBAD	0	430.00	22	Norms	0
77	KURUKSHETRA	THANESAR	0	633.80	22	Norms	0
	KURUKSHETRA						**0**
78	MAHENDRAGARH	ATELI NANGAL	677	332.15	22	Norms	49.470421
79	MAHENDRAGARH	KANINA	478	337.40	22	Norms	35.480984
80	MAHENDRAGARH	MAHENDRAGARH	0	416.70	22	Norms	0
81	MAHENDRAGARH	NANGAL CHAUDHRY	0	267.60	22	Norms	0
82	MAHENDRAGARH	NARNAUL	0	370.50	22	Norms	0
83	MAHENDRAGARH	NIZAMPUR	369	291.30	22	Norms	23.647734
84	MAHENDRAGARH	SATNALI	1244	415.50	22	Norms	113.71404
85	MAHENDRAGARH	SIHMA	478	318.80	22	Norms	33.525008
	MAHENDRAGARH						**255.83819**
86	MEWAT	FEROZEPUR JHIRKA	1224	477.90	22	Norms	128.68891
87	MEWAT	INDRI	0	538.40	22	Norms	0
88	MEWAT	NAGINA	3390	457.00	22	Norms	340.8306
89	MEWAT	NUH	11017	700.90	22	Norms	1698.7994
90	MEWAT	PINGWAN	0	403.50	22	Norms	0
91	MEWAT	PUNAHANA	10573	445.50	22	Norms	1036.2597
92	MEWAT	TAORU	0	609.50	22	Norms	0
	MEWAT						**3204.5786**
93	PALWAL	BADOLI	0	420.00	22	Norms	0
94	PALWAL	HASSANPUR	0	337.20	22	Norms	0
95	PALWAL	HATHIN	5721	311.70	22	Norms	392.31185
96	PALWAL	HODAL	2751	444.20	22	Norms	268.83872
97	PALWAL	PALWAL	7334	425.60	22	Norms	686.69709
98	PALWAL	PRITHLA	0	375.60	22	Norms	0
	PALWAL						**1347.8477**
99	PANCHKULA	BARWALA	0	634.60	22	Norms	0
100	PANCHKULA	MORNI	0		22	Norms	0
101	PANCHKULA	PINJORE	0	875.00	22	Norms	0
102	PANCHKULA	RAIPUR RANI	0	595.30	22	Norms	0
	PANCHKULA						**0**
103	PANIPAT	BAPOLI	0	356.30	22	Norms	0
104	PANIPAT	ISRANA	636	353.50	22	Norms	49.46172
105	PANIPAT	MADLAUDA	0	405.20	22	Norms	0
106	PANIPAT	PANIPAT	0	520.90	22	Norms	0
107	PANIPAT	SAMALKHA	0	451.10	22	Norms	0
108	PANIPAT	SANAULI KHURD	0	463.80	22	Norms	0
	PANIPAT						**49.46172**
109	REWARI	BAWAL	0	614.20	22	Norms	0
110	REWARI	DAHINA	0	430.40	22	Norms	0
111	REWARI	DHARUHERA	0	520.10	22	Norms	0
112	REWARI	JATUSANA	0	493.80	22	Norms	0
113	REWARI	KHOL AT REWARI	1810	404.20	22	Norms	160.95244
114	REWARI	NAHAR	340	423.30	22	Norms	31.66284
115	REWARI	REWARI	0	634.80	24	Norms	0

Saline Dynamic Ground Water Resources							
Sr. No.	**District**	**Assessment Unit Name**	**Poor Ground Water Quality (Ha)**	**Average Annual Rainfall (2015-19) mm)**	**Infiltration Factor**		**Saline Dynamic Ground Water Resources (Ha)**
			Saline		**Value**	**Norms / Field Value**	
	REWARI						**192.61528**
116	ROHTAK	KALANAUR	3420	363.00	22	Norms	273.1212
117	ROHTAK	LAKHAN MAJRA	5219	284.10	22	Norms	326.19794
118	ROHTAK	MAHAM	1883	369.60	22	Norms	153.1105
119	ROHTAK	ROHTAK	4388	348.50	22	Norms	336.42796
120	ROHTAK	SAMPLA	1608	401.10	22	Norms	141.89314
	ROHTAK						**1230.7507**
121	SIRSA	BARAGUDHA	3709	190.80	22	Norms	155.68898
122	SIRSA	DABWALI	17750	147.00	22	Norms	574.035
123	SIRSA	ELLENABAD	6961	135.40	22	Norms	207.35427
124	SIRSA	NATHUSARI CHOPTA	16987	241.50	22	Norms	902.51931
125	SIRSA	ODHAN	16404	175.20	22	Norms	632.27578
126	SIRSA	RANIA	12893	143.00	22	Norms	405.61378
127	SIRSA	SIRSA	189	320.80	24	Norms	14.551488
	SIRSA						**2892.0386**
128	SONIPAT	GANAUR	0	491.10	22	Norms	0
129	SONIPAT	GOHANA	3165	540.30	22	Norms	376.21089
130	SONIPAT	KATHURA	4909	487.00	22	Norms	525.95026
131	SONIPAT	KHARKHODA	2660	607.30	22	Norms	355.39196
132	SONIPAT	MUNDLANA	4629	551.40	22	Norms	561.53473
133	SONIPAT	MURTHAL	0	604.50	22	Norms	0
134	SONIPAT	RAI	591	582.40	22	Norms	75.723648
135	SONIPAT	SONIPAT	127	604.40	22	Norms	16.886936
	SONIPAT						**1911.6984**
136	YAMUNANAGAR	BILASPUR	0	879.10	22	Norms	0
137	YAMUNANAGAR	CHHACHHRAULI	0	1015.20	22	Norms	0
138	YAMUNANAGAR	JAGADHRI	0	1065.50	22	Norms	0
139	YAMUNANAGAR	KHIZRABAD	0	1015.20	22	Norms	0
140	YAMUNANAGAR	MUSTAFABAD	0	801.30	22	Norms	0
141	YAMUNANAGAR	RADAUR	0	914.10	22	Norms	0
142	YAMUNANAGAR	SADAURA (PART)	0	847.30	22	Norms	0
	YAMUNANAGAR						
						Total	**41370.799**

ANNEXURE XI

BLOCK/AU WISE NUMBERS OF IRRIGATION, DOMESTIC & INDUSTRIAL TUBEWELLS

S. NO.	DISTRICT / BLOCK/ Assesment Unit	TOTAL GEO. AREA	IRRIGATION			DEEP (DOMESTIC T/W)	DEEP (INDUSTIAL T/W)
			SHALLOW T/W	DEEP T/W	SALINE T/W		
1	AMBALA						
	Ambala-1	19317.60	3309			190	22
	Ambala-2	35123.11	1990			124	30
	Barara	23038.02	3739			149	3
	Naraingarh	27728.78	4592			140	177
	Saha	25847.59	1972			113	249
	Shahzadpur	20149.80	2328			111	33
	TOTAL	151204.9					
2	BHIWANI						
	Bawani Khera	40587.23	3598		238	33	4
	Behal	29577.64	2710		2994	60	
	Bhiwani	85484.60	5296	425	2974	86	
	Kairu	28708.96	2603	2795	2512	22	22
	Loharu	36729.22	4738		46	142	10
	Siwani	56757.83	3244		1622	52	
	Tosham	51881.92	7027	155	455	258	
	TOTAL	329727.4					
3	CHARKI DADRI						
	Badhra	36774.38	7670			176	7
	Baund	23436.54	2500		2531	17	
	Charki Dadri	43137.09	3055		744	18	
	Jhojhu	34001.67	3638		343	105	
	TOTAL	137350					
4	FARIDABAD						
	Ballabgarh	17172.72	3795		241	25	644
	Faridabad	24146.20	3588		456	93	252
	Faridabad Urban	19500.75	95			1592	352
	Tigaon	13458.74	1902			112	
	TOTAL	74278.41					
5	FATEHABAD						
	Bhattu Kalan	36362.06	5083			18	
	Bhuna	38581.50	4583			17	
	Fatehabad	55434.14	6402			53	13
	Jakhal	15291.22	5164			32	
	Nagpur	28808.70	4583			22	
	Ratia	37788.00	8459			38	16
	Tohana	40246.77	8504			34	11
	TOTAL	252512					
6	GURGAON						
	Farrukh Nagar	28639.9	2978			105	

S. NO.	DISTRICT / BLOCK/ Assesment Unit	TOTAL GEO. AREA	IRRIGATION			DEEP (DOMESTIC T/W)	DEEP (INDUSTIAL T/W)
			SHALLOW T/W	DEEP T/W	SALINE T/W		
	Gurgaon	9619.00	357			514	
	Gurgaon_Urban	31911.4	32			13410	9456
	Pataudi	27547.7	5636			259	1
	Sohna	28316.5	3889			242	
	TOTAL	126034.9					
7	HISAR						
	Adampur	36692.79	3637		1626	7	
	Agroha	32989.38	4621			6	
	Barwala	50633.26	11694		1299	10	
	Hansi	58827.60	11352		2138	15	2
	Hansi-II	29922.61	7198		1476	20	
	Hisar-1	62292.97	4866		1978	25	206
	Hisar-2	72208.82	4465		1540	20	
	Narnaund	40985.50		7861	969		
	Uklana	22974.36	400		495	30	
	TOTAL	407527					
8	JIND						
	Alewa	23546.97	4400		660	23	
	Jind	47698.48	14266		625	110	142
	Julana	35171.88	5713		3398	31	14
	Narwana	33294.78	3581		3500	34	45
	Pillukhera	21549.57	7324		2004	23	30
	Safidon	31433.77	9179		1703	81	11
	Uchana	50720.53	14763		1614	47	23
	Ujhana	31675.47	9278		1842	28	12
	TOTAL	275091					
9	JHAJJAR						
	Badli	20877.44	3715		412	6	
	Bahadurgarh	39644.16	7686		2314	1	11
	Beri	32791.16	3955		3999	18	
	Jhajjar	30829.17	4652		1148	27	5
	Machhrauli	16846.85	2876		446	12	
	Matanhail	36214.35	4294		4295	31	
	Sahlawas	16261.65	3461		2098	15	9
	TOTAL	193465					
10	K. KSHETRA					62	224
	Babain	13395.59	3408			65	776
	Ismailabad	20106.69	3788			222	887
	Ladwa	15675.04	3810			176	
	Pehowa	42413.27	8088			176	840
	Pipli	17732.00	4236			76	489
	Shahabad	27598.08	6016			165	776
	Thanesar	31499.61	8102			242	2956
	TOTAL	168420					

S. NO.	DISTRICT / BLOCK/ Assesment Unit	TOTAL GEO. AREA	IRRIGATION			DEEP (DOMESTIC T/W)	DEEP (INDUSTIAL T/W)
			SHALLOW T/W	DEEP T/W	SALINE T/W		
11	KAITHAL						
	Dhand	21998.58	5264			82	5
	Guhla	39160.07	9217			98	58
	Kaithal	51093.04	8234			192	219
	Kalayat	32689.11	4045		113	54	2
	Pundri	30757.73	8001			89	24
	Rajound	24482.79	4380			40	3
	Siwan	27232.84	6295			71	
	TOTAL	227414					
12	KARNAL						
	Assandh	39297.43	10210			94	170
	Gharaunda	28625.50	6008			114	200
	Indri	24300.78	7179			117	90
	Karnal	28811.80	6502			146	1003
	Kunjpura	23092.29	4888			75	43
	Munak	27113.30	6549			78	50
	Nilokheri	39957.54	12215			155	200
	Nissing	35853.05	10895			97	120
	TOTAL	247052					
13	M. GARH						
	Ateli	22313.23	5516			134	
	Kanina	35363.83	7865		436	83	
	M.garh	35882.87	6086			118	
	N.chaudhary	25039.76	820			140	10
	Narnaul	21102.53	960			75	1
	Nizampur	16841.24	231			88	
	Satnali	23714.10	2295			53	
	Sihma	13825.19	2571			100	
	TOTAL	194083					
14	MEWAT						
	F.P.Zhirka	27643.47	2876		296	160	
	Indri	17149.70	655		245	69	
	Nagina	17742.63	411		711	126	
	Nuh	29345.12	728		2307	174	10
	Pingwan	15546.90	416		84	54	
	Punhana	20838.63	1931			115	
	Taoru	21965.76	4278			115	1
	TOTAL	150232					
15	PALWAL						
	Badoli	18082.03	3389			83	33
	Hassanpur	15459.92	3567			60	
	Hathin	36019.79	4765			123	5
	Hodel	30054.35	5978			73	4
	Palwal	19956.34	3483		390	79	78

S. NO.	DISTRICT / BLOCK/ Assesment Unit	TOTAL GEO. AREA	IRRIGATION			DEEP (DOMESTIC T/W)	DEEP (INDUSTIAL T/W)
			SHALLOW T/W	DEEP T/W	SALINE T/W		
	Prithla	16382.74	2198			11	32
	TOTAL	135955					
16	PANIPAT						
	Bapoli	15669.39	3700			53	60
	Israna	27393.77	6180		1408	72	100
	Madlauda	36386.01	8881			58	75
	Panipat	21280.28	6047			90	280
	Samalkha	18920.24	6387			87	45
	Sanauli Khurd	10623.50	2820			38	50
	TOTAL	130273					
17	PANCHKULA						
	Barwala	21739.68	1726			93	4
	Morni	23315.24				5	
	Pinjore	29203.93	574			120	11
	R.P.Rani	14027.90	1821			77	
	TOTAL	88287					
18	ROHTAK						
	Kalanaur	28521.04	2581		2593	15	6
	Lakhan Majra	12689.09	1317		1059	6	4
	Meham	44704.29	5274		1247	6	4
	Rohtak	58318.89	8920		2013	80	22
	Sampla	22673.80	4719		530	9	11
	TOTAL	166907					
19	REWARI						
	Bawal	24004.59	4233		141	100	122
	Dahina	21015.93	4885			76	6
	Dharuhera	20126.54	1872			107	134
	Jatusana	20601.51	5720		300	47	6
	Khol	18909.65	3375			113	3
	Nahar	23430.14	6190		113	67	4
	Rewari	22799.45	2775		133	60	88
	TOTAL	150888					
20	SONEPAT						
	Ganaur	27210.10	8090			116	75
	Gohana	31544.21	8391		3181	7	11
	Kathura	19608.78	4047		1944	13	3
	Kharkhoda	30754.62	7158		1357	70	5
	Mundlana	29086.88	14093			37	5
	Murthal	19038.36	5100			107	102
	Rai	21677.20	4501			70	91
	Sonepat	36802.17	6737			18	104
	TOTAL	215722					
21	SIRSA*						
	Baragudha	53384.36	4793		4203	11	

S. NO.	DISTRICT / BLOCK/ Assesment Unit	TOTAL GEO. AREA	IRRIGATION			DEEP (DOMESTIC T/W)	DEEP (INDUSTIAL T/W)
			SHALLOW T/W	DEEP T/W	SALINE T/W		
	Dabwali	80125.71	8371	238	6398	22	2
	Ellenabad	52786.70	8364		1224	32	22
	N.S.Chopta	75703.95	3259		2334	8	
	Odhan	51579.91	5519		4167	11	2
	Rania	58955.35	6135		3690	98	26
	Sirsa	54456.78	9269	10	1003	141	42
	TOTAL	426993					
22	Y. NAGAR						
	Bilaspur	27563.09	3585			130	
	Chhachhrauli	25978.93	3904			43	150
	Jagadhari	29985.85	7086			95	2
	Khizrabad	28186.42	1689			110	15
	Mustafabad	20544.61	8471			76	
	Radhaur	24653.58	10452			108	
	Sadhaura	14864.80	2632			95	
	TOTAL	171777				657	
	TOTAL (HARYANA STATE)	**4421200**					

ANNEXURE XII

BLOCK/AU WISE UNIT DRAFT OF TUBE WELLS FOR IRRIGATION, DOMESTIC & INDUSTRIAL

S.NO.	DISTRICT/ BLOCK	TOTAL GEOGRAPHICAL AREA	IRRIGATION Annual Draft per unit GW Structure	DOMESTIC Annual Draft per unitGW Structure	INDUSTRIAL Annual Draft per unit GW Structure
			(SHALLOW T/W) (Ham)	(DOMESTIC T/W) (Ham)	(IDUSTRIAL T/W) (Ham)
1	AMBALA				
	Ambala-1	19317.60	1.81	10.51	15
	Ambala-2	35123.11	1.81	10.51	15
	Barara	23038.02	1.81	10.51	15
	Naraingarh	27728.78	1.81	5.26	15
	Saha	25847.59	1.81	7.88	15
	Shahzadpur	20149.80	1.31	4	15
	TOTAL	151204.9			
2	BHIWANI				
	Bawani Khera	40587.23	1	4	4
	Behal	29577.64	1.56	4	
	Bhiwani	85484.60	1	4	
	Kairu	28708.96	1.5	4	4
	Loharu	36729.22	1.25	4	4
	Siwani	56757.83	0.8	4	
	Tosham	51881.92	1.5	4	
	TOTAL	329727.4			
3	CHARKI DADRI				
	Badhra	36774.38	1.81	3.95	4
	Baund	23436.54	0.45	3.95	
	Charki Dadri	43137.09	0.8	3.95	
	Jhojhu	34001.67	1.51	3.95	
	TOTAL	137350			
4	FARIDABAD				
	Ballabgarh	17172.72	1.25	2.37	4
	Faridabad	24146.20	1.45	2.37	4
	Faridabad_Urban	19500.75	1.45	2.37	4
	Tigaon	13458.74	1.45	2.37	4
	TOTAL	74278.418			
5	FATEHABAD				
	Bhattu Kalan	36362.06	1	10.52	
	Bhuna	38581.50	1.4	4	
	Fatehabad	55434.14	2.5	5.26	1.8
	Jakhal	15291.22	2.75	10.52	
	Nagpur	28808.70	2.51	10.52	
	Ratia	37788.00	2.5	10.52	3.56

S.NO.	DISTRICT/ BLOCK	TOTAL GEOGRAPHICAL AREA	IRRIGATION Annual Draft per unit GW Structure (SHALLOW T/W) (Ham)	DOMESTIC Annual Draft per unitGW Structure (DOMESTIC T/W) (Ham)	INDUSTRIAL Annual Draft per unit GW Structure (IDUSTRIAL T/W) (Ham)
	Tohana	40246.77	2.5	10.52	3.56
	TOTAL	252512			
6	GURGAON				
	F. Nagar	28639.95	1.81	3.9	
	Gurgaon	9619.00	1.5	2.81	
	Gurgaon_Urban	31911.45	1.5	1.59	1.81
	Pataudi	27547.78	1.35	2.37	1.81
	Sohna	28316.51	1.81	2.37	
	TOTAL	126034.6			
7	HISAR				
	Adampur	36692.79	1	2.15	
	Agroha	32989.38	1.2	2.15	
	Barwala	50633.26	0.9	3.55	
	Hansi	58827.60	0.4	2.15	1.81
	Hansi-II	29922.61	0.4	2.15	
	Hisar-1	62292.97	1	2.15	1.1
	Hisar-2	72208.82	1	2.15	
	Narnaund	40985.50	1	2.15	
	Uklana	22974.36	1	4.00	
	TOTAL	407527			
8	JIND				
	Alewa	23546.97	1.5	5.0	4.03
	Jind	47698.48	1.5	5.0	1.81
	Julana	35171.88	0.5	5.0	1.23
	Narwana	33294.78	0.81	5.0	1.81
	Pillukhera	21549.57	1	5.0	1.31
	Safidon	31433.77	1.81	5.0	1.91
	Uchana	50720.53	1.11	5.0	1.1
	Ujhana	31675.47	1.11	7.88	
	TOTAL	275091			
9	JHAJJAR				
	Badli	20877.44	0.5	3.29	
	Bahadurgarh	39644.16	0.51	3.29	4
	Beri	32791.16	0.51	3.29	
	Jhajjar	30829.17	0.54	3.29	3
	Machhrauli	16846.85	0.4	3	
	Matanhail	36214.35	0.4	2.74	
	Sahlawas	16261.65	0.51	3.29	3
	TOTAL	193465			

S.NO.	DISTRICT/ BLOCK	TOTAL GEOGRAPHICAL AREA	IRRIGATION Annual Draft per unit GW Structure (SHALLOW T/W) (Ham)	DOMESTIC Annual Draft per unitGW Structure (DOMESTIC T/W) (Ham)	INDUSTRIAL Annual Draft per unit GW Structure (IDUSTRIAL T/W) (Ham)
10	KURUKSHETRA				
	Babain	13395.59	1.81	7.88	1.81
	Ismailabad	20106.69	1.81	7.88	1.81
	Ladwa	15675.04	1.81	7.88	1.81
	Pehowa	42413.27	1.81	7.88	1.81
	Pipli	17732.00	1.81	7.88	1.81
	Shahabad	27598.08	1.81	7.88	1.81
	Thanesar	31499.61	1.81	7.88	1.81
	TOTAL	168420			
11	KAITHAL				
	Dhand	21998.58	1.51	7.88	1.81
	Guhla	39160.07	1.81	7.88	1.81
	Kaithal	51093.04	1.81	7.88	1.81
	Kalayat	32689.11	1.51	7.88	1.81
	Pundri	30757.73	1.81	7.88	1.81
	Rajound	24482.79	1.81	7.88	1.81
	Siwan	27232.84	1.81	7.88	1.81
	TOTAL	227414			
12	KARNAL				
	Assandh	39297.43	1.5	7.88	4
	Gharaunda	28625.50	1.81	7.88	4
	Indri	24300.78	2	7.88	4
	Karnal	28811.80	1.81	7.88	4
	Kunjpura	23092.29	1.81	7.88	
	Munak	27113.30	1.81	12.81	
	Nilokheri	39957.54	1.81	12.81	4
	Nissing	35853.05	1.81	12.81	4
	TOTAL	247052			
13	M. GARH				
	Ateli	22313.23	0.67	4	
	Kanina	35363.83	1.3	4	
	M.garh	35882.87	0.64	0	
	N.chaudhary	25039.76	1.17	4	3.01
	Narnaul	21102.53	0.77	4	0.98
	Nizampur	16841.24	0.78	4	
	Satnali	23714.10	0.64	4	
	Sihma	13825.19	1.4	4	
	TOTAL	194083			
14	MEWAT				
	Firozpur Zhirka	27643.47	0.99	1.81	

S.NO.	DISTRICT/ BLOCK	TOTAL GEOGRAPHICAL AREA	IRRIGATION Annual Draft per unit GW Structure (SHALLOW T/W) (Ham)	DOMESTIC Annual Draft per unitGW Structure (DOMESTIC T/W) (Ham)	INDUSTRIAL Annual Draft per unit GW Structure (IDUSTRIAL T/W) (Ham)
	Indri	17149.70	1.25	4.27	
	Nagina	17742.63	1.25	1.81	
	Nuh	29345.12	1.05	1.81	1.81
	Pingwan	15546.90	1.05	2.83	
	Punhana	20838.63	1.57	1.81	
	Taoru	21965.76	0.89	1.81	1.81
	TOTAL	150232			
15	PALWAL				
	Badoli	18082.03	1.81	9.63	4.5
	Hassanpur	15459.92	1.54	3.95	
	Hathin	36019.79	1	3.16	4
	Hodel	30054.35	1	3.95	4
	Palwal	19956.34	1.3	3.95	4.51
	Prithla	16382.74	1.81	3.95	4.51
	TOTAL	135955			
16	PANIPAT				
	Bapoli	15669.39	1.81	6.57	4
	Israna	27393.77	1.3	3.57	4
	Madlauda	36386.01	1.3	4	4
	Panipat	21280.28	1.81	6.57	4
	Samalkha	18920.24	1.81	6.57	4
	Sanuli Khurd	10623.50		6.57	
	TOTAL	130273			
17	PANCHKULA				
	Barwala	21739.68	1.81	3.94	6
	Morni	23315.24			
	Pinjore	29203.93	1.81	3.94	6
	R.P.Rani	14027.90	1.81	3.94	
	TOTAL	88287			
18	ROHTAK				
	Kalanaur	28521.04	0.54	3.5	3.5
	Lakhan Majra	12689.09	0.97	3	3
	Meham	44704.29	0.81	3	3
	Rohtak	58318.89	0.54	4	4
	Sampla	22673.80	0.51	3	3
	TOTAL	166907			
19	REWARI				
	Bawal	24004.59	0.98	3.29	4
	Dahina	21015.93	0.96	3.22	4
	Dharuhera	20126.54	1.81	4.44	4

S.NO.	DISTRICT/ BLOCK	TOTAL GEOGRAPHICAL AREA	IRRIGATION Annual Draft per unit GW Structure (SHALLOW T/W) (Ham)	DOMESTIC Annual Draft per unitGW Structure (DOMESTIC T/W) (Ham)	INDUSTRIAL Annual Draft per unit GW Structure (IDUSTRIAL T/W) (Ham)
	Jatusana	20601.51	0.96	3.95	4.0
	Khol	18909.65	0.96	2.36	4.0
	Nahar	23430.14	0.96	3.29	4.0
	Rewari	22799.45	1.81	3.99	4.0
	TOTAL	150888			
20	SONEPAT				
	Ganaur	27210.10	1.15	5.91	3.0
	Gohana	31544.21	0.54	3.74	3.0
	Kathura	19608.78	0.65	2.94	1.81
	Kharkhoda	30754.62	0.5	5.75	3.0
	Mundlana	29086.88	1.0	5.69	3.0
	Murthal	19038.36	1.5	5.91	1.81
	Rai	21677.20	1.5	5.91	3.0
	Sonepat	36802.17	2.0	5.91	1.81
	TOTAL	215722			
21	SIRSA				
	Baragudha	53384.36	1.8	7.23	
	Dabwali	80125.71	2.0	4.0	
	Ellenabad	52786.70	1.81	10.29	1.81
	N.S.Chopta	75703.95	1.81	4	
	Odhan	51579.91	1.81	4	
	Rania	58955.35	1.81	7.88	1.81
	Sirsa	54456.78	1.81	7.88	1.81
	TOTAL	426993			
22	Y. NAGAR				
	Bilaspur	27563.09	1.81	7.88	
	Chhachhrauli	25978.93	1.81	7.88	15.0
	Jagadhari	29985.85	1.81	7.88	15.0
	Khizrabad	28186.42	1.81	7.88	15.0
	Mustafabad	20544.61	1.81	7.88	
	Radhaur	24653.58	1.81	7.88	
	Sadhaura	14864.80	1.81	5.25	
	TOTAL	171777			

ANNEXURE XIII

BLOCK / AU WISE UNIT RECHARGE (IN METER)

S. No	District	Assessment Unit Name	Recharge Worthy Area (Ham)	Annual Extractable Ground Water Recharge (Ham)	Unit Recharge (in meters)
1	2	3	4	5	6
1	AMBALA	AMBALA-I	19317.597	9365.020	0.43
2	AMBALA	AMBALA-II	35123.114	7754.940	0.19
3	AMBALA	BARARA	23038.018	6599.430	0.25
4	AMBALA	NARAINGARH	27428.780	9266.140	0.30
5	AMBALA	SAHA	25847.586	6070.800	0.21
6	AMBALA	SHAHZADPUR	20149.797	5841.440	0.26
7	BHIWANI	BAWANI KHERA	40587.230	6259.300	0.14
8	BHIWANI	BEHAL	29577.641	3315.870	0.10
9	BHIWANI	BHIWANI	85484.602	9318.140	0.10
10	BHIWANI	KAIRU	28708.958	2908.740	0.09
11	BHIWANI	LOHARU	36729.218	4480.790	0.10
12	BHIWANI	SIWANI	56757.829	7621.060	0.12
13	BHIWANI	TOSHAM	50849.917	8045.540	0.14
14	CHARKI DADRI	BADHRA	23436.543	7046.240	0.27
15	CHARKI DADRI	BAUND	36585.378	4889.900	0.12
16	CHARKI DADRI	CHARKHI DADRI	43137.094	4504.390	0.09
17	CHARKI DADRI	JHOJHU	34001.673	4309.510	0.11
18	FARIDABAD	BALLABGARH	15863.722	3330.910	0.18
19	FARIDABAD	FARIDABAD	16738.206	4862.110	0.26
20	FARIDABAD	FARIDABAD URBAN	19500.750	1739.580	0.08
21	FARIDABAD	TIGAON	13458.740	2327.480	0.15
22	FATEHABAD	BHATTU KALAN	36362.057	4527.890	0.11
23	FATEHABAD	BHUNA	38581.499	7316.180	0.18
24	FATEHABAD	FATEHABAD	55434.140	8369.400	0.13
25	FATEHABAD	JAKHAL	15291.217	7428.920	0.43
26	FATEHABAD	NAGPUR	28808.705	5730.430	0.17
27	FATEHABAD	RATIA	37787.997	15646.670	0.37
28	FATEHABAD	TOHANA	40246.768	17092.230	0.38
29	GURUGRAM	FARRUKH NAGAR	28608.953	4139.220	0.13
30	GURUGRAM	GURGAON	8331.000	1800.130	0.19
31	GURUGRAM	GURGAON URBAN	31911.447	6154.370	0.17
32	GURUGRAM	PATAUDI	27502.783	5065.700	0.16
33	GURUGRAM	SOHNA	25891.507	5161.780	0.17
34	HISAR	ADAMPUR	36692.787	8198.840	0.20
35	HISAR	AGROHA	32989.384	6563.980	0.18

S. No	District	Assessment Unit Name	Recharge Worthy Area (Ham)	Annual Extractable Ground Water Recharge (Ham)	Unit Recharge (in meters)
1	2	3	4	5	6
36	HISAR	BARWALA	50633.263	14413.250	0.26
37	HISAR	BASS	29922.615	5755.440	0.18
38	HISAR	HANSI	58827.600	8126.700	0.12
39	HISAR	HISAR-I	62292.972	10035.680	0.15
40	HISAR	HISAR-II	72208.822	7204.260	0.09
41	HISAR	NARNAUND	40985.498	7303.910	0.16
42	HISAR	UKLANA	22974.355	3157.790	0.12
43	JHAJJAR	BADLI	20877.445	2715.220	0.11
44	JHAJJAR	BAHADURGARH	39644.165	7440.960	0.16
45	JHAJJAR	BERI	32791.161	6299.050	0.17
46	JHAJJAR	JHAJJAR	30829.175	4410.900	0.12
47	JHAJJAR	MATANNAIL	16846.850	1934.820	0.10
48	JHAJJAR	SALHAWAS	36214.347	6525.240	0.16
49	JIND	ALEWA	16261.645	4388.660	0.24
50	JIND	JIND	23546.966	6363.010	0.24
51	JIND	JULANA	47698.484	19865.250	0.37
52	JIND	NARWANA	35171.882	7071.720	0.18
53	JIND	PILLUKHERA	33294.780	6564.330	0.17
54	JIND	SAFIDON	21549.569	8185.630	0.34
55	JIND	UCHANA	31433.772	13714.290	0.39
56	JIND	UJHANA	50720.527	17278.250	0.30
57	KAITHAL	DHAND	31675.470	9507.200	0.27
58	KAITHAL	GUHLA	21998.581	4673.320	0.19
59	KAITHAL	KAITHAL	39160.069	8717.670	0.20
60	KAITHAL	KALAYAT	51093.039	10855.240	0.19
61	KAITHAL	PUNDRI	32689.106	4466.640	0.12
62	KAITHAL	RAJOUND	30757.734	8695.400	0.25
63	KAITHAL	SIWAN	24482.786	4904.270	0.18
64	KARNAL	ASSANDH	27232.840	6419.270	0.21
65	KARNAL	GHARAUNDA (PART)	39297.431	9878.740	0.24
66	KARNAL	INDRI	28625.504	8633.110	0.27
67	KARNAL	KARNAL	24300.779	13426.540	0.49
68	KARNAL	KUNJPURA	28811.801	11100.720	0.34
69	KARNAL	MUNAK	23092.290	6140.990	0.23
70	KARNAL	NILOKHERI	27113.300	6266.360	0.20
71	KARNAL	NISSING AT CHIRAO	39957.540	13099.100	0.29
72	KURUKSHETRA	BABAIN	13395.589	12715.060	0.31
73	KURUKSHETRA	ISMAILABAD	20106.693	3241.370	0.22
74	KURUKSHETRA	LADWA	15675.038	4028.150	0.18

S. No	District	Assessment Unit Name	Recharge Worthy Area (Ham)	Annual Extractable Ground Water Recharge (Ham)	Unit Recharge (in meters)
1	2	3	4	5	6
75	KURUKSHETRA	PEHOWA	42413.273	3595.160	0.21
76	KURUKSHETRA	PIPLI	17731.999	9802.700	0.21
77	KURUKSHETRA	SHAHBAD	27598.083	4437.860	0.22
78	KURUKSHETRA	THANESAR	31499.606	7022.590	0.24
79	MAHENDRAGARH	ATELI NANGAL	21405.234	9066.660	0.26
80	MAHENDRAGARH	KANINA	35363.835	3883.760	0.16
81	MAHENDRAGARH	MAHENDRAGARH	34864.871	5967.360	0.15
82	MAHENDRAGARH	NANGAL CHAUDHRY	24670.763	1124.670	0.04
83	MAHENDRAGARH	NARNAUL	21102.525	1031.920	0.04
84	MAHENDRAGARH	NIZAMPUR	16841.242	607.610	0.03
85	MAHENDRAGARH	SATNALI	23714.103	1933.070	0.07
86	MAHENDRAGARH	SIHMA	13825.191	2906.460	0.19
87	MEWAT	FEROZEPUR JHIRKA	22435.472	3186.420	0.13
88	MEWAT	INDRI	17149.702	1800.540	0.09
89	MEWAT	NAGINA	16280.630	1517.410	0.08
90	MEWAT	NUH	26050.124	3670.430	0.12
91	MEWAT	PINGWAN	15546.902	1318.700	0.07
92	MEWAT	PUNAHANA	20838.628	3843.270	0.17
93	MEWAT	TAORU	18604.763	3605.790	0.17
94	PALWAL	BADOLI	18082.025	4017.250	0.11
95	PALWAL	HASSANPUR	15459.922	6305.850	0.38
96	PALWAL	HATHIN	35890.791	8614.360	0.22
97	PALWAL	HODAL	30054.350	8421.030	0.25
98	PALWAL	PALWAL	19956.340	8479.460	0.38
99	PALWAL	PRITHLA	16382.742	3158.480	0.17
100	PANCHKULA	BARWALA	21739.679	6912.490	0.30
101	PANCHKULA	MORNI	18103.931	4483.890	0.23
102	PANCHKULA	PINJORE	10827.904	3984.500	0.34
103	PANCHKULA	RAIPUR RANI	15669.386	3296.560	0.18
104	PANIPAT	BAPOLI	27393.771	5479.750	0.18
105	PANIPAT	ISRANA	36386.005	8490.220	0.22
106	PANIPAT	MADLAUDA	21280.280	6948.810	0.29
107	PANIPAT	PANIPAT	18920.239	6048.580	0.29
108	PANIPAT	SAMALKHA	10623.501	2418.460	0.20
109	PANIPAT	SANAULI KHURD	23284.587	4565.010	0.17
110	REWARI	BAWAL	19809.933	5803.770	0.26
111	REWARI	DAHINA	20126.537	3218.650	0.15
112	REWARI	JATUSANA	19395.509	3577.640	0.17
113	REWARI	KHOL AT REWARI	17321.650	2755.850	0.14

S. No	District	Assessment Unit Name	Recharge Worthy Area (Ham)	Annual Extractable Ground Water Recharge (Ham)	Unit Recharge (in meters)
1	2	3	4	5	6
114	REWARI	NAHAR	23430.144	4167.320	0.16
115	REWARI	REWARI	22799.449	5224.590	0.20
116	ROHTAK	KALANAUR	28521.039	5183.080	0.16
117	ROHTAK	LAKHAN MAJRA	12689.093	2764.230	0.19
118	ROHTAK	MAHAM	44704.285	8318.360	0.16
119	ROHTAK	ROHTAK	58318.890	9108.630	0.14
120	ROHTAK	SAMPLA	22673.802	4066.150	0.16
121	SIRSA	BARAGUDHA	53384.356	12328.710	0.20
122	SIRSA	DABWALI	80125.708	13857.880	0.15
123	SIRSA	ELLENABAD	52786.695	7609.690	0.12
124	SIRSA	NATHUSARI CHOPTA	75703.948	5501.200	0.06
125	SIRSA	ODHAN	51579.911	5741.390	0.10
126	SIRSA	RANIA	58955.346	8961.590	0.13
127	SIRSA	SIRSA	54456.784	8985.900	0.15
128	SONIPAT	GANAUR	27210.096	9003.010	0.29
129	SONIPAT	GOHANA	31544.214	9762.910	0.27
130	SONIPAT	KATHURA	19608.781	6825.420	0.33
131	SONIPAT	KHARKHODA	30754.625	7956.640	0.24
132	SONIPAT	MUNDLANA	29086.883	12667.580	0.39
133	SONIPAT	MURTHAL	19038.363	5282.240	0.26
134	SONIPAT	RAI	21677.198	5005.880	0.20
135	SONIPAT	SONIPAT	36802.166	12728.720	0.31
136	YAMUNANAGAR	BILASPUR	26463.085	6931.170	0.23
137	YAMUNANAGAR	CHHACHHRAULI	12778.928	12576.150	0.93
138	YAMUNANAGAR	JAGADHRI	29985.846	9599.970	0.28
139	YAMUNANAGAR	KHIZRABAD	14986.423	4948.420	0.29
140	YAMUNANAGAR	MUSTAFABAD	20544.610	8667.260	0.37
141	YAMUNANAGAR	RADAUR	24653.576	10549.670	0.38
142	YAMUNANAGAR	SADAURA (PART)	13864.795	4032.770	0.26

DYNAMIC GROUND WATER RESOURCES OF HARYANA AS ON MARCH 2022

Annexure- XIV

District	Assessment Unit Name	Assessment Unit code	Predominant Rock formation	Total area (Ha)	Hilly Area (Ha)	Recharge Worthy Area (Ha)	Poor Ground Water Quality (Ha)			Command Area (Ha)	Non-Command Area (Ha)	Normal Annual Rainfall (mm)	Normal Monsoon Rainfall (mm)	Specific Yield		Water Level Fluctuation (m)	Method adopted for computing rainfall recharge during Monsoon recharge (WLF/ RIF Method)	Infiltration Factor	
							As	Saline	F					Value	Norm /Field Value			Value	Norms / Field Value
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AMBALA	AMBALA-I	HR010100	Alluvium	19318	0	19317.6	NA	0	NA	19318	0	1317	994	15	Norms	0.11	RIF	22	Norms
AMBALA	AMBALA-II	HR010200	Alluvium	35123	0	35123.1	NA	0	NA	35123	0	917	694	15	Norms		RIF	22	Norms
AMBALA	BARARA	HR010300	Alluvium	23038	0	23038	NA	0	NA	23038	0	924	697	15	Norms	-0.40	RIF	22	Norms
AMBALA	NARAINGA RH	HR010400	Alluvium	27729	300	27428.8	NA	0	NA	27429	0	1381	1048	15	Norms	-0.15	RIF	22	Norms
AMBALA	SAHA	HR010500	Alluvium	25848	0	25847.6	NA	0	NA	25848	0	924	697	15	Norms		RIF	22	Norms
AMBALA	SHAHZADPUR	HR010600	Alluvium	20150	0	20149.8	NA	0	NA	20150	0	1621	1198	15	Norms	-0.23	RIF	22	Norms
BHIWANI	BAWANI KHERA	HR020100	Alluvium	40567	0	40587.2	NA	10733	NA	29834	0	185.67	161.04	10	Norms	1.27	RIF	22	Norms
BHIWANI	BEHAL	HR020200	Alluvium	29578	0	29577.6	NA	4078	NA	25500	0	379.4	327.90	10	Norms		RIF	22	Norms
BHIWANI	BHIWANI	HR020300	Alluvium	85465	0	85484.6	NA	17433	NA	68032	0	426.23	351.03	10	Norms	0.78	WTFM	22	Norms
BHIWANI	KAIRU	HR020400	Alluvium	28709	0	28709	NA	10196	NA	18513	0	353.08	287.48	10	Norms	-0.14	RIF	22	Norms
BHIWANI	LOHARU	HR020500	Alluvium	36729	0	36729.2	NA	1515	NA	35214	0	440.84	360.81	10	Norms	-0.18	RIF	22	Norms
BHIWANI	SIWANI	HR020600	Alluvium	56758	0	56757.8	NA	15191	NA	41567	0	266.36	233.43	10	Norms	0.43	RIF	22	Norms
BHIWANI	TOSHAM	HR020700	Alluvium	51882	1032	50849.9	NA	2014	NA	48836	0	353.08	287.48	12	Norms	0.72	RIF	22	Norms
CHARKHI DADRI	BADHRA	HR030100	Alluvium	36774	189	23436.5	NA	0	NA	36585	0	343.99	293.06	12	Norms	-0.26	RIF	22	Norms
CHARKHI DADRI	BAUND	HR030200	Alluvium	23437	0	36585.4	NA	750	NA	22687	0	547.87	451.40	12	Norms	0.36	RIF	22	Norms
CHARKHI DADRI	CHARKHI DADRI	HR030300	Alluvium	43137	0	43137.1	NA	497	NA	42640	0	507.87	421.4	12	Norms	0.56	RIF	22	Norms
CHARKHI DADRI	JHOJHU	HR030400	Alluvium	34002	0	34001.7	NA	1578	NA	32424	0	507.87	421.4	12	Norms		RIF	22	Norms

FARIDABAD	BALLABGARH	HR040100	Alluvium	21659	1309	15863.7	NA	7044	NA	10600	0	612.96	499.26	10	Norms	-0.41	WTFM	22	Norms
FARIDABAD	FARIDABAD	HR040200	Alluvium	39147	7408	16738.2	NA	772	NA	16466	0	699	542	10	Norms	-1.64	RIF	22	Norms
FARIDABAD	FARIDABAD URBAN	HR040400	Alluvium	19500		19500.8	NA	0	NA	17201	0	699	542	10	Norms		RIF	22	Norms
FARIDABAD	TIGAON	HR040300	Alluvium	13459	0	13458.7	NA	0	NA	13459		699	542	10	Norms		RIF	22	
FATEHABAD	BHATTU KALAN	HR050100	Alluvium	36362	0	36362.1	NA	158	NA	36204	0	176	148	12	Norms	-0.65	RIF	22	Norms
FATEHABAD	BHUNA	HR050200	Alluvium	38581	0	38581.5	NA	504	NA	38077	0	324	257	12	Norms	-0.21	RIF	22	Norms
FATEHABAD	FATEHABAD	HR050300	Alluvium	55434	0	55434.1	NA	0	NA	55434	0	324	257	12	Norms	0.59	RIF	22	Norms
FATEHABAD	JAKHAL	HR050400	Alluvium	15291	0	15291.2	NA	0	NA	15291	0	341	259	12	Norms		RIF	22	Norms
FATEHABAD	NAGPUR	HR050700	Alluvium	28809	0	28808.7	NA	0	NA	28809	0	324	257	12	Norms		RIF	22	
FATEHABAD	RATIA	HR050500	Alluvium	37788	0	37788	NA	0	NA	37788	0	213	170	12	Norms		RIF	22	Norms
FATEHABAD	TOHANA	HR050600	Alluvium	40247	0	40246.8	NA	0	NA	40247	0	341	259	12	Norms		RIF	22	Norms
GURGAON	FARRUKH NAGAR	HR060100	Alluvium	28640	31	28609	NA	0	NA	28609	0	401.6	270.05	10	Norms	-0.14	RIF	22	Norms
GURGAON	GURGAON	HR060200	Alluvium	34236	1288	8331	NA	0	NA	8331	0	673	486	10	Norms	-1.61	RIF	22	Norms
GURGAON	GURGAON URBAN	HR060500	Alluvium	31911		31911.4	NA	0	NA	31911	0	673	486	10	Norms		RIF	22	Norms
GURGAON	PATAUDI	HR060300	Alluvium	27548	45	27502.8	NA	0	NA	27503	0	466	321	10	Norms	-0.86	RIF	22	Norms
GURGAON	SOHNA	HR060400	Alluvium	35611	2425	25891.5	NA	1133	NA	32053	0	522.94	400.55	10	Norms	-1.02	RIF	22	Norms
HISAR	ADAMPUR	HR070100	Alluvium	36693	0	36692.8	NA	0	NA	36693	0	430	180	12	Norms	0.21	RIF	22	Norms
HISAR	AGROHA	HR070200	Alluvium	32989	0	32989.4	NA	0	NA	32989	0	260	210	12	Norms	0.51	WTFM	22	Norms
HISAR	BARWALA	HR070300	Alluvium	50633	0	50633.3	NA	689	NA	49944	0	430	350	12	Norms	-0.13	RIF	22	Norms
HISAR	HANSI	HR070500	Alluvium	58828	0	58827.6	NA	0	NA	58828	0	292	24	12	Norms	1.06	RIF	22	Norms
HISAR	HANSI-II	HR071000	Alluvium	29923	0	29922.6	NA	0	NA	29923	0	292	244	12	Norms	0.92	WTFM	22	Norms
HISAR	HISAR-I	HR070600	Alluvium	62293	0	62293	NA	0	NA	62293	0	488	406	12	Norms	-0.21	RIF	22	Norms
HISAR	HISAR-II	HR070700	Alluvium	72209	0	72208.8	NA	0	NA	72209	0	368	306	12	Norms	0.40	RIF	22	Norms
HISAR	NARNAUND	HR070800	Alluvium	40985	0	40985.5	NA	0	NA	40985	0	295	245	12	Norms	-0.32	RIF	22	Norms
HISAR	UKLANA	HR070900	Alluvium	22974	0	22974.4	NA	0	NA	22974	0	340	260	12	Norms		RIF	22	Norms

JHAJJAR	BADLI	HR080600	Alluvium	20877	0	20877.4	NA	0	NA	20877	0	482	380	12			RIF	22	
JHAJJAR	BAHADURGARH	HR080100	Alluvium	38644	0	39644.2	NA	8236	NA	30408	0	482	380	12	Norms	0.69	WTFM	24	Norms
JHAJJAR	BERI	HR080200	Alluvium	32791	0	32791.2	NA	5989	NA	26802	0	429	339	12	Norms	0.99	WTFM	24	Norms
JHAJJAR	JHAJJAR	HR080300	Alluvium	30581	0	30829.2	NA	7011	NA	23570	0	519	407	12	Norms	1.25	RIF	22	Norms
JHAJJAR	MACHHRAULI	HR080700	Alluvium	16847	0	16846.9	NA	3862	NA	12985	0	629	477	12	Norms		RIF	22	Norms
JHAJJAR	MATANNAIL	HR080400	Alluvium	35214	0	36214.3	NA	5915	NA	29299	0	383	302	12	Norms	0.15	RIF	22	Norms
JHAJJAR	SALHAWAS	HR080500	Alluvium	15262	0	16261.6	NA	5544	NA	9717.6	0	383	302	12	Norms	0.70	RIF	22	Norms
JIND	ALEWA	HR090100	Alluvium	23547	0	23547	NA	0	NA	23547	0	515	379	12	Norms	-0.01	RIF	22	Norms
JIND	JIND	HR090200	Alluvium	47698	0	47698.5	NA	0	NA	47698	0	576	374	12	Norms	0.61	RIF	22	Norms
JIND	JULANA	HR090300	Alluvium	35172	0	35171.9	NA	789	NA	34383	0	436.16	307.9	12	Norms	0.64	RIF	22	Norms
JIND	NARWANA	HR090400	Alluvium	33295	0	33294.8	NA	1671	NA	31624	0	441.4	286.6	12	Norms	-0.27	RIF	22	Norms
JIND	PILLUKHERA	HR090500	Alluvium	21550	0	21549.6	NA	1932	NA	19618	0	329	216.55	12	Norms	0.28	RIF	22	Norms
JIND	SAFIDON	HR090600	Alluvium	31434	0	31433.8	NA	0	NA	31434	0	567	443	12	Norms	-0.21	RIF	22	Norms
JIND	UCHANA	HR090700	Alluvium	50721	0	50720.5	NA	2672	NA	48049	0	497.9	341.9	12	Norms	0.83	RIF	22	Norms
JIND	UJHANA	HR090800	Alluvium	31675	0	31675.5	NA	0	NA	31675	0	576	374	12	Norms		RIF	22	Norms
KAITHAL	DHAND	HR100700	Alluvium	21999	0	21998.6	NA	0	NA	21999	0	523.07	410.01	12	Norms		WTFM	22	Norms
KAITHAL	GUHLA	HR100100	Alluvium	39160	0	39160.1	NA	0	NA	39160	0	518.31	399.47	12	Norms	-0.63	RIF	22	Norms
KAITHAL	KAITHAL	HR100200	Alluvium	51093	0	51093	NA	0	NA	51093	0	523.07	410.01	12	Norms	-1.54	RIF	22	Norms
KAITHAL	KALAYAT	HR100300	Alluvium	32689	0	32689.1	NA	720	NA	31969	0	403.45	326.84	12	Norms	0.15	RIF	22	Norms
KAITHAL	PUNDRI	HR100400	Alluvium	30758	0	30757.7	NA	0	NA	30758	0	523.07	410.01	12	Norms	-2.09	RIF	22	Norms
KAITHAL	RAJOUND	HR100500	Alluvium	24483	0	24482.8	NA	3822	NA	20661	0	403.45	326.84	12	Norms	0.85	WTFM	22	Norms
KAITHAL	SIWAN	HR100600	Alluvium	27233	0	27232.8	NA	0	NA	27233	0	518.31	399.47	12	Norms		RIF	22	Norms
KARNAL	ASSANDH	HR110100	Alluvium	39297	0	39297.4	NA	186	NA	39111	0	578.78	458.95	15	Norms	-0.49	WTFM	22	Norms
KARNAL	GHARAUNDA (PART)	HR110200	Alluvium	28626	0	28625.5	NA	0	NA	28626	0	487.08	376.68	15	Norms	-0.72	RIF	22	Norms
KARNAL	INDRI	HR110300	Alluvium	24301	0	24300.8	NA	0	NA	24301	0	667.99	546.86	15	Norms	-0.43	RIF	22	Norms
KARNAL	KARNAL	HR110400	Alluvium	28812	0	28811.8	NA	0	NA	28812	0	696.78	538.08	15	Norms	-0.60	RIF	22	Norms

KARNAL	KUNJPURA	HR110700	Alluvium	23092	0	23092.3	NA	0	NA	23092	0	696.78	538.08	15	Norms		RIF	22	Norms
KARNAL	MUNAK	HR110800	Alluvium	27113	0	27113.3	NA	0	NA	27113	0	487.08	376.68	15	Norms		RIF	22	Norms
KARNAL	NILOKHERI	HR110500	Alluvium	39958	0	39957.5	NA	0	NA	39958	0	648.06	497.12	15	Norms	-0.28	RIF	22	Norms
KARNAL	NISSING AT CHIRAO	HR110600	Alluvium	35853	0	35853.1	NA	0	NA	35853	0	578.78	458.95	12	Norms	0.33	RIF	22	Norms
KURUKSHETRA	BABAIN	HR120100	Alluvium	13396	0	13395.6	NA	0	NA	13396	0	624.24	490.65	12	Norms	-1.15	RIF	22	Norms
KURUKSHETRA	ISMAILABAD	HR120200	Alluvium	20107	0	20106.7	NA	0	NA	20107	0	624.24	490.65	12	Norms		RIF	22	Norms
KURUKSHETRA	LADWA	HR120300	Alluvium	15675	0	15675	NA	0	NA	15675	0	624.24	490.65	12	Norms	-0.94	RIF	22	Norms
KURUKSHETRA	PEHOWA	HR120400	Alluvium	42413	0	42413.3	NA	0	NA	42413	0	624.24	490.65	12	Norms	-1.44	RIF	22	Norms
KURUKSHETRA	PIPLI	HR120500	Alluvium	17732	0	17732	NA	0	NA	17732	0	624.24	490.65	12	Norms		WTFM	22	Norms
KURUKSHETRA	SHAHBAD	HR120600	Alluvium	27598	0	27598.1	NA	0	NA	27598	0	624.24	490.65	12	Norms	-1.79	RIF	22	Norms
KURUKSHETRA	THANESAR	HR120700	Alluvium	31500	0	31499.6	NA	0	NA	31500	0	624.24	490.65	12	Norms	-1.17	RIF	22	Norms
MAHEND RAGARH	ATELI NANGAL	HR130100	Alluvium	22313	908	21405.2	NA	677	NA	20728	0	314	220	12	Norms	-0.2	RIF	22	Norms
MAHEND RAGARH	KANINA	HR130200	Alluvium	35364	0	35363.8	NA	478	NA	34886	0	278	195	12	Norms	-1.72	RIF	22	Norms
MAHEND RAGARH	MAHENDR AGARH	HR130300	Alluvium	35883	1018	34864.9	NA	0	NA	34865	0	360	252	12	Norms	0.46	RIF	22	Norms
MAHEND RAGARH	NANGAL CHAUDHRY	HR130400	Alluvium	25040	369	24670.8	NA	0	NA	24671	0	339	237	12	Norms	0.6	RIF	22	Norms
MAHEND RAGARH	NARNAUL	HR130500	Alluvium	21103	0	21102.5	NA	0	NA	21103	0	420	294	12	Norms	0.65	RIF	22	Norms
MAHEND RAGARH	NIZAMPUR	HR130600	Alluvium	16841	0	16841.2	NA	369	NA	16472	0	339	237	12	Norms		RIF	22	Norms
MAHEND RAGARH	SATNALI	HR130700	Alluvium	23714	0	23714.1	NA	1244	NA	22470	0	360	252	12	Norms		RIF	22	Norms
MAHEND RAGARH	SIHMA	HR130800	Alluvium	13825	0	13825.2	NA	478	NA	13347	0	314	220	12	Norms		RIF	22	Norms
MEWAT	FEROZEPUR JHIRKA	HR140100	Alluvium	27643	5208	22435.5	NA	1224	NA	21211	0	534	402	10	Norms		RIF	22	Norms
MEWAT	INDRI	HR140600	Alluvium	17150	0	17149.7	NA	0	NA	17150	0	599.98	471.22	10	Norms		RIF	22	Norms
MEWAT	NAGINA	HR140200	Alluvium	17743	1462	16280.6	NA	3390	NA	12891	0	408	302	10	Norms	-1.14	RIF	22	Norms
MEWAT	NUH	HR140300	Alluvium	29345	3295	26050.1	NA	11017	NA	15033	0	683	498	10	Norms	0.18	RIF	22	Norms
MEWAT	PINGWAN	HR140700	Alluvium	15547	0	15546.9	NA	0	NA	15547	0	483.22	300.28	10	Norms		RIF	22	Norms

MEWAT	PUNAHANA	HR140400	Alluvium	20839	0	20838.6	NA	10573	NA	10266	0	450	300.28	10	Norms	0.25	RIF	22	Norms
MEWAT	TAORU	HR140500	Alluvium	21966	3361	18604.8	NA	0	NA	18605	0	552.3	395	10	Norms		RIF	22	Norms
PALWAL	BADOLI	HR150600	Alluvium	18082	0	18082	NA	0	NA	18082	0	392.17	304.26	10	Norms		RIF	22	Norms
PALWAL	HASSANPUR	HR150100	Alluvium	15460	0	15459.9	NA	0	NA	15460	0	442.17	344.26	10	Norms		RIF	22	Norms
PALWAL	HATHIN	HR150200	Alluvium	36020	129	35890.8	NA	5721	NA	30170	0	566.8	493.78	10	Norms	-0.25	RIF	22	Norms
PALWAL	HODAL	HR150300	Alluvium	30054	0	30054.4	NA	2751	NA	27303	0	499.82	396.43	10	Norms	-0.63	RIF	22	Norms
PALWAL	PALWAL	HR150400	Alluvium	19956	0	19956.3	NA	7334	NA	12622	0	655.79	496.64	10	Norms	-0.65	RIF	22	Norms
PALWAL	PRITHLA	HR150500	Alluvium	16383	0	16382.7	NA	0	NA	16383	0	545.79	436.64	10	Norms		RIF	22	Norms
PANCHKULA	BARWALA	HR160100	Alluvium	21740	0	21739.7	NA	0	NA	21740	0	1379	1093	15	Norms	-0.08	RIF	22	Norms
PANCHKULA	MORNI	HR160200	Not assessed Hiily Block																
PANCHKULA	PINJORE	HR160300	Alluvium	29204	11100	18103.9	NA	0	NA	18104	0	1379	1093	15	Norms	0.2517	WTFM	22	Norms
PANCHKULA	RAIPURRANI	HR160400	Alluvium	14028	3200	10827.9	NA	0	NA	10828	0	1379	1093	15	Norms	-0.226	RIF	22	Norms
PANIPAT	BAPOLI	HR170100	Alluvium	15669	0	15669.4	NA	0	NA	15669	0	356.3	269.6	12	Norms	-0.99	RIF	22	Norms
PANIPAT	ISRANA	HR170200	Alluvium	27394	0	27393.8	NA	636	NA	26758	0	353.7	249.5	12	Norms	0.4983	RIF	22	Norms
PANIPAT	MADLAUDA	HR170300	Alluvium	36386	0	36386	NA	0	NA	36386	0	522.7	439.7	15	Norms	-0.426	RIF	22	Norms
PANIPAT	PANIPAT	HR170400	Alluvium	21280	0	21280.3	NA	0	NA	21280	0	520.9	388.4	15	Norms	-1.02	RIF	22	Norms
PANIPAT	SAMALKHA	HR170500	Alluvium	18920	0	18920.2	NA	0	NA	18920	0	451.3	324.1	12	Norms	-0.9233	RIF	22	Norms
PANIPAT	SANAULI KHURD	HR170600	Alluvium	10624	0	10623.5	NA	0	NA	10624	0	612	518	12	Norms		RIF	22	Norms
REWARI	BAWAL	HR180100	Alluvium	24005	720	23284.6	NA	0	NA	23285	0	550	385	12	Norms	0.2467	RIF	22	Norms
REWARI	DAHINA	HR180600	Alluvium	21016	1206	19809.9	NA	0	NA	19810	0	550	385	12	Norms		RIF	22	Norms
REWARI	DHARUHERA	HR180700	Alluvium	20127	0	20126.5	NA	0	NA	20127	0	550	385	12	Norms		RIF	22	Norms
REWARI	JATUSANA	HR180200	Alluvium	20602	1206	19395.5	NA	0	NA	19396	0	550	385	12	Norms	-0.825	RIF	22	Norms
REWARI	KHOLAT REWARI	HR180300	Alluvium	18910	1588	17321.6	NA	1810	NA	15512	0	550	385	12	Norms	-1.1	RIF	22	Norms
REWARI	NAHAR	HR180400	Alluvium	23430	0	23430.1	NA	340	NA	23090	0	550	385	12	Norms	0.5167	RIF	22	Norms
REWARI	REWARI	HR180500	Alluvium	22799	0	22799.4	NA	0	NA	22799	0	550	385	12	Norms	-0.4843	RIF	22	Norms

ROHTAK	KALANAUR	HR190100	Alluvium	28521	0	28521	NA	3420	NA	25101	0	528	365	12	Norms		RIF	22	Norms
ROHTAK	LAKHAN MAJRA	HR190200	Alluvium	12689	0	12689.1	NA	5219	NA	7470.1	0	395	309	12	Norms		WTFM	24	Norms
ROHTAK	MAHAM	HR190300	Alluvium	44704	0	44704.3	NA	1883	NA	42821	0	395	309	12	Norms	-0.42	WTFM	22	Norms
ROHTAK	ROHTAK	HR190400	Alluvium	58319	0	58318.9	NA	4388	NA	53931	0	528	365	12	Norms	0.6567	RIF	22	Norms
ROHTAK	SAMPLA	HR190500	Alluvium	22674	0	22673.8	NA	1608	NA	21066	0	528	365	12	Norms	1.6	RIF	22	Norms
SIRSA	BARAGUDHA	HR200100	Alluvium	53384	0	53384.4	NA	3709	NA	49675	0	343.99	293.06	12	Norms	-0.4867	RIF	22	Norms
SIRSA	DABWALI	HR200200	Alluvium	80126	0	80125.7	NA	17750	NA	62376	0	343.99	293.06	12	Norms	-0.2643	RIF	22	Norms
SIRSA	ELLENABAD	HR200300	Alluvium	52787	0	52786.7	NA	6961	NA	45826	0	343.99	293.06	12	Norms	0.1014	RIF	22	Norms
SIRSA	NATHUSA RICHOPTA	HR200400	Alluvium	75704	0	75703.9	NA	16987	NA	58717	0	343.99	293.06	12	Norms	0.0517	RIF	22	Norms
SIRSA	ODHAN	HR200500	Alluvium	51580	0	51579.9	NA	16404	NA	35176	0	343.99	293.06	12	Norms	-0.3713	WTFM	22	Norms
SIRSA	RANIA	HR200600	Alluvium	58955	0	58955.3	NA	12893	NA	46062	0	343.99	293.06	12	Norms	-0.845	RIF	22	Norms
SIRSA	SIRSA	HR200700	Alluvium	54457	0	54456.8	NA	189	NA	54268	0	343.99	293.06	12	Norms	-1.88	RIF	22	Norms
SONIPAT	GANAUR	HR210100	Alluvium	27210	0	27210.1	NA	0	NA	27210	0	574	439	12	Norms	-1.6133	RIF	22	Norms
SONIPAT	GOHANA	HR210200	Alluvium	31544	0	31544.2	NA	3165	NA	28379	0	522	394	12	Norms	-0.23	RIF	24	Norms
SONIPAT	KATHURA	HR210300	Alluvium	19609	0	19608.8	NA	4909	NA	14700	0	582	424	12	Norms	0.0525	WTFM	22	Norms
SONIPAT	KHARKHODA	HR210400	Alluvium	30755	0	30754.6	NA	2660	NA	28095	0	547	418	12	Norms	0.825	WTFM	22	Norms
SONIPAT	MUNDLANA	HR210500	Alluvium	29087	0	29086.9	NA	4629	NA	24458	0	522	394	12	Norms	0.5833	RIF	22	Norms
SONIPAT	MURTHAL	HR210800	Alluvium	19038	0	19038.4	NA	0	NA	19038	0	558	420	12	Norms		RIF	22	Norms
SONIPAT	RAI	HR210600	Alluvium	21677	0	21677.2	NA	591	NA	21086	0	558	420	12	Norms	-0.17	WTFM	22	Norms
SONIPAT	SONIPAT	HR210700	Alluvium	36802	0	36802.2	NA	127	NA	36675	0	558	420	12	Norms	0.1425	RIF	22	Norms
YAMUNA NAGAR	BILASPUR	HR220100	Alluvium	27563	1100	26463.1	NA	0	NA	26463	0	901	646	15	Norms	-0.8	RIF	22	Norms
YAMUNA NAGAR	CHHACHH RAULI	HR220200	Alluvium	25979	13200	12778.9	NA	0	NA	12779	0	901	646	15	Norms	-1.148	RIF	22	Norms
YAMUNA NAGAR	JAGADHRI	HR220300	Alluvium	29986	0	29985.8	NA	0	NA	29986	0	901	646	15	Norms	-0.0477	RIF	22	Norms
YAMUNA NAGAR	KHIZRABAD	HR220700	Alluvium	28186	13200	14986.4	NA	0	NA	14986	0	901	646	15	Norms		RIF	22	Norms

YAMUNA NAGAR	MUSTAFABAD	HR220400	Alluvium	20545	0	20544.6	NA	0	NA	20545	0	901	646	15	Norms		RIF	22	Norms
YAMUNA NAGAR	RADAUR	HR220500	Alluvium	24654	0	24653.6	NA	0	NA	24654	0	901	646	15	Norms	-0.796	RIF	22	Norms
YAMUNA NAGAR	SADAURA (PART)	HR220600	Alluvium	14865	1000	13864.8	NA	0	NA	13865	0	901	646	15	Norms	1.258	RIF	22	Norms

Sl. No	District	Assessment Unit Name	Total Areaof Assessment Unit (Ha)	Recharge Worthy Area(Ha)	Recharge from Rainfall (Ham)	Recharge from Other Sources (Ham)	Total Annual Ground Water Recharge (Ham)	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use(Ham)	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (Over-Exploited/ Critical/ Semicritical/ Safe/Saline)
1	AMBALA	AMBALA-I	19317.597	19317.597	3629.650	5735.370	9365.020	936.500	8428.520	5989.290	330.000	1997.280	8316.570	1997.280	111.950	98.672	Critical
2	AMBALA	AMBALA- II	35123.114	35123.114	6599.400	1155.540	7754.940	775.490	6979.450	3601.900	450.000	1303.488	5355.390	1303.490	1624.060	76.731	Semi Critical
3	AMBALA	BARARA	23038.018	23038.018	4359.400	2240.030	6599.430	659.940	5939.490	6767.590	45.000	1566.288	8378.870	1566.290	0.000	141.071	Over Exploited
4	AMBALA	NARAINGARH	27728.780	27428.780	6575.130	2691.010	9266.140	926.610	8339.530	8311.520	2655.000	736.400	11702.920	736.400	0.000	140.331	Over Exploited
5	AMBALA	SAHA	25847.586	25847.586	4891.050	1179.750	6070.800	607.080	5463.720	3569.320	3600.000	890.892	8060.220	890.890	0.000	147.523	Over Exploited
6	AMBALA	SHAHZADPUR	20149.797	20149.797	4830.240	1011.200	5841.440	584.150	5257.290	3049.680	495.000	444.000	3988.680	444.000	1268.610	75.870	Semi Critical
Total			**151204.892**	**150904.892**	**30884.870**	**14012.900**	**44897.770**	**4489.770**	**40408.000**	**31289.300**	**7575.000**	**6938.348**	**45802.650**	**6938.350**	**3004.620**		
7	BHIWANI	BAWANI KHERA	40587.230	40587.230	1833.210	4426.090	6259.300	625.930	5633.370	3598.000	16.000	132.000	3746.000	132.000	1887.370	66.497	Safe
8	BHIWANI	BEHAL	29577.641	29577.641	1566.860	1749.010	3315.870	331.580	2984.290	4227.600	0.000	240.000	4467.600	240.000	0.000	149.704	Over Exploited
9	BHIWANI	BHIWANI	85484.602	85484.602	4797.270	4520.870	9318.140	465.900	8852.240	5721.000	0.000	344.000	6065.000	344.000	2787.240	68.514	Safe
10	BHIWANI	KAIRU	28708.958	28708.958	1639.990	1268.750	2908.740	290.870	2617.870	3904.500	88.000	88.000	4080.500	88.000	0.000	155.871	Over Exploited
11	BHIWANI	LOHARU	36729.218	36729.218	2163.790	2317.000	4480.790	448.080	4032.710	5922.500	40.000	568.000	6530.500	568.000	0.000	161.938	Over Exploited
12	BHIWANI	SIWANI	56757.829	56757.829	3118.200	4502.860	7621.060	762.110	6858.950	2595.200	0.000	208.000	2803.200	208.000	4055.750	40.869	Safe
13	BHIWANI	TOSHAM	51881.917	50849.917	3000.800	5044.740	8045.540	804.550	7240.990	10540.500	0.000	1032.000	11572.500	1032.000	0.000	159.819	Over Exploited
Total			**329727.394**	**328695.394**	**18120.120**	**23829.320**	**41949.440**	**3729.020**	**38220.420**	**36509.300**	**144.000**	**2612.000**	**39265.300**	**2612.000**	**8730.360**		
14	CHARKHI DADRI	BADHRA	23436.543	23436.543	2509.990	4536.250	7046.240	704.630	6341.610	14310.033	28.000	693.792	15031.840	693.790	0.000	237.035	Over Exploited
15	CHARKHI DADRI	BAUND	36774.378	36585.378	2842.030	2047.870	4889.900	488.990	4400.910	1125.000	0.000	67.150	1192.150	67.150	3208.760	27.089	Safe
16	CHARKHI DADRI	CHARKHI DADRI	43137.094	43137.094	3312.360	1192.030	4504.390	450.440	4053.950	2444.000	0.000	71.100	2515.100	71.100	1538.850	62.041	Safe
17	CHARKHI DADRI	JHOJHU	34001.673	34001.673	2518.740	1790.770	4309.510	430.950	3878.560	5493.380	0.000	414.750	5908.130	414.750	0.000	152.328	Over Exploited
Total			**137349.689**	**137160.689**	**11183.120**	**9566.920**	**20750.040**	**2075.010**	**18675.030**	**23372.413**	**28.000**	**1246.792**	**24647.220**	**1246.790**	**4747.610**		
18	FARIDABAD	BALLABGARH	17172.722	15863.722	1347.770	1983.140	3330.910	333.090	2997.820	4743.750	2576.000	59.250	7379.000	91.850	0.000	246.146	Over Exploited
19	FARIDAAD	FARIDABAD	24146.206	16738.206	2025.740	2836.370	4862.110	486.210	4375.900	5202.600	1008.000	220.410	6431.010	220.410	0.000	146.964	Over Exploited
20	FARIDABAD	FARIDABAD URBAN	19500.750	19500.750	1644.970	94.610	1739.580	173.960	1565.620	137.750	1408.000	3773.040	5318.790	3773.040	0.000	339.724	Over Exploited
21	FARIDABAD	TIGAON	13458.740	13458.740	1376.180	951.300	2327.480	232.750	2094.730	2757.900	0.000	264.902	3022.800	264.900	0.000	144.305	Over Exploited

Total			**74278.418**	**65561.418**	**6394.660**	**5865.420**	**12260.080**	**1226.010**	**11034.070**	**12842.000**	**4992.000**	**4317.602**	**22151.600**	**4350.200**	**0.000**		
22	FATEHABAD	BHATTU KALAN	36362.057	36362.057	1571.470	2956.420	4527.890	452.790	4075.100	3863.080	0.000	189.360	4052.440	189.360	22.660	99.444	Critical
23	FATEHABAD	BHUNA	38581.499	38581.499	2170.550	5145.630	7316.180	365.810	6950.370	6782.840	0.000	68.000	6850.840	68.000	99.530	98.568	Critical
24	FATEHABAD	FATEHABAD	55434.140	55434.140	3344.010	5025.390	8369.400	836.940	7532.460	15038.298	41.400	278.780	15358.470	278.780	0.000	203.897	Over Exploited
25	FATEHABAD	JAKHAL	15291.217	15291.217	929.690	6499.230	7428.920	742.900	6686.020	14355.920	0.000	336.000	14691.920	336.000	0.000	219.741	Over Exploited
26	FATEHABAD	NAGPUR	28808.705	28808.705	1834.830	3895.600	5730.430	573.040	5157.390	11503.330	0.000	231.440	11734.770	231.440	0.000	227.533	Over Exploited
27	FATEHABAD	RATIA	37787.997	37787.997	1676.800	13969.870	15646.670	1564.670	14082.000	34571.933	56.800	399.000	35027.730	399.000	0.000	248.741	Over Exploited
28	FATEHABAD	TOHANA	40246.768	40246.768	2585.810	14506.420	17092.230	1709.220	15383.010	19992.904	0.000	357.000	20349.900	357.000	0.000	132.288	Over Exploited
Total			**252512.382**	**252512.382**	**14113.160**	**51998.560**	**66111.720**	**6245.370**	**59866.350**	**106108.30**	**98.200**	**1859.580**	**108066.07**	**1859.580**	**122.190**		
29	GURGAON	FARRUKH NAGAR	28639.953	28608.953	2311.510	1827.710	4139.220	413.920	3725.300	5390.180	0.000	472.500	5862.680	472.500	0.000	157.375	Over Exploited
30	GURGAON	GURGAON	9619.000	8331.000	1134.690	665.440	1800.130	180.010	1620.120	535.500	0.000	1444.340	1979.840	1444.340	0.000	122.203	Over Exploited
31	GURGAON	GURGAON URBAN	31911.447	31911.447	4231.690	1922.680	6154.370	615.440	5538.930	47.380	17115.360	909.324	18072.060	909.320	0.000	326.273	Over Exploited
32	GURGAON	PATAUDI	27547.783	27502.783	2587.730	2477.970	5065.700	506.570	4559.130	7608.600	1.810	1165.500	8775.900	1165.500	0.000	192.491	Over Exploited
33	GURGA ON	SOHNA	28316.507	25891.507	2658.090	2503.690	5161.780	516.180	4645.600	7039.090	0.000	1089.000	8128.090	1089.000	0.000	174.963	Over Exploited
Total			**126034.690**	**122245.690**	**12923.710**	**9397.490**	**22321.200**	**2232.120**	**20089.080**	**20620.750**	**17117.170**	**5080.664**	**42818.570**	**5080.660**	**0.000**		
34	HISAR	ADAMPUR	36692.787	36692.787	4880.590	3318.250	8198.840	819.890	7378.950	3637.000	0.000	15.050	3652.050	15.050	3726.900	49.493	Safe
35	HISAR	AGROHA	32989.384	32989.384	1814.130	4749.850	6563.980	656.400	5907.580	5545.200	0.000	12.897	5558.100	12.900	349.480	94.084	Critical
36	HISAR	BARWALA	50633.263	50633.263	6870.420	7542.830	14413.250	1441.330	12971.920	10641.540	0.000	35.500	10677.040	35.500	2294.880	82.309	Semi Critical
37	HISAR	HANSI	58827.600	58827.600	3592.300	4534.400	8126.700	812.670	7314.030	4994.880	3.620	32.250	5030.750	32.250	2283.280	68.782	Safe
38	HISAR	HANSI-II	29922.615	29922.615	1647.260	4108.180	5755.440	287.780	5467.660	2879.200	0.000	43.000	2922.200	43.000	2545.460	53.445	Safe
39	HISAR	HISAR-I	62292.972	62292.972	5695.150	4340.530	10035.680	501.780	9533.900	5839.200	226.600	53.750	6119.550	53.750	3414.350	64.187	Safe
40	HISAR	HISAR-II	72208.822	72208.822	5702.040	1502.220	7204.260	360.220	6844.040	4465.000	0.000	43.000	4508.000	43.000	2336.040	65.868	Safe
41	HISAR	NARNAUND	40985.498	40985.498	2401.000	4902.910	7303.910	730.390	6573.520	14149.800	0.000	10.750	14160.550	10.750	0.000	215.418	Over Exploited
42	HISAR	UKLANA	22974.355	22974.355	994.550	2163.240	3157.790	315.780	2842.010	720.000	0.000	120.000	840.000	120.000	2002.010	29.557	Safe
Total			**407527.297**	**407527.297**	**33597.440**	**37162.410**	**70759.850**	**5926.240**	**64833.610**	**52871.820**	**230.220**	**366.197**	**53468.240**	**366.200**	**18952.400**		
43	JHAJJAR	BADLI	20877.445	20877.445	2075.870	639.350	2715.220	271.520	2443.700	1634.600	0.000	19.740	1654.340	19.740	789.360	67.698	Safe
44	JHAJJAR	BAHADURGARH	39644.165	39644.165	2090.290	5350.670	7440.960	744.100	6696.860	3919.860	44.000	3.290	3967.150	7.830	2725.170	59.239	Safe
45	JHAJJAR	BERI	32791.161	32791.161	1995.110	4303.940	6299.050	629.910	5669.140	2017.050	0.000	59.220	2076.270	59.220	3592.870	36.624	Safe
46	JHAJJAR	JHAJJAR	30829.175	30829.175	1621.800	2789.100	4410.900	441.090	3969.810	2512.080	15.000	88.830	2615.910	88.830	1353.900	65.895	Safe

47	JHAJJAR	MACHHRAULI	16846.850	16846.850	1296.240	638.580	1934.820	193.480	1741.340	1150.400	0.000	36.000	1186.400	36.000	554.940	68.131	Safe
48	JHAJJAR	MATANNAIL	36214.347	36214.347	2887.490	3637.750	6525.240	652.520	5872.720	1717.600	0.000	57.540	1775.140	57.540	4097.580	30.227	Safe
49	JHAJJAR	SALHAWAS	16261.645	16261.645	660.430	3728.230	4388.660	438.860	3949.800	1765.110	27.000	49.350	1841.460	49.350	2108.340	46.622	Safe
Total			**193464.787**	**193464.787**	**12627.230**	**21087.620**	**33714.850**	**3371.480**	**30343.370**	**14716.700**	**86.000**	**313.970**	**15116.670**	**318.510**	**15222.160**		
50	JIND	ALEWA	23546.966	23546.966	2610.880	3752.130	6363.010	636.300	5726.710	6644.000	24.180	115.000	6783.180	203.310	0.000	118.448	Over Exploited
51	JIND	JIND	47698.484	47698.484	4751.530	15113.720	19865.250	1986.530	17878.720	21541.660	257.020	550.000	22348.680	550.000	0.000	125.002	Over Exploited
52	JIND	JULANA	35171.882	35171.882	3876.060	3195.660	7071.720	707.170	6364.550	2856.500	17.220	155.000	3028.720	272.390	3218.440	47.587	Safe
53	JIND	NARWANA	33294.780	33294.780	3258.070	3306.260	6564.330	656.440	5907.890	2900.610	81.000	170.000	3151.610	259.750	2666.530	53.346	Safe
54	JIND	PILLUKHERA	21549.569	21549.569	1381.160	6804.470	8185.630	818.560	7367.070	5932.440	36.900	115.000	6084.340	180.810	1216.920	82.588	Semi Critical
55	JIND	SAFIDON	31433.772	31433.772	3136.840	10577.450	13714.290	1371.430	12342.860	16613.990	21.010	405.000	17040.000	405.000	0.000	138.056	Over Exploited
56	JIND	UCHANA	50720.527	50720.527	4552.940	12725.310	17278.250	1727.830	15550.420	16386.930	25.300	235.000	16647.230	387.870	0.000	107.053	Over Exploited
57	JIND	UJHANA	31675.470	31675.470	4387.430	5119.770	9507.200	950.720	8556.480	10298.580	0.072	220.640	10519.290	227.410	0.000	122.939	Over Exploited
Total			**275091.450**	**275091.450**	**27954.910**	**60594.770**	**88549.680**	**8854.980**	**79694.700**	**83174.710**	**462.702**	**1965.640**	**85603.050**	**2486.540**	**7101.890**		
58	KAITHAL	DHAND	21998.581	21998.581	2025.200	2648.120	4673.320	467.330	4205.990	7948.640	9.050	646.488	8604.170	646.490	0.000	204.569	Over Exploited
59	KAITHAL	GUHLA	39160.069	39160.069	2973.290	5744.380	8717.670	871.770	7845.900	16682.770	104.980	772.632	17560.390	772.630	0.000	223.816	Over Exploited
60	KAITHAL	KAITHAL	51093.039	51093.039	4703.640	6151.600	10855.240	1085.530	9769.710	14903.540	396.390	1387.584	16687.510	1387.580	0.000	170.809	Over Exploited
61	KAITHAL	KALAYAT	32689.106	32689.106	2124.960	2341.680	4466.640	223.330	4243.310	6107.950	3.620	425.520	6537.090	425.520	0.000	154.056	Over Exploited
62	KAITHAL	PUNDRI	30757.734	30757.734	3315.660	5379.740	8695.400	869.540	7825.860	14481.810	43.440	701.676	15226.930	701.680	0.000	194.572	Over Exploited
63	KAITHAL	RAJOUND	24482.786	24482.786	1206.620	3697.650	4904.270	490.420	4413.850	7927.800	5.430	315.360	8248.590	315.360	0.000	186.880	Over Exploited
64	KAITHAL	SIWAN	27232.840	27232.840	2484.250	3935.020	6419.270	641.930	5777.340	11546.039	10.860	559.764	12116.660	559.760	0.000	209.727	Over Exploited
Total			**227414.153**	**227414.153**	**18833.620**	**29898.190**	**48731.810**	**4649.850**	**44081.960**	**79598.549**	**573.770**	**4809.024**	**84981.340**	**4809.020**	**0.000**		
65	KARNAL	ASSANDH	39297.431	39297.431	4311.340	5567.400	9878.740	493.930	9384.810	15315.000	680.000	741.096	16736.100	741.100	0.000	178.332	Over Exploited
66	KARNAL	GHARAUNDA (PART)	28625.504	28625.504	2453.950	6179.160	8633.110	863.310	7769.800	10874.480	800.000	898.776	12573.260	898.780	0.000	161.822	Over Exploited
67	KARNAL	INDRI	24300.779	24300.779	3370.250	10056.290	13426.540	1342.650	12083.890	10768.500	360.000	570.960	11699.460	570.960	384.430	96.819	Critical
68	KARNAL	KARNAL	28811.801	28811.801	3533.280	7567.440	11100.720	1110.070	9990.650	11768.620	4012.000	1151.064	16931.680	1151.060	0.000	169.475	Over Exploited
69	KARNAL	KUNJPURA	23092.290	23092.290	3307.810	2833.180	6140.990	614.100	5526.890	8847.280	172.000	591.300	9610.580	591.300	0.000	173.888	Over Exploited
70	KARNAL	MUNAK	27113.300	27113.300	2715.580	3550.780	6266.360	626.640	5639.720	11853.690	200.000	999.297	13052.990	999.300	0.000	231.447	Over Exploited
71	KARNAL	NILOKHERI	39957.540	39957.540	4561.300	8537.800	13099.100	1309.910	11789.190	22109.150	800.000	1985.783	24894.930	1985.780	0.000	211.167	Over Exploited
72	KARNAL	NISSING AT CHIRAO	35853.054	35853.054	3652.180	9062.880	12715.060	1271.510	11443.550	19719.950	480.000	1242.716	21442.660	1242.720	0.000	187.378	Over Exploited

Total			**247051.699**	**247051.699**	**27905.690**	**53354.930**	**81260.620**	**7632.120**	**73628.500**	**111256.670**	**7504.000**	**8180.991**	**126941.660**	**8181.000**	**384.430**		
73	KURUKSHETRA	BABAIN	13395.589	13395.589	1219.330	2022.040	3241.370	324.140	2917.230	6168.480	405.440	310.000	6883.920	310.000	0.000	235.975	Over Exploited
74	KURUKSHETRA	ISMAILABAD	20106.693	20106.693	1830.200	2197.950	4028.150	402.820	3625.330	6856.280	1404.560	325.000	8585.840	325.000	0.000	236.829	Over Exploited
75	KURUKSHETRA	LADWA	15675.038	15675.038	1426.810	2168.350	3595.160	359.520	3235.640	6896.100	1605.470	1110.000	9611.570	1110.000	0.000	297.053	Over Exploited
76	KURUKSHETRA	PEHOWA	42413.273	42413.273	4659.780	5142.920	9802.700	980.270	8822.430	14639.280	1520.400	880.000	17039.680	880.000	0.000	193.140	Over Exploited
77	KURUKSHETRA	PIPLI	17731.999	17731.999	1948.150	2489.710	4437.860	443.790	3994.070	7667.160	885.090	380.000	8932.250	380.000	0.000	223.638	Over Exploited
78	KURUKSHETRA	SHAHBAD	27598.083	27598.083	3377.850	3644.740	7022.590	351.130	6671.460	10888.960	1404.560	820.000	13113.520	820.000	0.000	196.561	Over Exploited
79	KURUKSHETRA	THANESAR	31499.606	31499.606	4054.250	5012.410	9066.660	906.670	8159.990	14664.620	5350.360	1210.000	21224.980	1210.000	0.000	260.110	Over Exploited
Total			**168420.281**	**168420.281**	**18516.370**	**22678.120**	**41194.490**	**3768.340**	**37426.150**	**67780.880**	**12575.880**	**5035.000**	**85391.760**	**5035.000**	**0.000**		
80	MAHENDRAGARH	ATELI NANGAL	22313.234	21405.234	1145.530	2738.230	3883.760	388.380	3495.380	3695.720	0.000	536.000	4231.720	536.000	0.000	121.066	Over Exploited
81	MAHENDRAGARH	KANINA	35363.835	35363.835	1706.890	4260.470	5967.360	596.730	5370.630	10224.500	0.000	332.000	10556.500	332.000	0.000	196.560	Over Exploited
82	MAHENDRAGARH	MAHENDRAGARH	35882.871	34864.871	2209.040	1177.330	3386.370	338.640	3047.730	3895.040	0.000	0.000	3895.040	34.740	0.000	127.801	Over Exploited
83	MAHENDRAGARH	NANGAL HAUDHRY	25039.763	24670.763	802.890	321.780	1124.670	112.470	1012.200	959.400	30.100	560.000	1549.500	560.000	0.000	153.082	Over Exploited
84	MAHENDRAGARH	NARNAUL	21102.525	21102.525	850.850	181.070	1031.920	103.190	928.730	739.200	0.980	300.000	1040.180	300.000	0.000	112.000	Over Exploited
85	MAHENDRAGARH	NIZAMPUR	16841.242	16841.242	536.070	71.540	607.610	60.770	546.840	180.180	0.000	352.000	532.180	352.000	14.660	97.319	Critical
86	MAHENDRAGARH	SATNALI	23714.103	23714.103	1423.710	509.360	1933.070	193.310	1739.760	1468.800	0.000	212.000	1680.800	212.000	58.960	96.611	Critical
87	MAHENDRAGARH	SIHMA	13825.191	13825.191	737.620	2168.840	2906.460	290.650	2615.810	3599.400	0.000	400.000	3999.400	400.000	0.000	152.893	Over Exploited
Total			**194082.764**	**191787.764**	**9412.600**	**11428.620**	**20841.220**	**2084.140**	**18757.080**	**24762.240**	**31.080**	**2692.000**	**27485.320**	**2726.740**	**73.620**		
88	MEWAT	FEROZEPUR JHIRKA	27643.472	22435.472	1834.440	1351.980	3186.420	159.330	3027.090	2847.240	0.000	289.600	3136.840	289.600	0.000	103.626	Over Exploited
89	MEWAT	INDRI	17149.702	17149.702	1500.640	299.900	1800.540	180.050	1620.490	818.750	0.000	294.630	1113.380	294.630	507.110	68.706	Safe
90	MEWAT	NAGINA	17742.630	16280.630	925.650	591.760	1517.410	151.750	1365.660	513.750	0.000	228.060	741.810	228.060	623.850	54.319	Safe
91	MEWAT	NUH	29345.124	26050.124	1522.870	2147.560	3670.430	367.040	3303.390	764.400	18.100	314.940	1097.440	314.940	2205.950	33.222	Safe
92	MEWAT	PINGWAN	15546.902	15546.902	1149.860	168.840	1318.700	131.870	1186.830	436.800	0.000	152.820	589.620	152.820	597.210	49.680	Safe
93	MEWAT	PUNAHANA	20838.628	20838.628	803.050	3040.220	3843.270	192.170	3651.100	3031.670	0.000	208.150	3239.820	208.150	411.280	88.735	Semi Critical
94	MEWAT	TAORU	21965.763	18604.763	1808.470	1797.320	3605.790	360.580	3245.210	3807.420	1.810	208.150	4017.380	208.150	0.000	123.794	Over Exploited
Total			**150232.221**	**136906.221**	**9544.980**	**9397.580**	**18942.560**	**1542.790**	**17399.770**	**12220.030**	**19.910**	**1696.350**	**13936.290**	**1696.350**	**4345.400**		
95	PALWAL	BADOLI	18082.025	18082.025	2025.460	1991.790	4017.250	401.730	3615.520	6134.090	148.500	799.788	7082.380	799.790	0.000	195.888	Over Exploited
96	PALWAL	HASSANPUR	15459.922	15459.922	1037.320	5268.530	6305.850	315.290	5990.560	5493.180	0.000	236.520	5729.700	236.520	260.860	95.645	Critical
97	PALWAL	HATHIN	36019.791	35890.791	2439.680	6174.680	8614.360	430.720	8183.640	4765.000	20.000	521.520	5306.520	521.520	2877.120	64.843	Safe

98	PALWAL	HODAL	30054.350	30054.350	1985.630	6435.400	8421.030	842.100	7578.930	5978.000	16.000	288.350	6282.350	288.350	1296.580	82.892	Semi Critical
99	PALWAL	PALWAL	19956.340	19956.340	1204.070	7275.390	8479.460	847.950	7631.510	4527.900	351.780	312.050	5191.730	312.050	2439.780	68.030	Safe
100	PALWAL	PRITHLA	16382.742	16382.742	1849.110	1309.370	3158.480	315.850	2842.630	3978.380	144.320	43.450	4166.150	43.450	0.000	146.560	Over Exploited
Total			**135955.171**	**135826.171**	**10541.270**	**28455.160**	**38996.430**	**3153.640**	**35842.790**	**30876.550**	**680.600**	**2201.678**	**33758.830**	**2201.680**	**6874.340**		
101	PANCHKULA	BARWALA	21739.679	21739.679	5907.010	1005.480	6912.490	345.630	6566.860	3124.060	24.000	366.606	3514.670	366.610	3052.190	53.521	Safe
102	PANCHKULA	MORNI	23315.24	0	4107.280	376.610	0		0			0	0	0	0		Hilly Area
103	PANCHKULA	PINJORE	29203.931	18103.931	2924.570	1059.930	4483.890	224.200	4259.690	1038.940	66.000	473.040	1577.980	473.040	2681.710	37.044	Safe
104	PANCHKULA	RAIPUR RANI	14027.904	10827.904	**12938.860**	**2442.020**	3984.500	199.230	3785.270	3296.010	0.000	303.534	3599.540	303.530	185.730	95.093	Critical
Total			**64971.513**	**50671.513**	1143.920	2152.640	**15380.880**	**769.060**	**14611.820**	**7459.010**	**90.000**	**1143.180**	**8692.190**	**1143.180**	**5919.630**		
105	PANIPAT	BAPOLI	15669.386	15669.386	1917.810	3561.940	3296.560	329.650	2966.910	6697.000	240.000	348.210	7285.210	348.210	0.000	245.549	Over Exploited
106	PANIPAT	ISRANA	27393.771	27393.771	2919.860	5570.360	5479.750	547.980	4931.770	7045.200	400.000	257.040	7702.240	257.040	0.000	156.176	Over Exploited
107	PANIPAT	MADLAUDA	36386.005	36386.005	2265.840	4682.970	8490.220	424.510	8065.710	11545.300	300.000	232.000	12077.300	232.000	0.000	149.736	Over Exploited
108	PANIPAT	PANIPAT	21280.280	21280.280	1735.050	4313.530	6948.810	694.890	6253.920	10945.070	1120.000	591.300	12656.370	591.300	0.000	202.375	Over Exploited
109	PANIPAT	SAMALKHA	18920.239	18920.239	775.550	1642.910	6048.580	604.860	5443.720	11560.470	180.000	571.590	12312.060	571.590	0.000	226.170	Over Exploited
110	PANIPAT	SANAULI KHURD	10623.501	10623.501	**10758.030**	**21924.350**	2418.460	241.850	2176.610	5104.200	200.000	249.660	5553.860	249.660	0.000	255.161	Over Exploited
Total			**130273.182**	**130273.182**	2253.950	2311.060	**32682.380**	**2843.740**	**29838.640**	**52897.240**	**2440.000**	**2249.800**	**57587.040**	**2249.800**	**0.000**		
111	REWARI	BAWAL	24004.587	23284.587	1917.600	3886.170	4565.010	456.500	4108.510	4148.340	488.000	329.000	4965.340	329.000	0.000	120.855	Over Exploited
112	REWARI	DAHINA	21015.933	19809.933	2190.720	1027.930	5803.770	580.380	5223.390	4689.600	24.000	244.720	4958.320	244.720	265.070	94.925	Critical
113	REWARI	DHARUH ERA	20126.537	20126.537	1857.420	1720.220	3218.650	160.930	3057.720	3388.320	536.000	475.080	4399.400	475.080	0.000	143.878	Over Exploited
114	REWARI	JATUSANA	20601.509	19395.509	1501.530	1254.320	3577.640	178.880	3398.760	5491.200	24.000	185.650	5700.850	185.650	0.000	167.733	Over Exploited
115	REWARI	KHOL AT REWARI	18909.650	17321.650	2235.120	1932.200	2755.850	275.590	2480.260	3240.000	12.000	267.268	3519.270	267.270	0.000	141.891	Over Exploited
116	REWARI	NAHAR	23430.144	23430.144	1875.940	3348.650	4167.320	416.730	3750.590	5942.400	16.000	220.430	6178.830	220.430	0.000	164.743	Over Exploited
117	REWARI	REWARI	22799.449	22799.449	1985.630	6435.400	5224.590	522.460	4702.130	5022.750	352.000	247.380	5622.130	247.380	0.000	119.566	Over Exploited
Total			**150887.808**	**146167.808**	**13832.280**	**15480.550**	**29312.830**	**2591.470**	**26721.360**	**31922.610**	**1452.000**	**1969.528**	**35344.140**	**1969.530**	**265.070**		
118	ROHTAK	KALANAUR	28521.039	28521.039	1895.560	3287.520	5183.080	518.310	4664.770	1393.740	21.060	52.650	1467.450	52.650	3197.320	31.458	Safe
119	ROHTAK	LAKHAN MAJRA	12689.093	12689.093	569.860	2194.370	2764.230	276.420	2487.810	1277.490	12.000	18.000	1307.490	18.000	1180.320	52.556	Safe
120	ROHTAK	MAHAM	44704.285	44704.285	3002.940	5315.420	8318.360	831.840	7486.520	4271.940	12.000	18.000	4301.940	28.530	3174.050	57.462	Safe
121	ROHTAK	ROHTAK	58318.890	58318.890	4175.930	4932.700	9108.630	910.870	8197.760	4816.800	88.000	320.000	5224.800	320.000	2972.960	63.734	Safe
122	ROHTAK	SAMPLA	22673.802	22673.802	1604.270	2461.880	4066.150	406.620	3659.530	2406.690	33.000	27.000	2466.690	27.000	1192.840	67.405	Safe

Total			**166907.109**	**166907.109**	**11248.560**	**18191.890**	**29440.450**	**2944.060**	**26496.390**	**14166.660**	**166.060**	**435.650**	**14768.370**	**446.180**	**11717.490**		
123	SIRSA	BARAGU DHA	53384.356	53384.356	3007.460	9321.250	12328.710	1232.870	11095.840	8627.400	0.000	79.530	8706.930	79.530	2388.910	78.470	Semi Critical
124	SIRSA	DABWALI	80125.708	80125.708	3776.370	10081.510	13857.880	1385.790	12472.090	17218.000	3.620	88.000	17309.620	88.000	0.000	138.787	Over Exploited
125	SIRSA	ELLENABAD	52786.695	52786.695	2774.390	4835.300	7609.690	760.970	6848.720	15138.840	39.820	329.280	15507.940	329.280	0.000	226.436	Over Exploited
126	SIRSA	NATHUSARI CHOPTA	75703.948	75703.948	3554.850	1946.350	5501.200	550.120	4951.080	5898.790	0.000	32.000	5930.790	32.000	0.000	119.788	Over Exploited
127	SIRSA	ODHAN	51579.911	51579.911	2529.970	3211.420	5741.390	574.140	5167.250	9989.390	3.620	44.000	10037.010	44.000	0.000	194.243	Over Exploited
128	SIRSA	RANIA	58955.346	58955.346	2788.720	6172.870	8961.590	896.160	8065.430	11104.350	47.060	772.240	11923.650	772.240	0.000	147.837	Over Exploited
129	SIRSA	SIRSA	54456.784	54456.784	3086.190	5899.710	8985.900	449.290	8536.610	16794.990	76.020	1111.080	17982.090	1111.080	0.000	210.647	Over Exploited
Total			**426992.748**	**426992.748**	**21517.950**	**41468.410**	**62986.360**	**5849.340**	**57137.020**	**84771.760**	**170.140**	**2456.130**	**87398.030**	**2456.130**	**2388.910**		
130	SONIPAT	GANAUR	27210.096	27210.096	3798.260	5204.750	9003.010	900.300	8102.710	9303.500	225.000	685.908	10214.390	685.910	0.000	126.061	Over Exploited
131	SONIPAT	GOHANA	31544.214	31544.214	3224.330	6538.580	9762.910	976.290	8786.620	4531.140	33.000	26.180	4590.320	26.180	4196.300	52.242	Safe
132	SONIPAT	KATHURA	19608.781	19608.781	2064.530	4760.890	6825.420	341.280	6484.140	2630.550	5.430	38.220	2674.200	38.220	3809.940	41.242	Safe
133	SONIPAT	KHARKHODA	30754.625	30754.625	3313.930	4642.710	7956.640	397.830	7558.810	3579.000	15.000	402.500	3996.500	402.500	3562.310	52.872	Safe
134	SONIPAT	MUNDLANA	29086.883	29086.883	3487.250	9180.330	12667.580	1266.750	11400.830	14093.000	15.000	210.789	14318.790	210.790	0.000	125.594	Over Exploited
135	SONIPAT	MURTHAL	19038.363	19038.363	2817.460	2464.780	5282.240	264.110	5018.130	7650.000	184.620	632.691	8467.310	632.690	0.000	168.734	Over Exploited
136	SONIPAT	RAI	21677.198	21677.198	2807.500	2198.380	5005.880	500.590	4505.290	6751.500	273.000	413.910	7438.410	413.910	0.000	165.104	Over Exploited
137	SONIPAT	SONIPAT	36802.166	36802.166	4875.010	7853.710	12728.720	1272.870	11455.850	13474.000	188.240	106.434	13768.670	106.430	0.000	120.189	Over Exploited
Total			**215722.326**	**215722.326**	**26388.270**	**42844.130**	**69232.400**	**5920.020**	**63312.380**	**62012.690**	**939.290**	**2516.632**	**65468.590**	**2516.630**	**11568.550**		
138	YAMUNANAGAR	BILASPUR	27563.085	26463.085	4843.690	2087.480	6931.170	693.120	6238.050	6483.420	0.000	1024.920	7508.340	1024.920	0.000	120.364	Over Exploited
139	YAMUNANAGAR	CHHACH HRAULI	25978.928	12778.928	2155.280	10420.870	12576.150	628.810	11947.340	7066.240	2250.000	338.840	9655.080	338.840	2292.260	80.814	Semi Critical
140	YAMUNANAGAR	JAGADHRI	29985.846	29985.846	5488.480	4111.490	9599.970	960.000	8639.970	12825.660	30.000	748.980	13604.640	748.980	0.000	157.462	Over Exploited
141	YAMUNANAGAR	KHIZRABAD	28186.423	14986.423	2743.050	2205.370	4948.420	494.840	4453.580	3057.090	60.000	866.800	3983.890	866.800	469.690	89.454	Semi Critical
142	YAMUNANAGAR	MUSTAFABAD	20544.610	20544.610	3760.400	4906.860	8667.260	866.720	7800.540	15332.510	0.000	599.184	15931.690	599.180	0.000	204.238	Over Exploited
143	YAMUNANAGAR	RADAUR	24653.576	24653.576	4512.480	6037.190	10549.670	1054.970	9494.700	18918.120	0.000	851.472	19769.600	851.470	0.000	208.217	Over Exploited
144	YAMUNANAGAR	SADAURA (PART)	14864.795	13864.795	2537.750	1495.020	4032.770	403.270	3629.500	4763.920	0.000	499.320	5263.240	499.320	0.000	145.013	Over Exploited
Total			**171777.264**	**143277.264**	**26041.130**	**31264.280**	**57305.410**	**5101.730**	**52203.680**	**68446.960**	**2340.000**	**4929.516**	**75716.480**	**4929.510**	**2761.950**		
Grand total			**4397879.239**	**4320582.2**	**385278.830**	**562343.640**	**947622.47**	**87000.3**	**860622.17**	**1029677.1**	**59716.022**	**65016.27**	**1154409.41**	**65619.58**	**104180.6**	**134.14**	

DYNAMIC GROUND WATER RESOURCES OF HARYANA AS ON MARCH 2022 **Annexure- XIV…..continued**

S. No.	Name of District	Ground Water Recharge			Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Current Annual Ground Water Extraction				Annual GW Allocation for for Domestic Use as on 2027 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)
		Monsoon Season		Total Annual Ground Water Recharge (Ham)			Irrigation (Ham)	Industrial (Ham)	Domestic (Ham)	Total (Ham)			
		Recharge from rainfall (Ham)	Recharge from other sources (Ham)										
1	2	3	4	7	8	9	10	11	12	13	14	15	16
1	AMBALA	25133.77	7742	44897.77	4489.77	40408	31289.3	7575	6938.35	45802.65	6938.35	3004.62	113.35
2	BHIWANI	16203	12338	41949.44	3729.02	38220	36509.3	144	2612	39265.3	2612	8730.36	102.73
3	CHARKHIDADRI	9601.99	5157	20750.04	2075.01	18675	23372.41	28	1246.79	24647.22	1246.79	4747.61	131.98
4	FARIDABAD	5390.76	2873	12260.08	1226.01	11034	12842	4992	4317.6	22151.6	4350.2	0	200.76
5	FATEHABAD	13188.31	29693	66111.72	6245.37	59866	106108.3	98.2	1859.58	108066.07	1859.58	122.19	180.51
6	GURGAON	9717.56	5080	22321.2	2232.12	20089	20620.75	17117.17	5080.66	42818.57	5080.66	0	213.14
7	HISAR	20464.74	15628	70759.85	5926.24	64833	52871.82	230.22	366.2	53468.24	366.2	18952.4	82.47
8	JHAJJAR	9869.56	10266	33714.85	3371.48	30343	14716.7	86	313.97	15116.67	318.51	15222.16	49.82
9	JIND	22887.06	31453	88549.68	8854.98	79694	83174.71	462.7	1965.64	85603.05	2486.54	7101.89	107.41
10	KAITHAL	16046.93	17246	48731.81	4649.85	44082	79598.55	573.77	4809.02	84981.34	4809.02	0	192.78
11	KARNAL	24059.02	24849	81260.62	7632.12	73628	111256.67	7504	8180.99	126941.66	8181	384.43	172.41
12	KURUKSHETRA	15879.5	12502	41194.49	3768.34	37426	67780.88	12575.88	5035	85391.76	5035	0	228.16
13	MAHENDRAGARH	7062.54	3884	20841.22	2084.14	18757	24762.24	31.08	2692	27485.32	2726.74	73.62	146.53
14	MEWAT	7243.84	4446	18942.56	1542.79	17399	12220.03	19.91	1696.35	13936.29	1696.35	4345.4	80.09
15	PALWAL	9421.83	12710	38996.43	3153.64	35843	30876.55	680.6	2201.68	33758.83	2201.68	6874.34	94.19
16	PANCHKULA	11287.89	1370	15380.88	769.06	14612	7459.01	90	1143.18	8692.19	1143.18	5919.63	59.49
17	PANIPAT	9093.39	9590	32682.38	2843.74	29839	52897.24	2440	2249.8	57587.04	2249.8	0	192.99
18	REWARI	10347.05	5593	29312.83	2591.47	26721	31922.61	1452	1969.53	35344.14	1969.53	265.07	132.27
19	ROHTAK	7772.5	9608	29440.45	2944.06	26496	14166.66	166.06	435.65	14768.37	446.18	11717.49	55.74
20	SIRSA	20237.43	18917	62986.36	5849.34	57137	84771.76	170.14	2456.13	87398.03	2456.13	2388.91	152.96
21	SONIPAT	23469.35	22437	69232.4	5920.02	63312	62012.69	939.29	2516.63	65468.59	2516.63	11568.55	103.41
22	YAMUNANAGAR	20843.31	16025	57305.41	5101.73	52204	68446.96	2340	4929.52	75716.48	4929.51	2761.95	145.04
Total (Ham)		**315221.33**	**279407.29**	**947622.47**	**87000.3**	**860622.17**	**1029677.1**	**59716.02**	**65016.27**	**1154409.4**	**65619.58**	**104180.62**	**134.14**

DISTRICT WISE RECHARGE WORTHY AREA IN ALL CATEGORIES

Annexure- XV

S.No	Name of District	Total Recharge Worthy Area of Assessed Units (in sq.km)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%
1	AMBALA	1509	0	0%	552	36.63	193	12.8	763	50.57	-	-
2	BHIWANI	2674	1394	52.13	0	0%	0	0%	1280	47.87	-	-
3	CHARKHI DADRI	1343	792	58.98	0	0%	0	0%	551	41.02	-	-
4	FARIDABAD	577	0	0%	0	0%	0	0%	577	100	-	-
5	FATEHABAD	2518	0	0%	0	0%	742	29.49	1775	70.51	-	-
6	GURGAON	1211	0	0%	0	0%	0	0%	1211	100	-	-
7	HISAR	4068	2829	69.54	499	12.28	329	8.11	409	10.07	-	-
8	JHAJJAR	1536	1536	100	-	0%	0	0%	-	-	-	-
9	JIND	2680	660	24.63	196	7.32	0	0%	1824	68.05	-	-
10	KAITHAL	2228	0	0%	0	0%	0	0%	2228	100	-	-
11	KARNAL	2468	0	0%	0	0%	243	9.84	2225	90.16	-	-
12	KURUKSHETRA	1684	0	0%	0	0%	0	0%	1684	100	-	-
13	MAHENDRAGARH	1885	0	0%	0	0%	389	20.65	1495	79.35	-	-
14	MEWAT	1107	606	54.76	102	9.27	0	0%	398	35.97	-	-
15	PALWAL	1200	427	35.65	273	22.75	154	12.88	344	28.72	-	-
16	PANCHKULA	506	398	78.63	0	0%	108	21.37	-	-	-	-
17	PANIPAT	1296	0	0%	0	0%	0	0%	1296	100	-	-
18	REWARI	1503	1503	100	0	0%	0	0%	-	-	-	-
19	ROHTAK	1440	0	0%	0	0%	198	13.76	1242	86.24	-	-
20	SIRSA	3520	0	0%	496	14.11	0	0%	3024	85.89	-	-
21	SONIPAT	1996	711	35.65	0	0%	0	0%	1284	64.35	-	-
22	YAMUNA NAGAR	1432	0	0%	277	19.38	0	0%	1155	80.62	-	-

ANNEXURE XVI

DISTRICT WISE STAGE OF DEVELOPMENT & TEMPORAL VARIATIONS IN ANNUAL OVERDRAFT

Sr. No.	Name of District	SOD (%)					Temporal variations in District wise Annual overdraft (in Ham)				
		2009	2013	2017	2020	2022	2009	2013	2017	2020	2022
1	AMBALA	94	102	101	124	113	2951	-1160	-281	-10428	-5394.65
2	BHIWANI	79	169	117	110	103	11314	-43018	-6938	-3806	-1044.88
3	CHARKHI DADRI	0	0	160	139	132	0	0	-9963	-6803	-5972.19
4	FARIDABAD	81	99	126	126	201	3878	628	-3812	-3876	-11117.53
5	FATEHABAD	179	184	161	170	181	-48114	-52894	-35376	-37328	-48199.72
6	GURGAON	232	133	221	203	213	-30666	-7923	-23045	-21001	-22729.49
7	HISAR	91	112	104	91	82	5964	-8122	-2324	4986	11365.37
8	JHAJJAR	96	83	62	46	50	1775	7165	13120	18252	15226.7
9	JIND	99	113	130	113	107	841	-12959	-23324	-9898	-5908.35
10	KAITHAL	212	226	228	208	193	-56963	-67180	-58797	-58904	-40899.38
11	KARNAL	140	121	170	168	172	-34238	-15218	-48837	-49696	-53313.16
12	KURUKSHETRA	217	281	244	246	228	-40318	-93416	-43085	-51439	-47965.61
13	MAHENDRAGARH	107	86	94	106	147	-1404	3472	1733	-1650	-8728.24
14	MEWAT	67	74	100	81	80	7170	5617	35	3382	3463.48
15	PALWAL	105	102	107	99	94	-2120	-970	-3262	412	2083.96
16	PANCHKULA	85	80	68	62	59	2014	2901	3908	5292	5919.63
17	PANIPAT	167	163	188	176	193	-20591	-20960	-26211	-24442	-27748.4
18	REWARI	112	92	91	127	132	-3372	2623	3351	-7493	-8622.78
19	ROHTAK	68	70	57	50	56	14274	14411	14514	14978	11728.02
20	SIRSA	154	175	198	150	153	-40958	-47922	-63659	-27144	-30261.01
21	SONIPAT	122	111	96	110	103	-17109	-8666	2677	-6113	-2156.21
22	YAMUNA NAGAR	135	135	157	149	145	-17093	-17822	-27411	-25492	-23512.8

ANNEXURE XVII

DISTRICT WISE ANNUAL EXTRACTABLE GW RESOURCES & ANNUAL GW EXTRACTION FROM 2009-22

Sr. No.	Name of District	Total Geographical Area (ha)	Annual Extractable GW Resources (Ham)					Annual GW Extraction (Ham)				
			2009	2013	2017	2020	2022	2009	2013	2017	2020	2022
1	AMBALA	150905	52244	56306	50854	43224	40408	49293	57466	51135	53652	45803
2	BHIWANI	267495	55138	62121	40779	38137	38220	43824	105139	47717	41943	39265
3	CHARKHI DADRI	134335			16712	17417	18675			26675	24220	24647
4	FARIDABAD	57731	20228	17637	14739	14847	11034	16350	17009	18551	18723	22151
5	FATEHABAD	251850	60605	63229	57588	53528	59866	68945	116123	92964	90856	108066
6	GURGAON	121112	23261	23827	19077	20422	20089	53927	31750	42122	41423	42819
7	HISAR	406838	66249	70178	63946	53589	64833	60285	78300	66270	48603	5346
8	JHAJJAR	153659	42718	42462	34292	34042	30343	40943	35297	21172	15789	15117
9	JIND	268027	81714	81254	78713	77097	79694	80873	115137	102037	86995	85603
10	KAITHAL	222872	50783	53507	45978	54756	44082	54876	120687	104775	113659	84981
11	KARNAL	246865	85905	71946	69859	73090	73628	78548	87164	118696	122786	126942
12	KURUKSHETRA	168420	34323	51699	29923	35241	37426	74641	145115	73008	86680	85392
13	MAHENDRAGARH	188541	21437	25630	28032	25622	18757	22841	22158	26299	27271	27485
14	MEWAT	110702	21623	21813	18760	17624	17399	14453	16196	18725	14242	13937
15	PALWAL	120020	44771	46124	46880	34862	35843	46891	47094	50142	34451	33759
16	PANCHKULA	50671	13876	14553	12223	14003	14612	11862	11652	8315	8711	8692
17	PANIPAT	129637	30865	33281	29861	32041	29839	51456	54241	56072	56483	57587
18	REWARI	144017	27999	30962	38430	27829	26721	31371	28339	35079	35323	35344
19	ROHTAK	150389	45017	47795	33569	29747	26496	30743	33384	19055	14768	14768
20	SIRSA	352099	75452	63678	65224	54746	57137	87532	111600	128883	81890	87398
21	SONIPAT	199641	77426	80195	69531	59355	63312	94535	88861	66854	65469	65469
22	YAMUNA NAGAR	143277	48199	51040	48081	51759	52204	65292	68862	75492	77251	75716

ANNEXURE XVIII

ANNUAL EXTRACTABLE GW RESOURCES & ANNUAL GW EXTRACTION FROM 2009-22 (Per Ha)

Sr. No.	Name of District	Total Geo. Area (Ha)	Annual Extractable GW Resources per Ha					Annual GW Extraction per Ha				
			2009	2013	2017	2020	2022	2009	2013	2017	2020	2022
1	AMBALA	150905	0.346	0.3731	0.337	0.286	0.267	0.327	0.3808	0.3389	0.3555	0.3035
2	BHIWANI	267495	0.206	0.2322	0.1524	0.143	0.142	0.164	0.3931	0.1784	0.1568	0.1467
3	CHARKHI DADRI	134335	0	0	0.1244	0.13	0.139	0	0	0.1986	0.1803	0.1834
4	FARIDABAD	57731	0.35	0.3055	0.2553	0.257	0.191	0.283	0.2946	0.3213	0.3243	0.3836
5	FATEHABAD	251850	0.241	0.2511	0.2287	0.213	0.237	0.432	0.4611	0.3691	0.3608	0.4290
6	GURGAON	121112	0.192	0.1967	0.1575	0.169	0.165	0.445	0.2622	0.3478	0.342	0.3535
7	HISAR	406838	0.163	0.1725	0.1572	0.132	0.159	0.148	0.1925	0.1629	0.1195	0.0131
8	JHAJJAR	153659	0.278	0.2763	0.2232	0.222	0.197	0.266	0.2297	0.1378	0.1028	0.0983
9	JIND	268027	0.305	0.3812	0.2937	0.288	0.297	0.302	0.4296	0.3807	0.3246	0.3193
10	KAITHAL	222872	0.228	0.2401	0.2063	0.246	0.197	0.483	0.5415	0.4701	0.51	0.38
11	KARNAL	246865	0.348	0.2914	0.283	0.296	0.298	0.487	0.3531	0.4808	0.4974	0.5142
12	KURUKSHETRA	168420	0.204	0.307	0.1777	0.209	0.222	0.443	0.8616	0.4335	0.5147	0.5070
13	MAHENDRAGARH	188541	0.114	0.1359	0.1487	0.136	0.099	0.121	0.1175	0.1395	0.1446	0.1457
14	MEWAT	110702	0.195	0.197	0.1695	0.159	0.157	0.131	0.1463	0.1691	0.1287	0.1258
15	PALWAL	120020	0.373	0.3843	0.3906	0.29	0.298	0.391	0.3924	0.4178	0.287	0.281
16	PANCHKULA	50671	0.274	0.2872	0.2412	0.276	0.288	0.234	0.23	0.1641	0.1719	0.1715
17	PANIPAT	129637	0.238	0.2567	0.2303	0.247	0.230	0.397	0.4184	0.4325	0.4357	0.4442
18	REWARI	144017	0.194	0.215	0.2668	0.193	0.185	0.218	0.1968	0.2436	0.2453	0.2454
19	ROHTAK	150389	0.299	0.3178	0.2232	0.198	0.176	0.204	0.222	0.1267	0.0982	0.0981
20	SIRSA	352099	0.214	0.1809	0.1852	0.155	0.162	0.331	0.317	0.366	0.2326	0.24822
21	SONIPAT	199641	0.388	0.4017	0.3483	0.297	0.317	0.474	0.4451	0.3349	0.3279	0.3274
22	YAMUNA NAGAR	143277	0.336	0.3562	0.3356	0.361	0.364	0.456	0.4806	0.5269	0.5392	0.5284

ANNEXURE XIX

ANNUAL OVER-EXTRACTION OF GW RESOURCES & RATE OF DEWATERING OF AQUIFER IN HARYANA FROM 2009-2022

Sr. No.	Name of District	Total Geo. Area	Annual Over-extraction of GW reources per Ha					Rate of Dewatering of aquifer in m				
			2009	2013	2017	2020	2022	2009	2013	2017	2020	2022
1	AMBALA	150905	0.0196	-0.008	-0.002	-0.0691	-0.036	0.163	-0.064	-0.02	-0.576	-0.2979
2	BHIWANI	267495	0.0423	-0.161	-0.026	-0.0142	-0.004	0.352	-1.34	-0.22	-0.119	-0.0326
3	CHARKHI DADRI	134335	0	0	-0.074	-0.0506	-0.044	0	0	-0.62	-0.422	-0.3705
4	FARIDABAD	57731	0.0672	0.0109	-0.066	-0.0671	-0.193	0.56	0.091	-0.55	-0.56	-1.6048
5	FATEHABAD	251850	-0.191	-0.21	-0.14	-0.1482	-0.191	-1.592	-1.75	-1.17	-1.235	-1.5949
6	GURGAON	121112	-0.253	-0.065	-0.19	-0.1734	-0.188	-2.11	-0.545	-1.59	-1.445	-1.5639
7	HISAR	406838	0.0147	-0.02	-0.006	0.0123	0.028	0.122	-0.166	-0.05	0.102	0.2328
8	JHAJJAR	153659	0.0116	0.0466	0.0854	0.1188	0.099	0.096	0.389	0.712	0.99	0.8258
9	JIND	268027	0.0031	-0.048	-0.087	-0.0369	-0.022	0.026	-0.403	-0.73	-0.308	-0.1837
10	KAITHAL	222872	-0.256	-0.301	-0.264	-0.2643	-0.184	-2.13	-2.512	-2.2	-2.202	-1.5293
11	KARNAL	246865	-0.139	-0.062	-0.198	-0.2013	-0.216	-1.156	-0.514	-1.65	-1.678	-1.7997
12	KURUKSHETRA	168420	-0.239	-0.555	-0.256	-0.3054	-0.285	-1.995	-4.622	-2.13	-2.545	-2.3733
13	MAHENDRAGARH	188541	-0.007	0.0184	0.0092	-0.0087	-0.046	-0.062	0.153	0.077	-0.073	-0.3858
14	MEWAT	110702	0.0648	0.0507	0.0003	0.0305	0.031	0.54	0.423	0.003	0.255	0.2607
15	PALWAL	120020	-0.018	-0.008	-0.027	0.0034	0.017	-0.147	-0.067	-0.23	0.029	0.1447
16	PANCHKULA	50671	0.0397	0.0573	0.0771	0.1044	0.117	0.331	0.477	0.643	0.87	0.9735
17	PANIPAT	129637	-0.159	-0.162	-0.202	-0.1885	-0.214	-1.324	-1.347	-1.68	-1.571	-1.7837
18	REWARI	144017	-0.023	0.0182	0.0233	-0.0520	-0.060	-0.195	0.152	0.194	-0.434	-0.4989
19	ROHTAK	150389	0.0949	0.0958	0.0965	0.0996	0.078	0.791	0.799	0.804	0.83	0.6499
20	SIRSA	352099	-0.116	-0.136	-0.181	-0.0771	-0.086	-0.969	-1.134	-1.51	-0.642	-0.7162
21	SONIPAT	199641	-0.086	-0.043	0.0134	-0.0306	-0.011	-0.714	-0.362	0.112	-0.255	-0.0900
22	YAMUNA NAGAR	143277	-0.119	-0.124	-0.191	-0.1779	-0.164	-0.994	-1.037	-1.59	-1.483	-1.3676