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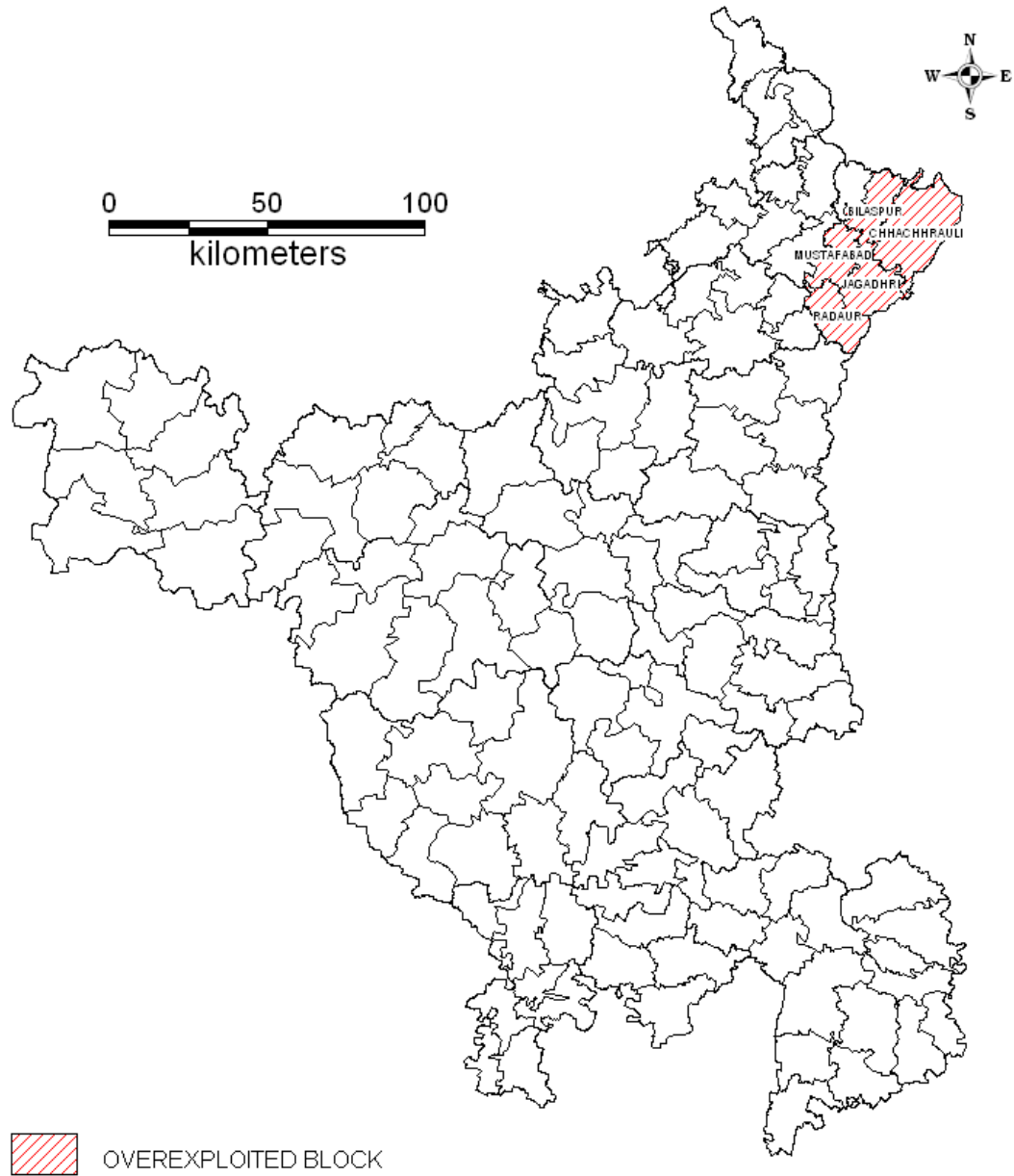


**Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Board**

**GROUND WATER MANAGEMENT PLAN IN
OVEREXPLOITED BLOCKS OF
YAMUNANAGAR DISTRICT, HARYANA**

**Central Ground Water Board
North Western Region
Chandigarh**

GROUND WATER MANAGEMENT PLAN
IN OVER EXPLOITED BLOCKS, DISTRICT YAMUNANAGAR,
HARYANA



GROUND WATER MANAGEMENT PLAN IN OVER EXPLOITED BLOCKS, DISTRICT YAMUNANAGAR, HARYANA

INTRODUCTION

Total geographical area of the district is 1756sq.km. Administratively, Yamuna Nagar district is divided into one sub-division and six-development blocks viz. Bilaspur, Chachrauli, Jagadhri, Mustafabad, Radaur and Sadhaura. Yamuna Nagar is thickly populated district. The population of the district is 12,14,205 as per 2011 census.

HYDROMETEOROLOGY

The climate of Yamuna Nagar district can be classified as subtropical monsoon, mild & dry winter, hot summer and sub-humid which is mainly dry with hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrates into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the southwest monsoon which lasts up to September. The transition period from September to November forms the post monsoon season. The winter season starts late in November and remains up to first week of March.

The normal annual rainfall of the district is 1107 mm, and is unevenly distributed over the area. The average rainy days are 43. The south west monsoon, sets in from last week of June and withdraws in the end of September, contributing about 81% of normal annual rainfall. July and August are the wettest months. Rest 19% rainfall is received during non-monsoon period in the wake of western disturbances and thunderstorms.

GEOMORPHOLOGY

1. Physiography: The district is divided into four Physiographic units

- Siwaliks
- Dissected Rolling Plains
- Interfluvial Plains
- Active And Recent Flood Plains
- Relict Plains

Siwaliks hills - Siwalik hill ranges occupy the northern fringe of Yamuna Nagar district and attain the height up to 950m AMSL. The hills are about 500m high with respect to the adjacent alluvial plains. These are characterized by the broad tableland topography that has been carved into quite sharp slopes by numerous ephemeral streams come down to the outer slopes of the Siwaliks and spread much of gravels boulders, pebbles in the beds of these streams.

Kandi Belt - A dissected rolling plain in the northern parts of district is a transitional tract between Siwaliks hills and alluvial plains. It is about 25 km wide and elevation varies between 250 and 375m AMSL.

Interfluvial plains - This tract is part of higher ground between Ghaggar and Chautang and includes high mounds and valleys. In general, the slope is from northeast to southwest.

Active and recent flood plains - This plain is narrow tract along river Yamuna in the district.

Relict wedge plain - This is almost in alignment to the surface water divide between the westward flowing Ghaggar and eastward flowing

2. Soil Types

- **Eutrochrepts/ Udorthents** - These are shallow and loamy sands to fine sandy loams, except in depressions, well-drained, non-saline, non-alkali, non-calcareous, mostly base saturated and are classified as loamy skeletal typic, lithyic, eutrochrepts/ udorthents. These soils are found in the Siwalik range.
- **Udipsamments/ udorthents** - These are loamy sand to sandy loam deep, excessively or well-drained, non-saline, non-alkali. These are placed under the associations of transitional tract between Siwaiks hills and alluvial plains.
- **Psammaquents and Haplaquepts** - These soils are found in Yamuna Plains
- **Haplaquept** - These soils are non saline, alkalinity hazards are classified as typic ustochrepts but water logged soils with loam to clay loam texture showing the effect of glazing, are classified as aeric/ typic Haplaquepts. Areas as aeridic soil moisture, moisture have soils classified as camborthics and torropsamments.

HYDROGEOLOGY

The ground water exploration in the district reveals that clay group of formations dominates over the sand group in the district area. Ground water in the district occurs in the alluvium under water table and semi-confined to confined conditions. These aquifers consist of sand, silt, gravels and kankar associated with clay and form highly potential aquifers. In alluvium, the permeable granular zones comprise fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and as well as vertical extent is extensive. In Kandi belt, which has not been explored fully boulders cobbles and pebbles, constitutes the major aquifer horizon. Siwalik Hills occupy marginal areas in the northeastern parts of the district constitute a low potential zone.

In Kandi areas, the shallow aquifers are isolated lenses embedded in clay beds whereas aquifers in alluvial areas occur on regional scale and have pinching and swelling disposition and are quite extensive in nature. These aquifers generally consists sands (fine to coarse grained) and gravels and are often intercepted by clay and kankar horizons. These aquifers are under unconfined to semi-confined conditions and support a large number of shallow tubewells within the depth of 50m only. The discharge of these tubewells varies between 100lpm and 500 lpm for moderate tubewells.

Under ground water exploration programme thirteen exploratory wells were drilled in the district. On average 3-12 of granular zones were deciphered in the depth range down to 450 m bgl. Exploratory wells drilled in depth range of 130 and 180 m bgl yield discharge in the range of 2700 to 4900 lpm for drawdown of 6.0 m to 12.0 m and Transmissivity of aquifers range between 1500 to 4900 m²/day. The yield potentials of aquifer below 200.0m bgl are yet to be evaluated.

Depth to water level

The depth to water level during pre-monsoon period in the district ranges between 1.99m bgl at to 17.26m bgl. The Depth to water level during post-monsoon period in the district ranges between 1.39m bgl to 31.50 m bgl.

The discharge of the shallow tubewells tapping unconfined aquifers e tubewells ranges from 100 lpm to 500 lpm with moderate Drawdown values. Near Manakpur, a phreatic aquifer

extending down to 88.0m bgl has Transmissivity value of 2500m²/day, lateral hydraulic conductivity of 31m /day, and specific yield of 2.1*10⁻²

GROUND WATER QUALITY:

The ground water of the district is alkaline in nature and is of low to medium salinity. Specific conductivity is a measure of total dissolved solids present in water and it ranges from 357µS/cm to 751µS/cm at 25⁰C. However, saline ground water-having EC value of 2180µS/cm is found at Mustafabad. Among anions, bicarbonate is the dominant anion and among cations, none of the cation dominates.

Suitability of Water

- **Domestic**

Ground water occurring in the shallow aquifer is by and large, fresh and potable. All chemical parameters are within the permissible limits for safe drinking waters set by BIS except nitrate at Bilaspur and Mustafabad where its values are 60 mg/l and 89 mg/l respectively, iron at Sabri (2.74mg/l) and Rasulpur (8.47mg/l) and arsenic at Shadipur (0.0152 mg/l).

- **Irrigation**

Plot of USSL diagram used for the classification of irrigation waters indicated that ground water fall under classes C₂S₁ and C₃S₁ and are therefore suitable for customary irrigation without any fear of sodium hazards on well drained soil. Presence of chemical constituents more than the permissible limits

<u>Constituent</u>	<u>No. of wells</u>	<u>Location with conc.</u>
EC > 3000µS/cm (n=14)	nil	--
Fluoride >1.5mg/l (n=14)	nil	--
Arsenic > 0.01mg/l (n=9)	1	Shadipur, 0.0152mg/l
Iron >1.0mg/l (n=6)	2	1. Rasulpur, 8.47 mg/l 2. Sabri, 2.74 mg/l

Type of water: Mixed cation-HCO₃ type

GROUND WATER RESOURCES:

The block wise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 90% (block-Sadhaura) to 188% (block-Jagadhri). The total replenish able ground water resource in the district is 484.41 mcm, of which the total existing ground water draft by all means is 666.49 mcm. The net utilizable ground water resources for future irrigation development are -184.92 MCM.

GROUND WATER RESOURCES OF YAMUNA NAGAR DISTRICT, HARYANA as on 31.03.11

Block Name	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation domestic industrial upto next 25 years (Ham)	Net Ground Water Availability for future irrigation development (Ham)	Stage Ground Water Development (%)	Category of Block
Bilaspur	9133	7519	9184	1665	-51	101	Over - Exploited
Chhachh rauli	12699	13081	14896	1815	-2197	117	Over-Exploited
Jagadhri	7458	10759	13984	3225	-6526	188	Over - Exploited
Mustafa bad	6756	9173	10403	1230	-3647	154	Over - Exploited
Radaur	8117	12990	14340	1350	-6223	177	Over - Exploited
Sadhaura	4278	2912	3842	1214	152	90	Critical
TOTAL	48441	56434	66649	10499	-18492	138	

GROUND WATER IRRIGATION SCENARIO

As per the data available from minor irrigation census 2006-07 the detailed number of shallow, deep, tubewells, lined, unlined water distribution system, land holdings of wells are given below for reference.

Distribution of Tubewells According to Owner's Holding Size

Sr.no	District	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Public	Group of Farmers	Total
1	Yamunanagar	138	1888	5448	170	202	12658	20504

Distribution of Tubewells According to Depth of tube well

No. by the depth of shallow Tube well							
Sr.no	District	(20-40 mts)	(40-60 mts)	(60-70 mts)	(70-90 mts)	(90-110 mts)	Total
1	YAMUNANAGAR	0	17512	1949	191	852	20504

Number of Ground Water Schemes and Potential Utilized by water distribution device

Ground Water Schemes according to water Distribution System				
Open Water Channel				
Sr.no	District	Lined/pucca	Unlined/kutcha	Total
1	YAMUNANAGAR	17171	3333	20504

PLAN OF THIS REPORT:

POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY OF IRRIGATION TUBE WELLS

The micro level transformation in the ground water management have vast impact potential to counter extensive ground water depletion faced by the state of Haryana, particularly in overexploited blocks.

There are around 3333 (out of 20504) tubewells (16.26%) operated by farmers for irrigation through unlined/Katcha open channel system in Yamunanagar district where water from the tubewell is discharge to the agricultural field. In this process huge (upto 30 %) quantity of ground water is wasted in soil moisture and evaporation losses. Around 85% of the tube wells are of shallow depth (< 60m) and remaining are deeper (60-110 m) depth. Thus majority of wells are tapping shallow Aquifer which is under stress due to overexploitation. Dynamic ground water resources (2011) indicate that Gross ground water draft for irrigation in Overexploited Blocks of Yamunanagar district is estimated at 628.07 MCM. It is expected that around 25% of over draft can be brought down by switching over to underground/surface pipeline based distribution from the prevailing unlined open channels. Thereby gross draft will be reduced to the tune of 21.76 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks. The measure if implemented will bring down the ground water overdraft from 142 % to 137.29%. The category of the blocks will also improve drastically resulting in boosting of agriculture and industrial development otherwise not sustainable in majority of the blocks in the state. The tubewells also consume enormous electricity which is subsidized and government incurs significant revenue on this account. The measures therefore will result in saving of energy and money. Pollution impact will be reduced whenever diesel engines are used by the farmers. The environmental and ecological condition in the irrigated land will improve. Unwanted weed growth will also be controlled inside the farm land. This will also be useful in the waterlogged/shallow water table areas as the seepage losses in these areas also aggravate the water logging. **Government should make/launch a mission mode program for installing the underground pipe lines instead of having *katcha* channel in the entire Haryana.** Heavy ground water overdraft can be reduced by these efforts. This will ensure **more crop per drop.**

POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY IN IRRIGATION TUBEWELLS, YAMUNANAGAR DISTRICT

Net Annual Ground Water Availability (mcm)	Total Draft (present) (mcm)	Gross Irrigation Draft (present) (mcm)	Gross Ground Water Draft for Domestic and industrial supply (mcm)	Percentage of unlined channel	Wastage through unlined channel, (mcm) (Col 3 X Col5 X 0.25 [#])	Potential of Reduced irrigation overdraft (Col3-col6) (mcm)	Gross draft after saving of water (mcm) (Col 7+Col4)	Present Stage of Development (%)	Stage of development afterwards((Col 8/Col1) X100) (%)	Reduction in stage of development after constructing pucca channel (Col9-Col10) (%)
1	2	3	4	5	6	7	8	9	10	11
441.63	628.07	535.22	92.85	16.26	21.76	513.46	606.31	142	137.29	4.93

#losses from open kuchha channel are around 25%.

COST ESTIMATE OF UNDERGROUND PIPE LINE

District	Block	Irrigated area by ground water scheme (ha)	Percentage of Unlined Channel(%)	Area under unlined Channels (ha)	Total cost @Rs.0.50 lack per hector(in cr) =Total irrigated area (by ground water scheme) of the block *0.5 *Col5	Total Cost in Rs.Cr. District wise
1	2	3	4	5	6	7
Yamunanagar	Bilaspur	18604	16.26	3025	15.13	80.12
	Chachrauli	22875	16.26	3719	18.60	
	Jagadhari	18926	16.26	3077	15.39	
	Mustafabad	17653	16.26	2870	14.35	
	Radaur	20496	16.26	3333	16.66	

***BLOCK
WISE DETAILS OF
DISTRICT
YAMUNANAGAR
HARYANA

(5 OE BLOCKS)***

Ground Water Scenario of Block

Block Name:- Bilaspur District :- Yamunanagar State :- Haryana		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	301.22
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	127 0
	Average Annual Rainfall mm	1107
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	177
	• Net Area Sown (Sq.Km)	218.31
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	186.04
	• Total Unirrigated Area (Sq.Km)	32.27
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	4.08-4.08 (mbgl)
	• Post –monsoon: (Nov2014)	----- (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	4
	• Depth Range (m)	146-460
	• Discharge (lpm)	2700-4900/6-12
	Aquifer Parameters	

	<ul style="list-style-type: none"> • Transmissivity (m²/day) 	2500		
	<ul style="list-style-type: none"> • Storativity 	2.1*10 ⁻²		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in μS/cm at 25⁰c 	975	975	
	<ul style="list-style-type: none"> • NO3 (mg/l) 	112	112	
	<ul style="list-style-type: none"> • F (mg/l) 	0.39	0.39	
	<ul style="list-style-type: none"> • Fe (mg/l) 	--	--	
	<ul style="list-style-type: none"> • As (mg/l) 	0.002	0.002	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	91.33		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	75.19		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	16.65		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	91.84		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	16.65		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-51		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	101		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>		

9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 18.50	Percentage % 37
10	Volume of unsaturated zone available for recharge (MCM)	252	
11.	Volume of water required for recharge (MCM)	335	
12.	Volume of surplus water available for recharge(MCM)	0.33	
CONSERVATION STRUCTURES		Area under unlined canal (hectares)	Total Cost (Rs. in crores)
13.	Underground pipe line @ Rs. 50000/-	3025	15.13
TOTAL			3.06

Ground Water Scenario of Block

Block Name:- Chachrauli District :- Yamunanagar State :- Haryana		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	531.55
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	174 0
	Average Annual Rainfall mm	1107
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	152
	• Net Area Sown (Sq.Km)	273.89
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	252.23
	• Total Unirrigated Area (Sq.Km)	21.66
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	1.99-17.26 (mbgl)
	• Post –monsoon: (Nov2014)	1.39-16.20 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	12
	• Depth Range (m)	146-460
	• Discharge (lpm)	2700-4900/6-12
	Aquifer Parameters	
	• Transmissivity (m ² /day)	2500

	<ul style="list-style-type: none"> • Storativity 	$2.1*10^{-2}$		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in $\mu\text{S}/\text{cm}$ at 25°C 	340	1648	
	<ul style="list-style-type: none"> • NO₃ (mg/l) 	0.9	87	
	<ul style="list-style-type: none"> • F (mg/l) 	0.08	0.37	
	<ul style="list-style-type: none"> • Fe (mg/l) 	0.18	0.31	
	<ul style="list-style-type: none"> • As (mg/l) 	0.0046	0.0096	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	126.99		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	130.81		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	18.15		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	148.96		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	18.15		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-21.97		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	117		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 23.20	Percentage % 46	
10	Volume of unsaturated zone available	444		

	for recharge (MCM)			
11.	Volume of water required for recharge (MCM)		591	
12.	Volume of surplus water available for recharge(MCM)		0.58	
RECHARGE/ CONSERVATION STRUCTURES		Area under unlined canal (hectares)	Total Cost (Rs. in crores)	Total Water saving in MCM
13.	Underground pipe line (area in hectares) @ Rs. 50000/-	3719	18.60	5.32
TOTAL			18.60	5.32

Ground Water Scenario of Block

Block Name :- Jagadhri District :- Yamunanagar State :- Haryana		
1.	GENERAL INFORMATION	
	• Geographical area (sq km)	272.70
	• Number of Villages inhabited • Un-inhabited	110 0
	• Average Annual Rainfall (mm)	1107
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	--
	• Net Area Sown (Sq.Km)	189.28
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	189.26
• Total UnIrrigated Area (Sq.Km)	2	
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	5.38-17.25 (mbgl)
	• Post –monsoon: (Nov2014)	4.92-14.51 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	6
	• Depth Range (m)	146-460
	• Discharge (lpm)	2700-4900/6-12
	Aquifer Parameters	
• Transmissivity (m ² /day)	2500	

	<ul style="list-style-type: none"> • Storativity 	$2.1*10^{-2}$		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in $\mu\text{S}/\text{cm}$ at 25°C 	244	377	
	<ul style="list-style-type: none"> • NO₃ (mg/l) 	-	1.9	
	<ul style="list-style-type: none"> • F (mg/l) 	0.08	0.25	
	<ul style="list-style-type: none"> • Fe (mg/l) 	0.12	0.62	
	<ul style="list-style-type: none"> • As (mg/l) 	0.0152	0.0152	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	74.58		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	107.59		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	32.25		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	139.84		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	32.25		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-65.26		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	188		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 19	Percentage % 38	
10	Volume of unsaturated zone available	228		

	for recharge (MCM)			
11.	Volume of water required for recharge (MCM)		303	
12.	Volume of surplus water available for recharge(MCM)		0.3	
RECHARGE/ CONSERVATION STRUCTURES		Area under unlined canal (hectares)	Total Cost (Rs. in crores)	Total Water saving in MCM
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3077	15.39	4.37
TOTAL			15.39	4.37

Ground Water Scenario of Block

Block Name:- Mustafabad District :- Yamunanagar State :- Haryana			
1.	GENERAL INFORMATION		
	Geographical area (sq km)	206.82	
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	79 0	
	Average Annual Rainfall mm	1107	
2.	GEOMORPHOLOGY		
	Major Physiographic	Alluvium Plain	
	Major drainages Basin Sub-Basin	Ganga Yamuna	
3.	LAND USE		
	<ul style="list-style-type: none"> • Current fallows (Sq.Km) • Net Area Sown (Sq.Km) • Area Sown More than Once (Sq.Km) • Total Irrigated Area (Sq.Km) • Total UnIrrigated Area (Sq.Km) 	-- 176.53 -- 176.53 --	
	PREDOMINANT GEOLOGICAL FORMATIONS		Younger alluvium
	HYDROGEOLOGY		
	5.	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
		Avg. Depth to water level (decadal)	
	<ul style="list-style-type: none"> • Pre- monsoon: (May 2015) • Post –monsoon: (Nov2014) 	----- (mbgl) ----- (mbgl)	
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	<ul style="list-style-type: none"> • No of wells drilled • Depth Range (m) • Discharge (lpm) 	4 146-460 2700-4900/6-12	
	Aquifer Parameters		

	<ul style="list-style-type: none"> • Transmissivity (m²/day) 	2500		
	<ul style="list-style-type: none"> • Storativity 	2.1*10 ⁻²		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in $\mu\text{S}/\text{cm}$ at 25⁰c 	--	--	
	<ul style="list-style-type: none"> • NO₃ (mg/l) 	--	--	
	<ul style="list-style-type: none"> • F (mg/l) 	---	--	
	<ul style="list-style-type: none"> • Fe (mg/l) 	--	--	
	<ul style="list-style-type: none"> • As (mg/l) 	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	67.56		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	91.73		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	12.30		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	104.03		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	12.30		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-36.47		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	154		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 36	Percentage % 72	

10	Volume of unsaturated zone available for recharge (MCM)	173		
11.	Volume of water required for recharge (MCM)	230		
12.	Volume of surplus water available for recharge(MCM)	0.22		
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Water saving in MCM
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2870	14.35	3.73
TOTAL			14.35	3.73

Ground Water Scenario of Block

Block Name:- Radaur District :-Yamunanagar State :- Haryana		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	291.01
	Number of Villages inhabited Un-inhabited	84 0
	Average Annual Rainfall (mm)	1107
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	--
	• Net Area Sown (Sq.Km)	205.54
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	204.96
	• Total UnIrrigated Area (Sq.Km)	--
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	14.48-14.48 (mbgl)
	• Post –monsoon: (Nov2014)	31.50-31.50(mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	9
	• Depth Range (m)	146-460
	• Discharge (lpm)	2700-4900/6-12
	Aquifer Parameters	

	<ul style="list-style-type: none"> • Transmissivity (m²/day) 	2500		
	<ul style="list-style-type: none"> • Storativity 	2.1*10 ⁻²		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in μS/cm at 25⁰c 	--	--	
	<ul style="list-style-type: none"> • NO₃ (mg/l) 	--	--	
	<ul style="list-style-type: none"> • F (mg/l) 	---	--	
	<ul style="list-style-type: none"> • Fe (mg/l) 	--	--	
	<ul style="list-style-type: none"> • As (mg/l) 	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	81.17		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	129.90		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	13.50		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	143.40		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	13.50		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-62.23		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	177		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 32	Percentage % 64	

10	Volume of unsaturated zone available for recharge (MCM)		243	
11.	Volume of water required for recharge (MCM)		323	
12.	Volume of surplus water available for recharge(MCM)		0.31	
RECHARGE/ CONSERVATION STRUCTURES		Area under unlined canal (hectares)	Total Cost (Rs. in crores)	Total Water saving in MCM
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3333	16.66	5.28
TOTAL			16.66	5.28