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

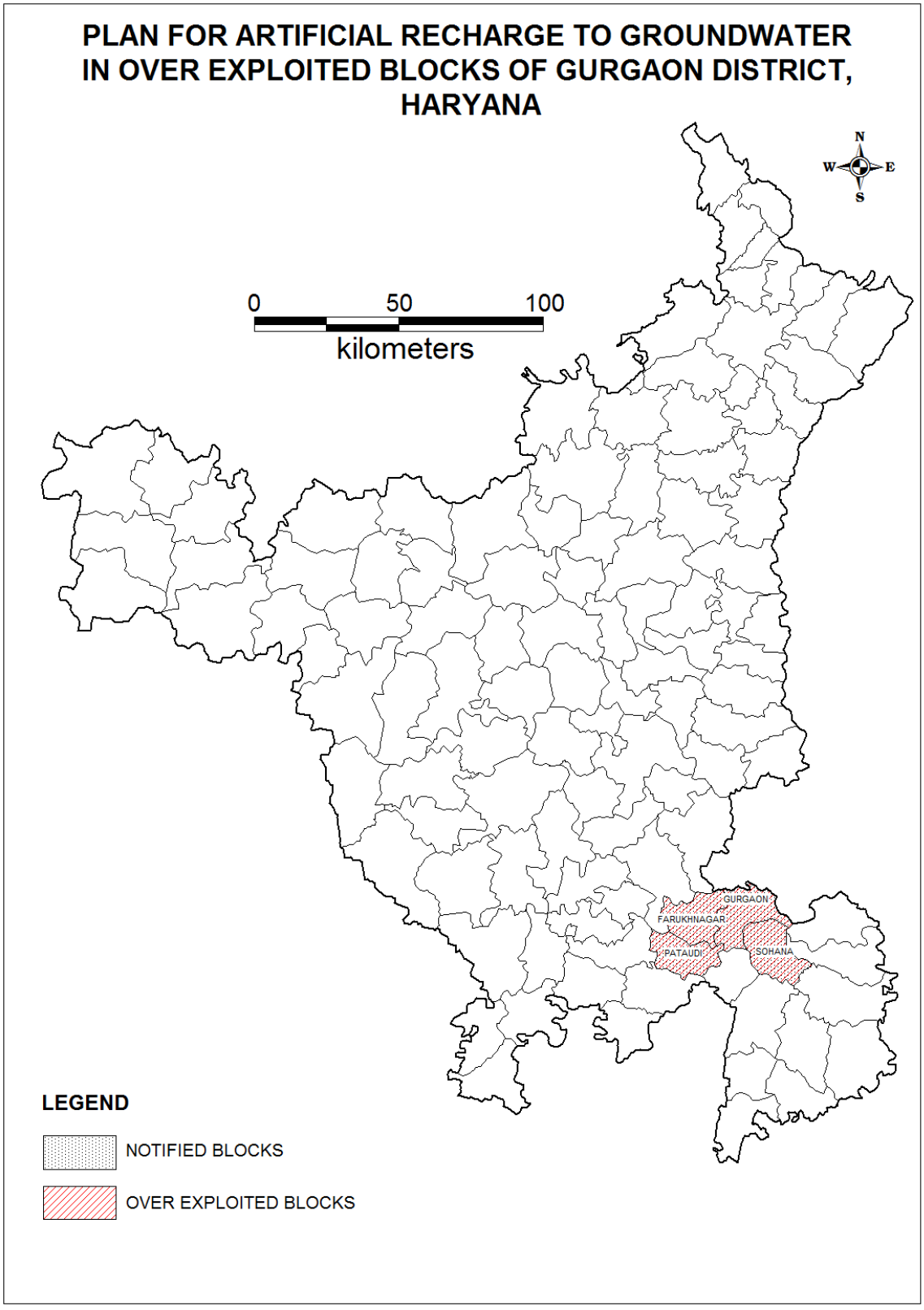
PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION

IN OVEREXPLOITED BLOCKS OF

GURGAON DISTRICT, HARYANA

Central Ground Water Board
North Western Region
Chandigarh



PLAN OF ARTFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT GURGAON HARYANA

INTRODUCTION

Administratively, the district is under control of Gurgaon Sub-division and is divided into into four development blocks i.e. Gurgaon, Pataudi, Farrukhanagar and Sohna. Gurgaon district has 9 towns and 286 villages with a total population of 15, 14,085 as per 2011 census.

HYDROMETEOROLOGY

The climate of the district can be classified as tropical steppe, semi-arid and hot which is mainly characterized by the extreme dryness of the Air except during monsoon months, intensely hot summers and cold winters. The normal annual rainfall is about 596 mm which is spread over 28 rainy days. 85% of rainfall occurs during south-west monsoon.

GEOMORPHOLOGY

The area is conspicuously flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. The alluvial plain is formed by the sahibi river which is tributary of River Yamuna. Soils of the Gurgaon district are classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks. In Pataudi and Sohna blocks the organic content of soils is lowest, just up to 0.20 per cent (very low category). In the rest of the district, organic contents is 0.2 to 0.40 percent and falls in low category.

HYDROGEOLOGY

The major part of Gurgaon district is underlain by Quaternary alluvium consisting of sand, clay and silt. The quartzite ridge trending NNE-SSW is located about 7 km east of town in which ground water occurs in fractures, joints and crevaces. Sandy layers at various depth form major water bearing horizons above the crystalline basement. Ground water in the Gurgaon block occurs in unconfined and semiconfined condition. The upper zone of saturation consists of fine sand with silt varying from place to place. In Udyog vihar and city area the depth of first aquifer varies from 34 to 43 mbgl. However in industrial area of Manesar top most aquifer can be encountered at 20m . The thickness of sandy layer is very limited. The drawdown are generally high indicating absence of highly potential ground water bearing aquifers. Tubewells in the depth range of 45 to 90 m bgl have been installed by different agencies in the block. The yield of these tubewells varies in different areas ranging within 129 to 606 lpm.

The pre-monsoon depth to water level in the district ranges from 0.91 mbgl to 35.84 m bgl & post monsoon water level ranges from 0.82 m bgl to 35.60 m bgl. The water level is deep in the northeastern, central and southeastern parts of the district .

GROUND WATER QUALITY:

The shallow ground water of the district is alkaline in nature (pH 7.25 to 8.13) and is moderately to highly saline (EC 638 to 10320 µS/cm). On comparing the concentration values of major ions with the recommended desirable and permissible concentration limits for drinking water (Bureau of Indian Standards) it is found that ground waters is mostly unsuitable for drinking purposes in 88% of wells mainly due to high nitrate and fluoride contents that exceed the maximum permissible limits of these parameters which are 45 mg/l and 1.5mg/l respectively.

Salinity (EC), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are generally the parameters for ascertaining the suitability of ground water for irrigational uses. These parameters range from 805 to 3410 µS/cm at 25^0C, 1.57 to 15.27 and –17.15 to 5.30 milli-equivalents respectively. Plot of USSL diagram used for the classification of irrigation waters indicated that ground water samples mostly fall under class C_3S_1 & C_3S_2 (56%). Such waters are likely to cause medium to high salinity hazards but they may not cause sodium hazards because of low SAR. The remaining 44% of water samples fall under C_3S_3, C_3S_4, C_4S_1, C_4S_2 C_4S_3 and C_4S_4 classes of irrigation water. Waters having C_4, C_3 and S_3 and S_4 may lead to both salinity and sodium hazards when used for irrigation under normal practices. Such waters, nevertheless, can be used for semi-salt tolerant to salt tolerant crops along with appropriate amount of gypsum on well drained soils.

GROUND WATER RESOURCES:

Ground Water Resources estimation of the district was done as on 31.03.2011 as per GEC-1997 for each individual block. Stage of ground water development in the district is 226%. The ground water development in all the blocks of the district has exceeded the available recharge and thus all the blocks have been categorized as "over exploited". Block Pataudi has relatively less development of ground water among all blocks i.e. 164%.

Net ground water availability of the district is 240.48 million cubic meter (mcm), ground water draft for all users is 544.18 mcm, whereas net ground water availability for future irrigation development is -303.7 mcm.

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 Shallow Tubewells According to Owner's Holding Size

No. of shallow tube wells by size class of individual owner							
Sr.no	District	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Others	Total
1	**Gurgaon**	**0**	**453**	**2465**	**29**	**6390**	**9337**

Distribution of Deep Tubewells According to Owner's Holding Size

No. of deep tube wells by size class of individual owner							
Sr.no	District	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Others	Total
1	**Gurgaon**	**0**	**139**	**124**	**3**	**1733**	**1999**

Distribution of Shallow Tubewells According to Depth of tube well

No. by the depth of shallow Tube well							
Sr.no	District	(0-20 mts)	(20-40 mts)	(40-60 mts)	(60-70 mts)	(>70 mts)	Total
1	**Gurgaon**	**0**	**8419**	**918**	**0**	**0**	**9337**

Number of Irrigation tubewells with water distribution System

Ground Water Schemes according to water Distribution System				
	Open Water Channel			
Sr.no	**District**	**Lined/pucca**	**Unlined/kutcha**	**Under ground pipe**
1	**Gurgaon**	**10412**	**1234**	**0**

PLAN OF THIS REPORT

In this plan 2 types of the recharge structures are proposed such as Roof Top Rain water harvesting in rural & urban areas and Recharge pits in agriculture lands of 5mt x 5mt x 3mt size. The pit will be surrounded by angle irons and barbed fencing. The size and depth depend on the availability of the land. The extra water available on the field will be stored in the pit and that will also be recharged to the ground water. **A summery outline of the artificial recharge plan for the entire district of each block is given at the beginning in tabular forms. This is followed by the salient features of each block along with the detailed structure-wise recharge plan and cost estimates.**

Details of the block wise type of suitable recharge structures and volume of water assured for annual recharge for each block, schematic design of recharge structures are annexed at annexure I & II.

This plan is focusing on the technical aspects of the ground water recharge through various means so that various implementing agencies may get the appropriate technical guidelines. The existing/ongoing schemes of the central or state govt. like MANERGA, IWSP, PMKVY, NABARD funded schemes, Urban Development schemes, departmentally funded projects etc. may be benefitted from the recharge plan by incorporating the input in the operational guidelines/ design and for locating the specific sites.

Agriculture university, engineering Collages, Academic and Research Institution, NGO may also take up the pilot or demonstrative projects in the blocks suitable to them to plan at local level as per local conditions.

Sr.no.	Type of Structure	No. of structures	Unit cost in Lakhs	Total cost of structure in Lakhs	Annual Recharge (MCM)
ROOF TOP RAIN WATER HARVESTING IN RURAL AND URBEN AREAS					
1	**Artificial Recharge Plan For Urban Areas.**	**9199**	**0.25**	**22.9975**	**0.976**
2	**Roof Top Rain Water Harvesting in Rural Areas**	**8772**	**0.25**	**21.93**	**0.51**
	Total	**17971**	**0.25**	**44.9275**	**1.486**
ARTIFICIAL RECHARGE IN FARMS					
1	**Artificial Recharge Plan Through Recharge Pits.**	2916	0.35	**10.206**	14.694
			Total	**55.13**	**16.18**

By the implementation of the proposed recharge structures there will be a reduction of 6.44% in stage of ground water development as tabulated below

Sr. no.	Total Draft (present) **(mcm)**	Recharge through different proposed structures **(mcm)**	Draft Reduced due to Recharge **(mcm)**	Stage of development (present)	Stage of development after recharge	Reduction in stage of development after recharge
1	**544.18**	**16.18**	**528**	**226%**	**219.56%**	**6.44%**

ARTIFICIAL RCEHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS OF GURGAON DISTRICT

Block Name	Total area of the village (in hectares)	10% of village area taken for farm recharge(sq m)	Total number of recharge pits	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall)	Cost of Pit @Rs. 35000/- (crores)
Farukhnagar	27003	27003000	810	1.802	2.835
Gurgaon	17219	44698000	517	4.76	1.8095
Pataudi	24585	71468000	738	6.539	2.583
Sohna	28385	21877000	852	1.592	2.982
			2916	14.694	10.206

Number of Recharge pits are based on following factors:

Availability of Irrigation wells in the farmer land

Area of sandy strata at shallow depth identified

Type of structure will be recharge pit/ Recharge well(where top three meters is clay)

ARTIFICIAL RECHARGE PLAN FOR RURAL AREAS OF GURGAON

ROOF TOP RAINWATER HARVESTING IN RURAL AREAS OF GUAGAON								
Name of District	Sr.no	Name of CD Block	Total area of the village (in hectares rounded up to one decimal place)	Number of households (2011 census)	No of Houses taken for Artificial Recharge (10% of total households)	Total No of AR Structures (one structure for each house)	Total recharge in MCM	Cost @ Rs.25000/- per structure (crores)
Gurgaon	1	**Farukhnagar**	**27003**	**21663**	**2166**	**2166**	**0.126**	**5.415**
	2	**Gurgaon**	**17219**	**19430**	**1943**	**1943**	**0.113**	**4.8575**
	3	**Pataudi**	**24585**	**25452**	**2545**	**2545**	**0.148**	**6.3625**
	4	**Sohna**	**28385**	**21181**	**2118**	**2118**	**0.123**	**5.295**
		Total	**97192**	**87726**	**8772**	**8772**	**0.51**	**21.93**

ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF GURGAON

District	Block	Town Name	Total Households	Total Population of Town	HousholdS taken for Atificial Recharge (10%)	Total Roof Top Area (sqm)	Vol of water available for recharge (MCM)	Cost @Rs.25000/- (crores)
1	2	3	4	5	5	6	7	
Gurgaon	PATAUDI	Hailey Mandi (MC)	**3973**	**20906**	**397**	**79460**	**0.039**	**0.9925**
	PATAUDI	Pataudi (MC)	**3481**	**20418**	**348**	**69620**	**0.034**	**0.87**
	GURGAON	Gurgaon (M Corp. + OG)*	**208229**	**886519**	**6247**	**1249374**	**0.71**	**15.6175**
	GURGAON	Garhi Harsaru (46) (CT)	**1539**	**7894**	**154**	**30780**	**0.017**	**0.385**
	SOHNA	Badshahpur (87) (CT)	**2980**	**15593**	**298**	**59600**	**0.023**	**0.745**
	FARRUKHNAGAR	Farrukhnagar (MC)	**2525**	**13513**	**253**	**50500**	**0.018**	**0.6325**
	GURGAON	Manesar (154) (CT)	**5074**	**23448**	**507**	**101480**	**0.058**	**1.2675**
	SOHNA	Sohna (MC)	**6850**	**36552**	**685**	**137000**	**0.053**	**1.7125**
	SOHNA	Bhondsi (168) (CT)	**3099**	**17410**	**310**	**61980**	**0.024**	**0.775**
	PATAUDI	Hailey Mandi (MC)	**3973**	**20906**	**397**	**79460**	**0.039**	**0.9925**
	PATAUDI	Pataudi (MC)	**3481**	**20418**	**348**	**69620**	**0.034**	**0.87**
						Total	**0.976**	**22.9975**

B. 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 1546 operated by farmers for irrigation through unlined/Katcha (14%) open channel system in Gurgaon district where water from the tubewell is discharge to the agricultural field. In this process huge quantity of ground water is wasted in soil moisture and evaporation losses.

Dynamic ground water resources (2011) indicate that Gross ground water draft for irrigation in Gurgaon district is estimated at 361.66 MCM. It is expected that around 4.85% 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 12.36 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks of Gurgaon Districts. The measure if implemented will bring down the ground water overdraft from 226% to 221 %. 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, GURGAON 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)	Pecentage of unlined channel	Wastage through unlined channel, (mcm) (Col 3 X Col5 X 0.30#)	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 canal (Col9-Col10) (%)
1	2	3	4	5	6	7	8	9	10	11
240.48	**544.18**	**362.66**	**181.52**	**13.63**	**12.36**	350.3	531.82	**226**	221	4.85

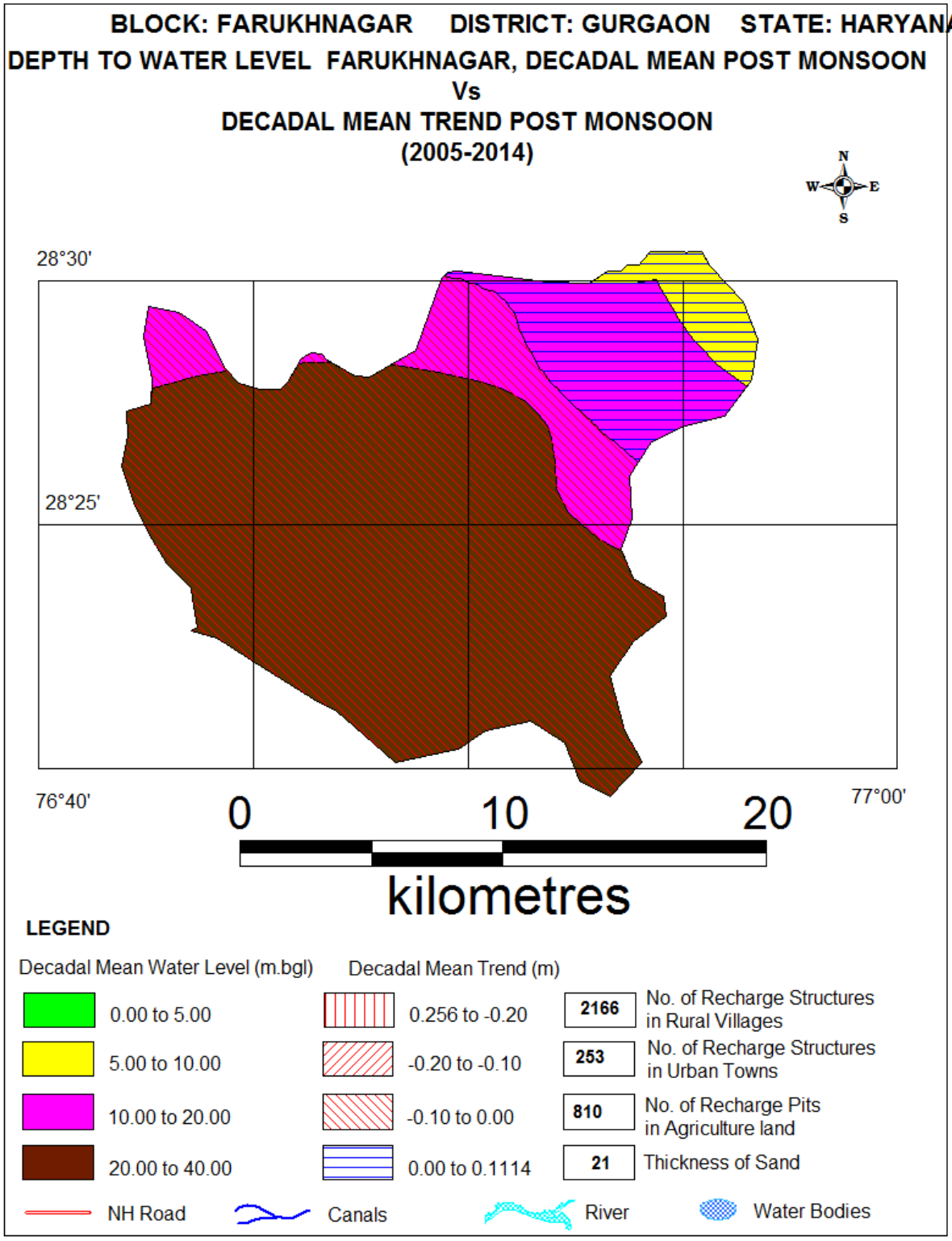
 # Losses from open kuchha channel are around 25%.

COST ESTIMATE OF UNDERGROUND PIPE LINE

District	Block	Irrigated area by ground water scheme (ha)	Percentage of Unlined Channel (%)	Area under unlined Channels	Total cost @Rs.0.50 lack per hector(in cr) Area *0.50/100 = Crores	Total Cost in Rs.Cr. District wise
GURGAON	**Farukhnagar**	20992	13.63	2861	14.31	**47.51**
	Gurgaon	10279	13.63	1401	7.01	
	Pataudi	23041	13.63	3140	15.70	
	Sohna	15401	13.63	2099	10.50	

BLOCK WISE PLAN OF DISTRICT GURGAON HARYANA

(4 OE BLOCKS)


BLOCK: FARUKHNAGAR DISTRICT: GURGAON STATE: HARYANA
DEPTH TO WATER LEVEL FARUKHNAGAR, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)
N
W
E
S
28°30'
28°25'
76°40'
77°00'
0
10
20
kilometres
LEGEND
Decadal Mean Water Level (m.bgl)
0.00 to 5.00
5.00 to 10.00
10.00 to 20.00
20.00 to 40.00
Decadal Mean Trend (m)
0.256 to -0.20
-0.20 to -0.10
-0.10 to 0.00
0.00 to 0.1114
2166
No. of Recharge Structures in Rural Villages
253
No. of Recharge Structures in Urban Towns
810
No. of Recharge Pits in Agriculture land
21
Thickness of Sand
NH Road
Canals
River
Water Bodies

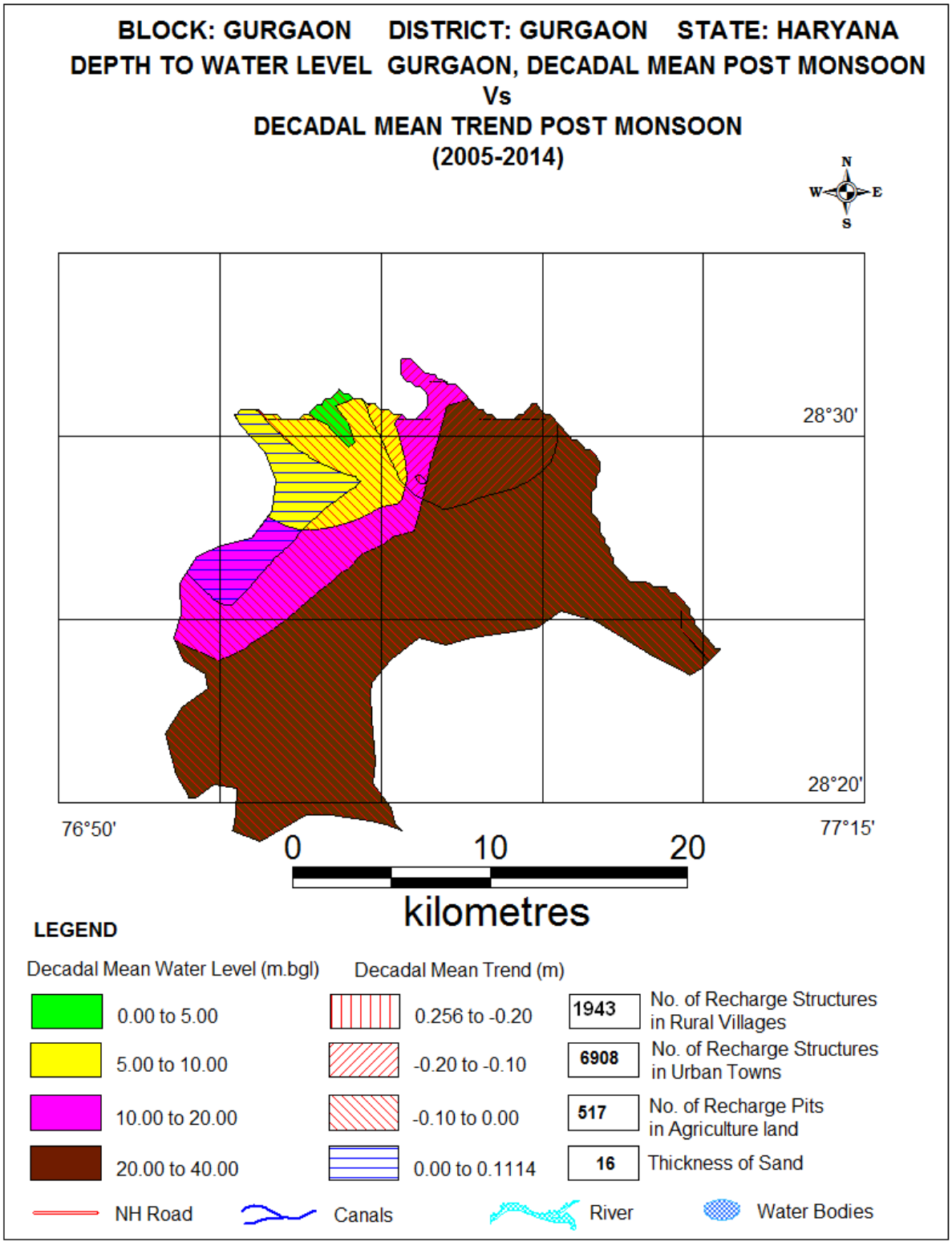
Ground Water Scenario of Block

Block Name :- Farukhnagar **District :-Gurgaon** **State :- Haryana**		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	*280.09*
	Number of Villages inhabited Un-inhabited	*53* *0*
	Average Annual Rainfall (mm)	*445*
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)	230.42
	Area Sown More than Once (Sq.Km)	--
	Total Irrigated Area (Sq.Km)	230.41
	Total UnIrrigated Area (Sq.Km)	1
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Younger alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	Pre- monsoon: (May 2015)	*10.07-35.01 (mbgl)*
	Post –monsoon: (Nov2014)	*4.92-33.20 (mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	No of wells drilled	*6*

	Depth Range (m)	*39.50-250.00*		
	Discharge (lpm)	*48-910-1-40*		
	Aquifer Parameters			
	Transmissivity (m2/day)	*204-593*		
	Storativity	------		
	Soil infiltration rate mm/ hour	--		
		Min	*Max*	*Avg.*
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*1565*	*10320*	
	• NO3 (mg/l)	*13*	*284*	
	• F (mg/l)	*0.16*	*4.35*	
	• Fe (mg/l)	-	-	
	• As (mg/l)	-	-	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	36.97		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	83.98		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	1.78		
	• Existing Gross Ground Water Draft for all Uses (MCM)	85.76		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	1.78		
	• Net Ground Water Availability for Future Irrigation Development	-48.79		

	(MCM)		
	• Stage of Ground Water Development / Over Draft (%)	232	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *21*	Percentage % 42
10	Volume of unsaturated zone available for recharge (MCM)	577	
11.	Volume of water required for recharge (MCM)	767	
12.	Volume of surplus water available for recharge(MCM)	6.86	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@Rs. 35000/-	810	2.835	1.802
14	RWH Rural @ Rs. 25000/-	2166	5.415	0.126
15	RWH Urban@ Rs. 25000/-	253	0.6325	0.018
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2861	14.31	2.86
	TOTAL		23.1925	4.806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DEPTH TO WATER LEVEL GURGAON, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)
N
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28°30'
28°20'
76°50'
77°15'
0
10
20
kilometres
LEGEND
Decadal Mean Water Level (m.bgl)
0.00 to 5.00
5.00 to 10.00
10.00 to 20.00
20.00 to 40.00
Decadal Mean Trend (m)
0.256 to -0.20
-0.20 to -0.10
-0.10 to 0.00
0.00 to 0.1114
1943
No. of Recharge Structures in Rural Villages
6908
No. of Recharge Structures in Urban Towns
517
No. of Recharge Pits in Agriculture land
16
Thickness of Sand
NH Road
Canals
River
Water Bodies

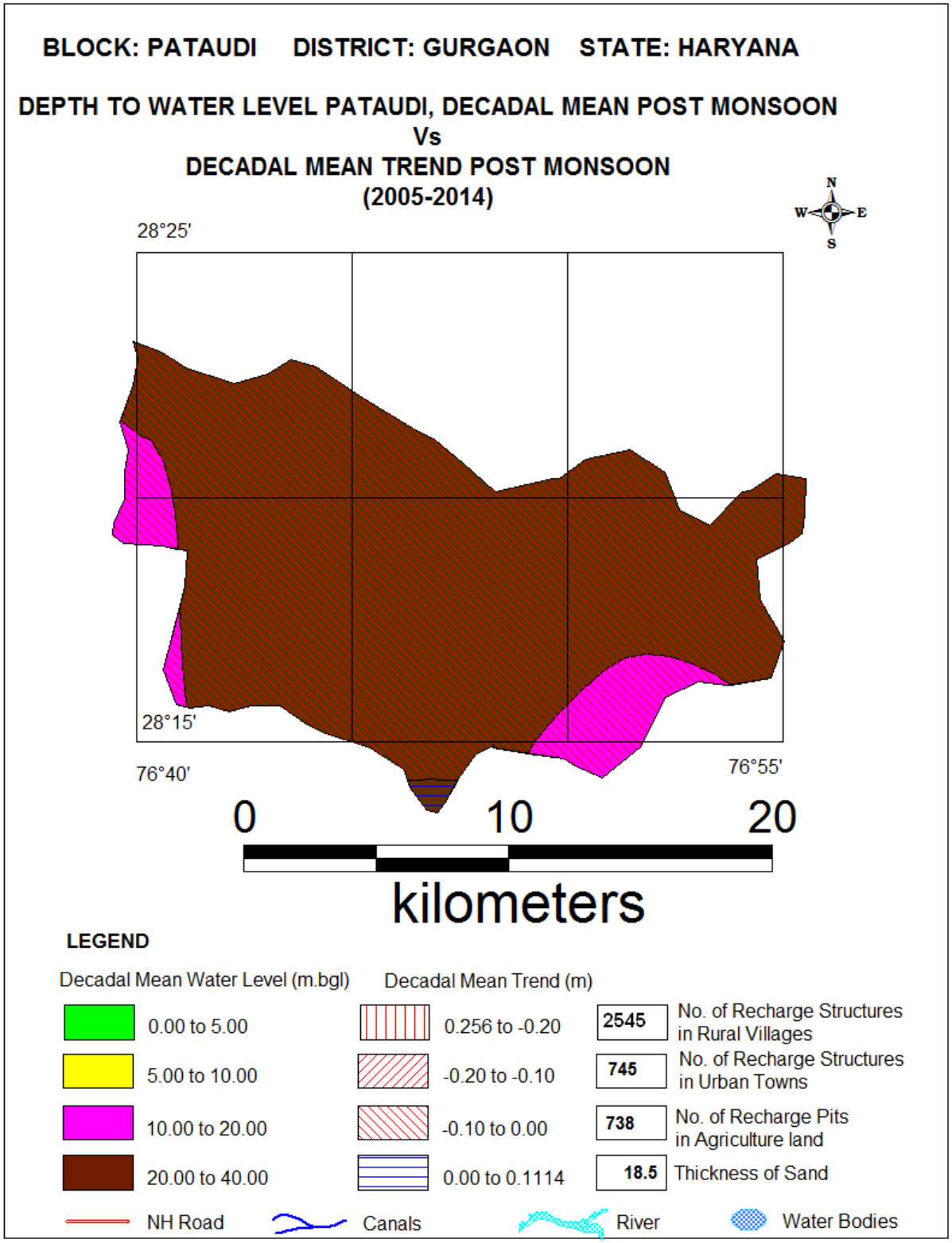
Ground Water Scenario of Block

Block Name:- Gurgaon **District :- Gurgaon** **State :- Haryana**		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	*354.62*
	Number of Villages inhabited Un-inhabited	*35* *0*
	Average Annual Rainfall (mm)	*710*
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)	116.09
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	103.28
	• Total UnIrrigated Area (Sq.Km)	12.81
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Younger alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	*39.89-39.89(mbgl)*
	• Post –monsoon: (Nov2014)	*37.37-38.12(mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*19*
	• Depth Range (m)	*39.50-250.00*
	• Discharge (Ipm)	*48-910-1-40*

	Aquifer Parameters			
	• Transmissivity (m2/day)	*204-593*		
	• Storativity	------		
	• Soil infiltration rate mm/ hour	--		
		Min	*Max*	*Avg.*
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*928*	*1436*	
	• NO3 (mg/l)	*85*	*89*	
	• F (mg/l)	*0.16*	*1.48*	
	• Fe (mg/l)	*0.00*	*0.85*	
	• As (mg/l)	*0.0021*	*0.0061*	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	75.85		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	62.48		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	171.28		
	• Existing Gross Ground Water Draft for all Uses (MCM)	233.76		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	171.28		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-157.91		
	• Stage of Ground Water Development / Over Draft (%)	308		
	• Category of Block	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in	*Extensive Irrigation*		

	ground water level		
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *16*	Percentage % 32
10	Volume of unsaturated zone available for recharge (MCM)	730	
11.	Volume of water required for recharge (MCM)	971	
12.	Volume of surplus water available for recharge(MCM)	8.68	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@Rs. 35000/-	517	1.8095	4.76
14	RWH Rural @ Rs. 25000/-	1943	4.8575	0.113
15	RWH Urban@ Rs. 25000/-	6908	17.27	0.775
16	Underground pipe line (area in hectares) @ Rs. 50000/-	1401	7.0	2.13
	TOTAL		30.937	7.778


BLOCK: PATAUDI DISTRICT: GURGAON STATE: HARYANA
DEPTH TO WATER LEVEL PATAUDI, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)
N
W
E
S
28°25'
28°15'
76°40'
76°55'
0
10
20
kilometers
LEGEND
Decadal Mean Water Level (m.bgl)
0.00 to 5.00
5.00 to 10.00
10.00 to 20.00
20.00 to 40.00
Decadal Mean Trend (m)
0.256 to -0.20
-0.20 to -0.10
-0.10 to 0.00
0.00 to 0.1114
2545
No. of Recharge Structures in Rural Villages
745
No. of Recharge Structures in Urban Towns
738
No. of Recharge Pits in Agriculture land
18.5
Thickness of Sand
NH Road
Canals
River
Water Bodies

Ground Water Scenario of Block

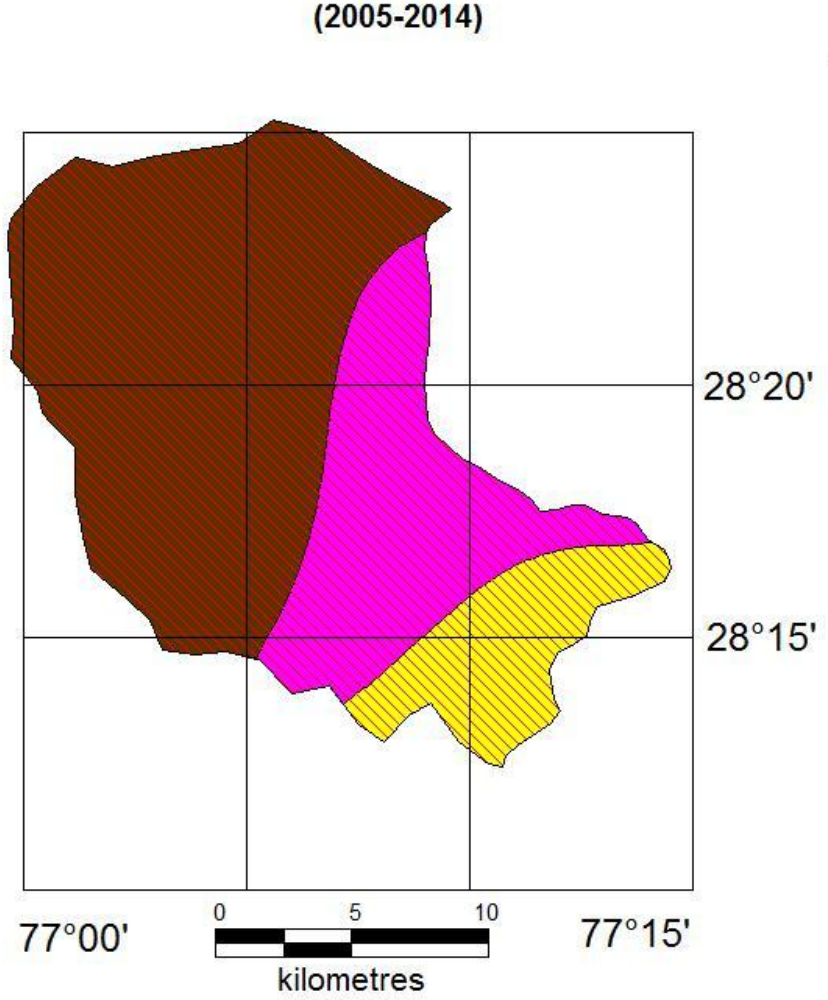
Block Name :- Pataudi **District :-Gurgaon** **State :- Haryana**		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	*275.61*
	Number of Villages inhabited Un-inhabited	*80* *0*
	Average Annual Rainfall (mm)	*610*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ganga* *Yamuna*
3.	LAND USE	
	• Current fallows (Sq.Km	1
	• Net Area Sown (Sq.Km)	213.12
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	209.92
	• Total UnIrrigated Area (Sq.Km)	3.20
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Younger alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	*18.09-35.84 (mbgl)*
	• Post –monsoon: (Nov2014)	*18.33-35.60(mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	

	• No of wells drilled	*11*		
	• Depth Range (m)	*39.50-250.00*		
	• Discharge (Ipm)	*48-910-1-40*		
	Aquifer Parameters			
	• Transmissivity (m2/day)	*204-593*		
	• Storativity	------		
	• Soil infiltration rate mm/ hour	--		
		Min	*Max*	*Avg.*
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*638*	*2033*	
	• NO3 (mg/l)	*33*	*131*	
	• F (mg/l)	*0.46*	*2.44*	
	• Fe (mg/l)	*0.1*	*0.33*	
	• As (mg/l)	*0.0033*	*0.0057*	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	75.72		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	120.11		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	4.38		
	• Existing Gross Ground Water Draft for all Uses (MCM)	124.49		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	4.38		
	• Net Ground Water Availability for Future	-48.77		

	Irrigation Development (MCM)		
	• Stage of Ground Water Development / Over Draft (%)	164	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m) 18.50*	Percentage % 37
10	Volume of unsaturated zone available for recharge (MCM)	568	
11.	Volume of water required for recharge (MCM)	755	
12.	Volume of surplus water available for recharge(MCM)	6.75	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@Rs. 35000/-	738	2.583	6.539
14	RWH Rural @ Rs. 25000/-	2545	6.3625	0.148
15	RWH Urban@ Rs. 25000/-	745	1.8625	0.073
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3140	15.7	4.09
	TOTAL		**26.508**	**10.85**

BLOCK: SOHNA DISTRICT: GURGAON STATE: HARYANA
DEPTH TO WATER LEVEL SOHNA, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)



LEGEND

Decadal Mean Water Level (m.bgl)	Decadal Mean Trend (m)		
0.00 to 5.00	0.256 to -0.20	2118	No. of Recharge Structures in Rural Villages
5.00 to 10.00	-0.20 to -0.10	1293	No. of Recharge Structures in Urban Towns
10.00 to 20.00	-0.10 to 0.00	852	No. of Recharge Pits in Agriculture land
20.00 to 40.00	0.00 to 0.1114	NA	Thickness of Sand

NH Road Canals River Water Bodies

Ground Water Scenario of Block

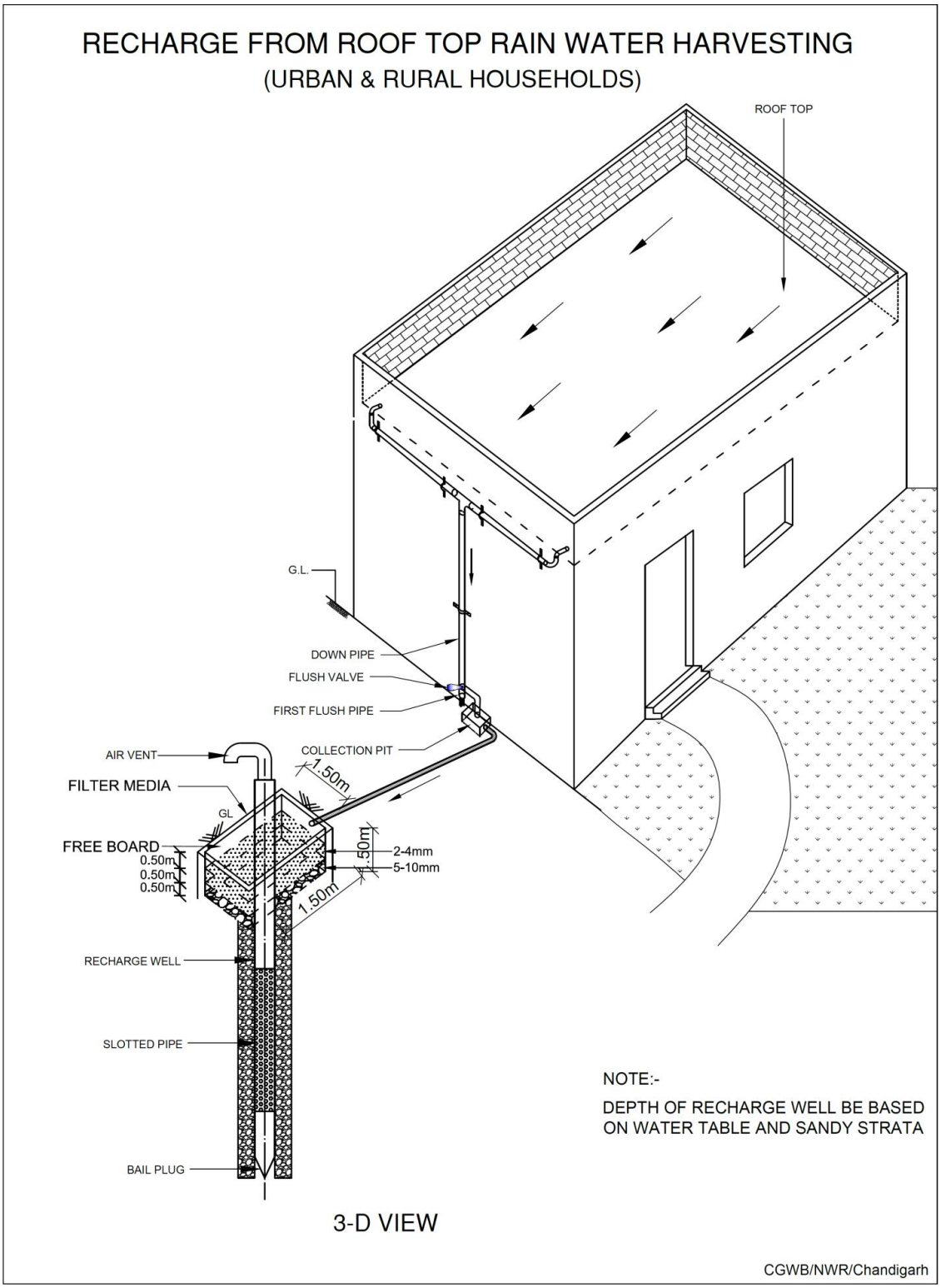
Block Name :- Sohna **District :-Gurgaon** **State :- Haryana**		
1.	GENERAL INFORMATION	
	Geographical area (sq km)	*339.01*
	• Number of Villages inhabited • Un-inhabited	*72* *0*
	Average Annual Rainfall mm	*485*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ganga* *Yamuna*
3.	LAND USE	
	• Current fallows (Sq.Km	15.22
	• Net Area Sown (Sq.Km)	169.73
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	166.61
	• Total UnIrrigated Area (Sq.Km)	3.12
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Younger alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	---------- *(mbgl)*
	• Post –monsoon: (Nov2014)	----------*(mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*6*
	• Depth Range (m)	*39.50-250.00*

	• Discharge (Ipm)	*48-910-1-40*		
	Aquifer Parameters			
	• Transmissivity (m2/day)	*204-593*		
	• Storativity	------		
	• Soil infiltration rate mm/ hour	--		
		Min	*Max*	*Avg.*
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	-	-	
	• NO3 (mg/l)	-	-	
	• F (mg/l)	-	-	
	• Fe (mg/l)	-	-	
	• As (mg/l)	-	-	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	51.94		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	96.09		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	4.08		
	• Existing Gross Ground Water Draft for all Uses (MCM)	100.17		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	4.08		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-48.23		
	• Stage of Ground Water Development / Over Draft (%)	193		
	• Category of Block	OE		

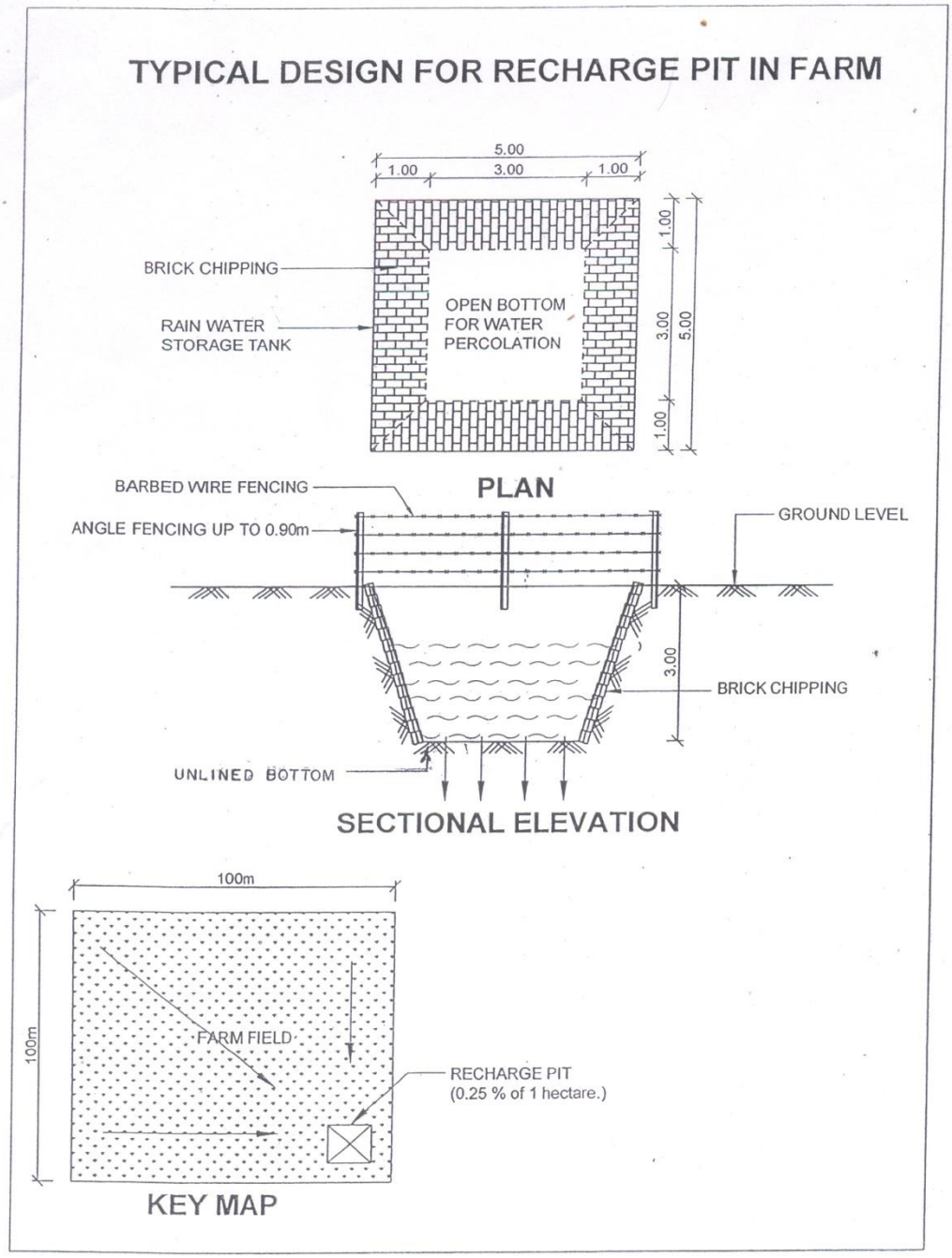
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* --	Percentage % --
10	Volume of unsaturated zone available for recharge (MCM)	698	
11.	Volume of water required for recharge (MCM)	929	
12.	Volume of surplus water available for recharge(MCM)	8.3	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@Rs. 35000/-	852	2.98	1.592
14	RWH Rural @ Rs. 25000/-	2118	5.295	0.123
15	RWH Urban@ Rs. 25000/-	1293	3.2325	0.077
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2099	10.49	3.27
	TOTAL		21.9975	5.062

Annexure-I


RECHARGE FROM ROOF TOP RAIN WATER HARVESTING
(URBAN & RURAL HOUSEHOLDS)
ROOF TOP
G.L.
DOWN PIPE
FLUSH VALVE
FIRST FLUSH PIPE
COLLECTION PIT
AIR VENT
FILTER MEDIA
GL
FREE BOARD
0.50m
0.50m
0.50m
1.50m
1.50m
1.50m
2-4mm
5-10mm
RECHARGE WELL
SLOTTED PIPE
BAIL PLUG
NOTE:-
DEPTH OF RECHARGE WELL BE BASED ON WATER TABLE AND SANDY STRATA
3-D VIEW
CGWB/NWR/Chandigarh

AnnexureII


TYPICAL DESIGN FOR RECHARGE PIT IN FARM
5.00
1.00
3.00
1.00
BRICK CHIPPING
RAIN WATER STORAGE TANK
OPEN BOTTOM FOR WATER PERCOLATION
1.00
3.00
5.00
1.00
PLAN
BARBED WIRE FENCING
ANGLE FENCING UP TO 0.90m
GROUND LEVEL
3.00
BRICK CHIPPING
UNLINED BOTTOM
SECTIONAL ELEVATION
100m
100m
FARM FIELD
RECHARGE PIT
(0.25 % of 1 hectare.)
KEY MAP