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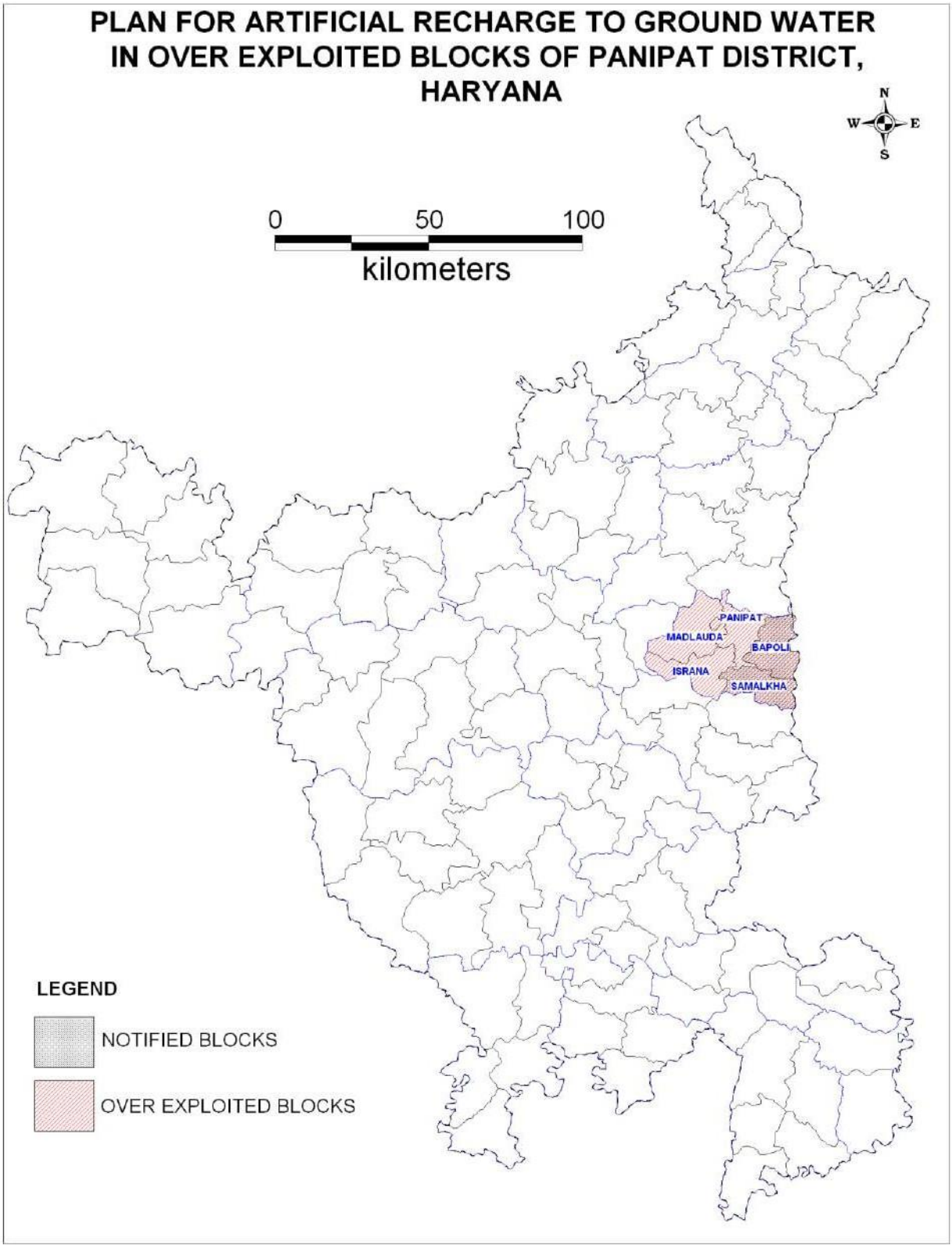
Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Board

PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN OVEREXPLOITED BLOCKS OF

PANIPAT DISTRICT, HARYANA

Central Ground Water Board
North Western Region
Chandigarh


PLAN FOR ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS OF PANIPAT DISTRICT, HARYANA
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50
100
kilometers
PANIPAT
MADLAUDA
BAPOLI
ISRANA
SAMALKHA
LEGEND
NOTIFIED BLOCKS
OVER EXPLOITED BLOCKS

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

INTRODUCTION

Administratively, the district is under control of Rohtak division and is divided into five development blocks i.e. Panipat, Bapoli, Samalkha, Madlauda and Israna. Panipat district has 12 towns and 186 villages with a total population of 12,02,811 as per 2011 census.

HYDROMETEOROLOGY

The climate of the district can be classified as tropical and dry sub humid. The normal annual rainfall is about 680 mm which is spread over 31 rainy days. 77% of rainfall occurs during south-west monsoon.

GEOMORPHOLOGY

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

HYDROGEOLOGY:

The district is occupied by geological formations of Quaternary age comprising of recent alluvial deposits belonging to the vast Gangetic alluvial plains. The Central Ground Water Board has drilled 08 exploratory boreholes in the depth range of 103 to 460 m and 35

piezometers in the depth range of 33 to 348 m and 01 Slim Hole to delineate and determine potential aquifer zones, evaluation of aquifer characteristics, behavior of water levels etc. Besides, also constructed 04 PZs through outsourcing by M/s WAPCOS Ltd.

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

Depth to water level in the district ranges from 2.51 in Madlauda Block to 84.00 m bgl in Samalkha Block during pre-monsoon (May,2015) period and 1.31 mbgl to 33.80 mbgl during post-monsoon period 2014. In major part of the district water level ranges between 10 m to 20 m bgl and spreads in part of Samalkha, Bapoli, Panipat, Madlauda and Israna blocks. The ground water levels more than 20m bgl has been recorded in part of Samalkha and Bapoli Blocks. The shallow water level in the depth range of 3 m to 5 m bgl spreads in part of Madlauda and Israna Blocks. The water logging conditions exists in South Eastern part of Madlauda block. During post monsoon period the area under water table of depth range more than 20 m bgl gets spreads covering parts of Samalkha and Bapoli Pundri Blocks. Besides, the water logging condition is also gets spreads in parts of Madlauda and Israna blocks.

Long-term net change of water levels during the period 2005-2014 reflected by ground water hydrograph indicates declining water level trend which may be due to over - exploitation of ground water. The rate of decline varies from 0.2 m/yr to 0.10 m/yr during premonsoon and from 0.1 to 0 m/yr during postmonsoon. The overall flow of ground water is towards south- west direction.

GROUND WATER QUALITY:

Chemical data of ground water from shallow aquifer indicates that ground water is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are generally less than 3000 µS/cm at 25^{o}C and ranges from 495 to 2685 µS/cm at 25^{o}C . Generally it is suitable for drinking purposes as chemical parameters are well within the permissible limits for safe drinking water set by Bureau of Indian standard (BIS). The fluoride concentration ranges from 0.2 to 7.52 mg/l. It is found to be higher than the permissible limit at Sink (5.33 mg/l) Khalila Majra (7.52 mg/l), Shahpur (1.58mg/l) & at Kharawas (4.92 mg/l). Iron concentration ranges from 0.28 in Samalkha Block to 1.23 mg/l in Madlauda Block and arsenic concentration ranges from 0.0014 in Samalkha Block to 0.0104 mg/l in Madlauda Block.

Type of water: Mg & Na-HCO3 type.

Ground water quality in Panipat City

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

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 163%. The ground water development in all the blocks of the district has exceeded the available recharge and thus all the blocks have been categorized as “over exploited”.

Net ground water availability of the district is 310.87 million cubic meters (mcm), ground water draft for all users is 506.44 mcm, whereas net ground water availability for future irrigation development is -19557 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	Panipat	2	127	2376	8389	5782	16676

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	Panipat	108	359	415	830	855	2567

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	Panipat	0	0	15046	1630	0	16676

Number of Irrigation tube wells with water distribution System

	Open Water Channel			
Sr.No	**District**	**Lined/pucca**	**Unlined/kutcha**	**Total**
1	Panipat	15075	4168	19243

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 x5mt x3mt 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 and 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.

A. POTENTIAL FOR REDUCTION IN OVERDRAFT AFTER RAINWATER HARVESTING AND ARTIFICIAL RECHARGE

Sr.no.	Type of Structure	No. of structures	Unit cost in Lakhs	Total cost of structure in Crores	Annual Recharge (MCM)
ROOF TOP RAIN WATER HARVESTING IN RURAL AND URBEN AREAS					
1	**Artificial Recharge Plan For Urban Areas.**	11376	0.25	28.44	**0.663**
2	**Roof Top Rain Water Harvesting in Rural Areas**	11891	0.25	29.73	**0.359**
	Total	**23267**	**0.25**	**58.17**	**1.022**
ARTIFICIAL RECHARGE IN FARMS					
3	**Artificial Recharge Plan Through Recharge Pits.**	9224	0.35	32.28	3.487
			Total	**90.45**	**4.509**

A1. ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF PANIPAT DISTRICT							
Block	**Town Name**	**Total Households**	**Total Population of Town**	**Households taken for AR 10%**	**Total Roof Top Area (200 sq.m) in cluster of 4-6 houses**	**Cost of recharge st @0.25lacs (Crores)**	**Vol of water available for recharge (MCM)**
1	3	2	3	4	5	6	7
PANIPAT	Panipat (M Cl + OG)	60905	295970	6091	1218100	15.2	0.355
PANIPAT	Kachrauli (1) (CT)	1074	5400	107	21480	0.3	0.006
PANIPAT	Kabri (18) (CT)	1393	7049	139	27860	0.3	0.008
PANIPAT	Sikanderpur (19) (CT)	1727	8894	173	34540	0.4	0.010
MADLAUDA	Asan Khurd (CT)	1511	6873	151	30220	0.4	0.009
PANIPAT	Panipat Taraf Ansar (CT)	8828	42877	883	176560	2.2	0.051
PANIPAT	Panipat Taraf Makhdum Zadgan (CT)	14066	67998	1407	281320	3.5	0.082
PANIPAT	Ugra Kheri(19) (CT)	4802	24440	480	96040	1.2	0.028
PANIPAT	Panipat Taraf Rajputan (CT)	5819	28803	582	116380	1.5	0.034
PANIPAT	Sec. 11&12 Part II (CT)	1773	8876	177	35460	0.4	0.010
PANIPAT	Kheri Nangal (131) (CT)	3738	18195	374	74760	0.9	0.022
SAMALKHA	Samalkha (MC + OG)	8128	39710	813	162560	2.0	0.047
			555085	**11376.4**	**2275280**	**28.4**	**0.663**

A2. ROOFROP RAINWATER HARVESTING IN RURAL AREAS OF PANIPAT DISTRICT

Name of District	Sr.no	Name of CD Block	Total area of the village (in hectares)	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.0.25 lakhs (Crores)
PANIPAT	1	Bapoli	**22435**	**22648**	**2265**	**2265**	**0.068**	**5.7**
	2	Israna	**27988**	**23542**	**2354**	**2354**	**0.071**	**5.9**
	3	Madluada	**33668**	**25170**	**2517**	**2517**	**0.076**	**6.3**
	4	Panipat	**15112**	**22202**	**2220**	**2220**	**0.067**	**5.6**
	5	Samalkha	**22005**	**25347**	**2535**	**2535**	**0.077**	**6.3**
		Total	**121208**	**118909**	**11891**	**11891**	**0.359**	**29.7**

A3. ARTIFICIAL RCEHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS OF PANIPAT 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 (1 recharge pit / hector) for 10% area	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall)	Cost of Pit (crores) @Rs.0.35 lakh
Bapoli	22435	22435000	2244	0.848	**7.9**
Israna	11850	11850000	1185	0.448	**4.1**
Madluada	15849	15849000	1585	0.599	**5.5**
Panipat	20104	20104000	2010	0.760	**7.0**
Samalkha	22005	22005000	2201	0.832	**7.7**
Total	92243	92243000	9225	3.487	**32.3**

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)

QUANTITATIVE IMPACT

Sr. no.	Total Draft (present) (mcm)	Overdraft (mcm)	Additional Recharge through 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	506.44	-195.57	4.509	501.931	163%	161.46%	1.54%

By the implementation of the proposed recharge structures there will be a reduction of 1.54% in stage of ground water development as tabulated below.

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 19243 tube wells operated by farmers for irrigation through unlined/Katcha 21.66% open channel system in Panipat district where water from the tube-well 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 Panipat district is estimated at 501.48 MCM. It is expected that around 13.26% 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 472 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks Panipat Districts. The measure if implemented will bring down the ground water overdraft from 204 MCM to 117 MCM. 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 tube wells 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 crops per drop**.

QUANTITATIVE REDUCTION IN OVERDRAFT AFTER ENHANCING GROUND WATER USE EFFICIENCY IN WATER DISTRIBUTION SYSTEM

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 0.25#)	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 ((Col8/Col1)X 100) (%)	Reduction in stage of development after constructing pucca canal (Col9-Col10) (%)
1	2	3	4	5	6	7	8	9	10	11
310.87	506.44	501.48	4.96	21.66	27.15	468.89	473.85	163	152.43	10.57

#losses from open kuchha channel are around 25%.

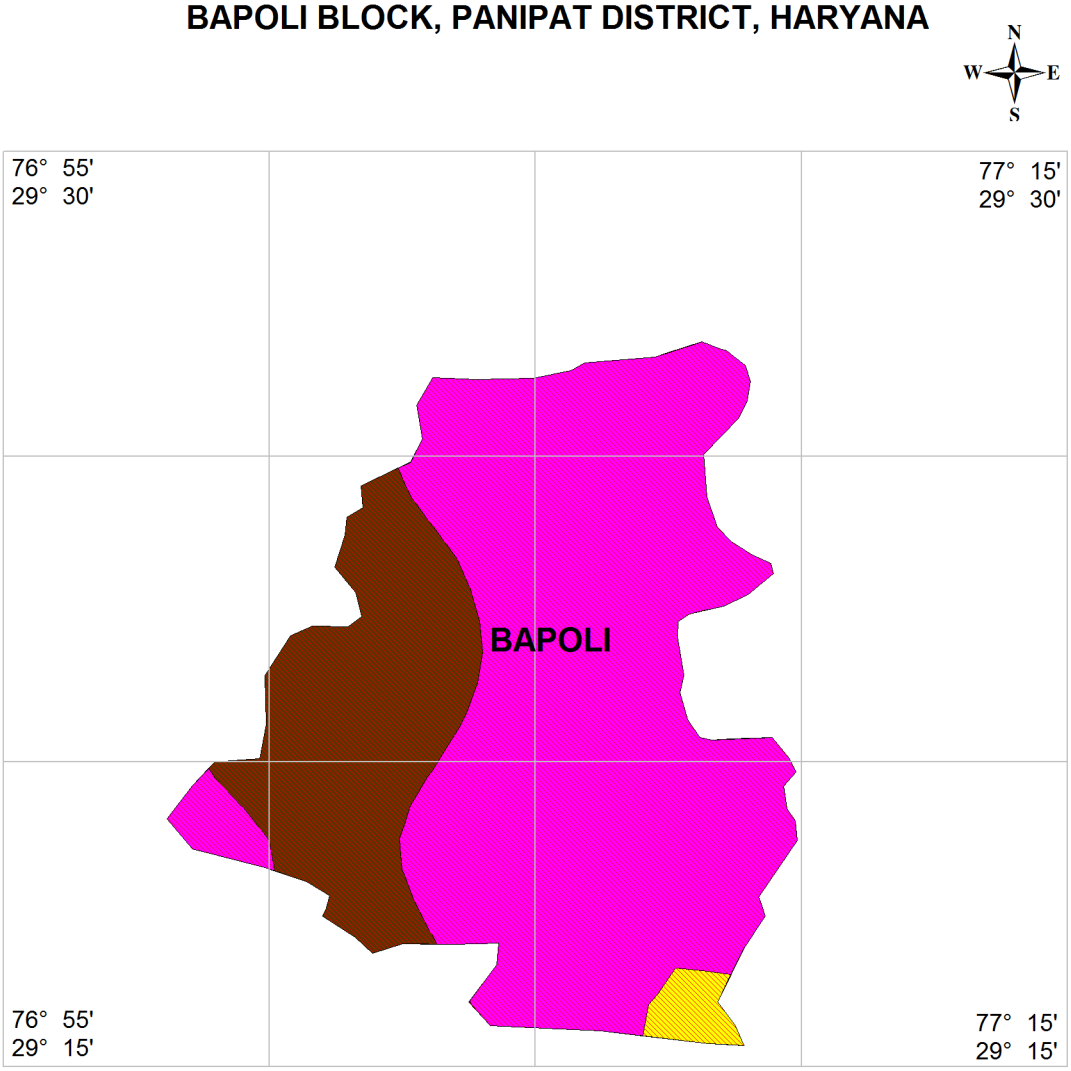
COST ESTIMATE OF UNDERGROUND PIPE LINE

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 (Col5*0.5)	Total Cost in Rs. Cr. District wise
1	2	3	4	5	6	7
Panipat	Bapoli	17716	21.66	3837	19.19	73.52
	Israna	8447	21.66	1830	9.15	
	Madlauda	15849	21.66	3433	17.16	
	Panipat	10212	21.66	2212	11.06	
	Samalkha	15659	21.66	3392	16.96	

BLOCK WISE PLAN OF DISTRICT PANIPAT HARYANA

(5 OE BLOCKS)

WATER LEVEL TREND, POST MONSOON (2005-2014)
Vs
MEAN DECADAL WATER LEVEL,POST MONSOON (2005-2014)
BAPOLI BLOCK, PANIPAT DISTRICT, HARYANA



LEGEND

Decadal Mean Water Level (mbgl)

- 5 to 10
- 10 to 20
- 20 to 40

Water Level Trend (m)

- -0.10 to 0.00

2265 No. of Recharge Structures in Rural Villages

2244 No. of Recharge Pits

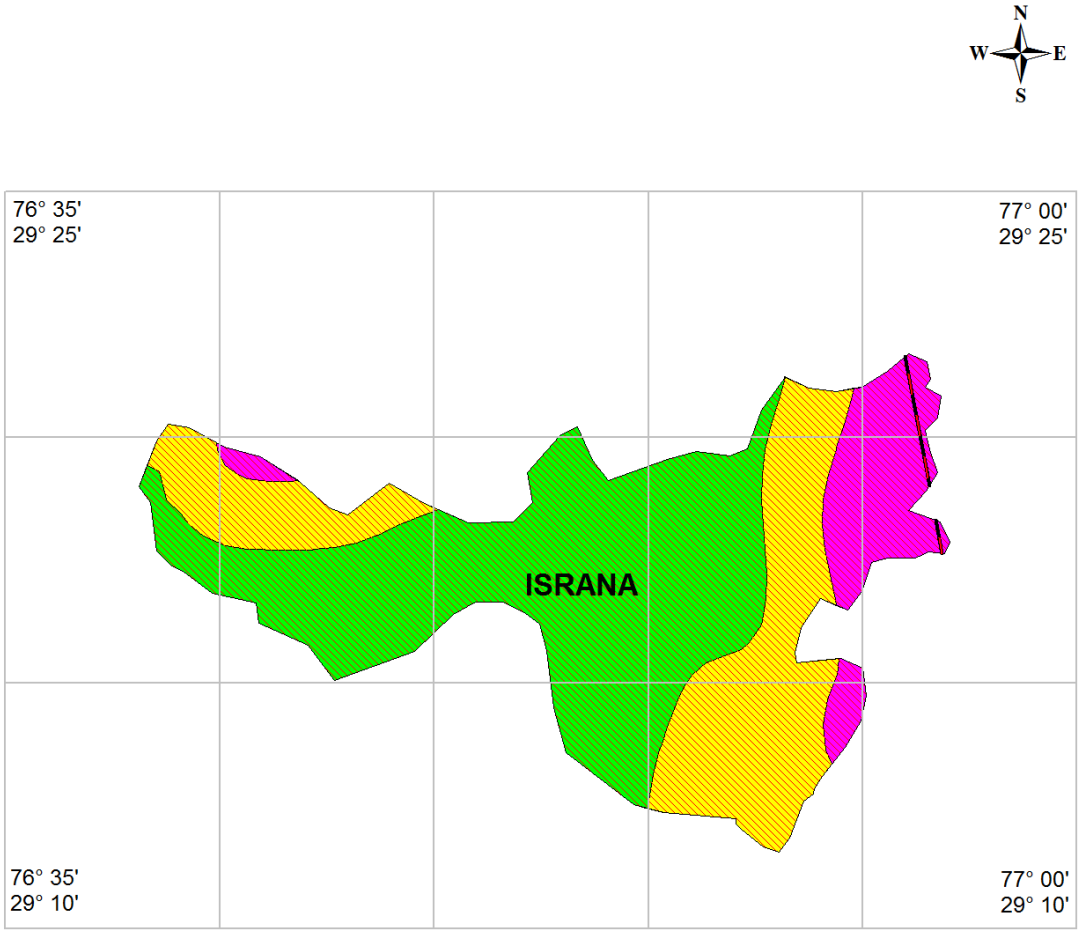
Ground Water Scenario of Block

	Block Name:- Bapoli **District :- Panipat** **State :- Haryana**	
	GENERAL INFORMATION	
	i) Geographical area (sq km)	*220.49*
	• Number of Villages inhabited • Un-inhabited	*49* --
	ii) Average Annual Rainfall (mm)	*680*
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)	179.99
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	179.99
	• Total UnIrrigated Area (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	*12.50-27.50(mbgl)*
	• Post –monsoon: (Nov2014)	*10.45-28.80 (mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*6*
	• Depth Range (m)	*69-462m*
	• Discharge (Ipm)	*4541lpm*
	Aquifer Parameters	
	• Transmissivity (m2/day)	*2340*

	• Storativity	*21.5* × 10^{-2}		
	• Soil infiltration rate *mm/hour*	*18*		
		Min.	Max	Avg.
		3	*72*	*18*
	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	--	--	
	• NO3 (mg/l)	--	--	
	• F (mg/l)	--	--	
	• Fe (mg/l)	--	--	
	• As (mg/l)	--	--	
	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	60.80		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	111.79		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	0.47		
	• Existing Gross Ground Water Draft for all Uses (MCM)	112.26		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	0.47		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-51.46		
	• Stage of Ground Water Development / Over Draft (%)	185		
	• Category of Block	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*		
	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *24*	Percentage % 48	
	Volume of unsaturated zone available for recharge (MCM)	247		

	Volume of water required for recharge (MCM)			329
	Volume of surplus water available for recharge(MCM)			3.02
RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	2244	7.9	0.848
14	RWH Rural @ Rs. 25000/-	2265	5.7	0.068
15	RWH Urban@ Rs. 25000/-	0	0	0
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3837	19.19	6.05
TOTAL			**32.79**	**6.966**

WATER LEVEL TREND, POST MONSOON (2005-2014)
Vs
MEAN DECADAL WATER LEVEL,POST MONSOON (2005-2014)
BLOCK ISRANA, PANIPAT DISTRICT, HARYANA



LEGEND

Decadal Mean Water Level (mbgl)

- 0 to 5
- 5 to 10
- 10 to 20
- 20 to 40

Water Level Trend (m)

- -0.10 to 0.00
- ROAD

2354 No. of Recharge Structures in Rural Villages

1185 No. of Recharge Pits

Ground Water Scenario of Block

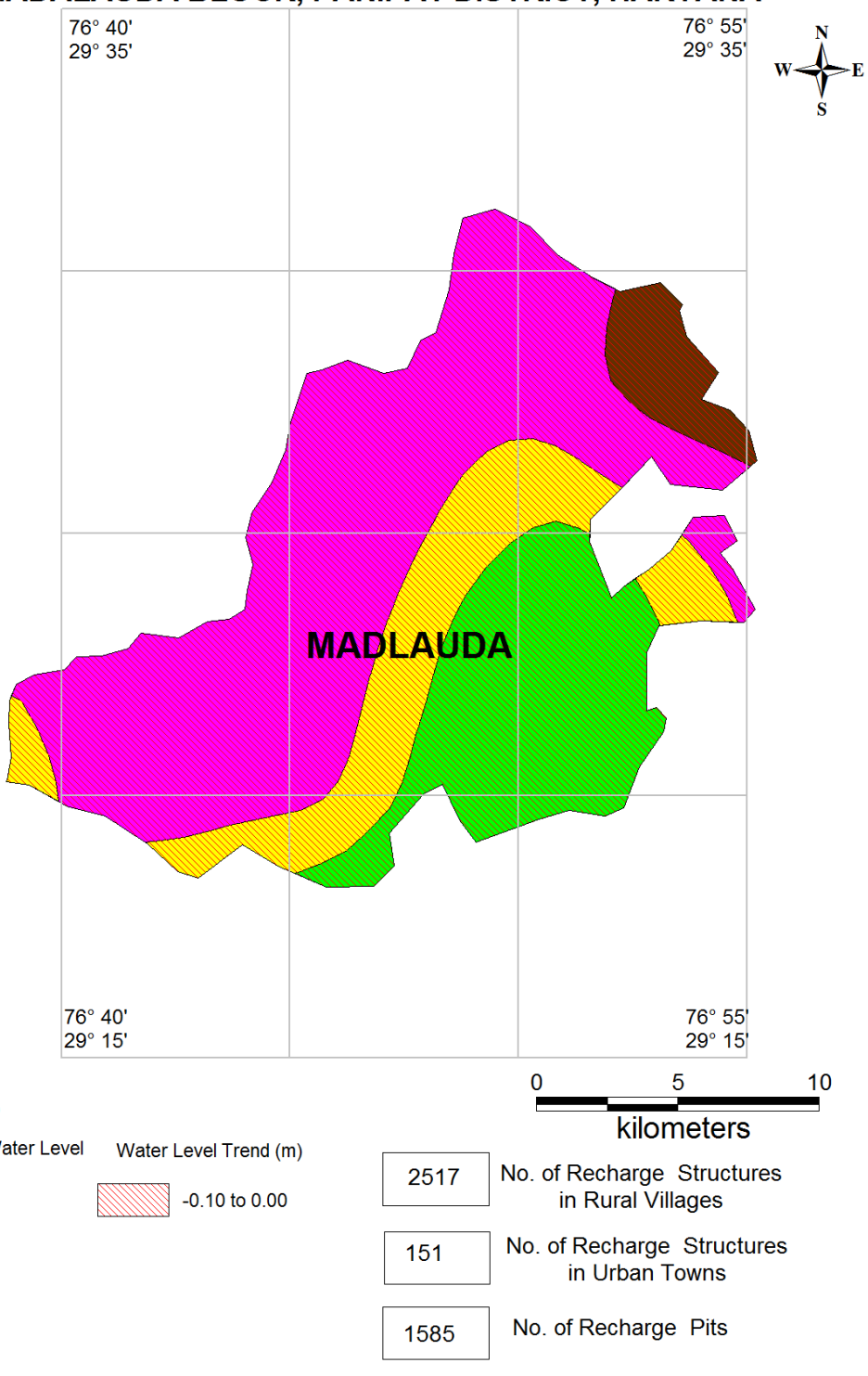
Block Name :- Israna **District :- Panipat** **State :- Haryana**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*283.98*
	• Number of Villages inhabited • Un-inhabited	*32* --
	ii) Average Annual Rainfall mm	*680*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ganga* *Yamuna*
3.	LAND USE	
	• Current fallows (Sq.Km	2.22
	• Net Area Sown (Sq.Km)	228.45
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	228.45
	• Total UnIrrigated Area (Sq.Km)	--
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)	*4.81-5.97 (mbgl)*

	• Post –monsoon: (Nov2014)	*3.10-9.12(mbgl)*		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)			
	• No of wells drilled	*6*		
	• Depth Range (m)	*69-462*		
	• Discharge (Ipm)	*4541*		
	Aquifer Parameters			
	• Transmissivity (m2/day)	*2340*		
	• Storativity	*21.5* × 10^{-2}		
	• Soil infiltration rate m*m/hour*	*18*		
		Min	*Max*	*Avg.*
		3	*72*	*18*
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*1145*	*2685*	
	• NO3 (mg/l)	*3.62*	*18*	
	• F (mg/l)	*0.48*	*7.52*	
	• Fe (mg/l)	*0*	*0.29*	
	• As (mg/l)	*0.0021*	*0.02949*	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	6991		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	86.17		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply	0.18		

	(MCM)		
	• Existing Gross Ground Water Draft for all Uses (MCM)	86.37	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	0.18	
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-16.46	
	• Stage of Ground Water Development / Over Draft (%)	124	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	*Extensive Irrigation*
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *25*	Percentage % 50
10	Volume of unsaturated zone available for recharge (MCM)	319	
11.	Volume of water required for recharge (MCM)	424	
12.	Volume of surplus water	3.88	

	available for recharge(MCM)			
RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	1185	4.1	0.448
14	RWH Rural @ Rs. 25000/-	2354	5.9	0.071
15	RWH Urban@ Rs. 25000/-	0	0	0
16	Underground pipe line (area in hectares) @ Rs. 50000/-	1830	9.15	4.67
TOTAL			**19.15**	**5.189**

WATER LEVEL TREND, POST MONSOON (2005-2014)
Vs
MEAN DECADAL WATER LEVEL,POST MONSOON (2005-2014)
MADALAUDA BLOCK, PANIPAT DISTRICT, HARYANA



LEGEND

Decadal Mean Water Level (m bgl)

- 0 to 5
- 5 to 10
- 10 to 20
- 20 to 40

Water Level Trend (m)

- -0.10 to 0.00

2517	No. of Recharge Structures in Rural Villages
151	No. of Recharge Structures in Urban Towns
1585	No. of Recharge Pits

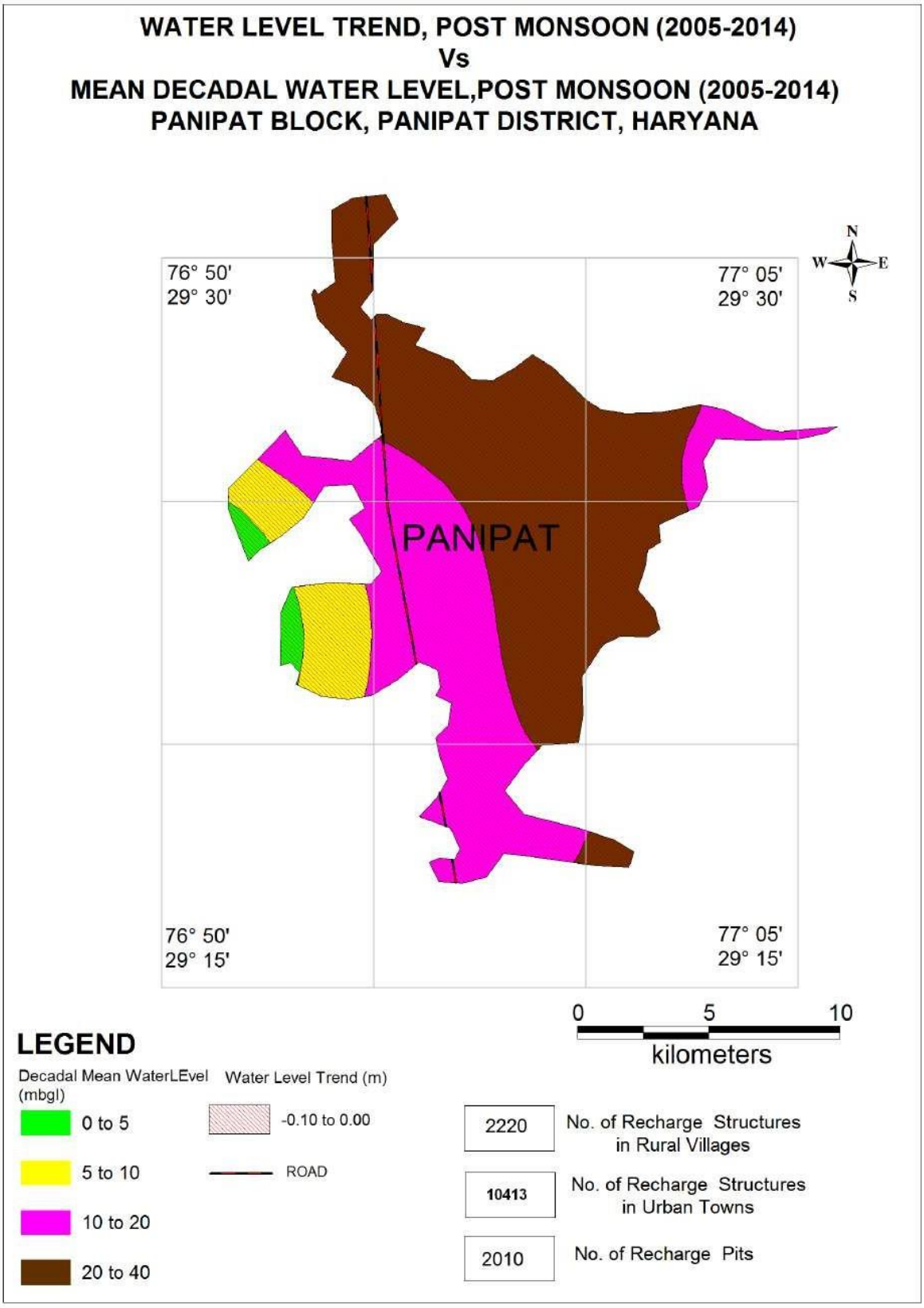
Ground Water Scenario of Block

Block Name :- Madlauda **District :- Panipat** **State :- Haryana**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*342.87*
	• Number of Villages inhabited • Un-inhabited	*35* --
	ii) Average Annual Rainfall (mm)	*680*
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)	263.08
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	263.08
	• Total UnIrrigated Area (Sq.Km)	--
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)	*2.51-12.52(mbgl)*
	• Post –monsoon: (Nov2014)	*1.31-14.30 (mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*8*
	• Depth Range (m)	*69-462*
	• Discharge (lpm)	*4541*

	Aquifer Parameters			
	• Transmissivity (m2/day)	*2340*		
	• Storativity	*21.5* × 10^{-2}		
	• Soil infiltration rate *mm/hour*	*18*		
		Min.	*Max*	*Avg.*
		3	*72*	*18*
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*790*	*2105*	
	• NO3 (mg/l)	*5.29*	*5.76*	
	• F (mg/l)	*0.13*	*18*	
	• *Fe (mg/l)*	--	*1.23*	
	• As (mg/l)	*0.0047*	*0.0138*	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	75.01		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	101.76		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	0.29		
	• Existing Gross Ground Water Draft for all Uses (MCM)	102.05		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	0.29		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-27.04		
	• Stage of Ground Water Development / Over Draft (%)	136		
	• 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)* *15.7*	Percentage % 31.4	

10	Volume of unsaturated zone available for recharge (MCM)	385
11.	Volume of water required for recharge (MCM)	512
12.	Volume of surplus water available for recharge(MCM)	4.69

RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	1585	5.5	0.599
14	RWH Rural @ Rs. 25000/-	2517	6.3	0.076
15	RWH Urban@ Rs. 25000/-	151	0.4	0.009
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3433	17.16	5.51
TOTAL			**29.36**	**6.194**


WATER LEVEL TREND, POST MONSOON (2005-2014)
Vs
MEAN DECADAL WATER LEVEL,POST MONSOON (2005-2014)
PANIPAT BLOCK, PANIPAT DISTRICT, HARYANA
76° 50'
29° 30'
77° 05'
29° 30'
N
W
E
S
PANIPAT
76° 50'
29° 15'
77° 05'
29° 15'
0
5
10
kilometers
LEGEND
Decadal Mean WaterLEvel (mbgl)
0 to 5
5 to 10
10 to 20
20 to 40
Water Level Trend (m)
-0.10 to 0.00
ROAD
2220
No. of Recharge Structures in Rural Villages
10413
No. of Recharge Structures in Urban Towns
2010
No. of Recharge Pits

Ground Water Scenario of Block

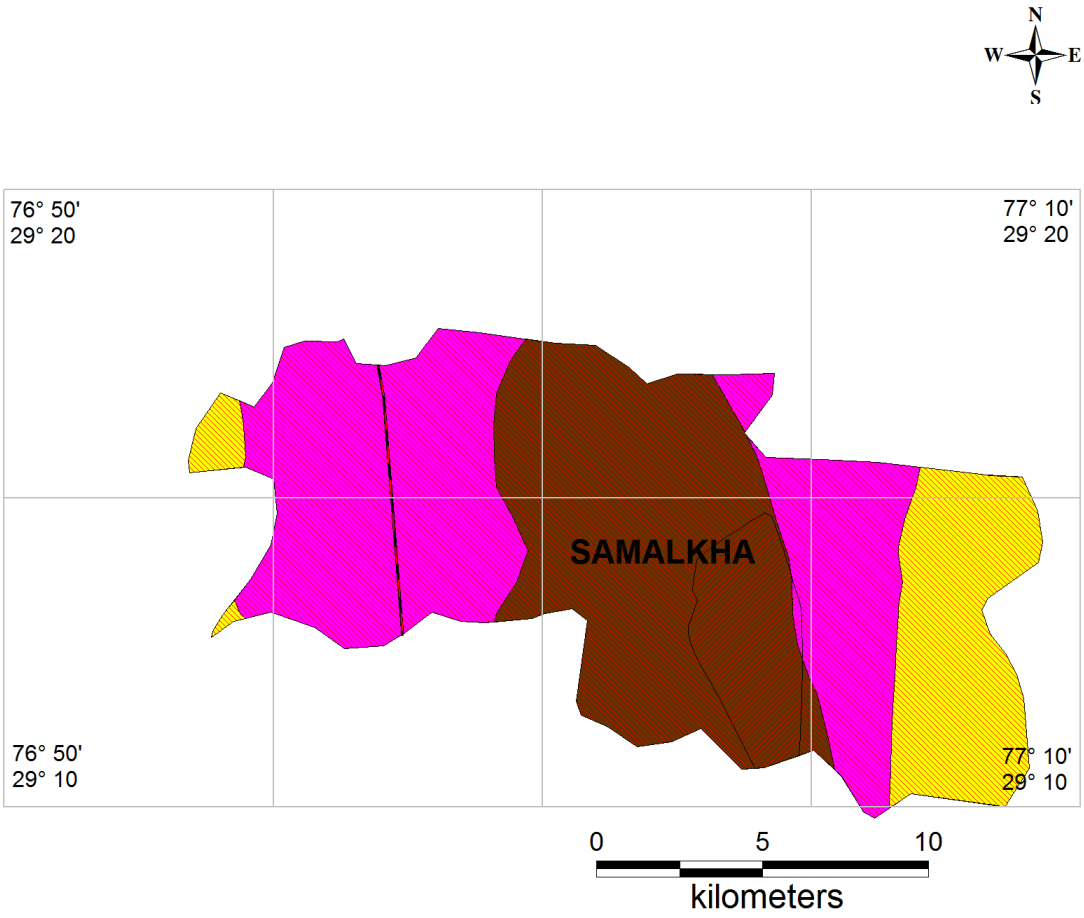
Block Name :- Panipat **District :- Panipat** **State :- Haryana**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*204.97*
	• Number of Villages inhabited • Un-inhabited	*34* *--*
	ii) Average Annual Rainfall (mm)	*680*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ganga* *Yamuna*
3.	LAND USE	
	• Current fallows (Sq.Km	3.38
	• Net Area Sown (Sq.Km)	118.35
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	118.35
	• Total UnIrrigated Area (Sq.Km)	0
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)	*15.52-18.00 (mbgl)*
	• Post –monsoon: (Nov2014)	*13.00-13.05 (mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*12*
	• Depth Range (m)	*69-462*
	• Discharge (lpm)	*4541*

	Aquifer Parameters			
	• Transmissivity (m2/day)	*2340*		
	• Storativity	*21.5* × 10^{-2}		
	• Soil infiltration rate *mm/hour*	*18*		
		Min	*Max*	*Avg.*
		3	*72*	*18*
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*605*		
	• NO3 (mg/l)	--	--	
	• F (mg/l)	*1.07*	--	
	• Fe (mg/l)	--	--	
	• As (mg/l)	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	60.28		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	104.27		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	3.28		
	• Existing Gross Ground Water Draft for all Uses (MCM)	107.55		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	3.28		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-47.27		
	• Stage of Ground Water Development / Over Draft (%)	178		
	• 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)* *19*	Percentage % 38	

10	Volume of unsaturated zone available for recharge (MCM)	230
11.	Volume of water required for recharge (MCM)	306
12.	Volume of surplus water available for recharge(MCM)	2.8

RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	2010	7.0	0.76
14	RWH Rural @ Rs. 25000/-	2220	5.6	0.067
15	RWH Urban@ Rs. 25000/-	10413	26.0	0.606
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2212	11.06	5.65
TOTAL			**49.66**	**7.083**

WATER LEVEL TREND, POST MONSOON (2005-2014)
Vs
MEAN DECADAL WATER LEVEL,POST MONSOON (2005-2014)
SAMALKHA BLOCK, PANIPAT DISTRICT, HARYANA



LEGEND

Decadal Mean Water Level (m bgl)

- 5 to 10
- 10 to 20
- 20 to 40

Water Level Trend (m)

- -0.20 to -0.10
- -0.10 to 0.00
- ROAD

2535	No. of Recharge Structures in Rural Villages
813	No. of Recharge Structures in Urban Towns
2201	No. of Recharge Pits

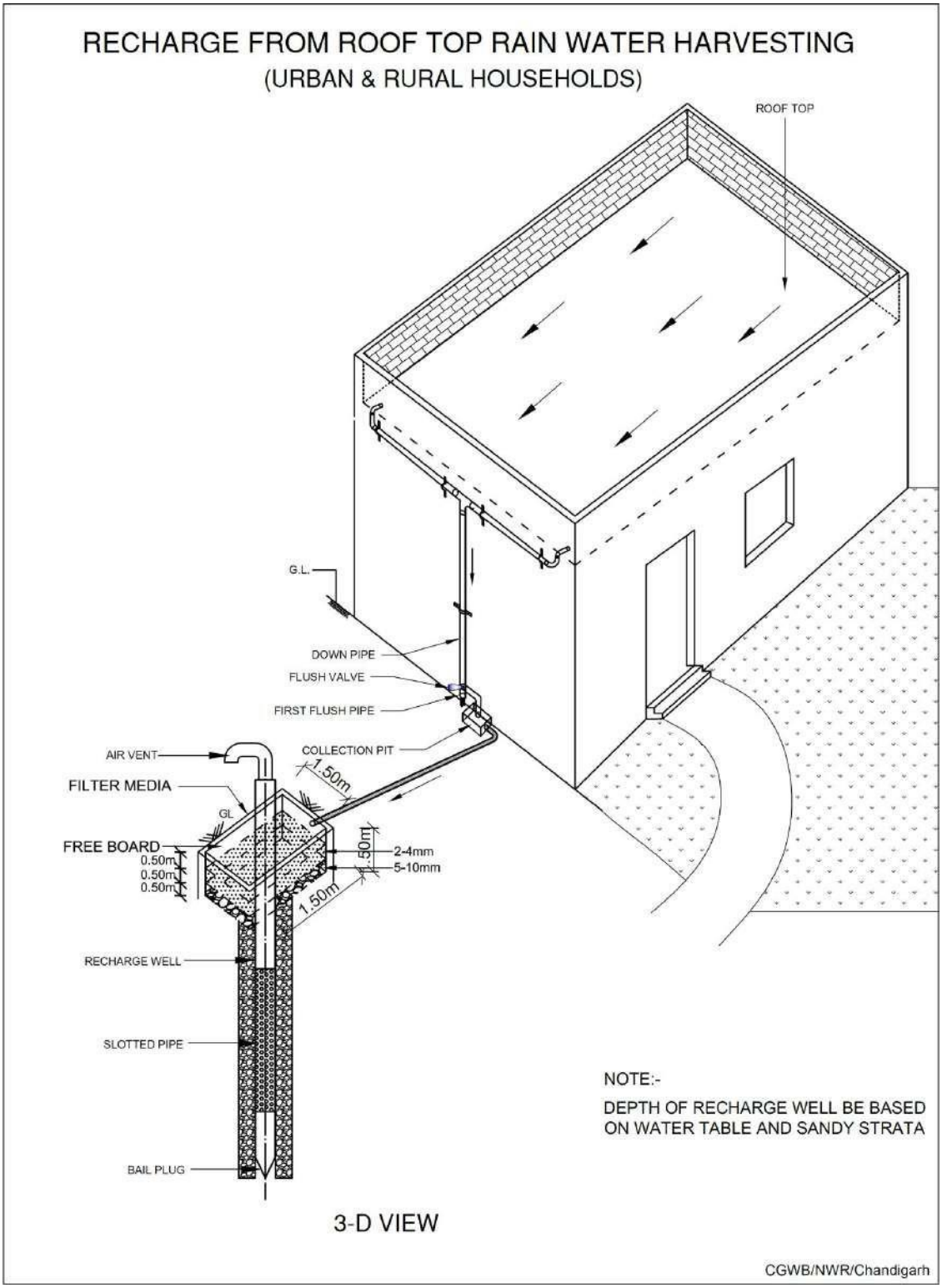
Ground Water Scenario of Block

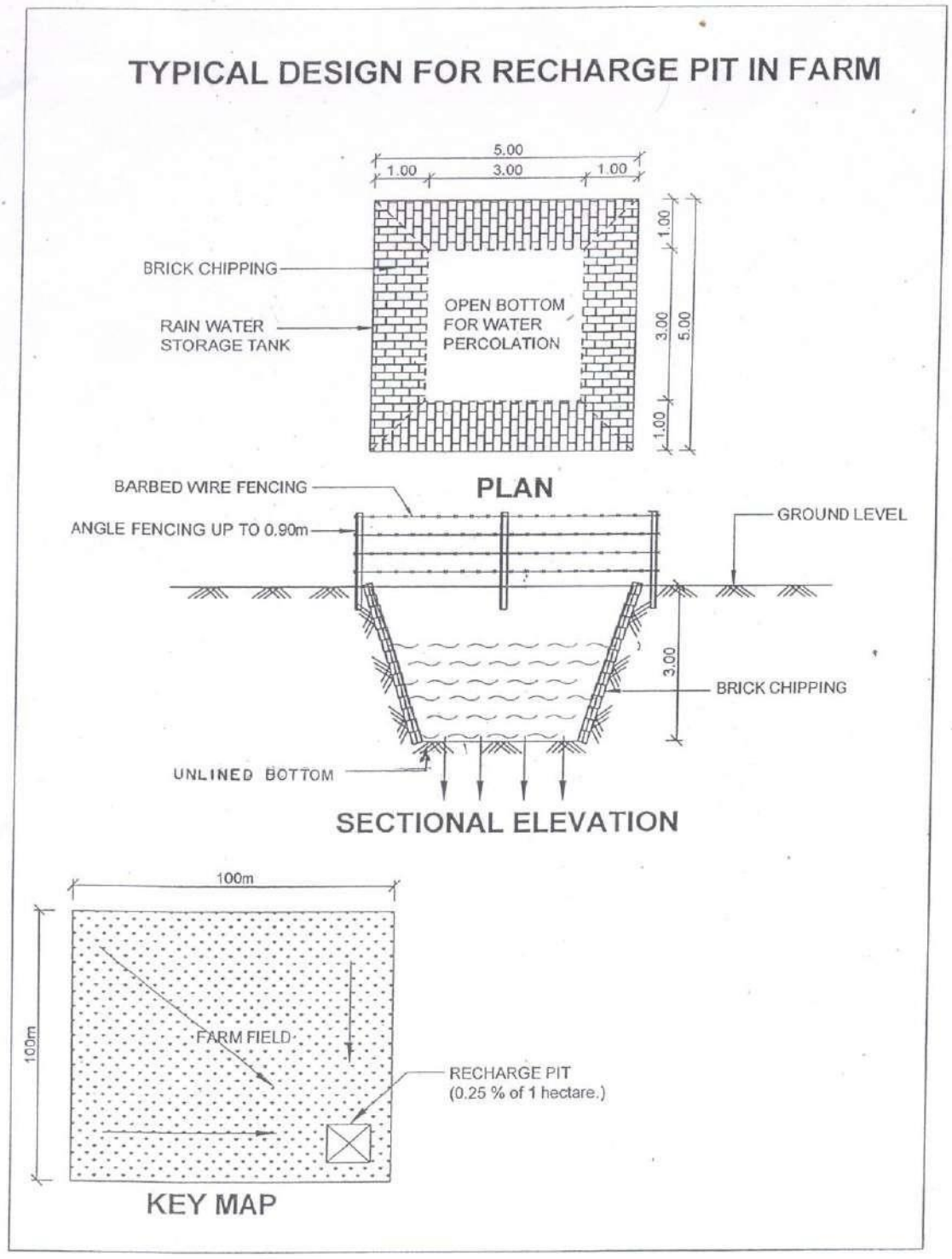
Block Name:- Samalkha **District :- Panipat** **State :- Haryana**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*197.57*
	• Number of Villages inhabited • Un-inhabited	*33* --
	ii) Average Annual Rainfall (mm)	*680*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ganga* *Yamuna*
3.	LAND USE	
	• Current fallows (Sq.Km	0
	• Net Area Sown (Sq.Km)	183.59
	• Area Sown More than Once (Sq.Km)	----
	• Total Irrigated Area (Sq.Km)	183.59
	• Total UnIrrigated Area (Sq.Km)	0
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)	*26.60-84.00 (mbgl)*
	• Post –monsoon: (Nov2014)	*9.95-33.80 (mbgl)*
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	*15*
	• Depth Range (m)	*69-462*
	• Discharge (Ipm)	*4541*
	Aquifer Parameters	
	• Transmissivity (m2/day)	*2340*

	• Storativity	*21.5* × 10^{-2}		
	• Soil infiltration rate *mm/hour*	*18*		
		Min	*Max*	*Avg.*
		3	*72*	*18*
7.	GROUND WATER QUALITY	Min	Max	
	• EC in µS/cm at 25^0c	*608*	*2500*	
	• NO3 (mg/l)	--	*2.39*	
	• F (mg/l)	*0.21*	*4.92*	
	• Fe (mg/l)	*0.28*	*0.41*	
	• As (mg/l)	*0.0014*	*0.003*	
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**		
	• Net Ground Water Availability (MCM)	60.28		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	104.27		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	3.28		
	• Existing Gross Ground Water Draft for all Uses (MCM)	107.55		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	3.28		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-47.27		
	• Stage of Ground Water Development / Over Draft (%)	178		
	• 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)* *18.4*	Percentage % 36	
10	Volume of unsaturated zone available	222		

	for recharge (MCM)	
11.	Volume of water required for recharge (MCM)	295
12.	Volume of surplus water available for recharge(MCM)	2.7

RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	2201	7.7	0.832
14	RWH Rural @ Rs. 25000/-	2535	6.3	0.077
15	RWH Urban@ Rs. 25000/-	813	2.0	0.047
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3392	16.96	5.28
TOTAL			**32.96**	**6.234**


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
1.50m
FILTER MEDIA
GL
FREE BOARD
0.50m
0.50m
0.50m
.50m
2-4mm
5-10mm
1.50m
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


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