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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 RUPNAGAR DISTRICT, PUNJAB

Central Ground Water Board
North Western Region
Chandigarh

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS DISTRICT RUPNAGAR PUNJAB

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT RUPNAGAR, PUNJAB

INTRODUCTION

Ropar district is located in the eastern part of the Punjab State and geographically lies between North latitudes of 76°19′00″ and 76°45′00″ and East longitudes of 30°44′00″ and 31°25′00″. The geographical extent of the area is 1440 sq.km. The area is bounded by Himachal Pradesh in the north and north east, Rupnagar, Nawanshahr and Ludhiana district in the west, Fatehgarh Sahib district in the South and Mohali district in the south east. Administratively the new Ropar district is divided into four tehsils – Rupnagar, Chamkaur Sahib, Anandpur Sahib and Nangal comprise of five development blocks.

The total population of the district is 684627 (as per census 2011).

Based on the physiography, the area can be divided into 4 units-Siwalik Hills, Intermontane valley of Sutlej, Kandi/Sirowal formations and alluvial plains-which run parallel to each other. The area is drained by Sutlej river basin.

RAINFALL AND CLIMATE

The district receives normal annual rainfall of 776 mm, which was spread over 41 days. 78% of the annual rainfall is contributed by southwest monsoon. Generally, rainfall increases from southwest to northeastern part of the district. The climate of the district can be classified as tropical steppe hot and semi-arid type.

GEOMORPHOLOGY AND SOIL TYPES

Based on geomorphology the entire district can be grouped into 4 units such as Siwalik Hills, Intermontane valley, alluvial fan and alluvial plain. The Siwalik Hills separates the main Himalayan ranges from the Indo-Gangetic alluvial plain. Sutlej River and its tributaries drain this valley. The coarse sediments brought down by hill torrents forms the alluvial fan deposits. These alluvial fans coalesced to form Kandi and Sirowal formation. The southern part of the district is mainly alluvial plain, which forms a part of vast Indo-Gangetic alluvail plain.

Two types of soils are found in the district-(1) Reddish chestnut soils which is seen in the northeastern part of the district, particularly in the Ropar and Anandpur Sahib blocks. These soils are loam to clay-loam in nature and decalcified and (2) Tropical Arid Brown soils (Weakly Solonized) are mainly found in rest of the area which are mainly calcareous sandy loam.

HYDROGEOLOGY

The Quaternary alluvial deposits belonging to the vast Indo-Gangetic Alluvium occurring in the southern blocks of the district forms the main aquifer system. The aquifers in the northern part are mainly Siwalik formation, Intermontane Valleys and Kandi/Sirowal formation.

These aquifers comprising fine to coarse sand are often intercepted with kankar horizons. Deeper aquifers in the range of 50-460 m are composed of fine to coarse sand, silt, gravel and kankar. From west to east the granular zones thin out and clay horizons with gravel or kankar become predominant.

Groundwater occurs under phreatic condition in the shallow aquifers of Quaternary alluvium deposits, Intermontane valley and Kandi formation while groundwater occurs under leaky confined to confined conditions in the deeper aquifers of alluvium.

In the case of unconfined aquifers, the depth to water level varies from 3.55 to 9.08 meters during pre-monsoon and 3.61 to 10.14 meters during post-monsoon. Seasonal fluctuation shows that in general there is an overall fall in water level except few isolated patches. The long-term trend of water level (10 years) shows a general decline in the entire district. The maximum fall is observed along the intermontane valley and the decline is at the rate of 1.05 m/year. Near the Siwalik hill, groundwater occurs at greater depth when compared to alluvial plains where it occurs at shallow depth.

The aquifer parameters show marked difference depending upon the subsurface lithology. The wells drilled in the intermontane valley shows more yield in the range of 1098-1500 lpm for 6.2 to 13.3 m drawdown. While the yield of wells tapping alluvial aquifers are in the range of 731 to 946 lpm for 4.4 to 8.2 m drawdown. This high discharge may be attributed to induced recharge from antecedent Sutlej River passing through the valley.

Ground Water Resources

The block-wise groundwater resource potential of Ropar district was calculated based on GEC-97 by excluding hilly areas. The net groundwater availability of district is 418.29 MCM, while the gross groundwater draft is 461.59 MCM only. This leaves a balance of -51.36 MCM for future development purpose, that is the district is deficit in water balance for future development. The stage of groundwater development for the district as a whole is 110%, which puts it in Over Exploited Category. While considering the development block wise, 3 out of 5 blocks namely Chamkaur Sahib, Nurpur Bedi and Morinda, stage of groundwater development has exceeded the available recharge (>100%), thus categorized as over- exploited.

Ground Water Quality

The ground water in the district is alkaline in nature with medium to high salinity. The chemical quality data from the shallow and deep aquifers indicate that all major cations (Ca, Mg, Na, K) and anions (CO_3, HCO_3, Cl, SO_4) are within the permissible limits set by BIS, 2012. The physical parameter such as electrical conductivity shows a wide variation from 470µS/cm in southern and northern part to 1225µS/cm in the central part of the district particularly, in Ropar block. Nitrate and fluoride concentration is below the prescribed permissible limit in entire district

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)	Big (>=10 ha)	Total
1	**Ropar**	**5430**	**6973**	**7934**	**3794**	**383**	**24514**

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)	Big (>=10 ha)	Total
1	**Ropar**	**96**	**143**	**266**	**119**	**15**	**639**

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	**Ropar**	**7081**	**6161**	**7595**	**3684**	**0**	**24521**

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**	**Under ground pipe**
1	**Ropar**	**956**	**23751**	**432**

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.

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.**	765	0.25	**1.91**	**0.096**
2	**Roof Top Rain Water Harvesting in Rural Areas**	3234	0.25	**8.09**	**1.350**
	Total	3999	**0.25**	**10.00**	**1.446**
ARTIFICIAL RECHARGE IN FARMS					
1	**Artificial Recharge Plan Through Recharge Pits.**	6366	0.35	22.281	8.048
			Total	**22.281**	**8.048**

By the implementation of the proposed recharge structures there will be a reduction of 1.92 % in stage of ground water development as tabulated below

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	**461.59**	**-51.36**	**9.494**	**452.096**	**110 %**	**108.08 %**	**1.92%**

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

Block Name	Total area of the village (in hectares)	10%of village area taken for farm recharge (hectares)	Total number of recharge pits	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall)	Cost of Pit @Rs.0..35 lakh (Crores)
Nurpur Bedi	**31729**	**3238**	**3238**	**4.338**	**11.33**
Chamkaur Sahib	**17821**	**1782**	**1782**	**2.782**	**6.24**
Morinda	**13253**	**1346**	**1346**	**1.582**	**4.71**
			6366	**8.048**	**22.28**

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)

ROOF TOP RAINWATER HARVESTING IN RURAL AREAS OF RUPNAGAR DISTRICT OF PUNJAB								
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	Total No of AR Structures	Total recharge in MCM	**Cost @ 0.25Lacs/structure (Crores)**
RUPNAGAR	1	Nurpur Bedi	**31729**	**20305**	**2031**	**2031**	**0.218**	**5.078**
	2	Chamkaur Sahib	**17821**	**11808**	**1181**	**1181**	**0.127**	**2.953**
	3	Morinda	**13253**	**11990**	**1199**	**1199**	**1.128**	**2.998**
		Total	**62803**	**44103**	**4411**	**4411**	**1.473**	**11.028**

ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF DISTRICT RUPNAGAR PUNJAB

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.0.25 lakh
RUPNAGAR	CHAMKAUR SAHIB	Chamkaur Sahib (NP)	2842	13920	284	56840	0.036	**0.71**
	MORINDA	Morinda (M Cl)	4805	24022	481	96100	0.060	**1.20**
		TOTAL	**7647**	**37942**	765	**152940**	**0.096**	**1.91**

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 Punjab, particularly in overexploited blocks. There are around 25160 tube wells operated by farmers for irrigation through unlined/Kutcha (63.57%) open channel system in Rupnagar 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 Rupnagar district is estimated at 858.40 MCM. It is expected that around 23.64 % 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 786.88 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 Rupnagar Districts. The measure if implemented will bring down the ground water overdraft from 110 % to 86.36 %. 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 *kutcha* channel in the entire Punjab**. 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, RUPNAGAR 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 0.30#)	Wastage through unlined channel in irrigated area by ground water scheme in OE blocks only	Potential of Reduced irrigation overdraft (Col 3-col 7) (mcm)	Gross draft after saving of water (mcm) (Col 8+Col4)	Present Stage of Development (%)	Stage of development afterwards((Col 9/Col1)X100) (%)	Reduction in stage of development after constructing pucca canal (Col 11 – Col 10) (%)
1	2	3	4	5	6	7	8	9	10	11	12
911.10	902.40	858.40	23.84	63.57	163.70	95.36	763.04	786.88	110	86.36	23.64

 # losses from open kuchha channel are around 30%.

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) =Total irrigated area (by ground water scheme) of the block *0.5 *Col4	Total Cost in Rs. Crores. District wise
1	2	3	4	5	6	7
RUPNAGAR	Anandpur Sahib	11774.6	94.39	11114	55.57	310.76
	Nurpur Bedi	13115	94.39	12379	61.90	
	Rupnagar	15953.4	94.39	15058	75.29	
	Chamkaur Sahib	13524	94.39	12765	63.83	
	Morinda	11480	94.39	10836	54.18	

SALIENT FEATURES OF HYDROGEOLOGY OF DISTRICT ROPAR

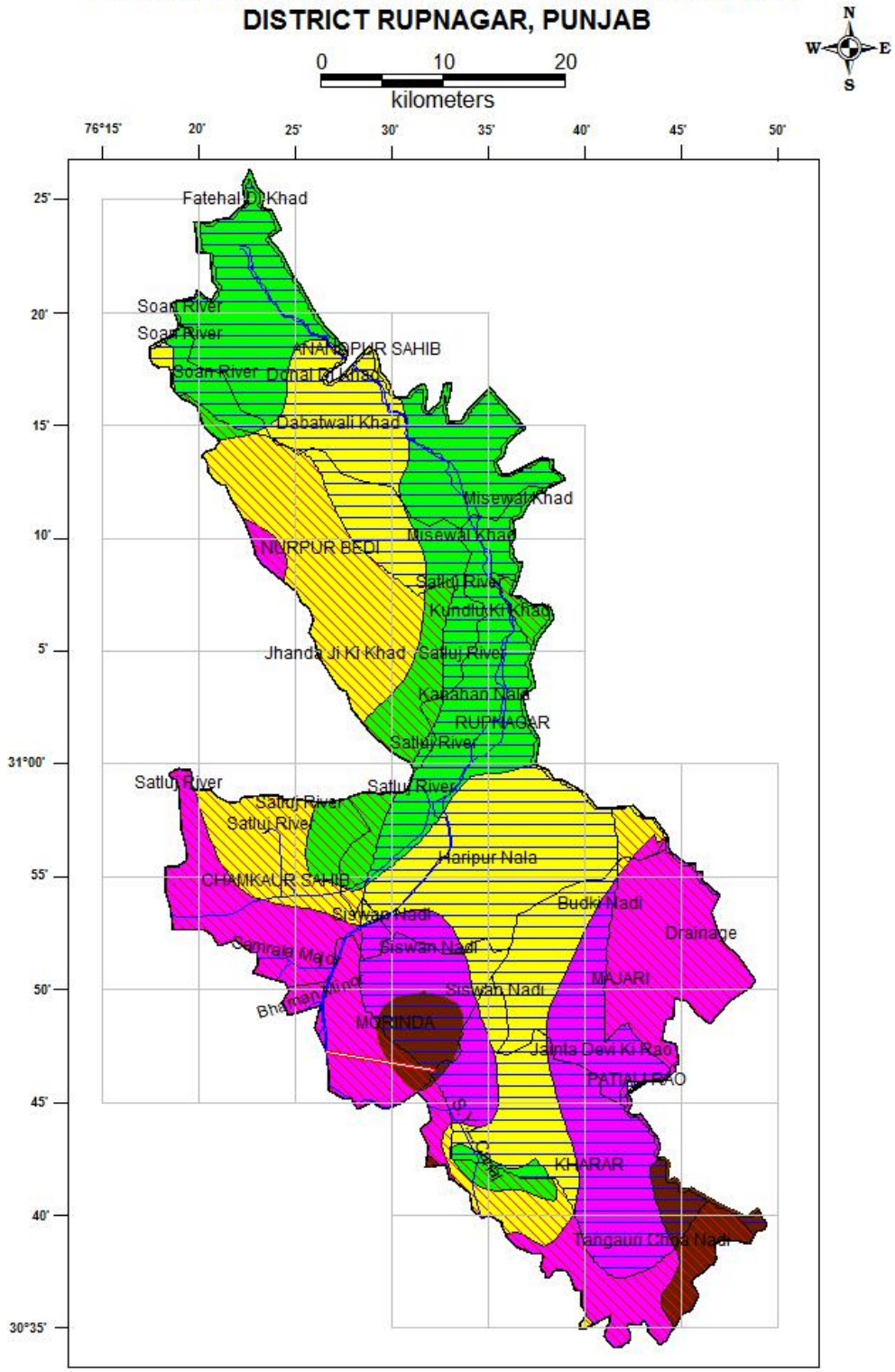
Wells Feasible	Rigs Suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures
Tube Wells	Direct and Reverse Rotary	35 - 185	1300 - 2500	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	50 - 220	1000 - 1300	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	25 - 180	600 - 1000	Recharge Shaft And Recharge Trench

DEPTH TO WATER LEVEL NOVEMBER 2014		
2.00 - 5.00 mbgl	National Highway	International Boundary
5.00 - 10.00 mbgl	Canals	State Boundary
10.00 - 20.00 mbgl	Water Bodies	Block Boundary
20.00 - 40.00 mbgl	Major Drainage	Block Headquarters

OTHER INFORMATION

Name of State	Punjab
Name of District	Rupnagar
Geographical Area	1369 sq.km.
Major Geological Formation	Alluviam and Shivaliks
Major Drainage System	Sutlej
Population (as on 2011)	6,84,627
Total Number of Blocks	5
Existing Major/Medium Irrigation Projects	S.Y.L. Canal
Utillizable Ground Water Resources 2011	418.29 (mcm)
Net Ground Water Draft	461.59 (mcm)
Stage of Ground Water Development	110 %
Average Annual Rainfall	775.6 mm
Range of Mean Daily Temperature	7- 40°C
Over Exploted Blocks	NURPUR BEDI CHAMKAUR SAHIB MORINDA

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER
DISTRICT RUPNAGAR, PUNJAB



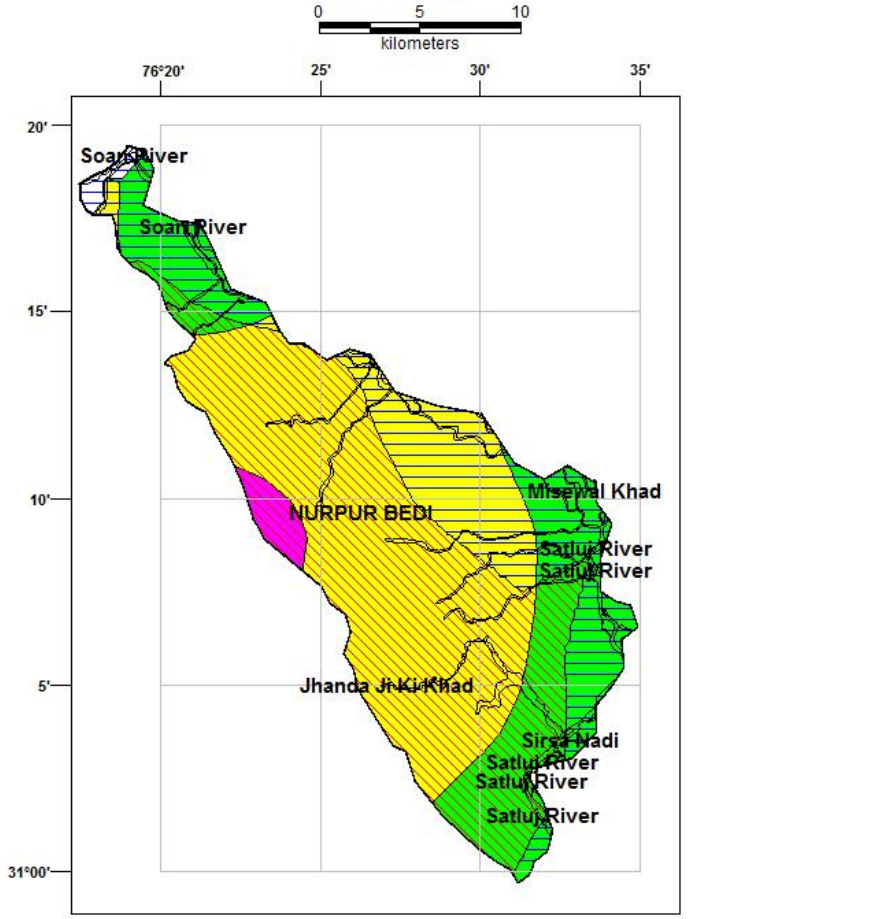
Legend

Refer Salient Features Of Hydrogeology

BLOCK WISE PLAN OF DISTRICT RUPNAGAR PUNJAB

(3 OE BLOCKS)

BLOCK NURPUR BEDI DISTRICT ROPAR, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

- 0.00 - 5.00 mbgl
- 5.00 - 10.00 mbgl
- 10.00 - 20.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00

- 2031 — No. of Recharge Structures in Rural Villages
- 3238 — Recharge Pits in Agricultural Land
- 43 — Thickness of Sand
- Canal Network
- Water Bodies

Ground Water Scenario of Block

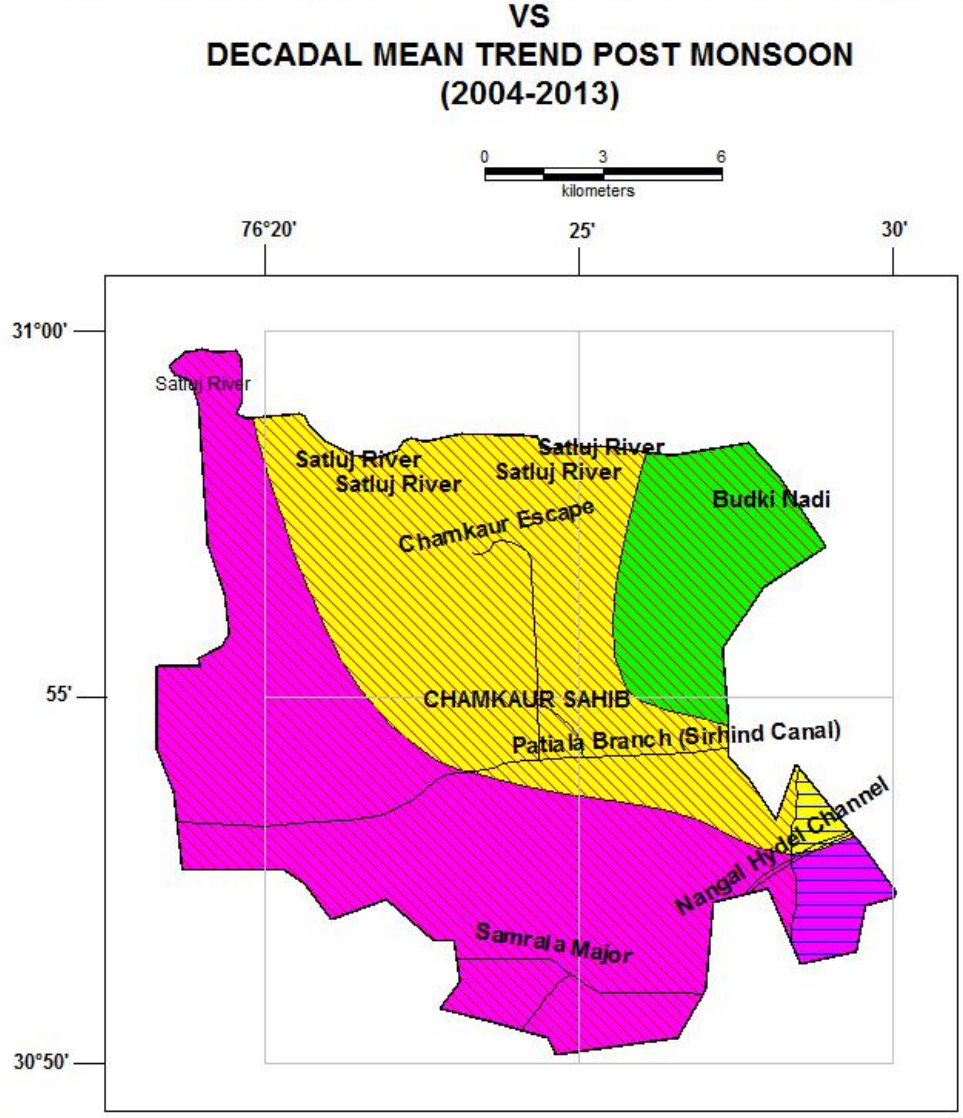
Block Name:- Nurpur Bedi **District:- Ropur**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*319.8*
	• Number of Villages inhabited • Un-inhabited	*137* *2*
	ii) Average Annual Rainfall (mm)	*828*
	iii) Area feasible for Artificial Recharge	*288*
	iv) Village identified under scarcity of Water?	*102*
	v) Village covered under water supply?	*100*
	vi) Water Tank exists in the village?	*20*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Satluj 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	340.77
	• Net Area Sown (Sq.Km)	150.33
	• Area Sown More than Once (Sq.Km)	1.28
	• Total Cropped Area (Sq.Km)	120.88
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	

	Major Water bearing Formation (Aquifer)	Fine to coarse Sand	
	Avg. Depth to water level (decadal)	Depth to water level May 2015 (mbgl)	
	• Pre- monsoon: (May 2015) • 9.80-12.63(mbgl)	*5.00-20.00 (mbgl)*	
	• Post –monsoon: (Nov2014) • 10.60-11.45(mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*6*	
	• Depth Range (m)	*50.0-459.63*	
	• Discharge (Ipm)	*310-2407*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*55-290*	
	• Storativity	*$1.2*10^{-3}$ to $7.75*10^{-4}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*498*	*1777*
	• NO3 (mg/l)	--	*20*
	• F (mg/l)	*0.28*	*0.54*
	• As (mg/l)	0.0001	0.0037
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Ham)	47.47	
	• Existing Gross Ground Water Draft for Irrigation (Ham)	46.42	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Ham)	2.32	
	• Existing Gross Ground Water Draft for all Uses (Ham)	48.73	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Ham)	3.56	
	• Net Ground Water Availability for Future Irrigation Development (Ham)	-2.51	

	• Stage of Ground Water Development / Over Draft (%)	103	
	• 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)* *43*	Percentage % 86
10	Volume of unsaturated zone available for recharge (MCM)	170.26	
11.	Volume of water required for recharge (MCM)	226.68	
12.	Volume of surplus water available for recharge(MCM)	9.48	

	RECHARGE/ CONSERVATION STRUCTURES	**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	3238	**11.33**	**4.34**
14	RWH Rural @ Rs. 25000/-	2031	**5.08**	**0.17**
15	RWH Urban@ Rs. 25000/-	0	**0.00**	**0.00**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	12379	**61.90**	**13.01**
TOTAL			**78.31**	**17.52**

BLOCK CHAMKAUR SAHIB DISTRICT ROPAR, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

- 2.00 - 5.00 mbgl
- 5.00 - 10.00 mbgl
- 10.00 - 20.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00

- 1181 — No. of Recharge Structures in Rural Villages
- 284 — No. of Recharge Structures in Urban Towns
- 1782 — Recharge Pits in Agricultural Land
- 34 — Thickness of Sand
- Canal Network
- Water Bodies

Ground Water Scenario of Block

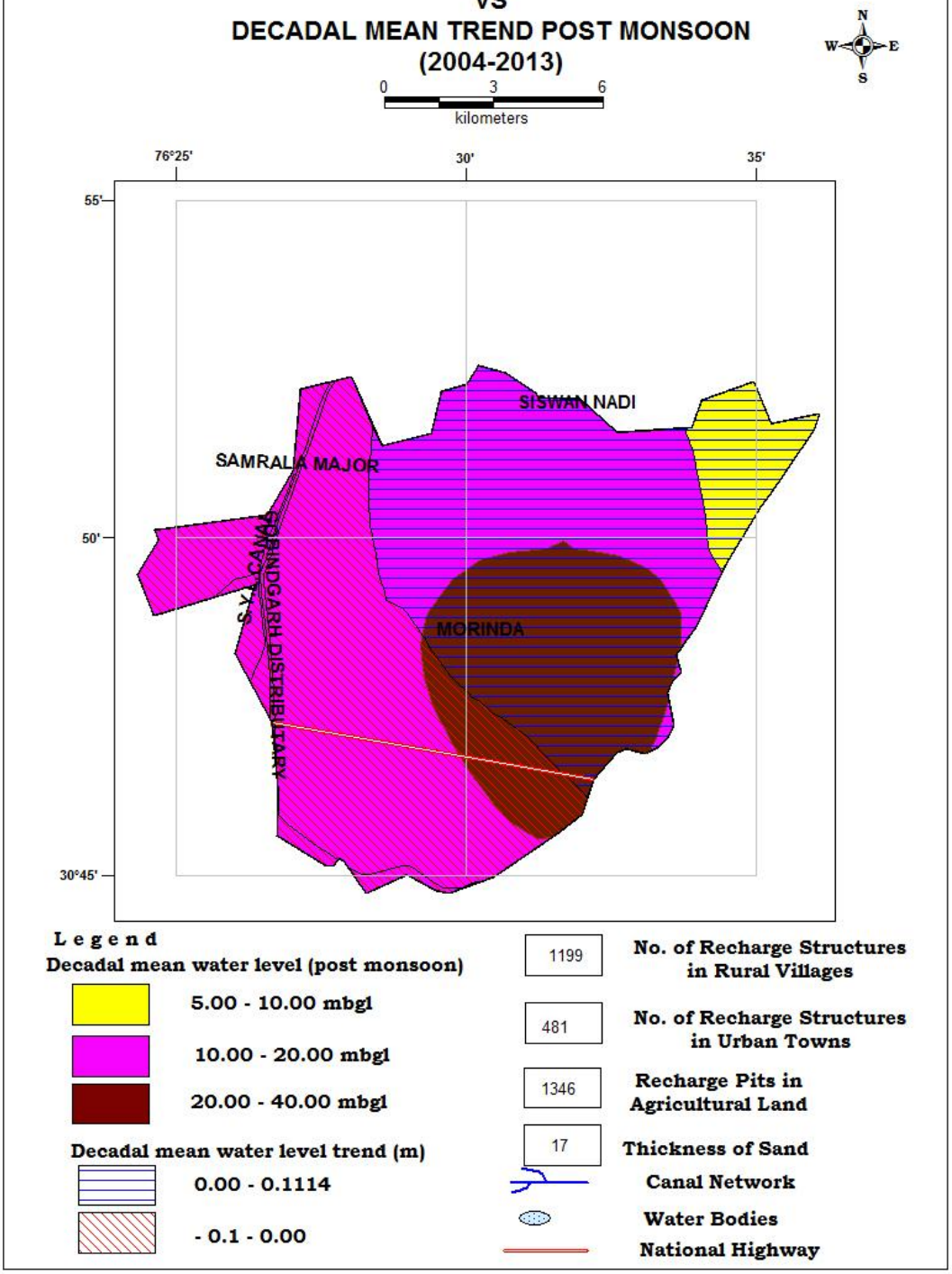
Block Name:- Chamkaur Sahib **District:- Ropur**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*151.6*
	• Number of Villages inhabited • Un-inhabited	*79* *7*
	ii) Average Annual Rainfall (mm)	*807*
	iii) Area feasible for Artificial Recharge	*136.44*
	iv) Village identified under scarcity of Water?	*99*
	v) Village covered under water supply?	*99*
	vi) Water Tank exists in the village?	*8*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Satluj100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	176.33
	• Net Area Sown (Sq.Km)	143.39
	• Area Sown More than Once (Sq.Km)	1.32
	• Total Cropped Area (Sq.Km)	144.71
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	

	Major Water bearing Formation (Aquifer)	Fine to coarse Sand	
	Avg. Depth to water level (decadal)	Depth to water level May 2015 (mbgl)	
	• Pre- monsoon: (May 2015) • 17.85-17.85(mbgl)	*10.00 -20.00(mbgl)*	
	• Post –monsoon: (Nov2014) • 18.04-18.04(mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*50.0-459.63*	
	• Discharge (Ipm)	*310-2407*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*55-290*	
	• Storativity	*$1.2*10^{-3}$ to $7.75*10^{-4}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*475*	*475*
	• NO3 (mg/l)	*7.5*	*7.5*
	• F (mg/l)	*0.45*	*0.45*
	• As (mg/l)	0.001	0.002
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Ham)	91.09	
	• Existing Gross Ground Water Draft for Irrigation (Ham)	190.29	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Ham)	1.71	
	• Existing Gross Ground Water Draft for all Uses (Ham)	191.99	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Ham)	2.61	
	• Net Ground Water Availability for Future Irrigation Development (Ham)	-101.81	

	• Stage of Ground Water Development / Over draft (%)	211	
	• 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)* *34*	Percentage % 68
10	Volume of unsaturated zone available for recharge (MCM)	80.71	
11.	Volume of water required for recharge (MCM)	107.46	
12.	Volume of surplus water available for recharge(MCM)	4.49	

	RECHARGE/ CONSERVATION STRUCTURES	**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	1782	**6.24**	**2.78**
14	RWH Rural @ Rs. 25000/-	1181	**2.95**	**0.13**
15	RWH Urban@ Rs. 25000/-	284	**0.71**	**0.04**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	12765	**63.83**	**53.30**
TOTAL			**73.72**	**56.25**

BLOCK MORINDA DISTRICT ROPAR, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

- 5.00 - 10.00 mbgl
- 10.00 - 20.00 mbgl
- 20.00 - 40.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00

1199	No. of Recharge Structures in Rural Villages
481	No. of Recharge Structures in Urban Towns
1346	Recharge Pits in Agricultural Land
17	Thickness of Sand
	Canal Network
	Water Bodies
	National Highway

Ground Water Scenario of Block

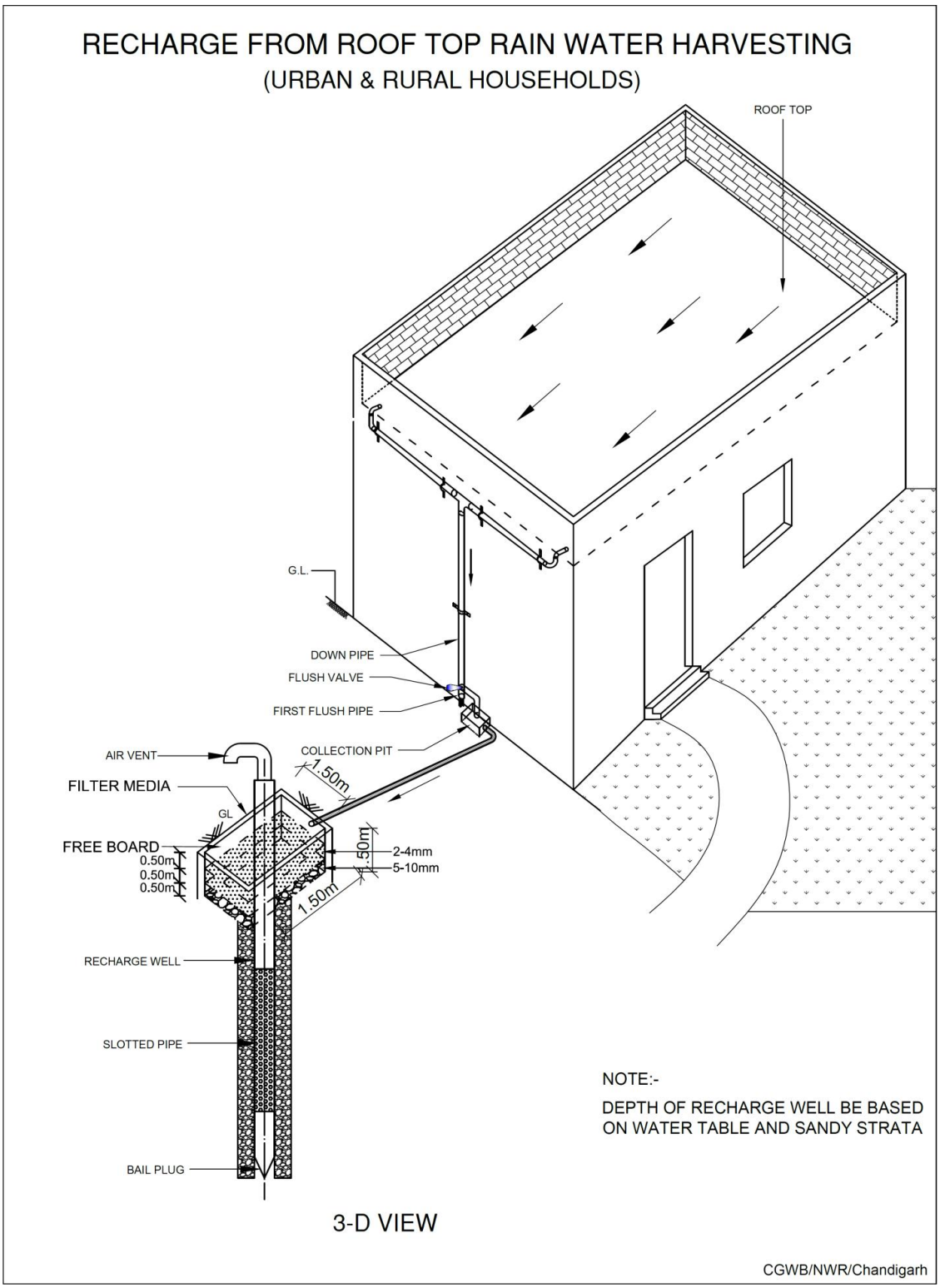
Block Name:- Morinda **District:- Ropur**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*169.5*
	• Number of Villages inhabited • Un-inhabited	*67* *1*
	ii) Average Annual Rainfall (mm)	*791*
	iii) Area feasible for Artificial Recharge	*169.50*
	iv) Village identified under scarcity of Water	*65*
	v) Village covered under water supply	*65*
	vi) Water Tank exists in the village	*17*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Satluj 50%* *Ghaggar 50%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	134.61
	• Net Area Sown (Sq.Km)	119.85
	• Area Sown More than Once (Sq.Km)	1.03
	• Total Cropped Area (Sq.Km)	120.88
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	

	Major Water bearing Formation (Aquifer)	Fine to coarse Sand	
	Avg. Depth to water level (decadal)		
	• Pre- monsoon: (May 2015) • 20.70-37.42(mbgl)	20.00-40.00 (mbgl)	
	• Post –monsoon: (Nov2014) • 19.40 – 36.10(mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*50.0-459.63*	
	• Discharge (Ipm)	*310-2407*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*55-290*	
	• Storativity	*$1.2*10^{-3}$ to $7.75*10^{-4}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	--	--
	• NO3 (mg/l)	--	--
	• F (mg/l)	--	--
	• As (mg/l)	0.001	0.0017
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Ham)	57.23	
	• Existing Gross Ground Water Draft for Irrigation (Ham)	103.71	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Ham)	3.67	
	• Existing Gross Ground Water Draft for all Uses (Ham)	107.38	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Ham)	4.86	
	• Net Ground Water Availability for Future Irrigation Development (Ham)	-51.31	

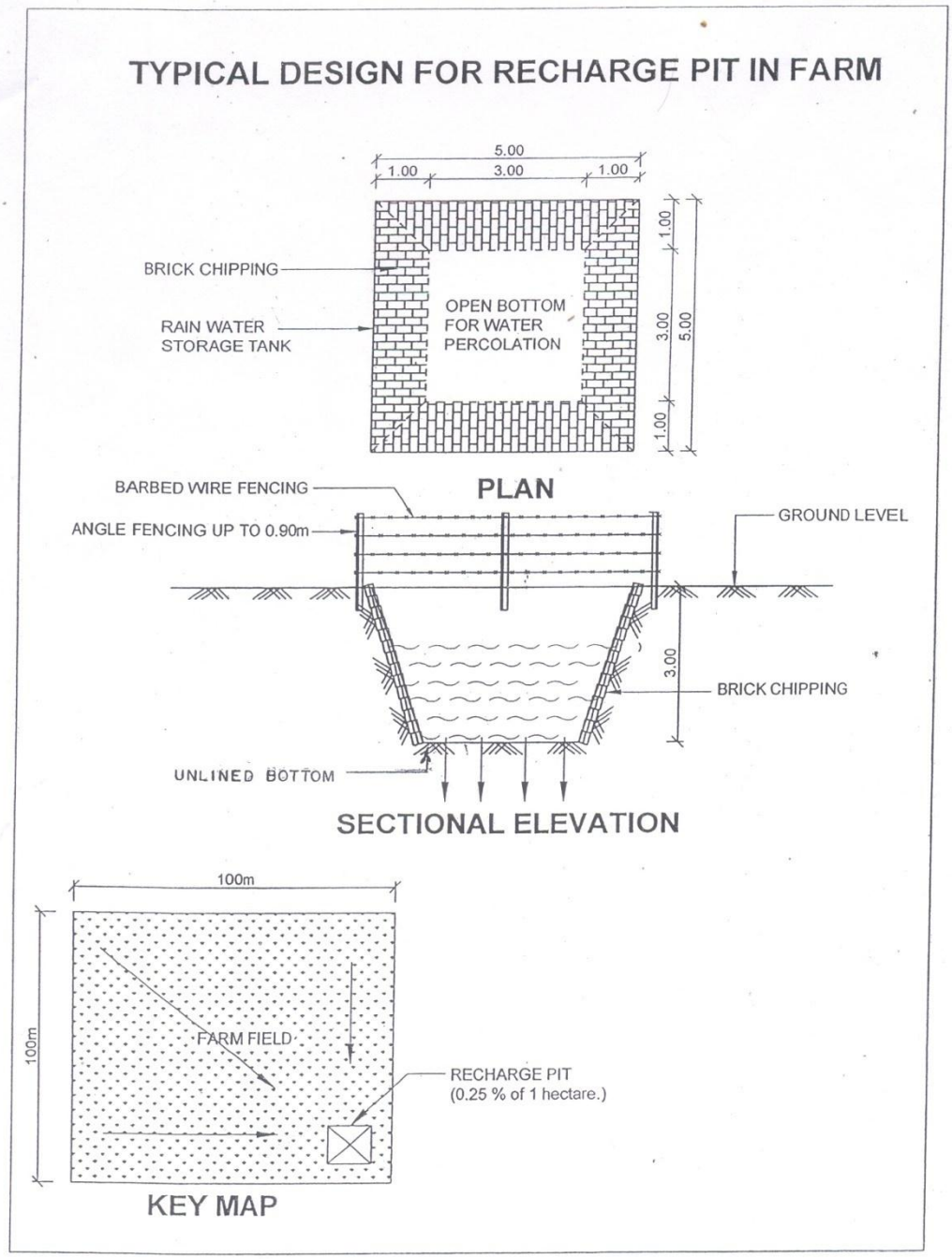
	• Stage of Ground Water Development Over Draft (%)	188	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	Extensive Irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m) 17*	Percentage % 34
10	Volume of unsaturated zone available for recharge (MCM)	90.24	
11.	Volume of water required for recharge (MCM)	120.15	
12.	Volume of surplus water available for recharge(MCM)	5.02	

	RECHARGE/ CONSERVATION STRUCTURES	**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	1346	**4.71**	**1.582**
14	RWH Rural @ Rs. 25000/-	1199	**3.00**	**1.128**
15	RWH Urban@ Rs. 25000/-	481	**1.20**	**0.096**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	10836	**54.18**	**29.05**
TOTAL			**63.09**	**56.25**

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
1.50m
FILTER MEDIA
GL
FREE BOARD
0.50m
0.50m
0.50m
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

Annexure-II


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