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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

OVER EXPLOITED BLOCKS OF BARNALA DISTRICT, PUNJAB

Central Ground Water Board
North Western Region
Chandigarh

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

PLAN OF ARTFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT BARNALA PUNJAB

INTRODUCTION

Barnala district of Punjab state lies between 30® to 30® 52' north latitudes and 75® 15' to 75' east longitudes. Total geographical area of the district is 1410 sq. km. The Barnala district is divided into two sub-divisions (tehsils) namely Barnala, Tappa, comprising three-community development blocks viz. Barnala, Sehna and Mahal Kalan for the purpose of administration. The district headquarter Barnala town falls in Barnala Tehsil.

RAINFALL & CLIMATE

The climate of Barnala district can be classified as tropical steppe, semi-arid and hot which is mainly dry with very hot summer and cold winter except during monsoon.

The normal monsoon and annual rainfall of the district is 434mm and 504mm, respectively which is unevenly distributed over the area 29 days. The south west monsoon, sets in from last week of June and withdraws in end of September, contributing about 81% of annual rainfall. The mean minimum and maximum temperature in the area ranges from 7.1®C to 40.4®C during January and May or June respectively.

GEOMORPHOLOGY AND SOIL TYPES

The area falling under Barnala distt. forms part of Indo gangetic plain. The area of the block in general is plain. The master slope of the area is towards the south west direction. There is no well defined drainage system in the area except some local drains like dhaula drain. This drain carry flood water when heavy rainfall occurs in the catchment area. Abohar branch of Sirhind canal system passes in south eastern part of the block. The entire canal belongs to Sirhind canal system of Bhakhra main canal. Soils of the district is loamy sand and sandy loam kaller land is also spotted at a few places.

HYDROGEOLOGY

The district is occupied by Indo-Gangetic alluvial plain of quaternary age and falls in Ghaggar sub basin. The ground water occurs in alluvium formations comprising fine to coarse sand, which forms the potential aquifers. In the shallow aquifer (up to 50m) ground water occurs under unconfined/water table conditions, where as in deeper aquifer, semi-confined/confined conditions exist.

The deep tube wells have been constructed by CGWB, which include 3 exploratory boreholes, 4 Piezometers to delineate and determine potential aquifer zones, evaluation of aquifer characteristics. The permeable granular zones comprising fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and vertical extent is limited. The borehole data reveals that clay group of formations dominate

over the sand group in the district area. Ground water in the district occurs in the alluvium under water table and semi confined to confined conditions.

The discharge of deep tube well in the area varies between 2400 and 2680 Ipm. The transmissivity values ranges from 1670 m^2/day and storativity ranges from $7.5*10^{-2}$.

The depth to water level ranges from 14.43 to 20.62 m bgl during pre-monsoon period and 16.99 to 24.28m bgl during post monsoon period. The seasonal fluctuation varies from 0.03 to (-) 3.66 m in the area. The long-term water levels trend indicates average fall of 0.50 m/year. The long term water level trend is also showing decline of water level from 8 to 10m.

The elevation of the water table in the district varies from 230m to 300 m above mean sea level. The highest elevation is in the northeastern part and the lowest in the southwestern part and reflects the topographic gradients. The hydraulic gradient in the northern eastern part is steep, whereas, in the southwestern part, it is gentle. The overall flow of ground water is from northeast to south-west direction.

Ground water resources

The block wise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 116% (Mahal Kalan) to 258% (Barnala). The net ground water resource of Barnala district have been estimated to be 1188.78 MCM and the gross ground water draft of the district is 1201.32 mcm leaving behind a shortfall of (-) 6177.80 MCM. The stage of ground water development in the district is 204%.

Ground Water Quality

CGWB has carried out studies for chemical quality of ground water in the area. The ground water of the district is alkaline in nature. The EC in the area ranges from 595 to 1260 Micromhos/cm. Nitrate values ranges between 0.40 to 200 mg/l and fluoride concentration ranges from 0.45 to 5.0 mg/l. At few places high fluoride and nitrate have been observed, thus the ground water in these places is harmful for human consumption. The shallow ground water is of Na- HCO_3 type.

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	**Barnala**	**500**	**916**	**2238**	**3362**	**1001**	**8017**

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	**Barnala**	**293**	**1765**	**5024**	**14578**	**4763**	**26423**

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	**Barnala**	**36**	**98**	**85**	**7799**	**0**	**8018**

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	**Barnala**	**97**	**34256**	**76**

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 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.**	3914	0.25	**9.78**	**0.271**
2	**Roof Top Rain Water Harvesting in Rural Areas**	7403	0.25	**18.50**	**0.398**
	Total	11317	**0.25**	**28.28**	**0.669**
ARTIFICIAL RECHARGE IN FARMS					
1	**Artificial Recharge Plan Through Recharge Pits.**	13046	0.35	45.66	8.508
			Total	**45.66**	**8.508**

By the implementation of the proposed recharge structures there will be a reduction of 1.74% 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	**1201.32**	**-617.78**	**9.177**	**1192.143**	**204%**	**202.26 %**	**1.74 %**

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

Block Name	Total area of the village (in hectares)	10%of village area taken for farm recharge (in hectares)	Total number of recharge pits	Annual recharge (MCM)= (Area*Runoff 15%	Cost of Pit @ Rs.35000/- (crores)
Barnala	**60337**	**6034**	**6034**	**3.405**	**21.11**
Sehna	**40360**	**4036**	**4036**	**3.091**	**14.12**
Mehal Kalan	**29764**	**2976**	**2976**	**2.012**	**10.41**
			13046	**8.508**	**45.64**

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 BARNALA DISTRICT OF PUNJAB								
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)**
BARNALA	1	**Barnala**	**60337**	**32872**	**3287**	**3287**	**0.172**	**8.22**
	2	**Sehna**	**40360**	**22692**	**2269**	**2269**	**0.115**	**5.67**
	3	**Mehal Kalan**	**29764**	**18465**	**1847**	**1847**	**0.111**	**4.62**
		Total	**130461**	**74029**	**7403**	**7403**	**0.398**	**18.51**

ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF DISTRICT BARNALA PUNJAB

District	Block	Town Name	Total House holds	Total Population of Town	House holds taken for Atificial Recharge (10%)	Total Roof Top Area (sqm)	Vol of water available for recharge (MCM)	Cost @Rs.25000/-per structure (crores)
BARNALA	BARNALA	Barnala (MCL)	24490	116449	2449	489800	0.171	**6.12**
	BARNALA	Handiya (NP)	2702	12507	270	54040	0.019	**0.68**
	BARNALA	Dhanuala (MCI)	3878	19920	388	77560	0.027	**0.97**
	SEHNA	Thapa (MCI)	4516	23248	452	90320	0.030	**1.13**
	SEHNA	Bhadaur (MCL)	3555	18561	356	71100	0.024	**0.89**
		TOTAL	**39141**	**190685**	**3915**	**782820**	**0.271**	**9.79**

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 26423 operated by farmers for irrigation through unlined/Katcha (99.46%) open channel system in Barnala 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 Barnala district is estimated at 1188.78 MCM. It is expected that around 50.73% 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 297.95 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 Barnala Districts. The measure if implemented will bring down the ground water overdraft from 204% to 153.27 %. 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 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, BARNALA 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
589.39	1201.32	1188.78	12.54	99.46	297.95	890.83	903.37	204	153.27	50.73

 # 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 @Rs50000/- per hector(in cr) =Total irrigated area (by ground water scheme) of the block *0.5 *Col4	Total Cost in Rs.Cr. District wise
BARNALA	Barnala	31761	99.46	**31589**	**157.95**	**332.37**
	Sehna	17164.6	99.46	**17072**	**85.36**	
	Mehal Kalan	17908.6	99.46	**17812**	**89.06**	

SALIENT FEATURES OF HYDROGEOLOGY OF DISTRICT BARNALA

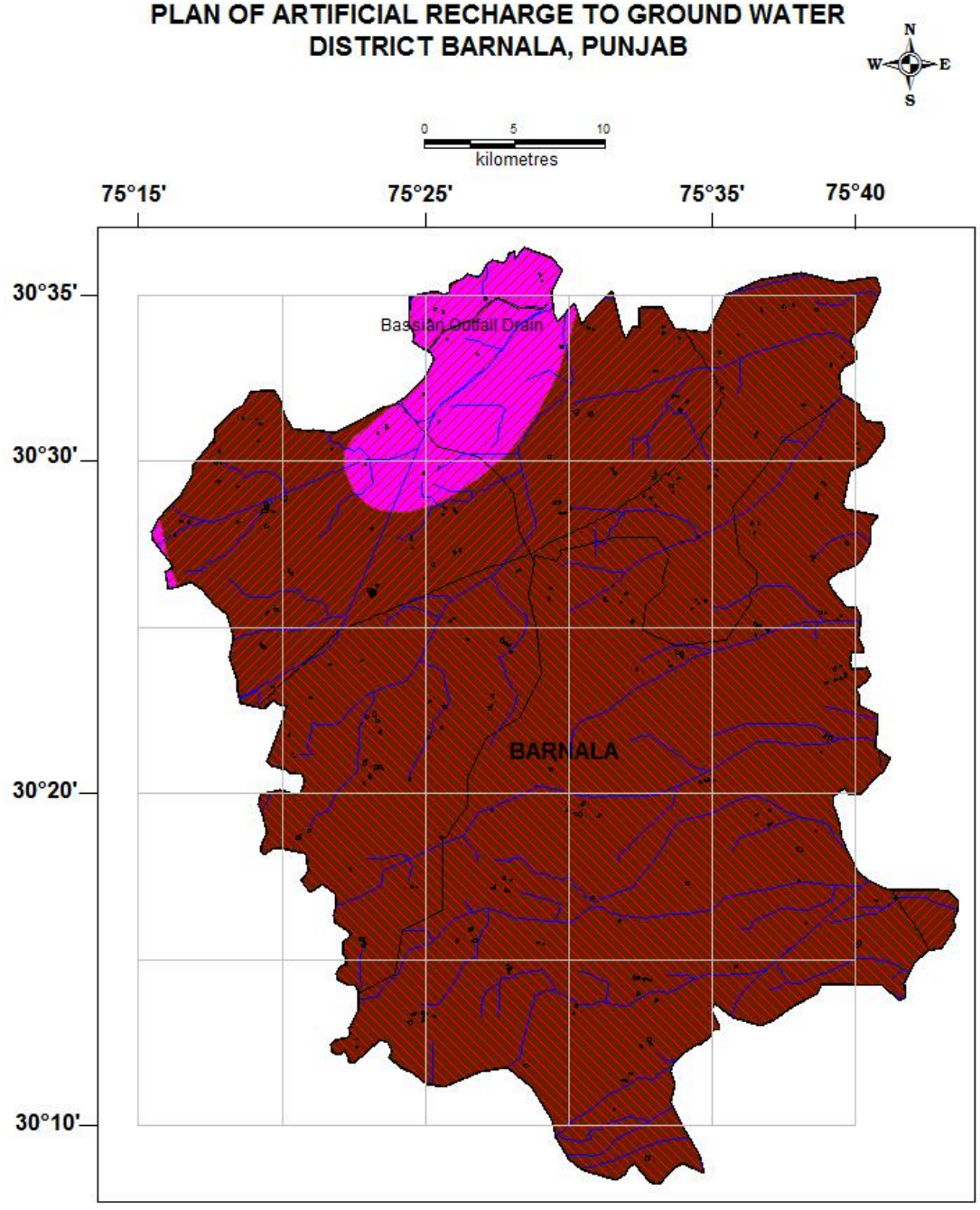
Wells Feasible	Rigs Suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures
Tube Wells	Direct and Reverse Rotary	50 - 100	1300 - 2500	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	40 - 150	1000 - 1300	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	50 - 100	600 - 1000	Recharge Shaft And Recharge Trench

DEPTH TO WATER LEVEL NOVEMBER 2014		
	National Highway	International Boundary
	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	Barnala
Geographical Area	1410 sq.km
Major Geological Formation	Alluviam
Major Drainage System	Ghaggar
Population (as on 2011)	5,96,294
Total Number of Blocks	3
Existing Major/Medium Irrigation Projects	Sirhind Canal and Bhakra Canal
Utillizable Ground Water Resources 2011	589.39 (mcm)
Net Ground Water Draft	1201.32 (mcm)
Stage of Ground Water Development	204 %
Average Annual Rainfall	552 mm
Range of Mean Daily Temperature	7° - 40° C
Over Exploted Blocks	BARNALA SEHNA MAHAL KALAN

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER
DISTRICT BARNALA, PUNJAB



Legend

Refer Salient Features of Hydrogeology

Decadal mean water level trend (m)

-0.20 -- -0.10

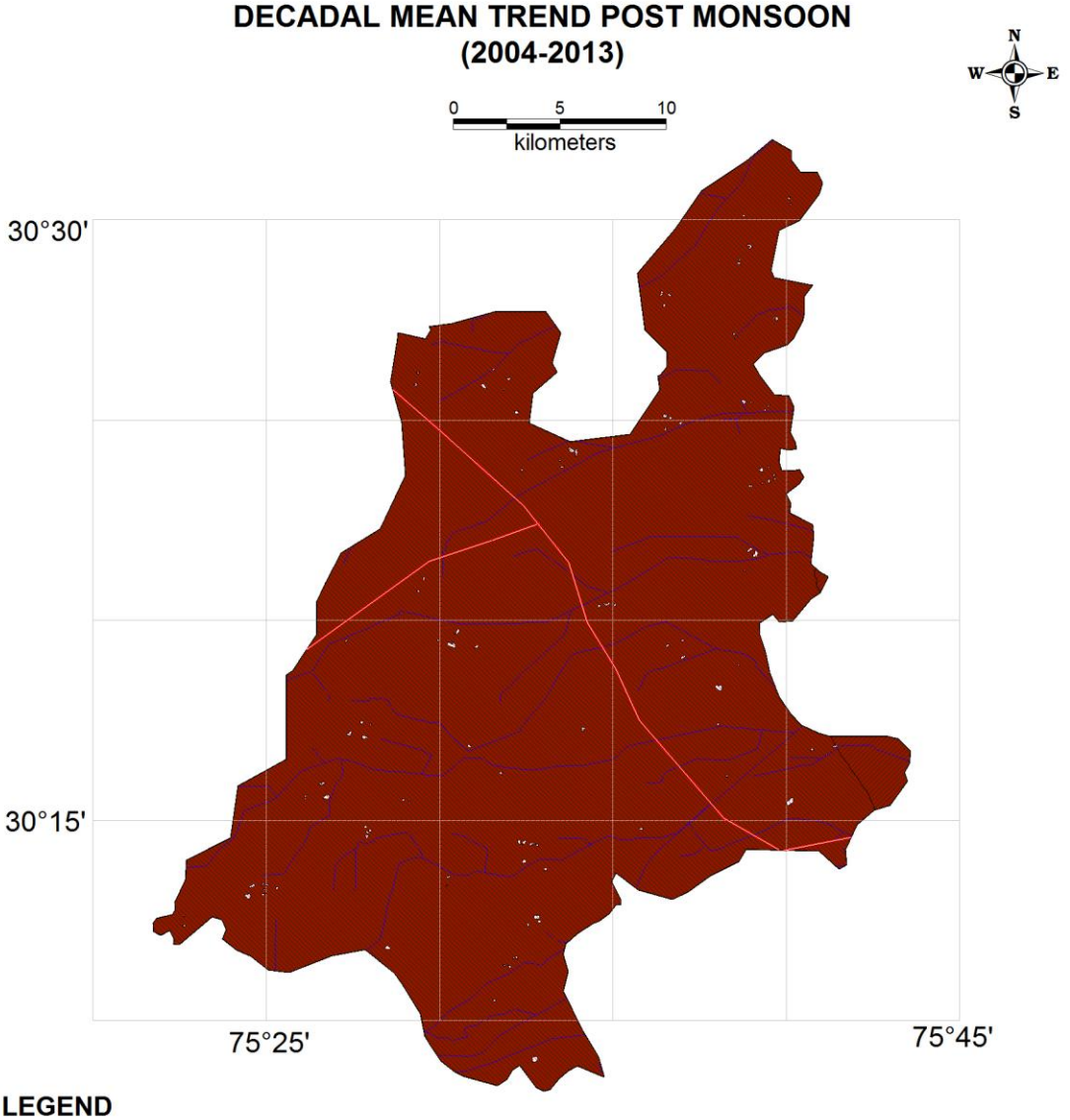
-0.10 -- -0.00

BLOCK WISE PLAN OF DISTRICT BARNALA PUNJAB

(3 OE BLOCKS)

BLOCK: BARNALA DISTRICT: BARNALA STATE: PUNJAB

DEPTH TO WATER LEVEL BARNALA, DECADAL MEAN POST MONSOON Vs DECADAL MEAN TREND POST MONSOON (2004-2013)



LEGEND

Decadal Mean Water Level (m.bgl)

20.00 to 40.00

NH Road

Canals

Decadal Mean Trend (m)

-0.10 to 0.00

Water Bodies

3287	No. of Recharge Structures in Rural Villages
3107	No. of Recharge Structures in Urban Towns
6034	No. of Recharge Pits in Agriculture land
27	Thickness of Sand

Ground Water Scenario of Block

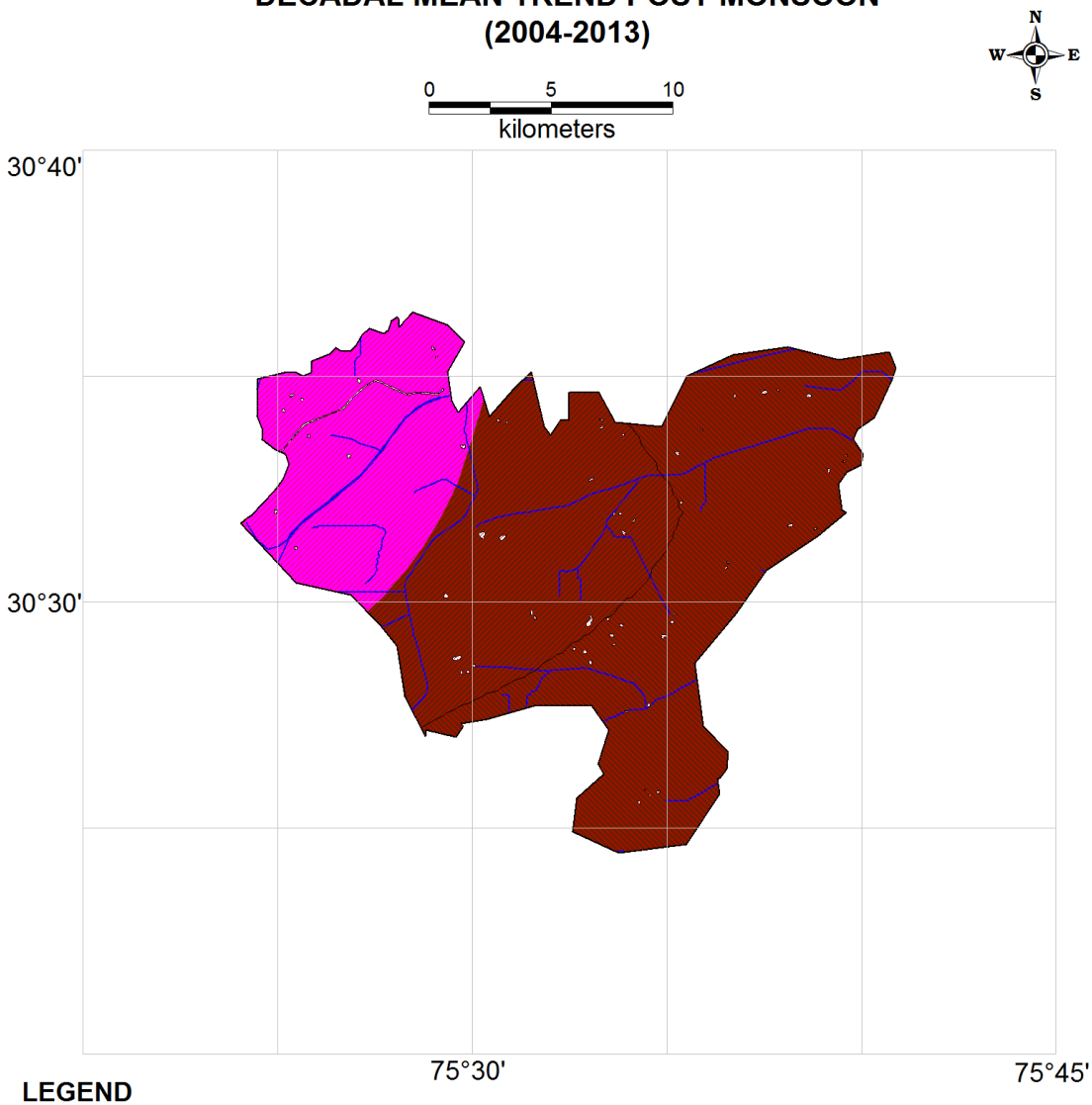
Block Name:- BARNALA **District:- BARNALA** **State:- PUNJAB**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*613.9*
	• Number of Villages inhabited • Un-inhabited	*60* *1*
	ii) Average Annual Rainfall (mm)	*434*
	iii) Area feasible for Artificial Recharge	*613.9*
	iv) Village identified under scarcity of Water	*46*
	v) Village covered under water supply	*46*
	vi) Water Tank exists in the village	*40*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ghaggar 95%* *Sutluj 5%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	658.22
	• Net Area Sown (Sq.Km)	580.33
	• Area Sown More than Once (Sq.Km)	114.09
	• Total Cropped Area (Sq.Km)	1728.42
	• Cropping Intensity	298
	• Area under Thur and Sem (Sq.Km)	0
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) 20.50 – 34.28 (mbgl)	*10.00 -40.00 (mbgl)*	
	• Post –monsoon: (Nov2014) 34.41 – 35.30 (mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*3*	
	• Depth Range (m)	*79.0-537.20*	
	• Discharge (Ipm)	*2500.3330*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*1620.36-20*	
	• Stortivity	*$1.42*10^{-2}$ to $7.5*10^{-2}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*520*	*520*
	• NO3 (mg/l)	*9.05*	*9.05*
	• F (mg/l)	*0.61*	*0.61*
	• As (mg/l)	*0.0005*	*0.0005*
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (MCM)	222.33	
	• Existing Gross Ground Water Draft for Irrigation (MCM)	565.27	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	7.48	
	• Existing Gross Ground Water Draft for all Uses (MCM)	572.75	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	10.97	
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-353.91	

	• Stage of Ground Water Development (%)			258	
	• 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)* *27*	Percentage % 54
10	Volume of unsaturated zone available for recharge (MCM)			1183.76	
11.	Volume of water required for recharge (MCM)			1574.25	
12.	Volume of surplus water available for recharge(MCM)			8.40	
RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge in mcm**	
13	Farm Recharge @ Rs. 35000/-	6034	21.11	3.405	
14	RWH Rural @ Rs. 25000/-	3287	8.21	0.172	
15	RWH Urban@ Rs. 25000/-	3107	7.76	0.217	
16	Underground pipe line (area in hectares) @ Rs. 50000/-	31589	157.95	141.68	
	TOTAL		**194.67**	**145.47**	

BLOCK: MAHAL KALAN DISTRICT: BARNALA STATE: PUNJAB

DEPTH TO WATER LEVEL MAHAL KALAN, DECADAL MEAN POST MONSOON Vs DECADAL MEAN TREND POST MONSOON (2004-2013)



LEGEND

Decadal Mean Water Level (m.bgl)

- 10.00 to 20.00
- 20.00 to 40.00
- NH Road
- Water Bodies

Decadal Mean Trend (m)

- -0.20 to -0.10
- -0.10 to 0.00
- Canals

1847 No. of Recharge Structures in Rural Villages

2976 No. of Recharge Pits in Agriculture land

Ground Water Scenario of Block

Block Name:- MAHAL KALAN **District:- BARNALA** **State:- PUNJAB**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*347.6*
	• Number of Villages inhabited • Un-inhabited	*38* *0*
	ii) Average Annual Rainfall (mm)	*504*
	iii) Area feasible for Artificial Recharge	*347.60*
	iv) Village identified under scarcity of Water?	*36*
	v) Village covered under water supply	*35*
	vi) Water Tank exists in the village	*28*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Sutluj 95%* *Ghaggar 5%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	296.41
	• Net Area Sown (Sq.Km)	263.30
	• Area Sown More than Once (Sq.Km)	525.82
	• Total Cropped Area (Sq.Km)	789.12
	• Cropping Intensity	300
	• Area under Thur and Sem (Sq.Km)	0
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*

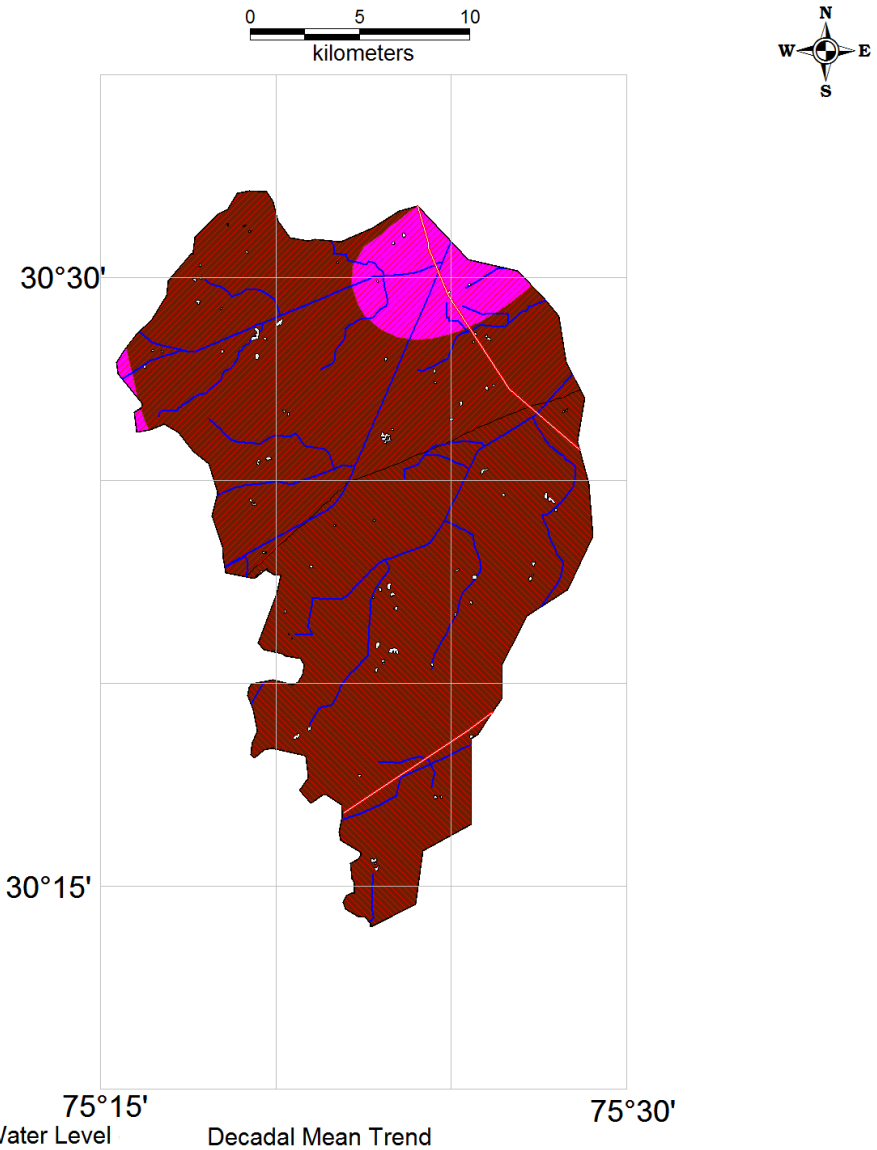
5.	HYDROGEOLOGY		
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand	
	Avg. Depth to water level (decadal)	Depth to water level May 2015 (mbgl)	
	• Pre- monsoon: (May 2015) 25.44 – 33.00 (mbgl)	20.00 - 40.00(mbgl)	
	• Post –monsoon: (Nov2014) 21.94 – 35.80 (mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*79.0-537.20*	
	• Discharge (Ipm)	*2500.3330*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*1620.36-20*	
	• Stortivity	*$1.42*10^{-2}$ to $7.5*10^{-2}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*365*	*365*
	• NO3 (mg/l)	*4.4*	*4.4*
	• F (mg/l)	*1.35*	*1.35*
	• As (mg/l)	--	--
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (MCM)	179.56	
	• Existing Gross Ground Water Draft for Irrigation (MCM)	206.86	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	1.99	
	• Existing Gross Ground Water Draft for all Uses (MCM)	208.85	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	2.92	

	• Net Ground Water Availability for Future Irrigation Development (MCM)		-30.22	
	• Stage of Ground Water Development / Over Draft (%)		116	
	• 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)* --	Percentage % --
10	Volume of unsaturated zone available for recharge (MCM)		670.26	
11.	Volume of water required for recharge (MCM)		891.51	
12.	Volume of surplus water available for recharge(MCM)		4.75	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@ Rs. 35000/-	2976	10.41	2.012
14	RWH Rural @ Rs. 25000/-	1847	4.61	0.111
15	RWH Urban@ Rs. 25000/-	-	-	-
16	Underground pipe line (area in hectares) @ Rs. 50000/-	17812	89.06	51.85
	TOTAL		**104.08**	**53.97**

BLOCK: SEHNA DISTRICT: BARNALA STATE: PUNJAB

DEPTH TO WATER LEVEL SEHNA, DECADAL MEAN POST MONSOON Vs DECADAL MEAN TREND POST MONSOON (2004-2013)



LEGEND

Decadal Mean Water Level (m.bgl)

- 10.00 to 20.00
- 20.00 to 40.00
- NH Road
- Water Bodies

Decadal Mean Trend (m)

- -0.20 to -0.10
- -0.10 to 0.00
- Canals

2269	No. of Recharge Structures in Rural Villages
808	No. of Recharge Structures in Urban Towns
4036	No. of Recharge Pits in Agriculture land

Ground Water Scenario of Block

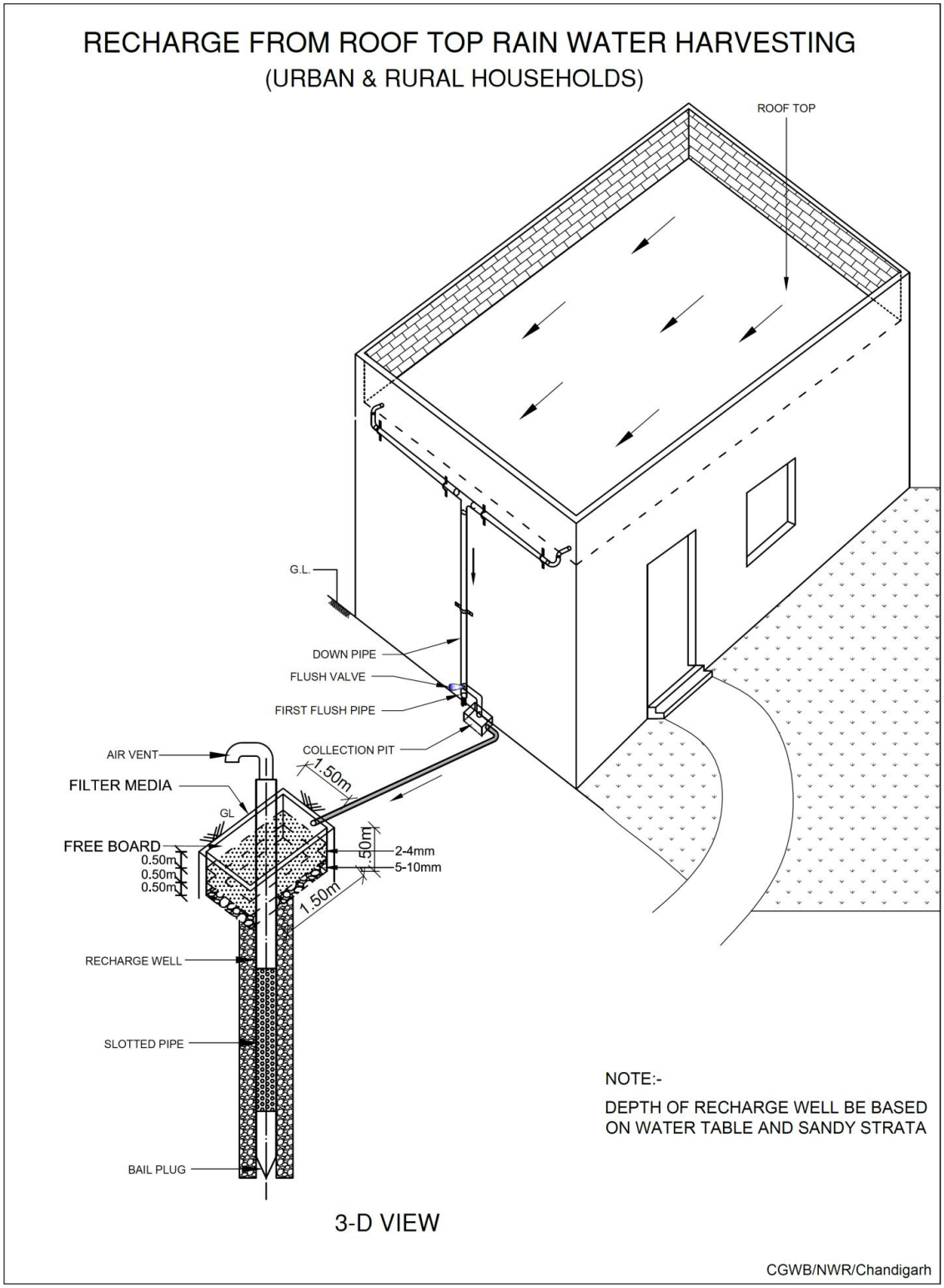
Block Name:- SEHNA **District:- BARNALA** **State:- PUNJAB**		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*390.2*
	• Number of Villages inhabited • Un-inhabited	*55* *0*
	ii) Average Annual Rainfall (mm)	*422*
	iii) Area feasible for Artificial Recharge	*390.20*
	iv) Village identified under scarcity of Water?	*35*
	v) Village covered under water supply	*35*
	vi) Water Tank exists in the village	*28*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Sutluj 93%* *Ghaggar 7%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	35754
	• Net Area Sown (Sq.Km)	31282
	• Area Sown More than Once (Sq.Km)	62108
	• Total Cropped Area (Sq.Km)	93390
	• Cropping Intensity	299
	• Area under Thur and Sem (Sq.Km)	0
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) 18.60 – 27.20 (mbgl)	20.00 – 40.00 (mbgl)	
	• Post –monsoon: (Nov2014) 19.45 – 28.90 (mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*79.0-537.20*	
	• Discharge (Ipm)	*2500.3330*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*1620.36-20*	
	• Stortivity	*1.42*10^{-2} to 7.5*10^{-2}*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^{0}c	*365*	*365*
	• NO3 (mg/l)	*4.4*	*4.4*
	• F (mg/l)	*1.35*	*1.35*
	• As (mg/l)	--	--
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (MCM)	187.50	
	• Existing Gross Ground Water Draft for Irrigation (Ham)	416.65	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	3.07	
	• Existing Gross Ground Water Draft for all Uses (MCM)	419.72	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	4.50	

	• Net Ground Water Availability for Future Irrigation Development (MCM)	-233.65	
	• Stage of Ground Water Development / Over Draft (%)	224	
	• 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)* --	Percentage % --
10	Volume of unsaturated zone available for recharge (MCM)	753.09	
11.	Volume of water required for recharge (MCM)	1000.51	
12.	Volume of surplus water available for recharge(MCM)	5.34	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge in mcm
13	Farm Recharge@rS. 35000/-	4036	14.12	3.091
14	RWH Rural @ Rs. 25000/-	2269	5.67	0.115
15	RWH Urban@ Rs. 25000/-	808	2.02	0.054
16	Underground pipe line (area in hectares) @ Rs. 50000/-	17072	85.36	104.43
	TOTAL		**107.17**	**107.69**

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
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