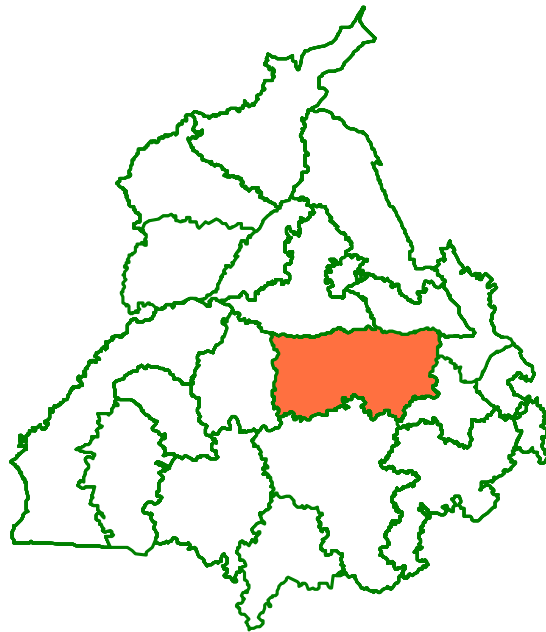




LUDHIANA DISTRICT PUNJAB



CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
2007



Contributors

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Regional Director

Our Vision

***“Water Security through Ground water
Management”***



GROUND WATER INFORMATION BOOKLET LUDHIANA DISTRICT, PUNJAB

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LUDHIANA DISTRICT AT A GLANCE

Sl No.	ITEMS	Statistics
1.	General Information	
	i) Geographical area (Sqkm)	3860
	ii) Administrative divisions (As on 31-03-2007)	
	Number of tehsils	1. Ludhiana 2. Khanna 3. Samrala 4. Jagraon
	Block	1. Delhon I 2. Doraha 3. Jagraon 4. Khanna 5. Ludhiana 6. Machhiwara 7. Mangat 8. Pakhowal 9. Samralat 10. Sidhwan Bet 11. Sudhar
	Number of Panchayat's	-
	Villages-	91
	iii) Population (As on 2001 census)	30,32,831
	iv) Average annual Rainfall (mm)	681 mm
2.	Geomorphology/	
	Major physiographic units	Plain
	Major drainages	Satluj and its tributary, and Budha nalah
3.	Land use (sqkm)	
	a) Forest area:	100 sq.km
	b) Net area shown	3250 sq.km
	c) Cultivable area	6080sq.km
4.	MAJOR SOIL TYPES	Sandy, clayey loam, alkaline in nature.
5.	AREA UNDER PRINCIPAL; CROPS	Wheat-2468 Paddy-2297 Maize-30 Cotton-4 Sugercane-51
6.	IRRIGATION BY DIFFERENT SOURCES	

	(Area and Number of Structures)	
	Dug wells	-
	Bore wells/Tubewells	2970 sq.km
	Tanks/ Ponds	-
	Canals	90 sq.km
	Other sources	-
	Net Irrigated area	3060 sq. km
	Gross irrigated area	6050 sq. km
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)	
	No. of Dug Wells	3
	No of Piezometers	10
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary alluvium
9.	HYDROGEOLOGY	
10.	<ul style="list-style-type: none"> • Major water bearing formations • (Pre-monsoon Depth to water level during 2006) • (Post-monsoon Depth to water level during 2006) • Long term water level trend in 10 yrs (1997-2006) 	Sand, Gravel 9.24-25.48 m bgl 5.09-33.62 m bgl Fall only (0.11m/y-1.34 m/y)
11.	GROUND WATER EXOLORATION BY CGWB (As on 31-3-2007)	
	No of Wells drilled (EW,OW,PZ,SH,Total)	15
	Depth range (m)	25m (PAU)- 408m (Bhaini raian)
	Discharge (Liters per second)	3-52.4 lps
	Storativity (S)	4.3×10^{-4} - 6.98×10^{-4}
	Transmissivity (m^2/day)	628-1120
12.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g. Ec, F, As, Fe)	NO ₃ - 45 mg/l
	Type of Water	Calcium bi carbonate
13.	DIANAMIC GROUND WATER RESOURCES (2004)- in MCM	
	Annual replenishable Ground Water Resources	2341.16
	Net annual Ground Water Draft	3380.89
	Projected demand for Domestic and Industrial Uses up to 2025	172
	Stage of Ground Water development	144
14.	AWARENESS AND TRAINNING ACTIVITY	
	Mass awareness Programs organized	nil
	Date	



	Place No of Participants	
	Water Management Training Program's Organized Date Place No of participants	nil
15.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	-
	Projects completed by CGWB (no & amount spent)	-
	Projects under technical guidance of CGWB (numbers)	-
16.	GROUND WATER CONTROL AND REGULATION	
	Number of OE blocks	10
	Number of Critical blocks	1
	NB of blocks notified	Ludhiana city
17.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Declining trend, Increasing quality problem



GROUND WATER INFORMATION BOOKLET LUDHIANA DISTRICT, PUNJAB

1.0 INTRODUCTION

Ludhiana district falls in central part of Punjab. The district is bounded between north latitude $30^{\circ} 33'$ and $31^{\circ} 01'$ and east longitude $75^{\circ} 25'$ and $76^{\circ} 27'$. The Satluj forms the border of the district in the north with Jalandhar and Hoshiarpur districts. Ropar and Fatehgarhsahib districts marks the eastern and south eastern boundaries. The western border is adjoining Moga and Ferozpur districts. The geographical area of the district is 3790 sq.kms.

Administratively Ludhiana district falls under Patiala division. The district has four sub-divisions viz-Ludhiana, Khanna, Samrala and Jagraon and eleven development blocks viz.- Ludhiana, Mangat, Doraha, Khanna, Dehlon, Pokhwal , Samrala , Machiwara, Jagraon, Sidhwanbet and Sudhar.

2.0 RAINFALL & CLIMATE

The climate of Ludhiana district can be classified as tropical steppe, hot and semi-arid which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrate into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south west monsoon which lasts up to September. The transition period from September to November forms the post-monsoon season. The winter season starts late in November and remains up to first week of March.

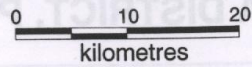
Rainfall: The normal annual rainfall of the district is 680 mm which is unevenly distributed over the area in 34 days. The south west monsoon , sets in from last week of June and withdraws in end of September, contributed about 78% of annual rainfall. July and August are the wettest months. Rest 22% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally rainfall in the district increases from southwest to northeast.

Normal Annual Rainfall	: 680mm
Normal monsoon Rainfall	: 528 mm
Temperature	
Mean Maximum	: 1.2°C(May&June)
Mean Minimum	: 5.8°C(January)
Normal Rain days	: 34



INDEX MAP

LUDHIANA DISTRICT, PUNJAB



INDEX

- | | | | |
|--|---------------------------------|--|--------------------|
| | GROUND WATER MONITORING STATION | | BLOCK HEAD QUARTER |
| | EXPLORATORY WELL | | DISTRICT BOUNDARY |
| | PIEZOMETER | | BLOCK BOUNDARY |
| | DISTRICT HEAD QUARTER | | |

3.0 GEOMORPHOLOGY & SOIL TYPE

The district area is occupied by Indo-Gangatic alluvium. And there are no surface features worth to mention except that area is plain and major drains are Satluj and its tributaries and Budha nala.

Soil is the end product of the parent material resulting from the consistent influence of climate, topography and the natural vegetation over a long period of time. In the district soil characteristics are influenced to a very limited extent by the topography, vegetation and parent rock. The variations in soil profile characteristics are much more pronounced because of the regional climatic differences. The soil of this zone has developed under semi-arid condition. The soil is sandy loam to clayey with normal reaction (pH from 7.8 to 8.5).

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The district area is occupied by Indo-Gangatic alluvium of Quaternary age. The subsurface geological formations of the area comprise of sand, silt, clay and kankar in various proportions. In general the Ground water of the district is fresh except in and around Ludhiana city where the ground water is polluted due to industrial effluents. The area is revealed by drilling data carried out down to 408 m by Central Ground Water Board and state govt. The lithological data of these boreholes indicate the presence of many sand beds forming the principal aquifers separated by clay beds at various depths.

The data indicates about 5 prominent sand horizons down to 400 m depth separated by thick clay horizons. The first aquifer generally occurs between 10 and 30m. The second is between 50 and 120m. Third between 150-175m. For the fourth between 200-250m and the fifth between 300-400m. The aquifers are giving discharge from 3-52 lps with 4.3×10^{-4} – 6.98×10^{-4} storativity and transivity is ranges between 628-1120 m²/day. The sand content in the aquifer in the district varies from 50 to 80%. Clay beds though thick at places occur mostly as lens and pinches out laterally. The granular material becomes coarser with depth. The aquifer at deeper levels acts as semi-confined to con fined.

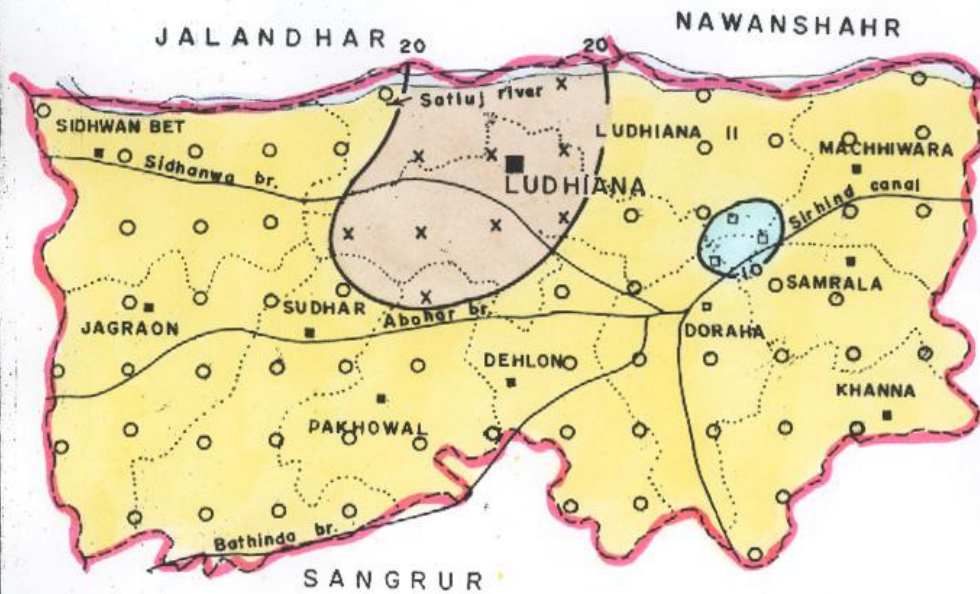
The depth to water level in the area is range between 9-26 m bgl. In the north eastern part ' Machhiwara ' block area itv ranges between 5-10 m bgl and 10-20 m in north central part of the district in Ludhiana city aqnd Bhaini raian . In rest of the area of the district it ranges between 20-30 meters.

During the pre monsoon period depth to water level varies between 9.24 to 25.48 m bgl and in post monsoon it ranges between 5.09-33.62 m bgl. The long



DEPTH TO WATER LEVEL (PRE MONSOON) LUDHIANA DISTRICT, PUNJAB

Km. 10 5 0 10 20 Km.



I N D E X

DEPTH TO WATER LEVEL (m. b. g. l)



5 — 10



10 — 20



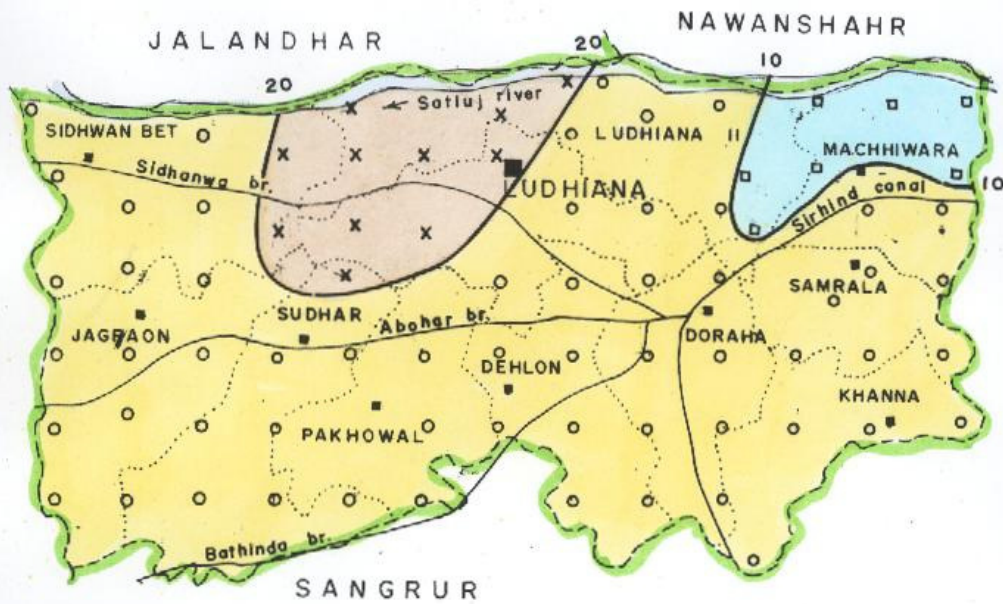
ABOVE 20



DEPTH TO WATER LEVEL (POST MONSOON)

LUDHIANA DISTRICT, PUNJAB

Km. 10 5 0 10 20 Km.



I N D E X

DEPTH TO WATER LEVEL IN m.b.g.l.

	5	—	10
	10	—	20
	ABOVE		20

term water trend indicate that the water level showing decline ranges from 0.11 m/y – 1.34 m/year.

4.2 Ground Water Resources

The Ground Water resources of the district was done in 2004 for each individual block as per GEC 1997 norms. Perusal of the estimates reveals overall stage of ground water development in the district is of the order of 144 %. The ground water development in all the blocks of the district have been categorized as over exploited and only Doraha block is in critical stage. Khanna, Pakhowal and Ludhiana blocks are showing 194 %, 187 % and 177 % respectively. Doraha block has least development of Ground Water i.e. 96 %. Net ground water availability of the district is 234116.98 ham.

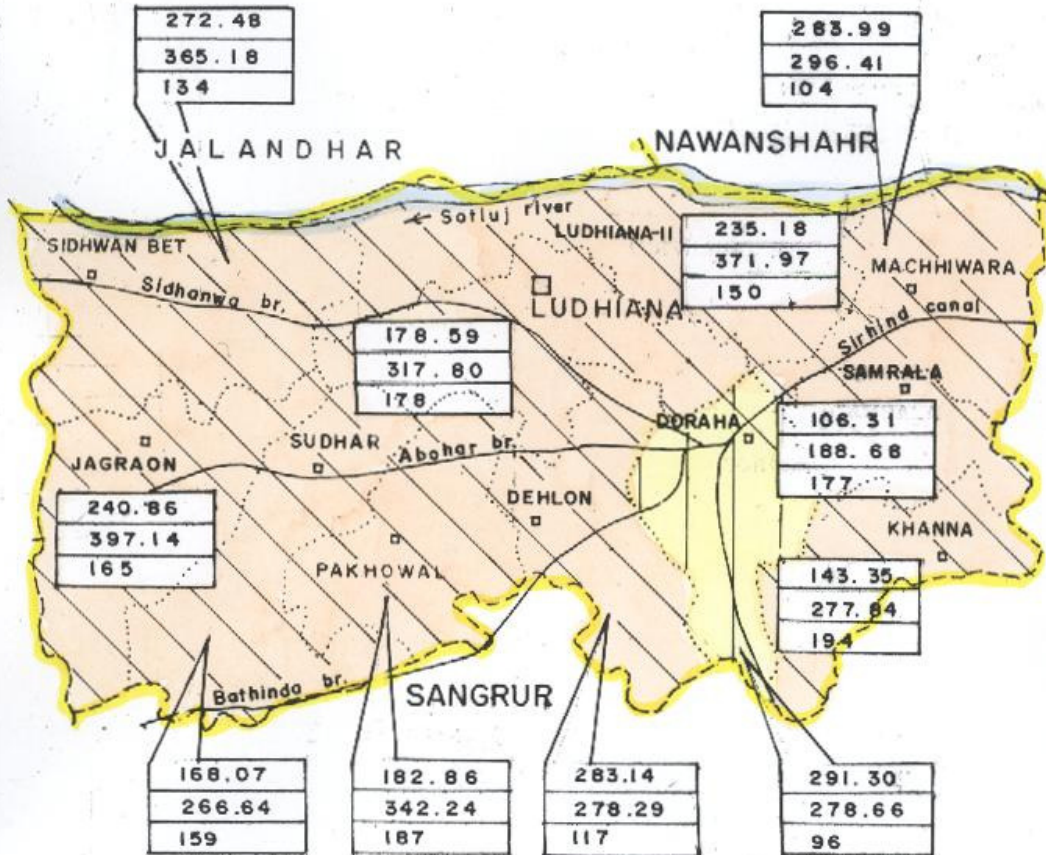
The blocks wise resource potential in the district has been assessed are given below.

STAGE OF GROUND WATER DEVELOPMENT AS ON 31-03-2004.
(Fig. in Ham)


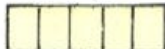
S.No.	Assessment Unit	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for all uses (5+6)	Allocation for domestic and industrial requirement supply upto next 25 years	Net Ground Water Availability for future irrigation development (4-5-8)	Stage Ground Water Development $7/4 \times 100$ (%)	Category of Block
1	DEHLON	23814.71	27480.17	349.30	27829.47	565.79	-4231.24	117	Over exploited
2	DORAHA	29130.46	26472.18	1394.36	27866.53	1582.98	1075.30	96	Critical
3	JAGRAON	24086.97	38238.41	1475.65	39714.06	1714.66	-15866.10	165	Over exploited
4	KHANNA	14335.10	26386.16	1397.87	27784.03	1588.67	-13639.73	194	Over exploited
5	LUDHIANA	17859.09	24837.66	6942.99	31780.65	7192.74	-14171.30	178	Over exploited
6	MACHIWARA	28399.11	29257.50	383.60	29641.10	579.42	-1437.82	104	Over exploited
7	MANGAT	23518.31	36835.43	362.47	37197.90	587.11	-13904.24	158	Over exploited
8	PAKHOWAL	18286.35	32808.91	1415.10	34224.01	1616.58	-16139.14	187	Over exploited
9	SAMRALA	10631.13	18357.17	511.44	18868.60	828.40	-8554.44	177	Over exploited
10	SIDHWANBET	27248.31	36213.79	304.36	36518.15	492.98	-9458.47	134	Over exploited
11	SUDHAR	16807.44	26386.16	278.71	26664.88	451.45	-10030.17	159	Over exploited
	TOTAL	234116.98	323273.54	14815.83	338089.38	17200.77	-106357	144	Over exploited

GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS LUDHIANA DISTRICT, PUNJAB

Km. 10 5 0 10 20 Km.

INDEX

178.59	GROUND WATER RESOURCE (MCM)
317.80	GROSS GROUND WATER DRAFT (MCM)
178	STAGE OF GROUND WATER DEVELOPMENT %
	OVER EXPLOITED BLOCK
	CRITICAL BLOCK

4.3 Ground Water Quality

Present data of chemical analysis of water samples collected from shallow aquifers (NHS-2006) indicates that ground water is slightly alkaline in nature (pH varies between 7.25-7.90). also ground water is fresh to moderate saline (Ec varies between 550-1320micromhos/cm at 25⁰C. All the chemical parameters are well with in the permissible limits for safe drinking water set by BIS 1991 revised in 2007 except for NO₃ at Bhalolpur (52 mg/l), Muskabad (8 mg/l), Kohara (104 mg/l), Begowal (56mg/l) , and Serian (57 mg/l).

Bicarbonate is the dominant anion while calcium or calcium along with magnesium is the dominant cation in he waters. By and large , quality ground water is suitable for drinking except at few places mentioned above due to high value of NO₃ exceeding 45 mg/l.

The suitability of ground water for Irrigation is generally assessed by the factors of salinity (EC), Sodium absorption ratio (SAR) & Residual Sodium carbonate (RSC). These parameters range between 550-1320 microsiemens /cm at 25⁰ C, 0.29-3.64 and (-) 1.68 to 4.08 respectively. Based upon the plot of EC Vs SAR on the USSL diagram for rating Irrigation Waters, C₂₅ & C₃S₁ classes of waters have been observed, Such waters will cause problems of neither salinity nor sodium hazard when used for customary Irrigation.

The shallow ground water is getting polluting by heavy metals like copper, lead, manganese and iron. How ever, in deeper aquifer the concentration of these heavy metals is low as compare to shallow aquifer. The over all review of trace elements analysis indicates that the presence of heavy metals in the ground water at shallow and deeper aquifers, which is due to industrial pollution.

Presence of chemical constituents more than the permissible limits:-

A.

Chemical constituents	Total wells	B15 limit of 1991 revised in 2007	Above limits	Location with value in mg/l
No ₃	8	45mg/l	5	Bhalolpur (52) Muskabad (58) Kohara (104) Begowal (56) Sherian (57)
Fe	5	1.0 mg/l	Nil	
As	5	0.01 mg/l	nil	

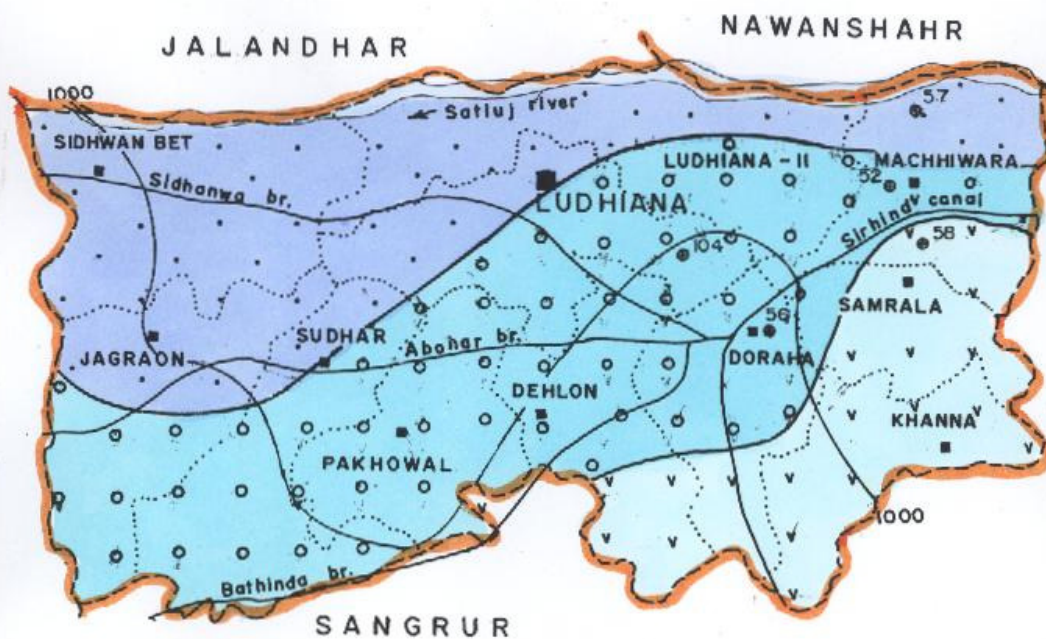
B. Type of water: - calcium bicarbonate



HYDROGEOLOGY

LUDHIANA DISTRICT, PUNJAB

Km. 10 5 0 10 20 Km.



Index

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	50 - 330	1300 3000	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	50 - 150	1000 1300	Water level is shallow recharge not required
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	40 - 70	600 1000	Water level is shallow recharge not required
ELECTRICAL CONDUCTIVITY (MICROMHOS/CM AT 25°C)		⑤ ² Nitrate > permissible limit of 50 mg/l			
1000		Limited up to depth explored ie deeper prospects yet to be found			



4.4 Status of Ground Water Development

Ground water development in the district has taken place through private and public agencies for both irrigation and drinking purposes and can be summarized as below: -

The water supply to the district is mainly based on ground water through tube wells. The water supply to the villagers is met out with the installation of hand pumps as spot & convenient source of water. The canal irrigation covers a very sound area of 90 sq. km out of 3060 sq. km area of total irrigated area. The remaining area is irrigated by ground water. The shallow tube wells in the district ranges from 25-90 m deep. Tapping the aquifer from 10-90m, With a discharge of 200 to 1500 lpm. Most of the shallow tubewells are either run by diesel engines or electric moters. 117352 no. of moters are working in district. The ground water discharge is between 600 1000 lpm in south east and is between 1300-300 lpm in the northern part of the district.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, delineation of potential aquifer characteristics. These studies also provide information on well design and drilling techniques. A well assembly of 305/203 mm dia combination, using about 80m 90 m housing length having slot size of 1.19 mm would be ideal for the district area. The 'V' wires galvanized Johnson screen-having 1.00mm slot width may also be used against granular zones, as it has more open space for entrance of water. The shallow tube wells up to 40 m depth should have 203 mm single dia pipe assembly with a suitable screen length. Direct or reverse rotary rig can carry out the drilling with a suitable length.

5.2 Water Conservation And Artificial Recharge

The North western and south western part of the district where water level decline exists, Artificial recharge structures may help in arresting this water level decline. Generally Recharge Trench with injection well structure is the suitable for artificial recharge. Water conservation methods like change in cropping pattern, change in Irrigation policy, timely plantation of paddy, promotion of sprinkler and drip irrigation etc. may be adopted to over come the ground water decline in the area.



6.0 GROUND WATER RELATED ISSUES & PROBLEMS

GROUND WATER DEPLETION

Significant water table decline has been observed in Northwestern and south western parts of Ludhiana district. The main cause of ground water depletion is its over-exploitation to meet the increasing demand of various sectors including Agriculture, Industry and Domestic. This declining water table trend, if not checked, would assume an alarming situation in the near future affecting agricultural production and thus economy. Ground Water Recharge and Ground Water Conservation may be done in these areas to over come the Water level decline.

7.0 RECOMMENDATIONS

1. In order to arrest the declining trend of water levels in North western and south western part of the district, the rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed.
2. Planned use of surface and ground water (conjunctive use) has to be done to over come both over exploitation and Ground water quality problems.
4. The construction of roof top rainwater harvesting structures should be made mandatory in building bye-laws, which will help in checking the falling water level trend in the towns of water level depleting areas.
5. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.
7. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited blocks.