BARNALA DISTRICT PUNJAB

CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
2013

Contributors

G.P.Singh

Scientist – B

Prepared under the supervision of

A.K. Bhatia

Regional Director

Our Vision

"Water Security through Ground water Management"

GROUND WATER INFORMATION BOOKLET, AMRITSAR DISTRICT, PUNJAB

C O N T E N T S

BARNALA DISTRICT AT A GLANCE

S. NO.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	1410
	ii. Administrative Divisions	
	Number of Tehsils	02 Barnala, Tappa
	Number of Blocks	03 Barnala Sehna, Mahal kalan.
	Number of Panchayats	-
	Number of Villages	
	iii. Population (as per 2011 Census)	16,33,879
	iv. Average Annual Rainfall (mm)	504
2.	GEOMORPHOLOGY	
	Major Physiographic Units	Alluvium Plain
	Major Drainage	Dhaula drain
3.	LAND USE (Sq. Km.)	
	a. Forest Area:	2
	b. Net area sown:	1240
	c. Total cropped area:	2610
4.	MAJOR SOIL TYPES	Tropical arid brown and arid brown
5.	AREA UNDER PRINCIPAL CROPS	Rice 1050 Wheat 1150
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number Of Structures)	
	Dug wells	-
	Tube wells/Bore wells	970 sq. km.
	Tanks/ponds	-
	Canals	270 sq. km.
	Other sources	-
	Net Irrigated area	1410 sq. km.
	Gross irrigated area	1240 sq. km.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB.	
	No. of dug wells	02
	No of Piezometers	04

8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium
9.	HYDROGEOLOGY	
	*Major Water bearing formation *(Pre-monsoon depth to water level) *(Post-monsoon depth to water level) *Long term water level trend in 10 yrs in m /yr	Sand & Gravel 4.43-20.62mbgl 6.99-24.28 mbgl 0.16-1.07 mbgl (Fall) 0.00-0.24 mbgl (Rise)
10.	GROUND WATER EXPLORATION BY CGWB	
	EW OW PZ SH	03 - 04
	Depth range (m)	49-400
	Discharge (liters per minute)	2400-2680
	Storativity (S)	$1.95x10^{-3}$ -4.7x10-3
	Transmissivity (m^2/day)	154-9410
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than the permissible limit EC, in micromhos at 25^0C F, in mg/l Fe, in mg/l As, in mg/l Type of Water	 667-4100 0.20-2.80 0.0002 to 0.0023 0.10 to 0.75 Na HCO3 type
12	DYNAMIC GROUND WATER RESOURCES (2009)	
	Annual Replenish able Ground water Resources	606.41
	Net Annual Ground water Draft	1195.94
	Projected Demand for Domestic and Industrial uses up to 2025	17.95
	Stage of Groundwater Development	197%
13	AWARENESS AND TRAINING ACTIVITY	Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	
15.	GROUND WATER CONTROL AND REGULATION	
	Number of Over Exploited Blocks.	03
	Number of Semi Critical Blocks	-
	Number of blocks notified	2
16	.MAJOR GROUND WATER PROBLEMS AND ISSUES.	Ground water salinity, Water level decline, High Fluoride

GROUND WATER INFORMATION BOOKLET BARNALA DISTRICT, PUNJAB

1.0 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.

2.0 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. 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 upto September. The transition period from September to October forms the post monsoon season. The winter season starts late in November and remains upto first week of March.

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. July and August are the wettest months. Rest 19% rainfall is received during non-monsoon period in the wake of western disturbance and thunderstorms. Generally rainfall in the district increases from southwest to northwest.

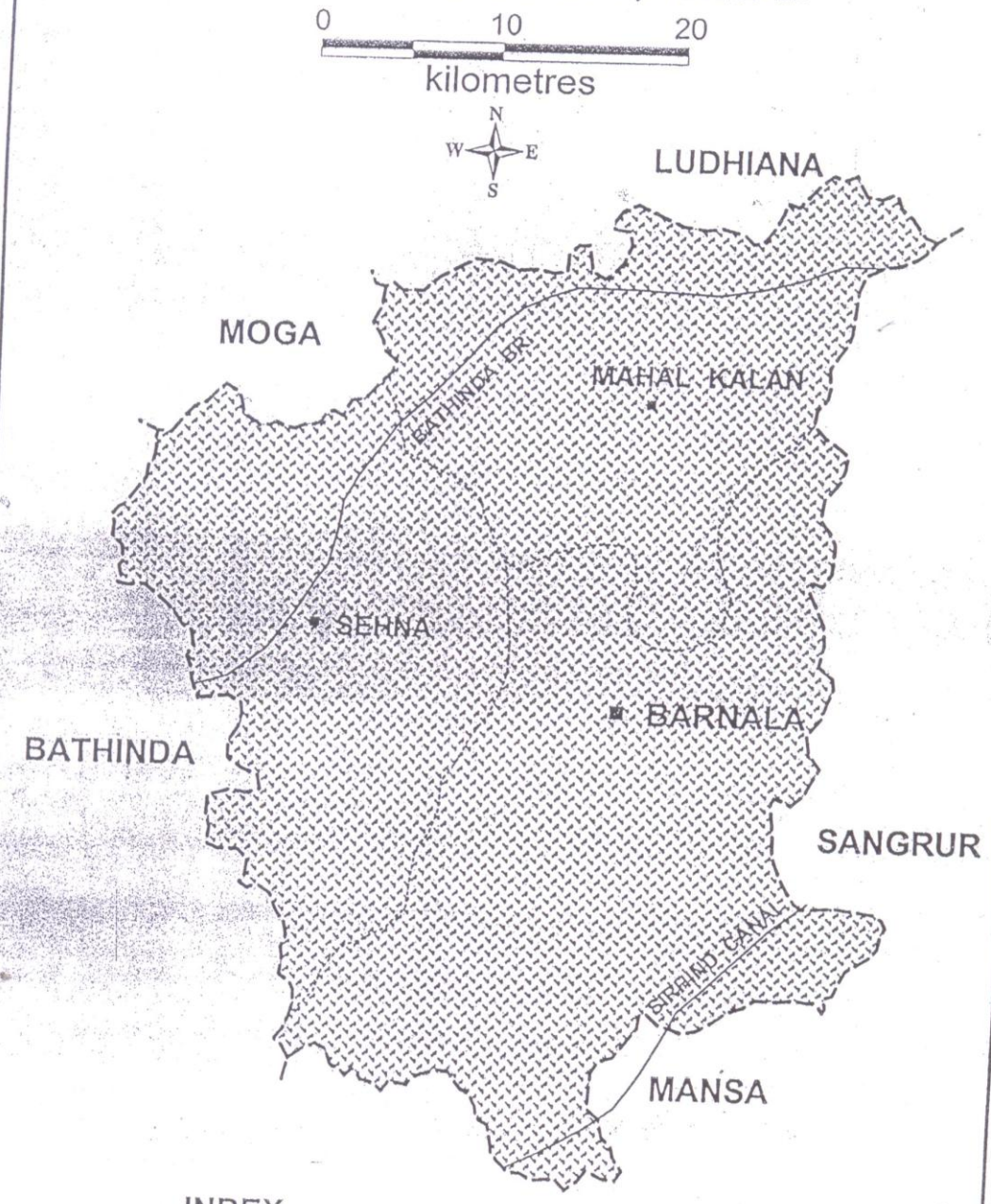
The mean minimum and maximum temperature in the area renges from 7.1®C to 40.4®C during January and May or June respectively.

3.0 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.

SOIL

BARNALA DISTRICT,PUNJAB



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ASID BROWN SOIL (SOLONI RED)

DISTRICT BOUNDARY

BLOCK BOUNDARDY

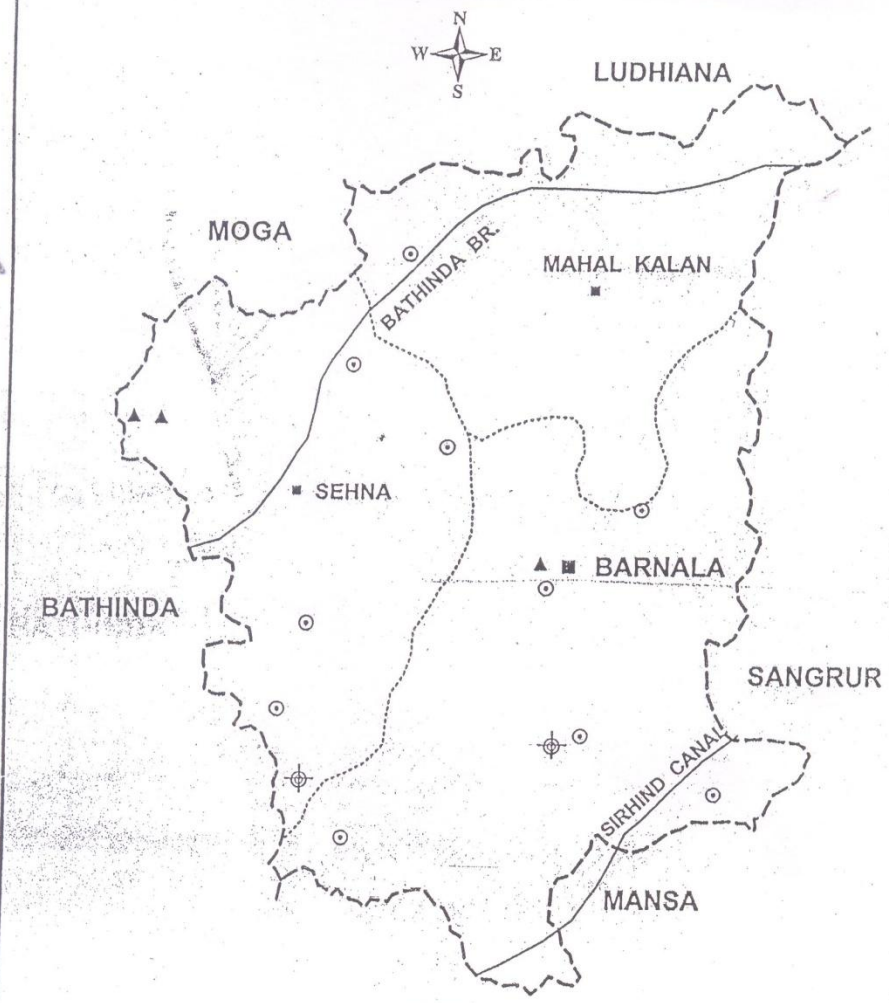
C G W B / NWR (S.K. Singh) D.O.NO. 62/2009

PLATE....1

INDEX MAP
BARNALA DISTRICT,PUNJAB

0 10 20

kilometres



INDEX

- NATIONAL HYDROGRAPH STATION
- PIEZOMETER
- EXPLORATORY BOREHOLE
- DISTRICT HEAD QUARTER
- BLOCK HEAD QUARTER
- DISTRICT BOUNDARY
- BLOCK BOUNDARY

C G W B / NWR (S.K. Singh) D.O.NO.74 / 2009

4.0 GROUND WATER SCENARIO

4.1 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 traditional dugwells tapping the shallow aquifer are not in use and most of them have been abandoned, however, this aquifer is being tapped by their hand pumps and shallow tube wells, which are widely used for domestic purposes. The deep tube wells have been constructed by CGWB, which has drilled 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.

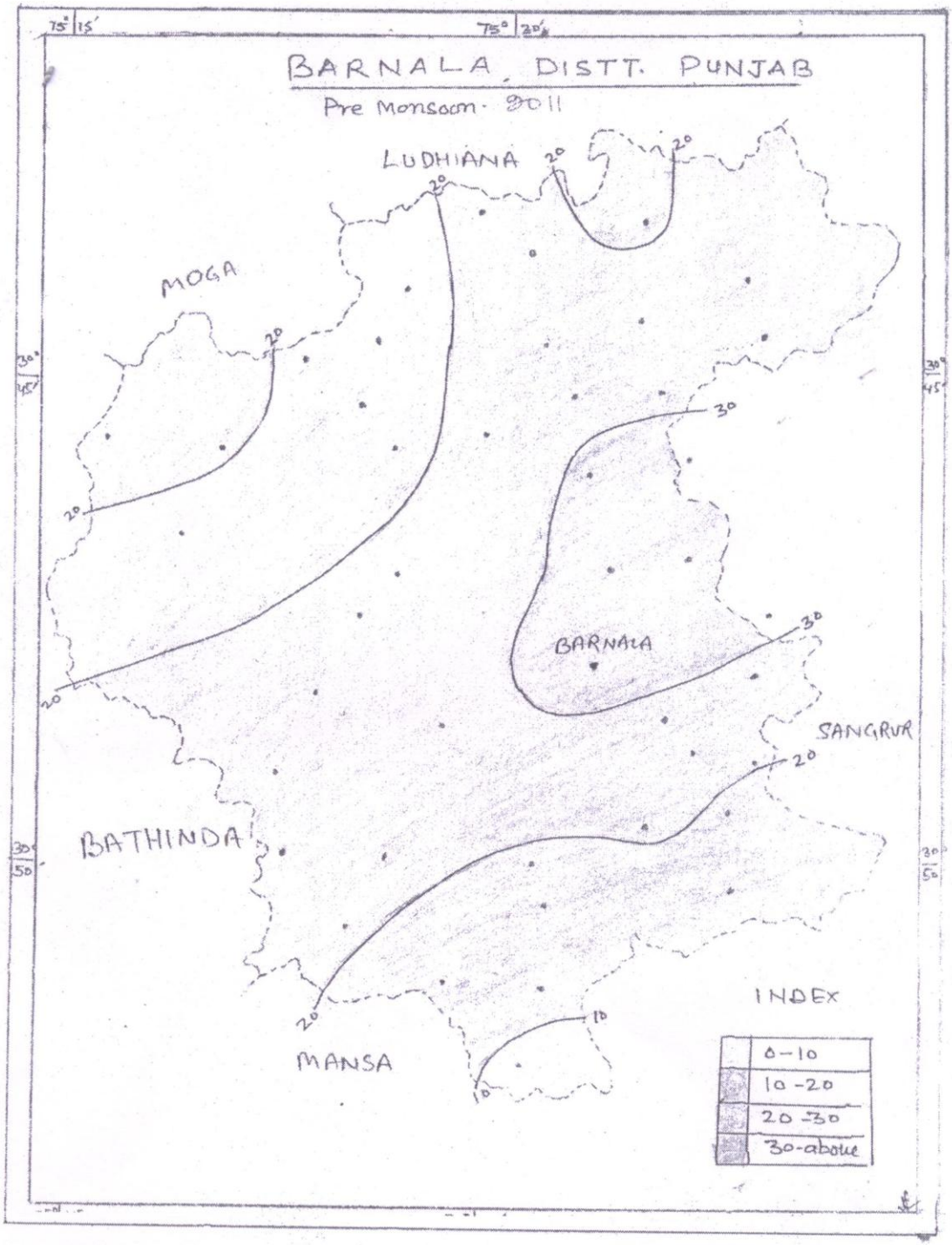
The discharge of deep tube well in the area varies between 2400 and 2680 Ipm. The tranmissivity values ranges from 1670 m^2/day and storativity ranges from $7.5*10^{-2}$.

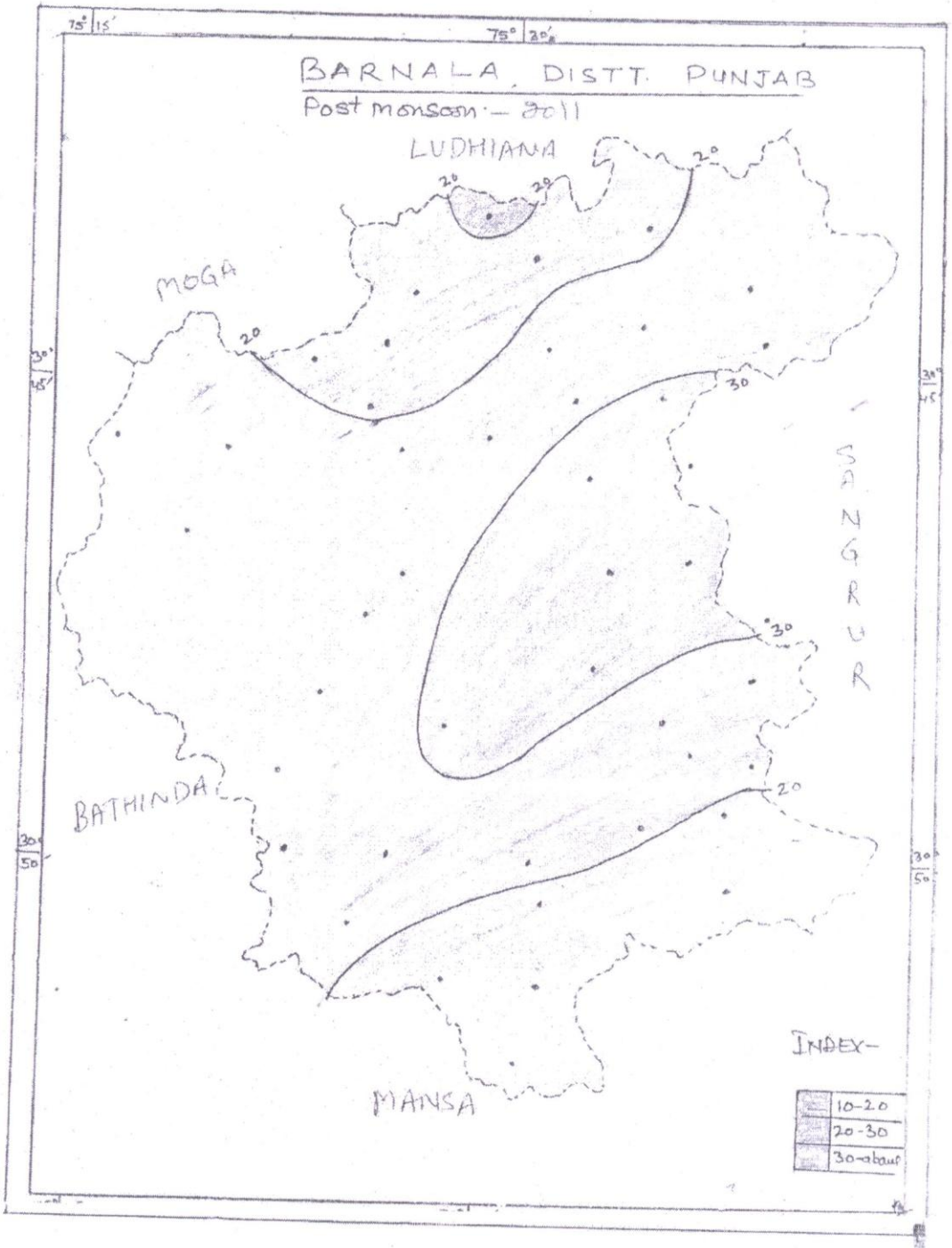
Water level behavior

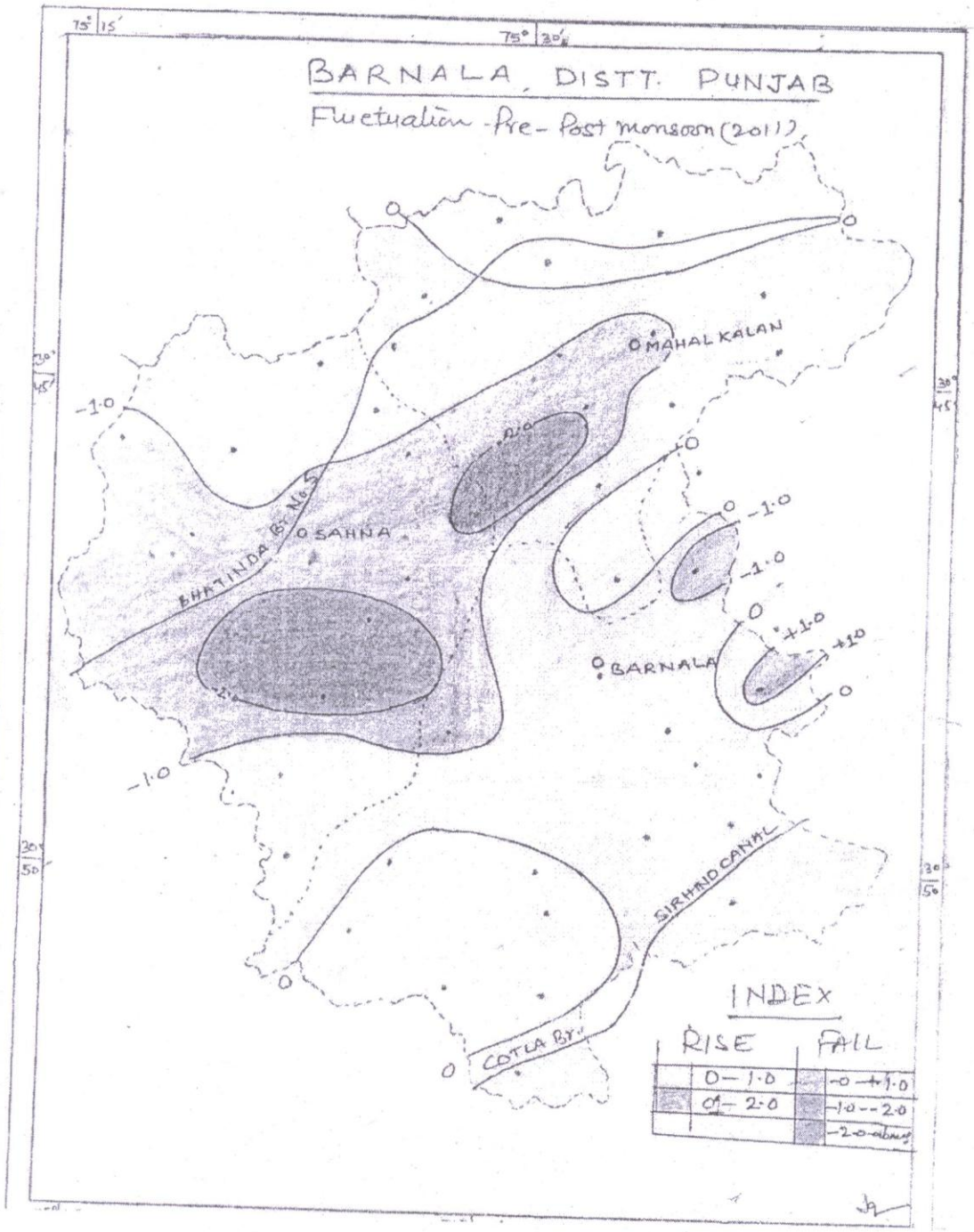
The depth to water level ranges from 14.43 to 20.62 m bgl during pre-monsoon period and 16.99 to 24.28m bgl during post monsoon period. The seasonal fluctuation varies from 0.03 to (-) 3.66 m in the area. The long-term water levels trend indicates average fall of 0.50 m/year. The long term water level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

Ground water flow

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.


BARNALA, DISTT. PUNJAB
Pre Monsoon. 2011
LUDHIANA
MOGA
BARNALA
SANGRUR
BATHINDA
MANSA
75° 15'
75° 20'
30° 45'
30° 50'
INDEX
0-10
10-20
20-30
30-above


BARNALA, DISTT. PUNJAB
Post monsoon – 2011
LUDHIANA
MOGA
BATHINDA
MANSA
SANGRUR
75° 15'
75° 20'
30° 45'
30° 50'
20
30
INDEX–
10-20
20-30
30-above


BARNALA, DISTT. PUNJAB
Fluctuation - Pre - Post monsoon (2011)
75° 15'
75° 20'
30° 45'
30° 50'
MAHAL KALAN
SAHNA
BHATINDA BR. No. 5
BARNALA
SIRHIND CANAL
COTLA BR.
-1.0
+1.0
INDEX
RISE
FALL
0 – 1.0
-0 – +1.0
1.0 – 2.0
-1.0 – -2.0
-2.0 above

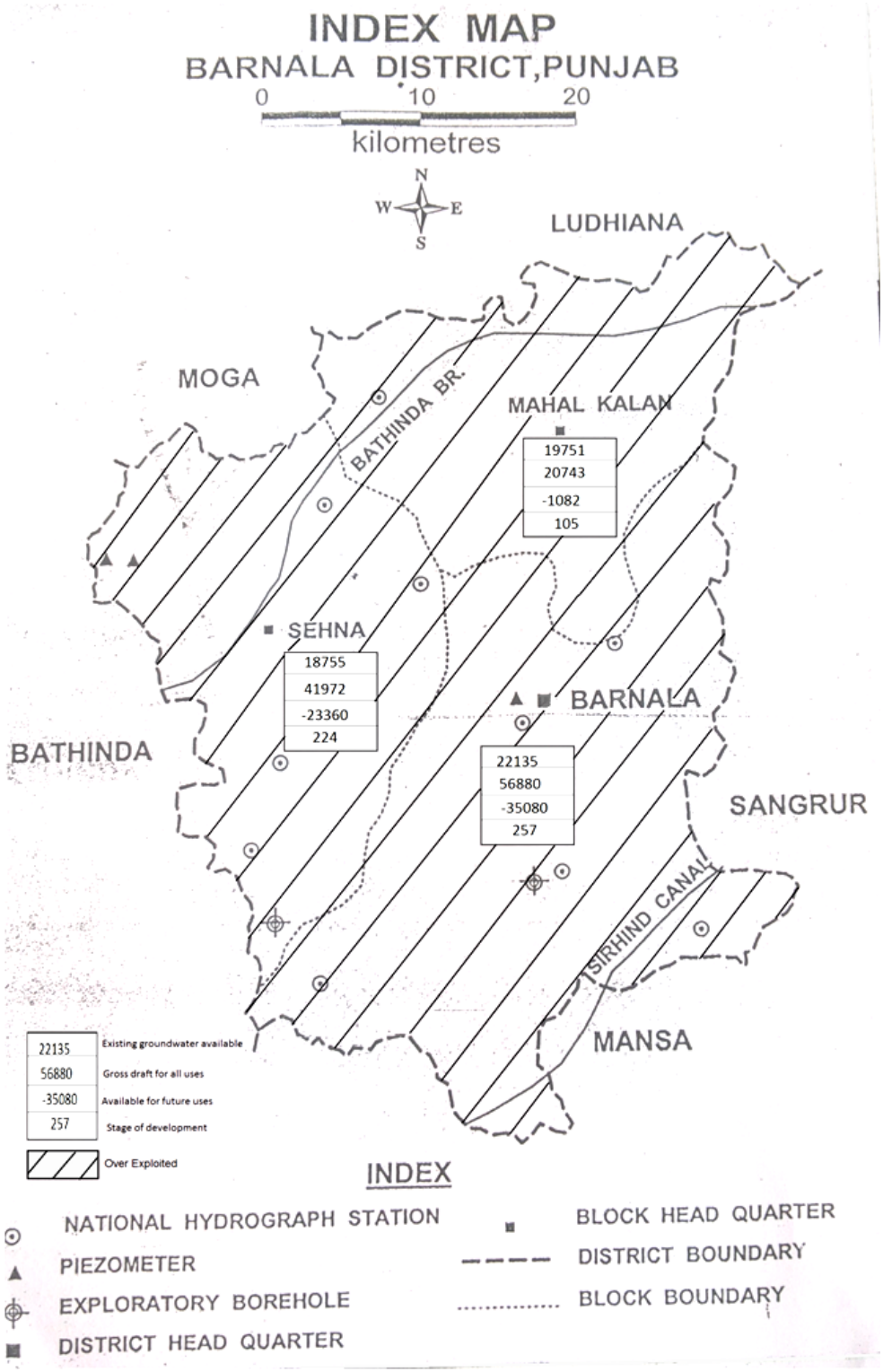
4.2 Ground water resources

The blockwise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 149% (Ghanaur) to 409% (Patran). The net ground water resource of Barnala district have been estimated to be 1490.83 MCM and the gross ground water draft of the district is 2911.65 mcm leaving behind a shortfall of (-) 1443.30 MCM. The stage of ground water development in the district is 195%.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF BARNALA DISTRICT, PUNJAB (AS ON 31-03-2009)

Assessment Unit/block	Net Annual Ground Water Availability (MCM)	Existing Gross Ground Water Draft for irrigation (MCM)	Existing Gross Ground Water Draft for Domestic (MCM)	Existing Gross Ground Water Draft for all uses (MCM)	Allocation for domestic and industrial requirement supply upto next 25 years (MCM)	Net Ground Water Availability for future irrigation development (MCM)	Stage Ground Water Development (%)	Category
Barnala	221.35	561.56	7.24	568.80	10.62	-350.83	257	Over exploited
Mahalkahlan	197.51	205.50	1.92	207.43	2.82	-10.82	105	Over exploited
Sehna	187.56	416.65	3.07	419.72	4.50	-233.60	224	over exploited
Total	606.41	1183.71	12.24	1195.94	17.95	-595.25	197	over exploited

Ground Water Development Potential and Categorization of Blocks



4.3 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 range of mineral concentration is tabulated below.

Constituents	**Minimum limit**	**Maximum limit**
ph	6.9	8.85
EC Micromhos/cm	535	1260
At 25° C		
CO_3 "	Nil	79
HCO_3	175	899
Cl	14	326
SO_4	8.0	355
NO_3	3.98	150
F	0.45	5.0
Ca	12	90
Mg	14	86
Na	14	480
K	4.5	135
TH as $CaCo_3$	147	471
As	0.0004	0.0020
Fe	ND	1.633

Type of Water

The shallow ground water is of Na- HCO_3 type.

Suitability of water

Three fourth ground water of the Distt. is suitable for drinking as well as for domestic purpose. Only 25% of the samples have been concentration of Nitrate and Fluoride above the permissible limit for drinking water (BIS)

4.4 Status of Ground Water Development

The drinking water supply is mainly through ground water in the district. The short fall in water supply to towns, cities and villages is met with the installation of hand pumps by public individually as spot and convenient source of water. The shallow tube wells tap unconfined auifer and depth varies from 40 to 70m. The tube wells constructed by the municipal corporation and other agencies have been constructed tapping deeper aquifer down to 100m. the shallow tube wells irrigate about 1370 sq. km. area in the district . Most of these shallow tube wells are cavity type and either run by diesel engines or electric motors. The discharge of these shallow tube wells/cavity wells range 600-1000 Ipm.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The present stage of ground water development varies from 105% (Mahal Kalan) to 257% (Barnala). All the eight blocks of the area fall in Over Exploited category. Hence, there is no scope of large-scale ground water resource development in the area .However, the shallow ground water can be exploited with caution through shallow tube wells (Cavity Type). PVC pipes are commonly used for constructing these tube wells. Drilling technique used for boring the shallow wells is locally developed.

5.2 Water Conservation and Artificial Recharge

In Patiala district, 4 pilot projects for artificial recharge to ground water were undertaken and same were completed successfully. These are namely (i). Pilot project for Artificial Recharge from Choe No.1 of Bhakra Main line canal, near village Dhanetha, Samana block (1999-2000), (ii) Pilot study for artificial recharge scheme to ground water from Sirhind Choe, (2000 - 2001), Pilot study for artificial recharge to ground water from Patiala Nadi (2001-2002) and Pilot study for artificial recharge to ground water from Miranpur choe (2001-2002). One Scheme for artificial recharge to roof top rain water harvesting for school buildings were undertaken in the area (2004-2005).

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

The major problem in respect of ground water in the district is the overall decline in the water level.It is apprehended that the declining ground water trend will further aggravate with installation of more tube wells. High fluoride (F) content, more than the permissible limit of 1.5 mg/l, in shallow ground water is observed at few places in the district, thus making the water harmful (unfit) for human consumption. High values of nitrates, more than the prescribed limit of 45 mg/l is also observed in shallow ground water at few places in the area.

7.0 AWARENESS & TRAINING ACTIVITY

No Mass Awareness or training program has been conducted so far.

8.0 Areas Notified By CGWB/CGWA

Mahal Kalan Block of District is notified in 2006 and Barnala Block is notified in 2011.

9.0 RECOMMENDATIONS

1. The dug wells traditionally used for the monitoring the water level in the area are either dried or abandoned in major part of the area. So, it is recommended to install shallow piezometers in all the blocks.
2. On the declining trend of ground water level a close watch be maintained and water level should be measured at different places. For this, 10 shallow (50 m) and 10 deep (200 m) piezometers 152 mm (6") dia. Should be constructed for regular monitoring of ground water level. These piezometers should be uniformly distributed with the proper provision of collection of water samples.
3. High fluoride areas can be mapped and the public be educated about its harmful effect on human body. Small defluoridation plants can be used and mixing of water can be practiced.
4. PVC pipe assembly may be used in case of shallow tube wells.
5. It is necessary to notify the entire district for registration of all ground water abstraction structures and for the construction of any tube well, prior permission should be sought from the Central Ground Water Authority.
6. Mass awareness programme should be organized to educate the people regarding consequences of mining of ground water and need for its effective/economic use. Public awareness programme should be arranged to make the people and industry aware about the menace of ground water pollution and dwindling ground water resources in the towns.
7. More canals should be laid for irrigation so that stress on ground water can be reduced.
8. Cropping pattern in the area should be changed by growing low water consuming crops instead of paddy.
9. Improved irrigation practices should be followed in order to reduce burden on irrigation water.