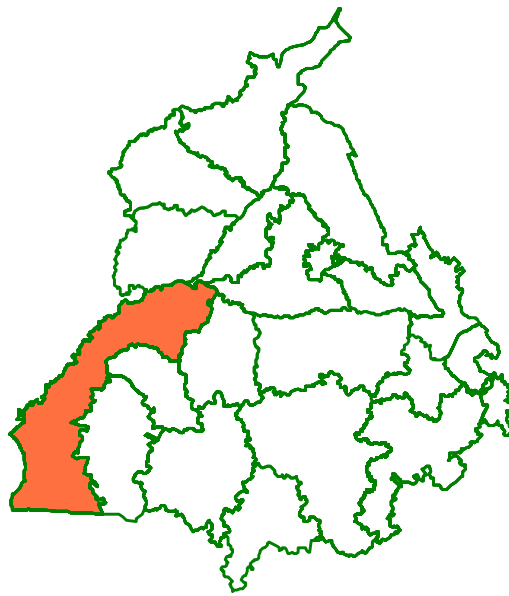




FIROZPUR DISTRICT PUNJAB



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 FEROZEPUR DISTRICT, PUNJAB

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FEROZEPUR DISTRICT AT A GLANCE

SI No.	ITEMS	Statistics
1.	General Information	
	i) Geographical area (Sq. km)	5850
	ii) Administrative divisions (As on.....) Number of tehsils/Block Number of Panchayat/Village	5/11 /1008
	iii) Population (As on 2001 census)	1744753
	iv) Average annual Rainfall (mm)	389
2.	Geomorphology	
	Major physiographic units	Upland plain, sand dunes tract, Younger flood plain, Active flood plain.
	Major drainages	River Satluj
3.	Land use (sqkm)	
	a) Forest area:	-0.12 Hectare
	b) Net area shown	1.33 Hectare
	c) Cultivable area	2.47 Hectare
4.	MAJOR SOIL TYPES	Sierozem soil, Desert soil
5.	AREA UNDER PRINCIPAL; CROPS	903 TH
6.	IRRIGATION BY DIFFERENT SOURCES (Area and Number of Structures)	
	Dug wells/ Bore wells	328.7 by tube wells/ Wells (10.87 % by total area irrigated in Punjab by TW/wells)
	Tanks/ Ponds	
	Canals	144.8 by canal (14.45% of total area irrigated in Punjab by canal) and
	Net Irrigated area	473500 Hectare
	Gross irrigated area	886800 Hectare
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007) No. of Dug Wells No of Piezometers	13 9
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium



9.	HYDROGEOLOGY	
	<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) 	<p>Sand gravel and Kankar 1.6 m –11.07 m bgl</p> <p>0.75 m –10.57 m bgl</p> <p>Rise in most of the area</p>
11.	GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)	
	No of Wells drilled (EW,OW,PZ,SH,Total)	Exploratory-12 Piezometer-3
	Depth range (m)	Up to 454 m bgl
	Discharge (Liters per second)	120-3000 lpm, Drawdown- 3.66 – 17.47 m
	Storativity (S)	0.638×10^{-3} and 27×10^{-3}
	Transmissivity (m^2/day)	327 m^2/day to 2600 m^2/day
12.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit EC, in micromhos at 25°C F, in mg/l As, in mg/l Fe, in mg/l	<p>3000</p> <p>1.5</p> <p>nil</p> <p>1.0</p>
	Type of Water	Na-HCO ₃ type
13.	DYNAMIC GROUND WATER RESOURCES (2004)- in mcm	
	Net Annual Ground Water Availability	2193.83
	Net annual Ground Water Draft	2311.36
	Projected demand for Domestic and Industrial Uses up to 2025	35.70
	Stage of Ground Water development	105%
14.	AWARENESS AND TRAINING ACTIVITY	
	Mass awareness Programs organized Date Place No of Participants	Nil

जल वर्ष
2007



Water Year
2007

	Water Management Training Program's Organized Date Place No of participants	Nil
15.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	No
	Projects completed by CGWB (no & amount spent)	No
	Projects under technical guidance of CGWB (numbers)	No
16.	GROUND WATER CONTROL AND REGULATION	
	Number of OE blocks	5
	Number of Critical blocks	One
	NB of blocks notified	Nil
17.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Ground water Salinity Water Logging



GROUND WATER INFORMATION BOOKLET FEROZEPUR DISTRICT, PUNJAB

1.0 INTRODUCTION

Ferozpur, the south western most district of Punjab State with a total geographical area of 5850 sq.km. is located between 29° 56' 47" and 31° 0' 7" north latitudes and 72° 52' 54" and 75° 01' 11" east longitudes . The district area falls in Survey of India degree sheet Nos. 44 J, 44F, 44I .

Administratively, the district is under control of Ferozpur division and is divided into 5 sub-divisions namely Ferozpur, Fazilka, Abohar, Zira and Jalalabad and 4 sub tehsils i.e. Arniwala Sheikh Subhan, Mamdot, Talwandi Bhai, Makhu.

The Ferozpur district forms a **part of Sutlej sub basin of main Indus basin** and is interrupted by clusters of sand dunes. The district area is an almost a flat terrain with a gentle slope towards south west direction.

Physiographically, it is characterized by **four distinct features i.e. the upland plain, sand dune tracts, younger flood plain and active flood plain.**

The river Sutlej that is of perrineal nature mainly drains the area. River Sutlej shows both influent and effluent nature in the area. The area is traversed by a dense network of canals.

In irrigation practices, contribution of tubewells are larger as compared to canal system i.e 137 % area irrigated by canal is being irrigated by tubewells.

2.0 RAINFALL & CLIMATE

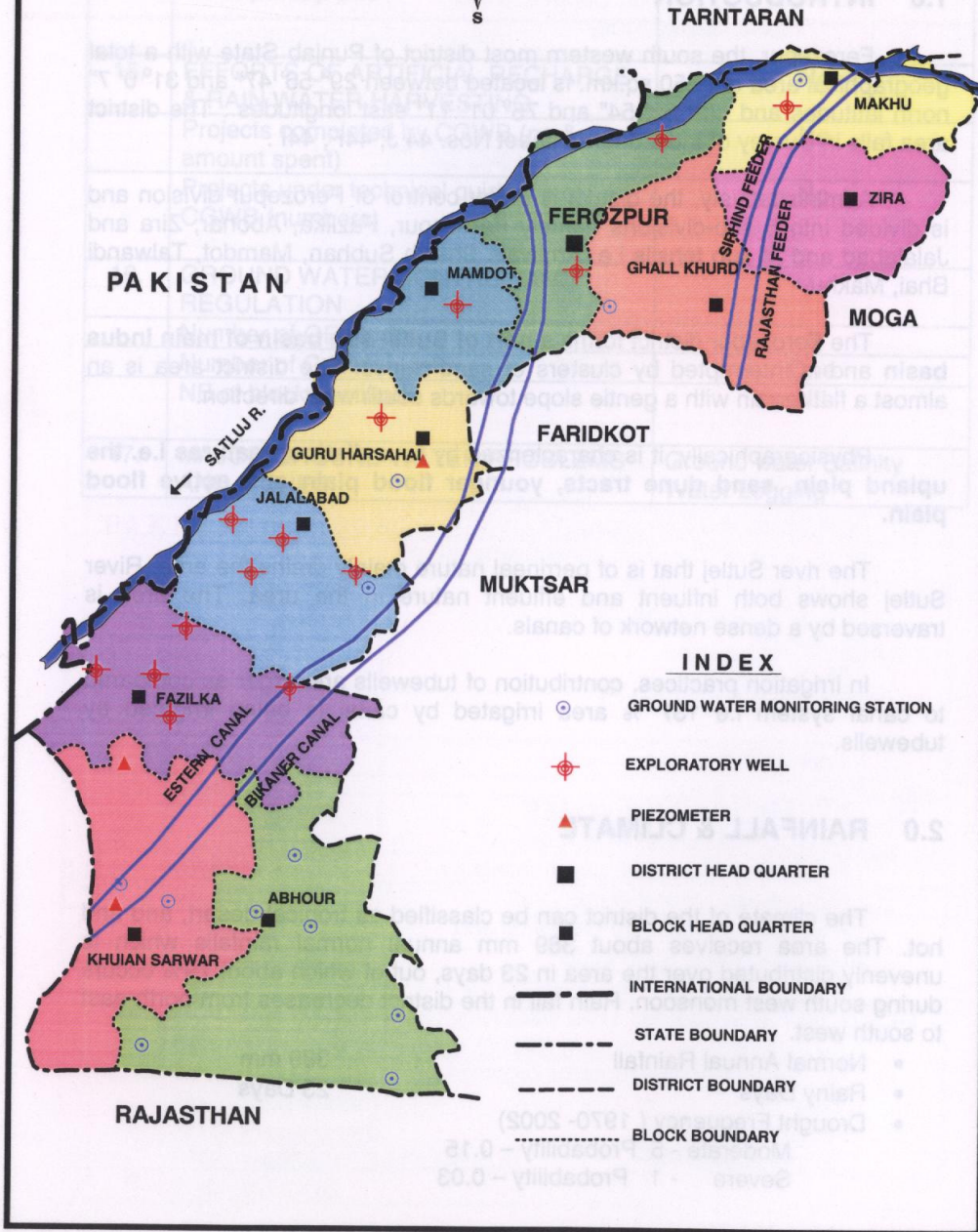
The climate of the district can be classified as tropical desert, arid and hot. The area receives about 389 mm annual normal rainfalls which is unevenly distributed over the area in 23 days, out of which about 79% occurs during south west monsoon. Rain fall in the district decreases from north east to south west.

- Normal Annual Rainfall : 389 mm
- Rainy Days : 23 Days
- Drought Frequency (1970- 2002)
 - Moderate - 5 Probability – 0.15
 - Severe - 1 Probability – 0.03



INDEX MAP FEROZPUR DISTRICT, PUNJAB

0 10 20
kilometres





- Normal monsoon Rainfall: 79% of the Total
Probability of Excess Rainfall : 42%
Probability of Normal Rainfall : 30%
Probability Of Deficient Rainfall : 27

3.0 GEOMORPHOLOGY

The district area forms a part of Indo-gangetic plain and Sutlej Sub basin of main Indus basin. The area as a whole is almost flat with a gentle slope towards the south westerly direction.

The physiographic of the district is broadly classified from north to south into four distinct features i.e. Upland plain, Sand dune tract, younger flood plain and active flood plain of Sutlej.

The soil of the district is of two types i.e. sierozem (in northern parts) and desert soils (in southern parts).

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The geological formations met within the district comprised of unconsolidated alluvial deposits of Quaternary age. The alluvial deposits comprises of sand, silt, clay and often associated with kankar. Fine to medium grained sand horizon form the potential aquifer in the area.

The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. The water level in the district is ranging from 1.6 to 11.07 m bgl in premonsoon and 0.75 to 10.57 m bgl after post monsoon at Ladhuwala and Bazidpura respectively.

The ground water in unconfined condition is abstracted through hand pumps (upto 30m) and through shallow and medium depth tubewells upto the depth of 175 meters in northern part of district and 125 m in central part of the district. Aquifer upto the depth of 175 m is leaky aquifer. Water from aquifer below the depth of 200 m is saline to highly saline in the southern part of district. These aquifer are confined aquifer.

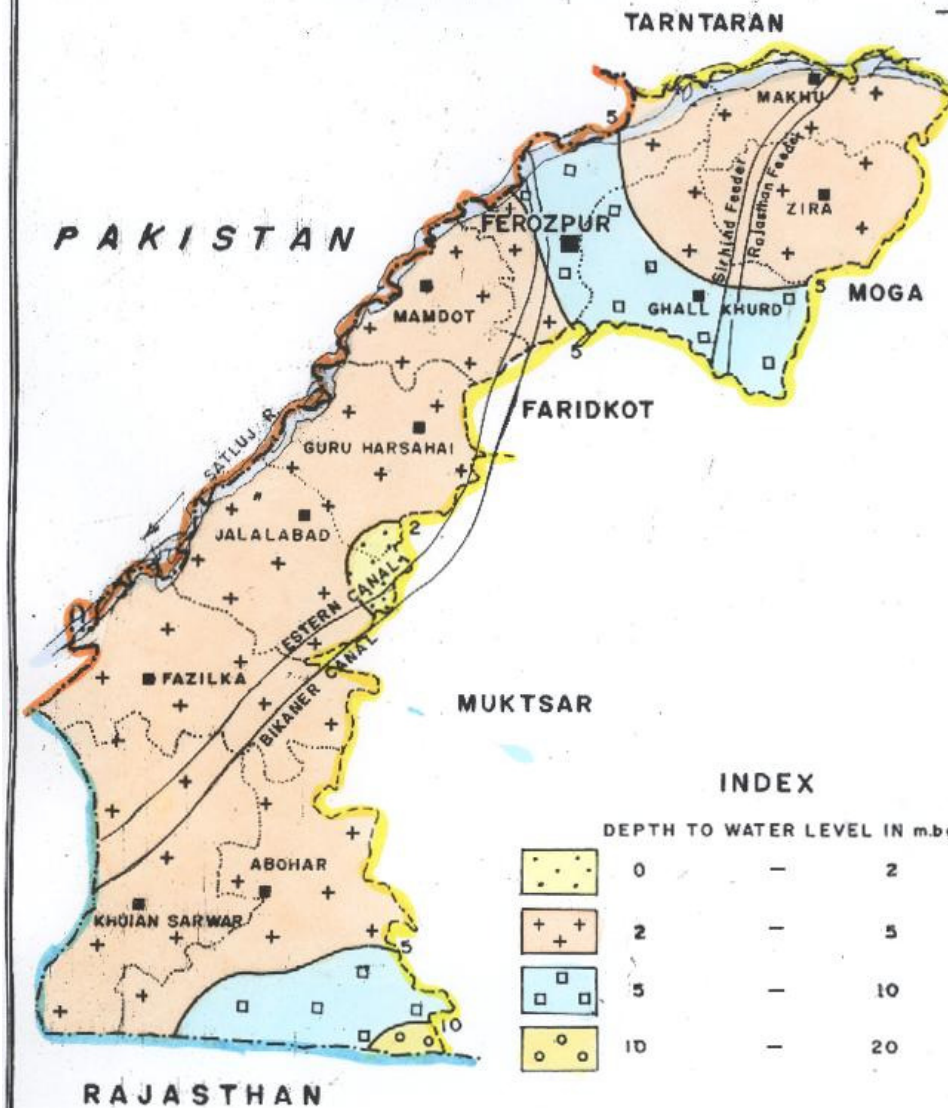
Aquifer System

The geometry and nature of aquifer provide the basic parameters for determining occurrence and movement of ground water and are significant for resource evaluation.



**DEPTH TO WATER LEVEL
(PRE MONSOON)
FEROZPUR DISTRICT, PUNJAB**

KM 0 5 10 20 30 40 KM



INDEX

DEPTH TO WATER LEVEL IN m.bgl

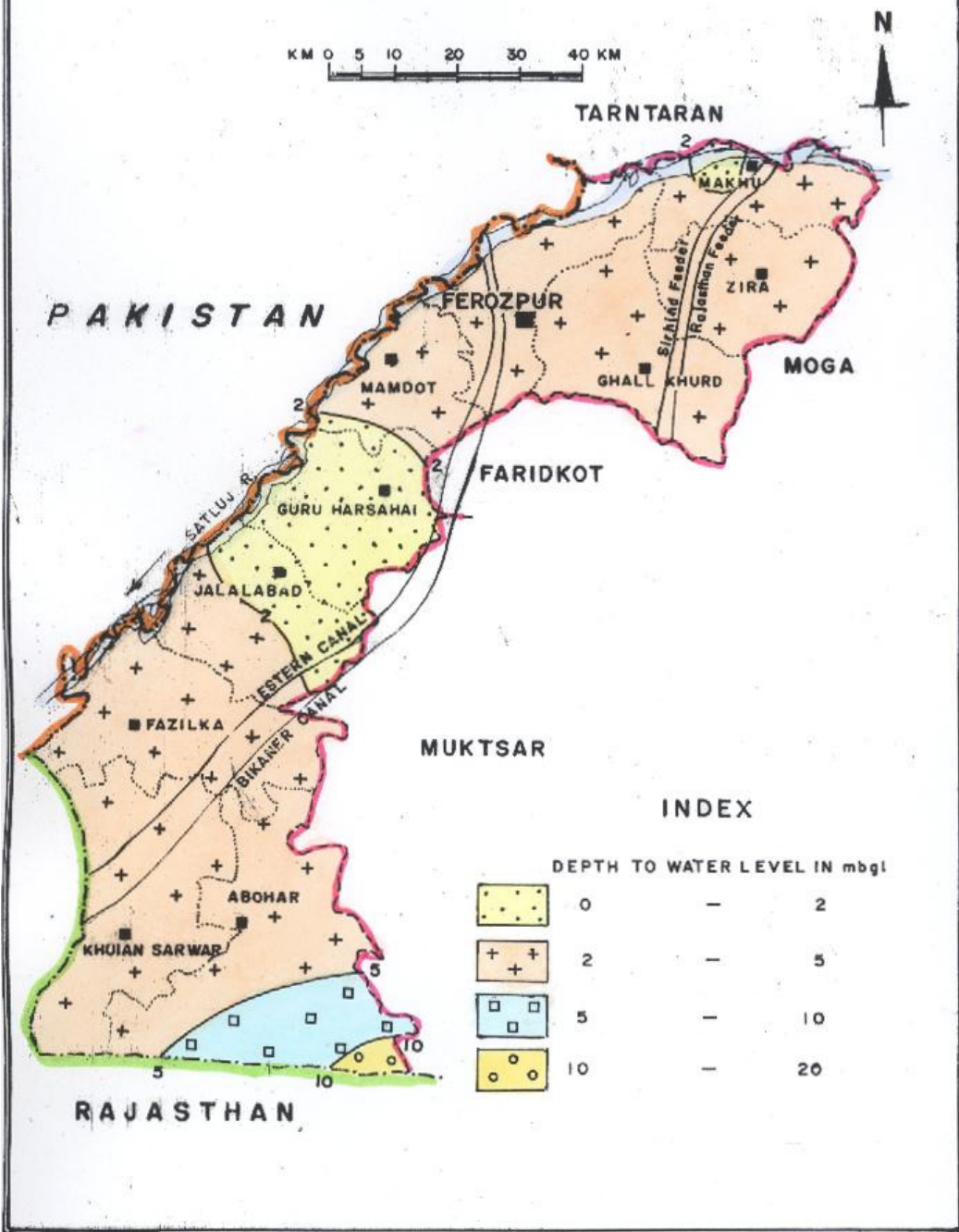
	0	-	2
	2	-	5
	5	-	10
	10	-	20

RAJASTHAN



**DEPTH TO WATER LEVEL
(POST MONSOON)
FEROZPUR DISTRICT, PUNJAB**

KM 0 5 10 20 30 40 KM



INDEX

DEPTH TO WATER LEVEL IN mbgl

	0	-	2
	2	-	5
	5	-	10
	10	-	20



The alluvial complex in the area constitutes a vast regional aquifer. Aquifer geometry is chiefly irregularly shaped tabular bodies of highly permeable sand interspersed with lenticular layer of semi pervious to impervious silty clay or clay layers.

The area has both unconfined/ semi unconfined and confined/ leaky confined aquifers. The alluvium forms the principal ground water reservoir and the principal aquifer material comprises fine to medium sand and sand often mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well connected granular zones that have a pinching and swelling disposition

The occurrence of clay beds is rather irregular and on a regional scale their extensions are limited. Thus while locally the presence of such beds can give rise to leaky confined or confined conditions.

The thickness of the alluvium varies from 200 to 300 m. in tubewells drilled upto the depth of 454 m. The thickness of alluvial formation increases towards north.

4.2 Ground Water Resources Estimation

Out of the total geographical area of 585000 ha of the district, the net area sown is 133000 ha (2000-01) and 328700 ha area is irrigated by tube wells, 144800 ha by canals. The district has 75,473 minor irrigation units.

Considering administrative block as unit has assessed ground water resource potential of the district. The gross ground water draft for all the uses from the net annual ground water availability of 2193.82 MCM is of 2287.693 MCM thus leaving 12956.43 MCM for further irrigation development. The stage of ground water development for all the blocks of the district exceeds 105%. The stage of of development in Fazilka, Ferozpur, Ghalkhurd, Guruharsahai, Jalalabad, Makhu and Zira are over exploited where ground water development is more than 100% and block Mamdot is in critical condition. Only Abohar and khuyiansarver is catagoriesed under safe category. Since the water table does not show significant decline in pre and post monsoon. The stage of ground water development in the district as a whole is 105%.

STAGE OF GROUND WATER DEVELOPMENT OF FEROPUR DISTRICT OF PUNJAB STATE
 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*100 (%)	Category of Block
1	ABOHAR	13823.69	3497.76	304.86	3802.62	458.96	9866.97	28	SAFE
2	FAZILKA	20683.44	26021.17	257.13	26278.30	386.86	-5724.59	127	OVER-EXPLOITED
3	FEROZEPUR	21547.25	24554.35	312.74	24867.09	470.87	-3477.97	115	OVER-EXPLOITED
4	GHALL KHURD	26137.34	34835.70	221.14	35056.85	334.04	-9032.40	134	OVER-EXPLOITED
5	GURU HAR SAHAI	27163.80	32823.48	223.22	33046.70	337.18	-5996.85	122	OVER-EXPLOITED
6	JALALABAD	23880.83	27150.37	241.67	27392.04	365.05	-3634.58	115	OVER-EXPLOITED
7	KHUYIAN SARWAR	17902.12	9661.50	265.04	9926.54	400.34	7840.28	55	SAFE
8	MAKHU	16592.30	20403.33	131.33	20534.66	198.37	-4009.40	124	OVER-EXPLOITED
9	MAMDOT	22656.41	20403.33	131.33	20534.66	198.37	2054.71	91	CRITICAL
10	ZIRA	28995.42	29418.39	278.14	29696.53	419.62	-842.59	102	OVER-EXPLOITED
	TOTAL	219382.61	228769.38	2366.61	231135.98	3569.66	-12956.43	105	

4.3 Ground Water Quality

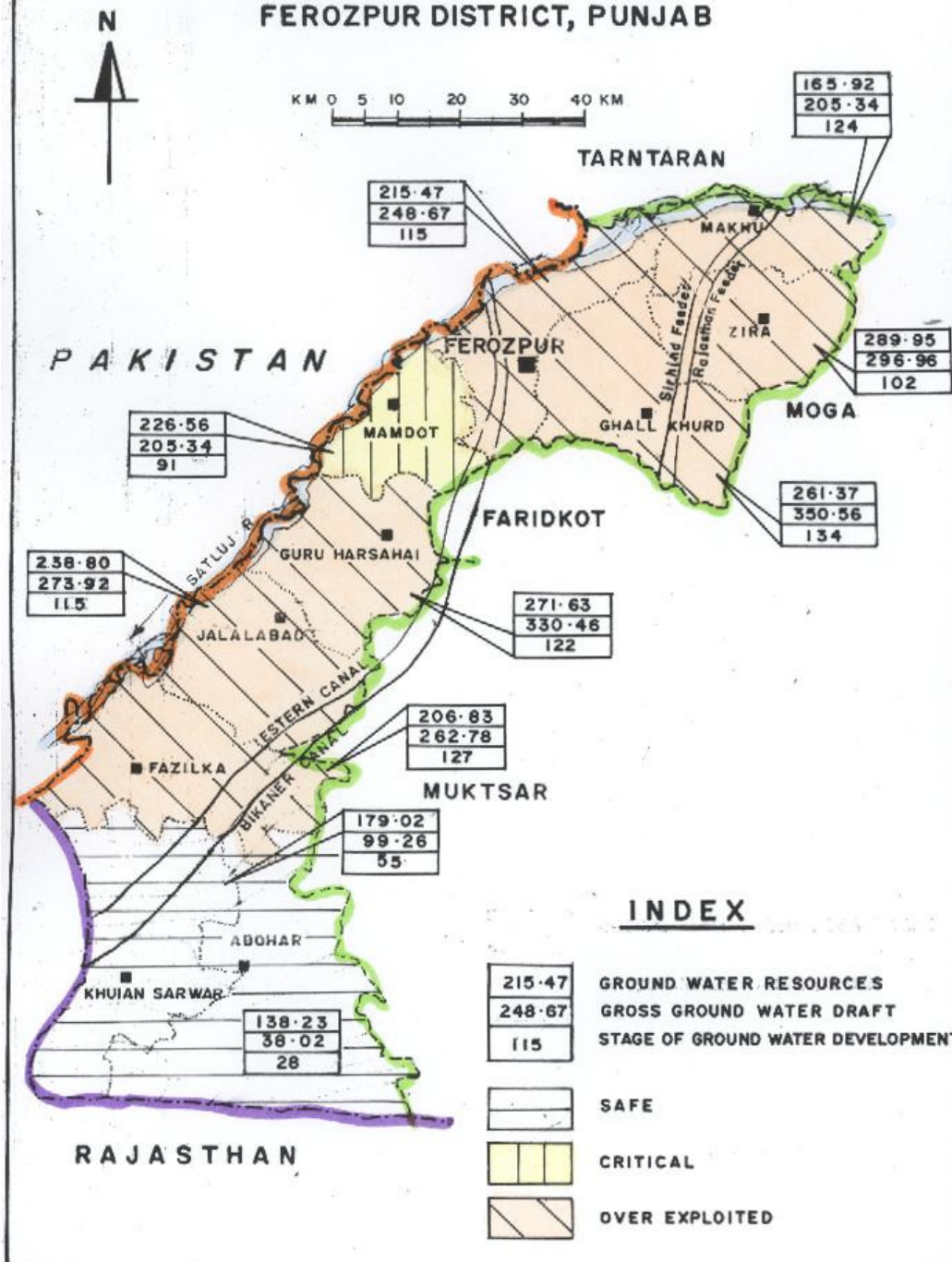
Chemical quality data obtained the analysis of ground water samples representing shallow aquifers (NHS- 2006) reveals that ground water is alkaline in nature. The EC of water samples is either fresh or very saline. Concentration of chemical constituents, in most of the well waters is within permissible limit of drinking water standards. However in few water samples EC is more than 3000 us/cm, F is more than 1.5, NO₃ is above 45 mg/l and Fe is more than 1.0 mg/l. Iron in excess than 1.0mg/l is found in waters from Waryam Khera and Sitogna (1.82mg/l) and (1.97mg/l). Among anions bicarbonate and chloride are the dominant anion and among cations none of the cation dominates. By and large, quality of ground water is of permissible class for domestic including drinking purposes.

Salinity (EC) Sodium Adsorption ration (SAR) and Residual Sodium Carbonate (RSC) are the basic parameters considered for ascertaining the irrigation suitability of ground water. Based on the plot of EC and SAR on USSL diagram for rating irrigation waters, it is observed that most of waters fall under C₂S₁, C₃S₁ and C₄S₂ classes. Such waters are likely to cause medium to very high salinity hazards, but no sodium hazards when used for



GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS

FEROZPUR DISTRICT, PUNJAB



customary irrigation . However , some waters having with S₂ classes may cause sodium hazards when used for irrigation on soils with restricted drainage . Such waters , nevertheless , can be used on well drained soils and for semi salt tolerant to salt tolerant crops such as wheat , rice etc.

Presence of chemical constituents more than permissible limits

A	Chemical Constituents	Total Wells	BIS limit 1991 (revised in 2007)	Above limits	Location with value
	EC	13	3000 us/cm	3	-
	F	13	1.5mg/l	4	-
	Fe	13	1.0mg/l	2	Waryamkhera and Sitogana(1.82/l, 1.97mg/l)
	As	13	0.01mg/l	Nil	-

B. Type of water - Na – HCO₃ Type

4.4 Geophysical studies

The findings of surface geophysical studies shows ground water to be saline at all levels in major parts of Abohar and few parts of Fazilka block , selected portion of the area is available with fresh water with in 80-200 m depth in Fazilka and Jalalabad blocks. As an over all conclusion of the present study in south west Ferozpur, it is evident that no fresh water occurs below 200 m depth.

Areas where possibility of fresh water with in 20-50 m depth is expected are Dangra-khrea, Rajpura, Dodewala, Juradkhera, Narainpur, Bajidpur, Rukanpura, in the south, Hasta kalan, Nakerian, Salem-shah and Chak-saidake in the north. Area where possibility of fresh water in the depth interval of 80-200 m depth is expected are Bahak-khas, Jhugge-gulabsinghwala, Bhamba-battu, Jamal-ke, Sohana-sander, Chak-Bandiwala, Gumaniwala, Chak-singhwala, Rana, Dhondji-quadim, Gubhaya, Mauzzam and the-qu-alander lying in Jalalabad and Fazilka blocks. Based on geophysical survey, depth wise variation in ground water quality in southern part are given in figure no. 1

5.0 GROUND WATER MANAGEMENT STRATEGY

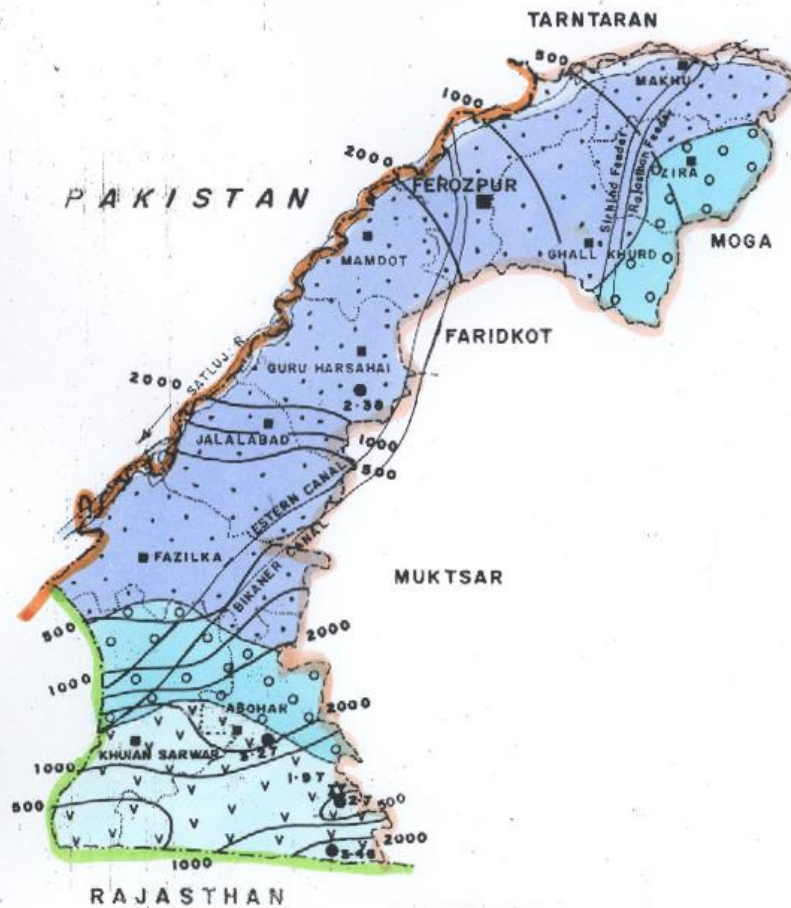
The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, and delineation of potential aquifer characteristics. These studies also provide information on well design



HYDROGEOLOGY FEROZPUR DISTRICT, PUNJAB



KM 0 5 10 20 30 40



INDEX

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	35 - 220	- 640	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	40 - 70	360 - 640	RECHARGE SHAFT AND INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	10 - 30	240 - 360	WATER LEVEL SHALLOW, RECHARGE NOT REQUIRED
ELECTRICAL CONDUCTIVITY (MICROMHOS / CM AT 25 °C)		2.7 ● FLUORIDE > PERMISSIBLE LIMIT 1.5 ppm			
1000		1.97 ☆ IRON > PERMISSIBLE LIMIT 1.0 ppm			



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' wire 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.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

In the district semi – unconfined aquifer 30-55 m , having salinity problem in central and northern part in patches. Aquifer 30-150 m depth in southern part and 55-175 m in northern part, relatively fresh water. This is the main source of tube well based water supply schemes. Aquifer systems below 200 meter depth have been reported to have saline water throughout the southern part of the district. Salinity is the main quality problem and second one is the high Fluoride concentration in Guruharsahai and Jalalabad blocks. However, in northern part there are some successful tube wells tapping this water.

The water level in the district area ranges from 1.6 m to 11.07 m bgl and the overall flow of the ground water is towards south west direction.

The seasonal fluctuation has been noticed the rise is up to 0.85m and also decline is up to 0.50 m. The rise has been observed in northern part whereas decline has been observed in southern part.

Water Logging

Water logging conditions have changed alarmingly in pre and post monsoon period. Only potential area for water logging shows increase of 300% from pre monsoon period. there is only spatial variation in water logged and critical area in the district and hardly quantitative change. In long term (1993-2002) water logged area has increased more than 300%, in 1993 it was only 51.1 Sq.km which was 197 Sq. km in year 2002.

7.0 RECOMMENDATIONS

1. The tubewells down to 110m depths can be constructed at places in the northern part of the district whereas in southern part upto 30m or where ever ground water is fresh in the form of thin lens.
2. In blocks namely Makhu , Ferozpur and Ghal Khurd, restrictions may be imposed for further development of ground water and people need to be educated for practices of water conservation.



3. As the area does not receives adequate amount of rainfall and surface being sandy generate little run-off, these together rules out the question of artificial recharge on large scale. However Rooftop rain water harvesting can be of local importance.
4. There is an urgent need to address the problem of Salinity management else area deprived of natural resource of fresh water will soon may face the problem of land degradation or soil salinity. To avoid situation of soil salinity in the area method of leaching and blending under the proper guidance, as discussed should be adopted.
5. In Northern part of Ferozpur district, there is less number of observation wells to monitor the water levels as most of the structures have gone dry. Hence shallow piezometers of 50m depths should be installed in northern part of the District.