Government of India
Ministry of Water Resources

GROUND WATER QUALITY IN BATHINDA, MANSA AND PATIALA DISTRICTS OF PUNJAB

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GROUND WATER QUALITY IN BATHINDA, MANSA AND PATIALA DISTRICTS OF PUNJAB

1.0 Introduction

A study of ground water quality in Bathinda, Mansa and Patiala districts of Punjab has been carried out with prime objective to study the geo-genic contamination of ground water by the various major and minor elements including arsenic and fluoride by Central Ground Water Board, Ministry of Water Resources. The findings of this report are as follows:

1.1 Ground Water Quality in Bathind District

The ground water of the district is alkaline in nature with pH values ranging from 7.45 to 8.24 and a mean pH value of 7.90. Well waters in the area are generally medium to highly saline. However, pockets of fresh water are also found. EC of waters show wide variations, it ranges from 395µS/cm at Derra Tappa to 4850µS/cm at 25°C at Dadde and average EC value is 2199µS/cm. The ground water is moderately hard in nature with total hardness expressed as $CaCO_3$ ranging from 119 to 654mg/l with a mean value of 375mg/l. Among cations, the concentration of calcium ranges from 20mg/l at Dialpur Mirza, Lahri & Jhanduke to 117mg/l at Ablu whereas magnesium concentration ranges between 1.2mg/l at Ablu and 118mg/l at Ghuda. Calcium content is within the permissible limit of 200mg/l (BIS) and an average concentration of 61mg/l is observed in the area. Likewise, magnesium, in most of the waters, is below 100mg/l and an average concentration of 54mg/l of Mg is found. Sodium concentration varies widely from 15 mg/l at Dera Tappa to 878mg/l at Dadde with an average of 331mg/l, whereas potassium concentration ranges from 6.0mg/l at Jhanduke to 342mg/l at Kaila Bhandar with an average of 84mg/l. In majority of the samples, the potassium content is less than 100 mg/l.

Among anions, bicarbonate is the dominant anion. Carbonate is found to be absent whereas bicarbonate concentration is found to be ranging between 203mg/l at Derra Tappa and 1598mg/l at Dadde with an average of 841mg/l. The chloride content varies between 6.6mg/l at Dera Tappa and 259mg/l at Kaila Bhandar. In most ground waters chloride concentration is less than 250mg/l and its average concentration is 162mg/l. The sulphate ranges between 10mg/l at Bhagi Bhandar and 480mg/l at Dadde. In majority of ground water samples, the concentration of sulphate is below 400mg/l and its average concentration in the district is 201mg/l. The nitrate levels in the district ranges from traces at Derra Tappa to 405mg/l at Dadde. The nitrate concentration in one-third well waters is more than 100mg/l. A mean concentration of nitrate in the area is 88 mg/l. High concentration of nitrate in ground water indicates its contamination due to anthropogenic activities such as indiscriminate use of nitrogenous fertilizers in agriculture and/or sewage disposal. The fluoride content in ground water of the district ranges from 0.27mg/l at Jajjal to 2.83mg/l at Dialpur Mirza. Fluoride in ground water is less than 1.0mg/l in 57% samples. However, significant numbers of well waters (43%) show fluoride > 1.5mg/l. The average F concentration in the area is 1.37mg/l.

Among cations, sodium is the predominant cation in 62% of waters; Ca+Mg in 28% and no single cation is dominant in 10% of ground waters in the area. Among anions, HCO_3 is the predominant anion in 76% of water samples and in the remaining 24% samples mixed anionic character is observed. Occurrence of Na - HCO_3 type in 48% wells show that at some places, the ground waters have under gone cation exchange phenomenon while wells having Na-HCO_3 + Cl type water indicates that the process of base exchange is still going on.

Comparing the concentration values of major ions with the standard concentration limits for drinking waters recommended by Bureau of Indian standards 1991, it is found that only about 30% ground waters are suitable for drinking purposes as concentration of all constituents are within permissible levels. The remaining ground waters are not suitable either due to salinity, high fluoride or high nitrate.

EC and SAR indicates that waters fall under C_2S_1, C_3S_1, C_3S_2, C_3S_4, C_4S_1, C_4S_2, C_4S_3, C_4S_4 classes of irrigation rating. Such waters when used for irrigation may cause medium salinity - low sodium, high salinity - low sodium and high salinity - high sodium hazards. Such water can be used on well-drained soils with adequate permeability and for salt tolerant crops and in conjunctive use with canal water. Classification based on RSC indicates that 33% of the waters are safe, and the remaining 67% are unsafe for irrigation use.

Plot of USSL diagram indicates that ground waters fall under C_2S_1 and C_3S_1 classes of irrigation rating. Such waters are suitable for irrigating semi-salt tolerant crops on soils having adequate permeability**.** Classification based on RSC indicates that 14% of the waters are unsafe for irrigational use.

1.2 Ground Water Qulaity in Mansa District

The ground water is alkaline in nature with pH values ranging from 7.77 to 8.78 with a mean pH value of 8.31. It is moderately to highly saline with EC values ranging from 635µS/cm at Budhlada to 5350µS/cm at 25°C at Fattamaluka with mean EC value of 2576µS/cm. The ground water is soft to hard in nature as total hardness values show a wide variation and ranges from 4mg/l at Bhikhi to 612mg/l with a mean value of 315mg/l. The calcium and magnesium concentrations are mostly less than 100mg/l. Calcium ranges from 12mg/l at Doda to 82mg/l at Jhand Khurd whereas magnesium content varies from 2.4mg/l at Bhikhi to 119mg/l at Burj Bhalaike with mean of 37 and 54 mg/l respectively. Sodium varies widely from 23mg/l at Budhlada to 1028mg/l at Fattamaluka with an average of 435mg/l. The concentration of potassium ranges from 2.0mg/l at Doda to 375mg/l at Burj Bhalaike with an average of 98mg/l. In majority of the samples, the potassium content is less than 100mg/l.

Among anions, carbonate ranges from nil at several places to 120mg/l at Junir with an average value of 33mg/l. The bicarbonate concentration ranges from 302mg/l at Ralla to 905mg/l at Kot Dhamru with an average of 557mg/l. The chloride concentration in ground water varies from 30mg/l at Budhlada to 728mg/l at Burj Bhalaike and its average concentration is 250mg/l. The sulphate content in the district ranges from trace at Ralla to

433mg/l at Fattamaluka with an average concentration of 459mg/l. The nitrate values are less than 45mg/l in nearly 60% wells and it ranges from 1mg/l at Doda to 161mg/l at Mansa with a mean value of 59mg/l. High concentration of nitrate in ground water may be due to indiscriminate use of fertilizers. The fluoride content of the district ranges from 0.16mg/l at Budhlada to 4.58mg/l at Junir. However, exceptionally high concentration of 7.84mg/l of fluoride is recorded at Bhikhi II. It is within the permissible limit of 1.5mg/l in about 70% samples.

Among cations, Na is the predominant cation in most water samples. Among anions, bicarbonate is dominant in 23.5% samples and in the remaining samples; none of the anion is dominant. Ground water is by and large Na-mixed anion type. Ground water at Fatta Maluka is of Na-SO_4 type.

On comparison with drinking water standards given by BIS, it is found that most of the waters have concentration of one or more chemical constituents above the permissible limit and thus are not suitable for drinking use. Only 40% ground waters are potable as these have all the chemical constituents within the permissible levels. The constituents that make them unfit for drinking are mainly NO_3, F, EC, or combination of these.

Plot in the USSL staff (1954) diagram indicates that waters fall under C_2S_1, C_3S_2, C_3S_3, C_3S_4, C_4S_1, C_4S_3 and C_4S_4 classes of irrigation rating. Such waters may create medium to very high salinity hazards and low to very high sodium hazards when used for irrigation under customary irrigation. However, these waters can be used for irrigating salt tolerant crops grown on soils with adequate permeability, only after addition of appropriate amounts of gypsum. Classification based on RSC indicates that only 35% of waters are safe and the remaining 65% of the waters are unsafe for irrigation use.

Arsenic contamination in ground water in district Mansa, Punjab, has been found in samples from 6 location, more than the prescribed limits by BIS, IS:10500. The details with result of these sites are mentioned in the table below and annexure I & II.

Sr. No.	Location	Type of Well	Depth (in Feet)	Owners Name	Arsenic (in mg/l)
1	Dhaipi	Tube Well (Submersible)	110	Shri Roop Ram	0.0287
2	Ghari Bhaggi	Hand Pump	80	Shri Sukhdev Singh (Panch)	0.0147
3	Meerpur Dhani	Hand Pump (Field)	90	Shri Harmesh Singh	0.0163
4	Bhame Kalan	Hand Pump	40	Bus Stand	0.2080
5	Nandgarh	Hand Pump	65	Shri Babu Singh	0.0102
6.	Kotra Kalan	Hand Pump	60	Shri Joginder Singh	0.011

1.3 Ground Water Quality in Patiala District

The ground water is moderately alkaline in nature. The pH values range from 7.63 to 8.54 with a mean pH value of 7.96. It is low to moderately mineralized as conductivity of well waters at 25°C ranges from 330μS/cm at Dhak Raba to 2870μS/cm at Hari Majra. In most waters, EC is below 2000μS/cm and average EC of the district is 1285 μS/cm. The ground water is moderately hard in nature with hardness value ranging from 102mg/l at Dera Bassi to 490mg/ at Hari Majra with a mean value of 244mg/l. The calcium concentration ranges from 12mg/l at Golu Majra to 74mg/ at Lacharu Kalan and magnesium concentration ranges from 10mg/l at Dera Bassi to 89mg/l at Hari Majra. The calcium and magnesium concentrations are less than 100 mg/l and their average concentration is 34 and 39mg/l respectively. The sodium concentration varies from 8.0mg/l at Dhak Raba to 567mg/l at Antala with an average of 203mg/l. The concentration of potassium ranges from 2.0mg/l at Rani Majrar to 57mg/l at Bassma (Pipla) with an average of 9.7mg/l. In majority of the samples analyzed, the potassium content is less than 10mg/l.

The presence of carbonate in the ground water is not recorded except at Tangori and Golu Majra, where it is recorded as 38 and 49mg/l respectively. The bicarbonate concentration ranges from 176mg/l at Dhak Raba to 855mg/ at Haluka with a mean value of 383mg/l. The chloride concentration varies from 20mg/l at several places to 285 mg/l at Mirapur with a mean value of 93mg/l. In most ground waters chloride is within the desirable limit of 250mg/l. The sulphate content varies widely and ranges from 13 mg/l at Dhak Raba to 1174mg/l at Antala. The nitrate concentration is within the permissible limit of 45 mg/l except at Haluka and ranges from nil at several places to 68m/l at Haluka. The average concentration of sulphate and nitrate is 229 and 14mg/l respectively. The fluoride content of the district is generally less than the permissible limit of 1.50mg/l in and ranges from 0.13 at Chhat to 2.33mg/l at Golu Majra with an average concentration of 0.57mg/l.

Among cations, sodium is the predominant cation and among anions, HCO_3 is the predominant anion in 68% samples followed by sulphate in 12%, chloride in 4% and mixed anionic character in the remaining samples. Majority of ground waters in the district are Na-HCO_3 type. This can be attributed either to precipitation of $CaCO_3$ due to loss of CO_2 or dissolution of Na-salts from the topsoil layers or to ion exchange reaction during the downward percolation of water. At some isolated places, ground water is Na-SO_4 type. At Dhak Raba ground water is of Ca-HCO_3 type and at Kalyan it is Mg- HCO_3 type. At Mirapur, Mg- Ca-Cl type indicating reverse ion exchange.

On comparison with BIS drinking water standards, it is observed that most of the waters (90%) are potable and can be used for drinking purposes. Nevertheless, ground water of Golu Majra has fluoride content 2.33mg/l and of Haluka has fluoride and nitrate content 1.89mg/l and 68mg/l respectively, which is beyond permissible levels. These waters are not suitable for drinking uses.

USSL diagram indicates that most of the waters fall under C_2S_1, C_2S_2, C_3S_1, C_3S_2, C_3S_4, C_4S_3 and C_4S_4 classes of irrigation rating. Majority of well waters fall under C_2S_1, C_3S_1 and C_3S_2 (76%) and may cause low to high salinity hazards when used for irrigation. However, these waters can be used for irrigating semi-salt tolerant to salt tolerant crops on soils with adequate permeability. Classification based on RSC indicates that 48% of waters are safe, 24% are marginal and remaining 28% are unsafe for irrigational use.

Table: 1 District-wise Concentration Ranges of Chemical Constituents in Groundwater of Punjab (2008)

Sr. No.	District	No. of Samples	Conc. Range	pH	EC at 25^{0}C in µS/cm	CO_3	HCO_3	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	T.H as $CaCO_3$
				←----------Concentration in mg/l----------→												
1	Bathinda	21	Min	7.45	395	0	203	6.6	10	0	0.27	20	1.2	15	6	119
			Max	8.24	4850		1598	259	480	405	2.83	117	118	878	342	654
			Mean	7.90	2199		841	162	201	88	1.37	61	54	331	84	375
2.	Mansa	17	Min	7.77	635	0	302	30	0	1	0.16	12	2.4	23	2	41
			Max	8.78	5350	120	905	728	1433	161	7.84	82	119	1028	375	612
			Mean	8.31	2576	33	557	250	459	59	1.65	37	54	435	98	315
3.	Patiala	25	Min	7.63	330	0	176	20	13	0	0.13	12	10	8	2	102
			Max	8.54	2870	49	855	285	1174	68	2.33	74	89	567	57	490
			Mean	7.96	1285	3.5	383	93	229	14	0.57	34	39	203	10	244
	Punjab	203	Min	6.90	290	0	115	6.6	0	0	0.11	8	1.2	6.4	0.6	40
			Max	8.96	15800	120	1598	728	1620	635	7.84	254	299	1380	560	1090
			Mean	7.82	1700	5.6	501	143	245	58	0.94	69	44	236	44	356

Table: 2 Frequency Distribution of well waters in different categories of drinking water suitability of Punjab State

S.No.	District	No. of Sample	EC in 25^{0}C in µS/cm			Cl in mg/l			F in mg/l			NO_3 in mg/l		
			<750	750-3000	>3000	<250	250-1000	>1000	<1.0	1.0-1.5	>1.5	<45	45-100	>100
1.	Bathinda	21	1	17	3	18	3	0	8	4	9	12	2	7
2.	Mansa	17	2	10	5	10	7	0	10	2	5	10	3	4
3.	Patiala	25	8	17	0	23	2	0	21	2	2	24	1	0

RESULTS OF ARSENIC ANALYSIS OF WATER SAMPLES **ANNEXURE-i**

COLLECTED FROM DISTRICT MANSA, PUNJAB

S.No.	LOCATION	TYPE OF WELL	DEPTH (in Feet)	OWNER'S NAME	Arsenic (in mg/l)
1	Dhaipi	TW	500	PHE	0.0034
2	Dhaipi	HP	45	Shri Malkit Singh	0.0023
3	Dhaipi	Submerssible	300	Shri Narain Singh	0.0027
4	**Dhaipi**	**Submerssible**	**110**	**Shri Roop Ram**	**0.0287**
5	Dhaipi	Submerssible	400	Goushalla	0.0063
6	Goga	HP	200	Shri Ranjeet Singh	0.0043
7	Goga	HP	100	Shri Baldev Singh	0.0036
8	Goga	Submerssible	110	Shri ReshamSingh	0.0076
9	Goga	Submerssible	250	Shri Pyara Singh	0.0046
10	Goga	Canal Water	_	Water Works	ND
11	Akalia	TW	700	PHE	0.0034
12	Akalia	Submerssible	70	Shri Jagdev Singh	ND
13	Akalia	TW (Pvt.)	300	Shri Jaspal Singh	ND
14	Akalia	TW (Field)	120	Shri Lakhveer Singh	ND
15	Akalia	HP (Field)	50	Shri Nachter Singh	ND
16	Bhai Desa	TW (Pvt.)	80	Shri Gurnel Singh	0.0027
17	Bhai Desa	Submerssible	110	Shri Sadhu Singh	0.0025
18	Bhai Desa	HP	60	Shri Gurdev Singh	ND
19	Bhai Desa	HP	50	Shri Mahender Singh	ND
20	Bhai Desa	TW (Pvt.)	400	PHE	0.0026
21	Mansa	Canal Water	_	Water Works	0.0027
22	Mansa	HP	40	Water Works, main gate	0.0031
23	Mansa	TW (Field)	100	Shri Karnail Singh, Rly phatak	0.0031
24	Mansa	HP	45	Shyam lal Dhaba	ND
25	Mansa	HP	70	Gymnasium ground, near bus stand	ND
26	Ghari Bhaggi	HP	40	Shri Joginder Singh (sarpanch)	0.0033
27	Ghari Bhaggi	TW (Pvt.)	70	Gurudwara (Dhoudi)	0.0055
28	**Ghari Bhaggi**	**HP**	**80**	**Shri Sukhdev Singh(Panch)**	**0.0147**
29	Ghari Bhaggi	HP	50	Shri Gurudev Singh	0.0054
30	Ghari Bhaggi	TW (Pvt.)	300	R.O Plant	0.0047
31	Sardelewqala	TW (Field)	70	Shri Jeevan Singh	0.0074
32	Sardulgarh	HP	80	Reenku Bus stop	0.0045
33	Sardulgarh	HP	50	Sardulgarh Kanchi	0.0020
34	Jhanda Khurd	HP	60	Water works	ND
35	Jhanda Khurd	Canal Water	_	Water works	0.0034
36	Sardulewala	Submerssible	120	Garg soap factory	0.0026
37	**Meerpur Dhani**	**HP (Field)**	**90**	**Shri Harmesh Singh**	**0.0163**
38	Fatta Maluka	HP	50	Shri Kartar Singh	ND
39	Dolowal	HP	40	Shri Pyara Singh	ND
40	Dolowal	Canal Water	_	Water works	ND
41	**Bhame Kalan**	**HP**	**40**	**Bus Stand**	**0.2080**
42	Lamkheer wala	HP	55	Shri .Najeer	0.0050

S.No.	LOCATION	TYPE OF WELL	DEPTH (in Feet)	OWNER'S NAME	Arsenic (in mg/l)
43	Lamkheer wala	HP	35	Shri Gurjit Singh	ND
44	Lamkheer wala	Canal Water	_	Water works	ND
45	Lamkheer wala	TW (Pvt.)	65	Shri Juneer Singh	ND
46	Lamkheer wala	TW (Pvt.)	80	Shri Malkit Singh	ND
47	Jhunir	HP	40	Bus Stand	ND
48	Jhunir	HP	70	PHC Campus	ND
49	Jhunir	Canal Water	_	Water works	0.0029
50	Jhunir	Submerssible	80	Shri Avtar Singh	ND
51	Jhunir	TW (Field)	80	Shri Babu Singh	ND
52	Burj Bhalaike	HP	40	Kabristan	0.0017
53	Burj Bhalaike	TW (Pvt.)	50	Shri Joginder Singh	0.0031
54	Danewala	HP	50	Bus Stand	0.0019
55	Nandgarh	HP	100	Shri Buta Singh (Sarpanch)	0.003
56	Nandgarh	Canal Water	_	Water works	0.0028
57	Nandgarh	TW (Field, Pvt.)	600	Shri Buta Singh	0.0036
58	Nandgarh	HP	70	Shri Kartar Singh	0.007
59	**Nandgarh**	**HP**	**65**	**Shri Babu Singh**	**0.0102**
60	Mofar	HP	60	Shri Balkar Singh	0.0043
61	Mofar	Canal Water	_	Water works	0.0038
62	Mofar	TW (Pvt.)	700	Shri Harmohan Singh	0.0048
63	Mofar	TW (Field)	200	Shri Ajit Indu (MLA)	0.0058
64	Boha	TW	50	Shri Major Singh (Sarpanch)	ND
65	Boha	HP	45	Bus Stand, Barela road	ND
66	Boha	Canal Water	_	Water works	0.0023
67	Boha	HP	50	Krishna Trading	ND
68	Talwala	TW	100	R.O Plant supply	0.0033
69	Talwala	HP	100	Shri Hem Raj	0.003
70	Talwala	TW (Pvt.)	80	Shri Harbans Singh	0.0053
71	Barnala	TW (Field)	100	Shri Harjit Singh	0.0037
72	Barnala	HP	70	Shri Malkit Singh	0.0044
73	Bare	HP	100	Shri Guljar Singh	0.0017
74	Budhlada	HP	50	Shri Bheena Singh	0.0022
75	Budhlada	TW (Pvt.)	85	Shri Binda, Bare road	ND
76	Budhlada	HP	60	ITI Chowk	0.002
77	Budhlada	Submerssible	100	Sr. Secondary boys school	0.0024
78	Budhlada	Canal Water	_	Water works	0.0032
79	Datewas	TW	700	Water Supply	0.0023
80	Datewas	HP	70	Sr. Secondary school, (Joginder Singh)	0.0021
81	Bareta	HP	80	Bus Stand	0.0065
82	Bareta	HP	55	Railway Phatak, Dharampur Road	0.0068
83	Dharampura	HP	60	Ayurvedic Dispensary	0.0092
84	Dharampura	TW (Field, Pvt.)	120	Shri Gurdev Singh	0.0088
85	Bacheyana	TW	100	PHE	0.0031
86	Gurera Kalan	HP	50	Gurudwara	0.0023
87	Guruke Kalan	TW (Pvt.)	100	Shri Narshi Singh	0.0017
88	Narenderpura	HP (Field)	50	Shri Motti Sardar	0.0026
89	Narenderpura	TW (Field)	100	Shri Jagpal	0.0021

90	Khilleon Kalan	TW (Pvt.)	70	Shri Kaka Singh	0.0046

S.No.	LOCATION	TYPE OF WELL	DEPTH (in Feet)	OWNER'S NAME	Arsenic (in mg/l)
91	Faruahi	TW	100	Shri Jagraj Singh	ND
92	Bhiki	TW	100	Block Panchyat office	0.0089
93	Bhiki	Canal Water	_	Water works	0.0031
94	Bhiki	TW (Field)	300	Shri Gurtej Singh	0.0023
95	Bhiki	HP	100	Market Thana road	0.0045
96	Mansa	TW (Pvt.)	100	Mansa Kandi	0.003
97	Thuthianwali	HP	50	Village Bus Stand	0.0020
98	Bhaini Bhagga	HP (Field)	60	Shri Gurdeep Singh	ND
99	Bhaini Bhagga	TW (Field, Pvt.)	110	Shri Gurdeep Singh	ND
100	Ralla	TW (Field)	90	Shri Batta Singh	ND
101	Ralla	HP	55	Shri Mama Singh	ND
102	Atala Kalan	TW (Pvt.)	250	Shri Gurdev Singh	ND
103	Atala Kalan	HP	60	Panchyat Ghar	ND
104	Atela Khurd	HP	70	Gurudwara	ND
105	**Kotra Kalan**	**HP**	**60**	**Shri Joginder Singh**	**0.011**

Note: 1. ND: Not Detectable

2. TW- Tube well
3. HP-Hand pump
4. **BIS** Desirable Limit for Arsenic in Drinking water: 0.01 mg/l

RESULTS OF ARSENIC ANALYSIS OF WATER SAMPLES CGWB, Chandigarh
COLLECTED FROM DISTRICT MANSA, PUNJAB

ANNEXURE ii

S.No.	Location	Date of collection	Source	Depth (ft)	Owners name	Arsenic ppb
1	Hero Kalan	04.08.10	TW-SM(P)	130	Sh. Deepak K	3
2	Hero Kalan	04.08.10	HP	125	Near bada-darwaja	ND
3	Hero Kalan	04.08.10	TW	500	CGWB	ND
4	Hero Khurd	04.08.10	TW-SM(P)	270	Gurudawar	ND
5	Hero Khurd	04.08.10	HP	100	Sh.Leela Singh	ND
					S/O Sh.Janu S	
6	**Dhaipi**	**05.08.10**	**TW-SM(P)**	**110**	**Sh.Rupram**	**23**
					S/O Sh.Persu S	
7	**Dhaipi**	**05.08.10**	**TW-SM(P)**	**110**	**Sh.Hardev S**	**16.1**
					S/O Sh.Dhana	
8	Dhaipi	05.08.10	HP	70	Balbinder S	4.6
					S/O Sh. Ajimer	
9	Kotra Kalan	05.08.10	HP	60	Jogender S	3
					S/O Sh. Jora S	
10	Kotra Kalan	05.08.10	HP	70	Govt.Primary school	N0
11	**Kotra Kalan**	**05.08.10**	**HP**	**80**	**Leela S S/O Bhan S**	**12.4**
12	Ghari Bhaggi-District	05.08.10	HP	80	Sukhedev S	8
	Bhatinda					
13	Ghari Bhaggi-District	05.08.10	HP	40	Laxman S	ND
	Bhatinda				S/o Sh. Bichtar S	
14	Ghari Bhaggi-District	05.08.10	HP	40	Gurudawar S Patti	4
	Bhatinda					
15	**Ghari Bhaggi-District**	**05.08.10**	**HP**	**180**	**Bhatinda Riwadi R C**	**12.9**
	Bhatinda					
16	**Meerpur**	**05.08.10**	**HP**	**90**	**Harmesh**	**15.9**

	Dhani				**S/o Amar S**	
17	Meerpur Dhani	05.08.10	HP	35	Outside Govt.Sch.P	6.8
18	**Nagal Dhani Near 16**	**05.08.10**	**HP**	**50**	**Sukhdev S/O Bana S**	**42**
19	Nandgarh	05.08.10	TW-SM(P)	685	Butta S S/o Sher S	3.5
20	**Nandgarh**	**05.08.10**	**TW**	**100**	**Gurudawar S Patti**	**10**
21	Nandgarh	05.08.10	HP	65	Babu S S/o Inder S	9.4
22	Nandgarh	05.08.10	HP	70	Aur S S/o Mukhtar	7.4
23	**Bhami Kalan**	**06.08.10**	**HP**	**40**	**Bus Std**	**270**
24	**Bhami Kalan**	**06.08.10**	**HP**	**40**	**Leela S S/o Sadlu S**	**176**
25	Bhami Kalan	06.08.10	HP	40.0000	Muktar S S/o Mehar	4
26	Bhami Kalan	06.08.10	HP	50	Mohar S S/o Muktar	3
27	Bhami Kalan	06.08.10	HP	50	Mahender S Ex Sarp.	ND
28	Bhami Kalan	06.08.10	TW-SM(P)	100	Mahender S Ex Sarp.	7.5
29	Nandgarh	06.08.10	HP	70	Goghi S S/o Tullu S	8.1
30	Nandgarh	06.08.10	HP	85	Chandu S S/o Harnish	7.3
31	Mansa	06.08.10	HP	45	IntMandi Bd G. House	ND
32	Mansa	06.08.10	TW-SM(P)	200	Asha Int. Hotel	1.8

Notation: 1. ND:Not Detectable 2.TW- SM(P)-Pvt T/W Submesible 3. HP-Hand pump

4. **BIS** Desirable Limit for Arsenic in Drinking water: 10ppb 5. ppb- part per billion