5.5 General Water Quality

5.5.1 Comparison of Bangladesh Standard and WHO Guideline

The results of the laboratory chemical analysis were compared with the Standard for Drinking Water in Bangladesh and the WHO Guideline Values for Drinking Water. The summarized results exceeding the standard and/or the guideline are shown in Table 5.5.9 to 5.5.14. The following descriptions show the results of all samples that exceed the Standard or the Guideline values. Analytical parameters and the standard numbers of testing method are shown in Table 5.5.1.

Table 5.5.1 Analytical parameters and the standard numbers

Analytical parameters	Standard No	Analytical parameters	Standard No
PH	4500 H^+ B	Sodium	3111 B
Temperature	Thermometric method	Potassium	3111 B
Electric conductivity	Electrometric method	Dissolved iron	3111 B
Hardness	Titrimetric method	Dissolved manganese	3111 B
TDS	2540 C	Calcium	3111 B
COD	5220	Magnesium	3111 B
Ammonium	Nessler's method	Cadmium	3113A, 3113B
Nitrite	4500 NO_2^- B	Total chromium	3113A, 3113B
Nitrate	APHA-4500	Copper	3113A, 3113B
Sulfate	4500 SO_4^{2-}	Lead	3113A, 3113B
Chloride	Turbidity of silver-chloride method	Mercury	3112B
Bicarbonate	Titrimetric method	Nickel	3113A, 3113B
Fluoride	4500 F^- D	Zinc	3111C
Cyanide	4500 CN^- E		

1) Observation Wells/Holes in Pourashava

a. **Deep groundwater in Chuadanga Pourashava**

As for water quality parameters of observation wells/holes deeper than 200m, those exceeding the standard in Bangladesh and/or WHO guideline values are Mn, Fe, Ca and COD.

NH_4 concentrations exceeded the standard in Bangladesh (0.5 mg/l) in 3 samples; however, the maximum value of 1.2 mg/l (well Ch-2) was not over the WHO guideline value (1.5 mg/l). As for Mn, 13 of the 24 samples exceeded the standard value in Bangladesh and the WHO value (0.1 mg/l). Of them, two were over the WHO health guideline value (0.5 mg/l) with a maximum level of 0.87 mg/l (well Ch-1). For Fe, 23 of the 24 samples exceeded the WHO guideline value (0.3 mg/l). Of them, 20 were over the standard in Bangladesh (1.0 mg/l) with a maximum value of 16 mg/l (well Ch-1). Ca concentrations exceeded the standard in Bangladesh (75 mg/l) in 17 of the 24 samples, the maximum value being 130 mg/l (well Ch-1).

The COD level in 1 of the 24 samples exceeded the standard in Bangladesh (4mg/l) with a content of 31mg/l (well Ch-1).

b. Deep groundwater in Jhenaidah Pourashava

As for water quality parameters of observation wells/holes deeper than 200m, those exceeding the standard in Bangladesh and/or WHO guideline values are Mn, Fe, Ca, Mg, Pb and COD.

Mn levels exceeded the Bangladesh and WHO values (0.1 mg/l) in 8 of the 23 samples, one of which was over the WHO health standard (0.5 mg/l). The maximum value was 0.72 mg/l measured at Jh-2-4 hole. Fe concentrations exceeded the WHO guideline value (0.3 mg/l) in 22 of the 23 samples. Of those, 19 were over the Bangladesh standard (1.0 mg/l), with a maximum value of 18 mg/l (well Jh-1). As for Ca, levels in 15 of the 23 samples exceeded the standard value in Bangladesh (75 mg/l), the maximum being 110 mg/l (well Jh-1). Mg levels exceeded the Bangladesh standard (35 mg/l) in 14 of the 23 samples with a maximum value of 38 mg/l (well Jh-1 and hole Jh-1-4). Pb levels exceeded the WHO guideline value (0.01 mg/l) in 3 samples; however the maximum was 0.013 mg/l (hole Jh-1-4), which is below the Bangladesh standard (0.05 mg/l). The COD in 1 of the 23 samples was in excess of the Bangladesh standard (4mg/l) with a value of 27 mg/l (well Jh-2).

c. Deep groundwater in Jessore Pourashava

As for water quality parameters of observation wells/holes deeper than 200m, those exceeding the standard in Bangladesh and/or WHO guideline values are pH, Mn, Fe, Ca, Mg and COD.

The pH of one sample (hole Js-1-4) was in excess of the standard in Bangladesh (ranging from 6.5 to 8.5) with a value of 8.86. Mn levels exceeded the Bangladesh and WHO values (0.1 mg/l) in 18 of the 19 samples, 11 of which were over the WHO health guideline value (0.5 mg/l); the maximum value was 2.3 mg/l measured at well Js-2. Fe levels in 18 of the 19 samples exceeded the WHO guideline value (0.3 mg/l). Of those, 16 samples had concentrations over the Bangladesh standard (1.0 mg/l) with a maximum value of 15 mg/l (well Js-2). The Ca content exceeded the standard value in Bangladesh (75 mg/l) in 10 of the 19 samples with a maximum value of 84 mg/l (well Js-1). One of the samples had Mg concentrations exceeding the Bangladesh standard (35 mg/l). The COD of 5 of the 19 samples exceeded the standard level in Bangladesh (4 mg/l) with a maximum value of 180 mg/l (well Js-2).

2) Observation holes in the Model Rural Areas

a. Bara Dudpatila Village, Chuadanga District

As for the water quality of deep observation wells established from core borings (depth of 300m), the parameters exceeding the standard in Bangladesh and/or WHO guideline values are

NH_4, Mn, Fe, Ca, Mg and COD.

Ammonia concentrations exceeded the Bangladesh standard (0.5 mg/l) in all 7 samples. The maximum level of 1.8 mg/l, found in one sample immediately after drilling, is over the WHO guideline value (1.5 mg/l). Mn levels exceeded the Bangladesh standard value (0.1 mg/l) in 5 of the 7 samples, one of which was over the WHO health guideline (0.5 mg/l) with a value of 0.51 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in all 7 samples. Of those, 6 samples were over the standard level in Bangladesh (1.0 mg/l) with a maximum value measured immediately after drilling of 15 mg/l. Ca concentrations exceeded the Bangladesh standard (75 mg/l) in 5 of the 7 samples. The maximum level of 110 mg/l was measured during the fifth month of monitoring. One sample contained Mg concentrations in excess of the permissible value in Bangladesh (35 mg/l). The maximum value of 43 mg/l was measured during the first month of monitoring. The COD of 2 of the 7 samples exceeded the level permitted in Bangladesh (4 mg/l), the maximum value measured in the second and third month of monitoring being 39 mg/l.

b. Krishna Chandrapur Village, Jhenaidah District

As for the water quality of deep observation wells established from core borings (depth of 300m), the parameters exceeding the standard in Bangladesh and/or WHO guideline values are pH, NH_4, Mn, Fe, Ca, Na and COD.

A pH of 8.78 exceeding the Bangladesh standard (ranging from 6.5 to 8.5) was observed during the first month of monitoring. Ammonia levels exceeded the Bangladesh standard (0.5 mg/l) in 5 of the 7 samples. Two of them had levels in excess of the WHO health guideline value (1.5 mg/l), the maximum value measured in the third month of monitoring being 1.6 mg/l. Mn levels exceeded the Bangladesh and WHO values (0.1 mg/l) in 5 of the 7 samples. However, all were below the WHO health guideline (0.5 mg/l), with a maximum value of 0.28 mg/l measured in the sixth month of monitoring. Fe concentrations exceeded the WHO guideline value (0.3 mg/l) in 6 of the 7 samples. All 6 samples had levels over 1.0 mg/l, with a maximum value of 5.3 mg/l measured in the sixth month of monitoring. Ca concentrations exceeded the Bangladesh standard (75 mg/l) in 5 of the 7 samples; the maximum value of 130 mg/l was measured in the fifth month of monitoring. Na concentrations exceeded the Bangladesh standard and the WHO guideline values (200 mg/l) in 1 of the 7 samples, with a level of 200 mg/l measured in the first month of monitoring. The COD of 2 of the 7 samples exceeded the standard level in Bangladesh (4 mg/l), with a maximum value of 39 mg/l measured in the first month of monitoring.

c. Rajnagar Bankabarsi Village, Jessore District

As for the water quality of deep observation wells established from core borings (depth of

300m), the parameters exceeding the standard in Bangladesh and/or WHO guideline values are NO_2, NH_4, Mn, Fe, Ni and COD.

Although 2 samples had nitrite levels in excess of the Bangladesh standard (1.0 mg/l), the content was 2.2 mg/l, which is below the WHO guideline value (3.0 mg/l). Ammonia levels exceeded the standard value in Bangladesh (0.5 mg/l) in 2 of the 7 samples. However, the maximum value of 1.1 mg/l measured in the fifth month of monitoring was not over the WHO guideline value (1.5 mg/l). Mn concentrations exceeded the WHO value (0.1 mg/l) in 1 of the 7 samples; however all were below the WHO health guideline value (0.5 mg/l). The maximum value, measured in the sixth month of monitoring, was 0.2 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in 3 of the 7 samples. Of those, none were over the Bangladesh standard (1.0 mg/l); the maximum value, measured in the sixth month of monitoring, was 0.70 mg/l. Nickel levels were over the WHO guideline value (0.02 mg/l) in 1 of the 7 samples although it did not exceed the standard in Bangladesh (0.1 mg/l). The maximum level, which was measured in the second month of monitoring, was 0.037 mg/l. The COD of 2 of the 7 samples exceeded the level permitted in Bangladesh (4 mg/l), with a maximum value of 39 mg/l measured immediately after drilling.

3) Views on Samples Exceeding the Standard Values

As for the samples from observation holes/wells in the Pourashavas and observation holes in the model villages, the explanation and the conditions of occurrence of the parameters exceeding the Bangladesh standard and WHO guideline are shown in Table 5.5.14. In regards to health impact, concentrations of Mn in some of the samples were above the WHO health guideline (0.5mg/l).

4) Improved Deep Wells in the Model Rural Areas

a. Bara Dudpatila Village, Chuadanga District

As for the water quality of Improved Deep Wells, the parameters exceeding the standard in Bangladesh and WHO guideline values are NO_2, NH_4, Mn, Fe, Ca and Pb.

NO_2 levels exceeded the standard value in Bangladesh (1 mg/l) in 3 of the 12 samples. Of those, none were over the WHO guideline value (3 mg/l), the maximum value being 2.5 mg/l. NH_4 concentrations exceeded the standard value in Bangladesh (0.5 mg/l) in 8 of the 12 samples. Of those, 6 were over the WHO guideline value (1.5 mg/l), the maximum value being 1.8 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in all 12 samples. Of those, none were over the WHO health guideline value (0.5 mg/l), the maximum value being 0.32 mg/l. Fe levels exceeded both the WHO guideline value (0.3 mg/l) and the Bangladesh standard (1.0 mg/l) in all 12 samples, the maximum value being 5.1 mg/l. Ca levels exceeded the standard value in Bangladesh (75 mg/l) in all 12 samples, the maximum value being 92 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 1 (0.010 mg/l) of the 12 samples. However, it was not over the Bangladesh standard (0.05 mg/l).

b. Krishna Chandrapur Village, Jhenaidah District

As for the water quality of Improved Deep Wells, the parameters exceeding the standard in Bangladesh and WHO guideline values are NH_4, Mn, Fe, Ca and COD.

NH_4 concentrations exceeded the standard value in Bangladesh (0.5 mg/l) in all 12 samples. Of those, 8 were over the WHO guideline value (1.5 mg/l), the maximum value being 5.4 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in 7 of the 12 samples. Of those, none were over the WHO health guideline value (0.5 mg/l), the maximum value being 0.46 mg/l. Fe levels exceeded both the WHO guideline value (0.3 mg/l) and the Bangladesh standard (1.0 mg/l) in all 12 samples, the maximum value being 9.8 mg/l. Ca levels exceeded the standard value in Bangladesh (75 mg/l) in all 12 samples, with a maximum value of 130 mg/l. COD concentrations exceeded the Bangladesh standard (4 mg/l) in 4 of the 12 samples, with a maximum value of 39 mg/l.

c. Rajnagar Bankabarsi Village, Jessore District

As for the water quality of Improved Deep Wells, the parameters exceeding the standard in Bangladesh and WHO guideline values are NO_2, NH_4, Mn, Fe, Pb and COD.

NO_2 levels exceeded the standard value in Bangladesh (1 mg/l) in 3 of the 12 samples. Of those, none were over the WHO guideline value (3 mg/l), the maximum value being 2.0 mg/l. NH4 concentrations exceeded the standard value in Bangladesh (0.5 mg/l) in 8 of the 12 samples. Of those, 6 were over the WHO guideline value (1.5 mg/l), the maximum value being 8.4 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO guideline value (both 0.1 mg/l) in 4 of the 12 samples. Of those, none were over the WHO health guideline value (0.5 mg/l), the maximum value being 0.20 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in 8 of the 12 samples. Of those, 3 were over the Bangladesh standard (1.0 mg/l), with a maximum value of 1.5 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 1 of the 12 samples with a value of 0.015 mg/l. However, it was not over the Bangladesh standard (0.05 mg/l). COD concentrations exceeded the Bangladesh standard (4 mg/l) in 1 of the 12 samples, with a value of 39 mg/l.

5) Existing Wells in the Study Area

a. Existing Wells in Rainy Season

As for the water quality of shallow existing wells, the parameters exceeding the standard in Bangladesh and/or WHO guideline values are TDS, NO_3, NO_2, NH_4, Mn, Fe, Cl, HCO_3, Ca, Mg, Na, F, Cd, Total-Cr, Pb, Ni and COD.

TDS levels exceeded the Bangladesh standard and WHO guideline values (both 1,000 mg/l) in 2 of the 23 samples. The maximum value is 1650 mg/l. NO_3 levels exceeded the standard value in Bangladesh (10 mg/l) in 3 of the 23 samples. The maximum value of 180 mg/l was over the WHO guideline value (50 mg/l). NO_2 levels exceeded the standard value in Bangladesh (1 mg/l) in 4 of the 23 samples. Of those, 3 were over the WHO guideline value (3 mg/l) with a maximum value of 4.2 mg/l. NH_4 concentrations exceeded both the standard value in Bangladesh (0.5 mg/l) and the WHO value (1.5 mg/l) in 7 of the 23 samples. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in 20 of the 23 samples. Of those, 9 were over the WHO health guideline value (0.5 mg/l), with a maximum value of 0.93 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in 19 of the 23 samples. Of those, 11 were over the Bangladesh standard (1.0 mg/l) with a maximum value of 11 mg/l. Cl levels exceeded the WHO guideline value (250 mg/l) in 1 (330 mg/l) of the 23 samples. However, it was not over the Bangladesh standard (600 mg/l). HCO_3 concentration exceeded the standard value in Bangladesh (600 mg/l) in 1 (720 mg/l) of the 23 samples. Ca levels exceeded the standard value in Bangladesh (75 mg/l) in 17 of the 23 samples with a maximum value of 160 mg/l. Mg levels exceeded the Bangladesh standard (35 mg/l) in 2 of the 23 samples, the maximum value being 45 mg/l. Na concentration exceeded the standard value in Bangladesh and the WHO value (both 200 mg/l) in 1 (290 mg/l) of the 23 samples. F concentrations exceeded the Bangladesh standard (1 mg/l) in 4 of the 23 samples. Of those, none were over the WHO guideline value (1.5 mg/l), the maximum value being 1.2 mg/l. Cd levels exceeded the WHO guideline value (0.003 mg/l) in 8 of the 23 samples. Of those, 5 were over the Bangladesh standard (0.005 mg/l), with a maximum value of 0.0079 mg/l. Total-Cr levels exceeded the standard value in Bangladesh (0.05 mg/l) in 21 of the 23 samples with a maximum value of 0.22 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 4 of the 23 samples. Of those, none were over the Bangladesh standard (0.05 mg/l), the maximum value being 0.030 mg/l. Ni levels exceeded the WHO guideline value (0.02 mg/l) in 14 of the 23 samples. Of those, none were over the Bangladesh standard (0.1 mg/l), the maximum value being 0.069 mg/l. COD concentrations exceeded the Bangladesh standard (4 mg/l) in 4 of the 23 samples, with a maximum value of 160 mg/l.

b. Production Wells in Rainy Season

As for the water quality of the production wells, the parameters exceeding the standard in Bangladesh and/or WHO guideline values are NO_2, NH_4, Mn, Fe and Ca.

NO_2 levels exceeded the Bangladesh standard (1 mg/l) in 1 (1.1 mg/l) of the 7 samples. However, it was not over the WHO guideline value (3 mg/l). NH_4 concentrations exceeded the standard value in Bangladesh (0.5 mg/l) in 2 of the 7 samples. Of those, none were over the WHO health guideline value (1.5 mg/l), the maximum value being 1.2 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in 5 of the 7 samples. Of those, 1 was over the WHO health guideline value (0.5 mg/l) with a value of 0.68 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in 4 of the 7 samples. Of those, 2 were over the Bangladesh standard (1.0 mg/l), with a maximum value of 1.5 mg/l. Ca levels exceeded the standard value in Bangladesh (75 mg/l) in 6 of the 7 samples, with a maximum value of 97 mg/l.

c. Existing Wells in Dry Season

As for the water quality of shallow existing wells, the parameters exceeding the standard in Bangladesh and/or WHO guideline values are TDS, NO_2, NH_4, Mn, Fe, Cl, HCO_3, Ca, Mg, Na, F, Pb, COD.

TDS levels exceeded the standard value in Bangladesh and WHO guideline values (both 1,000 mg/l) in 2 of the 23 samples. The maximum value is 1450 mg/l. NO_2 levels exceeded the standard value in Bangladesh (1 mg/l) in 2 of the 23 samples. Of those, 1 was over the WHO guideline (3 mg/l) with the maximum value of 3.3 mg/l. NH_4 concentrations exceeded both the standard value in Bangladesh (0.5 mg/l) and the WHO value (1.5 mg/l) in all 23 samples with a maximum value of 20 mg/l. Mn concentrations exceeded the Bangladesh standard and the WHO value (both 0.1 mg/l) in all 23 samples. Of those, 10 were over the WHO health guideline value (0.5 mg/l) with a maximum value of 1.5 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in 22 of the 23 samples. Of those, 20 were over the Bangladesh standard (1.0 mg/l) with a maximum value of 8.1 mg/l. Cl levels exceeded the WHO guideline value (250 mg/l) in 1 (570 mg/l) of the 23 samples. However, it was not over the Bangladesh standard (600 mg/l). HCO_3 concentrations exceeded the Bangladesh standard (600 mg/l) in 1 (700 mg/l) of the 23 samples. Ca levels exceeded the Bangladesh standard (75 mg/l) in 18 of the 23 samples, the maximum value being 130 mg/l. Mg levels exceeded the standard value in Bangladesh (35 mg/l) in 1 (37 mg/l) of the 23 samples. Na concentrations exceeded the standard value in Bangladesh and the WHO value (both 200 mg/l) in 2 of the 23 samples with a maximum value of 400 mg/l. F concentrations exceeded the standard value in Bangladesh (1 mg/l) in 3 of the 23 samples. Of those, 1 was over the WHO guideline value (1.5 mg/l) at 1.7 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 4 of the 23 samples. Of those, none were over the Bangladesh standard (0.05 mg/l); the maximum value was 0.037 mg/l. COD concentrations exceeded the Bangladesh standard (4 mg/l) in 5 of the 23 samples, with a maximum value of 85 mg/l.

d. Production Wells in Dry Season

As for the water quality of the production wells, the parameters exceeding the standard in Bangladesh and/or WHO guideline values are NH_4, Mn, Fe, Ca and Pb.

NH_4 concentrations exceeded both the standard value in Bangladesh (0.5 mg/l) and the WHO value (1.5 mg/l) in all 7 samples, the maximum value being 8.2 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in all 7 samples. Of those, 3 were over the WHO health guideline value (0.5 mg/l) with a maximum value of 0.75 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in all 7 samples. Of those, 6 were over the Bangladesh standard (1.0 mg/l), with a maximum value of 2.6 mg/l. Ca levels exceeded the standard value in Bangladesh (75 mg/l) in 6 of the 7 samples, with a maximum value of 110 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 2 of the 7 samples. Of those, none were over the Bangladesh standard (0.05 mg/l), the maximum value being 0.047 mg/l.

6) Existing Wells and Pond in the Model Rural Areas

a. Existing Wells in the Model Rural Areas

As for the water quality of shallow existing wells in the model rural areas, the parameters exceeding the standard in Bangladesh and/or WHO guideline values are TDS, NO_3, NO_2, NH_4, Mn, Fe, Cl, HCO_3, Ca, Mg, Na, Total-Cr, Pb, Ni and COD.

TDS levels exceeded the standard value in Bangladesh and WHO guideline values (both 1,000 mg/l) in 5 of the 15 samples, with a maximum of 1710 mg/l. NO_3 levels exceeded the standard value in Bangladesh (10 mg/l) in 4 of the 15 samples. Of those, none were over the WHO guideline value (50 mg/l), the maximum value being 23 mg/l. NO_2 levels exceeded the Bangladesh standard (1 mg/l) in 4 of the 15 samples. Of those, 2 were over the WHO guideline value (3 mg/l), the maximum value being 4.0 mg/l. NH_4 concentrations exceeded both the Bangladesh standard (0.5 mg/l) and the WHO value (1.5 mg/l) in 11 of the 15 samples with a maximum value of 27 mg/l. Mn concentrations exceeded the Bangladesh standard and the WHO value (both 0.1 mg/l) in 7 of the 15 samples. Of those, 4 were over the WHO health guideline value (0.5 mg/l) with a maximum value of 1.1 mg/l. Fe levels exceeded the WHO guideline value (0.3 mg/l) in all 15 samples. Of those, 9 were over the Bangladesh standard (1.0 mg/l), with a maximum value of 8.2 mg/l. Cl levels exceeded the WHO guideline value (250 mg/l) in 5 of the 15 samples. However, none were over the Bangladesh standard (600 mg/l), the maximum value being 540 mg/l. HCO_3 concentration exceeded the standard value in Bangladesh (600 mg/l) in 2 of the 15 samples, with a maximum of 757 mg/l. Ca levels exceeded the Bangladesh standard (75 mg/l) in all 15 samples, with a maximum of 110 mg/l. Mg levels exceeded the Bangladesh standard (35 mg/l) in 5 of the 15 samples, the maximum value being 47 mg/l. Na concentration exceeded the standard value in Bangladesh and the WHO value (both 200 mg/l) in 5 of the 15 samples, with a maximum of 410 mg/l. Total-Cr levels exceeded the standard value in Bangladesh (0.05 mg/l) in 2 of the 15 samples, with a maximum value of 0.066 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 2 of the 15 samples. Of those, none were over the Bangladesh standard (0.05 mg/l), the maximum value being 0.014 mg/l. Ni levels exceeded the WHO guideline value (0.02 mg/l) in 3 of the 15 samples. Of those, none were over the Bangladesh standard (0.1 mg/l), the maximum value being 0.029 mg/l. COD concentrations exceeded the Bangladesh standard (4 mg/l) in 4 of the 15 samples, with a maximum value of 44 mg/l.

b. Pond Water in the Model Rural Areas

As for the water quality of pond-water in the model rural areas, the parameters exceeding the standard in Bangladesh and WHO guideline values are NO_3, NO_2, NH_4, Mn, K, F, Pb and COD. NO_3 levels exceeded the standard value in Bangladesh (10 mg/l) in 4 of the 27 samples. Of those, none were over the WHO guideline value (50 mg/l), the maximum value being 42 mg/l. NO_2 levels exceeded the Bangladesh standard (1 mg/l) in 3 of the 27 samples. Of those, 2 were over the WHO guideline value (3 mg/l) with a maximum value of 6.6 mg/l. NH_4 concentrations exceeded the Bangladesh standard (0.5 mg/l) in 9 of the 27 samples. Of those, 2 were over the WHO value (1.5 mg/l), with a maximum of 4.8 mg/l. Mn concentrations exceeded the standard value in Bangladesh and the WHO value (both 0.1 mg/l) in 2 of the 27 samples. Of those, none were over the WHO health guideline value (0.5 mg/l), the maximum value being 0.16 mg/l. K levels exceeded the standard value in Bangladesh (12 mg/l) in 5 of the 27 samples; the maximum value was 62 mg/l. F concentrations exceeded the standard value in Bangladesh (1 mg/l) in 7 of the 27 samples. Of those, 5 were over the WHO guideline value (1.5 mg/l) with a maximum of 3.6 mg/l. Pb concentrations exceeded the WHO guideline value (0.01 mg/l) in 1 (0.011 mg/l) of the 27 samples. However, it was not over the Bangladesh standard (0.05 mg/l). COD concentrations exceeded the Bangladesh standard (4 mg/l) in 10 of the 27 samples, with a maximum value of 78 mg/l.

7) Deep Observation Well in Keshabpur Thana

As for the water quality of deep observation well in Keshabpur Thana, the parameters exceeding the standard in Bangladesh and WHO guideline values are NH_4 and Fe.

NH_4 concentrations exceeded the Bangladesh standard (0.5 mg/l) in one sample, with a value of 1.4 mg/l. However, it was not over the WHO value (1.5 mg/l). Fe level exceeded the WHO guideline value (0.3 mg/l) in one sample at 0.57 mg/l. However, it was not over the Bangladesh standard (1.0 mg/l).

5.5.2 Relations between Arsenic and General Quality Parameters

Based on the arsenic concentrations and other water quality parameters analyzed for the newly constructed observation wells/holes by the monthly monitoring program, the relations of arsenic concentrations and water quality parameters were examined.

Relation of Fe to As, NH_4, Eh and pH

Figure 5.5.1 shows the relations of dissolved iron to As, NH_4, Eh and pH in the observation well/holes. In the Study Area, the concentrations of Fe are generally high, ranging from 0 to 17mg/l. The groundwater samples having As concentrations more than 0.05mg/l show Fe concentrations ranging from 1 to 6mg/l. From the NH_4 - Fe plots shown in graph b), the samples contaminated by As have higher values of both Fe and NH_4. Graph c) shows that the Fe concentration increases with decreasing Eh. Most samples having Fe concentrations from 5 to 15mg/l show Eh values from -20 to +100mV. However, the samples contaminated by As are limited in the upper-left of the graph. The relationship between Fe and pH shows an inversely proportional correlation. As shown in graph d) the samples having more than 5mg/l in Fe show 6.8 to 7.5 in pH.

5.5.3 Re-analysis of water quality for observation holes of which hand pumps are to be installed, and instruction on their use

In order to ensure the safe use of the observation holes to be installed with hand pumps by the Study Team in the Pourashava and Model rural areas, their water quality was re-analyzed for re-confirmation. Seven observation holes, which were not in excess of the WHO guideline value for As throughout all the monitoring, were selected for hand pump installation out of all fifteen observation holes (not including those in Brahmakati, installed for the supplemental survey). The samples of the seven observation holes were collected in mid-September 2002. The results of the water quality re-analysis in Japan and instruction on the use of observation holes based on the results were as follows.

1) Results of water quality re-analysis

The results of the field measurement and laboratory analysis in Japan are shown in Table 5.5.17. The results are mostly in agreement with the results of the entrusted local laboratory in Bangladesh. It can be said that the results of the local analysis in Bangladesh are reliable.

In these results, some points that need to be considered in comparing the Bangladesh standards and WHO guidelines are mentioned below

As levels do not exceed the Bangladesh standard (=0.05mg/l). However, two of the seven samples slightly exceeded the WHO guideline (=0.01mg/l) both with a value of 0.011mg/l. As for Mn levels, five of the seven samples exceeded the Bangladesh standard (=0.1mg/l). Of those, two were over the WHO health guideline (=0.5 mg/l) with values of 0.60 mg/l and 0.50 mg/l respectively. As for Fe levels, six of the seven samples exceeded the Bangladesh standard (=1 mg/l) and the WHO health guideline (=0.3 mg/l). Some samples also exceeded the Bangladesh standard for NO2,Ca, Mg and COD. Heavy metals such as Cd, Total-Cr, Cu, CN, Pb, Hg and Ni were all below PQL.

These results show the following. The As levels of the two observation holes (OH-Jh2-4, OH-Ch1-4) that exceeded the WHO guideline had not exceeded the guideline during the monitoring. However, they showed slightly higher levels of As. The direct cause of the two observation holes exceeding the WHO guideline value may be the seasonal change in concentrations (In general, the results of monitoring show that high As concentrations tend to be seen in the rainy season) or the tendency of As concentrations to gradually increase, but it is unclear.

The Bangladesh standard of 0.1 mg/l for Mn is, according to the WHO guideline, set as a level likely to give rise to consumer complaints such as stained laundry or bad taste. Mn concentrations that exceeded the WHO health guideline value (＝0.5 mg/l) were found in only two of the measured samples, and were from the same wells containing As concentration above the WHO guideline value. All of the samples showed high iron concentrations that may be a problem in terms of taste, smell, etc, however will not have a direct impact on health. As for the one site (1.7 mg/l) that exceeded the Bangladesh standard value (＝1 mg/l) for NO2, it is below the WHO health guideline value (＝3 mg/l). Furthermore, it is common in Japan to set the standard for nitrogen concentrations including both NO2 and NO3 as "nitrogen as nitric acid and nitrogen as nitrous acid". Based on the Water Works Law in Japan, for example, the drinking water quality standard for nitrogen is 10 mg/l. Ca, Mg and COD are also not parameters that have a negative impact on health.

2) Measures taken by the Study Team for well use based on the results of water quality measurements

Based on the above results of the water quality re-analysis, the Study Team took the following measures regarding the use of the seven wells.

① As for the two wells OH-Jh2-4 (Jhenaidah) and OH-Ch1-4 (Chuadanga) that exceeded the WHO guideline values for As and Mn, hand pumps have already been installed by the Study Team, but they have not been dismantled in consideration of their convenience to residents. However, the Study Team has ensured that the wells are not used for drinking purposes by marking them with yellow paint to indicate the water is not safe to drink. In addition, they have instructed residents that they can continue to use the well for the purposes other than drinking.

② Hand pumps have also been installed at all the other wells. As iron concentrations are generally high and the oxidation-reduction potential (Eh value) is low, the reduction of iron and/or Mn concentrations in the water due to oxidation can be expected to some degree. The Study Team has instructed the residents to leave fetched water overnight or longer when using it for drinking purposes.

③ In order to ensure the residents fully understand the method of proper well use, the Study

Team gave instruction to the residents directly on site as they fetched water. They also gave the results of these measurement to keypersons, such as the village leader or the owners of the land where the wells had been installed, and made sure they had a good understanding of the situation. Moreover, they instructed the residents to contact DPHE if any problems concerning water quality, etc. arose in future.

As for the counterparts from the DPHE head office, the Study Team notified the measurement results to them and explained the above well use measures in order to obtain their agreement in advance. They also gave a similar explanation to the Executive Engineer, Sub-Assistant Engineer and Sub-Divisional Engineer from the DPHE local offices and Thana offices in Chuadanga, Jhenaidah and Jessore. Furthermore, as emphasized in the seminar in September, DPHE was requested once again to conduct monitoring whenever they have the opportunity in future.

5.5.4 Evaluation of General Water Quality

1) Observation Wells/Holes in Pourashava

Comparing the groundwater of observations holes established in shallow aquifers in the sites for test drilling in Pourashava to the existing wells (shallow wells and existing water source wells in Pourashava), the general water quality of observation wells/holes deeper than 200m is judged to be good across the board. Some of the general water quality parameters exceed WHO guideline values and/or the standard values in Bangladesh. However, highly toxic parameters, such as cadmium, chromium, copper, cyanide and mercury, are below the WHO guideline values and the standard in Bangladesh values in all of the samples.

As for Fe, many of the samples have levels exceeding the WHO guideline value and the Bangladesh standard. However, the WHO guideline values for iron are just levels likely to give rise to consumer complaints concerning color, taste, smell, etc. A guideline value based on health criteria has not been proposed. It is common knowledge that iron concentrations are often high in groundwater in a reducing state.

As with iron, there are many samples with Ca and Mg levels exceeding the Bangladesh standard. However, as a standard based on health criteria has not been proposed by WHO, it is not considered to be a serious problem.

As for Manganese, high concentrations are found in some samples. However, concentrations in deep groundwater are lower than in shallow groundwater. Moreover, about 80% of the samples from deep groundwater are below the health guideline value set by WHO.

As for lead, though 3 samples slightly and sporadically exceed the WHO guideline, they are not thought to have any effect on health.

Although levels of NH_4 exceed standard values in some of the samples, most are from shallow groundwater. The degree of contamination in deep groundwater was found to be comparatively low. The source of ammonia was not examined in the Study but it is speculated that shallow groundwater contamination is due to fertilizers and urine. In deep aquifers, on the other hand, contamination is thought to be due to the effect of biological decomposition by bacteria, etc.

As for COD, though some samples exceed the standard in Bangladesh, it is thought that they are affected by the reducing condition of groundwater rather than by organic contamination. A standard based on health criteria has not been proposed by WHO.

2) Deep Observation Holes in Model Rural Areas

In general, the water quality of deep groundwater from observation holes converted from core borings holes in the model villages was judged to be good. Although some general water quality parameters exceed the WHO guideline values and/or standard values in Bangladesh, highly toxic parameters, such as Cd, Total-Cr, Cu, cyanide, Pb and Hg, were below the WHO guideline values and the Bangladesh standards in all of the samples.

As for Mn, only one sample had levels in excess of the health guideline value set by WHO. Manganese is thought to have geologic origins, and concentrations tend to be high in groundwater in a reducing state.

As for Fe, many of the samples have levels exceeding standard values. However, the WHO guideline values for iron are just levels likely to give rise to consumer complaints concerning color, taste, smell, etc. A guideline value based on health criteria has not been proposed. It is common knowledge that iron concentrations are often high in groundwater in a reducing state.

As with Fe, there are some samples with Ca and Mg levels exceeding the standard in Bangladesh. However, as a standard based on health criteria has not been proposed by WHO, it is not considered to be a serious problem.

NO_2 concentrations also exceed the standard level in Bangladesh in 2 of the samples but they are below the WHO guideline value.

As for NH_4, although three of the samples indicate levels exceeding the WHO guideline value, they are not thought to have any effect on health, as mentioned above.

As for Na, although only one of the samples exceeds the WHO guideline value and the Bangladesh standard, the WHO guideline value for sodium is just a level likely to give rise to consumer complaints concerning color, taste, smell, etc. It is not thought to have any effect on health.

As for Ni, only one of the samples exceeds the WHO guideline value but it is below the Bangladesh standard. It is not considered to be a serious problem.

As for COD, though some samples exceed the standard in Bangladesht is thought that they are affected by the reducing state of groundwater rather than by organic contamination. A standard based on health criteria has not been proposed by WHO.

As compared with the general water quality of deep and shallow groundwater in the same village, deep groundwater is better than shallow groundwater. Figures 5.5.2 to 5.5.5 show some examples of the difference in Rajnagar Bankabarsi. In evaluating the general quality of deep groundwater, the results obtained from the Study show that deep groundwater is potable. As mentioned previously, although some parameters exceed the standard values, it is not considered to pose any health risks. Some samples slightly affected by salinity are also presently considered to be suitable for drinking.

3) Views on Samples Exceeding the Standard Values

As for the samples from observation wells/holes in the Pourashavas and observation holes in the model villages, the treatment method and the views on the parameters exceeding the Bangladesh standard and WHO guideline and are shown in Table 5.5.16. In consideration of health impact, it is necessary to treat the water contaminated with Mn. However, judging from the actual situation in Bangladesh, realistic measures will be difficult.

4) Improved Deep Wells in the Model Rural Areas

The actual depths of Improved Deep Wells are between deep tube wells (300m depth, i.e. Observation Wells, Core Borings) and shallow tube wells (around 50m depth, i.e. existing tube wells). The water quality (except As) of Improved Deep Wells is generally as good as deep observation wells/holes. However, high concentrations of NH_4 were found in many samples of Improved Deep Wells. This was also shown in many samples from shallow tube wells. As with shallow tube wells, Improved Deep Wells may also be contaminated by fertilizers, manure and livestock wastes. There is another possible cause of the NH_4contamination . Cow dung was used for the installation of Improved Deep Wells. Therefore, this may have caused the contamination of NH_4. In Chuadanga and Jhenaidah, the aquifers of the improved deep wells are shallower than Jessore's. So the concentrations of parameters such as Fe and Ca are higher.

5) Existing Wells in the Study Area (including the Model Rural Areas)

As mentioned earlier, the groundwater in existing wells indicates a reducing state on the whole. Almost all samples characterize fresh water though some samples show salinity. It is notable that some contamination of existing wells is found. From the viewpoint of potability, groundwater in existing wells often shows some contamination. Care needs to be taken for not only As contamination, but other parameters of water quality as well. N-related water quality parameters such as NO_3, NO_2, and NH_4, NO_3 and NO_2concentrations in the rainy season are higher than that of the dry season overall (as shown in Table 5.5.4 and 5.5.5). On the other hand, NH_4 concentrations in the rainy season are lower than in the dry season. Some oxidation-reduction reactions are likely to happen among the three parameters. Although NH_4

has no health-based guideline by WHO, high NH_4 concentrations may give rise to consumer complaints regarding odor or taste. Furthermore, NH_4 in water is an indicator of possible bacterial, sewage, and animal waste pollution. Seasonal changes are also observed for some parameters such as Cd, total-Cr, Ni and Zn. However, this reason was not examined in this study.

6) Pond Water in the Model Rural Areas

Since it has a low concentration of As, pond water is a possible water source for areas where other alternative water sources are limited. Due to its oxidation state, some water quality parameters show lower concentrations than in shallow groundwater such as heavy metals, Fe, Mn, hardness, Ca, Mg and so on. However, some other parameters show higher concentrations than in shallow groundwater. High COD is a serious problem for potability. It shows that pond water may be contaminated from the surface of the pond. Other contaminations through the surface of the pond also seem to have occurred. As a result, sanitary protection and treatment of raw water are essential for the potable use of pond water. Another problem is likely to be limitations in volume for drinking though it is not a problem of water quality.

Table 5.5.2 Results of Observation Well and Hole (1/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction / FAAS	Extraction / FAAS	SP	Extraction / FAAS	Extraction / FAAS	Extraction / FAAS	Extraction / FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg CaCO$_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg CaCO$_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jessore1																												
OW-JS1-BP	16-Jul-01	7.32	29.4	54.5	102	349	<PQL	<PQL	0.22	0.26	<PQL	6.7	8.4	475	80	22	51	5.2	0.27	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0071	<PQL	<PQL
OW-JS1-48h	19-Jul-01	7.31	28.7	54.4	98.6	348	<PQL	<PQL	0.21	0.13	<PQL	0.66	15	456	77	21	52	5.3	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS1-1M	19-Aug-01	7.27	30.0	58.3	89.9	373	<PQL	<PQL	<PQL	0.69	<PQL	8.4	9.5	429	65	25	66	4.8	0.20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS1-2M	15-Sep-01	7.13	28.2	60.5	104	387	<PQL	<PQL	<PQL	1.1	<PQL	8.8	7.4	488	71	33	63	4.9	0.24	<PQL	<PQL	0.0082	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS1-3M	16-Oct-01	7.20	30.0	82.8	109	530	<PQL	<PQL	0.14	1.2	<PQL	5.5	10	497	82	28	55	5.6	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS1-4M	07-Nov-01	7.43	26.9	81.8	115	524	<PQL	<PQL	<PQL	0.63	<PQL	13	8.3	456	82	33	51	5.0	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS1-5M	06-Dec-01	7.22	24.7	80.5	117	515	<PQL	<PQL	0.28	0.57	<PQL	8.9	7.3	460	84	33	52	4.6	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-1-BP	20-Jul-01	7.17	29.7	57.0	106	364	<PQL	<PQL	0.21	4.3	<PQL	3.7	5.0	475	86	20	54	3.2	0.41	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0087	27
OH-JS1-1-SIP-30min	20-Jul-01	7.23	29.6	52.6	102	337	<PQL	<PQL	<PQL	2.8	<PQL	2.5	5.8	418	82	19	33	2.7	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-1-SIP-140min	20-Jul-01	7.34	29.6	51.1	105	327	<PQL	<PQL	0.17	1.7	<PQL	10	7.9	418	85	20	28	2.6	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-2-BP	20-Jul-01	7.26	29.9	70.0	112	448	<PQL	<PQL	0.25	4.6	<PQL	7.1	30	570	91	21	110	4.6	1.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.015	77
OH-JS1-2-SIP-30min	20-Jul-01	7.32	29.7	58.3	107	373	<PQL	<PQL	0.18	2.2	<PQL	3.5	5.0	456	86	21	51	3.9	1.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	27
OH-JS1-2-SIP-140min	20-Jul-01	7.33	29.4	51.3	101	328	<PQL	<PQL	0.14	0.93	<PQL	2.6	4.1	481	80	21	28	3.5	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-3-BP	20-Jul-01	7.91	29.3	41.7	56.2	267	<PQL	<PQL	0.17	<PQL	<PQL	<PQL	3.0	285	35	21	38	3.9	0.41	<PQL	<PQL	0.0079	<PQL	<PQL	<PQL	0.0070	0.0053	<PQL
OH-JS1-3-SIP-30min	20-Jul-01	7.20	29.8	59.8	122	383	<PQL	<PQL	0.15	2.9	<PQL	6.9	13	551	100	22	51	4.5	0.53	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	130
OH-JS1-3-SIP-140min	20-Jul-01	7.40	29.8	53.9	113	345	<PQL	<PQL	0.21	0.96	<PQL	4.7	2.8	475	91	22	42	3.8	0.34	<PQL	<PQL	0.0072	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-4-BP	20-Jul-01	8.86	29.7	43.3	25.9	377	<PQL	<PQL	0.13	<PQL	<PQL	<PQL	28	266	9.8	16	83	5.3	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-4-SIP-30min	20-Jul-01	7.35	29.3	55.2	101	353	<PQL	<PQL	0.11	1.3	<PQL	4.7	9.9	475	80	20	65	4.7	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS1-4-SIP-140min	20-Jul-01	7.30	29.3	55.7	99.3	357	<PQL	<PQL	0.14	0.65	<PQL	3.1	12	475	79	21	66	4.9	0.28	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	27

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (2/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction / FAAS	Extraction / FAAS	SP	Extraction / FAAS	Extraction / FAAS	Extraction / FAAS	Extraction / FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jessore2																												
OW-JS2-BP	02-Aug-01	7.59	28.2	62.2	90.3	398	0.51	0.31	0.12	0.35	<PQL	2.9	54	439	67	23	78	4.3	0.36	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OW-JS2-48h	05-Aug-01	7.56	28.1	61.2	90.2	391	<PQL	<PQL	0.38	0.13	<PQL	0.86	59	429	67	23	80	4.0	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OW-JS2-1M	11-Sep-01	7.19	28.0	63.3	109	405	<PQL	<PQL	<PQL	2.3	<PQL	10	42	507	73	36	80	4.9	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS2-2M	18-Oct-10	7.24	29.9	94.8	110	607	<PQL	<PQL	<PQL	0.55	<PQL	6.3	47	507	82	28	75	6.2	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JS2-3M	06-Nov-01	7.99	27.1	89.8	113	575	<PQL	<PQL	0.37	0.74	<PQL	15	40	456	81	32	67	4.5	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OW-JS2-4M	05-Dec-01	7.24	24.3	89.4	113	572	<PQL	<PQL	0.22	0.65	<PQL	15	35	460	80	33	80	4.4	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS2-1-BP	06-Aug-01	7.19	28.5	58.0	113	371	<PQL	<PQL	<PQL	2.9	<PQL	3.4	4.6	453	88	25	42	1.7	0.50	<PQL	<PQL	0.010	0.010	0.0058	<PQL	<PQL	0.0085	38
OH-JS2-1-SIP-30min	06-Aug-01	7.37	28.6	54.1	107	346	<PQL	<PQL	<PQL	1.7	<PQL	1.8	3.0	429	83	24	28	1.3	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0074	<PQL
OH-JS2-1-SIP-140min	06-Aug-01	7.46	28.8	53.2	108	340	<PQL	<PQL	<PQL	1.1	<PQL	1.3	4.6	429	84	24	27	1.3	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	26
OH-JS2-2-BP	06-Aug-01	7.23	28.7	57.4	114	368	<PQL	<PQL	<PQL	3.2	<PQL	5.2	3.5	468	89	25	31	3.1	0.44	<PQL	<PQL	0.0066	0.020	<PQL	<PQL	0.0053	<PQL	76
OH-JS2-2-SIP-30min	06-Aug-01	7.27	29.1	56.7	111	363	<PQL	<PQL	<PQL	1.1	<PQL	4.0	1.9	439	87	24	33	3.1	0.45	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OH-JS2-2-SIP-140min	06-Aug-01	7.35	29.1	55.4	108	355	<PQL	<PQL	<PQL	0.58	<PQL	2.9	3.9	429	84	24	21	2.5	0.40	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OH-JS2-3-BP	06-Aug-01	7.50	29.4	56.0	93.1	359	1.4	0.60	1.6	0.39	<PQL	0.92	14	429	70	23	43	4.3	0.38	<PQL	<PQL	<PQL	<PQL	0.0051	<PQL	0.0083	0.012	38
OH-JS2-3-SIP-30min	06-Aug-01	7.28	29.3	58.6	105	375	2.5	<PQL	<PQL	0.95	<PQL	2.1	10	429	82	23	39	4.0	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	38
OH-JS2-3-SIP-140min	06-Aug-01	6.94	29.3	43.2	107	277	1.5	1.5	<PQL	0.72	<PQL	2.2	6.7	350	84	24	31	3.8	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS2-4-BP	06-Aug-01	7.62	29.3	80.1	65.0	513	<PQL	<PQL	<PQL	0.29	<PQL	3.4	15	507	43	22	160	4.4	0.40	<PQL	<PQL	<PQL	0.050	<PQL	<PQL	0.012	<PQL	180
OH-JS2-4-SIP-30min	06-Aug-01	7.23	29.2	50.9	93.1	325	0.41	<PQL	<PQL	0.20	<PQL	2.8	46	350	66	23	77	4.2	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JS2-4-SIP-140min	06-Aug-01	7.49	29.4	65.1	92.9	417	0.30	0.040	<PQL	0.19	<PQL	2.0	49	429	70	23	80	4.0	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (3/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jhenaidah1																												
OW-JH1-BP	18-Apr-01	7.25	24.8	76.8	141	492	0.46	<PQL	<PQL	0.18	<PQL	15	3.3	489	100	38	14	4.3	0.32	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.060	<PQL
OW-JH1-48h	21-Apr-01	7.22	25.3	78.2	146	501	0.41	<PQL	0.11	0.10	<PQL	3.6	1.5	499	110	38	14	3.8	0.25	<PQL	<PQL	<PQL	<PQL	0.011	<PQL	0.0063	0.016	<PQL
OW-JH1-1M	11-Jun-01	7.36	31.0	59.9	114	299	<PQL	<PQL	<PQL	0.19	<PQL	9.6	5.7	452	78	35	17	4.1	0.27	<PQL	<PQL	<PQL	<PQL	0.0065	<PQL	<PQL	0.0060	<PQL
OW-JH1-2M	04-Jul-01	7.96	28.5	44.2	69.6	283	<PQL	<PQL	0.17	0.091	<PQL	4.3	4.0	365	46	24	35	5.1	0.21	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH1-3M	12-Aug-01	7.30	29.3	51.6	105	330	<PQL	<PQL	<PQL	0.15	<PQL	9.9	2.6	371	77	27	27	3.6	0.28	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH1-4M	15-Sep-01	7.72	28.5	47.4	79.0	303	<PQL	<PQL	<PQL	<PQL	<PQL	2.6	4.4	371	43	36	36	3.9	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH1-5M	19-Oct-01	7.43	29.7	76.0	110	487	<PQL	<PQL	<PQL	<PQL	<PQL	7.5	1.5	449	80	30	19	4.9	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH1-6M	10-Nov-01	7.25	27.1	82.5	143	528	<PQL	<PQL	<PQL	0.35	<PQL	18	2.4	494	100	41	21	3.7	0.28	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH1-7M	07-Dec-01	7.26	24.7	79.8	147	510	<PQL	<PQL	0.11	0.32	6.6	17	2.6	500	100	42	21	3.5	0.37	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH1-1-BP	22-Apr-01	7.34	25.2	46.3	92.6	296	1.0	0.53	<PQL	0.35	13	2.6	3.3	269	68	25	15	3.0	0.50	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH1-1-SIP-30min	22-Apr-01	7.31	25.4	47.4	90.8	303	0.79	0.65	<PQL	0.33	<PQL	2.9	5.3	269	74	17	11	2.6	0.51	<PQL	<PQL	<PQL	<PQL	0.0097	<PQL	<PQL	<PQL	<PQL
OH-JH1-1-SIP-140min	22-Apr-01	7.27	25.4	47.8	91.0	306	0.68	0.65	<PQL	0.31	<PQL	2.9	8.5	273	74	17	11	2.6	0.53	<PQL	<PQL	0.0061	<PQL	0.011	<PQL	<PQL	<PQL	<PQL
OH-JH1-2-BP	22-Apr-01	7.25	25.4	60.2	109	385	0.69	<PQL	0.61	0.40	<PQL	3.6	2.6	371	85	24	18	4.0	0.29	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0094	<PQL
OH-JH1-2-SIP-30min	22-Apr-01	7.16	25.5	60.7	115	388	1.8	0.090	0.51	0.25	<PQL	2.5	3.7	371	92	24	14	3.7	0.35	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.13	<PQL
OH-JH1-2-SIP-140min	22-Apr-01	7.17	25.3	62.6	121	401	1.2	1.4	0.42	0.25	<PQL	2.2	3.7	371	96	25	12	3.8	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.014	<PQL
OH-JH1-3-BP	22-Apr-01	7.10	25.0	65.6	125	420	1.6	1.1	0.22	<PQL	19	4.2	7.0	387	99	27	15	4.6	0.35	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH1-3-SIP-30min	22-Apr-01	7.26	25.6	65.5	128	419	1.4	<PQL	0.78	0.15	17	2.2	7.2	390	100	26	14	4.1	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.015	<PQL
OH-JH1-3-SIP-140min	22-Apr-01	7.15	25.6	65.2	127	417	1.2	<PQL	0.78	0.14	15	1.9	4.5	390	100	26	14	4.2	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.011	<PQL
OH-JH1-4-BP	22-Apr-01	7.16	25.5	73.9	137	473	0.24	<PQL	<PQL	0.089	<PQL	3.6	1.1	480	99	38	13	4.4	0.34	<PQL	<PQL	<PQL	<PQL	0.013	<PQL	0.0092	0.0063	<PQL
OH-JH1-4-SIP-30min	22-Apr-01	7.14	25.2	75.8	138	485	0.26	<PQL	<PQL	<PQL	<PQL	2.3	1.5	488	99	38	13	4.6	0.29	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0069	<PQL	<PQL
OH-JH1-4-SIP-140min	22-Apr-01	7.20	25.0	75.2	140	481	0.36	<PQL	0.13	<PQL	<PQL	2.3	2.4	493	100	38	11	3.8	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0057	0.17	<PQL

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (4/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction /FAAS	Extraction /FAAS	SP	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jhenaidah2																												
OW-JH2-BP	03-Jun-01	7.30	31.3	61.5	134	307	<PQL	0.10	<PQL	0.096	<PQL	7.8	2.7	467	97	37	14	3.9	0.36	<PQL	<PQL	0.0085	<PQL	<PQL	<PQL	<PQL	0.0086	<PQL
OW-JH2-48h	06-Jun-01	7.64	30.7	61.2	135	306	<PQL	<PQL	0.18	<PQL	<PQL	2.3	9.3	456	98	36	15	4.1	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH2-1M	03-Jul-01	7.99	29.0	36.8	49.6	236	<PQL	<PQL	0.13	<PQL	<PQL	<PQL	3.2	272	26	23	14	5.4	0.17	<PQL	<PQL	0.011	<PQL	<PQL	<PQL	<PQL	<PQL	27
OW-JH2-2M	13-Aug-01	7.91	29.6	36.8	62.5	235	<PQL	<PQL	<PQL	<PQL	<PQL	0.56	1.7	234	36	27	18	3.6	0.17	<PQL	<PQL	<PQL	<PQL	0.0068	<PQL	<PQL	0.0090	<PQL
OW-JH2-3M	14-Sep-01	7.77	28.2	42.5	71.7	272	<PQL	<PQL	<PQL	<PQL	<PQL	1.8	4.8	312	36	35	21	11	0.21	<PQL	<PQL	0.0069	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH2-4M	18-Oct-01	7.91	29.8	47.0	57.0	301	<PQL	<PQL	<PQL	<PQL	<PQL	0.40	2.2	279	28	29	15	5.1	0.27	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0074	<PQL
OW-JH2-5M	05-Nov-01	7.38	26.8	71.3	122	457	<PQL	<PQL	0.15	0.12	<PQL	9.2	4.5	418	83	39	15	3.6	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-JH2-6M	04-Dec-01	7.86	24.4	49.1	76.7	314	<PQL	<PQL	<PQL	0.092	<PQL	1.5	3.9	284	39	37	14	4.0	0.20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-1-BP	07-Jun-01	7.32	31.4	52.1	99.7	260	0.52	<PQL	<PQL	1.3	<PQL	1.9	7.5	357	82	18	38	3.8	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0089	<PQL	<PQL
OH-JH2-1-SIP-30min	07-Jun-01	7.34	31.0	46.4	92.6	232	2.2	<PQL	0.13	0.81	<PQL	1.4	5.5	276	77	15	18	3.8	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-1-SIP-140min	07-Jun-01	7.40	31.4	49.9	101	250	0.74	<PQL	<PQL	0.63	<PQL	1.8	6.7	336	85	16	20	3.1	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-2-BP	07-Jun-01	7.26	31.4	61.8	99.1	309	<PQL	<PQL	0.35	1.4	<PQL	2.6	21	363	81	18	55	4.8	0.51	<PQL	<PQL	0.0055	0.011	<PQL	<PQL	<PQL	0.011	<PQL
OH-JH2-2-SIP-30min	07-Jun-01	7.45	31.2	54.1	104	270	0.43	<PQL	0.13	0.98	<PQL	1.7	11	361	86	18	34	4.1	0.40	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0090	<PQL
OH-JH2-2-SIP-140min	08-Jun-01	7.38	31.6	53.9	99.3	270	0.51	0.20	0.13	0.78	<PQL	1.1	8.8	285	83	16	15	4.1	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-3-BP	08-Jun-01	7.36	32.0	58.3	127	291	1.2	<PQL	0.14	0.63	<PQL	13	3.2	399	110	22	19	4.3	0.33	<PQL	<PQL	<PQL	0.016	0.0058	<PQL	0.0053	0.0076	<PQL
OH-JH2-3-SIP-30min	08-Jun-01	7.28	31.3	60.3	123	302	1.1	0.64	0.12	0.59	<PQL	2.1	3.4	427	100	22	23	4.2	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-3-SIP-140min	08-Jun-01	7.19	31.5	37.9	123	190	<PQL	0.47	0.12	0.47	<PQL	1.9	2.5	222	100	22	18	4.1	0.23	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-4-BP	08-Jun-01	7.88	31.2	49.0	53.8	245	<PQL	<PQL	0.11	<PQL	<PQL	0.47	16	304	25	29	48	5.5	0.27	<PQL	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	<PQL	<PQL
OH-JH2-4-SIP-30min	08-Jun-01	7.17	31.6	57.8	112	289	0.46	0.26	<PQL	0.72	<PQL	3.0	2.8	346	82	29	36	5.3	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-JH2-4-SIP-140min	08-Jun-01	7.09	31.5	41.4	121	207	<PQL	0.26	<PQL	0.37	<PQL	2.3	1.7	247	90	31	22	4.3	0.20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (5/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.002	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Chuadanga1																												
OW-CH1-BP	01-Jan-01	7.22	23.2	81.7	122	523	<PQL	0.16	0.65	0.29	<PQL	1.0	3.0	475	120	3.0	23	4.0	0.29	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH1-48h	22-Feb-01	7.27	23.9	84.1	155	538	<PQL	<PQL	1.1	<PQL	<PQL	0.77	2.3	492	130	29	18	3.5	0.30	<PQL	<PQL	<PQL	0.017	<PQL	<PQL	0.0057	<PQL	<PQL
OW-CH1-1M	26-Mar-01	7.41	26.8	56.0	88.1	359	<PQL	<PQL	0.48	<PQL	<PQL	12	2.0	315	67	21	19	7.5	0.11	<PQL	<PQL	<PQL	0.023	<PQL	<PQL	<PQL	0.0078	<PQL
OW-CH1-2M	26-Apr-01	7.26	25.1	64.9	133	415	0.29	<PQL	0.42	<PQL	<PQL	16	1.5	410	100	28	10	6.3	0.16	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0052	<PQL	<PQL
OW-CH1-3M	14-Jun-01	7.24	31.2	63.4	136	317	0.59	<PQL	<PQL	0.32	<PQL	2.1	<PQL	476	110	24	19	4.7	0.23	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0084	<PQL
OW-CH1-4M	05-Jul-01	7.32	28.9	52.5	146	336	0.73	<PQL	0.11	0.35	<PQL	1.7	2.2	481	130	20	20	5.3	0.23	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH1-5M	14-Aug-01	7.05	29.4	46.1	141	295	0.52	<PQL	<PQL	0.33	<PQL	2.7	1.4	351	90	24	13	3.6	0.23	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0065	<PQL
OW-CH1-6M	12-Sep-01	7.18	27.1	54.9	153	352	<PQL	<PQL	0.26	0.70	<PQL	1.5	1.9	488	130	27	10	3.5	0.21	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH1-7M	15-Oct-01	7.32	29.8	82.9	157	530	<PQL	<PQL	0.34	0.87	<PQL	2.6	0.73	507	130	26	10	4.7	0.31	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH1-8M	08-Nov-01	7.24	27.0	61.9	156	396	<PQL	<PQL	0.37	0.49	<PQL	3.7	1.4	494	130	29	15	3.9	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-CH1-1-BP	04-Feb-01	7.27	23.6	42.0	57.9	269	1.4	1.0	<PQL	0.52	<PQL	6.0	6.1	213	45	13	30	3.6	0.28	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	31
OH-CH1-1-SIP-30min	25-Feb-01	7.11	25.0	45.1	78.7	289	<PQL	<PQL	0.59	0.24	<PQL	1.8	2.0	259	64	15	17	4.5	0.29	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0060	<PQL	27
OH-CH1-1-SIP-140min	25-Feb-01	7.23	24.0	46.7	80.0	299	<PQL	<PQL	0.71	0.16	<PQL	1.9	1.5	259	65	15	14	3.4	0.27	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	0.0082	<PQL	29
OH-CH1-2-BP	04-Feb-01	7.37	24.5	37.1	57.1	237	<PQL	<PQL	0.44	0.17	<PQL	0.73	3.4	194	45	12	16	3.5	0.24	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0073	<PQL	<PQL
OH-CH1-2-SIP-30min	25-Feb-01	7.20	24.6	41.3	71.4	265	<PQL	<PQL	0.47	0.13	<PQL	1.6	1.3	241	58	13	13	3.7	0.27	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	0.0051	0.0066	<PQL
OH-CH1-2-SIP-140min	25-Feb-01	7.22	24.8	42.0	73.7	269	<PQL	<PQL	0.52	0.10	<PQL	1.4	0.87	241	61	13	12	3.7	0.32	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	0.0068	<PQL	<PQL
OH-CH1-3-BP	04-Feb-01	7.57	23.9	50.7	76.9	324	1.4	0.64	0.70	0.14	5.5	3.0	14	259	59	18	31	3.6	0.27	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	31
OH-CH1-3-SIP-30min	25-Feb-01	7.15	25.3	58.8	98.9	376	<PQL	0.20	0.83	0.33	<PQL	2.4	4.1	324	79	19	28	3.7	0.32	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	<PQL	<PQL	<PQL
OH-CH1-3-SIP-140min	25-Feb-01	7.12	24.8	58.2	99.4	373	<PQL	0.020	0.82	0.21	<PQL	1.9	2.2	333	80	20	19	3.7	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0052	0.0060	<PQL
OH-CH1-4-BP	04-Feb-01	7.35	24.1	74.8	101	479	<PQL	<PQL	0.24	0.090	<PQL	6.9	19	389	74	26	58	4.5	0.21	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	0.0095	<PQL	31
OH-CH1-4-SIP-30min	25-Feb-01	7.01	25.2	85.0	145	544	<PQL	<PQL	0.47	0.40	<PQL	2.3	4.9	500	120	28	43	4.1	0.31	<PQL	<PQL	<PQL	0.019	<PQL	<PQL	0.0050	0.031	<PQL
OH-CH1-4-SIP-140min	25-Feb-01	6.98	27.4	86.0	148	550	<PQL	<PQL	0.46	0.28	<PQL	2.1	2.7	490	120	27	22	4.8	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0060	0.070	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (6/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction /FAAS	Extraction /FAAS	SP	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Chuadanga2																												
OW-CH2-BP	18-Mar-01	7.22	28.3	77.9	114	499	0.42	0.28	0.13	0.34	<PQL	4.2	11	418	92	22	24	6.2	0.18	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0088	0.040	<PQL
OW-CH2-1M	29-Apr-01	7.30	24.7	64.8	127	415	0.84	<PQL	0.22	<PQL	<PQL	9.1	7.6	410	96	31	11	4.6	0.17	<PQL	<PQL	0.0089	<PQL	<PQL	<PQL	0.0053	0.012	<PQL
OW-CH2-2M	16-Jun-01	8.49	30.8	32.1	39.3	160	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	7.9	190	14	25	13	4.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH2-3M	07-Jul-01	7.57	28.4	41.8	82.6	268	0.22	<PQL	0.14	0.084	<PQL	0.75	8.3	319	62	21	17	5.5	0.19	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH2-4M	18-Aug-01	7.93	29.6	39.5	59.4	253	<PQL	<PQL	<PQL	<PQL	<PQL	0.32	6.7	254	38	23	13	3.7	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH2-5M	13-Sep-01	7.62	28.1	43.3	88.1	277	<PQL	<PQL	0.15	<PQL	<PQL	3.7	8.0	306	59	30	12	3.6	0.17	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH2-6M	17-Oct-01	7.61	29.8	57.9	90.8	371	<PQL	<PQL	1.2	<PQL	<PQL	2.2	4.7	332	64	27	12	5.1	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OW-CH2-7M	05-Nov-01	7.41	27.1	66.6	121	426	<PQL	<PQL	0.18	0.15	<PQL	9.7	6.2	380	89	33	13	3.7	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
OH-CH2-1-BP	16-Mar-01	7.15	28.8	59.5	90.7	381	2.6	2.7	1.2	0.50	<PQL	4.5	1.4	315	72	18	20	4.8	0.42	<PQL	<PQL	<PQL	0.017	0.0058	<PQL	0.0058	0.032	66
OH-CH2-1-SIP-30min	16-Mar-01	7.07	29.4	60.4	91.2	386	<PQL	0.020	4.4	0.48	<PQL	4.8	1.7	320	73	18	16	4.4	0.23	<PQL	<PQL	<PQL	0.025	0.0072	<PQL	<PQL	0.013	39
OH-CH2-1-SIP-140min	16-Mar-01	7.19	29.2	59.1	89.6	378	<PQL	<PQL	3.4	0.45	<PQL	4.9	1.9	315	71	19	15	4.4	0.32	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	0.0052	0.031	51
OH-CH2-2-BP	16-Mar-01	7.45	28.9	62.0	85.7	397	1.2	<PQL	0.14	0.32	<PQL	1.8	19	300	68	17	32	5.5	0.35	<PQL	<PQL	0.0055	0.014	<PQL	<PQL	<PQL	0.012	27
OH-CH2-2-SIP-30min	16-Mar-01	7.34	28.7	60.3	91.9	386	0.87	1.0	0.19	0.15	<PQL	1.6	15	303	75	17	26	5.7	0.37	<PQL	<PQL	<PQL	0.022	<PQL	<PQL	0.0061	<PQL	33
OH-CH2-2-SIP-140min	16-Mar-01	7.24	28.9	59.6	90.5	382	1.4	1.2	0.12	0.16	<PQL	1.4	10	305	73	18	19	4.9	0.33	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0060	<PQL	39
OH-CH2-3-BP	17-Mar-01	7.26	28.7	53.5	81.4	343	0.78	0.34	0.12	0.18	<PQL	1.5	2.4	300	64	17	20	4.4	0.28	<PQL	<PQL	<PQL	0.013	0.0066	<PQL	<PQL	0.017	<PQL
OH-CH2-3-SIP-30min	17-Mar-01	7.26	28.7	55.7	86.9	356	1.0	0.050	0.14	<PQL	<PQL	1.3	3.9	292	70	17	15	4.0	0.34	<PQL	<PQL	<PQL	0.020	<PQL	<PQL	<PQL	0.031	<PQL
OH-CH2-3-SIP-140min	17-Mar-01	7.29	28.6	54.9	87.8	352	0.86	0.52	0.43	<PQL	<PQL	1.3	2.1	296	70	18	18	4.1	0.34	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0073	0.019	<PQL
OH-CH2-4-BP	17-Mar-01	7.25	29.2	74.6	104	477	0.23	<PQL	<PQL	0.19	<PQL	5.1	10	407	82	22	37	6.6	0.24	<PQL	<PQL	<PQL	<PQL	0.0054	<PQL	0.0062	<PQL	<PQL
OH-CH2-4-SIP-30min	17-Mar-01	7.19	28.4	75.5	109	483	0.23	0.12	<PQL	0.16	<PQL	3.4	8.4	407	87	22	24	5.6	0.20	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	0.0059	<PQL	<PQL
OH-CH2-4-SIP-140min	17-Mar-01	7.30	28.0	76.1	112	487	<PQL	0.25	<PQL	0.081	<PQL	2.2	10	407	90	22	19	5.5	0.18	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0064	0.0068	<PQL

Excess of WHO guideline

Excess of Bangladesh Standard

Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.2 Results of Observation Well and Hole (7/7)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction /FAAS	Extraction /FAAS	SP	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Extraction /FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jessore3																												
OW-BM-CP-48h	12-Mar-02	8.33	25.8	65.4	28.1	419	<PQL	<PQL	1.4	<PQL	<PQL	0.57	6.2	361	19	9.5	120	2.0	0.42	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline Excess of Bangladesh Standard Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.3 Results of Core Boring

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jessore																												
CB-JSRb-0M	09-May-01	7.87	30.1	57.2	40.5	366	2.0	<PQL	<PQL	<PQL	<PQL	0.23	34	336	24	17	94	4.2	0.32	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	39
CB-JSRb-1M	21-Jun-01	7.91	31.1	59.2	38.0	296	1.9	2.2	0.16	<PQL	<PQL	0.26	29	338	23	15	100	4.7	0.34	<PQL	<PQL	0.0073	<PQL	<PQL	<PQL	0.012	0.0087	<PQL
CB-JSRb-2M	09-Jul-01	8.01	28.7	48.0	40.5	307	1.7	<PQL	0.15	<PQL	<PQL	<PQL	45	324	27	14	110	5.4	0.40	<PQL	<PQL	0.0082	<PQL	<PQL	<PQL	0.037	0.0062	27
CB-JSRb-3M	20-Aug-01	7.91	29.9	56.1	36.5	357	1.8	<PQL	<PQL	<PQL	<PQL	<PQL	30	312	20	15	140	3.6	0.36	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-JSRb-4M	11-Sep-01	7.94	28.2	53.5	39.4	342	<PQL	0.97	0.84	<PQL	<PQL	0.39	25	347	23	17	97	3.6	0.41	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-JSRb-5M	16-Oct-01	8.06	29.7	66.4	40.2	425	1.6	0.25	1.1	0.10	<PQL	0.32	26	351	24	16	94	4.2	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-JSRb-6M	07-Nov-01	7.88	27.0	66.4	43.1	425	0.49	1.9	<PQL	0.20	<PQL	0.70	21	342	27	16	86	3.7	0.36	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Jhenaidah																												
CB-JHKc-0M	05-May-01	7.35	31.3	65.4	138	419	2.0	<PQL	<PQL	<PQL	<PQL	1.8	8.1	505	110	29	35	6.1	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0071	0.011	27
CB-JHKc-1M	17-Jun-01	8.78	31.0	86.4	5.78	432	<PQL	<PQL	0.70	<PQL	<PQL	<PQL	96	442	4.3	1.5	200	2.4	0.60	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	39
CB-JHKc-2M	08-Jul-01	8.01	28.1	58.0	81.8	371	1.7	<PQL	0.12	0.12	<PQL	3.7	38	443	68	14	110	4.0	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-JHKc-3M	15-Aug-01	7.27	29.2	63.0	138	403	<PQL	<PQL	1.6	0.10	<PQL	2.4	7.0	507	110	23	25	4.3	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0097	<PQL	<PQL
CB-JHKc-4M	11-Sep-01	7.17	28.0	58.5	147	374	<PQL	<PQL	1.2	0.17	<PQL	2.5	2.9	517	120	29	20	3.9	0.20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0052	<PQL
CB-JHKc-5M	16-Oct-01	7.23	29.6	87.7	159	561	<PQL	<PQL	1.4	0.24	<PQL	2.7	2.2	513	130	26	19	4.8	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-JHKc-6M	09-Nov-01	7.29	27.3	85.7	151	548	<PQL	<PQL	1.5	0.28	<PQL	5.3	1.8	513	122	29	27	4.0	0.17	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Chuadanga																												
CB-CDBd-0M	30-Jan-01	7.01	24.4	82.2	124	526	<PQL	<PQL	1.8	0.25	<PQL	15	1.8	481	90	34	24	3.8	0.16	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0051	<PQL	<PQL
CB-CDBd-1M	27-Feb-01	7.12	23.2	80.4	141	514	<PQL	<PQL	1.4	0.17	<PQL	2.1	1.3	481	98	43	18	3.9	0.23	<PQL	<PQL	0.0088	<PQL	<PQL	<PQL	0.0061	0.0067	<PQL
CB-CDBd-2M	26-Mar-01	7.41	27.9	62.0	165	397	<PQL	<PQL	1.1	<PQL	<PQL	6.9	1.7	353	70	23	22	6.7	0.17	<PQL	<PQL	0.0054	0.013	<PQL	<PQL	0.012	<PQL	39
CB-CDBd-3M	27-Apr-01	7.98	24.9	43.7	67.6	279	<PQL	<PQL	0.72	<PQL	<PQL	0.79	1.3	273	35	33	14	4.7	0.11	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.11	39
CB-CDBd-4M	23-Jun-01	7.33	31.0	63.4	124	317	<PQL	<PQL	0.92	0.46	<PQL	3.5	0.73	459	94	30	16	4.8	0.16	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-CDBd-5M	10-Jul-01	7.28	29.1	52.5	128	336	<PQL	<PQL	1.2	0.51	<PQL	3.5	2.5	475	110	23	27	4.2	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
CB-CDBd-6M	18-Aug-01	7.29	29.6	58.7	122	375	<PQL	<PQL	1.2	0.39	<PQL	2.6	0.77	488	96	26	16	4.5	0.18	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.4 Results of Improved Deep Tubewell(1/2)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Jessore																												
IM-JSRb-1-0M	26-Nov-00	7.79	24.0	60.4	48.1	387	<PQL	<PQL	4.1	<PQL	<PQL	0.27	9.4	333	31	17	53	3.5	0.37	<PQL	<PQL	<PQL	0.017	0.0076	<PQL	<PQL	<PQL	<PQL
IM-JSRb-1-1M	03-Jan-01	7.63	24.0	62.4	55.5	399	<PQL	<PQL	5.9	0.20	<PQL	1.3	9.3	317	39	16	55	3.6	0.35	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
IM-JSRb-1-2M	06-Feb-01	7.73	25.7	58.2	56.2	373	1.6	<PQL	<PQL	<PQL	<PQL	0.21	11	315	37	19	71	3.1	0.39	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	<PQL	<PQL	<PQL
IM-JSRb-1-3M	27-Mar-01	7.83	28.4	56.3	56.0	360	<PQL	<PQL	1.1	<PQL	<PQL	0.73	13	315	39	17	69	5.8	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.095	<PQL
IM-JSRb-2-0M	26-Nov-00	7.80	23.6	63.2	47.3	404	<PQL	0.13	2.4	<PQL	<PQL	0.21	5.5	320	30	17	53	3.4	0.42	<PQL	<PQL	<PQL	0.025	<PQL	<PQL	0.010	<PQL	<PQL
IM-JSRb-2-1M	03-Jan-01	7.67	24.0	62.1	54.5	398	1.7	<PQL	8.4	0.17	<PQL	1.3	12	328	38	16	53	3.5	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0075	<PQL	<PQL
IM-JSRb-2-2M	06-Feb-01	7.72	23.6	56.9	55.1	364	1.5	1.5	<PQL	<PQL	<PQL	<PQL	11	315	36	19	68	3.1	0.40	<PQL	<PQL	<PQL	0.014	0.0061	<PQL	<PQL	<PQL	<PQL
IM-JSRb-2-3M	27-Mar-01	7.88	28.1	56.7	55.7	363	<PQL	<PQL	1.1	<PQL	<PQL	0.66	12	298	39	17	66	5.7	0.31	<PQL	<PQL	<PQL	<PQL	0.0066	<PQL	<PQL	0.017	<PQL
IM-JSRb-3-0M	26-Nov-00	7.45	23.9	64.0	50.0	410	<PQL	<PQL	2.7	0.16	<PQL	0.62	4.2	320	32	17	49	4.7	0.46	<PQL	<PQL	<PQL	0.015	0.015	<PQL	0.0059	<PQL	39
IM-JSRb-3-1M	03-Jan-01	7.45	23.8	61.5	55.7	393	2.3	0.15	6.7	0.20	<PQL	1.5	8.5	315	40	16	50	3.7	0.43	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0064	<PQL	<PQL
IM-JSRb-3-2M	06-Feb-01	7.46	24.3	56.9	57.8	364	2.4	2.0	<PQL	<PQL	<PQL	0.41	7.3	305	40	18	66	2.8	0.45	<PQL	<PQL	<PQL	0.017	<PQL	<PQL	<PQL	0.015	<PQL
IM-JSRb-3-3M	27-Mar-01	7.61	28.0	56.0	58.1	358	1.6	1.5	0.18	<PQL	<PQL	0.71	8.4	296	41	17	66	5.9	0.49	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.026	<PQL
Jhenaidah																												
IM-JHKc-1-0M	28-Feb-01	7.16	24.6	94.9	162	608	<PQL	<PQL	0.75	0.20	<PQL	3.2	0.87	546	130	29	29	4.9	0.31	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0098	<PQL	27
IM-JHKc-1-1M	24-Mar-01	6.99	27.5	59.6	152	382	<PQL	<PQL	4.0	0.24	<PQL	7.8	1.1	555	130	22	23	8.6	0.22	<PQL	<PQL	<PQL	0.017	<PQL	<PQL	<PQL	0.030	<PQL
IM-JHKc-1-2M	1st-May-01	7.26	30.9	68.2	153	437	<PQL	<PQL	5.4	0.46	<PQL	9.8	1.7	557	120	30	26	6.2	0.27	<PQL	<PQL	<PQL	0.018	<PQL	<PQL	<PQL	<PQL	<PQL
IM-JHKc-1-3M	17-Jun-01	7.21	30.8	68.6	149	343	<PQL	<PQL	4.5	0.35	<PQL	6.2	2.8	524	120	25	26	5.1	0.18	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	27
IM-JHKc-2-0M	28-Feb-01	7.07	23.7	90.4	162	578	<PQL	<PQL	1.7	<PQL	<PQL	1.5	2.0	500	130	29	27	4.5	0.24	<PQL	<PQL	<PQL	0.011	<PQL	<PQL	<PQL	<PQL	<PQL
IM-JHKc-2-1M	24-Mar-01	7.21	27.6	89.3	146	572	<PQL	<PQL	1.2	<PQL	<PQL	2.3	3.6	509	120	22	23	6.7	0.21	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	0.0073	0.10	<PQL
IM-JHKc-2-2M	1st-May-01	7.08	24.7	81.1	164	519	0.81	<PQL	1.6	<PQL	<PQL	2.3	2.4	532	130	30	14	4.8	0.16	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0062	0.072	<PQL
IM-JHKc-2-3M	17-Jun-01	7.23	30.9	66.0	144	330	<PQL	<PQL	1.5	0.10	<PQL	1.9	2.6	535	120	24	19	4.5	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
IM-JHKc-3-0M	28-Feb-01	6.79	24.1	94.5	163	605	<PQL	<PQL	1.3	0.14	<PQL	3.6	1.3	555	130	29	27	4.9	0.33	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	<PQL	<PQL	35
IM-JHKc-3-1M	24-Mar-01	7.11	27.6	87.3	146	559	<PQL	<PQL	1.8	<PQL	<PQL	2.5	3.1	505	120	21	22	6.7	0.31	<PQL	<PQL	0.0050	0.014	<PQL	<PQL	0.0087	0.036	<PQL
IM-JHKc-3-2M	1st-May-01	7.04	24.6	81.9	164	524	3.6	<PQL	2.1	<PQL	<PQL	3.6	1.1	525	130	30	14	5.3	0.18	<PQL	<PQL	0.0062	<PQL	0.0052	<PQL	<PQL	0.053	39
IM-JHKc-3-3M	17-Jun-01	7.09	30.9	65.9	146	330	<PQL	<PQL	4.7	0.18	<PQL	3.7	1.5	523	120	26	23	4.9	0.27	<PQL	<PQL	0.015	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.4 Results of Improved Deep Tubewell(2/2)

Analyte		pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method		pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit			Deg C	mS/m	mg CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	Date of sampling	pH	Temp	EC	Hardness	TDS	NO3	NO2	NH4	Mn	SO4	Fe	Cl	HCO3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Chuadanga																												
IM-CDBd-1-0M	14-Mar-01	7.01	28.2	62.5	100	400	<PQL	<PQL	1.5	0.32	<PQL	5.1	1.4	342	82	18	14	5.1	0.38	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	0.0070	<PQL	<PQL
IM-CDBd-1-1M	14-Apr-01	7.22	26.0	57.8	116	370	3.8	<PQL	1.6	0.25	<PQL	2.6	0.93	357	92	23	6.8	3.2	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.12	<PQL
IM-CDBd-1-2M	17-May-01	7.23	31.3	50.2	102	321	2.6	1.0	0.11	0.19	<PQL	2.8	1.8	346	80	22	12	4.2	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
IM-CDBd-1-3M	23-Jun-01	7.26	30.9	51.1	101	256	<PQL	<PQL	1.8	0.29	<PQL	2.9	<PQL	353	82	20	18	3.8	0.35	<PQL	<PQL	0.0063	<PQL	<PQL	<PQL	<PQL	0.0059	<PQL
IM-CDBd-2-0M	14-Mar-01	7.07	28.2	61.9	102	396	<PQL	<PQL	1.7	0.16	<PQL	3.2	0.81	348	83	19	13	5.6	0.47	<PQL	<PQL	<PQL	0.020	<PQL	<PQL	0.0052	0.066	<PQL
IM-CDBd-2-1M	14-Apr-01	7.15	25.7	55.4	112	355	2.6	2.3	<PQL	0.20	<PQL	2.5	1.0	341	90	22	6.9	3.2	0.32	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.15	<PQL
IM-CDBd-2-2M	17-May-01	7.23	31.3	50.0	101	320	2.7	2.5	<PQL	0.15	<PQL	2.1	1.6	333	80	21	12	4.2	0.40	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	<PQL	0.0092	<PQL
IM-CDBd-2-3M	23-Jun-01	7.27	31.0	51.3	99.5	257	<PQL	<PQL	1.7	0.24	<PQL	2.6	<PQL	348	81	18	13	3.3	0.37	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
IM-CDBd-3-0M	14-Mar-01	7.14	28.1	61.7	100	395	2.7	<PQL	<PQL	0.12	<PQL	2.5	1.3	326	82	18	13	5.3	0.39	<PQL	<PQL	<PQL	<PQL	0.0104	<PQL	<PQL	<PQL	<PQL
IM-CDBd-3-1M	14-Apr-01	7.72	24.9	54.6	109	350	2.9	<PQL	1.3	0.22	<PQL	2.4	1.7	351	87	22	6.8	3.1	0.36	<PQL	<PQL	<PQL	<PQL	0.0093	<PQL	<PQL	0.18	<PQL
IM-CDBd-3-2M	17-May-01	7.42	31.2	50.4	100	322	<PQL	<PQL	1.0	0.13	<PQL	2.2	1.7	341	80	21	15	3.1	0.37	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	<PQL	<PQL	<PQL
IM-CDBd-3-3M	23-Jun-01	7.29	31.0	51.2	95.8	256	<PQL	<PQL	1.7	0.23	<PQL	2.4	1.4	342	78	17	9.9	4.0	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.5 Results of 300 Existing Well Survey (Rainy Season)

Analyte	pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method	pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/FAAS	Extraction/FAAS	Extraction/FAAS	SP	Extraction/FAAS	Extraction/FAAS	Extraction/FAAS	Extraction/FAAS	Titration
Practical Quantitation Limit	0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit		Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Existing Well																											
EW-HJMd-R-[19]	7.00	26.4	70.2	166	449	0.80	<PQL	4.6	0.20	<PQL	11	1.8	460	140	31	21	1.9	0.53	<PQL	<PQL	<PQL	<PQL	0.013	<PQL	0.022	<PQL	<PQL
EW-JJDa-R-[38]	7.10	26.3	71.9	124	460	1.2	0.20	<PQL	0.91	<PQL	<PQL	10	460	100	27	34	1.3	1.1	<PQL	0.036	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-CDNI-R-[43]	7.00	26.3	101	193	646	16	2.8	0.11	0.45	36	0.57	43	500	160	34	26	3.6	0.48	0.0019	0.061	<PQL	<PQL	0.012	<PQL	0.048	<PQL	<PQL
EW-CDHw-R-[73]	7.20	26.2	68.3	141	437	0.36	0.26	3.4	0.93	<PQL	0.44	1.5	400	120	22	43	3.7	0.59	<PQL	0.050	<PQL	<PQL	0.017	<PQL	0.030	<PQL	<PQL
EW-JARj-R-[85]	7.20	26.3	158	75.6	1010	0.24	<PQL	0.11	0.44	<PQL	0.25	220	720	54	21	290	0.81	1.0	<PQL	0.066	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JBBs-R-[117]	7.10	26.1	52.3	119	334	<PQL	<PQL	1.6	0.76	<PQL	<PQL	2.3	320	99	20	9.0	1.6	0.50	0.0023	0.087	<PQL	<PQL	<PQL	<PQL	0.040	<PQL	<PQL
EW-HJNI-R-[147]	7.20	26.3	54.1	94.2	346	<PQL	<PQL	0.12	0.56	<PQL	0.36	20	340	69	25	15	1.4	0.61	<PQL	0.11	<PQL	0.017	<PQL	<PQL	0.0063	<PQL	<PQL
EW-HHHr-R-[26]	7.28	22.9	73.1	138	468	<PQL	0.25	<PQL	0.88	18	0.74	21	402	110	27	14	2.6	0.33	<PQL	0.10	<PQL	0.013	<PQL	<PQL	<PQL	<PQL	<PQL
EW-CJUt-R-[31]	7.10	26.6	51.7	115	331	1.1	<PQL	0.13	0.27	<PQL	0.59	6.8	340	110	6.1	21	1.4	0.40	<PQL	0.13	<PQL	0.015	<PQL	<PQL	0.047	<PQL	<PQL
EW-CCSk-R-[35]	7.00	26.4	59.9	74.9	383	1.4	<PQL	<PQL	0.64	<PQL	1.5	14	200	53	22	11	3.1	0.43	0.0051	0.14	<PQL	0.014	0.030	<PQL	0.069	0.051	<PQL
EW-HTKt-R-[46]	8.30	26.4	26.6	154	170	1.4	<PQL	0.11	0.20	6.5	1.2	13	360	130	23	8.0	3.4	0.52	0.0027	0.14	<PQL	0.010	<PQL	<PQL	0.035	0.024	<PQL
EW-CAAI-R-[72]	7.10	26.2	91.2	167	584	1.7	<PQL	0.10	0.38	8.2	0.92	26	460	140	25	19	4.0	0.35	0.0030	0.14	<PQL	0.014	<PQL	<PQL	0.038	0.011	<PQL
EW-HKRg-R-[74]	6.80	26.2	69.5	93.8	445	2.7	<PQL	<PQL	0.21	<PQL	5.0	15	240	82	12	16	1.9	0.40	0.0035	0.17	<PQL	<PQL	<PQL	<PQL	0.022	<PQL	<PQL
EW-JSBn-R-[88]	6.80	26.4	65.1	93.0	417	2.5	<PQL	0.11	0.36	<PQL	3.2	14	280	69	24	11	2.2	0.48	0.0039	0.17	<PQL	<PQL	<PQL	<PQL	0.048	0.047	<PQL
EW-HMNt-R-[95]	6.90	26.2	77.2	128	494	0.76	<PQL	3.2	0.36	<PQL	3.5	4.4	440	100	25	10	3.6	0.37	0.0052	0.17	<PQL	<PQL	<PQL	<PQL	0.026	<PQL	<PQL
EW-JKPj-R-[102]	6.80	26.1	258	164	1650	180	4.2	12	<PQL	<PQL	3.0	330	460	120	45	170	8.9	1.2	0.0073	0.18	<PQL	<PQL	<PQL	<PQL	0.065	0.016	160
EW-JHNn-R-[105]	6.70	26.0	63.0	107	403	11	3.2	0.10	0.14	<PQL	7.3	1.2	280	84	23	12	3.0	0.53	0.0076	0.20	0.0086	0.012	<PQL	<PQL	0.057	<PQL	39
EW-JMDk-R-[124]	7.10	23.0	93.3	48.1	467	<PQL	<PQL	4.6	<PQL	<PQL	2.2	53	420	13	35	95	4.8	1.1	0.0079	0.19	<PQL	<PQL	<PQL	<PQL	0.043	<PQL	39
EW-HSFI-R-[133]	6.90	25.8	65.7	117	420	0.30	<PQL	<PQL	0.69	7.6	0.34	2.4	360	90	27	16	1.3	0.50	<PQL	0.20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JJIc-R-[170]	7.10	25.8	40.1	125	257	0.71	<PQL	<PQL	0.74	<PQL	0.50	11	504	93	31	48	1.2	0.63	<PQL	0.21	<PQL	<PQL	<PQL	<PQL	0.0059	0.024	79
EW-HSAb-R-[177]	6.90	26.1	88.3	48.5	565	0.31	<PQL	0.11	0.76	<PQL	<PQL	24	340	33	15	52	2.7	0.49	<PQL	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JMCI-R-[201]	6.20	26.2	78.0	109	499	3.1	<PQL	5.6	0.098	<PQL	2.6	94	280	83	27	27	3.0	0.64	<PQL	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	0.015	<PQL
EW-JCPt-R-[207]	6.80	26.0	72.6	112	465	8.5	3.6	<PQL	0.30	<PQL	2.4	10	360	87	25	13	4.2	0.47	<PQL	0.22	<PQL	<PQL	<PQL	<PQL	0.0063	<PQL	<PQL
Production Well																											
EW-HTKt-R(PTW-2)	7.14	23.6	68.7	119	440	0.89	0.21	0.11	0.68	7.2	0.25	13	410	87	33	17	1.8	0.62	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.021	<PQL
EW-CCCd-R(PTW-2B)	7.09	23.5	69.3	123	444	<PQL	<PQL	1.1	0.19	<PQL	1.1	35	360	97	26	19	3.2	0.55	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-HJJn-R(PTW-3)	7.01	23.4	54.1	73	346	2.9	0.24	0.27	0.43	7.6	<PQL	4.1	340	61	12	24	2.1	0.56	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.019	<PQL
EW-JJJs-R(PTW-15)	7.09	23.2	101	114	644	<PQL	<PQL	0.10	0.29	8.9	0.73	110	480	82	31	59	2.7	0.41	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.053	<PQL
EW-HMMh-R(PTW-1)	7.12	23.7	53.0	102	339	4.5	0.17	1.2	<PQL	<PQL	1.5	3.0	330	83	20	8.7	2.8	0.27	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.069	<PQL
EW-HKKI-R(PTW-2)	7.12	23.6	67.8	111	434	7.4	1.1	<PQL	0.50	<PQL	0.48	16	380	86	25	10	2.2	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.054	<PQL
EW-HSSI-R(PTW-1)	7.09	23.4	75.4	128	483	<PQL	<PQL	0.18	<PQL	<PQL	<PQL	4.6	490	93	35	32	3.2	0.39	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	<PQL	0.028	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.6 Results of 300 Existing Well Survey (Dry Season)

Analyte	pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method	pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit	0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit		Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Existing Well																											
EW-HJMd-D-[19]	6.72	24.6	83.7	118	536	<PQL	<PQL	12	0.18	<PQL	8.1	1.1	448	96	22	10	2.6	0.35	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JJDa-D-[38]	7.14	24.4	81.3	102	520	0.31	0.020	6.6	1.5	<PQL	0.84	4.5	456	72	31	40	1.7	1.3	<PQL	<PQL	<PQL	<PQL	0.010	<PQL	0.0062	0.037	<PQL
EW-CDNt-D-[43]	7.09	23.7	100	161	642	2.0	3.3	7.8	0.68	46	3.4	13	463	130	30	36	4.0	0.58	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	33
EW-CDHw-D-[73]	7.13	23.6	68.5	119	438	<PQL	<PQL	13	1.3	<PQL	3.3	3.0	426	100	18	30	3.4	0.40	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JARj-D-[85]	7.11	24.4	184	66.2	1160	<PQL	0.020	7.1	0.42	<PQL	1.1	240	700	48	18	330	1.3	1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0072	<PQL	<PQL
EW-JBBs-D-[117]	6.93	23.8	58.6	84.6	375	<PQL	<PQL	9.2	0.23	<PQL	1.3	0.71	315	69	18	4.3	2.1	0.43	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0077	<PQL	<PQL
EW-HJNI-D-[147]	7.19	24.5	60.6	78.9	388	<PQL	<PQL	4.7	0.52	<PQL	2.2	2.2	328	59	20	12	1.7	0.55	<PQL	<PQL	<PQL	<PQL	0.0094	<PQL	0.0053	<PQL	<PQL
EW-HHHr-D-[26]	7.13	24.6	78.7	107	504	<PQL	0.47	7.4	0.98	20	2.5	18	383	90	17	7.8	2.9	0.41	<PQL	<PQL	<PQL	0.014	0.012	<PQL	<PQL	<PQL	<PQL
EW-CJUt-D-[31]	7.24	23.8	61.1	109	391	0.98	0.64	6.5	0.42	<PQL	1.4	7.7	319	90	19	15	3.8	0.28	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	<PQL	<PQL	<PQL
EW-CCSk-D-[35]	7.16	24.1	65.8	112	421	1.5	0.26	8.4	1.0	<PQL	2.6	12	324	93	19	4.3	3.6	0.28	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	<PQL	<PQL	<PQL
EW-HTKt-D-[46]	7.45	23.9	70.0	104	445	<PQL	<PQL	5.6	0.18	7.2	2.1	24	352	86	19	1.5	3.9	0.46	<PQL	<PQL	<PQL	0.015	<PQL	<PQL	<PQL	<PQL	<PQL
EW-CAAI-D-[72]	7.42	24.1	90.7	150	581	1.4	0.020	6.3	0.74	14	2.5	24	410	120	25	22	3.9	0.31	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0057	<PQL	<PQL
EW-HKRg-D-[74]	7.11	24.5	77.0	110	493	1.8	1.2	7.1	0.26	<PQL	4.9	14	387	89	21	8.6	2.7	0.31	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	<PQL	0.017	<PQL
EW-JSBn-D-[88]	6.89	24.3	60.5	96.0	387	<PQL	<PQL	9.7	0.45	<PQL	2.7	11	333	76	20	10	1.8	0.35	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.020	<PQL
EW-HMNt-D-[95]	6.85	24.5	81.1	105	520	<PQL	<PQL	11	0.28	8.1	4.7	1.9	444	80	24	19	3.2	0.26	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0072	<PQL	30
EW-JKPj-D-[102]	7.03	24.4	227	119	1450	<PQL	<PQL	20	0.41	<PQL	1.3	570	546	82	37	400	6.7	1.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0064	0.10	85
EW-JHNn-D-[105]	6.87	24.2	66.0	98.7	423	<PQL	<PQL	9.1	0.44	<PQL	3.1	1.1	370	79	20	10	2.6	0.20	<PQL	<PQL	<PQL	0.016	0.0070	<PQL	<PQL	<PQL	<PQL
EW-JMDk-D-[124]	6.93	24.7	105	98.8	672	<PQL	<PQL	15	0.46	<PQL	2.6	50	463	69	30	81	3.8	0.57	<PQL	<PQL	<PQL	<PQL	0.011	<PQL	0.0066	<PQL	24
EW-HSFI-D-[133]	7.21	23.7	70.7	115	453	<PQL	<PQL	8.2	1.0	<PQL	0.26	3.0	389	94	21	24	1.2	0.45	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-JJlc-D-[170]	7.13	24.5	92.8	109	594	<PQL	<PQL	4.9	1.2	<PQL	1.2	15	481	79	30	59	1.3	0.70	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0052	0.013	<PQL
EW-HSAb-D-[177]	7.07	23.8	100	138	627	<PQL	<PQL	5.9	0.93	<PQL	0.42	22	463	110	31	37	2.5	0.48	<PQL	<PQL	<PQL	0.011	<PQL	<PQL	0.0092	<PQL	<PQL
EW-JMCI-D-[201]	6.81	24.5	75.6	97.9	484	<PQL	<PQL	16	0.45	<PQL	1.7	0.98	407	77	21	21	2.6	0.28	<PQL	<PQL	<PQL	<PQL	0.037	<PQL	<PQL	<PQL	24
EW-JCPt-D-[207]	7.01	24.9	77.8	117	499	<PQL	<PQL	11	0.43	<PQL	3.1	9.2	407	99	18	11	3.9	0.32	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0079	<PQL	<PQL
Production Well																											
EW-HTKt-D-(PTW-2)	7.05	24.6	77.7	107	497	<PQL	<PQL	7.6	0.75	<PQL	1.4	12	416	79	28	24	2.8	0.57	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-CCCD-D-(PTW-2B)	7.01	24.0	81.9	111	524	0.95	<PQL	8.2	0.60	30	1.4	45	352	92	19	22	4.3	0.55	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
EW-HJJn-D-(PTW-3)	6.99	24.5	63.9	91.0	409	<PQL	0.050	7.2	0.46	<PQL	1.6	3.1	333	73	18	14	3.3	0.28	<PQL	<PQL	<PQL	<PQL	0.021	<PQL	<PQL	<PQL	<PQL
EW-JJJs-D-(PTW-15)	7.03	24.6	112	111	718	<PQL	<PQL	4.8	0.20	<PQL	1.4	110	444	82	29	92	3.5	0.41	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	<PQL	0.0055	<PQL
EW-HMMh-D-(PTW-1)	7.08	24.0	59.7	91.1	382	1.8	<PQL	7.7	0.23	<PQL	2.0	3.8	305	77	14	8.3	3.9	0.24	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	<PQL	0.016	<PQL
EW-HKKt-D-(PTW-2)	7.32	24.5	77.4	114	495	0.91	0.35	8.1	0.12	<PQL	2.6	3.6	426	92	21	6.1	2.7	0.26	<PQL	<PQL	<PQL	0.018	0.047	<PQL	<PQL	0.015	<PQL
EW-HSSt-D-(PTW-1)	6.99	23.9	93.0	147	595	0.83	<PQL	8.2	0.62	<PQL	0.67	5.7	509	110	33	29	3.3	0.44	<PQL	<PQL	0.0081	<PQL	<PQL	<PQL	0.0061	0.0087	<PQL

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.7 Results of Baseline Survey (Existing Well)

Analyte	pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method	pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit	0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit		Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
BS-CDBd-EW-006	6.95	23.9	79.3	122	508	23	3.9	<PQL	0.83	<PQL	1.7	33	455	110	20	16	5.8	0.53	<PQL	<PQL	0.032	0.016	0.0060	<PQL	0.020	<PQL	<PQL
BS-CDBd-EW-050	7.04	24.5	58.2	119	372	2.3	4.0	<PQL	1.1	<PQL	2.4	4.6	376	97	22	16	4.3	0.41	<PQL	0.066	0.012	<PQL	0.0092	<PQL	<PQL	<PQL	<PQL
BS-CDBd-EW-060	7.15	25.3	63.0	116	403	<PQL	<PQL	4.3	1.1	14	2.1	9.5	394	94	23	6.5	2.5	0.42	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BS-CDBd-EW-115	7.15	24.3	49.6	126	317	12	1.7	<PQL	0.29	<PQL	1.0	25	350	110	20	14	3.4	0.34	<PQL	<PQL	<PQL	<PQL	0.014	<PQL	0.0068	<PQL	<PQL
BS-CDBd-EW-168	7.09	24.3	52.2	98.5	334	16	2.7	<PQL	0.85	<PQL	1.0	1.3	350	85	13	6.7	2.0	0.57	<PQL	<PQL	<PQL	0.010	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JDCc-EW-044	7.01	23.1	76.8	155	492	11	0.27	2.5	0.40	<PQL	2.6	1.7	512	120	32	11	3.4	0.22	<PQL	<PQL	<PQL	0.012	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JDCc-EW-060	7.08	23.7	74.4	128	476	<PQL	<PQL	6.7	0.18	<PQL	8.2	37	420	100	28	14	3.9	0.40	<PQL	0.054	0.016	<PQL	0.014	<PQL	0.029	<PQL	<PQL
BS-JDCc-EW-091	6.92	23.7	74.7	119	478	<PQL	<PQL	9.4	<PQL	<PQL	0.48	4.8	455	89	30	16	2.6	0.30	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	39
BS-JDCc-EW-092	7.29	24.2	64.5	117	413	0.26	<PQL	2.6	<PQL	<PQL	0.44	1.7	411	94	23	12	1.2	0.32	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	39
BS-JDCc-EW-093	7.07	23.5	73.8	138	472	<PQL	<PQL	1.7	<PQL	<PQL	0.31	1.3	473	110	26	15	3.9	<PQL	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	<PQL	<PQL	39
BS-JSRb-EW-001	7.26	24.9	251	122	1600	<PQL	<PQL	2.9	<PQL	<PQL	0.73	320	595	80	42	350	3.8	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.022	<PQL	44
BS-JSRb-EW-012	7.09	25.3	247	153	1580	<PQL	<PQL	2.0	<PQL	<PQL	2.1	540	510	110	47	300	8.2	0.37	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0069	0.0051	<PQL
BS-JSRb-EW-026	7.01	23.0	246	117	1570	<PQL	<PQL	2.4	<PQL	<PQL	2.5	370	608	79	38	360	6.5	0.59	<PQL	<PQL	0.0056	<PQL	<PQL	<PQL	0.016	<PQL	<PQL
BS-JSRb-EW-035	6.87	24.1	199	155	1270	<PQL	<PQL	27	<PQL	<PQL	3.7	300	757	110	42	260	6.3	0.41	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.010	<PQL	<PQL
BS-JSRb-EW-048	7.28	25.3	267	135	1710	<PQL	<PQL	3.8	<PQL	6.6	4.2	490	569	93	42	410	7.7	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.016	<PQL	<PQL

Excess of WHO guideline　　Excess of Bangladesh Standard　　Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.8 Results of Baseline Survey (Pond)

Analyte	pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD
Method	pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	SP	FAAS	SP	FAAS	SP	Titration	FAAS	FAAS	FAAS	FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	SP	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Extraction/ FAAS	Titration
Practical Quantitation Limit	0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
Unit		Deg C	mS/m	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
BS-CDBd-P-01	7.54	23.7	23.8	39.4	152	<PQL	<PQL	0.45	<PQL	<PQL	<PQL	7.5	140	32	7.5	13	6.5	0.35	<PQL	<PQL	<PQL	0.029	<PQL	<PQL	<PQL	<PQL	<PQL
BS-CDBd-P-02	7.10	23.4	11.1	19.9	71.1	<PQL	<PQL	0.34	<PQL	<PQL	<PQL	4.1	67.8	17	2.9	2.7	5.1	0.33	<PQL	<PQL	<PQL	0.033	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JDCc-P-01	7.36	23.6	35.0	28.5	224	42	5.8	4.8	<PQL	7.4	<PQL	7.5	184	25	14	24	4.3	2.0	<PQL	<PQL	<PQL	0.018	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JDCc-P-02	7.39	23.9	15.8	34.2	101	2.8	0.020	1.1	0.10	<PQL	<PQL	3.5	87.5	34	0.20	4.1	7.1	1.4	<PQL	<PQL	<PQL	0.046	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JDCc-P-03	7.05	23.7	25.0	34.5	160	18	1.2	2.6	0.16	7.3	<PQL	5.0	123	32	2.0	7.4	2.0	3.6	<PQL	<PQL	0.0070	0.052	<PQL	<PQL	0.0056	<PQL	39
BS-JDCc-P-04	7.41	23.8	38.9	16.6	249	0.82	0.030	0.82	<PQL	<PQL	<PQL	2.3	219	14	13	31	7.0	0.63	<PQL	<PQL	<PQL	0.029	<PQL	<PQL	0.0054	<PQL	78
BS-JDCc-P-05	7.47	24.2	30.3	23.4	194	1.8	0.10	0.18	0.096	<PQL	<PQL	3.9	175	20	13	8.2	7.1	0.26	<PQL	<PQL	<PQL	0.019	<PQL	<PQL	<PQL	<PQL	78
BS-JSRb-P-01	7.72	24.1	30.0	24.9	192	1.2	<PQL	0.20	<PQL	6.9	<PQL	11	131	20	4.8	18	6.0	0.34	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0077	<PQL
BS-JSRb-P-02	7.32	22.4	32.8	39.6	210	<PQL	<PQL	0.41	<PQL	<PQL	<PQL	8.4	156	30	9.7	20	4.5	0.49	<PQL	<PQL	<PQL	0.029	0.011	<PQL	0.0090	0.0093	38
BS-JSRb-P-03	7.88	24.3	37.2	34.8	238	<PQL	<PQL	0.21	<PQL	7.1	<PQL	28	144	27	7.8	38	2.2	0.34	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	<PQL	0.011	<PQL
BS-JSRb-P-04	7.95	23.9	35.7	45.0	228	0.80	0.070	0.68	<PQL	<PQL	<PQL	24	144	31	14	21	9.7	0.31	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-05	7.30	23.7	48.4	41.0	310	<PQL	<PQL	0.30	<PQL	7.4	<PQL	52	136	30	11	46	4.0	0.44	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0059	<PQL	<PQL
BS-JSRb-P-06	7.80	23.5	96.6	75.0	618	0.31	<PQL	0.51	<PQL	7.9	<PQL	5.6	256	55	7.3	46	14	1.9	<PQL	<PQL	<PQL	0.014	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-07	7.80	23.1	35.8	43.8	229	1.4	<PQL	0.78	<PQL	<PQL	<PQL	24	152	31	7.2	15	30	0.27	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-08	7.40	23.0	57.2	38.7	366	<PQL	<PQL	1.1	<PQL	6.1	<PQL	59	184	26	11	44	48	2.2	<PQL	<PQL	<PQL	0.013	<PQL	<PQL	0.0079	<PQL	<PQL
BS-JSRb-P-09	7.50	22.7	48.8	48.3	312	<PQL	<PQL	0.34	<PQL	6.8	<PQL	59	192	37	12	26	7.6	0.31	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0062	<PQL	<PQL
BS-JSRb-P-10	7.70	23.1	64.8	63.6	415	0.23	<PQL	0.33	<PQL	<PQL	<PQL	97	208	47	17	43	7.4	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-11	7.56	23.7	29.0	36.1	186	<PQL	<PQL	0.44	0.086	<PQL	<PQL	2.9	140	30	5.9	11	5.9	0.30	<PQL	<PQL	<PQL	0.018	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-12	7.57	23.7	45.7	27.8	292	<PQL	<PQL	0.36	<PQL	5.8	<PQL	25	175	24	4.3	29	62	0.47	<PQL	<PQL	<PQL	0.036	<PQL	<PQL	<PQL	<PQL	78
BS-JSRb-P-13	7.43	23.4	29.7	44.0	190	3.8	0.43	0.25	<PQL	6.8	<PQL	4.3	158	34	9.9	6.9	6.3	0.39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-14	6.97	24.3	40.8	41.5	261	16	6.6	0.19	<PQL	<PQL	<PQL	36	140	32	9.8	32	5.0	0.49	<PQL	<PQL	<PQL	0.017	<PQL	<PQL	0.0056	<PQL	39
BS-JSRb-P-15	7.61	24.2	48.5	25.8	310	2.4	0.10	0.45	<PQL	<PQL	<PQL	39	171	19	6.4	41	2.4	0.48	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0081	<PQL	39
BS-JSRb-P-16	7.57	22.5	25.4	37.5	163	13	0.95	0.59	<PQL	<PQL	<PQL	4.8	140	30	7.0	11	3.5	1.1	<PQL	<PQL	<PQL	0.015	<PQL	<PQL	<PQL	<PQL	<PQL
BS-JSRb-P-17	7.02	22.4	44.5	35.8	285	2.0	0.27	0.23	<PQL	5.8	<PQL	26	158	26	9.4	34	2.4	2.4	<PQL	<PQL	<PQL	0.031	<PQL	<PQL	<PQL	<PQL	78
BS-JSRb-P-18	7.40	22.6	55.2	57.0	353	4.6	0.64	0.25	<PQL	8.0	<PQL	38	223	40	17	37	40	0.50	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0061	<PQL	39
BS-JSRb-P-19	7.17	21.9	23.2	38.6	148	7.1	0.72	0.38	<PQL	7.7	<PQL	2.8	122	36	2.5	5.7	7.0	0.59	<PQL	<PQL	<PQL	0.034	<PQL	<PQL	0.0051	<PQL	78
BS-JSRb-P-20	7.42	22.7	43.9	20.3	281	1.5	0.11	<PQL	<PQL	<PQL	<PQL	25	210	14	16	34	5.3	0.36	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0080	<PQL	<PQL

Excess of WHO guideline   Excess of Bangladesh Standard   Excess of both Bangladesh Standard and WHO guideline

(The values were determined as exceeding the standards before rounding off)

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (1/12)

Ch-1

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	<0.08	0.77	67	3.0	10	<0.005	<0.005
Maximum (mg/l)		0.16	1.1	0.87	16	130	29	23	<0.005	0.0057
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.034	0.39	0.36	4.5	114	23	16	<0.005	0.0051
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.025	0.30	0.26	2.7	111	20	15	<0.005	0.0051
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/2	2/2	1/2	1/2	2/2	0/2	0/2	0/2	0/2
	Monitoring	0/8	0/8	6/8	8/8	7/8	0/8	0/8	0/8	0/8
	Total	0/10	2/10	7/10	9/10	9/10	0/10	0/10	0/10	0/10
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	-	-	0/2	0/2	0/2
	Monitoring	0/8	0/8	2/8	8/8	-	-	0/8	0/8	0/8
	Total	0/10	0/10	2/10	10/10	-	-	0/10	0/10	0/10

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (2/12)

Ch-1-4

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	0.24	0.090	2.1	74	26	22	<0.005	0.005
Maximum (mg/l)		<0.02	0.47	0.40	6.9	120	28	58	<0.005	0.0095
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.39	0.26	3.8	105	27	41	<0.005	0.0068
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.37	0.22	3.2	102	27	38	<0.005	0.0066
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	2/3	3/3	2/3	0/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	2/3	3/3	2/3	0/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (3/12)

Ch-2

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	<0.08	<0.2	14	21	11	<0.005	<0.005
Maximum (mg/l)		0.28	1.2	0.34	9.7	96	33	24	<0.005	0.0088
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.053	0.27	0.12	3.8	64	26	14	<0.005	0.0055
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.028	0.18	0.10	1.9	56	26	14	<0.005	0.0054
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/1	0/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1
	Monitoring	0/7	1/7	1/7	4/7	2/7	0/7	0/7	0/7	0/7
	Total	0/8	1/8	2/8	5/8	3/8	0/8	0/8	0/8	0/8
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/1	0/1	0/1	1/1	-	-	0/1	0/1	0/1
	Monitoring	0/7	0/7	0/7	6/7	-	-	0/7	0/7	0/7
	Total	0/8	0/8	0/8	7/8	-	-	0/8	0/8	0/8

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (4/12)

Ch-2-4

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	0.081	2.2	82	22	19	<0.005	0.0059
Maximum (mg/l)		0.25	<0.1	0.19	5.1	90	22	37	0.0054	0.0064
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.13	0.10	0.14	3.6	87	22	27	0.0051	0.0062
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.084	0.10	0.13	3.4	87	22	26	0.0051	0.0062
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	2/3	3/3	3/3	0/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	2/3	3/3	3/3	0/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (5/12)

Jh-1

Practical Quantitation Limit		*0.02*	*0.1*	*0.08*	*0.2*	*0.5*	*0.05*	*0.05*	*0.005*	*0.005*
WHO Guideline		*3*	*1.5*	*0.5*	*0.3*	*-*	*-*	*200*	*0.01*	*0.02*
Bangladesh Standard		*1*	*0.5*	*0.1*	*1*	*75*	*35*	*200*	*0.05*	*0.1*
Parameter		**NO2**	**NH4**	**Mn**	**Fe**	**Ca**	**Mg**	**Na**	**Pb**	**Ni**
Minimum (mg/l)		<0.02	<0.1	<0.08	2.6	43	24	14	<0.005	<0.005
Maximum (mg/l)		<0.02	0.17	0.35	18	110	42	36	0.011	0.0063
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.11	0.17	9.8	82	35	23	0.0059	0.0051
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.11	0.15	8.0	78	34	21	0.0056	0.0051
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/2	0/2	1/2	2/2	2/2	2/2	0/2	0/2	0/2
	Monitoring	0/7	0/7	4/7	7/7	5/7	4/7	0/7	0/7	0/7
	Total	0/9	0/9	5/9	9/9	7/9	6/9	0/9	0/9	0/9
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	-	-	0/2	1/2	0/2
	Monitoring	0/7	0/7	0/7	7/7	-	-	0/7	0/7	0/7
	Total	0/9	0/9	0/9	9/9	-	-	0/9	1/9	0/9

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (6/12)

Jh-1-4

Practical Quantitation Limit		*0.02*	*0.1*	*0.08*	*0.2*	*0.5*	*0.05*	*0.05*	*0.005*	*0.005*
WHO Guideline		*3*	*1.5*	*0.5*	*0.3*	*-*	*-*	*200*	*0.01*	*0.02*
Bangladesh Standard		*1*	*0.5*	*0.1*	*1*	*75*	*35*	*200*	*0.05*	*0.1*
Parameter		**NO2**	**NH4**	**Mn**	**Fe**	**Ca**	**Mg**	**Na**	**Pb**	**Ni**
Minimum (mg/l)		<0.02	<0.1	<0.08	2.3	99	38	11	<0.005	0.0057
Maximum (mg/l)		<0.02	0.13	0.089	3.6	100	38	13	0.013	0.0092
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.11	0.083	2.8	99	38	13	0.0077	0.0072
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.11	0.083	2.7	99	38	13	0.0069	0.0071
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	0/3	3/3	3/3	3/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	0/3	3/3	3/3	3/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	0/3	3/3	-	-	0/3	1/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	0/3	3/3	-	-	0/3	1/3	0/3

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (7/12)

Jh-2

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO2	NH4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	<0.08	<0.2	26	23	14	<0.005	<0.005
Maximum (mg/l)		0.100	0.18	0.12	9.2	98	39	21	0.0068	<0.005
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.030	0.12	0.089	3.0	56	33	16	0.0052	<0.005
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.024	0.12	0.088	1.5	48	33	16	0.0052	<0.005
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	2/2	2/2	0/2	0/2	0/2
	Monitoring	0/6	0/6	1/6	3/6	1/6	3/6	0/6	0/6	0/6
	Total	0/8	0/8	1/8	5/8	3/8	5/8	0/8	0/8	0/8
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	-	-	0/2	0/2	0/2
	Monitoring	0/6	0/6	0/6	5/6	-	-	0/6	0/6	0/6
	Total	0/8	0/8	0/8	7/8	-	-	0/8	0/8	0/8

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (8/12)

Jh-2-4

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO2	NH4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	<0.08	0.47	25	29	22	<0.005	<0.005
Maximum (mg/l)		0.26	0.11	0.72	3.0	90	31	48	0.012	<0.005
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.18	0.10	0.39	1.9	66	30	35	0.0072	<0.005
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.11	0.10	0.28	1.5	57	30	34	0.0066	<0.005
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	2/3	2/3	2/3	0/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	2/3	2/3	2/3	0/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	1/3	3/3	-	-	0/3	1/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	1/3	3/3	-	-	0/3	1/3	0/3

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (9/12)

Js-1

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO2	NH4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	0.13	0.66	65	21	51	<0.005	<0.005
Maximum (mg/l)		<0.02	0.28	1.2	13	84	33	66	<0.005	0.0071
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.16	0.66	7.5	77	28	56	<0.005	0.0053
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.15	0.53	5.8	77	27	56	<0.005	0.0053
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/2	0/2	2/2	1/2	2/2	0/2	0/2	0/2	0/2
	Monitoring	0/5	0/5	5/5	5/5	3/5	0/5	0/5	0/5	0/5
	Total	0/7	0/7	7/7	6/7	5/7	0/7	0/7	0/7	0/7
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	-	-	0/2	0/2	0/2
	Monitoring	0/5	0/5	5/5	5/5	-	-	0/5	0/5	0/5
	Total	0/7	0/7	5/7	7/7	-	-	0/7	0/7	0/7

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (10/12)

Js-1-4

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO2	NH4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	0.11	<0.08	<0.2	9.76	16.14	64.79	<0.005	<0.005
Maximum (mg/l)		<0.02	0.14	1.3	4.7	80	21	83	<0.005	<0.005
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.13	0.68	2.7	56	19	71	<0.005	<0.005
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.13	0.41	1.4	40	19	71	<0.005	<0.005
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	2/3	2/3	2/3	0/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	2/3	2/3	2/3	0/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	2/3	2/3	-	-	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	2/3	2/3	-	-	0/3	0/3	0/3

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (11/12)

Js-2

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		**NO2**	**NH4**	**Mn**	**Fe**	**Ca**	**Mg**	**Na**	**Pb**	**Ni**
Minimum (mg/l)		<0.02	<0.1	0.13	0.86	67	23	67	<0.005	<0.005
Maximum (mg/l)		0.31	0.38	2.3	15	82	36	80	<0.005	<0.005
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.068	0.22	0.79	8.4	75	29	77	<0.005	<0.005
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.032	0.18	0.55	5.8	75	29	77	<0.005	<0.005
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/2	0/2	2/2	1/2	0/2	0/2	0/2	0/2	0/2
	Monitoring	0/4	0/4	4/4	4/4	3/4	1/4	0/4	0/4	0/4
	Total	0/6	0/6	6/6	5/6	3/6	1/6	0/6	0/6	0/6
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/2	0/2	0/2	2/2	-	-	0/2	0/2	0/2
	Monitoring	0/4	0/4	4/4	4/4	-	-	0/4	0/4	0/4
	Total	0/6	0/6	4/6	6/6	-	-	0/6	0/6	0/6

Table 5.5.9 Summarized results of Observation Wells and holes in Pourshava exceeding Bangladesh standard and WHO guideline (12/12)

Js-2-4

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		**NO2**	**NH4**	**Mn**	**Fe**	**Ca**	**Mg**	**Na**	**Pb**	**Ni**
Minimum (mg/l)		<0.02	<0.1	0.19	2.0	43	22	77	<0.005	<0.005
Maximum (mg/l)		0.040	<0.1	0.29	3.4	70	23	160	<0.005	0.012
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.027	<0.1	0.22	2.7	59	23	106	<0.005	0.0072
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.025	<0.1	0.22	2.7	58	23	100	<0.005	0.0066
No. of samples above BG Standard / No. of Total samples	Pumping Test	0/3	0/3	3/3	3/3	0/3	0/3	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	3/3	3/3	0/3	0/3	0/3	0/3	0/3
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3
	Monitoring	-	-	-	-	-	-	-	-	-
	Total	0/3	0/3	0/3	3/3	-	-	0/3	0/3	0/3

Table 5.5.10 Summarized results of Observation Wells and holes in Model Rural Areas exceeding Bangladesh standard and WHO guideline (1/3)

Ch-CB

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	0.72	<0.08	0.79	35	23	14	<0.005	<0.005
Maximum (mg/l)		<0.02	1.8	0.51	15	110	43	27	<0.005	0.012
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	1.2	0.28	4.9	85	30	20	<0.005	0.0062
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	1.1	0.22	3.4	80	29	19	<0.005	0.0059
No. of samples above BG Standard / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	0/7	7/7	5/7	6/7	5/7	1/7	0/7	0/7	0/7
	Total	0/7	7/7	5/7	6/7	5/7	1/7	0/7	0/7	0/7
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	0/7	1/7	1/7	7/7	-	-	0/7	0/7	0/7
	Total	0/7	1/7	1/7	7/7	-	-	0/7	0/7	0/7

Table 5.5.10 Summarized results of Observation Wells and holes in Model Rural Areas exceeding Bangladesh standard and WHO guideline (2/3)

Jh-CB

Practical Quantitation Limit		0.02	0.1	0.08	0.2	0.5	0.05	0.05	0.005	0.005
WHO Guideline		3	1.5	0.5	0.3	-	-	200	0.01	0.02
Bangladesh Standard		1	0.5	0.1	1	75	35	200	0.05	0.1
Parameter		NO_2	NH_4	Mn	Fe	Ca	Mg	Na	Pb	Ni
Minimum (mg/l)		<0.02	<0.1	<0.08	0.20	4.3	1.5	19	<0.005	<0.005
Maximum (mg/l)		<0.02	1.6	0.28	5.3	130	29	200	<0.005	0.010
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.95	0.15	2.6	95	22	62	<0.005	0.0060
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		<0.02	0.62	0.14	2.0	68	16	41	<0.005	0.0058
No. of samples above BG Standard / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	0/7	5/7	5/7	6/7	5/7	0/7	1/7	0/7	0/7
	Total	0/7	5/7	5/7	6/7	5/7	0/7	1/7	0/7	0/7
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	0/7	2/7	0/7	6/7	-	-	1/7	0/7	0/7
	Total	0/7	2/7	0/7	6/7	-	-	1/7	0/7	0/7

Table 5.5.10 Summarized results of Observation Wells and holes in Model Rural Areas exceeding Bangladesh standard and WHO guideline (3/3)

Js-CB

Practical Quantitation Limit		*0.02*	*0.1*	*0.08*	*0.2*	*0.5*	*0.05*	*0.05*	*0.005*	*0.005*
WHO Guideline		*3*	*1.5*	*0.5*	*0.3*	-	-	*200*	*0.01*	*0.02*
Bangladesh Standard		*1*	*0.5*	*0.1*	*1*	*75*	*35*	*200*	*0.05*	*0.1*
Parameter		**NO2**	**NH4**	**Mn**	**Fe**	**Ca**	**Mg**	**Na**	**Pb**	**Ni**
Minimum (mg/l)		<0.02	<0.1	<0.08	<0.2	20	14	86	<0.005	<0.005
Maximum (mg/l)		2.2	1.1	0.20	0.70	27	17	140	<0.005	0.037
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		0.78	0.36	0.10	0.33	24	16	103	<0.005	0.011
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		0.19	0.22	0.094	0.30	24	16	102	<0.005	0.0075
No. of samples above BG Standard / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	2/7	2/7	1/7	0/7	0/7	0/7	0/7	0/7	0/7
	Total	2/7	2/7	1/7	0/7	0/7	0/7	0/7	0/7	0/7
No. of samples above WHO Guideline / No. of Total samples	Pumping Test	-	-	-	-	-	-	-	-	-
	Monitoring	0/7	0/7	0/7	3/7	-	-	0/7	0/7	1/7
	Total	0/7	0/7	0/7	3/7	-	-	0/7	0/7	1/7

Table 5.5.11 Results of Improved wells exceeding Bangladesh standard and WHO guideline

Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
WHO Guideline		-	-	-	-	1000	50	3	1.5	0.5	250	0.3	250	-	-	-	200	-	1.5	0.003	-	2	0.07	0.01	0.001	0.02	3	-
Bangladesh Standard		6.5-8.5	-	-	200-500	1000	10	1	0.5	0.1	400	1	600	600	75	35	200	12	1	0.005	0.05	1	0.1	0.05	0.05	0.1	5	4
Parameter		pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Minimum (mg/l)		6.79	23.6	50.0	47.3	256	<0.2	<0.02	<0.1	<0.08	<5	<0.2	<0.6	296	30	16	6.8	2.8	0.15	<0.0015	<0.025	<0.005	<0.01	<0.005	<0.001	<0.005	<0.005	<20
Maximum (mg/l)		7.88	31.3	94.9	164	608	3.8	2.5	8.4	0.46	<5	9.8	13	557	130	30	71	8.6	0.49	<0.0015	<0.025	0.015	0.025	0.015	<0.001	0.010	0.176	39
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		7.34	27.1	64.5	104	399	1.0	0.33	2.1	0.17	<5	2.5	4	396	82	21	31	4.6	0.34	<0.0015	<0.025	0.0054	0.012	0.0057	<0.001	0.0057	0.030	22
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		7.34	27.0	63.3	95.0	389	0.51	0.047	1.1	0.14	<5	1.7	2.6	386	72	21	24	4.4	0.32	<0.0015	<0.025	0.0052	0.012	0.0055	<0.001	0.0055	0.012	21
No. of samples above BG Standard / No. of Total samples	Chuadanga	0/12	-	-	0/12	0/12	0/12	3/12	8/12	12/12	0/12	12/12	0/12	0/12	12/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12
	Jhenaidah	0/12	-	-	0/12	0/12	0/12	0/12	12/12	7/12	0/12	12/12	0/12	0/12	12/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	4/12
	Jessore	0/12	-	-	0/12	0/12	0/12	3/12	8/12	4/12	0/12	3/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	0/12	1/12
	Total	0/36	-	-	0/36	0/36	0/36	6/36	28/36	23/36	0/36	27/36	0/36	0/36	24/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	0/36	5/36
No. of samples above WHO Guideline / No. of Total samples	Chuadanga	-	-	-	-	0/12	0/12	0/12	6/12	0/12	0/12	12/12	0/12	-	-	-	0/12	-	0/12	0/12	-	0/12	0/12	1/12	0/12	0/12	0/12	-
	Jhenaidah	-	-	-	-	0/12	0/12	0/12	8/12	0/12	0/12	12/12	0/12	-	-	-	0/12	-	0/12	0/12	-	0/12	0/12	0/12	0/12	0/12	0/12	-
	Jessore	-	-	-	-	0/12	0/12	0/12	6/12	0/12	0/12	8/12	0/12	-	-	-	0/12	-	0/12	0/12	-	0/12	0/12	1/12	0/12	0/12	0/12	-
	Total	-	-	-	-	0/36	0/36	0/36	20/36	0/36	0/36	32/36	0/36	-	-	-	0/36	-	0/36	0/36	-	0/36	0/36	2/36	0/36	0/36	0/36	-

Table 5.5.12 Results of Existing wells exceeding Bangladesh standard and WHO guideline

Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
WHO Guideline		-	-	-	-	1000	50	3	1.5	0.5.	250	0.3	250	-	-	-	200	-	1.5	0.003	-	2	0.07	0.01	0.001	0.02	3	-
Bangladesh Standard		6.5-8.5	-	-	200-500	1000	10	1	0.5	0.1	400	1	600	600	75	35	200	12	1	0.005	0.05	1	0.1	0.05	0.05	0.1	5	4
Parameter		pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Minimum (mg/l)		6.20	22.9	26.6	48.1	170	<0.2	<0.02	<0.1	<0.08	<5	<0.2	0.71	200	13	6.1	1.5	0.81	0.20	<0.0015	<0.025	<0.005	<0.01	<0.005	<0.001	<0.005	<0.005	<20
Maximum (mg/l)		8.30	26.6	258	193	1650	180	4.2	20	1.5	46	11	570	720	160	45	400	8.9	1.7	0.0079	0.22	0.0086	0.018	0.047	<0.001	0.069	0.10	160
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		7.06	24.8	82	113	525	4.5	0.39	5.0	0.50	7.6	2.0	39	402	89	24	42	2.9	0.53	0.0021	0.069	0.0051	0.011	0.0078	<0.001	0.014	0.014	25.5
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		7.05	24.8	76.6	109	488	0.64	0.055	1.6	0.39	6.2	1.3	11	392	84	23	21	2.6	0.47	0.0018	0.046	0.0051	0.011	0.0063	<0.001	0.0087	0.0088	22.7
No. of samples above BG Standard / No. of Total samples	Rainy Season	1/30	-	-	0/30	2/30	3/30	5/30	9/30	25/30	0/30	13/30	0/30	1/30	23/30	2/30	1/30	0/30	4/30	5/30	21/30	0/30	0/30	0/30	0/30	0/30	0/30	4/30
	Dry Season	0/30	-	-	0/30	2/30	0/30	2/30	30/30	30/30	0/30	26/30	0/30	1/30	24/30	1/30	2/30	0/30	3/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	5/30
	Total	0/60	-	-	0/60	4/60	3/60	7/60	39/60	55/60	0/60	39/60	0/60	2/60	47/60	3/60	3/60	0/60	7/60	5/60	21/60	0/60	0/60	0/60	0/60	0/60	0/60	9/60
No. of samples above WHO Guideline / No. of Total samples	Rainy Season	-	-	-	-	2/30	1/30	3/30	7/30	10/30	0/30	23/30	1/30	-	-	-	1/30	-	0/30	8/30	-	0/30	0/30	4/30	0/30	14/30	0/30	-
	Dry Season	-	-	-	-	2/30	0/30	1/30	30/30	13/30	0/30	29/30	1/30	-	-	-	2/30	-	1/30	0/30	-	0/30	0/30	6/30	0/30	0/30	0/30	-
	Total	-	-	-	-	4/60	1/60	4/60	37/60	23/60	0/60	52/60	2/60	-	-	-	3/60	-	1/60	8/60	-	0/60	0/60	10/60	0/60	14/60	0/60	-

Table 5.5.13 Results of Existing Wells in Model Rural Areas exceeding Bangladesh standard and WHO guideline

Practical Quantitation Limit		0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
WHO Guideline		-	-	-	-	1000	50	3	1.5	0.5	250	0.3	250	-	-	-	200	-	1.5	0.003	-	2	0.07	0.01	0.001	0.02	3	-
Bangladesh Standard		6.5-8.5	-	-	200-500	1000	10	1	0.5	0.1	400	1	600	600	75	35	200	12	1	0.005	0.05	1	0.1	0.05	0.05	0.1	5	4
Parameter		pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Minimum (mg/l)		6.87	23.0	49.6	98.5	317	<0.2	<0.02	<0.1	<0.08	<5	0.31	1.3	350	79	13	6.5	1.2	<0.1	<0.0015	<0.025	<0.005	<0.01	<0.005	<0.001	<0.005	<0.005	<20
Maximum (mg/l)		7.29	25.3	267	155	1710	23	4.0	27	1.1	14	8.2	540	757	120	47	410	8.2	0.59	<0.0015	0.066	0.032	0.016	0.014	<0.001	0.029	0.0051	44
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)		7.08	24.2	125	128	800	4.4	0.84	4.4	0.36	5.7	2.2	140	482	99	30	120	4.4	0.38	<0.0015	0.030	0.0080	0.011	0.0066	<0.001	0.011	0.0050	25
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)		7.08	24.2	101	127	649	0.75	0.090	1.5	0.20	5.4	1.5	23	471	98	28	36	3.9	0.35	<0.0015	0.028	0.0065	0.011	0.0060	<0.001	0.0087	0.0050	24
No. of samples above BG Standard / No. of Total samples	Chuadanga	0/5	-	-	0/5	0/5	3/5	4/5	1/5	5/5	0/5	3/5	0/5	0/5	5/5	0/5	0/5	0/5	0/5	0/5	1/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5
	Jhenaidah	0/5	-	-	0/5	0/5	1/5	0/5	5/5	2/5	0/5	2/5	0/5	0/5	5/5	0/5	0/5	0/5	0/5	0/5	1/5	0/5	0/5	0/5	0/5	0/5	0/5	3/5
	Jessore	0/5	-	-	0/5	5/5	0/5	0/5	5/5	0/5	0/5	4/5	0/5	2/5	5/5	5/5	5/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	1/5
	Total	0/15	-	-	0/15	5/15	4/15	4/15	11/15	7/15	0/15	9/15	0/15	2/15	15/15	5/15	5/15	0/15	0/15	0/15	2/15	0/15	0/15	0/15	0/15	0/15	0/15	4/15
No. of samples above WHO Guideline / No. of Total samples	Chuadanga	-	-	-	-	0/5	0/5	2/5	1/5	4/5	0/5	5/5	0/5	-	-	-	0/5	-	0/5	0/5	-	0/5	0/5	1/5	0/5	1/5	0/5	-
	Jhenaidah	-	-	-	-	0/5	0/5	0/5	5/5	0/5	0/5	5/5	0/5	-	-	-	0/5	-	0/5	0/5	-	0/5	0/5	1/5	0/5	1/5	0/5	-
	Jessore	-	-	-	-	5/5	0/5	0/5	5/5	0/5	0/5	5/5	5/5	-	-	-	5/5	-	0/5	0/5	-	0/5	0/5	0/5	0/5	1/5	0/5	-
	Total	-	-	-	-	5/15	0/15	2/15	11/15	4/15	0/15	15/15	5/15	-	-	-	5/15	-	0/15	0/15	-	0/15	0/15	2/15	0/15	3/15	0/15	-

Table 5.5.14 Results of Pond Water in Model Rural Areas exceeding Bangladesh standard and WHO guideline

Practical Quantitation Limit	0	0 Deg C	0.02	0.5	0.13	0.2	0.02	0.1	0.08	5	0.2	0.6	20	0.5	0.05	0.05	0.1	0.1	0.0015	0.025	0.005	0.01	0.005	0.001	0.005	0.005	20
WHO Guideline	-	-	-	-	1000	50	3	1.5	0.5	250	0.3	250	-	-	-	200	-	1.5	0.003	-	2	0.07	0.01	0.001	0.02	3	-
Bangladesh Standard	6.5-8.5	-	-	200-500	1000	10	1	0.5	0.1	400	1	600	600	75	35	200	12	1	0.005	0.05	1	0.1	0.05	0.05	0.1	5	4
Parameter	pH	Temp	EC	Hardness	TDS	NO_3	NO_2	NH_4	Mn	SO_4	Fe	Cl	HCO_3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD
Minimum (mg/l)	6.97	21.9	11.1	16.6	71.1	<0.2	<0.02	<0.1	<0.08	<5	<0.2	2.3	67.8	14	0.20	2.7	2.0	0.26	<0.0015	<0.025	<0.005	<0.01	<0.005	<0.001	<0.005	<0.005	<20
Maximum (mg/l)	7.95	24.3	96.6	75.0	618	42	6.6	4.8	0.16	8.0	<0.2	97	256	55	17	46	62	3.6	<0.0015	<0.025	0.0070	0.052	0.011	<0.001	0.0090	0.011	78
Arithmetic Avarage assuming <PQL data has PQL value (mg/l)	7.46	23.4	39.0	37.5	250	4.5	0.64	0.68	0.085	6.0	<0.2	22	161	29	9.0	24	12	0.83	<0.0015	<0.025	0.0051	0.020	0.0052	<0.001	0.0057	0.0055	34
Logarithminc Avarage assuming <PQL data has PQL value (mg/l)	7.46	23.4	35.7	35.4	229	1.1	0.084	0.44	0.084	5.9	<0.2	13	155	28	7.1	19	7.1	0.59	<0.0015	<0.025	0.0051	0.018	0.0051	<0.001	0.0056	0.0054	29
No. of samples above BG Standard / No. of Total samples	0/27	-	-	0/27	0/27	4/27	3/27	9/27	2/27	0/27	0/27	0/27	0/27	0/27	0/27	0/27	5/27	7/27	0/27	0/27	0/27	0/27	0/27	0/27	0/27	0/27	10/27
No. of samples above WHO Guideline / No. of Total samples	-	-	-	-	0/27	0/27	2/27	2/27	0/27	0/27	0/27	0/27	-	-	-	0/27	-	5/27	0/27	-	0/27	0/27	1/27	0/27	0/27	0/27	-

Table 5.5.15(1/2) Deep wells (300m in depth) – Explanation of samples containing general water quality parameters exceeding standard values

Samples taken from deep groundwater observation holes/wells in Pourashava and deep groundwater observation holes in model villages

Item	Standard value (mg/l)		Remarks	No. of samples exceeding the standard	Conditions of occurrence
NO_2	Bangladesh	1	・The Bangladesh value is lower than the WHO value. ・The WHO guideline value is based on health. impact	2	Sporadically found in observation holes of model village in Jessore.
	WHO	3		0	
NH_3	Bangladesh	0.5	・The Bangladesh value is lower than the WHO value. ・A WHO guideline value based on health has not been set. The standard (1.5mg/l) is based on a level that is likely to give rise to complaints due to taste, odor, etc.	17	Continually found in observation holes of model villages in Jhenaidah and Chuadanga. Sporadically found in other observation wells/holes.
	WHO	(1.5)*		3	
Mn	Bangladesh	0.1	・The Bangladesh value is lower than the WHO value. ・The WHO guideline value of 0.5mg/l is a health- based value; a standard of 0.1mg/l has been set based on a level likely to give rise to complaints due to taste, odor , etc.	50	Sporadically found in observation holes of the model villages in Chuadanga. Continually found in other observation wells/holes.
	WHO	0.5		15	
Fe	Bangladesh	1	・WHO has not set a health-based guideline value. The standard (.0.3mg/l) is based on a level that is likely to give rise to complaints due to taste, odor, etc.	67	Continually found in all observation wells/holes..
	WHO	(0.3)*		79	

*The WHO guideline values placed in "( )" are levels likely to give rise to complaints due to taste, odor, etc. The others are health-based guideline values.

Table 5.5.15(2/2) Deep wells (300m in depth) – Explanation of samples containing general water quality parameters exceeding standard values

Samples taken from deep groundwater observation holes/wells in Pourashava and deep groundwater observation holes in model villages

Item	Standard value (mg/l)		Remarks	No. of samples exceeding the standard	Conditions of occurrence
Ca	Bangladesh	75	・A WHO guideline value based on health has not been set.	52	Continually found in all observation wells/holes.
	WHO	–		–	
Mg	Bangladesh	35	・A WHO guideline value based on health has not been set.	16	Distributed in concentration areas in observation wells of Jhenaidah.
	WHO	–		–	
Na	Bangladesh	200	・A WHO guideline value based on health has not been set.	1	Only found in one sample from an observation hole in a model village in Jhenaidah.
	WHO	–		–	
Pb	Bangladesh	0.05	・The Bangladesh standard is higher than the WHO value	0	Sporadic.
	WHO	0.01	・A WHO guideline value based on health has been set.	3	
Ni	Bangladesh	0.1	・The Bangladesh standard is higher than the WHO value	0	Only found in one sample from an observation hole in a model village in Jessore.
	WHO	0.02	・A WHO guideline value based on health has been set.	1	
COD	Bangladesh	4	・A WHO guideline value based on health has not been set.	13	Sporadic.
	WHO	–		–	

Table 5.5.16 Deep wells (300m in depth) – Explanation of samples containing general water quality parameters exceeding standard values

Samples taken from deep groundwater observation holes/wells in Pourashava and deep groundwater observation holes in model villages

Item	Presumed method of treatment	Remarks
NO_2	None in particular.	・Exceeds the Bangladesh standard but is less than 3mg/l, impact on human body is small
NH_3	None in particular.	・No impact on the human body
Mn	Coagulating sedimentation by oxidizing agent (Cl_2、$KMnO_4$) and filtering	・Considering water quality conditions in Bangladesh, it would be difficult to find groundwater sources with Mn levels less than 0.1mg/l. ・Removal of Mn is difficult. Removal by aeration without chemicals is less effective than for Fe ・The previously mentioned method could meet the standard of 0.5mg/l, but is economically and operationally difficult.
Fe	Aeration filtration	・There are many observation holes that continually exceed the Bangladesh standard but they do not impact health. ・With the previously mentioned method, many water sources are thought to be able to achieve iron levels of 1mg/l.
Ca	Coagulating sedimentation by alkali treatment	・There are many observation holes that continually exceed the Bangladesh standard but they do not impact health. ・The previously mentioned treatment method would be economically and operationally difficult
Mg	Coagulating sedimentation by alkali treatment	・There are observation wells in concentrated areas that exceed the Bangladesh standard but they do not impact health ・The previously mentioned treatment method would be economically and operationally difficult
Na	None in particular.	・It is thought that complaints about the taste will arise but there is no impact on health.
Pb	Coagulating filtration	・Although levels slightly exceed the WHO value, they are not over the Bangladesh standard. ・Because of the low concentration, complete removal by treatment is difficult.
Ni	Coagulation filtration	・Although levels slightly exceed the WHO value, they are not over the Bangladesh standard. ・Because of the low concentration, complete removal by treatment is difficult.
COD	Biological treatment＋ nitrification and denitrification	・The high COD concentrations are because groundwater in Bangladesh is in a highly reducing state.

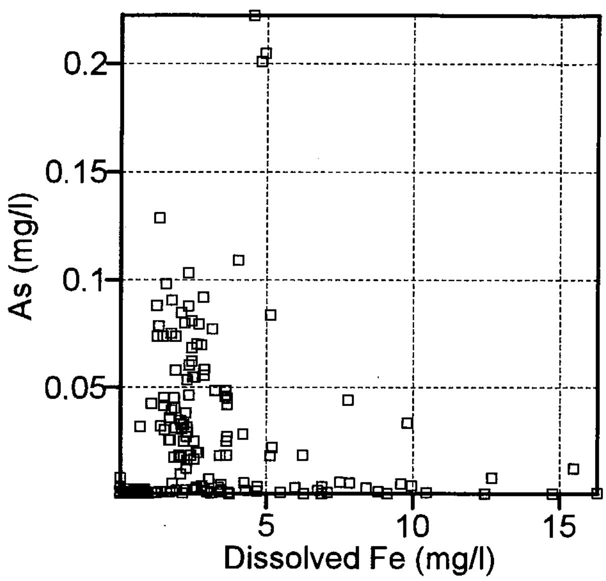
Table 5.5.17 Results of Observation Holes (Re-analysis)

Sample No	Date	EC (mS/m)	pH	ORP(Eh)	Temp(℃)
OH-JS1-4	15-Sep-02	88.8	7.14	78.5	26.2
OH-JS2-4	15-Sep-02	90.2	7.16	77.4	26.3
CB-JSRb	16-Sep-02	66.1	7.47	94.4	26.3
OH-JH2-4	13-Sep-02	82.5	6.89	111	26.1
OH-CH1-4	14-Sep-02	87.2	7.14	70.5	26.2
OH-CH2-4	14-Sep-02	73.5	7.16	95.5	26.2
CB-CDBd	13-Sep-02	90.4	7.35	124	26.3

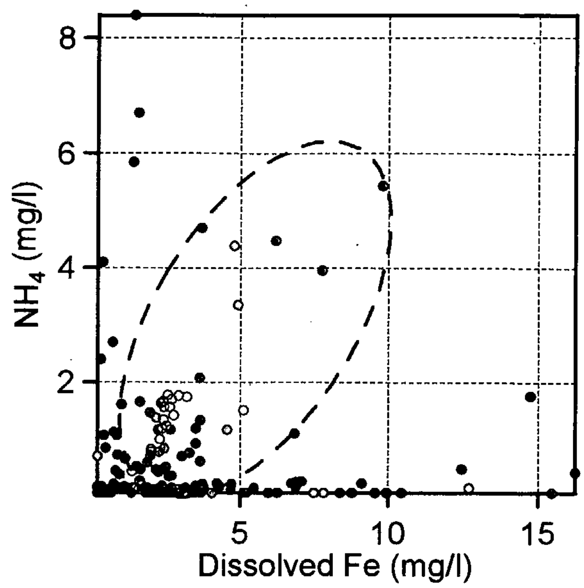
Analyte	pH	Temperature	Conductivity	Hardness	TDS	Nitrate	Nitrite	Ammonium	Dissolved Mn	Sulfate	Dissolved Fe	Chloride	Bicarbonate	Calcium	Magnesium	Sodium	Potassium	Fluoride	Cadmium	Total Cr	Copper	Cyanide	Lead	Mercury	Nickel	Zinc	COD	As
Method	pH meter	Thermo meter	Conductivity meter	Standard	Standard	SP	SP	IC	FAAS	IC	FAAS	Titration	IR	FAAS	FAAS	FAAS	FAAS	SP	FAAS	FAAS	FAAS	SP	FAAS	FAAS	FAAS	FAAS	Titration	FAAS
Practical Quantitation Limit			1	1	10	0.1	0.1	0.1	0.1	1	0.2	0.1	0.5	0.5	0.5	0.5	0.5	0.05	0.005	0.02	0.01	0.01	0.01	0.0005	0.06	0.01	2	0.001
Unit		Deg C	mS/m	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample No	pH	Temp	EC	Hardness	TDS	NO3	NO2	NH4	Mn	SO4	Fe	Cl	HCO3	Ca	Mg	Na	K	F	Cd	Cr	Cu	CN	Pb	Hg	Ni	Zn	COD	As
OH-JS1-4	7.4	22.5	81.9	310	470	<PQL	<PQL	<PQL	0.40	<PQL	3.8	7.3	520	53	32	48	5.0	0.11	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.01	4	0.002
OH-JS2-4	7.3	22.5	81.9	300	510	<PQL	<PQL	<PQL	0.30	<PQL	2.1	37	473	57	29	86	4.8	0.16	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.02	3	0.002
CB-JSRb	7.6	22.5	62.3	140	320	<PQL	1,7	<PQL	<PQL	<PQL	<PQL	19	360	26	25	91	3.3	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.02	5	<PQL
OH-JH2-4	7.1	22.5	75.8	420	450	<PQL	<PQL	<PQL	0.60	2	3.2	1.4	463	81	32	19	4.3	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.05	<PQL	0.011
OH-CH1-4	7.3	22.5	76.0	390	450	<PQL	<PQL	0.2	0.50	<PQL	3.4	0.9	488	81	32	16	4.8	0.10	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.01	3	0.011
OH-CH2-4	7.4	22.5	72.6	380	430	<PQL	<PQL	0.1	0.30	<PQL	2.3	4.2	454	71	30	15	4.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.02	3	0.002
CB-CDBd	7.2	22.5	81.4	380	490	<PQL	<PQL	0.4	<PQL	<PQL	1.7	1.2	509	62	36	17	4.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.18	<PQL	0.001

Excess of WHO guideline Excess of Bangladesh Standard Excess of both Bangladesh Standard and WHO guideline

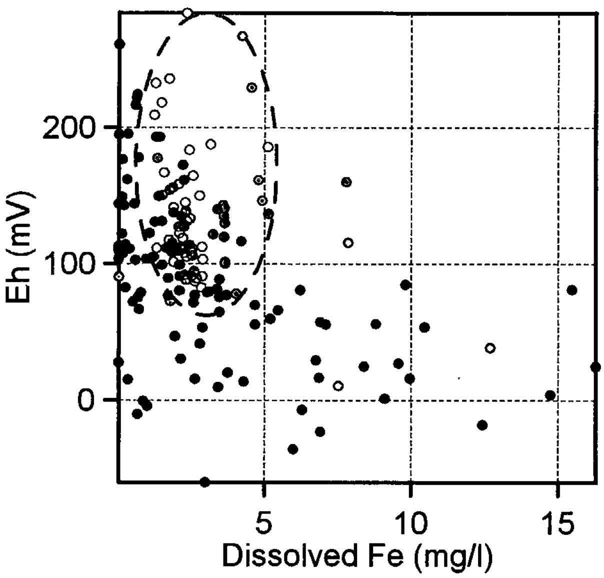
(The values were determined as exceeding the standards before rounding off)



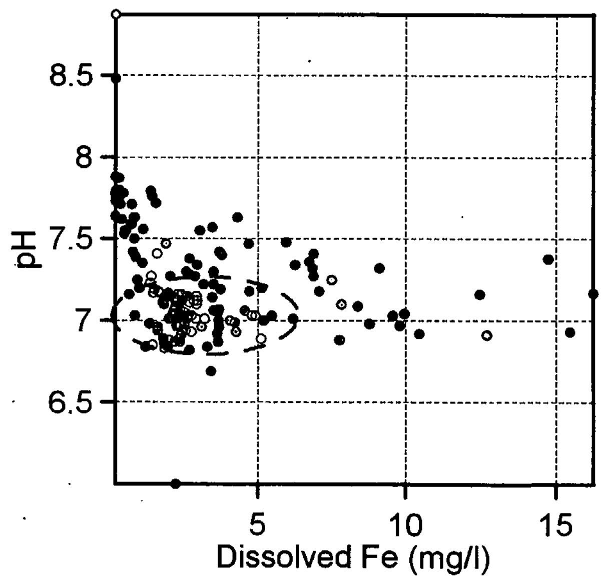
a) Relation between As and Fe



b) Relation among NH_4, Fe and As



c) Relation among Eh, Fe and As



d) Relation among pH, Fe and As

High Arsenic Concentration Zone

As Concentration (mg/l)
Analyzed by AAS

- ● 0 to 0.005
- ○ 0.005 to 0.01
- ● 0.01 to 0.05
- 0.05 to 0.1
- ◎ 0.1 to 0.5
- ● 0.5 to 1
- ● 1 to 2

[The arsenic concentration and other water quality parameters were analyzed in the monthly groundwater monitoring program in 2001.
The arsenic concentrations were analyzed by the AAS in Jhenaidah Laboratory.
The other water quality parameters were analyzed in Plasma+ Laboratory, Dhaka.]

Figure 5.5.1	**Relations of Dissolved Iron to As, NH_4, Eh, and pH in Groundwater of JICA Observation Wells/Holes**
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

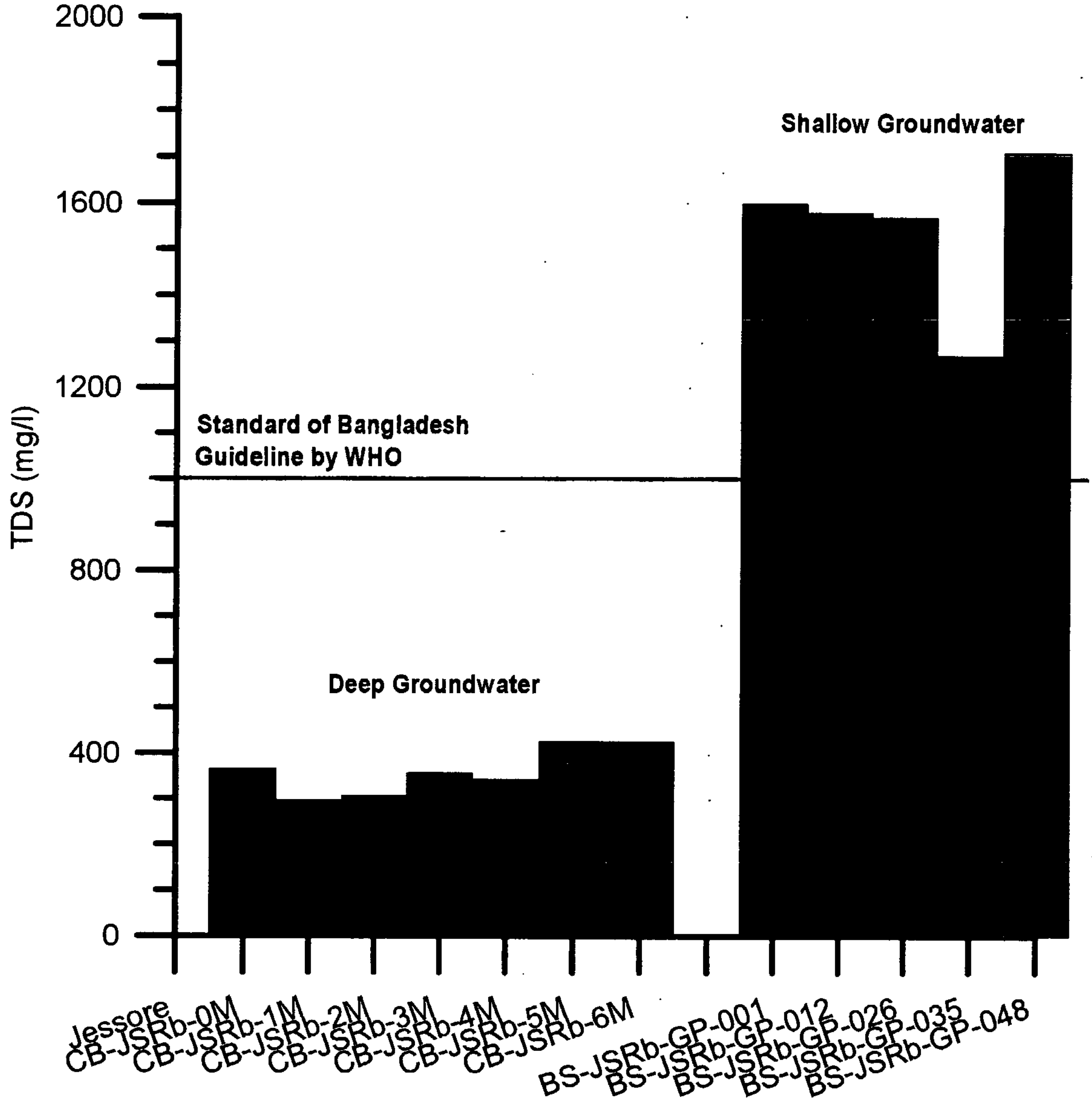


Figure 5.5.2	**TDS Data Comparison between Shallow and Deep Groundwater in Rajnagar Bankabarsi**
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

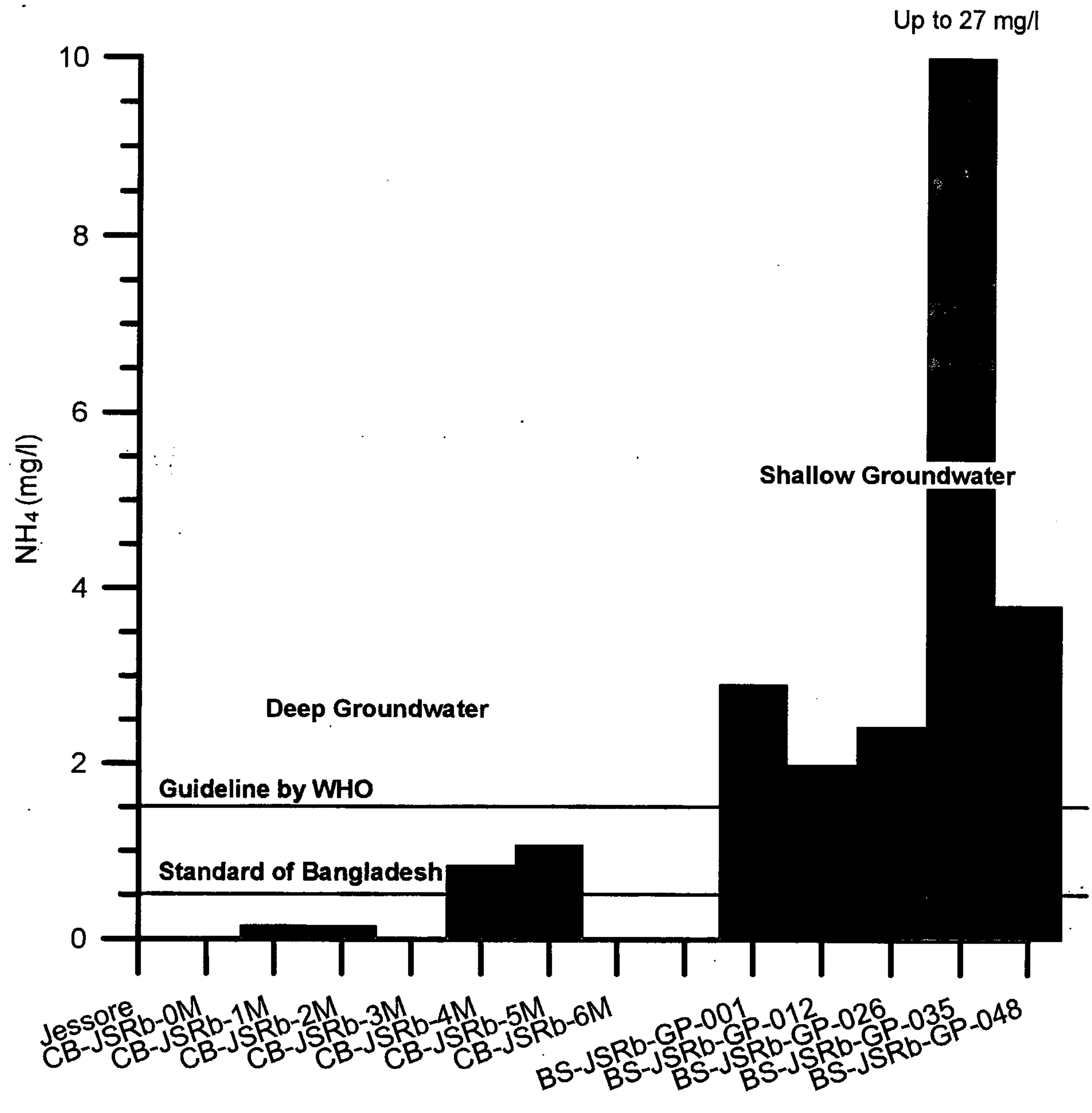


Figure 5.5.3	NH_4 Data Comparison between Shallow and Deep Groundwater in Rajnagar Bankabarsi

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

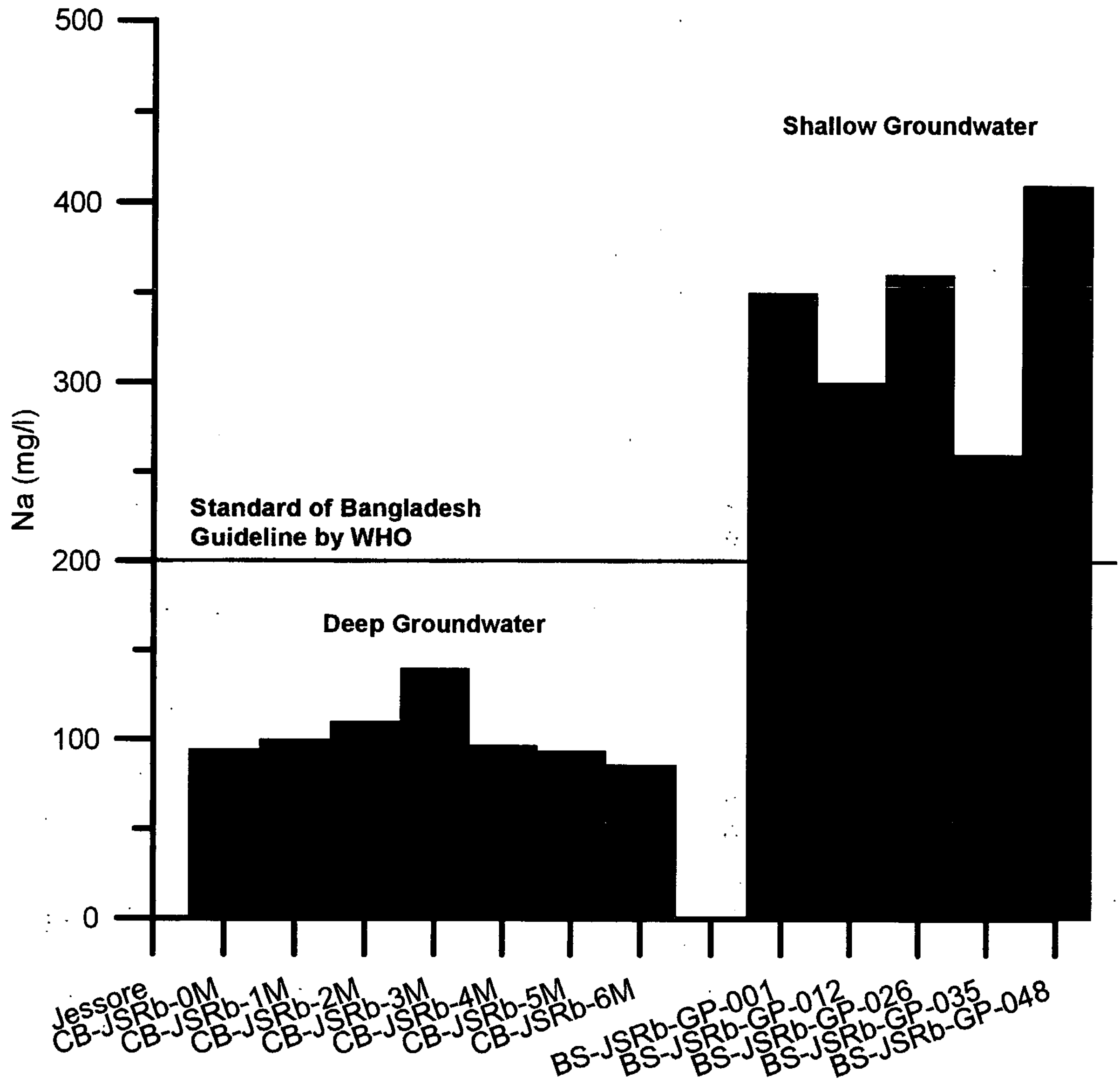


Figure 5.5.4	Na Data Comparison between Shallow and Deep Groundwater in Rajnagar Bankabarsi
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

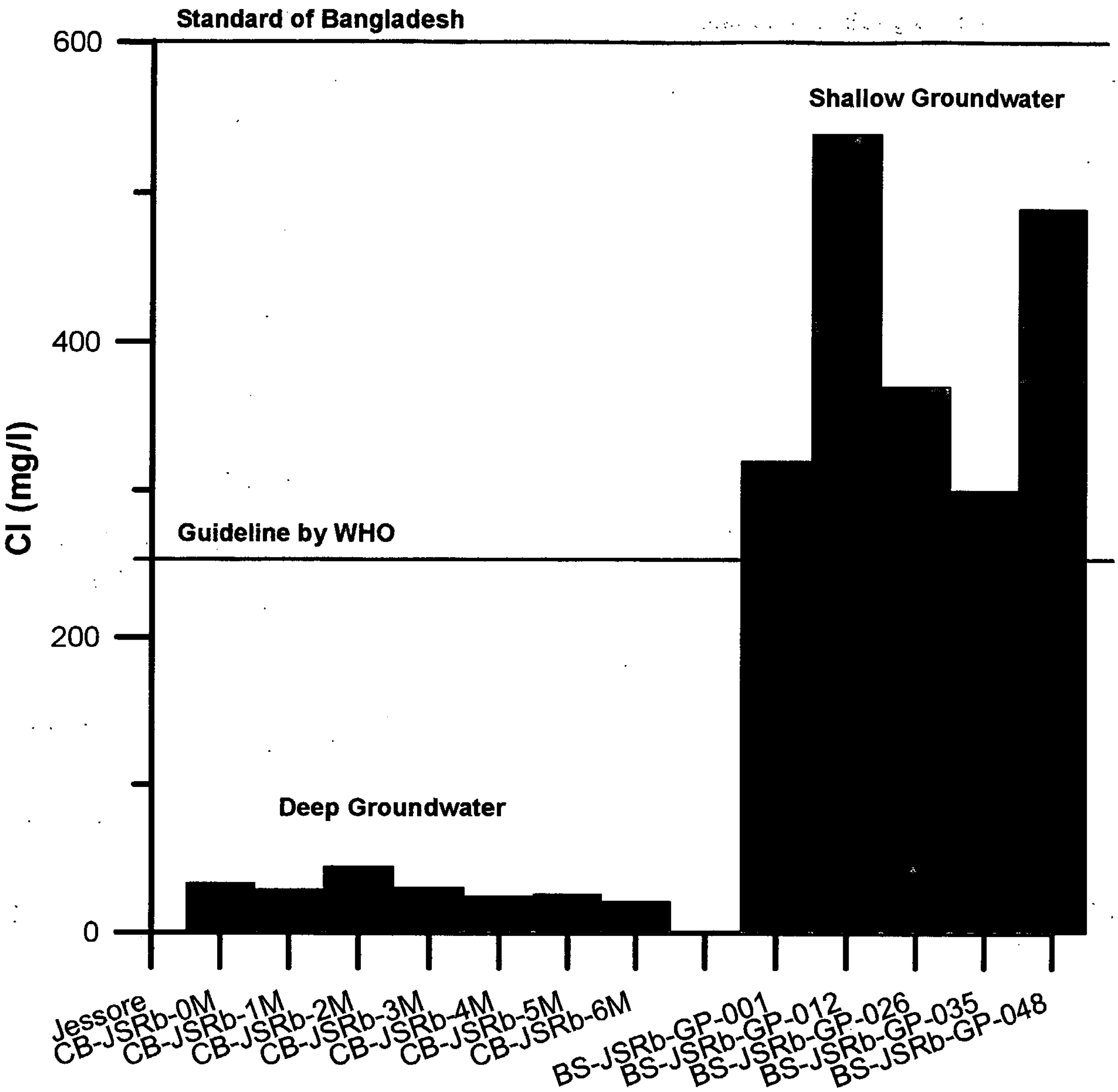


Figure 5.5.5	Cl Data Comparison between Shallow and Deep Groundwater in Rajnagar Bankabarsi
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

5.6 Core Sample Analysis

5.6.1 Results of Arsenic Analysis in Core Samples

1) CH-2 Site [Girls College, Chuadanga Pourashava]

Figure 5.6.1shows the results of the arsenic content test and leachate test at CH-2 site.

The total arsenic content is generally lower than 10ppm at depths from 0 to 204 m. In the shallow portion, clay and silt samples at depths from 0.17 to 6.50 m have slightly elevated total arsenic contents ranging from 5.6 to 9.7ppm. However, the samples from 13.3 to 91.2 m have small total arsenic contents ranging from 0.5 to 2.1ppm. The peaty silt sample collected from 102.50 to 102.63 m in depth has 17.73ppm. But some samples in depths from 206.0 to 245.2 m have high total arsenic content from 20 to 117ppm. The highest total arsenic content of 117.26ppm, which is also the highest in the study, was detected in a silty clay sample at depths from 207.50 to 207.72 m. It should be noted that such a higher value of arsenic content in the deep layers more than 200 m in depth has not been found in the previous studies in Bangladesh. The samples below 245.3 m have total arsenic contents ranging from 3.7 to 6.4ppm.

The results of the leachate test show that the samples from 0.1 to 45. 7 m in depth have almost less than 5 ppb of leached arsenic. In the samples from 52.0 to 192.5 m, slightly elevated leached arsenic was found at depths from 52.05 to 57.50 m (8.0 to 8.8ppb) and from 135.00 to 141.36 m (7.1 to 9.6ppb). In depths from 199.60 to 268.60 m, some samples show more than 10ppb of leached arsenic. The highest value of 20.5 ppb was detected from a fine to medium sand sample having 5.08ppm in total arsenic content. The sample having the highest total arsenic content of 117.26ppm shows only 11.0ppb. The samples below a depth of 271.3 m have less than 6ppb.

2) CH-CB Site [Bara Dudpatila Village, Damurhuda Upazila]

Figure 5.6.2 shows the results of the arsenic content test and leachate test at CH-BD site.

The samples from 0.0 to 100.8 m in depths have total arsenic content less than 10ppm. The clayey silt sample at depths from 111.65 to 111.85 m has a total arsenic content of 42.71ppm. The total arsenic content in the samples at depths from 119.3 to 223.5 m tends to increase with depth, from 3 to 14ppm. The clayey sample taken at a depth from 228.50 to 229.00 m has the highest total arsenic content of 93.57ppm at the site. Below this, the arsenic content ranged from 2.2 to 8.3ppm at depths from 233.0 to 268.2 m. In the samples below 270 m in depth, there are two (2) samples having more than 20ppm in total arsenic content. One is a fine to medium sand sample from 272.40 to 273.00 m (29.76ppm) and the other is very fine to fine sand sample from 290.00 to 290.40 m (47.09ppm).

The result of the leachate test shows that the shallow core samples within 100 m in depth have a very small value of leached arsenic, almost less than 5 ppb. However, the leached arsenic gradually increases with depth in the samples from 100 to 300 m. The leached arsenic ranges from 5 to 12ppb from 100 to 260 m, whereas the value ranges from 10 to 20ppb in depths from 264.5 to 290.4 m.

3) JH-1 Site [Arabpur, Jhenaidah Pourashava]

Figure 5.6.3 shows the results of the arsenic content test and leachate test at JH-1 site.

The vertical distribution of total arsenic content at the site is characterized by relatively higher values within 200 m in depth and very low arsenic content below the depth. Although the values range from 0 to 20ppm, relatively higher values more than 10ppm are found in a fine sand sample (8.40 to 9.00 m, 11.88ppm), silty fine sand sample (63.00 to 63.60 m, 17.95ppm), silty clay sample (100.55 to 100.37 m, 19.48ppm), very fine to fine sand sample (143.28 to 143.85 m, 16.68ppm), and fine to medium sand samples (183.00 to195.85 m, 10.61 to 14.38ppm). It is noted that the baseline of the total arsenic content increases with depth particularly from 100 to 200 m in depth. The samples in depths from 210 to 277 m have small total arsenic contents within 3ppm.

The result of the leachate test shows that the amount of leached arsenic is almost less than 5ppb from 0 to 300 m in depth except the samples from 61.6 to 67.0 m. The highest value of 90.5ppb was recorded in a silty fine sand sample (63.00 to 63.60 m) with a total arsenic content of 17.95ppm. The second and third highest values are found in a fine to medium sand sample (66.40 to 67.00 m, 59.9ppb) and fine to medium sand sample (61.60 to 62.00 m, 47.9ppb), respectively. Compared with the distribution of total arsenic content, only this portion has the appearance of arsenic both in the total content test and leachate test.

4) JH-KC Site [Krishna Chandrapur Village, Moheshpur Upazila]

Figure 5.6.4 shows the results of the arsenic content test and leachate test at JH-KC site.

The values of total arsenic content vary between 0 and 15ppm at the site. The general vertical distribution pattern is characterized by slightly higher values in the shallow portion within 30 m in depth, lower values less than 5ppm from 30 to 140 m, gradual increase from 2 to 5ppm at 150 m to 5 to 10ppm at 210 m, and a continuation of the range of variation up to 300 m in depth. The highest value of 12.96ppm at the site was recorded in the sample of sandy clay at depths from 25.70 to 25.85 m. It is noted that the background value of the arsenic content is higher in the fine sediments occurring below 195 m in depth.

5) JS-2 Site [Kharki, Jessore Pourashava]

Figure 5.6.5 shows the results of the arsenic content test and leachate test at JS-2 site.

The result of the total arsenic content test shows that higher values ranging from 40 to 60ppm are found at depths from 5 to 20 m. In the deeper portion, slightly elevated arsenic contents around 10ppm were found at depths around 160 and 210 to 250 m. The highest value of

63.15ppm in the site was found in a sample of peaty silt (14.45 to 14.78 m). The samples of peat, peaty silt, and clayey sediments at depths from 8.4 to 19.2 m have higher arsenic contents, which can be regarded as the source of arsenic contamination at the site. In the deeper portion, the samples having more than 10ppm are silty clay (159.50 to 159.65 m, 14.62ppm), silt (217.30 to 217.73 m, 10.57ppm), and sandy silt (252.00 to 252.15 m, 13.71 m). There is no increase of the baseline value of the arsenic content below 250 m in depth.

The result of the leachate test also shows that the arsenic is leached from the samples at shallow depths within 20 m as high as 20ppb. The maximum value of 20.3ppb was found in the peat sample at depths from 19.08 to 19.18 m with a total arsenic content of 50.70ppm. In the lower portion, the results show almost less than 5ppb except the samples taken from 252.0 to 273.9 m. The samples consist of sandy silt, fine to medium sand, and medium sand and have 5.2 to 8.6ppb.

6) JS-2 Site [Rajnagar Bankabarsi Village, Keshabpur Upazila]

Figure 5.6.6 shows the results of the arsenic content test and leachate test at JS-RB site.

The result of the total arsenic content test shows that the values are more than 50ppm in shallow samples within 10 m in depth and deeper samples obtained at depths from 250 to 260 m. The baseline value tends to increase from 1 to 15ppm with depth. The highest arsenic content of 67.61ppm was found from a silt sample at depths from 254.54 to 254.91 m. The clayey silt sample (256.23 to 256.66 m) beneath the silt sample also has a higher value of 60.22ppm. In the shallow portion, a peat sample (8.00 to 8.21 m) has 57.12ppm. The other samples of peat, peaty clay, and clay at depths from 7.0 to 9.9 m have values from 10.0 to 29.4ppm. It is noted that the baseline value of the arsenic content is higher than 10ppm below the highly contaminated samples at depths from 254.54 to 256.66 m, and that is clearly different from the baseline values in the upper layers.

The result of the leachate test shows that leached arsenic was found in some samples above 160 m in depth. The samples below 160 m in depth show less than 5ppb. The highest value of 16.6ppb was found from clayey silt at depths from 131.08 to 131.45 m. In the shallow portion, the peat samples having an arsenic content of 29.4 to 57.1ppm show only 7.3 to 10.3ppb. Since there is a peaty, very fine sand sample having 10.81ppm of arsenic at 61.8 to 62.0 m, the samples at depths from 61.8 to 75.0 m have 6.5 to 7.3ppb of leached arsenic.

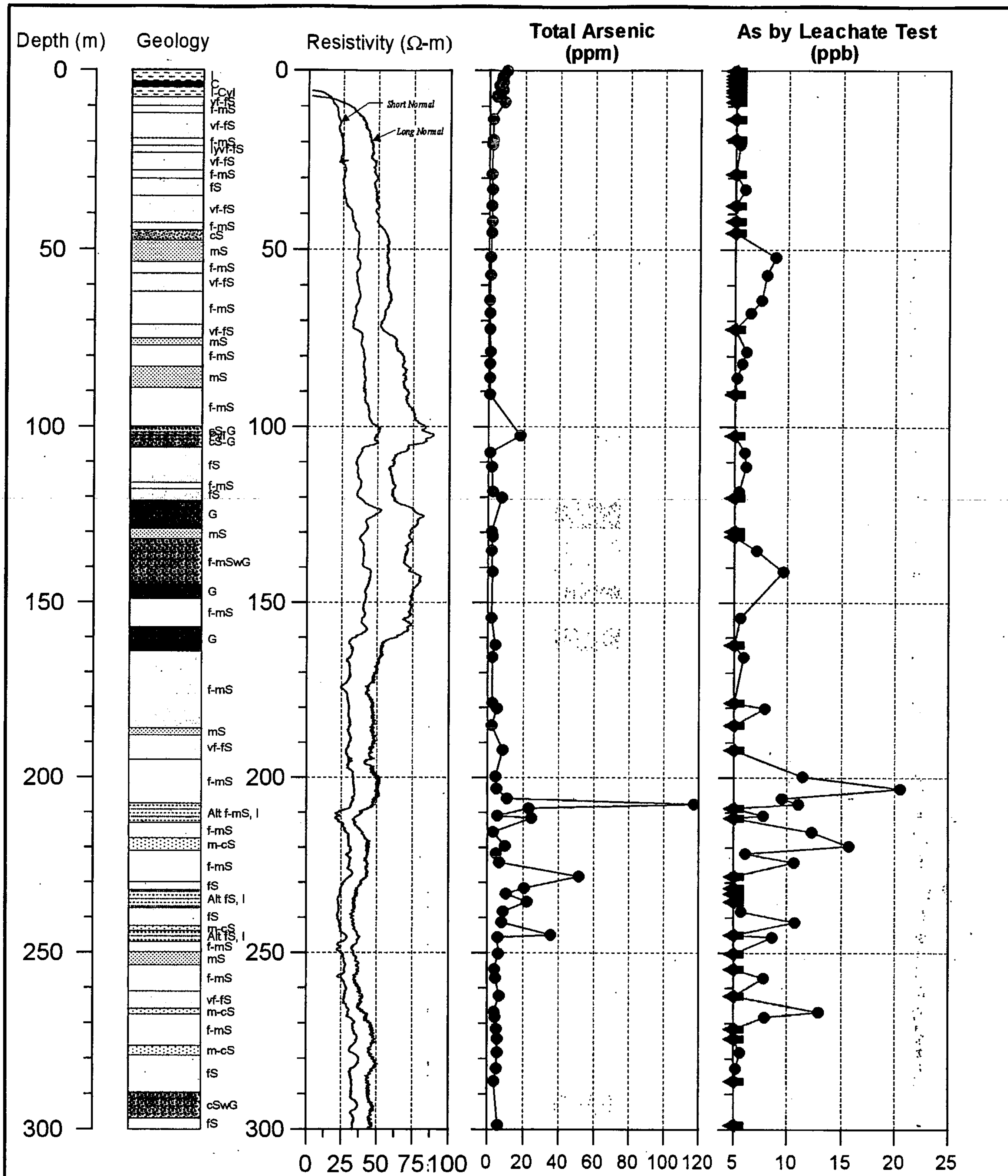
5.6.2 Evaluation of Arsenic Analysis

From the quality control test, secondary contaminations of core samples were not observed. It is evaluated that the sampling method and procedures employed in the study were satisfactorily performed.

The results of the total arsenic content test indicate the existence of arsenic in the soil not only in the shallow portion but also in the deeper portion up to 300 m in depth at some places. The occurrence of arsenic in the deeper layers indicates that there is a possibility of arsenic contamination originating from the deeper source. In other words, there is a potential of arsenic contamination in some places in the Study Area. However, the total arsenic content test does not show the form of arsenic occurrence. Therefore, it is difficult to judge whether or not the arsenic in deeper layers can easily be released into the groundwater. Moreover, there would be many complicated factors that control the release of arsenic from soil into groundwater. In the next step, it is necessary to research the occurrence and behaviors of arsenic that exists in the deeper layers.

Regarding the leachate test, the results are sometimes not in good agreement with the result of the arsenic content test. One of the probable reasons is that the in-situ groundwater conditions and laboratory conditions are different. For example, the extraction solution is controlled under acidic conditions; however, the general groundwater quality in the Study Area shows the pH is generally above 7. Due to the difference of leaching environment, some arsenic in the samples may not be released into the solution. Therefore, based on the results of this study, further detailed tests are required for research purposes.

It is also necessary to consider more sophisticated sampling methods to satisfy further detailed arsenic analysis, particularly for analyzing the form of the arsenic in soil.



C: Clay	Cy: Clayey
l: Silt	ly: Silty
S: Sand	Sy: Sandy
G: Gravel	w: with
v: very	-: to
f: fine	Alt: Alternation
m: medium	P: Peat
c: coarse	TS: Top Soil

Figure 5.6.1

Results of Arsenic Content Test and Leachate Test at CH-2 Site [Girls College, Chuadanga Pourashava]

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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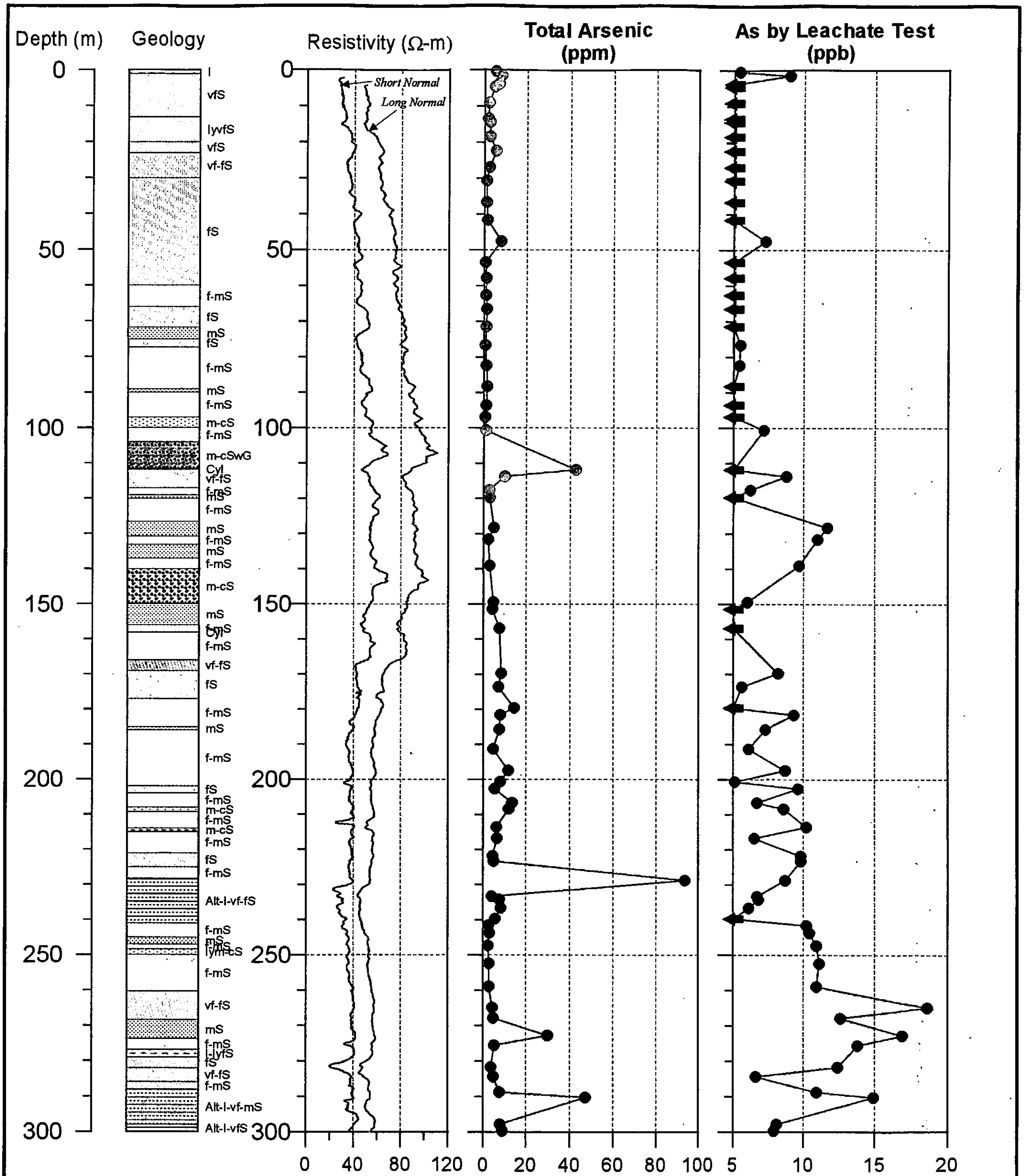

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Cy: Clayey
ly: Silty
Sy: Sandy
w: with
-: to
Alt: Alternation
P: Peat
TS: Top Soil

Figure 5.6.2	Results of Arsenic Content Test and Leachate Test at CH-BD Site [Bara Dudpatila, Damurhuda]

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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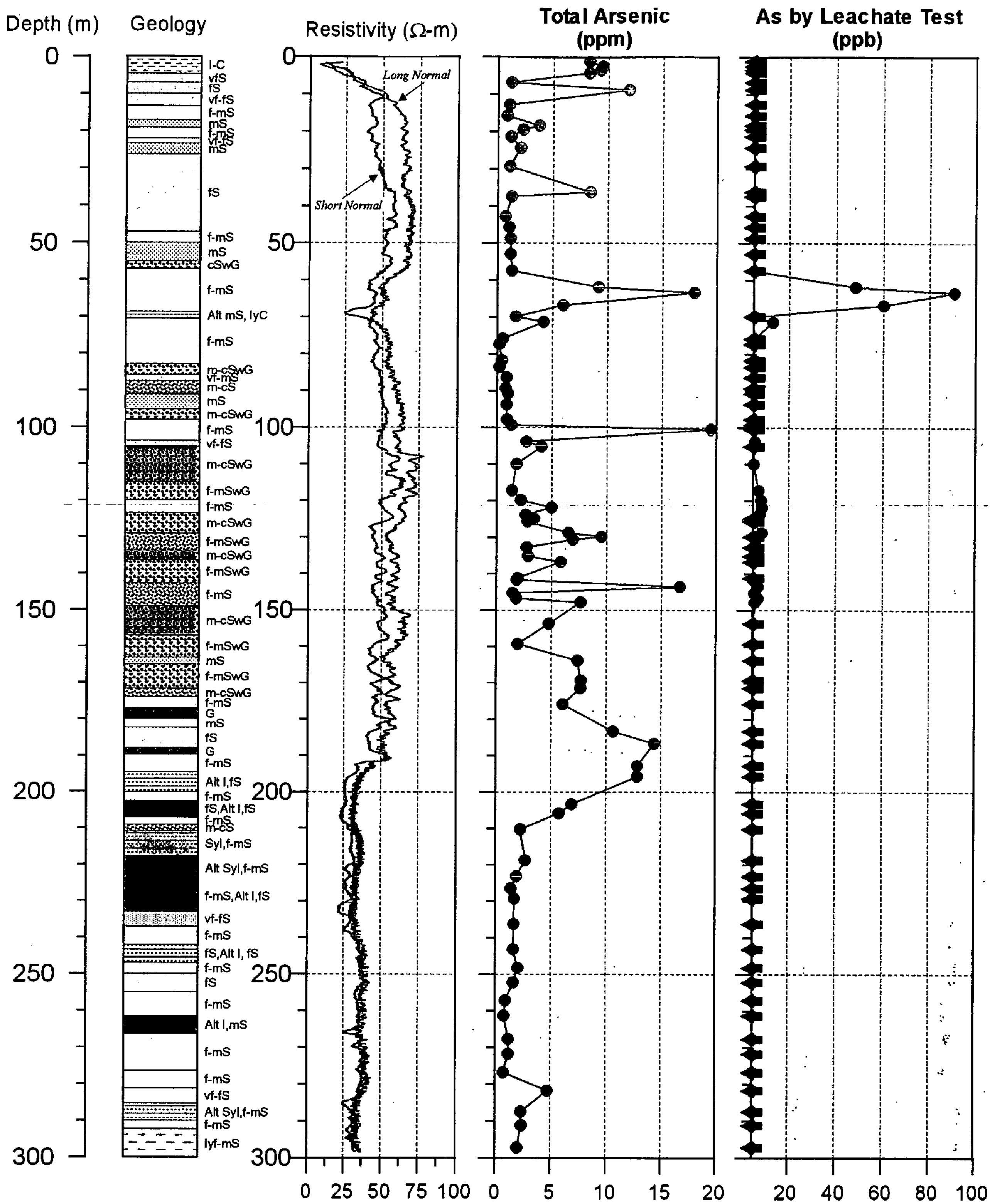

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Figure 5.6.3	**Results of Arsenic Content Test and Leachate Test at JH-1 Site [Arabpur, Jhenaidah Pourashava]**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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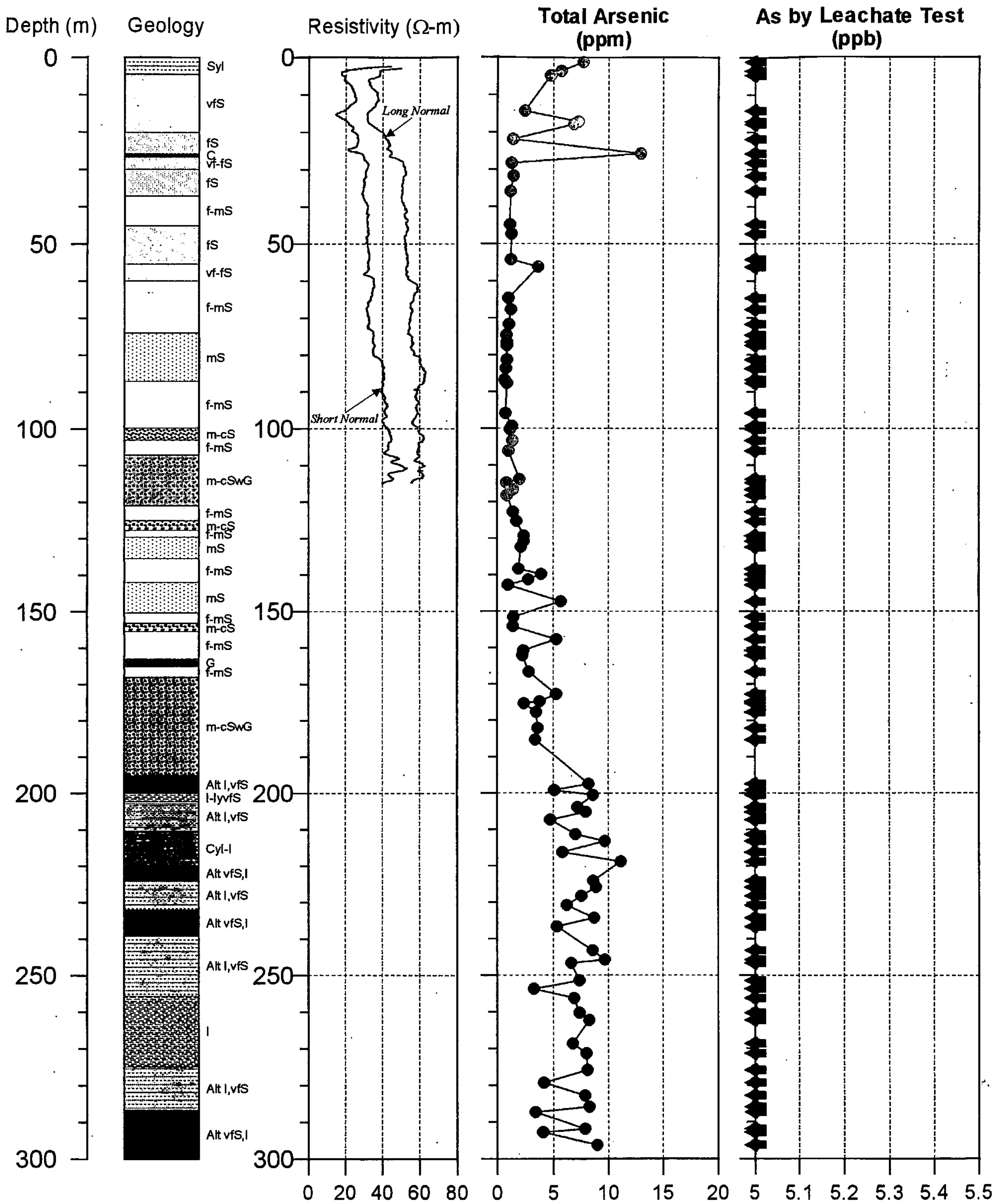

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G: Gravel	w: with
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f: fine	Alt: Alternation
m: medium	P: Peat
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Figure 5.6.4

Results of Arsenic Content Test and Leachate Test at JH-KC Site [Krishna Chandrapur, Moheshpur]

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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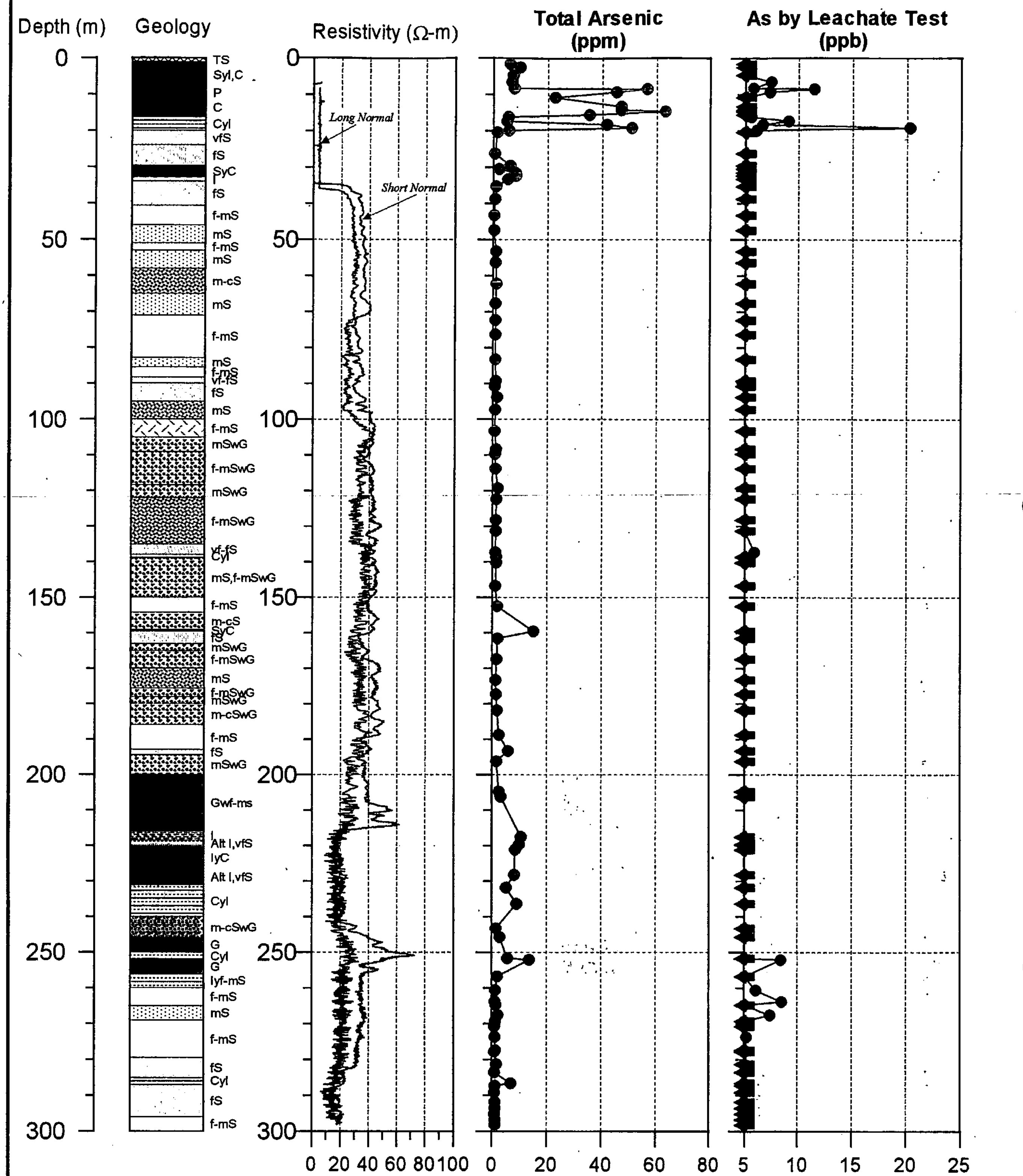

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Figure 5.6.5	**Results of Arsenic Content Test and Leachate Test at JS-2 Site [Kharki, Jessore Pourashava]**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

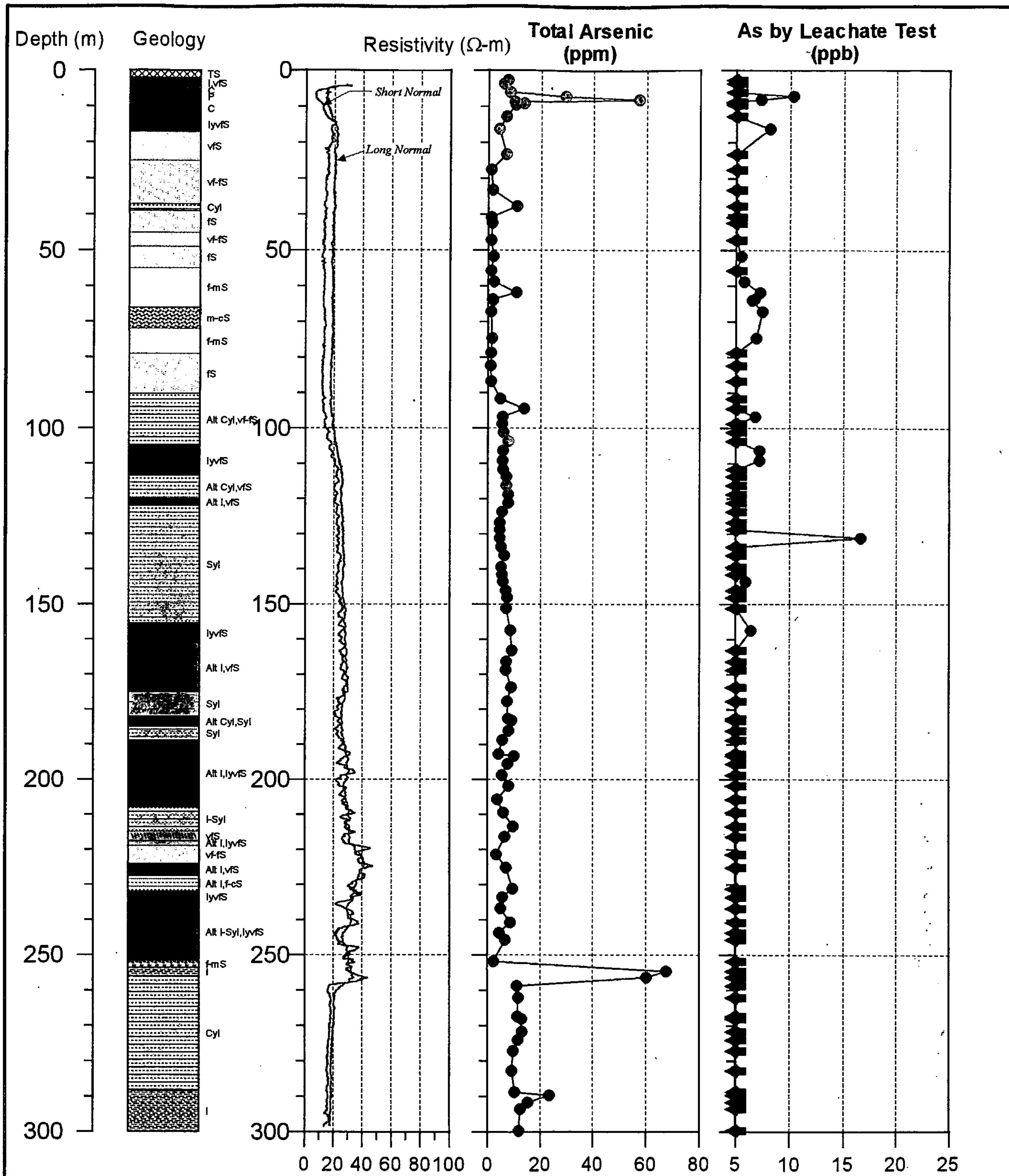

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Figure 5.6.6	**Results of Arsenic Content Test and Leachate Test at JS-RB Site [Rajnagar Bankabarsi, Keshabpur]**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

5.7 Evaluation of Deep Aquifers

5.7.1 Quantitative Evaluation

1) Specific Capacity

Figure 5.7.1 shows the distribution of specific capacity (*Sc*) values by drilling site. Ch-1 well in Chuadanga Pourashava has the greatest value of 257.1 m^2/day. The second greatest value was found at Js-1 well in Jessore Pourashava, having 85.4 m^2/day. On the other hand, the smallest *Sc* value of 2.5 m^2/day was found at Jh-1 well, while the second smallest value of 6.5 m^2/day was also found in Jhenaidah Pourashava at Jh-2 well. The *Sc* values of Ch-2 well and Js-2 well show 10.5 and 9.1 m^2/day, respectively.

The aquifer productivity of deep aquifers below 200 m in depth in the Study Area is smaller than that of the main aquifer used by the existing Pourashava production wells in terms of specific capacity.

2) Transmissivity

Figure 5.7.2 shows the vertical distribution of *T* values by district. In Chuadanga, the *T* values in the shallow aquifers within 162 m in depth range from 300 to 830 m^2/day. In the deep aquifer, Ch-1 well has a very high value of *T* about 16,000 m^2/day. However, the *T* values in Ch-2 well and Ch-2-4 hole shows 80 to 740 m^2/day.

In Jhenaidah District, the 100 m depth zone has higher values of *T* ranging from 2,000 to 3,400 m^2/day. The 150 m zone also shows higher values ranging from 400 to 1,850 m^2/day. The shallowest holes in the 50 m zone show 115 to 290 m^2/day. However, Jh-1and Jh-2 observation wells have very small *T* values below 2 m^2/day. The productivity of the deep aquifer in terms of transmissivity is smaller than that of shallow aquifers.

In Jessore District, the *T* values in the 150 m zone show smaller values, ranging from 2 to 300 m^2/day. The *T* values of the 50 and 100 m zones show 200 to 3,500 m^2/day. In the deep wells/holes, the rest mainly shows *T* values ranging from 30 to 80 m^2/day except Js-2 well.

The transmissivity value in the deep aquifer is generally smaller than that of shallow aquifers. However, the *T* values vary widely by place and by well/hole. The *T* values at Ch-1 well and Js-1 well indicate that the aquifer productivity is enough to supply water for a piped water system. However, the *T* values in Jhenaidah Pourashava are too small.

5.7.2 Qualitative Evaluation

1) As Concentration and Groundwater Quality

a. CH-1 Site [Poshu Hat, Chuadanga Pourashava]

Figure 5.7.3 shows the vertical distribution of arsenic concentration and groundwater quality by stiff diagram at CH-1 site. At the site, the arsenic concentrations generally ranged from 0.03 to

0.06 mg/l in holes Ch-1-1 to Ch-1-3 for the period from February to October 2001. However, the As concentrations in the deep groundwater measured in Ch-1 well and Ch-1-4 hole ranged from 0.002 to 0.04 mg/l, showing lower concentrations than the shallow aquifers.

The stiff diagrams show that the sizes of the diagrams from holes Ch-1-1 to Ch-1-4 are comparatively small. On the other hand, the size is larger in the deep groundwater, indicating that the chemical characteristics of the deep groundwater are different from the shallow ones.

Considering the existence of fine sediments such as very fine to fine sand layers at depths from 174 to 212 m, it can be said that the deep aquifer is separated from the shallow aquifers to a certain degree. However, there is no thick clay layer between the shallow aquifers and deep aquifer, it may be possible that groundwater can move vertically when the difference of hydraulic heads between the two aquifers is greater. A trilinear diagram showing the difference of water quality in CH-1 and CH-2 site is presented in Figure 5.7.6 and Figure 5.7.8.

b. JH-1 Site [Arabpur, Jhenaidah Pourashava]

Figure 5.7.4 shows the vertical distribution of arsenic concentration and groundwater quality by stiff diagram at JH-1 site. At the site, As concentrations are higher only in Jh-1-1 hole. The As concentration of holes Jh-1-2 and Jh-1-3 ranges from 0.01 to 0.03 mg/l. In the deep groundwater, the As concentrations also ranged from lower levels from 0.005 to 0.03 mg/l.

The stiff diagram of the Jh-1-1 hole is the smallest. The size of the diagrams of holes Jh-1-2 and Jh-1-3 is slightly larger than that of Jh-1-1 hole. Further, it is clear that the size of the diagrams of Jh-1 well and Jh-1-4 hole is larger than the shallow ones. At the site, it is possible to identify three (3) aquifers from hydrogeological and hydrochemical points of view. The shallow aquifer, which is separated from the underlying middle aquifers by alternating layers of medium sand and silty clay, has groundwater moderately contaminated by arsenic with a smaller-sized stiff diagram. The middle aquifer having less contaminated groundwater with slightly larger-sized stiff diagrams occurs at depths from 80 to 190 m. The deep aquifer, which occurs below the thick alternating layers of sandy silt and fine sand from 190 to 235 m, has groundwater less contaminated by arsenic with larger-sized stiff diagrams.

Although there is no pure and thick clay layer between the shallower aquifers and the deep aquifer, the hydrogeological and hydrochemical conditions suggest that the deep aquifer is separated at the present time from the shallow ones by the finer sediments at depths from 190 to 235 m. A trilinear diagram showing the difference of water quality in JH-1 and JH-2 site is presented in Figure 5.7.8 and Figure 5.7.9.

c. JS-1 Site [Ghop, Jessore Pourashava]

Figure 5.7.5 shows the vertical distribution of arsenic concentrations and groundwater quality by stiff diagram at JS-1 site, Jessore Pourashava. At the site, it is noted that the arsenic concentration in Js-1-2 hole, from which the 100 m zone aquifer is monitored, is the highest among the observation well/holes even though the arsenic levels range from 0.001 to 0.035 mg/l.

The stiff diagrams show that the groundwater quality of shallow aquifers measured in holes Js-1-1 to Js-1-3 shows to be Ca - HCO_3 type, whereas the deep groundwater measured at Js-1 well and Js-1-4 hole shows to be a different type of chemical composition, characterized by (Na+K) - HCO_3 type.

According to the geological columnar section, there are fine-grained layers including very fine sand and sandy silt at depths from 200 to 260 m. It is, therefore, regarded that the deep aquifer is separated from the shallow aquifers by the fine sediments. A trilinear diagram showing the difference of water quality in JH-1 and JH-2 site is presented in Figure 5.7.10 and Figure 5.7.11.

2) Arsenic in Soil and Groundwater

Arsenic in soil and groundwater was compared at three (3) drilling sites in Pourashava areas where core boring and the depth-wise distribution of arsenic monitoring were carried out

a. CH-2 Site [Girls College, Chuadanga Pourashava]

Figure 5.7.12 shows the vertical distribution of the total arsenic content, arsenic by leachate test, and arsenic concentration in groundwater at CH-2 site. The total arsenic contents in the core samples from depths shallower than 200 m are not high (less than 10 ppm). The result of the leachate test also shows the released arsenic by the test was very small in the portion, particularly at depths from 0 to 50 m where the amount was almost below 5 ppb. However, the arsenic concentration at Ch-2-1 hole, which has screen at depths from 44.5 to 53.5 m, shows groundwater highly contaminated by arsenic ranging from 0.12 to 0.23 mg/l. The reason may be that although the source of arsenic does not exist at the drilling point itself, the source must be located near the drilling point at a shallow depth so that the plume of contaminated water has reached the drilling point by advection and dispersion. The decreasing of arsenic concentration in groundwater with depth, which is observed in the holes from Ch-2-1 to Ch-2-3, also suggests that the source of arsenic is located in the shallow portion within 50 m in depth near the drilling site. The vertical distribution of arsenic concentrations in groundwater also indicates the downward movement of contaminated groundwater.

In the deeper portion below 200 m in depth, although the highest total arsenic content of 117.3 ppm was found in a silty clay sample at depths from 207.50 to 207.72 m and the values from 20 to 50 ppm were also found at depths from 210 to 250 m, the arsenic concentrations in groundwater measured in Ch-2 well and Ch-2-4 hole were very small, showing below 0.002 mg/l. To explain the reason of the phenomenon, the following three (3) hypotheses can be proposed:

- The arsenic in the deep soil is not released into groundwater, and remains in the soil.
- Some amount of the arsenic is leached into groundwater, but has not reached the deep aquifer due to the slow groundwater flow velocity.
- The arsenic is released in the groundwater, but the contaminated groundwater moves upward for the depression of piezometric head in the upper aquifers.

At the site, there is no crucial data to identify the reason. Further research and monitoring of groundwater conditions are required.

b. JH-1 Site [Arabpur, Jhenaidah Pourashava]

Figure 5.7.13 shows the vertical distribution of total arsenic content, arsenic by leachate test, and arsenic concentration in groundwater at JH-1 site. Since the total arsenic contents in the samples from 0 to 300 m in depth are below 20 ppm, a clear source of arsenic cannot be identified from the profile. However, the groundwater in Jh-1-1 hole, which has screen at depths from 48 to 57 m, has slightly elevated arsenic concentrations ranging from 0.043 to 0.055 mg/l. The slightly high arsenic groundwater was also found in the deep aquifer. It ranges from 0.01 to 0.03 mg/l at Jh-1-3 and Jh-1-4.

This might be related to the traveling time and flow path of deep groundwater as well as the mechanism of arsenic contamination in deep layers.

c. JS-2 Site [Kharki, Jessore Pourashava]

Figure 5.7.14 shows the vertical distribution of total arsenic content. At the site, the source of arsenic contamination is the shallow clayey sediments particularly peat, which has an arsenic content of 40 to 65 ppm. Below 20 m in depth, there is no arsenic source up to 300 m. However, the highest As concentrations ranging from 0.05 to 0.1 mg/l were found from Js-2-2 hole, which has screen pipes at a depth from 99 to 111 m. On the other hand, the groundwater in Js-1-1 hole, in which screen is located about 30 m below the peaty layers, does not show arsenic contamination in groundwater.

It is thought that the arsenic found in the groundwater of Js-1-2 hole is not derived straight from the shallow peaty layers by the vertical movement of groundwater, because the As concentration in Js-1-1 hole is clearly lower than that in Js-1-2. A possibility is that the plume of contaminated water reached the screen portion of Js-1-2 hole from the shallow portion of another area.

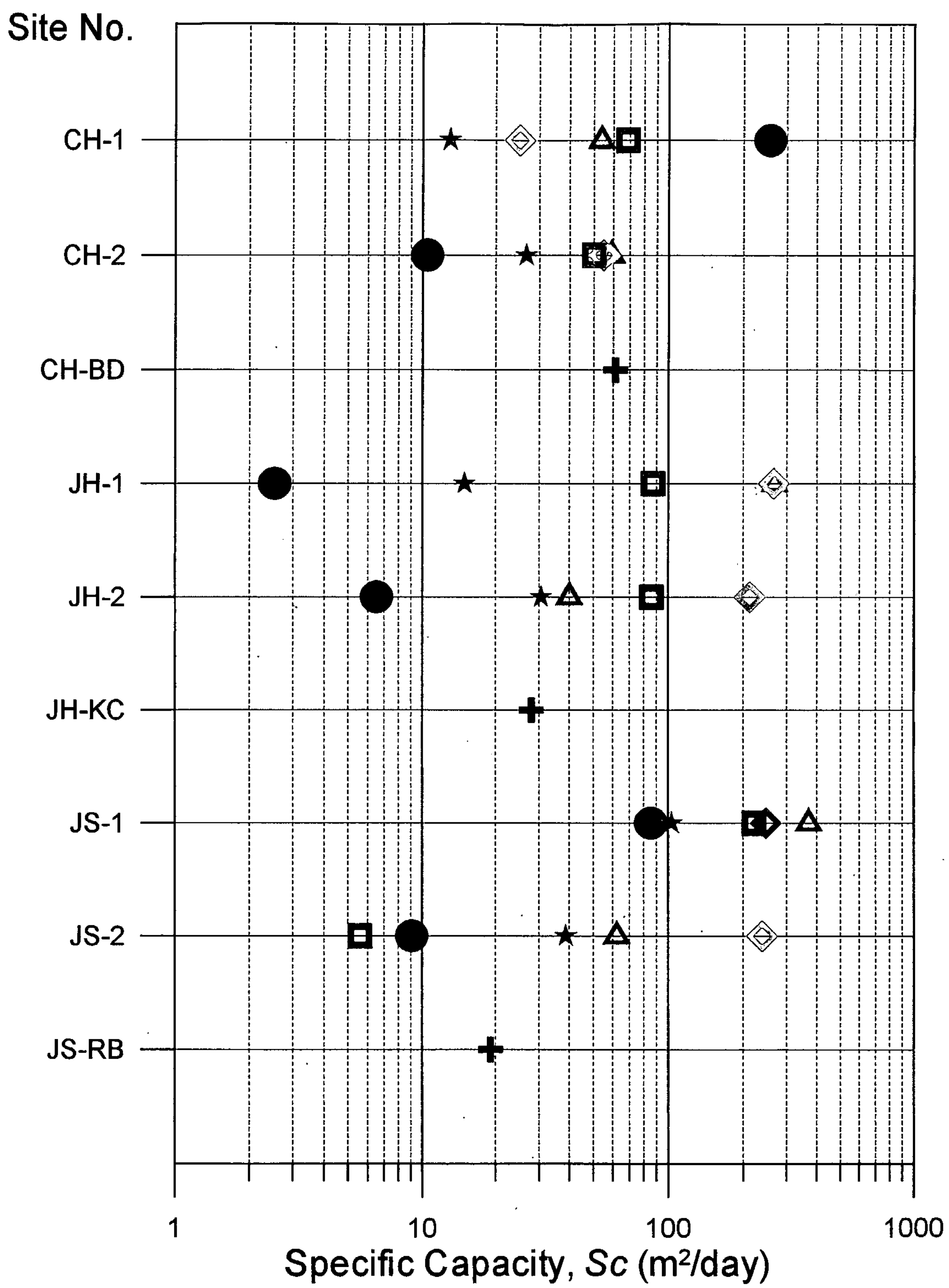
In the deep aquifers below 240 m in depth, there is no source of arsenic contamination. It is, therefore, evaluated that the deep aquifer at the site has no potential of future arsenic contamination by the arsenic originating from the deep layers.

3) Potential of Arsenic Contamination in Deep Aquifer

From the investigation results mentioned above, it can be said that there are two (2) possibilities to contaminate the groundwater of deep aquifers. One is that the seepage or leakage from shallow contaminated water reaches the deep aquifers. The possibility of such contamination originating from the shallow portion is high if there is no significant aquitard or aquiclude between the two aquifers. If the shallow aquifer and the deep aquifer are directly connected, the shallow groundwater can move downward easily when the piezometric head in the deep aquifer is lower than that of shallow aquifer.

Another possibility is that the deep aquifer is contaminated by the arsenic occurring in the deep layers. From the results of core sample analysis, CH-2 and CH-BD sites in Chuadanga District and JS-RB site in Jessore District have potential of such contamination. However, so far no significant arsenic contamination in groundwater has been detected. Although the potential of deep contamination exists at the sites, the possibility of deep contamination from the arsenic in the deep layers cannot be evaluated at present moment.

To evaluate the deep contamination, it is necessary to carry out further monitoring and detailed research on the deep groundwater conditions as well as the nature and environment of deep aquifers including the detailed form and occurrence of arsenic in the deep layers.



LEGEND

- Production Well (Dep.=300m)
- Obs. Hole (Dep.=50m)
- Obs. Hole (Dep.=100m)
- Obs. Hole (Dep.=150m)
- Obs. Hole (Dep.=300m)
- Obs. Hole (CB, Dep.=300m)

Figure 5.7.1 **Distribution of Specific Capacity at JICA Drilling Sites**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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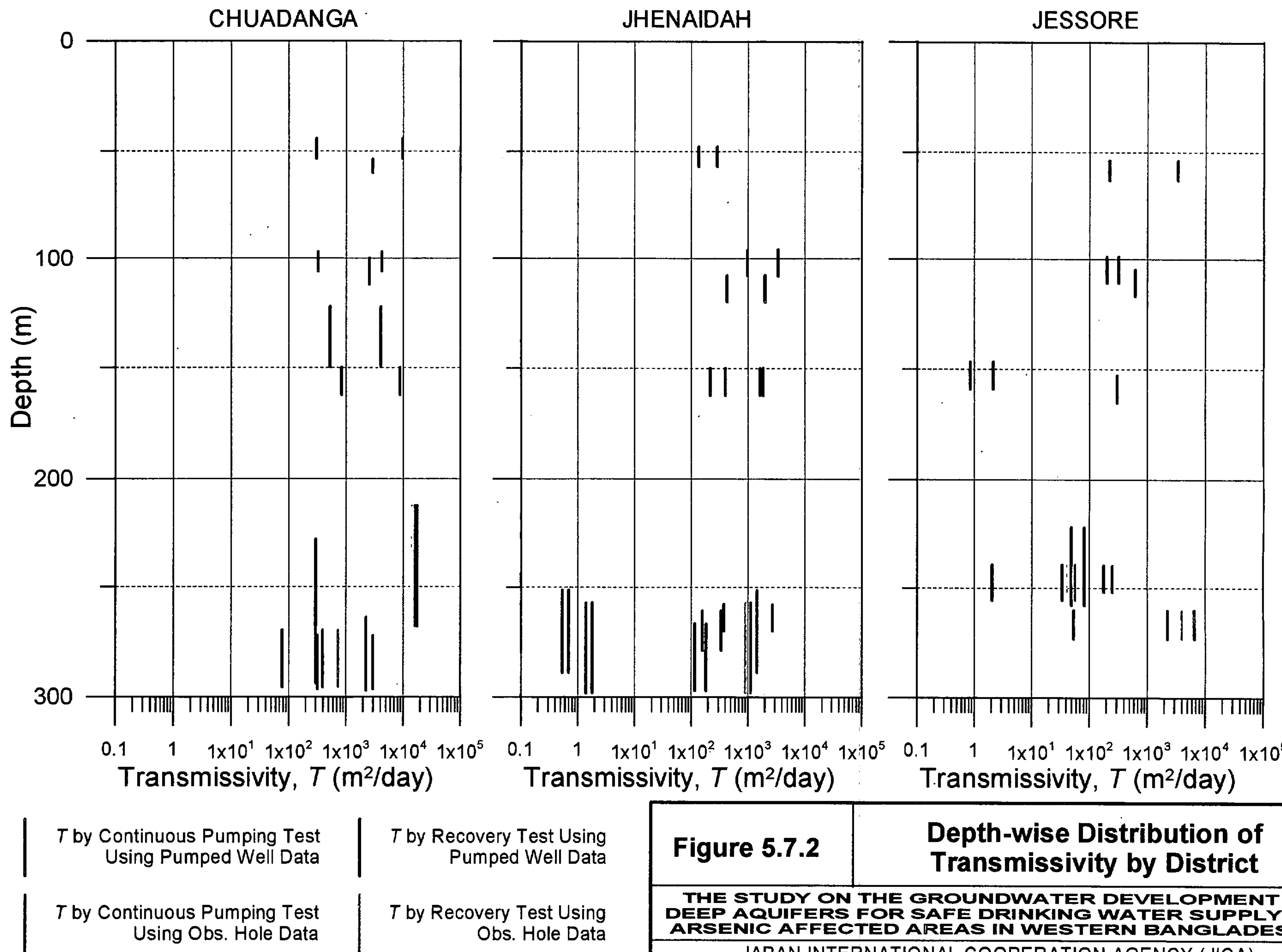

Figure 5.7.2	Depth-wise Distribution of Transmissivity by District

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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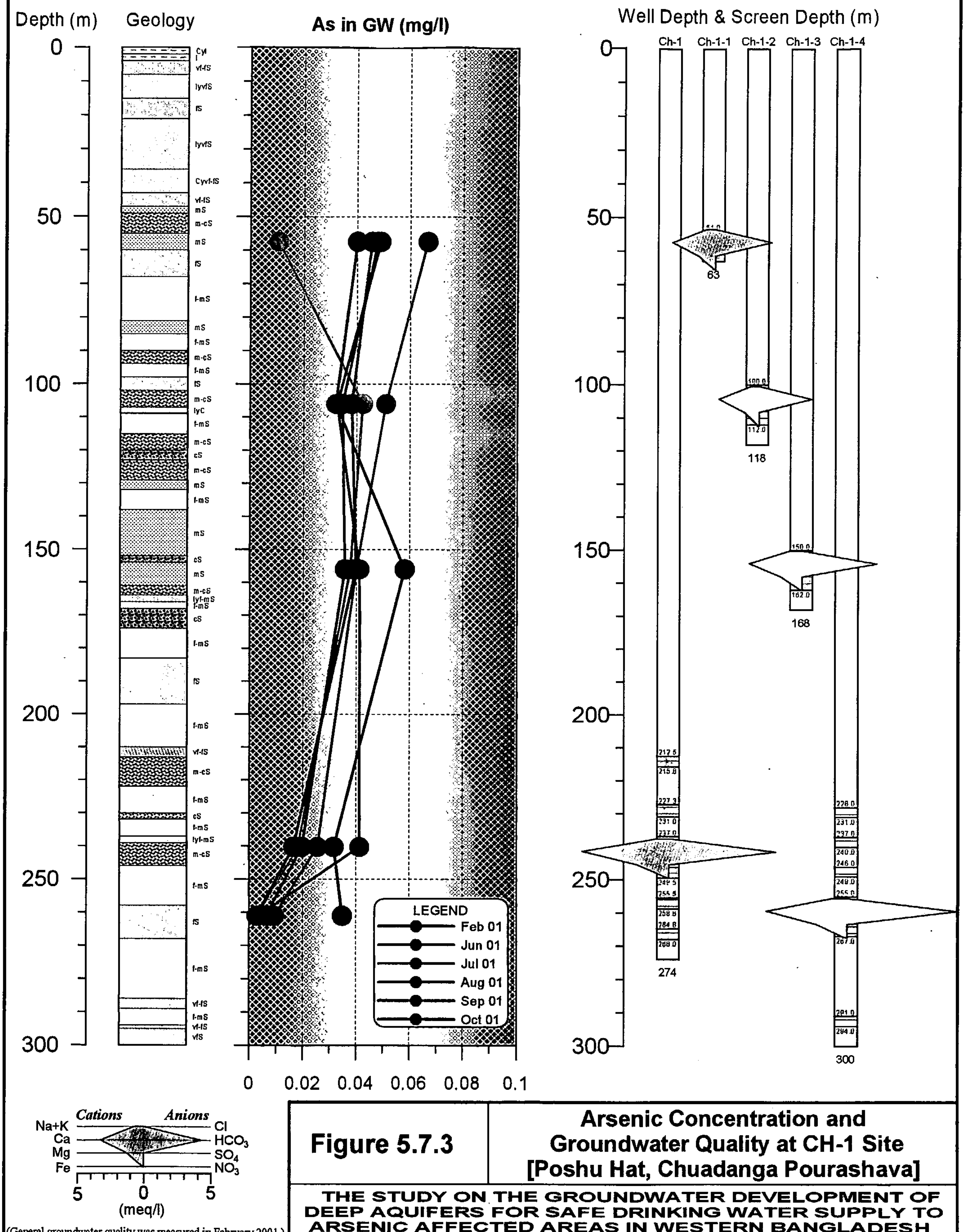

(General groundwater quality was measured in February 2001.)

Figure 5.7.3	Arsenic Concentration and Groundwater Quality at CH-1 Site [Poshu Hat, Chuadanga Pourashava]

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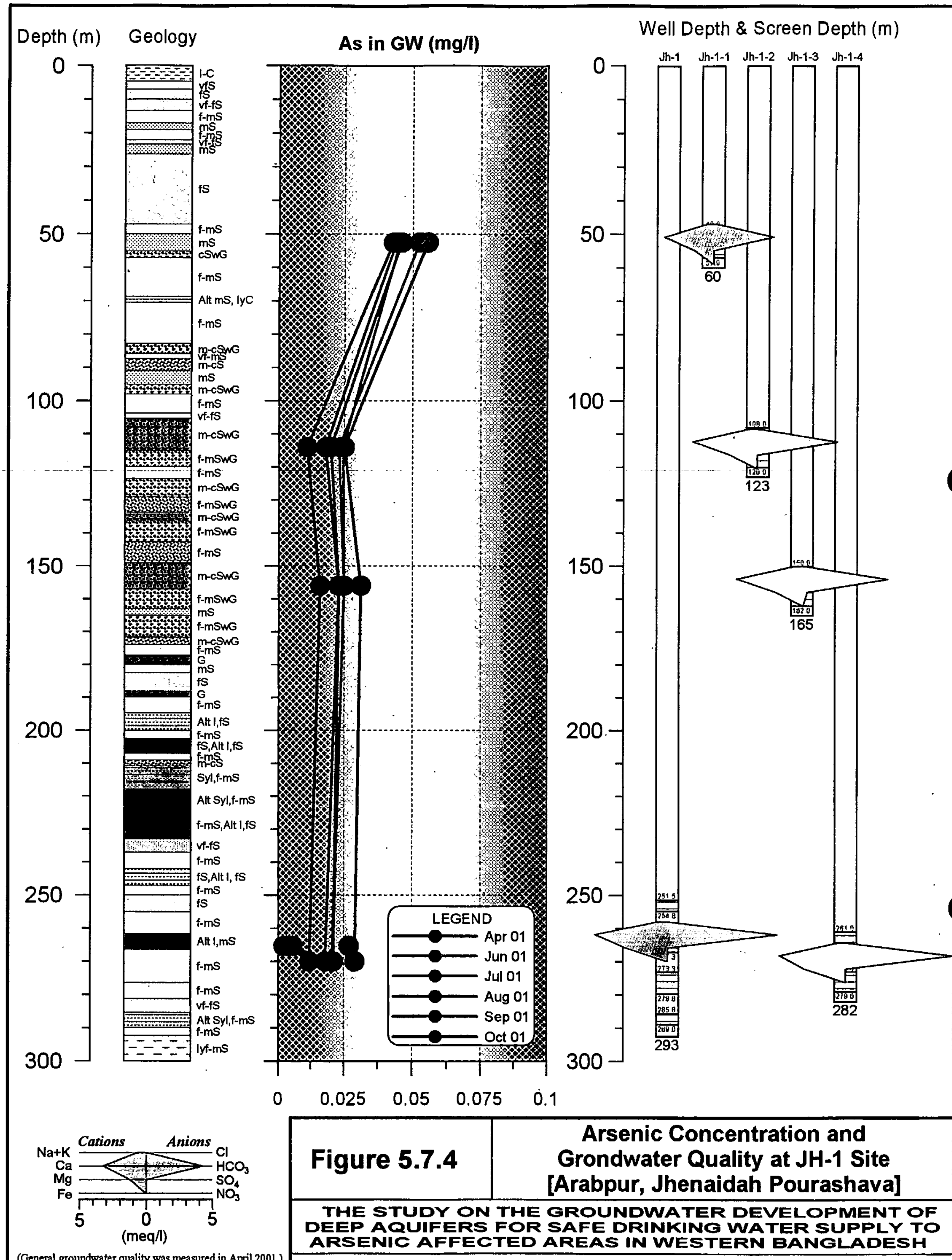

Figure 5.7.4	Arsenic Concentration and Grondwater Quality at JH-1 Site [Arabpur, Jhenaidah Pourashava]

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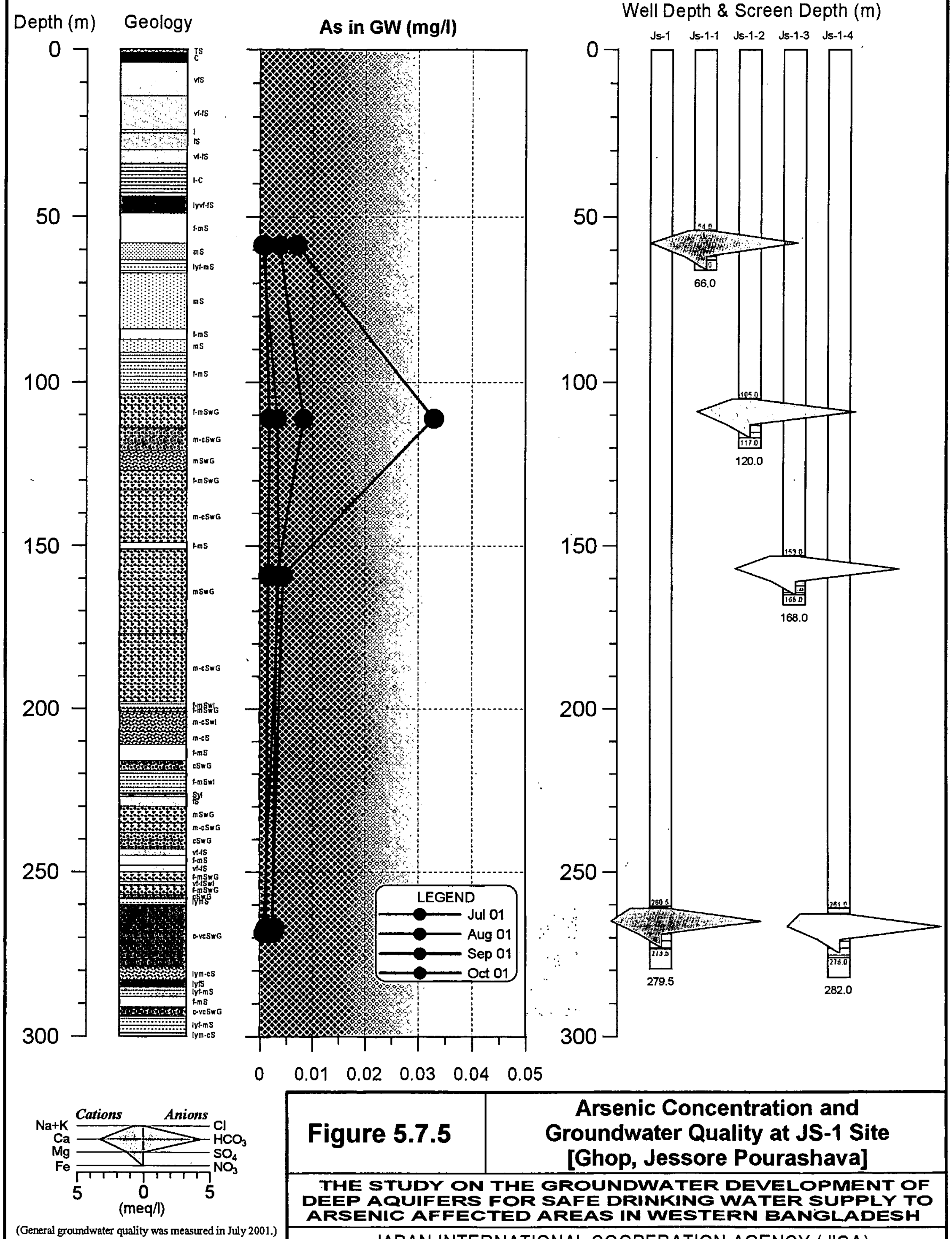

(General groundwater quality was measured in July 2001.)

Figure 5.7.5	Arsenic Concentration and Groundwater Quality at JS-1 Site [Ghop, Jessore Pourashava]

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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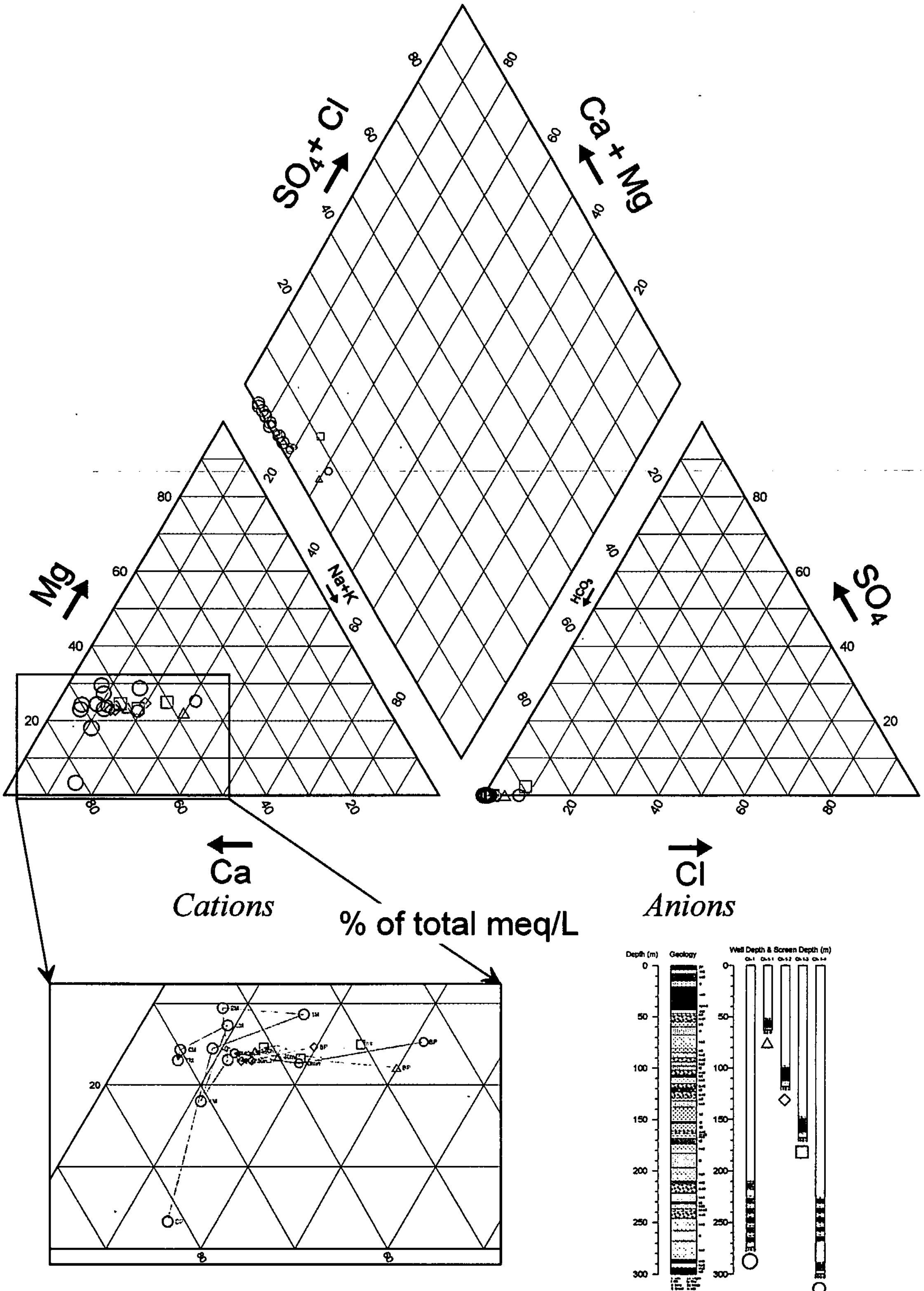

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48h: 48 hrs after Pumping Started
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2M: Apr. 2001
3M: Jun. 2001
4M: Jul. 2001
5M: Aug. 2001
6M: Sep. 2001
7M: Oct. 2001

Figure 5.7.6 — **Trilinear Diagram of Groundwater at CH-1 Site, Chuadanga**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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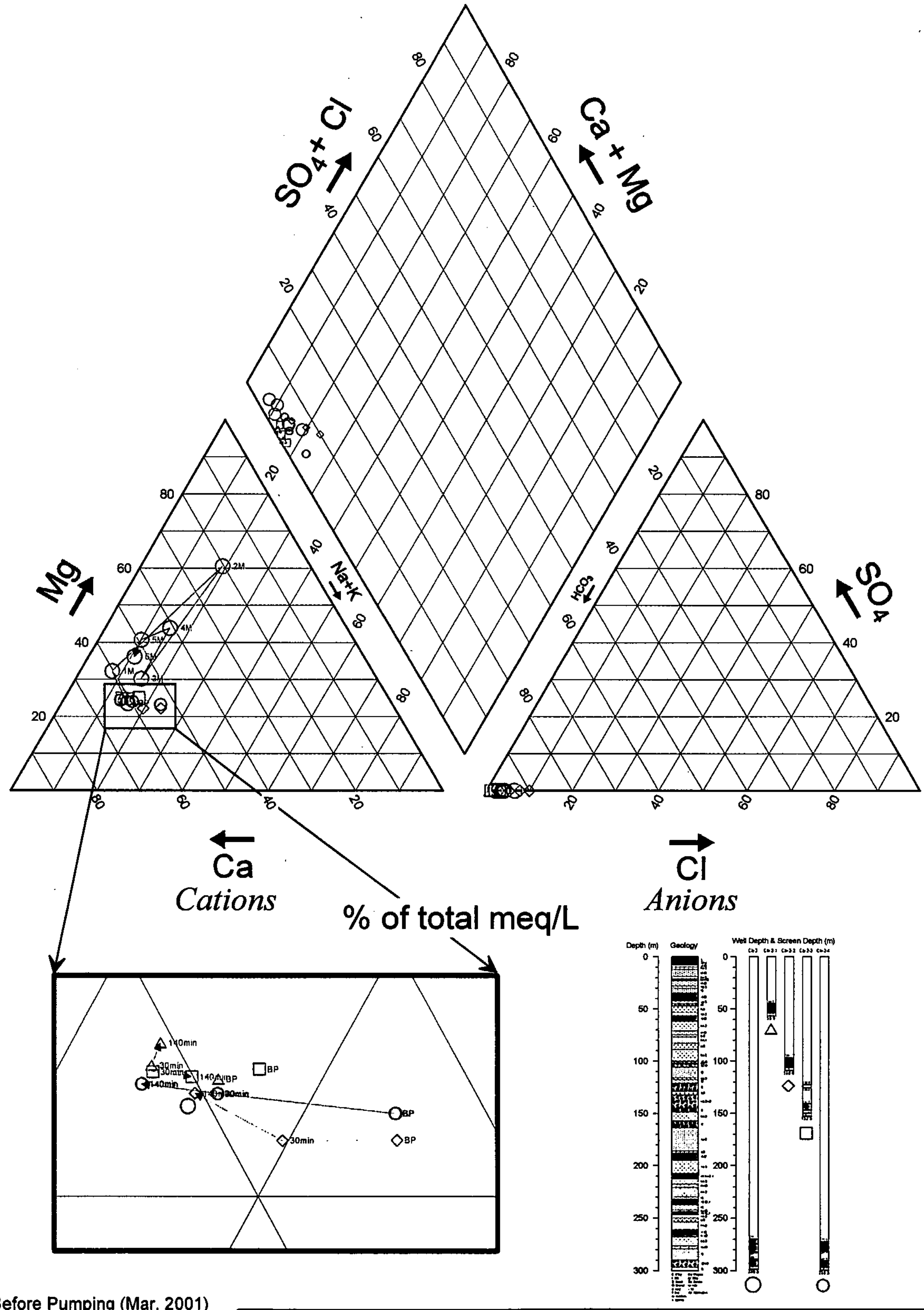

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2M: Jun. 2001
3M: Jul. 2001
4M: Aug. 2001
5M: Sep. 2001
6M: Oct. 2001

Figure 5.7.7	Trilinear Diagram of Groundwater at CH-2 Site, Chuadanga
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
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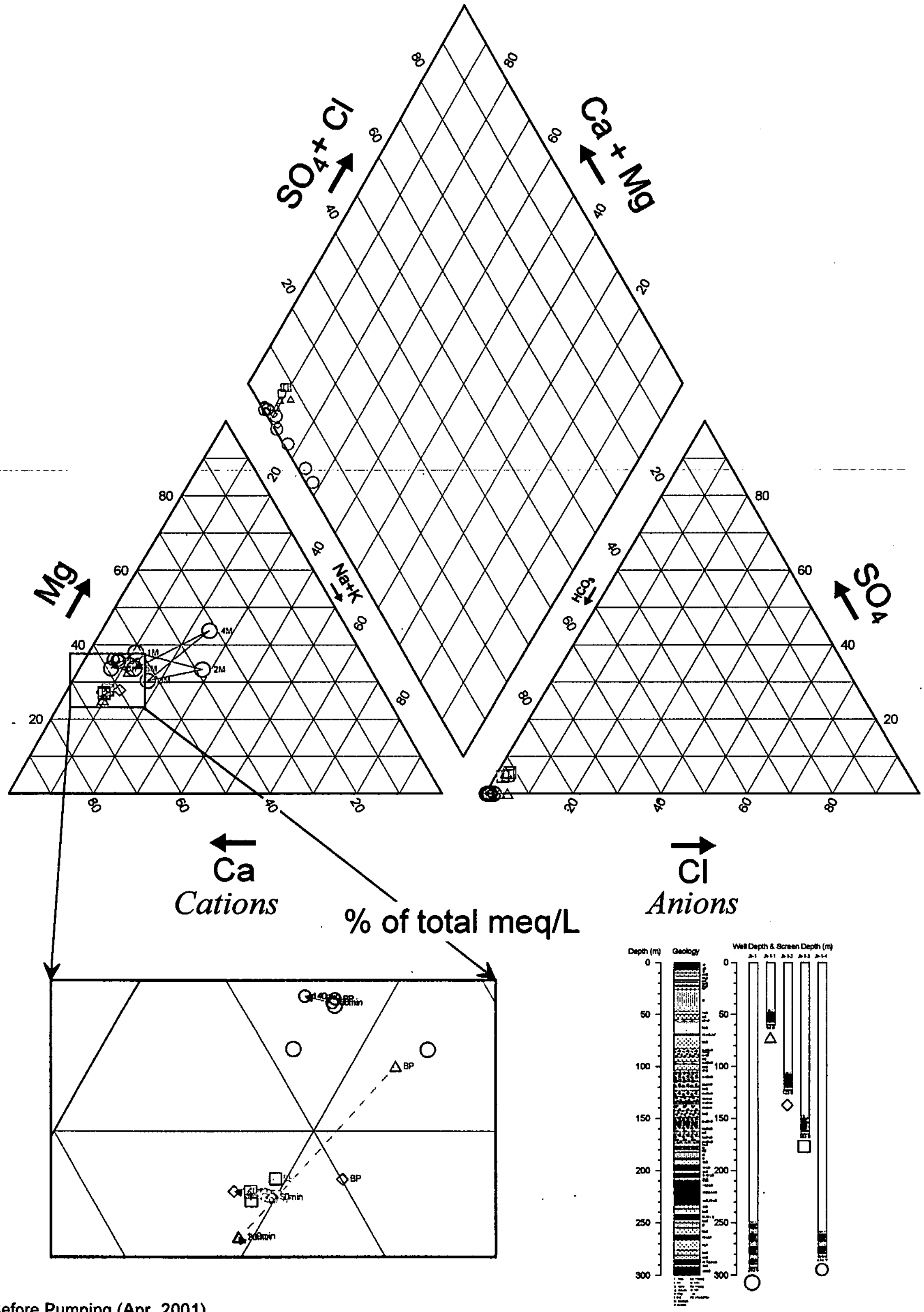

BP: Before Pumping (Apr. 2001)
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1M: Jun. 2001
2M: Jul. 2001
3M: Aug. 2001
4M: Sep. 2001
5M: Oct. 2001

Figure 5.7.8	**Trilinear Diagram of Groundwater at JH-1 Site, Jhenaidah**
THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH	
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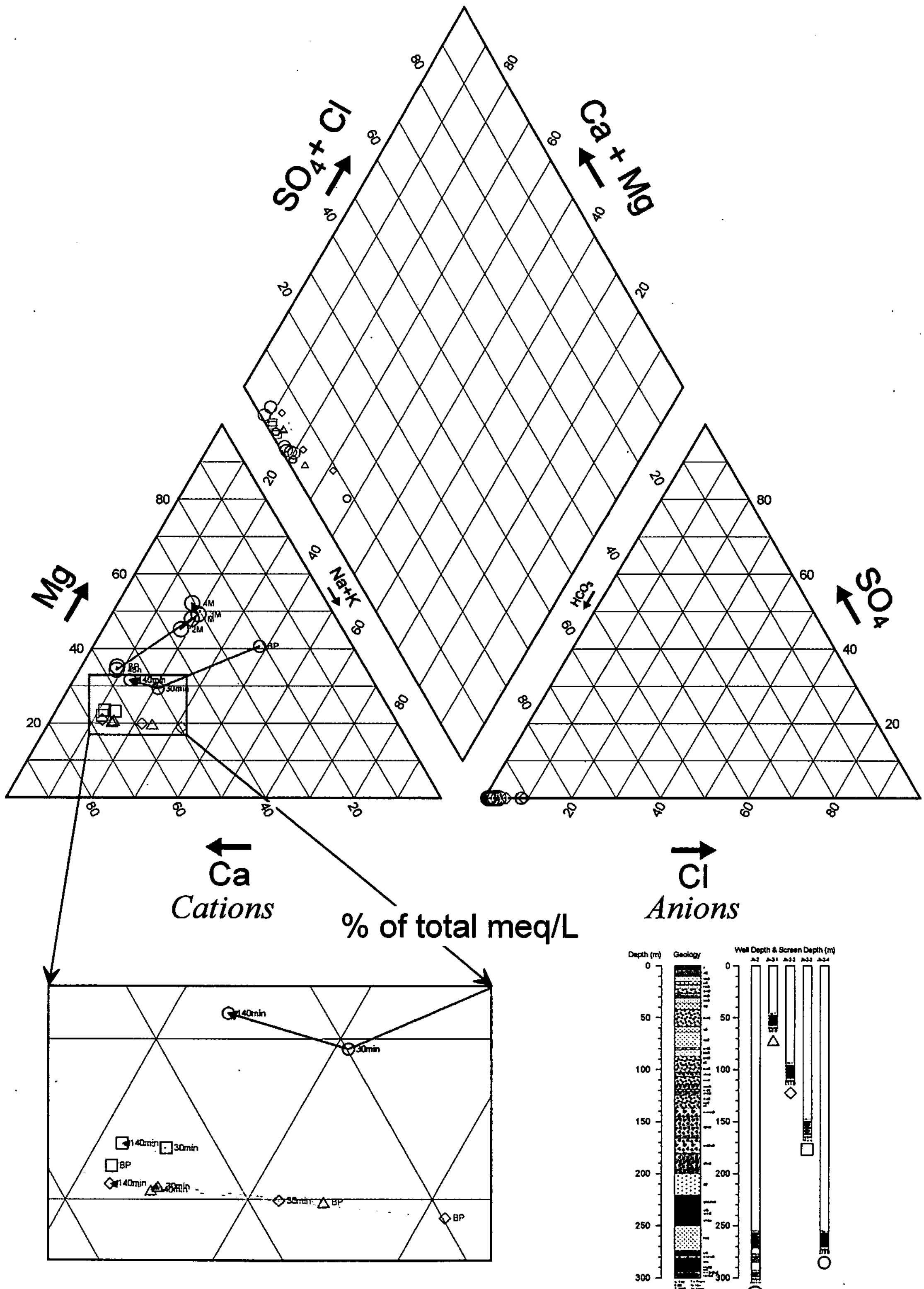

BP: Before Pumping (Jun. 2001)
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140min: 140min after Pumping Started
48h 48hrs after Pumping Started
1M: Jul. 2001
2M: Aug. 2001
3M: Sep. 2001
4M: Oct. 2001

Figure 5.7.9 **Trilinear Diagram of Groundwater at JH-2 Site, Jhenaidah**

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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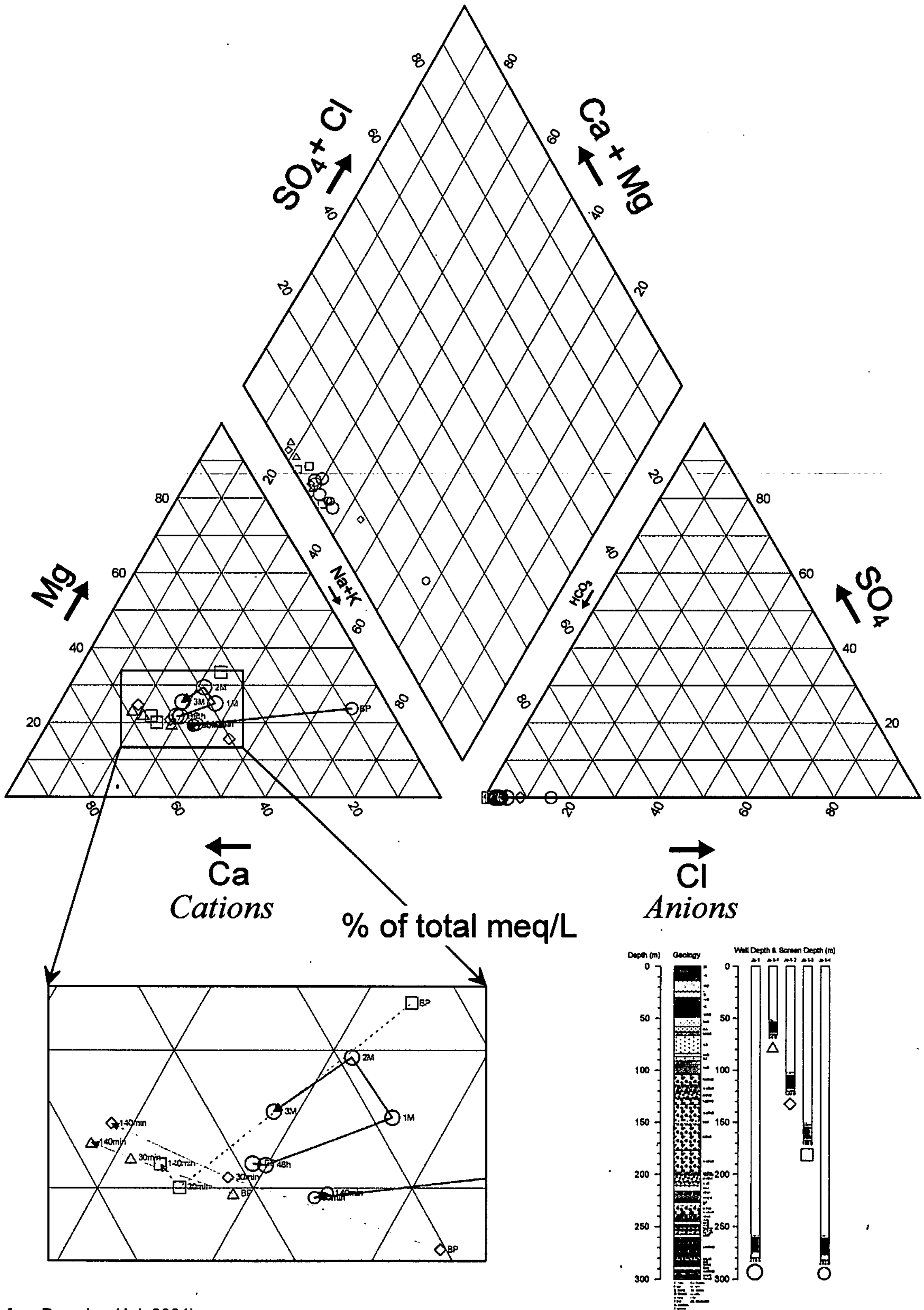

BP: Before Pumping (Jul. 2001)
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140min: 140min after Pumping Started
48h 48hrs after Pumping Started
1M: Aug. 2001
2M: Sep. 2001
3M: Oct. 2001

Figure 5.7.10	Trilinear Diagram of Groundwater at JS-1 Site, Jessore

THE STUDY ON THE GROUNDWATER DEVELOPMENT OF DEEP AQUIFERS FOR SAFE DRINKING WATER SUPPLY TO ARSENIC AFFECTED AREAS IN WESTERN BANGLADESH

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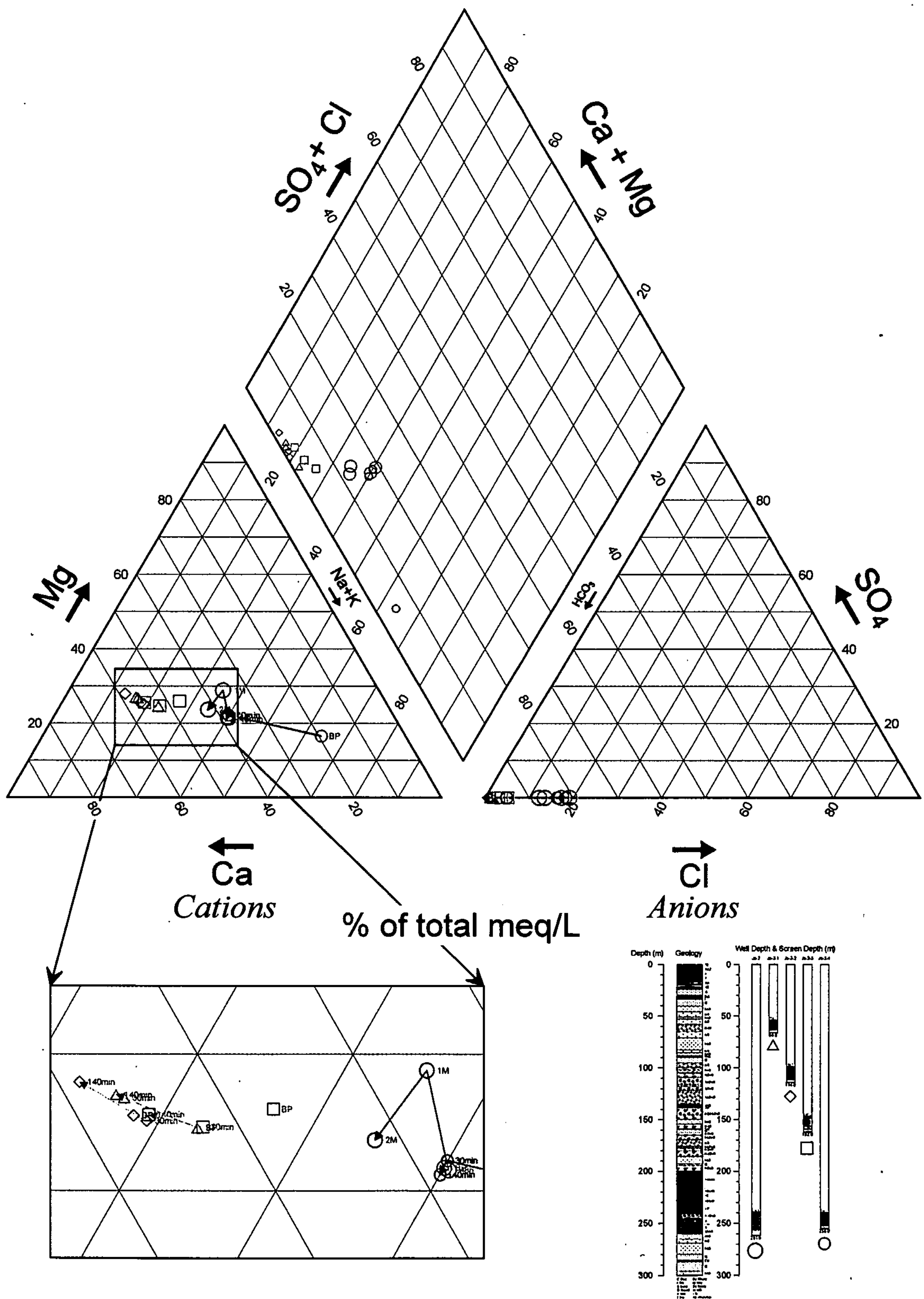

BP: Before Pumping (Aug. 2001)
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140min: 140min after Pumping Started
48h 48hrs after Pumping Started
1M: Sep. 2001
2M: Oct. 2001

Figure 5.7.11	Trilinear Diagram of Groundwater at JS-2 Site, Jessore

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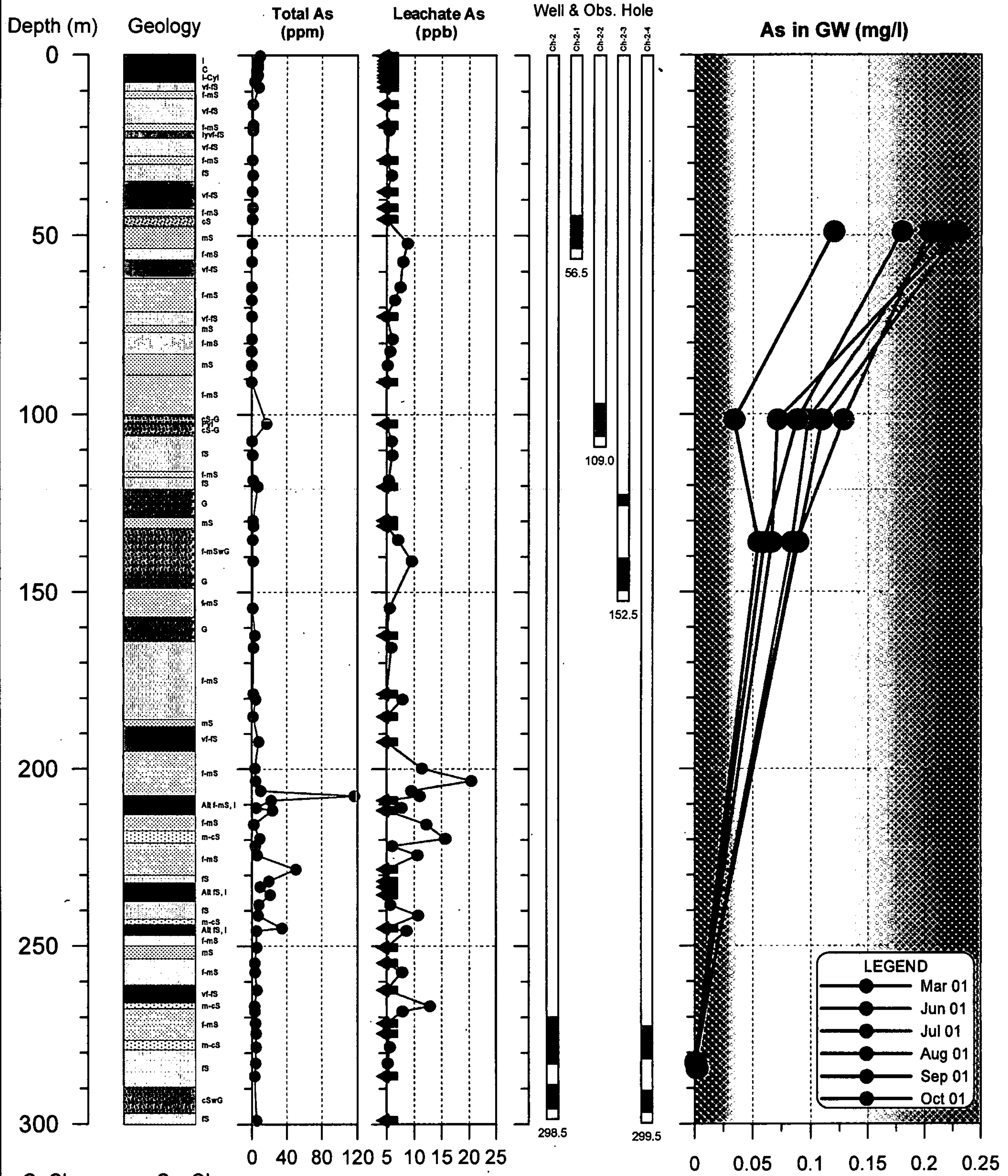

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TS: Top Soil

Figure 5.7.12	Arsenic in Soil and Groundwater at CH-2 Site [Girls College, Chuadanga Pourashava]

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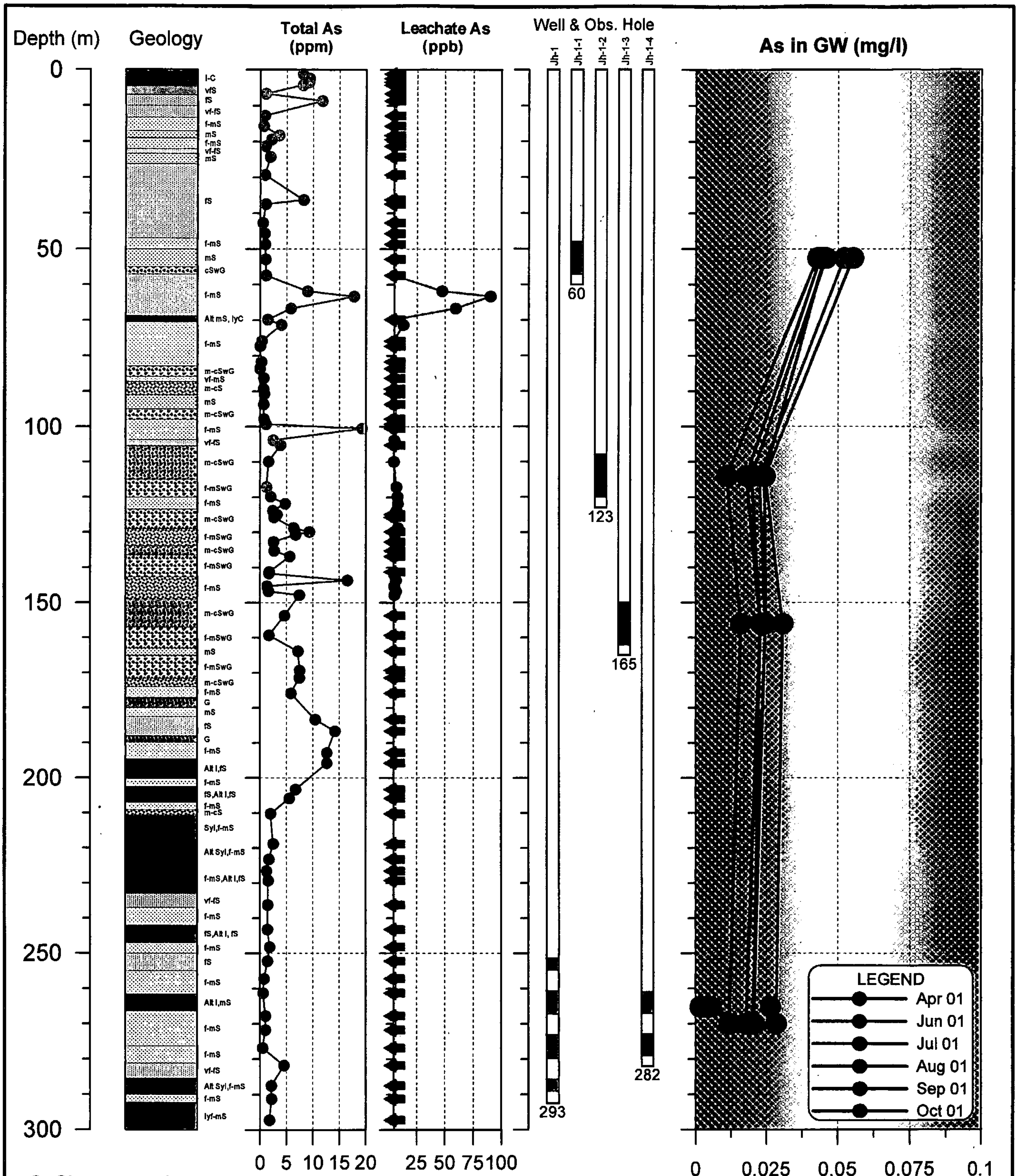

C: Clay
I: Silt
S: Sand
G: Gravel
v: very
f: fine
m: medium
c: coarse

Cy: Clayey
ly: Silty
Sy: Sandy
w: with
-: to
Alt: Alternation
P: Peat
TS: Top Soil

Figure 5.7.13 **Arsenic in Soil and Groundwater at JH-1 Site [Arabpur, Jhenaidah Pourashava]**

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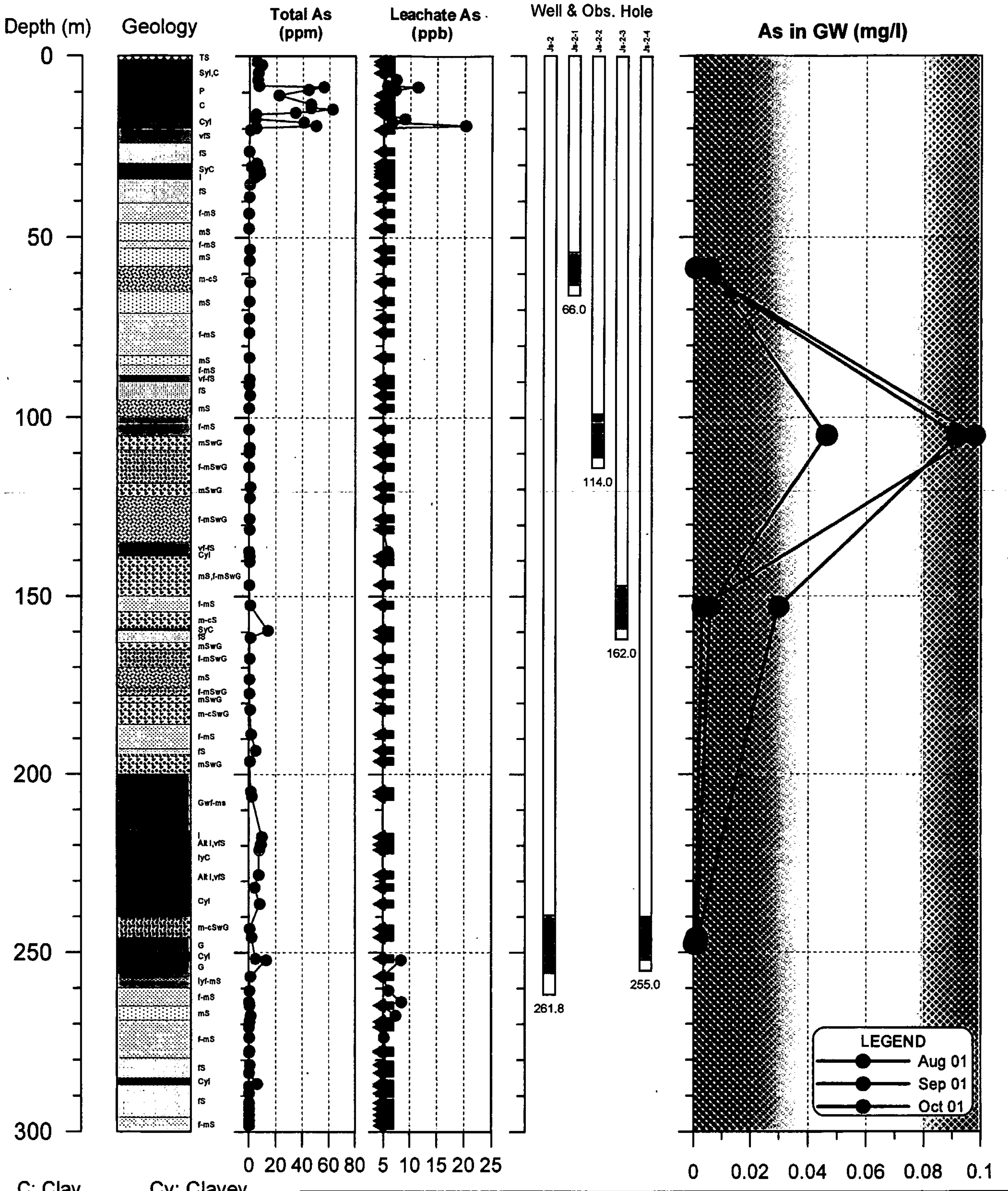

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Figure 5.7.14 **Arsenic in Soil and Groundwater at JS-2 Site [Kharki, Jessore Pourashava]**

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5.8 Regional Hydrogeologic Structures

5.8.1 Geological Profiles

A total of 7 geological profiles in N-S and W-E directions were prepared. For identifying the geologic units at each existing drilling record, the geologic descriptions and drilling records were carefully examined one by one comparing them with the neighboring existing well records and the resistivity profiles nearby. Transient electromagnetic measurement (TEM) and electric prospecting using the Schlumberger electrode configuration were used for the geophysical survey. The TEM measurements were carried out at 200 points in the study area. The TEM results clearly show the occurrence of subsurface resistivity layers up to a depth of 400m. The high resistivity layer, which corresponds to Second Aquifer (= Middle Aquifer) can be traced widely in most parts of the study area at depths from 100 to 200m. However, the high resistivity layer cannot be found in the southern part of the study area because C formation mainly consists of clayey layers.

The geological profiles along A - A' line to B - B' line are presented in Figures 5.8.1 to 5.8.2. The layer of these formations has a general tendency to become coarser toward the north. A, B and E formations lie flatly in the Study Area. C and D formations are slightly dipping toward the southeast in the Study Area. E formation lies flatly in the Study Area. The upper part of E formation is unconformably overlain by D formation with angular unconformity.

D formation declines from the northwestern area (Chuadanga thana) toward the southeastern area (Abhaynagar thana). The depths to the bottom of the formation widely vary from about GL-190 to 300 m+.

C formation is learning from the northwestern area (Chuadanga thana) toward the southeastern area (Abhaynagar thana) like D formation. The depths to the bottom are widely distributed from about GL-160 to 270 m+.

The base of B formation shows to be comparatively flat in the Study Area. The depths to the bottom are deep in the northeastern area (Sailkupa thana) while the depths are shallow in the southern area (Kesahbpur thana).

The thickness of A formation varies from 25 to 50 m. The bottom of A formation is not flat. The depths to the bottom tend to decrease (GL-25 m) in the northwestern area (Sailkupa thana), and to increase (about GL-50 m) in the southern area (Kesahbpur thana).

1) Geological Profile along A – A' Line (Figure 5.8.2)

The profile line is located in the western part of the Study Area from north to south. Along the profile line, there are three (3) core boring sites. The boundaries of geologic formations decline toward the south. The grain size of the sediments generally becomes smaller in the southern part. In C formation, several thick gravelly layers occur in Chuadanga and Jhenaidah Districts, but the layers disappear in the area between Moheshpur in Jhenaidah District and Chougacha in

Jessore District. From Jhikargacha in Jessore, thick clayey layers occur in C formation, but that cannot be seen well in Sharsha.

2) Geological Profile along B – B' Line (Figure 5.8.3)

The profile line is located in the eastern part of the Study Area from north to south. Along the profile line, there are three (3) core boring sites. The boundaries between E and D formations and D and C formation decline toward the south; however, the depths of the other formation boundaries vary from place to place. It can be seen from the profile that a thick gravel layer occurs in C formation from Chuadanga District to the south of Jessore town through Jhenaidah District. However, the gravel layer is not distributed in Moniranpur in Jessore District. Instead, a clayey layer occurs in C formation from south of Jessore town to Keshabpur. The thickness of the clayey layer suddenly increases from Moniranpur to Keshabpur. The clayey layer becomes about 100 m thick in the southern part of Keshabpur Upazila.

5.8.2 Isopach Map of Clayey Layers

From the geological profiles in the Study Area, it is understood that the distribution and thickness of clayey layers in C formation are very important to control groundwater flow in the Study Area. It clearly divides the shallow aquifer and the deep aquifer. And the concentration of arsenic and other groundwater quality are also different above the clayey layers and below the clayey layers. The arsenic concentration and groundwater quality in the deep aquifer overlain by the clayey layers clearly shows much better conditions than those in the shallow aquifer.

Figure 5.8.4 shows the isopach map of the clayey layers in C formation, indicating the thickness and area of distribution of the clay. The isopach map was prepared based on the results of core boring and drilling of observation wells/holes, results of the geophysical prospecting by TEM method, and data of existing well records. The clayey layers are distributed in the southern to western part of Jessore District. The clay is not distributed in Jhenaidah and Chuadanga Districts. In Jessore District, clayey layers more than 80 m thick are found in Keshabpur and Jhilkargacha. In Abhaynagar, the thickness increased to more than 80 m in the southeastern part toward Khulna. The areas having more than 50 m in thickness are distributed in all of Keshabpur, the central to southeastern part of Abhaynagar, central to southern Monirampur, central to northern Jhikargacha, and the northeastern part of Sharsha. On the other hand, the clayey layers are not distributed in the western part of Sharsha upazila, northern Jessore Sadar Upazila, and northwestern Bagarpara Upazila.

The isopach map will provide very important information on the hydrogeological characteristics of the Study Area as well as the strategy of deep groundwater development for a safe drinking water supply.

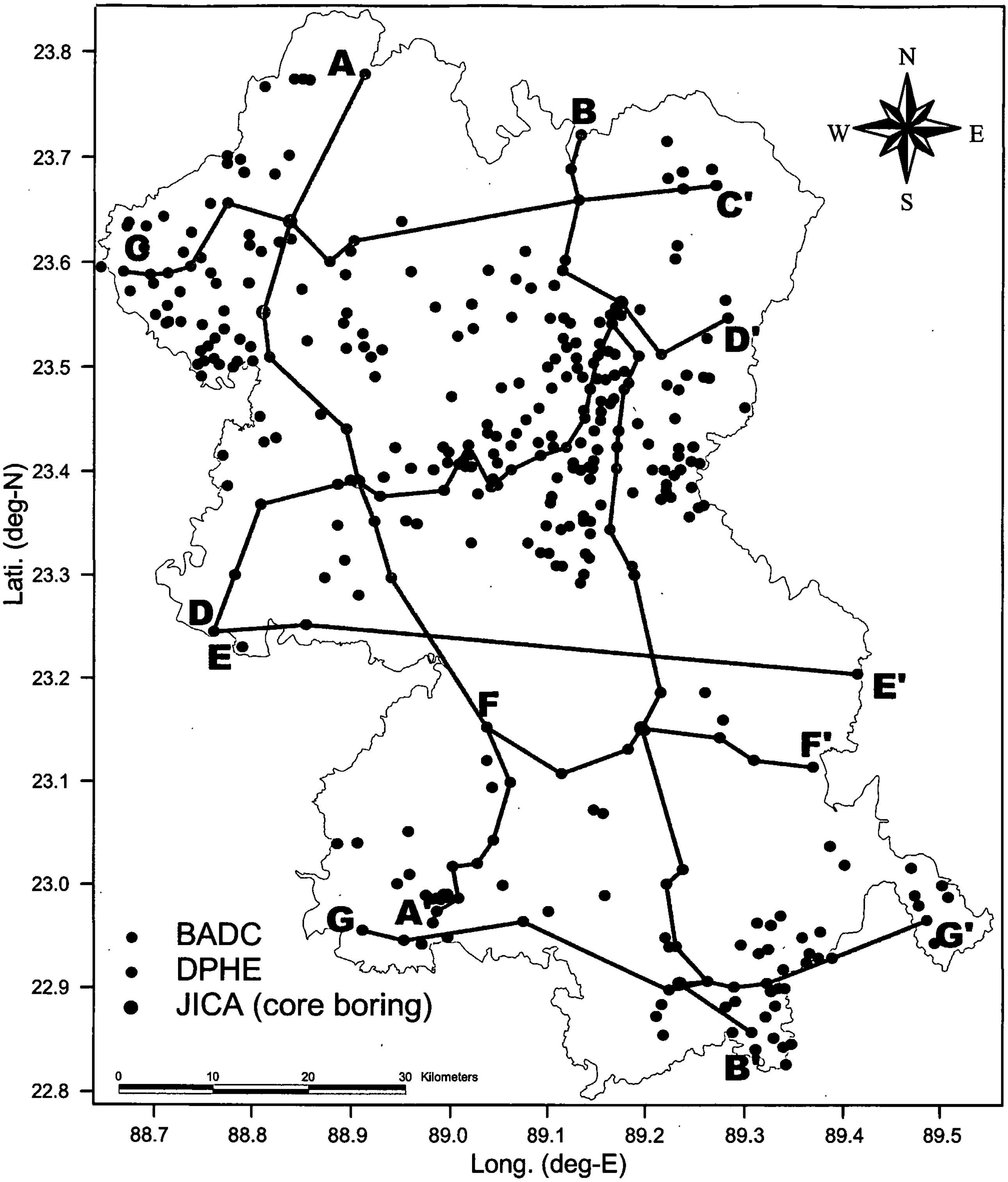

Figure 5.8.1	**Location Map of Geological Profile and Geological Log.**

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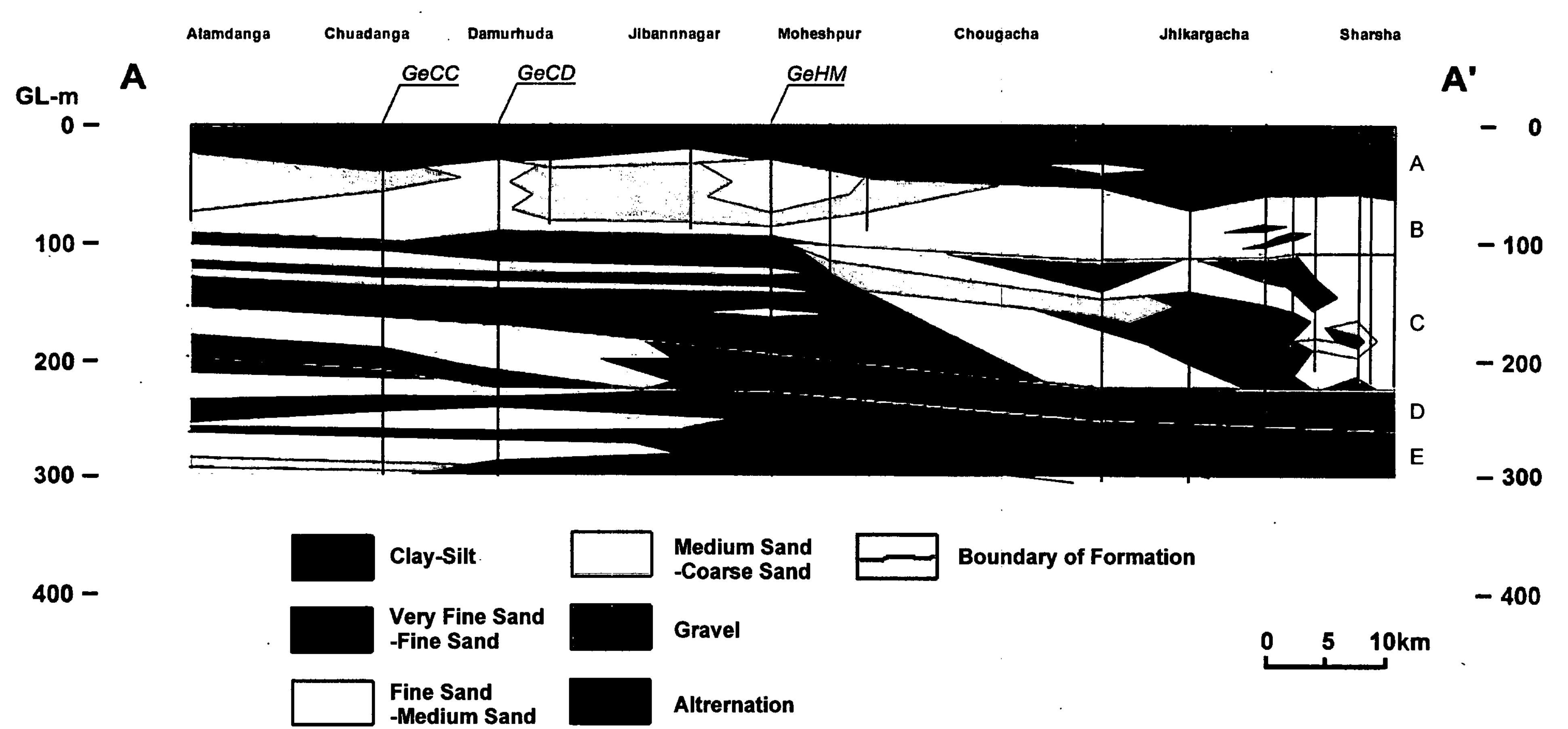

Figure 5.8.2 | **Geological Profile (A-A')**

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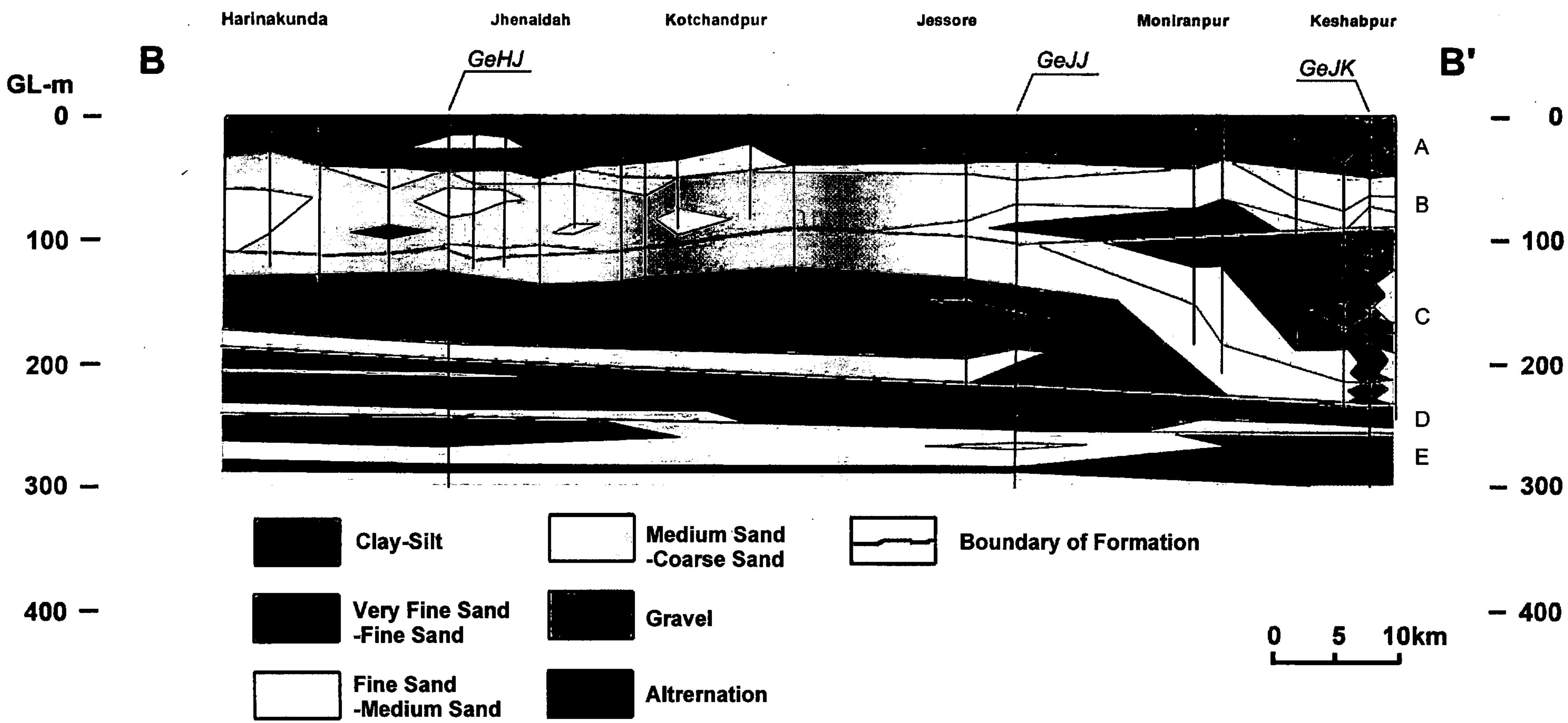

Figure 5.8.3	Geological Profile (B-B')
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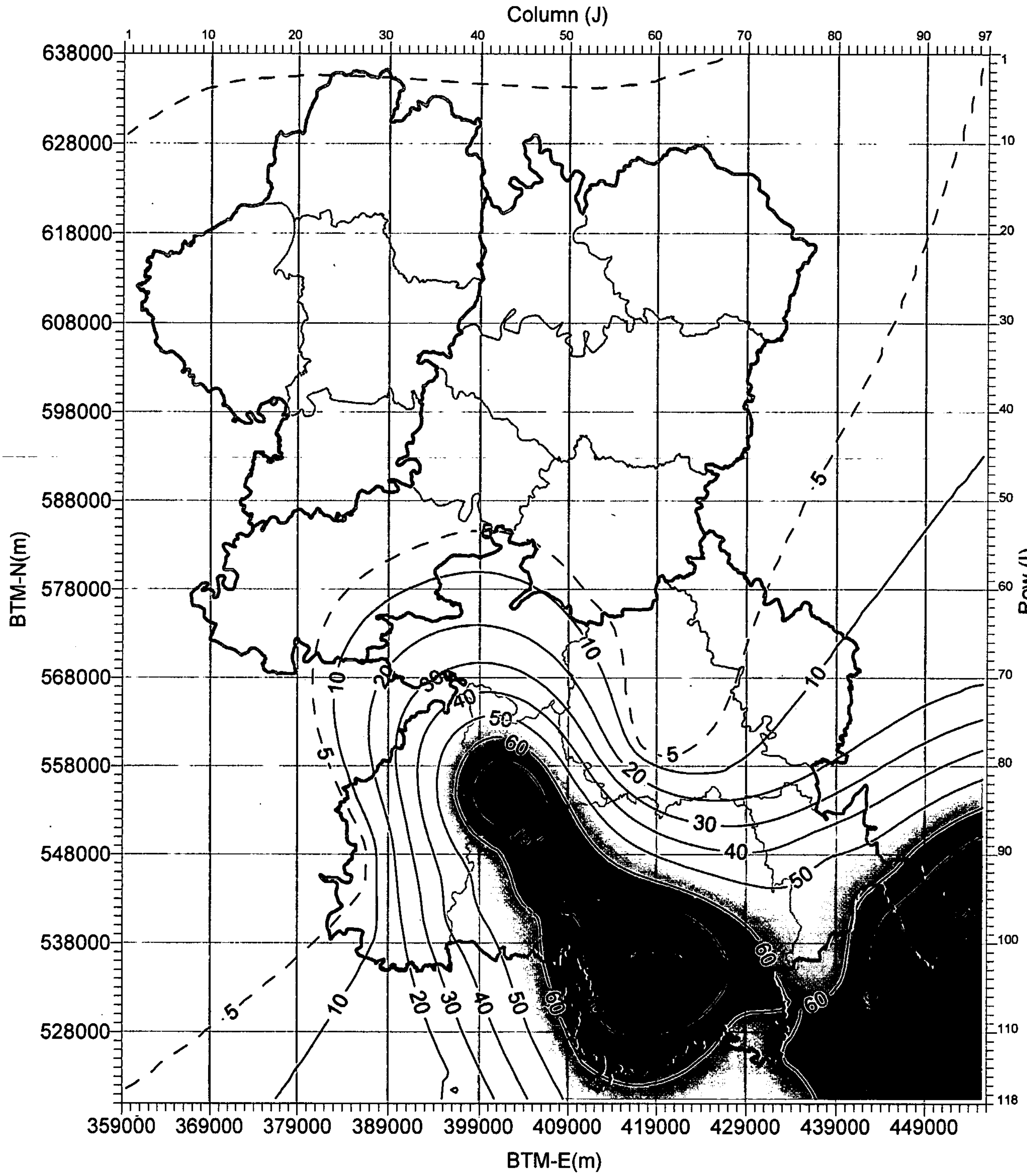

Equal Line of Clay Thickness (m)

Figure 5.8.4 | **Isopach Map of Clayey Layers in C Formation**

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