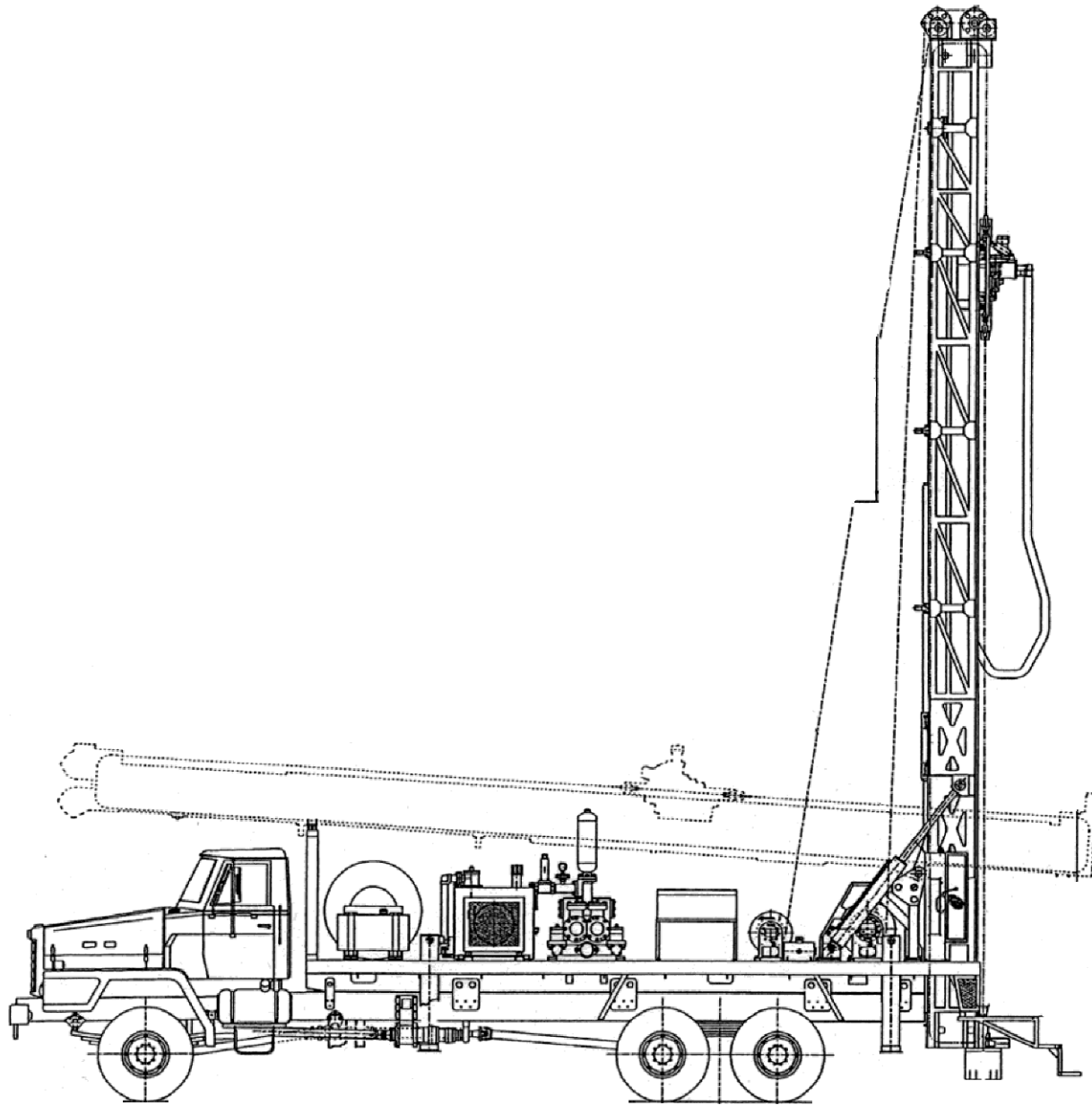


7. その他の資料・情報

- 7.1 基本設計図面集
- 7.2 水質調査結果
- 7.3 事業対象村落選定結果
- 7.4 社会状況調査
- 7.5 エチオピア国飲料水水質基準

7.1 基本設計図面集



OWNER :

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)

PROJECT NAME :

THE BASIC DESIGN STUDY ON THE PROJECT
FOR WATER SUPPLY
IN AMHARA NATIONAL REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CONSULTING ENGINEERS :

 NIPPON KOEI CO.,LTD.

DRAWING TITLE :

Rotary Drilling Rig

SCALE

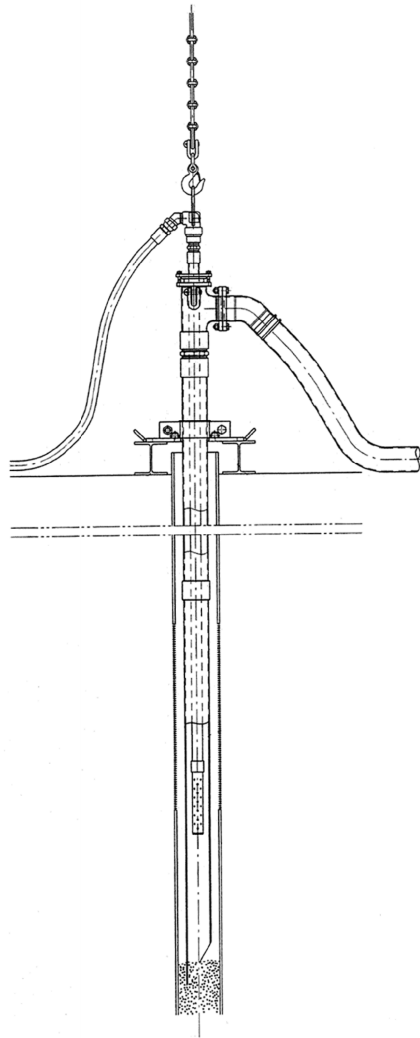
None

DATE

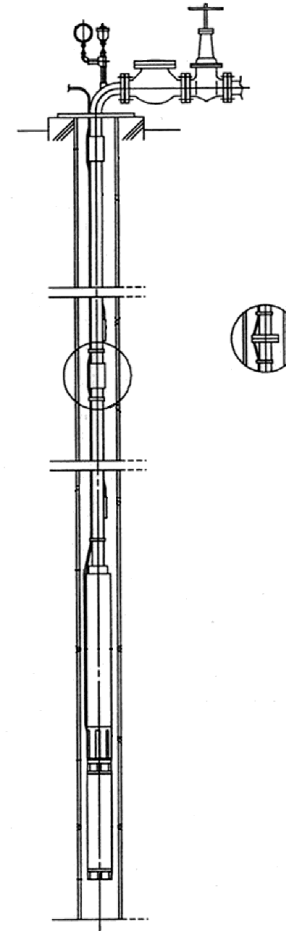
February 2005

DRAWING NO.


PE-1.1

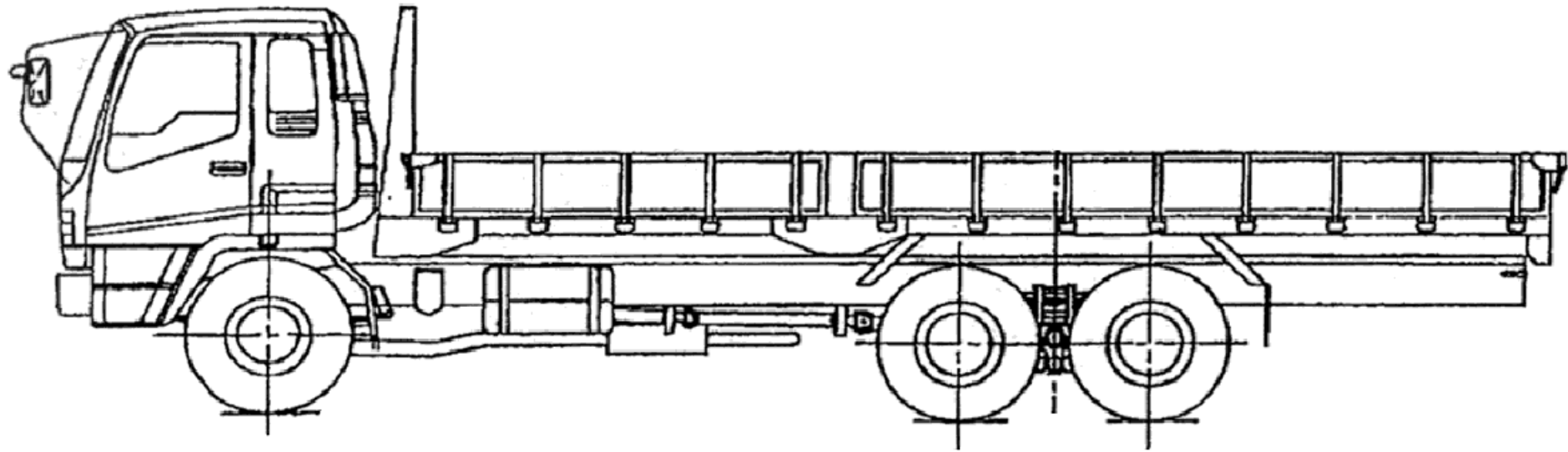


Air Lift Equipment



Pumping Test Machinery

OWNER :	PROJECT NAME :	CONSULTING ENGINEERS :	DRAWING TITLE :		
			Air Lift Equipment / Pumping Test Machinery		
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	THE BASIC DESIGN STUDY ON THE PROJECT FOR WATER SUPPLY IN AMHARA NATIONAL REGIONAL STATE IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA	 NIPPON KOEI CO.,LTD.	SCALE	DATE	DRAWING NO.
			None	February 2005	PE-2.1



OWNER :

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)

PROJECT NAME :

THE BASIC DESIGN STUDY ON THE PROJECT
FOR WATER SUPPLY
IN AMHARA NATIONAL REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CONSULTING ENGINEERS :



NIPPON KOEI CO.,LTD.

DRAWING TITLE :

Gargo Truck

SCALE

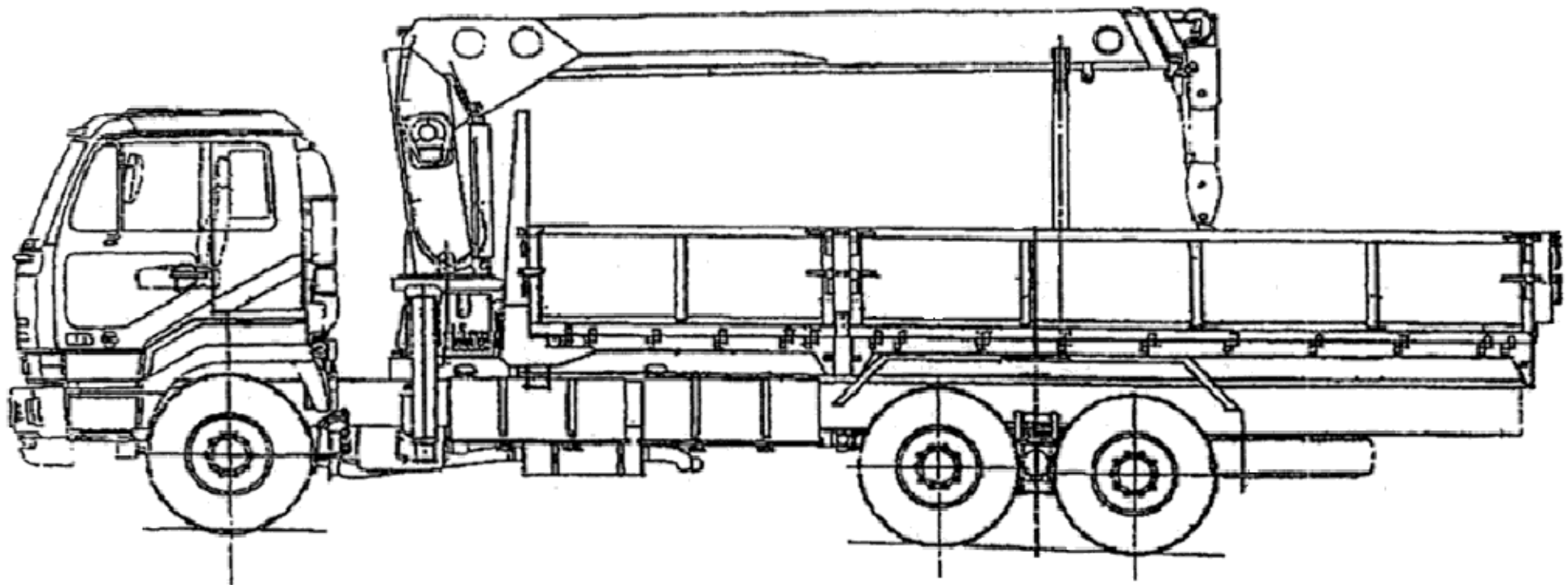
None

DATE

February 2005

DRAWING NO.

PE-3.1



OWNER :

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)

PROJECT NAME :

THE BASIC DESIGN STUDY ON THE PROJECT
FOR WATER SUPPLY
IN AMHARA NATIONAL REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CONSULTING ENGINEERS :



NIPPON KOEI CO.,LTD.

DRAWING TITLE :

Gargo Truck with Crane

SCALE

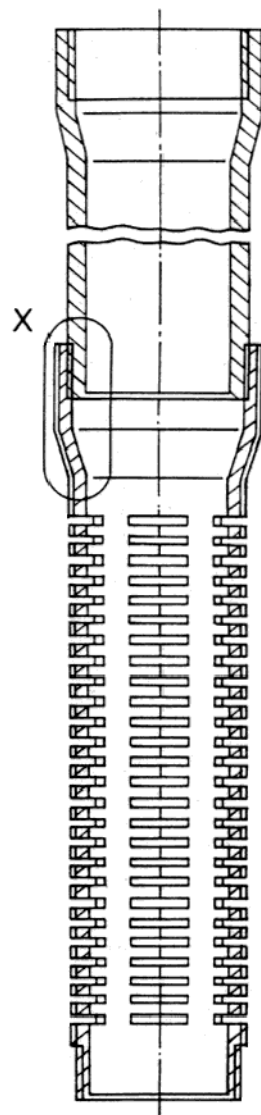
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DATE

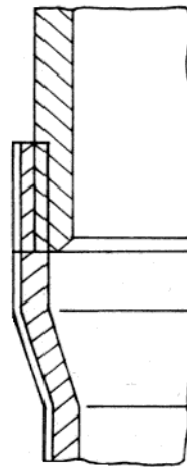
February 2005

DRAWING NO.

PE-3.2



Detail X



OWNER :

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)

PROJECT NAME :

THE BASIC DESIGN STUDY ON THE PROJECT
FOR WATER SUPPLY IN AMHARA REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CONSULTING ENGINEERS :



NIPPON KOEI CO.,LTD.

DRAWING TITLE :

Screen and Casing Pipe

SCALE

None

DATE

February 2005

DRAWING NO.

PE-4.1

7.2 水質調査結果

室内水質試験結果 (アムハラ州)

	Zone	Woreda	Water Point	Chemicals for Health Significance									Substance and parameters that may give rise to complaints from consumers											
				Ba	Cd	Cr	Cu	Mn	Pb	CN	F	No3	Zn	Al	Fe	H2S	TDS	Hardness	Cl	So4	Na	pH		
				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	mg/L	mg/L	mg/L	mg/L	-	
1	N. Shewa	Angolelan	DW-72	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.002	0.28	13	<0.1	<0.1	<0.1	Nil	412	204	3	7	12	12	7.86	
2	N. Shawa	Minjarshenora	BH-10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	1.08	10.08	0.2	<0.1	<0.1	Nil	567	158	10	12	62	62	7.68	
3	N. Wollo	Gidan	DW-22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.07	42.09	<0.1	<0.1	<0.1	Nil	218	78	20	8	7.5	8	6.64	
4	N. Wollo	Gubalafto	DW-32	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.002	0.24	28.8	0.2	<0.1	<0.1	Nil	830	432	10	3	24	3	7.69	
5	N. Wollo	Habru	DW-38	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.23	11.96	<0.1	<0.1	<0.1	0.32	453	217	7	10	14	10	7.72	
6	Oromyia	Bati	DW-57	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.62	46.52	<0.1	<0.1	<0.1	Nil	1695	720	112	195	103	195	7.58	
7	Oromyia	Chefa Dewa	DW-60	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.002	0.45	3.1	<0.1	<0.1	<0.1	Nil	495	217	11	13	32	13	7.22	
8	Oromyia	Julle Tumuga	DW-63	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.006	0.79	20.82	<0.1	<0.1	<0.1	0.32	1466	390	138	44	126	44	7.36	
9	S. Gonnder	Ibnat	DW-16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.002	0.22	50.95	<0.1	<0.1	<0.1	Nil	596	259	13	14	27	14	7.23	
10	S. Gonnder	Libo Kemkem	DW-10	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	0.004	0.44	24.62	0.2	<0.1	0.6	Nil	859	419	28	13	32	13	7.23	
11	S. Gonnder	Simada	CS-2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.33	23.04	<0.1	<0.1	<0.1	Nil	258	95	8	7	15	7	7.32	
12	S. Wollo	Jama	DW-53	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.41	5.32	<0.1	<0.1	<0.1	Nil	345	133	10	6	18	6	7.88	
13	S. Wollo	Mekdella	DW-52	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.007	0.17	177.2	<0.1	<0.1	<0.1	Nil	1097	292	114	46	86	46	7.61	
14	S. Wollo	Kelela	CS-9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001	0.28	19.94	1.2	<0.1	<0.1	Nil	438	200	1	-	15	1	7.67	
15	S. Wollo	Wegdie	DW-42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.002	0.35	14.18	<0.1	<0.1	<0.1	Nil	266	117	3	4	9	4	7.43	
16	S. Wollo	Werebaba	DW-40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.003	0.21	93.03	<0.1	<0.1	<0.1	Nil	665	283	53	19	16	19	7.02	
17	Waghimra	Dahina	DW-25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.005	0.29	20.38	0.2	<0.1	<0.1	Nil	605	283	12	10	20	10	7.27	
18	Waghimra	Sekota	DW-26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.003	0.42	33.23	0.9	<0.1	<0.1	Nil	714	360	10	15	18	15	7.71	
(Ethiopian Standards)				1.8	0.003	0.01	5	0.8	0.02	0.07	3	50	6	0.4	0.4	0.07	1776	392	533	483	358			

原位置水質試験結果 (アムハラ州)

No	Zone	Woreda	Area/Kebele	Basic Information				In-situ Water Quality Analysis											Topography	Geology	Remarks
				Geo-electrical survey	Geology	Proposed well depth (m)	Revised Qty of well		Specific Location (UTM)		Water Point	In-situ Analysis						Elevation (m amsl)			
							SBH	DBH	Easting	Northing		Temp (deg. C)	Ph	Cond. (micro-S/cm)	Fe (mg/l)	F (mg/L)	T.Coliform (colonies)				
1	North Wollo	Gidan	Tetergh (03)	FFSH	WFB	60	1		535787	1337719	CS3	11	7.7	200	Nil	Nil	18	3481	Depression	W.Basalt	We found only one water point
2	North Wollo	Gidan	Tingit	FFSH	WFB	60	1														No water point to be sampled
3	North Wollo	Gidan	Kebero Meda oll	FFSH	WFB	130		1	538386	1317126	DBH 22	12	6.4	200	Nil	Nil	15	3464	Plain	Alluvium	We found only one water point Labo Test
4	North Wollo	Gubalftu	Shelle mender 09						564518	1306607	BH 5	15	7.3	640	Nil	Nil	Nil	1908	Plain	Alluvium	We found only one water point
5	North Wollo	Gubalftu	Lengisa 010-Gdla mech						561050	1304451	DBH 32	20	7.5	780	Nil	Nil	Nil	1897	Plain	Alluvium	We found only one water point Labo Test
6	North Wollo	Gubalftu	Adembululo 010						560533	1304112	DBH 33	22	7.4	820	Nil	Nil	Nil	1907	Flood Plain	Alluvium	We found only one water point
7	North Wollo	Habru	Agamsa 027	C	WFB^	150		1													No water point to be sampled
8	North Wollo	Habru	Haro 027	C	WFB^	150		1	587514	1304887								1508	Plain	Basalt	No water point to be sampled
9	North Wollo	Habru	Sekela 015	C	WFB^	80	1		571857	1281117	DBH 38	19	7.5	420	Nil	Nil	1	1621	Plain	Basalt	- Labo Test
9	1	ditto	ditto	ditto					546678	1323938	DBH 24	12	7	420	Nil	Nil	57	3091	Plain	Basalt	-
10	North Wollo	Habru	Meja adea 07	C	WFB^	150		1	595418	1293893	No water point only inventory work ins done							1318	Depression	Basalt	No water point to be sampled
11	North Wollo	Habru	Sirinka Gerado 04	C	WFB^	80	1		564667	1300474	BH 6	20	7.5	880	Nil	Nil	2	1881	Plain	Basalt	-
11	2	ditto	ditto	ditto					564088	1300864	DBH 36	20	7.3	680	Nil	Nil	1	1878	Plain	Basalt	-
12	North Wollo	Habru	Jarota 07	C	WFB^	150		1													No water point to be sampled
13	North Wollo	Habru	Darimu 07	C	WFB^	150		1	574155	1296040	CS 5	19	7.3	660	Nil	Nil	50	1629	Depression	Basalt	We found only one water point
14	North Wollo	Habru	Abiyot Fire 07	C	WFB^	150		1													Area/kebele not found
15	North Wollo	Habru	Aware 09						571107	1291925	DBH 37	18	7.3	800	Nil	Nil	60	1658	Plain	Alluvium	We found only one water point
16	North Wollo	Meket	Defershe 023																		Area/kebele not found
17	North Wollo	Habru	Fakit 034	FFSH	WFB	80	1														Area/kebele not found
18	North Wollo	Meket	Tajaabo 025																		Area/kebele not found
19	North Wollo	Meket	Enatguya 017																		Area/kebele not found
20	North Wollo	Habru	Kega Ber 029	FFSH	WFB^	80	1														Area/kebele not found
21	North Wollo	Habru	Koso Mender	FFSH	WFB^	90	1														Area/kebele not found
22	North Wollo	Meket	Derek Wenz+Nacha Feres 031																		Area/kebele not found
23	North Wollo	Meket	Keynitu+Birafaf 032																		Area/kebele not found
24	North Wollo	Meket	Mekerecha+Zet Yibel 034																		Area/kebele not found
25	South Wollo	Jama	Begide+Ibayu 09	C	WFB	150		1	529637	1163850	DBH 56	17	7.7	500	Nil	Nil	95	2612	Plain	Alluvium	We found only one water point
26	South Wollo	Kelela	Chellhele 03	C	WFB	60	1		501781	1172476	CS 8	17	7.6	400	Nil	Nil	50	2507	Gentle Slope	W. Basalt	-
26	2	ditto	ditto						498237	1171478	CS9	16	7.4	240	Nil	Nil	15	2555	Flood Plain	Basalt	Labo Test
27	South Wollo	Kelela	Yimere 01						502735	1171251	DBH 48	18	7.3	400	Nil	Nil	> 100	2457	Flood Plain	W. Basalt	We found only one water point
28	South Wollo	Jama	Alley	C	WFB	60-70		2													Area/kebele not found
29	South Wollo	Jama	Laukubi & Tach kub 1	C	WFB	145		1	528793	1158220	DBH 54	17	7.6	350	Nil	Nil	45	2607	Flood Plain	Alluvium	-
29	2	ditto	ditto						526768	1160466	DBH 55	16	7.4	370	Nil	Nil	90	2591	Flood Plain	Alluvium	-
30	South Wollo	Jama	Ejerti michael 012	C	WFB	70		3													No water point to be sampled
31	South Wollo	Jama	Gerbo, Hodere 017	C	WFB	150		1	533335	1150883	DBH 53	16	8.3	320	Nil	Nil	15	2661	Gentle Plain	Basalt	We found only one water point Labo Test
32	South Wollo	Jama	Goelshe 017	FFSH	WFB	60		3													Area/kebele not found
33	South Wollo	Jama	Libanos 019	FFSH	WFB	130		1	524653	1138990	CS 15	12	7.3	260	0.5	Nil	> 100	2632	Flood Plain	Basalt	We found only one water point
34	South Wollo	Jama	Gende Gulo 020	FFSH	WFB	60		3	527101	1142102	CS 16	15	7.9	220	Nil	Nil	40	2594	Plain	Alluvium	We found only one water point
35	South Wollo	Worebabo	Keikesha 015	C	SD	180		1													Area/kebele "In-accessible"
36	South Wollo	Worebabo	Lhifu 015	C	SD	80		3													Area/ kebele "In-accessible"
37	South Wollo	Worebabo	Gedida 014	FFSH	WFB	140		1													Area/kebele "In-accessible"
38	South Wollo	Worebabo	Gubisa 05	FFSH	WFB	60		1	586744	1252660	DBH 40	18	6.9	580	Nil	Nil	> 100	2719	Depression	W. Basalt	We found only one water point Labo Test
39	South Wollo	Worebabo	Abo Gora 05	FFSH	WFB	150		1	584303	1257569	DBH 41	12	7.3	400	Nil	Nil	7	2547	Depression	W. Basalt	We found only one water point
40	South Wollo	Worebabo	Korekon 05	FFSH	WFB	70		2													No water point to be sampled
41	South Gondar	Simada	Agewoch 010	FFSH	WFB	60		3	417364	1258873	CS1	16	7	300	Nil	Nil	> 100	2491	Gentle Slope	Basalt	We found only one water point
42	South Gondar	Simada	Genta	C	WFB	50		1													No water point to be sampled
43	South Gondar	Simada	Mwerem 34	C	WFB	60		3	434772	1243901	DBH 19	20	6.8	260	Nil	Nil	10	2425	Flood Plain	Alluvium	We found only one water point
44	South Gondar	Simada	Goref 04	C	WFB	60		1													Area/kebele not found
45	South Gondar	Simada	Menkelila	FFSH	WFB	60		2	417973	1244960	DBH 21	16	7.4	300	Nil	Nil	2	2422	Plain	Alluvium	We found only one water point
46	South Gondar	Simada	Agamwuha 05	C	WFB	50		2	422907	1254669	DBH 20	18	7.1	240	Nil	Nil	0.5	2511	Flood Plain	Alluvium	We found only one water point
47	South Gondar	Simada	Chifchaf 06	FFSH	WFB	60		2	425952	1275999	CS2	17	7.2	240	Nil	Nil	10	2679	Depression	W. Basalt	We found only one water point Labo Test

原位置水質試験結果 (アムハラ州)

No	Zone	Woreda	Area/Kebele	Basic Information					In-situ Water Quality Analysis													
				Geo-electrical survey	Geology	Proposed well depth (m)	Revised Qty of well		Specific Location (UTM)		Water Point	In-situ Analysis						Elevation (m amsl)	Topography	Geology	Remarks	
							SBH	DBH	Easting	Northing		Temp (deg. C)	Ph	Cond. (micro-S/cm)	Fe (mg/l)	F (mg/L)	T.Coliform (colonies)					
48	1	South Gondar	Ibnat	Selamaya						409205	1339030	DBH 15	16	6.6	260	Nil	Nil	14	2597	Flood Plain	Basalt	Area/kebele repeated
48	2	ditto	ditto						408558	1339132	DH 2	16	7.1	360	Nil	Nil	6	2624	Flood Plain	Basalt		
49	1	South Gondar	Ibnat	Wegere Selamaya																		Area/kebele repeated
50	1	South Gondar	Ibnat	Checheho Jimnaderega	C	WFB	60	3	401381	1340061	DBH 17	The Hand pump is not working (only inventory)						2290	Flood Plain	Basalt	No water point to be sampled	
51	1	South Gondar	Ibnat	Minch Jimnaderega																		No water point to be sampled
52	1	South Gondar	Ibnat	Awsheri Jimnaderega					400710	1340339	DBH 18	19.1	7.1	480	Nil	Nil	8	2253	Plain	Alluvium	Area/kebele repeated	
53	1	South Gondar	Ibnat	Tinjut Ber	FFSH	WFB	60	1	397002	1340492	DBH 4	9.6	6.6	260		Nil	9	2238	Gentle Slope	Volcanic	Area/kebele repeated	
54	1	Oromiya	Bati	Garero 07	C	WFB	80	1	No water point													Area / kebele "In- accessible"
55	1	Oromiya	Bati	Alshayu+kersu					609383	1245884	DBH 57	18	7.5	1460	Nil	Nil	> 100	1498	Depression	W. Basalt	We found only one water point	Labo Test
56	1	Oromiya	Bati	Tachignaw Lkgo																		No water point to be sampled
57	1	Oromiya	Bati	Laygnaw Laygo, Kembere																		No water point to be sampled
58	1	Oromiya	Bati	Selmani 014	C	WFB	150	1	608753	1234395	DBH 59	13	7.5	800	Nil	Nil	> 100	1585	Depression	Alluvium	We found only one water point	
59	1	North Shewa	Angolelanaa Sagirt	Ambel+Koso					552123	1032921	DBH 74	10	7.6	180	Nil	*	12	2914	Gentle Slope	Alluvium	We found only one water point	
60	1	North Shewa	Angolelanaa Sagirt	Werga																		Area /kebele not found
61	1	North Shewa	Angolelanaa Sagirt	Seriti	C	WFB	60	1	547635	1053015	DBH 72	11	8	400	Nil	Nil	3	2786	Flood Plain	Alluvium	We found only one water point	Labo Test
62	1	North Shewa	Angolelanaa Sagirt	Liche Seriti Totose	C	WFB	60	1														Area/kebele not found
63	1	North Shewa	Angolelanaa Sagirt	Mongudo Cheke Zurya	C	WFB	60	1	545263	1048004	CS 18	13	7.3	400	Nil	*	3	2819	Plain	Alluvium	We found only one water point	
64	1	North Shewa	Angolelanaa Sagirt	Laftole aje Cheke	C	WFB	60	1														Area/kebele not found
65	1	North Shewa	Angolelanaa Sagirt	Cheke Town					543649	1045815	CS 17	13	8	360	Nil	*	5	2843	Plain	Basalt	-	
65	2	ditto	ditto						543085	1047202	DBH 73	12	8	240	Nil	*	Nil	2849	Plain	Alluvium	-	
66	1	Waghimra	Sekota	Tsetsergi abanachiros																		No water point to be sampled
67	1	Waghimra	Sekota	Tsatsu Dire Tiku, Ugulo																		No water point to be sampled
68	1	Waghimra	Sekota	Bewshu 015																		No water point to be sampled
69	1	Waghimra	Sekota	Chilkiwolo 010																		No water point to be sampled
70	1	Waghimra	Sekota	Shimidir/Limat Kinatchora 012																		Area/kebele not found
71	1	Waghimra	Sekota	Dibaran 011																		Kebele not found
72	1	Waghimra	Sekota	Gela Kamiru Arquatia 011																		Area/kebele not found
73	1	Waghimra	Sekota	Dirinziba, Tasaskiw																		Area /kebele repeated
74	1	Waghimra	Sekota	Nigunaleka 08					508088	1378586	DBH 31	19	7.5	840	Nil	Nil	Nil	2191	Gentle Slope	Alluvium	We found only one water point	
75	1	Waghimra	Sekota	Akjewshina 07																		No water point to be sampled
76	1	Waghimra	Sekota	Wellan and Chifte					503327	1390328	DBH 29	18	7.4	600	Nil	Nil	3	2163	Gentle Slope	W. Basalt	We found only one water point	
77	1	Waghimra	Sekota	Testsergi, Abanachir 015					501528	1398979	DBH 28	18	7.2	680	Nil	Nil	50	2134	Depression	Sand Stone	Misplaced	
78	1	Waghimra	Sekota	Tsatsu, Dire Tiku, Ugulo																		
79	1	Waghimra	Sekota	Shimhar Tiku 010					493808	1386400	CS 4	17	7.4	*	*	*	*	2081	Depression	Basalt	We found only one water point	
80	1	Waghimra	Sekota	Chilkiw 010 mizrib					493147	1385915	DBH 26	17	7.3	700	Nil	Nil	*	2129	Plain	W. Basalt	We found only one water point	
81	1	Waghimra	Sekota	Shimidir/Limat Chora	C	WFB	60	1														Area/kebele not found
82	1	Waghimra	Sekota	Dibaran 011																		Kebele not found
83	1	Waghimra	Sekota	Gelakamiru Arquatia	C	WFB	60	3														Area/kebele not found
84	1	Waghimra	Sekota	Dirinziba Tsaskiw, Sikuna																		No water point to be sampled
85	1	Waghimra	Sekota	Nigata Aleka 08																		No water point to be sampled
86	1	Waghimra	Sekota	Akejewshina 07					508247	1380436	The hand pump is not functioning						2122	Gentle Slope	Basalt	No water point to be sampled		
87	1	Waghimra	Dahana	kenubish	C	WFB	60	1	479493	1373839	DBH 25	16	6.8	520	Nil	Nil	*	2138	Depression	Basalt	We found only one water point	Labo Test
87	2	ditto	ditto	Welkementa					The area is not identified													
88	1	North Shoa	Minjar Shenkora	Chelle geberel	C	SD	220	1														No water point to be sampled
89	1	North Shoa	Minjar Shenkora	Chome Ager	C	SD	80	2														No water point to be sampled
90	1	North Shoa	Minjar Shenkora	Biruk Ager	C	SD	240	1														No water point to be sampled
91	1	North Shoa	Minjar Shenkora	Alemneh Dire	C	SD	220	1														No water point to be sampled
92	1	North Shoa	Minjar Shenkora	Kiticha	C	SD	250	1	554692	980477	Nowater point (pond and rain harvesting) only						1705	Flood Plain	Alluvium	No water point to be sampled		
92	2	ditto	ditto						554688	979531	Only rain harvestig from the roof						1708	Flood Plain	Alluvium	No water point to be sampled		
93	1	North Shoa	Minjar Shenkora	Golegolecha	C	SD	80	3														No water point to be sampled
94	1	North Shoa	Minjar Shenkora	Wmaga	C	SD	80	3														No water point to be sampled

原位置水質試験結果 (アムハラ州)

No	Zone	Woreda	Area/Kebele	Basic Information					In-situ Water Quality Analysis														
				Geo-electrical survey	Geology	Proposed well depth (m)	Revised Qty of well		Specific Location (UTM)		Water Point	In-situ Analysis						Elevation (m amsl)	Topography	Geology	Remarks		
							SBH	DBH	Easting	Northing		Temp (deg. C)	Ph	Cond. (micro-S/cm)	Fe (mg/l)	F (mg/L)	T.Coliform (colonies)						
95	1	North Shoa	Minjar Shenkora	Kiki	C	SD	80	2		949888	987544	Inventory							1799	Plain	Alluvium	No water point to be sampled	
96	1	North Shoa	Minjar Shenkora	Jejebakola	C	SD	80	1														No water point to be sampled	
97	1	North Shoa	Minjar Shenkora	Finanajo	C	SD	80	2														No water point to be sampled	
98	1	North Shoa	Minjar Shenkora	Aroge Minjar	C	SD	240		1	548220	989762	BH 10	18	7.6	540	Nil	*	*	1775	Plain	Alluvium	We found only one water point	
99	1	North Shoa	Minjar Shenkora	Zewelde	C	WFB^	80	2														No water point to be sampled	
100	1	North Shoa	Tamaber	Argaga	C	WFB^	150		1	593372	1098706	BH 9	Only inventory- The well has stopped since						1447	Plain	Alluvium	No water point to be sampled	
101	1	South Wollo	Harbu	Alimenta	C	WFB^	80	3														Area/kebele not found	
102	1	South Wollo	Harbu	Aderanba	FFSH	WFB^	160		1													No water point to be sampled	
103	1	South Wollo	Harbu	Meja	FFSH	WFB^	150		1													No water point to be sampled	
104	1	South Wollo	Harbu	Abunaye	FFSH	WFB^	160		1													No water point to be sampled	
105	1	South Wollo	Harbu	Wiensa	C	WFB	60	1														No water point to be sampled	
106	1	South Wollo	Kelela	Kersa 05	FFSH	WFB^	120		1	574867	1293107	DBH 39	19	8	400	Nil	Nil	Nil	1584	Flood Plain	Alluvium	We found only one water point	
107	1	South Wollo	Kelela	Weda Golwn 030	FFSH	WFB	60	2														No water point to be sampled	
108	1	South Wollo	Kelela	Inchimi 031	C	WFB	60	1														No water point to be sampled	
109	1	South Wollo	Kelela	Tika 034	FFSH	WFB	60	3		520695	1177265	CS 11	16	7.4	400	Nil	Nil	6	2557	Flood Plain	Alluvium	We found only one water point	
110	1	South Wollo	Kelela	Indoda 030	C	WFB	60	1		497788	1167325	CS 10	13	7.8	400	Nil	Nil	18	2450	Gentle Slope	Basalt	We found only one water point	
111	1	South Wollo	Kelela	Wedu Getu 036	C	WFB	120		1	517479	1183030	DBH 49	16	7.5	540	Nil	Nil	45	2574	Flood Plain	Basalt	-	
111	2	ditto	ditto							516939	1184515	Only inventory							2602	Flood Plain	Basalt	-	
112	1	South Wollo	Kelela	Kore/Fincheftu 037	FFSH	WFB	60	1		515717	1190071	CS 12	17	7.6	400	Nil	Nil	70	2712	Depression	W. Basalt	We found only one water point	
113	1	South Wollo	Kelela	GendeBorena 036	FFSH	WFB	60	1														No water point to be sampled	
114	1	South Wollo	Wegide	Yagi 014	FFSH	WFB	60	1		463012	1156207	DBH 42	15	7.4	240	Nil	Nil	40	2421	Gentle Slope	Basalt	We found only one water point	
115	1	South Wollo	Wegide	Golele 09	FFSH	WFB	120		1	467045	1158893	CS 6	15	7.1	220	Nil	Nil	20	2404	Gentle Slope	W. Basalt	We found only one water point	
116	1	South Wollo	Wegide	Kutiso 03 Abey	C	WFB	140		1	472146	1165943	DBH 44	17	7.2	360	Nil	Nil	30	2404	Flood Plain	Alluvium	We found only one water point	
117	1	South Wollo	Wegide	Bikili 04	C	WFB	60	3		469499	1163764	DBH 43	17	7.4	420	Nil	Nil	60	2412	Flood Plain	Alluvium	We found only one water point	
118	1	South Wollo	Wegide	Ayele Anba Rufa 02,04	C	WFB	60	2		473126	1166852	DBH 45	16	7.4	400	Nil	Nil	50	2394	Depression	Alluvium	We found only one water point	
119	1	South Wollo	Wegide	Haletu 07	C	WFB	60	1		469354	1162408	CS 7	16	7.3	360	Nil	Nil	25	2397	Gentle Slope	Basalt	We found only one water point	
120	1	South Wollo	Wegide	Yeshum	C	WFB	60	3		490952	1189460	DBH 47	18	7.5	500	Nil	Nil	40	2562	Plain	Alluvium	We found only one water point	
121	1	South Wollo	Meqdella	Ivelinta 02	FFSH	WFB	50	1		504166	1240525	CS 14	The tap is not working							2781	Flood Plain	Basalt	No water point to be sampled
122	1	South Wollo	Meqdella	Yebar 013	FFSH	WFB	50	1														No water point to be sampled	
123	1	South Wollo	Meqdella	Tilket 02	FFSH	WFB	50	1														No water point to be sampled	
124	1	South Wollo	Meqdella	Genatit 02	FFSH	WFB	50	1		510656	1240986	DBH 56	15	7.3	300	Nil	Nil	70	2829	Flood Plain	W. Basalt	We found only one water point	
125	1	South Wollo	Meqdella	Tija Fej 06	FFSH	WFB	50	1														Area/kebele not found	
126	1	South Wollo	Meqdella	Felana 06	FFSH	WFB	50	1														Area/kebele not found	
127	1	South Wollo	Meqdella	Gonderoch	FFSH	WFB	50	1														Area/kebele not found	
128	1	South Wollo	Meqdella	Meqdella	FFSH	WFB	50	1		507352	1241941	DBH 52	16	7.9	880	Nil	Nil	5	2795	Plain	Basalt	We found only one water point	
129	1	South Wollo	Meqdella	Feterot+Ychikech	FFSH	WFB	120		1													No water point to be found	
130	1	South Wollo	Meqdella	Dedere 05	FFSH	WFB	60	1		515954	1236052	DBH 50	15	7.3	200	Nil	Nil	55	2909	Plain	Basalt	-	
130	2	ditto	ditto							514984	1235882	CS 13	15	7.6	360	Nil	Nil	> 100	2896	Gentle Slope	Basalt	-	
131	1	South Wollo	Meqdella	Gose 05	FFSH	WFB	60	1														No water point to be found	
132	1	South Gondar	Ibnat	Tilbi						397889	1300900	DBH 2	18	6.5	260	Nil	Nil	Nil	2255	Gentle Slope	W. Basalt	-	
132	2	ditto	ditto							390414	1338275	DBH 3	9.5	7.6	460	0.5	Nil	5	2338	Depression	Basalt	-	
133	1	South Gondar	Ibnat	Kwalisa																		Area /kebele "In-accessible"	
134	1	South Gondar	Ibnat	Work mender acbr aba Jale						395300	1342062	DBH 13	19	6.9	800	Nil	Nil	4	2176	Depression	W. Basalt	-	
134	2	ditto	ditto							396208	1342473	DBH 14	20	6.7	620	Nil	Nil	6	2140	Gentle Slope	Basalt	-	
135	1	South Gondar	Ibnat	Wenber Ayhaayakwha						393956	1346013	DBH 11	18	6.7	480	Nil	Nil	7	2254	Depression	W. Basalt	-	
135	2	ditto	ditto							394103	1344058	DBH 12	20	7	500	Nil	Nil	8	2223	Gentle Slope	W. Basalt	-	
136	1	South Gondar	Libo Kemkem	Berengna Lentdur	FFSH	WFB^	80	1														Area/kebele not found	
137	1	South Gondar	Libo Kemkem	Zanzi	FFSH	WFB^	80	1		360215	1334674	DBH11	20	6.6	660	< 0.2	Nil	8	1828	Flood Plain	Alluvium	-	
137	2	ditto	ditto							359717	1334644	BH 1	20	7.9	440	< 0.2	Nil	Nil	1824	>>	Alluvium	-	
138	1	South Gondar	Libo Kemkem	Birvuha Ferfer	FFSH	WFB^	80	1														Area/kebele not found	
139	1	South Gondar	Libo Kemkem	Nashora Ferfer	FFSH	WFB^	80	1		378983	1359783	DBH 8	Only inventory, The hand pump is damaged						1972	Depression	W. Basalt	No water point to be sampled	

原位置水質試験結果（アムハラ州）

No	Zone	Woreda	Area/Kebele	Basic Information				In-situ Water Quality Analysis																
				Geo-electrical survey	Geology	Proposed well depth (m)	Revised Qty of well		Specific Location (UTM)		Water Point	In-situ Analysis						Elevation (m.amsl)	Topography	Geology	Remarks			
							SBH	DBH	Easting	Northing		Temp (deg. C)	Ph	Cond. (micro-S/cm)	Fe (mg/l)	F (mg/L)	T.Coliform (colonies)							
140	1	South Gondar	Libo Kemkem	Ashker Terara	C	WFB^	80	2															No water point to be sampled	
141	1	South Gondar	Libo Kemkem	Kurmat Ategecha	FFSH	WFB^	80	1		378571	1365258	DBH 6	18.9	6.7	680	Nil	Nil	2	1849	Depression	W. Basalt	We found only one water point	Labo Test	
142	1	South Gondar	Libo Kemkem	Atria agat Ashker	FFSH	WFB^	80	1															Area/kebele not found	
143	1	South Gondar	Libo Kemkem	Sholit Kalsholit	FFSH	WFB^	80	2	392025	1364977	DBH 5	Only inventory						2053	Plain	Basalt	No water point to be sampled			
144	1	South Gondar	Libo Kemkem	Ambo Asawegan	FFSH	WFB^	80	1															No water point to be sampled	
145	1	South Gondar	Libo Kemkem	Zelamin Janda	FFSH	WFB^	80	1	377937	1389451	DBH 10	20	7.1	820	Nil	Nil	14	1847	Flood Plain	W. Basalt	We found only one water point	Labo Test		
146	1	South Gondar	Libo Kemkem	Kalaymedhanialem	C	WFB^	160	1	367239	1376077	DBH 9	19	7	1040	Nil	Nil	3	1899	Plain	Alluvium	We found only one water point			
147	1	South Gondar	Libo Kemkem	Arbakello 015																			Area/kebele not found	
148	1	South Gondar	Libo Kemkem	Tirusina 015					594872	1196819	DBH 60	16	7	500	0.5	Nil	> 100	1572	Depression	Ig	-		Labo Test	
148	2	ditto							594516	1196323	DBH 61	15	7.2	660	Nil	Nil	> 100	1555	Depression	Basalt	-			
149	1	South Gondar	Libo Kemkem	Kille 012																			Area/kebele not found	
150	1	Oromiya	Artuma Fursi	Bete ordega Berbelay																			Area /kebele misplaced	
151	1	Oromiya	Artuma Fursi	Bkavakello Beteordega																			Area /kebele misplaced	
152	1	Oromiya	Artuma Fursi	Kersaadi+mutulu	C	WFB^	180		1														Area/kebele not found	
153	1	Oromiya	Artuma Fursi	Kara Kodema+Lale Gela	FFSH	WFB^	80	2															Area/kebele not found	
154	1	Oromiya	Artuma Fursi	Kodema Fugnu	C	WFB^	180		1														Area/kebele not found	
155	1	Oromiya	Artuma Fursi	Ireti	FFSH	WFB^	80	1		609124	1138892	DBH 66	18	6.9	680	Nil	Nil	> 100	1454	Depression	Ig	We found only one water point		
156	1	Oromiya	Artuma Fursi	Koro Rokesa Hader	FFSH	WFB^	80	2	609168	1141065	DBH 68	17	7.2	680	Nil	Nil	> 100	1396	Depression	Alluvium	We found only one water point			
157	1	Oromiya	Bati	Hdow Barigo, Hadow	FFSH	WFB^	80	1	In accissable														No water point to be sampled	
158	1	Oromiya	Bati	Kuni 03	FFSH	WFB^	80	2	610020	1242552	DBH 58	The hand pump is damaged only inventory						1749	Depression	W. Basalt	No water point to be sampled			
159	1	Oromiya	Julle Tumuga	Fugan Dembi	C	WFB^	80	2	614764	1134300	DBH 64	18	7.1	1280	Nil	Nil	> 100	1316	Gentle Slope	W. Basalt	-			
159	2	ditto							615073	1135234	DBH 65	16	7.1	900	0.2	Nil	> 100	1302	Gentle Slope	W. Basalt	-			
160	1	Oromiya	Julle Tumuga	Gerbi kille	FFSH	WFB^	80	2	609772	1133377	DBH 62	15	7	1300	Nil	Nil	1	1410	Depression	Basalt	-			
161	1	Oromiya	Julle Tumuga	Gerbi kille	FFSH	WFB^	70	3	609803	1133356	DBH 63	15	7	1200	Nil	Nil	20	1406	Depression	Alluvium	Area /kebele repeated	Labo Test		
162	1	Oromiya	Julle Tumuga	Merewa Hadere	C	WFB^	160		1	607316	1139645	DBH 67	17	7.2	1400	Nil	Nil	> 100	1426	Gentle Slope	Alluvium	We found only one water point		
163	1	Oromiya	Julle Tumuga	Guda Chelle	FFSH	WFB^	160		1	608052	1128470	DBH 8	Only inventory						1376	Depression	Alluvium	No water point to be sampled		
164	1	Oromiya	Julle Tumuga	Balchi Tikure	FFSH	WFB^	80	1	602121	1114466	DBH 70	19	7.1	2700	Nil	Nil	5	1141	Plain	Alluvium	-			
164	2	ditto							602930	1114645	DBH 71	20	7.1	2200	Nil	Nil	Nil	1178	Plain	Alluvium	-			
165	1	Oromiya	Julle Tumuga	Dula Chereka	FFSH	WFB^																	Area/kebele "In-accessible"	
166	1	Oromiya	Julle Tumuga	Arba wayu	C	WFB^	160		1														Area/kebele "In-accessible"	
				合計				130	34				96	90	83	83	83	83					16	

Note:

WFB: Stands for Weathered and Fractured Basalt

WFB^: Stands for Weathered and Fractured Basalt with thick soil cover

SD: Stands for thick soil deposit

FFSH: Stands for Found Feasible by its Surface Hydrogeological conditions

C: Stands for Conducted; Geophysical Survey is conducted in the areas indicated

NF: Stands for Not Feasible

NA: Stands for Not Accessible

Completed means water supply schemes are constructed in the areas in the past two year

Bold word: correction of miss-spelling and unsean erro

*: Duplicated location

The boreholes' depth of 164 wells was estimated and the remaining 36 boreholes' depth shall be estimated by Amhara Water Resource Development Bureau up to January, 2005.

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ETHIOPIAN GEOLOGICAL SURVEY CENTRAL GEOLOGICAL LABORATORY
WATER LABORATORY
DATA CODING FOR TRACE CONSTITUENTS

Dep./Proj. _____ Originator **Geomatrix** Approved by **HEAD, CGL**

Sample Type **Water** Source Area _____ Date Submitted **20/12/04**

Chemical Constituents in ppm(mg/lit.) _____ Date completed **24/01/05**
 Request No. **12685-2005PVT**

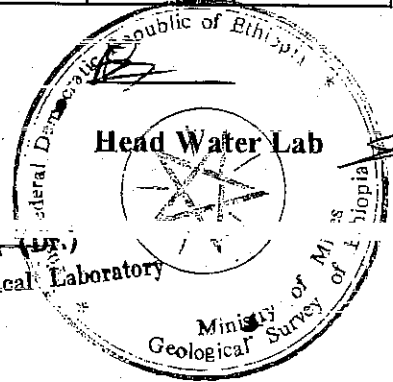
FIELD No.	Cond. CS-2	S.Wol. DW-53	S.Wol. DW-52	S.Wol. CS-9	S.Wol. DW-42	S.Wol. DW-40	Wag. DW-25	Wag. DW-26
LAB. No.	12695	12696	12697	12698	12699	12700	12701	12702
Barium (Ba)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium (Cd)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (Cr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper (Cu)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc (Zn)	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	0.2	0.9
Manganeses (Mn)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminum (Al)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Iron (Fe)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead (Pb)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide (CN)	0.001	0.001	0.007	0.001	0.002	0.003	0.005	0.003
Hydrogen Sulfide (H2S)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Total dissolved solids(TDS)	258	345	1097	438	266	665	605	714
Hardness	95.06	133.26	292.63	200.73	117.84	283.87	283.61	360.85

Analysed by Water Analysts

Checked by _____

Head, Central Geological Laboratory

[Signature]
 Tesfaye Lemma (Dr.)
 Head, Central Geological Laboratory



[Signature]
 Head Water Lab

ETHIOPIAN GEOLOGICAL SURVEY CENTRAL GEOLOGICAL LABORATORY
WATER LABORATORY
DATA CODING FOR MAJOR CONSTITUENTS

Dep./Proj. Originator *Geomatrix*

Approved by Head, CGL

Sample Type Water Source Area

Date Submitted 20/12/04

Chemical Constituents in ppm(mg/lit.)

Date completed ²⁴/01/05

Request No. 12685-2005PVT

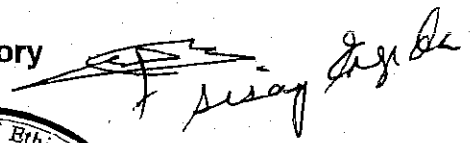
FIELD No.	Cond. CS-2	S.Wol. DW-53	S.Wol..DW-52	S.Wol. CS-9	S.Wol. DW-42	Wol.DW-40	Wag. DW-25	Wag. DW-26
LAB. No.	12695	12696	12697	12698	12699	12700	12701	12702
Chloride(Cl)	8	10	114	1	3	53	12	10
Sulphate(SO4)	7	6	46	-	4	19	10	15
Fluoride(F)	0.33	0.41	0.17	0.28	0.35	0.21	0.29	0.42
Nitrate(NO3)	23.04	5.32	177.2	19.94	14.18	93.03	20.38	33.23
Sodium(Na)	15	18	86	15	9	16	20	18
pH	7.32	7.88	7.61	7.67	7.43	7.02	7.27	7.71

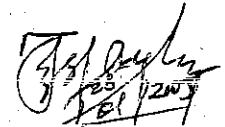
Analysed by Water Analysts

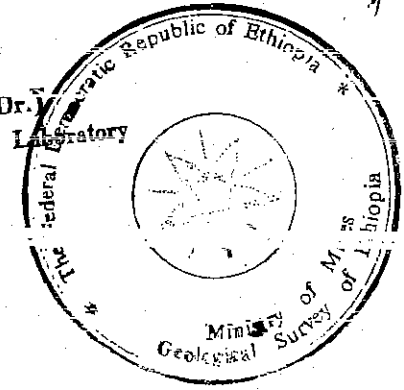
Checked by 

Head, Central Geological Laboratory

Head, Water Laboratory




Testaye Lemma (Dr.)
Head, Central Geological Laboratory



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ETHIOPIAN GEOLOGICAL SURVEY CENTRAL GEOLOGICAL LABORATORY
WATER LABORATORY
DATA CODING FOR MAJOR CONSTITUENTS

Dep./Proj. Originator *Geomatrix*

Approved by Head, CGL

Sample Type Water Source Area

Date Submitted 20/12/04

Chemical Constituents in ppm(mg/lit.)

Date completed 4/01/05

Request No. 12685-2005PVT

FIELD No.	N.Sh. DW-72	N.Sh. BH-10	N.W.DW-12	N.W.DW-32	N.W.DW-38	Or. DW-57	Or.DW-60	Or.DW-63	Gond. DW-16	Gond DW-10
LAB. No.	12685	12686	12687	12688	12689	12690	12691	12692	12693	12694
Chloride(Cl)	3	10	20	10	7	112	11	138	13	28
Sulphate(SO4)	7	12	8	3	10	195	13	44	14	13
Fluoride(F)	0.28	1.08	0.07	0.24	0.23	0.62	0.45	0.79	0.22	0.44
Nitrate(NO3)	13.29	10.08	42.09	28.8	11.96	46.52	3.1	20.82	50.95	24.62
Sodium(Na)	12	62	7.5	24	14	103	32	126	27	32
pH	7.86	7.68	6.64	7.69	7.72	7.58	7.22	7.36	7.23	7.23

Analysed by Water Analysts

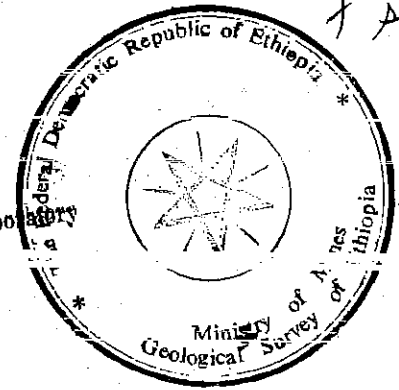
Checked by *[Signature]*

Head, Central Geological Laboratory

Head, Water Laboratory

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[Signature]
25/12/05
12/61
Teshaye Lemma (Dr.)
Head, Central Geological Laboratory



7.3 事業対象村落選定結果

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度		修正数量		記事
									(m)	SBH	DBH		
1	North Wollo	Gidan	Tetergh (03)	350	SBH	1	FFSH	WFB	60	1			
2	North Wollo	Gidan	Tingit	405	SBH	1	FFSH	WFB	60	1			
3	North Wollo	Gidan	Kebero Meda oll	1,225	DBH	1	FFSH	WFB	130		1		
4	North Wollo	Gubalftu	Shelle mender 09	1,050	DBH	1						Completed	
5	North Wollo	Gubalftu	Lengisa 010-Gdla mech	1,125	DBH	1						Completed	
6	North Wollo	Gubalftu	Adembulbulo 010	985	DBH	1						Completed	
7	North Wollo	Habru	Agamsa 027	1,090	DBH	1	C	WFB^	150		1		
8	North Wollo	Habru	Haro 027	1,135	DBH	1	C	WFB^	150		1		
9	North Wollo	Habru	Sekela 015	385	SBH	1	C	WFB^	80	1			
10	North Wollo	Habru	Meja adea 07	1,450	DBH	1	C	WFB^	150		1		
11	North Wollo	Habru	Sirinka Gerado 04	325	SBH	1	C	WFB^	80	1			
12	North Wollo	Habru	Jarota 07	1,500	DBH	1	C	WFB^	110		1		
13	North Wollo	Habru	Darimu 07	1,350	DBH	1	C	WFB^	150		1		
14	North Wollo	Habru	Abiyot Fire 07	1,650	DBH	1	C	WFB^	150		1		
15	North Wollo	Habru	Aware 09	2,500	DBH	1	C	WFB^	180		1		
16	North Wollo	Meket	Deferghe 023	390	SBH	1		WFB	70	1			
17	North Wollo	Habru	Fakit 034	310	SBH	1	FFSH	WFB	80	1			
18	North Wollo	Meket	Tajaabo 025	280	SBH	1	FFSH	WFB	70	1			
19	North Wollo	Meket	Enatguya 017	325	SBH	1	FFSH	WFB	70	1			
20	North Wollo	Habru	Kega Ber 029	415	SBH	1	FFSH	WFB^	80	1			
21	North Wollo	Habru	Koso Mender	295	SBH	1	FFSH	WFB^	90	1			
22	North Wollo	Meket	Derek Wenz+Nacha Feres 031	375	SBH	1	C	WFB	70				
23	North Wollo	Meket	Keynitu+Birafaf 032	255	SBH	1	FFSH	WFB	70				
24	North Wollo	Meket	Mekerecha+Zet Yibel 034	354	SBH	1	C	WFB	70				
25	South Wollo	Jama	Begide+Ibayu 09	1,500	DBH	1	C	WFB	150		1		
26	South Wollo	Kelela	Chellhele 03-Sembe	350	SBH	1	C	WFB	60	1			
27	South Wollo	Kelela	Yimere 01	250	SBH	1						NF	
28	South Wollo	Jama	Alley	500	SBH	1	C	WFB	70	2			
29	South Wollo	Jama	Laukubi & Tach kub 1	1,000	DBH	1	C	WFB	145		1		
30	South Wollo	Jama	Ejerti michael 012	750	SBH	2	C	WFB	70	3			
31	South Wollo	Jama	Gerbo, Hodere 017	1,050	DBH	1	C	WFB	90		1		
32	South Wollo	Jama	Goleisha 017	750	SBH	2	FFSH	WFB	60	3			

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度		修正数量		記事
									(m)	SBH	DBH		
33	South Wollo	Jama	Libanos 019	1,550	DBH	1	FFSH	WFB	130		1		
34	South Wollo	Jama	Gende Gulo 020	750	SBH	2	FFSH	WFB	60	3			
35	South Wollo	Worebabo	Kelkesha 015	1,250	DBH	1	C	SD	180		1		
36	South Wollo	Worebabo	Lhiftu 015	750	SBH	2	C	SD	80	3			
37	South Wollo	Worebabo	Gedida 014	1,000	DBH	1	FFSH	WFB	140		1		
38	South Wollo	Worebabo	Gubisa 05	250	SBH	1	FFSH	WFB	60	1			
39	South Wollo	Worebabo	Abo Gora 05	1,400	DBH	1	FFSH	WFB	150		1		
40	South Wollo	Worebabo	Korekon 05	500	SBH	2	FFSH	WFB	70	2			
41	South Gondar	Simada	Agewoch 010	750	SBH	1	FFSH	WFB	60	3			
42	South Gondar	Simada	Genta	250	SBH	1	C	WFB	50	1			
43	South Gondar	Simada	Mwerem 34	750	SBH	1	C	WFB	60	3			
44	South Gondar	Simada	Goref 04	150	SBH	1	C	WFB	60	1			
45	South Gondar	Simada	Menkelila	500	SBH	1	FFSH	WFB	60	2			
46	South Gondar	Simada	Agamwuha 05	500	SBH	1	C	WFB	50	2			
47	South Gondar	Simada	Chifchaf 06	500	SBH	1	FFSH	WFB	60	2			
48	South Gondar	Ibnat	Selamaya	1,250	DBH	1						Completed	
49	South Gondar	Ibnat	Wegere Selamaya	250	SBH	1						Completed	
50	South Gondar	Ibnat	Checheho Jimnaderega	750	SBH	2	C	WFB	60	3			
51	South Gondar	Ibnat	Minch Jimnaderega	250	SBH	1	C	WFB	60	1			
52	South Gondar	Ibnat	Awsheridi Jimnaderega	250	SBH	1	C	WFB	60	1			
53	South Gondar	Ibnat	Tinjut Ber	250	SBH	1	FFSH	WFB	60	1			
54	Oromiya	Bati	Garero 07	175	SBH	1	C	WFB^	80	1			
55	Oromiya	Bati	Alshayu+kersu	500	SBH	1						NF	
56	Oromiya	Bati	Tachignaw Lkgo	560	SBH	1	FFSH	WFB^	80	1			
57	Oromiya	Bati	Laygnaw Laygo, Kembere	600	SBH	2	FFSH	WFB^	80	2			
58	Oromiya	Bati	Selmani 014	1,000	DBH	1	C	WFB^	150		1		
59	North Shewa	Angolelanaa Sagirt	Ambel+Koso	455	SBH	1	FFSH	WFB	60	2			
60	North Shewa	Angolelanaa Sagirt	Werga	353	SBH	1	FFSH	WFB	60	1			
61	North Shewa	Angolelanaa Sagirt	Seriti	285	SBH	1	C	WFB	60	1			
62	North Shewa	Angolelanaa Sagirt	Liche Seriti Totose	300	SBH	1	C	WFB	60	1			
63	North Shewa	Angolelanaa Sagirt	Mongudo Cheke Zurya	325	SBH	1	C	WFB	60	1			
64	North Shewa	Angolelanaa Sagirt	Laftole aje Cheke	295	SBH	1	C	WFB	60	1			

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度		修正数量		記事
									(m)	SBH	DBH		
65	North Shewa	Angolelanaa Sagirt	Cheke Town	350	SBH	1							Completed
66	Waghimra	Sekota	Tsetsergi abanachiros	530	SBH	1							*
67	Waghimra	Sekota	Tsatsu Dire Tlku, Ugulo	600	SBH	2							*
68	Waghimra	Sekota	Bewshu 015	300	SBH	1	FFSH	WFB	60	1			
69	Waghimra	Sekota	Chilkiwolo 010	300	SBH	1	FFSH	WFB	60	1			
70	Waghimra	Sekota	Shimidir/Limat Kinatchora 012	350	SBH	1	FFSH	WFB	60	1			
71	Waghimra	Sekota	Dibaran 011	210	SBH	1							*
72	Waghimra	Sekota	Gela Kamiru Arquatia 011	700	SBH	2							*
73	Waghimra	Sekota	Dirinziba, Tasaskiw	750	SBH	2							*
74	Waghimra	Sekota	Nigunaleka 08	225	SBH	1	FFSH	WFB	60	1			
75	Waghimra	Sekota	Akjewshina 07	250	SBH	1							*
76	Waghimra	Sekota	Wellan and Chifte	150	SBH	1	FFSH	WFB	60	1			
77	Waghimra	Sekota	Testsergi, Abanachir 015	530	SBH	2	FFSH	WFB	60	2			
78	Waghimra	Sekota	Tsatsu, Dirc Tiku, Ugulo	600	SBH	2	FFSH	WFB	60	2			
79	Waghimra	Sekota	Shimhar Tiku 010	250	SBH	1	FFSH	WFB	60	1			
80	Waghimra	Sekota	Chilkiw 010 mizrib	300	SBH	1	FFSH	WFB	60	1			
81	Waghimra	Sekota	Shimidirla Limat Chora	350	SBH	1	C	WFB	60	1			
82	Waghimra	Sekota	Dibaran 011	210	SBH	1	FFSH	WFB	60	1			
83	Waghimra	Sekota	Gelakamiru Arquatiya	700	SBH	2	C	WFB	60	3			
84	Waghimra	Sekota	Dirinziba Tsaskiw, Sikuna	750	SBH	2	FFSH	WFB	60	3			
85	Waghimra	Sekota	Nigas Aleka 08	225	SBH	1	FFSH	WFB	60	1			
86	Waghimra	Sekota	Akejewshina 07	250	SBH	1	FFSH	WFB	60	1			
87	Waghimra	Dahana	Welkementa+kenubish	100	SBH	1	C	WFB	60	1			
88	North Shoa	Minjar Shenkora	Chelle geberel	1,500	DBH	1	C	SD	220		1		
89	North Shoa	Minjar Shenkora	Chome Ager	500	SBH	1	C	SD	80	2			
90	North Shoa	Minjar Shenkora	Biruk Ager	2,000	DBH	1	C	SD	240		1		
91	North Shoa	Minjar Shenkora	Alemneh Dire	1,750	DBH	1	C	SD	180		1		
92	North Shoa	Minjar Shenkora	Kiticha	1,250	DBH	1	C	SD	250		1		
93	North Shoa	Minjar Shenkora	Golegolecha	875	SBH	2	C	SD	80	3			
94	North Shoa	Minjar Shenkora	Wmaga	925	SBH	2	C	SD	80	3			
95	North Shoa	Minjar Shenkora	Kiki	625	SBH	2	C	SD	80	2			
96	North Shoa	Minjar Shenkora	Jejebakola	375	SBH	1	C	SD	80	1			

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度	修正数量		記事
									(m)	SBH	DBH	
97	North Shoa	Minjar Shenkora	Finanajo	575	SBH	2	C	SD	80	2		
98	North Shoa	Minjar Shenkora	Aroge Minjar	1,100	DBH	1	C	SD	240		1	
99	North Shoa	Minjar Shenkora	Zewelde	675	SBH	2	C	WFB^	55	2		
100	North Shoa	Tamaber	Argaga	600	DBH	1	C	WFB^	150		1	
101	South Wello	Harbu	Alimenta	750	SBH	2	C	WFB^	80	3		
102	South Wello	Harbu	Aderanba	1,000	DBH	1	FFSH	WFB^	160		1	
103	South Wello	Harbu	Meja	1,000	DBH	1	FFSH	WFB^	150		1	
104	South Wello	Harbu	Abunaye	1,000	DBH	1	FFSH	WFB^	160		1	
105	South Wello	Harbu	Wiensa	1,500	DBH	1	FFSH	WFB^	120		1	
106	South Wello	Kelela	Kersa 05	300	SBH	1	C	WFB	60	1		
107	South Wello	Kelela	Weda Golwn 030	700	SBH	2	FFSH	WFB	60	2		
108	South Wello	Kelela	Inchini 031	250	SBH	1	C	WFB	60	1		
109	South Wello	Kelela	Tika 034	750	SBH	2	FFSH	WFB	60	3		
110	South Wello	Kelela	Indoda 030	400	SBH	1	C	WFB	60	1		
111	South Wello	Kelela	Wedo Getu 036	1,240	DBH	1	C	WFB	120		1	
112	South Wello	Kelela	Kore/Fincheftu 037	500	SBH	1	FFSH	WFB	60	1		
113	South Wello	Kelela	GendeBorena 036	500	SBH	1	FFSH	WFB	60	1		
114	South Wello	Wegide	Yagi 014	300	SBH	1	FFSH	WFB	60	1		
115	South Wello	Wegide	Golele 09	1,000	DBH	1	FFSH	WFB	120		1	
116	South Wello	Wegide	Kutiso 03 Abey	1,250	DBH	1	C	WFB	140		1	
117	South Wello	Wegide	Bikili 04	800	SBH	2	C	WFB	60	3		
118	South Wello	Wegide	Ayele Anba Rufa 02,04	700	SBH	2	C	WFB	60	2		
119	South Wello	Wegide	Haleltu 07	400	SBH	1	C	WFB	60	1		
120	South Wello	Wegide	Yeshum	750	SBH	2	C	WFB	60	3		
121	South Wello	Meqdella	Ivelinta 02	300	SBH	1	FFSH	WFB	50	1		
122	South Wello	Meqdella	Yebar 013	300	SBH	1	FFSH	WFB	50	1		
123	South Wello	Meqdella	Tilket 02	350	SBH	1	FFSH	WFB	50	1		
124	South Wello	Meqdella	Genatit 02	300	SBH	1	FFSH	WFB	50	1		
125	South Wello	Meqdella	Tija Fej 06	250	SBH	1	FFSH	WFB	50	1		
126	South Wello	Meqdella	Felana 06	500	SBH	1	FFSH	WFB	50	1		
127	South Wello	Meqdella	Gonderoch	250	SBH	1	FFSH	WFB	50	1		
128	South Wollo	Meqdella	Meqdella	300	SBH	1	FFSH	WFB	50	1		

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度	修正数量		記事
									(m)	SBH	DBH	
129	South Wollo	Meqdella	Feterot+Ychikech	1,000	DBH	1	FFSH	WFB	120		1	
130	South Wollo	Meqdella	Dedere 05	200	SBH	1	FFSH	WFB	60	1		
131	South Wollo	Meqdella	Gose 05	500	SBH	1	FFSH	WFB	60	1		
132	South Gondar	Ibnat	Tilbi	250	SBH	1						NA
133	South Gondar	Ibnat	Kwalisa	1,000	DBH	1	C	WFB	140		1	
134	South Gondar	Ibnat	Work mender acbr aba Jale	250	SBH	1						NA
135	South Gondar	Ibnat	Wenber Ayhayakwha	250	SBH	1						NA
136	South Gondar	Libo Kemkem	Berengna Lentdur	350	SBH	1	FFSH	WFB^	80	1		
137	South Gondar	Libo Kemkem	Zanzi	300	SBH	1	FFSH	WFB^	80	1		
138	South Gondar	Libo Kemkem	Birwuha Ferfer	150	SBH	1	FFSH	WFB^	80	1		
139	South Gondar	Libo Kemkem	Nashora Ferfer	200	SBH	1	FFSH	WFB^	80	1		
140	South Gondar	Libo Kemkem	Ashker Terara	550	SBH	2	C	WFB^	80	2		
141	South Gondar	Libo Kemkem	Kurmat Ategecha	250	SBH	1	FFSH	WFB^	80	1		
142	South Gondar	Libo Kemkem	Atria agat Ashker	300	SBH	1	FFSH	WFB^	80	1		
143	South Gondar	Libo Kemkem	Sholit Kalsholit	750	SBH	2	FFSH	WFB^	80	2		
144	South Gondar	Libo Kemkem	Ambo Asawegan	300	SBH	1	FFSH	WFB^	80	1		
145	South Gondar	Libo Kemkem	Zelamin Janda	325	SBH	1	FFSH	WFB^	80	1		
146	South Gondar	Libo Kemkem	Kalaymedhanialem	1,750	DBH	1	C	WFB^	160		1	
147	South Gondar	Libo Kemkem	Arobakello 015	1,925	DBH	1	C	WFB^	140		1	
148	South Gondar	Libo Kemkem	Tirusina 015	1,000	DBH	1	FFSH	WFB^	160		1	
149	South Gondar	Libo Kemkem	Kille 012	500	SBH	1	FFSH	WFB^	70	2		
150	Oromiya	Artuma Fursi	Bete ordega Berbelay	1,200	DBH	1	C	WFB^	180		1	
151	Oromiya	Artuma Fursi	Bkavakello Beteordega	500	SBH	1	C	WFB^	70	1		
152	Oromiya	Artuma Fursi	Kersaadi+mutulu	1,000	DBH	1	C	WFB^	180		1	
153	Oromiya	Artuma Fursi	Kara Kodema+Lale Gela	700	SBH	2	FFSH	WFB^	80	2		
154	Oromiya	Artuma Fursi	Kodema Fugnu	1,500	DBH	1	C	WFB^	180		1	
155	Oromiya	Artuma Fursi	Ireti+Huda wello	500	SBH	1	FFSH	WFB^	80	1		
156	Oromiya	Artuma Fursi	Koro Rokesa Hader	662	SBH	2	FFSH	WFB^	80	2		
157	Oromiya	Bati	Hdow Barigo, Hadow	400	SBH	1	FFSH	WFB^	80	1		
158	Oromiya	Bati	Kuni 03	750	SBH	2	FFSH	WFB^	80	2		
159	Oromiya	Julle Tumuga	Fugan Dembi	750	SBH	2	C	WFB^	80	2		
160	Oromiya	Julle Tumuga	Gerbi kille	840	SBH	2	FFSH	WFB^	80	2		

事業対象村落選定結果

No	県	郡	村	人口	様式	数量	地下水 評価	地質	計画深度	修正数量		記事
									(m)	SBH	DBH	
161	Oromiya	Julle Tumuga	Gerbi kille	930	SBH	2	FFSH	WFB^	70	3		
162	Oromiya	Julle Tumuga	Merewa Hadere	1,100	DBH	1	C	WFB^	160		1	
163	Oromiya	Julle Tumuga	Guda Chelle	1,300	DBH	1	FFSH	WFB^	160		1	
164	Oromiya	Julle Tumuga	Balchi Tikure	450	SBH	1	FFSH	WFB^	80	1		
165	Oromiya	Julle Tumuga	Dula Chereka	640	SBH	2	FFSH	WFB^				NA
166	Oromiya	Julle Tumuga	Arba wayu	980	DBH	1	C	WFB^	160		1	
				110,044	SBH	156						
					DBH	44						
					Total	200				160	40	200

Note:

WFB: Stands for Weathered and Fractured Basalt

WFB^: Stands for Weathered and Fractured Basalt with thick soil cover

SD: Stands for thick soil deposit

FFSH: Stands for Found Feasible by its Surface Hydrogeological conditions

C: Stands for Conducted; Geophysical Survey is conducted in the areas indicated

NF: Stands for Not Feasible

NA: Stands for Not Accessible

Completed means water supply schemes are constructed in the areas in the past two years

Bold word: correction of miss-spelling and unseen error

*****: Duplicated location

: No proposed well

7.4 社会状況調査

社会状況調査

(1) 要請村落の特定

当初 166 村の 200 箇所における給水施設が要請された。州水資源局との聞き取りから、7つの郡（ギダン、マクダラ、シマダ、イブナット、セコタ、ダハナ、タマベル郡）でユニセフとの重複が認められた。原則、村での重複は今後ないとのことであったが、要請リストが作成されてから約2年の時間の経緯もあるので、村毎で重複があるかどうか確認する必要があった。また現地調査開始直後、①2～3時間徒歩でしかアクセスが出来ない村、すなわち、井戸工事車両の搬入が不可能となる村が9村、特に湧水開発で、予定していた水源の水量不足などで水源の問題で困難となった3村、②井戸がすでに建設されていた村、郡の判断で変更された村などが確認された。これらに対して、原則減少した施設数を同じ郡のすでにリストに載っているほかの村に振り分けるなどの作業を行ったため、村および集落の特定に長い時間を要する結果となった。

最終的に要請をまとめてみると、以下の表1のように、145村の需要予測人口総計約9万4千人に対して、手動ポンプ付き浅井戸と水中モーターポンプを設置した深井戸を建設する内容として整理された。

表1 対象村落要約表

県名	郡名	村の数	給水裨益人口
北ウオロ	ギダン	3村	1,925
	ハブル	12村	12,305
	メケト	3村	995
	グバルフ*1	-	0
南ウオロ	ジャマ	8村	7,850
	カララ	9村	4,640
	ウォレバブ	6村	5,150
	ワジドゥ	7村	5,200
	マクダラ	11村	3,950
	ハルブ	5村	5,250
南ゴンダール	シマダ	7村	3,400
	イブナット	5村	2,500
	ルボカムカム	14村	5,225
オロミア	バティ	6村	3,050
	アルトゥマ・フルシ	7村	5,912
	ジュレ・トウムカ	7村	6,350
北シヨア	アソグレナ・サケリット	6村	2,010
	ミンジャル・シェンコラ	12村	12,150
	タマベル	1村	600
ワグヒムラ	セコタ	15村	5,490
	ダハナ	1村	100
6県	21郡	145村	94,102

注：*1は3村の要請があったが全ての村で既存施設が確認されたため対象村落数は無い。

以上、グバルフ郡を除く20郡の郡事務所、145村の村長ならびに女性代表・青年代表を含む村役、さらには、具体的に要請をしている最終受益者である集落代表に対して、質問票を活用して聞き取り調査を実施した。以下、その調査結果を概括する。

(2) 社会調査の目的

社会調査は、以下のふたつの目的から、実施された。

- ① 給水施設の建設の要請のあった村の給水現状と社会経済状況を把握すること。
- ② 要請のあった村の給水施設を自主的に維持管理する準備度を把握すること。

(3) 社会調査の期間

2004年10月25日から11月30日

(4) 社会調査の方法

20郡の郡事務所、**145村**の村長ならびに女性代表・青年代表を含む村役、さらには、具体的に要請をしている最終受益者である集落代表に対して、質問票を活用して聞き取り調査を実施した。

(5) 主な社会状況調査結果

1) 調査集落数

145村の全村から聞き取り調査を実施した。ただし聞き取り集落数となると、148村に200の給水施設が要請されているが、その内171の要請集落から聞き取り調査を行うに留まった。郡ごとに、さらには、村ごとに状況に地域的な相違があるが、主な現況と意向調査の結果を以下に示す。

2) 既存の給水施設率

171集落の聞き取りから、39%の集落で給水施設が過去に存在したか、あるいは、現在も存在していることが確認された。13の給水施設を除いて、給水施設が遠距離に位置して不便であること、水因性の疾患が発生しているという問題がある。また、13の給水施設が機能しているが、同一村内ではあるが、要請のあった集落とは別の集落に位置している。

3) 村の開発事業への共同行動の度合い

74.8%の村で学校委員会、65.5%の村で保健委員会、8.2%の村でHIV/AIDS委員会が存在している。また、17%が給水委員会を組織した経験があることが明らかになった。MDGsの中で学校の存在が、平均で70%を超えることを考えると、要請のあった村は平均的に位置づけられる村といえる。

なお、村の開発事業に対して、村民の労務提供・現金供与などの参加の有無に関しては、全ての村

でなんらかの参加を経験していることが明らかになった。もっとも、7つの郡の村では、労務提供を100%参加して行った経験がなく、特に、アンゴレーナ・サグリット郡の供与率は15%を切る低いものであることが分かった。比較的、参加の低い郡はほかにバテイ、メケト、ワジドウ、ジュレトムガ、マクダレの各郡である。

また、現金の寄付に関しては、最低で1世帯あたり50セントの寄付、最高ではギダン郡では50,000ブルの現金供与の経験があり発電機を購入する資金に当てた経験がある。26%の村が何らかの形の現金供与での参加経験がある。労務提供による共同作業としては、学校の建設、農民研修所の建設、村役場の建設、テラス造りなどの土壌保全事業の経験がある。

要請している給水事業が認可された際には、全ての村で労務提供ならびに資材提供の用意があるとの村役場の表明があった。

4) 主な既存の水源

現在どのような水源を利用しているのかについては次の表2のような結果をみた。

表2 既存の水源別利用率

既存の水源	雨季	乾季
川	42 %	43 %
池	12 %	6 %
湧水	34 %	35 %
簡易保全された湧水	5 %	8 %
近隣にある浅井戸	1 %	2 %
手動ポンプ式井戸	5 %	5 %
その他	1 %	1 %

既存の水源の水質に対する意向については以下の表3のようである。雨季・乾季とも、いずれも75%以上の住民が、水質がよくないと答えており、衛生水の確保の意向の高さが示されている。

表3 既存の水源の水質

既存の水源	雨季	乾季
よい水質	15.8 %	13.5 %
がまんできる水質	7.6 %	11.1 %
よくない	76.6 %	75.4 %

世帯当りの生活用水の消費量については、1世帯あたり1日の平均消費量は68リットル程度であり、40リットルがもっとも頻繁にあるケースと判断された。なお、水質と病気との因果関係の認識は、男性で54%、女性で37%が何らかの形で認識しているに留まっている。逆に、男性で4.5%、女性で3.9%が、因果関係のあることを知らないとの結果になった。また全ての村で、水汲労働は女性の労働分担任であり、女性が病気もしくは身重の時以外、男性の家族成員が水汲労働に関与することはない。

5) 水料金の支払い意思

全ての村で原則的に、水料金の支払い意思があることが確認された。郡の段階での住民による水道料金の支払い経験としては、固定料金制が12.8%の村で経験されている。なお、使用量比例料金は一般ではない。固定料金制の場合では、1世帯1ヶ月に0.5ブルが最も多い。仮に、使用量比例料

金が導入されたと仮定した場合、住民の意向としては、ジェリカン 1 缶に対して、5 セントが最も多い傾向が判明した。

表 4 消費比例式料金にみられる単位あたりの料金額の住民の意向

ワラダ	投票数				計
	無料	0.05	0.10	0.25	
ギダン	0	35	0	0	35
ハブル	0	107	0	0	107
メケト	n.a.	n.a.	n.a.	n.a.	n.a.
ジャマ	0	124	0	0	124
カララ	15	65	57	0	137
ウォレバブ	0	70	0	0	70
ワジドゥ	42	75	12	0	129
アクダラ	4	81	82	0	167
シダマ	0	48	12	0	60
イビナット	28	91	2	0	121
ルボカムカム	80	101	0	0	181
バティ	0	133	0	0	133
アルトゥマ・フルシ	n.a.	n.a.	n.a.	n.a.	n.a.
ジュレ・トゥムガ	n.a.	n.a.	n.a.	n.a.	n.a.
アンゴレーナ・サグリト	0	9	0	0	9
ミンジャル・シェンコラ	85	161	185	91	522
タマベル	0	30	0	0	30
セコタ	10	85	0	6	101
ダハナ	15	0	0	0	15
計	279	1215	350	97	1,941
割合(%)	14	63	18	5	100

もっとも頻度の多い給水消費傾向が 1 世帯あたり 1 日 20 リットルであり、20 リットルあたりの価格を最も希望が多い 5 セントとすると、単純計算から 1 ヶ月当り 1 世帯、1 ブル 50 セントとなり固定料金制と同様な傾向を示していることになる。水道料金を支払う根拠としての費用という考え方についての理解度は、聞き取り調査の結果は以下の表 5 の通り。

表 5 維持管理費の理解度

費用種別	知っている		知らない	
	男性	女性	男性	女性
維持管理費用	94 %	88 %	6 %	12 %
改修費用	93 %	89 %	7 %	11 %
更新費用	89 %	84 %	11 %	16 %

なお、維持管理費用と改修費用が住民負担であることの認識は、一般に高いと思われるが、支払う準備があるかとの問いには、殆どが準備が整っていないとの回答であった。

6) 支払い能力

対象ワラダにおいて、既に敷設された給水施設では、固定料金制と使用比例料金制のふたつの料金制度があることが確認されている。その支払い実績を表 6 と表 7 に示した。

表 6 固定料金制度の支払い実績

1世帯あたりの月額固定料金 (単位ブル)	ワラダ別・固定料金制を採用した給水委員会組合数									料金別水利組合数
	キダン	ジヤマ	カララ	ウオレハブ	ワシトウ	シマダ	イブナット	ルホカムカム	セコタ	
0.10							1			1
0.25									1	1
0.30					2					2
0.50		3	1				2	2	2	10
1.25					1					1
1.50	1									1
2.00					1					1
3.00				1		1				2
3.25					1					1
計	1	3	1	1	5	1	3	2	3	20

固定料金制度では、数少ないサンプル数であるが、月額1世帯あたり0.5ブルが50%を占め、この程度の支払い能力は可能である。

表 7 消費比例式料金制度の支払い実績

ジェリカン (20l) あたりの料金	ワラダ別・固定料金制を採用した給水委員会組合数			料金別水利組合数
	ハブル	ジヤマ	ミンジャル・シェンコラ	
0.20			3	3
0.40	2			2
0.50		1		1
計	2	1	3	6

一方、消費比例式料金では、もとも多いのは20リットルあたり20セントの料金が殆どであり、支払い能力の目安として把握できる。

給水委員会の支出構造は、概ね3つに分類される。(1) 日常の操作費、(2) 修理などの維持費、(3) ポンプの更新費であるが、エチオピアの給水行政政策では、村落給水の場合は、更新費の利用者負担は義務付けがない。ハンドポンプの場合、日常の操作費の主要な出費は、管理人の給与であり、平均で100ブル程度である。この支払い形態は、給水委員会によってまちまちである。現金として支出せず、村が農作物の現物で支給したり、支給できる現金と現物支給あるいは耕作地の配分を組み合わせてたりする場合が多い。このこれに文房具費などが加わる。修理費に関する統計はないものの、隣接するオロミア州で維持費についての考察がなされ、投資額の約3%を年額に積み上げることが示唆されている。

7) 維持管理に向けての組織化の意向

維持管理に向けての組織化の意向を以下の表8に示す。

表 8 維持管理に向けての組織化の意向

維持管理に向けての住民の意向動向	組織する意向		参加意思	
	男性	女性	男性	女性
	99 %	98 %	92 %	80 %

以上であるが、社会主義時代に農協の強制的に動員された苦い経験があるので、依然、農民が組織化することに対して抵抗感情があるのも事実である。

8) アクセスならびに給水施設の土地の準備度からみた現況

アクセスならびに給水施設用の土地の準備度、さらには、予定給水点と集落との関係から、以下の表9のような結果をみている。

表9 給水施設へのアクセス

類別	割合
(1) アクセスも土地の準備度も問題ない	52 %
(2) 土地の準備度が不十分で、予定給水点と集落の距離が徒歩で往復 20 分以内	29 %
(3) アクセスが悪くなく住民による道路建設が必要で、予定給水点と集落の距離が往復 20 分から 40 分ほどかかることが予測される地域	11 %
(4) アクセスが悪くなく比較的長い道路の建設が必要な上、予定給水点と集落の距離が往復 40 分を超えると予測される地域	8 %

以上の相違に考慮した実施スケジュールの戦略を策定することが求められる。

(6) ワラダ別裨益効果

本案件が実施された場合のワラダ別裨益効果について、表 10 に示した。

全国給水マスタープランの基礎データを活用すると、工事完了を予定している 2009 年度の給水率を、事業を実施した場合としなかった場合を比較してみると、2.58%の給水率増加に資する。同時に、アムハラ州全体からみると、0.56%給水率増大に資する。

また、給水設計年である 2014 まで 3 年間と同じペースで、供与する機材が井戸を 5 年間に掘削すると仮定した場合、新たに 15 万 7 千人が衛生水のアクセスが可能となる試算である。この場合、対象の 20 ワラダでは、6.11%の向上、アムハラ州全体の 1.23%の給水率の向上に資することになる。表 10 を参照願いたい。

表 10 アムハラ州 裨益効果

県名	郡名	人口				給水人口			増加給水人口		給水率				給水率増加			
		2004 ^{*2}	2009 ^{*4}	2014 ^{*4}	2004 ^{*2}	W/O-P		W-P		2009 ^{*3}	2014	2000 ^{*2}	W/O-P		W-P		(points)	
						2009/2014	2009 ^{*3}	2014	2009				2014	2009	2014	2009	2014	
		a	b	c	d	e=d	f=e+h	g=e+i	h	i	j=d/a	k=e/b	l=e/c	m=f/b	n=g/c	o=m-k	p=n-l	
北ウオロ	ギダン	163,699	185,844	210,984	46,982	46,982	48,907		1,925		28.7%	25.3%		26.3%			1.04	
	ハプル	212,183	240,886	273,473	48,654	48,654	60,959		12,305		22.9%	20.2%		25.31%			5.11	
	メケト	236,790	268,822	305,188	53,396	53,396	54,391		995		22.6%	19.9%		20.23%			0.37	
	グバルフ*1																	0.00
南ウオロ	シヤマ	127,931	145,237	164,884	29,590	29,590	37,440		7,850		23.1%	20.4%		25.78%			5.40	
	カララ	144,063	163,551	185,676	22,546	22,546	27,186		4,640		15.7%	13.8%		16.62%			2.84	
	ウォレバブ	113,003	128,290	145,644	30,872	30,872	36,022		5,150		27.3%	24.1%		28.08%			4.01	
	ワジドゥ	131,618	149,423	169,636	27,508	27,508	32,708		5,200		20.9%	18.4%		21.89%			3.48	
	マクダラ	148,417	168,494	191,288	17,988	17,988	21,938		3,950		12.1%	10.7%		13.02%			2.34	
	ハルブ	232,534	263,990	299,702	59,343	59,343	64,593		5,250		25.5%	22.5%		24.47%			1.99	
南ゴンダール	シマダ	260,152	295,345	335,298	49,143	49,143	52,543		3,400		18.9%	16.6%		17.79%			1.15	
	イブナット	244,445	277,513	315,054	45,027	45,027	47,527		2,500		18.4%	16.2%		17.13%			0.90	
	麻 加カム	196,813	223,437	253,663	39,363	39,363	44,588		5,225		20.0%	17.6%		19.96%			2.34	
オロミア	バティ	136,626	155,108	176,091	23,049	23,049	26,099		3,050		16.9%	14.9%		16.83%			1.97	
	アムラフ	112,215	127,395	144,629	16,148	16,148	22,060		5,912		14.4%	12.7%		17.32%			4.64	
	ジュレトム	93,748	106,430	120,827	19,968	19,968	26,318		6,350		21.3%	18.8%		24.73%			5.97	
北ショア	アコレーナ・サガリット	90,907	103,205	117,166	14,991	14,991	17,001		2,010		16.5%	14.5%		16.47%			1.95	
	ミジヤル・シエンコラ	136,342	154,786	175,725	29,613	29,613	41,763		12,150		21.7%	19.1%		26.98%			7.85	
	タマベル	101,154	114,838	130,373	17,358	17,358	17,958		600		17.2%	15.1%		15.64%			0.52	
ワグヒムラ	セコタ	174,752	198,392	225,230	13,211	13,211	18,701		5,490		7.6%	6.7%		9.43%			2.77	
	ダハナ	131,667	149,478	169,699	28,177	28,177	28,277		100		21.4%	18.9%		18.92%			0.07	
	対象21郡	3,189,059	3,620,465	4,110,230	632,926	632,926	726,978	883,926	94,052	251,000	19.8%	17.5%	15.4%	20.08%	21.51%			2.58
	アムハラ州 ^{*2}	16,176,346	18,364,631	20,848,940	2,799,767	2,799,767	2,893,819	3,050,767	94,052	251,000	17.3%	15.2%	13.4%	15.76%	14.63%			0.56

注：

*1 は3村の要請があったが全ての村で既存施設が確認されたため、対象村落数はなくなった。

*2 Population(2004) from the Water Bureau, Amhara

*3 Estimation by the Water Bureau, Amhara; reviewed by the Team

*4 Population growth rate: 2.57%

・2009年: 計画200本完成予定年; 2014年: 本計画目標年次

・2009年裨益人口: 本BD聞き取り調査等による。

・2009年まで供与機材を使用して3年間で94,000人の裨益人口増加。その後2014年までの6年間で94,000x2の裨益人口増加を見込む(=2014年で282,000の増加給水人口)

*W-P: With project

*W/O-P: Without project

7.5 エチオピア国飲料水水質基準

THE FEDERAL DEMOCRATIC REPUBLIC OF **ETHIOPIA**
MINISTRY OF WATER RESOURCES

**SPECIFICATION FOR
ETHIOPIAN DRINKING WATER
QUALITY GUIDELINES**

*September 2002
Addis Ababa*

PREFACE

The development of tailor made national water quality guideline is necessary to promote and protect the public health, prevent and control diseases as well as to address the water quality concerns of the country. This guideline is developed on the basis of latest publications of WHO Guidelines for Drinking Water Quality Volumes- 1, 2, 3 and Addendum of volume-1 and taking into consideration a variety of local factors such as geographical, socio-economic and environmental conditions.

It is believed that this guideline is used as Ethiopian Drinking Water Quality Guideline encompassing recommendations for water quality requirement that will be fit for human consumption and other domestic purposes as well as water quality monitoring.

This guideline is dynamic and has to be improved and updated with new findings and developments in the field. Therefore, constructive comments and suggestions are always welcome.

1.0 SCOPE

This tailor made guideline value, developed on the principles of risk-benefit approach or acceptable risk, represents the concentration of the constituents that does not result in any significant risk to the health of the consumer over the Ethiopian lifetime of consumption.

2.0 APPLICATION

This guideline applies to microbiological, physical, chemical, radiological quality of drinking water. It is relevant to all domestic water uses such as drinking, food preparation and personal hygiene.

3.0 REQUIREMENTS

The basic quality requirements for drinking water are illustrated as follows: -

- 3.1 The drinking water shall be free from any diseases causing pathogenic organisms and concentration of toxic chemical compounds that have adverse effect on human health (as prescribed in **Tables-1, 2 and 5**).
- 3.2 The drinking water shall be fairly clear (i.e., of low turbidity and color) and contain no compounds that cause offensive taste and odor and free of substances and organisms that cause corrosion or encrustation of water supply system as presented in **Table-3**.
- 3.3 When the guideline values are exceeded, it should only be a signal to investigate and take remedial action. Short-term exposure, however, does not necessarily mean that the water is unsuitable for consumption. The amount by which, and the period for which, the guideline value can be exceeded without affecting public health depends upon the specific substance involved and its concentration.

A continuous effort should be made to maintain drinking water quality at the highest possible level. Although the guideline value recommends the quality of water acceptable for consumption, it does not imply that the quality of drinking water should be degraded to the recommended level.

All desirable parameters and substances should be examined whenever a doubt arises. When a new water supply source develops it has to be examined before any supply.

In order to keep the uniformity of measurement results units of microbiological quality, physical parameters, chemical constituents and radioactive substances should be the same as presented in **Tables-1, 2,3,4 and 5**.

Table-1 Bacteriological Quality

No.	Substance	Guideline Value (G _N)	Remark
A	Treated Water Entering the Distribution System		
1	<i>E.coli</i> or thermo tolerant Coliform bacteria	0/100 ml	Membrane filtration is recommended for low turbid water
2	Total Coliform Bacteria	0/100 ml	93.0 % of samples examined throughout the year
B	Treated Water In the Distribution System		
1	<i>E.coli</i> or thermo tolerant Coliform bacteria	0/100 ml	Membrane filtration is recommended for low turbid water
2	Total Coliform Bacteria	0/100 ml	93.0 % of samples examined throughout the year

Table-2 Chemicals of Health Significance

No.	Substance	Guideline (G _N) (mg/l)	Remark (Health Effect)
A Inorganic Constituents			
1	Arsenic	0.01 (P)	High incidence of skin & possibly other cancers
2	Barium	1.8	Increase blood pressure & suspect of cardiovascular diseases
3	Boron	0.3	Long-term exposure leads to gastrointestinal irritation
4	Cadmium	0.003	Kidney is the main target organ of toxicity
5	Chromium	0.10	Carcinogenicity suspect of chromium (VI) compounds
6	Copper	5	Acute gastric irritation & liver cirrhosis from long-term exposure
7	Cyanide	0.07	Acute toxicity is high. Effects on thyroid & particularly the nervous system on long-term exposure occurred.
8	Fluoride	3.0	At low conc. prevent dental carries. At high conc. increase risk of dental fluorosis, & much higher conc. leads to skeletal fluorosis.
9	Lead	0.02	Toxic to both the central & peripheral nervous systems, including subencephalopathic neurological effects.
10	Manganese	0.8	Neurotoxicity and other toxic effects
11	Mercury (total)	0.001	The kidney is the main target for inorganic Hg, whereas methyl-mercury affects mainly the central nervous system.
12	Nitrate (as NO ₃ ⁻)	50	Causes methaemoglobinaemia in infants and suspect of certain form of cancer risk
13	Nitrite (as NO ₂ ⁻)	6.0	” ” ” ”
14	Selenium	0.01	Long-term exposure cause toxic effect on nails, hairs and liver.
B Organic Constituents			
B1	Aromatic hydrocarbons	(µg/l)	
1	Benzene	10	Acute exposure at high conc. affects the central nervous system. At lower conc. it is toxic to haematopoietic system. Carcinogenic to humans (Group-1)
2	Benzo[a]pyrene	0.7	It causes cancer and induces tumors at the site of administration.
B2	Chlorinated alkanes		
1	Carbon tetrachloride	2	Possibly carcinogenic to humans (Group-2B)
2	1,2-dichloroethane	30	Possibly carcinogenic to humans (Group-2B)
B3	Chlorinated ethenes		
1	1,1-Dichloroethene	30	Potentially carcinogenic (Group-3)
2	Trichloroethene	70(P)	Potentially carcinogenic (Group-3)
3	Tetrachloroethene	40	Possibly carcinogenic to humans (Group-2B)

Table-2 (Cont.)

No.	Substance	Guideline (G _N) (mg/l)	Remark (Health Effect)
C Pesticides			
		(μ g/l)	Remark (Health Effect)
1	DDT	2	Possibly carcinogenic to humans (Group-2B)
2	Aldrine/Deldrine	0.03	Potentially carcinogenic (Group-3)
3	Chlordane	0.2	Possibly carcinogenic to humans (Group-2B)
4	Pentachlorophenols	9 (P)	Potentially carcinogenic to lab animals.
5	2,4-D	30	Possibly carcinogenic to humans (Group-2B)
D Disinfectant & Disinfectant By-products			
D1	Disinfectant	(mg/l)	Remark (Health Effect)
1	Chlorine	5	<ul style="list-style-type: none"> For effective chlorination, free residual chlorine 0.5 mg/l after 30 min of contact time & pH<8 Potentially carcinogenic (Group-3)
D2	Disinfectant By-products	(μ g/l)	
D2.1	Chlorophenol		
1	2,4,6-Trichlorophenol	200	Possibly carcinogenic to humans (Group-2B)
D2.2	trihalomethane		
1	Chloroform	200	Possibly carcinogenic to humans (Group-2B)

• P - Provisional guideline value (see WHO, Vol-1, p178)

• Group - is the IARC classification (see WHO, Vol-1, p35)

• The sum of the ratio of the concentration of (NO₃ & NO₂ to its respective guideline values should not exceed 1.

Table-3 Substances and Parameters that may Give Rise to Complaints from Consumers

No.	Substance	Guideline Value (G _N) (mg/l)	Remark (Adverse Effect)
A Physical Parameters			
1	True Color	22	Unpleasing appearance
2	Odor	Non-Objectionable	Unappealing to drink
3	Test	Non-Objectionable	Unappealing to drink
4	Temperature	Non-Objectionable	High temperature may enhance growth of micro organisms & may increase test, odor, color & corrosion
5	Turbidity	7	Stimulate after growth & cause objectionable appearance
B Inorganic Constituents			
1	Aluminum	0.4	Deposition of aluminum hydroxide flocks in pipes & exacerbation of discoloration of water by iron
2	Ammonia	2	Objectionable odor
3	Chloride	533	Undesirable taste
4	Copper	2	Increase corrosion of GI & steel fittings, staining laundry & sanitary ware and give rise taste problem.
5	Hardness	392*	Based on 300 as Reference WHO recommendation
6	Hydrogen Sulfide	0.07	Objectionable rotten egg odour
7	Iron	0.4	Cause reddish-brown color, promote iron-bacteria & stain laundry & plumbing fixtures
8	Manganese	0.13	Stain laundry & plumbing fixtures and give rise to undesirable taste to beverages. Deposited as black precipitate in pipes. Certain micro organisms concentrate to give taste, odor, & turbidity problem.
9	Dissolved Oxygen	-	Low DO encourage for anaerobic reaction & formation of NO ₂ , H ₂ S giving rise to odor. It also increase Fe(II).
10	pH	6.5 – 8.5	High pH imparts taste & soapy feel, while low pH cause corrosion. Preferably <8.0 for effective disinfection
11	Sodium	358	Undesirable taste
12	Sulfate	483	Causes noticeable taste & corrosion of pipes
13	TDS	1776	Undesirable taste
14	Zinc	6	Imparts astringent taste & opalescent and develop a greasy film on boiling.
B Disinfectants & Disinfectant by-products			
	Disinfectants	(µg/l)	
1	Chlorine	600 – 1000	Taste and odour problem

* There is no as such any Guideline figure set by WHO. However the maximum recommended value of 300 is taken for calculation.

Table-4 Chemicals not of Health Significance at Concentration Normally Found in Drinking Water

No.	Substance	Guideline Value (G _N)	Remark
1	Asbestos		U
2	Silver		U
3	Tin		U

U – It is unnecessary to recommend a health-based guideline value, because they are not hazardous to human health at concentrations normally found in drinking water.

Table-5 Radioactive Constituents of Drinking Water

No.	Substance	Screening Value (Bq/litre)	Remark (Health Effect)
1	Gross alpha activity	0.1	<ul style="list-style-type: none"> If a screening value exceeded, more detail radionuclide analysis is necessary. WHO & other countries' is the same value. The main concern is Cancer
2	Gross beta activity	1	

4.0 SAMPLING TECHNIQUE

The detail procedure for preservation and handling of samples is presented in WHO, Vol-3 chapter-4 and ISO Water- Sampling- Part 3: Reference No. 5667-3:1994(E).

4.1 General Requirement For Bacteriological Sampling

Sampling for bacteriological examination should be carried out using sterile container of glass or polyethylene. Samples should be preserved under low temperature of 2 to 5 °C during storage and transport. The time between sampling and analysis should not exceed 6 hours, and 24 hours is considered the absolute maximum. If ice is not available, the transport time must not exceed 2 hours.

The bacteriological test should be accompanied with turbidity and free residual chlorine and pH where chlorination is applied. The minimum recommended frequency of sampling and analysis for on spot and piped distribution water supply schemes are given in Table-6 and Table-7 respectively.

Table-6 Minimum Frequency of Sampling and Analysis of On-spot Distribution Water Schemes

Sources & Mode of supply	Minimum frequency of sampling & Analysis		Remarks
	Bacteriological	Physico-chemical	
HDW & shallow well with HP	Sanitary protection Bacteriological test only if situation demands	Once initially, thereafter as situation demands	The situation requiring testing are change in environmental conditions, outbreak of water born diseases, or increase in incidents of water born diseases
BH-with HP	Once initially, thereafter as situation demands	Once initially, thereafter as situation demands	Ditto
Protected spring	Once initially, thereafter as situation demands	Periodically for residual chlorine if water is chlorinated	Ditto

BH = Borehole, HDW = Hand-dug-well, HP = Hand-pump

Table-7 Minimum Sample Numbers for Piped Drinking Water in the Distribution System

Group	Pop served	No of Annual samples
1	<5000	2
2	5000-100,000	(Pop/5000) x 6
3	>100,000	(Pop/ 10,000) + 120

4.2 General Requirement for Physico-Chemical Sampling

In general samples for physico-chemical analysis are recommended to be stored in a clean glass or polyethylene bottles at a low temperature in the dark (see **Table-8**). It is essential that the container should not be a cause of contamination and absorb or adsorb the constituents to be determined.

Table-8 Allocation of Physico-chemical Parameters (of interest) to the Type of Preservation

No.	Preservation by	Suitable for	Not Suitable for	Remarks
1	Acidification to pH<2	Alkali metals Aluminum Ammonia Arsenic Alkali earth metal Nitrate Total hardness Phosphorus, total Heavy metal	Cyanide Sulfides Carbonates, bicarbonates, CO2 Nitrites	Don't use sulfuric acid for Calcium and lead. Don't use hydrochloric acid for silver, lead and mercury. Don't use nitric acid for tin.
2	Cooling to 2°C to 5°C	Alkalinity Ammonia Conductivity Nitrate Nitrite Odour Orthophosphates Sulfates Total residue		

Every newly developed source has to be tested for full physico-chemical analysis before any service. Then after, the sampling for piped system should be carried out in such a way that one sample should be taken every two years for ground water sources such as borehole, shallow-tube-well and spring.

Surface water intended for water supply source should be sampled at least 6 times per year per site to detect the maximum and minimum concentration of interest. Then after two full physico-chemical analyses per year is recommended.

In all water sources when situation demands testing should be done for important parameters. These special situations are change in environmental condition, outbreak of water born diseases or increase of water born diseases.

4.3 Identification and Records

The source of the sample and the conditions under which it was collected should be recorded and attached to the bottle immediately after filling. At least the following information should be included with the sample (See **Figure-1**).

Figure-1 Suggested Form to Accompany Water Samples

Water-quality monitoring program		
SAMPLING DATA		
1	Region	
2	Zone	
3	Wereda	
4	Town/Village	
5	Sampling site	
6	Source	
7	Nature of sample (Treated or non-treated)	
8	Residual chlorine	
9	Date of sampling	
10	Time of sampling	
11	Sampled by (Organization)	

5.0 TESTING METHODS

The following test methods are selected mainly from ISO (International Organization for Standardization), based on WHO recommendation, to serve as reference test methods, in which every water quality laboratory in the country should develop towards it (see Table-9 to Table-13). International Organization for Standardization (ISO) is a worldwide federation of national standards bodies (ISO member bodies).

Table-9 Bacteriological Quality of Drinking Water

1	SUBSTANCE	REFERENCE	TEST METHOD
1	<i>E.coli</i> or thermo tolerant Coliform bacteria	ISO 9308-1:1990 or ISO 9308-2:1990	Determination & enumeration of coliform organisms, thermo-tolerant <i>coliform</i> organisms and presumptive <i>escherchia coli</i> – Part 1: Membrane filtration method Determination & enumeration of coliform organisms, thermo-tolerant <i>coliform</i> organisms and presumptive <i>escherchia coli</i> – Part 2: Multiple Tube (MPN) method
2	Total Coliform bacteria	ISO 9308-1:1990 or ISO 9308-2:1990	Determination & enumeration of coliform organisms, thermo-tolerant <i>coliform</i> organisms and presumptive <i>escherchia coli</i> – Part 1: Membrane filtration method Determination & enumeration of coliform organisms, thermo-tolerant <i>coliform</i> organisms and presumptive <i>escherchia coli</i> – Part 2: Multiple Tube (MPN) method

- Membrane filtration is recommended for low turbidity water

Table-10 Substances and Parameters that May Give Rise to Complaints from Consumers

1	SUBSTANCE	REFERENCE	TEST METHOD
A	Physical Parameters		
1	True Color	ISO 7887:1984(E)	Examination and Determination of Color
2	Odor	WHO, Vol-2, p358	Panel evaluation
3	Test	WHO, Vol-2, p358	Panel evaluation
4	Turbidity	ISO 7027:1990(E)	Determination of Turbidity
B	Inorganic constituents		
1	Aluminum	ISO 12020:1997(E)	Determination of Aluminum AAS method
2	Ammonia	ISO 7150-2:1986(E)	Determination of Ammonium Part2: Automated spectrophotometric method
3	Chloride	ISO 9297:1989(E)	Determination of Chloride – silver nitrate titration with chromate indicator (Mohr's method)
4	Copper	ISO 8280:1986(E)	Flam Absorption Spectrophotometric method
5	Hardness	ISO 6059:1984	Determination of the sum of calcium and magnesium - EDTA titrimetric method
6	Hydrogen Sulfide	WHO, Vol-2, p243	Methylene blue colorimetric method
7	Iron	ISO 6332:1988(E)	Determination of Iron - Spectrometric Method using 1,10-phenanthroline
8	Manganese	ISO 6333:1986(E)	Determination of Manganese Formaldoxime spectrometric method
9	DO	WHO, Vol-2, p324	Electrochemical probe or dissolved oxygen meter
10	pH	ISO 10523:1990(E)	Determination of pH
11	Sodium	ISO 9964-3: 1993(E)	Determination of Sodium and potassium by flam emission spectrophotometry
12	Sulfate	ISO 9280:1990(E)	Gravimetric method
13	TDS	WHO, Vol-2, p367	Conductivity probe
14	Zinc	ISO 8288:1986(E)	Flam Absorption Spectrophotometric method
B	Disinfectant		
1	Chlorine	ISO 7393-2:1985(E)	Determination of free chlorine and total chlorine using N,N-diethyly-1, 4 phylenediamine, for routine control process

Table-11 Chemicals Of Health Significance

1	SUBSTANCE	REFERENCE	TEST METHOD
A	Inorganic Constituents		
1	Arsenic	ISO 6595:1982(E)	Determination of total Arsenic – silver diethyl dithiocarbonate spectrophotometric method
2	Barium	WHO, vol-2, p175	AAS, using either direct aspiration into an air-acetylene flame or atomization in a furnace.
3	Boron	ISO 9390:1990(E)	Determination of Borate – spectrophotometric method using Azomethine-H
4	Cadmium	ISO 5961:1994(E) ISO 8288:1986(E)	Determination of cadmium – by AAS method Flam Absorption Spectrophotometric method
5	Chromium	ISO 11083:1994(E)	Determination of chromium (vi) – spectrometric method using 1,5-diphenylcarbazine
6	Copper	ISO 8288:1986(E)	Flam Absorption Spectrophotometric method
7	Cyanide	ISO 6703:1984(E)	Determination of cyanide- Part 1: Determination of total cyanide
8	Fluoride	ISO 10359-1:1992(E)	Electrochemical probe method - for potable and lightly polluted water
9	Lead	ISO 8288:1986(E)	Flam Absorption Spectrophotometric method
10	Manganese	ISO 6333:1986(E)	Determination of Manganese Formaldoxime spectrometric method
11	Mercury (total)	ISO 9965-3: 9984(E)	Determination of total mercury- by flameless AAS – method after digestion with bromine
12	Nitrate (as NO ₃ ⁻)	ISO 7890-3:1988(E)	Determination of nitrate- Part 3:spectrometric method using sulfosalicylic acid.
13	Nitrite (as NO ₂ ⁻)	ISO 6777:1984(E)	Determination of nitrite - Molecular Absorption spectrometric method
14	Selenium	ISO 9965:1993(E)	Determination of Selenium – AAS method (hydride technique)
B	Organic Constituents		
B1	Aromatic hydrocarbons		
1	Benzene	WHO, Vol-2, p462	A purge and trap gas chromatographic procedure with photoionization detection
2	Benzo[a]pyrene	WHO, Vol-2, p496	Gas chromatography in conjunction with mass spectrographic
B2	Chlorinated alkanes		
1	Carbon tetrachloride	WHO, Vol-2, p390	A purge and trap gas chromatography
2	1,2-dichloroethane	WHO, Vol-2, p411	A purge and trap gas chromatographic procedure
B3	Chlorinated ethenes		
1	1,1-Dichloroethene	WHO, Vol-2, p432	A purge and trap gas chromatographic procedure
2	Trichloromethene	WHO, Vol-2, p445	A purge and trap gas chromatographic procedure
3	Tetrachloroethene	WHO, Vol-2, p453	A purge and trap gas chromatographic procedure

Table-11 (Cont.)

C	Pesticides	Reference	Test Method
1	DDT	WHO, Vol-2, p639	Gas Chromatography with electron-capture detector.
2	Aldrine/Deldrine	WHO, Vol-2, p604	Extraction with pentane followed by Gas Chromatography with electron-capture detector
3	Chlordane	WHO, Vol-2, p628	Extraction with pentane followed by gas chromatography with electron capture detector
4	Pentachlorophenols	ISO 8165-1:1992(E)	Determination of selected monovalent phenols Part1: Gas-chromatographic method after enrichment by extraction
D	Disinfectant & disinfectant bi-product		
D1	Disinfectant		
1	Chlorine	ISO 7393-2:1985(E)	Determination of free chlorine and total chlorine using N,N-diethyly-1, 4 phylenediamine, for routine control process
D2	Disinfectant By-products		
D2.1	Chlorophenol		
1	2,4,6-Trichlorophenol	ISO 8165-1:1992(E)	Determination of selected monovalent phenols-Part 1: Gas chromatographic method after enrichment by extraction
D2.2	Trihalomethane		
1	Chloroform	WHO, Vol-2, p850	Gas chromatography- with detection by flame ionization, electron-capture, or mass spectroscopy

Table-12 Chemicals not of Health Significance at Concentration normally Found In Drinking Water

1	SUBSTANCE	REFERENCE	TEST METHOD
1	Asbestos	WHO, Vol-2, p168	Transmission electron microscopy (TEM) with identification by energy depressive X-ray analysis and selected-area electron diffraction (TEM/SAED)
2	Silver	WHO, vol-2, p339	Spectrographic and colorimetric method with diithi-zone
3	Tin	WHO, vol-2, p361	AAS either direct aspiration into a flame or furnace technique

Table-13 Radioactive Constituents of Drinking Water

¹	SUBSTANCE	REFERENCE	TEST METHOD
1	Gross alpha activity	ISO 9696:1992	Measurement of Gross Alpha activity in non-saline water - thick source method.
2	Gross beta activity	ISO 9697:1992	Measure of gross beta activity in non-saline water

6.0 SANITARY INSPECTION

Sanitary survey and WQ analysis are complementary activities that should be conducted by both the water supply agency as well as surveillance agency. The sanitary inspection forms, prepared in the form of checklist, are possible to determine an overall measure of the sanitary state of the supply.

6.1 Frequency of Sanitary Inspection

One of the most important surveys is that undertaken when new water sources are developed. When alternative water sources are under consideration, each should be surveyed. The guiding principle is that no new water supply should be approved without a sanitary inspection. Routine surveys of existing supplies should be undertaken periodically as stated in **Table-14** by the community, water supplier and surveillance agency.

Table-14 Minimum Annual Frequency of Sanitary Survey

¹	Source & Mode of Supply	Community	Water-supply Agency	Surveillance Agency
1.0	On Spot supply			
1.1	Hand-dug well (Without windlass)	6	-	-
1.2	Hand-dug well (With windlass)	6	-	-
1.3	Dug well with hand-pump	4	-	0.5
1.4	Shallow & deep tube well with hand-pump	4	-	0.5
1.5	Gravity spring	4	-	0.5
2.0	Piped Supply			
2.1	Groundwater with & without chlorination	-	0.5	0.5
2.2	Treated surface water with chlorination:			
	<5,000 Pop	-	0.5	0.5
	5,000 to 20,000 Pop	-	1	0.5
2.3	Distribution system of piped supply	-	6	0.5