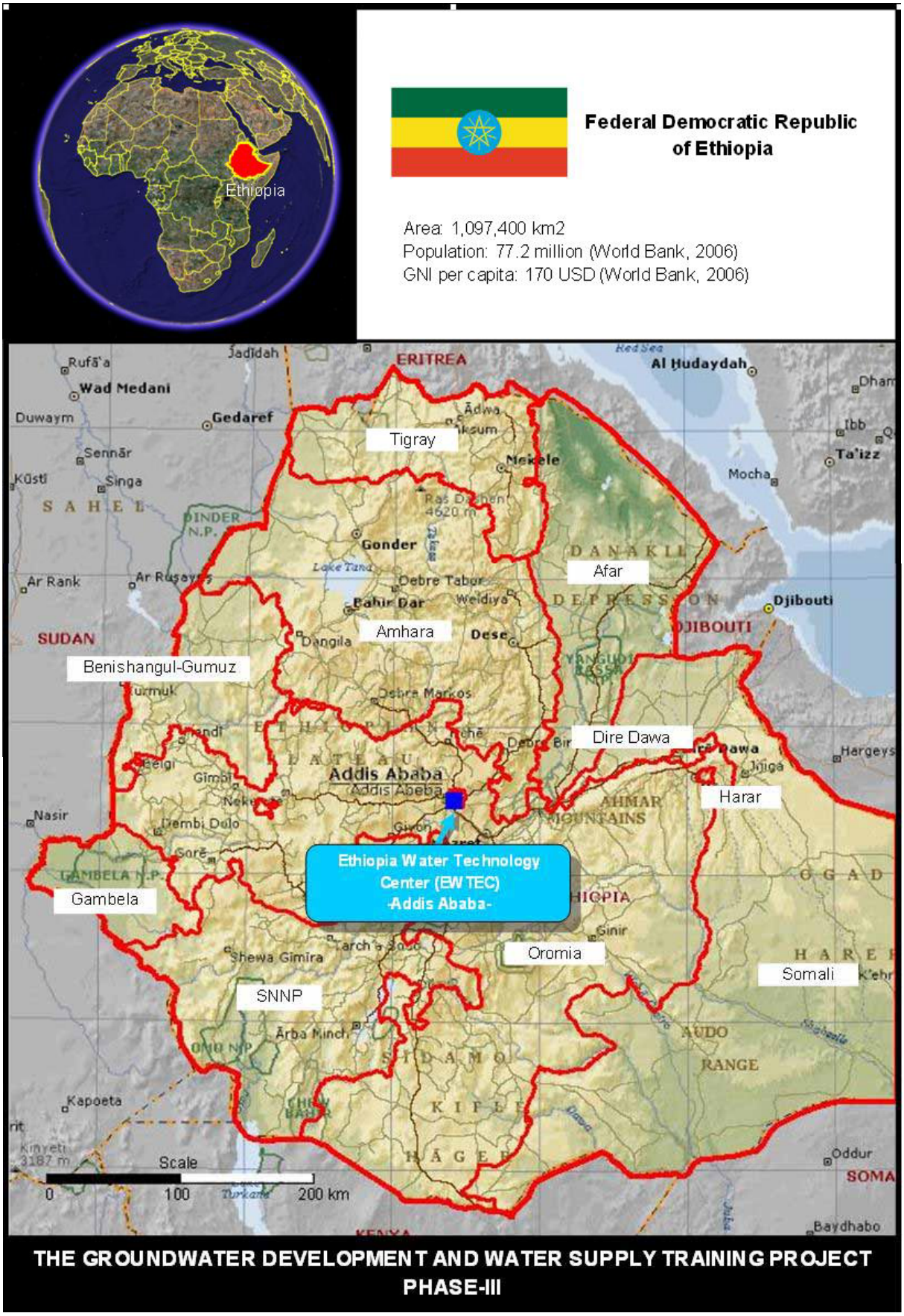
Japan International Cooperation Agency (JICA)
The Federal Democratic Republic of Ethiopia
Ministry of Water Resources (MoWR)

Training Needs Assessment Survey

Volume I
(Report)

June 2009

Ethiopia Water Technology Center
(EWTEC)



Location Map of Project Area

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1. Introduction

1.1 Background

The Millennium Development Goal 7 calls on countries to “halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.” According to the recent MDG assessment report of WHO/UNICEF (2008), the coverage of safe drinking water in Ethiopia increased from 13 % to 42 % between 1990 and 2006 and the country is somewhat on good track to meet its MDG target. On the other hand, even though the country registered some progress on its safe drinking water coverage it is still low when compared to the average level of coverage of Sub-Saharan African countries, which is estimated about 58 %, and it is still very low compared to its neighboring countries, such as Sudan and Kenya, whose safe drinking coverage reached 70 % and 57 % respectively in 2006 (WHO/UNICEF, 2008).

In sum, the above-mentioned situations indicate that there is a need to accelerate the provision of drinking water supply and sanitation services if the country is to meet its MDG target by year 2015. In this regard, the Government of Ethiopia has taken various measures on improving the existing low coverage of water supply and sanitation by providing an enabling environment- adopting national water resource policy (1998), water resource strategy (2001), water sector development program (2002), and water supply and sanitation master plan (2003), and by adopting the universal access program (2005). The UAP aims to achieve 100 percent sanitation and 98 percent drinking water supply in rural areas by the target year of 2012. However, lack of appropriate human resources, both in terms of necessary skills and adequate number, in the administrative agencies as well as in the private sector, is one of the major challenges in the achievement of these targets.

In response to this, since 1998 the Japan government (through its JICA Ethiopia office) embarked on the technical cooperation project: Groundwater Development & Water Supply Training Project, later named the Ethiopian Water Technology Center, and assisted the cultivation of human resources in the water supply sector. Phase 1 and phase 2 of this project have been completed, and phase 3 of this project was launched in January 2009. It is as part of this phase 3 activity that JICA has carried out this training needs survey in order to identify the skill gaps in the administrative agencies, TVETCs, and in the private sector that are engaged in water development related activities..

1.2 Objectives of the training needs assessment survey

The primary objective of this needs survey is to determine the gap in capabilities of the technical and professional staff in government agencies and enterprises involved in water related activities in the country, as well as in TVETC which has water technology department, and to list out the required training areas which will be used as input for the activity in EWTEC phase 3 project.

It aims to collect and utilize information that allows EWTEC to prepare water technology related training programs that respond to the needs of the private sector and NGOs.

Training needs assessment is a practical tool of obtaining details, which will be utilized as a planning base for further steps in the given activity. In that respect, this needs survey also aims to assess the market potential that will allow EWTEC to expand its service and operate independently by generating its own income on a sustainable basis.

This survey is also aimed to get feedback for strengthening the training management system of EWTEC.

1.3 Scope of the survey

This training needs assessment survey covered the following sector offices.

1. Core Public Sector
2. Public Enterprise
3. TVETC
3. Private Sector
4. NGO

The government agencies that operate in the water sector (core public sector)

- Regional Water Bureau (RWB)
- Zonal Water Resource Development Office (ZWRO)
- Woreda Water Offices/Desks (WWO)
- Town Water Supply Services managed by water boards (TWSS)*

*The number of towns in Ethiopia reached about 900, and most have water services that are managed, depending on their size, either by water committees (for small systems) or water boards (for bigger systems). This study included only those water service offices of bigger towns that are managed by water boards.

Public enterprises that are engaged in water study, design & construction supervision; drilling and other water works constructions activities

- Water Works Construction Enterprise (WWCE)
- Water Works Design and Supervision Enterprise (WWDSE)
- Water Well Drilling Enterprise (WWDE)

And also engaged in these activities,

- instructors of Technical and Vocational Education and Training Colleges (TVETC) that have a Water Technology Department, and;
- private drilling companies, private consulting firms, and NGOs that are currently engaged with water related activities.

The administrative set-up of Ethiopia is structured with nine regional states and two city

administrations. Under each of the regional states, there are zonal and woreda level administrative offices. The zonal administrative offices are generally responsible to provide coordination support to the woreda administrative offices. In all administrative offices, with the exception of Harari & Addis Ababa city administration, there exist Regional Water Bureau (RWB) and Woreda Water Offices (WWO). And with the exception of Tigray, Afar & Harari regional states, in all other regions there exists Zonal Water Resource Development Offices (ZWRO).

Accordingly, the number of offices and the sample taken from the different sectors such as public, TVETC, private and NGOs that are engaged with water related activities are listed in Table 1.

Table 1 Summary of sampling number

Core Public Sector

No.	Region	RWB			ZWRO			WWO			TWSS		
		No. of office	No. of office visited	No. of respondants	No. of office	No. of office visited	No. of respondants	No. of office	No. of office visited	No. of respondants	No. of office	No. of office visited	No. of respondants
1	Oromia	1	1	11	17	4	16	262	4	16	53	3	5
2	Amhara	1	1	25	10	3	12	113	3	14	50	2	12
3	Tigray	1	1	10	0	0	0	34	3	13	17	2	9
4	SNNP	1	1	17	13	2	18	134	2	6	19	1	4
5	Afar	1	1	10	0	0	0	31	1	2	8	1	1
6	Somali	1	1	16	9	1	4	53	1	4	1	1	4
7	Benishangulu	1	1	2	3	1	4	20	1	9	3	1	9
8	Gambella	1	1	10	3	1	1	12	1	6	2	1	7
9	Harari	0	0	0	0	0	0	0	0	0	1	1	9
10	Addis Ababa	0	0	0	0	0	0	0	0	0	1	1	10
11	Dire Dawa	1	1	2	0	0	0	0	0	0	1	1	2
	Total	**9**	**9**	**103**	**55**	**12**	**55**	**659**	**16**	**70**	**156**	**15**	**72**

RWB: Regional Water Bureau, ZWRO: Zonal Water Resource Office, WWO: Woreda Water Office, TWSS: Town Water Supply Service

Public Enterprise

	Region	WWCE			WWDSE			WWDE		
		No. of office	No. of office visited	No. of respondants	No. of office	No. of office visited	No. of respondants	No. of office	No. of office visited	No. of respondants
1	Oromia	1	1	14	1	1	9	0	0	0
2	Amahara	1	1	10	0	0	0	0	0	0
3	Tigray	1	1	10	0	0	0	0	0	0
4	SNNP	1	1	15	0	0	0	0	0	0
5	Afar	1	1	13	0	0	0	0	0	0
6	Somali	1	1	11	0	0	0	0	0	0
7	Benishangul	1	1	5	0	0	0	0	0	0
8	Federal	1	1	2	1	1	1	1	1	3
	Total	**8**	**8**	**80**	**2**	**2**	**10**	**1**	**1**	**3**

WWCE: Water Works Construction Enterprise, WWDSE: Water Works Design and Supervision Enterprise, WWDE: Water Well Drilling Enterprise

TVETC

	TVETC	Region	No. of sample	No. of respondants
1	Bahir dar	Amahara	1	7
2	Kombolcha	Amahara	1	9
3	Maichew	Tigray	1	9
4	Hawassa	SNNP	1	9
5	Luci	Afar	1	11
6	Jijiga	Somali	1	13
7	Assosa	Benishangul	1	7
8	Woliso	Oromia	1	17
9	Asslea	Oromia	1	10
		Total	**9**	**92**

Private sector- Drilling Companies

	Company	Region	No of Sample
1	HYDRO Construction & Eng.	Addis Ababa	1
2	KLR Ethio Water Well Drilling	Addis Ababa	1
3	Addis Geosystems	Addis Ababa	1
4	Tekeze Deep Water Wells Drilling	Tigray	1
5	Saba Construction*	Addis Ababa	1
6	Nile Drilling & Exploration	Addis Ababa	1
7	Bava Water Well Project	Addis Ababa	1
8	Saba Engineering	Addis Ababa	1
9	Pile Foundation & Water Well Drill	Addis Ababa	1
10	CGC Overseas Consstruction Eth.Ltd.	Addis Ababa	1
11	AL-Nile Business Group Plc	Addis Ababa	1
12	Hard Rock Drilling & Engineering	Addis Ababa	1
	Total		**12**

* Saba Construction is not at present in the business of drilling works but involves in other water construction works.

Private sector- Consulting Firms

	Consulting Firm	Region	No of Sample
1	Metaferia Consulting Engineers	Addis Ababa	1
2	AG Consult	Addis Ababa	1
3	Accura Engineering Consultancy	Addis Ababa	1
4	MS Consultancy	Addis Ababa	1
5	Zenas Engineering	Addis Ababa	1
6	AWE Consultants	Addis Ababa	1
7	Tropics Consulting Engineers	Addis Ababa	1
8	Tefera Berhe Water Works Consultant	Addis Ababa	1
9	IWMI-Ethiopia*	Addis Ababa	1
10	Karamara Engineering Consultancy	Addis Ababa	1
11	Hywas Engineering Consultants	Addis Ababa	1
12	Core Consulting Engineers	Addis Ababa	1
	Total		**12**

* A research organization of an international NGO

NGOs

	NGO	Region	No of Sample
1	Oxfam America	Addis Ababa	1
2	World Vision Ethiopia	Addis Ababa	1
3	Kana Yelimat Mahiber	Addis Ababa	1
4	Alliance for Dvelopment	Addis Ababa	1
5	Water Action	Addis Ababa	1
6	Coopeazione Intennationale (COOPI)	Addis Ababa	1
7	Society of International Missionaries	Addis Ababa	1
8	Ethio wetlands and natural resources association	Addis Ababa	1
9	Relief Society of Tigray(REST)	Tigray	1
10	Organization of Rehabilitation Development in Amhara (ORDA)	Amhara	1
11	Intermon Oxfam	Addis Ababa	1
12	Water Aid Ethiopia	Addis Ababa	1
	Total		**12**

1.4 Survey methodology

Semi-Structured Questionnaires

Semi-Structured Questionnaires have been used to collect data from Regional Water Bureaus, Zonal and Woreda Water Office, Town Water Service Offices and Water Works Public Enterprises, as well as from all Technical & Vocational Education and Training Centers (TVETCs), which have water technology departments. Three teams of experts have been organized to collect the data from regional, zonal, and woreda level government water sector offices and the TVETCs.

The semi-structured questionnaires have also been employed to collect data from private

sector/drilling companies & consulting firms/ and NGOs. The questionnaires have been distributed to and collected from these sectors offices through post office, in person and by e-mails.

The questionnaires are attached in Annex 1.

Focus Group Discussions

To get additional information from the selected woreda water offices and all TVETCs group discussions have been conducted with technical staff and college instructors respectively.

Secondary Data

This needs assessment survey also draws on reports and data produced by two earlier related studies that JICA conducted by employing local consulting firms, and these are:

- Impact study on EWTEC project, 2007
- Survey on the situation and training needs of TVETC, public enterprise, and private firms/companies engaged in the construction & maintenance of water supply schemes, 2008

Sampling Techniques

Convenient sampling has been applied for selection of sample zones and woreda water offices of the public sector; and random sampling has been used for selection of sample offices from the private sector engaged in water related activities- consulting firms, drilling companies.

The questionnaires for private drilling companies and consulting firms are distributed using the list obtained from the Ministry of Water Resources.

NGOs related to water activity were identified with the help of WSF (Water and Sanitation Forum) under Christian Relief & Development Association (CRDA), which is the umbrella organization of NGOs working in the country. Currently, over 50 NGOs have been registered with WSF. Among them, the questionnaire was distributed to 29 NGOs for which contact details (email and telephone number) could be identified.

The number of contacted and actual number of responding organizations from private sector and NGOs is as follows:

Contacted Sector	No of contacted organizations/ or questionnaires distributed/	Actual number (%) of responded organizations
Private Consulting Firms	24	12 (50 %)
Private Drilling Companies	17	12 (70 %)
NGOs	29	12 (41%)

2. Institutional framework and manpower

2.1 Core public sector

2.1.1 Main responsibility

Regional proclamations issued for establishment of the regional water resource development bureaus (such as Procl. No 99/2004 of Amhara; Procl. No 54/1994 E.C of Tigray), and for establishment of Town Water Supply Services (such as Procl. No 82/2003 of Amhara; Procl. No 40/2002 of SNNP; and Procl. No 122/1994 E.C of Tigray) are used for defining the general job responsibilities of the Regional Water Resources Development Bureau and Town Water Supply Service, respectively. And for Zonal and Woreda Water Offices the information collected from interviewing concerned staff at each office are used for defining the responsibilities.

(1) Regional Water Resource Development Bureaus (RWB)

- Preparation of regional water policies and regulations
- Formulation, coordination and supervision of regional water and sanitation program
- Collect and maintain regional hydrological database
- Perform regulatory work (such as licensing and standardization) for water supply & irrigation development activities in the region
- Undertake study, design & construction of schemes: spring developments, small & large gravity schemes, motorized schemes, boreholes and shallow wells
- Prepare tender document & perform contract administration & supervision of contracted out water supply & irrigation large scale projects
- Provide technical support and build the capacity of zonal and woreda water offices

(2) Zonal Water Resource Development Offices (ZWRO)

- Perform study, design & supervision for water supply projects of shallow well sources in the woredas within their zone.
- Provide technical support on schemes maintenances in complex cases that are beyond the capacity of woreda technicians.
- As assigned by the regional bureau, perform construction supervision on water supply projects contracted out to private contractor by the regional water bureau
- Play other facilitating and coordinating roles in building the technical capacity of the woredas technical staff within the zone

It should be noted that the scope of responsibilities of ZWRO vary from region to region. For instance, in the case of Oromia, the zone office perform groundwater assessment study of deep wells by its own technical staff, where as in Gambela, the office is entrusted with limited responsibilities

that do not go beyond providing of some technical assistance on scheme maintenance.

(3) Woreda Water Offices (WWO)

- Responsible to perform study and design for water schemes development of hand dug wells, spring water sources, on the spot water distribution and limited lengths of pipelines with gravity system
- Perform study and design of small scale irrigation and drainage systems
- Assist communities in hiring local service providers or contractors for the construction work of the water schemes
- Supervises or guides the construction of the hand dug wells or spring development
- Supervises or guides the construction of ponds, micro-dams, river diversions, river bank intakes, etc
- Provides water schemes maintenance support to the communities
- Perform community promotion work in mobilizing the beneficiaries in participating Kebeles for development, operation and management of the water schemes.
- Assist the community in development and management of sanitation facilities
- Perform other community promotion work to create awareness on the danger of using water from unsafe sources and the importance of using potable water

(4) Town Water Supply Services (TWSS)

- Operate treatment plant, reservoirs, pumps, generators, and other electro-mechanical equipment
- Perform leakage detection and control activities
- Perform water quality control testing as per the standards
- Perform preventive maintenance activities on installed electro-mechanical equipment
- Perform water meter inspection and maintenance work
- Undertake preliminary hydrogeological and engineering studies, prepare tender documents, perform construction supervision of water supply projects (applies only to some bigger TWWS)

2.1.2 Major problems

Based on the assessment of this survey and the information collected with previous study of JICA (2007)[1], the major common problems related with human resources observed in the core public sector water offices are summarized in Table 2.

Table 2 Summary of major human resource related problems observed in core public sector

[1] Impact study on EWTEC project, 2007

Core public sector water offices	Major human resource problems
RWB and ZWRO	■ Shortage of experienced professionals in all fields ■ High rate of staff turnover
WWO	■ Critical shortage of professional staff ■ Lack of practical skills with the existing medium level technical staff (TVETC graduates) ■ Budgetary and logistics constraints negatively affect the practical engagement of existing technical staff on assigned tasks
TWSS	■ Shortage of trained staff but the problem with less degree of its criticality when compared to the other core public sector water offices ■ Shortage of training provisions for existing staff in the area of electro-mechanical maintenance, leakage control, water quality control, etc

2.1.3 Manpower

Information of professional and technical staff in the core public sector, which could be potential trainees of EWTEC was collected through questionnaires and interviews. The field of professional background and qualification level were classified into the categories shown in Table 3. The number of manpower asked in the questionnaire is divided into “existing” and “future plan” in five years.

Table 3 Classification of professional and technical staff

Category No.	Relevant field of professional background	Qualification level
1	Hydrogeologist, Hydrologist Engineering Geologist, Geotech Engineer, Geologist, Geophysicist	■ BSc and above ■ Advanced diploma/Diploma
2	Chief driller, Driller Assistant driller	■ 10^{th} grade and above ■ Below 10^{th} grade
3	Mechanic, Mechanical Engineer, Technician	■ Technical school diploma and above ■ Below diploma
4	Water supply engineer, Water resource engineer, Sanitary engineer, Hydraulic engineer, Civil engineer, Aid engineer or technician	■ Diploma and above ■ Below diploma
5	Electrical Engineer, Electrician	■ Diploma and above ■ Below diploma
6	Chemist, Biologist, Lab technician	■ Diploma and above
7	Sociologist, Economist	■ Diploma and above
8	Hand pump technician	-
9	Administrative expert, Accountant, Procurement expert	-

Estimated number of professional manpower at RWB, ZWRO, WWO and TWSS in each region is summarized in the following tables (Table 4, Table 5, Table 6 and Table 7). It should be noted that the total number was estimated from the average of limited sampling data by simply multiplying by the number of offices in each region except for RWB. Therefore, the result gives a very rough idea of total number and detailed discussion on the figure maybe risky. The original data is attached in Annex 2.

Table 4 Professional and technical staff summary of Regional Water Bureau (existing staff and future recruitment plan in five years)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Amhara	6	16	22	2	0	2	3	7	10	6	4	10	4	0	4	3	0	3	5	0	5	0	0	0	22	0	22
Tigray	19	15	34	0	0	0	10	0	10	20	20	40	5	0	5	2	0	2	4	0	4	16	0	16	17	0	17
Oromia	51	50	101	6	10	16	23	15	38	42	20	62	47	40	87	23	10	33	23	10	33	0	0	0	12	10	22
SNNP*	10	-	10	3	-	3	32	-	32	14	-	14	4	-	4	5	-	5	4	-	4	1	-	1	10	-	10
Afar	7	0	7	3	4	7	8	2	10	12	1	13	4	2	6	3	0	3	2	1	3	0	0	0	0	0	0
Somali	9	0	9	1	0	1	4	1	5	17	5	22	3	2	5	0	5	5	3	1	4	0	0	0	20	0	20
Benshangul	6	2	8	0	0	0	2	0	2	3	1	4	1	0	1	1	0	1	1	0	1	0	0	0	16	0	16
Gambela	2	1	3	0	0	0	6	4	10	5	13	18	1	0	1	3	1	4	0	1	1	0	0	0	0	0	0
Harari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Addis Ababa CA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dire Dawa CA	1	1	2	1	1	2	1	1	2	5	2	7	1	0	1	0	1	1	0	1	1	1	0	1	7	0	7
Total	111	85	196	16	15	31	89	30	119	124	66	190	70	44	114	40	17	57	42	14	56	18	0	18	104	10	114

CA: City Administration

* Future recruitment plan of SNNP RWB was not provided and it doesn't indicate zero.

Table 5 Professional and technical staff summary of Zonal Water Resources Development Office (existing staff and future recruitment plan in five years)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Amhara	17	23	40	0	0	0	6	0	6	10	40	50	7	3	10	13	0	13	7	3	10	0	0	0	0	0	0
Tigray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oromia	43	65	108	0	0	0	65	40	105	51	77	128	23	17	40	5	26	31	22	48	70	9	14	23	22	17	39
SNNP	33	52	85	0	0	0	20	26	46	26	85	111	7	13	20	13	7	20	7	20	27	0	0	0	7	0	7
Afar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Somali	0	0	0	0	0	0	18	0	18	0	0	0	9	0	9	0	0	0	0	0	0	9	0	9	27	0	27
Benishangul	3	0	3	0	0	0	0	0	0	12	0	12	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0
Gambela	0	0	0	0	0	0	0	0	0	0	0	0	3	3	6	0	0	0	0	0	0	0	0	0	0	0	0
Total	96	140	236	0	0	0	109	66	175	99	202	301	49	36	85	31	33	64	39	71	110	18	14	32	56	17	73

Table 6 Professional and technical staff summary of Woreda Water Office (existing staff and future recruitment plan in five years)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Amhara	34	531	565	0	0	0	226	339	565	339	226	565	34	531	565	0	226	226	34	147	181	79	113	192	34	0	34
Tigray	44	102	146	0	0	0	44	0	44	102	112	214	0	0	0	10	10	20	10	24	34	68	0	68	0	0	0
Oromia	79	865	944	0	0	0	289	393	682	655	917	1572	262	210	472	0	79	79	472	131	603	0	0	0	0	79	79
SNNP	0	670	670	0	0	0	335	268	603	402	201	603	0	67	67	67	67	134	0	67	67	0	67	67	134	67	201
Afar	0	0	0	0	0	0	31	31	62	31	31	62	31	31	62	0	0	0	0	0	0	0	0	0	31	31	62
Somali	0	106	106	0	0	0	0	53	53	265	265	530	53	53	106	0	53	53	0	106	106	0	106	106	106	0	106
Benishangul	0	0	0	0	0	0	0	0	0	180	0	180	80	0	80	0	0	0	0	0	0	0	0	0	0	0	0
Gambela	0	0	0	0	0	0	12	0	12	60	36	96	12	0	12	0	0	0	0	0	0	36	36	72	12	0	12
Total	157	2274	2431	0	0	0	937	1084	2021	2034	1788	3822	472	892	1364	77	435	512	516	475	991	183	322	505	317	177	494

* The collected information didn't show the available staff of current and future hydrogeologist. Therefore the figure for future recruitment plan was taken from the approved staff structure of the woreda.

Table 7 Professional and technical staff summary of Town Water Supply Service (existing staff and vacant/future recruitment plan)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Amhara	50	50	100	0	0	0	75	100	175	125	300	425	125	50	175	200	0	200	25	25	50	150	50	200	350	50	400
Tigray	17	0	17	0	0	0	34	0	34	34	0	34	18	0	18	9	9	18	9	0	9	0	0	0	230	0	230
Oromia	0	0	0	0	0	0	90	53	143	16	0	16	249	53	302	122	0	122	0	16	16	0	0	0	302	90	392
SNNP	0	0	0	0	0	0	0	0	0	76	76	152	19	19	38	57	0	57	0	0	0	0	0	0	76	0	76
Afar	0	0	0	0	0	0	16	0	16	0	8	8	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0
Somali	0	0	0	0	0	0	10	0	10	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	2	1	3
Benishangul	0	0	0	0	0	0	0	0	0	3	0	3	21	0	21	0	0	0	0	0	0	18	0	18	12	3	15
Gambela	0	0	0	0	0	0	4	2	6	0	2	2	2	2	4	0	6	6	0	0	0	0	0	0	2	4	6
Harari	2	0	2	0	0	0	1	0	1	3	0	3	0	0	0	0	0	0	1	0	1	0	0	0	4	0	4
Addis Ababa	3	2	5	0	0	0	41	13	54	83	9	92	11	3	14	8	0	8	8	2	10	0	0	0	No info	0	0
Dire Dawa	0	2	2	0	0	0	2	1	3	0	0	0	5	0	5	2	0	2	0	0	0	0	0	0	6	0	6
Total	72	54	126	0	0	0	273	169	442	340	395	735	459	127	586	399	15	414	43	44	87	168	50	218	984	148	1132

* No. of Town water supply service in Tigray was estemated by taking the propotional figure of Amhara that is almost 50% of the no. of Woreda.

(1) Regional Water Resource Development Bureaus (RWB)

The current human resource situation in RWB is generally characterized as follows:

- About 31% (281 out of 895) of job positions are currently vacant or planned to be filled in the future (*future recruitment plan of RWB in SNNP was not provided, therefore the percentage of vacant position (31%) is considered minimum)
- Among the professionals, the requirement of hydrogeologists (category no.1), and water supply engineers (category no.4), are relatively higher (Figure 1).

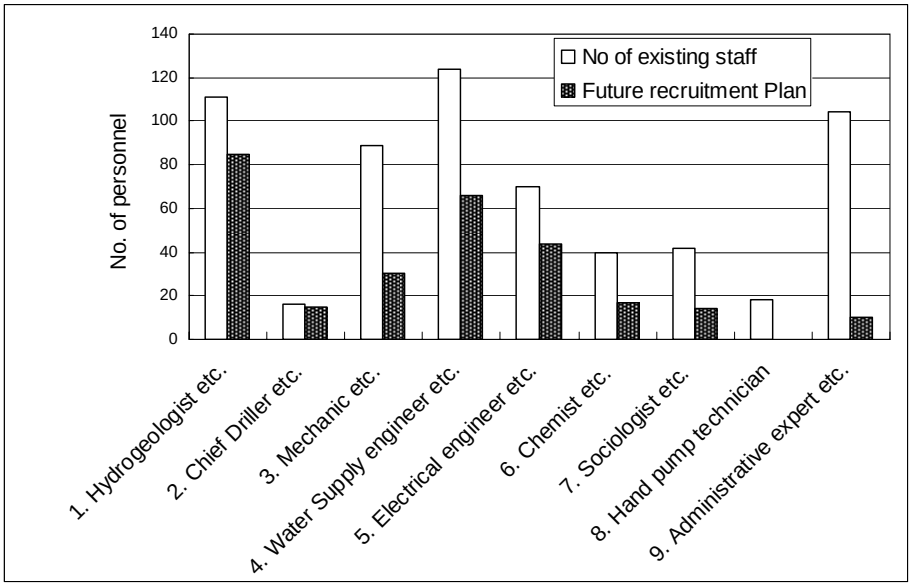


Figure 1 Existing staff and vacant/future recruitment plan in Regional Water Bureaus (RWB)

(2) Zonal Water Resources Development Office (ZWRO)

The current human resource situation in ZWRO is generally characterized as follows:

- About 54% (579 out of 1,076) of job positions are currently vacant or planned to be filled in the future.
- Among the professionals, the requirement of hydrogeologists (category no.1), and water supply engineers (category no.4), are relatively higher. Especially, the requirement of water supply engineer (category no.4), is triple of the existing manpower (Figure 2).

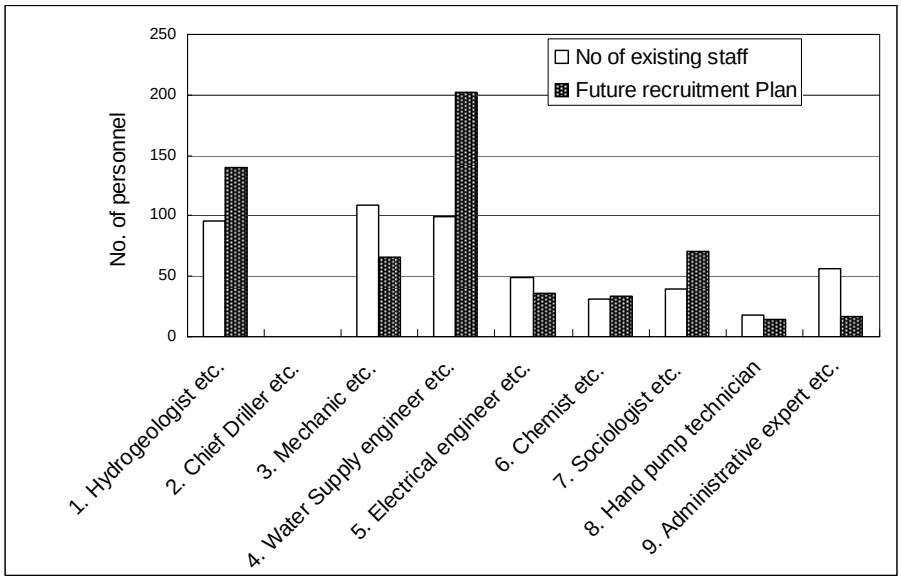


Figure 2 Existing staff and vacant/future recruitment plan in Zonal Water Resources Development Office (ZWRO)

(3) Woreda Water Office (WWO)

The current human resource situation in WWO is generally characterized as follows:

- About 61% (7,447 out of 12,140) of job positions are currently vacant or planned to be filled in the future.
- Among the professionals, the requirement of hydrogeologists (category no.1), and water supply engineers (category no. 4), are relatively higher. Especially, the number of hydrogeologists category no.1), shows an outstanding gap (Figure 3).

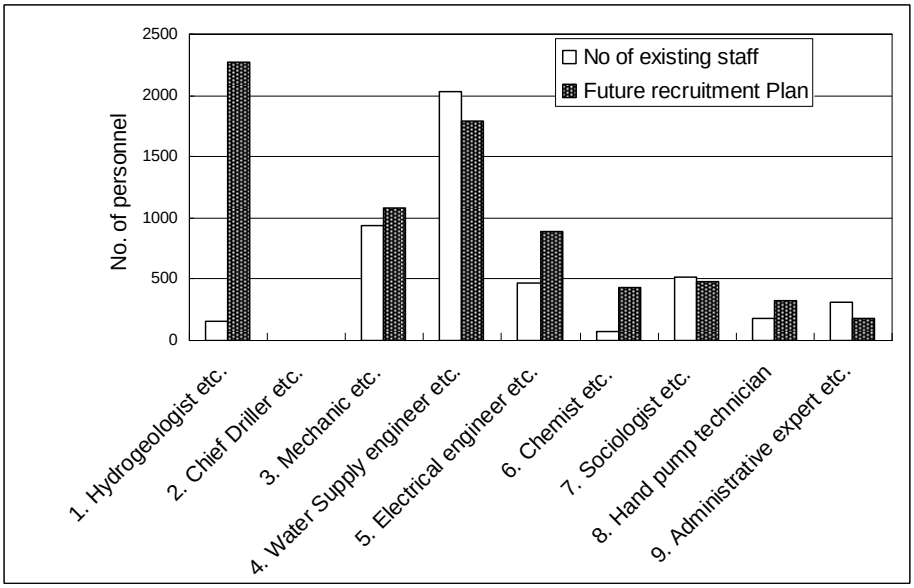


Figure 3 Existing staff and vacant/future recruitment plan in Woreda Water Office (WWO)

(4) Town Water Supply Service (TWSS)

The current human resource situation in TWSS is generally characterized as follows:

- About 25% (1,002 out of 3,740) of job positions are currently vacant or planned to be filled in the future.
- Among the professionals, the requirement of water supply engineers (category no.4), is relatively higher (Figure 4).

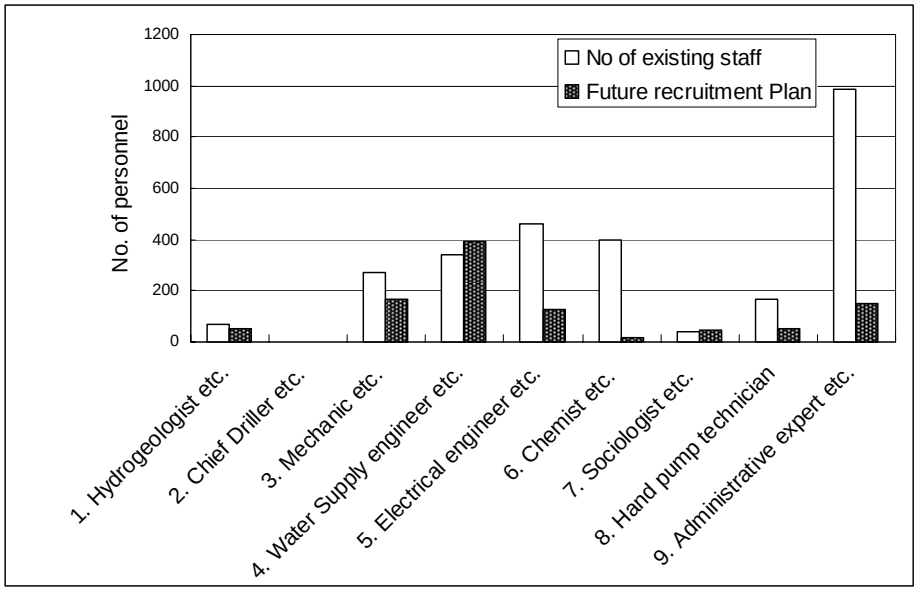


Figure 4 Existing staff and vacant/future recruitment plan in Town Water Supply Service (TWSS)

2.2 Public enterprises

2.2.1 Main responsibilities

(1) Water Works Design & Supervision Enterprise (WWDSE)

Currently there are two Water Works Design & Supervision Public Enterprises in the country, with one being federal and the other is under Oromia regional government, and both are located in Addis Ababa. Prior to their establishment, the water works design & supervision function at the federal level and in Oromia region was performed under the departments structured in the Ministry of Water Resources and the Oromia regional water bureau, respectively.

WWDSE conducts feasibility and final studies on new water schemes, rehabilitation and expansion of water supply and sanitation projects which involve the following main tasks:

- Conduct topographic surveys and determines exact location of project sites

- Conducts hydrological, hydrogeological investigations
- Conduct demand and socio-economic surveys
- Undertake design of wells, well heads, transmission lines, distribution systems and reservoirs) the electro-mechanical component
- Develop quantities and specifications for all system components
- Prepare cost estimates for all system components
- Undertake design of rain water harvesting mechanisms (such as roof and rock-catchments etc.)
- Undertake design work for pump testing
- Prepare contract documents

In addition, WWDSE performs construction supervision of water supply and sanitation projects which involve the following main tasks:

- Supervising the construction of the project on behalf of the client as per the contract document
- Review and approve construction plans, engineering estimates, technical reports and payment certificates.
- Review and approve variation in work orders

(2) Water Works Construction Enterprise (WWCE) & Water Well Drilling Enterprise (WWDE)

Currently there are eight (8) public Water Works Construction Enterprises and one (1) public Water Well Drilling Enterprise in the country. Out of the eight (8) public WWCEs, seven (7) are regional, and the remaining one (1) WWCE and one public WWDE are under the federal government.

And in looking back to the history of their establishment, the majority of the regional WWCEs have been established with the equipment, manpower, and other facilities of former regional offices of the Ethiopian Water Works Construction Authority (which presently operates as the WWCE under the federal government) following the restructuring and decentralization of the water sector that took place in 1990s in the country.

WWCE and WWDE perform deep and shallow water well drilling, water well rehabilitation, pumping test and pump installation.

The WWDE main tasks are basically restricted to drilling work. In the case of WWCE, in addition to drilling work, they perform the following tasks:

- Civil works of water supply system such as pipe laying, construction of reservoirs
- Construction of dams for drinking water supply
- Construction of dams, canals & tunnels for irrigation systems

2.2.2 Major problems

The following problems are reported by the previous survey on the current condition of WWCE in Tigray, Amhara, Oromia and SNNP conducted by JICA (JICA 2008[2]).

- Lack of well developed skills of the technical staff
- Lack of a well developed procurement system
- Lack of sufficient construction and maintenance equipment
- Lack of refreshment training for technical staff
- Lack of knowledge on drilling technology
- Lack of drilling equipment maintenance
- Lack of GIS knowledge
- Lack of short term training on groundwater
- Lack of skill upgrading for drillers
- Lack of skill upgrading for electricians and mechanics
- Lack of sufficient construction and maintenance equipment

2.2.3 Manpower

Information of professional and technical staff from public enterprises (WWCE, WWDSE, WWDE), which could be potential trainees of EWTEC was collected through questionnaire and interview. The field of professional background and qualification level were classified in the same category with core public sector shown in Table 3. The number of manpower asked in the questionnaire is divided into “existing” and “future plan” in five years.

The collected number of professional manpower in each organization is summarized in Table 8.

[2] JICA 2008: Survey on the situation and training needs of TVETC, public enterprises and private firms/companies engaged in the construction and maintenance of water supply scheme

Table 8 Professional and technical staff summary of public enterprises on water sector (existing staff and future recruitment plan in five years)

Region	Name of Organization	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
		Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Amhara	WWCE	9	5	14	35	30	65	33	35	68	84	50	134	10	11	21	0	0	0	0	0	0	3	4	7	23	10	33
Tigray	WWCE	7	4	11	12	0	12	8	11	19	0	0	0	1	2	3	0	0	0	0	0	0	4	0	4	0	0	0
Oromia	WWCE	21	35	56	95	18	113	70	20	90	0	25	25	5	5	10	0	0	0	0	0	0	0	0	0	0	0	0
	WWDSE	44	17	61	0	0	0	1	0	1	55	0	55	1	0	1	13	2	15	6	0	6	0	0	0	12	2	14
SNNP	WWCE	5	2	7	26	0	26	23	25	48	0	0	0	4	3	7	0	0	0	0	0	0	2	2	4	0	0	0
Afar	WWCE	3	4	7	4	5	9	12	2	14	10	13	23	4	5	9	2	2	4	2	2	4	1	2	3	14	7	21
Somali	WWCE	3	12	15	48	53	101	4	15	19	1	26	27	1	6	7	0	4	4	1	1	2	0	0	0	0	0	0
Benishangul	WWCE	1	3	4	6	2	8	6	3	9	10	6	16	1	1	2	0	0	0	1	0	1	0	0	0	8	4	12
Federal	WWCE	2	2	4	10	6	16	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WWDSE	60	0	60	3	0	3	8	0	8	28	0	28	5	0	5	25	0	25	3	0	3	0	0	0	37	0	37
	WWDE	6	4	10	20	0	20	10	1	11	3	1	4	0	0	0	1	0	1	4	0	4	10	0	10	0	0	0
Total Number of Staff		161	88	249	259	114	373	176	114	290	191	121	312	32	33	65	41	8	49	17	3	20	20	8	28	94	23	117

The current human resource situation in public enterprises (WWCE, WWDSE, WWDE) is generally characterized as follows:

- About 34% (512 out of 1,503) of job positions are currently vacant or planned to be filled in the future.
- Among the professionals, the requirement of hydrogeologists (category no.1); chief drillers (category no.2); mechanics (category no.3); and water supply engineers (category no.4), are equally high (Figure 5).

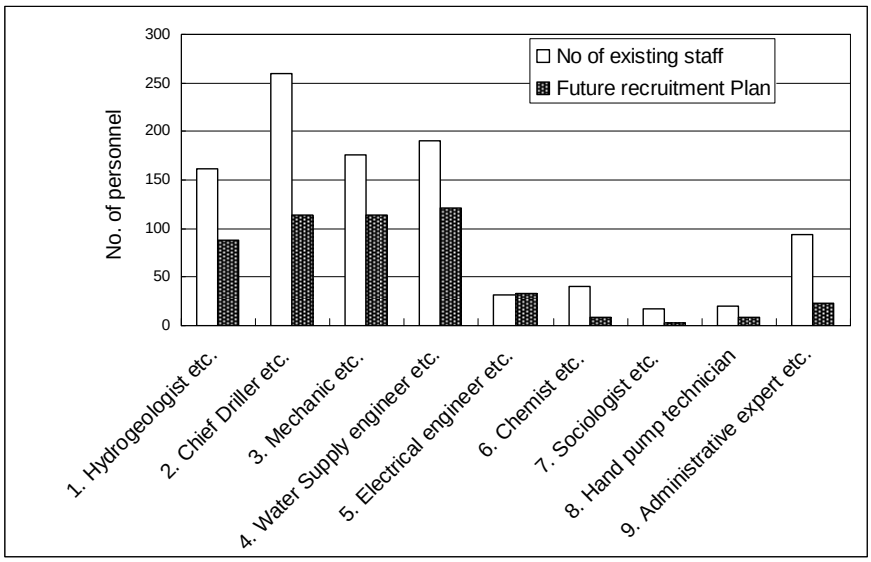


Figure 5 Existing staff and vacant/future recruitment plan in public enterprises (WWCE, WWDSE, WWDE)

2.3 TVETC (Water Technology Department)

2.3.1 Main responsibility of TVETC instructors

There are 9 TVETCs which have Water Technology Department in Ethiopia as shown in Table 1. The Department is subdivided into three courses, those are:

- Electro Mechanical Technology Course (EMT)
- Small Scale Irrigation and Drainage Course (SSID)
- Rural Water Supply and Sanitation Course (RWSS)

The major responsibility of the instructors of these courses is to provide theoretical & practical training for trainees, and detailed tasks include:

- Preparation of curriculum, text books, training schedules and conducting class room education;
- Prepare the list and take initiatives to fulfill the necessary equipment and materials for laboratory, workshop and field work for conducting the practical training

- Facilitate and select related practical training areas such as factories, organizations, on-going projects for conducting demonstrative practical training

The curriculum of each course requires conducting practical training, including the following items;

(1) Electro Mechanical Technology Course (EMT)

- Installing the electrical system
- Maintaining electrical measuring instruments & control panel devices
- Maintaining electric motors and generators
- Installing generators & water pumps
- Operating & maintaining water pumps
- Operating & maintaining diesel & dewatering pump gasoline engine

(2) Small Scale Irrigation and Drainage Course (SSID)

- Conducting resources investigation
- Designing small scale irrigation system
- Designing drainage system
- Operating & maintaining of small scale irrigation and drainage systems
- Supervising the small scale irrigation and drainage construction

(3) Rural Water Supply and Sanitation Course (RWSS)

- Investigating rural water supply sources, ground & surface, and performing water quality analysis
- Designing rural water supply schemes
- Supervising rural water supply construction
- Operating rural water supply scheme
- Developing human extra disposal facilities and management of sludge water

2.3.2 Major problems

The major problems are asked through questionnaire and interview for deans and department heads at each TVETC. The result shows high rate in lack of practical skills, lack of teaching materials and lack of equipment (Table 9). In addition, other problems are raised (Table 10). The situation of Water Technology Department of TVETC is considered very serious in all aspects.

Table 9 Major problems in TVETC

Major Problems	Yes	Total No. of respondents

Major Problems	Yes	Total No. of respondents
There is lack of practical skills of instructors	26	28
There is lack of skill in teaching methodology	11	
There is lack of adequate teaching materials (text books etc.)	23	
There is lack of teaching aids (practical training equipment)	25	

Table 10 Other problems in TVETC

TVETC	Other Problems
Bahir Dar	■ Lack of workshops with necessary equipment ■ Lack of transportation for normal service for academic staff (as the college is far from the town) ■ No enough chance for sponsoring masters degree program for instructors of the college and so there is a need to get organizations that give sponsorship of masters program ■ Lack of adequate training program on skill gaps for instructors ■ Lack of transportation service both for normal and field work ■ Lack of budget for necessary raw materials and research & development activities
Maichew	■ Lack of internet services ■ To produce well trained technicians the instructors must be trained and there must also be well equipped laboratory for assessment
Komborcha	■ There is a need for revision of the college's curriculum
Awassa	■ Practical skill development training for the instructors
Lucy	■ More support is needed from voluntary organizations on teaching materials such as reference books, soft copies, etc.
Jijiga	■ Insufficient number of instructors ■ Insufficient budget to provide students with practical skills development ■ Lack of classrooms for main course instructors ■ Lack of reference books in the form of hard & soft copy
Asossa	■ Lack of respective manpower ■ Lack of internet service ■ Lack of organized institution for practical attachment ■ Lack of personal initiative ■ Lack of incentives ■ Places to undertake practical training are not suitable ■ Lack of transportation for field work and apprentice ■ EWTEC has to conduct practical training program at least once in a year for trainees/instructors of TVETC ■ There is a need for revision of the college's curriculum
Weliso	■ Instructor turnover ■ Lack of transportation for field work ■ We are willing to pay for the training at the institutional level but the capacity to finance is determined by the budget allocated for this purpose

2.3.3 Manpower (number of instructors)

The current number of instructors at each college is shown in Table 11.

Table 11 Number of instructors under Water Technology Department in each TVETC

	College	Region	EMMT	SSID	RWSS	Total
1	Bahir Dar	Amhara	4	6	7	17
2	Maichew	Tigray	4	8	10	22
3	Komborcha	Amhara	6	5	8	19

	College	Region	EMMT	SSID	RWSS	Total
4	Awassa	SNNP	7	12	12	31
5	Lucy	Afar	5	7	8	20
6	Jijiga	Somali	7	5	6	18
7	Asossa	Benishangul	5	6	4	15
8	Weliso	Oromia	7	7	7	21
9	Assela	Oromia	11	8	9	28
	Total		**64**	**71**	**56**	**191**

EMT: Electro Mechanical Technology Course, SSID: Small Scale Irrigation and Drainage Course, RWSS: Rural Water Supply and Sanitation Course

2.4 Private sector

2.4.1 Main activities

(1) Drilling companies

The activities and functions of private drilling companies are almost the same as those of water works public enterprises. Although water source investigation is not their major activity, some companies have the ability to conduct geophysical surveys.

(2) Consulting firms

Private consulting firms are taking a very important role in the water sector. Many activities or components in the donor funded projects or government projects are subcontracted out to local consulting firms. The major activities of consulting firms in the water sector are categorized as follows.

- Water source investigation (aerial photo analysis, geophysical investigation, etc.)
- Water supply facility designing (land surveys, preparation of drawings, etc.)
- Supervision of water facility construction
- GIS mapping
- Groundwater modeling
- Remote sensing
- Socio-economic surveys
- Quantity survey for construction
- Other related survey (needs surveys, impact surveys, etc.)

2.4.2 Major problems

(1) Drilling companies

In the previous needs survey on private drilling companies, existence of skill gap and necessity of training for their staff was pointed out (JICA 2008[3]). Major problems in private drilling companies are shown in Table 12.

Table 12 Major problems in private drilling companies

Drilling firm	Major problem mentioned
KLR	■ Lack of skill to overcome drilling problem ■ Lack of skill in drilling ■ Inadequate know-how on drilling method ■ Poor data handling
Al- Nile	■ Shortage of drilling engineers & technicians to maintain rig and compressor ■ Absence of standard drilling method
East Africa Drillers	■ Skill limitation in exploring groundwater potential ■ Shortage of spare parts ■ Skill limitation of trouble shooting in drilling activity
Yadot	■ Shortage of drillers in the market ■ Shortage of spare parts in the market ■ Skill limitation in maintenance of compressor and hydraulic oil work
SAVA Engineering	■ Shortage of qualified drillers
Hydro const. & Eng.	■ Shortage of spare parts ■ Shortage of construction material
Hard Rock	■ Absence of short term training ■ Skill limitation in drilling operation
Tana WWD	■ Absence of training institute for private firms' staff
WATECH PLC	■ No institution that gives training ■ JICA gives training for Gov. employees only ■ Employees engaged in drilling are less literate and this makes training difficult

*Source: JICA 2008

(2) Consulting firms

In the previous needs survey on private consulting firms (JICA 2008), their major problems are described as shown in Table 13.

Table 13 Major problems in private consulting firms

Consulting firm	Major problems
HAYWAS	■ Inadequate funds for training ■ Lack of training on modeling & operation ■ Lack of software and programs for design and study purpose
Metaferia Consult	■ No adequate training institution ■ Restriction of EWETC for private sectors

[3] JICA 2008: Survey on the situation and training needs of TVETC, public enterprises and private firms/companies engaged in the construction and maintenance of water supply schemes

Consulting firm	Major problems
Building & const. Eng.	■ Shortage of design software ■ Professional staff turn over

*Source: JICA 2008

2.4.3 Manpower

Information of professional and technical staff of private sector (drilling/water works construction company and consulting firm), which could be potential trainees of EWTEC was collected through the questionnaire. The field of professional background and qualification level are classified in the same category with core public sector shown in Table 3. The number of manpower asked in the questionnaire is divided into “existing” and “future plan” in five years.

The collected number of professional manpower in each organization is summarized in Table 14 and Table 15.

Table 14 Professional and technical staff summary of private drilling/water works construction companies on water sector (existing staff and future recruitment plan in five years)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
HYDRO Construction & Eng.	2	1	3	16	4	20	9	0	9	4	0	4	7	0	7	0	0	0	0	0	0	2	0	2	5	1	6
Saba Construction*	0	0	0	0	0	0	8	13	21	19	10	29	1	4	5	1	1	2	0	1	1	0	0	0	17	3	20
Nile Drilling & Exploration	3	3	6	13	4	17	2	2	4	1	1	2	3	2	5	0	0	0	0	0	0	2	1	3	3	3	6
Bava Water Well Project	0	1	1	1	1	2	1	1	2	0	1	1	0	2	2	0	0	0	0	0	0	0	1	1	1	1	2
Saba Engineering	9	0	9	20	0	20	18	0	18	4	0	4	14	0	14	2	0	2	3	0	3	2	0	2	5	0	5
Pile Foundation & Water Well Drilling	3	2	5	23	2	25	2	2	4	0	0	0	3	3	6	0	0	0	0	0	0	2	2	4	2	1	3
KLR Ethio Water Well Drilling	3	2	5	8	2	10	2	1	3	0	2	2	1	1	2	0	0	0	0	0	0	2	2	4	3	1	4
Addis Geosystems	6	8	14	6	6	12	4	4	8	0	0	0	2	2	4	1	2	3	0	0	0	0	0	0	3	2	5
Tekeze Deep Water Wells Drilling	3	3	6	7	2	9	2	2	4	0	0	0	2	2	4	0	0	0	0	0	0	0	0	0	0	0	0
CGC Overseas Consstruction Eth.Ltd.	2	3	5	10	5	15	5	10	15	0	0	0	1	2	3	0	0	0	0	0	0	0	0	0	2	2	4
AL-Nile Business Group Plc	6	0	6	20	0	20	2	0	2	5	0	5	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Hard Rock Drilling & Engineering	3	2	5	5	6	11	3	0	3	0	1	1	0	1	1	0	0	0	0	0	0	1	2	3	0	0	0
Total	40	25	65	129	32	161	58	35	93	33	15	48	37	19	56	4	3	7	3	1	4	11	8	19	41	14	55

Table 15 Professional and technical staff summary of private consulting firms on water sector (existing staff and future recruitment plan in five years)

Region	Hydrogeologist, hydrologist, Enging. Geologist, Geo-technical Eng., Geologist, Geo-physicist			Chief Driller, Driller, Assistant Driller			Mechanic, Mechanical Engineer, Technician			WS engineer, Water resource eng., Sanitary eng., Hydraulic eng., Civil eng., Aid eng./technicians			Electrical engineer, Electrician			Chemist, Biologist, Lab technician			Sociologist, Economist			Hand pump technician			Administrative expert, Accountant, Procurement expert		
	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Metaferia Consulting Engineers	6	2	8	0	0	0	2	0	2	12	4	16	1	0	1	0	0	0	2	0	2	0	0	0	4	2	6
AG Consult	4	5	9	5	5	10	3	5	8	9	15	24	2	0	2	1	0	1	1	3	4	1	1	2	3	3	6
CORE Consulting Engineers	4	0	4	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	2	0	0	0	4	0	4
Accura Engineering Consultancy	1	0	1	0	0	0	0	1	1	2	8	10	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Hywas Engineering Consultants	3	0	3	0	0	0	3	2	5	5	3	8	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2
MS Consultancy	2	0	2	0	0	0	1	0	1	18	11	29	1	1	2	1	0	1	3	2	5	1	1	2	3	1	4
Zenas Engineering	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
AWE Consultants	1	2	3	0	0	0	0	0	0	2	4	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Karamara Engineeirng Consultancy	2	3	5	0	0	0	0	0	0	2	3	5	1	1	2	0	0	0	0	0	0	0	0	0	1	0	1
Tropics Consulting Engineers	0	0	0	0	0	0	0	0	0	10	0	10	0	0	0	0	0	0	2	0	2	0	0	0	2	0	2
Tefera Berhe Water Works Consultant	3	1	4	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
IWMI-Ethiopia	10	0	10	1	0	1	0	0	0	3	0	3	0	0	0	0	0	0	2	1	3	0	0	0	2	0	2
Total	37	13	50	6	5	11	9	8	17	66	49	115	5	2	7	4	0	4	13	6	19	2	2	4	23	8	31

(1) Drilling/Water works construction companies

In looking over the technical staff requirement of the studied 12 private drilling companies, the requirement of drillers (chief drillers, drillers, assistant drillers) are very high which is followed by relatively equal high requirement of hydrogeologists, electricians and mechanics.

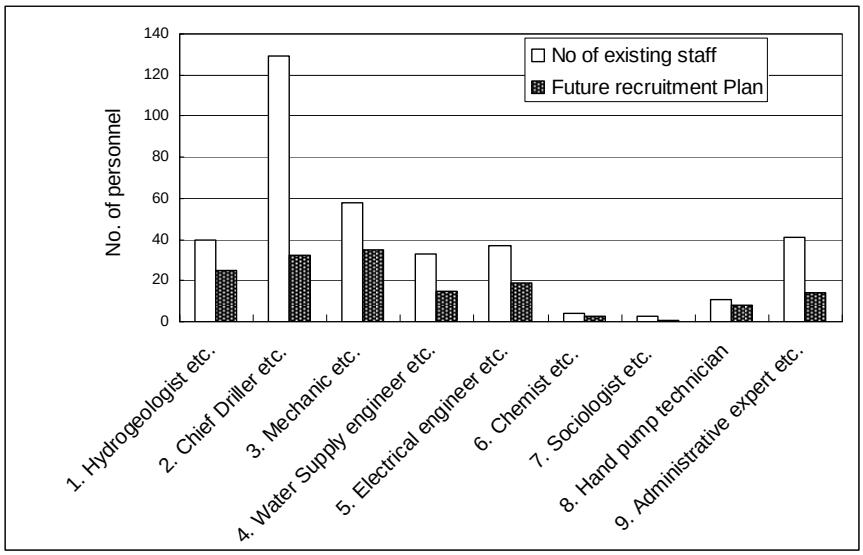


Figure 6 Existing staff and vacant/future recruitment plan in private drilling/water works construction companies (result of 9 companies)

(2) Consulting firms

Among the technical staff requirement of the studied 12 consulting firms, the requirement of water supply engineers (category no. 4), is very high which is followed by Hydrologists (category no. 1).

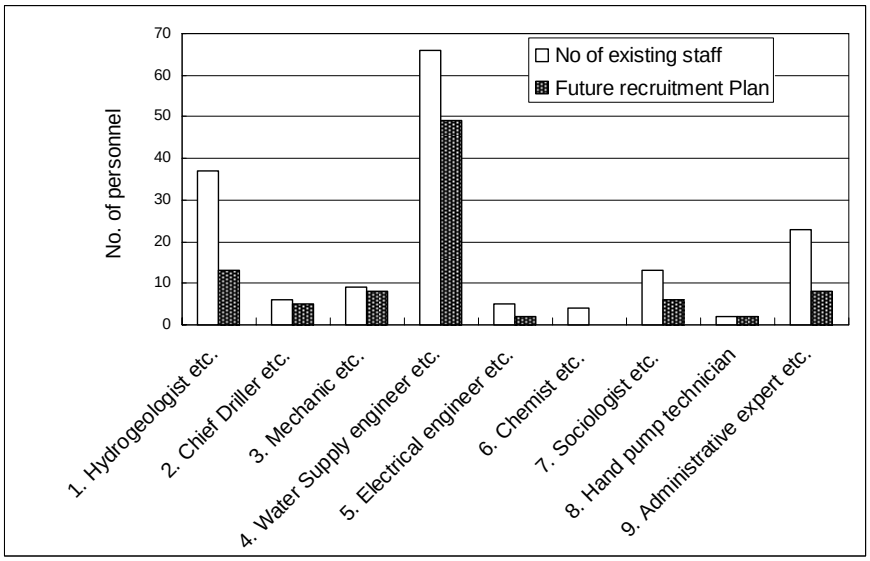


Figure 7 Existing staff and vacant/future recruitment plan in private consulting firms (result of 12 firms)

2.5 NGO

2.5.1 Major activities

The level of activities is not uniform among NGOs engaged in water supply. Their involvement in six major activity categories was surveyed (Table 16).

Table 16 Area of NGOs activities related to water supply

Category of activities	No. of responded NGOs	Total No. of respondents
Water supply development/construction	11	12
Water supply scheme rehabilitation	8	
Soil and water conservation activities	6	
Capacity building for managing water schemes	10	
Capacity building for local government office	6	
Funding for water construction and monitoring	7	

Table 17 shows type of water schemes which NGOs are constructing. It shows that major water schemes for NGOs are hand dug wells and developed spring among the respondents.

Table 17 Type of water schemes which NGOs most frequently constructs (in priority order)

Organization	Priority	Type of Water Schemes
Oxfam	1	Hand dug well
	2	Spring development
	3	Borehole
	4	Sand dam, pond
	5	For irrigation: River diversion, pump irrigation
World Vision Ethiopia	1	Borehole drilling both shallow well and deep well drilling
	2	Spring development
	3	Hand-dug well
	4	Water harvesting structure
	5	Small scale dam
Kana Yelimat Mahiber (KYM)	1	Hand dug well
	2	Spring development
Alliance for Development	1	Spring development
	2	Hand dug well
	3	Rain water harvesting
	4	Bore hole
	5	Shallow wells
Coopeazione Internationals (COOPI)	1	Hand dug well
	2	Pond
	3	Birka
	4	Borehole
	5	Spring development
Society of International Missionaries	1	Spring capping
	2	Shallow well drilling
	3	Traditional well rehabilitation

Organization	Priority	Type of Water Schemes
	4	Percussion well drilling (pilot program)
	5	Hand dug wells
Ethio wetlands and natural resources association (EWNRA)	1	Construction and installation of hand pumps
	2	Spring Development
Intermon Oxfam	1	Spring development
	2	Hand dug wells
	3	Shallow and deep boreholes
Water Aid Ethiopia	1	Spring development with gravity distribution
	2	Spring with public fountain
	3	Hand dug well
	4	Shallow well
	5	Sand dam (at test level)

2.5.2 Major problems

The major technical problems observed for the failure of NGOs water schemes are summarized in Table 18. Ten NGOs responded that poor study & design is one of the major causes of the their water schemes' failure; and four responded that poor construction supervision is one of the major causes of failure, and two responded poor community promotion work or lack of sufficient community participation as one of the major causes.

Table 18 Major technical problems observed for the failure of most water schemes developed by NGO

Organization	Major technical problems	Causes of the problem	Measures taken to solve the problem
Oxfam Americ	Suitability with local situation Management	Study Less attention on the soft ware aspects	Work on the TOR of the study from on set Focus on the soft aspect equally as the engineering aspect
World vision Ethiopia	Dry well Head problem Back pressure problems related to pope works Well collapsing and related drilling tools stacking Frequent rigs and truck failure	Study design design construction / poor supervision poor operation and maintenance	
Kana Yelimat Mahiber	Sometimes there is a problem to get the water eye	Site selection	To solve the problem first we participate the community members especially elderly in selection sites
Alliance for development	Insufficient schemes management inadequate study \ design	Insufficient community participation Not qualified/experienced water technicians	Intensive & continued training for targeting commutates Seeking consultants inputs (more expenditure)
Water action	Yield reduction of Bore Holes and springs leakage of pipelines Seepage of structures	Study Construction Construction	Revising the studied document and quality control (supervision) during construction
Coopeazione Internationals	Sustainability Design	Study: in most cases the study focus on technical feasibility, less attention given for social factors Using inappropriate technology for specific areas	Improve the community involvement in the study, planning and implementation of the project. Select suitable technology for different scenarios
Society of international Missionaries	Some drilled wells are abandoned Hard to use hand pumps for 80-90meter deep wells	topography or Capacity of the hand pump	
Ethio wetlands and natural resources association (EWNRA)	Interruption of excavation due to availability of underground flat stone / rock during hole excavation for hand pump installation at some of the sites-in two of the sites of hand pump installation underground flat stone /rock was found after 6 meters of excavation work	study	A site change close to the already agreed sites was done in consultation and approval from the community. The rechosen sites are not far from those sites and it is in range of 20-30 meters. The cost for re-excavating the sites was borne by the construction firm was as it was agreed initially
Intermon Oxfam	Siltation in boreholes Check in hand dug wells and water contamination Decline in spring yield Spring box crack and taken away by flood Frequent pump breakdown	Construction and supervision Construction and supervision Study Design and construction Study, design and installation	After the problem was discovered redesign, rehabilitation and maintenance were undertaken.
Water Aid Ethiopia	Decline in water production, quality Breakage of pumps, taps, etc.	Lack of comprehensive study Use of inferior quality material, poor management of schemes, poor installation	Training of community, improvement in the procurement process

2.5.3 Manpower

Number of technical staff among the responded NGOs was listed in Table 19.

Table 19 Number of technical staff in NGOs engaged in the water sector

Organization	Type of technical staff	No of Staff	Major Task
World Vision Ethiopia	Water engineers	75	Supervision of civil works including water works
	Hydrogeologists	3	Plan, study, and design, and supervise water works as drilling, rehabilitation, and pump test
	Drillers	6	Drilling, Well rehabilitation
	Pump technicians	5	Electro-mechanical installation and maintenance
	Mechanics	2	Rig and truck maintenance
Kana Yelimat Mahiber	Program coordinator (Sociology background)	1	Coordinate implement of project in all phases of project cycle
	Project Officers	2	Coordinate implement of project in two targets
	Executive Director	1	Administer the overall programs of the organization
	Support staff	5	They are responsible to carry out activities that support the direct programs of the organization
	Volunteers	14	They are engaged in voluntary service for the targets of the organization
Alliance for development	Agricultural economist	1	Responsible for all programs (planning, monitoring & evaluations)
	Health officials	1	Responsible for health problem
Water action	Senior water Resource Offices	3	Control design over all activities of the projects
	Project manager	3	Managing over all activities
	Project coordinators	3	Coordinating over all activities
	Construction Forman	10	Control of all construction
	Plumbing Forman	4	Control of plumbing activities
	Site engineer	2	Giving technical support of site
	Division Manager	2	Technical support
Coopeazione Internationals (COOPI)	Hydrogeologist	3	Study site selection, project coordination, planning , reporting , monitoring , supervising
	Technicians	5	Technical work
Society of international Missionaries	Water civil engineers	1	Coordinating, training staff
	Water technicians	5	
Ethio wetlands and natural resources association (EWNRA)	General manager	1	Project proposal development, overall monitoring and support for project activities implementation
	Natural resources specialist	1	Participate in project proposal development, baseline data collection and analysis, mentoring & evaluation of the projects
	Wetland and Biodiversity Specialist	1	Participate in project proposal development and follow up of the project activities
	Metu field Office coordinator	1	Coordinate overall project activities

Organization	Type of technical staff	No of Staff	Major Task
		1	Collaborate with the line offices of Govt in order to undertake the planned activities
		1	Ensure the potential contractors for the installation and construction of hand pumps and spring development will be hired
		1	Follow up of day-to-day activities
Intermon Oxfam	Program manager	1	Program coordination, team management, planning, project appraisal, monitoring and evaluation, strategy development
	Infrastructure development program officer, sanitation, hygiene and community development program officer	1	Project appraisal, planning , assist partners in community organization and capacity building, development sanitation hygiene promotion strategy and monitoring evaluation
Water Aid Ethiopia	Country director	1	Planning, coordinating and manage over all institutional policies and fund
	WASH director	1	plan, coordinate and manage projects related to water supply and sanitation, he is in charge of supervising the Advisors and senior water supply and sanitation
	Water supply advisor	1	Appraise and supervise water supply project, guide staffs, advise the institution on issues related to water supply
	Senior water supply engineer	2	Prepare project, follow up water supply project, monitor and check for the consistence
	Sanitation advisor	1	Appraise and supervise sanitation project, guide staffs on issues related to sanitation, and advise the institution on issues related to sanitation
	Senior sanitation specialist	1	Prepare project, follow up progress of sanitation project
	Regional coordinator	1	Coordinate regional offices and follow up implementation of projects that runs directly Water Aid Ethiopia
	Contract funding manager	1	Prepare projects for fund raising, check implementation of programs in accordance with the agreement and prepare report
	Project site coordinator	3	Responsible for all project implementation, design, construction, report preparation
	Project engineer	2	Assist the project site engineer, responsible for detailed design and supervision work

3. Findings on training needs

3.1 Core public sector

3.1.1 Evaluation of current EWTEC training courses

(1) Currently provided modules

EWTEC has been providing 5 basic courses which are; Groundwater Investigation course, Drilling Technology course, Drilling Machinery Maintenance Technology course, Water Supply Engineering course and Electro Mechanical Maintenance Technology course. To evaluate the contents of these basic courses, importance of each module of the courses were questioned to the relevant technical staff of RWB, ZWRO, WWO and TWSS. The questionnaire was prepared for each field of training and was distributed to the relevant fields of technical staff members in each office including ex-EWTEC trainees who understand the details of the contents of each module. In addition, the head of an office and a department were asked to fill the same questionnaires of all the fields. The results are shown in the following tables. Most of the responses show “very important” or “important” for all the modules of all 5 courses.

Table 20 Review of modules in the EWTEC basic courses provided by RWB, ZWRO, WWO and TWSS

A. Groundwater Investigation

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Occurrence and Groundwater Movement (Groundwater Hydrology)	53	80.3%	11	16.7%	2	3.0%	0	0.0%
2	Groundwater Investigation Methods	64	95.5%	3	4.5%	0	0.0%	0	0.0%
3	Drilling Technology and water well management	56	81.2%	11	15.9%	2	2.9%	0	0.0%
4	Geophysical Logging Test	50	74.6%	11	16.4%	5	7.5%	1	1.5%
5	Pumping Test	56	81.2%	13	18.8%	0	0.0%	0	0.0%
6	Water Chemistry	39	57.4%	29	42.6%	0	0.0%	0	0.0%
7	Geology and Hydrogeology of Ethiopia	44	66.7%	18	27.3%	3	4.5%	1	1.5%
8	Groundwater modeling and GIS	53	80.3%	12	18.2%	1	1.5%	0	0.0%

B. Drillling Technology

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Introduction to Geology and Hydrogeology	22	61.1%	12	33.3%	2	5.6%	0	0.0%
2	Drilling Administrative Techniques	25	69.4%	8	22.2%	2	5.6%	1	2.8%
3	Units of Measurement and their application	20	54.1%	13	35.1%	3	8.1%	1	2.7%
4	Drilling Machines and Tools	22	62.9%	9	25.7%	4	11.4%	0	0.0%
5	Drilling Technology	28	77.8%	7	19.4%	1	2.8%	0	0.0%
6	Functions of the Drilling Machine and equipment	24	66.7%	12	33.3%	0	0.0%	0	0.0%
7	Recovery of Drilling Problems (Trouble Shooting)	28	77.7%	5	13.9%	2	5.6%	1	2.8%
8	Practical Training	31	86.1%	4	11.1%	0	0.0%	1	2.8%

C. Drilling Machinery Maintenance Technology

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Basic knowledge	32	76.2%	8	19.0%	2	4.8%	0	0.0%
2	Truck	22	53.6%	11	26.8%	4	9.8%	4	9.8%
3	Top Head Drive type drilling machines	25	65.7%	8	21.1%	3	7.9%	2	5.3%
4	Diesel engine and Injection pump	28	68.3%	8	19.5%	4	9.8%	1	2.4%
5	Down the Hole Air hammer	26	63.4%	7	17.1%	6	14.6%	2	4.9%
6	Air compressor	27	65.8%	9	22.0%	4	9.8%	1	2.4%
7	Percussion type drilling machine	21	50.0%	12	28.6%	5	11.9%	4	9.5%
8	Electrical devices on Diesel engine	29	70.7%	10	24.4%	0	0.0%	2	4.9%

D. Water Supply Engineering

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Introduction of Water Supply Engineering	48	71.6%	13	19.4%	6	9.0%	0	0.0%
2	Planning of water supply	51	76.1%	14	20.9%	1	1.5%	1	1.5%
3	Water source	48	71.6%	16	23.9%	2	3.0%	1	1.5%
4	Contamination of water bodies/Pollution and sanitation facilities	45	68.2%	20	30.3%	1	1.5%	0	0.0%
5	Water Quality Management & Control	52	78.8%	12	18.2%	2	3.0%	0	0.0%
6	Purification facilities	40	63.4%	19	30.2%	3	4.8%	1	1.6%
7	Basic design criteria of water supply facilities and tender document preparations	49	73.1%	13	19.4%	3	4.5%	2	3.0%
8	Mechanical & Electrical Facilities	44	66.7%	19	28.8%	3	4.5%	0	0.0%
9	Transmission & Distribution Facilities	51	77.3%	14	21.2%	1	1.5%	0	0.0%
10	Structure Analysis & Construction of water works	56	83.6%	9	13.4%	1	1.5%	1	1.5%

E. Electro-Mechanical Maintenance Technology

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Fundamentals of Electricity and Measurements	50	68.5%	17	23.3%	6	8.2%	0	0.0%
2	Submersible Pump	62	83.8%	10	13.5%	2	2.7%	0	0.0%
3	Sequence Control	56	77.8%	10	13.9%	6	8.3%	0	0.0%
4	Diesel engines	49	64.5%	19	25.0%	7	9.2%	1	1.3%
5	Electrical Devices on Diesel Engines	53	70.6%	14	18.7%	8	10.7%	0	0.0%
6	Electric Motors and Generators	63	82.9%	10	13.2%	3	3.9%	0	0.0%

In addition to the 5 basic courses, other short term courses (advanced or on-demand) provided by EWTEC were asked to evaluate. Especially, Groundwater modeling course and GIS course shows a high rate of “very important.”

Table 21 Review of EWTEC’s additional courses by RWB, ZWRO, WWO and TWSS

F.Other Training Courses

No	Modules	Very Impotant		Important		little importance		Not important	
		persons	%	persons	%	persons	%	persons	%
1	Groundwater modeling	49	83.1%	10	16.9%	0	0.0%	0	0.0%
2	GIS	51	86.4%	8	13.6%	0	0.0%	0	0.0%
3	Remote sensing	42	76.4%	12	21.8%	1	1.8%	0	0.0%
4	Well diagnosis	27	50.9%	23	43.4%	3	5.7%	0	0.0%
5	Well rehabilitation	39	69.6%	14	25.0%	3	5.4%	0	0.0%
6	Appropriate technology (rope pump)	33	56.9%	20	34.5%	5	8.6%	0	0.0%
7	Local social development	32	56.1%	18	31.6%	6	10.5%	1	1.8%

(2) Requested additional modules in each field of training

Modules which respondents consider important to be added in each field of training are summarized

in the following tables. RWB significantly indicated the need for "contract administration" in the field of groundwater investigation and water supply engineering courses. The module for "CAD (Auto CAD and Water CAD)" operation was high for water supply engineering course.

Table 22 Additionally requested modules for each training field by RWB, ZWRO, WWO and TWSS (The figures in the table represent respondent numbers. Modules requested by only 1 respondent are not shown. For all results, see Annex 2)

Technical Field: Groundwater Investigation

Requested modules	RWB	ZWRO	WWO	TWSS	Total
Contract administration & procurement	7	2	1	0	**10**
Geophysical investigation	5	2	0	0	**7**
Remote sensing	2	4	0	0	**6**
GIS	1	4	0	0	**5**
Water resources development	3	0	0	2	**5**
Well maintenance	4	0	0	0	**4**
Basic knowledge for geology & hydrology	0	0	1	2	**3**
Water quality	1	0	1	1	**3**
Structural geology	1	1	0	0	**2**
Recovery of Drilling Problems (Trouble Shooting)	1	1	0	0	**2**

Technical Field: Drilling Technology

Requested modules	RWB	ZWRO	WWO	TWSS	Total
Groundwater Hydrology	1	1	0	0	**2**

Technical Field: Drilling Machinery Maintenance Technology

Requested training	RWB	ZWRO	WWO	TWSS	Total
Basic knowledge on machines	0	3	0	0	**3**
Engineering management	2	1	0	0	**3**
Diesel Engines Maintenance	2	0	0	0	**2**
Electrical system	2	0	0	0	**2**
Electricity measurement	0	2	0	0	**2**
Electric motors & generators	0	2	0	0	**2**
Hydraulic system maintenance	2	0	0	0	**2**

Technical Field: Water Supply Engineering

Requested modules	RWB	ZWRO	WWO	TWSS	Total
CAD (AutoCAD, Water CAD)	7	5	2	1	**15**
Water leakage control	0	0	0	6	**6**
Water quality analysis	1	0	3	2	**6**
Contract Administration	2	0	1	1	**4**
Water retention structure (dam) and design	2	1	0	0	**3**
SAP	1	1	0	0	**2**
Water resource development	0	0	0	2	**2**
Introductory to Hydrology	0	1	0	1	**2**
Surface water Harvesting (irrigation)	2	0	0	0	**2**

Technical Field: Electro Mechanical Maintenance Technology

Requested modules	RWB	ZWRO	WWO	TWSS	Total
Control system (panel board)	3	2	0	3	**8**
Solar pump panel maintenance	3	2	1	0	**6**
Surface pump	3	0	0	2	**5**
Submersible pump	3	0	1	1	**5**
Hand pump maintenance	1	1	2	0	**4**
Pump testing	4	0	0	0	**4**
Automotive electricity	4	0	0	0	**4**
Maintenance of Unit Devices	0	2	0	1	**3**
Electronics for controlling motors & generators	2	0	0	1	**3**
Pumps with appropriate tech.	0	0	1	1	**2**
Booster pump installation and maintenance	0	0	0	2	**2**
Water quality control	1	0	0	1	**2**
Diesel engines	0	2	0	0	**2**
Rewinding electric motors	1	0	1	0	**2**

3.1.2 Demand for advanced or intensive training courses

Among the above mentioned modules which are currently provided in the course and/or additionally requested, the following topics are requested to be offered as an advanced (or intensive) course (Table 23).

Table 23 Requested advanced or intensive training courses for each training field by RWB, ZWRO, WWO and TWSS (The figures in the table represent respondent numbers. The items requested by only 1 respondent are not shown. For all results, see Annex 2)

Technical Field: Groundwater Investigation

Requested training	RWB	**ZWRO**	WWO	TWSS	Total
GW modeling	15	6	3	4	28
GIS	13	7	3	4	27
Groundwater investigation methods	12	7	1	2	22
Basic knowledge of geology & hydrogeology	9	10	1	1	21
Drilling technology & Well management	10	2	3	1	16
Pumping Test	7	5	2	0	14
Water Chemistry	8	2	2	2	14
Geophysical logging test	6	4	0	1	11
Electrical device and generator	0	0	2	4	6

Technical Field: Drilling Technology

Requested training	RWB	**ZWRO**	WWO	TWSS	Total
Drilling technology and engineering	5	2	1	1	9
Drilling administrative techniques	3	2	1	1	7
Recovery of drilling problems	3	3	1	0	7
Drilling tools and accessories	3	2	1	0	6
Practical training	2	1	2	1	6
Groundwater Hydrology	3	2	0	0	5
Others (air compressor, mud pump, holdback and downdeed use)	0	3	0	0	3
Water measurements & their application	1	0	1	0	2

Technical Field: Drilling Machinery Maintenance Technology

Requested training	RWB	ZWRO	WWO	TWSS	Total
Electrical devices on diesel engine	3	8	2	0	13
Top head driver type drilling machine	4	8	0	0	12
Air compressor	5	5	0	0	10
Diesel engine and Injection pump	3	4	1	0	8
Basic knowledge on machines	2	3	1	1	7
Down the Hole Air Hammer	3	3	0	0	6
Percussion type drilling machine	3	0	1	0	4
Truck	4	0	0	0	4
Pumps mechanism & maintenance	2	0	0	0	2
Electrical system	2	0	0	0	2
Hydraulic system maintenance	2	0	0	0	2

Technical Field: Water Supply Engineering

Requested training	RWB	ZWRO	WWO	TWSS	Total
Water quality management	16	3	7	4	30
Planning water supply	7	10	5	7	29
Basic design criteria	7	4	4	2	17
Structure analysis& construction of water works	5	5	3	3	16
Transmission & Distribution Facilities	2	4	0	4	10
Leakage control system	0	2	0	4	6
Tender document preparation	2	1	2	1	6
Mechanical and electrical facilities management	2	1	0	1	4
Introductory to geology and hydrogy	1	0	1	0	2

Technical Field: Electro Mechanical Maintenance Technology

Requested training	RWB	ZWRO	WWO	TWSS	Total
Electrical motors and generators	12	8	4	16	40
Submersible pump	10	10	5	9	34
Sequence Control	7	7	1	6	21
Electrical devices on diesel engines	8	3	1	2	14
Diesel engines	6	3	4	1	14
Fundamental of electricity and measurements	2	4	3	3	12
Control panel	2	1	0	1	4
Surface pump and electrical motors	2	0	0	1	3
Others (hand pump maintenance, GIS)	1	0	1	0	2

Technical Field: Others

Requested training	RWB	ZWRO	WWO	TWSS	Total
Geophysics & Groundwater monitoring	2	0	3	1	6
Water quality	2	0	2	0	4
Well Rehabilitation	2	0	2	0	4
GIS	2	0	1	1	4
Local Social Development	1	0	2	0	3
Pump maintenance	2	1	0	0	3
Geology	3	0	0	0	3
Structural geology	1	0	1	0	2
Remote sensing	1	0	1	0	2

3.1.3 Training duration and season

Appropriate duration for each training course currently provided by EWTEC was asked in the questionnaire. The result is shown in Table 24, which indicates a longer desired period (approximately 4 weeks more) than the currently given duration for all the courses.

Table 24 Requested duration for training courses by RWB, ZWRO, WWO and TWSS

Training Course	Current course duration (weeks)	Requested average duration	No. of respondent

		(weeks)	
Groundwater Investigation	12	16	49
Drilling Technology	12	16	23
Drilling Machinery Maintenance Technology	12	16	32
Water Supply Engineering	8	11	51
Electro-mechanical Maintenance Technology	8	12	58

For advanced (or intensive) courses, the suggested duration is summarized in Table 25.

Table 25 Duration for advanced (or intensive) courses suggested by RWB, ZWRO, WWO and TWSS

Training Course	Average duration suggested (weeks)
Groundwater Investigation	5.7
Drilling Technology	4.6
Drilling Machinery Maintenance Technology	5.1
Water Supply Engineering	5.4
Electro-mechanical Maintenance Technology	5.9

*Suggestions of over 20 weeks were omitted.

At the same time, preferable months for the training were asked in the questionnaire. The result shows the period between June and September is preferable for all the courses, which indicates the rainy season, when not much work is conducted. The results do not differ in each region (Table 26).

Table 26 Proposed months for training by RWB, ZWRO, WWO and TWSS (above: by training course, below: by region)

By Training Course

Training courses	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Groundwater Investigation	2%	2%	5%	8%	8%	12%	16%	16%	16%	9%	5%	4%
Drilling Technology	1%	2%	5%	7%	8%	11%	14%	15%	16%	9%	6%	4%
Drilling Machinery Maintenance Technology	1%	1%	4%	6%	7%	12%	17%	17%	17%	10%	5%	4%
Water Supply Engineering	2%	2%	3%	5%	4%	13%	18%	16%	16%	10%	7%	4%
Electro-Mechanical Maintenance Technology	2%	4%	4%	5%	5%	11%	17%	18%	17%	9%	5%	3%
Groundwater modeling	2%	2%	4%	4%	5%	12%	19%	19%	16%	10%	5%	3%
GIS	2%	2%	4%	6%	6%	13%	18%	17%	15%	9%	5%	3%
Remote sensing	1%	2%	4%	5%	5%	12%	19%	19%	16%	8%	6%	3%
Well diagnosis	2%	2%	4%	6%	6%	11%	16%	16%	16%	11%	6%	3%
Well rehabilitation	2%	4%	4%	6%	6%	11%	16%	16%	16%	10%	6%	3%
Appropriate technology	2%	2%	5%	6%	7%	13%	18%	19%	15%	7%	3%	3%
Local Social Development	0%	0%	0%	0%	25%	25%	25%	25%	0%	0%	0%	0%

By Region

Training courses	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amhara	3%	3%	3%	2%	2%	5%	17%	17%	24%	13%	11%	1%
Tigray	0%	4%	12%	0%	0%	28%	28%	28%	0%	0%	0%	0%
Oromia	1%	1%	1%	1%	1%	12%	20%	20%	17%	12%	7%	7%
SNNP	1%	1%	2%	7%	8%	15%	21%	20%	14%	7%	2%	2%
Afar	4%	5%	8%	9%	12%	12%	11%	11%	12%	8%	4%	4%
Somali	4%	4%	8%	16%	11%	13%	9%	11%	11%	7%	5%	1%
Benishangul	8%	8%	0%	0%	0%	4%	12%	19%	13%	13%	12%	12%
Gambela	0%	1%	2%	2%	1%	15%	18%	18%	20%	11%	7%	6%
Harari	0%	0%	6%	6%	12%	12%	19%	19%	22%	4%	1%	0%

3.1.4 Actual requirement at woreda, zone and town level

Until now, the major target of EWTEC training was regional level, but EWTEC intends to expand the target to WWO, ZWRO and TWSS. To formulate training courses for these organizations, the gap between actual work requirements and the skill of workers was studied during the survey.

(1) Actual requirement at woreda level

Compared to the official responsibilities that the woreda technical staff is entrusted to perform as indicated in 2.1.1, they currently engaged in most of their time in carrying out only limited activities. The actual work conducted at woreda level was questioned during the study. To obtain this information, possible tasks are listed in a separate questionnaire as a supplementary questionnaire[4] and frequency of engagement for each task was selected from the following classifications.

4: Very often (more than once a week)
3: Often (more than once a month)
2: Only sometimes (more than once a year)
1: No requirement (never or less than once a year)

At the same time, the skills of respondents to fulfill the same tasks were evaluated by themselves from the following classifications to understand the gap between actual tasks and the ability to perform them.

4: Excellent
3: Good
2: Satisfactory
1: Needs improvement

The listed tasks (work details) are copied from the curriculum modules of TVETC Water Technology Department, which is categorized into three categories; those are “Rural Water Supply and Sanitation (41 work details),” “Small Scale Irrigation and Drainage (39 work details),” “Electro Mechanical (29 work details).” Each category was compiled in a questionnaire sheet and given to concerned staff in WWO (Annex 2).

According to the collected data, many of the tasks listed were responded as “Only sometimes” or “No requirement” (Annex 2). Among them, the items for which more than 50% of the respondents answered as “Often” or “Very often” are summarized in Table 27.

Table 27 Actual work details at WWO level (more than 50% of total respondents answered the

[4] Details of work listed in the supplementary questionnaire are exactly the same as the details of TVETC curriculum. Because many staff in WWO and some staff in ZWO and TWSS are the graduates of TVETC, they are assumed to be familiar with the listed items. Also, the results could be used for feedback to TVETC curriculum.

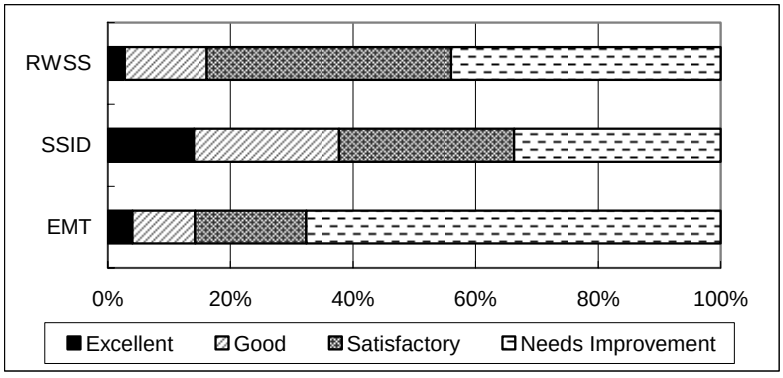
Frequency of tasks as “Often” or “Very often”)

Work Category	Work details
Water Pump Operation & Maintenance	Maintaining hand pumps
Generator Set & Water Pump Installation	Installing hand pumps
Resources Investigation	Investigating surface water resource
	Assessing groundwater potential
	Surveying socio-economic conditions
Small Scale Irrigation System Design	Designing water harvesting structures
	Designing ground water source for irrigation
	Designing channel structures
	Preparing specification & bill of quantities
Drainage System Design	Overviewing drainage
	Investigating drainage conditions
	Designing surface drainage systems
Small Scale Irrigation and Drainage Systems Operation & Maintenance	Distributing irrigation water & monitoring it
	Monitoring soil & water quality
	Planning maintenance
Small Scale Irrigation and Drainage Systems Operation & Maintenance	Managing construction
	Guiding construction of ponds

Tasks related to hand pumps are plausible considering the actual water supply condition at Woreda level. “Assessing groundwater potential” is assumed as potential of shallow groundwater for hand dug wells. Tasks related to small scale irrigation are also prominent. There are fewer requirements for electrical maintenance work.

Regarding the competency to fulfill the tasks listed, most answered as “Satisfactory” or “Needs improvement,” which are the second and first of the four categories. The results are summarized in Figure 8.

Among the tasks listed in Table 27, more than 50% of respondents answered Satisfactory” or “Needs improvement” for each item except for “Assessing groundwater potential,” “Surveying socio-economic conditions,” and “Monitoring soil & water quality.”



Technical Field	Question	No. of respondents
Rural Water Supply and Sanitation	41 items	24
Small Scale Irrigatin and Drainage	39 items	8
Electro Mechanical Technology	29 items	14

Figure 8 Competency of WWO staff to accomplish required tasks

(2) Actual requirement at Zonal level

The same questionnaire given to WWO was also given to ZWRO staff. The whole result is attached in Annex 2. There were a total of 12 respondents (3 to 4 persons for each work category) from ZWRO in all the regions, which is too limited to make discussion on the results. However, as a reference, the results are shown below.

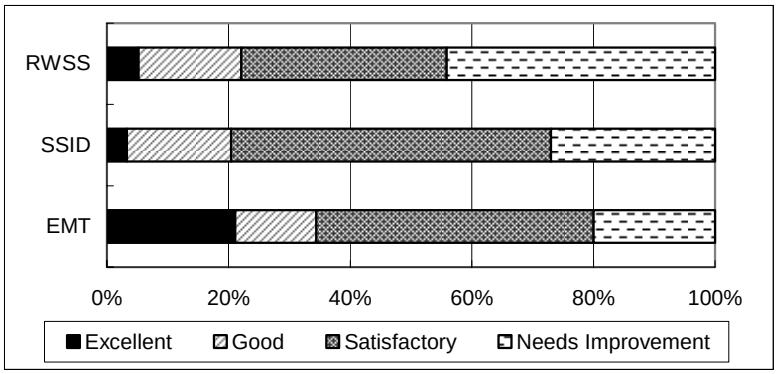
The tasks for which more than 50% of the respondents answered as “Often” or “Very often” are summarized in Table 28.

Table 28 Actual work details at ZWRO level (tasks more than 50% of total respondents answered as “Often” or “Very often”)

Work Category	Work Details
Rural Water Supply Source Investigation	Carrying out water demand assessment
	Assessing groundwater sources
Electrical System Installation	Testing and trouble shooting electrical installation
Electric Motor and Generator Maintenance	Identifying dc generators & motors
	Identifying ac generators & motors
	Maintaining electric motors
	Maintaining generators
Water Pump Operation & Maintenance	Maintaining submersible pumps
Diesel & Dewatering Pump Gasoline Engine Operation & Maintenance	Operating diesel engine
	Maintaining electrical system
	Maintaining gasoline engine of dewatering pumps
Resources Investigation	Assessing ground water potential
	Surveying socio-economic conditions
	Analyzing water demand and quality

Compared to the result of the same question for WWO which has more work on hand pump installation and maintenance, the tasks in ZWRO are more related to the maintenance of electrical system such as motor pumps and generators.

Regarding the competency to fulfill the tasks listed, most answered as “Satisfactory” or “Needs improvement,” which are the second and first of the four categories. The results are summarized in Figure 9.



Technical Field	Question	No. of respondents
Rural Water Supply and Sanitation	41 items	3
Small Scale Irrigatin and Drainage	39 items	4
Electro Mechanical Technology	29 items	4

Figure 9 Competency of ZWO staff to accomplish required tasks

(3) Town Water Supply Services

The same questionnaire given to WWO and ZWRO was also completed by TWSS staff. The whole result is attached in Annex 2. Most respondents are the technical staff on electro mechanical field and few numbers of staff answered for the question related to rural water supply and small scale irrigation for detailed discussion. As a reference, all the results are explained below.

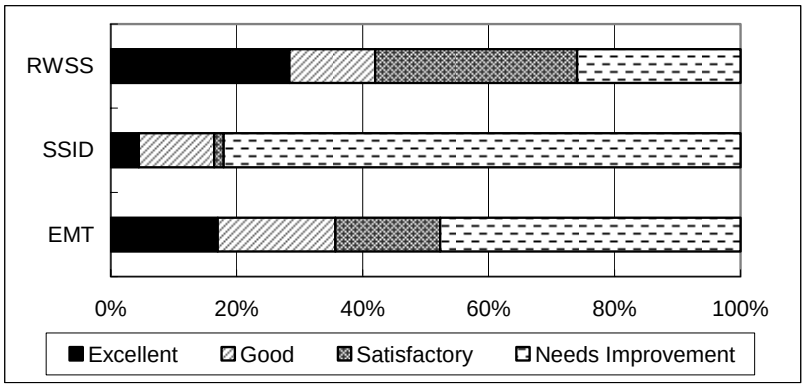
Table 29 shows frequency of engagement on the tasks for which more than 50% of the respondents answered as “Often” or “Very often.”

Table 29 Actual work details at TWSS level (more than 50% of total respondents answered the frequency of the tasks as “Often” or “Very often”)

Work Category	Work details
Small Scale Irrigation and Drainage Systems Operation & Maintenance	Monitoring soil & water quality
	Planning maintenance
	Guiding implementing maintenance
Small Scale Irrigation and Drainage Construction Supervision	Construction of generator/pump/house
Electrical System Installation	Installing electrical wires
	Installing distribution board & connecting final sub-circuits
	Terminating wires to fittings
	Testing and trouble shooting electrical installation
Repairing Measuring Instruments & Control Panel Devices	Maintaining electrical measuring instruments
Electric Motor and Generator maintenance	Maintaining electric motors
Water Pump Operation & Maintenance	Operating water pumps
	Maintaining surface water pumps
Diesel & Dewatering Pump Gasoline Engine Operation & Maintenance	Maintaining electrical system
Rural Water Supply Construction Supervision	Guiding the construction of reinforced concrete

	reservoir
Rural Sanitation	Guiding management of sludge water

According to the results, tasks related to the maintenance of electrical system such as motor pumps and generators are more common, which is similar to ZWRO. The situation on level of competency to fulfill the tasks seems to be better than WWO and ZWRO (Figure 10).



Technical Field	Question	No. of respondents
Rural Water Supply and Sanitation	41 items	2
Small Scale Irrigatin and Drainage	39 items	4
Electro Mechanical Technology	29 items	23

Figure 10 Competency of TWSS staff to accomplish required tasks

3.2 Public enterprises

3.2.1 Evaluation of current EWTEC training courses

(1) Currently provided modules

Among the water works public enterprises, WWCE has been a major organization which participated in the Drilling Technology course and the Drilling Machinery Maintenance Technology course provided by EWTEC. The needs assessment was conducted for all the water works public enterprises, including WWCE, WWDSE and WWDE. To evaluate the contents of the current basic courses provided by EWTEC, the technical staff of these organizations were asked the importance of each course module. This was asked mostly to ex-EWTEC trainees who understand the content of each module. In addition, office and department heads were asked the same question. The results are shown in the following tables. Most of the responses show “very important” or “important” for all the modules of all 5 courses.

Table 30 Review of EWTEC basic course modules by public enterprises (WWCE, WWDSE, WWDE)

A. Ground Water Investigation

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Occurrence and Groundwater Movement (Groundwater Hydrology)	12	92.3%	1	7.7%	0	0.0%	0	0.0%
2	Groundwater Investigation Methods	12	92.3%	1	7.7%	0	0.0%	0	0.0%
3	Drilling Technology and water well management	11	84.6%	2	15.4%	0	0.0%	0	0.0%
4	Geophysical Logging Test	8	61.5%	5	38.5%	0	0.0%	0	0.0%
5	Pumping Test	7	53.8%	6	46.2%	0	0.0%	0	0.0%
6	Water Chemistry	6	46.2%	7	53.8%	0	0.0%	0	0.0%
7	Geology and Hydrogeology of Ethiopia	10	76.9%	3	23.1%	0	0.0%	0	0.0%
8	Groundwater modeling and GIS	11	84.6%	2	15.4%	0	0.0%	0	0.0%

B. Drilling Technology

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Introduction to Geology and Hydrogeology	5	38.5%	8	61.5%	0	0.0%	0	0.0%
2	Drilling Administrative Techniques	9	69.2%	4	30.8%	0	0.0%	0	0.0%
3	Units of Measurement and their application	5	38.5%	7	53.8%	1	7.7%	0	0.0%
4	Drilling Machines and Tools	11	84.6%	2	15.4%	0	0.0%	0	0.0%
5	Drilling Technology	12	92.3%	1	7.7%	0	0.0%	0	0.0%
6	Functions of the Drilling Machine and equipment	9	69.2%	4	30.8%	0	0.0%	0	0.0%
7	Recovery of Drilling Problems (Trouble Shooting)	12	92.3%	1	7.7%	0	0.0%	0	0.0%
8	Practical Training	10	76.9%	3	23.1%	0	0.0%	0	0.0%

C. Drilling Machinery Maintenance Technology

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Basic knowledge	8	72.7%	2	18.2%	1	9.1%	0	0.0%
2	Truck	4	36.3%	5	45.5%	2	18.2%	0	0.0%
3	Top Head Drive type drilling machines	11	100.0%	0	0.0%	0	0.0%	0	0.0%
4	Diesel engine and Injection pump	11	100.0%	0	0.0%	0	0.0%	0	0.0%
5	Down the Hole Air hammer	9	81.8%	2	18.2%	0	0.0%	0	0.0%
6	Air compressor	11	100.0%	0	0.0%	0	0.0%	0	0.0%
7	Percussion type drilling machine	1	9.1%	9	81.8%	1	9.1%	0	0.0%
8	Electrical devices on Diesel engine	8	72.7%	3	27.3%	0	0.0%	0	0.0%

D. Water Supply Engineering

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Introduction of Water Supply Engineering	9	69.2%	4	30.8%	0	0.0%	0	0.0%
2	Planning of water supply	9	69.2%	4	30.8%	0	0.0%	0	0.0%
3	Water source	7	58.3%	5	41.7%	0	0.0%	0	0.0%
4	Contamination of water bodies/Pollution and sanitation facilities	8	66.7%	4	33.3%	0	0.0%	0	0.0%
5	Water Quality Management & Control	10	76.9%	3	23.1%	0	0.0%	0	0.0%
6	Purification facilities	5	45.4%	5	45.5%	1	9.1%	0	0.0%
7	Basic design criteria of water supply facilities and tender document preparations	11	84.6%	1	7.7%	1	7.7%	0	0.0%
8	Mechanical & Electrical Facilities	8	61.5%	5	38.5%	0	0.0%	0	0.0%
9	Transmission & Distribution Facilities	9	69.2%	4	30.8%	0	0.0%	0	0.0%
10	Structure Analysis & Construction of water works	11	84.6%	2	15.4%	0	0.0%	0	0.0%

E. Electro-Mechanical Maintenance Technology

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Fundamentals of Electricity and Measurements	8	61.5%	4	30.8%	1	7.7%	0	0.0%
2	Submersible Pump	11	84.6%	2	15.4%	0	0.0%	0	0.0%
3	Sequence Control	8	61.5%	5	38.5%	0	0.0%	0	0.0%
4	Diesel engines	10	76.9%	3	23.1%	0	0.0%	0	0.0%
5	Electrical Devices on Diesel Engines	11	84.6%	2	15.4%	0	0.0%	0	0.0%
6	Electric Motors and Generators	13	100.0%	0	0.0%	0	0.0%	0	0.0%

In addition to the 5 basic courses, they were also asked to evaluate other short term courses (advance or on-demand) provided by EWTEC. Especially, groundwater modeling course and GIS course showed a high rate of “very important.”.

Table 31 Review of EWTEC additional courses by public enterprises (WWCE, WWDSE, WWDE)

F. Other Training Courses

No.	Modules	Very Important		Important		little importance		Not important	
		Persons	%	Persons	%	Persons	%	Persons	%
1	Groundwater modeling	11	78.6%	3	21.4%	0	0.0%	0	0.0%
2	GIS	11	78.6%	3	21.4%	0	0.0%	0	0.0%
3	Remote sensing	9	64.3%	5	35.7%	0	0.0%	0	0.0%
4	Well diagnosis	8	57.1%	6	42.9%	0	0.0%	0	0.0%
5	Well rehabilitation	6	46.2%	7	53.8%	0	0.0%	0	0.0%
6	Appropriate technology (rope pump)	6	42.9%	5	35.7%	2	14.3%	1	7.1%
7	Local social development	7	50.0%	4	28.6%	2	14.3%	1	7.1%

(2) Requested additional modules in each field of training

Modules which respondents consider important to be added in each field of training are summarized in the following tables.

Table 32 Additionally requested modules for each training field by Public Enterprises (WWCE, WWDSE, WWDE) (The figures in the table represent the number of respondents. Modules requested by only 1 respondent are not shown in the table. For all results, see Annex 3)

Technical Field: Groundwater Investigation

Requested training	WWCE	WWDE	WWDSE	Total
Structural geology	3	0	0	3
Groundwater Investigation	2	0	0	2
Drilling Maintenance	2	0	0	2
Water quality	1	0	1	2
GW recharge	0	0	2	2

Technical Field: Drilling Technology

Requested training	WWCE	WWDE	WWDSE	Total
Introduction to geology and hydrology	3	0	0	3
Compressor maintenance	2	0	0	2
Core drilling	2	0	0	2
Drilling equipment Maintenance	1	1	0	2

Technical Field: Drilling Machinery Maintenance Technology

Requested training	WWCE	WWDE	WWDSE	Total
Hydraulic system	4	0	0	4
Hydraulic system trouble shooting	3	0	0	3
Maintenance management	3	0	0	3
Air compressor	3	0	0	3
Submersible pump	2	0	0	2
Electronic fuel injection	2	0	0	2

Technical Field: Water Supply Engineering

Requested training	WWCE	WWDE	WWDSE	Total
Software application (CAD, Epanet, Arc GIS etc)	0	0	6	6
Land survey	2	0	0	2
Resource Investigation	2	0	0	2
Design of water treatment plant	1	0	1	2
Construction Methodology	1	0	1	2
Project planning (Management of material, manpower and machinery)	2	0	0	2
Hydrology	2	0	0	2
Construction and contract management	0	0	2	2
Groundwater and surface water modeling	0	0	2	2

Technical Field: Electro Mechanical Maintenance Technology

Requested training	WWCE	WWDE	WWDSE	Total
Surge (water hammer) analysis	0	0	3	3

3.2.2 Demand for advanced or intensive training courses

Among the above mentioned modules which are currently provided in the course and/or additionally requested, the following topics are requested to be offered as an advanced (or intensive) course (Table 33).

Table 33 Requested advanced or intensive training course for each training field by public enterprises (WWCE, WWDSE, WWDE) (The figures in the table represent respondent numbers. Items requested by only 1 respondent are not shown. For all results, see Annex 3)

Technical Field: Groundwater Investigation

Requested training	WWCE	WWDE	WWDSE	Total
Groundwater Investigation	6	0	4	10
Well management	5	1	2	8
GIS	6	0	2	8
GW modeling	5	0	2	7
Water chemistry	4	0	0	4
Pumping test	3	0	0	3
Drilling Technology	3	0	0	3
Geology and Hydrology of Ethiopia	2	0	0	2

Technical Field: Drilling Technology

Requested training	WWCE	WWDE	WWDSE	Total
Drilling technology Trouble shooting	21	0	0	21
Drilling technology	16	2	0	18
Drilling machinery and tools	14	2	0	16
Practical training	10	0	0	10
Geology and Hydrology	7	0	0	7
Drilling Administrative technique	4	0	0	4
Core drilling	2	0	0	2
Mud rotary drilling	2	0	0	2

Technical Field: Drilling Machinery Maintenance Technology

Requested training	WWCE	WWDE	WWDSE	Total
Top head drive type drilling machines	17	0	0	17
Air compressor	16	0	0	16
Electrical Devices on Diesel Engine	9	0	0	9
Diesel engine	7	0	0	7
Injection pump	7	0	0	7
Truck	5	0	0	5
DTH hammer	3	0	0	3
Submersible pump	2	0	0	2
Pneumatic brake system	2	0	0	2
Material schience and heat treatment	2	0	0	2

Technical Field: Water Supply Engineering

Requested training	WWCE	WWDE	WWDSE	Total
The design of water supply facilities	7	0	3	10
Structure analysis	4	0	2	6
Tender documents preparation	4	0	1	5
Transmission & Distribution Facilities	1	0	4	5
Water source Investigation	2	0	1	3
Water supply planning	1	0	1	2
Irrigation	2	0	0	2

Technical Field: Electro Mechanical Maintenance Technology

Requested training	WWCE	WWDE	WWDSE	Total
Electrical devices on diesel Engine	6	0	0	6
Submersible pump	5	0	0	5
Generators and motors	4	0	0	4
Sequence control	3	0	0	3
Fundamentals of Electricity & measurements	2	0	0	2

3.2.3 Training duration and season

Appropriate duration for each training course currently provided by EWTEC was asked in the questionnaire. The results are shown in Table 34, which indicates a longer period (approximately 3 to 6 weeks more) than the currently given duration for all the courses.

Table 34 Requested duration for training courses by public enterprises (WWCE, WWDSE, WWDE)

Training Course	Current course duration (weeks)	Requested average duration (weeks)	No. of respondents
Groundwater Investigation	12	17	13

Training Course	Current course duration (weeks)	Requested average duration (weeks)	No. of respondents
Drilling Technology	12	18	18
Drilling Machinery Maintenance Technology	12	18	15
Water Supply Engineering	8	11	15
Electro-mechanical Maintenance Technology	8	11	13

For advanced (or intensive) courses, the suggested duration is summarized in Table 35.

Table 35 Duration for advanced (or intensive) courses suggested by public enterprises (WWCE, WWDSE, WWDE)

Training Course	Average duration suggested (weeks)
Groundwater Investigation	5.8
Drilling Technology	7.2
Drilling Machinery Maintenance Technology	6.3
Water Supply Engineering	5.6
Electro-mechanical Maintenance Technology	5.8

* Suggestions of over 20 weeks were omitted.

At the same time, preferable months for the training were asked in the questionnaire. The results shows the period between June and September is preferable for all the courses, which indicates the rainy season, when not much work is conducted (Table 36). The result is similar to that of the core public sector.

Table 36 Proposed months for training by public enterprises (WWCE, WWDSE, WWDE)

Training courses	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Groundwater Investigation	5%	0%	0%	0%	3%	18%	21%	23%	13%	10%	3%	5%
Drilling Technology	3%	3%	3%	0%	3%	16%	19%	22%	14%	11%	3%	5%
Drilling Machinery Maintenance Technology	6%	3%	3%	6%	3%	14%	14%	20%	17%	9%	3%	3%
Water Supply Engineering	4%	4%	0%	0%	0%	22%	17%	17%	17%	9%	9%	0%
Electro-Mechanical Maintenance Technology	4%	4%	7%	11%	7%	14%	18%	18%	11%	7%	0%	0%
Groundwater modeling	13%	13%	0%	0%	0%	17%	22%	22%	9%	4%	0%	0%
GIS	8%	8%	4%	4%	8%	13%	17%	17%	8%	8%	4%	0%
Remote sensing	8%	8%	4%	4%	8%	13%	17%	17%	8%	13%	0%	0%
Well diagnosis	5%	11%	5%	0%	5%	11%	16%	16%	16%	11%	0%	5%
Well rehabilitation	0%	12%	4%	0%	4%	8%	12%	20%	16%	12%	4%	8%
Appropriate technology	14%	14%	14%	0%	0%	7%	14%	21%	7%	7%	0%	0%

3.3 TVETC-Water Technology Department

3.3.1 Priority area of training

Deans and department heads were asked priority areas of training for TVETC instructors. The training areas are listed according to the course curriculum of each course (EMT, SSID, RWSS). The

results show a very high priority in all training areas (Table 37).

Table 37 Priority areas of training for TVETC instructors

Training areas		High		Medium		Low		None	
		No. of respondents	%	No. of respondents	%	No. of respondents	%	No. of respondents	%
EMT	Electrical System Installation	7	41%	6	35%	3	18%	1	6%
	Repairing Measuring Instruments & Control Panel Devices	14	82%	3	18%	0	0%	0	0%
	Electric Motor and Generator maintenance	16	94%	0	0%	1	6%	0	0%
	Water Pump Operation & Maintenance	14	87%	1	6%	1	6%	0	0%
	Diesel & Dewatering Pump Gasoline Engine Operation & Maintenance	13	81%	2	13%	1	6%	0	0%
	Generator Set & Water Pump Installation	14	88%	2	13%	0	0%	0	0%
SSID	Resources Investigation	11	73%	2	13%	2	13%	0	0%
	Small Scale Irrigation System Design	13	77%	4	24%	0	0%	0	0%
	Drainage System Design	10	59%	7	41%	0	0%	0	0%
	Small Scale Irrigation and Drainage Systems Operation and Maintenance	13	77%	4	24%	0	0%	0	0%
	Small Scale Irrigation and Drainage Construction Supervision	16	94%	1	6%	0	0%	0	0%
RWSS	Rural Water Supply Source Investigation	12	67%	2	11%	2	11%	2	11%
	Rural Water Supply Scheme Design	14	82%	2	12%	1	6%	0	0%
	Rural Water Supply Construction Supervision	15	79%	3	16%	1	5%	0	0%
	Rural Water Supply Scheme Operation	15	88%	2	12%	0	0%	0	0%
	Rural Sanitation	13	72%	3	17%	2	11%	0	0%
Others	Teaching Methodology	9	64%	4	29%	1	7%	0	0%
	Rural Community Participation	14	82.3%	2	12%	1	6%	0	0%

Table 38 Other suggested high priority training areas in TVETC

TVETC	Other suggested high priority training areas
Bahir Dar	■ Turbine & Refrigeration ■ Water quality ■ Soil survey and soil diagnosis and soil laboratory analysis ■ GPS operation & data collection using GPS for field surveys ■ Operation/utilization of theodolites, total stations and leveling instruments
Komborcha	■ Software training: Water CAD, GIS, Global Mapper ■ Groundwater investigation software, HEC-HEMS, HEC-RAS, SWAT, MOD-Flow
Jijiga	■ Training that focuses on how to organize small scale service providers/on trouble shooting in remote rural areas
Asossa	■ Soil test in laboratory ■ Use of generators for irrigation systems ■ Practical training for different irrigation systems
Weliso	■ Work ethics
Assela	■ Practical training at site or at the local training area of the college for trainers and students of the college

3.3.2 Training duration and season

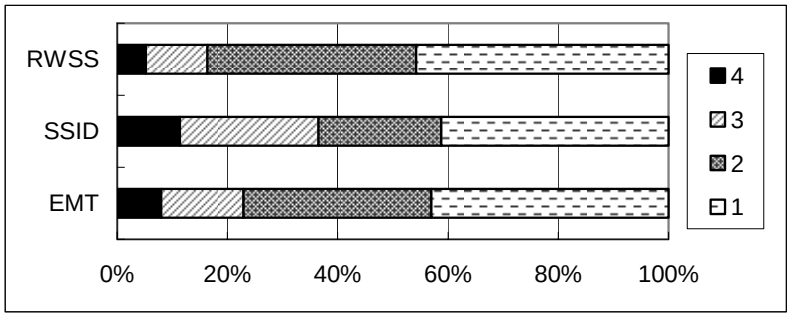
Preferable months and duration of training for TVETC instructors are summarized in Table 39. Since all TVETCs have a summer break in July and September for about two months, this season is preferable for the training of instructors.

Table 39 Preferable months and duration of training for TVETC instructors

TVETC	Proposed duration (weeks)			Preferred months for Training			Remark
	EMMT	SSID	RWSS	EMMT	SSID	RWSS	
Bahir Dar	8	8	8	June, July & August	June, July & August	June, July & August	Teachers are free in Summer season
Maichew	8	8	8	July-September	July-September	July-September	
Komborcha	8	8	8	July-August	July-August	July-August	
Awassa	12			June-July	June-July	June-July	
			12			June, July & August	
Lucy	4	4	4	August	July	July	
	4			August			
			8			July-August	
Jijiga	16	16	16	June-September	June-September	June-September	
	5.5	5.5	5.5	July-August	July-August	July-August	
		8			August-September		
			8			July-August	
	12			June-August			Teachers are free in Summer season
Asossa	3	3	3	July	August	June	
	12			July-September			
		5			May-July		
			4			July	
	3						
		3					
Weliso	2	2	2	July-August	December	July-August	
	8	8	8	July-April	July-April	July-April	
			12			July-September	
		8	8		July-August	July-August	
Assela	3	3	2	May	June	June	

3.3.3 Evaluation of TVETC instructor skills

An additional study was conducted for TVETC instructors to evaluate their knowledge and practical skills on the subjects to be taught to the students of each course (RWSS, SSID and EMT). Instructors answered their level of knowledge and skills according to the contents of the course curriculum. The results are summarized in Figure 11. The whole results are attached in Annex 4. The results show that most of the instructors are lacking practical experience in all the courses.



4= I have sufficient knowledge and experience.
3= I have sufficient theoretical knowledge and some practical experience.
2= I have basic theoretical knowledge and little practical experience.
1= I have basic theoretical knowledge but no practical experience.

Course	Question	No. of respondents
EMT	41 items	18
SSID	39 items	18
RWSS	29 items	27

Figure 11 Self evaluation results on the skills of TVETC instructors

3.4 Private sector-drilling company

3.4.1 Evaluation of current EWTEC training courses

The actual work carried out by private drilling companies are deep and shallow water well drilling, water well rehabilitation, pumping test and pump installation. These tasks are very similar to WWDE and the drilling part of the WWCE.

Through questionnaires, the contents of the current basic courses provided by EWTEC were evaluated by the private drilling companies. The result shows higher interest in some modules even in the courses other than Drilling Technology course, such as groundwater investigation. The results are shown in the following tables.

Table 40 Evaluation of EWTEC basic course modules by private drilling companies

A. Ground Water Investigation

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Occurrence and Groundwater Movement (Groundwater Hydrology)	4	57%	2	29%	1	14%	0	0%
2	Groundwater Investigation Methods	8	100%	0	0%	0	0%	0	0%
3	Drilling Technology and water well management	5	63%	2	25%	1	13%	0	0%
4	Geophysical Logging Test	4	50%	3	38%	1	13%	0	0%
5	Pumping Test	4	50%	4	50%	0	0%	0	0%
6	Water Chemistry	4	50%	1	13%	3	38%	0	0%
7	Geology and Hydrogeology of Ethiopia	4	50%	3	38%	1	13%	0	0%
8	Groundwater modeling and GIS	4	50%	2	25%	2	25%	0	0%

B. Drillling Technology

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Introduction to Geology and Hydrogeology	0	0%	5	63%	3	38%	0	0%
2	Drilling Administrative Techniques	7	88%	0	0%	1	13%	0	0%
3	Units of Measurement and their application	1	13%	4	50%	2	25%	1	13%
4	Drilling Machines and Tools	4	57%	3	43%	0	0%	0	0%
5	Drilling Technology	5	63%	3	38%	0	0%	0	0%
6	Functions of the Drilling Machine and equipment	6	75%	2	25%	0	0%	0	0%
7	Recovery of Drilling Problems (Trouble Shooting)	7	88%	1	13%	0	0%	0	0%
8	Practical Training	5	63%	3	38%	0	0%	0	0%

C. Drilling Machinery Maintenance Technology

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Basic knowledge	6	75%	2	25%	0	0%	0	0%
2	Truck	2	25%	3	38%	3	38%	0	0%
3	Top Head Drive type drilling machines	5	63%	3	38%	0	0%	0	0%
4	Diesel engine and Injection pump	2	25%	5	63%	1	13%	0	0%
5	Down the Hole Air hammer	4	50%	3	38%	1	13%	0	0%
6	Air compressor	4	50%	4	50%	0	0%	0	0%
7	Percussion type drilling machine	1	13%	3	38%	2	25%	2	25%
8	Electrical devices on Diesel engine	3	38%	3	38%	2	25%	0	0%

D. Water Supply Engineering

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Introduction of Water Supply Engineering	6	86%	1	14%	0	0%	0	0%
2	Planning of water supply	5	71%	2	29%	0	0%	0	0%
3	Water source	5	71%	2	29%	0	0%	0	0%
4	Contamination of water bodies/Pollution and sanitation facilities	3	43%	4	57%	0	0%	0	0%
5	Water Quality Management & Control	4	57%	3	43%	0	0%	0	0%
6	Purification facilities	3	43%	3	43%	1	14%	0	0%
7	Basic design criteria of water supply facilities and tender document preparations	4	50%	4	50%	0	0%	0	0%
8	Mechanical & Electrical Facilities	2	25%	5	63%	1	13%	0	0%
9	Transmission & Distribution Facilities	2	29%	5	71%	0	0%	0	0%
10	Structure Analysis & Construction of water works	4	50%	4	50%	0	0%	0	0%

E. Electro-Mechanical Maintenance Technology

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Fundamentals of Electricity and Measurements	4	50%	3	38%	1	13%	0	0%
2	Submersible Pump	7	78%	2	22%	0	0%	0	0%
3	Sequence Control	3	33%	3	33%	3	33%	0	0%
4	Diesel engines	3	33%	5	56%	1	11%	0	0%
5	Electrical Devices on Diesel Engines	5	56%	4	44%	0	0%	0	0%
6	Electric Motors and Generators	7	78%	2	22%	0	0%	0	0%

In addition to the 5 basic courses, other short term courses (advance or on-demand) provided by EWTEC were evaluated as follows.

Table 41 Evaluation of EWTECs additional courses by private drilling companies

F.Other Training Courses

No.	Modules	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Groundwater modeling	3	38%	2	25%	3	38%	0	0%
2	GIS	4	50%	3	38%	1	13%	0	0%
3	Remote sensing	3	38%	4	50%	1	13%	0	0%
4	Well diagnosis	3	38%	4	50%	1	13%	0	0%
5	Well rehabilitation	5	63%	1	13%	2	25%	0	0%
6	Appropriate technology (rope pump)	1	13%	5	63%	1	13%	1	13%
7	Local social development	1	13%	4	50%	2	25%	1	13%

3.4.2 Demand for advanced or intensive training courses

Among the above mentioned modules which are currently provided in the course and/or additionally requested, the following topics are requested to be offered as an advanced (or intensive) course (Table 42).

Table 42 Requested advanced or intensive training courses for each training field by private drilling companies (figures in the table represent respondent numbers.)

Technical Field: Groundwater Investigation

Requested training	Total
Groundwater investigation methods	5
Well management	4
GW modeling	3
Pumping test	3
GIS	2
Geology & hydrogeology of Ethiopia	1
Geophysical Logging	1

Technical Field: Drilling Technology

Requested training	Total
Drilling machines & tools	5
Recovery of drilling problems	2
Drilling administrative techniques	2
Practical training	2
Drilling Technology	2
Introduction to Geology and Hydrogeology	1

Technical Field: Drilling Machinery Maintenance Technology

Requested training	Total
Air compressor	5
Top head drive type drilling machine	3
Diesel engine & injection pump	2
Down the Hole Air hammer	2
Percussion type drilling machine	1
Basic Knowledge	1
Mud pump	1

Technical Field: Water Supply Engineering

Requested training	Total
Planning of water supply	4
Tender document preparation	3
Transmission & distribution facilities	3
Constructuion of water works	2
Water quality management & control	2
Introduction of water supply engineering	2
Mechanical & electrical facilities	1

Technical Field: Electro Mechanical Maintenance Technology

Requested training	Total
Submersible pump	5
Electrical devices on diesel engine	4
Electronincs for controlling motors & generators	3

3.4.3 Training duration and season

Appropriate duration for each training course currently provided by EWTEC was asked in the questionnaire. The result is shown in Table 43, which indicates a longer desired period (1 or 2 weeks) for each of the current courses.

Table 43 Requested duration for training courses by private drilling companies

Training Course	Current course duration (weeks)	Average requested duration (weeks)	No. of respondents
Groundwater Investigation	12	14	6

Training Course	Current course duration (weeks)	Average requested duration (weeks)	No. of respondents
Drilling Technology	12	13	7
Drilling Machinery Maintenance Technology	12	14	7
Water Supply Engineering	8	10	7
Electro-mechanical Maintenance Technology	8	9	8

Preferable months for the training for the private drilling companies are between June and September for all the courses, which indicates the rainy season, when not much work is conducted (Table 44). The result is similar to other sectors.

Table 44 Proposed months for training by private drilling companies

Training course	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Groundwater investigation			1	2	2	4	5	5	5	1	1	
Drilling technology	1	1	1	1		2	4	4	3	2	2	
Drilling machinery maintenance technology	2	2	2	1		3	5	5	2	1	1	
Water supply engineering	1	1	1	1	1	2	3	3				
Electro-mechanical maintenance technology						4	7	7	3	1	1	
Groundwater modeling	1	1	1	1	1	4	4	5	4			
GIS	1	1	1	1	1	4	4	5	3			
Remote sensing	1	1	1	1	1	4	3	4	2			
Well diagnosis				1	1	4	3	4	3	1	1	
Well rehabilitation				1	1	3	2	3	2	2	2	1
Appropriate technology (rope pump)						2	2	3	2	1	1	

3.5 Private sector- consulting firms

3.5.1 Evaluation of current EWTEC training courses

Through questionnaires, each training course provided by EWTEC was evaluated by the private consulting firms. The result is shown in Table 45.

Table 45 Evaluation for current EWTEC training courses by private consulting firms

No	Training Courses	Very Important		Important		Little Importance		Not Important	
		Count	%	Count	%	Count	%	Count	%
1	Groundwater investigation	9	75%	2	17%	1	8%	0	0%
2	Drilling technology	6	60%	2	20%	1	10%	1	10%
3	Drilling machinery maintenance technology	6	60%	2	20%	0	0%	2	20%
4	Water supply engineering	9	75%	1	8%	2	17%	0	0%
5	Electro-mechanical maintenance technology	7	78%	1	11%	0	0%	1	11%
6	Groundwater modeling	7	58%	5	42%	0	0%	0	0%
7	GIS	9	75%	3	25%	0	0%	0	0%
8	Remote sensing	9	75%	3	25%	0	0%	0	0%
9	Well diagnosis	6	60%	3	30%	0	0%	1	10%
10	Well rehabilitation	7	70%	2	20%	0	0%	1	10%
11	Appropriate technology (rope pump)	5	50%	4	40%	0	0%	1	10%

3.5.2 Demand for advanced or intensive training courses

In addition to the training courses currently provided in EWTEC, the following training courses are requested to be offered as separate courses (Table 46).

Table 46 Proposed training by private consulting firms

Course Title	Duration (weeks)	Course Content Details
Water quality study	2	Sampling, storage, transport, analysis & evaluation
Aqua testing	2	Planning, data collection, analysis, evaluation & reporting
Groundwater management	2	Contamination, exploitation, zoning, legitimacy, catchments
Water well construction	2	Well design, material specification, construction methods, trouble shooting
Water works construction management	4	Procurement & procurement planning; contract administration; supervision of: pipe laying, reservoir construction, electro-mechanical installation, drilling work, diversion/intake construction/, dams construction & treatment plant.
Design for electro-mechanical equipment for water supply	-	
Design for waste water treatment	-	
Design for water treatment structures	-	
Pumping test Operation & Maintenance	4	
Operation of hydraulic gates	2	
Dam operation & maintenance	4	
Detention ponds for storm water management	2	
Canal sanitation	2	
Physical modeling of hydraulic structure	4	
Water supply system modeling	1	
Contaminant transport modeling	1	
Decision support system for ground water management	1	
Geostatistical methods for groundwater assessment	1	
Water supply network modeling	2	Water CAD
Sewer modeling	2	Sewer CAD
Sand dams	0.5	There are many localities in Ethiopia suitable for sand dams
Rainwater harvesting	0.5	Roof catchments, ground storage
Infiltration galleries	0.5	Design of construction
Slow & rapid sand filters	2	Highly applicable for surface treatment
Basics of irrigation	1	Surface, Dip, Sprinkler
Basics of hydropower	1	Concept of hydropower
Borehole Construction & Logging Software (Strater)	-	
Integrated Water Resource Management	2	Institutional Set-ups; policy, strategy & regulation
Irrigation management	2	Irrigation efficiency; water allocation and management
Water resources modeling	3	Water resources simulation; river basin development
Agricultural water management	2	Soil & water conservation; interventions & technologies for agricultural productivity
Design of water retaining structures	4	Design of reservoirs, balancing chambers, etc
Design of water treatment plants	4	

Course Title	Duration (weeks)	Course Content Details
Design of appropriate waste water treatment units	-	Waste stabilization ponds, septic tank with cultivated wet land, etc
Average duration (weeks)	2.1	

3.5.3 Training duration and season

Preferable months for training for the private drilling companies are between July and August for all the courses, which indicates the rainy season, when not much work is conducted (Table 47). The result is similar to other sectors. The average duration for the training is 2.1 weeks, which is much shorter than other sectors (Table 46).

Table 47 Proposed season for training by private consulting firms

Training course	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Groundwater investigation							3	4	1			
Drilling technology						1	2	2				
Drilling machinery maintenance technology						1	3	3				
Water supply engineering						1	4	4	2	2	2	2
Electro-mechanical maintenance technology					1	1	1	1				
Groundwater modeling				1	1		4	5	2			
GIS	1	1					3	5	2	1		
Remote sensing	1	1					3	4		1		
Well diagnosis						1	2	2				
Well rehabilitation						1	2	2				
Appropriate technology (rope pump)							1	4	1			

3.5.4 Operational situation

The majority of respondents expressed interest in the training courses of EWTEC. However, the following comments by private consulting firms give an idea of their situation.

- It is difficult to have optimistic and big future plan on training issues due to the following major factors: 1) most of the staff employed in the firm already have higher education training, 2) staff turnover is high, 3) getting continuous project assignments is difficult to keep full time professional staff in the firm. However, general capacity building work is needed in all respects.
- We are not at present involved much in source identification tasks with our internal staff, but hire professionals when the need arises
- Since we are a research organization, we don't usually send our staff for technical/practical training like EWTEC courses. However, some of EWTEC courses, such as GIS, RS, modeling, are relevant to our organization
- As a consulting office it is difficult to cover full training costs. Nevertheless, an option for partially supporting training costs will be studied in the future. EWTEC courses, such as water supply engineering, groundwater modeling & GIS are important for our long-term staff.

3.6 NGO

3.6.1 Demand for training

The results of the question asking about important training and target trainees are summarized in Table 48. The NGOs that have drilling machines show high interest in the training on drilling technology and drilling machinery maintenance technology. It is known that at least the following 8 NGOs possess drilling equipment and necessary staff.

- Catholic church
- REST
- Ethiopian Orthodox Church
- World Vision
- Norwegian Church Aid
- Meckaneyesas
- Kalehiwot
- ELVIA

Other NGOs whose line of involvement is mainly on hand dug wells and spring development showed interest in training areas on groundwater investigation, local social development (community mobilization, organization and management) and GIS, etc.

3.6.2 Training duration and season

Preferable months for training for NGOs are between June to September, which is the same as other sectors. The requested duration for training is different from each type of training (Table 48).

Table 48 Important training field areas and target trainee for NGO

Name of Organization	Priority	Training field area	Target Trainees		Suggested Duration	
			Profession	No of Potential Trainees	Duration in Weeks	Preferred Month for Training
Oxfam Americ	1	Training on the water management	Water			
World vision Ethiopia	1	Drilling technology	Drillers	3	8	Aug, Sept
	2	Drilling machinery maintenance technology	Mechanic	2	8	Aug, Sept
	3	Electro-mechanical maintenance technology	Pump technicians	3	8	
	4	Ground water modeling GIS RS all international	Hydrogeologists and water engineers	4	8	
	5	Water supply engineering	water resource engineers and hydrogeologist	3	8	
Kana Yelimat Mahiber	1	Groundwater investigation	Agriculture	2		
	2	Water supply engineering	Agriculture	4		
	3	Rehabilitation of well	Agriculture	4		
	4	Local social development	Agriculture and sociology	3		
	5	Diagnostic Investigation of well	Agriculture	4		
	6	community mobilization	Agriculture sociology & Administration	3		
	7	Small scale water scheme planning implementation and super vision	Agriculture, sociology & Administration	3		
Alliance for development	1	Community management and water supply				
	2	Rehabilitation of well and springs				
Water Action	1	Construction materials and equipment	Engineer	7	12	Jul, Aug, Sept
			Forman	10	12	Jul, Aug, Sept
	2	Hand dug and shallow wells and construction	Forman	10	12	Jul, Aug, Sept
	3	Construction supervision	Engineer	5	12	Jul, Aug, Sept
			Forman	7	12	Jul, Aug, Sept
	4	Specification and bid document preparation	Engineer	3	12	Jul, Aug, Sept
	5	Design water systems using software	Engineer	8	12	Jul, Aug, Sept
Coopeazione Internationals (COOPI)	1	Rehabilitation of well	technicians		12	
	2	GIS	Hydrogeologists		12	
	3	Groundwater investigation	Hydrogeologists		12	
	4	Remote sensing	Hydrogeologists		12	
Ethio wetlands and natural resources association (EWNRA)	1	Groundwater investigation	EWNRA Technical staffs	1	4	
		Local social development				
		Water supply engineering				
	2	Groundwater modeling (International)	Technical staffs	1	4	
		Geographical Information System				
		Geographical Information System				
		Remote sensing (International)				
	3	Diagnostic Investigation of well	EWNRA Technical staffs	1	4	
		Rehabilitation of well				
	4	Hand pumps maintenance and management	EWNRA Technical staffs	3	4	
Intermon Oxfam	1	Groundwater modeling (International)	Water resource engineer	1	2	Jul, Sept
	2	Geographical Information System 2(International)	Water resource engineer and economist	2	1	Jul, Aug, Sept, Oct
	3	Remote sensing (International)		1	2	Jul, Aug, Sept
REST	1	Drilling Technology		7	12	
	2	Drilling Machinery Maintenance		2	12	
	3	Ground Water Investigation GIS & Remote Sensing		5	12	
	4	Water Supply Engineering & Ground Water Modeling		5	12	
	5	Electro mechanical Technology		2	8	
ORDA	1	Ground Water Investigation Methods	Geologist	1		June
	2	Ground Water Modeling & GIS	Geologist& Engineers	4		June
	3	Basic Design criteria of Water Supply facilities & tender doc preparation.	Engineers	2		June
Water Aid Ethiopia	1	Project management	Engineers	3		
	2	Rural water supply design	Water supply/ civil engineers	2		
	3	Alternative technology	Water supply engineers	2		
	4	Community development	Sociologists/economists	5		

4. Willingness to pay

4.1 Core public sector

In this study, the core public sector water offices encompasses the regional water resource development bureaus (RWB), zonal water resource development offices (ZWRO), woreda water offices/desks (WWO) and the town water service offices (TWSS). The first three public sector water offices (RWB, ZWRO and WWO) operate with government allocated budget where as the last one (TWSS) operate by generating their own income- through collection of monthly water sales and other service charges from customers.

Accordingly, the analysis of the willingness to pay for coverage of training costs in core public sector water organizations is carried out for government- and non-budgeted core public sector water offices separately, as follows.

4.1.1 Government-budgeted core public sector water offices (RWB, ZWRO and WWO)

The response summary (Figure 12) on general willingness to pay shows that out of the total number of 37 government budgeted core public sector offices included in this study, 24, or 65%, show general willingness at least to cover some cost of the training provisions; seven, or 19 %, do not show willingness, and the remaining six, or 16 %, are undecided.

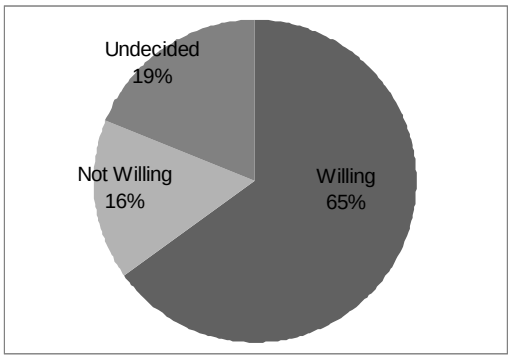


Figure 12 Budgeted core public sector response on willingness to pay for training

In looking at the responses made (Figure 13) on the level of the training cost coverage by budgeted public sector offices that showed general “willingness” to pay, the majority (63 %) are only willing to cover per-diem and transportation costs for their staff in training courses that may be conducted by EWTEC.

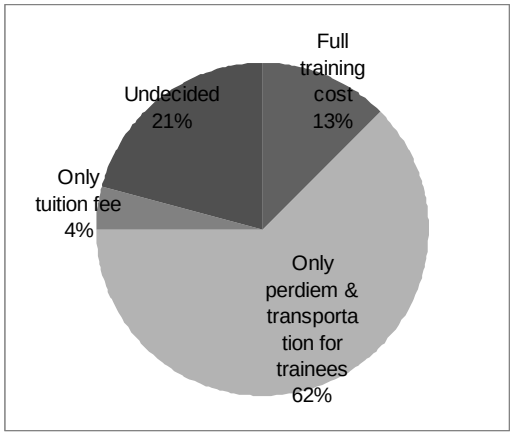


Figure 13 Response on level of training cost coverage by the "willing" budgeted public sector offices

Experience having allocated training budget

Only 11 (or 30 %) of the budgeted core public sector offices have experienced having budget allocated to cover training costs of their staff, and of those offices which responded as having training budget, 73 % are regional water bureaus (RWB) and the remainder were ZWRO. Whereas not a single WWO responded as having training budget allocated.

4.1.2 Non-budgeted core public sector water office (TWSS)

As shown in Figure 14, the responses made by 15 town water service offices, which are managed by boards, show that 14, or 93 %, are generally willing at least to cover some cost of the training for their staff on training courses that may be given by EWTEC.

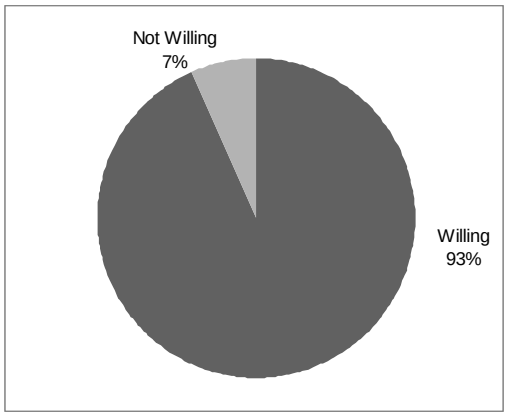


Figure 14 TWSS's general willingness to pay for training cost coverage

In looking at the responses made (Figure 15) on the level of the training cost coverage by those TWSS which showed general “willingness” to pay, 57 % are only willing to cover per-diem and transportation costs, and only 7 % are willing to cover full training costs for their staff on training courses that may be conducted by EWTEC.

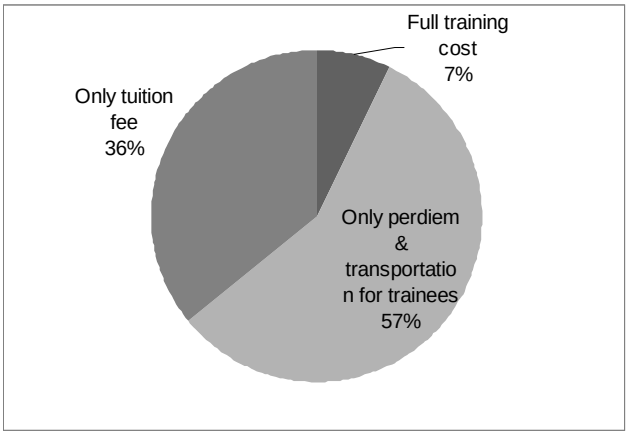


Figure 15 Response on level of training cost coverage by the "willing" TWSS

Experience having allocated training budget

Out of the total 15 contacted TWSS, 14, or 93 %, responded as having allocated training budget. However, only 57 % responded by providing the amount of training budget they allocated in the past three years for training their staff.

4.2 Public enterprise

Out of the total eleven (11) public enterprises included in this study, ten (10), or 91 %, responded their general willingness to cover at least some cost of the training for their staff on training courses that may be given by EWTEC. And the remaining one (1) public enterprise did not complete this part of the questionnaire so it is taken as “undecided,” which comprises 9 % of total respondents as shown in Figure 16.

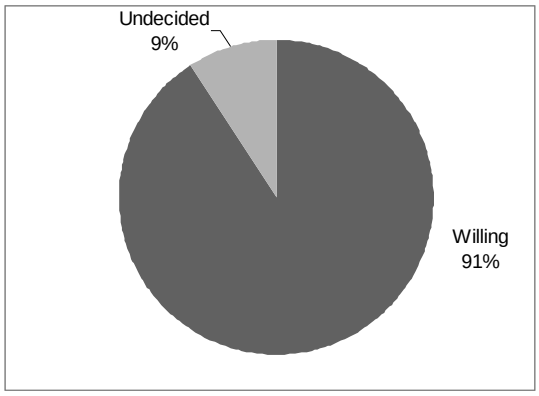


Figure 16 Public Enterprises' general willingness to pay for training costs

Out of the ten (10) public enterprises that showed general “willingness” to pay, 40 % are willing to cover only tuition fees, 30 % are willing to cover full training costs, 20 % are willing to cover only per-diem and transportation costs, and 10 %, or one, is undecided on the level of their cost coverage for their staff on training courses that may be conducted by EWTEC (Figure 17).

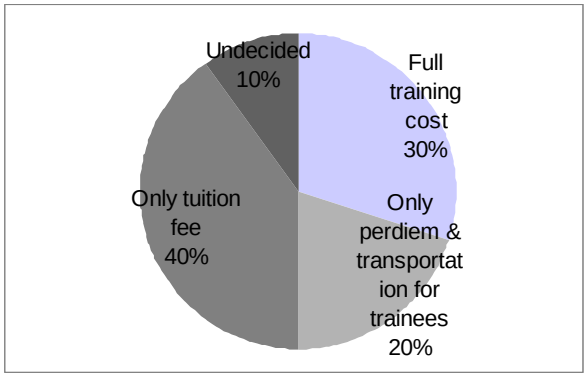


Figure 17 Response on level of training cost coverage by the "willing" public enterprises

4.3 TVETC

Out of the total nine (9) TVETC included in this study, six, or 67 %, are generally willing to cover at least some costs of the training, and the remaining three, or 33 %, are not willing to pay for training costs of courses that may be given by EWTEC for their academic staff.

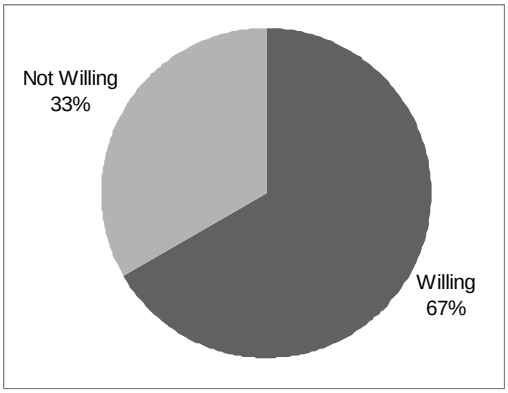


Figure 18 TVETC's general willingness to pay for training costs

Out of the six (6) TVETC which showed general “willingness” to pay, three, or 50 %, are willing to cover only per-diem and transportation costs for their participating trainees, and the other three, or 50 %, are undecided on the level of their cost coverage for their staff on courses that may be conducted by EWTEC (Figure 19).

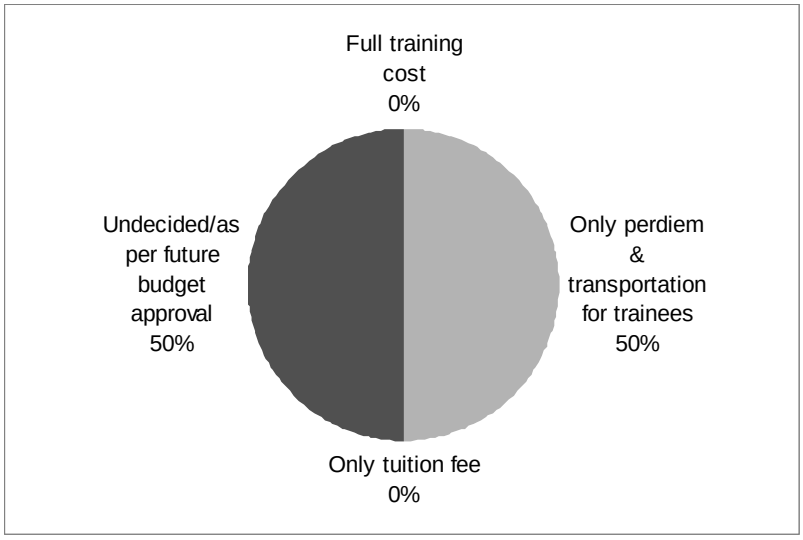


Figure 19 Response on level of training cost coverage by the "willing" TVETCs

4.4 Private sector

4.4.1 Private drilling companies

Out of the total twelve (12) drilling companies responded to this study, half or 50% are generally willing to cover at least some cost of the training; and the remaining half or 50% are undecided-whether they are willing or not to pay for training costs of courses that may be given by EWTEC for their academic staff.

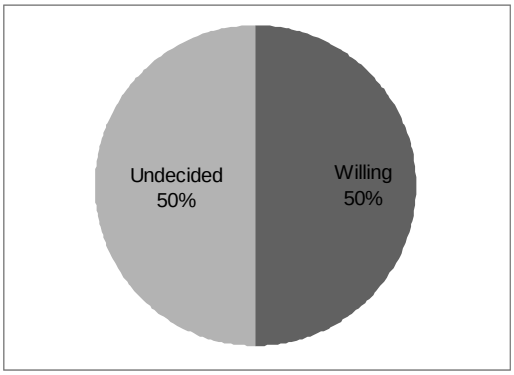


Figure 20 Private drilling companies' general willingness to pay for training costs

And only three of the drilling companies responded with a suggested fee for training provision for their staff at EWTEC, with an average amount of 75 birr/person/day.

4.4.2 Private consulting firms

Out of the total twelve (12) private consulting firms which responded to this study, eight, or 67 %,

are generally willing to cover at least some costs; three, or 25 %, did not showing willingness to pay for training costs, and the remaining one, or 8 %, was undecided whether willing or not to pay for training costs of courses that may be given by EWTEC for its staff.

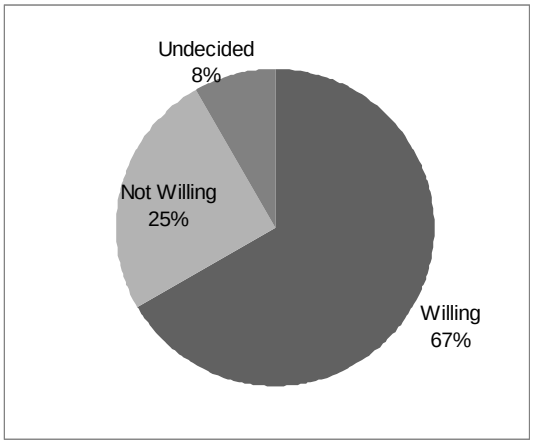


Figure 21 Private consulting firms' general willingness to pay for training costs

And out of the 12 consulting firms included in this study, eight, or 67 %, provided suggested fee for training provision for their staff at EWTEC, with an average amount of 1,605 birr/person/day. However, this average amount is very misleading and not very representative because of the high amount of variation between the highest and lowest suggested fee figures. On the other hand, the median of the suggested fees is about 250 birr/person/day and this figure seems more representative than the mean or the average fee.

4.5 NGOs

Out of the total eleven (12) NGOs which responded to this study, nine, or 75%, are generally willing to cover at least some costs; two, or 17%, are undecided, and the remaining one, or 8%, was not willing to pay for training costs that may be given by EWTEC for its staff (Figure 22).

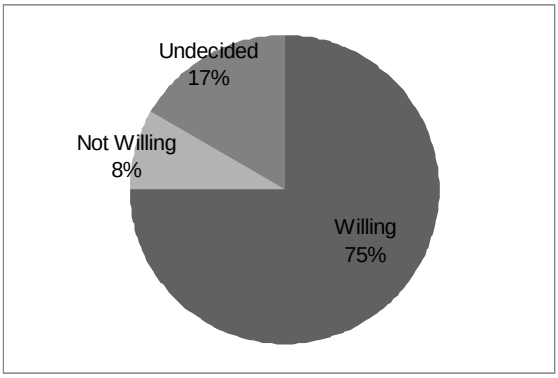


Figure 22 NGOs' general willingness to pay for training costs

And out of the 12 NGOs included in this study, only four responded with a suggested fee for

training their staff at EWTEC and the amount varies form 20 to 10,000 birr/person/day.

Out of the 12 NGOs included in this study, nine responded as having experience in the provision of in-house training for their staff. Out of these nine NGOs, seven responded that they conduct the in-house training only by external trainers, whereas two use both external and internal trainers for their in-house training.

Table 49 NGOs' experience of in-house training

Organization	Training area	Profile of trainers
Oxfam Americ	The soft ware aspect like management, organization, and marketing	The private sector
World vision Ethiopia	Construction work procurement, supervision and contract administration	National consultants
	Drilling and mechanics	Drilling machine producing companies for a very short time
Kana Yelimat Mahiber	HIV/AIDS	Target populations
	Water scheme management and maintenance	Committee members
Water Action	Integrated watershed management	Project managers
	Gender	HQ and Project staffs
	Socio-economic study	HQ and Project staffs
	Operation and maintenance	HQ and Project staffs
Society of International Missionaries	On-the-job training	
Intermon Oxfam	Project planning	Project coordinators and project managers
	Gender mainstreaming	Social workers, Sanitarians, gender focal persons
	Sanitation and hygiene promotion	Social workers, sanitarians and project coordinators
	Integrated water resource management (IWRM)	Project manager or coordinators, planning officers, water resource engineers and environmentalists
ORDA	Water supply construction, operation, maintenance Technologies for hygine and sanitation	
REST	Groundwater hydrogy Water supply development Electrical maintenance Hydraulic engineering Training for technicians (12grade, construction management, supervision, coordination) Welding Black smithing	Maichew TVETC, Arbaminch Water Technology, Dr. Tenalem, Biselex, JICA
Water Aid Ethiopia	Planning, monitoring & evaluation Financial management PHASET Community development	Graduate with wide range of experience in the area

4.6 Summary of willingness to pay

The overall summary responses from all of the responding organizations are not much difference from the majority of the summary response presented on each group of organizations above. Out of the total of 107 organizations or offices which responded to this study, seventy six, or 71% are generally willing to cover at least some cost of the training provisions to the participants of their trainees on the training courses that will be potentially given by EWTEC; seventeen, or 16% are undecided and fourteen, or 13% of the total responding offices are not willing to pay for training costs that will be potentially given by EWTEC for its staff (Figure 23).

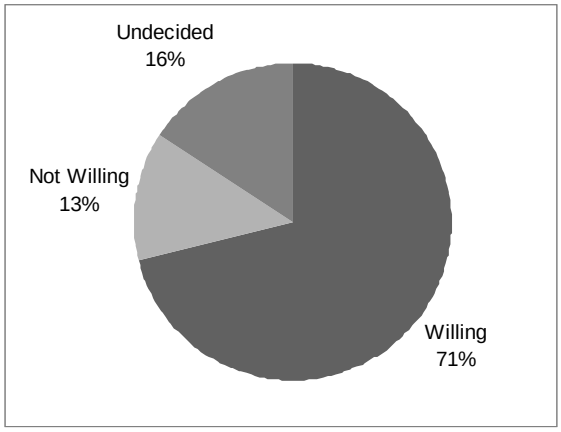


Figure 23 Summary on general willingness to cover training costs

5. Analysis and discussion

5.1 Core public sector and public enterprise

5.1.1 Summary of manpower

The total number (existing and future (in five years)) of professional and technical staff (categorized in Table 3) in the core public sector (RWB, ZWRB, WWO and TWSS) estimated from the collected sample data is summarized in Table 50.

Table 50 Summary on the number of professional and technical staff in the core public sector

	Existing	Future (in five years)	Total
RWB	614	281	895
	69%	31%	100%
ZWRO	497	579	1076
	46%	54%	100%
WWO	4,693	7,447	12,140
	39%	61%	100%
TWSS	2,738	1,002	3,740
	73%	27%	100%
Total	8,542	9,309	17,851
	48%	52%	100%

The result indicates that more than 50% of technical and professional job positions are currently vacant or expected to be filled in the coming five years. Apparently the vacancy rate in WWO is the highest and ZWRO is the second. RWB and TWSS are relatively in a better situation. (Note that these figures were estimated from a limited number of samples, therefore, it may not necessarily indicate the actual number except for RWB. But the results are similar to the figures estimated by another survey, JICA 2007[5]).

Table 51 Summary on the number of technical staff in public enterprises

	Existing	Future (in five years)	Total
WWCE	636	485	1,121
	57%	43%	100%
WWDSE	301	21	322
	93%	7%	100%
WWDE	54	6	60
	90%	10%	100%
Total	991	512	1,503
	66%	34%	100%

Table 51 shows the number of technical staff in the public enterprises. Compared to the core public sector, the situation of personnel assignment in the public enterprise is better.

The following figures show the number of personnel in the public sector (core public sector and public enterprise) by regions (Figure 24) and by profession (Figure 25).

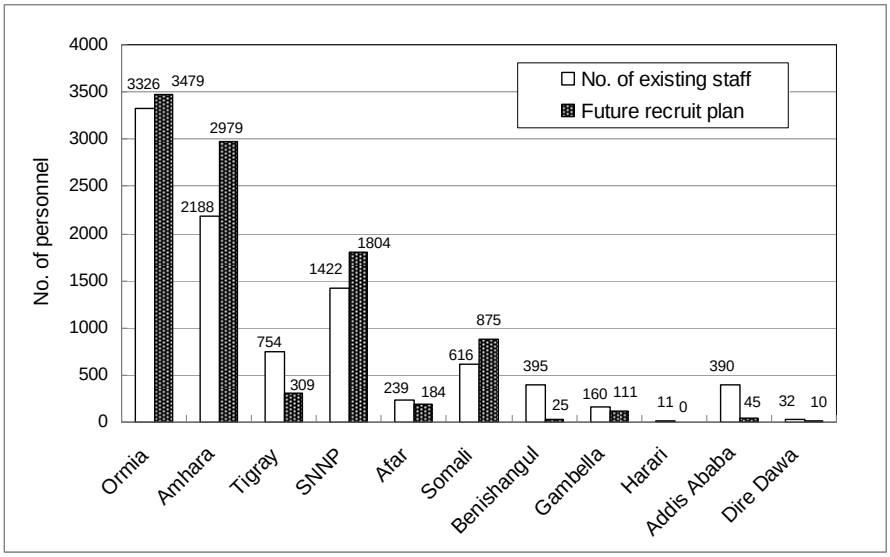


Figure 24 Number of personnel in public sector (core public sector and public enterprises) by regions

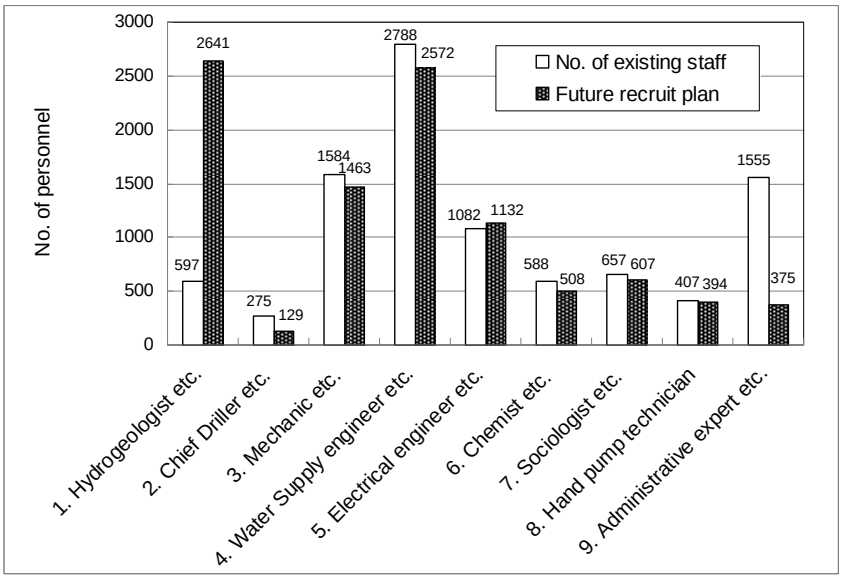


Figure 25 Number of personnel in public sector (core public sector and public enterprises) by regions

Oromia and Amhara regions cover more than 60% of the total number followed by SNNP, Tigray and Somali regions. In looking by category of profession, the problem with shortage of staff is much critical in the professional category of hydro geologist, etc. as these positions are currently occupied with only 18 % of the total requirement (Table 29). Looking into the specific area of the public sector

[5] Impact study on EWTEC project, 2007

water offices, this critical shortage of the hydrogeologist, etc. group of profession is found in the WWO as it is only about 6% (or 157 from the estimated total requirement of 2,341) of this group of profession currently occupied in these offices.

5.1.2 Training area on groundwater investigation and management

(1) Potential trainees

This training are is targeting hydrogeologists, hydrologists, engineering geologists, geotech engineers, geologists, and geophysicists. Among the technical staff in this field (estimated to be about 3,000 in total), the number in WWO shows the highest, making up more than 80% (if the future recruitment plan is effective). Although the responsibility is different at each level of office, all are considered to be potential trainees of the groundwater investigation course currently provided by EWTEC.

Table 52 Potential number of technical & professional for training on groundwater investigation in the core public sector and public enterprises

Name of Organization	Hydrogeologist, Hydrologist, Engineering geologist, Geo-technical Engineer, Geologist, Geo-physicist						
	BSc & above			Advanced diploma/Diploma			Total potential trainees =c1+c2
	Existing staff (a)	Future recruitment Plan (b)	c1 = (a)+(b)	Existing staff (a)	Future recruitment Plan (b)	c2 = (a)+(b)	
1. RWB	105	80	185	6	5	11	196
2. ZWRO	96	140	236	0	0	0	236
3. WWO	123	2,274	2,397	34	0	34	2,431
4. TWSS	72	53	125	0	1	1	126
5. WWCE / WWDSE	161	66	227	0	22	22	249

(2) Additional modules

According to the evaluation results on the modules of the current groundwater investigation course provided by EWTEC, all are evaluated as very important or important. Most of the requested additional modules are already included in some way in the course. However, requests for a module on "contract administration and procurement" were raised by several RWBs and the demand seems to be high at RWB level. It could be a separate module in the course.

(3) Demand for advanced or intensive courses

Among the requested intensive or advanced courses, groundwater modeling, GIS, and groundwater investigation method are the highest in demand. As a groundwater investigation method, different kinds of geophysical surveys are considered to be very important for RWB and ZWRO, and in some

cases, for WWO. It is possible to give as a separate intensive course, but geophysical investigation alone should not be considered as the only means of groundwater investigation.

The methodology of groundwater modeling is considered important at RWB level and WWDSE, and some ZWRO depending on the existence of well fields to be modeled. It has to be linked with water resource analysis and environmental issues such as groundwater pollution.

GIS is quite important to all level of organizations nowadays because regions, zones, woreda and towns as well as WWCE/WWDSE need to make their own database of water resources.

In addition, although the results of the survey could not detect high demand, water quality management and water chemistry are also considered very important issues considering current water quality problems, such as high fluoride and iron concentration in the groundwater in the rift valley area.

5.1.3 Training area on drilling technology

(1) Potential trainees

Potential trainees for the drilling technology course are mechanics, supervisors/superintendents, chief drillers, drillers and technicians who have a diploma or certificate of general and auto mechanics. The organizations are RWB, WWCE, WWDSE and WWDE (also private drilling companies and some NGOs which are described later).

Table 53 Potential number of technical & professional for training on drilling technology in the core public sector and public enterprises

	Existing staff	Future recruitment plan	Total
RWB	16	15	31
WWCE/WWDSE/WWDE	259	114	373
TOTAL	429	150	579

Since the establishment of EWTEC, 193 trainees have participated in the courses and most of the participants are from RWB and WWCE. RWB used to have drilling rigs, such as Atlas Copco (R-50) donated from UNICEF (to SNNR, Oromia, Afar, Tigray, and Amhara), but they have been transferred to their respective enterprises, except Oromia and Afar. Most RWBs still have service rigs. Besides the current equipment inventory data collected in this survey, RWB in Tigray, Amhara, and Somali are in the process of procuring deep drilling machines (up to 450 to 600m) and already RWB in Afar has procured one deep well drilling rig. However, those rigs are most probably transferred to regional WWCE.

(2) Additional modules required in the current course

The additional modules requested by the public sector and public enterprises are mostly related to each other, and most of these modules are already provided in the course, for example, hydraulic systems, recovery of tools, well maintenance, pumping tests, etc. Among the requested modules, the only ones which are not provided in the drilling technology course are groundwater quality and top head drive rotation mechanism. Especially the later topic is considered more important for the trainees of this field. Beside this, to elaborate each module to meet the demand of the trainees, additional time, reference books, manpower and workshop tools are indispensable to support the extra demand.

(3) Demand for advanced or intensive courses

The additional and advanced courses proposed by each organization are selected based on the equipment they have and the problems encountered frequently. The needs assessment shows there is still a gap to fill, not only for professional trainees, but also for their bosses. Among the requested advanced courses, essential ones are;

- Drilling administration (planning & management of projects) is useful for both parties to execute projects within the given planned period and it avoids unnecessary cost and material wastage.
- Trouble shooting (recovery of tools) is an advanced course in the drilling technology curricula of each school and emphasizes to have a good skill to recover the lost tools during the drilling period due to drilling problems encountered naturally or by the driller himself. To make the course effective, it needs reference books, various types of equipment for fishing purposes, and audio visual materials.
- Well maintenance (Rehabilitation of wells) course needs a service rig and different development accessories to be applied in different mechanisms. Technology is used mechanically or chemically to maintain the well and recover it to its original state.
- Well diagnosis with a borehole TV camera is an initial investigation applied to resolve problems of wells for decision making to maintain a well (mechanically or chemically). This course shall focus on operating the camera, analysis of images, and how to decide to maintain the well based on the findings.
- Deep well drilling and operation system applied for back-up pressures, maintaining up-hole velocities, casing installation handling, etc. Demand for deep well drilling is rising in Addis Ababa and other regions, such as Tigray, Amhara, Oromia, and Somalia.

5.1.4 Training area on drilling machinery maintenance technology

(1) Potential trainees

Major trainees of this field of training are mechanic, mechanical engineer, technician and chief driller and major target organization will be WWCE (federal and regional), WWDE, WWDSE (federal

and regional) and RWB.

(2) Additional modules required in the current course

Most of the requested items for additional modules are already included in the current course in some ways and some are not relevant with the course. The only essential module to be included in the course is maintenance management (planning). This is important especially for maintenance managers, workshop managers, workshop heads, and chief mechanics. This can also be a separate training course as an advanced course.

(3) Demand for advanced or intensive courses

First, according to the result of study, many respondents from WWCE and RWB requested top head rotary type drilling rig, air compressor, and auto electricity as separate intensive courses. Most of these organizations have these types of machines, and in most cases their technical staff is not able to maintain all types of problems that arise during operation of their rigs. The training provided by EWTEC is designed to cover general knowledge on all related subjects. So to acquire the right knowledge on maintenance methods on these specific machines, more practical training is needed at an advanced level.

Second priority fields are diesel engine, DTH hammer and truck. These are given in many universities, colleges, and training centers in the country, except DTH air hammer. However, practical exercises may not be sufficient in these institutions.

- Top head rotary type drilling rig includes hydraulic circuit reading, construction, troubleshooting, testing, adjustment and maintenance methods of hydraulic pumps, control valves, hydraulic motors, high pressure lines, hydraulic cylinders, all hydraulic systems of drilling rigs of different make.
- Air compressor includes design, pneumatic circuit reading, troubleshooting, testing and adjustment and maintenance methods of different made air compressors and DTH hammers.
- Diesel Engine includes electronic control modules (ECM) principle, design, trouble shooting, testing and maintenance methods of different made ECM operated diesel engines.
- Maintenance management includes planning for drilling rig air compressors, DTH hammers, diesel engines, trucks, and related water well drilling equipment.

5.1.5 Training area on water supply engineering

(1) Potential trainees

The major trainees of this training field are water supply engineer, water resource engineer, sanitary engineer, hydraulic engineer, civil engineer, aid engineer and/or technicians. In EWTEC, the major target organization for this field of training has been RWB. According to the collected data, there is a

large number of staff related to this field of training at zonal, woreda, and town levels. The public enterprises have also shown high interest in the courses. However, water supply schemes in rural areas and those in towns are completely different. The course contents need to be properly arranged according to the target participants (rural and town).

Table 54 Potential number of technical & professional for training on water supply engineering in the core public sector and public enterprises

Name of Organization	Water supply engineer, Water resource engineer, Sanitary engineer, Hydraulic engineer, Civil engineer, Aid engineer/technicians						
	Diploma & above			Below diploma			Total potential trainees =c1+c2
	Existing staff (a)	Future recruitment Plan (b)	C1 = (a)+(b)	Existing staff (a)	Future recruitment Plan (b)	c2 = (a)+(b)	
1. RWB	105	80	185	6	5	11	196
2. ZWRO	96	140	236	0	0	0	236
3. WWO	123	2,274	2,397	34	0	34	2,431
4. TWSS	72	53	125	0	1	1	126
5. WWCE/WWDE/ WWDSE	162	84	246	29	37	66	312
Total	558	2,631	3,189	69	43	112	3,301

(2) Additional modules required in the current course

Requirement of software operation such as Auto CAD, Water CAD and EPANET was the highest at RWB and ZWRO level and public enterprise. Other requested modules are already included in the current training course as theory, but the listed items are considered very important and need to be improved by adding practical exercise. Among the listed items, water leakage control is a very critical issue in large towns. Contract administration or tender document preparation is also important and has been lectured in the current course but needs to be improved by introducing simulation method, for example.

(3) Demand for advanced or intensive courses

The demand for separate training in water quality management was the highest. This includes treatment plant, pollution protection and water quality testing. Since there are a very limited number of laboratories for water quality testing in the country, this area of activity needs to be improved. Leakage control system is requested from TWSS in several major regions.

5.1.6 Training area on electro mechanical maintenance technology

(1) Potential trainees

The major trainees of this training field are electrical engineer and electrician, and so far, the major target of EWTEC training on this subject has been RWB. However, according to the study, technical staff in ZWRO and TWSS are also frequently engaged in work related to electro mechanical

maintenance. Especially, TWSS has a large number of electrical engineers and electricians (more than 400). WWO is also considered as a potential target, although there seem to be not many electrical water schemes are constructed at woreda level until now.

(2) Additional modules required in the current course

All the course modules are recognized as very important according to the results of the study. The requisition of additional modules is almost similar in all regions. Among the requested modules, different types of electric motors, operation and maintenance of surface pumps, hand pump maintenance and rewinding of electrical motors are considered important to be included in the current course. Others are already included in the current training course.

(3) Demand for advanced or intensive courses

Electrical motor and generator, submersible pump and sequence control are the most demanded topics. The main electrical problems are electrical controlling and therefore, these three components are considered the most important in the actual work. Even in the current training course provided by EWTEC, these occupy more than 70% of the total course time.

5.2 TVETC

Almost in all courses conducted at TVETC, the instructors recognize that they have basic theoretical knowledge but no practical experience in most of the subjects. In addition, they are completely lacking in teaching material, such as equipment and textbooks.

Most of the graduates are supposed to be employed by woreda water offices in the respective regions and the employment rate is high at all the colleges (more than 90%, JICA 2008[6]). This indicates that the curriculum of TVETC has to be designed based on the actual work at the woreda level. However, in the questionnaires which asked the frequency of engagement of different type of work at the woreda level (questioned items for each type of work are the same as each subject of the TVETC curriculum), many of the work items are answered as “only sometimes” or “no requirement.” This is mainly caused by lack of budget at WWO. The subjects in the current curriculum of Water Technology Department are all important but appear to be too broad and general for the actual work at woreda level. It may be necessary to revise the curriculum to give more emphasis on the actual work at woreda level.

Based on the acquired information on the actual work at the woreda level, necessary and possible trainings for the TVETC instructors are summarized below.

Table 55 Necessary training for TVETC instructors

[6] JICA 2008: Survey on the situation and training needs of TVETC, public enterprises and private firms/companies engaged in the construction and maintenance of water supply schemes

Course Title	Target instructors	Contents of training
Groundwater investigation and management	RWSS	Introduction to groundwater: ■ Method of investigation, analysis, management theory Practice of groundwater investigation: ■ Electric sounding ■ Well drilling observation ■ Pumping test ■ GPS handling and data collection
Electric Machinery Maintenance Technology	EMT	Practice in workshop ■ Electrical controlling circuit (sequence control) ■ Repairing of electrical measuring instruments ■ Electrical machines (motors and generators) ■ Water pump maintenance (submersible and surface pump) ■ Diesel engine ■ Hand pump installation and maintenance
Water supply engineering	RWSS SSID	Observation of water supply facilities ■ Water supply plan ■ Water source ■ Water quality ■ Treatment plant ■ Transmission & distribution pipe
Appropriate Technology	RWSS SSID	Basic knowledge on appropriate technology: ■ Lifting systems ■ Usability ■ Cost Plan and design of rainwater harvesting system: ■ Scale ■ Structure ■ Method of harvesting ■ Cost Small scale irrigation / water conservation: ■ Drip irrigation ■ Treatment device
Water quality management	RWSS SSID	Basic water chemistry: ■ Dissolved ions in water ■ Drinking water standard ■ Water quality and hazardous ions in health Method of chemical analysis: ■ On-site analysis ■ Analysis by spectroscope ■ Collection and preservation of water sample and analysis
Environmental Assessment	RWSS SSID	Introduction: ■ Legal and institutional arrangement ■ Criteria of assessment ■ Items of assessment ■ Methodology, impact, measures Case study: ■ Environmental assessment case

5.3 Private sector

5.3.1 Private drilling companry

(1) Potential trainees

The number of professional and technical staff is much different among the drilling companies and it cannot be simply averaged. According to the criteria of Ministry of Water Resources (MoWR), private drilling companies are divided into 8 grades depending on the number of drilling equipment

and human resources. Currently, there are 51 private drilling companies registered under MoWR. Based on the criteria, minimum required number of professional staff at each grade is calculated in Table 56.

Table 56 Minimum number of technical staff in the private drilling companies registered under MoWR

Grade	No. of registered private drilling companies	Hydrologist/geologist		Drillers		Electrician	
		Min. no. per company*	Total	Min. no. per company*	Total	Min No. per company*	Total
1	15	2	30	13	195	3	45
2	2	2	4	7	14	2	4
3	15	2	30	3	45	1	15
4	3	1	3	2	6	1	3
5	9	0	0	3	27	1	9
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	7	0	0	0	0	1	7
Total	51		67		287		83

* Minimum manpower requirement for each grade level is based on the criteria of MoWR.

Basically, the calculated figures in the table could be considered potential numbers for training. However, most of the staff in the private companies are considered professionals and may not need any further training. Moreover, most of the staff are busy with their ordinary work. Table 57 shows the potential number of trainees for the major EWTEC training courses responded directly from the 12 private drilling companies. The result gives some idea that the drilling companies have interest to send more than 40% of their actual technical and professional staff to EWTEC training for each listed course, except water supply engineering.

Table 57 Potential number of technical and professional staff for the EWTEC training from the private drilling companies (result of 12 companies)

EWTEC training course	Groundwater investigation			Drilling Technology			Drilling Machinery Maintenance Tech.			Water supply engineering			Electro mechanical engineering tech.		
Existing/Future plan	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Total No. of staff who could be trainees at EWTEC (total of 12 companies)	18	15	33	47	18	65	30	14	44	4	2	6	15	10	25
Total no. of staff in the firm (total of 12 companies)	40	25	65	129	32	161	58	35	93	33	15	48	37	19	56

(2) Required training

Out of the five basic training fields of EWTEC two are directly relevant and one has importance to some extent to the private drilling companies. These fields in order of importance are as follows:

- Drilling technology
- Drilling machinery and maintenance technology
- Groundwater investigation

All of the modules under these training courses are evaluated either as very important or important by the majority of the responding private drilling companies. The suggestion on additional modules and advanced/intensive courses for each training field is almost similar to those of public enterprises. This is because there is not much difference in their activity and their equipment. Necessary training for private drilling companies is considered the same as those for public enterprises mentioned in 5.1.2, 5.1.3, 5.1.4.

5.3.2 Private consulting firms

(1) Potential trainees

Due to the variation in grade and work category as well as their internal personnel administration practices (dependency level on freelance work force) the number of professional and technical staff is much different among the private consulting firms and it cannot be simply averaged. According to the criteria of Ministry of Water Resources (MoWR), consulting firms in water sector are licensed in five areas of work and the five consulting work areas are classified with different grades as follows:

1. Water resources (general) consulting firms with three grades
2. Water supply and sewerage and/ or sanitary/ environmental engineering consulting firms with eight grades,
3. Irrigation and drainage consulting firms with six grades,
4. Hydropower engineering consulting firms with six grades, and
5. Hydrology and/ or hydro geology engineering consulting firms with six grades.

Currently, there are 67 private consulting firms registered under MoWR. Based on the MoWR criteria, minimum required number of professional staff in licensed private consulting firms at each grade is calculated in Table 58.

Table 58 Minimum number of technical staff in the private consulting firms registered under MoWR

Consulting firm category	Grade	Total No of registered private consulting firms	Estimate of minimum No of manpower requirement in private consulting firms									
			Water supply/ Water resource/ Sanitary/ Hydraulic/ Environmental engineer		Engineering aids		Hydrologist/ Hydro geologist		Irrigation/ Drainage engineer		Hydropower engineer	
			Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total
GWRCF	3	11	7	77	1	11	2	22	1	11	1	11
WWSSCF	3	1	5	5	1	1	1	1	0	0	0	0
WWSSCF	5	11	2	22	1	11	1	11	0	0	0	0

Consulting firm category	Grade	Total No of registered private consulting firms	Estimate of minimum No of manpower requirement in private consulting firms									
			Water supply/ Water resource/ Sanitary/ Hydraulic/ Environmental engineer		Engineering aids		Hydrologist/ Hydro geologist		Irrigation/ Drainage engineer		Hydropower engineer	
			Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total	Min No. per firm*	Total
WWSSCF	6	13	1	13	0	0	1	13	0	0	0	0
IDCF	3	1	2	2	1	1	1	1	4	4	0	0
IDCF	4	1	1	1	1	1	1	1	3	3	0	0
IDCF	5	5	0	0	1	5	1	5	2	10	0	0
IDCF	6	13	0	0	0	0	1	13	1	13	0	0
HPECF	3	1	2	2	1	1	1	1	0	0	4	4
HPECF	6	1	0	0	0	0	1	1	0	0	1	1
HHGCF	5	1	2	2	1	1	1	1	0	0	0	0
HHGCF	6	8	1	8	0	0	1	8	0	0	0	0
Total		**67**		**132**		**32**		**78**		**41**		**16**

* Minimum manpower requirement for each grade level is based on the criteria of MoWR.

GWRCF: Water Resources (General) Consulting Firm
WWSSCF: Water Supply & Sewerage and/or Sanitary/Environmental Engineering Consulting Firm
IDCF: Irrigation and Drainage Consulting Firm
HPECF: Hydropower Engineering Consulting Firm
HHGCF: Hydrology and/or Hydro Geology Consulting Firm

The estimated total number of the minimum staffing requirement of the 67 registered private consulting firms as calculated above in Table 58 is not showing the proportional increase when compared with the total number of the professional and technical staff estimated for 12 responding private consulting firms as calculated in Table 15 and one main reason that account for this may be the probable inclusion of freelance experts in their staff size by the responding 12 private consulting firms.

(2) Required training

According to the collected data, all the five basic courses and other six on-demand basic courses are evaluated as very important by the majority of responding private consulting firms. Looking on each specific course, the private consulting firms may have potential trainees in the following training fields.

- Groundwater investigation and management
- Water supply engineering

Table 59 shows the number of potential trainees among 12 consulting firms which responded to the questionnaire.

Table 59 Potential number of technical and professional staff for the EWTEC training from the private consulting firms (result of 12 firms)

EWTEC training course	Groundwater investigation			Drilling Technology			Drilling Machinery Maintenance Tech.			Water supply engineering			Electro mechanical engineering tech.		
Existing/Future plan	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total	Existing	Future Plan	Total
Total No. of staff who could be trainees at EWTEC (total of 12 firms)	10	4	14	0	0	0	0	0	0	24	12	36	1	0	1
Total no. of staff in the firm (total of 12 firms)	37	13	50	6	5	11	9	8	17	66	49	115	5	2	7

Looking into details of their required training, their requirement is diverse but the subjects are more specific than those requested by other organizations of the public sector (Table 46). Among those, requirement of those related to designing of water supply facility, modeling and simulation are relatively high. In addition, there is certain number of potential trainees for groundwater modeling, GIS and remote sensing. Since they are already working as professionals in the country, the required level should be higher than other sectors.

(3) Negative factors for provision of training

The suggestions (as general comment) made by some of these companies reflect the reality of the current working environment in the private consulting firms. Currently most of these consulting firms do not maintain more than a few technical staff on permanent employment but employ highly skilled or specialized professionals for short-term assignments upon getting projects. Even of the few employed staff it is suggested there is high turnover and this condition plus the difficulty of getting projects on a continuous basis usually does not encourage the companies for investing in development of their human resources. Moreover, the few available permanent staff in the consulting firms are usually higher level trained experts and to design common training courses (basic or advanced) that will be given along with other public sector experts may not be suitable as there will be much difference in caliber. Therefore, it may demand to design courses specifically for these companies and this will not be effective as these companies may not come with a sufficient number of trainees.

5.4 NGO

(1) Required training

The operational involvement of NGOs in water scheme development activities is mainly on hand dug wells, spring development and to a lesser extent in the development of shallow and deep wells. Due to the variation in terms of their level of involvement in water service related activities, their training areas are also much diversified.

Considering the activities they are involved and the problems they are facing, the possible necessary training courses are summarized in Table 60.

Table 60 Necessary training for NGOs

Course Title	Target trainees	Contents of training
Drilling technology	Chief drillers Assistant drillers	Planning: ■ Site preparation, materials, fuel, plan of operation Practice: ■ Transportation ■ Temporary work ■ Drilling practice ■ Installation of casing and screen ■ Pumping test ■ Water sample collection ■ Arrangement of drill log and cuttings
Drilling machinery maintenance technology	Mechanical engineer, Mechanic	Basic knowledge of drilling machinery: ■ Type of rig component ■ Mechanism ■ Diesel engine ■ Truck ■ Hydraulic system ■ Diesel engine ■ Air compressor ■ Electric machineries On-site practice: ■ Drilling site of DT course
GIS mapping	Water supply engineer	■ Introduction of GIS: Example of GIS application, GIS component, data input, GPS handling, coordinates ■ GIS software practice: Arc View and/or similar software
Appropriate Technology	Water supply engineer Water supply technician Hydrogeologist	Basic knowledge on appropriate technology: ■ Lifting systems ■ Usability ■ Cost Plan and design of rainwater harvesting system: ■ Scale ■ Structure ■ Method of harvesting ■ Cost Small scale irrigation / water conservation: ■ Drip irrigation ■ Treatment device
Rope pump manufacturing and installation	Artisan Water supply technician Plumber	■ Producing without jig, ■ Selection of materials, ■ Measurement ■ Welding ■ Producing with jig ■ Alignment ■ Painting ■ Installation and maintenance ■ Application to small scale irrigation
Hand pump maintenance	Artisan Water supply technician	Basics of Afridev pump: ■ Component, mechanism, parts On-site practice: ■ Installation and maintenance (Installation, dismantling, pulling up riser pipe, replacement of parts) Basics of Afridev pump: ■ Component, mechanism, parts On-site practice: ■ Installation and maintenance (Installation, dismantling ,pulling up riser pipe , replacement of parts) ■ How to train users or community (TOT)
Dug well construction /spring protection	Artisan Water supply technician	Practice of dug well: ■ Excavation, lining, slab, apron etc. Practice of spring: ■ Ditch, lining, cover, aqueduct etc.

Course Title	Target trainees	Contents of training
Social development	Water supply engineer Sociologists Economists Community promoters	Practice of socio-economic study: ■ Study items ■ Methodology ■ Reporting Extraction of community's issues: ■ Discussion and conclusion Community participation: ■ Case study ■ PCM, PRA Decision making in community: ■ Options, method of implementation, cost ■ Community organization and management
Project management	Water supply engineer Economist	Introduction to project management: Work schedule management: ■ Target, timeline, input, piecework Financial management: ■ Fund ■ Cost management ■ Cash flow Personnel management: ■ Employment, personnel changes & arrangement Risk management: ■ Measures for accident, manual Monitoring and evaluation

6. Conclusion

6.1 Existence of high potential demand

The result of the survey shows that there is generally a high demand from all sectors for water technology short-term training courses of both basic and advanced ones in EWTEC. According to the result of this survey, the total potential number of the professional and technical staff (including vacant positions or future plan requirements) is estimated to be around 20,000 only in the public sector without including private sector and NGO. Since its establishment in 1998 EWTEC has trained a total number of more than 2,000 of technical staff in various water technology short-term training courses and there is no other similar training center in the country that specialized with the provision of the water technology short-term training courses as its main line of operation. This indicates that there still remains a high portion of the demand for the provision of this service to be satisfied in the coming years. The result of the survey also provided inputs on additional modules requirement and for design of additional courses which will enable EWTEC more responsive to the needs of the public and other sectors-private and NGOs.

Moreover, from all the sectors the majority of responding organizations showed willingness to cover at least some cost of the training and this provides indication that the existence of the real demand for water technology training courses of EWTEC in the country.

6.2 The need to focus on practical exercises

The result of the survey generally indicates the need to focus more on practical aspect on all the training given in EWTEC. Lack of practical skills is a common problem with TVETC instructors because most of them directly joined the TVETC as fresh graduates from universities and this in turn has an impact on the TVETC students who will be employed at WWO.

6.3 Recommended training courses

As results of the study, the following training courses are recommended for each target group (Table 61).

Table 61 Recommended training courses for each target group

Technical field area	Level	Course title	Job title	Suggested duration (weeks)	Core public sector				Public enterprise			Private sector		TVETC	NGO	Other govt. org. (GSE, Univ., etc)	Remarks
					RWB	ZWRO	WWO	TWSS	WWCE	WWDSE	WWDE	Drilling company	Consulting firm				
Groundwater investigation /management	Basic	Groundwater investigation/management (1)	Hydrogeologist, water engineer etc.	14-16	◎	◎	○	◎	◎	◎	◎	○		◎	○	○	
		Groundwater investigation/management (2)	Hydrogeologist, water engineer etc.	3-4			◎							◎			For WWO staff and TVETC teachers (RWSS)
	Advanced / Intensive	Geophysical investigation	Hydrogeologist, geologist etc.	3-4	◎	○			○	◎	○	◎	○			○	
		GIS	Hydrogeologist, Water engineer etc.	3-4	◎	◎	○	○	○	◎	○			○	○	○	
		Groundwater modeling	Hydrogeologist, geologist etc.	3-4	◎	○		◎		◎			○			○	
		Remote sensing	Hydrogeologist, geologist etc.	3-4	○	○				○			○			○	
		Water quality management	Hydrogeologist, chemist	3-4	◎	○	○	○		◎				◎	○	○	Sampling, water quality analysis etc.
		Water chemistry	Hydrogeologist, chemist	3-4	◎	○	○			◎			○	○		○	Basic of isotope hydrology etc.
Drilling technology	Basic	Drilling technology	Chief driller, assistant driller	14-16	◎				◎	○	◎	◎			○	○	
	Advanced / Intensive	Drilling administration	Chief driller, office manager	2	○				◎	○	◎	○			○	○	
		Trouble shooting	Chief driller, assistant driller	3-4	◎				◎	○	◎	○			○		
		Well rehabilitation	Chief driller, assistant driller	3-4	◎				◎	○	◎	◎			○		
		Well diagnosis with a borehole TV	Chief driller, assistant driller, geologist	2	◎				◎	○	◎	◎			○		
		Deep well drilling	Chief driller, assistant driller	6-8	○				◎	○	○	○					
Drilling machinery maintenance technology	Basic	Drilling machinery maintenance	Mechanical engineer, mechanic etc.	14-16	○				◎	○	◎	○				○	
	Advanced / Intensive	Top head rotary type drilling rig	Mechanical engineer, mechanic etc.	3-4	○				◎	○	◎	○				○	
		Air compressor	Mechanical engineer, mechanic etc.	3-4	○				◎	○	◎	○				○	
		Diesel Engine	Mechanical engineer, mechanic etc.	3-4	○				◎	○	◎	○				○	
		Maintenance management	Mechanical engineer, mechanic etc.	3-4	○				◎	○	◎	○				○	
Water supply engineering	Basic	Water supply engineering (1)	Water supply engineer, civil engineer	10-12	◎	◎		◎	◎	◎				◎			Town water supply
		Water supply engineering (2)	Water supply technician etc.	4-6			◎							◎			For WWO staff and TVETC teachers (RWSS/SSID)
	Advanced / Intensive	Water quality management	Water supply engineer, chemist, biologist, lab technician etc.	3-4	◎	○		◎	◎	○							Treatment plant etc.
		Leakage control system	Water supply engineer, plumbing technicians etc.	3-4	◎			◎	○	○							
		Water CAD, Epanet	Water supply engineer, civil engineer	3-4	◎	○		◎	◎	◎							
Electric machinery maintenance technology	Basic	Electric machinery maintenance technology (1)	Electrical engineer, electrician	10-12	◎	◎	◎	◎	○	○	○			◎			
		Electric machinery maintenance technology (2)	Electrical engineer, electrician	3-4			◎							◎			For WWO staff and TVETC teachers (EMT)
	Advanced / Intensive	Electrical motor and generator	Electrical engineer, electrician	3-4	◎	◎	○	◎	◎	○				○			
		Submersible pump	Electrical engineer, electrician	3-4	◎	◎	○	◎	◎	○				○			
		Sequence control	Electrical engineer, electrician	3-4	◎	◎	○	◎	◎	○				○			
Others	Basic	Rope pump manufacturing & installation	Artisan, technician	4-5	○	○	◎							○	◎		
	Basic	Hand pump maintenance	Water supply technician etc.	2-3	○	○	◎							◎	◎		
	Basic	Dug well construction/spring protection	Artisan, water supply technician etc.	2-3	○	○	◎							◎	◎		
	Basic	Appropriate technology	Water supply engineer, technician etc.	2-3	○	○	◎							◎	◎		
	Basic	Environmental assessment	Water supply engineer, geologist etc.	2-3	○	○	◎							◎	○		
	Basic	Social development	Water supply engineer, economist etc.	2-3	○	○	◎							◎	◎		
	Basic	Project management	Water supply engineer, economist etc.	2-3	◎	◎	◎							◎	◎		

◎: Very high priority
○: High priority