

### (3) Outline of Water Supply Scheme

Although specification of the facilities is not finalized, an outline of the scheme and the basic components are solidified at this point as follows.

- 1) Target Year : 2015
- 2) Design supply amount : 20 liter/person/day (L/cd)
- 3) Design usage : Domestic household use  
(Domestic animals and industry use are not concerned)
- 4) Design phase : Preliminary study level
- 5) Components of facility : Deep well (w/ a submerged motor), Water tank,  
Distribution pipes, Public faucets, Control house with  
generator (w/o water treatment facility)

### (4) Integration of Initial Environmental Examinations

During master plan phase, specification of the project is not studied. According to the Ethiopian guideline of environmental assessment, Environmental Impact Assessment Procedural Guideline Series 1, "screening process" should be implemented to master plan study. Screening, equivalent to Initial Environmental Examinations (IEE) in "JICA Guideline", is the processes of determining whether or not a project proposal requires Environmental Assessment (full EIA in Ethiopian terms) and the level at which the assessment should occur. In this period, screening report or IEE report is prepared. The IEE report is recommended to contain:

- \* the proposed activities and its potential impacts,
  - \* characteristics of the location (sensitivity of the area),
  - \* size (small, medium and large scale),
  - \* degree of public interest, and
- \* institutional requirement, Environmental enhancement and monitoring considerations.

## 12.4.2 Site descriptions

### (1) Natural Environment

A characteristic of topography of the Rift Valley Basin area, which forms a portion of Great Rift Valley, is a typical gently-sloped valley with flat plane at the middle. Sequences of lakes are positioned along the center of the valley. Ceaseless tectonic motion stimulates volcanic activities along the valley, and underground substances are carried up to the surface by hot springs and past volcanic activities.

The surface water (river) do not reach ocean and evaporates in the basin, and inorganic salts are ever being accumulated. As the results, poisonous substances such as fluorides are widely distributed in the lakes, surface water, and in groundwater of the basin. Many of the residents have no other choice but to drink the poisonous water. Safe water supply to the area is being a difficult issue in the area.

As the results of land use development for agriculture or for grazing, most of the area, except some natural reserve areas (Figure 12.5), had lost their original plants and animals.

### (2) Social and Economic Status

The project site is focusing on towns in the Rift Valley Lakes Basin in which complex regional boundary divides Oromia region and SNNPR (Table 12.3). There are varieties of ethnic groups in SNNPR whose language and culture are different from one another. Political boundaries, such as zones and woredas, roughly depict their living areas.

The population of the RVB is about 8.9 million as of year 2005. The ratio of population in Oromia region and SNNPR are 74% and 26% accordingly. Estimated population, in year 2015, of selected towns are 58,812 (29%) in Oromia region and 140,680 (71%) in SNNPR.

RVB's population density is three times higher than the average of Ethiopia's, and 7.8% of the national GDP, 8.5 billion Birr (2005 price level), is of RVB's production.

On the other hand, GDP per capita is about 72 (US\$) /year which means most of the people in RVB receives less than a dollar a day. Water highly contaminated by fluoride in RVB is not suitable for either drinking and for irrigation, thus it is presumed that the fluoride contamination is being one of the reason for preventing RVB's economic development.

Table 12.3: Social Variations of Target Towns

Region	Zone	Town	Ethnic Groups (%)	Language (%)	Religion (%)
Oromia	Arsi	O-12 O-11 O-29 O-30	Oromo (82.9) Amhara (15.4)	Oromiffa (80.0) Amharic (19.2)	Muslim (59.33) EOC (39.95)
	West Arsi	O-10 O-34 O-40 O-41 O-42			
SNNPR	Hadiya (Alaba SW)	S-09 S-54 S-55	Hadiya (78.2) Silte (10.1) Kambaata (2.2) Soddo Gurage (1.8) Amhara (1.6)	Hadiya (79.6) Silte (10.1) Kambaata (3.2) Amharic (2.6) Soddo Gurage (1.0)	Protestants (46.81) EOC (22.23) Muslim, (22.14) Catholic (5.38) Traditional (1.46)
	Kembata Timbaro	S-14 S-15	Kambaata (55.2) Alaba (13.8) Timbaro (11.0) Silte (8.5) Hadiya (5.5)	Kambaata (55.4) Alaba (14.0) Timbaro (10.7) Silte (8.4) Hadiya (5.6)	Protestants (49.0) Muslim, (29.8) EOC (12.2) Catholic (6.2) Traditional (1.5)
	Sidama	S-17	Sidama (88.6) Amhara (4.2) Oromo (3.0) Welayta (1.8)	Sidamo (88.6) Amharic (4.2) Oromiffa (3.0) Welayta (1.8)	Protestants, (62.5) Traditional (13.6) EOC (8.2) Muslim (8.0) Catholicism (4.2)
	Gurage	S-53	Gedeo (81.2) Oromo (8.3) Amhara (4.4) Sidama (1.2) Silt'e (1.1)	Gedeo (81.5) Oromiffa (7.8) Amharic (7.6) Sidamo (1.1)	Protestants (43.2) Traditional (24.6) EOC (22.1) Catholic (2.8) Muslim (2.8)
	Wolayita (ex. Semien Omo Zone)	S-30 S-59	Welayta, (44.2) Gamo (26.7) Kullo (10.2) Gofa (9.1) Basketo (1.9) Konta (1.9) Amhara (1.8)	Welayta (44.3) Gamo (25.9) Kullo (10.2) Gofa (8.9) Amharic (2.3) Basketo (2.1) Konta (1.8)	EOC (39.0) Protestants (35.8) Traditional (18.6) Catholic. (2.9)
	Silite	S-46	Silt'e (98.2) Amhara (0.9)	Silt'e (98.2) Amharic (0.9)	Muslim, (96.7) EOC (3.1)
	(Alaba)	S-51	Alaba (53.1) Silte (33.0) Kambaata (7.4) Amhara (2.1) Hadiya (1.6)	Alaba (53.8) Silte (32.5) Kambaata, (5.8) Amharic (5.1) Hadiya (1.3)	Muslim, (93.8) EOC (4.6) Protestant (1.2)

EOC: Ethiopian Orthodox Christianity

Source: CSA 2005 National Statistics, 1994 Population and Housing Census of Ethiopia: Results for Southern Nations, Nationalities and Peoples' Region, Vol. 1

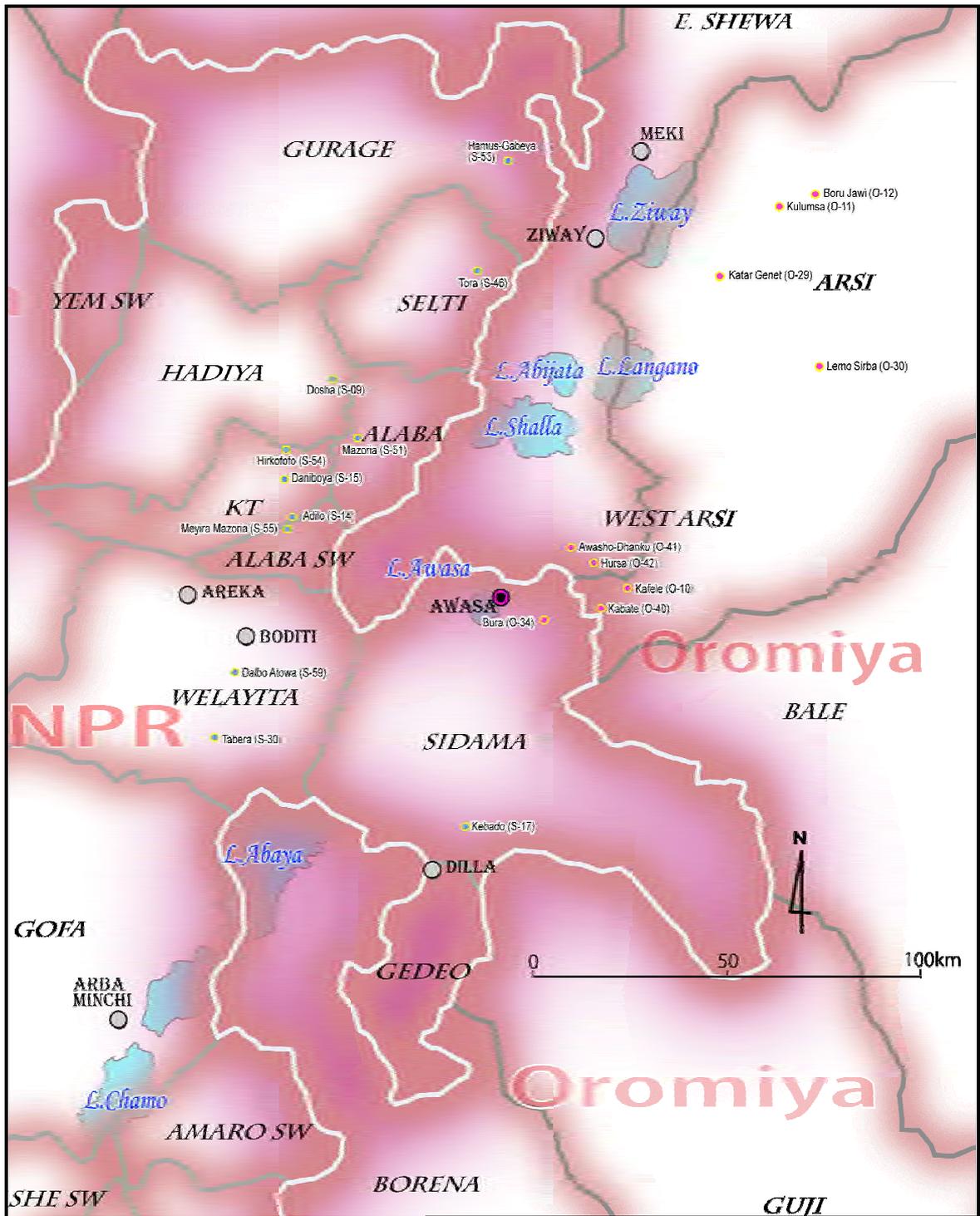


Figure 12.6	Ethnic Groups' Boundaries and Location of Selected Small Towns
THE STUDY ON GROUNDWATER RESOURCES ASSESSMENT IN THE RIFT VALLEY LAKES BASIN	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

### (3) Fluorosis Problem

There are wide spread and serious victims of dental and skeletal fluorosis in Rift Valley area. The cause of the disease is known as intake of fluoride. It is observed that there is a relationship between distribution of fluoride contaminated area (Figure 12.9) and prevalence of fluorosis.



Figure 12.7: Fluorosis Patients in Rift Valley Area

Ethiopian water quality standard for fluoride concentration limits the value below 3.0 mg/l whereas WHO limits it below 1.5 mg/l (Table 12.4). WHO also recommends that lower fluoride concentration at the higher temperature area due to necessity of greater amount of water consumption compared to cooler areas (Figure 12.8).

Table 12.4: Fluoride Concentration Standard

Country/Organization	Limiting Value
Ethiopia	below 3.0 mg/l
WHO	below 1.5 mg/l
WHO (target value, taking temperature of rift valley in to consideration)	0.8 - 1.2mg/l
Japan	below 0.8 mg/l
U.S. EPA Standard* (after 1985)	below 4.0 mg/l
U.S. EPA (before 1985)	below 2.4 mg/l

\*Maximum Contaminant Level Goal (MCLG)

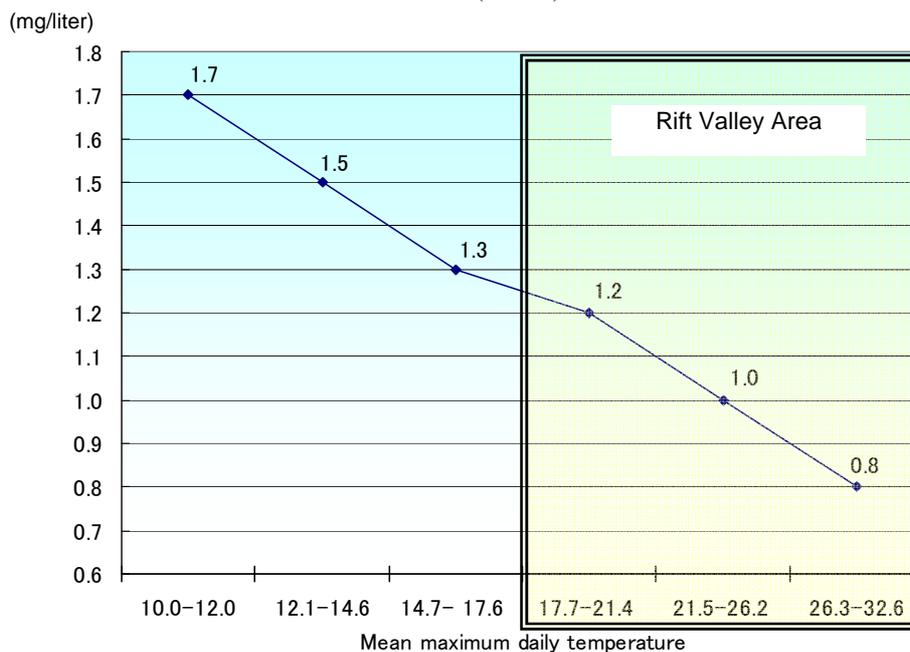


Figure 12.8: Temperate Related Fluoride Limit in Drinking Water by WHO (Guideline Value)

**[Defluoridation Measures in RVB]**

According to Ministry of Water and Energy, three types of defluoridation techniques are being practiced in RVB.

- Nalgonda technique
- Bone char
- Reverse osmosis

**a) Nalgonda Technique (NT)**

It is a technique came from India. India has abolished NT about 30 years ago due to its many short comings, such as:

- \*Not efficient (reduce only 75% of fluoride) ,
- \*Can't use for raw water with fluoride content over 10mg/liter,
- \*Procurement of chemicals is difficult for community,
- \*Sludge treatment,
- \*Aluminum ion (Al<sup>+3</sup>) residue which may cause brain damage,
- \*Sulfate ion SO<sub>4</sub><sup>-2</sup> which may cause vomiting, and
- \*Not applicable to AIFI.

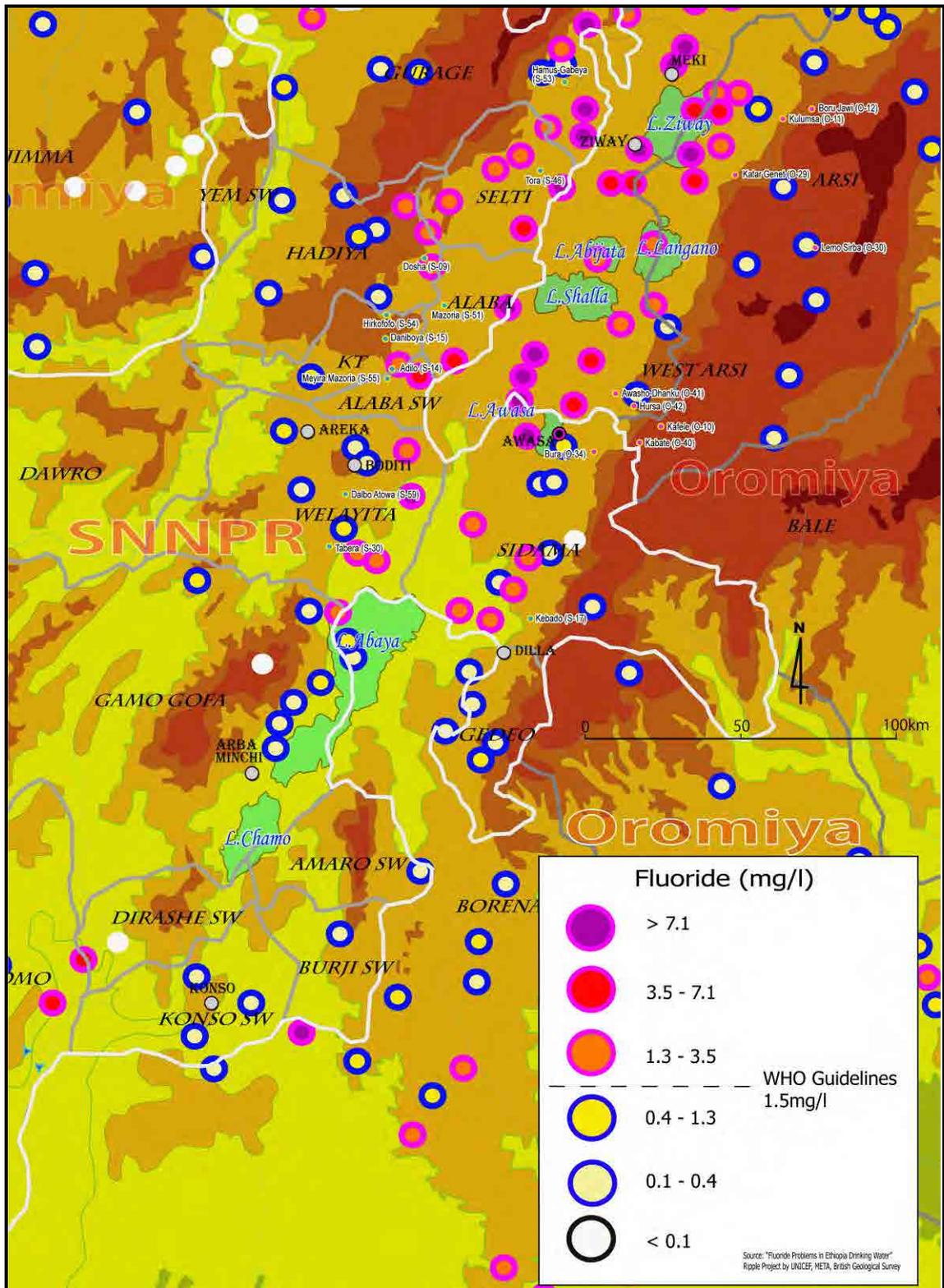


Figure 12.9 Fluoride Concentration and Location of Selected Small Town

THE STUDY ON GROUNDWATER RESOURCES ASSESSMENT IN THE RIFT VALLEY LAKES BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Table 12.5: Nalgonda Technique Site-1

Survey Date	3 MAY 2011	
Town	<b>Adami Tulu</b>	
Woreda	Jido Kombokucha	
Zone	East Shewa	
Informant	W/t Shewalul, WSP.expert, Jido Kombolcha Woreda Rural Water Supply, Jido Kombolcha Woreda 0916337942	
Number of plants Operating/Existing (Amount of water treated/plant)	*1 of 4 is functioning (20-80)ton/day. Others are not used due to malfunctioning	
Auxiliary Facilities	Electric power supply, Taps, Storage house, sludge disposal chamber	
Managing Organization	Woreda Water Bureau	
Effectiveness for reduction	Raw water (mg/l)	unknown
	Treated water (mg/l)	unknown
Serving population	10,000	
Price of water	20 cents/25 liter	
Treatment cycles	4 times/day (Peak time), now 1time/day	
Installation organization	Catholic Relief Services (CRS). American based NGO  CRS provided the facility and chemicals (18 bags of aluminum sulfate and 10 bags of lime). Woreda is promised to supply the chemicals if the community needs.	
Installation cost (Birr)	Unknown	
Running cost (Birr/mo.)	Unknown (Chemicals are supplied by Government)	
Years of operation	7 mo.	
Notes:  *BH is 120m deep. There was no queue  * It is troublesome for community operators to take chemicals up to the tank every time, mix, wait few hours, and dispose residues.  * Supply capacity is limited due to allow clogging for each cycle.		



Mixing tank (left) and elevation tank



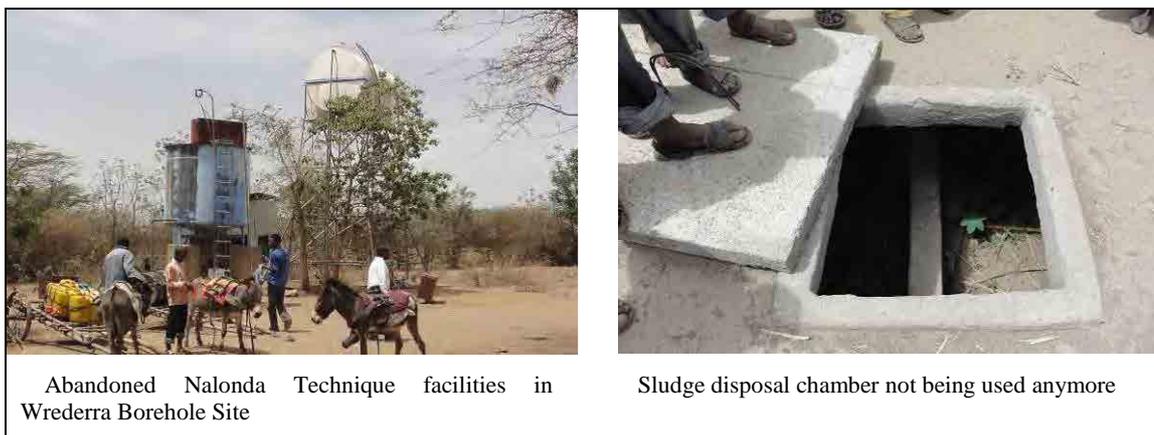
Inside of mixing tank. Some residue of chemicals is seen at the bottom.

Figure 12.10: Nalgonda Technique Facilities in Adami Tulu

Table 12.6: Nalgonda Technique Site-2

Survey Date	2 MAY 2011	
Town	<b>Alem Tena</b>	
Woreda	Bora	
Zone	East Shewa	
Informant	Mr. Dabic Mekonnen, (Sanitation Water Supply Expert), and Mr. Kasu Tufa (Irrigation Expert) , Bora Woreda Rural Water Supply, Dugda Bora Woreda 0913310399	
Number of operating/existing plants (Amount of water treated/plant)	0 facility of 5 existing facilities (0 ton/day)	
Auxiliary Facilities	Borehole, Generator, Taps, Storage house, sludge disposal chamber	
Managing Organization	(Alem Tena Catholic Church)	
Effectiveness for reduction	Raw water (mg/l)	9 - 13 (mg/liter)
	Treated water (mg/l)	-
Serving population	1,000 - 2,733	
Price of water	25 Cents (/20 liter)	
Treatment cycles	Nor working	
Installation organization	CRS and its local partner local partner, the Alem Tena Catholic Church, funded by U.S. Agency for International Development's (USAID) Office of Foreign Disaster Assistance (OFDA). OFDA also fund for training the operators	
Installation cost (Birr)	Unknown	
Running cost (Birr/mo.)	Not working but designed as:4,000 liter/Batch * 5 kg of Aluminum Sulfate & * 2.5kg of Lime	
Years of operation	After 4 years of operation, abandoned for 5 years. No budget in	

	community to buy chemicals
Notes:	
*Fluoride value is up to 26.7 mg/l of Fluoride (Wrederra Borehole)	
*Instruction given by CRS: “Mix, Leave 3hrs, Supply (Separate, dispose sludge)”	
*Taking milk is known for expelling fluoride by calcium, but the amount of milk supply is decreasing	
*Too many organizations are involved. Responsible organization does not seem to be exist.	



Abandoned Nalonda Technique facilities in Wrederra Borehole Site

Sludge disposal chamber not being used anymore

Figure 12.11: Nalgonda Technique Facilities in Alem Tena

<u>Operation Cost of Nalgonda System and Change in Water Price</u>	
<u>Assuming:</u>	
*Number of users	2,000
*Amount of consumption	20 liter/c/day
*Total amount of consumption	40 m <sup>3</sup>
*40 m <sup>3</sup> of water treated by	4,000 (tank capacity) * 2 (set of tanks) * 5 (times/day) note: 5 cycles are maximum for 1 facility (2 hrs needed/cycle)
<u>Price of Chemical</u>	
*Aluminum Sulfate	300 Birr/bag (50kg)
*Lime	200 Birr/bag (100kg)
<u>Amount of chemicals needed for a batch (Daily consumption for 2,000 people, price)</u>	
*Aluminum Sulfate	5.0 kg/4,000m <sup>3</sup> (50 kg, 300 Birr)-----(a)
*Lime	2.5 kg/4,000m <sup>3</sup> (25 kg, 50 Birr)------(b)
<u>Other Cost</u>	
*Operator x2	20Birr/day/person x 2----- (c)
<u>Total Cost</u>	
*Transportation fee, repair cost not included	
(a)+(b)+(c)=390 birr	
<b><u>Price for 1 jerry can= 19.5 cents of price up (almost 100% up)</u></b>	

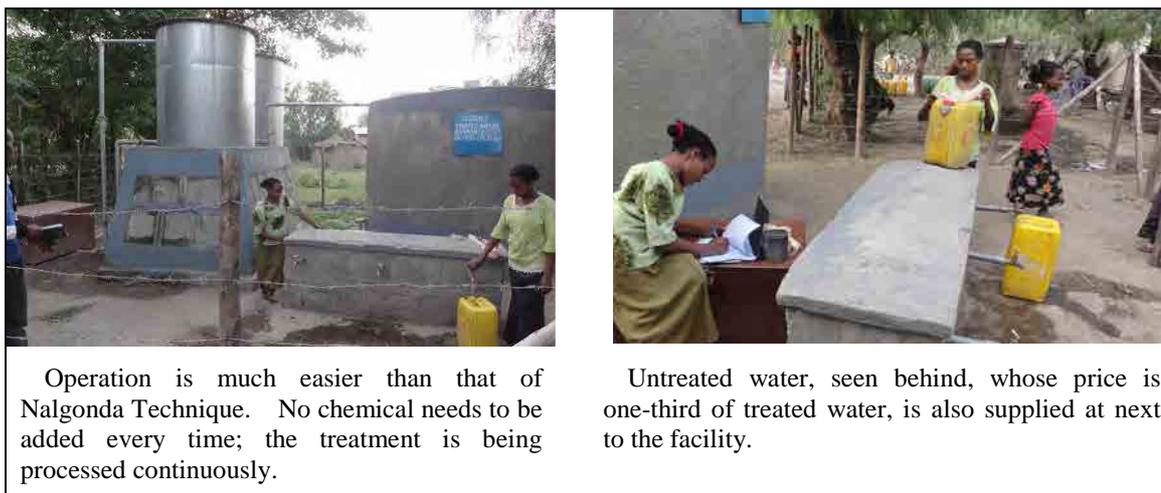
**b) Defluoridation by Bone Char**

Defluorosis technique is supported by NGOs. There is only one facility, but it is managed

well. The bone char type is effective for achieving Ethiopian standard, but can not meet WHO standard and costly. It is estimated that the residents are not able to sustain the facility by them.

Table 12.7: Bone Char Defluoridation (Site 3)

Survey Date	3 MAY 2011	
Town	<b>Meki</b>	
Woreda	Dugda	
Zone	E. Shewa	
Informant	Water, Mine and Energy Dugda Office Rural Water Supply Office, Manager Mr. Kabeto Tola and Water supply Programme Expert Mr. Tariku 0913157198	
Number of operating/existing plants (Amount of water treated/plant)	1 facility (10 ton/day) Fluoride removal filters based on animal bone char combined with calcium phosphate pellets	
Auxiliary Facilities	Borehole, Generator, Taps, Storage house	
Managing Organization	Wayo Gabriel Town	
Effectiveness for reduction	Raw water (mg/l)	4.93 (mg/liter)
	Treated water (mg/l)	2.0 (mg/liter)
Serving population	7,690	
Price of water	Treated water: 75 cents/30 liter (50 cents/20 liter), Raw water 25 cents/30 liter,	
Installation organization	Oromo Self-Help Organisation: OSHO (NGO) Funded by: Swiss Interchurch Aid (HEKS). System was developed by: Catholic Diocese of Nakuru: CDN (Kenyan NGO). CDN supplied initial filter material and support OSHO for operation	
Installation cost (Birr)	Unknown	
Running cost (Birr/mo.)	Unknown Bone char production facilities is planned to construct in Mojo	
Years of operation	1 year (Since May 2009)	
Notes: *Food/tea smell changes after cooking *Ready-made bone char is imported from Kenya, it can be recycled. It is planned to produce in Mojo, Ethiopia. *Bone char-treated water is rejected by religious (Muslims) thought at first, but granted now. *Untreated water is also supplied at the side of treated water.		



Operation is much easier than that of Nalgonda Technique. No chemical needs to be added every time; the treatment is being processed continuously.

Untreated water, seen behind, whose price is one-third of treated water, is also supplied at next to the facility.

Figure 12.12: Bone Char Defluoridation Facilities in Meki

The water committee is able to pay around 50% of the filter material replacement costs, the salary of the caretaker and the costs for pumping of raw water. The half of its operation cost needs to be supported from out side continuously.

### c) Defluoridation by Reverse Osmosis

Defluoridation by reverse osmosis practiced in RVB is only one instance done by private factory. The surrounding residents receive good quality of water at fair price.

Table 12.8: Reverse Osmosis Defluoridation Facilities in Meki

Survey Date	3 MAY 2011	
Town	<b>Meki</b>	
Woreda	Dugda	
Zone	East Shewa	
Informant	Mr. Ato Matiyas, Manager, Lassale Agro Industry 0921362767	
Number of operating/existing plants (Amount of water treated/plant)	1 facility (7 ton/day)	
Auxiliary Facilities	Discharge pond for bounced water from the facility	
Managing Organization	Lassale Agro Industry	
Effectiveness for reduction	Raw water (mg/l)	9.0 (mg/liter)
	Treated water (mg/l)	1.145 mg/liter, pH: 8
Serving population	500 household	
Price of water	25 cents (20 litre), 45 cents (over 20 liter). It can be given away, but the farm thinks that in order to prevent abusing of the water, charging some amount is necessary.	
Installation organization	Lassale Agro Industry	
Installation cost (Birr)	Unknown	

Running cost (Birr/mo.)	Unknown
Years of operation	0.5 year
Notes:	
<p>* The purpose of the reverse osmosis water treatment plant was introduced to the farm for washing food processing containers.</p> <p>* The farm provides excess water to neighboring residents (500 household, 2500 people approximately). Some are coming from 10 km away.</p> <p>* Outline of Lasalle Agro Processing Farm</p> <ul style="list-style-type: none"> <li>- Founded 3 years ago.</li> <li>- Catholic organization. Some of the shareholders are from Italy. Some are monks and priests.</li> <li>- Producing strawberry jam and cheese, it will produce yogurt, and wine. The farm will be in full-capacity in August</li> <li>- 45 employee paid 16 Birr/day (after tax reduction) or over.</li> <li>- Profit will be used for supporting children and teachers.</li> </ul>	



All of facilities of reverse osmosis plant. Membrane is white drum in the back.



Purified water is supplied at the gate of the farm. The queue is formed from early in the morning.

Figure 12.13: Reverse Osmosis Defluoridation Facilities

#### 4) Application of Defluoridation Facilities

First of all, groundwater with insufficient quality, including fluoride polluted water, is disregarded for this Study. However, if there is a fluoridation treatment technology which is affordable by the local community, materials are available locally, and efficient in reducing fluoride, the technology shall be used for towns without good quality of water.

Nalgonda Technology and bone char are not suitable because they do not have ability reducing fluoride below WHO standard. Only Reverse-osmosis is feasible with condition that there is a consensus to pay the treatment fee, including replacement of spare parts, among the residents in subject town.

Table 12.9: Summary of Defluoridation Techniques in RVB

Method	Description	Goods	Bads
<b>Nalgonda Technology</b>	Mixture of Aluminum Sulfate and Lime stone.	Resources are available in Ethiopia	<p>* Effectiveness: only effective for fluoride contamination under 10 mg/l, and efficiency in reduction of fluoride is low. Residue of aluminum ion in water may give another health problem.</p> <p>* It creates sludge with high contamination of fluoride.</p> <p>* Operation and maintenance of facility is difficult for community: Procurement of chemical supply, maintenance and repair of facility.</p>
<b>Bone Char filtration</b>	Filtration through bone char	Daily maintenance is simple and no discontinuation is necessary	<p>*Bone char production farm is necessary. Creating of appropriate quality of bone char is difficult</p> <p>* Can not meet WHO standard</p> <p>* Costly</p> <p>* Treated water smells slightly when it is cooked</p>
<b>Reverse Osmosis</b>	Filtration through membrane	<p>*Highly efficient</p> <p>*Easy operation</p>	*Costly. Residents need to agree on the amount of payment for good quality of water

### 12.4.3 Impact assessment for water supply scheme

An impact which may be caused by implementation of planned water supply scheme is assessed by a representative staff, noted below, of Ministry of Water and Energy with support of JICA Study Team.

Name: Dawit Tafesse, Habteselassie  
 Position: Environment Expert,  
 Organization: Ground Water Study, Development and Management,  
 Ministry of Water and Energy

Impact is assessed for two periods: impacts may occur during construction period and during operation period. For rating the degree of significance, “a”, “b”, “c” and “d” are used. Definition of each is as follows.

- a : Significant negative impact is expected.
- b : Negative impact is expected to some extent.
- c : Extent of negative impact is unknown. (A further examination is needed, or the impact could be clarified as the study progresses)
- d : No impact or negligibly small impact is expected.

The results of assessment are shown in Table 12.10.

Table 12.10: Assessed Impacts by Water Supply Scheme

S/N	Impacts	Rating		Description
		During Const- ruction	During Opera- tion	
Social Environment	1. Involuntary Resettlement	d	d	All the facilities will be placed outside settlement area: the size of each water supply facility is small; and its position can be adjusted easily to avoid resettlement.
	2. Local economy such as employment and livelihood	d	d	There would be some job opportunity provided to locals by water users' groups; they rather have positive impacts on local economy.
	3. Land use and utilization of local resources	d	d	No adverse impact is expected on land use and utilization of local resources, but positive impacts by installation of water supply facility such as increasing of the land value are expected.
	4. Local communities and decision-making institutions	d	d	No negative impact is expected on local society. The facilities will not displace or affect local community. Contrarily, new water supply facility is going to give good profound impacts to the local community since securing water is one of the most significant needs in their community.
	5. Existing infrastructures and services	d	d	There would be negligible interference with construction vehicles and obstruction of traffic in case pipes would be laid crossing village roads. However, since there are almost no paved roads in the rural area, the burying work of a pipe crossing the road is expected to finish within an hour.
	6. The poor/ indigenous/ ethnic minority/ women/ children	d	d	Highly positive impacts are expected for women and children by saving their time for water fetching and spend the time for other productive work.
	7. Misdistribution of benefit and social cost	d	d	The same with above "4".
	8. Historical/ cultural heritage	d	d	The sizes of water supply facilities are small; and, it is movable in proximity area at planning stage. It does not interfere with historical/cultural heritage.
	9. Local conflict of interests	d	c	There are various kinds of ethnic groups, especially in SNNPR, whose languages and religions are different from one another even they live in proximity area. Although state law defines water resources are the state government property, emotional conflict may occur due to installation and way of running the water supply facility near the boundary of ethical border.
	10. Water usage, Water rights, Communal rights	d	d	There would be highly positive impact on water usage of the community. The facility should contribute to the communal rights of villages since the distribution is managed by village water committee or water users group.
	11. Sanitation	d	d	The facility allows amount of water supply for sanitation use. It gives highly positive impact to the community health.

	S/N	Impacts	Rating		Description
			During Const- ruction	During Opera- tion	
	12.	Health Hazards/Risk, Infectious Diseases such as HIV/AIDS	d	d	Public health and sanitation condition will be improved by improving accessibility to clean water. HIV/AIDS problem is not expected to occur at water facility installation work due to its limited time and small size of the construction.
Natural Environment	13.	Important/ valuable geographical and geological features/ resources	d	d	There is no such place in the regions. No impact is expected.
	14.	Soil erosion	d	d	No soil erosion is expected by installation and use of water supply facility.
	15.	Amount and quality of groundwater	d	d	There would be no negative impact on quality of groundwater by installation and operation of the facility. Quality of ground water will be tested at the first place, and the water is utilized only if the water quality is appropriate. Like-wise, amount is also measured to judge if there is enough supply of ground water at the test. However, groundwater level may be decreased in long-term. Periodical monitoring is necessary in order to assure planned amount of water supply.
	16.	Amount of natural reservoir/ flow	d	d	Extracting deep ground water has almost no impact on the flow rate of river at the surface.
	17.	Coastal zone	d	d	There is no coastal area in and near RVB.
	18.	Flora, Fauna, Biodiversity	d	d	Game Reserve or Forest Reserve is excluded from the project area.
	19.	Meteorology/ climate	d	d	There is no plan of large scale construction or facility as to give negative impact on the climate.
	20.	Aesthetic landscape	d	d	There will be no large-scale facility that may affect surrounding landscape. Surge tank, if planned, may change the surrounding view; however, it is expected to give negative impact.
	21.	Global warming	d	d	Diesel motor pumps emit CO <sub>2</sub> ; however, there would be no large scale generators to be installed as to give negative impact on global warming.
	Pollution	22.	Air pollution	d	d
23.		Water pollution	d	d	Although groundwater in large portion of the target area is contaminated by fluoride, wells that indicate high fluoride values will be disregarded as project well at the planning stage. Water pollution during construction phase is easily avoidable with the proper supervision of work. There is no waste water discharge from the facilities during operation.

S/N	Impacts	Rating		Description
		During Const- ruction	During Opera- tion	
24.	Soil contamination	d	d	Falling down of some oil droplets from heavy machineries is expected in during construction phase but it is negligible impact. There is no soil contamination occurs during operation phase either.
25.	Solid waste amount increase	d	d	Excavated soil is properly disposed in routine manner. There is no solid waste produced by water supply facility during operation phase.
26.	Increase of noise and vibration	d	d	Since heavy machineries will be operated during construction phase, noise and vibration will occur; however, the duration is limited.
27.	Ground level subsidence	d	d	The capacities of pump motors are extremely smaller, compare to those causes ground subsidence. No ground subsidence is expected.
28.	Offensive odor	d	d	There would be no source of odor at the water supply facility.
29.	Sedimentation	d	d	There is no sedimentation on river bed or reservoir bed occurred by installation of the water supply facility.
30.	Increase of Accidents	d	d	There is no circumstances provoke accidents, by installation of the facilities.

a : Significant positive/negative impact is expected.

b : Positive/negative impact is expected to some extent.

c : Extent of positive/negative impact is unknown. (A further examination is needed, or the impact could be clarified as the study progresses)

d : No impact or negligibly small impact is expected.

#### 12.4.4 Alternatives

Table 12.11 shows probable impacts found in the check list. Avoidance, mitigation measures, and monitoring plans are studied for the probable impacts. Groundwater was indicated as the item noticed even if the rating is [d].

Table 12.11: Impacts Expected in Check Sheet

S/N	Impacts	Rating		Description
		During Const- ruction	During Opera- tion	
9.	Local conflict of interests	d	c	There are various kinds of ethnic groups, especially in SNNPR, whose languages and religions are different from one another even they live in proximity area.. Although state law defines water resources are the state government property, emotional conflict may occur due to installation and way of running the water supply facility near the boundary of ethical border.
15.	Amount and quality of groundwater	d	d	There would be no negative impact on quality of groundwater by installation and operation of the facility. Quality of ground water will be tested at the first place, and the water is utilized only if the water quality is appropriate. Like-wise, amount is also measured to judge if there is enough supply of ground water at the test. However, groundwater level may be decreased in long-term. Periodical monitoring is necessary in order to assure planned amount of water supply.

c: Extent of positive/negative impact is unknown. (A further examination is needed, or the impact could be clarified as the study progresses)

##### (1) Avoidance of Local Conflict of Interest

In order to find appropriate measures for social conflicts over installation and operation of water facility, study was carried out as follows.

Purpose: To find out present status of social conflict in RVB

Method: Hearings to responsible staffs near the regional border

Findings:

- There have not been social conflicts, such as sequence of violence erupted in Jimma Zone in 2006 and March of 2011, over two regions. Installation of water facilities will not cause conflicts over two regions.
- Integration of Oromos and Shidamas are expected by implementation of new water facilities together. SNNPR government is paying good attention for facilitation of communities when implementing a project together with elder community leaders.
- Tribal conflicts happen occasionally; however, in most of the case, their causes are personal emotion and not based on socially oriented ideas.
- Although cooperation between different ethnic groups are possible, unequal distribution of burden to one side may cause complains.

According to collected information on present status of social conflicts RVB, present scheme will not aggravate social conflicts in border area: alternatives for present scheme are not necessary in terms of social conflict.

a) Social Conflict Survey (Oromia)

Organization	West Arsi Zonal water Mineral and Energy Office, Oromia Regional Bureau
Name	Abebe Muleta
Job Title	Water Supply Programme Eexpert
Woreda/Zone	West Arsi Zone, Oromia
Venue	Shashemene
Hearing Day	May 3, 2011
Note	<ul style="list-style-type: none"> <li>➤ There is a new boundary between two (Oromia and SNNPR) regions by 2001 Referendum. For example, Intaye (Capital city of Wondo Woreda) became a part of Oromia Region. One of the water source for Asawa, Ambo springs in Intaye also moved to Oromia Region.</li> <li>➤ Water source on or inter boundary may cause conflict. If a new water facility is away from the border, there should be no problem for construction.</li> <li>➤ The causes are not religious one but of race (Oromo x Shidama). Both of them are Moslim majorities.</li> </ul>

b) Social Conflict Survey (SNNPR-1)

Organization	Sidama Zonal Administration Office
Name 1	Alemu Kelkai
Job Title	Head of Secretary, Sidama Zonal Administration
Name 2	Abiru Dekemo
Job Title	Head of Sidama zone Water, Mine and Energy Bureau.
Name 3	Kifle Hameso
Job Title	Special Advisory to Head of Sidama Zonal Administration
Name 4	Alemayehu Arsicha
Job Title	Chief Community Facilitator
Woreda/Zone	Sidama Zone, SNNPR
Venue	Awasa
Hearing Day	May 4, 2011
Note	<ul style="list-style-type: none"> <li>➤ The severe conflicts occurred between Borecha Woreda and Hawasa Zuria Woreda. In October of 2010, emotional eruption between a tribe of Omoro and Shidama result 10 deaths. The cause is totally personal and not religious.</li> <li>➤ Zonal office of the border line communities have experienced in resolving conflict by making periodical meeting with elders of both side of communities. There will not be aggravation of conflict due to water facility development activities on the border line areas, rather this development works can integrate the peoples together and reducing the possible conflict among them.</li> <li>➤ New boundary of 2001 Referendum is not completed yet.</li> <li>➤ There is no water treatment facility in the Shidama Zone. Water must be taken from a source with good quality of water. Another authority: Water Supply and Sewage Authority constructing water transfer scheme from Ambo spring water source to Awasa</li> </ul>

c) Social Conflict Survey (SNNPR-2)

Organization	Borecha Woreda Administration Office
Name	Temesgen Mengistu
Job Title	Vice head of Borecha woreda
Woreda/Zone	Borecha Woreda, Sidama Zone, SNNPR
Venue	Borecha
Hearing Day	May 4, 2011
Note	<ul style="list-style-type: none"> <li>➤ Conflicts are usually caused by grazing land (individual interest) by nomads between two tribes (Regions).</li> <li>➤ Conflicts are solved by the Regional Governments.</li> <li>➤ Water facilities are welcomed by the area and not be the cause of the conflict</li> <li>➤ If benefit or burden became larger on one ethnic group during operation of water facility managed by two ethnic groups, it may trigger social conflict.</li> </ul>

d) Social Conflict Survey (SNNPR-3)

Organization	Awasa Zuria Woreda Administrational Office
Name	Boche Tsegaye
Job Title	Vice head of Awasa Zuria Woreda Administrational Office
Woreda/Zone	Awasa Zuria, Sidama Zone, SNNPR
Venue	Dore
Hearing Day	May 4, 2011
Note	<ul style="list-style-type: none"> <li>➤ A part of Awasa Zuria Woreda was merged in Oromia Region by 2001 Referendum, but the border is not clear yet. Causes of conflicts are competition for spring grassland for their livestock.</li> <li>➤ This area has high fluoride concentration. SNNPR government is conveying water to Oromia regions by trucks. We are in good cooperation.</li> </ul>

(2) Avoidance of Impacts on Groundwater Quality and Quantity

Strict source selection excludes groundwater source with inappropriate quality (wells with fluoride concentration exceeding 1.5mg/l) in planning stage. This practice assures supply of good quality of water to subject towns.

Quantity of groundwater will also be confirmed by drawdown tests. Depletion of groundwater is expected that it will not occur. However, excessive use of a deep well may cause decline of groundwater level in long term. There are following alternatives at present; however, deep well is thought to be the best choice by the comparison (Table 12.12). Shortcomings of deep well can be covered effectively by JICA's technical assistance.

Table 12.12: Alternatives for Deep Well

Water Source	Pros	Cons
(1) Deep Well	<ul style="list-style-type: none"> <li>- Good water quality is expected since wells with good quality of water will be utilized</li> <li>- Stable supply is expected</li> </ul>	<ul style="list-style-type: none"> <li>- It is difficult to find good aquifer</li> <li>- Initial cost is high</li> </ul>

(2) Intake from surface water/ reservoir/shallow well	- There might be surface water with low fluoride content.	- Chemicals must be procured and stocked all time. - Operation and maintenance of the machine requires skilled staffs - Amount of raw water supply may not be stable.
(3) Water Transfer by Pipe	- Good quality of water can be supplied	- Construction of pipe lines with elevation tanks are costly, so as the operation cost (operation of generators).
(4) Water Transfer by Trucks	- Good quality of water can be supplied	- Trucking is costly due to maintenance fee of trucks and operation staffs. - Amount of water can be supplied at a time is limited. Good and operation under appropriate planning is necessary.
(5) Rain Harvesting	- Rain water is almost free from fluoride contamination	- Appropriate maintenance of storage water quality is not easy for local residences.
(6) Natural Spring	- Water quality and flow rate could be dependable.	- Usually it is already utilized and maintained. - Quantity may not be enough
(6) No Plan	- The residents are not required to pay for new water. - No extra labor is required.	- Area with insufficient water will remain.

#### 12.4.5 Mitigation Measures

##### (1) Mitigation Measures for Local Conflict of Interest

Facilitation of communities during planning and implementation is necessary especially at the facilities at the borders of ethnic groups. Public participation should be promoted with responsible offices. Based on past practices by the responsible government agencies, project information should be provided as far as possible by the project proponent, and effective management plan in the responsible community should be formulated with agreement of the communities.

##### (2) Mitigation Measures for Impacts on Groundwater Quality and Quantity

Decline of groundwater level in long-term is found as only “possibility” of the impact by implementation of the project; however, it is assumed that rate of the occurrence is low and not predictable. At present, implementation of drawdown test for verifying the water supply capacity is the best mitigation measure to prevent depletion of groundwater in long-term.

#### 12.4.6 Monitoring

##### (1) Monitoring for Local Conflict of Interest

Proceedings of public participation in planning stage and operation stage to be checked by

the responsible regional offices.

(2) Monitoring for Impacts on Groundwater Quality and Quantity

In order to keep good water quality and quantity of the groundwater supply scheme, periodical monitoring is necessary. Regional office should carry out water quality examination together with chemical fertilizer-origin pollutants such as nitrate nitrogen once a year.

Community can play important roles for maintaining the facilities in good condition and reporting abnormal phenomenon or malfunctioning of facilities to the responsible regional office. Draft check list for communities is attached in the following page (Table 12.13).

Table 12.13: Community Facility Monitoring Check Sheet (Draft)

Subject		Particulars		Frequency of checking	Check if Defect/ Problem is found	Measures taken?
Facility	Well	1.	Is the water near human activity? (Kept away from contamination?)	/week		
	Control House	2.	Is control house door properly locked and safe from robbery?	/week		
		3.	Are all facilities in place (any thing missing)?	/week		
		4.	Is there any malfunctioning of facilities?	/week		
		5.	Is the fuel enough?	/week		
	Pipes	6.	Isn't there leakage from pipes?	/month		
	Elevation Tank	7.	Cleaning inside of the elevation tank	/6 month		
	Public Faucet	8.	Isn't it broken or malfunctioning?	/week		
		9.	Is it kept from contamination?	/week		
	General	10.	Does WUG have sufficient spare parts?	/week		
Water Quality (at faucet)	11.	Odor	<b>If there is an abnormality, stop using the water and report it to the District office immediately.</b> <b>The district office will check the water quality in short time.</b>	/week		
	12.	Taste		/week		
	13.	Color		/week		
	14.	Turbidity		/week		
Water Quantity	15.	Isn't the quantity decreasing?	/week			
Accounting	16.	Does WUG have problem in collection of water tariff	/month			
	17.	Does WUG have enough saving for buying fuel?	/month			
	18.	Does WUG have enough saving for spare parts?	/month			
Report	19.	Submitting of this report	/month			

Responsible Personnel				
	Name of responsible person	Organization	Position	Telephone Number

Town				
District				

Place for documents to be kept			
Type of Documents		Place	Name of responsible person (Position)
1.	Facility Drawings	District Office	
2.	Specifications of maintenance parts	District Office	
3.	Record of maintenance	District Office	
4.	Accounting documents	WUG	
5.	Record of monitoring (this paper)	District Office	

Submitted by: (Name) \_\_\_\_\_ Position \_\_\_\_\_ (WUG)

Date: \_\_\_\_\_

Received by: (Name) \_\_\_\_\_ Position \_\_\_\_\_ (District Office)

Date: \_\_\_\_\_

Received by: (Name) \_\_\_\_\_ Position \_\_\_\_\_ (DWE)

Date: \_\_\_\_\_