

A Study of Water Supply and Sanitation Services in Shebedino Wereda of Sidama Zone: Case of Midre-Genet



Research Report 2

Action Research on Community-managed Water Supply, Sanitation and Hygiene Services in Shebedino Wereda, Sidama Zone of Southern Nations Nationalities and Peoples Region

A Study of Water Supply and Sanitation Services in Shebedino Wereda of Sidama Zone: Case of Midre-Genet



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**Action Research on Community-managed Water Supply, Sanitation and Hygiene Services
in Shebedino Wereda, Sidama Zone of Southern Nations Nationalities and Peoples Region**

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Photo captions and credit

The cover photo is a portrait of men, women and children fetching from one of the water points in Midre Genet. The picture of the rig was obtained from Norwegian Church Aid.

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Acronyms

BoWRD	Bureau of Water Resources Development
MGRWSSS	Morocho-Midre Genet Rural Water Supply and Sanitation Services
MoWR	Ministry of Water Resources
SNNPR	Southern Nations, Nationalities, and Peoples Regional
ToR	Terms of Reference
WASH	Water, Sanitation and Hygiene
WSC	Water and Sanitation Committee
WWD	Wereda Water Desk

1. Introduction

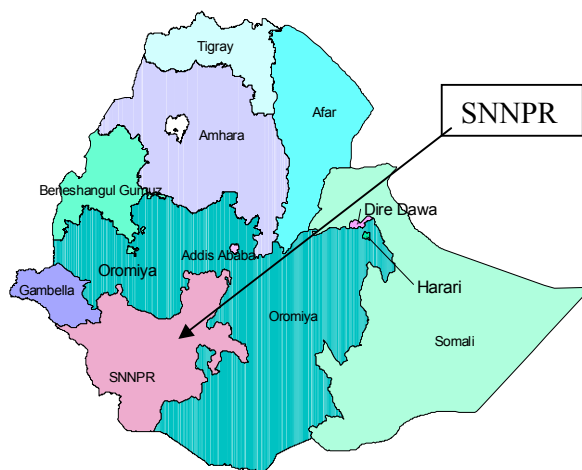
1.1. Background

The Millennium Development Goal (MDG) for water supply and sanitation is to reduce by half the proportion of people who don't have sustainable access to safe drinking water and sanitation by 2015. This means that coverage has to be increased dramatically. It is not only coverage that needs to be increased but the sustainability of implemented water and sanitation systems must be ensured to be able to deliver water and sanitation services indefinitely. As indicated in the Action Research Program Concept Note, these are the two goals of scaling up community management of rural water supply and sanitation services.

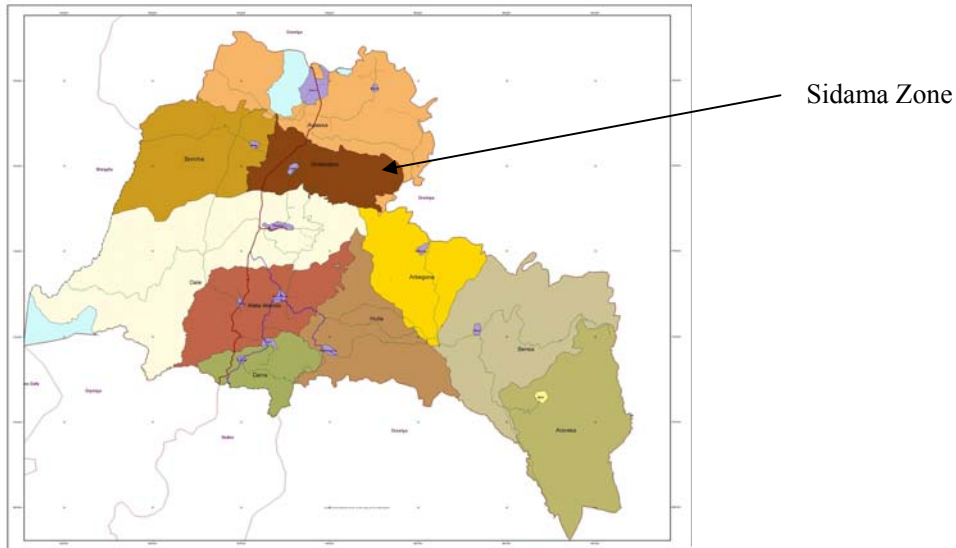
Community management of water supply and sanitation systems has become the main model of implementing water and sanitation services in rural areas. It has proved to be a successful and effective model for water and sanitation provision, but it also has its problems and constraints associated with technical and social factors. There is a long experience in rural water service provision in Ethiopia and many organizations work in the sector using community management approaches. However experiences are not shared and coordination among stakeholders is not optimal. In order to learn from experiences and address existing problems and gaps, an Action Research Project for scaling up of community management has been initiated in Ethiopia in 2004. Organizations working in the water and sanitation sector established a National Steering Committee to coordinate the implementation of the Action Research and ensure the dissemination of information and lessons learnt.

1.2. The study area

The Action Research is taking place in a pilot district, namely in Shebedino Wereda of Sidama Zone, Southern Nations Nationalities and Peoples Region (SNNPR) (Figs 1–3). This case study of the Midre-Genet Rural Water and Sanitation Service is an input to support the Action Research on Scaling up of Community-managed Water Supply and Sanitation Services.



Picture 1. Location of Southern Nations Nationalities and Peoples Region



Picture 2. Map of Sidama Zone and location of Shebedino, the pilot wereda for Action Research



Picture 3. Location of Midre Genet in Shebedino Wereda

1.3. Objectives of the study

As stated in the terms of reference (ToR) for the study (Annex A), this study was conducted with two objectives:

- to increase coverage in the Action Research wereda and learn from the process about what influence coverage, and
- to analyze issues which influence sustainability and learn from the process about factors which contribute to sustainability.

Specifically, the study aims at:

- identifying and assessing problems in performance and management of the water service,
- assessing the performance and management of the WASH Committee,
- identifying capacity-building mechanisms needed for the WASH Committee to work effectively,
- identifying appropriate institutional support needed to run the service effectively and the capacity gap faced by the institutions to support such a water service,
- providing financial estimate needed to upgrade and improve the water service,
- identifying the technical support needed to upgrade and improve the water service, and
- suggesting and recommending resource mobilization mechanism for replacement, operation and maintenance costs.

1.4. Methods of the study

Zenas Engineering, a local consulting firm, conducted the study in November 2005. The Firm mobilized a team of two consultants: W/t Yemarshet Yemane who is Water and Sanitation Engineer and Ato Siseraw Dinku (Social Anthropologist) to undertake the study. As per the requirements of the ToR (Annex 1), documents were consulted (Annex 2).

The team conducted a desk review of relevant program documents and field investigation. Fieldwork was undertaken in the project area to gather information on the water supply scheme and its management from the Regional Bureau of Water Resources Development (BoWRD), the Sidama Zone and Shebedino Wereda Water Desks, the Morocho-Midre Genet Water Service and Sanitation Committee, and user communities through direct interviews and discussions. No formal survey was conducted using structured questionnaires. Group discussions and interviews were held with different members of the Committee and with water users using checklists of topics. Six members of the committee were interviewed (list provided in Annex 3), and other users contacted in different groups were 26 (7 men and 19 women). A number of individual households were also visited in Midre Genet and Morocho villages (list of persons contacted at Wereda level is provided in Annex 3). In addition, physical observation and spot check of pipelines and other structures of the water supply system as well as sanitation facilities were conducted. It should be mentioned that lack of information on the scheme was a serious problem during the study. Project documents and information on the borehole, pump, etc were not found from the concerned offices. Although several studies and pump testing were reported to have been conducted earlier, the study team did not succeed to find copies of the reports from the different institutions.

Network analysis of the existing water supply scheme and of the proposed expansion work was also made using WaterCad for AutoCAD v6.5. The model results for the existing system and proposed expansion are attached at the end of this report as Annexes 4 and Annex 5, respectively. The consultant also conducted bacteriological tests and physico-chemical analysis of water samples taken from the borehole, reservoir, and water points in Midre Genet and Gebre Kirstos villages with the assistance of the regional Water Resources Development Bureau. Results of the analyses are presented in Annex 5. Key findings and preliminary conclusions were also presented by the consultants and discussed at the Scaling up Learning Workshop attended by representatives of major stakeholders including Plan International, IRC, WaterAid, MoWR, and regional WRD bureaus. The draft version of the report was also submitted to Plan International for review and comments. This final report has incorporated the comments and requirements for additional information made by the workshop participants and concerned project staff of Plan International.

2. Existing water supply scheme

2.1. Scheme construction

The existing water supply constructed 25 years ago was initially designed to serve communities of Midre Genet Kebele and the surrounding villages Gebre Kirstos and Morocho. The source of water for Midre Genet Kebele and surrounding villages is ground water from a drilled borehole. The then Southern Region Water Supply and Sewerage Authority completed the construction of the scheme in 1981.



Picture 5. MG water supply reservoir

A Chinese contractor had done the construction of the scheme. The scheme is a motorized scheme comprising then (in 1981) a borehole of about 224 meters depth, 50m³ masonry circular reservoir, about 700 meters long 3" GS pipe rising main, 2,900 meters 1¼" GS pipe distribution main, and four distribution water points. Earlier, water used to be pumped from the borehole to the reservoir, and distributed to the communities through four

distribution water points.

In 1999 the scheme was expanded to serve additional three neighbouring villages of Gimbi Kebele. The Sidama Development Program paid for cost of expansion works. The expansion work comprised of about 1,000 meters of pressure main of 2½” GS pipes and 1,500 meters of 1½” GS pipe distribution main, and two 8m³ elevated steel tankers, and three distribution water points. Presently, the water supply system has seven water points serving four main user villages.

2.2. User communities and water use

The main users of the water supply scheme are the communities living in Midre-Genet, Morocho, Gebre Kirstos and Gumbi villages (Table 1). The exact number of users is not known since no track of users is kept but anybody that comes to the water point can buy any amount of water. Since there is no other source of water supply in the area, especially during dry seasons, the water scheme is also used by the other neighbouring villages. According to informants, user villages include Midre-Genet, Morocho, Gebre Kirstos and Gumbi villages.

Members of the Water and Sanitation Committee (WSC) and other users report that there is increasing pressure on the service, and the number of users is estimated to range between 15,000 and 20,000 people.

Improving the present distribution system by upgrading the pipeline and further expanding the scheme to those kebeles through construction of additional water points is being considered by the WSC to address the problem related to the scarcity of water supply in the area.



Picture 4. Gebre Kirstos children in queue to fetch water from Midre Genet Water supply scheme

Table 1. Villages that use a given water point

Water points	Main user villages	Other (seasonal) user villages
Midre Genet	Midre Genet	Dilla Gumbe, Albano, Konsoreano and Borchha
Gebre Kirstos	Gebre Kirstos	Diramo, Aferara and Chenge kebeles
Morocho	Morocho	Morcha negash, Morcha shondolo, Bonoya, Teberako and Kutela
Gumbi	Gumbi	Remuda and Gololagn

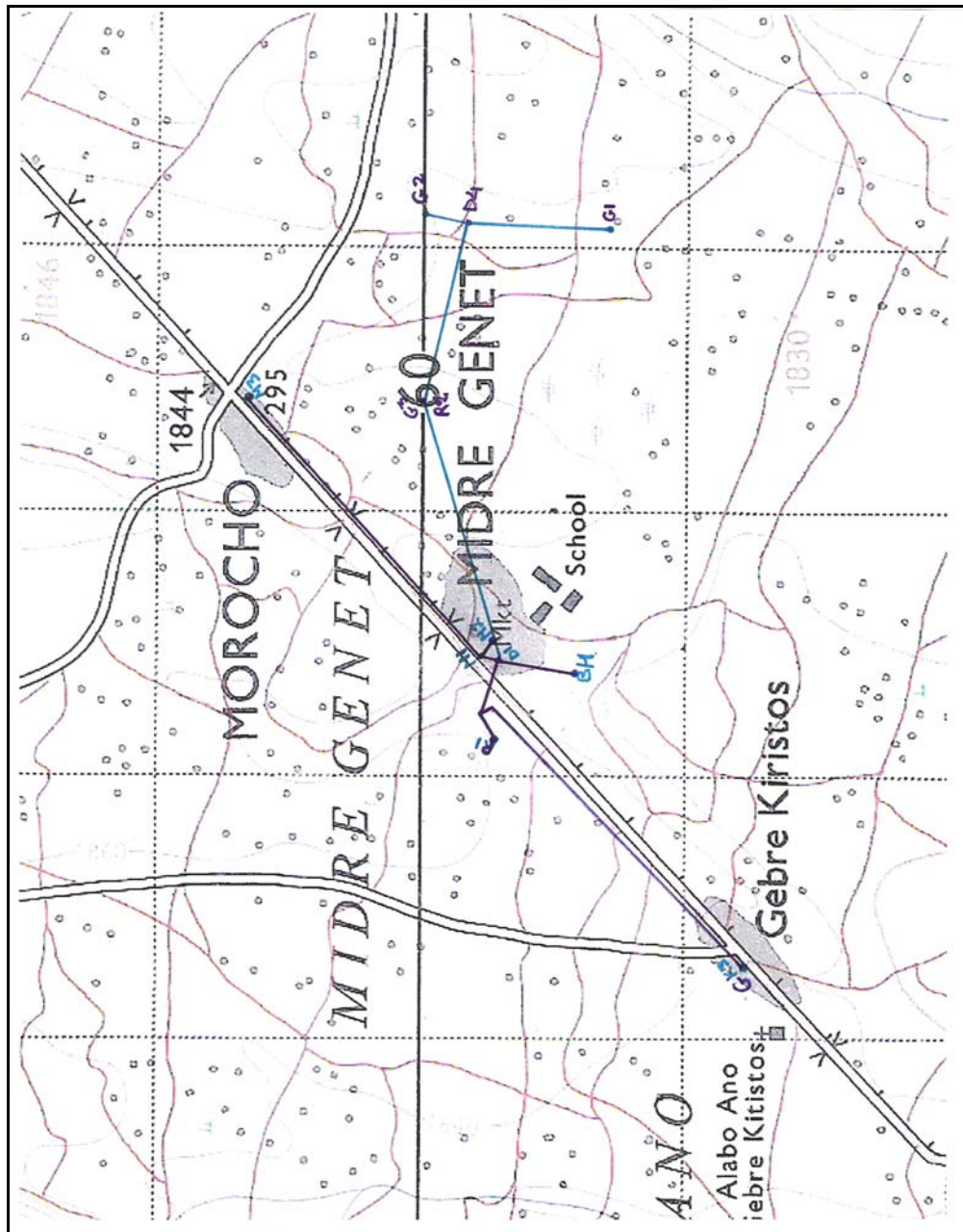
Ground water from a drilled borehole is the source of clean water supply for Midre Genet Kebele and the surrounding villages. During the dry season the villagers collect water from this groundwater source even for watering their cattle. During the wet season, however, except the community in the Midre Genet Kebele, the villagers use the clean water supply from the groundwater mainly for drinking and use tradition sources like seasonal springs and ponds in their vicinity for other purposes, such as cooking and washing.



Picture 6. Men, women and children of Gebre Kirstos village in a queue to fetch water from Midre Genet Scheme and a water committee member on duty

2.3. Scheme assessment

The layout of the existing scheme and the future proposed expansion based on a Global Positioning System data is shown in the diagram.



Scale 1:20000

Legend: BH – Borehole R1- 50 m³ Reservoir R2- 16 m³ reservoir
 G1, G2, G3- Gumbi water points M1, M2, M3–Morocho water points
— Existing Old Pipe Line — Extended pipe line

Pictre 7. Layout of existing water supply scheme

2.4. Scheme analysis

The seven water points, two reservoirs and pump house of the existing water supply scheme are in good physical condition particularly for their age and all are operational during the visit. Though no complaint of leakage or pipe breakdown was reported regarding the water main, from the data collected about water produced and sold daily, the unaccounted for water was calculated to be about 25%. It was reported by the Water Committee that the day-by-day water pumped fills at least once both the 50m³ and 16m³

reservoirs, meaning a minimum of 66m³ per day and this is excluding any water that might be distributed while pumping. On the other hand, from the data collected about water sold for the last 14 months, average water sold per day amounts to about 50m³, showing a loss of at least 16m³ per day.

The existing Midre Genet Water Supply Scheme was also analyzed assuming:

- one borehole with a pump placed at 63m below ground level with a pumping power of 3KW
- two reservoirs with 16m³ and 50m³ capacity at the same elevation (1871m.a.s.l) at different location, and
- galvanized steel pipes of the following size:

<u>Diameter (mm)</u>	<u>Length (m)</u>
32	1,500.00
40	2,875.00
65	1,000.00
75	610.00

Based on this information, network analysis using WaterCad software was run for the branch network. The water distribution model result (Annex 4), is interpreted as follows.

Assumptions in data used for network analysis:

- average volume of water sold at each water point during the last Ethiopian year were considered as demand data for each distribution water points.
- Operational time of water point was assumed to be every day and was taken as 8 hours per day.
- Pump was placed at 63 meters depth, as reported by the Water and Sanitation Committee.

2.5. Analysis of results

In the existing system, the pump is supplying simultaneously to the reservoir and to the distribution system until the reservoir is filled. The analysis shows, the velocities and head losses for some part of the distribution line are high and as a result the pressure is too low at those junction nodes whether water is collected while water is being pumped or distributed straight from the reservoirs. This shows that the existing distribution pipe size for some part of the main is very small to accommodate the direct pumping flow.

2.6. Water quality analysis

The physiochemical analysis of the water from the borehole and bacteriological analysis of water from borehole, reservoir (50m³) and Gebre Kiristos distribution point have been conducted. The physiochemical result at borehole site shows that the water meets WHO guidelines (Annex 5). The bacteriological test result shows that total coliform count for water taken from borehole site is 3, which is acceptable by the WHO standard. However, the biological analyses for water from the reservoir and Gebre Kiristos water point show higher total coliform counts, with total coliform count for water from reservoir and Gebre Kiristos water point being 15 and 50, respectively. Though it is not possible to conclude that there is danger in health from these results without information on the fecal pollution, the results clearly indicate that there is contamination at some point through the water main. This is possible since interruption of supply can create low pressure and even a vacuum condition in the pipeline and thus allowing contamination from the ground entering readily through the leak points on the pipes.

3. Management of the water supply and sanitation services

3.1. The Water and Sanitation Committee

A Water and Sanitation Committee manages the water supply system. Before 1991, the management committee was part of the formal kebele administration, and the committee was composed of five members including the Kebele Chairperson, cashier and representatives of the then Women and Youth Associations. Some of these committee members including the chairman were not members of the direct user communities, and hence not committed for the proper management of the system. According to the present committee members, funds were abused and service was frequently interrupted. In 1991, a new independent committee consisting of five elected members was established with the facilitation of the Water Department. In 2001, with the expansion of the system, the committee was reorganized again to include representatives from the new user villages and to establish a 'Congress'. The Tropics Consulting Engineers introduced the new structure and facilitated the election process. Four new members were included in the management committee and a body of representatives called 'Congress' consisting of 28 members (7 from each village community) was established. Only three of the nine executives and eight of the twenty-eight representatives are women.



Picture 8. Midre Genet Water Supply Congress on meeting



Picture 9. MG Water Supply Executive Board members on meeting

The present Morocho-Midre Genet Water Service and Sanitation Committee is composed of a Chairperson, a Secretary (who also serves as the bookkeeper of the committee), a Cashier, a Storekeeper, and five other members. The executive committee is responsible for the overall management of the scheme. The Congress seems to have a representative function. According to members, tasks of the Congress include monitoring service conditions in their respective villages and reporting to the management committee. Specific tasks of the Congress and relationships with the Committee are not clearly defined and known by members.

The management of the scheme also includes eight employees: seven Fee Collectors (five women and two men) recruited from the user communities and an Operator, working for the past 25 years. The Operator was previously trained by the Chinese contractor to operate the generator. The Fee Collectors are responsible for selling water and keeping the water points clean, and the Operator looks after the system in general. The Fee Collectors are paid 70 Birr/month, and the Operator 130 Birr/month. There are no watchmen around the water points, power house of the new office at the moment, and the need for this post was not felt by the Committee at the time of the study.

According to the Wereda Water Desk, the Committee is one of the best committees in the Wereda. Committee members are reliable and committed to properly manage and improve the system. They cover full range of operating and maintenance expenses plus continuing repairs and some reserves for renewal and improvement expenses from their internal revenue. They have replaced the old diesel pump generator with electrical systems, spending about 18,000 Birr. The Committee has recruited Fee Collectors for each water point, which was not the case in the past. They have built an office quarter in Midre Genet with a

cost of about 40,000 Birr. The construction of the office was completed in 2005, and the Committee has a plan to equip it with necessary furniture and equipment. They also possess a stock of essential maintenance tools. At the time of the study, the community had a saving of 63,376 Birr deposited in their bank account at the Awassa Branch of Commercial Bank of Ethiopia. The Chairperson and the Cashier of the Committee operate the bank account.



Picture 10. People visiting the newly constructed WASH office of the Midre Genet community

Now the Committee has a plan to upgrade the pipeline and expand the water service to private connection and other neighbouring kebeles. They also have a plan to setup an office and employ permanent staff for the day-to-day management of the water service activities. However, Committee members stressed that they require external financial as well as technical assistance to realize their plan to replace existing old pipelines and expand the service.

The Committee also requires capacity building support in terms of training and systems development. During the last 17 years, Committee members received general training on management of WSS services only twice: first for two days in 1995 at Abela and then for three days in 2003 at Leku. They think that the training was not adequate to effectively manage the system. Committee members require training in the areas of hygiene and sanitation promotion and financial and property management. The Operator needs training on basic maintenance and repair of the scheme. The Fee Collectors also require training on basic bookkeeping and sanitation. Moreover, the committee does not have any bylaw to govern their internal affairs. They also do not have other management and financial manuals or relevant work guidelines to guide their activities.

In the present decentralized system, the Wereda is the closest level to provide support services to rural communities. However, Wereda structures lack the necessary capacity in terms of skilled human resource, budget and logistic to do their jobs effectively. Committee members reported that in the past support from concerned Wereda offices in terms of capacity building/training, technical assistance, and follow up has been minimum. Supports from the WWD and regional BoWRD have been limited to repair of facilities following requests for major maintenance/repair works. The committee covers per diem of mechanics (operation and maintenance staff of the offices) and transport (fuel) costs when they require such services. Committee members think that the maintenance service provided by the office is expensive, and prefer to have their own technicians to timely solve problems in a cost effective manner.

3.2. Financial system

Full coverage of operation and maintenance (and repair) costs is an important component of the Midre Genet WSS community management system. The community financial system is based on fixed water rates set through consultation with user communities and concerned offices. Fee Collectors sell water to users based on tariffs set for different containers. For individual users the payment is done per tank of water fetched. The price of a jerry can of about 20 liters capacity is 10 cents. The committee collects revenues from Fee Collectors on fortnightly or monthly basis based on water meter readings at a rate of 4 Birr/m³, issuing receipts in return.

The Committee Secretary serves as the bookkeeper of the committee responsible for recording incomes and expenditures and preparation of quarterly financial reports. The study team observed excellent documentation of accounts; however, it is not systematic bookkeeping. Financial report is prepared and submitted to the WWD on quarterly basis. However, there is no system of financial monitoring and control at the community level. User communities are not well informed about the incomes and

expenditures from the water service, but they trust that the Committee is doing fine. Accounts of the committee were audited only once in 2000 by the Regional Bureau of Water Resources Development and the auditors were satisfied with the records and documentation of the committee.

3.3. Income and expenditure

Monthly income from water sale ranged between 2,592 and 6,432 Birr in 2004, showing significant increase from the previous year, which was between 1,830 and 5,007 Birr (Table 2). This is according to users because of increasing number of users. Monthly expenditure has also become higher in recent time because of spending for office construction.

Table 2. Monthly income from and expenditure for Midre Genet Water Supply in years 2003 and 2004

2003			2004		
Months	Income	Expenditure	Months	Income	Expenditure
September	1,830.00	2,264.80	September	3,557.00	2,755.00
October	3,375.00	5,302.13	October	3,560.00	2,990.40
November	3,760.00	1,536.00	November	6,147.50	5,663.75
December	3,012.50	4,852.15	December	5,122.50	5,134.00
January	3,242.50	2,336.80	January	5,047.00	5,958.95
February	5,007.50	5,483.55	February	6,576.00	5,349.85
March	4,300.00	4,115.72	March	6,056.45	5,998.35
April	2,787.50	2,316.82	April	4,431.00	5,902.11
May	3,175.00	4,467.99	May	4,324.00	5,288.04
June	3,765.00	1,998.34	June	2,592.00	2,844.34
July	2,777.50	2,450.99	July	6,432.00	4,533.54
August	3,772.50	4,710.00	August	5,160.00	4,699.45
Total	40,805.00	41,835.29	Total	59,005.45	57,117.78

The committee fully covers operation and maintenance costs of the scheme from water sale. Monthly recurrent expenditure is estimated at 2,270 Birr. Main costs include:

- staff salary (620 Birr);
- electric service (average 1,150 Birr); and
- spare parts purchase, transport and payments for mechanics (about 500 Birr).

Income was below expenditure in 2003 (Table 3).

Table 3. Average annual income and expenditure in years 2003 and 2004

Years	Income	Expenditure	Balance
2003	3,400	3,486	-86
2004	4,917	4,760	157

While both income and expenditure in 2004 show increases from the previous year, difference between monthly incomes and expenditures was not significant. As a result, saving for repairs and replacement was very low or nonexistent in recent years. Because of this and increase of prices of spare part and repair services, the Committee has made tariff adjustment in February 2005. According to the Water Committee, the adjustment was made in consultation with the Wereda Water Desk and user communities. The data on monthly income since the adjustments show growth in overall revenue but decrease in the quantity of water sold.

3.4. Water tariff and sale

The tariff for selling water until February 2005 had been 2.50 Birr/m³ (5cents/20 liters). Tariff since then had increased by almost 100%, to 4–5 Birr/m³ (10cents/20 liters) (Table 4). The amount of water sold

has reduced from 30-40% after the tariff adjustment. The quantity of water sold was calculated by dividing the money collected from each water point during the period before and after tariff increase by 2.5 and 4 Birr, respectively. Similar calculation was made for the same months before and after February 2005, but the results of quantity of water sold were found the same.

Table 4. Total water sold in M³

Water point	Sept.04–Feb.05	Mar.– Aug.05
	(2.5 Birr/m ³)	(4 Birr/m ³)
Midre Genet 1	1743.4	933
Midre Genet 2	2055.2	1101
Morocho	2073	1892
Gebre Kiristos	1557	1231.75
Gumbi 1	683.2	339.25
Gumbi 2	1906.52	625.75
Gumbi 3	1045	636
Total	11,063.32	6,758.75

The adjustment was meant to cover increasing costs of operation and maintenance. However, available data show there has been no financial gain. The demand for water varies seasonally. It is observed that during rainy seasons, the community inclines to use other water source options and hence the demand for the tap water decreases. Whereas, during dry season, demand for tap water increases as there is no other water source to supplement the supply. Committee members believe users are able and willing to pay. Similarly, contacted user individuals/households in Midre Genet confirmed that they are aware of operation and maintenance requirements of the scheme and are willing to pay for the improved water service.

3.5. Sanitation and hygiene promotion

Integration of sanitation and hygiene activities with the water supply is very weak in the study area. The WSC with the support of relevant offices is assumed to be responsible for creating awareness and promoting good hygiene and sanitation practices. However, efforts in this regard were very limited.

It is reported that as a result of the government initiated health extension service (regional sanitation program), increasing number of households have built pit latrines. However information on the use of the latrines and personal and domestic hygiene conditions is generally lacking. The study team learnt that in Midre Genet town, which is a kind of rural centre or small town, almost all households use pit latrines made from local materials and family labour and the level of knowledge of health-related benefits of water supply is good. Contacted community members reported, however, that construction and use of latrines in rural villages is low.

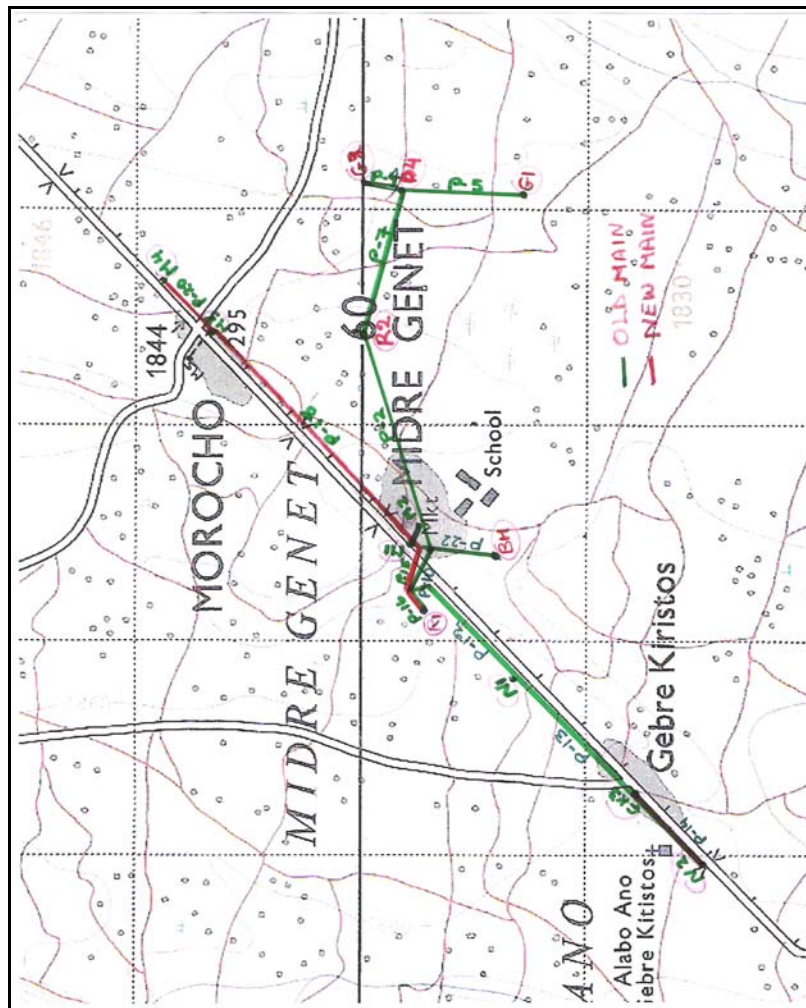
4. Cost estimates for service improvement and expansion works

The Water Committee, as stated earlier, intends to upgrade the pipeline and expand the system to four neighbouring Kebeles and to some private connections particularly in Midre Genet town. Two of the water points were planned to be in Gebre Kirsitos neighborhood and the other two in Morocho. This means a pipe extension work of at least 850 m to supply water to this new neighborhood.

There is a need to disinfect water on a regular basis prior to supplying to the community. This can only be done at the two existing reservoirs, by implication there needs to be independent rising mains from the Borehole to the two reservoirs. This means the existing pump will first pump water straight to the reservoirs using these independent rising mains, water will be disinfected at the reservoirs prior to its distribution, and disinfected water will then be distributed via the distribution system to the user community.

Network analysis for the proposed expansion in distribution and independent rising mains was done using WaterCad software for the branched network. Preliminary analysis result shows that the pressure head at Water Point M5 is below 1m (Annex 5) and Water Point M5 cannot be served from the reservoir R1 (50m³ reservoir). It is therefore suggested to do the extension work to Water Point N2 and M4 with a 1¼” diameter GI pipe and the existing 1½” distribution main from Midre Genet Water Point M1 to Morocho Water Point M3 be replaced with 2” diameter GI pipe. With these adjustments, the velocities and head loss in the distribution line is found to be low and as a result the pressure at all junction nodes is relatively good. This also shows that the remaining existing pipe sizes are enough to accommodate water coming from the reservoirs.

As is indicated in in Annex 5, one of the solutions to reduce the head loss in the distribution main thus increasing the pressure at the water points is having independent rising main. This will also provide an option for distributing water that has been disinfected at the reservoir sites as has been noted earlier. Reservoir R2 already has an independent rising main. A parallel main of 3” from R1 to M1 is then to be laid to make the rising main from Reservoir 1 independent. It involves itemized costs for having an independent line (Tables 5 and 6) and demands expansion line (Picture 11) to new neighborhood.



Picture 11. Expansion Network Scale 1: 20000

Table 5. Details of the expansion network

S. N	Label	Length (m)	Diameter (mm)	Main Type	Hazen- Williams C
1	P-02	1000	65	GI Old	100
2	P-04	0190	32	GI Old	100
3	P-05	0550	32	GI Old	100
4	P-07	0725	32	GI Old	100
5	P-08	0040	32	GI Old	100
6	P-10	0490	75	GI Old	090
7	P-12	0660	40	GI Old	130
8	P-13	0750	40	GI Old	090
9	P-14	0450	32	GI New	120
10	P-15	0240	75	GI New	120
11	P-16	0110	75	GI New	120
12	P-17	0075	40	GI New	120
13	P-18	1275	50	GI New	120
14	P-20	0275	40	GI New	120
15	P-22	0250	75	GI Old	090
Total Length		7,080			

Table 6. Cost estimate for the Expansion Work

No.	Description	Unit	Quantity	Unit price	Total price
I	PIPES AND FITTINGS				
1.1	P-15 (75 mm GS)	M	0240	145.00	34,800.00
1.2	P-16 (75 mm GS)	M	0110	145.00	15,950.00
1.3	P-14 (32 mm GS)	M	0450	067.00	30,150.00
1.4	P-17 (40 mm GS)	M	0075	081.00	6075.00
1.5	P-18 (50 mm GS)	M	1275	090.00	114,750.00
1.6	P-20(40 mm GS)	M	0275	081.00	22,275.00
	Sub Total - I		2425		224,000.00
II	CONSTRUCTION				
2.1	Pipes and Fittings Installation	%	224,000.00	040.00	89,600.00
2.2	Excavation in Common Soil	M ³	679.00	012.50	8487.50
2.3	Excavation in Soft Rock	M ³	0339.50	024.00	8148.00
2.4	Excavation in Hard Rock	M ³	0169.75	036.00	6111.00
2.5	Back Filling and Compaction	M ³	1188.25	012.00	14259.00
	Sub Total - II				126605.50
III	BOREHOLE PUMP TEST	No	1	10,000	10,000.00
	Total (I + II + III)				360605.50
	Contingency (10%)				36060.55
	Grand Total				396666.05

It should be noted that expansion of the water service is dependent upon results of the proposed pump test and actual local demands. This should also be followed by basic survey and design works. Therefore, what can be provided at this level is preliminary cost estimates for service expansion. Activities to expand the water service include:

- survey and design works including identification of new user villages,
- preparation of bill of quantities for supply of pipes and fittings,
- pipe laying and construction works, and

- construction of additional water points in Gebre Kirstos (where existing supply is not sufficient) and newly identified user villages in Morocho.

Service expansion and improvement works may also include repair/maintenance of existing water points, fencing of new points, and construction of washing and bathing facilities (cloth washing basins and separate shower rooms for males and females) and cattle troughs close to water points. The ideas of constructing such facilities and introducing paid shower services to encourage personal hygiene were forwarded to and accepted by contacted committee members and users. However, such proposals need to be further discussed and agreed with all concerned communities in each village, and detailed action plans and cost estimates drawn considering local community contributions. In addition to the aforementioned activities, hygiene and sanitation promotion works (including awareness creation and construction of demonstration latrines) and capacity building initiatives (such as training of management committee members and provision of materials) should also be considered in determining service improvement costs and required institutional support.

With respect to resource mobilization for extension and upgrading works, costs may be shared among donors, the local government, and user communities. Donors such as Plan International may cover costs for construction activities, purchase of materials (such as pipes, fittings, and chlorine), pump test and labour. User communities will continue covering operation and routine maintenance expenditures. They may also cover costs for repairing existing water points, fencing, and constructing cloth washing basins, shower rooms, troughs and model latrines. The kebele and wereda administrations facilitate local resource mobilization and provide spaces for construction of facilities. Regional Bureau of Water Resources may provide technical assistances for study, design and supervision works, whilst the Wereda Water Desk and Health Offices could conduct awareness raising activities and provide training for the committee and its employees. They could also provide reference materials for hygiene and sanitation education and assist the committee in preparing bylaws, operation manuals and guidelines.

5. Sustainability factors

The Midre Genet Water Supply Scheme has given service for more than 17 years without interruption. The main reasons for this are the strength of the WASHCO and external institutional support for service improvement and major repair works, and establishment of appropriate and accepted financing system also contributed to its sustainability. In addition to these, the overall clear and favorable policy environment for community management of water and sanitation services at both federal and regional levels and opportunities related to the location of Midre Genet (its accessibility and location close to the wereda and regional capitals to buy spare parts and get other services) have contributed to the success of the service. Main factors that have contributed to the sustainability of Midre Genet Water Supply Service in the past are highlighted as follows.

5.1. Appropriateness of technology

Simplicity and appropriateness of technology adopted, very much affect the technical sustainability of rural water supply schemes. As is the case of Midre Genet, any water supply scheme should be operated and maintained within the local capacity and basic tools for routine maintenance should be available at local level. However, unlike Midre Genet, sustainability in scheme operation does not come in having one indispensable operator, serving alone for the last 25 years, but always in having at least one other trained and capable replacement.

The tasks of an operator as in case of rural schemes like Mider Genet where source is from a motorized borehole and distribution via public water points is simple and straightforward. Even then, what Midre Genet water supply scheme lacks, but that which is very basic to sustainability is operators' manual in a local language containing details of key tasks.

Midre Genet depends on the public and NGOs for supply of goods and services and this for the time being has contributed significantly to its sustainability. In the long run, the public sectors role will be as defined

in the Water Policy. When that happens, and when the public sector starts playing its regulatory role, the need to involve the private sector to provide goods and services would then become inevitable along with the need for community management. The private sector will then contribute to sustainability by creating market for spare parts, replacement of equipment and repair services.

Furthermore, the reliability of the water resource/supply, quality of water, accessibility of scheme and quality of construction works are important factors among others, affecting the sustainability of water supply schemes. Guaranteed access to an adequate and clean water supply system has caused the community to be willing to pay even when the tariff rate is raised by 60%.

5.2. Having strong community management

The existing water and sanitation management committee of Midre Genet is very strong, dedicated, and has won the trust of user communities. The committee consists of nine members elected from core user villages, and the members have been in office for the last 17 years.

The Midre Genet water supply service shows that properly supported communities have both the ability and the willingness to manage their own water systems. It has proved the capability of user communities to take charge of administering their water systems by independent, elected, and committed water and sanitation committee.

Water supply and sanitation services are considered sustainable—and therefore ‘successful’—when the user community manages to finance operations and maintenance, and if possible replacement and improvement/expansion costs. The financial freedom that Midre Genet Committee exercises like in setting up its water tariff, in expanding the scheme, in the decision it made for constructing the new office, etc is also a factor that contributes to sustainability. With the freedom that the Committee exercises, however, also comes the need to be accountable to the community that the Committee commits itself to serve. For example, prior to expansion of supply to new communities, it is important that the Committee consults with the existing user communities concerning their view and investigates the community's desired service level. Because, communities' awareness of benefits of a safe water supply scheme increases with time and the communities' demand for water and a better service level is inevitable. This collective decision is one aspect of social sustainability.

Social sustainability relates to the political platform and has much to do with long-term commitment and participation. As in the case of Midre Genet, in addition to local ownership of the water scheme at its core, it is also about commitments and collective actions to improve services at the local level. Owing to the long independent management of the water supply system by the community through elected committee members, strong sense of ownership has developed in the user communities. Users feel that they are primarily responsible for the proper management, operation and maintenance of the system.

Other crucial aspects of sustainability are institutional. Institutional sustainability has to do with existing regulations and state policies on the one hand, and procedures and relationships within the community management arrangement on the other hand. As noted in the previous parts of this report, the regional government has taken up community management for implementing water and sanitation services in rural areas.

5.3. Financial feasibility

Community financing is at the heart of the community management system and has created strong sense of ownership and responsibility by users, and it also has led to improved services as well as request for expansion. In order to guarantee sustainability of the service, a policy of supplying water with ‘affordable’ charges, as much of the recurrent costs of operation and maintenance (for partial cost recovery system), has been adopted by the Management Committee. Since the communities in all the villages do not have easy access to clean and adequate drinking water supply, they are willing to pay for improved and reliable service and have successfully financed the operation and maintenance of their scheme for the past 17 years. In addition to this, they have been able to improve the pump generator, construct office quarter,

and possess a set of maintenance tools. They also had been able to deposit more than 63,000 Birr in the Awassa Commercial Bank as a reserve fund.

5.4. Getting institutional support

The case of Midre Genet WSS also shows the fact that water users are in charge of their own water supply system does not mean they are able to do everything themselves. As mentioned in the preceding sections, the Midre Genet Water Service has been improved with the support of external agencies including the Regional Government and Sidama Development Association. Zonal and wereda water offices have also been providing some technical supports and services for major maintenance and repair works.

This clearly shows that integrated effort of all stakeholders is an important factor for sustainable water supply. Roles and responsibilities of the main stakeholders need to be defined and capacity of each built, and conducive environment be created to each so that all would play their part freely and willingly. Effective management of the water system entailed partnership with and supports from outside agencies namely the private sector for provision of goods and services, and NGOs and public sector for promotion and support.

5.5. WASH Committee being a legal entity

There is a draft proclamation providing for the reorganization of urban and rural water supply and sanitation services prepared by the Regional Water Resource Development Bureau in 2004 and submitted to the Regional Council for endorsement. When approved and put into effect, this legislation is expected to create more conducive environment for the establishment and operation of rural WASH Committees. However, it should be noted that rural structures such as WSCs do not necessarily need formal recognition (registration) to function and obtain support services from other institutions. The Midre Genet WSSC does not have a legal identity but it has been managing the water supply service for long. Its experience shows that so far absence of official registration by government authorities does not seem to have constrained WSCs from demanding and obtaining services from government institutions, from opening and using bank accounts, from publishing financial vouchers in their names, and from establishing themselves as independent offices responsible for the administration of their water supply services. Nevertheless, as repeatedly stated by contacted committee members, they require formal recognition for the purpose of accountability and to confidently run their activities, to undertake investments, to possess property, to engage in contractual agreements, and to sue and to be sued.

5.5. Meeting the capacity building need

Although formal training and support in work systems development were minimal, key members of the Midre Genet WSS Committee are school teachers who have exposure to formal bureaucracies. They therefore are able to introduce and practice appropriate administration and management system for the water supply service. However, without intentional and regular provision of appropriate training to water committee members, operators, etc, it would be very difficult to sustain proper management of the scheme.

Human resource development hence takes precedence and is essential to ensure that various stakeholders are able to carry out their roles and responsibilities. It is one that is vital for sustainability. Capacity building should be timed correctly so that the knowledge is given when needed and can be put into practice immediately. At present, the Midre Genet Water committee is in need of proper accounting training and training for a replacement operator is crucial.

5.6. Women involvement in decision-making

Women's representation in the Congress as well as in the Management Committee is low; men members occupy key positions in the committee. It is difficult to establish direct effects of this on the sustainability of the service. In Midre Genet Water Committee there are two women. Though few in number, this is a move that would enable women in the decision-making process. However, this does not mean women's involvement in decision-making regarding the existing management of the water supply service is

satisfactory. It is understandable that increased participation of women will enhance appropriateness of decisions related to tariff setting, service improvement, and hence effectiveness of service administration.

In addition, women should be viewed not only as providers and managers of domestic water and hygiene, but also as mainstream interest groups that can also play key roles in promoting increased use of water, domestic hygiene and environmental sanitation in the community. If so, more consideration should be given and intentional move need to be made to gender aspects and the active participation of women in the management of scheme and in the decision-making process for sustainability.

5.7. Documentation

One aspect that affects all the decision-making process, and thus sustainability, is lack of information on what has been done in the past. Thus knowing the history of the water supply scheme, any measures done in the past would not only save money and time from avoiding duplication of effort but would help one to learn from experience. Like in case of Midre Genet, lack of well-documented data, geological and electrical logs including pumping test done during drilling and recently would incur some expense from doing pump test again.

6. Conclusion and recommendations

6.1. Conclusion

The Midre Genet water supply scheme was constructed 25 years ago. It was initially designed to serve Midre Genet Kebele and the surrounding villages Gebre Kirstos and Morocho. However, in 1999 the scheme was expanded to serve three additional neighbouring villages of Gimbi Kebele. In recent years, more users are coming from neighbouring kebeles and users reported that there is increasing pressure especially in dry season on the water service. The exact number of users is not known, but the number of core users from the four villages is estimated to reach 15,000–20,000 people. Because of scarcity of water sources in the wereda, more users (5,000–10,000 people) are coming from other villages. The Water and Sanitation Committee considers that improving the present distribution system by upgrading the existing pipeline and expanding the service to those kebeles will address this problem.

Results of the expanded period network analysis show that the velocities and head loss in the distribution line is high and as a result the pressure too low at all junction node. This shows that the existing distribution pipe size is very small to accommodate the direct pumping flow from the rising main.

Regarding the quality of water, since bacteriological analyses at the reservoir and Gebre Kiristos water point show higher coliform counts, it is recommended to disinfect water prior to supplying water for users. The physiochemical result at borehole site shows that the water meets WHO guidelines.

The Midre Genet WSS service is being managed by a Water and Sanitation Committee, which is composed of nine members (only three women) including a Chairperson, Secretary and Cashier elected by user communities in the four villages. In addition to the executive committee, which is responsible for the overall management of the scheme, there is a Congress of 28 members (7 people from each site) with a representative function. Specific tasks of this Congress and relationships with the Committee are not clearly defined and known by members. Besides, the structures do not have bylaws to govern themselves. The management of the scheme also includes eight employees: seven Fee Collectors recruited from the user communities and an Operator.

The water and sanitation management committee is strong, dedicated, and has won the trust of the communities. Committee members are reliable and committed to properly manage and improve the water service. They cover full range of operation and maintenance expenses plus continuing repairs and some reserves for renewal and improvement expenses from internal revenues. They have replaced the old diesel

pump generator with electrical systems, recruited Fee Collectors for each water point, and have built an office quarter and a stock of essential maintenance tools. At the time of the study, the Committee had a saving of 63,376 Birr deposited in their bank account at the Awassa branch of Commercial Bank of Ethiopia. Now, the Committee has a plan to upgrade the pipeline and expand the water service to private connection and other neighbouring kebeles. They also have a plan to set up an office and employ permanent staff for the day-to-day management of the water service activities.

However, upgrading and expansion of the service is beyond the current capacity of the committee. Besides, they require capacity building support in terms of training on relevant areas and work systems development. The Committee also requires supports from concerned wereda offices for operation and maintenance of the scheme and for financial control. However, the wereda institutions themselves lack the necessary capacity in terms of skilled human resource, budget and logistics to provide the required supports effectively.

The Midre Genet water services fully cover its operation and maintenance costs from internal revenues. Water is sold at a price of 4 Birr/m³. For individual users the payment is done per container of water fetched. The price of a jerry can of about 20 liters capacity is 10 cents. Before February 2005, this rate was 2.50 Birr/m³ (5 cents/20 litre). The tariff was increased to meet increasing costs of operation and maintenance. However, available data on water sale show that the adjustment of tariff has led to decreasing use of water by households (by 30–40%). One reason for this could be that some households may not afford the new price.

The Committee Secretary is responsible for recording financial transactions and preparation of periodic financial reports. The Committee submits quarterly statements to the WWD on quarterly basis; but there exists no system by which similar reports are presented to user communities or members of the Congress. There is also no regular auditing of accounts.

With respect to sanitation and hygiene activities, the committee's performance is very weak. No significant activity has been done in this regard.

6.2. Recommendations

1. Disinfection at the reservoir site with free residual chlorine measured at the faucet most distant from the reservoir where chlorine is added to the water supply is recommended to improve the quality of water. In order to do that the existing water supply distribution pattern should be redesigned to have independent rising mains from the Borehole to the reservoirs. This option is also preferred to upgrading the distribution pipe sizes to accommodate water straight from the pump since this option would allow the possibility of distributing disinfected water to the community from the reservoir.
2. To expand to new areas (potential users) and improve services, pump test data should be collected, final collective decision should be made and final cost estimate should be prepared. Pump test is highly recommended prior to any expansion work. Budget for service improvement and expansion should also include expenses for social sector and capacity building activities.
3. Supports to upgrade and expand the water supply service should include (a) financial assistance for supply of materials (such as pipes and fittings), construction works, and pump test; (b) technical assistances for survey and design works and other studies as well as supervision; (c) capacity building supports including training for a new operator, committee and congress members and employees and support in drafting bylaw, operation manuals and guidelines, and provision of reference materials; (d) continuous support by the Wereda Water Desk and the Wereda Health Office in relation to operation and maintenance of the WSS, hygiene and sanitation education, follow up support, and annual audit of accounts. However, this is a preliminary analysis, and for final design detail pump and borehole information is required to come up with the most viable solution.

4. To avoid overlaps of responsibilities and introduce clear lines of accountability, clarifying the roles and responsibilities of the Committee and the Congress and training of community members in relevant areas such as financial management is highly recommended. Fee Collectors and the Operator of scheme also need training in basic bookkeeping skills and maintenance and repair of facilities. Besides, capacity of the committee in development of work systems and procedures should be built. Supports may include assistances to develop bylaw, financial management and procurement manuals, and provision of essential references for sanitation and hygiene education, as well as formal recognition by the concerned government authority and annual audit service.
5. Available data on water sale show that the recent increase of tariff from 2.50 to 4 Birr/m³ seems to have resulted in decreased consumption of water by households. This suggests that encouraging increased use of water while maintaining price low could be a better strategy to enhance health impacts as well as financial gains. Sanitation and hygiene education could be instrumental in this regard to create awareness on the health and economic benefits of safe water supply and encourage increased use. Along with enhanced awareness creation efforts, introducing decreasing block tariff with a social tranche for low-income consumers could also be considered to encourage adequate use of safe water supply by households. Users may for instance be charged for services received at a rate of 15 cents/40 liters (3.60/m³). Other income generating services such as shower service may also be introduced to increase income for service improvement and replacement reserve.
6. Planning and implementation of hygiene and sanitation activities is generally found to be very weak undermining impacts of water supply services on health status of users. This component should therefore receive adequate attention by the committee and by concerned institutions. Interventions in this regard may include: (a) knowledge, attitude and practice study on water, hygiene and sanitation issues at the community level; community awareness creation/raising on water, hygiene and sanitation issues in coordination with the Wereda Health Office (and Village-based Health Extension Workers); training of members of the management committee, congress as well as fee collectors and operators on integrated water supply, hygiene and sanitation education and provision of basic reference materials; training of local artisans on latrine construction and provision of essential pictures and tools for them; and construction of demonstration latrines (at least one latrine in each village) using locally available materials and labor. Planning for sanitation and hygiene promotion should consider ongoing government efforts (such as Regional Health Extension and Sanitation programs) and upcoming Wereda WASH program financed by the World Bank.
7. User's participation in planning and financial monitoring and control is very limited. This needs to be improved, and the committee should primarily be accountable not to wereda institutions but to the user community. The committee should regularly present reports and develop more transparent systems in financial management and procurement. Women's involvement is also lower than men's in the management of the water supply service. Since women are primarily responsible for the collection and management of water and domestic health, they should have at least equal representation in management and should take active part in decision-making.
8. Continuous support in terms of follow up, technical advice, operation and maintenance, etc by the Wereda Water Desk and Health office remains an important factor for sustainable management of rural schemes. However, in the study wereda, the offices themselves do not have the required capacity to efficiently provide services to a network of rural systems due to resource (human, financial, physical) limitations. Building the capacity of the wereda offices should therefore be considered in strengthening the rural systems. Specific capacity building needs of the offices should be identified and addressed based on the upcoming capacity assessment of the Wereda.

Annexes

Annex 1. Terms of Reference

Background

Medre Genet is one of villages in Shebedino district, which is located 24 km South East of Awassa, the capital city of SNNPR. The village is easily accessible, as it is located along side of the asphalt road, which links Awassa to the other important cities in SNNPR. The population of the town is estimated to be 6000.

Existing water supply system

In the 1980's Midre Genet and its two neighboring villages faced a critical shortage of potable water supply. Thus in 1987 with the request of the community and the support of the Chinese Government these three villages Midre genet, Morocho and Gebere Kirstos were served with motorized bore hole through the extension of 4 water points. The yield of the borehole is estimated to be 3 l/sec at a depth of 224 mts.

In year 2001 the system was expanded for another 2 neighboring villages through the support of the Sidama Development Program and with construction of 3 additional community water points. Presently the system has 7 water points serving 5 Kebeles or villages. Since there is no any other source of water supply in the area the water scheme is also used by other neighboring villages.

Management of the schemes.

The water scheme has given service for more than 17 years with out service interruption. One of the major reasons lies behind the management of the WASH committee. The scheme has committed and motivated WASH Committee to manage the water scheme. Actually the water committee is considered as the best in the Wereda. The management of the water scheme includes 9 WASH Committee members, 8 paid water attendants or caretakers to manage and look after the points. The WASH Committee has one operator to look after the system in general. In addition, there is lack of training of the WASH Committee to carry out effective maintenance.

Technical issues

Due to the increasing number of population and the end of the design period the scheme has faced serious shortage of water. The WASH Committee would like to expand the service to private connection and to other neighboring Kebeles but due to such problem it is unable to utilize its capacity. The WASH Committee has claimed that the upgrading of the pipeline is a priority and critical issue. The Committee has taken the initiative of changing the existing old diesel pump generator to electrical systems. Overall the committee is strong in its management and has won the trust of the community.

Financial issues

The water committee monthly income is estimated to be 1900 Birr, which is the highest in the Wereda/district. The water tariff is based on selling by container basis. The tariff has been set through community consultation. So far the management committee has 56,200 Birr at the Awassa Commercial Bank. Recently the WASH committee has spent some amount of the savings for construction of its office quarter.

Institutional issues

The WASH committee has put forward that the support from sector office in terms of technical, software or capacity building is minimal or none despite the frequent request of the WASH committee to gain some support from such organizations.

Accordingly, the NSC is looking for (as per the recommendation of the inception workshop) the case study of the water service in order that, the input will support the Action Research on Scaling Up of Community Managed Water Services.

Objective of the study

- To increase coverage in the action research district and learn from the process which influence coverage.
- To analyze the issues which influence sustainability and learn from the process, which contribute to sustainability?

The major issues to be identified will include, but not limited, to the following

1. Identify and assess the core problem facing the water service performance and its management. (Legal, institutional, technical, capacity, financial, social and environmental etc).
2. Look the issues of WASH committee performance and management skill effectively?
3. What type of capacity building mechanism is needed for the water service and WASH Committee to work effectively in the long term?
4. Identify appropriate institutional back up support needed to run the service effectively and the capacity gap faced by the institution to support such a water service.
5. What is the financial estimate needed to upgrade and improve the water service for the next phase of the project?
6. What is the technical support needed to upgrade and improve the water service to the next phase of the project?
7. Suggest and recommend resource mobilization mechanism for the replacement cost and operation and maintenance taking into consideration community contribution and other local and external sources.
8. Analyze how government policy and strategy applied in the water service management and its shortcoming of policy implementation.

Terms and conditions

- Presentation of the study to be done at the Nov 14- 18, 2005 Scaling Up Workshop.
- The case study will be carried out with close coordination, collaboration and consultation of Plan Ethiopia, Wereda Action Research Team, Zonal and Wereda Water Desks.
- The draft report shall be submitted to the TAG and NSC review before July 30, 2005.

Annex 2. Documents consulted

1. Action Research for Scaling Up of Community Managed Water Supplies: Organizational Structure, Roles and Responsibilities.
2. Concept Note. Action Research for Scaling Up of Community Managed Rural Water Supply and Sanitation Services in Ethiopia.
3. Proceedings of the Inception Workshop of Action Research for Scaling Up of Community Managed Rural Water Supply and Sanitation Services. Organized by Plan Ethiopia at Awassa from 4-7 April 2005. Compiled by Bekele Haile. April 2005. Addis Ababa.
4. Proclamation for the Reorganization of Urban and Rural Water Supply and Sanitation Services. Draft (in Amharic). SNNRS. 1997 E.C.
5. Regional Water Sector Strategy. Final Report. SNNPRS. Water Resources Development Bureau. June 2004. Awassa.
6. Strategic Plan (1997 - 2002). SNNPRS. Water Resources Development Bureau. September 1997 E.C. Awassa. (In Amharic).

Annex 3. List of persons contacted

1. Ali Ahmed, Member (Gebre Kiristos), MGRWSSS Water & Sanitation Committee.
2. Almaz Tsegaye, Expert, Shebedino Wereda Women Affairs Office.
3. Kassech Haile, Member (Morcho), MGRWSSS Water & Sanitation Committee.
4. Maja Waleyu, Member (Morcho), MGRWSSS Water & Sanitation Committee.
5. Mulugeta Dagne, Secretary (Midre-Genet), MGRWSSS Water & Sanitation Committee.
6. Sara Sorsa, Member, (Midre-Genet), MGRWSSS Water & Sanitation Committee.
7. Tomas Araya, Community Promoter, Shebbedino Wereda Water Desk.
8. Wubetu Tessema, Chair Person (Midre-Genet), MGRWSSS Water & Sanitation Committee.

Annex 4. Water distribution model results: Scenario I

Title: Midre Genet Water Supply Project

Project Engineer: Y.Y

Project Date: 02/10/06 08:03:57 AM

Comments: EXISTING SYSTEM

Scenario summary	
Scenario	Base
Active topology	Base-Active Topology
Alternative	
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings	Base-Initial Settings
Alternative	
Operational alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Liquid characteristics			
Liquid	Water at 20 °C (68 °F)		Specific gravity 1.00
Kinematic viscosity	1.0037e-6	m ² /s	

Network inventory			
Pressure Pipes	15	Number of Tanks	2
Number of Reservoirs	1	- Constant Area:	2
Number of Pressure	12	- Variable Area:	0
Junctions			
Number of Pumps	1	Number of Valves	0
- Constant Power:	1	- FCV's:	0
- One Point (Design Point):	0	- PBV's:	0
- Standard (3 Point):	0	- PRV's:	0
- Standard Extended:	0	- PSV's:	0
- Custom Extended:	0	- TCV's:	0
- Multiple Point:	0	- GPV's:	0
Number of Spot Elevations	0		

Pressure pipes inventory			
32.0 mm	1,500.00m	65.0 mm	1,000.00m
40.0 mm	2,875.00m	75.0 mm	617.00m
Total Length	5,992.00m		

Reservoirs @ 7.00 hr			
Label	Calculated Hydraulic Grade (m)	Inflow (m ³ /day)	Outflow (m ³ /day)
BH	1,779.00	-267.35	267.35

Pressure Junctions @ 7.00 hr				
Label	Calculated Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)	Demand (Calculated) (m ³ /day)
D1	1,873.67	221.90	22.67	0.00
D2	1,873.51	220.27	22.51	0.00
D3	1,872.40	209.41	21.40	0.00
D4	1,864.50	151.74	15.50	0.00
G1	1,863.64	192.25	19.64	7.74
G2	1,863.64	143.33	14.64	13.74
G3	1,871.77	46.72	4.77	13.74
GK3	1,866.34	248.00	25.34	24.03
J-5	1,871.95	48.49	4.95	0.00
M1	1,869.21	90.14	9.21	21.00
M2	1,868.87	204.25	20.87	24.75
M3	1,859.14	89.42	9.14	33.40

Pressure Pipes @ 7.00 hr										
Label	Control Status	Discharge (m ³ /day)	Velocity (m/s)	Upstream Hydraulic Grade (m)	Downstream Hydraulic Grade (m)	Calculated Friction Head loss (m)	Calculated Minor Head loss (m)	Pressure Pipe Head loss (m)	Head loss Gradient (m/km)	
P-2	Open	57.55	0.20	1,873.67	1,872.00	1.67	0.00	1.67	1.67	
P-4	Open	13.74	0.20	1,864.50	1,863.64	0.86	0.00	0.86	4.52	
P-5	Open	7.74	0.11	1,864.50	1,863.64	0.86	0.00	0.86	1.56	
P-6	Open	35.22	0.32	1,872.00	1,871.95	0.04	0.00	0.05	9.14	
P-7	Open	21.48	0.31	1,871.95	1,864.50	7.45	0.00	7.45	10.35	
P-8	Open	13.74	0.20	1,871.95	1,871.77	0.18	0.00	0.18	4.52	
P-9	Open	209.80	0.55	1,873.67	1,873.51	0.17	0.00	0.17	11.11	
P-11	Open	-106.62	0.28	1,872.00	1,872.40	0.40	0.00	0.40	3.17	
P-12	Open	24.03	0.22	1,872.40	1,866.34	6.05	0.00	6.06	4.30	
P-17	Open	24.75	0.23	1,869.21	1,868.87	0.34	0.00	0.34	4.54	
P-18	Open	33.40	0.31	1,869.21	1,859.14	10.07	0.00	10.07	7.90	
P-21	Open	267.35	0.70	1,779.00	1,778.80	0.07	0.13	0.20	40.27	
P-22	Open	267.35	0.70	1,877.84	1,873.67	4.04	0.13	4.17	17.97	
P-24	Open	130.65	0.34	1,873.51	1,872.40	1.11	0.00	1.11	4.62	
P-25	Open	79.15	0.73	1,873.51	1,869.21	4.30	0.00	4.30	39.05	

Pumps @ 7.00 hr							
PMP-1	On	1,778.80	1,877.84	267.35	99.04	1.00	3.00

Tanks @ 7.00 hr								
Label	Calculated Hydraulic Grade (m)	Calculated Level (m)	Pressure (kPa)	Calculated Percent Full (%)	Calculated Volume (m ³)	Inflow (m ³ /day)	Outflow (m ³ /day)	Current Status
R-1	1,872.00	1.00	9.79	37.7	17.82	106.62	-106.62	Filling
R-2	1,872.00	1.00	9.79	66.7	8.00	22.32	-22.32	Filling

Pressure Junctions @ 0.00 hr					
Label	Calculated Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)	Demand (Calculated) (m ³ /day)	
D1	1,871.59	201.50	20.59	0.00	
D2	1,871.58	201.46	20.58	0.00	
D3	1,871.79	203.44	20.79	0.00	
D4	1,864.50	151.74	15.50	0.00	
G1	1,863.64	192.25	19.64	7.74	
G2	1,863.64	143.33	14.64	13.74	
G3	1,871.77	46.72	4.77	13.74	
GK3	1,865.73	242.03	24.73	24.03	
J-5	1,871.95	48.49	4.95	0.00	
M1	1,867.29	71.33	7.29	21.00	
M2	1,866.95	185.45	18.95	24.75	
M3	1,857.21	70.61	7.21	33.40	

Pressure Pipes @ 0.00 hr									
Label	Control Status	Discharge (m ³ /day)	Velocity (m/s)	Upstream Structure Hydraulic Grade (m)	Downstream Structure Hydraulic Grade (m)	Calculated Friction Head loss (m)	Calculated Minor Head loss (m)	Pressure pipe head loss (m)	Head loss Gradient (m/km)
P-2	Open	-26.99	0.09	1,871.59	1,872.00	0.41	0.00	0.41	0.41
P-4	Open	13.74	0.20	1,864.50	1,863.64	0.86	0.00	0.86	4.52
P-5	Open	7.74	0.11	1,864.50	1,863.64	0.86	0.00	0.86	1.56
P-6	Open	35.22	0.32	1,872.00	1,871.95	0.04	0.00	0.05	9.14
P-7	Open	21.48	0.31	1,871.95	1,864.50	7.45	0.00	7.45	10.35
P-8	Open	13.74	0.20	1,871.95	1,871.77	0.18	0.00	0.18	4.52
P-9	Open	26.99	0.07	1,871.59	1,871.58	0.00	0.00	0.00	0.25
P-11	Open	76.19	0.20	1,872.00	1,871.79	0.21	0.00	0.21	1.70
P-12	Open	24.03	0.22	1,871.79	1,865.73	6.05	0.00	6.06	4.30
P-17	Open	24.75	0.23	1,867.29	1,866.95	0.34	0.00	0.34	4.53
P-18	Open	33.40	0.31	1,867.29	1,857.21	10.07	0.00	10.07	7.90
P-24	Open	-52.16	0.14	1,871.58	1,871.79	0.20	0.00	0.20	0.84
P-25	Open	79.15	0.73	1,871.58	1,867.29	4.30	0.00	4.30	39.05
P-2	Open	-26.99	0.09	1,871.59	1,872.00	0.41	0.00	0.41	0.41
P-4	Open	13.74	0.20	1,864.50	1,863.64	0.86	0.00	0.86	4.52

Pumps @ 0.00 hr							
Label	Control Status	Intake Pump Grade (m)	Discharge Pump Grade (m)	Discharge (m ³ /day)	Pump Head (m)	Relative Speed	Calculated Water Power (kW)
PMP-1	Off	1,778.80	1,877.84	267.35	99.04	1.00	3.00

Tanks @ 0.00 hr									
Label	Calculated Hydraulic Grade (m)	Calculated Level (m)	Pressure (kPa)	Calculated Percent Full (%)	Calculated Volume (m ³)	Inflow (m ³ /day)	Outflow (m ³ /day)	Current Status	
R-1	1,872.00	1.00	9.79	37.7	17.82	-76.19	76.19	Draining	
R-2	1,872.00	1.00	9.79	66.7	8.00	-62.22	62.22	Draining	

Annex 5: Results of bacteriological tests and physico-chemical analysis

Date of sampling: 23/02/98

Date of testing: 23/02/98

Nature of sample: untreated

Address of sender: _____

Zone/Wereda: Sidama

Wereda: Shebedino

Village: Midre Genet

Source: BH

S/No: 0928B

EXAMINATION

Test	Media used	Incubation temperature	Incubation time	Colony count	Disinfected
Total coliform	M0000002E	35°C + 0.5°C	22–24 hours	3	-
Fecal coliform	-	44.5°C + 0.2°C	24 hours	-	-
Fecal streptococci	-	35°C + 0.5°C	48 hours	-	-

Remark

Reported on: 30/02/98

by: Yalemwork W/M

Bacteriological Test

Date of sampling: 23/02/98

Date of testing: 23/02/98

Nature of sample: Untreated

Address of sender: _____

Zone/Wereda: Sidama

Wereda: Shebedino

Village: Midre Genet/Reservoir

Source: BH

S/No: 0930B

EXAMINATION

Test	Media used	Incubation temperature	Incubation time	Colony count	Disinfected
Total coliform	M0000002E	35°C + 0.5°C	22–24 hours	15	-
Fecal coliform	-	44.5°C + 0.2°C	24 hours	-	-
Fecal streptococci	-	35°C + 0.5°C	48 hours	-	-

Remark

It needs disinfection

Reported on: 30/02/98

by: Yalemwork W/M

Water physico-chemical analysis

Date of sampling (EC)	23/02/98	Zone/Wereda	Sidama
Date of testing (EC)	28/02/98	Wereda	Shebedino
Nature of sample	Untreated	Village	Mire Genet
Address of sender	Zenas Engineering	Source	BH
Sample taken by	Yalemwork W/M	GPS Northing [UTM]	
S/No.	0931c	Easting [UTM]	
		Altitude [m]	

Total hardness	30 mg/L as CaCO ₃	Conductivity	210 µs/cm
Calcium	18 mg/L as CaCO ₃	Turbidity	1NTU
Magnesium	12 mg/L as MgCO ₃	Temperature	23.8 °c
Total alkalinity	135.2 mg/L	T.D.S	205 mg/L
Bicarbonate	135.2 mg/L	Total Cl ₂	0.06 mg/L
Hydroxide	0.00 mg/L	PH	6.96
Carbonate	0.00 mg/L	Silica (SO ₂)	
Dissolved NH₃	0.110 mg/L		

Cations	mg/L	meq/L	Anions	mg/L	meq/L
Na⁺¹	48.9003	2.1261	Cl ⁻¹	2.0000	0.0560
NH₄⁺¹	0.1160	0.0060	F ⁻¹	0.8200	0.0430
K⁺¹	8.0000	0.2050	HCO ₃ ⁻¹	164.9440	2.7040
Ca⁺²	7.2000	0.3600	NO ₃ ⁻¹	9.6800	0.1560
Mg⁺²	2.8800	0.2400	NO ₂ ⁻¹	0.0126	0.0003
Fe⁺²	0.1970	0.0070	Br ⁻¹	0.0700	0.0010
Cu⁺²	0.1200	0.0380	CO ₃ ⁻²	0.0000	0.0000
Mn⁺²	0.2000	0.0072	SO ₄ ⁻²	1.4000	0.0290
Cr⁺⁶	0.0600	0.0070	PO ₄ ⁻³	0.2200	0.0070
Total		2.9963	Total		2.9963

Remark:

The analyzed water sample is physico-chemically fit for drinking

Analyzed on: 28/02/98
Approved on: 17/04/98

By: Yalemwork W/mariam
By: Eyasu Maru

Bacteriological Test

Date of sampling: 23/02/98

Date of testing: 23/02/98

Nature of sample: Untreated

Address of sender: _____

Zone/Wereda: Sidama

Wereda: Shebedino

Village: Midre Genet-Gebre Kirstos Water Point

Source: BH

S/No: 0931B

EXAMINATION

Test	Media used	Incubation temperature	Incubation time	Colony count	Disinfected
Total coliform	M0000002E	35°C + 0.5°C	22–24 hours	50	-
Fecal coliform	-	44.5°C + 0.2°C	24 hours	-	-
Fecal streptococci	-	35°C + 0.5°C	48 hours	-	-

Remark

It needs disinfection

Reported on: 30/02/98

By: Yalemwork W/M

About Plan

Plan is an international, child-centred humanitarian development organisation without religious, political or governmental affiliation. Child sponsorship is the basic foundation of the organisation.

Plan's Vision

Plan's Vision is of a world in which all children realize their full potential in societies that respect people's rights and dignity.

Plan's Mission

Plan strives to achieve lasting improvements in the quality of life of deprived children in developing countries through a process that unites people across cultures and adds meaning and value to their lives by:

- enabling deprived children, their families and their communities to meet their basic needs and to increase their ability to participate in and benefit from their societies
- building relationships to increase understanding and unity among people of different cultures and countries
- promoting the rights and interests of the world's children



Program principles

- Child-centeredness
- Institutional learning
- Integration
- Gender equity
- Environmental sustainability
- Empowerment & sustainability
- Co-operation

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