WaterAid Madagascar

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EXECUTIVE SUMMARY

The following report presents the findings from the School of International and Public Affairs (SIPA)'s 2008 EPD WaterAid Madagascar Workshop team. The team designed an analysis model, sensitive to local conditions, to further support WaterAid Madagascar's recent efforts to develop a comprehensive evaluation system of the impacts of their water and sanitation projects. Safe access to water supplies and improved sanitation are a platform for sustainable growth, providing central pillars for achieving both short-term and long-term development in these communities. After the initial assessment, which isolated specific indicators, the team built a comprehensive methodology with the goal of measuring the wide range of community and individual socio-economic impacts. The preliminary findings and recommendations in this report are intended to serve as a launching point for a wider inquiry into the interconnections between water, sanitation, and the crucial poverty reduction indicators. This report serves as a foundation for WaterAid Madagascar to build future studies and suggests potential areas for more rigorous data collection.

To fulfill and support WaterAid's efforts and requests, the team undertook a two-phase process to achieve their stated objectives: (1) cost-benefit model design phase and (2) field-testing and model refinement phase. The team built a specific model to estimate the economic and social benefits of these projects, adapting the tools as appropriate for a localized study of several villages in the region surrounding Ambositra, Madagascar. The project resulted with four main outputs for WaterAid Madagascar:

- *Model and Instruments*: framework, indicators, formulas, data collection instruments, and samples of excel data-processing worksheets
- *Results of Demo Model Testing*: Analysis of data collected from two villages, a treatment village Ampila and a control village Fasimena in the rural commune of Ambositra. This collected data is demonstrative only and should not be used in any capacity except as a learning tool and potential technique for data analysis
- *Lessons Learned*: Recommendations to further enhance this study and use of the model
- *Recommendations and Policy Implications*: Suggested advocacy messages and potential use of our findings

The model isolates seven areas of impacts connecting the wide range of measured indicators. The following section provides a summary of our field testing and model, although we recognize that our findings are not conclusive due to limited sample size of 21 households per village. Due to the small sample size, we strongly caution against placing too much emphasis on our findings, and recommend WaterAid Madagascar continue to develop our methodology and repeat this study with larger sample in the future to obtain more comprehensive and reliable data.

Incomes and Livelihoods: The close proximity of safe water and sanitation systems is related with increased wealth and production capacity of vegetables and livestock. The survey suggested that out of the 42 households surveyed in both villages, the total capital assets accumulated, both in the physical and monetary forms, is higher in Ampila than in Fasimena. The monetary difference of values of production in vegetables and fruit is 18% greater, livestock is 36% higher, and rice is 32% higher in Ampila. From the findings, the team recommends future studies to measure the relationship to food security in the region.

Health: The collected data suggest a difference in number of cases of water-borne diseases, a health impact widely documented as resulting from increased access to safe water and sanitation services. Another study should be conducted to further explore our preliminary findings that on a bi-weekly basis, Ampila saves 10,300 MGA due to reduced health care costs. Future analysis could include time-saved from improved health.

Education: Sustainable access to water alleviates collection responsibilities for the community, especially women and children. Water and sanitation services also reduce school absenteeism. The increased attendance and enrollment rates in Ampila lead to higher rates of school completion. This is a critical long-term impact that can be measured in monetary terms. Or limited study implies higher expected future returns, estimated at 60.9 Million MGA in Ampila.

Gender: The survey results suggested that in Ampila, women were responsible for collecting water in 65% of households. Therefore there are significant timesaving benefits for women. In addition, women are active members in the Water Committees, an important social institution responsible for the management and maintenance of water systems in the community.

Community Management: The creation of Water Committees provides the first well-organized form of local community organization, bringing new initiatives to the project sites. These committees ensure the sustainability of WaterAid's projects through the management from the community and household contributions to cover maintenance costs. Community management indicators have significant potential for future analysis. This project presents initial findings and recommends additional research focus on this area.

Two Other Potential Areas: Psychological Impacts and Environmental Sustainability are two additional areas that were not within the scope of this project to measure systematically but that the team believes has importance for future and more focused studies. For example, WaterAid's projects have increased awareness of individual behavior on ecosystem functioning and resulted with reforestation projects, have improved hygiene and personal welfare, and have enabled village beautification projects through flower gardens and by improving cleanliness.

Based upon our findings, there are three main categories of recommendations for WaterAid's future projects: (1) use of the model, (2) future studies, and (3) policy implications. The first recommendation is to collect data for the projected impact indicators in baseline studies. In order to provide results with high validity, it is crucial to have accurate and comprehensive baseline data to demonstrate the changes within one specific community. Secondly, additional area specific tools should be developed for future evaluations. The team discovered significant evidence that several of the focus areas, including community management, psychological impacts, and environmental sustainability, are crucial development indicators with great potential for future study. This requires more focused research to build stronger and more comprehensive measurement models. The final recommendations suggest ways to transform the findings presented within this report into policy directives for WaterAid Madagascar. Based upon interviews with regional development directors and national administrators, Madagascar's development goals could be significantly advanced by adequate water and sanitation services and the impacts they have on other areas. Linking these impacts and providing tangible results, like this study, can help build awareness and raise political attention for ensuring universal and sustainable water and sanitation coverage.

ABBREVIATIONS

CISCO	Bureau of Education / Circonscription Scolaire
CVM	Contingent Valuation Method
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HDI	Human Development Index
IRC	IRC International Water and Sanitation Centre
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
JIRAMA	Malagasy Electricity and Water
MAP	Madagascar Action Plan
MDG	Millennium Development Goals
QIA	Qualitative Information System
SAF/FJKM	Department of Development of the Church of Jesus Christ in Madagascar / Sampan'Asa Fampandrosoana/Fiangonan'i Jesosy Kristy eto Madagasikara
SIPA	School of International and Public Affairs
SIRSA	System for Rural Information and Food Security / Système d'Information Rurale et de Sécurité Alimentaire
UNDP	United National Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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I. PROJECT OBJECTIVES AND APPROACH

Rationale

The critical need for improving access to safe water and sanitation services has been recognized by all levels of international development strategies, yet support and financing remain proportionally low[1]. Providing these services to the poorest communities in Madagascar will remain a key development challenge that the country will continue to face in the coming years.

In an effort to achieve compliance with the Millennium Development Goals (MDGs), the Government of Madagascar has made significant strides to achieve these goals, although desired results still remain below the targeted figures. In 2006, access to safe drinking water in Madagascar was achieved for only 14% of the rural compared to 66% of the urban population (WaterAid, 2006a). Access to sanitation remains a greater challenge as WaterAid's report (2006a) indicates, as only 7.5% of the rural and 27% of the urban population had access to adequate sanitation services. In order to meet the targets in 2015, WaterAid calculates that Madagascar needs to spend 117 million USD per annum, six times the current spending level (WaterAid, 2005).

Additional resources will be critical for Madagascar to increase the proportion of citizens with safe water supply and improved sanitation. Effective advocacy will therefore be needed to persuade governments and their development partners of the benefits of expanding water and sanitation services.

WaterAid requested our team to perform a cost-benefit analysis of improving access to clean water and sanitation in certain rural and urban areas of Madagascar, localizing their methodologies and testing them in the Malagasy context. WaterAid will draw upon our work in order to advocate for increased resources and attention to improving access to clean water and appropriate sanitation services.

Project Objectives

The main objective is to develop a preliminary methodology for estimating the economic and social costs and benefits of safe water supply and improved sanitation in Madagascar. This methodology will be used by WaterAid, Malagasy government officials and parliamentarians, and with key development partners such as the World Bank and African Development Bank, to advocate for increased investments in water and sanitation.

The following four items describes the main objectives for the EPD Workshop team:

1. Model design
    - Reviewing of the current literature on frameworks and methodologies for valuing the benefits of improved water and sanitation services;

[1] Basic sanitation is the lowest-cost option for securing sustainable access to safe, hygienic, and convenient facilities and services for excreta and sullage disposal that provide privacy and dignity while ensuring a clean and healthy living environment both at home and in the neighborhood of users (UNDP, 2005).

- Developing a methodology for estimating the economic and social benefits of safe water supply and improved sanitation in selected communes in Madagascar;
- Refining and adapting a methodology appropriate for the Malagasy context;
- Designing tools and instruments for collecting required information and data while recognizing local conditions and needs

2. Demo Model Testing
    - Collecting, analyzing and comparing relevant data from
        i. A village where there have been substantial improvements in access to safe water and sanitation facilities;
        ii. A comparable village where there have been no improvements
3. Implementation Instructions
    - Identifying instructions and guidance for future use of our tools and data collection instruments
4. Advocacy Tools
    - Identifying key advocacy focus areas that emerge from the research and potential strategies for future studies to comprehensively link the project benefits to broader messages.

Final Report Structure

The final report is designed to provide a clear and informative presentation to future readers looking to build upon our work. We are using a deductive approach to help clarify and substantiate our final recommendations and research tools. Thus our report will first explore the theoretical framework, contextualizing the project and field of analysis. This provides the pillars used to develop our methodology and later our specific surveys and data collection instruments. After providing the justification for our tools and design we will demonstrate how they are implemented through our specific fieldwork in two villages located in the region of Ambositra, Madagascar. Although our data has no explanatory power and remains inconclusive, the report structure is intended to demonstrate how this demo case could be analyzed for future studies. This report will ultimately provide an example of how to calculate the monetary impacts of improved water services, suggestions for areas that are worth future exploration and recommendations for model refinement in future projects.

II. BACKGROUND

Current Methodologies

The United Nations Millennium Declaration, codified in the Millennium Development Goals (MDGs), confirmed the central role of water and sanitation in sustainable development and towards poverty alleviation (WHO website). However, many of these countries do not allocate sufficient funds in this sector. It is estimated that halving the proportion of people without access to safe water supply services would cost an estimated 1.8 billion USD per year while halving the proportion of people without access to both water and sanitation would cost an estimated 11.3 billion USD annually (WHO website).

These figures show the critical need for increased investment in this sector. In this regard, some studies have been conducted to isolate methods to measure the potential socio-economic benefits usually at the level of national development objectives. Cost and benefit analyses available on a global scale frequently conclude that the benefits still outweigh the costs regardless of what scenario is considered. However, the benefits and the costs of increasing access to improved water and sanitation vary considerably depending on the type of technology selected (WHO, 2004). Since the late 1960's guidelines on economic evaluation have been available after cost benefit analysis became a routine part of development project appraisal process (Little and Mirrelees, 1968). While for the costs, the most recent and comprehensive analyses by Hutton et al. (2006) include the full investment and annual running costs of the intervention, for the benefits they mostly concentrate on the health and time saving impacts of access to water and sanitation. For health, they measure the benefit by calculating the reduction in incidence rates (number of cases reduced per year) and reduction in mortality rates (number of deaths avoided per year). As for time savings they calculate the income generated by the time they saved by having the water point closer to home as well as by the time saved by not being sick (Hutton et al., 2006) [2]. Results from WHO study establish that access to improved water and sanitation reduces the average diarrhea episodes by 10%, which amounts to a total annual economic benefit of 84 billion USD (WHO, 2004).

Nevertheless, there has been an increasing interest in measuring a broader set of impacts, especially at a localized level[3]. If all interventions were to have a more careful consideration of the potential benefits in addition to the costs, it would demonstrate that there are higher returns and would tip the balance in favor of positive investment decisions in the sector[4].

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[2] WHO website says: "The benefits of the interventions included time savings associated with better access to water and sanitation facilities, the gain in productive time due to less time spent ill, health sector and patients costs saved due to less treatment of diarrheal diseases, and the value of prevented deaths."
http://www.who.int/water_sanitation_health/wsh0404/en/index.html

[3] According to the WHO website: "it is recommended to conduct detailed country case studies as a follow-up to this global analysis." http://www.who.int/water_sanitation_health/wsh0404/en/index.html

[4] As stated in the WHO website: "Beyond reducing the water-borne and water-washed diseases, providing better access to improved water and sanitation confers many other diverse benefits ranging from the easily identifiable and quantifiable (costs avoided, time saved) to the more intangible and difficult to measure (convenience, well-being). As much as feasible, these must be taken into account in a cost-benefit analysis."
http://www.who.int/water_sanitation_health/wsh0404summary/en/index.html

WaterAid's Activities

WaterAid's mission is to ensure poor communities access to safe water supplies through simple technologies. Its approach integrates water, sanitation, and hygiene education in order to provide crucial steps to reduce poverty. This approach is designed to maximize the results and provide long-lasting community impacts. There has been a recent shift in their project framework, moving towards a rights-based approach that recognizes the rights of poor and those excluded from basic services.

WaterAid Madagascar has developed local partnerships to provide day-to-day management of the projects and to help build local capacity and knowledge. In the region of Ambositra, WaterAid specifically works with the regional office of the department of development of the Church of Jesus Christ in Madagascar, SAF/FJKM, which stands for *Sampan'Asa Fampandrosoana/Fiangonan'i Jesosy Kristy eto Madagasikara*. They operate jointly to implement sustainable technologies by using community resources and providing local training so that communities can carry out sustainable operation and maintenance.

To this effect, WaterAid's projects have two components: the hard, or technical component and the soft, or capacity building component. The technical aspects of WaterAid projects include the construction of water distribution systems, including tap-stands, piping network, and drainage system as well as specific types of latrines. There are different technologies available dependent upon different local conditions; in Madagascar, the study site has gravity-fed systems requiring no energy inputs thus reducing running costs. The softer aspects of WaterAid's projects are associated with ensuring the sustainability of these systems through local capacity building; hygiene education, technical training, and improved local water management in the form of Water Committees with sub-committees for each tap stand.

Local Context

This project focuses on the conditions and local needs in Madagascar. The Malagasy Government reports that only 35% of the entire population of Madagascar has access to safe drinking water (GoM, 2006).

The government of Madagascar is concerned with sanitation. Since the launch of the Madagascar WASH campaign in 2002, hygiene and sanitation have been systematically integrated within water supply programs[5]. The WASH campaign promotes key messages including hand washing with soap; effective use of hygienic latrines and ensuring safe water does not become contaminated at the source. Furthermore, in its report *Sanitation – the Challenge* it was revealed that five million working days and 3.5 million school days were being lost due to ill health caused by bad sanitation. The value of these losses was estimated to be 300 times greater than the amount of public money actually being spent on sanitation (GoM et al., 2003).

[5] Introduced by the Water Supply and Sanitation Council at the International Conference on Freshwater in Bonn, Germany in December 2001, the WASH campaign is a concerted global advocacy effort by members and partners of the Collaborative Council to place sanitation, hygiene, and water firmly on the political agenda.

Madagascar

Country Profile

Located in the Indian Ocean off the south-east coast of Africa, Madagascar is the fourth largest island in the world, covering 587,000 km^2. Out of the island's 19 million inhabitants, 73% of the total population lives in rural areas. The Malagasy population is composed of 18 ethnic groups who all speak different dialects of Malagasy[1].

In the UNDP Human Development Report, Madagascar was ranked 143 out of a total 173 countries in their Human Development Index (HDI) (UNDP, 2006)[2]. GDP in 2006 was 17.27 billion, and per capita GDP was $900. Additionally, 50% of the population lives below the poverty line, the vast majority in rural areas.

Water Supply

The country's water supplies are estimated to be 337km^3/year (Metz, 1994). Groundwater resources are estimated to be 55km^3/year while rainfall averages around 1700mm/year but due to high regional variation are not equally distributed.

In urban areas, the state-owned company, JIRAMA (Jiro sy Rano Malagasy – Malagasy Electricity and Water) provides water supply and distribution in Madagascar. JIRAMA faces severe financial constraints: tariffs remained constant from 2001 to mid-2005 despite high inflation; operational performance is unsatisfactory with high losses and poor maintenance; billing, metering and revenue collection practices are poor.

In the rural areas, numerous NGOs' attempts in the 1980s allowed rural villagers to obtain drinking water via wells and gravity fed systems. In addition, NGOs and other stakeholders have developed new demand-led and participative approaches of providing the workforce, local materials and transport. World Bank, UNDP, UNICEF, JICA and some international NGOs like WaterAid, CARE International and MERAIR mainly finance these water supply projects in rural areas.

Sources:
1.CIA, The World Factbook. https://www.cia.gov/library/publications/the-worldfactbook/geos/ma.html *Last accessed on November 2007*.
2. UNDP Reports Madagascar website : http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_MDG.html
3. FAO Aquastat website: http://www.fao.org/nr/water/aquastat/countries/madagascar/indexfra.stm

Despite the efforts made to date by the government to improve water and sanitation provision service, the number of people with effective access is still very low and differs greatly between rural and urban areas (**Table II.1**). It is important to study separately both the rural and urban contexts, as each reflects different characteristics of Madagascar's water and sanitation system. The socio-economic differences of rural and urban communities are stark, illustrating variations in income generating activities, differences in health practices, and many other aspects of rural vs. urban life. The breadth and depth of their differences makes the rural and urban water and sanitation situations difficult to compare.

Table II.1: Percentage of the Malagasy population with access to services by area

Area/Type of services	Water	Sanitation
Urban areas	66%	27%
Rural areas	14%	7.5%

Source: WaterAid (2006)

In 2006, the improvement and extension of water and sanitation services were set as a priority for the national government and included in the Madagascar's Action Plan (MAP), the government of Madagascar's UN-supported and results-oriented growth and poverty reduction strategy (GoM, 2006). This program defines the specific goals that Madagascar aims at achieving by 2012. In addition to infrastructure building, and sustainable improvement of access to drinking water and sanitation, these include reducing family size, supporting economic growth, increasing GDP, increasing land and property ownership, as well as improving the World Bank Business Climate Ranking and foreign direct investment (IMF, 2007).

Madagascar has four levels of decentralizations: the central government, the six provinces, 22 regions, 1557 communes, and 17,433 fokontany. Each commune is supposed to have its own development action plan to improve water and sanitation situation. However, most of them lack both the funding and the staff to produce significant outcomes (WaterAid, 2005).

The team assessed multiple impact areas of Wateraid's water and sanitation project in two rural communes[6], Ampila and Fasimena, outside of Ambositra, Madagascar. Ambositra is a small urban town located in the central highland province of Fianarantsoa, Madagascar, five hours south of Madagascar's capital Antananarivo. It is the capital of the Amoron'I Mania region, which had an estimated population of 693,200 in 2004 (WFP, 2006). The rural economy is driven mainly by agricultural activities, such as rice growing and animal-raising. The Director of Regional Development identified the region production-gap and lack of self-sufficiency. This manifests itself with food security problems (Interview, January 8 2008). According to the "Documents de Planification," the regional ten-year development plan, the region produces only 5,000 tons of the 45,000 tons of rice it needs for self-consumption. Therefore, the regional government's priority is to reduce the dependence on food and rice imports from neighboring regions.

In addition, the regional report produced by SIRSA, identified building new potable and irrigation water infrastructure as the region of Amoron'I Mania's development priority (SIRSA, 2006). According to this report, 48% of the communes in the southern portion of Madagascar, place water infrastructure as one of the three top priorities for local development. More specifically, in the province of Fianarantsoa, 90% of the communes collect water from rivers and streams while 6% collect water from stagnant pools of water. This means that 96% of all water in this province is not reliable or safe for consumption.

[6] A commune is a regional unit of government, below the district level and above the Fokotany or village level.

WaterAid Projects in Ampila

Like most WaterAid projects described above, WaterAid's interventions in Ampila consisted of the two parts: the construction of facilities and education and training of the beneficiaries (**Figure II.1**). They installed one water tank using gravity-fed systems for the water supply in Ampila and Vohimalaza Sud and eight tap stands in Ampila. They also built 50 pit latrines in total with three households per latrine on average for Ampila and Vohimalaza Sud.

In addition to those installations, they facilitated and motivated the formation of the Water Committee, the governing body that was responsible for maintaining the water source and the tank, and eight Tap Stand Subcommittees for operating each tap stand. WaterAid also educated community members on the necessary cleaning and repair of facilities, record keeping as well as the collection of water tax. They also conducted WASH hygiene training to villagers in Ampila.

Figure II.1: Water tank, tap stand and pit latrine installed in Ampila by WaterAid and SAF/FJKM

III. MODEL AND INSTRUMENT DESIGN

1. Framework

This study begins by building a theoretical framework connecting water access with socio-economic development. The first key question guiding our analysis focuses on *how* WaterAid projects impact individuals, households and the community. The second considers how the projects could impact these beneficiaries in different areas of daily life.

Unit of Analysis

Given the scale of WaterAid's projects and their integrated approach, our model distinguishes the impacts on the individual and household from community-wide benefits. An individual-

based approach is suitable to highlight who benefited the most from the projects especially from the gender perspectives. A household-based approach puts more focus on the improvements in the livelihood and welfare on the family level. We adopted, however, the community-based approach considering that a household or individual-based approach alone would have missed some of the critical structural changes the community experienced after the projects.

Area of Analysis

Although our main goal is to evaluate the monetary impacts of WaterAid's project, the components of the human-rights based approach and integrated waster resource management approach help guide the framework of our project. The Human Rights framework to development generates important questions on how improved water access impact equity, accountability, empowerment and participation. It pushes us to explore the connections between improved water and sanitation with priorities of poverty elimination, gender equality, self-reliance and self-determination. Approaching the communities from the perspective of comprehensive social, economic, cultural and political processes reveals additional benefits of the improved water resource management, which is not always fully captured by the monetary valuation.

Another key insight comes from the complimentary Integrated Water Resource Management (IWRM) approach. This approach promotes coordinated development and management of water, land, and related resources, in order to maximize the economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem functions (GWP, 2000). In this approach interests and activities that are traditionally conceptualized as unrelated are integrated into a broader set of interrelationships, for example the mixture of building local governance capacity with technical training for maintaining the faucets. IWRM moves beyond direct hardware development and looks at how this approach builds a multifaceted framework of water resource management's relationship to poverty alleviation and economic development.

Considering these perspectives, we consider closely the WaterAid's discussion paper (2004a), which identifies multiple impact areas of their water and sanitation projects: livelihoods and incomes, socio-cultural life, health and hygiene, psychological impact, education, gender issues, community management and sustainability. These broad categories of analysis shaped the focus of our initial data collection process[7]:

- *Incomes and livelihoods*
- *Health*
- *Education*
- *Community management*
- *Gender related issues*
- *Psychological impacts*
- *Environment sustainability*

[7] Although we have identified seven categories, we have limited our final monetary analysis to five categories, integrating psychological impacts and environmental sustainability into our broader qualitative descriptions. We also did not include the socio-cultural analysis generally used by WaterAid.

The linkages between water/sanitation access and the latter categories are discussed and developed in the hypothesis section.

Connection of water to the Millennium Development Goals

The eight Millennium Development Goals (MDGs) are international targets to halve world poverty by 2015, agreed upon by all 189 United Nations member states at the UN Millennium Summit in 2000. The Goals are:

Goal 1: Eradicate extreme poverty and hunger: convenient access to water supplies increases valuable time for economic activity; improved health allow individuals to better absorb nutrients and reduces costs of treatment; portion of water often used for kitchen gardens increasing food security; reduces amount of time and money spent on carrying water to households.

Goal 2: Achieve universal primary education: improved water access allows children to attend school; sanitation in schools encourages girls to attend; boys freed from herding livestock to distant water points; and water and sanitation facilities at schools attract teachers and improves female attendance.

Goal 3: Promote gender equality and empower women: women are actively involved in all stages of WaterAid community projects and their involvement has a positive impact on their status and position in the community; women are freed time spent on traveling to collect water at long distances from homes; and women involved community decisions.

Goal 4: Reduce child mortality by two thirds for children under five: hygiene education, clean water and sanitation significantly reduce water-related diseases which kill thousands of children every day.

Goal 5: Improve maternal health: access to water frees pregnant women from collecting water and cleaning, accessible water and sanitation help women to minimize the chances of illness or even death to the baby and themselves.

Goal 6: Combat HIV/AIDS: reduces malaria and other diseases; water of higher quality is available for drinking and hygiene which reduces sickness, protecting the immune systems of those living with HIV.

Goal 7: Ensure environmental sustainability: all future water supply and sanitation projects supported by WaterAid will address the issues of water depletion and contamination through appropriate integrated water resource management. Prevents pollution and land and water erosion.

Goal 8: Develop a global partnership for development: WaterAid's work with partnership organizations, governments and national and international agencies towards achieving the MDGs is part of a mutually reinforcing framework to improve overall human development; water resources are not limited by political boundaries; cooperation over water resource management is critical.

Sources: Adapted from WaterAid website: http://www.wateraid.org/international/what_we_do/policy_and_research/6241.asp, UNDP website: http://www.undp.org/mdg/, WHO/UNICEF (2004) and IWMI (2006b)

2. Methodology

Cost-Benefit Analysis

The final goal of this study is to provide a model and instruments to estimate the monetary impacts of improved access to water and sanitation on the community. As WHO (2006) addresses in their work on cost-benefit analysis, "as with estimation of costs, the first step in estimation is to identify all possible impacts of the intervention, and to select the relevant for inclusion in the analysis". These impacts are converted into monetary values in order to conduct cost-benefit analyses. In our study, we evaluate the BENEFITS SIDE ONLY since the costs to WaterAid are the project operation costs incurred by them which are easily quantified.

If the benefits are not measured through markets another choice is to use contingent valuation method (CVM) by asking people to directly state their willingness-to-pay for specific services based on a hypothetical scenario or to use the contingent choice method which asks individuals to make tradeoffs among a set of services or characteristics (Dinwiddy and Teal, 1996). This provides a non-monetary measure of value: these prioritized expected benefits of investments show how benefits from one project exceed benefits from another.

3. Hypothesis

This section is organized according to the seven categories of impacts identified in the framework section. These are the links between water and each category of impact that we expect to find through our household surveys. They are predicted links, often resulting from our initial focus group interviews as well as literature reviews. Proving the links between areas to water was not the primary focus of this research so these are not rigorously tested links. Also the data collected is intended only for demonstrative purposes and not as a comprehensive data set. Below are the basic hypotheses guiding the research.

Incomes and livelihoods

Access to water in close proximity to dwellings is likely to have numerous impacts on community members' income and asset creation. The access to water provides the ability to irrigate and spend extra time in local gardens results with greater harvests, which in turn can lead to greater wealth. Other significant impacts include the ability to diversify and increase crop varieties. Thus we expect to find a greater value in the village with water improvements. Thus, since we expect to find a significant difference in food security between villages with and without improved water services, we will measure overall community wealth of available resources (Turner et al., 2006). We recognize that certain products will not be sold in the market but will still hold monetary value for the community.

Based upon our initial findings, we also expect to find a difference in quantity of and ability to care for livestock. The availability of water for use by animals and the ability to clean them more frequently translates into a higher potential asset value. Livestock, especially large animals like cows, are places to store household's accumulated wealth in Madagascar (Ferguson, 1994).

Thus, if incomes are rising as expected and no banking or saving institutions are present options, we expect wealth is partly stored in additional number of livestock.

The changes in wealth and production directly impact food self-sufficiency as well. Rural development projects, such as WaterAid's interventions, have the potential to encourage construction of community granaries to protect against seasonal fluctuations in food production (SIRSA, 2006). Thus we predict that increased food production and ability to store increases food self- sufficiency could studied to show the link with WaterAid projects[8].

Health

Based upon the literature from the WHO and UNICEF (2000), we predict that the health of the community members is clearly and directly impacted by improved water and sanitation services. As the WHO report (WHO 2004) identifies, the main outcome of these services is a reduction in the number of cases of diarrhea and accordingly a proportionate reduction in the number of deaths.
Therefore, based upon the connections of water to health, we expect to find a significant difference in the number of cases of diarrhea between the village with water and sanitation improvement and the village without[9]. Therefore the decreased occurrence of sickness will then lead to decreased cost of health care, increased school attendance and more productive income activities.

Hygiene practice is also examined to verify the health impact associated with water and sanitation. A study by Curtis et al. (2000) showed that hand washing with soap and water after contact with fecal matter can reduce diarrhea cases by 35% or more. WaterAid provides hygiene education and trainings with villagers as part of their projects. Information related to hygiene is then relayed by the ad hoc water committees created during the project. Our assumption is that water projects affect behavioral changes in hygiene practice, which consequently causes health improvement and economic benefits in the community.

The improved health of communities can also be linked to improved nutrition. Water access could allow for increased vegetable and livestock productivity, as well as additional time saved by the proximity to the water source, which is often spent on fieldwork. The increased supply of protein and vitamins from vegetables and livestock increases nutrient and calorie intake. Additionally, reduced instances of sickness improve nutrient retention and improved nutritional conditions have long-term impacts on labor productivity.

Education

Sustained and reliable access to water is often cited as a key alleviation of water collection responsibility from the community, specifically women and children. Other studies have linked time-saved to increased studying by children. According to WaterAid (2004b), the world's poorest countries, millions of children are unable to attend school due to household chores and

[8] For example, one of our interviews in Tsinjony revealed that by using the taxes from the Water Committee, the community was able to build a community granary to store rice (often the currency used to pay the tax).
[9] In addition, the village with WaterAid intervention was provided with WASH hygiene training.

responsibilities for collecting water. For example, in the Rimecha Michiko community in Ethiopia, students are absent from school for two or three days a week because they are taking animals on a six-hour round trip to find water. Moreover, families often know they should boil water to kill bacteria, but if their children have to collect firewood they have even less time for learning (WaterAid, 2004b). Health improvements also suggest reduction in school absenteeism.

Thus our hypothesis is that villages that receive WaterAid interventions will have higher school attendance rates. With every additional level of education, we assume that their potential income also rises. Thus villages with higher education levels are expected to have higher income returns in the future.

Gender Related Issues / Time Savings

Most literature suggests that women are primarily responsible for the collection of water (WaterAid, 2004a). As stated by WaterAid (2006b), "many benefits of water, sanitation and hygiene projects particularly impact upon women. As the main collectors of water it is often their lives that change the most dramatically." Thus by making water available closer to their home, women should have additional time freed for other activities. Women are further spared from having to walk to isolated water points or to find private places to go to the toilet are also at less risk from sexual harassment (Water Aid, 2006b). Additionally, the creation of water committees provides additional opportunities for women to be in positions of community leadership.

Community Management

The installation of tap stands and improved sanitation facilities require cleaning, maintenance and repair based on feasible economic contributions from community members as a form of "tax". They also require more abstract forms of management such as decision-making, member selection for committees responsible for the condition of the facilities, information dissemination, and problem solving. Therefore, we contend that these new services strengthen and empower the function of community management. The creation of water committees provide organized structures for community engagement and gain legitimacy for making decisions and recommendations. We believe that a sense of ownership and participation in the decision-making process form psychological and technical bases for the sustainable management of water systems. Built into these committees are also forms of codified expectations on resource distribution. The water committees have arbitration and mediation roles to solve disputes over water use and have the authority to set quotas for water use. Thus this kind of organizational structure could have long-term impacts on sustainability of the systems and empowerment of the community involved.

Psychological Impacts

The access to water and sanitation impacts the psyche of the community in several ways. In Ethiopia, for instance, the psychological impacts show themselves through the reduced tension from the safe arrival of the female family member that fetches the water and the increased students' self-respect by having clean uniforms (WaterAid, 2001). In Madagascar, we expect the installation of the water systems is a status symbol and generates respect from other communities. Water has allowed for some villages to plant more flowers in a village beautification process. There are also better hygiene and health conditions, which empower and activate the community.

We believe that there may be measurable psychological impacts on the community resulting from improved water and sanitation facilities and that the water and sanitation impacts are easily differentiated in this area.

Environmental Sustainability

We predict that through the process of protecting the area around the source of water, an environment crucial for groundwater recharge and water quality, the water projects have a potential to promote understanding of the relationship of water access to the surrounding natural environment[10].

4. Indicators

In this section, we define the indicators that aim to measure the specific connection between the WaterAid projects with different aspects of the socio-economic sphere. We then identify the data that needs to be collected in the field to calculate those indicators. Finally, we critically assess the validity of the selected indicators. We pose the following questions: do the selected indicators accurately capture the impacts we are attempting to measure and are there effective correlations between WaterAid's project and the areas of impacts? Our principle indicators are highlighted in italicized text.

Table III.1 reflects the different categories and indicators that measure each specific impact. The two checks indicate the areas of impact that are more directly described by the indicator.

For purposes of clarity and consistency, this report analyzes indicators under impact area subsections to which the specific indicator is most directly related. Thus, each indicator is analyzed within the framework that has been designed at the beginning of this section. For instance, we analyze time-savings indicators under the gender category to demonstrate the role of water and sanitation in empowering women although time savings can also explain improvement in incomes and livelihoods through extra fieldwork, thus increasing agricultural production.

[10] It should be noted that the installed water systems, if mismanaged, may interfere with environmental sustainability negatively by causing water exploitation, pollution, etc.

Table III.1: Impact matrix

Indicator \ Area of Impact	Incomes & Livelihoods	Health	Education	Gender related issues	Community management	psychological effects	environmental sustainability
Increased capital assets	☑☑					☑	
Agricultural production	☑☑						
Livestock	☑☑						
Other products	☑☑						
Increased savings	☑☑					☑	
Increased food security	☑☑	☑	☑			☑	☑
Decreased health care expenditures	☑	☑☑				☑	
Diet improvement	☑	☑☑	☑			☑	
Improved hygiene		☑☑	☑	☑		☑	☑
decreased school absenteeism			☑☑			☑	
Increased school enrollment			☑☑			☑	
Increased school completion			☑☑			☑	
Increased expected lifetime income return from education			☑☑			☑	
Increased time saved	☑		☑	☑☑	☑	☑	
Decision making process satisfaction					☑☑	☑	
Maintenance and repair satisfaction					☑☑	☑	
Members selection satisfaction					☑☑	☑	
Member Participation					☑☑	☑	

☑☑ direct impact ☑ indirect impact.

A critical assessment for indicator selection process

This box discusses key aspects of the indicator selection process. It highlights the need for a critical assessment of the selected indicators for measuring the link between improved access to water and an increase in community welfare.

In UNICEF's guide for monitoring and evaluation (UNICEF, 1991), they refer to specific criteria an indicator should comply with in order for the evaluation to fulfill its objectives. Among these, two are of particular interest in the case of our evaluation. They are requiring the testing of the validity and the reliability of the selected indicators as they relate and measure the identified impact of water and sanitation services.

Validity of the indicators

The validity criterion test aims to ensure that the selected indicators effectively measure the actual contribution of WaterAid interventions to the improvement of community welfare. One example of the validity criterion test examines how we can claim that the indicator about livestock capital or rice savings effectively measures the impact of water on the wealth of the community.

Reliability of the data

The reliability criterion refers to the accuracy of the data collected. It addresses the following question: Is the data collected from the different instruments and tools reliable? In an analysis, any specific circumstance that could affect the field research must be taken into account (e.g. harvesting season, post-cyclone period).

Therefore, during the field research, different sources of information were utilized in order to increase the reliability through the data triangulation method.

Incomes & livelihoods

Improved access to water and sanitation increases the wealth of the community and can be demonstrated in the following ways: increased capital assets and increased savings. The rationale behind this contention has been discussed in the previous section.

a. Increased capital assets

To numerically assess the link between improved access to water and increased wealth, we calculate '*the monetary value of the assets on a per household basis in the community*.' Household assets are defined as the annual agricultural production of vegetables and fruits, animal farming and other income generating products, such as cakes and wooden sculptures, and values of their property. The local market prices are assigned as the monetary value for these products. The data collected at the household level are later aggregated to the community level.

b. Increased savings

Another measurement of wealth is to evaluate *'the amount of savings in money and kind'*. This variable compares saving levels before and after the project at a household level and should then be aggregated to a community level.

Health

Measuring the positive impacts on health within the community considers both the rate of disease occurrence and the quality of household diets. The main question is if the incidence of water-related diseases decreased since the start of the project. It also asks if households' hygiene behaviors and diets have improved and or diversified. It is measured in the following categories.

a. Decreased health care expenditures

To measure the economic effects of improved health as a result of access to safe water and improved sanitation conditions the study must calculate the savings gained due to the reduction of healthcare costs. This looks at individuals as units of analysis and aggregates to household or community levels. We look particularly at cases of diarrhea and bilharzia (schistosomiasis) to assess these savings effects, as they are the most common water borne diseases in the region.

In this regard, we use the standard indicator *'number of diarrhea cases in the community in the last two weeks'*, which is the most frequently used in the current literature on the subject. Providing we can determine the subsequent health care costs, we can then measure the cost reduction it entails for the community.

In order to ensure high validity of the findings, health data must be triangulated and confirmed as relevant to the specific site location. Thus a household survey can be used to confirm international health studies of rural communities' findings by asking households their most frequent health symptoms or concerns.

b. Improved hygiene practices

In order to measure hygiene behavior changes, the following indicators are taken from the literature (Favin, 2004):

- *'average number of bathing a week' with a distinction between adult men and women, boys and girls'*;
- *'percentage of survey respondent washing their hands after using the latrine'*;
- *'percentage of survey respondents having babies who wash their hands after changing babies'*;
- *'percentage of survey respondents washing hands before cooking'*.

The last three indicators distinguish between people using soap or not.

c. Diet improvement

The proximity of the water point and the implementation of auxiliary systems to reuse the water allow the community members to grow more vegetables and raise more animals. This results with dietary changes in the households. Therefore, the objective is to demonstrate how closer access to water has helped improve and diversify households' diets.

In this regard, we measure *'the number of households of the community who meet the minimum weekly requirements in terms of proteins'*.

Education

As suggested in the hypothesis section, there are three approaches to measuring the impacts of water and sanitation provision on education rates within the community. The three categories are as follows: the attendance rate, the enrollment rate and the completion rate.

a. Reduced absenteeism

To validate the hypothesis that access to water and sanitation leads to an improvement in the school attendance rate, the *'number of school days missed in the last month'* will be calculated.

b. Increased enrollment

To explore the impact of WaterAid projects on higher enrollment rates, the survey considers the '*net percentage of children of the appropriate age range enrolled in x-level of education, x representing middle school, high school or university respectively*'[11].

[11] According to some studies "…….some issues concerning quantity remain. Specifically, achieving acceptable enrollment and particularly grade completion rates is still a challenge in many countries, which reflects issues related to delayed entry, drop out, and repetition rates" (page 2)
http://www.copenhagenconsensus.com/Files/Filer/CC%20LAC/CCLAC%20AWP/AVP_Education_Urqiuola_1V.pdf
In the paper Apples *and oranges: Educational enrollment and attainment across countries in Latin America and the Caribbean,* Calderón and Urquiola calculate net enrollment rates by: age specific and/or based on a single source of data within each country (a household survey) and they used these to rank countries' performance in getting children into school on time and keeping them there and turning their contact with the school system into years of schooling.
http://www.columbia.edu/~msu2101/UrquiolaCalderon(2004).pdf

The definition of *'appropriate age'* is critical for this study, leading us to discriminate against the children who are enrolled in x-level of school but do not belong to the appropriate age range, that is;

- Middle school: we measure the ratio of number of children enrolled in middle school between 11 and 15 over the total number of children between 11 and 15;
- High school: we measure the ratio of number of children enrolled in high school between 16 and 18 over the total number of children between 16 and 18;
- University: we measure the ratio of number of children enrolled in university between 19 and 25 over the total number of children between 19 and 25.

c. Increased completion

This indicator measures the '*net percentage of children in each appropriate age range with x-level of education being the highest completed school level , x being primary, middle school or high school'* as an indicator to validate the hypothesis that the impact of WaterAid projects on education translates into higher completion rates, that is;

- Primary school level: we measure the ratio of number of children between 11 and 25 with highest level of education being primary school over the total number of children between 11 and 25;
- Middle school level: we measure the ratio of number of children between 16 and 25 with highest level of education being middle school over the total number of children between 16 and 25;
- High school: we measure the ratio of number of children between 19 and 25 with highest level of education being high school over the total number of children between 19 and 25.

University completion rates are not included based upon the assumption that the 5-year life time period of WaterAid projects is too short to observe any effect on the university completion rates and also based on our observations that no one completed university in the households surveyed, although enrollment numbers vary.

d. Increased expected lifetime income

A second indicator is derived from the completion rates that measure *'the expected lifetime income collectively earned in each community from different education completion levels'*.

This indicator provides expected future return for individuals according to the completion level of achieved education. It is calculated as future expected income based on the probability of completion for a child age 10 or below. It is an average estimation over the three levels of education; primary, middle and high school.

Gender Related Issues / Time Savings

Most literature studies emphasize the link between time savings and women empowerment as women are generally responsible for water related activities (water collection, cooking, house cleaning, clothes washing, children bathing, etc.). Therefore, we want to measure the

consequences of closer access to water for women. In this regard, we first need to confirm that water is actually collected by women.

A preliminary indicator will thus measure the gender distribution of those responsible for fetching water for a household, aggregated to the community level. We then calculate time-saved and subsequent income gains for women assuming that they can reallocate their time for other productive activities.

a. Women participation in water collection

We first calculate the percentage of women participating in water collection activities in the community. This calculation is sensitive to the gender breakdown in the community so that proportion is considered when analyzing gender responsibilities, i.e. considering validity of the indicator.

b. Time saved from avoiding water collection activities

To evaluate the effect of time savings, we measure the '*number of hours saved by the person who collects the water'*.

c. Potential additional income generation

Assuming women's primary role in water collection activities has been demonstrated, we can calculate the *'potential amount of income generated thanks to time saving.'* based on the hourly woman wage data available from a study conducted in 1995. (Glick, 1999)

Community Management

To measure the effects of the water projects in terms of governance and community management, analysis focuses on the measurement of the community member's satisfaction of the work of the water committee using a satisfaction scale. Furthermore, the team measures the degree of community members' participation in the local water management. We also discover opinions about tax contribution from community members. This is a way to measure whether or not the creation of water committees effectively translate into the formation of a certain sense of collective action and of community involvement.

Thus the team evaluates the following indicators:

a. Satisfaction with committees' performance to maintenance and repair

The '*percentage of respondents that perceive the water committees complete their responsibilities.'*

b. Satisfaction with problem resolution by water committees

The *'percentage of respondents that are satisfied with problem solving process of the water committees'*

c. Satisfaction with member selection process of water committees

The '*percentage of respondents that are satisfied with member selection process of the water committees.'*

d. Satisfaction with decision-making process of water committees

We measure the '*percentage of respondents that are satisfied with the decision-making process of the water committees'*

e. Participation in meetings organized by water committees

The '*percentage of respondents that have participated in meetings organized by water committees.*'

f. Water tax / Contribution

Using records from the Water Committee, the team calculates '*the willingness-to-pay based upon the monthly or annual taxes collected.'*

g. Opinions about tax/contribution to water committees

The '*percentage of respondents that think that they make a fair amount of economic contribution to the water committees.'*

Psychological Impacts

We did not design any specific indicator to measure the psychological effects of improved water and sanitation although indicators in community management reveal some aspects of community perception and empowerment. However, these impacts should not be disregarded, as although they are less tangible, they are still present and can be captured with a more qualitative analysis (pictures of the village, initial focus group interviews, etc.)

Environment Sustainability

No quantitative indicators have been developed for this category although initial findings suggest significant changes in environmental perception due to the need to protect the source of water and regulate consumption. We observed that SAF/FJKM offers support for reforestation around the source and encourages water users to monitor and regulate their consumption, especially during the dry season. Records show that there have been 1000 trees replanted as part of the SAF/FJKM project (SAF/FJKM Interview, 12 January 2008, Ambositra). Thus, the possible future indicator includes '*the number of trees that have been replanted around the source of Ampila'*.

5. Formulas

This section explains the process to obtain numerical figures of the selected indicators described in the previous section. The formulas are calculated based upon data collected from the previously described indicators. **Table III.2** and **Table III.3** explain which indicators and formulas are used to calculate the monetary impacts at both the household level and at the community level.

Table III.2: Formulas for the household level

Valuation methodologies for different impacts of water projects at Household Level				
Impact		Formula	Collection Method	Observations
Incomes & Livelihoods				
i	*Value of capital asset*	**i=p*q** p =price of the product q = quantity of the product	 Market research Household survey	The prices used for the agricultural output, animal farming an other products production when manually asked may result in inflated prices Some prices are subject to seasonal variation for some products the correlation of WaterAid water projects and the productions not strong
Health				
h	*Treatment cost of sickness per house*	**h = i*ci** i = number of cases of water related diseases ci = treatment cost per illness	 Household survey Household survey	To accurately calculate the number of sicknesses, it is better to use a standard costs depending on the sickness. Occurrence of sickness doesn't discriminate by ages which may cause inflated cases in houses with large number of kids.
n	*Weekly protein intake*	**n = po*qo** po = number of portions of protein rich food per week qo = quantity of protein per portion taken	 Household survey International literature	Nutrition depends on the weights and lifestyle of each individual. Portions' sizes pegged to international standards may not reflect the community surveyed.
Education				
ge	*Net enrollment rate*	**ge = ke/te** ke = number of children of appropriate age that have enrolled in the appropriate level te = total number of children of the appropriate age range for that schooling level	 Household survey Household survey	The net enrollment/completion rate might be underestimating the actual enrollment/completion rate. Net enrollment/completion rates, we may have ignored the fact that some children might have completed school though they are not within the age-appropriate schooling level that were enrolled in that level.
gc	*Net completion rate*	**gc =kc/tc** kc = number of children of appropriate age that have completed in the appropriate level tc = total number of children of the appropriate age range for that schooling level	 Household survey Household survey	
Gender				
t	*Time saved from not collecting water*	**t=(min /60)*w** min = total minutes saved per day w = hourly wage	 Household survey International literature	Wage rate might vary and for more accuracy it needs to be region specific. Also, it may not reflect the actual income that they received when they save time. If added to incomes and livelihoods community, it might cause double counting.
Community Management				
	Decision making process *Maintenance and repair* *Member selection* *Member participation* *Member contribution*	**No formula-** the impact of governance was capture via open ended questions by asking to rank and describe the different activities performed by the water and borne fountain committee	Household survey Household survey Household survey Household survey	
wtx	*Water Tax collection*	**wtx = Σ tx** tx= tax contribution per household	Household survey	This measure cannot be added to the benefits since it is a sustainability or willingness-to-pay measure. More accurate when the data is triangulated

Table III.3: Formulas for the community level

Valuation methodologies for different impacts of water projects at Community Level				
Impact		Formula	Collection Method	Observations
Incomes & Livelihoods				
I	*Value of assets of the community*	**I= Σ V** V = total value of the resource per year	 Household survey/ market research	
Health				
H	*Health*	**H= Σ C** C = aggregate cost of the treatment of the diseases	 Household survey	Costs may vary due to transportation costs, medicine-specific costs etc.
N	*Nutrition*	**N=Σ R** R = number of houses that consume minimum weekly protein requirement	 International literature	Counting the number with the minimum daily intake may not be accurate enough It may serve a better purpose to limit calculations to individual and household level
Education				
A	*Absenteeism*	**A = Σ DM/ Total Number Houses** DM = number of days missed of school		Averages may be affected in the presence of outliers in the community, specially if it is a small sample.
EV	*Completion*	**EV=(1-Pp)*PVLI+Pp*(1-Pm)*PVLI+ Pp*Pm*(1-Ph)*PVLI+Pp*Pm*Ph*PVLI** Pp = Completion rate of primary school Pm = Completion rate of middle school Ph = Completion rate of high school PVLI = Present value of Lifetime income	 Household Survey Household Survey International literature	The expected value of lifetime income cannot be added to the other benefits. It may be difficult to attribute the impact on water on completion.

Health

To calculate the number of households obtaining the minimum weekly protein requirements, each household is asked the portions of high protein foods (meat and fish) consumed per week. This is multiplied by the corresponding average protein grams per portion[12]. Then we count the number of households that meet the minimum weekly protein intake requirement, determined from a survey of international literature[13].

Education

The following describes the process to calculate the present value of lifetime income for a specified level of education:

- Calculate the amount of future income in the time (t) which was inflated by the inflation rate π_t from the current income level $income_{t0}$[14]:
  $income_t = income_{t0}(1+\pi_t)$
- Convert it into the present value in the time of t_0 based on the interest rate π_t:
  $$\frac{income_{t0}(1+\pi_t)}{(1+\pi_t)}$$
- Sum up all the present value of future income from t_0 to the life expectancy at birth minus the completion age of each level of education, $LE-CA$:
  $$\sum_{t=t0}^{LE-CA} \frac{income_{t0}(1+\pi_t)}{(1+\pi_t)}$$

As noted, $(1+\pi_t)$ in the numerator cancels $(1+\pi_t)$ in the denominator, leaving $Income_{t0} * (LE-CA)$. For example, if the life expectancy in Madagascar is 59 and children complete the middle school at the age of 16, $LE-CA$ which is used in the calculation for middle school graduates should be $LE-CA$ = 59 – 16 = 44.

The income used for our calculation was the average hourly wage of men and women in the households/individuals sector in 1995 according to the highest level of education completed (Glick, 1999). The 1995 income was brought to present value by using the consumer price indexes CPI in 1995 and the current year[15]: $Income_{t0} = Income_{95} * \frac{CPI_{to}}{CPI_{95}}$

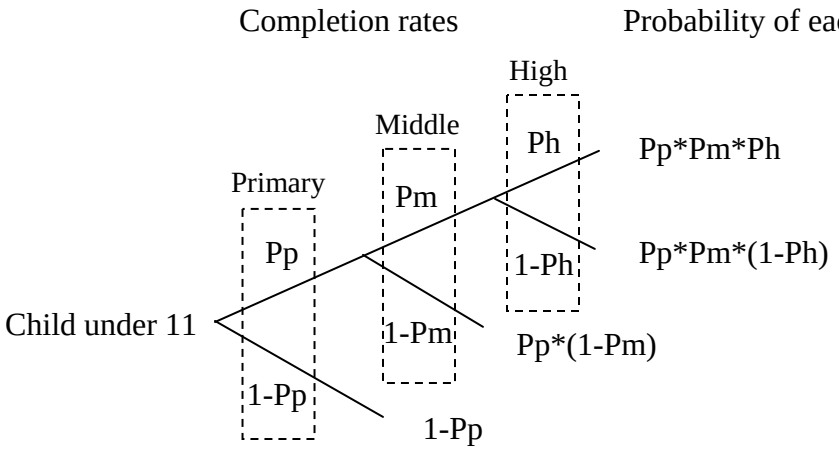
[12] The average protein quantity per portion is based on the calculation made by the Center for Nutrition Policy and Promotion of the USDA (United States Department of Agriculture). The quantity of protein for 100g of meat is 26.41g.

[13] We defined minimum protein daily requirement as the safe level of protein intake for a 60 kg man or woman aged 30-60. This figure is taken from Energy and Protein requirements report of a Joint FAO/WHO/UNU Expert Consultation available on the following link http://www.fao.org/docrep/003/AA040E/AA040E06.htm#note24

[14] In our calculation, we take the year of 2007 as the current base year because the most recent published data on income and inflation was not available for 2008.

[15] Inflation data measured by the CPI is usually national inflation data. In developing countries, this data does not always reflect the large variations between regions. However, it was not possible to find the local (rural) inflation data in Madagascar.

The expected value is calculated based on the completion rate of each level of education. That is, a randomized child under 11 has four educational scenarios: (1) he/she doesn't complete the primary school; (2) he/she completes the primary school but not the middle school; (3) he/she completes both the primary and middle schools but not the high school; (4) he/she completes the primary, middle and high schools. The possibility of each scenario is calculated as the joint possibility of completion rates: $P(A \cap B) = P(A) * P(B)$ as shown in the probability tree below.



Then, using these probabilities, one is able to calculate the total potential difference in lifetime salaries per child under 11, and aggregate to the community level.

Gender / Time Savings

In order to calculate the potential amount of income generated due to time saving, we use the average hourly wage of uneducated women in 1994 (Glick, 1999). The 1994 income is adjusted to present value using the same formula as the one used for calculating education benefits. This number is applied to the average amount of time saved across households in each village. Time saved on a community level is based upon individual household responses in the household survey.

Community Management

In order to capture community management, sustainability and governance, we used tax data as proxy for an economic value. In the governance excel sheet we recorded the data of "water tax" collected by water committees. Water Tax was collected in MGA and/or rice. The rice was converted into MGA using market prices, or price per kilogram of rice multiplied by the amount of rice given in kilograms.

6. Excel Model

The excel model performs the actual calculations based on the input data collected from the survey. We made five different workbooks for the different indicators. The different workbooks are: incomes and livelihoods, health, education, gender/time saving and community management. Within each workbook, there are two main worksheets, (1) community level and (2) household level[16]. In the worksheet on the household level, the data is collected for each household and is then aggregated using the appropriate formulas and inputted into the community level worksheets. In the community level worksheets, the results from each commune are compared against each other. Additionally, each workbook has worksheets, including the graph of the results. Instructions on how to use the actual excel tools are shown in the **Annex III**.

7. Data Collection Instruments

In order to collect the required data of variables we use several instruments. Below is a summary of the main data collection tools used in this study.

Mixed Method Approach

Since the WaterAid projects impact a mixture of social and economic areas, we decided to use the mixed method approach for our data collection, combining direct quantitative study with qualitative surveys. This approach increases the reliability of the measurements as well as increases the validity of the study. When possible, we used triangulation techniques to verify the reliability of the information that is being collected.

The integration of both quantitative and qualitative measures into current evaluation tools is the central challenge of our project for comprehensive analysis of the water sector. The Q-squared or mixed methods techniques are valuable and unique because of the multiple data sources that are combined into an overall evaluation (Kanbur, 2003)[17]. The quantitative data can be gathered from numerous sources, including household surveys, census data, opinion polls, official files and records information, or indexes to list a few. Thus quantitative data refers to information that can be converted from abstract ideas into specific monetary or numerical values. Qualitative studies vary in form and examine a wide range of subjects and research questions. Qualitative analysis includes information gathering from historical records, legal codes, letters or written texts, media accounts, open ended responses to survey questions, observations, interviews or focus groups, and finally participatory approaches. Thus this includes descriptive text (Woolcock, 2002). While data is extremely limited in Madagascar, there are governmental and non-governmental institutions that collect potentially useful data.

An emerging technique in the field of water resource management is defined by measuring and studying community management. This requires tools that can effectively analyze these

[16] Gender/time saving and community management are not included on this separation of analysis levels. The gender/time saving and community management sheets are only designed for communities that have had a WaterAid intervention and thus provides the total aggregated number for the communities on the single worksheet.
[17] For further information see Bryman, A. (2004).

institutions. The IRC International Water and Sanitation Centre (IRC) has developed and refined methodologies that transform qualitative information into numerical form[18]. There are useful techniques to effectively reflect stakeholder perceptions. The Quantitative Information Appraisal (QIA) can be used to quantify people's perceptions and help guide future policy and management decisions (IRC 2004). This requires that questions be structured specifically to gather intended information. They include categorical questions (y=1, n=0), cardinal numbers (percentages and or index), and ordinal numbers (descriptive categories with describe scores). The Qualitative Information Appraisal method can be used to measure the impact and perceptions of issues like community management (water committees) or gender impacts.

Our approach is therefore both qualitative and quantitative. Qualitative techniques are used to validate the correlation between WaterAid projects and any improvement observed in the community welfare, while quantitative instruments are essential for monetary valuation purposes.

Household Survey

Household survey questionnaires collect the majority of data necessary for obtaining the data required for the different variables. We assume the respondents of the survey will know the production of capital assets, education levels of children, health conditions as well as daily food intake of their household members.

The questionnaire is structured so that the subject of the questions shifts smoothly from the general topics into the specific indicators. This is intended to elicit a quick and accurate answer from respondents.

The structure of the household survey is also designed to facilitate collection of qualitative data. The form of survey questions include open-ended questions as well as data specific formats. The open-ended questions allowed for the collection of different perceptions, opinions, and experiences around the impacts of the water project to the households and to the community. Please see the household survey, attached in a separate file.

Focus Group

Focus groups help verify some of the data collected from household surveys; we assembled focus groups comprised of community leaders in order to gain perspective not only from households but also from selected community members[19]. It is necessary for the data collected for community management to be triangulated with the information obtained from the Water Committee focus group. This is in order to capture the difference in perceptions and

[18] IRC is a center that facilitates the "sharing, promotion, and use of knowledge so that governments, professionals, and organizations are better able to support poor men, women, and children in developing countries to obtain water and sanitation services." IRC provides accessible, high-quality information and specific research using a network of experts in the field of water and sanitation. http://www.irc.nl/page/3258

[19] Community leaders include the director of the local school, members of the water committee, the president of the fokontony, and the community technician.

understanding of community organization and management practices. **Annex IV** presents the developed guides for focus groups, which could be used as part of the methodology to triangulate the data collected.

Individual Interview

The list of focus group and individual interviews we conducted in our two field visits are shown in **Annex I**. These interviews were designed to identify the current development situation and characteristics of the region as well as their priorities and governmental policies for water and sanitation services.

Visual Record

Photographs and other visual instruments help to document the situation and circumstances that are difficult to describe or that are better described through these tools. For example, in order to measure maintenance and sustainability of the water projects, photographs of the tap stands are very useful in showing their present condition as a testament of how they are maintained by the community, and as an instrument to compare them with one another.

IV. DEMO MODEL TESTING AND ANALYSIS TECHNIQUES

1. Field Research Methodology

Selection of the Pilot Communities

After designing our framework and our hypotheses we decided to run the model on a small experimental basis to test its feasibility for future application. WaterAid Madagascar selected a rural field location where our team could visit and test our tools and instruments in a demo model testing . In 2002, WaterAid completed water related projects in several villages in the region of Amoron'i Mania, which is located 180 km from the capital Antananarivo [20] . Additionally, WaterAid informed the SIPA team that we would receive assistance from the Director of the SAF/FJKM regional office in Ambositra who implemented WaterAid's 2002 projects.

Due to the lack of adequate baseline data in the impact areas we were interested in measuring, the team chose to compare two villages. We isolated one village with WaterAid intervention and compared it to that of a village with similar characteristics that had not yet received any water or sanitation projects. After visiting nine rural villages with and without water projects surrounding Ambositra, the first SIPA team selected the villages of Ampila and Fasimena in the commune of Ambositra II: the former as the intervention site and the latter as the control site. In the selection process, the team carefully analyzed the basic demographic and geographic characteristics and ultimately determined that Fasimena shared certain important qualities with Ampila, which would justify a benefit analysis comparison (**Table IV.1**). These characteristics included population size, proximity to Ambositra, main income generation activities, land and climatic features and accessibility to natural water resources. In addition, identical community organizations exist in both villages. These organizations are termed Compagnie, and they provide a basic social security for the dead and the need. Both villages benefit from external interventions from the Millennium Challenge Account (MCA) geranium programme [21] which were launched in both villages at the same time.

[20] http://travelingluck.com/Africa/Madagascar/Fianarantsoa/_1077804_Ampila.html#themap

[21] The MCA launched in both communities a project of geranium production. Therefore, potential impacts on the evaluation project are neutralized.

Table IV.1: Basic profile of selected villages

Characteristics	*Ampila*	*Fasimena*
Population	750	770
Proximity to Ambositra	3 km	2.5 km
Main income generation activities	• Rice Cultivation	• Rice Cultivation • Cake baking
Water resources	• Tap stands • River • Natural spring	• River • Natural spring
Access to Water	30min * 4-5 times per day (prior to the project)	20 min * 4-5 times per day
Community organizations	Social organization (compagnie)	Social organization (compagnie)
External intervention	MCA (geranium project)	MCA (geranium project)

There are several constraints with this approach which make our even more unreliable. In order to evaluate the benefits of WaterAid's project, we made the assumption that any difference in the indicators we evaluate stems from the impacts of the WaterAid project. We recognize that there might be other exogenous and endogenous factors that may have potentially influenced the development and current state of these two villages. It is difficult to report with absolute certainty, for instance, that any difference in livelihoods we observed between Ampila and Fasimena resulted from the water project and not because of another variable. Though we believe we sufficiently accounted for other externalities that may be responsible for changes in our indicators we have to keep in mind the inherent limitations of this approach.

During the second SIPA team visit in March, we collected the data of variables necessary for the calculation of indicators using several instruments discussed in the Data Collection Instruments section. In the household survey, we asked questions based on household survey questionnaires we developed for households that was chosen based on the accessibility and cooperation to the survey in each village. The original number of households we aimed to visit was 40 to 50 for each village in the four days we would be in the field. However, upon testing our survey in the field, it became clear that we would not be able to reach our targeted number of households. We were eventually able to survey 21 households in each village. Although this small sample size raised concerns of low credibility of data, our main aim was to test our model in order to determine whether or not it is possible to measure and capture the social and economic impacts of water and sanitation project interventions.

2. Results and Analysis

This section discusses findings from our model testing, our analytical approaches to assess the findings and impacts generated from the WaterAid project and identifies areas we need to refine for improving our model. This section aims to demonstrate our techniques of model testing and analysis in order to prove our mode is feasible in practice. It is important to emphasize, however,

that the figures obtained through model testing are not statistically significant due to the small sample size.

2.1 Incomes and livelihoods

a. Findings

Table IV.2 and **Figure IV.1** summarize our findings from the comparison of two village's capital assets expressed in MGA.

Table IV.2. Amount of capital assets in incomes and livelihoods (currency unit: million MGA)

	Ampila	Fasimena	Difference
Vegetables & Fruit (legumes ary Voanikazo)	***34,695,595***	***29,340,025***	***5,355,569***
Green vegetables (legumes verts)			
Green bean (haricot vert)	1,395,900	142,650	1,253,250
Tomato (votabia)	29,265	798,000	-768,735
Cucumber (concombre)	679,000	213,000	466,000
Zucchini (courgette)	5,173,000	112,000	5,061,000
Pea (petits pois)	423,000	711,000	-288,000
Spinach (brède)	3,776,000	418,000	3,358,000
Shushu	0	0	0
Squash	61,667	75,000	-13,333
Cabbage (lysoa)	300,000	0	300,000
Hot pepper (sakai)	1,272	598	626
Onion (tongolo)	264,000	0	264,000
Sasoety	0	240,000	-240,000
Starchy Food (feculents)			
Potato (ovy)	1,820,000	1,081,500	738,500
Sweet potato (vomanga)	7,312,500	13,180,500	-5,868,000
Cassava (manioc)	2,167,500	5,502,600	-3,335,100
Taro	56,000	205,800	-149,800
White bean (tsaramaso)	962,867	1,151,644	-188,777
Soy bean (soja)	10,733	22,400	-11,667
Chickpea (voanjobory)	0	675,000	-675,000
Vopoa	14,700	24,500	-9,800
Corn (katsaka)	855,250	1,152,800	-297,550
Fruit (voanikazo)			
Banana (akondro)	204,400	17,500	186,900
Orange (voasary)	345,000	486,000	-141,000
Peache (paiso)	224,100	557,100	-333,000
Mango (manga)	36,875	15,000	21,875
Grape	0	0	0
Apple (pomme)	10,800	1,500	9,300
Papaya (papay)	200	0	200
Pineapple (mananasy)	50,400	9,600	40,800
Persimmon (kaky)	0	10,000	-10,000
Loquat (pibasy)	24,000	0	24,000

Other Vegetables & Fruit (legumes ary Voanikazo)			
Peanut (voanjo)	8,792,000	2,075,333	6,716,667
Coffee (café)	101,833	1,462,500	-1,360,667
Livestock (bibi)	***36,727,300***	***27,059,767***	***9,667,533***
Cow & zebu (omby)	20,900,000	8,800,000	12,100,000
Pig (kisoa)	14,400,000	16,800,000	-2,400,000
Chicken (akoho)	627,300	1,193,100	-565,800
Hive (tantely)*	800,000	266,667	533,333
Rice (vary)	***25,927,000***	***19,581,624***	***6,345,376***
Average harvest per household (kg/yr)	1,309	937	372
Other Products (zavatra Hafa	***10,786,000***	***25,088,000***	***-14,302,000***
Wood sculpture (kakhazo)	2,240,000	360,000	1,880,000
Weaved product (lamba landy)	386,000	108,000	278,000
Terracotta pot	0	0	0
Brick	8,150,000	6,110,000	2,040,000
Pottery	0	0	0
Cakes (gateau)	0	18,330,000	-18,330,000
Traditional medicine	10,000	180,000	-170,000
Savings (faniry)	***6,564,600***	***581,500***	***5,983,100***
Rice (vary)	6,012,600	511,500	5,501,100
Money (vola)	552,000	70,000	482,000
Total	***114,700,495***	***101,650,916***	***13,049,579***

* assuming each hive produces 25 l/year of honey

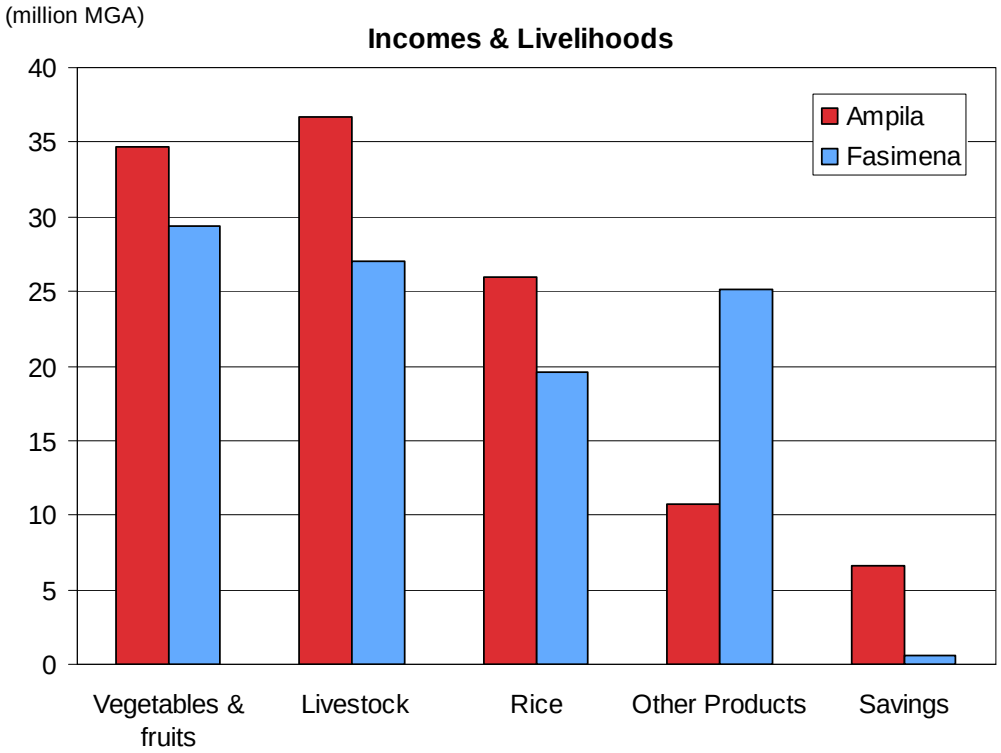


Figure IV.2: Amount of capital assets in incomes and livelihoods

Vegetables and Fruit

The monetary value of vegetable and fruit production is greater by 18% in Ampila than in Fasimena. The biggest difference is found in the production of green vegetables such as green beans, zucchini and spinach (brède). As for the starchy food, the relation is the opposite; Fasimena produces more starchy food including manioc and taro by 43%. The production of all fruit is also greater in Fasimena compared with fruit production in Ampila (1.1 million MGA in Fasimena; 0.9 million MGA in Ampila), although it is not consistent across fruit; Ampila produces more bananas, apples and pineapples, while Fasimena produces more oranges and peaches.

However, it is important to realize that the average market price of the green vegetables (1,150 MGA/kg) is more than double that of the starchy food and fruits (560 MGA/kg for the starchy food and 413 MGA/kg for fruits). This indicates that Ampila's total crop production has a higher market value than that of Fasimena.

As for other agricultural products, farmers in Ampila produce a significant amount of peanuts valued at 8.8 million MGA, compared to peanut farmers in Fasimena who produce a total of peanuts worth of 2.1 million. On the other hand, people in Fasimena grow more coffee, producing as much as 1.5 million MGA as compared with Ampila's annual production valued at 0.1 million MGA.

Livestock

The data on livestock shows that the total value of livestock in Ampila is higher than in Fasimena by 36%. A closer analysis shows significant variation between livestock species. For example, the value of zebus in Ampila is 12.1 million MGA more than in Fasimena, whereas more pigs and chickens are farmed in Fasimena. The average number of zebus owned per household is 1.8 in Ampila and 0.8 in Fasimena. On the other hand, the average number of chickens in Fasimena per household is 9.2, almost twice of that of households in Ampila, which is 4.9.

We also collected data for fish but didn't include our analysis for several reasons. There was a significant discrepancy between values of fish assets as a result of two houses in Fasimena. Fasimena raised 20.4 million MGA more than Ampila (2.0 million MGA in Ampila; 22.4 million MGA in Fasimena). Household data from Fasimena revealed that only five houses produce fish and that they produce them in large quantities, and that two house produces between 15 and 300 times more than the others houses. This is anomaly in our data suggests inaccuracy in data collection so we are not including fish in our final assessments.

Rice

Our household surveys revealed that Ampila produces 32% more rice than Fasimena. The average rice harvest per household was 1,179 kg/year in Ampila vs. Fasimena's average rice harvest per household of 848 kg/year. There is an even larger per house difference in rice production when limiting the analysis only to houses that are growing rice (1,309 kg/year in Ampila versus 937 kg/year in Fasimena, in both of which 19 households have rice production).

Other Products

When looking at other productive activities, we observed a large variance of activities among households. This implies that income generation activities other than rice, vegetable and livestock production are rather unique to the individual households and do not depict systematic differences at the community level. In this category, we observed that Fasimena is more active in production in monetary terms: 10.8 million MGA in Ampila versus 25.1 million MGA in Fasimena. The composition of products is quite different between communities; more wood sculptures and bricks are produced in Ampila while cakes are produced in Fasimena.

Savings

There is a remarkable difference in community savings across Ampila and Fasimena. The annual amount of saving both in rice and money is significantly larger in Ampila. Households in Ampila are shown to save 11 times more rice and seven times more money than households in Fasimena. Additionally, 81% of households surveyed in Ampila state that their income has increased since the water project started.

Total capital assets

The total amount of capital assets accumulated in the 21 households both in the physical and monetary forms is 13% higher in Ampila than in Fasimena.

b. Analysis

Vegetables and Fruit

The water project suggests increased vegetable and fruit production in Ampila because as our original focus group interviews revealed, households used the water from the tap stands for their food production, and also as a result of the time saving effect. The household survey found that 47% of sample households responded that they had increased their vegetable and fruit production since the water project started. We therefore assume that at least half of the population uses water from the tap stands to sustain and grow their vegetables. Tap stands also provide water for irrigation during the dry period of year, allowing for an increase in the variety of and ability to grow vegetables. The results suggest that improved access to water has resulted in an increase in the quantity and frequency of vegetable irrigation and in the size of the fields under production. These combined factors account for the higher productivity of vegetables observed in Ampila.

It is important to note that we should be careful in interpreting the results of vegetable and fruit production because the profile of water use significantly differs depending upon the households and types of vegetables and fruits that are farmed; 38% of sample households explain that their

households' vegetable production has not increased at all since the start of the water project because they do not use water from the tap stands to water their produce, but from other sources such as the river or natural springs. Households may use these other sources for convenience and or to follow certain rules, as the river may be closer than the tap stand to personal gardens and because some tap stands allow villagers to use water only for drinking. Other households simply rely on rainwater for their vegetable and fruit production.

The validity of indicators are relatively high since the linkage with water access is rather obvious but, as discussed in the model refinement parts, further enhancement of validity is required. The reliability of data is high for products which are sold in the market but low for products which are consumed by households who produce them.

Livestock

The survey showed mixed overall effects on livestock, while, as a whole, we notice a distinct increase in economic benefits derived from animal farming in Ampila; 74% of sample households acknowledged that animal farming improved since the water project because of improved hygiene conditions. They are able to wash animals and their stables more frequently due to access to water from tap stands. Although rules for the use of tap stand water usually limit water use to human consumption, water draining systems have generally been implemented to ensure that water is reused for irrigation or for watering animals. Thus, the validity of the indicators of livestock production is high. Moreover, the promotion of hygiene practices that impact animal farming is a feature of WaterAid programs, in which the construction of pens to limit the movement of pigs and chickens in the village is encouraged. Improved hygiene and health conditions of livestock might affect the sale price of livestock and also reduce veterinary costs, which are not taken into account in the present evaluation.

The amount of fish comprised a large proportion of livestock value in Fasimena. However, we found no causal relationship between water and fish production since fish is kept in ponds and/or rivers which do not require water from tap stands provided by the project. We should also note that the numbers of fish reported by both villages might not be reliable as there respondents are often not sure about the accurate number of fish being cultivated.

The reliability of data is extremely high with the only exception being fish, since counting the number of livestock is straightforward and considered accurate.

Rice

The observed increase in rice production is not a direct impact of the water project. People in Ampila do not use the water from the tap stands for irrigating their rice paddies. However, 41% of households in Ampila

responded that they use the additional time saved as a result of improved access to water and sanitation for their field-work. Thus, the significant difference in rice production is potentially attributed to the increased labor inputs due to the increased availability of time and labor productivity resulting from improved health.

Other Products

We found minimal impact of improved water on other sources of income in Ampila. The link between water and textile production, such as wood sculptures and woven products, is unclear since these might not require water for production. Water from rivers or other water sources are most often used for brick making in both Ampila and Fasimena as five out of eight households that make bricks reported they do not use water from tap stands for brick production. Hence, income increases through brick production are not directly connected to WaterAid's project.

A significant difference in the amount of community assets generated from other products between Ampila and Fasimena is derived from cake production. No production of cake was observed in Ampila. Thus, we can conclude that there would be no water effect on cake production. We should also note that 57% of capital values generated by cake production in Fasimena come from one sole household that depends primarily on the profits for their houses' income. Due to the small sample size in our survey, there is increased risk that the sample is not representative of these villages' livelihoods and would consequently skew our results and analysis.

However, the water project can possibly increase their capital assets with regard to the production of other products by using the additional time saved due to improved access to water and sanitation. To this effect, 4% of sample households answered that they spent their saved time for non-agricultural income generation activities.

Savings

Impacts from WaterAid interventions can be seen as an increase in savings both in rice and in other monetary terms. Further, 80% of sample households stated their income has increased since the water project started. However, there are some factors that must be carefully examined; the difference in the saving amount of rice might result from the difference in production amount of rice based on available land for production, rice growing techniques, or preference in each community for allocation of time and resources. People in Fasimena produce less rice than in Ampila. This is potentially attributed to shifting land use patterns, increased cash crop production could cause decreased cultivation of rice paddies as land area is limited. Consequently, the amount of rice saving is smaller in Fasimena. Thus, we might have double counted the impacts of water on rice production by looking at the difference in rice saving.

It is difficult to identify the source of money saving since multiple explanations are possible, such as sales of vegetables, livestock or bricks. The link between the improved water and

sanitation condition in Ampila to the community's savings is not direct, and is thus challenging to articulate. The overall amount of savings is not only the consequence of a series of production and consumption activities but also a function of choice and preference within households and the community. In addition, there are external pressures on people's saving behaviors such as those influenced by community organizations, which is discussed later in the section of community governance.

The consequences of increased savings are shown through enhanced food security during the food shortage season, and more generally through financial security for emergency events, such as a health crisis or temporal/permanent loss of productive workers within households. This, in turn, can be a secondary long-term effect of water projects, which is important but difficult to quantify and beyond the scope of our field-testing.

Housing

We tried to measure increased housing assets in the community by asking if any new houses had been built in the area where people shared the same tap stand, and if any improvements had been made to the respondent's house. However, we decided not to include monetary value of housing in the community caused by improved access to water and sanitation. This is due to the fact that there was no systematic way to accurately count the number of new houses in Ampila, and we were unable to obtain the market price of property in the community. Thus, the data reliability of housing value is extremely low in our survey. Moreover, similarly as saving, it is difficult to prove behavioral patterns that the more income people have, the more they would invest in housing. Therefore, water impacts on housing are not assessed.

c. Model Refinement

Impacts on incomes and livelihoods generated from water can be measured by identifying linkages between increased access to water and each area of production. Thus, survey questions should be designed to detect which type of production activity requires water from tap stands and how much water is needed for each activity.

Measuring housing value is challenging in an immature property market. However, using the triangulation method by evaluating information from households, a community leader, focus groups, and official data if available, can raise data reliability.

2.2 Health and Nutrition

a. Findings

Health

We wanted to know the number of cases of water borne diseases – diarrhea and bilharzia or schistosomiasis – that occurred in each household over the past two weeks, but no case was found for bilharzia. Four cases of diarrhea were reported in households in Ampila and seven cases were reported in households in Fasimena. The total cost associated with treating diarrhea in Ampila was 3,900 MGA, versus 14,200 MGA in Fasimena (**Figure IV.2**). The summary including treatment cost per case is shown in **Table IV.3** below. Thus, an estimation of the economic saving due to the reduction in health care expenditures is 14,200 - 3,900 = 10,300 MGA.

Table IV.3: Cases of diarrhea and their associated costs

	Ampila	Fasimena
Diseases		
Cases of diarrhea in the last two weeks	4	7
Treatment cost per illness	1,000 MGA * 3 cases 900 MGA* 1 case	200 MGA * 1 case 1,000 MGA * 2 cases 3,000 MGA * 4 cases
Total cost of diarrhea cases in the past two weeks	3,900	14,200

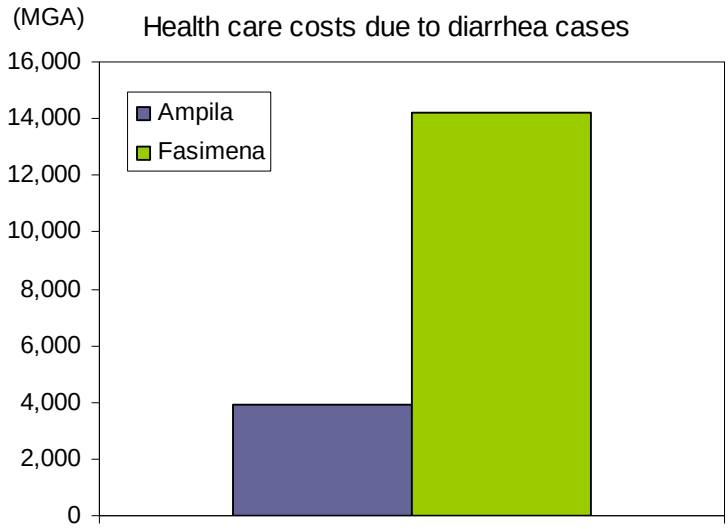


Figure IV.2: Total cost of diarrhea cases in the past two weeks

Hygiene Practice

As shown in **Table IV.4**, the average number of times that people bathe per week is higher in Ampila than in Fasimena.

However, our survey results in **Table IV.5** do not demonstrate any significant difference in hand washing practices between Ampila and Fasimena.

Table IV.4: Number of bathing per week

	Ampila	Fasimena
Average number of bathing per week		
Adult men	3.75	1.67
Adult women	3.48	1.73
Boy	4.25	2.21
Girl	4.34	2.35
Total	3.95	1.99

Table IV.5: Hand washing practices

	Ampila	Fasimena
Washing hands practice after using latrines (% of respondents)		
No	24	19
Yes without Soap	29	29
Yes with Soap	48	52
Washing hands practice after changing a baby (% of respondents who have a baby)		
No	33	14
Yes without Soap	17	29
Yes with Soap	50	57
Washing hands practice before cooking (% of respondents)		
No	0	14
Yes without Soap	52	43
Yes with Soap	48	38
NA	0	5

Nutrition

According to our household survey, 3 households in Ampila consume minimum weekly protein requirements, whereas no households in Fasimena consume minimum weekly protein requirements as shown in the **Table IV.6**.

Table IV.6: Number of households which meet the minimum protein requirements

	Ampila	Fasimena
Diet diversification		
Number of households meeting minimum protein requirements	3	0

b. Analysis

Health

Our survey findings show the reduction in treatment costs of diarrhea in Ampila as compared with Fasimena. The results must be considered cautiously because of the questionable reliability of the data collected. Only two and three households in Ampila and Fasimena, respectively,

reported cases of diarrhea. This small sample size in both villages prevents us from drawing general conclusions.

Health indicators are usually sensitive to circumstances and exceptional events. One should also be aware that the results might have been influenced by external factors such as the period of the year (wet/dry season, harvesting/food shortage period) or climatic phenomena (cyclone, cold wave, etc.). For example, a few households reported cases of sickness due to a recent period of rainy weather that occurred just before the field survey, which could have affected respondents' perceptions of their health situation.

Moreover, low public awareness of water related disease could lead to low and/or poor reporting and go undiagnosed. Thus health related data has a low level of credibility.

In addition, the data related to treatment costs are not as reliable as household expenditures on basic necessities because they might vary depending on income levels and availability of treatment options for individual households, which is unaffected by water. The treatment options can range from traditional medicine to clinics (Centre de Sante de Base) and hospitals with dramatic cost variation associated with one option to the other. In fact, we observed great variance in costs across households, which could possibly distort the final results.

Nutrition

Nutrition situations of villagers are better in Ampila than in Fasimena; 70% of sample households answered they have changed in diet since the water project started by eating more and/or by diversifying their diet. Thus, possible causes of nutrition improvement are the increased agricultural production itself and/or the increased purchasing power generated from increased capital assets.

However, further examination reveals that the three households that meet minimum protein requirements present distinct diet characteristics substantially different from the rest of the sample households in Ampila. They eat 20 times more protein rich meals every week than the rest of the sample. This indicates that our sample might be skewed. Also, the amounts of consumed food reported by villagers are estimated values. Low reliability of nutrition raises a concern of credibility in our findings.

Finally, we are concerned about the possibility that villagers without the water project might have exaggerated the difficulty of their situations supposing that this survey might be used as a preliminary assessment for future possible projects.

c. Model Refinement

Results of our model testing conclude that there is a high validity in the health indicators when measuring their impacts on health situations, while the reliability of information is generally low. Thus, the reliability of the data should be improved by taking the following measures.

Since the variation in treatment cost per case is basically unaffected by the introduction of water, the constant unit cost should be used for the estimation of savings in health care expenditures. The normal treatment costs of water borne diseases in the region should be estimated by looking at official and reliable sources, such as hospitals, doctors, pharmacies, clinics, etc., to verify the reported expenditures from the household survey.

Health indicators ideally have to be measured over a long time period to raise credibility of data. Also, people's understanding of water related diseases should be examined by requesting details of individual symptoms. Other possible underlying causes of diseases such as seasonality, locality, chronic diseases, as well as recent sporadic events are to be taken into account to prevent misleading conclusions. Triangulation methods to compare findings with secondary sources of data such as national studies on health and nutrition, hospital records, etc. should be also explored.

Assessment of a linkage between water and nutrition is critical and claims of changes in diet should be supported by contextual survey questions. A more rigorous study must be designed and conducted, including daily observations or records of food consumption. This may mean encouraging villagers to keep a detailed log of their food intake.

In our survey, hygiene practice questions should be structured by asking about practices not on an individual level but on a household level in order to conduct an accurate assessment on the household and community levels.

Additional health indicators can be designed to measure the foregone income due to illnesses resulting from poor access to water and sanitation. The amount of foregone income can be obtained by multiplying working days lost by adults due to water related sickness by the average daily wage.

2.3 Education

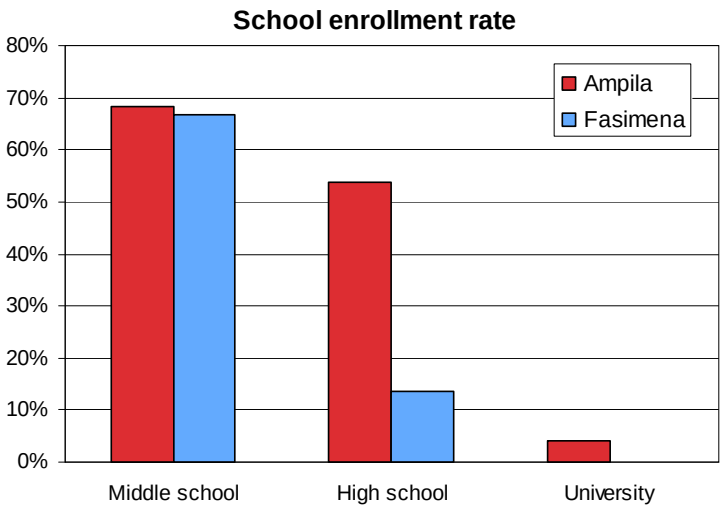
a. Findings

Among the children in the sample households, the average number of school absence days last month is slightly smaller in Ampila (2.0 days) compared to Fasimena (2.4 days). The enrollment rate for middle school is not different between the two villages while the enrollment rates for high schools and universities are significantly higher in Ampila (**Figure IV.3**). The completion rates show similar trends: the same completion rate for primary school and higher completion rates for middle and high schools (**Figure IV.4**). Therefore, Ampila demonstrates higher rates of school achievement at the higher levels of education. Based on the completion rates for each stage of education, we can estimate the expected lifetime income earned by children under 11 over their lifetime, which are 633 million MGA in Ampila and 572 million MGA in Fasimena. In other words, by taking the difference, approximately 60,850 MGA of additional future return,

which is equal to 35,800 USD, is expected to be earned in Ampila as a result of different rates of educational achievement.

Table IV.7: Indicators on education

	Ampila	Fasimena
School attendance		
average # school days missed last month	2.045	2.357
School enrollment		
% children attending middle school (11-15)	68%	67%
% children attending high school (16-18)	54%	14%
% children attending university (19-25)	4%	0%
School completion		
% children with CPE being the highest completed school level (11-25)	47%	47%
% children with middle school being the highest completed school level (16-25)	47%	16%
% children with high school being the highest completed school level (19-25)	8%	0%
Expected lifetime income		
Expected lifetime income per child under 11 (MGA)	18,075,861	16,337,248
Expected lifetime income in the sample households (MGA)	632,655,143	571,803,672



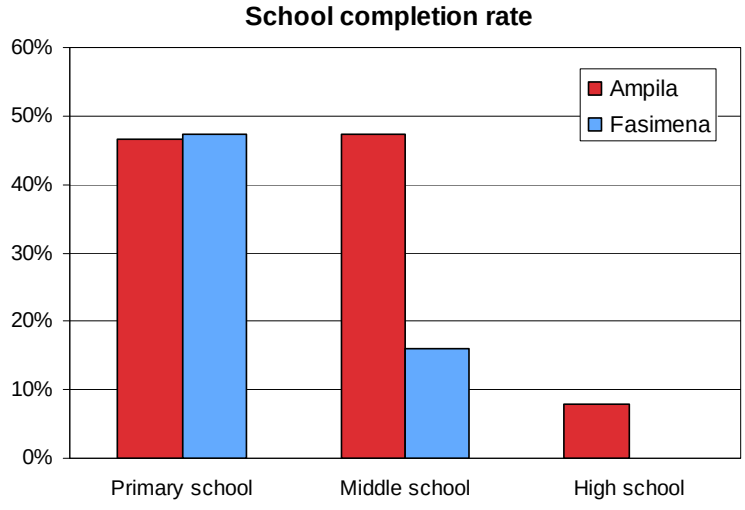


Figure IV.3: Enrollment rates by level of schooling **Figure IV.4: Completion rates by level of schooling**

b. Analysis

Our survey results support the conclusions of our literature review that fetching water is usually the task of women and children (WaterAid, 2004b). To further demonstrate this point, we averaged responses from Ampila and Fasimena and found that 65% of the sample households responded that women fetch the water, whereas 54% answered that children fetch the water. People spend an average of 113 minutes per day in fetching water from the river or natural sources. As will be discussed in the time saving section, access to the water from tap stands dramatically reduces the time and workload of those who collect water, and can explain the

improved attendance, enrollment and completion rates of children in Ampila. Initial interviews revealed that increased household wealth, increased family importance, and reduced household responsibilities at the crucial age for middle school were factors contributing to these changes in enrollment and completion.

Improved hygiene conditions were also observed and can be linked to the closer access to water and sanitation facilities. This eventually reduces the incidence and rate of water borne diseases, ultimately resulting in a lower rate of school absenteeism due to sickness. In addition, increased income and/or capital assets can also have affected the completion rate by helping parents pay tuition. In sum, all of the above delineated impacts of water projects may have worked simultaneously to result in a significant increase in enrollment and completion rates regarding higher levels of education in Ampila. Note, however, that we do not evaluate the direct effect of water access in schools but rather the indirect effects of water projects within the villages where children live. We assume that no observable difference in the rates for primary school enrollment is a result of the Government of Madagascar's recently adopted policies to ensure free and compulsory education for primary school students.

It is reasonable to expect that an individual who achieves a higher level of education will earn a higher level of income in the future. We estimate that approximately 1.7 million MGA in additional income will be obtained by a child in Ampila compared to one in Fasimena due to the completion of higher levels of education. By aggregating it according to the number of children under 11 in Ampila, the long-run economic impacts of water projects in the community level is quite substantial.

c. Model refinement

The most referenced link between increased access to water and education is rate of absence; if children are healthier, they will be more diligent (reference). In the specific context of Madagascar, we also expect school enrollment and completion to be affected by the water projects.

However, the complete monetary evaluation of the impacts on education would have required more information than was actually available. Additionally, we could not control for external factors that might have impacted school enrollment and completion. For instance, exogenous disturbances such as supplementary nutrition given in the schools in food canteen programs subsidized by the government or in the case of girls, the availability of water and sanitation in schools may have affected our results. Other factors that may have affected our results include

the distance from the house to the school, the availability of space in the schools[22], and tuition policies.

In addition, using data from schools and/or related governments would provide more reliable results in a more efficient manner. In our case, the unavailability of school records and census data forced us to exclusively rely on the household surveys to measure attendance, enrollment and completion. The availability of historical school records before the water projects began would enable us to exclude some of the external factors discussed above, which affect treatment and control villages differently.

Also, the calculation of future incomes is based on data from studies conducted in 1995 at a national level (Glick, 1999). Current country information on average wage preferably in the region in question should be used in order to improve the reliability of the data on current and future income levels.

2.4 Gender / Time Savings

a. Findings

Our survey results show that 68% of households in Ampila answered women fetch water normally[23]. Thus, women are the primary beneficiary from time saving in the village. Households in Ampila save on average 85 minutes per day collecting water. This is time saved resulting entirely from the installation of tap stands. The amount of time saved for the whole sample is 28.3 hours a day. Moreover, 95% of households in Ampila acknowledged the time saving effect from the water supply.

Approximately 45% of households spent their saved time for income generating activities: 41% of households answered they engaged in fieldwork such as rice and vegetable farming, 4% responded that they conduct other income generating activities. Also, 38% of households explained they could do more housework, such as cleaning the house, washing clothes, etc.

If we assume this saved time will be spent for any productive activities and therefore apply the average hourly wage of women without education for households/individuals (615.6 MGA/hour) as a potential income return, they could earn an additional 17,412 MGA a day, or 6.4 million MGA (3,740 USD) a year.

Similarly, the installation of latrines around the house enables a household to save 19 minutes a day on average, as prior to using latrines they were forced use this time on going into the forest. However, not all the households benefit from latrine provision; 38% of households answered they have saved time with latrines, whereas 37% of households did not recognize any time saving. Furthermore, more than 20% of the sampled households said they already had latrines

[22] When available seats in the nearest school run out, thus children are forced to go to a private school or a farther school which may impede them to enroll and complete, which affect values of our indicators.
[23] Please note that the % is different from the % in the health parts because in the health part, the % is calculated by taking the average between two villages.

before the project was launched in the village. The total time saved by the sampled households is 2.5 hours a day converted to economic values of 1,529 MGA a day or 0.56 million MGA (328 USD) a year. Given than 65% of the people collecting water are women, we can conclude that time saving related to water collection activities mainly benefit women.

Table IV.8. Time saving effect of water collection and latrine visits in Ampila

	Average per household	Total time saved		Additional potential income by time saving		
Unit	minutes/day	minutes/day	hours/day	MGA/day	MGA/year	USD/year
Water collection	84.9	1,697	28.3	17,412	6,355,294	3,740
Latrine visit	18.6	149	2.5	1,529	558,008	328

b. Analysis

Time saving is one of the most direct and easily measurable indicators with which to evaluate water impacts. Spending long hours every day for water collection deprives one of potential opportunities for other productive activities. In our survey, almost half of the sample households responded that they have used the time saved for income generating activities. Even if people spend the time saved on activities that are not directly linked to income generation such as washing clothes and cleaning their houses, these activities would improve their household's hygiene conditions and might have an indirect effect on their labor productivity and capacity.

The time saving effect of latrine provision is around one tenth that of tap stands provision. Although people usually spend less time in going to the bathroom than in fetching water, it does not necessarily mean that building latrines has less impact on the community. Unlike the water provision, the benefits of latrine provision are shared with all the family members almost equally. In our survey, the reason there is a smaller time saving effect is that the number of households who benefited from the latrine provision was limited. In addition, data reliability may be questionable since some of households might have answered for time saved not per household but per individual in our survey. In addition, there are some households who built pit latrines on their own initiative and funding, and our data might have included the time saving effect of those households.

c. Model refinement

The reliability of data on time saved from water collection is relatively high because, in most cases, respondents of the household survey are adult women who benefit the most from water provision. On the other hand, the data reliability for time saving due to latrine provision is questionable because of the reasons mentioned in the analysis section. We revised the survey questions to account for these factors.

In addition, the hourly wage we used to calculate additional potential income is the inflated value based on the data in 1994 for the urban non-educated women in households/individuals sector (Glick, 1995). It lessens the reliability of data since we recognize this might not necessarily fit the real situations in Ampila due to both changing economic conditions over time and urban/rural disparities. The use of more recent data could provide a more accurate calculation of the time

saving effects. Still, converting to economic terms provides an insight into the opportunity costs associated with time lost by the community before the projects.

The time saving effect is the only indicator through which comparison before and after the projects was possible in Ampila requiring different treatment from other indicators. Noting that other indicators evaluate the overall impacts of water on each area including the indirect ones through time saving, the values of potential additional income calculated in this section should not be simply aggregated with other economic values since part of time saving effects is reflected in other valuating indicators and combining them presents a risk of double counting.

2.5 Community Management

a. Findings

An interview with the president of the Water Committee revealed the following findings: the Water Committee and eight Tap Stand Committees are responsible for water management in Ampila.

The Water and Tap Stand Committees were established as part of the WaterAid intervention. They provides training for the newly established committees. The role of the Water Committee is to manage water and sanitation services including ensuring water source and water tank maintenance, and provide hygiene education to villagers.

Based on the interview with the president of the Water Committee, we found that members of the Water Committee and Tap Stand Subcommittees are selected through local elections. The preference in membership is given to those members who are women, social, able to write, read, and have knowledge of hygiene.

Each Tap Stand Subcommittee has established its own set of written rules. The following is the summary of different areas that the rules address:

1. Set the rules and decisions villagers should follow to maintain their tap stands properly; this includes regulating water use and intake especially during the dry season;
2. Arrange repair of facilities when necessary by asking local technicians from the Water Committee;
3. Establish a system for collecting contributions or user taxes;
4. Organize committee meetings and welcome guest events;
5. Information dissemination to villagers

By using ranking techniques that ask the respondent's degree of satisfaction with the Water Committee and Tap Stand Subcommittees' activities out of four scores (4=very well/happy, 3=well/happy, 2=not well/happy, 1=very poor/unhappy), we found the following:

- More than 70% of households chose 4 when asked for their impression of the committees' completion of works;
- 87% of households chose 4 when asked for their impression of the committees' problem solving function;

- 77% of households ranked their impression of the committees' member selection process as 4;
- 100% of households chose the rank of 4 with regard to the committees' decision making process;
- More than 80% of sample households think that the Water Committee listens to villagers;
- Over 60% of households have participated in the meetings organized by the Water committees and/or Tap Stand Subcommittees;
- 90 % of households think that the amount of water tax is fair.

Several households explained that in the past, the major water related problem in Ampila was chronic water shortage during the dry season, and the committees addressed the issue by regulating water usage to prevent over consumption.

An interview with a member of a Tap Stand Subcommittee revealed the committees have actively promoted hygiene education, although the effectiveness of the promotion was not evaluated.

Other possible influences on saving practices can be attributed to Compagnie, a community organization in Ampila and Fasimena that was previously mentioned. They promote basic social security functions consisting of taking rice as savings for insurance and ceremonial occasions that can be accessed by any community member who contributes to the cache. However, since this group is present in both in Ampila and Fasimena, we assume the impacts of their activities should be canceled out in our evaluation.

b. Analysis

We believe that the WaterAid interventions had the following impacts in the community through the introduction of water management institutions:

- Provide for the sustainability of the project through the promotion of community management; community organizations formed as a result of the water project help sustain the systems by being responsive to the communities' needs, investing in their water facilities as community assets, and continuing long-term maintenance;
- Improve health conditions of villagers through the promotion of hygiene practices by community organizations;
- Empower women as community leaders, elected as members of the community organizations;

These three effects identified through our research are critical conditions for sustaining increases in community welfare, but the project is still too nascent to valuate long-term monetary impacts of these effects on governance and community management. Thus, these have not yet been included in the economic benefit calculations.

However, we have been able to observe that the activities of the committees affect the villagers' behaviors, which ultimately can generate long-term economic and social benefits. For example, people tend to plant flowers around the tap stands as well as around their houses, practices which are encouraged by the Tap Stand Subcommittees. Though it is challenging to quantify the

psychological impacts, it is recognized that these activities are important for establishing an ensuing sense of community pride and ownership. Also, people limit water use based upon the committee's rules and suggestions so that they can sustain the reserve water in their tank. In the long run, these practices will provide a positive effect on the environmental, economic and social welfare of the community. Therefore, the analysis of water management and governance helps articulate the process of change in people's behaviors and in the socioeconomic welfare of the community.

The community's ability and willingness to save was used as an indicator in our measurement of community assets in both Ampila and Fasimena. Such measures can be affected by the existence of other organizations such as the Compagnie whose influences should be identified and excluded in the calculation.

There is a concern that reliability of some satisfaction indicators is not very high in our research. There reason is because a question such as are you happy with a decision making process of the water committee? did not address a specific process of decision making within the community organization. Thus, these types of questions might have been interpreted differently, and led to low credibility of answers from villagers.

c. Model Refinement

Evidence of improved water and sanitation on community management can be used to explain supplemental effects on economic benefits yielded from the water and sanitation project. Management capacity built through the project intervention may be responsible for improving social welfare in the community. It can be also used to support the connections of water to other areas of impact by specifying the influences that water management institutions have on people's behavior in the community.

Investigating the possible external influences from other community activities and organizations should be conducted by identifying how and when the management capacity has been developed and by whom. There might be other ongoing project activities that build community capacity to manage water and sanitation, thus income increases. In that case, economic benefits should be extrapolated from the impacts of our study.

Another function of community governance that should be analyzed further, is the creation of a forum for developing and carrying through new projects and initiatives based upon identified community needs. The institution of rice storage initiated by the Water Committee in another rural village of Madagascar, Tsinjony, is possible evidence that water governance could have a multiplier effect of increasing the community capital in the long run through a community organization established by the project. Although these initiatives were not observed in Ampila through our field-testing, this connection of community governance and increased community capita should be taken into consideration for further research.

2.6 Statistical Analysis

In order to examine whether there is a statistically significant difference in the monetary values

of income and livelihoods that we measured in Ampila and Fasimena, we conducted, and recommend using in future studies, a two-sample hypothesis testing (t-test) for unpaired samples assuming that households surveyed are randomly chosen and that production amounts of livelihoods and savings are normally distributed over the households in both communities. The results of analysis are show in **Annex II**. Although the test does not show any statistically significant difference in the amounts of rice, vegetables and fruit, livestock and other production between Ampila and Fasimena, this should be attributed to the small sample size of our survey (n=21). Even when comparing the amount of savings and health costs, the differences of which are numerically substantial, the statistical difference is not significant. Thus it is quite important to pay a careful attention while interpreting the results of our field-testing and to reserve any assertion of the causality between the projects and observed increase in community welfare considering the pilot nature of our survey. In order to have a statistically significant result, it would be necessary to increase the number of households in the sample size, as well as strengthening the evidence of linkages to judge the genuine impacts of the project.

2.7 Overall Summary

Table IV.9 shows the overall summary of the model testing in the field.

Table IV.9: Summary of benefits analysis

Model design				**Model Test Results**		
Assumed impact of water	Indicators	Critical Assessment		Results		Benefits by water provision
		Indicator validity	Data reliability	Ampila	Fasimena	Ampila - Fasimena
Income and livelihoods						
Increase in community wealth	monetary value of vegetable and fruit production	high	high	34,695,595	29,340,025	***5,355,569***
	monetary value of livestock capital	medium	high	39,227,300	49,959,767	**-10,732,467**
	monetary value of other productions	medium	high	10,786,000	25,088,000	**-14,302,000**
	monetary value of rice production	medium	high	25,927,000	19,581,624	**6,345,376**
	monetary value of savings (money and rice)	medium	high	6,564,600	581,500	**5,983,100**
	monetary value of housing	low	low	Not collected	Not collected	**0**
Total Amount of Monetary Value						**-9,718,764**
Health						
Decrease in diarrhea cases	# diarrhea cases in the community in the last two weeks	high	very low	3,900	14,200	**10,300**

Hygiene Practice	Average # of bathing per week	high	medium	3.95	1.99	**Positive**[24]
	% of respondents that wash hands after using latrine	high	medium	With soap=48% Without soap=29 % No=24%	With soap =52% Without soap=29% No=19%	**Not clear**
	% of respondents that wash hands after changing babies	high	medium	With soap =50% Without soap=17% No=33%	With soap =57% Without soap=29% No=14%	**Not clear**
	% of respondents that wash hands before cooking	high	medium	With soap =48% Without soap=52% No=0	With Soap =38% Without soap=43%, No=14% NA=5%	**Not clear**
Improved nutrition	# households in the community eating minimum daily requirements	medium	very low	3	0	**Not clear**
Total Amount of Monetary Value						**10,300**
Education						
Decrease in school absenteeism	# school days missed in the last month	low	low	2.05	2.36	**Not clear**
Enhanced school enrollment	% children enrolled in middle school	high	medium	68%	67%	**Not clear**
	% children enrolled in high school	high	medium	54%	14%	**Positive**
	% children enrolled in university	high	medium	4%	0%	**Not clear**
Enhanced school completion	% children with CPE being the highest completed school	low	medium	47%	47%	**Not clear**
	% children with middle school being the highest completed school	low	medium	47%	16%	**Positive**
	% children with high school being the highest completed school	low	medium	8%	0%	**Positive**
	% children with university being the highest completed school	low	medium	0	0	**No Impact**
Increase in community wealth	Expected lifetime income for children under 11	High	low	632,655,143	571,803,672	**60,851,470**
Total Amount of Monetary Value over the lifetime of children under 11						**60,851,470**

[24] The 'positive' category refers to a non statistical statement of possible impact. We expect that the statistical significance of the variables with *Impact* could change if the sample size increases.

Gender / Time saving						
Time saving	Average time saved for water provision per day by each household (minute)	high	high	84.9	NA	**Positive**
	Average time saved for sanitation provision per day by each household (minute)	high	high	18.6	NA	**Positive**
	Additional potential annual income from water provision	high	high	6,355,294	-	**6,355,294**
	Additional potential annual income from sanitation provision	high	high	558,008	-	**558,008**
	Person who usually fetch water	high	high	**Women=67.6 %** Men=32.4%	NA	
Total Amount of Monetary Value						**6,913,302**
Community governance						
Sustainable community management	% of respondents that evaluate completion of works by Water Committees as highest rank	high	high	70%	NA	**Positive**
	% of respondents that ranks the highest satisfaction with problem solving	high	medium	87%	NA	**Positive**
	% of respondents that ranks the highest satisfaction with member selection by WC	high	medium	77%	NA	**Positive**
	% of respondents that ranks the highest satisfaction with decision making process by WC	high	medium	100%	NA	**Positive**
	% of respondents that think WC listen to villagers	high	high	90%	NA	**Positive**
	% of respondents that have participated in meetings of WC	high	high	62%	NA	**Positive**
	Opinions on the price of water tax	high	high	**Fair=90.5%,** Cheap=9.5%	NA	**Positive**

3. Refinement of Data Collection Instruments

Two important instruments utilized in our field-testing, the Focus Group Guide and the Household Survey Questions, have been refined according to a number of elements discussed in our model refinement sections that are based on our field research experiences.

Focus Group Guide

Our Focus Group Guide shown in **Annex IV.1** comprises two sections; the earlier section includes questions for a control unit without a project intervention, and the latter section includes questions for a treatment with water and sanitation facilities provided by a project intervention. The main objective of the earlier section is to conduct preliminary research in order to discover the socio-economic situation as well as conditions of water and sanitation in the unit of analysis of that control unit. Questions in the earlier section are to be directed toward a chief of the unit and/or members of community organizations. Findings from the focus group interviews fine-tune the scope of areas that are affected by project intervention. This contributes numerous ideas around which to develop a linkage between water and specific production activities for designing household survey questions.

The latter section guides researchers to identify impacts from the project intervention at the community level. Findings are to be examined and compared with results obtained through household surveys to verify survey results. The latter half of this section highlights water governance by identifying potentially affected areas, including community participation, project sustainability, women empowerment, and hygiene practice. Findings reveal ways that project intervention can influence community management.

Household Survey Questionnaire

Our Household Survey questions shown in **Annex IV.2** are designed to identify a linkage of water and sanitation to the selected indicators to measure the impacts resulting from project interventions. Some questions aim to capture people's behavioral patterns by assessing the likelihood and tendency of community members to do certain things, like save money. By asking contextual questions that aim to identify people's perceptions, researchers can identify values, opinions, and psychological elements of a community, which can help them identify the multiple economic and social benefits that improved access to water and sanitation can have on individuals.

V. RECOMMENDATIONS

We are presenting the following three categories of recommendations for WaterAid Madagascar based upon the findings and observations of our study: use of our model; future possible expansion of the model; and policy connections. Most of our detailed and specific recommendations are interwoven with the Results and Analysis section. They are also reflected in our edited household survey and excel tools. Below, we try to capture our main suggestions and provide inspiration for continuing and further developing our model from the past six months.

Use of the Model

a. Validity of Indicators

1. *Collecting Baseline data*: WaterAid, partners or organizations with similar research questions need to specify the areas and indicators they hope to track from the inception of a project and consistently track there after. In order to increase the validity of the findings, project evaluations should be based on inter-temporal comparisons within the same community. While our model can be replicated using spatial comparisons when adequate baseline data is not available, we strongly recommend refining baseline data collection.

   We also recommend supporting the collection of specific data from the identified impact areas and specific indicators. This requires cooperation from the community at the project site to track indicators such as school enrollment and completion, changes in instances of sickness, or Water Committee meeting notes. Information on other organizations could greatly expand the potential analysis of the impacts of the projects.

2. *Proving the Impact*: We strongly recommend conducting systematic evaluations linking and demonstrating the connection of water and sanitation projects to each of our identified areas and indicators. By providing a more rigorous analysis of how water connects to impact areas, it further solidifies potential messages and increases the validity of the indicators. We are including a possible water demand chart in **Tables V.1 and V.2** that we designed but were unable to implement. Understanding the specific relationship and nature of each impact is crucial to justify the monetary benefit analysis. This should not be a primary focus of time or resources for WaterAid but part of the initial preliminary assessment to identify the scope and focus of the subsequent valuation study in the selected communities. Questions from this tool can be incorporated into the household survey if more reliability is required.

3. *Diversifying Data Sources*: We recommend promoting data triangulation to improve data validity. This includes monitoring studies from other local, regional, national, or international organizations. This also includes helping to maintain strong partnerships with other active actors in the region. For example the current works of SIRSA could significantly support or advance the monetary evaluations of agricultural products and livestock. Data collected by CISCO needs to be examined more closely to identify the

possible reliable information on education. They also provide crucial data and studies that validate preliminary findings from this project.

4. *Increasing Sample Size*: We recommend increasing the sample size in the full application of our model and instruments to get representative and definitive results for the benefits assessment.

5. *Integrating Data Comparison Techniques*: Another technique is to identify a control community without a WaterAid project to be used as a comparison to the WaterAid village being monitored. Monitoring a control village has potential to reveal regional trends or other factors exogenous to the water projects. Future projects could also use the control village approach for more rigorous triangulation. The use of both baseline data and a control village will allow further and more comprehensive analysis of the benefits and impacts.

b. Reliability of Data

6. *Clarifying Survey Questions:* Additional time and resources need to focus on the translation of survey questions. Conveying ideas, especially abstract ideas such as psychological impacts, environmental sustainability, or community management, requires additional linguistic skill. Many of our questions, specifically ones which were qualitative in nature, were not adequately translated into Malagasy or conveyed clearly. We have lower reliability of our data in the community management section because of the concern that questions were interpreted differently or not phrased in a way that elicits standard or common responses. For example concepts of social organization or social legitimacy are challenging to translate into Malagasy and in areas where these structures were only recently introduced. While we have refined our survey, there are still significant opportunities to refine these questions further.

7. *Increasing Consistency in Survey Answers:* We also encourage continuing to refine our survey to increase reliability of data. Sometimes we observed inconsistent, often contradicting, answers from villagers not only due to inaccurate memory they have but also due to ambiguous wordings or because there was not a straightforward flow of questions in our questionnaire. We have made revisions to put contextual questions in the specific order to help remind them of the past events. This effort should be made through repeated testing of the survey and future surveys should be aware of our efforts to modify and remedy these reliability concerns.

Future Studies and Focus Areas

The following are recommendations for future studies in specific areas.

a. Other Contexts

We recommend conducting critical assessment of our survey tools before applying the model to other parts of Madagascar since this survey was specifically designed for Ampila and Fasimena

and would not accurately reflect or measure conditions in every part of the country. Any future study in Madagascar should use our model and techniques but be aware that certain dynamics will change in other communities. These could include some of the following: water scarcity, geographic and climate variation between regions, major natural disasters, primary economic production, or communal/regional social dynamics. We therefore recommend initial assessments of each new site location, identifying how local conditions impact water use.

b. Other Scales of Analysis

This model was designed for the community level analysis of specific projects. There is a potential for expanding this into a larger scale trying to estimate regional or national trends.

For a regional analysis, WaterAid would need to monitor several villages (with inter-temporal comparison of before and after). This multi-location approach would aim that statistical studies can reveal trends and further substantiate arguments for the impacts of the WaterAid projects. By giving insights into large-scale trends, this will potentially help further solidify advocacy messages.

c. Other Methodologies

For lack of available baseline data, this model adopts a static approach, by comparing two communities at one time, after the project was implemented. A more comprehensive and dynamic approach could be used to compare the evolution of the two villages. This implies monitoring both the treatment and the control communities on two time scales, both before and after the project. This methodology is based on evolutional comparison rather than situational comparison. It encourages further and more comprehensive analysis of the benefits and impacts.

Monitoring a control village has potential to reveal regional trends or other factors exogenous to the water projects that the static approach fails to capture. Future projects could also use this type of technique for more rigorous triangulation.

We also recommend using a Participatory Approach to include community based monitoring and involvement in the process. This could include partnering with local universities or academic institutions permanently located in the region. This would enhance the quality of data collected and the variety, perhaps increasing the potential for better triangulation.

d. Partner with Local Universities or Organizations

This project could be greatly aided through a formal partnership with a local university, whose faculty and students could provide additional support and continuity of the project. Their field presence and contacts could greatly benefit future monitoring efforts.

e. Other Indicators

1. Community Management

Based upon our observations and information gathered from our interviews, one possible future study should focus specifically on developing a systematic valuation methodology for the impacts on community management and governance. We also recommend further study of the relationship of water committees and its members to newly initiated community driven projects.

We also suggest measuring the impacts of water committees on local social structures. The water committees codify basic rules for social behavior, providing forums for conflict resolution and establishing legitimate authority with the capacity. These are crucial structures for ensuring development projects being sustained.

Our hypothesis remains that the introduction of a water committee provides important structure for community to articulate their goals and needs. The committee provides authority to organize the community. By gaining the community's respect, they are able to develop and implement new projects by community's initiatives. These are significant changes within the social dynamics of the communities. We therefore suggest using or initial survey and expanding on the new QIS techniques.

2. Gender Related Issues

We observed a strong relationship between the improved access and safety of water to the social role of women in the community. We therefore recommend that a future study integrate gender perspectives more systematically into each indicator. In order to achieve this, we recommend several issues of consideration. The first is to increase gender differentiation in the number of questions directly related to water. The second is to consider how gender is impacted in our different areas of analysis. For instance, a more systematic study of the number of community leadership positions assumed by women reflects changing importance and capacity of women's social roles. This has a potential to be linked to economic benefits[25].

3. Psychological Effects

This area also showed an extreme potential in our initial interviews. While a very soft side of the impacts, communities responded very positively to questions about how they perceived their community with the new water and sanitation systems. Potential indicators could include improved hygiene[26], community pride[27],

[25] For example, the first team's interviews with the Mayor of the Commune of Tsarasotra revealed that villages with water committees were active in regional trade fairs and economic expositions. Our team was unable to investigate the impact of this participation but noted that it was primarily women taking the active role. Therefore, if there were monetary benefits from participation in the activities, that could be ascribed to the empowerment of women in the community based upon the water project and newly formed water committee.

[26] Ampila, Vohimalaza Sud, and Tsinjony all reported and showed us new enclosed structures for showering and bathing. These private washing facilities both encourage additional bathing but also provide the crucial privacy for women. This also impacts the more abstract concepts of individual dignity.

[27] This requires a systematic survey to assess claims observed during the first team's visit, where Ampila, Tsinjony and Vohimalaza Sud directly spoke about their community pride and honor for having the functioning water systems

village beautification, or improved health and nutrition. These require more time and expertise to interpret but can provide information important for a broader advocacy campaign. These categories can also require the quantitative-qualitative methodology to transform the concepts into presentable numbers.

4. Environmental Sustainability

This area should also be studied in more depth. Other forms of analysis include scientific evaluations of pollution rates in the river and soil. The first group also noted that reforestation projects supported by SAF/FJKM around the source of water for the villages, raised awareness of the connections between their actions (deforestation) and environmental goods (water quantity and quality). This could be studied by looking at the connection of public awareness to behaviors like reforestation efforts or reduction in charcoal production, a profit generating activity which unsustainably burns vegetation. One technique would be to estimate the economic value based on potential avoided costs for replacing or substituting lost ecosystem services. For example, if water quality is improved, the value is equal to the measure cost of controlling pollution.

5. Incomes and Livelihoods

We recommend measuring the relative importance of each animal to the overall production in the village. Ideally, this is part of the initial assessment to verify the role each species of livestock plays in the community and their dependence on water and sanitation programs. See **Table V.1** of the relative ranking for an example of how to present these findings. This chart connects perceived importance of animals with water demand.

The indicators for incomes and livelihoods can be refined further by applying the concept of "increased community resilience and food security." The underlying idea is that capital assets not only have the short-term market values but also significant long-term and indirect consequences for community self-sufficiency and reliability of food sources and incomes depending on what and when to produce based on the local circumstances in food availability. Techniques to measure this indicator include the value of goods produced during dry periods, the avoided cost of food and or supplies purchased.

6. Housing

The connection between access to water and sanitation and improved housing is indirect. Yet, if water and sanitation contribute to the improvement of the general community welfare, housing is a form of investment and stored wealth. Moreover a village with access to water and sanitation is more likely to attract migrants than a village without access. This could lead to an increase in house building leading to an increase in labor demand, etc. One example was a narrative from a family that identified their son as having returned to the village once water systems were available. He built is own house and resettled in the village.

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and additional sanitation facilities. This was also mentioned when the first team tried to assess technology diffusion in the region. This area would need additional and more systematic study but has raised initial questions.

Though the monetary valuation is particularly challenging due to the immaturity of the real estate market in the region, housing improvement could potentially bring dramatic structural economic change to the community.

Thus, we recommend that indicators should be developed to measure this connection. This would require a very specific and rigorous step-by-step analysis to ensure the validity of the indirect link with water and sanitation.

Policy Implications

1. Our findings suggest that the access to clean and reliable water as well as improved sanitation services are basic requirements for socio-economic development. With further study and more representative data, this model could more accurately portray systemic changes within the different units of analysis as a result of access to clean water and improved sanitation systems.

2. These projects have short and long term impacts. The short term impacts include increased community wealth and improved health. The long-term benefits include increased income due to higher levels of education. It also includes slow changes in social structure and organization due to active water committees. It is important to emphasize the benefits over a long time period.

3. We recommend using the framework of analysis that links the impacts of water and sanitation to other larger development goals and priorities. This includes the ambitious goals of the MAP. Water and sanitation services have demonstrated connections to achieving MDGs and national development priorities.

4. Emphasize quantitative evidence including increased capital assets, increased expected future return from education, and reduced health care costs.

5. Emphasize qualitative findings: increased community management, institutionalization of management body, empowerment and the sense of ownership for women, and psychological impacts.

Table V.1: Water demand and characteristics for livestock

Characteristics of Demand and Benefit	Cows (Zebus)	Chicken	Fish	Pigs	Ducks	Rabbits	Hives
Frequency of use (daily, several a week, weekly, monthly)							
Times washed per week							
Current quantity used per wash							
Quantity needed per (time?)							
Times given drinking water per week							
Current quantity used per Day							
Actual Quantity needed per Day							
How critical is good water quality (high, medium, low)							
Season variation in water demand							
Growing season							
Harvests per year							
Priority within village							
Site of use (home, near home, fields, within community)							
Source of water							
Direct benefits							
Monetary value							
Indirect benefits							
Sustainability							

Source: Adapted from IWMI (2006) and WaterAid (2004c)

Table V.2: Water demand and characteristics for vegetables and fruit

Characteristics of Demand and Benefit	Green bean	Tomato	Cucum-ber	Zucchi-ni	Spinach	Potato	Sweet potato	Cassava (manioc)	White bean	….
Frequency of Use (daily, several times a week, weekly, monthly)										
Current Quantity Used Per Day										
Actual Quantity Needed per Day										
How critical is good water quality (high, medium, low)										
Season variation in water demand										
Growing season										
Harvests per year										
Priority within village										
Site of use (home, near home, fields, within community)										
Source of water										
Direct benefits										
Monetary value										
Indirect benefits										
Sustainability										

Source: Adapted from IWMI (2006) and WaterAid (2004c)

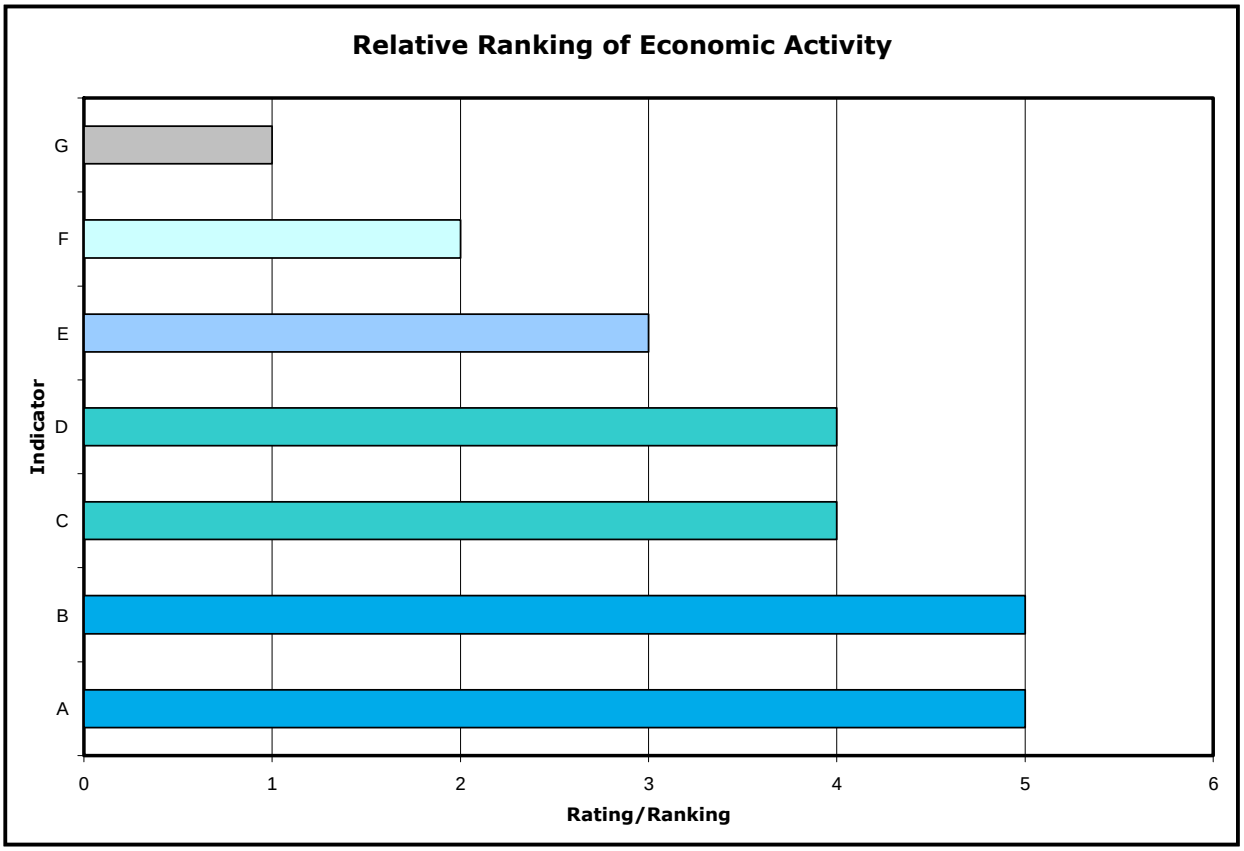

Figure V.1: Relative ranking method

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ANNEXES

ANNEX I

1. LIST OF FOCUS GROUPS AND INTERVIEWS

Organization and Interviewee	Location	Subject	Date
Mayor of Ambositra, Administrative Director, Finance Director	Lapan'ny Tanana	Regional information and water governance	8-Jan
Chief, eldest member, former school master of the community, and the Water Committee	Tsinjony	Community characteristics and impacts of project intervention	8-Jan
SAF/FJKM	Ambositra	Project activities about water and sanitation	9-Jan
Chief of the village, Community Members	Vohimalaza Nord	Community characteristics and impacts of project intervention	10-Jan
Chief of the village, Community Members, the Water Committee	Vohimalaza Sud	Community characteristics and impacts of project intervention	10-Jan
Systeme d'information Rurale et de Securite Aliementaire(SIRSA)	Ambositra	Regional information of local agricultural market	11-Jan
Mayor of Ambositra II, Deputy Mayor	Ambositra	Regional information	11-Jan
Mayor of the community	Antoebositra	Characteristics of the community that has no water and sanitation	11-Jan
Community members	Ampila	Community characteristics and impacts of project intervention	11-Jan
Caisses d'Epargne et de Crédit Agricole Mutuels(CECAM)	Tsarasotra	Micro-credit Loans and program in Tsinjony and Manarimony	14-Jan
Community members	Amboniarivo	Characteristics of the community that has no water and sanitation	14-Jan
Secretary, Treasurer	Tsarasotra	Community governance and project intervention	14-Jan
Chief of the community	Manarimony	Characteristics of the community that has no water and sanitation	15-Jan
Community members	Fasimena	Characteristics of the community that has no water and sanitation	15-Jan
World Bank	Antananarivo	World Bank Monitoring and Evaluation Programs in Madagascar	17-Jan
Service de l'Assainissement et du Génie Sanitaire		Health impacts	18-Jan
Chef de Region Amaron'I Mania	Ambositra	Regional policy and water projects	11-Mar
Mayor of Ambositra II,	Ambositra	Regional development plan and education	11-Mar
High School	Ambositra	Data collection	12-Mar
Middle School	Ambositra	Data collection	12-Mar
Elementary School	Ambositra	Data Collection	12-Mar
President of the Water Committee	Ampila	Community governance	13-Mar

ANNEX II

2. HOUSEHOLD SURVEY RESULT

i. Incomes and Livelihood

Ampila

Household		H 1	H 2	H 3	H 4	H 5	H 6	H7	H8	H9	H10	H 11	H 12	H 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21
Tap Stand #	Unit	#1	#4	#5	#3	#6	#4	#2	#2	#6	#7	#5	#3	#1	#3	#6	#8	#7	#5	#2	#2	#8
Rice																						
Rice	Kg/yr	140	1200	800	210	0	700	4875	4875	975	200	2400	1000	1000	1000	0	210	200	500	360	2925	
Vegetables/fruit																						
Green beans	kg/yr	0	80	120	50	0		60	0		10	140	0	0	300	50	0	144	60	20	0	0
potatoes	kg/yr	0	0	0	0	0		50	0	0	10	30	0	0	0	0	0	400	100	10	0	2000
sweet potatoes	kg/yr	0	0	150	300	200	120	600	0	90	50	900	300	90	1800	1000	45	1000	250	200	30	1000
white beans	kg/yr	0	80	0	300	6.67		60	0	6.7	3.3	20	33	6.7	20	200	27	5	60	30	17	0
manioc	kg/yr	0	0	150	0	2,000	75	300		90	100	375	300	140	210	2000	35	1000	250	200	0	0
tomatoes	kg/yr	0	0	3	12.90	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
cucumbers	kg/yr	0	75	174	0	15	0	200	0	0	15	0	0	0	50	50	50	20	15	15	0	0
zucchini	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	210	2000	35	1000	250	200	0	0
peas	kg/yr	0	0	9	0	0	0	60	0	0	3.3	0	0	0	1	3	10	60	0	10	0	0
tarro	kg/yr	0	0	0	0	0	0	25	0	0	0	0	0	0	0	60	45	60	0	10	0	0
Spinach(brèdes)	kg/yr	0	0	0	20	0	0	20	0	7	10.5	105	10.5	0	240	0	0	1440	25	10	0	0
hot peppers	kg/yr	10	0	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	5	0	0	0

onions	kg/yr	0	9	10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	200	0	0
soy beans	kg/yr	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	10	0	7	0
vopoa	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	5	0	0	0
peanuts	kg/yr	0	4000	0	0	0	0	26	0	0	10	16.7	0	0	0	200	0	3	100	40	0	0
coffee	kg/yr	0	0	10	0	0	0	0	0	10	0	0	0	0	0	0	8	0	3	0	0	0
bananas	kg/yr	0	16	26	10	0	0	10	0	0	150	0	0	0	20	0	0	0	45	15	0	0
oranges	kg/yr	0	40	50	0	0	0	75	0	40	0	160	40	2	100	0	0	0	30	30	8	0
peaches	kg/yr	0	40	80	8	0	0	20	0	72	20	300	96	10	0	36	0	0	30	15	20	0
corn	kg/yr	0	0	5	90	0	40	180	0	10	50	480	50	0	120	200	0	200	100	0	30	0
mangos	kg/yr	0	0	0	0	0	0	0	0	0	0	0	80	0	30	8	0	0	30	0	0	0
grapes	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pineapples		0	0	10	0	0	0	0	0	0	0	0	0	0	75	0	0	0	20	0	0	0
shushu	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
loquat	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0
squash	kg/yr	0	0	60	8		0	0	0	0	0	0	0	0	0	0	0	25	18	0	0	0
apple	kg/yr	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
papaya		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chickpeas/garbanzo bean (voanjobory)	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cabbage	kg/yr	0	0	0	0	0	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
persimon	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A type of cucumber(sasoety)	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
livestock																						

cows & zebus		1	3	3	4	5	2	2	0	3	1	2	1	1	1	1	2	1	0	0	4	1
pigs		2	8	1	1	1		1	0	1	1	1	0	0	0		3	1	2	0	1	0
chickens		0	0	8	2	4	0	20	5	8	3	7	4	4	0	3	11	0	2	14	7	0
fish		0	0	0	0	0		0	0	0	0	0	0	0	0	0	200	100	100	0	100	0
hives		0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0
other products																						
geranium		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
manioc stems/stalks	kg/yr	400	1	0	0	0	0				40	40	40	30	0	1000	0	0	0	0	0	0
wood sculptures	MGA	1040 000	0	0	0	1000 000	0	0	0	0	0	0	0	0	2000 00	0	0	0	0	0	0	0
weaved products	MGA	1200 00	0	0	0	1500 00	0	0	0	0	0	0	0	0	0	0	2000 0	9600 0	0	0	0	0
terracota pots	MGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bricks	pcs	0	0	0	0	0	0	50,00 0	50,00 0	20,00 0	60,00 0	30,00 0	0	0	0	4000 0	0	0		1500 0	0	0
potteries	MGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cakes	pcs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
traditional medicine		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1000 0	0	0	0	0
Savings																						
rice		0	0	0	0	0	0	4000	0	200	0	600	600	0	66	0	0	0	0	0	0	0
money	MGA	120,0 00	0	0	12,00 0	0	0	0	0	0	0	0	0	0	1600 00	0	2000 00	6000 0	0	0	0	0
Housing																						0
new houses	per year	3	8	8	0	0	0	6	5	6	3	2	0	0	2	3	1	2	3	0	4	0

Fasimena

Household		H 1	H 2	H 3	H 4	H 5	H 6	H 7	H 8	H 9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21
Rice																						
rice	kg/yr	350	4000	600	350	140	70	0	2,000	360	300	96	0	30	1950	400	945	2833	257	390	585	2145
Vegetables & fruit																						
green beans	kg/yr	48	0	0	0	0	0	0	10	0	3.3	0.0	0.0	3.3	6	0	0	20	0	0	0	15
potatoes	kg/yr	90	0	0	0	0	0	0	1000	0	5	0	0	0	190		0	0	0	0	200	60
sweet potatoes	kg/yr	0	0	0	0	0	0	0	3600	1800	100	5	0	100	300	40	0	500	70	30	2700	5400
white beans	kg/yr	0	400	1.33	0	0	2.28	0	26.7	26.7	13.3	16.7	0.0	16.7	100	10	0	333	7	20	23.3	50
manioc	kg/yr	0	0	0	0	0	0	0	300	450	200	60	30	180	300	40	0	500	70	12	5400	10800
tomatoes	kg/yr	0	0	0	0	0	0	0	540	0	5	0	0	0	25	0	0	0	0	0	0	0
cucumbers	kg/yr	0	0	0	0	0	0	0	40	0	3	0	0	0	60	0	0	90	0	0	0	20
zucchinis	kg/yr	0	0	0	0	0	0	0	0	0		0	0	0	60	0	0	0	0	0	0	20
peas	kg/yr	0	0	0	0	0	0	0	250	0	3.3	0	0	0	10	0	0	0	0	0	0	0
tarro	kg/yr	0	0	0	0	0	0	0	75	120		10	0	0	0	0	0	500	0	0	0	30
Spinach(brèdes)	kg/yr	8	0	0	0	0	0	0	90	30	24	0	0	12	25	0	0	20	0	0	0	0
hot peppers	kg/yr	0	0	0	0	0	0	0	100	0	0.625	0	0	4	20	0	0	0	0	0	0	0
onions	kg/yr	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
soy beans	kg/yr	0	0	0	0	0	0	0	33.3	6.7	10	0	0	0	100	0	0	10	0	0	0	0
vopoa	kg/yr	0	0	0	0	0	0	0	12	0	0	0	0	3	20	0	0		0	0	0	0
peanuts	kg/yr	0	0	0	0	0	0	0	75	0	2.7	0	0	0	570	0	0	0	390	0	0	0
coffee	kg/yr	0	400	0	0	0	33.3	0	0	0	0	1.7	0	0	0	0	0		0	0	0	15
bananas	kg/yr	0	0	0	5	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0
oranges	kg/yr	0	0	0	0	70	0	20	600	0	120	0	0	0	0	0	0	0	0	0	0	0
peaches	kg/yr	480	0	0	15	40	0	6	1200	40	20	20	0	36	0	0	0	0	0	0	0	0
corn	kg/yr			0	50	0	0	0	54	60	20	72	0	150	450	0	0	1000	10	180	0	50
mangos	kg/yr	0	0	0	0	0	0	0	30	0	20	10	0	0	0	0	0	0	0	0	0	0
grapes	kg/yr	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0
pineapples		0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
shushu	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
loqoat	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

squish	kg/yr	50		0	0	0	0	0	0	0	0	0	0	0	50	0	0	25	0	10	0	0
apple	kg/yr	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
papaya		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chickpeas/garbanzo bean(voanjoboy)	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	0	0	0	0
cabbage	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
persimon	kg/yr	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
A type of cucumber(sasoety)	kg/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	0	0	0	0
Livestock																						
cows & zebus		0	0	0	0	0	0	0	0	5	5	0	0	0	1	0	0	0	4	0	0	1
pigs		0	3	2	1	0	0	0	14	0	0	0	0	1	0	0	0	0	3	2	1	1
chickens		0	9	0	0	6	0	0	50	7	15	8	4	10	20	0	1	20	3	10	6	25
fish		0	0	0	0	0	0	0	3000	1200	200	0	0	0	0	0	0	0	80	0	0	100
hives		0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Other Products																						
geranium		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
manioc stems/stalks	kg/yr	0	0	0	0		0	0	0	100	30	25	0	0	900	0	0	0	0	0	0	0
wood sculptures	MGA	0	0	0	0	0	0	0	0	0	0	0	36000	0	0	0	0	0	0	0	0	0
weaved products	MGA	0	0	0	0	0	0	0	36000	0	72000	0	0	0	0	0	0	0	0	0	0	0
terracota pots	MGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bricks	pcs	0	0	0	20,000	0	0	0	0		50000	0	0	0	0	0	0	100000	10000	0	20,000	3000
potteries	MGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cakes	pcs	0	0	0	0	0	18300	0	0	0	0		0		0	20160	0	0	0	33.3333	0	0
traditional medicine		0	0	0	0	0	0	0	0	0	0	0	0	0	180000	0	0	0	0	0	0	0
Saving																						
rice		0	0	0	0	0	0	0	300	120	0	0	0	0	0	45	0	0		0	0	0
money	MGA	0	0	0	0	0	0	0	0	10000	0	0	0	0	60000	0	0	0	0	0	0	0
Housing																						
new houses	per year	5	5	5	0	0	0	0	6	6	1	3	0	2	3	3	0	0	3	3	6	1

ii. Health

Ampila

	# cases of diarrheas in the last two weeks	total medical care cost to cure one case of diarrhea (medicine, consultation, etc.)	# cases of bilharziose	total medical care cost to cure one case of bilharziose (medicine, consultation, etc.)	total cost for the household	Rice consumed kg/week	# protein-based meals consumed a week (assumption: 1portion = 100g)	# of proteins per portion	# vegetable-based courses consumed a week	Total protein gain per individual per week	Total vitamin gains per individual per week
H 1	0	0	0	0	0	16	21	26.41	21	554.61	0
H 2	0	0	0	0	0	12	21	26.41	-	554.61	NA
H 3	0	0	0	0	0	8	21	26.41	-	554.61	NA
H 4	0	0	0	0	0	12	1	26.41	7	26.41	0
H 5	0	0	0	0	0	18	1	26.41	1	26.41	0
H 6	0	0	0	0	0	18	2	26.41	3	52.82	0
H 7	0	0	0	0	0	10	1	26.41	21	26.41	0
H 8	0	0	0	0	0	6	1	26.41	21	26.41	0
H 9	0	0	0	0	0	9	0.25	26.41	21	6.60	0
H 10	0	0	0	0	0	10	0.25	26.41	21	6.60	0
H 11	0	0	0	0	0	8	1	26.41	14	26.41	0
H 12	0	0	0	0	0	6	0.25	26.41	14	6.60	0
H 13	0	0	0	0	0	8	0.04	26.41	14	1.10	0
H 14	0	0	0	0	0	24	1	26.41	14	26.41	0
H 15	3	1000	0	0	3000	36	0.25	26.41	21	6.60	0
H 16	0	0	0	0	0	42	3.5	26.41	21	92.44	0
H 17	1	900	0	0	900	48	0.083	26.41	21	2.20	0
H 18	0	0	0	0	0	60	0.5	26.41	21	13.21	0
H 19	0	0	0	0	0	24	0.25	26.41	21	6.60	0
H 20	0	0	0	0	0	91	4	26.41	17	105.64	0
H 21	0	0	0	0	0	52.5	7	26.41	14	184.87	0

Fasimena

	# cases of diarrheas in the last two weeks	total medical care cost to cure one case of diarrhea (medicine, consultation, etc.)	# cases of bilharziose	total medical care cost to cure one case of bilharziose (medicine, consultation, etc.)	total cost for the household	Rice consumed kg/week	# protein-based meals consumed a week (assumption: 1portion = 100g)	# proteins per portion	# vegetable-based courses consumed a week	Total protein gain per individual per week	Total vitamin gains per individual per day
H 1	0	0	0	0	0	6	1	26.41	1	26.41	0
H 2	0	0	0	0	0	20	1	26.41	3	26.41	0
H 3	0	0	0	0	0	14	0.25	26.41	1	6.6025	0
H 4	0	0	0	0	0	20	0.25	26.41	21	6.6025	0
H 5	0	0	0	0	0	44	0.25	26.41	14	6.6025	0
H 6	0	0	0	0	0	8	0.25	26.41	1	6.6025	0
H 7	0	0	0	0	0	14	0.25	26.41	4	6.6025	0
H 8	0	0	0	0	0	15	4	26.41	21	105.64	0
H 9	0	0	0	0	0	22	1.75	26.41	21	46.2175	0
H 10	0	0	0	0	0	20	0.5	26.41	21	13.205	0
H 11	0	0	0	0	0	12	0.25	26.41	21	6.6025	0
H 12	0	0	0	0	0	4.6	1	26.41	21	26.41	0
H 13	1	200	0	0	200	26	1	26.41	14	26.41	0
H 14	2	1000	0	0	2000	78	1	26.41	21	26.41	0
H 15	0	0	0	0	0	24	0	26.41	21	0	0
H 16	0	0	0	0	0	6	1	26.41	21	26.41	0
H 17	0	0	0	0	0	30	3	26.41	21	79.23	0
H 18	0	0	0	0	0	60	1	26.41	21	26.41	0
H 19	0	0	0	0	0	63	1	26.41	14	26.41	0
H 20	0	0	0	0	0	28	3	26.41	14	79.23	0
H 21	4	3000	0	0	12000	70	1	26.41	17.5	26.41	0

Ampila

Perception of Hygiene Improvement for project intervention
(4=very much improved, 3=somewhat improved, 2=not really, 1=not at all)

Answer	Frequency of answer	Percentage
1	1	4.76
2	2	9.52
3	18	85.71
Total	21	

Perception of Change in Diet for project intervention (Yes or No)

Answer	Frequency of answer	Percentage
No	6	28.57
Yes	15	71.43
Total	21	

Description of the Diet Changes

Answer	Frequency of answer	Percentage
Eat clean food by washing food	6	28.57
Eat different things	2	9.52
Eat more	6	28.57
Eat more and different things	2	9.52
NA	5	23.81

iii. Education

Ampila

	H 1	H 2	H 3	H 4	H 5	H 6	H 7	H 8	H 9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21	Total Ampila (ratio on total number of children)
# children in the Household (age 3-25)	4	5	2	1	7	5	3	1	3	5	2	5	7	5	6	7	3	9	3	8	4	95
# children in the Household (age 11-15)	1	2	2	0	1	2	0	0	0	2	0	2	3	3	0	1	0	0	0	3	0	22
# children in the Household (age 16-18)	1	1	0	1	1	0	0	1	0	0	0	0	1	1	0	3	0	2	0	1	0	13
# children in the Household (age 19-25)	2	1	0	0	5	0	3	0	1	3	0	0	1	0	0	3	0	3		3	0	25
school attendance																						
# Days of absenteeism in the last month	0	1	1	0	0	1	0	0	6	7	7	0	0	2	5	2	3	3	2	0	5	2.045454545
school enrollment																						
# children attending school	3	5	2	0	0	4	0	1	2	3	2	4	3	4	2	6	2	1	2	6	2	0.547368421
# children attending middle school(11-15)	1	2	2	0	0	2	0	0	0	1	0	1	2	1	0	1	0	0	0	2	0	0.681818182
# children attending high school(16-18)	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	1	0	0.538461538
# children attending university(19-25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.04
school completion																						
# children with CPE being the highest completed school level (11-25)	1	3	2	1	0	2	1	0	0	1	0	1	3	4	0	6	0	0	0	3	0	0.466666667
# children with middle school being the highest completed school level (16-25)	2	1	0	1	3	0	1	0	0	1	0	0	0	3	0	5	0	0	0	1	0	0.473684211
# children with high school being the highest completed school level (19-25)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.08

Fasimena

	H 1	H 2	H 3	H 4	H 5	H 6	H 7	H 8	H 9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21	Total Fasimena (ratio on total number of children)
# children in the household (3-25)	3	6	9	6	8	5	4	5	9	5	1	1	5	8	5	0	8	7	6	2	4	107
# children in the household (11-15)	0	3	1	2	0	0	2	1	1	1	0	1	3	3	0	0	2	2	2	0	0	24
# children in the household (16-18)	0	1	2	2	0	1	1	2	1	3	0	0	0	2	1	0	2	1	1	0	2	22
# children in the household (19-25)	0	2	2	1	0	1	1	1	3	3	0	0	3	0	2	0	3	4	0	0	2	28
school attendance																						
# Days of absenteeism in the last month	1	0	4	3	0	1	9.5	7	0	4	1	0	3	7	7	0	2	0	0	0	0	2.357142857
school enrollment																						
# children attending school	2	4	4	3	6	2	2	4	3	2	1	1	3	7	1	0	7	7	5	2	2	0.635514019
# children attending middle school(11-15)	0	2	0	2	0	0	1	1	1	0	0	1	1	2	0	0	3	0	2	0	0	0.666666667
# children attending high school (16-18)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0.136363636
# children attending university(19-25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
school completion																						
# children with CPE being the highest completed school level (11-25)	0	3	0	2	0	0	2	3	1	4	0	1	1	2	0	0	7	2	2	0	5	0.472972973
# children with middle school being the highest completed school level (16-25)	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	0	0	2	0.16
# children with high school being the highest completed school level (19-25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

iv. Gender / Time Savings

Ampila

Time Saving	Units	H 1	H 2	H 3	H 4	H 5	H 7	H 8	H 9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21	H 22	Average	Total	Total	Hourly wage	Additional potential income of time saving for women		
Tap stand#		#1	#4	#5	#3	#6	#4	#2	#2	#6?	#7	#5	#3	#1	#3	#6	#8	#7	#5	#2	#2	#8	min/ day	min/day	hour/ day	MGA	MGA/day	MGA/yr	USD/ year
Time saved for Water supply																													
Time	min/day	28	150	50	150	20	300	60	75	36	45	33	111	168	140	48	NA	40	48	80	45	70	84.9	1697	28.3	615.62	17411.8	6,355,294	3739.5
Time saved for Latrine provision																													
Time	min/day/person	15	NA	30	NA	NA	NA	NA	48	NA	15	NA	NA	3	NA	NA	NA	10	NA	13	15	NA	18.6	149	2.5	615.62	1528.8	558,008	328.3

Persons who fetch water in sample households

	Ampila		Fasimena	
	Frequency of Answer	Percentage	Frequency of Answer	Percentage
Adult men	2	5.41%	2	6.90%
Adult women	17	45.95%	10	34.48%
Male child	10	27.03%	9	31.03%
Female child	8	21.62%	8	27.59%

Ways to spend saved time for project intervention

	Ampila	
	Frequency of answer	Percentage
Crochet	1	2.78
Earn Salary from work	1	2.78
Handcrafts	1	2.78
Play(child)	1	2.78
Fieldwork	15	41.67

Housework	14	38.89
Relax	1	2.78
Study	1	2.78

Perception of Time Saving Effect from water supply (Yes or No)

Answer	Frequency of answer	Percentage
No	1	4.76
Yes	20	95.24

Perception of Time Saving Effect from using latrine (Yes or No)

Answer	Frequency of answer	Percentage
No	8	38.10
Yes	8	38.10
NA	5	23.81

v. Community Management and Governance (Ampila)

Evaluation of completion of work done by the Water Committee (4=Very well, 3=well, 2= Not well 1=Very poor)

Answer	Frequency of answer	Percentage
2	1	7.14
3	3	21.43
4	10	71.43

Evaluation of completion of work done by Tap Stand Committees (4=Very well, 3=well, 2= Not well 1=Very poor)

Answer	Frequency of answer	Percentage
2	1	5
3	2	10
4	17	85

Satisfaction with Problem Solving Function of the Water/Tap Stand Committees if they know the function (4=very happy, 3=happy, 2= unhappy, 1=very unhappy)

Answer	Frequency of answer	Percentage
2	1	12.5
4	7	87.5

Satisfaction with member selection at the Water /Tap Stand Committees (4=very happy, 3=happy, 2= unhappy, 1=very unhappy)

Answer	Frequency of answer	Percentage
0	1	5.56
3	3	16.67
4	14	77.78

Satisfaction with Decision Making Process of the Water / Tap Stand Committees if they know the process (4=very happy, 3=happy, 2= unhappy, 1=very unhappy)

Answer	Frequency of answer	Percentage
4	16	100

Participation rate in meetings of the Water / Tap Stand Committees. (Yes or No)

Answer	Frequency of answer	Percentage
No	8	38.1
Yes	13	61.9

The Water/Tap Stand Committees listen to villagers? (Yes or No)

Answer	Frequency of answer	Percentage
No	3	15
Yes	17	85

Opinions about the Price of Water Tax (3=expensive, 2=fair, 1=cheap)

Answer	Frequency of answer	Percentage
1	2	9.52
2	19	90.48

vi. Statistical Analysis

Unpaired t-test results

Variable	t-value	P-value
Vegetables & fruit	0.36	0.72
Livestock	-0.42	0.68
Rice	0.69	0.49
Other products	-1.28	0.21
Savings	1.36	0.18
Health costs	-0.83	0.41

ANNEX III

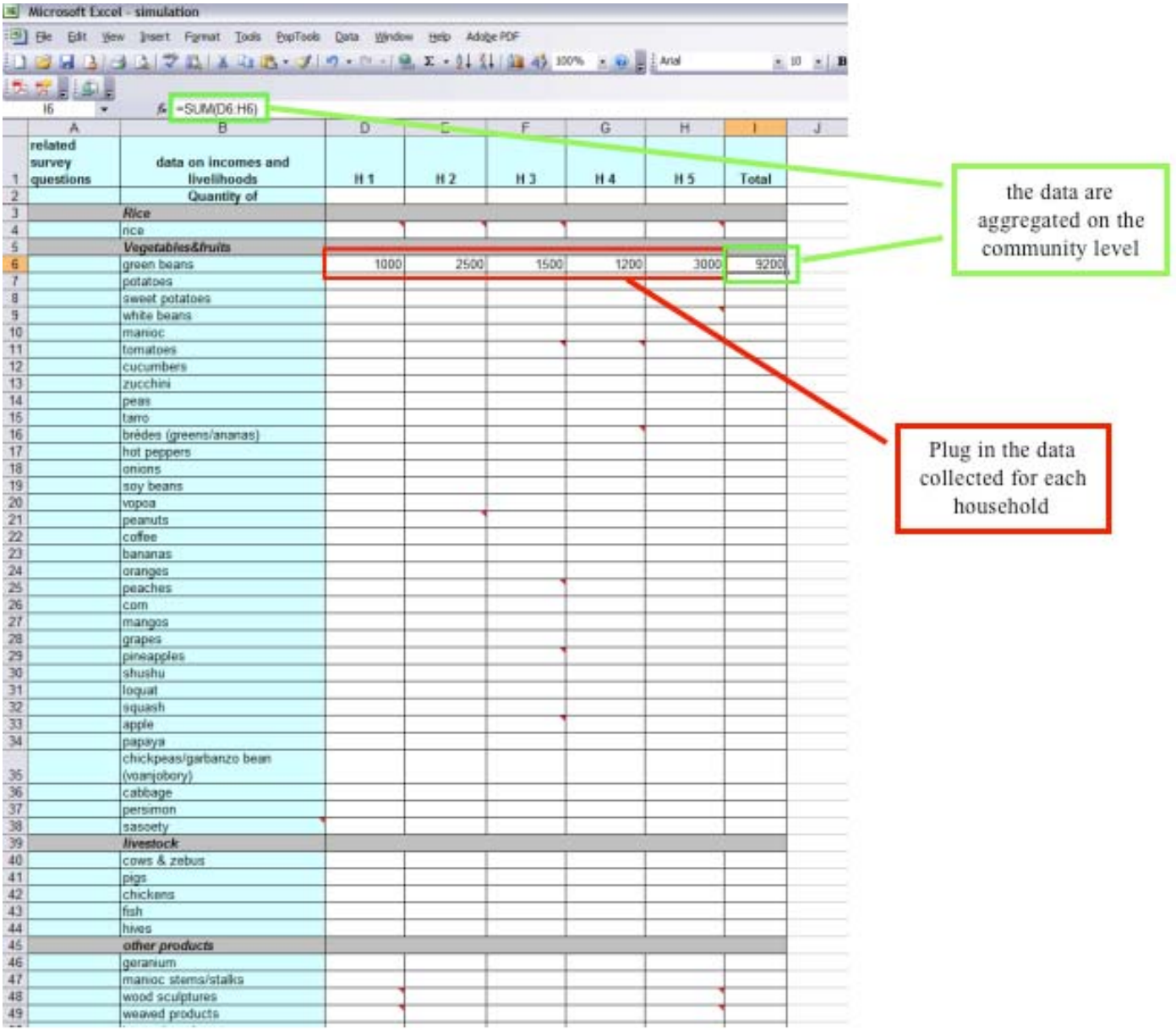
Excel Tool Quick Manual

This annex section provides the general guidelines on how to use the Excel Tools we designed to help the evaluator process the data collected on the field. These tools automatically aggregate on the community level the data that have been gathered at the household level.

We have created five tools, one for each area of impact for which quantitative indicators have been defined: incomes and livelihoods, health, education, gender/times savings, and community management.
Each tool is composed of four worksheets:

- two for data processing at the household level (one for each village)
- one to data aggregation at the community level
- one for data analysis (histograms)

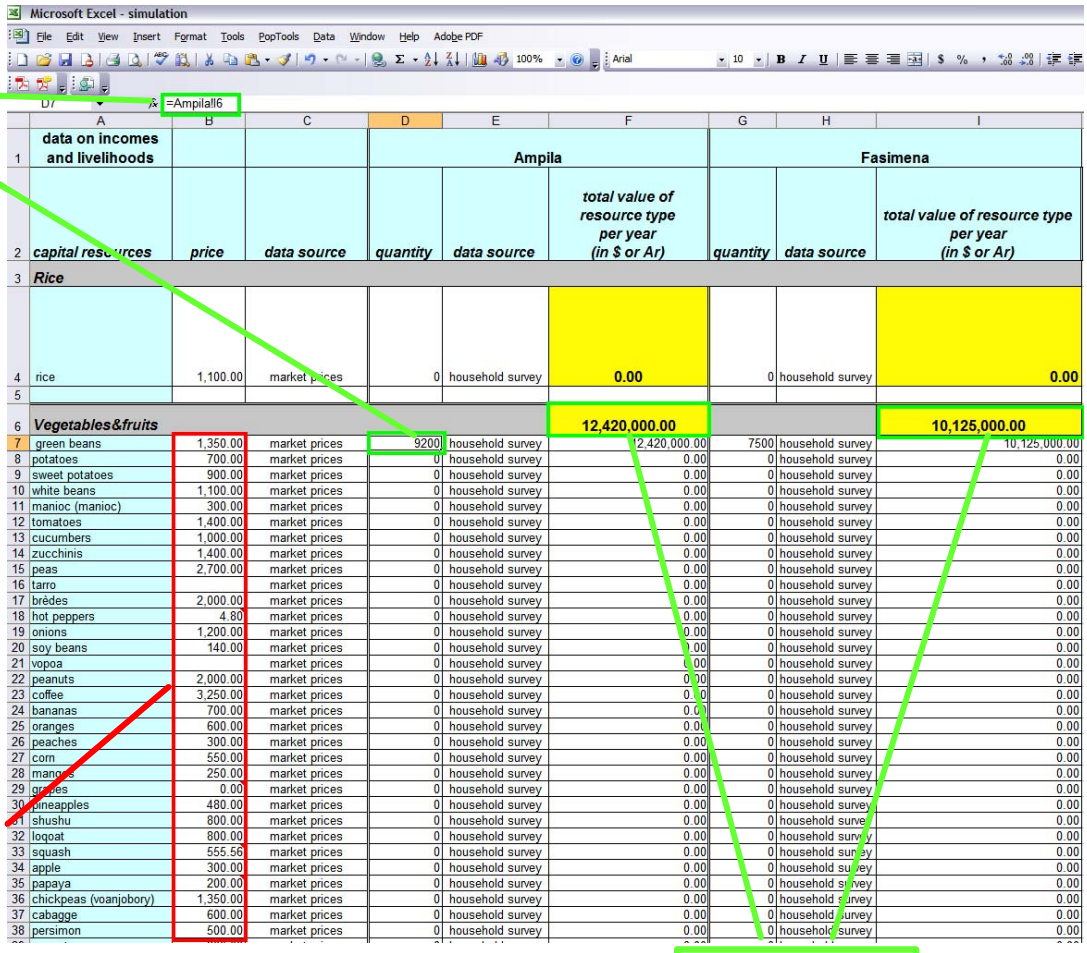
Step 1: Data processing in the household-level worksheet



	related survey questions	data on incomes and livelihoods	H 1	H 2	H 3	H 4	H 5	Total
2		Quantity of						
3		*Rice*						
4		rice						
5		*Vegetables&fruits*						
6		green beans	1000	2500	1500	1200	3000	9200
7		potatoes						
8		sweet potatoes						
9		white beans						
10		manioc						
11		tomatoes						
12		cucumbers						
13		zucchini						
14		peas						
15		taro						
16		brèdes (greens/ananas)						
17		hot peppers						
18		onions						
19		soy beans						
20		vopoa						
21		peanuts						
22		coffee						
23		bananas						
24		oranges						
25		peaches						
26		corn						
27		mangos						
28		grapes						
29		pineapples						
30		shushu						
31		loquat						
32		squash						
33		apple						
34		papaya						
35		chickpeas/garbanzo bean (voanjobory)						
36		cabbage						
37		persimon						
38		sasoety						
39		*livestock*						
40		cows & zebus						
41		pigs						
42		chickens						
43		fish						
44		hives						
45		*other products*						
46		geranium						
47		manioc stems/stalks						
48		wood sculptures						
49		weaved products						

Step 2: Data aggregation in the community-level worksheet

The aggregated data are automatically reported

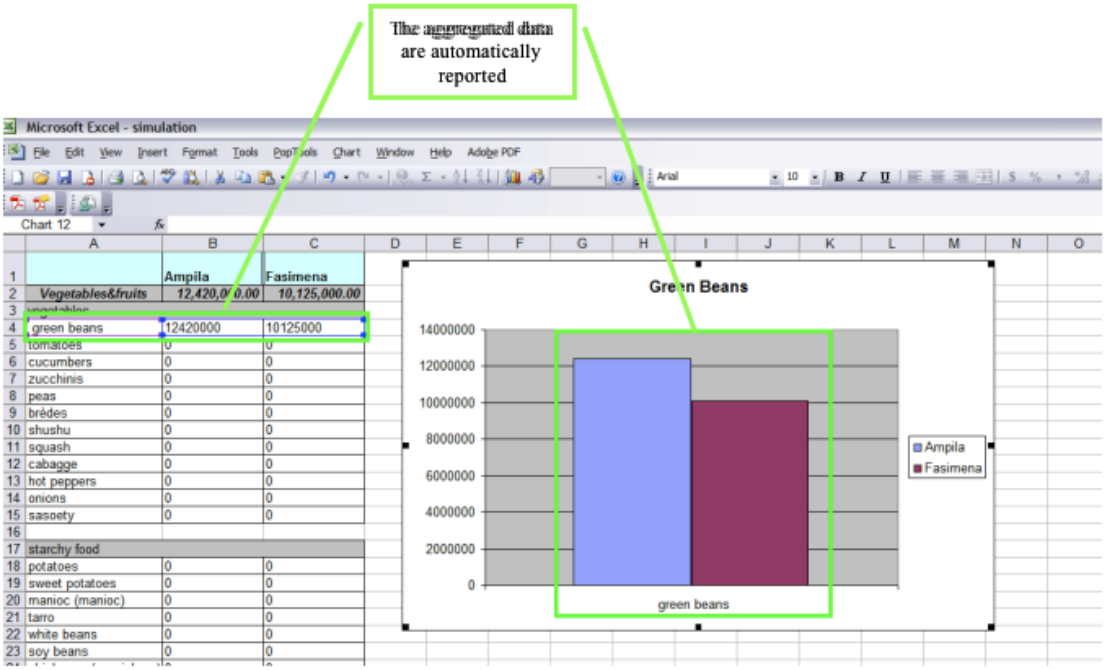


	A	B	C	D	E	F	G	H	I
1	data on incomes and livelihoods			Ampila			Fasimena		
2	capital resources	price	data source	quantity	data source	total value of resource type per year (in $ or Ar)	quantity	data source	total value of resource type per year (in $ or Ar)
3	Rice								
4	rice	1,100.00	market prices	0	household survey	0.00	0	household survey	0.00
5									
6	Vegetables&fruits					12,420,000.00			10,125,000.00
7	green beans	1,350.00	market prices	9200	household survey	12,420,000.00	7500	household survey	10,125,000.00
8	potatoes	700.00	market prices	0	household survey	0.00	0	household survey	0.00
9	sweet potatoes	900.00	market prices	0	household survey	0.00	0	household survey	0.00
10	white beans	1,100.00	market prices	0	household survey	0.00	0	household survey	0.00
11	manioc (manioc)	300.00	market prices	0	household survey	0.00	0	household survey	0.00
12	tomatoes	1,400.00	market prices	0	household survey	0.00	0	household survey	0.00
13	cucumbers	1,000.00	market prices	0	household survey	0.00	0	household survey	0.00
14	zucchinis	1,400.00	market prices	0	household survey	0.00	0	household survey	0.00
15	peas	2,700.00	market prices	0	household survey	0.00	0	household survey	0.00
16	tarro		market prices	0	household survey	0.00	0	household survey	0.00
17	brèdes	2,000.00	market prices	0	household survey	0.00	0	household survey	0.00
18	hot peppers	4.80	market prices	0	household survey	0.00	0	household survey	0.00
19	onions	1,200.00	market prices	0	household survey	0.00	0	household survey	0.00
20	soy beans	140.00	market prices	0	household survey	0.00	0	household survey	0.00
21	vopoa		market prices	0	household survey	0.00	0	household survey	0.00
22	peanuts	2,000.00	market prices	0	household survey	0.00	0	household survey	0.00
23	coffee	3,250.00	market prices	0	household survey	0.00	0	household survey	0.00
24	bananas	700.00	market prices	0	household survey	0.00	0	household survey	0.00
25	oranges	600.00	market prices	0	household survey	0.00	0	household survey	0.00
26	peaches	300.00	market prices	0	household survey	0.00	0	household survey	0.00
27	corn	550.00	market prices	0	household survey	0.00	0	household survey	0.00
28	mangos	250.00	market prices	0	household survey	0.00	0	household survey	0.00
29	grapes	0.00	market prices	0	household survey	0.00	0	household survey	0.00
30	pineapples	480.00	market prices	0	household survey	0.00	0	household survey	0.00
31	shushu	800.00	market prices	0	household survey	0.00	0	household survey	0.00
32	loqoat	800.00	market prices	0	household survey	0.00	0	household survey	0.00
33	squash	555.56	market prices	0	household survey	0.00	0	household survey	0.00
34	apple	300.00	market prices	0	household survey	0.00	0	household survey	0.00
35	papaya	200.00	market prices	0	household survey	0.00	0	household survey	0.00
36	chickpeas (voanjobory)	1,350.00	market prices	0	household survey	0.00	0	household survey	0.00
37	cabagge	600.00	market prices	0	household survey	0.00	0	household survey	0.00
38	persimon	500.00	market prices	0	household survey	0.00	0	household survey	0.00

Process additional data (other sources: official reports, market prices, etc.)

The data are ready for analysis

Step 3: Data analysis in the chart worksheet



	A	B	C
1		Ampila	Fasimena
2	*Vegetables&fruits*	*12,420,000.00*	*10,125,000.00*
3			
4	green beans	12420000	10125000
5	tomatoes	0	0
6	cucumbers	0	0
7	zucchinis	0	0
8	peas	0	0
9	brèdes	0	0
10	shushu	0	0
11	squash	0	0
12	cabagge	0	0
13	hot peppers	0	0
14	onions	0	0
15	sasoety	0	0
16			
17	starchy food		
18	potatoes	0	0
19	sweet potatoes	0	0
20	manioc (manioc)	0	0
21	tarro	0	0
22	white beans	0	0
23	soy beans	0	0

ANNEX IV.1

FOCUS GROUP INTERVIEW GUIDE
For Control

Water Access

1. Where do people in this village take water from?

(Source, Well, River, Lake, Other _____)

2. What do people use water for?

(Drinking, Bathing, Washing hands, Washing cloths, Vegetable production, Fruit production, Rice production, Feeding /washing animals, Watering flowers and plants, Other _____)

3. How many people take water from each water source?
4. Is there any problem related to water in this village?
    a If yes, please specify

Sanitation

5. Do people in this village have latrines?
6. If not, where people usually go for toilet?

Income and Livelihood

7. What is the main source of income in this village?
8. What kind of products do people produce in this village? Please specify names of products.
    a Vegetables:
    b Fruits:
    c Rice
    d Animals:
    e Other products:
    f Flowers and plants:
9. Do people sell a part of their production?
    a If yes, about how much do they usually sell?
10. Where do people sell their products?
11. From when to when is the season of

Dry: _____, Wet: _____

Harvest: _____, Food shortage: _____

Health and Hygiene

12. Are water born diseases i.e. diarrhea prevalent in this village?
13. If yes, how do people treat the disease?
    a Use traditional medicine
    b Buy medicine
    c Visit the doctor
    d Visit the CBS(Centre de Santé de Base)
    e Visit the hospital
14. How much does it cost approximately for the treatment of diarrhea?
15. How much does it cost approximately for the treatment of billarhoze?
16. Is there any other common disease in this village?

Education

17. How many children are there in this village?
18. Do all the children go to school?
19. Where do children in this village usually go to school?
    a Elementary School:
    b Middle School:
    c High School:
    d University:

Community Governance

20. Is there any community organization in this village?
    a If yes, please specify the name of the organizations
    b What kind of activities?
    c Is there any female member of the organizations?
        a If yes, please specify which organizations
        b What roles do women play in the organizations?

21. Do women actively participate in a community activity in this village?
22. Are there any meetings where community members discuss problems?
    a If yes, what kind of agendas is discussed?
23. Is there any community organization or other projects that encourage people to save money/rice? i.e. Social Organization(Compagnie)
    a If yes, name the organization(s)
24. Is there any community organization that provides hygiene education?
    a If yes, who organizes the hygiene training?
    b What kind of activities?
    c How often?

25. Do you give any contribution to this organization in money and/or in kind?
    a If yes, how much?

Environment

26. Is there any environmental concern in this village? i.e. water pollution, deforestation
    a if yes, please specify the type of problem
    b how serious it is ?

External Influence

27. Is there any past and ongoing projects related to water, sanitation, or hygiene?
    a. If yes, describe (year, activity)
    b. Who funded it?
    c. Do you know the cost of the project?
    d. Do you see any tangible changes caused by the project?
28. Is there any ongoing development project such as food security, microfinance, energy etc in the community?
    a If yes, please describe what kind of project.
    b Who funded it?
    c Since when it has started?

FOCUS GROUP INTERVIEW GUIDE

For Treatment / Water Committee

Water Access

1. How many Tap Stands are there in this village?
2. How many people take water from each Tap Stand?
3. What do people use water from a Tap Stand for (they can choose more than one option)? (Drinking, Bathing, Washing hands, Washing cloths, Vegetable production, Fruit production, Rice production, Feeding /washing animals, Watering flowers and plants, Other _____)
4. If people do not use water from a Tap Stand, where people take water from? (Source, Well, River, Lake, Other _____)
5. Do people save time in fetching water compared to before the project started?
6. Is there any problem related to water (quality and /or shortage) in this village?
    a. If yes, please specify which problem

Sanitation

7. How many latrines are there in this village?
8. Do people save time in using latrines before the project started?

.

Impact

9. Do you see any tangible change in the village compared to before the project started?
    a If yes, please specify which types of changes.

Alternatively, these are samples of specific questions.

10. Do you see any increase in agricultural production since the water project started? i.e. Vegetables, Fruits, Rice production?
11. Do you see any improvement in animal raising since the water project started?
12. Do you see any increase in other product production i.e. brick making?
13. Do you see any improvement in health and nutrition, since the water project started?
14. Do you see an increase in the number of children go to school, the number of children achieved higher education?

15. Do you see any improvement in problem solving in the community compared to before the project started?
16. Do you see any improvement in environment issues compared to before the water project started?
17. Do you see any improvement in beautification of the community such as increased the number of flower planted?

Water Committee

Role and responsibility

18. Can you describe the role and responsibility of the Water Committee?
    a Manage water and sanitation services
    b Ensure availability of water source
    c Provide hygiene education to villagers
    d Other
19. Can you describe the role and responsibility of the Tap Stand Committee(s)?
    a Set expectations and rules for villagers to well maintain their tap stands
    b Set the schedule of and arrange repair of water facilities when it is necessary by asking local technicians of the Water Committee.
    c Introduce system for collecting contributions or user taxes.
    d Organize committee meetings and welcome guest events
    e Information delivery to villagers
    f Other
20. Is there any rule that restrict an amount of water from Tap Stands for a specific use i.e. Water from Tap stands is only for drinking
    a If yes, please describe the rule(s)
    b Please explain reasons why you set up the rule(s).

Membership

21. How many members are working for the Water Committee?
    a. Of those, how many men and women?
22. What kind of positions do you have in the Water Committee?

23. How did you select the members?
24. Are there any criteria of membership of the Water Committee such as age, gender, skills and knowledge?
25. How many members are working for each Tap Stand Committee?
    a Of those, how many men and women?
26. What kind of positions do you have in each Tap Stand Committee?
27. How did you select the member?
28. Are there any criteria of membership such as age, gender, skills, and knowledge?
29. Is there regular replacement of members?
    a If yes, how often?

Meeting and decision-making

30. How many times do you meet?
31. Are those meetings open to the villagers?
32. What kind of agendas do you discuss at meetings usually?
33. How do you convey decisions made in the meetings to villagers?

Water tax

34. Do you collect water tax from each household for the water management and committee operation?
    a. If yes, how much?
    b. By what form (money, rice, etc)?
    c. How often?
35. How do you use the collected tax?
36. Do you use it for sanitation (latrines) too?
    a If yes, what kind of activities, how often and how much cost?

Gender

37. Do you see any change in women's roles in the community since the water project started?
    ① If yes, please describe how.

38. Do girls attend more school than before the project started?

Hygiene Practice

39. Do you see any change in hygiene practice among community members since the water project started?
    a If yes, please describe how.

Community Organizations

40. Is there any other community association organized by the community?
    a If yes, please specify the names of the organizations
    b Please specify the activities that this organization realizes.
41. Is there any new community initiative/project since the water project started? i.e. constructing rice storage building etc

External Influence

42. Is there any other past and ongoing projects related to water, sanitation, or hygiene?
    a If yes, describe (year, activity)
    b Who funded it?
    c Do you know the cost of the project?
    d Do you see any tangible changes caused by the project?
43. Is there any organization that encourages people to save rice/money in the community? i.e. Social Organization(Compagnie)
    a If yes, please describe the type of organization
44. Is there any ongoing development project such as food security, microfinance, energy etc in the community?
    a If yes, please describe what kind of project.
    b Who funded it?
    c Since when it has started?

ANNEX IV.2

HOUSEHOLD SURVEY QUESTIONNAIRE

A. HOUSEHOLD OVERVIEW & EDUCATION

	Members of the house(people living in)	*Occupation*	*Age*	*School (EPP, CEG, Lycee, University)*	*School Location*	*Highest educational level completed for those who are not currently enroll schools*	*Days of kids absence from school last month*	*Reasons for absence*
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

B. WATER ACCESS

1. Where does your house take water from? (check all that apply)
    a. Water fountain_____
    b. Source_____
    c. Well_____
    d. River _____
    e. Lake _____
    f. Other _____
2. How long does it take to get water from here (minutes to hours)? (if multiple answers in 1., specify for each of them)

_____

3. How many times does your house fetch water per day?

_____

4. Who usually goes to fetch the water for your house?
    a. Adult woman _____
    b. Adult man _____
    c. Female child (under 15 yrs. old) _____
    d. Male child (under 15 yrs. old) _____
    e. Other _____

TIME SAVINGS AND PSYCHOLOGICAL IMPACTS

<For Treatment>

1. Does your family save time in fetching water compared to before? (Y/N)
    a. If yes, about how much time saved per day?

    _____

    b. How does he/she normally spend the time saved?

    _____

2. Does your family have Kabone? (Y/N)
    a. If yes, was it built after the project started? (Y/N)

3. Does your family save time in using Kabone compared to before? (Y/N)
    a. If yes, about how much time saved per day?

    _____

    b. How does he/she normally spend the time saved?

    _____

4. Have your house planted any flowers around your house? (Y/N)
5. Does your house use water from the fountain to water plants? (Y/N)
6. How much of water does your house use for plants per one time?

_____

7. How many times a week does your house water plants?

_____

C. INCOME AND LIVELIHOODS

I. GENERAL INFORMATION

- Memo for internal use only -
This question is asked to not every but several households to see the variance of their perception. Dry and wet seasons relate strongly to the water stress/availability and harvesting and food shortage seasons relate strongly to the food availability and prices

II. RICE

<Production>

1. How many times does your house harvest rice per year?

   _____

2. How much of rice does your house produce per harvest (kg/bag)?

   _____

3. How many parcels of rice paddies does your house have?

   _____

4. What is the size of a parcel (ha/m^2)? (Approximately, if possible ask to see the rice paddies)

   _____

5. How much of rice does your house produce per parcel per harvest (kg/bag)?

   _____

6. Does your house produce rice for itself or receive a wage from land owners? (produce for itself/receive a wage/both)

   _____

   a. If your house produces for itself, does your house own or rent parcels?

      _____

      i. If your house rents parcels, how much does your house pay per month?

         _____

7. Do you use any technique (c.f. SRI) for rice growing? (Y/N)

   a. If yes, specify

      _____

<Storage>

8. Does your house eat all your rice or sell part of it?

_____

9. Does your house store part of your rice? (Y/N)
    a. If so, how much do you store (kg/bag/cup)? How often per year?

_____

<Period of Soudure>

10. During the "*Periode de Soudure*" (sept-feb), does your house need to purchase additional rice? (Y/N)
    a. If yes, how long?

_____

III. VEGETABLES AND FRUITS

11. Does your house have vegetable or fruits gardens? (Y/N)
    a. If yes, what does your house produce in the gardens? (let them answer spontaneously, and then use Chart 1)

_____

    b. Does your house sell part of (name of vegetables/fruits they produce) in the market? (Y/N)

_____

    c. Does your house purchase additional (name of vegetables/fruits they produce) from the market? (Y/N)

_____

<For Treatment >

12. Has the water project increased the vegetable/fruits production of your house? (4=very much, 3=somewhat, 2=not really, 1=not at all, 0=not sure)

_____

13. Please explain the reasons.

_____

Chart 1

Type	*Produce? (Y/N)*	*How many harvests per year?*	*How much per harvest? (kg/bag)*	*Sell? (Y/N)*	*Do you use water from the Tap Stand for production? (Y/N)*	*How much water per day?*
Vegetables						
Green bean						
White bean						
Pea						
Soy bean						
Peanut						
Potato						
Sweet potato						
Manioc (cassava)						
Taro						
Tomato						
Cucumber						
Zucchini						
Bredes (spinach)						
Hot pepper						
Onion						
Corn						
Vopoa						
Coffee						

Fruits						
Banana						
Orange						
Peach						
Mango						
Grape						
Grape						
Pineapple						

d. LIVESTOCK

14. Does your house own animals? (Y/N)

a. If yes, what animals does your house have? (Let them answer spontaneously, and then ask use Chart 2)

_____

<For Treatment>

b. Has the water project improved hygiene of animal of your house?
(4=very much, 3=somewhat, 2=not really, 1=not at all, 0=not sure)

_____

Chart 2

	Cow /Zebu	*Chicken*	*Pig*	*Hive*	
Does your house raise? (Y/N)					
How many?					
Does your house eat?(meat) (Y/N)					
Does your house consume their by-products*? (Y/N)					
→ Specify					
Does your house sell? (Y/N)					
Does your house sell their by-products*? (Y/N)					
→ Specify					
Does your house use water from the Borne fountain for feeding animals? (Y/N)					
Does your house use water from the Borne fountain for washing animals? (Y/N)					

* By-products: milk, egg, allevin, fur, honey, etc.

e. OTHER PRODUCTS / ACTIVITIES

15. Are there any other products your house produces? Use chart 3.

Chart 3

	Geranium	*Manioc Leaves*	*Wood sculpture*	*Weaved products*	*Terracotta pot*	*Brick*	*Pottery*	*Cakes*
Does your house produce? (Y/N)								
How much per year?								
Does your house eat? (Y/N)								
Does your house sell? (Y/N)								
Do you use water from the Bourne fountain for production? (Y/N)								

16. Has your family increased income since the water project started? (Y/N)
    a. If yes, please explain the reason

    _____

VI. SAVINGS

17. Does your house save money? (Y/N)
    a. If yes, does your house try to save regularly?

    _____

    b. How much per year?

    _____

18. How much saving does your house have now?

_____

<For Treatment >

19. Since the water project, have your house saved more or less?

_____

    a. Please explain the reasons.

_____

20. Does your house save money through any other organization i.e. microfinance organization (CECAM if they don't understand)? (Y/N and specify the name)

_____

VII. HOUSING

- Memo for internal use only -

The goal of this section is to continue looking at the overall increase of wealth in the community. Housing is another form of wealth. Investments in renovations and upkeep reflect a certain value. One direct connection is that with water, there are more bricks being produced which go directly to housing renovations. We are also looking to see if there are trends in villages and how they might relate back to water. If Treatment has a significantly higher rate of house improvements than Control, and the main differential variable is the WaterAid project, it will warrant further investigation.

21. How old is your house?

_____

22. Has your family ever made any improvements? (Y/N)

    a. If yes, when was the last improvement?

    _____

    b. What did your family improve? How much did it cost your family?

    _____

    c. How did your family pay for it?

    _____

<For Treatment >

23. Are there any new houses in the borough since the water project started (either under construction or finished)? (Fonkotanys are made of Boroughs) (Y/N)
    a. If yes, how many?

    _____

D. HEALTH

I. Hygiene Practices

Person	Adult Men	Adult Women	Boy	Girl	Others	
Number of people						
How often do the following people in your house bathe per week?						
Do you wash your hands after using latrines? 2.Yes with soap 1.Yes without soap 0. No						
Do you wash your hands after changing your zaza (baby) if your house has babies? 2.Yes with soap 1.Yes without soap 0.No						
Do you wash your hands before eating? 2.Yes with soap 1.Yes without soap 0.No						
<For Treatment> Since the water project, has the number of bathing and washing hands increased? (Y/N)						
If yes, by how much increased after the project?						

II. Diseases

1. Have any members of your household been sick in the past two weeks? (Y/N/don't know) (*If not, skip to end)*

_____

2. How many members of your household have been sick within the last two weeks?

_____

3. Do you know what the sickness was/is? (Y/N and specify in the chart below)

_____

Person	1	2	3	4	5	6	7
What the sickness was? 1=Stomach ache 2=Fever 3=Vomiting 4=Diarrhea 5=Headache 6=Body ache 7=Bilharziose							
Can you describe the symptoms of the disease(s)?							
What did you do? 1=Nothing 2=Drink water 3=Drink tea 4=Stay in bed 5=Go outside 6=Use traditional medicine i. Cost of traditional medicine ii. Distance to purchase medicine 7=Visit the doctor i. Cost of doctor's visit ii. Distance to doctor 8=Visit the CBS (Centre de Santé de Base) i. Cost of CBS visit ii. Distance to the CBS 9=Visit the hospital i. Cost of hospital visit ii. Distance to the hospital 10=Purchase medicine i. Cost of Medicine ii. Type of Medicine							

III. Nutrition

- Memo for internal use only -

The goal of this section is to evaluate the differences in food consumption between villages. This supports the vegetable and fruit survey above. The goal is to support claims of changes in food consumption because of access to water.

4. How many meals does your house cook per day?

_____

5. Is this the same throughout the year? (Y/N)
    a. If no, are your house's meals:
        i. Different month to month _____
        ii. Less during the periode du soudure _____

<For Treatment>

6. Since the water project, has your house changed your diet? (Y/N)
    a. If yes, how changed? (eat more/eat less/eat different things)

    _____

7. What does your house usually eat for:
    a. Breakfast _____
    b. Lunch _____
    c. Dinner _____
    d. If no, what does your house eat instead of vary (rice)?
        iii. Mangahazo (manioc) _____
        iv. Tsakotsako/Katsaka (corn) _____
        v. Mofo (bread) _____
8. How many kapoaka of rice does your house cook per meal?

    _____

9. How often does your house have loaka (protein) during the week? (*If no, skip to #23)*
    a. Once every meal _____
    b. Once every day _____
    c. Once every week _____
10. How many kilograms of loaka does your house eat per week?

    _____

11. How often does your house eat vegetables?
    a. Once every meal _____
    b. Once every day _____

c. Once every week _____

12. How many kilograms of vegetables does your house eat per week?

_____

F. COMMUNITY MANAGEMENT AND GOVERNANCE

<For Treatment>

Function

1. Do you know what type of work the Water community organization(s) do? (Y/N)
   (if not, skip to #4)
   a. If yes, please name their works

   _____

2. How well does the Water community organization(s) complete their works? (4=Very well, 3=well, 2=Not well, 1=very poor) and why?

_____

Problem Solving

<For Treatment>

3-1. Since the Water project, has your house had any problem of water shortage? (Y/N)
   a. If yes, specify for how long and why.

   _____

   b. How the water shortage problem was solved?

   _____

   c. By who?

   _____

<For Control>

3-2. Does your house have any problem of water shortage? (Y/N)

   a. If yes, specify for how long and why.

   _____

b. How the water shortage problem was solved?

_____

c. By who?

_____

d. Does your house have a conflict with your neighbors over water ?(Y/N)

e. If yes, can you describe the conflict?

_____

<For Treatment>

4. Have you asked the water committee to solve any other problem related to the water and sanitation? (Y/N) *(if not skip to #6)*
   a. If yes, please explain what the problem was.

   _____

   b. How was the problem solved?

   _____

   c. Were you happy with the solution? (Y/N)
5. Would you ask the Water committees if you have a problem with the water in the future?(Y/N)

6. How happy are you with the problem solving by the committee (4=very happy, 3=happy, 2=not happy, 1=very unhappy) and why?

_____

Contributions (water tax)

7. Does your household pay water tax? (Y/N) *(if not, skip to part d)*
   a. If yes, how much (Ariary/Francs/rice)?

   _____

   b. How often?

   _____

   c. If no, are you able to use the Bourne Fountaine if you are not paying the tax?

_____

8. Do you know how the water tax is used? (Y/N)
    a. If yes, how?

_____

9. Do you feel it is expensive, fair or cheap (3=expensive, 2=fair, 1=cheap) and why?

_____

Member selection

10. How happy are you with their member selection process (4=very happy, 3=happy, 2=not happy, 1=very unhappy), and why?

_____

Decision making and a sense of ownership

11. Have you attended the water committee's meetings? (Y/N)
12. Do you think the members of the water committee listen to villagers? (Y/N)

Hygiene Promotion

13. Have you ever participated in hygiene promotion activities provided by the water committees? (Y/N)
    a. If yes, what kind of activities were they?

_____

External influence from other community projects i.e. energy

14. Is there any other group or organization in your community? (Y/N and specify in the chart below)

Organizations	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Name							
Roles/ Activities							
Benefit from its activities 4=very much 3=a little 2=not really 1=not at all							
Reasons							

<For Control>

- Memo for internal use only –
This section aims at investigating whether Control has community groups that have functions of governance and conflict resolution in their community.

1. Is there any group or organization in your community? (Y/N and specify in the chart below)

Organizations	***1***	***2***	***3***	***4***	***5***	***6***	***7***
Name							
Roles/ Activities							
Benefit from its activities 4=very much 3=a little 2=not really 1=not at all							
Reasons							