



**MANAGEMENT AND MAINTENANCE
OF A LOW COST WASTE
WATER RECYCLING SYSTEM AT
HOUSEHOLD LEVEL**



Manual developed with a support from Scottish Government through the partnership between Trócaire and SCiAF Kigali, July 2016

Management and maintenance of a low cost water recycling system at household level

Training manual

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List of Abbreviations

COCOF	Conseil Consultatif des Femmes
IPFG	Initiative pour la Promotion de la Famille et du Genre
MMM	Medical Missionaries of Mary
SCIAF	Scottish Catholic International Aid Fund
UNICOOPAGI	Union des Coopératives Agricoles Intégrées

1. INTRODUCTION

Climate change is now seen as a universal reality and there is an emerging evidence that climate change poses a threat for development in Rwanda. An understanding of the emerging trends of climate change and its effects in Rwanda is an important starting point in addressing the negative effects of climate change. The impact is significant and poses a threat to the country's economy varying across geographic areas, sectors, social and economic groups at the national level. In general, rural women, children and other disadvantaged segments of society will be the most affected socio-demographic groups.

Different organizations and Ministries have already started to deal with possible adaptation measures focusing on rural areas. It is in this line that Trócaire, an international development agency working in Rwanda, launched a pilot project named "Water for Agricultural Production" with a support from the Scottish Government through partnership with SCIAF. This project aims to integrate technologies and practices in rain water and waste water management to boost agricultural production and increase climate change resilience for small farmers.

Waste water recycling is one of the technologies used by Trócaire's project to broaden the options available to poor rural communities and manage water more efficiently and sustainably, in the context of limited resources and climate threats. Waste water recycling aims to filter and reuse grey water (waste water from different household activities) for beneficial purposes such as agricultural irrigation, livestock and garden watering. Bio-sand filters have been installed within households in Kamonyi, Nyamagabe and Nyanza districts in collaboration with COCOF-Musambira, IPFG and MMM-Kirambi, Trocaire's local implementing partners.

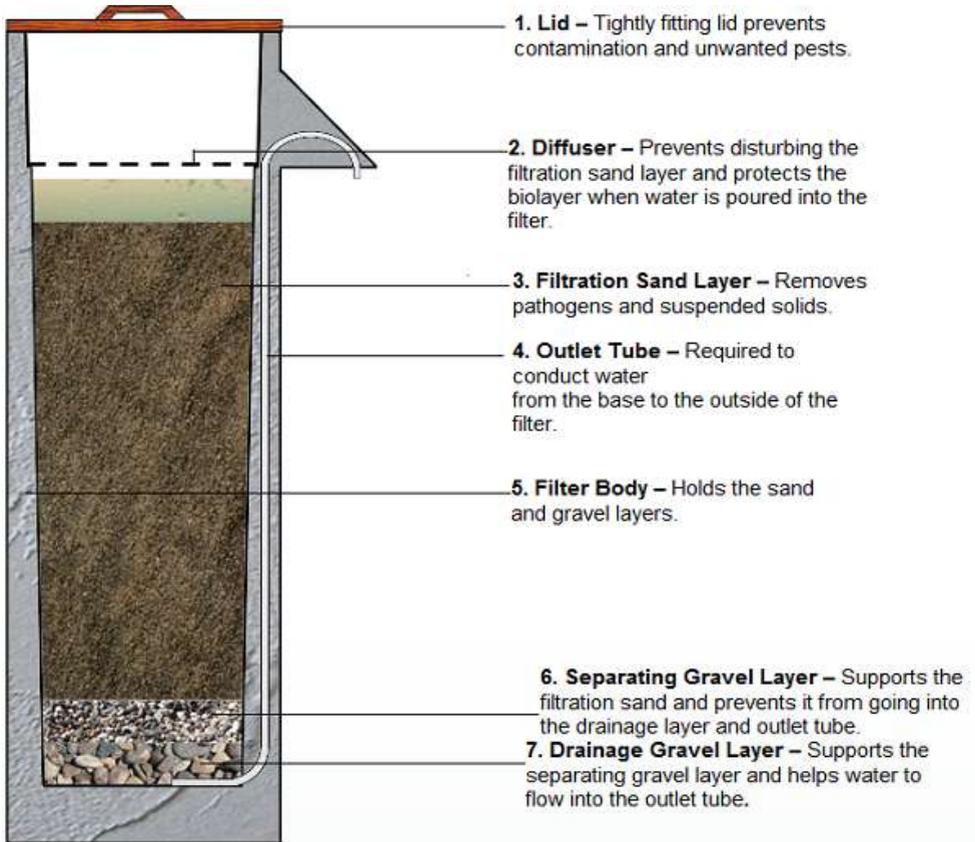
This guidebook introduces the “Bio-sand filter” as a water recycling system and gives guidance on the installation and maintenance of the system. It can be used by the project beneficiaries for efficient management and maintenance of the system but it can also be useful for the project scale-up.

2. BRIEF OVERVIEW OF BIO-SAND FILTER

The bio-sand filter is an adaptation of the traditional slow sand filter, which has been used for community water treatment for almost 200 hundred years. The bio-sand filter is smaller and is adapted for intermittent use, thus it suitable for households. The filter container can be made of concrete or plastic and is filled with layers of specially selected and prepared sand and gravel.

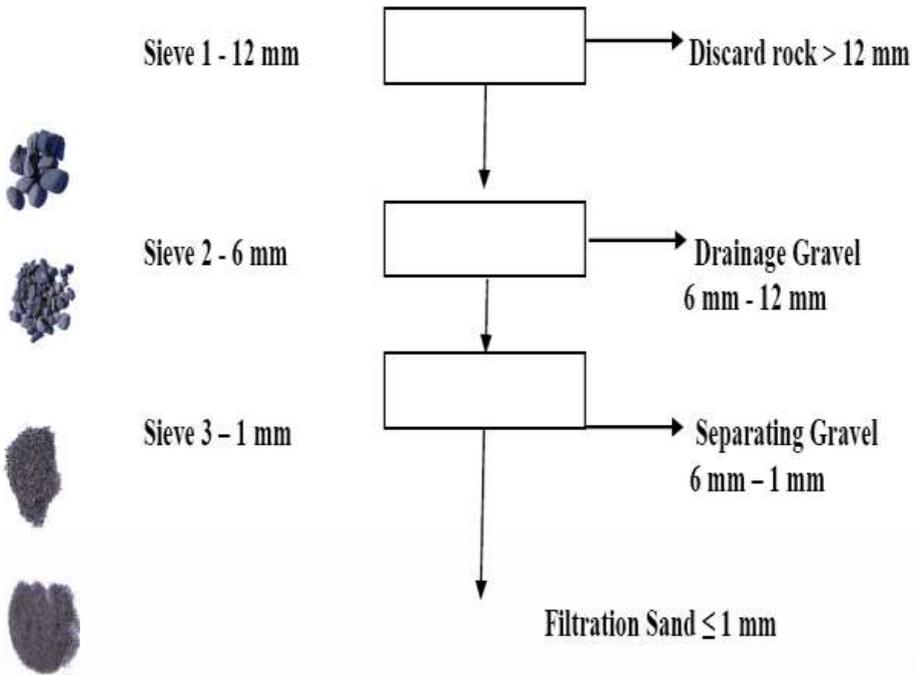
The bio-sand filter is a cheap water recycling option in that it functions without electricity, running water, moving parts or any other added inputs. The filter is built with affordable local materials in order to foster individual ownership. The bio-sand filter is designed for household use and provides filtered waste water for different purposes including agriculture.

2.1. Components of Wastewater Recycling System (Bio-sand Filter)



(Centre for affordable and sanitation technology: CAWST, training manual, September 2009 Edition)

2.2. Filtrating sand and gravel sizes and disposition



3. INSTALLATION PROCESS

Good materials are needed to properly construct and install a plastic bio-sand filter. You need to identify a proper workspace that provides adequate shelter and storage for your materials, sieves, sand and gravel. The filtration sand should be covered to keep it dry and avoid contamination. You may consider storing your tools and materials in a locked and secured area.

3.1. Sand and gravel: Selection

Selecting and preparing the filtration sand and gravel is crucial for the efficient functioning of the bio-sand filter. It is always required to go through all the steps. Poor selection and preparation of the filtrating sand could lead to poor performance and a considerable amount of work to solve the problem. Crushed rock is the best type of filtrating sand since it is less likely to be contaminated with pathogens or organic material.

3.2. Sand and gravel: Preparation

Steps:

- The sand must be sieved through a 12 mm sieve, a 6 mm sieve, and a 1 mm sieve, respectively.



Sand sieving and sorting according to the recycling layers

- Discard the material that does not pass through the 12 mm sieve.
- Store the material that is captured by the 6 mm sieve – this is used for your drainage gravel layer.
- Store the material that is captured by the 1 mm sieve – this is used for the separating gravel layer.

- The material that passes through the 1 mm sieve is the filtration sand that goes into your filter.
- When sieving, look under the sieve and watch the falling material. If very little or no material is falling out, then you stop sieving that batch of sand or gravel.

Wash the gravel and the sand



Sand being washed before use; the sand must be washed until you get clear water



3.3. Installation process



Fix the pipe system in the container and connect it to the receiving container both installed in a suitable/chosen place.

3.4. Packing process

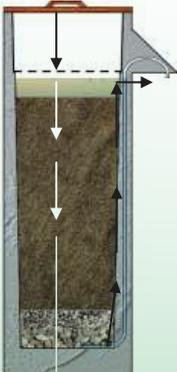


Filling the container with sand and gravel according to the sand sizes



4. WASTE WATER RECYCLING PROCESS

The process is driven by gravity principle where waste water passes through different levels of the sand from the top of the filter to the bottom before reaching the pipe which reconducts the filtered water to the outlet attached to a prepared container for storage.



How to use the biosand



Pour grey water (*the relatively clean waste water generated in households or office buildings without fecal contamination. Sources of grey water include baths, clothes washing, dish washing and other kitchen appliances*) in the container for filtration



Grey water passes through the sand layers and gets into the receiving container through the pipe.



The clean water received can be used for different other purposes than consumption. For example here it is being used for watering vegetables. It can also be used for house cleaning...

5. BIOSAND FILTER MANAGEMENT AND MAINTENANCE

5.1. Management of bio-sand filter system

All household users, including children, need to learn how the filter works, how to use it properly and how to maintain it. Proper use includes the following:

- Use the filter at least once every 1-2 days, preferably 2-4 times each day.
- Use the best source of water (least contaminated; *grey water from bathroom and from cloth washing are considered to be the least contaminated*) that is available; the better the source of water, the better the treated water will be.
- The lid should always be kept on the filter
- The diffuser must always be in place when pouring water into the filter, never pour water directly onto the sand layer. Slowly pour grey water onto the filter.



5.2. Maintenance

- During normal use, the outlet tube may get contaminated via dirty hands, animals, or insects. Clean the outlet tube regularly with soap and water.
- Clean the inside of the filtered water storage container when it looks dirty, when you do regular maintenance or at least once a month.
- The spaces between the sand grains will become clogged with suspended solids over time. As a result, the flow rate will slow down. A slower flow rate is not an issue in terms of water quality. In fact, the slower the flow rate, the better the water quality. However, it may become so slow that it is inconvenient for the user. In this case the user will need to do basic maintenance (called the “swirl and dump”, see below) to fix it. There is also a need to clean the outlet tube, safe storage container, diffuser, lid, and outside surfaces of the filter on a regular basis.
- Measure the flow rate and if it is less than 0.5 liter/minute, then the “**swirl & dump**” maintenance is required.

5.3. Steps for swirl and dump maintenance

- Remove the filter lid.
- If there is no water above the diffuser, add about 4 liters of water.
- Remove the diffuser.
- Using the palm of your hand, lightly touch the very top of the sand and move your hand in a circular motion; be careful not to make the top of the sand go deeper into the filter.



- Scoop out the dirty water with a small container.
- Dump the dirty water away from the filter.
- Make sure the sand is smoothly leveled.
- Replace the diffuser or wash the existing one.
- Repeat the swirl & dump steps until the flow rate has been restored.
- Set up the storage container to collect the filtered water.
- Refill the filter.
- When you finish all the steps, wash your hands with soap and water.

5.4. Tank cleaning

- Normally the filter tank does not need to be cleaned except when the sand and gravel need to be replaced.
- When the filter tank needs to be cleaned, take the sand and gravel out of the filter container and then with clean water and a cleaning cloth, scrub the whole inner part of the tank until it is clean.

6. ADVANTAGES OF THE BIO-SAND FILTER SYSTEM

- The bio-sand filter is made of simple and affordable materials. Its functioning is simple and so is its maintenance.
- The system is cheap with a cost varying from region to region, depending on the cost of local materials and labor. The table below shows the estimated cost for one bio-sand filter.

No	Items	Quantity	Unit cost in RWF	Total cost in RWF	Total cost in USD
1	Filter tank	1	23,000	23,000	29.68
2	Filtered water receiving tank	1	12,000	12,000	15.48
3	Pipe	1	2,000	2,000	2.58
4	Nipple	1	500	500	0.64
5	Elbow	2	500	1000	1.29
6	Couple	1	500	500	0.64
7	T-Flow	1	200	200	0.25
8	Tangit	1	7,000	7,000	9.03
9	Sand	170kg	FF	30,000	38.72
10	Gravels	50kg	FF	30,000	38.72
11	Installation	FF	FF	14,000	18.07
TOTAL				120,200	155.15

Exchange rate got from BNR website: 1RWF=774.73USD (27th July 2016)

- The system is durable. If well maintained and used properly, the filtering sand and gravel can last one to two years before replacement.
- Bio-sand filter can filter 0.5 to 1 liter per minute
- The installation is very quick: When all materials are available, it takes one day except for the rainy period when it takes longer for the sand to dry.
- The maintenance and management don't require a technician; anyone trained can do it
- It's an easy way to get water for kitchen garden watering without walking miles, and this is what makes it helpful especially for women and kids



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