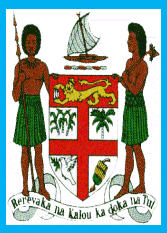
Government of Fiji



Ministry of Works, Transport and Public Utilities
Water and Sewerage Department

FIJI RURAL WATER AND SANITATION

Practical Guidelines For Rural Water Supply Management Plan

May 2012

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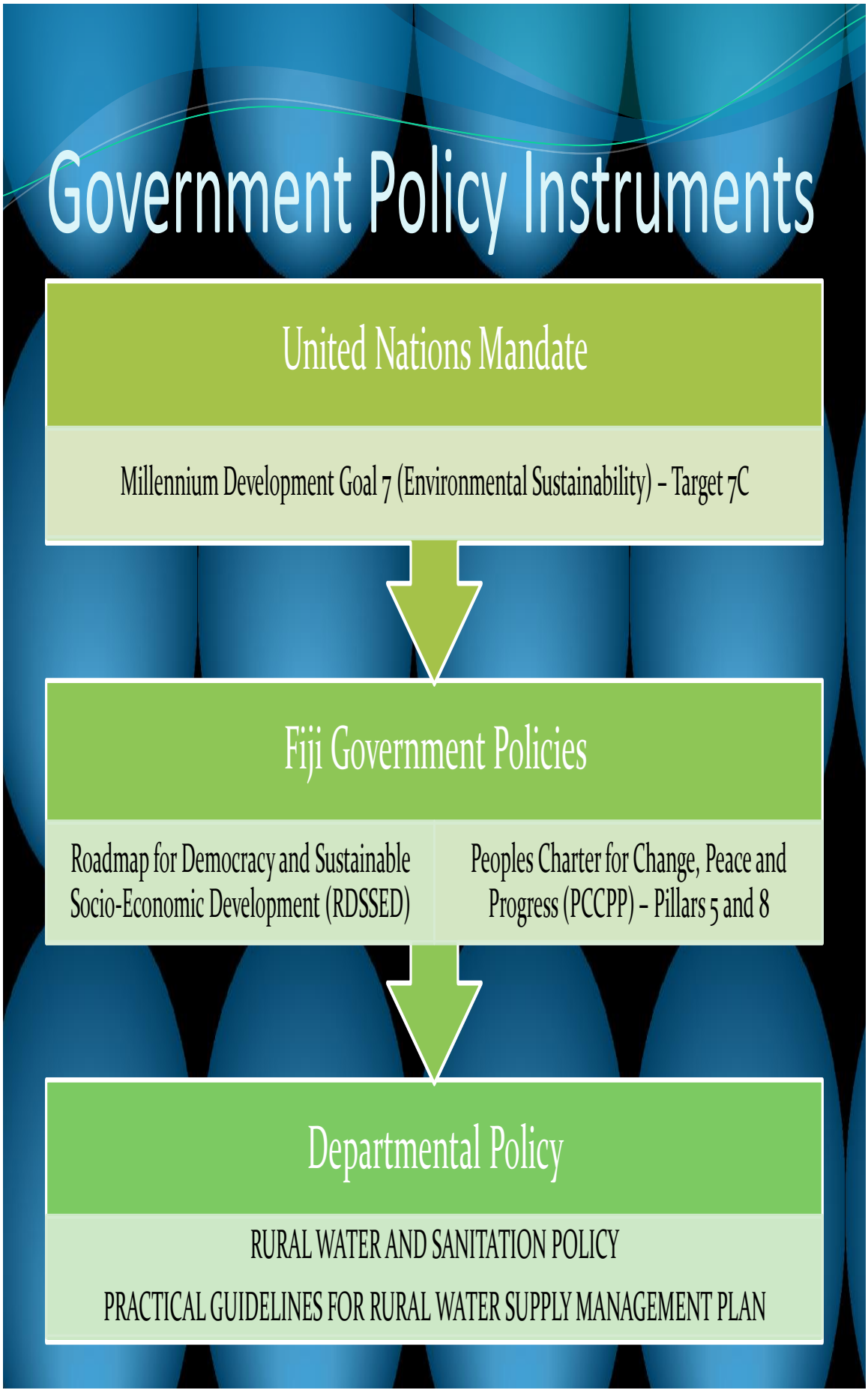
Government Policy



Foreword

The Rural Water and Sanitation Policy has been approved by Cabinet for implementation by 1st June 2012. This policy is a statement by Government on it commitments to improving water and sanitation services in rural areas.

The main mechanism of this policy is the formulation of Water Supply Management Plans (WSMP).Basically the WSMP document will contain all the technical information on the investigations and designs, operations and maintenance as well as the methodology to conduct capacity building in the rural communities. The Government, through the Department of Water and Sewerage shall use this document as a roadmap to improve water supply and management services in the rural areas of Fiji.

Besides, the Department of Water and Sewerage of my Ministry, with consultations with relevant agencies and stakeholders had put together a translation of the policy requirement of WSMP to a working document to guide implementing agencies. This book provides the guideline to the formulation of the WSMP thus the title **"Practical Guidelines for Rural Water Supply Management Plan".**

It must be noted that this book provides a guide only and it is strongly advised that implementing agencies further develop their own manual for ease of WSMP formulation.

Please contact the Department of Water and Sewerage for any further queries.

I wish you all the best in formulating your WSMP.

Commander Francis B. Kean
Permanent Secretary for Works, Transport and Public Utilities

Acknowledgement

The Water and Sewerage Department are thankful to everyone who has contributed to the development of this Guide. They include:

Government Ministries and Departments
Water Authority of Fiji
University of South Pacific
Fiji National University
World Health Organization
Reef Explorer
Rotary Pacific Water for Life Foundation
Live and Learn
SPC/SOPAC
Soqosoqo Vakamarama
Mr. Steve Thon

Glossary and Definitions

(a) *"Desalination"* refers to any process that removes some amount of salt and other minerals from water in order to make it is suitable for human consumption.

(b) *"Groundwater"* refers to subterranean water sources such as aquifers and springs.

(c) *"Hazard"* refers to any biological, chemical, physical or radiological agent that has the potential to cause harm to human health or the environment.

(d) *"Metered Schemes"* refers to Water Project Schemes that are metered and maintained by the Water Authority of Fiji for which they collect tariffs.

(e) *"Peri –urban"* refers to the areas outside of the CBD that are connected to the Water Authority of Fiji reticulation system and pays water tariffs to the Authority.

(f) *"Rainwater harvesting"* is the accumulating and storing, of rainwater for reuse. Rainwater collected from the roofs of houses, tents and local institutions can make an important contribution to the availability of drinking water.

(g) *"Risk"* refers to the likelihood of a hazard causing harm in exposed populations in a specified time frame, including the magnitude of that harm.

(h) *"Rural"* in this policy refers to all areas outside of the metered Urban and Peri-urban water reticulation systems.

(i) *"Safe water"* refers to water that is free of any harmful substance (contaminants) including physical, chemical, biological and microbiological agents that can cause serious health effects. It is suitable for human consumption and use such as cooking, drinking and for personal hygiene.

(j) *"Sanitation"* refers to the provision of facilities and services for the safe disposal of wastewater and human excreta.

(k) *"Surface water"* refers to running (rivers and streams) or quiescent (lakes, dams and reservoirs) water found on the land surface usually as a result of run-off precipitation

(l) *Urban"* refers to the Central Business Districts (CBD) that are connected to a Water Authority of Fiji reticulation system and pays water tariffs to the Authority

1. Introduction

1.1 Water Supply Management Plan (WSMP) refers to the holistic, systematic and integrated approach that must be used during the provision of Rural Water and Sanitation systems.

1.2 The objective of the WSMP is to optimize rural water supply systems given all available sources as well as cater for the sanitation aspects of water supply schemes to minimize risks to human and environmental health. The WSMP aims to ensure the development of appropriate and sustainable community-owned and maintained systems through capacity building and community involvement in their construction and operation and maintenance.

1.3 A Water Supply Management Plan (WSMP) must be developed as per guidelines given below and approved by the Water and Sewerage Department (WSD) before any funding request and construction or upgrade of a rural water supply and sewerage system may proceed.

2. Description of Village Community

2.1 The WSMP must provide for the following details about the rural community. Refer to **Appendix 1** for Table 1.

1. Village Name
2. Address
3. Total No. of Household
4. Village Population
5. Existing Water Supply System
6. Existing Wastewater Disposal System
7. Village Contact Person

3. Estimate of Water Demand and Wastewater Generation

3.1 The WSMP must include an estimate of rural community water demand. The demand estimate should take into account the likely increase in population growth and water usage within a ten year period after project implementation and updated in **Appendix 1** - Table 4.

3.2 The following are minimum standards for calculation of water demand estimates:

- Domestic consumption - 100 litres (L) per person per day
- Other Commercial Uses (e.g. Tourism) – 150 litres per person per day

3.3 Storage capacity of reservoirs shall be calculated to cater for 24 hours of supply to the community at a rate no less than that defined in 3.2.

3.4 The WSMP must include an estimate of the potential volume of wastewater generated through the water supply scheme based on the estimated water demand. Estimated volume should be separated by wastewater type, with grey water and black water being the minimal categories to be addressed. Calculations can be estimated using minimum standard of 80 litres per person per day for wastewater. See **Appendix 1**, Table 5 for a sample wastewater generation estimate format.

4. Assessment of Water Sources

4.1 The WSMP requires that the quantity of water provided by water sources must be sufficient to meet the estimated water demand. Water sources must be investigated and once a suitable and appropriate water source is identified, further investigations of lower priority sources are not necessary. All details must be included in **Appendix 1 -** Table 2.

1. Rainwater Harvesting
2. Groundwater – Spring
3. Surface Water
4. Groundwater - Aquifer
5. Others (Sea Water Desalination)

Please refer to a detailed flow chart for water resource assessment in **Appendix 2**.

4.2 Reports on all investigations done on water quantity and quality checks on different sources must be recorded in the WSMP.

4.3 The WSMP should identify hazards to each water source (e.g. flood-prone areas, contaminated sites, animal grazing/holding areas, wastewater disposal, other potentially-impacting land-use practices, etc.) and potential mitigation measures for minimizing each hazard.

5. Rules for Water Extraction

5.1 The WSMP must include an assessment of local water sources and identify the limits, if any, to each source and whether a source should be rationed at any time given supply limits. The following minimum information must be included in this assessment:

1. Source
2. Type of Extraction
3. Amount of Extraction
4. Limits of Extraction

See **Appendix 1,** Table 3 for a sample water extraction limit format.

6. Water Supply Design

6.1 The WSMP must include a detailed plan (e.g. flow chart or diagram) describing all the water supply system infrastructure including, but not limited to: collection from the water source, pumps, storage areas, treatment systems, filters, and pipelines (See examples in **Appendix 3**).

6.2 The WSMP must include estimated budgets for the capital and operational costs of the water supply system along with details of all materials and/or earthworks required for construction and operation of the system

6.3 The WSMP should consider that rural water projects are generally conducted in poor rural communities and thus should be implemented within the level of technical skills and economic means of the host community.

6.4 The WSMP should consider that all projects, no matter how simple or complex, require accurate technical data, such as survey information, water flows, water demands, soil characteristics, etc. for both immediate planning and implementation and subsequent review in the event of operational problems or project expansion.

6.5 All appropriate data and information collected about the site and water supplies must be archived with the community, partnering institutions/NGO, and the Water and Sewerage Department for future reference

6.6 The WSMP should ensure that technologies used to improve water and sanitation should be appropriate and best-suited given the expressed needs and capacities of the community and the related risks and hazards identified during source and site assessments.

6.7 The WSMP requires that the community be assisted to understand the pros and cons of technological options available for avoiding identified water hazards and risks from water supplies when designing new water systems or system upgrades.

6.8 The WSMP must indicate what measures (Risk Assessment) will be taken to reduce risks to water sources and human health from the disposal of wastewater and human excrement. (Refer to **Appendices 5 (Rainwater), 6 (Groundwater) – 7 (Surface water) for common hazards/risks)**

The WSMP must assess hazards and risks to the water supply and from the wastewater systems including:

1. Catchment, Source and Intake
2. Pre-treatment and Treatment
3. Storage and Distribution

All hazards associated with the Catchment, Source and Intake, Pre-treatment and Treatment, Storage and Distribution process must be identified. For each hazard identified, describe whether it is under control (if so, using what control measures/barriers). If the hazard is not under control, determine the likelihood and magnitude of the risk and its consequence if it did occur. Assign priority to each hazard and describe the corrective action(s) needed to be taken to minimize risk. If a hazard under control, it can be assigned "Not a Priority".

See sample tables with this information in **Appendix 1,** Tables 6 - 8**.**

Please refer to the Drinking Water Safety Planning (A Practical Guide for Pacific Island Countries) for further clarifications. The Keeping your Drinking Water Safe Toolkit can also be used for assessing health risks.

6.9 The technologies used to improve water and sanitation should be chosen for the community in light of its expressed needs and capacities. The following treatment options could be considered in conjunction with hazards identified under item 6.8 above**:**

1. Stream/Creek/River source

Sedimentation/clarifier → On-line Filter → Storage → Appropriate Filter @ kitchen tap

2. Spring Source

Cover the source → On-line Filter → Storage → Appropriate Filter @ kitchen tap

3. Wells Source

Provide Cover → Appropriate Filter Set-up

4. Borehole Source

On-line Filter → Storage → Appropriate Filter

Addition of any further disinfectants (Chlorine, Ultraviolet light, etc) should be considered where appropriate

6.10 The WSMP require the following standards to be used for the testing of water quality for rural water supplies.

1. National Drinking Water Quality Standards

Parameters in Small Water Supplies

Parameter [a]	**Maximum Value**
pH	6.5 – 8.5
Colour	5 TCU
Turbidity	5 NTU
Residual Chlorine [b]	0.2 – 0.5 mg/L
Total Dissolved Solids(TDS)	500mg/L
Conductivity	1000µS/cm
Thermo tolerant Coli forms	0 per 100ml
E. Coli	0 per 100ml
Total Coli forms	0 per 100ml

[a] Additional parameters can be monitored but these are the minimum requirements.
[b] Only if chlorine is added to the water system

6.11 The WSMP should encourage, where appropriate, the use of local materials and practices including traditional system designs, construction methods, and labour practices; construction practices that are familiar can be more readily supported by the community than practices that are different or unnecessarily complex. This is an important element in fostering the community's sense of ownership of the water supply system

6.12 The WSMP should include identification of all appropriate safety procedures to be followed during both the construction and operational phases of the system.

6.13 Pipes and fittings used in the water systems schemes must be to Australian and New Zealand Standards. *(AS/NZS 1254:2010 PVC-U pipes and fittings for storm water and surface water applications and AS/NZS 4765:2000 PVC -M)*

7. Wastewater and Sanitation System Design

7.1 The WSMP must comment on whether wastewater volume is likely to increase as a result of any new or upgraded water supply system. If a project is likely to increase the volume of wastewater created by a community, the WSMP must develop appropriate measures and facilities for its disposal. Appropriate measures for wastewater disposal are those that minimize avoidable risks to human health, water sources, and the environment in general.

7.2 The WSMP must include a detailed plan (e.g. flow chart or diagram) describing the treatment and disposal of all grey and black water system infrastructure including, but not limited to: traps, pumps, storage areas, treatment and disposal systems, filters, and pipelines The wastewater treatment and disposal system should be able to cater to estimated maximum water demand of the community households as detailed in section 3.4 and should be able to function for a minimal period of one week without power supply.

7.3 Approved systems for managing human excrement include:

1. Flush toilets with standard septic tanks and site-appropriate secondary treatment and disposal systems.
2. Water-seal toilets where they pose no risk to human health, water source/s, or the environment in general.
3. Composting toilets.

See **Appendix 2** for a flow chart for selection waste disposal type. Please refer to the Clean Communities- A practical guide to building and maintaining toilets in the Pacific (Live and Learn).Information on different toilet types are in **Appendix 4.**

7.4 The design and construction of the sewerage systems and septic tanks should meet the following minimum standards:

1. Public Health Act
2. Standard for Septic Tank(Central Board of Health)
3. National Liquid Waste Standards - Environment Management Act 2005

7.5 The WSMP must include estimated budgets for the capital and operational costs of the wastewater treatment and disposal systems for the community along with details of all materials and earthworks required for construction and operation of the system.

7.6 The WSMP should consider that rural wastewater projects are generally conducted in poor rural communities and thus should be implemented within the level of technical skills and economic means of the host community.

7.7 All appropriate data and information collected about the site and wastewater systems must be archived with the community, partnering institutions/NGO, and the Water and Sewerage Department for future reference.

7.8 The WSMP requires that the community be assisted to understand the pros and cons of technological options available for avoiding identified wastewater hazards and risks from wastewater disposal systems when designing new or upgrading existing wastewater systems.

7.9 The WSMP should encourage, where appropriate, the use of local materials and practices including traditional system designs, construction methods, and labour practices; construction practices that are familiar can be more readily supported by the community than practices that are different or unnecessarily complex. This is an important element in fostering the community's sense of ownership of the wastewater treatment and disposal system.

7.10 The WSMP should include identification of all appropriate safety procedures to be followed during both the construction and operational phases of the system.

7.11 Pipes and fittings used in all wastewater system schemes must be to Australian and New Zealand Standards *(AS/NZS 1260:2009 PVC-U pipes and fittings for drain, waste and vent application).*

8. Capacity Building

8.1 The WSMP must identify and provide necessary funding, for

(i) Awareness and education programme on water, sanitation and health.
(ii) Training of Village Water Committee for overall responsibility of the scheme and collection of levy from users
(iii) Hands on training on system operation and maintenance
(iv) Community awareness about practices to maintain good quality and quantity of water resources in order to ensure sustainability;
(v) Training on the use of Keeping your Drinking Water Safe Toolkit(SOPAC) and Sanitation Innovation Kit (Live and Learn)
(vi) Tool Kits with appropriate tools for operation and Maintenance of the water and wastewater systems
(vii) Operation and Maintenance Manuals for the systems

9. Operation and Maintenance Requirements

9.1 The Operation and Maintenance Manuals or technical guidelines must be submitted to the Water and Sewerage Department and rural community upon completion of projects. These should be used by the community for the operation and maintenance of the scheme.

9.2 The community must keep appropriate records of action taken in operating and maintaining the water supply and wastewater systems. Additional financial request for upgrading or expanding the scheme will depend on the extent to which the community has followed the operation and maintenance guidelines under the WSMP and the Maintenance Manuals.

10. Management Arrangement

10.1 A Water Committee that will be responsible for the overseeing of the water supply or wastewater scheme must be established in each rural community and their responsibilities confirmed.

10.2 Management arrangements should include but are not limited to:

- Oversight of the scheme;
- Collection of water levies;

- Operating and maintaining the scheme and keeping maintenance records(receipts and activities undertaken);
- Checking on compliance to extraction limit if any for protection of water sources;
- The collection and recording of information about water sources and water use
- Methods and procedures for limiting water pollution.
- Monitoring of receiving water bodies
- Monitoring of water quality of their drinking water using H_2S kit.

10.3 The roles and responsibilities, frequency and contact details of the persons responsible for monitoring and regular maintenance of the water supply must be clearly stated in the WSMP.A sample is given in **Appendix 1** – Table 9.

11. Memorandum of Agreement

11.1 The WSMP must include a Memorandum of Agreement endorsed by relevant stakeholders. All parties must agree to the terms of the MOA and WSMP terms. A sample of the MOA is in **Appendix 5**.

Appendices

Appendix 1 WSMP Templates

Table 1: Village Community Details

Items	Details
Village Name	
Address	
Total No. Of Household	
Existing Water Supply Scheme	
Existing Wastewater Disposal System	
Village Population	
Village Contact Person	

Table 2: Water Sources

Water Sources	Quantity	Quality Check	Remarks
Surface Water			
Ground Water			
Rain Water			
Others			

Table 3: Water Extraction Limits

Source	Type of Extraction	Amount of Extraction	Limits to Extraction

Table 4: Water Demand Estimate

Population To Be Served(Maximum) **A**	**Estimated Usage Daily** **B**	**Estimated Usage (population per annum) (A x 100 L/d x 365 days) C**	**Storage Capacity (litres)** **D**	**Expected Water Supply Volume (annual) (1.25 of D)**

Table 5: Wastewater Estimates

Population To Be Served (Maximum) **A**	**Estimated Wastewater daily** **B**	**Estimated Wastewater (population per annum) (A x 80 l/d x 365 days)** **C**	**Expected Wastewater Volume (annual)** **D**

Risk Assessment

Catchment, Source and Intake

Table 6

Hazard	**Cause/ Hazard Event**	**Control Measure /Barrier**	**Likelihood**	**Consequence**	**Priority**	**Corrective Action**

Pre-treatment and Treatment

Table 7

Hazard	Cause/Hazard Event	Control Measure /Barrier	Likelihood	Consequence	Priority	Corrective Action

Storage and Distribution

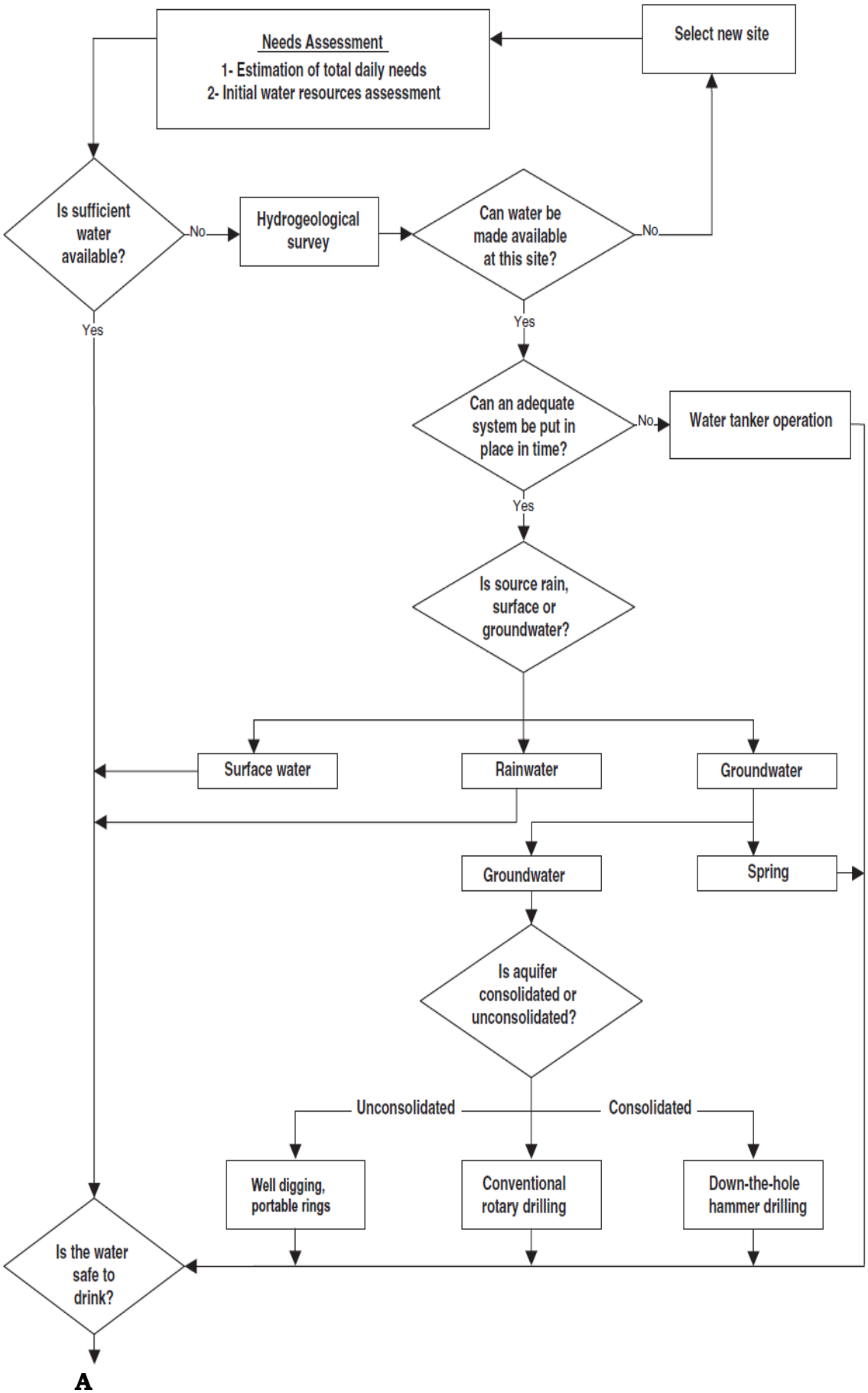
Table 8

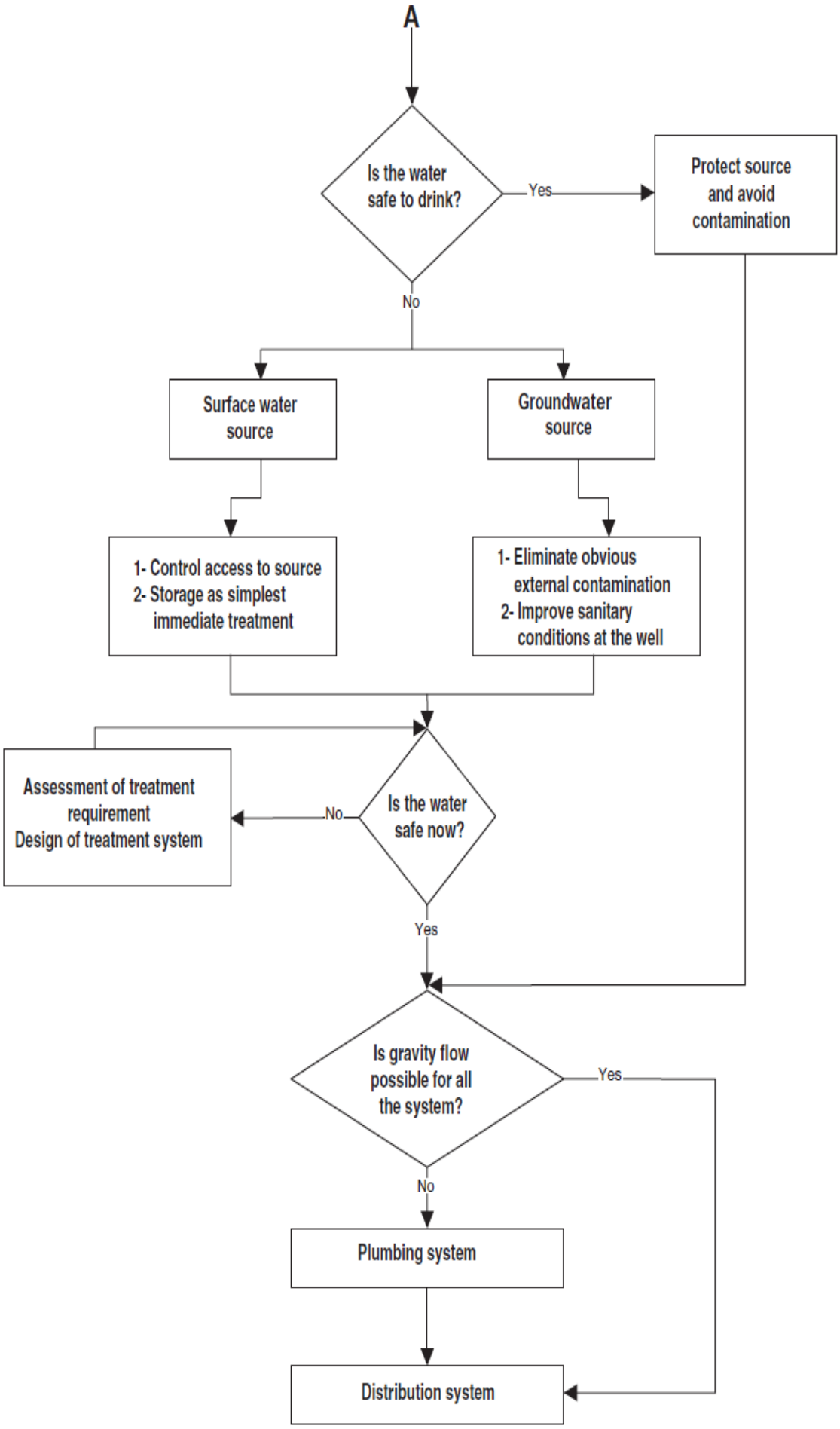
Hazard	Cause/Hazard Event	Control Measure /Barrier	Likelihood	Consequence	Priority	Corrective Action

Table 9: System Monitoring and Maintenance

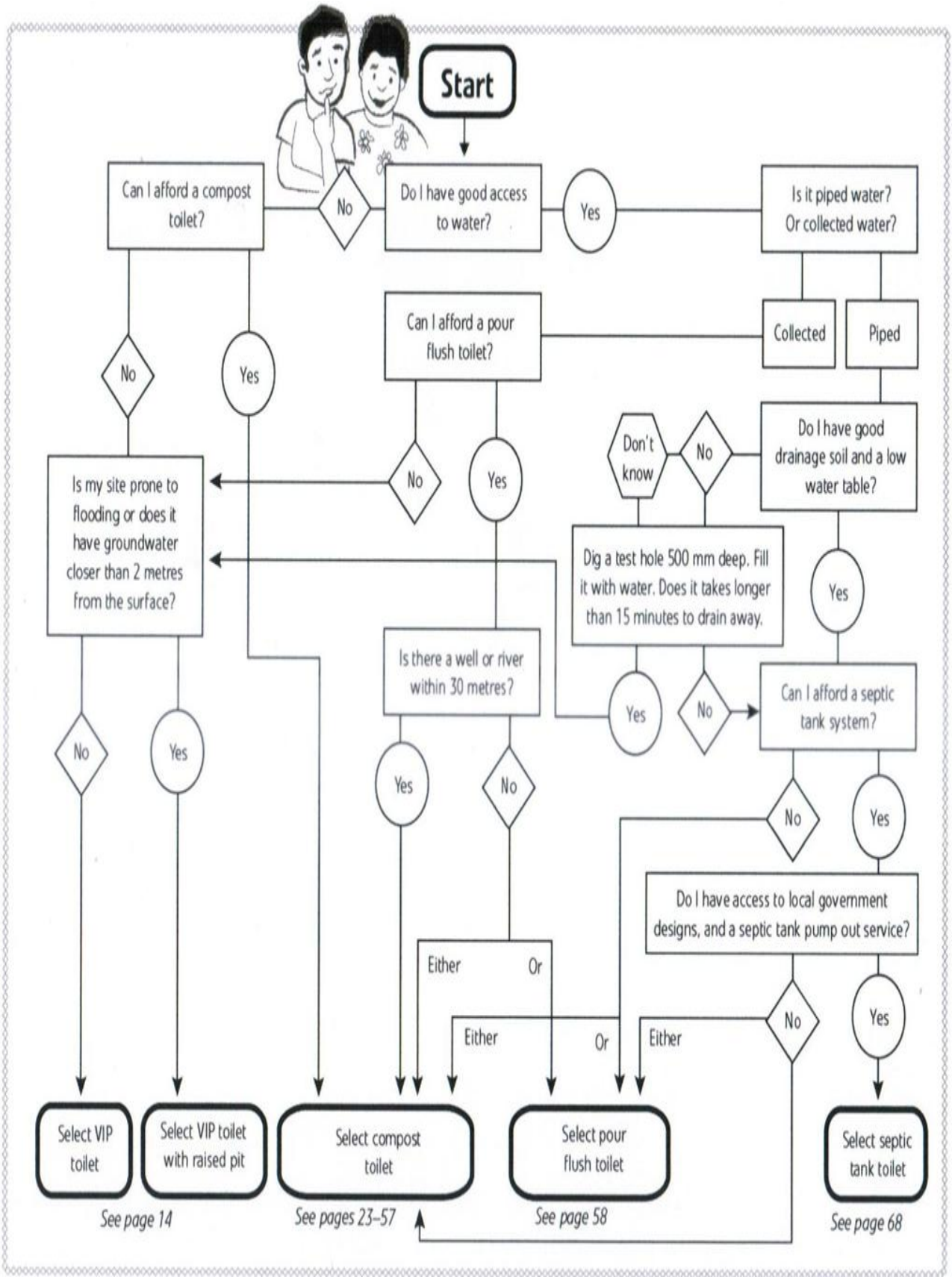
Roles and Responsibilities	**Frequency**	**Person Responsible**	**Contact Details**
Checking Catchment – roof and gutters	Monthly		
Checking treatment – chlorinators, filters	Monthly		
Sampling of water supply	Monthly for microbiology and annual for chemistry (or when required)		
Checking Water Source	Monthly (when required)		
Checking Storage Tank	Weekly (when required)		

Appendix 2 Flow chart for water resource assessment


Needs Assessment
1- Estimation of total daily needs
2- Initial water resources assessment
Select new site
Is sufficient water available?
No
Hydrogeological survey
Can water be made available at this site?
No
Yes
Yes
Can an adequate system be put in place in time?
No
Water tanker operation
Yes
Is source rain, surface or groundwater?
Surface water
Rainwater
Groundwater
Groundwater
Spring
Is aquifer consolidated or unconsolidated?
Unconsolidated
Consolidated
Well digging, portable rings
Conventional rotary drilling
Down-the-hole hammer drilling
Is the water safe to drink?
A


A
Is the water safe to drink?
Yes
Protect source and avoid contamination
No
Surface water source
Groundwater source
1- Control access to source
2- Storage as simplest immediate treatment
1- Eliminate obvious external contamination
2- Improve sanitary conditions at the well
Assessment of treatment requirement
Design of treatment system
No
Is the water safe now?
Yes
Is gravity flow possible for all the system?
Yes
No
Plumbing system
Distribution system

Flow Chart for Wastewater Disposal System



Refer to Clean Communities- A practical guide to building and maintaining toilets in the Pacific - Live & Learn Environmental Education

Appendix 3 Water Supply Plan Template

Water source(s)	☐ Rainwater	☐ Groundwater	☐ Surface Water	☐ Other
Uses of the supply	☐ Drinking ☐ Food preparation (including cleaning food preparation surfaces) ☐ Hand washing ☐ Bathing ☐ Others, Please Explain _____			
Treatment methods	☐ Filtration ☐ Chlorine ☐ UV Light ☐ Other, Specify_____			
Map Of System Example	Use this flow diagram to map your system. Include your water source, storage tanks and treatment systems			

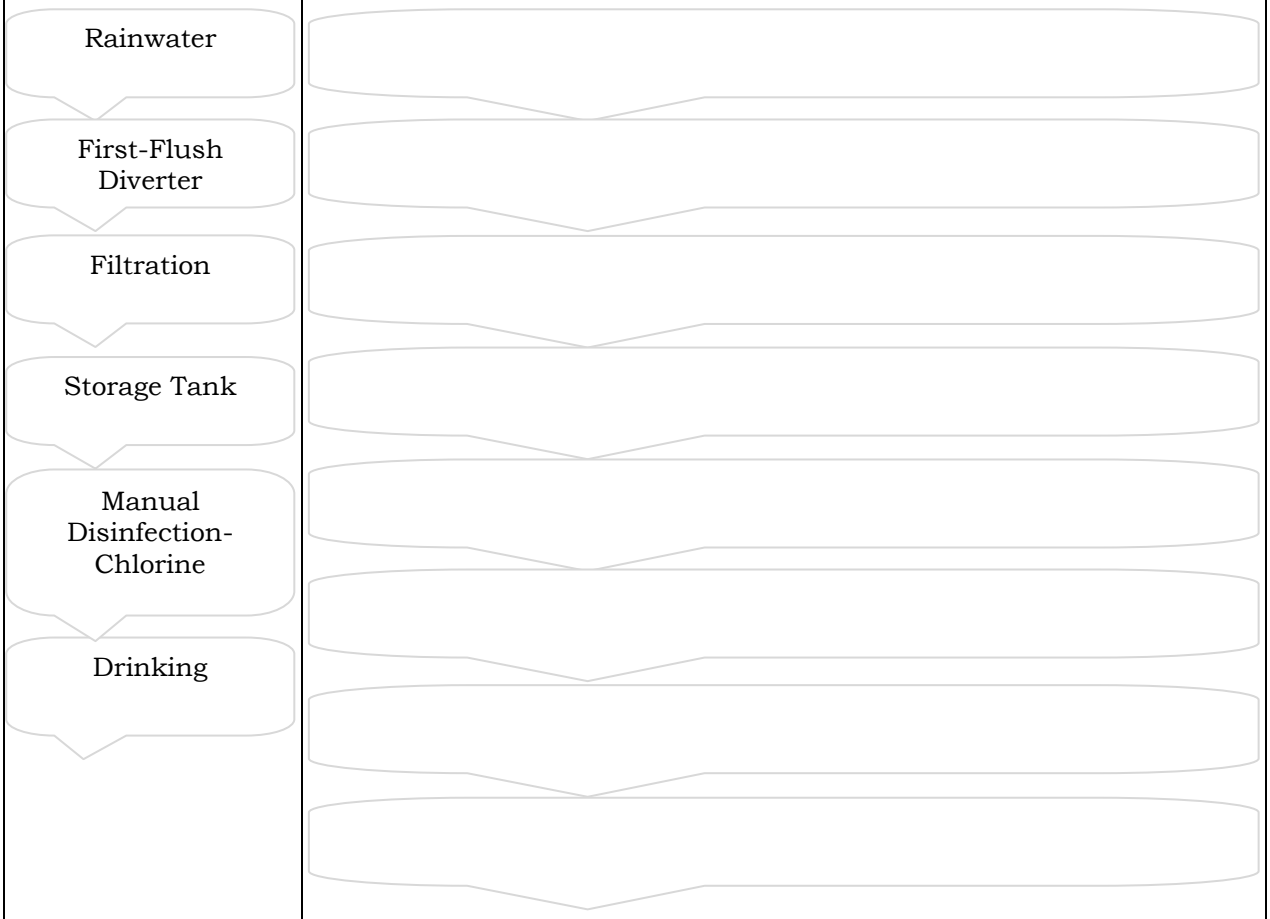
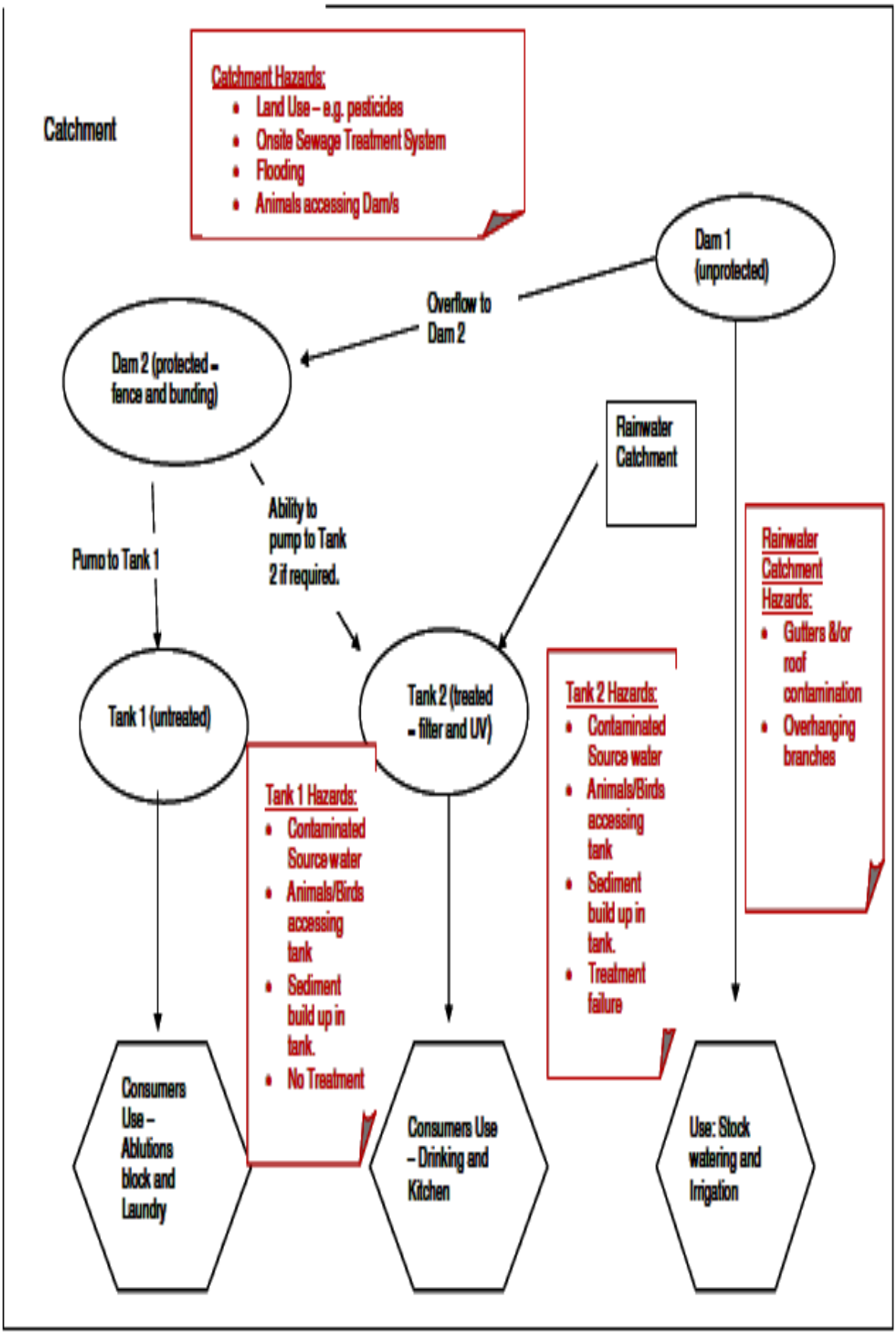


Figure 1. Example Drawing of System



Appendix 4 Wastewater Disposal Types

1. Compost Toilets

They are designed to suit a variety of customs, cultures and climates, and vary enormously in price. Compost toilet has proved to be most effective in water-logged areas where pit-latrines and septic tanks are inappropriate. It is a simple design that does not require electricity or great investment. Built using local materials, it is a self-contained unit that produces good compost and protects the soil and water from any contamination. The selection of the most appropriate type and design of compost toilet will depend on many factors which include social and cultural norms, attitude to faeces, existing hygiene and sanitation practises, sources of drinking water, availability of organic residues, climate, soil types, patterns of habitation and local construction materials etc. Note that, in dry climates, desiccating or drying toilets may sometimes be more appropriate than composting toilets because the dry ambient air can be encouraged to flow through the faeces chamber removing any moisture, thus rendering the faeces dry and odourless. It is important to realise that any compost toilet programme also requires an education programme to ensure that the principals of use and maintenance are clearly understood and accepted by the user group.

Compost toilets are often built with two chambers for simplicity of construction and operation. The two chambers are used alternately; decomposition continuing in the full one until it is emptied just prior to the other one becoming full. Each chamber has its own opening for removal of mature, non-odorous compost. Some types of compost toilet batch the waste in movable receptacles on trolleys or turntables whilst others generate the compost slowly and continuously as the material progresses through the device. Some require electricity for small heating elements (in cold climates) or fans (to ensure a positive airflow through the system). Some compost toilets combine the urine and faeces whilst others separate them. The compost formed by the combination of urine and faeces is better but these toilets are more likely to smell if used carelessly and they require much greater quantities of carbonaceous residues like sawdust and straw. Many of the more complex types require dry access under the toilet via a basement or cellar room.

The compost toilet described here is designed to be a highly effective solution to sanitation in high water table and waterlogged areas. However, it can be used as a reliable and low cost water conserving technology in many other areas as well. It can be built beside or as part of a house in rural, urban or peri-urban areas and can even be established inside a house or apartment. It has the potential to make a significant contribution to domestic water conservation in towns and cities as well as rural areas. Also, since there is no need to connect it to sewerage systems, there is no extra burden on often already overloaded services.

The compost toilet is suitable for use by a family, or it can be built in clusters for institutions, schools, hostels and so on. However, it is recommended that the use of compost toilets is managed within the community and that very good education and awareness raising is done before building begins. Open access community compost toilets are not recommended other than in well-educated and highly motivated communities.

Location

Any toilet would usually be located on the down-wind side of a dwelling and the same applies for compost toilets. However, when built and designed well with good education, the compost toilet does not give any bad odours and can be placed almost anywhere. It should be remembered that vent pipes only function effectively when there is a passage of air over the top of them so site selection should take account of this. Access for compost removal should be within the owners plot to prevent disputes later, especially important in very crowded communities. A significant advantage of compost toilets is that their location is not dependent on the location of sewers or gradients. They can be established in a confined space either within or beside a human dwelling, whether it is a thatched hut or high rise apartment block.

Construction

The compost toilet comprises a raised slab over two chambers. The chambers are built on the ground, not in it. In much waterlogged areas, or those prone to flooding, a slightly raised plinth can be made. The chambers are plastered with cement internally in order to waterproof them and make compost removal tidier. Over each chamber there is a hole in the slab for faeces and a funnel to receive the urine.

In the simplest version, the chamber doors are closed by bricks and mud mortar, both of which can be reused to close it again. However, ferro cement, timber, marine ply or other materials may also be used where they are appropriate locally.

The chambers are designed to have an accumulation time of about nine months to allow thorough composting of the contents and elimination of pathogens. The compost produced is an almost dry, crumbly, black product having a light, pleasant, earthy odour. There is no fly nuisance or any odour problem and the toilets remain clean and pleasant to use. The plant bed needs almost no maintenance and the only requirement is to cut back excessive growth which can be chopped up and added to the compost chamber if required.

Benefits of compost toilets

The use of compost toilets means that cities and peri-urban areas do not need to extend capital intensive sewerage networks and sewage treatment plants. The recurring cost of maintaining additional infrastructure is also avoided. Both these factors represent a huge saving. Also, in areas where toilets would be flushed with municipal water there is an enormous saving in water requirements. Cross contamination between water mains and sewers is eradicated where compost toilets are well established as the standard sanitation technology. Soils are steadily improved by the regular addition of good quality compost. Conventional sewage treatment invariably leaves a dangerous sludge that still needs further treatment or incineration whereas compost toilet systems produce a useful product.

In water logged areas where there was previously no satisfactory sanitation system operating, the benefits that compost toilets provide are clear. They can

prevent ground and surface water contamination and protect people's health in areas where open defecation on the ground or directly into water bodies has been the norm. The production of safe compost and effective use of the urine and wash water are also a significant benefit.

The technology also lends itself extremely well to areas with hard rocky soils where excavation of pits is difficult, expensive or inappropriate. Again the compost is valuable and can help to provide a better chance of establishing plant cover on thin and fragile soils.

2. Septic Tanks

A septic tank is a water tight tank that typically receives waste from a flush toilet. They are useful in areas with a high water table (due to the sealed nature contamination of the water table is less likely) and when a reliable water supply is present. The system provides some level of treatment to the waste through the separation of solids.

The tank should be emptied routinely to ensure effluent does not contain unsafe levels of pathogens and that the sludge does not occupy too high a proportion of the tank. Ideally the effluent from the septic tank should be attached to a sewerage system, however in many cases the outlet is connected to a drainage field or wetlands for further treatment.

Advantages

The system reduces the level of odour and flies
The user has the convenience of a WC which can be located indoors

Disadvantages

The system comes at a high cost including the cost of land
Water is required (both in quantity and reliability)
Permeable soil is required for drainage
Requires regular emptying

Soak Pits

A soak pit, also known as soak away or leach pit, is a covered, porous-walled chamber that allows water to slowly soak into the ground. Pre-settled wastewater or grey water effluent from an upstream collection and storage/treatment facility or collected storm water is discharged to the underground chamber from where it infiltrates into the surrounding soil.

If there is no intention or no need to reuse wastewater *or* grey water, soak pits can offer a cost-efficient opportunity for a partial treatment of storm water, grey water *or* wastewater effluents from *a* primary treatment (e.g. septic tank, twin-pits for pour-flush toilets)and a relatively safe way of discharging it to the environment and therewith recharging groundwater bodies Soak pits are used the same way as leach fields), but require less space as well as less operation and maintenance. But they generally also can receive less influent and the groundwater pollution may be higher than with leach fields.

Advantages

- Low capital cost and requires minimal operation & maintenance
- Can be built and repaired with locally available materials and by the community
- Small land area required
- Simple technique with a high acceptance
- Recharging groundwater bodies

Disadvantages

- Pre-treatment (e.g. settling) of the incoming effluent is required to prevent clogging and limit health risk, although eventual clogging is inevitable
- Applicable only were soil conditions allow infiltration, the groundwater table is at least 1.5 m below the soak pit, there is no risk for flooding and any water well is in a distance of at least 30 m
- Difficult to realise in cold climates
- Should be avoided for high daily volumes of discharged effluents

Wetlands

A free-surface constructed wetland (also called free water surface flow or FWS) is a series of flooded planted channels or a basin that aims to replicate the naturally occurring processes of a natural wetland, marsh or swamp. As water slowly flows through the wetland, particles settle, pathogens are destroyed, and organisms and plants utilise the nutrients. It is especially appropriate for pre-treated and settled wastewater or as treatment stage in hybrid constructed wetlands. Pre-treating of wastewater in e.g. a septic tank or biogas settler is necessary to avoid excess accumulation of solids and garbage. Because of the open water surface, there is a risk of mosquito breeding if not properly designed. Plants grown on the wetland may be used for composting or energy production and the effluent can be used for aquaculture and irrigation. This system is appropriate for small sections of urban areas (e.g. decentralised treatment for a community or several housings or small industries) or even more appropriate for peri-urban and rural communities because of the land surface required. This system is appropriate for small sections of urban areas (e.g. decentralised treatment for a community or several housings or small industries) or even more appropriate for peri-urban and rural communities because of the land surface required.

Advantages

- No chemical required, process stability
- No electrical energy required
- Low operation and maintenance
- Can be built and repaired with locally available materials
- Aesthetically pleasing, less odour and flies
- Can be combined with aquaculture and agriculture
- High reduction in BOD and solids; moderate pathogen removal
- Construction can provide short-term employment to local labourers

Disadvantages

- May facilitate mosquito breeding
- Long start up time to work at full capacity
- Requires large land area
- Requires expert design and supervision
- Moderate capital cost depending on land, liner, etc.
- Not very tolerant to cold climates

3. Water Seal (Pour flush toilet)

A pour-flush toilet is like a regular flush toilet, except that instead of the water coming from the cistern above, it is poured in by the user. When the water supply is not continuous, any cistern-flush toilet can become a pour-flush toilet. Just like traditional flush toilets, there is a water seal that prevents odours and flies from coming back up the pipe.

A pour-flush toilet is like a regular flush toilet except that instead of the water coming from the cistern above, it is poured in by the user. When the water supply is not continuous, any cistern flush toilet can become a pour-flush toilet. Just like a traditional *flush toilet*, there is a water seal that prevents odours and flies from coming back up the pipe.

Water is poured into the bowl to flush the toilet of excreta; approximately 2 to 3 L is usually sufficient. The quantity of water and the force of the water (pouring from a height often helps) must be sufficient to move the *excreta* up and over the curved water seal. Both pedestals and squatting pans can be used in the pour flush mode. The S-shape of the water seal determines how much water is needed for flushing. To reduce water requirements, it is advisable to collect toilet paper or other dry cleansing materials separately.

Advantages

- The water seal effectively prevents odours
- The excreta of one user are flushed away before the next user arrives
- Suitable for all types of users (sitters, squatters, wipers and washers)
- Low capital costs; operating costs depend on the price of water

Disadvantages

- Requires a constant source of water (can be recycled water and/or
- collected rain water)
- Cannot be built and/or repaired locally with available materials
- Requires some education to be used correctly

Appendix 5

MEMORANDUM OF AGREEMENT

(To be amended accordingly)

This Memorandum of Agreement (MOA), dated ....., is between

Background

(This section shall be completed by the implementing agency giving a background on the village water and sanitation project)

ARTICLE 1

Village Commitments:

- *(Name)* Village will select a Project Manager from the village whose sole responsibility in the project is to oversee the implementation of the project in the village. The project manager will be responsible for coordinating village labour, safeguarding project tools (tool room) and materials, ensuring that the project timeline is adhered to, and maintaining communication with onsite project staff *(WAF/NGO)*. The project timeline is attached to this MOA.

- No Interference on work due to land dispute, etc.

- *(Name)* village will include at least 1 woman from on the Water Committee as of *(Date).*

- *(Name)* Village Water Committee and Project Manager will have weekly meetings starting (Date) and continuing throughout the duration of the project to coordinate and plan project activities in the village. Minutes must be kept for all meetings, and copies of the minutes will be provided to Ministry of Provincial Development.

- *(Name)*Village Water Committee will begin using a log book by *(Date)* to record all maintenance, repairs, and modifications made to the water system.

- *(Name)* Village Water Committee will begin keeping proper accounting records by *(Date)* of all monies collected and spent by the Water Committee. Records will be submitted to Ministry of Provincial Development monthly and presented in the village meeting.

- *(Name)* Village Water Committee will open a committee bank account by *(Date)* with all monies collected by the Water Committee.

- *(Name)* Village Water Committee will begin collecting user fees as of *(Date)* from all households and businesses utilizing the water system. The user fees should be no less than *($... / house / week/month).* This money will be deposited into the Water Committee Bank account, and records of the collection submitted monthly to Ministry of Provincial Development and in the village meeting.

- *(Name)* Water Committee will organize the project tool room by *(Date)* and conduct a monthly audit of all tools and project materials stored there. Tools must be signed in and out every time they are used.

- *(Name)* Village will store all project materials safely and securely. All project tools and small materials are to be stored in the tool room constructed by the project. The tool room will be locked, with the project manager, *(WAF/NGO)* holding keys for the room.

- *(Name)* Village will provide a chains and locks by *(Date)* to secure the area around the water tanks.

- *(Name)* Village is committed to providing village labour to complete the water and sewerage systems.

ARTICLE 2

Funding Agency Commitments pending the successful acquisition of funds to complete the project:

- Government/WAF/NGO will acquire the funds necessary to complete the project.

- Government/WAF/NGO will provide all construction materials and plans, technical expertise, and earth works necessary to complete the projects

- Government/WAF/NGO will provide training and user manuals for the operation and maintenance of the water and sewerage systems.

By signing below, I hereby do agree to honour the above outlined commitments.

Appendix 6 Common sources of rainwater contamination and how to reduce the risks

System Component	Source of Contamination	Action
Roof and Gutter	Build-up of leaves, dirt and animal droppings	• Install a first-flush diverter • Clean the gutters and roof regularly • Install gutter shields • Mount TV antennae off roof • Maintain the guttering • Remove overhanging branches • Use leaf filters or screening at the tank inlet • Conduct regular inspections • Treat the water (filtration and disinfection)
	Roof material (such as lead-based)	• Don't collect water from roofs coated or painted with substances that may leach hazardous materials (such as lead from lead-based paints) • Maintain roof, gutters and downpipes in good condition • Replace lead flashing • Seal any exposed treated timber
	Spray drift (such as pesticides and fertilisers)	• Clean the gutters and roof regularly • Install a first-flush diverter
	Solar hot-water system, overflows and bleed-off pipes from roof-mounted appliances such as cooling systems and hot-water services	• Don't collect water from the gutters below solar hot water systems • Ensure overflow and bleed-off pipes do not discharge onto the roof or into gutters that collect the rainwater supply
Screens and strainers	Build-up of dirt and debris in strainers	• Clean screens and strainers regularly • Conduct regular inspections
Storage tank	Birds, animals, insects, algal growth	• Install screens on all tank inlets and overflows with maximum 1mm mesh • Cover the tank with a light-proof cover • Conduct regular inspections of tank covers and screens to ensure they are intact • Treat the water (filtration and disinfection)
	Sediment build-up within the tank	• Clean (desludge) regularly (minimum every two years) • Clean before receipt of carted water • Locate the draw-off point for taking water from the tank at least 150 mm above the base of the tank (the manufacturer's minimum height for the draw-off point should be noted)
	Tank materials	• Ensure storage tanks comply with Australian and New Zealand Standards.
		• Ensure the tank is structurally sound • Chemically adjust pH in new concrete tanks
In-ground storage tank	Seepage from surface water/sub-surface water such as sewage from a septic tank	• Ensure the tank is properly designed and sealed to prevent entry of surface or sub-surface water • Ensure the tank is not buried in land contaminated with chemicals • Ensure the buffer distance between the tank and wastewater disposal system complies with Environment and Health guidelines. • Treat the water (filtration and disinfection)
	Pump and plumbing materials	• Ensure buried pipes are installed away from and shallower than septic tanks or wastewater pipe work • Ensure all tank materials in contact with drinking water comply with Australian, New Zealand and local Standards.

Appendix 7 Common sources of groundwater contamination and how to reduce the risks

System Component	Source of Contamination	Action
Bore	Surface water run-off	• Raise the bore head above the ground, surface drainage flows away from the bore head • Ensure the bore is surrounded with a concrete slab with the bore casing protruding above the slab and sloping away from the bore head • Ensure the bore cover is securely in place and free from holes or cracks • Ensure the bore casing is intact • Locate livestock fences at least 50 m from bore • Treat the water (filtration and disinfection) • Conduct regular inspections
	Sub-surface contaminants	• Avoid extracting water from sites with known contaminants, including heavy industrial and intensive agricultural areas • Test the source water for chemicals • Treat the water (filtration and disinfection)
	Sewage	• Ensure the buffer distance between bore and wastewater disposal system complies with Environment and Health Guidelines • Maintain the septic tank system • Treat the water (filtration and disinfection)
	Naturally occurring chemicals within water (such as heavy metals and arsenic)	• Test the source water and assess results against guideline values in the National Drinking Water Quality Standards
	Leaching from bore casings, pipes or plumbing materials	Ensure all materials in contact with drinking water comply with Australian and New Zealand Standards and local standards. • Conduct regular inspections
Pump	Chemical spillage	• Ensure engines are mounted on a separate concrete slab • Ensure fuel or oil spillage is prevented from getting in the bore – use bounded plinth. • Maintain the pump to prevent deterioration of the fuel and lubricant lines
Storage tank	Birds, animals, insects, algal growth	• Install screens on all tank inlets and overflows with maximum 1mm mesh • Cover and seal the tank with a light-proof cover • Conduct regular inspections • Treat the water (filtration and disinfection)
	Sediment build-up within the tank	• Clean (de-sludge) regularly (minimum every two years) • Clean before receipt of carted water • Locate the draw-off point for taking water from the tank at least 150 mm above the base of the tank (the manufacturer's minimum height for the draw-off point should be noted)
	Tank materials	• Ensure storage tanks comply with Australian ,New Zealand and Local Standards
In-ground storage tank	Tank materials	• Make sure they are structurally sound • Chemically adjust pH in new concrete tanks

System Component	Source of Contamination	Action
	Seepage from surface water/sub-surface water such as sewage from septic tank	• Ensure the tank is properly designed and sealed to prevent entry of surface or sub-surface water • Ensure the tank is not buried in land contaminated with chemicals • Ensure the buffer distance between the tank and wastewater disposal system complies Environment and Health Guidelines. • Treat the water (filtration and disinfection) • Maintain the system
Distribution lines	Stagnant water in pipes	• Flush the pipe work if not used for more than one week • Ensure pipes are self-draining or drained every six months • Bury pipes at least 300 mm below ground and protect them from tree roots • Have a plumber double check any plumbing works to ensure no cross-connections have occurred
	Pump and plumbing materials	• Ensure buried pipes are installed away from and shallower than septic tanks or wastewater pipe work • Ensure all materials in contact with drinking water comply with Australian, New Zealand and local Standards

Appendix 8 Common sources of surface water contamination and how to reduce the risks

System Component	Source of Contamination	Action
Catchment area	Activities in the catchment area of human and animal may cause chemical and bacteriological contamination as well as high turbidity of water at source due to leaching soil erosion etc.	Stop animal grazing and human activities Such as timber logging
Source Protection Source of GFWS may be any one of the following or combination of two or more a)Spring b) Stream c) Impounding reservoir d) River e)Any other(Specify)	Competing demand of water for other purpose.	Stop giving consent for water use by other purposes other than drinking alone
	Flooding of source may increase turbidity, contamination etc. Trespassing of human and animal may cause various degree of contamination	Stop animal grazing and human activities Such as timber logging and fence off area
Intake Structure	Structure, may cause leaching of contamination and water leakage ,Back up storage at intake may help in mitigation of drought situation. Trespassing may contaminate water at intake	Water management use, Counter climate change effects Install back up tank and fence off intake structure area.
Raw Water Conveying main	Any leakage may expose to risk of contamination	Repair Raw Water main or replace with new main
Treatment Unit	Poor operational practice may lead to large-scale contamination and increased public health risks In-adequate O&M fund may affect proper O&M of Treatment unit compromising preventing steps against contamination,	Stop animal grazing and human activities Such as timber logging Water Committee to budget funds and maintenance work to be carried out periodically.

System Component	Source of Contamination	Action
	Chemicals used if any during treatment process, should be free from contamination Trespassing to be avoided	Fence off Treatment area
Clear Water Service Reservoir & disinfection	Prevent possibility of recontamination, due to poor condition of clear water reservoir	Frequent testing of water and check dosage or filters used, reservoir to be repaired periodically
Distribution Net-Work	Leakage combined with low pressure ,damage pipes and fittings may cause the risk of contamination	Repair raw water main or replace with new main
Water Collection Conveying Storage &Use at House-hold	Possibility of microbiological Contamination from collection point of distribution network and point of use is wide-spread	Frequent testing of water and check dosage or filters used

Appendix 9 List of maintenance activities for rural water supply systems

Villages with rural water supplies will be required to keep records of system inspections and test results for at least two years. Use this list to help gather information for the village records (note this list is not exhaustive)

Water source: rainwater	Clean spouting/gutters (three-monthly and after storms) Check and trim overhanging branches (annually) Inspect and repair downpipes (annually) Check condition of roof (annually)
Water source: groundwater	Check the bore head and any other mechanisms installed is watertight and protected from surface flows (monthly) Check bore is securely protected such as fences, locks (monthly) Check maintenance and operation of the pump (monthly)
Tank	Check inlet and outlet screens (three-monthly) Check access covers (monthly) Clear strainer of debris (three-monthly and after storms) Check for presence of mosquito larvae in tank water (monthly) Check structural condition (annually) Check sludge level and internal cleanliness (every two years or as required)
Distribution system	Check plumbing/piping is fully operational and well maintained (annually)
Treatment system	Replace filters (as per manufacturer's advice or earlier if a decrease in water flow is noticed) Test chlorine level is at or above 0.5 mg/L (at least weekly or after heavy rains) Test pH level is 6.5–8.5 (weekly) Check UV light is operating and free from scum (weekly) Replace UV lamps every 12 months (or as per manufacturer's instructions)
Water quality testing	*E. coli* test* (initially to identify risk, when the system is new or altered, or after a significant event such as heavy rainfall) Chemical test – (initially to identify risk, when the system is new or altered, or after a significant event)

* Assess results against standard values in the *National Drinking Water Quality Standards.* Note: To ensure the water supply system has not been compromised over prolonged shut down periods, maintenance checks are recommended.

Appendix 10 Common ways to treat water supply

Filtration

Filters can remove particular contaminants within the water. Filtration can remove some sediment, chemicals, algal toxins (which are a specific type of chemical) and microorganisms.

Filters are commonly installed with the regular plumbing between the roof catchment area and the storage tank. They are normally used in combination with ultraviolet light and/or chlorine disinfection.

Some filters are more effective than others. Consult a water treatment specialist to help choose the filtration method most appropriate for the contaminants you need to remove.

Disinfection

Disinfection is generally the last step of water treatment and will remove most disease-causing microorganisms. It is important to realise that disinfection will not remove chemical contaminants.

Ultraviolet light disinfection

Ultraviolet (UV) light is a common and effective form of disinfection, which kills many kinds of microorganisms. A UV disinfection system can be installed with the regular plumbing before the point of use (such as the kitchen tap).

Filtration to remove sediment often needs to occur before the water reaches the UV disinfection unit because UV light cannot penetrate dirty or 'cloudy' water. For best results, UV disinfection should be used either at the point of use or in combination with chlorination.

UV disinfection systems need to be designed and installed by a water treatment specialist.

Chlorine disinfection

Chlorine is often used to disinfect water because it is accessible, economical and can treat large volumes of water with a residual effect. Water can be chlorinated either through an automatic dosing system within your regular plumbing or manually added to the tank.

It takes about 5 mg of chlorine per litre of water to disinfect the water in the tank. However, this will depend on the quality of the water. For effective disinfection there should still be at least 0.2 - 0.5 mg/L present in the water 30 minutes after dosing the water.

The testing can be done with a suitable chlorine test kit (such as a swimming pool kit). If the measured chlorine is below 0.2 - 0.5 mg/L, repeat chlorine dosing until this level is reached.

Appendix 11 WSMP Checklist

Implementing Agencies are encouraged to use this checklist to ensure the requirements relating to the water supply management plan are fulfilled.

Requirements	**Checklist**	
	Yes	**No**
1.Description of Village		
2.Estimate of Water Demand		
3.Assessment of Water Sources		
- *Quality Check*		
- *Quantity Check*		
- *Hazards Identification*		
4.Rules of Water Extraction		
5.Water Supply Design		
- *Description of System*		
- *Project cost Estimate*		
- *Risk Assessment*		
6.Wastewater and Sanitation Design		
- *Description of System*		
- *Project cost Estimate*		
7.Capacity Building		
- *Training and Awareness Programme*		
- *Toolkit for Operation and Maintenance*		
8.Operation and Maintenance Requirements		
- *Technical Guidelines/Manuals*		
9.Management Arrangements		
10.Memorandum of Agreement		

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WHO/SDE/WSH/05.06
WHO, 2005

Drinking Water Planning Guidelines
A Practical Guide for Pacific Island Countries
WHO/SOPAC/AUSAID

Keeping Your Drinking Water Safe Community Toolkit
SOPAC

Clean Communities- A Practical Guide to Building and Maintaining Toilets in the Pacific
Live & Learn Environmental Education

A Guide to Completing a Water Supply Management Plan
For schools using private drinking water supplies
Department of Health, Melbourne

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