

**CAPACITY BUILDING TRAINING FOR CATCHMENT MENTORS (CHAMPIONS)**

**INTRODUCTION TO WATER USE MODULE 5 (C)**

**SECTION 2: LEARNERS GUIDE**

**Integrated Water Resources Management**

**Strategies, Guidelines and Pilot Implementation in Three Water Management Areas,  
South Africa**

**Department of Water Affairs and Forestry**

**South Africa**

This module contains restricted information and is  
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Ref. J. No. 123/138-0154

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**FPCD**

**Date: September 2003**

**The content of this training material is in line SAQA guidelines**

**THIS WORKBOOK BELONGS TO:**

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## **HOW TO USE THIS MANUAL**

This manual provides an introduction to **Water Use**. It provides participants with the necessary information to understand the process of managing a water catchment area. It also explains the concept of groundwater, as well as water related diseases and how to avoid them.

It is expected of the participants to attend the training sessions and participate in all the exercises. It would be very useful to carefully study the whole manual. You are also welcome to make notes on this manual, as needed, in the wide right margin of each page.

In addition, the results of the various exercises must be verified with the information in this manual.

*You must make sure that you understand the work presented in the notes and never hesitate to ask questions.*

**We hope you will enjoy this course and gain much from it.**

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## INTRODUCTION TO WATER USE – MODULE 5 (C)

### 1. INTRODUCTION TO WATER USE

#### 1.1 EXPLAIN THE PRINCIPLES OF WATER CATCHMENT

This unit focuses on the characteristics of water flow in a water catchment area. It will recognize and indicate water uses in a catchment area and determine the economic value of water. Finally, it will indicate ways to conserve water as a resource.

##### 1.1.1 WHAT IS A CATCHMENT AREA?

Imagine you are standing on a bridge across a river and you are looking upstream or against the flow of the stream. What do you see?

The surroundings you see is where the water comes from and it forms part of the **catchment area** of the river at that point. Hills or mountains form the borders of the catchment area and is called a watershed. A watershed is the line from where water that falls on the one side (A) will only flow towards a river on that side. Water that falls on the other side of the line (B) will only flow to rivers on the opposite side.

Behind you in the valley are lands with crops, a village, rural area with different housing communities and a nature reserve. When you turn around you see that the river flows through a big town with different industries and columns of smoke revealing various activities. There is also a power station with different cooling systems and a cloud of steam in the air. A little further down, the river flows into the sea. All the events form the **activities of a catchment area** with the river as the water source and fertile soil that forms the surrounding watershed. All these activities need water from the river system for their survival.

##### 1.1.2 CHARACTERISTICS OF WATER FLOW IN A CATCHMENT AREA

The physical aspects of a catchment area is as follows:

- ❖ An area that supplies water to a specific stream or streams.
- ❖ This area is boarded by hills or rocky outcrop that determine the flow of the water to a stream or river.
- ❖ Some catchment areas are created through law.
- ❖ Catchment areas may be part of a physical catchment area or include parts of different catchment areas.

### 1.1.3 RECOGNITION OF WATER USE IN A CATCHMENT AREA

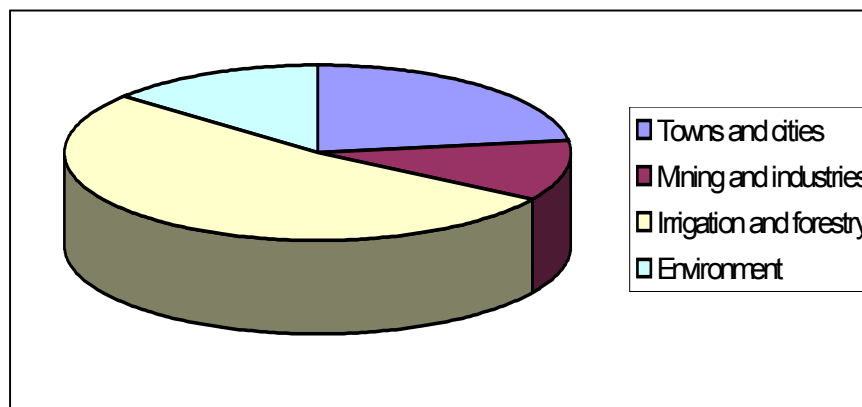
It is important to ensure that the water system is used in the best possible manner. South Africa is divided in nineteen water management areas. This would be beneficial if it could be unified into one big catchment area with only one mouth to the sea. This way a large volume of water would be saved. The Tugela River is an example of such a big catchment area. Alternatively a water catchment area can consist of a number of different river systems or catchment areas as in the Eastern Cape. A catchment management agency would be formed in each of the areas with the common viewpoint that the water should be used to benefit everybody in the area.

The catchment area management agency could liaise with the stakeholders to determine:

- ❖ How much water is needed for the community or communities?
- ❖ The quality of water use.
- ❖ Planting seasons in the case of farming.
- ❖ Evaluation of water sources to address all the needs.

Different kinds of water users have different requirements / demands on the available resources. Water is needed to sustain life (biological reserve) and the amount of water from streams and rivers should be comparable to the normal household needs. The national use of water in the different categories of water users is showed in the diagram below:

**Figure 1: Water Use Categories**



#### **ACTIVITY 1**

Individual work

Identify and discuss the various types of water users in your area.

## 1.1.4 DIFFERENT TYPES OF USERS

A variety of water use sectors exist. The Department of Water Affairs and Forestry (DWAF) and Local Authorities use the definition of water use groups.

### 1.1.4.1 *Municipal users*

Municipal water use includes both city and rural communities and is provided by a water services provider on behalf of the water services authority. It consists of three user groups:

- Household use:  
Household consumption differs from rural, peri-urban and high-income households.
- Commercial, Institutional and Dry Institutional use:  
This refers to general water use in business rather than use for production.
- Industrial use:

This refers to the use of water in industry, mining or power generation. This type of use is situated in a specific area and is supplied by the water services provider (WSP).

### 1.1.4.2 *Industries, mining and power generation*

This category of water use is the same as the Municipal Industrial group, except that they extract water directly from the water source and refuse is pumped back into the water source. ((The Local Authority does not handle Refuse.) Strategic use like power generation may be included in this group.

### 1.1.4.3 *Agriculture*

Agricultural water use primarily includes irrigation and livestock. These users get water from:

- Regional Water Schemes.
- Local water user societies.
- Directly from ground or surface water.

### 1.1.4.4 *Other registered or licensed water users*

It is expected form water users groups to register or to apply for licenses for water use.

Licenses are categorized as follows:

- **Storage:** When water loss is caused, specific catchment areas are used that don't relate to the abstraction of water. An example is city "waterfronts" or catchment areas that manage floods.

- **Recreation:** Recreation is associated with a natural water body e.g. water sport, conservation and tourism. Large catchment areas are usually associated with recreation and income is generated by its use. Restrictions may be placed on activities in the accumulation level.
- **In-stream and band activities:** This refers to an obstruction that changes the pattern of the water flow. Examples are construction and mining activities. Licenses are required for these activities.
- **Activities:** Any activity that may have a negative impact on the quality of the water resource. This applies specifically to the dumping of refuse (including ground water in mining).

#### **1.1.4.5 Non-registered water use**

Water users as specified in Schedule 1 of the National Water Act (NWA) do not have to register, as their water use is negligible. Emergency services are also a part of this category.

Note: Please do the activities on the next two pages.

**ACTIVITY 2****Individual Assignment**

Read the following advertisement – “Public Notice” carefully:

***ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS: 400kV power line  
(transmission) between the Grootvlei substation near Kuruman and the  
Pofadder substation near Kimberley***

Notice is given in terms of Regulation 4(6), Government Notice R. 1183 under Section 26 of the Environment Conservation Act (Act No. 73 of 1989) that Eskom proposes to construct and operate a 400kV transmission power line between the existing Grootvlei substation (north-west of Kuruman) and Pofadder (north of Kimberley) substations covering a length of approximately 300 - 500 km.

This transmission line is important in an effort to provide the necessary electricity to power the Kimout initiative near Bloemfontein.

In order to ensure that you are identified as an Interested or Affected Party (I&AP), please submit your name, contact details and the reason for your interest to the firm below, on or before **FRIDAY 25 May 2003**.

To register as an I&AP or to obtain any further information, please contact the Public Participation Consultant. Our details are as follows:

**Clean Water Environmental (Pty) Ltd.**

**Contact person: Rina Visser**

**P. O. Box 136**

**Kimberley**

**8301**

**Telephone: (053) 362-2918**

**Facsimile: (053) 362-2553**

**E-mail: rina@cleanwater.co.za**

Answer the following questions in your workbook:

- According to the Notice, which project will be embarked on?
- According to which act should the project be conducted?
- Outline the measures that should be introduced in terms of the impact of water in the Springs area.
- Name the companies that are involved in the Grootvlei project.
- Describe the aim of the project.
- Which particulars must be provided to register as an interested party?

**ACTIVITY 3****Group work**

Complete the following questionnaire about your catchment area:

QUESTION	ANSWER
1. Who is in charge of your catchment area?	
2. What is the legal provision measure?	
3. How much do the following people pay? <ul style="list-style-type: none"> <li>• Owner.</li> <li>• Users.</li> <li>• Water supply agency.</li> </ul>	
4. Is there a local management committee in your town?	
5. In case of an existing management committee: <ul style="list-style-type: none"> <li>• Who represents the committee?</li> <li>• When was the committee chosen?</li> <li>• How often did they meet in the past six months?</li> <li>• What are the duties of the management?</li> <li>• How do they record their meetings?</li> <li>• How does it relate to other management groups in your town? e.g.: churches, development committee, etc.</li> </ul>	
6. Who is responsible for the: <ul style="list-style-type: none"> <li>• Day to day management?</li> <li>• Routine maintenance?</li> <li>• Emergency repairs?</li> </ul>	
7. Is anybody trained to do the work?	
8. What tools were suggested and where could they be purchased?	
9. Is there a history of maintenance of supply? <ul style="list-style-type: none"> <li>• What was the reason for the delay?</li> <li>• What were the results of the delay?</li> </ul>	
10. What was the water supply used for?	
11. How was the construction process organised? <ul style="list-style-type: none"> <li>• How long did it take?</li> <li>• Were there any delays in the process?</li> <li>• Which technical services were used and where was it found?</li> <li>• Was the Government able to supply the services?</li> </ul>	
12. Is the water supplied to more than one community? <ul style="list-style-type: none"> <li>• If yes, what is the relationship between the communities?</li> <li>• Who was responsible for the initiation of the water supply?</li> <li>• Who did the community think was responsible for the water supply?</li> <li>• What is the role of the police regarding the supply of water?</li> </ul>	

### 1.1.5 THE ECONOMIC IMPORTANCE OF WATER

There are different general principles when determining the economic value of water and the associated costs for the supply thereof. The value of water depends on both the user and the use of water.

The economic components include the following:

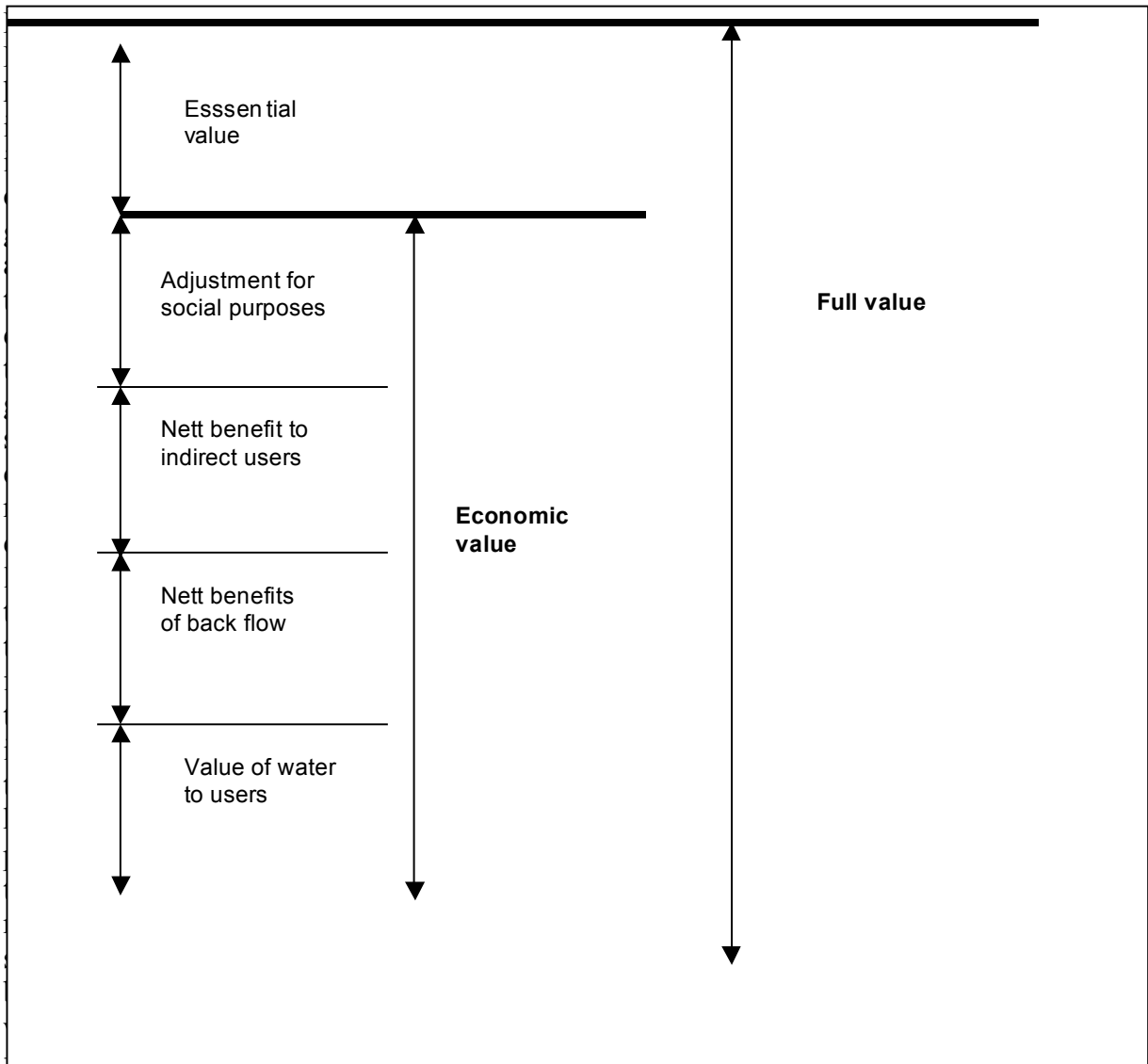
- ❖ Value of water to its end-users.
- ❖ Net benefits of return flow.
- ❖ Net benefits due to indirect use.
- ❖ Alterations due to social aims.

Concern has been voiced over the social consequences of the concept of “water as an economic and social good”: How would this affect poor people’s access to water? (While the Dublin Principles refer to “water as an economic good”, water is referred to as an economic and social good in Chapter 18 of Agenda 21).

To avoid some of the confusion on this concept, there is a need to distinguish clearly between valuing and charging for water. The value of water in alternative uses is important for the rational allocation of water as a scarce resource (using i.e. the “opportunity cost” concept), whether by regulatory or economic means. Charging for water means to apply an economic instrument, which affects behaviour towards conservation and rational use of water, exercise demand management and ensure cost recovery.

(Source: Integrated Water Resources Management. How GWP TAC sees it. GWP, March 2000. As quoted in “Water Resources Management, p. 36, DANIDA SECTOR POLICIES, 2000, entitled ‘Water Resources Management’

The components of the users’ value of water, in determining the essential value of the water.

**Figure 2: Essential Value**

### **1.1.5.1 Value of water to the users**

To industrial and agricultural users the value is at least equal to the profitable value of the product. In household use, the willingness to pay for water represents a lower value, seeing that there are also other uses for water (e.g. flush toilets).

### **1.1.5.2 Nett benefits of Return Flow**

Return flow of water that is captured for peri-urban, industrial and agricultural uses represent an important element of hydrological systems. The effect of it must be taken into account in estimating the value and cost of water.

Example: part of the captured water will supplement the underground water table as well as the flow to rivers and streams. It is however important to note that the benefits of return flow are critically dependent on that part of water that may be lost due to evaporation.

### **1.1.5.3 Nett benefits of indirect use**

A typical example of these benefits can be seen in agricultural schemes where water is also supplied for household use (drinking and personal hygiene) as well as for livestock purposes. This leads to improved health and/or higher income to the rural poor. Apart from the benefits to livestock, it provides irrigation channels, water for wild animals, birds, fauna and flora as well as 'in-stream' benefits. It is also known that irrigation schemes may have a negative effect on the environment and social set-up. This may lead to difficult times and poorer households. The consequences are:

- Saturation of the soil (marshy).
- Lowering of under ground water levels (underground water supply to hand pumps may dry up).
- Contamination.
- Water born illnesses.

### **1.1.5.4 Determining the aims of communities**

When water is used in households and the agricultural sector, it may be necessary to make the following adjustments:

- Poverty relief.
- Work and food assurances (especially in rural areas where grain prices are high in the absence of additional expansion of irrigated agriculture and where it may be hard to get hold of imported food and grain).

#### **ACTIVITY 4**

##### **Individual assignment**

- Explain the components of economic value according to diagram 2.

### 1.1.6 METHODS OF SAVING WATER

Only 1% of the total water supply in the world is available for human consumption. The rest is salty or locked up in glaciers. This relatively small percentage of 1% maintains the world's agriculture, production sectors and households.



By saving water, you also save on other services

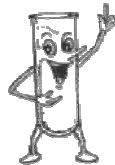
#### Example:

By using less water one needs less energy to heat the water and thus save on your electricity bill. By following a simple savings program the environment is assisted in storing, purifying, disseminating and handling water.

The four basic components in a water savings program is as follows:

#### 1.1.6.1 Step 1: *Be stingy!*

Look at your water utilisation habits. A lot of water is wasted because we think water is plentiful and cheap. About 75% of water used in your household is used in the bathroom. Become aware of the water that you use and look for ways to use less water.



“ Think before you use water!”

#### 1.1.6.2 Step 2: *Repair leaks!*

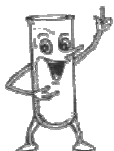
A drop of water per second wastes about 12 000 litres of water per annum. Leaks are your biggest enemy in your water saving program.

#### 1.1.6.3 Step 3: *Install water saving equipment!*

There are many kinds of water saving equipment on the market.

#### Example:

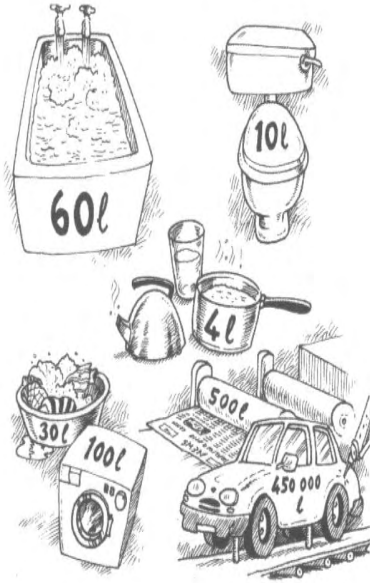
- Flow regulators for showerheads.
- Appliances to restrict the toilet capacity.



“Invest a little money, time and work and the savings will be big!”

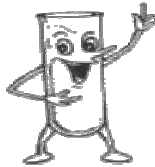
**1.1.6.4 Step 4: Re-use water!**

Re-used water is often suitable for other purposes without the need for filtration. Severe **droughts** may necessitate **re-use** of water. When maximum saving is necessary, use water as economically as possible!



**Savings outside the home**

It is a fact that when water is used outside the home, waste is at its worst. Do not wait until your lawn is brown before putting on the sprinklers. One sprinkler that uses about 25 litres per minute uses in an hour 50% more than a combination of ten flush toilets, two 5-minute showers, two dish washers and a washing machine with a full load of dirty clothes. The basic principle is not to water the garden and lawn more than is needed. Therefore one should not follow a fixed pattern.



“Water the lawn or plants only when needed!”

**Activity 5**

**Group work**

Work together as friends:

Study the following:

A rural village uses 10 000 liters per day on average. All this water is carried in buckets from the nearest river.

Discuss the following by using the pictures provided:

- Where do you think the water that people use in Johannesburg comes from?
- Do you think the people in Johannesburg would use less water if they had to carry it from the river? Give a reason for your answer.
- ‘A person in Johannesburg uses about 200 liters of water per day. Calculate the number of ten liter buckets each person in Johannesburg would have to get from the river?’
- Give a reason for your answer.
- Think of ways in which people in Johannesburg could use less water.
- Link your ideas to the pictures on the right.



**OPTIONAL ACTIVITY**

**Individual Assignment**

Study your own home.

Determine if you are Water wise by completing the questionnaire below:

QUESTION	ANSWER	SOLUTION TO ACHIEVE	WHEN WILL THE PROBLEM BE SOLVED (CUT-OFF DATE)
1. Are there any leaking taps in your home?			
2. How long does every person at home shower?			
3. Does your family wash their hands with warm or cold water?			
4. When brushing your teeth, do you close the tap properly?			
5. Do you pay the water bill on time every month?			
6. Are there leaking toilets in your home?			
7. Do you wash the vegetables under a running tap or in the sink?			
8. Do you clean the gutters with a hose or broom?			
9. Do you consider your home "Water wise"?			

## 1.2 EXPLAIN THE CONCEPT OF GROUND WATER COLLECTION AND ABSTRACTION

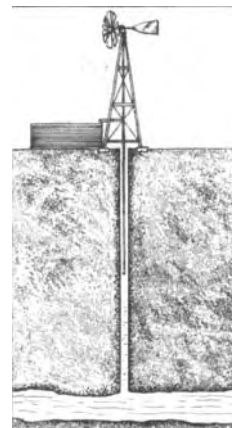
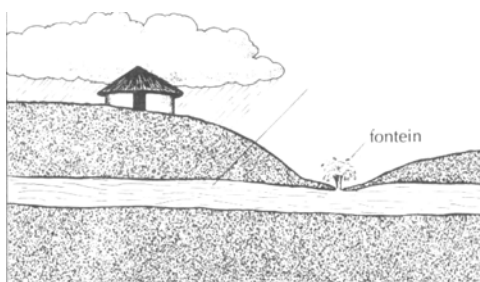
This unit will study the flow of ground water and its role in the water cycle. You will also learn about ground water in aquifers, cracks and sand. Attention is also given to the extraction of groundwater.

### 1.2.1 FLOW OF GROUND WATER AND ITS ROLE IN THE WATER CYCLE

**Ground water** is water that is stored in underground caverns and spaces in the ground, sand and rocks. The area covered by this water is known as the **saturation zone**. The top of this zone is known as the **water table**. The water table may be deep or shallow and may deplete or rise due to many different reasons. The water table may rise due to heavy rains and long lasting droughts may lower the water table.

Ground water moves slowly when stored in the layers of soil, sand and rocks (known as water filters). The speed at which the water moves depends on the size of the spaces between the sand and rocks as well as the manner in which these spaces are linked. Water filters consist of gravel, sand, sandstone or broken rocks, for instance dolomite. These rocks allow water to flow through it. Ground water supplies are exhausted by droughts and human use, and are replenished by rain, or melting ice.

Ground water circulates as part of the water cycle. Ground water, which is replenished by rain or ice, flows slowly to the point where it could be extracted or used. Example: a fountain or borehole.



Remember that ground water does not stay underground, nor does it “wait around” until it is needed. To illustrate this, think of the water cycle. Atmospheric water precipitates to form rain or snow, and becomes surface water and / or ground water. At times, ground water may circulate back to the surface in the form of the ‘eye’ of an underground water spring. The water from the spring may ‘spill’ out and become a stream and, along with other surface water, flow into rivers and streams to the ocean or evaporate before it reaches the ocean and ends up in the atmosphere again.

Precipitated (rain) water flows towards streams that form in valleys or on lower ground. Some of the water disappears into the soil and fills up the ground water levels. This is called **infiltration**.

A number of factors play a role in the amount of water that infiltrates into underground aquifers. For instance, if the soil is saturated, the water table will be relatively high and far less water will infiltrate the ground (think of a sponge for example – the more water in the sponge, the less additional water it will absorb). More water is left to flow into the rivers and streams, creating greater opportunities for flooding. Another factor is the speed with which the precipitated water falls. During a heavy downpour of rain or a flash flood, the speed at which the water runs across the ground may be so rapid that infiltration is hampered. In both cases, the opposite is also true.

When groundwater eventually reaches the surface, it is called **release**. Groundwater release contributes greatly towards stream flow.

The period that groundwater remains underground is highly variable. This may vary from several days to periods of thousands of years. The average period is approximately two weeks.

### 1.2.2 IDENTIFICATION OF GROUND WATER IN WATER AQUIFERS, FRACTURES AND SAND

Although ground water can occur anywhere on earth, there are certain zones that can be saturated more easily, since they can accommodate more water. An aquifer is an underground (geological) formation that:

- ❖ Allows water to percolate to fountains.
- ❖ Contains loose materials that can release useful amounts of water when a borehole or pit is erected there.

Aquifers come in all shapes and sizes and may vary in size from a few hectares to several thousand square meters. The thickness also varies greatly.

Several types of aquifers have been identified, namely:

- ❖ **Porous aquifers:** This includes sandy rocks (e.g. sandstone) that allow water to filtrate in-between individual particle. (Most types of rocks and soils allow the infiltration of water. Clay soils are an exception, as they do not have spaces between particles to allow for the infiltration of water).
- ❖ **Broken aquifers:** This aquifer is encountered where rocks have been crushed or weathered to a point where water can infiltrate the cracks/crevices.
- ❖ **Unrestricted aquifers:** When the pressure of the water table is too high, the water will infiltrate through the opening of the well.

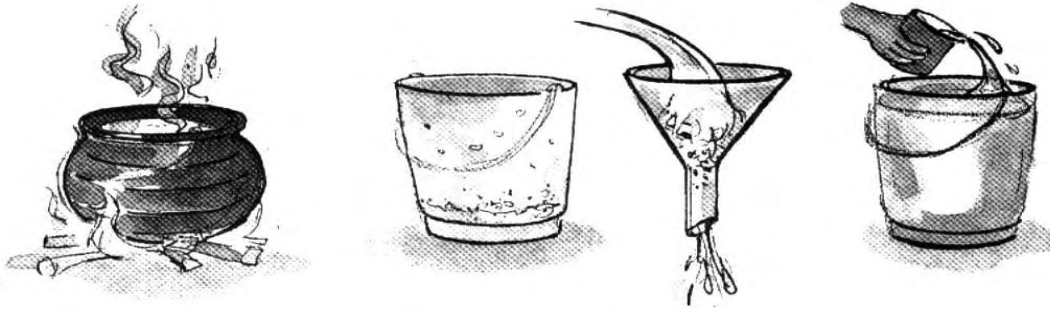
### **ACTIVITY 6**

#### **Individual Assignment**

Work together as friends:

For centuries people have used draw-wells to extract water from the ground. Many people still make use of this method. There are different ways to clean water, suitable for drinking purposes, and to prevent diseases.

- Study the pictures below:
- Explain, by using the pictures, how you can make water safe to drink.



## 1.3 EXPLAIN THE CONCEPT OF SURFACE WATER COLLECTION AND ABSTRACTION

This unit will explain the flow of surface water and its role in the water cycle. I will teach you to learn about surface water collection in nature, and how people can help in saving water. It will also study the abstraction of surface water through natural elements and human activity and determine the principles of resource management of surface water.

### 1.3.1 THE FLOW OF SURFACE WATER AND ITS ROLE IN THE WATER CYCLE

We already know that some rainwater infiltrates the ground slowly and forms an underground water resource. The rest of the water stays behind on the surface and is called surface water.

#### 1.3.1.1 *Surface water*

Surface water includes:

- Rain and that is safe to drink.
- Highland Surface water –This water comes from high mountains and is usually clean and safe to drink.
- Lowland surface water that is located in places down stream near human habitation. This water is usually dirty and unsafe to drink.

#### 1.3.1.2 *What happens with the surface water?*

- Rivers are formed
  - A river is a body of water that originates in the mountains and flows in the riverbed to lower ground and eventually to the sea.
  - Rain causes the river to flow.
  - Rivers also form when snow melts.
  - Rivers flow to the sea where the water cycle is repeated.
- Lakes originate
  - A Lake is an inland water body that is formed in a depression.
- Rivers and rain feed most lakes.
  - Lakes lose their water through evaporation, seepage and rivers.

## 1.3.2 SURFACE WATER COLLECTION AND ABSTRACTION

### 1.3.2.1 Storage of surface water

When there are no natural fountains, rivers will only start flowing after a large amount of rain has fallen or snow/glaciers have melted. Water that flows during the wet season needs to be stored in a dam, so that it can be available throughout the year. Even if the river flows throughout the year, the water should be stored for the dry season.

Water is also stored in rock fissures (cracks) and in the ground. This can be found:

- On the surface and it can form a fountain; or
- In-between small stones and rocks and needs to be pumped with a borehole.

Plants use some of the water that seeps into the ground. Some exotic plants use a great deal of water and reduce availability of water for other uses.

Some underground water resources have dried up as a result of big plantations of exotic trees. Plants that grow naturally in South Africa are known as indigenous plants, whereas plants from other countries are known as exotic plants. The Department of Water Affairs and Forestry have stated that they are committed to eradicating exotic plants from our environment.

### 1.3.2.2 Use of Rivers and Lakes

- Source of fresh water  
Rivers and lakes provide water for industries and human and animal consumption.
- Transport  
Rivers and lakes can be used for transporting goods, animals and people.
- Electricity  
Hydro-electricity is generated through utilizing the energy of rivers and lakes.
- Fisheries  
A number of the world's largest rivers and lakes support important fishing industries.
- Sport  
Sporting events such as sailing or power boating are practiced on these lakes. Canoeing and bird watching are popular on and along rivers.
- Irrigation  
In very dry areas rivers are a very important source of water for irrigating crops.

**ACTIVITY 7**

**Individual Assignment:**

Use the content of "Use of rivers and lakes" for the following exercise. Distinguish between the use of surface water collection and abstraction.

SURFACE WATER COLLECTION	SURFACE WATER ABSTRACTION

**1.3.3 PRINCIPLES TO RESOURCE MANAGEMENT OF SURFACE WATER**

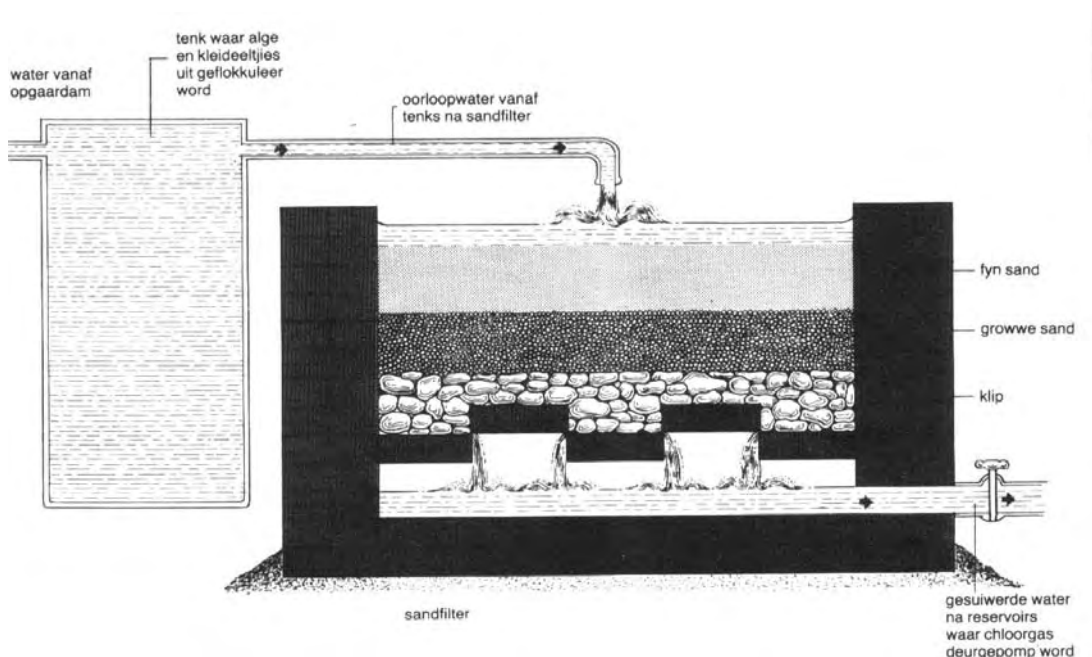
**1.3.3.1 Storage of water**

Dams are built in running rivers with a high volume of water, to prevent the water from flowing back to the sea. The riverbeds must be analysed before a dam is built to see if it is strong enough and waterproof. It is also necessary to predict the rainfall. Most of our available water comes from dams. It works like a bank account that builds up during a good season to provide funds for the dry season.

The dam wall blocks the river, to prevent the lost of to much water. Most dam walls are built with ground and gravel with a waterproof core wall made of concrete. Dam Walls are also equipped with:

- Outlet/overflows for floodwater, and
- Water purification plants.

**Figure 3: Basic Water Purification**



Most people in urban areas only have to turn a tap on to get water. This water usually comes from far to reach the tap.

Rain is stored in storage-dams, known as reservoirs. High walls need to be built in order to store the water in the reservoir.

**1.3.3.2 Provision of clean water**

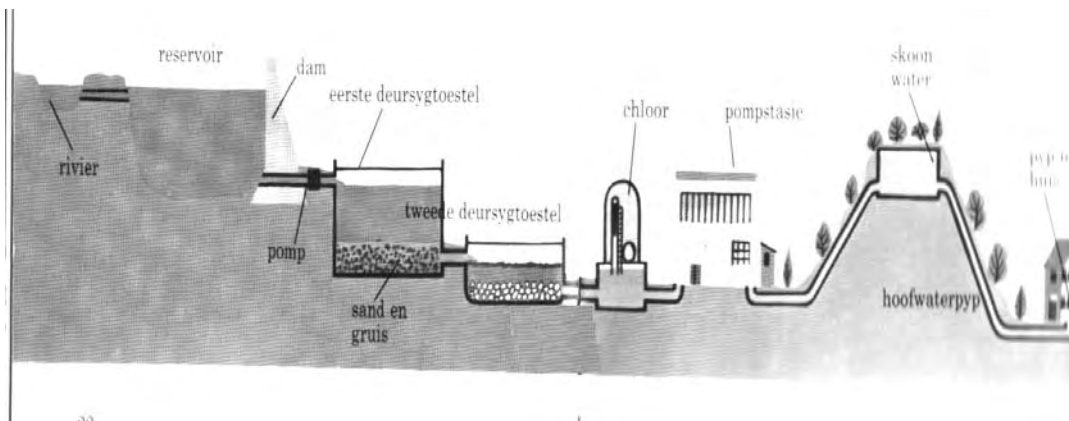
Most people in urban areas only have to turn on a tap to get water. This water usually reaches the tap from afar.

Rain is stored in storage-dams, known as **reservoirs**. High walls need to be built in order to store the water in the reservoir.

Water flows via a pipe to waterworks to get purified. The water seeps through layers of ground and gravel and most impurities stay behind in the sand. In the next step the water gets treated with a chemical known as **chlorine** to kill all germs.

The clean water then gets stored in large reservoirs. The water flows from the reservoir along the main water pipe and then on to our houses.

**Figure 4: Provision of Clean Water**



**ACTIVITY 8**

**Individual Assignment**

Study the comic (ask your facilitator to provide you with a copy).

Explain in short sentences the process of providing clean water to a city.

## 1.4 THE IMPORTANCE OF LEGISLATION IN THE WATER SECTOR

This unit focuses on the principles and goals of the National Water Act (Act 36 of 1998). It will also serve to familiarise you with the Environmental Act. The unit will also focus on indicating the goals of Municipal laws (by laws).

### 1.4.1 RELEVANT NATIONAL LEGISLATION AND WATER USE LICENCES

Water quality management is regulated and/or controlled through a hierarchical set of laws, which ranges between:

- ❖ South African Water Resource Management and is in accordance with the International stipulations of which Agenda 21 is a prominent example.
- ❖ The Constitution (Act 108 of 1996) is the highest law, and guarantees rights to all citizens of South Africa.
- ❖ Sectoral Environmental laws of which the National Water Act (Act 36 of 1998) is a prominent example.

The basic principles and goals of the National Water Act can be summarised as follows:

- ❖ The Legislation will be subject to, and shall not conflict with the Constitution in all affairs including the protection of public affairs and the rights and responsibilities of all parties, public and private sectors, in relation to water. Notice will be taken of existing uses, within the existing Water Act and will actively promote the constitutional demands.
- ❖ All water wherever it is found in the water cycle is a community resource. The use there of will be regulated Nationally. All water will have the same status, irrespective of where it originates.
- ❖ There will be no ownership of water, but rather a right (of the environment – and basic human usage) or power to use it. Any authorisation of water use shall not be on an on-going basis.
- ❖ The location of water in relation to ground will not be considered as a right to use it.
- ❖ The goal to manage the quality, quantity and reliability of the community's water resources, is to offer an optimal, long-term, environmental conservation, as well as social and economic benefit to the community making use of it.
- ❖ Water will be conserved to ensure that all people have access to sufficient water; and
- ❖ The National Government is the caretaker of the nations water resources. Guided by its duty to promote public trust, the National Government is responsible, and has power over water resources and the reasonable allocation and use of water. It is also responsible for the transfer of water between catchment areas and International Water Affairs.

### 1.4.2 RELEVANT ENVIRONMENTAL LEGISLATION

The use of water and the quality of water are regulated by a number of authorities that are directly or indirectly managed by the Department of Water Affairs and Forestry, in co-operation with other Government Departments, for example:

- ❖ Licensing of water that might have an impact on the quality of water in terms of regulation 40 of the National Water Act (Act 36 of 1998).
- ❖ Issuing of licences for tipping-sites in terms of section 20 of the Environmental Conservation Act (Act 73 Of 1989).
- ❖ Recommendations for the approval of Environmental Management programmes in terms of section 39 of the Minerals Act (Act 50 of 1991).
- ❖ Recommendations for the approval of environmental impact assessments in terms of section 21,26 and 28 of the Environmental Conservation Act (Act 73 of 1989).

### 1.4.3 MUNICIPAL FUNCTIONING

At national level, the mandate of the Department of Water Affairs and Forestry is to manage water quality and quantity in an efficient and equitable manner. It aims to do this in a manner that promotes co-operative and participative governance. The Department promotes the participation of public interest groups and other government departments when it comes to the use, development and conservation of water resources.

Through integration, provision is made for socio-economic and environmental needs. This allows holistic decision making to take place in order to have a minimal impact on the quality of water.

This co-operative environmental management is facilitated by catchment management forums that serve as an institutional mechanism to get all the relevant parties involved in the management of water resources.

## 1.5 COMMON WATER RELATED DISEASES

This unit focuses on making the learner aware of diseases commonly related to water and sanitation. Furthermore, the unit examines the measures that can be taken to prevent these diseases. It will also find the link between polluted water and diseases.

### 1.5.1 HEALTH

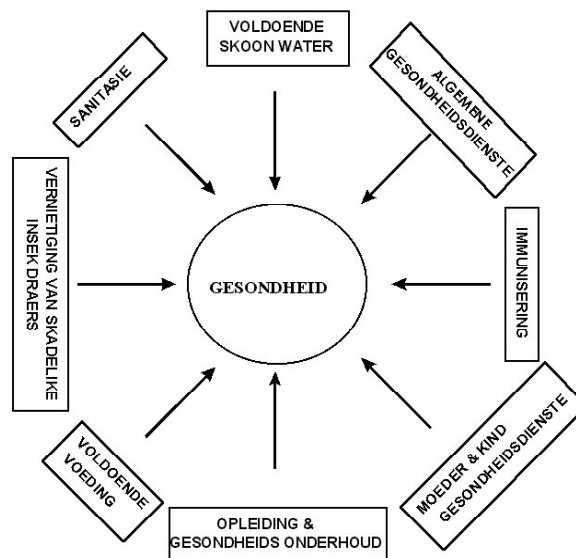
The definition of Health according to the “ World Health Organisation (WHO) is:



Health is a state of full physical, psychological and social being and not merely the presence of diseases.

The following illustrates the factors that are needed for good health with reference to the definition.

**Figure 5: Health factors**



## 1.5.2 DISEASES COMMONLY RELATED TO WATER AND SANITATION

### 1.5.2.1 Water related diseases

Many diseases are water related and that is why still standing water (that attract mosquitoes) and muddy places around the house and water points are a threat to health. That is why it is important to manage wastewater.

A concrete slab can be built around taps to prevent water from being wasted. You can also use wastewater to water your plants and vegetables, as it is environmentally friendly and saves water.

To prevent illness it is important to use safe water for:

- Drinking.
- Brushing Teeth.
- Mouthwash.
- Washing of hands.
- Rinsing of fruit and vegetables.
- Cleaning of kitchen utensils.
- Bathing.

Water related diseases could be divided into four categories, namely:

- Diseases as a result of pathogenic organisms.  
This includes eggs, larva or parasites in the water.
- Indirect diseases.  
Indirect diseases are caused by still standing water that serve as a breeding place for insects (e.g. mosquitoes) which uses the water as part of their lifecycle
- Diseases caused by water shortage.  
When little water is available for important needs such as drinking and cooking, the water available for personal hygiene such as water for bathing, washing of hands and clothes will also be to little.
- Diseases caused by toxic substances diseases.  
Chemicals like **lead** mercury, insecticides, radioactive waste and other materials are wasted or dumped in water, which leads to an increase in diseases.

The following table shows the type of diseases, their names, symptoms, and transmission paths and how it can be prevented.

**Table 1: Symptoms, transmission and Prevention**

Disease	Infections	Symptoms	Transmission	Control
<b>Diseases, directly caused by organisms, larva and parasites</b>				
Diarrhoea	Cholera  Dysentery  Unspecified Diarrhoea	Loose stool Watery stools. Diarrhoea are usually followed by vomiting Watery stools with blood in them Fever Vomiting Stomach pain More than 5 watery stools in 24 hours Vomiting Fever	From human stool to mouth	Wash hands after having gone to the toilet and before meals. Use safe water for drinking. Clean cups and kitchen utensils. Rinse fruit and vegetables. Defecate in safe areas. Cook meals thoroughly. Protect food from flies
Worm Infections	Bilharzias	Stomach pain Blood in urine and stools.	Eggs are found in the urine or stool of the infected person. Eggs end up in water and penetrate snails where they become worms. They then penetrate the skin of people that come in contact with the snail in the water.	Keep water free from snails for 24 hours. Drain small ponds.
<b>Indirect diseases</b>				
Mosquitoes and other waterborne insect diseases	Malaria  Tsetse fly  House fly	Fever Headache Trembling Diarrhoea  Narcolepsy  River blindness	Malaria is caused by infected female mosquitoes  This is caused by a fly bite when flies breed in or near water	Destroy breeding places around houses by:  Disposing of cans and broken bottles (any hollow thing that can hold water).  Covering store buckets, rainwater tanks, boreholes etc. Drain small ponds and fill it up again.  Cut grass and plants around the house that can collect water.

**ACTIVITY 9**

Fieldwork:

Undertake a fieldtrip to the nearest source of surface water (river, dam, pan, etc.) To find out if the river is clean, you need to do the following:

Observe the river/dam: -

Be on the look out for the presence of solid waste; observe the river flow (fast or slow), plants in the river, the clearness of the water. Take note of the smell of the water.

Write down your findings on the included observation sheet.

**OBSERVATION SHEET**

Name of river, stream, dam: \_\_\_\_\_

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

Circle the suitable answer:

- |   |               |          |            |  |
|---|---------------|----------|------------|--|
| 1. Does the water smell?  | Yes           | No       |            |  |
| 2. Are there plants in the water?                               | Yes           | No       |            |  |
| 3. Is the water...?   | Clear         | Turbid   | Muddy      |  |
| 4. Does the river flow...?                                      | Fast          | Slow     | Not at all |  |
| 5. Are there visible signs of the following types of pollution? |               |          |            |  |
| Solid waste   | Factory waste | Sewerage |            |  |
| Household Washing activities                                    | Other         |          |            |  |

### **1.5.2.2 Sanitation related disease**

The recent cholera epidemic reminds us of the importance of effective sanitation. The bacteria that cause Cholera are transmitted through water that is infected with human excretion that means that the disease spreads easily from individuals to individuals.

The communities that are most at risk, are those that are dependent on rivers for washing, drinking, cleaning and cooking purposes as well as those communities where sanitation facilities are poor or non-existent. The Department of Water Affairs and Forestry therefore focuses on the provision of safe water and sanitation facilities (even if it is just a temporary solution) to communities.

Communities that have no sanitation facilities are forced to use the bushes along the river as "toilets". These communities are also dependent on the same river for washing, drinking, cooking and cleaning purposes. The cholera virus is spread when the communities drink the polluted water.

In communities that have sanitation facilities, the human faeces get disposed of and get treated at a sewage works. These communities have access to safe water and therefore the occurrence of cholera is low.

When there are no sanitation facilities, the untreated water flows to the nearby river or even through the living areas. The risk of cholera is increased in the following ways:

- These areas might be situated near the part of the river where people still use untreated water.
- Children play in the polluted water.
- Human faeces flows through the water.
- Communities are often densely populated and that increases the risk of cholera.
- In some areas the existing sanitation facilities are so poor, that the communities don't use them.
- Solid waste in this area increases the risk of infection, because insects (e.g. flies) transmit the disease.
- If people defecate in the vegetable garden or if the vegetable gardens are cultivated with human faeces.

A number of sanitation related diseases could be identified. The diseases must be prevented as it is widespread and it occurs frequently.

### **1.5.2.3 Types of worm related diseases**

Many people suffer from one or more worm infections. All worm infections, except the guinea worm and urinary schistosomiasis are spread through eggs found in human faeces.

- Whip worm (trichuriasis).

Whipworms are as thin as thread. These worms show the same characteristics as roundworms.

➤ Roundworm.

Roundworms have a round shape and are about as long as a man's foot. The worms live in a person's intestines and feed on the food eaten by the person. When a person has a lot of worms they will feel weak, as the worms use part of their food. Another danger is that the worms may, by their presence, block the intestines and cause difficulties in defecating. The eggs of the worms are excreted in the stool.

To become infected, the eggs have to enter the body through the mouth. Roundworm follows the faecal-oral route of transmission, just like diarrhoea.

For roundworm two routes of transmission are especially important:

- The first one is a dirty finger. That is why children are more frequently infected than adults. Children put their fingers and all kinds of other things in their mouths.
- The second route is raw vegetables or fruit on the ground. Raw vegetables and fruit may be contaminated with eggs when people with roundworm defecate in a field where vegetables or fruit are growing.

➤ Pinworm (enterobiasis)

Pinworms are very small and thin. The worms live in a person's intestines. They come out of the anus at night and lay eggs in the anus opening. The eggs are excreted in the stools. Pinworms cause severe itching of the anus. The person will scratch and so the eggs get on to the fingers. Unclean fingers often spread pinworms.

➤ a) Hookworm.

Hookworms are small and red in colour. The worms live in a person's intestines and feed on his blood by making small wounds in the wall of the intestines. When there are many worms sucking blood, the person will feel weak and tired. Hookworms' eggs are excreted in the stool. In the ground these eggs will develop into worms. The worms get into the skin of the feet when people with bare feet walk on contaminated ground. Hookworm infection can be prevented when people wear shoes, or when people do not walk with bare feet in places where people sometimes defecate.

➤ b) Guinea worm.

This worm lives in a person's legs, which causes a wound that hinders walking. When an infected person enters the water, the worm's larva is released into the water. The larva then infects small shellfish. When another person drinks the infected water, the larva that develop into worms, gets ingested. As a result of this cycle, this is a common disease, because people drink water from unsafe dams.

➤ c) Ringworm.

Ringworm is a skin disease that is not caused by a worm. It is called ringworm, because it forms small circles on the skin. This disease is found on the head (between the hair) and between toes and under the nails. It spreads in the same manner as scabies and the treatment is the same.

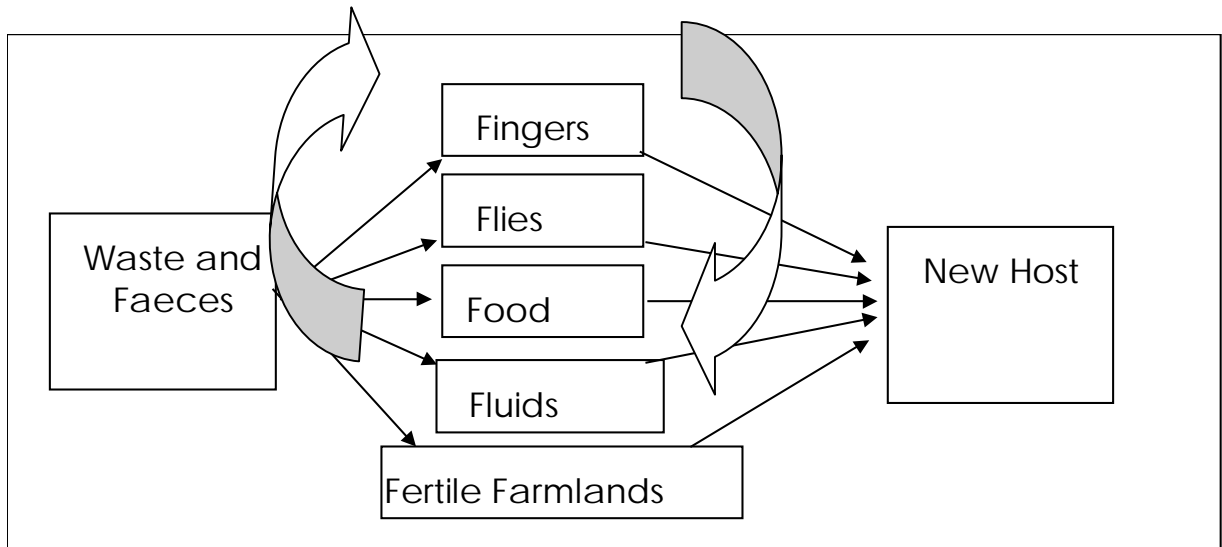
### 1.5.3 THE SPREAD OF SANITATION RELATED DISEASES

The safe disposal of faeces, as well as the management thereof, is just as important as a safe water supply when it comes to the prevention of diseases.

There are many ways in which diseases can be spread as a result of poor sanitation facilities.

#### 1.5.3.1 Five important sanitation points to remember

The following figure with the **five “F’s”** illustrates the most important aspects of sanitation related diseases.



There are many ways in which the germs of waste products (excretion and waste) can reach the mouth. However, many times germs are spread through fingers, food and water. Fingers get dirty when hands are not washed after defecation or the handling of waste. Germs then infiltrate the body when dirty fingers are put in the mouth. The risk among children is higher, since they frequently put their hands in their mouths.

Sometimes faeces are used in farmlands to fertilise the soil. When the crops are not properly washed and cooked, the germs will spread to people.

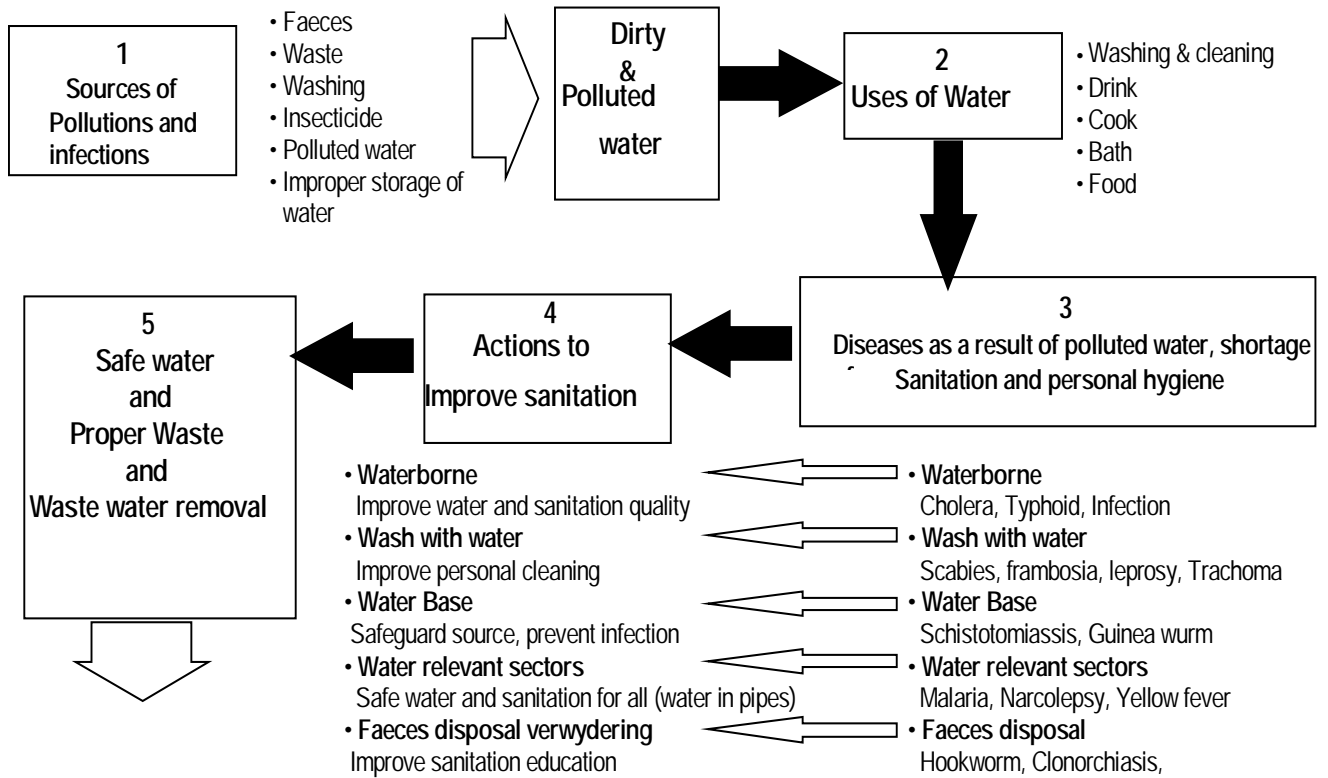
#### 1.5.3.2 Safe storage places for faeces.

A safe, clean and well-built toilet is a place where faeces cannot contaminate. If there are no toilets, defecation must take place where:

- People and animals do not come into contact with it.
- Flies can't come near it.
- Faeces cannot be used for fertilisation.
- Faeces cannot infiltrate the water supply or water table.
- Bilharzias are not a health problem in rivers.

**1.5.4 THE LINK BETWEEN POLLUTED WATER AND DISEASES**

Throughout this guide we became aware of the ways in which:



**Keep in mind:**

**BE WATERWISE!**