NQF Level: 3 **US No: 116274**

Learner Guide

Primary Agriculture

Farm planning for conservation and water harvesting

My name: . . . . . .

Company: . . . . . .

Commodity: . . . . . Date: . . . . . .

The availability of this product is due to the financial support of the National Department of Agriculture and the AgriSETA. Terms and conditions apply.

agriculture
Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

AgriSETA

Before we start...

Dear Learner - This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

Title:	Assist in farm planning and layout for conservation and rainwater harvesting				
US No:	116274	**NQF Level:**	3	**Credits:**	3

The full unit standard will be handed to you by your facilitator. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

This unit standard is one of the building blocks in the qualifications listed below. Please mark the qualification you are currently doing:

Title	ID Number	NQF Level	Credits	Mark
National Certificate in Animal Production		3	120	❒
National Certificate in Mixed Farming Systems		3	120	❒
National Certificate in Plant Production		3	120	❒

Please mark the learning program you are enrolled in:

Your facilitator should explain the above concepts to you.

Are you enrolled in a:	Y	N
Learnership?	❒	❒
Skills Program?	❒	❒
Short Course?	❒	❒

This Learner Guide contains all the information, and more, as well as the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed and include it in your **Portfolio of Evidence**. Your PoE will be required during your final assessment.

You will be assessed during the course of your study. This is called *formative assessment*. You will also be assessed on completion of this unit standard. This is called *summative assessment*. Before your assessment, your assessor will discuss the unit standard with you.

Enjoy this learning experience!

How to use this guide ...

Throughout this guide, you will come across certain re-occurring "boxes". These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

What does it mean? Each learning field is characterized by unique terms and **definitions** – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner.

You will be requested to complete **activities**, which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box.

Examples of certain concepts or principles to help you contextualise them easier, will be shown in this box.

The following box indicates a **summary** of concepts that we have covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of the concepts listed.

My Notes ...

You can use this box to jot down questions you might have, words that you do not understand, instructions given by the facilitator or explanations given by the facilitator or any other remarks that will help you to understand the work better.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

What are we going to learn?

What will I be able to do?

When you have achieved this unit standard, you will be able to:

- ♦ Plan, lay out and develop a maintenance programme for conservation and infrastructure development
- ♦ Design, construct and maintain resource use practices that include, but not restricted to, soil and water erosion prevention measures in an agricultural environment.
- ♦ Assist in a land capability analysis to serve as the basis for development of an area or an enterprise selection for the farm.
- ♦ Design and construct prevention structures and infrastructure necessary for the farm area or the farm enterprise applying sustainable resource use principles
- ♦ Design and construct all structures using simple tools and equipment.
- ♦ Monitor implementation of principles for natural resource management and infrastructure maintenance.
- ♦ Maintain, report faults, and where appropriate repair them under supervision.

What do I need to know?

It is expected of the learner attempting this unit standard to demonstrate competence against the unit standard:

- ♦ NQF 2: Apply layout principles for conservation and infrastructure or equivalent.

Learning Outcomes

At the end of this learning module, you must is able to demonstrate a basic knowledge and understanding of:

- ♦ Role and function of soil and water samples, weather information, vegetation, infrastructure, livestock and crop characteristics, production cycles, records, markets, health and hygiene within production procedures.
- ♦ Description, characteristics and properties of vegetation, infrastructure, weather, production cycles, markets within production procedures.
- ♦ Livestock and crop characteristics
- ♦ Regulations and legislation related to production procedures.
- ♦ Understand the procedures and principles followed to determine the viability of an enterprise.
- ♦ Understand how the land's capability affects viable land use planning.

Introduction

In order for a farming enterprise to be successful the decision about what to farm must be informed by detailed and accurate information about:

- What natural and other resources are available,
- The characteristics of these resources, and
- How these resources can be used sustainably.

Once we have a detailed understanding of these we can consider which land-use options are the most appropriate for the given context. In order to select our enterprise we must have a thorough understanding of the various input and resource needs of a given enterprise so that these needs can be met sustainably. We must understand fully what resources are required in order to farm at maximum efficiency, and those resources must be available in the appropriate quantity and be of the right quality.

For example, it does not make sense to plan a dairy enterprise when there is insufficient grazing and water available.

The next step is to put the right things in the right place (structures and infrastructure) so that the available resources are conserved, used sustainably, and so that the farming enterprise is implemented in the most efficient way possible.

Once established, the structures and infrastructure must be monitored and maintained routinely so that the farming activities continue to run smoothly and for the natural resource base to be conserved.

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Session 1

The role of land capability in development or enterprise selection

After completing this session, you should be able to:
SO 1: Assist in a land capability analysis as the basis for the development of an area or an enterprise selection for a farm.

In this session we explore the following concepts:

- Natural resource qualities and sustainable use,
- Natural resource survey,
- Including livestock and human needs.

1.1 Natural Resources Overview

Natural resources are the elements that are naturally part of the local environment; soil, water, climate, vegetation, animals and other living organisms, and topography.

Climate

Climate is the summary of weather conditions experienced in an area of a long period of time. Weather is the climatic conditions experienced at a particular time, such as over a day or week. The data includes precipitation (rainfall, hail, and snow), temperatures, wind, daylight hours and humidity.
For example, climate statistics may indicate that the average winter daytime temperature for an area is 12ºC but today the temperature is 22ºC and yesterday it may have been 2ºC.

Preciptation

The most basic information we gather about precipitation is the average total annual rainfall an area has received over a period of time. However, this, alone, is insufficient; we must have more details so that we can use this information in our planning process. Rainfall data is based on averages. We must have additional information so that we can incorporate all possibilities into the planning for rainwater

harvesting. Precipitation includes fog, snow, hail and rain. The following questions can be answered by getting data from the local weather office:

- What is the least amount of rain experienced in each month?

  Knowing when it does NOT rain helps us to plan how to meet our water needs during the anticipated dry season.

- What is the maximum amount of rain experienced in each month?

  This gives us an idea of how much water can enter the landscape over a short period of time – in other words, how much can we harvest.

- How much rain has been experienced in a 24-hour period?

  When there is heavy rain in a short period of time it can lead to flooding. If we know what we can expect in extreme conditions, we can plan for this. The other issue to consider is the less vegetation there is covering the ground, the more run-off there will be.

- What are the average monthly minimum and maximum temperatures?

  This information is very important when taking possible activities into account because all farming activities are affected by temperature; seed germination, plant growth and development, and animal well-being.

- How intense is the wind? From which direction/s and during which months?

  Strong wind places stress on plants and animals. Knowing the local wind patterns helps us decide what can be done where to manage wind problems. The other issue to consider with wind is what load it carries. In coastal areas, for example, the wind could be carrying salt. In this case, the wind barrier should be such that it can absorb the load without harming the windbreak. For example, the windbreak should be grown using salt-tolerant plants.

- What time does the sun rise and set through the seasons?

  Daylight hours have an impact on the germination of some seeds, and therefore, particularly if the area is further south, this information helps us select the appropriate plant varieties for a plant-based enterprise.

- What is the average humidity throughout the year?

  Humidity has an impact on both plants and animals.

An important aspect to consider with climate is the average annual evapo-transpiration rate of an area. This is done by comparing the average annual precipitation with the evaporation rate. When the evapo-transpiration rate is close to the rainfall figure the area is very dry and arid and therefore easily degraded.

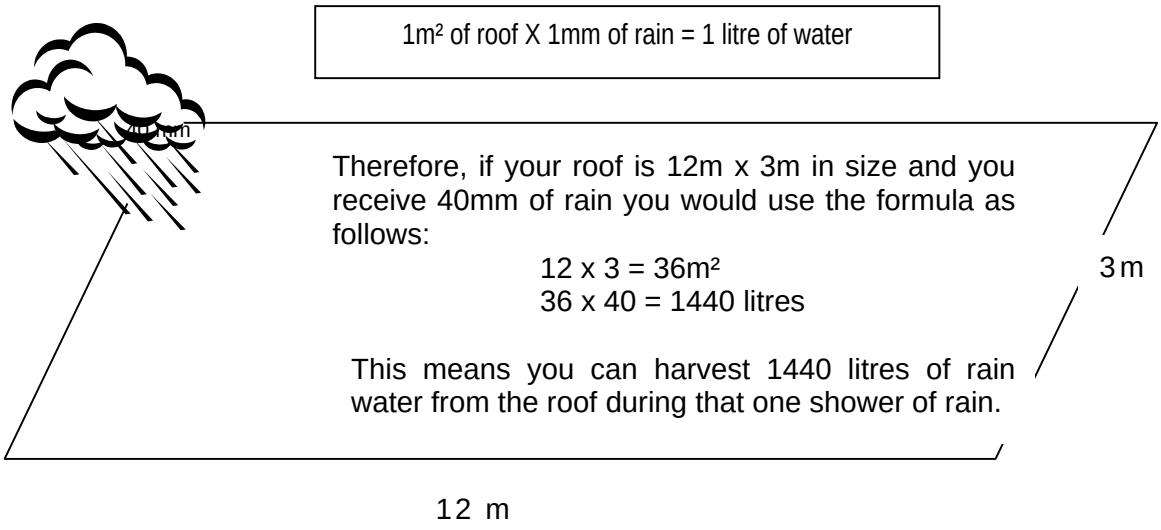
Together with soil, climate plays a significant role in determining the natural vegetation of an area. High rainfall and higher temperatures usually lead to larger plant communities, such as forests. Low rainfall and low temperatures usually lead to sparser and hardier plants that are also usually smaller. Imagine, for a moment,

the difference between the forests in the Knysna area compared with the sparse Drakensberg Mountains, or with the savannah grasslands of the Kalahari.

Water harvesting potential

In order to calculate water harvesting potential we must have accurate rainfall data for our area. It helps to know what the average rainfall is both during each month of the year, as well as the highest ever downpour in a 24-hour period. Our water harvesting system must be planned to take these patterns into account. The nearest weather office can provide this information.

We use this information about our rainfall patterns to plan our water harvesting and storage. In order to calculate how much water can be harvested from a roof we can use this formula:



The formula to calculate surface run-off is the same, but we then take into account that, in general, run-off usually (depending on soil and vegetation) starts when there is more than 16 mm of rain falling per hour. If there is less than that amount of rain then the rain is more likely to percolate into the soil and there will be less run-off.

Please complete Activity **1** at the end of the session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Soil

Soil is the outermost layer of the earth's surface. It can take up to thousands of years for soils to form; the colder and drier the area, the longer it takes. For this reason we consider soil to be a non-renewable resource and it is critical to the sustainability of agriculture that soil be conserved and soil degradation and desertification prevented.

Generally speaking, the top 30 - 40 cm of soil is top soil, it is darker (due to the humus content) and it is where most plants (especially smaller ones) find nutrients. Sub-soil contains less humus, less air, fewer soil organisms and it provides minerals for deeper rooted plants (trees). Below this there may be bedrock, depending on the geology of an area, and it often has an effect on the soil above it.

♦ Soil types

Different soil types have different characteristics.

Type	Characteristics
Clay:	Can be moulded into a ball, often grey in colour. Few air spaces. Holds water. Easily compacted.
Silt:	Larger soil particles than clay. Normally part of other soils.
Loam:	A balance between sand, silt and clay.
Sand:	Larger particles. Often poorer in fertility. Leaches easily. Warms up quickly. Does not compact easily.
Gravel:	Small rock particles. Normally part of sub-soil. Will be closer to the surface in eroded soils.

Soil is made up of:

- ♦ Minerals,
- ♦ Moisture (water),
- ♦ Gases (air),
- ♦ Living organisms (bacteria, earthworms, bacteria, mites, beetles, termites woodlice, etc.), and
- ♦ Humus: the remains of dead plants, insects and animals (decaying material).

Soil Minerals: Mineral elements are essential for healthy soil and are constantly recycled and made available to plants through the action of humic acid (released by humus, it dissolves minerals so that they can be absorbed by plant roots).

Soil and parent rock has a major influence on veldt management. Different soil types determine the yield and palatability of grazing in the long term. Important soil characteristics to remember are described below.

Colour: is determined by iron content, parent rock, organic matter:

- e.g. red means good drainage and aeration
- grey in the lower layers indicates a high water table

Texture: Indicates the ratio of clay, sand and silt in the soil

- The clay content and the water and nutrient holding capacity
- Sand contains between 0 – 10 % clay
- Loamy sand contains 10 – 20 % clay
- Clay loam contains 20 – 55% clay
- Clay contains > 55 % clay

Structure: Is determined by the soils ability to form larger structural units

- A soil with no structure would simply crumble after compaction
- Soils with strong structure impact on plant's roots to penetrate hampering water and nutrient assimilation.

Please complete Activity **2** at the end of the session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. .. .
. . . . . .
. . . . . .

Vegetation on the farm

There are three plant categories to consider when planning for conservation and rainwater harvesting on the farm:

- Indigenous vegetation,
- Alien and invasive plant species, and
- The crops or food plants that will be grown.

♦ Indigenous vegetation:

South Africa has one tenth of all plant species in the world, in an area that is 1% of all land surface. The indigenous vegetation of South Africa is divided into seven biomes, each with its own distinct characteristics.

- Forest
- Fynbos
- Grassland
- Nama Karoo
- Savanna
- Succulent Karoo
- Thicket

Each of these biomes is further divided into groups. For example, the Grassland Biome comprises of coastal grassland, highveld grassland and mountain grassland. These three groups also comprise of further sub-groups, or vegetation types.

It is important that we understand as much as we can about the local plants as this will influence our management decisions. For example, if we are intending to use the farm for grazing then the grass is a primary resource that must be managed in such a way that its condition improves over time. The carrying capacity of the farm for both livestock and wildlife can be provided by the local Department of Water Affairs and Forestry; this department surveyed all the farms in South Africa and the information is in their records.

Forest: Found in frost-free areas with an annual rainfall exceeding 525 mm, predominantly on the south eastern parts of the country. The economic value of forests lie in timber products and tourism. The main invader plant is Blackwood, *Acacia melanoxylon*. From a conservation point of view it is important to conserve the animal species that enable the succession process to be maintained as well as conserving the plant gene pool. (3 vegetation types). The main threats to forests are not from agriculture, but from the expansion of the tourism industry, the establishment of pine plantations, and the extraction of plants for firewood, medicine and building materials

Fynbos: The Cape Floral Kingdom is the smallest of the six global Floral Kingdoms. It has a diverse range of species and a third of all South Africa's plant species are found in this Kingdom, and so too are two thirds of all the Red Data Book plant species. There is a high level of endemism and any expansion in almost any area could well endanger several species. Besides rapid urbanisation, the major threat to Fynbos is the encroachment of alien plants in high-lying areas and agriculture in low-lying areas. An additional threat is fire; although Fynbos is adapted to fire, the threat is fire in the wrong season. Agriculturally these areas converted to wheat, grazing, fruit orchards and viticulture. Any agricultural activity planned within this biome must be done with great care to ensure that the impact on local ecological process is minimised.

Grassland: This biome is found mainly in the high central plateau of the country, and the inland areas of Kwazulu-Natal and the Eastern Cape. It stretches from the coast up to the escarpment, up to an elevation of almost 3 000 m above sea level. It is characterised by two categories of grasses; sweet grasses with a lower fibre content, and sour grasses with a higher fibre content. There are only isolated trees in protected valleys. From an agricultural point of view this biome is very important as it forms the foundation of the dairy, beef and wool production areas of the country, and large tracts of grassland has been converted to maize, sorghum, wheat

and sunflower production. The main threat to grasslands is poor livestock management; this can lead to changes in the proportion of pioneer, creeping and annual grasses.

Nama Karoo: This, the second-largest of South Africa's biomes, occurs on the central plateau of the western half of the country – it has not been researched in great detail. It is in an area of high evapo-transpiration and very little of the rain that falls reaches the rivers. The main agricultural value of this biome is small-stock farming, and closer to the Orange river, some irrigated crops such as lucerne, grapes and cotton. The soil is very easily eroded and thus overgrazing can cause severe damage to the ecology. It is therefore critical to ensure that stocking levels are within the carrying capacity of grazing.

Savanna: This is the largest biome in southern Africa, occupying almost half of the land area. It occurs in a range of altitudes, soil types and temperature ranges. The grass layer remains dominant as a result of low rainfall, fires and grazing. Most of the grass species that occur in this biome have adapted to surviving periodic fires. From an agricultural perspective this biome is important as it is the foundation for livestock farming. However, a range of other agricultural activities are undertaken in these areas, including grain, oil seed, sugar cane and vegetable production, subtropical fruit orchards, game farming, mining, some exotic plantations, and ecotourism.

Succulent Karoo: This biome is situated on the south-western boundary of the country in areas of low winter rainfall and extreme summer aridity. The vegetation consists of dwarf succulent shrubs and flowering annuals. The area has not been extensively researched and is of little importance from an agricultural point of view due to lack of water. Sheet erosion over the past 200 years has left little or no topsoil. In parts of this region there is ostrich farming, and where irrigation is possible, some grapes, fruit and other crops are grown. The main economic activity is tourism. However, this biome has a high number of red data species.

Thicket: Characterised by closed shrub land to low forest – replacing forest in low rainfall areas. Evergreen or succulent trees, shrubs and vines dominate the biome. It is almost impenetrable. There are five vegetation types within the biome. Wood used for firewood. Some areas have been cleared to plant crops – the soils are usually humus-rich. Some areas are used for Angora and Boer goat or ostrich farming. In other areas the vegetation has been cleared for Lucerne and other crops, or orange orchards. The main threat from an agricultural perspective is where there is intensive, poorly managed farming with goats or ostriches. Knowledge about the plant population is applied in soil conservation practices as well; in order to harvest surface run-off and to prevent erosion, we must keep the soil covered. Ideally the cover should be indigenous plants.

♦ Alien and invasive plant species

Besides the treat that alien and invasive plant species pose to the ecological functioning of natural systems, they also absorb and use more ground water than

indigenous species. Thus it makes sense to control these plants in order to maximise the water harvesting potential of the farm

♦ **Crops and other food plants**

Crops should be placed in the ideal growing environment to suit the specific crop's requirements.

♦ **Genetically engineered plants**

An additional controversial issue in the agricultural industry is the increasing use of genetically engineered plants. There are four ways in which genetic engineering can destroy biodiversity in agriculture:

1. Pushing out crop diversity and narrowing the genetic base of agriculture to only a few crops.
2. Accelerating the expansion of monocultures of these crops.
3. Leading to the destruction of on-farm biodiversity through the use of broad-spectrum herbicides and herbicide-resistant crops.
4. Threatening the survival of species through ecological impact – in particular in gene transfer (when a genetically modified organisms cross-pollinate with and other members of the same plant family).

Please complete Activity **3 & 4** in at the end of the session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

1.2 Assessing the needs of an enterprise

In order to decide what to do, exactly, on the farm, consider each possible activity in terms of:

Characteristics	What does this 'thing' do? What does it look like? Does it have specific behaviour that should be taken into account?
Production cycles	How is it produced? How does it multiply? When? What waste or by-product is produced?
Records	What kinds of information must be kept?
Market information	Is this a seasonal product? Is there a time when there is a greater demand for the product?

Health and hygiene	How can you keep the produce or animals in peak condition? What must be done to prevent pests/diseases? What are the production practices that ensure the highest possible quality product?
Legal issues	Are there legal requirements related either to the production of this product, or related to the market for it?

Characteristics, needs and outputs of some domestic animals

Requirements and Characteristics	If movement controlled e.g. tractor systems	If allowed to forage
Chickens		
If used for eggs then provide grit. Scratch and manure. Eat worms and insects. Combine well with fish if placed over pond..	Good foragers. Can rotate in food production areas to control pests but can damage plants if not controlled. Can be used in variety of tractor systems, both moveable and static.	Good foragers. Combine well with orchards. Susceptible to predation.
Geese		
Eat weeds, weeds, slugs and snails. Provide security.	Good foragers. Can rotate in food production areas to control pests but can damage seedlings and plants by trampling.	Good foragers. Combine well with orchards. Susceptible to predation.
Ducks		
Need a pond. Will control slugs and snails. Combine well with fish.	Good foragers. Can rotate in food production areas to control pests	Good foragers. Combine well with orchards.
Rabbits		
Reproduce very rapidly. Simple, clean housing required. Will dig out of pens – secure with buried fencing or raised pens.	Combine well with chickens, worms and fish.	Do not allow rabbits to roam freely.
Pigs		
Need less coarse forage. Can utilise household scraps. Can combine with ponds for manure to be used as fish food. .	Useful diggers and manurers. Can work on an 8-plot rotation system. If in pens or tractors a deep litter system prevents foot rot and prevents flies from reproducing.	Need grain to harden fat for commercial viability. Healthier if used in free-range system.

Goats		
Ruminants. Adaptable. Need good fencing. Rich manure. Eat almost anything.	Can clear an area efficiently. Control with tethering. Disease transfer from own manure.	Control with tethering. Control numbers to minimise damage.
Sheep		
Ruminant. Tolerate dry climates. Consider predation, flocking instinct and shearing needs.		Can use cereal stubble for food.
Donkeys		
Can produce milk. Hardy.	Can provide 'labour'	Tolerate poorer feed than cattle.
Cattle		
Ruminant. Combination of fodder and pasture system maximised nutritional input.	Can help control stalk borer if left to forage crop residues. If so, still need additional nutrients	High temperature areas cause more animal stress. Do well in extensive forage systems.

Every farming enterprise needs water, as do the people who live on the property. Different farming activities require varying amounts of water. Some of the water needs would have to be met either in the form of rainfall, or if that is not possible, through irrigation. You must know the crop that you are thinking of growing in order to see whether or not the crop's water needs can be met through rainfall.

The rainfall must also occur at the time that the plants need water. For example, it does not help to plant maize in the Western Cape and rely on rainfall to provide the crop's water needs; their rainfall occurs predominantly in winter. It is likely to be dry at the time when the maize is supposed to be planted, and the seeds won't germinate.

If you are planning to include animals in your farming activities you must provide sufficient water to meet their needs. The larger the animal, the more water it needs.

In order to calculate how much water is required by a farming activity, use the table below as a reference.

Calculating daily water requirements	
For people	
	Litres
If tapped water is available, per person per day for all purposes.	60
If water is carried over a distance every day, per person per day for cooking, washing and drinking.	15 – 20
If water is scarce, for cooking and drinking only, 5 litres per person per day.	5
TOTAL	

For animals (Please note these figures are guidelines only and the actual amounts will vary depending on the area, breed and season)	
Beef cattle	30 – 60 per beast
Dairy cattle	Up to 80 per beast
Sheep 3.5 litres	3.5 per beast
Pigs 9 litres	9 per beast
Poultry	5 litres per 20 birds
TOTAL	

Water sources in a farming environment can be any of the following:

- Piped water supply from a municipality,
- Borehole,
- River,
- Dam, or
- Spring.

Please remember that no-one is allowed to extract water from rivers, dams or underground reservoirs without permission from the Department of Water Affairs and Forestry.

Once you have established how much water your farming enterprise needs, and where you will get this water, you must think about where you want the water to be, because you must plan to transport the water to it's point of use.

1.3 Selecting an enterprise

The process of selecting an enterprise is made whilst taking the information about natural resources and the needs of various enterprises into account. The natural resource base must be able to sustain the selected enterprise. The following should be taken into account:

- Water flow onto and off the farm.
- Terrestrial (land) and aquatic (water) living organisms found on the farm.
- Expected biomass to be removed from farm and required inputs to replace the loss.
- Establishing if any natural resources like thatching grass or reeds that can be harvested at a sustainable rate.

1.4 Basic layout requirements

The layout of a farm is planned by taking into account the activities that will be undertaking, the structures and infrastructure required by these activities and also the natural resources and natural landscape of the area. The list below provides a few examples of structures and infrastructure that could form part of a farm. It is impossible to provide a list that is applicable to every farming enterprise.

Layout requirements and considerations	
Access / transport	All produce from the farm must be taken off the farm, and inputs brought onto the farm. Consider the distance that must be travelled and the condition of the roads.
Beehives	Keep away from people. Must be close to forage and water sources. Needs sheltered areas; protection from wind.
Borehole	Situated where the source of underground water is – consider how water will be pumped to where it is used/needed.
Bridges	Make sure these do not interfere with wetlands. Take maximum flood levels into account.
Compost heaps	Near to the source of materials and easy to transport finished products to where it will be used/sold.
Dams	Ideally, above the area where water will be used so that water can be gravity fed.
Electrical generator	Consider noise and length of cabling.
Farm house	In an unproductive area, but centrally located on the farm to save on transport costs. Ideally also placed for good visibility, such as to look out for fires.
Fencing	Separating specific activities on the farm, different grazing camps, and, if appropriate, security.
Fields	In areas where the land is suitably productive. Consider access routes.
Firebreak	On the boundary where fire is likely to come from.

Layout requirements and considerations	
Food stores	Closest to where the animals are fed.
Grazing	Consider the suitability of grazing areas. Divide into camps based on herds and carrying capacity.
Input stores	Closest to where it will be used. Consider storage requirements of materials, e.g. temperature, humidity, etc.
Intensive food garden	If appropriate, nearest the farmhouse.
Irrigation	Access to water is crucial to success of any farm. To save on installation costs the use of gravity-fed systems should be exploited to the maximum to keep the need for pumps to a minimum
Milk sheds	Consider input requirements; electricity and water. Consider distance cows walk to the milk sheds. If milk is converted into other products, consider how the milk will reach the production area.
Nursery / greenhouse	Access to water, inputs, electricity. Consider transport of produce to market.
Orchard	Access to water and pack house. Consider theft and pollination.
Pack house	Consider proximity to fields/orchards/place of production. Consider condition of the road (bruised fruit, etc.).
Poultry shed	Access to water and proximity to feed. What about slaughter options; if on site, then electricity and storage must be considered.
Water reservoir	How is water pumped, and how far? The longer the distance, the higher the capital and maintenance costs.
Windbreak	At right angles to the prevailing wind.
Woodlot	Keep away from fire hazards.
Workshop	Closest to where vehicles are garaged.

Please complete Activity **5** at the end of this session

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

ACTIVITY

1

SO 1 AC 1-3

Group Activity: Divide into groups and decide

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

Climate interpretation:

Months	mm	Min °C	Max °C	Wind Information		
				Months	**Direction**	**Speed**
January	74	18.1	25.4			
February	95	18.4	25.6			
March	106	17.5	24.9			
April	80	15.0	23.6			
May	55	12.7	22.4			
June	40	10.7	21.1	Winter Winds	W-NW	14-22 knots
July	51	10.3	20.9			
August	51	10.9	21.0			
September	93	12.3	20.9	Summer winds	E-NE	22- 33 knots
October	95	13.9	21.4			
November	90	15.4	22.8			
December	74	16.9	24.3			

The table above provides climatic data for the East London area. Use the information in the table to answer the following questions:

1. What is the average annual rainfall for this area?

. . . . . .

2. During which month/s does the East London area receive the most rainfall?

. . . . . .

3. Would it be appropriate for a local farmer to erect windbreaks only on the north-western boundary of his fields?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

4. During which months can a farmer start planting seeds that need a minimum temperature of 16°C in order to germinate?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

5. Do you think a farmer in this area should be concerned about frost?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

6. Using the formula provided, how much water could be harvested in a field that is 200 m x 100 m, assuming there is more rain than 16 mm per hour, during the month of September.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:	**Assessment:**

2

SO 1 AC 1-2

Group Activity: Assessing soil on the farm by performing elementary tests

My Name:
. . . . . .
My Workplace:
. . . . . .
My ID Number:
. . . . . .

In an ideal situation, we would send soil samples to a professional laboratory for testing. The results will provide us with information about soil minerals and soil condition. However, we can perform elementary tests on soils ourselves and this will give us a good idea of what kind of soil we have and what its potential might be.

You can start off by answering a few questions (as the indigenous people of the world have been doing for centuries) that can reveal a lot about soil:

Assessing Soil: Questions to ask
• What colour is it? • How does it taste? • How well does it retain water? • How much sand does it contain? • How does it feel? • Is it firm? • What does it look like when it is wet / dry? • What plants (weeds) are growing in it? • How healthy are these plants (specifically a crop)? • How well does water drain through it? • Was the soil from a slope? • Was the soil from high ground? • How much work does the soil need in order to produce a good crop? • Is the soil suited to a specific crop? • What is the organic content of the soil?

Your facilitator will provide you with three distinctly different soil samples. You are going to test each soil sample and assess the potential of the three samples. Make sure you divide your soil sample into four so that you have enough soil for all four tests.

Once you have conducted each test, complete the table below to record your findings.

Test 1: What kind of soil do we have: Bottle test.

Use three equally sized bottles. Place the same amount of soil from each sample into the bottle, about half-full. Fill the jar with water, close the lid and shake it well. Let the bottle stand. The soil particles will settle according to their weight and size; heavy particles will settle first and silt is likely to stay suspended for up to a few weeks.

The layers that form will give you and indication of what kind of soil you have; clay, loam, sandy.

Test 2: What kind of soil do we have: Moulding test

Take a small amount of soil in the palm of your hand. Add enough water to make a paste, similar to bread dough. Mix it thoroughly and try to answer the following questions, using the table below as guideline for your answers.

1. How does it feel?
2. Does it form a ball?
3. Can you form a ribbon?
4. Can you bend it into a circle without it breaking?
5. Is it consistently moist?

Characteristics of various types of soil structures
(from Production Without Destruction)

Soil Texture	Feel (moist)	Forms a ball	Makes a ribbon	Moulded into circle	Consistency moisture
Sand	Very gritty	N o	No	No	Loose
Sandy Loam	Gritty	Yes, easily deformed	Yes, dull surface, poorly formed	Yes, but breaks	Holds together
Loam	Gritty	Yes	Yes, dull surface, poorly formed	Yes, but cracks do form	Holds together
Silty Loam	Velvety	Yes	Yes, dull surface, poorly formed	Yes, few small cracks	Holds together
Clay Loam	Gritty and sticky	Yes, very stable	Yes, shiny surface, well formed	Yes	Firm
Clay	Extremely sticky with slight grittiness	Yes, very resistant to moulding	Yes, shiny surface, well formed	Yes, does not crack	Firm to extremely firm

Test 3: How healthy is our soil: Peroxide test

Peroxide reacts to bacteria by bubbling vigorously. The more bacteria, the more bubbles. Bacteria are the foundation of soil ecology; if there is a low bacteria population it is likely that the food web of soil organisms is unstable and the population low. We can assess the general potential of soil using peroxide. (Peroxide is available at most chemists for a small amount. Use 20% strength, if possible.)

Test 4: How healthy is our soil: Living organism audit

A health soil will contain a diverse range of living organisms, including prey and predator species. Take the three samples and use the Soil and Compost Life sheets to record how many of which species you are able to find in your sample. Assess the condition of your samples based on the organisms you are able to find. Use the sheets of white paper provided by your facilitator as the base on which to work – it's easier to see the organisms.

Soil Testing Results				
Record your results,	BOTTLE TEST	MOULDING TEST	PEROXIDE TEST	LIVING ORG AUDIT
Sample 1				
Sample 2				
Sample 3				

This information is retained in order to help you make an informed decision regarding the possible enterprises that can be undertaken on the farm and also what kinds of inputs would be necessary in order to promote soil health.

Facilitator comments:

Assessment:

ACTIVITY

3

SO 1 AC 1-3

Individual Activity:
Vegetation and agriculture questionnaire

My Name:
. . . . . .
My Workplace:
. . . . . .
My ID Number:
. . . . . .

Answer the following questions:

1. In which biome is the farm where you are working located?

. . . . . .

. . . . . .

2. What are the main agricultural threats to this biome?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

3. What are the key invasive plants that threaten local indigenous plants?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

4. Which biome covers the largest surface area of South Africa and what are the main agricultural activities of this biome?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

5. Which biome has the largest number of species and threatened species? Where is this biome found?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

6. What do you think should be done to protect the biodiversity of plants on the farm where you are working?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:	**Assessment:**

4

SO 1 AC 1-2

Group Activity: Survey of the farming activities and impact on the local ecology

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

This activity involves an excursion onto the farm where, in small groups, you will survey the natural resources and the physical layout of the land. Whilst doing so you will also assess the condition of the farm and identify areas that have been negatively impacted upon by farming activities.

The facilitator will provide you with:

- A map of the area to be surveyed,
- Test results of water and soil samples that have been taken,
- A list of significant indigenous plants and animals (if appropriate),
- A list of key invasive/alien species, and
- Appropriate climate information.

In your group, walk around the farm to the identified recording sites and write down your assessment of the natural resources and physical layout of the land. Make sure you remember to include observations about degraded areas.

SURVEY POINTS	Recording Site
A	
B	

SURVEY POINTS	Recording Site
C	
D	
E	
F	
G	

SURVEY POINTS	Recording Site
H	
I	
J	

Facilitator comments:

Assessment:

5

SO 1 AC 1-2

Individual Activity: Enterprise needs analysis, selection and elementary layout

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

Based on the knowledge and skills you have gained so far, what do you think is the ideal enterprise for the farm where you are working? You may select more than one, if this is appropriate. Motivate your answer based on available natural resources and what these enterprises require from the surrounding natural resources. Provide a basic map for the layout of this enterprise, based on the farm where you are currently working. Staple the map to this page.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:

Assessment:

Concept (SO1: AC 1, 2, 3)	I understand this concept	Questions that I still would like to ask
Natural resource qualities in relation to conservation and sustainable resource use.		
A natural resource survey and physical observation to decide on appropriate land capability options for an identified area, a given farm layout and identified infrastructure needs.		
Plant, livestock and human needs.		

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Session 2 Prevention structures and infrastructure

After completing this session, you should be able to:
SO 2: Design and construct prevention structures and infrastructure necessary for the farm area or the farm enterprise applying sustainable resource use principles.

In this session we explore the following concepts:

- Conservation principles
- Maintenance Principles
- Designing and constructing effective conservation applications
- Designs and elementary requirements for the construction of structures

2.1 Conservation principles

Sustainable agriculture is an approach to food production that stresses the conservation of the land whilst still meeting the farmer's needs for high productivity. The farming activities are seen within the ecological context of farming operations and inputs are weighed up against their intended action as well as within the inter-relationships on the farm. For example, the use of chemicals may end up being a course of action a farmer chooses not to take because of the impact it will have on the predator species and therefore the localised food webs.

By applying ecologically sound decision-making the farmer often depends less on external inputs, which reduces his cost of production and therefore increases his profits.

The outcome of developing an ecologically sound plan is to improve soil health, biodiversity, and water quality over time.

⑤ Soil conservation and conditioning

Soil conservation involves the on-going promotion of soil health by preventing soil erosion and degradation through wind and water action; using sustainable strategies to enrich soil, such as the making and using of compost, crop rotation, double

digging, liquid nutrients, green manure, mulching and/or trench beds. It also includes:

- Minimising damage to the soil while clearing the field to plant and where possible, retaining trees.
- Disturbing soil as little as possible during the process of loosening it.
- Planning for deep and shallow root systems.
- Aerating the soil.
- Providing drainage.
- Preventing soil degradation and erosion.
- Preventing bare ground; maintain ground covers
- Recycling minerals back into the soil (such as with green manure, compost, crop rotation).
- Building up soil humus and keeping it covered with mulch.
    - Applying appropriate methods to harvesting water contours, bunds, and/or swales.
    - Soil rehabilitation through the repair of eroded areas, improving compacted soil, attending to mineral deficiencies by using animal manures, green manure, and appropriate plant species, and the development of permanent plant communities
    - Using plants, animals and other living organisms to recycle minerals
    - Soil conservation through erosion control, low tillage systems, and the protection of wetlands)
    - Promoting soil life through the application of mulches and developing a good humus layer

⑤ Water management

Managing water resources sustainably involves the following:

- Identify the quality and quantity of all water sources.
- Identify suitable places for micro-catchment rainwater harvesting; net systems, contour bunds, contour ridges, swales, semi-circular bunds, mulch-pits or tanks. Generally speaking micro-catchment rainwater harvesting is applied within 30 m of the collecting area in cultivated areas with slopes of a ratio between 1:1 and 3:1. Harvested water is typically stored directly into the soil profile, but this is not always the case.
- Identify the suitable places for long slope catchments; trapezoidal bunds, contour stone bunds, and contours. This is generally applied in areas where there is an overland flow of rain water on surfaces and rills over areas between 30 and 200m.where the slope ranges from 2:1 to 10:1. Harvested water is stored in the soil profile
- Identify how slopes can be used to channel water to where it is needed.
- Identify how water can be used more economically in the buildings.
- Identify ways for grey water (water that has been used for washing) to be used.
- If dams are going to be built: Identify the individual or organisation that would be able to provide technical assistance. Make sure you have permission. Ensure

that the construction takes 100-year rainfall occurrence into account and that it is not where buildings are below the wall in the case of the wall failing.

- Where possible, use trees to help stabilise micro- and long-slope catchments.
- Minimise water loss on the landscape through mulch and by incorporating windbreaks.

2.2 Maintenance Principles

The monitoring of structures and infrastructure, as well as conservation measures that have been implemented must be done at regular, defined intervals. Some of these elements would have to be monitored on a daily basis, some weekly, bimonthly, or monthly. Some may need quarterly monitoring. It varies from element to element.

2.3 Designing and constructing effective conservation applications

Water conservation is applied through:

- Protecting wetlands,
- Ensuring that rain run-off is slowed down so that it is can percolate into the soil,
- Effective harvesting of rainwater,
- Wise use of water resources by applying methods to minimise water needs.

METHODS OF HARVESTING WATER

Type	Classification	Main uses	Description	Where appropriate	Limitations
Micro-catchments	Short slope catchment techniques	Trees and grass	Closed grid of diamond shapes or open ended 'V's formed by small earth ridges, with infiltration pits	For tree planting in situations where land is uneven or only a few trees are planted	Limited to small-scale. Not easy to apply mechanised cultivation between tree lines
Contour bunds or swales	Short slope catchment technique	Trees and grass	Earth bunds on contours spaced at 5 – 10 metres apart with furrow upslope and cross ties	For tree planting on a large scale	Not suitable for uneven terrain

Type	Classification	Main uses	Description	Where appropriate	Limitations
Semi-circular bunds	Short slope catchment technique	Rangeland and fodder, and trees	Semi-circular shaped earth bunds with tips on contour. In a series with bunds in staggered formation	Useful for grass re-seeding, fodder or tree planting in degraded rangeland	Cannot be mechanised therefore dependent on hand labour
Contour ridges	Short slope catchment technique	Crops	Small earth ridges on contour at 1.5m – 3m apart with furrow upslope and cross-ties. Uncultivated ridges between ridges	For crop production in semi-arid areas, especially where soil fertile and easy to work	'New' technique and people reluctant to change 'old way' of doing things
Trapezoidal bunds	Long slope catchment technique	Crops	Trapezoidal shaped earth bunds capturing runoff from external catchment and overflowing around wingtips	Widely suitable in a variety of designs for crop production in arid and semi-arid areas	Labour-intensive and uneven depth of runoff within plot
Contour stone bunds	Long slope catchment technique	Crops	Small stone bunds constructed on the contour at spacing of 15 – 35m apart, slowing and filtering runoff	Versatile system for crop production in a wide variety of situations. Suitable for resource-poor farmers	Only possible where abundant loose stone available
Permeable rock dams	Flood water harvesting	Crops	Long, low rock dams across valleys slowing and spreading flood water as well as healing gullies	Suitable for situation where gently sloping valleys are becoming gullied and better water spreading is required	Very site-specific and needs considerable stone as well as provision of transport
Water spreading bunds	Flood water harvesting	Crops and rangeland	Earth bunds set at a gradient, with 'dog-leg' shape, spreading diverted flood water	For arid areas where water is diverted from water course into crop or fodder block	Does not impound much water and in the early stages after construction it requires high maintenance

TABLE: SUMMARY CHART OF MAIN WATER HARVESTING TECHNIQUES
(from Water Harvesting, FAO, 1991)

Please note that you will participate in a practical component for this section as part of Session 3.

Please complete Activity **6** at the end of this session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

6

SO 2 AC 1-4

Group Activity: Vegetation and agriculture questionnaire

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

Introduction:

In Activity 4, page 28 of your Learner Guide, you conducted a survey. Select two degraded or ecologically threatened areas and devise a plan to rehabilitate them. Write your answers in the space provided.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:

Assessment:

Concept (SO 2, AC 1, 2, 3, 4)	I understand this concept	Questions that I still would like to ask
Conservation principles		
Maintenance Principles		
Designing and constructing effective conservation applications		
Designs and elementary requirements for the construction of structures		

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Session 3 Designing and constructing structures

After completing this session, you should be able to:
SO 3: Design and construct all structures using simple tools and equipment

In this session we explore the following concepts:

- Selecting the appropriate tools and equipment
- Using simple tools and equipment
- Caring for and maintaining tools

This session is entirely practical in nature. You will be part of a team that will be constructing simple structures using appropriate tools and equipment. Your facilitator will either help you set up a plan to undertake this as part of your normal duties on the farm, or, if it is more appropriate, s/he will provide you with an opportunity to undertake this during the course. The activity will involve the construction of any four of the following (or similar) structures:

- Bunds
- Gabions
- Contour bunds
- Mulching
- Hedgerows
- Wind power
- Solar power

Please complete Activity **7** at the end of this session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

7

SO 3 AC 1-3

Group Activity: Practical demonstrations and application: Observe and discover

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

Construct any **four** of the following (or similar) structures:

- Bunds
- Gabions
- Contour bunds
- Mulching
- Hedgerows
- Wind power
- Solar power

At the end of this activity, write a detailed instruction sheet that could be used to tell someone else who has no experience how to make it and what its purpose is. Make sure you include:

- A list of required materials with specifications,
- A list of tools that will be required,
- How to care for the tools and equipment, and
- A detailed, step-by-step set of instructions.

Write your answer in the space provided below:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:

Assessment:

Concept (SO 3, AC 1, 2, 3)	I understand this concept	Questions that I still would like to ask
Selecting the appropriate tools and equipment		
Using simple tools and equipment		
Caring for and maintaining tools		

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Session 4

Monitoring the implementation of principles for natural resource management and infrastructure maintenance

After completing this session, you should be able to:
SO 4: Monitor the implementation of principles for natural resource management and infrastructure maintenance

In this session we explore the following concepts:

- The infrastructure plan
- Monitoring farm layout and infrastructure
- Observe and collect data for efficient protection and maintenance
- Problem-solving

4.1 The infrastructure plan

Everything that is used on the farm to make things happen more smoothly and more efficiently is part of the infrastructure and structure; access, services, water harvesting structures, buffer zones, contouring, fencing and irrigation. The infrastructure of a farm varies from enterprise to enterprise.

Each component of the infrastructure and all structures must be monitored and maintained on a regular basis in order keep them functioning at optimum levels. It is likely that the farmer has a list that provides guidelines on a daily, weekly, monthly, quarterly and annual basis for specific things to be checked.

4.2 Monitoring farm layout and infrastructure

Monitoring is done by using a checklist. The checklist will identify what the ideal conditions are that should be observed. Sometimes there could be sensory clues that indicate the state of the item concerned.

Please complete Activity **8** at the end of this session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

8

SO 4 AC 1-3

Group Activity: Maintenance of structures and infrastructure

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

There are three parts to this activity.

Part One:

Below is a list of structures and infrastructure that are parts of various farming enterprises. Select two from each category and find out what the optimum operational requirements are for each of these, according to the farm's maintenance policy, by asking the three questions below

Maintenance Policy How do I know it is functioning properly? How often must it be checked? What must I look for to make sure it is working properly?	
INFRASTRUCTURE	
Access road	
Bridges	
Dams	
Fencing	
Water reservoir	

Maintenance Policy How do I know it is functioning properly? How often must it be checked? What must I look for to make sure it is working properly?	
STRUCTURES	
Nursery / greenhouse	
Firebreak	
Orchard	
Woodlot	
Fence	

Maintenance Policy How do I know it is functioning properly? How often must it be checked? What must I look for to make sure it is working properly?	
NATURAL RESOURCES	
Soil in a field	
Grazing area	
River / stream / spring	

Part Two:

Select one item from each category – one of those selected in Part One – and assess the item concerned according to the procedures required for the farm.

Infrastructure:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Structure:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Natural Resource:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Part Three:

Once the monitoring and assessment data gathering is complete (Part Two), make suggestions for the repair and/or maintenance of the item concerned.

Infrastructure:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Structure:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Natural Resource:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Facilitator comments:	Assessment:

Concept (SO 4, AC1, 2 ,3)	I understand this concept	Questions that I still would like to ask
Monitoring farm layout and infrastructure		
The infrastructure plan		
Observe and collect data for efficient protection and maintenance		
Problem-solving		

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Session 5 Attending to minor faults and maintenance

After completing this session, you should be able to:
SO 5: Monitor the implementation of principles for natural resource management and infrastructure maintenance

In this session we explore the following concepts:

- Causes of destruction, erosion or pollution
- Identifying maintenance needs
- Maintaining conservation structures

There are many things that can go wrong with the infrastructure, structures and natural resources on a farm. It is important to be prepared, first of all, for as many eventualities as possible. If you are uncertain about what can happen in a particular area, find out. Speak to neighbouring farmers or people from the relevant government departments.

If something has gone wrong, then firstly, identify the problem and what caused it, then suggest what should or could be done to rectify the problem.

A fire hazard was identified adjacent to an orchard. A band of fire retardant and fire resistant trees and shrubs were planted on the side of the orchard facing the direction from which fire was most likely to enter. However, the fire changed direction twice, as the wind changed unexpected and as a result, two rows of trees on another boundary of the orchard were damaged by fire. In order to prevent this from happening again it is advisable to establish some form of fire break on that side of the orchard (as well as replacing the trees that are dead). Since the hazard from that side may not be as severe as the side of the original firebreak, it may only be necessary to keep a strip of mown grass as a firebreak.

Please complete Activity **9** at the end of this session

My Notes ...

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

5.1 Causes of destruction, erosion or pollution

Wind and water are the two key causes of erosion and destruction in a farming environment, and the farming activities themselves are the causes of pollution. We must manage these in order to maximise efficiency on the farm.

It is important to consider the cause and effect of conditions. In the case of pollution, we must understand what happens if a particular substances enters the ecology of an area. In some cases the natural environment can cope with certain inputs up to a point (threshold) but thereafter it causes pollution.

⑤ Water harvesting and management applications

Water harvesting applications and methods are vulnerable to the elements. If the structure is not strong enough to deal with the volume of water that is channelled into it then it could be damaged or eroded. For example, the flow of surface water across a landscape that is slowed down by a contour. If the contour is not high and wide enough, then water pressure could find the weakest point in the contour wall and push through it, leading to erosion in the field.

Thus the first cause of destruction is when an application has not been made to withstand the worst-case scenario. In the first section of this module we discussed how important rainfall data is; we use it to establish the best possible specifications for the structure we are putting into place to manage or harvest an aspect of the natural environment (e.g. wind or water). Proper planning prevents future maintenance.

⑤ Wind

Salt, silt, sand, pollution and moisture are carried in winds and can affect temperature, health, plant growth, animal appetites and available light (such as fog). We may wish to either diffuse or deflect winds, to protect a farming activity, or, if we wish harvest wind power, we can channel it to something like a wind pump. Winds don't always blow in the same direction all year round and looking at the flagging on existing trees will give us an indication of local wind conditions and direction.

♦ Planning windbreaks

- Good windbreak plants usually have fibrous stems, needle-like, furry or waxy leaves, and are often white underleaf.
- The height of a windbreak should generally be one fifth of the distance between windbreaks.

- Make sure the length of the windbreak is longer than the area to be protected.
- Use earth mounds to facilitate wind flow, if appropriate.

♦ **Windbreaks using plants**

- Use species that will grow easily - a nursery or forestry department could provide this information. The larger species that form the main part of the windbreak should allow almost half of the wind to flow through them.
- Provide the initial plants with protection (reeds, shade cloth, stakes).
- Provide mulch though stones or plant material.
- Provide water through diversion drains, swales or bunds.

♦ **Wind shelters using other materials**

Wind shelters can be constructed from anything that will slow down or deflect wind; reeds, shade-cloth, bamboo. When a shelter from wind has been created using materials other than plants, the potential damage increases. For example, shade-cloth that has not been securely fixed to support structures can easily tear and become damaged.

My Notes ...

ACTIVITY

9

SO 5 AC 1-3

Group Activity: Maintenance Survey

My Name:

. . . . . .

My Workplace:

. . . . . .

My ID Number:

. . . . . .

In your group, select one item from each category below and find out what the maintenance requirements of these items are, within the operational management of the farm where you are working

	How often is it checked or monitored?	Who monitors it?	What is this person looking for?	Who repairs or maintains it?
Structures				
Fence				
Trellis				
Windbreak				
Infrastructure				
Road				
Irrigation system				
Pack house cooling system				

Water reservoir				
Wind pump				
Soil Conservation				
Mulch cover				
Plant cover				
Crop rotation				
Water conservation / harvesting				
Bunds				
Contour walls/mounds				
Dam				
Swales				

Facilitator comments:

Assessment:

Concept (SO 5, AC 1, 2, 3)	I understand this concept	Questions that I still would like to ask
Maintaining conservation structures		
Causes of destruction, erosion or pollution		
Identifying maintenance needs		

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Am I ready for my test?

- Check your plan carefully to make sure that you **prepare in good time**.
- You have to be found **competent** by a qualified **assessor** to be declared competent.
- Inform the assessor if you have any **special needs** or requirements **before** the agreed date for the test to be completed. You might, for example, require an interpreter to translate the questions to your mother tongue, or you might need to take this test orally.
- Use this worksheet to help you prepare for the test. These are **examples** of **possible questions** that might appear in the test. All the information you need was taught in the classroom and can be found in the learner guide that you received.

1. ***I am sure*** *of this and understand it well*
2. ***I am unsure*** *of this and need to ask the Facilitator or Assessor to explain what it means*

Questions	1. I am sure	2. I am unsure
You are leading a team to construct a simple form of prevention or infrastructure that would control the degradation. Use the following criteria to design and construct such a simple structure.		
1. Design a conservation plan that will explain how the structure will enable the degraded area to recover.		
2. Draw a design plan for the proposed structure.		
3. Display the design for the construction of the structure and the appropriate materials and simple tools required for the construction of the structure.		
4. Draw a plan how you will utilise your team and construct the structure.		
5. Once the structure has been completed demonstrate the ability to maintain tools and equipment.		

Checklist for practical assessment ...

Use the **checklist** below to help you prepare for the part of the practical assessment when you are observed on the **attitudes** and **attributes** that you need to have to be found competent for this learning module.

Observations	Answer Yes or No	Motivate your Answer (Give examples, reasons, etc.)
Can you identify problems and deficiencies correctly?		
Are you able to work well in a team?		
Do you work in an organised and systematic way while performing all tasks and tests?		
Are you able to collect the correct and appropriate information and / or samples as per the instructions and procedures that you were taught?		
Are you able to communicate your knowledge orally and in writing, in such a way that you show what knowledge you have gained?		
Can you base your tasks and answers on scientific knowledge that you have learnt?		
Are you able to show and perform the tasks required correctly?		
Are you able to link the knowledge, skills and attitudes that you have learnt in this module of learning to specific duties in your job or in the community where you live?		

- The assessor will complete a checklist that gives details of the points that are checked and assessed by the assessor.
- The assessor will write commentary and feedback on that checklist. They will discuss all commentary and feedback with you.
- You will be asked to give your own feedback and to sign this document.
- **It will be placed together with this completed guide in a file as part of you portfolio of evidence.**
- The assessor will give you feedback on the test and guide you if there are areas in which you still need further development.

Paperwork to be done ...

Please assist the assessor by filling in this form and then sign as instructed.

Learner Information Form				
Unit Standard	**116274**			
Program Date(s)				
Assessment Date(s)				
Surname				
First Name				
Learner ID / SETA Registration Number				
Job / Role Title				
Home Language				
Gender:	Male:		Female:	
Race:	African:	Coloured:	Indian/Asian:	White:
Employment:	Permanent:		Non-permanent:	
Disabled	Yes:		No:	
Date of Birth				
ID Number				
Contact Telephone Numbers				
Email Address				
Postal Address			Signature:	

Glossary

Term	Description
Soil degradation	The process whereby there is a reduction in, or loss of, productivity in the soil as a result of denudification, soil erosion and/or bush encroachment.
Desertification	Serious land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variation and human activities.
Biome	Vegetation units with similar structures sharing important plant species and similar ecological processes
Vegetation types	Groups of plant communities found within a biome that have different characteristics, but still similar in type.
Alien or invasive plants	Plants that have been introduced to into South Africa either intentionally or unintentionally, and have become naturalised, i.e. are capable of reproducing or spreading without the direct assistance of people. these plants threaten both agricultural productivity and natural ecosystems.

My Notes ...

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Bibliography

Books:

Alien weeds and invasive plants: A complete guide to declared weeds and invaders of South Africa, Lesley Henderson. (Plant Protection Research Institute, 2001.)

Betting on Biodiversity – Why Genetic Engineering Will Not Feed the Hungry or Save the Planet, Vandana Shiva. Research Foundation for Science, Technology and Ecology.

How to grow more vegetables than you ever thought possible on less land than you can imagine, John Jeavons.. (Ten speed press, 2002)

People's Farming Workbook, Environmental and Development Agency Trust. (David Philip Publishers, 1995)

Production without destruction, Helen L Vukasin, et al. (Natural Farming Network, 1995)

Vegetation of South Africa, Lesotho and Swaziland, Edited by Barrie Low and A. (Tony) G. Rebelo. (Department of Environmental Affairs and Tourism, 1998.)

Journals:

Desert Margins Program. Proceedings of a national workshop. Appropriate Restoration Technologies in South Africa. Potchefstroom. 1998.

World Wide Web:

wordnet.princeton.edu/perl/webwn

Terms & Conditions

Acknowledgements

■ **Project Management:**

M H Chalken Consulting
IMPETUS Consulting and Skills Development

■ **Donors:**

Boland College

■ **Authenticator:**

Ms D Naidoo

■ **Technical Editing:**

Ms S Spies

■ **OBE Formatting:**

Ms B Enslin

■ **Design:**

Didactical Design SA (Pty) Ltd

■ **Layout:**

Ms N Matloa

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

REGISTERED UNIT STANDARD:

Assist in farm planning and layout for conservation and rainwater harvesting

SAQA US ID	UNIT STANDARD TITLE		
116274	Assist in farm planning and layout for conservation and rainwater harvesting		
SGB NAME		**REGISTERING PROVIDER**	
SGB Primary Agriculture			
FIELD		**SUBFIELD**	
Field 01 - Agriculture and Nature Conservation		Primary Agriculture	
ABET BAND	**UNIT STANDARD TYPE**	**NQF LEVEL**	**CREDITS**
Undefined	Regular	Level 3	3
REGISTRATION STATUS	**REGISTRATION START DATE**	**REGISTRATION END DATE**	**SAQA DECISION NUMBER**
Registered	2004-10-13	2007-10-13	SAQA 0156/04

PURPOSE OF THE UNIT STANDARD

A learner achieving this unit standard will be able to plan, lay out and develop a maintenance programme for conservation and infrastructure development, and will design, construct and maintain resource use practices that include, but not restricted to, soil and water erosion prevention measures in an agricultural environment.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that a learner attempting this unit standard will demonstrate competence against the unit standards or equivalent:

- NQF 2: Apply layout principles for conservation and infrastructure.

UNIT STANDARD RANGE

Whilst range statements have been defined generically to include as wide a set of alternatives as possible, all range statements should be interpreted within the specific context of application.

Range statements are neither comprehensive nor necessarily appropriate to all contexts. Alternatives must however be comparable in scope and complexity. These are only as a general guide to scope and complexity of what is required.

UNIT STANDARD OUTCOME HEADER

N/A

Specific Outcomes and Assessment Criteria:

SPECIFIC OUTCOME 1

Assist in a land capability analysis to serve as the basis for development of an area or an enterprise selection for the farm.

OUTCOME RANGE

"Land capability" may refer to intensive or extensive crop and animal systems, as well as aquaculture, horticultural production systems and/ or human well-being. All types of analysis are included according to purpose of the appropriate basic infrastructure, but not restricted to the analysis soil and water. A comprehensive analysis of the farm or selected enterprise on the farm could be considered.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

An understanding of natural resource qualities in relation to conservation and sustainable resource use is demonstrated.

ASSESSMENT CRITERION 2

A natural resource survey and physical observation to decide on appropriate land capability options for an identified area, a given farm layout and identified infrastructure needs is used.

ASSESSMENT CRITERION 3

Plant, livestock and human needs are included.

SPECIFIC OUTCOME 2

Design and construct prevention structures and infrastructure necessary for the farm area or the farm enterprise applying sustainable resource use principles.

OUTCOME RANGE

Structures include but are not restricted to bunds, gabions, mulching, wetland protection contours and soil preparation methods. It includes comprehensive tasks related to energy, roads and building infrastructure.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

An understanding of conservation principles is demonstrated.

ASSESSMENT CRITERION 2

An understanding of maintenance principles is demonstrated.

ASSESSMENT CRITERION 3

An understanding of design for the effective working of conservation and constructed applications is demonstrated.

ASSESSMENT CRITERION 4

Appropriate designs for the construction of structures are provided.

ASSESSMENT CRITERION 5

Designs and elementary requirements for construction of structures are displayed using appropriate media.

SPECIFIC OUTCOME 3

Design and construct all structures using simple tools and equipment.

OUTCOME RANGE

Simple tools and equipment include but are not restricted to bunds, gabions, mulching, wetland protection contours and soil preparation methods. It includes a variety of tools and equipment appropriate for the construction or maintenance task.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The ability to select the appropriate tools for construction and maintenance is demonstrated.

ASSESSMENT CRITERION 2

Simple tools and equipment is used to construct basic infrastructure.

ASSESSMENT CRITERION 3

The ability to care for and maintain tools and equipment for infrastructure maintenance is demonstrated.

SPECIFIC OUTCOME 4

Monitor implementation of principles for natural resource management and infrastructure maintenance.

OUTCOME RANGE

All principles for efficient design of layout of the farm and infrastructure, as well as properties of material should be considered.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

An understanding to monitor the design of the farm layout and infrastructure according to agricultural, water catchment and environmental conservation principles is demonstrated.

ASSESSMENT CRITERION 2

An understanding of the infrastructure plan is demonstrated.

ASSESSMENT CRITERION 3

The ability to observe and collect data for efficient protection and maintenance is demonstrated.

ASSESSMENT CRITERION 4

The ability to find solutions to correct problems and faults is demonstrated.

SPECIFIC OUTCOME 5

Maintain, report faults, and where appropriate repair them under supervision.

OUTCOME RANGE

A comprehensive approach should be taken to the maintenance of the layout of the farm and infrastructure. Maintenance of infrastructure is not limited to catchment management methods, protection and regular maintenance tasks.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

An understanding of the maintenance of conservation structures and infrastructure related to the selected farm enterprise(s) is demonstrated.

ASSESSMENT CRITERION 2

Causes of destruction, erosion or pollution are identified.

ASSESSMENT CRITERION 3

Maintenance needs are identified.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

The assessment of qualifying learners against this standard should meet the requirements of established assessment principles.

It will be necessary to develop assessment activities and tools, which are appropriate to the contexts in which the qualifying learners are working. These activities and tools may include an appropriate combination of self-assessment and peer assessment, formative and summative assessment, portfolios and observations etc.

The assessment should ensure that all the specific outcomes; critical cross-field outcomes and essential embedded knowledge are assessed.

The specific outcomes must be assessed through observation of performance. Supporting evidence should be used to prove competence of specific outcomes only when they are not clearly seen in the actual performance.

Essential embedded knowledge must be assessed in its own right, through oral or written evidence and cannot be assessed only by being observed.

The specific outcomes and essential embedded knowledge must be assessed in relation to each other. If a qualifying learner is able to explain the essential embedded knowledge but is unable to perform the specific outcomes, they should not be assessed as competent. Similarly, if a qualifying learner is able to perform the specific outcomes but is unable to explain or justify their performance in terms of the essential embedded knowledge, then they should not be assessed as competent. Evidence of the specified critical cross-field outcomes should be found both in performance and in the essential embedded knowledge.

Performance of specific outcomes must actively affirm target groups of qualifying learners, not unfairly discriminate against them. Qualifying learners should be able to justify their performance in terms of these values.

- Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA.

- Any institution offering learning that will enable achievement of this unit standard or assessing this unit standard must be accredited as a provider with the relevant ETQA.

- Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The person is able to demonstrate a basic knowledge of:

- Role and function of soil and water samples, weather information, vegetation, infrastructure, livestock and crop characteristics, production cycles, records, markets, health and hygiene within production procedures.
- Description, characteristics and properties of vegetation, infrastructure, weather, production cycles, markets within production procedures.
- Livestock and crop characteristics.
- Regulations and legislation related to production procedures.
- Relationship of outcomes within unit standards in relation to each other and within production procedures.
- Purpose is to ensure that the learner is able to consider all factors when deciding on what enterprise to establish.

- Literacy and numeracy skills.
- Communication and reporting skills.
- Understand the procedures and principles followed to determine the viability of an enterprise.

Intermediate Knowledge

The person is able to demonstrate a basic knowledge of:
- Understand how the land`s capability affects viable land use planning.

UNIT STANDARD DEVELOPMENTAL OUTCOME

N/A

UNIT STANDARD LINKAGES

N/A

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING

Problem Solving: relates to all specific outcomes.

UNIT STANDARD CCFO ORGANIZING

Self-management: relates to all specific outcomes.

UNIT STANDARD CCFO COLLECTING

Interpreting Information: relates to all specific outcomes.

UNIT STANDARD CCFO SCIENCE

Use Science and Technology: relates to all specific outcomes.

UNIT STANDARD CCFO DEMONSTRATING

The world as a set of related systems: relates to all specific outcomes.

UNIT STANDARD CCFO CONTRIBUTING

Self-development: relates to all specific outcomes.

UNIT STANDARD ASSESSOR CRITERIA

N/A

UNIT STANDARD NOTES

N/A