SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

Unlocking the potential of sugarcane

SUSFARMS®

Sustainable Sugarcane Farm Management System

4th Edition

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SASA

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This fourth version has been revised by Dr John Scotcher (Forestlore Consulting); Michelle Binedell, Poovie Govender and David Wilkinson (SASRI); and Janet Edmonds (Midlands Collaboration Coordinator).

WHAT IS THE PURPOSE OF THIS MANUAL?

When SUSFARMS® was first published in a manual (Version 1: February 2008), it contained a vast amount of information pertaining to the development of the system as well as detailed notes on each of the auditable measures (then called verifiers).

The purpose of subsequent editions was to produce a simpler version of the manual to serve as a valuable guide for the implementation of SUSFARMS® and an enabler for checking one's progress towards the implementation and achievement of legal requirements or better management practices. While reference may be made to the original SUSFARMS® manual, Edition 2: 2012 or Edition 3: 2015; this version (Version 4: 2019) may be used (on its own) to assist growers in the implementation of practices which are either legal requirements or better management practices.

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CHAPTER 3: Planet

INTRODUCTION

The **Su**stainable **S**ugarcane **F**arm **M**anagement **S**ystem (SUSFARMS®) is a farming system designed to encourage sustainable, responsible sugarcane production through the implementation of better management practices (BMPs). These BMPs are designed to reduce negative impacts on the environment, comply with legislation, maintain a high level of social responsibility and assist in ensuring financial sustainability.

Each legal requirement or BMP within SUSFARMS® is expressed as a MEASURE thereby making it possible to assess the extent of implementation of these BMP's. The SUSFARMS® Progress Tracker contains a list of legal requirements and BMP's and can be used to track progress over time.

The MEASURES that are contained within SUSFARMS® are…

- ✓ PRACTICAL - involving experience rather than just theory
- ✓ WORKABLE - directed to ensuring the practice is achievable
- ✓ SUSTAINABLE in the long term
- ✓ ACCEPTABLE to legislators, environmentalists and growers, and
- ✓ Have the capacity to be used as an EXTENSION TOOL.

BMPs are based on knowledge derived from scientific studies, or in the absence of such data, on best available knowledge and may require upgrading as new technology, thinking and methods are developed.

SUSFARMS® has been designed to try and reduce the negative impacts on the environment whilst ensuring economic sustainability and social upliftment through implementation of better management practices.

Implementation of the system by the grower should result in improved performance in the environmental, social and economic spheres.

SUSFARMS® is a guide only and growers should exercise due diligence to ensure that s/he has complied with all the laws applicable for his/her farm.

SUSFARMS® is in keeping with the worldwide trend towards sustainable agriculture and in keeping with South Africa's strategic plan for agriculture and the Department of Agriculture's policy on agriculture for sustainable development.

THE CONCEPTUAL FRAMEWORK

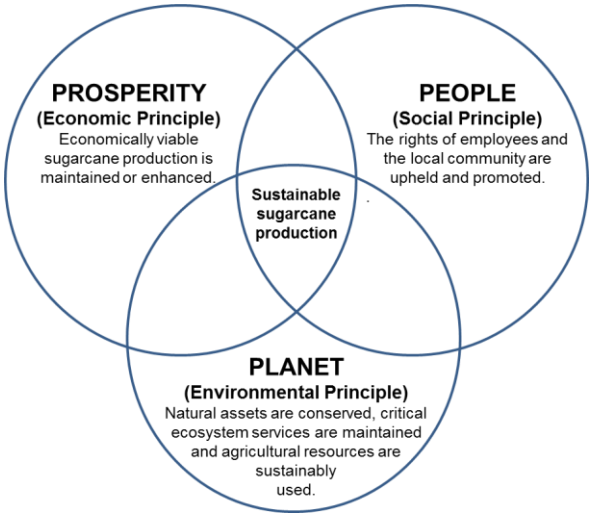
The SUSFARMS® framework was developed as a four-tiered set of principles, criteria, indicators and verifiers. This framework provided a mechanism for the articulation and acknowledgement of relevant international and South African legislation as well as sugar industry standards, which can be applied by means of better management practices.

Three main principles make up the main framework of the SUSFARMS® system. They are:

PROSPERITY
This embodies the economic principle whereby economically viable sugarcane production is maintained or enhanced.

PEOPLE
This embodies the social principle whereby the rights of employees, suppliers/contractors and the local community are upheld and promoted.

PLANET
This embodies the environmental principle whereby natural assets are conserved, critical ecosystem services are maintained and agricultural resources are sustainably used.



In attempting to attain each of these principles, sugarcane agriculture should ensure that the attainment of one principle does not neglect another principle.

For example, in pursuing the principle of “prosperity”(i.e. improving profitability), one should not neglect the environmental principle of “planet” and allow negative impacts on the biophysical environment.

This simple user guide has done away with the words criteria, indicators and verifiers, but has rather categorized the three main sections of people, prosperity and planet under two main headings – namely "**A statement of intent**" (previously called *criteria*) and "**measures**" (previously called *indicators* and *verifiers*).

The **Statement of Intent** is a broad statement indicating the overall objective (or desired outcome) of the implementation of legal compliant or better management practices.

Measures on the other hand are the 'auditable' elements of a SUSFARMS® system and form an integral part of the SUSFARMS® Progress Tracker. They have a number of attributes that allow them to be good measures of sustainable agriculture - they are fair to both small and large farms, they can be adapted and applied to all regions in the sugar industry and relate to operational aspects of sugarcane production.

For each practice that is required, there is a related 'measure' that serves to 'check' whether legal requirements have been implemented or better management practices are in place. Achievement of a 'measure' will contribute to the achievement of good farm management.

Measures are allocated to two main categories:

Legal requirements	**These are practices which are legally binding – i.e. they are required by law**
Better management practices	**These are practices which are not legally binding, but, if implemented will contribute to enhancing the overall sustainability of crop production**

Relevant international and national laws and regulations, as specified in each measure, are the minimum requirement to demonstrate compliance with the law.

THE SUSFARMS®PROGRESS TRACKER

Since each legal requirement or better management practice (BMP) has been described as a measure, we can check and then track the implementation of sustainability practices at one point in time, or over a longer period of time.

The “SUSFARMS Progress Tracker” is an Excel Spreadsheet Application which allows for easy selection and scoring and serves as a checklist of each measure, against which full achievement, partial achievement or non-achievement of a requirement or practice can be indicated. It follows the SUSFARMS® manual and all measures can be cross-checked to the manual for more details.

An online version of the Progress Tracker also exists for registered growers from certain mill regions who have been notified of the need to submit their self-assessments online.

Once completed, the Progress Tracker provides one with a progress report. This report can be used to develop an action plan that can serve to plan the way forward towards the implementation and achievement of new measures.

The Progress Tracker can therefore be used as a self-assessment, allowing a sugarcane grower to check, by his own standard, the extent to which his management practices, systems and administration, meet the requirements of SUSFARMS®. Provided the examination is done rigorously and timeously, the sugarcane grower should be able to identify progress towards each measure at any time.

PROSPERITY

Economically viable sugarcane production is maintained or enhanced

Module 1.1 Land Use Plan

Module 1.2 Annual Production Plan

Module 1.3 Annual Financial Plan

Module 1.4 Financial Compliance

Module 1.1 LAND USE PLAN		STATEMENT OF INTENT The agronomic and mechanisation practices of the sugarcane farm are integrated with the climate, soils, water and topography to obtain optimum and sustained economic crop production
Measures		**Notes**
Legal requirement	**A documented land-use plan or other maps exist, containing details and specifications with regard to:** • Conservation terraces (indicating vertical intervals and height of terrace banks) • Waterways (indicating their location and waterway category) • Roads and cane extraction system (indicating the location and type of road i.e. diagonal, crest, access or district road) • Road drainage for all roads • Natural wetlands and watercourses (indicating their location) • Dams (indicating their location) • Quarries (indicating their location) • Rubbish dumps (indicating their location)	***This section deals only with the existence of a Land Use Plan or detailed farm map. The implementation of various structures that are contained on this plan (or map) is addressed in Modules 3.10, 3.11 and 3.12.*** To obtain optimum economic crop production, it is necessary to integrate the agronomic and mechanisation practices with the climate, soils, water and topography of the farm unit. The grower has to recognise that different parts of the farm require different types of management and these must be integrated into a balanced working plan. It is vital to ensure that, while striving for optimum yields, protection of the environment is maintained. A land use plan (LUP) is a combination of a surface water management network, a cane extraction network and a production management programme. The LUP should be a Land Use Design for the entire farm area covering all commodities and not just cane. Surface water management structures provide the basis of all LUPs. Surface water management structures consist of mechanical conservation works such as storm drains, conservation terraces and waterways (refer to Module 3.10: Soil conservation: Layout). All land of slopes 2% and over require conservation terraces (refer to DAEA publication, Conservation of Farm Land in Kwazulu-Natal). For sugarcane, specific designs may apply for those slopes <4% such as in the irrigated areas where parallel conservation terraces are used. Together with the crop, the construction of surface water management structures in the field ensures the protection of the most important resource on the farm - the soil. A LUP is not required by law, however, the Department of Agricultural Technical Services and the South African Sugar Association reached an agreement on procedures by which technical services for combating and preventing soil erosion on sugarcane lands in Natal were to be provided to canegrowers. Some of the conditions included the following:

		1. Each owner and occupier must comply with the Conservation of Agricultural Resources Act 43 of 1983, with particular regard to the cultivation of virgin soil and the Regulations pertaining to the Soil Conservation Scheme. 2. In the coastal areas where only sugarcane is grown, responsibility for technical planning and the provision of plans and specifications was vested in the South African Sugar Association Experiment Station (now SASRI). 3. In areas where sugarcane farming forms only part of a mixed farming enterprise (the midlands of KZN), the Department of Agriculture Technical Services and the South African Sugarcane Research Institute will jointly be responsible for providing these services. The choice of where to obtain these services was left to the individual canegrower. On these grounds, it has been agreed that the possession of a Land Use Plan is a 'legal' requirement. LUPs should therefore be designed and drawn up according to the recommended standards of the South African Sugarcane Research Institute (SASRI) and the Department of Agriculture and Environment Affairs (DAEA). For slopes greater than 4% an LUP must contain details and specifications regarding: • Conservation terraces • Waterways • Roads and cane extraction system • Types of road drainage systems • Natural wetlands and watercourses • Dams • Quarries; and • Rubbish dumps

Better management practice	• Staff/labour housing and workshop • Soil Parent Material • Soil Form including depth, TAW (total available water) and erodibility • Non-arable and natural areas • Wet agricultural land (relic wetlands) • Fields including number and area in hectares • Minimum tillage fields • Fields suitable for green cane harvesting (trashing) • Fields suitable for mechanisation • Historically or culturally important sites	In addition, an LUP (or map) should contain details and specifications regarding: • The location of staff/labour housing and workshop • Soil Parent Material • Soil Form including depth, TAW (total available water) and erodibility Soil parent material, soil forms and soil erodibilities should be determined using the SASRI publication, "Identification and management of the soils of the South African Sugar Industry, 3rd edition, 1999". (Refer to Module 3.10 – Soil Conservation: Layout). Total available water (TAW) is the available water capacity (AWC) multiplied by the effective rooting depth (ERD) of a particular soil and is used to determine the irrigability of a soil. Other areas that should be shown on a map or plan include: • Non-arable and natural areas (Refer to Module 3.1: Threatened, critical and protected species and ecosystems). • Wet agricultural land (relic wetlands) • Fields including number and area in hectares • Minimum tillage fields • Fields suitable for green cane harvesting • Fields suitable for mechanisation • Historically or culturally important sites

	An LUP on irrigated farms should contain details and specifications regarding: • Bulk and in-field irrigation system design • Irrigation blocks • Irrigation types • Electric power supply system for irrigation • For irrigated fields, surface and subsurface water management structures i.e. drainage system network (dimensions stipulated in SABI norms) and waterways • Dams, dyke and canal network for irrigation	LUP requirements for dealing with irrigated farms, should address both surface and sub-surface water management (in addition to those detailed above). The LUP should therefore include the following: • Bulk water and in-field irrigation system design (permanent infrastructure) • Irrigation blocks (i.e. an area that is irrigated at one time) • Irrigate type (e.g. sprinkler, centre pivot, linear, drip, micro-jet) • Electric power supply from the on-farm transformer and pump station positioning for irrigation • Surface and subsurface water management structures i.e. drainage system network (dimensions stipulated in SABI norms) and waterways • Dams, dyke and canal network (include dam capacity and dyke dimensions as stipulated in SABI norms) for irrigation. The existence of a LUP does not necessarily imply that the grower has permission to cultivate new land. Only the DAEA can authorise the cultivation of new land. The implementation of waterways, conservation terraces and extraction roads must be done according to SASRI standards and in accordance with other applicable environmental, and if applicable, municipal law. In some cases, new extraction roads in sensitive areas may require authorisation (refer to Module 3.11: Soil conservation: Extraction). The LUP should be implemented over a period of ten years, or in a time frame that allows the farmer to maintain the economic viability of the crop - preferably a maximum of 10 years, based on a 10% replanting programme. Implementation of the LUP enables the conservation of soil and water, increases yield potential, the long term sustainability of the natural resources on the farm and profitability for the farmer.

Module 1.2 ANNUAL PRODUCTION PLAN		STATEMENT OF INTENT Production potential of the land is maintained or enhanced
Measures		**Notes**
Better management practice	**The production potential of the land is maintained or enhanced through recording and monitoring inputs and outputs.** **A field specific record-keeping system exists, showing:** • Area of sugarcane recorded in hectares • Area planted to each variety recorded in hectares • Replant dates are recorded • Sugarcane yield in tons cane per hectare harvested • The average RV% recorded • All fertiliser applications recorded annually • All agrochemical (herbicide and pesticide) applications recorded annually • Net irrigation water used is recorded • Net rainfall recorded annually • Net electricity usage for sugarcane production is recorded in kWh	In order to ensure an economically viable farming unit into the future, it is necessary to plan and then record against that plan, what was actually achieved. Only by monitoring over time will it be possible to ensure that the production potential of the land is maintained or enhanced. The following inputs and outputs will contribute toward managing this important aspect of the LUP. • The area of sugarcane on the farm must be recorded annually (in hectares) and depicted over time. • The area planted to each variety must be recorded annually (in hectares). • Sugarcane yield (in tons cane per hectare harvested) must be measured annually, and also depicted over time, with the objective of improving yields over time. • Actual yields should be compared with potential yield using SASRI benchmarks. • The SA sugar industry uses recoverable value (RV% cane) to estimate the amount of sucrose in cane. The average RV% should be recorded per crop cycle. • The date of replant should be recorded on a field basis so that age of ratoons can be monitored. • A Land Use Plan must be used to provide soil form information which will influence variety performance. • The type, rate, frequency and cost of fertilisers should be recorded annually and interpreted over time in relation to the yield of the sugarcane crop. • Volumes of all agrochemicals (herbicides and pesticides) used, should be recorded. • A record of annual planting, harvesting and transport costs must be kept. • A record of infrastructure establishment and maintenance must be kept. • Record net irrigation water consumed annually. • Record net rainfall received annually • Record net electricity used (in kWh) for all sugarcane production practices.

	• Net diesel used for all sugarcane on-farm production operations is recorded • Net diesel used for sugarcane transport to the mill is recorded • Records of sampling (done once every four years) for the following: - Soil pH - Acid saturation - Salinity (where this is an issue)	• Record diesel usage for all sugarcane on-farm production operations. • Record diesel used for sugarcane transport to the mill. • Record sampling (done once every four years) for the following: - Soil pH - Acid saturation - Salinity (where this is an issue)

Better management practice	**The production potential of the land is maintained or enhanced through the calculation and achievement of production standards:** • The average RV% for the farm should exceed an industry average of 10% • The average mass of agrochemical active ingredient applied (kg/ha) should not exceed 5kg ai/ha per annum • The actual yield compared to an established yield potential using an appropriate tool • The actual yield compared and recorded against the mill average	**The production potential of the land is maintained or enhanced through the calculation and achievement of production standards** **Relative value (RV%):** The average RV% for the farm should exceed an industry average of 10% **Average mass of agrochemical active ingredient applied:** In order to establish the average mass of agrochemical active ingredient applied per annum, the total mass of active ingredients in all agrochemicals applied to cane is recorded and expressed as an average (in kg active ingredient per hectare of area under cane). All herbicides, fungicides, nematicides, ripeners and insecticides are classified as agrochemicals. The agrochemical label will indicate the volume or mass of active ingredient in the product *Note: Do not include adjuvants (e.g. oils, surfactants or other additives).* The intention is to compare against a global standard of 5kg ai/ha/annum and reduce use over time. **Comparison of actual yield against yield potential:** The yield potential of a farm can be established using a number of web-based or mobile app tools. One such tool is called *StalkGro* and can be accessed from the SASRI website at https://sasri.org.za/decision-support-tools/ *MyCanesim Lite* is a cell phone app for android and iOS phones. The app is a simplified version of the MyCanesim model, requiring only eight inputs from drop down lists, for quick simulation of sugarcane crop growth, water use and yield. MyCanesim Lite can be downloaded for free from the Google Play Store or the i-Store. **Comparison of yield against mill average:** A simple benchmarking exercise can involve the comparison of actual yields against mill average. This provides a very simple indicator of productivity, but is not as useful as establishing your potential using the above-mentioned tools.

Better management practice	• Net primary energy used per ton of cane per annum (MJ/t/annum) compared against a global standard of 300 MJ/t	**Net primary energy used for all on-farm operations per ton cane per annum:** Primary energy use per ton of cane (excluding the energy required to transport the cane to the mill) should be calculated annually for all sugarcane on-farm production operations with the objective of reducing energy use each year. The global standard is 300 MJ/t. ***Primary energy is the sum*** of ***direct*** and ***indirect*** energy use. The calculation of each component is explained below. ***A.*** ***Direct (on-farm) energy use*** – defined as energy content of diesel and electrical power used for on-farm operations $$EU_{direct} = \frac{[(D_{total} - D_{excluded}) \times 37] + [(E_{total} - E_{excluded}) \times 3.6]}{t_{sc}}$$ Where EU_{direct} = Energy use (direct) [MJ.t-1] D_{total} = annual diesel consumed [l], E_{total}l = annual electrical energy consumed [kWh], $D_{excluded}$ = annual diesel excluded (see notes below) [l], $E_{excluded}$ = annual electricity excluded (see notes below) [kWh], t_{sc} = tons of sugarcane harvested in the milling season [t] **Notes:** I. The above equation calculates energy used in: • production of sugarcane (this includes re-establishment, ratoon management, harvest and transport to loading zones), • all contracted operations related to sugarcane production, • sugarcane fallow crops, • farm workshop requirements, and staff and family residing on the farm. II. The excluded variables (***$D_{Excluded}$*** and ***$E_{excluded}$***) account for: • fuel required in road haulage • fuel and electricity required for the production of crops other than sugarcane (if no records are available this must be reasonably estimated) • fuel that is used for personal travel (non-farming related) III. If contracted work is conducted, diesel consumption is unknown or if the contribution from other crops is difficult to calculate, then contact the local extension specialist for assistance.

Better management practice		**B.** ***Indirect energy use*** – defined as is the energy used to manufacture and transport agronomic inputs (fertilisers, herbicides etc.). To account for the energy used to ***manufacture*** the product $$EU_{indirect} = \frac{(m_N \times 56.9) + (m_P \times 9.3) + (m_K \times 7) + (m_{lime} \times 0.12) + (m_{h\&f} \times 355.6) + (m_i \times 358)}{Y_{sc}}$$ Where mn = Nitrogen application rate [kg.ha-1], mp = Phosphorus application rate [kg.ha-1] mk = Potassium application rate [kg.ha-1] mlime = lime application rate [kg.ha-1] mh&f = herbicide and fungicide application rate [kg.ha-1] mi = insecticide application rate [kg.ha-1] Y_{sc} = tons harvested divided by area under cane [t.ha-1] To account for the ***transportation*** of the fertiliser $$EU_{indirect\_trans} = \frac{(m_N + m_P + m_K + m_{lime} + m_{h\&f} + m_i) \times 0.64}{Y_{sc}}$$

Better management practice	• Energy used for sugarcane transport to the mill (MJ/t) is calculated and compared to a global standard of 50 MJ/t.	**Efficiency of energy used for cane transport (MJ/t):** Energy use per ton of cane transported should be calculated annually with the objective of reducing energy use each year. The global standard is 50 MJ/t. This can be calculated by the following equation. If the total diesel used in road transport (directly from the field to mill, or trans-loading zone to mill) is known, the energy use is calculated by the equation below. $$EU_{trans} = \frac{D_{trans} \times 37}{t_{sc}}$$ Where EU_{trans} = Energy use in transport [MJ.t^{-1}], and D_{trans} = annual diesel consumed in transport [l] t_{sc} = tons of sugarcane harvested in the milling season [t] If the total diesel consumed is unknown EU can be estimated using the following equation. $$EU_{trans} = \frac{(d \times 2)}{c} \times \frac{1}{PL} \times 37$$ Where PL = payload of haulage vehicle [t], d = lead distance (one-way) to mill [km], and c = average fuel efficiency of haulage vehicle [km.l^{-1}]. The fuel efficiency of trucks and haulage tractors range from 1.5 km.l^{-1} (32t rigs) to 2.5 km.l^{-1} (smaller tractor trailer rigs). If one is unsure, contact a local haulier or extension specialist.

Module 1.3 ANNUAL FINANCIAL PLAN		STATEMENT OF INTENT Profitability and viability of a farming operation is planned on an annual basis
Measures		**Notes**
Better management practice	**Profitability and/or viability of a farming operation is assessed on an annual basis. Accurate record keeping and monthly account management are critical components of the Annual Financial Plan.** It should consider the following inputs: • Annual budget is drawn up • Cash flow and savings projections should be drawn up annually. • All transactions associated with the farming activities must be captured on a monthly basis and monthly reports generated • Monthly account management undertaken • Annual Financial Statements are prepared • An annual review of the profitability of the business undertaken • Full understanding of the obligations of a business owner • Up-to-date with loans/debts • Measure repayment ability to service debts and loans • Determine whether expenses on depreciated vehicles and equipment is justified or not.	There are a number of activities associated with annual financial planning. Getting assistance with financial planning is advised. Annual financial planning relies on accurate record-keeping as per the Annual Production Plan and those aspects identified in the section below: 1. A budget for income and expenses should be drawn up as per the production plan as well as other monthly expenses such as living costs, finance costs, insurance and also asset replacement, taxes, bonds and hire purchase. 2. Cash flow and savings projections should be drawn up annually. 3. All transactions associated with the farming activities must be captured on a monthly basis and monthly reports generated. 4. Monthly account management should be undertaken which reviews the budget and cash flow and forecasts for the following months in order to take action when required. 5. Annual Financial Statements should be prepared by an Accountant and these should be audited for specific entities. 6. An annual review of the profitability of the business should be undertaken using suitable financial indicators. 7. All growers should have a full understanding of their obligations as business owners. 8. All growers should be up-to-date with loan and debt repayments. 9. All growers should measure their repayment ability to service debts and loans. 10. An evaluation should be undertaken to determine whether expenses on depreciated vehicles and equipment is justified or not.

Module 1.4 FINANCIAL COMPLIANCE		STATEMENT OF INTENT Compliance with relevant financial legislation is achieved and maintained
Measures		**Notes**
Legal requirement	• Register for tax with SARS • Submit income tax returns for the past tax year • Make all necessary payments to SARS • Receive any refunds due	The South African Revenue Services (SARS) requires that all legal entities, as well as individuals that receive employment income, be registered for income tax. Depending on factors such as turnover and payroll amounts, growers could also be liable to register for other taxes, duties, levies and contributions such as VAT, PAYE and UIF contributions. Growers must be registered with SARS for income tax. To be tax-compliant you should make sure that: • You do not have any outstanding tax and other statutory returns • You do not owe any money to SARS, unless a payment arrangement or suspension of debt has been agreed to; • You are registered for all the tax products that you are liable for; and • Your registration is kept up to date. Key tax information to maintain and keep handy: • IT12: A copy of your tax return. • IT14: A copy of the tax return of your business. • ITA34: Your personal tax assessment for the latest tax year and/or the assessment for your business for the latest year. • Tax number: Both your personal and business tax registration numbers (and VAT number if registered as a VAT vendor). • Tax compliance certificate/status: If registered for e-filing, this can be obtained or accessed through the SARS website.

Legal requirement	• Register business owners and employees for PAYE • Submit PAYE returns and pay PAYE on a monthly basis • Register with either SARS or the UIF for the purposes of contributing to the Fund • Pay UIF contributions to SARS or the UIF in respect of employees on a monthly basis • Pay a Skills Development Levy at a rate of 1% of the total remuneration payable to employees (if applicable)	**Employees tax:** SITE and PAYE are the two elements of employee's tax. Employees tax is the tax that employers must deduct from the employment income of employees such as salaries, wages and bonuses and pay over to SARS monthly. An employer must issue an employee with a receipt known as an employee's tax certificate (an IRP5/IT3(a)) if SITE or PAYE have been deducted. This discloses the total employment income earned for the year of assessment and the total SITE and/or PAYE deducted and paid to SARS. Standard Income Tax on Employees (SITE) is not a separate tax. It is merely a method that means employees who earn less than a certain amount pay income tax as a full and final liability on the information to the specific employer. Pay-As-You-Earn (PAYE) ensures that an employee's income tax liability is settled in a continuing fashion, while the income is earned. The advantage of this is that the tax liability for the year is settled over the course of the whole year of assessment. **Unemployment Insurance Fund (UIF):** Every employer and employee must, on a monthly basis contribute to the UIF. The monthly contributions are shared equally between the employer and employee. The employer contributes 1% of an employee's salary and the employee contributes 1% of his/her salary. **Compliance with the Skills Development Levies Act, 9 of 1999 (SDL Act):** The SDL Act establishes a compulsory levy scheme for the purpose of funding education and training. Farmers/employers must pay a skills development levy at a rate of 1% of the leviable amount (section 3(c) (the total amount of remuneration paid by an employer to its employee during any one month). The levy must be paid monthly to SARS.

Legal requirement	• Establish if you qualify to pay Provisional Tax • Keep up-to-date with the Provisional Tax returns and payments (Feb and August) • Register with VAT if annual turnover > R1million • Pay and submit VAT returns as required • Ensure Annual Financial Statements are drawn up, audited and submitted, if required	**Provisional Tax**: any person who receives income (or to whom income accrues) other than a salary, is a provisional taxpayer. Provisional tax is not a separate tax from income tax. It allows taxpayers to provide for their final tax liability by paying two amounts during the year of assessment, to ensure that the taxpayer does not have a large tax debt on assessment. It is based on estimated / anticipated taxable income and is paid in advance, through at least two payments during the year of assessment. On assessment, the Provisional Tax payments will be off-set against the liability for normal tax for the applicable year of assessment. Provisional tax estimates and payments are made on IRP6 forms. **Compliance with Value Added Tax Act No. 89 of 1991** Farmers may register as a VAT vendor if applicable. This is in terms of Section 23 of the VAT Act. Usually, farmers are registered to pay VAT on a six-monthly cycle, but other VAT return frequencies exist (monthly, two-monthly and annually), based on turnover, activity type and determination by the Commissioner. This means that these farmers must finance the VAT that they incur on their operating and capital costs for long periods before they get a refund from SARS. The VAT Act currently provides that some farmers may acquire certain goods that are used or consumed for agricultural, pastoral or other farming purposes at the zero-rate. This rule was implemented mainly to assist these farmers with their cash flow before they earn income from their produce. Business owners have to perform certain duties if they are registered or liable (taxable supplies in excess of R 1 million) to register for VAT. Growers should understand and be aware of other tax types such as provisional tax, dividends tax and capital gains tax. It is important to get an accountant or bookkeeper to trace all business finances and to facilitate tax compliance. Training and support to growers and/or their bookkeepers in terms of being aware of and understanding compliance aspects and their responsibilities in this regard is available to members of the South African sugar industry through their grower associations.

PEOPLE

The rights of employees, suppliers/contractors and the local community are upheld and promoted

Module 2.1 HEALTH AND SAFETY	STATEMENT OF INTENT A working environment that is safe and without risk to the health of the employees is provided and maintained
Measures	**Notes**
Legal requirement ***Compliance with the Occupational Health and Safety Act 85 of 1993*** • A copy of the OHSA must be made available on each farm • The farmer can demonstrate familiarity with relevant sections • A policy must be made available to employees, detailing relevant sections of the Act and their application • The policy must clearly set out a commitment to workplace health and safety and a zero tolerance for non-compliance	**Compliance with the Occupational Health and Safety Act 85 of 1993** A copy of the Occupational Health and Safety Act 85 of 1993 ("OHSA") must be made available on each farming operation, and all employees working on the farm must become familiar with those sections which are relevant to their circumstances. Available at www.labour.gov.za *Sections that are relevant to the farmer are:* 8 General duties of employers to their employees, 9 General duties of employers and self-employed persons to persons other than their employees, 13 Duty to inform, 17 Health and safety representatives, 18 Functions of health and safety representatives, 19 Health and safety committees, 23 Certain deductions prohibited, 24 Report to inspector regarding certain incidents, 26 Victimisation forbidden, 32 Formal enquiries, 34 Obstruction of investigation or enquiring or failure to render assistance; and 38 Offences, penalties and special orders of court. 41 This Act not affected by agreements. *Employees also have responsibilities in terms of the OHSA, as qualified in section:* 14 General duties of employees at work, 15 Duty not to interfere with or misuse things, 17 Health and safety representatives, 18 Functions of health and safety representatives, 19 Health and safety committees, 20 Functions of health and safety committees, 32 Formal enquiries, 37 Acts or omissions by employees; and 38 Offences, penalties and special orders of court. 41 This Act not affected by agreements.

Legal requirement	**The farmer must provide and maintain systems of work, plant and machinery that are safe and without risk to health.** • Workshops, storerooms, ablutions and other employee workplaces are neat and tidy • Passageways in the workplace kept free of obstacles • First Aid Boxes adequately stocked, accessible and maintained • Fire extinguishers appropriately labelled (with their contents and purpose identified), accessible and regularly serviced • All electric plugs and socket outlets covered • Circuit breakers and panel boards labelled • Earth leakage device is present • Moving parts of machines, power take off and fan belts guarded • Machinery used for lifting clearly indicates the maximum permissible load • Only employees who are trained and in possession of the necessary licences operate driven machinery. • Personal Protective Equipment ("PPE") (such as earplugs, safety goggles, safety boots, and hard hats) are issued to employees and worn at all times • All signage is clear, unambiguous and, where necessary, in two official languages • Taps and pipes which contain water which is not fit for human consumption are marked	**Safe Working Environment** In terms of the Occupational Health and Safety Act 85 of 1993 – section 8, farmers are required to provide and maintain a working environment that is safe and without risk to the health of his/her employees. On a sugarcane farm, these would be: • Workshops, storerooms, ablutions and other employee workplaces are neat and tidy • Passageways in the workplace are kept free of obstacles • If greater than 5 employees, first aid boxes are adequately stocked, accessible and maintained. The contents of these boxes is dependent on the types of hazards identified on the farm (e.g. cuts, sprains, bee stings, snake bites etc). • Fire extinguishers are appropriately labelled, accessible, their contents and purpose identified, and regularly serviced • All electric plugs and socket outlets are covered • Circuit breakers and panel boards are labelled • Earth leakage devices must be used. • Moving parts of machines, power take off (pto's) and fan belts must be guarded. • Machinery used for lifting clearly indicates the maximum permissible load. • Only employees who are trained and in possession of the necessary licences may operate driven machinery. • Personal Protective Equipment ("PPE") (such as earplugs, face masks, safety goggles, safety boots, and hard hats) must, subject to the nature of work being conducted, be issued to employees and worn at all times. • All signage must be clear, unambiguous and, where necessary, in two official languages. • Taps and pipes which contain water which is not fit for human consumption must be so marked. • For every 50 employees (or part thereof), at least one employee must be trained in first aid and in possession of a certificate of competency. • Employees who arrive at work intoxicated or become intoxicated during working hours must be removed from the workplace.

Legal requirement	• For every 50 employees (or part thereof), at least one employee is trained in first aid and in possession of a certificate of competency. • Employees who arrive at work intoxicated or become intoxicated during working hours are removed from the workplace	
	• Employees are informed of the need to consume sufficient quantities of water, especially in extreme temperatures	**Water quality and water supply** The Occupational Health and Safety Act 85 of 1993, Environmental Regulations for Workplaces, 1987 - regulation 2(4) states that employers must inform employees of the need to consume sufficient water especially in extreme heat. In addition, workers in the field should be supplied with sufficient potable water (5-10 litres) per worker per day depending on environmental conditions. All drinking water that is not from a municipal supply should be tested by a recognised potable water testing facility and should be suitable for human consumption. **Total Injury Frequency Rate (TIFR)** Farmers should maintain records of all injuries on his farm. These include injuries that require first aid, medical assistance, result in lost time or are disabling in nature. A lost time accident is defined as an unexpected and unplanned event which results in a personal injury which causes the worker to be unable to carry on with his/her normal duties on the next day or next shift. These injury incidents should be recorded for all permanent workers, contract workers and seasonal workers and records should be maintained for 5 years. **Risk assessments** Farmers should ensure that health and safety risks are identified against a risk assessment schedule.
Better management practice	• All farmers to supply sufficient safe drinking water to each worker operating in the field (5-10 litres of water per worker per day depending on the environmental conditions) • All drinking water that is not from a municipal supply is tested by a recognised potable water testing facility and is suitable for human consumption • The farmer maintains records of all injuries (first aid, medical, lost time or disabling) and records the frequency of lost time events for a period of 5 years • Farmers should demonstrate that the main health and safety risks, and measures to mitigate them, have been implemented through an annual risk assessment	

Legal requirement	**The farmer provides and maintains precautionary measures with respect to potential hazards to the health and safety of employees:** • The farmer takes steps to eliminate or mitigate any hazard or potential hazard to the safety or health of employees before resorting to personal protective equipment. • Hazardous chemical substances (HCS) to be handled and stored in accordance with SANS 10206:2010 • Chemicals are stored in a room that can be locked • All stored chemicals clearly identified • Safety Data Sheets (SDS) are available for all chemicals used and are available at point of use • Employees are made aware of and/or trained on the use and understanding of the SDS and its contents. • Flammable liquids are stored separately from other chemicals • An inventory of chemical use and record of where each chemical was applied, is maintained • Gloves and face masks are available • Washing facilities available	**Implement precautionary measures to avoid hazards** Employers are required, in terms of section 8 of the OHSA to take reasonable and practicable precautionary measures in order to mitigate identified hazards and potential hazards as to protect employees. On a sugarcane farm, these precautionary measures may include : • Hazardous chemical substances (HCS) for which an occupational exposure limit (OEL) is prescribed, or any substance for which an OEL is not prescribed, or which creates a hazard to health, is stored in accordance with SANS 10206:2010. • Chemicals are stored in accordance with the manufacturer's instructions and in a room that can be locked (refer to Module 3.14: Agrochemicals) • All stored chemicals must be clearly identified • Safety Data Sheets (SDS) must be made available for all chemicals used and should be available at point of use • Employees should be made aware of and/or trained on the use and understanding of the SDS and its contents. • Flammable liquids are stored separately from other chemicals • An inventory of chemical use and record of where each chemical was applied, is maintained • Gloves and face masks must be made available and worn when decanting or handling chemicals • Washing facilities are available for employees who deal with chemicals • Empty chemical containers are to be returned to the supplier, or disposed of safely to an appropriate waste disposal site

	• Empty chemical containers returned to the supplier, or disposed of safely to an appropriate waste disposal site	
Legal requirement	**Farmers must ensure that health and safety representatives are nominated and elected:** • If more than 20 employees are employed, one health and safety representatives should be appointed per 50 employees (or part thereof). • If more than one health and safety representative is appointed, a health and safety committee is established.	**Health and Safety Representatives** The OHSA makes provision for the designation of health and safety representatives in reference to the number of workers employed. Section 18 of the OHSA sets out the functions and responsibilities imposed upon health and safety representatives. For the purposes of a sugarcane farmer, the following is relevant: • The obligation to nominate and elect health and safety representatives only arises in circumstances where an employer employs more than 20 employees. • For every 50 employees (or part thereof), one health and safety representative must be appointed. • Only full-time employees may be nominated and elected as health and safety representatives. • If more than one health and safety representative is appointed, the farmer must establish a health and safety committee, which committee must hold meetings at least every 3 months (minutes of the meetings must be kept for a minimum period of 3 years).
Legal requirement	**Farmers provide information, instructions, training and supervision as is necessary to ensure the health and safety at work of the employee:** • Work is performed and plant or machinery is used under the general supervision of a person trained in the hazards associated with it	**Training for health and safety** Farmers must provide their employees with information, instructions, training and supervision as is necessary to ensure their health and safety. In the sugarcane farm context, the following information, instructions, training or supervision are considered the minimum: • Work is performed and plant or machinery is used under the general supervision of a person trained in the hazards associated with it.

Better management practice	• Training courses for staff health and safety must be implemented to ensure that >90% of employees, contractors, seasonal workers and migrant workers have basic training in health and safety measures related to their work • Environmental awareness programmes are encouraged • Employees at management and supervisor level are encouraged to attend sugarcane agriculture certificate courses at SASRI • Training records kept for minimum of 5 years	• Greater than 90% of all employees, contractors, seasonal workers and migrant workers should receive basic training in health and safety measures related to their work. • General health and safety induction training (before employees commence work) • Training on the need for and use of PPE. • Training on the handling, use, storage and disposal of HCS. • Training on the procedures to follow in the event of an emergency or accident. • Hygiene training courses for staff, particularly HIV/AIDS and cholera awareness • Environmental awareness programmes that deal with water conservation in particular employees at management level are encouraged to attend sugarcane agriculture certificate courses administered by SASRI • Training records should be kept for a minimum of five years (These may include attendance registers, certificates of attendance or an inventory of formal and informal training interventions that took place over the year).
Legal requirement	**Farmers who provide employee villages must ensure that the villages are safe and without risk to the health of the employee:** • Ensure all drinking water is suitable for human consumption • Ensure safe disposal of sewage	**Village Management** Many, if not all, sugarcane farms have farm workers living on the property. In some cases, these can be quite extensive villages. Farmers who provide such accommodation should provide a minimum of services. Better management practices include: • All drinking water is filtered and tested, by a recognised potable water testing facility, at not less than six monthly intervals in terms of suitability for human consumption • Sewage is safely disposed *via* septic tanks and French drains (for villages of less than 150 people), or the Primary Effective Toilet (PET) • The relevant municipality must be consulted to determine the requirements of their by-laws for water and sanitation systems and connections. • Village sites and their surrounds are clear of rubbish (paper, tins, plastic bags, bottles) • An adequate number of waste disposal bins are provided (at least one for each household) • Recycling of glass, tins, paper, organic kitchen waste and oil is encouraged and adequate containers are on site to manage the programme • Recycling practices and disposal facilities should be identified in local areas and assistance sought from them. Refer to Module 3.4: Pollution control.
Better management practice	• Waste disposal bins are provided • Provisions for recycling of glass, tins, paper, organic kitchen waste and oil are made	

Legal requirement	• Farmers ensure that all persons who may be directly affected by his activities are not exposed to hazards to their health and safety	**Safe environment for persons other than employees** In terms of the Occupational Health and Safety Act 85 of 1993 – section 9 (2), farmers who are not employers are required to ensure that even persons not in their employ are not affected by his activities or exposed to hazards. The Act states: "9(2) Every self-employed person shall conduct his undertaking in such a manner as to ensure, as far as is reasonably practicable, that he and other persons who may be directly affected by his activities are not thereby exposed to hazards to their health or safety".

Module 2.2 LABOUR		STATEMENT OF INTENT The right to fair labour practice is upheld
Measures		**Notes**
Legal requirement	***Compliance with the Basic Conditions of Employment Act, 75 of 1997*** • A summary of the BCEA is kept on the farm • No employees are under the age of 15 • No employees are between the ages of 15 and 18 in employment that is inappropriate or places the child at risk.	**Compliance with the Basic Conditions of Employment Act, 75 of 1997 (BCEA)** The Sectoral Determination for the Farm Worker sector was established in terms of section 51 (1) of the BCEA. This Sectoral Determination prescribes the minimum conditions of employment and wages that employers and employees must comply within the farming sector. A summary of the Act should be kept on the farm as per the requirements of section 30 of the Act, A farmer is permitted to employ a child defined in the BCEA as a person who is under the age of 18. No farmer may however employ a child who is under the age of 15 and no farmer may employ a child (ages 15 – 18) in employment that is inappropriate for a person of that age and that places at risk the child's well-being, education, physical or mental health or spiritual, moral or social development. This includes work that is hazardous to their health or working with highly hazardous chemicals. (Note that Section 3 (1) of the South African Schools Act, 1996 (Act 84 of 1996) requires every parent to ensure that every child for whom he/she is responsible attend a school until the last day of the year in which the child/children reaches the age of 15 or the ninth grade, whichever occurs first).

Legal requirement	**A written contract of employment between the farmer and employees exists that regulates, in terms of the Act:** • Full name and address of Employer • Name and occupation of Employee (or a brief description of the work for which the farm worker is employed) • Place of work that the Employee is required to tender services • Date employment began • Days of work, ordinary working hours and overtime limits • Employee's wage or hourly rate, rate of pay for overtime and method of payment • Any deductions to be made from wages • Leave entitlement • Notice period • Termination of employment **Minimum Wage** • All workers (contract, seasonal and migrant workers) should receive a wage above or equal to the minimum wage **Forced Labour** • There should be no valid reports or evidence of forced labour on the farm	Upon employment of a farm worker, the grower must issue to the farm worker, a written contract of employment. The written contract of employment must include the following information: - • full name and address of Employer; • name and occupation of Employee (or a brief description of the work for which the farm worker is employed); • place of work that the Employee is required to tender services; • date employment began, days of work and ordinary working hours; • employee's wage or hourly rate, rate of pay for overtime and method of payment; • any deductions to be made; • leave entitlement; • notice period; and • termination of employment. Of particular importance is the obligation on the Employer to explain the written particulars to the Employee in a language and manner that he/she understands, in the event that he/she is unable to understand same in English. **Minimum Wage** Farmers are to ensure that the minimum wage extends to all contract workers, seasonal and migrant workers. **Forced Labour** The Constitution of South Africa, the International Labour Organization and the BCEA prohibit all forced labour. Farmers must provide evidence that forced labour is NOT practiced.
	• A copy of Sectoral Determination 13 must be made available in the workplace	It is a legal requirement that farmers keep a copy of the Sectoral Determination available in the workplace at all times, and make it available for inspection by an employee or an inspector from the Department of Labour.

Legal requirement	***Unemployment benefits*** • All farmers must be registered with either SARS or the UIF for the purposes of contributing to the Fund • All farmers must pay UIF contributions to SARS or the UIF in respect of their employees on a monthly basis	**Unemployment benefits** The Unemployment Insurance Act, 63 of 2001 ("UIA") and the Unemployment Insurance Contributions Act, 4 of 2002 ("UICA") provide for the regulation of different aspects of unemployment insurance. The UIA was enacted to establish the Unemployment Insurance Fund ("UIF") to provide for the payment from the Fund to certain employees upon certain events occurring. The UICA was enacted to regulate the collection of contributions to the UIF. The UIA provides for 5 different benefits (unemployment, illness, maternity, adoption and dependent benefits). In brief: • The UIA only applies to persons who are considered "employees". In order to qualify as an "employee", the person must work more than 24 hours per month and receive remuneration for the services rendered. • Every employer and employee must, on a monthly basis contribute to the UIF. The monthly contributions are shared equally between the employer and employee. The employer contributes 1% of an employee's salary and the employee contributes 1% of his/her salary. The total amount paid to the UIF is 2% of an employee's salary. There is an earnings ceiling upon which the 2% contribution is calculated. Currently that earnings ceiling is R14 872. This means that if an employee's monthly salary exceeds the earnings ceiling, the 2% contribution will be calculated in accordance with the earnings ceiling and no more. It is the employer's responsibility to ensure that it deducts, from its employees' wages, the employee 1% contribution. In terms of Section 10 of the UICA, where an employer is liable to pay contributions, the employer must register with SARS or the UIF office (whichever is applicable to such employer) for the payment of the contributions Employers must pay the 1% they deducted from workers, together with the 1% they have contributed, to the UIF or SARS before the 7th day of every month.

Legal requirement	***Worker Compensation*** **The Compensation for Occupational Injuries and Diseases, Act 130 of 1993 (COIDA) provides compensation to employees for disablement caused by workplace accidents or occupational diseases which are contracted during employment** • Farmers have registered with the Compensation Commissioner • Farmers have a record of the wages paid to employees, time worked, payment for piece work, overtime and any other prescribed particulars • Farmers have annually (from 1 March to the last day of February of the following year) furnished the Commissioner with a return showing amount of earnings for that year • Accidents and occupational diseases have been reported timeously • Claims for compensation have been lodged in the prescribed manner.	**Worker Compensation** If an employee meets with an accident resulting in his/her disablement or death, the employee or the dependents of the employee are entitled to certain benefits provided for in COIDA. In order for an employee or his/her dependents to benefit from the Compensation Fund, an employer must comply with certain obligations. These include: • Farmers must register with the Compensation Commissioner and furnish particulars as prescribed in terms of COIDA (section 80 of COIDA). • Farmers must keep records of all employees, their wages, time worked, payment for piece work, overtime and any other prescribed particulars. These records must be maintained for a period of four years (section 81 of COIDA). • Farmers must annually (from 1 March of the immediately preceding year to the last day of February of the following year) furnish the Compensation Commissioner with a return showing the amount of earnings paid to employees for the preceding year (section 82 of COIDA). • Farmers have the assessment determined by the commissioner within the period prescribed by the Act (section 83 of COIDA). • Farmers must pay their annual assessment fee to the Compensation Fund. • Farmers are solely responsible for the payment of the annual assessment fee, the assessment fee may not be deducted from an employee's salary. Claims for compensation must be lodged in accordance with the procedures outlined in COIDA. These procedures include: • Written or verbal notice must be given by the employee to the farmer as soon as possible after the accident (section 38) or the commencement of an occupational disease or a disease that has arisen out of and in the course of his/her employment (section 68(1)). • Farmers must report an accident to the Compensation Commissioner within seven days of being notified of the accident (section 39) or within 14 days in the case of an occupational disease (section 68(2)). • In respect of accidents, the official form that needs to be completed is referred to as "W.Cl 2 - Notice of Accident and Claim for Compensation". This form should be completed whenever an employee meets with an accident that leads to personal injury or where medical treatment is required or in the case of death. It is the employer's duty to submit the W.Cl 2 within a period of 7 days to the Compensation Commissioner. • Claims for compensation must be lodged within 12 months of the date of the accident.

Legal requirement	***Compliance with the Employment Equity Act, 55 of 1998*** • Designated employers must, in order to achieve employment equity, implement affirmative action measures for people from designated groups in terms of this Act. • No person may unfairly discriminate against any employee in any employment policy or practice. ***Compliance with the Labour Relations Act, 66 of 1995*** • Farmers respect the rights of employees to form and join trade unions and to establish workplace forums for collective bargaining i.e. employees have the right to freedom of association • Employees have the right not to be unfairly dismissed or subjected to unfair labour practice • Farmers have a copy of Schedule 8 of the Act, 'Code of Good Practice: Dismissal' on the farm	**Employment Equity** **Compliance with the Employment Equity Act, 55 of 1998** The promotion of equal opportunity and fair treatment in employment through the implementation of affirmative action measures to eliminate unfair discrimination as required in terms of the Employment Equity Act 55 of 1998. • There is evidence that a farmer who satisfies the definition of a "designated employer" - employs 50 or more employees or a farmer that employs less than 50 employees but has a turnover that is equal to or above the applicable annual turnover of a small business in terms of the Schedule 4 of this Act - has taken steps to promote equal opportunity in the workplace by eliminating unfair discrimination in any employment policy or practice. Designated employees must, in order to achieve employment equity, implement affirmative action measures for people from designated groups in terms of this Act, viz. black people, woman and people with disabilities. • In addition, no person may unfairly discriminate against an employee in any employment policy or practice including race, gender, sex, pregnancy, marital status, family responsibility, ethnic or social origin, sexual orientation, age, disability, religion, HIV status, conscience, belief, political opinion, culture, language and birth. **Compliance with the Labour Relations Act, 66 of 1995** Growers should ensure that the rights of employees to form and join trade unions and to promote the establishment of workplace forums for collective participation and bargaining relating to matters of mutual interest as required in terms of the Labour Relations Act 66 of 1995, are respected. Growers are to keep a copy of Schedule 8 of the Act, 'Code of Good Practice: Dismissal' on the farm. Obtainable from www.labour.gov.za

Module 2.3 LAND TENURE		STATEMENT OF INTENT The right to land use is upheld
Measures		**Notes**
	The right to use land is demonstrated • Farmers who use land for sugarcane farming must be able to demonstrate their right to use the land	**The right to use land is demonstrated** Farmers must be able to provide evidence of ownership and/or use rights to their land either through land title, legal evidence of ownership or lease of land (i.e. lease contract). If written evidence is not available, then customary rights can be sought through a verbal agreement between the land user and the appropriate tribal structure.
Legal requirement	***Compliance with the Restitution of Land Rights Act, 22 of 1994, as amended*** • Land owners respect the rights of communities with legitimate and demonstrable rights to that land to lodge claims through the Land Claims Court as entitled in terms of the Act.	**Restitution of Land Rights** The Restitution of Land Rights Act, 22 of 1994, as amended, provides for the restitution of rights in land or communities disposed of such rights after 19 June 1913 as a result of past racial discriminatory laws or practices. The Act has its origin in the Constitution of the Republic of South Africa Act 108 of 1996 which provides for restitution of a property or equitable redress to a person or community dispossessed of property as a result of past discriminatory laws. The Act is the legislative means to protect persons, or categories of persons disadvantaged by unfair discrimination. The Act is managed through the Commission of Restitution of Land Rights consisting of a Chief Land Claim Commissioner; a Deputy Land Claims Commissioner and Regional Land Claims Commissioners. Any person who or the representative of any community which is entitled to claim restitution of a right in land may lodge such a claim with supporting evidence for such a claim. If the claim has been lodged in the prescribed manner, is not precluded by the provisions of section 2 of that Act (Entitlement to restitution) and is not frivolous or vexatious then the claim shall be published in the Government Gazette. The Regional Land Claims Commissioner is then obliged to advise the owner of the land in question and any other party which might have an interest in the claim. The Regional Land Claims Commissioner is also obliged to inform the owner that he/she may not sell, exchange , donate, lease, subdivide, rezone, or develop the land in question without having given the Regional Land Claims Commissioner one month's written notice of his/her intention to do so. Further, no claimant who occupied the land in question at the date of the commencement of the Act (2 December 1994) may be evicted from the land without the written authority of the Chief Land Claims Commissioner. No person shall remove, destroy or damage any improvements upon the land without the written permission of the Chief Land Claims Commissioner and no claimant or other person may enter upon and occupy the land without the permission of the owner or lawful occupier. A Land Claims Court administers the powers contained in the Act, specifically Chapter 3.

Legal requirement	***Compliance with the Land Reform (Labour Tenants) Act 3 of 1996*** • Farmers uphold the rights of labour tenants to occupy and use that part of the farm to which they are legally entitled to in terms of the Act.	Farmers must uphold the right of a person who was a labour tenant on 2 June 1995 to occupy and use that part of the farm to which they are legally entitled in terms of the Act, or to acquire land subject to the provisions of the Act. It is important for farmers to understand what is meant by the term "labour tenant" for the purposes of the Act. Please read section 2 of the Act to see when a person is considered a "labour tenant" and as such entitled to certain rights. Labour tenants have a legal right with his/her family members to occupy and use that part of the land that they were occupying or using on 2 June 1995. The right of a labour tenant in this regard may only be terminated in accordance with the provisions of the Act (section 3). In addition, labour tenants may only be evicted in terms of an order of the Court issued under this Act (section 5). The right of use or occupation of a labour tenant may therefore only be terminated, in one of the following ways: • the labour tenant waiving his/her rights; • upon the death of the labour tenant; • upon his/her eviction, after application is made to the Land Claims Court and an order for eviction is granted. Labour tenants also have the right to acquire land, subject to the provisions of the Act (section 16). Finally, the owner of affected land or any other person whose rights are affected are entitled to compensation as prescribed by the Constitution for the acquisition by the applicant of land or a right in land (section 23).
Legal requirement	***Compliance with the Extension of Security of Tenure Act 62 of 1997*** • Farmers uphold the rights of occupiers to reside on and use land to which they are legally entitled to in terms of the Act.	Farmers must uphold the rights of occupiers to reside on and use land on which he/she resided and which he/she used on or after 4 February 1997. In brief, the Act applies to occupiers defined as a person residing on land which belongs to another person, and who has or on 4 February 1997 or thereafter had consent or another right in law to do so. It excludes a labour tenant in terms of the Land Reform (Labour Tenants) Act 3 of 1996. The Act makes it possible, through State assistance, to facilitate the planning of both on-site and off-site developments for occupiers. It provides for rights and duties of both the occupier and the owner and lays down the legal responsibilities in terms of termination of rights of residence (section 8), limitations on eviction (section 9) and restoration of residence and use of land by persons who have been evicted contrary to the provisions of the Act (section 14).

Module 2.4 COMMUNITY DEVELOPMENT & STAKEHOLDER ENGAGEMENT		STATEMENT OF INTENT Farmers contribute towards the economy of the local community and engage stakeholders effectively
Measures		**Notes**
Better management practice	***Preferential employment opportunities*** • People living on the farm, or in close proximity to the farm receive preferential opportunity • Farmers participate in community capacity building initiatives ***Consultation and engagement with local communities and stakeholders*** • Farmers consult and pro-actively engage with local communities and other stakeholders	**Preferential employment opportunities** Although difficult to measure, farmers should make every possible effort to contribute towards the establishment of a sustainable local economy. One of the ways to achieve this is by adopting a policy of employing residents from the local community or from labour tenants on the farm. People living on the farm, or in close proximity to the farm, should receive preferential opportunities for employment. **Consultation and engagement with local communities and stakeholders** There is growing evidence that agricultural growth and efficient management of natural resources are dependent on the political, legal and administrative capabilities of rural communities to determine their own future and to protect their natural resources and other economic interests (Rukini, 2004). In the absence of this power, the result is an abuse of common property resources, disenfranchisement of rural people, especially women, and the weakening or breakdown of rural economic institutions (Rukini, 2004). Farmers are therefore encouraged to pursue a process of pro-active consultation and engagement with local communities and other important stakeholders, either independently, or through a local forum, support group, non-government organisation or other participatory mechanisms. The objective would be to establish both stakeholder and community needs and aspirations, as well as farmer needs and aspirations, and work towards a commonly agreed goal for the mutual benefit of all participating parties. While this might seem a challenging prospect, experiences elsewhere have indicated that sound community and stakeholder relationships are a contributing factor towards a sustainable and peaceful future.

Module 2.5 SKILLS DEVELOPMENT		STATEMENT OF INTENT Farmers contribute towards skills development
Measures		**Notes**
Legal requirement	***Compliance with the Skills Development Levies Act, 9 of 1999*** • Farmers/employers must pay a skills development levy at a rate of 1% of the total remuneration unless they are exempt from having to pay the levy	**Compliance with the Skills Development Levies Act, 9 of 1999 (SDL Act)** The SDL Act establishes a compulsory levy scheme for the purpose of funding education and training. According to Section 3(c), farmers/employers must pay a skills development levy at a rate of 1% of the total monthly remuneration of an employee (including overtime payments, leave pay, bonuses, commissions and lump sum payments). The levy must be paid monthly to SARS. **IMPORTANT**: An employer is exempt from having to pay the levy to SARS if the total remuneration payable to all its employees' for the next twelve months, will not exceed the amount of R 500 000 (note: this amount increases from time to time).
Better Management Practice	• Farmers provide opportunities for staff development - these may include sending staff on relevant formal training courses, such as SASRI's Junior or Senior Certificate Course or STC training courses • Farmers conduct "in-house" training events	Several accredited training courses exist for farm and office personnel. Employers should familiarise themselves with these courses and make use of the industry training courses offered so that employees may benefit from the training. These include: • Junior Certificate Course in Sugarcane Agriculture offered by SASRI • Senior Certificate Course in Sugarcane Agriculture offered by SASRI • Various courses related to sugarcane production offered by the Shukela Training Centre In addition, farmers could conduct "in-house" training events using SASRI resources such as Ingede articles, poster sets, booklets, guides or videos and keep records of these events.

Module 2.6 PUBLIC RECREATION		STATEMENT OF INTENT Recreational facilities for the public are provided on a voluntary basis where appropriate
Measures		**Notes**
Legal requirement	***The law does not oblige farmers to make land available for the uses outlined in this section but if they do, they must comply with the applicable laws. Any public access may expose farmers to liability for claims if someone using that access is hurt or killed or suffers harm in some other way.*** ***Public use of land for recreational use is available on the farm on a voluntary basis*** **Facilities for public use exist:** • Growers should be familiar with the obligations associated with allowing public access to their properties • Toilet facilities comply with requirements of applicable municipal by-laws • Where re-establishment of indigenous wildlife (mammals, fish) has occurred, it has been done in accordance with the legislation	**Public recreational facilities** Recreational facilities could be developed where suitable opportunities exist. The main objectives of providing recreational facilities are to dispel the impression that areas of unplanted land are not utilised and to use the opportunity to overcome negative public perceptions about sugarcane farms. However, public access can bring a host of problems for the cane farmer and it will be necessary to look at all the ramifications before proceeding. Land use planning laws for the province may require the farmer to get permission from the municipality for a different use of agricultural land. If the land falls within the land use / zoning scheme for the municipal area, restrictions may exist for the use of the land. Proper planning will help to reduce the possible problems. It is preferable to involve clubs rather than individuals, as this will increase expertise and reduce problems. **Fishing** In many cane areas, streams and rivers provide high quality angling. Care is needed to ensure that well-intentioned management measures do not have detrimental side effects. Weirs designed to improve carrying capacity must be carefully sited to avoid siltation due to the reduction in velocity. If weirs are built, gabions or similar type structures should be used and banks reinforced where there is a danger of side cutting. A central overflow should be provided, discharging into a pool of reasonable depth from which fish will be able to move upstream Dams are regulated by the National Water Act, 36 of 1998. The introduction of fish is subject to obtaining permission from the relevant provincial authority, and this procedure should be strictly adhered to. Where the fish is a protected, alien or invasive species, additional permission is required in terms of the National Environmental Management: Biodiversity Act, 10 of 2004. In the interests of indigenous fish conservation, the release of exotic angling fish is not permitted in some regions. Indigenous species present should be identified before introductions are considered.

Legal requirement	• Suitable 'exclusion of liability' signs should be clearly displayed • Farmers should control public access for reasons of security and fire protection	**Dams** Dam sites should be carefully chosen and be selected so as to avoid wetlands. The dam will constitute a water use in terms of the National Water Act, 36 of 1998 (Section 21(a), (b) and (c)) and a water use licence will be required. In addition, the dam may require an environmental authorisation in terms of the National Environmental Management Act Regulations published under sections 24 and 24D of that Act. Use of vleis, marshes, water sponges and water courses is also subject to authorisation under the Conservation of Agricultural Resources Act, 43 of 1983 - Regulation 7 published in terms of section 29 of the Act. Environmental authorisation in terms of the National Environmental Management Act, 107 of 1998 as well as authorisation in terms of the National Water Act, 36 of 1998 (in the form of a general authorisation or water use licence) is required before any weir or other structure within or near to a watercourse is built. Dams with irregular shorelines and areas of shallows are more productive of wildlife than those that are deep and steep sided. Islands should be constructed where possible to provide safe nesting sites for waterfowl. If the public are given access to dams, suitable exclusion of liability signs should be clearly displayed. **Signage** Suitable exclusion of liability signs should be clearly displayed in all areas of the farm to which the public has access. Necessary facilities such as signboards, picnic tables, braai facilities, toilets and dustbins, will cost money. Advice should be sought from the relevant conservation services as well as the relevant municipality in respect of any requirements of municipal by-laws. Protected species must not be endangered through public use of the land. **Access control** The need to control access for reasons of security and fire protection can be integrated with recreation by: • limiting access to certain times of year • providing game guards/field rangers working through organisations such as angling, hunting, hiking or bird watching clubs and youth groups, and requiring the organisations to assume part of the responsibility of controlling the activities of their members

Better Management Practice	• Trails for public use are designed and maintained to minimise soil loss	**Hiking/mountain biking** Since the level of use generally increases progressively once hiking or biking trails have been established, they should be carefully designed at the start to reduce the danger of subsequent erosion and deterioration. Adequate provision must be made for toilet facilities, campfire sites and firewood. **Information and education** Simple notice boards, maps and handouts should be used to inform visitors not only about the natural assets of the estate, but also about associated cane production and environmental conservation measures. **Maintenance** Regular maintenance is a basic requirement in the management of recreational facilities listed and any other similar facilities.

Module 2.7 HERITAGE		STATEMENT OF INTENT Cultural assets are protected
Measures		**Notes**
Legal requirement	***Compliance with the National Heritage Resources Act, 25 of 1999*** • Maintenance, repair and management of historically important sites, buildings, graves, archaeological and palaeontological sites and artefacts, rock art, and important cultural sites is practiced in terms of the law	The National Heritage Resources Act 25 of 1999 replaces the National Monuments Act, 28 of 1969 and provides for the conservation and management of heritage resources in South Africa. In doing so, the National Heritage Resources Act provides specifically for the conservation and management of the "national estate", which includes:- • places and buildings of cultural significance; • historical settlements; • archaeological and paleontological sites; and • graves and burial grounds. In providing for the conservation and management of the "national estate", the National Heritage Resources Act, places certain obligations, in that no person:- • may destroy, damage, deface, excavate, alter or sub-divide any heritage site without a permit issued by the South African Heritage Resources Authority (SAHRA) responsible for the heritage site (section 27(18)); and • may destroy, alter, exhume or remove the grave of a victim of conflict, a grave or burial ground older than sixty years, which is situated outside a formal cemetery, or bring onto a burial ground any excavation equipment or equipment which assists in the detection or recovery of metals unless authorised to do so, in terms of a permit issued by SAHRA or a provincial Heritage Resources Authority; Section 38 of the Act requires that any person who intends to undertake a development categorised as: • the construction of a road, wall, power line, pipeline or canal or barrier exceeding 300m in length; • the construction of a bridge exceeding 50m in length; • any development or other activity which will change the character of the site exceeding 5000m² in extent; • the rezoning of a site exceeding 10000m² in extent; must, at the very earliest stages of initiating the development, notify the responsible Heritage Resources Authority and further furnish it with details relating to the location, nature and extent of the proposed development.

Legal requirement		Of critical relevance to farmers in KZN, is that the Act provides that any province which has enacted legislation which provides for a provincial Heritage Resources Authority and the management of heritage resources at a provincial level, takes precedence over the Act, insofar as they relate to provincial areas of competence. Should such a development be part of an environmental impact assessment required in terms of the National Environmental Management Act, 107 of 1998 (i.e. an EIA), then the provisions of section 38 do not apply. However, the assessment process must fulfill the requirements of the relevant heritage resources authority, and their comments and recommendations must be taken into account. Thus, farmers who have sites, areas, or objects on their farms that are either of heritage value, or have the potential to be declared as such, must be aware of the limitations they impose regarding normal day to day farming activities, or for the cultivation of new land. A number of provinces also have provincial heritage legislation, which takes precedence over the National Heritage Resources Act where similar provisions exist. As mentioned, this applies in KZN where the KwaZulu-Natal Heritage Act, 4 of 2008, together with the KwaZulu-Natal Heritage Regulations, 2012 (PN 40 of 2 April 2012), apply to heritage resources found on farms within the province. Where the provincial Act does not regulate a matter pertaining to heritage resources, then the national Act applies. Thus, a sugarcane farmer in KZN who has landmark sites/objects or potential landmark sites/objects on his farm may be constrained by this legislation in terms of the protection the law gives these sites or objects.

Legal requirement		**KwaZulu-Natal Heritage Act, 4 of 2008** The KwaZulu-Natal Heritage Resources Act 10 of 1997 has now been repealed by the KwaZulu-Natal Heritage Act, 4 of 2008. This Act established the Amafa aKwaZulu-Natali Heritage Council which is the provincial Heritage Resources Authority insofar as the province of KwaZulu-Natal is concerned. The KwaZulu-Natal Heritage Act provides for the general protection of:- • structure; • graves of victims of conflict; • traditional burial places; • battlefield sites, archaeological sites, rock art sites, paleontological sites, historical fortifications and meteorite impact sites; and The KwaZulu-Natal Heritage Act also provides that none of the above may generally be damaged, altered, demolished or removed from its original position unless authorised by the Amafa aKwaZulu-Natali Heritage Council. The Amafa aKwaZulu-Natali Heritage Council may confer Heritage Landmark status on sites (section 38) which the council believes constitute important elements of the heritage of the Province, but which are not owned by the Provincial Government or a local authority. The owner of the potential Heritage Landmark may make written representations or submissions regarding the conferral of Heritage Landmark status within a period of not less than 30 days. In the event that Heritage Landmark status is conferred onto a site, no person may damage, alter, redecorate, remove from its original position, subdivide or amend any plan thereof, unless the Heritage Landmark status of the site is withdrawn by the Amafa aKwaZulu-Natali Heritage Council. The same process applies to the Amafa aKwaZulu-Natali Heritage Council conferring Provincial Landmark status as well as Heritage Object status, in terms of Section 39 and 43 of the Act. The conferral of Heritage Object Status only applies to sites which are not owned by the Provincial Government or a local authority and Provincial Landmark sites are those owned by the Provincial Government or local authority.
Better management practice	• Historically important sites should be incorporated into the Land Use Plan	

Chapter 3

PLANET

Natural assets are conserved, critical ecosystem services are maintained and agricultural resources are sustainably used

Module 3.1 THREATENED, CRITICAL AND PROTECTED SPECIES AND ECOSYSTEMS		STATEMENT OF INTENT Threatened, critical and protected species and ecosystems are protected
Measures		**Notes**
Legal requirement	**Threatened and protected species** • No natural forest, or indigenous tree in that forest, or any trees deemed protected tree in terms of the National Forests Act 84 of 1998 and as identified in the *Government Gazette* may be cut, damaged or destroyed except under a licence.	There are two Acts that regulate the protection of listed plants and animals. These are the National Forest Act (NFA) which protects certain tree species only, while the National Environmental Management: Biodiversity (NEM: BA) protects certain animal and plant species that are in need of special protection measures. The NFA provides for the protection of a particular tree, a particular group of trees, particular woodlands or trees belonging to a particular species The list is largely confined to indigenous species, but occasionally the Minister may declare alien species such as oaks, pines and gum trees of historical importance or exceeding a certain size but in a separate declaration. The declaration of a list of protected species under this Act is made annually in the Government Gazette and a copy of the latest list of protected trees can be found in the Department of Forestry website: www.daff.gov.za. The effect of a declaration means that no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport purchase, sell, donate any protected tree, unless under a license or in terms of an exemption. The NFA also allows the Minister to declare a list of National Forest Types as Natural Forests. These types comprise seven Forest Groups and one azonal forest type. The effect of this notice is that no person may cut, disturb, damage or destroy any indigenous tree, or remove or receive any such tree from a natural forest except in terms of a licence or an exemption published by the Minister in the Gazette. The NEM:BA provides for the listing of species that are threatened or in need of protection (which are further classified as critically endangered, endangered, vulnerable or threatened). The most recent regulation was published in April 2004 and the main purpose is to provide for the implementation of restricted activities involving listed threatened or protected species.

Legal requirement	• Farmers are to comply with the requirements of the National Environmental Management: Biodiversity Act, 10 of 2004 in terms of any identified restricted activity (section 57), a threatening process or a listed threatened species (section 53). • Farmers are to comply with the requirements for protected and specially protected species as prescribed in terms of provincial legislation.	Restricted activities involving listed threatened or protected species include: (i) hunting, capturing or killing; (ii) gathering or plucking; (iii) picking, damaging or destroying; (iv) possessing or exercising physical control over; (v) growing, breeding or propagating; (vi) moving or translocating Should a farmer wish to carry out a restricted activity involving any of the listed threatened or protected species, application for a permit must be made to the relevant authority. A restricted activity may only take place with a permit and under any conditions attached to the permit. A risk assessment would be required before a permit would be issued. The list of threatened species that would typically occur in a forest management unit would be oribi, Cape Parrot, the three species of cranes, blue swallow, various aloes, cycads, stag beetles, vultures, some mole species, black stork, bald ibis, grass owl, blue duiker, baboon spiders, bullfrogs, dwarf chameleon, Denham's bustard, southern ground hornbill, serval, reedbuck and various clivia species. **Regionally protected species** Various provincial Acts or Ordinances give protection to certain plants and animals. Provincial legislation generally prohibits certain conduct relating to protected species, such as keeping of certain animals, hunting, setting of snares or traps, sale and purchase of game. Farmers should be aware of and comply with these prohibitions. Generally speaking, national legislation trumps provincial legislation.

Legal requirement	**Threatened and protected ecosystems** • No process or activity in a listed threatened ecosystem may take place in the absence of a permit	**Threatened and protected ecosystems** Ecosystems that are threatened and in need of protection can be identified by a number of interlinked pieces of legislation. National ecosystems that are threatened and in need of protection have been identified under the National Environmental Management: Biodiversity Act .The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction and to preserve sites of exceptionally high conservation value. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. Criteria were developed to identify threatened terrestrial ecosystems, with thresholds for critically) endangered (CU), endangered (ER) and vulnerable (VU) ecosystems. The listing of these ecosystems has implications in terms of activities requiring environmental authorisation under the National Environmental Management Act, and may have implications in terms of municipal land use planning applications. Future implications include having to obtain permission for a threatening process within these ecosystems, biodiversity management implications, and the potential imposition of monitoring and reporting requirements. The list of ecosystems that are threatened and in need of protection can be accessed from the DEA website (www.environment.gov.za).

Better Management Practice	**Threatened and protected ecosystems** • Fire sensitive natural vegetation is protected through an effective fire protection programme • Voluntary protection of land based on its inherent environmental characteristics e.g. establishment of conservation agreements or formation of conservancies is encouraged	**Fire sensitive natural vegetation** Much of the eastern half of South Africa is characterised by fire/climax grasslands or savannah that owe their very nature to their long history of association with fires. The sour grasslands in particular require regular top-growth removal by fire, since adequate removal by grazing alone is difficult in these grasslands. There are normally four major objectives for using fire in grassveld management: • to burn off unpalatable growth that remains from the previous season and which if left unburnt, will result in a moribund grassland • to stimulate growth at the end of the dry season • to destroy parasites such as ticks • to control the encroachment of undesirable plants (both woody and forbs) – this is usually only successful in a limited number of applications These are largely agricultural reasons, but fire also plays a significant role in maintaining ecosystem functioning. In addition, most grassland species (both plants and animals) are well adapted to a frequent fire regime. The regular application of fire in grasslands therefore serves both the strictly agricultural requirements a farmer may have, as well as playing a particularly important role in maintaining the ecosystem functions. As a general rule of thumb, fires in grassland should be applied every two to three years, although in ungrazed grassland, an annual burn is acceptable. If bush control is also required, a less frequent fire regime, which allows the accumulation of sufficient grass biomass to have an impact on the bush, should be applied. Head-fires (i.e. with the wind) are more effective against bush encroachment than a back-burn (against the wind), but can pose increased risks to the farmer. There are practical ways of resolving this, such as starting with a back-burn and then initiating a head-fire that will burn towards the back-burn. Finally, certain indigenous plant communities, such as natural forests, are usually sensitive to fires. Adequate protective measures should be taken in this regard to minimise damage to forest margins. This could encompass initiating the fires at the forest margin, and burning away from the forest. All burning must comply with the requirements of the National Veld and Forest Fire Act as well as any by-laws applicable in the municipal area. **Voluntary protection** The National Environmental Management: Protected Areas Act together with various other statutes provide for the formal protection of land based on its inherent environmental characteristics. Provincial environmental authorities and nature conservation bodies also promote less formal protection of biodiversity through, for example, the establishment of conservation agreements with landowners (biodiversity stewardship agreements), and the formation of conservancies.

Better Management Practice	**Better management practices have been implemented in all natural areas and heritage resources are protected** • Natural areas should be identified and mapped • Natural areas should be managed with fire • Natural vegetation should be classified • Natural vegetation on the farm, or adjoining farms/neighbours should be connected in the form of corridors	**Identification and management of natural and cultural resources** All natural areas, cultural resources and planted areas of the farm form part of a natural and agricultural resource. Planning must cover the entire farm area including the natural areas. These areas should be identified and mapped to a recognisable level such as grassland, natural forests, wetlands and riverine areas. To ensure consistency as to what constitutes a riverine area, the length of a river can be used as a unit of measurement, rather than area of land. A register should also be compiled to supplement information represented on maps. A register of any existing cultural resources should be identified and mapped. They include resources such as archaeological remains (material remains resulting from human activity and which are older than 100 years such as artefacts and human remains), structures such as rock art, artefacts and features associated with military history older than 75 years of age. The owner of land on which a heritage resource exists may request the assistance of the South African Heritage Resources Agency for the protection of that resource. **Veld burning** Grassland should be burnt on a rotational plan, at intervals of between two and four years, to maintain the vigour and health of the grassland, reduce the hazard of combustible fuel build-up and prevent the succession of woody vegetation. Wetlands may require special attention regarding burning. For example, any nests of wetland birds should be noted and efforts made to protect the sites from controlled burns. However, it is important that wetlands are burnt on a regular basis, but care must be taken to avoid any resulting peat burns which have a lasting impact on the soil and can burn for months at a time. Reference should be made to the series of information booklets entitled, 'Wetland Fix' and the National Veld and Forest Fire Act 101 of 1998. **Management of natural areas** As a minimum, all natural/unplanted areas should be classified using a simple approach such as natural forest, grassland, watercourses (wetlands and riparian habitat) and woodland. Ideally natural vegetation on the farm, or adjoining farms/neighbours, should be connected in the form of corridors to encourage movement of animals, and provide a habitat for predators of sugarcane pests.

Better Management Practice	• Farmers have considered the costs and benefit of removing sugarcane from wetlands and areas adjacent to watercourses • Nesting sites of protected bird species should be identified • Snares should be removed and destroyed • Farmers should become members of a Conservancy Association	Formal management planning should include the entire land area and provide for operations such as alien and invasive plant control, weed and invader plant control, veld burning and smoke management. Farmers should, from both a cost and environmental perspective, avoid marginal lands for sugarcane. Appropriate to the concept of scale, intensity and risk, farmers should consider the removal of historically planted sugarcane from watercourses, and areas adjacent to watercourses that, while lawfully established at the time and indeed remain a lawful activity, are now considered a poor management practice. Therefore removal of sugarcane from wetlands should be subjected to a cost benefit analysis and be implemented over a period of time. **Nesting sites** Nesting sites of threatened and protected bird species should be identified and recorded on a map. **Poaching** The elimination of all forms of poaching on farms is to be encouraged. The areas where snares are found should be identified and the dates and numbers of snares found should be recorded and then destroyed. The theft of plants such as tree ferns, cycads and Clivia lilies is also regarded as poaching. **Conservancy Associations** A conservancy is a voluntary association of environmentally conscious land-owners and land-users who choose to co-operatively manage their natural resources in an environmentally sustainable manner without necessarily changing the land use of their properties. Any farmer or group of farmers wishing to use the term “conservancy” will need to register and have a bone fide conservancy. Conservancies are co-ordinated through the National Association of Conservancies and Stewardship of South Africa (NACSSA) The vision is to promote stewardship of natural resources at a community level (see www.nacsa.org.za)

Better Management Practice	• Indigenous plant seeds (excluding protected species) should be collected and potted as part of a plant rescue programme or for the purpose of re-establishment elsewhere	Forest and bush restoration is not difficult, and often requires only that the area to be restored be kept free of invaders to allow the re-growth of indigenous plants. These areas do not have to be large and can be small isolated 'islands' which will act as 'stepping stones' for the movement of wildlife. Consideration should be given to watercourses as the first areas to rehabilitate. The watercourses will act as corridors protruding into the cultivated land areas. To re-establish natural forest or woodland, farmers are encouraged to use local species of the plant community that would have occurred naturally in the area. Seedlings should be collected and potted until they are large enough to plant out. (Refer to SASRI Information Sheet 1.1 – Establishing vegetation in degraded wetlands).
Legal requirement	• Where hunting takes place, this should be done in accordance with the National Environmental Management: Biodiversity Act, 10 of 2004 and provincial conservation legislation	Hunting is regulated at both a national and provincial level. At a national level, a permit is required to hunt any listed threatened or protected species. Norms and standards have been promulgated for hunting, applicable either generally or in respect of a specific species. Where hunting takes place, this must also be in accordance with both the national and provincial legislation.

Module 3.2 ALIEN AND INVASIVE SPECIES		STATEMENT OF INTENT Alien and invasive species and weeds posing potential threats to biodiversity are controlled
Measures		**Notes**
Legal requirement	**Compliance with the Regulations published in terms of the Conservation of Agricultural Resources Act 43 of 1983 for the control of weeds.** • Declared weeds (Category 1 plants) that occur on land or on inland water are controlled • Category 2 plants that occur on land or inland water outside a demarcated area are controlled. • Category 2 plants may not be planted within 30 m of the 1:50 year flood line of a water resource unless authorised under the National Water Act.	There are two Acts that control the spread of weeds(CARA) and alien and invasive species (NEM:BA) **Conservation of Agricultural Resources Act, 43 of 1983** The first piece of legislation to combat weeds and invader plants was the Conservation of Agricultural Resources Act (CARA) The objectives of the Act are, *inter alia,* to combat weeds and invader plants to ensure the conservation of natural agricultural resources. The Act prohibits the selling, possession, transport, or disposal of any weed or invader plant. Regulations were published in March 2001 which declared certain species of plants as weeds and invader plants - indigenous plants that will invade veld or increase in density (bush encroachment) as a result of poor grazing practices. The CARA Regulations separates the weeds into three categories in terms of their threat to the ecological functioning of natural systems and the productive use of land. **Category 1 plants** Declared weeds are known as Category 1 plants and may not occur on any land or inland water surface, and must be controlled a – this includes mechanical, chemical and biological control as well as the mandatory requirements of follow-up operations. Examples of Category 1 plants are: Mauritius thorn, pom-pom weed, inkberry, triffid weed, camphor tree, lantana, oleander, various prickly pear species, American bramble, sesbania and Bugweed. **Category 2 plants** These may also not occur on any land or inland water surface other than what is known as a demarcated area. The area in which Category 2 plants are permited contains most of the commercial tree species No land user may allow Category 2 plants to occur within 30m of the 1:50 year flood line of a water resource (river, stream, spring, lake, dam or wetland) unless authorised in terms of the NWA. Examples of Category 2 plants are black wattle, blackwood, silver wattle, eucalyptus and pine (all commercial forestry species), poplar, castor-oil plant and weeping willow.

Legal requirement	• No Category 3 plants have been planted or propagated after 30 March 2001 • Category 3 plants must be removed if they occur within 30 m of the 1:50 year flood line of a water resource. • A control plan exists for the management of invasive plant species on the farm	**Category 3 plants** These are not permitted to occur on any land or water surface, but as they are the most benign of the three categories, plants in existence at the time of the commencement of the regulations (30 March 2001) are not required to be removed. However, if they occur within 30m of the 1:50 year flood line of a river, stream, spring, lake, dam or wetland, then they must be removed. No Category 3 plants may be established, propagated, sold or acquired after 30 March 2001. Examples of Category 3 plants are: loquat, jacaranda, various species of privets, syringa, firethorns, cassia, tipu tree and others. **National Environmental Management: Biodiversity Act 10 of 2004** The second piece of legislation is the National Environmental Management: Biodiversity Act (NEMBA). This Act regulates both alien and invasive plant and animal species through the publication of both Regulations and lists of alien and invasive species. The Regulations came into effect on 1 October 2014 and were amended in July 2016 **List of Alien and Invasive Species** NEMBA has Regulations that list invasive plants and animals that pose potential threats to biodiversity. No person may conduct a restricted activity (see below) involving a listed alien or invasive species without first obtaining a permit, unless exempted from such requirement. Unfortunately, some weeds recognised under CARA have, to some extent, been duplicated under the Alien and Invasive Species Regulations. This duplication is confusing and creates uncertainty in both the regulator and the farmer. However, as the CARA List is likely to be repealed, the latest AIS Regulations should be followed. **Invasive species control plans** The Department of Environment Affairs have drafted guidelines for the development of monitoring, control and eradication plans for species listed as invasive (September 2015). The guidelines are intended for use by any land manager wishing to manage invasive species on their land. They are available on the following website: https://www.environment.gov.za/sites/default/files/legislations/nemba_invasivespecies_controlguideline.pdf

Legal requirement		Restricted activities include: (i) importing; (ii) possessing or exercising physical control over; (iii) growing, breeding or propagating; (iv) moving or translocating; (v) trading in, (vi) any other prescribed activity, in respect of such species, unless authorised in terms of a permit which may require a risk assessment before the application for a permit will be considered. The list of alien and invasive species is extensive and confusing and involves over 300 species of plants and 200 species of animals. The current list (2016) can be accessed from the DEA website (www.environment.gov.za). Restricted activities involving certain alien or invasive species may be totally prohibited, in which case a permit will not be granted.
Better Management Practice	• Farmers should be aware of, and should consider using biological weed control measures for areas on their farms	**Biological weed control** Host-specific insects, pathogens, or mites can be released on some alien species, e.g. chromolaena, lantana, water hyacinth. These eat leaves, stems, shoots, flowers or roots, eventually killing the plant. These host-specific organisms eat only one weed species and do not attack related crops or indigenous plants. SASRI is mass-rearing biological control agents for chromolaena, lantana, pereskia, water hyacinth, water lettuce and kariba weed (Salvinia). These agents are released in KZN by the Department of Environmental Affairs, 'Working for Water' programme. Farmers can contact SASRI, should they want to source these agents.

Module 3.3 FIRE		STATEMENT OF INTENT Veld and forest fires are prevented
Measures		**Notes**
Legal requirement	**Farmers comply with the National Veld and Forest Fire Act 32 of 1998.** • Farmers are members of the local Fire Protection Association • Farmers prepare and maintain firebreaks on the boundary of the adjoining land • Farmers provide notice to neighbours of the intention to burn • Farmers provide notice to the fire protection association of the intention to burn • Farmers have the necessary equipment and personnel to fight fires • Farmers are aware of the annual restrictions on the burning of firebreaks and crop residue (trash)	**Farmers must comply with the National Veld and Forest Fire Act, 101 of 1998.** All farmers should be members of the local Fire Protection Association (FPA) which provides regular updates on the Fire Danger Index (FDI) Every farmer on whose land a veld-fire may start or burn or spread is required to prepare and maintain a fire-break on his/her side of the boundary between his/her land and the adjoining land. Required notice to neighbours and the fire protection association for the area must be given. In so far as fire breaks are concerned, the farmer must consider the weather conditions at the time, particularly the humidity, ambient temperature wind speed and direction. The type of terrain and vegetation of the area should also be considered. The fire break must be wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land. The proposed fire break should be reasonably free of inflammable material (cow dung) capable of carrying a veldfire across it. Furthermore, each farmer must ensure that prescribed or equipment, protective clothing and trained personnel, reasonably required in the circumstances is available. The farmer must also ensure that in his/her absence, there are responsible persons who will extinguish or assist in extinguishing the fire and take all reasonable steps to alert owners of adjoining land and the relevant Fire Protection Association. Therefore, adequate fire-fighting equipment and facilities with accessible water points must be available and, ideally, a 'fire cell' agreement between neighbours with a plan of action ready in the event of a runaway fire in the neighbourhood. Boundaries and fire breaks can be grassed and mown on slopes steeper than 2%, where cultivation or soil disturbance is not a permissible alternative. Fields should be harvested strategically to prevent runaway fires burning large sections of the farm. Waterways and roads should be used in the fire break plan.

Module 3.4 POLLUTION CONTROL		STATEMENT OF INTENT Significant pollution of the environment is prevented, contained, minimised or remedied
Measures		**Notes**
Legal requirement	**Air pollution is avoided, or where it cannot be avoided, is minimised:** • Restrictions on burning at weekends and other periods when burning is prohibited, are complied with • Provincial traffic authorities are advised when burning along public roads • Safe practices are followed when burning along public roads	The primary legislation governing pollution control is the National Environmental Management Act (NEMA). "Pollution" is defined, and includes any change in the environment caused by any substances, noise, odour and/or dust. NEMA places a general duty of care on all persons to prevent significant pollution (or degradation) of the environment, and where pollution has occurred, to minimize and rectify that pollution or degradation. Farmers therefore have a duty to be proactive to ensure that farming activities do not cause air, water or land pollution. Farmers must also be aware that where there has been an emergency incident which has caused or may cause pollution or degradation of the environment, or harm to any person, farmers must immediately report the incident to the relevant authorities, to take steps to clean up after such incident, and to follow the procedures set out in section 30 of NEMA. Air pollution as a result of burning should be avoided, or where it cannot be avoided, is minimised (Refer to SASRI Information Sheets 4.7 – 'The pros and cons of trashing/burning at harvest' and 4.8 – 'Industrial guidelines for burning sugarcane'). Green cane harvesting (trashing) should be encouraged wherever possible.
Better Management Practice	• Areas sensitive to burning are identified e.g. public roads, residential areas, beaches, power lines, etc. • Barrier of unburnt cane left adjacent to sensitive areas • Consider weather forecasters and local knowledge as to the advisability and time of burning • Plan the harvest programme so that there are always fields that may be green cane harvested or safely burned if burning is inadvisable	**Reduction of impact to the environment** The objective would be to reduce where possible: • The smuts from fires falling onto sensitive areas, e.g. residential, schools, beaches, etc. • The smoke from cane fires constituting a hazard to road users and annoyance to the public. • Disruption of power supply. **The correct code of practice would be to:** • Identify the sensitive areas in each region, e.g. public roads, residential areas, beaches, power lines, etc.

Better Management Practice	• Advise authorities whenever an unintended burn occurs • Record fields burnt, date and time of burn • Cane in stacks in the fields or on the zones should not be burnt • Cane under power lines flattened before burning to prevent arcing	• Communicate with the local authorities regarding the intended practices and the intention to fully co-operate. • Adhere to the National Veld and Forest Fire Act, 101 of 1998 • Leave a barrier of unburnt cane adjacent to the identified sensitive areas; the barrier zone should be burnt only when there is no alternative, for example, at the time of re-establishment and then only when the wind is in the right direction. • Be advised by the weather forecasters and local knowledge as to the advisability and time of burning. • Map areas of the farm for burning/mulching according to the agronomic/economic and environmental factors. • Plan the harvest programme so that there are always fields that may be green cane harvested or safely burned if burning is inadvisable. • Advise authorities (FPA) whenever an unintended burn occurs near sensitive areas. • Near sensitive areas record the fields burnt, date and time of burn. • Cane in stacks in the fields or on the zones should not be burnt as it is ineffective and can be a hazard. • Cane under power lines should be flattened before burning to prevent the possibility of arcing. **Safety Management** Burning along public roads can be hazardous. Advise provincial traffic authorities of each and every burn. Road signs indicating 'burning in progress, slow down, switch on headlights, smoke hazard etc. should be used together with flashing lights and waving of red flags at both ends of the burn.

Better Management Practice	**Better management practice systems are in place to prevent soil and water pollution:** • Organic fertiliser should be regularly analysed • Organic fertiliser stock piles are placed at least 30m away from natural water sources or stormwater run-off systems • Organic fertiliser stock piles are protected against the breeding of insects and pests and from wind-blown dispersal • Residential/public areas are avoided when siting organic stock piles	**Management of organic fertiliser stockpiles** • Organic fertiliser should be regularly analysed • The Common law obliges farmers not to create a nuisance. Any stockpile which is a nuisance may expose the farmer to civil claims. • Stockpiles should not be placed near natural water sources where they can contaminate natural water systems. A minimum distance of 30m is suggested. • They should not be placed where ground water can be contaminated. • Residential or public areas should be avoided when siting stockpiles. • Stockpiles must be protected against the breeding of insects and pests. • There should be no standing water at the stockpile site.
Better Management Practice	• Wash-bay facilities are provided for cleaning tractors and equipment • Run-off from the wash-bay is directed into a protected sump to minimise contamination of ground-water. • Collected contaminated water must be lawfully disposed of • Oil and diesel from vehicles serviced in fields and workshops is collected and lawfully disposed of • Servicing of vehicles does not occur in the proximity of waterways	**Management of Farm workshop** • Proper washbay facilities should be provided for cleaning tractors and equipment, and all run-off from the washbay should be directed into a protected sump to minimise contaminating ground water. • Old engine oil should be emptied into containers and recycled, and not poured onto the ground. • The use of all equipment and power supply points should comply with NOSA requirements. **Management of Farm land** • If vehicles and equipment are serviced in the field, oil and diesel should be drained into containers and removed, together with discarded spares. • Servicing of vehicles in the field should not occur anywhere near a waterway or watercourse, to minimise the chance of water pollution as a result of spilled diesel and oils. • Cane residue should be removed from road drains and pipes to avoid blockages.

Legal requirement	**Waste is avoided or measures are in place to reduce the amount of waste generated, and to ensure that waste is re-used, recycled and recovered in an environmentally sound manner before being safely treated and disposed of.** • Small waste disposal sites that are exempted from the need to be registered comply with conditions of the exemption • Steps should be taken to avoid visible littering	**Waste disposal** In terms of the National Environmental Management Waste Act, waste is defined as any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered. Waste that does not pose an immediate threat to human life or the environment (i.e. household waste, garden waste, dry industrial and commercial waste) is classified as general waste Waste management activities, may only take place in terms of a waste management licence or in accordance with the relevant norms and standards published under the Waste Act. Waste management activities include activities, above specified thresholds, relating to: • storage • recycling or recovery • disposal The waste activities which may be relevant to farmers and the farming context include: • the disposal of inert waste to land of more than 25 tons, unless the waste is disposed of for the purposes of levelling and building which has been authorised by or under other legislation; • the disposal of general waste to land covering an area of more than 50 m^2; and • The disposal of hazardous waste to land. Any person who stores waste must take steps to ensure that the containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste, adequate measures are taken to prevent accidental spillage or leaking, the waste cannot be blown away, nuisances such as odour, visual impacts and breeding of vectors do not arise and that pollution of the environment and harm to health are prevented.

		In KwaZulu-Natal, there exists legislation (Prevention of Environmental Pollution Ordinance 21 of 1981) that prevents littering. Farmers therefore need to be aware of their legal responsibility in terms of prevention of littering, particularly regarding visibility of that litter from a public road. Littering by staff should be controlled by providing refuse bins, especially at residential sites and in the workshop area.
Legal requirement	**The disposal of hazardous substance is controlled** • Empty containers previously holding hazardous substances are returned to the supplier where the label requires that they be returned • If not required to be returned to the supplier, the container is safely disposed of at an authorised landfill site	The Hazardous Substances Act 15 of 1973 provides for the control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of hazardous substances which may cause injury, ill-health or death to humans. Because of its reference to disposal, this aspect is dealt with under waste management. As far as a sugarcane farmer is concerned, it is only Groups I and II that are of relevance for disposal. Thus, empty containers previously holding Group I and Group II hazardous substances (as identified on the product label), must be securely closed to prevent leakages and returned to the suppliers, where the label requires it to be so returned. When not required to be returned to the supplier, empty containers should be perforated, flattened and buried in the ground (if authorised as a hazardous waste disposal site), or disposed of at a hazardous waste disposal site.

Module 3.5 TRANSFORMATION OF THE NATURAL ENVIRONMENT		STATEMENT OF INTENT Significant transformation of the environment is prevented, contained, minimised or remedied
Measures		**Notes**
Legal Requirement	**Farmers have the appropriate authorisation to undertake identified activities, and they comply with the conditions of that authorisation (either in terms of the Environment Conservation Act, 73 of 1989 (sections 21, 22 and 26) or the National Environmental Management Act, 107 of 1998 (section 24)** **Environmental authorisation is held for listed activities, where appropriate. These include:** • construction or expansion of various structures (including dams) within a watercourse or within 32 metres of the edge of a watercourse • infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand or rock of more than 5 cubic metres from a watercourse • the clearance of more than 1 ha of indigenous vegetation in prescribed areas or more than 20ha of indigenous vegetation • physical alteration of virgin soil to agriculture of 100 hectares or more • clearance of indigenous vegetation of more than 300m^2 in certain sensitive geographical areas • construction or expansion of roads above prescribed thresholds	**In order to minimise the impact of activities which may have a detrimental effect on the environment authorisation of scheduled or listed activities is required** Activities which may not commence without environmental authorisation from the competent authority were last revised in 2017. As part of the application for environmental authorisation, certain activities require a basic assessment process, whilst those with a potentially greater impact require a longer scoping and environmental impact reporting process. Activities that may affect a sugarcane farmer include, *inter alia*: • construction or expansion of various structures (including dams) within a watercourse or within 32 metres of the edge of a watercourse • infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand or rock of more than 5 cubic metres from a watercourse • the clearance of more than 1 ha of indigenous vegetation in prescribed areas or more than 20ha of indigenous vegetation • physical alteration of virgin soil to agriculture of 100 hectares or more • clearance of indigenous vegetation of more than 300m^2 in certain sensitive geographical areas and • construction or expansion of roads above prescribed thresholds The authorisation that provides for the conducting of listed activities may have conditions attached to them, and farmers should ensure that they comply with these conditions. **Note**: All EIAs need to be conducted by an independent and registered Environmental Impact Assessment Practitioner (EAP).

Module 3.6 QUARRIES		STATEMENT OF INTENT Management of quarries to prevent environmental impacts
Measures		**Notes**
Legal Requirement	**Farmers must comply with the requirements of the Department of Mineral Resources and any environmental authorisation under the NEMBA EIA Regulations and Listing Notices.** • Mining permits required for existing and new quarries and borrow-pits if the material is to be sold • Quarries should be marked on a Land Use Plan	**Legal Requirements for Quarries** Existing quarries and borrow pits on private property owned or used by farmers from which material (including soil, gravel or sand) is, or will be, extracted for use on another location on the property is defined as a mineral under the Mineral and Petroleum Resources Development Act (MPRDA). A borrow pit or quarry is a mine at which mining takes place under the MPRDA because it is "any excavation in the earth……whether being worked or not, made for the purpose of searching for or winning a mineral". Accordingly, a mining permit or an exemption under the MPRDA is required for the mining which takes place at a quarry or a borrow pit. But an exemption from the requirement to obtain a mining permit is applicable where "any landowner or lawful occupier of land…lawfully takes sand, stone, rock, gravel or clay for farming or for effecting improvements in connection with the land or community development purposes" and is not "sold or disposed of". Farmers are therefore exempted from the requirements to obtain a mining permit and all the requirements relating to such permits if they do not sell the material. As far as an environmental authorisation is concerned, the current EIA Regulations require an EIA for activities which require a mining permit. Where no mining permit is required (for example where there is an exemption as described above), no EIA is required In brief, if a landowner takes sand, stone, rock, gravel or clay for farming or for making improvements in connection with land or community development purposes and it is not sold, then no mining permit or environmental authorisation is required. • Landowners and lawful occupiers of land are exempted from the requirements of a mining permit if material from quarries and borrow pits is used for on-farm improvements or community developments purposes and is not sold • Material removed from existing quarries or borrow pits where the material is sold require a mining permit from the Department of Mineral Resources

Legal Requirement		• Establishment of new quarries or borrow-pits that are exempt from the requirements of a mining permit are exempt from the requirements for an environmental authorisation. • Establishment of new quarries or borrow-pits that require a mining permit (the material is to be sold) will require an environmental authorisation • Landowners need to investigate their rights in the case of expropriation for quarries where the material is required by a third party Farmers are to note that in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002, Mines and Works Regulations, GNR.527 of 23 April 2004,at any quarry, all debris and other loose material and stones on the surface must be cleared to a distance of at least three metres from the edge of the quarry.
Better Management Practice	• Quarries should have minimum visual impact and should not be sited on public or recreation routes • Topsoil from new quarries and borrow-pits should be set aside for eventual closure • Disused quarries should be rehabilitated or converted to water bodies (dams).	**Better Management Practices for Quarries** Wherever possible construction of quarries on farm land should be avoided. If this is not possible then: • New quarries and borrow-pits should not be sited on public or recreation routes and should have the least visual impact. • Topsoil should be stored to facilitate eventual rehabilitation when closed. • Quarries should be drained when no longer in use, rehabilitated or turned into permanent water storage bodies, e.g. a dam. In this case, the quarry will need to be registered with the DWS and may require a water use licence

Module 3.7 WATER USE		STATEMENT OF INTENT Water resources are conserved
Measures		Notes
Legal requirement	• Water use is authorised if that use meets the requirements of a Schedule I activity as defined in the National Water Act 36 of 1998 • Some water may fall outside of schedule 1, and should be registered with DWA • Some water may fall outside of schedule 1 and has been registered with DWA, but authorisation may not have been received yet	All water use has to be authorised and this authorisation is granted in four different categories, namely: 1. Schedule 1 Water Use 2. Existing lawful water use 3. General Authorisation of Water Use 4. Licensed Water Use With the exception of Schedule 1 water use, all other categories of authorised water use, need to be registered with the DWA. **Schedule 1 Water Use** Water use is authorised in terms of that use being a Schedule I activity as defined in the National Water Act 36 of 1998 viz • Water is taken from a water resource to which that person has lawful access for reasonable domestic use, small gardening not for commercial purposes and the watering of animals (excluding feedlots) which graze on that land within the grazing capacity of the land. However, the water use must not be excessive in relation to the capacity of the water resource and the needs of other users. • Water is stored and used from run-off water from a roof. • Water is used in emergency situations for human consumption or firefighting. **Water use outside of Schedule 1** Water use that falls outside Schedule 1 includes: taking and storing water, activities which reduce stream flow (e.g. cultivation of crops), waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. If any water use falls outside Schedule 1 use, it must be registered with the Department of Water Affairs who will process the necessary authorisation.

Module 3.8 WETLANDS & WATERCOURSES		STATEMENT OF INTENT Wetlands and natural watercourses are conserved
Measures		**Notes**
Legal requirement	**Vleis, marshes, water sponges and water courses are protected in terms of Regulations published under the Conservation of Agricultural Resources Act 43 of 1983** • Utilisation of vegetation in a wetland or within the flood area of a water course or within 10 meters horizontally outside the flood area has not damaged the area • No cultivation or drainage of a vlei, marsh or water sponge, or any land within the flood area or within 10m horizontally outside the flood area or water course, has occurred, unless authorised	**Protection of wetlands/water courses under the Conservation of Agricultural Resources Act** In terms of the regulations published under the Conservation of Agricultural Resources Act, no land user may utilise vegetation in a vlei, marsh or water sponge or within a flood area of a water course, or within 10 metres horizontally outside such flood area in a manner that causes or may cause deterioration of, or damage to natural agricultural resources. Furthermore, no land user may drain any vlei, marsh or water sponge on his farm unit, or cultivate any land on his farm unit within the flood area of a water course, or within 10 metres horizontally outside the flood area of a water course, unless he obtains written permission by the executive officer. In addition, activities within 32m of the edge of a watercourse (including wetlands) and any infilling or excavation of more than 5m^3 from a watercourse must first obtain Environmental Authorisation in terms of the EIA Regulations. However, the above prohibition does not apply in respect of either:- • a vlei, marsh or water sponge that has already been drained or is under cultivation at the commencement of the regulations, provided that this is not done at the expense of the conservation of natural agricultural resources; • land within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course that is under cultivation at the commencement of the regulations, provided that it has already been protected against excessive soil loss due to erosion through the action of water.
	The flow pattern of water is regulated in terms of Regulations published under the Conservation of Agricultural Resources Act 43 of 1983 • No run-off water from a water course has been diverted to another water course, unless authorised	**Regulation of flow pattern of water under the Conservation of Agricultural Resources Act** The flow pattern of water is regulated in terms of Regulations published under the Conservation of Agricultural Resources Act 43 of 1983. • No run-off water from a water course has been diverted to another water course, unless authorised in terms of a run-off control plan approved by the Department of Agriculture and Rural Development, or through an authorisation in terms of the Environmental Conservation Act, 73 of 1989 or the National Environmental Management Act, 107 of 1998 with authorisation by the Department of Water Affairs and Sanitation.

Legal requirement	• No category 2 or 3 plants have been allowed within 30m of the 1:50 year flood line of wetlands	**Wetland Management** In terms of the regulations published under the Conservation of Agricultural Resources Act, (unless authorised in terms of the National Water Act), no land user shall allow category 2 or category 3 plants, within 30 metres of the 1:50 year flood line of a wetland. Both category 2 and category 3 plants are discussed in Module 3.2: Alien and invasive species
Better Management Practice	**Better management practices are implemented for wetland management.** • Natural wetlands have been identified and mapped • Controlled burning/grazing is being practiced in wetland areas	**Protection of wetlands** • Natural wetlands should not be planted to crops. • Wetlands and watercourses should be identified and mapped and adequately protected or rehabilitated. e.g. removing alien invaders, encouraging relevant vegetation and removal of any drains. • Alien invaders and exotic plants should be removed. • Wetlands and watercourses should be considered as sensitive areas with regards to burning. • Wetlands must be managed correctly, e.g. controlled burning and controlled grazing. • Access roads should not cross wetlands. • Forested riparian zones should not be burnt. NB. The Mondi Wetland Project is a valuable reference point for guidelines to protect and rehabilitate wetlands and should be contacted as the first step in any wetland management programme (see www.wwf.wetlands.org.za/manage.htm) **Defining and classification of wetlands** • Soil indicators - A wetland can be defined as an area that is flooded for a sufficiently long period for waterlogging to become the dominant factor determining the diagnostic characteristics of the soil, with the presence of mottling or gleyed horizons due to the anaerobic conditions. (See Department of Water Affairs and Forestry: A Practical procedure for identification and delineation of wetlands and riparian areas. This document provides a guide to the identification of wetlands, using soils, vegetation and position in the landscape.) **Soil forms - characteristically wetland soils:** • Champagne • Katspruit • Willowbrook • Rensburg • Kroonstad

Better Management Practice		Apart from the Champagne form (topsoil horizon is characterised by high amounts of organic material and is saturated with water for long periods), the rest are characterised by the presence of a G horizon, which has as one of its diagnostic characteristics, the presence of a gley material that has been or is subject to intense reduction as a result of long periods of saturation with water. In all cases, these soils are associated with hygrophilous vegetation (vegetation adapted for life in saturated soil conditions e.g. vlei grasses, reeds, bulrushes, sedges, ncema and swamp forest woody plants such as the fig trees, wild poplar, quinine tree, water pear, mingerhout, etc.) and bottomland sites or upland springs. **Soil forms that may also be classified as wetland soils:** • Cartref • Longlands • Fernwood • Estcourt They are all characterised by the presence of an E horizon, which is generally formed as a result of a temporary build-up of water above the B-horizon. If these soils occur with the absence of hygrophilous (water-loving) vegetation and at a characteristic position in the landscape (see below), they are not typically wetland soils and could be planted. But if hygrophilous vegetation is present, and they exist in a bottomland site or in a flat, level area adjoining a river system, they must be classified as wetland soils. **Soil forms that may be classified as wetland soils, depending on the extent and depth below the surface of the soft plinthic B-horizon:** • Longlands • Westleigh • Avalon
Better Management Practice		The degree of saturation of the soft plinthic B-horizon will determine whether the soil can be classified as a wetland. As the soft plinthic B horizon has been formed under the conditions of a fluctuating water table, the degree of wetness will depend on whether the plinthite is being actively formed, or whether it is a relic. If the plinthite is being actively formed, and the soil supports hygrophilous vegetation in a typical wetland landscape, then the soil can be classified as wetland. The inclusion of the Avalon, Westleigh and Longlands soil forms with an active soft plinthic B horizon less than 400 mm below the surface, and supporting hygrophilous vegetation in a typical wetland landscape, is therefore justified and, under these circumstances, should not be planted.

Better Management Practice		Finally, the Dundee form should be considered a special case. Dundee forms are associated with floodplains, which should not be planted to any crop whatsoever. Floodplains form an invaluable function in ecological processes and are usually associated with typical floodplain grasses, or sometimes with characteristic trees such as figs and fever trees. Special care must therefore be exercised if a Dundee form is identified. • **Soil wetness indicator**: There should be signs of wetness within 500 mm of the soil surface. A soil auger will be necessary to determine the existence of a diagnostic wetland soil property. • **Vegetation indicator**: Those soils that are sufficiently inundated or saturated by surface or ground water to develop the wetland characteristics described above also support vegetation typically adapted for life in saturated soil conditions. These include swamps, marshes, vleis and sponges. • **Landscape indicator**: The landscape will also assist in determining the presence of a wetland; in particular, flat level areas adjoining a river in a bottomland site. However, upland areas also contain wetlands and these may not be so obvious. The eye of a stream can assist in this regard.
Better management practice	• Natural watercourses have been identified and mapped • Alien invaders and exotic plants are being removed from watercourses regularly • Forested riparian areas are not burnt • Disturbed watercourses are being rehabilitated	**Natural streams and watercourses** **Stream orders**: Non-branching channel segments are classified as first order streams. Streams receiving only first order streams are termed second order streams and so on. **Duration of stream flow:** A **perennial stream** carries water almost all year round (90% of the time and more) in a well-defined channel. An **intermittent stream** flows only during the wet season, perhaps for a few months of the year and also has a well-defined channel. A **watercourse** (or ephemeral stream) flows during and for short periods following rain; channels are often not well defined. Watercourses, provided they are not wetlands, are ideal to site planned waterways. • The presence of riverine, fringing woody plants or reeds, bulrushes, sedges and hygrophilous grasses are clear indications of the presence of a watercourse that should not be planted to within 10 m (as laid down by the Conservation of Agricultural Resources Act, 43 of 1983).

		• Cognisance must also be taken of the Department of Water Affairs ("DWA") procedures for identification and delineation of wetlands and riparian areas which provides a guide for identification of wetlands using soils, vegetation and the position in the landscape. • Note that disturbance of a watercourse or wetland may require a licence from DWA as well as Environmental Authorisation in terms of the 2014 EIA Regulations. • Indigenous vegetation along stream banks should not be removed. • Where vegetation has been removed, the introduction of suitable indigenous plants should be encouraged and pressure points plugged. • Wetlands that have been degraded should be rehabilitated (see Wetland Management: Mondi Wetlands Project). • Forested riparian areas should not be burnt.
Legal Requirement	**Wet agricultural land** • No mechanical practices are being used to clean drains, except authorised • Existing drains have not been widened or deepened • There is no evidence of active erosion • Approved plans are available for any alterations to existing drains	**Wet agricultural land** Wetlands that have been drained in the past (also known as relic wetlands) may continue to be cropped. However, no new drains of any kind may be excavated. • Where soil has been deposited in existing drains, no mechanical practices are allowed to be used to clean the drains. The deposit may only be removed by hand tools. • While keeping a good vegetative cover to prevent erosion, the vegetation within the drain must be managed. It is permissible to slash or spray vegetation and remove the debris. • The drains may not be widened or deepened. There should be no evidence of erosion. • Where it is not practical or cost effective to sustain crop production, the wet agricultural land should be allowed to revert back to wetland. • A management and maintenance plan should be implemented which includes the closing of existing drains and the removal of alien invasive plants until such time as indigenous vegetation has been re-established. • Relic drains and wetlands – must be managed to maintain water flow. Ideally all relic wetlands should be removed from production and rehabilitated over time. • Planting new cane land - If sugarcane replaces another agricultural crop such as maize or vegetables, a permit from the Department of Agriculture, Forestry and Fisheries is not required. However, special attention is needed to ensure that the conservation layout conforms to that of sugarcane. A permit from the agricultural authority is required before any virgin/new land (veld, pasture or timber) can be planted to cane or for any conversion from dryland to irrigated land. Where land has not been cultivated for 10 years, it reverts back to virgin land status. Under NEMA, environmental authorisation is required for the clearance of more than 1ha of indigenous vegetation, and for the physical alteration of virgin soil to agriculture if it exceeds 100 ha in extent.
Better management practice	• Relic wetlands have or are being rehabilitated	

Open drain in wetland

Well managed riparian zone with buffer

A typical wetland in the KZN midlands

Typical wetland soil

Module 3.9 IRRIGATION & DRAINAGE		STATEMENT OF INTENT Irrigation systems are planned and managed to conserve water
Measures		Notes
Better Management Practice	**Planning and design of irrigation systems** • The irrigation system can meet the daily peak crop water requirements (ET) (or some agreed proportion of the daily peak crop water requirement) • The volume of water applied per irrigation event (target application depth) should not be greater than 50% of the storage capacity of the soil (Total Available Water – TAW) • The water source is taken into account in planning and design of an irrigation system	**Climate and Crop -** The irrigation system capacity is largely a function of the maximum crop water requirements, Evapotranspiration (ET), which is dependent on prevailing weather conditions. The irrigation system should be capable of meeting the daily crop water requirement (or an acceptable portion of the crop water requirement in the case where rainfall is relatively high and irrigation is used as supplementary). **Soil -** The volume of water applied per irrigation event (target depth) should not be greater than the storage capacity of the soil (Total Available Water – TAW). Generally, the maximum application depth should not be greater than 50% of the TAW. The depletion level should also match the application depth such that some space is available in the soil to capture and store rainfall. These, however, are guidelines and may be altered for specific applications. Estimates of soil TAW are given for soils of the SA sugar industry in Bulletin No. 19, 'Identification and Management of the Soils of the South African Sugar Industry', the third edition of which was published by SASRI in 1999. Suitability of the main soil groups for irrigation is given in Table 9 on page 151 of the bulletin (see also Module 3.10: Soil Conservation: Layout, Mapping of soils). The volume of water applied by the irrigation system can be adjusted by the altering the emitter, the stand/set time or the cycle length. In addition, the rate at which water is applied (emitter application rate) should not be greater than the rate at which the soil can absorb the water (infiltration rate). Emitter applications which exceed infiltration rates will result in runoff. **Water source -** The location of the water source relative to the farm/field will dictate to a large degree the capital and operating costs of the system. Hence, care must be taken in the planning phase to ensure that the irrigation system is economical viable. The second issue relates to the water quality available. Poor water quality can limit the use of micro-irrigation systems, in addition to degrading the soil and diminishing the crop yield. See monitoring and evaluation section for more details on procedures for taking water samples and water quality standards suitable for irrigation. Silt laden river water could also inflict excessive wear on pump impellers and nozzles in pressurised systems.

Better Management Practice	• The growers' preferences are taken into account in planning and design of an irrigation system • The irrigation system is designed in accordance with SABI norms • Design documentation for irrigation systems must be retained	**Grower's preferences** The irrigation system must be well suited to the end user's preferences. These preferences would mostly be related to availability of labour, capital costs of the system and knowledge levels required for effective management of the system. The irrigation system layout and routine management requirements should be presented and agreed upon by the farmer at the planning stage. A common problem is the inability to isolate irrigation systems or irrigation blocks so that crops with different requirements can be managed appropriately. On sugarcane farms, only a portion of the crop is harvested at a time. This results in fields with crops of various ages and water requirements. Similarly, some fields maybe fallowed or planted with a green manure crop with no or different irrigation requirements. Hence, the irrigation system controls and block layout should be aligned with the field layout for easy matching of irrigation applications to crop water requirements. **SABI Norms** Irrigation engineering is a highly specialised design discipline, with every type of irrigation system having its own specific design norms that have to be adhered to. While the designer has a role to play, the end user needs to take ownership by ensuring that the appointed designer (preferably, a SABI approved designer) meets both the SABI design Norms and Standards and the end-user's requirements. For details of design norms and accredited irrigation designers, contact SABI – http://www.sabi.co.za. SABI design norms are also available in the Irrigation Design Manual published by the ARC - Institute for Agricultural Engineering, P/Bag X134, Pretoria, 0001 or email iaeinfo@arc.agric.za. **Design Documentation** For new irrigation systems and/or upgrades, the professional irrigation designer should provide the irrigator with a design report. This document should be stored safely. It may be required when further considering expansions and/or modifications to the system. The design report should, at very least, contain: • layout plans, • detailed drawings, • pump curves (illustrating the pump duty point, rated efficiency and power, and suction height specifications) • maintenance and management manual, • SABI peak design form, • list of quantities, and • cost estimation

Better Management Practice	**Operation and Monitoring** • Irrigation systems are operated according to design specifications by regularly checking pressure and discharge (flow)	**Measuring pressure and flow rates** The design report would indicate what the required pressures and/or flow rates should be at critical points. These critical points would typically occur at the inlet to the irrigation system (at the pump station), or at the inlet to an irrigation block, lateral or furrow. At this location, the pressure in the system should be monitored and compared against the design inlet pressure provided in the design report. A system operating at the correct pressure should supply the correct amount of water. Deviation from the design inlet pressure provides a warning of pump or in-field problems, such as leakages or pipe bursts (low pressure), worn nozzles (low pressure), blocked emitters (high pressure), etc. Care should also be taken to ensure that pressure gauges are calibrated every two years. The discharge from emitters can also be measured regularly and compared to the design application rate. Monitoring is a continuous process, consisting of activities undertaken on a daily basis by the system operator, and should therefore be simple and easy to do.
Better Management Practice	**Irrigation scheduling** • Irrigation scheduling is practiced using an appropriate method to prevent over and under irrigation	**Irrigation Scheduling** Knowing when to irrigate and how much water to apply requires knowledge of the amount of water in the soil and/or the crop water status. Knowledge can be gained through direct measurement or indirect estimation. Direct measurement usually involves the use of soil water sensors. These include, for example, continuous logging capacitance probes, neutron meters, tensiometers and the wetting front detector. Indirect methods typically include the use of a weather based crop model. Crop models calculate the soil water content by solving the soil water balance on a daily basis. When the soil water content in the model reaches a predetermined depletion level, an irrigation event is recommended. The My Canesim, SAsched and CanePro models are available for irrigation scheduling in the SA sugarcane industry. A farmer may also compute their own soil water budget to schedule irrigation. Daily evapotranspiration values for a full canopied sugarcane crop (ETCref) and rainfall (amongst others) can be obtained from the SASRI weather web – http://portal.sasa.org.za/weatherweb/

Better Management Practice	**The irrigation system is maintained in accordance with a predetermined schedule** • Preventative maintenance is performed to keep the system within manufacturers/design specifications	**Preventative Maintenance** Lack of maintenance will result in a decrease in system performance. An effective maintenance program for irrigation systems includes: • Servicing schedules (including an inventory and spares in stock to be kept), and • Replacement schedules for the different components. Some general guidelines on maintenance of in-field irrigation systems are provided below, but complete information on the maintenance of different irrigation system components is provided in the Irrigation User Manual published by the ARC-Institute for Agricultural Engineering, P/Bag X134, Pretoria, 0001 or email iaeinfo@arc.agric.za. Most manufacturers also provide specific maintenance schedules for their products. ***Micro irrigation systems:*** *Maintenance schedule for micro-irrigation systems (manual control)** **Action** / **With each cycle** / **Monthly** / **Annually** Inspect system for leakages: X Check system pressure and flow rate: X Flush laterals (depending on the water quality): X (or weekly) Service air valves and pressure control valves: X Check hydraulic and electrical connections: X Check functioning of hydraulic valves on filter bank and inspect moving parts: X Chlorine treatment (depending on the water quality and method of application): X (or monthly) Take water sample at end of system and evaluate water quality changes: X (or monthly) *The recommended maintenance schedule can be adapted for automatic systems, e.g. system pressure can be monitored monthly.

Better Management Practice

Sprinkler irrigation systems: *Maintenance schedule for sprinkler irrigation systems (manual control)*:*

Action	With each cycle	Annually
Inspect the system for leakages	X	
Check system pressure and system flow	X	
Service air valves and hydrants		X
Check sprinklers for wear and replace springs, washers and nozzles where necessary		X
Flush mainlines		X
Replace rubbers at quick coupling pipes where necessary		X

*The suggested maintenance schedule can be adapted for automatic permanent systems, e.g. system pressure can be monitored monthly.

After the irrigation season, and before the pipes are stored, the following must be done:

- Mark all the holes in quick coupling pipes with paint so that they can be repaired.
- Remove all gaskets from pipes if they are stored in the sun.
- Replace all damaged and hardened gaskets.
- Replace all worn male and female pipe fittings.
- Replace all dragline pipes that have more than three joints.
- Check standing pipes for corrosion and replace if necessary.
- Ensure that all standing pipes are the same length and straight.

Better Management Practice

<u>Moving irrigation systems:</u> Maintenance schedule of centre pivots

Action	After each revolution	After each 4th revolution	Seasonal
Electrical			
Switch on pivot and listen to each motor and starter. If any abnormal sound is heard, remove and service.			X
Replace end tower's electric bulb (if out) and remove dust, insects and water where necessary.			X
Check tower panel and main control cabinet. Clean panels, remove dust, insects e.g. wasps, etc.			X
Inspect condition of wiring of pivot			X
Inspect electrical motor cable condition, earth conductor and connections			X
Structure			
Tighten all bolts and nuts where necessary. Ensure that earth conductors are clean.			X
Grease pivot		X	X
Grease pin that holds swing mechanism of towable pivots to prevent rusting		X	X
Check system for leakages. Repair if necessary			X
Replace gearbox oil			X
Drain and replace lubricants in motors			X
Grease moving parts and roller bearings	X		X
Check U-couplings, grease if necessary			X
Check wheel bolts and adjust as prescribed	X	X	X
Check wheel pressure and adjust as prescribed	X		X
Check flange fittings for leakages, secure and replace if necessary	X		X
Inspect framework for sturdiness – tighten bolts if necessary	X		X
Check that all the safety switches work			X
Check that all the drainage valves work	X		X
Clean sand trap if necessary	X		X

Better Management Practice

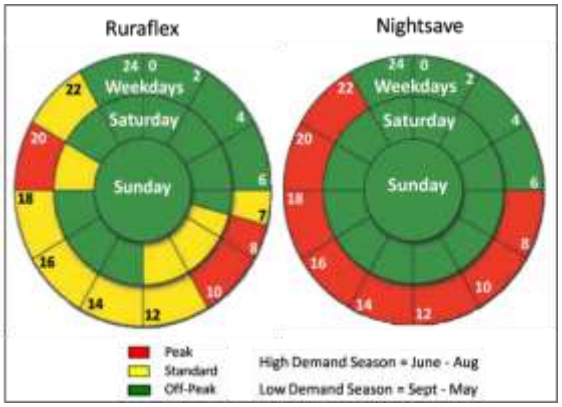
Sprinklers			
Check nozzles for wear, replace if necessary			X
Check that the pressure meter works correctly			X
Check the condition of the sprinklers			X
Check pivot pressure and pressure at beginning of towers			X
Check for blockages in nozzles	X	X	X
Flush the system (especially when not in use for more than a month)		X	X
Equipment			
Check functioning of end nozzles and check nozzle for wear			X
Inspect cut-off action of end nozzle – repair or replace if necessary			X
Check stop in slot micro switch, adjust if necessary	X		X
Test the automatic reverse-action movement of pivots by switching the hand lever forward and back			X
Fill wheel tracks deeper than 150 mm with timber or stones		X	

With linear systems, the following additional measures must be kept in mind when maintenance is undertaken:
Drive: All electrical cables must be checked regularly and replaced if necessary. Check bearings and belts and adjust if necessary.
Alignment: Check alignment according to manufacturer's prescriptions. Where a system uses a supply line that must be towed, the road must be as even and dry as possible to make the towing of pipe easier.

Maintenance schedule of centrifugal pumps

Monitor	**Monthly**	**1 000 Operating hours**	**Bi-annually**	**Annually**
Check alignment / settings			X	
Replace oil			X	
Inspect bearings and clean		X		
Inspect all parts for wear and do hydraulic test (check pressure against flow)	X			
Inspect the gland packing leakage (it must leak slightly, because it is lubricated by water)	X			
Replace the gland packing				X
Inspect cables and electric equipment			X	

Note: Centrifugal pumps are by far the most commonly used.

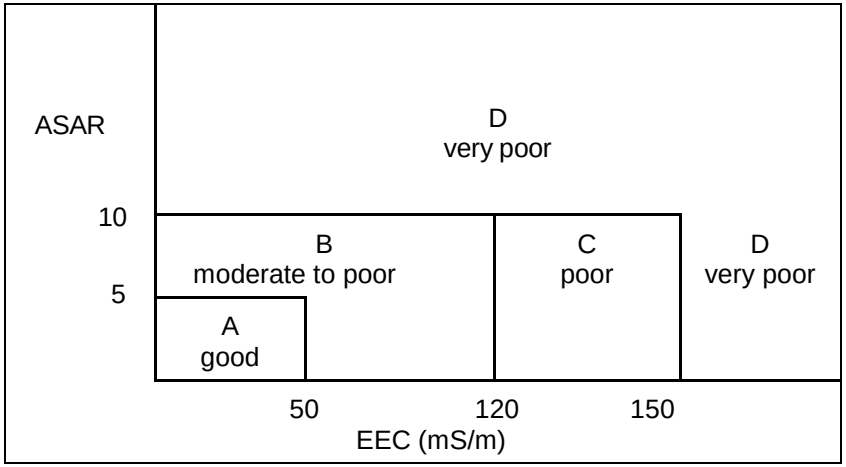
Better Management Practice	**Energy Use Efficiency** • The electric motor coupled to the irrigation pump is not excessively over-sized • The most appropriate ESKOM electricity tariff option has be selected	**Correct pump and motor size** Over-sizing of motors is common and can cause an unnecessary increase in energy requirements. The motor should be selected to operate at a high load relative to capacity. The key to an efficient pumping system is to select the best motor/pump combination at the design stage. **Correct electricity tariff option** The Ruraflex option offers the most flexibility for irrigators and is generally the default option. The Ruraflex tariff provides opportunities where pump operation can be shifted to off-peak periods. In other words, use of electricity during low demand and off-peak periods is rewarded with lower charges.  Designated periods for peak, standard and off-peak consumption for the Ruraflex and Nightsave Rural tariff options The Nightsave option is best suited for high load factor applications e.g. 24x7 pumping with a notified maximum demand of 25kVa and greater. These high load factor (continuous pumping) situations are not likely to occur in irrigation. The occurrence of rainfall, for example, will prevent continuous irrigation. The Landrate option is for customers with a demand not exceeding 100kVa. The energy charge is fixed and does not vary according to time of year, but is dependent on the size of supply.

Better Management Practice	• Pump operation, informed by irrigation scheduling, is limited during the electricity peak hours when possible	**Pump operation** Full use should be made of the off peak pumping opportunities. Given that irrigation systems only need to operate at their peak capacity for part of the season, the irrigation system can be operated at night whenever possible and only extend into electricity peak periods when irrigation demand requires it. The biggest opportunity for reduced pumping is through better use of rainfall. Managing the irrigation system to use as much of the rainfall that occurs in a season through effective irrigation scheduling, can significantly reduce the amount of irrigation water pumped, and through that, reduce energy use.
Better Management Practice	**Evaluation** • The irrigation system is evaluated at least every two years to ensure uniform and accurate application of water	**Evaluation** The objectives of evaluating the performance of an irrigation system are to: • determine if the system is working according to a farmer's assumptions and design specifications in terms of the amount of water applied, • determine how much variation there is in the amounts of water applied across the field/farm (uniformity) and whether or not the measured variation has a significant impact on crop yields, deep percolation (drainage) and runoff losses, fertiliser use efficiencies and production costs, • determine the causes of the variation in applied water, • check the efficiency with which power is being used, and • produce recommendations to improve on any aspects that would result in the effective use of water and energy. There are a number of published evaluation methodologies for the various types of irrigation systems. A particularly useful resource is the *Manual for the Evaluation of Irrigation Systems* published by ARC - Institute for Agricultural Engineering, P/Bag X134, Pretoria, 0001 or email iaeinfo@arc.agric.za. SASRI, Extension Specialist and/or Irrigation consultants can be used to conduct irrigation system evaluations.

Better Management Practice	**Water monitoring, metering and recording`** • Irrigation water volume is measured at the point of abstraction to ensure compliance with authorized allocation and abstraction rates • A record of water used per annum should be kept	**Monitoring, measuring and recording water use** Section 26(1)(b) of the National Water Act, 36 of 1998 states that the Minister may make regulations requiring that the use of water from a water resource be monitored, measured and recorded. Water users may be required by written notice to measure the water that they take. This implies that for some measuring water volumes abstracted from a water resource is a legal requirement[1] while for others it is a best management practice. Despite the aforementioned, water users must limit the rate at which they take the water to a maximum abstraction rate.[2] Nevertheless, measuring of water used can be valuable for benchmarking and improving the performance of irrigation from season to season. It is difficult to make improvements without some sort of measurement.
Better Management Practice	**Monitoring Water Quality** The quality of irrigation water is monitored twice a year (during winter and summer) for irrigation suitability	**Water Quality** To keep soil degradation to a minimum and sustain crop yields, the quality of irrigation water must be regularly monitored by having samples analysed at the Fertiliser Advisory Service (FAS) laboratories at Mount Edgecombe. Collection of water samples using clean PVC containers (which have been rinsed at least twice with the water to be sampled) is discussed in the SASRI Information Sheet 5.12. The sampling point should be representative of the irrigation abstraction point. Samples should be taken during both low flow (winter) and high flow (summer) months. Water should be analysed to determine: • Electrical conductivity (representing total concentration of soluble salts), adjusted for dilution/leaching due to local rainfall (EEC [mS/m]). • Concentration of sodium (Na), calcium (Ca), magnesium (Mg), pH and bicarbonate, calculated as adjusted sodium adsorption ratio (ASAR). The relationship between ASAR and EEC, as shown in the figure overleaf, is used to determine the quality class of irrigation water

Note: [1] Where the authority has requested a water user to monitor the taking of water, Regulation 8 and 11 in Government Gazette No. 38311 applies
[2] The maximum abstraction rate can be found in the Government Gazette No. 38311 at Regulations 5 and 6, or dependant on the water users licence

Better Management Practice



For easy reference, this table can also be used to decide if the water quality is appropriate for irrigation:

Class	EEC (mS/m)	ASAR
A = Good	<50	<5
B = Moderate to poor	50 - 120	5 - 10
C = Poor	120 - 150	<10
D = Very poor	>150	>10

Class A
Suitable for use on all irrigated soils. Shrink-swell soil types may still show reduced infiltration and drainage, particularly if they already have excess Na present (reflected in high saturated paste SAR values or exchangeable sodium percentage (ESP) values from soil testing). Ensure drainage is adequate to prevent salt accumulation over time, particularly at high irrigation rates.

Class B
Suitable for irrigation on well-drained soils only (deep red and brown soils, sandy profiles e.g. Hutton, Griffin, Inanda, Magwa, Fernwood). Salinity and/or sodicity hazards make it unsuitable for irrigation of poorly drained soils, eg Bonheim, Estcourt, Katspruit, Kroonstad, Rensburg, Swartland and Valsrivier form soils. Where it is used, ensure drainage is adequate to prevent salt accumulation over time.

Class C
Poor quality water which can only be used on very well drained soils (well oxidised red soils and sandy profiles) if water of better quality is not available. Excessive salinity may reduce the normal crop growth response expected under irrigation. Particular care must be taken to avoid waterlogging, so manage application amounts and ensure good drainage.

Class D
Unsuitable for irrigation of sugarcane under normal irrigation practice. May need to consider water treatment to remove excess salt.

Better Management Practice

- Annual soil samples are taken for irrigated lands and assessed for total soluble salts and sodium absorption ratio and practices are adapted when required

Salinity and Sodicity

Salinisation is generally caused by poor water management such as inadequate drainage or over irrigation and/or non-uniform irrigation. Salts accumulate in the soil thereby affecting soil sustainability and crop production. Different types of salt-affected soil conditions (e.g. saline, sodic or saline-sodic soils), together with their management are discussed in SASRI Information Sheet 5.11.

Soils from irrigated lands should be sampled at 300mm intervals up to 900mm in depth and be assessed for total soluble salts measured by the electrical conductivity (EC) and sodium adsorption ratio (SAR). The threat of salinity and sodicity on sugarcane land, based on soil EC values and SAR, is given in the three tables below.

Categories and properties of saline and sodic soils:

Type	Electrical conductivity (mS/m)	SAR (ESP)	Dominant cation(s)	pH (water)	Effect on soil structure
Normal	< 400	< 6 (< 7)	None	< 8.5	None
Saline	> 400	< 6 (< 7)	Mainly Ca and Mg	< 8.5	None (osmotic interference of plant uptake of water)
Saline-sodic	> 400	> 6 (> 7)	Ca, Mg and Na	< 8.5	Early stages of dispersion
Sodic	< 400	> 6 (> 7)	Mainly Na	> 8.5	Severe dispersion and possible Na toxicity

Salinity hazard to sugarcane based on electrical conductivity (EC) value of the soil saturation extract:

Soil EC value (mS/m)	Salinity level	Effect on sugarcane growth
0-200	Non saline	None
200-400	Slightly saline	Slightly affected
400-600	Moderately saline	Severely affected
>600	Strongly saline	Very severely affected

Sodicity hazard to cane based on critical SAR values for various soil forms:

Critical SAR 6 (Critical ESP 7)	Critical SAR 10 (Critical ESP 12)	Critical SAR 15 (Critical ESP 17)
Generally poorly drained, highly dispersed grey soils derived mainly from Dwyka tillite,Vryheid sediments and sandy alluvium.	Mainly slowly draining black swelling clays associated with dolerite Pietermaritzburg and Vryheid shales, Swazi basic rocks and heavy alluvium	Mainly well drained, non –dispersive soils associated with Recent Sands and other parent materials in upland positions.
Estcourt	Arcadia	Champagne
Glenrosa	Rensburg	Inanda
Katspruit	Bonheim	Cartref
Longlands	Mayo	Clovelly
Mispah	Milkwood	Dundee
Kroonstad	Tambankulu	Fernwood
Swartland	Willowbrook	Griffin
Valsrivier		Hutton
Wasbank		Oakleaf
Westleigh		Shepstone
		Shortlands

SASRI recommends that soils suitable for irrigation have an SAR less than 15 and EC less than 200 mS/m in the top 900mm of soil.

Reclamation measures are discussed in SASRI Information Sheet 5.11 and include surface and subsurface drainage, leaching of salts by over-irrigation, and amelioration with gypsum and filtercake.

Legal requirement

Irrigation with wastewater

- Irrigation with wastewater is authorised
- The conditions of that authorisation are complied with
- Precautionary monitoring is executed according to the National Water Act, 36 of 1998

Irrigation with wastewater

Irrigation with industrial wastewater or water from waterworks is regarded as a controlled activity (a water use in terms of sections 21(e) and 37(1) of the National Water Act, 36 of 1998) and is subject to authorisation by the Department of Water Affairs. Where the use falls within the scope of the General Authorisation (GN 399 of 26 March 2004, revised by GN 665 of 6 September 2013), then it must be registered. If not, then a water use licence is required.

In terms of the General Authorisation, water samples should be taken monthly to monitor and control any detrimental impact on the environment of accumulated salts, nutrients and trace elements in the soil. Samples should be analysed in a laboratory accredited in terms of SANS 17025:2005, or one which participated in a recognized Proficiency Testing Scheme or which has proof of intra- and inter-laboratory proficiency.

Legal requirement	**Irrigated land has been protected against waterlogging and salination by as many of the following measures as are necessary for each particular situation:** • Feeder channels, irrigation furrows and storage and catchment dams for irrigation water shall be made impermeable • Land has not been irrigated with water that is too high in salt content • Soil conservation works have been constructed to draw off excess surface and subsurface water so as to dispose of it, to prevent the waterlogging and salination of lower lying land. • Fertilisers that could contribute to salination have been avoided • Soil ameliorants have been applied to land showing signs of salination.	Reasonable care must be taken to prevent: • waterlogging of the soil; • nuisance conditions from flies, mosquitos, odour or secondary pollution; • waste entering a watercourse; • chemical or physical deterioration of the soil; • unreasonable chemical or physical deterioration of the soil; • contamination of run-off water or stormwater; • unauthorised use of the wastewater by members of the public; or • people being exposed to the mist originating from the irrigation. **Waterlogging and salination of irrigated land** Protection of irrigated land from waterlogging and salination is regulated in terms of Regulations published under the Conservation of Agricultural Resources Act 43 of 1983. These measures state that: (a) Feeder channels, irrigation furrows and storage and catchment dams for irrigation water shall be made impermeable. (b) The land concerned shall not be irrigated excessively or with water with too high a salt content. (c) A suitable soil conservation work shall be constructed and thereafter be maintained in order to draw off excess surface and subterranean water and to dispose thereof safely to prevent the waterlogging and salination of lower lying land. (d) Fertilizer which could contribute towards salination shall not be applied. (e) If the land concerned shows signs of salination, a suitable soil ameliorant shall be applied in order to improve the production potential of that land. Guidelines for acceptable norms for conveyance losses can be found from the following WRC report: Reinders, F, van der Stoep, I, Lecler, N, Greaves, K, Vahrmeijer, J, Benade, N, du Plessis, F, van Heerden, P, Steyn, J, Grove, B, Jumman, A and Ascough, G. 2010. *Standard and guidelines for improved efficiency of water use from dam wall release to root zone application*. Report No. TT 466/10. Water Research Commission, Pretoria, RSA.

Legal requirement	**Drainage management.** • No new drainage systems have been established without first obtaining a water use licence under the National Water Act, 36 of 1998 and, where necessary, an environmental authorisation under the National Environmental Management Act, 107 of 1998	**Drainage** Draining wetlands constitutes a water use (section 21(c) and 21(i) of the National Water Act, 36 of 1998, and possibly others) and requires a water use licence as well as Environmental Authorisation in terms of the EIA Regulations (December 2014). Such authorisation is unlikely to be granted. If these are identified as wetlands or riparian areas they must not be planted to sugarcane. Where drainage exists, no obvious soil loss or other harmful effects on the environment should be evident, as required by the Conservation of Agricultural Resources Act Regulations Subsurface drainage may be provided in cases where: • Irrigation is practiced and natural drainage is insufficient to maintain a uniform and adequate water table, and\or providing adequate leaching of salts, and where electrical conductivity is 2.5 or more, or exchangeable sodium percentage is 15 or more (see SASRI Information Sheets 5.11 and 5.12). • Wet agricultural land is presently under cultivation. Although such land may be drained (provided it is considered lawful under the NWA, CARA and the EIA Regulations), the costs and effort to drain should be weighed carefully against any increase in yield likely to be obtained from the drained area.

Better Management Practice	• Existing drainage systems are managed to maintain flow • Existing drains are stabilised with grass • Drain outlets are protected to prevent erosion • An annual maintenance programme exists	**Maintenance Programme** An annual maintenance programme of the drainage system is necessary. Where soil has been deposited in existing drains no mechanical means are allowed to be used to clean the drains; the deposit may only be removed by hand. This is to prevent the reshaping of drainage structures or alterations of flow paths by machines. In addition, mechanical machines are likely to leave the drains bare which pose the risk of erosion before the sides are re-vegetated. A good vegetative cover that does not hinder the flow of water should be maintained.

Module 3.10 SOIL CONSERVATION: LAYOUT		STATEMENT OF INTENT Soil erosion is minimised
Measures		**Notes**
Legal requirement	***Compliance with Regulations published under the Conservation of Agricultural Resources Act 43 of 1983 to minimise soil erosion*** **Cultivation of new land:** • Except with written authority, no virgin land has been cultivated • Except with written authority, no land has been cultivated if it has a slope of more than 20% • Except with written authority, no land has been cultivated if it has a slope of more than 12%, and is situated in certain magisterial areas **For EXISTING conditions:** • Maximum slope limits are adhered to according to the soil erodibility rating in KZN • There should be no signs of visible erosion	**Regulations under the Conservation of Agricultural Resources Act** Farmers must comply with the Regulations published under section 29 of the Conservation of Agricultural Resources Act as amended in 2001. NB: The Better Management Practices developed for sugarcane are designed to meet the requirements of the Conservation of Agricultural Resources Act. In most circumstances, farmers who implement the BMPs would meet the general requirements of the Regulations. **Cultivation of land:** • Except with written authority, no virgin land shall be cultivated (land which in the opinion of the executive officer has at no time during the preceding ten years been cultivated). **Cultivation of land with slope:** • Except with written authority, no land shall be cultivated if it: - has a slope of more than 20%; or - has a slope of more than 12%, and is situated in certain magisterial areas, with specified erodible soils and physical properties (the magisterial districts of Eshowe, Alexandria, Albany, Bathurst and East London.) NB: This prohibition does not apply to land which was under cultivation on the date of commencement of the regulations (*viz*. 1 June 1984), provided such land is protected against excessive soil loss due to erosion through the action of water

Legal requirement

Norms for upper slope limits on sugarcane land.

The Department of Agriculture and Rural Development (DARD) (previously known as the DAEA) applies upper slope limits for the cultivation of sugarcane in KwaZulu-Natal. The table below describes the land preparation and conservation practices that are required for the various maximum slope % according to soil erodibility. This information is considered in respect of permit applications for planting sugar cane on virgin soil.

Soil erodibility rating	**High**	**Moderate**	**Low**
USLE K value	**0.9 - 0.4**	**0.4 – 0.2**	**0.2 – 0.1**
Land preparation and conservation practices	**Maximum slope %**		
1. Conventional tillage with conservation structures, cane residue burnt and tops scattered.	10	15	20
2. Conventional tillage with conservation structures and full green cane harvesting.	15	20	25
3. Conventional tillage, strip plant, with spill over roads and full green cane harvesting.	15	20	25
4. Minimum tillage with conservation structures, cane residue burnt and tops scattered.	20	25	30
5. Minimum tillage with conservation structures and full green cane harvesting.	25	30	30
6. Minimum tillage, strip plant with spill over roads and full green cane harvesting.	n/a	n/a	30

(Refer to W B Russell “Reducing Rainfall and Runoff Erosion on Cultivated Land” in *Conservation of Farmland in KwaZulu-Natal* (1998) ISBN 1-86871-029-7)

Notes:
“Conservation structures” = water carrying structures such as contour banks
“Full green cane harvesting” implies leaving all residues after harvest
The practice of burning, standing cane and spreading the tops does not qualify.
If a practice (e.g. full green cane harvesting) is not a tried and accepted method in an area (e.g. Midlands), then it cannot be chosen.

Better Management Practice	• Soil types (forms) are mapped and classified in terms of their erodibility	**Mapping of Soils** **Soil types:** Soil types should be mapped and classified in terms of their erodability, and visible soil erosion should be mapped, measured and monitored over time, and addressed through specified measures (McCulloch and Stranack, 1995). Soil is a living, dynamic resource that supports plant life. It is made up of different sized mineral particles (sand, silt and clay), organic matter and numerous species of living organisms. A healthy soil should contain 1 000 kg/ha earthworms, 2 700 kg/ha fungi, 1 700 kg/ha bacteria, 150 kg/ha protozoa and 1000 kg/ha arthropods and small animals. The rate of soil loss should not exceed the rate of soil formation. To ensure this, adequate soil protection measures must be implemented. In addition, the soil's chemical and physical composition should not be altered to such an extent that it adversely affects the growth of crops, vegetation or animal life within the soil body. Soils should also be managed in such a way as to limit the effect that leachate from the soil has on the environment. **Soil identification:** Each soil has its own characteristic chemical, physical and morphological properties. Refer to SASRI Bulletin No. 19, 'The Identification and Management of the Soils of the South African Sugar Industry', Appendix 3, page 156. To make sound management decisions, it is important that a grower knows the major soil types found on the farm. Fertiliser and herbicide applications, drainage systems, tillage practices, irrigation, conservation planning and variety selection are all soil dependent. All farms should have a soil parent material map, and preferably a soil survey indicating soil form, depth and percentage clay of each field (see Module 1.1 – Land Use Planning).

Better Management Practice

Soil depth:
Soil depth can be categorised as follows:

Depth category	Depth mm
Shallow	<400
Moderate	400 – 1000
Deep	>1000

Soil moisture content:
The Available Water Content (AWC) of soil can be estimated from the percentage clay in the topsoil. Where the rooting depth is known, an estimation of Total Available Water (TAW) can be made. TAW is calculated using the following formula:

TAW = AWC x effective rooting depth

(Refer to SASRI Bulletin No. 19, 'The Identification and Management of the Soils of the South African Sugar Industry', page 158 for the ranges of AWC according to clay%).

Soil erodibility:

Different soils have different erodibility potential and can be categorised accordingly. Well-structured soils with a high clay content tend to be more resistant to erosion than the sandy non-structured soils. For example, a Shortlands soil will be more resistant to erosion than a Cartref soil. It therefore follows that different soils will require different management practices according to their erodibility category (K factor).

Consideration must be given to the erodibility of the soil, particularly where cultivation takes place. Those soils falling into the erodible groups 3 and 4 (see below), require extra precautions and full use must be made of both biological and mechanical conservation measures.
(See SASRI Bulletin No. 19 'The Identification and Management of the Soils of the South African Sugar Industry', Table 2, page 142).

Better Management Practice		**Soils are categorised into four broad groups of increasing erodibility:** **Notes:** • **K value – Based on the soil erodibility nomograph developed by Wischmeier *et al.* (1974). From this nomograph the Universal Soil Loss Equation (USLE) K factor can be estimated for each soil. For the sugar industry, K ratings have been developed based on results from trials using runoff plots and the nomograph.** **Refer to page 159 of the SASRI Bulletin No. 19 'The Identification and Management of the Soils of the South African Sugar Industry.'** **Soil physical and chemical properties and limitations:** Soil physical and chemical properties have a major impact on irrigation, drainage and nutritional management. See SASRI Bulletin No. 19 'The Identification and Management of the Soils of the South African Sugar Industry', Table 9 on page 151, for information regarding the suitability of soils for irrigation. **Soil and leaf threshold levels for sugarcane:** Excessive applications of fertiliser and/or ameliorants must be avoided. To determine the exact nutrient requirements it is essential that regular and comprehensive soil and leaf sampling be undertaken. Soil test values and nutrient threshold levels are used to calculate the amount and type of nutrients required to attain optimum crop growth (see SASRI Information Sheet 7.16). For further information on nutrition and soil amelioration see SASRI Information Sheets 7.1 to 7.18.

Group	Erodibility	Erosion hazard	K value
Group 1	LOW	1	K values <0.2
Group 2	MODERATE	2	K values 0.2 – 0.4
Group 3	HIGH	3	K values 0.4 – 0.6
Group 4	VERY HIGH	4	K values >0.6

Better Management Practice

Toxic levels of heavy metals
Concentrations (mg/l) at which common heavy metals can become toxic to living organisms are given below.

Organism	Heavy metals						
	Cu	Zn	Pb	Cd	Fe	Mn	Al
Toxicity in solutions to plants	0.02	1.3	1.7	2.1	9.3	0.06	0.93
Toxicity in solution to fish	0.02	1.3	1.7	2.1	250	100	1.5
Drinking water	1.5	15	0.1	0.01	1.0	0.5	-
Water for farm animals	0.5	25	0.1	0.05	-	-	5
Irrigation water	0.2	2	5	0.01	5	0.2	5.0

pH levels also have an effect on the toxicity levels of certain elements in the soil:
- Al is toxic at high and low pH
- Cu is toxic at pH 5 or below.

These measurements should be taken at replant and recorded spatially on a map.

Soil compaction: (refer to SASRI Information Sheet 6.2)
The use of infield transport and loaders can cause compaction, breaking down the soil structure, and can damage the cane stools. Loams are more compactable than clays or sands and compaction intensifies with increasing soil moisture. The use of infield transport and loading systems, and other heavy machinery, should be avoided when conditions are wet. It is also important to use the right tyres to minimise compaction.

Compaction can be identified by the following:
- ponding on a soil with a fine sandy texture
- observations using a penetrometer
- digging a pit and observing root growth, and looking for evidence of a ‘hardpan’
- crusting on the soil surface
- smeared, shiny soil surface
- lack of cracks, deep roots or earthworm holes
- a platey soil structure
- grey, anaerobic topsoil
- mottling caused by impeded drainage.

Better Management Practice

For a given amount of compactive effort, the resulting soil bulk density will depend on the amount of moisture present in the soil, as shown below.

The following table shows critical values for bulk density and porosity for different soil types.

Soil texture	Bulk density (kg/m^3)		Porosity (%)	
	Normal range	Critical value	Normal range	Critical value
Clay soil (>35%)	1 100 to 1 300	1 500	58 to 51	43
Sandy soil (<20%)	1 500 to 1 700	1 800	43 to 36	32

Better Management Practice	**Conservation structures are in place to minimise soil erosion** • All land over 2% slope is protected by conservation structures • Panel widths do not exceed specifications for slopes • Highly erodible soils are protected by conservation structures on slopes over 1.5% • Broad-based contour banks are constructed on slopes of up to 12% • On slopes steeper than 12% improved bench contour banks are constructed • Conservation structures do not exceed 300m in length on weak (sandy) soils, or 400m on good (clay) soil • Conservation structures are kept free from silt and debris where necessary • Conservation structures have been checked on plough-out for line, level and grade • Conservation structures are stabilised through a suitable vegetative cover • Conservation structures (to discharge water from selected crestlines, across the slope, to selected waterways) should have acceptable accelerating gradients	**Contour banks (refer to Page 3-54: Diagram of Conservation Works)** • A total surface water management plan is a basic requirement in a Land Use Plan. • Contour banks used in conservation agriculture are hydraulically designed structures placed in the field to protect the land situated immediately below. Spacing is influenced by slope, soil and management practices. Acceptable standards are calculated using the universal soil loss equation (USLE) and are determined using the SASRI Nomograph, a tool developed by SASRI in collaboration with the DAEA (now known as DARD), to determine contour bank spacing for land use planners. • Panel widths should not exceed 60m on slopes <12%, 45 m on slopes 12-20% and 30 m on slopes 20-30%. • All land over 2% slope must be protected by conservation structures (refer to DAEA publication, Conservation of Farm land in Kwazulu-Natal, ISBN 1-86871-029-7). For sugarcane, specific designs may apply for those slopes <4% such as in the irrigated areas where parallel conservation structures are used. • Parallel layout, i.e. the structures are parallel to one another: This system is ideal for surface water management on irrigated farms and may incorporate the irrigation design into the layout. Often this type of design needs to consider the safe removal of water from flat irrigated land to prevent in-field ponding. The parallel system may require more waterways than normal, and in many instances the structures (contour banks) may act as artificial waterways. • Lands consisting of soil classified as highly erodible should be protected by conservation structures on slopes over 1.5%. • Broad-based contour banks should be constructed on slopes of up to 12%, and may be planted over provided cane row alignment is parallel to the contour. On slopes steeper than 12%, improved bench contour banks should be constructed (refer to Page 3-54: Diagram of Conservation Works). • Conservation structures will discharge water from selected crest lines, across the slope, to selected waterways. • These structures should have accelerating gradients ranging from 1:300 to 1:100, i.e. clay soil 1:100, loam soils 1:200, sandy soils 1:300. The gradient of the last 20 m of the conservation structures should be increased to ensure that the discharge of water into the waterway is accelerated. • Conservation structures should not exceed 300 metres in length on weak (sandy) soils and 400 metres on good (clay) soils. • Conservation structures must be kept free from silt and debris and, especially during the first two seasons, should be checked for line, level and grade. • Conservation structures must be maintained, and may require periodic re-establishment.

		For methods of contour bank construction refer to SASRI Senior Certificate Course notes or the DAEA publication, 'Conservation of Farmland in KwaZulu-Natal' (1998) ISBN 1-86871-029-7. **Additional conservation measures** • Depending on soil type and slope, additional protection may be required such as minimum tillage, green cane harvesting and strip replanting. • To prevent uncontrolled storm water from open veld, stone outcrops or forestry areas flowing through a cane field, grassed storm water drains must be constructed to divert the run-off safely to a safe discharge area. **Spill-over roads** These roads form part of a conservation management system and should only be used where circumstances allow, such as on extremely erodible soils.
Better Management Practice	**Waterways are in place** • Waterways should be sited at the lowest point of selected natural depressions • In the absence of natural depressions, artificial waterways may be constructed at right angles to the natural contour and/or adjacent to the crest road • The waterway dimensions must conform to Land Use Plan specifications	**Waterways (refer to Page 3-54: Diagram of Conservation Works)** • Waterways are the starting point when implementing a Land Use Plan (LUP). • They are hydraulically designed structures, suitably protected by vegetation or paving, that are designed to safely convey the discharge from conservation structures (contour banks) to a natural stream or river. • They should be sited at the lowest point of selected natural depressions. • If natural depressions do not exist, artificial waterways may be constructed, located at right angles to the natural contour, and/or adjacent to the crest road. • Minimum width and depth is based on specifications designed to ensure hydraulic stability. The minimum width at the top end of a waterway should be 4 m, and the minimum depth 0.3 m above the grass mat. Bottom end widths are determined using the SCS (USA Soil Conservation Service) method. A basic rule of thumb for waterways on slopes of up to 15% and catchments of less than 10 hectares is an increase in width of 0.4 m for every hectare of catchment.

Better Management Practice	• Discharge ends of waterways are protected to prevent any undercutting • Earth waterways have been planted with a creeping grass suitable to the area • For new waterways, revetts have been spaced at 10m intervals across the main axis of the waterway to prevent erosion until such time as the vegetative cover is adequate • Additional protection where extraction routes cross waterways is in place • Verges have not been hoed for weed control • Waterways are not used as roads or paths • Waterways allow the free flow of surface water	• Discharge ends of waterways, especially when spilling into rivers or streams with steep banks, must be protected to adequately prevent any undercutting. • Earth waterways should be planted to a creeping grass suitable to the area such as the grasses *Stenotaphrum secundatum* (coastal couch/buffalo grass), *Cynodon dactylon* (ngwengwe grass), *Paspalum notatum* (Bahia grass), *P. urvilli* (Vasey grass), and the sedges *Cyperus immensus* (Kwane grass), *Isolepus proliferia* (green trailing sedge), *Juncus lomatophyllus* (leafy juncus) and Kikuyu. They must be revetted to provide erosion checks that will remain operational until such time as the vegetative cover is adequate. The revetts should be spaced at 10 m intervals across the main axis of the waterway. Revetts consist of bundles of cane tops fastened in rows across the waterway, with the butt ends facing uphill. Each bundle is secured in place by wooden pegs driven through the bundle into the ground. • Where extraction routes cross waterways, additional protection is required in the form of stone packing, without changing the shape of the waterway. • Vegetated waterways should be kept mown and free from silt and debris. Waterway verges should not be hoed for weed control. • Waterways must never be used as roads or paths. • Movement of surface water into and down the waterway must not be hindered, i.e. water must be free flowing. • Waterway dimensions should be maintained; the waterway will require periodic re-establishment. • For more specialised waterways, growers should seek professional advice for designs. Final placement of waterways will depend on field and site conditions.

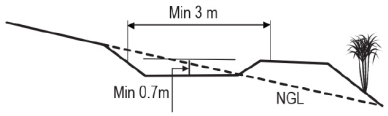
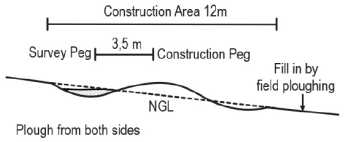
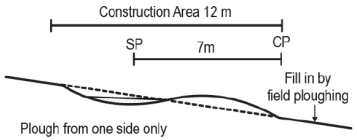
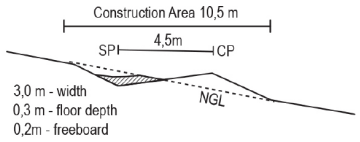
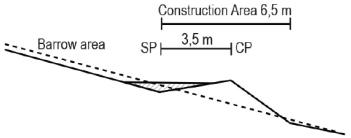
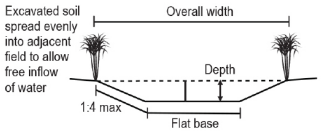
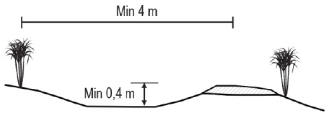
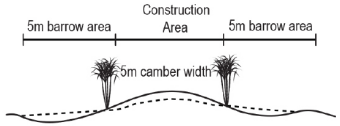
Better Management Practices

Waterway dimensions

Category	Catchment Area (ha)	Slope %		
		2% - 5%	5% - 10%	10% - 30%
A	1 -4	4m	4m	4m
B	5 - 6	4m	5m	5m
C	7	5m	6m	6m
D	8	5m	6m	7m
E	9 - 10	6m	7m	8m
F	11 - 12	6m	8m	9m
G	13	8m	9m	10m
H	14	8m	10m	11m
I	15	9m	10m	12m
J	16 - 17	10m	12m	13m
K	18 - 20	10m	12m	14m
L	21	11m	13m	15m
M	22	12m	14m	16m
N	23 - 24	12m	15m	17m
O	25	13m	16m	18m
P	26 - 27	14m	17m	19m
Q	28	14m	17m	20m
R	29 - 30	15m	18m	21m

For more detailed design refer to the DAEA report, ‘Standards and Norms for Soil and Water Conservation Planning in KwaZulu-Natal’, by WB Russell. Cedara Report No. N/A/93/32 dated 1/10/1994.

Diagram of conservation works

STRUCTURE	TYPE	CROSS- SECTION (not to scale)	GRADIENTS	SURFACE	USE
STORM WATER DRAIN			From 1:500 to 1:150 Dependent on length, catchment size and soil type	Soil	To catch water from unprotected catchments above layout scheme
CONTOUR BANKS	BROAD BASE up to 5%		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles over the structure
	BROAD BASE up to 12%		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles over the structure
	BENCH Shallow soils <400 mm deep		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period.
	IMPROVED BENCH Moderate Deep soils >400 mm deep		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles from the panel above to the road.
WATERWAYS	NATURAL Grassed		Up to 30% up and down slope	Planted with creeping grass: Revets	To collect concentrated flows of water from terraces. Placed in natural drainage lines.
	ARTIFICIAL Grassed		Up to 20% across slope	Planted with creeping grass: Revets	To collect concentrated flows of water from terraces. Can be placed across slopes. (Avoid if possible)
ROADS	CREST		Variable up to 8%	Hardened	Cane extraction
	TERRACE	See 'CONTOUR BANKS' above	1:250 to 1:150	Hardened	Cane extraction
	DIAGONAL	See 'BENCH CONTOUR BANKS' above	Constant 8-12% maximum	Hardened	Where crests are over 10%. Cane extraction.

Contour bank

Broad based conservation structure (contour bank)

Grassed waterway

In-field machinery can cause compaction

Grassed waterway

Module 3.11 SOIL CONSERVATION: EXTRACTION	STATEMENT OF INTENT Soil erosion is minimised
Measures	**Notes**

Better Management Practice

Roads are sited to minimise soil loss.

- All roads are included in the land-use plan
- Land-use plan specifies road drainage for each road
- Farm roads follow the crestlines and/or conservation structures except under specified circumstances
- Crest roads are on crests of 12% gradient or less
- Diagonal roads are on slopes of greater than 12%
- Soil erosion is minimised on unusually steep (>12%) areas where roads are constructed
- Routes are selected to minimise impacts on sensitive areas
- Primary roads (5m in width) are not constructed within 20m of a stream, river or wetland, except where they cross
- Secondary roads (at least 4m wide) are used for field access and cane haulage

Siting of Roads

Adequate steps should be taken to cater for road drainage as specified in the LUP.

- Farm roads other than those listed as follows should be at the crest lines and/or the conservation structures. Roads such as diagonal roads, boundary roads, cut-off or slope break roads can be used wherever they are necessary to ensure the rational use of land.
- Particular attention should be paid to the protection and drainage of roads. The correct siting of mitre drains is therefore essential.
- Diagonal roads should be sited where the slope is too steep for crest roads, i.e. greater than 12% land slope. Their gradient should be constant, preferably between 1:12 (8%) to 1:8 (12%). At least two cross drains should be located between adjacent and correctly spaced conservation structures. Maximum spacing between cross drains are:

Diagonal road gradient	Spacing: moderate to resistant soil	Spacing: erodible shallow soil
8-10%	50 m	40 m
12%	30 m	20 m

- Routes should be selected to avoid sensitive areas such as indigenous forests, special natural communities, wetlands, archaeological or historical sites and other natural areas. Construction of river crossings should not result in concentration of the flow of the water in the river, and roads should not interrupt the hydraulic flow of a wetland (e.g. drying up the wetland below the crossing). A water licence may be required in terms of section 21 (c) and 21 (i).
- Primary roads, e.g. hilo roads, which are 5 m in width must not be constructed within 20 m of a steam, river or wetland, except where they cross.
- Secondary roads, e.g. terrace roads, are used for field access and cane haulage, and should not be less than 4 m wide.

<table>
<tr><td>Better Management Practice</td><td>• Tertiary roads (at least 3.5m wide) are used for infield access
• Roads cross watercourses at right-angles
• Water drained off primary roads flows through a minimum of 10 m of natural vegetation or cane field before entering the water course
• Discharge points are provided to protect the upper road channel
• Roadside drains are grassed or paved</td><td>• Tertiary roads are used for infield access, and should not be less than 3.5 m wide.
• Where it is imperative to construct unusually steep roads, special surface protection must be provided. Otherwise, re-asses the desirability of planting the catchment area.
• Roads should cross watercourses at right angles.
• No water is to be led off primary roads directly into watercourses, but must flow at least through 10 m of vegetation/cane field before entering the watercourse.
• Protection of the road upper channel is vital and discharge points should be catered for
• Roadside drains should be grassed or paved.</td></tr>
<tr><td>Legal requirement</td><td>Roads are constructed to minimise soil loss
• New roads, or upgrades to existing roads, in sensitive areas or exceeding prescribed thresholds constructed after 8 September 1997, are authorised</td><td rowspan="2">Road Construction
New roads, or the upgrading of existing roads, in sensitive areas or exceeding prescribed widths constructed after the 8 September 1997 may require environmental authorisation under NEMA. Furthermore, should road construction affect a watercourse in terms of section 21(c) and 21(i) of the National Water Act, 36 of 1998, it may be necessary to apply for a Water Use Licence. However, there is a provision under the General Authorisations (e.g. for altering the bed, banks, course or characteristics of a watercourse under GN 1198 of 18 December 2009) which may ease the need for licensing under certain conditions. Farmers should check these conditions before building a road.

• Drifts should be confined to sites where there is solid rock, or should be constructed of suitable durable material, e.g. concrete or Reno mattress.
• Cut and fills should be stabilised with suitable grasses.</td></tr>
<tr><td>Better Management Practice</td><td>• Drifts are confined to sites where there is solid rock, or are constructed of suitable material
• Cut and fills are stabilised with suitable grasses</td></tr>
</table>

Better Management Practice	**Road maintenance.** • Crest road camber is maintained where necessary • Mitre drains are constructed where necessary • Water from district roads is diverted into stable waterways • Road drains and verges are kept clear of invading vegetation to allow free flow of surface water • Boundary breaks that are used as roads, are protected from erosion • Grasses on secondary and tertiary roads are maintained by slashing or chemical control • Primary road surfaces are protected by quarry, stone or cement	**Roads are maintained to minimise soil loss** • Crest road camber should be maintained at all times, and mitre drains should be constructed where wash can be expected between conservation structures. • Road drains must be routinely maintained, cleared after grading and kept free of invading vegetation. In particular, the correct number of drains must be constructed to meet the slope requirements of the road. • Water from district roads should be diverted into stable waterways. • Road drains and verges should be kept clear of invading vegetation to allow free flow of surface water. • Boundary breaks that are used as roads must be protected to reduce erosion. • Maintenance of grasses on secondary and tertiary roads should be by slashing or chemical means. • Road surface protection will depend on the type of road and the density of traffic, and will take the form of quarry, stone or cement.
Better Management Practice	**Road culverts are in place to manage water discharge and minimise soil loss.** • Culverts can accommodate a 1:10 year flood • Diameter of culverts is a minimum of 600mm • Culverts and their discharge points are protected	**Road culverts** One large designed culvert is superior to two smaller culverts that equal the same capacity. • To avoid choking, the diameter of a culvert should be at least 600 mm. • Culverts must be able to accommodate a 1:10 year flood. • Culverts should be protected by rock pitching where necessary and discharge points that are protected from scouring. Should a culvert affect the watercourse in terms of section 21(c) and 21(i) of the National Water Act, 36 of 1998, it may be necessary to apply for a Water Use Licence. However, there is a provision under the General Authorisations which may ease the need for licensing under certain conditions.

Better Management Practice

Maximum spacing between culverts on haulage roads:

Road gradient %	Spacing (moderate to resistant soils)	Spacing (erodible shallow soils: <500 mm, <15% clay)
1 – 5	150 m	120 m
6 – 10	120 m	90 m
11 – 15	95 m	70 m
16 – 20	50 m	35 m

Typical culvert sizes according to catchment area and run-off potential:

Catchment area (ha)	Diameter of culvert (mm) (high run-off potential*)	Diameter of culvert (mm) (medium runoff potential*)	Diameter of culvert (mm) (low runoff potential*)
1	600	600	600
2	600	600	600
3	600	600	600
4	600	600	600
5	600	600	600
6	675	600	600
7	750	600	600
8	750	600	600
9	825	600	600
10	825	600	600
15	1050	675	600
20	1050	750	600
30	1350	900	600
40	1350	1050	750
50	1500	1050	750
60	1800	1200	825
70	1800	1200	900
80	1800	1350	900
90	2000	1350	1050
100	2000	1500	1050

*Run-off potential is affected by slope, soil and vegetation.

Better management practice	**Road bridges are constructed to accommodate floods** • Farm bridges on primary roads can accommodate a 1:20 year flood • Bridges on secondary roads can accommodate a 1:10 year flood	**Road bridges are constructed to minimise soil loss** • Farm bridges should be of a suitable capacity to accommodate a 1:10 year (secondary roads) or 1:20 year (primary roads) flood. Larger bridges, where flow rates exceed 30 cubic metres per second, should be designed by a professional engineer. (See guidelines under the National Water Act, 36 of 1998). • Should a bridge affect the watercourse in terms of section 21(c) and 21(i) of the National Water Act, 36 of 1998, it may be necessary to apply for a licence. However, there is a provision under the General Authorisations which may ease the need for licensing under certain conditions. • The construction of a bridge near a watercourse requires environmental authorisation in terms of the National Environmental Management Act, 107 of 1998. • Constructed cut and fills should be stabilised by grassing with suitable grasses, e.g. vetiver. • For any new main road construction through the farm, the Department of Environmental Affairs should be approached. • Water from district roads, e.g. discharged from culverts, must be safely passed into stable waterways.

Primary Road (5 m in width)

Secondary Road (4 m in width)

Tertiary Road (3.5 m in width)

Crest Road (cambered)

Module 3.12 SOIL CONSERVATION: MANAGEMENT		STATEMENT OF INTENT Farming operations are managed well so as to prevent soil erosion
Measures		**Notes**
Better management practice	**Implement better management practices to minimise soil erosion:** • A maximum of 20% of the soil surface should be tilled as a percentage of land under cane per annum. • Minimum tillage is practised on slopes greater than 11% on erodible soils, 13% on moderately erodible soils and 16% on resistant soils. • Where conventional tillage is practised, the slopes need to be less than those above, and practised on the contour. • Row alignment is at right angles to the slope. • Row alignment may run with the slope only under the following situations: - on slopes of less than 2%; - on parallel crest areas of less than 2% on erodible soils, 3% on moderately erodible soils and 4% on resistant soils; - conservation structures must be in place; and - rows must not run over conservation structures.	**Tillage** Minimum tillage (including hand chipping) must be practised on slopes greater than 11% on erodible soils, 13% on moderately erodible soils and 16% on resistant soils with a maximum of 20% of the soil surface being tilled as a percentage under cane. Refer to the SASRI Nomograph for sugarcane panel width and the DAEA upper slope limits for the cultivation of sugarcane in KZN. Refer to Module 3.10: Soil Conservation: Layout On slopes of less than those above, conventional tillage is acceptable provided ploughing is carried out on the contour and not up and down the slope. Ploughing should be discontinued with the advent of high intensity storms in summer. **Row alignment** Row alignment should be at right angles to the slope, and should preferably be established by the master line technique – refer to Senior Certificate Course notes on Land Use Planning. On slopes of less than 2% and on parallel crest areas of less than 2% on erodible soils, 3% on moderate soils and 4% on resistant soils, row alignment may run with the slope provided conservation structures are used and rows do not run over the conservation structures.

Better management Practice	**Strip planting is practised to minimise soil loss.** • Strip planting on all slopes exceeding 2% is advisable, except as specified • Strip planting is practiced only on areas that are equal to or less than three panels (three times the recommended vertical interval for that particular soil and slope) with sugarcane of at least six months difference in age on the upper and lower bordering strips • Where strip planting is not practised, standards for dimensions and location of conservation structures (i.e. contour banks) have been adjusted according to the SASRI nomograph and DAEA upper slope limits • Alternate strip planting is practised on slopes above 12%	**Strip planting** Strip planting is recommended on all slopes exceeding 2%, except on certain irrigation layouts, e.g. centre pivot, short-run slopes and adjacent to valley bottoms. The width of a strip should not exceed three times the recommended vertical interval for that particular soil and slope (not exceed three panels) with sugarcane of at least six months difference in age on the upper and lower bordering strips. . If strip planting is not practised, standards for dimensions and location of conservation terraces should be adjusted according to the SASRI nomograph for sugarcane panel width and the DAEA upper slope limits for the cultivation of sugarcane in KZN. Refer to Module 3.10: Soil Conservation: Layout. On slopes above 12%, alternate strip planting must be practised.

Better management practice	**Harvesting operations minimise soil loss and compaction** • Wet, poorly drained soils are harvested during the dry season • Grab loaders and infield vehicles are operated with low tyre pressures and preferably radial ply tyres • Total mass is distributed over all axles, with infield loads not exceeding 5 tons per axle • Where tandem axles are used, make use of walking beams • Vehicles must drive on the interrow only • Where wheel and row spacing do not match, infield traffic is confined to the minimum number of inter rows	**Harvesting operations** The harvesting operation should be planned to minimise negative environmental impacts. It must take into account topography, soils (erodibility and compactability), weather, extraction routes, waterway crossings and loading zone sites. Equipment having the least impact on the environment should be used. Ensure that the stack trenches are covered once the stacks have been removed, and discourage labour from attacking and killing wildlife during the harvesting operation. • Plan to harvest cane in wet, poorly drained areas in the drier winter season. Grab loaders and infield vehicles should be operated with care to minimise damage to soil and cane stools. • Vehicle operators, cane cutters and crane operators should be trained and tested if certification is necessary. The Shukela Training Centre (STC) provides training, visit their website at www.sasa.org.za or contact your local SASRI Extension Specialist. • Keep tyre pressure low for good surface contact. Radial tyres are better than cross-ply. • Ensure total mass is distributed over all axles. Infield loads should not exceed 5 tons per axle. • Where tandem axles are used, make use of walking beams to gain more control and reduce compaction. • Vehicles should be driving only on interrows. • Confine infield traffic to the same path each year.
	Green cane harvesting and/or burning of sugarcane is practised in terms of economic, social and environmental conditions. • The harvesting operation results in >30% groundcover (consisting of tops or leaves) to improve soil organic content	**A cane residue blanket is valuable because it:** • conserves valuable moisture by reducing evaporation and run-off • suppresses weed growth • reduces soil erosion • reduces surface capping and compaction of soils. Because of the above attributes, a cane residue blanket increases sucrose yields in many situations. Growers should ensure that greater than 30% of the area harvested is covered with tops or leaves.

Better management practice	**Burning** • Cool burns in the morning on slopes of less than 15% in cool, wet or low lying areas is practised • Burnt tops are left scattered evenly in the field to help with soil and moisture **Crop residue management (green cane harvesting)** • Mulching is practised on slopes of greater than 15% and in areas where the cane residue blanket does not increase the risk of stools rotting or inhibits ratooning	**A yield response to a crop residue blanket is greatest when:** • cane is harvested in the summer months • cane is grown on high yield potential soils • rainfall is marginal • altitude is <500 m. When the burnt tops are left scattered (i.e. not windrowed) after harvest, they provide a mulch, which is about 50% as effective (in terms of soil and water conservation), as a full crop residue blanket. Scattered tops therefore serve a very useful purpose and should not be raked into windrows. A cool burn in the early morning when dew is still present ensures that a greater quantity of burnt tops is left as mulch. **Burning at harvest generally results in:** • higher output from cane cutters • higher payloads • cleaner cane **Burning at harvest is generally advantageous in the following situations:** • altitudes greater than 500 m • valley bottoms, high water table areas and where full irrigation is practised • where ratoon chlorosis is endemic. On request SASRI will assess the economics of burning or green cane harvesting for each field or farm area. **Better management practices** • Green cane harvesting should be practised for maximum conservation, particularly on steep slopes and erodible soils. • On slopes greater than 15%, green cane harvesting should be practised during the wet season to reduce the impact of raindrop action. • On slopes greater than 15%, the land should have adequate protective cover during the season when high intensity storms occur. These areas should therefore be cut early in the season to allow for adequate canopy development before summer. • After burning, the tops should be left scattered evenly in the field to help with soil and moisture conservation. • Green cane harvesting should result in >30% of ground cover (consisting of tops and leaves) after harvesting to improve soil organic content. • A cool burn in the morning (provided it conforms with the codes of burning practice) provides more tops than a late afternoon, hot burn.

Legal requirement	• New cane is not planted closer than 10m from the edge of a wetland or water course or as authorised • Sugarcane is not planted closer than 10m from a natural forest	**Choice of land newly planted to sugarcane has considered environmental and economic parameters** • Sugarcane is chosen after consideration of soil type, land aspect, other crops being grown in the area, susceptibility to pests and diseases and restrictions imposed by the Local Pest Disease and Variety Control Committee. • Cane should not be planted on marginal sites (shallow erodible soils) where profitability is questionable and the natural environment would be impacted upon. • In accordance with the Regulations published under the Conservation of Agricultural Resources Act, 43 of 1983, cane should not be planted closer than 10 m from the defined edge of a wetland or dam and 10 m from the defined edge of an indigenous forest, or as specified in terms of an environmental authorisation or water use licence. • Planting restrictions regarding natural heritage sites of conservation significance are determined by the management plan as per registration requirements. • Cane should not be cultivated within 10 m from the flood area of a watercourse or within 10 m horizontally outside the flood area of a watercourse (refer to Module 3.8: Wetlands and watercourses). • Planting should not be carried out close to archaeological or historical sites, sinkholes and caves, the edges of cliffs or steep slopes.

Cane residue blanket

Alternate panel harvesting

Module 3.13 HAULAGE		STATEMENT OF INTENT Sugarcane is transported efficiently and safely with spillage and overloading avoided
Measures		**Notes**
Better management practice	• The loading and transport operation is RTMS certified	**RTMS accreditation** The Road Transport Management System (RTMS) is a voluntary, self-regulation scheme that encourages operators and consignors engaged in freight logistics to implement recommended practice that contributes to the preservation of roads infrastructure, improves road safety and increases the productivity of the logistics strategy. Transport operators who invest in becoming RTMS accredited are recognised for their commitment to responsible business through a series of concessions. It will be a self-administered scheme which supports the principles of good corporate governance, implemented by participating companies. Participants adhere to agreed standards in the following areas: • Load optimisation • Driver wellness • Vehicle maintenance • Productivity. *Consult the RTMS website (www.rtms.co.za) for more information and details on becoming accredited*
Legal requirement	• A grower identifies him/herself as a Consignor if he transports greater than 500t cane in a month	Haulage of sugarcane consists of two practices, namely loading and transport. Both practices have certain legal responsibilities for the grower, depending on whether he/she performs the function themselves or employs the services of a contractor. **Establishing levels of responsibility for loading and haulage operations** ***Consignor/Consignee Road Freight Legislation and Overloading*** New regulations associated with Sections 49, 74A and 74B of the National Road Traffic Act (Act No 93 of 1996) were published in October 2014 and became effective on 31 January 2015. These regulations (330 A, B, C and D) could have severe financial and practical implications that affect <u>all players</u> in the transporting of goods of more than 500 tons per any one month, on public roads in South Africa.

Legal requirement		In the regulations, a consignor has been defined as follows: "…a person excluding a consignor of dangerous goods in terms of regulation 273, who is named or otherwise identified as the consignor of goods in the goods declaration relating to the transportation of more than 500 000 kilograms of goods in a month by road or engages an operator of a vehicle, either directly or indirectly or through an agent or other intermediary, to transport the goods by road or has possession of, or control over, the goods immediately before the goods are transported by road or loads a vehicle with the goods, for transport by road, at a place where goods are stored in bulk or temporarily held but excludes a driver of the vehicle, or any person responsible for the normal operation of the vehicle during loading;" A sugarcane grower (with a monthly load greater than 500 tons) can therefore be considered a consignor if he "has possession of…the goods [cane] immediately before the goods are transported by road or loads a vehicle with the goods…" making these regulations applicable to the grower, regardless of whether a contractor is used for loading and/or road transport. In other words, the grower, loading operator and road transport operator are all regarded as consignors and have to consider this legislation. Regulations 330A and B directly affect the Consignor and, to a lesser extent, the Consignee. These state: **"330A. Offering and acceptance of goods on overloaded vehicle prohibited** (1) A consignor or consignee of goods shall not offer goods or accept goods if the vehicle in which it is transported is not loaded in terms of the provisions for the loading and transportation of goods as prescribed in this Act. (2) A consignor shall require from the operator of the vehicle in which the goods he or she offers for transport and in which the goods will be transported, a written submission as to the payload of such vehicle and the distribution of such load on a vehicle. (3) If a consignor is responsible for the loading of a vehicle of an operator, he or she shall take such steps as are necessary to ensure that the vehicle is loaded as contemplated in subregulation (1) and (2). (4) A consignor or consignee shall not conclude a contract with the operator to transport goods on a vehicle, if the vehicle is overloaded when such load is transported on such vehicle."

Legal requirement		**"330B. Consignor to have a method of determining mass** (1) A consignor shall use a method of establishing the mass of a vehicle and any axle or axle unit of such vehicle that is accurate as to ensure that such vehicle axle or axles are not overloaded in terms of Part IV of Chapter VI. (2) A consignor shall keep a record of the mass of every load transported from his or her premises as contemplated in subregulation (1). (3) The record as contemplated in subregulation (2) shall be put at the disposal of any traffic officer or person appointed as contemplated in section 50 or authorised as contemplated in section 82 of the Act". **"330C. Goods declaration to be carried on a motor vehicle** A person operating on a public road a motor vehicle which carries goods shall be in possession of a declaration containing the following information: • the licence number of each vehicle in the combination of vehicles; • the nature and quantity of goods transported; • the contact particulars of the operator or in the case of a combination of vehicles, of every operator in the combination of vehicles; • the particulars of the consignor and consignee of the load or in the case of loads collected at and delivered to more than one consignor and consignee, the particulars of every consignor or consignee; • the name, residential and postal address of every natural person or in the case of a juristic person, the responsible director or member, an agent, consignor, consignee or operator listed in the declaration; • the consignor and operator shall conclude a written agreement for the transportation of goods stating- (i) the nature of the agreement; (ii) the loading instructions; and (iii) the responsibilities of the parties. • schedule of insurance as contemplated in regulation 330D". **"330D. Consignor or Consignee to insure goods to be carried on a motor vehicle** A consignor or consignee of goods shall not transport goods on a public road or accept goods unless such transportation is fully insured for damages that can occur as a result of an incident. "

Legal requirement	• A written agreement exists between a grower consignor and loading operator in terms of loading instructions and responsibilities of parties	**LOADING (from zone to haulage vehicle)** Loading operators (whether it be the grower or outside contractor) are also considered consignors. It is therefore necessary for a consignor and operator to conclude a written agreement for the transportation of goods stating- (i) the nature of the agreement; (ii) the loading instructions; and (iii) the responsibilities of the parties.(Regulation 330C) Many loading operators have a role to play in ensuring that the axle mass load of the haulage vehicle conforms to the National Roads Traffic Act of 1996, Section 234-239 Regulations.
Better management practice	**Loading equipment** • The loading equipment is appropriate for the task • All loading equipment is inspected daily to ensure safe and efficient operation • All equipment is maintained according to regular maintenance schedules **Trained & competent loading staff** • Loading staff are trained to use the loading equipment properly • A schedule of training needs is compiled and matched to a training plan • A record of all training conducted is maintained • Competency assessments are conducted for all staff and operations	Growers who load their own cane could perform a number of better management practices to ensure that their equipment, staff and loading operations are efficient, safe and comply with regulations regarding overloading. **The loading equipment is appropriate and in good working condition.** • The loading equipment is appropriate for the task. • All loading equipment is inspected daily to ensure safe and efficient operation • All equipment is maintained according to regular maintenance schedules. **All loading staff are trained and competent** • Loading staff are trained to use the loading equipment properly. • A schedule of training needs is compiled and matched to a training plan. • A record of all training conducted is maintained • Competency assessments are conducted for all staff and operations.

Better management practice	**Safe loading operations** • The loading operation timetable and practices are arranged in a reasonable fashion so that driver fatigue is minimised • Equipment operators undergo regular medical check-ups • There is regular and open communication between management, equipment operators and loading staff on matters that affect the safe operation of the business • When using side-loading trailers, cable drains are parallel and deep enough to guide cables and are closed after use	**Loading operations are conducive to safe and efficient operation** • The loading operation timetable and practices are arranged in a reasonable fashion so that driver fatigue is minimised. • Equipment operators undergo regular medical check-ups. • There is regular and open communication between management, equipment operators and loading staff on matters that affect the safe operation of the business. • When using side-loading trailers, cable drains should be parallel and deep enough to guide cables and are closed after use.

Legal requirement	• A written agreement exists between a grower consignor and haulage operator in terms of responsibilities of parties • Compliance with the National Road Traffic Act 93 of 1996 in terms of the manner in which sugarcane can be transported (section 246 of the National Road Traffic Regulations 1999 as amended in Government Gazette Notice No. R846, published 31 October 2014), is practised • Compliance with the axle mass of the load vehicle (section 234 – 239 of the National Road Traffic Regulations 1999) as amended in Government Gazette Notice No. R846, is practised	**HAULAGE** Haulage operators (whether it be the grower or outside contractor) are also considered consignors. It is therefore necessary for a grower consignor and haulage operator to conclude a written agreement for the transportation of goods stating- (i) the nature of the agreement; (ii) the loading instructions; and (iii) the responsibilities of the parties.(Regulation 330C) The manner in which cane should be carried is covered by the National Roads Traffic Act, 93 of 1996, Section 246 of National Road Traffic Regulation 1999, as amended by the Minister of Transport in Government Gazette Notice No. R846, published 31 October 2014. The axle mass load of the vehicle must conform to the National Roads Traffic Act of 1996, Section 234-239 Regulations. In terms of the manner in which cane is to be carried, responsible parties are to ensure that: 1. the goods do not come into contact with the surface of the road and are safely contained and securely fastened in the body of the vehicle; 2. the drivers view is not obscured in anyway; 3. where the gross mass of the vehicle is 3 500kgs or more, there is at least one emergency warning light which is double sided, consists of red reflective material or is painted red and has retro-reflectors in each corner; 4. the maximum gross vehicle mass, gross axle massload or gross axle unit massload of the vehicle, is not exceeded 5. the goods on a semi-trailer are not overhanging **Transportation by way of railway** Growers must ensure that the transporting of cane is managed in accordance with the requirements of the Railway Safety Regulator which includes the requirement of being in possession of a safety permit. The chief executive officer of the Regulator may impose any condition on such safety permit, including but not limited to the validity of a safety permit and the conditions relating to the transport of cane.

Better Management Practices	**Haulage vehicles are loaded safely and efficiently, avoiding spillage** • The legal load capacity of the haulage vehicle is known and documented • A method exists for determining the mass of the load on the vehicle • The measuring method is calibrated regularly • A back-up method exists should the usual method fail • Vehicle loads are properly secured. • Sugarcane is tightly stacked • Stacks are of uniform size • All loose cane is removed prior to transport • Vehicles are loaded and dispatched according to an agreed schedule to avoid negative impact on the value chain **Driver wellness** • Drivers' schedules must be arranged such that driving hours are not only within the legal limits but are scheduled to minimise driver fatigue • Depot facilities and workplace conditions must be conducive to driver health and well-being	Growers who haul their own cane could perform a number of better management practices to ensure that their equipment, staff and haulage operations are efficient, safe and comply with regulations regarding overloading and road safety. **Vehicles are loaded safely and efficiently, avoiding spillage** • The legal load capacity of the haulage vehicle is known and documented. • A method exists for determining the mass of the load on the vehicle. • The measuring method is calibrated regularly. • A back-up method exists should the usual method fail • Vehicles loads are properly secured. • Cane should be stacked tightly (woven or spliced). • Stacks should be of uniform size. Separating the cutting and stacking operations assists in maintaining a constant stack size. • Careful infield loading will result in tidier bundles or loads. When loading mechanically, ensure that the cane is properly placed into the trailer and that there is no overloading. • Vehicles are loaded and dispatched according to an agreed schedule to avoid negative impact on the value chain. All loose cane must be removed before the haulage vehicle leaves the field or zone. This also applies after the haulage vehicle has offloaded the cane at the mill and leaves the mill-yard. Vehicles leaving the mill-yard should be cleared of any loose cane. Cane protruding from the sides of the vehicle must be trimmed and good quality roads and zones will help ensure that cane spillage is minimised. **Driver wellness is managed for improved efficiency** • Drivers' schedules must be arranged such that driving hours are not only within the legal limits but are scheduled to minimise driver fatigue. • Depot facilities and workplace conditions must be conducive to driver health and well-being. • Drivers undergo regular medical examinations to ensure that they are fit and competent to perform their duties. • There is regular and open communication between management and drivers on matters that affect the safe operation of the business.

Better management practice	• Drivers undergo regular medical examinations to ensure that they are fit and competent to perform their duties • There is regular and open communication between management and drivers on matters that affect the safe operation of the business **Trained & competent drivers** • Drivers are trained to use the loading equipment properly • Schedule of training needs compiled & matched to plan • Competency assessments are conducted for all drivers. **Detailed records are maintained** Records are kept of all relevant documents pertaining to the loading and haulage operation: • Trip-mass records • Accident and incident reports • Vehicle fault reports • Vehicle service and maintenance records • Record of driving hours • Staff medical • Staff training records.	**All drivers are trained and competent** • Drivers are trained to use the loading equipment properly. • A schedule of training needs is compiled and matched to a training plan. • Competency assessments are conducted for all drivers. **Detailed records are maintained** Records are kept of all relevant documents pertaining to the loading and haulage operation: • Trip-mass records • Accident and incident reports • Vehicle fault reports • Vehicle service and maintenance records • Record of driving hours • Staff medical • Staff training records. **Definition and License code required for Haulage Tractors** • The driver needs a code B - it was originally published as a EC but has recently been changed by the Department of Transport. • The driver will need a PRDP (public driving permit) - the vehicle is a goods vehicle and has a GVM of more than 3 500 kg • Max GCM of 48 tons - if it has a single drive axle • Max speed 40km/h - slow speed brakes • Flashing amber lights visible from front and rear of the vehicle • Steering axle min. axle mass load must be greater than 15% of the tractor GCM • Annual road worthiness - goods vehicle over 3 500 kg

Module 3.14 AGROCHEMICALS		STATEMENT OF INTENT Acquisition and use of agricultural remedies and fertilisers are controlled
Measures		**Notes**
Legal requirement	**Prohibited remedies** • Farmers are prohibited, in terms of the Fertilisers, Farm Feeds and Agricultural and Stock Remedies Act 36 of 1947, from acquiring and using agricultural remedies that contain - 2,4-D (dimethylamine salt) - 2,4-DB (sodium salt) - dicamba (dimethylamine salt) - any other salts or esters of 2,4-D (except APM salt) on farms in certain Magisterial Districts. - Monocrotophos - Chlordane - Lindane (gamma – BHC) • The aerial application of agricultural remedies listed above, as well as any agricultural remedy containing 2,4-D (iso-actylesther), NCPA (potassium salt), MCPB (sodium salt), any salt or esters of triclopyr or salts of dicamba is prohibited in KwaZulu-Natal • Farmers are prohibited from acquiring, selling, disposing or using any agricultural remedy containing the pesticide chlorobensilate • The sale and use of the fertiliser “Super phosphate + Cu” is prohibited in KZN and Mpumalanga	**Fertilisers, Farm Feeds and Agricultural and Stock Remedies Act, 36 of 1947** In terms of Section 7bis of the Fertilisers, Farm Feeds and Agricultural and Stock Remedies Act 36 of 1947, the Minister may prohibit the acquisition, disposal, sale or use of fertilisers and agricultural remedies. Farmers are prohibited, in terms of the Act, from acquiring and using agricultural remedies that contain: • 2,4-D (dimethylamine salt) • 2,4-DB (sodium salt) • dicamba (dimethylamine salt) • any other salts or esters of 2,4-D (except APM salt) on farms in the Magisterial District of Camperdown and certain farms in the Magisterial District of Pietermaritzburg and Richmond The Act also prohibits: • the sale, acquisition, disposal or use of Monocrotophos containing remedies; (25 February 2005) • the sale acquisition, disposal or use of Chlordane in technical or any other form; (26 August 2005) • the use of agricultural remedies containing lindane (gamma – BHC) as an active ingredient. (29 May 2009) The aerial application of agricultural remedies listed above, as well as any agricultural remedy containing 2,4-D (iso-actylesther), NCPA (potassium salt), MCPB (sodium salt), any salt or esters of triclopyr or salts of dicamba is prohibited in KwaZulu-Natal. Farmers are prohibited from acquiring, selling, disposal or using any agricultural remedy containing chlorobensilate (a pesticide and probable human carcinogen). The sale and use of the fertiliser “Super phosphate + Cu” is prohibited in KwaZulu-Natal and Mpumalanga. Farmers should also be mindful of regulations relating to Agricultural Remedies (GNR.935 of 22 September 2006) and regulations regarding Fertilisers (GNR 250 of 23 March 2007).

Legal requirement	**Storage of fertilisers and agrochemicals.** • Buildings where agrochemicals are kept are secure and comply with the relevant standards • Toxic Group I poisons are secured in a separate, locked storage area • No agrochemical is stored near food and animal feed • Safety requirements are available. • Safety Data Sheets (SDS) are available at point of use for all chemicals used. • Employees are made aware of and/or trained on the use and understanding of the SDS. • Storage area is easily drained and a sealed sump to collect spillage has been constructed • A daily inventory and record of products used and returned to the store is controlled by a designated member of the farm staff	**Storage of fertilisers and agrochemicals** In terms of GNR.935 of 22 September 2006: *Regulations relating to agricultural remedies*, all handling, storage and disposal requirements of the South African National Standards ("SANS") must be observed by the farmer insofar as agricultural remedies are concerned. SANS 10206 is the primary standard regulating the use and storage of pesticides. The buildings or storerooms where agrochemicals are kept need to be of sound construction, well ventilated and secure, and have adequate warning signs posted. Highly toxic Group 1 poisons should be secured in a separate, locked, storage area. No agrochemical may be stored near food or animal feed and the building or storeroom must not be accessible to unauthorised people. Normal safety requirements must be available, e.g. water and washing facilities, firefighting equipment, and any other special requirements specified on the product label. Safety Data Sheets (SDS) must be available at point of use for all chemicals used and employees must be made aware of or trained on the use and understanding of the SDS and its contents. The storage area must be easily drained and a sealed sump constructed where spillage can be collected. There needs to be a daily inventory of products used and returned to the store, controlled by a responsible, senior member of the farm staff. For further details on the requirements for buildings in which agrochemicals are stored see SASRI Information Sheet 11.1 and the AVCASA Guidelines for the Storage of Agrochemicals and Stock Remedies (which are more applicable to the storage of large quantities of chemicals).

Legal requirement	**Application of agrochemicals** • Mixing of agrochemicals is carried out in a well-ventilated area and the necessary protective clothing, is worn • Washing of equipment is done in a manner which avoids soil and water pollution	**Application of fertiliser and agrochemicals** • To ensure the correct type and quantities of fertiliser and lime are applied, soil samples should be taken at regular intervals and sent to the SASRI FAS laboratory for analysis. • Calibration of fertiliser equipment, placement of fertiliser and timing of fertiliser application all affect crop performance and require careful management. • Over-fertilisation can impact on the soil environment and lead to acidification and nutrient imbalance. It can also be washed into rivers and dams, causing pollution. Excessive and unnecessary lime application can accelerate organic matter breakdown and lead to nutrient imbalances and shortages • Organic materials such as chicken litter, kraal manure, abattoir waste and effluent must be used with caution and only after obtaining qualified advice and guidance. Refer to SASRI Information Sheets 7.4 (Filtercake) and 7.14 (Use of poultry manure). • For any agrochemical to work effectively it must be applied at the correct rate to the desired target crop or surface (e.g. soil). Application techniques must minimise losses when spraying, and ensure that materials reach the desired target. Chemicals that do not reach the target not only waste of money, but are also the cause of environmental pollution and, in many instances, pose a threat to non-target crops growing nearby. A number of factors influence the efficacy of a particular agrochemical. The product must be applied at the correct concentration (application rate), at the correct place (target), at the right time (crop stage) and under the correct weather and soil conditions. Correct dilution (spray volumes) and the correct application equipment (including nozzle size and operating pressures) will influence droplet size and the resultant distribution on the target crop or surface. Weather conditions, particularly temperature, relative humidity and wind speed also play a significant role in determining the amount of chemical product that eventually reaches the target. For example, it is not advisable to spray when wind speeds exceed 10 km/h, and high temperatures together with low relative humidity will result in faster evaporation of droplets (therefore losses). Every effort must therefore be made to apply agrochemicals under the conditions and in the manner specified on the product label. These will be different for each product, so growers must familiarise themselves with each set of requirements. Refer to SASRI Senior Certificate Course notes and AVCASA course notes, Module 6: Basic Principles of Pest Control Application.
Better management practice	• Fertiliser application is managed in terms of soil requirements, as determined by SASRI's FAS or equivalent laboratory. • Soil samples are taken at regular intervals to ensure correct type and quantity of fertiliser • Agrochemicals are applied at the correct rate, the specific target, the correct growth stage and under suitable weather conditions. • The total mass of active ingredient in all agrochemicals applied is recorded and calculated	

Better management practice		• The safe application of any agrochemical product is regulated by the precautions and requirements on the product label. Details of mixing and disposal procedures, application rates and safety equipment required are also given on the label. Mixing should be carried out in a well-ventilated area and the necessary protective clothing specified on the label must be worn. Empty product containers should never be left in the field (refer to Module 2.1: Health and Safety). • Take cognisance of sensitive crops in adjacent fields or farms and spray responsibly. • After application, ensure that washing of equipment is done in a manner which avoids contamination of soil and water (refer to Module 3.4: Pollution Control). • Extra care is essential when applying Groups 1 and 2 chemicals in sensitive areas and during changeable weather conditions. • For more information see: - SASRI Information Sheet 10.6 (Herbicide labels) - SASRI Herbicide Selector available at www.sasri.org.za - A Guide to the Use of Herbicides, 1998, 16th Edition, Vermeulen, Grobler and van Zyl, National Department of Agriculture; - A Guide to the Use of Pesticides and Fungicides In the Republic of South Africa, 1996, 37th Edition, Krause, Nel and van Zyl, Directorate of Livestock Improvement and Agricultural Production Resources, National Department of Agriculture; and - A Guide to the Use of Plant Growth Regulants, Defoliants and Desiccants, Vermuelen and Grobler, Plant Protection Institute, Subdivision Weeds, Pesticides and Herbicides, Department of Agriculture. **Recording agrochemical usage** In order to establish the amount of agrochemicals used by farmers, the total mass of active ingredients in all agrochemicals applied is recorded and expressed as an average (in kg active ingredient per hectare of area under cane). The intention is to compare against a global standard of 5kg ai/ha/annum and reduce use over time. All herbicides, fungicides, nematicides and insecticides are classified as agrochemicals. The agrochemical label will indicate the volume or mass of active ingredient in the product.

Legal requirement	**Operators and equipment** • All application equipment is serviced and calibrated regularly • All operators using agrochemicals are trained and provided with the necessary safety equipment • Agrochemicals are applied according to the manufacturer's specifications.	**Operators and equipment** All application equipment must be serviced and calibrated regularly, and must be maintained in good working order. Each product is registered with a particular application method(s) and no other methods may be employed. These details are printed on the product label. Operators must be trained and provided with the necessary safety equipment stipulated on the label. It is necessary to ensure that all operators who apply agrochemicals under contract to growers are registered to do so as pest control operators. Pest control operators are also required to comply with the Pest Control Operator Regulations (GN R98 of 18 February 2011). Refer to SASRI training videos and training course for operators and supervisors. See references under 'Application of Agrochemicals' above and AVCASA Course Notes, Module 6: Basic Principles of Pest Control Application.
Legal requirement	**Disposal of containers and unused chemicals (see also Module 3.4: Pollution Control)** • Empty chemical containers should be returned to the supplier if this is a requirement stipulated on the label • Empty containers that are not required to be returned to the supplier are rendered unusable • Flammable material from containers may not be burnt, unless at a licensed facility	**Disposal of containers and unused chemicals** The disposal of product containers must be carried out in a responsible manner. Pesticide waste and empty containers must be disposed of according to the instructions appearing on the label. The containers of highly toxic, Group 1 poisons must be returned to the supplier for safe disposal. Waste and other containers should preferably be returned to the local supplier or sent to a registered waste disposal company (which is appropriately licenced). Triple-rinsed empty pesticide containers (with the exception of plastics drums that previously contained a pesticide) can be sent to a registered reprocessing company in terms of SANS 10406. Pesticide waste and empty punctured containers may only be disposed of on the farm if the site is registered as a hazardous waste landfill site in terms of the National Environmental Management: Waste Act 59 of 2008. Other requirements of this Act and SANS 10206 must also be adhered to in managing and disposing of pesticide waste and empty containers. In all instances containers must be perforated and rendered unusable after draining and triple rinsing. Glass containers must be shattered, whilst plastic and metal containers must be punctured. Spillage and unused chemical must be collected and may be reapplied to fields following the guidelines in SASRI Information Sheet 11.2. Flammable material from containers may not be burnt, unless thermal destruction occurs at an appropriately licensed facility.

Module 3.15 PESTS AND DISEASES		STATEMENT OF INTENT Plant diseases and insect pests are prevented and controlled
Measures		Notes
Legal requirement	**Farmers comply with the Agricultural Pests Act 36 of 1993** • Farmers are required to notify the local department of agriculture if flying locusts arrive, or if breeding swarms of red-billed queleas are present • Farmers have complied with any control measures as instructed by the Minister of Agriculture	**Agricultural Pests Act** The Agricultural Pests Act 36 of 1993 provides for the combating and prevention of agricultural pests. In terms of Section 5 of the Act, a land user is obliged to notify their local department if flying locusts or voetgangers have appeared on their land, if flying locusts have deposited eggs thereof, or roosting or breeding red-billed quelea are present thereon. Moreover the land user is obliged to accurately describe whereupon the abovementioned pests occur and furnish all relevant information to their local department.
Legal requirement		**Sugar Act** The Sugar Act, 9 of 1978 brings into effect what is known as the Sugar Industry Agreement, 2000 ("the Sugar Agreement"). Every aspect of the way the industry is governed is regulated through the Sugar Agreement. **Sugar Industry Agreement** Farmers are to be mindful of chapter 3 of the Sugar Agreement and to note that compliance with the Pest, Disease and Variety Control Rules for the industry as well as local area specific Regulations must be followed. A farmer may be obliged to undertake remedial measures, or the harvesting or destruction of sugarcane in order to combat the spread of any pest or disease or if he plants an unapproved sugarcane variety. This may only occur in a "proclaimed area" which must be published in the Government Gazette. In terms of the Sugar Agreement, in the event that the South African Sugar Association ("SASA") deems it expedient that remedial operations on, or the harvesting or destruction of any cane infested with any disease or pest be made compulsory, SASA may proclaim by notice in the Government Gazette any control area or part thereof, in which remedial operations shall be compulsory.

Legal requirement	**Farmers comply with the Sugar Act 9 of 1978** • Farmers within a proclaimed area have complied with any remedial operations required by the SA Sugar Association	In terms of this notice, SASA may publish procedures, directions or orders for the purposes of regulating remedial operations of cane infested with any disease or pest. Farmers are obliged to carry out the remedial measures, as determined by SASA in the notice. In the event that the farmer fails or omits to promptly comply with any procedure, direction or order in terms of the notice, the Local Pest, Disease and Variety Control Committee ("LPDVCC"), may at the expense of the farmer, cause the procedure, direction or order to be carried out. In the event that this occurs, the farmer forfeits all rights to the proceeds of the cane harvested upon the land in question. It is critical to note that in the event that the proceeds are insufficient to meet the costs incurred by SASA, SASA will be entitled to claim the shortfall from the farmer. Farmers are to note that the Local Pest, Disease and Variety Control officers, must be allowed to enter land situated in a control area, upon presentation of written authorisation by either the LPDVCC or by SASA. Moreover they are to be mindful that the LPDVCC may cause an officer to inspect any cane and remove samples thereof, on any land within its jurisdiction, in order to ascertain whether any hostile pest or disease exists on the land.
Better management practice	**Farmers have implemented an Integrated Pest Management System** • Farmers have notified their Local LPD&VC Committee regarding the outbreak of any major pest or disease on their farm or area • Farmers keep abreast with latest rules and recommendations from their LPD&VC Committee	**Integrated Pest Management** Integrated pest management (IPM) is a broad-based approach that integrates practices for economic control of pests. IPM aims to suppress pest populations below the economic injury level or economic threshold. An IPM programme consists of a series of best practices applied in an area-wide context, aimed at reducing plant stress – thereby reducing the potential for pest or disease damage. **The following best practices form part of an IPM approach:** • Farmers should notify their Local LPD&VC Committee regarding the outbreak of any major pest or disease on their farm or area. • Farmers must keep abreast with latest rules and recommendations from their LPD&VC Committee.
Legal requirement	• Certified or approved seedcane is used for all crop re-establishment i.e. from first or second stage nursery blocks	In accordance with the Sugar Agreement and the Pest, Disease and Variety Control Rules, only certified or approved seedcane should be used for all crop re-establishment i.e. from first or second stage nursery blocks.

Better management practice	• Fields due for re-plant are checked for RSD prior to eradication of the penultimate crop • 100% crop eradication is achieved before planting • RSD positive fields are fallowed for a minimum of 3 months from the death of the last volunteer • Resistant varieties are chosen due to their suitability to specific growing conditions • No single variety occupies greater than 30% of area under cane • Growers undertake scouting for pests and diseases on their farms with their own staff • Growers conduct regular training on pests and diseases with their scouting staff • Growers record and monitor trends on the incidence of pests and diseases on a field basis for their farm • An integrated approach towards the control of any threatening pests on the farm are implemented	**The following best practices form part of an IPM approach:** • Fields due for re-plant should be checked for RSD prior to eradication of the penultimate crop and 100% crop eradication should be achieved before planting. • RSD positive fields should be fallowed for a minimum of 3 months from the death of the last volunteer. • Growers should choose resistant varieties suitable to their specific growing conditions and ensure a varied variety disposition. • No single variety should occupy greater than 30% of area under cane. • Growers should undertake scouting for pests and diseases on their own farms using with their own staff and not only rely on P&D teams. • Growers should ensure that their scouting staff are educated and trained on identification of pests and diseases by conducting regular training. • Growers should record pest and disease levels, monitoring trends over time on a field basis for their farm. • An integrated approach towards the control of any threatening pest or disease on the farm should be followed (i.e. planting sedges or melinis, releasing predators, encouraging bats, variety choice etc)

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