Good Environmental Management Guidelines:

Vineyard Water Use Management

GEM Viticulture
National Good Environmental Management Project

Cooperative Research Centre for Viticulture

GEM Guidelines: Vineyard Water Use Management

Acknowledgment

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The Cooperative Research Centre for Viticulture

The Cooperative Research Centre for Viticulture is a joint venture between Australia's viticulture industry and leading research and education organisations. It promotes cooperative scientific research to accelerate quality viticultural management from vine to palate. Australian grape growers and winemakers are key stakeholders in the CRCV, contributing levies matched by the Commonwealth Government and invested by the Grape and Wine Research and Development Corporation in the Centre.

GEM Guidelines: Vineyard Water Use Management

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Introduction

Good Environmental Management (GEM) practices involve vineyard management activities that reduce any negative impacts on the environment, and which may sustain and even improve the natural resource base which grape growing depends upon.

Why adopt Good Environmental Management practices?

There are many reasons why a wine grape grower or vineyard manager may wish to adopt GEM practices on their vineyard. In many cases the adoption of these practices are as much for good business management as they are for environmental improvements. Some of the reasons include:

- maintaining the natural resource base of the vineyard for future grape production;
- improving the economic viability of the business through better management of resources and reducing certain inputs (e.g. fertilisers, pesticides etc);
- demonstrating to customers, neighbours and the general community good environmental performance;
- meet industry, community and government expectations about environmental management;
- maintaining or gaining access to certain markets (especially those with high environmental standards);
- meet personal goals relating to the protection of the environment and natural resources.

What is in this document?

This document presents guidelines for GEM practices for *Vineyard Water Use Management*. It is part of a series of guidelines developed to provide wine grape growers and vineyard managers with information about adopting GEM practices.

Other documents available in the series* include:

- *Pest and Chemical Management;*
- *Vineyard Fertiliser and Soil Management*
- *Equipment, Machinery and Vehicle Management.*

*It should be noted that there is some crossover of information between these documents.

The GEM Guidelines have been written from a national perspective and so they provide general information not specific to any region. They have been written to directly link with the Viticare Environmental Risk Assessment (VERA) tool (see next page).

Each document in the series describes:

- activities relevant to the document topic which can be undertaken in association with a viticultural enterprise;
- the environmental aspects of these activities and any potential impacts;
- guidance on appropriate management and viticultural practices;
- a range of possible actions to address the impact;
- recommendations for monitoring, measuring and recording to inform decision-making.

Introduction

How should this document be used?

This document should be used as a starting point by growers, managers or regional industry officers seeking to address the environmental impacts associated with everyday viticultural activities. While it may be possible to use it as a stand-alone source of information on how to address environmental risk, the guidelines are best used together with the VERA tool. It is recommended that the GEM Guidelines be used in the following way:

- **Attend a *Research to Practice® Getting Started with Environmental Management in Viticulture* workshop.** This workshop introduces participants to the VERA tool and helps them conduct an environmental risk assessment of their business.
- **Apply the VERA tool to individual businesses.** This should help to identify those environmental aspects and impacts that have the greatest potential risk, and therefore determine what needs to be addressed.
- **Having identified the areas that need addressing, refer to the relevant GEM Guidelines** for suggested management and production actions that could be taken to reduce the associated risks.

REMEMBER:

These GEM Guidelines are:

- only one source of information and should not be seen as the final answer to addressing environmental risk in a vineyard;
- a guide to current good environmental management practices for grape growers and vineyard managers;
- not production or technically based best management practice guidelines.

VERA

VERA is a CD-ROM developed by the Cooperative Research Centre for Viticulture (CRCV). It is a tool that is intended to provide a starting point for grape growers and vineyard managers to begin building formal environmental management into their overall vineyard management planning. It lists a number of management areas or categories (e.g. water use management) and the associated activities, and describes relevant environmental aspects and potential impacts (risks).

VERA helps growers to:

- think more about their viticultural practices and how these might impact on their vineyard and the wider environment;
- prioritise these issues;
- plan actions to address the issue and to reduce the risks associated with these impacts.

Should growers wish they can then build upon this base to develop a more structured approach to environmental management such as an Environmental Management System (EMS).

Growers attending a *Research to Practice® Getting Started with Environmental Management in Viticulture* workshop will receive a copy of the VERA tool as part of the training materials.

Where do the GEM Guidelines fit with other environmental programs?

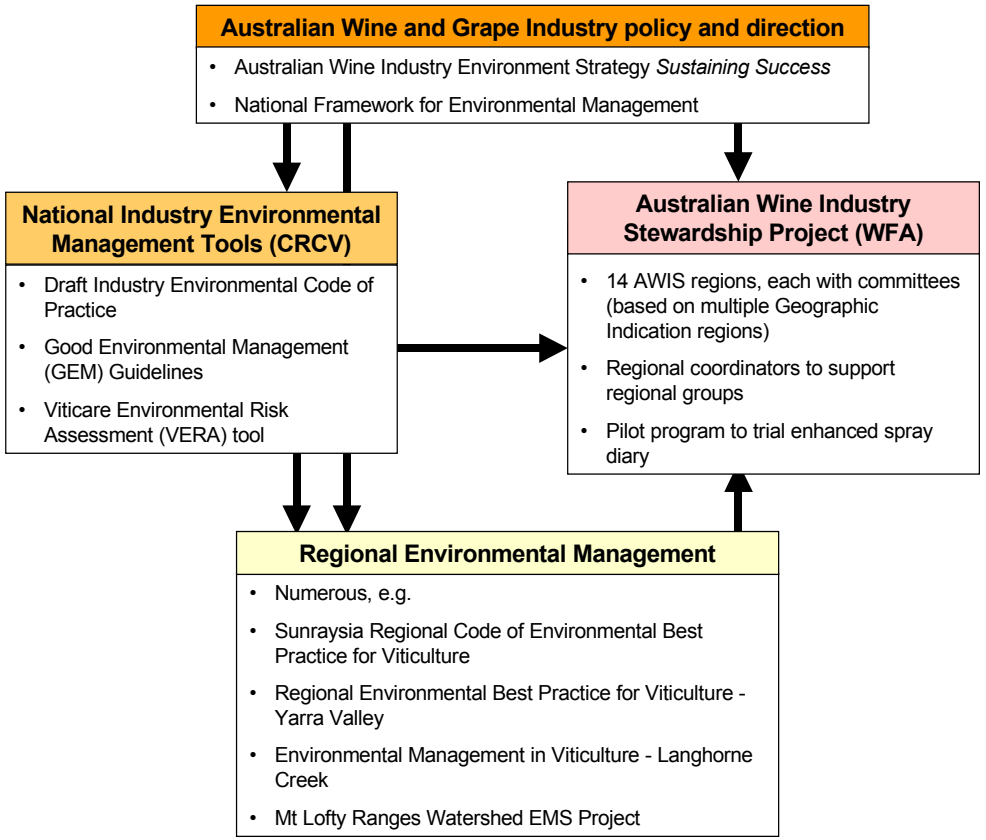
The Australian Wine Industry's Environment Strategy *Sustaining Success** was developed to provide guidance to all wine industry members about improving environmental performance and demonstrating environmental credentials. In support of this strategy the CRCV has developed a number of nationally focused documents (in addition to these GEM Guidelines and the VERA tool) including a *National Framework for Environmental Management* and a *Draft Industry Environmental Code of Practice*.

Also at a national level, the Australian Wine Industry Stewardship project, managed by the Winemakers Federation of Australia (WFA) and launched in 2005, will develop a national program to allow the industry to demonstrate its environmental credentials. Through this program regional coordinators will encourage grape growers and winemakers to participate and assist them to achieve environmental targets.

Beyond these national initiatives many grape growers have been supported at the local level through regional environmental management projects. A number of these projects have developed *Regional Codes of Environmental Best Management Practice for Viticulture* (or Regional Environmental BMPs). Such documents highlight particular regional environmental issues and may provide more specific information to assist the adoption of environmental best practice. Local grower associations can provide information about all of these programs and what is happening in their region.

**Available online at www.wfa.org.au (follow the links to >>Issues>>Environment)*

How the GEM Guidelines and other environmental programs fit together



Section 1: SOURCING WATER AND IRRIGATION OF VINEYARDS

Environmental Objectives

Water is a SCARCE AND VALUABLE RESOURCE in Australia and irrigation is a key water use activity in vineyards. Water must be USED EFFICIENTLY and managed with due consideration of potential off site ENVIRONMENTAL IMPACTS associated with its use, including effects on stream flow and groundwater resources, water table levels, salinity, soil erosion, issues of contamination and impacts on flora and fauna.

Irrigation is the practice of applying water to a site for the purpose of growing an agricultural crop.

Irrigation water can be sourced from a stream, lake, dam, bore or other on or off site source. The removal of water from natural courses/reservoirs/ground water tables, and the storage of water in dams have the potential to impact on the local or regional environment in a number of ways. Storage of water on-farm presents a number of issues that are separate from good irrigation principles. The building of on-farm water storage sites is increasingly coming under license conditions.

The purpose of irrigation is to deliver a specified amount of water to the vineyard at defined times throughout the growing season in order to produce grape yields of a desired amount and quality. The most common irrigation methods include drip or trickle, overhead and under vine sprinklers, and flood or furrow. Irrigation needs to be employed appropriately to minimise impacts in the vineyard and prevent adverse off-site impacts on the environment.

All activities relating to extraction, storage and application of irrigation water must meet local, regional, state and national guidelines and regulations. Examples include:

- *Australian Code of Practice for Agricultural Irrigation* and the *Irrigation Association of Australia Environmental Policy* both available by visiting http://www.irrigation.org.au
- On-farm water storage development and management regulations and policies of local councils, catchment management authorities and State government departments.

Additional guidelines may also apply according to the requirements of the winery, or any cooperatives or associations to which the vineyard is a member.

Risk activity – IRRIGATION (WATER EXTRACTION)

Aims

- Monitor soil moisture and vines to determine requirements for water budgeting.
- Avoid over-extraction.

Section 1: SOURCING WATER AND IRRIGATION OF VINEYARDS

Risk activity – WATER STORAGE (ON-FARM DAMS)

Aims

- Monitor and maintain dams on a regular basis to identify any impacts on the surrounding environment.
- Manage potential leaching and drainage issues.

Risk activity – IRRIGATION (WATER APPLICATION)

Aims

- Give consideration to the characteristics of the irrigation system (e.g. match to soil type).
- Monitor system for efficiency and uniformity of delivery.
- Regularly service and maintain system as necessary.
- Irrigate in an efficient manner by:
  - monitoring soil moisture and vines to determine water need.
  - scheduling vineyard water applications only as needed.

ASPECTS

Those aspects associated with the extraction and application of irrigation water for use in vineyards that have the potential for adverse environmental impacts include:

- use of water;
- sourcing water from river/creek/stream;
- sourcing water from lake;
- sourcing water from bore;
- potential for excessive irrigation;
- use of chemicals to clean out irrigation pipes/lines;
- potential for leakage and overflows;
- location of dams.

POTENTIAL ENVIRONMENTAL IMPACTS

The remainder of this section provides details about potential environmental impacts for each of the risk activities associated with the extraction and application of irrigation water for use in vineyards. It also outlines actions to help avoid those risks, and recommendations on data collection to aid management decisions. Impacts include:

1. Impact upon volume and speed of flow downstream in water courses / adverse effects on hydraulic flow.
2. Depletion of natural resources / water table at local level.
3. Adverse impacts upon fauna and flora / changes to biodiversity.
4. Contamination of land, surface water / groundwater from run-off or leakage / overflow from dams.
5. Waterlogging, rising water tables and increased soil salinity.
6. Soil erosion caused by run-off.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 1

Impact upon volume and speed of flow downstream in water courses / adverse effects on hydraulic flow

Aspect/s

- **Sourcing water from river/creek/stream**
- **Location of dams**

Explanation

Sourcing irrigation water from rivers, creeks and streams impacts upon volume of flow of these watercourses (information about this can be difficult to find and generally these issues are managed on a catchment or state basis). Dams can also have environmental effects on natural water movement as they can impact on the sub-surface water balance in the area surrounding them. This can often be seen as waterlogging downstream/slope of the dam, which makes it difficult or impossible for vegetation to grow there.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
303	**Extraction**	Identify local/regional /state water management plans and water harvesting regulations for the water sources used and ensure compliance including use, licensing, allocation and entitlements.	Monitor volumes of water being removed from water courses: • using a flow meter; or • calculating from irrigation scheduling information. Monitor efficiency of irrigation practices.
314	**Storage**	Line dams to minimise movement of water through the soil. Investigate options for re-vegetating drainage lines or waterlogged areas downstream/slope of dams.	Monitor: • soil moisture status around dams; • vegetation cover downstream/slope of dams.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 2 **Depletion of natural resources / water table at local level**

Aspect/s

- **Sourcing water from a lake**
- **Sourcing water from a bore**

Explanation

Removing water from a lake for the purpose of irrigation results in the depletion of that water resource. With regards to extraction of underground (bore) water, each ground water system is unique and requires individual management plans. The type of ground water system impacts on the recharge rates of the water table. Management of ground water resources generally occurs at the aquifer scale.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
305 307	**Extraction**	Identify local/regional /state water management plans and water harvesting regulations for the water sources used and ensure compliance including use, licensing, allocation and entitlements. Investigate and participate in activities to improve the sustainability of ground water. Once a bore is no longer required it should be decommissioned.	Monitor volumes of water being removed from surface water sources: • using a flow meter; or • calculating from irrigation scheduling information. When using bore water sources: • at commission determine the volume of water available and flow rate of bore; • annually (at minimum) measure bore drawdown and sustainability, and salinity of the water; • maintain the bore to reduce the risk of contamination of the aquifer; • regularly monitor water quality. Monitor efficiency of irrigation practices.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 3 **Adverse impacts upon fauna and flora / changes to biodiversity**

Aspect/s

- **Sourcing water from river/creek/stream**
- **Sourcing water from a lake**

Explanation

Removing water from a river, creek or stream for the purpose of irrigation will impact on the volume and speed of flows in such watercourses. Similarly, removing water from a lake will change lake levels. These effects are likely to have an impact on species of flora and fauna and thus local biodiversity as the aquatic habitat of various organisms is altered. While this area remains subject to considerable debate and further research is needed, all actions relating to extracting irrigation water from surface water sources should be undertaken with consideration to managing impacts on biodiversity.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
304 306	Extraction	Implement biodiversity monitoring plans to provide base line information on biodiversity status. Make contact with local groups involved in biodiversity management for more information on local issues and important species.	Record: • vegetation types and amounts; • types and numbers of regionally important fauna species.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact **4** **Contamination of land, surface water / groundwater from run-off or leakage / overflow from dams**

Aspect/s

- **Potential for excessive irrigation**
- **Use of chemicals to clean out irrigation pipes**
- **Potential for leakage and overflows**

Explanation

Off-site contamination of land, surface water and ground water results when chemicals and nutrients are applied inappropriately, either in respect to timing, amount or application method. Chemicals used to clean irrigation pipes and prevent blockage of emitters include chlorine and acids and their mis- or over-use may result in contamination problems. Contamination can occur through direct contact of the contaminant with the soil or by the movement of contaminated soil particles with run-off water. Maintenance of farm dams should be ongoing to ensure minimal leakage of stored water. Overflows on farm dams should be designed to minimise the impact on the environment and overflow areas need to be maintained to ensure they work as required.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
310 311 312 313	**Application** and **Storage**	Identify sources of contamination. Reduce the contaminant load in the environment by: • applying all chemicals according to their registration details; • efficient irrigation scheduling and fertiliser application; • using integrated pest management (IPM) principles to control pests, diseases and weeds; • determining if there are more efficient practices/products to clean irrigation pipes/lines. Maximise ground cover both within and around the vineyard to reduce run-off. Minimise the volume of cleaning/flushing water put through the irrigation system and re-use rinse water on site.	Monitor: • run-off water quality; • water quality of nearby streams, lakes etc and ground water; • health of vegetation affected by contaminated run-off water; • level of contaminants in water used to clean irrigation systems; *(Continued on next page...)*

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact **4**

Contamination of land surface water / groundwater from run-off or leakage / overflow from dams

(…continued from previous page)

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
310 311 312 313	**Application** and **Storage**	*(…continued from previous list)* Ensure cleaning chemicals are kept to a minimum and investigate alternative non-toxic options for cleaning irrigation systems. Prevent off-site movement of cleaning water by: • collecting, containing and managing contaminated drainage water where possible; • diverting contaminated water away from water ways and heavily vegetated soil. Maintain dam walls to minimise leakage. Keep dam overflow spillways and dam walls free of trees and construct overflows to minimise erosion and land slip. Stabilise soil on dam overflow banks, considering vegetation patterns and ensure cover is adequate at all times. Design overflows to contain contaminated water and minimise contamination of nearby water sources. Identify and ensure compliance with local/regional /state management plans for vegetation (including re-vegetation), soil and nutrients, and water.	*(…continued from previous list)* Monitor: • amounts of cleaning chemicals used for irrigation pipes/lines; • stability of dam walls and overflow areas. Record likely contaminant sources and methods for reducing impacts. Analyse soil for possible contaminants to determine base line data. Record overflow activity of dams.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 5

Waterlogging, rising water tables and increased soil salinity

Aspect/s

- **Use of water**
- **Potential for excessive irrigation**

Explanation

Rising water tables, waterlogging and movement of salts into the root zone can be inter-linked issues in irrigated vineyards. At the regional level, rising water tables may occur due to changes in hydrology, often as a result of different activities in the groundwater catchment area, including removal of deep-rooted perennial vegetation and local irrigation practices. Rising water tables generally appear about 20-60 years after clearing. At the local level, excessive irrigation may result in (generally) temporary occurrences of perched water tables, especially where compact subsoils exist. Waterlogged soils can result from a combination of natural conditions (e.g. extensive rainfall periods/rising ground water) and inappropriate irrigation practices for the site.

Both rising and perched water tables cause waterlogging of vine roots, resulting in poor growth and yields and potential damage to vines and other vegetation. A saline water table near the root zone (i.e. within 1-2m of the soil surface) can result in salt being brought to the surface by capillary action. Evaporation thereafter concentrates salt in upper soil levels and in extreme cases a crust of salt is observed on bare soil surfaces during spring and early summer. Salt can be toxic to many plants at high concentrations and thus saline groundwater in the root zone can impact adversely on vines, cover crops and potentially on soil structure. Increased soil salinity can also occur if the irrigation water used is saline. Ideally the electrical conductivity of irrigation water should be less than 1.0dS/m; if between 1.0-1.8dS/m management options such as salt tolerant root stocks, mulching, maintaining ground covers and/or increasing the irrigation leaching fraction may be necessary.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
300 301 302 308	**Application**	Understand local hydrology. Commit to and implement local and regional water management, salinity and drainage plans. Identify any impediments to water movement through the soil in the vineyard/locally.	Rainfall. Depth of water table. Efficiency of irrigation practices.

(Continued on next page...)

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 5 **Waterlogging, rising water tables and increased soil salinity** *(…continued from previous page)*

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
300 301 302 308	Application	*(…continued from previous list)* Identify drainage options, including installation of surface/ sub-surface drains if necessary. Assess requirements for soil amelioration to improve drainage and incidence of perched water tables. Locate any existing water table monitoring points / 'test wells' (piezometers) and establish additional points if required. Install soil moisture monitoring equipment. Consider water table trends when planning to extend or plant a new vineyard and avoid high risk areas. Coordinate a program to identify localised areas of waterlogging/salinity, and at-risk areas, and develop management plans. Implement soil management techniques where possible e.g. • mulching to minimise evaporation of water from soil surface to limit concentration of salts in the root zone; • gypsum application to improve soil drainage and reduce salinity. Apply a leaching fraction to flush salts from the root zone as needed. Promote efficient irrigation, which minimises drainage, and thus increases the distance to the water table. There may be a trade-off however between reduced drainage and the need for sufficient water application to leach salts from the root zone. Investigate alternate quality water sources if salinity of the irrigation water is an issue.	Soil drainage/infiltration rates. Salinity of water table, soil and irrigation water.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 6 **Soil erosion caused by run-off**

Aspect/s

- **Potential for excessive irrigation**

Explanation

Movement of water over bare soil results in soil particles being dislodged and carried along the water path. The greater the volume and speed of water that moves, the more soil particles are picked up and moved with the water. Erosion can result, ranging from the creation of minor depressions to major gullies and land degradation, potentially requiring extensive mechanical treatment.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
309	Application	Identify local soil and water management plans. Identify areas of soil erosion and contribute to land restoration. Target emitter output and irrigation design to the soil infiltration rate. Improve soil stability by: • maintaining soil cover as much as possible (e.g. cover crops, mulch and volunteer ground cover growth); • considering maintaining soil cover on the under vine bank; • managing any hard setting and crusting problems; • increasing soil organic matter to improve water infiltration.	Record size and amount of erosion area. Monitor erosion sites using photos or diagrams.

Activity: WATER EXTRACTION, STORAGE AND APPLICATION

Potential impact 6 **Soil erosion caused by run-off** *(… continued from previous page)*

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
309	Application	*(…continued from previous list)* Irrigate efficiently by: • minimising water run-off from irrigation; • installing soil moisture monitoring equipment. Divert run-off water to covered soil. Reduce traffic and animal movement through eroded sites. Install sediment traps where necessary, especially to avoid transport into waterways.	

Remember the Environmental Objectives for SOURCING WATER AND IRRIGATION OF VINEYARDS from the start of this section

As WATER EXTRACTION, STORAGE AND APPLICATION can be an essential component of SUCCESSFUL GRAPE GROWING in some regions, it is important to CONSIDER THE ENVIRONMENTAL IMPACTS associated with these activities. Good Environmental Management means MINIMISING THE POTENTIAL FOR RISK from impacts on stream flow, depletion of water resources, adverse impacts upon fauna and flora, potential for contamination of land and water, and land degradation from waterlogging, salinity and soil erosion. These Guidelines provide one way to consider the risks associated with the sourcing water and irrigation of vineyards, and outline Aims and Actions to LIMIT ENVIRONMENTAL IMPACTS.

Section 2: DISPOSAL OF EXCESS WATER AND DISUSED EQUIPMENT

Environmental Objectives

Irrigation is a key water use activity in vineyards but excess water can be generated. DISPOSAL OF EXCESS WATER via drainage and pumps must be undertaken with due consideration of potential ENVIRONMENTAL IMPACTS including contamination of land and water, soil erosion and subsidence and impacts on flora and fauna. The presence of disused drip lines and sub-mains in soil can also contaminate land.

Excess water can be produced as a result of rainfall events or irrigation activities. Systems need to be developed to ensure the adequate management and disposal of all sources of excess water. Re-use of water on site should be investigated as the first option, followed by disposal via drainage systems. Irrigation best practice should aim to minimise the production of excess water.

Vineyard redevelopment activities can result in old and unused irrigation drip lines and sub-mains remaining in the soil. If left in the ground these can be a source of contamination, as well as becoming a litter problem at a later date.

All activities relating to extraction, storage and application of irrigation water must meet local, regional, state and national guidelines and regulations.

Additional guidelines may also apply according to the requirements of the winery, or any cooperatives or associations to which the vineyard is a member.

Risk activity – DISPOSAL OF EXCESS WATER VIA DRAINAGE AND PUMPS

Aims

- Minimise impact of excess water by re-use or recycling.

Risk activity – DISUSED DRIP LINES AND SUB-MAINS IN SOIL

Aims

- Minimise impacts of disused drip lines and sub-mains both on and off site.
- Dispose of disused drip lines and sub-mains in an environmentally appropriate manner.

ASPECTS

Those aspects associated with the disposal of excess water via drainage and pumps, and presence of disused drip lines and sub-mains in soil which have the potential for adverse environmental impacts include:

- potential for leakage and overflows;
- potential for disused/damaged equipment to be left in the ground.

Section 2: DISPOSAL OF EXCESS WATER AND DISUSED EQUIPMENT

POTENTIAL ENVIRONMENTAL IMPACTS

The remainder of this section provides details about potential environmental impacts for each of the risk activities associated with the disposal of excess water via drainage and pumps, and presence of disused drip lines and sub-mains in soil. It also outlines actions to help avoid those risks, and recommendations on data collection to aid management decisions. Impacts include:

1. Possible contamination of land, surface water / groundwater
2. Off site soil erosion / subsidence caused by run-off
3. Adverse impacts upon fauna and flora / changes to biodiversity.

Activity: MANAGING EXCESS WATER / DISUSED EQUIPMENT IN SOIL

Potential impact 1

Possible contamination of land, surface water / ground water

Aspect/s

- **Potential for leakage and overflow**
- **Potential for disused / damaged equipment to be left in the ground**

Explanation

Disposal of excess water via drainage systems can provide the opportunity for contamination of land, surface water and ground water as a result of leakage and overflow of excess water which may be contaminated. Contamination of land may also result from old, damaged or disused irrigation equipment (e.g. drip lines/sub-mains) being left in the ground, particularly when a change in land use has occurred and knowledge of the existence and impact of old irrigation equipment is lost.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
315	Disposal	Identify and minimise possible sources of contamination of excess water. Design drainage lines in accordance with all regulations. Stabilise and maintain drainage lines using effective ground cover. Identify regional regulations regarding storm water re-use and disposal. Maintain pumps. Avoid excavating surface drains that may intercept water tables.	Measure and record quality of excess water. Monitor timing and amounts of excess water produced and analyse for management options. Monitor stability of vegetation cover of drainage lines.
318	Lines/mains	Remove all old, damaged and unused irrigation equipment from the vineyard. Dispose of equipment in and environmentally sound manner, including investigating re-use/recycling options. Review and update existing vineyard maps or plans when considering redevelopment.	Record any new vineyard redevelopment on existing maps or plans.

Activity: MANAGING EXCESS WATER / DISUSED EQUIPMENT IN SOIL

Potential impact 2 **Off site soil erosion / subsidence caused by run-off**

Aspect/s

- **Potential for leakage and overflow**

Explanation

Erosion and soil subsidence can occur as a result of water movement over or through soil, including leakage or overflows of excess water.

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
316	Disposal	Minimise potential for erosion and subsidence by ensuring: • potential risk areas maintain good ground cover; • drainage lines/channels are checked for signs of destabilisation and properly maintained. Identify and implement: • relevant local soil management plans; • local restoration projects associated with erosion control.	Monitor drainage lines and adjacent sites for erosion and subsidence activity. Record levels of erosion and subsidence pre- and post stabilisation.

Activity: MANAGING EXCESS WATER / DISUSED EQUIPMENT IN SOIL

Potential impact 3 — **Adverse impact upon fauna and flora / changes to local biodiversity**

Aspect/s

- **Potential for leakage and overflow**

Explanation

Overflow of excess irrigation water into a natural water course or leakage into soil and the ground water table are likely to have an impact on species of flora and fauna and thus local biodiversity as the aquatic/soil habitat of various organisms is altered. The effects may be related to the amount of water input into the ecosystem, or the quality of the water (e.g. contaminated).

Vera Ref. No.	Risk activity	Action to avoid impact	Monitor, Measure, Record
317	Disposal	Avoid construction of surface drains in sites of important habitat value where possible. Implement biodiversity monitoring plans to provide base line information on biodiversity status. Make contact with local groups involved in biodiversity management for more information on local issues and important species.	Record: • vegetation types and amounts; • types and numbers of regionally important fauna species.

Remember the Environmental Objectives for DISPOSAL OF EXCESS WATER / DISUSED EQUIPMENT from the start of this section

As DISPOSAL OF EXCESS WATER via drainage and pumps and the PRESENCE OF DISUSED DRIP LINES AND SUB-MAINS in soil can be an inevitable outcome of irrigation practices on some vineyards, it is important to CONSIDER THE ENVIRONMENTAL IMPACTS associated with these activities. Good Environmental Management means MINIMISING THE POTENTIAL FOR RISK from contamination of land and water, soil erosion and subsidence and adverse impacts upon fauna and flora. These Guidelines provide one way to consider the risks associated with disposal of excess water via drainage and pumps and the presence of disused drip lines and sub-mains, and outline Aims and Actions to LIMIT ENVIRONMENTAL IMPACTS