

# GUIDELINES FOR THE ESTABLISHMENT AND OPERATION OF CATTLE FEEDLOTS IN SOUTH AUSTRALIA

Second Edition  
February 2006



Government of South Australia  
Primary Industries and Resources SA

**GUIDELINES FOR THE  
ESTABLISHMENT AND OPERATION  
OF CATTLE FEEDLOTS  
IN SOUTH AUSTRALIA;  
SECOND EDITION  
FEBRUARY 2006**

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**SECOND EDITION**

**FEBRUARY 2006**

These Guidelines are a revision of the first edition of the guidelines of June 1994. They have been prepared by the Department of Primary Industries and Resources (SA), the Environment Protection Authority and the Local Government Association of South Australia in consultation with the Australian Lot Feeders Association and the feedlot industry.

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## 1 PREFACE

The cattle lot feeding industry in South Australia is an important sector of the domestic and export beef industries. It delivers all year round production of a product of consistent quality which is readily accepted by its customers, and is an important value adding component to both the beef and grains industries. Feedlots are important influences on regional economies as well as the economy generally.

The number and size of feedlots across Australia is increasing. With this increasing intensity comes the increasingly important duty to ensure minimum interference with the enjoyment of life and property outside the feedlot, and the duty to prevent adverse impacts on the environment. This realisation led to the formation of National Guidelines For Beef Cattle Feedlots in Australia which were aimed at promoting the development of a feedlot industry which is both sustainable and responsive to community expectations. The national Guidelines provide a framework of acceptable principles for the establishment and operation of feedlots in Australia.

State laws and local government guidelines provide the legislative framework for developments in South Australia. They provide more stringent and detailed requirements to take account of specific regional requirements. Laws and regulations concerning developments do change to reflect government policy and community demands. Guidelines need to be revised to reflect the changing requirements.

Customers are becoming more discerning about the way their food is produced. As a consequence the ability of an industry or sector to demonstrate that environmentally friendly production methods are used will be an increasingly important marketing tool. These revised guidelines contain the principles and practices to ensure high standards of establishment and operation of feedlots in South Australia. By implementing the environmental management principles in these guidelines feedlot operators will be able to demonstrate that they are meeting customer requirements as well as their general environmental duty of care.

The guidelines incorporate feedlot industry best management practices and current environmental management requirements. Technical feedlot information used in the revision of these guidelines has been sourced from the National Guidelines For Beef Cattle Feedlots in Australia (2<sup>nd</sup> Edition), the Reference Manual for the Establishment and Operation of Beef Cattle Feedlots in Queensland, the New South Wales Feedlot Manual, National Feedlot Environmental Code of Practice and the Model Code of Practice for the Welfare of Animals - Cattle.

The guidelines are intended to assist orderly development and economic operation of feedlots while minimising their environmental impact. They are not intended to be a legal or statutory document.

It is recommended that these guidelines be used for planning all feedlot developments and be used by planning authorities for evaluating all feedlot proposals.

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## **2 DESCRIPTION OF A FEEDLOT**

### **2.1 Definition of a Feedlot**

A beef feedlot is a confined yard area with watering and feeding facilities where cattle are held and completely hand or mechanically fed for the purpose of production.

This includes any adjoining or nearby area where:

- such cattle are yarded, tended, loaded and unloaded
- the animal wastes from the feedlot are accumulated or treated pending removal or disposal; and
- facilities for feeding such cattle are maintained or in which the feed is stored, handled or prepared.

This definition does not include the feeding or penning of cattle in this way for weaning, dipping or similar husbandry purposes or for drought or other emergency feeding, or at a slaughtering place or in recognised saleyards.

### **Considerations**

A cattle feedlot is a change of land use from agricultural activities to intensive animal keeping.

A cattle feedlot does not include an area where cattle, which have daily access to pasture which is able to sustain more than 50% of their daily feed dry matter intake, are confined for the feeding of supplementary rations.

Supplementary feeding for production or weight gain in a paddock is classed as a feedlot when the paddock is unable to sustain more than 50% of the cattle feed required from pastures or crops which have a yield which is reasonable or commonly accepted for the district.

While a feedlot development may not meet the criteria for accreditation under the National Feedlot Accreditation Scheme (NFAS), it must comply with these guidelines

### **2.2 Feedlot Classes**

To take account of a wide range of possible conditions different classes of feedlots will be authorised which require different management and development standards. A brief description of these classes is provided in Table 1. More details on the design and operational practices relating to these classes are listed in Appendix 2 and Appendix 3.

**Table 1. Description of Feedlot Classes**

Class	Permitted Stock Numbers	Design Standard	Construction Standard	Operation Standard	Pen Floor Construction	Effluent Handling System Essential	Operating Season
1	Limited by separation distances and environmental impacts	High. May be close to impact locations	High	High	Graded & compacted hard pen floor	Yes	All year
2	Limited by separation distances and environmental impacts	High. Removed from impact locations	High	Less stringent than class 1	Graded and compacted hard pen floor	Yes	All year
3	Up to 1000 head depending on separation distances and environmental impacts	Basic  Well removed from impact locations	Basic	Basic	Graded pen floor on clay soils having low, intermediate and high plasticity, clayey sands and clayey gravels. Note:- sandy soils are not suitable as a class 3 pen floor. For all year round feedlots on sandy soils refer to class 1 or 2.	Yes	All year
4	Up to 1000 head depending on separation distances and environmental impacts	Basic  Well removed from impact locations	Basic	Basic	No special preparation	Yes	Opportunity feedlot <b>for dry season operation only.</b>  Annual rainfall less than 500 mm, permitted operation from 1st October to 31st May;  Annual rainfall over 500 mm, permitted operation from 1st November to 30th April
<p>NOTE:- Supplementary feeding for production or weight gain in a paddock is classed as a Class 4 feedlot when the paddock is unable to sustain more than 50% of the cattle feed required from pastures or crops which have a yield which is reasonable or commonly accepted for the district.</p>							

**Note:-** Where the area per Standard Cattle Unit is less than 9 square metres, or exceeds 25 square metres, the feedlot is not eligible for acceptance into the National Feedlot Accreditation Scheme



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### 3 APPROVAL PROCESS

3.1 Under current South Australian planning legislation the term "farming" does not include feedlots which are defined as "intensive animal keeping". Accordingly feedlots are a change of land use from general farming. This change of use requires planning approval from the planning authority, which is generally the local council.

3.2 Proposals for approval of feedlot development should be made to the local council planning authority, with the exception of foreign investments which must proceed as outlined in section 16.

3.3.1 Standard application forms are available from all Councils, the Development Assessment Commission, or can be accessed on the Planning SA web site at [www.planning.sa.gov.au/dev\\_proposals/publications/DevAppForm.pdf](http://www.planning.sa.gov.au/dev_proposals/publications/DevAppForm.pdf)

3.3.2 Appendix 1 shows the typical information that should accompany the application. Additional information may be required for sensitive sites, or to comply with non-feedlot related provisions of the approval process. It is suggested that the requirements are discussed with the Council planning officer before proceeding. As the referral of most feedlot developments to the EPA is mandatory, it is suggested that the EPA also be contacted to establish if they have any specific requirements.

The Minister, if of the opinion that the proposal is of major social, economic or environmental significance, may declare the proposal a Major Development. The Major Development Panel will determine the level of information and assessment required; i.e. Development Report (DR), Public Environmental Report (PER), or Environmental Impact Statement (EIS).

3.3.3 The Council will examine the proposed development and decide:

- the kind of development (complying, non-complying, or development for consideration on merit <sup>5</sup>);
- the relevant authority for the application;
- whether the application needs to be referred to prescribed bodies or other government agencies; and
- whether the public needs to be notified of the application

3.3.4 Council will determine whether consultation or referrals with State agencies are necessary. If a cattle feedlot falls within the criteria defined in Schedules 21 and 22 (activities of environmental significance and major environmental significance respectively) of the Regulations, the application must be referred to the Environment Protection Authority (EPA) for advice and direction respectively.

3.3.4.1 A Council must have regard to the EPA's advice in relation to cattle feedlots of a size defined in Schedule 21, namely:

- (a) *an average of more than 250 but not more than 500 cattle per day over any period of 12 months; or*

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<sup>5</sup> If the development is listed as a complying development the council must grant approval. Developments such as feedlots which are subject to mandatory referral to other agencies can not be a complying development. Non-complying development is also listed in the Council's Development Plan. Whilst a development approval can still be sought it is more difficult to obtain.

Development for consideration on merit refers to any development that is not listed as either complying or non-complying development. It is assessed by the Council having regard to the objectives and principles of development control within the Council's Development Plan.

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(b) *where the yard or area is situated in a water protection area (as declared under Part 8 of the Environment Protection Act 1993)—an average of more than 100 but not more than 200 cattle per day over any period of 12 months,*

The EPA has four weeks to respond.

3.3.4.2 However, the planning authority must comply with any direction given by the EPA in relation to cattle feedlots of a size defined in Schedule 22 namely:

- (a) *not less than an average of 500 cattle per day over any period of 12 months; or*
- (b) *where the yard or area is situated in a water protection area (as declared under Part 8 of the Environment Protection Act 1993)—not less than an average of 200 cattle per day over any period of 12 months,*

In this instance the EPA has six weeks to respond and may direct the Planning Authority to refuse the application.

A map depicting the Water Protection Areas of South Australia is shown in Appendix 4, and a map of the Prescribed Wells Areas, Prescribed Surface Water Areas, and Prescribed Watercourses is shown in Appendix 5.

3.3.5 A feedlot is often a Category 3 development under the Council Development Plan and is subject to general public notification, with attendant appeal rights. This means that a notice must be published in newspapers and public representations received by council regarding the development.

If cattle feedlots are defined as Category 2 developments, only the immediate neighbours have appeal rights. There are no appeal rights for a Category 1 development.

3.3.6 A Council, in deciding whether to grant a development approval, must have regard to:

- (1) the provisions of the relevant Development Plan.

Typical provisions in a Development Plan for a cattle feedlot proposal may relate to:

- The intensity of land use proposed;
  - Impact on adjoining uses: distance from townships and neighbouring dwellings, transmission of disease, need for separation distances, etc;
  - Potential for pollution or other health hazards;
  - Odour: prevailing wind directions, local meteorological conditions, etc;
  - Water: distance from rivers, bores, wells, reservoirs, underground supplies, nutrient loads, surface run off etc;
  - Land: soil deterioration, denudation, waste disposal methods, erosion, dust, etc;
  - Waste facilities and methods of disposal: storage capacities, operation and maintenance of facilities, hygiene standards, disposal of dead animals, pest control, storm water, etc;
  - impact on the amenity of the area: siting, design and appearance of buildings, landscaping, proximity to roads, maintenance, concentration in one locality, etc;
  - Suitability of access, types of vehicles, on-site provision for loading or unloading of vehicles;
  - Suitability of fencing, pens, animal security etc;
  - Site suitability; size of holding, slope, water logged or flood prone, etc;
- (2) any comments by a State agency or a referral body; and,
  - (3) any representations received as a result of public notification and consultation on the

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application.

3.3.7 The Council should make a decision on an application:

- generally, within 8 weeks;
- or if involving a State agency report, within 12 weeks; and
- if involving a referral body, within 14 weeks.

3.3.8 Appeal rights to the Environment, Resources and Development Court may apply for the applicant and third parties who made representations on the application.

Once appeals have been resolved, the development (if approved) may proceed. This process is described in the Planning Approval Flow Chart in Figure 1.

3.3.9 Approvals for development may also be required under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999). Approval will be required if the proposed feedlot

- has, will have, or is likely to have a significant impact on a matter of national environmental significance such as
  - World Heritage Properties
  - RAMSAR wetlands of international importance
  - Listed threatened species and communities
  - Migratory species protected under international agreements
  - The Commonwealth marine environmentand
- The feedlot development is not subject to one of the exceptions. The feedlot does not require approval from the Environment Minister under the Act if:-
  - The feedlot development is approved under, and taken in accordance with, a State management plan that is accredited by the Commonwealth for the purposes of a bilateral agreement,
  - The feedlot development is approved under, and taken in accordance with, a Commonwealth management plan that is accredited by the Environment Minister for the purposes of a Ministerial declaration,
  - The feedlot development has been authorised by a Government decision on which the Minister's advice has been sought.

Documentation on the referral process, including documentation requirements, can be obtained by contacting Environment Australia's Community Information Unit on 1800 803 772, or by accessing the information for proponents website at

<http://www.environment.gov.au/epbc/proponents/proponents.html>

3.3.10 Composting Operations

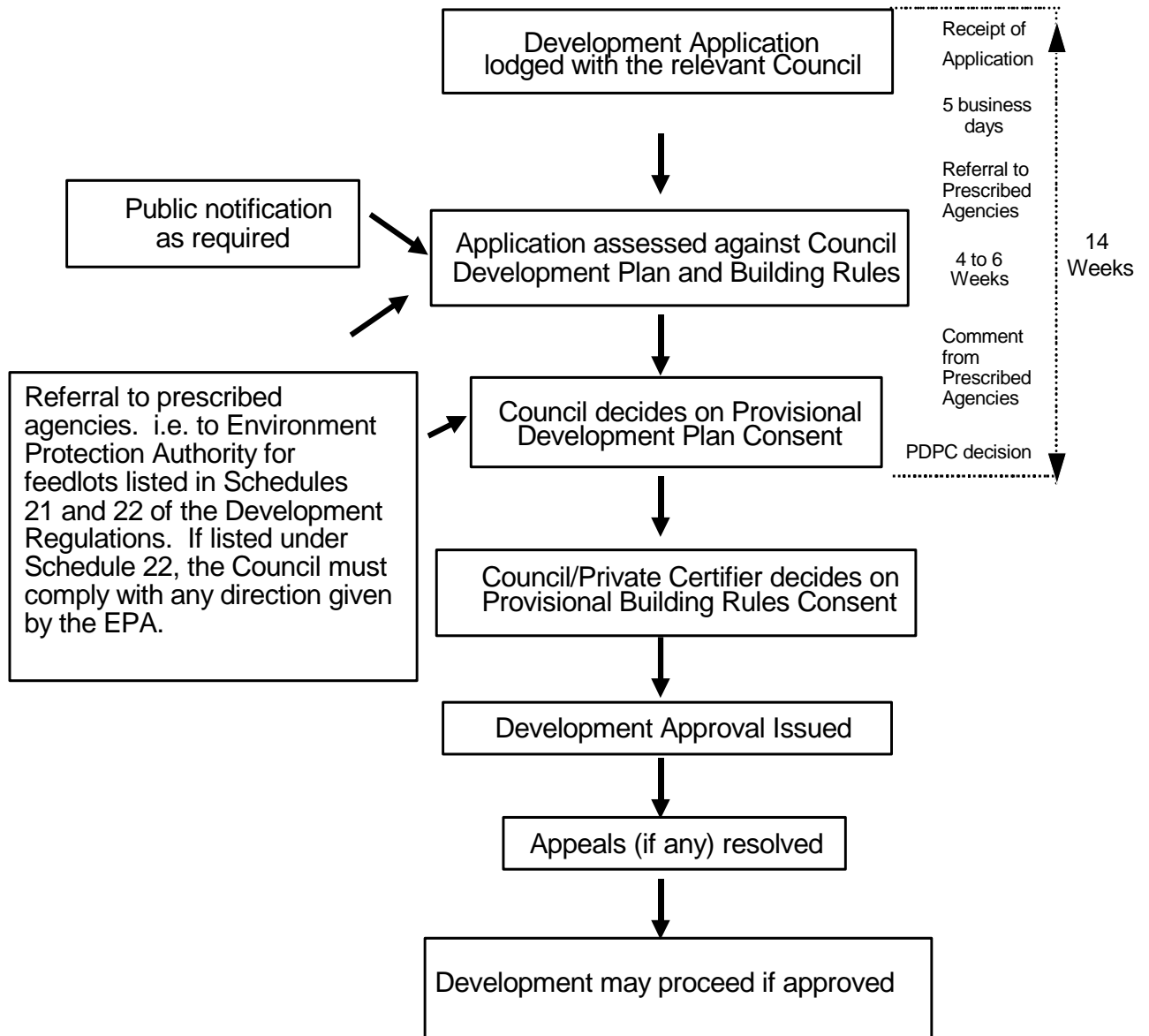
Active composting of waste materials, including pen manure and waste feedstuffs requires planning approval.

Depending on the annual amount of material composted the activity may require licensing by the Environment Protection Authority (EPA). A guide is available from the EPA which identifies the information that should be provided with a development application for a composting facility.

Where more than 20 tonnes of compost may be produced per year the Council must refer the

application to the EPA as part of the assessment process. Facilities producing more than 200 tonnes per year will need to be licensed under the Environment Protection Act, 1993. Facilities producing less than 200 tonnes per year do not need a license.

**FIGURE 1: TYPICAL DEVELOPMENT APPROVAL PROCESS FOR A CATTLE FEEDLOT**



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## 4 PLANNING PRINCIPLES

- 4.1. Cattle feedlots should not create any significant adverse impact, including denudation, erosion, pollution of the environment, nuisance, human health risk, cattle welfare problems or loss of visual amenity. They must be consistent with the relevant planning principles and objectives contained within the Development Plan of the local planning authority.
- 4.2. The feedlot property should be sufficient in area to cater for the sustainable utilisation of effluent as a minimum. Off site disposal of solid wastes may be approved on a case by case basis.
- 4.3. Feedlots should be sited, designed and managed to ensure that unreasonable interference with the comfortable enjoyment of life and property off site does not occur. Consideration should be given to odour and dust emissions, flies and noise exceeding appropriate background levels, as well as off site transport effects.
- 4.4. Feedlots should be sited, designed and managed to ensure that underground water resources and surface water resources do not become degraded by the feedlot development. Consideration should be given to runoff from the feedlot and the manure stockpile, and the effluent irrigation water, effluent irrigation tail-water, and contaminated runoff from the effluent utilisation area.

Feedlots are a non-complying development In the Mount Lofty Ranges Water Protection Area. Their establishment would be considered incompatible with the water harvesting and protection role of the area.

- 4.5. Planning authorities should take account of potential urban encroachment when granting construction approval for the feedlot.
- 4.6. All effluent and other wastes shall be properly managed and disposed of without adverse effects on public health and the environment, including water resources. The nutrient load, salt organic matter of the effluent and manure should be effectively utilised.

Waste disposal on land must take account of the nutrient load of the waste, and be done in a manner which ensures sustainability of the land and the environment. The cropping capacity of the effluent and manure utilisation areas must be maintained or improved, so that the land is not degraded by soil erosion, contamination, structural decline, salinisation or waterlogging.

- 4.7. Solids or liquid wastes should not be spread on the property within the prescribed distance of dwellings, watercourses or roads as described in the section on Separation distances.
- 4.8. All buildings, pens, runs, holding yards and other ancillary structures should be sited as unobtrusively as possible. All animals should be adequately confined within appropriate enclosures and fencing which do not detract from the visual amenity of the locality.
- 4.9. Suitable trees and shrubs should be planted and maintained around buildings, pens, runs, holding yards or other ancillary structures intended for animal husbandry, to screen these activities from adjoining roads and properties.
- 4.10. All facilities should be designed with the welfare of the cattle a consideration.

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## **5 SITE SELECTION**

### **5.1 Planning**

Forward planning is an important aspect of feedlot development. Feed storage, feed mills, pens, drainage and effluent all need to be sited in a logical manner. Most feedlots expand in size within a few years. Therefore it is sensible to plan for future expansion and to ensure a free flow of feed materials and cattle.

### **5.2 Site Selection**

When selecting a site for the feedlot the following aspects must be taken into consideration:

- existing or future residential development, neighbouring homes, and rural community amenity. Sufficient area must be available to maintain separation distances, and allow for future development.
- availability of grains, fodder and cattle
- availability of services such as water, electricity and road infrastructure
- sources of good quality clay and rubble for construction
- the risk of groundwater pollution and prevention of degradation of surface water. A feedlot should not be sited above ground water resources which are considered vulnerable to contamination. Sufficient separation distance must be allowed between the feedlot and surface water resources or waterways. See the section on Separation Distances for more detail.
- the risk of flooding – the feedlot must be above the level of flooding with average recurrence interval of 100 years
- slope – the pen floor should have a slope of between 2 – 6% away from the feed bunks. Slopes are often described as percentages, for example a 3% slope is a uniform fall (or rise) of 3 metres over a horizontal distance of 100 metres. The pen slope may utilise the natural slope of the site, or the slope may be artificially constructed.
- the site must be able to be isolated from external runoff
- sufficient area must be available to operate an effective effluent management system
- sufficient area must be available for the sustainable utilisation of liquid wastes
- sufficient area should be available for sustainable manure utilisation, which may occur on or off site.
- soil types must be suitable for effluent and manure utilisation, and must be able to maintain the agronomic regimes imposed.
- availability of labour and support services
- local meteorology. Rainfall, humidity, wind and temperature all impact on the welfare of the cattle. Site performance characteristics may be modified by installation of shelters, shade, and other structures, but this will increase the cost of construction and management of the feedlot.

### **5.3 Future Expansion**

When establishing a feedlot, attention must be given to future expansion plans. This not only involves careful site selection but also requires a feedlot design that allows expansion at minimum cost and disruption.

Future expansion should be considered in the development application for new feedlots with thought being given to the availability of suitable land for separation distances as they would be required for the future expansion options. Where practical this land should be owned by the

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developer as future change of land use within the separation distance may reduce the opportunity to expand.

An application for staged development can be considered under the Development Act. With prior consultation and agreement with the relevant planning Authority (usually the Council), time frames for completion of a development can be extended under this legislation.

#### **5.4 Community Consultation**

Community consultation in the decision-making process is important in the management of odour. The proponent, as part of the planning process, should recognise and address the public's perceptions and concerns associated with the emitted odours and other environmental concerns. It is usually appropriate to meet with the neighbouring residents and discuss the proposal before a development application is lodged with the appropriate planning authority.

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## **6 ENVIRONMENTAL LEGISLATION IN S.A.**

### **6.1 Water Resources Act 1997.**

In seeking to establish or expand a feedlot a proponent should seek advice from the Department administering the Water Resources Act 1997 as to the availability of water in that location and the approvals required.

The Water Resources Act 1997 is administered by the Department for Water, Land and Biodiversity Conservation on behalf of the Minister for Environment and Conservation.

The Water Resources Act establishes a system for the sustainable use and management of the water resources of South Australia. An essential aspect of the Act is the establishment of water access rights which can be held separately from the land through, over or under which water flows.

Section 7 establishes the right to take water. In a prescribed area of the State authorisation, in the form of a water licence, is required to take water from a prescribed watercourse, lake or well or to take surface water from a surface water prescribed area.

In areas of the State which are not prescribed water must not be taken if to do so would detrimentally affect the ability of another person to exercise the right to take water or would detrimentally affect the enjoyment of the amenity of water in the watercourse or lake by the occupier of the land.

Section 29 establishes the process whereby water licences are granted.

A licence

- must specify the water resource from which the water is to be taken; and
  - must, in the case of a licence endorsed with a water (taking) allocation, specify the part or parts of the resource from which the water may be taken; and
- must be endorsed with a water allocation.
- is subject to conditions prescribed from time to time by regulation and such other conditions as are endorsed on the licence by the Minister; and
- remains in force until the licence is terminated by or under the Water Resources Act; and
- may specify intervals at which the Minister may vary the conditions of the licence.

A licence (including the water allocation of the licence) is personal property vested in the licensee and will pass to another person under Division 3 or (subject to that Division) in accordance with any other law for the passing of property.

A licensee who contravenes or fails to comply with a condition of his or her licence is guilty of an offence. Penalties may be of a financial nature or may result in cancellation, suspension or variation of the licence.

Sections 34 and 35 determine the allocation of water. The water allocation, or a component of the water allocation, of a licence may be obtained from the Minister, from the holder of another licence, or by converting a water (holding) allocation to a water (taking) allocation. The Minister's decision to allocate an amount of water on a licence must be consistent with the relevant water allocation plan. Water allocation plans are prepared in accordance with section 101 of the Act. It should be noted that the Minister, under section 37, may reduce the water allocation endorsed on a licence in order to protect the resource.

### **6.2 Environment Protection Act**



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The Environment Protection Act 1993 (the Act) is the primary pollution control legislation in South Australia. The Objects of the Act seek to ensure that measures are taken to protect, restore and enhance the quality of the environment.

Both the Environment Protection Authority (EPA) and Councils have responsibilities to administer and enforce the provisions of the Act and its policies.

The Act applies to proposed or existing feedlot operations in South Australia in the following ways:

### **6.2.1 General environmental duty**

Section 25 of the Act establishes a general environmental duty which any person undertaking any activity anywhere in the State must comply with. Section 25(1) states that “a person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise environmental harm”. Other parts of this Section qualify how Section 25(1) should be interpreted in any specific situation. For example, the following issues need to be considered in determining what ‘measures’ should be taken to prevent or minimise environmental harm:

- the nature of the pollution (or potential pollution) and the receiving environment;
- the cost of various measures that might be undertaken by the operator within the context of what others do in their industry (or type of industry);
- the current state of technology and likelihood of various measure being successful.

In addition, if a person operates in accordance with the conditions of a licence or an exemption issued under the Act or the provisions of an environment protection policy, the EPA is not likely to take action for any breach of the general environmental duty.

Where the EPA considers that an activity is not being operated in accordance with the general environmental duty an environment protection order can be issued requiring compliance with the duty in a specified manner. Appeal rights exist for operators who are aggrieved by any order which may be issued to them.

### **6.2.2 Licensing**

Under Schedule 1 of the Act feedlots are defined as an activity of major environmental significance and as such need a licence if they:

- feed an average of 500 or more cattle per day over any period of 12 months; or
- feed an average of 200 or more cattle per day over any period of 12 months where the feedlot is situated in a water protection area (see Appendix 4).

The application for a licence must be made to the Environment Protection Authority. When the complete application is received, the proposed development must be advertised as required under the Act. A licence, with appropriate operating conditions, may then be issued.

A licence may only be granted if the development has valid development approval. If the development has received approval through the process described in Section 3 of these guidelines, with referral to the EPA under Schedule 22 of the Development Regulations 1993, the EPA must grant the licence.

When a licence is issued under the Environment Protection Act 1993, it will contain conditions for its ongoing operation and management. These may include conditions for ongoing monitoring and reporting of environmental factors.

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### 6.2.3 Environment Protection (Water Quality) Policy 2003

The Environment Protection (Water Quality) Policy 2003 (hereafter referred to as the Water Quality Policy) applies to all surface water and groundwater resources within South Australia. The Water Quality Policy establishes a number of important obligations, including:

- the need for a person undertaking an activity to take all reasonable and practicable measures to avoid the discharge of waste from that activity into any surface or groundwaters, or onto land in a manner which is likely to lead to the entry of waste into any surface or groundwaters;
- the need to avoid the discharge of a pollutant (including nutrients, microbes, sediment and organic matter) into any surface or groundwaters which leads to the exceedance of specified water quality criteria for particular water bodies;
- the need to avoid any discharge of certain types of pollutants (including washdown from animal enclosures and animal faeces) from entry into any surface or groundwaters, or onto land in a manner which is likely to lead to the entry of waste into any surface or groundwaters; and
- the need to locate, design, construct and operate wastewater storage lagoons according to specified criteria.

The Water Quality Policy also requires the operator of cattle feedlot to ensure that their premises incorporates a wastewater management system and that such a system is effectively operating while cattle are held in a feedlot situation.

Expiation notices can be issued or prosecution action taken by the EPA for breaches of most provisions in the Water Quality Policy. In addition, the EPA can issue environment protection orders requiring compliance with the provisions of the Policy in a certain manner and within a specified time frame.

More information on the Water Quality Policy can be found on the EPA web site at <http://www.epa.sa.gov.au/water.html>

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## 6.2.4 Summary of Environmental Legislation

A summary of environmental legislation that affects primary production in South Australia is available from Primary Industries and Resources SA. The purpose of the Summary is to provide a first point of reference to legislation that is relevant to and may affect their activities. The Summary is not intended to be a substitute for legal advice on individual situations.

The Summary identifies generic primary industry activities, cross-references those activities to relevant legislative provisions and requirements and provides comments on the intention, operation and implications of the legislation and regulations.

The topics addressed in the Summary of Legislation are:

### Volume 1

- Water management
  - Water quality
  - Irrigation
  - Groundwater use
  - Farm dam development and use
- Natural Resources and Biodiversity management
  - Native vegetation clearance
  - Protection of flora and fauna
- Soil management
  - Soil conservation
  - Soil contamination

### Volume 2

- Managing Waste
  - Organic farm waste
  - Chemical waste
- Noise and Odour Control

### Volume 3

- Chemical management
  - Agricultural chemical use
  - Dangerous chemicals
  - Use of veterinary chemicals
  - Fertiliser usage
- Stock and crop protection
  - Pest plant, vermin and disease control
- Genetic improvement
  - Genetically modified food sources

### Volume 4

- Grazing management
  - Stock control
  - Protection of native vegetation
- Fire management
- Development controls and heritage protection
  - Development control
  - Cultural heritage

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## **Volume 5**

- Land based aquaculture
  - Aquaculture regulation
  - Pollution and waste management
  - Water use
- Forestry

Each section of the Summary of environmental legislation addresses issues such as:

- Principal obligations
- Definitions
- Enforcement
- Licensing requirements
- Appeals and compensation
- Offences and penalties
- Additional references

The Summary of legislation is available in both print and Compact Disk (CD) forms

For further information, contact:

The Manager, Environmental Policy

Agriculture, Food and Fisheries Division, PIRSA

Ph: 08 8463 3191      Fax: 08 8463 3197

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## 7 MONITORING AND REPORTING

### 7.1 General Requirement

All feedlots should have a planned program of monitoring and recording activities in the feedlot to prevent or minimise breakdowns which have the potential to cause environmental harm or animal welfare problems. Ideally this program should be developed in conjunction with appropriate authorities and reviewed periodically. Key parameters will vary with the size of the feedlot but could include rainfall, feeding regimes, pen cleaning patterns, cattle turnover, sickness, deaths, local complaints etc.

Where feedlots, in the opinion of the Local Council or relevant State agency, are causing objectionable pollution or cruelty to animals, or are located at a sensitive site they should be subject to additional requirements for on-going monitoring and control. Monitoring of ground-waters for the build up of nutrients may be necessary.

All feedlots accredited under the national Feedlot Accreditation Scheme (NFAS) must have a planned programme of monitoring and reporting.

### 7.2 National Pollutant Inventory (NPI)

The National Pollutant Inventory (NPI) is a database designed to record the types and amounts of certain substances being emitted to the air, land and water.

Larger Australian facilities have been progressively required to estimate and report annually their emissions for the NPI. The first reporting period started on July 1 1998. Estimates of emissions from smaller industry, households and everyday activities are made by State and Territory environment agencies and are also be listed on the database.

#### 7.2.1 Industry Handbook for Beef Feedlots

Industries for which an Industry Handbook has been published are required to report on emissions. An industry Handbook consists of the NPI Guide and one or more Emission Estimation Technical Manuals. An Intensive Livestock (Beef Cattle) Handbook has been published and it includes the Emission Estimation Technical Manual for Intensive Livestock – Beef Cattle. The manual is available for downloading from the web site [http://www.npi.ea.gov.au/handbooks/approved\\_handbooks/fbeef.html](http://www.npi.ea.gov.au/handbooks/approved_handbooks/fbeef.html).

If a feedlot

- uses more than a certain amount of one or more substances on the NPI reporting list, or
- consumes more than a specified amount of fuel or electric power, or
- emits more than a certain amount of nitrogen or phosphorus to water

then the feedlot is required to estimate and report emissions of those substances to the Environment Protection Authority in South Australia.

Ninety (90) substances are currently listed for reporting. They are listed in a range of categories. The full list is available from the web site [http://www.npi.ea.gov.au/about/list\\_of\\_subst.html](http://www.npi.ea.gov.au/about/list_of_subst.html).

Category 1 contains a broad range of substances (most substances on the NPI reporting list fall into Category 1). They are typically present in materials used for production purposes. If the feedlot facility uses 10 tonnes or more per year of a Category 1 substance, an emission estimation of that Category 1 substance must be reported. Reporting of category 1 substances is based on usage, rather than emission. Some Category 1 substances are also Category 2a or 2b substances and therefore have more than one threshold. Emissions from all sources must be reported if any

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threshold is tripped.

### 7.2.2 Feedlot NPI Substance Reporting Thresholds

A beef feedlot potentially has NPI reporting requirements associated with the following reporting thresholds:

- **Category 1 – Ammonia from animals.** Substances listed under categories 1 and 1a have limited use as inputs to a beef cattle feedlot. The minor quantities of chemicals used for cleaning and veterinary purposes are unlikely to exceed the 10 tonnes per year trigger level for reporting. Most feedlots, however, are likely to trigger the reporting requirement for ammonia. ***In general if the capacity of a feedlot exceeds 122 SCU, the ammonia threshold of 10 tonnes per year will be exceeded.***
- **Category 2 – Emissions to air associated with fuel combustion.** The category 2a threshold for fuel usage is triggered if

- More than 400 tonnes of fuel or wastes are burned per year; or
- More than 1 tonne of fuel or waste is burned within one hour

The category 2b threshold is triggered if

- More than 2000 tonnes of fuel or waste is burned per year; or
- More than 60,000 megawatt hours (MWh) of energy is used per year; or
- Maximum power consumption is 20 megawatts or more at any time

- **Category 3 – Total Nitrogen and Total Phosphorus releases to surface water.** Total nitrogen and total phosphorus only have to be reported if they are emitted to rivers, creeks, or other water bodies. Water bodies include water courses which only flow intermittently. If effluent from the feedlot operations reaches water bodies and exceeds the thresholds of 15 tonnes total nitrogen or 3 tonnes total phosphorus per year then the amount emitted has to be estimated and reported.

More details on reporting requirements, substance thresholds, and emission estimation techniques are available in the Industry Handbook and from the NPI web site.

### 7.2.3 Useful information

The booklet guide to reporting is available for downloading from the web site <http://www.npi.ea.gov.au/handbooks/guidetoreporting.html>.

Reporting forms are available for downloading from the web site [http://www.npi.ea.gov.au/handbooks/pubs/99\\_00reportingform.pdf](http://www.npi.ea.gov.au/handbooks/pubs/99_00reportingform.pdf)

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## 8 SITE PREPARATION & PEN FLOOR MANAGEMENT

The feedlot site needs sufficient area to cater for feed pens, lanes, yards, holding pens, feed processing, effluent ponds, parking etc. This does not take into account separation distances around the feedlot.

The design, construction and management of the pens should aim to achieve the following objectives:-

- Reduce the time that the pen floor takes to dry out after rainfall
- Reduce the strength and duration of odour emission
- Reduce dust emissions
- Maintain the health and welfare of the cattle
- Improve animal production.

Pen rows should run parallel with the contour of the site to minimise pen to pen drainage. The maximum acceptable pen to pen drainage occurs when the cross slope is equal to the slope down the pen.

### 8.1 Feed Troughs

Feed trough length will depend on the number of cattle to be fed within the pen. Cattle of 600 kg live-weight require a minimum of 300 mm of trough space when fed once daily. More frequent feeding will allow the trough space per head to be reduced. A minimum of 150 mm for young cattle and 180 mm for steers and bullocks is recommended.

Feed troughs should be on the high side of the pens. Feed troughs should be constructed of durable material which is not easily damaged and can not be moved by the cattle. They should have an internal profile which can be easily cleaned, and the external sides should meet the ground at right angles to prevent manure and spilt feed accumulating beneath the trough. The ends should be open, and long runs of troughs should include drainage points to allow drainage after rainfall.

### 8.2 Self Feeders

Self feeders usually require filling once or twice a week. A space allowance of 75 – 100 mm per head should be allowed. Self feeders should be placed at the top of the pens with their long axis perpendicular to the fence. They should be filled from outside to avoid access problems in wet weather.

### 8.3 Water Troughs

Access to an adequate supply of good quality water is essential for the survival, welfare and performance of feedlot cattle. At least 30 mm of trough length per head should be provided. Low volume shallow troughs are preferred to minimise the amount of wastewater which is generated during cleaning. A good quick supply of water is essential for low volume troughs.

Water troughs should be in the lower half of the pens, with provision for any spillage and water discharged during cleaning to drain directly to the drainage system to avoid creating wet spots. This may be done by locating the drainage bung in the bottom fence of the pen, or installing an underground sewer drain, or a concreted surface drain to convey the water away from the pen.

Water troughs should have vertical external sides which meet the ground at right angles to prevent manure accumulating beneath the trough. A solid frame should be constructed over the trough to

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prevent cattle climbing in. A solid cover over the float valve is essential.

#### **8.4 Aprons**

Reinforced concrete aprons of at least 2.5 metres in width should be provided along all feed troughs, self feeders and water troughs. The apron should slope away from the feed or water and should be able to support the passage of pen cleaning machinery.

#### **8.5 Pen Slope**

A smooth, consistent pen slope is very important in promoting the runoff of storm water. Pens should not be constructed with slopes of less than 2% as the drainage of rainfall will be ineffective. The ideal is considered to be 3 – 4%. As slopes increase there is a greater risk of transport of manure into the drains and sedimentation system after rainfall. It is preferable to harvest manure from the pens rather than the drains and sedimentation system where it takes longer to dry out and creates stronger and longer lasting odours.

The length of flow down slope should be a maximum of 65 metres to limit the distance cattle must move to feed and minimise erosion. Pen depth should be decreased for steeper slopes – for every 1% of slope greater than 3% the maximum pen depth should decrease by 5 metres. For example pens on a 4% slope should not exceed 60 metres in depth, on 5% should not exceed 55 metres, and on 6% should not exceed 50 metres.

#### **8.6 Aspect**

A northerly aspect is most desirable for maximising exposure to winter sun and providing some shelter from cold southerly prevailing winds. However, if shade is to be installed, a north-south orientation of the rows will make installing shade structures easier.

#### **8.7 Pen Floor Construction**

Well constructed and managed pen floors, in conjunction with good pen cleaning practices, increase animal productivity.

The pen floor must not break down during winter. The following general specification for pen floor construction is the minimum preparation for class 1 and 2 feedlots. This method is also suggested for class 3 feedlots where the natural soil is suitable, ie clays having low, intermediate and high plasticity, clayey sands and clayey gravels.

- The area should be cleared of trees, scrub, and stumps. Tree roots should be grubbed to 300 mm below natural ground surface.
- Topsoil should be stripped from the area and stockpiled for later reclamation work.
- All holes should be back-filled with suitable clay or gravel
- If the exposed material is of a suitable quality for pen floor foundations ie clays having low, intermediate and high plasticity, clayey sands and clayey gravels, the area should be ripped, brought to optimum moisture level for compaction, and compacted to 95% of standard maximum laboratory dry density with a suitable roller.
- Cut, fill and grade the foundation to a smooth 3 – 6% slope away from the feeding areas.
- The top 300 mm surface fill should consist of a suitable gravelly clay to provide a sufficiently durable pen surface. This should be laid in even layers having a maximum thickness of 200 mm prior to compaction, brought to optimum moisture level for compaction, and compacted to 95% of standard maximum laboratory dry density with a



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suitable roller.

For feedlots built on sandy soils the following method is suggested for the construction of the pen floor foundation

- The area should be cleared of trees, scrub, and stumps. Tree roots should be grubbed to 300 mm below natural ground surface.
- All holes should be back-filled with coarse sand.
- The sand base should be graded, watered and compacted to form a smooth 3 – 6% slope away from the feeding area
- The top 450 mm surface fill should consist of a suitable gravelly clay to provide a sufficiently durable pen surface. This should be laid in even layers having a maximum thickness of 200 mm prior to compaction, brought to optimum moisture level for compaction, and compacted to 95% of standard maximum laboratory dry density with a suitable roller.

### **8.8 Manure / Soil Interface Layer**

Experience has shown that the winter climate in southern Australia is not suited to the development and maintenance of a manure/soil interface layer. This layer can be developed in feedlots in summer rainfall regions where high evaporation assists drying of the pad. In these situations the interface layer acts as an impermeable seal on the pen floor, preventing infiltration of water and nutrients into the soil beneath the pens.

In South Australia it is now recommended that all manure be removed from pens during cleaning, leaving the compacted pen floor exposed and clean.

### **8.9 Fences and gates**

Pen fences should be at least 1.4 metres high, although higher fences may be required for excitable cattle. The posts may be of steel or timber, and should be set into the ground at least 900 mm, and at least 3.2 metres apart to facilitate cleaning under the fences.

Fences constructed with cable are stronger than wire or barbed wire fences, and minimise hide damage. Top rails and belly rails improve the strength of the fence, and increase its operational life. The bottom cable or wire should be 400 mm above the pen surface to enable under fence cleaning with a push bar.

Gates should be of solid construction, preferably of welded steel pipe. Gates constructed in this way are heavy and may require the posts to which they are attached to be supported with an overhead frame. This frame must be high enough so that pen cleaning equipment can pass beneath.

Gates should be long enough to block the cattle laneway when open. Gateways should be set at an angle so that tight turns into pens are avoided.

### **8.10 Laneways**

Lane widths of between 4 and 5 metres are generally suitable for moving cattle and machinery into and out of pens. Wider laneways increase the risk of cattle turning around, while narrower laneways restrict the access by cleaning machinery.

Laneway fences should be constructed with cable or plain wire. The use of barbed wire or electric wires should be avoided.

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## 9 SEPARATION DISTANCES

### 9.1 General

The environmental impacts of a cattle feedlot such as water quality degradation, dust and odours can be controlled firstly by good feedlot design and management practices and secondly by restricting cattle numbers and maintaining suitable separation between feedlots and impact areas. All activities which are likely to cause the increased emission of odours, such as manure spreading or effluent irrigation, should be performed when the prevailing weather conditions and the time of day will cause the least odour emission and impact on sensitive receptors.

These guidelines provide a system of classification which will allow cattle numbers to be varied according to the management standards, proposed and achieved. The distance which the feedlot must be from impact areas is not increased proportionally to the numbers of cattle being held but more in accordance with the probable pattern of odour dispersal. This means that large feedlots are not sited unnecessarily long distances away from impact areas.

The system described in the guidelines will assist planning authorities to provide tangible benefits to operators with proven satisfactory performance, and conversely downgrade the classification of the feedlot and reduce cattle numbers if standards of operation decline. Importantly the adoption of the separation distance and cattle numbers system will assist in minimising the environmental impact of feedlots.

Separation distances relating to a feedlot development consist of two components -

- Fixed distances, which relate to geographic features of the location and
- Variable distances, which relate to the feedlot size, management, waste management, climate and topography
- In some cases where there is complicated terrain or unusual meteorological factors, or there are other significant odour sources nearby, then it may be more appropriate to determine the potential odour impact by odour source modelling.

### 9.2 Fixed Separation Distances

Fixed separation distances shall be the least horizontal distance between the boundary of the feedlot complex and each of the relevant features as shown in Table 2.

**Table 2. Fixed Separation Distances**

Public road - except as below	200 m
Public road - unsealed with less than 50 vehicles per day excluding feedlot traffic	50 m
Major watercourse	200 m
Other watercourse as defined by a blue line on a 1:50000 current SA Government topographical map	100 m
Property boundary	20 m

### 9.3 Variable Separation Distances 1

Variable separation distances are based on the dispersion of odours from their source. They are

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used to determine allowable cattle numbers and management practices necessary to satisfy adopted air quality objectives. A weighting scheme has been used to allow for different types of premises affected by odour.

### 9.3.1 Number of cattle and size of separation distance

The following equations provide estimates of the maximum allowable standard cattle numbers **N** at any one time for a site at distance **D** metres from an impact zone **or** the distance for a specified number of standard cattle.

#### Equation 1. Allowable cattle numbers.

$$N = (D \div S)^2$$

OR

#### Equation 2. Separation distance calculation

$$D = \sqrt{N \times S}$$

N = Maximum number of standard cattle units at any one time.

D = Separation distance in metres between the closest points of the feedlot, including the pens, manure storage areas, effluent system and loading or unloading facilities and the most sensitive receptor or impact location

S = Composite Site Factor (= S1 x S2 x S3 x S4)

The factors S1, S2, S3, and S4 relate to stocking density, receptor type, topography and vegetation and can be determined from Tables 4, 5, 6, and 7 respectively.

The cattle numbers **N** referred to in equations 1 and 2 are Standard Cattle Units (SCUS). A Standard Cattle Unit is defined as a beast of 600 kilograms live weight.

Different feedlots cater for different size cattle or a range of cattle sizes. Larger cattle usually produce more manure than smaller cattle, and hence have a greater potential for odour production. The guidelines allow the manure and odour potential of different weight cattle to be derived from SCUs by the use of Table 3.

Table 3.

Standard Cattle Units Conversion Table

Live - Weight of Beast (kg)	Number of Standard Cattle Units
750	1.18
700	1.12
650	1.06
<b>600</b>	<b>1.00</b>
550	0.94
500	0.87
450	0.81
400	0.74
350	0.67
300	0.59

### 9.3.1.1 Live Weight

The cattle numbers are calculated using Table 3 and the appropriate live weight for the feedlot. The appropriate live weight to be used for a feedlot will be the **maximum average live weight** which will occur at any time during the year. For feedlots operating all year round with regular cattle turnoff this will be the average live weight of cattle on feed. For feedlots with one draft of cattle, or feedlots operating on an “all in – all out” basis the weight to be used will be the turnoff weight.

If the appropriate weight is between the weights listed in Table 3, the weight must be rounded up to the next highest value.

For example a maximum average live weight of 420 kg is rounded up to 450 kg which is equivalent to 0.81 SCUs. If equation 1 allows a site to have 1000 SCUs, the equivalent number of 420 kg animals is 1,235.

The number of Standard Cattle Units held at any one time at the feedlot can be calculated from the relationship  $SCU = N \times Cs$ , where

SCU = number of Standard Cattle Units

N = the number of cattle at the feedlot

Cs = conversion factor of average live weight of cattle to Standard Cattle Units – see table 4. The average live weight for the feedlot is determined by weighing or feedlot management records.

#### Example calculation

A cattle feedlot starts 80 cattle per week at an average live weight of 350 kg, and turns off 76 cattle per week (after losses and culls) at 450 kg. Feedlot records show that the following cattle are on feed:-

100 starter cattle at average 350 kg = 35,000 kg

100 week 1 cattle at average 355 kg = 35,525 kg

100 week 2 cattle at average 364 kg = 36,400 kg

99 week 3 cattle at average 374 kg = 37,006 kg

96 week 4 cattle at average 384 kg = 36,859 kg

96 week 5 cattle at average 394 kg = 37,867 kg

96 week 6 cattle at average 405 kg = 38,909 kg

96 week 7 cattle at average 417 kg = 39,984 kg  
 96 week 8 cattle at average 428 kg = 41,059 kg  
 96 week 9 cattle at average 439 kg = 42,134 kg  
 96 finished cattle at average 450 kg = 43,210 kg.

The total weight of cattle on feed is 423,954 kg for the 1071 head. The average weight is 396 kg, which is equivalent to 0.74 SCU. The SCU stocking rate for the feedlot is 1071 head x 0.74 = 793 SCU.

### 9.3.2 Composite Site Factor - S

The value of S to apply in equations 1 or 2 depends on site specific information pertaining to the proposed stocking density, population centres or homes and intervening terrain factors.

#### Composite Site Factor Tables.

Table 4 – Value of S1			
Stocking Density (m <sup>2</sup> /standard cattle unit)	Feedlot Class		
	1	2	3 & 4
10	95	128	158
11	92	123	152
12	88	118	146
13	85	113	140
14	82	108	133
15	78	103	127
16	74	98	121
17	70	93	115
18	67	88	109
19	62	83	102
20 & over	58	78	96

Table 5 – Value of S2	
Receptor type	Value
Large towns >2000 persons	1.6
Towns >100 persons	1.2
Small towns >20 persons	1.0
Rural Residential (intensive)	1.0
Rural residential (extensive)	0.7
Rural farm residence	0.3
Rural school	0.3
Rural Church/Community Centre	0.2
Public area (minimum value)	0.05

Table 6 – Value of S3	
Topography	Value
High relief at > 10% from site	0.7
Low relief at > 2% from site	1.2
Valley drainage zone	2.0
Flat	1.0

Table 7 – Value of S4	
Intermediate Landscape	Value
Few trees, long grass, crops	1.00
Undulating hills	0.93
Level wooded landscape	0.85
Heavy Timber	0.77
Significant Hills and Valleys	0.68

Note: Manure stockpile areas should be regarded as feedlot pens for the purpose of applying separation distances.

For large feedlots with complex topographic or meteorological features or other significant odour

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sources nearby, then it may be more appropriate to determine the potential odour impact by odour source modelling. On site meteorological data may be required.

These calculations need to be undertaken for all types of sensitive receptors (and likely future sensitive receptors) to ensure that appropriate separation distances are provided.

### 9.3.3 Application of Site Factors

#### Stocking Density Factor, S1

The factor S1 for each class of feedlot will vary with the stocking density proposed and is determined from Table 4.

The stocking density is considered as the minimum area available per standard cattle unit held in the pen. The minimum area likely to be approved on animal welfare grounds in open yard feedlots is 10 m<sup>2</sup>/SCU. If stocking density is not an integer value, it is rounded to the nearest integer value. For stocking densities which allow an area of 20 m<sup>2</sup> or more per SCU the 20 m<sup>2</sup>/SCU value is used.

#### Receptor Factor, S2

The factor S2 will vary depending on the likely receptor and is determined from Table 5.

The sensitive receptor may be a neighbour's house, small town or large town that may be affected by odour generated at the feedlot.

For a town the distance is measured from the closest point of the proclaimed town boundary. For a rural farm residence, the distance is the closest part of the residence itself, excluding any yards.

Rural residential (or rural living) developments result from land subdivision into blocks of land which are larger than town residential blocks but smaller than traditional commercial agriculture. This usually results in houses being spaced closer than farming residences but further apart than in towns and cities. Where more than 5 rural residential blocks adjoin each other they can be considered a rural residential development.

**Intensive residential developments** are defined as individual blocks of less than 1 hectare.

**Extensive residential developments** are individual blocks which range from 1 – 10 hectares.

Public areas are those subject to occasional community use. Higher values are appropriate for public areas used frequently or sensitive in nature such as schools and frequently used halls and recreation areas.

#### Terrain Factor, S3

The terrain factor S3 varies according to topography and is determined from Table 6. This factor is primarily concerned with air drainage flow paths at night time (the katabatic wind effect), or the impact of low level night time temperature inversions.

High relief is regarded as up-slope terrain or a hill that projects above the 10% rising grade line from the feedlot. Thus the receptor location will be either uphill from the feedlot or be behind a significant obstruction which would deflect low velocity air movement away from the receptor.

Low relief is regarded as terrain which is generally below the 2% falling grade line from the feedlot. Thus the receptor will be downhill from the feedlot.

A valley drainage zone has topography at low relief (as above) with significant confining side walls.

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Topographical features of the selected site may adversely affect the odour impact under certain circumstances. During the early evening or night time under low wind speed conditions, population centres located in a valley complex at a lower elevation than a feedlot may be subject to higher odour concentrations as a result of down-valley wind or the occurrence of low-level inversions. Unless site specific information has been gathered under conditions dominated by low wind speeds, the value for the factor S3 given in Table 6 should apply.

### **Vegetation and Surface Roughness Factor, S4**

The factor S4 will vary according to vegetation density and intervening topography and is determined from Table 7.

The tree cover may disappear during the life of the feedlot requiring a change in cattle numbers at that time.

Upper storey and lower storey tree cover should not provide shade for confined stock but act as a buffer promoting odour dispersion. The congregation of stock in shaded areas results in the formation of wet patches and a subsequent increase in odour generation potential. The values suggested for S4 given in Table 7 for tree covered areas should be used with care by regulatory bodies and a number of provisions should qualify an approval given on this basis. For example, no concession should be given for an intention to plant a barrier, and should an occupier fail to maintain a stipulated barrier then a reduction in the allowed number of cattle would be necessary. However, operators should be encouraged to plant and maintain upper storey and lower storey vegetation which would not cast shadows on to the feedlot. This will modify wind speed through the feedlot, improve visual amenity, odour dispersion, dust reduction and noise attenuation.

### **Descriptions of Vegetation and Topography Factors:-**

**Few Trees, Long Grass, Crops** This is essentially open, flat country and a light scattering of timber and a permanent covering of tall grass. The essential vegetation is distributed continuously across the separation distance. Isolated clumps of trees or cropping land also fit into this category.

**Undulating Hills** Generally low level rolling terrain, with no significant vegetation. If significant vegetation exists the values for wooded or timbered country may apply.

**Level wooded landscape** This is open forest country with trees at least 4 metres high, and in which the tree density is not sufficient to form a complete canopy, but is able to influence air movement. Lower storey vegetation would commonly be absent or sparse. This description does not apply to scattered clumps of trees. The density is such that the vegetation can be considered as a continuous belt.

**Heavy Timber** This is a forest with dense stands of tall timber forming a complete canopy. There is limited understorey. The trees must be at least 4 metres tall and cover the greater of at least 400 metres or 60 percent of the distance between the feedlot and the receptor.

**Significant Hills and Valleys** This describes the situation where one or more lines of hills which are sufficiently large to influence air movement exist between the feedlot and the receptor.

### **Example Calculations**

**Example 1:-** *A proposed class 1 feedlot of 5000 head operating all year round with regular turnoff of cattle, average live weight at entry 400 kg, average live weight at turnoff 550 kg, and stocking density 14 m<sup>2</sup>/beast near a rural residence, on a flat site with no significant tree cover.*

The **maximum average live weight** which will occur for feedlots operating all year round with regular cattle turnoff will be the average live weight of cattle on feed. The average live weight of

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cattle on feed will be

$$(400 + 550) \div 2 = 475 \text{ kg.}$$

Cattle of 475 kg live weight are equivalent to 0.87 Standard Cattle Units each (Table 3). Therefore the 5000 head are equivalent to  $5000 \times 0.87 = 4350$  Standard Cattle Units. The planned stocking density for the 5000 head is  $14 \text{ m}^2/\text{head}$ , which is equivalent to  $14/0.87 = 16.1 \text{ m}^2$  per Standard Cattle Unit.

The site factors are

<b>S1</b>	=	74	(Table 4: Class 1 with $16 \text{ m}^2/\text{SCU}$ )
<b>S2</b>	=	0.3	(Table 5: Rural farm residence)
<b>S3</b>	=	1.0	(Table 6: Flat topography)
<b>S4</b>	=	1.0	(Table 7: Few trees, long grass, crops)

Using Equation 2  $D = \sqrt{N \times S}$ , the minimum distance of the feedlot from a rural residence is:

$$\begin{aligned} D &= \sqrt{4350 \times 74 \times 0.3 \times 1.0 \times 1.0} \\ &= 1464 \text{ metres.} \end{aligned}$$

**Example 2:- A proposed class 2 feedlot operating all year round with regular turnoff, average live weight at entry 500 kg, average live weight at turnoff 800 kg, with stocking density  $18 \text{ m}^2/\text{beast}$  and 2500 metres from a town of greater than 100 people on flat terrain and light tree cover in cropping land.**

The **maximum average live weight** which will occur for feedlots operating all year round with regular cattle turnoff will be the average live weight of cattle on feed. The average live weight of cattle on feed will be

$$(500 + 800) \div 2 = 650 \text{ kg.}$$

Cattle with a live weight of 650 kg are equivalent to 1.06 Standard Cattle Units each (Table 3). The area of  $18 \text{ m}^2/\text{beast}$  is equivalent to  $18.1/1.06 = 17 \text{ m}^2/\text{Standard Cattle Unit}$ .

The site factors are

<b>S1</b>	=	93	(Table 4: Class 2 with $17 \text{ m}^2/\text{SCU}$ )
<b>S2</b>	=	1.2	(Table 5: Town >100 persons)
<b>S3</b>	=	1.0	(Table 6: Flat topography)
<b>S4</b>	=	1.0	(Table 7: Few trees, long grass, crops)

Using Equation 1  $N = (D \div S)^2$  the maximum number of cattle allowed is

$$\begin{aligned} N &= [2500/(93 \times 1.2 \times 1.0 \times 1.0)]^2 \\ &= 502 \text{ Standard Cattle Units} \div 1.06 \text{ (SCU conversion factor Table 3.)} \\ &= 474 \text{ head.} \end{aligned}$$

**Example 3:- A proposed class 4 feedlot operating for one draft of cattle per year, average live weight at entry 400 kg, average live weight at turnoff 550 kg, with stocking density  $20 \text{ m}^2/\text{beast}$  and 5000 metres from a town of greater than 100 people on flat terrain and light tree cover in cropping land.**

The **maximum average live weight** which will occur for feedlots with one draft of cattle will occur



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when all the cattle are at turnoff weight. The weight of cattle for this determination is therefore 550 kg.

Cattle with a live weight of 550 kg are equivalent to 0.94 Standard Cattle Units each (Table 3). The area of 20 m<sup>2</sup>/beast is equivalent to 20/0.94 = 21.3 m<sup>2</sup>/Standard Cattle Unit.

The site factors are

<b>S1</b>	=	96	(Table 4: Class 4 with 20 or more m <sup>2</sup> /SCU)
<b>S2</b>	=	1.2	(Table 5: Town >100 persons)
<b>S3</b>	=	1.0	(Table 6: Flat topography)
<b>S4</b>	=	1.0	(Table 7: Few trees, long grass, crops)

Using Equation 1  $N = (D \div S)^2$  the maximum number of cattle allowed is

$$\begin{aligned} N &= [5000 / (96 \times 1.2 \times 1.0 \times 1.0)]^2 \\ &= 1884 \text{ Standard Cattle Units} \div 0.94 \text{ (SCU conversion factor Table 3.)} \\ &= 2004 \text{ head.} \end{aligned}$$

## 9.4 Variable Separation Distances 2

### 9.4.1 Effluent treatment systems or land disposal areas

Adequate separation distances must be preserved between all effluent treatment systems or land disposal areas and sensitive features. They are in addition to the separation distances for the feedlot as described above and are calculated separately using Tables 8 and 9. The separation distances reflect the standard of treatment or method of disposal. Significant reductions in separation distances accrue from those effluent treatment systems and waste disposal methods which reduce the production of odours.

Distances are measured from the edge of the effluent treatment systems or the effluent disposal area.

#### Effluent treatment systems

Normally the effluent treatment systems are adjoining or near to the feedlot in which case the effluent treatment systems separation distances are satisfied by the separation distances determined from Equations 1 or 2 (section 9.3.1) except for the requirements for separation distances from roads, water courses and property boundaries detailed in Table 8.

Separation distances between effluent treatment systems which are remote from the feedlot itself, and homes which are not under the control of feedlot management are detailed in Table 8.

The separation distances are detailed for the following effluent treatment systems.

System A	Settlement lagoon, and aerobic lagoon
System B	Settlement lagoon and anaerobic lagoon
System C	Anaerobic lagoon only
System D	Runoff straight to pasture
	Sludge drying beds
	Drying lagoons

More advanced systems of effluent management and treatment have been employed in other parts of the world. They can reduce the environmental risk and environmental nuisance of handling feedlot effluent. The adoption of more advanced treatment systems for feedlot effluent are encouraged, and will be assessed on a case by case basis.

**Table 8 Separation distances surrounding effluent treatment systems**

EFFLUENT TREATMENT SYSTEM	Distance in metres			
	A	B	C	D
Large towns >2000 persons	500	1000	1500	2000
Towns >100 persons	500	500	1000	1500
Small towns >20 persons	200	400	500	1000
Rural farm residence not owned by feedlot	100	300	400	500
Public area (minimum value)	50	100	150	200
Public road - except as below	50	100	150	200
Public road - unsealed with less than 50 vehicles per day excluding feedlot traffic	50	50	50	50
Major watercourse	200	200	200	200
Other watercourse as defined by a blue line on a 1:50000 current SA Government topographical map	100	100	100	100
Property boundary	20	20	20	20

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## Solid and liquid waste disposal to land categories

Separation distances are determined using **Table 9** for the following effluent disposal methods.

### Disposal method A

- Discharge by injection directly into the topsoil at a rate not exceeding either the hydraulic or nutrient and salinity limits determined for the soil type

### Disposal method B

- Solids that have been completely composted
- effluent having a solids content of not more than 1%

### Disposal method C

- Mechanical spreaders in combination with “ploughing-in” type equipment
- downward effluent discharge nozzles
- discharged material is not projected to a height of more than 2 metres above ground level

### Disposal method D

- All effluents that are discharged or projected to a height in excess of 2 metres above ground level.
- Liquid effluent in which water remains visible on the soil surface for periods in excess of one hour.
- Separated solids or sludge (except fully composted solids) that remain on the soil surface for more than 24 hours (ie. Are not immediately ploughed in)

Where more than one category of disposal to land is used the method which requires the greatest separation distance is used to determine the separation distance.

When waste is to be spread or discharged, account should be taken of actual and forecast wind conditions so as to prevent any waste being carried by the wind into the separation distance, or the creation of an odour nuisance to neighbouring properties.

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**Table 9 Separation distances surrounding waste disposal areas**

DISPOSAL METHOD	Distance in metres			
	A	B	C	D
Large towns >2000 persons	500	1000	1500	2000
Towns >100 persons	500	500	1000	1500
Small towns >20 persons	200	400	500	1000
Rural farm residence not owned by feedlot	100	300	400	500
Public area (minimum value)	50	100	150	200
Public road – except as below	50	100	150	200
Public road – unsealed with less than 50 vehicles per day excluding feedlot traffic	50	50	50	50
Major watercourse	100	200	200	200
Other watercourses as defined by a blue line on a 1:50000 current SA Government topographical map	50	100	100	100
Property boundary	20	20	20	20

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## 9.5 Odour Assessment Using Odour Source Modelling

### 9.5.1 Need for Odour Modelling

Where the EPA is of the opinion that a feedlot development involves a significant probability of odour impacts, it will require a quantitative odour assessment at an early stage of the assessment process. The need for such an assessment will be determined on a case-by-case basis and will depend on the size and class of the feedlot, other significant potential odour sources nearby, the terrain, meteorological effects and the sensitivity of the surrounding land use. In general, the EPA requires that an odour assessment

- be carried out as outlined within the EPA Guideline “Odour Assessment Using Odour Source Modelling”. A copy of this bulletin can be downloaded from the site [http://www.epa.sa.gov.au/pdfs/guide\\_odour.pdf](http://www.epa.sa.gov.au/pdfs/guide_odour.pdf)
- be undertaken and certified to the EPA’s satisfaction by a competent and reputable analyst accepted by the EPA, at the proponent’s expense.

This process requires the analyst to satisfy the EPA that the assessment was done objectively and independently.

Community consultation in the decision-making process is important in the management of odour. In conjunction with the quantitative odour assessment, the EPA expects the proponent, as part of an environmental management plan, to recognise and address the public’s perceptions and concerns associated with the emitted odours

### 9.5.2 EPA Guideline “Odour Assessment Using Odour Source Modelling”.

The main elements of the EPA Guideline “Odour Assessment Using Odour Source Modelling” are summarised below. For more details see the full publication.

Modelling should not be considered the only method of assessing the potential odour impacts of a development.

Other tools that can be used to assess the potential odour impacts are:

- complaint history
- previous practical experience with the activity
- consultation outcomes
- community odour diaries and surveys
- assessment of emission control proposals.

The principal legislation addressing odour in South Australia is the *Environment Protection Act 1993* (the Act). In particular, section 25 imposes the general environmental duty on all persons undertaking an activity that emits odour, or might emit odour, to take all reasonable and practicable measures to prevent or minimise any resulting environmental harm. In addition, the causing of odour may constitute environmental nuisance, an offence under section 82 of the Act.

#### 9.5.2.1 Modelling

An accurate estimation of the odour emission rates need to be supplied. The odour levels must represent full production under normal operation as well as increased odour emissions from abnormal operation. An estimate of background odour concentrations may also be required.

The measurement of odour must be done in accordance with the Australian standard 'Stationary Source Emissions-Determination of odour concentration by dynamic olfactometry' AS4323.3:2001, Standards Australia.

The dispersion model ‘**Ausplume**’ is generally appropriate for most situations.

The odour criteria are population dependent; they reflect the potential for increased

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environmental nuisance or harm associated with increasing potential for community exposure to the odour. The predicted odour levels (three-minute means) must not exceed the following odour levels 99.9% of the time at surrounding sensitive receptors, not including houses on the property of the development (see table 10 below).

**Table 10 Odour Level Standards**

Number of people	Odour units (Australian Standard) (3-minute average, 99.9%)
2000 or more	2
350 or more	4
60 or more	6
12 or more	8
Single residence (less than 12)	10

In making an odour assessment, one needs to assess the number of people in a defined area or cluster. Judgement may be required to determine the best criteria to use, as differing situations may require the use of more than one criterion. Some examples include:

1. If an odour source is in an area with a rural residence to the north and a town of 500 people to the south, then the appropriate criterion is 10 odour units for the single residence and 4 odour units for the town.
2. If a rural odour source has 4 houses nearby, one in each direction, then the appropriate criterion is 10 odour units at each house.
3. If a cluster of houses with a population of 70 people is near an odour source, the appropriate criterion is 6 odour units.

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## **10 MANAGING LIQUID AND SOLID WASTES FROM FEEDLOTS**

### **10.1 General**

Under Section 23 of the Environment Protection (Water Quality) Policy 2003 all feedlots in South Australia, whether existing or new developments, must have a wastewater management system, and this system must operated effectively in respect to all wastewater generated while the property is being used as a cattle feedlot. All existing feedlots, whether licensed or unlicensed, or approved prior to the implementation of this policy, must have an approved wastewater management system.

South Australian feedlots are unlikely to generate much runoff in summer as water spilled by drinking cattle, sprayed for heat or dust relief on hot summer days and liquid contained in the animal excretions evaporate within the confines of the holding pens.

The major runoff from the feedlot will occur in winter. All runoff from the feedlot must be controlled. The runoff control system must be able to prevent the runoff from

- leaving the feedlot property
- infringing the separation distances specified in tables 8 & 9
- degrading surface or underground water
- causing the uncontrolled build-up of nutrients in the runoff or effluent disposal areas.

Unless feedlots are constructed at the top of a hill, diversion banks or drains must be installed around the top of the feedlot area to prevent uncontaminated water entering the feedlot. The diversion system should be designed and constructed to work without over topping or failure in all circumstances up to 1 in 20 year recurrence interval storm event. The feedlot area then becomes a controlled drainage area, from which all contaminated runoff must be collected and conveyed to an effluent treatment system. The usual method is to use open drains and gravity flow.

### **10.2 Drains**

General design features for feedlot drains include

- drains must be lined with material of sufficiently low permeability to minimise the potential for leaching of contaminants into the soil or underground water resources.
- they must be have sufficient flow capacity to avoid overtopping.
- they must be free flowing to avoid excessive sediment build up. They must be maintained in a clean weed free condition.
- they must have sufficient bed gradient to effectively convey suspended sediments to the sedimentation system without excessive scouring of the drain bed. Flow velocities will be affected by the drain cross section profile, dimensions, slope and drain bed material. Maximum permissible flow velocities to prevent scouring will depend on the drain bed material.
- they should be topped with a durable all-weather surface to permit access by cleaning equipment.

The drains should be designed to carry, at a non scouring velocity, peak water flow rates resulting from a design storm with an average recurrence interval of 20 years, using a runoff co-efficient of 0.8.

The specified design storm is a site specific rainfall event with a 20 year recurrence interval which

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has a duration equal to the catchment's time of concentration. This is the time taken for water to flow from the most remote point of the catchment to the catchment outlet.

Drains require regular maintenance to remove weeds and repair erosion and scouring after rainfall events, and require cleaning to remove sediments which have been deposited from run-off. For ease of operation drains should have relatively flat beds and side batters. Machinery used for cleaning drains, such as graders or front end loaders, can maintain drains with this cross section more easily than "V" and rounded bed drains.

### **10.3 Sedimentation Systems**

The purpose of a sedimentation system is to remove as much as is practical of the entrained solids in feedlot runoff. The system should be designed and managed to

- minimise the solids passing from the sedimentation system into the storage lagoon. The advantages of this are the reduction in sludge build-up in the storage lagoon and the reduced need to de-sludge the lagoon, and the reduced biological loading of the storage lagoon which reduces the intensity and duration of odour emissions.
- promote free drainage with minimal clogging of the sedimentation weir
- promote the rapid drying of the deposited material. Rapid drying reduces the intensity and duration of odour emissions
- prevent leakage of effluent into the soils or groundwater. The system must be constructed on low permeability soils, or sealed with suitable clay or a synthetic liner
- allow easy and cost effective removal of the deposited material.

#### **Types of Sedimentation Systems**

The national guidelines describes three types of sedimentation systems suitable for cattle feedlots. The characteristics of these are described in table 11



**Table 11 Characteristics of Sedimentation Systems for Cattle Feedlots**

<b>Sedimentation System</b>	<b>General Description</b>	<b>length/width ratio</b>	<b>scaling factor <math>\lambda^{(*)}</math></b>
Basin	Wide and shallow with maximum depth less than 1 metre.  Sedimentation weir controls discharge into the storage lagoon  Free draining with shallow slope (approximately 0.1%) to sedimentation weir.  Compacted gravel base to allow mechanical removal of dried sediments.	2 - 3	2.5
Terrace	Wide shallow waterway with slope 0.1 - 0.5%.  Sedimentation weir controls discharge into storage lagoon or next terrace  2 - 3 terraces may be constructed in series  Free draining with slope to sedimentation weir.  Compacted gravel base to allow mechanical removal of dried sediments.	8 - 10	1
Pond	An excavated hole with depth greater than 1 metre.  Does not drain completely after rainfall  Solids settle to form a sludge layer which must be removed at intervals of 1 - 5 years  Pond usually needs to be pumped out to allow de-sludging	2 - 3	6

\* Scaling factor is used in Equation 3

General design and performance requirements of sedimentation systems are that they can

- achieve effluent flow velocities of .005 m/s or less which are sufficient to enable the settlement of at least 50% of entrained solids
- accommodate the design storm having
  - an average recurrence interval of 20 years
  - with a duration equal to the time of concentration of the feedlot controlled drainage area
  - using run-off coefficients of 0.8 for the feedlot pens, roads and other hard standing areas, and 0.4 for grassed areas within the feedlot controlled drainage area.
- prevent any waste from leaching through the system lining. For clay lined sedimentation systems, the liner must consist of at least two layers of clay placed in uniform horizontal layers, each of 150 millimetres compacted thickness, and must have a permeability of  $10^{-10}$

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<sup>9</sup> metres per second or less.

In areas where sufficient clay is not available or the clay is not suitable, it will be necessary to use a synthetic liner. The synthetic liner must be equipped with a leak detection system.

The volume required to achieve the required velocity and settling is determined by using the relationship

$$\text{Equation 3:- } V = Q_p \times (l/w) \times (\lambda/0.005)$$

Where  $V$  = the volume of the sedimentation system

$Q_p$  = peak inflow rate for the design storm in the Controlled Drainage Area

$l/w$  = length to width ratio, where  $l$  is in the direction of flow. Typical values are shown in table 11.

$\lambda$  = scaling factor which takes account of sediment accumulation and frequency of removal. Values are shown in table 11.

0.005 is the maximum flow velocity in metres / second.

It is recommended that the *Rational Method* as described in "Australian Rainfall and Runoff 1987" should be used in determining  $Q_p$  for the above relationship.

The sedimentation area should then be cleaned out and the solids directly spread onto agricultural land or temporarily stored in the manure stockpile area. The sedimentation area cleaning schedule for different classes of feedlots is outlined in Appendix 3.

#### 10.4 Sedimentation Control Weir

The function of the sedimentation control weir is to slow the flow of the effluent in the sedimentation system to the critical velocity to allow entrained solids to settle, and also enable the liquid to drain from the sediments deposited on the upstream side. During the process the weir regulates the depth of the ponding within the sedimentation system and the rate of discharge into the storage lagoon.

Sedimentation weirs should be designed to safely discharge design storm events up to the 50 year ARI design storm without overtopping the earthen bank. A minimum freeboard of 900 mm should be provided between the top of the weir and the top of the embankment.

Suitable types of weirs are

- the horizontal drop board type - consisting of one, and occasionally two rows of removable drop boards installed within a concrete channel through the bank of the sedimentation system. The boards are wedged apart to facilitate drainage, and the gaps can be progressively widened to hasten drainage from the sediments. The boards can be completely removed to assist cleaning.
- the vertical timber type - consisting of timber boards mounted vertically within a concrete channel through the bank of the sedimentation system. The gaps between the boards can not be adjusted, and generally the structure can not be removed to allow access for cleaning.
- the adjustable vertical slot throttle weir - consisting of two steel plates installed across the sedimentation terrace on the upstream side of a short concrete masonry wall. The gap can be adjusted to facilitate drainage, and the plates can be completely removed to allow access for cleaning.

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To prevent scouring of the inlet into the storage lagoon energy dissipation structures or a concrete slipway should be installed between the sedimentation weir and the storage lagoon.

## 10.5 Storage Lagoon

The runoff (effluent) from cattle feedlots is generally high in nutrients, salts and organic matter. This effluent can contaminate surface and underground water resources and soils if it is allowed to flow out of the feedlot in an uncontrolled manner, or is irrigated onto agricultural land which is not capable of assimilating the water and nutrients. In most regions of South Australia the winter rainfall prevents the safe irrigation of effluent onto agricultural land during winter. Therefore the effluent, the majority of which is derived from the winter rainfall, needs to be stored until it can be utilised safely.

The storage lagoon must be of sufficient capacity to accommodate the runoff from May to October inclusive with an average recurrence interval of 20 years. However in water pollution sensitive areas, the water protection agency may insist on a greater storage capacity in order to reduce the risk of lagoon overflows.

The required runoff storage lagoon capacity can be calculated according to Equation 4:

**Equation 4:  $Q = [(R_p \times A_p) + (R_b \times A_b) + ((D - E) \times AI)] \times 10 \times SF$**

where Q	=	Volume	(kilolitres)
R <sub>p</sub>	=	May to October inclusive runoff from the pens, with a recurrence interval of 20 years or greater (mm)	
A <sub>p</sub>	=	Area of pens (ha)	
R <sub>b</sub>	=	May to October inclusive runoff from rest of CDA, with a recurrence interval of 20 years or greater (mm)	
A <sub>b</sub>	=	Area of rest of CDA (ha)	
D	=	May to October inclusive rainfall with a recurrence interval of 20 years or greater (mm)	
E	=	Average May to October inclusive lagoon evaporation (mm)	
AI	=	Surface area of the lagoons (ha)	
SF	=	Safety Factor - usually 1.25	

Equation 4 shows that the capacity of the storage lagoon will vary for each location and will depend on the configuration of the feedlot, the area of the pens, and winter rainfall. Factors which affect the proportion of rainfall which runs off include pen slope, cleaning frequency, soil type and rainfall intensity.

For protection of the earthen structure, the storage lagoon should have a spillway designed for safely passing a design storm with an average recurrence interval of 50 years at non scouring velocity. In addition, a 900 mm freeboard above the spillway will adequately protect the embankment from over-topping during extreme rainfall events and from wave erosion on windy days.

Despite the pre-treatment of settling the suspended solids, the runoff will contain a considerable amount of organic compounds when entering the storage lagoon. Where practical, the water depth in the storage lagoon should be kept shallow (less than 1.5 metres) to minimise anaerobic breakdown of the wastewater which causes offensive odours.

At this stage, there is no published data available for runoff from feedlots in South Australia. However, results from runoff research on engineered catchments has been used as a guide for estimating runoff from feedlots. Estimates of storage lagoon capacity are given in Table 12, **as a guide only**. The estimates were derived by making the following assumptions:

- \* Runoff (May to October = 0.5 x ( May to October rainfall - 200) inclusive) (mm)  
(relationship derived from research data)
- May to October rainfall = numerically equivalent to mean rainfall for a 1 in 20 year annual rainfall (mm) recurrence
- \* Lagoon evaporation = 200 mm
- \* Safety factor = 1.25

**Table 12 Typical Capacity for Storage Lagoon (kilolitres)**

CDA (hectares)	Average annual rainfall (mm/year)			
	250	350	450	550
1	320	1030	1820	2700
5	1600	5150	9100	13500
10	3200	10300	18200	27000
15	4800	15450	27300	40500
20	6400	20600	36400	54000

### 10.5.1 Sealing The Lagoon

To prevent seepage from the storage lagoon contaminating soil or groundwater the lagoon base, sides and bank must be sealed with material with a permeability less than  $1 \times 10^{-9}$  metres per second. If it is not possible to achieve this with the on-site clay, it will be necessary to import clay which meets specification, or use a suitable synthetic liner.

All surfaces to be clay lined must be cleared of vegetation and tree roots grubbed, stripped of topsoil and prepared to the required levels and gradients by cutting and filling, as required. This will involve over-excavation to accommodate the required thickness of clay lining.

To produce a satisfactory bonding surface for the placement of subsequent layers all of the areas to be clay lined must be:

- scarified or ripped to a minimum depth of 150 mm,
- watered to produce the correct moisture content
- compacted to at least 95% of the standard maximum laboratory dry density. This degree of compaction may be achieved by rolling each layer of material with at least eight (8) passes of a sheepfoot roller.

The minimum required thickness of clay lining depends on the maximum depth of effluent in contact with the clay lining and the duration of that contact. For sedimentation systems and storage lagoons with maximum depths of effluent less than 2 metres the minimum thickness of clay liner is 300 mm. For lagoons with depths greater than 2 metres the minimum thickness of clay

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liner is 450 mm

Clay lining material should be placed in uniform, horizontal layers, not exceeding 200 mm in thickness prior to compaction, and watered to bring the clay to the optimum moisture level for compaction. Following the completion of compaction, final trimming of all clay lined areas should be carried out to produce a smooth, uniform surface, in accordance with the design specifications of the lagoon.

### **10.5.2 Effluent Pond Construction**

The EPA has published a guideline on "Wastewater and Evaporative Lagoon Construction" which is available from the EPA or can be downloaded from the internet site [http://www.epa.sa.gov.au/pdfs/guide\\_lagoon.pdf](http://www.epa.sa.gov.au/pdfs/guide_lagoon.pdf).

The guideline advises those proposing to construct a wastewater or evaporation lagoon on construction techniques that should assist in meeting obligations under the Environment Protection Act 1993 and the Environment Protection (Water Quality) Policy 2003.

The South Australian EPA is planning to review this guideline to outline the geotechnical requirements when dealing with specific wastewater and site characteristics.

## **10.6 Evaporation Systems**

Evaporation systems must be capable of containing the runoff from the feedlot controlled drainage area for a 96 percentile wet year. They should only be considered where the annual evaporation exceeds annual rainfall by a large margin and sustainable spreading on land is not feasible - for example in the dry pastoral districts where it is not possible to reliably grow crops and improved pastures.

Evaporation systems are not the preferred option. Evaporation concentrates the nutrients and salts in the stored effluent which makes the consequences of overtopping or lagoon failure more serious, and the concentrated sludge is more difficult to dispose of. The sludge may be mixed with stockpiled pen manure at a rate which permits safe use on agricultural land, or it may be composted with manure or other organic materials. However, depending on the concentration of salts, sustainable utilisation of the sludge on agricultural land may not be feasible. In this situation the most likely disposal option may be disposal into properly engineered land-fill.

## **10.7 Solid Waste Management**

Manure should be regularly collected and removed from the pens. Regular cleaning under fences and around feed and water troughs is important in reducing fly breeding sites, odour production and dust potential.

Pens should be cleaned and maintained in accordance with the conditions of planning approval or licensing. The maximum time intervals between operations for each class of feedlot is shown in table 13 in Appendix 3.

Pen cleaning operations should remove all accumulated manure down to the pen surface.

Mounding of manure to provide dry laying areas for the animals is not recommended. Mounds interfere with the pen drainage and create wet spots which promotes pen floor breakdown and increased odour production on the up-hill sides of the mounds. Where permanent gravel or earth mounds are employed within pens they should be of a design and alignment which does not interfere with the cleaning operations and the drainage of water from the pens.

Where Class 4 feedlots utilise small holding paddocks at light stocking densities the manure

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should be incorporated into the soil within 4 days of closure of the feedlot for winter, and a crop planted in that paddock.

### **10.7.1 Stockpiling Manure**

Applications of manure to agricultural land should match cropping, rainfall and other agronomic factors. In South Australia this usually means that the manure is spread on cropping land just prior to the break of the season before the crop is planted. However, pen cleaning operations are carried out on a regular basis, which means that the manure must be stored until it can be used. All storage of manure should be within the controlled drainage area of the feedlot.

The manure stockpile will commonly be used to store manure from pen cleaning, sludge from the sedimentation system and storage lagoon, spilt feed cleaned from feed bunks, roadways and feed preparation areas, and sediments from drains. During storage the materials in the stockpile will begin to decompose, which will reduce the total amount of material which will need to be spread later, and will also change the composition and balance of nutrients. After several months of storage the weight of manure which remains may be reduced by up to 40%. The nitrogen content will be reduced due to conversion to gaseous forms which are lost to the atmosphere, but the concentration of other non-volatile nutrients such as phosphorus will increase.

Depending on the length of time the manure is stored and the internal temperatures reached within the stockpile, significant numbers of weed seeds and pathogens may be killed.

The addition of manure to the stockpile is best done at between 25 - 35% moisture content and the manure should be placed in layers using a bulldozer or wheeled loader. This should ensure adequate compaction as the stockpile is being formed. Poor compaction will allow air to enter the stockpile. If oxygen is able to enter a stockpile the heat produced during decomposition may cause the stockpile to ignite spontaneously and burn.

Manure stockpile areas should be established within the feedlot controlled drainage area and with a regular 1 - 3% slope. The foundation of the area should be prepared to the same specifications as the feed pen foundation, and the surface should be finished with a layer of compacted gravel to ensure all weather access. The manure stockpiles should be constructed up and down the slope of the area, not across the slope. This will assist drainage.

### **10.7.2 Composting**

Composting needs development approval from the planning authority. See section 3.3.10 for more details.

Composting of manure and other organic wastes will convert the materials into a valuable soil conditioner which can be used on the feedlot property or sold. Composting has the potential to cause environmental harm if it is not located, designed and operated properly.

Where management of feedlot manure or disposal of carcasses involves processing by composting, the compost site should be within the feedlot controlled drainage area. If it is established at a different location it will need its own controlled drainage area and effluent management system.

It is recommended that the composting is done to the Australian Standard SA 4454.2003.

## **10.8 Effluent And Manure Utilisation**

There are a number of water resource protection policies which relate to the utilisation of effluent. Controls for the use of effluent are

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- Under the Water Resources Act 1997 "...a person must not undertake...using effluent in the course of carrying on a business in a catchment area at a rate that exceeds the rate prescribed by the plan". This means that all persons undertaking schemes to use effluent in the course of carrying on a business in a prescribed water resources area will need to obtain a permit. All effluent used will be metered, and a monitoring bore must be installed into the upper aquifer for observation of nutrient and water levels. Spreading effluent heavier than 1 kilolitre per hectare may require a permit. Check the details for your area with the relevant Catchment Management Board. Penalties for offences are \$5,000 for a person or \$10,000 for a body corporate.
  - If the EPA suspects on reasonable grounds that an activity is causing or is likely to cause environmental harm the Authority may require the person carrying on that activity to undertake a monitoring and reporting programme.

The objective of feedlot waste utilisation is to employ crops, pastures and soils to effectively utilise or assimilate the nutrients, salts, organic matter and water in the wastes in a sustainable manner.

The essential features of a sustainable waste utilisation system are

- nutrients are not leached below the active root zone of the crop or pasture. This prevents contamination of groundwater resources.
- dissolved or suspended contaminants are not transported from utilisation areas to watercourses. This prevents contamination of surface water resources.
- effluent and manure are not applied excessively. This prevents the degradation of the chemical and physical properties of the soil which lead to nutrient overloading, salinisation, sodicity, acidification, erosion, poor infiltration and waterlogging.
- the productivity of the land used for waste utilisation is enhanced
- neighbouring landholders are not subjected to odour and dust nuisance because of poorly timed and managed waste application practices.

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The recommended approach to determining sustainable spreading rates of wastes is described in the general mass balance relationship:-

$$\text{Mass of Constituent Applied} \leq \text{Mass of Constituent Removed} + \text{Mass of Constituent Safely Stored} + \text{Mass of Constituent Released into Environment in Acceptable Form}$$

Each of the constituents of the effluent and manure needs to be considered individually and the lowest application rate based on this relationship used. The main constituents which will affect the spreading rate are nitrogen, phosphorus, potassium and salts. Effluents which have a high Biological Oxygen Demand (BOD) may exceed soil BOD input limits and will need to be considered separately.

Water application may be the limiting constituent of very dilute effluents, which will require the development of an irrigation schedule based on moisture deficit principles to determine the spreading limit and the area required. An Irrigation Management Plan should be developed which describes how the effluent will be spread and demonstrates that the nutrients applied in the effluent will be taken up by pastures or crops.

To enable good management of effluent and manure utilisation, and the development of an Irrigation management Plan, it is important that the composition of the waste is known. While average industry values or mass balance modelling can be used for over-all system design purposes, the composition of the wastes can be highly variable. Regular sampling and analysis should be used to establish the range of nutrients which is in the wastes to be spread.

Details on sustainable spreading of feedlot effluent and manure are contained in the "Manual For Spreading Nutrient Rich Wastes on Agricultural Land". This manual is available on CD from Primary Industries and Resources SA and includes a spreadsheet model which can be used to calculate sustainable spreading rates. It is recommended that information from this manual be used for the waste spreading system design, the sampling and analysis of soils and wastes, and the monitoring of environmental impacts.

The wastewater should be irrigated in such a manner that the height of the throw is kept as low as practical and water should not remain ponded on the soil surface for more than one hour after irrigation is completed.

In areas with easily polluted water resources, it is important that the irrigation system used has a high uniformity of application and the overall management is of a high standard. It is recommended that the waste water irrigation system meet the irrigation industry of Australia standards for irrigation system design and operation.



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## 11 WATER SUPPLY

Cattle must have access to an adequate supply of cool, clean, suitable quality, drinking water.

The water requirement of a 450 kilogram animal during hot weather may be up to 70 litres per day. In addition, where water is required for dust control, an additional application of 5 litres plus 2 litres per day may be required per square metre of pen floor. In very dry conditions 15 litres per square metre every 10 days is recommended. This is an extra requirement of 22.5 litres per animal per day at normal stocking densities. Care must be taken to ensure water application for dust control does not cause wet spots and increase odour.

Daily requirements for water therefore approach a maximum of 100 litres per day during hot weather. This amount must be able to be delivered to the pens over an 8 hour period. If wastewater from the aerobic storage lagoon is recycled for dust control the reliance on fresh water will be significantly reduced. However care must be exercised in the use of the recycled water to prevent aerosol formation during sprinkling and the risk of spreading disease, or excessive odour generation due to overhead spraying.

Cattle are reasonably tolerant of water with high levels of salts. They can tolerate up to 10,000 mg/l TDS for limited periods, but the recommended maximum for growth is 5,000 mg/l TDS. Generally the higher the salinity of drinking water the higher the salinity of the feedlot effluent and manure, which can create problems with their safe utilisation.

Storage of at least 2 days peak water supply at the feedlot to insure against breakdowns in the normal water supply is a useful precaution.

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## **12 PUBLIC AND ENVIRONMENTAL HEALTH**

### **12.1 General**

The Public and Environmental Health Act and Regulations provides for the local authority (councils) to deal with environmental nuisance/insanitary conditions, including:

- premises giving rise to a health risk
- risk of infestation by rodents and other pests
- offence to any land owner in the vicinity
- offensive odours/materials emitted from premises
- insanitary conditions
- discharge of waste into public or another private property
- inadequate facilities for sanitation
- protection of water supplies
- disposal of dead animals

Administration of the Public and Environmental Health Act and Regulations in local government areas is by local councils, and in non local government areas, the Department of Human Services.

### **12.2 Minimisation of noise**

Heavy vehicles entering or leaving feedlot premises before 7am and after 6pm may provide grounds for noise complaints. To prevent problems, property access points and roads on the premises should be located well away from noise-sensitive receptors. A minimum separation of 100m is recommended. All vehicles and motors connected with the operation should have efficient exhaust mufflers. The impact of noise on noise-sensitive receptors from increased heavy vehicle traffic on public roads also should be considered when planning access to the property.

Noise on adjacent properties from hammer mills, roller mills, grain elevators and conveyers used in the storage, transfer and preparation of stock feed should not exceed existing ambient background noise levels before 7am and after 10pm. Enclosure and efficient insulation may be required for feed preparation plant.

### **12.3 Fly Control**

To prevent flies breeding in the undisturbed manure, any cattle pens which are to remain empty for more than four days must be cleared of all manure within three days of the cattle being removed. Particular attention must be paid to removal of solid wastes under fence lines and around feed and water troughs.

Manure which accumulates in the drains and the settling lagoon after rain creates odours and can provide fly breeding sites. This sediment should be removed as soon as it is dry enough to handle.

Feed which is spilt in the feed preparation area and around the cattle feed troughs must be removed weekly.

Fly populations which develop in the feed preparation and the manure stock pile areas should be controlled by the use of chemical sprays or baits registered for the purpose.

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## 12.4 Dust Control

Dust generally should not be a major problem with good feedlot design and management. Dust will tend to occur during prolonged dry periods and the worst problems develop during the late afternoon and at dusk when the cattle start moving around. This creates health problems for the cattle, staff and neighbours.

Different approaches which may be used to prevent dust from being created in feedlot pens and on roads and service areas are

- more frequent removal of manure
- increase stocking density within allowable limits, which has the effect of maintaining the pad in a moister state
- application of water
- use of commercial dust suppressant on roads and service areas.

Where water is applied to control dust the aim should be to apply initially approximately 10 - 15 litres/sq metre over the whole area followed by follow-up applications at 10 day intervals or when necessary. Mobile sprinklers (or travelling irrigator) or mobile water trucks are usually preferred to fixed sprinklers

## 12.5 Disposal of Dead Cattle

Any significant feedlot will have animals to dispose of and adequate arrangements must be made to handle this on an on-going basis. Average industry figures show a mortality of around 0.7%. However, the disposal of large numbers of carcasses in the event of a catastrophe must also be considered as part of feedlot planning.

Dead cattle must be disposed of immediately upon discovery. To minimise disease transfer carcasses should be removed from the pens using a front end loader rather than dragging the carcass as this releases body fluids along the drag path. Post mortems should be performed in designated areas before carcass disposal.

The most common methods used for carcass disposal are composting, burial, and cremation. Cremation should only be used where composting or burial is not possible. While burial is the most common method of carcass disposal, composting is considered industry best practice.

- Decomposition is fast - in as little as 40 days for an adult carcass
- It produces sufficient heat to kill pathogens which may be present in the carcass
- It reduces potential groundwater pollution risks and soil contamination
- Nutrients from the composted carcass can be utilised on the property.

### 12.5.1 Composting

Adult cattle should be composted using the following method:-

1. In the manure stockpile area, or approved composting site, place a layer of dry organic matter 30 - 45 centimetres deep on the ground over an area slightly larger than the carcass. Straw, sawdust or hay are all suitable.
2. Place the dead animal on the bed and cover with another layer of the dry organic material to a depth of 30 centimetres.

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3. Cover the whole lot with 60 centimetres depth of semi-dry organic material such as feedlot pen manure, stockpiled manure, or silage. This layer needs to be at least 60 centimetres deep to contain odours and exclude scavengers.
  4. Allow the pile to "work" for 20 days undisturbed. Internal temperatures should reach between 65 - 75°C.
  5. After 20 days, or when the internal temperature falls below 60°C, turn the pile and expose the carcase. Cover the carcase again with 30 centimetres of dry organic material and 60 centimetres of semi-dry material.
  6. Allow the pile to "work" for another 20 days undisturbed. Internal temperatures should reach 70°C and then slowly decrease. After the 40 days only large bones and some hair will remain.

The composted carcase can then be incorporated with manure or solid wastes for spreading on land.

### **12.5.2 Burial**

While burial has been a common method of carcase disposal, it is not recommended, as there is the potential for contamination of ground waters, surface waters and the soil. If burial is undertaken the minimum requirements are listed below.

Burial pits should be established in low permeability soils on a site well removed from surface waters, drainage lines or gullies. The pit must be located so that all water runoff is directed away from the pit. Use of diversion bunds or trenches may be required.

Pits should be deep but relatively narrow, and are best dug using an excavator. The bottom of the pit must be at least 2 metres above the highest ground water level at the site. Avoid rocky areas. If the pit is in lighter soils the pit should be lined with at least 600 millimetres of clay.

The carcase of each animal should be opened at the time of placing in the pit and the carcase immediately covered by at least 500 mm of soil to reduce odour and exclude flies and vermin. The pit can be progressively filled with carcasses until sufficient pit capacity remains for the pit to be sealed with clay and compacted to a minimum depth of 1 metre. Soil should be mounded over the top, and replenished should the pit subside to below ground level. The site where mortalities are buried should be recorded for future reference.

If there are mass mortalities then a simple pit as described is not sufficient and a more comprehensive design is required. In the case on an exotic disease the disposal would probably be managed under the AUSVETPLAN. Advice can be sought from Primary Industries and Resources or the Environment Protection Authority.

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## 13 ANIMAL HEALTH REGULATIONS

Cattle feedlots must conform with regulations applying to cattle run under range conditions. The regulations under the various Acts are summarised below.

### 13.1 Stock Act

Primary Industries and Resources SA (PIRSA) approved Property Identification Code (PIC) tags, which include tail tags or ear tags, are required on all cattle which leave the property for sale or slaughter. Cattle which are held at the feedlot for 7 days or longer must be identified with the tail tag of the feedlot property.

Veterinary advice should be sought for unaccountable sickness or deaths to prevent excessive losses. Some diseases are legally notifiable.

With the eradication of tuberculosis and brucellosis the Stock Act places no other day to day requirements on management.

### 13.2 Agricultural Chemicals

Veterinary chemicals, vaccines, antibiotics, and feed supplements containing drugs have to be used as instructed or under veterinary instruction.

For cattle to be sold as eligible for the European Union (EU) market, they must never have been treated with hormone growth promotants (HGP) at any time in their lives. The penalty for false declarations regarding HGP status are substantial.

If feedlot operators wish to sell their cattle as EU eligible, they must -

- Obtain a valid HGP declaration from the vendor when buying stock.
- Have a satisfactory system in place (e.g. a colour coded eartag system) to ensure the identity of those stock throughout their period within the feedlot, so that a similar declaration can be safely made when the stock are finished and sold for slaughter.

When cattle are sold through a saleyard system and declared EU eligible, they must also be identified with pink HGP-free property tailtags. Pink HGP-free tailtags are obtained by the same ordering process as are conventional white tailtags but require that a declaration on the order form be signed such that the pink HGP free tail tags will only be applied to cattle which it is known have never been treated with HGP's at any time in their life.

Like any other cattle producer, feedlot operators wishing to use HGP's have certain responsibilities-

- When purchasing HGP's they must complete a Purchaser Declaration provided by the registered HGP retailer.
- They must permanently identify all HGP treated cattle/buffalo with the prescribed triangular ear mark at the time of implantation.
- They must keep records of all HGP's purchased, used, stored on property or given away.
- They must keep records of all HGP-treated cattle/buffalo purchased, sold or kept on the property.

The ear mark can be applied to either ear and punches for the purpose can be obtained from registered HGP retailers. The records required must be kept for 2 years.

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## 14. ANIMAL WELFARE

The health and welfare of cattle kept in feedlots is paramount and must be a primary factor in the design and management of feedlots. Bogging, exposure to excessively cold and hot conditions, over-crowding, mistreatment and other such actions constitute cruelty and must be avoided.

### 14.1 Code of Practice

Cattle feedlots must comply with the animal welfare provisions of the “Model Code of Practice for the Welfare of Animals – Cattle” and the “Australian Lot Feeders' Association Code of Practice: Cattle Welfare in Feedlots”. Compliance is the responsibility of the feedlot manager. Model Codes of Practice also exist for the transport of livestock. These Codes are available from the Department of Primary Industries and in the National Guidelines for Beef Cattle Feedlots in Australia.

The welfare code incorporates basic welfare needs of cattle including requirements for intensive systems such as management practices, health inspections, yard and feeding management.

### 14.2 Destruction of Stock

Where sick or injured cattle have to be destroyed the methods recommended in the Model Code of Practice for Welfare of Animals (Cattle) should be adopted.

### 14.3 Heat Stress or Excessive Heat Load.

Excessive heat load in feedlot cattle during the summer months can result in significant production losses and animal welfare considerations.

High body heat loads can develop in feedlot cattle when a combination of local environmental conditions and animal factors exceed the animal’s ability to dissipate body heat. Initially excessive heat load will lead to a reduction in feed intake which results in production losses. However, with severe or prolonged elevation in body temperature, tissue and organ damage can result and can cause deaths of large numbers of cattle in extreme weather conditions.

#### 14.3.1 Management of Excessive Heat Load

Feedlot operators can influence the amount of heat load experienced by their cattle during hot conditions by implementing a range of management strategies. If implemented individually these strategies may only have a limited effect, but when used in combination they can significantly reduce the effect of heat load on feedlot cattle.

It is important that the management of excessive heat load be **proactive** rather than **reactive**. The development of heat load monitoring strategies and action plans will help in minimising heat load rather than simply responding to an event when it occurs.

An effective excessive heat load management plan consist of three main components

1. a **pre-summer review** of the feedlot’s preparedness for an excessive heat load event
2. a **summer management programme** to reduce the risk of an excessive heat load event, and be alert for the earliest signs of an event occurring
3. the preparation and implementation of and **excessive heat load event strategy** when an excessive heat load event is forecast or occurs.

#### Pre-Summer Review

This review should examine the feedlot site, design, infrastructure and management with a view to

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identifying the site risk, pens most at risk, and the adequacy of facilities such as water troughs, shade, or sprinkler systems. Management plans can then be developed to reduce the impact of excessive heat load on vulnerable cattle.

Meteorological records can assist in predicting the probability and severity of an excessive heat load event at the feedlot site.

The environment within the pens may differ from that of the surroundings. Other factors such as shade, pad depth and moisture, obstructions to air movement, stocking density, animal size, and their diet all influence the climate within the pens.

The review should examine the livestock management practices at the feedlot which may affect the impact of an excessive heat load event, including

1. identifying the most susceptible cattle
2. the timing of cattle movements and handling
3. nutrition and feeding programmes
4. the type of cattle purchased for feeding over the summer

### **Summer Management Programme**

A summer management programme should be designed to minimise the occurrence of excessive heat load in cattle. The main components of the programme are

1. ongoing upgrade and maintenance of infrastructure
2. implementation of a summer diet and feeding programme as required. Metabolic heat produced during digestion and metabolism of food is the primary source of body heat load in cattle. Highly digestible high energy diets produce less metabolic heat and are the most efficient for summer production. Summer diets therefore need to maximise the use of low heat-increment feed ingredients such as oils, oilseeds, grains and high quality roughages. However, under hot conditions when cattle reduce their feed intake a higher roughage diet may help to maintain their dry matter intake and reduce the risk of acidosis.
3. management of resources, livestock and personnel to reduce excessive heat load
4. ongoing monitoring of weather, animal behaviour, and Heat Load Index. A heat load index which combines black bulb temperature, relative humidity and wind speed has been developed, and has proved to be a good indicator of physiological stress. Current day and four day forecasts of Heat Load Index are available on an experimental web site for a number of districts around Australia. More information may be available on the web site [www.katestone.com.au/mla/](http://www.katestone.com.au/mla/)

### **Excessive Heat Load Event Strategy**

The excessive heat load event strategy should be prepared before the hot season during the pre-summer review. All staff and employees must be trained and be familiar with the strategy, and be able to recognise the signs of, and reduce the impact of an excessive heat load event.

The strategy needs to include a plan of action which can be implemented when an excessive heat load event is forecast, as well as plans of action when the event is actually occurring.

The action plans may include some or all of the following

1. pre planned dietary changes. This may include reducing the amount of feed on offer, or

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increasing the amount of high quality roughage. Feed changes are a trade-off in risk between losses due to excessive heat load, reduced performance due to lower energy intake, and sudden increase in intakes after the excessive heat load event which may lead to acidosis or high heat loads if the increase in intake coincides with another period of hot or humid weather.

2. stopping animal handling and movements, and other practices which increase cattle stress
3. use of sprinklers if relative humidity is low
4. use of portable water troughs for high risk groups of cattle.

### 14.3.2 Recognising Excessive Heat Load in Cattle

There are two major components when assessing heat load in cattle – the response of the cattle to the conditions, and measurements of the prevailing weather conditions. The cattle are the key indicator – they will indicate by their appearance and behaviour whether they are getting hot or not.

A number of observations and measurements can be used to assess cattle response to heat load. These include

1. respiration rate and panting score
2. cattle behaviour
3. dry matter intake
4. internal body temperature

Ideally all cattle should be assessed, commencing before any anticipated adverse weather conditions. Where the assessment of all cattle is not feasible those most vulnerable should be monitored. The most vulnerable cattle are

- cattle which are heavily finished
- newly arrived cattle
- hospitalised cattle, especially those with respiratory ailments
- black cattle are most vulnerable, with light colours least vulnerable. Red cattle are intermediate
- *Bos Taurus* are more vulnerable than *Bos Indicus* types.

#### 14.3.2.1 Respiration Rate and Panting Score

Respiration rate and panting score are very useful indicators of heat load in cattle. They are the first visual responses seen during hot conditions, and panting score in particular can be quickly assessed by feedlot personnel.

Panting scores of vulnerable cattle should be assessed before 8:00 am and then at two hourly intervals until at least 6:00 pm.

Panting scores from 0 (normal) to 4.5 (severely stressed) with a photo guide adapted from the MLA Tips and Tools Feedlot : FL10 information sheet are shown in the following table.

For management purposes, if more than 10% of cattle are showing panting scores of 2 or above, all handling and movement of the affected cattle should be stopped and only resumed




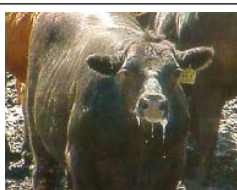






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when conditions become cooler and cattle have returned to normal.

Cattle with a panting score of 3.5 or greater are in danger of death if they do not receive some relief from the hot conditions.

## Respiration Rate and Panting Score

Breathing Condition	Panting Score	
No panting - normal	0	
Slight panting, mouth closed, no drool or foam	1	
Fast panting, drool or foam present	2	
Fast panting, drool or foam present, with occasional open mouth	2.5	
Open mouth and some drooling. Neck extended and head usually up	3	
Open mouth and some drooling. Neck extended and head usually up. Tongue out slightly.	3.5	
Open mouth with tongue out, with drooling. Neck extended and head up.	4	
Open mouth with tongue out, with drooling. Neck extended and head down.	4.5	

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### 14.3.2.2 Cattle Behaviour

During hot weather cattle often change their behaviour in an attempt to become more comfortable. These behaviour changes can be used with panting scores to assess the impact of excessive heat load on the cattle. The following list describes progressive behaviour as cattle are exposed to increasing heat load.

1. body alignment with the sun
2. shade seeking
3. increased time spent standing
4. reduced dry matter intake
5. crowding over the water trough
6. body splashing
7. agitation and restlessness
8. reduction or absence of rumination
9. bunching to seek shade from other cattle
10. open mouthed and laboured breathing. **This is the first sign that the animal's system is failing to cope with the hot conditions**
11. excessive salivation
12. staggering and inability to move
13. collapse, convulsions, coma
14. physiological failure and death

### 14.3.2.3 Dry Matter Intake

Dry matter intake usually decreases when cattle are exposed to hot conditions, particularly when high energy diets are being fed. This is an attempt by the cattle to bring metabolic heat production into balance with their heat dissipation capabilities.

### 14.3.2.4 Internal Body Temperature

While the measurement and monitoring of internal body temperature is useful in assessing changing heat load in cattle it is difficult to measure under commercial feedlot conditions. Currently there is no equipment available for commercial use.

### 14.3.2.5 Heat Load Index (HLI)

A heat load index which combines black bulb temperature (BGT), relative humidity (RH) and wind speed (WS km/hr) has been developed, and has proved to be a good indicator of physiological stress.

Heat Load Index =  $32.5 + (0.09 \times RH) + (1.4 \times BGT) - (0.57 \times WS)$ . This index can be used to estimate the environmental heat load placed on cattle.

The table below shows threshold values of Heat Load Index for classes of cattle both shaded and unshaded. Above the threshold values cattle will have a net gain in body heat. Below the threshold they will be able to maintain a net loss of body heat. These values are a guide only and

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can vary depending on other factors such as diet, feed intake, type of shade and HGP effects.

### Heat Load Index (HLI) Threshold Values

Class of Cattle	Threshold Values	
	Unshaded	Shaded
Newly arrived within last 2 weeks	74	74
Sick or recovering	73	73
Dark coated (black, dark red)	79	82
Light coated (white, grey)	82	84
Body condition score 3 – dark coat	79	82
Body condition score 3 – light coat	82	84
Body condition score 4 – dark coat	77	80
Body condition score 4 – light coat	80	82
No adaption	74	78
Adaption	82	84

Heat load accumulated by cattle over time can also be calculated. This is known as the HLI-hour, and is the number of hours over a period (1 – 2 days) when the heat load index is above a threshold value – nominally 72. This provides a better indication of the heat load accumulating in the animal than a single estimate of THI.

The THI-hour can be used to calculate recovery times. The best recovery occurs when the HLI is below 72 for between 4 – 6 hours over-night. More details on HLI-hour calculations can be found in the MLA report FLOT.316: "Excessive heat load index for feedlot cattle".

#### 14.3.2.6 Summary

Assessing heat load in cattle

- use the heat load index via the internet site < [www.katestone.com.au/mla/](http://www.katestone.com.au/mla/) > to determine current weather heat load and predictions for the next 3 – 5 days
- use the heat load accumulation over time (HLI – hour) to determine if cattle have adequate time to cool down overnight, or will be carrying heat loads into the following day
- assess panting scores from 6:00 am to 6:00 pm on hot days (HLI over 80). A panting score of 1 at 6:00 am indicates a potential problem if a high HLI is encountered during the day
- observe cattle behaviour in the pens.
- The cattle are the key – they will let you know when they are getting hot.

#### 14.3.3 More Information

More information on managing excessive heat load in feedlot cattle is available in the Meat and Livestock Australia On farm Tips and Tools publication "Heat Load in Feedlot Cattle", Feedlot

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FL08 – FL13, December 2002. Contact 1800 155 900.

#### **14.4 Feedlot Shade**

Shade can have a large impact on the body heat load experienced by cattle by reducing solar radiation and slowing the rate of gain of body heat. Shade can improve cattle comfort and productivity and increase profitability under some climatic conditions.

The design of shade structures should ensure that ventilation beneath the structure is maximised, afternoon shade is maximised, and where possible, air temperatures are kept below body temperature.

##### **14.4.1 Orientation of Shade Structures**

In South Australia's hot dry climate the optimal alignment of shade structures is north-south. This allows the shade to move across the pen throughout the day and assist the drying of the pen floor beneath the structure.

A slope of 15° rising to the east provides two extra benefits – the shade roof will create its own passive air movement as air heated beneath the roof rises, and the slope will allow a larger area to be shaded during the mid to late afternoon when the day temperature is usually highest.

##### **14.4.2 Size of Shade Structures**

The relationships between shaded area, stocking density and cattle performance have not yet been defined. However, general recommendations from research can be applied.

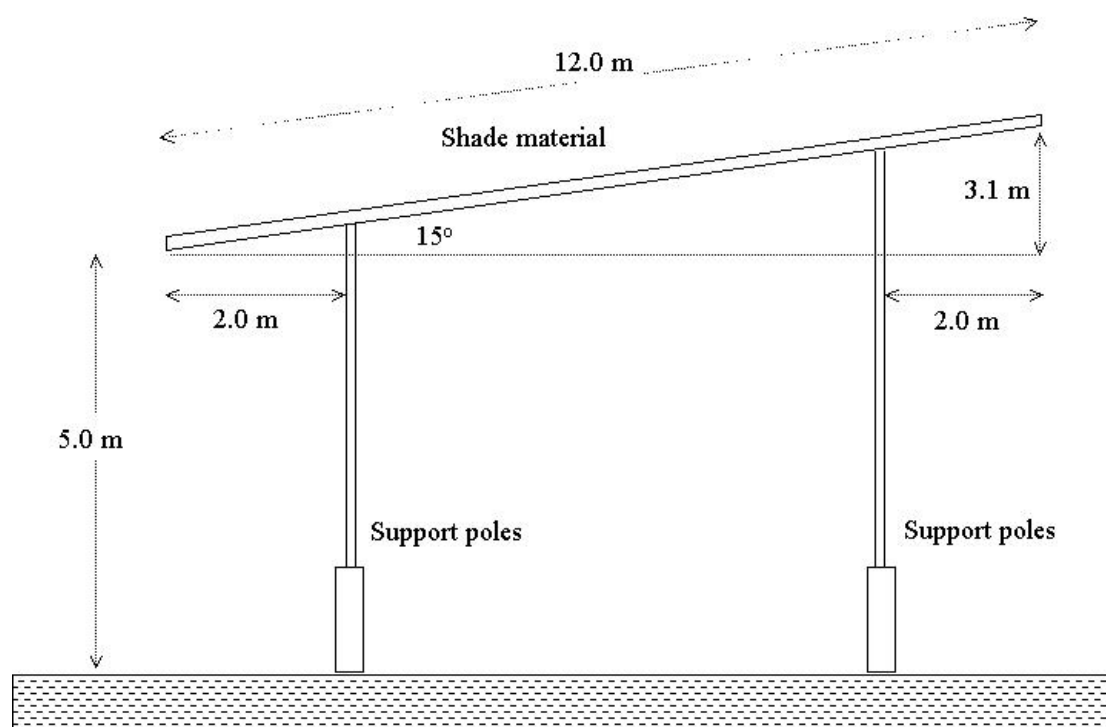
The minimum requirement is that the area of shade be sufficient to cover all animals. Recommended shade areas per head range from 1.9 sq metres to 6.0 sq metres.

Higher shade structures provide more cool air for the cattle, and allow the shade to move across the pen faster. Minimum suggested height is 5.0 metres on the western side rising at a slope of 15° towards the eastern side to the maximum height of 8.1 metres. Most shade structures are 12 metres wide.

A concept diagram of a shade structure is shown below.

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## Concept Shade Structure Design – End Elevation



### **14.4.2 Positioning of Shade Structures**

The shade should be positioned in the pen so that animals have access to the shade as it moves across the pen during the day, particularly during the afternoon when daily temperatures are at their maximum.

Daily maximum temperatures often occur during the afternoon between 2 and 4 pm CST, and research shows that cattle often show most stress in the period 3 – 5 pm CST, so it is important that the shade is within the pen during these times. For feedlots in the mid north of South Australia in mid summer with eastern eaves at 8.1 metre high the shade throw is 10 metres from the shade structure at 4:00 pm and 35 metres at 6:00 pm. This means that the shade structure needs to be located towards the western side of the feed pens to ensure the shade remains in the pens during the late afternoon.

### **14.4.3 Shade Materials**

The most common shade materials are galvanised sheeting or shade cloth due to availability and relatively low cost.

Shade cloth has the advantage of allowing air to pass through the material, but shade cloth can be affected by degradation of the material, bird damage, hot exhaust gases from cleaning machinery, and vermin damage if furled during the winter.

Galvanised sheets have a longer service life and can allow free flow of air if spaces are left between the sheets. They are generally heavier than shade cloth to erect and support, requiring more substantial structures.

### **14.4.4 Management of Shaded Areas**

The use of shade structures will result in a moist area beneath the shade due to deposition of faeces and urine. This area, if not managed to limit manure accumulation and moisture build

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up, may result in increased humidity and elevated ammonia levels beneath the shade and in the pen.

Repair and maintenance of the pen surface will also be high in this area. The area should be regularly cleaned of wet manure to limit odour production and ammonia emissions.

Shade structures of the dimensions outlined above allow access by sunlight to the pen floor as the shade moves across the pen throughout the day. This will assist in reducing the occurrence of shade related wet pen conditions.

#### **14.4.5 Structural Design of Shade Structures**

Shade structures need to be designed carefully with attention paid to the loads that the structure must bear.

Wind blowing against the structure results in directional loads. Side loading is caused by wind action against walls and posts, while wind action on a sloping roof can cause the roof to act either as a wing or an aerofoil depending on wind direction.

These forces must be taken into account when designing the structure.

The mass of material supported by the structure is called the “dead load”. The dead load of galvanised sheeting is higher than for shade cloth, so the support structures need to be more substantial.

The dynamic load of the shade structure is a load that varies in character. It typically results from movement of a structural member or other variable or oscillating force. For example wind gusts cause dynamic loading by swinging of the structure or alternating uplift and downdraft loads.

The ability of the structure to shed load and damp out oscillations becomes important when taking account of dynamic loads.

It is recommended that engineering advice be sought in the design and placement of feedlot shade structures.

#### **14.5 Mandatory Reporting Of Cattle Deaths**

Mandatory reporting is required by all feedlots on animal welfare and exotic disease alert grounds.

Where an unusual number of deaths and/or sick cattle occur in a 24 hour period a veterinarian must be consulted to establish the cause of the incident. An unusual number of deaths and/or sick cattle are defined according to the number of cattle that the feedlot is feeding at the time of the incident. The draft requirements are as follows:-

- Feedlots with up to and including 5000 head – greater than 3 deaths or 20 pulls in a 24 hour period
- Feedlots with more than 5000 head on feed – loses greater than 0.04% of the cattle on feed, or pulls greater than 0.4% of the number of cattle on feed in a 24 hour period.

Where the deaths/illnesses are suspected to be caused by an emergency/infectious disease AUSVETPLAN procedures must be implemented.

Where an emergency/infectious disease is confirmed not to have caused the deaths/illnesses reporting procedures according to the level shown in table 12 must be implemented.

**Table 12 Cattle Deaths Reporting Trigger Levels**

Cattle on Feed	Level 1	Level 2
Up to 150 head	10%	20%
151 – 500	8%	10%
501 – 1000	6%	8%
1001 – 3000	3%	5%
3001 – 5000	2%	4%
Over 5000	100 head	200 head

Where an incident has caused death levels less than Level 1, the feedlot should implement its relevant quality system procedures and requirements, which may include veterinary consultation.

Where there are sufficient deaths in a 24 hour period to trigger reporting at Level 1 or Level 2 at an accredited feedlot, the feedlot must notify the Australian Lot Feeders association (ALFA), of the incident in writing without delay. ALFA provides an incident report form to accredited feedlots which can be faxed. If more deaths subsequently occur which increase the reporting to Level 2 ALFA must be notified again.

#### **Contact details for ALFA**

Australian Lot Feeders Association  
GPO Box 149  
Sydney NSW 2001  
Phone 02 9241 6988  
Fax 02 9241 6986

#### **14.6 Restricted Material For Feeding Cattle**

Stock food intended for ruminants must not contain restricted animal material. Restricted animal material includes all materials from animals with a backbone (vertebrates). This includes previously allowed substances such as:

- fish and poultry material
- pig, horse or donkey, and kangaroo meat
- blood products
- meat originally designated for human consumption.

Restricted animal material **does not include** milk, milk products, gelatine, tallow or extracted oils.

The ban has been imposed following overseas research which has found there is a potential link between Bovine Spongiform Encophalopathy (BSE or commonly called "Mad Cow Disease") and a variant form of Creutzfeldt - Jakob Disease (vCJD). People who consume meat and other products from cattle affected by BSE could develop the potentially fatal vCJD. A ban on feeding ruminant materials to ruminant animals was imposed to prevent the recycling of BSE causing agents.

#### **Labelling Requirements for Stock Food**

Any stock food manufactured after 20th December 2001 that contains restricted animal material must have the following words noticeably displayed on the label or invoice certificate



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**This product contains restricted animal material  
DO NOT FEED TO CATTLE, SHEEP, GOATS, DEER OR OTHER RUMINANTS**

Stock food not containing restricted animal material must have the following words noticeably displayed on the label of invoice certificate

**This product does not contain restricted animal material**

**Legal Responsibilities When Feeding Livestock.**

It is an offence to feed restricted animal material to ruminants.

A person is prohibited from feeding ruminants or allowing ruminants to feed on restricted animal material, or to dispose of the material in such a manner that ruminants may gain access to it, whether or not the material has been rendered suitable for animal consumption.

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## 15 ENVIRONMENTAL MANAGEMENT

### National Feedlot Environmental Code of Practice

In 1998, industry proposed the development of a National Feedlot Environmental Code of Practice to draw together divergent opinion and consolidate it into a universally approved document that forms the basis of future environmental activity. This approach was consistent with that employed in the successful development of the National Guidelines and the implementation of the NFAS, satisfying the requirement to achieve a balance between self-regulation and public accountability.

The National Feedlot Environmental Code of Practice (the Code) was developed by the Australian Lot Feeders' Association in consultation with all Commonwealth/State/Territory agriculture and environment departments, the Cattle Council of Australia, the lotfeeding industry, the Feed Lot Industry Accreditation Committee (FLIAC), the Meat Research Corporation and environmental groups.

While the Code has been developed to address the legislative requirements of States and Territories with respect to environmental matters, it is intended that it will be used primarily by feedlot management and staff. It specifies environmental performance objectives, operational objectives and practices that provide ways of achieving compliance with the environmental duty of care. The Code also provides the community and regulatory authorities with a means by which they can assess the industry's performance.

The Feedlot Industry Accreditation Committee (FLIAC) has adopted the Code, as a replacement upgrade for the ALFA Code of Practice for Protection of the Environment, ensuring that all National feedlot Accreditation Scheme (NFAS) accredited feedlots must now comply with the newly developed Code. The Code has been endorsed by the Standing Committee for Agriculture and Resource Management (SCARM).

### Environment Management Plans

To ensure that all environmental impacts are considered when planning a feedlot development it is useful to develop an Environment Management Plan (EMP) for the feedlot property. This plan may also be valuable in the approval process for feedlot developments in environmentally sensitive areas.

The primary purpose of the EMP is to document how the feedlot development will impact on the relevant environmental factors and how those impacts may be mitigated and managed so as to be environmentally acceptable.

The Environment Management Plan should detail the methods and procedures which will be used to achieve the planned environmental targets and objectives. The plan should allocate responsibilities for the various requirements and should also address both short term targets and longer term objectives.

The following checklist may be useful in developing an EMP for the feedlot development.

#### Checklist

Consider impacts on

- Water resources
- Bushland areas and Reserves
- Wetlands and waterways
- Water protection areas

Consider site contamination or details of previous land uses which may have contaminated the soil.

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Address relevant issues from the following list and identify control measures to address environmental impacts

- Air quality
- Dust
- Odour
- Noise
- Surface water
- Groundwater
- Wastewater Reuse
- Solid and Liquid waste
- Resource Storage
- Pest Control
- Compressed/Liquid Gas
- Discharges to Land
- Discharges to Surface water
- Discharges to Groundwater

Provide information on

- Operating hours
- Timescale for completion of construction works
- Planned timelines for construction and operation
- Site stormwater drainage provisions and chemical spill management measures/systems
- Waste management practices

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## 16 FOREIGN INVESTMENT

The Commonwealth Government through the Foreign Investment Review Board (FIRB) has decision making powers for foreign investment proposals in Australia.

Foreign investment proposals in excess of \$3 million for feedlot properties or \$5 million for feedlot properties combined with an abattoir must be examined by the FIRB. Proposals are examined to ensure they comply with the national interests and may be referred to the Commonwealth Department of Primary Industries and Energy or the Commonwealth Department of the Arts, Sport, Environment, Tourism and Territories for comment.

To avoid duplication, arrangements have been made between the Commonwealth and the states, to jointly assess proposals involving both state and Commonwealth decisions e.g. Environmental Impact Statements.

The FIRB has published the following booklet which is available from Commonwealth Government bookshops in all states (55 Currie Street, Adelaide).

"Australia's Foreign Investment Policy : A Guide for Investors".

Foreign investment proposals should be sent:-

Foreign Investment Review Board  
Department of the Treasury  
Parkes Place  
**PARKES ACT 2600**

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## 17 ELECTRICITY SUPPLIES

While the feedlot itself is not a large consumer of electricity the associated feedmill of a large feedlot requires considerable power for conveying, rolling and mixing feeds.

Arrangements need to be made with ETSA Utilities regarding connection to supplies throughout the State. Single phase SWER line connections are generally available for small domestic requirements, but a large feedmill requires three phase supply, the cost of which may have to be met by the feedlot development.

Since deregulation of the electricity market a number of suppliers are able to supply power to developing feedlots. Check the rates and contractual agreements for prospective suppliers of power.

## 18 ABATTOIRS

In South Australia all stock (cattle) must be slaughtered through abattoirs that are accredited by the Meat Hygiene Unit.

There are around 15 large (abattoirs) & 40 small (slaughterhouses) Meat Works in South Australia

Small meat works (slaughterhouses) cater for small towns, they are normally owned by the local butcher.

Mutual recognition required all states to comply with Australian Standards for :

- construction
- continuous qualified Meat Inspection on site
- HACCP based meat safety program

All domestic meat works in South Australia meet this requirement.

This enables all to sell meat unrestricted on the Australian (interstate) and New Zealand domestic markets.

Abattoirs registered by AQIS also have Government Veterinary inspection as a requirement of Importing countries.

The export abattoirs gain licences for specific overseas markets (countries), Feedlots need access to an export registered abattoir if they aim to market meat overseas.

Export abattoirs are required to satisfy the requirements of :

- **AUSMEAT** - Product Descriptions
- **AFFA (AQIS)** - compliance with Australian Standards & Export Meat Orders
- **Meat & Livestock Association** - licences organisations to export meat

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## **19 VEHICULAR ACCESS TO FEEDLOTS**

### **19.1 Main Roads**

The primary concern of Transport SA is to ensure that access to a development is safe and convenient. A large feedlot operation is likely to generate a substantial volume of traffic, especially large delivery vehicles. The developer would therefore be asked to meet all costs (namely design and construction) of any works deemed necessary by the Department in order to provide safe access to the feedlot. For example, local road widening to accommodate separate right turn lanes and left turn lanes might be required.

Should the property have frontage to more than one road, all access should normally be via the less trafficked road. Should the junction of this road be under the care and control of the Department of Road Transport and require upgrading to cater for the increase in traffic generated by the feedlot, then the junction would need to be designed and constructed to the satisfaction of the Department with all costs being borne by the developer.

Other requirements are that:

The development, including signs, should be fully contained within existing property boundaries.

Sufficient on-site parking should be provided and the car park layout should be designed to Australian Standard 2890.1-1986.

Sufficient on-site manoeuvring area should be provided to enable all vehicles to enter and exit the site in the forward direction.

Direct access will not be permitted to roads which are proclaimed controlled-access roads unless no other suitable alternative access exists.

### **19.2 Local Government Roads**

The increased heavy vehicle traffic flow generated by feedlots generally results in increased road maintenance costs for rubble roads. In some cases the local Council may wish to recover some of the increased costs from the feedlot operator.

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## 20. NATIONAL FEEDLOT ACCREDITATION SCHEME (NFAS).

The feedlot industry has developed a quality assurance system that meets community expectations by delivering industry compliance with national management and environmental standards. The scheme is designed to achieve consistency of production within all feedlots by ensuring each feedlot is operating its own Quality Assurance scheme.

The National Feedlot Accreditation Scheme (NFAS) was introduced in 1993. It was the first quality assurance system introduced by a rural industry group, an approach that is being increasingly adopted by other rural industries.

The NFAS ensures codes of practice and guidelines for the industry are followed. These include:

1. The Australian Lot Feeders' Association's Code of Practice for Protection of the Environment.
2. The Australian Model Code of Practice for the Welfare of Animals - Cattle.
3. The Australian Veterinary Association's Code of Practice for the Safe Use of Veterinary Medicines on Farms.
4. AUS-MEAT grain fed specifications
5. National Guidelines for Beef Cattle Feedlots in Australia
6. Compliance with state and local government legislation

These codes and practices are translated into practical feedlot management through each feedlot's own QA system.

Currently, there are 600 accredited feedlots in Australia with a total capacity of 770,000 cattle. This represents over 90% of commercial feedlot capacity in Australia.

Only grainfed beef from NFAS accredited feedlots is eligible for export grainfed beef certification under the Export Control Act administered by AQIS.

The NFAS is administered by AUS-MEAT Limited and overseen by the Feed Lot Industry Accreditation Committee (FLIAC) comprising representatives from government and industry.

### 20.1 How NFAS Operates

To be accredited a feedlot operator must:

- have documented procedures in place, specifically for the feedlot which meet the requirements of the industry standards;
- maintain records that these procedures have been adhered to for all cattle prepared at the feedlot; and
- undergo a third party audit of these procedures, records and facilities at the feedlot.

All feedlots wishing to participate in the NFAS should complete a NFAS Application Form and lodge it with AUS-MEAT Limited.

#### Postal Address:

NFAS Accreditation  
AUS-MEAT Limited  
PO Box 3175, South Brisbane, Qld, 4101

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Phone: 07 3247 7200  
Fax: 07 3247 7222  
NFAS Free Call: **1800 621 903**

## **20.9 FEEDLOTS MOVE TO MANDATORY ID**

THE Australian Lot Feeders Association (ALFA) supports the mandatory electronic identification of feeder cattle under the NLIS scheme. On induction all feeder cattle must be tagged to allow feedlots to accurately trace back ownership of cattle to point of origin.



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## 21. REFERENCES, FURTHER READING AND ACKNOWLEDGMENTS,

The following key documents have been consulted:

"Queensland Government Guidelines for Establishment and Operation of Cattle Feedlots", Queensland Department of Primary Industries (1 September 1989).

Reference Manual for the Establishment And Operation of Beef Cattle Feedlots in Queensland, Queensland Department Of Primary Industries 2000.

"Feedlot Advisory Manual." NSW Agriculture and Fisheries (February 1997).

"National Guidelines for Beef Cattle Feedlots in Australia – 2<sup>nd</sup> Edition" SCA Report No. 47 CSIRO Publications, 1997.

"Model Code of Practice for Welfare of Animals - Cattle"

"National Beef Cattle Environmental Code of Practice" Meat and Livestock Australia (June 2000).

The following persons and organisations were involved in the preparation of this document.

- T J Clark (Principal Author) Rural Solutions South Australia
- W G Giles (Committee Chair) Primary Industries and Resources S.A.
- P A Hazell Environment Protection Authority
- C A Harris Environment Protection Authority
- S Austin Department of Water, Land and Biodiversity Conservation
- P Myers Lot-feeder, member of Australian Lot Feeders Association
- N Ashby Lot-feeder, member of Australian Lot Feeders Association
- J Kassebaum Lot-feeder, member of Australian Lot Feeders Association
- Australian Lot Feeders Association
- Animal Welfare Advisory Committee
- EPA

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## APPENDIX 1

### FEEDLOT PLANNING APPLICATION – DOCUMENTATION REQUIREMENTS

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#### 1 Applicant & Site Information

1.1 Name, Postal Address, Telephone and Facsimile numbers of:

- Applicant
- Owner of Subject Land
- Feedlot Manager

1.2 Description of Subject Land, including Hundreds, Section numbers, County, Local Government Authority and total farm area.

1.3 Locality Plans

- Cadastral plan of vicinity (preferably 1:50,000).
- Topographic plan (1:50,000) showing location of all buildings, commercial and recreation facilities and clearly denoting occupancy, use and separation distances.
- Topographic plan showing
  - location of all watercourses and drainage lines
  - limit of 1 in 100 year flood
  - environmentally sensitive sites
- Land Use plan showing local government zoning and land use in vicinity of the feedlot
- Aerial (Survey) Photograph of Site

Note: The data required in the locality plans may be shown on one plan providing that the data is clear.

#### 2 Climatic Information

- Mean Annual Rainfall
- Average Monthly Rainfall
- Rainfall Intensity Data
  - 1 in 20 year, 24 hour storm
  - 1 in 100 year one hour storm
- Average Monthly Evaporation
- Monthly Maximum and Minimum Temperatures
- Wind speed and Direction Frequency by Month

Note: Data should be from nearest recording station. Data limitations and collection site must be indicated.

#### 3 Feedlot Information

3.1 Outline of Proposal

Documentation outlining the proposal including

- cattle capacity, numbers to be fed annually and market weight
- stocking density
- feedlot class (see table 1)
- pen floor construction specifications
- proposed management programme

- 
- operational timetables
  - separation distances: actual and calculated from separation distance equation
  - and other relevant details.

### 3.2 Site Plan

showing location on subject property of feedlot pens and infrastructure, buildings, roads, drainage lines and waste utilisation areas.

### 3.3 Pen layout Plan

showing layout of pens, cattle lanes, feed alleys, induction facility, etc. Pen dimensions and water/feed facilities to be shown.

### 3.4 Drainage Plan

showing extraneous drainage exclusion system, pen slopes, drains, sedimentation basins, holding ponds, etc.

### 3.5 Waste Plan

showing the location, area and proximity to watercourses of all land on which wastes will be utilised, estimates of quantities and types of wastes.

### 3.6 Native Vegetation Plan

documentation showing the location and area of existing native vegetation and extent of proposed clearing.

### 3.7 Revegetation plan

showing the location and numbers of trees and shrubs to be planted around buildings, pens, as wind breaks or visual screens. Include names of species to be planted, and numbers.

### 3.8 Traffic

details of traffic volumes, routes and access to be used.

### 3.9 Water Supply

documentation on source, quality and adequacy of supply, annual consumption, water licenses.

### 3.10 Carcase Disposal Plan

showing location and method of disposal of carcasses, estimates of numbers.

### 3.11 Feedlot Development Plan

documentation outlining the work and development schedule for the construction of the feedlot and associated infrastructure

Note: The data required in the various plans may be shown on one plan providing that the data is clear.

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## 4 Soils & Groundwater Information

### 4.1 Soil Description

data showing the suitability of soils for purposes intended, basic physical and chemical properties for pens, ponds, irrigation and waste utilisation.

Documentation required	All Feedlots
Soil Description in Feedlot Pens, Roadways, Laneways, and Controlled Drainage Areas	<ul style="list-style-type: none"><li>- Soil classification in accordance the soil classification system described in Appendix A of AS 1726.</li><li>- Particle size distribution and plasticity limits:</li><li>- The visual identification methods described in AS 1726 may be used by suitably qualified and experienced persons, for classifying soils in the field. However, is there is doubt about the suitability of the material, the administering authority may direct the applicant to arrange for laboratory testing, in accordance with the appropriate sections of AS 1289. All such laboratory testing must be carried out by a soils laboratory, accredited by the National Association of Testing Authorities (NATA).</li></ul>
Soil Description in Waste Utilisation Areas	Texture, pH, ECe, Total N, Nitrate N, Total P, Colwell P, Exchangeable Sodium Percentage (ESP), Organic carbon, Chloride
Clay Lining of effluent drains, settling areas, storage or treatment ponds, manure stockpile areas, composting areas	<ul style="list-style-type: none"><li>- Soil classification in accordance with the soil classification system described in Appendix A of AS 1726.</li><li>- Particle size distribution and plasticity limits:</li><li>- The visual identification methods described in AS 1726 may be used by suitably qualified and experienced persons, for classifying soils in the field. However, if there is doubt about the suitability of the material, the administering authority may direct the applicant to arrange for laboratory testing, in accordance with the appropriate sections of AS 1289. All such laboratory testing must be carried out by a soils laboratory, accredited by the National Association of Testing Authorities (NATA).</li></ul>

### 4.2 Bore Locations

plan showing location, depth of and depth to standing water level (SWL) of all bores on the property and all relevant neighbouring properties.

### 4.3 Springs, Seeps and Salt Scalds

plan showing location of any of these

### 4.4 Ground Water Analysis

chemical and microbiological analysis of existing ground water.

### 4.5 Geology

documentation of geology underlying the property from existing geological maps.

### 4.6 Hydrogeological Assessments

Site specific detailed report assessing impacts on ground water

## 5 Solid Waste Utilisation Information

### 5.1 Soil Conservation Plan

details showing location of existing and proposed soil conservation works on the solid

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waste application area.

#### 5.2 Drainage Plan

showing drainage from waste application area and distance from watercourses.

#### 5.3 Nutrient And Salt Balance

documentation showing that the size of the application area is sufficient to handle the nutrient and salts expected in the wastes, any off farm disposal arrangements to be specified.

#### 5.4 Manure Stockpile

plan showing size and location of manure stockpile and runoff controls.

#### 5.5 Manure Spreading Programme

documentation outlining method, frequency and management program for manure spreading.

### **6 Liquid Waste Management Information**

#### 6.1 Soil Conservation Plan

details showing location of existing and proposed soil conservation works on the solid waste application area.

#### 6.2 Drainage Plan

showing drainage from waste application area and distance from watercourses.

#### 6.3 Holding/Evaporation Pond

documentation indicating capacity, annual runoff volumes, overflow frequency.

#### 6.4 Sediment Control System

documentation showing size and method of operation.

#### 6.5 Effluent Irrigation Water Balance

documentation showing that the size of the utilisation area is sufficient to handle the volume of effluent expected without runoff or seepage at flow-rates or strengths liable to cause pollution.

#### 6.6 Nutrient And Salt Balance

documentation showing that the size of the application area is sufficient to handle the nutrient and salts expected in the effluent

#### 6.7 Irrigation Method

documentation outlining irrigation method

### **7 Odour, Noise, Dust & Pest Control Information**

#### 7.1 Odour

assess generation, impact and control of odour nuisance. Odour assessment using odour source modelling may be required, depending on the size of the feedlot and sensitivity of adjacent land.

#### 7.2 Dust

statement outlining dust control measures considered necessary

#### 7.3 Noise

statement outlining noise control measures considered necessary

#### 7.4 Pest Control

outline of proposed pest control measures (rodent, birds, flies, feral animals)

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## **8 Animal Welfare**

8.1 Statement of compliance with the Model Code of Practice for the Welfare of Animals - Cattle as endorsed by the Standing Committee of Agriculture and Resource Management (SCARM).

## **10 Composting**

10.1 Refer to the Environment Protection Authority for current guidelines..

## **11 Environment Management Plan**

11.1 Draft Environment Management Plan

Documentation indicating how environmental risks are managed, including a monitoring plan

## **12 Sundry Information**

12.1 Visibility

Statement outlining the degree of visibility of the development by the public.

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## **APPENDIX 2                      GENERAL SPECIFICATIONS**

### **FOR THE DESIGN AND CONSTRUCTION OF CATTLE FEEDLOTS IN SOUTH AUSTRALIA**

#### **1. Siting**

- Feedlots must be sited so as to minimise the potential for adverse impacts on the community and the environment.
- Feedlots must not be sited above groundwater resources which are vulnerable to contamination.
- Feedlots must not be sited in flood prone areas

#### **2. Pen Floor Preparation**

- Class 1 and 2 - Graded and compacted foundation of clay soil having low, intermediate and high plasticity, clayey sands or clayey gravels. Surface of compacted rubble or clayey gravel. See more detail in section 8 for pen floor construction method.
- Class 3 - Graded and compacted foundation of clay soil having low, intermediate and high plasticity, clayey sands or clayey gravels. Note:- sandy soils are not suitable as a class 3 pen floor. For all year round feedlots on sandy soils pen floors should match class 1 & 2 specifications.
- Class 4 – no special preparation. It is expected that a crop will be grown on these areas in the non-feeding season.

#### **3. Pen Slope**

- Class 1 & 2 - 3% - 4% away from feeding area
- Class 3 & 4 - 2% - 6% away from feeding area
- Cross slope must not be greater than front to back slope to minimize pen to pen drainage.

#### **4. Pen Dimensions**

- Pen width must allow sufficient space for feeding cattle at the feeding method and frequency specified in the plans
- Pen depth will depend on the number of cattle to be fed in the pen and the stocking density subject to the following limitations
  - For a 2% or 3% slope the maximum pen depth is 65 metres
  - For a 4% slope the maximum pen depth is 60 metres
  - For a 5% slope the maximum pen depth is 55 metres
  - For a 6% slope the maximum pen depth is 50 metres

#### **5. Feed Troughs and Feeders – essential features**

- located at the top of the pen slope
- designed to minimize wastage of feed
- easily cleaned
- sides meet the ground at right angles
- free draining to prevent accumulation of rainwater
- located on a durable apron capable of withstanding the passage of cleaning machinery
- apron slopes away from the feeder/trough
- apron allows a minimum standing width for the cattle of 2.5 metres

#### **6. Water Troughs – essential features**

- located in the bottom half of the pen
- float valve protected to minimize wastage of water
- drainage during cleaning is directed out of the pen
- sides meet the ground at right angles
- located on a durable concrete apron capable of withstanding the passage of cleaning

- 
- machinery
  - apron slopes away from the trough
  - apron allows a minimum standing width for the cattle of 2.5 metres
  - protective frame to prevent entry by cattle

#### **7. Pen Fencing**

- adequate for stock control
- does not interfere with drainage or pen cleaning

#### **8. Diversion Banks and Drains**

- divert external water away from the feedlot controlled drainage area
- must be capable of carrying the peak flow-rate of a 1 in 20 year design storm at non scouring velocity

#### **9. Pen Drains**

- must be capable of carrying the peak flow-rate of a 1 in 20 year design storm at non scouring velocity
- should have a cross section which allows easy cleaning with on-site equipment
- must have a permeability of  $1 \times 10^{-9}$  m/sec or less.

#### **10. Sedimentation System**

- must be capable of managing the peak flow-rate of a 1 in 20 year design storm
- must have a permeability of  $1 \times 10^{-9}$  m/sec or less
- must be able to be cleaned out easily
- the sedimentation control weir must be able to safely discharge a 1 in 50 year design storm
- the sedimentation control weir must have a free board of at least 900 mm between the top of the weir and the top of the bank of the sedimentation system.

#### **11. Storage Lagoon**

- must be able to store the runoff from a 1 in 20 year wet winter with a minimum 25% sludge allowance or safety margin
- must have a permeability of  $1 \times 10^{-9}$  m/sec or less
- the spillway must be designed to safely discharge a 1 in 50 year design storm at non scouring velocity
- the spillway must have a free board of at least 600 mm between the base of the spillway and the top of the bank of the storage lagoon

#### **12. Manure Stockpile Area**

- should be within the controlled drainage area (CDA) of the feedlot complex. If not within the CDA it must
  - comply with the relevant separation distances
  - be isolated from external water flow by banks and drains
  - collect and manage all rainfall and water entering the stockpile area.
- must have a slope of between 1 – 3% and be free draining
- must be prepared to the same specifications as a Class 1 or Class 2 pen foundation, and be finished with a layer of rubble.
- must have a permeability of  $1 \times 10^{-9}$  m/sec or less

#### **13. Effluent Utilisation Area**

- Must be large enough to accommodate the sustainable spreading of the effluent from the feedlot taking into account
  - Soil type
  - Nutrients removed from the area in agricultural produce such as grain, hay, silage, green chop fodder, or live-weight gain of grazing animals



- 
- Hydraulic loading limits
  - to ensure even-ness of application the effluent irrigation system should comply with the irrigation industry of Australia standards for irrigation system design and operation.
  - the height of throw of the irrigation system should be kept as low as possible
  - ponding of effluent on the surface should not be evident for more than 1 hour after irrigation is complete
  - prevailing weather conditions must be taken into account when deciding the time of the day when effluent is to be spread.

#### **14. Manure Utilisation Areas**

- Must be large enough to accommodate the sustainable spreading of the effluent from the feedlot taking into account
  - Soil type
  - Nutrients removed from the area in agricultural produce such as grain, hay, silage, green chop fodder, or live-weight gain of grazing animals.

#### **15. Carcase Disposal Site**

- Burial pits should be established in low permeability soils on a site which is undulating and well drained. Pits should be deep but relatively narrow, and are best dug using an excavator. They should be at least 2 metres above the highest water level at the site. Avoid rocky areas and lighter soils. Pits dug in lighter soils should be lined with a one metre thick impermeable clay liner on the sides and bottom.

## APPENDIX 3

### OPERATIONAL SPECIFICATIONS FOR FEEDLOT CLASSES

**Table 13** Maximum Pen Cleaning Interval (Weeks)

Stocking Density (sq.m. / head)	Feedlot Class			
	1	2	3	4
10	7	14	26	26 and de-stocking *
15	10	20		
20	14	26		

**Note:** For **Class 1** feedlots and **Class 2** feedlots where the cleaning interval is less than one draft of cattle, removal of pack manure must only be carried out when weather conditions are such that damage to the pad will not occur and in regions of the pen (mainly near feed and water areas) where there is sufficient manure pack to scrape.

\* Pens should be scraped clean of manure within 4 days of destocking the opportunity feedlot. Where manure is ~~not scraped and removed~~ the manure should be incorporated into the soil within four (4) days. It is suggested that a crop be grown following incorporation of the manure into the soil.

**Table 14** Maximum Intervals for Operational Activities

Activity	Class 1	Class 2	Class 3	Class 4
Remove feed residues from feeders	Weekly	Weekly	Weekly	Weekly
Clean water troughs	Weekly	Weekly	Weekly	Weekly
Remove spilt feed	Weekly	At pen cleaning	26 Weekly	26 Weekly
Eliminate wet patches	Weekly	Monthly	At pen cleaning	At pen cleaning
Repairs to pen floor potholes	Weekly	Monthly	26 Weekly & prior to winter	Before each feeding season
Under fence cleaning *	Monthly	Quarterly	At pen cleaning	At pen cleaning
* or as soon as practical after manure accumulation obstructs pen drainage				

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## Standard Feedlot Operational Specifications

1. **Feeding out equipment** should be operated to minimise spillage
2. **Pen cleaning** must be carried out
  - At the frequency specified by the feedlot class and stocking density in table 17.
  - In a manner which ensures the design slopes of the pen floor are maintained.
  - In a manner which avoids damage to the pen floor surface. If, after cleaning, the pen floor surface needs repairing, repairs should be made to return it to the original pen floor specification.
3. **Water troughs and float valves** should be maintained to minimise overflows and spillage.
4. **Wastewater resulting from trough cleaning** must be disposed of without causing erosion or ponding on the pen surface
5. **Drainage channels**
  - must be repaired or maintained as soon as practical following damage
  - sediments must be removed as soon as practical after their deposition significantly impedes the flow of liquid effluent
6. **Sedimentation systems**
  - must be cleaned as soon as practical following deposition of significant amounts of sediment
  - must be repaired and maintained to ensure efficient operation
  - clay liners must be protected and kept moist to prevent surface cracking
  - the integrity of synthetic liners must be monitored regularly using a suitable leak detection system.
7. **Storage Lagoons**
  - must be de-sludged as soon as the sludge volume exceeds the maximum sludge volume specified in lagoon design specifications, or 50% of the total storage volume
  - must be managed to avoid over-topping
  - may be used for dust control in pens and roadways provided that aerosol or fine droplet formation is avoided, and surface runoff is minimal
  - clay liners must be protected and kept moist to prevent surface cracking
  - the integrity of synthetic liners must be monitored regularly using a suitable leak detection system.
8. **Manure, sludge and other solid wastes** must be
  - either stockpiled within the controlled drainage area of the feedlot, or immediately used on the feedlot property, or transported away from the feedlot property
  - managed to avoid spontaneous combustion
9. **Effluent and manure utilisation**
  - must be managed to maintain or improve the production capacity of the waste utilisation areas
  - must be managed according to the principals of ecologically sustainable development

- 
- must be applied to agricultural land at rates which do not exceed the rates at which the water and nutrients can be
    - assimilated by plants and removed from the area in harvested produce
    - or safely stored in the soil
    - or safely released into the environment in an acceptable form.
  - The rate of application and volume applied should be such that no surface runoff occurs, excessive deep percolation is avoided and no ponding is evident one hour after application
  - Unless unusual weather patterns prevent, the storage lagoon must be lowered to bottom water level by the anticipated beginning of winter.

**10. Carcase disposal** must be undertaken in a manner which avoids environmental harm or nuisance.

**11. Community amenity**

- The feedlot must be operated in a manner which avoids unreasonable interference with the comfortable enjoyment of life and property off-site, or with off-site commercial activity. It is advisable to have a regular and open, two way, communication with neighbours, to avoid problems and to allow for the speedy resolution of any complaints.

**12. Incident Monitoring and Recording**

- Records of all incidents which have the potential to impact on the environment should be maintained. The records which should be maintained include
  - the time, date and duration of the incident
  - details of corrective measures
  - the results of assessments of the environmental impacts caused by the incident
  - details of any increase in cattle mortalities
  - details of changes in management which may result in enhanced environmental performance.

**13. Incident Reporting**

- Licensed feedlots may be required to submit annual reports to the Environment Protection Authority.
- As soon as practical after becoming aware of an incident which has the potential to cause environmental harm the feedlot operator must inform the Environment Protection Authority.
- Details of any sudden increase in cattle mortalities must be notified to the Chief Inspector of Stock.

**14. National Pollutant Inventory Reporting**

- All feedlots which exceed trigger level emissions of substances listed on the National Pollutant Inventory (NPI) substance list must estimate the level of emissions and report the emissions to the Environment Protection Authority.

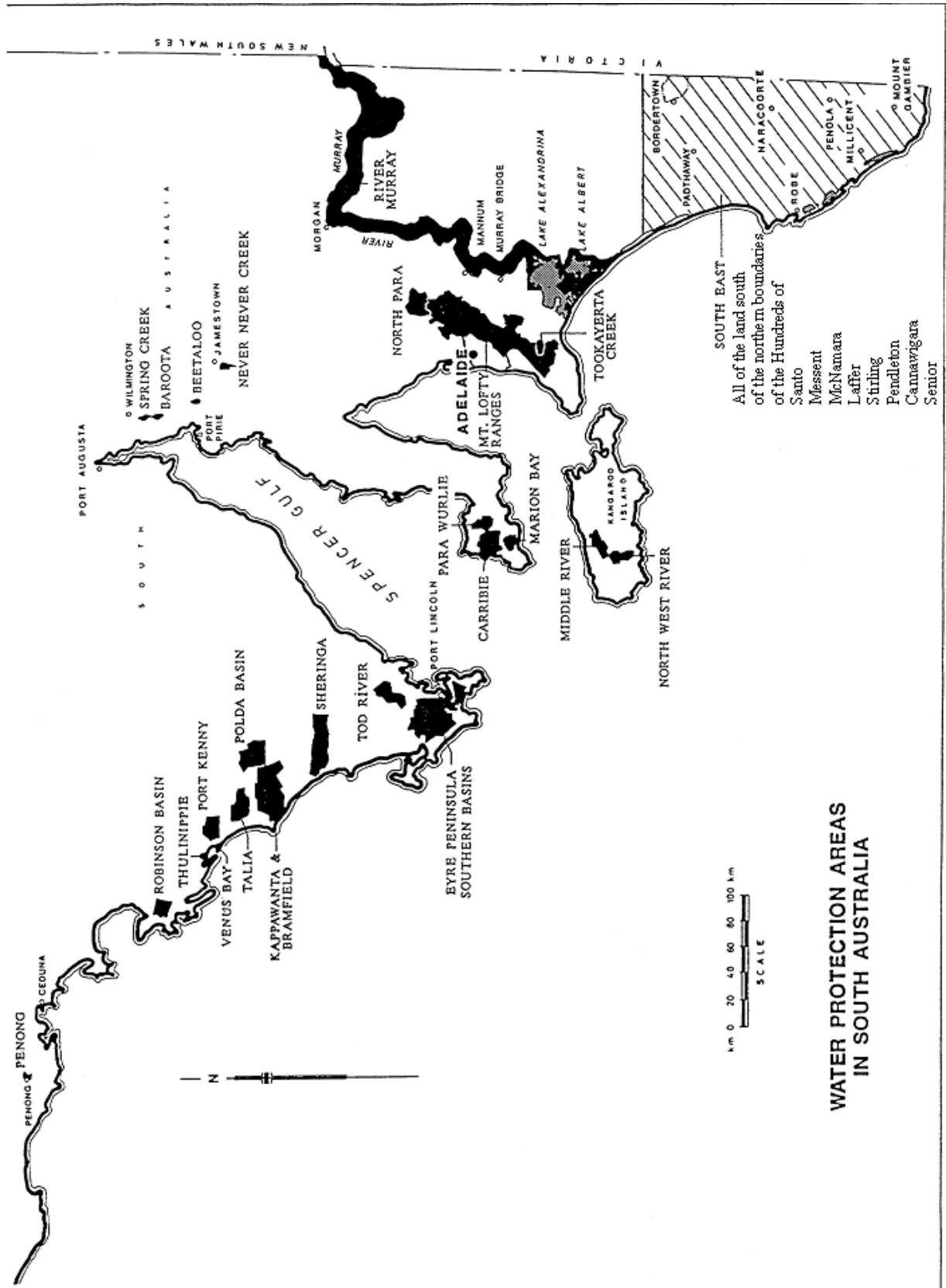
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## **APPENDIX 4      WATER PROTECTION AREAS OF SOUTH AUSTRALIA**

### **Water Protection Areas**

1.      Baroota (Mid-North)
2.      Beetaloo (Mid-North)
3.      Carribie (Yorke Peninsula)
4.      Eyre Peninsula Southern Basins
5.      Kappawanta and Bramfield (Eyre Peninsula)
6.      Marion Bay (Yorke Peninsula)
7.      Middle River (Kangaroo Island)
8.      Mount Lofty Ranges
9.      Never Never Creek (Mid-North)
10.     North Para River (Central)
11.     North West River (Kangaroo Island)
12.     Para Wurlie (Yorke Peninsula)
13.     Penong (Eyre Peninsula)
14.     Polda Basin (Eyre Peninsula)
15.     Port Kenny (Eyre Peninsula)
16.     River Murray
17.     Robinson Basin (Eyre Peninsula)
18.     Sheringa (Eyre Peninsula)
19.     South East
20.     Spring Creek (Mid-North)
21.     Talia (Eyre Peninsula)
22.     Thulinippie (Eyre Peninsula)
23.     Tod River (Eyre Peninsula)
24.     Tookayerta Creek (Central)
25.     Venus Bay (Eyre Peninsula)

# MAP OF WATER PROTECTION AREAS IN SOUTH AUSTRALIA



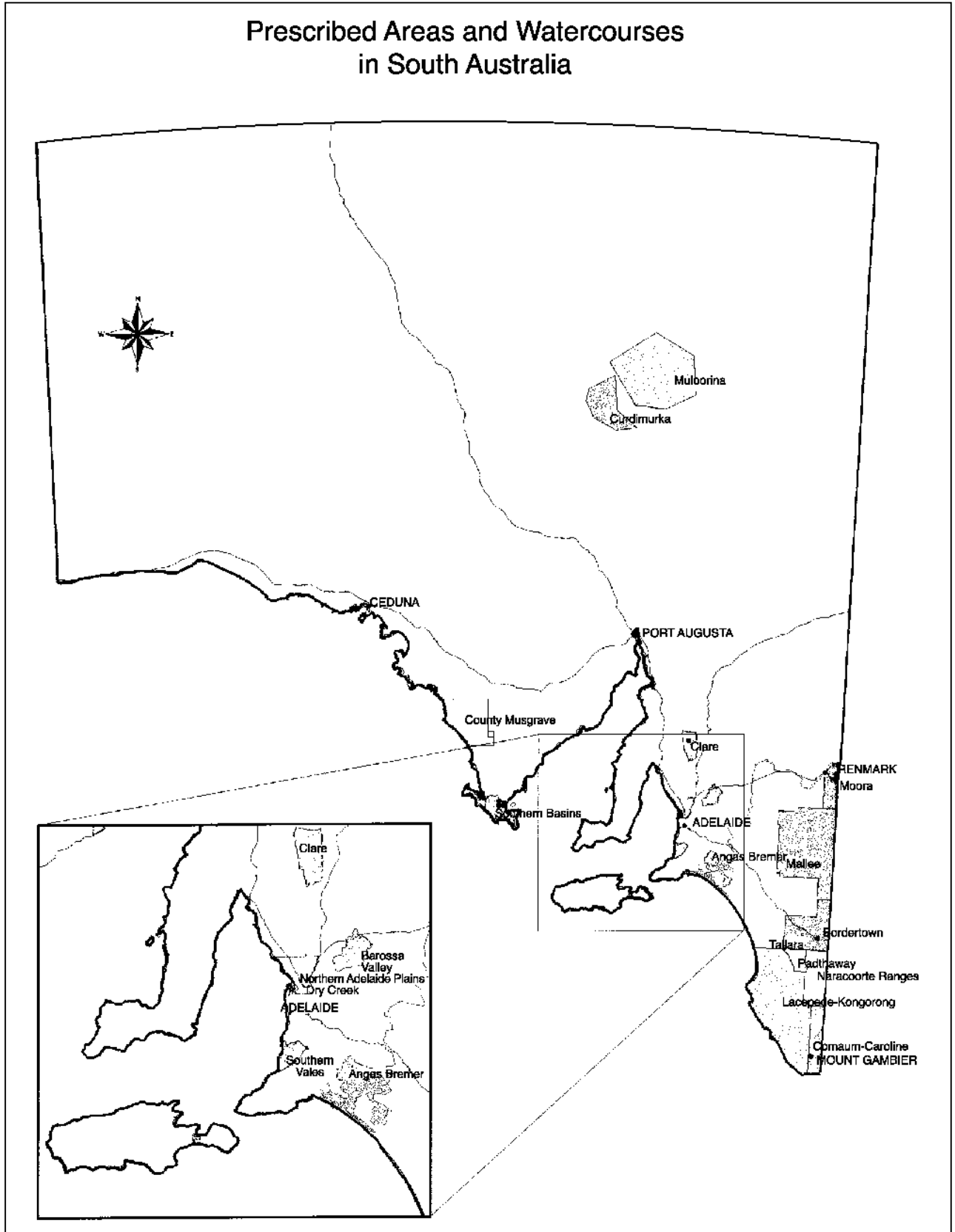
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## **APPENDIX 5 – PRESCRIBED AREAS AND WATERCOURSES IN SOUTH AUSTRALIA**

### **Prescribed Wells Areas, Prescribed Surface Water Areas, and Prescribed Watercourses**

1. Curdimurka Prescribed Wells Area (located in the far north)
2. Muloorina Prescribed Wells Area (located in the far north)
3. County Musgrave Prescribed Wells Area (located on Eyre Peninsula)
4. Southern Valley Prescribed Wells and Surface Water Area
5. Clare Valley Prescribed Wells and Surface Water Area
6. Barossa Valley Prescribed Wells and Surface Water Area
7. Northern Adelaide Plains Prescribed Wells Area
8. Bolivar Prescribed Watercourse
9. Dry Creek Prescribed Wells Area
10. Chapman's Creek Intake Prescribed Watercourse (located adjacent to the Northern Adelaide Plains Prescribed Wells Area)
11. Middle Beach Intake Prescribed Watercourse (located adjacent to the Northern Adelaide Plains Prescribed Wells Area)
12. Northern Intake Prescribed Watercourse (located adjacent to the Northern Adelaide Plains Prescribed Wells Area)
13. Southern Vales Prescribed Wells Area
14. River Murray Prescribed Watercourse
15. Mallee Prescribed Wells Area
16. Noora Prescribed Wells Area
17. Angas Bremer Prescribed Wells Area
18. Tatiara Prescribed Wells Area (located in the South East)
19. Padthaway Prescribed Wells Area (located in the South East)
20. Naracoorte Ranges Prescribed Wells Area (located in the South East)

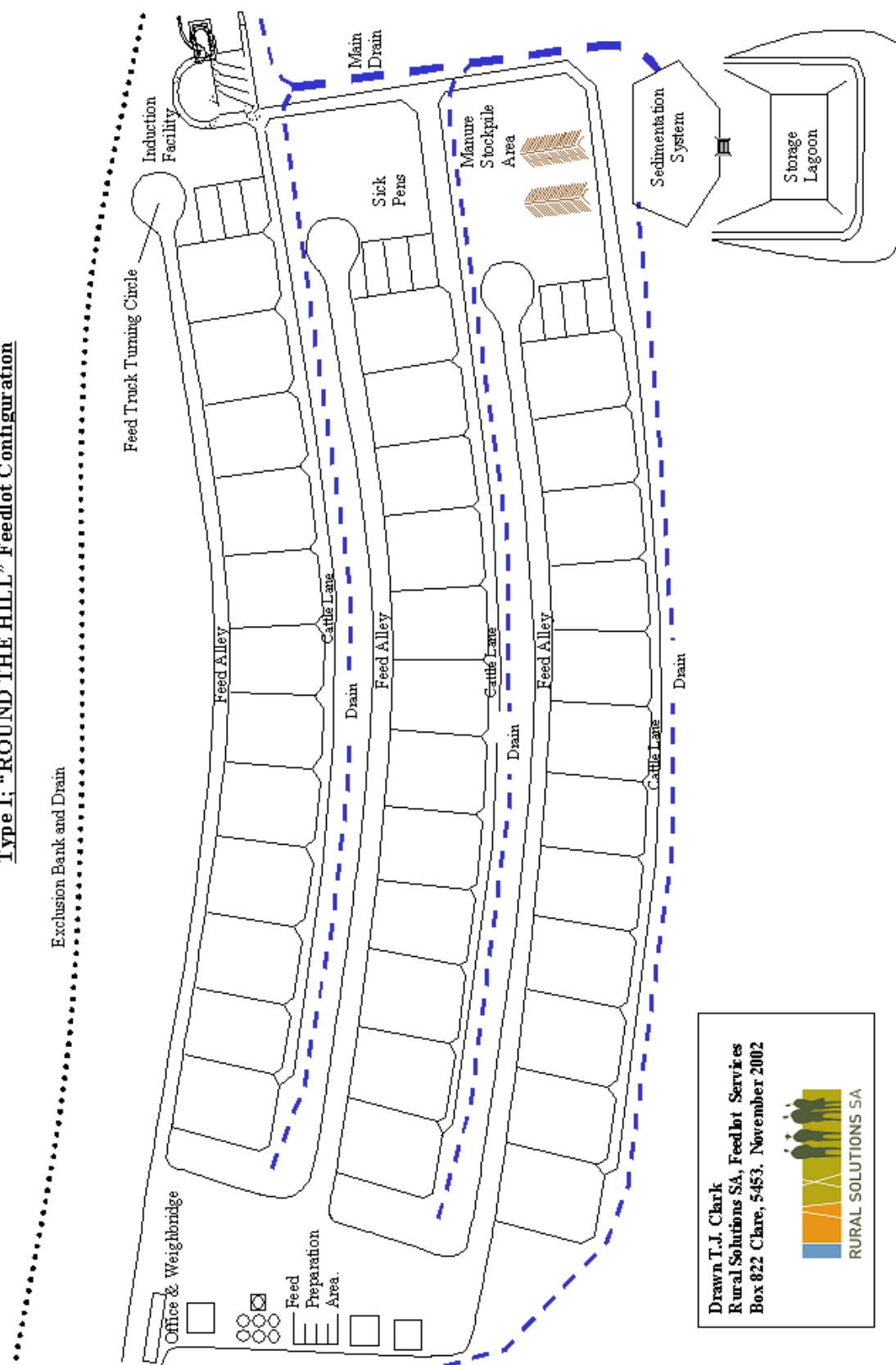
## Prescribed Areas and Watercourses in South Australia





## APPENDIX 6 - TYPICAL FEEDLOT LAYOUTS

**Type 1: "ROUND THE HILL" Feedlot Configuration**

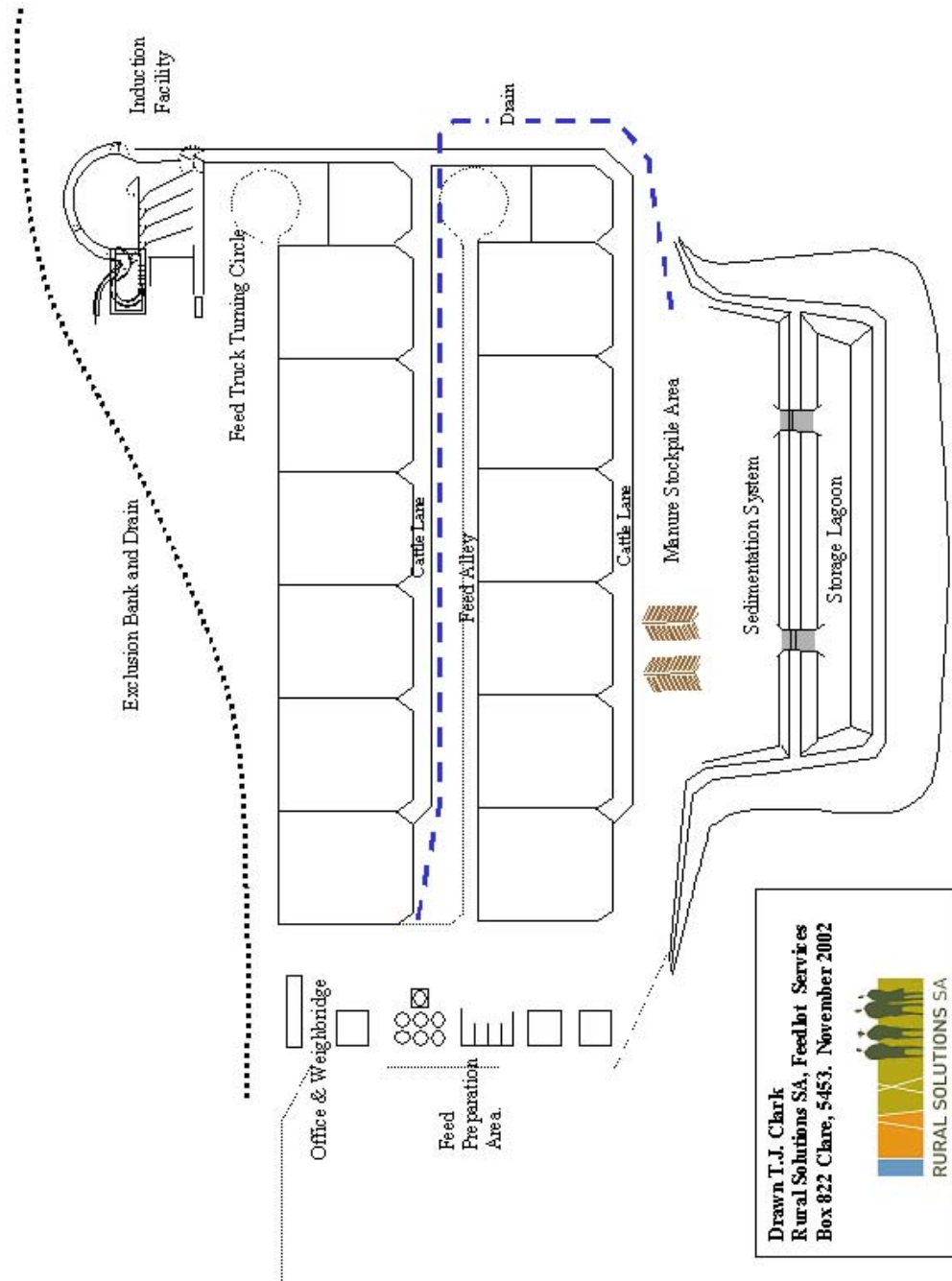


Drawn T.J. Clark  
 Rural Solutions SA, Feedlot Services  
 Box 822 Clare, 5453. November 2002




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**Type 2, "TERRACED" Feedlot Configuration**

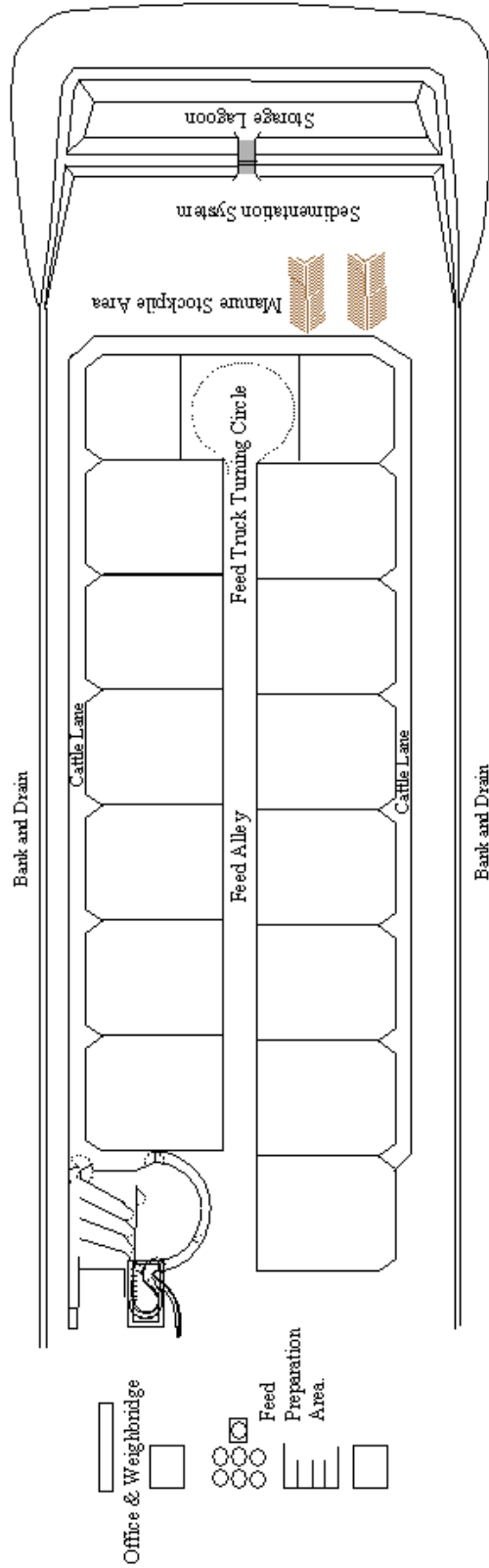


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 Rural Solutions SA, Feedlot Services  
 Box 822 Clare, 5453. November 2002



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**Type 3: "BACK TO BACK" Feedlot Configuration**



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 Rural Solutions SA, Feedlot Services  
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## APPENDIX 7

### ENVIRONMENTAL GUIDELINES FOR EFFLUENT LAGOONS IN SOUTH AUSTRALIA.

#### 1. LAGOON CONSTRUCTION – Environmental Considerations

This is not a guideline on how to construct effluent lagoons. Its purpose is to highlight environmental considerations which are important in the design of the lagoon.

***All lagoons must be designed to prevent any unapproved / non-permitted or uncontrolled discharge of untreated effluent, partially treated effluent or reclaimed water to adjoining land, soils, groundwater, waterbodies or marine environment.***

##### **Base:**

1. The base of the storage pond must be more than 1 metre above the highest seasonal groundwater level.

##### **Embankments:**

1. Provide embankments to prevent inflow of stormwater/ surface runoff or outflow of effluent, similarly provide extra storage to prevent overtopping.
2. Minimum embankment freeboard should be 600mm above design storage capacity.
3. In areas with potential for inundation the embankment of the lagoon must be above the 1 in 25 year flood level or maximum high tide level for that area, whichever is the highest.

##### **Lining:**

1. Effluent Lagoons should be lined with an impervious material, eg compacted clay and/or synthetic membrane to prevent seepage.
2. Clay Lining:
  - a) All clay linings should have a minimum compacted thickness of 600mm;
  - b) Any clay used for lining of an effluent lagoon must have a permeability of no greater than  $1 \times 10^{-9}$  m/sec;
  - c) Clay Lining should be protected from desiccation during construction of the lagoon;
  - d) Finished lining should be tested to ensure permeability;
  - e) If groundwater is encountered during excavation of the lagoon then the site must be dewatered and dried before lining with clay can occur;
3. Synthetic Membranes:
  - a) Membranes should have a smooth finish on both sides and not embossed;
  - b) Membranes to be uniform in thickness across the entire area of the lining;
  - c) All membranes should be free from pinholes, blisters and contaminants;
  - d) All joints and seals on membranes should be tight to ensure membranes still exhibits water tight properties;
  - e) Membranes should be covered with a minimum of 500mm earth cover, any earth cover must not contain sharp, jagged rocks, roots, debris or any other material which may be abrasive or may puncture the membrane, and must be applied in a manner that does not damage the lining;
  - f) Certifications should be provided that state membrane used for the lagoon has met all necessary requirements.

##### **Signage:**

1. Where lagoons contain effluent of lesser quality than Class A as defined in the South Australian Reclaimed Water Guidelines signs must be erected and displayed at appropriate intervals around the storage area indicating the presence of effluent and/or reclaimed water.
2. Lagoons in close proximity to residential areas should be fenced off with person proof

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fencing to reduce the potential for exposure to the effluent.

**Location:**

1. Lagoons for the storage and treatment of effluent should not be built on land within:
  - a) 100 metres of a bore, well or watercourse identified:
    - i) as a blue line on a current series 1:50,000 Department of Environment and Natural Resources topographic map;
    - ii) as any river, creek or other natural watercourse (wether modified or not); or a channel (which includes a drain, gutter or pipe);
    - iii) by an on-site inspection by local environmental health officer or licensing authority;
  - b) 100 metres of the pool level for the River Murray and Lakes and above the 1956 flood level:
  - c) 400 metres of any dwelling on neighbouring properties or a town boundary:
  - d) 5 metres from any farm drive:
  - e) 50 metres of any property boundaries or public roads.

## **2. LAGOON MAINTENANCE**

**General Maintenance:**

1. Banks must be checked for evidence or indications that erosion has or will take place
2. All fences must be in satisfactory condition. All gates and doors to person proof fencing must be fitted with locks at all times.
3. Structures:
  - a) All inlet and outlet pipework and structures must be checked regularly to ensure adequate functioning, eg flow rates.
  - b) All associated pumps and aeration devices must be checked to ensure working condition. Any unsatisfactory parts must be replaced with new ones.
  - c) Any baffles or materials designed to reduce shortcircuiting in the lagoon (lowering detention times) must be checked to ensure there has been no collapse or deterioration of the structure allowing effluent to shortcircuit the system.
4. Weed Growth
  - a) Banks of the lagoons should be checked for any weeds that are on the water surface or at the water line. The presence of such growths can encourage mosquito breeding. Control can be done by a suitable weedicide or regular maintenance.
  - b) Vegetation on the upper banks is favoured as it can prevent erosion or collapse of lagoon edges due to wave action. Any vegetation grown for this purpose will need to be monitored regularly. Trees should not be established on the banks of lagoons for these purposes.
5. Mosquitoes
  - a) Mosquitoes will generally use the lagoons for breeding sites. If the lagoons are healthy, performing adequately and vegetation is minimal at the water surface then the lagoons will be unfavourable breeding grounds.
  - b) It is important that the lagoon is not overloaded resulting in the system becoming septic and anaerobic. It is also important that no "dead spots" in the lagoons occur where there is no movement of water or air through the system.

**Cleaning Lagoons:**

Lagoons should be designed to ensure efficient cleaning and desludging in future years:

- i) Weeds:

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- a) There is no definitive scheduling of when to remove weeds from the lagoons. Some weeds may in fact be helping in reducing the nutrient concentration on the final effluent. It is suggested that you use these guidelines to coo-ordinate when to remove and how much to remove:
  - b) When the weeds form a mat over the lagoon and the bottom is no longer visible.
  - c) When there is evidence that detention times in the lagoons are shorter than required due to capacity of lagoons being reduced via weed build up.
  - d) When removing weeds it is suggested that a harvest of 50% of weeds be done. This will allow some weeds to remain and continue in the removal of nutrients.
  - e) BOD, SS and F. Coli levels can be used as indicators of shortcircuiting.

ii) Desludging:

- f) Lagoons should be desludged when it is apparent that sludge levels in the lagoons are causing loss of detention in the lagoons and degeneration of the effectiveness of treatment.
- g) Sludge levels should be measured annually.
- h) Sludge levels should never exceed more than 2/3rds of lagoon capacity.
- i) Indications that lagoon is still working under peak capacity with high sludge levels could indicate the system can tolerate elevated sludge levels and the need for desludging may not be necessary in the immediate future.
- j) Clay Lining of lagoons must be checked after each desludging to ensure its structure and integrity has not been damaged or compromised. Any damage to lining will need to be repaired before water can be reintroduced into that pond.
- k) All lagoons will need to be desludged at some point.